Appendix 3: IFB-CO-15577-SSSB-Book2-Part4-SOW-ANNEX C-SRS-CW-UK

Civil Works at the Site Saxa Vord, UK

1. General

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

1.2. For better understanding of the scope and local site conditions, photographs and videos filed in … shall be reviewed and taken into consideration by the Bidders when formulating their bid offers.

1.3. Additional documentation, such as existing site layouts, building and utility plans are filed in … and shall also be thoroughly analyzed by the Bidders in order to formulate their bid offers. The document package includes:

f) Drawing 073/BLDH/G/H001 (PDF) – Configuration Equipment Layout for Room H001 (SSSB Shelter) Building H, RRH Saxa Vord

g) Drawing 073/SITE (PDF) – Cable & Duct Routes for Saxa Vord

h) JSP 604 LEAFLET 3032 MOD Radio Site Clearance and Protection Part 2: Volume 2;

a. Saxa Vord has a TPS 77 AD Radar, Chapter 7 Annex C is applicable.

b. For the HF/UHF aspect, Chapter 5 Annex A, C, D is applicable.

1.4. DEFRA and Environmental & Planning portals.

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 the radiation right outside the fence line is within the limits established in respective THN legislation for publicly accessible areas 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 or its THN equivalent

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. Removal and disposal of existing H&S fences including their foundations.

2.3. 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.

2.4. Provision and construction of access roads to each antenna provided by the Contractor (for further details on road works refer to the SOW – ANNEX C).

2.4.1. the roads shall be designed and built as internal roads and as such they will not serve as public use roads

2.4.2. 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)

2.4.3. there is no drive through antenna fields i.e. over the areas with buried grounding screen

2.4.4. 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)

2.4.5. 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)

2.4.6. designed service life: minimum 20 years

2.4.7. 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:

2.4.7.1. occasional traffic of light transport vehicles (maximum 3.5 T each) for the maintenance and security needs

2.4.7.2. sporadic traffic of cranes or lifting platforms to assure maintenance access to the top mounted antenna components

2.4.8. one line, no sidewalks

2.4.9. in principle no curbs required

2.4.10. 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

2.4.11. where curbs are required they shall be made of concrete as prefabricated

2.4.12. example of the locations that might require installation of curbs are road sections running over culverts

2.4.13. when culverts are required to assure adequate drainage they shall be made of reinforced concrete as prefabricated

2.4.14. any drainage and any culvert outlet shall be designed and built in such a way not to cause erosion of the existing adjacent terrain

2.4.15. designed speed limit of the roads: 30 km/h

2.4.16. the road minimum turning circle of 10,0 m

2.4.17. 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)

2.4.18. all sections of the roads shall be built with drainage works required for chosen pavement

2.4.19. 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.

2.4.20. no horizontal traffic signs required

2.4.21. no vertical traffic signs required

2.5. Provision and installation/ construction of the new SSSB block house with following characteristics:

2.5.1. The new SSSB block house shall be erected inside the envelope of existing warehouse with inside dimensions of approximately 6.6m x 13.2m.

2.5.2. The general envelope and size of the new SSSB block house shall be based on the design of the existing block house for SSSB system at Benbecula site, where the inside dimensions are approximately 4.0m x 9.0m.

2.5.3. The Contractor shall adapt the dimensions and structure for the new SSSB block house as required:

2.5.3.1. to assure provision and installation of all required SSSB equipment with it supporting systems such as power distribution, UPS, HVAC, fire detection and alarm system, fire extinguishers, lightning protection and grounding etc.

2.5.3.2. to assure efficient and convenient O&M of new SSSB system to be installed within the SSSB block house

2.5.3.3. to assure preservation of existing systems and infrastructure in the warehouse such as power distribution, lighting, fire detection and alarm system, emergency doors etc.

2.5.3.4. to assure that in case of emergency (for example fire) staff can safely evacuate from the warehouse through its existing gates an doors and from the SSSB block house

2.5.3.5. to assure that the new SSSB block house meets all requirements stipulated in respective THN UK H&S law and regulations

2.5.4. Energy Class “A” envelope

2.5.5. Windowless block house to house all SSSB equipment with supporting equipment and installations provided by the Contractor

2.5.6. Structured and finished as stipulated in the SOW - ANNEX C

2.5.7. Provided with all equipment and installations as stipulated in the SOW - ANNEX C:

2.5.7.1. external doors (including emergency doors) with locks and closing mechanisms (no alarm, no cameras, no intrusion detection system, no card readers – just security doors and locks)

2.5.7.2. Electrical distribution system including power panels, light fixtures – indoor and outdoor, emergency lights, power sockets, switches

2.5.7.3. Lightning protection and grounding

2.5.7.4. Fire detection and alarm system

2.5.7.5. Fire extinguishers (no fire hydrants, no automatic fire extinguishing system)

2.5.7.6. HVAC system (since there is no water network envisaged I advise to exclude HVAC systems based on chilled water)

2.5.7.7. Weather, sound and fire insulation as required

2.5.7.8. Floors and ceilings suitable for power distribution, piping, air circulation, fire prevention and other H&S measures as required for the SSSB block house purpose

2.5.7.9. 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 C.

2.5.7.10. Drainage system (no sanitary and potable water in the block house, no toilets, no showers) to evacuate any drained water outside of the block house, then further outside of the warehouse and integration as required with site drainage system

2.5.7.11. Manholes, cable and pipe interface panels required for introduction into the SSSB block house (and through the structure of the existing warehouse) of all installations and to assure air intake, air exhaust etc.

2.5.8. 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, UPS, 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 block house itself.

2.6. Provision and installation of new HVAC system for the new SSSB block house with all piping, cabling and ancillaries as stipulated in the SOW - ANNEX C:

2.6.1. Outdoor HVAC unit(s) shall be installed, within the warehouse or outside the warehouse, 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)

2.6.3. The Contractor shall adapt as required air ducting and make required penetrations in the walls of the existing warehouse to accommodate new HVAC

2.6.4. The Contractor shall close all redundant penetrations (with mortar, plastering, finishing/painting of affected sections in partitions) in walls of the existing warehouse to assure correct and efficient operation of new HVAC system provided by the Contractor

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

2.7.1. 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, fire detection and alarm, lights, power distributed to antenna fields etc.)

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

2.7.2.1. 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

2.8. Provision and installation of UPS system as stipulated in the SOW – ANNEX C.

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 C:

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 new SSSB block house and all equipment provided by the Contractor for SSSB project (including HVAC, fire detection and alarm, antennas)

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 fire detection and alarm system in the new SSSB block house as stipulated in the SOW - ANNEX C.

2.11. The fire alarm shall be reported to the Buffer Centre at Boulmer using existing connections from the site to the Buffer Centre.

2.12. Provision and installation of fire extinguishers in the new SSSB block house as stipulated in the SOW - ANNEX C.

2.13. Removal and disposal of:

2.13.1. all antennas and masts that become redundant as the result of new SSSB system provision.

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

2.14. 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 C.

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

2.14.2. 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

2.15. Provision and installation of RF and power cabling with associated cable trays, ducts, earthwork, backfilling, marking in the terrain etc.

2.15.1. Note that the site is protected by robust double security fence with additional perimeter security systems (including underground mounted equipment protecting against burrowing/ digging/ drilling under the fence)

2.15.2. Therefore, any works conducted by the Contractor, shall not degrade integrity/ effectiveness of the existing security fences and related security systems

2.15.3. Respective information on sections of the existing security fences, where the entries for all (to be provided and installed by the Contractor) cabling, ducting, piping etc. shall be executed, will be delivered to the Contractor at a later stage

2.15.4. All works conducted by the Contractor shall include earthworks, landscaping, surface drainage and backfilling (including provision of the same quality and quantity of material, the top gravel layer etc.) to the same standard as existing at the site before the Contractor started its works:

2.15.4.1. Outside the outer perimeter fence

2.15.4.2. Between outer and inner perimeter fence

2.15.4.3. Inside the inner perimeter fence towards cable entry panel(s) for SSSB system

2.16. Provision and installation of required cable entry panels and manholes with covers:

2.16.1. THN UK offers for reuse existing manholes as shown in supporting photographs and videos

2.16.2. The Contractor shall modify the existing manholes as required for new SSSB system installation

2.16.3. In case it is not suitable to reuse existing manholes or the Contractor decides to install new once, provision and installation of complete new manholes (including their covers) with all associated works shall be included in the scope executed by the Contractor

2.17. 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 C.

2.18. 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):

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

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

2.19. 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).

2.20. The Contractor shall ensure the antenna arrays, including foundations, masts, antenna and cabling, are capable of withstanding a 1 in 50 year extreme environmental event throughout the minimum life of the structure. The Contractor shall calculate these environmental conditions at the antenna array sites using EN 1990 – 1999 Eurocode Series standards and DEF STAN 00-35 (Part 4). The antenna arrays and provision of information on the arrays shall comply with the UK MOD's DIO Practitioner Guides for Design and Appraisal and Condition Inspection (PG 09/08 and PG 10/08).

2.21. Supporting Civil Works:

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

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

2.21.3. 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.

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

IFB-CO-15577-SSSB

NATO Communications and Information Agency
Agence OTAN d'information et de communication

BOOK II

PART IV – STATEMENT OF WORK

SOW - ANNEX D

SYSTEM REQUIREMENT SPECIFICATIONS (SRS) TECHNICAL (NETHERLANDS)

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1 Introduction

1.1 Overview

1.1.1 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:

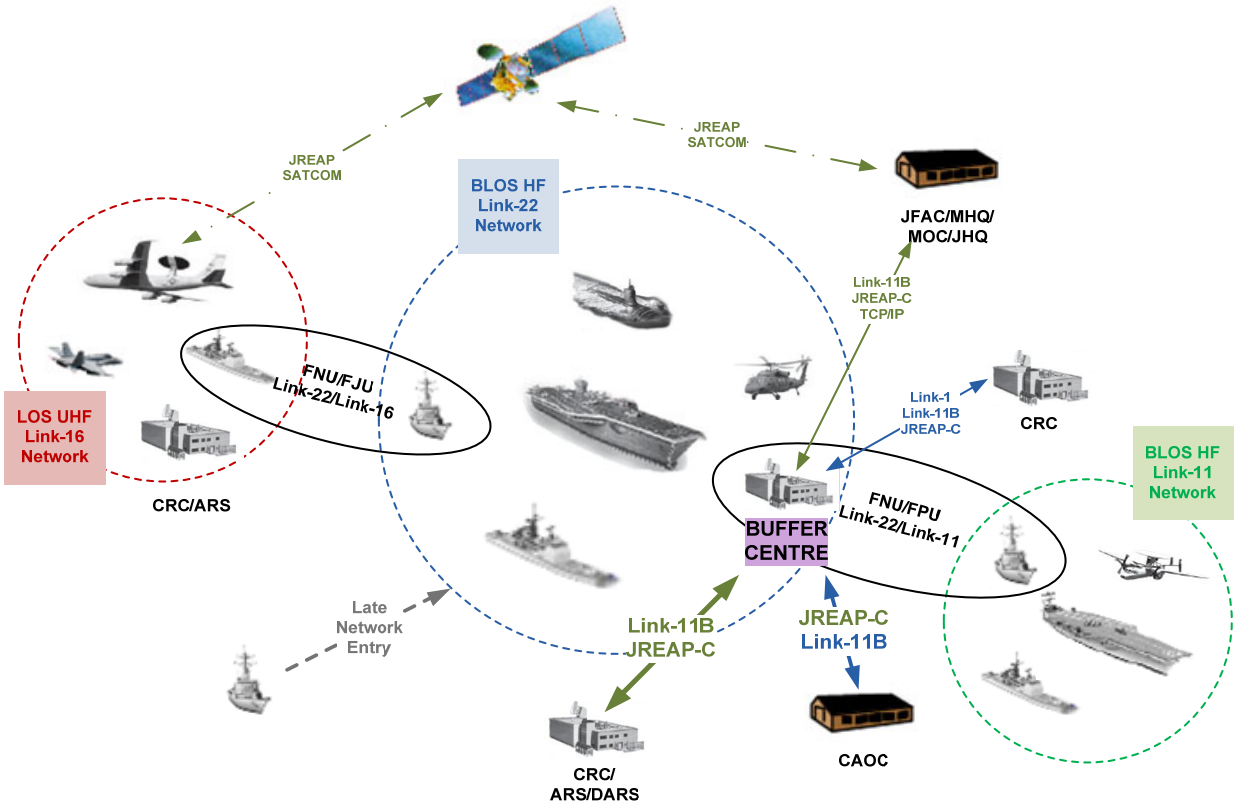

Figure 1: Tactical data exchange layout.

1.1.2 The SSSB system is organised in three sub-systems, see Figure 2:

1.1.3 Radio Network Communication: Provided by several radio sites.

1.1.4 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.

1.1.5 Signals Transport: Transport of digital and analogue signals:

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

b. None co-located Radio Sites, where HF TX, HF RX and UHF components are separated, but located in the same area. The distances between the components can vary.

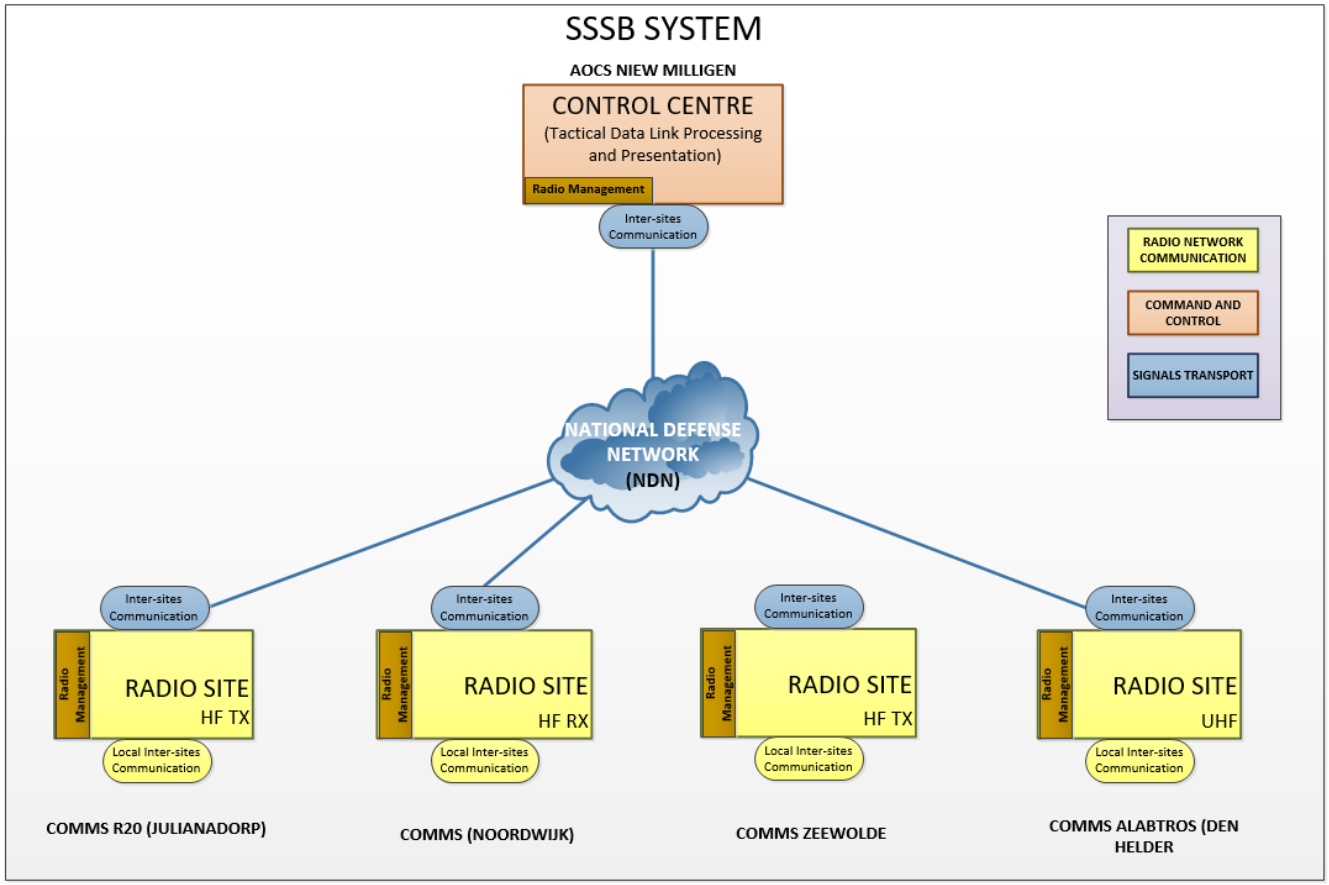

Figure 2: SSSB System, block diagram.

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 Centre.

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

1.2.3 The purpose of this document is to specify the system requirements for the SSSB-UK-GR-NL System as depicted by Figure 2 above, and consisting of:

a. Four SSSB Radio Sites, HF-TX/RX/UHF Sites at Noordwijk, Julianadorp (R20), Albatros (Den Helder) and Zeewolde connected to Buffer Centre at Nieuw Milligen shall be implemented by the Contractor (see Figure 3 to Figure 7). The distances between the SSSB sites are shown in Figure 8.

b. The NLD National Defence Network (NDN) for the transport of the signals between the Buffer Centre at AOCS Nieuw Milligen the four Radios Sites at R20 (Julianadorp), Noordwijk, Zeewolde and ALBATROS (Den Helder). The National Defense Network (NDN) will be provided by the Host Nation. The distances between the SSSB sites are shown in Figure 8.

1.2.4 Radio Sites

a. The Radio Sites at Noordwijk, Julianadorp (R20), and Albatros (Den Helder) are already existing SSSB COMMS Sites, which have to be upgraded/renewed. The existing operational functionality has to be kept till the SSSB Final System Acceptance to assure operational continuity.

b. The Radio Site Zeewolde is a military site without any existing SSSB functionality. This site will become a new SSSB COMMS site.

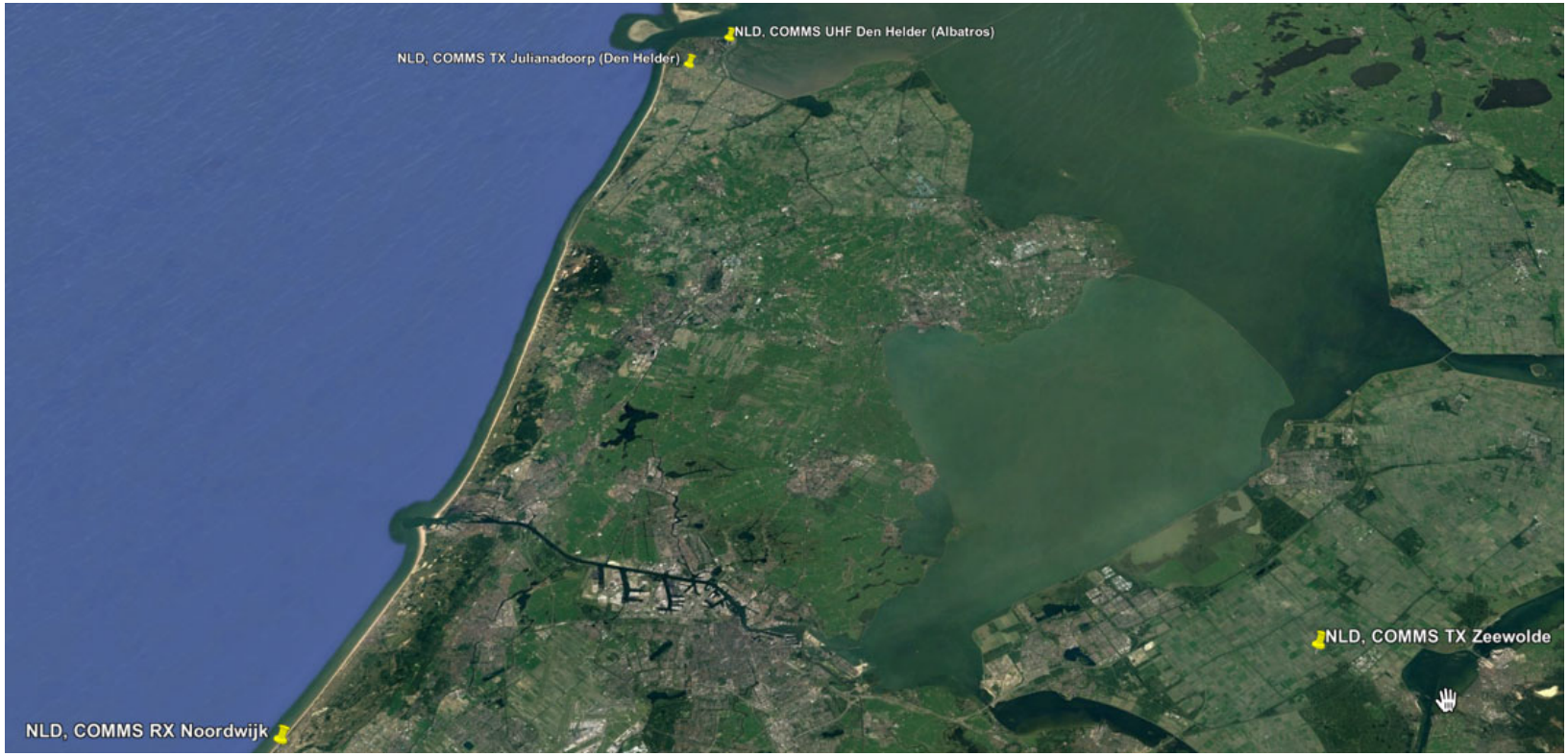

Figure 3: NLD SSSB TX/RX/UHF COMMS locations

Figure 4: HF Rx Site Noordwijk, the Netherlands – Current Site Configuration

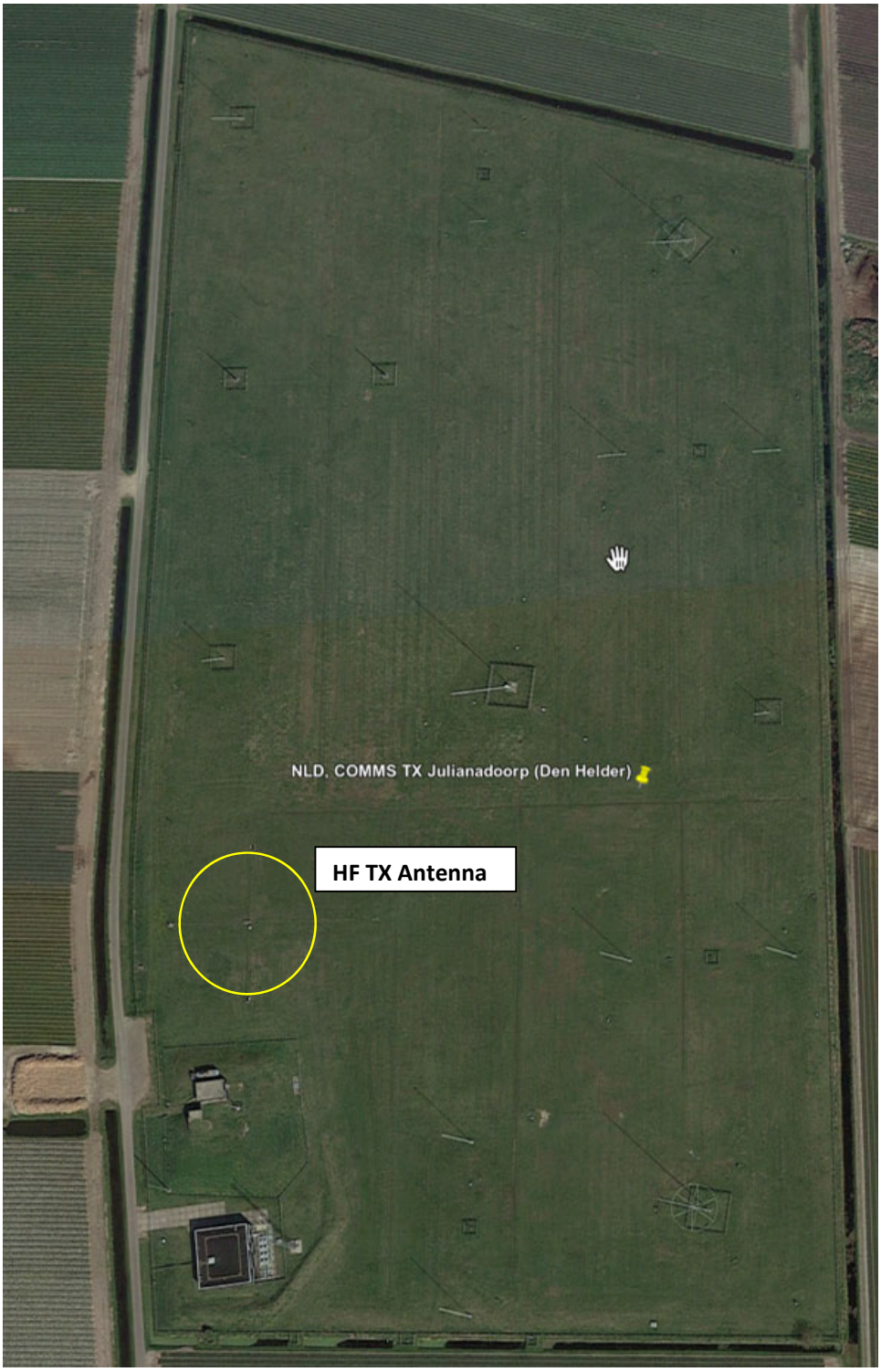

Figure 5: Tx Site at Julianadorp (R20) (Den Helder), The Netherlands

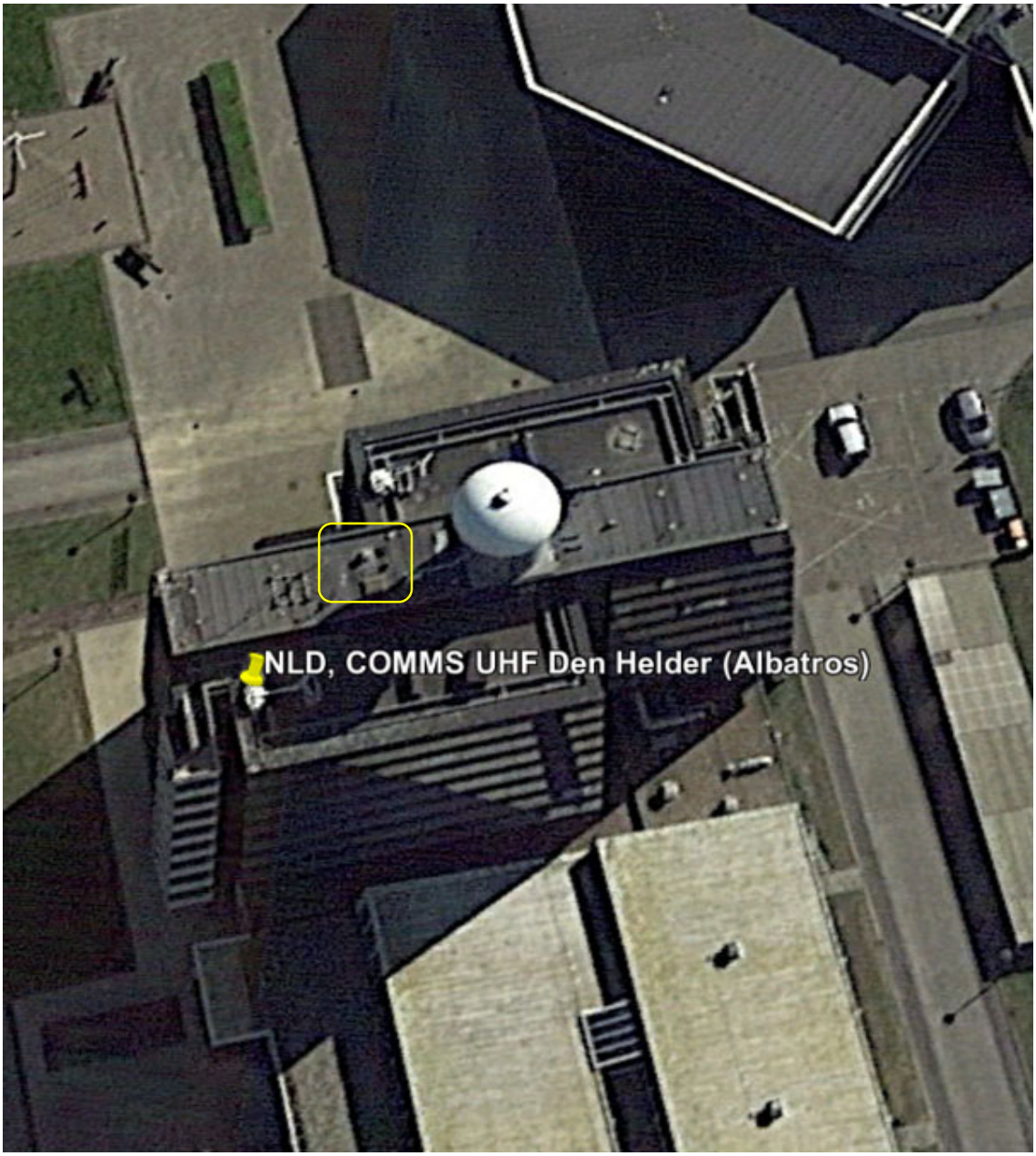

Figure 6: UHF TRX Site Albatros (Den Helder), The Netherlands

Figure 7: HF Rx Site Zeewolde Location, The Netherlands

LOS Distances Km Elev (m)			1	2	3	4	5
			RX Noordwijk	Tx Julianadorp (R20 (Den Helder)	Tx Zeewolde	UHF Albatros (Den Helder)	Niew Milligen
1		RX Noordwijk	X	72	67	77	89
2		Tx Julianadorp (R20 (Den Helder)	72	X	78	6	104
3		Tx Zeewolde	67	78	X	80	27
4		UHF Albatros (Den Helder)	77	6	80	X	105
5		Niew Milligen	89	104	27	105	X

Figure 8: Distances between SSSB Site locations (*Km*), Site elevations (*m*).

1.2.5 Radio Sites will consist of:

a. 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 9 to Figure 12.

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 9 to Figure.

b. The HF-TX and UHF Site include also a Radio-Over-IP (RoIP) server for non-secure Voice Coordination functions; see Figure 10 to Figure 12

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 10 to Figure 12.

1.2.8 Inter-site Communication:

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

b. Multiplexers are transporting SSSB services between the HF TX sites and the HF RX site, see Figure 9, Figure 10 and Figure 12.

1.2.9 The Buffer Centre is dedicated to the four 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.

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. Monitoring of the status operations of infrastructure and equipment.

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

a. The Contractor for the implementation of the four Radio Sites. DLOS microwave inter-site communication is currently not foreseen, but might be recommended by the contractor where advisable.

b. The THN NLD 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 Centre (BCC) at Nieuw Milligen.

1.3 Scope

1.3.1 The overall SSSB project consists of the following phases:

1.3.2 Phase 1:

a. General Civil Works, at the four Radio Sites, including buildings including new build at Zeewolde), electrical power supplies, HVAC, etc.

1.3.3 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 NLD

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

1.3.4 Phase 1: The Contractor shall implement the Civil Works portion of the SSSB NLD at Radio Sites at Noordwijk, Julianadorp (R20), Albatros (Den Helder) and Zeewolde.

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

1.3.6 The Contractor shall implement the Radio Communications portion of the SSSB NLD project with the installation of the HF-TX/RX/UHF Sites at Noordwijk, Julianadorp (R20), Albatros (Den Helder) and Zeewolde within Phase 2.A.

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

1.3.8 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 1.4.6)

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)

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

c. Provided to the Contractor as PFE

[A] Operational requirements:

a. The RMC is implemented at all Radio Sites and the Buffer Centre.

b. The RMC is mainly operated from the Buffer Centre, 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.

[B] Operational functions:

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

i. Power up/down

ii. Mode selection

iii. Frequency selection

b. Power level selection, where applicable

c. BITE

d. Status monitor

e. Services – Equipment allocation

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

g. PSTN (Public Switching Telephone Network) access

h. Versatile Link Interface/Remote (VLI/R)

i. And other functionalities not listed here that may be THN specific.

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.

[A] The NB/WB Gateway can:

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

b. Transport radio PTT signal via IP

c. Handle digital signals

d. Handle VoIP streams

e. 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)

a. 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 Centre at Nieuw Milligen.

2.2 Connectivity

2.2.1 The inter-site connections between the Buffer Centre and the four Radio Sites shall be implemented via the NLD National Defence Network (NDN).

2.2.2 There shall be a main connection between the Buffer Centre 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 RX Radio Site at Noordwijk will not be manned.

b. The TX Radio Site at Julianadorp (R20) will not be manned.

c. The UHF Radio Site at Albatros (Den Helder) will not be manned

d. The TX Radio Site at Zeewolde will not 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 all fully equipped and fully integrated racks for the four 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 Centre) shall allow air and naval surveillance of the North 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 NLD system sites are:

a. The Buffer Centre, located at Nieuw Milligen which will be implemented by NATO NCI Agency.

b. HF-TX/RX/UHF Sites at Noordwijk, Julianadorp (R20), Albatros (Den Helder) and Zeewolde, shall be implemented by the Contractor.

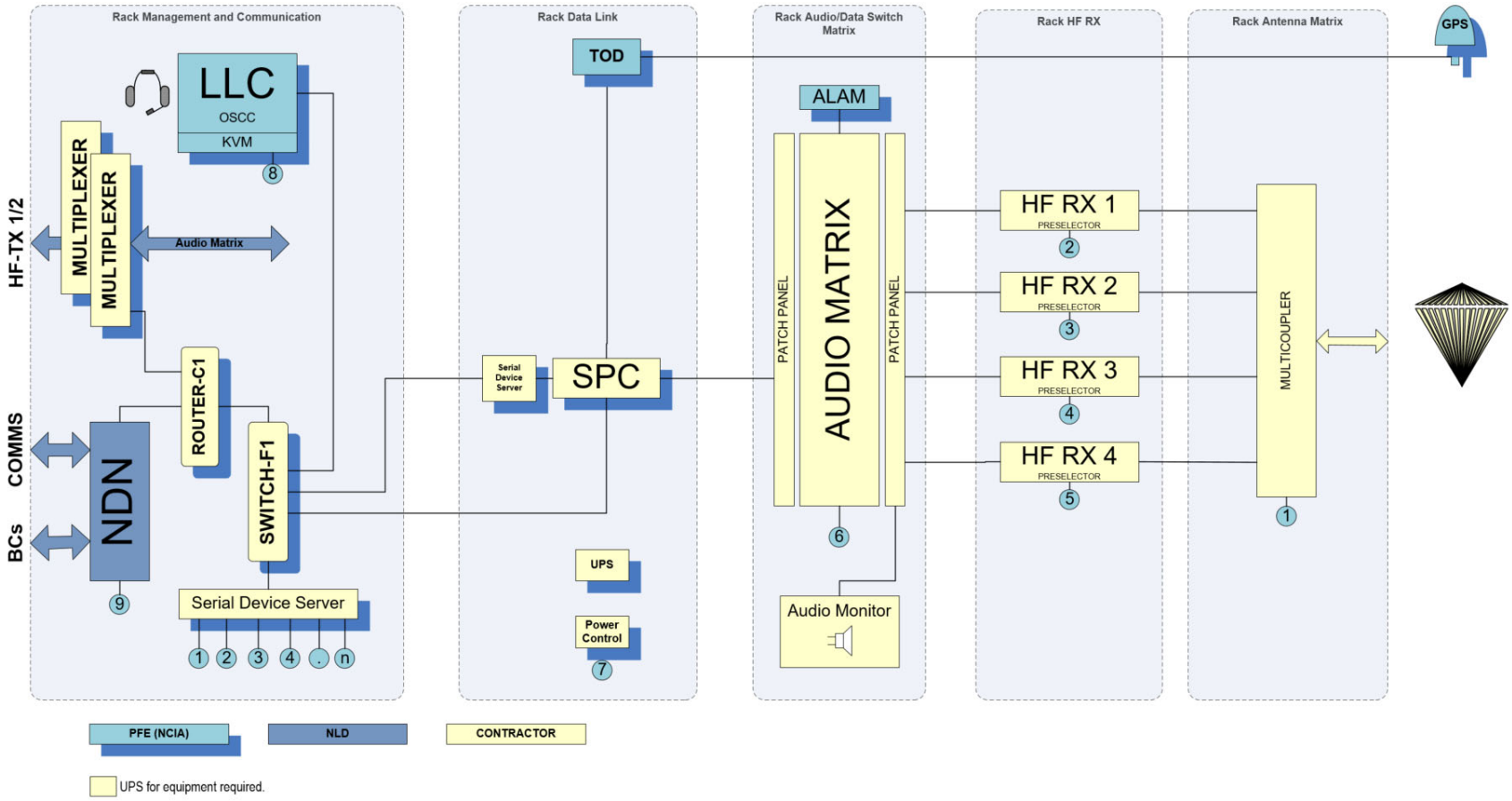

Figure 9: HF-RX Noordwijk Radio site block diagram

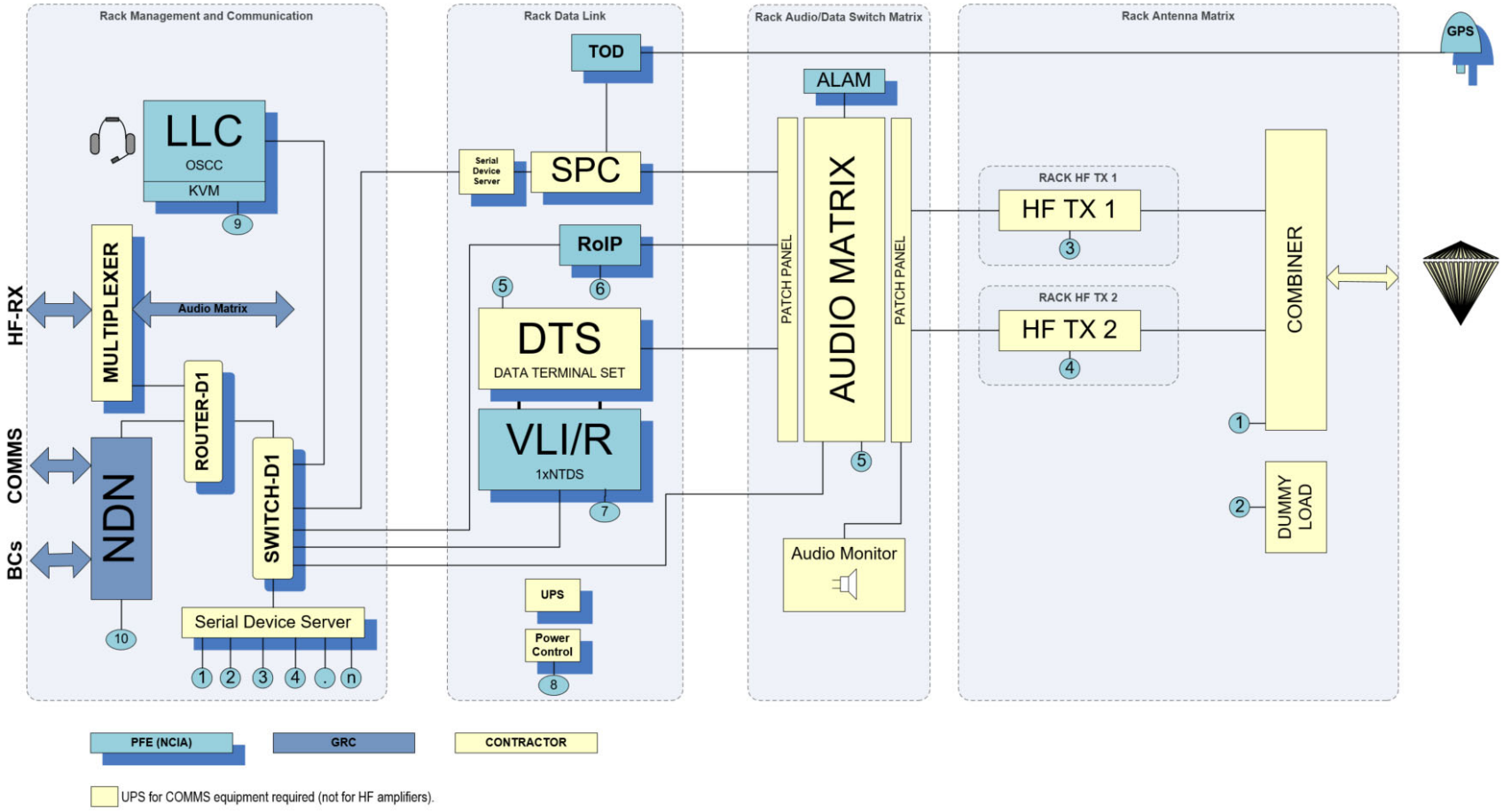

Figure 10: HF TX Julianadorp (R20) Radio site block diagram

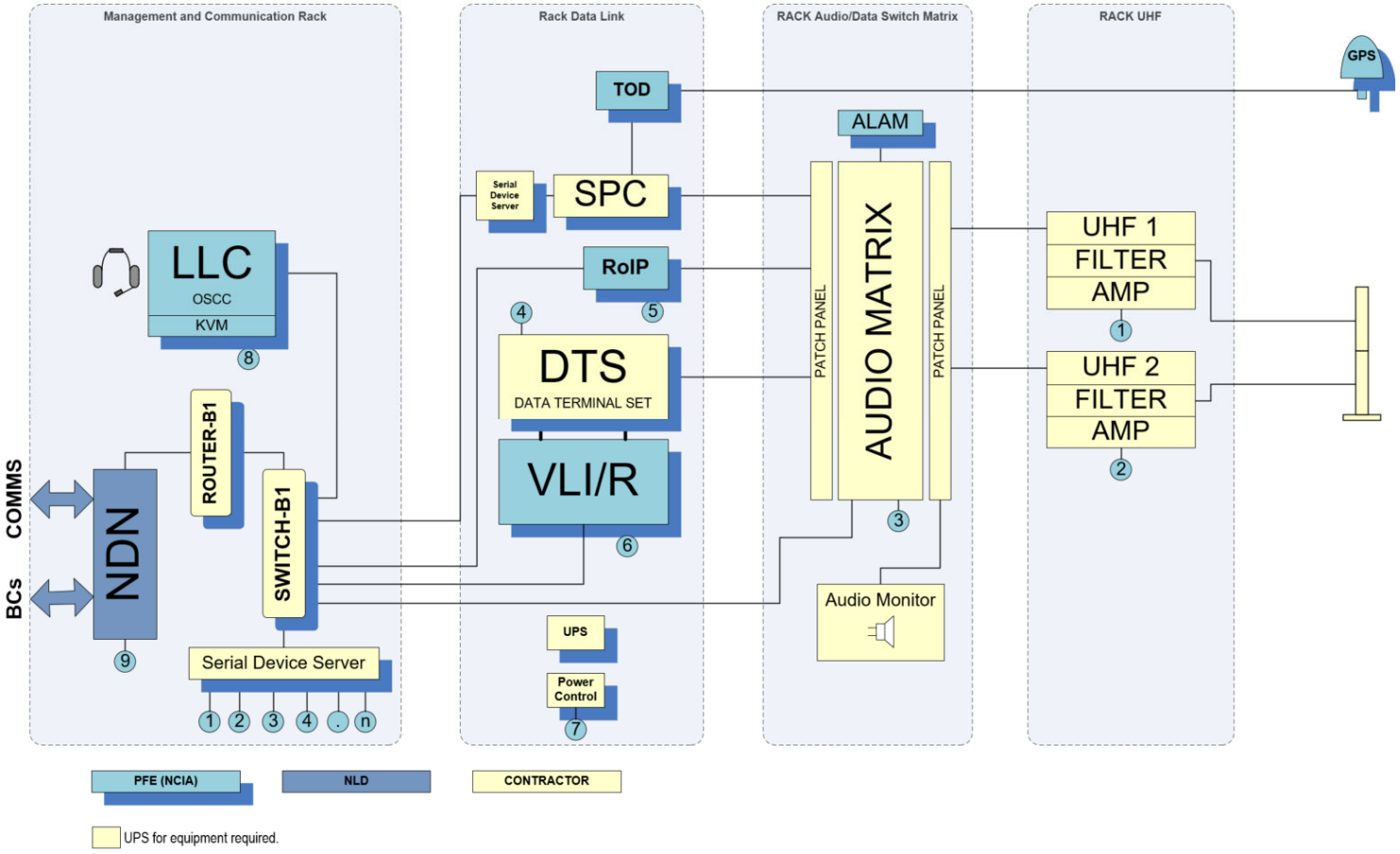

Figure 11: UHF Albatros (Den Helder) Radio site block diagram

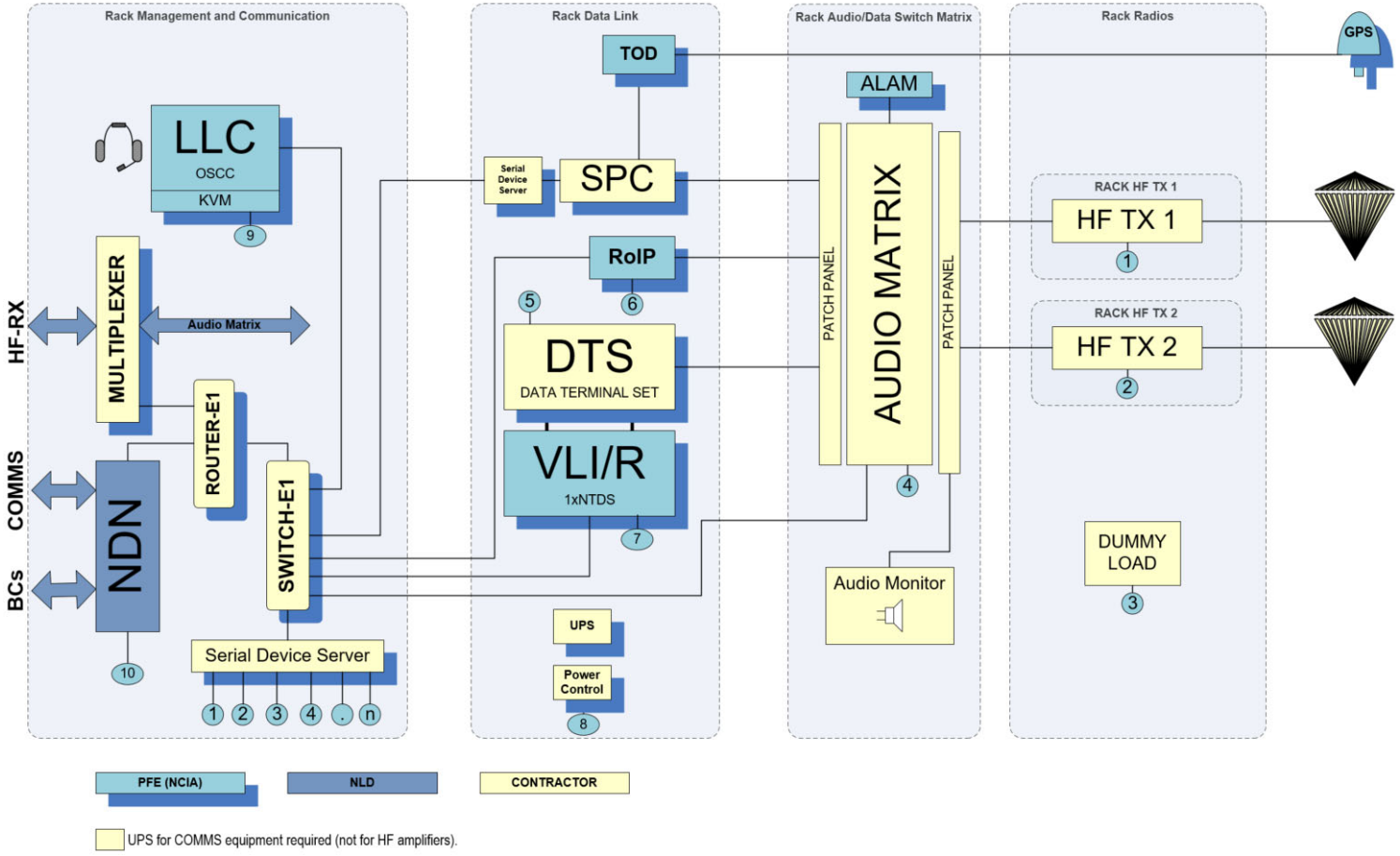

Figure 12: HF TX Zeewolde Radio site block diagram

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 Noordwijk

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

2.8.2 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.

2.8.3 Block diagram showing the components related to the Radio Communication site is described in Figure 9: HF-RX Noordwijk Radio site block diagram

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

2.8.5 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 Niew Milligen to the other SSSB COMMS sites.

2.8.6 HF-RX Equipment.

[A] 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 fields

i. Qty 1 Wide band antenna, vertical polarization for SSSB, 4 channels

ii. RF cabling (incl. trenching)

b. HF Receivers component

i. Qty 4 HF Receivers for SSSB with pre-selectors

ii Qty 1 HF Multi-coupler

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

iv. Qty 1 Audio Monitor

v. Qty 1 TOD-HQ, GPS, military grade, SAASM, incl. antenna

(PFE)

vi. Qty 1 SPC

vii. Qty 1 Radio Management Equipment Set (PFE)

viii Qty 1 Network Router

ix. Qty 1 Switch

x. Qty 2 Multiplexer

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

xii. UPS for COMMS equipment, except for HF TX amplifiers.

xiii. Qty 1 Power switch with remote control capability.

xiv. Qty 1 ALAM (PFE)

xv. All racks with accessories, internal and cabling

2.8.7 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.

2.8.8 Other CW requirements that are Contractor responsibility are specified in SOW Section 14 and the NLD specific SRS (CW) Annex F.

2.9 Radio Communication Sub-system Julianadorp (R20)

2.9.1 This site is a non-collocated HF-TX site.

2.9.2 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.

Block diagram showing the components related to the Radio Communication site is described in Figure 10. The Contractor shall provide the “yellow” colored components and integrate the others, under the scope of this Contract.

2.9.3 HF-TX Components:

a. HF-TX radio component

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

c. Routers, Switches and Serial Converters

d. Long distance comms land line to the Buffer Centre at Niew Milligen to the other SSSB COMMS sites.

[A] 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 or GFE:

a. HF-TX Antenna field

b. Qty 1 Wide band monocone antenna, vertical polarization for SSSB, with Combiner

c. 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 Dummy load 5 kW (GFE)

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

iv. Qty 1 Audio Monitor

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

vi. Qty 1 DTS (GFE)

vii. Qty 1 SPC

viii. Qty 1 VLI/R (PFE)

ix. Qty 1 Radio Management Equipment Set (PFE)

x. Qty 1 RoIP Server (unsecure voice) (PFE)

xi. Qty 1 Network Router

xii. Qty 1 Network Switch

xiii. Qty 1 Multiplexer

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

xv. Qty 1 Power switch with remote control capability.

xvi. Qty 1 ALAM (PFE)

xvii. All racks with accessories, internal and cabling

xviii. UPS for COMMS equipment, except for HF TX amplifiers.

2.9.4 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.

2.9.5 Other CW requirements that are Contractor responsibility are specified in SOW Section 14.

2.10 Radio Communication Sub-system Albatros (Den Helder)

2.10.1 This site is a non-co-located UHF site.

2.10.2 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.

Block diagram showing the components related to the Radio Communication site is described in Figure 11. The Contractor shall provide the “yellow” colored components and integrate the others, under the scope of this Contract.

2.10.3 UHF Components:

a. UHF radio component

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

c. Routers, Switches and Serial Converters

d. Long distance comms land line to the Buffer Centre at Niew Milligen to the other SSSB COMMS sites.

[A] UHF Equipment. The Contractor is to provide, but not limited to, the following equipment for the radio components, less any equipment listed as PFE or GFE:

a. UHF Antennas

i. Qty 1 Co-linear antenna with two channels

ii. RF cabling (incl. trenching)

b. UHF RTX component

i. 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)

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

iii. Qty 1 Audio Monitor

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

v. Qty 1 DTS (GFE)

vi. Qty 1 SPC

vii. Qty 1 VLI/R (PFE)

viii. Qty 1 Radio Management Equipment Set (PFE)

ix. Qty 1 RoIP Server (unsecure voice) (PFE)

x. Qty 1 Network Router

xi. Qty 1 Network Switch

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

xiii. Qty 1 Power switch with remote control capability.

xiv. Qty 1 ALAM (PFE)

xv. All racks with accessories, internal and cabling

xvi. UPS for COMMS equipment, except for HF TX amplifiers.

2.10.4 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.

2.10.5 Other CW requirements that are Contractor responsibility are specified in SOW Section 14.

2.11 Radio Communication Sub-system Zeewolde

2.11.1 This site is a non-colocated HF-TX site.

2.11.2 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.

Block diagram showing the components related to the Radio Communication site is described in Figure 12: HF TX Zeewolde Radio site block diagram . The Contractor shall provide the “yellow” colored components and integrate the others, under the scope of this Contract.

2.11.3 HF-TX Components:

a. HF-TX radio component

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

c. Routers, Switches and Serial Converters

d. Long distance comms land line to the Buffer Centre at Niew Milligen to the other SSSB COMMS sites.

[A] 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 or GFE:

a. HF-TX Antenna field

i. Qty 2 Wide band monocone antenna, horizontal polarization for SSSB

ii. RF cabling (incl. trenching)

b. 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

iii. Qty 1 Dummy load 5 kW

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

v. Qty 1 Audio Monitor

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

vii. Qty 1 DTS

viii. Qty 1 SPC

ix. Qty 1 VLI/R (PFE)

x. Qty 1 Radio Management Equipment Set (PFE)

c. Qty 1 RoIP Server (unsecure voice) (PFE)

i. Qty 1 Network Router

ii. Qty 1 Network Switch

iii. Qty 1 Multiplexer

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

v. Qty 1 Power switch with remote control capability.

vi. Qty 1 ALAM (PFE)

vii. All racks with accessories, internal and cabling

viii. UPS for COMMS equipment, except for HF TX amplifiers.

2.11.4 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.

2.11.5 Other CW requirements that are Contractor responsibility are specified in SOW Section 14.

2.12 Radio Management and Command and Control Sub-system

2.12.1 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 Centre/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.

2.12.2 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.

2.12.3 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 Section 4.

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

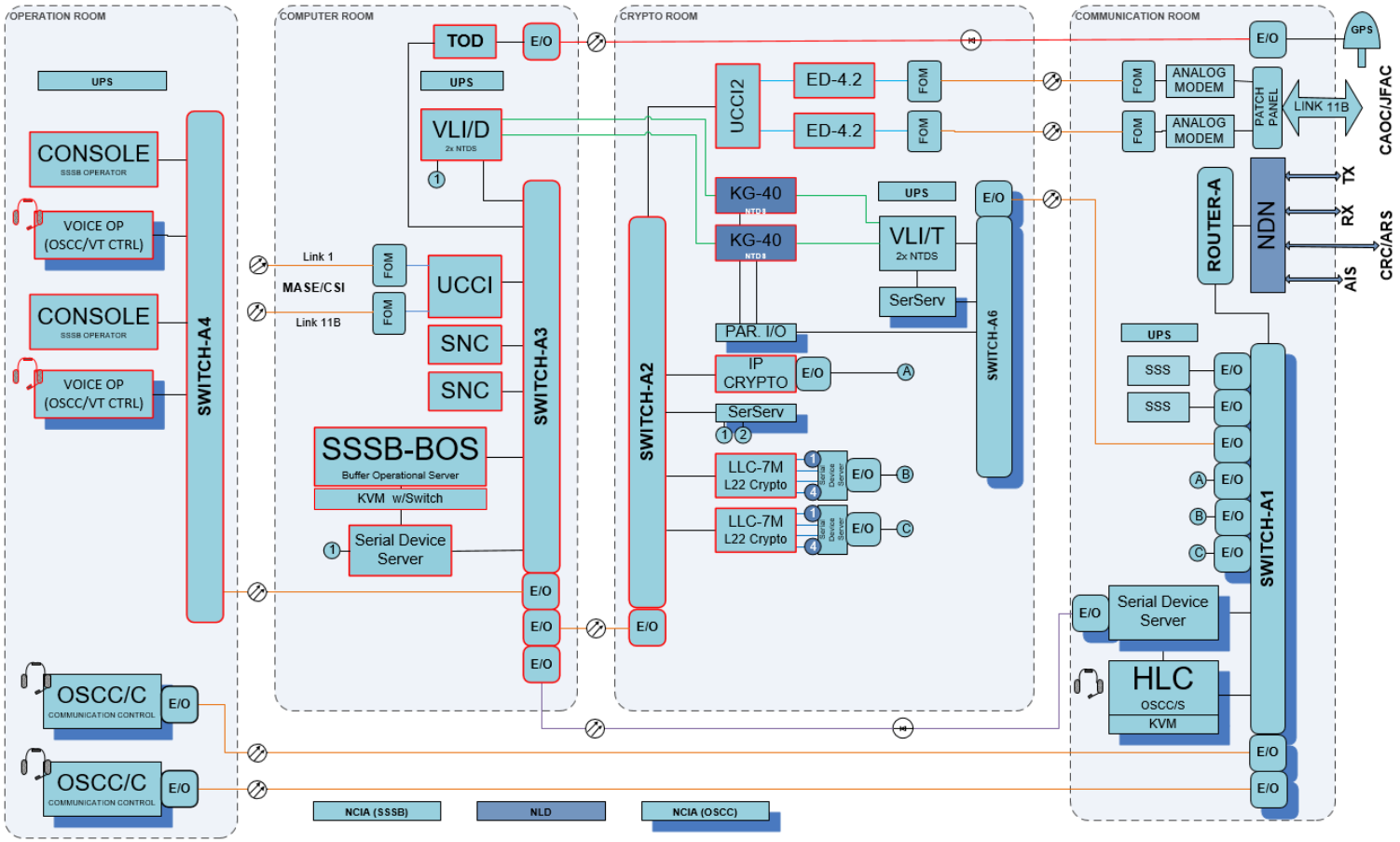

Figure 13: SSSB BC at Nieuw Milligen block diagram

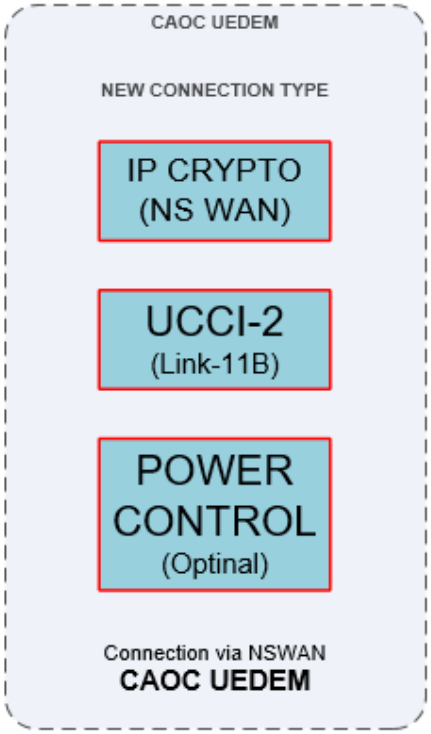

Figure 14: SSSB BC connection to CAOC UEDEM

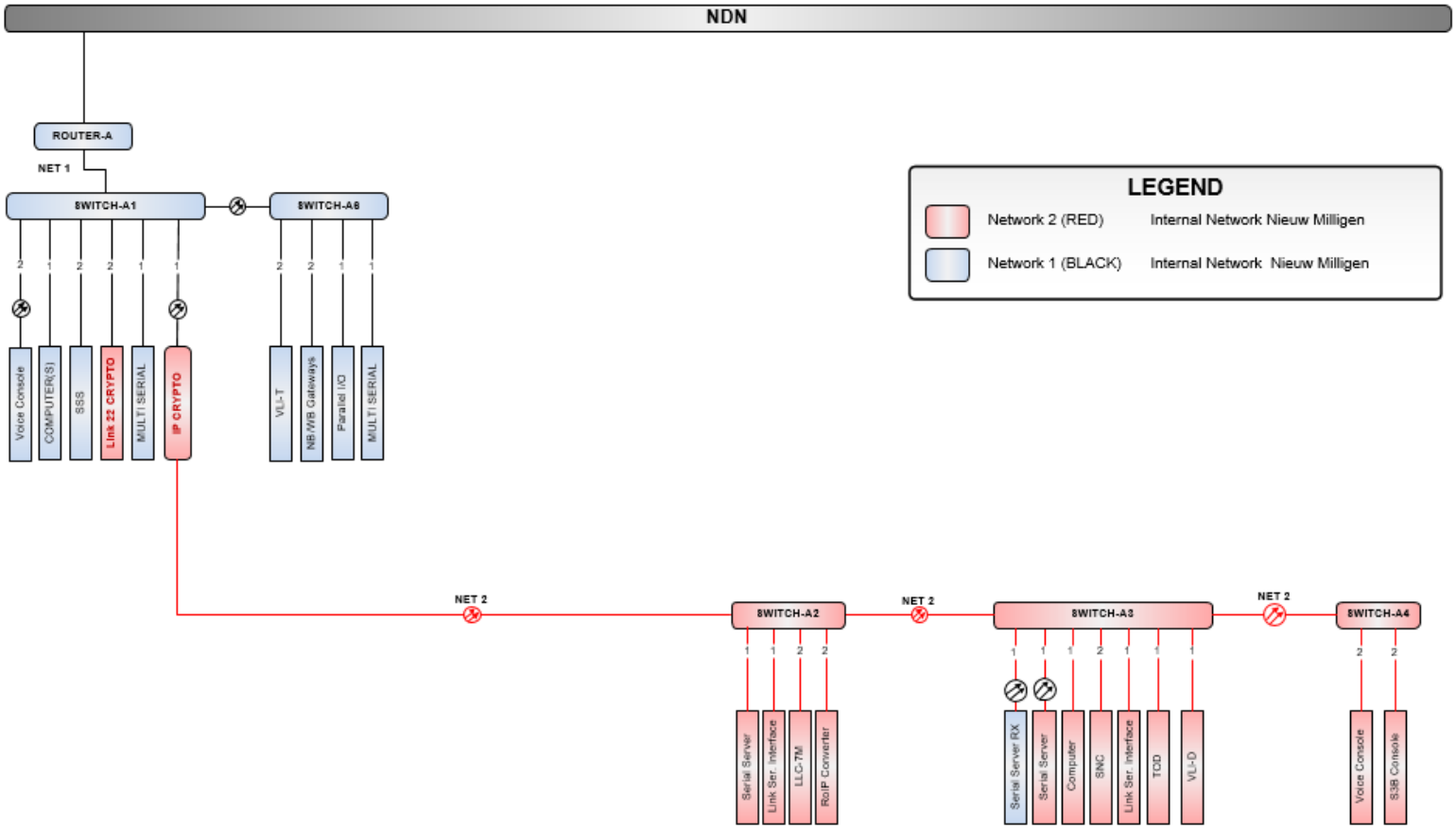

Figure 15: SSSB Brief Network Overview 1/2

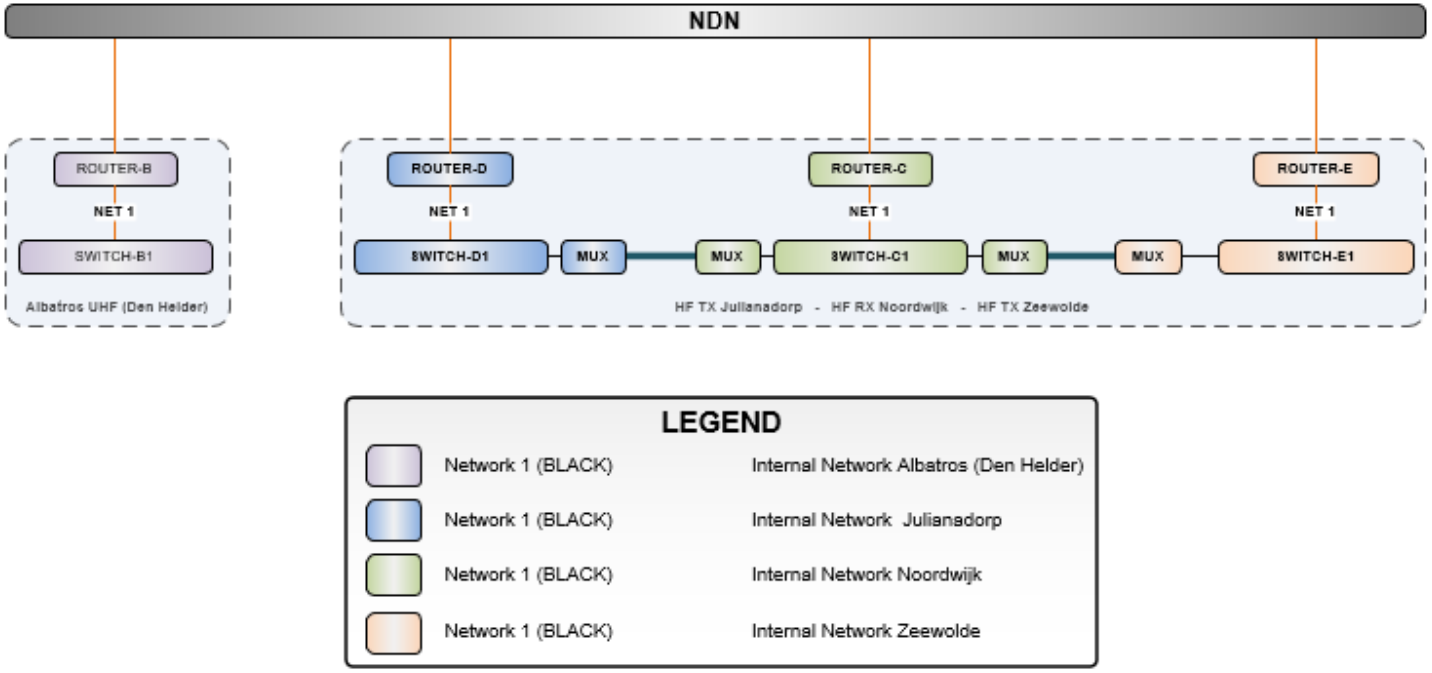

Figure 16: SSSB Brief Network Overview 2/2

2.13 System Integration and Testing

2.13.1 The Contractor shall be responsible to perform the testing activities as specified in SOW Section 12.

2.14 Summary of Responsibilities

This paragraph provides a summary of the areas of responsibilities of the Contractor, as illustrated in:Figure 17: Areas of responsibilities among Contractor, Purchaser and THN.

2.14.1 The Contractor shall be responsible for the:

a. Implementation of the 4 (four) Radio Sites, including integration of the PFE elements.

b. RX Site Noordwijk is a non-collocated site.

   i. Separate COMMS HF-RX

c. RX Julianadorp (R20) is a non-collocated site.

   i. Separate COMMS HF-TX.

d. UHF Albatros (Den Helder) is a non-collocated site.

   i. Separate COMMS UHF.

e. RX Site Zeewolde is a non-collocated site.

   i. Separate COMMS HF-TX.

f. Implementation of DLOS microwave inter-site communication is currently not foreseen, but might be considered upon contractor recommendation.

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

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

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

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

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

a. Implementation of the Buffer Centres.

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

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

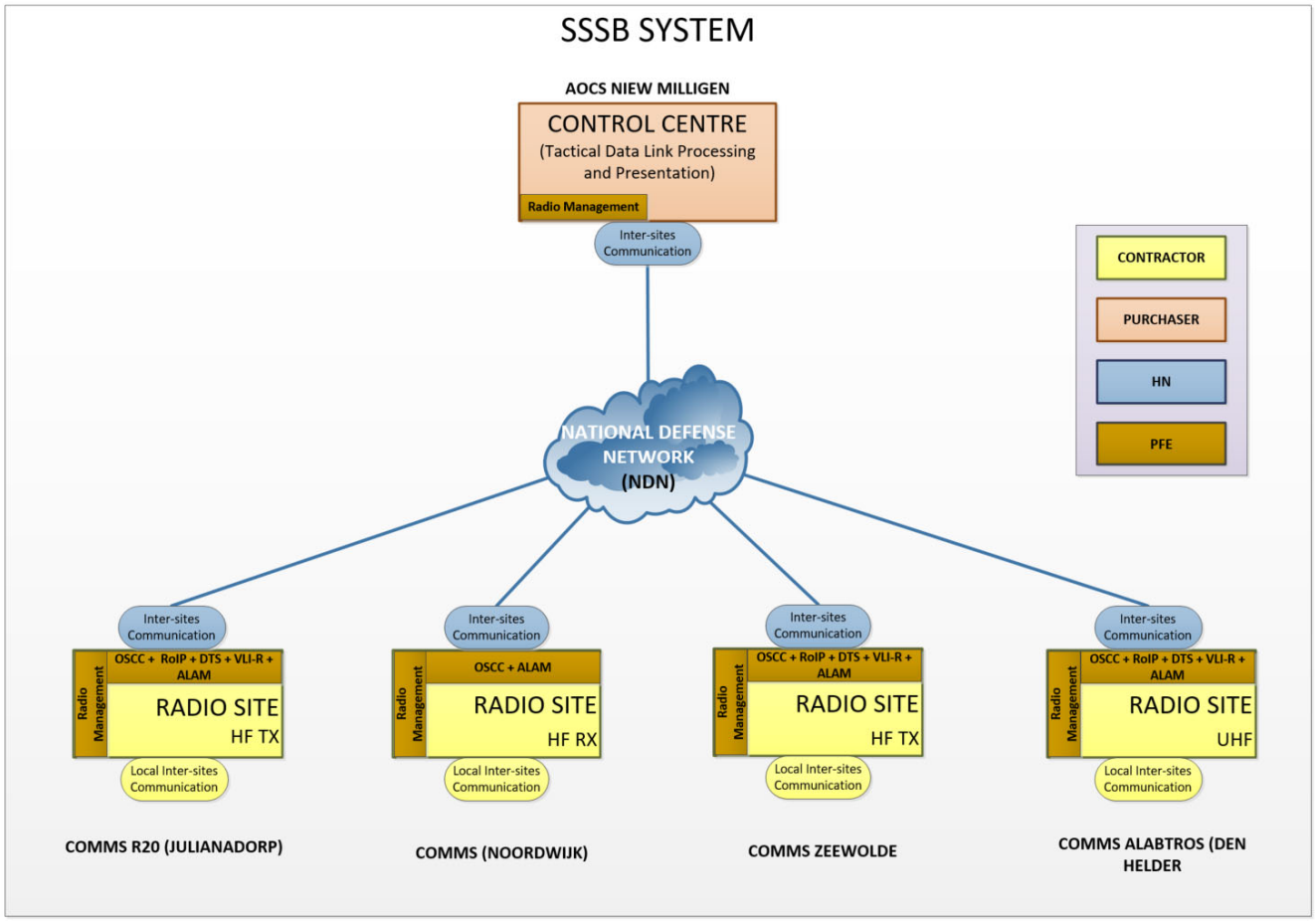

Figure 17: Areas of responsibilities among Contractor, Purchaser and THN

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 required), trolleys, office furniture and workbench).

b. 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:

i. 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):

i. 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:

ii. COMMS HF TX.

a. COMMS HF RX.

b. COMMS UHF.

h. SMS Alert Panels shall:

i. Indicate the individual states/alerts by an LED.

ii. Have an Alert Buzzer.

iii. Have an ACKNOWLEDGE button to acknowledge any alert and switch off the Alert Buzzer.

iv. Have a LED/Buzzer Test Button:

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

i. The error detection and correction measures necessary, to identify the displayed fault.

ii. To recover the operational state, if possible.

iii. To secure the related equipment and its surrounding environment - up to the level of human and building safety.

iv. A list of Alerts and triggering Sub-Alerts as well as the detailed description of each alert - added as an appendix.

v. A procedure how to change the triggering sub-alert(s)

vi. 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.

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):

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

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

e. 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.

f. 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.

g. Modes of operation:

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

ii. CW (A1A class of emission5)

iii. Link 11 and Link 22

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

i. Audio inputs 28: 0 ± 3 dBm and 10.3 dB PEP/avg on balanced ungrounded

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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.

lines with 600 ohm terminations.

j. PTT input.

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

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

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

n. 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.

o. 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.

p. Sideband attenuation: 60 dB below PEP.

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

r. Harmonic attenuation: 45 dB below PEP.

s. Spurious attenuation: 45 dBc.

t. 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).

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

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

   i. 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).

   ii. 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).

   iii. 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 signal inputs terminated in 600 ohm dummy loads).

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

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

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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.

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

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

z. Programmed channels: 99.

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

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

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

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

ee. Power consumption (max): 20 kW.

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

gg. Weight (max): 750 kg.

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

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

jj. Cooling`/ventilation system: forced air.

hh. 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.

ii. 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

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of maximum receive sensitivity within 23 milliseconds or less after reset of
the radio set keyline.
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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):

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

ii. ± 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.

e. Modes of operation:

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

ii. AM (A3E, classes of emission7).

f. 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.

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

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

i. PTT/Mute input.

j. 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 receiver8.

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

i. Group (or differential) delay (max): 500 μs (within the frequency range 815

[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] 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.

÷ 3.050 Hz).

j. BITE: embedded.

k. Programmed channels: 99.

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

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

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

o. Power consumption (max): 700 W.

p. Rack mountable with size (max): 19” x 580 mm x 3U (W x D x H).

q. Weight (max): 35 kg.

r. Operating temperature: 0 ÷ +40 °C.

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

t. Transmitter section.

u. 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.

v. 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.

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

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

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

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

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

bb. Harmonic attenuation: 70 dBc.

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

dd. 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).

ee. 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:

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

gg. 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.

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

ii. Input signal protection:

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

kk. 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.

ll. Image frequency rejection: 80 dB.

mm. IF rejection: 80 dB.

nn. Spurious frequency rejection: 80 dB.

oo. 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

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

ii. 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

3.6.9 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.

3.6.10 Analog and Discrete signals:

a. Analog Signals Narrow Band (NB)

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

b. Analog Signals Wide Band – NRZ

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

c. PTT/KEYLINE Open Collector

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

   ii. Receive: Open

d. PTT/KEYLINE +6V

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

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

e. PPT/KEYLINE V.28

   i. Transmit: positive voltage max +12V

   ii. Reception: negative voltage max -12V

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

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

   v. Serial: From 4800 to 11520 b/s

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

g. PT/CT

   i. Vmin -0.3 V

   ii. Vmax +31V,

   III. Output: Open drain to +28V

   iv. Imax 5mA

   v. Rj ~1kOhm

h. 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

l. 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

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

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

k. Gain: 0 ±0,5 dB

l. Frequency response (max): NB: ±2 dB between 20 and 3.400 Hz

m. Frequency response (max): WB: ±2 dB between 20 and 26/48 kHz

n. Switching time (max): 10 ms

o Local control: keyboard and LCD display

3.7 Dummy Load

3.7.1 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

3.8 HF Transmitter Antenna

3.8.1 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.

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

3.8.3 HF TX Antenna (Horizontal Polarisation) requirements:

a. HF dipole antenna with horizontal polarization (Sky Wave) with the following minimum requirements:

b. Type: Dipole

c. Frequency range: 2 ÷ 30 MHz

d. Polarization: horizontal

e. Input impedance: 50 ohm

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

g. VSWR (max): 2.0:1 or less over most of frequency band; 2.5:1 maximum

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

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

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

i. Dimensions (max):

i. The maximum dimensions of the HF Antenna shall be based on the ground available at the TX site.

ii. Standard dimensions (length/width):

- 80x50 m

j. Height: maximum height in line with THN regulations

k. 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:

l 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;

i. High Temperature: Norm: + 65° C for operation;

ii. Low Temperature: Norm: - 50° C for operation;

iii. Minimum 44 - 61 m/s ±10% wind at Noordwijk

iv. Minimum 44 - 61 m/s ±10% wind at Julianadorp (R20)

v. Minimum 44 - 61 m/s ±10% wind at Den Helder (Albatros)

vi. Minimum 44 - 61 m/s ±10% wind at Zeewolde

vii. 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.

viii. Hailstones of up to 25 mm diameter, 0.9 g/cm3 density and 58 m/s terminal velocity;

ix. 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;

x. The fundamental resonance frequency of the mast with equipment shall be greater than 3 Hz;

xi. The design of the antenna masts shall take into account seismic conditions of THN.

xii. 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.

3.8.4 HF TX Antenna (Vertical Polarisation) requirements:

a. HF antenna with vertical polarization (Ground Wave), 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:

i. Type: monocone (inverted cone)

ii. Frequency range: 2 ÷ 30 MHz

iii. Polarization: vertical

iv. Input impedance: 50 ohm

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

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

vii. VSWR (max):

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

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

ix. Dimensions (max):

1. The maximum dimensions of the HF Antenna shall be based on the ground available at the TX/RX sites.
2. Standard dimensions (diameter):
   - 80 m
3. To be determined during site survey.

x. Height: maximum height in line with National regulations

xi. 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:

xii. 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;

xiii High Temperature: Norm: + 65° C for operation;

1. Low Temperature: Norm: - 50° C for operation;
2. 44 - 61 m/s ±10% wind at Noordwijk
3. 44 - 61 m/s ±10% wind at Julianadorp (R20)
4. 44 - 61 m/s ±10% wind at Albatros (Den Helder)

5. 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.
6. Hailstones of up to 25 mm diameter, 0.9 g/cm3 density and 58 m/s terminal velocity;
7. 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;
8. The fundamental resonance frequency of the mast with equipment shall be greater than 3 Hz;
9. The design of the antenna masts shall take into account seismic conditions of THN.
10. 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.

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

3.9 UHF Antenna

3.9.1 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 m
l. Height: 3 m
m. Weight (max): 35 kg
n. Environmental operation:

i. 44 - 61 m/s ±10% wind at Noordwijk

ii. 44 - 61 m/s ±10% wind at Julianadorp (R20)

iii. 44 - 61 m/s ±10% wind at Albatros (Den Helder)

iv. 44 - 61 m/s ±10% wind at Zeewolde

v 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.

o. Omnidirectional

3.10 Receiver HF/SSB

3.10.1 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 [9]

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

h. Modes of operation:

i. AM including USB, LSB and ISB in compliance with STANAG 5511 and STANAG 5522

ii. CW

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

j. Mute input

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

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

m. 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

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

4400 Hz; gain for each sideband adjustable to within 1/2 dB of nominal output

n. 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 terminals10

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

p. 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 latter by fc ±5 % shall not degrade the output SINAD by more than 1 dB.

q. 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.

r. 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.

s. 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.

t. Image frequency rejection: 70 dB

u. IF rejection: 70 dB

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

w. 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.

x. 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.

y. Out-of-band IMD: for a two-tone equal-amplitude input signals with each

[10] 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.

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.

z. Automatic Gain Control (AGC):
    i. Attack time delay (max): 12 ms (from no signal to a two-tone +19 dBm signal).
    ii. 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).
    iii. Recycle period: capability of repeating the above operations every 100 ms (with a period between data signals higher than 10 ms).
    iv. 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.

aa. BITE: embedded

bb. Local and remote (BITE) controls

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

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

ee. Power consumption (max): 350 W

ff. Rack mountable with size (max): 19” x 580 mm x 3U (W x D x H)

gg. Weight (max): 20 kg

hh. Operating temperature: 0 ÷ +40 °C

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

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

3.11 HF-RX Pre-Selector

3.11.1 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

l. Rack mountable with size (max): 19” x 580 mm x 2U (W x D x H)

j. Weight (max): 20 kg

k. Operating temperature: 0 ÷ +40 °C

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

m. Intermodulation distortion: better than 35 dB

3.12 HF-RX Multi-coupler

3.12.1 Rack mountable HF-RX Multi-coupler in order to allow the use of one HF antenna with two (4) 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): 1

f. Number of outputs (receivers): 2

g. VSWR input/output (max): 1.5: 1

h. Isolation between RF outputs: 30 dB

i. Rack mountable with size (max): 19” x 480 mm x 4U (W x D x H)

j. Weight (max): 70 kg

k. Operating temperature: 0 ÷ +40 °C

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

m. 5dB signal amplification

n. Minimum signal loss

o. Minimum distortion

The contractor shall consider the implementation of an Active Multi-coupler.

The contractor shall justify the selection of the Multi-coupler to the purchaser.

3.13 HF Receiver Antenna

3.13.1 The physical and environmental requirements of this antenna and supporting structure are the same as for the HF Transmitter antenna specified in section 3.8.4.

3.14 RF Cabling

3.14.1 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):

i. 10 dB/100m @ 225 MHz;

ii. 15 dB/100m @ 400 MHz

b. Standard 7/8” coaxial cable attenuation (max):

i. 0.2 dB/100m @ 2÷4 MHz

ii. 0.3 dB/100m @ 6 MHz

iii. 0.4 dB/100m @ 10 MHz

iv. 0.7 dB/100m @ 30 MHz

v. 1.8 dB/100m @ 225 MHz

vi. 2.5 dB/100m @ 400 MHz

c. Standard 1-5/8” coaxial cabling attenuation (max):

i. 0.1 dB/100m @ 2÷4 MHz

ii. 0.2 dB/100m @ 6 MHz

iii. 0.3 dB/100m @ 10 MHz

iv. 0.4 dB/100m @ 30 MHz

3.14.2 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.

3.15 19” Standard Rack Cabinets

3.15.1 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

c. Suitable number of covering blank panels

d. A proportionate magneto-thermal differential breaker and a warning light

e. Front service socket set

f. Proportionate cooling set for equipment heat removal in the worst case

g. Ventilation slits to allow for forced cooling

h. Service drawer, minimum 2U height, placed to be easily accessible by a standing person. One every three racks.

i. Suitable protections against dust for the cables inputs and for ventilation slits

j. 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.

k. External not removable label in metallic material, reporting the following data:

   i. Inventory number and contract date (contract nr. Contract number of mm.dd.yyyy Inventory)

   ii. Purchaser

   iii. Contractor (contracting Company name)

   iv. Use destination

3.15.2 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.

3.15.3 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).

3.16 Combiner

3.16.1 The power combiner represents the mean of combining transmitter powers providing isolation between the separate signal paths.

3.16.2 Combiner shall be compliant to the following requirements:

a. Type: hybrid at -3 dB

b. Frequency: 2-30 MHz

c. Impedance: 50 ohms

d. Load ports: 2 x 50 ohms 7/8" EIA

e. Power: 2 x input channels, each 5 kW PEP VSWR (max): 1.3:1 Insertion

f. Loss (max): 0.5 dB

g. Isolation: 20 dB

3.17 Multiplexer

3.17.1 The Multiplexer shall transport Audio signals/services and discrete 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.

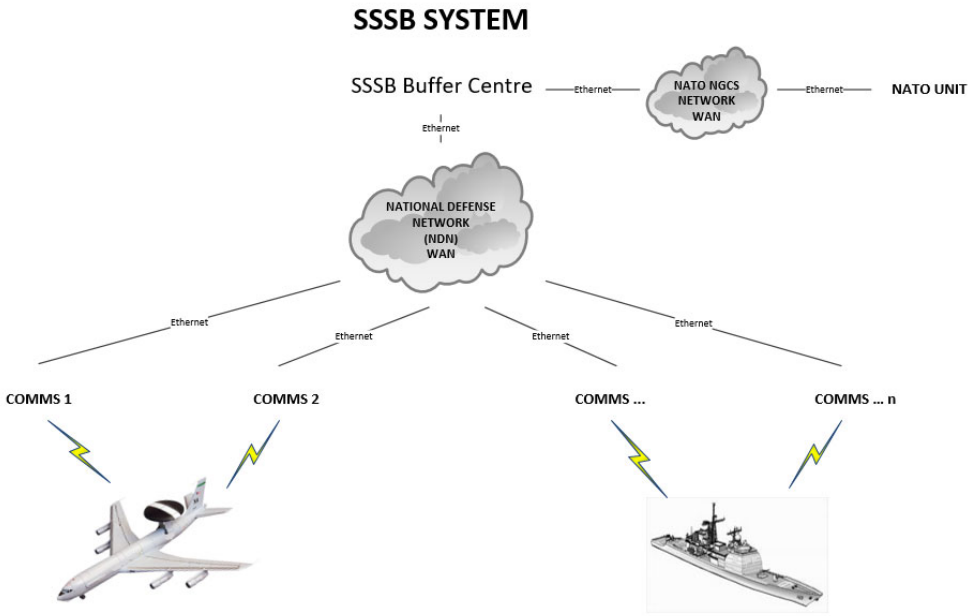

Figure 18: SSSB Network Overview

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:

i. STANAG 4430 NRS IDD

ii MIL Grade GPS SAASM

b. SPC supports the following control Interface:

i. 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

i. NG 278-A018-LLCIRS/B4

ii. NG 278-A018-SPCSS/B4

iii. NG 278-A018-SPCSS/B4, Appendix A, HF FF Media

iv. NG 278-A018-SPCSS/B4, Appendix B, UHF FF Media

v. 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:

a. LOCAL

b. SPC Serial Splitter (SSS)

c. 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)

[A] 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:

i. MIL-STD-188-203A,

ii. SPAWAR-S-850,

iii. MIL-STD-1397,

iv. STANAG 5511,

v. 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:

i. Naval Tactical Data System (NTDS).

d. DTS supports the following control Interface:

i. 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 F 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 19, which requests for the use of TDS computers, crypto's, DTSs and RF transceivers for distribution over the air.

Figure 19: 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

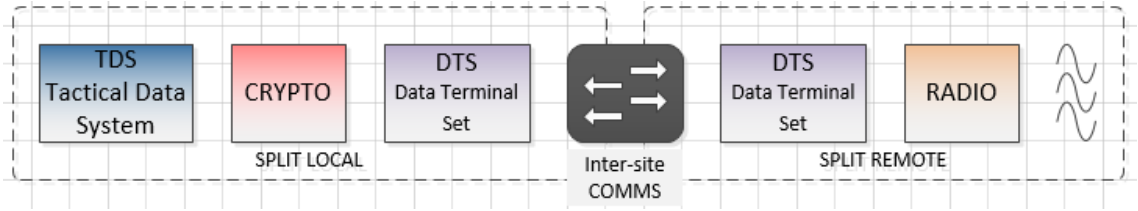

Figure 20: SSSB/Link 11 system – DTS Split-Site architecture

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.

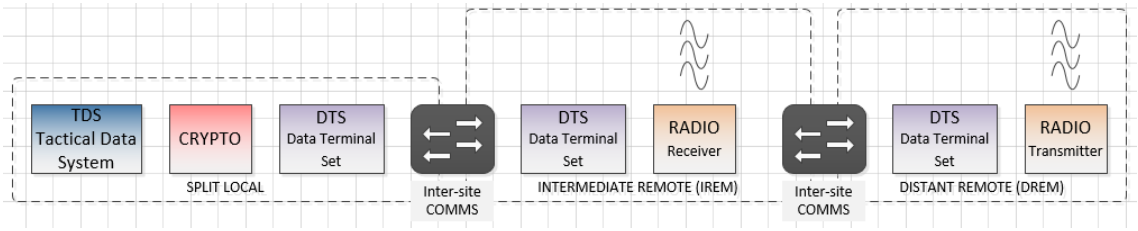

Figure 21: SSSB/Link 11 system – DTS Split-Split site architecture

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:

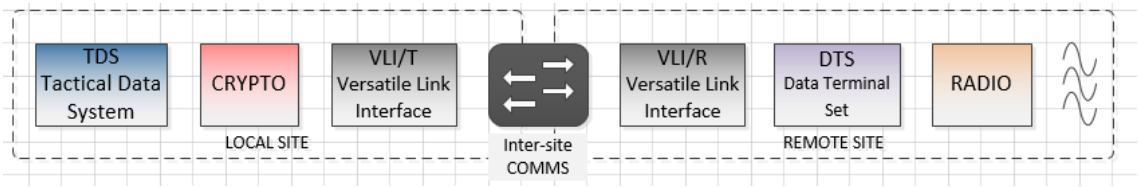

Figure 22: SSSB/Link 11 system – NATO Versatile Link Interface (VLI) architecture

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.

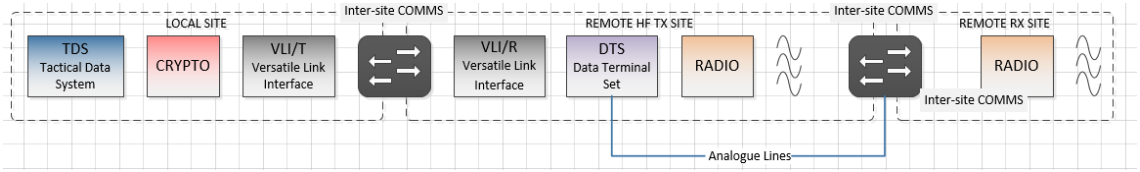

Figure 23: SSSB/Link 11 system – Simplified final architecture

4.3 UPS System

4.3.1 If it is subsequently found that additional UPS capacity is required for the correct operations of the CIS equipment in the facility building of the radio sites, then the provision of such additional UPS will be the Contractor's responsibility. In addition, if replacement of battery pack(s) of existing UPS appliances or UPS maintenance is required then the Contractor shall also provide such replacement/services.

4.3.2 In case complementary UPS NB appliances are required, the Contractor shall supply a UPS system with at least the following characteristics:

a. Input voltage 400 Vac three phases with neutral, 45 to 65 Hz, double-online conversion with zero time transfer.

b. Output Power sized in accordance to the applied loads, considering a minimum of 20 minutes of backup power in case of a power failure.

c. Batteries shall be of sealed maintenance-free type, replacement of the batteries shall be possible without powering down the UPS.

d. The expected battery lifetime shall be at least 9 years.

e. UPS shall be rated for a 20% spare capacity.

4.4 Rooms Air Conditioning

4.4.1 Additional air conditioning civil works might needed based on the results of the Contrators site survey, to fulfill the cooling requirements of the SSSB System.

4.5 HF Transmitters Equipment Cooling

4.5.1 The Contractor shall provide cooling for HF transmitters in accordance with:

a. Close circuit operations

b. Intake air filters from the outside

c. Ventilation or Ventilation/Cooling of the racks with high heat dissipation. Adjustable air flow to keep the mean temperature to the optimal value for the operating equipment. The energy consumption and the air flow shall be kept as low as possible.

4.5.2 The following requirements shall be complied with:

a. 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. The cooling system shall be of heat-pump type, air/air reversible, with split unit installed on the walls.

d. The equipment shall be installed outside, preferably on the roof and splinter protected.

e. High quality COTS shall be used.

f. The system shall be automatic and provided with remote control and monitoring interfaces

g. Noise and vibrations shall be kept as low as possible and conforming to working environment specifications

h. Use of fluid is not recommended.

i. The air flow shall be in ducts. Plenum is not recommended. It is recommended the use of suitable diffusers.

j. The recommended cooling gas is R 407 C type or in accordance with the latest regulations.

k. The incoming air flow shall be filtered at least to M Class.

l. The Inside/outside openings shall be shaped (zig-zag) for splinter protection and secured to avoid entrance of animals, objects, etc.

m. The racks shall be provided with automatic air flow control to maintain a constant operating temperature.

n. Whenever possible avoid the use of ON/OFF devices.

o. Special consideration shall be used in considering the heat exchanged of the HF transmitters with the room environment.

p. Minimal energy absorption shall be one of the main design requirements.

q. In addition:

   i. Outside openings shall be secure.

   ii. Heat distribution using insulated copper pipes.

   iii. 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

   i. On metal duct, fixed in ordered manner.

   ii. 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

   i. 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.

   ii. 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 manufacturer 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:

   i. At both ends

   ii. At every inspection well

   iii. Every 10 m along the cable ducts or cable ladders

   iv. 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 For antennas that require a ground plane, the Contractor shall:

a. Prepare the installation area in accordance to section 4.9 below.

b. Excavate up to 30 cm the area intended for the laying of the ground plane and verify the flatness.

c. Place pins on the area to allow position identification of antenna and guy line plinths.

d. Put in place a layer of dry rubble on the levelled area.

e. Install the ground plane as per Manufacturer specifications.

f. Put in place a layer of at least 10cm of mixed quarry.

4.7.4 For antennas that do not require ground plane, the Contractor shall:

a. Clean and prepare the area.

b. Place pins on the area to allow position identification of antenna and guy lines plinths.

4.7.5 In addition, the Contractor shall perform the following Civil Works for HF antenna installations:

a. Construction in reinforced concrete of the plinths of such a size to be compatible with the manufacturer specifications and the results of the soil tests.

b. The plinth at the base of the antenna mast shall be large enough to avoid that the grass growing around the area to come in contact with the antenna structure.

c. Connect the metal structures among them to the earth pins.

d. Prepare the base of the antenna for the RF cable joint, and the other devices as service power socket, discharger and air obstacle light power transformer.

e. Build a security/safety fence around the concrete base of at least 1m high. Fence material and size shall be adequate to avoid personnel accidental contact and wild animal access.

f. Antenna installation in accordance with the manufacturer instructions.

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 shall be not mounted on existing buildings. A stand-alone mast/pole construction shall be used instead.

4.9 Microwave DLOS Antenna Installation

4.9.1 Implementation of DLOS microwave inter-site communication is currently not foreseen for the NLD.

4.10 Antennas Field Area Preparation (see also SRS (CW) Annex F)

4.10.1 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.

4.10.2 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.

4.10.3 All excavated spoil that is not re-used shall be disposed by the Contractor as per HN regulations.

4.10.4 After the preparation of the antenna field, the HF antennas shall be installed.

4.10.5 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. No civil, military or private aerodrome or helipad was confirmed within the site boundary or in the proximity to date;

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.

4.10.6 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.

4.10.7 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.

4.10.8 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. 4.11 below.

4.10.9 Marking and painting shall be provided for the antenna main vertical structures/poles when relevant in compliance with ICAO norms, and valid national NL regulations.

4.10.10 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.

4.10.11 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.

4.11 Antenna Obstruction Lights (Aircraft Warning Lights)

4.11.1 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 NL regulations.

4.11.2 All the antennas shall be provided with obstruction light kits, based on LED technology for low/no maintenance.

4.11.3 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.

4.12 Lightning System

4.12.1 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

4.13 Ground and Earth System

4.13.1 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.

4.13.2 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.

4.13.3 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.

4.14 Site Monitor System

4.14.1 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.

4.14.2 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.

4.14.3 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.

4.14.4 Any other recommendation from the Contractor in relation to the installed devices shall be detailed in his bidding proposal.

4.14.5 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.

4.15 Non-Functional Requirements

4.15.1 Reliability, Availability, Maintainability and Testability (RAMT) Program

4.15.2 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.

4.15.3 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.

4.15.4 Maintainability and Testability Requirements (MTR)

4.15.5 Maintainability shall be expressed as Mean Time To Repair (MTTR) and Mean Time to Restore the System (MTTRS):

4.15.6 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.

4.15.7 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.

4.15.8 The MTTR at Site Level shall not exceed 30 minutes and the TTRMax (95%) shall not exceed 60 minutes.

4.15.9 The MTTRs at Site Level shall not exceed 45 minutes.

4.15.10 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).

4.15.11 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).

4.15.12 Availability Requirements

4.15.13 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.

4.15.14 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.

4.15.15 Inherent availability (Ai) shall be calculated as MTBCF / (MTBCF + MTTRS).

4.15.16 Inherent availability (Ai) shall be greater than 99.9 %.

4.15.17 Mean Time To Repair (MTTR)

4.15.18 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.

4.15.19 For HL1/2 tasks, the MTTR shall not exceed 30 minutes.

4.15.20 For HL3 tasks, the MTTR target figure is 120 minutes.

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

   i. '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

   i. HF: '300 NM gapless coverage'

   ii. UHF: 'LOS up to 150 NM'

c. HF Operational Modes

   i. Ship-Shore High Speed Data exchange NTDS Link 11 as per MIL-STD-188-203-1A and STANAG 5511

   ii. Ship-Shore High Speed Data Exchange Link 22 as per STANAG 5522

   iii. Voice SSB for coordination, Ship-Shore

d. Transmitters

   i. HF TX power 5kW peak and mean, frequency range 2-30 MHz, SSB for Link 11, Link 22 modes and Voice mode

e. Propagation Type

   i. Link 11 Vertical polarization, Ground wave

   ii. Link 22 Vertical polarization, Ground wave

   iii. Link 22 Sky wave

   iv. Voice Coordination Vertical polarization, Ground wave

f. Minimum S/N in Link 11 mode

   i. 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:

g. Receiver minimum input power value:

   i. PIN = -105 dBm (equivalent to 1.27 µV / 50 Ohm)

h. Receiver input Signal Noise Ratio value

   i. S/N = 15 dB

i. Minimum S/N in Voice mode

   i. 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:

   ii. Input signal: -110 dBm (equivalent to 0.7 Volt / 50 Ohm)

   iii. Output S/N: 10 dB

j. TX Antenna Field

   i. The following parameters are the minimum requirement for the TX Antenna Field:

      1. Coverage Area: 300 NM
      2. Minimum S/N: 10 dB at the receiver antenna
      3. TX Power: 5 kW
      4. Simulations: Month/Day/Hour
      5. Frequency: 2 to 30 MHz
      6. BW: 3 kHz
      7. RX Antenna: Isotropic Vertical
      8. Man Made Noise: -150 dBW/Hz (shipboard)
      9. Propagation: Ground Wave
      10. Polarization: Vertical/Horizontal,
      11. Elliptic

k. Results representation

   i. 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

Transmission				**Reception**	
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								

ii. Legend:

O	No Coverage
X	Coverage
	Not evaluated

iii. 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:

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

i. Excess of SWR

ii. Difficult automatic tuning of the final stage of the amplifier

b. Coupling

i. Spurious emission due to intermodulation between transmitters

ii. Spurious emission in the TX bandwidth influence the quality of distant reception

iii. 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:

i. Transmitter characteristics

ii. Power Level

iii. Antenna decoupling

iv. Antenna characteristics

b. 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:

i. Richard C. Jonson, “Antenna engineering Handbook”, Third edition

b. Initial values:

i. Frequency: 2 – 30 MHz

ii. Power Level: 5 kW

iii. TX Antennas relative distances: (per Final Project)

iv. Antenna characteristics: (per Final Project)

v. 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.

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NATO Communications and Information Agency
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BOOK II

PART IV – STATEMENT OF WORK

SOW - ANNEX E

SITE INFORMATION DATA PACKAGE (NETHERLANDS)

THE CONTENTS OF BOOK II, PART IV – STATEMENT OF WORK, SOW - ANNEX E, SITE INFORMATION DATA PACKAGE (NETHERLANDS) CAN BE FOUND IN THE BIDDERS LIBRARY, SECTION 11

IFB-CO-15577-SSSB

NATO Communications and Information Agency
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BOOK II

PART IV – STATEMENT OF WORK

SOW - ANNEX F

SYSTEM REQUIREMENTS SPECIFICATIONS (CIVIL WORKS) (THE NETHERLANDS)

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PART A – SUMMARY AND GENERAL REQUIREMENTS

PART B – DETAILED DESCRIPTION AND TECHNICAL SPECIFICATIONS

APPENDIXES

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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 by the Contractor in order to accommodate the SSSB system with its supporting infrastructure (such as SSSB electrical installation, UPS etc.).

1.1.2. It is the Contractor's responsibility to provide the Purchaser with complete and finished civil works as specified in this Annex and in 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, installations 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; removal of fence sections if required, then temporary closure of the fence gap according to respective THN security 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 NLD agrees to provide this at any of the sites which shall be specifically agreed with THN NLD 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 NLD agrees to provide those at the sites in which case it shall be specifically agreed with THN NLD 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. Landscaping

ii. Antenna foundations and masts

d. Utilities:

i. SSSB electrical distribution system

ii. Drainage system for antenna fields

iii. SSSB lightning protection and grounding system

e. Protective works

i. Antenna field fences and gates

1.4 Current Situation

1.4.1. The existing situation at the Netherlands (NLD) radio sites is described further within the NLD Site Information Data Package (SIDP) Annex of this SOW (IFB-CO-15577-SSSB SOW Annex E (NATO R*******D). This site is an operational site built in 1986.

1.4.2. The Topographical survey plan (IFB-CO-15577-SSSB SOW Annex E (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 four NLD radio sites at Noordwijk, Julianadorp (R20), Den Helder (Albatros) and Zeewolde efficiently. He shall design and construct facilities that make future expansion and enhancements possible, whilst maintaining minimum 'buffer' zones for security according to THN NL 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 14 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 E (NATO R*******D) and in support of Purchaser-provided information. It includes: Diesel Generators, Power Switch Gear, UPS and batteries.

SECTION 2 DESCRIPTION OF THE CIVIL WORKS (CW)

2.1 Preliminary Remark

2.1.1. This Statement of Requirements (SOW) represents, to the best possible extent, the definition by the Purchaser of the needs expressed by the operational users.

2.1.2. This definition has been provided 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 Bidder, during the bidding phase, and the Contractor during the execution phase. A similar principle shall apply to other bid-related requirements stated throughout this SOW Annex where, for the avoidance of doubt, such obligations shall transfer to the Contractor during the execution phase.

2.1.3. The site installations shall be designed to meet the operational requirements and to incorporate environmentally friendly measures to reduce life-cycle costs.

2.1.4. The design of these facilities shall be such as to enable personnel to perform the required maintenance and control functions in the best possible and economical way.

2.1.5. The structure of these civil works requirements 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.

2.1.6. The broad requirements and the summary technical description are included below:

a. The Contactor’s approach and choices shall be fully justified and documented through its studies, legal and technical references, documentation, etc.

b. 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 is described in SOW Annex E (IFB-CO-15577-SSSB SOW Annex E (NATO R*******D)).

3.1.2. The existing site lay-outs, showing existing limits, fences, access and internal roads, parking, etc., are represented in the drawings provided within the SOW SIDP Annex (IFB-CO-15777-SSSB SOW Annex E) and include where available:

a. The plans of the existing utilities: water, electricity, 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 site survey shall be executed by the Contractor in line with the Schedule of Supply and Services (SSS) 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 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. Details on the current existing NLD Power Station is provided by THN NLD.

3.3.2. Details of the Point of Contact (POC) for the Electrical Power distributor will be confirmed prior to/ or during the Preliminary Site Surveys.

3.4 Surveys and soil tests

3.4.1. Prior to the design development 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).

3.4.2. 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. Subsequent reports shall be the references for the design development that the Contractor shall execute in accordance with the clauses at SECTION 18 (AE – Design).

3.5 External public access road

3.5.1. 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.

3.5.2. To that purpose, the Contractor shall:

a. Confirm whether a preliminary joint inspection with the responsible local authorities (Local Police and Construction Services and any other relevant authorities) is necessary. However, in all cases the maximum axle load of public roads has to be respected.

b. Agree with those 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.

3.6 Commercial and Host Nation Telecommunication Service Providers

3.6.1. The SIDP Annex Appendices (IFB-CO-15577-SSSB SOW Annex E) contains some THN provided drawing describing the fiber optic and cable entry points.

3.6.2. All relevant actions regarding telecommunication providers will be handled by the THN and not the Contractor.

3.6.3. The THN will be responsible for any termination of services which will impact the execution of works by the Contractor.

3.6.4. 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 the Netherlands. This shall comply with the criteria defined in SECTION 18 of this document (A/E Design).

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. Description of building systems (structural, mechanical, electrical, data cabling etc.), interior and exterior finishes of executed penetrations, and the construction 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 in SECTION 5 and SECTION 19 of 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 supervision, control and 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 architect and 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 the Netherlands.

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 the environment evaluation and permits that are required in given locations as one of the first deliverables.

5.3 More requirements concerning this procedure are included in SECTION 19.

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, in support of all technical requirements.

6.1.2. Site preparation and demolition works. This shall include:

a. Construction of the site offices for the Administration, the Contractor and its 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.

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 Asbestos

6.2.1. 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.

6.2.2. The Contractor shall address this aspect where necessary during design phase, construction permit process and in execution phase.

6.2.3. 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

6.3 Earthworks

6.3.1. Earthworks works shall be executed in accordance with the requirements as 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. antenna foundations

c. trenches, buried cables and ducts

d. fences and outdoor signage

6.4 Foundations for antennas and supporting infrastructure

6.4.1. Those works shall be executed in accordance with the requirements stipulated at SECTION 21 for the following:

a. The antenna masts

b. Fences and outdoor signs as necessary.

6.5 Rain water drainage

6.5.1. The rain water drainage system, when required for stability of the antenna masts, towers and supporting infrastructure, shall meet the following requirements:

a. Collection and evacuation of rain water

b. Drainage of surface and sub-surface water

c. Control of ground water level

d. Protection against flooding.

6.5.2. The rain water drainage system shall be kept separated from the existing sewage disposal system.

6.5.3. The connection to the existing drainage system of the local community at the radio sites shall be coordinated with the local authority.

6.5.4. A study approved by this local authority shall be included in the 30% design.

6.5.5. Any works shall be executed in accordance with the requirements stipulated herein in this Annex and in site specific Appendixes.

6.6 Buried cables, cable ducts and trenches

6.6.1. 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 ducts in accordance with applicable THN NL 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 NL technical and legal regulations.

6.6.2. 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 ANTENNA FIELDS AND MISCELLANEOUS CONSTRUCTIONS

7.1 General

7.1.1. The structures and installations shall be designed to meet the principles of the Netherlands Ministry of Defence (NLD MOD) national/ military constructions standards and/or standards specified elsewhere in this SOW Annex and in site specific Appendixes.

7.1.2. Furthermore, the site installations 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.

7.2 Antenna foundations

7.2.1. 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 D Section 4 Technical Requirements: Systems and Infrastructure).

b. Minimum technical standards defined herein in this Annex and in site specific Appendixes.

SECTION 8 FIRE FIGHTING AND FIRE PROTECTION

8.1 General

8.1.1. The Contractor shall comply with the national and regional legislations as well as with guidelines from the local authority.

8.1.2. A detail description of the minimum requirement is included in SECTION 23 of this Annex that addresses general fire prevention measures.

8.2 Fire Prevention

8.2.1. Materials and technique used in buildings and utilities shall be chosen taking due regard of their flammability.

8.2.2. Fire prevention measures shall be coordinated with a recognized competent authority (for example local fire brigade).

SECTION 9 ELECTRICAL WORKS

9.1 Electrical Systems Overview

9.1.1. The electrical distribution system serving the SSSB shall include:

a. Integration with Mains Supply System (details can be found in the SIDP Annex)

b. SSSB Electrical Distribution System

c. Integration with Power Back-up (Diesel Generators)

d. No-break power supply (UPS)

e. Lightning protection and Grounding system

9.1.2. A detail description of the required electrical distribution system and equipment is included herein in this Annex and in site specific Appendixes that addresses the following:

a. Integration with existing electrical installations

b. Electrical distribution panels

c. Cables and wiring

d. Electrical equipment

e. UPS

f. Lightning protection and grounding connection

g. Legal inspections for electrical works

SECTION 10 LANDSCAPING, PLANTING AND GARDENING

10.1 Those works shall be executed in accordance with the requirements described herein in this Annex and in site specific Appendixes.

10.2 The Contractor shall include all phases of erosion, sedimentation and dust control as an integral part of the design and construction of the site.

10.3 This shall include both temporary erosion and sedimentation control measures applied during the construction and permanent stabilization remaining in effect after construction is completed.

10.4 At the end of the construction works, vegetative cover shall be used to provide dust and erosion control.

10.5 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 11 TELEPHONY AND DATA

11.1 Telephony Requirements

11.1.1. Telephony requirements will remain a THN responsibility.

11.1.2. Further requirements can be found in Section 2 of Annex D to the core SOW (NLD SRS(Tech)) as well as the core SOW itself.

11.1.3. Further information will also be available via the NLD MOD (DMO/JIVC).

SECTION 12 HEALTH AND SAFETY (H&S)

12.1 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 the Netherlands H&S legislation regarding the welfare of workers.

12.2 The Contractor shall include in the design and execution phase all required information regarding health and safety taking into account that:

12.2.1. The Contractor shall propose at least one individual that possesses all legally required accreditations in the Netherlands to fulfil the role of “H&S coordinator”.

12.2.2. The H&S coordinator shall be responsible for safety coordination in the design and execution phase.

12.3 In this context, the execution of the 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.

12.4 Further detailed instructions are included at Section 12 of the core SOW and herein in this Annex and in site specific Appendixes .

PART B – DETAILED DESCRIPTION AND TECHNICAL SPECIFICATIONS

SECTION 13 INTRODUCTION

13.1 The goal of this project is that after completion of the civil works NCI Agency, with support from THN NLD, will be in a position to allow the installation and operation of the SSSB Comms System as described in the SOW and Annexes D to F.

13.2 Infrastructure 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 NLD.

13.3 In this context it is important to note that:

13.3.1. These installations shall as much as possible integrate harmoniously into the rural but relatively inhabited landscape of the four NLD radio sites.

13.3.2. Local Authority details for the four NLD radio sites are as follows:

a. Noordwijk: Details to follow

b. Julianadorp (R20): Details to follow

c. Den Helder (Albatros) : Details to follow

d. Zeewolde: Details to follow

13.4 Below and in the following sections, some general considerations and design elements are presented which shall guide the Contractor during the design development and execution.

13.5 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.

13.6 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.

13.7 The opinions and proposals of the A/E Architect and author of the design shall be formulated explicitly in the relevant technical descriptions.

13.8 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.

13.9 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 14 TECHNICAL SPECIFICATIONS

14.1 Aims.

14.1.1. 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.

14.1.2. 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.

14.1.3. Where appropriate, materials and technical solutions are prescribed by the Purchaser in general terms. However, the technical solutions offered by the Contractor shall be validated and justified (calculation notes, technical sheets, etc.) by the Contractor's design office (A/E), which takes full responsibility for it.

14.1.4. The Contractor shall develop their design and present their detailed 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

14.2 Technical documents:

14.2.1. 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)

14.3 The work schedule.

14.3.1. 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).

14.3.2. 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 Contract 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.

14.3.3. This schedule shall also include all the tests and trials planned for prior the technical acceptance of major equipment, site tests, provisional acceptance, etc.

14.4 Documents relating to and explaining the choice of Architect and Engineer Company (A / E).

14.4.1. 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).

14.5 Health and Safety Coordination Documents

14.5.1. 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).

14.5.2. 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, 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” as specified in the NLD Health and Safety at Work Act 1974

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.

14.6 Other documents

14.6.1. 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.

14.6.2. 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)

14.6.3. Antenna fields and miscellaneous constructions shall include as a minimum:

a. General plans/ layouts per building and level (1/100 scale) with equipment layout

b. All the cross sections drawings necessary in order to be able to obtain a complete concept of the design (scale 1/50)

c. The detail 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

14.6.4. Electrical works shall include as a minimum (scale 1/50 or 1/100):

a. Electrical installation plans and drawings (with location of the main components – main power distribution board, equipment power distribution boards, UPS, battery rack, high-voltage cabin, etc.)

b. Plans with indication of sockets

c. Schematic diagram of the energy distributions including the distributions from the main power distribution board to the electrical distribution boards

14.6.5. Landscaping shall include as minimum:

a. General plans and drawings (scale 1/100 and / or 1/200)

b. Landscaping, planting and gardening areas with significant details

c. The establishment of geodetic landmarks

d. The waste collection and storage area before disposal

14.6.6. Telephony and Data Network shall include as a 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

14.7 Explanatory texts and calculation notes.

14.7.1. 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.

14.7.2. 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.

14.7.3. They shall include a summary of the main construction elements:

a. Antenna and mast foundations

b. Antenna and mast structures

c. Retaining wall structure should that be required for antenna and mast erection

14.7.4. Structural calculations, stability studies, electrical 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 site specific Appendixes, the nature of the soil and local weather and climatic conditions

c. Relate to Electricity, Data and Telephony and all other equipment provided by the Contractor

d. Base heat load calculations on the principles of relevant standards and best practices applicable in THN and local climatic conditions.

e. 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.

f. They shall include quantity (bill of quantities).

SECTION 15 APPLICABLE DOCUMENTS AND STANDARDS

15.1 The documents 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.

15.2 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.

15.3 This Annex and site specific Appendixes refer to numerous directives and standards the Contractor shall comply with for:

15.3.1. Designs

15.3.2. Equipment and material specifications and performance parameters

15.3.3. Provision of equipment and material

15.3.4. Execution of civil works

15.3.5. Installation of equipment and utilities

15.3.6. Testing and commissioning

15.4 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:

15.4.1. The equivalent standards introduce equal or more stringent requirements

15.4.2. The equivalent standards are recognized, applicable and in force in the THN including their MOD

15.4.3. 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 in site specific Appendixes.

15.5 A list of NLD MoD applicable documents and standards is as follows:

15.5.1. To follow but will be provided through THN MoD (RVB) prior to Contract Award.

SECTION 16 MISCELLANEOUS

16.1 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 and in site specific Appendixes.

16.2 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.

16.3 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.

16.4 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 17 SURVEYS

17.1 Existing situation

17.1.1. The existing situation is presented in the SSSB NLD - SIDP provided in Annex E to the core SOW.

17.1.2. The information in the NLD 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.

17.2 Topographic survey and soil tests

17.2.1. 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.

17.2.2. 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.

17.2.3. Results of any previous soil tests carried out on the initiative of the NLD MOD that were made available as part of the Bidder’s Information Package are only indicative. The Contractor shall still be responsible to conduct soil tests.

17.2.4. The soil tests for the final design shall be conducted by a specialized firm, recognized and accredited by THN.

17.2.5. The soil tests shall be completed before any works execution at the site.

17.2.6. 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 NLD real estate surveyor. This survey shall identify and document results in accordance with respective THN standards and legislation.

17.2.7. The survey shall also identify all cables and pipelines present in the work area as well as the connections to the public domain.

17.3 Asbestos inventory on the site

17.3.1. In addition to the information available within the SSSB NLD - SIDP (Annex E) it is the Contractor's responsibility to conduct the necessary asbestos surveys and readings ahead of any site works.

17.3.2. 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.

17.4 Other inventories

17.4.1. It is the Contractor’s responsibility to conduct an inventory prior to any intervention on the construction site.

17.4.2. 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.

17.4.3. 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.

17.4.4. 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.

17.4.5. The inventory file shall be supplied to the Purchaser in triplicate at least 10 working days before the start date of the works.

17.5 Precautions to be taken throughout the duration of the work

17.5.1. 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 18 ARCHITECTURE AND ENGINEERING (A/E) DESIGN

18.1 General

18.1.1. 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 THN NLD 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.

18.1.2. 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.

18.2 Mechanical resistance and stability

18.2.1. 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.

18.2.2. 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

18.2.3. The Contractor shall design the civil works for the following minimum service life within which no significant modernization shall be required:

a. Electrical installations: 30 years

b. Antenna masts: 30 years

c. Any other infrastructure and installations: 20 years

18.3 Environmental and climatic conditions

18.3.1. The 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

e. Wind load imposed by winds of min 190 km/h speed, without ice formation.

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 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.

18.4 Safety in case of fire

18.4.1. 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

18.5 Hygiene, health and the environment

18.5.1. 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.

18.6 Safety and accessibility in use.

18.6.1. 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.

18.7 Protection against noise

18.7.1. 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.

18.7.2. 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.

18.8 Energy economy and heat retention

18.8.1. The construction works 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.

18.8.2. The construction works shall also be energy-efficient, using as little energy as possible during their construction and dismantling.

18.9 Sustainable use of natural resources

18.9.1. 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.

18.10 Design rules

18.10.1. 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.

18.11 Verification of studies and designs by an approved control office

18.11.1. 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.

18.11.2. The studies and designs shall be checked and approved by an independent accredited control office before presentation to the Purchaser.

18.11.3. 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.

18.11.4. 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.

18.12 Calculation notes

18.12.1. The calculation notes shall be dated and signed, the different versions shall be numbered.

18.12.2. 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.)

18.12.3. The calculation notes and the complete structure design shall be based on principles presented in following publications (not exhaustive list):

a. a. ISO 2394:2015 - General principles on reliability for structures

b. b. EN 1990: Eurocode - Basis of structural design

c. 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

18.13 Presentation of calculation notes

18.13.1. 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.

18.13.2. 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.

18.13.3. 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 19 CONSTRUCTION PERMIT PROCEDURE

19.1 The Contractor shall submit the complete file of the required construction permits, supplemented by the environment impact study, and any other studies and permits that are required at the radio site locations.

19.2 The submittal of the construction permit file shall meet respective THN laws and regulations.

19.3 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.

19.4 The Contractor shall be solely responsible for all required administrative efforts associated with construction permit application (for example meetings with local authorities, electricity providers, fire brigade, preparation of required documents, reports, analysis etc.)

19.5 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 20 CIVIL WORKS INFRASTRUCTURE

20.1 Site organization criteria

20.1.1. The organization of the site shall be proposed by the Contractor.

20.1.2. 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.

20.2 Fences, signs and marking

20.2.1. 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.

20.2.2. 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.

20.2.3. 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 woks site/area fence replacement by a permanent new fence, provided by the Contractor where applicable

20.3 Contractor’s facility and equipment at the site

20.3.1. 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.

20.3.2. 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.

20.3.3. 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 documents shall be made available both at the site during site visits and via email when required.

20.3.4. 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.

20.4 Demolition and site preparation works

20.4.1. 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).

20.4.2. Any damage caused by lack of care and / or precision by the Contractor shall be repaired by the Contractor and at the Contractor’s expense and to the satisfaction of the Purchaser.

20.4.3. 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.

20.4.4. 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.

20.4.5. 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 his expense.

20.4.6. Amongst other THN rules and regulations in force the Contractor shall also apply requirements stipulated in:

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

20.4.7. 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.

20.4.8. 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.

20.4.9. The Contractor shall provide to the Purchaser certificates of destruction, recovery or recycling of the products scoped for disposal.

20.4.10. 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.

20.4.11. All costs for loading, unloading, transport, handling and recycling are the responsibility of the Contractor; as well as the costs of landfills and the taxes inherent in the evacuation of excavation products if such taxes are due by NCIA /THN (see Contract Special Conditions).

20.5 Possible pollution

20.5.1. 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.

20.5.2. 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.

20.6 Tree felling/Shrub Removal

20.6.1. 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.

20.6.2. 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.

20.6.3. 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.

20.7 Disassembly and disconnection of existing utilities

20.7.1. In case any works at the site (including dismantling and demolition works) that 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.

20.7.2. The temporary termination of utilities and services includes disconnections and dismantling works, which shall also be the Contractor's responsibility.

20.7.3. 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.

20.7.4. 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).

20.7.5. 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.

20.7.6. 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.

20.7.7. 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.

20.8 Protection of adjacent infrastructure and installations

20.8.1. 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.

20.8.2. The equipment and measures shall be installed and implemented in accordance with respective THN regulations in force.

20.8.3. 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

20.8.4. 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.

20.9 Site connection to utilities

20.9.1. The Contractor shall be responsible for connection of the site to all utilities (electricity, telephone network, fiber optic cabling, and drainage networks etc.).

20.9.2. The connection to all utilities shall be planned and implemented in accordance with respective THN regulations.

20.9.3. 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.

20.9.4. The cost for the utilities shall be billed directly to the Contractor by the companies providing respective utilities and services.

20.9.5. It is the Contractor’s responsibility to make arrangements for the provision of all utilities and services (including payment arrangements) with respective providers.

20.9.6. The removal of any temporary site connections to utilities (electricity, telephone network, fiber optic cabling, water distribution and drainage networks, sewage system, gas network), 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.

20.10 Cleaning before commissioning

20.10.1. 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.

20.10.2. 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.

20.10.3. 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.

20.10.4. 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.

20.11 Earthworks

20.11.1. 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.

20.11.2. It is the Contractor's responsibility to verify by any means deemed useful (i.e. by field survey with the utilization 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.

20.11.3. 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.

20.11.4. 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.

20.11.5. The Contractor shall take into account any required groundwater recovery works and groundwater lowering.

20.12 Protection, against any damage, of all existing utilities and structures crossing and located along the earthworks.

20.12.1. 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.

20.12.2. During the earthworks, the Contractor is obliged to maintain a safe distance (vertically and horizontally) from water, gas, sewage, electricity, telephone lines etc.

20.12.3. 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.

20.12.4. 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.

20.13 Buried Cables, Sheaths and Conduits - Construction of Trenches

20.13.1. The cable laying shall be completed in trenches for all outdoor cables as stipulated in this Annex and in site specific Appendixes.

20.13.2. The cable laying shall be done in accordance with respective THN regulations, including the foundation layer, protective conduits and sheaths, safety marking, backfill etc.

20.13.3. 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. be of a sufficient size to ensure at least 50% of reserve;

c. fitted with a wire puller;

d. In case of a cable pull, the activity shall be followed by a replacement wire puller.

20.13.4. All of the cables (data, signal, electrical) shall be provided as armoured (galvanized steel wire armor cables), UV and weather resistant as stipulated in ISO 4892.

SECTION 21 ANTENNA FIELDS AND MISCELLANEOUS CONSTRUCTIONS

21.1 Earthworks

21.1.1. The earthworks for the foundations of each antenna masts and other structures (such as fences, sign poles etc.) shall be executed in accordance with respective THN regulations.

21.1.2. When conducting earthworks, the Contractor shall protect personnel, machinery and equipment against landslides by adequately supporting and strengthening the earthworks.

21.1.3. 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.

21.1.4. 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.

21.1.5. The backfill shall be conducted with compactions of all successive layers with the thickness of each layer not exceeding 20 cm.

21.2 Foundations

21.2.1. The foundations of each antenna masts and other structures (such as fences, sign poles etc.) shall be executed in accordance with respective THN regulations.

21.2.2. 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.

21.2.3. 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.

21.2.4. 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.

21.2.5. 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

21.3 Concrete

21.3.1. Concrete used can be either poured in place or as precast concrete (unless specific requirements are further formulated for given infrastructure)

21.3.2. 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

21.3.3. 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 recognised organizations such as:

a. CE certification of factory production control

b. Federation of the European Precast Concrete industry

21.4 Metallic structures

21.4.1. 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

21.5 Wooden structures

21.5.1. 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

21.6 Metal protection plates

21.6.1. Depending on the requirements relating to Physical Security the need for steel protection plates (minimum thickness 6 mm) may appear.

21.6.2. 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

21.7 Sealing

21.7.1. The Contractor shall design and execute waterproofing membranes for foundations.

21.7.2. The waterproofing membranes shall be implemented in accordance with the various standards and technical specifications in force in within the THN.

21.7.3. Waterproofing membranes for foundations shall protect against humidity, runoff and temporary standing water.

21.7.4. The detailed design shall be tailored to local hydrological conditions, soil type and terrain shape (also known as landform) around the foundations.

21.7.5. The chosen material shall be free of any solvent and odorless.

21.8 Thermal insulation of buildings

21.8.1. The thermal insulation shall be implemented in accordance with various standards and technical specifications in force in the THN. The Contractor shall

apply the thermal insulations as required when closing the penetrations made by the Contractor for installation of the SSSB system.

21.8.2. 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.

21.8.3. 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.

21.8.4. Heat bridges are to be avoided as far as possible.

21.8.5. All heat insulation, for walls, floors, roofs and 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.

21.8.6. 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.

21.8.7. 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.

21.9 Protective sheaths/ sleeves

21.9.1. The Contractor shall supply and install protective sheaths/sleeves for every passage of utility pipes and lines (when passing between compartments.

21.9.2. The sheaths/sleeves shall be of the same Fire Class as the partition in which they are installed.

21.9.3. The sheaths shall guarantee the fire-resistant sealing of all penetrations by expansion under the effect of heat.

21.9.4. 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.

21.9.5. The sheaths shall protrude approximately 3 cm on each side of the crossings.

21.9.6. 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.

21.9.7. The fire-proof acoustic material shall be of the same Fire Class as the partition in which it is installed.

21.10 Paint

21.10.1. The Contractor shall paint sections of all interior and exterior walls, ceilings and other elements of structure, that were affected by penetrations made by the Contractor for installation of SSSB system. The painting shall be adequate for given material and its location (indoor versus outdoor):

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.

21.11 Various interior equipment

21.11.1. The Contractor shall provide and install various pictograms, signs, etc.

21.11.2. When applicable, the interior equipment (for example health and safety signs) shall comply with THN regulations and standards in force.

21.11.3. The locations and number of all interior equipment shall be determined by the Contractor according to the function of given SSSB equipment and required Health and Safety measures.

21.11.4. The interior equipment choice, its material and proposed locations, before purchase from vendors, shall be presented by the Contractor to the Purchaser for approval. All markings and descriptions shall be provided in THN official language and in English.

21.11.5. The pictograms and signs shall be:

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. Fixed to the equipment with a high coefficient of resistance to tearing

21.12 Outdoor equipment

21.12.1. The Contractor shall provide and install various outdoor equipment as necessary for efficient and safe operation of installations and other infrastructure subject to this contract.

21.12.2. When applicable, the outdoor equipment (for example marking of EM Field Zones, etc.) shall comply with THN regulations and standards in force.

21.12.3. 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.

21.12.4. The exterior equipment choice, its material and proposed locations, before purchase from vendors, shall be presented by the Contractor to the Purchaser for approval.

21.12.5. All markings and descriptions shall be provided in THN official language and in English.

21.12.6. All components of the outdoor equipment shall be UV resistant (confirmed by relevant CoC or at least Product Data Sheet issued by respective manufacturers).

21.12.7. All components of the outdoor equipment shall be capable of withstanding environmental condition as stipulated herein in this Annex and in site specific Appendixes, without suffering permanent mechanical damages.

21.12.8. All of the markings, which are not installed on buildings, wooden fences or antenna masts, shall be mounted on support elements made of either hot dip galvanized steel tubes or extruded aluminum profiles.

21.12.9. The tubes made of hot dip galvanized steel shall meet relevant requirements stipulated herein in this Annex and in site specific Appendixes.

21.12.10. 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.

21.12.11. 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.

SECTION 22 ANTENNA MAST SPECIFICATION

22.1 General Remark

22.1.1. The Contractor shall design, provide and install required number of new antenna masts at each site capable of supporting the SSSB system.

22.1.2. The term antenna masts includes also DLOS towers.

22.1.3. The Contractor shall provide suitable antenna mast foundations required for the installation of new antenna masts.

22.1.4. The Contractor shall obtain all necessary Military and Civil permissions for the installation and operation of these masts and all related installation activities.

22.1.5. 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.

22.1.6. 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.

22.1.7. 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).

22.1.8. 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

22.1.9. The installation of antenna masts and all ancillaries shall be done in accordance with respective manufacturer instructions and guidance.

22.1.10. 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

22.1.11. The expected lifetime of the mast, antennas, foundation and ancillaries shall be at least 30 years without the need for substantial maintenance and replacement.

22.1.12. 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).

22.2 Environmental requirements

22.2.1. 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. Wind load imposed by winds of min 190 km/h speed, without ice formation

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 are provided in site specific Appendixes.

22.3 Applicable Publications

22.3.1. 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

22.3.2. 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).

22.4 Antenna field Preparation

22.4.1. Antenna field preparation works include tasks as stipulated herein in this Annex above.

22.4.2. Additionally, the following works shall be executed:

a. For 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.

22.5 Foundation

22.5.1. The foundation shall be made of reinforced concrete.

22.5.2. 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.

22.5.3. 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.

22.5.4. 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.

22.5.5. 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.

22.5.6. 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.

22.6 Mast structure

22.6.1. The mast structure shall be in accordance with the following:

a. The mast, safe to climb devices, anti-slip surfaces, safety bars, 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 equivalents (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