PETROBRAS	TECHNICAL SPECIFICATION	Nº:	I-ET-3010.00-5517-768-PPT-003
	CLIENT: SRGE		SHEET: 1 of 17
	JOB: TELECOMMUNICATION DATA		
	AREA: -		
TIC	TITLE: HULL WLAN SYSTEM		INTERNAL
			OI/CS

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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 Wireless Local Area Network System (WLAN) that shall be installed in PETROBRAS FPSO Unit: Accommodation Module, Hull Industrial Areas and Main Deck.

2. ABBREVIATIONS

ECD	Data Communications Equipment
MCO	microcomputer (Workstation)
IMP	Printer
SW	Layer 2 Switch
PP	Patch Panel
PDD	Data Distributor Panel
DIO	Optical Internal Distributor
ROT	Router
TMD	Data Plug Socket
GK	Access Media Gateway (Gatekeeper)
OW	WAN Optimizator
CP	WLAN Controller
FW	Firewall
PA	WLAN Access Point
SW	Layer 3 Switch
SVR	Server
OTDR	Optical Time-Domain Reflectometer
WLAN	Wireless Local Area Network

3. REFERENCE DOCUMENTS, CODES AND STANDARDS

3.1 The detailed design shall be made, at least, in accordance with requirements of those International and National Standards listed below:

a. ABNT NBR 5410 – Instalações Elétricas de Baixa Tensão;

b. ABNT NBR 6814 – Fios e cabos elétricos - Ensaio de resistência elétrica;

c. ANATEL - Lei Nº 9.472, of 16 July 1997;

d. ANSI/EIA/TIA 568-B2-1 – Commercial Building Telecommunications Cabling Standard;

e. ANSI/EIA/TIA 568-C.2 – Balanced Twisted-Pair Cabling Components;

f. ANSI/EIA/TIA 568-D.3 – Optical Fiber Cabling Components Standard

g. IEC 61892 – Mobile and fixed offshore units – Electrical installations – All Parts;

h. IEC 60079 – Explosive Atmospheres – All Parts;

i. IEC 60092 – Electrical installations in ships – All Parts;

j. IEC 60228 – Conductors of insulated cables;

k. IEC 60331 – Fire-resisting characteristics of electric cables;

l. IEC 60332 – Flame-retardant characteristics of electric cables;

m. IEC 62444 – Cable glands for electrical installations;

n. IEC 60529 – Degrees of Protection Provided by Enclosures (IP Code);

o. IEEE 802.11 standards in various versions (versions "a" through "n");

p. 802.11 ac - standards in 802.11 providing 5 GHz band, retroactively labelled as Wi-Fi 5;

q. 802.11 ax - standards in 802.11 is designed to operate in all band spectrums between 1 and 7 GHz, marketed as Wi-Fi 6;

r. IEEE 802.11 i – Wi-Fi Protected Access 2 (WPA2), WPA;

s. IEEE 802.3 af - Standard specifies Power over Ethernet (PoE), also Power over LAN (PoL);

t. IEEE 802.3 at - Standard specifies Power over Ethernet Plus (PoE+), also knowledge to Power over LAN (PoL);

u. NFPA 70 – National Electrical Code;

v. NFPA 72 – National Fire Alarm and Signaling Code;

w. NFPA 76 - Standard for the Fire Protection of Telecommunications Facilities

x. OSHA Rules - Occupational Safety and Health Administration

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. NR-10: Segurança em Instalações e Serviços em Eletricidade.

c. NR-37:Segurança e Saúde em Plataformas de Petróleo.

4. GENERAL REQUIREMENTS

4.1 CONTRACTOR shall provide all the materials to install all equipment, accessories and infrastructure that compose the WLAN System.

4.2 CONTRACTOR shall elaborate a Calculation Report for WLAN System, in accordance with Standards listed herein and this PETROBRAS technical specification requirement.

4.3 Electrical installations, equipment and materials shall comply with the requirements of IEC 60079, IEC 61892-7 and Classification Society.

4.4 All equipment, installations and materials shall be type approved and certified by international recognized laboratory and shall be in accordance with INMETRO Portaria n° 115, March 21st 2022 and its annexes.

4.5 CONTRACTOR shall provide the structured cabling network points for all WLAN Access Point (PA) in accordance with Technical Specification: I-ET-3010.00-5517-768-PPT-002 – HULL STRUCTURED CABLING NETWORK.

4.6 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.

4.7 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.

4.8 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.

4.9 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 FOR ELECTRICAL 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.

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

4.11 CONTRACTOR shall supply all equipment and accessories approved and certificated by Classifying Society and in technical conformity with the International and National standardization organism: ABNT, IEC and INMETRO.

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

4.13 Safety Grounding of telecommunication panels enclosure shall be according to I-ET-3010.00-5140-700-P4X-001 - SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS." Grounding by simply supporting the casing on the steel structure of the FPSO shall not be acceptable.

4.14 Equipment and accessories shall be specified, built and assembled using non-combustible, non-corrosive and mechanically rigid materials.

4.15 When designing a box, its size and shape shall be chosen taking into account the devices it will house and what else may be added in future, in order to enable easy servicing even after future expansion.

4.16 When drilling holes in boxes for incoming and outgoing cables by means of cable glands, care shall be taken to refrain from drilling more holes than it is necessary and, if in fact this may occur, the extra holes shall be closed with plugs.

4.17 All grounding bus bars shall be of tin-plated copper and painted with green strips.

4.18 All connections to the grounding network for equipment and boxes shall be made by means of bolted terminals.

4.19 CONTRACTOR shall install the DC Distribution Panel for 19” rack with circuits breakers on each Telecommunication rack listed on Detailed Design Project.

4.20 In order to avoid humidity and water ingress inside the boxes, CONTRACTOR shall apply appropriate material in the screw thread, bolts, cable glands, cover plugs and joints, according to IEC 60079 and IEC 60529.

4.21 The boxes shall have the cable glands installed facing lateral sides and/or bottom side. Cable glands installed facing upward are not acceptable. It is also not acceptable any opening facing the upward of the box, even if it is closed by cover plug.

4.22 CONTRACTOR shall ensure by inspection of a qualified personnel that all equipment installations are according to the IEC/ABNT standards requested in this technical specification.

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

4.24 All data equipment shall support the latest SNMP protocol version.

5. SYSTEM DEFINITIONS

5.1 WLAN System shall be defined as a complementary network access to PETROBRAS Corporative network on Accommodation Module, Main Deck and Hull Industrial Areas.

5.2 All transmitter radios and appliances, if applicable, shall be certified in accordance with ANATEL Standards and CONTRACTOR shall provide all necessaries licenses to regular operating in Brazil.

5.3 For all equipment proposed, it shall be ensured, by CONTRACTOR, that all items do not have an EoS/EoL warning issued by the manufacturer.

5.4 CONTRACTOR shall consider some requirements on own energy power detailed design to feed Access Point (PA):

a. It shall be fed, mainly, by PoE (IEEE 803.3 af) or PoE+ (IEEE 803.3 at), always if is possible;

b. If it is not possible, it shall be fed by the 220 VAC from UPS switchboard panel.

5.5 All Access points installed in topsides modules (not scope of this technical specification) shall use the WLAN controller installed in telecommunication equipment room.

6. TECHNICAL REQUIREMENTS

6.1 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.

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

6.3 In case of difficulty for supplying some accessory with external body made with non-metallic materials, it will be necessary to submit them for analysis and approval of PETROBRAS.

6.4 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).

6.5 In outdoor areas, exposed to marine atmosphere, CONTRACTOR shall avoid the galvanic corrosion of equipment, antennas, panels, boxes, coaxial cables and fixing accessories. Galvanic insulation shall be implemented wherever contact between different metallic materials is needed.

6.6 Equipment and materials shall be supplied and installed with all threads, hinges, bolts, cover plugs, cable glands and flanges lubricated with anti-seize (loctite) or similar grease.

6.7 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 reserve holes.

6.8 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.

6.9 Detailed engineering of design shall be render feasible through strategic installation of components, so as to minimize the number of connections and thus optimize costs of materials and/or work to be done.

6.10 Equipment, cables, boxes, materials and accessories for installation in the industrial areas (outdoor or indoor) of unit shall be specified and assembled taking into account the adverse operating conditions on FPSO such as:

a. Atmosphere with high content of humidity, salts hydrocarbons and other corrosive factors;

b. Environment subject to the presence of explosive gases shall be in accordance with Hazardous area classification;

c. Exposure to weather conditions (sun and rain) and maritime atmosphere;

d. Air temperature: From -10ºC up to +50ºC;

e. Air Humidity: 95%.

6.11 CONTRACTOR shall ensure for wireless devices connected to WLAN System, at least, the thresholds values informed below. These values shall be confirmed on the site survey and the Calculation Report used in the detailed design.

a. WLAN frequency band standard: 2.4 GHz and 5.8 GHz;

b. Minimum rate transmission (throughput) of 24 Mbps;

c. Signal-to-noise Ratio Min (S/N): 25.0 dB

6.12 PETROBRAS will send to CONTRACTOR, during the detailed design, the following information:

a. Client IP address range;

b. APs IP address range;

c. DHCP scope and definitions;

d. VLANs ID;

e. SSID;

f. WLAN security definitions;

g. Management interface info;

h. NTP server IP address.

6.13 CONTRACTOR shall consider all equipment will be installed and utilized in Brazil territory ("Country Code" = Brazil).

6.14 The Indoor Access Points shall not have external antennas.

6.15 Following below the technical specifications of each appliances.

6.15.1. Wireless Controller

a. Manufacturer: CISCO System

b. Model: Cisco Catalyst 9800 Series Wireless Controller for up to 200 Access Points, or the newer model indicated by the manufacturer to replace it in case of EoL/EoS announcement;

c. License: 9800 Series Wireless Controller for up to 250 Cisco Access Points;

d. License: Base Software License;

e. License: 250 AP Adder License for the 9808 Controller (eDelivery);

f. Power Module: Cisco 9800 Series Wireless Controller Redundant Power Supply;

g. Cable: AIR Line Cord;

h. SFP Module: 1000BASE-SX SFP transceiver module.

6.15.2. Indoor Access Point - Accommodation:

a. Manufacturer: CISCO System licensed to be managed by controller

b. Model: Cisco catalyst 9130AX Access Points, or the newer model indicated by the manufacturer to replace it in case of EoL/EoS announcement;

c. Antenna: It shall have Internal Antenna - 2.4 GHz/5 GHz;

d. Pattern: IEEE 802.11 ax.

6.15.3. Outdoor Access Point – Hull Industrial Areas and Main deck

a. Manufacturer: CISCO System licensed to be managed by controller

b. Model: Cisco Catalyst 9124AX Series Outdoor Access Point, or the newer model indicated by the manufacturer to replace it in case of EoL/EoS announcement;

c. Antenna: External Dual-Band Omnidirectional Antennas or antenna: External Dual-Band Directional Antennas as per coverage required;

d. Minimum gain for omni: 4 dBi @2.4GHz and 7 dBi @5.0GHz;

e. Pattern: 802.11 ax.

6.15.4. Minimum requirements for enclosure to be used in industrial areas

a. Type of Protection: in accordance with requirements for installed environment;

b. EX Zone 1

c. Gas Group: IIA;

d. Ingress Protection: IP-66.

6.15.5. For reference, see some figures to illustrate the WLAN Access Point mounted in enclosure to install in Hull Industrial Areas or Externals Areas (Main Deck).

Figure 1: Examples of Access Points for external areas

7. SCOPE OF SUPPLY

7.1 CONTRACTOR shall be responsible to supply, install, configure, test and commissioning the WLAN System in PETROBRAS FPSO Unit, within the scope of the Contract and in accordance with this Technical Specification that shall be composed, at least, by:

a. 02 (two) WLAN Controllers;

b. The number of Indoor Access Point applied in accommodation area shall be defined though the calculation report issued by CONTRACTOR during the detailed design and approved by PETROBRAS;

c. The number of outdoor Access Point applied in Hull Industrial Areas, main deck, engine room and forecastle shall be defined though the calculation report issued by CONTRACTOR during the detailed design and approved by PETROBRAS;

d. The minimum number of Indoor Access Point and outdoor Access Point provided shall be the number foreseen in WLAN arrangement and online drawings issued.

e. Supports, accessories, junction boxes, installation materials, cables and others in accordance with manufacturers requirements.

7.2 In addition, CONTRACTOR shall supply all accessories and materials needed to correct installation of WLAN System.

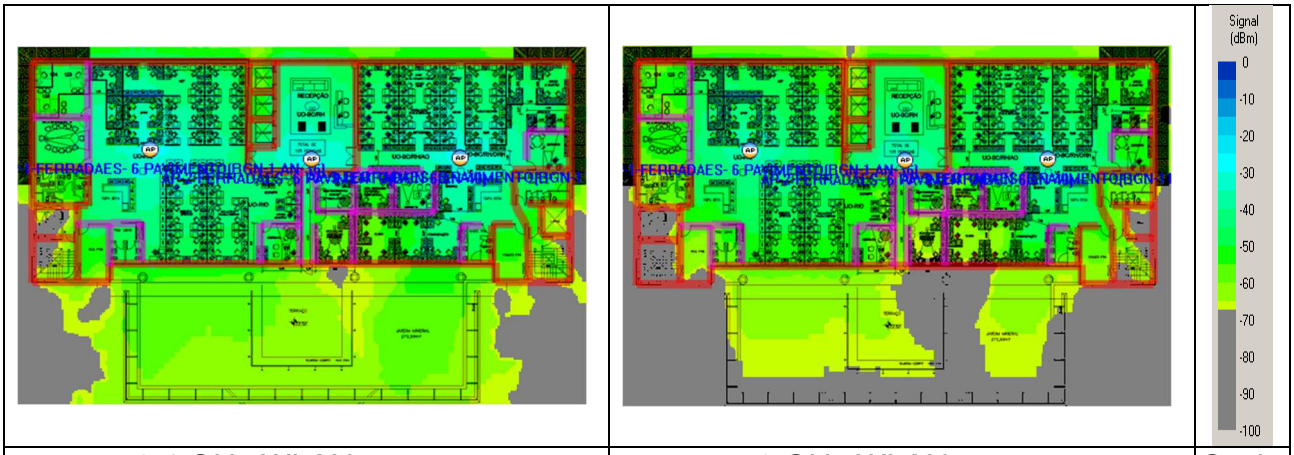
7.3 Every warranty, license and services purchased from CISCO manufacturer shall be transferred to Petrobras Smart Account (SA), which ID is tic.petrobras.com.br. From other vendors, whenever required, it shall be done and assessed with PETROBRAS.

8. DIMENSIONING CRITERIA

8.1 CONTRACTOR shall ensure WLAN signal covering in all Accommodation Module and Hull Industrial Areas, including Main Deck, Engine Room and Forecastle.

8.2 As radiating cables from UHF Active Repeater System operate in wide band frequency (up to 2.4 GHz), they shall be used to reinforce by passive RF propagation and guarantee better WLAN coverage inside closed rooms, cabins and offices, that have no Access Points installed inside.

8.3 CONTRACTOR shall use the Ekahau Site Survey Pro, version 9.0.3, or TamoGraph Site Survey Pro, version 6.0. (Build 241) or better as the Wifi Coverage Prediction Software to elaborate the WLAN Calculation Report coverage. Any other Coverage Prediction Software shall be approved by PETROBRAS.



2.4 GHz WLAN cover	5.0 GHz WLAN cover	Scale

Figure 2: Predictive Report

8.4 CONTRACTOR shall consider the following WLAN detailed design requirements for 2.4 GHz and 5 GHz:

a. Minimum AP signal strength required	- 55 dBm
b. Minimum AP PHY Data Rate required - Uplink	24.00 Mbps
c. Minimum AP PHY Data Rate required - Downlink	24.00 Mbps
d. Signal Noise Ratio required	25 dBm
e. Maximum Noise Level Desired	- 90 dBm
f. 40 MHz Channel Width	Allowed
g. 20 MHz Channel Width	Allowed
h. 80 MHz Channel Width	Allowed
i. 160 MHz Channel Width	Allowed

8.4.1. Just in case, for some small area, the signal strength is worst than -55 dBm (values above absolute value of 55), Petrobras can be consulted to assess it and approve it or not.

8.5 Following the example of a preliminary survey using the Ekahau Wifi Coverage Prediction Software to define the WLAN coverage in 2.4GHz and 5GHz and the number of Access Points.

8.5.1. Survey routes and Access Points example:

Figure 3: Access points placed by survey

Area-8 (962.9 m²)

Coverage Requirement: **Voice + Data**	Signal Strength Min	**-67.0 dBm**
	Signal-to-noise Ratio Min	**25.0 dB**
	Data rate Min	**24 Mbps**
	Number of Access Points Min	**2 at min. -75.0 dBm**
	Channel Overlap Max	**2 at min. -85.0 dBm**
	Round Trip Time (RTT) Max	**200ms**
	Packet Loss Max	**2.0 %**
Capacity Requirement	**45** Generic Laptop [Background Sync] **45** Generic Smartphone [Background Sync] **Total: 90 (45 Mbits/s)**	

Area-9 (446.6 m²)

Coverage Requirement: **Voice + Data**	Signal Strength Min	**-67.0 dBm**
	Signal-to-noise Ratio Min	**25.0 dB**
	Data rate Min	**24 Mbps**
	Number of Access Points Min	**2 at min. -75.0 dBm**
	Channel Overlap Max	**2 at min. -85.0 dBm**
	Round Trip Time (RTT) Max	**200ms**
	Packet Loss Max	**2.0 %**
Capacity Requirement	**5** Generic Laptop [Background Sync] **15** Generic Smartphone [Background Sync] **Total: 20 (10 Mbits/s)**	

Figure 4: Survey calculation example

8.5.2. Access Points example

Figure 5: Access points placed by survey

8.5.3. Simulated Access Points example

AP #	Access Point			
51	Cisco AP1550 (4)			
	802.11n	1	250 mW	Cisco AP1550 with AIR-ANT2547V-N 2.4GHz 4dBi
	802.11n	36	250 mW	Cisco AP1550 with AIR-ANT2547V-N 5GHz 7dBi
52	Cisco AP1550 (5)			
	802.11n	1	250 mW	Cisco AP1550 with AIR-ANT2547V-N 2.4GHz 4dBi
	802.11n	36	250 mW	Cisco AP1550 with AIR-ANT2547V-N 5GHz 7dBi
53	Cisco AP2802i 2.4GHz + 5GHz (28)			
	802.11n	1	250 mW	Cisco AP2802i 2.4GHz Macro
	802.11ac	36	250 mW	Cisco AP2802i 5GHz Macro
54	Cisco AP2802i 2.4GHz + 5GHz (29)			
	802.11n	1	250 mW	Cisco AP2802i 2.4GHz Macro
	802.11ac	36	250 mW	Cisco AP2802i 5GHz Macro
55	Cisco AP2802i 2.4GHz + 5GHz (30)			
	802.11n	1	250 mW	Cisco AP2802i 2.4GHz Macro
	802.11ac	36	250 mW	Cisco AP2802i 5GHz Macro
56	Cisco AP2802i 2.4GHz + 5GHz (31)			
	802.11n	1	250 mW	Cisco AP2802i 2.4GHz Macro
	802.11ac	36	250 mW	Cisco AP2802i 5GHz Macro
57	Cisco AP2802i 2.4GHz + 5GHz (32)			
	802.11n	1	250 mW	Cisco AP2802i 2.4GHz Macro
	802.11ac	36	250 mW	Cisco AP2802i 5GHz Macro
58	Cisco AP2802i 2.4GHz + 5GHz (33)			
	802.11n	1	250 mW	Cisco AP2802i 2.4GHz Macro
	802.11ac	36	250 mW	Cisco AP2802i 5GHz Macro
59	Cisco AP2802i 2.4GHz + 5GHz (34)			
	802.11n	1	250 mW	Cisco AP2802i 2.4GHz Macro
	802.11ac	36	250 mW	Cisco AP2802i 5GHz Macro
60	Cisco AP2802i 2.4GHz + 5GHz (35)			
	802.11n	1	250 mW	Cisco AP2802i 2.4GHz Macro
	802.11ac	36	250 mW	Cisco AP2802i 5GHz Macro

Table 1: Simulated Access Points example

8.5.4. Signal Strength example on 2.4 GHz band

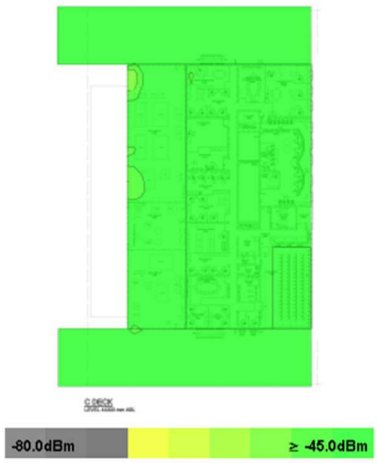


Figure 6: signal strength example on 2.4 GHz band from survey

8.5.5. Signal Strength example on 5 GHz band

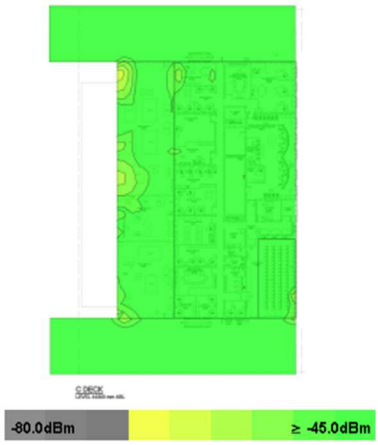


Figure 7: signal strength example on 5 GHz band from survey

9. COMMISSIONING

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

9.2 A technician with professional level certified by the manufacturer of the WLAN equipment provided shall perform the Installation, configuration and Commissioning activities.

9.3 The following verifications shall be 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. Configure an user to log into the device remotely: This operation enables a user to remotely log in to the device in the central equipment room to deploy services.

f. Configure a SSID for tests purposes and measurements of power and throughput.

9.4 CONTRACTOR shall follow the verifications and commissioning activities in accordance with Contract documents and this Technical Specification.

9.5 CONTRACTOR shall use the WLAN Site Survey software and accessories to prove the coverage attendance.

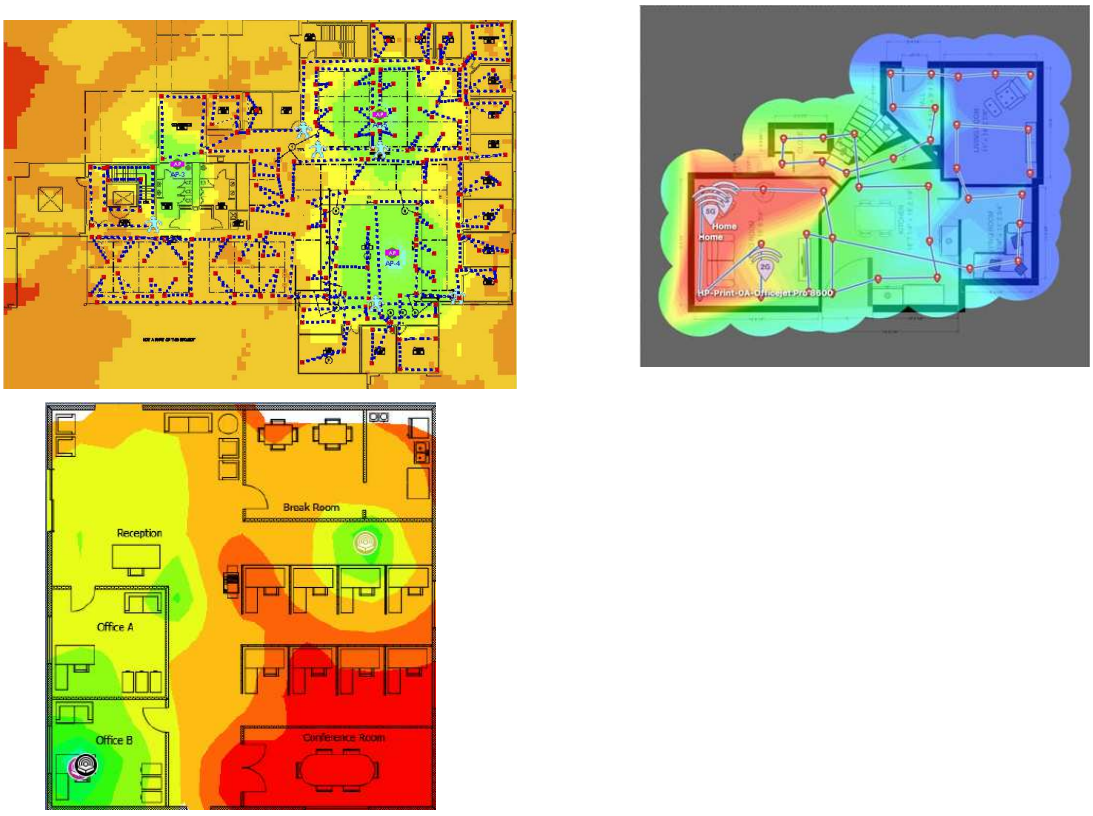


Figure 8: Site Survey Software

9.6 CONTRACTOR shall submit the Site Survey report for PETROBRAS analyze and approval.

9.7 As a matter of general acceptance, it shall be considered: equipment delivered; powered; configured with Petrobras corporate parameters; remotely accessed; interconnected among them; configured on Petrobras management network; service coverage attended all around the vessel, tested with mobile devices in the vessel.

10. CONTRACTOR TECNICHAL TEAM REQUIRMENTS

10.1 CONTRACTOR shall dispose professionals and teams with the profiles listed below, to meet the quality of the technical service and the deadlines agreed with PETROBRAS.

10.2 Technical team: Professional with WLAN intermediate manufacturer certification with minimum experience of two years in WLAN projects. Responsible for coordinating the teams and validating the project, the assembly and the configurations of the equipment.

11. ASSEMBLY AND CONFIGURATION SYSTEM

11.1 The assembly and configuration consisting in execution of all the necessary activities for put the WLAN network in operation following all requirement of this technical specification.

11.2 The assembly and configuration phase shall be started after analysis, comments and approval by PETROBRAS of all the documentation that composes the detailed design and configuration plan issued by CONTRACTOR.

11.3 PETROBRAS considers the assembly and configuration activity subdivided into the following stages:

11.3.1. Mechanical assembly: placement and fixation of the equipment, materials and cables that compose the system in the respective places and under the conditions provided by the detailed design.

11.3.2. Interconnection: all electrical, signal and ground connections between the equipment and materials that compose the system and the existing associated systems, including interconnections in the electrical panels.

11.3.3. Energization: activation of the electrical supply of the equipment that compose the system.

11.3.4. Configuration: execution of all programming tasks, by software and hardware (if necessary) to initialization and customization of each equipment within the specified technical characteristics, comprising:

a. Initial and basic configuration for access permission and physical interconnections.

b. Advanced configuration, including all parameters required by WLAN network.

c. Local tests: execution of all necessary tasks for the placement and verification of each equipment, which composes the WLAN.