USER MANUAL

PSD-LI27

PSS-LI33 / PSS-LI37

NOV. 27, 2018

GS Instech Co., Ltd.

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[CHANGE RECORD]

DATE	NAMES	DESCRIPTIONS	VERSION	REMARK
NOV 17, 2018	KO. SUNGMOO	Original Draft	1.0	
DEC 27, 2018	KO. SUNGMOO	Add Label Information	1.1	

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1. General

1.1. Purpose

This document introduces features, specifications, structures and operation guideline for the PSD-LI27/PSD-LI33/LI37.

1.2. Copyright

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1.3. FCC Warning Statements

FCC Warning Statement for system is follows. Must attach the label under manufacturing.

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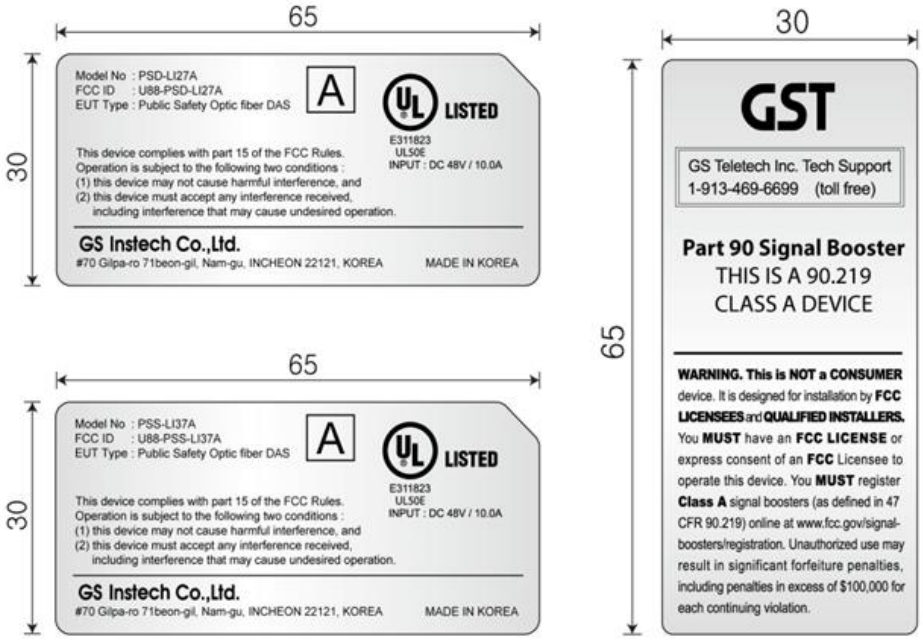

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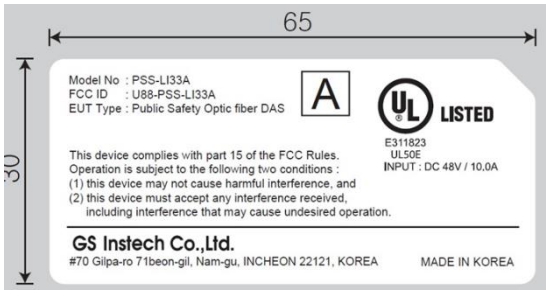

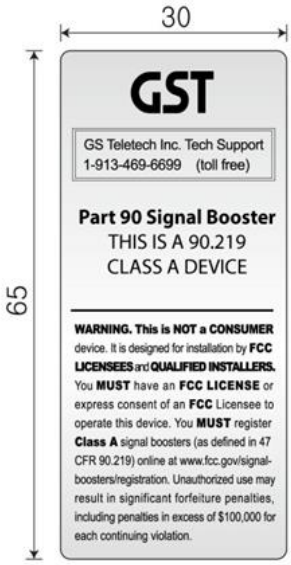

Model ID and Manufacturer Info Label and Hot Surface Warning Label

FCC 90.219 Statement Label and Hot Surface Warning Label

Figure 1. FCC/ UL Certification Statement [Class A]

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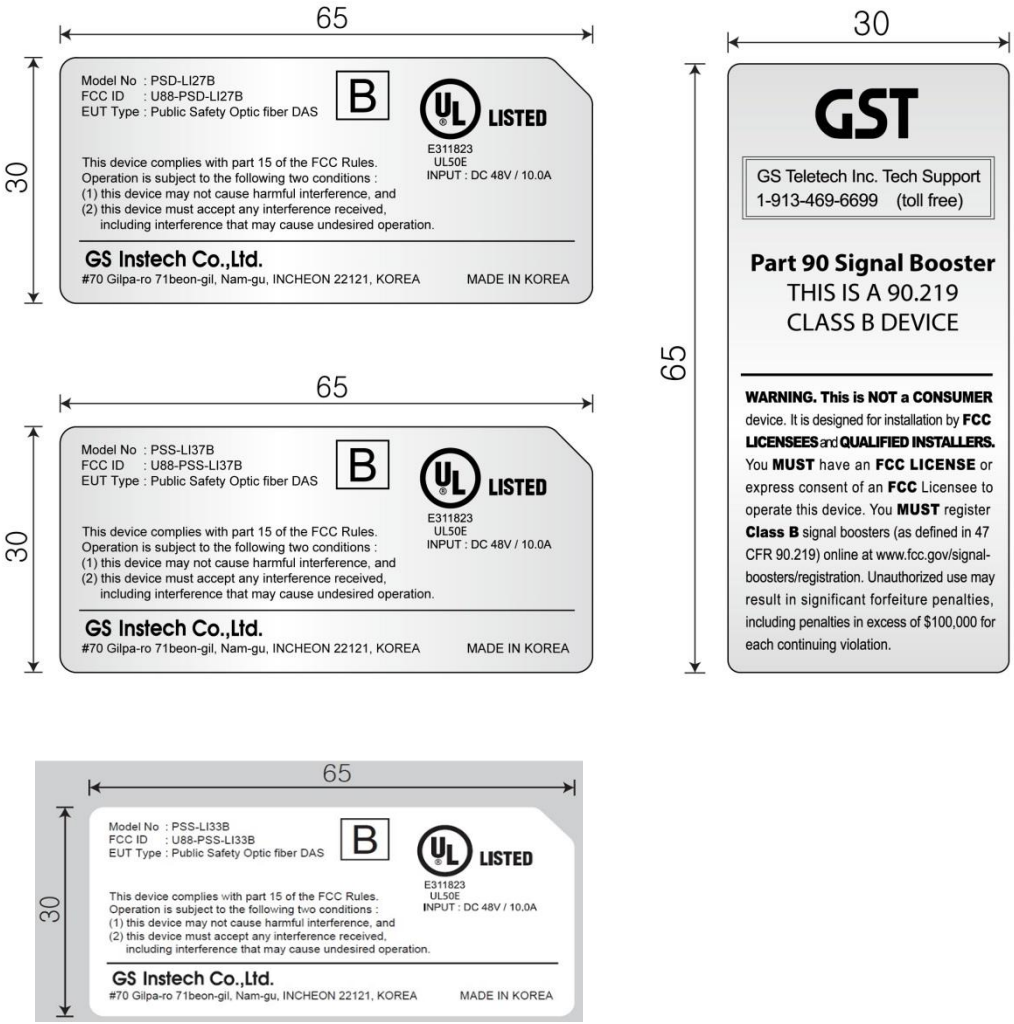

Figure 2. FCC/ UL Certification Statement [Class B]

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

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1.3.1 FCC Part 15.105

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

1.3.2 FCC Caution

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. Use of unauthorized antennas, cables, and/or coupling devices not conforming with ERP/EIRP and/or indoor-only restrictions is prohibited.

1.3.3 Radiation Exposure Statement

The product complies with the FCC RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user's body or set the device to lower output power if such a function is available.

1.3.4 FCC Warning Labels

1) FCC Part 15.19

The FCC Certification label has attached right side of the device. The FCC Certification label contained FCC 15.19 warning statement, Device type (A or B), FCC, ISED and UL ID

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

2) FCC Part 90.219

Booster Warming Label is attached left side of the device. This label has contains FCC 90.219, IC warning statements and contact phone number for a trouble shooting.

3) FCC Part 90 Class B

Prior to equipment use the service must be registered with the FCC.

This can be done through the FCC's website at https://signalboosters.fcc.gov/signal-boosters

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1.4. Antenna installation

Antennas must be installed in accordance with FCC 90.635.
The height of the antenna above average terrain (HAAT) must not exceed limit in the following table.

Type	Model name(s)	HAAT (m)	Antenna again
SU	PSS-DAS-LI33	444.65	3dBi
	PSS-DAS-LI37	281.43	3dBi
DU	PSD-DAS-LI27	212.17	15dBi

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2. Introduction

2.1. System Overview

PS-DAS is designed to improve coverage and capacity of Public Safety networks. Receiving signal via antenna, it provides coverage Building in RF shadow.

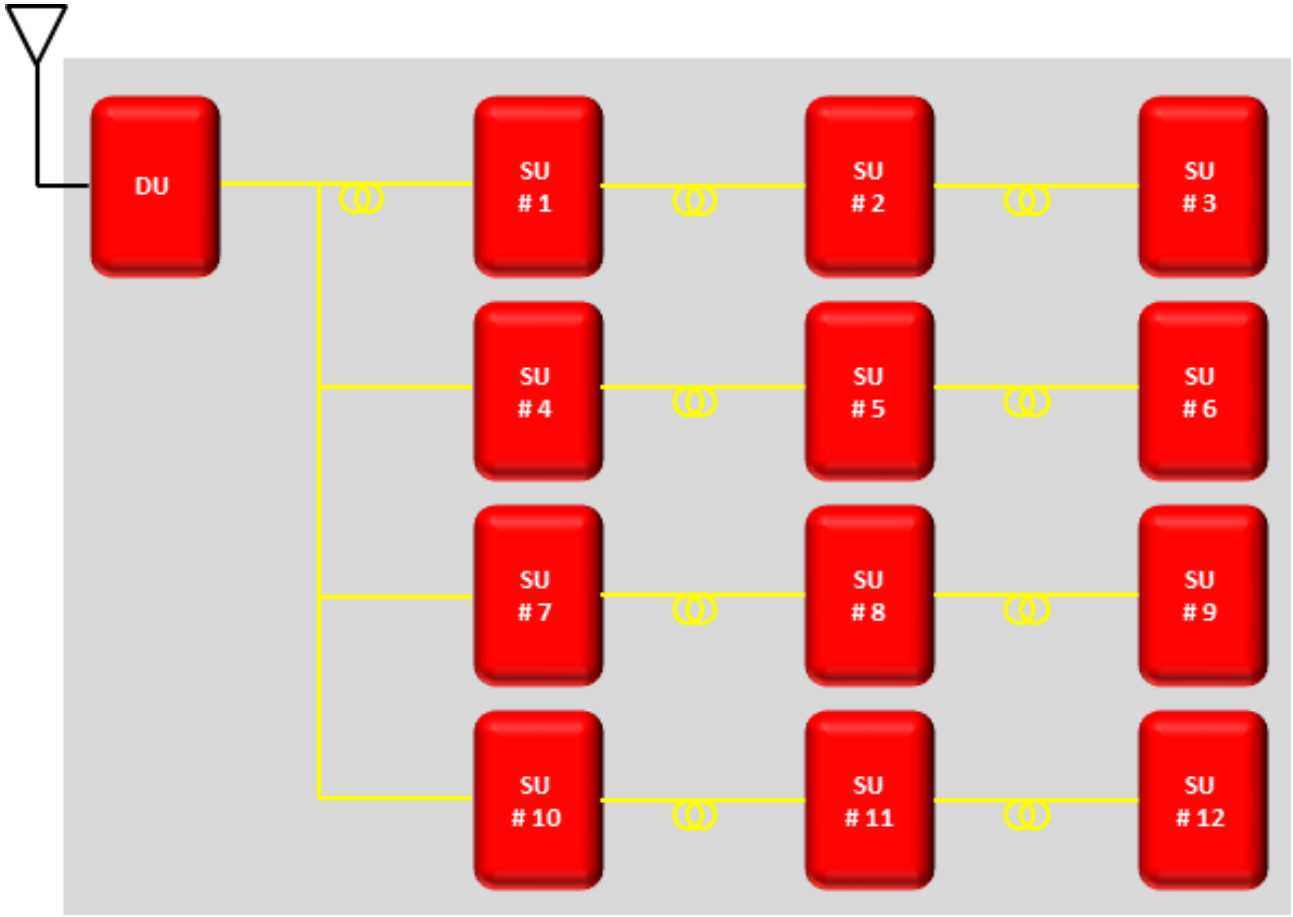

Figure 3. PS-DAS Application Configurations

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2.2. Main Features

- All-in One Donor Unit
  - Compose several units such as Optic Transceiver, NMS, PSU, BDA, Cavity Filter etc.
  - Convenient to install in Middle Size Building with proper cost of one set
- Support the Antenna Feeding Solution
  - Receiving signal via Antenna
- Choose the Filtering Methods accord to the operating condition
  - For Neutral Host installations, able to support the Full Band Filtering
- Improving Service Quality under Multi-Carriers Area
  - Up to 6 Non-Contiguous block and gain per block based on Downlink Input Topologies
  - Dealing with Near-far & Uplink Noise Floor Rise
- Topologies
  - 1:4 Branches between DU and SU.
  - 3 Daisy Chain is possible by Internal Optic Daisy Chain Circuit.
  - One DU can accommodate a total of 12 SU.
- Supporting Technologies
  - LTE, P25
- Supporting Frequencies
  - Public Safety Dual band (700M, 800M)
- Supporting Output Power
  - Composite 5W with PSD-DAS-LI33 (2W per Band)
  - Composite 2W with PSD-DAS-LI37 (5W per Band)
- Functions
  - Support AGC, ALC, , ASD
- FCC Part 22, 24,27,90 & Part 15B class A / Class B

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3. System Design for PSD-LI27 (Donor Unit)

3.1. Exterior View

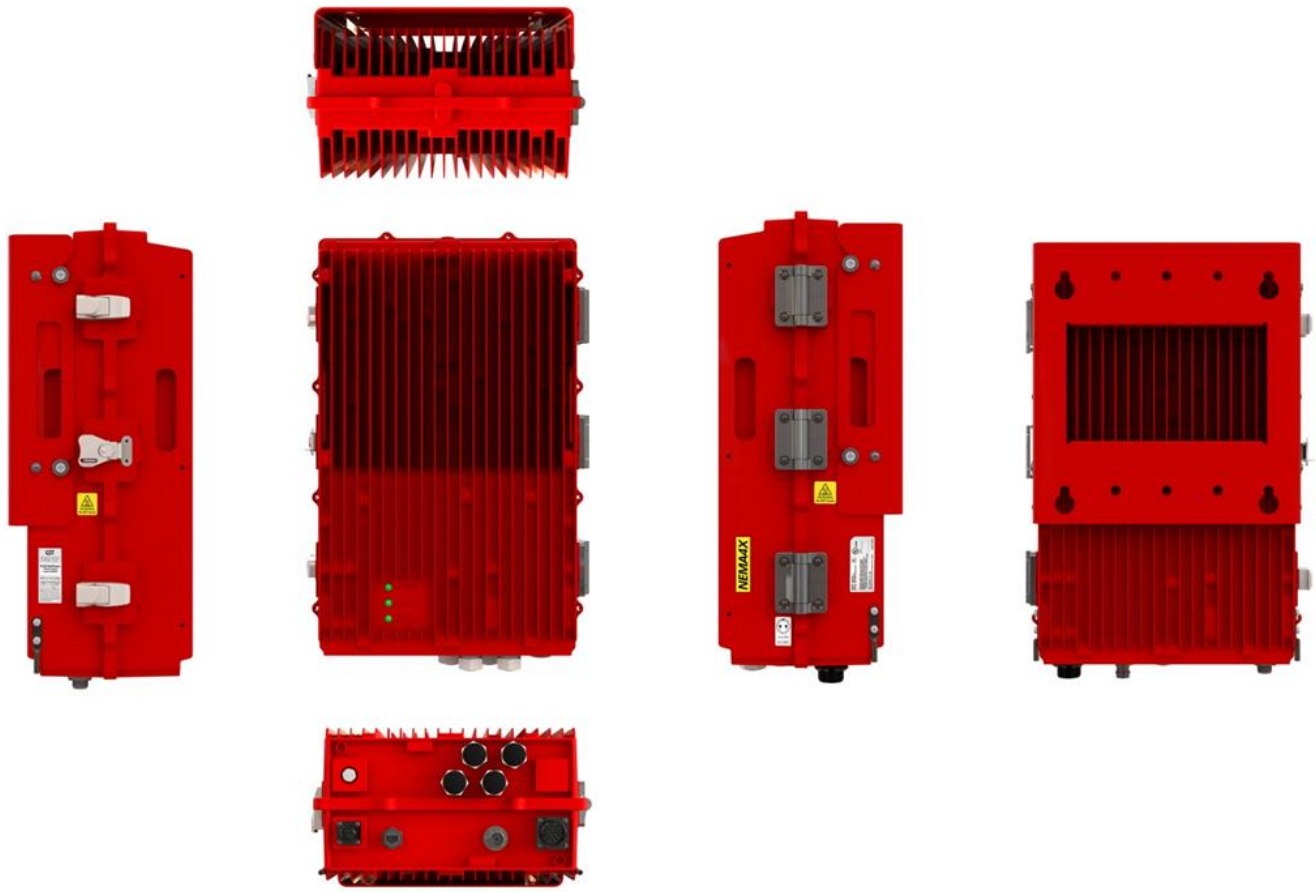

Figure 4. PSD-LI27 Exterior View

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3.2. Interior View

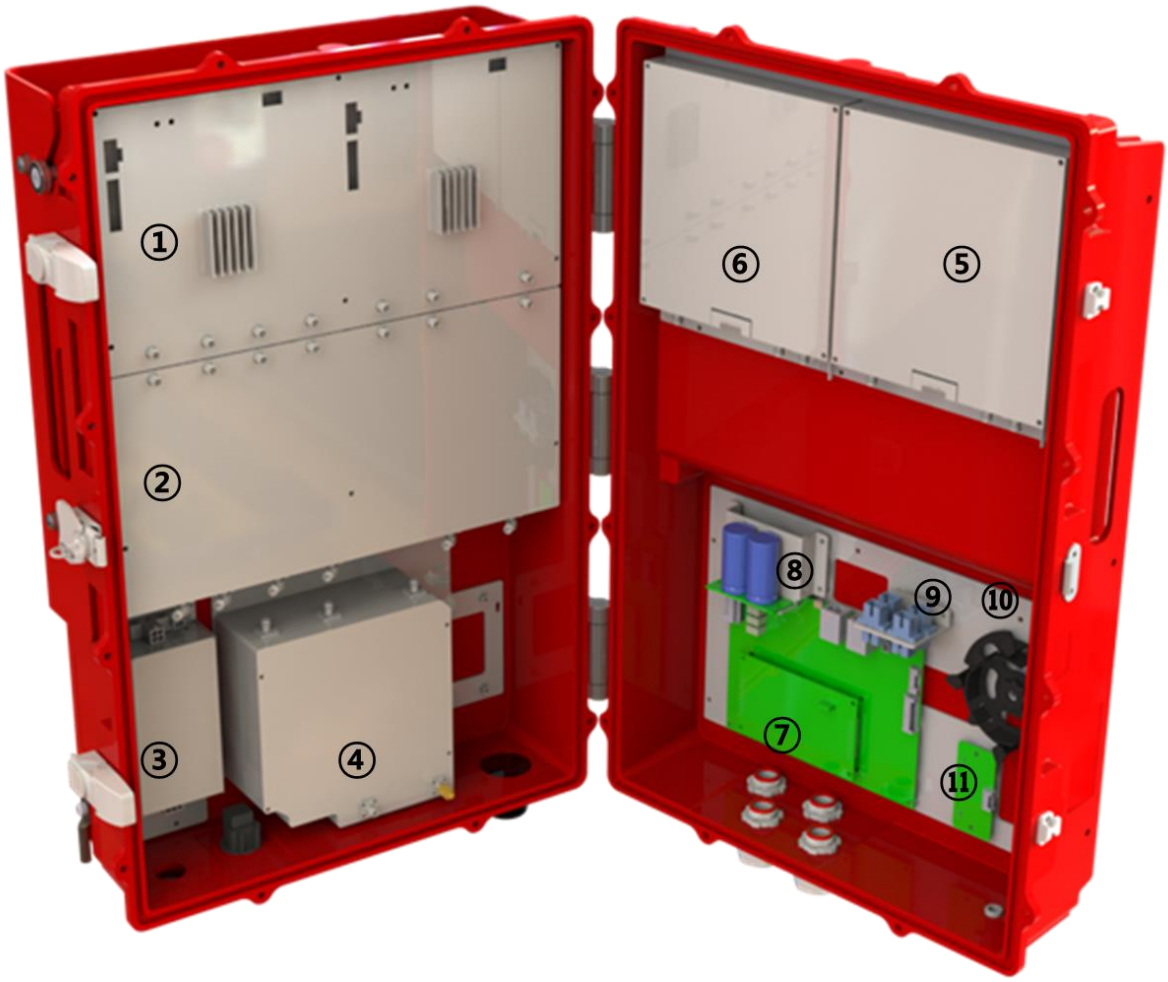

Figure 5. PSD-LI27 Interior View

No	Name	Remark
1	DFU	700/800 Digital Filter Unit
2	RFU	700/800 RF Unit
3	PSU	In : DC +48V / Out : DC +28V
4	Cavity Filter	Duplexer for 700/800M
5	DOU1	Donor Optic Unit (2Port)

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6	DOU2	Donor Optic Unit (2Port)
7	I/O B'rd	Control and communication between each internal module, connection with upper level management system
8	External Condenser	Using for Dying GASP
9	Optic Connector	Link Between the DOU and Optic Fiber Cable
10	Optic Fiber Reel	After connecting the cable, spool the long extra cable
11	LED B'rd	Displays the operating status and alarm status of the system

Table 1. PSD-LI27 Unit Configuration

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3.3. External Interface

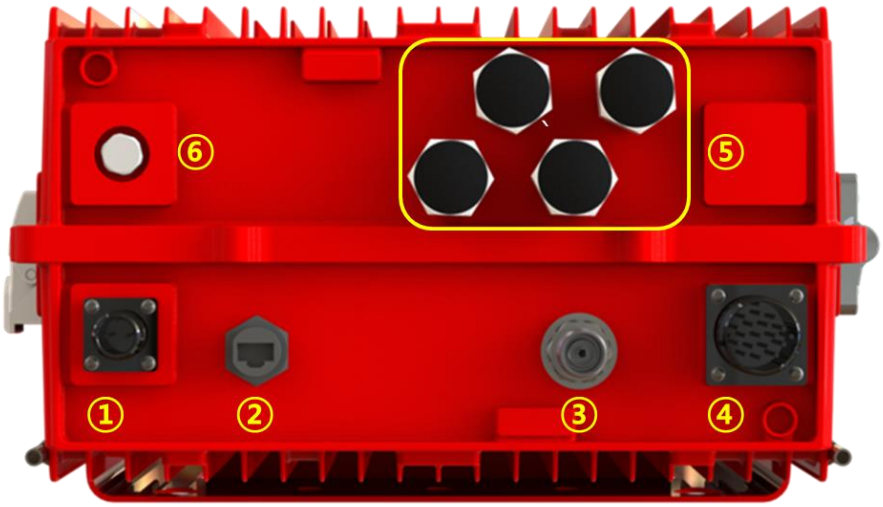

Figure 6. PSD-LI27 External Interface

No	NAMES	DESCRIPTION	SPECIFICATION
1	DC IN	DC Input Outlet	MS3102A 14S-9P
2	LAN	Communicate a data between DU and Server	RJ-45 Waterproof
3	ANT	Feeding Downlink Signal / Transmit Uplink Output	4.3-10 Mini Din Connector
4	External Alarm	Send the alarm status to the External alarm Panel	MS3102A 22-14P
5	Optic	Link Between DU and SU	Metal Cable Gland
6	Vent-Core	Maintain Humidity & Temp Inside	IP66

Table 2. PSD-LI27 External Interface Description

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4. System Design for PSS-LI33 (Service Unit)

4.1. Exterior View

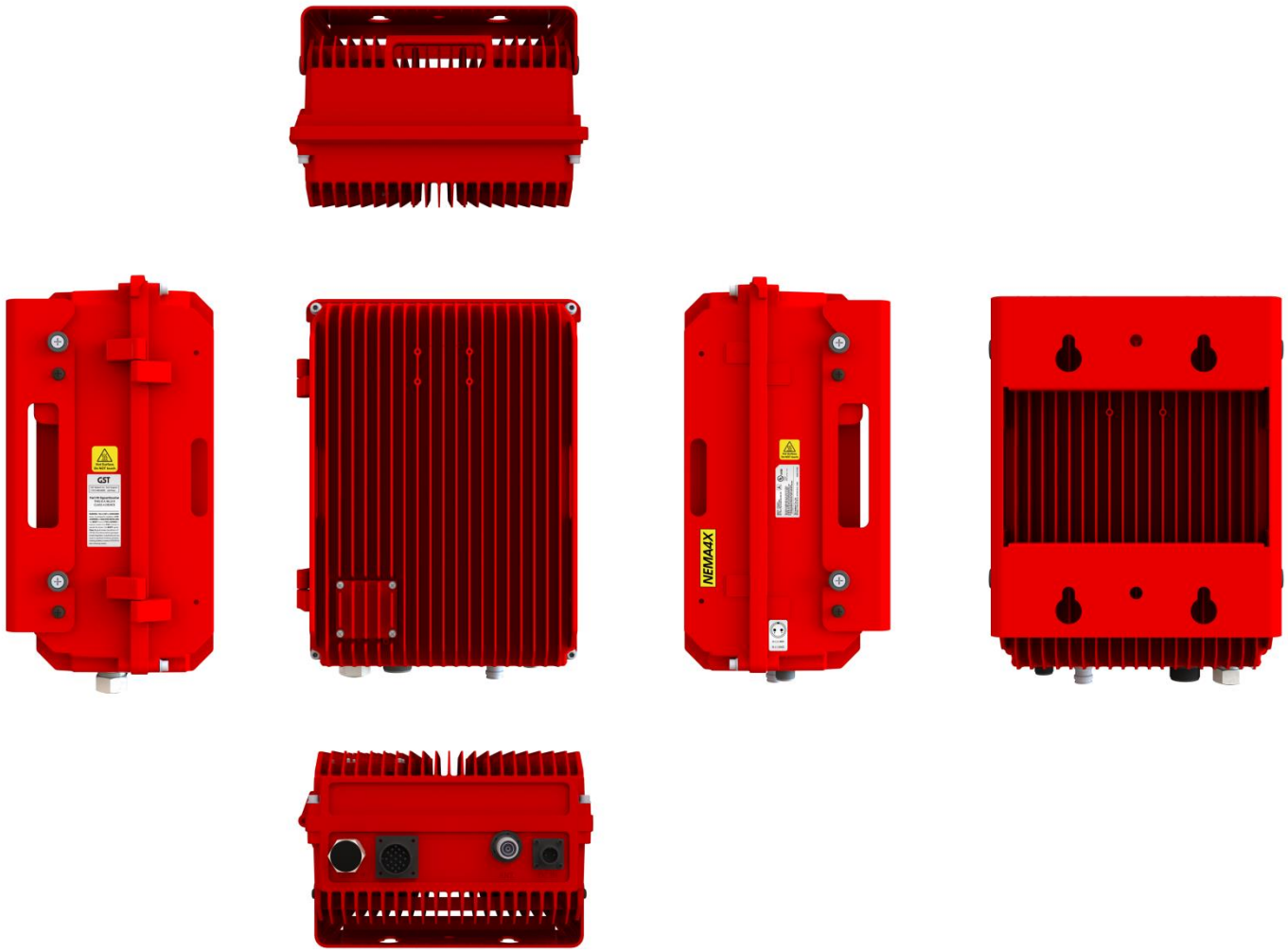

Figure 7. PSS-LI33 Exterior View

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4.2. Interior View

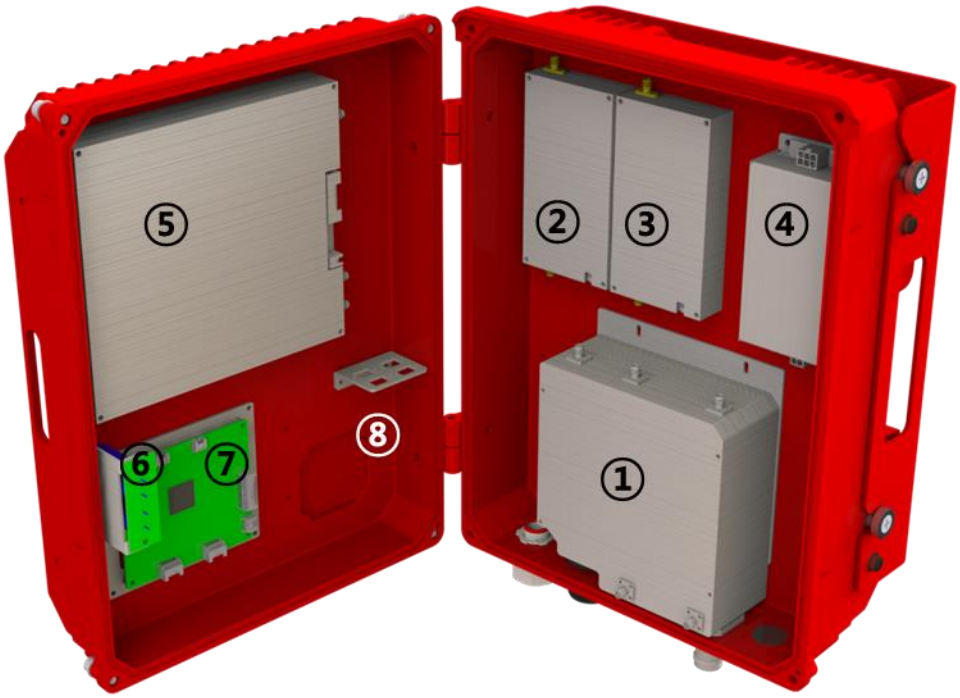

Figure 8. PSS-LI33 Interior View

No	Name	Remark
1	Cavity Filter	Duplexer for 700M & 800M
2	DL 800 HPA	1900MHz RF Power Amp Unit
3	DL 700 HPA	700MHz RF Power Amp Unit
4	PSU	DC Input Voltage: 48VDC / DC Output Voltage: +28V
5	SOU	Service Optic Unit
6	External Condenser	Using for Dying GASP
7	NMS Board	Apply for GUI/ Communicate with Donor Unit
8	Optic Connector	4Way RF Channel Distribute Unit

Table 3. PSS- LI33 Unit Configuration

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4.3. External Interface

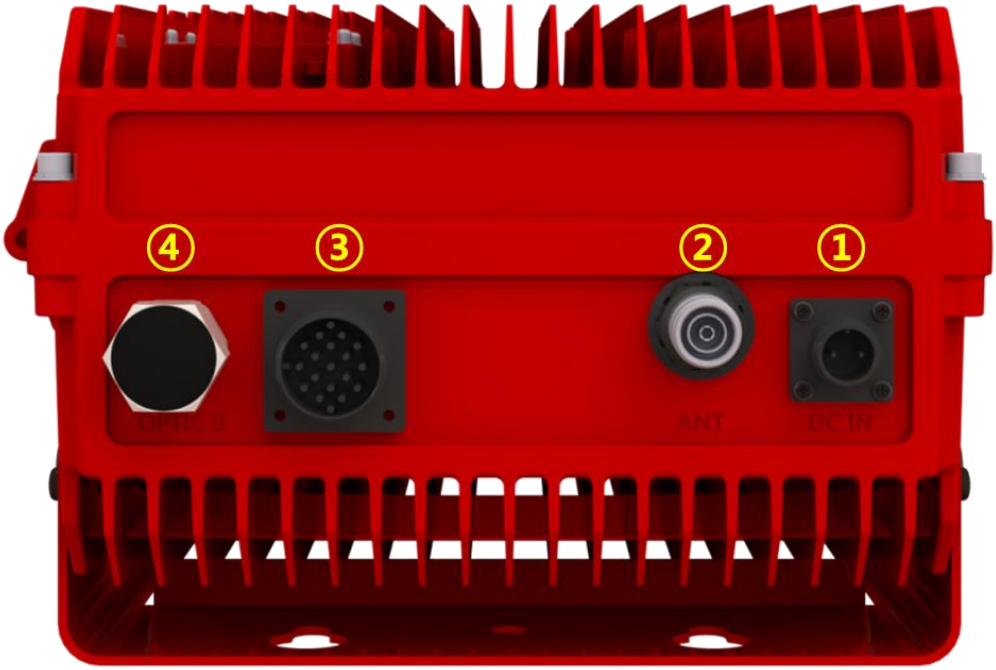

Figure 9.PSS-LI33 External Interface

No	NAMES	DESCRIPTION	SPECIFICATION
1	DC IN	DC Input Outlet	MS3102A 14S-9P
2	ANT	Feeding Uplink Signal / Transmit Downlink Output	4.3-10 Din Connector
3	External Alarm	External Alarm Panel connect	MS3102A 22-14P
4	OPTIC 0	Insert the optic cable to Donor Unit	Metal Cable Gland

Table 4. PSS-LI37 External Interface Description

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5. System Design for PSS-LI37 (Service Unit)

5.1. Exterior View

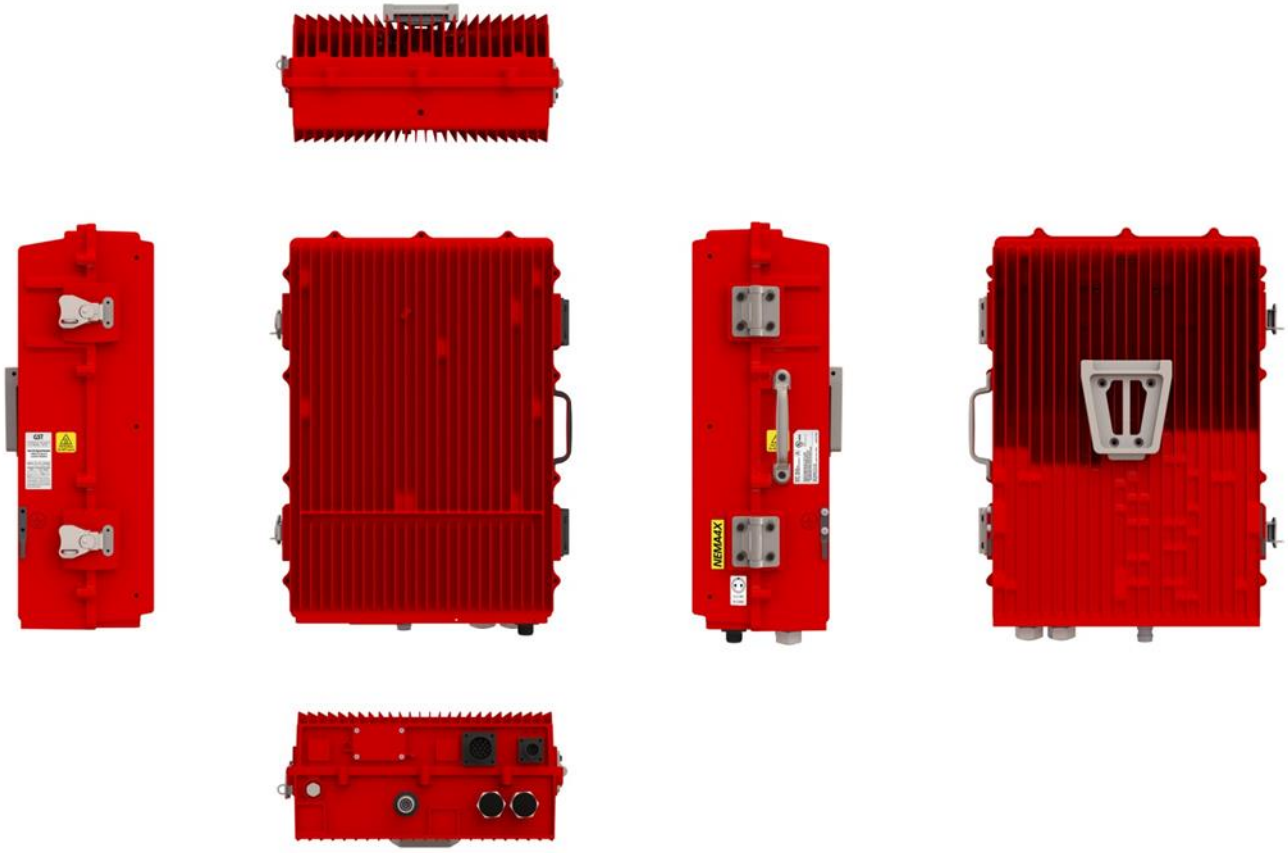

Figure 10. PSS-LI37 Exterior View

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5.2. Interior View

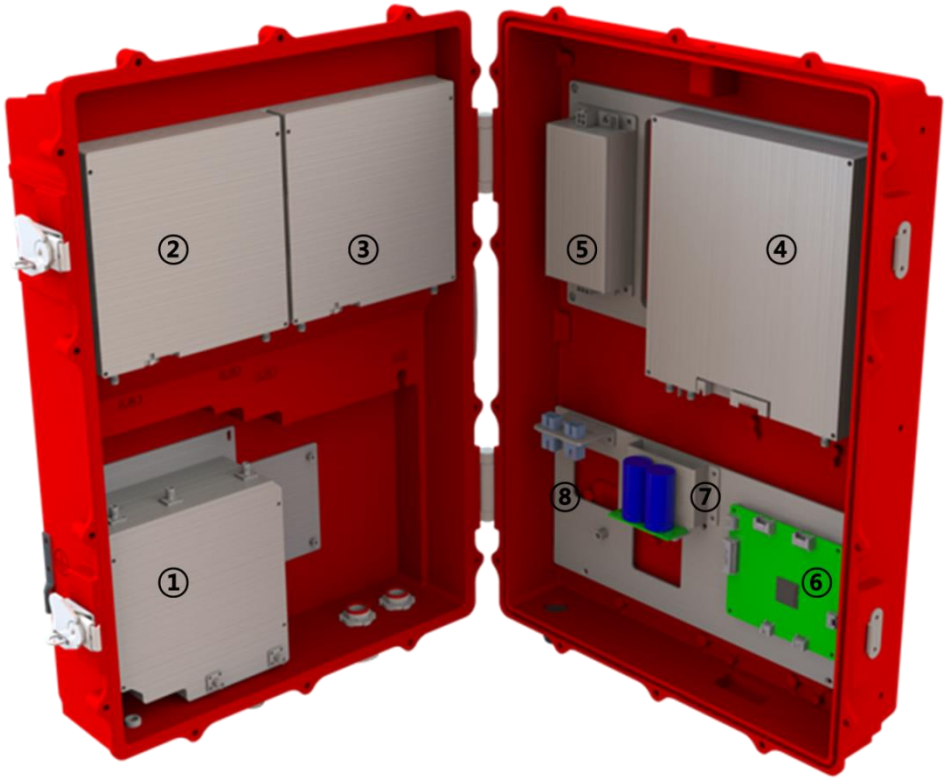

Figure 11. PSS-LI37 Interior View

No	Name	Remark
1	Cavity Filter	Duplexer for 700M & 800M
2	DL 800 HPA	1900MHz RF Power Amp Unit
3	DL 700 HPA	700MHz RF Power Amp Unit
4	SOU	Service Optic Unit
5	PSU	DC Input Voltage: 48VDC / DC Output Voltage: +28V
6	NMS Board	Apply for GUI/ Communicate with Donor Unit
7	External Condenser	Using for Dying GASP
8	Optic Connector	4Way RF Channel Distribute Unit

Table 5. PSS- LI37 Unit Configuration

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5.3. External Interface

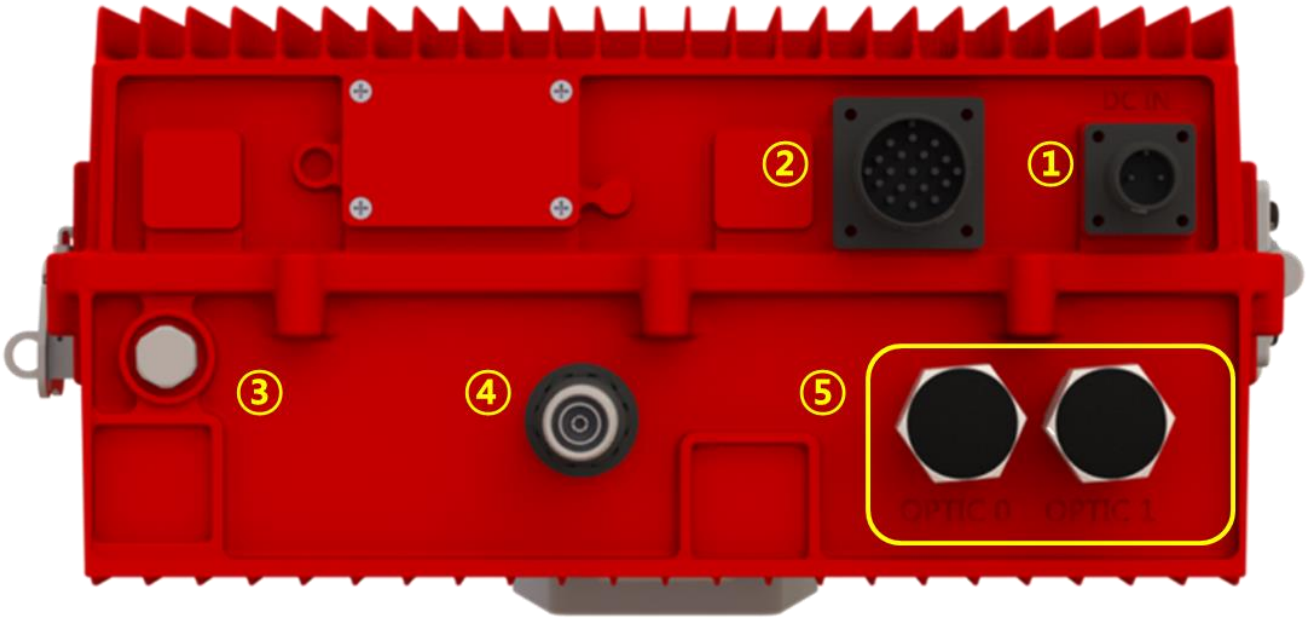

Figure 12. PSS-LI37 External Interface

No	NAMES	DESCRIPTION	SPECIFICATION
1	DC IN	DC Input Outlet	MS3102A 14S-9P
2	External Alarm	External Alarm Panel connect	MS3102A 22-14P
3	Vent-Core	Maintain Humidity & Temp Inside	IP66
4	ANT	Feeding Uplink Signal / Transmit Downlink Output	4.3-10 Din Connector
5	OPTIC 0 / 1	Insert the optic cable to Donor Unit	Metal Cable Gland

Table 6. PSS-LI37 External Interface Description

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6. System Specification

6.1. RF Performance

Parameter		Down Link	Up Link	Remark
Frequency Range		758MHz~768MHz	788MHz~798MHz	LTE
		769MHz~775MHz	799MHz~805MHz	P25
		851MHz~861MHz	806MHz~816MHz	P25
Input Range		-62dBm ~ -17dBm/ Total	-62dBm	Per Band
Output Power		+33dBm with PSS-LI33	+27dBm(0.5W)	2W
		+37dBm with PSS-LI37	With PSD-LI27	5W
Gain	Range	50dB ~ 95dB	44dB ~ 89dB	PSS-LI33
		54dB ~ 99dB		PSS-LI37
	Adjust Step	1dB	1dB	
	Accuracy	±1dB	±1dB	
Channel Capacity		【P25】6.25 / 12.5 / 25 / 50 / 75 KHz		Class A
		【LTE】5M, 10M		Class B
		【P25】100 / 125 / 150 / 175 / 200 / 225 / 250 KHz		
Ripple		3dB p-p		
Roll off		> 50dBc @ Channel OBW ±1MHz		
EVM		< 8% for 67QAM	< 5% for 16QAM	For LTE
Frequency Error		< 0.05ppm		
System Delay		< 220us		Exclude Fiber Optic Delay
Noise Figure		Less than 6dB @ Min & Max Gain		Only UL
VSWR		< 1.5 : 1		
OB Unwanted Emission		<-5.5dBm @50KHz ≤ Δf < 5.05MHz (RBW: 100KHz)		For LTE
		<-12.5dBm @5.05MHz ≤ Δf < 10.05MHz (RBW: 100KHz)		
		<-13dBm @10.5MHz ≤ Δf < 15MHz (RBW: 1MHz)		
ACLR		> 45dBc @ ±5MHz, ±10MHz, ±20MHz, ±40MHz		For LTE

Table 7. PS-DAS RF Performance Description

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6.2. Frequency Information

6.2.1. Frequency Information

No	NAMES	DESCRIPTION	SPECIFICATION
DL	700 (PSBB)	758MHz ~ 768MHz	LTE
	700 (PSNB)	769MHz ~ 775MHz	P25
	800 (PSNB)	851MHz ~ 861MHz	P25
UL	700 (PSBB)	788MHz ~ 798MHz	LTE
	700 (PSNB)	799MHz ~ 805MHz	P25
	800 (PSNB)	806MHz ~ 816MHz	P25

Table 8. PS-DAS Frequency Allocation

6.2.2. Block Diagram

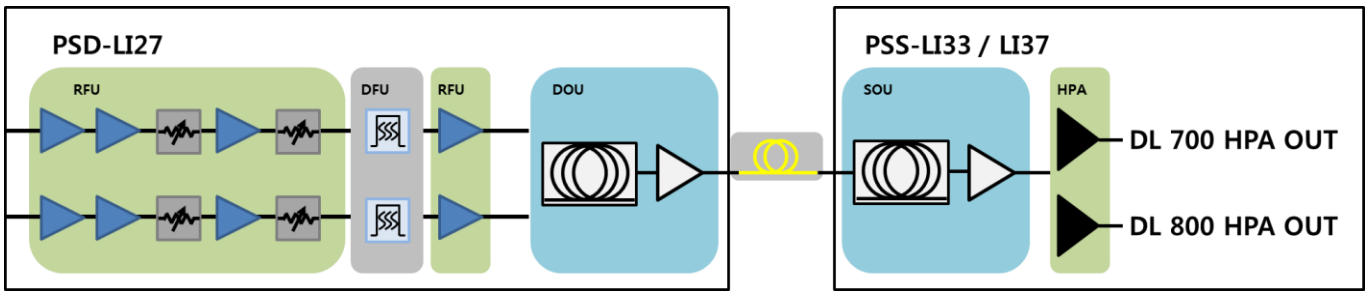

Figure 13. System Block Diagram

[MHz]

Service	Donor Antenna		RFU		DFM		HPA		Remarks
	Start	Stop	Start	Stop	Start	Stop	Start	Stop	
DL 700	758	775	758	775	758	775	758	775	
DL 800	851	861	851	861	851	861	851	861	
UL	788	816	788	816	788	816	788	816	

Table 9. PS-DAS Module Frequency Information

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6.2.3. Service Plan

1) The LTE network integrates Upper D band and FirstNet to have max. 10MHz Service BW.
2) The P25 Network has a Guard Band of 768-769MHz and 775-776MHz.

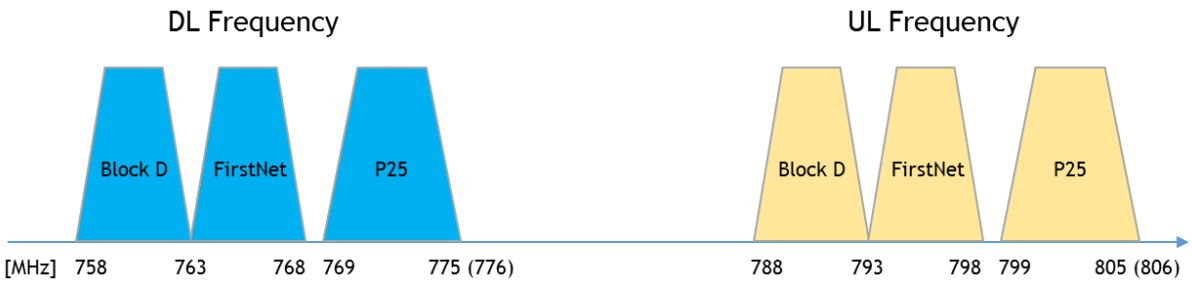

Figure 14. 700MHz Band Allocation

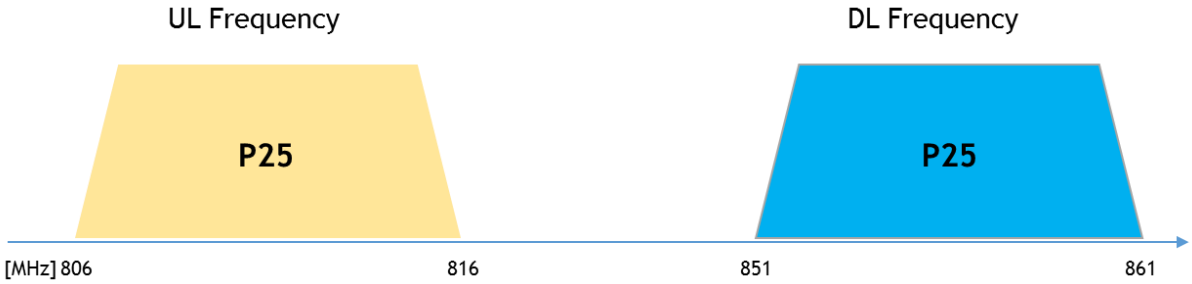

Figure 15. 800MHz Band Allocation

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6.3. Configuration & Mechanical Specification

Parameter		Specification	Remark
Donor/ Service Antenna Filter		DUPLEXER+BAND COMBINER	One port In/Output
Power Supply		DC Input Voltage: 48VDC	
Operation Temperature		-40°C~+60°C (5~95%RH)	
Storage Temperature		-40°C~+80°C (5~95%RH)	
Connectors	Antenna	4.3-10 Mini DIN Female	
	Power	MS-3106A 14S-9P	
	Ext. Alarm	MS3102A 22-14P	
	Optic	SC/APC	
Cable		1/2" Plenum-Rated Air-Dielectric Coaxial Cable	
Size	PSD-LI27	13.8 x 21.7 x 7.9	Inches
	PSS-LI33	11.2 x 15.2 x 6.9	Inches
	PSS-LI37	13.2 x 18.9 x 6.4	Inches
Weigh	PSD-LI27	56.2	Lbs.
	PSS-LI33	31.5	Lbs.
	PSS-LI37	40.3	Lbs.
Power Consumption	PSD-LI27	106	W
	PSS-LI33	92	W
	PSS-LI37	140	W
Environment		IP66	
MTBF		100,000 hours or higher	
Grounding		nonferrous metal and anchoring point on bottom	For RF and power cabling
Mount Application		Wall Mount	

Table 10. PS-DAS Configuration & Mechanical Specification

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6.4. External Alarm Connect

Alarm No.	Alarm Name	Pin No.	Relay Name	Cable Color	Remarks
Alarm1	User Defined	1	NC1	Black	
		2	COM1	Brown	
		3	NO1	Red	
Alarm2	User Defined	4	NC2	Orange	
		5	COM2	Yellow	
		6	NO2	Green	
Alarm3	User Defined	7	NC3	Blue	
		8	COM3	Violet	
		9	NO3	Gray	
Alarm4	User Defined	10	NC4	White	
		11	COM4	Black & White Dotted line	
		12	NO4	Brown & Black Dotted line	
External Alarm Input. #1	User Defined	13	NC5	Red & Black Dotted line	
		14	COM5	Orange & Black Dotted line	
		15	NO5	Yellow & Black Dotted line	
External Alarm Input. #2	User Defined	16	NC6	Green & Black Dotted line	
		17	COM6	Blue& Black Dotted line	
		18	NO6	Violet & Black Dotted line	

- If system alarm occurs, Alarm information transfer to the alarm panel that is hardwired through the EXT ALARM port.
- The system supports Dry Contact Form C.
- The System can send a total of 4 alarms to the Alarm Panel according to user defined.
- Also, according to the User environment, the system can input two external alarms and transmit them to the alarm panel.

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7. System Block Configuration

7.1. Block Diagram

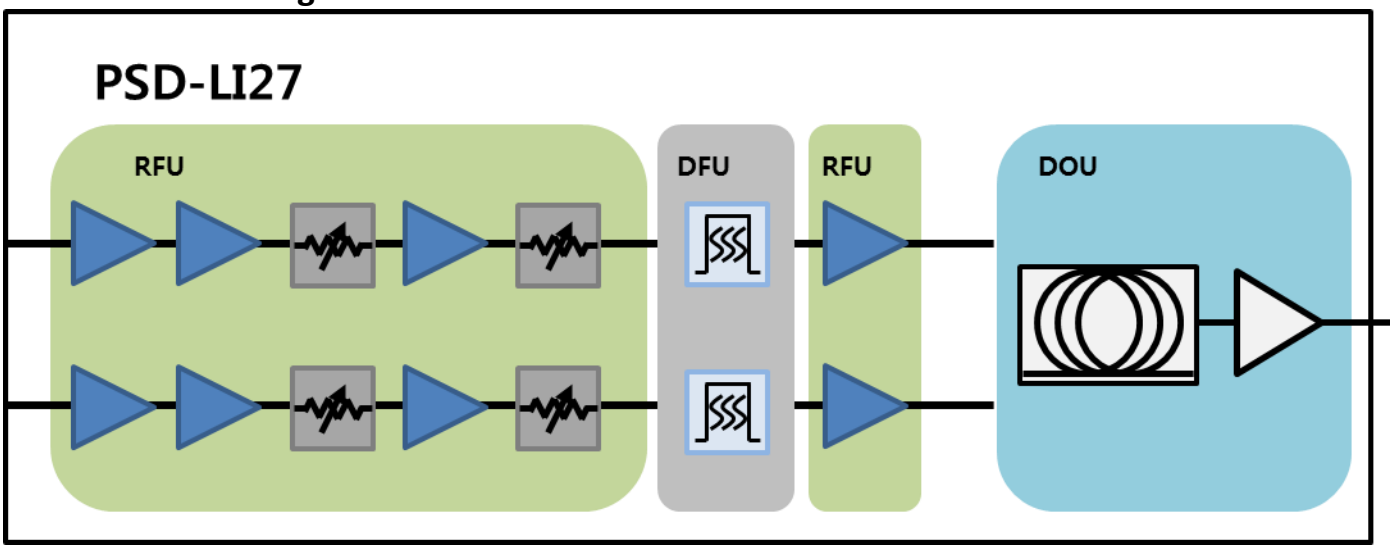

Figure 16. PSD-LI27 Block Diagram Configuration

The repeater improves service in the Dual Band Public safety networks.
User may select frequency band according to the site peculiarities.
After receiving a weak signal from Donor antenna, the PSD-LI27 sends downlink signal to PSS-LI33/37 using DOU. DOU supports the translation of RF signal to Optic signal for connecting PSS-LI37 through the fiber optic cable. And then Uplink Signal that received from PSS-LI37 amplify, is send to the Base station via Donor Antenna.

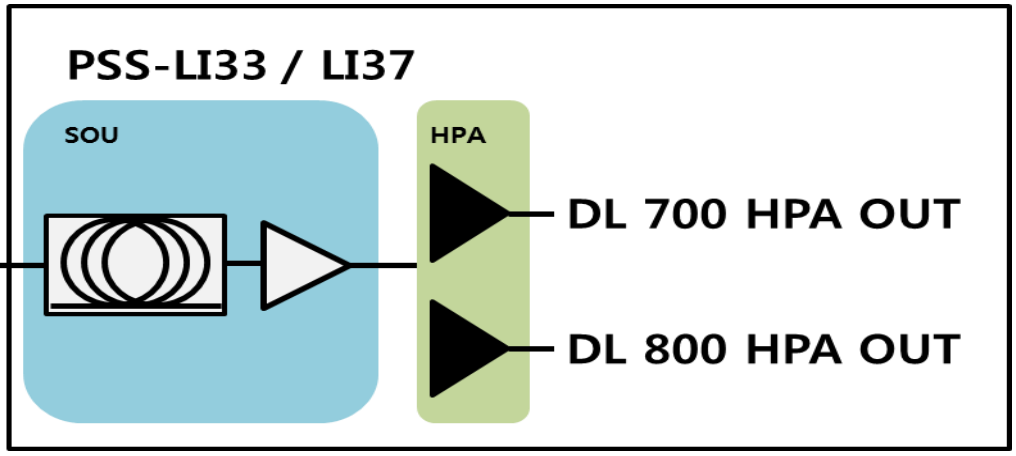

Figure 17. PSS-LI33 / 37 Block Diagram Configuration

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PSS-LI33/37 is operating very similar to the PSD-LI27

After receiving an Uplink Signal from service antenna, the PS-DASD-LI33/37 sends Uplink signal to PSD-LI27 using SOU (Service Optic Unit).
SOU supports the translation of RF signal to Optic signal for connecting PSD-LI27 through the fiber optic cable. And then Down Signal that received from PSD-LI27 amplify, is send to the Mobile station via Service Antenna.

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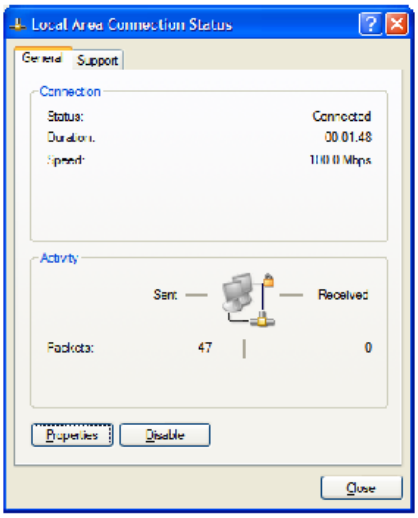
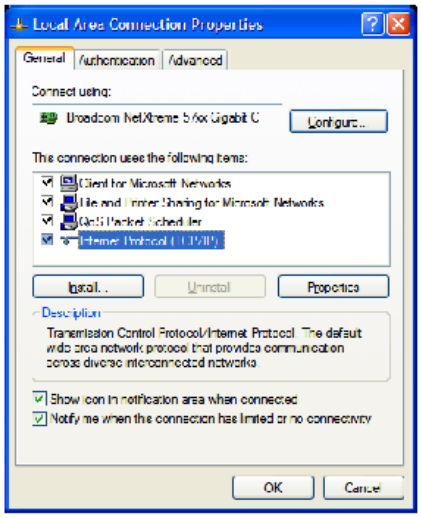
8. GUI Overview

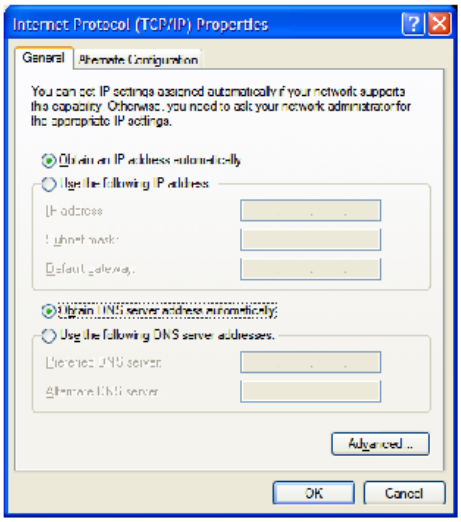
- Provide all functions that can be performed at Service Unit will be available thru the Donor Unit.
- Support the GUI pages that will be addressable via UDP Interface.

8.1. Configuration the Laptop to Connect to the Repeater

- Connect an Ethernet crossover cable from the LAN port of the repeater's bottom side to your laptop







1. Go to Local Connection
2. Click on "Properties"

3. Highlight "Internet Protocol"
4. Click on "Properties"

5. Choose "Obtain DNS Server address automatically"
6. Clink OK

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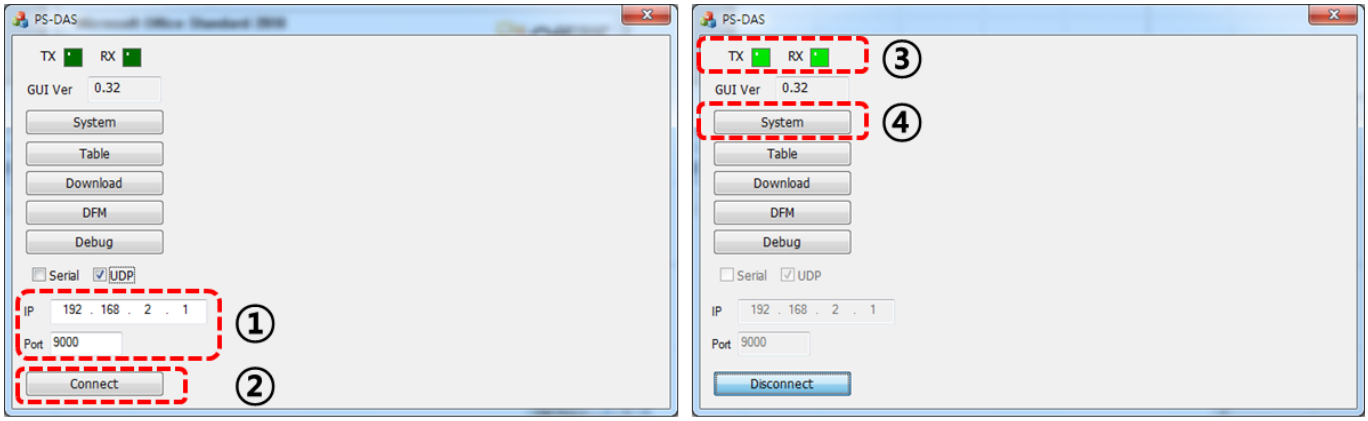
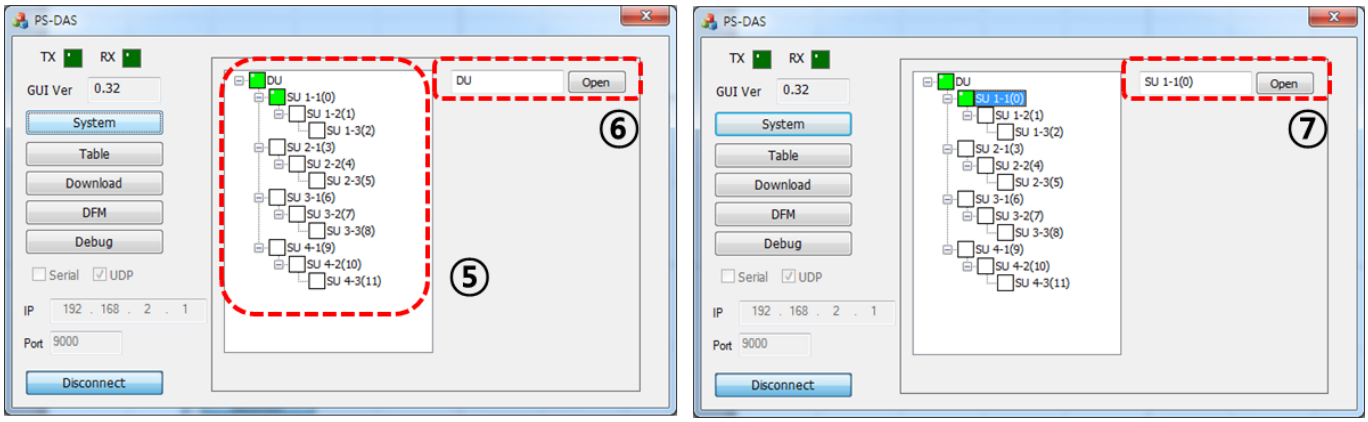
8.2. Login-In Screen

- GUI Screen for Log-In
- Enter the IP Address ① "**192.168.2.1**" and Port into GUI Main Screen. And then ② **Connect**.
- If the window at the top of the screen ③**blinks green**, you can verify that the connection has completed successfully.



- The laptop connected to the System, you can check ⑤ **Topology tree** of the PS-DAS by pressing the System button on the screen.
- Click the location of the device you wish to access in the tree on the screen and click ⑦ **Open button**, user has moving to the target device.



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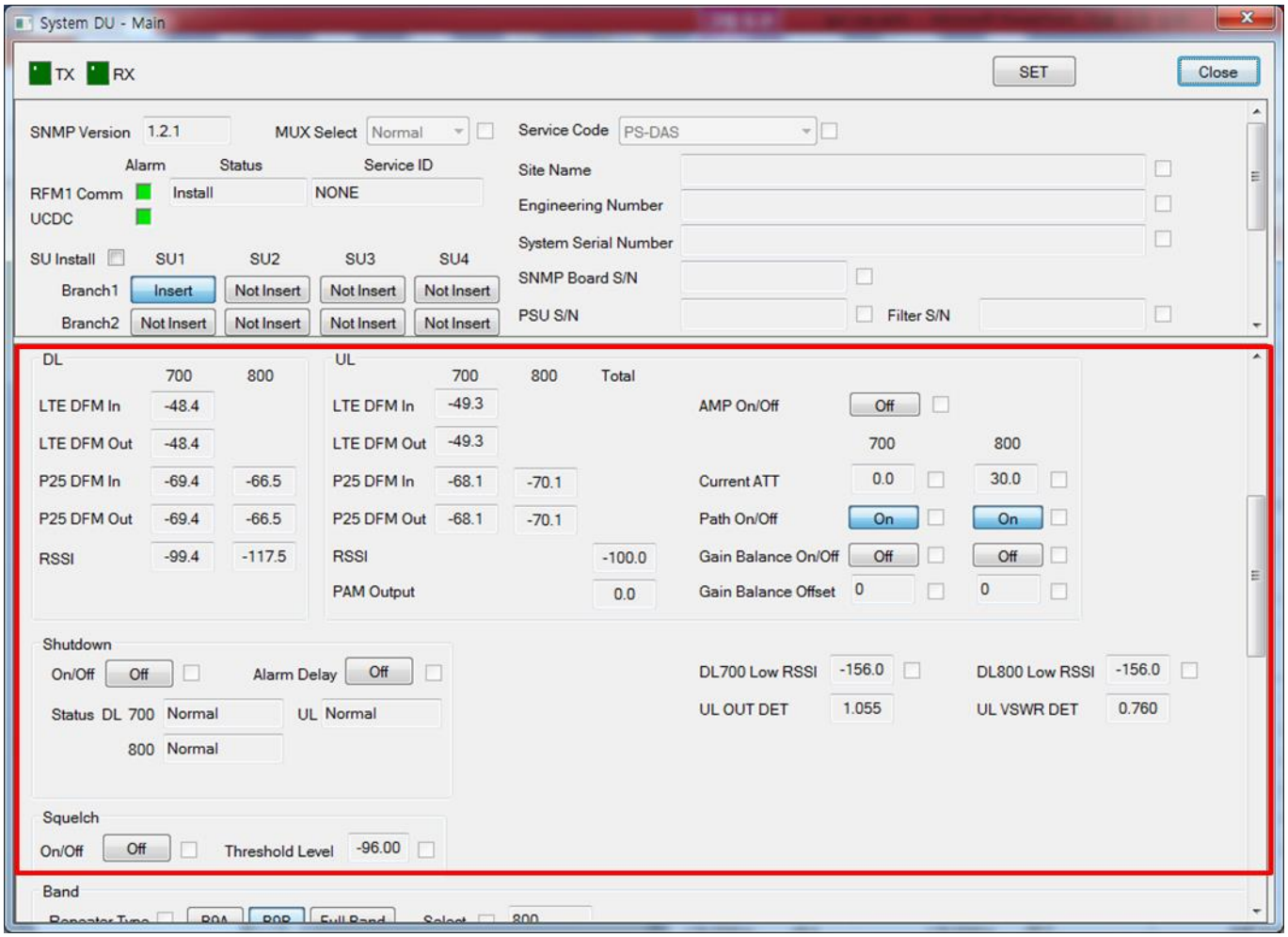
8.3. RF Status

- GUI Screen for display Repeater's RF Status



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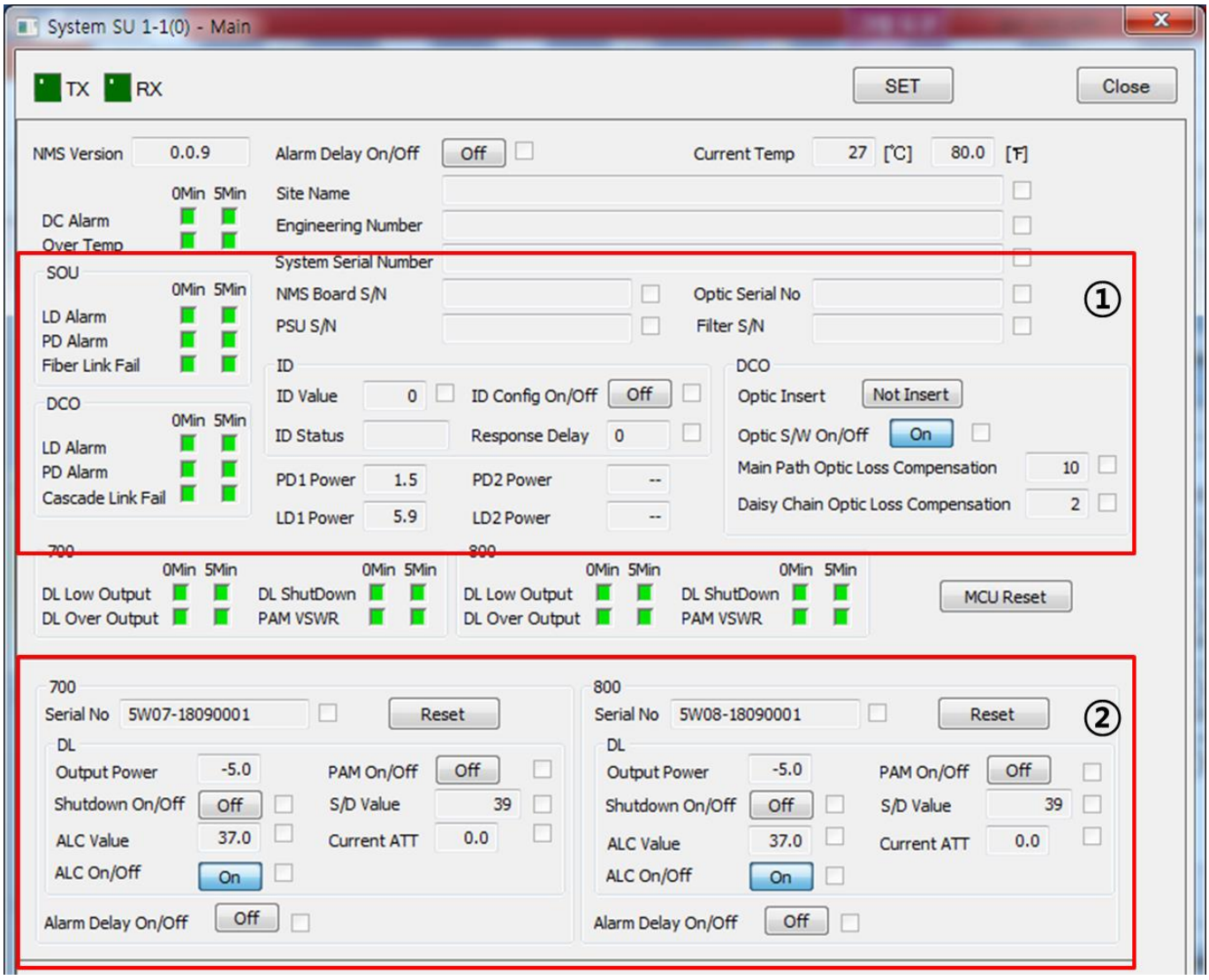
8.4. SU Configuration

- GUI Screen in order to change the RF values
- User may change the various RF values of the repeater on this page
- Changes will not take effect until you click "Apply" button
- This menu is where the installer will choose references for specific implementation
- ① in the GUI screen shows SOU behavior, PD / LD Power Level detection, and SOU related alarms.
- ② in the GUI screens involve the operation of DL 700 / 800 HPA. Display On / Off control , status and Alarm information of HPA.



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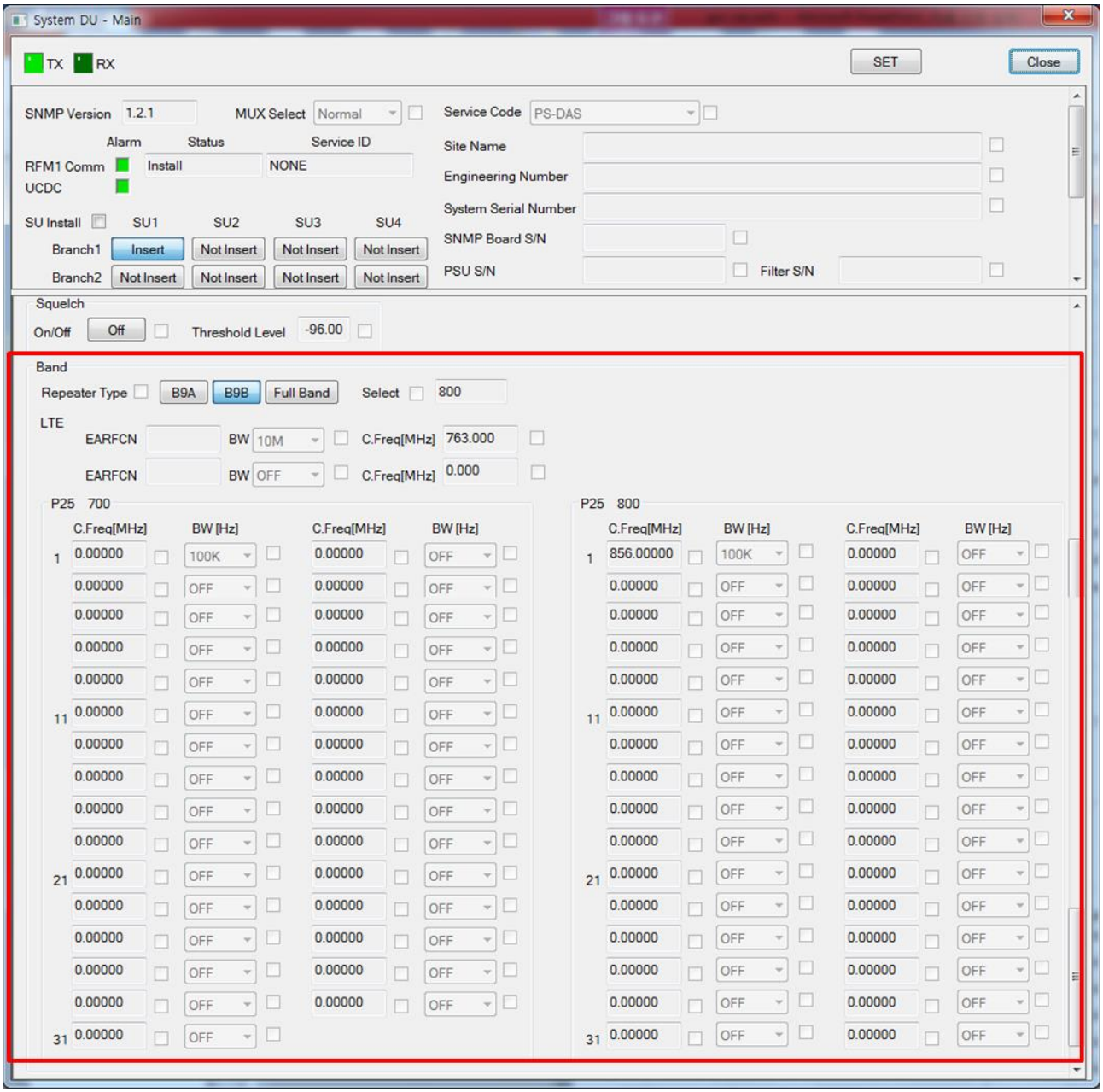
8.5. Band Selection

- Repeater support the capacity of P25 and LTE Technologies
- For P25, 32 non-contiguous bands can be used
- Support the LTE 5MHz, 10MHz
- User can set the desired channel using the GUI



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9. System Installation

- This chapter describes how to install the repeater and Cabling method
- The needed accessories and tools are list up as below

#	Contents		Picture	Q'ty
1	Mounting Bracket			1EA
2	AC Power Cable SJT 3/16 AWG, 6ft			1EA
3	Frame Ground Cable with Tubular Cable Lug, 6ft			1EA
4	Installation purchase set	EYE BOLT(M12)		1EA
		M5x12mm WRENCH BOLT, SEMS		2EA
		PH(+) M4x8mm ,SEMS		4EA
5	Mounting Screw set	LAG SCREW 3/8"x3"		2EA
		HEX HEAD 3/8"x2", SCM440		2EA
		Φ10.5mm/Φ21mm PLAIN WASHER		2EA
		Φ10.2mm/Φ18.4mm SPRING WASHER		2EA
6	Tubing Tube Sleeve Black	Φ30mm/L:150mm Adhesive Polyolefin 3:1 Heat Shrink		1EA

Table 11. PS-DAS Installation Accessories

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9.1. Warnings and Hazards

9.1.1. Electric Shock

- Opening the Repeater could result in electrical shock and may cause severe injury
- Operating the Repeater with antennas in very close proximity facing each other could lead to severe damage to the repeater

9.1.2. Exposure to RF

Working with the repeater while in operation, may expose the technician to RF electromagnetic fields that exceed FCC Rules for human expose.

Visit the FCC Website at http://www.fcc.gov/oet/rfsafety to learn more about The effects of exposure to RF electromagnetic fields

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9.2. Service Man Installation Guide

9.2.1. PSS-LI37 Fixing the Wall Mount Type

The procedure for fixing the pole type system is as follows.

1) To mount the system on the wall, first fix the bracket on the wanted position.
2) Hang the system to the hooking position at the top of the mounting bracket
3) Push the system to the hooking position at the bottom of the mounting bracket.

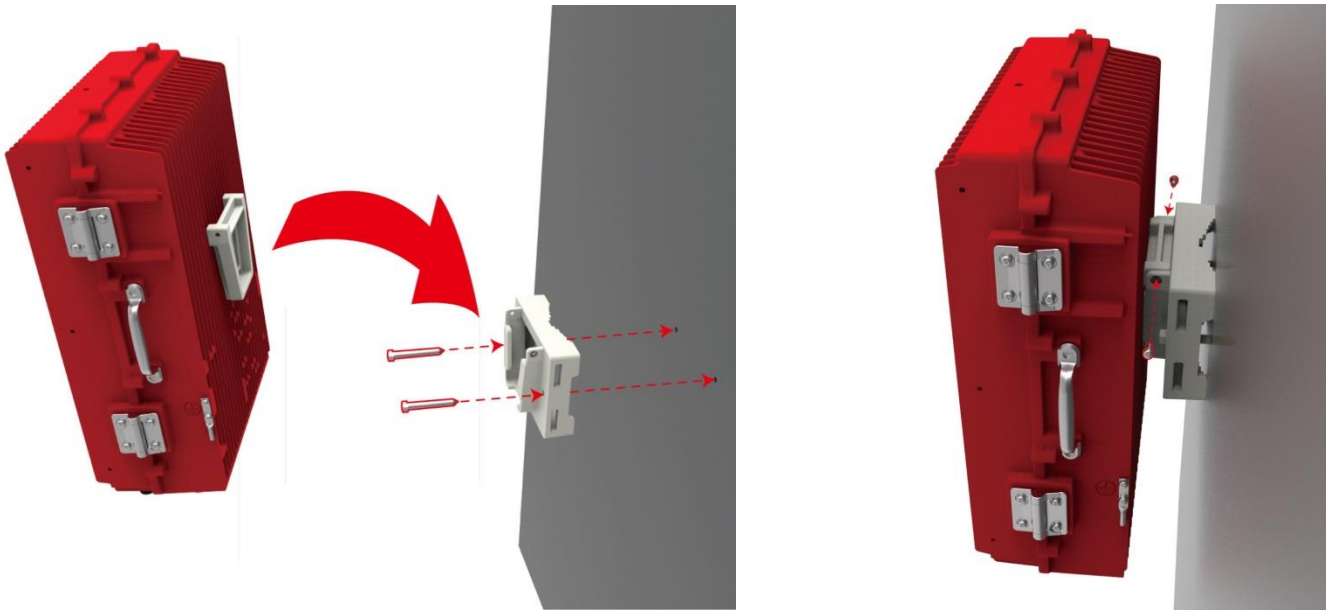

Figure 18. The way to fix firmly the System for Pole Mounting

WARNING	**Protection gloves and goggles** Make sure that worker wears protection gloves and goggles to prevent damages from debris while drilling holes in a Pole or Wall
CAUTION	**Cautions while drilling on the pole** Drilling thru-hole on a center of the pole

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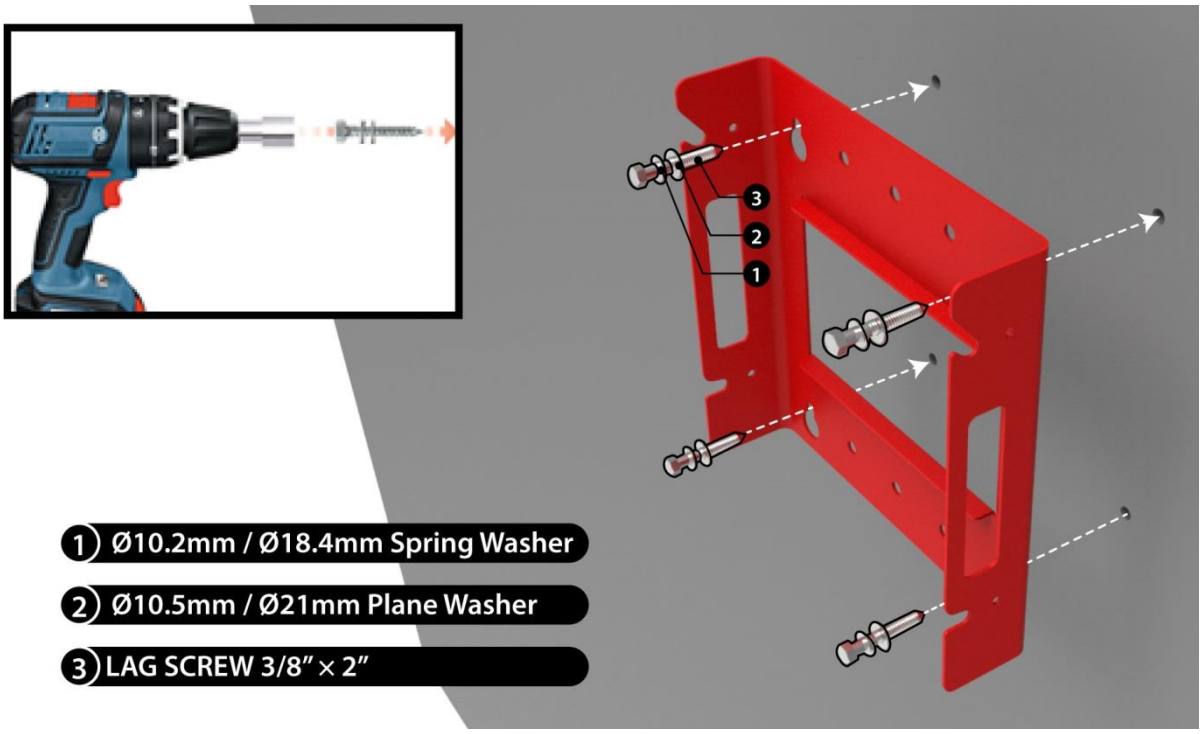
4) Align the system with the fixing holes of the mounting bracket and fix them firmly

9.2.2. PSD-LI27 / PSS-LI33 Fixing the Wall Mount Type



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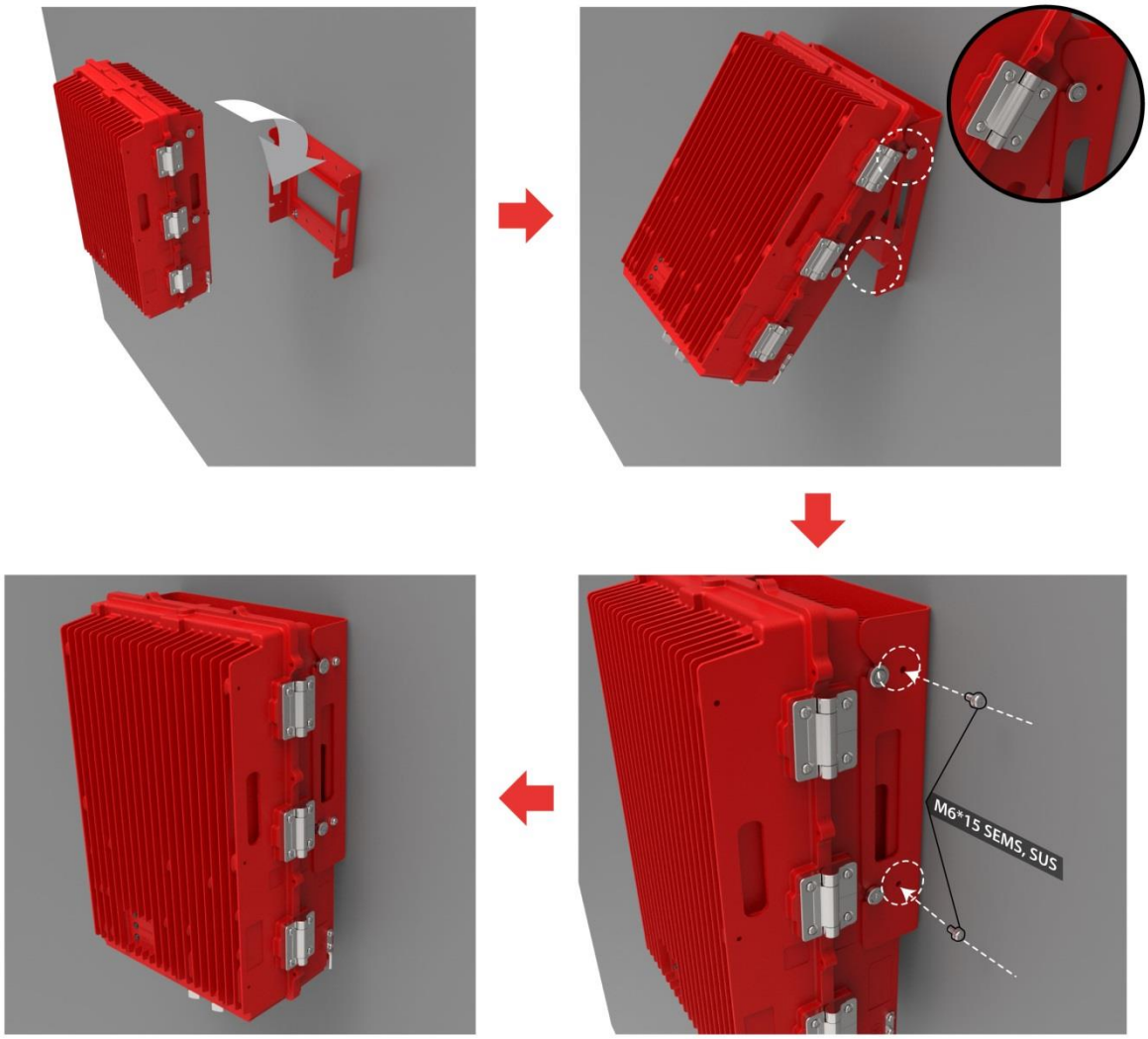

Figure 19.The way to fix firmly the System for Wall Mounting

CAUTION

Cautions System leveling

Before fixing the system, Check the horizontal and vertical level using a spirit level

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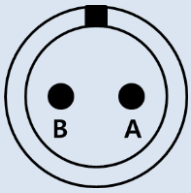
9.3. Cable Connection

9.3.1. DC Power cable connection

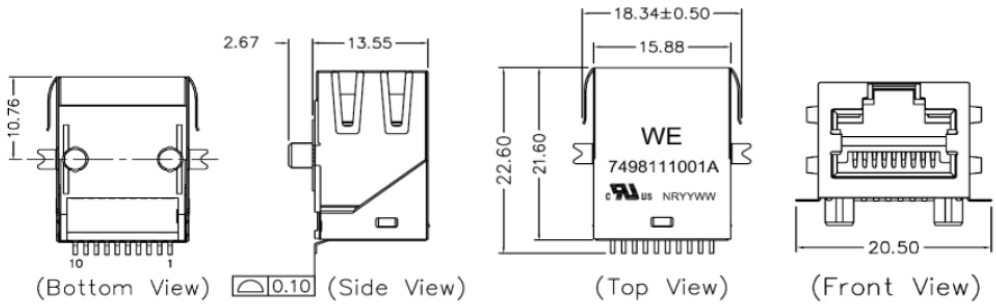
- Repeater supports a free DC Input voltage 48V
- Provided Power cable is single type, so it can be used flexibly
- The pin description of DC Port is below. User should connect exact polarity of DC

Port Outlook (System Side)	Port numbering for MS	NAME	Description
	A	DC (+)	+48V
	B	GND	GND

- The specification & Connection of DC Power Cable
  - DC Connector: CAR3102A-14S-9S
  - Connect Port A for inserting DC Power

9.3.2. Local Maintenance Connection

- Repeater Support a RJ-45 connector



9.3.3.

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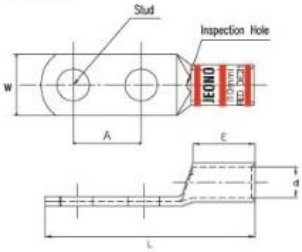
9.3.4. Grounding cable Connection

- Frame(Earth) Wire size is AWG #6. The way to install the grounding cable is below

- The specification of ground terminal lug is like below (Refer to JOCT 0202-RL05)

TUBULAR CABLE LUGS, TWO-HOLE, STANDARD BARREL AND LONG BARREL TYPE-CT

- Material : Electrolytic Copper (TPC)
- Surface : Tin Plated
- With Inspection Hole
- Color Coded to Show Proper Die Number and Color 10㎟~630㎟
- To IEC 60228 Class 2 and Class 5
- UL Listed 486A-486B up to 35KV



Part No Explation : JOCO 0201-X X 04 → Stud Size(mm, UNC)

Tongue Form R : Round Type
S : Square Type

Barrel Form *S : Standard Barrel Type
*L : Long Barrel Type

Part Number	Wire Range				Stud Size	Dimension (mm)							Color Code & Die No	Q'ty / bag
	CODE		FLEX			W	d	A	E		L			
	AWG	㎟	AWG	㎟					*S	*L	*S	*L		
JOCT 0202-XX05	6	16	6	16	M5	12	5.4	16	15	30	50	67	Blue 24 JOCD-6	300
JOCT 0202-XX06					M6									
JOCT 0202-XX08					M8	15.5		19			67	82		
JOCT 0202-XX10					M10									
JOCT 0202-XX12					M12	18		22			70	85		

Frame Ground

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