PETROBRAS	TECHNICAL SPECIFICATION	Nº: I-ET-3010.2D-5524-941-P54-001	
	CLIENT: AGUP		SHEET: 1 of 14
	JOB: HIGH CAPACITY FPSO - GAS EXPORTATION ALL ELECTRIC		
	AREA: ATAPU 2 AND SÉPIA 2		
EXP	TITLE: INFRASTRUCTURE FOR PRM SYSTEM ON A SPREAD MOORING FPSO		INTERNAL
			EXP/TAID/AG

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REVISION INDEX

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL ISSUE
A	REVISED WHERE INDICATED

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	SEP/05/22	OCT/25/2022							
DESIGN	EXP	EXP							
EXECUTION	Y3S7	Y3S7							
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1. SUBJECT

1.1 The objective of this document is to describe all infrastructure that Unit shall have in advance to receive a Permanent Reservoir Monitoring (PRM) System in a Spread Mooring anchored FPSO for SÉPIA and ATAPU fields, which will be done by defining some requirements, identifying the interfaces and scope of supplying and services.

1.2 These requirements were based on preliminary data and are subject to change after complete study.

2. ABBREVIATIONS

CCR	Central Control Room
CCS	Control and Safety System
FPSO	Floating Production Storage and Offloading
HVAC	Heating, Ventilation and Air Conditioning
NAS	Network Attached Storage
PRM	Permanent Reservoir Monitoring
QC	Quality Control
STP	Shielded Twisted Pair
UPS	Uninterruptible Power Supply

3. REFERENCE DOCUMENTS, CODES AND STANDARDS

3.1 General Standards

a. IEC-60079 – Electrical Devices for Explosive Gaseous Atmospheres;

b. NMEA 0183 – Standard for Maritime interface between electronic devices.

3.2 Brazilian Standards

3.2.1. *INMETRO*

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.

3.2.2. *NR's – Normas Regulamentadora*

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

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

c. It shall be followed all others NR's – Normas Regulamentadoras (Regulatory Standards) from Ministério do Trabalho (Brazilian Ministry of Labor) applicable to this Technical Specification.

3.2.3. Anatel – Resolutions of ANATEL.

3.3 Definitions

3.3.1. All definitions shall follow I-ET-3010.00-1200-940-P4X-002 GENERAL TECHNICAL TERMS. The main ones are copied below:

a. SELLER: Company contracted by PETROBRAS (BUYER) to construct the FPSO.

b. RISER CONTRACTOR: Company contracted by PETROBRAS to supply flexible risers.

c. PRM CONTRACTOR: Company contracted by PETROBRAS to supply the PRM system.

b. PETROBRAS: BUYER that uses the PRM system for reservoir management.

3.3.2. Any information to be exchanged with PETROBRAS related to this specification shall be addressed to PETROBRAS Geophysical Acquisition Group.

4. GENERAL REQUIREMENTS

4.1 Equipment and accessories shall attend the ingress protection degree, protection type, classifications zone and groups established by IEC / ABNT.

4.2 SELLER shall only supply equipment, cables, accessories approved and certificated by Classifying Society and technical conformity with the International and National standardization organism: ABNT, IEC and INMETRO.

4.3 SELLER shall provide information of locations and other requirements of all infrastructures supplied and installed by SELLER for PETROBRAS during Detail Design.

5. SYSTEM DEFINITIONS

5.1 A PRM System uses permanently installed cables on the seabed with embedded sensors (geophones/accelerometers and hydrophones) to provide seismic data during the lifetime of the field.

5.2 The System comprises equipment installed on the FPSO and subsea, composed by:

5.2.1. **FPSO**

a. PRM equipment: receives the signal from subsea sensors and converts it to be recorded on the NAS.

b. Operation and Quality control workstation.

c. NAS: Seismic data storage.

d. UPS: Provides power supply in event of power failure.

e. Junction Boxes: placed at riser balcony an in Seismic Instrument Room.

f. Deck cable: fiber optic cable from riser balcony to Seismic Instrument Room.

5.2.2. **Subsea**

a. Sensors: Geophones/Accelerometers and Hydrophones.

b. Seismic Cables: Connect sensors and distribution units.

c. Distribution Units: Interface between umbilical and sensor cables.

d. Umbilical: Connection between topside and subsea.

5.3 Refer to schematics on Figure 1 for system diagram.

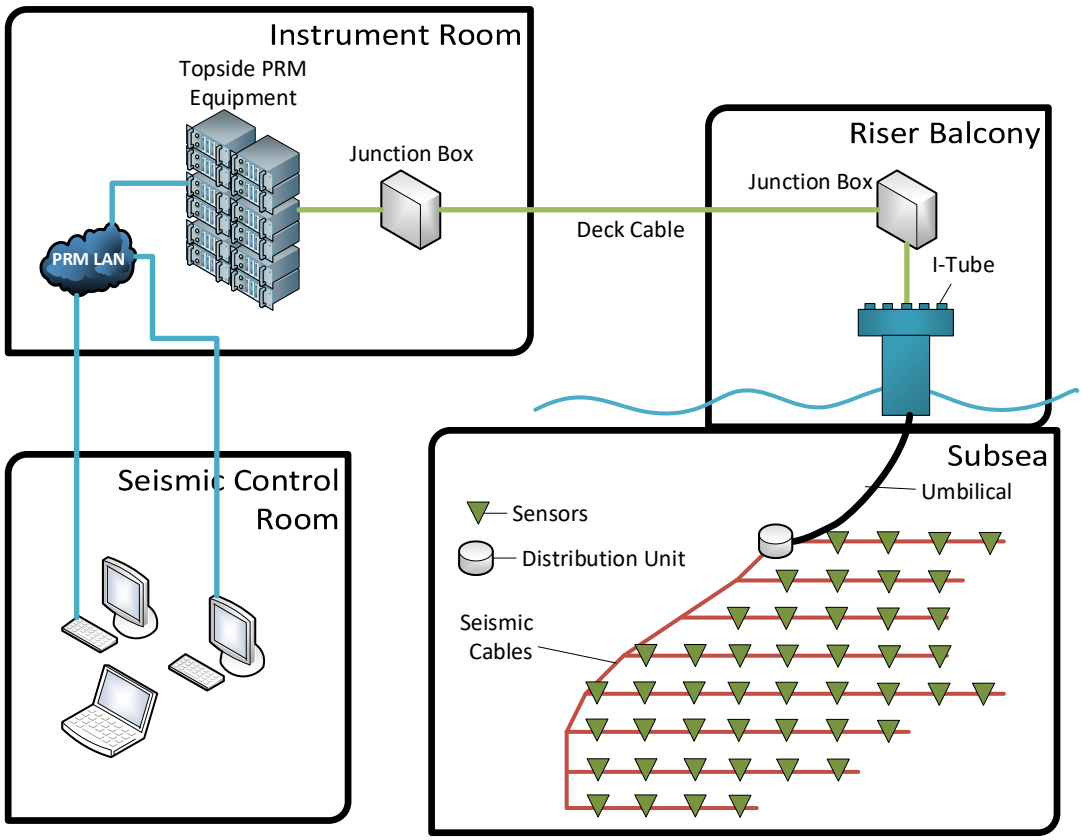

Figure 1 – PRM components schematics.

6. PRM INFRASTRUCTURE REQUIREMENTS

6.1 Seismic Instrument Room

6.1.1. Location

a. Seismic Instrument Room will be used to house the panels that contain the recording system including lasers (for optical system) or power cabinets (for electrical system). SELLER shall provide this space in a dedicated room.

b. SELLER shall provide enough space to accommodate 16 (sixteen) 19" cabinets with dimensions of 220 x 60 x 100cm (H x W x L) each, with elevated floor for all of them and support/baseplate to properly fixate those cabinets on the floor.

c. Circulation space of at least 70 cm in the front and rear of the cabinets shall be provided for maintenance and heat exchanges.

d. Each cabinet will weight approximately 800kg.

e. Wall space for up to 06 (six) junction boxes for deck cable interfacing (fiber optic cables form riser balcony) shall be provided, each 120 x 60 x 25 cm (H x W x D).

f. SELLER shall provide cable routing trays from those junction boxes on the wall to space where each PRM Cabinets is supposed to be installed in Seismic Instrument Room.

g. SELLER shall provide cable routing trays with 300 mm width among all PRM cabinets.

h. SELLER shall provide a TELECOM PANEL with the following dimensions: 250 mm x 600 mm x 800 mm (depth x width x height) on the wall of Seismic Instrument Room, on which some telecom infrastructure will be terminated. Also, SELLER shall provide cable routing from this TELECOM PANEL to PRM Cabinets.

6.1.2. Electrical

a. The required electrical output power for PRM system is 45 kW from dedicated UPS (with dedicated battery bank), 40kW on Seismic Instrument Room and 5kW on Seismic Control Room.

b. An intermittency factor and simultaneity factor of 100% shall be considered, as all equipment is expected to be on at all time.

c. SELLER shall provide a 690VAC circuit from Normal Electrical Panel for PRM UPS. This circuit shall be terminated UPS position in Seismic Instrument Room, from panel PN-5143502 on Hull HNPR1.

d. SELLER shall provide electrical cable routing tray from this electrical panel to PRM UPS location.

e. As a matter of information, electrical panel for PRM cabinets will be located on PRM UPS and will be provided by PRM CONTRACTOR.

f. SELLER shall provide electrical cable routing tray from PRM UPS location to each PRM 19” cabinet.

g. The UPS output voltage will be three-phase 220VAC.

h. PRM UPS will be provided by PRM CONTRACTOR, with dedicated lead-acid battery bank to be installed on dedicated battery room.

i. SELLER shall provide electrical cable routing tray of 100 x 300 mm (H x W) from battery banks, in Battery Room, to space where UPS is supposed to be installed, in Seismic Instrument Room, with MCT on all routing path.

j. As a matter of information, the UPS to be provided by PRM CONTRACTOR to power PRM cabinets will be about 60 kVA, with 220 VAC output and an autonomy of 8 minutes, enough to safely power down the PRM equipment. Additionally, the battery bank to be supplied by PRM CONTRACTOR will be 240 VDC, with about 118 lead acid elements at 1,75 V, distributed on 2 or 3 rows and 2 steps.

k. SELLER shall provide 02 (two) LAN point from Data Structured Cabling PRM below the location reserved for UPS panel in Seismic Instrument Room in order to allow PRM UPS to be connected to Special Monitoring DMZ network so that it can remotely monitored using the unit's PI system from CCR screens.

l. PRM CONTRACTOR will provide OPC-UA drivers compatible with Osisoft's PI OPC-UA Connector for the UPS remote interface in order to provide data for reading. In other words, data from PRM's UPS shall be readable from PI.

m. As a matter of information, this connection with PI system is meant for monitoring only, i.e., no commands are allowed from this LAN connection to PRM UPS panel.

n. SELLER shall provide facilities so that UPS to be installed can be interconnected to the Energy Shut-Down (ESD) system.

o. PRM CONTRACTOR shall provide a dry contact (Digital Input) in order to receive a shutdown command from the CSS. If this command is received, PRM shall safely shutdown the system.

p. PRM system shall safely shutdown if:

    i. HVAC shutdown (signal is received through CSS shuddown),

    ii. or other plant conditions (signal received through CSS shutdown).

q. SELLER shall also provide power on Seismic Instrument Room from some normal electrical panel (5kW at 220VAC) with a master circuit braker, 16 biphase circuit brakers and 4 spares.

r. SELLER shall additionally provide proper power cable routing for each PRM cabinet from this panel.

6.1.3. **HVAC**

a. SELLER shall provide cold air in the Seismic Instrument Room, taking care that PRM cabinets will be placed rear to rear, so that there will be hot and cold aisles configuration.

b. The maximum total thermal load on Seismic Instrument Room is 40 kW (plus 5% for cable losses and plus 15% for contingency) for all cabinets and maximum for one cabinet is supposed to be 4 kW. The temperature inside the room shall be kept between 10ºC and 30 ºC, and the humidity between 40 and 60%.

c. The expected air flow on cabinets is front to rear, with the room being designed in a way to create cold and hot isles. As a matter of information, there shall be no air communication over the top of the cabinets to avoid cold/hot air short circuit and loss of efficiency on heat removal.

d. An intermittency factor and simultaneity factor of 100% shall be considered, as all equipment is expected to be on all the time.

6.2 **Seismic Control Room**

a. The Seismic Control Room will be used to accommodate the workstations, one telephone extension line, one printer and one VHF base station radio, where operators (seismic observers) and Petrobras representative will perform the project control and data QC. It is important that the Seismic Instrument Room and the Seismic Control Room be located in different environment for noise isolation purpose.

b. SELLER shall provide 02 (two) tables and chairs for operator workstations: one table with dimensions of 0,75m x 2m (W x L) and another one with dimensions of 0,75m x 1,5m (W x L), according to architecture layout.

c. SELLER shall provide a 24U 19” cabinet with dimensions of 100 x 60 x 90 cm (H x W x L).

d. SELLER shall provide one storage cabinet/shelf with dimensions of 200 x 90 x 60 cm (H x W x L).

6.2.1. **Electrical**

a. The required electrical output power for PRM Seismic Control Room equipment is 5kW at 220VAC.

b. This power shall be delivered by small UPS provided by SELLER powered from a 220VAC output normal panel.

c. 220VAC power outlets from small UPS for the operation of workstations, monitors and printer that shall be supplied by SELLER.

d. It shall be supplied 06 (six) power sockets (Brazilian standard) shall be provided for each workstation table, 02 (two) power sockets for printer (to be installed on the storage cabinet) and 02 (two) power sockets close to the 19" rack to be installed on floor.

6.2.2. **Networking and communication**

a. For each of the 02 (two) operation workstation, SELLER shall provide:

   i. 03 (three) PETROBRAS LAN outlets for each workstation;

   ii. 03 (three) CAT-6 STP LAN cable for PRM Ethernet switch. These cables shall be terminated on TELECOM PANEL on instrument room from item 6.1.1 h.

b. SELLER shall also provide, install and activate01 (one) VHF base station in the Seismic Control Room.

6.3 **Riser Balcony**

a. SELLER shall reserve 03 (three) umbilical slots.

b. SELLER shall provide space for up to 06 (six) junction boxes, 02 (two) per umbilical slot.

c. These junction boxes will be installed up to 5 (five) meters from the I-tube.

d. The junction box dimensions required are 120 x 60 x 25 cm (H x W x D).

e. SELLER shall submit to PETROBRAS for comments/information junction box position relative to I-tube and junction box technical specifications.

f. SELLER shall provide the local support for all 06 (six) junction boxes at riser balcony area.

6.4 **Communication and Cabling**

a. DECK CABLE: SELLER shall provide a dedicated cable routing trays from riser balcony junction boxes to Seismic Instrument Room junction boxes for 06 (six) optical cables with maximum 32mm diameter and 320mm bending radius.

b. SPACE FOR GPS ANTENNA: SELLER shall provide on antenna deck a spot for the PRM GPS ANTENNA, cleared from obstructions, to correct receive GPS signal. The antenna will be provided by PRM contractor.

c. GPS CABLE: SELLER shall provide 02 (two) coaxial cables for GPS signal from PRM GPS ANTENNA to the instrument room. These cables shall be terminated on TELECOM PANEL on Seismic Instrument Room stated on item 6.1.1 h.

d. OPTICAL LAN CABLE: SELLER shall provide an optical cable with, at least, 04 (four) multimode pairs (two main + two spares) from PETROBRAS Telecommunication Upper Room to the TELECOM PANEL on Seismic Instrument Room stated on item 6.1.1 h. These optical cable pairs shall be terminated proper optical distribution panel in both sides.

e. WIRELESS NETWORK LINK: SELLER shall provide an adequate infrastructure to be used on an omnidirectional 20 km range wireless network link equipment, consisting of:

   i. It shall be installed one pipe with 4 inch diameter and 3 meters height. The location will be defined during the project detail.

   ii. It shall be pulled 02 (two) RF cable cellflex 7/8 inch 50 ohms from Telecommunication Upper Room to the pipe described above.

   iii. It shall be pulled 02 (two) STP cat-6 cables from Telecommunication Upper Room to the pipe described above.

   iv. PRM CONTRACTOR will be responsible for the radio equipment supply and installation.

   v. All such infrastructure shall be terminated inside TELECOM PANEL in Seismic Instrument Room stated on item 6.1.1 h.

6.5 **System Diagram**

6.5.1. The diagram on Figure 2 is for illustrative purpose only to represent the components and interconnections of the topside PRM system.

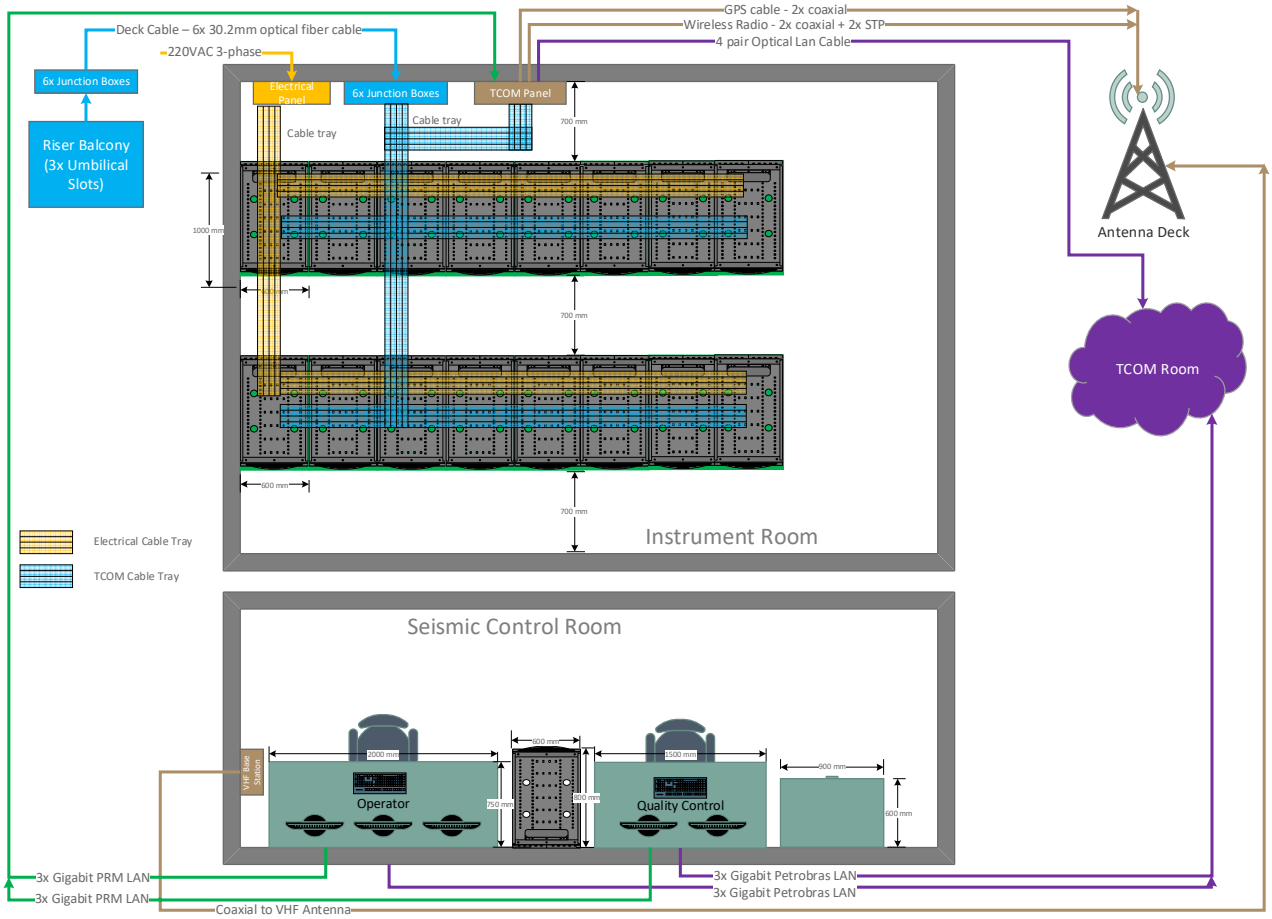

Figure 2 – Topside PRM system interconnection diagram and requirements

7. SCOPE OF SUPPLY

7.1 SELLER shall provide the items below as per technical requirements previously stated.

a. Space for 19” cabinets provisioning and fixation points on the ground/floor (Item 6.1).

b. Cable tray for deck cables from PRM Junction Boxes on riser balcony to PRM Junction Boxes on instrument room (item 6.4 a.)

c. Cable trays from battery room, from electrical normal panel and from optical riser balcony JBs through false floor to Seismic Instrument Room (items 6.1.1 f., g., h and 6.1.2 d., f., i.6.2.1).

d. Space for a GPS antenna on top roof.

e. Coaxial cables from GPS area to PRM Seismic Instrument Room (inside TELECOM PANEL) (item 6.4 b., c.).

f. Telecommunication cables and TELECOM PANEL on Seismic Instrument Room shall be supplied and installed (items 6.4 d. and 6.4e. and 6.2.2 a.)

g. Space and proper fixation support for junction boxes to be installed on riser balcony (items 6.3 a., b., c. and d.).

h. Space and support for junction boxes to be installed in Seismic Instrument Room (item 6.1 e.).

i. Specified Power Supply on Seismic Instrument Room (item 6.1.2).

j. Specified Power Supply, with UPS on Seismic Control Room (item 6.2.1)

k. Specified HVAC (item 6.1.3).

l. Proper infrastructure for one wireless antenna (item 6.4 e.).

m. VHF base station in Seismic Control Room (item 6.2.2 b.).

7.1.1. SELLER shall take into account that PRM equipment may be not available for shipyard installation before the FPU starts production.

7.1.2. SELLER shall also take in account that the deck cable and junction boxes installation to be done by PRM CONTRACTOR might be supervised by PETROBRAS.

7.2 Annex has a summary of expected scope.

8. COMISSIONING

8.1 All cables and panels provided by SELLER shall be tested according to telecommunication and electrical technical requirements.

9. PRM CONTRACTOR SCOPE CLARIFICATIONS

9.1 PRM CONTRACTOR will provide:

a. 19” cabinets procurement and installation.

b. Deck cable procurement and installation.

c. Topsides PRM equipment and its installation on cabinets.

d. UPS for PRM equipment on Seismic Instrument Room.

e. PRM optical network, electrical cable supply and installation (including cabling among cabinets and excluding cables specified on 7.1.

f. Cable interconnections between TELECOM PANEL to PRM Cabinets on Seismic Instrument Room.

g. Cable interconnections between normal electrical panel to UPS.

h. Junction boxes procurement and installation in Seismic Instrument Room.

i. Electrical and optical splices for PRM cables.

j. Wireless Network equipment and antennas procurement and installation.

10. LEGALIZATION REQUIREMENTS

10.1 SELLER shall provide to PETROBRAS all documents and forms required properly filled to legalize the VHF base station to be installed in Seismic Control Room, subject of this technical specification, including the payment of the ART (technical responsibility term) to CREA and assigned report of non-ionizing radiation.

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

10.3 Antennas supplied 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.

10.4 SELLER shall be responsible for the procedures in order to legalize the VHF base station radio.

10.5 SELLER 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.

10.6 SELLER shall issue these documents, at least, 200 days before the unit leaves the shipyard.

11. ANNEX

EQUIPMENT/INFRASTRUCTURE	LOCATION	SELLER	PRM CONTRACTOR
19" cabinets (6.1.1 a.)	Seismic Instrument Room (SIR)	Space Provision	Supply and install
JBs for optical cables (6.1.1 b.)	Seismic Instrument Room (SIR)	Space Provision	Supply and install
Telecom Panel (6.1.1 h.)	Seismic Instrument Room (SIR)	Supply and install	
UPS (6.1.2 h.)	Seismic Instrument Room (SIR)	Space Provision	Supply and install
Two LAN ports for PRM UPS (6.1.2 k.)	Seismic Instrument Room (SIR)	Supply and install	
ESD Interconnection to PRM UPS (6.1.2 n.)	Seismic Instrument Room (SIR)	Supply and install	
Floor fixation suports (6.1.1 b.)	Seismic Instrument Room (SIR)	Supply and install	
SIR 690V 45kW power on PRM UPS location (6.1.2 c.)	Seismic Instrument Room (SIR)	Supply and install	
HVAC (6.1.3)	Seismic Instrument Room (SIR)	Supply and install	
Electrical Panel from Normal Panel (6.1.2 g)	Seismic Instrument Room (SIR)	Supply and install	
Tables/chairs (6.2 b.)	Seismic Control Room (SCR)	Supply and install	
24U 19” cabinet (6.2 c.)	Seismic Control Room (SCR)	Supply and install	
Storage Cabinet/Shelf (6.2 d.)	Seismic Control Room (SCR)	Supply and install	
VHF base station and cables (6.2.2 b.)	Seismic Control Room (SCR)	Supply and install	
UPS 5KVA (6.2.1 a.)	Seismic Control Room (SCR)	Supply and install	
Power outlets (6.2.1 c.)	Seismic Control Room (SCR)	Supply and install	
Workstation and monitors (6.2 a.)	Seismic Control Room (SCR)	Space Provision	Supply and install
Printer (6.2 a.)	Seismic Control Room (SCR)	Supply and install	
Telephone extension set (6.2 a.)	Seismic Control Room (SCR)	Supply and install	
Petrobras LAN cables/outlets (6.2.2 a. i.)	Seismic Control Room (SCR)	Supply and install	
PRM LAN cables/outlets (6.2.2 a. ii.)	Seismic Control Room (SCR)	Supply and install	
HVAC	Seismic Control Room (SCR)	Supply and install	
Three umbilical slots (6.3 a.)	Riser Balcony	Supply and install	
JBs for optical cables (6.3 b.)	Riser Balcony	Space Provision	Supply and install
Support JBs for optical cables (6.3 f.)	Riser Balcony	Supply and install	
Deck Cable (6.4 a.)	Riser Balcony to SIR	Cable Routing	Supply and install
Battery bank (6.1.2 h)	Battery Room	Space Provision	Supply and install
Cable Trays (6.1.2 i.)	From Battery Room to SIR	Supply and install	
Cable Trays (6.1.1 h.)	From Telecom Panel to 19" cabinets	Supply and install	
Cable Trays (6.1.1 f.)	From SIR junction boxes to PRM Cabinets	Supply and install	
Cable Trays (6.1.1 g.)	Between PRM Cabinets on SIR	Supply and install	
Electrical Cable Trays (6.1.2 f.)	From SIR UPS to PRM Cabinets locations	Supply and install	
Electrical Cable Trays (6.1.2 r.)	From Normal Panel to PRM Cabinets Locations	Supply and install	
Optical LAN Cable (6.4 d.)	PETROBRAS Telecom Upper Room to PRM TELECOM PANEL	Supply and install	
GPS antena (6.4 b.)	Top Deck	Space Provision	Supply and install
GPS antenna coaxial cable (6.4 c.)	From Top Deck do Telecom Panel in SIR	Supply and install	
Pipe for wireless radio (6.4 e)	Top Deck	Supply and install	
Wireless Radio (6.4 e)	Seismic Control Room (SCR)	Space Provision	Supply and install
Cables for Wireless Radio (6.4 e)	From Top Deck do Telecom Panel in SIR	Supply and install	
FTP cable (6.4 e)	From Top Deck do Telecom Panel in SIR	Supply and install	

Table 1 – Expected scope summarization