k. Autonomy: not less than 30 minutes at full load (including 30% of spare capacity)

l. Minimum operating life time: 10 (ten) years

24.11.9. Command

a. As a minimum, the following commands shall be provided locally and remotely:

i. System OFF
ii. System on UPS
iii. System on Static By-pass
iv. System on Manual By-pass
v. Alarm silence switch

24.11.10. Control

a. As a minimum, the following possibilities shall be provided:

b. Measurement of:

i. Input current
ii. Input voltage
iii. Input power
iv. DC voltage
v. DC current
vi. Output voltage
vii. Output current
viii. Output frequency
ix. Output power

c. A mimic display indicating different operation mode showing the status of main circuit breakers and switches

d. As a minimum, visual and audible alarms:

i. Battery at low level and low voltage
ii. System on by-pass
iii. Input supply failure
iv. Overload
v. High temperature
vi. USP not answering – communication lost
vii. Logging of previous minimum 200 alarms shall be possible

viii. The UPS shall be provided with two contacts for remote alarms, one for urgent (red) alarm and one for non-urgent (yellow) alarm

e. Automatic battery check-up

24.11.11. Communication and remote control

a. In addition, the UPS shall be provided with:

i. Communication interface RS232/C, or Ethernet RJ45

ii. SNMP V. 3.x compliant

b. The UPS shall be equipped with appropriate output protection. A short-circuit in the UPS distribution panel shall not damage the UPS.

24.12 Lightning protection and grounding connection

24.12.1. Lightning protection

a. The Contractor shall design and provide the most suitable solution to ensure lightning protection of all provided equipment, installations and infrastructure in accordance with applicable legislations and standards in given Territorial Host Nation.

b. The earth electrode (respective wires and penetration rods) system shall be able to handle the lightning current for dispersal into the ground.

c. The lightning protection system shall be compliant with:

i. IEC 62305-1:2010 Protection against lightning - Part 1: General principles or THN equivalent.

ii. IEC 62305-2:2010 Protection against lightning - Part 2: Risk management or THN equivalent.

iii. IEC 62305-3:2010 Protection against lightning - Part 3: Physical damage to structures and life hazard or THN equivalent.

iv. IEC 62305-4:2010 Protection against lightning - Part 4: Electrical and electronic systems within structures or THN equivalent.

d. The equipment shall not be damaged and the Communications and Information Systems (CIS) equipment shall continue to operate without degradation when subjected to the lightning waveforms conforming to STANAG 4370 edition 7, AECTP 250 - leaflet 254 atmospheric electricity and lightning.

e. Appropriate Surge Protection Devices (SPD) and other lightning protection measures shall be used to provide sufficient protection for the equipment. They shall be compliant with (non-exhaustive list):

i. IEC 61643-11:2011 Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods or THN equivalent.

ii. IEC 61643-12:2020 Low-voltage surge protective devices - Part 12: Surge protective devices connected to low-voltage power systems - Selection and application principles or THN equivalent.

iii. IEC 61643-21:2000+AMD1:2008+AMD2:2012 CSV Consolidated version

iv. Low voltage surge protective devices - Part 21: Surge protective devices connected to telecommunications and signalling networks - Performance requirements and testing methods or THN equivalent.

v. IEC 61643-22:2015 Low-voltage surge protective devices - Part 22: Surge protective devices connected to telecommunications and signalling networks - Selection and application principles or THN equivalent.

24.12.2. Grounding

a. Grounding study / ground resistance measurements at various locations (indoor premises for SSSB system, antenna locationsetc.) shall be performed by the Contractor in order to ensure good operation including lightning protection.

b. The main grounding network shall consists of grounding rings buried under the antenna foundations.

c. All metallic parts of the SSSB system in the buildings shall also be connected to this grounding system.

d. The Contractor shall integrate the SSSB grounding system with existing grounding system of the site according to respective THN laws and regulations.

e. The grounding installation shall be compliant with IEC 60364-5-54:2011 Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors or THN equivalent.

SECTION 25 ROADS AND LANDSCAPING

25.1 General

25.1.1. This scope shall include:

a. Temporary roads

b. Landscaping (sodding, planting and gardening).

25.1.2. Administrative activities, geodetic & design activities, as well as execution of the construction works, including works supervision, quality assurance, quality control and health & safety measures shall be planned, organized and executed in compliance with:

a. THN national legislation

b. National standards or international standards that are applicable in THN (when THN equivalent standards do not exist or are superseded by international standards applicable in THN)

c. Best industry practices that are most relevant to the scope of work

25.2 Temporary roads

25.2.1. During constructing phase the Contractor may need a temporary road network to access all required areas, and a temporary parking/ storage area to execute works under this contract.

25.2.2. It is the Contractor's responsibility to build this temporary road network and temporary parking /storage as well as to demolish them and to restore the site to the required condition as before the Contractor's works commence.

25.3 Landscaping

25.3.1. In addition to the measures that the Contractor shall implement during the execution of the site works, at the end of the site civil works the Contractor shall complete finishing and landscaping in order to stabilize the soil and prevent erosion.

25.3.2. These works shall include sowing and planting.

25.3.3. Any works, although having an aesthetic aspect, shall in no way interfere with the existing physical security measures. Therefore, the Contractor shall take particular care during the design and execution of landscaping works to assure that the effectiveness of any of the site security measures stays intact (i.e. planting of shrubs shall not limit monitoring of any sensitive points and areas and shall not reduce the required lighting level).

Appendix 1: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX F-SRS-CW-NLD

Civil Works at the Site Noordwijk, NL

1. **General**

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX F - System Requirements Specifications (Civil Works) – the Netherlands.

1.2. The site, including antenna fields, is located within NATURA 2000 area that is designated under following directives respectively:

1.2.1. Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, amended by:

1.2.1.1. Regulation (EU) 2019/1010 of the European Parliament and of the Council of 5 June 2019

1.2.2. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, amended by:

1.2.2.1. Council Directive 97/62/EC of 27 October 1997

1.2.2.2. Regulation (EC) No 1882/2003 of the European Parliament and of the Council of 29 September 2003

1.3. The Contractor shall plan, organize and execute all works, as well as obtain all required permissions and authorizations, taking into account requirements introduced by the directives related to NATURA 2000 and their implementations as directed in respective THN regulations and standards.

2. **Responsibilities of the Contractor**

2.1. If the Contractor identifies that existing not used/ not operational infrastructure, installations and equipment shall be removed to enable installation and correct O&M of SSSB system and its supporting infrastructure, it is the Contractor’s responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.2. Provision and installation of new steel RF cabling manhole covers at the entry points to the COMMS building (executed only if the Contractor provides new sections of outdoor RF cabling for antennas):

2.2.1. Locking mechanisms, such as a sliding locking bar that can be secured with a padlock to enable it to be secured when not in use.

2.2.2. The padlock, as the minimum shall meet following requirements:

2.2.2.1. Body made from hardened steel

2.2.2.2. Inner components made from non-corrosive materials

2.2.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.2.2.4. Precision, minimum 3-pin cylinder lock mechanism

2.2.2.5. Minimum 3 keys

2.2.2.6. Suitable for outdoor use, weatherproof

2.3. Provision and installation of SSSB electrical installation with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX F:

2.3.1. Complete SSSB electrical installation, both indoor and outdoor, with dedicated EPDBs (Equipment Power Distribution Boards), including surge protection devices and residual current devices (RCD), required to power all equipment provided by the Contractor for SSSB project (including power distributed to antenna fields etc.)

2.3.2. Integration of the SSSB electrical installation with existing MPDB (Main Power Distribution Board) and other power panels as required:

2.3.2.1. The integration shall include installation of adequate circuit breakers, and modification of existing power distribution system and the power boards/ panels as required to connect power cables for SSSB electrical installation

2.4. Provision and installation of UPS system as stipulated in the SOW – ANNEX F.

2.5. Provision and installation of SSSB lightning protection and grounding system with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX F:

2.5.1. Complete SSSB lightning protection and grounding system, both indoor and outdoor (including surge protection devices, grounding rings (including buried, roof and mast mounted elements), grounding rods, lightning rods, trays, ducts and other ancillaries) required to protect all equipment provided by the Contractor for SSSB project (including antennas)

2.5.2. Integration of the SSSB lightning protection and grounding system with existing lightning protection and grounding system of the site according to respective THN laws and regulations:

2.5.2.1. The integration shall include execution of necessary earth works, welding, anticorrosive protection, and necessary modification of existing lightning protection and grounding system.

2.6. Removal and disposal of:

2.6.1. 1(one) antenna – main structure – wooden pole

2.6.2. all ducting, cabling, grounding, guyed lines, foundation, anchoring and other ancillaries related to the antenna and the antenna mast that is scoped for disposal.

2.7. Provision and installation of required number of new antenna masts capable of supporting the SSSB system and with all associated works (antenna field preparation, foundation, trenches etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX F.

2.7.1. The antenna masts and shall be designed for minimum service life of 30 years without the need for substantial maintenance

2.7.2. The antenna masts and shall be provided with cathodic protection system (including protection of the guy anchors) designed for minimum service life of 30 years without the need for substantial maintenance

2.8. Provision and installation of indoor sections of RF and power cabling with associated cable trays, ducts etc.:

2.8.1. Indoor, the Contractor shall install the RF cabling and connect it to new SSSB equipment at one end, and at the other end – connect it to existing RF cabling terminations at the inside of EMP shield

2.9. Provision and installation of outdoor RF cabling and power cabling for antennas:

2.9.1. THN NL offers for reuse existing RF cabling.

2.9.2. The Contractor shall modify the existing outdoor RF cabling terminations (for example by providing and installing outdoor RF cabling extensions with all required ancillaries and related civil works such as earthworks, ducting, piping, backfilling etc.) required for new SSSB antennas

2.9.3. The power distribution, grounding connections and the location for new indoor SSSB equipment (that shall be provided by the Contractor) is within Electromagnetic Pulse (EMP) protected enclosure. Therefore, any works conducted by the Contractor shall not degrade integrity/ effectiveness of the existing EMP protected enclosure.

2.9.4. In case it is not possible to reuse existing outdoor RF cabling, following activities shall be included in the scope executed by the Contractor:

2.9.4.1. Dismantling and hand-over to THN NL of redundant RF cabling

2.9.4.2. Installation of new RF cabling with associated earthwork, backfilling, ducting, trays, and marking of the cable runs in the terrain.

2.9.4.3. Provision and installation of required manholes including the manhole to accommodate cable entry into the building via EMP shield

2.9.4.4. All cables leaving or entering the EMP protected area shall be routed through the existing EMP cable entry panel.

2.9.4.5. Provision and installation of new steel RF cabling manhole cover(s) at the entry points to the COMMS building

2.10. Provision and installation of safety marking and labelling, both indoor and outdoor, for all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX F.

2.11. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.11.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.11.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.12. All metal works exposed to outdoor environment such as antenna masts with their ancillaries, cable trays and ladders, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5M Maritime, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.13. When designing and erecting masts with all associated ancillaries, the Contractor shall take into account wind load imposed by winds of min 190 km/h speed, without ice formation.

2.14. Supporting Civil Works:

2.14.1. Rebuilding of pavements after pipe, cabling, ducting and other installation works.

2.14.2. Associated earthworks and backfilling, drilling for the pipes, cabling, ducting and other installation works.

2.14.3. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting and other installation works.

2.14.4. Water, sound and fire insulation as required in all areas affected by the Contractor works.

Appendix 2: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX F-SRS-CW-NLD

Civil Works at the Site Zeewolde, NL

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX F - System Requirements Specifications (Civil Works) – the Netherlands.

2. Responsibilities of the Contractor

2.1. Provision and installation of Health and Safety (H&S) fence around each of the antennas, that shall be provided and installed by the Contractor:

2.1.1. The fence shall form continues line around each antenna.

2.1.2. The fence shall be built in such a distance from antennas to assure that:

2.1.2.1. the radiation right outside the fence line is within the limits established in: ICNIRP Occupational standard. Richtlijn: Health Physics, Volume 74, Number 4 Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields up to 300 GHz

2.1.2.2. and the fence does not interfere with SSSB system operation

2.1.3. The timber elements of the fence shall be made of impregnated wood that is robustly protected against local weather and soil conditions:

2.1.3.1. pressure treated timber

2.1.3.2. protected against rot, fungal, bacterial and insect damage

2.1.3.3. all-weather wood sealer shall be applied on all elements that are to be buried before burying them, and on their sections protruding from the ground level for min 30 cm

2.1.3.4. pressure treated wood shall dry for a few weeks after purchasing it before applying a wood sealer (for details the manufacturer recommendations shall be followed)

2.1.3.5. the wood impregnation agents shall be compliant with Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products

2.1.3.6. the Contractor shall apply the level of treatment for the timber to be used for the Use Class 4 (External use which has direct soil or water contact. For example, fence posts or decking which is sunk into the ground.) according to ISO 21887:2007 Durability of wood and wood-based products — Use classes (or respective THN equivalent)

2.1.3.7. the timber shall be characterized by its inherent durability of minimum Class 3: life span of 10-15 years.

2.1.4. The fence shall extend to a height of at least 1.2 m above ground level throughout.

2.1.5. Fence posts shall be of minimum cross-section 15cm x 15cm and installed at centers not exceeding 1.5 m.

2.1.6. Fence post shall be installed in concrete foundations of the size adequate to the soil type and wind load at each site.

2.1.7. Fence posts shall be mounted straight/vertical.

2.1.8. Fences around each antenna shall have at least one double leaf gate constructed to the same standard as the fence and shall open outwards.

2.1.9. The gates shall be of minimum 3.0m width, manually operated, equipped with closing mechanism and a padlock.

2.1.10. Each gate leaf shall be mounted on minimum 3(three) hinges.

2.1.11. The closing mechanism at the gates, as the minimum shall meet following requirements:

2.1.11.1. locking mechanisms, such as a sliding locking bar that can be secured with a padlock.

2.1.12. The padlock at the gates, as the minimum shall meet following requirements:

2.1.12.1. Body made from hardened steel

2.1.12.2. Inner components made from non-corrosive materials

2.1.12.3. Hardened boron steel shackle minimum 10 mm diameter

2.1.12.4. Precision minimum 3-pin cylinder lock mechanism

2.1.12.5. Minimum 3 keys

2.1.12.6. Suitable for outdoor use, weatherproof

2.1.13. The fence shall have at least three horizontal timber elements, perpendicularly connected at both ends to the fence posts.

2.1.14. The horizontal timber elements shall be of minimum cross-section 15cm x 2.5cm and installed as follows:

2.1.14.1. The top surface of the top horizontal timber element aligned with the top surface of the posts

2.1.14.2. The rest of horizontal timber elements evenly spaced in such a way that the bottom surface of the bottom horizontal element shall be around 25-30cm above ground level

2.1.15. The fence structure shall be erected using galvanized steel fixings such as nuts, bolts, washers and other carpentry fittings

2.1.16. Use of nails is forbidden

2.2. If the Contractor identifies that existing not used/ not operational infrastructure, installations and equipment shall be removed to enable installation and correct O&M of SSSB system and its supporting infrastructure, it is the Contractor’s responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.3. Provision and installation of new steel RF cabling manhole covers at the entry points to the COMMS building (executed only if the existing cable entry panel is not suitable for reuse by the Contractor)

2.3.1. Locking mechanisms, such as a sliding locking bar that can be secured with a padlock to enable it to be secured when not in use.

2.3.2. The padlock, as the minimum shall meet following requirements:

2.3.2.1. Body made from hardened steel

2.3.2.2. Inner components made from non-corrosive materials

2.3.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.3.2.4. Precision, minimum 3-pin cylinder lock mechanism

2.3.2.5. Minimum 3 keys

2.3.2.6. Suitable for outdoor use, weatherproof

2.4. Provision and installation of SSSB electrical installation with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX F:

2.4.1. THN NL offers for reuse existing power distribution system with existing 2(two) power sockets to connect 2(two) 5 kW transmitters. Should that existing installation be not suitable, require any modification and installation of additional items it shall be the Contractor's responsibility as stipulated hereafter below.

2.4.2. Complete SSSB electrical installation, both indoor and outdoor, with dedicated EPDBs (Equipment Power Distribution Boards), including surge protection devices and residual current devices (RCD), required to power all equipment provided by the Contractor for SSSB project (including power distributed to antenna fields etc.)

2.4.3. Integration of the SSSB electrical installation with existing MPDB (Main Power Distribution Board) and other power panels as required:

2.4.3.1. The integration shall include installation of adequate circuit breakers, and modification of existing power distribution system and the power boards/ panels as required to connect power cables for SSSB electrical installation

2.5. Provision and installation of UPS system as stipulated in the SOW – ANNEX F.

2.6. Provision and installation of SSSB lightning protection and grounding system with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX F:

2.6.1. Complete SSSB lightning protection and grounding system, both indoor and outdoor (including surge protection devices, grounding rings (including buried, roof and mast mounted elements), grounding rods, lightning rods, trays, ducts and other ancillaries) required to protect all equipment provided by the Contractor for SSSB project (including antennas)

2.6.2. Integration of the SSSB lightning protection and grounding system with existing lightning protection and grounding system of the site according to respective THN laws and regulations:

2.6.2.1. The integration shall include execution of necessary earth works, welding, anticorrosive protection, and necessary modification of existing lightning protection and grounding system.

2.7. Removal and disposal of:

2.7.1. Existing outdoor RF cable terminations if they become redundant as a result of the Contractor's works.

2.7.2. Existing reinforced concrete antenna foundations all ducting, cabling, grounding, anchoring and other ancillaries related to the antenna foundations that are scoped if they become redundant as a result of the Contractor’s works.

2.7.3. These activities can only be exercised after THN approval of each item scoped for removal and disposal.

2.8. Provision and installation of required number of new antenna masts capable of supporting the SSSB system and with all associated works (antenna field preparation, foundation, trenches etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX F.

2.8.1. The antenna masts and shall be designed for minimum service life of 30 years without the need for substantial maintenance

2.8.2. The antenna masts and shall be provided with cathodic protection system (including protection of the guy anchors) designed for minimum service life of 30 years without the need for substantial maintenance

2.9. Provision and installation of indoor sections of RF and power cabling with associated cable trays, ducts etc.:

2.9.1. Indoor, the Contractor shall install the RF cabling and connect it to new SSSB equipment at one end, and at the other end – connect it to existing RF cabling terminations at the indoor part of the cable entry panel

2.10. Provision and installation of outdoor RF cabling and power cabling for antennas:

2.10.1. THN NL offers for reuse existing outdoor sections of RF cabling.

2.10.2. The Contractor shall modify the existing outdoor RF cabling terminations (for example by providing and installing outdoor RF cabling extensions with all required ancillaries and related civil works such as earthworks, ducting, piping, backfilling etc.) required for new SSSB antennas

2.10.3. In case it is not possible to reuse existing outdoor RF cabling, following activities shall be included in the scope executed by the Contractor:

2.10.3.1. Dismantling and hand-over to THN NL of redundant RF cabling.

2.10.3.2. Installation of new RF cabling with associated earthwork, backfilling, ducting, trays, and marking of the cable runs in the terrain.

2.10.3.3. Provision and installation of required manholes including the manhole to accommodate cable entry into the building if the existing cable entry panel is not suitable for reuse by the Contractor

2.10.3.4. Modification of existing or provision and installation of a new cable entry panel for the cabling provided and installed by the Contractor.

2.10.3.5. Provision and installation of new steel RF cabling manhole cover(s) at the entry points to the COMMS building should the manhole be provide and installed by the Contractor.

2.11. Provision and installation of safety marking and labelling, both indoor and outdoor, for all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX F.

2.12. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.12.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.12.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.13. All metal works exposed to outdoor environment such as antenna masts with their ancillaries, cable trays and ladders, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5M Maritime, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.14. When designing and erecting fences and masts with all associated ancillaries, the Contractor shall take into account wind load imposed by winds of min 190 km/h speed, without ice formation.

2.15. Supporting Civil Works:

2.15.1. THN NL offers for reuse existing penetrations in walls, floors, and ceilings as presented in ‘Transmit site Zeewolde - Site information’ (Version number 1.0, Date: 19-08-2020) and supporting photographic documentation. Should these existing penetrations be not suitable or require any modification it shall be the Contractor’s responsibility to execute required works for installation of SSSB equipment.

2.15.2. Rebuilding of pavements after pipe, cabling, ducting and other installation works.

2.15.3. Associated earthworks and backfilling, drilling for the pipes, cabling, ducting and other installation works.

2.15.4. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting and other installation works.

2.15.5. Water, sound and fire insulation as required in all areas affected by the Contractor works.

Appendix 3: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX F-SRS-CW-NLD

Civil Works at the Site Albatros, NL

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX F - System Requirements Specifications (Civil Works) – the Netherlands.

2. Responsibilities of the Contractor

2.1. If the Contractor identifies that existing not used/ not operational infrastructure, installations and equipment shall be removed to enable installation and correct O&M of SSSB system and its supporting infrastructure, it is the Contractor’s responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.2. Provision and installation of SSSB electrical installation with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX F:

2.2.1. THN NL offers for reuse existing power distribution system including:

2.2.1.1. existing 2(two) circuit breakers (2 x B16) at the power panel located in the room for new SSSB system installation

2.2.1.2. the 2 x B16 circuit breakers are connected to two power outlets installed in the vicinity of planed location for new SSSB system so power cables (to be provided and installed by the Contractor), between those outlets and new SSSB equipment, will be approximately 5m long for each SSSB rack

2.2.1.3. indoor cable trays

2.2.1.4. should that existing installation be not suitable, require any modification and installation of additional items it shall be the Contractor’s responsibility as stipulated hereafter below

2.2.2. Complete SSSB electrical installation, both indoor and outdoor, with dedicated EPDB(s) (Equipment Power Distribution Board(s)), including surge protection devices and residual current devices (RCD), required to power all equipment provided by the Contractor for SSSB project

(including power distributed to antennas located right above the SSSB room, on the building roof)

2.2.3. Integration of the SSSB electrical installation with existing MPDB (Main Power Distribution Board) and other power panels as required:

2.2.4. The integration shall include installation of adequate circuit breakers, and modification of existing power distribution system and the power boards/ panels as required to connect power cables for SSSB electrical installation

2.3. Provision and installation of UPS system as stipulated in the SOW – ANNEX F.

2.4. Provision and installation of SSSB lightning protection and grounding system with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX F:

2.4.1. Complete SSSB lightning protection and grounding system, both indoor and outdoor (including surge protection devices, grounding rings (including roof and mast mounted elements), lightning rods, trays, ducts and other ancillaries) required to protect all equipment provided by the Contractor for SSSB project (including antennas)

2.4.2. Integration of the SSSB lightning protection and grounding system with existing lightning protection and grounding system of the site according to respective THN laws and regulations:

2.4.2.1. The integration shall include execution of necessary welding, anticorrosive protection, and necessary modification of existing lightning protection and grounding system.

2.5. Removal and disposal of:

2.5.1. one antenna mast (approximately 6m height) mounted on the building roof;

2.5.2. 2 x 19 inch rack with various communication and electronic equipment

2.5.3. all ducting, cabling, grounding, guyed lines, foundation, anchoring and other ancillaries related to the antenna and the antenna mast that are scoped for disposal.

2.6. Provision and installation of required number of new antenna masts capable of supporting the SSSB system with all associated works (foundation/ interface plate to the building roof etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX F.

2.6.1. The antenna mast(s) shall be designed for minimum service life of 30 years without the need for substantial maintenance

2.6.2. The antenna mast(s) shall be installed on the roof of an existing multistory building

2.7. Provision and installation of indoor and outdoor RF cabling of the length approximately 25m for each SSSB antenna:

2.7.1. THN NL offers for reuse indoor RF cabling trays

2.7.2. Should the offered trays are not suitable for new SSSB installation it is the Contractor’s responsibility to provide and install new cable trays

2.8. Removal and disposal of existing support structure and fixings of the existing RF cable conduit leading to the building roof from the floor right below.

2.9. Provision and installation of a new support structure and fixings for the existing RF cable conduit leading to the building roof from the floor right below:

2.9.1. All elements shall be made from galvanized steel

2.9.2. All elements shall be protected against corrosion as specified hereafter and in the SOW – ANNEX F.

2.10. Refurbishment of existing or removal and disposal, and then provision of a new galvanized steel conduit for RF cable leading to the building roof from the floor right below:

2.10.1. Regardless of which option is chosen by the Contractor, the conduit shall be protected against corrosion as specified hereafter and in the SOW – ANNEX F

2.10.2. Regardless of which option is chosen by the Contractor, the conduit shall be watertight sealed

2.11. Provision and installation of safety marking and labelling, both indoor and outdoor, for all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX F.

2.12. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.12.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.12.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.13. All metal works exposed to outdoor environment such as antenna masts with their ancillaries, cable trays and ladders, bolts, nuts, washers, fasteners etc. (regardless if buried/concealed or not) shall be protected against corrosion category C5M Maritime, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.14. When designing and erecting the mast(s) with all associated ancillaries, the Contractor shall take into account wind load imposed by winds of min 190 km/h speed, without ice formation.

2.15. Supporting Civil Works:

2.15.1. Associated drilling for the pipes, cabling, ducting and other installation works.

2.15.2. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting and other installation works.

2.15.3. Water, sound and fire insulation as required in all areas affected by the Contractor works.

Appendix 4: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX F-SRS-CW-NLD

Civil Works at the Site Julianadorp, NL

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX F - System Requirements Specifications (Civil Works) – the Netherlands.

2. Responsibilities of the Contractor

2.1. Provision and installation of Health and Safety (H&S) fence around each of the antennas, that shall be provided and installed by the Contractor:

2.1.1. The fence shall form continues line around each antenna.

2.1.2. The fence shall be built in such a distance from antennas to assure that:

2.1.2.1. the radiation right outside the fence line is within the limits established in: ICNIRP Occupational standard. Richtlijn: Health Physics, Volume 74, Number 4 Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields up to 300 GHz

2.1.2.2. and the fence does not interfere with SSSB system operation

2.1.3. The timber elements of the fence shall be made of impregnated wood that is robustly protected against local weather and soil conditions:

2.1.3.1. pressure treated timber

2.1.3.2. protected against rot, fungal, bacterial and insect damage

2.1.3.3. all-weather wood sealer shall be applied on all elements that are to be buried before burying them, and on their sections protruding from the ground level for min 30 cm

2.1.3.4. pressure treated wood shall dry for a few weeks after purchasing it before applying a wood sealer (for details the manufacturer recommendations shall be followed)

2.1.3.5. the wood impregnation agents shall be compliant with Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products

2.1.3.6. the Contractor shall apply the level of treatment for the timber to be used for the Use Class 4 (External use which has direct soil or water contact. For example, fence posts or decking which is sunk into the ground.) according to ISO 21887:2007 Durability of wood and wood-based products — Use classes (or respective THN equivalent)

2.1.3.7. the timber shall be characterized by its inherent durability of minimum Class 3: life span of 10-15 years.

2.1.4. The fence shall extend to a height of at least 1.2 m above ground level throughout.

2.1.5. Fence posts shall be of minimum cross-section 15cm x 15cm and installed at centers not exceeding 1.5 m.

2.1.6. Fence post shall be installed in concrete foundations of the size adequate to the soil type and wind load at each site.

2.1.7. Fence posts shall be mounted straight/vertical.

2.1.8. Fences around each antenna shall have at least one double leaf gate constructed to the same standard as the fence and shall open outwards.

2.1.9. The gates shall be of minimum 3.0m width, manually operated, equipped with closing mechanism and a padlock.

2.1.10. Each gate leaf shall be mounted on minimum 3(three) hinges.

2.1.11. The closing mechanism at the gates, as the minimum shall meet following requirements:

2.1.11.1. locking mechanisms, such as a sliding locking bar that can be secured with a padlock.

2.1.12. The padlock at the gates, as the minimum shall meet following requirements:

2.1.12.1. Body made from hardened steel

2.1.12.2. Inner components made from non-corrosive materials

2.1.12.3. Hardened boron steel shackle minimum 10 mm diameter

2.1.12.4. Precision minimum 3-pin cylinder lock mechanism

2.1.12.5. Minimum 3 keys

2.1.12.6. Suitable for outdoor use, weatherproof

2.1.13. The fence shall have at least three horizontal timber elements, perpendicularly connected at both ends to the fence posts.

2.1.14. The horizontal timber elements shall be of minimum cross-section 15cm x 2.5cm and installed as follows:

2.1.14.1. The top surface of the top horizontal timber element aligned with the top surface of the posts

2.1.14.2. The rest of horizontal timber elements evenly spaced in such a way that the bottom surface of the bottom horizontal element shall be around 25-30cm above ground level

2.1.15. The fence structure shall be erected using galvanized steel fixings such as nuts, bolts, washers and other carpentry fittings

2.1.16. Use of nails is forbidden.

2.2. If the Contractor identifies that existing not used/ not operational infrastructure, installations and equipment shall be removed to enable installation and correct O&M of SSSB system and its supporting infrastructure, it is the Contractor’s responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.3. Provision and installation of new steel RF cabling manhole covers at the entry points to the COMMS building (executed only if the Contractor provides new sections of outdoor RF cabling for antennas and current EMP cable entry plate is not suitable for use for new SSSB system):

2.3.1. Locking mechanisms, such as a sliding locking bar that can be secured with a padlock to enable it to be secured when not in use.

2.3.2. The padlock, as the minimum shall meet following requirements:

2.3.2.1. Body made from hardened steel

2.3.2.2. Inner components made from non-corrosive materials

2.3.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.3.2.4. Precision, minimum 3-pin cylinder lock mechanism

2.3.2.5. Minimum 3 keys

2.3.2.6. Suitable for outdoor use, weatherproof

2.4. Provision and installation of SSSB electrical installation with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX F:

2.4.1. THN NL offers for reuse existing power distribution system including:

2.4.1.1. existing 2(two) power sockets of 63 A each (installed in the vicinity of planed location for new SSSB system so power cables (to be provided and installed by the Contractor) will be approximately 5m long for each SSSB rack)

2.4.1.2. indoor cable trays

2.4.1.3. should that existing installation be not suitable, require any modification and installation of additional items it shall be the Contractor's responsibility as stipulated hereafter below

2.4.2. Complete SSSB electrical installation, both indoor and outdoor, with dedicated EPDBs (Equipment Power Distribution Boards), including surge protection devices and residual current devices (RCD), required to power all equipment provided by the Contractor for SSSB project (including power distributed to antenna fields etc.)

2.4.3. Integration of the SSSB electrical installation with existing MPDB (Main Power Distribution Board) and other power panels as required:

2.4.3.1. The integration shall include installation of adequate circuit breakers, and modification of existing power distribution system and the power boards/ panels as required to connect power cables for SSSB electrical installation

2.5. Provision and installation of UPS system as stipulated in the SOW – ANNEX F.

2.6. Provision and installation of SSSB lightning protection and grounding system with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX F:

2.6.1. Complete SSSB lightning protection and grounding system, both indoor and outdoor (including surge protection devices, grounding rings (including buried, roof and mast mounted elements), grounding rods, lightning rods, trays, ducts and other ancillaries) required to protect all equipment provided by the Contractor for SSSB project (including antennas)

2.6.2. Integration of the SSSB lightning protection and grounding system with existing lightning protection and grounding system of the site according to respective THN laws and regulations:

2.6.2.1. The integration shall include execution of necessary earth works, welding, anticorrosive protection, and necessary modification of existing lightning protection and grounding system.

2.7. Removal and disposal of:

2.7.1. CODAN HF antennas will removed by THN NL. However, the Contractor is required to remove and dispose the foldable antenna masts, each 12 m height;

2.7.2. Any legacy / old racks are to be disassembled and stored indoors on site in a premises provided by THN NL;

2.7.3. all ducting, cabling, grounding, guyed lines, foundation, anchoring and other ancillaries related to the antennas and the antenna masts that are scoped for disposal.

2.8. Provision and installation of required number of new antenna masts capable of supporting the SSSB system and with all associated works (antenna field preparation, foundation, trenches etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX F.

2.8.1. The antenna masts and shall be designed for minimum service life of 30 years without the need for substantial maintenance

2.8.2. The antenna masts and shall be provided with cathodic protection system (including protection of the guy anchors) designed for minimum service life of 30 years without the need for substantial maintenance

2.8.3. The air obstacle lights will only be required when any of the new antennas is higher than existing 45m height antenna

2.9. Provision and installation of indoor sections of RF cabling of the length approximately 12 m for each SSSB rack, with associated cable trays, ducts etc:

2.9.1. Indoor, the Contractor shall install the RF cabling and connect it to new SSSB equipment at one end, and at the other end – connect it to existing RF cabling terminations at the inside of EMP shield

2.9.2. The new RF cables shall be installed in the existing cable trays to the maximum possible extent

2.9.3. Where necessary, the Contractor shall provide and install new sections of cable trays for RF cabling

2.10. Removal and disposal of the existing indoor coaxial cables.

2.11. Provision and installation of outdoor RF cabling and power cabling for antennas:

2.11.1. THN NL offers for reuse existing RF cabling.

2.11.2. The Contractor shall modify the existing outdoor RF cabling terminations (for example by providing and installing outdoor RF cabling extensions (approximate length of the required extensions: 70m for each antenna) with all required ancillaries and related civil works such as earthworks, ducting, piping, backfilling etc.) required for new SSSB antennas

2.11.3. The power distribution, grounding connections and the location for new indoor SSSB equipment (that shall be provided by the Contractor) is within Electromagnetic Pulse (EMP) protected enclosure. Therefore, any works conducted by the Contractor shall not degrade integrity/ effectiveness of the existing EMP protected enclosure.

2.11.4. In case it is not possible to reuse existing outdoor RF cabling following activities shall be included in the scope executed by the Contractor:

2.11.4.1. Dismantling and hand-over to THN NL of redundant RF cabling

2.11.4.2. Installation of new RF cabling with associated earthwork, backfilling, ducting, trays, and marking of the cable runs in the terrain.

2.11.4.3. Provision and installation of required manholes including the manhole to accommodate cable entry into the building via EMP shield

2.11.4.4. All cables leaving or entering the EMP protected area shall be routed through the existing EMP cable entry panel.

2.11.4.5. Provision and installation of new steel RF cabling manhole cover(s) at the entry points to the COMMS building

2.12. Provision and installation of safety marking and labelling, both indoor and outdoor, for all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX F.

2.13. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.13.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.13.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.14. All metal works exposed to outdoor environment such as antenna masts with their ancillaries, cable trays and ladders, fences, gates, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5M Maritime, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.15. When designing and erecting fences and masts with all associated ancillaries, the Contractor shall take into account wind load imposed by winds of min 190 km/h speed, without ice formation.

2.16. Supporting Civil Works:

2.16.1. Rebuilding of pavements after pipe, cabling, ducting and other installation works.

2.16.2. Associated earthworks and backfilling, drilling for the pipes, cabling, ducting and other installation works.

2.16.3. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting and other installation works.

2.16.4. Water, sound and fire insulation as required in all areas affected by the Contractor works.

IFB-CO-15577-SSSB-AMD3

NATO Communications and Information Agency

NCI AGENCY

BOOK II

PART IV – STATEMENT OF WORK

SOW - ANNEX G

SYSTEM REQUIREMENT SPECIFICATIONS (SRS) - TECHNICAL (GREECE)

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Introduction

1.1 Overview

The Ship-Shore-Ship-Buffer (SSSB) system is a real-time digital link buffer system supporting the exchange of tactical information between the NATO Air Defence Ground Environment (NADGE) system, Airborne Early Warning (AEW) systems and Naval Forces through the use of NATO data Link-1, Link 11, Link 11B and Link 22. This is illustrated in Figure 1:

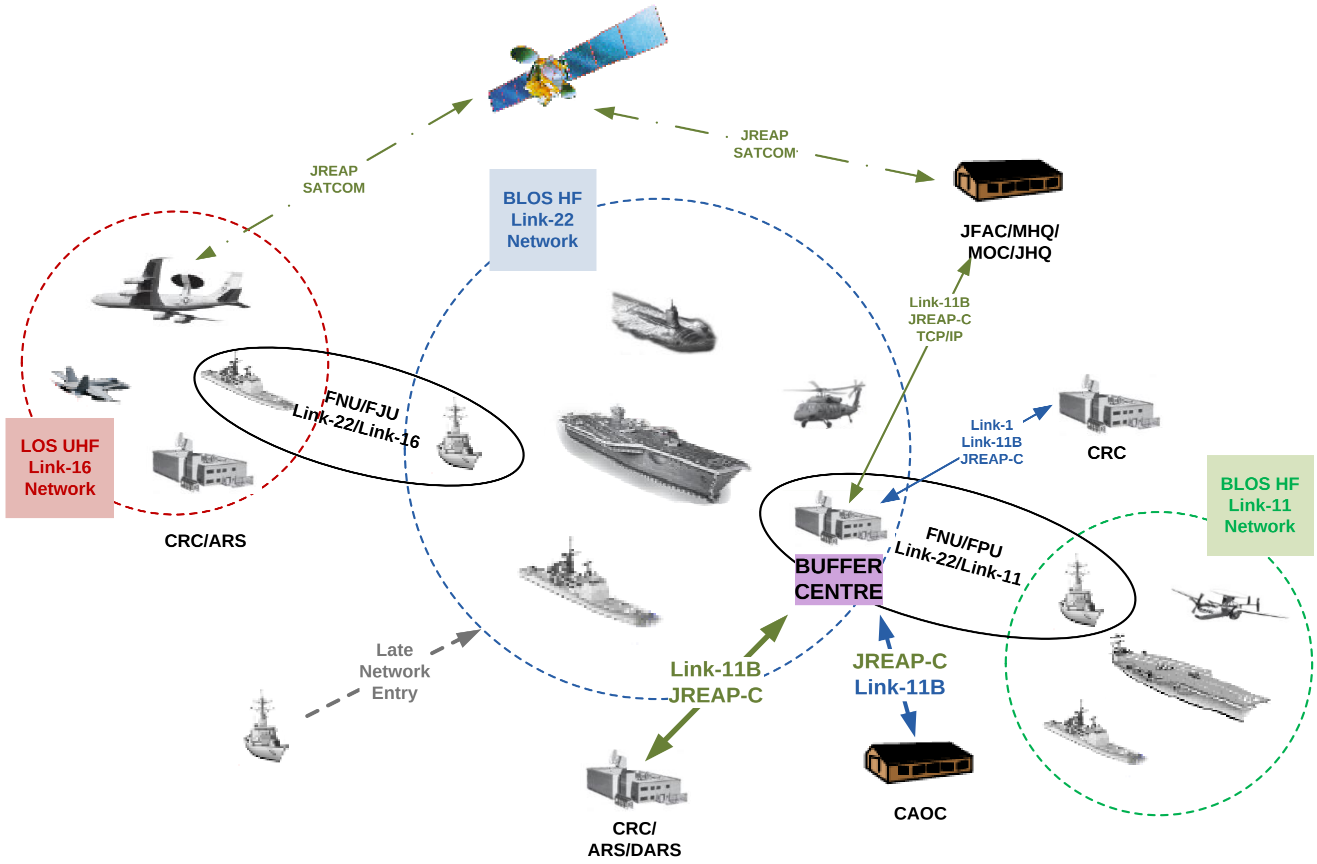

Figure 1: Tactical data exchange layout.

The SSSB system is organised in three sub-systems, see **Error! Reference source not found.**:

Radio Network Communication: Provided by several radio sites.

Command and Control:

a. Tactical Data Link Processing and Presentation, provided at the main and remote SSSB Control Centre.

b. Distributed Radio Control and Management of the communication equipment, provided at all sites.

Signals Transport: Transport of digital and analogue signals:

c. Co-located Radio Sites, where HF-TX, HF-RX and UHF components are located within the same compound.

d. Non-Colocated Radio Sites, where HF-TX, HF-RX and UHF components are partly or fully separated, but located in the same area. The distances between the components can vary.

1.2 Purpose

1.2.1 The purpose of the SSSB system is to provide communication between Maritime and Airborne Early Warning (AEW) units and their Command and Control Centre, located at the Buffer Centres.

1.2.2 The SSSB-UK-GR-NL project aims at providing the Territorial Host Nation of Greece (THN) with a SSSB system that is planned to upgrade the existing SSSB system within Greece.

1.2.3 The purpose of this document is to specify the system requirements for the SSSB-UK-GR-NL System as depicted by **Error! Reference source not found.** below, and consisting of:

a. Six SSSB Radio Sites, HF-TX/RX/UHF Sites at Kartsinoudi, Limnonari and 7th Air Force Radar sites on the island of Skyros, Mavros and Sideros sites on the island of Crete and a new site on the island Kythira connected to Buffer Centres at ARS Larissa, CRC Panis and CRC Ziros (Crete), shall be implemented by the Contractor (see

b. Figure 2 to Figure 9). The distances between the SSSB sites are shown in Figure 10.

c. The GRC National Defence Network (NDN) for the transport of the signals between the Buffer Centres at ARS Larissa, CRC Panis and CRC Ziros (Crete) and the six Radios Sites at Sites at Kartsinoudi, Limnonari and 7th Air Force Radar sites on the island of Skyros, Mavros and Sideros sites on the island of Crete and a new site at Naval Entity (NE) 47 on the island Kythira.

d. The National Defense Network (NDN) will be provided by the Host Nation.

1.2.4 Radio Sites

a. The Radio Sites at Kartsinoudi, Limnonari, Mavros and Sideros are already existing SSSB COMMS Sites, which have to be upgraded/renewed.

b. The existing operational functionality has to be kept till the SSSB Final System Acceptance to assure operational continuity.

c. The Radio Sites at 7th Air Force Radar Station and Naval Entity 47 are military sites without any existing SSSB functionality. This site will become new SSSB COMMS sites.

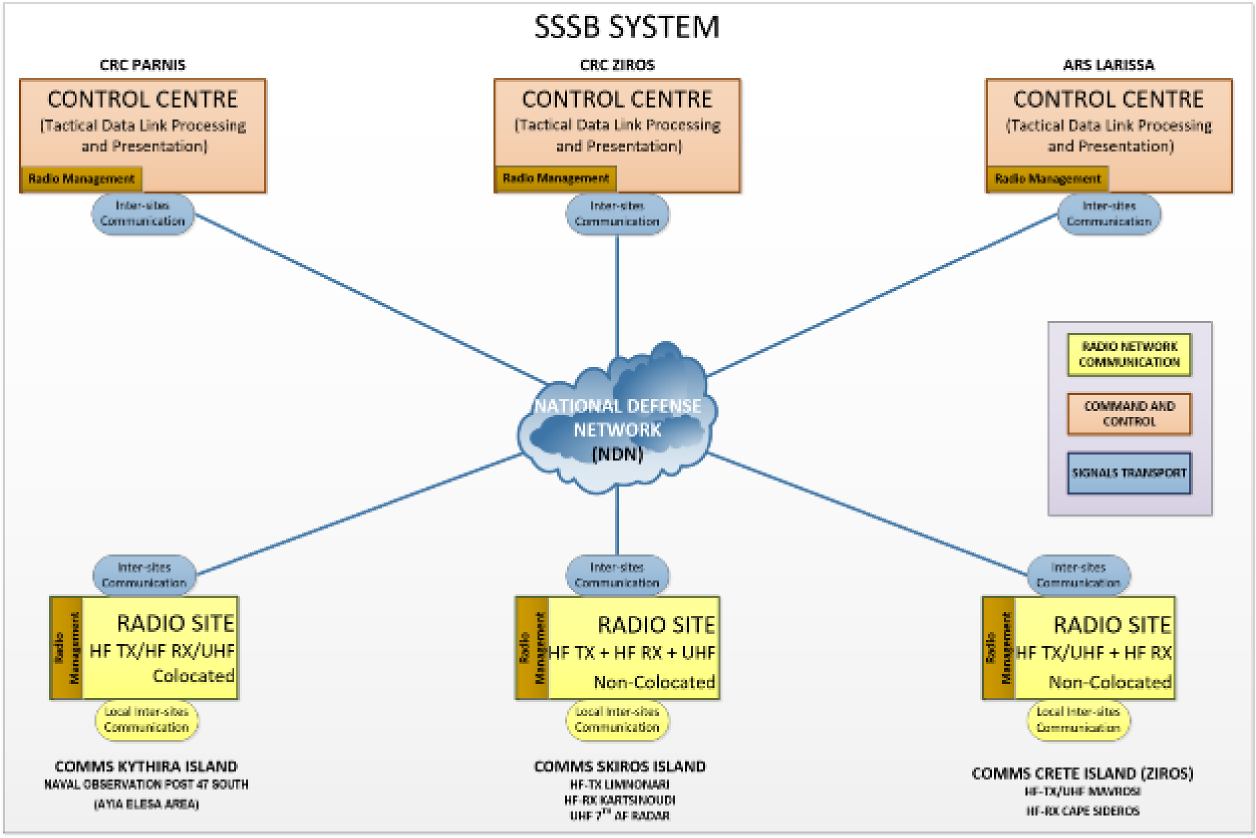

Figure 2: GRC Buffer Centres and TX/RX/UHF COMMS locations.

Figure 2: GRC Buffer Centres and TX/RX/UHF COMMS locations (less Crete)

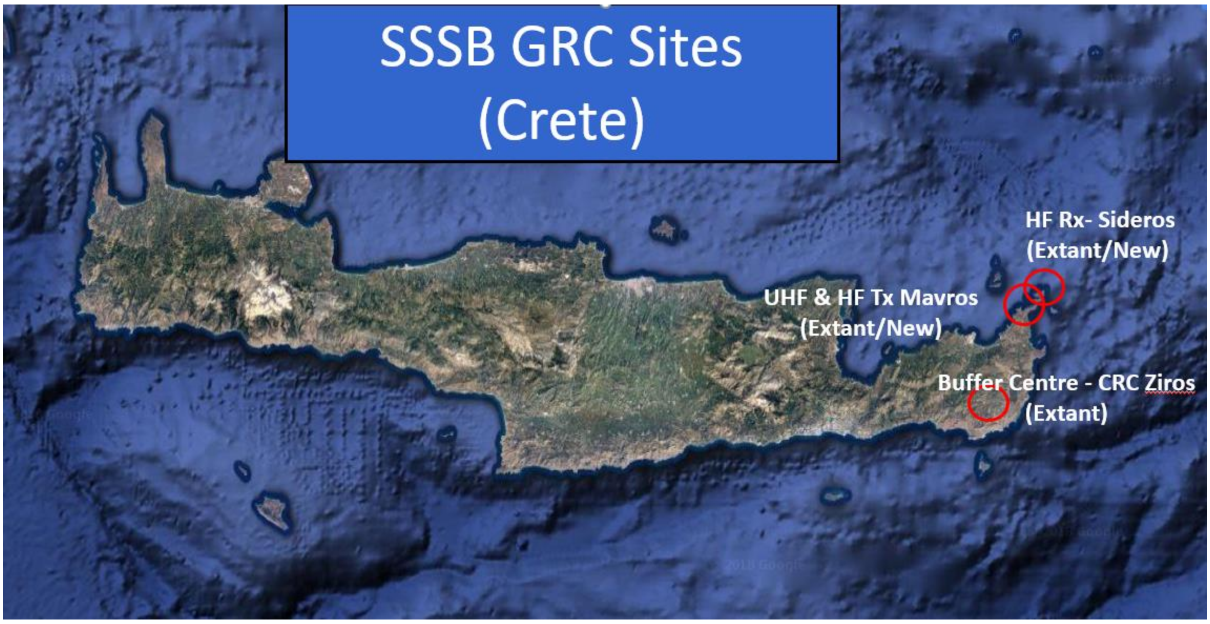

Figure 3: GRC Buffer Centres and TX/RX/UHF COMMS locations (Crete)

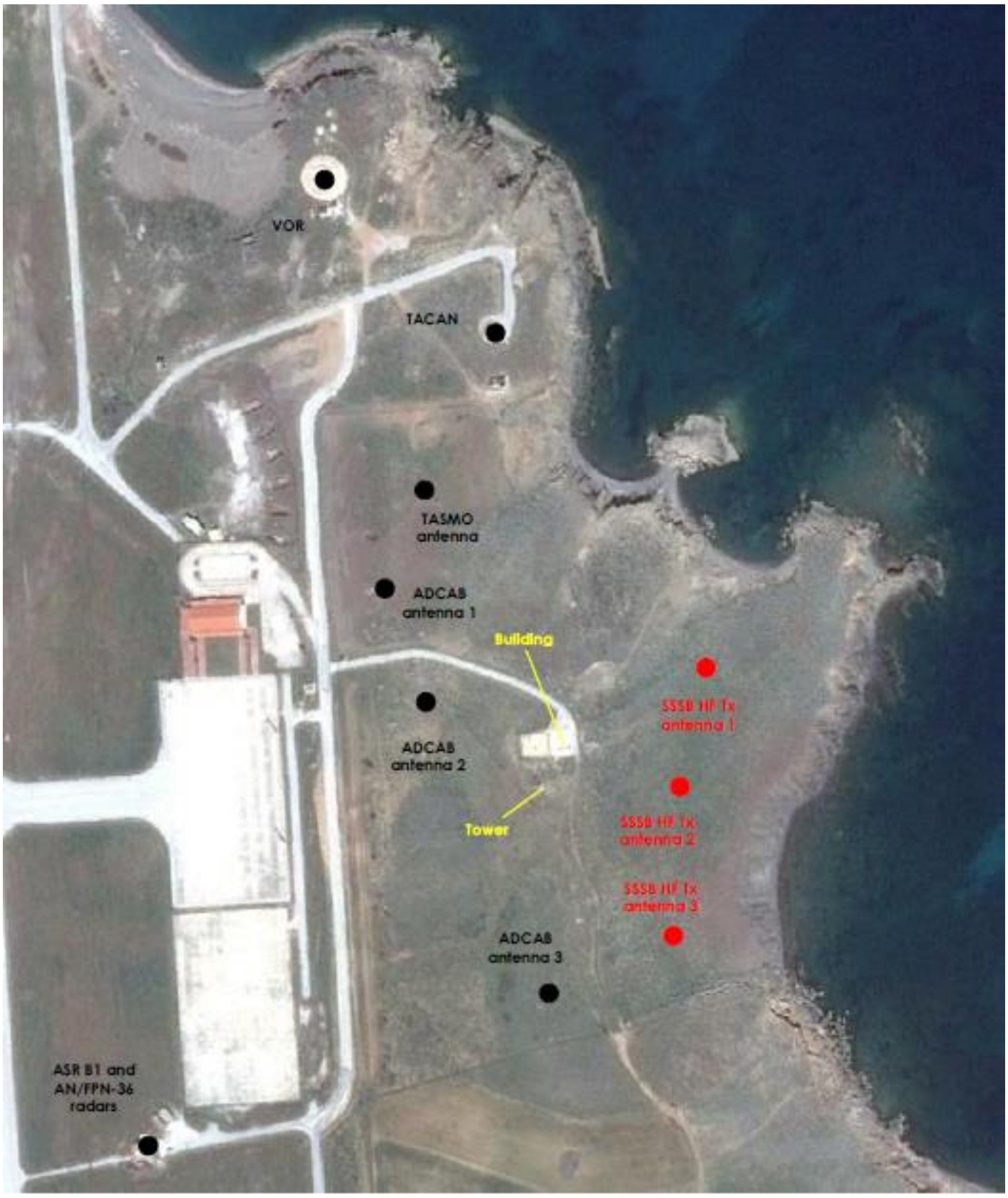

Figure 4: HF-TX Site Kartisinoudi (Skyros Island) – Current Site Configuration

Figure 5: HF-RX Site Limnonari (Skyros Island) – Current Site Configuration

Figure 6: New UHF Site 7th Air Force Radar Station (Skyros Island)

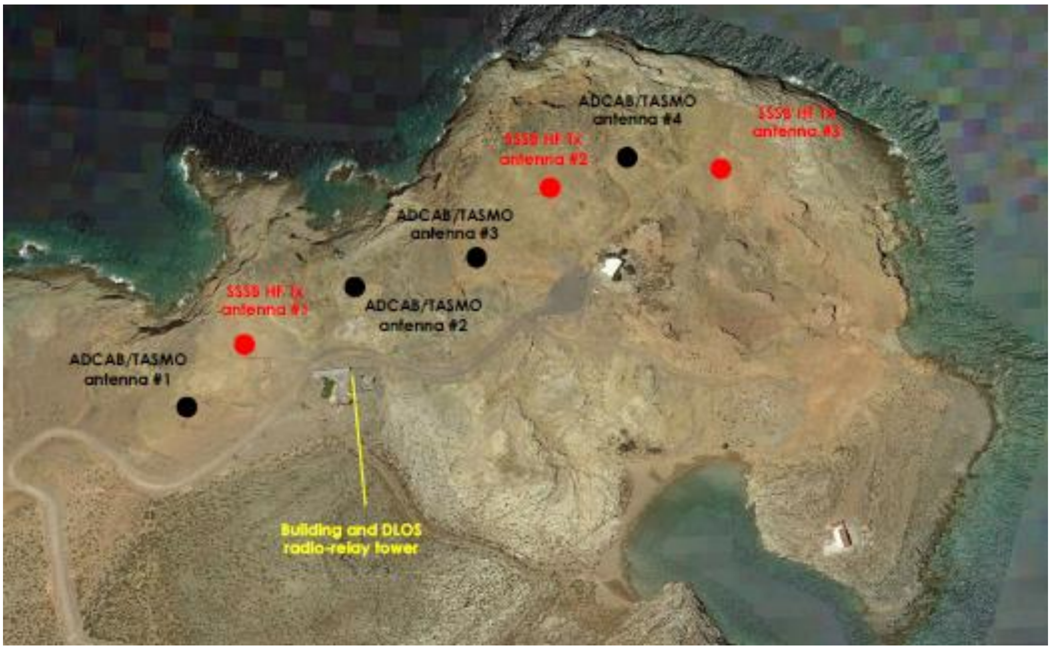

Figure 7: HF-RX site Cape Sideros (Crete Island) Current Site Configuration

Figure 8: HF-TX/UHF site Cape Mavros (Crete Island) Current Site Configuration

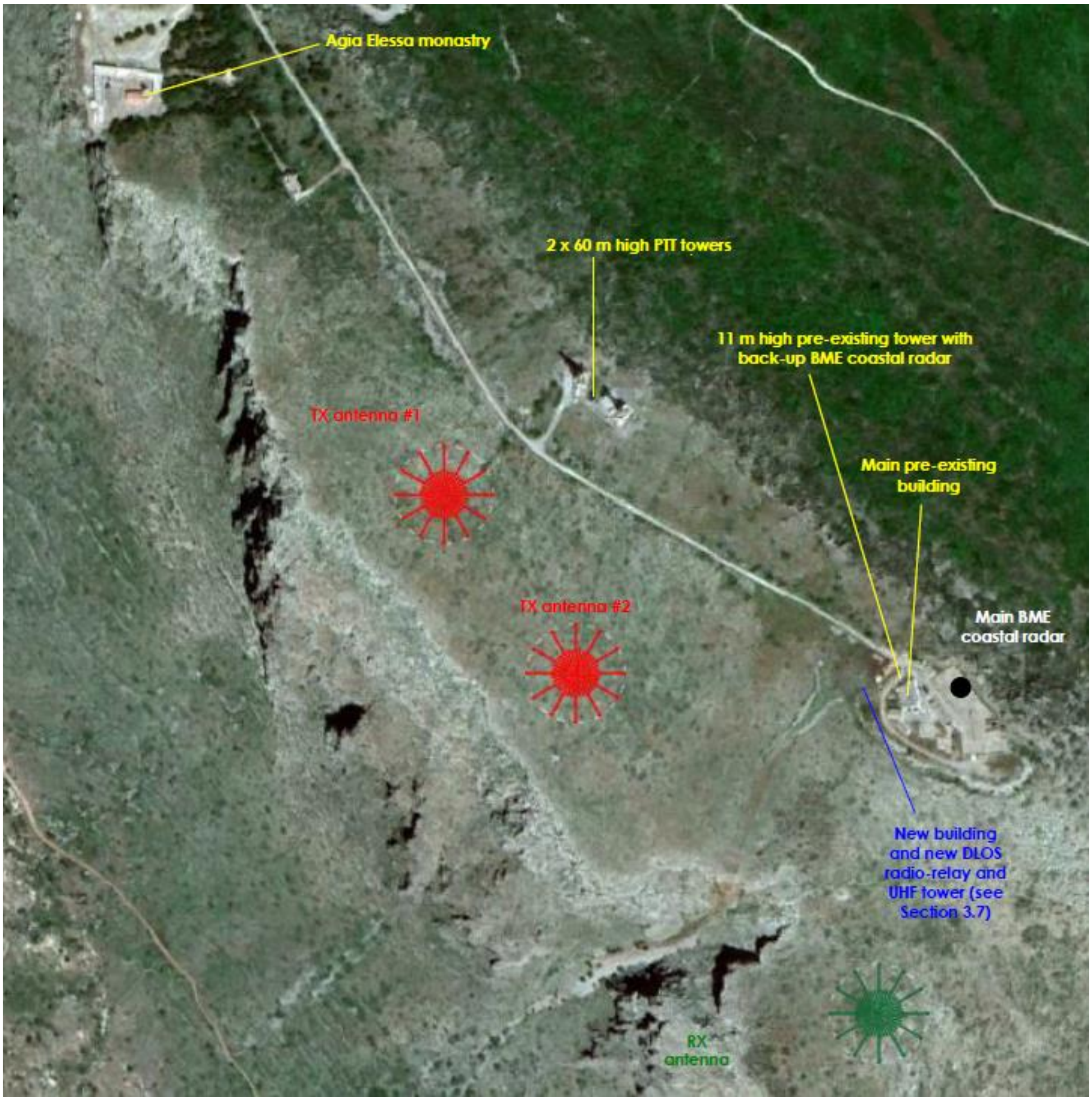

Figure 9: New HF TRX/UHF site Naval Entity (NE) 47 (Kythira Island)

LOS Distances Km Elev (m)			1	2	3	4	5	6	7	8
			Kartsinoudi (Skyros)	Limnonari (Skyros)	7th AF Radar (Skyros)	Sideros (Crete)	Mavros (Crete)	NE 47 (Kythera)	ARS Larissa	CRC Ziros (Crete)
1	15	Kartsinoudi (Skyros)	X	25	7	437	440	340	208	459
2	28	Limnonari (Skyros)	25	X	18	414	416	330	230	437
3	187	7th AF Radar (Skyros)	7	18	X	432	433	316	215	453
4	22	Sideros (Crete)	437	414	432	X	8	316	600	32
5	139	Mavros (Crete)	440	416	433	8	X	311	600	25
6	104	NE 47 (Kythera)	340	330	316	316	311	X	391	313
7	131	ARS Larissa	208	230	215	600	600	391	X	615
8	809	CRC Ziros (Crete)	459	437	453	32	25	313	615	X

Figure 10: Distances between SSSB Site locations (*Km*), Site elevations (*m*).

1.2.5 Radio Sites will consist of:

a. Site Monitoring System (SMS), providing the site status/alerts and equipment alerts.

b. Radio Communication Equipment. To be installed at the Radio Site and dedicated to the Ship-Shore-Ship communication in HF (BLOS) and in UHF (LOS) in the Link 11 and Link 22 mode for the Tactical Data exchange and in Voice mode for the operators' coordination; see Figure 11 to Figure 16.

1.2.6 Radio Management (local) Equipment. Equipment consisting of computers and interface concentrators to provide control of communication devices as follows:

a. The Radio Sites include one Low-Level Controller computer (LLC), one serial line concentrator (multi-serial), one network switch and one network router; see Figure 11 to Figure 16.

b. The HF-TX/UHF Site includes also a Radio-Over-IP (RoIP) converter (Narrow-Band/Wide-Band Gateway) for secure and non-secure Voice Coordination functions; see Figure 11, Figure 13, Figure 14 and Figure 16.

1.2.7 Data Link Equipment. Equipment consisting of Data Terminal Set (DTS) / Signal Processing Controller (SPC), Remote Versatile Link Interface (VLI/R) to provide Link 11 signal interface; see Figure 11 to Figure 16.

1.2.8 Automatic Identification System (AIS) receiver and a dedicated antenna for the reception of information. The AIS receivers in general are placed where HF-TX capability is provided. Final decisions on site placement will follow the best LOS position for the AIS receiver.

1.2.9 Inter-site Communication:

a. Distributed system dedicated to the connection between the Radio sites and between the Radio sites and the Buffer Centres.

1.2.10 The Buffer Centres are dedicated to the six Radio Sites for:

a. Translation of the Link 11 and Link 22 protocols into Link-1, Link 11B and JREAP-C in accordance with STANAG 5511, STANAG 5522, STANAG 5601, STANAG 5616, STANAG 5518 (latest revisions). Presentation of the Air, Surface and Subsurface tactical picture. Processing of the Automatic Identification System (AIS) Receive-Only information.

b. Radio Management (remote).

c. Management of the VOICE Co-ordination of the Link 11/Link 22 data links.

d. Providing secure data encryption of Link 11 (COMSEC).

e. Providing secure data encryption of Link 22 (COMSEC).

f. Providing secure voice encryption for HF (COMSEC).

g. Providing secure voice encryption for UHF (COMSEC).

h. Providing Link 22 ECM-resistant (EPM) capability.

i. Providing ECM-resistant communications for UHF Voice (EPM Functionality - SATURN).

j. Monitoring of the status operations of infrastructure and equipment.

1.2.11 The overall responsibility of the implementation of the SSSB-GRC system lays with the NCI Agency (the Purchaser), whilst the implementation of the three sub-systems is delegated to:

a. The Contractor for the implementation of six Radio Sites, of nine (9) DLOS microwave inter-site communication systems and for one Fibre Optic (F/O) land line.

b. The THN for the provision of the inter-connection land lines between the Buffer Centres and the Radio Sites (via the NDN).

c. The NCI Agency for the implementation of the SSSB Buffer Control Centres (BCC) at ARS Larissa, CRC Panis and CRC Ziros.

1.3 Scope

1.3.1 The overall SSSB project consists of the following phases:

1.3.2 Phase 1:

1.3.3 General Civil Works, by the HN Contractor, for the Radio Sites, including buildings (including new build at NE47 on Kythira), electrical power supplies, HVAC, etc.

1.3.4 Phase 2:

a. A - Radio Communications and inter-sites communications, including associated equipment and civil works, by the Contractor, within scope of this Contract

b. B - Land Inter-sites Communications, by the THN

c. C - Command and Control system at the SSSB Buffer Centres by the NCI Agency

1.3.5 Phase 1: The Contractor shall implement the Civil Works portion of the SSSB at the sites at Kartsinoudi, Limnonari and at 7th Air Force Radar on the island of Skyros, Mavros and Sideros sites on the island of Crete and at Naval Entity (NE) 47 on the island of Kythira (this shall be a new build).

1.3.6 Phase's 2.A, 2.B and 2.C: Execution shall be co-ordinated, between the Contractor, the THN and the Purchaser, respectively NCI Agency.

1.3.7 The Contractor shall implement the Radio Communications portion of the SSSB project with the installation of the HF-TX/RX/UHF Sites at Kartsinoudi, Limnonari and 7th Air Force Radar sites on the island of Skyros, Mavros and Sideros sites on the island of Crete and a new site on the island Kythira within Phase 2.A.

1.3.8 In addition, the Contractor shall provide technical support to the THN and the Purchaser for phases 2.B and 2.C.

1.3.9 The technical support, to be provided by the Contractor, is to consist of, but not be limited to the following:

a. Assisting the THN and the Purchaser in the final identification of the number and characteristics of signals to be transported between the Sites;

b. Assisting the THN and the Purchaser in the integration and testing phases by generating the signals to be transported between the Sites;

c. Assisting the THN and the Purchaser in the overall system integration and testing phases. In the operation of the Radio Management System (RMS) from the Buffer Centres, local sites and verification of the correct transport of the signals between the sites and Buffer Centres.

1.4 Purchaser Furnished Equipment (PFE)

1.4.1 To allow the Contractor to complete the implementation of the Radio Sites a number of equipment is provided as PFE.

1.4.2 The PFE equipment/system provided for the technical integration of the SSSB is:

a. Radio Management Equipment, (See Para 1.4.5)

b. Versatile Link Interface, (See Para 1.4.6)

c. Narrowband/ Wideband Voice over IP Gateway, (See Para 1.4.7)

d. Advanced Link Analysis Module (ALAM), (See Para 1.4.8)

e. Time of Day (TOD), (See Para, 1.4.9)

1.4.3 PFE Specifications

1.4.4 The PFE specifications and characteristics are described below.

1.4.5 Radio Management:

a. Radio Management Console (RMC) - based on the SSSB Open System Communication Control (OSCC) Low Level Controller (LLC)

1.4.5.1 The RMC is the operator's interface to the Radio Management Sub-System (RMSS) and is part of the RMSS.

a. Provided to the Contractor as PFE

1.4.5.2 Operational requirements:

i. The RMC is implemented at all Radio Sites and the Buffer Centres.

ii. The RMC is mainly operated from the Buffer Centres, but can also be operated locally at the radio sites, to allow COMMS management, maintenance and site monitoring of all modalities, including Link 11/Link 22 Data.

1.4.5.3 Operational functions:

i. Local and remote control of the installed equipment for:

ii. Power up/down

iii. Mode selection

iv. Frequency selection

v. Power level selection, where applicable

vi. BITE

vii. Status monitor

viii. Services – Equipment allocation

ix. Access to the Local and Long Haul Networks for telephone communication between the Sites and the Buffer Centres.

x. PSTN (Public Switching Telephone Network) access

xi. And other functionalities not listed here.

xii. For all COMMS equipment, which needs to be controlled by the RMC, the NCI Agency will develop new drivers/modules. The contractor shall provide the ICDs for all devices to NCI Agency having a control interface.

1.4.6 The Versatile Link Interface is a media converted between NTDS/ATDS interfaces to IP interface in accordance with:

a. MIL-STD-1397

b. ISO-8877

1.4.7 Narrowband/ Wideband Voice over IP Gateway provided to the Contractor as PFE is as follows:

a. The NB/WB Gateway provides signaling information transport for unsecured voice via IP between the SSSB Radio sites and the Buffer Centres SSSB Operator position.

1.4.7.1 The NB/WB Gateway can:

i. Transport analog Unsecure Voice via IP (bi-directional)

ii. Transport radio PTT signal via IP

iii. Handle digital signals

iv. Handle VoIP streams

v. Provide standard serial interface for radios

1.4.8 The Advanced Link Analysis Module (ALAM) analyses Link 11 and Link 22 audio signals and quantifies their quality.

1.4.9 Time of Day (TOD)

c. TOD-HQ, GPS, military grade, SAASM, incusive the. antenna

SECTION 2 SSSB System Requirements

2.1 Operational Dependence

2.1.1 The SSSB System is operationally dependent on the Buffer Centres at ARS Larissa, CRC Panis and CRC Ziros.

2.2 Connectivity

2.2.1 The inter-site connections between the Buffer Centres and the six Radio Sites shall be implemented via the GRC National Defence Network (NDN).

2.2.2 There shall be a main connection between the Buffer Centres and the radio sites, via the NDN.

2.2.3 There shall be fallback (backup) connection between all SSSB sites.

2.3 Standardisation

2.3.1 In order to allow interoperability of the HF/UHF radio elements the Contractor shall respect the technical prescriptions contained in the following, (but not limited to) NATO and Military Standards:

a. STANAG 5511 TACTICAL DATA EXCHANGE – LINK 11/11B, Ed. 9, January 2016, NATO UNCLASSIFIED

b. STANAG 5501, Tactical Data Exchange – Link 1 (Point-to-Point), Ed. 7, NATO UNCLASSIFIED

c. STANAG 5601, "Standards for Interface of NATO Data – Links 1, 11, 11B and 14 Through a Buffer", edition 7, January 2014, NATO UNCLASSIFIED

d. STANAG 5501, Tactical Data Exchange – Link 1 (Point-to-Point), Ed. 7

e. MIL-STD-1397C(SH), "INPUT / OUTPUT INTERFACES, STANDARD DIGITAL DATA,NAW SYSTEMS", 1 June 1995, UNCLASSIFIED.

f. STANAG 5522 NATO IMPROVED LINK ELEVEN (NILE) - LINK 22, Ed. 5, January 2016, NATO UNCLASSIFIED.

g. NG-278-A011-LLCIRS, Interface Requirements Specification (IRS) for the Link-Level COMSEC (LLC) segment of the Link 22 (NILE) System, NILE PMO, 28 July 2016.

h. NG-278-A011-SPCSS, Segment Specification for the Signal Processor Controller (SPC) of the Link 22 (NILE) System, NILE PMO, 28 July 2016.

i. STANAG 5518, JOINT RANGE EXTENSION APPLICATION PROTOCOL (JREAP. Ed, 4,26-Apr-2019, NATO UNCLASSIFIED.

j. STANAG 4372 Ed 3
SATURN – A fast frequency hopping ECCM mode for UHF radio

k. ITU-R M.1371-4, Technical characteristic for an Automatic identification system using time-division multiple access in the VHF maritime mobile band, 04/2010

l. NMEA 0183, Standard for Interfacing Marine Electronic Devices.

m. RFC 2833 RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals (VoIP)

n. RFC 3261 Session Initialization Protocol (SIP) (VoIP)

o. RFC 3350 Real Time Protocol (RTP) (VoIP)

p. RFC 3351 Real Time Protocol (RTP) (VoIP)

q. EUROCAE ED 137 (RoIP)

r. MIL-STD-188-203A, Interoperability and Performance Standards for Tactical Digital Information Link (TADIL) A, 8 January 1988.

2.3.2 The Contractor shall implement the Radio Communications System (RCS) and associated equipment and Civil Works in compliance with the governing THN electrical standards.

2.3.3 The Contractor shall implement the RCS and associated equipment and Civil Works in compliance with the Low Voltage Directive 2006/95/EC and/or THN equivalent.

2.4 Design requirements

2.4.1 In order to remove the impact of long haul lines delay in the Link 11 “DTS Split” configuration, the Contractor shall implement Link 11 using “Local DTS” configuration at the Radio Site (RS) and the NATO Versatile Link Interface (VLI) architecture between the Buffer Centres and the Radio Site (RRS) (see paragraph 5.1).

2.4.2 The Contractor shall dimension the system to allow implementation of the Tactical Data Link 22 service. The Link 22 service will use the existing Link 22 radios via the Link 22 modem (SPC).

2.4.3 The Contractor is to design the system in order to allow remote control of operational commands and manual control of maintenance commands. In the design and implementation of the automation and the remote control systems the following criteria shall be used:

a. The TX Radio Site at Kartsinoudi (Skyros) will not be manned.

b. The RX Radio Site at Limnonari (Skyros) will not be manned.

c. The UHF Radio Site at 7th AF Radar Site (Skyros) will not be manned

d. The TX/UHF Radio Site Mavros (Crete) will not be manned.

e. The RX Radio Site at Sideros (Crete) will not be manned.

f. The TX/RX/UHF Radio Site on Kythira will be manned

2.4.4 For the PFE sub-system for control and management of the communication equipment the Contractor shall provide the technical documentation and support to the purchaser in the configuration and customisation of the sub-system in relation to the communication equipment delivered by the Contractor.

2.4.5 The Data Link Equipment (DLE) and the RMSS will be provided to the Contractor as PFE six (6) weeks before the Factory Acceptance Test (FAT). The FAT is the last stage before commencing the on-site implementation activities. The handover of the PFE will allow the Contractor to be autonomous and independent in the implementation and the implementation verification of the six Radio Sites.

2.4.6 At the FAT the contractor shall provide fully equipped and fully integrated racks for the six radio sites (including PFE, radio and COMMS equipment and full applied wiring).

2.4.7 The FAT shall cover Voice and Data signal verification, equipment test, wiring test and SSSB functional test of the all RRH sites systems. The interconnection wiring between the racks shall represent a one-to-one wiring replication as integrated at the radio sites.

2.4.8 Local and remote COMMS control capability verification shall be part of the FAT, where the RMSS shall be used to prove the remote control capability. Local control capability shall be proven using the individual device control user interfaces.

2.4.9 A functional test of the Site Monitoring System (SMS) shall be included in the FAT.

2.4.10 It is the Contractor’s responsibility to test the integration of the Contractor-provided equipment with relevant equipment, elements and systems provided as PFE and demonstrate that both the Contractor’s equipment and PFE are compatible and function correctly as stipulated SOW Section 3 and described in the enclosed document references.

2.4.11 The Contractor is also required to provide all the necessary support to the Purchaser and the THN for system integration and testing.

2.5 Operational Requirements

2.5.1 The fundamental requirement of the SSSB system is to implement a data exchange for:

a. Network Link 11 – TADIL A without degradation of the information content, as specified in Para 2.3.1 Ref. a, r.

b. Network Link 22 – NILE without degradation of the information content as specified in Para 2.3.1 Ref. f, g, h.

2.5.2 The integration of the Radio Sites with the SSSB BCC (at the Buffer Centres) shall allow air and naval surveillance of the Aegean Sea: in the HF frequency range with data Link 11/Link 22 mode and VOICE mode, up to 300 NM[1], and in the UHF spectrum up to 28 NM Ground-to-Ground and 150 NM Ground-to-Air.

[1] LINK-22 will also be supporting the Long Range waveform for distances up to 1000 NM.

Monitoring and control of communication resources will be delegated to the Buffer Centres.

2.6 Configuration of the SSSB System

2.6.1 The principle SSSB system sites are:

a. The Buffer Centres, located at ARS Larissa, CRC Panis and CRC Ziros which will be implemented by NATO NCI Agency.

b. HF-TX/RX/UHF Sites at Kartsinoudi, Limnonari and new UHF component at 7th Air Force Radar sites on the island of Skyros, Mavros and Sideros sites on the island of Crete and a new site on the island of Kythira, shall be implemented by the Contractor.

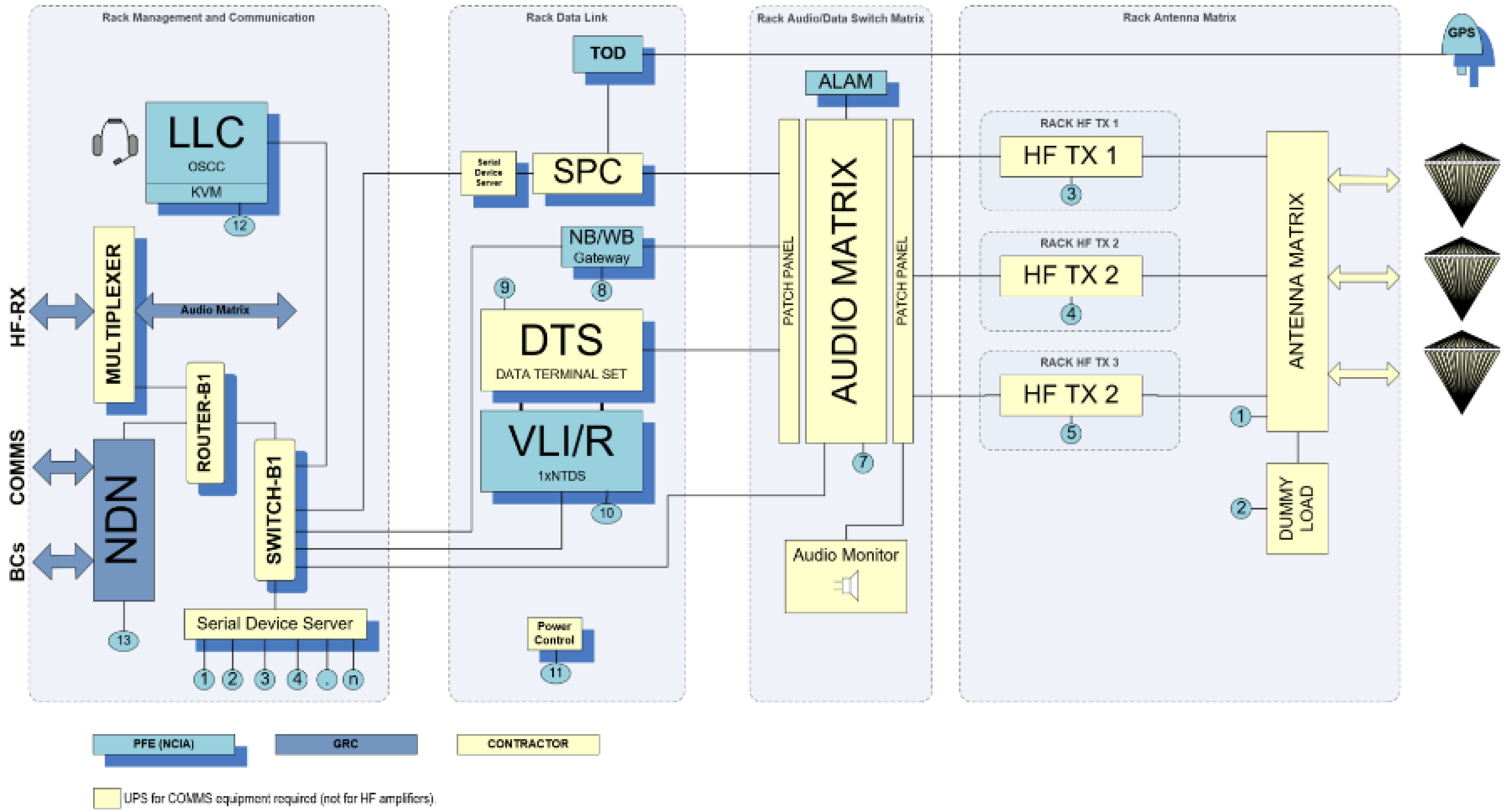

Figure 11: HF-TX Kartsinoudi (Skyros) Radio site block diagram

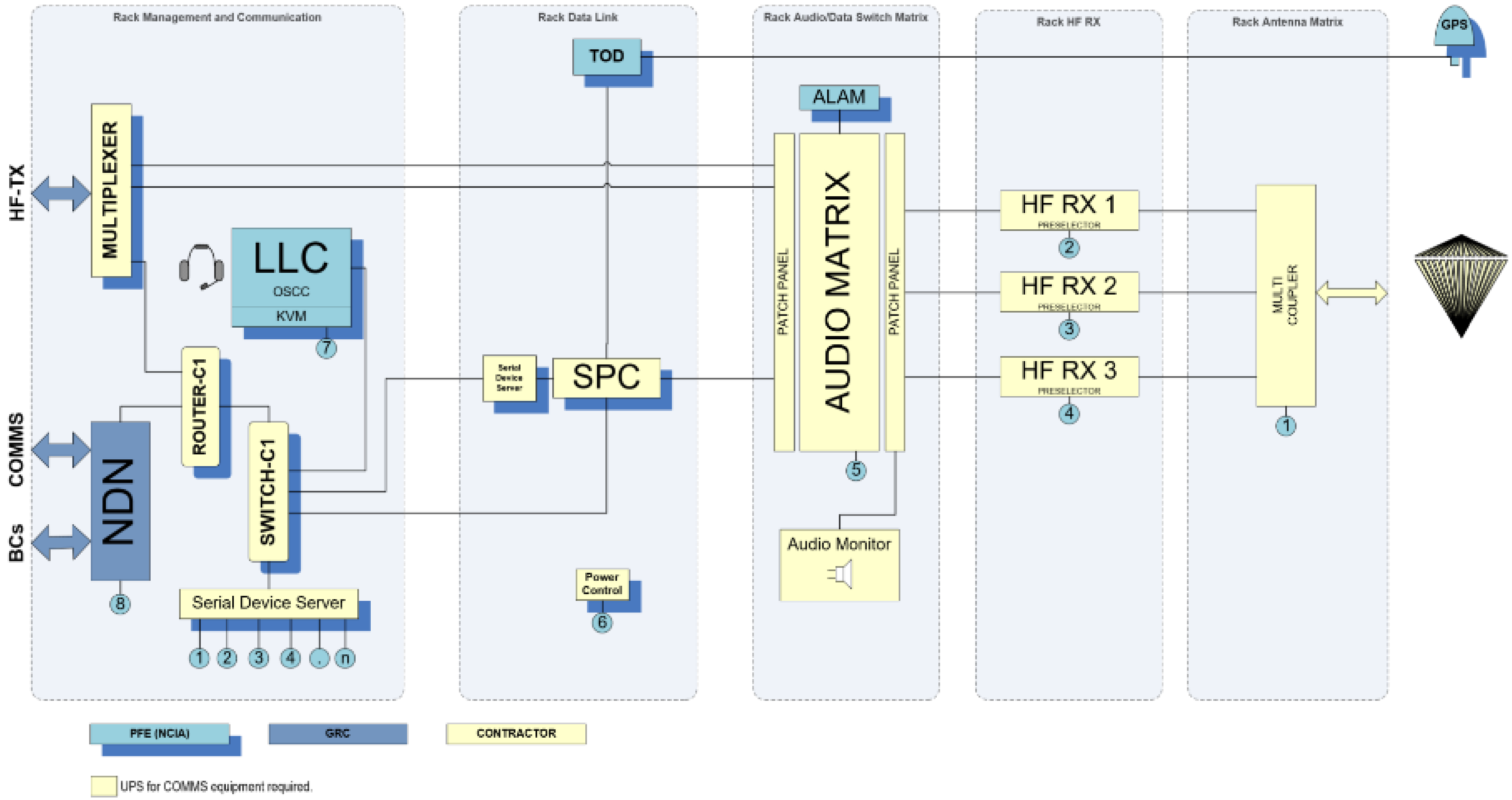

Figure 12: HF-RX Limnonari (Skyros) Radio site block diagram

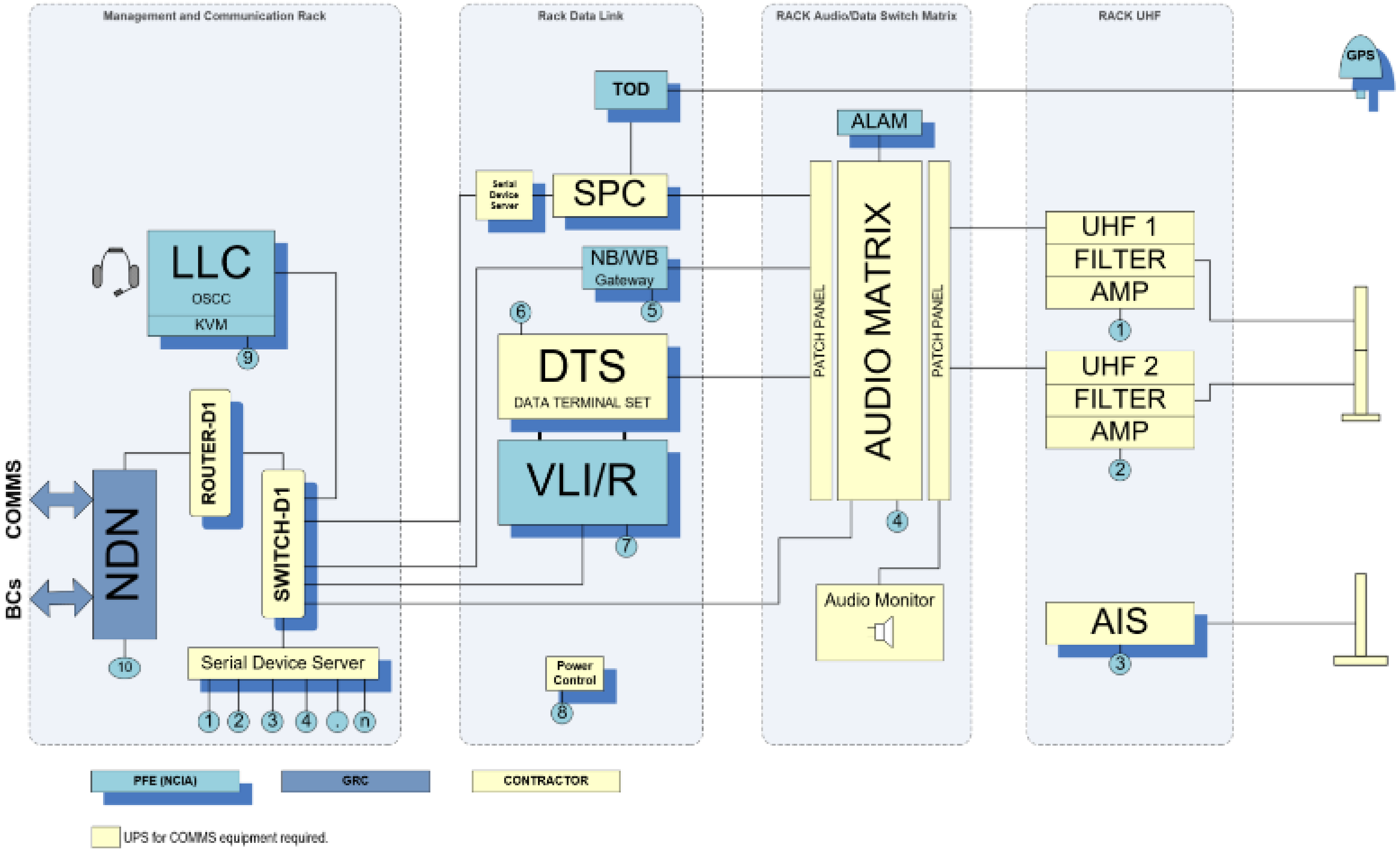

Figure 13: UHF 7th AF Radar Station (Skyros) Radio site block diagram

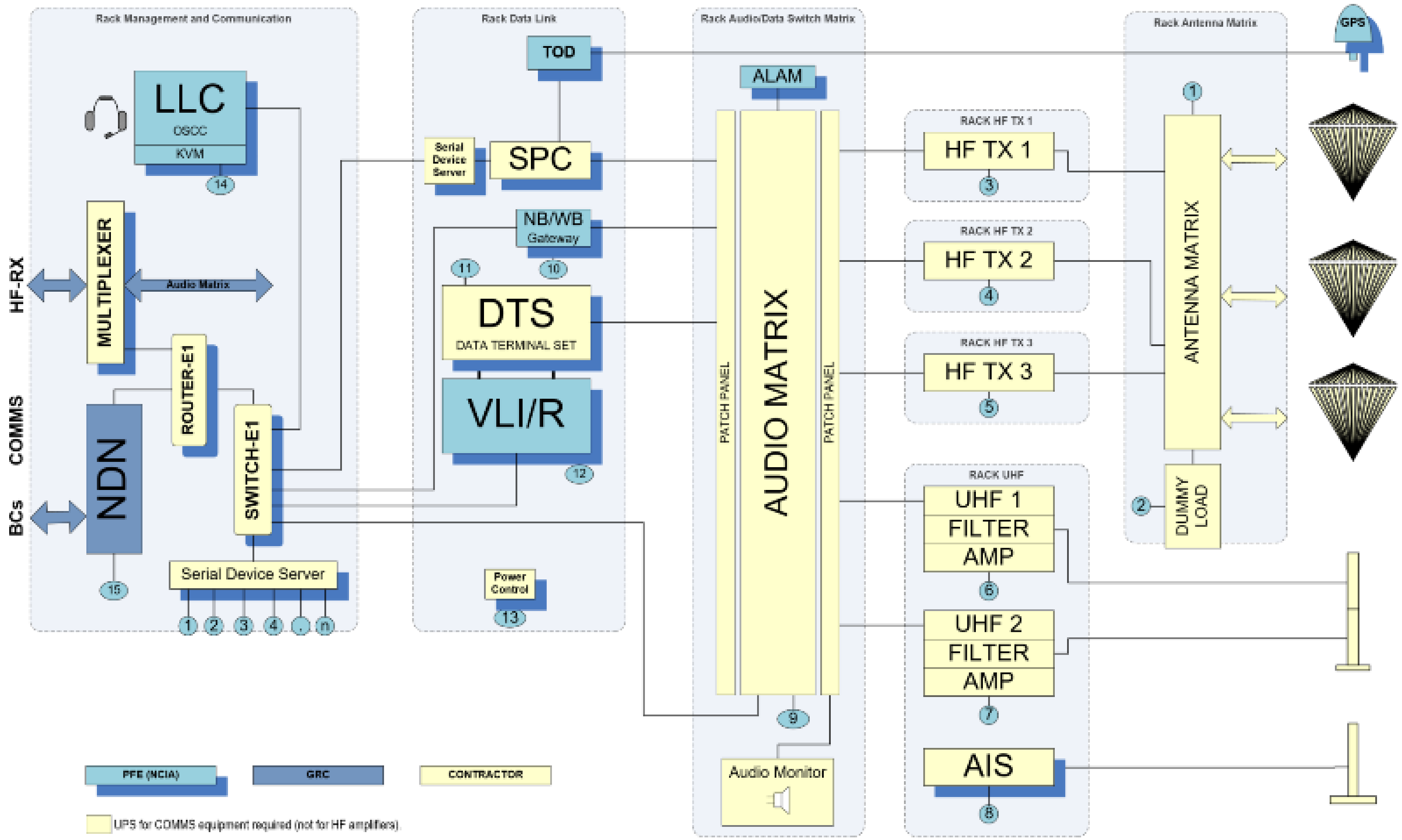

Figure 14: HF-TX/UHF Mavros (Crete) Radio site block diagram

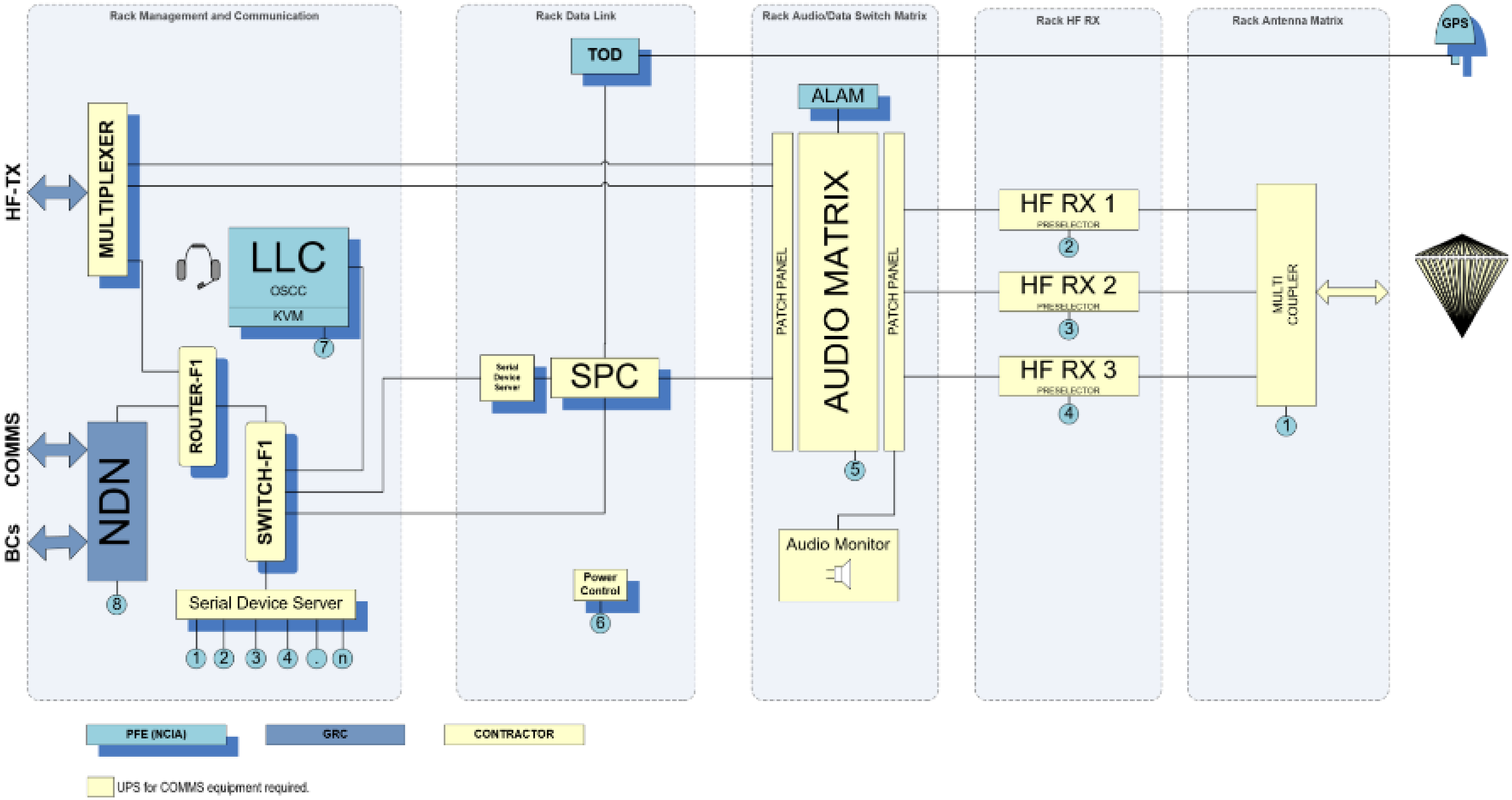

Figure 15: HF-RX Sideros (Crete) Radio site block diagram

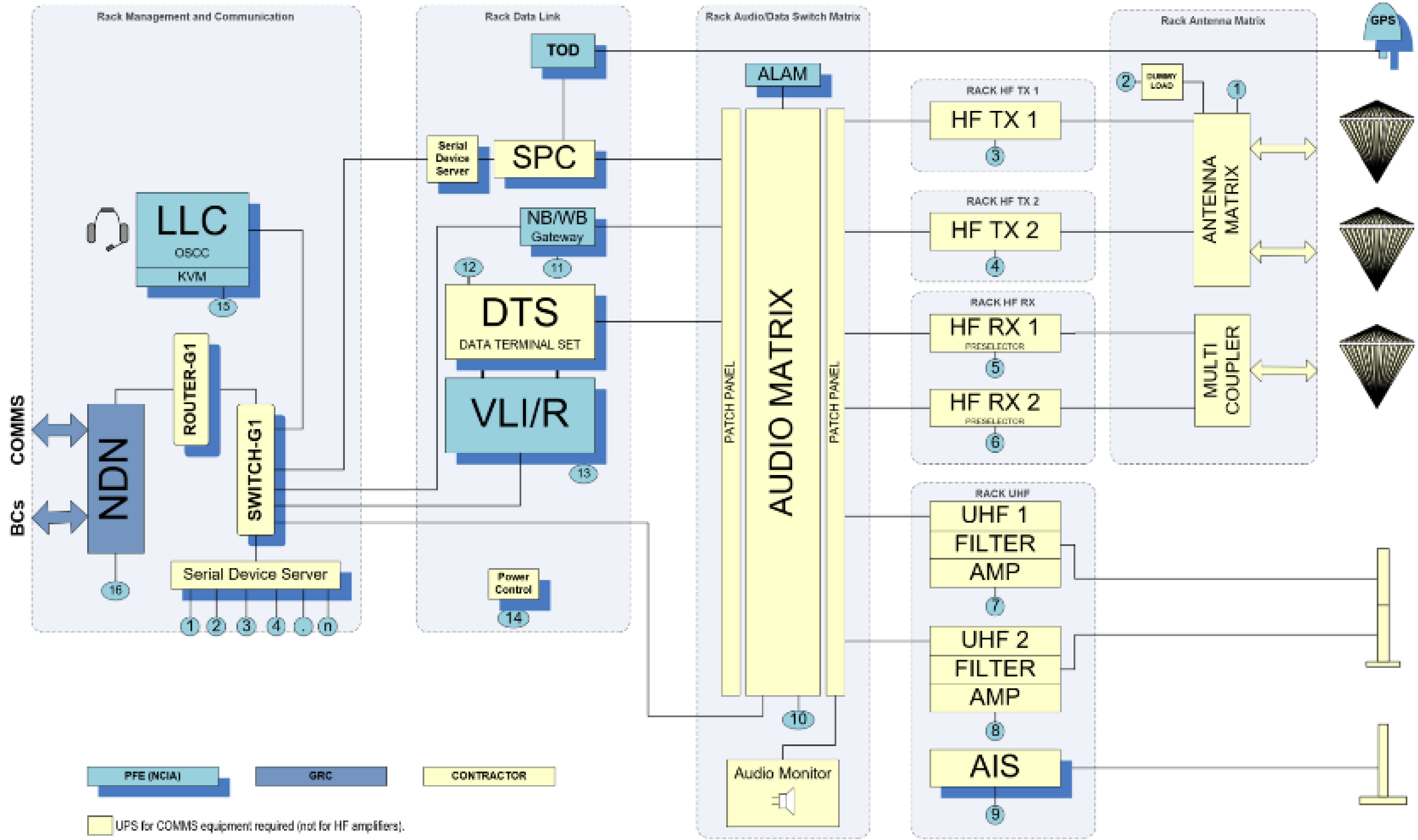

Figure 16: HF-RX/TX/UHF Kythira Radio site block diagram

2.7 Multichannel analysis of surface waves (MASW) / Cone Penetration Test (CPT) and Geotechnical Assessment Analysis

2.7.1 For each COMMS site the contractor shall provide a study/analysis covering the following topics, but not limited to, depending on the individual situation of each COMMS site:

a. Fulfilment of project requirements

b. Interference/distortion with other internal or external systems are existing:

   i. HF, UHF and DLOS

   ii. RX and TX

   iii. Selected antennae

   iv. Towers

c. Antenna Field and placement of SSSB Antennas

d. Interference with on-site installed Radars

2.7.2 For RX in addition:

a. Radiation from lightning discharges (atmospheric noise due to lightning)

b. Unintended radiation from electrical machinery, electrical and electronic equipment, power transmission lines, or from internal combustion engine ignition (man-made noise)

c. Emissions from atmospheric gases and hydrometeors

d. The ground or other obstructions within the antenna beam

e. Radiation from celestial radio sources

2.7.3 Soil Examination:

a. Multichannel analysis of surface waves (MASW) as conventional seismic approach for near surface investigation including seismic anomaly detection.

b. Cone Penetration Test (CPT) for detection of geotechnical properties of existing soils.

c. Detailed MASW/CPT analysis result and Geotechnical assessment result

d. Type and sizing of the selected foundations

2.8 Radio Communication Sub-system Kartsinoudi (Skyros)

2.8.1 The SSSB COMMS system at Skyros is non-collocated composed of three separated sites HF-TX, HF-RX and UHF-TRX locations.

2.8.2 This site is a non-collocated HF-TX location.

2.8.3 The Contractor shall:

a. Install and integrate CIS and the PFE equipment at the radio sites, including supporting sub-systems (e.g. UPS, SMS, etc.)

b. Implement necessary Civil Works related directly to CIS equipment provided by the Contractor and any additional necessary Civil Works outside the main Civil Works, which were already contracted by the HN under a separate Contract.

c. Test, monitor and control the needed equipment including Aerials, Antennae, Radio equipment, etc.

2.8.4 Block diagram showing the components related to the Radio Communication site is provided in Figure 11.

2.8.5 The Contractor shall provide the "yellow" colored components and integrate the others, under the scope of this Contract.

2.8.6 HF-TX Components:

a. HF-TX radio component

b. Radio management, Link 11 DTS, Link 22 SPC, TOD and VLI/R

c. Routers, Multiplexer, Switches and Serial Converters

d. Long distance comms land line to the Buffer Centre at ARS Larissa, CRC Panis and CRC Ziros to the other SSSB COMMS sites.

2.8.7 HF-TX Equipment. The Contractor is to provide, but not limited to, the following equipment for the radio components, less any equipment listed as PFE:

i. HF-TX Antenna field

1. Qty 3 Wide band monocone antennas, vertical polarization for SSSB.

2. RF cabling (incl. trenching)

ii. HF Transmitters

iii. Qty 3 HF Solid State Radio Transmitters 5 kW for SSSB (Link 11, Link 22 and Voice), including cooling/ventilation system

iv. Qty 1 Antenna matrix for HF-TX antennas

v. Qty 1 Dummy load 5 kW

vi. Qty 1 Audio data/voice switch matrix, also capable of switching Link 22 discrete signals, with patch panels

vii. Qty 1 Audio Monitor

viii. Qty 1 ALAM (PFE)

ix. Qty 1 TOD-HQ, GPS, military grade, SAASM, incl. antenna (PFE)

x. Qty 1 DTS

xi. Qty 1 SPC

xii. Qty 1 VLI/R (PFE)

xiii. Qty 1 Radio Management Equipment Set (PFE)

xiv. Qty 1 Narrow-Band/Wide-Band Gateway (secure and unsecure voice) (PFE)

xv. Qty 1 Multiplexer

xvi. Qty 1 Network Router

xvii. Qty 1 Network Switch

xviii. Qty 2 Serial Device Servers, RS-232/RS-422

xix. Power switch (multi) socket based unit with IP connectivity, allowing the individual Power-Down/Power-UP for a connected device with remote control capability.

xx. All racks with accessories, internal and cabling

xxi. UPS for COMMS equipment, except for HF-TX amplifiers.

2.8.8 DLOS connection in conjunction with the Final GRC National Defense Network (NDN) Design, as appropriate.

2.8.9 The civil works to be implemented by the Contractor shall include but not limited to the implementation of Antenna fields including RF cables and ducting.

2.8.10 Other CW requirements that are the Contractor responsibility are specified in SOW Section 12 and more specifically in the GRC specific System Requirements Specification (Civil Works) Annex (SRS (CW)) I.

2.9 Radio Communication Sub-system Limnonari (Skyros)

2.9.1 The SSSB COMMS system at Skyros is non-collocated composed of three separated sites HF-TX, HF-RX and UHF-TRX locations.

2.9.2 This site is a non-collocated HF-RX location.

2.9.3 The Contractor shall:

a. Install and integrate CIS and the PFE equipment at the radio sites, including supporting sub-systems (e.g. UPS, SMS, etc.).

b. Implement necessary Civil Works related directly to CIS equipment provided by the Contractor and any additional necessary Civil Works outside the main Civil Works, which were already contracted by the HN under a separate Contract.

c. Test, monitor and control the needed equipment including Aerials, Antennae, Radio equipment, etc.

2.9.4 Block diagram showing the components related to the Radio Communication site is provided in Figure 12

2.9.5 The Contractor shall provide the “yellow” colored components and integrate the others, under the scope of this Contract.

2.9.6 HF-RX Components:

a. HF-RX radio component

b. Radio management, Link 22 SPC, TOD

c. Routers, Multiplexer, Switches and Serial Converters

d. Long distance comms land line to the Buffer Centre at ARS Larissa, CRC Panis and CRC Ziros to the other SSSB COMMS sites.

2.9.7 HF- RX Equipment.

2.9.8 The Contractor is to provide, but not limited to, the following equipment for the radio components, less any equipment listed as PFE:

a. HF-RX Antenna field

i. Qty 1 Wide band monocone antenna, vertical polarization for SSSB, 3 channels

ii. RF cabling

b. HF Receivers component

i. Qty 3 HF Receivers for SSSB with preselectors

ii. Qty 1 HF multi-coupler

iii. Qty 1 Audio data/voice switch matrix, also capable of switching Link 22 discrete signals, with patch panels

iv. Qty 1 Audio Monitor

v. Qty 1 ALAM (PFE)

vi. Qty 1 TOD-HQ, GPS, military grade, SAASM, incl. antenna (PFE)

vii Qty 1 SPC

viii Qty 1 Radio Management Equipment Set (PFE)

ix. Qty 1 Multiplexer

x. Qty 1 Network Router

xi. Qty 1 Network Switch

xii. Qty 2 Serial Device Servers, RS-232/RS-422

xiii. Power switch (multi) socket based unit with IP connectivity, allowing the individual Power-Down/Power-UP for a connected device with remote control capability.

xiv. UPS for COMMS equipment.

2.9.9 The civil works to be implemented by the Contractor shall include but not limited to the implementation of Antenna fields including RF cables and ducting.

2.9.10 Other CW requirements that are Contractor responsibility are specified in SOW Section 14 and the SRS (CW) Annex.

2.10 Radio Communication Sub-system 7th Air Force Radar Site (Skyros)

2.10.1 The SSSB COMMS system at Skyros is non-collocated composed of three separated sites HF-TX, HF-RX and UHF-TRX locations.

2.10.2 This site is a non-collocated UHF TRX location.

2.10.3 The Contractor shall:

a. Install and integrate CIS and the PFE equipment at the radio sites, including supporting sub-systems (e.g. UPS, alarm control, monitoring, etc.)

b. Implement necessary Civil Works related directly to CIS equipment provided by the Contractor and any additional necessary Civil Works outside the main Civil Works, which were already contracted by the HN under a separate Contract.

c. Test, monitor and control the needed equipment including Aerials, Antennae, Radio equipment, etc.

2.10.4 Block diagram showing the components related to the Radio Communication site is provided in Figure 13.

2.10.5 The Contractor shall provide the “yellow” colored components and integrate the others, under the scope of this Contract.

2.10.6 UHF TRX Components:

a. UHF radio component

b. Radio management, Link 11 DTS, Link 22 SPC, TOD and VLI/R

c. AIS reception component

d. Routers, Switches and Serial Converters

e. Long distance comms land line to the Buffer Centre at ARS Larissa, CRC Panis and CRC Ziros to the other SSSB COMMS sites.

2.10.7 UHF Equipment.

The Contractor is to provide, but not limited to, the following equipment for the radio components, less any equipment listed as PFE:

a. UHF Antennas

b. Qty 1 Co-linear antenna with two channels

c. RF cabling (incl. trenching)

d. UHF TRX component

e. Qty 2 100 W UHF radio transceivers upgradable to support Link 22 EPM and Voice SATURN and Have Quick II
The UHF radios shall be upgradeable latest at Site Acceptance Test (SAT)

The Link 22 EPM is an Upgrade Capability.

The upgrade shall be performed via SW upgrade (HW interface already present).

The L22 EPM SW upgrade shall EXIST latest at time of the COMMS Radio Site Acceptance Test (RSAT) - meaning:

- The UHF Radio Manufacturer shall provide a written statement containing:
  - The L22 EPM SW Upgrade Part Number
  - L22 EPM NSN
  - A statement about how the upgrade is integrated
- Capability demonstration:

  A. Can be performed at COMMS site by Software upgrade by HN COMMS experts:
  - Delivery lead time (arrival at the purchaser) not exceeding four (4) weeks after a L22 EPM purchase request submitted by the purchaser to the equipment manufacturer - for the radios under this contract.
- B. Must be performed at Manufactures Premises:
  - Shipment of L22 EPM upgraded equipment from the manufacturer premises to the purchaser not later than four (4) weeks after equipment delivery at manufacturer premises - for the radios under this contract.

UHF radio transceivers upgradable to support Link 22 EPM.

f. Qty 2 UHF Amplifiers

g. Qty 1 AIS receiver with antenna (PFE)

h. Qty 1 Audio data/voice switch matrix, also capable of switching Link 22 discrete signals, with patch panels

i. Qty 1 Audio Monitor

j. Qty 1 ALAM (PFE)

k. Qty 1 TOD-HQ, GPS, military grade, SAASM, incl. antenna (PFE)

l. Qty 1 DTS

m. Qty 1 SPC

n. Qty 1 VLI/R (PFE)

o. Qty 1 Radio Management Equipment Set (PFE)

p. Qty 1 Narrow-Band/Wide-Band Gateway (secure and unsecure voice) (PFE)

q. Qty 1 Network Router

r. Qty 1 Network Switches

s. Qty 2 Serial Device Servers, RS-232/RS-422

t. Power switch (multi) socket based unit with IP connectivity, allowing the individual Power-Down/Power-UP for a connected device with remote control capability.

u. All racks with accessories, internal and cabling

v. UPS for COMMS equipment.

2.10.8 DLOS connection in conjunction with the Final GRC National Defense Network (NDN) Design, as appropriate.

2.10.9 The civil works to be implemented by the Contractor shall include but not limited to the implementation of Antenna fields including RF cables and ducting.

2.10.10 Other CW requirements that are the Contractor responsibility are specified in SOW Section 14 and more specifically in the System Requirements Specification (Civil Works) Annex (SRS (CW)).

2.11 Radio Communication Sub-system Mavros (Crete)

2.11.1 The SSSB COMMS system at Skyros is non-collocated composed of three separated sites HF-TX, HF-RX and UHF-TRX locations.

2.11.2 This site is a non-collocated HF-TX/UHF-TRX location.

2.11.3 The Contractor shall:

a. Install and integrate CIS and the PFE equipment at the radio sites, including supporting sub-systems (e.g. UPS, alarm control, monitoring, etc.)

b. Implement necessary Civil Works related directly to CIS equipment provided by the Contractor and any additional necessary Civil Works outside the main

Civil Works, which were already contracted by the HN under a separate Contract.

c. Test, monitor and control the needed equipment including Aerials, Antennae, Radio equipment, etc.

2.11.4 Block diagram showing the components related to the Radio Communication site is provided in Figure 14.

2.11.5 The Contractor shall provide the “yellow” colored components and integrate the others, under the scope of this Contract.

2.11.6 HF-TX/UHF Components:

i. HF-TX radio component

ii. UHF radio component

iii. Radio management, Link 11 DTS, Link 22 SPC, TOD and VLI/R

iv. AIS reception component

v. Routers, Switches and Serial Converters

vi. Long distance comms land line to the Buffer Centre at ARS Larissa, CRC Panis and CRC Ziros to the other SSSB COMMS sites.

HF-TX/UHF Equipment. The Contractor is to provide, but not limited to, the following equipment for the radio components, less any equipment listed as PFE:

a.HF-TX Antenna field

i. Qty 3 Wide band monocone antennas, vertical polarization for SSSB.

ii. RF cabling (incl. trenching)

b. UHF Antennas

i. Qty 1 Co-linear antenna with two channels

ii. RF cabling (incl. trenching)

c. HF Transmitters, UHF-RX/TX component

i. Qty 3 HF Solid State Radio Transmitters 5 kW for SSSB (Link 11, Link 22 and Voice), including cooling/ventilation system

ii. Qty 1 Antenna matrix for HF-TX antennas

iii. Qty 1 Dummy load 5 kW

iv. Qty 2 100 W UHF radio transceivers upgradable to support Link 22 EPM and Voice SATURN and Have Quick II.
The UHF radios shall be upgradeable latest at Site Acceptance Test (SAT)

The Link 22 EPM is an Upgrade Capability.

The upgrade shall be performed via SW upgrade (HW interface already present).

The L22 EPM SW upgrade shall EXIST latest at time of the COMMS Radio Site Acceptance Test (RSAT) - meaning:

- The UHF Radio Manufacturer shall provide a written statement containing:
  - The L22 EPM SW Upgrade Part Number
  - L22 EPM NSN
  - A statement about how the upgrade is integrated
- Capability demonstration:

  A. Can be performed at COMMS site by Software upgrade by HN COMMS experts:
  - Delivery lead time (arrival at the purchaser) not exceeding four (4) weeks after a L22 EPM purchase request submitted by the purchaser to the equipment manufacturer - for the radios under this contract.
- B. Must be performed at Manufactures Premises:
  - Shipment of L22 EPM upgraded equipment from the manufacturer premises to the purchaser not later than four (4) weeks after equipment delivery at manufacturer premises - for the radios under this contract.

UHF radio transceivers upgradable to support Link 22 EPM.

v. Qty 1 AIS receiver with antenna (PFE)

vi. Qty 1 Audio data/voice switch matrix, also capable of switching Link 22 discrete signals, with patch panels

vii. Qty 1 Audio Monitor

viii. Qty 1 ALAM (PFE)

ix. Qty 1 TOD-HQ, GPS, military grade, SAASM, incl. antenna (PFE)

x. Qty 1 DTS

xi. Qty 1 SPC

xii. Qty 1 VLI/R (PFE)

xiii. Qty 1 Radio Management Equipment Set (PFE)

xiv. Qty 1 Narrow-Band/Wide-Band Gateway (secure and unsecure voice) (PFE)

xv. Qty 1 Network Router

xvi. Qty 1 Network Switch

xvii. Qty 1 Multiplexer

xviii. Qty 2 Serial Device Servers, RS-232/RS-422

xix. Power switch (multi) socket based unit with IP connectivity, allowing the individual Power-Down/Power-UP for a connected device with remote control capability.

xx. All racks with accessories, internal and cabling

xxi. UPS for COMMS equipment, except for HF-TX amplifiers.

2.11.7 DLOS connection in conjunction with the Final GRC National Defense Network (NDN) Design, as appropriate.

2.11.8 The civil works to be implemented by the Contractor shall include but not limited to the implementation of Antenna fields including RF cables and ducting.

2.11.9 Other CW requirements that are the Contractor responsibility are specified in SOW Section 14 and more specifically in the System Requirements Specification (Civil Works) Annex (SRS (CW)).

2.12 Radio Communication Sub-system Sideros (Crete)

2.12.1 The SSSB COMMS system at Skyros is non-collocated composed of three separated sites HF-TX, HF-RX and UHF-TRX locations.

2.12.2 This site is a non-collocated HF RX location.

2.12.3 The Contractor shall:

a. Install and integrate CIS and the PFE equipment at the radio sites, including supporting sub-systems (e.g. UPS, alarm control, monitoring, etc.)

b. Implement necessary Civil Works related directly to CIS equipment provided by the Contractor and any additional necessary Civil Works outside the main Civil Works, which were already contracted by the HN under a separate Contract.

c. Test, monitor and control the needed equipment including Aerials, Antennae, Radio equipment, etc.

2.12.4 Block diagram showing the components related to the Radio Communication site is provided in Figure 16.

2.12.5 The Contractor shall provide the "yellow" colored components and integrate the others, under the scope of this Contract.

2.12.6 HF-RX Components:

a. HF-RX radio component

b. Radio management, Link 22 SPC, TOD

c. Routers, Switches and Serial Converters

d. Long distance comms land line to the Buffer Centre at ARS Larissa, CRC Panis and CRC Ziros to the other SSSB COMMS sites.

HF-RX Equipment. The Contractor is to provide, but not limited to, the following equipment for the radio components, less any equipment listed as PFE:

a. HF-RX Antenna field

i. Qty 1 Wide band monocone antennas, vertical polarization for SSSB, 3 channels

ii. RF cabling

b. HF Receivers component

i. Qty 3 HF Receivers for SSSB with preselectors

ii. Qty 1 HF multi-coupler

iii. Qty 1 Audio data/voice switch matrix, also capable of switching Link 22 discrete signals, with patch panels

iv. Qty 1 Audio Monitor

v. Qty 1 ALAM (PFE)

vi. Qty 1 TOD-HQ, GPS, military grade, SAASM, incl. antenna (PFE)

vii. Qty 1 SPC

viii. Qty 1 Radio Management Equipment Set (PFE)

ix. Qty 1 Network Router

x. Qty 1 Network Switch

xi. Qty 1 Multiplexer

xii. Qty 2 Serial Device Servers, RS-232/RS-422

xiii. Power switch (multi) socket based unit with IP connectivity, allowing the individual Power-Down/Power-UP for a connected device with remote control capability.

xiv. All racks with accessories, internal and cabling

xv. UPS for COMMS equipment.

2.12.7 DLOS connection in conjunction with the Final GRC National Defense Network (NDN) Design, as appropriate.

2.12.8 The civil works to be implemented by the Contractor shall include but not limited to the implementation of Antenna fields including RF cables and ducting.

2.12.9 Other CW requirements that are the Contractor responsibility are specified in SOW Section 14 and more specifically in the System Requirements Specification (Civil Works) Annex (SRS (CW)).

2.13 Radio Communication Sub-system NOP-47S (Kythira)

2.13.1 The SSSB COMMS system at Skyros is non-collocated composed of three separated sites HF-TX, HF-RX and UHF-TRX locations.

2.13.2 This site is a collocated HF-TX, HF-RX and UHF-TRX location.

2.13.3 The Contractor shall:

a. Install and integrate CIS and the PFE equipment at the radio sites, including supporting sub-systems (e.g. UPS, alarm control, monitoring, etc.)

b. Implement necessary Civil Works related directly to CIS equipment provided by the Contractor and any additional necessary Civil Works outside the main Civil Works, which were already contracted by the HN under a separate Contract.

c. Test, monitor and control the needed equipment including Aerials, Antennae, Radio equipment, etc.

2.13.4 Block diagrams showing the components related to the Radio Communication sites are described in Figure 16.

2.13.5 The Contractor shall provide the “yellow” colored components and integrate the others, under the scope of this Contract.

2.13.6 HF-TX/RX/UHF Components:

a. HF-TX radio component

b. HF-RX radio component

c. UHF radio component

d. Radio management, Link 11 DTS, Link 22 SPC, TOD and VLI/R

e. AIS reception component

f. Routers, Switches and Serial Converters

g. Long distance comms land line to the Buffer Centre at ARS Larissa, CRC Panis and CRC Ziros to the other SSSB COMMS sites.

HF-TX/RX/UHF Equipment. The Contractor is to provide, but not limited to, the following equipment for the radio components, less any equipment listed as PFE:

i. HF-TX Antenna field

 i. Qty 2 Wide band monocone antennas, vertical polarization for SSSB.

 ii. RF cabling (incl. trenching)

ii. HF-RX Antenna field

 i. Qty 1 Wide band antenna, vertical polarization for SSSB, 2 channels

 ii. RF cabling

c .HF Antennas

 i.Qty 1 Co-linear antenna with two channels

 ii.RF cabling (incl. trenching)

d.HF Transmitters, UHF-RX/TX component

i. Qty 2 HF Solid State Radio Transmitters 5 kW for SSSB (Link 11, Link 22 and Voice) including, cooling/ventilation systems

ii. Qty 1 Antenna matrix for HF-TX antennas

iii. Qty 1 Dummy load 5 kW

iv. Qty 2 100 W UHF radio transceivers upgradable to support Link 22 EPM and Voice SATURN and Have Quick II.
The UHF radios shall be upgradeable latest at Site Acceptance Test (SAT)

The Link 22 EPM is an Upgrade Capability.

The upgrade shall be performed via SW upgrade (HW interface already present).

The L22 EPM SW upgrade shall EXIST latest at time of the COMMS Radio Site Acceptance Test (RSAT) - meaning:

- The UHF Radio Manufacturer shall provide a written statement containing:
  - The L22 EPM SW Upgrade Part Number
  - L22 EPM NSN
  - A statement about how the upgrade is integrated
- Capability demonstration:

  A. Can be performed at COMMS site by Software upgrade by HN COMMS experts:
  - Delivery lead time (arrival at the purchaser) not exceeding four (4) weeks after a L22 EPM purchase request submitted by the purchaser to the equipment manufacturer - for the radios under this contract.
- B. Must be performed at Manufactures Premises:
  - Shipment of L22 EPM upgraded equipment from the manufacturer premises to the purchaser not later than four (4) weeks after equipment delivery at manufacturer premises - for the radios under this contract.

UHF radio transceivers upgradable to support Link 22 EPM.

v. Qty 1 AIS receiver with antenna

vi. Qty 1 Audio data/voice switch matrix, also capable of switching Link 22 discrete signals, with patch panels

vii. Qty 1 Audio Monitor

viii. Qty 1 ALAM (PFE)

ix. Qty 1 TOD-HQ, GPS, military grade, SAASM, incl. antenna (PFE)

x. Qty 1 DTS

xi. Qty 1 SPC

xii. Qty 1 VLI/R (PFE)

xiii. Qty 1 Radio Management Equipment Set (PFE)

xiv. Qty 1 Narrow-Band/Wide-Band Gateway (secure and unsecure voice) (PFE)

xv. Qty 1 Network Router

xvi. Qty 1 Network Switch

xvii. Qty 2 Serial Device Servers, RS-232/RS-422

xviii. Power switch (multi) socket based unit with IP connectivity, allowing the individual Power-Down/Power-UP for a connected device with remote control capability.

xix. All racks with accessories, internal and cabling

xx. UPS for COMMS equipment, except for HF-TX amplifiers.

f. HF Receivers component

i. Qty 2 HF Receivers for SSSB with preselectors

ii. Qty 1 HF multi-coupler

2.13.7 The civil works to be implemented by the Contractor shall include but not limited to the implementation of Antenna fields including RF cables and ducting.

2.13.8 Other CW requirements that are the Contractor responsibility are specified in SOW Section 14 and more specifically in the System Requirements Specification (Civil Works) Annex (SRS (CW)).

2.14 Inter/Intra-Sites Communication Sub-system

2.14.1 The inter-sites Communication, provided by the THN via the NDN network, will provide all the necessary channels to allow the exchange of data, voice and control signals between the Buffer Centres and the Radio Sites. THN will also provide a backup communication line between the Radio Sites. The contractor is responsible for the intra-site communication, which will be needed as laid down in Section 4.14. The following list enumerates the type and minimum number of required services/channels:

a. Radio Sites to/from a Buffer Centre

i. Qty 1 IP line with a constant minimum no less than 4 Mbps (better 10 Mbps) for the following:

1. Qty 1 Link 11 monitoring, VoIP, total 64 kb/s

2. Qty 1 Link 22 monitoring, VoIP, total 64 kb/s

3. Qty 1 Link 11 VOICE line, RoIP, total 64 kb/s
4. Qty 1 Link 22 VOICE line, RoIP, total 64 kb/s
5. Qty 2 UHF Voice (NB and WB) lines, RoIP, total 128 kb/s
6. Qty 4 intercom line, RoIP, total 128 kb/s
7. Qty 1 Link 11 Data Line, IP, total 128 kb/s
8. Qty 4 Link 22 Data Lines, IP, total 256 kb/s
9. Qty 4 AIS Data Lines, IP, total 256 kb/s
10. Qty 1 Control & Monitoring, IP, total 2048 kb/s

2.14.2 The Contractor shall provide support to the THN and the Purchaser in the integration and testing of the inter-sites/intra-sites communication sub-systems.

2.14.3 The delay, jitter, throughput of the inter-sites/intra-sites communication sub-systems have to fulfill the requirements for Link 11, Link 22, voice and network specifications.

2.15 Radio Management and Command and Control Sub-system

2.15.1 The SSSB Command and Control system is a product consisting of hardware and software elements developed by the NCI Agency SSSB Section. The Command and Control Centres/Buffer Centres, in combination with the SSSB Radio Sites, will be integrated and tested by the Purchaser, while the contractor will provide engineering support at the Radio Sites.

2.15.2 The radio management system, delivered as PFE, is a product consisting of hardware and software elements developed by the NCI Agency SSSB Section. Before delivery the product has to be configured and customized by the purchaser in order to operate with the communication equipment used at the radio sites. The integration of the SSSB Radio Sites is based on ICDs.

2.15.3 Technical characteristics, documentation and technical support, related to the control of the communication equipment, is to be provided by the Contractor to the purchaser with the system design at PDR and CDR in accordance with SOW **Error! Reference source not found.**

2.15.4 The technical integration documentation is to be provided by the contractor, beside other technical documents, as Interface Control Documents (ICDs) format describing the format of the control messages and the protocol.

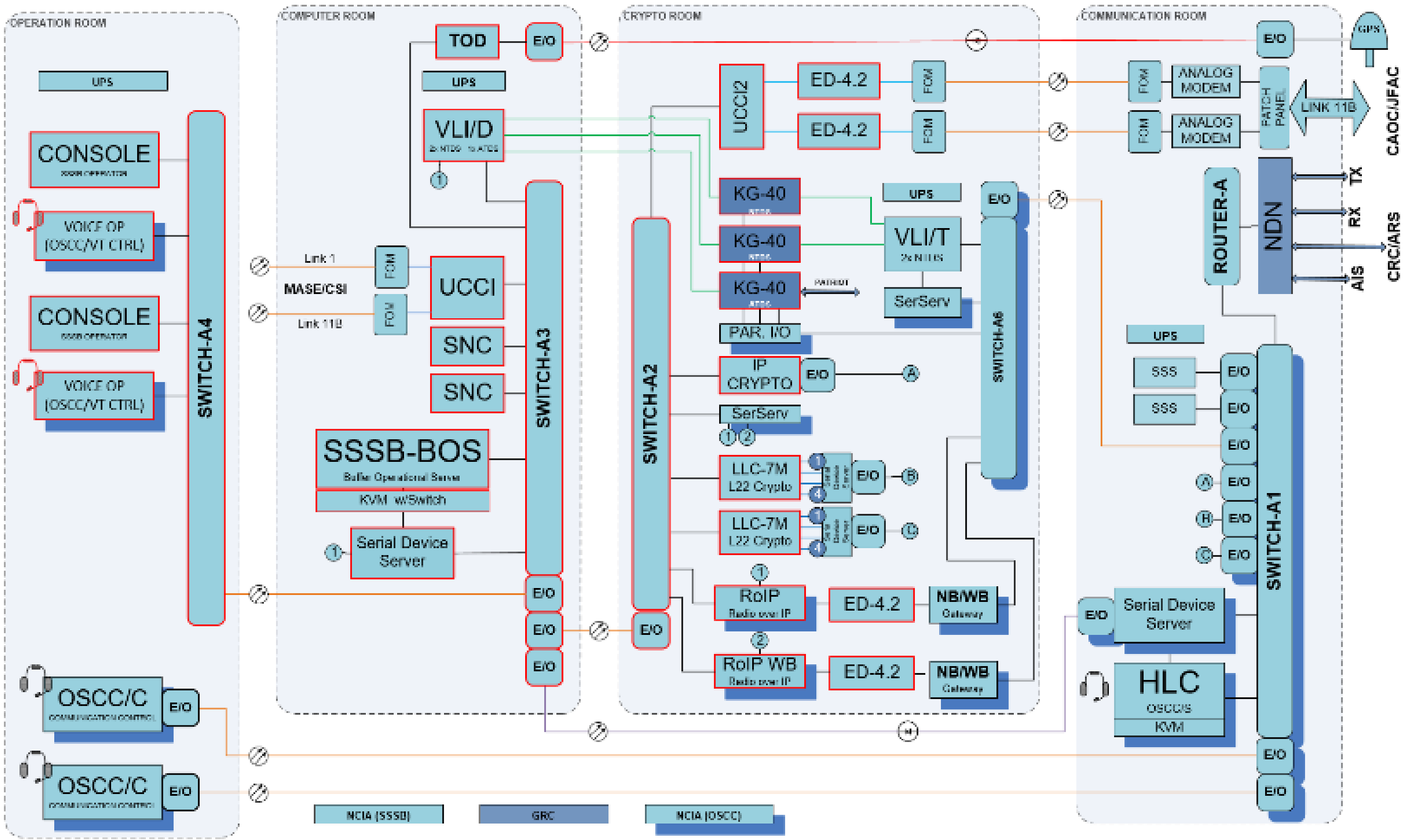

Figure 17: SSSB BC at CRC Parnis block diagram

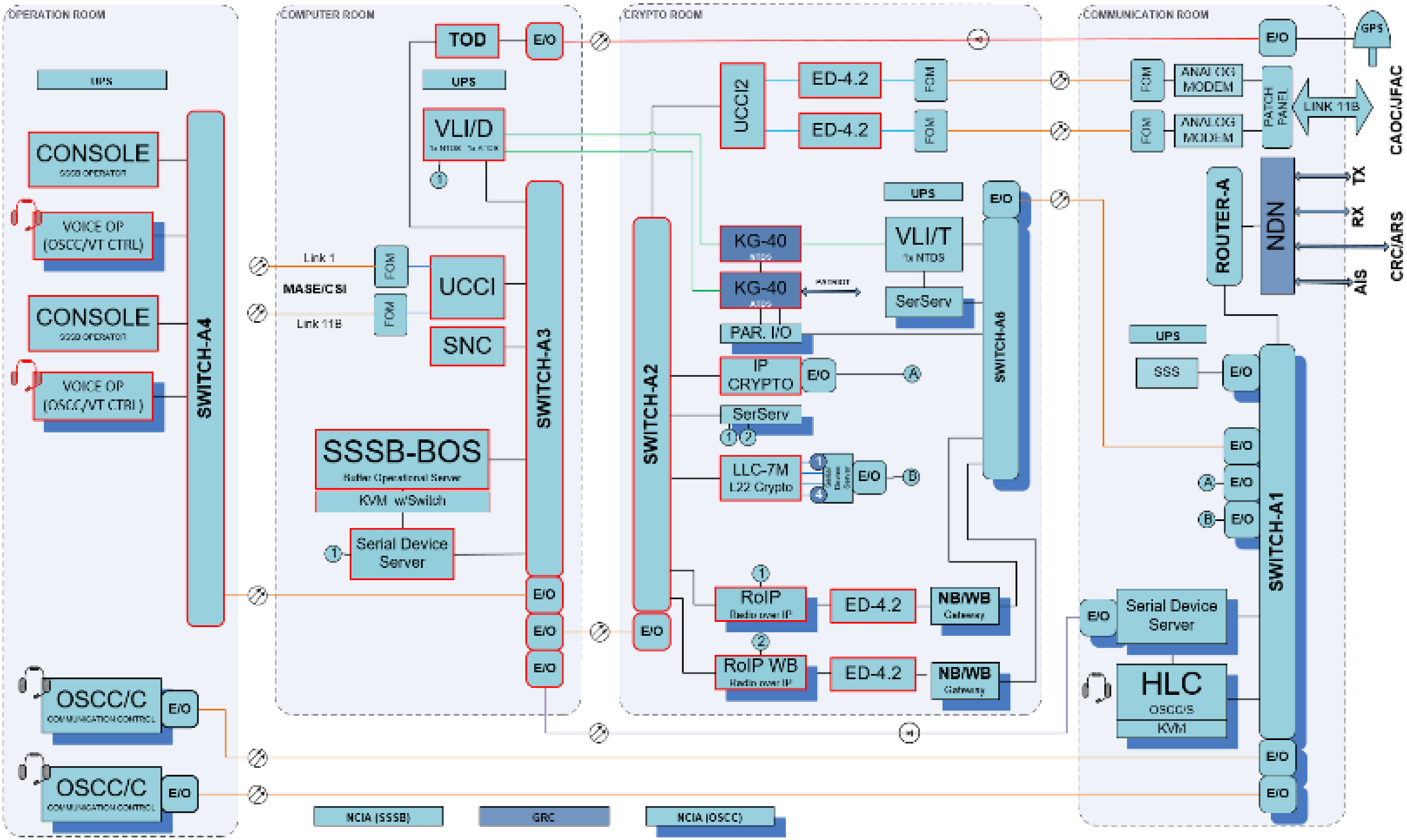

Figure 18: SSSB BC at CRC Ziros block diagram

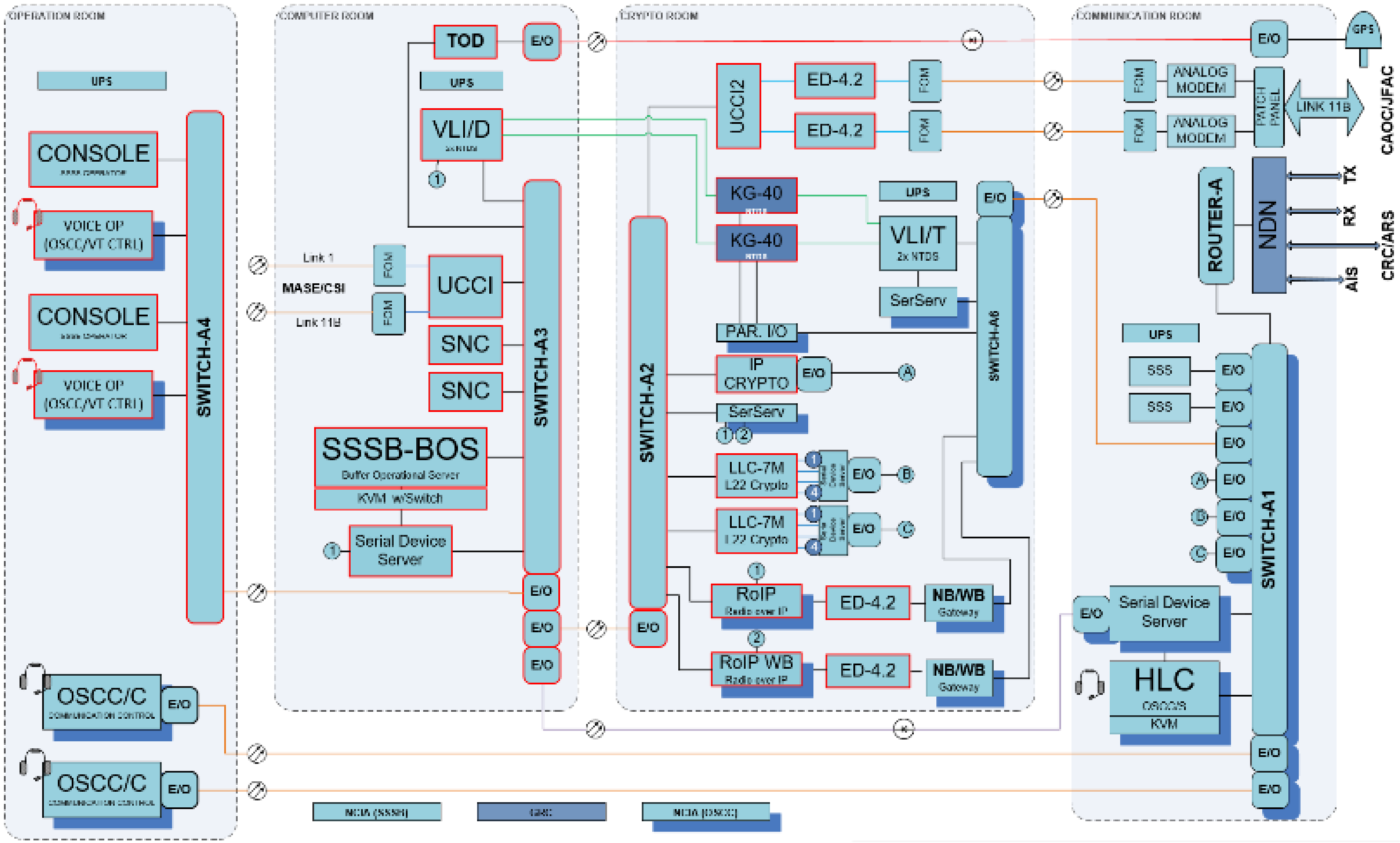

Figure 19: SSSB BC at ARS Larissa block diagram

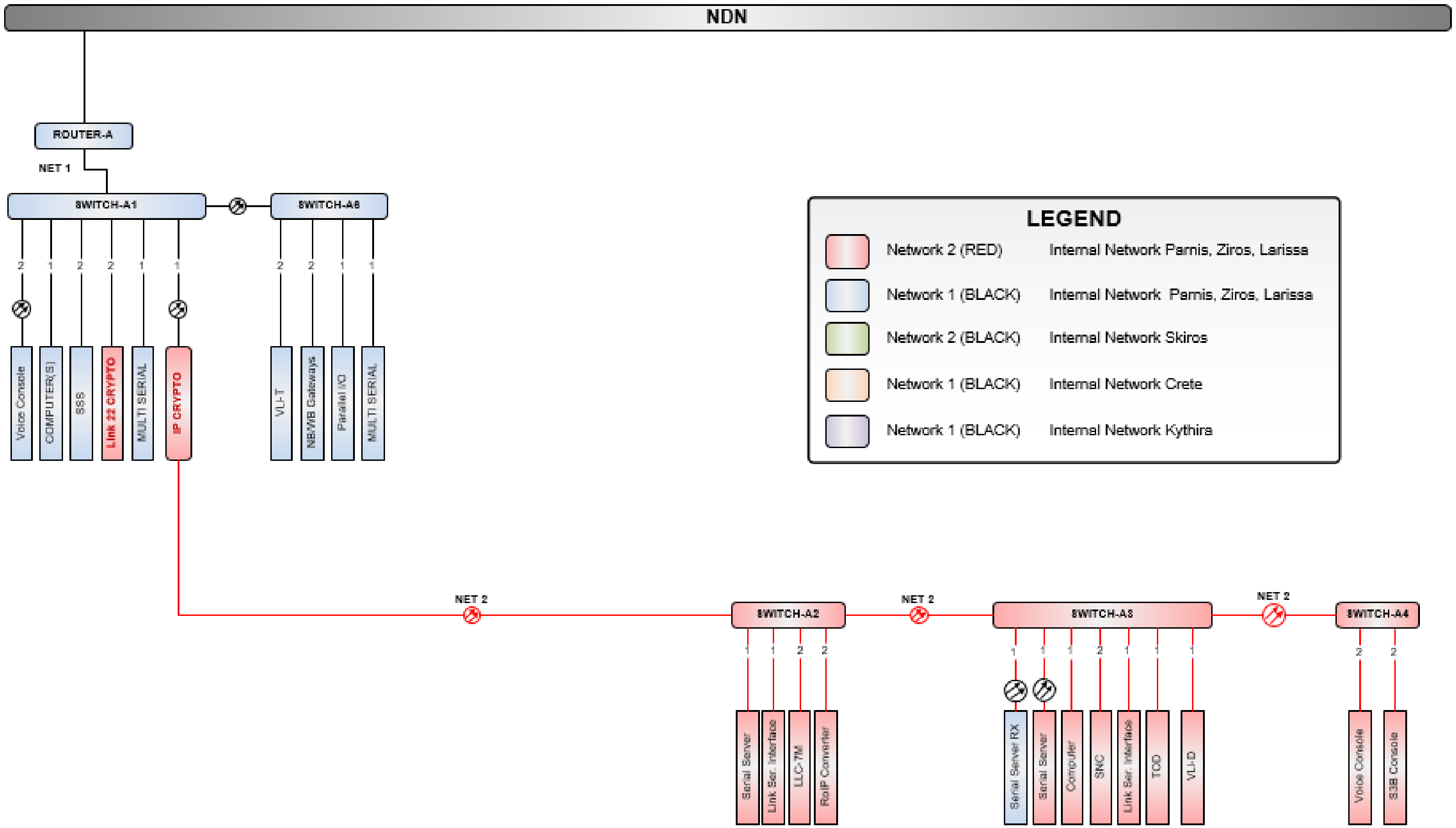

Figure 20: SSSB Brief Network Overview 1/2

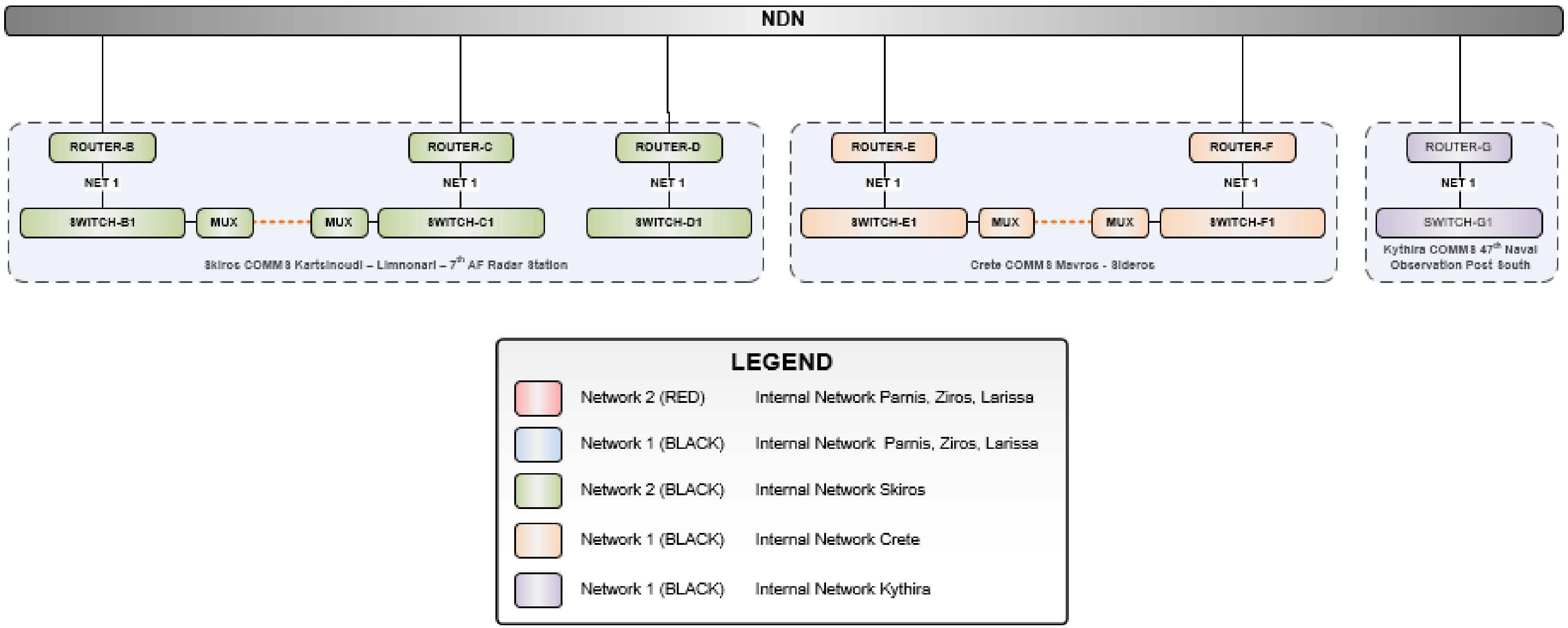

Figure 21: SSSB Brief Network Overview 2/2

2.16 System Integration and Testing

2.16.1 The Contractor shall be responsible to perform the testing activities as specified in SOW Section 10.

2.17 Summary of Responsibilities

2.17.1 This paragraph provides a summary of the areas of responsibilities of the Contractor, as illustrated in Figure 22.

2.17.2 The Contractor shall be responsible for the:

a. Implementation of the 6 (six) Radio Sites, including integration of the PFE elements.

b. TX Site Kartsinoudi (Skyros) is a non-collocated site.
   - Separate COMMS HF-TX.

c. RX Site Limninari (Skyros) is a non-collocated site.
   - Separate COMMS HF-RX.

d. UHF Site 7th AF Radar (Skyros) is a non-collocated site.
   - Separate COMMS UHF.

e. RX Site Sideros (Crete) is a non-collocated site.
   - Separate COMMS HF-RX.

f. TX/UHF Site Mavros (Crete) is a non-collocated site.
   - Separate COMMS HF-TX/UHF.

g. TX/RX/UHF Site Kythira is a collocated site.
   - COMMS HF-TX.
   - COMMS HF-RX.
   - COMMS UHF.

h. Implementation of nine DLOS connections in conjunction with the Final GRC National Defense Network (NDN) Design, as appropriate.

i. Laying of 1 F/O cables underground, ~20 Km.

j. Delivery of racks for inter-site/intra-site communication equipped with power distribution and accessories including racks for NDN equipment.

k. Support to Purchaser/THN for Radio Sites and Buffer Centres for integration and testing of inter-site communication.

l. Provision of the required information to the Purchaser in the customization and configuration of the radio management PFE elements.

m. Support to Purchaser/THN for Radio Sites and Buffer Centres for integration and testing of inter-site communication.

The Intersite Communication Test, per SSSB Buffer Centre, will have a minimum duration of:

i. Preparation: 1 week

ii. Site Acceptance Test: 1 week

Contractor engineering manning at the COMMS Sites during activities: To be calculated by the contractor.

n. Support to Purchaser for overall integration and testing of the complete SSSB system.

2.17.3 The Purchaser (NCI Agency) will be responsible for the:

n. Implementation of the Buffer Centres.

o. Delivery of the PFE elements to the Contractor for radio site installation, integration and testing.

p. Overall authority over the integration and testing of the SSSB system as a whole.

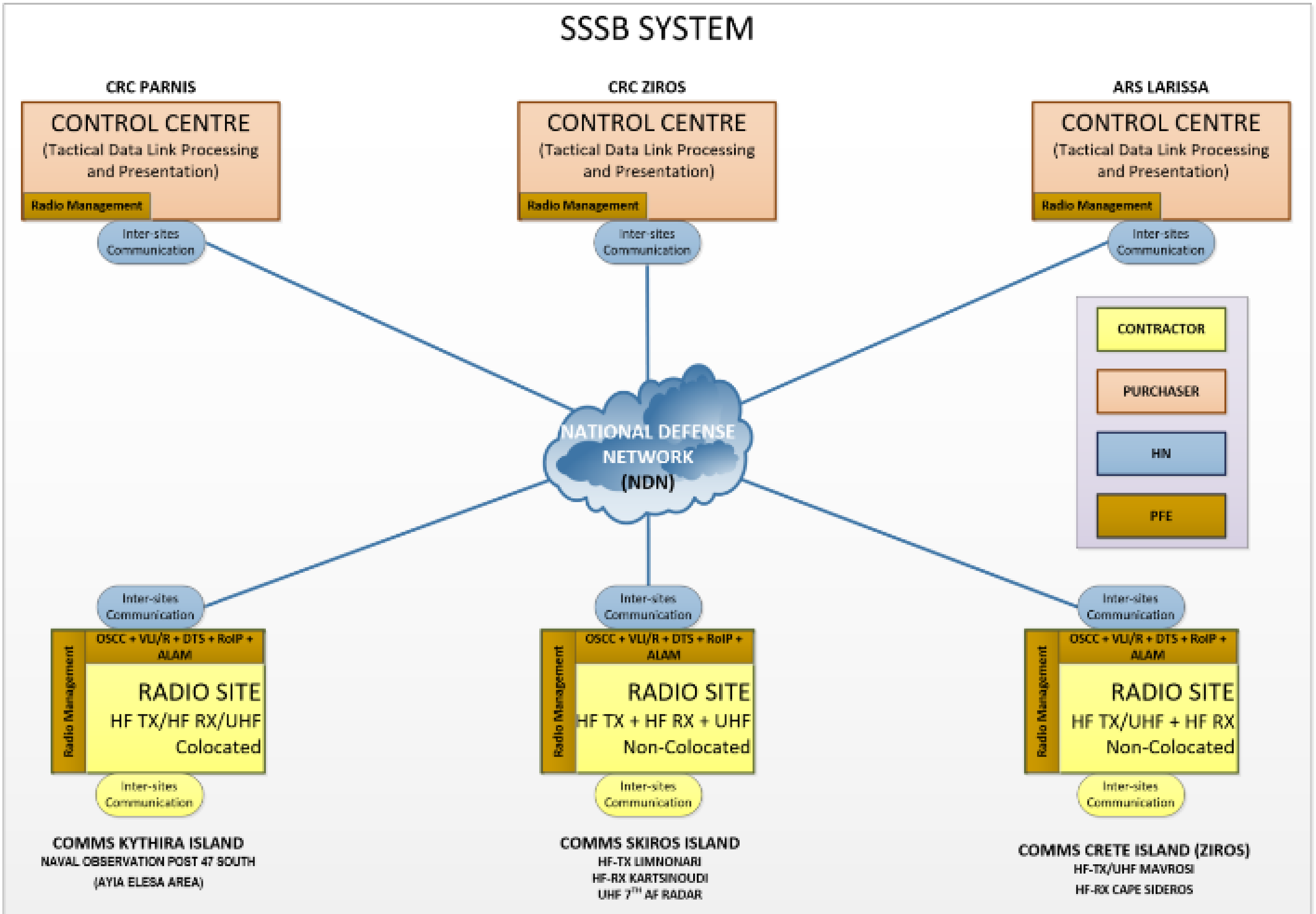

Figure 22: Areas of responsibilities among Contractor, Purchaser and THN

SECTION 3 Technical Requirements: Equipment and Antennas

3.1 Requirements

3.1.1 The following specifications are to be understood as minimal project requirements and NATO MMR criteria for the SSSB HW equipment.

3.2 General requirements

3.2.1 In accordance with NATO requirements, the Contractor is to assemble the site equipment with racks of standard dimensions, 19 inch standard, in order to achieve:

a. Uniform implementation in terms of colour, height, depth and accessories.

b. Simplified assembly and acceptance.

c. Simplified installation.

3.2.2 The Contractor shall provide a 20% of growth capacity in terms of space in the racks, power and power socket requirements.

3.2.3 Installation of Equipment:

a. The Contractor shall install equipment racks, miscellaneous devices and antennas, inclusive of materials, cables and all the necessary accessories until finalisation and acceptance by the Purchaser.

b. Any additional minor equipment or communications devices (e.g. modems), not encompassed in the present or following sections, shall be delivered and installed by the Contractor at the sites in case they are required for the proper functioning of the system.

3.2.4 Furniture (Also refer to THN specific SRS (CW) Annexes):

a.The Contractor shall provide the necessary furniture for each site - meaning each working position at each site/sub-site e.g. tables, cabinets, office chairs (office chairs: highest European Standard/THN required), trolleys, office furniture and workbench).

- A list of the furniture shall be proposed by the Contractor in the bidding offer.

3.3 Site Monitor System (SMS)

3.3.1 The Contractor shall supply one Site Monitor System at each site. This shall be compatible with any monitoring system already installed by the THN.

3.3.2 Function:

a. The function of the SMS is to reveal the status of operation of the respective SSSB Radio Site.

3.3.3 The SMS shall provide the vital site states and alarms via an interface to the site operator.

3.3.4 The SMS shall convey the monitored data to the SSSB Open System Communication Control (OSCC HLC/LLC) in time using a software interface:

a. States and Alerts triggering sub-alerts shall be changeable/selectable.

b. On request, the SMS logfile contents shall be provided to the OSCC.

c. The contractor shall provide an SMS ICD for OSCC implementation to the purchaser.

3.3.5 Architecture:

a. The data to be monitored shall be available at the local and remote SMSs.

b. The SMS system shall have a redundance capability.

c. The data to be monitored shall be conveyed to the other SMS at remote sites.

d. The SMS will relay to the remote monitoring station at the other site and the control centre via Local Area Network (LAN) and Long Haul Network (LHN).

e. The contractor shall implement the software interface to the OSCC using SNMP V. 3.x where also ‘get’ and ‘set’ functionality shall be included

f. The contactor shall install a SMS Alert Panel at one of the COMMS racks at the front side:

   - The SMS Alert panel shall represent the status of the local site.

g. The contractor shall install a desk mountable SMS Alert Panel at the location requested by the THN (in general 1 unit, but if needed 2units - e.g. 2nd unit is to be installed at Saxa Vord RRH-O):

   - The desk mountable SMS Alert Panel shall represent the status of all logical combined SSSB sites, e.g. for the RRH Saxa Vord COMMS site:
     - COMMS HF TX.
     - COMMS HF RX.

  - COMMS UHF.

h. SMS Alert Panels shall:

  - Indicate the individual states/alerts by an LED.
  - Have an Alert Buzzer.
  - Have an ACKNOWLEDGE button to acknowledge any alert and switch off the Alert Buzzer.
  - Have a LED/Buzzer Test Button:

i. The contractor shall provide a “SMS ALERT PANEL- RESPONSE PROCEDURE” which describes in detail:

  - The error detection and correction measures necessary, to identify the displayed fault.
  - To recover the operational state, if possible.
  - To secure the related equipment and its surrounding environment - up to the level of human and building safety.
  - A list of Alerts and triggering Sub-Alerts as well as the detailed description of each alert - added as an appendix.
  - A procedure how to change the triggering sub-alert(s)
  - NOTE: This document and its procedures shall be part of the COMMS training to be provided by the contractor.

3.3.6 Monitored data:

a. Radio Receivers, HF and UHF.
b. Radio Transmitters, HF and UHF.
c. Low Tension power network.
d. Low Tension UPS.
e. Electric system.
f. Air conditioning system.
g. Equipment air cooling system.
h. Fire Alarms.
i. Anti-intrusion system.

3.3.7 Any other SMS integration recommendation from the contractor in relation to the installed devices shall be detailed in his bidding proposal.

3.3.8 The final SMS Alert Panel Status/Alert list and their triggering sub-states and sub-alerts will be defined and agreed on before the CDR – where the THN holds the final decision.

3.3.9 Any other SMS integration recommendation from the contractor in relation to the installed devices shall be detailed in his bidding proposal.

3.4 Rack Transmitter HF/SSB – 5 kW

3.4.1 The Contractor shall supply, integrate and test HF transmitter equipment of

"Solid State" technology.

3.4.2 A typical configuration of the transmitter rack 5 kW, which has the dimension of a standard rack, includes the control circuits, low level RF, power amplifier and power supply.

3.4.3 The Contractor shall supply, integrate and test rack transmitter in accordance with the typical configuration as stated before and shall provide forced air circuit cooling system for the HF-TX or, in case equipment cooling use room ambient air and the available A/C is not adequate then the Contractor shall upgrade or improve the A/C system to the needed level.

Modern state of the art liquid cooled high power transmitters, compliant to the listed requirements, are also acceptable.

3.4.4 The equipment of the rack transmitter component shall meet the following minimum requirements:

a.Frequency range: 2 ÷ 29,9999 MHz.

b. Frequency tuning steps: 10 Hz.

c. Tuning time (max): 10 s.

d. Frequency stability (max):

e. ± 1 part in 107 after 30 minute warm up period.

f. ± 1 part in 108 for any period of 24 hours after a warm up period of 4 hours under any combination of specified service conditions.

g. RF output power: 5 kW nominal PEP and mean, into a 50 ohm impedance unbalanced to ground and with VSWR up to 1.3:12.

h. Power steps: 1/1, 1/2, 1/4 and 1/8 of maximum output power. Other values of power steps are acceptable as long as they will be within 25% range from the required ones.

i. Modes of operation:

j. AM (A3E, R3E, H3E and J3E classes of emission3) including Upper Sideband (USB) and Lower Sideband (LSB) simultaneously or independently[4].

k. CW (A1A class of emission5)

l. Link 11 and Link 22

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[2] Above VWSR 1.3:1 the transmitter should de-rate the output power according to MIL-STD 188-141C.

[3] Respectively: double-sideband, single-sideband reduced (or variable) level carrier, single-sideband full carrier and single-sideband suppressed carrier for single channel analogue telephony (see ITU "Radio regulations – Appendices").

[4] Independent Side Band (ISB).

[5] Double-sideband without the use of a modulating sub-carrier for single channel keyed telegraphy.

m. Duty cycle: 100 % under all applicable service conditions.

n. Audio inputs 28: 0 ± 3 dBm and 10.3 dB PEP/avg on balanced ungrounded lines with 600 ohm terminations.

o. PTT input.

p. Sidetone: to be provided at the HF audio outputs (both USB and LSB).

q. Time delay (max): 3.5 ms (for any single frequency over the range 500 ÷ 3.050 Hz) (design objective 2.5 ms).

r. Group (or differential) delay (max): 500 μs (within the frequency range 815 ÷ 3.050 Hz).

s. Frequency response: 2.5 dB passband fc +415 ÷ fc +3.050 Hz for the USB and fc -415 ÷ fc -3.050 Hz for the LSB (max); 3 dB at 300 Hz (max with respect to the peak response between 450 ÷ 3.050 Hz); 60 dB at fc +5.000 and fc -1.500 Hz for the USB; 60 dB at fc -5.000 and fc +1.500 Hz for the LSB.

t. Phase jitter (max): 2.5 degrees (rms value) and the probability of a shift greater than 30 degrees shall be 0.01 % when measured at the signal output terminals6.

u. Sideband attenuation: 60 dB below PEP.

v. Carrier suppression (where applicable): 50 dB below PEP.

w. Harmonic attenuation: 45 dB below PEP.

x. Spurious attenuation: 45 dBc.

y. In-band intermodulation distortion (IMD): 35 dB below PEP (with reference to IMD products generated by two equal level in-band audio tones spaced 440 Hz).

z. In-band noise: 50 dB below PEP (in each sideband when measured in a 3 kHz bandwidth).

aa. Out-of-band noise (max):

bb. 10 μV (at any frequency between 2 ÷ 24 MHz, with the exception of fc ±15 % and HFoscillator frequency, when measured in a 3 kHz bandwidth using a two-tone test signal input).

cc. 2 μV (at any frequency between 2 ÷ 24 MHz, with the exception of fc ±15 % and HF oscillator frequency, when measured in a 3 kHz bandwidth with the audio signal inputs terminated in 600 ohm dummy loads).

dd. 10 μV (at any frequency between 2 ÷ 24 MHz, within fc ±15 % but with the exception of fc ±3 kHz, when measured in a 3 kHz bandwidth with the audio

[6] Measurements shall be performed over a sufficient number of adjacent frame pairs to establish the specified probability with a confidence of 95%; measured values shall be the average phase in an averaging time of 9,09 ms or 18.18 ms for frame lengths of 13,3 ms or 22 ms, respectively.

signal inputs terminated in 600 ohm dummy loads).

ee. 1 μV (with the transmitter in the off keyed condition, at any frequency between 2 ÷ 24 MHz when measured in a 3 kHz bandwidth).

ff. Attack-time delay (max): 7 ms (to reach 90 % of rated power output).

gg. Release-time delay (max): 10 ms.

hh. Built-In Test Equipment (BITE): embedded.

ii. Programmed channels: 99.

jj. Monitor: hours of operation, number of failures, tuning numbers, forward and reflected power.

kk. Remote control: frequency, mode, power level, BITE.

ll. Remote control interfaces: EIA RS 232 (or, equivalently, 422 or 485) and/or 10Base-T IEEE 802.3 (Ethernet).

mm. Power supply: 400 Vac ± 10 % three phases @ 45 ÷ 65 Hz.

nn. Power consumption (max): 20 kW.

oo. Size (max): 1200 x 900 x 2100 mm (W x D x H).

pp. Weight (max): 750 kg.

qq. Operating temperature: 0 ÷ +40 °C.

rr. Relative humidity: 90 % at +40 °C without condensation.

ss. Cooling`/ventilation system: forced air.

tt. In the event of a power outage, the status of the transmitter is to be kept to avoid reconfiguring the exciter portion when the power comes back This shall be obtained by hardware capacity through the transmitter rack itself (e.g. through non-volatile memory) or by the use of a small-size UPS circuit dedicated to the HF transmitter assembly except the amplifier portion.

uu. Transmission exchange time: conforming Link 11 DATA mode

From MIL-STD 188-203 1A:

5.1.7 Switching time. A time period shall be allocated to allow for the switching between the transmit state and receive states. This switching shall be automatic and shall conform to the timing diagram illustrated in FIGURE 5.

a. Receive-to-transmit switching occurs when the picket recognizes its address code, the DNCS recognizes a picket stop code, or the DNCS detects loss of signal presence. When switching from the receive state to transmit state, a silent period of 10 milliseconds shall be required during which the audio output from the DTS to the transmitter shall be inhibited. The audio composite signal shall be applied to the transmitter by the DTS within three frame intervals of the beginning of the silent period. The DTS shall apply the radio keyline a minimum of 7 milliseconds and a maximum of one frame interval prior to the application of the audio composite signal. After application of the audio composite signal and radio set keyline, the transmitter RF output shall reach at least 90 percent of its rated power within 7.0 milliseconds.

b. Transmit-to-receive switching occurs at the end of the transmission, that is, the picket stop code or address code. When switching from the transmit to receive state, the transmitter RF output shall be reduced to the quiescent noise level of 0.1 microvolt (µV) or less in a 6 kHz bandwidth centered on the nominal carrier frequency, and the receiver shall be capable of maximum receive sensitivity within 23 milliseconds or less after reset of the radio set keyline.

3.5 UHF Transceivers Assembly

3.5.1 Rack mountable UHF transceiver compliant to Link 11, Link 22 and SSSB Voice standards and equipped with RF filter automatic tuning and amplifier. UHF transceiver have to be upgradeable for Link 22 EPM, voice HAVE QUICK II and SATURN capability. Minimum requirements will be:

a. Frequency range: 225 ÷ 400 MHz.

b. Frequency tuning steps: 25 kHz.

c. Tuning time (max): 7.5 ms.

d. Frequency stability (max):

e. ± 0.0005% of the selected fc after 5 minutes warm up period.

f. ± 5 parts in 106 for any period of 6 months after a warm up period of 30 minutes under any combination of specified service conditions.

g. Modes of operation:

h. FM (F3E class of emission) inclusive of Link 11 data as per STANAG 5511.

i. AM (A3E, classes of emission7).

j. IF selectivity: 6 dB bandwidth of at least 50 kHz (with a peak-to-peak ripple over 90 % of the bandwidth not exceeding 3 dB) and 60 dB bandwidth of maximum 200 kHz.

k. Audio inputs8: nominal 0 ± 3 dBm and 10.3 dB PEP/avg on balanced ungrounded lines with 600 ohm terminations.

l. Audio outputs: nominal 0 ± 3 dBm (adjustable) and 10.3 dB PEP/avg on balanced ungrounded lines with 600 ohm terminations.

m. PTT/Mute input.

n. Phase jitter (max): 2.5 degrees (rms value) and the probability of a shift greater than 30 degrees shall be 0,01 % when measured at the signal output terminals of the transmitter or receiver9.

o. Time delay (max): 3.5 ms (for any single frequency over the range 500 ÷ 3.050 Hz) (design objective 2.5 ms).

p. Group (or differential) delay (max): 500 µs (within the frequency range 815 ÷ 3.050 Hz).

q. BITE: embedded.

r. Programmed channels: 99.

s. Remote control: frequency, mode, power level, BITE.

t. Remote control interfaces: EIA RS 232 (or, equivalently, 422 or 485) and/or 10Base-T IEEE 802.3 (Ethernet).

u. Power supply: 230 Vac ± 10 % single phase @ 45 ÷ 65 Hz.

v. Power consumption (max): 700 W.

w. Rack mountable with size (max): 19”

   The size and weight shall be compliant to the Human Engineering Standard MIL-STD 1472G.

x. Weight (max): 35 kg - See above.

y. Operating temperature: 0 ÷ +40 °C.

a. Relative humidity: 90% at +40 °C without condensation.

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[7] Respectively: double-sideband, single-sideband reduced (or variable) level carrier, single-sideband full carrier and single-sideband suppressed carrier for single channel analogue telephony

[8] Inclusive of keyline simplex method.

[9] Measurements shall be performed over a sufficient number of adjacent frame pairs to establish the specified probability with a confidence of 95%; measured values shall be the average phase in an averaging time of 9.09 ms and 18.18 ms for frame lengths of 13.3 ms and 22 ms, respectively.

b. Transmitter section.

c. RF output power: nominal 100 W PEP and 25 W carrier at m = 100% into a 50 ohm impedance unbalanced to ground and with VSWR not exceeding 3:1 over the defined frequency range.

d. Power steps: 1/1, 1/2 and 1/4 of maximum output power. Other values of power steps are acceptable as long as they will be within 25% range from the required ones.

e. Duty cycle: 100% under all applicable service conditions.

f. Attack-time delay (max): 7 ms (within ±1 dB of its steady state output from the receipt of a keying signal).

g. Sidetone: to be provided at the UHF receiver audio output.

h. Frequency modulation deviation: ±20 kHz when produced by a +10 dBm signal at the audio input.

i. Frequency response (max): 2 dB between 450 ÷ 3.050 Hz and 3 dB at 300 Hz.

iii. Harmonic attenuation: 70 dBc.

jj. Spurious attenuation: 70 dBc at fc ±10 MHz.

kk. In-band IMD: 35 dB below a two-tone test level (935 and 1.045 Hz) for a frequency deviation of ±20 kHz (measurements to be performed on the demodulated transmitter output).

ll. In-band noise: the audio output detected in a nominal 50 Hz audio bandwidth by a test receiver shall be at least 50 dB below the audio output detected when a carrier at the same RF power level deviated ±20 kHz at a 1 kHz rate is applied to the test receiver RF input (with the transmitter at full rated RF power output and with the audio input terminated with a 600-ohm resistor).

3.5.2 Receiver section:

a. RF input: 50 ohm impedance unbalanced to ground.

b. Audio frequency response (max at the receiver output and relative to the peak response between 450 ÷ 3.050 Hz): 2 dB between 450 ÷ 3.050 Hz and 3 dB at 300 Hz for a reference RF input signal level of -73 dBm with peak deviation of 20 kHz applied to the receiver input terminals.

Frequency modulation deviation: an input of ±20 kHz deviation and -67 dBm shall produce a signal output of +10 dBm.

c.Input signal protection:

d. The receiver shall not be damaged by the continuous application of a +35 dBm RF signal

e. The receiver shall be protected when the transmitter is at full power and the electrical isolation between the transmitter and receiver antenna terminals is as low as 26 dB; the protection circuit shall activate within 150 ms time interval used by the transmitter to go from the carrier “on” to the carrier “off” condition; provision shall be made to override the protection circuitry to the extent required to monitor the transmitter at full power; the override feature shall provide the required receiver output when the electrical isolation between the transmitter antenna terminal and receiver antenna terminals is in the range 26 dB to 36 dB.

f. Image frequency rejection: 80 dB.

g. IF rejection: 80 dB.

h. Spurious frequency rejection: 80 dB.

i. In-band IMD: 30 dB below a two-tone test level (935 and 1.045 Hz) for a frequency deviation of ±20 kHz.

3.5.3 UHF pre-post selector filter.

3.5.4 Tunable RF filter to improve the selectivity performances of the UHF Link 11 transceiver assembly. The component shall be mounted within the same rack of the UHF transceiver. Minimum requirements:

a. Control from the associated UHF transceiver

b. Frequency range: 225 – 400 MHz

c. RF power rating: 100 W FM modulation

d. Selectivity: 50 dB bandwidth: ±8 MHz

e. Input/output impedance: 50 ohm unbalanced

f. Insertion loss: 2 dB max

3.6 Audio/Data Matrix

3.6.1 The Audio/Data Matrix is a switching equipment to commute audio, data (including sidetone) and keyline signals between local consoles, remote consoles, communication equipment and radio transceivers to be provided for all the involved sites.

3.6.2 Audio/Data Switch Matrix to be integrated by the Contractor shall meet the following requirements:

3.6.3 Switching the system from Link 11 to Link 11 HF and UHF, audio and key lines

3.6.4 Switching the system from Link 22 to Link 22 HF and UHF, audio and key lines

3.6.5 Connecting the audio and control signals, VOICE, Link 11 DATA and Link 22 DATA, to the radio equipment HF and/or UHF for all operational modes of SSSB Voice, Link 11 and Link 22.

3.6.6 Extra lines for expansion of two additional services and two additional equipment’s

a. Technology: solid state switching, non-blocking

b. Audio inputs/outputs: 600 ohm balanced

c. Management of input/output PTTs/Mutes/Keylines

d. Audio channels isolation: Providing a maximum decoupling/isolation between signal lines for the Link 22 MSN 1-18 and MWF modulations (MSN), to avoid Crosstalk.

e. The matrix (including the setting of all nodes) shall be reprogrammable/configurable successfully via the remote control interface in less than 5s.

f. Rack mountable: 19”

g. Matrix capacity two times the minimum needed

3.6.7 The Audio/Data Matrix shall be integrated with the “Matrix Bypass” patch panels meeting the following minimum requirements:

a. Passive unit

b. Individual monitor of all the input and output matrix ports

c. Monitoring shall be possible during normal usage and during patching (must be possible at any time)

3.6.8 Individual manual bypass of all matrix ports with disconnection of service and/or equipment from the matrix:

a. Every patch connector named according provided service

b. Provided with a sufficient number of bypass patch cables

The Audio/Data Matrix shall be integrated with the “Audio Monitor” Unit, with the following minimum capabilities:

a. Audio monitor channel 1 for VOICE

b. Audio monitor channel 2 for Link DATA

c. The Audio Monitor Unit (AMU) shall be operated in auto mode when the two channels are connected to the Audio/Data Matrix. The AMU shall be operated in Manual mode using the patch cables from the audio monitor channel port at the patch panel to the patch panel port of the signal to be monitored.

3.6.9 Analog and Discrete signals:

a. Analog Signals Narrow Band (NB)

b. 600 Ohm, 0 +/- 3 dBm for Link 11 and +9 dBm for Link 22, 300 to 3400 Hz

c. Analog Signals Wide Band – NRZ

d. 600 Ohm, +/- 4V TX and +/- 5V RX for Link 22, 16 to 24 kHz

e. PTT/KEYLINE Open Collector

f. Transmit: 0 +/- 0.25V DC (sink 10mA)

g. Receive: Open

h. PTT/KEYLINE +6V

i. Transmit: +6.0 + 1.0, -0.25 V DC (source 2mA)

j. Receive: 0.0 + 0.75, -0.25 V DC (sink 10mA)

k. PPT/KEYLINE V.28

l. Transmit: positive voltage max +12V

m. Reception: negative voltage max -12V

n. **NOTE:** PTT / Keyline - It should be possible to configure any type of input with any type of output

o. Remote control interfaces Serial RS-232 unbalanced / RS-422 balanced and optional 10Base-T IEEE 802.3 (Ethernet).

p. Serial: From 4800 to 11520 b/s

q. Discrete Signals – Used in Secure Voice UHF Wide Band (WB)

r. PT/CT
   i. Vmin -0.3 V
   ii. Vmax +31V,
   iii. Output: Open drain to +28V
   iv. Imax 5mA
   v. Rj ~1kOhm

s. CGC
   i. Vmin -0.3V
   ii. Vmax +5.5V
   iii. Internal pullup (10 kOhm) to +5V
   iv. Input: Schmitt-trigger
   v. Vt- 0.9..1.8V
   vi. Uh >0.25V

t. DPPT
   i. Vmin -0.3 V
   ii. Vmax +31V (7V)
   iii. Output: Open drain with internal pull-up (47 kOhm) to +28V
   iv. Imax 25mA

v. Rj ~230 Ohm

vi. DPPT: contact to GND short circuit proof up to 7V

u. BB/~DP

i. Vmin -32 V

ii. Vmax +0.3V

iii. Output: Open drain

iv. Imax 3.5mA

v. Rj > 2.5 kOhm

vi. Base-Band/Diphase

vii. Contact (open drain) to GND; Open (>100kOhm) when unit is not powered. Controls the base-band/diphase operation.

xiii. NOTE: Discrete Signals – Minimal input/output delay, as it can affect the correct functioning of the ciphering.

1. Gain: 0 ±0,5 dB
2. Frequency response (max): NB: ±2 dB between 20 and 3.400 Hz
3. Frequency response (max): WB: ±2 dB between 20 and 26/48 kHz
4. Switching time (max): 10 ms
5. Local control: keyboard and LCD display

3.7 Rack HF Antenna Matrix

3.7.1 Coaxial switching systems intended to be used for the connection of every transmitter to each antenna at the HF TX COMMS sites. The minimum requirements are:

a. Automatic/manual and 4 rows by 4 columns type with interlock protection and remote indication matrix status

b. Frequency range: 2 ÷ 29.9999 MHz

c. Input and output impedance: 50 ohm

d. Power rating: 10 kW PEP and mean

e. Insertion loss (max): 0.1 dB

f. VSWR (max): 1.1:1 (into 50 ohm and in all the specified frequency range)

g. RF channels isolation: 70 dB (over the specified frequency range)

h. Remote control interfaces: EIA RS 232 (or, equivalently, 422 or 485) and/or 10Base-T IEEE 802.3 (Ethernet)

ii. Power supply: 230 Vac ± 10% single phase @ 45 ÷ 65 Hz

j. Power consumption (max): 3 kW

k. Size (max): 1.000 mm x 1.000 mm x 42 U (W x D x H)

l. Weight (max): 500 kg (including HF dummy load)

m. Operating temperature: 0 ÷ +40 °C

n. Relative humidity: 90% at +40 °C without condensation

3.8 Dummy Load

3.8.1 The minimum requirements are:

a. HF dummy load capable of continuous power dissipation of 5 kW compliant with the following minimum requirements:

b. Frequency range: 2 ÷ 29.9999 MHz

c. Direct connection into 50 ohm coaxial line

d. Power dissipation capability: continuous 5 kW

e. VSWR (max): 1.1:1

f. Optional remote control interfaces: EIA RS 232 (or, equivalently, 422 or 485) and/or 10Base-T IEEE 802.3 (Ethernet)

g. Power supply: 230 Vac ± 10 % single phase @ 45 ÷ 65 Hz

h. Power consumption (max): 2 kW

i. Operating temperature: 0 ÷ +40 °C

J. Relative humidity: 90% at +40 °C without condensation

k. Cooling system: forced air

l. Interlock protection

3.9 HF Transmitter Antenna

3.9.1 The design, production and installation of the antenna masts shall comply with the following standards:

a. EN ISO 1461 – Hot dip galvanized coatings on fabricated iron and steel articles;

b. EN 10204 Metallic materials. Types of inspection documents;

c. EN 10025 – Hot rolled products of structural steels. General technical delivery conditions;

d. EN ISO 14 713 (Part 1, 2 and 3) – Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures;

e. EN 10210-1 – Hot finished structural hollow sections of non-alloy and fine grain steels;

f. ISO 898 (part 1, 2 and 5) – Mechanical properties of fasteners made of carbon steel and alloy steel;

g. ISO 5817 – Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections;

h. ISO 6520-1 – Welding and allied processes - Classification of geometric imperfections in metallic materials - Part 1: Fusion welding.

3.9.2 The expected lifetime of the antenna mast shall be at least 15 years without the need for substantial maintenance.

3.9.3 Antenna requirements:

a. Due to possible future expansions and limited space at the TX site, a combination of Monocone and Multi-feed antennas with similar performance characteristics should be considered.

HF antenna with vertical polarization, omnidirectional azimuth radiation pattern and high efficiency and high gain at low take-off angle in order to sustain ground wave propagation over all the interested spectrum compliant with the following minimum requirements:

b.Type: monocone (inverted cone)

c. Frequency range: 2 ÷ 30 MHz

d. Polarization: vertical

e. Input impedance: 50 ohm

f. Azimuth plane pattern: omnidirectional (within ± 1 dB)

g. Elevation plane pattern: high gain at low take-off angles (nominal 5 dBi @ 2 MHz)

h. VSWR (max):

i. 2,0:1 into 50 ohm and in all the specified frequency range (transmitting)

j. 2,0:1 into 50 ohm and, at least, in the frequency range 2 ÷ 30 MHz (receiving)

k. Power handling capability (transmission): Based on the HF transmitter power

l. Dimensions (max):
The maximum dimensions of the HF Antenna shall be based on the limited ground available at the TX site, taking into account that in the future an additional antenna for Link 22 (skywave) might be placed at this location.

m. Diameter (maximum dimensions, guy to guy with ground screen included):

- 80 m (transmitting), see also paragraph 3.9.3 (l)
- 80 m (receiving)

n. Height: maximum height in line with THN regulations

o. The antenna sub-systems mounted on the antenna masts, as well as the antenna masts themselves shall be capable of withstanding following environmental conditions without suffering degradation of system performance (gain, pattern type, sensitivity) and without suffering permanent mechanical damages:

- Local weather conditions pertaining temperature, snow load and ice accumulation (glaze ice – 0.9 g/cm³), as per STANAG 4370. The region is defined as conditions A3 Intermediate and C0 Mild Cold (according to STANAG 4370) for the purpose of this Contract;
- High Temperature: Norm: + 65° C for operation;
- Low Temperature: Norm: - 50° C for operation;
- 44 - 61 m/s ±10% wind at Kartsinoudi (Skyros)
- 44 - 61 m/s ±10% wind at Limnonari (Skyros)
- 44 - 61 m/s ±10% wind at 7th AF Radar Site (Skyros)
- 44 - 61 m/s ±10% wind at Mavros (Crete)
- 44 - 61 m/s ±10% wind at Sideros (Crete)
- 44 - 61 m/s ±10% wind on Kythira
- It will be the Contractors responsibility to retrieve local wind speed data, including exceptional wind speed data, for each local COMMS site from the THN authorities and plan and install appropriate antennas accordingly to meet the local climatic conditions.
- Hailstones of up to 25 mm diameter, 0.9 g/cm3 density and 58 m/s terminal velocity;
- Sand and dust concentrations up to 1 g/m³, with particle size down to 20 µm at an air speed up to 20 m/s;
- The fundamental resonance frequency of the mast with equipment shall be greater than 3 Hz;
- The design of the antenna masts shall take into account seismic conditions of HN.

p. The antenna shall be provided with grounding/earthing and air obstacle light kits; each light kit shall include a double toroid transformer to be connected to light power supply at the base of the related antenna; the installations of air obstacle lights shall be implemented in accordance to ICAO Annex 14, Volume 1, Chapter 6, “Visual aids for denoting obstacles”, latest edition. The antenna and the support structure shall be treated so as to withstand installation in proximity of the sea.

q. Due to the prevailing corrosive climatology conditions (weather conditions with extremely negative impact on the exposed equipment) within the COMMS sites areas, cathodic protection (or equivalent measure) of the antennas shall be provided.

r. Further details on mast specifications and requirements can be found in the Section 25 of SRS (CW) Annex I.

3.10 UHF Antenna

3.10.1 Collinear UHF antenna with two dipoles with omnidirectional azimuth radiation pattern compliant with the following minimum requirements:

a. Type: 2-channel collinear dipoles antenna

b. Frequency range: 225 ÷ 400 MHz

c. Polarization: vertical

d. Omnidirectional azimuth radiation pattern

e. Input impedance: 50 ohm

f. Directivity gain: nominal 2 dBi

g. VSWR (max): 2.5:1 (into 50 ohm and in all the specified frequency range)

h. Isolation between channels: 25 dB

i. Power capability: 400 W

j. Dimensions (max):

k. Diameter: 0.35

l. Height: 3 m

m. Weight (max): 35 kg

n. Environmental operation:

o. Minimum 44 - 61 m/s ±10% wind at Kartsinoudi (Skyros)

p. Minimum 44 - 61 m/s ±10% wind at Limnonari (Skyros)

q. Minimum 44 - 61 m/s ±10% wind at 7th AF Radar Site (Skyros)

r. Minimum 44 - 61 m/s ±10% wind at Mavros (Crete)

s. Minimum 44 - 61 m/s ±10% wind at Sideros (Crete)

t. Minimum 44 - 61 m/s ±10% wind on Kythira

u. It will be the Contractors responsibility to retrieve local wind speed data, including exceptional wind speed data, for each local COMMS site from the THN authorities and plan and install appropriate antennas accordingly to meet the local climatic conditions.

v. Omnidirectional

3.11 Receiver HF/SSB

3.11.1 Rack mountable HF receiver compliant to Link 11, Link 22 and SSSB Voice standards compliant to the following minimum requirements:

a. Frequency range: 2 ÷ 29.9999 MHz

b. Frequency tuning steps: 10 Hz

c. Tuning time (max): 10 s 10

d. Frequency stability (max):

e. ± 1 part in 107 after 30 minute warm up period

f. ± 1 part in 108 for any period of 24 hours after a warm up period of 4 hours under any combination of specified service conditions

3.11.2 RF input: 50 ohm impedance unbalanced to ground with an input VSWR not exceeding 2,5:1 over the operating frequency range

a. Modes of operation:

- AM including USB, LSB and ISB in compliance with STANAG 5511 and STANAG 5522
- CW

b. Audio outputs: 0 ± 3 dBm (adjustable) and 10,3 dB PEP/avg on balanced ungrounded lines with 600 ohm terminations

c. Mute input

d. Time delay (max): 3.5 ms (for any single frequency over the range 500 ÷ 3.050 Hz) (design objective 2.5 ms).

e. Group (or differential) delay (max): 500 μs (within the frequency range 815 ÷ 3.050 Hz)

f. Audio frequency response (max): 2 dB passband 450 ÷ 3.050 Hz at the receiver output; response down by 2.5 dB between 415 and 450 Hz; response down by 3 dB at 300 Hz; response down by 60 dB at -400 and 4400 Hz; gain for each sideband adjustable to within 1/2 dB of nominal output

g. Phase jitter (max stability): 2.5 degrees (rms value) and the probability of a shift greater than 30 degrees shall be 0.01 % when measured at the signal output terminals11

h. Sensitivity: -110 dBm producing a S+N/N of 10 dB (in both USB and LSB over the specified frequency range)

i. De-sensitisation dynamic range: with the receiver in a SSB mode of operation (with the passband setting providing a nominal 3 kHz bandwidth) and tuning centered on a sinusoidal input test signal which level is adjusted to produce an output SINAD of 10 dB, a single interfering sinusoidal signal equal to or less than 90 dB above the test signal level and offset from this

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[10] When the radio is operated with an external automatic antenna multi-coupler, the coupler tuning time should not exceed 60 s.

[11] Measurements shall be performed over a sufficient number of adjacent frame pairs to establish the specified probability with a confidence of 95%; measured values shall be the average phase in an averaging time of 9,09 ms and 18.18 ms for frame lengths of 13,3 ms and 22 ms, respectively.

latter by fc ±5 % shall not degrade the output SINAD by more than 1 dB.j. Linearity: with the receiver operating at maximum sensitivity and with a reference input signal that produces an output SINAD of 10 dB, the output SINAD shall increase monotonically and linearly within +1.5 dB for a linear increase in input signal level until the output SINAD is equal to 30 dB; when saturation occurs, the output SINAD may vary +3 dB for additional increase in signal level.

j. Input signal protection: the receiver (with primary power on or off) shall not be damaged by the application of any input RF signal up to +53 dBm (open circuit peak value) applied to the receiver input terminals for a duration of 1 minute.

k. Internally generated spurious outputs (max): -112 dBm for 99 % of the available 3 kHz channel; -100 dBm for 0.8 % of the available 3 kHz channel; for 0.2 % of the available 3 kHz channel, spurious signals may exceed these levels.

l. Image frequency rejection: 70 dB

m. IF rejection: 70 dB

n. Other signals spurious: 55 dB for frequencies from fc ±2.5 % to fc ±30 % and 70 dB for frequencies beyond fc ±30 %.

o. Audio frequency Total Harmonic Distortion (THD): with the receiver at rated output level, 35 dB below a reference tone level that is a RF test signal (producing a frequency within 300 ÷ 3050 Hz) 35 dB above the receiver noise threshold.

p. In-band IMD: with reference to two input signals of -53 dBm each spaced 110 Hz apart at frequencies selected to produce audio outputs in the 450 ÷ 3050 Hz range, 35 dB below the output level of either audio tone.

q. Out-of-band IMD: for a two-tone equal-amplitude input signals with each tone at -36 dBm or greater (with the closest signal spaced 30 kHz from the operating frequency), second order (and higher-order) responses shall produce an output SINAD equivalent to a single 110 dBm tone.

r. Automatic Gain Control (AGC):

- Attack time delay (max): 12 ms (from no signal to a two-tone +19 dBm signal).
- Decay (or release delay) time (max): 20 ms (from a 16 tone +19 dBm signal to a two-tone -81 dBm signal, in the data mode).
- Recycle period: capability of repeating the above operations every 100 ms (with a period between data signals higher than 10 ms).

s. Dynamic range: the AGC shall maintain the receiver output level at 0 ± 3 dBm when the input signal level is in the range -87 ÷ +13 dBm.t. t. BITE: embedded

t. Local and remote (BITE) controls

u. Remote control interfaces: EIA RS 232 (or, equivalently, 422 or 485) and/or 10Base-T IEEE 802.3 (Ethernet)

v. Power supply: 230 Vac ± 10 % single phase @ 45 ÷ 65 Hz

w. Power consumption (max): 350 W

x. Rack mountable with size (max): 19”

The size and weight shall be compliant to the Human Engineering Standard MIL-STD 1472G.

y. Weight (max): 20 kg - See above.

z. Operating temperature: 0 ÷ +40 °C

aa. Relative humidity: 90 % at +40 °C without condensation

bb. Time delay (max): 3.5 ms (for any single frequency over the range 500 ÷ 3.050 Hz) (design objective 2.5 ms).

3.12 HF-RX Pre-Selector

3.12.1 Rack mountable HF-RX pre-selector to allow the use of the receiver with strong input signals (improved receiver input selectivity). Each pre-selector shall meet the following minimum requirements:

a. Automatic/manual and fast tuning type (less than 10 ms) with RF input signal protection

b. Frequency range: 2 ÷ 29.9999 MHz

c. Selectivity: 3 dB at 2% off the operating frequency and 50 dB at fc ±10 %

d. Gain: 0 ±3 dB

e. Noise Figure (max): 20 dB

f. IMD: 35 dB

g. Power supply: 230 Vac ± 10 % single phase @ 45 ÷ 65 Hz

h. Power consumption (max): 100 W

i. Rack mountable with size (max): 19”

The size and weight shall be compliant to the Human Engineering Standard MIL-STD 1472G.

j. Weight (max): 20 kg - See above.

k. Operating temperature: 0 ÷ +40 °C

Relative humidity: 90 % at +40 °C without condensation

- Intermodulation distortion: better than 35 dB

3.13 HF-RX Multi-coupler

3.13.1 Rack mountable HF-RX multi-coupler in order to allow the use of one HF antenna with two (2) HF receivers. The following minimum characteristics for multi-coupler shall be met:

a. Low noise and high linearity, operative also in presence of strong signals minimizing distortion and intermodulation

b. Frequency range: 2 ÷ 29.9999 MHz

c. Input pass band filter: 2 ÷ 29.9999 MHz, high rejection of out-of-band signals

d. Input and output impedance: 50 ohm

e. Number of inputs (antenna): The input/output of the Multi Couplers shall be in relation to the number of radios and antennas, as listed in the respective THNs figures (block diagrams). The contractor shall calculate the correct number of Multi Coupler I/O lines.

f. Number of outputs (receivers): See above.

g. VSWR input/output (max): 1.5: 1

h. Isolation between RF outputs: 30 dB

i. Rack mountable with size (max): 19”

j. The size and weight shall be compliant to the Human Engineering Standard MIL-STD 1472G.

k. Weight (max): 70 kg - See above.

l. Operating temperature: 0 ÷ +40 °C

m. Relative humidity: 90 % at +40 °C without condensation

3.14 HF Receiver Antenna

The physical and environmental requirements of this antenna and supporting structure are the same as for the HF Transmitter antenna specified in Section 3.9.

3.15 RF Cabling

3.15.1 Different type of coaxial cabling to be provided for all the involved sites with the aim to connect transceivers and antennas to be compliant to the following minimum requirements:

a. Standard RG-213/U coaxial cable attenuation (max):
   - 10 dB/100m @ 225 MHz;
   - 15 dB/100m @ 400 MHz

b. Standard 7/8” coaxial cable attenuation (max):
   - 0.2 dB/100m @ 2÷4 MHz
   - 0.3 dB/100m @ 6 MHz
   - 0.4 dB/100m @ 10 MHz
   - 0.7 dB/100m @ 30 MHz

- 1.8 dB/100m @ 225 MHz
- 2.5 dB/100m @ 400 MHz

c. Standard 1-5/8” coaxial cabling attenuation (max):

- 0.1 dB/100m @ 2÷4 MHz
- 0.2 dB/100m @ 6 MHz
- 0.3 dB/100m @ 10 MHz
- 0.4 dB/100m @ 30 MHz

3.15.2 The RF cabling shall be equipped with the proper connectors and cannot be directly connected to the transmitters; they shall pass from a suitable panel to be provided and installed at the entrance of the barrack/building; this latter panel shall be provided and equipped with suitable surge dischargers.

3.16 19” Standard Rack Cabinets

3.16.1 19” standard rack cabinets, having the dimensions indicated in this document, in the drawings and, in any case, able to support the installation of the envisaged devices:

a. Ground connection kit for each frame part

b. Two supply ribbons for the active parts, cabled on the back post, composed by at least 12 VDE (C15) type sockets

d. Suitable number of covering blank panels

e. A proportionate magneto-thermal differential breaker and a warning light

f. Front service socket set

g. Proportionate cooling set for equipment heat removal in the worst case

h. Ventilation slits to allow for forced cooling

i. Service drawer, minimum 2U height, placed to be easily accessible by a standing person. One every three racks.

j. Suitable protections against dust for the cables inputs and ventilation slits

k. External label in order to identify the rack in accordance with ANSI/TIA/EIA–606 o ISO/IEC 14763-1 Standards. The label shall be placed either on the front or on the rear of the rack

l. External not removable label in metallic material, reporting the following data:

- Inventory number and contract date (contract nr. Contract number of mm.dd.yyyy Inventory)
- Purchaser
- Contractor (contracting Company name)
- Use destination

3.16.2 The rack/frame protection level shall be at least IP 20 and the supply shall include the supports and those elements required to install cable bundling and blocking.

3.16.3 The rack shall be compliant to IEC 60297 or THN standard and shall be suitable for structured cablings having TIA/EIA 568-C or THN standards or similar. The rack shall be able to contain a 19" Units number equal to how much indicated in the design and in the related estimate. The frame shall allow a correct installation and cablings management (e.g., the cables shall be installed in the observance of minimum bend radius).

3.17 Multiplexer

3.17.1 The Multiplexer shall transport Audio signals/services and discreet signals between the HF TX sites and the HF RX site. The selection of Multiplexers shall be performed in close coordination with the purchaser and the THN. The final decision on the selected multiplexer type is with the purchaser.

3.18 Network/Router/Switches

3.18.1 Every SSSB COMMS site will constitute a local area network within the boundaries of the SSSB COMMS system.
A COMMS site is connected to the Buffer Centre via the THN National Defense Network (NDN) with the SSSB Buffer Centre.
Between the Buffer Centre and other NATO units, data (SSSB Data, JCHAT, Tactical Data, etc.) will be exchanged via the NATO NGCS network.

3.18.2 The selection of Routers shall be performed in close coordination with the purchaser and the THN. The final decision on the selected Router type is with the THN.

3.18.3 For Network connections between the COMMS racks and to the router, F/O is preferred.

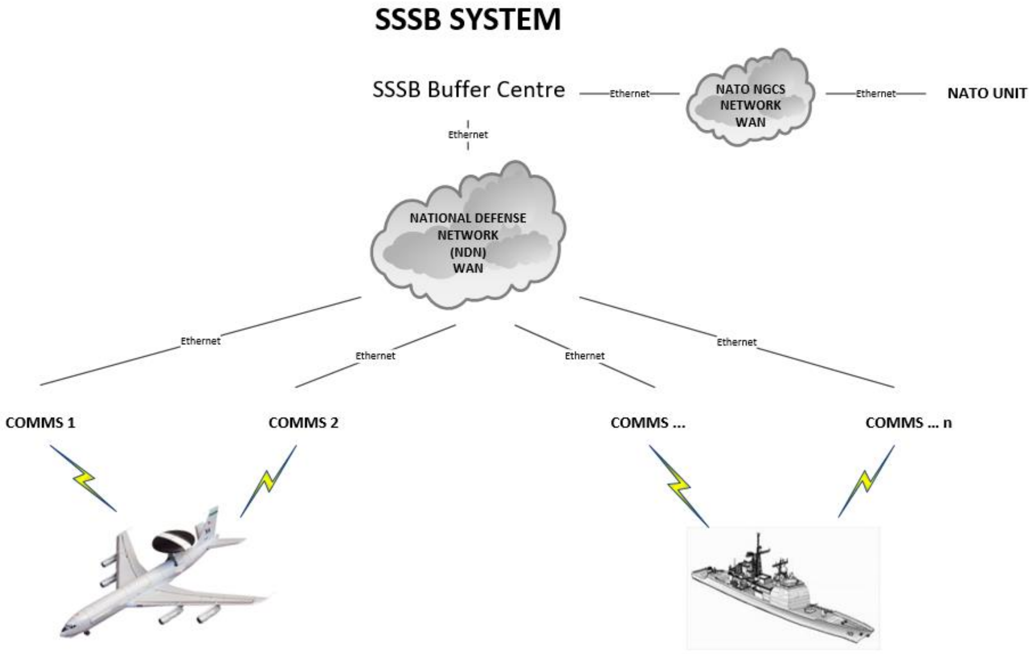

Figure 23: SSSB Network Overview

3.19 Time of Day Server (TOD)

3.19.1 A Military Grade Time of Day (TOD) HQ/SATURN GPS server with Selective Availability Anti-spoofing Module (SAASM) shall be used as time reference.

3.19.2 Time Reference for SPC, Frequency Synchronisation for UHF radios and Time Reference for applicable equipment.

3.19.3 The TOD shall fulfil the following requirements:

a. DTS Conforming standards:
   - STANAG 4430 NRS IDD
   - MIL Grade GPS SAASM

b. SPC supports the following control Interface:
   - Serial RS-232 unbalanced (and/or) 10Base-T IEEE 802.3 (Ethernet).

c. GPS Antenna included
d. Have Quick (HQ) Time Code output
e. Low Phase Noise Sine Wave Output 10MHz
f. Provides NTP, PTP
g. Supports the number of devices to be connected.

3.20 Link 22 Signal Processing Controller (SPC)

3.20.1 The purpose of the SPC is to provide the modem functions and control of the

Link 22 network in radio communication HF-UHF.

3.20.2 SPC Conforming standards:

a. NILE Interface Requirements Specification and NILE Communication Media Segment Specification
   - NG 278-A018-LLCIRS/B4
   - NG 278-A018-SPCSS/B4
   - NG 278-A018-SPCSS/B4, Appendix A, HF FF Media
   - NG 278-A018-SPCSS/B4, Appendix B, UHF FF Media
   - NG 278-A018-SPCSS/B4, Appendix D, UHF FF Media

b. STANAG 4205
c. STANAG 4372
d. STANAG 4539 Annex D

3.20.3 The SPC is intended to support the following configurations:

LOCAL

a. SPC Serial Splitter (SSS)
b. Standard, Long Range, High Throughput Link 22 Waveforms and Maintenance Waveform are implemented in the SPC (MSN 1-18, MFW).

3.20.4 SPC supports the following control Interface:

a. Serial RS-232 unbalanced (and/or) 10Base-T IEEE 802.3 (Ethernet).

3.21 Link 11 Data Terminal Set (DTS)

3.21.1 The purpose of the DTS is to provide the modem functions and control of the TADIL-A/Link 11 network in radio communication HF-UHF-SATLINK.

3.21.2 Link-11 modem is defined in MIL-STD-188-203A - Interoperability and Performance Standards for Tactical Digital Information Link (TADIL) A.

3.21.3 The Modem shall fulfil the following requirements:

a.DTS Conforming standards:
   - MIL-STD-188-203A,
   - SPAWAR-S-850,
   - MIL-STD-1397,
   - STANAG 5511,
   - EIA RS-232-C

b.Single Tone (SLEW) and Multi Tone (CLEW) Link 11 Waveforms are implemented in the DTS

c. DTS supports the following Input/Output data interface:
   - Naval Tactical Data System (NTDS).

d. DTS supports the following control Interface:

- Serial RS-232 unbalanced (and/or) 10Base-T IEEE 802.3 (Ethernet).

SECTION 4 Technical Requirements: Systems and Infrastructure

4.1 General

4.1.1 The following paragraphs define the minimal requirements the Contractor shall be compliant with in order to implement auxiliary SSSB systems and to perform infrastructure activities (including cabling).

4.1.2 Civil Works related requirements associated with and in support of the technical requirements can be found in Section 14 of the core SOW as well as in detail in the System Requirements Specifications (Civil Works) (SRS(CW) that can be found at Annex I to the core SOW.

4.2 DTS Link 11 Architecture

4.2.1 The encrypted stream of Link 11 data from one TDS computer, such as the SSSB buffer server, to another – or more – TDS computer, such as a naval TDS, responds to the basic architecture of Figure 24, which requests for the use of TDS computers, crypto's, DTSs and RF transceivers for distribution over the air.

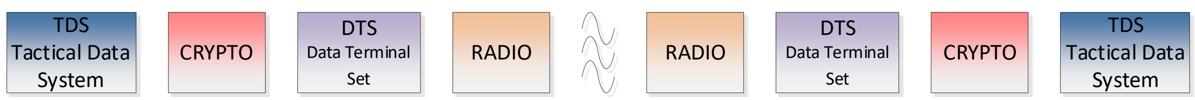

Figure 24: SSSB/Link 11 system – Basic architecture

4.2.2 Other solutions were developed throughout the history of deployment of SSSB and Link 11 installations in order to handle situations with radio sites unmanned or remote with respect to the buffer and control centres and efficiently transport multiple audio and control signals between the DTS and the radio equipment. They are known as:

4.2.3 Split-Site DTS, In which the two primary functions of the Link 11 Terminal set (control and conversion into audio signal) are split between two physical locations, a split-local site as the control centre and a split-remote site with both radio transmitters and receivers. A DTS is required at each location

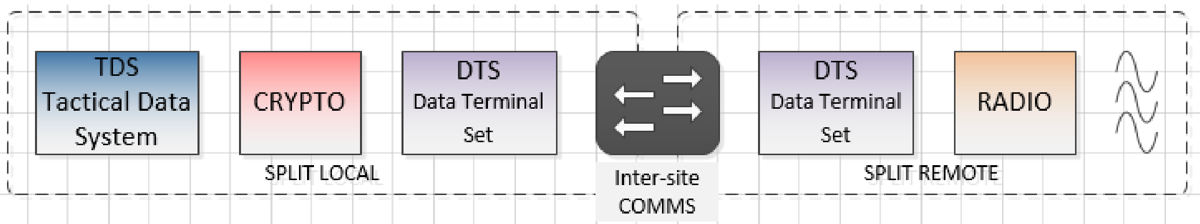

Figure 25: SSSB/Link 11 system – DTS Split-Site architecture

4.2.4 Split-Split Suited for remote independent transmit and receive radio sites, with the radio receiver located at the Intermediate Remote Site (IREM), the transmitter at the Distant Remote Site (DREM) and the TDS computer at the split local Site. A DTS is required at each location.

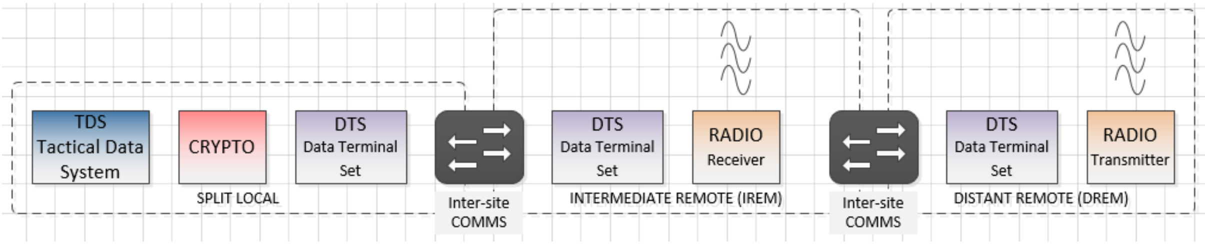

Figure 26: SSSB/Link 11 system – DTS Split-Split site architecture

4.2.5 In both of the configurations above, couples of wireline modems are to be used to connect the DTS devices. According to the technical data from the producer of the DTS model used in most recent NCI SSSB installations, the round-trip delay over the digital links from the local site to a remote site must be less than 65 ms.

4.2.6 For the scope of this project, since the radio sites are remote with respect to the control site(s) and the respective inter-sites communication sub-systems could be implemented, to date, only through the use of the National Digital Network (NDN), such timing requirements could have been achieved only through a very performing NDN.

4.2.7 In order to overcome this limitation and relax the timing requirements for the Inter-site communication sub-system, NCIA developed an alternative design with the use of the VLI (Versatile Link Interface) interfaces. Multiple and differentiated VLI interfaces within the Link 11 architecture provide for the exchange of data and control signal between the TDS computer and the remote DTS:

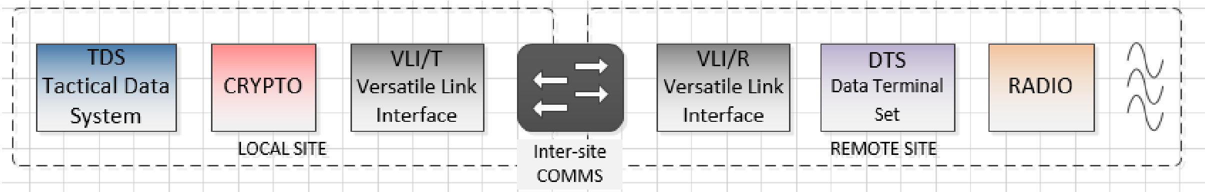

Figure 27: SSSB/Link 11 system – NATO Versatile Link Interface (VLI) architecture

4.2.8 One VLI device in remote configuration (VLI/R) is connected to the DTS of the radio site. It emulates the remote TDS and thus terminates completely the Link 11 interface and all the timing requirements associated to it.

4.2.9 One VLI device in terminal configuration (VLI/T) in the local site. The VLI/T receives Link 11 data from the VLI/R via the NDN network and regenerates the Link 11 signal for the TDS.

4.2.10 One VLI device in data configuration (VLI/D or DLI) in between the TDS computer and the Link11, in order for the computer to interface the crypto NTDS or ATDS port.

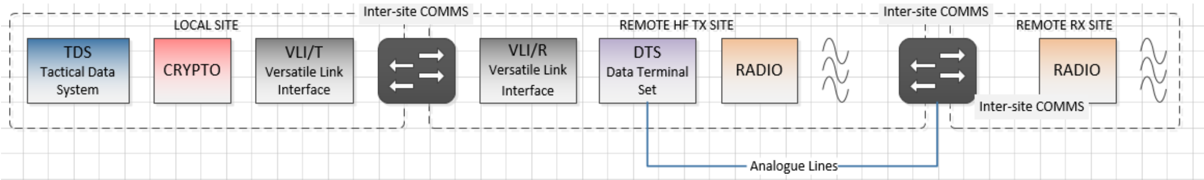

Figure 28: SSSB/Link 11 system – Simplified final architecture

4.3 UPS System

4.3.1 The Contractor shall provide UPS system in order to protect sensitive units from having logical and physical damages in the case of the Prime Power failures. Detailed requirement is formulated in Annex I and in site specific Appendixes

4.4 Rooms Air Conditioning

4.4.1 The Contractor shall provide new HVAC system with all piping, cabling and ancillaries as stipulated in the SOW - ANNEX I and in site-specific Appendixes.

4.5 HF Transmitters Equipment Cooling

4.5.1 The Contractor shall provide cooling for HF transmitters that shall meet following requirements:

a. Close circuit operations

b. Intake air filters from the outside

c. Adjustable air flow to keep the mean temperature to the optimal value for the operating equipment.

d. The energy consumption shall be kept as low as possible.

e. The cooling equipment shall be compatible with the installed fire extinguishing system (e.g. providing suitable interfacing, to stop HVAC in case of fire).

b. The cooling equipment shall be duplicated in order to guarantee continuous operations.

c. High quality COTS shall be used.

d. The system shall be automatic and provided with remote control and monitoring interfaces

e. Noise and vibrations shall be kept as low as possible and conforming to working environment specifications

f.

g. The incoming air flow shall be filtered at least to M Class.

h. The Inside/outside openings shall be shaped (zig-zag) for splinter protection and secured to avoid entrance of animals, objects, etc.

i. Special consideration shall be used in considering the heat exchanged of the HF transmitters with the room environment.

j. In addition:

- Outside openings shall be secure.
- Heat distribution using insulated copper pipes.
- Outside Moisture discharge.

4.6 RF Cable Laying

4.6.1 The cable shall be of the following types:

a. Flexible cable (wrappable/cable conduit lay)

b. Rigid/semi rigid cable

4.6.2 The Contractor shall follow the below instructions related to the installation environment:

a. Internal, laid

- On metal duct, fixed in ordered manner.
- On metal duct or vertical cable ladder, fixed on the ducts or ladders with cable clamps designed to support the cable weight. The clamps shall be installed at least every linear meter of the cable length.

b. External, laid in cable duct trench at a depth of 60cm with inspection wells every 50m

- If flexible routed through pipes are used then the size of the pipes shall be sufficient to easily proceed with the installation of the cables. The size of the pipes shall also allow the installation of the same quantity of cables again as the initial installation.
- If rigid lay in pipes made of two half concrete or clay pipes, with cable laying on the bottom half covered by the second half and sealed with mortar. Inspection wells shall be provided at junction points.

4.6.3 The Contractor shall perform the installation in accordance with the following general requirements:

a.The curve radius of the laid cables shall conform to the cable manu facturer specifications.

b.In cable routing special care shall be made in order to avoid torsions that can damage the cable and which can prevent pulling out and/or further insertion of additional cables.

c. Cable junctions are allowed only where they correspond to inspection wells.

d. Cable section shall be the same for the whole length of the cable.

e. The cables shall be labelled and identified with cable strips:
   - At both ends
   - At every inspection well
   - Every 10 m along the cable ducts or cable ladders
   - Every time the cable change course

4.7 HF Antenna Installation

4.7.1 The Contractor shall conduct and/or obtain a proper soil study at the locations of antenna foundations, in order to determine the required design and size of those foundations.

4.7.2 Health and safety measures shall be implemented: including but not limited to safe to climb structures, sharp corners avoidance and proper safety marking.

4.7.3 Further requirements are stipulated in Annex I and in site specific Appendixes.

4.8 UHF Antenna Installation

4.8.1 The Contractor shall install the UHF antennas on a climbing galvanized steel pylon. The length of the pylon shall be identified by the Contractor per each site. UHF antenna as well as AIS antenna shall be not mounted on existing buildings. A combined stand-alone mast/pole construction shall be used instead.

4.8.2 Further requirements are stipulated in Annex I and in site specific Appendixes.

4.9 Antennas Field Area Preparation (see also SRS (CW) Annex I)

4.9.1 The site preparation activities are needed to clear all the designated areas inside the sites. In particular the areas dedicated to the HF antennas, the construction/refurbishment of barrack buildings and as well, if needed, the construction of the road. A summary of the preparation activities that may be required include:

a. Clearing through cutting and stripping to surface level of any type of vegetation (trees, bushes and shrubs, including the remove of roots related to trees of medium size through excavation);

b. Clearing through crushing of main rocks;

c. Removal of any other items that can obstacle the constructions/installations;

d. Digging of topsoil/grass layer, at least 20 cm deep, ground levelling and compacting;

e. Excavation for the construction of the road, the barrack/building and for the external cabling distribution systems for services (power, signal and RF cabling);

f. Preparation of the area designated for the HF antennas.

4.9.2 The zones designated for the HF antennas shall be in different areas at a distance to be analysed and defined. After the clearing of those areas (from trees, bushes, shrubs, main rocks, topsoil, etc.), the related preparation includes (for each area):

a. The flattening with slope close as much as possible to 0%; such flattening shall be performed at least for the expected surface of the ground screen.

b. The excavation of the area intended for the laying of the HF antenna's ground screen. The bottom of the excavation shall be as flat as possible.

c. The placement of pins to allow immediate position identification of the HF antenna tower and guy line plinths.

d. The placement of a first layer of dry rubble (e.g. fine materials passing sieve, crushed rock, mixed quarry or similar) on all the excavated and flattened area for the laying of the HF antenna's ground screen.

4.9.3 All excavated spoil that is not re-used shall be disposed by the Contractor as per HN regulations.

4.9.4 After the preparation of the antenna field, the HF antennas shall be installed.

4.9.5 Such installations include:

a. The construction in reinforced concrete of the antenna plinths. The size and characteristics shall be compatible with the manufacturer specifications, the results of the soil tests, specific seismic and static calculations and the local environmental conditions (wind speed, temperature, a.s.o.);

b. The preparation of the antenna bases for the RF cabling joints, and the other devices (service power sockets, dischargers, power transformers for air obstacle lights, etc.);

c. The installation of the ground screens (provided along with the antennas) as per manufacturer specifications;

d. The installation of air obstacle lights (provided along with the antennas) when relevant as per manufacturer specifications.

e. The driving into the ground of the earthing/grounding rods (provided along with the antennas). The positions and insertion conditions shall be compatible with the manufacturer specifications and with the results of the soil tests;

f. The electrical connection of the entire antenna metal structures (including the ground screens) to the earthing/grounding rods;

g. The placement of a second layer of dry rubble (e.g. fine materials passing sieve, crushed rock, mixed quarry or similar) in order to fill the all excavated area for the laying of the antenna's ground screens.

4.9.6 Each HF antenna installation shall be capable of acceptable performance when exposed to wind speeds of a minimum 44-61 m/s ±10%. The antennas and the supporting structure shall be designed and treated so as to withstand salt and other effects due to the vicinity of the sea.

4.9.7 As mentioned in other section of the annex it will be the Contractors responsibility to retrieve local wind speed data, including exceptional wind speed data, for each local COMMS site from the THN authorities and plan and install appropriate antennas accordingly to meet the local climatic conditions.

4.9.8 The air obstacle lights infrastructure kits shall include transformers to be connected to the power supply at the base of the antennas, as outlined in para 4.10 below.

4.9.9 Marking and painting shall be provided for the antenna main vertical structures/poles when relevant in compliance with ICAO norms, and valid national THN regulations.

4.9.10 The RF cabling shall be implemented with coaxial cables, minimum section 1-5/8" for the long external runs and 7/8" for cable tails and connections to devices and panels. The cables shall pass from a suitable panel installed at the entrance of the barrack/building and equipped with surge dischargers and earthing kits to be connected with the lightning protection system of the barrack/building.

4.9.11 In order to prevent physical damage to the HF antennas and protect personnel from hazardous RF voltages, the installation shall be completed with the installation of fence(s) around the HF antenna field. The material and size of this security/safety fence(s) shall be adequate to avoid personnel accidental contact and wild animal access.

4.10 Antenna Obstruction Lights (Aircraft Warning Lights)

4.10.1 The infrastructure shall be implemented in accordance to ICAO Annex 14, Volume 1, Chapter 6, "Visual aids for denoting obstacles", latest edition, as well as valid national THN regulations.

4.10.2 All the antennas shall be provided with obstruction light kits, based on LED technology for low/no maintenance.

4.10.3 The kit shall include a double toroid transformer to be connected to LT power supply at the base of the antennas.

a. The LT power cable(s), connected to the electric panel of the site, shall be laid into a PVC pipeline laid underground with a sufficient number of inspection wells.

b. Further requirements are stipulated in Annex I and in site specific Appendixes.

4.11 Lightning System

4.11.1 The lightning system, which specific characteristics shall be identified in relation to the structure to be protected, shall be designed in relation to the following regulations:

a. EN 62305-1:2011, "Protection against lightning - Part 1: General principles" or THN equivalent

b. EN 61000 or THN Equivalent

c. Safety regulations

d. Further requirements are stipulated in Annex I and in site specific Appendixes

4.12 Ground and Earth System

4.12.1 The earth system shall be implemented by means of an underground copper braid laid along the building perimeter reinforced with ground earth stakes accessible and sectioned via inspection wells.

4.12.2 The earth system shall be sized in accordance with the electric system specifications and of the surround soil type and quality. In any case the total earth resistance shall not be in excess of a few tenths of an Ohm.

4.12.3 The ground system shall be implemented by connecting all metal structures existing in the building and of the concerned structures related to the civil infrastructure and the existing systems like electricity, air cooling ventilation heating etc.

4.12.4 Further requirements are stipulated in Annex C and in site specific Appendixes.

4.13 Site Monitor System

4.13.1 The Contractor shall supply a Site Monitor System functionality at each HF-TX, HF-RX and UHF sites in support of the SSSB Open System Communication Control (OSCC). It shall be compatible with any monitoring system already installed by the THN.

4.13.2 Function:

a. The function of the site monitor system is to reveal the status of operation of the respective SSSB Radio Site.

b. The monitor system shall provide the vital site states and alarms via an interface to the SSSB Open System Communication Control (OSCC LLC).

c. The monitor system shall provide the vital site states and alarms via an interface to the SSSB Open System Communication Control (OSCC LLC).

d. One rack mountable Alarm/Status panel installed at one of the racks shall be provided.

e. One desk/wall mountable Alarm/Status panel shall be provided.

4.13.3 Architecture:

a. The data to be monitored are conveyed to the management system that will relay to the remote monitoring station at the other sites and the control centre via Local Area Network (LAN) and Long Haul Network (LHN).

b. Vital Site States.

c. Monitored data.

d. Radio Receivers, HF and UHF.

e. Radio Transmitters, HF and UHF.

f. Low Tension power network.

g. Low Tension UPS.

h. Electric system.

i. Air conditioning system.

j. Equipment air cooling system.

k. Fire Alarms.

l. Anti-intrusion system.

4.13.4 Any other recommendation from the Contractor in relation to the installed devices shall be detailed in his bidding proposal.

4.13.5 The technical integration documentation is to be provided, beside other technical documents, as the Interface Control Documents (ICDs) format describing the format of the control messages and the protocol to be used to exchange the SMS information with the OSCC.

4.14 DLOS Microwave Inter-Site Connections

The contractor shall integrate nine (9) DLOS Inter-site connections.

DLOS Inter-site connections shall be integrated at:

4.14.1 Pagia on Skyros Island

a. Integrate DLOS connection between Pagia and Kartsinoudi (DLOS system IDU/ODU including DLOS dishes).

b. Integrate DLOS connection between Pagia and 7th Air Force Radar Station (DLOS system IDU/ODU including DLOS dishes).

c. Integrate DLOS connection between Pagia and Efstratios (DLOS system IDU/ODU including DLOS dishes).

d. Integrate DLOS connection between Pagia and Skopelos (DLOS system IDU/ODU including DLOS dishes).

4.14.2 Skopelos on Skopelos Island

a. Integrate DLOS connection between Skopelos and Pilion (DLOS system IDU/ODU including DLOS dishes).

4.14.3 Limnonari on Skyros Island

a. Integrate DLOS connection between Limnonari and Efstratios (DLOS system IDU/ODU including DLOS dishes).

4.14.4 Cape Mavros on Crete Island

a. Integrate DLOS connection between Cape Mavros and Kyriamadi (DLOS system IDU/ODU including DLOS dishes).

4.14.5 Cape Sideros on Crete Island

a. Integrate DLOS connection between Cape Sideros and Kefalas (DLOS system IDU/ODU including DLOS dishes).

4.14.6 ARS Larissa on Continental Mainland

a. Integrate DLOS connection between ARS Larissa and Pilion (DLOS system IDU/ODU including DLOS dishes).

4.14.7 DLOS Hot-Standby Systems

The integration of eighteen (18) DLOS systems shall be performed as a 1+1 hot standby configured system. Some of the systems shall provide additional space diversity capabilities. The systems shall be integrated at the following locations:

a. Skyros Island
    - 1x at Kartsinoudi COMMS HF-TX.
    - 1x at Limnonari COMMS HF RX.
    - 1x at 7th Air Force Radar Station COMMS UHF-TRX.
    - 4x at Pagia DLOS Relay Station.
        - Two (2) systems shall provide space diversity capabilities.

b. Crete Island
    - 1x at Cape Mavros COMMS HF TX and UHF TRX.
    - 1x at Cape Sideros (Forward Naval Base Kyriamadi area) COMMS HF-RX.
    - 1x at Kefalas (Forward Naval Base Kyriamadi area) DLOS radio-relays station.
    - 1x at Kefalas (Forward Naval Base Kyriamadi area) NDN Access Point.

c. Efstratios Island
    - 2x at Efstratios DLOS Relay Station
        - Systems shall provide space diversity capabilities.

d. Skopelos Island
    - 2x at Skopelos DLOS Relay Station
        - Systems shall provide space diversity capabilities.

e. Pilion (Continental GRC)
    - 2x at Pilion DLOS Relay Station
        - Systems shall provide space diversity capabilities.

f. ARS Larissa (Continental GRC)

- 1x at ARS Larissa DLOS Relay Station
  - Systems shall provide space diversity capabilities.

4.14.8 The Contractor shall perform the structural analysis on the existing DLOS towers to validate that the existing towers are fit for installation of the new DLOS antennas.

4.14.9 Pending on the results of the Contractor's structural analysis of the existing DLOS towers the Contractor shall be responsible for:

a. either refurbishment of the existing towers, or
b. removal and disposal of given towers and provision and installation of new DLOS towers
c. Regardless if the DLOS towers are refurbished or provided as new structures the DLOS towers shall meet requiments stipulated in Annex I

4.15 F/O underground Lines

Fibre Optic underground lines have to be installed at:

4.15.1 Kyriamadi on Crete Island

a. Lay F/O cable underground from Kyriamadi to Palaikastro ~20 Km F/O line.

b. Further requirements are stipulated in Annex I and in site specific Appendixes.

4.16 Non-Functional Requirements

4.16.1 Reliability, Availability, Maintainability and Testability (RAMT) Program

4.16.2 Basic Reliability shall be expressed as Mean Time Between Failures (MTBF), where 'failure' is understood to mean any condition in which an item, assembly, sub-system or the entire system is not operating according to specification. The MTBF of the system shall not be less than 350 hours.

4.16.3 Mission Reliability shall be expressed as Mean Time Between Critical Failures (MTBCF), where 'critical failure' is understood to mean any condition in which the entire system is not operating according to specification. The MTBCF of the system shall not be less than 1000 hours.

4.16.4 Maintainability and Testability Requirements (MTR)

4.16.5 Maintainability shall be expressed as Mean Time To Repair (MTTR) and Mean Time to Restore the System (MTTRS):

4.16.6 MTTR shall be calculated for all kind of failures (Critical and non-critical) and shall include fault isolation, access, disassembly, remove and replace, reassembly, configuration, check-out and start-up, and to exclude administrative and logistics delay times.

4.16.7 MTTRS shall be calculated for critical failures only and shall include fault isolation, access, disassembly, remove and replace, reassembly, configuration, check-out and start-up, and to exclude administrative and logistics delay times.

4.16.8 The MTTR at Site Level shall not exceed 30 minutes and the TTRMax (95%) shall not exceed 60 minutes.

4.16.9 The MTTRs at Site Level shall not exceed 45 minutes.

4.16.10 The System shall be designed to include Built-In Test Equipment (BITE) capable of on-line detection of 95% of all failure modes (Fault Detection rate).

4.16.11 The System shall have a Built–In Test Equipment capable to isolate 80% of the detected failures to 1 LRU, 90% to no more than 2 LRUs, 95% to no more than 3 LRUs and 100% to no more than 5 LRUs (Fault Isolation rates).

4.16.12 Availability Requirements

4.16.13 Operational readiness is the measure of the degree to which an item is in an operable and ready-for-use state at the start of a mission or operation, when the mission or operation is called for at an unknown time.

4.16.14 The inherent availability of a system is driven by the reliability and maintainability of the Product. It is described as the probability that a system, when used under stated conditions in an ideal support environment (e.g., no lack of support resources) will operate sufficiently at any point in time. It excludes preventive maintenance, delay times.

4.16.15 Inherent availability (Ai) shall be calculated as MTBCF / (MTBCF + MTTRS).

4.16.16 Inherent availability (Ai) shall be greater than 99.9 %.

4.16.17 Mean Time To Repair (MTTR)

4.16.18 Mean Time To Repair (MTTR) for hardware faults is the average elapsed time of corrective maintenance. The MTTR elements contributing to the MTTR value shall be those listed in MIL-HDBK-470A, section D2.0, Table D-I.

4.16.19 For HL1/2 tasks, the MTTR shall not exceed 30 minutes.

4.16.20 For HL3 tasks, the MTTR target figure is 120 minutes.

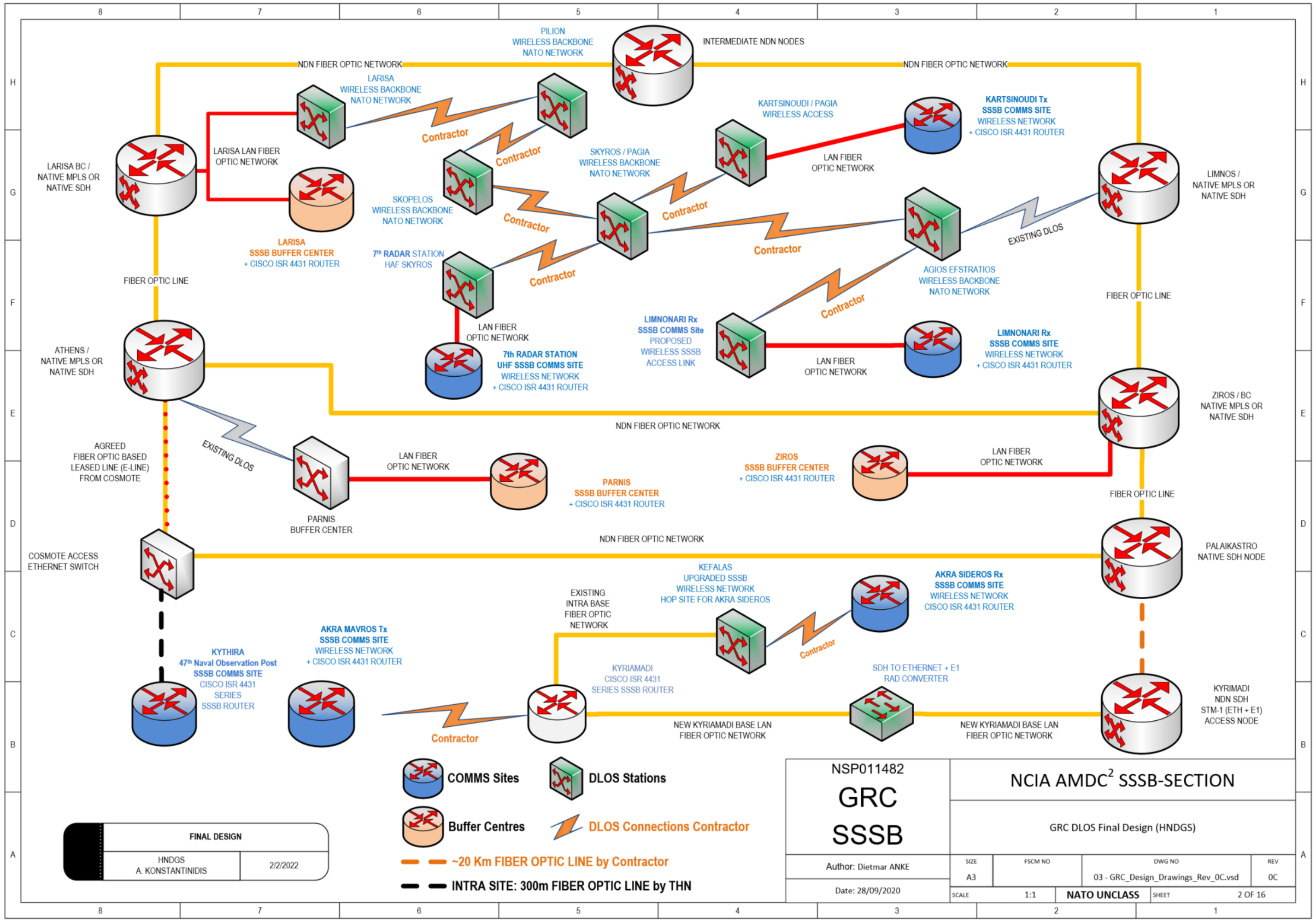

Figure 29: GRC National Defence Network (NDN)

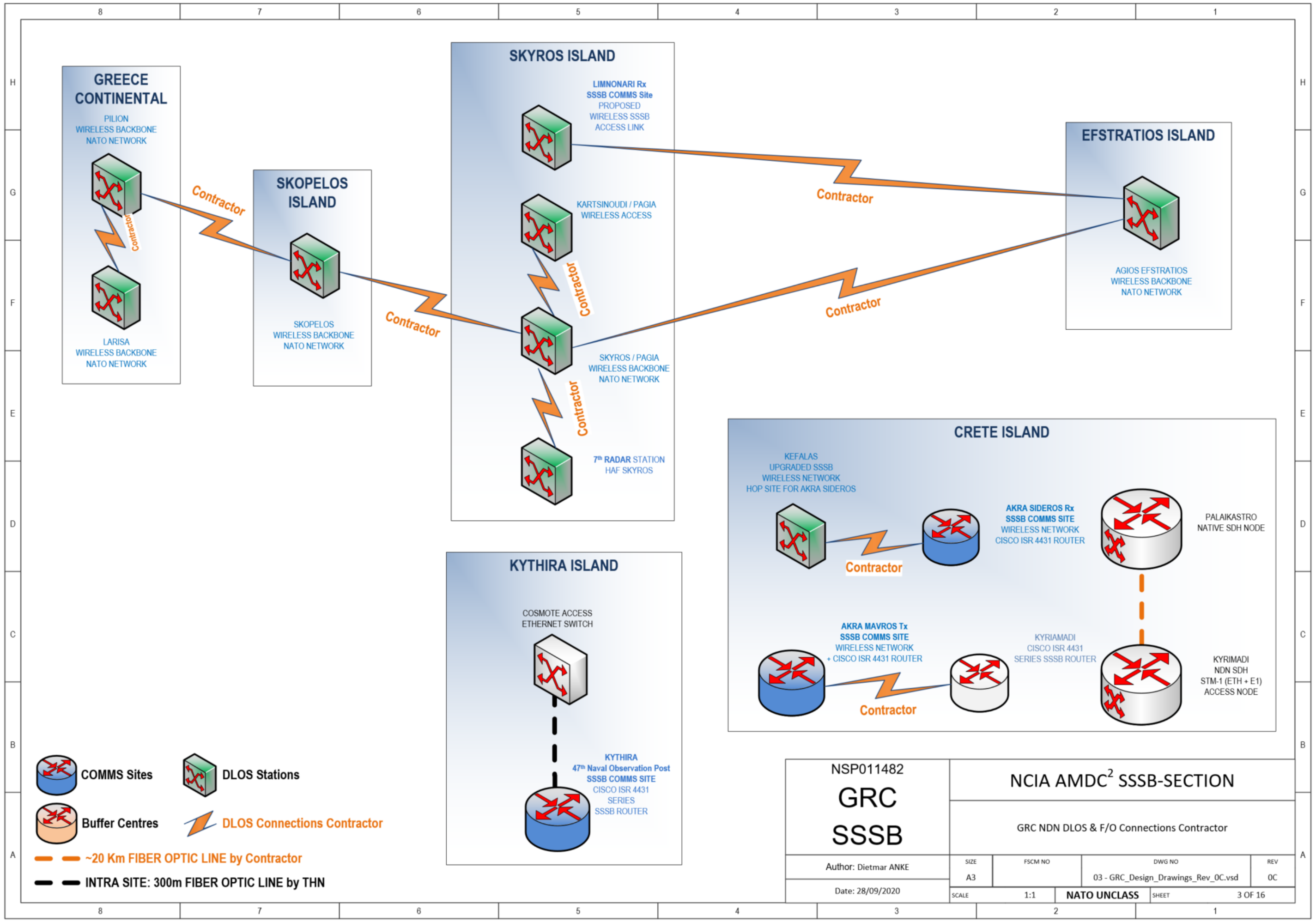

Figure 30: GRC NDN - DLOS & F/O Connections Contractor Responsibilities

SECTION 5 Technical Verifications

5.1 Technical Verifications

5.1.1 These activities are studies dedicated to the verification of the technical and operational.

5.1.2 The Contractor shall prove the EM coverage as per the following:

a. SSSB Operational Requirement

- ‘To provide a real-time automatic exchange of Air Defence (AD) data between Maritime Forces and NATO Air Defence Ground Environment (NADGE)’

b. Radio coverage

c. HF: ‘300 NM gapless coverage’

d. UHF: ‘LOS up to 150 NM’

e. HF Operational Modes

f. Ship-Shore High Speed Data exchange NTDS Link 11 as per MIL-STD-188-203-1A and STANAG 5511

g. Ship-Shore High Speed Data Exchange Link 22 as per STANAG 5522

h. Voice SSB for coordination, Ship-Shore

i. Transmitters

j. HF-TX power 5kW peak and mean, frequency range 2-30 MHz, SSB for Link 11, Link 22 modes and Voice mode

k. Propagation Type

l. Link 11 Vertical polarization, Ground wave

m. Link 22 Vertical polarization, Ground wave

n. Link 22 Sky wave

o. Voice Coordination Vertical polarization, Ground wave

p. Minimum S/N in Link 11 mode

q. With reference to MIL-188-203-1A para 5.1.13, in order to identify the coverage area in Link 11 mode, using the simulation program Advanced Stand Alone Prediction System (ASAPS), the following values can be used to guarantee a BER value better than 10-3:

r. Receiver minimum input power value:

s. PIN = -105 dBm (equivalent to 1.27 µV / 50 Ohm)

t. Receiver input Signal Noise Ratio value

u. S/N = 15 dB

v. Minimum S/N in Voice mode

w. In this operational mode for the HF receiver it is possible to assume the following conditions for the input and output (minimum sensitivity) that a good quality of the Voice signal delivered by the receiver:

x. Input signal: -110 dBm (equivalent to 0.7 Volt / 50 Ohm)

y. Output S/N: 10 dB

z. X Antenna Field

aa. The following parameters are the minimum requirement for the TX Antenna Field:

- Coverage Area: 300 NM
- Minimum S/N: 10 dB at the receiver antenna
- TX Power: 5 kW
- Simulations: Month/Day/Hour
- Frequency: 2 to 30 MHz
- BW: 3 kHz
- RX Antenna: Isotropic Vertical
- Man Made Noise: -150 dBW/Hz (shipboard)
- Propagation: Ground Wave
- Polarization: Vertical/Horizontal,
- Elliptic

bb. Results representation

cc. Recommended tabular representation (examples):

Area of interest:	300 nm	**TX Antenna type**
S/N	10 dB	

Transmission				Reception	
TX Power		5 kW		RX Antenna	Isotropic Vertical
Mode		See Table		BW	3 kHz
Winter				Man Made Noise	-150 dBW/Hz @ 3 MHz
Summer				Required Days	95%
Day	D	Hour		Confidence Level S/N Ration	95%
Night	N	Hour			

Freq (MHz)	Sky Wave Propagation				Ground Wave Propagation			
	January		July		January		July	
2								
3								
4								
5								
6								
7								
8								
…								
29								
30								

dd. Legend:

O	No Coverage
X	Coverage
	Not evaluated

ee. Recommended map representation:

Location		**Antenna**			
Frequency		**Season**		**Time of Day**	
TX Power	5 kW	**Propagation**		**Man Made Noise**	-150 dBm (ITU R, P372)
Reception confidence	95%	**Required Days**	95%	**Bandwidth**	3 kHz

5.1.3 HF Transmitter decoupling: For the radio sites the Contractor shall verify the transmitter decoupling to.

a. Verify if the decoupling between the TX antennas it is sufficient to allow the correct operation of the transmitters in relation to the radiated signal quality.

5.1.4 The Contractor shall verify whether the radio communication system presents side effects related to insufficient decoupling:

a. High coupling

b. Excess of SWR

c. Difficult automatic tuning of the final stage of the amplifier

d. Coupling

e. Spurious emission due to intermodulation between transmitters

f. Spurious emission in the TX bandwidth influence the quality of distant reception

g. Spurious emission outside the TX bandwidth influence the receivers of the RX site

5.1.5 The Contractor shall verify that maximum values recommended for the spurious emission values due to TX intermodulation are not exceeded:

a.The quantity of the spurious emission values are related to:

- Transmitter characteristics
- Power Level
- Antenna decoupling
- Antenna characteristics
- It is assumed that that quantity shall not be bigger than the spurious values generated by the transmitter when used with a dummy load that

is 30/35 dB lower than the value of the two tones generated with full power

5.1.6 Recommended procedure:

a. Reference:

b. Richard C. Jonson, “Antenna engineering Handbook”, Third edition

c. Initial values:

d. Frequency: 2 – 30 MHz

e. Power Level: 5 kW

f. TX Antennas relative distances: (per Final Project)

g. Antenna characteristics: (per Final Project)

h. Equipment characteristics: (per Final Project)

5.1.7 Results representation:

a. The Contractor shall provide drawings, representing the mutual decoupling between the antennas in dB, versus the relative distance, and versus the maximum coupling allowed by the transmitters and of the RF infrastructure

5.1.8 Decoupling between the TX Antenna Field and the RX Antenna Field. For the six radio sites the Contractor shall verify the TX and RX Antenna Fields decoupling.

5.1.9 To verify if the decoupling between the antenna fields it is sufficient to allow the correct operation of the SSSB system in relation to the potential corruption of information due to the amplification and demodulation process provided by the receivers related to string signals radiated by the transmitters.

5.1.10 HF Receiving Antennas efficiency:

a.Contractor shall verify the HF receiving efficiency;

b. Contractor shall implement the RX site with one single receiver antenna;

c. Contractor shall ensure that the antenna shall drive, using a multi-coupler or an antenna matrix, two HF Receivers with the associated division of the received signal from the antenna;

d. Contractor shall verify that, in standard operational conditions, the received signal from a Naval Unit located within the SSSB coverage area is compatible with the receiver Signal Noise figure;

5.1.11 Such verification is deemed necessary even if, due to former experience in similar installation, the S/N ratio provides an external noise higher than the noise generated at the input of the receiver.

5.1.12 In addition, the Contractor shall also verify if the presence of strong received signals produces any distortions at the receiver side. In such case the Contractor shall evaluate if the receiver characteristics are able to cope with such case. In case of adverse results, the Contractor shall propose any specification changes accordingly.

IFB-CO-15577-SSSB-AMD3

NATO Communications and Information Agency

NCI AGENCY

BOOK II

SECTION IV – STATEMENT OF WORK

SOW – ANNEX I

SYSTEM REQUIREMENTS SPECIFICATIONS (CIVIL WORKS) (GREECE)

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PART A – SUMMARY AND GENERAL REQUIREMENTS

SECTION 1 OVERVIEW

1.1 General

1.1.1. The purpose of this section is to outline the civil works-related requirements that shall be met for the preparation and construction of the building, utilities and other facilities required to accommodate the SSSB system with its supporting infrastructure (such as SSSB electrical installation, HVAC, UPS etc.). It is the Contractor's responsibility to provide the Purchaser with complete and finished civil works as specified in this Annex and site specific Appendixes

1.2 General Responsibilities of the Contractor

1.2.1. Site specific Appendixes provide information on the civil works scope relevant for each respective site.

1.2.2. The Contractor shall be responsible for meeting all requirements specified in those Appendixes.

1.2.3. The Contractor shall cross reference the requirements stipulated in site specific Appendixes with respective requirements described in this Annex and the SOW Main Body, and shall meet all of them.

1.2.4. In relation to all deliverables (for example pieces of equipment, material, structural works, systems, subsystems, components, line-replaceable units etc.) that are part of any installation and/or construction works, as specified in the core SOW, this Annex and site specific Appendixes, the Contractor shall be responsible for the following:

a. Design

b. Delivery to the site

c. Installation and construction (as required) including any supporting structures, systems, installation and auxiliary material and equipment.

d. Provision of access to all premises (including building/ arranging temporary access for the duration of installation/ construction works to all premises (e.g. preparation of temporary roads, temporary parking and operation areas for machinery such as cranes, concrete mixers, etc.) including ramps to introduce equipment to buildings and rooms etc., removal of fence sections if required, then temporary closer of the fence gap according to respective THN security driven requirements and finally, reinstallation of the removed sections to their original conditions before the removal)

e. Temporary storage including protection/ guarding of stored items (unless THN GRC agrees to provide this at any of the sites which shall be specifically agreed with THN GRC in relation to individual sites)

f. Removal of all of the temporary structures the Contractor may have erected.

g. Provision of all required utilities the Contractor needs for the execution of the project (power, water, internet connection etc.). This may require provision of power generators with construction site power distribution system, fuel tanks, water tanks etc. (unless THN GRC agrees to provide those at the sites in which case it shall be specifically agreed with THN GRC in relation to individual sites).

h. Removal and disposal of any waste being the result of the Contractor's work.

i. Certification as required in accordance with respective THN Law, regulations and standards.

j. Testing and commissioning.

k. Integration with existing systems as required.

l. Modification of existing facilities, infrastructure and installations as required.

1.3 Operational Requirements

1.3.1. This shall include:

a. Site demolition and preparation works

b. Usage of external public access road

c. Site works:

   i. Paved areas

   ii. Landscaping

   iii. Antenna foundations and masts

d. Functional Areas:

   i. Operations

   ii. Administration

e. Utilities:

   i. Environment control system (HVAC)

   ii. Electrical distribution system

   iii. Drainage system

   iv. Lightning protection and grounding system

f. Protective works

   i. Fences and gates

   ii. Fire protection systems

1.4 Current Situation

1.4.1. The existing situation at the Greek (GRC) radio sites is described further within the GRC Site Information Data Package (SIDP) Annex of this SOW (IFB-CO-15577-SSSB SOW Annex H (NATO R*******D).

1.4.2. The Site Information Data Package (IFB-CO-15577-SSSB SOW Annex H (NATO R*******D) shows the boundaries of the existing installations as well as the currently available military domain.

1.4.3. The Contractor shall use the available land at the six GRC radio sites at Kartsinoudi, Limnonari and 7th AD Radar site on Skyros as well as sites at Sideros and Mavros on Crete and Naval Entity 47 (NE47) on Kythira efficiently. The Contractor shall design and construct facilities that make future expansion and enhancements possible, whilst maintaining minimum 'buffer' zones for security according to THN GRC instructions that will be provided during the Contractor's site survey. In this context, any requirement for land expropriation shall be limited to the bare minimum and shall not exceed the proposed expropriation (if any) detailed in Section 12 of the SOW (IFB-CO-15577-SSSB -Book 2-Part 4-SOW).

1.4.4. The existing power plant details are provided in SOW (IFB-CO-15577-SSSB SOW Annex H (NATO R*******D) and in supporting Purchaser-provided information. It includes: Diesel Generators, Power Switch Gear, UPS and batteries.

SECTION 2 DESCRIPTION OF THE CIVIL WORKS (CW)

2.1 This Statement of Requirements (SOW) represents to the extent possible the definition by the Purchaser of the needs expressed by the operational users.

2.2 This definition has been done from a global perspective but does not represent a finalized nor complete product. In this particular context the term TBD means to be determined by the Contractor, during the bidding phase, and the Contractor during the execution phase. A similar principle shall apply to other requirements stated throughout this SOW Annex where, for the avoidance of doubt, such obligations shall transfer to the Contractor during the execution phase.

2.3 The site installations and the building shall be designed to meet the operational requirements and to incorporate environmentally friendly measures to reduce life-cycle costs.

2.4 The design of these facilities shall be such as to enable the personnel to perform the required maintenance and control functions in the best possible economical way.

2.5 The structure of these civil works requirements as defined herein in this Annex and in site specific Appendixes is still generic and not definitive. It is the Contractor’s responsibility to complete and expand it as required for the design and the execution of the works under this contract in line with good engineering practices and when justified and required applying state of the art technical solutions. In the same context the use of Building Life-Cycle Cost (BLCC) Programs is recommended.

2.6 The broad requirements and the summary technical description are included below:

2.6.1. The Contactor’s approach and choices shall be fully justified and documented through its studies, legal and technical references and documentation, etc.

2.6.2. The Contractor should be aware that there will be no need to prepare any Environmental study/analysis for areas dedicated to Greek national defence in line with Greek legislation (Greek Government Gazette FEK 209-A’-21.9.2011 – Environmental Licensing of Projects and Activities, Setting in Function with the creation of an Environmental Balance and Other Provisions of the Ministry of Environment, Article 1, Paragraph 2).

2.6.3. The Contractor shall prepare a Radio Hazard Study for the personnel in TX sites, especially for the Radio Site at Mavros on the island of Crete.

2.6.4. Testing and Acceptance shall comply with the provisions in Section 12 and 13 of the core SOW. Successful completion of Construction/Factory Acceptance Tests of the Civil Works elements shall be achieved prior to the installation of the transmitting and receiving COMMS equipment (including integrated PFE equipment).

SECTION 3 SURVEYS

3.1 Existing situation.

3.1.1. The existing situation at is described in SOW Annex B (IFB-CO-15577-SSSB SOW Annex B (NATO R*******D).and includes:

3.1.2. The existing site lay-out, showing existing limits, fences, access and internal roads, parking, etc., is represented in the drawings provided within the SOW SIDP Annex (IFB-CO-15777 SOW Annex H) and includes where available:

a. The plans of the existing utilities: water, electricity, sewage, etc.

b. As Built Drawings for existing facilities

c. Initial Land survey

d. Initial Topographic survey report including existing limits.

3.1.3. The Contractor is reminded that the SIDP annex is provided purely as background info for the Contractor's benefit. It has no particular contractual status and it is the Contractor's responsibility to check and validate those data for design and realization of the site civil works.

3.2 Preliminary Site survey

3.2.1. A preliminary Site survey shall be executed by the Contractor at the first stage of the execution phase and as the minimum shall address following:

a. Construction site office

b. Access road to the site

c. Situation of cables, ducts, other buried infrastructure etc.

d. Structures, Buildings and infrastructure to be demolished/ dismantled

e. Health and Safety as dictated by the H&S THN laws and regulations

3.3 Commercial Electrical Power station

3.3.1. In remote locations, commercial distribution ring implementations are uncommon.

3.3.2. Further details on existing main distribution networks are provided herein in this Annex below and can be requested from THN GRC at the Contractor's site surveys or in preparation phase for such surveys.

3.4 ISLAND OF CRETE

3.4.1. Sideros HF TX Site (AKRA SIDERO) shall be converted to a HF RX site.

a. There is a Medium Voltage Line connection to the site with no ring implementation.

b. Within the facility, THN GRC has dual MV Transformers for redundancy.

c. As the site shall be converted to RX only, current power capacity in Watts (possibly as high as 1000kW) is no longer needed / required.

d. THN GRC will install a Transformer and will deliver Low Voltage (LV) to the existing at the site Main Power Distribution Board (MPDB).

e. THN GRC will also install a power meter for LV once the required capacity has been confirmed by the Contractor

f. Indicative low voltage ratings available are 78kVA, 135VA and 250kVA.

3.4.2. Mavros HF RX Site (AKRA MAVRO) shall be converted to a HF TX site.

a. Radio Site Mavros being an Rx Site has power delivered in Low Voltage.

b. There is a transformer installed at the site entrance gate.

c. The Contractor shall analyse whether this transformer shall be upgraded, along with the cabling and the LV MPDB at the facility.

d. Currently installed capacity equals the rating of the Generators at 100kVA.

e. The Contractor shall define the Total Power Requirement for the new TXs and all other equipment provided by the Contractor under this contract.

f. The Contractor shall note that 250kVA is the maximum LV power available at the site.

g. Retrofitting of the LW installation for the power lines feeding the new TXs and all other equipment provided by the Contractor under this contract shall be executed by the Contractor.

h. A maximum of 250kVA will be requested / programmed by THN GRC based on power consumption figures provided by the Contractor.

3.4.3. Kartsinoudi HF TX Site shall have the same configuration as in the old Akra Sidero that is present in Kartsinoudi, with dual / redundant Medium Voltage Transformers.

a. Existing MV line is installed as aerial line until reaching the site gate.

b. From the site gate onwards the MV line is installed underground.

c. The number of HF transmitters, under this contract, shall be reduced to three units.

d. Therefore, the Contractor shall execute one of the two options:

i. Dismantle existing MV transformers and relevant MV Switches and convert the entire installation from MV to LV

ii. Refurbishment of the existing installation.

e. The Contractor shall propose and implement the most suitable of the above stipulated options.

f. Indicative low voltage ratings available are 78kVA, 135VA and 250kVA.

g. Summary for Kartsinoudi TX Site:

i. KARTSINOUDI is not part of the local commercial LV, MV distribution ring.

ii. The Contractor shall either convert existing MV installation to LV or refurbish where needed keeping the existing layout.

iii. If it is converted to LV, a maximum of 250kVA will be requested / programmed by THN GRC based on power consumption figures provided by the Contractor.

3.4.4. Limnonari HF RX Site has no connection to the commercial main power distribution network.

a. Existing design relies on 24h per day continuous operation of power generators (PGS).

b. The Contractor shall dismantle and dispose of existing PGS and provide and installed new ones as per requirements stipulated thereafter in this Annex and in the site specific Appendix.

3.5 KYTHIRA ISLAND

3.5.1. NE 47 HF Radio Site is connected to the LV commercial main power distribution network.

a. The Contractor shall upgrade the existing power connection

b. Existing connection is at 78kVA.

c. Indicative low voltage ratings available are 78kVA, 135VA and 250kVA.

d. Summary for NE 47 HF Radio Site

i. The NE 47 Radio Site on Kythira is not part of the local commercial LV, MV distribution ring.

ii. The Contractor shall upgrade the existing LV installation assuring that the new transformer (to be provided by the Contractor) has sufficient capacity to support existing loads and the new SSSB system with its supporting equipment

iii. Further requirements are stipulated hereafter in this Annex and in the site specific Appendix

iv. A maximum of 250kVA will be requested / programmed by THN GRC based on power consumption figures provided by the Contractor.

3.5.2. As the LV power provision to the NE 47 HF Radio Site shall not be interrupted, any station shall not be dismantled before, either a temporary connection has been provided, or the new station is built and connected to the commercial electrical distribution network and fully operational.

3.5.3. All interim and long-term power planning shall be coordinated with the electrical power supplier, the local power distributor and the Purchaser.

3.5.4. It is the Contractor's sole responsibility to ensure that all electrical power supply required for the neighborhood is delivered at all time without significant interruption in accordance with the electrical power supplier obligations and practice.

3.5.5. Details of the Point of Contact (POC) for the Electrical Power distributor will be confirmed prior to/or during the Contractors Site Surveys

3.6 Surveys and soil tests

3.6.1. Prior to any studies and start of the works the Contractor shall execute a detailed topographic survey, as well as the necessary soil investigations, in order to complete and verify the information provided by NCI Agency and/or the Territorial Host Nation (THN).

3.6.2. Any topographic survey and soil tests shall be executed under the sole responsibility of the Contractor and the survey and soil test reports shall be presented to the Purchaser. The reports shall be the references for the subsequent studies and designs that the Contractor shall execute in accordance with requirements stipulated herein in this Annex and in site specific Appendixes.

3.7 External public access road

3.7.1. Although the road to access the site is outside of the military area, the Contractor shall be responsible for maintaining this road in a state equivalent to what it was at the beginning of the works.

3.7.2. To that purpose the Contractor shall:

a. Submit request for an authorisation to the local authorities in case of works required on public roads (i.e. excavations, dismantling of signs and traffic lights).

b. Agree with the local authorities on the conditions to be met during the execution of the works regarding traffic, protection measures in case of heavy vehicles traffic, reparation works after the execution, etc.

c. Record the findings and decisions in a report to be signed for acceptance / approval by both parties. One copy of this report, duly signed by all parties involved, shall be provided to the Purchaser

3.8 Commercial and Host Nation Telecommunication Service Providers

3.8.1. The SIDP Annex Appendices (IFB-CO-15577-SOW Annex H) contains some THN provided drawing describing the fiber optic and cable entry points.

3.8.2. All relevant actions regarding telecommunication providers will be handled by the THN and not the Contractor.

3.8.3. The THN will be responsible for any termination of services which will impact the execution of works by the Contractor.

3.8.4. In case it is required the Contractor shall provide an appropriate route from the fiber optic and cable entry points, to a location conveniently close to the area identified to accommodate the termination equipment, power and space for any termination equipment. The THN shall provide the National Defence Network (NDN) connection to each SSSB COMMS site. At the SSSB COMMS sites, the Contractor shall integrate the router and all local network related lines and equipment, needed for the SSSB system functionality, including inter-site connections

SECTION 4 ARCHITECTURE AND ENGINEERING (A/E) DESIGN

4.1 The Civil Works scope of the contract shall include the studies, documents and drawings necessary for execution of the works.

4.2 Those studies and works shall meet various criteria such as but not limited to:

4.2.1. Building regulations;

4.2.2. Stability;

4.2.3. Functionality;

4.2.4. Technical specifications;

4.2.5. Fire protection;

4.2.6. Physical security;

4.3 In this framework and unless they possess the required capacity, accreditations and authorisations, the Contractor shall sub-contract the studies, the design and the control of the works to an A/E company (A/E) accredited and maintaining a permanent office in Greece. This shall comply with the criteria defined herein in this Annex.

4.4 Consequently, the term "A/E firm" or "A/E" shall be understood as "the sub-Contractor in charge of and responsible for the studies, designs and the control of the civil works".

4.5 The overall mission of the A/E firm includes:

4.5.1. The pre-design studies and schematic design.

4.5.2. The schematic design, as the minimum, shall include:

a. Floor plans

b. Site plans

c. Building elevations (all four sides - the east, west, north and south)

d. Description of building systems (structural, mechanical, HVAC, electrical, fuel distribution, fire protection, data cabling etc.), interior and exterior finishes, and the building site with supporting schematic and conceptual drawings

4.5.3. The application/file for the Request of the Construction Permit shall be submitted during the execution phase as specified herein in this Annex.

4.5.4. The planning, preparation, execution, follow-up of the design studies (30% and 100%) and construction documents (drawings and specifications establishing the requirements for the civil works scope of the project).

4.5.5. The participation in the supervision, the control and the acceptance (including but not limited to provisional and final acceptance) of the execution of the civil works part of the contract.

4.5.6. The participation in any follow-up tasks during the warranty phase.

4.5.7. The fulfilment of their responsibility as the architect and the author of the project in accordance with all applicable national laws and specific regulations such as or equivalent to the deontology, laws, directives, recommendations, etc. applicable in Greece.

SECTION 5 CONSTRUCTION PERMIT

5.1 The Contractor shall prepare and submit construction permits to the THN authorities for THN approval.

5.2 The Contractor shall provide the construction permit, supplemented by any other permits that are required in given locations as one of the first deliverables.

5.3 The Contractor shall prepare the design and all studies (including the Radio Hazard Studies), which shall be submitted to the appropriate department of the Hellenic Navy General Staff (HNGS/C4) for approval.

5.4 According to the MINISTERIAL DECISION 26229/1123/1987 (Government Gazette 749/D' 10.8.1987) "Terms and procedures for issuing construction permits for the execution of military projects" NATIONAL DEFENSE AND ENVIRONMENT, SPATIAL PLANNING & PUBLIC WORKS, an approval from an independent control office or by the locally responsible urban planning services is not required.

5.5 More requirements concerning the construction permit procedures are provider thereafter in this Annex.

SECTION 6 CIVIL WORKS INFRASTRUCTURE

6.1 General

6.1.1. This part includes all works, which shall be executed in a coordinated manner for the realization of the site general infrastructure as defined herein in this Annex and in site specific Appendixes.

6.1.2. Site preparation and demolition works shall include:

a. Construction of the site offices for the Administration, the Contractor and his sub-contractors

b. Demolition works that are necessary prior to the construction of the new facilities, including disposal of all materials in accordance with the applicable local/THN legislation.

c. Stockpiling of the top soil for re-spread after completion of construction works so that final landscaping can be established in the shortest possible time.

d. Where required the removal and disposal of existing fuel tanks.

Note: Precautions and required measures shall be taken by the Contractor to prevent soil pollution and/or remove possible existing contaminated soil during these activities.

6.2 Dismantling and recovery of equipment

6.2.1. The Contractor shall be responsible for dismantling, removal and disposal of various structures, installations and equipment. Further requirements are stipulated hereafter in this Annex and in site specific Appendixes.

Note: The THN is responsible for the current installed SSSB System Equipment and will follow NATO standard Excessive Surplus procedure, derived from the IS(NOR) NSIP manual, for the existing SSSB equipment recorded in JFAI list. As a result, the THN will provide to the Contractor not later than at PDR:

- a list of equipment the Contractor shall dismantle and disposed of;
- a list of equipment, equivalent to the JFAI Equipment list, which the Contractor shall dismantle and relocate to THN managed storage facility.

6.3 Asbestos

6.3.1. The attention of the Contractor is drawn to the fact that Asbestos may be present on the site under various forms like, among others, cable ducts, wall covers and various pipes and ducts.

6.3.2. The Contractor shall address this aspect where necessary in construction permit application, in the design and the execution phase.

6.3.3. It is the Contractor's responsibility to take appropriate measures for the containment, removal and disposal of asbestos in accordance with applicable THN legislation:

a. Such measures shall be applied in relations to the Contractor's scope, in areas affected by the Contractor's works

b. The Contractor shall confirm in writing that asbestos was contained and removed from the areas affected by the Contractor's works

c. The Contractor shall immediately notify respective THN authorities in case any asbestos is identified at the sites

6.3.4. Up to and including 20.0 m^3 (in summary for all of the SSSB GRC sites) of material contaminated with asbestos shall be removed and disposed of by the Contractor. Any excess of that shall be counted as an additional effort for which the Contractor is entitled to raise an additional claim.

6.4 Earthworks

6.4.1. Earthworks works shall be executed, in accordance with requirements stipulated herein in this Annex and in site specific Appendixes, taking into account all coordination measures related to:

a. The demolition works and preparation of the site

b. Road, antenna and building foundations

c. Trenches, buried cables and ducts

d. Roads, parking, walk pads

e. Fences and outdoor signage

f. Fuel tanks and piping

g. Etc.

6.5 Foundations for roads, antennas, paved areas and various building structures

6.5.1. Those works shall be executed, in accordance with requirements stipulated herein in this Annex and in site specific Appendixes, for the following:

a. The paved areas: roads, walk pads, parking, etc.

b. The antenna masts

c. Fences and outdoor signs

d. Power generators

e. Fuel tanks

f. Other building structures and areas as necessary.

6.6 Rain water drainage

6.6.1. A storm sewer system shall be provided where necessary and shall be as a minimum at 1.5 m away from the building grade beams.

6.6.2. The storm sewer system and drainage system, when required for stability of the buildings, antenna masts, towers and supporting infrastructure, shall meet following requirements:

a. Collection and evacuation of rain water discharged from each building drainage system, antenna fields, roads, pathways etc.

b. Drainage of surface and sub-surface water

c. Control of ground water level

d. Protection against flooding.

6.6.3. The storm sewer system and drainage shall be kept separated from any existing sewage disposal system.

6.6.4. The connection to the existing drainage system of the local community at the radio sites shall be coordinated by the Contractor with the local authority. Further requirements are stipulated herein in this Annex and in site specific Appendixes.

6.6.5. A study prepared by the Contractor and approved by this local authority shall be included in the 30% design.

6.7 Buried cables, cable ducts and trenches

6.7.1. Those works shall be executed, in accordance with the requirements stipulated herein in this Annex and in site specific Appendixes, for the following:

a. As a general principle all required cables (electricity, data, etc.) shall be laid in the ground in protective pipes and conduits in accordance with applicable THN technical and legal regulations.

b. When for any reason this is not possible (for example due to conflict with existing utilities and/or other infrastructure, different protection measures required, etc.) the cables shall be installed in on the ground ducts and trays and/or overhead support structures in accordance with applicable THN technical and legal regulations.

6.7.2. Trenches for cables and ducts:

a. Those works shall be executed for all the cables and ducts to be installed on the site, including cables and ducts from and to the buildings and antenna locations.

b. Special attention shall be paid to coordination of all earthworks to be executed on the site in order to avoid damages to existing / already executed installations (roads, foundations, water drainage, etc.).

SECTION 7 BUILDINGS AND MISCELLANEOUS CONSTRUCTIONS

7.1 Building general

7.1.1. The building shall be designed:

a. To fulfil the requirements defined hereafter in this Annex and in site specific Appendixes

b. To meet the principles of “the Greek Ministry of Defence (GRC MOD) national/military constructions standards and/or as specified herein in this Annex and in site specific Appendixes.

7.1.2. The building shall be designed and line with the following THN legislation and regulations:

a. Presidential Decree 244/1980:"Cement Regulation for Concrete Works (Pre-stressed, Reinforced and Unarmed) (Government Gazette 69/A'/1989).

b. ELOT EN 10080, ELOT 1421-1, ELOT 1421-3 "Standards for concrete reinforcement steels".

c. Ministerial Decision D11E/0/30123/1991 (Government Gazette 1068/B'/31-12-1991 "Amendment of the New Concrete Regulation for the Design and Construction of Concrete Works".

d. Ministerial Decision D17a/116/4/FN429/18-10-2000 (Reinforced Concrete Regulation) EKOS 2000.

e. Ministerial Decision D14/50504/2002 (Government Gazette 537/B; /1-5-2002) "Adaptation of the Concrete Technology Regulation to the Requirements of the Harmonized Standard" ELOT EN 197-1.

f. Ministerial Decision D17a/141/3/FN 275/1999 (Government Gazette 2184/B/20-12-1999) "Hellenic Earthquake Regulation 2000" (Approval of the Greek Earthquake Regulation)

g. Ministerial Decision 16462/29/2001 (Government Gazette 917/B'/17.7.2001) "Cement for the Construction of Concrete Works".

h. Ministerial Decision D14/92330/08 (1416/B'/17.7.08) (Government Gazette 381/B'/24.3.2000) "Approval of the New Regulation of Concrete Reinforcement Steel Technology".

i. Ministerial Decision DIPAD/OIK. 372/2014 (Government Gazette 1457/B'/5.6.2014) "Approval of the application and use of the Euro codes in combination with the respective National Appendices)

j. Government Gazette 59/D/3-2-1989 "Building Regulations".

k. Joint Ministerial Decision D6/B'/OIK 5825 (Government Gazette 407/B/2010) "Approval of the Energy Efficiency Regulation of Buildings (KENAK)".

l. Ministerial Decision F.7.5/1816/88/2004 (Government Gazette 470/B/5-3-2004) "Replacement of the current Regulation of Internal Electrical Installations with the ELOT Standards and other relevant provisions".

m. Manual of Standard Distribution Structures of Public Power Corporation (PPC), the Instructions Distribution of PPC SA.

n. Greek Technical Specifications-Government Gazette 2221/30-07-12 with mandatory application in all public works.

o. Sewerage Regulation

p. Amendment and Supplementation of Presidential Decree 71/88 "Building Fire Protection Regulation" (Government Gazette 1316/B/31-12-1998)

q. Presidential Decree 41/2018 "Building Fire Protection Regulation" (Government Gazette 80/A'/7-5-2018)

7.1.3. Furthermore the site installations and the building shall be designed in a “smart way” in order to not only meet the operational requirements, but also taking into account state of the art technical solutions resulting in environment friendly facilities with a reduced life-cycle cost.

7.1.4. A general SSSB site layout showing the building requirements is provided at figures 1 to 3. Any layout may be adapted to suit local conditions and to provide better accommodation for the SSSB function.

7.1.5. As a general rule the rooms in the new building shall be column free.

7.1.6. All works shall be executed in accordance with the technical specifications stipulated herein in this Annex and in site specific Appendixes.

7.2 New SSSB building

7.2.1. The building shall be windowless and shall include as a minimum the following:

Description	Minimum usable dimensions (m^2)	Remarks	Security Class
Supply Storage Room/ Workshop and Test facilities for electronic equipment	12 m^2	Miscellaneous storage area for technical administrative materials and supplies Average occasional occupancy 2 persons	N/A
SSSB Equipment room	50 m^2	As defined in IFB Book 2 Part 4 SoW and its supporting appendices. If the building design provides for a separate Environment Control room (HVAC) the size of SSSB Equipment room can be proportionally decreased	Class I
Power Generator room	50 m^2	2 generators; exterior access is required in addition to direct access from inside of the building areas	

Main Power switchgear room	TBD		
UPS/Battery room	TBD		
Environment Control room (HVAC)	TBD	If not housed in SSSB Equipment Room. Including fresh air input. Exterior access is required in addition to direct access from inside of the building areas.	
Vestibule	$4m^2$	At the main entry to the SSSB building, equipped with double door that assures protection against outdoor conditions when opening the double door of the SSSB Equipment Room	

Table 7-1 – Room Requirements

7.2.2. A site block diagram block diagram representing all functional areas of the new site is shown in **Error! Reference source not found.**.

7.3 Antenna foundations

7.3.1. This item is to be designed by the Contractor taking into account:

a. The antennas and any associated equipment as specified in the SRS Tech Annex (Annex A Section 4 Technical Requirements: Systems and Infrastructure).

b. Minimum technical requirements defined herein in this Annex and in site specific Appendixes.

SECTION 8 HEATING VENTILATION AND AIR CONDITIONING (HVAC)

8.1 An Environmental Control System (ECS)

8.1.1. An ECS shall be provided for the following areas:

a. The new SSSB building

b. In other premises at various sites, as HVAC system dedicated for SSSB system and its supporting installations provided by the Contractor.

8.1.2. To the extent possible and practical the HVAC for all premises and installations shall be combined.

8.1.3. The detailed requirements are stipulated hereafter in this Annex and in site specific Appendixes.

SECTION 9 FIRE FIGHTING AND FIRE PROTECTION

9.1 Fire Systems Overview

9.1.1. The fire protection system shall be provided in the new SSSB building and in other premises at various sites, where SSSB system and its supporting installations are provided by the Contractor.

9.1.2. The fire protection system shall consist of:

a. Fire prevention measures

b. A fire detection system

c. A fire alarm system

d. A firefighting system

9.1.3. The Contractor shall comply with the national and regional legislations as well as with guidelines from the local authority.

9.1.4. A detail description of the minimum requirement, stipulated hereafter in this Annex and in site specific Appendixes, addresses the following:

a. General fire prevention measures

b. Fire detection

c. Fire alarm

d. Fire fighting

9.2 Fire Prevention

9.2.1. Materials and technique used in buildings and utilities shall be chosen taking due regard of their flammability.

9.2.2. Fire prevention measures shall be coordinated with a recognized competent authority (for example local fire brigade).

9.3 Fire Detection

a. A Fire detection system shall be in accordance with applicable national standards and regulations, and shall be provided in every single room of the new SSSB building and in other premises at various sites, where SSSB system and its supporting installations are provided by the Contractor.

9.4 Fire Alarm

9.4.1. A Central fire alarm (audible and visual) shall include as a minimum:

a. Fire detectors

b. Fire alarm buttons throughout the new SSSB building and in other premises at various sites, where SSSB system and its supporting installations are provided by the Contractor

c. A synoptic panel that shall be located in permanently manned functional areas as defined by the THN.

9.5 Firefighting system

9.5.1. Throughout the site, the fire extinguishing equipment shall be provided appropriately to the usage of the rooms and installed equipment.

9.5.2. Notices, marking, signs shall be displayed giving full instructions on procedure to be followed and action to be taken in case of fire.

9.5.3. This shall include, as appropriate, automatic fire extinguishing system at the Site Kythira, Naval Entity 47 South (TX-RX), fire extinguishers fire blankets, fire protection tools (for example axes, shovels etc.) as stipulated in respective THN rules and regulations.

SECTION 10 ELECTRICAL WORKS

10.1 Electrical Systems Overview

10.1.1. The electrical distribution system serving the SSSB shall include:

a. Mains Supply System and/or integration with existing Main Supply System (details on existing systems can be found in the SIDP Annex)

b. Electrical Distribution System (switchgears)

c. Power Back-up (Diesel Generators)

d. No-break power supply (UPS)

e. Building standard electrical equipment

f. External building lighting

g. Lightning protection and Grounding system

10.1.2. A detailed description of the required electrical distribution system and equipment is provided hereafter in this Annex and in site specific Appendixes, and addresses the following:

a. General

b. HV/MV/LV (as required) electrical power station

c. Mains power distribution board (MPDB) and/or integration with existing MPDB

d. Electrical distribution panels

e. Cables and wiring

f. Electrical equipment

g. Emergency lights

h. Electrical power back-up

i. UPS

j. Lightning protection and grounding connection

k. External lighting

l. Legal inspections for electrical works

SECTION 11 ROADS, PAVED AREAS AND LANDSCAPING

11.1 Roads, Paved Area and Landscaping Overview

11.1.1. The following facilities and features shall be provided by the Contractor:

a. Antenna access roads

b. Parking areas and paved connections to existing site roads and existing parking

c. Walk pads and Walkways

d. Landscaping, planting and gardening

11.2 Antenna Access Roads

11.2.1. These roads shall be connected to the existing site roads and/or existing roads that provide access to given sites, and shall provide connections to all antenna locations.

11.3 Parking Areas

11.3.1. Inside of the fence a parking area for minimum three (3) vans (maximum 3.5T each) shall be provided. It shall be conveniently located not to interfere with the functions of the internal road system.

11.4 Paths and Walkways

11.4.1. Those works shall be executed in accordance with requirements stipulated hereafter in this Annex and in site specific Appendixes.

11.5 Landscaping, Planting and Gardening

11.5.1. Those works shall be executed in accordance with requirements stipulated hereafter in this Annex.

11.5.2. The Contractor shall include all phases of erosion, sedimentation and dust control as an integral part of the design and construction of the site.

11.5.3. This shall include both temporary erosion and sedimentation control measures applied during the construction and permanent stabilization remaining in effect after construction is completed.

11.5.4. At the end of construction works vegetative cover shall be used to provide dust and erosion control.

11.5.5. The Contractor as an integral part of the construction project shall provide planting of trees, shrubs and ground cover for aesthetic purposes but only where they were present beforehand.

SECTION 12 TELEPHONY AND DATA

12.1 Telephony Requirements

12.1.1. Telephony requirements will remain a THN responsibility.

12.1.2. Where not in existence, the Contractor shall coordinate with the THN but it would be expected that the Telephone and Data system would include details on:

a. PABX

b. Terminal equipment

c. Maintenance position

d. Cabling

e. Connection to the outside networks

12.1.3. Further requirements can be found in Section 2 of Annex A to the core SOW (GRC SRS (Tech)) as well as the core SOW itself.

SECTION 13 HEALTH AND SAFETY (H&S)

13.1 Without prejudice to their overall legal obligations regarding health and safety of their personnel during the execution of the works, the Contractor and his sub-contractors shall apply the principles of the preventative measures defined in Greek H&S legislation regarding the welfare of workers.

13.2 The Contractor shall ensure that during H&S Planning following THN legislation and regulations are taken into account and complied with:

13.2.1. Presidential Decree 305/1996 (Government Gazette 212/A/29-8-1996) "Minimum safety and health requirements to be applied to temporary or mobile construction sites in compliance with Directive EEC 57/1992".

13.2.2. Law 4412/2016 "Public Procurement of Works, Supplies and Services" (adjustment to Directives 2014/24/EU and 2014/25/EU), Article 138 "General Obligations of the Contractor", Paragraph 7 (Government Gazette 147/A/8-8-2016).

13.2.3. Law 3850/2010 "Ratification of the Code of Laws for Health and Employee Safety" (Government Gazette 84/A/2-6-2010)

13.3 The Contractor shall include in in the design and execution phase all required information regarding health and safety taking into account that:

13.3.1. The Contractor shall propose at least one individual who possesses all legally required accreditations within THN GRC to fulfil the role of “H&S coordinator”.

13.3.2. The H&S coordinator shall be responsible for safety coordination in the design and execution phase.

13.3.3. Based on Law 3850/2010 "Ratification of the Code of Laws for Health and Employee Safety" (Government Gazette 84/A/2-6-2010), Article 8 "Obligation to employ a safety technician and occupational physician":

a. The Contractor has the obligation to use the services of a "security technician" (TEXNIKOS ASFALEIAS) if the employees for the execution of the project will be less than fifty (50).

b. The Contractor has the obligation to use the services of a "security technician" (TEXNIKOS ASFALEIAS) and an "occupational physician" (IATROS ERGASIAS) if the employees for the execution of the project will be fifty (50) or more.

13.4 In this context the execution of the H&S coordination for this project shall be assigned only to individuals who fulfil the legal conditions and are authorized to execute the missions of the H&S design coordinator and the H&S execution coordinator.

13.5 Further detailed instructions are included hereafter in this Annex and in respective sections of the core SOW.

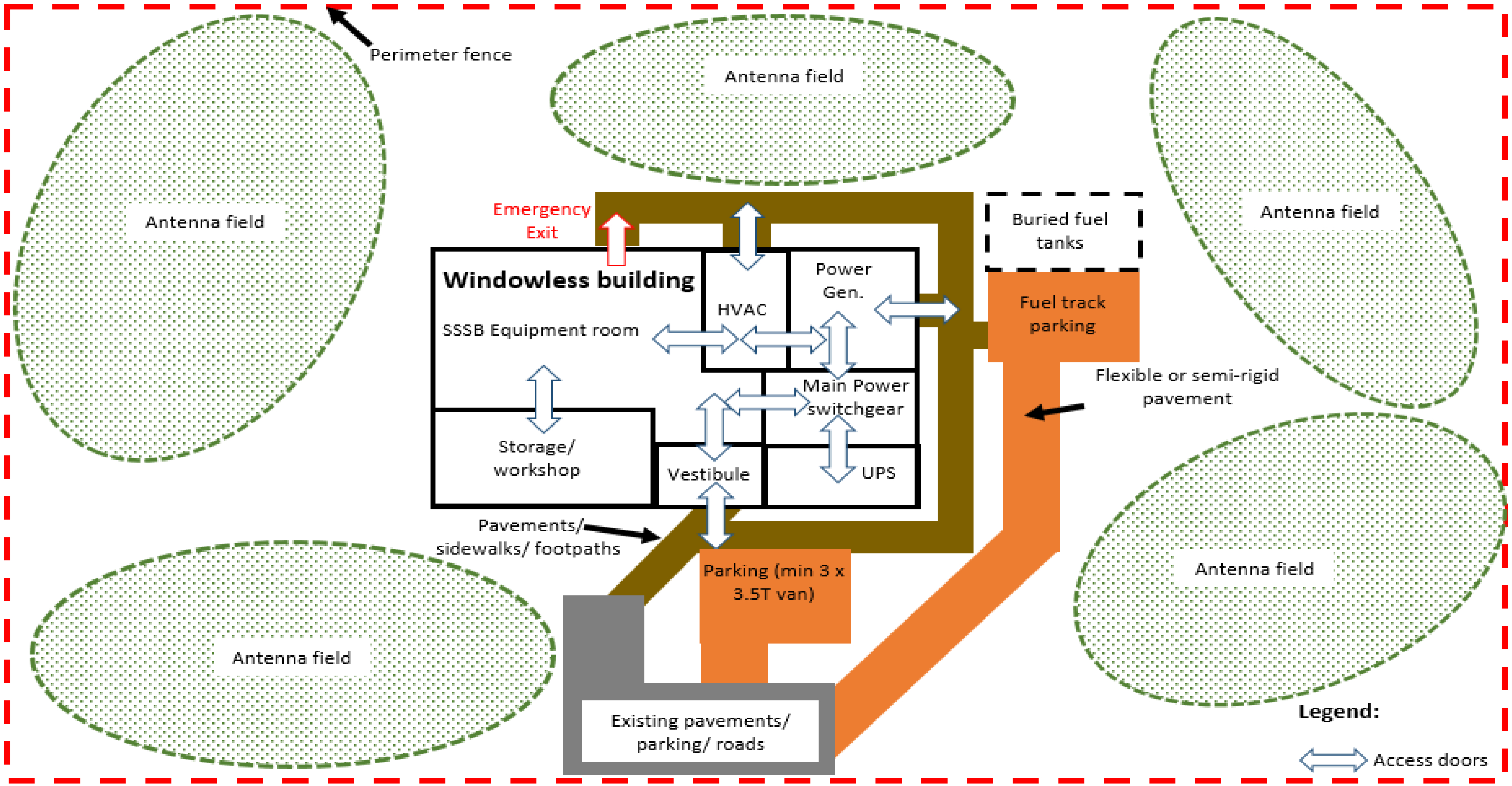

Figure 1 – Functional Site Block Diagram

Part B – DETAILED DESCRIPTION AND TECHNICAL SPECIFICATIONS

SECTION 14 INTRODUCTION

14.1 The goal of this project is that after completion of the civil works NCI Agency with support from THN GRC, will be in position to allow the installation and operation of the SSSB Comms System as described in the SOW and Annexes G to I.

14.2 Infrastructure and buildings shall be built to meet the operational and technical criteria laid down by NATO MMR (Minimum Military Requirements) and the standards and legal documents of the THN GRC.

14.3 In this context it is important to note that:

14.3.1. These installations shall as much as possible integrate harmoniously into the rural but relatively inhabited landscape of the local areas.

14.3.2. Local Authority details for the six GRC radio sites are as follows:

a. Site Kartsinoudi, Skyros Island (HF TX): Skyros Municipality.

b. Site Limnonari, Skyros Island (HF RX): Skyros Municipality.

c. 7th Radar, Skyros Island (UHF TRX): Skyros Municipality.

d. Co-located HF TX/HF RX COMMS Site, Kythira Island: Kythira Municipality

e. Site Sideros, Crete Island (HF TX) - This Site shall be converted to HF RX): Sitia Municipality.

f. Site Mavros, Crete Island (HF RX) - This Site shall be converted to HF TX): Sitia Municipality.

14.3.3. The Contractor can request THN GRC to provide Local Authority details for the following DLOS stations:

a. Skopelos DLOS radio-relays station

b. Agios Efstratios DLOS radio-relays station

c. Pelion DLOS radio-relays station

d. ARS Larissa DLOS radio-relays station

e. Pagia DLOS radio-relays station

14.3.4. These installations will on occasion be occupied and operated by military and civilian, female and male personnel as part of routine O&M of the various sites.

14.4 Below and in the following sections, some general considerations and design principles are presented which shall guide the Contractor during the design development and execution.

14.4.1. Knowledge and skills from outside of the Purchaser community are therefore called upon so that, the most relevant solutions are integrated into the offer, without losing sight of operational, economic or other criteria.

14.4.2. Without prejudice to the responsibilities of the Architect and Engineer Company (A/E) (for reference see respective sections herein in this Annex) the attention of the Contractor is drawn to the fact that any material, equipment and installation, regardless of what it might be, shall be submitted for the approval of the A/E and then presented to the Purchaser, before implementation.

14.4.3. The opinions and proposals of the A/E architect and author of the design shall be formulated explicitly in the relevant technical descriptions.

14.4.4. Any material, equipment, structure and installation used, installed, built, modified, and connected without having been presented to the Purchaser, with or without the agreement of the A/E, risks having to be immediately dismantled and removed from the site, by and at the expense of the Contractor, without the latter being able to claim any compensation.

14.4.5. In addition, copies of the delivery and shipping manifests of materials and equipment sent to the radio site shall be delivered both to the Purchaser and THN PM/Site Coordinator.

SECTION 15 TECHNICAL SPECIFICATIONS

15.1 Aims.

15.1.1. The study, designs and work execution shall comply with the requirements stipulated herein in this Annex. The requirements are linked to the Civil Works requirements also formulated herein in this Annex and in site specific Appendixes.

15.1.2. Where applicable, a specific level of performance, a specific technical description or a specific reference to an existing product, Purchaser Furnished Equipment (PFE), may be included in the SOW. In this case the Contractor shall comply with it as necessary.

15.1.3. Where appropriate, materials and technical solutions are prescribed by the Purchaser in general terms. However, the technical solutions offered by the Contractor must be validated and justified (calculation notes, technical sheets, etc.) by the Contractor's design office (A/E), which takes full responsibility for it.

15.1.4. The Contractor shall develop their design and present their descriptions in the form of relevant graphics, drawings, layouts, calculation, and narrative including the following as a minimum:

a. Nature of construction, demolishing, dismantling, refurbishment or new build works as well as installation works
b. Application – where and why given material and equipment are used / proposed for installation, construction, demolishing and dismantling works
c. Equipment, installations and material performance parameters
d. Bill of quantities in accordance with THN standards or standards in force in the THN (for example Civil Engineering Standard Method of Measurement (CESMM))
e. Unit of measurements for offered material, equipment, installations, demolishing and dismantling works as well as structures
f. Identification and description of method of implementation (including earth works, construction, installation, demolishing and dismantling works)
g. Work schedule
h. Health and Safety coordination documents

15.1.5. Without prejudice to the requirements laid out in the core SOW document, the Contractor shall respect the requirements and composition of the undermentioned civil works.

15.2 Technical documents.

15.2.1. The Contractor shall provide within the Technical Documents the following:

a. Plans/ drawings

b. Explanatory texts and calculation notes

c. Detailed descriptions of works and equipment

d. The quantity (bill of quantities)

15.3 The work schedule.

15.3.1. The Contractor shall propose a succinct Gantt-type schedule, presenting the main stages of the work to be carried out and in line with the Schedule of Supply and Services (SSS).

15.3.2. This schedule shall present the "civil works sub-project" integrated into the core of this SSSB project and shall be established taking into account all the requirements mentioned in this Contractor document, including the main milestone delivery dates (civil works and installation of SSSB transmission equipment, external services, etc.) and the necessary links between the specific civil works tasks and the other tasks of the core project.

15.3.3. This schedule shall also include all the tests and trials planned for prior the technical acceptance of major equipment, site tests, provisional acceptance, etc.

15.4 Documents relating to and explaining the choice of Architect and Engineer Company (A / E).

15.4.1. The Contractor shall demonstrate that their choice of A/E satisfies the qualitative selection rules as well as its composition as described in the core SOW, Section 6 (Quality Assurance).

15.5 Health and Safety Coordination Documents

15.5.1. The Contractor shall provide the name, contact details and list of Suitably Qualified and Experienced Person (SQEP) of the person(s) appointed as Health and Safety Coordinator(s).

15.5.2. The Contractor shall provide formal documents (such as certified copies of relevant diplomas, professional certificates, certificates of successfully exams or exams organized specifically for the H&S on construction sites, civil works and related designs) demonstrating that the Health and Safety Coordinator(s) are:

a. Qualified and capable of being responsible for H&S of the study phase, design and, if the bid is selected, for the safety coordination in execution phase

b. Possesses all legally required accreditations in the THN to fulfil the role of “health and safety coordinator”.

c. Has professional experience and proof of professional experience shall be provided in the form of a declaration of honor signed by the candidate for the “health and safety coordinator”

d. The Purchaser reserves the right to check all the information requested; in the event of inaccuracies, the Contractor runs the risk of seeing his offer as not meeting requirements.

15.6 Other documents

15.6.1. Technical documents (the pre-design and schematic design shall include (non-exhaustive list):

a. Plans/ drawings:

b. All plans/ drawings shall be produced in English.

c. For formats, numbering, legends, representations, symbols and other indications the Contractor shall adhere to respective standards and best engineering / design practices.

15.6.2. Civil Works Infrastructure shall include as a minimum:

a. The general situational layout showing the construction site, the site installations, buildings, access to the site, cables, pipes etc. (scale 1/500)

b. The general site plan (1/500) including the demolition phases, accesses, roads and parking lots, buildings, foundations for antennas and other installations, fences, safety zones, etc.

c. Drainage installations (1/100 and / or 1/200 scale)

d. Cables, pipes, ducts and trenches (1/100 and / or 1/200 scale

15.6.3. Buildings and miscellaneous constructions shall include as a minimum:

a. General plans/ layouts per building and level (1/100 scale) with equipment layout

b. The cross sections drawings necessary in order to be able to obtain a complete concept of the design (scale 1/50)

c. The schematic plans and drawings necessary to obtain a complete idea of the construction systems and materials to be used (scale 1/50, 1/20 or 1/10)

d. Roof plans with outlets (1/100 scale)

Note: without prejudice to the responsibilities of the A/E, all architectural plans shall be produced and signed by a chartered architect who is accredited in THN

15.6.4. HVAC shall include as a minimum (scale 1/50 or 1/100):

a. HVAC installation plans and drawings (with location of main equipment such is indoor and outdoor units, ventilation groups etc.)

b. Ventilation ducts

c. In summary, all the drawings and cross sections necessary to make the Contractors proposal understandable.

15.6.5. Fire protection and fighting shall include as a minimum (scale 1/50 or 1/100):

a. Fire detection and fire alarm plans (with locations of the main components such as the automatic fire extinguishing system, control panel, fire detection sensors, fire alarm buttons, fire extinguishers, etc.)

b. Fire compartmentalization plan per building / zone

15.6.6. Electrical works shall include as minimum (scale 1/50 or 1/100):

a. Electrical installation plans and drawings (with the location of the main components – main power distribution board, electrical distribution boards, power generators, UPS, battery rack, high-voltage cabin, etc.)

b. Plans with indication of lighting points and sockets

c. Schematic diagram of the energy distributions including the distributions from the main power distribution board to the electrical distribution boards

15.6.7. Fuel supply system shall include as a minimum (scale 1/50 or 1/100):

a. Fuel supply system installation plans and drawings (with location of main equipment such is daily and buried fuel tanks, pump stations, pipes, cathodic protection etc.)

b. In summary, all the drawings and cross sections necessary to make the Contractors proposal understandable

15.6.8. Roads, paved areas and landscaping shall include as minimum:

a. General plans and drawings (scale 1/100 and / or 1/200)

b. Details of the structure of roads, parking lots, paths, sidewalks, and other relevant structures, etc. (scale 1/100 and / or 1/50)

c. Landscaping, planting and gardening areas with significant details

d. The establishment of geodetic landmarks

e. The waste collection and storage area before disposal

15.6.9. Physical Security shall include as minimum (scale 1/50 or 1/100):

a. Security zone plans including the location of fences, gates, security doors and locks for the new SSSB building and the refurbishment at 7th Air Force Radar Station (Skyros Island), including any details necessary for proper understanding of the solution

15.6.10. Telephony and Data Network shall include as minimum (scale 1/50 or 1/100):

a. Data and Telephony installation plans (with installation of main components, main telephone distributor, data cabinets, etc.)

b. Plans with data sockets

c. The plans of the buried outdoor cables

Note: Provision of Telephony and Data Network infrastructure and services is normally the responsibility of the THN and would normally be in situ.

15.7 Explanatory texts and calculation notes.

15.7.1. All stability studies shall be carried out in accordance with the requirements set out herein in this Annex and the principles of relevant national standards and best practices applicable in the THN.

15.7.2. They shall also include a description of the construction systems proposed with major constraints and major details in order to be able to assess the constructions as well as the technical characteristics.

15.7.3. They shall include a summary of the main construction elements:

a. Composition of interior walls (materials, thicknesses, types, etc.)

b. Composition of exterior walls (materials, thicknesses, types, etc.)

c. Interior and exterior joinery

d. Coverings (floors, ceilings, walls, etc.) by room or space

e. Drainage

f. Antenna and mast foundations

g. Antenna and mast structures

h. Retaining wall structure should that be required for antenna and mast erection

15.7.4. Structural calculations, stability studies, electrical calculations, HVAC parameters calculations, fuel supply system calculations, equipment studies and documents shall:

a. Relate to construction works requiring a stability study or civil engineering equipment requiring a study

b. Take into account at least the requirements provided in this Annex and in site specific Appendixes the nature of the soil and local weather and climatic conditions

c. Relate to HVAC, electricity, data and telephony, fire protection system, fuel installations and all other equipment provided by the Contractor

d. Base heat loss and heat load calculations on the principles of relevant standards and best practices applicable in THN and local climatic conditions.

15.7.5. They shall include description of the works and supplies necessary for the realization of the infrastructure and equipment installation in accordance with the standards and legislation in force in the THN.

15.7.6. They shall include quantity (bill of quantities).

SECTION 16 APPLICABLE DOCUMENTS AND STANDARDS

16.1 The documents and standards mentioned in this section are applicable to other parts of this Annex and site specific Appendixes. The other parts of this Annex and site specific Appendixes may supplement and/or amend the mentioned documents and standards when necessary.

16.2 In case of inconsistencies and/or contradictions it is the Contractor's responsibility to sort and / or prioritize the documents cited, including the standards and directives, which they consider to be applicable and taking precedence over other documents. This process shall be in accordance with respective THN laws and regulations.

16.3 This Annex and site specific Appendixes refer to numerous directives and standards the Contractor shall comply with for:

16.3.1. Designs

16.3.2. Equipment and material specifications and performance parameters

16.3.3. Provision of equipment and material

16.3.4. Execution of civil works

16.3.5. Installation of equipment and utilities

16.3.6. Testing and commissioning

16.4 The Contractor is allowed to comply with equivalents of the directives and standards, referred to in this Annex and in site specific Appendixes, when all of the following conditions are met:

16.4.1. The equivalent standards introduce equal or more stringent requirements

16.4.2. The equivalent standards are recognized, applicable and in force in the THN including their MOD

16.4.3. The Contractor shall be able to proof (as applicable) by design, analysis, CoC, DoC, demonstration and testing that by meeting requirements to equivalent standards the Contractor meets or exceeds requirements stipulated in directives and standards referred to in this Annex and site specific Appendixes

16.5 A list of THN GRC applicable documents and standards is as follows:

16.5.1. Presidential Decree 244/1980:"Cement Regulation for Concrete Works (Pre-stressed, Reinforced and Unarmed) (Government Gazette 69/A'/1989).

16.5.2. ELOT EN 10080, ELOT 1421-1, ELOT 1421-3 "Standards for concrete reinforcement steels".

16.5.3. Ministerial Decision D11E/0/30123/1991 (Government Gazette 1068/B'/31-12-1991 "Amendment of the New Concrete Regulation for the Design and Construction of Concrete Works".

16.5.4. Ministerial Decision D17a/116/4/FN429/18-10-2000 (Reinforced Concrete Regulation) EKOS 2000.

16.5.5. Ministerial Decision D14/50504/2002 (Government Gazette 537/B; /1-5-2002) "Adaptation of the Concrete Technology Regulation to the Requirements of the Harmonized Standard" ELOT EN 197-1.

16.5.6. Ministerial Decision D17a/141/3/FN 275/1999 (Government Gazette 2184/B; /20-12-19990 Hellenic Earthquake Regulation 2000 (Approval of the Greek Earthquake Regulation).

16.5.7. Ministerial Decision 16462/29/2001 (Government Gazette 917/B'/17.7.2001) "Cement for the Construction of Concrete Works".

16.5.8. Ministerial Decision D14/92330/08 (1416/B'/17.7.08) (Government Gazette 381/B'/24.3.2000) "Approval of the New Regulation of Concrete Reinforcement Steel Technology".

16.5.9. Ministerial Decision DIPAD/OIK. 372/2014 (Government Gazette 1457/B'/5.6.2014) "Approval of the application and use of the Euro codes in combination with the respective National Appendices)

16.5.10. Government Gazette 59/D/3-2-1989 "Building Regulations".

16.5.11. Joint Ministerial Decision D6/B'/OIK 5825 (Government Gazette 407/B/2010) "Approval of the Energy Efficiency Regulation of Buildings (KENAK)".

16.5.12. Ministerial Decision F.7.5/1816/88/2004 (Government Gazette 470/B/5-3-2004) "Replacement of the current Regulation of Internal Electrical Installations with the ELOT Standards and other relevant provisions".

16.5.13. Manual of Standard Distribution Structures of Public Power Corporation (PPC), the Instructions Distribution of PPC SA.

16.5.14. Greek Technical Specifications-Government Gazette 2221/30-07-12 with mandatory application in all public works.

16.5.15. Sewerage Regulation

16.5.16. Amendment and Supplementation of Presidential Decree 71/88 "Building Fire Protection Regulation" (Government Gazette 1316/B/31-12-1998)

16.5.17. Law 4412/2016 "Public Procurement of Works, Supplies and Services" (adjustment to Directives 2014/24/EU and 2014/25/EU) Government Gazette 147/A/08-08-2016.

16.5.18. Royal Degree of 13.5/1936 (Government Gazette 23-06-1936) "Regulation of Internal Hydraulic Installations" and the respective amendments

16.5.19. The Technical Instructions of the Technical Chamber of Greece TEE (TOTEE)

16.5.20. Technical Instructions of the Technical Chamber of Greece No2411/86 "Facilities in Buildings and plots: Cold-Hot Water Distribution" and 2412/86 "Facilities in Buildings and plots: Sewerage Networks"

16.5.21. Presidential Decree 41/2018 "Building Fire Protection Regulation" (Government Gazette 80/A'/7-5-2018)

SECTION 17 MISCELLANEOUS

17.1 The Purchaser requires the presence on site of a qualified Contractor's representative (Reference SOW Section 2 - Key Personnel), who possesses thorough knowledge of all the civil works data and requirements as stipulated in this Annex and in site specific Appendixes, qualified and capable to coordinate all of the respective works. This Contractor's representative shall be also, in a timely manner, aware of all technical aspects to ensure effective and efficient coordination with the production, delivery, construction as well as installation of equipment and material stipulated in this Annex in site specific Appendixes.

17.2 In case the Contractor's representative does not possess all required qualifications, experience and accreditation, the Contractor shall nominate additional individual (s) who have the required qualification and experience and to whom the execution of those concerned elements shall be entrusted.

17.3 The Contractor shall take into account sizing, qualities, quantities, level of efforts, tools and machinery required to meet all requirements of the SOW, this Annex and site specific Appendixes. If it appears during execution that certain works / supplies have been undersized, the relative costs (additional works / supplies) shall be entirely borne by the Contractor.

17.4 If not already supplied by the THN the Contractor shall supply first aid kits to THN H&S standards and regulations for the protection of own personnel during execution of the works. This shall include any necessary and associated first aid signage (i.e. Emergency contacts/locations etc.).

SECTION 18 SURVEYS

18.1 Existing situation

18.1.1. The existing situation is presented in the SSSB GRC - SIDP provided in Annex H to the core SOW.

18.1.2. The information in the GRC SIDP represents the boundaries of the existing military land and the planned extension that is in progress in order to determine the limits of the future site to be imperatively respected by the Contractor. If during the study of the offers by the Contractor it appeared to them that these limits must be moved and / or extended, it is up to the Contractor to justify this to the Purchaser.

18.2 Topographic survey and soil tests

18.2.1. The Contractor shall be responsible for conducting the surveys necessary for the definitive, complete and correct identification of the structures and installations at the site.

18.2.2. In the execution phase, the Contractor shall not exceed the limits of the existing site as defined in the contractual documents included in the SOW.

18.2.3. Results of any previous soil tests carried out on the initiative of the GRC MOD that were made available as part of the Bidder's Information Package are only indicative. The Contractor shall still be required to conduct soil tests.

18.2.4. The soil tests for the final design shall be conducted by a specialized firm, recognized and accredited by THN.

18.2.5. The soil tests shall be completed before any works execution at the site.

18.2.6. Before start of any works at the site the Contractor shall perform a detailed topographic survey. The survey shall be executed by certified and accredited by a THN GRC real estate surveyor. The survey shall identify and document results in accordance with respective THN standards and legislation.

18.2.7. The survey shall also identify all cables and pipelines present in the work area as well as the connections to the public domain.

18.3 Asbestos inventory on the site

18.3.1. In addition to the information available within the SSSB GRC - SIDP (Annex H) it is the Contractor's responsibility to conduct the necessary asbestos surveys and readings ahead of any site works.

18.3.2. The Contractor is reminded that any Asbestos inventory report provided by the THN during the bidding phase is provided purely as background info for the Contractors benefit. They have no particular contractual status and it is the Contractor's responsibility to check and validate those data for design and realization of the site civil works.

18.4 Other inventories

18.4.1. It is the Contractor’s responsibility to conduct an inventory prior to any intervention on the construction site.

18.4.2. This inventory shall cover all of the installations and infrastructure (including buried, concealed, on the ground and over the ground) that will remain and will not remain in place after the works in the scope of this contract are finished.

18.4.3. The purpose of this inventory is to define without possible dispute the current state and functionality of all the installations and infrastructure (including buried, concealed, on the ground and over the ground) including the ones to be demolished.

18.4.4. The inventory of the installations and infrastructure that may need to be demolished shall also define conditions under which this demolition works shall be conducted, specifically in case of asbestos presence.

18.4.5. The inventory file shall be supplied to the Purchaser in triplicate at least 10 working days before the start date of the work.

18.5 Precautions to be taken throughout the duration of the work

18.5.1. The Contractor shall ensure to take all necessary measures to avoid nuisance on the site and in the vicinity thereof. This includes but is not limited to:

a. Rational planning

b. Noise reduction measures

c. Measures to reduce dust/mud

SECTION 19 ARCHITECTURE AND ENGINEERING (A/E) DESIGN

19.1 General

19.1.1. In its design and when making any choice of materials to be used, build in and installed during civil works the Contractor shall assure compliance with the THN A/E regulations on construction products as well as (EU) no 305/2011 of the European Parliament and of the Council of 9 March 2011 concerning construction products.

19.1.2. Construction works as a whole and in their separate parts must be fit for their intended use taking into account the health and safety of persons involved throughout the life cycle of the works.

19.2 Mechanical resistance and stability

19.2.1. The construction works shall be designed and built in such a way that the loadings and use that are liable to act on them during their construction in progress and service life shall not lead to any of the following:

a. Collapse of the whole or part of the work

b. Major deformations to an inadmissible degree

c. Damage to other parts of the construction works or to fittings or installed equipment as a result of major deformation of the load-bearing construction

d. Damage by an event to an extent disproportionate to the original cause.

19.2.2. The Contractor shall design the civil works for service life in accordance with following standards or THN equivalents:

a. ISO 15686-1:2011 Buildings and constructed assets - Service life planning - Part 1: General principles and framework

b. ISO 15686-2:2012 Buildings and constructed assets - Service life planning - Part 2: Service life prediction procedures

c. ISO 15686-4:2014 Building Construction - Service Life Planning - Part 4: Service Life Planning using Building Information Modelling

d. ISO 15686-8:2008 Buildings and constructed assets - Service-life planning - Part 8: Reference service life and service-life estimation

e. ISO/TS 15686-9:2008 Buildings and constructed assets - Service-life planning - Part 9: Guidance on assessment of service-life data

f. ISO/TR 15686-11:2014 Buildings and constructed assets - Service life planning - Part 11: Terminology

19.2.3. The Contractor shall design the civil works for the following minimum service life within which no significant modernisation shall be required:

a. The new SSSB building: 50 years

b. Roads, parking and pavements: 30 years

c. Electrical installations: 30 years

d. HVAC: 20 years

e. Fuel tanks and associated installations: 30 years

f. Antenna masts: 30 years

g. Any other infrastructure and installations: 20 years

19.3 Environmental and climatic conditions

19.3.1. The new SSSB building, installations, utilities and any other infrastructure with their foundations and ancillaries, that are the Contractor’s responsibility, shall be capable of withstanding the following environmental conditions without suffering degradation of performance and without suffering permanent mechanical damages:

a. Local climatic conditions defined according to STANAG 4370, edition 7, November 2019 – AECTP-230 Climatic Conditions (Edition 1), where following climatic categories are applicable:

   i. A3 Intermediate and

   ii. C0 Mild Cold

b. Ice accumulation: glaze ice 0.9 g/cm³

c. High Temperature: + 49° C for operation

d. Low Temperature: - 19° C for operation

19.3.2. When designing and erecting the new SSSB building, masts with all associated ancillaries, fences etc. the Contractor shall apply Eurocode EN1991-1-4 (Eurocode 1 Part 1-4: General actions Wind actions). This publication provides guidance on the determination of natural wind actions for the structural design of buildings and civil engineering works. For the calculation procedure and especially for the determination of wind actions following shall be applied:

a. The fundamental basic wind velocity $v_{b,0}$ which is the 10 minute mean wind velocity with an annual risk of being exceeded of 0.02 irrespective of wind direction at a height of 10m above flat open country terrain, has a value in the National Annex $v_{b,0}$=33m/s for the Greek Islands in general.

b. The basic wind velocity v_b, which is the fundamental basic wind velocity modified to account the direction of the wind and the season, shall be calculated from the equation: $v_b = c_{dir} \times c_{season} \times v_{b,0}$. The recommended value for c_{dir} (the directional factor) and c_{season} (the season factor) is 1.

c. Terrain roughness: There are 5 terrain categories. For the two sites in Skyros Island (Kartsinoudi and Limnonari) as well as Site Sideros in Crete, the terrain category is No 0 (sea or coastal area exposed to the open sea). For the Site Kythira and Site Mavros in Crete the terrain category is No III (Area with regular cover of vegetation or building or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest)).

19.3.3. Hailstones of up to 25 mm diameter, 0.9 g/cm³ density and 58 m/s terminal velocity

19.3.4. Sand and dust concentrations up to 1 g/m³, with particle size down to 20 µm at an air speed up to 20 m/s

19.3.5. The design, manufacturing, installation and building process shall ensure that all infrastructure is resilient against salt corrosion as many of the radio sites are located close to the sea. Further requirements are provided in site specific Appendixes.

19.4 Safety in case of fire

19.4.1. The construction works shall be designed and built in such a way that in the event of an outbreak of fire:

a. The load-bearing capacity of the construction can be assumed for a specific period of time

b. The generation and spread of fire and smoke within the construction works are limited

c. The spread of fire to neighboring construction works is limited

d. Occupants can safely leave the construction works or be rescued by other means

e. The safety of rescue teams is taken into consideration

19.5 Hygiene, health and the environment

19.5.1. The construction works shall be designed and built in such a way that they shall, throughout their life cycle, not be a threat to the hygiene or health and safety of workers, occupants or neighbours, nor have an exceedingly high impact, over their entire life cycle, on the environmental quality or on the climate during their construction, use and demolition, in particular as a result of any of the following:

a. The giving-off of toxic gas

b. The emissions of dangerous substances, volatile organic compounds (VOC), greenhouse gases or dangerous particles into indoor or outdoor air

c. The emission of dangerous radiation

d. The release of dangerous substances into ground water, marine waters, surface waters or soil

e. The release of dangerous substances into drinking water or substances which have an otherwise negative impact on drinking water

f. Emission of flue gases or faulty disposal of solid or liquid waste

g. Dampness in parts of the construction works or on surfaces within the construction works.

19.6 Safety and accessibility in use.

19.6.1. The construction works shall be designed and built in such a way that they do not present unacceptable risks of accidents or damage in service or in operation such as slipping, falling, collision, burns, electrocution and injury from explosion.

19.6.2. The new SSSB building shall be designed and built taking into consideration accessibility and use for disabled persons.

19.7 Protection against noise

19.7.1. The construction works shall be designed and built in such a way that noise perceived by the occupants or people nearby is kept to a level that shall not threaten their health and shall allow them to sleep, rest and work in satisfactory conditions.

19.7.2. The Contractor shall assure that the minimum health and safety requirements regarding the exposure of workers to the risks arising from noise are meet as stipulated in the Directive 2003/10/EC of the European Parliament and of the Council of 6 February 2003 or equivalent THN regulation / standard.

19.8 Energy economy and heat retention

19.8.1. The construction works and their heating, cooling, lighting and ventilation installations shall be designed and built in such a way that the amount of energy they use shall be as low as practically possible, assuring their full functionality and performance according to the contractual requirements, taking into account the occupants and the climatic conditions of the location.

19.8.2. The construction works shall also be energy-efficient, using as little energy as possible during their construction and dismantling.

19.9 Sustainable use of natural resources

19.9.1. The construction works shall be designed, built and/or demolished in such a way that the use of natural resources is sustainable and in particular ensure the following:

a. Reuse or recyclability of the construction works, their materials and parts after demolition (if applicable)

b. Durability of the construction works

c. Use of environmentally compatible raw and secondary materials in the construction works.

19.10 Design rules

19.10.1. The design, execution and control rules for the works shall be defined by THN standards and technical specifications (EUROCODES, etc.), relating to the mechanical strength and stability of the construction works and their structural components.

19.11 Verification of studies and designs by an approved control office

19.11.1. The stability and equipment calculations relating to the civil works part of the project shall be conducted and signed off by an engineer or any other person with the required training and qualifications, legally recognized and accredited for the type of work or equipment relevant to his/her part of the study and design of which he/she in charge of.

19.11.2. The studies and designs shall be checked and approved by an independent accredited control office before presentation to the Purchaser.

19.11.3. This control is required in execution and the risks relating to possible modifications and their costs resulting from this control shall be exclusively attributable to the Contractor.

19.11.4. The independent control office shall be approved by the THN Accreditation body, the EA (European Co-operation for Accreditation), the ILAC (International Laboratory Accreditation Co-operation) or the IAF (International Accreditation Forum). The regulatory body must, however, be from a NATO member country participating in the financing of the project.

19.12 Calculation notes

19.12.1. The calculation notes shall be dated and signed, the different versions shall be numbered.

19.12.2. The calculation notes shall clearly present as the minimum following elements:

a. The starting hypotheses
b. Material characteristics
c. Modelling of the structure and the way in which general stability is considered
d. The values of the actions and their references
e. The calculation method used
f. The values of the safety coefficients and the references
g. Considered combinations and references
h. The requirements required for the service limit state (limit deformations, etc.)
i. The sustainability requirements (minimise material use, energy consumption, pollution emissions, waste generation, etc.)

19.12.3. The calculation notes and the complete structure design shall be based on principles presented in following publications (not exhaustive list):

a. ISO 2394:2015 - General principles on reliability for structures

b. EN 1990: Eurocode - Basis of structural design

c. EN 1991: Eurocode 1 - Actions on structures

d. EN 1992: Eurocode 2 - Design of concrete structures

e. EN 1993: Eurocode 3 - Design of steel structures

f. EN 1994: Eurocode 4 - Design of composite steel and concrete structures

g. EN 1995: Eurocode 5 - Design of timber structures

h. EN 1996: Eurocode 6 - Design of masonry structures

i. EN 1997: Eurocode 7 - Geotechnical design

j. EN 1999: Eurocode 9 - Design of aluminium structures

19.13 Presentation of calculation notes

19.13.1. The detailed calculation notes and the detailed design (including execution design) produced by A/ E shall be verified and approved by an independent control office before transmission to the Purchaser.

19.13.2. The endorsement of the independent control office does not automatically imply acceptance of these calculation notes and designs by the Purchaser. The latter reserves the right to monitor and make any comments it deems necessary.

19.13.3. The Contractor shall submit the detailed calculation notes and the detailed design (including execution design), verified and approved beforehand by the independent control office, to the Purchaser, within a period taking into account:

a. The schedule for works execution

b. Upstream of this work (manufacturing time, supply, etc.)

c. The period necessary for the Purchaser to review these documents as stipulated in SSS

SECTION 20 CONSTRUCTION PERMIT PROCEDURE

20.1 General

20.1.1. The Contractor shall prepare the designs and all studies (e.g. the Radio Hazard Studies) and submit them to the appropriate department of the Hellenic Navy General Staff (HNGS/C4) for approval.

20.1.2. The Contractor shall submit the complete file of the construction permits, supplemented by any other studies and permits that are required at the radio site locations.

20.1.3. The submittal of the construction permit file shall meet respective THN laws and regulations.

20.1.4. The Contractor shall be solely responsible for preparation and submittal of the construction permit file in terms of its completeness, correctness and timely presentation to relevant THN authorities.

20.1.5. The Contractor shall be solely responsible for all required administrative efforts associated with constrcution permit application (for example meetings with local authorities, electricity providers, fire brigade, preparation of required documents, reports, analysis etc.)

20.1.6. The works can only start after obtaining the construction permit. If necessary, the Contractor shall adapt its Civil Works design and technical solutions by implementing any modifications, required by the relevant THN authorities in order to bring the file into full compliance with THN laws and regulations. This entire process shall be executed at no additional cost to the Purchaser.

SECTION 21 CIVIL WORKS INFRASTRUCTURE

21.1 Site organization criteria

21.1.1. The organisation of the site shall be proposed by the Contractor.

21.1.2. The solution chosen by the Contractor shall reduce or even prevent any nuisance to the environment and the surrounding area, such as noise, dust, mud, debris etc. In particular, the public roads leading to the site shall be kept free in all circumstances, unless prior agreement has been obtained from the local authority.

21.2 Fences, signs and marking

21.2.1. The Contractor does not have the exclusive right to use the accesses to the site. Free access for the Purchaser, THN personnel as well as their vehicles shall be ensured throughout the duration of works in compliance with civil and military security rules.

21.2.2. Before the start of any works at the site the Contractor shall close the work site/area by means of a fence. This fence shall:

a. Assure the necessary access to the site (including emergency gate(s))

b. Be made using prefabricated panels with a minimum height of 1.80 m and composed of a galvanized steel frame and covered with a galvanized steel trellis

c. Be installed in a solid manner in accordance with respective THN regulations in force.

d. Include the necessary signage, lighting and beaconing

e. Remain the property of the Contractor (including the necessary signage, lighting and beaconing) throughout the duration of the contract and the Contractor shall ensure its maintenance and if necessary, repairs.

21.2.3. The Contractor shall keep in place the work site/area fence:

a. Until the work site/area is declared jointly, by the Contractor and the Purchaser, as secured and safe and

b. Until the work site/area fence replacement by a permanent new fence, provided by the Contractor where applicable

21.3 Contractor's facility and equipment at the site

21.3.1. Except for facilities and installations offered to and agreed by the Contractor for use for the entire duration of the project, the Contractor is responsible for provision of all necessary facilities and installations at the site for its staff and subcontractors. This includes provision and installation of electricity, water and gas meters.

21.3.2. All of the facilities and installations mentioned in the paragraph right above shall meet the regulations and legal prescriptions in accordance with respective THN regulations in force.

21.3.3. The Contractor shall make available to the Purchaser, at the latter's request, for the duration of the work, up to and including the date of Provisional Acceptance, all prescriptions, specifications, standards, measurement code and all other documents deemed necessary for planning, designing and execution of works. The document shall be made available both at the site during site visits and via email when required.

21.3.4. In addition, the Contractor shall make available on an ad hoc basis to the Purchaser, at the latter's request, all the measuring instruments (theodolite, leveler, level, measure tape, rangefinder etc.) necessary to control the proper performance of the work at the site.

21.4 Demolition and site preparation works

21.4.1. The dismantling and demolition of any required work shall be executed with the greatest care in order to preserve the infrastructure, installations and equipment remaining in place and in compliance with best industry practices and with respective THN regulations in force (including the regulations on the protection of the environment).

21.4.2. Any damage caused by lack of care and / or precision by the Contractor shall be repaired by the Contractor at the Contractor's expense and to the satisfaction of the Purchaser.

21.4.3. The dismantling and demolition works shall include as required indoor and outdoor elements of all kinds, visible, buried, concealed, over ground regardless of their dimensions, location, height in the building, including all incorporated and adjoining elements such as means of anchoring, assembling, fixing, etc.

21.4.4. The remaining in place infrastructure, installations and equipment shall be preserved in their stable state by any suitable means such as props, scaffolding, woodwork, pinning, excavation formwork, anchoring, temporary supporting structures etc.

21.4.5. Unless specifically mentioned elsewhere in the SOW and / or subsequently in any Purchaser's communication to the Contractor, the products of dismantling and demolition (including asbestos), as well as the earthworks products shall be evacuated from the site by the Contractor at its expense.

21.4.6. Amongst other THN rules and regulations in force the Contractor shall also apply requirements stipulated in (or THN legislative equivalent):

a. Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste

b. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

21.4.7. The cost for disposal at facilities to which the products of dismantling, demolition and earthworks are evacuated is the sole responsibility of the Contractor. The Contractor shall strictly comply with the latest regional regulations in force governing these matters.

21.4.8. The Contractor shall evacuate the products of dismantling, demolition works and any other waste generated by the Contractor's activities only to the approved facilities for disposal, sorting and recycling.

21.4.9. The Contractor shall provide to the Purchaser certificates of destruction, recovery or recycling of the products scoped for disposal.

21.4.10. The Contractor shall also provide official proof (approval by local/regional authorities) confirming its qualification as a collector / transporter for the products mentioned herein in this Annex. Otherwise, the Contractor shall entrust the collection and/or transport of these products to a subcontractor duly approved by the local/regional authorities, for which the Contractor shall also provide the official proof requested above.

21.5 Possible pollution

21.5.1. Identification of soil pollution not known before effective date of contract signature.

a. In the event of the identification of soil pollution during earthworks (for example, but not limited to hydrocarbons), the Contractor shall immediately notify the Purchaser.

b. The Contractor shall take all precautionary measures without delay and shall follow the procedures outlined by the municipal and regional authorities for the removal of polluted land and its treatment on an approved site.

c. If the quantity of polluted soil does not exceed 20 m^3 no additional costs to the Purchaser shall be claimed by the Contractor.

d. For the quantities above 20 m^3, the Contractor can submit an ECP claim to the Purchaser in accordance with Clause 37 of the Contract Special Provisions.

21.6 Tree felling/Shrub Removal

21.6.1. Where required tree felling permits and tree felling execution is the responsibility of the Contractor and shall be executed at no additional cost to the Purchaser.

21.6.2. Required tree felling/shrub removal also includes the complete removal of stumps and roots within a radius of at least 2.50 m from each removed tree and to a depth of at least 1.00 m by any appropriate means (the use of explosives is however prohibited) as well as the leveling off the ground by filling the void by means of arable earth or native soil, free of all waste of organic origin, hard elements, rubble of all types and implemented in layers of 0.20 m thickness and compacted.

21.6.3. The Contractor will be instructed to cut the trees, shrubs and any other vegetation only if necessary for the SSSB project implementation and not for Contractor's convenience and/or additional profit. Therefore, it shall be noted that in case Territorial HN Law and regulations require to pay compensation (to national authorities, local authorities or any other public or private institution or entity) for trees, shrubs and any other vegetation that have been cut and/or requires replanting any of them in other areas as a form of that compensation, or combination of both those measures, it shall be the Territorial HN responsibility.

21.7 Disassembly and disconnection of existing utilities

21.7.1. In case any works at the site (including dismantling and demolition works) require temporary termination of utilities and services delivered to the site and/or to any other property that is affected by this temporary termination, it shall be the Contractor's responsibility to coordinate all efforts and obtain necessary approvals from local THN authorities, utility providers etc. in accordance with respective THN regulations in force.

21.7.2. The temporary termination of utilities and services includes disconnections and dismantling works, which shall also be the Contractor's responsibility.

21.7.3. The disconnections and dismantling works shall be conducted only if necessary and with the greatest care in order to preserve utilities which must remain in place.

21.7.4. The works shall be conducted in compliance with best industry practices and with respective THN regulations in force (including the regulations on the protection of the environment).

21.7.5. Any damage caused by lack of care and/or precision by the Contractor shall be repaired by the Contractor at their own expense and to the satisfaction of the Purchaser and local authorities governing respective utilities.

21.7.6. Before starting any dismantling, the Contractor shall disconnect, under its responsibility the electrical, telephone, fiber optic, heating and water supply networks, including emptying of these installations when required.

21.7.7. The products and waste generated in conjunction with dismantling works shall be removed by the Contractor at his expense in accordance with the requirements stipulated in relevant paragraphs above.

21.8 Protection of adjacent infrastructure and installations

21.8.1. The Contractor shall be responsible for provision and installation of all necessary equipment and measures for the protection of the infrastructure and installations adjacent and located in the immediate vicinity to the works executed under this contract, as necessary.

21.8.2. The equipment and measures shall be installed and implemented in accordance with respective THN regulations in force.

21.8.3. The equipment and measures shall meet the following requirements (non-exhaustive list):

a. Provide temporary protection against shock, water, dust, etc.

b. Assure passage of people and vehicles as required

c. Meet requirements of respective THN health and safety regulations

21.8.4. The Contractor shall be responsible for the removal of any temporary equipment and measures as soon as possible, depending on the work progress and upon the agreement with the Purchaser and relevant THN authorities.

21.9 Site connection to utilities

21.9.1. The Contractor shall be responsible for connection of the site to all utilities (electricity, telephone network, fiber optic cabling, drainage networks etc.).

21.9.2. The connection to all utilities shall be planned and implemented in accordance with respective THN regulations.

21.9.3. The Contractor shall be responsible for payment of all costs for utilities used by the Contractor and its Sub-Contractors during the entire duration of the project.

21.9.4. The cost for the utilities shall be billed directly to the Contractor by the companies providing respective utilities and services.

21.9.5. It is the Contractor’s responsibility to make arrangements for the provision of all utilities and services (including payment arrangements) with respective providers.

21.9.6. The removal of any temporary site connections to utilities (electricity, telephone network, fiber optic cabling, water distribution and drainage networks), as well as the restoration of all utilities connections to their initial state before the Contractor started activities at the site, are the Contractor’s responsibility.

21.10 Cleaning before commissioning

21.10.1. The Contractor is responsible for cleaning, restoration and making good of all areas, facilities, installations and site terrain (indoor and outdoor) that were affected by the Contractor’s activity.

21.10.2. This cleaning, restoration and making good shall take place before the provisional acceptance preceding the commissioning of the installations, equipment and facilities at given site.

21.10.3. The result of this cleaning, restoration and making good of all areas, facilities, installations and site terrain (indoor and outdoor) shall be to a high sanitary condition allowing commissioning and immediate use at the latest upon provisional acceptance of this civil works part.

21.10.4. The cleaning, restoration and making good activities shall also include the site immediate vicinity, access road and any other infrastructure and terrain outside of the site that were affected by the Contractor’s activity.

21.11 Earthworks

21.11.1. The Contractors' attention is specifically drawn to the existence of underground pipes, cables and other infrastructure located in the works area. The plans, maps and layouts will be provided at or prior to provision of the Bidder’s Information Package.

21.11.2. It is the Contractor's responsibility to verify by any means deemed useful (i.e. by field survey with the utilisation of ground penetration radar etc.) the accuracy of any plans, maps and layouts and to supplement them if necessary before any earthworks. No additional costs by the Purchaser will be accepted in this context.

21.11.3. It is the Contractor’s responsibility to execute all of the required earthworks under this contract in accordance with respective THN regulations. This activity includes the following (non-exhaustive list) tasks:

a. Excavations

b. Trenching and ditching

c. Profiling and compacting

d. Landfills and backfills

e. Slope and cut works (including strengthening of any surfaces by means of chemical, mechanical end any other engineering method (including retaining walls))

f. Stabilisation works for any earthworks as directed by A/E design and results of soils tests and studies

g. Move of earth masses within the site and outside if any surplus of earth requires evacuation to designated areas

h. Demolition of all types of rock masses, roots, installations and structures of any type and size buried in the earthworks area

i. All soils tests, studies and samplings deemed necessary by the project author (A / E)

j. The tests shall be executed by approved THN official laboratory in the presence of a qualified engineer or other qualified representative from the Contractor’s A/E or Sub-Contracted A/E.

21.11.4. The following topsoil cutting requirements shall be taken into account:

a. The topsoil layer shall be removed to an average thickness of 20 cm over the entire extent of the work area.

b. Depositing of this topsoil layer shall be done at a location designated in the implementation plans and designs on the site with the aim for its re-use in the locations provided for in the plans and designs.

c. The topsoil level shall be free of stones greater than 5cm diameter and free of foreign impurities.

21.11.5. The Contractor shall take into account any required groundwater recovery works and groundwater lowering.

21.12 Protection, against any damage, of all existing utilities and structures crossing and located along the earthworks.

21.12.1. The Contractor shall take into account any protection against damage of existing utilities and structures crossing and located along the earthworks. Where necessary the utilities and structures shall be hanged or supported by temporary fixings to allow continuity of services provided by those utilities and structures.

21.12.2. During the earthworks, the Contractor is obliged to maintain a safe distance (vertically and horizontally) from water, gas, sewage, electricity, telephone lines etc.

21.12.3. In case of encountering utilities and structures not shown in the project documentation or hazardous material of any type (including unexploded ordnance, explosive remnants of war etc.) the Contractor shall mark the place immediately and notify ASAP the Force Commander relevant of the THN/local authorities, companies (such as energy providers, water providers etc.) as well as the Purchaser, through the designated H&S chain of command.

21.12.4. The Contractor shall carry out hand excavation in every case where the depths and location of executed works imply risk of damage to other existing infrastructure and/or utilities. Notwithstanding the above, when using mechanical equipment, the earthworks shall be continuously observed so each excavated volume of soil is monitored.

21.13 Evacuation of rainwater

21.13.1. The Contractor shall design and build the complete drainage system for the new SSSB building and when required shall connect it to existing site drainage system, according to the requirements of the THN local authorities.

21.13.2. The Contractor shall make coordination with the local authority and if required develop a study to be approved by the latter.

21.13.3. Description:

a. Where rainwater pipes will be placed in the same trench with existing wastewater drainage pipes, the design and work shall be carried out so that no confusion is possible between the two types of pipes.

b. The piping system shall be built with adequate slopes so that the rainwater flows properly.

c. The drillings at the pipe entries to the buildings shall be executed with good care and without burrs.

d. The penetrations shall be fitted with sheaths/ sleeves on the entire thickness of the walls and floors.

e. These sheaths/ sleeves shall have a larger diameter (about 1cm) than the outside diameter of the pipe to be protected. The filling of the joints and spaces between pipes and sheaths/ sleeves shall be made from a waterproof material with perfect elasticity and great thermal and chemical characteristics.

f. The installation shall provide all necessary elements according to A/E design, such as fixed and removable assemblies, elbows, fittings, expansions, supports, manholes, air intake for atmospheric pressure, connections and joints, sumps, cast iron covers for manholes and sumps in accordance with EN-124 of THN equivalents etc.

g. Before testing and commissioning of the installation, the Contractor shall conduct a complete cleaning of the installation.

21.14 Buried Cables, Sheaths and Conduits - Construction of Trenches

21.14.1. In principle, the trenches and embankments shall be executed during the earthworks phase, before any construction of roads, paths and/or other paved areas.

21.14.2. The cable laying shall be completed in trenches for all outdoor cables as stipulated in this Annex and in site specific Appendixes.

21.14.3. The cable laying shall be done in accordance with respective THN regulations, including the foundation layer, protective conduits and sheaths, safety marking, backfill etc.

21.14.4. Whenever cables are placed in protective conduits and sheaths:

a. The inside surfaces of any protective conduits and sheaths shall be even and smooth without any burrs;

b. Shall be of a sufficient size to ensure at least 50% of reserve;

c. Shall be fitted with a wire puller;

d. In case of a cable pull, the activity shall be followed by a replacement wire puller.

21.14.5. All of the cables (data, signal, electrical) shall be provided as armoured (galvanized steel wire armor cables), UV and weather resistant (ISO 4892).

SECTION 22 NEW SSSB BUILDINGS, ANTENNA FIELDS AND MISCELLANEOUS

22.1 Earthworks

22.1.1. The earthworks for the foundations of the new SSSB building, antenna masts and other structures (such as roads, fences, parking, fuel installations, sign poles etc.) shall be executed in accordance with respective THN regulations.

22.1.2. When conducting earthworks, the Contractor shall protect personnel, machinery and equipment against landslides by adequately supporting and strengthening the earthworks.

22.1.3. If for any reason the supporting and/or strengthening of the slopes is not possible, the Contractor shall execute the earthworks assuring natural slope inclination in given soil conditions.

22.1.4. The Contractor is also responsible for backfilling of all excavations to ensure required stability of the backfill and structures affected by and related to given earthworks.

22.1.5. The backfill shall be conducted with compactions of all successive layers with the thickness of each layer not exceeding 20 cm.

22.2 Foundations

22.2.1. The foundations of the new SSSB building, antenna masts and other structures (such as roads, fences, parking, fuel installations, sign poles etc.) shall be executed in accordance with respective THN regulations.

22.2.2. All required foundation shall be built in prepared excavations where the bottom of the excavation shall be levelled and covered with a sub-base material layer to ensure stability of the built foundation.

22.2.3. The design of the foundation shall be developed with due consideration given also to the frost depth (also known as frost line) where the location requires it.

22.2.4. The foundation shall be protected by vertical and horizontal hydro insulation (damp course) according to requirements driven by local hydrological conditions, soil type and terrain shape (also known as landform) around the foundations.

22.2.5. The horizontal hydro insulation (damp course) shall be tightly connected with the vertical one so that the joints of the insulations materials do not become places where water ingress occurs.

22.3 New SSSB Building structure

22.3.1. Choice of structures.

22.3.2. As part of the “turnkey” analysis, for any new build infrastructure, the Contractor shall offer the best quality / price ratio for building structures (including maintenance and repair costs over the lifetime), taking into account the following:

a. The requirements stipulated herein in this Annex and in site specific Appendixes

b. Fire compartmentalization

c. The specific function of each room and installation

d. The load bearing structural elements such as foundations, floors, ceilings, beams and lintels etc. shall be made of reinforced concrete.

22.3.3. The walls (both load bearing and non-load bearing), external and internal, shall be made of one of the below listed materials or combination of those:

a. Reinforced concrete

b. Masonry

c. Pre-Panelized Load Bearing Metal Stud Walls

d. Engineering Brick

e. Stone

f. Calcium silicate board – only for internal partitioning walls and ceilings

22.3.4. All of the premises shall be free of any columns.

22.3.5. Modular layouts shall be used wherever possible.

22.3.6. The materials used to construct buildings and other infrastructure shall not contain asbestos. The Contractor shall confirm this by providing the Purchaser with an “asbestos-free” certificate for the new SSSB building and "asbestos-safe" for a renovated building, issued by accredited body in the THN.

22.4 Concrete

22.4.1. Concrete used can be either poured in place or as precast concrete (unless specific requirements are further formulated for given infrastructure).

22.4.2. The used technology shall be presented in the form of drawings and narrative including as a minimum:

a. Detail plans

b. Formwork and reinforcement plans

c. The execution methods and the special precautions to be taken during the construction of reinforced concrete structures

d. Concrete and steel inspection requirements

22.4.3. The requirements for any pre-fabricated concrete elements shall refer to standards, codes of best practice and guidelines applicable in the THN and issued by recognized organizations such as:

a. CE certification of factory production control

b. Federation of the European Precast Concrete industry

22.5 Masonry

22.5.1. Masonry shall meet the characteristics and performance requirements as specified in EN 771-1+A1: 2015 ‘Specification for masonry units’ or the THN national equivalent.

22.5.2. The implementation of the masonry shall be based on specialised techniques in order to allow perfect incorporation of various equipment and installations in the masonry.

22.5.3. The Contractor shall be allowed to use hollow masonry blocks. These blocks shall ensure the stability of load-bearing masonry, and meet the specific requirements for masonry including respective requirements applicable to:

a. Hollow masonry blocks

b. Structural galvanized steel reinforcements

c. Mortar

d. Build and installation techniques

22.6 Metallic structures

22.6.1. The following standards or THN equivalents shall apply (non-exhaustive list):

a. EN 10025-2:2019 Hot rolled products of structural steels

b. EN 10025-3:2019 Hot rolled products of structural steels - normalized rolled weld able fine grain structural steels

c. EN 10025-4:2019 Hot rolled products of structural steels - thermomechanical rolled weld able fine grain structural steels

d. EN 10025-5:2019 Hot rolled products of structural steels with improved atmospheric corrosion resistance

e. EN 10025-6:2019 Hot rolled products of structural steels - flat products of high yield strength structural steels in the quenched and tempered condition

f. EN 10248-1:1996 Hot rolled sheet piling of non-alloy steels

g. EN 10269:2013 Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties

h. EN ISO 898-3:2018 Mechanical properties of fasteners made of carbon steel and alloy steel. Flat washers with specified property classes

i. EN ISO 898-1:2013 Mechanical properties of fasteners made of carbon steel and alloy steel. Bolts, screws and studs with specified property classes. Coarse thread and fine pitch thread

j. EN ISO 3506-1:2020 Fasteners. Mechanical properties of corrosion-resistant stainless steel fasteners. Bolts, screws and studs with specified grades and property classes

k. BS EN ISO 3506-2:2020 Fasteners. Mechanical properties of corrosion-resistant stainless steel fasteners. Nuts with specified grades and property classes

l. EN ISO 3506-4:2009 Mechanical properties of corrosion-resistant stainless steel fasteners. Tapping screws

m. EN ISO 9606-1:2017 Qualification testing of welders. Fusion welding. Steels

n. EN 287-6:2018 Qualification test of welders. Fusion welding. Cast irons

o. EN ISO 9606-2:2004 Qualification test of welders. Fusion welding. Aluminum and aluminum alloys

p. EN 1708-1:2010 Welding. Basic welded joint details in steel. Pressurized components

22.7 Wooden structures

22.7.1. The following standards or THN equivalents shall apply (non-exhaustive list):

a. EN 338:2016 Structural timber. Strength classes

b. EN 14081-2:2018 Timber structures. Strength graded structural timber with rectangular cross section. Machine grading; additional requirements for type testing

c. EN 384:2016+A1:2018 Structural timber. Determination of characteristic values of mechanical properties and density

22.8 Facades

22.8.1. As part of the “turnkey” study, for the new SSSB building the Contractor shall offer the best quality / price ratio for building structures (including maintenance and repair costs over the lifetime), taking into account of the following:

a. Respective requirements stipulated in this Annex and in site specific Appendixes

b. Fire compartmentalization

c. The specific function of each room and installation

22.8.2. Facades shall be designed in the light of the following criteria:

a. Lighting

b. Insulation

c. Protection, etc.

22.8.3. Facades shall not contain crevices or protrusions that might serve as footholds for anyone climbing up or along the facade.

22.8.4. There shall be no external stairways.

22.8.5. Facades and other surfaces shall be easy to clean and sandblast.

22.8.6. Facade surfaces shall be made of materials which do not require the use of cleaning products based on dichloromethane (methylene chloride). Surfaces shall therefore be cleanable using high-pressure water jets without chemical additives.

22.8.7. Facades shall not include crevices or protrusions that might serve as a shelter or perch for birds.

22.8.8. For finishing material of the facades the Contractor will have the choice between (in no order of priority):

a. Treatment and finishing of cast-in-place concrete

b. Architectural concrete elements

c. Exterior masonry facings of concrete blocks or terracotta bricks

d. Metal or other cladding elements.

22.9 Canopy type metal cladding

22.9.1. The Contractor shall supply and install self-supporting canopy type metal cladding made of stainless steel, rigid metal sheets.

22.9.2. The used technology shall be presented in the form of drawings and narrative including as the minimum:

a. Sizing and type of steel

b. The load-bearing structure

c. The cladding panels

d. The finishes and the installation requirements

22.9.3. The canopy type claddings shall be installed above all entries to the new SSSB building that serve as daily-use doors.

22.9.4. It is not required to install the canopy type claddings above doors that are only emergency doors or that serve only to introduce equipment into the building (such as, power room door, HVAC room door).

22.10 Metal protection plates

22.10.1. Depending on the requirements relating to Physical Security the need for steel protection plates (minimum thickness 6 mm) may appear.

22.10.2. The used technology shall be presented in the form of drawings and narrative including as the minimum:

a. Sizing and type of steel

b. The finishes and the installation requirements

c. Any special parts and fixings

22.11 Roofs

22.11.1. **General**

a. This section addresses the use of materials and the realization of all works that provide roof cover for the buildings. The roofs of the various areas of the design shall not negatively affect the stability of the whole building, and shall protect the buildings in a watertight and durable manner against bad weather.

b. All the elements used shall withstand agents and atmospheric impact, as well as the weight of equipment and maintenance personnel.

c. If THN regulations dictate, then the structural elements shall be the subject of a stability study (calculation notes) including the definition of materials (type, composition, protection and finishes), execution methods and special precautions to be taken during the implementation of these works.

d. Detail drawings, steel schedules and other relevant documents shall be provided before execution.

e. Regardless of the solutions proposed, they shall include all the special parts necessary for the construction of the roofs, such as fittings, fixings, reinforcements, flaps, corner profiles, closures, hatches, gutters, etc.

f. The design, production and installation of roof covers and other relevant elements shall be carried out in perfect coordination with the various elements of other installations that must pass through the roofs (for example cable passages).

22.11.2. **Rainwater evacuation**

a. In principle, all the elements relating to the collection and evacuation of rainwater from the roofs (gutters and downspouts) shall be plastic rainwater piping systems.

b. The rainwater evacuation system form the roofs shall meet requirements stipulated in following standards or THN equivalent (no exhaustive list):

   i. EN 12200-1:2016 Plastics rainwater piping systems for above ground external use. Unplasticized poly (vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system.

   ii. EN 607:2004 Eaves gutters and fittings made of PVC-U. Definitions, requirements and testing

22.12 Sealing

22.12.1. The Contractor shall design and execute waterproofing membranes for the buildings and other foundations including all the elements providing the waterproofing of the entire new SSSB building and as required for building renovation works at various sites (respective scope at each site is described in site specific Appendixes).

22.12.2. The waterproofing membranes shall be implemented in accordance with various standards and technical specifications in force in the THN.

22.12.3. Waterproofing membranes for foundations shall protect against humidity, runoff and temporary standing water.

22.12.4. The detailed design shall be tailored to local hydrological conditions, soil type and terrain shape (also known as landform) around the foundations.

22.12.5. The chosen material shall be free of any solvent and odorless. It shall clog pores and prevent water absorption from cementing masonry and concrete by capillary action.

22.12.6. The Contractor shall also install a waterproofing membrane under floor and wall tiles in the form of:

a. Liquid foil as one-constituent substance made of synthetic resins, minimum two layers, or

b. Sealing compounds manufactured on the basis of synthetic resins and cement, minimum two layers, with additional sealing reinforcements made of glass-fiber tapes or mats.

c. Regardless of chosen technology, the Contractor shall strengthen the corners, inlets and pipe penetrations. They shall be covered with sealing tapes and mats (flanges, bands). Ideally, all these products should come from one manufacturer.

d. Regardless of chosen technology, the Contractor shall assure waterproofing membrane minimum thickness of 1.5 mm.

22.12.7. Regardless of chosen technology, as the minimum, the Contractor shall provide a waterproofing membrane as follows:

a. To cover the entire floor surface under the tiles

b. To cover walls to the height of a minimum 0,1m from the floor top surface

22.12.8. The Contractor shall also provide a waterproofing membrane and other technical solutions (for example open joints) in order to control the descending humidity of the cavity walls:

a. At the bottom of cavity walls

b. At the top of the door and window openings

22.13 Thermal insulation of the new SSSB building

22.13.1. The thermal insulation shall be implemented in accordance with various standards and technical specifications in force in the THN.

22.13.2. The following standards and directives shall be applied for the thermal insulation design, calculation of losses and installation works (not exhaustive list):

a. Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings or THN equivalent.

b. ISO 13789:2017 Thermal performance of buildings — Transmission and ventilation heat transfer coefficients

c. ISO 52000-1:2017 Energy performance of buildings — Overarching EPB assessment

d. EN 12667:2001 Thermal performance of building materials and products. Determination of thermal resistance or THN equivalent.

22.13.3. The thermal insulation shall be water repellent, it shall be neither hygroscopic nor capillary. It shall not shrink, shall not sag after installation, shall not promote the development of mould and shall not be a growing medium for bacteria.

22.13.4. All the walls of the exterior shell (facades, pitched and flat roofs) shall be the subject of a hygrometric analysis taking into account the expected interior climate and the characteristics of the various materials that might be included in the composition of the walls. The final composition of the walls shall be adjusted in light of the findings of the study in order to avoid any condensation and associated damage, especially in air-conditioned premises in winter.

22.13.5. The class of vapour barrier shall be determined either by calculation or on the basis of the recommendations listed in respective THN standards, having regard to transitory weather extremes, the thermal and hydrological inertia of the roofing materials.

22.13.6. Heat bridges are to be avoided as far as possible.

22.13.7. All heat insulation, for walls, floors, roofs and ducts, including ventilation ducts, shall be made of environmentally-friendly materials. It shall not give off volatile organic compounds. Their heat conductivity should be lower than 0.044W/mK.

22.13.8. In the event of fire, there shall be virtually no development (or low) of smoke and no toxic gases. Fire class minimum A2-s1d0, according to EN 13501-1:2018 or THN equivalent.

22.13.9. The material used for insulations shall be tested for determining the non-combustibility performance according to ISO 1182:2020 Reaction to fire tests for products — Non-combustibility test.

22.14 Protective sheaths/ sleeves

22.14.1. The Contractor shall supply and install protective sheaths/sleeves for every passage of utility pipes and lines (for example ventilation, electrical, HVAC pipes and any other ducts) when passing between compartments.

22.14.2. The sheaths/sleeves shall be of the same Fire Class as the partition in which they are installed.

22.14.3. The sheaths shall guarantee the fire-resistant sealing of all penetrations by expansion under the effect of heat.

22.14.4. The sheaths shall be made of non-flammable, low smoke halogen-free thermoplastic material and shall be placed in line with the walls, floors and ceilings to be crossed over their entire thickness.

22.14.5. The sheaths shall protrude 3 cm on each side of the crossings.

22.14.6. The inner diameter of the sheath shall be 1 cm larger than that of the pipes to be protected. The space between the pipe and the sheath shall be filled with a fire-proof acoustic material presenting a durable elasticity over time and perfect chemical inertia between the different materials present.

22.14.7. The fire-proof acoustic material shall be of the same Fire Class as the partition in which it is installed.

22.15 Interior flooring

22.15.1. The internal flooring shall be implemented in accordance with various standards and technical specifications in force in the THN.

22.15.2. The floors shall be of heavy-duty industrial type with surface finish.

22.15.3. The floor surfaces shall be non-reflecting, fire-resistant and non-toxic.

22.15.4. They shall neither attract nor harbour dust and be easy to clean. Therefore, no carpeting material shall be used.

22.15.5. The floors shall be resistant to shocks caused by the use and transport of equipment to be installed under this contract.

22.15.6. The floors shall withstand rain, sleet and snow falling/dripping off boots and/or equipment moved in as well as salt from rain water.

22.15.7. In all facilities housing SSSB electronic equipment, UPS, HVAC, power generators, MPDP anti-static flooring shall be provided in accordance with:

a. EN 61340-5-1:2016 Electrostatics. Protection of electronic devices from electrostatic phenomena or THN equivalent.

b. EN 61340-4-1:2004+A1:2015 Electrostatics. Standard test methods for specific applications. Electrical resistance of floor coverings and installed floors or THN equivalent.

22.15.8. The anti-static flooring shall maintain electrostatic dissipative (ESD) and conductive coating performance without the need for special ESD waxes or polishes.

22.16 Tile floor

22.16.1. Unless specifically required to provide a raised floor for cabling, piping and HVAC installations, the following facilities shall not be provided with raised floor and shall be finished with ceramic tiles:

a. Corridors, hallway, vestibule

b. Walls in all premises with floor tiles - to the height of minimum 0,1m from the floor top surface

22.16.2. When making the choice of tiles the Contractor shall adhere to EN-14411:2016 Ceramic tiles. Definition, classification, characteristics, assessment and verification of constancy of performance and marking or THN equivalent.

22.16.3. The tiles shall meet the following requirements:

a. Anti-slip finish - R13 (Non Slip Tiles) according to DIN 51130 CEN/TS 16165 (B) standard

b. Hardness: PEI (Porcelain Enamel Institute) abrasion class – minimum 4

c. Number of revolutions – minimum 6000

d. Stain resistance class – minimum 4

e. Chemical resistance - Class A according to ISO 10545-13 Ceramic tiles — Part 13: Determination of chemical resistance

f. Bending resistance and breaking strength – minimum values for chosen material according to ISO 10545-4:2019 Ceramic tiles — Part 4: Determination of modulus of rupture and breaking strength

g. Minimum dimensions: 45 cm x 45 cm

h. Neutral Colour

i. The colour of the joints shall be determined by the Contractor according to the colour of the tiles that have been chosen.

j. The Contractor shall also install PVC (or aluminum) edge tile trims integrated into the tiling and protecting all edges. The colour of the tile trims shall be determined by the Contractor according to the colour of the tiles that have been chosen.

k. The tiles shall be the same in all premises (including the producer, the brand, color, type and model)

22.17 Raised Floor

22.17.1. The raised floor shall meet requirements stipulated in EN 12825:2001 Raised Access Floors or THN equivalent.

22.17.2. The free height under the raised floor panels shall be determined by the Contractor taking into account the pipes and equipment of any kind to be installed under the false floor as well as the needs resulting from the HVAC calculations.

22.17.3. The load bearing capacity of the raised floor shall be determined by the Contractor taking into account all of the loads imposed on the floor in given premises. However, the minimum load bearing capacity shall be 10 kN/m2.

22.17.4. The raised floors shall be made of a metal pedestal structure with floor panels of standardized dimensions 60cm x 60cm.

22.17.5. The Contractor shall determine the need for special floor panels with ventilation grills taking into account needs resulting from the HVAC design and calculations. If such needs exist, the Contractor shall provide those special floor panels with ventilation grills.

22.17.6. The pedestal structure shall meet the following requirements:

a. Baseplates of galvanized steel

b. Galvanized steel columns welded to the baseplate

c. Die-cast aluminum or steel heads

d. Locking nuts for height adjustment

e. When required - lockable stringers made of galvanized steel, to assure rigidity to the understructure and stability against lateral strain

f. When pedestals are omitted due to obstructions, i.e. electrical services, air ducting, etc., special bridging stringers shall be used

22.17.7. The floor panels shall meet following requirements:

a. Easily removable and replaceable by means of the suction cup

b. Neutral Colour

c. The tiles shall be the same in all premises (including the producer, the brand, color, type and model)

d. Fire class A1, according to EN 13501-1:2018 or THN equivalent.

e. Fire resistance class minimum REI 30 according to EN 13501-2:2016 Fire classification of construction products and building elements or THN equivalent.

22.18 Interior walls

22.18.1. Fixed dividing walls shall be made of masonry with a minimum thickness of 10 cm.

22.18.2. The walls shall have the following fire resistance: FR60/FR1hr/REI60 or FR120/FR2hr/REI120 depending on the prevailing laws and standards. The Contractor shall note that respective THN regulations and standards in force may introduce stricter requirements for specific premises i.e. power generator rooms. In such case, the Contractor shall follow these requirements.

22.18.3. It should be possible to remove these masonry walls without compromising the stability or load-bearing capacity of the structure.

22.19 Interior walls finishing

22.19.1. Interior wall finishing for example cementing shall be carried out over the total height and width of the wall to be treated on all exposed surfaces.

22.19.2. It is the Contractor’s responsibility to identify solutions according to various standards and technical specifications in force in the THN respectively to given premises.

22.19.3. The top layer of the finishing shall be intended to correct the flatness of the exposed wall surfaces as well as the surfaces out of tolerance. Smooth and finished topcoat for painting shall be assured.

22.19.4. The design and execution shall be conducted in accordance to following standards or THN equivalent (not exhaustive list):

a. EN 13914-1:2016 - Design, preparation and application of external rendering and internal plastering. External rendering

b. EN 15824:2017 - Specifications for external renders and internal plasters based on organic binders

c. EN 998-1:2016 - Specification for mortar for masonry. Rendering and plastering mortar

22.20 Paint

22.20.1. The Contractor shall paint all interior and exterior walls, ceilings and other elements of structure (such as beams, lintels etc.), regardless the material they are made of, with adequate painting for given material and its location (indoor versus outdoor) and with approval of the THN:

a. The exterior elements painting shall be adequate for local climatic conditions.

b. The interior painting shall be water repellent.

c. In principle, all paint shall have a matt finish.

d. All paints used in the building, whether acrylic, latex or enamel, shall meet the most stringent environmental criteria. Preference shall be given to products which have a European Ecolabel or THN equivalent.

e. When paint and fungicides are being applied to surfaces, any materials such as varnish and lacquers that release organic hydrocarbons shall be avoided.

f. Preference shall be given to water-based products (acrylic paints), paints with a high concentration of solid substances (high-solid paints) or powder-based paints (used on industrially prefabricated construction elements).

g. When finishing, repair or renovation work is being carried out, waste materials from painting (brushes, tins, rags, etc.) shall be treated as hazardous waste, and the Contractor shall observe the regulations governing the disposal of these types of materials.

h. Acrylic paint on smooth surfaces

i. Decorative matt paint for interior use coated in varnish shall not contain solvents based on copolymers in aqueous dispersion.

j. Primarily, it shall be used on porous or permeable mineral-based surfaces such as plasterwork, masonry, concrete, etc. It can be also used for plasterboard, fibre glass fabric, rough-cast surfaces and wallpaper.

22.20.2. It shall meet the following requirements:

a. Odourless, solvent-free, shall not emit organic substances

b. Washable in accordance with ISO 11998:2006 Paints and varnishes — Determination of wet-scrub resistance and cleanability of coatings

c. Negligible surface tension

d. Permeable

22.21 Wood varnish

22.21.1. It shall be aqueous colorless varnish for interior use, based on a polyurethane-acrylic dispersion.

22.21.2. It shall meet the following requirements:

a. Non-toxic

b. Very low odour

c. Scratch-resistant, durable and UV-resistant

d. Easy to clean

22.22 Concrete floor paint

22.22.1. Concrete floor paint shall be applied for the entire floors as part of building renovation works stipulated in site specific Appendixes.

22.22.2. It shall meet the following requirements:

a. Two-component (a resin base component supplied with a separate chemical activator to be mixed together before use) paint either epoxy or polyurethane paint

b. Shall be able to withstand oil, petrol and other chemical spills, without eroding through or corroding the floor paint

c. Shall withstand excessive sun and UV exposure.

d. Shall withstand rain, sleet and snow falling/dripping off boots and/or equipment moved in as well as salt from rain

e. Neutral colour.

22.23 Ceilings

22.23.1. Ceilings shall be designed to prevent condensation and the accumulation of dirt and shall be easy to clean.

22.23.2. The Contractor is allowed to install suspended ceilings.

22.23.3. The suspended ceilings shall meet requirements stipulated in EN13964:2014 Suspended Ceilings Requirement and Test Methods or THN equivalent.

22.23.4. Fully finished suspended ceilings shall meet the requirements for acoustics, the integration of all piping and technical installations, fire resistance as well as other specific requirements of this project.

22.23.5. The possible presence of expansion joints shall be taken into account in the design and the installation of suspended ceilings as the joints shall comply with the manufacturer's instructions.

22.23.6. The suspended ceiling shall be made with application of materials and installation technology suitable for temperature and humidity conditions in given premises.

22.23.7. The suspended ceiling shall be provided as a complete solution including all necessary elements such as (not exhaustive list):

a. Support nets for the slats or the plates, the suspensions

b. The supply, the installation and the finishing of the metal slats and the plates

c. An absorbent mattress above the false ceiling and / or an anti-dust veil according to need

d. The creation of at least one access hatch per room

e. The peripheral finishes

f. The housings for luminaires and ventilation and possible suction grilles

g. The equipotential bonding according to relevant standards in force

h. Neutral Colour

22.24 Doors

22.24.1. **Exterior doors**

a. Exterior doors shall be provided as complete solution including all necessary elements such as (not exhaustive list):

   i. Frames with anchoring and doors sets

   ii. Full door panels/ door leaf (no glazing)

   iii. All necessary accessories, tightening of joints, finishes and seals

   iv. Locks and door handles

   v. Hinges (minimum four brushed stainless steel hinge plates on each single door and eight on each double door)

   vi. Door stops and draught excluders

b. A written guarantee of at least 10 years on the profiles and their finishes shall be assured.

c. All the means of anchoring the joinery to the structural work shall be made of stainless steel, and shall not be visible after installation.

d. The door frames shall meet following requirements:

   i. Metal angular profile made of at least 2 mm steel sheet galvanized on both sides

   ii. Stainless steel threshold with perforation

e. The door panels/ door leaf shall meet following requirements:

i. Steel core reinforced with horizontally and vertically welded steel profiles.

ii. The exterior side of the door shall be covered with the steel sheet of minimum 2 mm of thickness and inside with the steel sheet of 1.5mm.

iii. Internal isolation made of high density rockwool

f. The doors shall meet following requirements as the minimum:

i. Shall be equipped with safety hinges reinforced with anti-rising mechanisms

ii. Burglary resistant class CR4 according to EN 1627:2011 or THN equivalent

iii. Mechanical resistance M+5 according to EN 1192:2000 or THN equivalent

iv. Frequency of use f6 (200,000 cycles) according to EN 1191:2012 or THN equivalent

v. Fire resistance minimum E60/EW60 according to EN 13501-2:2016 or THN equivalent. The Contractor shall note that respective THN regulations and standards in force may introduce stricter requirements for specific premises i.e. power generator rooms. In such case, the Contractor shall follow these requirements.

vi. Thermal insulation T3 ≤2.5 W/m2K according to EN 10077-1:2017 and EN 10077-2:2017 or THN equivalent

vii. Airtightness L2 according to EN 12207:2016 and EN 1026:2016 or THN equivalent

viii. Water tightness 6A according to EN 1027:2016 and EN 12208:2000 or THN equivalent

ix. Wind resistance VC4 according to EN 12211:2016 and EN 12210:2016 or THN equivalent

x. Galvanized steel base with a high performing powder coat finish according to EN 12944-6:2018 or THN equivalent

xi. The door size shall allow introduction and removal of all equipment into all intended premises. Nevertheless, minimum dimensions for door opening shall be:

xii. Single hung door (minimum dimensions): breadth – 90 cm, height – 210 cm

xiii. Double hung door (minimum dimensions): breadth – 150 cm, height – 210 cm

xiv. Neutral Colour

22.24.2. **Internal doors**

a. Internal doors shall be provided as complete solution including all necessary elements such as (not exhaustive list):

   i. Frames with anchoring and doors sets

   ii. Full door panels/ door leaf (no glazing)

   iii. All necessary accessories, tightening of joints, finishes and seals

   iv. Locks and door handles

   v. Hinges (four brushed stainless steel hinge plates on each single door and eight on each double door)

   vi. Door stops and draught excluders

b. A written guarantee of at least 10 years on the profiles and their finishes shall be assured.

c. All the means of anchoring the joinery to the structural work shall be made of stainless steel, and shall not be visible after installation.

d. The peripheral connections of the doors with the shell shall be adapted to the configuration of the building. They shall take into account the nature, thickness and position of adjoining materials.

e. Each door should comprise a frame (made of wood, metal or prefabricated sections) and a door leaf (consisting of a solid wooden core with extra-hard facing panels, wooden edges and edge-strips, finished with decorative paint or panels, or enameled sheet-steel facing).

f. The decorative facing should consist of laminated plates, natural wood panels, sheet steel or thermolacquered sheet aluminum.

g. Door furniture shall be made of brushed stainless steel.

h. Door fire resistance shall be minimum E60/EW60 according to EN 13501-2:2016 or THN equivalent. The Contractor shall note that respective THN regulations and standards in force may introduce stricter requirements for specific premises i.e. power generator rooms. In such case, the Contractor shall follow these requirements.

i. The door size shall allow introduction and removal of all equipment into all intended premises. Nevertheless, minimum dimensions for door opening shall be:

   i. Single hung door (minimum dimensions): breadth – 90 cm, height – 210 cm

   ii. Double hung door (minimum dimensions): breadth – 150 cm, height – 210 cm

   iii. The total thickness of the door leaf shall be a minimum of 39mm

   iv. Neutral Colour

j. Single hung door shall be provided for:

i. Environment Control room (HVAC) and SSSB Equipment room

ii. Between Main Power Switchgear room and SSSB Equipment room

iii. For graphically presented concept see **Error! Reference source not found.**

k. Double hung door shall be provided for all other premises in between them and also to the outside of the building (including emergency exit):

i. For graphically presented concept see **Error! Reference source not found.**

22.25 Hatches

22.25.1. Large ducts shall be equipped with man-sized access hatches to enable internal cleaning. Smaller ducts shall be equipped with hatches large enough to allow access to cleaning tools. These hatches shall be accessible and shall be placed at regular intervals so that access to the full length of the duct is possible. Hatches have to have a suitable locking mechanism fitted to prevent unauthorised entry to cabling routed in the ducts.

22.25.2. Each hatch shall have a suitable locking mechanism fitted to prevent unauthorised entry to cabling routed in the ducts. One such example is a hinged, locking pit bar set in concrete surround of the pit structure. Hinge at one end and a steel bar that covers the length of the hatch/cover, with a security approved padlock fixing at the other end. To protect from weather erosion, the padlock housing shall be covered where necessary.

22.25.3. When hatches are required to access space overhead (for example to access HVAC installations, plenums under roofs etc.) they shall meet the following requirements:

a. When hatches are required to access space overhead. This item shall include the frame, the cover, and the ladder.

b. Such hatches should be secured with an appropriate locking mechanism e.g. security approved padlock

c. The frame of the access hatch cover shall be made of aluminum. The frame shall be perfectly integrated into the ceiling slab. The frame shall be fitted with a polyethylene soundproofing seal which prevents any metal-to-metal contact and ensures a stable seat for the cover

d. The telescopic or retractable ladder system shall be provided as sturdy and rigid when deployed. The ladder system shall be made of selected steel with electrolytic treatment.

e. It shall comply with EN 14975:2006+A1:2010 Loft ladders or THN equivalent. Requirements, marking and testing

f. The ladder rungs shall be equipped with an anti-slip profile

22.26 Locks

22.26.1. **General**

a. The locks shall remain the property of the Purchaser and all keys shall be returned to the Purchaser; in the event of a breach of this condition, the lock fittings concerned shall be replaced at the Contractor's expense.

b. Locks shall carry a ten-year guarantee against manufacturing defects, corrosion or malfunctions.

c. Unless specified differently further in this Annex, for Class I and Class II areas (defined according to AC/35-D/2001-REV3 NATO Security Committee Directive on Physical Security, 25 November 2020), the Contractor shall provide and install locks that meet respective THN security requirements.

22.26.2. **Internal doors locks**

a. Internal doors shall be fitted with five-pin cylinders, with keys duplicated according to a key chart of the type set out below. In all cases keys shall be compatible with European-type, or THN equivalent, profiled cylinders or half-cylinders and have a minimum basic length of 60 mm, with the possibility of adding standard extension sections on one or both sides up to a total length of 140 mm.

b. In relevant cases this compatibility standard shall also apply to:

i. extendable cylinders

ii. tubular locks

iii. padlocks

iv. safety bolts

v. cam locks

vi. contact cylinders

c. The key chart shall be structured as follows:

i. One general master key

ii. One master key for plant areas (power, UPS, HVAC etc.)

iii. One master key for other areas (workshop, storage)

iv. One master key for Class I and Class II areas

d. The Contractor shall make further consultation with THN on type of locks to be fitted. Further consideration may be needed with the THN once proposed designs of areas are known.

e. The installation of locks shall be based on several different key profiles, both in terms of individual keys and in terms of the various master keys; the purpose of this is to avoid any re-cutting.

f. All doors must be fitted with cylinders, including doors to storage cavities, trapdoors leading to ducts, etc.

g. Internal doors giving access to Class I and Class II areas shall be equipped with protected cylinders and non-duplicable keys. In such cases, the Contractor shall provide a factory certificate stating that:

i. The keys will not be duplicable for a period of at least 15 years, certified by an international guarantee

ii. Rotors and stators contain steel or tungsten carbide inserts or plates protecting the cylinder against drilling

iii. Some of the pins are of the mushroom type to enhance resistance to lock-picking

iv. Each cylinder shall have five keys, and three of each master key should be supplied

22.26.3. **External doors locks.**

a. External doors shall be fitted with at least five-pin protected cylinders, with keys duplicated according to a key chart of the type set out for internal doors. In all cases keys shall be compatible with European-type profiled cylinders used with multi-point locking systems.

b. External doors giving access to Class I and Class II areas shall be equipped with protected cylinders and non-duplicable keys. In such cases, the Contractor shall provide a factory certificate stating that:

i. The keys will not be duplicable for a period of at least 15 years, certified by an international guarantee

ii. Rotors and stators contain steel or tungsten carbide inserts or plates protecting the cylinder against drilling

iii. Some of the pins are of the mushroom type to enhance resistance to lock-picking

iv. Each cylinder shall have five keys, and three of each master key should be supplied

22.27 Handles

a. These shall be U-shaped with a diameter of approximately 20 mm, a length of approximately 135 mm and a projection of 70 mm. They should be attached by means of pressure screws and mounted on two circular rosettes.

b. Two material groups shall be used for handles pending the Contractor’s choice are as follows:

i. **Polyamide**. Door handles shall be made of coloured nylon material and reinforced along their full length. The nylon shall have a smooth, non-porous surface resistant to oil, detergent, acid and disinfectant and should be non-flammable and non-combustible. A selection of colours shall be available so that door fittings can be harmonised with the colours of other fittings and the doors themselves.

ii. **Metal**. These fittings shall be made of stainless steel or of a light metal with a high magnesium content; they shall not be susceptible to scratches or cracks and should be free of corrosive materials. Zamak zinc alloy and other less robust alloys shall be avoided.

22.28 Door-blocking device

a. Access doors shall be fitted with a device allowing them to be automatically blocked open at a 90° (or greater) angle if necessary.

b. Each door shall be equipped with stainless steel door stopper with plastic or rubber covers.

22.29 Emergency exit door-bars

a. Emergency doors shall meet requirements as stipulated herein it this Annex above and should be fitted with electro-magnetic (or similar) contact switches as part of an Intruder Detection System.

b. There should be no external means of opening emergency doors.

c. Emergency doors shall facilitate evacuation of the building without allowing entry from the outside.

d. In order to protect occupants emergency exit doors shall close automatically.

e. Emergency exit doors shall remain closed at all times.

f. Emergency exit bars (panic-bars) shall be fitted to allow emergency doors to be opened from the inside in the event of an evacuation.

g. Panic bars should have a three point locking mechanism or be equipped with a mortise lock. They shall meet building standard EN 1125:2008 Building hardware or THN equivalent. Panic exit devices operated by a horizontal bar, for use on escape routes. Requirements and test methods.

22.30 Drainage

a. Administrative & design activities, equipment and installation characteristics, as well as execution of the works, including works supervision, quality assurance, quality control, testing & commissioning and health & safety measures shall be planned, organized and executed in compliance with standards and legislation applicable and in force in THN. Following documents are applicable (the list is neither exhaustive nor limitative):

i. Directive 2000/60/EC of the European Parliament and of The Council of 23 October 2000 establishing a framework for Community action in the field of water policy or THN equivalent.

ii. Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration or THN equivalent.

iii. Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council or THN equivalent.

iv. BS EN 12056-3:2000 Gravity drainage systems inside buildings. Roof drainage, layout and calculation or THN equivalent.

b. The capacity of the drainage shall be determined by the Contractor taking into account the size of facility, its location (including meteorological data), function and its occupancy.

c. Before testing and commissioning of the installation, the Contractor shall:

i. Clean the drainage network

ii. Check the tightness of the installation

iii. Tighten all fixings of devices and accessories

22.31 Various interior equipment

22.31.1. The Contractor shall provide and install various stairs, doormats, pictograms, signs, fire extinguishers etc.

22.31.2. When applicable, the interior equipment (for example fire extinguishers) shall comply with THN regulations and standards in force.

22.31.3. The locations and number of all interior equipment shall be determined by the Contractor according to the function of given premises and site occupancy.

22.31.4. The interior equipment choice, its material and proposed locations, before purchase from vendors, shall be presented by the Contractor to the Purchaser for approval.

22.31.5. All markings and descriptions shall be provided in THN official language and in English.

22.31.6. The Contractor shall provide undermentioned interior equipment and accessories.

22.31.7. Premises numbering plates:

a. Numbering and identification plates for the premises to be installed on each/by each door

b. The plates shall be made from extruded aluminum plates

c. The format of the plate shall be approximately 14x11 cm:

i. finish: thermos-lacquered

ii. tint: to be determined by the Architect

iii. cover: transparent polycarbonate

iv. shape: convex with longitudinal toothed edges

v. leaf: 100% recycled paper

vi. color: to be determined by the Architect

22.31.8. **Pictograms:**

a. Rigid, unalterable plastic pictograms in square or rectangular shape.

b. Colored and standardized in accordance with respective THN regulations and standards in force.

c. The graphics, wording and acronyms shall be legible

d. Fixing:

i. the pictograms related to prohibitions, obligations and warnings shall be glued to the walls using a special glue, with a high coefficient of resistance to tearing

ii. when attached to the equipment, the pictograms shall be fixed with a high coefficient of resistance to tearing

iii. the pictograms related to rescues, evacuation routes and indications of services shall be suspended from ceilings or false ceilings, by cables, with cable ends of elements suitable for fixing to false ceilings and at the other end, a plate clamp shall allow the fixing of the plates

iv. the evacuation plans shall be fixed to the walls by screws and nylon plugs

22.31.9. **Fire extinguishers:**

a. Shall comply with THN regulations and standards in terms of their characteristic, capacity, number, access to them, their marking and locations

b. The following standards shall apply:

i. BS EN 3-7:2004+A1:2007 Portable fire extinguishers. Characteristics, performance requirements and test methods or THN equivalent.

ii. BS EN 3-8:2006 Portable fire extinguishers. Additional requirements to EN 3-7 for the construction, resistance to pressure and mechanical tests for extinguishers with a maximum allowable pressure equal to or lower than 30 bar or THN equivalent.

iii. BS EN 3-9:2006 Portable fire extinguishers. Additional requirements to EN 3-7 for pressure resistance of CO2 extinguishers or THN equivalent.

iv. BS EN 3-10:2009 Portable fire extinguishers. Provisions for evaluating the conformity of a portable fire extinguisher to EN 3-7 or THN equivalent.

c. Portable fire extinguishers of minimum 6 kg:

   i. Dry powder extinguisher: Class ABC and suitable for fires involving electronic equipment up to 1000 V

   ii. Carbon dioxide (CO_2) extinguisher: Class B and Electrical Equipment

d. Fixing devices by which each extinguisher is hung on the wall shall be dimensioned to withstand the weight of the latter and its contents, as well as immediate and easy access to each fire extinguisher

e. The Contractor shall assure commissioning of the fire extinguishers by an authorized and accredited in THN fire expert

f. The commissioning shall include checking that:

   i. The extinguishers have been installed properly

   ii. Hoses and horns are attached correctly

   iii. Each extinguisher is the right weight and pressure

   iv. They are completely undamaged

g. The commissioning shall be confirmed with a certificate verifying that extinguishers have been commissioned in accordance with THN regulations.

22.32 Outdoor equipment

22.32.1. The Contractor shall provide and install various outdoor equipment as necessary for efficient and safe operation of buildings, installations and other infrastructure subject to this contract.

22.32.2. The components of the outdoor equipment include the building identification panels as well as all other indications and signs allowing an unambiguous identification of provided site infrastructure, as well as all the equipment related to the site operation.

22.32.3. When applicable, the outdoor equipment (for example marking of EM Field Zones, marking of fuel tank areas, evacuation assembly point, escape routes etc.) shall comply with THN regulations and standards in force.

22.32.4. The locations and number of all outdoor equipment shall be determined by the Contractor according to the function of given SSSB equipment and required Health and Safety measures.

22.32.5. The exterior equipment choice, its material and proposed locations, before purchase from vendors, shall be presented by the Contractor to the Purchaser for approval.

22.32.6. All markings and descriptions shall be provided in THN official language and in English.

22.32.7. All components of the outdoor equipment shall be UV resistant (confirmed by relevant CoC or at least Product Data Sheet issued by respective manufacturers).

22.32.8. All components of the outdoor equipment shall be capable of withstanding environmental condition as stipulated herein in this Annex, without suffering permanent mechanical damages.

22.32.9. All of the markings, which are not installed on building walls, fences or antenna masts shall be mounted on support elements made of either hot dip galvanized steel tubes or extruded aluminum profiles.

22.32.10. The tubes made of hot dip galvanized steel shall meet relevant requirements stipulated herein in this Annex.

22.32.11. The top surface of the supporting elements shall be provided with finishing profiles, in synthetic material, adapted to the shapes and dimensions of the tubes or extruded aluminum profiles.

22.32.12. The supporting elements shall be mounted on concrete foundations by chemical anchoring, the number of which shall depend on the dimensions of marking plate installed on given support elements and the loads that shall be transferred to the ground through respective foundation.

22.32.13. The Contractor shall provide and install building identification panels near each building. The panels shall meet following characteristics:

a. Precise location shall be proposed by the Contractor and is subject to the Purchaser’s approval

b. Mounted on supporting elements mentioned above in such a way that its bottom edge shall be approximately 120 cm above ground level

c. Panel frame made from extruded aluminum profiles and installed on supporting elements in a way that allows the identification panel to be slid in the frame from one side

d. Panel frame fitted with fixing lugs assuring solid connection to the supporting elements

e. Panel made from profiled aluminum sheet and fitted with fixing lugs assuring solid connection to the panel frame

f. Dimensions of the panel: height – 40 cm; width – 160 cm

g. Color (RAL – International Colour Standards):

   i. Supporting elements: RAL (TBC by THN)

   ii. Panel Frame: RAL (TBC by THN)

   iii. Panel: RAL (TBC by THN)

   iv. Letters: RAL (TBC by THN)

h. The shape of the letters shall be “ARIAL BLACK”, the height of the letters shall depend on the number of letters to be entered, depending on the panel. The texts shall be produced by screen printing. The system shall allow all subsequent modifications without changing the structure of the panels.

i. The system shall have an evolutionary character and a great flexibility of modification on demand as well as the possibility of adaptation in the same product range. All elements shall comply with the requirements of ISO 9001.

SECTION 23 ANTENNA MAST SPECIFICATION

23.1 General Remark

23.1.1. The Contractor shall design, provide and install required number of new antenna masts at each site capable of supporting the SSSB system.

23.1.2. The term antenna masts includes also DLOS towers.

23.1.3. The Contractor shall provide suitable antenna mast foundations required for the installation of new antenna masts.

23.1.4. The Contractor shall obtain all necessary Military and Civil permissions for the installation and operation of these masts and all related installation activities.

23.1.5. The Contractor shall conduct geotechnical soil analysis and Multichannel Analysis of Surface Waves (MASW) at the locations of the antenna field in order to determine the required design and size of antenna foundations as well as collect data for the SSSB system design.

23.1.6. The Contractor shall execute all works for antenna field preparation and subsequent installation of masts, antennas and associated cabling, including but not limited to:

a. Cutting and removal of trees, shrubs, any other vegetation and their roots

b. Excavation and trenching works

c. Levelling, profiling, compacting, backfilling

d. Erosion prevention measures including drainage installations, retaining walls, sodding and planting, strengthening of slopes and antenna fields with geotechnical materials, geotechnical composite crates, and any other technology as required

e. Provision of the necessary RADHAZ signage around antenna fields in accordance with THN Health and Safety Regulations.

23.1.7. The Contractor shall implement Health and Safety measures, according to THN legislation and standards in force, including but not limited to safe to climb structures, sharp corners avoidance, anti-slip surfaces, safety bars and grips, and proper safety marking (including identification and marking of EM Field Zones).

23.1.8. As part of the antenna field preparations the Contractor shall implement the following RADHAZ measures:

a. A Radio Hazard Study for the Transmission Sites shall be carried out by the Contractor at the Contractor's cost, before installation and in accordance with provided legislation. The study shall take into account the positioning of the new antennas. Emphasis shall be given at the new Tx Sites on Kythira and at Mavros (Crete).

b. Immediately after the installation of the new antennas and systems at the Tx Sites, experimental measurements under real operating conditions shall be executed by the Contractor.

c. RADHAZ theoretical calculations carried out by the Contractor before the installation shall be compared/evaluated against real time conditions/measurements.

23.1.9. The Contractor shall provide and install mast ancillaries including but not limited to:

a. Grounding system

b. Lightning protection system

c. Air obstacle lights

d. Required cabling

e. Cable support structures (ladders, trays, cable hangers and their fixings, cable cleats etc.)

f. Electrical, radio and grounding connections to the mast and relevant equipment installed on it

g. Cathodic protection system

h. Sufficient RADHAZ signs surrounding each antenna field line in accordance with THN H&S legislation and regulations

23.1.10. The installation of antenna masts and all ancillaries shall be done in accordance with respective manufacturer instructions and guidance.

23.1.11. All equipment and material delivered shall be:

a. New

b. High quality and high efficiency

c. To the most possible extent of standard manufacturing

d. Known brand and manufacturer with good logistic support

23.1.12. The expected lifetime of the mast, antennas, foundation and ancillaries shall be at least 30 years without the need for substantial maintenance and replacement.

23.1.13. All components of the mast, antennas, foundation, safety marking and ancillaries shall be UV resistant (confirmed by relevant CoC or at least Product Data Sheet issued by respective manufacturers).

23.2 Environmental requirements

23.2.1. The antenna sub-systems mounted on the antenna masts, as well as the antenna masts themselves, their foundation and ancillaries (including air obstacle lights) shall be capable of withstanding following environmental conditions without suffering degradation of system performance (gain, pattern type, sensitivity) and without suffering permanent mechanical damages:

a. Local climatic conditions are defined according to STANAG 4370, edition 7, November 2019 – AECTP-230 Climatic Conditions (Edition 1), where following climatic categories are applicable:

   i. A3 Intermediate and

   ii. C0 Mild Cold

b. Ice accumulation: glaze ice 0.9 g/cm³

c. High Temperature: + 49° C for operation

d. Low Temperature: - 19° C for operation

e. When designing and erecting masts with all associated ancillaries, the Contractor shall apply Eurocode EN1991-1-4 (Eurocode 1 Part 1-4: General actions Wind actions). This publication provides guidance on the determination of natural wind actions for the structural design of buildings and civil engineering works. For the calculation procedure and especially for the determination of wind actions following shall be applied:

   i. The fundamental basic wind velocity vb,0 which is the 10 minute mean wind velocity with an annual risk of being exceeded of 0.02 irrespective of wind direction at a height of 10m above flat open country terrain, has a value in the National Annex vb,0=33m/s for the Greek Islands in general.

   ii. The basic wind velocity v_b, which is the fundamental basic wind velocity modified to account the direction of the wind and the season, shall be calculated from the equation: $v_b=c_{dir} \times c_{season} \times v_{b,0}$. The recommended value for c_{dir} (the directional factor) and c_{season} (the season factor) is 1.

   iii. Terrain roughness: There are 5 terrain categories. For the two sites in Skyros Island (Kartsinoudi and Limnonari) as well as Site Sideros in Crete, the terrain category is No 0 (sea or coastal area exposed to the open sea). For the Site Kythira and Site Mavros in Crete the terrain category is No III (Area with regular cover of vegetation or building or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest).

f. Hailstones of up to 25 mm diameter, 0.9 g/cm³ density and 58 m/s terminal velocity

g. Sand and dust concentrations up to 1 g/m³, with particle size down to 20 µm at an air speed up to 20 m/s

h. The antenna design and manufacturing must ensure that it is resilient against salt corrosion as many of the radio sites are located close to the sea. Further requirements provided in site specific Appendixes.

23.3 Applicable Publications

23.3.1. The calculation notes and the complete structure design shall be based on principles presented in the following publications or THN equivalent (not exhaustive list):

a. ISO 2394:2015 - General principles on reliability for structures

b. EN 1990: Eurocode - Basis of structural design

c. EN 1991: Eurocode 1 - Actions on structures

d. EN 1992: Eurocode 2 - Design of concrete structures

e. EN 1993: Eurocode 3 - Design of steel structures

f. EN 1994: Eurocode 4 - Design of composite steel and concrete structures

g. EN 1997: Eurocode 7 - Geotechnical design

h. EN 1998: Eurocode 8 - Design of structures for earthquake resistance

23.3.2. All outdoor installations, unless stated otherwise below, shall assure level of protection against dust and water minimum IP 65 according to IEC60529:1989/AMD2:2013/COR1:2019 - Corrigendum 1 - Amendment 2 - Degrees of protection provided by enclosures (IP Code).

23.4 Antenna field Preparation

23.4.1. Antenna field preparation works includes tasks as stipulated herein in this Annex above.

23.4.2. Additionally the following works shall be executed:

a. For the antennas that require a ground plane, the Contractor shall:

i. Excavate the soil layer approximately 30 cm thick in the area intended for the ground plane installation

ii. Assure the flatness as per the antenna manufacturer installation guide

iii. Place pins on the area to allow position identification of antenna and guy line plinths

iv. Put in place a layer of dry rubble on the levelled area

v. Install the ground plane as per the antenna manufacturer installation guide

vi. Cover the ground plane with a layer of at least 10cm thick of mixed quarry.

vii. Place pins on the area to allow position identification of antenna and guy line plinths

viii. Prepare the base of the antenna for the RF cable joint, and the other devices such as service power socket, discharger, air obstacle light power transformer etc.

b. For antennas that do not require ground plane the Contractor shall:

i. Clean and prepare the area as stipulated earlier in this Annex

ii. Place pins on the area to allow position identification of antenna and guy lines plinths

iii. Prepare the base of the antenna for the RF cable joint, and the other devices such as service power socket, discharger, air obstacle light power transformer etc.

23.5 Foundation

23.5.1. The foundation shall be made of reinforced concrete.

23.5.2. The size of the foundation blocks shall be compatible with the manufacturer specifications, the results of the soil tests and relevant design and calculations made by the Contractor.

23.5.3. The foundation at the base of the antenna mast shall be large enough to avoid that grass and other vegetation growing around the area come in contact with the antenna structure.

23.5.4. The foundation blocks shall be profiled in a way that assures easy evacuation of water from the foundation blocks and antenna mast elements mounted on them. Under no circumstances, the foundation blocks shall accumulate water on their surfaces.

23.5.5. All required foundation shall be erecter in prepared excavations where the bottom of the excavation shall be levelled and covered with subbase material layer to assure stability of the erected foundation.

23.5.6. The foundation shall be protected by hydro insulation according to requirements driven by local hydrological conditions, soil type and terrain shape (also known as landform) around the foundations.

23.6 Mast structure

23.6.1. The mast structure shall be in accordance with the following:

a. The mast, safe to climb devices, anti-slip surfaces, safety bars and grips and cable support structures, further called mast structures, shall be made of steel, hot deep galvanised or sherardized (vapour/dry galvanised).

b. The mast shall be designed and built preferably as a tubular structure.

c. The fundamental resonance frequency of the mast structures with equipment shall be greater than 3 Hz.

d. The design, production and installation of the mast structures shall comply with following standards or THN equivalent (not exhaustive list) respectively to the technical solution defined by the Contractor:

i. BS EN 10204:2004 – Metallic products. Types of inspection documents

ii. BS ISO 404:2013 – Steel and steel products. General technical delivery requirements

iii. BS EN 10025-1:2004 – Hot rolled products of structural steels. General technical delivery conditions

iv. BS EN 10025-2/3/4:2019 – Hot rolled products of structural steels. Technical delivery conditions

v. BS EN 10025-5:2019 – Hot rolled products of structural steels. Technical delivery conditions for structural steels with improved atmospheric corrosion resistance

vi. BS EN 10210-1:2006 – Hot finished structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements

vii. BS EN 10210-2:2019 – Hot finished steel structural hollow sections. Tolerances, dimensions and sectional properties

viii. BS EN 10210-3:2020 – Hot finished steel structural hollow sections. Technical delivery conditions for high strength and weather resistant steels

ix. ISO 14713-1:2017 – Zinc coatings — Guidelines and recommendations for the protection against corrosion of iron and steel in structures — Part 1: General principles of design and corrosion resistance

x. ISO 14713-2:2019 – Zinc coatings — Guidelines and recommendations for the protection against corrosion of iron and steel in structures — Part 2: Hot dip galvanizing

xi. ISO 14713-3:2017 – Zinc coatings — Guidelines and recommendations for the protection against corrosion of iron and steel in structures — Part 3: Sherardizing

xii. ISO 898-1:2013 – Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread

xiii. ISO 898-2:2012 – Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes — Coarse thread and fine pitch thread

xiv. ISO 898-3:2018/AMD 1:2020 – Mechanical properties of fasteners made of carbon steel and alloy steel — Part 3: Flat washers with specified property classes — Amendment 1

xv. ISO 898-5:2012 – Mechanical properties of fasteners made of carbon steel and alloy steel — Part 5: Set screws and similar threaded fasteners with specified hardness classes — Coarse thread and fine pitch thread

xvi. ISO 2320:2015 – Fasteners — Prevailing torque steel nuts — Functional properties

xvii. ISO 16047:2005/AMD 1:2012 – Fasteners — Torque/clamp force testing — Amendment 1

xviii. ISO 10684:2004/COR 1:2008 – Fasteners — Hot dip galvanized coatings — Technical Corrigendum 1

xix. BS EN 10269:2013 – Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties

xx. ISO 5817:2014 – Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections

xxi. ISO 6520-1:2007 – Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding

xxii. ISO 6520-2:2013 – Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 2: Welding with pressure

23.6.2. The mast structure protective treatment technology shall assure that the complete structures can withstand installation in proximity of the sea.

23.7 Protective paint

23.7.1. The steel structure of the mast as well as access ladder or stairs, cable ladder, floor of platforms shall be painted in accordance with the RAL colour coding schema which will be provided to the Contractor at the PDR.

23.7.2. The time between the galvanisation and the painting shall be as short as possible.

23.7.3. After cleaning of the steel galvanised structure, one coat of primary and two coats of polyurethane paint shall be applied as a minimum. A minimum thickness of 80μm shall be obtained.

23.7.4. The protective paint shall meet requirements as stipulated in following standards:

a. ISO 12944-2:2017 Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments

b. ISO 12944-3:2017 Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 3: Design considerations

c. ISO 12944-4:2017 Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 4: Types of surface and surface preparation

d. ISO 12944-5:2019 Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 5: Protective paint systems

23.8 Grounding and lightning protection

23.8.1. The mast structures shall be equipped with suitable lightning protection and grounding kit, which shall ensure lightning protection of installed equipment.

23.8.2. It shall consist of adequate lightning rods, surge arresters, grounding rings, connection, special anticorrosive protection for buried sections and such forth.

23.8.3. The design, production and installation of the grounding and lightning shall be compliant with requirements stipulated herein in this Annex.

23.9 Air Obstacle Lights

23.9.1. The installations of air obstacle lights shall be implemented in accordance to ICAO Annex 14, Volume 1, Chapter 6, “Visual aids for denoting obstacles”, latest edition.

23.9.2. Each light kit shall include a double toroid transformer to be connected to light power supply at the base of the related antenna.

23.9.3. The air obstacle lights shall be of following characteristics:

a. Based on LED technology

b. High-intensity lights

c. Equipped with alarm/remote status control device(s)

d. Equipped with galvanized steel wire protection guard

e. Low wind load factor

f. No RF-radiations

g. The level of protection against dust and water shall be minimum IP 66 according to IEC 60529:1989/AMD2:2013/COR1:2019 - Corrigendum 1 - Amendment 2 - Degrees of protection provided by enclosures (IP Code)

h. High-temperature resistant borosylicate glass

i. Body made of marine grade copper free aluminium

23.10 Cabling and cable support structures

23.10.1. The design, production and installation of cabling and cable support structures shall be compliant with requirements stipulated herein in this Annex.

SECTION 24 HEATING VENTILATION AND AIR CONDITIONING (HVAC)

24.1 General

24.1.1. The HVAC system shall include at the minimum the following main elements:

a. The environmental control system, Air Conditioning (AC) in:

i. The premises as specified in site specific Appendixes

ii. Minimum, in the following premises of the new SSSB building

- SSSB Equipment room
- UPS/Battery room
- Supply Storage Room/ Workshop and Test facilities for electronic equipment
- Vestibule and corridor

b. The Heating and Ventilation system in all other areas of the new SSSB building

c. Fire valves in air ducting system to isolate different sections

d. Acoustic noise dampers in air ducting system

e. Fire dampers in air ducting system

f. Heating elements/radiators

g. All related equipment and accessories

h. The Legal Inspection

24.1.2. The Contractor shall provide a reliable and efficient Environment Control System over its service life.

24.1.3. The HVAC system in the new SSSB building shall have as the minimum 20% of spare capacity for future expansion in heat loads.

24.1.4. The HVAC system at all sites shall be designed in such way that it can provide essential services during maintenance or system breakdown of a unit.

24.1.5. Continuity of operation shall be assured by dividing the total HVAC load into two or more small units, as economically suitable. The HVAC system shall be flexible enough so that in the event of breakdown of part of the system, the remaining units shall be capable of meeting the SSSB system load requirements.

24.1.6. The equipment used shall comply with the documents listed below (the list is neither exhaustive nor limitative):

a. IEC 60335-2-88:2002 Household and similar electrical appliances - Safety - Part 2-88: Particular requirements for humidifiers intended for use with heating, ventilation, or air-conditioning systems or THN equivalent or THN equivalent.

b. IEC 60335-2-40:2018 Household and similar electrical appliances - Safety - Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers or THN equivalent.

c. ISO 52016-1:2017 Energy performance of buildings — Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads — Part 1: Calculation procedures or THN equivalent.

d. EN 16798-1:2019 Energy performance of buildings. Ventilation for buildings. Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics or THN equivalent.

e. EN 16798-3:2017 Energy performance of buildings. Ventilation for buildings. For non-residential buildings. Performance requirements for ventilation and room-conditioning systems or THN equivalent.

f. EN 16798-7:2017 Energy performance of buildings. Ventilation for buildings. Calculation methods for the determination of air flow rates in buildings including infiltration or THN equivalent.

g. European Council Directive 93/68/EEC of 22 July 1993

h. Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility or THN equivalent.

i. MIL-STD 461G (or THN equivalent) – Requirements for the control of electromagnetic interference characteristics of subsystems and equipment, December 2015.

j. Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer amended by Commission Regulation (EU) 2017/605 of 29 March 2017 or THN equivalent.

k. Pressure Equipment Directive 2014/68/EU, CE marked and provided with EC Declaration of Conformity or THN equivalent.

24.1.7. In order to assure suitable indoor air quality the Contractor shall use a HVAC system that shall use a refrigerant that shall be commercially available for the system' life expectance or at least assure the capacity to switch to new refrigerant without major modifications.

24.2 Quality criteria

24.2.1. All equipment used shall be ambient physicochemical and fluids resistant.

24.2.2. Equipment, materials and accessories as well as technical installation non explicitly described in this SOW shall be conceived by the Contractor such that they satisfy the following conditions:

a. Good operation of installation they belong to

b. Perfect integration in the environment (for instance in false ceiling or under raised floor)

c. Easy operation by the users

d. Long MTBF

e. Simplified operation and maintenance

f. Quick repair

g. Possibility to upgrade or modify without important re-engineering

24.2.3. All equipment and material delivered shall be new, of high quality, of high efficiency, of standard manufacturing, known brand and manufacturer with good logistic support.

24.2.4. Hybrid and self-made equipment are not allowed.

24.3 Automatic Control Systems

24.3.1. For effective control of design conditions and economical operation, the Contractor shall group together areas having similar load characteristics, such as electronic equipment module or the power module. The following criteria shall be applied:

a. Control arrangement shall be as simple as possible for minimum maintenance and maximum performance

b. Electric heaters, shall be thermostatically controlled

c. According to accepted criteria for winter comfort of personnel (ASHREA Comfort or other applicable standards) the wet bulb temperature in the various areas should be comprised between 18°C and 21°C, however to obtain indoor Relative Humidity of 40% or higher, it may be necessary to add moisture to humidify the air.

24.3.2. Where heating, air conditioning, and/or ventilation system are provided, the heating system shall be designed to operate integrally with other systems. When more than one system is installed in one area, necessary equipment to control systems shall be provided to ensure that the requirements are continuously met and the systems are not working against each other.

24.4 Acoustic noise requirement

24.4.1. The noise level generated on site when all equipment, that includes electronic equipment, transmitters, HVAC, power generators, UPS etc. are operating simultaneously shall not exceed Noise Rating NR55 (defined by ISO 1996) measured 10 m distant from the perimeter fence.

24.4.2. If one duct or one duct system includes air inlet or air outlet grills for ventilation or air conditioning of different rooms, the noise produced in any of these rooms and transmitted through these ducts to any other of these rooms shall have from room to room an attenuation minimum in dB at least equal to the attenuation guaranteed by the partition separating these rooms.

24.4.3. It is the Contractor's responsibility to determine and foresee, in function of the materials used, all precautions/method/measures to guaranty that the specifications in this SOW are met. Some measures can be amongst others, acoustic baffles, acoustic insulation materials in some ducts, mechanic and elastic suspension of some equipment groups etc.

24.4.4. The Noise Rating level shall not exceed following values:

a. Supply Storage Room/Workshop and Test facilities for electronic equipment – NR60

b. SSSB Equipment room (if no HVAC inside– NR50

c. Corridor and vestibule– NR45

d. Power Generator room – NR75

e. Main Power switchgear room – NR70

f. UPS/Battery room – NR70

g. Environment Control room (HVAC) – NR75

24.4.5. Diesel Generators room

a. It is the Contractor's responsibility to foresee in his offer all thermal and acoustic protection measures required to satisfy the conditions specified in this SOW for the rooms adjacent to the diesel generators room considering the acoustic pressure level generated by the proposed materials.

b. Acoustic baffles to reduce the noise generated by the diesel generators and cooling fans to the level specified in this SOW for the outside of the building shall also be provided.

24.5 Heating system

24.5.1. Where an air conditioning system is not provided, the heating system shall be provided by means of fixed heating elements/radiators.

24.5.2. It is the Contractor's responsibility to proposed the most suitable solution taking into consideration the most economic and ecologic parameters.

24.5.3. The heating system shall be designed to provide essential services during maintenance or system breakdown. The following criteria shall be met:

a. Normal Operation Conditions: Continuity of operation shall be assured by dividing the total design into sections as economically suitable.

b. Emergency Operation Conditions: The minimum possible standby equipment shall be provided only where operation of a complete system is absolutely essential for any of the following reasons:

i. Site survival

ii. Personnel safety

iii. Maintenance of essential services

24.6 Heating capacity

24.6.1. It is the Contractor's responsibility to establish the heating budget to determine the capacity of the heating system.

24.6.2. The following norms and standards shall apply for the design of the buildings regarding energy performances and heat loss calculations:

a. Respective THN standards and regulations.

b. Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency or THN equivalent

24.6.3. Subject to the prescriptions of the paragraph above that have precedence, the basis for heat loss calculation during winter time shall be as follows:

a. External conditions:

i. External temperature

ii. Relative humidity

iii. Wind speed

b. Internal conditions T°C/ RH:

i. Workshop and Test facilities for electronic equipment: 20°C/ 40%

ii. SSSB Equipment room: 20°C/ 40%

iii. Corridors/ vestibule: 18°C/ not considered

iv. Power Generator room: 18°C/ not considered

v. Main Power switchgear room: 18°C/ not considered

vi. UPS/Battery room: 18°C/ not considered

c. Characteristics of the new SSSB buildings. The expected transfer coefficients K (in W/m²K) are to be defined by the A/E during the design of the new SSSB buildings in order:

i. To comply with the most recent regional regulations in the respective THN

ii. To optimize the life cycle costs of the site installations.

24.7 Radiators

24.7.1. Radiators shall be provided in premises where full environment control system is not required, such as the diesel generator room, the main power switchgear room (only if no UPS is installed there).

24.7.2. The dimensions of the radiators shall be adapted to the available space, to warrant satisfactory esthetical aspect.

24.7.3. The thickness of the radiators shall not exceed 20 cm. Radiators located in escape paths, such as corridors, shall not create obstacle and safety hazard.

24.7.4. Radiators shall be mounted on brackets and solidly anchored to solid walls.

24.7.5. Sealing shall be by means of mortar. The use of plaster is not allowed.

24.7.6. The radiators shall be installed minimum 10 cm above the finished floor level.

24.7.7. The colour of radiators shall be proposed in RAL scale during contract implementation and it shall be subject to the Purchaser’s approval.

24.8 HVAC - Full Air Conditioning

24.8.1. The area where full air conditioning (temperature and humidity control) is required shall be conditioned by means of local air conditioner located in the HVAC room. Note: The air conditioner units may eventually be located in the SSSB Equipment room as long as it does not interfere with the electronic equipment layout.

24.8.2. The area that requires full air conditioning is to be closed-door operated. Hence fresh air input shall be provided.

24.8.3. This area includes:

a. SSSB Equipment room

b. UPS room

c. Supply Storage Room/ Workshop and Test facilities for electronic equipment

d. Corridors and vestibule

e. Any other area judged necessary by the Contractor based on good operation of the site.

24.8.4. The air conditioner units shall include as a minimum:

a. One air filter

b. One cooling bank with drip pan

c. One heating bank

d. One humidifier

e. Two motor-ventilators

f. One condensation water drainage.

g. Filter:

   i. The filter(s) shall be of cassette, high efficiency type

   ii. The pressure drop when cleaned shall not exceed 150 Pa.

24.8.5. Cooling and heating banks:

a. The banks shall be made of copper pipes with aluminum fins.

24.8.6. Ventilators:

a. The ventilator groups shall be with two rotation speeds. The lower speed shall be less than approximately 450 rpm, the higher speed shall be less than approximately 1500 rpm.

b. The unit shall be dimensioned to deliver 70% of its capacity at lower speed.

24.8.7. Fresh air input (Air Handling unit):

a. Fresh air input for areas that require full air conditioning shall be treated through air handling unit. The fresh air shall be brought to this area through an air ducting system.

b. The fresh air input flow shall be constant.

c. The air speed measured at 50 cm from the fresh inlet grille shall not exceed 25 cm/sec.

d. Filter:

i. The air handling unit shall be equipped with air filters that comply with ISO 16890, coarse 50%.

ii. Filters and pre-filters shall be of pocket type.

iii. The mounting of air filters shall allow easy maintenance.

13.1.1. Heating and Cooling Banks:

e. Air speed through the banks shall not exceed 3 m/sec for heating bank and 2.5 m/sec for cooling bank

f. Heating banks:

i. The heating banks shall be made of copper pipes with aluminum fins.

ii. The pre-heating bank (the one in contact with external non heated air) shall be protected by an anti-freeze thermostat. This thermostat shall be set at +5°C.

g. Cooling banks:

i. The cooling banks shall be made of copper pipes and fins.

ii. Droplet breaker shall also be provided.

iii. A condensation drip pan shall be provided.

13.1.2. Motor-ventilator group:

h. Ventilators shall be of centrifugal type with low acoustic noise level compatible with this SOW.

i. Ventilators shall be of asynchronous, cage type, protection IP54, and 1500 rpm.

j. Ventilators shall be selected for continuous operation with 45% spare capacity.

k. Fans shall be belt driven such that good operation is ensured with n-1 belts in service.

l. Bearings shall be of greased for life type.

m. Each fan shall be statically and dynamically balanced.

24.8.8. Humidifier.

a. The humidifier shall be dimension to humidify the air at -10°C 90% RH to 20°C 50% RH with 20% spare.

24.8.9. Silencer.

a. Silencers shall be provided to meet the acoustic noise levels required in this SOW.

24.9 Air Ducts

24.9.1. Air ducting layout and dimensions shall be determined by the Contractor. The dimensions of the air ducts shall be adjusted to ensure proper balance of static pressure.

24.9.2. Unless otherwise specified, all air ducts shall be in galvanized steel with exception for the exhaust conduits that shall be in stainless steel.

24.9.3. All precautions shall be taken during the work execution to prevent back pressure from ventilators. The pressure loss shall not exceed 0.3. Changes of dimensions in ducting path shall be progressive.

24.9.4. After installation, the air ducting system shall be subject to air tightness test according to EN 12599:2012 or THN equivalent.

24.9.5. Air ducts shall comply with following requirements:

a. All ducts shall be air tight and shall not show any opening other that required for inspection and maintenance

b. Elastic sleeves inserted between two ducts shall be maximum 25 cm in length; they shall be class A1 fire resistant (according to EN 13501-1:2018 or THN equivalent) and when exposed to heat shall not produce any toxic or corrosive fumes, gas or vapor.

c. The distance between metallic ducts and inflammable materials shall be minimum 15 cm

d. The length of one section shall not exceed 6 m.

24.9.6. Fittings. Ducts shall be equipped with:

a. All necessary fixing devices

b. All devices such as air baffles required for proper air balancing

c. All required non return baffles

d. All fire protection baffles (see also other relevant sections herein in this Annex)

e. Air tight access panels for internal cleaning.

24.9.7. Fire protection – see other relevant sections herein in this Annex

24.10 Grills

24.10.1. Numbers and position of air inlet and air outlet grilles shall be determined by the Contractor.

24.10.2. Air inlet and outlet dimensions resulting from required air flow and air speed shall be determined by the Contractor.

24.10.3. All grills shall be integrated into the room's architecture.

24.10.4. Care shall be taken to prevent whistling due to air pressure loss through the grills.

24.10.5. The acoustic noise due to air speed through the grills shall be between NR 25 and NR 30.

24.10.6. The air inlet grill shall be double deflection type, adjustable by special tool. The speed and orientation of air flow shall be such that:

a. The acoustic noise level applicable to the room are met

b. The air flow does not create any uncomforted feeling to the users

c. Uniform air temperature distribution is ensured in the rooms.

24.10.7. The air outlet shall be adjustable with a simple louver type cover compatible with the air inlet grills.

24.11 Compressor

24.11.1. The number and type of compressors shall allow multi-level of power.

24.11.2. Each compressor shall have its own control and command box.

24.12 Evaporator

24.12.1. The evaporators shall be equipped with a refrigerant circuit tightness control system to guaranty a refrigerant loss of less than 1 gr per year.

24.13 Refrigerant Circuit

24.13.1. The refrigerant circuit shall be in copper tubes specially treated for refrigerant usage.

24.13.2. The refrigerant circuit shall include as a minimum:

a. Connecting pipes between each compressor, the condenser and the evaporator

b. One electromagnetic valve
c. One dryer filter
d. One thermostatic expansion valve
e. One liquid sight glass
f. One refrigerant tank with stop valve, level indicator and safety valve
g. One stop valve
h. One refrigerant charging valve
i. Compressor connections.

24.14 Condenser

24.14.1. The chiller shall include one or two water condensers consisting of one back flow exchanger with copper tubes with fins deck, tubular plates and steel voids. The copper tube deck shall be cleanable.

24.15 Circuit condenser-cooling system

24.15.1. Amongst other things, it shall include:

a. Anti-vibration coupling at connection to the condenser (both ways)
b. One stop valve
c. One transfer pump
d. One anti-return valve
e. One adjustment valve

24.15.2. This circuit shall be thermal insulated and protected by heating tape (or other suitable means) capable to maintain the liquid temperature at 15°C with an ambient temperature of -25°C.

24.16 Acoustic isolation

24.16.1. The chillers and their compressors shall be mounted on vibration dampers.

24.16.2. The compressors shall be equipped with acoustic isolation such that the acoustic noise level of the chillers does not exceed NR70.

24.17 Cooling system

24.17.1. Characteristics:

a. The cooling system shall fulfil the requirements of the climatic conditions, existing at the different geographical locations of the COMMS sites.
b. The acoustic noise level at 10m distance from the cooling system shall not exceed 50dBA

24.17.2. It shall be composed of:

a. Self-supporting housing in galvanized steel, with special treatment against salt corrosion and be UV light resistant.

b. Cooling bank with copper tubes with fins in aluminum lacquered with a copper collector.

c. Low noise helicoids balanced ventilators.

d. Motors supplied in 3x400 V, 50 Hz, IP 55, connected to a waterproof connection box, IP 65. Each motor shall have its own safety switch.

24.18 Cooling plant control panel.

24.18.1. The cooling plant control panel shall comply with specification stipulated herein in this Annex. It shall include all command, control, alarms and protection devices required for good and safe operation of the cooling plant.

24.18.2. Operation and adjustment

a. The operation of the cooling plant shall be automatic

b. The adjustment of operating parameters shall be of electronic type

c. The designed shall guaranty the imposed parameters together with maximum economy during operation of the system

d. All devices automatically operated shall also be provided with a manual command.

24.19 HVAC – Miscellaneous

24.19.1. Ventilation of diesel generator room:

a. The room temperature shall not exceed 35°C. When the room temperature reaches 30°C the ventilator shall start at high speed. When the room temperature decreases and reaches 15°C the ventilator shall operate at low speed. When the room temperature reaches 5°C the ventilator shall stop.

b. Manual operation of the ventilator shall be possible.

c. The ventilator shall be helicoids type.

d. The speed of the ventilator shall be 1500/750 rpm

e. The acoustic noise shall be such to meet the requirement in this SOW.

f. The air velocity through the exhaust duct shall not exceed 7m/sec.

24.20 Louvres.

24.20.1. Given the size of air inlet/outlet required for proper operation/cooling of the diesel engines, automatically operated louvers shall be provided in front of the transfer grilles and acoustic baffles. These louvers shall automatically open when one diesel engine starts. They shall automatically close after a pre-determined time delay to allow proper cooling of the diesel engines after engine stop.

24.21 Fuel Tanks and Distribution

24.21.1. In various locations, as stipulated in site specific Appendixes, one (or two) buried fuel tanks shall be provided for the two power generators.

24.21.2. In case of providing two underground fuel tanks for power generators they shall be installed at the same level and a by-pass connection shall be provided between the thanks.

24.21.3. Two day-tanks, one for each diesel generator shall also be provided. These tanks shall be located in the diesel generator room.

24.21.4. The fuel storage thanks shall be buried in the vicinity of the diesel generators room.

24.21.5. All works required for the installation of the fuel tanks, interconnection, fuel distribution, calibration, cleaning and rinsing before use, certification and testing are part of this SOW.

24.21.6. The fuel buried tanks shall be mounted on a foundation made of reinforced concrete and anchored to the foundation assuring suitable stability also against buoyancy force even when the tanks are empty.

24.21.7. The fuel tanks and associated equipment shall be installed in accordance with regulations and standards applicable and in force in the Territorial Host Nation (THN) as well as in compliance to:

a. AC/4-M(96)001, dated 10 July 1996- NATO Approved Technical Criteria and Standards for POL Facilities

b. STANAG 3756, edition 4, 9 September 2002 - Facilities And Equipment for Receipt and Delivery of Aviation Kerosene and Diesel Fuels

24.21.8. The buried fuel tanks shall meet following specification, installation requirements and be equipped at the minimum with the listed below auxiliaries:

a. Cylindrical, double walled tanks

b. Tanks and the auxiliaries shall be provided with grounding and cathodic protection systems

c. If required by THN regulation at this specific geographical location ground water observation bore shall be provided

d. All tanks and pipework installations shall be fitted with leak detection switches to give the user a remote alarm before the second skin is breached

e. Equipped with monitoring/ control equipment (i.e. a control panel)

f. Calibration of tanks in liters (every 10 mm of depth or as appropriate)

g. Automatic tank gauge

h. Dip-stick for manual inventory control of the fuel level

i. Overfill prevention equipment and tank venting equipment with flame arrestor mesh

j. Manholes providing access from grade level to underground equipment, including tank sumps, tank riser pipes, monitoring equipment, submersible pumps, valves and piping connections etc.

k. Spill containers to prevent spilled product from entering the soil near the fill and vapor-return riser connections (during normal tank-fill operation, or in the event of tank overfill). The spill containers shall catch spillage to help prevent soil contamination and groundwater pollution.

l. Fully redundant fuel pumps enabling transfer of the fuel to both generators

m. In case of providing two underground fuel tanks for power generators, the fuel pumps shall enable fuel transfer from one to another tank

n. Emergency, manually operated fuel pumps enabling transfer of the fuel to both generators

o. Installation of the fuel tank (tanks) shall be executed in a way that enables convenient and safe fuel transfer from fuel trucks to the tanks

p. Filling pipes, which shall terminate at a suitable location near the internal road or parking area for the fuel track

q. Marking of the fuel tank area in THN language (i.e. smoking/ open fire forbidden etc.) and in English

r. Special precaution shall be taken to prevent the fuel becoming too viscous in the pipes by cold temperature.

24.21.9. The capacity of the tanks shall be determined by the Contractor based on the following requirements:

a. For the diesel generators underground fuel storage tank(s) - the capacity shall assure at least 7 (seven) days (unless stated otherwise in respective site specific Appendixes) of continuous operation under maximum rated load of the power generators provided by the Contractor and additional 20% of spare capacity for expansion in power generator's loads

b. For the day-tanks – the capacity of each day-tank shall assure at least 24 (twenty four) hours (unless stated otherwise in respective site specific Appendixes and unless limited, by respective THN GRC legislation, to other maximum allowed indoor fuel storage capacity) of continuous operation under maximum rated load of the power generators provided by the Contractor

24.22 Fuel distribution

24.22.1. A fuel pumping station comprising two motor-driven self-priming screw pumps shall be provided.

24.22.2. Both pumps shall be equipped with special cut-off valves and drain cocks plus a non-return valve including the return to the main thank.

24.22.3. A manually- operated mechanical pump shall also be provided.

24.22.4. The special cut-off valve shall be equipped with a locking contact to prevent the corresponding pump from operating when the valve is not secured in the safe position, i.e. open for delivery and closed for bleeding or drainage.

24.22.5. The two day-tanks for power generators shall include:

a. A drainage pipe with a drain cock fitted with a stopper

b. A sampling nozzle with a cock with stopper

c. All associated piping, valves, stopcocks etc.

24.22.6. The refilling of the day-tanks from the buried tank(s) shall be fully automatic, and possible from each buried diesel generator tank to each daily tank.

24.22.7. The automatic refilling shall be initiated automatically when the fuel level in a daily tank drops below programmed level.

24.22.8. Manual refilling of the daily tanks shall also be possible.

24.22.9. A visual fuel-level indicator shall be provided on each day-tank.

24.22.10. The Contractor shall also provide a technical solution that allows safe and fast fuel transfer from daily tanks to the buried fuel tanks in case of emergency. This technical solution shall be in compliance with THN Law and regulations concerning firefighting and protection measures.

SECTION 25 FIRE PROTECTION AND FIRE FIGHTING

25.1 General

25.1.1. The Contractor shall pay special attention to the coordination between this section and all the other sections in order to present a coherent overall solution without contradiction.

25.1.2. In this context, the Contractor shall pay special attention to the design of the ventilation and smoke extraction systems that shall be provide according to respective THN regulations and standards in force.

25.1.3. Administrative & design activities, equipment and installation characteristics, as well as execution of the works, including works supervision, quality assurance, quality control, testing & commissioning and health & safety measures shall be planned, organized and executed in compliance with following standards and reference documents (the list is neither exhaustive nor limitative):

a. Commission Decision of 3 May 2000 implementing Council Directive 89/106/EEC as regards the classification of the resistance to fire performance of construction products, construction works and parts thereof or THN equivalent.

b. 2000/553/EC: Commission Decision of 6 September 2000 implementing Council Directive 89/106/EEC as regards the external fire performance of roof coverings or THN equivalent.

c. BS EN 54 series: Fire detection and fire alarm systems or THN equivalent.

d. BS EN 1125:2008 Building hardware. Panic exit devices operated by a horizontal bar, for use on escape routes. Requirements and test methods or THN equivalent.

e. BS EN 1366-2:2015 Fire resistance tests for service installations. Fire dampers or THN equivalent.

f. BS EN 1366-8:2004 Fire resistance tests for service installations. Smoke extraction ducts or THN equivalent.

g. BS EN 1634-1:2014+A1:2018 Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Fire resistance test for door and shutter assemblies and openable windows or THN equivalent.

h. BS EN 1634-2:2008 Fire resistance and smoke control tests for door, shutter and openable window assemblies and elements of building hardware. Fire resistance characterization test for elements of building hardware or THN equivalent.

i. BS EN 1634-3:2004 Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Smoke control test for door and shutter assemblies or THN equivalent.

j. ISO 3864-1:2011Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings

k. BS EN 12101-2:2017 Smoke and heat control systems. Natural smoke and heat exhaust ventilators or THN equivalent.

l. BS EN 12101-3:2015 Smoke and heat control systems. Specification for powered smoke and heat control ventilators (Fans) or THN equivalent.

m. BS EN 13238:2010 Reaction to fire tests for building products. Conditioning procedures and general rules for selection of substrates or THN equivalent.

n. BS EN 13501-1:2018 Fire classification of construction products and building elements. Classification using data from reaction to fire tests or THN equivalent.

o. BS EN 13501-2:2016 Fire classification of construction products and building elements. Classification using data from fire resistance tests, excluding ventilation services or THN equivalent.

p. BS EN 13501-3:2005+A1:2009 Fire classification of construction products and building elements. Classification using data from fire resistance tests on products and elements used in building service installations: fire resisting ducts and fire dampers or THN equivalent.

q. BS EN 13501-4:2016 Fire classification of construction products and building elements. Classification using data from fire resistance tests on components of smoke control systems or THN equivalent.

r. BS EN 13501-5:2016 Fire classification of construction products and building elements. Classification using data from external fire exposure to roofs tests or THN equivalent.

s. BS EN 14306:2015 Thermal insulation products for building equipment and industrial installations. Factory made calcium silicate (CS) products. Specification or THN equivalent.

t. BS EN 14604:2005 Smoke alarm devices or THN equivalent.

u. BS EN 15650:2010 Ventilation for buildings. Fire dampers or THN equivalent.

v. BS EN 15725:2010 Extended application reports on the fire performance of construction products and building elements or THN equivalent.

w. BS EN 50200:2015 Method of test for resistance to fire of unprotected small cables for use in emergency circuits or THN equivalent.

25.2 Fire detection

25.2.1. Fire detection system shall be equipped with safety wiring with the following characteristics:

a. Category F3- resistance to fire with mechanical shock and water assessed in combination

b. Hard PVC outer casing with aluminum protection

c. Solid copper conductors with silicone rubber

d. Tinned copper earthing conductor

25.2.2. All detectors, warning pushbuttons, as well as evacuation buttons, shall be connected to separate iteration loops so that in the event of a wiring interruption, all other points remain operational. Deviations from the main loop are not permitted. At the connections, the cables shall be protected with eyelets. The cabling between the detectors, the alarms and the fire detection/alarm control panel shall be done in F3 cable, placed in a cable duct or in a 3/4 "PVC tube.

25.3 Fire detection/alarm control panel

25.3.1. The panel shall be installed in a TBD location for the entire new SSSB building and various premises as stipulated in site specific Appendixes. Under no circumstances, this control panel(s) shall be located within other control panels of any equipment.

25.3.2. The control panel shall be controlled by microprocessors and enable monitoring and command of at least following functions:

a. Fire detection

b. Fire warning (transmitted by alarm, sirens, etc.)

c. Fault monitoring

25.3.3. It shall be equipped with a printer (with paper roll) which shall print all of the incidents.

25.3.4. It shall be contained in a cabinet of solid manufacture and robust finish, which shall be closed by means of a key and a security lock. 6 (six) keys shall be included in the delivery.

25.3.5. The control panel shall be equipped with a user manual indelibly affixed to an aluminum or plastic plate and affixed on the wall next to the control panel or directly on the control panel.

25.3.6. The site plan shall be hung near the control panel. The plan shall include the location of the detectors, pushbuttons and the control panel(s).

25.3.7. A test button(s) for testing all LED indicators shall be provided.

25.3.8. For each monitored zone, the control panel shall record as the minimum:

a. all fire alarms

b. all faults in the control units as well as disconnection of a zone, a detector or a push button

c. all power interruptions

d. on battery operation

e. "Out of service" - "In test" - "Fault" signals

f. earthing error in the network, siren circuit and supply circuit

g. Data on automatic extinguishing systems i.e. out of service state, in service state, empty bottles/tanks, full bottles/tanks, etc.

25.3.9. When the control panel detects a fire alarm, the ventilation and cooling shall always stop, the fire valves shall close.

25.3.10. The power supply shall be integrated in the control unit and protected against any contact by means of modular protective plates. It shall be protected against electrical disturbances (lightning, overvoltage, etc.).

25.3.11. The control panel shall be equipped as the minimum with:

a. Automatic switch: mains – back up power/back up power – mains

b. A button that triggers a general evacuation alarm. The tone of this alarm shall be clearly different from that of the fire alarm

c. Indicator of battery low voltage

d. Indicator (both in optical and acoustic form) showing the panel operation on battery

e. Full control of complete power supply and battery charger (including fuses); any anomaly shall trigger error indication in optical form

f. All cables shall be introduced into the control panel through the rear of the panel

25.3.12. The control panel shall have following characteristics:

a. 230V power supply. +/- 10% (48-62Hz.)

b. Ambient temperature: 0°C to 50°C

c. Degree of humidity: 95%

25.3.13. Fire detection system shall be provided with backup power with the following characteristics:

a. An autonomous emergency power supply with sealed lead acid (SLA) rechargeable batteries and charging units (including transformer, rectifier etc.) shall be an integral part of the system

b. Battery charger with automatic control of the charging current according to the temperature

c. Fast charging of batteries in case of complete discharge

d. The batteries shall be completely airtight (no formation of corrosive or explosive gases). They shall always maintain their full capacity with the use of an automatic and constant control system of voltage and power

e. The batteries shall automatically switched on and off, without operator intervention, depending on whether the mains supply is switched off or restored

f. The autonomy of batteries shall assure at least 72 hours of operation for the surveillance functions and 60 minutes for the sirens

g. A fault signal shall be transferred to the fire detection/alarm control panel if any of the above mentioned conditions are not met

h. Surge protection shall be provided

i. The operating state of the installation shall be indicated by a control lamp at the fire detection/alarm control panel

25.3.14. The fire detection/alarm control panel shall display with optical and acoustic signals:

a. FIRE

b. DANGER

25.3.15. It shall be possible to stop the acoustic signal by means of a switch. However, detection of any other alarm shall automatically restore the acoustic signal.

25.3.16. The optical signal shall only switch off after the alarm has been canceled or the fault has disappeared.

25.3.17. Optical signals on the control panel shall be realized be means of LEDs.

25.3.18. A "TEST" button(s) shall be provided for activation/deactivation of the acoustic warning of a circuit to be tested. The other circuits remain in standby state for a possible warning.

25.3.19. The fire detection/alarm control panel shall process the information coming from various fire detection circuits and generate the following alarm signals:

a. Fire detection alarm – when a fire is detected by fire detectors or by manual activation of a push button. All sirens in the same building are activated. The signal sounds a continuous tone

b. Evacuation alarm - the alarm which can be activated by means of a button at the fire panel. The tone must be clearly distinguishable from the fire detection alarm. Audible throughout the entire building and its immediate vicinity.

25.3.20. The fire detection/alarm control panel shall be fitted with an automatic telephone selector which shall notify the programmed telephone numbers in the event of an error or an alarm;

a. The telephone selector shall be suitable for use on digital as well as analogue telephone lines

b. The telephone numbers to be programmed will be determined later by the Purchaser in the execution phases.

c. The recorded message shall be in the THN official language and in English

25.4 Fire/smoke detectors

25.4.1. Fire/smoke detectors, further called detectors, shall meet requirements as per respective standards stipulated herein in this Annex above.

25.4.2. The communication protocol between the fire detection/alarm control panel and the detectors shall be insensitive to induction fields from electrical devices such as frequency controls, electric variations, high current power supplies, etc.

25.4.3. The detectors shall present an aesthetically pleasing exterior appearance. Visible areas must be finished to a high standard and be free from defects (no burrs or cracks).

25.4.4. In case the detectors are installed in a concealed manner (for example in rooms with suspended ceiling to monitor the space above the suspended ceiling) then they shall be indelibly marked as follows:

a. This marking shall mention the detector number as indicated on the display of the fire detection/alarm control panel

b. The detector number shall be stamped on or next to each detector base

25.4.5. Manufacturing and composition:

a. Each detection point shall consists of a removable detector and a fixed base

b. The detectors shall contain no putrescible liquid elements

c. The detectors shall not include elements capable of oxidizing and rusting or which may become unstable under the effect of normal temperature and a normal degree of humidity of the rooms in which they are installed

d. The detectors shall be designed in such a way to enable their removal with a suitable tool, mounted on a rod, without having to use a ladder or stepladder

25.4.6. Interchangeability:

a. The detection elements of all models shall be easily interchangeable without affecting the nature of the circuits, by using a standardized base

25.4.7. Operation and signaling:

a. The detectors shall trigger respective alarm as soon as the pre-set chemical or physical conditions are met for their activation

b. The detectors shall not trigger the warning in the following situations:

i. Normal change in the situation and composition of the air

ii. Normal vibrations of the elements where they are fixed

iii. Normal changes in temperature and humidity of the premises in which they are installed

iv. Electromagnetic disturbances (high frequency and magnetic radiation)

c. The detectors shall not become deranged due to aging within the timeframe, stipulated by their manufacturer, assuring that they are fully operational and safely reach the recommended intervals of their sensitivity adjustment

d. The detectors shall maintain the warning signal until it is stopped by manual operation at the control panel. At this time, the detectors shall automatically switch back to standby mode

e. Each detector shall assure operation of an individual light signal. This light shall be an integral part of the base or of the detector itself. The light intensity must be sufficient for the light signal to be visible at human height in daylight and in dusty rooms or in other difficult conditions.

25.4.8. Installation:

a. The number of detectors to be installed shall be determined by the Contractor in their design based on respective THN standards and legislation

b. In principle, smoke detectors shall also be placed in any attics, plenums, in all corridors and technical rooms

c. Ionization smoke detectors shall not be used at all.

25.5 Fire alarm

25.5.1. The Contractor shall delivery and install manually operated alarm push buttons, further called buttons, in order to report any outbreak of fire.

25.5.2. The number, location and characteristics of the buttons shall be determined by the Contractor in their design based on respective THN standards and legislation in force.

25.5.3. The buttons shall consist of a small, unalterable red box (PVC) colored in the mass and recessed.

25.5.4. The buttons shall be made of fire-retardant red PVC which is protected by a small easily breakable (plasticized) glass pane.

25.5.5. The buttons shall be activated by breaking the plasticized glass without tools. Broken glass shall not injure the user.

25.5.6. In the event of glass breaking and pressing the button, it shall transmit automatically the electrical signal to the sirens.

25.5.7. Each button shall be equipped with perfectly visible and legible note: "In case of fire, break the glass" written in the official language of THN and in English.

25.5.8. It shall be possible to test the button using a small wrench/key included with the delivery (one for each button) without having to break the glass or cause an unwanted fire signal.

25.5.9. The button shall have a recessed LED, which lights up when the fire alarm is activated.

25.5.10. Installation of the alarm push buttons shall meet following requirements:

a. The mounting height shall be 1.5 m above finished floor level

b. Minimum degree of IP protection: IP 30

c. All safety circuits connected to detectors, sirens and alarm buttons shall have cables with a minimum cross section of 1.5 mm^2

d. All wiring of category F3 - resistance to fire with mechanical shock and water assessed in combination

e. Authorized ambient temperature: from -10 to + 50 ° C.

25.6 Alarm Sirens

25.6.1. The Contractor shall delivery and install electromechanical or electronic alarm sirens, further called sirens.

25.6.2. The number, location and characteristics of the sirens shall be determined by the Contractor in their design based on respective THN standards and legislation in force.

25.6.3. The sirens shall meet the following requirements:

a. It shall be possible to monitor and control them from the fire detection/alarm control panel

b. They shall be in red color and made of fire-retardant PVC

c. Equipped with a built-in LED light with flashing light effect

d. The red LED shall blink in conjunction with the alarm sound

e. They shall have several tones – minimum as stipulated herein tin this Annex above

f. They shall emit sound minimum 110 dB over 1 m or 95 dB over 3 m

g. minimum degree of IP protection:

  i. for indoor sirens: IP 54

  ii. for outdoor sirens: IP 65

25.7 Fire door closing mechanisms and holders (retainers).

25.7.1. The Contractor shall delivery and install fire door closing mechanisms and holders (retainers) as and when required.

25.7.2. The fire door number, location and characteristics shall be determined by the Contractor in their design based on respective THN standards and legislation in force.

25.7.3. Fire door closing mechanisms and holders (retainers) shall meet the following requirements:

a. Each leaf of the fire doors located in the corridors and fire doors leading to the different parts of the buildings shall be equipped with an electromagnetic door holder (retainer) combined with a door closer

b. The electromagnetic door holder (retainer) shall consists of a backing/keeper plate and a magnet

c. The backing/keeper plate shall be provided with movable fixing brackets

d. It shall be possible to monitor and control them from the fire detection/alarm control panel

e. The electromagnetic door holder (retainer) shall be equipped with a push button mounted on the magnet base to allow manual closing of the door leafs with zero residual force for instant release

f. Power supply: 24V DC from the fire detection/alarm control panel

g. Die cast zinc alloy mounting base

h. Steel, electro plated magnet and backing/keeper plate

i. Operating temperature: 0 to + 50 ° C

j. The door closer shall ensure automatic and reliable closing of the door leaf when the fire detection system is activated

k. In normal situation, the fire doors are blocked in the open position by the energized magnets

l. In the event of a fire alarm, the magnets shall be de-energized and the doors shall close automatically.

25.8 Fire safety signs and safety markings

25.8.1. The Contractor shall delivery and install fire safety signs and safety markings as and when required.

25.8.2. Their number, location and characteristics shall be determined by the Contractor in their design based on respective THN standards and legislation in force.

25.8.3. Fire safety signs and safety markings shall meet following requirements:

a. Made in synthetic material, resistant to discoloration

b. Suitable for both exterior and interior use

c. Assembly is carried out in the places indicated, according to the manufacturer's instructions.

d. They shall be installed in such a way that they are clearly visible from the entrance doors, escape routes, etc.

e. When required, the necessary evacuation plans shall be provided as well

25.9 Fire fighting

25.9.1. Requirements for portable fire extinguishers are already described in other sections of this Annex.

25.9.2. This paragraph concerns the additional means that shall be provided by the Contractor according to their design based on respective THN standards and legislation.

25.9.3. The additional means the Contractor shall provide and install are:

a. Fire dampers

b. Automated full volume fire suppression system for the site of Kythira, Naval Entity 47 South (TX-RX)

25.9.4. The fire dampers, the automated full volume fire suppression system, fire detection and fire alarm shall be integrated into one cohesive fire protection and fighting system that shall be fully compatible with fire zones identified in the design for the new SSSB building and for various premises as stipulated in site specific Appendixes.

25.10 Fire dampers

25.10.1. The number, location and characteristics of the fire dampers shall be determined by the Contractor in their design based on respective THN standards and legislation in force.

25.10.2. The fire dampers shall meet following requirements:

a. installed at the HVAC ducts

b. fitted with a servomotor and limit switches

c. the servomotor shall be installed in a heat-resistant box

d. the mode of operation shall be “fail-safe”, that is to say that in the event of a voltage drop, the valve is controlled to close by a spring device specially developed for this purpose

e. The actuator shall comply with standards BS EN 61000-6-3:2007+A1:2011 and BS EN IEC 61000-6-4:2019 or THN equivalent.

f. the valves shall be maintenance free

g. the valve position indicator shall be present in the external part thereof

h. an easily removable and efficient inspection hatch shall be provided in the ventilation duct to the fire damper

i. when a fire damper cannot be fitted in line with the fire walls, the ventilation ducts protruding from the fire walls shall be provided with a fire protection covering of the same fire resistance as the corresponding fire wall.

j. made of galvanized steel sheet

k. fitted with a shutter consisting of a mineral fiber panel with metal sheet coating on both sides; minimum thickness of the shutter shall be 40 mm

l. accessory parts in galvanized steel

m. servomotor supply voltage determined according to the chosen fire panel (shall be coordinated with relevant requirements which address Fire Detection in this Annex)

n. fire resistance rating value of the damper shall be equal to the resistance of the corresponding fire wall

25.11 Automated full volume fire suppression system

25.11.1. The automated full volume fire suppression system shall meet the undermentioned requirements.

a. The design and implementation, further called the solution, shall assure safeguarding of site personnel and the equipment in following premises as the minimum:

b. Supply, Storage Room/ Workshop and Test facilities for electronic equipment

c. SSSB Equipment room

d. Power Generator room

e. Main Power switchgear room

f. UPS/Battery room

25.11.2. The above indicated areas shall be protected including their respective upper and lower plenums (entire volume above the suspended ceiling and below the raised floor); this shall be known as a full-volume solution.

25.11.3. The solution shall include any requirements for integration with other systems in the facility. Such systems shall include (but are not limited to) fire detection & alarm, heating, ventilation and air conditioning (HVAC) and electrical systems.

25.11.4. The solution shall be certified by an authorized representative or government body in THN and respective certificates of compliance shall be issued.

25.11.5. The fire suppressant shall be based on chemical compound FK-5-1-12.

25.11.6. The solution shall be compliant with following publications or their THN equivalents:

a. Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006

b. ISO 14520-5:2019 Gaseous fire-extinguishing systems — Physical properties and system design - Part 5: FK-5-1-12 extinguishant

c. ISO 16003:2008 Components for fire-extinguishing systems using gas— Requirements and test methods — Container valve assemblies and their actuators; selector valves and their actuators; nozzles; flexible and rigid connectors; and check valves and non-return valves

d. ISO/TS 21805:2018 Guidance on design, selection and installation of vents to safeguard the structural integrity of enclosures protected by gaseous fire-extinguishing systems

25.11.7. The solution shall provide an automatic leak detection system defined as a calibrated mechanical, electrical or electronic device for detecting leakage of F-Gases which, on detection, alerts the operator or a service company of any leakage.

25.11.8. The design shall identify all safety characteristics of the recommended solution which shall be included in the SSSB Site Safety Case.

25.11.9. The solution shall result in integrated fire detection and fire suppression system.

13.1.3. Suppression System.

a. The solution shall identify detailed descriptions of essential specifications considered in the design; examples shall include (but are not limited to);

i. temperature assumptions

ii. applicable standards

iii. over and under-pressure assumptions

iv. suppression materials and characteristics

v. Compatibility with the design of raised floor and suspended ceiling structure (including but not limited to pedestal base, pedestal head, pedestal, diagonal bracing, floor tiles, ceiling panels etc.)

vi. airflow requirements in conjunction with HVAC design

vii. physical components of the solution including quantities

25.11.10. The Contractor shall determine the maintenance policy (MP) and provide technical manuals and As-built drawings as appropriate to that MP that include description of the integrated system, description of the sequence of operation of fire detection and fire suppression systems installed in the facility, system test requirements; and user system maintenance requirements.

25.11.11. The solution shall consider how the system is to be installed (locations of components).

25.11.12. The solution shall address each of the issues identified in this Annex as well as any additional issues identified by the Contractor.

25.11.13. The solution shall consider siting and mounting of all components, including gas bottles and associated frames. Consideration shall be given to the effect of blast on the mounted equipment.

25.11.14. The solution shall consider differing methods of pressure management including airflow apertures between the protected premises, pressure relief valves as needed etc.

25.11.15. The solution shall consider and identify all tests to be conducted as proof of the design.

25.11.16. The solution shall identify any incident recording capability and built-in-test interrogation capability.

25.11.17. The solution proposal shall include all configuration management activities.

25.11.18. The solution shall include approval by the government or designated authority in THN and issue of certificates of compliance.

25.11.19. The solution shall identify annual support costs, including annual safety checks and issue of certificates of testing.

25.11.20. The solution shall identify suppression material replenishment costs in the event of operation of the system.

25.11.21. The solution shall explain annual support contracts offered by the selected sub-contractor, including any call-out or annual help desk costs.

SECTION 26 ELECTRICAL WORKS

26.1 General

26.1.1. The Electrical Works shall include:

a. The High Voltage/ Medium Voltage Power Station

b. The Low Voltage (LV) Main Power Distribution Board (MPDB) and/or the integration with existing LV MPDB

c. The Electrical Distribution Panels

d. The Distribution Cables and Wiring

e. The Electrical Equipment

f. The Emergency Lighting

g. The Power Back-up

h. The Uninterruptible Power Supply

i. The Lightning Protection and Grounding Connection

j. The External Lighting

k. The Electrical Works Legal Inspection

26.2 Applicable documents

26.2.1. The below list is nor exhaustive neither limitative.

26.2.2. The electrical installations and the equipment used shall comply with the documents listed below:

a. IEC 60038: IEC standard voltages or THN equivalent.

b. IEC 60364: Electrical installations of buildings or THN equivalent.

c. IEC 60309: Plugs, socket-outlets and couplers for industrial purposes or THN equivalent.

d. IEC 61009: Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses or THN equivalent.

e. IEC 61537: Cable management - Cable tray systems and cable ladder systems or THN equivalent.

f. IEC 61643: Low-voltage surge protective devices or THN equivalent.

g. IEC TR 60083: Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC or THN equivalent.

h. IEC 60529: Degrees of protection provided by enclosures (IP Code) or THN equivalent.

i. EN 60598-1:2015+A1:2018 Luminaires. General requirements and tests or THN equivalent.

j. Directive 2014/30/EU of The European Parliament and of The Council of 26 February 2014 – electromagnetic compatibility or THN equivalent.

k. MIL-STD 461G (or THN equivalent) – Requirements for the control of electromagnetic interference characteristics of subsystems and equipment, December 2015

l. Directive 2014/35/Eu of The European Parliament and of The Council of 26 February 2014 – ‘low voltage directive’ or THN equivalent.

m. Particular rules imposed by the electrical power supply company

26.3 Quality criteria

26.3.1. All equipment used shall be ambient physicochemical and fluids resistant.

26.3.2. All equipment and material delivered shall be new, of high quality, of standard manufacturing, known brand and manufacturer with good logistic support.

26.3.3. All equipment shall fulfil the THN legislation requirements for electrical equipment.

26.3.4. Hybrid and self-made equipment are not allowed.

26.3.5. Equipment, materials and accessories as well as installation techniques not explicitly described in this SOW shall be conceived by the Contractor such that they satisfy the following conditions:

a. Good operation of installation they belong to

b. Perfect integration in the environment (for instance in false ceiling)

c. Easy operation by the users

d. Long MTBF

e. Simplified operation and maintenance

f. Quick repair

g. Possibility to upgrade or modify without important re-engineering.

26.4 HV Electrical Power Station

26.4.1. Existing electrical power situation and details are available within the SIDP Annex.

26.5 New HV/MV Power Station.

26.5.1. The Contractor shall provide a New HV/MV power station that shall comply with the documents listed below. The below list is nor exhaustive neither limitative:

a. Commission Regulation (EU) 2019/1783 of 1 October 2019 amending Regulation (EU) No 548/2014 on implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to small, medium and large power transformers or THN equivalent.

b. Commission Regulation (EU) No 548/2014 of 21 May 2014 on implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to small, medium and large power transformers or THN equivalent.

c. Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products or THN equivalent.

d. EN 50708-1-1:2020 Power transformers. Additional European requirements. Common part. General requirements or THN equivalent.

e. EN 50708-2-1:2020 Power transformers. Additional European requirements. Medium power transformer. General requirements or THN equivalent.

f. EN 50708-3-1:2020 Power transformers. Additional European requirements. Large power transformers. General requirements or THN equivalent.

26.5.2. The size of the HV/MV station shall be determined by the Contractor taking into consideration:

a. directives from the HV/MV power supply provider

b. the total site power requirements plus 30% spare capacity for future expansion

26.5.3. Inspection and acceptance of the HV/MV station by an accredited company shall take place prior to acceptance by the Purchaser.

26.5.4. The aim of this HV/MV power station is primarily to provide the required power supply to the site.

26.5.5. Should the commercial power supply company request the Contractor to increase the capacity of the power station for their own need, for instance local distribution of electrical power supply, then the related costs shall be supported by the commercial power supply company. The Purchaser will only support the cost related to this SOW.

26.5.6. The design, procurement and installation of the HV/MV power station shall be in accordance with local regulations and shall be closely coordinated with the local HV/MV power supply provider.

26.5.7. The HV/MV power station shall be subdivided in cubicles/cabinets and include as a minimum:

a. HV/MV disconnecting switches

b. ON-OFF switch with HV/MV fuses

c. HV/MV circuit breaker

d. lightning arresters

e. Capacitive Divider Bridge to supply three “live” warning lights

f. Earth disconnecting switch

g. Warning lights showing the open and closed positions of the disconnecting switches

h. Auxiliary contacts shall be provided for remote warning signals

i. All other equipment that are required by National and local regulations (e.g. interlocking and padlocking equipment for use with local system with loop or multiple distribution)

j. Footstool, rod, hook, rubber gloves etc.

k. Warning and operating voltage signs

l. HV/MV equipment circuit diagram

m. Rechargeable portable lamp with 2 hours autonomy

26.5.8. The blowing of one HV fuse shall cause the three-pole break to trip.

26.5.9. The control for the disconnecting switches shall be manual; they shall be locked to each other and to the access door to obviate any risk of mistake.

26.5.10. The transformer fed by this station shall be protected on the low voltage side.

26.5.11. Rated power: To be determined by the Contractor

26.5.12. Frequency: 50 Hz

26.5.13. The neutral shall be grounded

26.5.14. Connections:

a. On HV/MV side: to be defined by the Contractor in co-ordination with the commercial power supply company

b. On LV side: Underground cable

26.6 Tests

26.6.1. The test shall comply with national and local Standards. The tests shall include the following:

a. Measurement of heating

b. Short-circuit resistance tests

c. Overload curves with prior load of 50, 75 and 90%

d. Measurement of winding resistance when cold

e. Dielectric rigidity tests with applied and induced voltages

f. No-load tests

g. Transformation ratio measurement

h. Thermometers operation.

26.7 HV cables

26.7.1. The HV/MV cables shall conform to IEC 60183:2015 or THN equivalent.

26.7.2. The size of the cables shall be determined by the Contractor taking into consideration Voltage drop.

26.8 Mains Power Distribution Board (MPDB)

26.8.1. **General Requirements for the MPDB.**

a. The MPDB shall comply with EN 61439-6:2012 Low-voltage switchgear and control gear assemblies, Busbar trunking systems (busways) or THN equivalent.

b. In addition to the sub-paragraphs below, the general requirements for Electrical Distribution Panels mentioned in relevant paragraphs below also apply to the MPDB.

c. The board shall be located in the Main Power switchgear room. It shall be of steel sheet construction and shall incorporate easy access to all components for maintenance.

d. The MPDB shall be divided in cabinets. The front doors of each cabinet shall be of hinged type and have locking devices with single handle and be lockable with a key. The rear access shall be of the panel type and fitted with snap-on screws for easy removal.

e. All doors shall be connected to the cabinet or box framework by two tinned copper stranded conductors.

f. Meters, switches, alarm lights/led, indicator lights/led shall be mounted on the front doors or behind an outer doors when required due to H&S regulations. Adjustable devices shall be lockable.

g. An Emergency OFF push button shall be mounted on the board. It shall be protected to prevent inadvertent operation.

h. A mimic diagram, showing the operation positions of the switches, controls, meters and indicator lights in the circuit order shall be provided on the front doors of the board.

i. All components, cables and cable connections shall be properly labelled.

j. The MPDB shall contain all switching, control protection, lightning arrestors, metering, alarms indication and connection devices for the distribution of AC power supply to the electronic equipment (no-break), domestic utilities and auxiliary loads (short-break).

k. The MPDB shall also contain an automatic change over switch, which shall switch over from the mains input to the standby power input or vice versa.

l. A copper earthing bus bar shall also be provided.

m. The power distribution throughout the site shall be 400V/230V – four wire + ground, TN-S.

n. The TN-C segments of electrical installation will be only allowed if in conformity to IEC 60364 and when it is required. An example when TN-C connections might be required is on the input to the UPS, as it requires constantly-connected PE & N conductors to ensure an ever-present earth reference.

26.8.2. **MPDB input connections.**

a. The MPDB shall be equipped as the minimum with input connections for:

i. LV connection from the secondary side of the main step-down transformer

ii. Standby power (short-break) connections from the Diesel Control Boards

iii. Control alarm signal cables from main step-down transformer

b. The input connections shall be equipped with motor controlled circuit breakers with thermo magnetic protection.

26.8.3. **MPDB output connections.**

a. The MPDB, as the minimum, shall be equipped with output connection to:

i. The Equipment Power Distribution Board (EPDB)

ii. The power input to the UPS rectifier

iii. The power input to the Diesel Control Board

iv. The Power Panels for building utilities

v. The Power Panel for the Environment Control (HVAC) equipment

b. All power outputs shall be equipped with circuit breaker and contactors. The contactors shall be controlled on the one hand by “ON-OFF” push buttons on the front surface of the panel and on the other hand by time delay relays, enabling a supply cut-off to be followed by cascaded re-connections to various users so that whole load is not abruptly connected to the stand-by generator. The control system (push button or time delay relay) shall be selected by means of “manual-automatic” switches.

c. All circuit-breakers shall comply with EN 60947-2:2017+A1:2020 Low-voltage switchgear and control gear or THN equivalent.

d. The integration with existing MPDB shall include installation of adequate circuit breakers, and modification of existing power distribution system and the power boards/ panels as required to connect power cables for SSSB electrical installation.

26.8.4. **Capacitor Bank**

a. When require, a capacitor bank shall be provided and integrated with the MPDB to maintain a power factor equal to 0.95.

b. The capacitor bank shall be compliant with (the list is nor exhaustive neither limitative) IEC 60871, IEC 60831, IEC 61921, IEC 60099, IEC 60076, IEC 61869 or THN equivalent.

c. The capacitor bank shall be controlled by an electronic regulator with selector of power factors, auto-manual selector, and step indicators.

26.8.5. **Measurement equipment.**

a. The MPDB shall, as a minimum, have the following meters:

i. One voltmeter with associated selector switch to permit measurement of the HV input between phases;

ii. One voltmeter with associated selector switch to permit measurement of the LV input between phases and between phase and neutral;

iii. Three ammeters to permit measurement of the phase current from the LV side of the HV transformer on the input bus-bar;

iv. Three ammeters to permit measurement of the phase current on the output bus-bars;

v. One kilowatt meter;

vi. One frequency meter;

vii. One power factor meter;

viii. One kilowatt hour meter.

b. Alarm indicators, as the minimum, shall be provided on the MPDB for the following fault conditions:

i. Mains supply disconnected;

ii. HV breaker tripped;

iii. Transformer over temperature;

iv. Earth fault on HV.

c. All alarms for the HV/MV, LV, Stand-by and UPS power supplies shall be remotely indicated at the SSSB operator control console.

26.9 Site Monitoring System (SMS)

26.9.1. Site Monitoring System is a COMMS site sub system (not PFE) in order to supervise the correct operations of infrastructure and equipment. On the other hand, the major function of the system is to reveal the status of operation of a site. It shall adapt, to an already installed SMS, taking over the Alarm/States of the monitored components.

26.9.2. Site Monitoring System is distributed over all SSSB COMMS sites.

26.9.3. The system consists of an alarm panel per site allowing visualizing (via LEDs) and audible (via buzzer) alarms, managed by the SMS. Furthermore, it shall have an Alarm Acknowledge button, LED Test functionality and a Power LED.

26.9.4. The Alarm Panel shall be installed in the equipment room (SSSB COMMS room) into the front of a rack.

26.9.5. One desk mountable Alarm Panel, if requested by the THN, shall be installed at remote/local location chosen by the THN. It shall have the identical functionality as the Alarm panels, installed at the SSSB COMMS sites – but here representing Alerts/States for all SSSB COMMS sites dedicated to a SSSB Buffer Centre.

26.9.6. The SMS shall communicate all alerts/states to the SSSB Opens System Communication Control System (OSCC), which will present the states of the different SSSB COMMS sites and COMMS devices at all OSCC components (e.g. to the SSSB Operator at the SSSB Buffer Centre).

26.9.7. The bi-directional exchange of information between the SMS and the SSSB OSCC shall be performed preferably by SNMP v.3x or by Dry-Contacts (I/O device). The Contractor is invited to recommend other techniques for the information exchange between SMS and OSCC, where a final decision shall be performed by the Purchaser.

26.9.8. All SSSB COMMS devices, including Purchaser Furnished Equipment (PFE) shall be monitored by the SMS. This shall be valid for all devices providing an alarm or status by any means (IP, Serial, Dry-Contact, or any other).

REMARK:

The OSCC will perform control of SSSB COMMS key equipment. For COMMS devices, where ”concurrent” access of SMS and OSCC is not possible – OSCC will take precedence to intercept alarms/states and will provide them to the SMS for further processing.

The THN shall have the final decision on the device alarms/states to be indicated at the Alarm Panels. The THN shall also have the final decision on multiple sub-alerts causing an active alarm indication at the Alarm Panel LED.

26.9.9. The Contractor shall provide an ICD to the Purchaser latest at the Critical Design Review Meeting (CDR), representing the SW interface between the SMS and the OSCC.

26.10 Electrical Distribution Panels

26.10.1. Equipment shall be designed for rated voltage of 500 V AC. It shall be capable of withstanding, for one second, the dynamic and thermal effects produced by the short-circuit current to be determined by the Contractor but in any case not less than:

a. 15 kA effective

b. 37.5 kA asymmetrical amplitude

26.10.2. The Contractor shall indicate on his drawings the rating and characteristics of the equipment offered.

26.10.3. All electrical equipment fitted in electrical panels or used to control lighting and power supply circuits shall be designed to withstand the stress resulting from maximum short-circuit current that might occur at the point where the equipment in question is located.

26.10.4. The equipment layout in the panels shall be clear, logical and rational, enabling all the items to be easily mounted, connected and maintained and the relationship between the various components to be easily understood.

26.10.5. The compartment within the cabinets and the boxes shall be of a size to permit rapid and safe access to the equipment housed in them. The overall size of each panel shall be such that new lead-outs can be added.

26.10.6. The degree of protection shall be at least IP 30.

26.10.7. The cabinets shall include a framework to hold the equipment, enclosed with panels of fire-proof insulating material.

26.10.8. The frame works shall be equipped with DIN rails to which equipment shall be mounted.

26.10.9. The covering panels shall have openings through which the cut-off controls can be reached while all live parts remain protected. Protection of the complete unit with cabinet door open shall be at least IP 20.

26.10.10. The front doors shall be of hinged type and have locking devices with single handle and be lockable with a key.

26.10.11. All doors shall be connected to the cabinet or box framework by two tinned copper stranded conductors.

26.10.12. Meters, switches, alarm lights/led, indicator lights/led shall be mounted on the front doors or behind an outer doors when required due to H&S regulations. Adjustable devices shall be lockable.

26.10.13. Each board/panel shall include 30% spare, non-equipped space.

26.10.14. Each board/panel shall be clearly marked on the outer side of the door by means of thermoplastic plate engraved with following information:

a. Voltage (for instance 3 x 400 V + N – 50 Hz)

b. Destination (for instance EPDB – No-Break)

c. Type of distribution (for instance TN-S)

26.10.15. Each board shall be equipped with internal lighting.

26.11 Distribution Boards/Panels Equipment

26.11.1. **Switches**

a. Switches shall conform to IEC 60669, IEC 60947, IEC 62626 or THN equivalent.

b. Each pole shall provide a double break, with breaking and making speed independent of the operator.

c. The switches shall be of rotary, bar or knife type.

d. If switches have associated fuses, the switch-fuse assembly shall be fitted in the same compartment box.

e. Each switch shall be operated by means of rugged handle at the front which, by its position and markings, clearly shows whether the switch is open or closed.

f. If the control handles are located on the doors, they shall be equipped with a coupling system enabling the doors to be opened without handles being dismantled. In no circumstances shall this system permit the position of the handle to be inverted in relation to the position of the switch it controls.

26.11.2. **Circuit-breakers**

a. The circuit-breakers shall conform to IEC 60947, IEC 60898, EN 61008, EN 61009 or THN equivalent.

b. The circuit-breakers shall have a breaking capacity at least equivalent to the short-circuit current assumed possible where they are located.

c. When circuit-breakers do not have the required breaking capacity, they must be linked with high breaking-capacity fuses.

d. The breaking capacity of the circuit-breakers shall not be lower than 10 kA with a 400 V power supply.

e. The circuit-breakers shall be of the air, dry-breaking type with a manual reset system. In the event that the assumed established current is over 15 kA, control must be effected by energy storage devices operated by hand or by electric motors.

f. The control device shall always be situated on the front of the circuit-breaker.

g. Each pole shall be equipped with and adjustable thermo-magnetic release.

26.11.3. **Small Automatic Switches**

a. Single pole automatic switches will be accepted. The Contractor shall determine the type and rated current of the equipment on the basis of the circuits to be protected. They shall be of the fixed type. Manually controlled and fitted with a thermos-magnetic trip device.

b. In the case of equipment not protected by upstream fuses, the effective breaking capacity shall be at least 15 kA. The electrodynamics resistance and closing capacity shall be at least 37.5 kA asymmetrical amplitude.

26.11.4. **Earth Leakage Circuit Breaker**

a. An earth Leakage Circuit Breaker shall be provided as required by the IEC 60364.

26.11.5. **Tele breakers**

a. Tele breakers are accepted. These devices shall have solid silver contacts or a mercury-contact relay system.

b. The connecting screws shall be made of nickel-plated brass, with oscillating clams, for connecting conductors with a cross-section of up to 2.5 mm^2.

c. They shall be fitted with a built-in or separate indicator or light showing the position of the contacts and with an operating lever or push-button.

d. The rated voltage shall be at least 250 V and the rated current 10 A.

e. The heating, in continuous operation, shall not exceed 80°C.

26.11.6. **Fuses**

a. The fuses shall be of the blade cartridge type with handle, have a high breaking capacity and have enclosed quick-melting system. In motor supply circuits, fuses of time-lag type shall be installed if motor starting current makes it necessary.

b. The fuses shall conform to IEC 60269-2, Low-voltage fuses – fuses mainly for industrial application.

c. As far as possible thermomagnetic circuit-breakers shall be used and fuse cut-outs only be accepted for capacities of 2 amps or less or in any cases where the best thermomagnetic circuit-breaker on the market have less breaking capacity than the estimated short-circuit current at the point where they are installed.

d. When fuse cut-outs are used they shall always be mounted on a fuse-holder disconnector.

e. The disconnectors shall be of the load-break type.

26.11.7. **Contactors**

a. The contactors shall conform to IEC 60947-4-2, IEC 60947-4-1, and IEC 61095 or THN equivalent.

b. The contactors shall have a double-break system on each pole. Motor – controlling contactors shall be linked to adjustable thermal relays in the absence of a circuit-breaker.

c. The relays shall be adjusted such that the extremes temperature permissible for which the motors are protected cannot be exceeded, i.e. maximum 1.5 x in for less than two minutes.

d. The associated relays shall act on all phases.

e. Upstream protection by means of fuses or circuit-breakers shall be suitably rated and shall have a breaking capacity at least equivalent to the short-circuit current which might occur where they are located. This protection shall be grouped in the same compartment as the corresponding contactor.

f. Each contactor shall be equipped with at least two auxiliary “NO” contacts and two auxiliary reverse contacts.

g. The thermal relays shall also have auxiliary contacts, either one “NO” plus one “NC”, or a reverser.

26.11.8. **Instrument transformer**

a. When required, the Contractor shall provide and install the instrument transformer that shall be of a dry type, insulated with Araldite.

26.11.9. **Equipment Power Distribution Board (EPDB)**

a. One EPDB shall be provided in the SSSB Equipment room. It shall be of steel sheet construction and shall incorporate easy access to all components for maintenance.

b. The EPDB shall be divided in two sections:

i. One No-Break section supplied from the UPS

ii. One Short-Break section supplied from the MPDB

c. The compartment within the cabinet shall be of a size to permit rapid and safe access to the equipment housed in them. The overall size of each panel shall be such that new lead-outs can be added.

d. The degree of protection shall be at least IP 30.

e. The two front doors shall be of hinged type and have locking devices with single handle and be lockable with a key.

f. The two doors shall be connected to the cabinet or box framework by two tinned copper stranded conductors.

g. The No-Break section and the Short-Break section shall each be equipped with:

i. One four-pole bus bar

ii. One four-pole input circuit-breaker with thermomagnetic protection. However, if there are any upstream panels with overcurrent protection devices, the EPDB shall have instead input switches (contactors) as this is not a good engineering practice to have two overcurrent protection devices directly in series.

iii. One voltmeter with selector switch (phase-phase and phase-neutral)

iv. Three ammeters

v. A copper grounding bus bar

vi. Output power feeders;

h. Meters, switches, alarm lights/led, indicator lights/led shall be mounted on the front doors or behind an outer doors when required due to H&S regulations.

i. An Emergency OFF push button shall be mounted on the panel. It shall be protected to prevent inadvertent operation (see also relevant sections herein in this Annex below).

j. The No-Break section shall provide power supply distribution to all SSSB equipment that cannot suffer any power supply interruption.

k. The Short-Break section shall provide power supply to all SSSB equipment that can accept short power interruption and to all auxiliary and utility loads.

l. Note: The power interruption is dictated by the time required for the change over from mains to stand-by power supply.

26.12 Power Panel (PP)

26.12.1. Power Panels shall be provided for utilities and auxiliary loads and shall be provided and installed throughout the new SSSB building and in other premises as stipulated in site specific Appendixes.

26.12.2. They shall be of steel sheet construction, mounted on walls. The general degree of protection shall be at least IP 30. The degree of protection for the power panel in the air conditioning room shall be IP 54.

26.12.3. The front doors shall be of hinged type and be lockable with a key.

26.12.4. The doors shall be connected to the cabinet by two tinned copper stranded conductors.

26.12.5. The panels shall contain:

a. One four-pole set of bus-bars

b. One copper earthing bar

c. One four-pole input circuit breaker

d. All the required switching, overload protection circuit-breakers and fuses, switches, etc. in accordance with national and local regulations

e. Earth leakage current circuit-breakers shall be provided whenever required in accordance with IEC 60364 or THN equivalent.

26.12.6. All equipment and accessories in the panels shall be mounted on DIN rail.

26.12.7. The load connected to each 3-phase supply shall be equally distributed between the three phases, as far as practicable, to ensure optimum balance between the phases.

26.12.8. All auxiliary and utility loads shall be connected to the short-break (mains and stand-by) power supply.

26.13 Cables and wiring

26.13.1. The following cables and wiring are required:

a. The LV power cable between the HV transformer, LV, side and the MPDB;

b. The power cables between the stand-by generating sets and the MPDB;

c. The LV cables to connect the Mains Power Distribution Board to the Equipment Power Distribution Board and Power Panels;

d. The LV cable to the UPS power input;

e. The LV cable from the UPS to the Equipment Power Distribution Board

f. All wiring for distribution of power from the Equipment Power Distribution Boards and Panels to electronic equipment, lighting, outlets, utilities, etc.

g. All required power cables from the buildings to various antenna locations

h. LV cables between the MPDB and the Diesel Generator Control Boards;

i. All remote control and signaling cables

j. All cables to connect external lighting, fire detection and alarm system

k. All cabling and wiring required for proper and intended functioning of all equipment provided under this statement of work

l. All earthing cables

26.13.2. **Technical requirements.**

a. All cables and wires shall be rated for current carrying capacity in accordance with the applicable industry standards.

b. Free movement of cables shall be assured when equipment is pulled out for maintenance/repair.

c. Wires and cables shall be placed and protected as to prevent contact with rough irregular surfaces and sharp edges. Cables connecting to components mounted onto doors or panels shall be protected so that no possibility of damage arises during opening and closing of doors or panels.

d. Cable harnesses shall be routed away from heat generating equipment and no wire or cable connection shall be in tension.

e. For the dimensioning of the bending radius of cables the regulations of DIN VDE 0298, part 3 or equivalent shall be followed.

f. All soldered connections shall be clean and smooth in appearance and shall provide excellent electrical conductivity. The insulation of soldered wires shall not show damage from the heat of the soldering operation.

g. All electrical cables shall conform to IEC 60228, IEC 60287-3-2 (Economic optimization of power cable size) or THN equivalent.

26.13.3. **Redundant cables**

a. Redundant cables shall be removed or stop-ended and clearly marked:

b. The term “STOP END” means the provision of a permanent seal in which all cores are insulated and protected so that the cable can be energized safely.

c. Removed cables shall be disposed of in accordance with THN local standards and regulations in force.

26.13.4. **Jointing and terminating of cables**

a. All joint and termination equipment shall be used to the Manufacturer’s recommendations.

b. The Contractor shall provide evidence that the joint or termination Manufacturer has stated that the materials to be employed are suitable for the type of cable to be jointed or terminated.

c. A cable shall not be cut until the jointing or terminating commences and the work shall proceed continuously until it is completed. All necessary precautions shall be taken to prevent damage and ingress of moisture and impurities. Cable ends shall be free from moisture before jointing commences. Where circumstances prevent completion the cable ends shall be sealed.

d. Core identification shall be matched at each joint without twisting or crossing of the cores. Where numbered cores are jointed to coloured cores, the system adopted shall be consistent throughout all cable runs and, on sites with existing installations, consistent with the system already in use. The location of the joint shall be recorded and included in the handover documentation.

e. Joints selected for use with armoured cables shall not reduce the fault current withstand capacity nor increase the impedance of the circuit protective conductor.

f. Armouring and metal sheaths shall be connected by a bonding conductor directly to the external earthing terminal of the equipment at all terminations. Metal sheaths of single core cables shall be bonded and earthed at one point only, unless indicated otherwise, and insulated glands shall be used at the open-circuit end or ends.

g. Cable tails at terminations shall be formed by separating and bringing out the cores. Each tail shall be long enough to connect to the terminals of the equipment.

h. For three phase circuits the phase conductors shall be arranged, where practical, in trefoil formation where they pass through enclosures of equipment.

i. For HV/MV and LV terminations coloured or numbered discs shall be provided on the outside of sealing boxes to indicate the disposition of the phases and neutral conductors inside. Insulating tape shall not be used for marking cables inside joints or terminations.

j. Continuity of spare cores shall be maintained at joints, and at terminations the cores shall be connected to earth at the supply end and in a spare terminal at the load end.

k. For screened cable, continuity of screening shall be maintained across the joint.

l. Armour Termination shall be by means of mechanical cable glands. For armoured cables the glands shall have an earth bond attachment.

26.13.5. **Marking and notices**

a. A marking system, including all information fields of the labels, shall be presented to the Purchaser for acceptance.

b. Identification labels shall be fixed to the outside of equipment enclosures. Label format and materials shall be appropriate to the installation and shall be fixed by non-corrosive materials appropriate to the intended application and location.

c. Characters for labels fixed on the means of isolation at the origin of each installation shall be at least 10mm high and 1.5mm thick. On all other labels characters shall be at least 4mm high and 0.5mm thick.

d. Where there are two or more incoming supplies this shall be clearly indicated at each point of isolation. Labels on single-phase equipment supplied from a three-phase supply shall indicate the phase to which it is connected.

e. A label indicating the system concerned shall identify all joint boxes.

f. A diagram showing the allocation of terminals for each incoming cable shall be permanently fixed inside each joint box cover. The diagram shall be afforded protection suitable for the environment in which it is located.

26.13.6. **Marking of cables**

a. Marker slabs, with cast iron marker plates secured to a concrete base, shall permanently identify the location of buried cables. The wording on the markers shall be “HV CABLE” or “LV CABLE” as appropriate; in addition the word “JOINT” shall be added where appropriate. Alternatively, marker posts shall only be used where they do not cause obstruction or danger.

b. Cable marker slabs shall be installed, as required, flush with the finished ground level, on the precise line of the cable.

c. Cable markers shall be located at every point where a cable enters a building, sub-station, plinth or distribution pillar, at each joint, change of direction, road and pathway crossing, and along the route of the cable at intervals not exceeding 45m.

d. Trunking and ducting shall be permanently and conspicuously identified.

e. Cables shall be permanently and conspicuously identified.

f. Cable identification shall be located within 500mm of terminations and joints, at least once within each separate compartment through which the cables pass, at intervals not exceeding 24m, and shall coincide with the colour bands, where used. Consideration shall also be given to identifying cables at entry or exit points and where buried cables emerge from the ground.

g. Every cable end shall be provided with a means of identification showing the designation, number and cross-sectional area of cores and rated voltage of the cable.

h. All cables, conductors and wires shall be easily, clearly, permanently identified, and each cable, conductor or wire used for interconnection in any power board and equipment or outside connection between any power equipment and power boards, shall be labelled at both ends with the same number or letter. Permanent cable tags, labels, marking clips, heat shrinkable sleeves, etc. shall be used for that purpose. The identification number or letter shall be given on the installation drawings.

i. The colour identification of cores shall comply with EN 60445:2017 Basic and safety principles for man-machine interface, marking and identification. Identification of equipment terminals, conductor terminations and conductors or THN equivalent.

j. For live conductors the identification shall extend throughout the length of the cables.

k. Cables forming part of alarm, control, communication or monitoring circuits shall have identification sleeves at their terminations with specific circuit identification. Identification shall be consistent with the relevant wiring diagrams.

26.13.7. Cable separation

a. Metallic information technology cabling and mains power cabling shall be separated as specified in EN 50174-2:2018 - Information technology. Cabling installation. Installation planning and practices inside buildings or THN equivalent.

b. However, whenever there is RED and BLACK equipment installed, separation requirements for cabling and the actual equipment shall meet requirements stipulated in SECAN Doctrine and Information Publication (SDIP) - Selection and Installation of Equipment for the Processing of Classified Information: SDIP-29/2.

c. 30% of additional space shall be allowed along cable routes for future additions and cable supports shall be of adequate size for the ultimate load.

d. Adequate space shall be left between cable runs and the building fabric and other services to allow for the future removal or installation of cables.

26.13.8. **External cabling**

a. All electrical connection between buildings, antenna locations and external lights shall be made with underground cables which run in ducts/trenches to facilitate cable replacement. Each cable shall be run in one piece without splices or junctions.

b. The cables shall be provided as armoured (a steel or aluminium armour in the form of tape(s), wires or braids) and compliant with IEC 60502, EN 50267, EN 60332-1-2 (for single core cables) or THN equivalent.

c. The cables shall be covered by sheaths and insulation protecting against local climatic condition and assuring sufficient UV resistance in accordance with EN 50289-4-17:2015 or THN equivalent.

d. The size and insulation shall be in accordance with national and local standards/regulations, taking into account the maximum load and ambient temperature.

26.13.9. **Laying cable in trenches:**

a. The cables runs must be protected against damages by earth settlement, contact with hard objects and the impact of hand tools in the event of excavation work and also against chemical action due to soil ingredients.

b. In ground subject to long or frequent flooding, when the cable lies in ground water for two months per year or when the trench acts as a drain, the cables shall be considered as permanently immersed and shall be laterally (water shall not penetrate into the cores of the cable) and longitudinally (with a barrier that shall prevent the spread of moisture along the cable length) watertight.

c. The cables shall be buried at a minimum depth of:

   i. 0.6 m for low voltage cables, signal cables and telephone cables;

   ii. 0.8 m for high voltage cables

d. 1 m below ground accessible to vehicles.

e. The trenches shall be as narrow as possible: ± 50 cm for one cable.

f. The depth of the trench shall be 10 cm more than the depth at which the cables are to be buried. The bottom of the trench must be free of any rough objects that may damage the external sheath of the cables.

g. The cables shall be laid on a 10 cm layer of sand or fine earth. They shall then be covered with another 10 cm layer of sand or fine earth. A marker shall be placed 20 cm above the upper part of the cables. The trench shall then be filled in with a layer of maximum thickness 15 cm, carefully tamped to give the sub-soil the same consistency as it had before the trench was dug.

h. In principle, the radius of the curve shall be 20 times the diameter of the cable with the biggest external diameter.

i. Cables installed on the surface shall be parallel with the lines of the building construction and properly aligned.

j. Cables buried below ground shall, as far as practicable follow the features of the site such as roadways and building lines. Ducts at road and crossings shall normally be at right angles to the line of the road.

26.13.10. **Internal cabling**

a. All cables between the MPDB and Power Boards or Power Panels shall be shielded. Electrical continuity of cable shielding shall be provided to assure correct grounding. All cabling shall run in cable ducts or on cable racks/trails.

b. The wiring for lighting fixtures, power sockets and any other auxiliary equipment shall run in tubing embedded in wall or ceiling or in tubing on the surface of walls and ceilings.

c. All cables shall have non-toxic, non-flammable coating.

d. All cables shall be halogen-free, low smoke, thermoplastic insulated and sheathed cables in compliance with IEC 62821 or THN equivalent.

26.13.11. **Signaling and data cables**

a. Following standards apply (the below list is not exhaustive neither limitative):

   i. ISO/IEC 11801 – Information technology - Generic cabling for customer premises

   ii. ISO/IEC TR 14763-2-1:2011 Information technology - Implementation and operation of customer premises cabling - Part 2-1: Planning and installation - Identifiers within administration systems

   iii. EN 50174-1:2018+A1:2020 Information technology. Cabling installation. Installation specification and quality assurance or THN equivalent.

   iv. EN 50174-2:2018 - Information technology. Cabling installation. Installation planning and practices inside buildings or THN equivalent.

   v. EN 50174-3:2013+A1:2017 Information technology. Cabling installation. Installation planning and practices outside buildings or THN equivalent.

   vi. EN 50346:2002+A2:2009 Information technology. Cabling installation. Testing of installed cabling or THN equivalent.

   vii. EN 50173 series - Information technology. Generic cabling systems

viii. EN 50310:2016+A1:2020 Telecommunications bonding networks for buildings and other structures or THN equivalent.

ix. IEC 61754 series - Fibre optic interconnecting devices and passive components - Fibre optic connector interfaces or THN equivalent.

x. IEC 61935-1:2019 Specification for the testing of balanced and coaxial information technology cabling - Part 1: Installed balanced cabling as specified in ISO/IEC 11801-1 and related standards or THN equivalent.

xi. ISO/IEC 14763-3:2014+AMD1:2018 CSV - Information technology - Implementation and operation of customer premises cabling - Part 3: Testing of optical fibre cabling or THN equivalent.

xii. GRC MINISTERIAL DECISION 72146/2316/30.12.2018 (Government Gazette 21/B´/7.01.2009) - Determination of the technical specifications of the works regarding the telecommunication networks outside buildings.

b. Additionally the construction of the F/O network shall comply with ITU's International Standards and Recommendations.
All conductors not in used in a cable shall be grounded at both ends.

26.13.12. **List of cables**

a. The list of cables shall include:

i. Cable number

ii. Cable standardised cross-section

iii. Cable diameter

iv. Operating voltage

v. Insulating voltage of the cable guaranteed by the manufacturer

vi. Length laid in meters

vii. Type of cable (according to Standards)

viii. Colour of external covering

ix. Wiring diagram

x. Cable course from the beginning to the end of the cable

26.13.13. **Cable supports**

a. Cable support management shall be compliant to EN 61537:2007 Cable management. Cable tray systems and cable ladder systems or THN equivalent.

b. The type and sizes of cable support systems shall be selected by the Contractor to suit the circumstances of the installation, unless otherwise indicated. Following preferences shall be taken into account:

i. For horizontal runs - cable tray or cable rack

ii. For vertical runs - cable cleats or cable tray or cable rack

iii. Where marshalling of cables occurs (eg. at switchboards) - cable racks.

26.13.14. **Protective finishes for ferrous materials**

a. All ferrous metal for cable tray, cable racks, cable ladder, cable hangers and their fixings and suspensions shall have a galvanised finish.

b. Galvanised finishes shall be hot dipped to EN ISO 1461 or THN equivalent, except that support steelwork in dry indoor unpolluted areas shall be galvanised to EN 10346 or THN equivalent.

c. In coastal and polluted areas where ferrous materials are used, consideration shall be given to the use of stainless steel or silicon steel with l2OO g/m2 coating ISO 1461.

26.13.15. **Cable trays**

a. Cable of different categories (HV cable, LV cables, Signalling cable etc.) shall be laid in different cable trays.

b. The cable trays shall be made of hot-galvanised (450 gr/m²) mild steel with minimum zinc thickness of 30 µ. The cable trays may take various forms as follows:

i. Type A: A unit consisting of angle-iron uprights and bars in bent sheet metal forming a closed U. This type shall mainly be reserved for cables with a large cross-section.

ii. Type B: In perforated sheet metal. This type shall mainly be used for cables with small cross section such as remote signaling, remote control and telephone cables, etc.

iii. Type C: In wide-gauge metal mesh (± 5 x 5 cm). This type is suitable for all kinds of cable.

c. When made from metal plate they shall comply with EN 10130:2006, EN 10131:2006 or EN 10149-3:2013 as appropriate or THN equivalent.

d. The cable tray units shall be self-supporting, their strength and the spacing of the bearing elements shall be such that the maximum sag in the horizontal run shall be 1/220 of the span.

e. Bends, tees, risers, reducers and four-way crosspieces shall be factory made wherever possible, and shall be of the same construction, material, thickness and finish as the cable tray. All tees and crosspieces shall have a 45°gusset on each side from the point of intersection.

f. Cable trays shall be cut along a line of unperforated material. Holes cut in cable trays for the passage of cables shall be fitted with grommets, bushes or other lining. Cutting of cable trays shall be kept to a minimum.

g. Each length of a cable tray shall be securely bolted to an adjacent length with factory made couplings of adequate dimensions to prevent sagging or twisting in accordance with the Manufacturer's recommendations. Where required, bolts and nuts shall be appropriately dimensioned mushroom-head steel roofing type. Ends of coupling bolts shall not come into contact with the cables. No welding shall be used in the joining of cable trays.

h. Where cables are laid on the cable tray they shall be secured by ties, each tie securing the cables of only one circuit. The ties shall be of a proprietary type low in halogen, self-extinguishing and ultra-violet resistant. The use of wire or similar material is not permitted. Ties shall be used at less than 600mm intervals along each cable, and within 100mm of each bend or set.

i. Cables shall be supported by cable cleats where cable trays are vertical.

j. Cable trays shall be fixed at regular intervals in accordance with Manufacturer's recommendations but not exceeding 1200mm and at 225mm from bends and intersections. A minimum clear space of 25mm shall be left behind all cable trays.

k. Cable trays shall be installed with a 20mm gap at building or structural expansion joints.

l. Cable tray supports shall be installed within 150mm on either side of the joint.

26.13.16. **Cable cleats**

a. Cable cleats shall be made from materials that are resistant to corrosion without the need for treatment or special finish. Plastic materials shall be non-brittle down to minimum - 20°C. Non-metallic cleats used for low smoke fume (LSF) cables shall be of LSF material.

b. Cable cleats shall be of a size such that they can be tightened down to grip the cables without exerting undue pressure or strain on them. For vertical cables two-bolt cable cleats shall be used which shall grip the cables firmly enough to prevent them slipping.

c. The cable cleats shall comply with IEC 61914:2015 Cable cleats for electrical installations or THN equivalent.

d. The spacing of cable cleats shall:

   i. Assure the ability of the cleat to withstand axial slippage forces

   ii. Assure resistance to electro-mechanical forces – i.e. the ability of the cleat to withstand the forces between the cables in the event of a short-circuit

   iii. Assure the cleats shall be located immediately on each side of bends in the cable.

e. Single core cables shall be cleated with trefoil cleats where appropriate.

26.13.17. **Cable racks and cable ladders**

a. Cable racks shall comply with relevant standards referenced herein in this Annex and shall be constructed from proprietary systems using channel sections with return lips and compatible fixing accessories.

b. Ladder rack shall be factory made from steel complying with relevant standards referenced herein in this Annex.

c. Racks and supports shall be selected to provide adequate support without racks sagging more than 1/360 of the support span.

d. Cable racks and ladders shall be installed with a 20mm gap at building or structural expansion joints. Supports shall be installed within 150mm on either side of the joint.

e. Cables shall be fixed to racks and ladders by cable cleats.

26.13.18. **Suspension and fixing**

a. Proprietary suspension systems comprising channel sections with return lips and compatible fixing accessories or slotted angles complying with BS 6946 shall be used. Fixings may be fabricated from mild steel flat bar where necessary. Metal arc welding shall comply with EN 1011 or THN equivalent.

b. Suspensions and fixings shall comply with respective paragraphs stipulated herein in this Annex.

c. Bolts, nuts, washers and screws shall be non-corrosive and compatible with the environment in which they are installed.

26.13.19. **Bonding**

a. Metallic cable trays, racks and ladders shall be electrically and mechanically continuous throughout and bonded to the earth system.

b. Supplementary bonding shall be installed wherever necessary, between component parts of cable trays, racks or ladders where the method of mechanical connection does not provide permanent and reliable metal-to-metal joints of negligible impedance.

c. After the cables are laid all the openings pierced through obstacles/walls shall be properly sealed, so that they remain watertight and dust proof and have the same fire resistance as the walls. After assembly, damage to galvanisation shall be made good by the application of a zinc-rich paint or by a cold galvanisation substance.

d. The bearing elements shall be made of galvanised steel (450 gr/m^2) at least 30 μ thick. All precautions shall be taken to obviate corrosion resulting from the Fe-Zn galvanic couple.

e. One the side of the cable tray shall be left with free access along its entire length so that operations (laying or removing of cables) are not hampered by the bearing elements.

f. Bearing elements shall be fixed to partitions, walls, ceiling or the framework of the building. In no circumstances bearing elements may be fixed to parts liable to be subsequently removed.

g. For the purpose of assembling the units and making cross-points, accessories produced by the manufacturer shall be used as far as possible.

26.14 Electrical equipment

26.14.1. Standard power sockets

a. Standard power sockets shall conform to Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety or THN equivalent.

b. There is no harmonised household plug system throughout Europe. Therefore, the standard power sockets shall fall under national legislation.

c. They shall be designed for a rated current of 16A.

d. At the level of lighting switch in all rooms and in corridors, one power sockets 230 V/16 A shall be provided in the wall for utility (for instance connection of a vacuum cleaner) use, conveniently placed at 30 cm above floor level. In large rooms, additional sockets shall be provided around the room at a location easily accessible (hence not behind a cupboard or behind a door). The number of additional sockets shall be determined according to the function of the room.

e. In offices, in addition to the utility socket, three sockets per desk position shall be provided for connection of computers and peripherals. RJ45 connectors shall also be provided for data and telephony connections.

f. Where fixed appliance is foreseen, one socket per appliance shall be provided. These sockets are in addition to the sockets mentioned above.

g. Whenever required for instance for appliances, heating system etc., 3-phase sockets shall also be provided.

h. The sockets shall be compliant with:

i. IEC 60884-1:2002+AMD1:2006+AMD2:2013 CSV Plugs and socket-outlets for household and similar purposes - Part1: General requirements or THN equivalent.

ii. IEC 60906-1:2009 IEC system of plugs and socket-outlets for household and similar purposes - Part 1: Plugs and socket-outlets 16 A 250 V ac. or THN equivalent.

26.14.2. Industrial type sockets

a. These sockets shall conform to:

i. IEC 60309-1:1999+AMD1:2005+AMD2:2012 CSV Plugs, socket-outlets and couplers for industrial purposes - Part 1: General requirements or THN equivalent.

ii. IEC 60309-4:2006+AMD1:2012 CSV Plugs, socket-outlets and couplers for industrial purposes - Part 4: Switched socket-outlets and connectors with or without interlock or THN equivalent.

b. They shall be used amongst other for outdoor sockets.

c. These sockets shall be provided with protective caps when not in used. The caps shall be solidly fixed to the sockets. Their degree of protection shall be IP 65.

26.14.3. **Lighting fixtures**

a. Lighting throughout and outside the building as well as emergency lights shall be provided for the new SSSB building and other premises as stipulated in site specific Appendixes.

b. The lighting fixtures shall conform to:

i. IEC 60598-1:2020 Luminaires - Part 1: General requirements and tests or THN equivalent.

ii. IEC 60598-2-1:2020 Luminaires - Part 2-1: Particular requirements - Fixed general purpose luminaires or THN equivalent.

iii. For the outdoor luminaires: IEC 60598-2-3:2002+AMD1:2011 CSV Luminaires - Part 2-3: Particular requirements - Luminaires for road and street lighting or THN equivalent.

iv. When ground recessed luminaries are used they shall conform to IEC 60598-2-13:2006+AMD1:2011+AMD2:2016 CSV or THN equivalent.

v. In alignment with the design of the fire protection system, when luminaire with limited surface temperatures are required, for use in operating areas with fire hazard, they shall conform to IEC 60598-2-24:2013 Luminaires - Part 2-24: Particular requirements - Luminaires with limited surface temperatures or THN equivalent.

c. The light intensity level at 0.85 m above ground level shall be:

i. Supply, Storage Room/ Workshop and Test facilities for electronic equipment – 500 Lux

ii. SSSB Equipment room – 500 Lux

iii. Corridor and vestibule – 200 Lux

iv. Power Generator room – 200 Lux

v. Main Power switchgear room – 200 Lux

vi. UPS/Battery room – 200 Lux

vii. Environment Control room (HVAC) – 200 Lux

d. All the lighting shall be LED where each LED shall have a life expectancy of a minimum 50,000 hrs in compliance with IEC 62722-2-1:2014.

e. The colour temperature for the LED lights installed indoor shall be 5000 K or above.

f. The LED lighting, both indoor and outdoor, shall conform to:

i. IEC 62717:2014+AMD1:2015+AMD2:2019 CSV LED modules for general lighting - Performance requirements or THN equivalent.

ii. IEC 62612:2013+AMD1:2015+AMD2:2018 CSV Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements or THN equivalent.

iii. IEC 62722-2-1:2014 Luminaire performance - Part 2-1: Particular requirements for LED luminaires or THN equivalent.

iv. IEC 62031:2018 LED modules for general lighting - Safety specifications or THN equivalent

v. IEC 62384:2020 DC or AC supplied electronic control gear for LED modules - Performance requirements or THN equivalent.

g. The lights shall meet Electromagnetic (EM) immunity requirements as specified in IEC 61547:2020 Equipment for general lighting purposes - EMC immunity requirements or THN equivalent.

h. In order to correctly identify EM environment, measurement and testing, as well as installation and mitigation techniques, the Contractor shall comply with IEC 61000 series – Electromagnetic compatibility (EMC).

i. The level of protection against dust and water shall be as per IEC 60529 or THN equivalent:

i. For indoor luminaires: minimum IP 21

ii. For outdoor luminaries: minimum IP 66

j. The resistance of outdoor luminaires to mechanical impacts shall be minimum IK08 in compliance with IEC 62262:2002 Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code) or THN equivalent.

k. The lighting fixtures shall be connected to the mains and standby power supply (short-break). However, in the SSSB equipment area, a number of lighting fixtures, conveniently located, shall be connected to the no-break power supply through the EPDB.

26.14.4. **Emergency lights**

a. The Contractor shall provide emergency lighting complaint with:

i. IEC 60598-2-22:2014+AMD1:2017 CSV Luminaires - Part 2-22: Particular requirements - Luminaires for emergency lighting or THN equivalent.

ii. IEC 61347-2-7:2011+AMD1:2017 CSV Lamp control gear - Part 2-7: Particular requirements for battery supplied electronic control gear for emergency lighting (self-contained) or THN equivalent.

iii. IEC 62034:2012 Automatic test systems for battery powered emergency escape lighting or THN equivalent.

iv. IEC 60529 - the level of protection against dust and water shall be minimum IP 65 or THN equivalent.

b. In its design of the new SSSB building, the Contractor shall analyse which of the below listed emergency lights are required and provide them respectively in order to meet requirements stipulated in legislations and standards in force and applicable in respective Territorial Host Nations:

i. Emergency lighting - to ensure the safety lighting is provided promptly, automatically and for a suitable time, in a specified area when the normal mains power supply to the usual lighting installation fails

ii. Emergency escape lighting - to enable safe exit from a location and/or building in the event of failure of the mains' normal supply

iii. Emergency escape route lighting - to enable the safe exit from a location or building for occupants by providing appropriate visual conditions and direction finding on escape routes, and in special locations, and to ensure that firefighting and safety equipment can be readily located and used

iv. Open area lighting - to reduce the likelihood of panic and to enable safe movement of occupants towards escape routes by providing appropriate visual conditions and direction finding

v. High risk task area lighting - to contribute to the safety of people involved in a potentially dangerous process or situation and to enable proper shut down procedures to be carried out for the safety of other occupants of the location or the building

26.14.5. **Emergency lights locations**

a. The Contractor shall assure that the emergency luminaires are located to give appropriate illuminance, in the event of a failure of the normal lighting in the following locations (not exhaustive list):

i. Open areas (are often called anti-panic lighting) – these are areas larger than 60m² floor area or may be areas identified by the fire risk assessment as requiring safety illumination.

ii. Emergency exit and escape routes – these shall be provided with signs. The signs shall be illuminated to indicate unambiguously the route of escape to a point of safety. Where direct sight of an emergency exit is not possible an illuminated directional sign (or series of signs) shall be provided to assist progression towards the emergency exit.

iii. Every change of direction leading to an escape door shall be illuminated. An escape lighting luminaire (complying with IEC 60598-2-22 or THN equivalent.) shall be sited near each exit door and at positions where it is necessary to emphasize potential danger or safety equipment.

iv. Emergency luminaires shall be mounted near the following positions and fire safety equipment:

Each exit door intended to be used in an emergency

Stairs so that each flight of stairs receives direct light

Change in level

Mandatory emergency exits and safety signs

Change of direction

Intersection of corridors

Outside and near to each final exit

First aid post – shall be illuminated to 15 Lux minimum at the reference plane

Firefighting equipment – shall be illuminated to 15 Lux minimum at the reference plane

Fire alarm call points – shall be illuminated to 15 Lux minimum at the reference plane

26.14.6. **Technical premises**

a. Emergency lighting shall be provided in all power generator rooms, control rooms, plant rooms, switch rooms and adjacent to main switchgear or control equipment associated with the provision of normal and emergency lighting to the premises.

b. External areas in the immediate vicinity of exits:

i. In order to assist dispersal to a place of safety, the external areas in the immediate vicinity of final exits shall be illuminated. This shall be in accordance with the illumination level for escape routes of not less than 1 Lux at the reference plane.

ii. If the area outside the building has hazards in darkness, such as a riverbank or steep stairs, the fire risk assessment shall determine if further emergency luminaires are needed until a place of safety can be reached. This might involve the placement of emergency lighting on the outside of a building adjacent to the final exit door.

c. The number of emergency luminaires shall be determined by the Contractor such that the level of light intensity is:

   i. For escape routes the horizontal illuminance on the floor along the centreline of an escape route shall be not less than 1 Lux.

   ii. In areas of high risk minimum 15 Lux at the reference plane and the uniformity of the high-risk task area lighting illuminance shall be maintained across the area.

   iii. In open area (anti-panic) lighting, the horizontal illuminance shall be not less than 1 Lux at the floor level of the empty core area which excludes a border of 0.5m of the perimeter of the area.

   iv. In technical premises (power generator rooms, control rooms, plant rooms, switch rooms etc.) the illuminance shall be not less than 15 Lux in plane of visual task.

   v. For panic bars & pads and security devices the horizontal illuminance shall be not less than 5 Lux on plane of panic bar/pad and vertical at vertically mounted/wall mounted security devices.

d. The emergency lights powered by batteries shall meet the following requirements:

   i. Autonomy shall be of a minimum 1 hour

   ii. The operational status of the emergency lighting fixture shall be indicated by green (operational) and red (action required) led

   iii. The emergency lighting fixtures shall be testable by means of built in test push button

e. All emergency luminaires shall be free of harmful stroboscopic effects.

f. Some high output emergency luminaires can produce a glare effect which can interfere with the observation of safety signs and obstructions on the escape route. This is known as disability glare. The most common fittings to cause disability glare are the ‘frog eye’ type. Therefore, the Contractor should avoid this particular type of emergency lights. However, it they are to be provided, the Contractor shall take particular care when placing these types of fittings so to avoid disability glare. This can be achieved by making sure they are at least 30° out of direct line of sight from the escape route.

g. The emergency lighting system shall have a suitable means for simulating failure of the normal supply for testing and maintenance purposes. These shall be able to be operated by the user/owner of the system so that they can carry out regular tests of the system.

26.14.7. **Emergency stop push-button**

a. The Emergency stop push-buttons shall be provide on each equipment and machinery provided under this contract unless:

i. The emergency stop device would not lessen the risk, either because it would not reduce the stopping time or because it would not enable the special measures required to deal with the risk to be taken

ii. The equipment/ machinery is portable hand-held and/or hand-guided

b. The Emergency stop push-button shall meet the following requirements:

i. Tamper Resistant - an emergency stop actuator shall be constructed so that it can only be removed from the inside of a panel. Removal from the outside of the panel is acceptable if it requires a tool.

ii. Shall not be a replacement for proper safeguarding or automatic safety devices.

iii. The activation of the emergency stop shall not impair the effectiveness of other safety devices.

iv. A mushroom type push button, red colour.

v. It shall be protected to prevent inadvertent operation.

vi. Its activation shall be possible without opening any panels, flaps, doors or any other type of covers with easy access and no obstructions.

c. It shall be in conformity with the requirements of the following directives and standards. The below list is neither exhaustive nor limitative:

i. Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery or THN equivalent.

ii. ISO 13850:2015 Safety of machinery. Emergency stop function — Principles for design or THN equivalent.

iii. IEC 60204-1:2016 Safety of machinery – Electrical equipment of machines or THN equivalent.

iv. IEC 60947-5-5:1997+AMD1:2005+AMD2:2016 CSV - Low-voltage switchgear and control gear - Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function or THN equivalent.

v. IEC 60947-5-1:2016 Low-voltage switchgear and control gear - Control circuit devices and switching elements - Electromechanical control circuit devices or THN equivalent.

vi. Local codes and installation requirements

26.14.8. **Legal inspections for electrical works**

a. The Contractor shall request an independent company duly accredited in the Territorial Host Nation to execute all inspections legally required in this Territorial Host Nation.

b. Those inspections shall be identified in the schedule of supply and services.

c. No electrical work shall be accepted as long as the Purchaser is not in possession of the inspection report stating the compliance of the installation.

26.15 Electrical Power Back Up

26.15.1. General

a. The Contractor shall provide two fully redundant and identical diesel fuel power generators for the new SSSB building and at other sites as stipulated in site specific Annexes.

b. The capacity of each power generator shall be sufficient to assure full operational capability of entire SSSB site with only one generator while the other is maintained/ repaired or remains in stand-by mode.

c. The two power generators shall form the Power Generating Set (PGS). The PGS shall be designed and manufactured to comply with applicable European Union (EU) safety regulations, standards and requirements.

d. The PGS shall meet the safety requirements as specified in ISO 8528-13:2016 Reciprocating internal combustion engine driven alternating current generating sets — Part 13: Safety or THN equivalent.

e. The capacity of the PGS (with only one power generator working at a time) shall be determined by the Contractor and shall assure full operational capability of:

   i. SSSB System

   ii. Any other IT systems provided as PFE

   iii. HVAC

   iv. Lights (indoor and outdoor)

   v. Fire protection and fighting

   vi. All other needed domestic loads

   vii. The total load imposed by the above listed components shall be increased by 20% for further expansion

f. The PGS shall be the back-up (emergency) source of electrical power and shall be capable of providing power for the entire SSSB site in case of main power failure. Hence, the Contractor shall design the system and provide equipment to meet requirements for power generators rated as Emergency Standby Power (ESP) according to ISO 8528-1:2018.

g. However, as stipulated in Appendix 6 (Limnonari site), the Contractor shall provide power generators rated as Prime Rated Power (PRP) according to ISO 8528-1:2018 (further requirements are stipulated herein in this Annex and in site specific Appendix) for that specific site.

h. The PGS rating shall be established for Voltage, Phase, Frequency and Speed at 400 V, 50 Hz and 1500 rpm.

i. Each of the power generators shall be able to provide emergency power on variable loads for guaranteed minimum lifetime of 10,000 running hours.

j. If the COMMS site is located in an area where historical utility data indicates a large number of average yearly outages and/or substantially long outages, then the Prime Rated Power (PRP) generators shall be considered.

k. The PGS system shall allow for both manual and automatic switchover between the two power generators. It shall be possible for the user to program the automatic switchover for a specific date and hour at intervals from 0 (zero) hrs. to 24 hrs.

l. When the local power grid is available, the PGS shall be capable and equipped with necessary accessories to operate in standby mode, ready to automatically activate when necessary.

m. The PGS shall withstand and operate in the environmental conditions of the COMMS site geographical location, without showing any evidence of damages, permanent deformations or reduction of performances, when assuring full operational capability of entire SSSB sites.

n. The PGS shall be installed in a sound attenuated, weatherproof, rust resistant hard-wall enclosure.

o. The sound insulation shall be non-hydroscopic.

p. The enclosure shall be equipped with rodent barriers on inlets and outlets.

q. The sound attenuated enclosure shall be removable to allow lifting of the generator set for repair. It shall be made of steel or aluminium sheets.

r. The PGS shall be installed on a steel rust resistant chassis with chassis drain plugs.

s. The chassis shall be equipped with anti-rollover forklift tunnels to ensure safe lifting and handling.

t. The chassis and brackets shall be reinforced to guarantee robustness during handling and transport.

u. The enclosure and chassis shall be fully washable both externally and internally with a nozzle.

v. The enclosure shall be provided with internal LED lighting with micro-switches.

w. The enclosure shall be provided with battery compartment externally accessible for easy maintenance.

x. The enclosure shall be provided with inspection doors with double frame and airtight gasket.

y. The inspection doors shall be equipped with snap handles and key locks.

z. At least one of the inspection doors shall be provided with a document holder installed on the inside of the doors.

aa. The PGS shall be mounted on oil resistant vibration insulation elements, and include adequate lifting points for movement of the PGS with a crane.

bb. The PGSs shall include all the necessary earthing and safety equipment (cables, connectors, fire extinguishers, fire fuel shut-off valves, instructions, etc.) to protect the equipment and the personnel.

cc. Each socket shall be equipped with a circuit breaker. The circuit breakers shall be complaint with IEC 60947:2021 series and with IEC 60898.

dd. All connectors shall be IEC 60309 industrial type, with a minimum IP54 waterproof rating as per IEC 60529:1989/AMD2:2013/COR1:2019 and equipped with caps for weather protection when not in use.

ee. All components of the PGS electrical system shall comply with the EMC requirements as stipulated in:

   i. The Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility or THN equivalent

   ii. MIL-STD 461G – Requirements for the control of electromagnetic interference characteristics of subsystems and equipment, December 2015 or THN equivalent

ff. The engine/generator assembly shall be a standard product of a current manufacturer and a company regularly engaged in production of such equipment.

gg. The Contractor shall provide the engine manufacturer’s recommended lubricants/coolants and data concerning their equivalents, including the manufacturer and supplier details.

hh. All of the PGS enclosure external surfaces, chassis, fuel tank, connector caps and covers shall be painted with protective paint.

ii. The paint finish shall be guaranteed against any visible deterioration for a minimum of ten (10) years.

26.15.2. **Certificates**

a. An authorised technical surveillance authority, recognized in the THN, shall approve the mechanical and electrical safety of the PGS.

b. The PGS shall be supplied with CE mark and EC Declaration of Conformity in compliance with the Directive 2006/42/EC of the European

Parliament and of the Council of 17 May 2006 on machinery and amending Directive 95/16/EC or THN equivalent.

26.15.3. **Engine**

a. The diesel engine shall be of a quick start, water-cooled industrial type. It shall be designed for standby power rating (note the exception for Limnonari site where the power generators shall be rated as Prime Rated Power (PRP))

b. The engine shall be directly coupled to the synchronous electrical alternator.

c. The engine power shall be such to drive the alternator at full load with power factor 0.8 lagging under all environmental conditions of the COMMS site geographical location.

d. The engine shall be capable of operating at light loads for extended periods of time and shall provide means to reduce carbonisation (periodic cleaning of exhaust parts should not be required).

e. The engine shall meet requirements for performance class G2 or better according to ISO 8528-2:2018 Reciprocating internal combustion engine driven alternating current generating sets — Part 2: Engines.

f. The declaration of power, fuel and lubricating oil consumption shall be determined in accordance with ISO 3046-1:2002 Reciprocating internal combustion engines — Performance — Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods — Additional requirements for engines for general use.

g. The Specific fuel consumption and power output shall be quoted at standard (ISO) ambient conditions. The Contractor shall provide in technical documentation the de-rating curves or correction curves or formulae or calculations applicable to the generator for the power deration and fuel consumption for the environmental conditions as stipulated the COMMS site geographical location.

h. The engine shall be started electrically using batteries. Preheating system to keep the engine ready to start and take the full load, from 0 to 100%, within 15 seconds from standstill, shall be provided.

i. The cyclic irregularity influenced by the dynamic characteristics of the mechanical system, including engine, flywheel, alternator rotor, shaft and coupling shall be such that the flicker of lights shall be avoided.

j. The engine start system shall allow to be operated locally and remotely.

k. During each initial start of the engine, a system shall be provided to pre-lube at low idle speed. When the internal oil pressure reaches a predetermined safe value, the engine speed shall then increase to alternator set operating speed.

l. Convenient access for maintenance shall be assured. For example there shall be no need to remove the sound attenuated enclosure to access coolant refill gauge, change oil and filters etc.

m. Injection pumps and injection valves shall be of a type not requiring adjustment in service and shall be of a design allowing quick replacement by technicians without special diesel engine experience.

n. The engines shall have an individual electronically controlled injection pump and injection valve for each cylinder, any one of which shall be removable and replaceable from stock parts.

o. Fuel lines between injection pumps and valves shall be of heavy seamless tubing.

p. Where applicable, air filters including pre-filters and dust traps shall be mounted behind the engine, over the alternator as not to restrict the access to rocker covers and fuel injection pump.

q. The oil sump shall be equipped with a screw-in type stop that is easily accessible. An alternate solution shall include a cock with a pipe stopped by a mounted screw-on type stop. The length of the pipe shall be long enough that drained oil can be caught in a vessel beside the unit. If the oil cannot be drained by gravity flow, the engine sump shall be equipped with a hand pump.

r. The following standard equipment shall be provided as the minimum:

   i. Electrical starter

   ii. Safety shutdown system for low oil pressure, high temperature, over-speed and low fuel level with LED, re-settable indicators of the manual reset type

   iii. Dual fuel (fuel and fuel/ water), oil and air filters in accordance with the manufacturer's specifications

   iv. Fuel meters to measure the net consumption of fuel by the engine in grams and litres. The meters shall have temperature correcting capability

   v. Heavy-duty tube oil cooler with the temperature controlled by a thermostat valve

   vi. Lubricating oil pump

   vii. Fuel transfer pump

   viii. Radiator and belt-driven fan with mechanical protection, capable of cooling the engine on full load at environmental conditions specified for the COMMS site geographical location

   ix. Exhaust silencer

   x. Oil pressure and temperature meters

xi. Coolant temperature meter

xii. Low oil pressure alarm

xiii. Over speed alarm

xiv. Low coolant level alarm

xv. High coolant temperature alarm

xvi. Hot and moving parts protection

xvii. Anti-vibration, oil resistant shock absorbers

xviii. Reinforced lifting hooks for crane hoisting

xix. Ground connection of electrical installation

xx. Digital diagnostic control panel

xxi. Supply and spill fuel-lines with fittings and fitted to the day-tank

xxii. Exterior (piped to the edge of the enclosure) flexible oil and coolant drain lines with interior valves for ease of service

xxiii. Fill of suitable lubricating oil, and anti-freeze for cooling system to assure performance at environmental conditions specified for the COMMS site geographical location

xxiv. Aluminium ladder or platform, to ease check and service of the PGS, compliant with ISO 14122 series

s. Characteristics:

i. Engine Type: 4-stroke

ii. Engine speed: 1500 rpm

iii. Insulation: H class or better

iv. Protection: IP 23 or better according to IEC 60529: 1989/ AMD2: 2013/ COR1:2019

26.15.4. **Lubrication System**

a. The lubrication system shall comprise an engine driven pump to circulate lubricating oil under pressure.

b. Full flow filters shall be provided together with replaceable elements.

c. Lube oil make-up shall be automatically monitored and alarmed by the control system.

d. The lubrication system shall be provided with alarms and trip sensors for high/low oil levels and temperatures and fitted with a crankcase heater if required.

26.15.5. **Engine Cooling**

a. The engine cooling system shall be capable of adequately cooling the diesel generator engine when the diesel generator is supporting full load at the specified maximum outdoor ambient air temperature characteristic for the COMMS site geographical location.

b. The on-skid radiator cooling system shall be provided with the following:

i. Water pumps for jacket water and turbocharger intercooler cooling complete with thermostatic bypasses

ii. Water-air heat exchanger(s) for jacket water and turbocharger intercooler cooling complete with all necessary interconnection(s) to the on-board radiator

iii. Automatic control of radiator fans, including automatic cycling for even running hours

iv. Alarms and trip sensors for high/low coolant levels and temperatures

c. All cooling system components shall be monitored and alarmed by the control system.

d. The engine shall be provided with a thermostatic valve placed in the jacket water outlet between the engine and the cooling source.

e. This valve shall maintain the proper jacket water temperature under all load conditions.

f. A flexible connecting section shall be provided between the radiator and discharge louver frame.

g. The radiator shall be mounted in front of the engine, onto the skid base with oil resistant anti vibration mountings.

26.15.6. **Engine Heaters**

a. The engine shall be equipped with a thermostat controlled coolant immersion heater, (powered from the auxiliary power distribution) to aid engine starting, in cold weather specified for the COMMS site geographical location.

b. The heater shall be automatically switched off, when the engine is running.

26.15.7. **Exhaust System**

a. The diesel engine exhaust system shall be composed of:

i. The exhaust silencer of a non-spark type/ equipped with spark arrestor capable of the following:

Low-pressure drop

Damping engine pulsations, backfiring and preventing any engine resonance

Sound attenuation as required to meet the noise level specified

ii. The discharge pipe work

iii. Flanged flexible stainless steel thermal expansion bellows at the diesel engine exhaust outlet

iv. Support structures and fixings

b. The exhaust shall be stainless steel, insulated as required.

c. The exhaust outlet shall be stainless steel provided with a mechanical closing valve.

d. The discharge stack, and exhaust systems shall be supplied complete with roof, wall and ground mounts as required and complete with anti-vibration supports as required.

e. The exhaust shall discharge from the outside of the diesel generator room.

f. Other noise control measures including splitter attenuators and acoustic linings shall be considered with regard to reducing the noise levels

g. The complete exhaust system shall be designed such as not to exceed the noise limit of 70 dBA at a distance of about 7 meters from the output of the exhaust (in accordance with ISO 1996-1:2016) at full rated load.

h. The silencer shall be located outside of the power generator room and connected to the set through an INOX (stainless steel) compensator.

i. Fixation of exhaust pipes and silencer shall take into account thermal expansion and vibration.

j. Purge valves shall be foreseen at the low points to evacuate any condensation.

k. Exhaust emission shall meet requirements as specified in Regulation (Eu) 2016/1628 of the European Parliament and of the Council of 14 September 2016 or THN equivalent.

l. The fuel (diesel) level emission shall be measured according to ISO 8178-4:2020 Reciprocating internal combustion engines — Exhaust emission measurement — Part 4: Steady-state and transient test cycles for different engine applications

26.15.8. **Insulation**

a. The Contractor shall provide and install thermal insulation on the diesel generator and supplied auxiliaries where required for the efficiency of the works, to meet regulatory requirements and safety of personnel.

b. All insulation materials shall not contain any asbestos or asbestos based products.

c. No part of the works that can be touched during normal operation shall have a surface temperature in excess of 50°C.

d. All insulation applied to pipe work, machinery, and ducting shall be clad with aluminum or stainless steel cladding of appropriate thickness not less than that conforming with BS 5970:2012 (or THN equivalent standard) Thermal insulation of pipework, ductwork, associated equipment and other industrial installations in the temperature range of -100°C to +870°C. Code of practice.

e. All insulation exposed to the weather shall be sufficiently clad to be completely weatherproof.

f. Insulation and cladding shall be designed and applied with proper allowance for expansion and contraction.

26.15.9. **Fuel Supply**

a. Two fuel day-tanks (fitted with locking mechanism) each having a capacity for at least 24 hours of continuous operation under rated power shall be provided in the generator room.

b. They shall be compliant with the latest EU Safety Regulations or THN equivalent.

c. Automatic and manual re-fill of the day-thank from storage tanks located outside the building shall be provided.

d. Fuel level indication as well as low fuel level alarm in the daily thank shall also be provided.

e. All associated piping, pumps, valves stopcocks etc. shall also be provided.

f. The fuel supply system shall be equipped with an automatic stop system due to lack of fuel.

g. The tank shall be provided with the necessary equipment to supply the generator with fuel and as a minimum shall include the following:

i. A fuel level indicator

ii. A pump with in and out pressure gauges and automatic and manual ON/OFF operation

iii. Low and high level alarms (sound alarms shall be capable of being disabled for tactical reasons)

iv. An auxiliary hand pump and associated manual valves

v. A fuel strainer on supply pump inlet with water separator

vi. A vent cap

vii. A drain valve with locking handle

viii. Engine return pipes

ix. A fuel leak detector

x. A fuel consumption meter

h. For detailed characteristics of the fuel tanks see also other relevant paragraphs herein in this Annex and in site specific Appendixes.

26.15.10. **Alternator**

a. The alternator shall be a synchronous, regulated, drip proof industrial type.

b. It shall be self-excited of a rotating field brushless design.

c. Its hall be provided with sealed-for-life bearings.

d. The synchronous alternator shall be rated for a nominal output and overload capacity at the specified environmental and operating conditions for the COMMS site geographical location and shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 per cent above or below rated voltage.

e. The instantaneous voltage dip shall not exceed 20% of rated voltage when full load, at rated power factor, is suddenly applied.

f. Recovery of stable operation shall occur within 5 seconds. Steady state modulation shall not exceed +0.5%.

g. Alternator windings shall be braced for full line ground fault currents, with solidly grounded neutral system.

h. The alternator housing shall be weatherproof and rated to minimum IP23 IEC 60529:1989/AMD2:2013/COR1:2019.

i. The alternator output shall be wired to heavy-duty terminations, via an appropriately rated, moulded case circuit breaker, with overload and short circuit protection.

j. The insulation to windings shall have an oil, moisture, salt air, fungus proof finish and epoxy coated with surface which shall not retain dust or condensation.

k. It shall be possible to put the set in service after long periods in unheated storage without the necessity for drying up insulation.

l. The winding insulation shall be minimum Class H according to IEC 60085:2007 Electrical insulation - Thermal evaluation and designation.

m. The exciter shall be a fast response type, with a rotating 3-phase full-wave bridge.

n. The exciter shall have a low time constant and large capacity to minimize voltage transients under severe load changes.

o. The alternator shall be AVR (Automatic Voltage Regulator) controlled (digital type).

p. The regulator shall include 1-phase/3-phase voltage sensing, automatic short circuit protection and shall include automatic under frequency protection to allow the generator to operate at no load at less than synchronous speed for engine start-up and shutdown procedures.

q. The AVR shall be capable of maintaining voltage at ± 1.0% of any value within 10% of the nominal voltage throughout the full range of rated load and power factor conditions.

r. Droop, stability and voltage set point adjustments shall be done by operator interface.

s. The AVR shall be capable of preventing sustained over voltage during over speed conditions following the loss of load.

t. After a sudden load rejection at rated power factor, rated voltage shall be restored within 2 seconds.

u. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceed 110% of the rated current of the generator set on any phase for more than 60 seconds.

   i. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown).

v. Controls shall be provided to individually monitor all three phases of the output for short circuit conditions.

   i. The control/protection system shall monitor the current level and voltage.

   ii. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown).

w. Controls shall be provided to monitor the kW load on the generator set and initiate an alarm condition (overload) when total load on the generator set exceeds the generator set rating in excess of 5 seconds.

x. All software, programming leads and software dongles and the like shall be provided if a PC/ laptop programmable system is offered.

y. The excitation system shall include the following features and facilities as the minimum:

   i. Voltage setting control

   ii. Power factor control

   iii. Protection against AVR failures (e.g. over/under excitation combined with over/under voltage)

   iv. Supervised fault detection

v. An excitation system which shall withstand short circuits and synchronising of the machine up to 90˚ out of phase without failure of the components

vi. A brushless excitation system.

z. Alternator characteristics:

i. Nominal Voltage: 400 V, three phase

ii. Nominal frequency: 50 Hz

iii. Rated output: to be determined by the Contractor

iv. Power factor: 0.8 lagging

v. Efficiency: min 90% at power factor 0.8 lagging

vi. Phase unbalance: < 5%

vii. Load: Action shall be taken to keep voltage regulations within tolerances considering disturbances generated by harmonic distortion generated by the UPS

26.15.11. **Coupling**

a. The elastic coupling between the engine and the alternator shall be such as to prevent abnormal wear and overheating of the bearings due to slight misalignment within the specified tolerances.

b. Any part of the elastic coupling subject to wear shall be easily accessible for inspection and replacement.

c. The PGS shall be mounted on a rigid steel frame mounted on concrete base and isolated by means of resilient mounting.

d. The efficiency of the resilient mounting shall be over 85%.

26.15.12. **Starting System with Batteries**

a. Each engine shall be provided with an on-skid 24 V DC electric starting system.

b. The electric starting system, as the minimum shall be composed of:

i. The electric starting motors

ii. Low maintenance starting batteries

iii. Ventilated battery housing

iv. Vibration-free battery rack/tray

v. Interconnection cables

vi. 240 V AC battery chargers

c. The battery chargers shall be capable of re-charging the batteries to full potential within one hour after a cranking cycle and shall be adjustable to compensate for the battery self-discharge rate during standby periods.

d. The starting batteries shall be lead acid, maintenance free type, minimum 9 years expected life time.

e. The batteries and starters shall be capable of ten (10) starts per hour with minimum 5 consecutive start attempts.

f. All battery system components shall be monitored and alarmed by the control system

g. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.

h. The control system shall include time delay start (adjustable 0~300 seconds) and time delay stop (adjustable 0 ~ 600 seconds) functions.

i. The voltage drop at the battery terminals during the starting operation: this voltage drop shall be limited to such a value still ensuring correct operation of all alarm and control circuits.

j. Lockable battery isolator switch shall be provided for use during maintenance and storage.

26.15.13. **Digital Diagnostic Control Panel**

a. The Digital Diagnostic Control Panels, one for each power generator, shall be installed in the power generator room. They shall be mounted on resilient mountings and installed on a frame close to the alternators or installed on the floor near the generators.

b. The digital Diagnostic Control Panel shall be mounted behind door equipped with key lock and porthole/ visor.

c. The digital Diagnostic Control Panel shall be a sturdy, self-supporting, of suitably treated and painted steel sheet assuring minimum IP 23 protection according to IEC 60529: 1989/ AMD2: 2013/ COR1:2019

d. The digital Diagnostic Control Panel shall contain as the minimum:

i. The static battery charger

ii. The starting procedure

iii. The command equipment:

One 3 position switch: OFF-AUTO-MANUAL

Two push-buttons: START – STOP for use in manual position

One emergency stop push-button (see paragraph 28.49. Emergency stop push-button)

A push button to stop the audible alarm

An alarm reset push-button

An alarm lamp test button

iv. Communication ports:

Ethernet interface (RJ45)

1xRS232 / 2xRS485 interface with Modbus protocol support

USB 2.0/3.0 interface

Analog / GSM / ISDN / CDMA modem communication support

SMS messages

ECU Modbus interface

isolated secondary RS485

v. A Command & Control system able to show the following information as the minimum:

Generator load

Generator voltage

Generator current

DC battery voltage

DC battery current

Running time meter (engine hour counter)

Frequency

Oil pressure

Oil temperature

Coolant temperature

Engine speed (rpm)

Status indicator for the alarms

Audible alarm (10 dB over generator noise)

vi. The following displayed digital information and alarms shall be reported as the minimum:

Coolant high temperature

Oil high temperature

Low oil pressure

High oil pressure

Missed start

Battery charger failure

Over speed

Under speed

Over voltage

Under voltage

Low fuel level (below 25%)

AVR alarms

PG not answering – communication lost

vii. In case one of these alarms occurs, the following sequence shall be followed:

The corresponding alarm appears on the control panel and the audible alarm is activated

The audible alarm is stopped by means of the related push-button

After the audible alarm is stopped the visual alarm stays on

The visual alarm disappears after activation of the reset push-button

26.15.14. **Accessories and miscellaneous equipment**

a. Each power generator shall be provided, as the minimum with the following accessories and miscellaneous equipment:

i. At least one (1) dry powder fire extinguisher Class ABC and suitable for fires involving electronic equipment up to 1000 V, mounted in such a manner that it is easily accessible from the ground, properly sized according to the generator type and meeting requirements stipulated in following standards:

EN 3-7:2004+A1:2007 Portable fire extinguishers. Characteristics, performance requirements and test methods

EN 3-8:2006 Portable fire extinguishers. Additional requirements to EN 3-7 for the construction, resistance to pressure and mechanical tests for extinguishers with a maximum allowable pressure equal to or lower than 30 bar

EN 3-10:2009 Portable fire extinguishers. Provisions for evaluating the conformity of a portable fire extinguisher to EN 3-7

ii. One (1) maintenance tool kit

iii. Stowage box for maintenance tool kit designed to restrict the entry of water and the tools shall be secured in place

iv. Plate or plates (as required), located in a convenient position without creating confusion with each other, imprinted on photosensitive anodized aluminium, conforming to type H, MIL-DTL 15024G, with a matt black background with the following information printed:

Operating instructions, emergency procedures, precautionary instructions to avoid personnel injury or equipment damage, servicing instruction, electrical schematics, technical characteristics, nomenclature and serial number

Centre of gravity marking with matt black colour

26.16 UPS

26.16.1. The Contractor shall provide UPS system in order to protect sensitive units from having logical and physical damages in the case of the Prime Power failures. Additionally, the UPS shall have 30% of spare capacity.

26.16.2. The UPS system shall provide protection against data loss and system damage due to power failures, voltage dips, voltage spikes, under voltage, overvoltage, switching spikes, interference voltages, frequency changes and harmonic distortion.

26.16.3. Although a main central UPS unit is preferred, the Contractor may choose, when justified by best engineering practice and improving efficiency of the system, to also provide local UPS equipment where UPS power is required away from the Equipment room/ Control Console room.

26.16.4. The UPS system shall be compliant with:

a. IEC 62040-1:2017/COR1:2019 Corrigendum 1 - Uninterruptible power systems (UPS) - Part 1: Safety requirements or THN equivalent.

b. IEC 62040-2:2016 Uninterruptible power systems (UPS) - Part 2: Electromagnetic compatibility (EMC) requirements or THN equivalent.

c. IEC 62040-3:2011 Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements or THN equivalent.

d. IEC 62040-4:2013 Uninterruptible power systems (UPS) - Part 4: Environmental aspects - Requirements and reporting or THN equivalent.

26.16.5. The UPS system shall protect all SSSB equipment except for 5Kw HF Power amplifiers.

26.16.6. The UPS shall be on line, double conversion type.

26.16.7. Input Characteristics:

a. Voltage: 400 V 3-phases ± 10%

b. Frequency: 50 Hz ± 5%

c. Input power factor: > 0.9 lagging

d. THD: < 5% in accordance with IEC TS 61000-3-4 or THN equivalent.

e. Two inputs are required: one to supply the rectifier and one to supply the by-pass.

26.16.8. Output Characteristics:

a. Rated out power: to be determined by the Contractor

b. Power factor: from 0.8 to 1

c. Nominal voltage: 3-phases 400/230 V ± 1%

d. Nominal frequency: 50 Hz ± 0.5%

e. Voltage transients: ±3% for load change from 0 to 100% or from 100 to 0%

f. System efficiency: > 90% at full load

g. Operating time on batteries: minimum 30 minutes under maximum designed load (including 30% of spare capacity)

26.16.9. The UPS shall meet the following requirements:

a. Soft start

b. Zero transfer time

c. Surge suppressor

d. Static bypass for overload

e. Manual bypass for maintenance

f. Battery monitoring

g. Protection against deep discharge of batteries

h. Redundant backup management system with minimum N+2 modules

i. Hot-swappable modules, which means it shall be possible to replace /insert another module even when UPS is fully energized and working without interruption for the operation

j. The sound pressure level shall not exceed 65 dB(A) in accordance with ISO 3746:2010

k. Operating temperature/ Humidity: 0 to 40 (°C) / 0 - 95% (Non-Condensing)

l. Thermal protection

26.16.10. Batteries shall meet following requirements:

a. Replacement of the batteries shall be possible without powering down the UPS

b. The batteries shall be valve regulated LEAD-ACID (the type and model which does not require dedicated ventilation)

c. The batteries shall be compliant with:

i. IEC 60896-21:2004 Stationary lead-acid batteries - Part 21: Valve regulated types - Methods of test or THN equivalent.

ii. IEC 60896-22:2004 Stationary lead-acid batteries - Part 22: Valve regulated types - Requirements or THN equivalent.

d. Shall be located in one cabinet adjacent to the UPS cabinet

e. Autonomy: not less than 30 minutes at full load (including 30% of spare capacity)

f. Minimum operating life time: 10 (ten) years

26.16.11. **Command**

a. As a minimum, the following commands shall be provided locally and remotely:

i. System OFF

ii. System on UPS

iii. System on Static By-pass

iv. System on Manual By-pass

v. Alarm silence switch

26.16.12. **Control**

a. As a minimum, the following possibilities shall be provided:

b. Measurement of:

i. Input current

ii. Input voltage

iii. Input power

iv. DC voltage

v. DC current

vi. Output voltage

vii. Output current

viii. Output frequency

ix. Output power

c. A mimic display indicating different operation mode showing the status of main circuit breakers and switches.

d. As a minimum, visual and audible alarms:

i. Battery at low level and low voltage

ii. System on by-pass

iii. Input supply failure

iv. Overload

v. High temperature

vi. USP not answering – communication lost

vii. Logging of previous minimum 200 alarms shall be possible

viii. The UPS shall be provided with two contacts for remote alarms, one for urgent (red) alarm and one for non-urgent (yellow) alarm

e. Automatic battery check-up

26.16.13. **Communication and remote control**

a. In addition, the UPS shall be provided with:

i. Communication interface RS232/C, or Ethernet RJ45

ii. SNMP V. 3.x compliant

b. The UPS shall be equipped with appropriate output protection. A short-circuit in the UPS distribution panel shall not damage the UPS.

26.17 Lightning protection and grounding connection

26.17.1. **Lightning protection**

a. The Contractor shall design and provide the most suitable solution to ensure lightning protection of all provided equipment, installations and infrastructure in accordance with applicable legislations and standards in given Territorial Host Nation.

b. The earth electrode (respective wires and penetration rods) system shall be able to handle the lightning current for dispersal into the ground.

c. The lightning protection system shall be compliant with:

i. IEC 62305-1:2010 Protection against lightning - Part 1: General principles or THN equivalent.

ii. IEC 62305-2:2010 Protection against lightning - Part 2: Risk management or THN equivalent.

iii. IEC 62305-3:2010 Protection against lightning - Part 3: Physical damage to structures and life hazard or THN equivalent.

iv. IEC 62305-4:2010 Protection against lightning - Part 4: Electrical and electronic systems within structures or THN equivalent.

d. The equipment shall not be damaged and the Communications and Information Systems (CIS) equipment shall continue to operate without degradation when subjected to the lightning waveforms conforming to STANAG 4370 edition 7, AECTP 250 - leaflet 254 atmospheric electricity and lightning.

e. Appropriate Surge Protection Devices (SPD) and other lightning protection measures shall be used to provide sufficient protection for the equipment. They shall be compliant with (non-exhaustive list):

i. IEC 61643-11:2011 Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods or THN equivalent.

ii. IEC 61643-12:2020 Low-voltage surge protective devices - Part 12: Surge protective devices connected to low-voltage power systems - Selection and application principles or THN equivalent.

iii. IEC 61643-21:2000+AMD1:2008+AMD2:2012 CSV Consolidated version

iv. Low voltage surge protective devices - Part 21: Surge protective devices connected to telecommunications and signaling networks - Performance requirements and testing methods or THN equivalent.

v. IEC 61643-22:2015 Low-voltage surge protective devices - Part 22: Surge protective devices connected to telecommunications and signaling networks - Selection and application principles or THN equivalent.

26.17.2. **Grounding**

a. For all the new buildings in Greece according to Government Gazette FEK 1222/B/2006), a grounding study shall be prepared by the Contractor.

b. Grounding study / ground resistance measurements at various locations (the new SSSB building, other indoor premises for SSSB system, antenna locations, fuel tanks, fences etc.) shall be performed by the Contractor in order to ensure good operation including lightning protection.

c. The main grounding network shall consists of grounding rings buried under the foundations of the new SSSB building and antenna foundations.

d. All metallic parts in the new SSSB building and of the SSSB system in all premises shall also be connected to this grounding system.

e. The Contractor shall integrate the SSSB grounding system with existing grounding system of the site according to respective THN laws and regulations.

f. The grounding installation shall be compliant with IEC 60364-5-54:2011 Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors or THN equivalent.

26.17.3. **External lighting**

a. The Contractor shall design, provide, install and connect external / outdoor emergency lights.

b. All related works shall be coordinated with the civil works site manager.

c. The external lighting installation shall be complaint with IEC 60364-7-714:2011 Low-voltage electrical installations - Part 7-714: Requirements for special installations or locations - External lighting installations or THN equivalent.

26.17.4. **Lighting fixtures**

a. The lighting fixtures shall meet following requirements:

i. The level of protection against dust and water shall be as per IEC 60529: minimum IP 66

ii. The resistance to mechanical impacts shall be minimum IK08 in compliance with IEC 62262:2002 Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code) or THN equivalent.

iii. Latest generation LED technology

iv. Housing and cover: in die-cast aluminium, designed with small surface exposed to wind and with integrated cooling fins into the cover

v. Highly resistant to temperature and UV radiation

vi. Connection: in die-cast aluminium and with gaskets to secure frame according to designed inclinations

vii. Lighting diffuser: clear, tempered glass, minimum 4mm thick

viii. Coating: polyester resin for powder coating, resistant to corrosion and saline environments

ix. Equipped with automatic temperature control device so that in the event of an unexpected LED temperature rise, caused by particular weather conditions or a LED failure, the system shall reduce the luminous flux to lower the working temperature and guarantee proper operation

x. Equipped with a safety diode to protect against voltage peaks

xi. Equipped with heat dissipation system designed and made to allow the operation of the LED lights with temperatures guaranteeing excellent performance / efficiency and durability of at least 50.000 hrs in compliance with IEC 62722-2-1:2014 or THN equivalent.

SECTION 27 ROADS, PAVED AREAS AND LANDSCAPING

27.1 General

27.1.1. This scope shall include:

a. The access roads to each antenna provided by the Contractor at the site of Kythira, Naval Entity 47 South (TX-RX)

b. Parking areas at the site of Kythira, Naval Entity 47 South (TX-RX)

c. Pavements/sidewalks and footpaths to link the new SSSB building with internal access roads/parking existing in the vicinity (see Figure 1)

d. Temporary roads

e. Landscaping (grass/turf sodding, planting and gardening).

27.1.2. The detailed requirements related to earthworks, foundations, collection and drainage of water are included in other sections of this SOW. Therefore this section focuses on the realization of the pavements, related works and landscaping.

27.1.3. Administrative activities, geodetic & design activities, as well as execution of the construction works, including works supervision, quality assurance, quality control and health & safety measures shall be planned, organized and executed in compliance with:

a. THN national legislation

b. National standards or international standards that are applicable in THN (when THN equivalent standards do not exist or are superseded by international standards applicable in THN)

c. Best industry practices that are most relevant to the scope of work

27.2 Roads, parking, pavements and walk paths

27.2.1. The requirements for antenna access roads are formulated in site specific Appendix and herein below.

27.2.2. Where required, temporary removal of fences and gates, doors etc. shall be coordinated with the THN authorities in order to allow access of the Contractors machinery, equipment and deliveries etc. It is the Contractor’s responsibility to temporary remove gates, fences, doors etc. and to reinstate them once any work is completed by the Contractor that has required temporary removal. Any damages caused by the Contractor shall be rectified by the Contractor at no cost to the Purchaser or THN.

27.2.3. Access to buildings shall be designed so as to avoid any damage to them and their surroundings during vehicle maneuvers.

27.2.4. Where pavements/sidewalks and footpaths are required to link the new SSSB building with internal roads and parking, existing in the vicinity, they shall be minimum 1.5 metres width, with flexible or semi-rigid pavement.

27.2.5. Any pathways to wider building access points (i.e. the double doors to HVAC and power generator rooms etc.) are to ensure they are at least 0.5 metres wider on each side of the pathway to allow sufficient space for machinery maneuvering.

27.2.6. Slope access ramps, with flexible or semi-rigid pavement, shall be provided for buildings accesses to accommodate any level differences.

27.2.7. The parking lot shall be designed taking into account:

a. its sporadic use by commercial vehicles such as fuel trucks and regular use for personal vehicles and vans (maximum 3.5 T each):

b. minimum 3 parking positions for vans (maximum 3.5 T each)

c. it shall have similar characteristics as the antenna access roads but it shall be built with flexible or semi-rigid pavement

27.2.8. The fuel truck parking position, for refueling the buried fuel tanks, shall be designed to assure convenient and safe refueling as well as maneuvering of the fuel truck. It shall have the pavement required for refueling operations (i.e. made of non-flammable materials, sealed and washable).

27.2.9. Longitudinal slopes shall not exceed 10% and cross slopes shall be between 2% and 4%.

27.3 Drainage.

27.3.1. All sections of the roads, pavements, pathways and parking shall be built with drainage works required for chosen pavement type.

27.3.2. Runoff water shall be collected by a drainage network combined with curbs, outlets, gutters, ditches, pipes and culverts. This water shall be evacuated to the public sewage network or to dispersion drains depending on the existing situation and proposed design.

27.4 Access roads to antennas.

27.4.1. These roads shall be provided for all antennas as shown in the diagram (figure 2) below. The Contractor is required to choose one of the presented options or a combination of both assuring that:

a. all antennas are accessible in an efficient and safe manner (i.e. the risk of damage to any elements of any antenna is minimized to the maximum possible extent)

b. there is no drive through antenna fields i.e. over the areas with buried grounding screen

c. conveniently located areas for service vehicles are provided to assure access to all antenna components (i.e. crane or lifting platform access is possible to reach the top mounted antenna components)

d. when the access road does not form a closed loop, sufficiently large area shall be provided to enable safe and convenient turnaround of vehicles (including cranes or lifting platforms for maintenance requirements)

27.4.2. If for the unity of road design and economy of scale it is proved efficient and economically justifiable, the Contractor can choose the same technology for the antenna access roads as for the other site roads. In such case all roads shall be built with flexible or semi-rigid pavement.

27.5 Temporary roads

27.5.1. During constructing phase the Contractor may need a temporary road network to access all required areas at all sites, and a temporary parking/ storage area to execute works under this contract at any of the sites.

27.5.2. It is the Contractor’s responsibility to build this temporary road network and temporary parking /storage as well as to demolish them and to restore the site to the required condition as before the Contractor’s works commenced.

27.5.3. Alternatively, the Contractor can rebuilt the temporary roads into antenna access roads that shall meet requirements stipulated in this Annex and site specific Appendixes.

27.6 Landscaping

27.6.1. In addition to the measures that the Contractor shall implement during the execution of the site works, at the end of the site civil works the Contractor shall complete finishing and landscaping in order to stabilize the soil and prevent erosion.

27.6.2. These works shall include sowing and planting.

27.6.3. Any works, although having an aesthetic aspect, shall in no way interfere with the existing physical security measures. Therefore, the Contractor shall take particular care during the design and execution of landscaping works to assure that the effectiveness of any of the site security measures stays intact (i.e. planting of any shrubs shall not limit monitoring of any sensitive points and areas and shall not reduce the required lighting level).

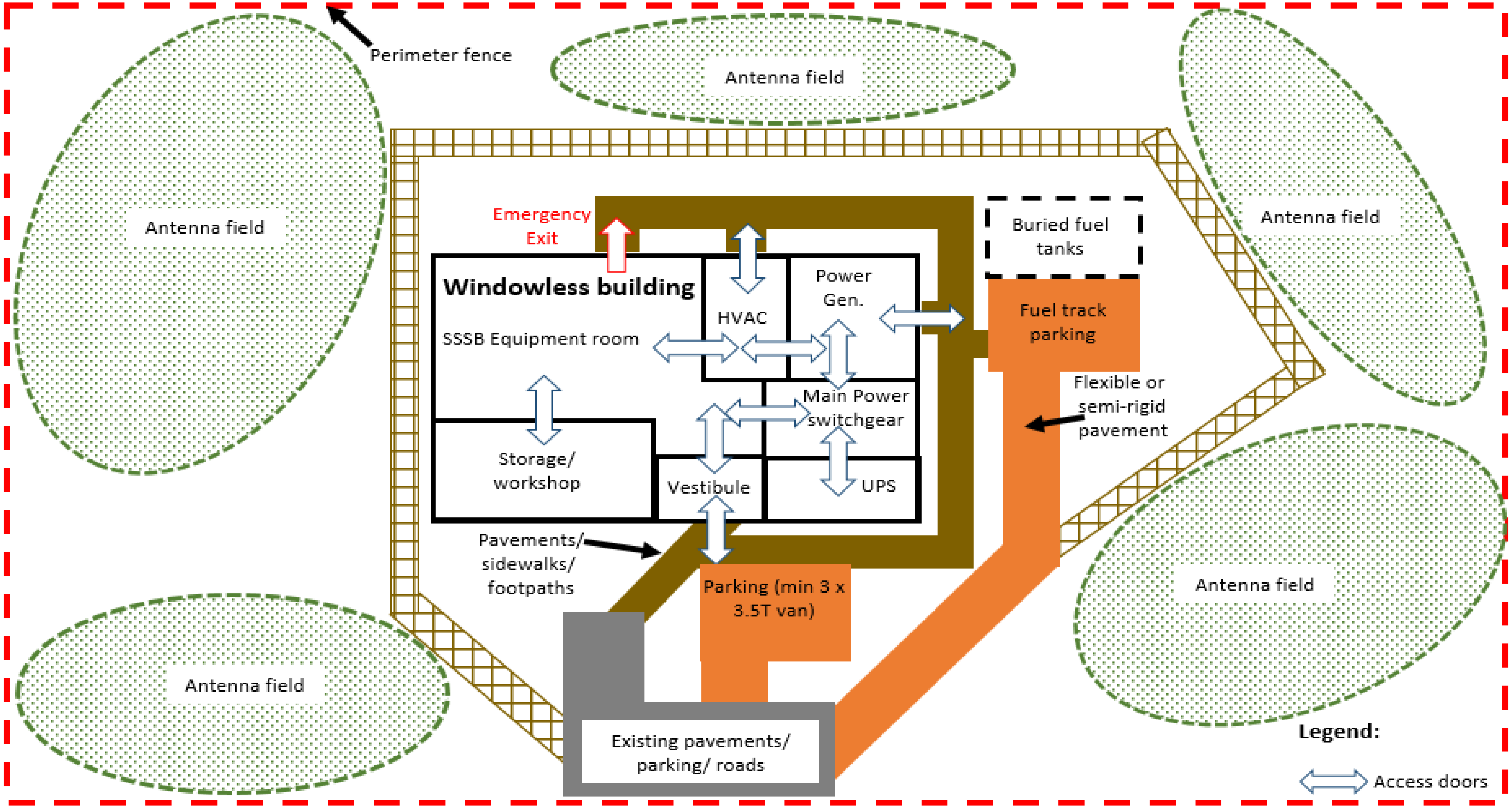

Figure 2 – Antenna Access with Closed Loop Road

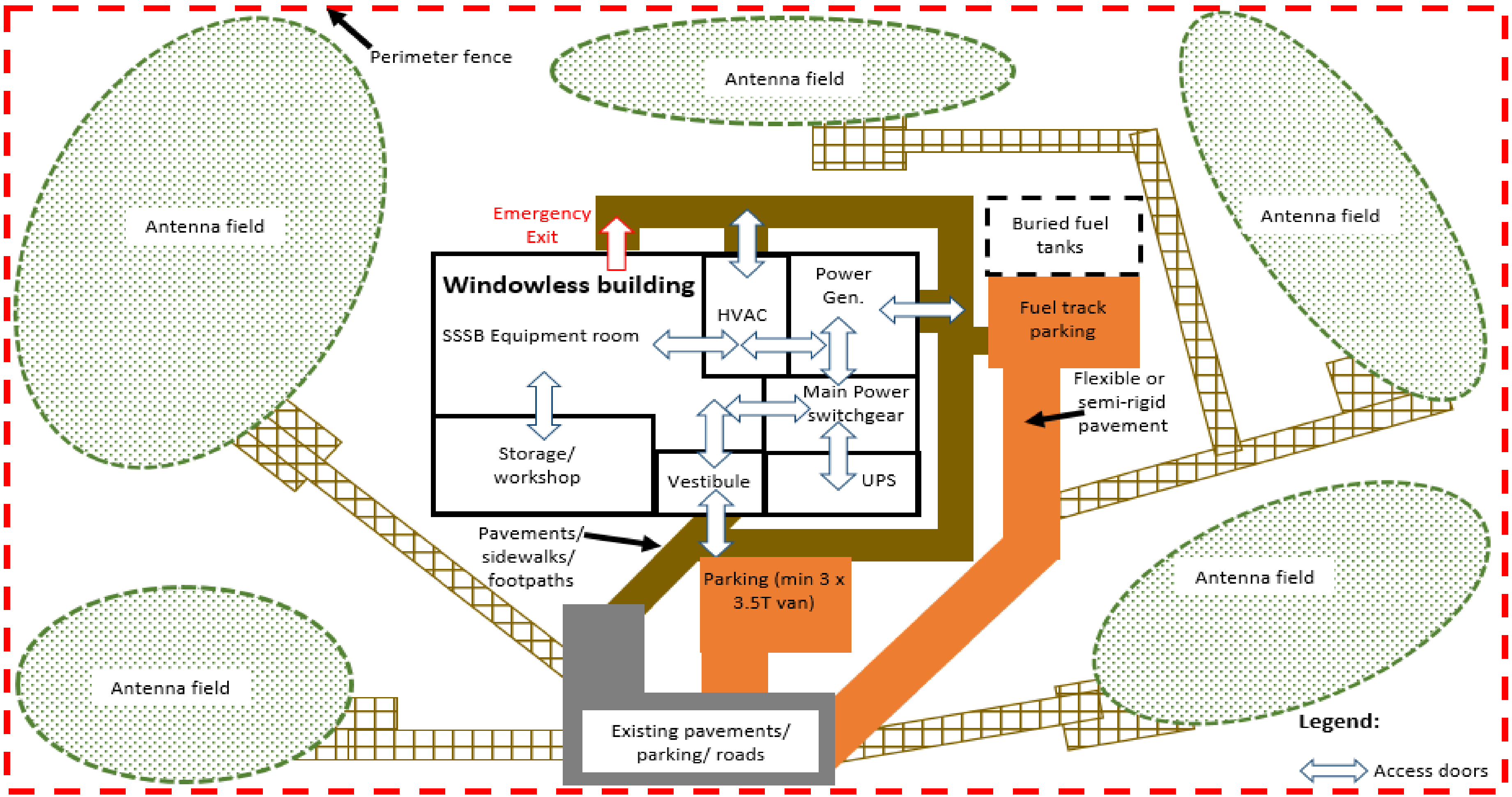

Figure 3 – Antenna Access with Vehicle Turnaround Area

Appendix 1: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX I-SRS-CW-GRC

Civil Works at the Site Kartsinoudi, Skyros Island (HF TX), GR

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX I - System Requirements Specifications (Civil Works) – Greece.

2. Responsibilities of the Contractor

2.1. Provision and installation of security fence around the existing building and antenna fields:

2.1.1. The fence shall form continues line around the existing building, the antenna fields and all other infrastructure and installations provided by the Contractor, with the exception of the site perimeter section along the coastline/ waterfront. In case the fence sections built by the Contractor do not reach the coastline on the left and right side of the antenna fields, the fence shall also be built along the coastline.

2.1.2. The fence shall be built in such a distance from antennas to assure that the radiation right outside the fence line is within the limits established in respective THN legislation for publically accessible areas and the fence does not interfere with SSSB system operation.

2.1.3. The fence shall be an Anti-Intruder chain link fence complying with BS 1722-14:2017 (Fences - Specification for open mesh steel panel), Category 2: Boundary/perimeter fences or THN equivalent standard.

2.1.4. The fence mesh shall be corrosion-protected (plastic coating or galvanizing or painting or combination of the mentioned technologies) and shall extend to a height of at least 2.4m above ground level throughout.

2.1.5. The fence shall be topped with three (3) strands of barbed wire or sabre wire facing outward and upwards at an angle of forty-five (45) degrees raising the total fence height by a minimum of 0.5m throughout its entire length.

2.1.6. The under-fence gap shall not exceed fifty (50) mm and the fence shall either be buried in the ground (where it is adequately protected against corrosion), buried in concrete footings or stapled to a hard standing.

2.1.7. Fence posts shall be of galvanized and corrosion-protected steel positioned at centers not exceeding 3m.

2.1.8. Fence post shall be installed in concrete foundations.

2.1.9. Fence posts shall be mounted straight/vertical to accommodate the topping according to BS 1722-10:2019 (Fences - Specification for anti-intruder fences in chain link and welded mesh) or THN equivalent standard.

2.1.10. Both main and emergency gates shall be constructed to the same standard as the fence and shall open inwards or laterally. If opened inwards, the gates shall be double leaf gates.

2.1.11. The location, where to install the emergency gates, will be provided during the Contractor's site survey.

2.1.12. The gates shall be of minimum 3.5m width, manually operated, equipped with closing mechanism and a security padlock.

2.1.13. Each door leaf shall be mounted on minimum 3(three) hinges.

2.1.14. The closing mechanism at the gates, as the minimum shall meet following requirements:

2.1.14.1. THN security approved locking mechanisms, such as a sliding locking bar that can be secured with a security approved padlock, and ground locking pins to enable it to be secured when not in use.

2.1.15. The security padlock at the gates, as the minimum shall meet following requirements:

2.1.15.1. Body made from hardened steel

2.1.15.2. Inner components made from non-corrosive materials

2.1.15.3. Hardened boron steel shackle minimum 15 mm diameter

2.1.15.4. Precision minimum 5-pin cylinder lock mechanism

2.1.15.5. Minimum 3 keys with duplication service for code

2.1.15.6. Suitable for outdoor use, weatherproof

2.1.15.7. Tested against impact, drilling, cutting, lever – test certificate /CoC issued by the supplier shall be provided

2.1.15.8. Minimum GRADE 3 – Medium / High Security: according to Central European Norm (CEN Grade) or EN 12320:2012 Building hardware. Padlocks and padlock fittings. Requirements and test methods

2.1.16. Ground surfaces under gates shall be paved with concrete and designed to bear load of wheeled vehicles with minimum 30T of the vehicle gross weight.

2.1.17. The fence shall be designed and installed to maximize the use of straight sections in order to permit an unobstructed field of vision.

2.2. If the Contractor identifies that existing fence including its foundations and/or any other not used/ not operational infrastructure, installations and equipment shall be removed to enable installation and correct O&M of SSSB system and its supporting infrastructure, it is the Contractor's responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.3. If the Contractor decides to install new fuel tanks at the locations of currently existing fuel tanks, the Contractor shall also remove and dispose of the three existing diesel buried fuel tanks (20000 Liter each tank) for the generators:

2.3.1. Removal and disposal of existing fuel tanks together with existing pipes, pumps, cathodic protection and other auxiliaries.

2.3.2. Cleaning of the existing tanks with removal of sludge from its bottom, ventilation to "gas free", removal and disposal of waste o fuel

2.3.3. Removal and disposal of the existing pavement cover over the existing tanks

2.3.4. Inspection of the internal surface of concrete tank pits and restoration of the concrete pits with liquid injection/ ejection using suitable mortars

2.3.5. Refurbishment of existing tank manholes (including their still covers/ hatches)

2.3.6. Execute all necessary activities, according to requirements stipulated in respective THN laws and regulations, in case the Contractor causes or identifies fuel spill during removal of the buried fuel tanks

2.4. Regardless if the Contractor installs new fuel tanks in the current fuel tanks location or else, it remains the Contractor's responsibility:

2.4.1. to remove and dispose of all sections of fuel pipes that are installed in the building and anywhere else on the ground surface and above the ground

2.4.2. to remove and dispose of all pumps, valves and other auxiliaries related to currently existing fuel supply system, that are installed in the building and anywhere else on the ground surface and above the ground

2.5. Provision and installation of new buried fuel tanks with cathodic protection, piping, cabling and all ancillaries as stipulated in the SOW - ANNEX I.

2.6. Provision and installation of new concrete pavement over the new fuel tanks.

2.7. Removal and disposal of existing HVAC system:

2.7.1. Removal and disposal of outdoor units including metallic fence around them

2.7.2. Removal and disposal of HVAC indoor units dedicated to SSSB equipment room

2.7.3. Removal and disposal of all piping, cabling, air ducting, cable trays, fixings, control panels, and other ancillaries related to the HVAC units that are scoped for disposal

2.8. Provision and installation of new HVAC system dedicated for SSSB system with all piping, cabling and ancillaries as stipulated in the SOW - ANNEX I:

2.8.1. Provision and installation of metallic fence for outdoor HVAC unit:

2.8.1.1. Specification of the fence at least equal to existing one as shown below in figure 1.

Figure 1

2.8.1.2. Locking mechanisms, such as a sliding locking bar that can be secured with a padlock to enable it to be secured when not in use.

2.8.2. The padlock, as the minimum shall meet following requirements:

2.8.2.1. Body made from hardened steel

2.8.2.2. Inner components made from non-corrosive materials

2.8.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.8.2.4. Precision minimum 3-pin cylinder lock mechanism

2.8.2.5. Minimum 3 keys

2.8.2.6. Suitable for outdoor use, weatherproof

2.8.3. Outdoor HVAC unit(s) shall be installed in adequate housing for local weather conditions with impact of sea water mist

2.8.4. Modification and refurbishment of existing reinforced concrete foundation or removal and disposal of existing foundation and provision and installation of new reinforced concrete foundation

2.9. Restoration works of the roof (externally), ceiling (internally) and walls of the COMMS Kartsinoudi building, which is a reinforced concrete structure. In several areas at the roof of the building and the front facade the concrete part has been eroded and the steel reinforcement has been exposed and corroded:

2.9.1. Restoration of reinforced-concrete structures as described in this appendix further below.

2.9.2. Restoration of entire front facade including plastering and painting with special weather resistant coatings (painting scheme and RAL color code will be provided by the Purchaser at a later stage).

2.9.3. Restoration of 5(five) existing, metallic window gratings and 1(one) existing, metallic door grating:

2.9.3.1. Sandblasting of their entire structure, complete removal of corrosion, anticorrosive painting as specified further herein and in the SOW – ANNEX I;

2.9.3.2. Repair and greasing of hinges;

2.9.3.3. Repair of locking mechanisms for padlocks.

2.9.4. Removal of old insulation for the entire roof of the building and reapplication and installation of a new one.

2.9.5. Restoration of all internal walls, floors and ceiling, including plastering and painting in the room for SSSB equipment (RAL color code will be provided by the Purchaser at a later stage).

2.9.6. Concrete floor painting shall meet requirements as stipulated in SOW - ANNEX I

2.10. Removal and disposal of eight ventilation shafts with their turrets, utilized by current HF TXs:

2.10.1. In case that a number of the ventilation shafts become redundant due to the dismantling of current, redundant equipment or the cooling method / procedure for the new SSSB equipment differs from the existing ones, then appropriate closure of the openings to the roof structure shall be executed.

2.10.2. If forced ventilation utilizing raised floor structures (including air ducting) is the required method for cooling / operating new SSSB equipment, the Contractor shall also provide and install the raised floor. In such case the raised floor shall meet requirements stipulated in the SOW - ANNEX I.

2.11. Provision and installation of adequate number of ventilation shafts and turrets for new SSSB equipment as required.

2.12. Removal and disposal of RF cabling manhole covers at the entry points to the COMMS building.

2.13. Provision and installation of new steel RF cabling manhole covers at the entry points to the COMMS building:

2.13.1. Locking mechanisms, such as a sliding locking bar that can be secured with a padlock to enable it to be secured when not in use.

2.13.2. The padlock, as the minimum shall meet following requirements:

2.13.2.1. Body made from hardened steel

2.13.2.2. Inner components made from non-corrosive materials

2.13.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.13.2.4. Precision, minimum 3-pin cylinder lock mechanism

2.13.2.5. Minimum 3 keys

2.13.2.6. Suitable for outdoor use, weatherproof

2.14. Refurbishment of the existing RF cabling manholes including restoration of the concrete walls with liquid injection/ ejection using suitable mortar.

2.15. Removal and disposal of power distribution system, both indoor and outdoor, that becomes redundant when the new SSSB system with its dedicated electrical installation (further called SSSB electrical installation) is provided and installed by the Contractor:

2.15.1. The scope includes removal and disposal of redundant cabling, sockets, power panels, junction boxes, switches, cables, trays, ducts and other ancillaries.

2.15.2. THN may wish to preserve some parts of the redundant electrical installation and its ancillaries. Relevant guidance will be provided to the Contractor at a later stage.

2.16. Provision and installation of SSSB electrical installation with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.16.1. Complete SSSB electrical installation, both indoor and outdoor, with dedicated EPDBs (Equipment Power Distribution Boards), including surge protection devices and residual current devices (RCD), required to power all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, fire detection and alarm, power distributed to antenna fields etc.)

2.16.2. Integration of the SSSB electrical installation with existing MPDB (Main Power Distribution Board) and Medium Voltage Transformer:

2.16.2.1. The integration shall include installation of adequate circuit breakers, cabling provision and installation, and modification of existing power distribution system and the power boards/ panels as required to connect power cables for SSSB electrical installation

2.16.3. If the integration with existing MPDB is not possible, the Contractor shall:

2.16.3.1. remove and dispose of the existing MPDB

2.16.3.2. provide and install a new MPDB

2.16.3.3. integrate SSSB electrical installation with the new MPDB

2.16.3.4. integrate all remaining electrical installation of entire building with the new MPDB

2.17. Provision and installation of UPS system as stipulated in the SOW – ANNEX I.

2.18. Removal and disposal of two existing power generators together with existing piping, cabling, air intake, air outlet, louvers, control panels, grounding and all other ancillaries

2.19. It is possible that THN GRC decides to preserve the power generators. In such case, the Contractor shall remove power generators from their current location and store them within the site. Further guidance will be provided to the Contractor at a later stage.

2.20. Provision and installation of two fully redundant power generators with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.20.1. The PGS shall be the back-up (emergency) source of electrical power and shall be capable to provide power for entire SSSB site in case of main power failure. Hence, the Contractor shall design the system and provide equipment to meet requirements for power generators rated as Emergency Standby Power (ESP) according to ISO 8528-1:2018

2.20.2. Modification and refurbishment of existing reinforced concrete foundation or removal and disposal of existing foundation and provision and installation of new reinforced concrete foundation for both power generators.

2.20.3. The foundation (regardless if modification of existing foundation is executed or new foundation is provided) shall be designed and built in such a way to prevent transfer of vibrations from generators to the rest of building structure.

2.20.4. The existing power load of the site (without equipment that shall be provided by the Contractor) that shall be connected to the PGS is 15 kW

2.20.5. The Contractor shall provide the PGS with 20% of spare capacity for further load expansion

2.21. Removal and disposal of lightning protection and grounding system, both indoor and outdoor, that becomes redundant when the new SSSB system with its dedicated lightning protection and grounding system (further called SSSB lightning protection and grounding system) is provided and installed by the Contractor:

2.21.1. The scope includes removal and disposal of redundant cabling, conductors, arresters, grounding rings (including buried, roof and mast mounted elements) grounding rods, lightning rods, trays, ducts and other ancillaries.

2.21.2. THN may wish to preserve some parts of the redundant lightning protection and grounding system and its ancillaries. Relevant guidance will be provided to the Contractor at a later stage.

2.22. Provision and installation of SSSB lightning protection and grounding system with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.22.1. Complete SSSB lightning protection and grounding system, both indoor and outdoor (including surge protection devices, grounding rings (including buried, roof and mast mounted elements), grounding rods, lightning rods, trays, ducts and other ancillaries) required to protect all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, fire detection and alarm, antennas, fences etc.)

2.22.2. Integration of the SSSB lightning protection and grounding system with existing lightning protection and grounding system of the site according to respective THN laws and regulations:

2.22.2.1. The integration shall include execution of necessary earth works, welding, anticorrosive protection, and necessary modification of existing lightning protection and grounding system.

2.23. Removal and disposal of:

2.23.1. three (3) ADCAB antennas and one (1) TASMO antenna;

2.23.2. three (3) SSSB existing HF TX antennas;

2.23.3. one (1) DLOS tower with antennas;

2.23.4. all ducting, cabling, grounding, guyed lines, foundation, anchoring and other ancillaries related to the antennas that are scoped for disposal.

2.24. Provision and installation of required number of new antenna masts capable of supporting the SSSB system and new DLOS tower with all associated works (antenna field preparation, foundation, trenches etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX I.

a) The antenna masts and the DLOS tower shall be designed for minimum service life of 30 years without the need for substantial maintenance

b) The antenna masts and the DLOS tower shall be provided with cathodic protection system (including protection of the guy anchors) designed for minimum service life of 30 years without the need for substantial maintenance

2.25. Removal and disposal of the SSSB, ADCAB and TASMO equipment located in the COMMS building.

2.26. Removal of current SSSB HF transmitters located in the COMMS building and storage of those transmitters within existing building on the site.

2.27. Provision and installation of fire detection and alarm system in SSSB equipment room and in power generator room as stipulated in the SOW - ANNEX I.

2.28. The fire alarm:

2.28.1. Shall be reported to the site duty officer (the duty officer office location will be provided during the Contractor’s site survey)

2.28.2. Shall be reported to the site commander (the site commander office location will be provided during the Contractor's site survey)

2.28.3. Shall send notifications /alerts to the mobile phones of the site commander and the site duty officer

2.29. Provision and installation of fire extinguishers in SSSB equipment room and in power generator room as stipulated in the SOW - ANNEX I.

2.30. Provision and installation of safety marking and labelling, both indoor and outdoor, for all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX I.

2.31. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.31.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.31.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.32. All metal works exposed to outdoor environment such as antenna masts with their ancillaries, HVAC components, cable trays and ladders, fences, gates, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5M Maritime, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.33. The complete structural design and its execution for all structures, equipment and installations provided, installed and/or modified by the Contractor shall meet THN GRC seismic requirements. Therefore, the Contractor shall meet respective requirements as stipulated in following publications:

2.33.1. EN 1998-1:2004, Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings

2.33.2. EN 1998-3:2005 Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings and its implementation

2.33.3. EN 1998-4:2006 Eurocode 8: Design of structures for earthquake resistance – Part 4: Silos, tanks and pipelines

2.33.4. EN 1998-5:2004 Eurocode 8: Design of structures for earthquake resistance – Part 5: Foundations, retaining structures and geotechnical aspects

2.33.5. EN 1998-6:2005 Eurocode 8: Design of structures for earthquake resistance – Part 6: Towers, masts and chimneys

2.33.6. Ministerial Decision D17a/141/3/FN 275/1999 (Government Gazette 2184/B;/20-12-19990 Hellenic Earthquake Regulation 2000 (Approval of the Greek Earthquake Regulation)

2.34. The Contractor shall also consider in its design additional measures that are required to secure provided equipment against earthquake impact. Those measures include, but are not limited to, special fixing to the floors (including when installed on a raised floors) and fixing elements mounted at the rack tops to secure them to the walls.

2.35. When designing and erecting masts with all associated ancillaries, fences and all other outdoor installed equipment, the Contractor shall apply Eurocode EN1991-1-4 (Eurocode 1 Part 1-4: General actions Wind actions). This publication provides guidance on the determination of natural wind actions for the structural design of buildings and civil engineering works. For the calculation procedure and especially for the determination of wind actions following shall be applied:

2.35.1. The fundamental basic wind velocity $v_{b,0}$ which is the 10 minute mean wind velocity with an annual risk of being exceeded of 0.02 irrespective of wind direction at a height of 10m above flat open country terrain, has a value in the National Annex $v_{b,0}$,0=33m/s for the Greek Islands in general.

2.35.2. The basic wind velocity v_b, which is the fundamental basic wind velocity modified to account the direction of the wind and the season, shall be calculated from the equation: $v_b=c_{dir} \times c_{season} \times v_{b,0}$. The recommended value for c_{dir} (the directional factor) and c_{season} (the season factor) is 1.

2.35.3. Terrain roughness: There are 5 terrain categories. For the two sites in Skyros Island (Kartsinoudi and Limnonari) as well as Site Sideros in Crete, the terrain category is No 0 (sea or coastal area exposed to the open sea). For the Site Kythira and Site Mavros in Crete the terrain category is No III (Area with regular cover of vegetation or building or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest).

2.36. Additionally, the Contractor shall design and execute the works in compliance with following publications respectively:

2.36.1. Presidential Decree 244/1980:"Cement Regulation for Concrete Works (Prestressed, Reinforced and Unarmed) (Government Gazette 69/A'/1989

2.36.2. ELOT EN 10080, ELOT 1421-1, ELOT 1421-3 "Standards for concrete reinforcement steels". 3. Ministerial Decision D11E/0/30123/1991 (Government Gazette 1068/B'/31-12-1991 "Amendment of the New Concrete Regulation for the Design and Construction of Concrete Works”

2.36.3. Ministerial Decision D17a/116/4/FN429/18-10-2000 (Reinforced Concrete Regulation) EKOS 2000.

2.36.4. Ministerial Decision D14/50504/2002 (Government Gazette 537/B;/1-5-2002) "Adaptation of the Concrete Technology Regulation to the Requirements of the Harmonized Standard" ELOT EN 197-1.

2.36.5. Ministerial Decision 16462/29/2001 (Government Gazette 917/B'/17.7.2001) "Cement for the Construction of Concrete Works".

2.36.6. Ministerial Decision D14/92330/08 (1416/B'/17.7.08) (Government Gazette 381/B'/24.3.2000) "Approval of the New Regulation of Concrete Reinforcement Steel Technology".

2.36.7. Ministerial Decision DIPAD/OIK. 372/2014 (Government Gazette 1457/B'/5.6.2014) "Approval of the application and use of the Eurocodes in combination with the respective National Appendices)

2.36.8. Government Gazette 59/D/3-2-1989 "Building Regulations".

2.36.9. Joint Ministerial Decision D6/B'/OIK 5825 (Government Gazette 407/B/2010) "Approval of the Energy Efficiency Regulation of Buildings (KENAK)".

2.36.10. Ministerial Decision F.7.5/1816/88/2004 (Government Gazette 470/B/5-3-2004) "Replacement of the current Regulation of Internal Electrical Installations with the ELOT Standards and other relevant provisions".

2.36.11. Manual of Standard Distribution Structures of Public Power Corporation (PPC), The Instructions Distribution of PPC SA.

2.36.12. Greek Technical Specifications-Government Gazette 2221/30-07-12 with mandatory application in all public works.

2.36.13. THN GRC Sewerage Regulation

2.36.14. Amendment and Supplementation of Presidential Decree 71/88 "Building Fire Protection Regulation" (Government Gazette 1316/B/31-12-1998)

2.36.15. Presidential Decree 41/2018 "Building Fire Protection Regulation" (Government Gazette 80/A'/7-5-2018)

2.37. Supporting Civil Works:

2.37.1. Rebuilding of pavements after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.37.2. Associated earthworks and backfilling, drilling for the pipes, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.37.3. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.37.4. Closing of all redundant penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling to assure correct and efficient operation of new HVAC system provided by the Contractor

2.37.5. Water, sound and fire insulation as required in all areas affected by the Contractor works.

2.38. Restoration of reinforced-concrete structures:

2.38.1. After the removal of all corroded concrete parts by using water-blasting, sandblasting the following works shall be executed according to the GRC National Regulation (Code ELOT TP 1501-14-01-04-00-2009 “Local retrofitting of concrete element damage caused by reinforcement corrosion”):

2.38.1.1. Cleaning of the steel reinforcements with mechanical wire brushing and then priming after three hours with appropriate anticorrosive material in accordance with manufacturer’s recommendations.

2.38.1.2. Application, in layers, anticorrosive mortar (the thickness shall be in accordance with manufacturer’s recommendations) covering the reinforcement.

2.38.1.3. Once the reinforcement remediation is completed, the application of two different appropriate water-proof cement coating in layers shall be followed.

2.38.1.4. Dismantling and replacement of damaged parts of networks and auxiliary works.

2.38.2. In case that the reinforcing bars are corroded and have lost more than 20% of their diameter, they shall be cut and removed. In such event, removed steel bars shall be replaced with new steel bars of the same diameter. For the above procedure the following works shall be executed in accordance with GRC National Regulation (Code PETEP:14-01-11-00 “Anchoring of new steel reinforcement bars in existing concrete elements”):

2.38.2.1. Identification of the anchor positions of the new steel reinforcement bars.

2.38.2.2. Cleaning of the concrete area in accordance with GRC National Regulation (Code PETEP:14-01-01-01 “Removal of loose or adhered material from concrete surfaces”).

2.38.2.3. Roughening of the concrete surface.

2.38.2.4. Boring holes in the concrete at the anchor positions (In General holes diameter=Steel bar diameter + 4mm) in accordance with GRC National Regulation (Code PETEP:14-01-03-02 “Drilling in concrete members with cut-off of encountered reinforcement”).

2.38.2.5. Roughening by wire-brushing inside the hole and remove dust by air blowing, wash with clean water, removal of the water by air blowing.

2.38.2.6. Insertion of sufficient amount of adhesive material.

2.38.2.7. The new steel bars shall be held properly in order to remain unmovable until the coagulation of the adhesive material.

2.38.3. The minimum thickness of reinforcement cover of slabs, beams and columns of a construction is prescribed by National Regulation (Greek Code for Reinforced Concrete 2000 in conjunction with the Greek Antiseismic Regulation 2003). In general the minimum thickness of reinforcement cover is not allowed to be less than the diameter of the steel bar+20mm for a reinforced-concrete structure in a marine environment. Especially:

2.38.3.1. For a reinforcing bar in a column the minimum thickness of reinforcement cover is not allowed to be less than 40mm and not less than the diameter of the steel bar+20mm.

2.38.3.2. For a reinforcing bar in a slab the minimum thickness of reinforcement cover is not allowed to be less than 35mm and not less than the diameter of the steel bar+20mm.

2.38.4. Once the reinforcement remediation is completed, the application of two different appropriate waterproof cement coating in layers to the external surfaces shall be followed. The restoration of the concrete area shall be completed with the works of plastering and painting.

Appendix 2: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX I-SRS-CW-GRC

Civil Works at the Site Kythira, Naval Entity 47 South (TX-RX), GR

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX I - System Requirements Specifications (Civil Works) – Greece.

2. Responsibilities of the Contractor

2.1. Provision and installation of security fence around the new SSSB building (that shall be built by the Contractor) and antenna fields:

2.1.1. The fence shall form continues line around the building, the antenna fields and all other infrastructure and installations provided by the Contractor.

2.1.2. The area planned for the new SSSB building is already fenced and included in the territory of Naval Entity 47 South. Therefore, some sections of the new fence might not be required around the new SSSB building. Additionally, removal and disposal of some sections of the existing fence, at the new SSSB building location, might be required which then shall be done by the Contractor. In such case, the new fence built around antenna fields shall be connected with existing fence at the area of new SSSB building. Relevant guidance will be provided to the Contractor at a later stage.

2.1.3. The fence shall be built in such a distance from antennas to assure that the radiation right outside the fence line is within the limits established in respective THN legislation for publically accessible areas and the fence does not interfere with SSSB system operation.

2.1.4. The fence shall be an Anti-Intruder chain link fence complying with BS 1722-14:2017 (Fences - Specification for open mesh steel panel), Category 2: Boundary/perimeter fences or THN equivalent standard.

2.1.5. The fence mesh shall be corrosion-protected (plastic coating or galvanizing or painting or combination of the mentioned technologies) and shall extend to a height of at least 2.4m above ground level throughout.

2.1.6. The fence shall be topped with three (3) strands of barbed wire or sabre wire facing outward and upwards at an angle of forty-five (45) degrees raising the total fence height by a minimum of 0.5m throughout its entire length.

2.1.7. The under-fence gap shall not exceed fifty (50) mm and the fence shall either be buried in the ground (where it is adequately protected against corrosion), buried in concrete footings or stapled to a hard standing.

2.1.8. Fence posts shall be of galvanized and corrosion-protected steel positioned at centers not exceeding 3m.

2.1.9. Fence post shall be installed in concrete foundations.

2.1.10. Fence posts shall be mounted straight/vertical to accommodate the topping according to BS 1722-10:2019 (Fences - Specification for anti-intruder fences in chain link and welded mesh) or THN equivalent standard.

2.1.11. Both main and emergency gates shall be constructed to the same standard as the fence and shall open inwards or laterally. If opened inwards, the gates shall be double leaf gates.

2.1.12. The location, where to install the emergency gates, will be provided during the Contractor’s site survey.

2.1.13. The number of gates shall be chosen by the Contractor to assure access to the new SSSB building, all antenna fields and all other infrastructure and installations provided by the Contractor.

2.1.14. The gates shall be of minimum 3.5m width, manually operated, equipped with closing mechanism and a security padlock.

2.1.15. Each door leaf shall be mounted on minimum 3(three) hinges.

2.1.16. The closing mechanism at the gates, as the minimum shall meet following requirements:

2.1.16.1. THN security approved locking mechanisms, such as a sliding locking bar that can be secured with a security approved padlock, and ground locking pins to enable it to be secured when not in use.

2.1.17. The security padlock at the gates, as the minimum shall meet following requirements:

2.1.17.1. Body made from hardened steel

2.1.17.2. Inner components made from non-corrosive materials

2.1.17.3. Hardened boron steel shackle minimum 15 mm diameter

2.1.17.4. Precision minimum 5-pin cylinder lock mechanism

2.1.17.5. Minimum 3 keys with duplication service for code

2.1.17.6. Suitable for outdoor use, weatherproof

2.1.17.7. Tested against impact, drilling, cutting, lever – test certificate /CoC issued by the supplier shall be provided

2.1.17.8. Minimum GRADE 3 – Medium / High Security: according to Central European Norm (CEN Grade) or EN 12320:2012 Building hardware. Padlocks and padlock fittings. Requirements and test methods

2.1.18. Ground surfaces under gates shall be paved with concrete and designed to bear load of wheeled vehicles with minimum of 30T of the vehicle gross weight.

2.1.19. The fence shall be designed and installed to maximize the use of straight sections in order to permit an unobstructed field of vision.

2.2. If the Contractor identifies that existing fence including its foundations and/or any other not used/ not operational infrastructure, installations and equipment shall be removed to enable installation and correct O&M of SSSB system and its supporting infrastructure, it is the Contractor's responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.3. Provision and installation of new buried fuel tanks with cathodic protection, piping, cabling and all ancillaries as stipulated in the SOW - ANNEX I.

2.4. Provision and installation/ construction of new:

2.4.1. fuel truck parking position (it can overlap with the parking positions for vans if THN fire prevention regulations allow that) built with flexible pavement or semi-rigid pavement.

2.4.1.1. The area shall be large enough to assure convenient and safe refuelling from the fuel truck and its safe and convenient manoeuvring to reach and leave that refuelling position. All of that manoeuvring shall be possible with three-axis fuel truck (capacity around 20000 L) over paved surface that meets requirements stipulated in the SOW. Accessing or leaving the refuelling area by the fuel truck on reverse gear is acceptable.

2.4.2. minimum 3 (three) parking positions for vans (maximum 3.5 T each) built with flexible or semi-rigid pavement

2.4.2.1. The area shall be large enough to assure convenient and safe parking of minimum three VANs (3.5T each) and their safe and convenient manoeuvring to reach and leave parking positions by a 3.5T VAN while any other two parking positions are already occupied by two 3.5T VANs. All of that manoeuvring shall be possible over paved surface that meets requirements stipulated in the SOW. Accessing or leaving the parking area by a VAN on reverse gear is acceptable.

2.4.3. connection of the above mentioned pavements with existing paved road/ parking of the Naval Entity 47 South built with flexible or semi-rigid pavement

2.4.4. pavements/sidewalks and footpaths as required to link the new building with new built and existing internal site roads and parking built with flexible or semi-rigid pavement

2.4.5. access roads to antennas

2.4.6. for further details on road works, parking, footpaths and pavements refer to the SOW – ANNEX I and next paragraph of this Appendix

2.5. Provision and construction of access roads to each antenna provided by the Contractor (for further details on road works refer to the SOW – ANNEX I).

2.5.1. the roads shall be designed and built as internal roads and as such they will not serve as public use roads

2.5.2. all antennas shall be accessible in an efficient and safe manner (i.e. the risk of damage to any elements of any antenna when driving vehicles on these roads is minimized to the maximum possible extent)

2.5.3. there is no drive through antenna fields i.e. over the areas with buried grounding screen

2.5.4. conveniently located areas for service vehicles shall be provided to assure access to all antenna components (i.e. crane or lifting platform access is possible to reach the top mounted antenna components)

2.5.5. when the access road does not form a closed loop, sufficiently large area shall be provided to enable safe and convenient turnaround of vehicles (including cranes or lifting platforms used for maintenance purposes)

2.5.6. designed service life: minimum 20 years

2.5.7. the antenna access roads shall be designed as a light road system made of concrete open work plates, with load bearing capacity to be designed by the Contractor, for:

2.5.7.1. occasional traffic of light transport vehicles (maximum 3.5 T each) for the maintenance and security needs

2.5.7.2. sporadic traffic of cranes or lifting platforms to assure maintenance access to the top mounted antenna components

2.5.8. one line, no sidewalks

2.5.9. in principle no curbs required

2.5.10. curbs shall only be installed at selected road sections when necessary to assure stability of the road and slopes as well as adequate drainage and protection against erosion

2.5.11. where curbs are required they shall be made of concrete as prefabricated

2.5.12. example of the locations that might require installation of curbs are road sections running over culverts

2.5.13. when culverts are required to assure adequate drainage they shall be made of reinforced concrete as prefabricated

2.5.14. any drainage and any culvert outlet shall be designed and built in such a way not to cause erosion of the adjacent terrain

2.5.15. designed speed limit of the roads: 30 km/h

2.5.16. the road minimum turning circle of 10,0 m

2.5.17. the road lane width shall be minimum 3,0 m with possible local widening taking into account the vehicle turning circle (including paths of the front and the rear overhang)

2.5.18. all sections of the roads shall be built with drainage works required for chosen pavement

2.5.19. road works shall also include the slopes improvement along any section of the road whenever such improvement is required to protect the slopes and the road itself against erosion, landslides etc.

2.5.20. no horizontal traffic signs required

2.5.21. no vertical traffic signs required

2.6. Provision and installation of new HVAC system for the new SSSB building with all piping, cabling and ancillaries as stipulated in the SOW - ANNEX I:

2.6.1. Outdoor HVAC unit(s) shall be installed in adequate housing for local weather conditions with impact of sea water mist

2.6.2. Provision and installation of new reinforced concrete foundation for outdoor HVAC unit(s)

2.7. Provision and installation/ construction of the new SSSB building with following characteristics:

2.7.1. Energy Class “A” envelope

2.7.2. Windowless building to house all SSSB equipment with supporting equipment and installations provided by the Contractor

2.7.3. Structured and finished as stipulated in the SOW - ANNEX I

2.7.4. Provided with all equipment and installations as stipulated in the SOW - ANNEX I:

2.7.4.1. Internal and external doors (including emergency doors) with locks and closing mechanisms

2.7.4.2. Electrical distribution system including power panels, light fixtures -indoor and outdoor, emergency lights, power sockets, switches

2.7.4.3. Lightning protection and grounding

2.7.4.4. Automated full volume fire suppression system

2.7.4.5. Fire detection and alarm system

2.7.4.6. Fire extinguishers

2.7.4.7. HVAC system

2.7.4.8. Weather, sound and fire insulation as required

2.7.4.9. Floors and ceilings suitable for power distribution, piping, air circulation, fire prevention and other H&S measures as required for the SSSB building purpose

2.7.4.10. If forced ventilation utilizing raised floor structures (including air ducting) is the required method for cooling / operating SSSB equipment, the Contractor shall also provide and install the raised floor. In such case the raised floor shall meet requirements stipulated in the SOW - ANNEX I.

2.7.4.11. Drainage system

2.7.4.12. Manholes, cable and pipe interface panels required for introduction into the SSSB building of all installations and assure air intake, air exhaust, power generator exhaust etc.

2.7.4.13. Supplied with all equipment, installations and ancillaries required for Operation and Maintenance (O&M) of SSSB system and its supporting systems (HVAC, electrical power and distribution system, power generators, UPS, automated full volume fire suppression system fire detection and fire alarm etc.) for unmanned facility with only occasional presence of personnel for O&M purposes of the housed equipment and the building itself.

2.7.5. As the minimum, the building shall have following premises:

2.7.5.1. SSSB Equipment Room – minimum 50 m2 (Note: If the building design provides for a separate Environment Control room (HVAC) the size of SSSB Equipment room can be proportionally decreased)

2.7.5.2. The SSSB Equipment Room shall be built as NATO Class I area in accordance with:

2.7.5.2.1. AC/35-D/2001-REV3 Directive on Physical Security, dated 25 November 2020

2.7.5.2.2. AC/35-D/1030 NATO Security Committee Guidelines on Physical Security, dated 20 May 2005

2.7.5.3. When designing and executing the works for SSSB Equipment Room as NATO Class I area, the Contractor shall only meet requirements that pertain to:

2.7.5.3.1. wall, floor, and ceiling structures

2.7.5.3.2. security doors and locks

2.7.5.4. All other security measures, listed below, for the SSSB Equipment Room in order to meet requirements of NATO Class I area, are THN GRC responsibility and are not part of this project scope:

2.7.5.4.1. an entry control system

2.7.5.4.2. security barriers

2.7.5.4.3. security lighting

2.7.5.4.4. intrusion detection systems (IDS)

2.7.5.4.5. surveillance systems (CCTV)

2.7.5.4.6. access control at points of entry and an interface with the appropriate deployment of security guards or forces etc., 2.7.5.5. Power Generator Room – minimum 50 m2

2.7.5.6. Main Power Switchgear Room

2.7.5.7. UPS/Battery Room

2.7.5.8. Environment Control Room (HVAC) if not hosed in SSSB Equipment Room

2.7.5.9. Supply Storage Room/ Workshop and Test facilities for electronic equipment – minimum 12 m2

2.7.5.10. Vestibule, of minimum 4m2, at the main entry to the SSSB building, equipped with double door that assures protection against outdoor conditions when opening the double door of the SSSB Equipment Room

2.8. Provision and installation of SSSB electrical installation with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.8.1. Complete SSSB electrical installation, both indoor and outdoor, with SSSB building MPDB (Main Power Distribution Board), dedicated EPDBs (Equipment Power Distribution Boards), including surge protection devices and residual current devices (RCD), required to power all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, automated full volume fire suppression system, fire detection and alarm, lights, power distributed to antenna fields etc.)

2.8.2. Integration of the SSSB electrical installation with existing 250 kVA Medium Voltage Transformer (MVT)contractor

2.8.2.1. The integration shall include installation of adequate circuit breakers at the existing Commercial Power Panel (CPP) by the MV transformer, cabling provision and installation, and any other necessary modifications to connect power cables to the MPDB installed in the new SSSB building.

2.8.2.2. The existing 250 kVA MVT is located at a distance of about 200 m from the main site gate, inside the naval entity. In front of the fence at a distance of 30m before the main gate, there is a supply coming from the main transformer.

2.8.2.3. Should the integration with existing 250 kVA MVT be not possible, the Contractor shall provide and install a new transformer dedicated for SSSB system.

2.9. Provision and installation of UPS system as stipulated in the SOW – ANNEX I.

2.10. Provision and installation of two fully redundant power generators with associated cabling, ducting, cable trays, reinforced concrete foundation and ancillaries as stipulated in the SOW - ANNEX I:

2.10.1. The PGS shall be the back-up (emergency) source of electrical power and shall be capable to provide power for entire SSSB site in case of main power failure. Hence, the Contractor shall design the system and provide equipment to meet requirements for power generators rated as Emergency Standby Power (ESP) according to ISO 8528-1:2018.

2.10.2. The foundation shall be designed and built in such a way to prevent transfer of vibrations from generators to the rest of building structure.

2.11. Provision and installation of SSSB lightning protection and grounding system with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.11.1. Complete SSSB lightning protection and grounding system, both indoor and outdoor (including surge protection devices, grounding rings (including buried, roof and mast mounted elements), grounding rods, lightning rods, trays, ducts and other ancillaries) required to protect new SSSB building and all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, automated full volume fire suppression system fire detection and alarm, antennas, fences etc.)

2.11.2. Integration of the SSSB lightning protection and grounding system with existing lightning protection and grounding system of the site according to respective THN laws and regulations:

2.11.2.1. The integration shall include execution of necessary earth works, welding, anticorrosive protection, and necessary modification of existing lightning protection and grounding system.

2.12. Provision and installation of required number of new antenna masts capable of supporting the SSSB system with all associated works (antenna field preparation, foundation, trenches etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX I.

2.12.1. The antenna masts shall be designed for minimum service life of 30 years without the need for substantial maintenance.

2.12.2. The antenna masts shall be provided with cathodic protection system (including protection of the guy anchors) designed for minimum service life of 30 years without the need for substantial maintenance.

2.13. Provision and installation of automated full volume fire suppression system, fire detection and alarm system in the new SSSB building as stipulated in the SOW - ANNEX I.

2.14. The fire alarm:

2.14.1. Shall be reported to the site duty officer (the duty officer office location will be provided during the Contractor’s site survey)

2.14.2. Shall be reported to the site commander (the site commander office location will be provided during the Contractor’s site survey)

2.14.3. Shall send notifications /alerts to the mobile phones of the site commander and the site duty officer

2.15. Provision and installation of fire extinguishers in the new SSSB building as stipulated in the SOW - ANNEX I.

2.16. Provision and installation of safety marking and labelling, both indoor and outdoor, for the new SSSB building, all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX I.

2.17. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.17.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.17.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.18. All metal works exposed to outdoor environment such as antenna masts with their ancillaries, HVAC components, cable trays and ladders, fences, gates, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5M Maritime, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.19. The complete structural design and its execution for all structures, equipment and installations provided, installed and/or modified by the Contractor shall meet THN GRC seismic requirements. Therefore, the

Contractor shall meet respective requirements as stipulated in following publications:

2.19.1. EN 1998-1:2004, Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings

2.19.2. EN 1998-3:2005 Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings and its implementation

2.19.3. EN 1998-4:2006 Eurocode 8: Design of structures for earthquake resistance – Part 4: Silos, tanks and pipelines

2.19.4. EN 1998-5:2004 Eurocode 8: Design of structures for earthquake resistance – Part 5: Foundations, retaining structures and geotechnical aspects

2.19.5. EN 1998-6:2005 Eurocode 8: Design of structures for earthquake resistance – Part 6: Towers, masts and chimneys

2.19.6. Ministerial Decision D17a/141/3/FN 275/1999 (Government Gazette 2184/B;/20-12-19990 Hellenic Earthquake Regulation 2000 (Approval of the Greek Earthquake Regulation).

2.20. The Contractor shall also consider in its design additional measures that are required to secure provided equipment against earthquake impact. Those measures include, but are not limited to, special fixing to the floors (including when installed on a raised floors) and fixing elements mounted at the rack tops to secure them to the walls.

2.21. When designing and erecting masts with all associated ancillaries, fences and all other outdoor installed equipment, the Contractor shall apply Eurocode EN1991-1-4 (Eurocode 1 Part 1-4: General actions Wind actions). This publication provides guidance on the determination of natural wind actions for the structural design of buildings and civil engineering works. For the calculation procedure and especially for the determination of wind actions following shall be applied:

2.21.1. The fundamental basic wind velocity $v_{b,0}$ which is the 10 minute mean wind velocity with an annual risk of being exceeded of 0.02 irrespective of wind direction at a height of 10m above flat open country terrain, has a value in the National Annex $v_{b,0}$,0=33m/s for the Greek Islands in general.

2.21.2. The basic wind velocity v_b, which is the fundamental basic wind velocity modified to account the direction of the wind and the season, shall be calculated from the equation: $v_b = c_{dir} \times c_{season} \times v_{b,0}$. The recommended value for c_{dir} (the directional factor) and c_{season} (the season factor) is 1.

2.21.3. Terrain roughness: There are 5 terrain categories. For the two sites in Skyros Island (Kartsinoudi and Limnonari) as well as Site Sideros in Crete, the terrain category is No 0 (sea or coastal area exposed to the open sea). For the Site Kythira and Site Mavros in Crete the terrain category is No III (Area with regular cover of vegetation or building or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest).

2.22. Additionally, the Contractor shall design and execute the works in compliance with following publications respectively:

2.22.1. Presidential Decree 244/1980:"Cement Regulation for Concrete Works (Prestressed, Reinforced and Unarmed) (Government Gazette 69/A'/1989

2.22.2. ELOT EN 10080, ELOT 1421-1, ELOT 1421-3 "Standards for concrete reinforcement steels". 3. Ministerial Decision D11E/0/30123/1991 (Government Gazette 1068/B'/31-12-1991 "Amendment of the New Concrete Regulation for the Design and Construction of Concrete Works”

2.22.3. Ministerial Decision D17a/116/4/FN429/18-10-2000 (Reinforced Concrete Regulation) EKOS 2000.

2.22.4. Ministerial Decision D14/50504/2002 (Government Gazette 537/B;/1-5-2002) "Adaptation of the Concrete Technology Regulation to the Requirements of the Harmonized Standard" ELOT EN 197-1.

2.22.5. Ministerial Decision 16462/29/2001 (Government Gazette 917/B'/17.7.2001) "Cement for the Construction of Concrete Works".

2.22.6. Ministerial Decision D14/92330/08 (1416/B'/17.7.08) (Government Gazette 381/B'/24.3.2000) "Approval of the New Regulation of Concrete Reinforcement Steel Technology".

2.22.7. Ministerial Decision DIPAD/OIK. 372/2014 (Government Gazette 1457/B'/5.6.2014) "Approval of the application and use of the Eurocodes in combination with the respective National Appendices)

2.22.8. Government Gazette 59/D/3-2-1989 "Building Regulations".

2.22.9. Joint Ministerial Decision D6/B'/OIK 5825 (Government Gazette 407/B/2010) "Approval of the Energy Efficiency Regulation of Buildings (KENAK)".

2.22.10. Ministerial Decision F.7.5/1816/88/2004 (Government Gazette 470/B/5-3-2004) "Replacement of the current Regulation of Internal Electrical Installations with the ELOT Standards and other relevant provisions".

2.22.11. Manual of Standard Distribution Structures of Public Power Corporation (PPC), The Instructions Distribution of PPC SA.

2.22.12. Greek Technical Specifications-Government Gazette 2221/30-07-12 with mandatory application in all public works.

2.22.13. THN GRC Sewerage Regulation

2.22.14. Amendment and Supplementation of Presidential Decree 71/88 "Building Fire Protection Regulation" (Government Gazette 1316/B/31-12-1998)

2.22.15. Presidential Decree 41/2018 "Building Fire Protection Regulation" (Government Gazette 80/A'/7-5-2018)

2.23. Supporting Civil Works:

2.23.1. Rebuilding of pavements after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.23.2. Associated earthworks and backfilling, drilling for the pipes, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.23.3. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.23.4. Closing of all redundant penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling to assure correct and efficient operation of new HVAC system provided by the Contractor

2.23.5. Water, sound and fire insulation as required in all areas affected by the Contractor works.

Appendix 3: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX I-SRS-CW-GRC

Civil Works at the Site Sideros, Crete Island (HF RX), GR

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX I - System Requirements Specifications (Civil Works) – Greece.

2. Responsibilities of the Contractor

2.1. If the Contractor identifies that existing fence including its foundations and/or any other not used/ not operational infrastructure, installations and equipment shall be removed to enable installation and correct O&M of SSSB system and its supporting infrastructure, it is the Contractor’s responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.2. If the Contractor decides to install new fuel tanks at the locations of currently existing fuel tanks, the Contractor shall also remove and dispose of the three diesel buried fuel tanks (20000 Liter each tank) for the generators:

2.2.1. Removal and disposal of existing fuel tanks together with existing pipes, pumps, cathodic protection and other auxiliaries.

2.2.2. Cleaning of the existing tanks with removal of sludge from its bottom, ventilation to “gas free”, removal and disposal of waste o fuel

2.2.3. Removal and disposal of the existing pavement cover over the existing tanks

2.2.4. Inspection of the internal surface of concrete tank pits and restoration of the concrete pits with liquid injection/ ejection using suitable mortars

2.2.5. Refurbishment of existing tank manholes (including their still covers/ hatches)

2.2.6. Execute all necessary activities, according to requirements stipulated in respective THN laws and regulations, in case the Contractor causes or identifies fuel spill during removal of the buried fuel tanks

2.3. Regardless if the Contractor installs new fuel tanks in the current fuel tanks location or else, it remains the Contractor’s responsibility:

2.3.1. to remove and dispose of all sections of fuel pipes that are installed in the building and anywhere else on the ground surface and above the ground

2.3.2. to remove and dispose of all pumps, valves and other auxiliaries related to currently existing fuel supply system, that are installed in the building and anywhere else on the ground surface and above the ground

2.4. Provision and installation of new buried fuel tanks with cathodic protection, piping, cabling and all ancillaries as stipulated in the SOW - ANNEX I.

2.5. Provision and installation of new concrete pavement over the new fuel tanks.

2.6. Removal and disposal of existing HVAC system:

2.6.1. Removal and disposal of outdoor units including metallic fence around them

2.6.2. Removal and disposal of HVAC indoor units dedicated to SSSB equipment room

2.6.3. Removal and disposal of all piping, cabling, air ducting, cable trays, fixings, control panels, and other ancillaries related to the HVAC units that are scoped for disposal

2.7. Provision and installation of new HVAC system dedicated for SSSB system with all piping, cabling and ancillaries as stipulated in the SOW - ANNEX I:

2.7.1. Provision and installation of metallic fence for outdoor HVAC unit:

2.7.1.1. Specification of the fence at least equal to existing one as shown below in figure 1.

Figure 1

2.7.1.2. Locking mechanisms, such as a sliding locking bar that can be secured with a padlock to enable it to be secured when not in use.

2.7.2. The padlock, as the minimum shall meet following requirements:

2.7.2.1. Body made from hardened steel

2.7.2.2. Inner components made from non-corrosive materials

2.7.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.7.2.4. Precision minimum 3-pin cylinder lock mechanism

2.7.2.5. Minimum 3 keys

2.7.2.6. Suitable for outdoor use, weatherproof

2.7.3. Outdoor HVAC unit(s) shall be installed in adequate housing for local weather conditions with impact of sea water mist

2.7.4. Modification and refurbishment of existing reinforced concrete foundation or removal and disposal of existing foundation and provision and installation of new reinforced concrete foundation

2.8. Restoration works of the roof (externally), ceiling (internally) and walls of the COMMS Sideros building, which is a reinforced concrete structure. In several areas at the roof of the building and the front facade the concrete part has been eroded and the steel reinforcement has been exposed and corroded:

2.8.1. Restoration of reinforced-concrete structures as described in this appendix further below.

2.8.2. Restoration of entire front facade including plastering and painting with special weather resistant coatings (painting scheme and RAL color code will be provided by the Purchaser at a later stage).

2.8.3. Restoration of 4(four) existing, metallic window gratings and 1(one) existing, metallic door grating:

2.8.3.1. sandblasting of their entire structure, complete removal of corrosion, anticorrosive painting as specified further herein and in the SOW – ANNEX I;

2.8.3.2. repair and greasing of hinges;

2.8.3.3. repair of locking mechanisms for padlocks.

2.8.4. Removal of old insulation for entire roof of the building and reapplication and installation of a new one as required.

2.8.5. Restoration of all internal walls, floors and ceiling, including plastering and painting in the room for SSSB equipment (RAL color code will be provided by the Purchaser at a later stage).

2.8.6. Concrete floor painting shall meet requirements as stipulated in SOW - ANNEX I.

2.9. Removal and disposal of 8(eight) ventilation shafts with their turrets, utilized by current HF TXs:

2.9.1. In case that a number of the ventilation shafts become redundant due to the dismantling of current, redundant equipment or the cooling method / procedure for the new SSSB equipment differs from the existing ones, then appropriate closure of the openings to the roof structure shall be executed.

2.9.2. If forced ventilation utilizing raised floor structures (including air ducting) is the required method for cooling / operating new SSSB equipment, the Contractor shall also provide and install the raised floor. In such case the raised floor shall meet requirements stipulated in the SOW - ANNEX I.

2.10. Provision and installation of adequate number of ventilation shafts and turrets for new SSSB equipment as required.

2.11. Removal and disposal of RF cabling manhole covers at the entry points to the COMMS building.

2.12. Provision and installation of new steel RF cabling manhole covers at the entry points to the COMMS building:

2.12.1. Locking mechanisms, such as a sliding locking bar that can be secured with a padlock to enable it to be secured when not in use.

2.12.2. The padlock, as the minimum shall meet following requirements:

2.12.2.1. Body made from hardened steel

2.12.2.2. Inner components made from non-corrosive materials

2.12.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.12.2.4. Precision, minimum 3-pin cylinder lock mechanism

2.12.2.5. Minimum 3 keys

2.12.2.6. Suitable for outdoor use, weatherproof

2.13. Refurbishment of the existing RF cabling manholes including restoration of the concrete walls with liquid injection/ ejection using suitable mortar.

2.14. Removal and disposal of power distribution system, both indoor and outdoor, that becomes redundant when the new SSSB system with its dedicated electrical installation (further called SSSB electrical installation) is provided and installed by the Contractor:

2.14.1. The scope includes removal and disposal of redundant cabling, sockets, power panels, junction boxes, switches, cables, trays, ducts and other ancillaries.

2.14.2. THN may wish to preserve some parts of the redundant electrical installation and its ancillaries. Relevant guidance will be provided to the Contractor at a later stage.

2.15. Provision and installation of SSSB electrical installation with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.15.1. Complete SSSB electrical installation, both indoor and outdoor, with dedicated EPDBs (Equipment Power Distribution Boards), including surge protection devices and residual current devices - RCD, required to power all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, fire detection and alarm, power distributed to antenna fields etc.)

2.15.2. Integration of the SSSB electrical installation with existing power distribution system:

2.15.2.1. The integration shall include installation of adequate circuit breakers, cabling provision and installation, and modification of existing power distribution system and the power boards/ panels as required to connect power cables for the entire site with SSSB electrical installation

2.15.2.2. Note that Conversion from a mixed Medium Voltage/ Low Voltage Installation, which includes medium voltage transformers, medium and low voltage Switching Gear/ Control Gear / Cabinets, to a pure Low Voltage Installation is required.

2.15.2.3. The reason being the reduced power requirements by the conversion of the TX site to RX site. The new transformer is going to be supplied, owned and maintained by the Local Power Utility Provider and is going to be part of the new Power Utility Connection for the installation.

2.15.2.4. The conversion to a pure Low Voltage design shall include Restoration / Replacement of Low Voltage Switch Gear / Control Gear, Cabinets, cabling etc. - to be executed by the Contractor.

2.15.3. If the integration with existing MPDB is not possible, the Contractor shall:

2.15.3.1. remove and dispose of the existing MPDB

2.15.3.2. provide and install a new MPDB

2.15.3.3. integrate SSSB electrical installation with the new MPDB

2.15.3.4. integrate all remaining electrical installation of entire building with the new MPDB

2.16. Provision and installation of UPS system as stipulated in the SOW – ANNEX I.

2.17. Removal and disposal of two existing power generators together with existing piping, cabling, air intake, air outlet, louvers, control panels, grounding and all other ancillaries.

2.18. It is possible that THN GRC decides to preserve the power generators. In such case, the Contractor shall remove power generators from their current location and store them within the site. Further guidance will be provided to the Contractor at a later stage.

2.19. Provision and installation of two fully redundant power generators with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.19.1. The PGS shall be the back-up (emergency) source of electrical power and shall be capable to provide power for entire SSSB site in case of main power failure. Hence, the Contractor shall design the system and provide equipment to meet requirements for power generators rated as Emergency Standby Power (ESP) according to ISO 8528-1:2018.

2.19.2. Modification and refurbishment of existing reinforced concrete foundation or removal and disposal of existing foundation and provision and installation of new reinforced concrete foundation for both power generators.

2.19.3. The foundation (regardless if modification of existing foundation is executed or new foundation is provided) shall be designed and built in such a way to prevent transfer of vibrations from generators to the rest of building structure.

2.19.4. The existing power load of the site (without equipment that shall be provided by the Contractor) that shall be connected to the PGS is 15 kW

2.19.5. The Contractor shall provide the PGS with 20% of spare capacity for further load expansion

2.20. Removal and disposal of lightning protection and grounding system, both indoor and outdoor, that becomes redundant when the new SSSB system with its dedicated lightning protection and grounding system (further called SSSB lightning protection and grounding system) is provided and installed by the Contractor:

2.20.1. The scope includes removal and disposal of redundant cabling, conductors, arresters, grounding rings (including buried, roof and mast mounted elements) grounding rods, lightning rods, trays, ducts and other ancillaries.

2.20.2. THN may wish to preserve some parts of the redundant lightning protection and grounding system and its ancillaries. Relevant guidance will be provided to the Contractor at a later stage.

2.21. Provision and installation of SSSB lightning protection and grounding system with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.21.1. Complete SSSB lightning protection and grounding system, both indoor and outdoor (including surge protection devices, grounding rings (including buried, roof and mast mounted elements), grounding rods, lightning rods, trays, ducts and other ancillaries) required to protect all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, fire detection and alarm, antennas, fences etc.)

2.21.2. Integration of the SSSB lightning protection and grounding system with existing lightning protection and grounding system of the site according to respective THN laws and regulations:

2.21.3. The integration shall include execution of necessary earth works, welding, anticorrosive protection, and necessary modification of existing lightning protection and grounding system.

2.22. Removal and disposal of:

2.22.1. three (3) ADCAB antennas and one (1) TASMO antenna;

2.22.2. three (3) SSSB existing HF TX antennas;

2.22.3. one (1) DLOS tower with antennas;

2.22.4. all ducting, cabling, grounding, guyed lines, foundation, anchoring and other ancillaries related to the antennas that are scoped for disposal.

2.23. Provision and installation of required number of new antenna masts capable of supporting the SSSB system and new DLOS tower with all associated works (antenna field preparation, foundation, trenches etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX I.

2.23.1. The antenna masts and the DLOS tower shall be designed for minimum service life of 30 years without the need for substantial maintenance.

2.23.2. The antenna masts and the DLOS tower shall be provided with cathodic protection system (including protection of the guy anchors) designed for minimum service life of 30 years without the need for substantial maintenance.

2.24. Removal and disposal of the SSSB, ADCAB and UHF equipment located in the COMMS building.

2.25. Removal of current SSSB HF transmitters located in the COMMS building and storage of those transmitters within existing building on the site.

2.26. Provision and installation of fire detection and alarm system in SSSB equipment room and in power generator room as stipulated in the SOW - ANNEX I.

2.27. The fire alarm:

2.27.1. Shall be reported to the site duty officer (the duty officer office location will be provided during the Contractor's site survey)

2.27.2. Shall be reported to the site commander (the site commander office location will be provided during the Contractor's site survey)

2.27.3. Shall send notifications /alerts to the mobile phones of the site commander and the site duty officer

2.28. Provision and installation of fire extinguishers in SSSB equipment room and in power generator room as stipulated in the SOW - ANNEX I.

2.29. Provision and installation of safety marking and labelling, both indoor and outdoor, for all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX I.

2.30. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.30.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.30.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.31. All metal works exposed to outdoor environment such as antenna masts with their ancillaries, HVAC components, cable trays and ladders, fences, gates, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5M Maritime, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.32. The complete structural design and its execution for all structures, equipment and installations provided, installed and/or modified by the Contractor shall meet THN GRC seismic requirements. Therefore, the Contractor shall meet respective requirements as stipulated in following publications:

2.32.1. EN 1998-1:2004, Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings

2.32.2. EN 1998-3:2005 Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings and its implementation

2.32.3. EN 1998-4:2006 Eurocode 8: Design of structures for earthquake resistance – Part 4: Silos, tanks and pipelines

2.32.4. EN 1998-5:2004 Eurocode 8: Design of structures for earthquake resistance – Part 5: Foundations, retaining structures and geotechnical aspects

2.32.5. EN 1998-6:2005 Eurocode 8: Design of structures for earthquake resistance – Part 6: Towers, masts and chimneys

2.32.6. Ministerial Decision D17a/141/3/FN 275/1999 (Government Gazette 2184/B;/20-12-19990 Hellenic Earthquake Regulation 2000 (Approval of the Greek Earthquake Regulation).

2.33. The Contractor shall also consider in its design additional measures that are required to secure provided equipment against earthquake impact. Those measures include, but are not limited to, special fixing to the floors (including when installed on a raised floors) and fixing elements mounted at the rack tops to secure them to the walls.

2.34. When designing and erecting masts with all associated ancillaries, fences and all other outdoor installed equipment, the Contractor shall apply Eurocode EN1991-1-4 (Eurocode 1 Part 1-4: General actions Wind actions). This publication provides guidance on the determination of natural wind actions for the structural design of buildings and civil engineering works. For the calculation procedure and especially for the determination of wind actions following shall be applied:

2.34.1. The fundamental basic wind velocity $v_{b,0}$ which is the 10 minute mean wind velocity with an annual risk of being exceeded of 0.02 irrespective of wind direction at a height of 10m above flat open country terrain, has a value in the National Annex $v_{b,0}$,0=33m/s for the Greek Islands in general.

2.34.2. The basic wind velocity v_b, which is the fundamental basic wind velocity modified to account the direction of the wind and the season, shall be calculated from the equation: $v_b = c_{dir} \times c_{season} \times v_{b,0}$. The recommended value for c_{dir} (the directional factor) and c_{season} (the season factor) is 1.

2.34.3. Terrain roughness: There are 5 terrain categories. For the two sites in Skyros Island (Kartsinoudi and Limnonari) as well as Site Sideros in Crete, the terrain category is No 0 (sea or coastal area exposed to the open sea). For the Site Kythira and Site Mavros in Crete the terrain category is No III (Area with regular cover of vegetation or building or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest).

2.35. Additionally, the Contractor shall design and execute the works in compliance with following publications respectively:

2.35.1. Presidential Decree 244/1980:"Cement Regulation for Concrete Works (Prestressed, Reinforced and Unarmed) (Government Gazette 69/A'/1989

2.35.2. ELOT EN 10080, ELOT 1421-1, ELOT 1421-3 "Standards for concrete reinforcement steels". 3. Ministerial Decision D11E/0/30123/1991 (Government Gazette 1068/B'/31-12-1991 "Amendment of the New Concrete Regulation for the Design and Construction of Concrete Works”

2.35.3. Ministerial Decision D17a/116/4/FN429/18-10-2000 (Reinforced Concrete Regulation) EKOS 2000.

2.35.4. Ministerial Decision D14/50504/2002 (Government Gazette 537/B;/1-5-2002) "Adaptation of the Concrete Technology Regulation to the Requirements of the Harmonized Standard" ELOT EN 197-1.

2.35.5. Ministerial Decision 16462/29/2001 (Government Gazette 917/B'/17.7.2001) "Cement for the Construction of Concrete Works".

2.35.6. Ministerial Decision D14/92330/08 (1416/B'/17.7.08) (Government Gazette 381/B'/24.3.2000) "Approval of the New Regulation of Concrete Reinforcement Steel Technology".

2.35.7. Ministerial Decision DIPAD/OIK. 372/2014 (Government Gazette 1457/B'/5.6.2014) "Approval of the application and use of the Eurocodes in combination with the respective National Appendices)

2.35.8. Government Gazette 59/D/3-2-1989 "Building Regulations".

2.35.9. Joint Ministerial Decision D6/B'/OIK 5825 (Government Gazette 407/B/2010) "Approval of the Energy Efficiency Regulation of Buildings (KENAK)".

2.35.10. Ministerial Decision F.7.5/1816/88/2004 (Government Gazette 470/B/5-3-2004) "Replacement of the current Regulation of Internal Electrical Installations with the ELOT Standards and other relevant provisions".

2.35.11. Manual of Standard Distribution Structures of Public Power Corporation (PPC), The Instructions Distribution of PPC SA.

2.35.12. Greek Technical Specifications-Government Gazette 2221/30-07-12 with mandatory application in all public works.

2.35.13. THN GRC Sewerage Regulation

2.35.14. Amendment and Supplementation of Presidential Decree 71/88 "Building Fire Protection Regulation" (Government Gazette 1316/B/31-12-1998)

2.35.15. Presidential Decree 41/2018 "Building Fire Protection Regulation" (Government Gazette 80/A'/7-5-2018)

2.36. Supporting Civil Works:

2.36.1. Rebuilding of pavements after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.36.2. Associated earthworks and backfilling, drilling for the pipes, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.36.3. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.36.4. Closing of all redundant penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling to assure correct and efficient operation of new HVAC system provided by the Contractor.

2.36.5. Water, sound and fire insulation as required in all areas affected by the Contractor works.

2.37. Restoration of reinforced-concrete structures:

2.37.1. After the removal of all corroded concrete parts by using water-blasting, sandblasting the following works shall be executed according to the GRC National Regulation (Code ELOT TP 1501-14-01-04-00-2009 “Local retrofitting of concrete element damage caused by reinforcement corrosion”):

2.37.1.1. Cleaning of the steel reinforcements with mechanical wire brushing and then priming after three hours with appropriate anticorrosive material in accordance with manufacturer’s recommendations.

2.37.1.2. Application, in layers, anticorrosive mortar (the thickness shall be in accordance with manufacturer’s recommendations) covering the reinforcement.

2.37.1.3. Once the reinforcement remediation is completed, the application of two different appropriate water-proof cement coating in layers shall be followed.

2.37.1.4. Dismantling and replacement of damaged parts of networks and auxiliary works.

2.37.2. In case that the reinforcing bars are corroded and have lost more than 20% of their diameter, they shall be cut and removed. In such event, removed steel bars shall be replaced with new steel bars of the same diameter. For the above procedure the following works shall be executed in accordance with GRC National Regulation (Code PETEP:14-01-11-00 “Anchoring of new steel reinforcement bars in existing concrete elements”):

2.37.2.1. Identification of the anchor positions of the new steel reinforcement bars.

2.37.2.2. Cleaning of the concrete area in accordance with GRC National Regulation (Code PETEP:14-01-01-01 “Removal of loose or adhered material from concrete surfaces”).

2.37.2.3. Roughening of the concrete surface.

2.37.2.4. Boring holes in the concrete at the anchor positions (In General holes diameter=Steel bar diameter + 4mm) in accordance with GRC National Regulation (Code PETEP:14-01-03-02 “Drilling in concrete members with cut-off of encountered reinforcement”).

2.37.2.5. Roughening by wire-brushing inside the hole and remove dust by air blowing, wash with clean water, removal of the water by air blowing.

2.37.2.6. Insertion of sufficient amount of adhesive material.

2.37.2.7. The new steel bars shall be held properly in order to remain unmovable until the coagulation of the adhesive material.

2.37.3. The minimum thickness of reinforcement cover of slabs, beams and columns of a construction is prescribed by National Regulation (Greek Code for Reinforced Concrete 2000 in conjunction with the Greek Antiseismic Regulation 2003). In general the minimum thickness of reinforcement cover is not allowed to be less than the diameter of the steel bar+20mm for a reinforced-concrete structure in a marine environment. Especially:

2.37.3.1. For a reinforcing bar in a column the minimum thickness of reinforcement cover is not allowed to be less than 40mm and not less than the diameter of the steel bar+20mm.

2.37.3.2. For a reinforcing bar in a slab the minimum thickness of reinforcement cover is not allowed to be less than 35mm and not less than the diameter of the steel bar+20mm.

2.37.4. Once the reinforcement remediation is completed, the application of two different appropriate waterproof cement coating in layers to the external surfaces shall be followed. The restoration of the concrete area shall be completed with the works of plastering and painting.

Appendix 4: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX I-SRS-CW-GRC

Civil Works for DLOS and Fiber Optic Interconnection to the National Defense Network, Crete Island, GR

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX I - System Requirements Specifications (Civil Works) – Greece.

2. Responsibilities of the Contractor

2.1. Removal and disposal of:

2.1.1. one (1) DLOS tower with antennas;

2.1.2. all ducting, cabling, grounding, foundation, anchoring and other ancillaries related to the DLOS tower with antennas that are scoped for disposal.

2.2. Provision and installation of new DLOS tower with all associated works (antenna field preparation, foundation, trenches etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX I.

2.2.1. The DLOS tower shall be designed for minimum service life of 30 years without the need for substantial maintenance

2.2.2. The DLOS tower shall be provided with cathodic protection system designed for minimum service life of 30 years without the need for substantial maintenance

2.3. Provision and installation of Fiber Optic Interconnection to the National Defense Network with all associated ancillaries, installations and civil works:

2.3.1. The connection shall be provided to Forward Naval Base Kyriamadi NDN access point (Fiber Optic based NDN) from Palaikastro village

2.3.1.1. Starting Point in the village Palaikastro (Coordinates: 35°11’ North, 26°15’ East)

2.3.2. The works shall be implemented according to:

2.3.2.1. THN Ministerial Decision oik. 72146/2316/2008 – Government Gazette 21/B/7-1-2009: “Definition of the technical specifications of the works concerning the installations of telecommunication networks outside buildings”

2.3.2.2. THN Law 4463/2017 – Government Gazette 42/A/2017: “Measures to reduce the cost of installing high-speed electronic communications-Harmonization of legislation in Directive 2014/61/EU and other provisions”

2.3.3. The works shall include (not exhaustive list) all listed below tasks with provision and installation of all material, structures, installations and equipment:

2.3.3.1. All necessary permits, administrative arrangements and surveys as stipulated in relevant THN regulations

2.3.3.2. Site preparation, organization of works, road marking and traffic regulation measures as required for affected road sections

2.3.3.3. Construction of a trench under the road surface of various type (asphalt, reinforced concrete, gravel and others) including crossing of road junctions

2.3.3.4. The trench dimension shall be 0,10m width at its bottom, 0,50m depth

2.3.3.5. Installation of one (1) High Density Poly Ethylene 40mm diameter HDPE conduit for the fiber optic

2.3.3.6. The trench shall be filled with grout (cement based) of suitable composition compatible with the excavated soil

2.3.3.7. Restoration of pavements, other structures and installations affected by the Contractor’s work to the same standard as before commencement of the fiber optic installation

2.3.4. Installation of secure manholes with manhole covers:

2.3.4.1. The manhole covers shall be made of cast iron in accordance with EN-124 or THN equivalents

2.3.4.2. The manholes shall be fitted approximately every 500m (indicative distance that shall be adapted by the Contractor depending on the terrain and location of required installations)

2.3.4.3. Manholes shall be equipped with locking mechanism integrated on the manhole cover

2.3.4.4. Installation of fiber-optic cable and the corresponding outdoor optical connectors, including all necessary fiber optic splicing

2.3.4.5. Installation of indoor cabinets, optical patch panels, connectors and auxiliary accessories

2.4. If the Contractor identifies that existing not used/ not operational infrastructure, installations and equipment shall be removed to enable installation of the fiber-optic SSSB system and/ or DLOS tower will all supporting infrastructure, it is the Contractor's responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.5. Provision and installation of safety marking and labelling, both indoor and outdoor, for all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX I.

2.6. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.6.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.6.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.7. All metal works exposed to outdoor environment such as cable trays and ladders, cabinets, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5I: 'Very high', defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.8. The complete structural design and its execution for all structures, equipment and installations provided, installed and/or modified by the Contractor shall meet THN GRC seismic requirements. Therefore, the Contractor shall meet respective requirements as stipulated in following publications:

2.8.1. EN 1998-1:2004, Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings

2.8.2. EN 1998-3:2005 Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings and its implementation

2.8.3. EN 1998-4:2006 Eurocode 8: Design of structures for earthquake resistance – Part 4: Silos, tanks and pipelines

2.8.4. EN 1998-5:2004 Eurocode 8: Design of structures for earthquake resistance – Part 5: Foundations, retaining structures and geotechnical aspects

2.8.5. EN 1998-6:2005 Eurocode 8: Design of structures for earthquake resistance – Part 6: Towers, masts and chimneys

2.8.6. Ministerial Decision D17a/141/3/FN 275/1999 (Government Gazette 2184/B;/20-12-19990 Hellenic Earthquake Regulation 2000 (Approval of the Greek Earthquake Regulation)

2.9. The Contractor shall also consider in its design additional measures that are required to secure provided equipment against earthquake impact. Those measures include, but are not limited to, special fixing to the floors (including when installed on a raised floors) and fixing elements mounted at the rack tops to secure them to the walls.

2.10. When designing and erecting the DLOS tower with all associated ancillaries, and all other outdoor installed equipment, the Contractor shall apply Eurocode EN1991-1-4 (Eurocode 1 Part 1-4: General actions Wind actions). This publication provides guidance on the determination of natural wind actions for the structural design of buildings and civil engineering works. For the calculation procedure and especially for the determination of wind actions following shall be applied:

2.10.1. The fundamental basic wind velocity $v_{b,0}$ which is the 10 minute mean wind velocity with an annual risk of being exceeded of 0.02 irrespective of wind direction at a height of 10m above flat open country terrain, has a value in the National Annex $v_{b,0}$,0=33m/s for the Greek Islands in general.

2.10.2. The basic wind velocity v_b, which is the fundamental basic wind velocity modified to account the direction of the wind and the season, shall be calculated from the equation: $v_b = c_{dir} \times c_{season} \times v_{b,0}$. The recommended value for c_{dir} (the directional factor) and c_{season} (the season factor) is 1.

2.10.3. Terrain roughness: There are 5 terrain categories. For the two sites in Skyros Island (Kartsinoudi and Limnonari) as well as Site Sideros in Crete, the terrain category is No 0 (sea or coastal area exposed to the open sea). For the Site Kythira and Site Mavros in Crete the terrain category is No III (Area with regular cover of vegetation or building or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest).

2.11. Additionally, the Contractor shall design and execute the works in compliance with following publications respectively:

2.11.1. Presidential Decree 244/1980:"Cement Regulation for Concrete Works (Prestressed, Reinforced and Unarmed) (Government Gazette 69/A'/1989

2.11.2. ELOT EN 10080, ELOT 1421-1, ELOT 1421-3 "Standards for concrete reinforcement steels". 3. Ministerial Decision D11E/0/30123/1991 (Government Gazette 1068/B'/31-12-1991 "Amendment of the New Concrete Regulation for the Design and Construction of Concrete Works”

2.11.3. Ministerial Decision D17a/116/4/FN429/18-10-2000 (Reinforced Concrete Regulation) EKOS 2000.

2.11.4. Ministerial Decision D14/50504/2002 (Government Gazette 537/B;/1-5-2002) "Adaptation of the Concrete Technology Regulation to the Requirements of the Harmonized Standard" ELOT EN 197-1.

2.11.5. Ministerial Decision 16462/29/2001 (Government Gazette 917/B'/17.7.2001) "Cement for the Construction of Concrete Works".

2.11.6. Ministerial Decision D14/92330/08 (1416/B'/17.7.08) (Government Gazette 381/B'/24.3.2000) "Approval of the New Regulation of Concrete Reinforcement Steel Technology".

2.11.7. Ministerial Decision DIPAD/OIK. 372/2014 (Government Gazette 1457/B'/5.6.2014) "Approval of the application and use of the Eurocodes in combination with the respective National Appendices)

2.11.8. Government Gazette 59/D/3-2-1989 "Building Regulations".

2.11.9. Joint Ministerial Decision D6/B'/OIK 5825 (Government Gazette 407/B/2010) "Approval of the Energy Efficiency Regulation of Buildings (KENAK)".

2.11.10. Ministerial Decision F.7.5/1816/88/2004 (Government Gazette 470/B/5-3-2004) "Replacement of the current Regulation of Internal Electrical Installations with the ELOT Standards and other relevant provisions".

2.11.11. Manual of Standard Distribution Structures of Public Power Corporation (PPC), The Instructions Distribution of PPC SA.

2.11.12. Greek Technical Specifications-Government Gazette 2221/30-07-12 with mandatory application in all public works.

2.11.13. THN GRC Sewerage Regulation

2.11.14. Amendment and Supplementation of Presidential Decree 71/88 "Building Fire Protection Regulation" (Government Gazette 1316/B/31-12-1998)

2.11.15. Presidential Decree 41/2018 "Building Fire Protection Regulation" (Government Gazette 80/A'/7-5-2018)

2.12. Supporting Civil Works:

2.12.1. Rebuilding of pavements after pipe, cabling, ducting and other installation works.

2.12.2. Associated earthworks and backfilling, drilling for the pipes, cabling, ducting and other installation works.

2.12.3. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting and other installation works.

2.12.4. Water, sound and fire insulation as required in all areas affected by the Contractor works.

Appendix 5: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX I-SRS-CW-GRC

Civil Works at the Site Mavros, Crete Island (HF TX), GR

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX I - System Requirements Specifications (Civil Works) – Greece.

2. Responsibilities of the Contractor

2.1. Provision and installation of security fence around the existing building and antenna fields:

2.1.1. The fence shall form continues line around the existing building, the antenna fields and all other infrastructure and installations provided by the Contractor.

2.1.2. The fence shall be built in such a distance from antennas to assure that the radiation right outside the fence line is within the limits established in respective THN legislation for publically accessible areas and the fence does not interfere with SSSB system operation.

2.1.3. The fence shall be an Anti-Intruder chain link fence complying with BS 1722-14:2017 (Fences - Specification for open mesh steel panel), Category 2: Boundary/perimeter fences or THN equivalent standard.

2.1.4. The fence mesh shall be corrosion-protected (plastic coating or galvanizing or painting or combination of the mentioned technologies) and shall extend to a height of at least 2.4m above ground level throughout.

2.1.5. The fence shall be topped with three (3) strands of barbed wire or sabre wire facing outward and upwards at an angle of forty-five (45) degrees raising the total fence height by a minimum of 0.5m throughout its entire length.

2.1.6. The under-fence gap shall not exceed fifty (50) mm and the fence shall either be buried in the ground (where it is adequately protected against corrosion), buried in concrete footings or stapled to a hard standing.

2.1.7. Fence posts shall be of galvanized and corrosion-protected steel positioned at centers not exceeding 3m.

2.1.8. Fence post shall be installed in concrete foundations.

2.1.9. Fence posts shall be mounted straight/vertical to accommodate the topping according to BS 1722-10:2019 (Fences - Specification for anti-intruder fences in chain link and welded mesh) or THN equivalent standard.

2.1.10. Both main and emergency gates shall be constructed to the same standard as the fence and shall open inwards or laterally. If opened inwards, the gates shall be double leaf gates.

2.1.11. The location, where to install the emergency gates, will be provided during the Contractor's site survey.

2.1.12. The gates shall be of minimum 3.5m width, manually operated, equipped with closing mechanism and a security padlock.

2.1.13. Each door leaf shall be mounted on minimum 3(three) hinges.

2.1.14. The closing mechanism at the gates, as the minimum shall meet following requirements:

2.1.14.1. THN security approved locking mechanisms, such as a sliding locking bar that can be secured with a security approved padlock, and ground locking pins to enable it to be secured when not in use.

2.1.15. The security padlock at the gates, as the minimum shall meet following requirements:

2.1.15.1. Body made from hardened steel

2.1.15.2. Inner components made from non-corrosive materials

2.1.15.3. Hardened boron steel shackle minimum 15 mm diameter

2.1.15.4. Precision minimum 5-pin cylinder lock mechanism

2.1.15.5. Minimum 3 keys with duplication service for code

2.1.15.6. Suitable for outdoor use, weatherproof

2.1.15.7. Tested against impact, drilling, cutting, lever – test certificate /CoC issued by the supplier shall be provided

2.1.15.8. Minimum GRADE 3 – Medium / High Security: according to Central European Norm (CEN Grade) or EN 12320:2012 Building hardware. Padlocks and padlock fittings. Requirements and test methods

2.1.16. Ground surfaces under gates shall be paved with concrete and designed to bear load of wheeled vehicles with minimum 30T of the vehicle gross weight.

2.1.17. The fence shall be designed and installed to maximize the use of straight sections in order to permit an unobstructed field of vision.

2.2. If the Contractor identifies that existing fence including its foundations and/or any other not used/ not operational infrastructure, installations and equipment shall be removed to enable installation and correct O&M of SSSB system and its supporting infrastructure, it is the Contractor's responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.3. If the Contractor decides to install new fuel tanks at the locations of currently existing fuel tank, the Contractor shall also remove and dispose the 1 diesel buried fuel tanks (20.000 lt tank) for the generators:

2.3.1. Removal and disposal of existing fuel tanks together with existing pipes, pumps, cathodic protection and other auxiliaries.

2.3.2. Cleaning of the existing tanks with removal of sludge from its bottom, ventilation to "gas free", removal and disposal of waste o fuel

2.3.3. Removal and disposal of the existing pavement cover over the existing tanks

2.3.4. Inspection of the internal surface of concrete tank pits and restoration of the concrete pits with liquid injection/ ejection using suitable mortars

2.3.5. Refurbishment of existing tank manholes (including their still covers/ hatches)

2.3.6. Execute all necessary activities, according to requirements stipulated in respective THN laws and regulations, in case the Contractor causes or identifies fuel spill during removal of the buried fuel tanks

2.4. Regardless if the Contractor installs new fuel tanks in the current fuel tanks location or else, it remains the Contractor's responsibility:

2.4.1. to remove and dispose of all sections of fuel pipes that are installed in the building and anywhere else on the ground surface and above the ground

2.4.2. to remove and dispose of all pumps, valves and other auxiliaries related to currently existing fuel supply system, that are installed in the building and anywhere else on the ground surface and above the ground

2.5. Provision and installation of new buried fuel tanks with cathodic protection, piping, cabling and all ancillaries as stipulated in the SOW - ANNEX I.

2.6. Provision and installation of new concrete pavement over the new fuel tanks.

2.7. Removal and disposal of existing HVAC system:

2.7.1. Removal and disposal of outdoor units

2.7.2. Removal and disposal of HVAC indoor units dedicated to SSSB equipment room

2.7.3. Removal and disposal of all piping, cabling, air ducting, cable trays, fixings, control panels, and other ancillaries related to the HVAC units that are scoped for disposal

2.8. Provision and installation of new HVAC system dedicated for SSSB system with all piping, cabling and ancillaries as stipulated in the SOW - ANNEX I:

2.8.1. Renovation of metallic fence for outdoor HVAC unit:

2.8.1.1. Sandblasting as needed, complete removal of corrosion, anticorrosive painting as specified further herein and in the SOW – ANNEX I;

2.8.1.2. Repair and greasing of hinges;

2.8.1.3. Repair of locking mechanisms for padlocks

2.8.2. The padlock, as the minimum shall meet following requirements:

2.8.2.1. Body made from hardened steel

2.8.2.2. Inner components made from non-corrosive materials

2.8.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.8.2.4. Precision minimum 3-pin cylinder lock mechanism

2.8.2.5. Minimum 3 keys

2.8.2.6. Suitable for outdoor use, weatherproof

2.8.3. Outdoor HVAC unit(s) shall be installed in adequate housing for local weather conditions with impact of sea water mist

2.8.4. Modification and refurbishment of existing reinforced concrete foundation or removal and disposal of existing foundation and provision and installation of new reinforced concrete foundation

2.8.5. If currently existing fenced location is not sufficient for new outdoor HVAC unit(s) (including convenient and safe access for its O&M) new location shall be provided / built by the Contractor, with new foundation and new fence of the specification at the minimum equal to existing one.as shown in figure 1. In such case, the Contractor shall also remove and dispose of existing fence and foundation of the existing outdoor HVAC unit.

Figure 1

2.9. Renovation of two ventilation shafts with their turrets, utilized by current equipment:

2.9.1. The renovation of metallic part of the shafts and turrets shall include:

2.9.1.1. sandblasting of their entire structure, complete removal of corrosion, anticorrosive painting as specified further herein and in the SOW – ANNEX I

2.9.2. The restoration of concrete/ masonry part of the turrets shall be done according to procedure described in this appendix further below

2.9.3. Old insulation on the turrets and at their interface with the building roof shall be removed as required and new insulation shall be installed

2.9.4. In case that a number of the ventilation shafts become redundant due to the dismantling of current, redundant equipment or the cooling method/ procedure for the new SSSB equipment differs from the existing ones, then appropriate closure of the openings to the roof structure shall be executed. In such case, the Contractor shall remove and dispose redundant shafts and turrets.

2.9.5. If forced ventilation utilizing raised floor structures (including air ducting) is the required method for cooling / operating new SSSB equipment, the Contractor shall also provide and install the raised floor. In such case the raised floor shall meet requirements stipulated in the SOW - ANNEX I, paragraph 24.18.

2.10. Provision and installation of adequate number of ventilation shafts and turrets for new SSSB equipment as required.

2.11. Removal and disposal of RF cabling manhole covers at the entry points to the COMMS building.

2.12. Provision and installation of new steel RF cabling manhole covers at the entry points to the COMMS building:

2.12.1. Locking mechanisms, such as a sliding locking bar that can be secured with a padlock to enable it to be secured when not in use.

2.12.2. The padlock, as the minimum shall meet following requirements:

2.12.2.1. Body made from hardened steel

2.12.2.2. Inner components made from non-corrosive materials

2.12.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.12.2.4. Precision, minimum 3-pin cylinder lock mechanism

2.12.2.5. Minimum 3 keys

2.12.2.6. Suitable for outdoor use, weatherproof

2.13. Refurbishment of the existing RF cabling manholes including restoration of the concrete walls with liquid injection/ ejection using suitable mortar.

2.14. Removal and disposal of power distribution system, both indoor and outdoor, that becomes redundant when the new SSSB system with its dedicated electrical installation (further called SSSB electrical installation) is provided and installed by the Contractor:

2.14.1. The scope includes removal and disposal of redundant cabling, sockets, power panels, junction boxes, switches, cables, trays, ducts and other ancillaries.

2.14.2. THN may wish to preserve some parts of the redundant electrical installation and its ancillaries. Relevant guidance will be provided to the Contractor at a later stage.

2.15. Provision and installation of SSSB electrical installation with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.15.1. Complete SSSB electrical installation, both indoor and outdoor, with dedicated EPDBs (Equipment Power Distribution Boards), including surge protection devices and residual current devices - RCD, required to power all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, fire detection and alarm, power distributed to antenna fields etc.)

2.15.2. Integration of the SSSB electrical installation with existing MPDB (Main Power Distribution Board) and Medium Voltage Transformer:

2.15.2.1. The integration shall include installation of adequate circuit breakers, cabling provision and installation, and modification of existing power distribution system and the power boards/ panels as required to connect power cables for SSSB electrical installation

2.15.3. If the integration with existing MPDB is not possible, the Contractor shall:

2.15.3.1. remove and dispose of the existing MPDB

2.15.3.2. provide and install a new MPDB

2.15.3.3. integrate SSSB electrical installation with the new MPDB

2.15.3.4. integrate all remaining electrical installation of entire building with the new MPDB

2.16. Provision and installation of UPS system as stipulated in the SOW – ANNEX I.

2.17. Removal and disposal of two existing power generators together with existing piping, cabling, air intake, air outlet, louvers, control panels, grounding and all other ancillaries.

2.18. It is possible that THN GRC decides to preserve the power generators. In such case, the Contractor shall remove power generators from their current location and store them within the site. Further guidance will be provided to the Contractor at a later stage.

2.19. Provision and installation of two fully redundant power generators with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.19.1. The PGS shall be the back-up (emergency) source of electrical power and shall be capable to provide power for entire SSSB site in case of main power failure. Hence, the Contractor shall design the system and provide equipment to meet requirements for power generators rated as Emergency Standby Power (ESP) according to ISO 8528-1:2018.

2.19.2. Modification and refurbishment of existing reinforced concrete foundation or removal and disposal of existing foundation and provision and installation of new reinforced concrete foundation for both power generators.

2.19.3. The foundation (regardless if modification of existing foundation is executed or new foundation is provided) shall be designed and built in such a way to prevent transfer of vibrations from generators to the rest of building structure.

2.19.4. The existing power load of the site (without equipment that shall be provided by the Contractor) that shall be connected to the PGS is 15 kW

2.19.5. The Contractor shall provide the PGS with 20% of spare capacity for further load expansion

2.20. Removal and disposal of lightning protection and grounding system, both indoor and outdoor, that becomes redundant when the new SSSB system with its dedicated lightning protection and grounding system (further called SSSB lightning protection and grounding system) is provided and installed by the Contractor:

2.20.1. The scope includes removal and disposal of redundant cabling, conductors, arresters, grounding rings (including buried, roof and mast mounted elements) grounding rods, lightning rods, trays, ducts and other ancillaries.

2.20.2. THN may wish to preserve some parts of the redundant lightning protection and grounding system and its ancillaries. Relevant guidance will be provided to the Contractor at a later stage.

2.21. Provision and installation of SSSB lightning protection and grounding system with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.21.1. Complete SSSB lightning protection and grounding system, both indoor and outdoor (including surge protection devices, grounding rings (including buried, roof and mast mounted elements), grounding rods, lightning rods, trays, ducts and other ancillaries) required to protect all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, fire detection and alarm, antennas, fences etc.)

2.21.2. Integration of the SSSB lightning protection and grounding system with existing lightning protection and grounding system of the site according to respective THN laws and regulations:

2.21.2.1. The integration shall include execution of necessary earth works, welding, anticorrosive protection, and necessary modification of existing lightning protection and grounding system.

2.22. Removal and disposal of:

2.22.1. one (1) ADCAB antenna;

2.22.2. one (1) UHF antennas;

2.22.3. one (1) SSSB existing HF RX antenna;

2.22.4. one (1) DLOS tower with antennas;

2.22.5. all ducting, cabling, grounding, guyed lines, foundation, anchoring and other ancillaries related to the antennas that are scoped for disposal.

2.23. Provision and installation of required number of new antenna masts capable of supporting the SSSB system and new DLOS tower with all associated works (antenna field preparation, foundation, trenches etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX I.

2.23.1. The antenna masts and the DLOS tower shall be designed for minimum service life of 30 years without the need for substantial maintenance.

2.23.2. The antenna masts and the DLOS tower shall be provided with cathodic protection system (including protection of the guy anchors) designed for minimum service life of 30 years without the need for substantial maintenance.

2.24. Removal and disposal of the SSSB, ADCAB, UHF equipment (including Rx, matrix, communication control system etc.) located in the COMMS building.

2.25. Removal of current SSSB HF receivers and UHF radios located in the COMMS building and storage of this equipment within existing building on the site.

2.26. Provision and installation of fire detection and alarm system in SSSB equipment room and in power generator room as stipulated in the SOW - ANNEX I.

2.27. The fire alarm:

2.27.1. Shall be reported to the site duty officer (the duty officer office location will be provided during the Contractor's site survey)

2.27.2. Shall be reported to the site commander (the site commander office location will be provided during the Contractor's site survey)

2.27.3. Shall send notifications /alerts to the mobile phones of the site commander and the site duty officer

2.28. Provision and installation of fire extinguishers in SSSB equipment room and in power generator room as stipulated in the SOW - ANNEX I.

2.29. Provision and installation of safety marking and labelling, both indoor and outdoor, for all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX I.

2.30. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.30.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.30.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.31. All metal works exposed to outdoor environment such as antenna masts with their ancillaries, HVAC components, cable trays and ladders, fences, gates, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5M Maritime, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.32. The complete structural design and its execution for all structures, equipment and installations provided, installed and/or modified by the Contractor shall meet THN GRC seismic requirements. Therefore, the Contractor shall meet respective requirements as stipulated in following publications:

2.32.1. EN 1998-1:2004, Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings

2.32.2. EN 1998-3:2005 Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings and its implementation

2.32.3. EN 1998-4:2006 Eurocode 8: Design of structures for earthquake resistance – Part 4: Silos, tanks and pipelines

2.32.4. EN 1998-5:2004 Eurocode 8: Design of structures for earthquake resistance – Part 5: Foundations, retaining structures and geotechnical aspects

2.32.5. EN 1998-6:2005 Eurocode 8: Design of structures for earthquake resistance – Part 6: Towers, masts and chimneys

2.32.6. Ministerial Decision D17a/141/3/FN 275/1999 (Government Gazette 2184/B;/20-12-19990 Hellenic Earthquake Regulation 2000 (Approval of the Greek Earthquake Regulation)

2.33. The Contractor shall also consider in its design additional measures that are required to secure provided equipment against earthquake impact. Those measures include, but are not limited to, special fixing to the floors (including when installed on a raised floors) and fixing elements mounted at the rack tops to secure them to the walls.

2.34. When designing and erecting masts with all associated ancillaries, fences and all other outdoor installed equipment, the Contractor shall apply Eurocode EN1991-1-4 (Eurocode 1 Part 1-4: General actions Wind actions). This publication provides guidance on the determination of natural wind actions for the structural design of buildings and civil engineering works. For the calculation procedure and especially for the determination of wind actions following shall be applied:

2.34.1. The fundamental basic wind velocity $v_{b,0}$ which is the 10 minute mean wind velocity with an annual risk of being exceeded of 0.02 irrespective of wind direction at a height of 10m above flat open country terrain, has a value in the National Annex $v_{b,0}$,0=33m/s for the Greek Islands in general.

2.34.2. The basic wind velocity v_b, which is the fundamental basic wind velocity modified to account the direction of the wind and the season, shall be calculated from the equation: $v_b = c_{dir} \times c_{season} \times v_{b,0}$. The recommended value for c_{dir} (the directional factor) and c_{season} (the season factor) is 1.

2.34.3. Terrain roughness: There are 5 terrain categories. For the two sites in Skyros Island (Kartsinoudi and Limnonari) as well as Site Sideros in Crete, the terrain category is No 0 (sea or coastal area exposed to the open sea). For the Site Kythira and Site Mavros in Crete the terrain category is No III (Area with regular cover of vegetation or building or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest).

2.35. Additionally, the Contractor shall design and execute the works in compliance with following publications respectively:

2.35.1. Presidential Decree 244/1980:"Cement Regulation for Concrete Works (Prestressed, Reinforced and Unarmed) (Government Gazette 69/A'/1989

2.35.2. ELOT EN 10080, ELOT 1421-1, ELOT 1421-3 "Standards for concrete reinforcement steels". 3. Ministerial Decision D11E/0/30123/1991 (Government Gazette 1068/B'/31-12-1991 "Amendment of the New Concrete Regulation for the Design and Construction of Concrete Works”

2.35.3. Ministerial Decision D17a/116/4/FN429/18-10-2000 (Reinforced Concrete Regulation) EKOS 2000.

2.35.4. Ministerial Decision D14/50504/2002 (Government Gazette 537/B;/1-5-2002) "Adaptation of the Concrete Technology Regulation to the Requirements of the Harmonized Standard" ELOT EN 197-1.

2.35.5. Ministerial Decision 16462/29/2001 (Government Gazette 917/B'/17.7.2001) "Cement for the Construction of Concrete Works".

2.35.6. Ministerial Decision D14/92330/08 (1416/B'/17.7.08) (Government Gazette 381/B'/24.3.2000) "Approval of the New Regulation of Concrete Reinforcement Steel Technology".

2.35.7. Ministerial Decision DIPAD/OIK. 372/2014 (Government Gazette 1457/B'/5.6.2014) "Approval of the application and use of the Eurocodes in combination with the respective National Appendices)

2.35.8. Government Gazette 59/D/3-2-1989 "Building Regulations".

2.35.9. Joint Ministerial Decision D6/B'/OIK 5825 (Government Gazette 407/B/2010) "Approval of the Energy Efficiency Regulation of Buildings (KENAK)".

2.35.10. Ministerial Decision F.7.5/1816/88/2004 (Government Gazette 470/B/5-3-2004) "Replacement of the current Regulation of Internal Electrical Installations with the ELOT Standards and other relevant provisions".

2.35.11. Manual of Standard Distribution Structures of Public Power Corporation (PPC), The Instructions Distribution of PPC SA.

2.35.12. Greek Technical Specifications-Government Gazette 2221/30-07-12 with mandatory application in all public works.

2.35.13. THN GRC Sewerage Regulation

2.35.14. Amendment and Supplementation of Presidential Decree 71/88 "Building Fire Protection Regulation" (Government Gazette 1316/B/31-12-1998)

2.35.15. Presidential Decree 41/2018 "Building Fire Protection Regulation" (Government Gazette 80/A'/7-5-2018)

2.36. Supporting Civil Works:

2.36.1. Rebuilding of pavements after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.36.2. Associated earthworks and backfilling, drilling for the pipes, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.36.3. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.36.4. Closing of all redundant penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling to assure correct and efficient operation of new HVAC system provided by the Contractor.

2.36.5. Water, sound and fire insulation as required in all areas affected by the Contractor works.

2.37. Restoration of reinforced-concrete structures:

2.37.1. After the removal of all corroded concrete parts by using water-blasting, sandblasting the following works shall be executed according to the GRC National Regulation (Code ELOT TP 1501-14-01-04-00-2009 “Local retrofitting of concrete element damage caused by reinforcement corrosion”):

2.37.1.1. Cleaning of the steel reinforcements with mechanical wire brushing and then priming after three hours with appropriate anticorrosive material in accordance with manufacturer’s recommendations.

2.37.1.2. Application, in layers, anticorrosive mortar (the thickness shall be in accordance with manufacturer’s recommendations) covering the reinforcement.

2.37.1.3. Once the reinforcement remediation is completed, the application of two different appropriate water-proof cement coating in layers shall be followed.

2.37.1.4. Dismantling and replacement of damaged parts of networks and auxiliary works.

2.37.2. In case that the reinforcing bars are corroded and have lost more than 20% of their diameter, they shall be cut and removed. In such event, removed steel bars shall be replaced with new steel bars of the same diameter. For the above procedure the following works shall be executed in accordance with GRC National Regulation (Code PETEP:14-01-11-00 “Anchoring of new steel reinforcement bars in existing concrete elements”):

2.37.2.1. Identification of the anchor positions of the new steel reinforcement bars.

2.37.2.2. Cleaning of the concrete area in accordance with GRC National Regulation (Code PETEP:14-01-01-01 “Removal of loose or adhered material from concrete surfaces”).

2.37.2.3. Roughening of the concrete surface.

2.37.2.4. Boring holes in the concrete at the anchor positions (In General holes diameter=Steel bar diameter + 4mm) in accordance with GRC National Regulation (Code PETEP:14-01-03-02 “Drilling in concrete members with cut-off of encountered reinforcement”).

2.37.2.5. Roughening by wire-brushing inside the hole and remove dust by air blowing, wash with clean water, removal of the water by air blowing.

2.37.2.6. Insertion of sufficient amount of adhesive material.

2.37.2.7. The new steel bars shall be held properly in order to remain unmovable until the coagulation of the adhesive material.

2.37.3. The minimum thickness of reinforcement cover of slabs, beams and columns of a construction is prescribed by National Regulation (Greek Code for Reinforced Concrete 2000 in conjunction with the Greek Antiseismic Regulation 2003). In general the minimum thickness of reinforcement cover is not allowed to be less than the diameter of the steel bar+20mm for a reinforced-concrete structure in a marine environment. Especially:

2.37.3.1. For a reinforcing bar in a column the minimum thickness of reinforcement cover is not allowed to be less than 40mm and not less than the diameter of the steel bar+20mm.

2.37.3.2. For a reinforcing bar in a slab the minimum thickness of reinforcement cover is not allowed to be less than 35mm and not less than the diameter of the steel bar+20mm.

2.37.4. Once the reinforcement remediation is completed, the application of two different appropriate waterproof cement coating in layers to the external surfaces shall be followed. The restoration of the concrete area shall be completed with the works of plastering and painting.

Appendix 6: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX I-SRS-CW-GRC

Civil Works at the Site Limnonari, Skyros Island (HF RX), GR

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX I - System Requirements Specifications (Civil Works) – Greece.

2. Responsibilities of the Contractor

2.1. Provision and installation of security fence around the existing building and antenna fields:

2.1.1. The fence shall form continues line around the existing building, the antenna fields and all other infrastructure and installations provided by the Contractor, with the exception of the site perimeter section along the coastline/ waterfront. In case the fence sections built by the Contractor do not reach the coastline on the left and right side of the antenna fields, the fence shall also be built along the coastline.

2.1.2. The fence shall be built in such a distance from antennas to assure that the radiation right outside the fence line is within the limits established in respective THN legislation for publically accessible areas. and the fence does not interfere with SSSB system operation.

2.1.3. The fence shall be an Anti-Intruder chain link fence complying with BS 1722-14:2017 (Fences - Specification for open mesh steel panel), Category 2: Boundary/perimeter fences or THN equivalent standard.

2.1.4. The fence mesh shall be corrosion-protected (plastic coating or galvanizing or painting or combination of the mentioned technologies) and shall extend to a height of at least 2.4m above ground level throughout.

2.1.5. The fence shall be topped with three (3) strands of barbed wire or sabre wire facing outward and upwards at an angle of forty-five (45) degrees raising the total fence height by a minimum of 0.5m throughout its entire length.

2.1.6. The under-fence gap shall not exceed fifty (50) mm and the fence shall either be buried in the ground (where it is adequately protected against corrosion), buried in concrete footings or stapled to a hard standing.

2.1.7. Fence posts shall be of galvanized and corrosion-protected steel positioned at centers not exceeding 3m.

2.1.8. Fence post shall be installed in concrete foundations.

2.1.9. Fence posts shall be mounted straight/vertical to accommodate the topping according to BS 1722-10:2019 (Fences - Specification for anti-intruder fences in chain link and welded mesh) or THN equivalent standard.

2.1.10. Both main and emergency gates shall be constructed to the same standard as the fence and shall open inwards or laterally. If opened inwards, the gates shall be double leaf gates.

2.1.11. The location, where to install the emergency gates, will be provided during the Contractor’s site survey.

2.1.12. The gates shall be of minimum 3.5m width, manually operated, equipped with closing mechanism and a security padlock.

2.1.13. Each door leaf shall be mounted on minimum 3(three) hinges.

2.1.14. The closing mechanism at the gates, as the minimum shall meet following requirements:

2.1.14.1. THN security approved locking mechanisms, such as a sliding locking bar that can be secured with a security approved padlock, and ground locking pins to enable it to be secured when not in use.

2.1.15. The security padlock at the gates, as the minimum shall meet following requirements:

2.1.15.1. Body made from hardened steel

2.1.15.2. Inner components made from non-corrosive materials

2.1.15.3. Hardened boron steel shackle minimum 15 mm diameter

2.1.15.4. Precision minimum 5-pin cylinder lock mechanism

2.1.15.5. Minimum 3 keys with duplication service for code

2.1.15.6. Suitable for outdoor use, weatherproof

2.1.15.7. Tested against impact, drilling, cutting, lever – test certificate /CoC issued by the supplier shall be provided

2.1.15.8. Minimum GRADE 3 – Medium / High Security: according to Central European Norm (CEN Grade) or EN 12320:2012 Building hardware. Padlocks and padlock fittings. Requirements and test methods

2.1.16. Ground surfaces under gates shall be paved with concrete and designed to bear load of wheeled vehicles with minimum 30T of the vehicle gross weight.

2.1.17. The fence shall be designed and installed to maximize the use of straight sections in order to permit an unobstructed field of vision.

2.2. If the Contractor identifies that existing fence including its foundations and/or any other not used/ not operational infrastructure, installations and equipment shall be removed to enable installation and correct O&M of SSSB system and its supporting infrastructure, it is the Contractor's responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.3. If the Contractor decides to install new fuel tanks at the location of currently existing fuel tank, the Contractor shall also remove and dispose 1(one) diesel buried fuel tank (20000 Liter) for the generators:

2.3.1. Removal and disposal of existing fuel tank together with existing pipes, pumps, cathodic protection and other auxiliaries.

2.3.2. Cleaning of the existing tank with removal of sludge from its bottom, ventilation to "gas free", removal and disposal of waste o fuel

2.3.3. Removal and disposal of the existing pavement cover over the existing tank

2.3.4. Inspection of the internal surface of concrete tank pit and restoration of the concrete pit with liquid injection/ ejection using suitable mortars

2.3.5. Refurbishment of existing tank manholes (including their still covers/ hatches)

2.3.6. Execute all necessary activities, according to requirements stipulated in respective THN laws and regulations, in case the Contractor causes or identifies fuel spill during removal of the buried fuel tanks

2.4. Regardless if the Contractor installs new fuel tanks in the current fuel tanks location or else, it remains the Contractor's responsibility:

2.4.1. to remove and dispose of all sections of fuel pipes that are installed in the building and anywhere else on the ground surface and above the ground

2.4.2. to remove and dispose of all pumps, valves and other auxiliaries related to currently existing fuel supply system, that are installed in the building and anywhere else on the ground surface and above the ground

2.5. Provision and installation of new buried fuel tanks with cathodic protection, piping, cabling and all ancillaries as stipulated in the SOW - ANNEX I.

2.5.1. The site has no main power supply. Therefore, the fuel tanks shall be sized accordingly to support entire site without the need of refueling for minimum of 15 (fifteen) days, namely:

2.5.1.1. all equipment provided by the Contractor under the scope of SSSB Project

2.5.1.2. all other existing installations and systems

2.5.1.3. 20% for further expansion in power generator loads

2.6. Provision and installation of new concrete pavement over the new fuel tanks.

2.7. Removal and disposal of existing HVAC system:

2.7.1. Removal and disposal of outdoor units including metallic fence around them

2.7.2. Removal and disposal of HVAC indoor units dedicated to SSSB equipment room

2.7.3. Removal and disposal of all piping, cabling, air ducting, cable trays, fixings, control panels, and other ancillaries related to the HVAC units that are scoped for disposal

2.8. Provision and installation of new HVAC system dedicated for SSSB system with all piping, cabling and ancillaries as stipulated in the SOW - ANNEX I:

2.8.1. Provision and installation of metallic fence for outdoor HVAC unit(s):

2.8.1.1. Specification of the fence at least equal to existing one as shown in figure 1.

Figure 1

2.8.1.2. Locking mechanisms, such as a sliding locking bar that can be secured with a padlock to enable it to be secured when not in use.

2.8.2. The padlock, as the minimum shall meet following requirements:

2.8.2.1. Body made from hardened steel

2.8.2.2. Inner components made from non-corrosive materials

2.8.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.8.2.4. Precision minimum 3-pin cylinder lock mechanism

2.8.2.5. Minimum 3 keys

2.8.2.6. Suitable for outdoor use, weatherproof

2.8.3. Outdoor HVAC unit(s) shall be installed in adequate housing for local weather conditions with impact of sea water mist

2.8.4. Modification and refurbishment of existing reinforced concrete foundation or removal and disposal of existing foundation and provision and installation of new reinforced concrete foundation

2.9. Restoration works of the roof (externally), ceiling (internally) and walls of the COMMS Limnonari building, which is a reinforced concrete structure. In several areas at the roof of the building and the front facade the concrete part has been eroded and the steel reinforcement has been exposed and corroded:

2.9.1. Restoration of reinforced-concrete structures as described in this appendix further below.

2.9.2. Restoration of entire front facade including plastering and painting with special weather resistant coatings (painting scheme and RAL color code will be provided by the Purchaser at a later stage).

2.9.3. Removal of old insulation as required at the roof sections along the front facade of the building and installation/ installation of a new one.

2.9.4. Restoration of all internal walls, floors and ceiling, including plastering and painting in the room for SSSB equipment and power generator (RAL color code will be provided by the Purchaser at a later stage).

2.9.5. Concrete floor painting shall meet requirements as stipulated in SOW - ANNEX I

2.10. Removal and disposal of two ventilation shafts, utilized by current equipment:

2.10.1. In case that a number of the ventilation shafts become redundant due to the dismantling of current, redundant equipment or the cooling method / procedure for the new SSSB equipment differs from the existing ones, then appropriate closure of the openings in the building structure shall be executed.

2.10.2. If forced ventilation utilizing raised floor structures (including air ducting) is the required method for cooling / operating new SSSB equipment, the Contractor shall also provide and install the raised floor. In such case the raised floor shall meet requirements stipulated in the SOW - ANNEX I.

2.11. Provision and installation of adequate number of ventilation shafts and turrets for new SSSB equipment as required.

2.12. Removal and disposal of RF cabling manhole covers at the entry points to the COMMS building.

2.13. Provision and installation of new steel RF cabling manhole covers at the entry points to the COMMS building:

2.13.1. Locking mechanisms, such as a sliding locking bar that can be secured with a padlock to enable it to be secured when not in use.

2.13.2. The padlock, as the minimum shall meet following requirements:

2.13.2.1. Body made from hardened steel

2.13.2.2. Inner components made from non-corrosive materials

2.13.2.3. Hardened boron steel shackle minimum 10 mm diameter

2.13.2.4. Precision, minimum 3-pin cylinder lock mechanism

2.13.2.5. Minimum 3 keys

2.13.2.6. Suitable for outdoor use, weatherproof

2.14. Refurbishment of the existing RF cabling manholes including restoration of the concrete walls with liquid injection/ ejection using suitable mortar.

2.15. Removal and disposal of power distribution system, both indoor and outdoor, that becomes redundant when the new SSSB system with its dedicated electrical installation (further called SSSB electrical installation) is provided and installed by the Contractor:

2.15.1. The scope includes removal and disposal of redundant cabling, sockets, power panels, junction boxes, switches, cables, trays, ducts and other ancillaries.

2.15.2. THN may wish to preserve some parts of the redundant electrical installation and its ancillaries. Relevant guidance will be provided to the Contractor at a later stage.

2.16. Provision and installation of SSSB electrical installation with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.16.1. Complete SSSB electrical installation, both indoor and outdoor, with dedicated EPDBs (Equipment Power Distribution Boards), including surge protection devices and residual current devices (RCD), required to power all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, fire detection and alarm, power distributed to antenna fields etc.)

2.16.2. Integration of the SSSB electrical installation with existing MPDB (Main Power Distribution Board):

2.16.2.1. The integration shall include installation of adequate circuit breakers, and modification of existing power distribution system and the power boards/ panels as required to connect power cables for SSSB electrical installation

2.16.3. If the integration with existing MPDB is not possible, the Contractor shall:

2.16.3.1. remove and dispose of the existing MPDB

2.16.3.2. provide and install a new MPDB

2.16.3.3. integrate SSSB electrical installation with the new MPDB

2.16.3.4. integrate all remaining electrical installation of entire building with the new MPDB

2.17. Provision and installation of UPS system as stipulated in the SOW – ANNEX I.

2.18. Removal and disposal of two existing power generators together with existing piping, cabling, air intake, air outlet, louvers, control panels, grounding and all other ancillaries.

2.19. It is possible that THN GRC decides to preserve the power generators. In such case, the Contractor shall remove power generators from their current location and store them within the site. Further guidance will be provided to the Contractor at a later stage.

2.20. Provision and installation of two fully redundant power generators with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.20.1. The site has no main power supply. Therefore, the power generators shall be sized accordingly to support entire site, namely:

2.20.1.1. all equipment provided by the Contractor under the scope of SSSB Project

2.20.1.2. all other existing installations and systems of 15kW power load

2.20.1.3. 20% for further expansion in power generator loads

2.20.2. The PGS shall be the primary source of electrical power and shall be capable to provide power continuously for entire SSSB site. Hence, the Contractor shall design the system and provide equipment to meet requirements for power generators rated as Prime Rated Power (PRP) according to ISO 8528-1:2018

2.20.2.1. Unlimited number of hours per year (8760 hr/yr less service)

2.20.2.2. Variable load

2.20.2.3. Not to exceed 70% average of the Prime rating during any operating period of 24 hours

2.20.3. Modification and refurbishment of existing reinforced concrete foundation or removal and disposal of existing foundation and provision and installation of new reinforced concrete foundation for both power generators.

2.20.4. The foundation (regardless if modification of existing foundation is executed or new foundation is provided) shall be designed and built in such a way to prevent transfer of vibrations from generators to the rest of building structure.

2.21. Removal and disposal of lightning protection and grounding system, both indoor and outdoor, that becomes redundant when the new SSSB system with its dedicated lightning protection and grounding system (further called SSSB lightning protection and grounding system) is provided and installed by the Contractor:

2.21.1. The scope includes removal and disposal of redundant cabling, conductors, arresters, grounding rings (including buried, roof and mast mounted elements) grounding rods, lightning rods, trays, ducts and other ancillaries.

2.21.2. THN may wish to preserve some parts of the redundant lightning protection and grounding system and its ancillaries. Relevant guidance will be provided to the Contractor at a later stage.

2.22. Provision and installation of SSSB lightning protection and grounding system with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.22.1. Complete SSSB lightning protection and grounding system, both indoor and outdoor (including surge protection devices, grounding rings (including buried, roof and mast mounted elements), grounding rods, lightning rods, trays, ducts and other ancillaries) required to protect all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, fire detection and alarm, antennas, fences etc.)

2.22.2. Integration of the SSSB lightning protection and grounding system with existing lightning protection and grounding system of the site according to respective THN laws and regulations:

2.22.2.1. The integration shall include execution of necessary earth works, welding, anticorrosive protection, and necessary modification of existing lightning protection and grounding system.

2.23. Removal and disposal of:

2.23.1. one (1) ADCAB antenna;

2.23.2. one (1) SSSB HF RX antenna;

2.23.3. one (1) UHF antennas;

2.23.4. all ducting, cabling, grounding, guyed lines, foundation, anchoring and other ancillaries related to the antennas that are scoped for disposal.

2.24. Provision and installation of required number of new antenna masts capable of supporting the SSSB system with all associated works (antenna field preparation, foundation, trenches etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX I.

2.24.1. The antenna masts shall be designed for minimum service life of 30 years without the need for substantial maintenance

2.24.2. The antenna masts shall be provided with cathodic protection system (including protection of the guy anchors) designed for minimum service life of 30 years without the need for substantial maintenance

2.25. Removal and disposal of the SSSB, ADCAB and UHF equipment located in the COMMS building.

2.26. Removal of current SSSB HF receivers and UHF radios located in the COMMS building and storage of this equipment within existing building on the site.

2.27. Provision and installation of fire detection and alarm system in SSSB equipment room and in power generator room as stipulated in the SOW - ANNEX I.

2.28. The fire alarm:

2.28.1. Shall be reported to the site duty officer (the duty officer office location will be provided during the Contractor’s site survey)

2.28.2. Shall be reported to the site commander (the site commander office location will be provided during the Contractor’s site survey)

2.28.3. Shall send notifications /alerts to the mobile phones of the site commander and the site duty officer

2.29. Provision and installation of fire extinguishers in SSSB equipment room and in power generator room as stipulated in the SOW - ANNEX I.

2.30. Provision and installation of safety marking and labelling, both indoor and outdoor, for all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX I.

2.31. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.31.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.31.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.32. All metal works exposed to outdoor environment such as antenna masts with their ancillaries, HVAC components, cable trays and ladders, fences, gates, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5M Maritime, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.33. The complete structural design and its execution for all structures, equipment and installations provided, installed and/or modified by the Contractor shall meet THN GRC seismic requirements. Therefore, the Contractor shall meet respective requirements as stipulated in following publications:

2.33.1. EN 1998-1:2004, Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings

2.33.2. EN 1998-3:2005 Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings and its implementation

2.33.3. EN 1998-4:2006 Eurocode 8: Design of structures for earthquake resistance – Part 4: Silos, tanks and pipelines

2.33.4. EN 1998-5:2004 Eurocode 8: Design of structures for earthquake resistance – Part 5: Foundations, retaining structures and geotechnical aspects

2.33.5. EN 1998-6:2005 Eurocode 8: Design of structures for earthquake resistance – Part 6: Towers, masts and chimneys

2.33.6. Ministerial Decision D17a/141/3/FN 275/1999 (Government Gazette 2184/B;/20-12-19990 Hellenic Earthquake Regulation 2000 (Approval of the Greek Earthquake Regulation).

2.34. The Contractor shall also consider in its design additional measures that are required to secure provided equipment against earthquake impact. Those measures include, but are not limited to, special fixing to the floors (including when installed on a raised floors) and fixing elements mounted at the rack tops to secure them to the walls.

2.35. When designing and erecting masts with all associated ancillaries, fences and all other outdoor installed equipment, the Contractor shall apply Eurocode EN1991-1-4 (Eurocode 1 Part 1-4: General actions Wind actions). This publication provides guidance on the determination of natural wind actions for the structural design of buildings and civil engineering works. For the calculation procedure and especially for the determination of wind actions following shall be applied:

2.35.1. The fundamental basic wind velocity $v_{b,0}$ which is the 10 minute mean wind velocity with an annual risk of being exceeded of 0.02 irrespective of wind direction at a height of 10m above flat open country terrain, has a value in the National Annex $v_{b,0}$,0=33m/s for the Greek Islands in general.

2.35.2. The basic wind velocity v_b, which is the fundamental basic wind velocity modified to account the direction of the wind and the season, shall be calculated from the equation: $v_b=c_{dir}$ x c_{season} x $v_{b,0}$. The recommended value for c_{dir} (the directional factor) and c_{season} (the season factor) is 1.

2.35.3. Terrain roughness: There are 5 terrain categories. For the two sites in Skyros Island (Kartsinoudi and Limnonari) as well as Site Sideros in Crete, the terrain category is No 0 (sea or coastal area exposed to the open sea). For the Site Kythira and Site Mavros in Crete the terrain category is No III (Area with regular cover of vegetation or building or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest).

2.36. Additionally, the Contractor shall design and execute the works in compliance with following publications respectively:

2.36.1. Presidential Decree 244/1980:"Cement Regulation for Concrete Works (Prestressed, Reinforced and Unarmed) (Government Gazette 69/A'/1989

2.36.2. ELOT EN 10080, ELOT 1421-1, ELOT 1421-3 "Standards for concrete reinforcement steels". 3. Ministerial Decision D11E/0/30123/1991 (Government Gazette 1068/B'/31-12-1991 "Amendment of the New Concrete Regulation for the Design and Construction of Concrete Works”

2.36.3. Ministerial Decision D17a/116/4/FN429/18-10-2000 (Reinforced Concrete Regulation) EKOS 2000.

2.36.4. Ministerial Decision D14/50504/2002 (Government Gazette 537/B;/1-5-2002) "Adaptation of the Concrete Technology Regulation to the Requirements of the Harmonized Standard" ELOT EN 197-1.

2.36.5. Ministerial Decision 16462/29/2001 (Government Gazette 917/B'/17.7.2001) "Cement for the Construction of Concrete Works".

2.36.6. Ministerial Decision D14/92330/08 (1416/B'/17.7.08) (Government Gazette 381/B'/24.3.2000) "Approval of the New Regulation of Concrete Reinforcement Steel Technology".

2.36.7. Ministerial Decision DIPAD/OIK. 372/2014 (Government Gazette 1457/B'/5.6.2014) "Approval of the application and use of the Eurocodes in combination with the respective National Appendices)

2.36.8. Government Gazette 59/D/3-2-1989 "Building Regulations".

2.36.9. Joint Ministerial Decision D6/B'/OIK 5825 (Government Gazette 407/B/2010) "Approval of the Energy Efficiency Regulation of Buildings (KENAK)".

2.36.10. Ministerial Decision F.7.5/1816/88/2004 (Government Gazette 470/B/5-3-2004) "Replacement of the current Regulation of Internal Electrical Installations with the ELOT Standards and other relevant provisions".

2.36.11. Manual of Standard Distribution Structures of Public Power Corporation (PPC), The Instructions Distribution of PPC SA.

2.36.12. Greek Technical Specifications-Government Gazette 2221/30-07-12 with mandatory application in all public works.

2.36.13. THN GRC Sewerage Regulation

2.36.14. Amendment and Supplementation of Presidential Decree 71/88 "Building Fire Protection Regulation" (Government Gazette 1316/B/31-12-1998)

2.36.15. Presidential Decree 41/2018 "Building Fire Protection Regulation" (Government Gazette 80/A'/7-5-2018)

2.37. Supporting Civil Works:

2.37.1. Rebuilding of pavements after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.37.2. Associated earthworks and backfilling, drilling for the pipes, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.37.3. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.37.4. Closing of all redundant penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling to assure correct and efficient operation of new HVAC system provided by the Contractor

2.37.5. Water, sound and fire insulation as required in all areas affected by the Contractor works.

2.38. Restoration of reinforced-concrete structures:

2.38.1. After the removal of all corroded concrete parts by using water-blasting, sandblasting the following works shall be executed according to the GRC National Regulation (Code ELOT TP 1501-14-01-04-00-2009 “Local retrofitting of concrete element damage caused by reinforcement corrosion”):

2.38.1.1. Cleaning of the steel reinforcements with mechanical wire brushing and then priming after three hours with appropriate anticorrosive material in accordance with manufacturer’s recommendations.

2.38.1.2. Application, in layers, anticorrosive mortar (the thickness shall be in accordance with manufacturer’s recommendations) covering the reinforcement.

2.38.1.3. Once the reinforcement remediation is completed, the application of two different appropriate water-proof cement coating in layers shall be followed.

2.38.1.4. Dismantling and replacement of damaged parts of networks and auxiliary works.

2.38.2. In case that the reinforcing bars are corroded and have lost more than 20% of their diameter, they shall be cut and removed. In such event, removed steel bars shall be replaced with new steel bars of the same diameter. For the above procedure the following works shall be executed in accordance with GRC National Regulation (Code PETEP:14-01-11-00 “Anchoring of new steel reinforcement bars in existing concrete elements”):

2.38.2.1. Identification of the anchor positions of the new steel reinforcement bars.

2.38.2.2. Cleaning of the concrete area in accordance with GRC National Regulation (Code PETEP:14-01-01-01 “Removal of loose or adhered material from concrete surfaces”).

2.38.2.3. Roughening of the concrete surface.

2.38.2.4. Boring holes in the concrete at the anchor positions (In General holes diameter=Steel bar diameter + 4mm) in accordance with GRC National Regulation (Code PETEP:14-01-03-02 “Drilling in concrete members with cut-off of encountered reinforcement”).

2.38.2.5. Roughening by wire-brushing inside the hole and remove dust by air blowing, wash with clean water, removal of the water by air blowing.

2.38.2.6. Insertion of sufficient amount of adhesive material.

2.38.2.7. The new steel bars shall be held properly in order to remain unmovable until the coagulation of the adhesive material.

2.38.3. The minimum thickness of reinforcement cover of slabs, beams and columns of a construction is prescribed by National Regulation (Greek Code for Reinforced Concrete 2000 in conjunction with the Greek Antiseismic Regulation 2003). In general the minimum thickness of reinforcement cover is not allowed to be less than the diameter of the steel bar+20mm for a reinforced-concrete structure in a marine environment. Especially:

2.38.3.1. For a reinforcing bar in a column the minimum thickness of reinforcement cover is not allowed to be less than 40mm and not less than the diameter of the steel bar+20mm.

2.38.3.2. For a reinforcing bar in a slab the minimum thickness of reinforcement cover is not allowed to be less than 35mm and not less than the diameter of the steel bar+20mm.

2.38.4. Once the reinforcement remediation is completed, the application of two different appropriate waterproof cement coating in layers to the external surfaces shall be followed. The restoration of the concrete area shall be completed with the works of plastering and painting.

Appendix 7: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX I-SRS-CW-GRC

Civil Works at the Site 7th Air Force Radar Station, Skyros Island (HF TX), GR

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX I - System Requirements Specifications (Civil Works) – Greece.

2. Responsibilities of the Contractor

2.1. If the Contractor identifies that existing fence including its foundations and/or any other not used/ not operational infrastructure, installations and equipment shall be removed to enable installation and correct O&M of SSSB system and its supporting infrastructure, it is the Contractor's responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.2. Provision and installation of new HVAC system, based on split units and heat recovery ventilator as required, with sufficient capacity for SSSB system and existing equipment in the equipment room with all piping, cabling and ancillaries as stipulated in the SOW - ANNEX I.

2.2.1. The existing equipment generates heat load of 3 kW

2.2.2. There is operational HVAC unit in the room (9000 BTU) whose capacity shall be considered by the Contractor when designing and installing a new HVAC system

2.3. Restoration works in the equipment room:

2.3.1. Restoration of all internal walls and ceiling, including plastering and painting in the room for SSSB equipment (RAL color code will be provided by the Purchaser at a later stage).

2.3.2. The two pre-existing openings of the room (one door leading to outside of the building and one window) shall be walled and the built in mortar/ concrete/ masonry shall be finished with plastering and painting on both sides.

2.3.3. Removal and disposal of the current access door to the equipment room and the door between equipment room and the adjacent room (location for the new power generator) with their doorframes.

2.3.4. Provision and installation of new doors with door frames, locks and other ancillaries as stipulated in the SOW – ANNEX I:

2.3.5. this new doors shall be of solid wood or steel plated, free of abrasions to detect attempts of surreptitious entry

2.3.6. the frame and fixing of the doors shall be at least as strong as the doors itself

2.3.7. no glass shall be used

2.3.8. the doors equipped with a Group B lock as per ACE Security directives and drill resistant (group B lock is one which a NATO Member has certified as suitable for the protection of material classified up to NATO S*CR*T)

2.3.9. keys or other required device for changing the combination shall be provided with the locks

2.3.10. hardened steel installed between the lock case and the door itself

2.3.11. the doors dimensions suitable for easy access of personnel and equipment/ rack to the premises interior (at least a clear opening of 2000 (H) × 900 (W) mm)

2.4. Removal and disposal of power distribution system, both indoor and outdoor, that becomes redundant when the new SSSB system with its dedicated electrical installation (further called SSSB electrical installation) is provided and installed by the Contractor:

2.4.1. The scope includes removal and disposal of redundant cabling, sockets, power panels, junction boxes, switches, cables, trays, ducts and other ancillaries.

2.4.2. THN may wish to preserve some parts of the redundant electrical installation and its ancillaries. Relevant guidance will be provided to the Contractor at a later stage.

2.4.3. Removal and disposal of light fixtures in the SSSB room

2.5. Provision and installation of SSSB electrical installation with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.5.1. Complete SSSB electrical installation, both indoor and outdoor, with dedicated EPDBs (Equipment Power Distribution Boards), including surge protection devices and residual current devices (RCD), required to power all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, fire detection and alarm, power distributed to antenna fields etc.) and the existing THN electronic equipment in the SSSB room, as well as internal lighting of the room

2.5.2. Provision and installation of light fixtures (including emergency lights) in the SSSB room as stipulated in the SOW – Annex I.

2.5.3. Integration of the SSSB electrical installation with existing MPDB (Main Power Distribution Board) and Medium Voltage Transformer:

2.5.4. The integration shall include installation of adequate circuit breakers, cabling provision and installation, and modification of existing power distribution system and the power boards/ panels as required to connect power cables for SSSB electrical installation

2.6. Provision and installation of UPS system as stipulated in the SOW – ANNEX I.

2.7. Provision and installation of 1(one) power generator with integrated daily fuel tank (no other fuel tanks required) with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.7.1. The PG shall be the back-up (emergency) source of electrical power and shall be capable to provide power for all equipment in the SSSB room in case of main power failure. Hence, the Contractor shall design the system and provide equipment to meet requirements for power generators rated as Emergency Standby Power (ESP) according to ISO 8528-1:2018

2.7.2. The existing power load (without equipment that shall be provided by the Contractor) that shall be connected to the PG is 10 kW

2.7.3. The power generator shall be installed in such a way to prevent transfer of vibrations from the generator to the rest of building structure.

2.7.4. The daily fuel tank of the power generator shall be sized adequately to assure continues operation under full load for minimum of 5 (five) hours

2.7.5. The daily fuel tank shall be reinforced with non-cutting edge bulkheads.

2.7.6. External fuel inlet with warning light for full tank shall be provided with lockable cap (with lock).

2.7.7. Refilling by hand from jerry cans or locally from a mobile tank with electric pump shall be possible during operation of the PG.

2.8. Removal and disposal of lightning protection and grounding system, both indoor and outdoor, that becomes redundant when the new SSSB system with its dedicated lightning protection and grounding system (further called SSSB lightning protection and grounding system) is provided and installed by the Contractor:

2.8.1. The scope includes removal and disposal of redundant cabling, conductors, arresters, grounding rings (including buried, roof and mast mounted elements) grounding rods, lightning rods, trays, ducts and other ancillaries.

2.8.2. THN may wish to preserve some parts of the redundant lightning protection and grounding system and its ancillaries. Relevant guidance will be provided to the Contractor at a later stage.

2.9. Provision and installation of SSSB lightning protection and grounding system with associated cabling, ducting, cable trays and ancillaries as stipulated in the SOW - ANNEX I:

2.9.1. Complete SSSB lightning protection and grounding system, both indoor and outdoor (including surge protection devices, grounding rings (including buried, roof and mast mounted elements), grounding rods, lightning rods, trays, ducts and other ancillaries) required to protect all equipment provided by the Contractor for SSSB project (including HVAC, fuel supply system, fire detection and alarm, antennas, etc.)

2.9.2. Integration of the SSSB lightning protection and grounding system with existing lightning protection and grounding system of the site according to respective THN laws and regulations:

2.9.2.1. The integration shall include execution of necessary earth works, welding, anticorrosive protection, and necessary modification of existing lightning protection and grounding system.

2.10. Provision and installation of required number of new antenna masts capable of supporting the SSSB system with all associated works (antenna field preparation, foundation, trenches etc.), air obstacle lights, lightning protection, grounding and other ancillaries as stipulated in the SOW - ANNEX I.

2.10.1. The antenna masts shall be designed for minimum service life of 30 years without the need for substantial maintenance

2.10.2. The antenna masts shall be provided with cathodic protection system (including protection of the guy anchors) designed for minimum service life of 30 years without the need for substantial maintenance

2.11. Provision and installation of fire detection and alarm system in SSSB equipment room and in power generator room as stipulated in the SOW - ANNEX I.

2.11.1. The fire alarm (both visual (beacon) and audio (siren)) shall be transferred to the location within approximately 40m distance from SSSB equipment and power generator room. Detailed guidance will be provided to the Contractor at a later stage.

2.12. Provision and installation of fire extinguishers in SSSB equipment room and in power generator room as stipulated in the SOW - ANNEX I.

2.13. Provision and installation of safety marking and labelling, both indoor and outdoor, for all structures, machinery and installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX I.

2.14. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.14.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.14.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.15. All metal works exposed to outdoor environment such as antenna masts with their ancillaries, HVAC components, cable trays and ladders, fences, gates, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5M Maritime, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.16. The complete structural design and its execution for all structures, equipment and installations provided, installed and/or modified by the Contractor shall meet THN GRC seismic requirements. Therefore, the Contractor shall meet respective requirements as stipulated in following publications:

2.16.1. EN 1998-1:2004, Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings

2.16.2. EN 1998-3:2005 Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings and its implementation

2.16.3. EN 1998-4:2006 Eurocode 8: Design of structures for earthquake resistance – Part 4: Silos, tanks and pipelines

2.16.4. EN 1998-5:2004 Eurocode 8: Design of structures for earthquake resistance – Part 5: Foundations, retaining structures and geotechnical aspects

2.16.5. EN 1998-6:2005 Eurocode 8: Design of structures for earthquake resistance – Part 6: Towers, masts and chimneys

2.16.6. Ministerial Decision D17a/141/3/FN 275/1999 (Government Gazette 2184/B;/20-12-19990 Hellenic Earthquake Regulation 2000 (Approval of the Greek Earthquake Regulation)

2.17. The Contractor shall also consider in its design additional measures that are required to secure provided equipment against earthquake impact. Those measures include, but are not limited to, special fixing to the floors (including when installed on a raised floors) and fixing elements mounted at the rack tops to secure them to the walls.

2.18. When designing and erecting masts with all associated ancillaries, fences and all other outdoor installed equipment, the Contractor shall apply Eurocode EN1991-1-4 (Eurocode 1 Part 1-4: General actions Wind actions). This publication provides guidance on the determination of natural wind actions for the structural design of buildings and civil engineering works. For the calculation procedure and especially for the determination of wind actions following shall be applied:

2.18.1. The fundamental basic wind velocity $v_{b,0}$ which is the 10 minute mean wind velocity with an annual risk of being exceeded of 0.02 irrespective of wind direction at a height of 10m above flat open country terrain, has a value in the National Annex $v_{b,0}$,0=33m/s for the Greek Islands in general.

2.18.2. The basic wind velocity v_b, which is the fundamental basic wind velocity modified to account the direction of the wind and the season, shall be calculated from the equation: $v_b=c_{dir} \times c_{season} \times v_{b,0}$. The recommended value for c_{dir} (the directional factor) and c_{season} (the season factor) is 1.

2.18.3. Terrain roughness: There are 5 terrain categories. For the two sites in Skyros Island (Kartsinoudi and Limnonari) as well as Site Sideros in Crete, the terrain category is No 0 (sea or coastal area exposed to the open sea). For the Site Kythira and Site Mavros in Crete the terrain category is No III (Area with regular cover of vegetation or building or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest).

2.19. Additionally, the Contractor shall design and execute the works in compliance with following publications respectively:

2.19.1. Presidential Decree 244/1980:"Cement Regulation for Concrete Works (Prestressed, Reinforced and Unarmed) (Government Gazette 69/A'/1989

2.19.2. ELOT EN 10080, ELOT 1421-1, ELOT 1421-3 "Standards for concrete reinforcement steels". 3. Ministerial Decision D11E/0/30123/1991 (Government Gazette 1068/B'/31-12-1991 "Amendment of the New Concrete Regulation for the Design and Construction of Concrete Works”

2.19.3. Ministerial Decision D17a/116/4/FN429/18-10-2000 (Reinforced Concrete Regulation) EKOS 2000.

2.19.4. Ministerial Decision D14/50504/2002 (Government Gazette 537/B;/1-5-2002) "Adaptation of the Concrete Technology Regulation to the Requirements of the Harmonized Standard" ELOT EN 197-1.

2.19.5. Ministerial Decision 16462/29/2001 (Government Gazette 917/B'/17.7.2001) "Cement for the Construction of Concrete Works".

2.19.6. Ministerial Decision D14/92330/08 (1416/B'/17.7.08) (Government Gazette 381/B'/24.3.2000) "Approval of the New Regulation of Concrete Reinforcement Steel Technology".

2.19.7. Ministerial Decision DIPAD/OIK. 372/2014 (Government Gazette 1457/B'/5.6.2014) "Approval of the application and use of the Eurocodes in combination with the respective National Appendices)

2.19.8. Government Gazette 59/D/3-2-1989 "Building Regulations".

2.19.9. Joint Ministerial Decision D6/B'/OIK 5825 (Government Gazette 407/B/2010) "Approval of the Energy Efficiency Regulation of Buildings (KENAK)".

2.19.10. Ministerial Decision F.7.5/1816/88/2004 (Government Gazette 470/B/5-3-2004) "Replacement of the current Regulation of Internal Electrical Installations with the ELOT Standards and other relevant provisions".

2.19.11. Manual of Standard Distribution Structures of Public Power Corporation (PPC), The Instructions Distribution of PPC SA.

2.19.12. Greek Technical Specifications-Government Gazette 2221/30-07-12 with mandatory application in all public works.

2.19.13. THN GRC Sewerage Regulation

2.19.14. Amendment and Supplementation of Presidential Decree 71/88 "Building Fire Protection Regulation" (Government Gazette 1316/B/31-12-1998)

2.19.15. Presidential Decree 41/2018 "Building Fire Protection Regulation" (Government Gazette 80/A'/7-5-2018)

2.20. Supporting Civil Works:

2.20.1. Rebuilding of pavements after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.20.2. Associated earthworks and backfilling, drilling for the pipes, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.20.3. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after pipe, cabling, ducting, air intake, air outlet, exhaust and other installation works.

2.20.4. Closing of all redundant penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling to assure correct and efficient operation of new HVAC system provided by the Contractor

2.20.5. Water, sound and fire insulation as required in all areas affected by the Contractor works.

Appendix 8: IFB-CO-15577-SSSB-BookII-PartIV-SOW-ANNEX I-SRS-CW-GRC

Civil Works for DLOS antenna replacement, 5 (five) locations, GR

1. General

1.1. The detailed description and technical specifications of below listed works are formulated in the SOW - ANNEX I - System Requirements Specifications (Civil Works) – Greece.

1.2. All of the works described hereafter shall be executed at five different sites:

1.2.1. Skopelos DLOS radio-relays station

1.2.2. Agios Efstratios DLOS radio-relays station

1.2.3. Pelion DLOS radio-relays station

1.2.4. ARS Larissa DLOS radio-relays station

1.2.5. Pagia DLOS radio-relays station

2. Responsibilities of the Contractor

2.1. Removal and disposal of:

2.1.1. 16 DLOS antennas and their interconnection coaxial cables;

2.1.2. 2 at ARS Larissa DLOS radio-relays station
2.1.3. 4 at Pelion DLOS radio-relays station
2.1.4. 4 at Skopelos DLOS radio-relays station
2.1.5. 4 at Pagia (SKYROS ISLAND) DLOS radio-relays station
2.1.6. 2 at Agios Efstratios DLOS radio-relays station

2.2. all ducting, cabling and other ancillaries related to the DLOS antennas with coaxial cables that are scoped for disposal.

2.3. Provision and installation of new DLOS antennas with their interconnection coaxial cables as stipulated in the SOW and associated ANNEXES.

2.4. Provision and installation of required hardware that shall assure safe and secure installation of new DLOS antennas on existing DLOS masts.

2.5. If the Contractor identifies that existing not used/ not operational infrastructure, installations and equipment shall be removed to enable installation of the DLOS antennas with their coaxial cables, it is the Contractor's responsibility to remove and dispose of the above mentioned infrastructure, installations and equipment. This activity can only be exercised after THN approval of each item scoped for removal and disposal.

2.6. Provision and installation of safety marking and labelling, both indoor and outdoor, for installations provided by the Contractor, as stipulated in the SOW Main Body and in the SOW – ANNEX I.

2.7. All concrete works exposed to outdoor environment (regardless if buried or not) shall be executed with the utilization of concrete that meets, as the minimum, following requirements according to EN 206:2013+A2:2021 (or THN equivalent standard):

2.7.1. exposure class of XS1 and strength of C 32/40 for structures exposed to airborne salt but not in direct contact with sea water;

2.7.2. exposure class of XS3 and strength of C 33/45 for structures located at tidal and spray zones.

2.8. All metal works exposed to outdoor environment such as cable trays and ladders, cabinets, bolts, nuts, washers, fasteners etc. (regardless if buried or not) shall be protected against corrosion category C5I: ‘Very high’, defined according to ISO 12944-5:2019 (or THN equivalent standard).

2.9. The complete structural design and its execution for all equipment and installations provided, installed and/or modified by the Contractor shall meet THN GRC seismic requirements. Therefore, the Contractor shall meet respective requirements as stipulated in following publications:

2.9.1. EN 1998-1:2004, Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings

2.9.2. EN 1998-3:2005 Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings and its implementation

2.9.3. EN 1998-4:2006 Eurocode 8: Design of structures for earthquake resistance – Part 4: Silos, tanks and pipelines

2.9.4. EN 1998-5:2004 Eurocode 8: Design of structures for earthquake resistance – Part 5: Foundations, retaining structures and geotechnical aspects

2.9.5. EN 1998-6:2005 Eurocode 8: Design of structures for earthquake resistance – Part 6: Towers, masts and chimneys

2.9.6. Ministerial Decision D17a/141/3/FN 275/1999 (Government Gazette 2184/B;/20-12-19990 Hellenic Earthquake Regulation 2000 (Approval of the Greek Earthquake Regulation)

2.10. When designing and installing the DLOS antennas with all associated ancillaries, the Contractor shall apply Eurocode EN1991-1-4 (Eurocode 1 Part 1-4: General actions Wind actions). This publication provides guidance on the determination of natural wind actions for the structural design of buildings and civil engineering works. For the calculation procedure and especially for the determination of wind actions following shall be applied:

2.10.1. The fundamental basic wind velocity $v_{b,0}$ which is the 10 minute mean wind velocity with an annual risk of being exceeded of 0.02 irrespective of wind direction at a height of 10m above flat open country terrain, has a value in the National Annex $v_{b,0}$=33m/s for the Greek Islands in general.

2.10.2. The basic wind velocity v_b, which is the fundamental basic wind velocity modified to account the direction of the wind and the season, shall be calculated from the equation: $v_b = c_{dir} \times c_{season} \times v_{b,0}$. The recommended value for c_{dir} (the directional factor) and c_{season} (the season factor) is 1.

2.10.3. Terrain roughness: There are 5 terrain categories. For the two sites in Skyros Island (Kartsinoudi and Limnonari) as well as Site Sideros in Crete, the terrain category is No 0 (sea or coastal area exposed to the open sea). For the Site Kythira and Site Mavros in Crete the terrain category is No III (Area with regular cover of vegetation or building or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest).

2.11. Additionally, the Contractor shall design and execute the works in compliance with following publications respectively:

2.11.1. Presidential Decree 244/1980:"Cement Regulation for Concrete Works (Prestressed, Reinforced and Unarmed) (Government Gazette 69/A'/1989

2.11.2. Ministerial Decision D14/50504/2002 (Government Gazette 537/B;/1-5-2002) "Adaptation of the Concrete Technology Regulation to the Requirements of the Harmonized Standard" ELOT EN 197-1.

2.11.3. Ministerial Decision 16462/29/2001 (Government Gazette 917/B'/17.7.2001) "Cement for the Construction of Concrete Works".

2.11.4. Ministerial Decision DIPAD/OIK. 372/2014 (Government Gazette 1457/B'/5.6.2014) "Approval of the application and use of the Eurocodes in combination with the respective National Appendices)

2.11.5. Government Gazette 59/D/3-2-1989 "Building Regulations".

2.11.6. Ministerial Decision F.7.5/1816/88/2004 (Government Gazette 470/B/5-3-2004) "Replacement of the current Regulation of Internal Electrical Installations with the ELOT Standards and other relevant provisions".

2.11.7. Manual of Standard Distribution Structures of Public Power Corporation (PPC), The Instructions Distribution of PPC SA.

2.11.8. Greek Technical Specifications-Government Gazette 2221/30-07-12 with mandatory application in all public works.

2.11.9. Amendment and Supplementation of Presidential Decree 71/88 "Building Fire Protection Regulation" (Government Gazette 1316/B/31-12-1998)

2.11.10. Presidential Decree 41/2018 "Building Fire Protection Regulation" (Government Gazette 80/A'/7-5-2018)

2.12. Supporting Civil Works:

2.12.1. Rebuilding of pavements after cabling, ducting and other installation works.

2.12.2. Associated earthworks and backfilling, drilling for the cabling, ducting and other installation works.

2.12.3. Closing of the penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls, floors, roofs and ceiling after cabling, ducting and other installation works.

2.12.4. Water, sound and fire insulation as required in all areas affected.

ATTACHMENT F

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