PETROBRAS	TECHNICAL SPECIFICATION	Nº:	I-ET-3010.00-5515-762-PPT-002
	CLIENT: SRGE		SHEET: 1 of 39
	JOB: OPERATIONAL RADIO		
	AREA: -		
TIC	TITLE: GMDSS AND OPERATIONAL RADIO SYSTEMS		INTERNAL
			OI/CS

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REVISION INDEX

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0	ORIGINAL ISSUE
A	REVISED WHERE INDICATED
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1. SUBJECT

1.1 The subject of this document is to establish the criteria and basic characteristics for the detailed design, supply and installation of the GMDSS System, AIS System and Operational Radio System that shall be installed in PETROBRAS FPSO Unit.

2. ABBREVIATIONS

ABNT	Associação Brasileira de Normas Técnicas (Brazilian Association of Technical Standards)
AIS	Automatic Identification System
AM	Amplitude Modulation
ANATEL	Agência Nacional de Telecomunicações (National Telecommunications Agency)
CCR	Central Control Room
DC / CC	direct current / Corrente contínua
DMR	Digital mobile radio
DSC	Digital Selective Calling
EAR	Electric and Automation Room
EPIRB	Emergency position-indicating radio beacons
FM	Frequency Modulation
FPSO	Floating, production, storage and offloading
GMDSS	Global Maritime Distress and Safety System
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
INMETRO	Instituto Nacional de Metrologia (National Institute of Metrology)
IP	Internet Protocol
IP-XX	Ingress Protection - XX
IS	Intrisic Security
ITU	International Telecommunication Union
LAN	Local area network
LSZH	Low Smoke Zero Halogen
MCT	Multi Cable Transit
MHz	Megahertz
NCC	Net Connection Corporation
PTT	Push-To-Talk
RIC	Rede Interna Petrobras (Petrobras Internal Network)
SART	Search and rescue transponder
SMA	Serviço Móvel Aeronáutico (Aeronautical Mobile Service)
SMM	Serviço Móvel Marítimo (Maritime Mobile Service)
SOLAS	Safety of Life at Sea
SPM	Serviço de Produção E Manutenção (Maintenance and Production Service)
UHF	Ultra High Frequency
VHF	Very High Frequency

3. REFERENCE DOCUMENTS, CODES AND STANDARDS

3.1 International Standards

a. IEC 60079: Electrical apparatus for explosive gas atmospheres - all parts
b. IEC 60092-502: Electrical installations on ships
c. IEC 60331: Tests for electric cables under fire conditions - circuit integrity – all parts
d. IEC 60529: Degrees of protection provided by enclosures (IP code)
e. IEC 60533: Electrical and electronic installations in ships - electromagnetic compatibility
f. IEC 60945: Maritime navigation and radiocommunication equipment and systems – general requirements – methods of testing and required test results
g. IEC 61000: Electromagnetic compatibility (EMC) series - all parts
h. IEC 61892-7: Mobile and fixed offshore units - electrical installations - part 7: hazardous area
i. IEC 61892-1: Mobile and fixed offshore units – Electrical installations – Part 1: General requirements and conditions
j. IEC 61993-2: Maritime navigation and radiocommunication equipment and systems - Automatic Identification Systems (AIS) - Part 2: Class A shipborne equipment of the Automatic Identification System (AIS) - Operational and performance requirements, methods of test and required test results
k. IMO Harmonization of GMDSS Requirements for Radio Installations on Board SOLAS Ships
l. Sub-Committee on Radio communications and Search and Rescue (COMSAR)/Circ.32
m. IMO LSA Code: International Life-Saving Appliance Code.
n. IMO MODU Code - Code for the Construction and Equipment of Mobile Offshore Drilling Units
o. IMO Resolution A.1021: Codes on Alerts and Indications.
p. IMO Resolution A.801: Provision of Radio Services for the Global Maritime Distress and Safety System.
q. IMO Resolution A.888: Criteria for the Provision of Mobile-Satellite Communication Systems in the Global Maritime Distress and Safety System (GMDSS)
r. IMO SOLAS: International Convention for the Safety of Life at Sea
s. IMO SN/Circ.227: Guidelines for the installation of a shipborne Automatic Identification System (AIS)
t. MODU Code 11.6 and IMO MSC.80(70) as required in MODU Code 11.8
u. ISO 7240-19: Fire Detection and Alarm Systems - Design, installation, commissioning and service of sound systems for emergency purposes.

3.1.1. According to Amendments adopted by Maritime Safety Committee (MSC), 99th session 16-25 May 2018, that entered into force on 1 January 2020, amendments to chapter IV of SOLAS, and the appendix to the annex to the Convention, it was

replaced all references to "Inmarsat" with references to a "recognized mobile satellite service".

3.2 Brazilian Standards

a. INMETRO PORTARIA Nº 115 (21/Março/2022): regulamento de avaliação da conformidade de equipamentos elétricos para atmosferas potencialmente explosivas, nas condições de gases e vapores inflamáveis e poeiras combustíveis.

b. It shall be followed all others NR's: Normas Regulamentadoras (Regulatory Standards) the Secretaria de Trabalho do Ministério da Economia (Secretary of Labor of the Brazilian Ministry of Economy) applicable to this Technical Specification.

c. NR-10: Segurança em instalações e serviços em eletricidade

d. NR-37: Segurança e saúde em plataformas de petróleo

e. ANATEL: Resolutions of Agência Nacional de Telecomunicações

f. ICA 63-10: Estações Prestadoras de Serviços de Telecomunicações e Tráfego Aéreo

g. ICA 63-25: Preservação e Reprodução de Dados de Revisualizações e Comunicações AST

h. NORMAM 01/DPC: Embarcações Empregadas na Navegação em Mar Aberto.

i. NORMAM 27/DPC: Homologação de Helideques Instalados em Embarcações e em Plataformas Marítimas.

3.3 Classification Society

3.3.1. The detailed design shall be submitted to approval by Classification Society. The design and installation shall take into account their requirements and comments.

4. GENERAL REQUIREMENTS

4.1 CONTRACTOR shall consider the main source of GPS signal for GMDSS console from GPS compass, for details design info see document "SATELLITE SYSTEM – I-ET-3010.00-5512-762-PPT-001". The secondary (backup) source shall be the GPS from the Positioning System specified in I-ET-3010.00-5537-850-PEA-001.

4.2 For more technical requirements details to antennas mounting and cables launching, CONTRACTOR shall consider, at least, the guideline on item 5 of "HARMONIZATION OF GMDSS REQUIREMENTS FOR RADIO INSTALLATIONS ON BOARD SOLAS SHIP", issued by IMO and IEC standards.

4.3 The GMDSS and Operational Radio systems shall comply with items 6 and 8 of the guideline “HARMONIZATION OF GMDSS REQUIREMENTS FOR RADIO INSTALLATIONS ON BOARD SOLAS SHIP”, issued by IMO and IEC standards.

4.4 All requirements for ensure the Helicopter communications, according to RESOLUTION MSC.80 (70) are described in I-ET-3010.00-5515-762-PPT-001 AERONAUTICAL COMMUNICATION SYSTEM.

4.5 For PETROBRAS detailed design requirements for installation, configuration, tests training and commissioning, CONTRACTOR shall comply with the DESCRIPTIVE MEMORANDUM I-MD-3010.00-5510-760-PPT-001 – GENERAL CRITERIA FOR TELECOMMUNICATIONS DESIGN.

4.6 For telecommunications symbols, the Detailed Design shall comply with the Technical Specification: I-ET-3000.00-0000-940-P4X-002 – SYMBOLS FOR PRODUCTION UNITS DESIGN.

4.7 For telecommunications TAGs, the Detailed Design shall comply with the Technical Specification: I-ET-3000.00-1200-940-P4X-001– TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.

4.8 All electrical requirements for telecom package shall be in accordance with I-ET-3010.00-5140-700-P4X-003 – ELETRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE, I-ET-3010.00-5140-700-P4X-001 - SPECIFICATION FORELECTRICAL DESIGN FOR OFFSHORE UNITS, I-DE-3010.00-5140-700-P4X-003 - GROUNDING INSTALLATION TYPICAL DETAILS and I-ET-3010.00-5140-700-P4X-005 - REQUIREMENTS FOR HUMAN ENGINEERING DESIGN FOR ELECTRICAL SYSTEMS OF OFFSHORE UNITS.

4.9 For one line interconnections reference see: I-DE-3010.00-5515-762-PPT-001 GMDSS AND RADIO OPERATIONAL ONE LINE DIAGRAM

4.10 CONTRACTOR shall provide all materials to full installation of all equipment and deliver to PETROBRAS a list with all equipment and its respective quantity.

4.11 For each console, CONTRACTOR shall provide infrastructure of 05 (five) points from STRUCTURED CABLING NETWORK (LAN).

4.12 The power supply of this system is scope of this technical specification.

4.13 The equipment and accessories installed in outdoor or industrial areas shall be suitably rugged and their external bodies shall be made in non-metallic material, suitable for harsh environments and in accordance with IEC and ABNT standards, apart from the ones whose classification area require to be metallic as Ex-d junction boxes.

4.14 Brackets, bolts, nuts, washers and any other mechanical fixing elements shall be made in stainless steel.

4.15 In case of difficulty for supplying some equipment and accessory with external body made with non-metallic materials, CONTRACTOR shall submit them for analysis and approval of PETROBRAS.

4.16 It shall be avoided equipment and accessories with their external bodies built in aluminum alloy. Anything different shall be submitted to PETROBRAS approval. In case of approval, this alloy shall not contain in its composition more than 0.25 % of copper and shall comply with the ASTM-B-179 standard (ANSI alloy 356.1).

4.17 The equipment and accessories shall attend the ingress protection degree standard IEC 60529, protection type defined in IEC 61892, and IEC 60079 for electrical devices installed in hazardous areas.

4.18 All radios shall be homologated by ANATEL (Brazilian Government Authority) for their respective frequency uses requested in this technical specification.

4.19 Antennas shall be homologated by ANATEL as per Resolution n° 715/2019 (Certificação e homologação de produtos para telecomunicações) according to their types, gain and purposes: basically, point-to-point antennas requires homologation whereas point-to-area do not.

4.20 All equipment that will make part of technical proposal shall have **type approval certificate by Classification Society** and technical conformity with the International and National standardization organism: IMO, ABNT, IEC, INMETRO and ANATEL.

4.21 The equipment and materials shall be supplied packed suitable for long periods of storage and be protected against mechanical impact and adverse weather conditions.

4.22 Equipment and materials shall be supplied with cable passage holes sealed with plastic plugs in the holes to be used, and definitive plugs (made of the same material as the equipment and accessories), in the spare holes.

4.23 For the hazardous areas shall be employed equipment for “increased safety” and/or “intrinsically safe” type. The employment of explosion-proof type equipment or any others available models shall be submitted for analysis of PETROBRAS.

4.24 Electrical equipment installed in external (open) safe areas, foreseen to operating during emergency shutdown ESD-3 shall be certified for installation in hazardous areas Zone 2 Group IIA temperature T3, according to IEC 61892-1.

4.25 CONTRACTOR shall submit the Calculation Report with the total loss for each RF cables that will be used for this system before the purchase order, for PETROBRAS analysis and approval. This Calculation Report shall have information about:

a. Distances between the radios and antennas;

b. Quantity of connections;

c. Datasheet of the equipment, antennas, RF cables and connectors;

d. The RF power output in the Radio;

e. The RF power expected in antenna (without considering the antenna gain);

f. Total loss of the radiant system.

4.26 All RF cables shall be tested and certified with appropriate instrument. All tests results shall be submitted to PETROBRAS approval. The parameters tested shall be, at least, but not limited to:

a. VSWR;

b. Distance to fault (VSWR);

c. Return Loss;

d. Cable Loss.

4.27 CONTRACTOR shall provide a complete list for the instruments, tools and materials necessaries for the maintenance of all GMDSS and radio operational systems.

4.28 CONTRACTOR shall provide the Technical Manual and operational manual of all equipment of GMDSS system and radio operational system including the GMDSS Console and the Radio operational console. It shall contain drawings, diagrams and procedures dealing with their assembly, operation and maintenance (views, cuts, details, one line and interconnection diagrams, assembly, operation and maintenance procedures).

4.28.1. These documents shall be in printed media and digital media in Brazilian Portuguese and shall be delivered to PETROBRAS before the systems commissioning. These documents shall be available in the radio room during the operations.

4.29 The operational radio console shall be installed inside the radio room beside the GMDSS console.

4.30 According to Regulation 19 of SOLAS Chapter V - all FPSOs shall carry an Automatic Identification Systems (AIS) capable of providing information about the ship to other ships and to coastal authorities automatically.

4.31 All RF cables shall be protected by Coaxial RF Surge Protector/Lighting Arrestor before ingress to radios consoles, due to atmospheric discharge. An example is shown in figure 1.

Figure 1: RF Surge Protector/Arrestor.

4.32 In outdoor areas, exposed to a maritime atmosphere, CONTRACTOR shall beware to avoid the galvanic corrosion of equipment, antennas, panels, boxes, coaxial cables fixing accessories. For reference only, follow the example in figure 2:

Figure 2: Insulation to avoid galvanic corrosion.

4.33 CONTRACTOR shall utilize tubing term-contractile materials (adhesive lined heat shrink tube) as a sealant form for ending, cable splices or bundling of cables. It shall create a barrier against water, moisture, dirt and other environmental contaminants. The figure 3 shows an example:

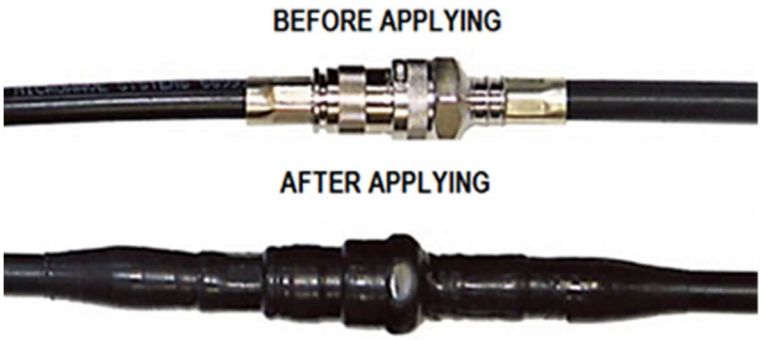


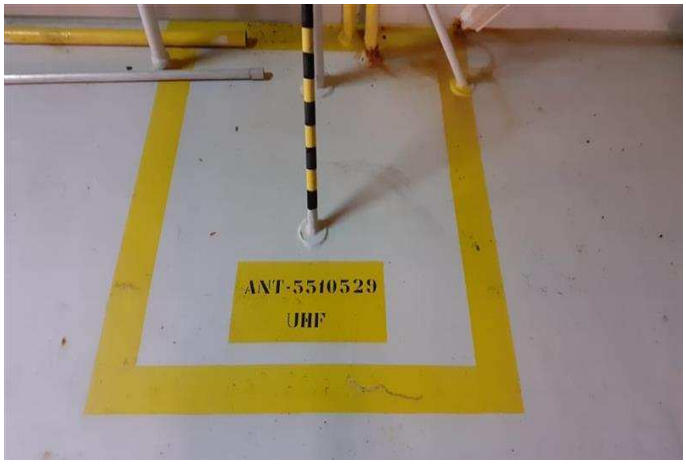
Figure 3: Connections protection.

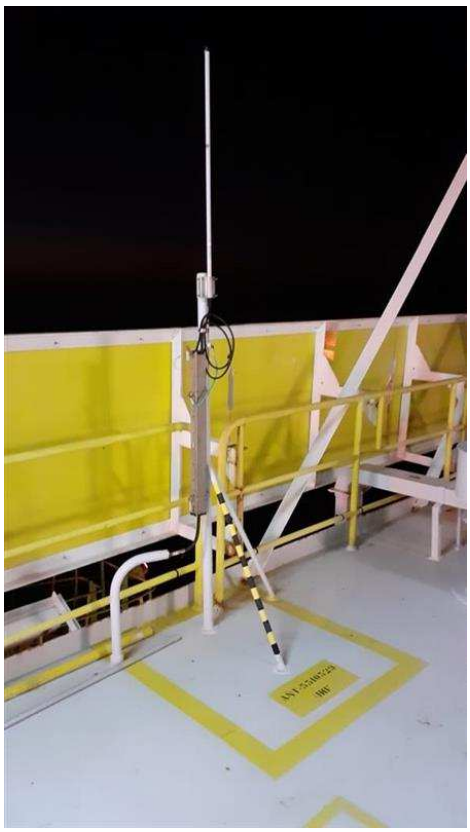
4.34 In order to avoid extra efforts on the connection of the RF cable to the antenna, the use of a flexible RF tail shall be mandatory to make this connection, as shown in figures 4 and 5:

Figure 4: RF flexible tail.

Figure 5: Connection between RF cable and RF flexible tail.

4.35 All antennas shall have its access area identified with its TAG and system painted on the floor as shown in example on figures 6A and 6B.





Figures 6A and 6B: Examples of antenna's identification on the floor.

4.36 The antennas also shall have identification as requested in section 13 of I-MD-3010.00-5510-760-PPT-001 - GENERAL CRITERIA FOR TELECOMMUNICATIONS DESIGN.

4.37 CONTRACTOR shall guarantee the properly preservation of all batteries of GMDSS and Operational Radio Systems (even for portable devices) from purchase to the sail away of the FPSO by means of periodic reports.

4.38 Telecom Upper Room and Telecom Lower Room shall have 01 (one) entire spare MCT (Multi Cable Transit) equipped with at least 06 (six) positions of 03 (three) different diameters. Such MCT shall be positioned under room false floor towards FPSO stern with a cable tray up to Top Roof floor edge.

4.39 All incoming and outcoming cables (FTP, fiber optics, electrical and optic patch cord, RF cables, control cables) shall enter and exit the rack (PDD, BAS, CTV, PTV, RPT, SAT, ACR, PBX, AUV, LTE, CIT, POB and consoles CRO) through removable aluminum or non-magnetizing. The use of any type of sealing mass for cable entrance is forbidden. It will not be allowed to run cables through racks sides. It shall also be reserved at least 10% for future expansion.

4.40 The AIS device shall be installed according to IMO SN/Circ.227. The positioning and heading data shall be received from GNSS and AHRS of I-ET-3010.00-5537-850-PEA-001 (POSITIONING AND NAVIGATION SYSTEMS FOR UEP (FPSO and SS)) according to items 4.1, 4.2 and 4.3 of IMO SN/Circ.227. The ‘Reference point of position’ (item 5.2 of IMO SN/Circ.227) shall be the ‘GNSS A antenna’ position of I-ET-3010.00-5537-850-PEA-001. Any password to change the AIS ‘Reference point of position’ shall be readily available.

5. SYSTEM DEFINITIONS

5.1 The GMDSS (Global Maritime Distress and Safety System) allows communication with auxiliary vessels, other units and with the Brazilian coast station. It must follow all IMO/SOLAS regulated requirements and the equipment must be is installed in an appropriate console in the Radio Room.

5.2 It shall be applied to sea area A3, that define the following items:

a. Maritime MF/HF/SSB-AM base station radio with DSC;

b. Maritime VHF/FM base station radio with DSC;

c. Inmarsat, equipped with: radio, C-band transceiver, message terminal, printer and GPS system;

d. GMDSS watertight portable radio;

e. Portable SART

f. Fixed EPIRB.

5.3 Additionally, it shall be provided:

a. AIS (Automatic Identification System).

5.4 As a matter of Philosophy, in order to attend IMO rules, PETROBRAS requires the following equipment to be duplicated: VHF/FM with DSC on the same console in

Radio Room and the Inmarsat-C on different console at CCR. It shall be also installed a remote control of the MF/HF on such console in CCR.

5.5 To fill the last IMO requirement, PETROBRAS provide his own technician as the Shore Based maintenance team, which information is updated to Brazilian Navy every new FPSO.

6. TECHNICAL REQUIREMENTS

6.1 GMDSS System

6.1.1. All GMDSS system shall comply with the requirements for operating in area A3 and the radio equipment shall be according to IMO Harmonization of GMDSS Requirements for Radio Installations on Board SOLAS Ships.

6.1.2. According to MODU and IMO SOLAS the power supply shall be exclusive for this system and with enough capacity to feed the radio equipment and charge the dedicated battery bank.

6.1.3. The power supply requirements and definitions shall be fulfilled to Brazilian Maritime Regulation NORMAM-01/DPC, Section V, Chapter 4 and IMO SOLAS, Chapter IV, Regulation 13 and amendments.

6.1.4. The battery bank shall be installed in appropriate area defined during the detailed design and in accordance with IMO, IEC and ABNT standards.

6.1.5. It shall be provided an exclusive DC switchboard for the GMDSS equipment installed inside the GMDSS console.

6.1.6. According to IMO COM/Circ.105 annex 13 it shall be installed inside the CCR one additional GMDSS console with (01) one VHF/FM-SMM - DSC (Maritime Mobile Service), (01) one MF/HF remote unit, 01 (one) Inmarsat C with EGC and 01 (one) NAVTEX to guarantee permanent monitoring of the distress and safety frequencies including maritime safety information.

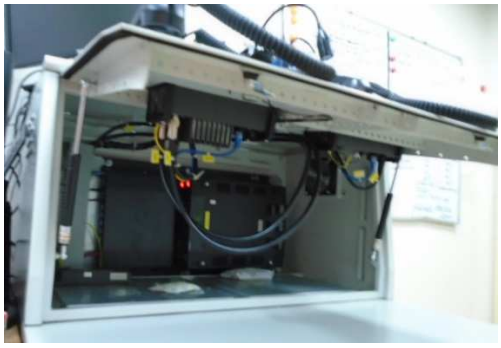
6.1.7. All GMDSS radios shall be installed in an adequate and exclusive console.

6.1.8. GMDSS console shall have a lamp unit for emergency lighting powered in 12 / 24 VDC from the Battery charger.

6.1.9. The GMDSS Console shall have the switchboards accessible from the external part of the console as the example in figures 7A and 7B.

Figures 7A and 7B: Example of Console switchboards

6.1.10. The GMDSS Console shall provide an easy manner to make maintenance in the equipment installed inside it. It shall be made by tipper cover in the front plate of the console as the example in Figures 8A and 8B.



Figures 8A and 8B: Example of easy access to equipment rear inside the console.

6.1.11. Each GMDSS console shall have a fan cooling placed preferably at their sides to exhaust heat from inside the console.

6.1.12. Each radio inside each GMDSS console shall have a dedicated circuit breaker.

6.2 AIS System (Class A)

6.2.1. Automatic Identification System (AIS) is a reporting system used in the identification of marine vessels and its location. Vessels equipped with this system allows each other to communicate automatically, dynamically and regularly update their position, speed, course and information such as vessel identity.

6.2.2. Following equipment shall compose the AIS system:

a. AIS Transponder;
b. VHF/GPS Antenna;
c. AIS Control panel;
d. RS-232/422/485 Serial Device IP converter;

6.2.3. AIS Transponder

6.2.3.1. The AIS transponder shall have the minimum requirements below:

i. Input voltage: +12 VDC to +24 VDC;
ii. Temperature: -10ºC to + 50 ºC;
iii. Receivers: 156,025 – 162,025 MHz (TDMA); 156,525 MHz (Channel 70, DSC);
iv. Channel bandwidth: 25 KHz;
v. RF Output Power:
    1. High: 12.5 W;
    2. Low: 1W;
    3. Low power forced control (gas alarm): 1W;
vi. Frequency: 156.025 - 162.025 MHz;
vii. Interfaces: RS-232 connection and IP interface.
viii. IEC 61993-2 (Class A) compliant

6.2.3.2. The AIS transponder shall have 01 (one) RS-232 serial interface in order to be interconnected to an ethernet/serial converter, whose ethernet interface shall be connected to PETROBRAS LAN network.

6.2.4. RS-232/422/485 Serial Device IP converter

a. Ethernet Standard: IEEE 802.3, 802.3ab, 802.3u;
b. RJ45 Port Connector Type: RJ45;
c. RJ45 Port Number: 1;
d. RJ45 Transmission Speed: 10/100 BaseT(X), Auto-sensing;
e. Power Operating: 12/24 VCC;
f. Port Connector: DB9 male;
g. Port Number: 1;
h. Serial Type: RS-232/422/485;
i. Transmission Speed: 50~ 976.5 kbps;

6.2.5. GPS Antenna

a. Antenna type: Active patch antenna;
b. Frequency: 1570 to 1608 MHz;
c. Impedance: 50 Ohm;
d. Polarization: Circular;

e. Coverage: Hemispherical;
f. Selectivity: 45 dB down at center ±25 MHz;
g. Gain: 24 dB.

6.2.6. VHF Antenna

a. Antenna type: glass fiber omnidirectional dipole;
b. Polarization: Vertical;
c. Recommended RF cable, type double screened with a maximum loss of 3 dB;
d. RF impedance equal to 50 Ohms;
e. Gain: 3dB;
f. Ingress Protection: IP-66.

6.2.7. Control panel

a. Display: Minimum of 4in;
b. Input voltage: +12 VDC to +24 VDC;
c. Temperature: -10ºC to + 50 ºC;
d. Ingress protection: IP-54

6.3 NAVTEX system

6.3.1. NAVTEX is an internationally coordinated and automated direct-printing service for promulgation of navigational and meteorological warnings, meteorological forecasts and other urgent information to FPSOs.

6.3.2. Following equipment shall compose the NAVTEX system:

a. NAVTEX Receiver;
b. Control Panel;
c. Antenna;

6.3.3. NAVTEX Receiver

a. Navtex Receiver: 490 kHz, 518 kHz and 4209.5 kHz simultaneous reception;
b. Sensitivity: 490-518 kHz - 12dBuV@10ohm/150pF - 6dBuV@50ohm
4209,5 kHz - 12dBuV@10ohm/150pF - 6dBuV@50ohm;

c. DC input: 12 to 24VDC;

6.3.4. Control panel

a. Mounting method: Flush mount or bracket;
b. Voltage: 12 to 24VDC;
c. Ingress protection: IP-54;
d. Ambient temperature: -10°C to 55°C;
e. Display: Minimum 4in.

6.4 Operational Radio Console (installed inside Radio Room)

6.4.1. The Operational Radio Console shall be built in aluminum and/or steel profiles and plates, IP-42 sealing, with front doors, and it shall present the following characteristics:

6.4.1.1. Removable drawers or trays (chassis) on telescopic rails, with fixation supports, frontal plate and handles. To bear the installation of loudspeakers, protection grids, microphones, connectors, cables, power supplies, operation controls (remote or local) and transceivers chassis or transceivers with frontal controls;

6.4.1.2. Plates with handles for frontal closing;

6.4.1.3. Dimensions: To be defined during the detailed design to comply with the International Classifying Society requirements.

6.4.1.4. The Operational Radio Console shall have the switchboards accessible from the external part of the console as the example in figures 7A and 7B.

6.4.1.5. The Operational Radio Console shall provide an easy manner to make maintenance in the equipment installed inside it. It can be made by tipper cover in the front plate of the console.

6.4.1.6. The Technical Manual of the Console Radio operation shall contain drawings, diagrams and procedures dealing with their assembly, operation and maintenance (views, cuts, details, one line and interconnection diagrams, assembly, operation and maintenance procedures).

a. These documents shall be in printed media and digital media in Brazilian Portuguese and shall be delivered to PETROBRAS before the systems commissioning. These documents shall be available in the radio room during the operations.

6.4.1.7. Console shall have a fan cooling placed preferably at their sides to exhaust heat from inside the console.

6.5 VHF/FM-SMM without DSC (Maritime Mobile Service)

6.5.1. Following equipment shall compose the VHF/FM-SMM without DSC:

a. 1 (one) Fixed Transceiver;
b. 1 (one) Microphone;
c. 1 (one) Outdoor Antenna whip;
d. 1 (one) External Power Supply (if necessary);

6.5.2. VHF/FM-SMM BASE STATION

6.5.2.1. For operation in the Maritime Mobile Service (SMM), with operational characteristics according to Brazilian and International Legislation (ITU-T) and complying with the following features:

a. Frequency Range:From 136 up to 174 MHz, ITU Marine bands;
b. Frequency stability: Better than 10 ppm;
c. Number of channels: All Maritime Mobile Service (SMM) ITU frequency channels plan;
d. RF Power Output: 25 WRMS selected in the control;
e. RF Power Output: Possibility to reduce to 6 watts RMS;
f. RF connections type UHF/50 Ohm;
g. Supply voltage: 12 VDC, nominal;
h. External power supply 220 VAC (+ 20 %), 60 Hz;
i. Input in DC from the Battery Charger;
j. Automatic switching device for switching to an external DC voltage to feed the transceiver in case of failure in AC voltage;
k. Protection against polarity inversion for the DC power supply;
l. On/Off Switch;
m. LCD Display: to show channel, power High or low, TX and RX.
n. TX signaling;
o. Operation Temperature: From -25ºC to +55ºC;
p. Relative Humidity: Up to 95 %;
q. Receiver sensitivity: 0.3 µV for 12 dB SINAD (-119 dBm);
r. Homologated by ANATEL to operate in SMM frequencies.

6.5.3. Microphone

a. Desk microphone with PTT key for all radios installed in the CCR and offices;
b. Hand microphone with PTT key and support for radios installed in radio console.

6.5.4. Antenna

a. Fiberglass external body;
b. Vertical type;
c. Recommended RF cable, type double screened with a maximum loss of 3 dB;
d. RF impedance: 50 Ohms;
e. Homologated by ANATEL to operate in SMM frequencies.
f. Note: The VHF antennas shall be placed in a position that is as elevated and free as possible, with at least 02 meters horizontal separation from constructions made by conductive materials.

6.5.5. External power supply (if necessary)

a. If the fixed transceiver does not have an internal DC power supply and have a single DC input, CONTRACTOR shall supply an AC/DC power converter with input 220 VAC (+ 20 %), 60 Hz and output DC accordingly to supplied transceiver characteristics. In this case, the power supply shall switch an external DC voltage to feed the transceiver in case of failure in AC voltage supplying.

6.6 Portable VHF/FM-SMM Transceivers - Intrinsically Safe (IS)

6.6.1. For operation in the Maritime Mobile Service (SMM), with operational characteristics according to Brazilian and International Legislation (ITU), and it shall comply with the following features:

a. Frequency Range: From 136 up to 174 MHz, ITU Marine bands;
b. Number of Channels: All international Marine channels frequencies;
c. Frequencies programming: Preferably via software;
d. RF Power output: 5 WRMS selected at Control;
e. Internal loudspeaker and headphone output;
f. Channel selector;
g. Connector for external microphone;
h. LCD Display: to show the channel, power, TX and RX.

i. Hands-free operation.

j. Intrinsically Safe Portable Transceivers (attending the requirements for the International Classifying Society).

k. Homologated by ANATEL to operate in SMM frequencies.

6.6.2. The equipment and accessories to be used in hazardous areas shall attend the classifications areas, protections type and groups established by “National Institute of Metrology Standardization and Industrial Quality – INMETRO”, “International Electro technical Commission – IEC” and ‘Brazilian Association for Technical Standards – ABNT”.

6.6.3. CONTRACTOR shall present the certification emitted by “National Telecommunications Agency - ANATEL”, for the total characteristics specified and that Certificate shall join the technical proposal.

6.7 UHF-SPM (Maintenance and Production Service)

6.7.1. For operation in the Production and Maintenance Service (SPM), with operational characteristics according to Brazilian and International Legislation (ITU-T), and it shall comply with the following features:

a. 01 (one) Fixed Transceiver;

b. 01 (one) Microphone;

c. 01 (one) Outdoor Antenna;

d. 01 (one) Power Supply.

6.7.2. Fixed Transceiver (UHF-SPM)

6.7.2.1. The UHF Production and Maintenance Service (SPM) equipment shall have the following technical characteristics and it shall be in digital technology (DMR) in accordance with ANATEL (Resolution N° 558 - 20/12/2010) and compatible with UHF Active Repeater describe in I-ET-3010.00-5515-762-PPT-003 HULL UHF ACTIVE REPEATER SYSTEM.

a. Frequency Range: From 450 up to 470 MHz;

b. Number of Channels: Minimum of 16 (sixteen) half-duplex channels;

c. Frequencies programming: Preferably via software;

d. RF Power output: 25 WRMS;

e. Channel spacing: 12.5 / 25 kHz;

f. RF connections type UHF/50 Ohm;

g. Internal loudspeaker;

h. Input connector for DC voltage with fuse protection;

i. Supply voltage: 12 / 24 VDC, nominal;

j. External power supply 220 VAC (+/- 20 %), 60 Hz;

k. Channel selector;

l. Color LCD Display: to show the channel, power and TX/ RX mode;

m. Connector for microphone and external loudspeaker;

n. To allow configuration of frequencies and facilities by software

o. Homologated by ANATEL to operate in UHF suggested frequencies range.

6.7.3. Microphone

a. Desk microphone with PTT key for all radios installed in the CCR and offices;

b. Hand microphone with PTT key and support for radios installed in radio console.

6.7.4. Antenna

a. Fiberglass external body;

b. Vertical type;

c. RF cable;

d. RF impedance equal to 50 Ohm;

e. Homologated by ANATEL to operate in UHF suggested frequencies range.

6.7.5. Power supply

a. Shall be furnish a power supply in 220 VAC (+ 20 %), 60 Hz;

b. If the fixed transceiver does not have an internal DC power supply and have a single DC input, CONTRACTOR shall supply an AC/DC power converter with input 220 VAC (+ 20 %), 60 Hz and output DC accordingly to supplied transceiver characteristics. In this case, the power supply shall switch an external DC voltage to feed the transceiver in case of failure in AC voltage supplying.

6.8 Portable UHF-SPM Transceivers - Intrinsically Safe (IS)

6.8.1. For operation in the Production and Maintenance Service (SPM), with operational characteristics according to Brazilian and International Legislation (ITU-T). It shall be in digital technology (DMR) accordingly with ANATEL (Resolution N° 558 - 20/12/2010), compatible with UHF Active Repeater and it shall comply with the following features:

a. Frequency Range: From 450 up to 470 MHz;
b. Number of Channels: Minimum of 16 (sixteen) half-duplex channels;
c. RF Power output: 4 Watts RMS;
d. Protection against output overload and short-circuit;
e. Protection against antenna impedance mismatching;
f. Protection against overheating;
g. Audio compression in transmission;
h. Internal loudspeaker and headphone output;
i. Protection against polarity inversion for the DC power supply;
j. Color Display;
k. Channel selector;
l. On/Off key;
m. Volume control;
n. Clarifier;
o. TX/RX signaling;
p. Connector for external microphone;
q. Hands-free operation;
r. To allow configuration of frequencies and facilities by software.

6.8.2. For each portable transceiver it shall be supplied the following accessories:

a. 03 (three) batteries (Lithium type), sealed, rechargeable, with capacity for a minimum of 12 (twelve) hours operation;
b. 02 (two) single battery chargers;
c. Hand microphone with PTT key and built-in loudspeaker, Intrinsically safe and ingress protection IP-67;
d. 02 (two) headsets intrinsically safe with ingress protection minimum IP-66, suitable to use with earmuffs and industrial helmet. It is acceptable twin cups with microphone to adapt in industrial helmet, also intrinsically safe and IP-66, however in this case the accessory shall have CA (Approval Certificate from Brazilian Ministry of Labor);
e. Telescopic or flexible vertical antenna type;
f. Leather carrying kit with shoulder belt and belt fitting.

6.8.2.1. Headset connection for conversation and audio streaming (HFA, HSP and A2DP profiles) and/or stereo plug (compatible with portable radio) as part of the Personal Protection Equipment approved for hazardous locations with:

a. Loudspeaker internally to ear muffs attachable to helmets
b. Ear muffs to reduce noise levels at least in 20 decibels
c. Sound pressure level 90 dB at 0,3 m
d. Frequency range 200 Hz ~ 8 kHz
e. Omni-directional microphone with frequency range 50 Hz ~ 16 kHz

Figure 9 - Headset illustration example

6.9 Programming Kit

6.9.1. Programming kit shall be supplied with hardware accessories and software for programming of the fixed and portable UHF and VHF transceivers.

6.9.2. It´s expected to be delivered: cables with different interfaces for each radio supplied and a CD software with licenses.

6.10 Battery Charger and Battery Bank for Operational radios

6.10.1. Battery Charger

6.10.1.1. It shall be supplied a battery charger for free vented lead-acid batteries with a sufficient capacity to feed all equipment of the Operational Radio Console as described below:

a. Rectifiers toggled in high frequency;
b. Input voltage of two phase: 220VAC (180 to 275VAC), with frequency strip 45 to 66Hz;
c. Nominal output voltage for consumer: (+24) VCC, with (-) negative grounded;
d. Maximum power: Dimensioned to 120% of nominal charge;
e. Output current shall be defined during the detailed design;
f. It shall be considered 30% for future expansion;
g. Units of rectification shall operate with the current equalized;

h. Modular system with rectification units (URs) with 25 Amperes each one (maximum), in agreement with the need and it shall allow future enlargements so that, in case of failure of one UR module, the other ones shall keep all equipment working;

i. Ventilation for convection forced (ventilated);

j. The electrostatic discharge shall be in agreement with the norm IEC-1000-4-2;

k. EMC shall be in agreement with norm CISPR22 or EN 55022;

l. Tension outbreak shall be in agreement with norm IEC-1000-4-5;

m. Voltage Default and Adjustable Range: 12 / 24 VDC;

n. Static regulation: + / - 0,1%;

o. Ripple psophometric: <2 mV rms;

p. Power factor: Greater than 0,89 at 50% load or more;

q. Acoustic noise: <60 dBa;

r. Automatic shutdown of the batteries bank for minimum tension in discharge;

s. Universal interface for system of remote supervision;

t. Operation temperature: 0-50°C;

u. Relative Humidity: 10% to 95%;

v. The sensors shall accuse among other the following events: interruption of the batteries and fuse, ventilation lack, flotation abnormal, high / low input / output voltage, discharged battery, height temperature;

w. It shall show voltage and current by display in front of the equipment;

x. It shall have protection in the AC input with fuses and suppressors and in the DC output with fuse and high temperature;

y. It shall have the communication interface to the Process Controllers or Fire & Gas Controllers, for outgoing real-time data (event or alarm) and incoming commands;

z. It shall be provided an interface between (-)48 VDC battery charges and CSS-HFGS according to I-ET-3010.00-5520-861-P4X-001 - CONTROL AND SAFETY SYSTEM - CSS.

aa. It shall have SNMP interface to connection to the PETROBRAS LAN Network.

6.10.2. **Battery Bank**

6.10.3. It shall be supplied a free vented lead-acid batteries bank with a sufficient capacity to feed all equipment from the Operational Radio Console as described below:

a. Voltage shall be: +12 / 24 Volts;

b. Nominal capacity: It shall be defined during the detailed design;

b. Autonomy: 30 (thirty) minutes;

c. As the batteries will be exposed the saline atmosphere, the poles shall be protected to avoid the corrosion and they shall be identified;

d. The container shall be made of resistant plastic;

e. It shall be compound for batteries, stationary type, Free Vented Lead Acid (FVLA);

f. The batteries shall be in accordance with ANATEL, ABNT and IEC standards applicable for telecommunications applications;

g. The battery bank shall be installed in appropriate area defined during the detail design and in accordance with IMO, IEC and ABNT standards;

h. The battery bank shall be installed such that it allows visual inspections to be made in batteries electrolytes.

i. Each battery bank shall reserve at least, 20% of its capacity for future installations.

j. It shall be considered an aging rate of 25% for batteries cells.

k. A power factor of 80% for loads shall be take into account.

7. SCOPE OF SUPPLY

7.1 CONTRACTOR shall supply, install, test and commission the GMDSS System and Operational Radio System and give the necessary training to PETROBRAS personnel, within the scope of the Contract and in accordance with this Technical Specification.

7.2 These Systems shall be composed as described below:

a. Main GMDSS System for Sea area A3;

b. GMDSS dedicated Battery Charger and Battery Bank;

c. GMDSS console to CCR;

d. AIS (Automatic Identification System);

e. Serial / IP converter;

f. NAVTEX System;

g. Operational Radio System;

h. Operational Radio Console;

i. Battery Charger and Battery Bank;

j. All documents required by international rules for the radio room;

k. All radio room accessories required by international rules.

7.3 GMDSS System

7.3.1. Considering that the Radio Room is separate from the Central Control Room installations to comply with the IMO COM/Circ 105 August 1991 annex 13 it shall be foreseen 02 (two) GMDSS console in order to guarantee permanent monitoring of the distress and safety frequencies including maritime safety information.

7.3.2. It shall be supplied 02 (two) GMDSS consoles, one installed inside the radio room denominated as Main GMDSS console and another one installed inside the CCR denominated as CCR-GMDSS console.

7.3.3. All communication equipment required by INTERNATIONAL MARITIME ORGANIZATION (IMO) standard, for ship distress communication shall be combined in one console on radio room.

7.3.4. CONTRACTOR shall consider that PETROBRAS FPSO Unit will operate in area A3, for all technical IMO requirements and ITU recommendations.

7.3.5. All equipment listed at column “A3 HF solution” at table on item 2.3 of “Harmonization of GMDSS requirements for radio installations on board SOLAS ship”, issued by IMO, and Chapter 4, Section VI of Brazilian Maritime Regulation NORMAM-01/DPC. In addition, it shall fulfill to all IMO SOLAS requirements, resolutions and amendments applicable.

7.3.6. The GMDSS station based on MF/HF and Inmarsat C and shall be combined in a radio console fitted with dual operation handsets and control panels. The console shall be provided with two separate messaging terminals with supporting keyboards and printers.

7.3.7. Consoles shall have AC and DC switchboard inside with circuitbreakers and spare to power equipment.

7.3.8. The mandatory and General Radio System shall consist of the following equipment are listed below, but not limited to:

7.3.8.1. **03 (three) independent VHF/FM -SMM with built-in DSC feature (Class A)**

a. Each radio shall consist of a 25W VHF radiotelephone, a DSC modem with channel 70 Watch Receiver, and shall comply with GMDSS carriage requirement for safety and general communication. The radios shall have continuous watch on channel 70;

b. 02 (two) VHF/FM -SMM with DSC shall be installed in Main GMDSS console;

c. 01 (one) VHF/FM -SMM with DSC shall be installed in CCR-GMDSS console.

7.3.8.2. **01 (one) MF / HF-SMM radio system, 150W with a scanning DSC receiver and NBDP**

a. The equipment shall be suitable for operation in the Maritime Mobile Service (SMM), with operational characteristics according to International Legislation (ITU-T). The MF/HF Base Station Radio shall fulfill MF/HF DSC Class A requirements, including NBDP monitor, keyboard, printer, microphone and loudspeaker;

b. 01 (one) MF/HF -SMM with DSC and NBDP shall be installed in main GMDSS console;

c. In additional it shall be provided 01 (one) MF/HF remote control unit to be installed in CCR-GMDSS console.

7.3.8.3. **02 (two) Inmarsat C with EGC**

a. The Inmarsat C terminal shall include:

i. Antenna for Mini-C;
ii. Data Terminal;
iii. Keyboard;
iv. Alarm Panel.

b. 01 (one) Inmarsat C with EGC shall be installed in Main GMDSS console;

c. 01 (one) Inmarsat C with EGC shall be installed in CCR-GMDSS console.

7.3.8.4. **01 (One) SOLAS 24VDC battery bank and battery charger**

a. The DC power supply required to feed all GMDSS equipment. It shall be scope of this GMDSS system and comply with the technical requirements, according with item 7 of “Harmonization of GMDSS requirements for radio installations on board SOLAS ship”, Chapter IV, Regulation 13 of Safety of Life at Sea, both issued by IMO, and Chapter 4, Section VI of Brazilian Maritime Regulation NORMAM-01/DPC. In addition, it shall fulfill to all IMO SOLAS requirements, resolutions and amendments applicable;

b. The Battery Charger shall have the communication interface to the Process Controllers or Fire & Gas Controllers, for outgoing real-time data (event or alarm) and incoming commands;

c. 01 (one) 24VDC distribution box with circuit breakers for the distribution of the GMDSS battery voltage to the required equipment.

7.3.8.5. **EPIRB**

a. According to SOLAS IV - 7.1.6, CONTRACTOR shall supply 02 (two) EPIRB. One with automatic release mechanism and another one with manual release mechanism;

b. The EPIRB with automatic release mechanism shall be installed on the top of accommodation module;

c. The EPIRB with manual release mechanism shall be installed inside the Central Control room;

d. The EPIRB battery shall have minimum 3 years until its expiration date during the commissioning;

e. The hydrostatic valve shall have minimum 2 years until its expiration date during the commissioning phase.

7.3.8.6. **Radar Transponder**

a. Radar Transponders (SART) with battery capacity for 96 hours standby and 8 hours of continuous operation and standard wall bracket. The SART´s shall provide both manual and automatic activation;

b. Quantity: The quantity shall be defined according to IMO Resolution A.1023 taking into account the number of lifeboats;

c. It shall be installed 01 (one) radar transponder in each muster station to be informed by PETROBRAS in detail design and 02 (two) spare units shall be kept in the Radio Room;

d. The SART battery shall have minimum 3 years until its expiration date during the commissioning phase;

e. Additionally, inside each Lifeboat it shall have one SART according to MODU CODE 10.14 and IMO Resolution A.802(19). This item is specified in I-ET-3010.00-5400-947-P4X-007 - TOTALY ENCLOSED FIREPROOF LIFEBOATS AND DAVITS. Such SART radio shall be installed inside each lifeboat.

7.3.8.7. **Watertight GMDSS VHF portable radio**

a. VHF GMDSS Ex portable radios shall be provided for operation in the Maritime Mobile Service (SMM), with operational characteristics according to International Legislation (ITU-T).

b. Each radio shall be supplied with 01 (one) battery charger, 01 (one) non-rechargeable battery and 01 (one) additional rechargeable battery (one comes with radio and the other is the additional);

c. Quantity: The quantity shall be defined according to IMO Resolution A.1023 taking into account the number of lifeboats;

d. It shall be installed 01 (one) GMDSS VHF portable radio in each muster station and 02 (two) spare units shall be kept in the Radio Room;

e. The single chargers for VHF maritime watertight portable radios shall be installed in the following locations:

   i. 01 at each muster station.

   ii. 02 at Radio Room.

f. The GMDSS radios non-rechargeable batteries shall have minimum 3 years until its expiration date during the commissioning phase;

g. Additionally, each Safety Boat shall have GMDSS radios according to MODU CODE 10.14 and IMO Resolution A.809(19).

7.3.8.8. **Main GMDSS Console**

a. It shall be supplied 01 (one) GMDSS console to be installed inside the radio room;
b. It shall be able to install all radios required by GMDSS regulations for area A3;
c. It shall be provided a gooseneck type lamp (Figure 11);
d. The grounding bar shall be provided for the grounding of all equipment;
e. Following the typical design for the main GMDSS Console (Figure 10).

Figure 10 - Typical GMDSS Console

Figure 11 -Gooseneck type lamp

7.3.8.9. **CCR GMDSS Console**

a. It shall be provided 01 (one) GMDSS console to be installed inside the Central Control Room;
b. It shall be able to install 01 (one) VHF/FM-SMM with built-in DSC required by GMDSS regulations for area A3;
c. 01 (one) MF/HF remote control unit;
d. 01 (one) NAVTEX;
e. 01 (one) Inmarsat C with EGC, Data Terminal, Keyboard and Alarm Panel;
f. The grounding bar shall be provided for the grounding of all equipment;
g. It shall be provided a gooseneck type lamp (Figure 11);
h. Following the typical design for the CCR-GMDSS Console (Figure 12).
i. Such CCR GMDSS console shall be fed by the same battery charger of GMDSS console installed in Radio Room.

Figure 12 - Typical CCR-GMDSS Console

7.4 Automatic Identification System (AIS)

7.4.1. It shall be supplied 01 (one) AIS system as required on IMO SOLAS, Chapter V, Regulation 19, IMO Resolution MSC.74(69) and Brazilian Maritime Regulation NORMAM-01/DPC, Section VI, Chapter 4.

7.4.2. The AIS system shall be powered by 24 VDC operational radio Battery Charger.

7.4.3. The AIS system shall be installed on the Operational Radio Console.

7.4.4. It shall be supplied 01 (one) port RS-232 Serial / IP device server, manufactured by Advantech MODEL EKI-1522.

7.4.5. Interface to receive the positioning and heading data from GNSS and AHRS.

7.5 NAVTEX

7.5.1. It shall be supplied 01 (one) complete NAVTEX system, include receiver module, control panel and antenna.

7.5.2. The NAVTEX system shall be powered by 24 VDC operational radio Battery Charger.

7.5.3. The NAVTEX system shall be installed in the CCR-GMDSS console.

7.6 VHF/FM-SMM Network (Mobile Maritime System)

7.6.1. CONTRACTOR shall supply, install, test and commission the following equipment:

7.6.2. **VHF/FM-SMM BASE STATIONS**

a. 02 (two) VHF/FM-SMM without DSC (Maritime Mobile Service) base stations in the Central Control Room (CCR): 01 (one) on the Production Staff Workstation and 01 (one) on the Maritime Staff Workstation;

b. The VHF/FM-SMM without DSC base station at Production Staff Workstation shall be limited to a maximum of 6W.

c. 01 (one) VHF/FM-SMM without DSC (Maritime Mobile Service) base station, limited to a maximum of 6W at operational radio console in Radio Room (beside the GMDSS console);

d. 01 (one) VHF/FM-SMM without DSC (Maritime Mobile Service) base station, limited to a maximum of 6W, in the Transport and Logistic Technician (TLT) office at Topside;

e. 01 (one) VHF/FM-SMM without DSC (Maritime Mobile Service) base station in the Vessel coordinator office (COEMB);

f. 01 (one) VHF/FM-SMM without DSC (Maritime Mobile Service) base station in the SEISMIC CONTROL Room;

g. 01 (one) VHF/FM-SMM without DSC (Maritime Mobile Service) base station in the TELECOM UPPER ROOM;

h. 01 (one) VHF/FM-SMM without DSC (Maritime Mobile Service) base station for each CRANE with headset and FOOT PTT each one according to I-ET-3010.00-5266-631-P4X-001 and its Data Sheet Basic project document attachment.

i. 01 (one) VHF/FM-SMM without DSC (Maritime Mobile Service) base station for Pull-in winch according to RISER PULL-IN AND PULL-OUT SYSTEM.

j. All VHF/FM-SMM maritime base stations installed outside the radio console shall be powered by FPSO AC-UPS;

k. All VHF/FM-SMM maritime base stations shall be supplied with exclusive power supply and table PTT (except the VHF/FM-SMM base station installed in operational radio console, it shall be supplied with handheld PTT and its support);

l. All radio equipment and accessories supplied shall be homologated by ANATEL to operate in SMM frequencies;

m. CONTRACTOR shall be responsible for issue all documents in order to legalize the system according to Brazilian legislation. These documents shall be delivered to PETROBRAS at minimum 200 days before the FPSO Sail Away from the shipyard.

7.6.3. VHF/FM-SMM PORTABLE RADIOS

7.6.3.1. 24 (twenty-four) VHF/FM-SMM maritime portable radios, with LCD display, IS (Intrinsically Safe).

7.6.3.2. For each portable transceiver shall be supplied the following accessories:

a. 02 (two) batteries (Lithium or Nickel Cadmium type), sealed, rechargeable, for a minimum endurance of 6 (six) hours;

b. 01 (one) single battery chargers;

c. Hand microphone with PTT key and built-in loudspeaker with ingress protection IP-67;

d. Telescopic or flexible vertical antenna type;

e. Leather carrying kit with shoulder belt and belt fitting.

7.6.3.3. Additionally, it shall be delivered 05 (five) single battery chargers.

7.6.3.4. The VHF/FM-SMM maritime portable shall be able to select all Maritime International frequency channels plan.

7.6.3.5. The portable radios, batteries and all accessories shall be suitable for operation in Zone 1 (Ex ib IIA T3 Gb) hazardous areas in an outdoor tropical marine environment.

7.6.3.6. 02 (two) multi charger six-way battery for portable radios with six displays maximizes talk-time and life cycles to be installed in CCR and in TLT Room at Topsides;

7.6.3.7. All radio equipment supplied shall be homologated by ANATEL to operate in all maritime frequencies.

7.6.3.8. CONTRACTOR shall be responsible for issue all documents in order to legalize the system according to Brazilian legislation. These documents shall be delivered to PETROBRAS at minimum 200 days before the FPSO Sail Away from the shipyard.

7.6.4. **Programming Kit**

a. It shall be supplied 01 (one) Programming Kit and software for all base station and portable radios for using in the maintenance and programming of VHF Radios during the unit operation.

7.6.5. **VHF SYSTEM - REMOTE ACCESS**

7.6.5.1. CONTRACTOR shall supply, install, test and commission a VHF IP gateway model RG1000e from Elcomplus manufacturer in order to allow remote access from PETROBRAS onshore Remote Control Room.

7.6.5.2. This VHF IP gateway shall be able to tune all maritime international channels.

7.6.5.3. It shall be provided 02 (two) VHF IP gateways and 04 (four) radio console software licenses, compatible with SmartPTT solution, to be installed in PETROBRAS computer on board and in onshore Remote Control Room.

7.6.5.4. The software licenses shall be applied as follow: 01 (one) for the resident telecommunication technician on board; 02 (two) for Remote Control Room onshore; and 01 (one) as spare to be defined later by Petrobras.

7.6.5.5. Each VHF IP gateways shall have its own power supply unit so that radios can be operated in parallel.

7.6.5.6. In case of any switch is required inside cabinet to allow the VHF remote access, it shall be followed the same technical specification of electrical access switch stated on I-ET-3010.00-5517-768-PPT-001 HULL DATA NETWORK.

7.7 UHF-SPM (Production and Maintenance Service)

7.7.1. CONTRACTOR shall supply, install, test and commission the following equipment:

7.7.2. **UHF-SPM BASE STATIONS**

a. 01 (one) UHF-SPM base station in Radio Room installed in operational radio console;

b. 03 (three) UHF-SPM base stations in the Central Control Room (CCR): 02 (two) on the Production Staff Workstation and 01 (one) on the Maritime Staff Workstation;

c. 01 (one) UHF-SPM base station in AEAR – Automation and Electric Panels Room at M17, limited to a maximum of 6W;

d. 01 (one) UHF-SPM base station in FWD Temporary Refuge (Forecastle), limited to a maximum of 6W;

e. 01 (one) UHF-SPM base station in Operators Room at M15B, limited to a maximum of 6W;

f. All UHF base stations installed outside the radio console shall be powered by FPSO Emergency Energy System (AC-UPS);

g. All UHF base stations installed inside the operational radio console shall be powered by 220 VAC essential bus bar and by 24 VDC from operational radio Battery Charger;

h. All UHF base stations shall be supplied with exclusive power supply and table PTT. (except the UHF base station installed in operational radio console, it shall be supplied with handheld PTT and its support);

i. The UHF frequency plan will be informed by PETROBRAS during the detailed design;

j. All radio equipment supplied shall be homologated by ANATEL to the frequencies used;

k. The minimum operating frequency range of the UHF transceivers shall be from 450 to 470 MHz, with a minimum of 16 (sixteen) channels available for programming;

l. CONTRACTOR shall be responsible for issue all documents in order to legalize the system according to Brazilian legislation. These documents shall be delivered to PETROBRAS at minimum 200 days before the FPSO Sail Away from the shipyard;

m. All UHF radios shall use digital modulation technology (DMR) in order to comply with ANATEL Resolution 558/2010.

7.7.1. UHF-SPM PORTABLE RADIOS

a. 240 (two hundred and forty) UHF-SPM portable radios, Intrinsically Safe (IS) with external microphone, with color LCD display;

b. For each radio shall be provided:

i. 01 (one) remote speaker microphone with ingress protection IP-67, 01 (one) spare battery;

ii. 01 (one) charger;

iii. 01 (one) carry case and;

iv. 02 (two) head-set intrinsically safe ad with ingress protection minimum IP-66, suitable to use with earmuffs and industrial helmet. It is acceptable twin cups with microphone to adapt in industrial helmet, also intrinsically safe and IP-66, however in this case the accessory shall have CA (Approval Certificate from Secretary of Labor of the Brazilian Ministry of Economy);

c. The radios, batteries and all accessories shall be suitable for operation in Zone 1 (Ex ib IIA T3 Gb) hazardous areas in an outdoor tropical maritime environment;

d. The minimum operating frequency range of the UHF transceivers shall be from 450 to 470 MHz, with a minimum of 16 (sixteen) channels available for programming;

e. 12 (twelve) multi charger six-way battery for portable radios with six displays maximizes talk-time and life cycles;

f. The UHF frequency plan will be informed by PETROBRAS during the detailed design;

g. All radio equipment and accessories supplied shall be homologated by ANATEL;

h. CONTRACTOR shall be responsible for issue all documents in order to legalize the system according to Brazilian legislation. These documents shall be delivered to PETROBRAS at minimum 200 days before the FPSO Sail Away from the shipyard;

i. All UHF radios shall use digital modulation technology (DMR) in order to comply with ANATEL Resolution 558/2010.

7.7.2. **Programming Kit**

a. It shall be supplied 01 (one) Programming Kit and software to be used for all UHF base station and portable radios maintenance and programming during the unit operation.

7.7.2.1. **UHF fire fighter portable radio**

a. 12 (twelve) UHF FIRE FIGHTER watertight portable radio Intrinsically Safe (IS) with external microphone, with color LCD display, according to SOLAS Chapter II-2, regulation;

b. Each radio shall be supplied with 01 (one) single battery charger, 01 (one) extra rechargeable battery;

c. Additional 12 (twelve) spare batteries for such radios shall be supplied.

d. The radio body shall have a different color from UHF-SPM operational portable radios, to make it clear the specific purpose of such fire fighter portable radios.

e. UHF Fire Fighter portable radios shall be of digital modulation, full compatible with UHF Active Repeater System and to me configured with the same UHF frequency plan;

f. Water Ingress Protection of radio and accessories shall be IP67.

g. The single chargers for red portable watertight firefighter radios shall be installed in the following locations:

i. 03 (three) at Radio Room

ii. 09 (nine) at Emergency Response Base

7.7.3. **Operational radio console**

7.7.3.1. An appropriate operational radio console shall be installed in the Radio Room, beside the GMDSS console to integrate, internally, the installation of the following equipment, including their respective power supply unit:

a. 01 (one) VHF/FM-SMM maritime base radio with transmission power limited in 6W;

b. 01 (one) UHF-SPM base station;

c. 02 (two) VHF/AM-SMA radios (according to I-ET-3010.00-5515-762-PPT-001);

d. 01 (one) AIS system.

7.7.4. **Battery charger and battery bank**

7.7.4.1. Appropriate battery charger and battery bank independent of GMDSS power system shall be supplied and installed to feed the equipment installed in the operational radio console and all other necessities:

a. 01 (one) VHF/FM-SMM maritime base radio;

b. 01 (one) UHF base station;

c. 02 (two) VHF/AM-SMA radios;

d. 01 (one) AIS system.

7.7.5. **Rack for remote VHF service**

7.7.5.1. It shall be provided 01 (one) closed rack as per I-ET-3010.00-5517-768-PPT-002 HULL STRUCTURED CABLING NETWORK for the installation VHF gateway and cabling.

8. COMMISSIONING

8.1 CONTRACTOR shall be responsible to realize a technical commissioning activity, check, test and evaluate the operation of equipment, panels, installations, protections and RF covering, in order to permit or authorize their use under normal operating conditions.

8.2 A professional team certified on GMDSS systems and Operation radio systems by vendor shall perform the Installation and Commissioning activities.

8.3 The following verifications, at least, shall be verified as scope of commissioning activities in accordance with Contract and this Technical Specification.

a. Check hardware and network environments;

b. Basic commissioning: After checking the physical environment of the products, check whether, the basic information such as software system, license, and system time is correct, ensuring that the site is running properly;

c. After checking physical environments, check basic information for accuracy. The basic information includes the software system, licenses, and system time. This ensures that the local equipment works properly and suits interconnection commissioning;

d. Device check: Check devices to ensure that the device status meet deployment requirements and prepare for access commissioning and basic service commissioning;

e. Configuring a user to login to the device remotely: This operation enables a user to remotely login to the device in the central equipment room to deploy services.

f. Check and record values of VSWR, return loss and distance to fail obtained from properly calibrated Anritsu Cell Master Tool or similar for each device installed.

g. A proper table with measured values of VSWR at each device (antenna, coupler, splitter, radio) shall be presented comparing them to manufacturer values.

8.4 PETROBRAS shall realize a visual inspection to check the presence of all items listed on the detailed design and fill in the configurations and handbooks:

a. Equipment configurations;

b. Antennas systems;

c. Antennas cables;

d. Lightning protection;

e. Masts, towers (stays, painting, lightning, …);

f. Wiring, security devices, frames, panels, racks, receivers, energy, software implantation;

g. Handbooks;

h. Marking (Equipment Homologation and Operation Certificate);

i. Technical and legal documentation.

8.5 As a matter of general acceptance, at shipyard, it shall be considered the capacity and autonomy tests for battery banks and chargers; parameters configured (IMO, MMSI, Call Sign); radios voice tested; AIS tested and connected to PETROBRAS LAN; Inmarsat C tested; printer tested; SART radios self-tested; EPIRB self-tested; GDMSS watertight tested; sealed batteries delivered; automatically switchover between AC to DC power and vice-versa.

9. NORMATIVE DOCUMENTATION FOR RADIO ROOM

9.1 Maintenance and Operational Manuals

9.1.1. CONTRACTOR shall be responsible to provide the following documentation: Maintenance Manual and Operational Manual for all GMDSS Console equipment, on work ship language (Brazilian Portuguese), as required by DPC to legalize the Ship Radio Station.

9.2 ITU-T Publications

9.2.1. CONTRACTOR shall be responsible to provide, at least, the following ITU-T documentation, necessary and required by DPC to legalize the Ship Radio Station:

a. International Telecommunication Union (ITU) Publication 'List IV – List of Coast Stations and Special Service Stations';

b. ITU Publication 'Manual for Use by the Maritime Mobile and Maritime Mobile Satellite Services (Maritime Manual)';

c. ITU Radio Regulations (Volume 1 to 4) – Carriage onboard is optional;

d. Global Maritime Distress and Safety System (GMDSS) Fitted Installations;

e. ITU Publication 'List V – List of Ship Stations and Maritime Mobile Service Identity Assignments';

f. ITU Publication 'List IV – List of Coast Stations and Special Service Stations' containing a list of coast station and coast earth stations with which communications are likely to be established, showing watch-keeping hours,

frequencies and charges, and a list of coast stations and coast earth stations providing navigational and meteorological warnings, and other urgent information for ships;

g. ITU Publication 'Manual for Use by the Maritime Mobile and Maritime Mobile Satellite Services (Maritime Manual)';

h. ITU Radio Regulations (Volume 1 to 4).

9.3 Global Maritime Distress and Safety System Log Record

9.3.1. CONTRACTOR shall be responsible to provide the Global Maritime Distress and Safety System (GMDSS) radio logbook.

10. NORMATIVE RADIO ROOM REQUIREMENTS

10.1 CONTRACTOR shall be responsible to provide all radio room requirements:

a. All documents required in item 9 shall be kept in the Radio Room, accommodate in adequate book shelfs;

b. It shall be installed in a visible place a radio station prefix;

c. It shall be installed in a visible place a Radio Room clock with red and green radio silence zones.

11. MANAGEMENT REQUIREMENTS

11.1 The Battery Charger shall permit a remote control and monitor, through:

a. Dry contacts;
b. SNMP - Internet Protocol (IP);
c. Supervisory Control and Data Acquisition (SCADA).

11.2 The Battery Charger shall permit a local control and monitor, through:

a. Local desktop;

b. Human Machine Interface (HMI).

11.3 The Battery Charger shall have interface with the following systems, for outgoing real-time data (event or alarm) and incoming commands:

a. Fire and Gas Panel (FGS): Automatically activate fire and gas emergency alarms;

b. Structured Cabling and Optical Data Network (LAN) or HULL Structured Cabling Network System.

c. It shall be provided an interface between battery chargers and CSS-HFGS according to I-ET-3010.00-5520-861-P4X-001 - CONTROL AND SAFETY SYSTEM - CSS.

12. SHUTDOWN TELECOMMUNICATIONS SYSTEM

12.1 To meet the requirements of IEC 60079-0 and CENELEC CLC / TR 50427, CONTRACTOR shall provide a shutdown telecommunication system to avoid ignition risks when flammable gases leak was detect in the antenna deck.

12.2 The GMDSS and operational radios equipment shall be turned off when the fire and gas panel detect flammable gases in the antenna deck.

12.3 This automation can be done in the electrical panel or inside the radio operation console.

13. LEGALIZATION REQUIREMENTS

13.1 CONTRACTOR shall provide to PETROBRAS all documents and forms required properly filled to legalize all the Operational Radios to be installed in PETROBRAS FPSO Unit, subject of this technical specification, including the payment of the ART (technical responsibility term) to CREA and assigned report of non-ionizing radiation.

13.2 CONTRACTOR shall be responsible for the procedures in order to legalize all the Operational Radios.

13.3 CONTRACTOR shall provide the requested signed report of ANATEL resolution number 700 about Evaluation of Human Exposure to Electric, Magnetic and Electromagnetic Fields Associated with the Operation of Radiocommunication Transmitting Stations for each radio to be licensed.

13.4 CONTRACTOR shall deliver this form filled, at least, 200 days before the unit leaves the shipyard.

13.5 FLAG STATE REGISTRATION

13.5.1. CONTRACTOR shall be responsible to provide all documentation necessary and required, at last revision, to legalize the Ship Radio Station of the PETROBRAS FPSO Unit by flag state. These documents shall be delivered to PETROBRAS at minimum 200 days before the FPSO Sail Away from the shipyard.