Comba

CriticalPoint

PUBLIC SAFETY BI-DIRECTIONAL AMPLIFIER

USER MANUAL

RXxxV2 QE: 1-0-2

Comba Telecom Ltd.

The information contained herein is the responsibility of and is approved by the following, to whom all enquiries should be directed:

0.1 CONTENTS

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0.2 INDEX TO FIGURES AND TABLES

0.3 HISTORY

Change No.	ENU	Details Of Change
1	1-0-0	This manual first created and issued in May 2020.
2	1-0-2	Manual updated to reflect current released FW version in March 2022

0.4 GLOSSARY OF TERMS

Abbreviation	Definition
AHJ	Authority Having Jurisdiction
ALC	Automatic Level Control
ATT	Attenuator
BTS	Base Transceiver Station
CH	Channel
CSA	Cross Sectional Area
dB	Decibel
dBm	Decibels relative to 1 milliwatt
DL	Downlink
DT	Donor Terminal
DPX	Duplexer
FS	Frequency Selection
Hz	Hertz
ID	Identification
IF	Intermediate Frequency
LNA	Low Noise Amplifier
LOS	Line-of-Sight
MCU	Main Control Unit
MHz	Megahertz
MT	Mobile Terminal
MTBF	Mean Time Between Failures
NF	Noise Figure
OMC	Operation & Maintenance Center
OMT	Operation & Maintenance Terminal
PA	Power Amplifier
PLL	Phase Locked Loop
PSU	Power Supply Unit
RF	Radio Frequency
SMA	Sub-Miniature A Connector
UL	Uplink
VAC	Volts Alternating Current
VDC	Volts Direct Current
VSWR	Voltage Standing Wave Ratio

0.5 SAFETY NOTICES AND ADMONISHMENTS

This document contains safety notices in accordance with appropriate standards. In the interests of conformity with the territory standards for the country concerned, the equivalent territorial admonishments are also shown.

Any installation, adjustment, maintenance, and repair of the equipment must only be carried out by trained, authorized personnel. At all times, personnel must comply with any safety notices and instructions.

Specific hazards are indicated by symbol labels on or near the affected parts of the equipment. The labels conform to international standards, are triangular in shape, and are colored black on a yellow background. An informative text label may accompany the symbol label.

Hazard labeling is supplemented by safety notices in the appropriate equipment manual. These notices contain additional information on the nature of the hazard and may also specify precautions.

Note: The grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications could void the user's authority to operate the equipment.

For compliance with the general population RF exposure limits, each individual antenna used for this transmitter must be installed to provide a separation distance greater than 64.031cm or more from all persons during normal operation and must not be co-located with any other antenna for meeting RF exposure requirements.

Warning Notices:

These draw the attention of personnel to hazards that may cause death or injury to the operator or others. Examples of use are cases of high voltage, laser emission, toxic substances, point of high temperature, etc.

WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. The PS BDA can be configured as Class A or Class B Signal Booster. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

Note: The grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications could void the user's authority to operate the equipment.
Alert:
These draw the attention of personnel to hazards that may cause damage to the equipment. An example of use is the case of static electricity hazard.

Caution notices may also be used in the handbook to draw attention to matters that do not constitute a risk of causing damage to the equipment but where there is a possibility of seriously impairing its performance, e.g. by mishandling or gross maladjustment. Warnings and Cautions within the main text do not incorporate labels and may be in shortened form.

Disconnection of the 2 RF connectors may cause damage to the equipment when power is on.
The application antenna and RF cable are not provided. The antenna gain should not exceed 10 dBi.

WARNING!
Use only authorized and approved antennas, cables and/or coupling devices! The use of unapproved antennas,
cables or coupling devices could cause damage and may be of violation of FCC regulations. The use of unapproved antennas, cables and/or coupling devices is illegal under FCC regulations and may subject the user to fine.

End of Section

1 GENERAL INFORMATION

The RXxxV2 is a new digital dual band public safety repeater (hereafter referred to as PS BDA) designed to protect the lives of first responders and building occupants. Through the use of digital filtering technology, the RXxxV2 helps eliminate adjacent channel interference to allow band/channel selectivity and support Public Safety 700MHz and 800MHz bands. Up to 32 narrowband filters for Class A or 3 wideband filters for Class B can be simultaneously supported in each of the 700MHz and 800MHz Public Safety frequencies via a web-based GUI, which provides versatility and total control to the user.

Main Features

- Public Safety 700MHz and 800MHz Bands.
- Class A BDA, 32 channels per band or Class B BDA, 3 sub-bands.
- Channel selective or Band selective, software programmable.
- Auto diagnostic.
- Uplink squelch per channel for Class A.
- User adjustable gain control (AGC), UL and DL independent per channel.
- 700MHz and 800MHz band compatible, software adjustable.
- Built in mandatory isolation testing for oscillation prevention.
- Easy commission and setup via Web-based GUI, and SNMP supported
- Weatherproof enclosure, IP65/NEMA4.
- Fully compliant with the 2019 NFPA 1221 Code.
- Competitive size and weight.
- Alarming output to supervised circuits for antenna failure, signal booster failure, and more as required.

The following figure shows the enclosure of the PS BDA.

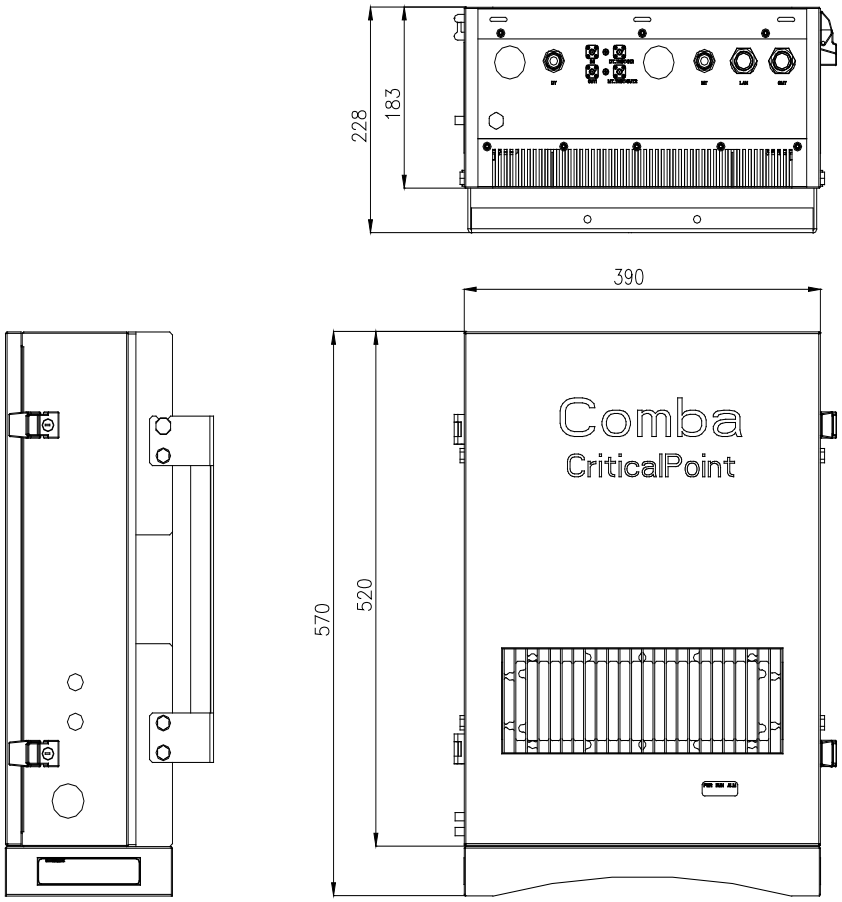


Figure 1: Front, Side and Bottom Views of the PS BDA Enclosure

Specifications-Class A

Electrical			**700MHz**	**800MHz**
Frequency Range, Uplink		MHz	799-805	806-817
Frequency Range, Downlink		MHz	769-775	851-862
Channel Bandwidth		KHz	12.5/25/75	12.5/25/75
Number of Channels			32	32
Total Output Power, Uplink		dBm	30	
Total Output Power, Downlink		dBm	37	37
Maximum System Gain		dB	100	100
Gain Adjustment Range (1dB step)		dB	0-30	0-30
Pass Band Ripple, p-p		dB	≤ 5	≤ 5
Uplink Noise Figure		dB	≤ 5	≤ 5
System Group Delay	Bandwidth: 12.5KHz	μsec	≤ 35	≤ 35
	Bandwidth: 25KHz		≤ 27	≤ 27
	Bandwidth: 100KHz		≤ 15	≤ 15
Out-of-Band Suppression	Bandwidth: 12.5KHz	dBc	≥ 80 @ filter center + 75KHz	≥ 80 @ filter center + 75KHz
	Bandwidth: 25KHz		≥ 80 @ filter center + 75KHz	≥ 80 @ filter center + 75KHz
	Bandwidth: 100KHz		≥ 80 @ filter center + 200KHz	≥ 80 @ filter center + 200KHz
Intermodulation		dBm	≤ -13	≤ -13
Spurious	9kHz to 1GHz	dBm	FCC Compliance	FCC Compliance
	1GHz to 12.75GHz	dBm		
Maximum RF Input Power without Damage		dBm	+10	+10
Maximum RF Input Power without Overdrive		dBm	-20	-20
Input VSWR			≤ 1.5	≤ 1.5
Impedance		Ω	50	50
Mechanical				
Dimensions, H x W x D		in(mm)	22.4 x 15.4 x 9.0 (570 x 390 x 228)	
Weight (without bracket)		lb(kg)	66.2 (30)	
Power Supply		VAC	100-240/47-63Hz	
		VDC	-40 ~ -58	
Power Consumption	Single band	W	135	
	Dual band	W	165	
Enclosure Cooling			Convection	
RF Connectors			N-Female	
Test Port			SMA, -27dB	
Maximum Input for Dry Contact Port			24VDC, 1A / 110VAC, 0.5A	
Operating Temperature		ºF (ºC)	-27 to +140 (-33 to +60)	
Operating Humidity			≤ 95%	
Environmental Class			UL50E Type 4	

Note: Typical specifications at room temperature,

Specifications-Class B

Electrical			**700MHz**	**800MHz**
Frequency Range, Uplink		MHz	788-805	806-817
Frequency Range, Downlink		MHz	758-775	851-862
Operating Bandwidth		MHz	0.2-10	0.2-10
Number of Sub Bands			3	3
Total Output Power, Uplink		dBm	30	
Total Output Power, Downlink		dBm	37	37
Maximum System Gain		dB	100	100
Gain Adjustment Range (1dB step)		dB	0-30	0-30
Pass Band Ripple, p-p		dB	≤ 5	≤ 5
Uplink Noise Figure		dB	≤ 5	≤ 5
System Group Delay		μsec	≤ 6.5	≤ 6.5
Out-of-Band Suppression		dBc	≥ 45 @ filter edge + 0.6MHz ≥ 60 @ filter edge + 1MHz	≥ 45 @ filter edge + 0.6MHz ≥ 60 @ filter edge + 1MHz
Intermodulation		dBm	≤ -13	≤ -13
Spurious	9kHz to 1GHz	dBm	FCC Compliance	FCC Compliance
	1GHz to 12.75GHz	dBm		
Maximum RF Input Power without Damage		dBm	+10	+10
Maximum RF Input Power without Overdrive		dBm	-20	-20
Input VSWR			≤ 1.5	≤ 1.5
Impedance		Ω	50	50
Mechanical				
Dimensions, H x W x D		in(mm)	22.4 x 15.4 x 9.0 (570 x 390 x 228)	
Weight (without bracket)		lb(kg)	66.2 (30)	
Power Supply		VAC	100-240/47-63Hz	
		VDC	-40 ~ -58	
Power Consumption	Single band	W	135	
	Dual band	W	165	
Enclosure Cooling			Convection	
RF Connectors			N-Female	
Test Port			SMA, -27dB	
Maximum Input for Dry Contact Port			24VDC, 1A / 110VAC, 0.5A	
Operating Temperature		ºF (ºC)	-27 to +140 (-33 to +60)	
Operating Humidity			≤ 95%	
Environmental Class			UL50E Type 4	

Note: Typical specifications at room temperature,

The rated output power of this equipment is for single carrier operation. For situation when multiple carrier signals are present, the rating would have to be reduced by 3.5dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

2 EQUIPMENT DESCRIPTION

2.1 FUNCTIONAL BLOCK DIAGRAM

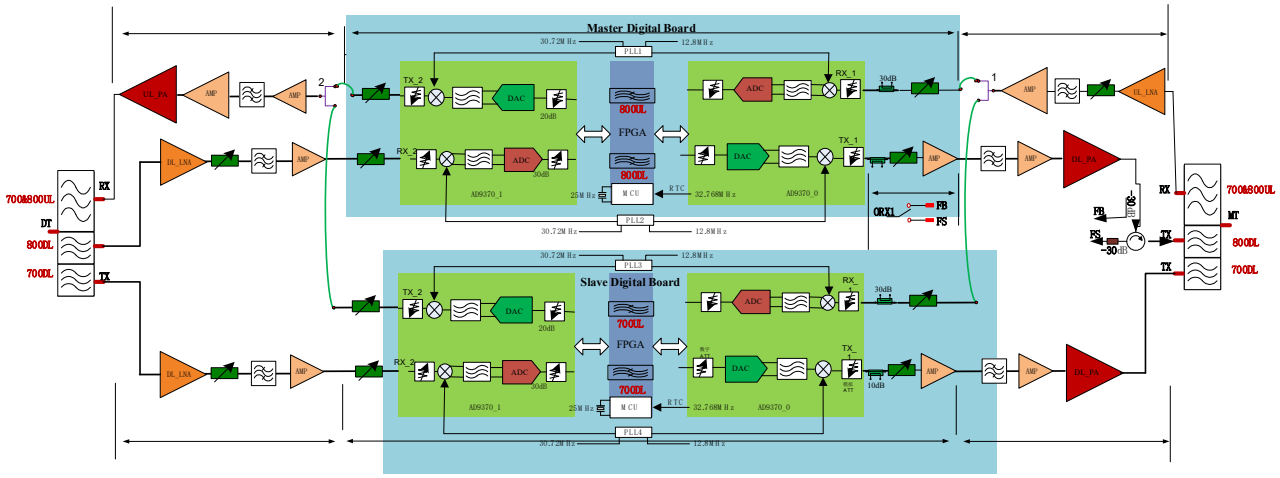


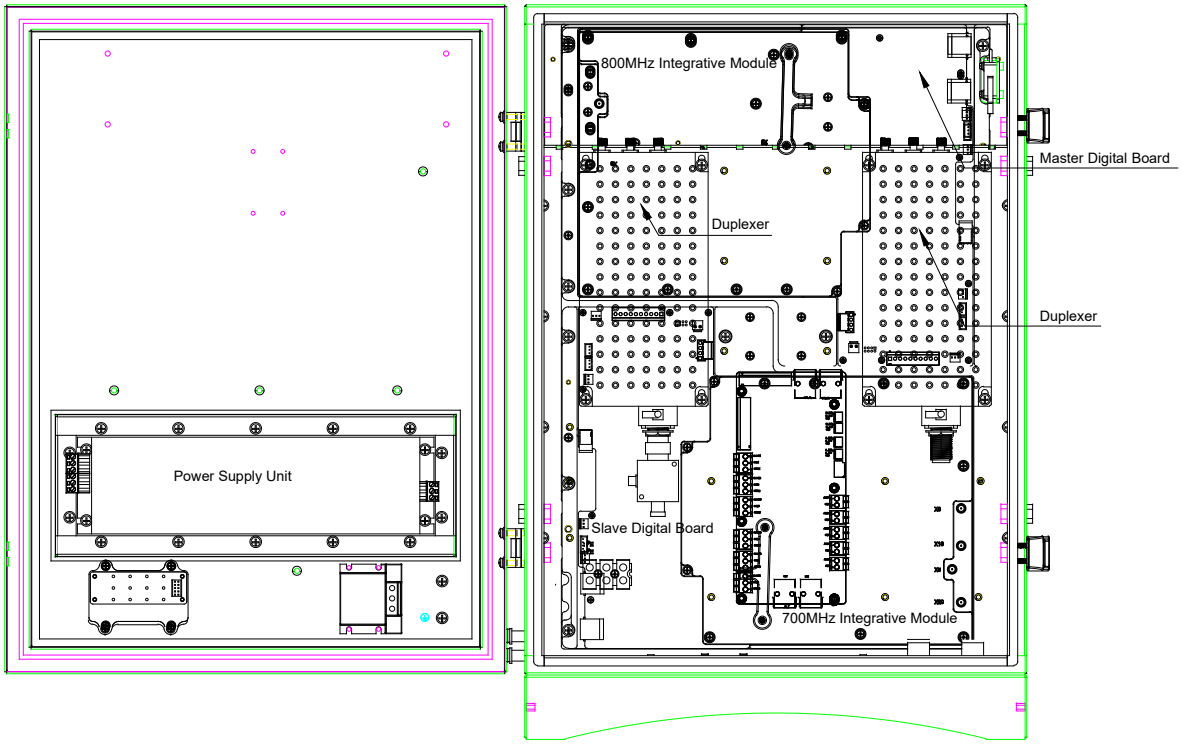
Figure 2: PS BDA Functional Block Diagram

In the downlink path, the donor tower signals are received by the donor antenna of the repeater, connected to the DT port. Downlink and uplink are separated with a duplexer, then the signals are sent to the LNA module for pre-amplification and to the digital RF integrated module for digital filtering and frequency conversion. Then the downlink signals are sent to the downlink PA to amplify power, then filtered and combined on the same cable pathway via the duplexer. The signals are transmitted at the MT port to the service antennas.

In the uplink path, the mobile signals are received by the service antennas. After the MT port integrated duplexer, the signals are sent to the LNA, integrated module for digital filtering, then to the PA for power amplification and to the duplexer. After that, the uplink signals are sent to the donor antenna for transmission back to the donor tower.

2.2 EQUIPMENT LAYOUT

Shown below is the internal layout of the PS BDA.



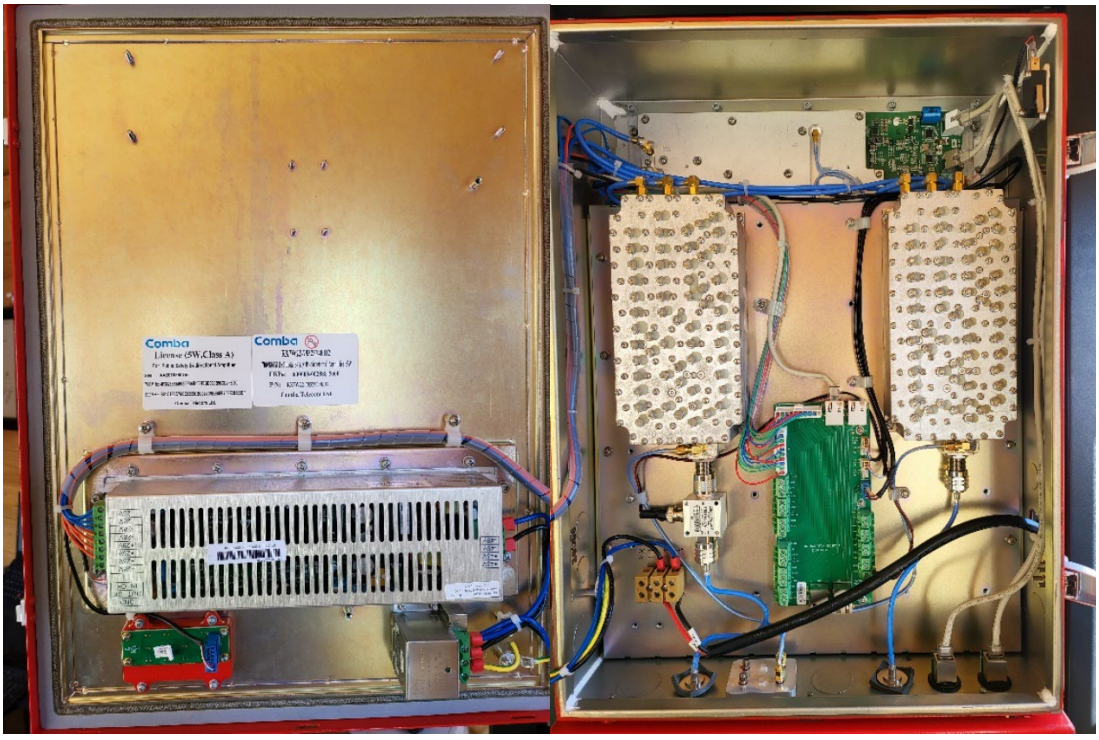


Figure 3: Layout of the PS BDA

2.3 EQUIPMENT CONSTITUTION

The typical PS BDA unit consists of the following components:

Master Digital Board and Slave Digital Board: The MCU is used to monitor and control the operation of the repeater. It also provides the communication interface for remote control and status indication. LED indicators provide the operation status of the MCU.

Duplexer: The duplexer is located near the MT and DT terminals and permits the uplink and downlink signals to share a common antenna.

700MHz/800MHz Digital Integrated Module and Power Amplifier: Consists of the Power Conversion module, RF module, digital process module and monitoring modules. The Power Conversion module converts +28V DC voltage into +9VJK and +9VRF. +9VJK, +9VRF are supplied to the monitoring unit, and the RF unit in the integrated module separately. The RF module amplifies and converts the RF signal to IF signal. The Digital process module converts the IF signal into baseband signal via AD conversion and extraction, and filtering. After that, the IF signal will be amplified and converted to an RF signal by the RF module for RF filtering and amplification. The Monitoring module monitors and controls the system parameters and is the interface for both remote monitoring and local commissioning.

Power Supply Unit (PSU): The PSU converts the input voltage into a stable DC supply to provide power for the internal functional modules.

3 INSTALLATION

3.1 WARNINGS AND ALERTS

Radio Frequency Energies

There may be situations, particularly for workplace environments near high-powered RF sources, where recommended limits for safe exposure of human beings to RF energy could be exceeded. In such cases, restrictive measures or actions may be necessary to ensure the safe use of RF energy.

High Voltage

The equipment has been designed and constructed to prevent, as far as reasonably practicable danger. Any work activity on or near equipment involving installation, operation or maintenance must be, as far as reasonable, free from danger.

Where there is a risk of damage to electrical systems involving adverse weather, extreme temperatures, wet, corrosive or dirty conditions, flammable or explosive atmospheres, the system must be suitably installed to prevent danger.

Protective Earthing

Equipment provided for the purpose of protecting individuals from electrical risk must be suitable for the purpose and properly maintained and used.

Handling Precautions

This covers a range of activities including lifting, lowering, pushing, pulling, carrying, moving, holding or restraining an object, animal or person from the equipment. It also covers activities that require the use of force or effort, such as pulling a lever, or operating power tools.

Where some of the abovementioned activities are required, the equipment must be handled with care to avoid being damaged.

Electrostatic Discharge (ESD)

Observe standard precautions for handling ESD-sensitive devices. Assume that all solid-state electronic devices are ESD-sensitive. Ensure the use of a grounded wrist strap or equivalent while working with ESD-sensitive devices. Transport, store, and handle ESD-sensitive devices in static-safe environments.

3.2 SITE PLANNING CONSIDERATIONS

3.2.1 SITE PLANNING

Site Considerations

Outdoor equipment is designed to be waterproof, rainproof, and with snow protection. Temporary protection should be taken when the equipment enclosure is opened for installation or maintenance in an outdoor environment. The equipment must not be opened for installation or maintenance in bad weather (e.g. hail storm, rainfall, extreme temperatures and high humidity)

Installation Location

Mounting surface shall be capable of supporting the weight of the equipment.

In order to avoid electromagnetic interference, a proper mounting location must be selected to minimize interference from electromagnetic sources such as large electrical equipment.

Environmental

Humidity has an adverse effect on the reliability of the equipment. It is recommended to install the equipment in locations having stable temperature and unrestricted air-flow.

The installation location for the product should be well ventilated. The equipment has been designed to operate at the temperature range and humidity level as stated in the product specifications in the datasheet.

Direct sun light exposure to the equipment should be avoided. Provide additional shelter if necessary.

Power Supply

The power supply unit (PSU) provides power to all modules within the equipment. Depending on the product variant, it is recommended that the PSU be operated on a dedicated circuit breaker or fused circuit.

Grounding Requirement

Verify that the equipment has been well grounded. This includes antennas and all cables connected to the system. Ensure lightning protection for the antennas is properly grounded.

Cable Routing

Depending on equipment configuration, a variety of types of cables are required. Where applicable, ensure cables are properly routed and secured so that they are not damaged.

Manual Handling

During transportation and installation, take necessary handling precautions to avoid potential physical injury to the installation personnel and the equipment.

3.2.2 INSTALLATION CHECKLIST

- Working space available for installation and maintenance for each mounting arrangement. Ensure unrestricted airflow.
- Ensure earth ground point is within reach of the ground wire.
- Ensure a power source is within reach of the power cord and the power source has sufficient capacity.
- Where appropriate, ensure unused RF connectors are terminated.
- Do not locate the equipment near large transformers or motors that may cause electromagnetic interference.
- Reduce signal loss in feeder cable by minimizing the length and number of RF connections.
- Ensure VSWR of antennas system < 1.5:1.
- Ensure equipment will be operated within the stated environment (see datasheet).
- Observe handling of all cables to prevent damage.
- Donor antenna should have a narrow beamwidth and positioned in line-of-sight (LOS) to the donor BTS site so that the donor signal level is maximized. This allows the use of minimum gain to achieve the maximum DL output power. The UL gain is typically set lower than or equal to the DL gain to minimize noise interference to the donor tower.
- Ensure that the radio system has a Control Channel present, if a Control Chanel is not present, then a Bias-T can be installed at the donor antenna/donor coax to provide integrity monitoring per the AHJ (software configuration on page 30, “Donor DC Voltage Alarm”).
- Service antennas should be selected based on the type of service area, e.g., indoor antenna for indoor application, and panel antenna for outdoor application.
- You must have an FCC License or express consent of an FCC Licensee to operate this device.

3.3 INSTALLATION PROCEDURES

3.3.1 GOODS INWARDS INSPECTION

- Verify the number of packages received against the packing list.
- Check all packages for external damage; report any external damage to the shipping courier. If there is damage, a shipping agent should be present before unpacking and inspecting the contents because damage during transit is the responsibility of the agent.
- Open and check each package against the packing list. If any items are missing, contact Comba.
- Do not remove items from anti-static packing until ready for installation. If damage is discovered at the time of installation, contact the shipping agent.

3.3.2 TOOLS

See Appendix A for a full list of the recommended tools required for installation and routine maintenance.

3.3.3 PREPARATION

- Wall mounting may be done with masonry bolts supplied, which make use of the outer holes. Alternatively, adequate lag screws may be substituted (not provided) to mount to a plywood backboard.

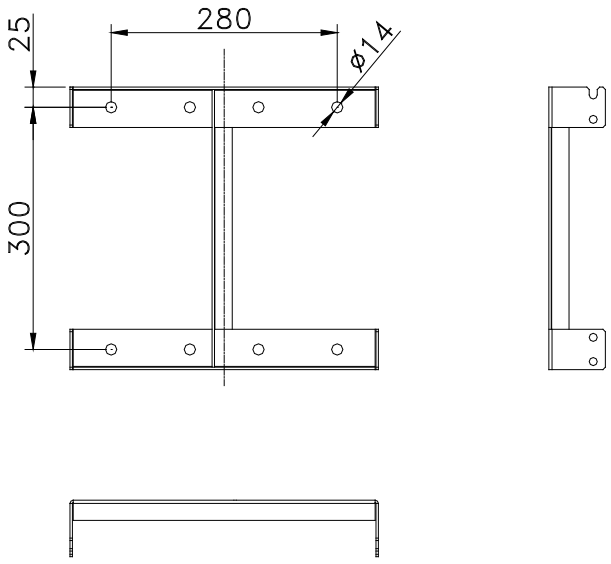


Figure 4: Mounting Rack Overview

3.3.4 WALL MOUNTING

- Drill four holes on the wall using the position of four holes on the mounting rack as a guide. Fix the mounting rack to the wall using four masonry bolts (M10x110mm).
- Install the Mounting Rack to the wall.
- Hang the equipment and secure the enclosure to the mounting rack.

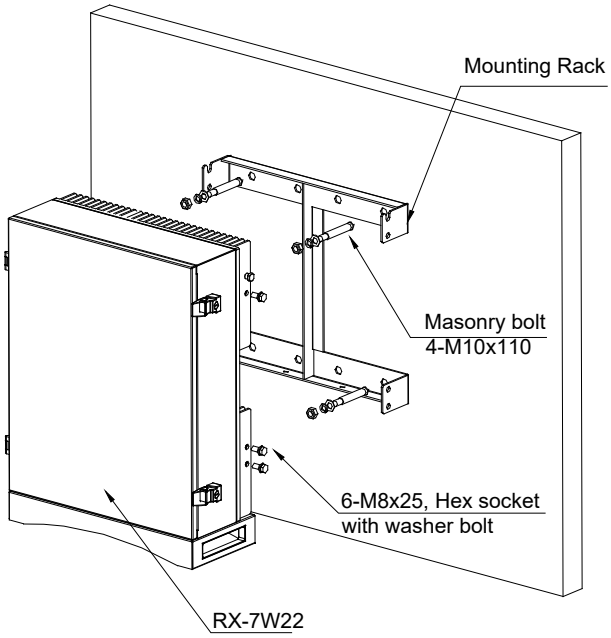


Figure 5: PS BDA Wall Mounting

3.3.5 DRIP-LOOP

Comba recommends that every horizontal cable entry to the equipment forms a 'U' before its entry to the equipment. Water on the cable will drip down at the bottom of the loop and will not accumulate at the equipment connectors.

3.4 EQUIPMENT CONNECTORS

3.4.1 PS BDA CONNECTORS

The PS BDA is designed for all cable entries from the right or left of the enclosure, as shown in the following figure.

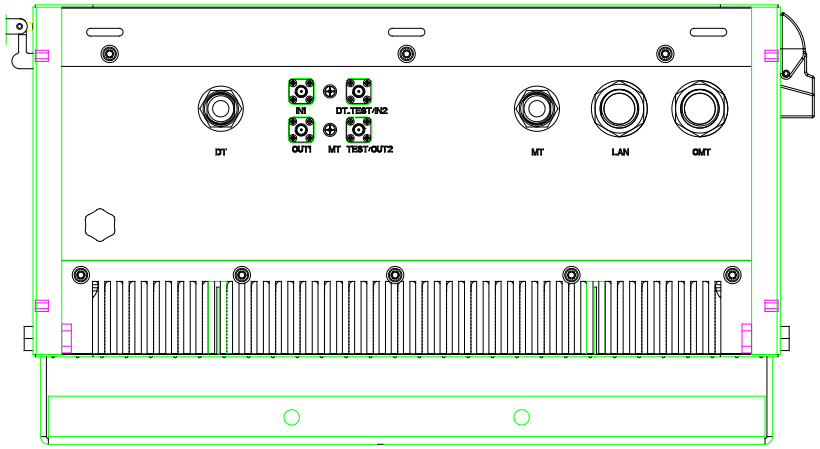


Figure 6: Equipment Connectors

Table 1: Equipment Connectors

Identifier	Descriptions
Power	Power cable needs to be run through conduit to the unit, use one of the knockouts from the chassis for the cabling. The power cable is not provided with the unit and the cable shall be rated to support DC -48V and min. current 4A.
DT Test	SMA connector for DT port test, -27dB coupling to DT port, available for both downlink and uplink test.
MT Test	SMA connector for MT port test, -27dB coupling to MT port, available for both downlink and uplink test.
DT	N-Female connector for connection to donor antenna.
MT	N-Female connector for connection to service antenna.
OMT	RJ45 Connector for local WEB GUI connection.
LAN	RJ45 Connector for remote access/internet connection.
Alarm Cables	Alarm cables need to be run through conduit to the unit, use one of the knockouts from chassis for the cabling. The alarm cables are not provided with the unit.

3.4.2 PS BDA LED INDICATORS

The LED indicators help user to check the equipment status easily.

Table 2: LED Indicators

Identifier	Color	Indication
PWR	Green	Power indicator. ON = power on; OFF = power off.
RUN	Green	Operation indicator, flashes every second to indicate normal operation.
ALM	Red	Alarm indicator. ON = alarm; OFF = no alarm.

3.4.3 GROUNDING CONNECTION

Ground Connection

To ensure safe operation of the product, a ground (earth) connection is required. For single phase AC power source, the product must be grounded by connecting the “earth wire” of the power cord to the ground terminal of the AC supply. For operating this product with DC power system (such as rectifiers), the product should not be connected to power systems that switch open the return lead because the return lead could function as the ground (earth) connection for the equipment.

Protective Ground Connection

The enclosure must be grounded securely by connecting a copper wire (CSA 16mm^2) to the grounding terminal on the equipment/rack, and the other end to a protective ground (i.e., building earth point). An internationally acceptable color code of the ground connection wire is green/yellow.

Such a ground connection implements the “Protective Ground Connection” and must be connected to the equipment at the designated ground point. In general, do not connect the supply before establishing an adequate ground (earth) connection.

Construct the ground wire and use appropriate crimp connectors where necessary. Locate and connect the equipment grounding terminal to a protective ground (i.e., building earth point).

3.4.4 RF CABLE CONNECTION

RX78V2 PS BDA RF cables connections are as follows:

- MT port → Connects to the feeder cable for service antennas.
- DT port → Connects to the donor antenna cable.

3.4.5 ETHERNET CONNECTION

Connect Ethernet (remote access) with ‘LAN’ port in the panel.
Connect locally with Ethernet with the ‘OMT’ port in the panel (for operator’s maintenance terminal).

3.4.6 DRY CONTACT ALARM AND EXTERNAL ALARM CONNECTION

Below are the definitions of dry contact cables.
6 x Dry Contact Alarms are supported, and both Normally Open and Normally Closed are supported.
4 x External Alarms are supported, and both Normally Open and Normally Closed are supported via GUI.

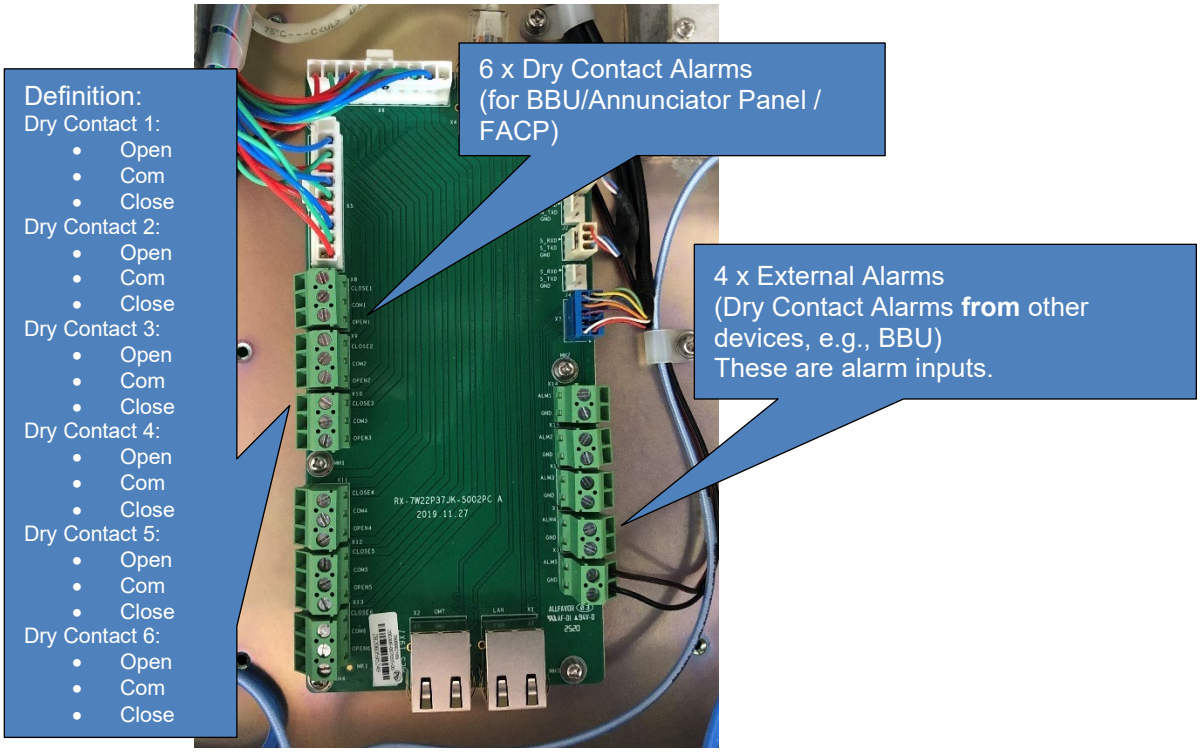


Figure 7: Dry Contact and External Alarm connection

3.4.7 POWER CONNECTION

- **DC**: 0V -> Power Supply Positive, -48V -> Power Supply Negative
- **AC**: L -> AC Live (Hot), N-> AC Neutral, PE-> AC Ground from AC power supply

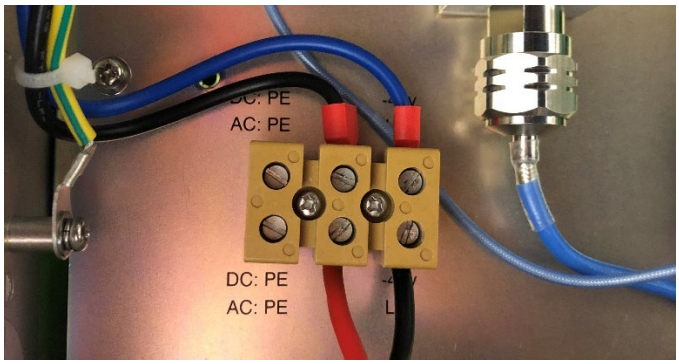


Figure 8: Power Cable connection

End of Section

4 COMMISSIONING

4.1 PRE-COMMISSIONING TASKS

After equipment installation, perform the following steps before equipment powering and commissioning:

- Verify that the expected voltage, current and power levels do not violate any ratings.
- Visually inspect the power connection within the equipment. Ensure that the power cable is correctly and securely connected, including the grounding wire, RF cable and other cables.
- Check the grounding connection and verify that the ground resistance is less than 5Ω.
- Test the antenna system and ensure that the echo loss within working frequency is less than -14dB (VSWR<1.5).
- For more information, check with Comba support and white papers/tech notes from www.combausa.com
- You must have an FCC License or express consent of an FCC Licensee to operate this device.

4.2 COMMISSIONING PROCEDURE

Perform the following procedures for system commissioning.

Table 3: Commissioning Task Explanation

Commissioning Tasks	Observation
1. Isolation detection	● Detects isolation between the service antennas and donor antenna. It can be done from the “commissioning” option at the top menu bar or through Management – Isolation. Performing a manual isolation test in addition to this test is highly recommended.
2. Set filter frequencies	● Enter the center frequency of each channel, only DL frequencies are required. The BDA will automatically setup the UL frequencies based on the licensed band plan.
3. Set filter bandwidth	● Set the filter bandwidth of each channel. The filter bandwidth can be set in batch or individually. Different filter bandwidth results in different delay and rejection. Check the datasheet for details.
4. DL gain	● The DL gain shall be set based on per channel donor input power and target output power: Recommended target output power: ○ 8 channels: 28dBm per channel ○ 10 channels: 27dBm per channel ○ 16 channels: 25dBm per channel ○ 20 channels: 24dBm per channel ○ 32 channels: 22dBm per channel ○ X channels: [37 – 10*log(X)] dBm per channel The target output power can be set in the WEBGUI. Then the gain = (target output power – input power) The gain can be set in batch.
5. UL gain	● UL gain shall be set based on the below criteria: ○ The general uplink noise floor and spurious emission shall be meeting FCC requirement and local jurisdiction’s ordinance. ○ The UL channel power received at Base Station shall meet local jurisdiction’s ordinance. ● Adjust uplink per channel target output power, channel gains, wideband attenuators (in WEBOMT) to meet these requirements. ● Using external attenuators can be considered if the software gain/attenuation cannot meet the requirements. ● UL Squelch and NetProtect features are highly recommended to use to decrease the noise created on the donor tower.
6. Test	● Follow jurisdiction test plan to confirm the settings and validate system performance.

End of Section

5 WEB GUI

The PS BDA can be monitored and controlled via the WEB GUI. Use the following guide to complete the system parameter settings and commissioning.

5.1 WEB GUI CONNECTION

Step 1: Connect the OMT port from the BDA to your PC RJ45 port with the regular RJ45 cable to set up a physical connection. Setup Computer IP address: 192.168.8.100 / 255.255.255.0

Step 2: Open a browser (browser Chrome or Firefox, suggested display resolution is 1024×768), input Web GUI **IP address: 192.168.8.101**, click [Enter]. Must use “incognito mode” for Chrome or “Private Mode” for Firefox / Microsoft Edge

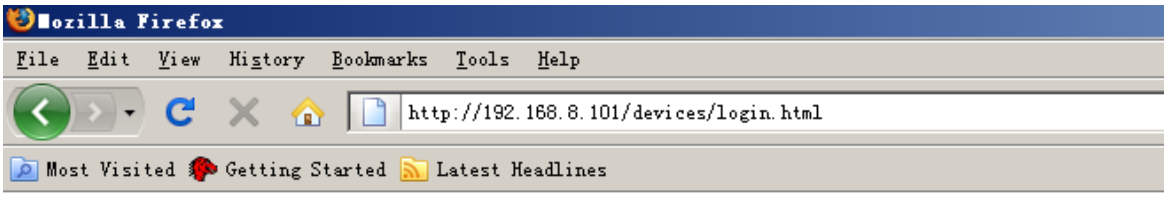


Figure 9: Input IP Address

Step 3: Input **Username: admin; Password** (default password: **admin**). Click [Log in].

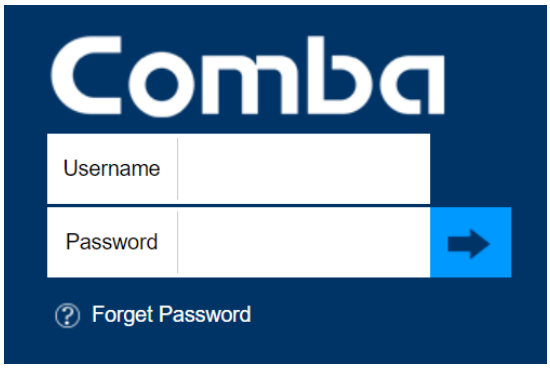


Figure 10: Input Username and Password

5.2 WEB GUI INTRODUCTION

After logging in, the Web GUI main screen will appear.

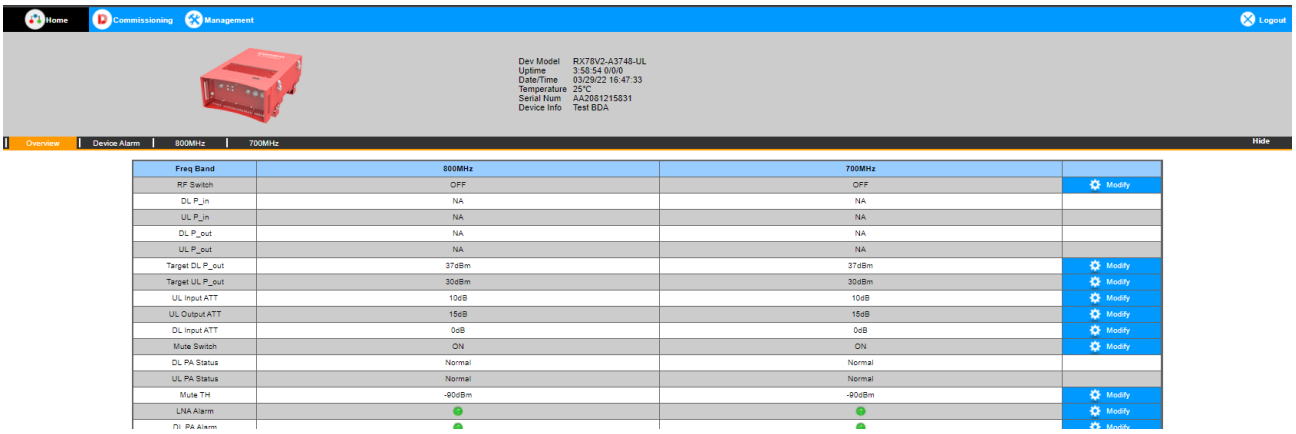


Figure 11: Web GUI Main Screen

On the Comba Web GUI Home Screen, there are three Menu bars:
[Home], [Commissioning], and [Management].

5.2.1 [HOME]

The [Home] Screen shows the equipment status, such as RF Switch status, PA status, alarm information, etc.

- **Overview**

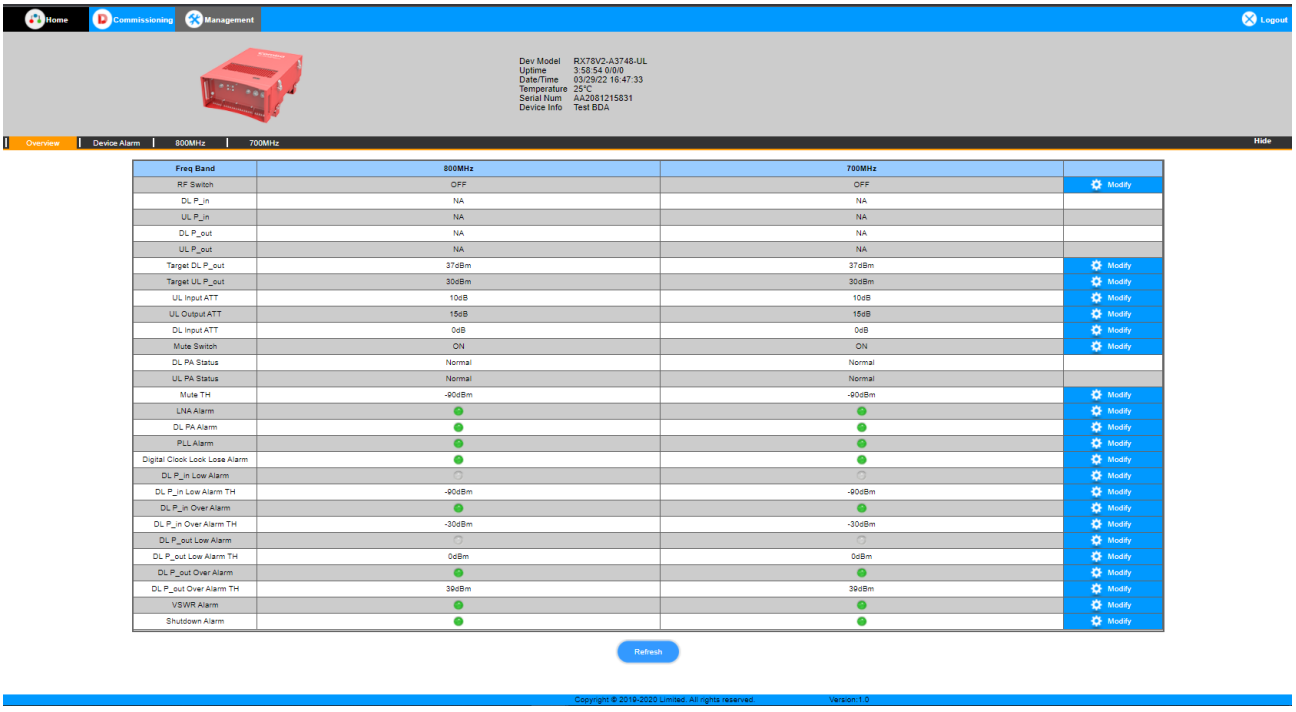


Figure 12: Overview Screen

RF Switch [Setting] – Turn on or off 700MHz or 800MHz
DL P_in [Measurement] – Composite DL input power
UL P_in [Measurement] – Composite UL input power
DL P_out [Measurement] – Composite DL output power
UL P_out [Measurement] – Composite UL output power
Target DL P_out [Setting] – The target composite DL output power, can be adjusted from 30-37dBm
Target UL P_out [Setting] – The target composite UL output power, can be adjusted from 27-30dBm
UL Input ATT [Setting] – the software controlled wideband attenuator at UL frontend,

- Setting the attenuation will reduce the overall gain for all uplink channels (wideband)
- Set the attenuator when the input power is high (typically when input power > -20dBm)

UL Output ATT [Setting] – The software controlled wideband attenuator at UL backend,

- Setting the attenuation will reduce the overall gain for all uplink channels (wideband) and also attenuate the output power.
- Set the attenuator when full power is not needed in the uplink. The attenuator will improve the noise floor.

DL Input ATT [Setting] – the software controlled wideband attenuator at DL frontend,

- Setting the attenuation will reduce the overall gain for all downlink channels (wideband)
- Set the attenuator when the input power is high (typically when input power > -30dBm)

Mute Switch [Setting] – Uplink Squelch switch, all uplink channels will be muted when there is no input higher than the threshold
DL PA Status [Informational – Downlink PA status
UL PA Status [Informational] – Uplink PA status
Mute TH [Setting] – Uplink Squelch threshold, uplink channels will be muted when there is no input higher than the threshold

All alarms refer to Appendix - Alarms

- LNA Alarm
- DL PA Alarm
- PLL Alarm
- Digital Clock Lock Lose Alarm
- DL P_in Low Alarm
- DL P_in Low Alarm TH
- DL P_in Over Alarm
- DL P_in Over Alarm TH
- DL P_out Low Alarm
- DL P_out Low Alarm TH
- DL P_out Over Alarm
- DL P_out Over Alarm TH
- VSWR Alarm
- Shutdown Alarm

➢ Device Alarm

This screen shows the alarm status.

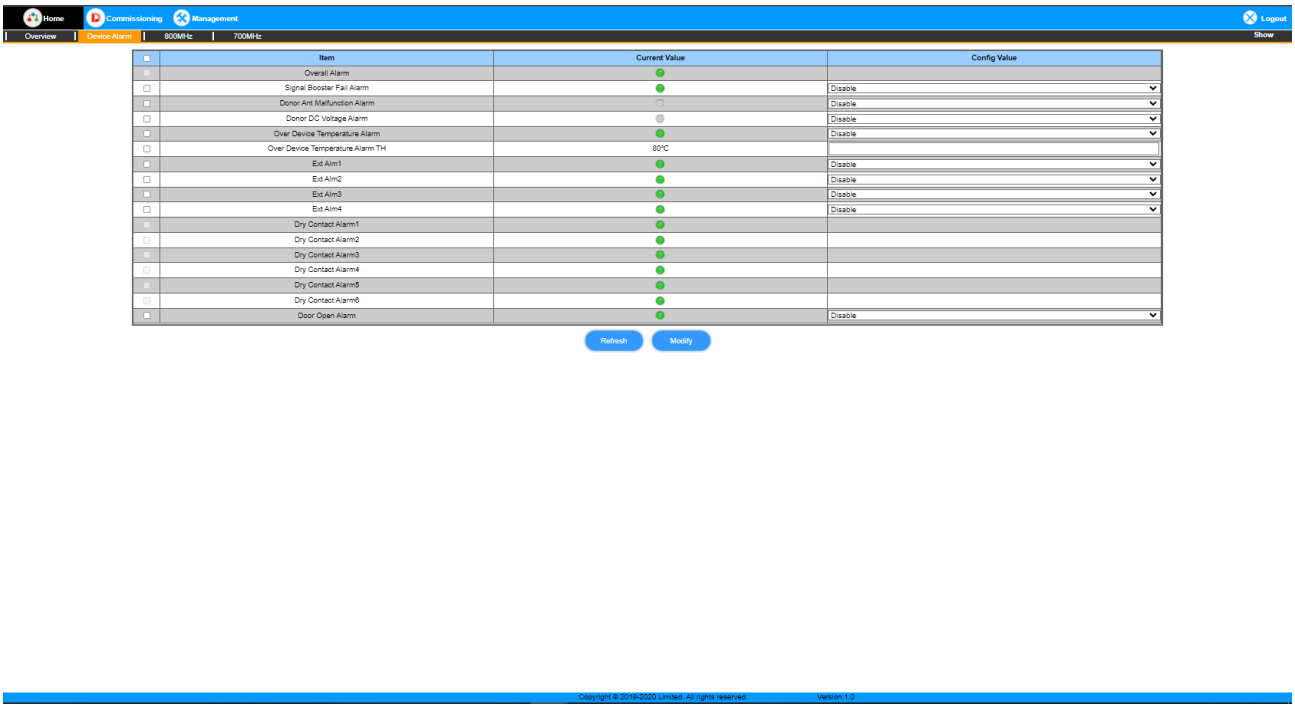


Figure 13: Device Alarm Screen

All alarms refer to Appendix - Alarms

- Overall Alarm
- Signal Booster Fail Alarm
- Donor Ant Malfunction Alarm
- Donor DC Voltage Alarm (If using the Bias-T option between the donor antenna/donor coax, enable the “Donor DC Voltage Alarm” on the “Device Alarm” page and disable “DL P_in Low Alarm” on the “Overview” page)
- Over Device Temperature Alarm
- Over Device Temperature Alarm TH
- Ext Alm 1
- Ext Alm 2
- Ext Alm 3
- Ext Alm 4
- Dry Contact Alarm 1
- Dry Contact Alarm 2
- Dry Contact Alarm 3
- Dry Contact Alarm 4
- Dry Contact Alarm 5
- Dry Contact Alarm 6
- Door Open Alarm

➢ 800MHz/700MHz

This screen is available for the PS BDA to adjust the center frequency and the bandwidth. Based on the BDA configuration ordered, you may see both bands or a single band.

Figure 14: Class A - 800MHz Screen

Click on the Modify to change the filter settings.
Center Freq [Setting] – The center frequency of the filter
Bandwidth [Setting] – The Bandwidth of the filter, check the spec sheet for the delay for each filter bandwidth
Switch [Setting] – Individual filter control, can turn on or off each individual filter
DL_P in [Measurement] – Downlink input power for this filter
DL Target – Target channel output power
DL_P out [Measurement] – Downlink output power for this filter
UL_P in [Measurement] – Uplink input power for this filter
UL Target – Target channel output power
UL_P out [Measurement] – Uplink output power for this filter
DL Gain [Setting] – Downlink gain for this filter
UL Gain [Setting] – Uplink gain for this filter

Click on the Batch to change the filter settings in batch. Options below indicate settings available in the batch setting mode.
Start Filter [Setting]* – The first filter in this batch setting
End Filter [Setting]* – The last filter in this batch setting
*Start/End Filter Note: If these are left blank, the batch setting will change all filters, 1-32
Bandwidth [Setting] – The Bandwidth of the filters from start to end filter
Switch [Setting] – Batch filter control, can turn on or off all filters from start to end filter
DL Target – Target channel output power for the selected filters
UL Target – Target channel output power for the selected filters
DL Gain [Setting] – Downlink gain for the selected filters
UL Gain [Setting] – Uplink gain for the selected filters

5.2.2 [COMMISSIONING]

A "**Work Flow**" of the commissioning process is shown on [Commissioning] Screen. Click the [Start] button, the software will guide you through the commissioning step by step. For details, please refer to chapter 5.3 on page 43.

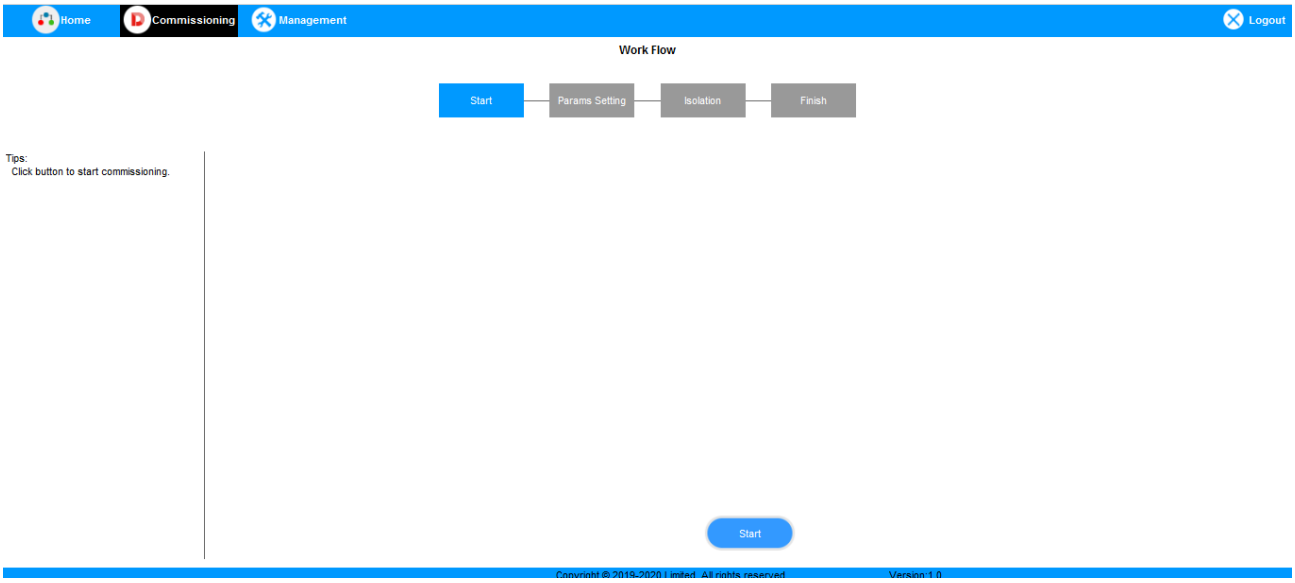


Figure 15: Commissioning Screen

5.2.3 [MANAGEMENT]

Other parameters can be configured on the [Management] Screen. It includes Device Info, Comm. Setting, Alarm Setting, Isolation, Reset, Report, Log and Security.

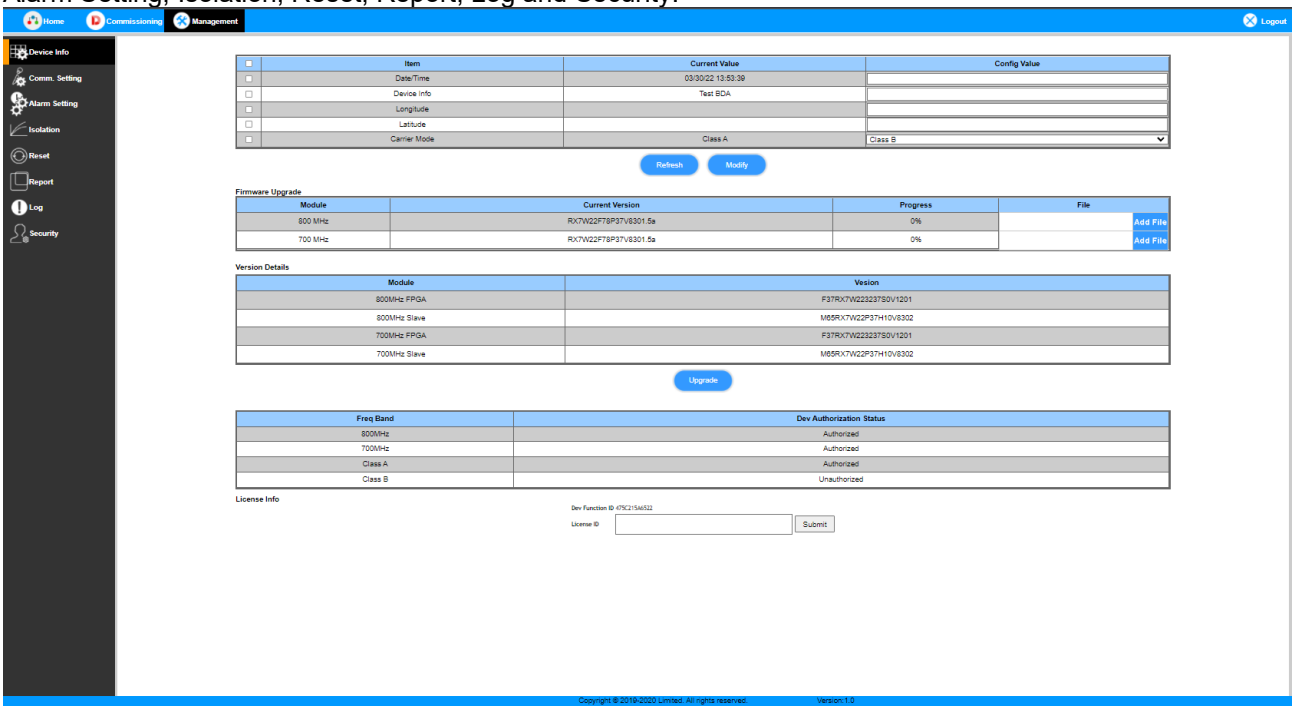


Figure 16: Management Screen

➢ Device Info

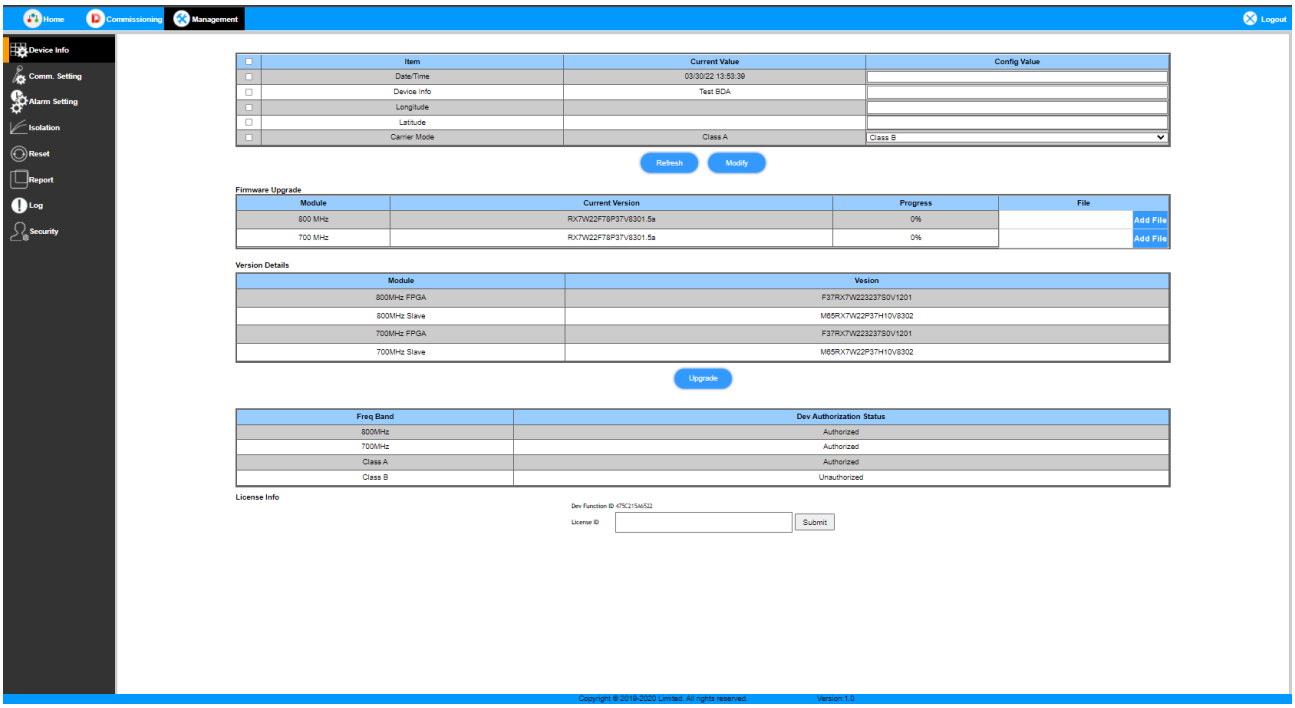


Figure 17: Management – Device Info

Device Info Window:
Date/Time – Set the time to the local BDA time. Clicking in the “Config Value” box will automatically update the input with your computer time.
Device Info – This is a configurable value where the user can describe BDA Information, such as room number or radio system.
Longitude – Enter the longitude of the location of the BDA or building here. Acceptable format is E0-E180 or W0-W180
Latitude – Enter the latitude of the location of the BDA or building here. Acceptable format is N0-N90 or S0-S90
Carrier Mode – Class A or Class B configurable, must contact Comba Sales or Support to change

Firmware Upgrade Window:
800 & 700 MHz Modules – Display current BDA FW versions and where FW can be upgraded by using [Add File] then click on [Upgrade]

Firmware Version Details Window:
800 & 700 MHz FPGA & Slave Modules – Display current FPGA & Slave FW versions and where FW can be upgraded

Newest firmware can be checked for at combausa.com/en/downloads

Frequency Band Window:
Displays what bands and Class BDA purchased, to change BDA Class, contact Comba Sales or Support

License ID Window – For the CriticalPoint BDA, users can switch the configuration anytime by changing the license in the WEBOMT. There are 4 difference licenses: 700MHz single band license, 800MHz single band license, Class A and Class B. Both 700MHz and 800MHz single band licenses are provided with a single band unit. Users can switch between 700MHz configuration and 800MHz configuration. To upgrade from single band to dual band, users need to purchase the dual band upgrade license.

If the equipment is in dual band originally, no license will be provided, because the equipment already comes with dual band activated.

For a Class A upgrade, users will need to purchase a license. Class A BDAs already come compatible with a Class B license.

Contact your Comba Sales or Support Team for changes.

➢ Comm. Setting

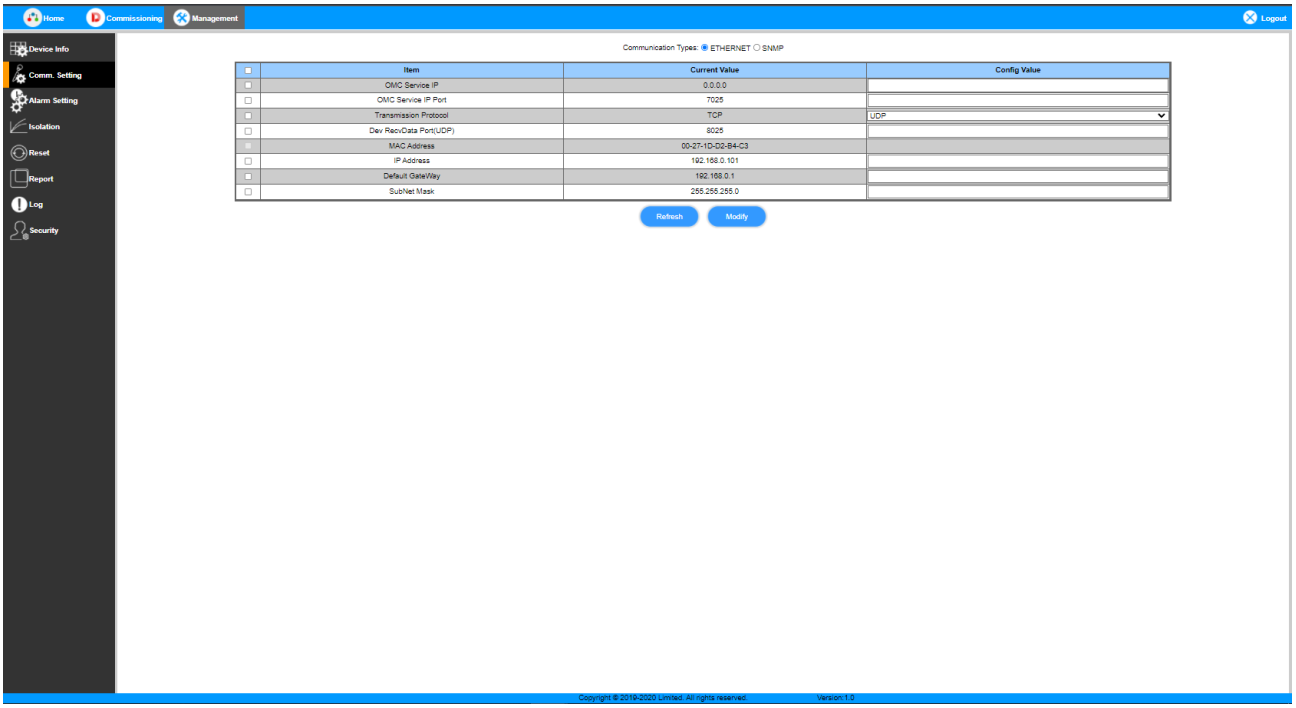


Figure 18: Management – Comm. Setting

Communications Type - This is where remote communication settings are configured:
ETHERNET – Works for Comba Remote Monitoring Platform (CMS)
SNMP – Support 3rd party monitoring platform using SNMP protocols, SNMP V2/V3 are supported

Contact Comba Support at techsupport@combausa.com for MIB files.

➢ Alarm Setting

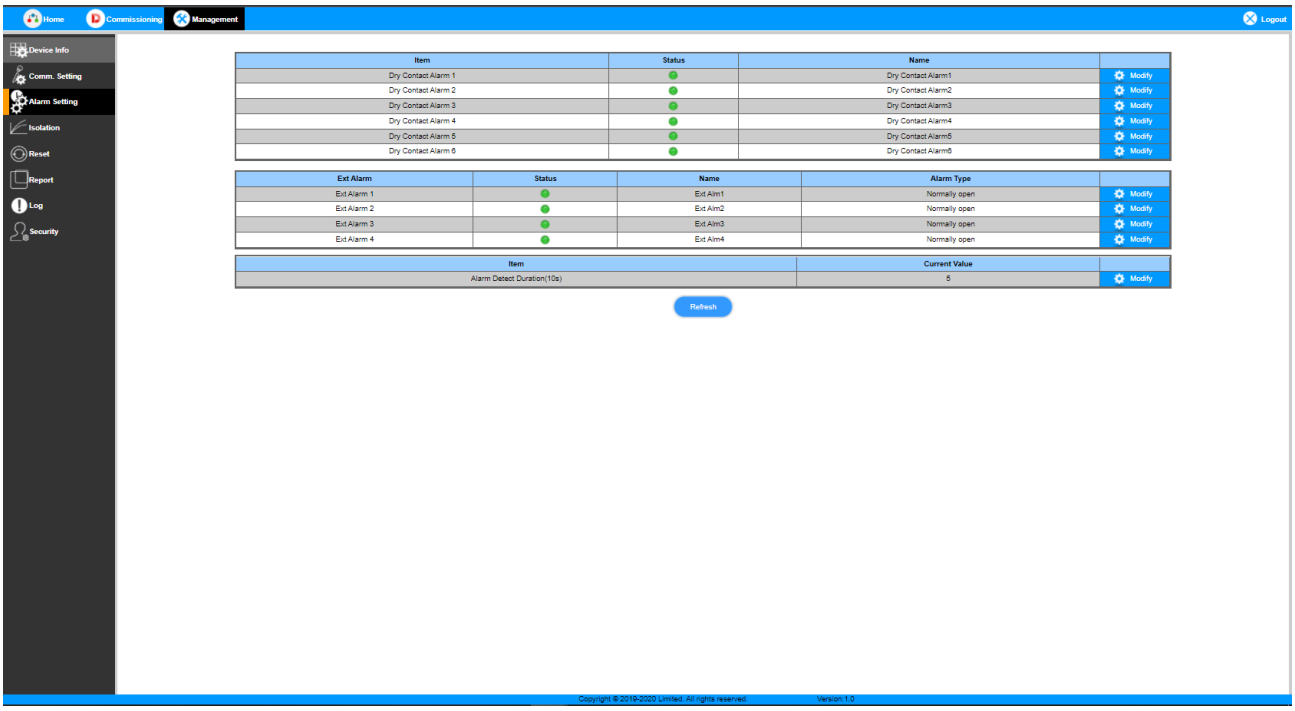


Figure 19: Management-Alarm Setting

Dry Contact Alarms are for dry contact alarm outputs to either the BBU, Annunciator Panel, or Fire Alarm Control Panel. Not all 6 will be used for all installations. For each dry contact, there is a coordinated relay inside the BDA chassis that has a common, normally open, and normally closed contact. These are labeled on the relay board. The user is responsible for programming the alarms as required by the jurisdiction.

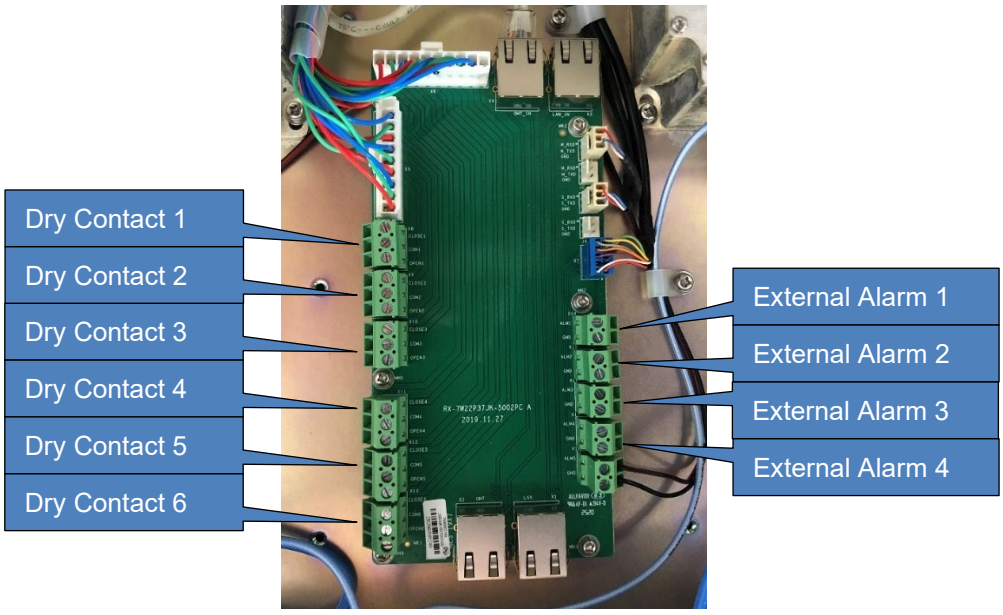


Figure 20: Dry Contact and External Alarm connection

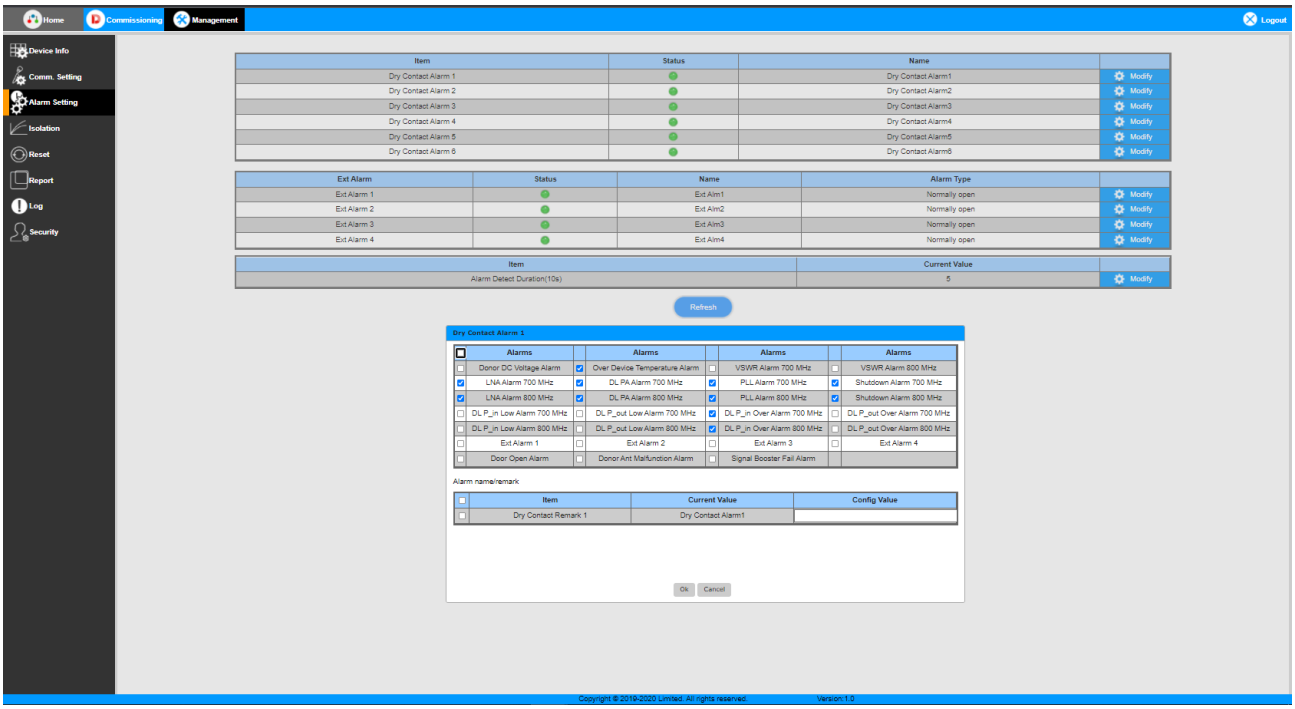


Figure 21: Management-Alarm Setting

For each dry contact alarm, the user can configure which BDA alarms trigger the relay. This can be done by clicking “Modify” located next to each dry contact alarm.

A typical configuration where alarming to the FACP is done at the Comba BBU is:

1. Dry Contact Alarm 1: Signal Booster Fail Alarm
2. Dry Contact Alarm 2: Donor Antenna Malfunction Alarm

In this scenario, dry contact alarm 1 and 2 are both connected to the external alarm inputs on the Comba BBU, and alarming to the FACP or annunciator panel is done through the Comba BBU.

Note that all alarms are user configurable – the user is responsible for determining what dry contacts are needed for the jurisdiction and programming them as required.

The External Alarms are dry contact inputs into the BDA that the BDA can then use to show alarm status. These can be configured by clicking on the “Modify” button and selecting Normally Open or Normally Closed. The user can also rename the External Alarms to display in the GUI that is being physically monitored.

The Alarm Detect Duration(10s) is the time in which an alarm needs to be active before switching the relay status. For example, in the screenshot above, the current value is 5. A signal booster fail alarm would need to be present for 50 seconds to have the dry contact relay 1 change states. This value can be configured between 1 (for 10 seconds) to 100 (for 1,000 seconds).

➢ Isolation

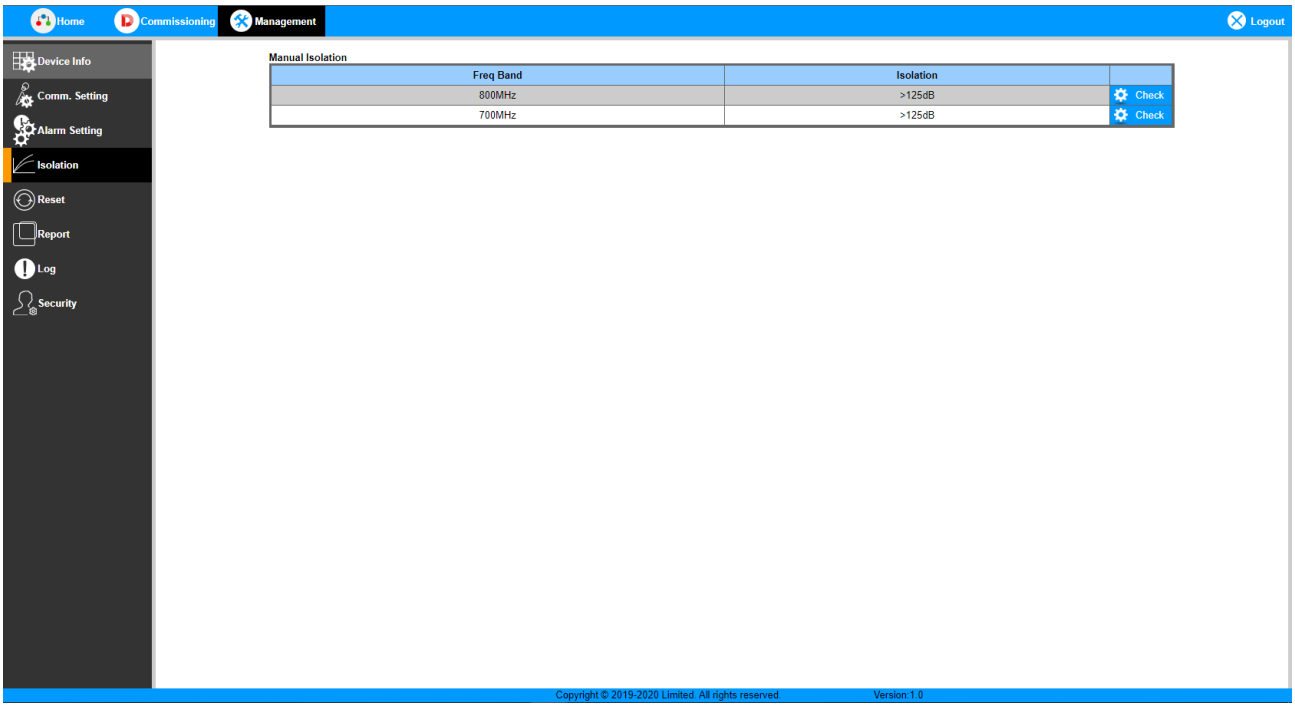


Figure 22: Management – Isolation

Manual Isolation: The BDA injects a DL signal in the guard band out of mobile terminal and measures the resulting signal level on the donor terminal. The difference between the injected and measured signal levels is the manual isolation measurement.

*Note: If external changes are made to the DAS that would affect the isolation after the commissioning Work Flow are made, rechecking isolation may be done in this menu without running through the Work Flow process a second time.

➢ Reset

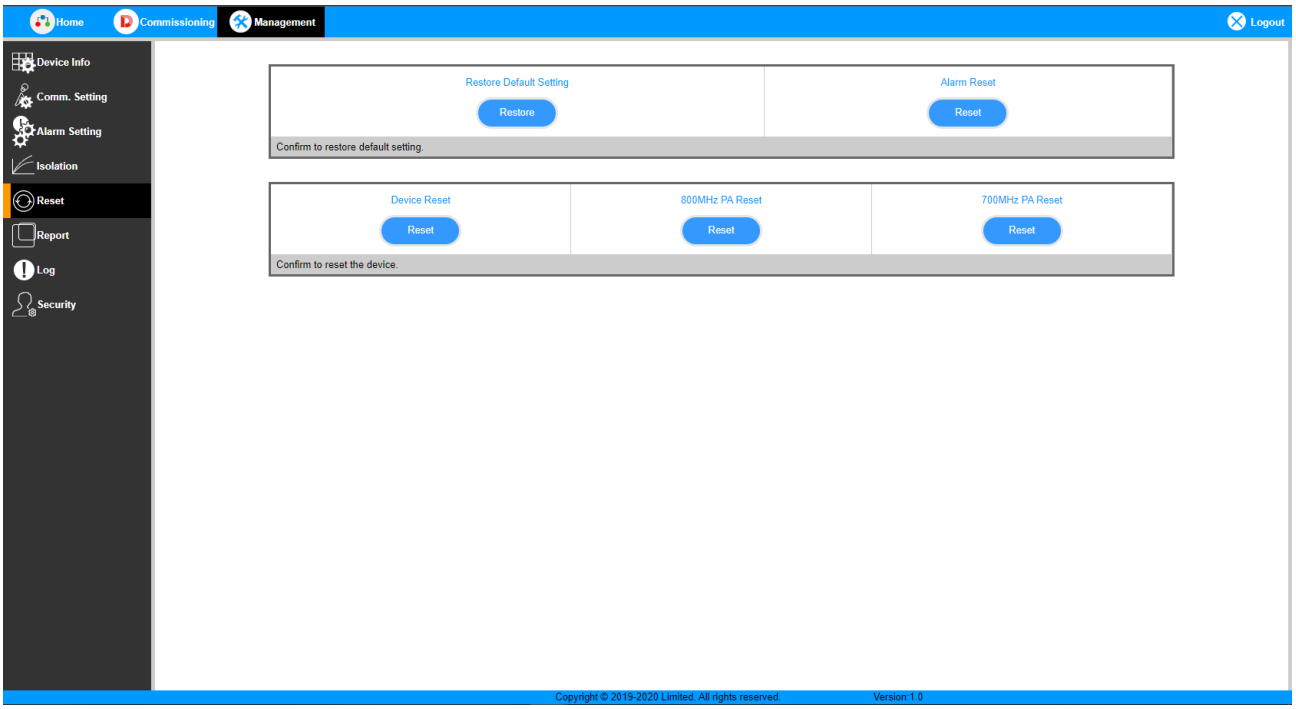


Figure 23: Management – Reset

- Restore Default Setting: Click “Restore” to restore the BDA to factory default. This will clear all settings in the BDA. This cannot be undone.
- Alarm Reset: Click “Reset” to clear the entire alarm log. This cannot be undone.
- Device Reset: Click “Reset” to perform a software reboot of the BDA. This will temporarily turn off RF for approximately 1 to 3 minutes (BDA will show RED Alarm LED on front panel during reboot process).
- 800MHz PA Reset: Click “Reset” to perform a software reboot of the 800MHz PA. This will temporarily turn off RF for approximately 5 seconds on the 800MHz band. This should be used when troubleshooting 800MHz PA alarms.
- 700MHz PA Reset: Click “Reset” to perform a software reboot of the 700MHz PA. This will temporarily turn off RF for approximately 5 seconds on the 700MHz band. This should be used when troubleshooting 700MHz PA alarms.

➢ Report

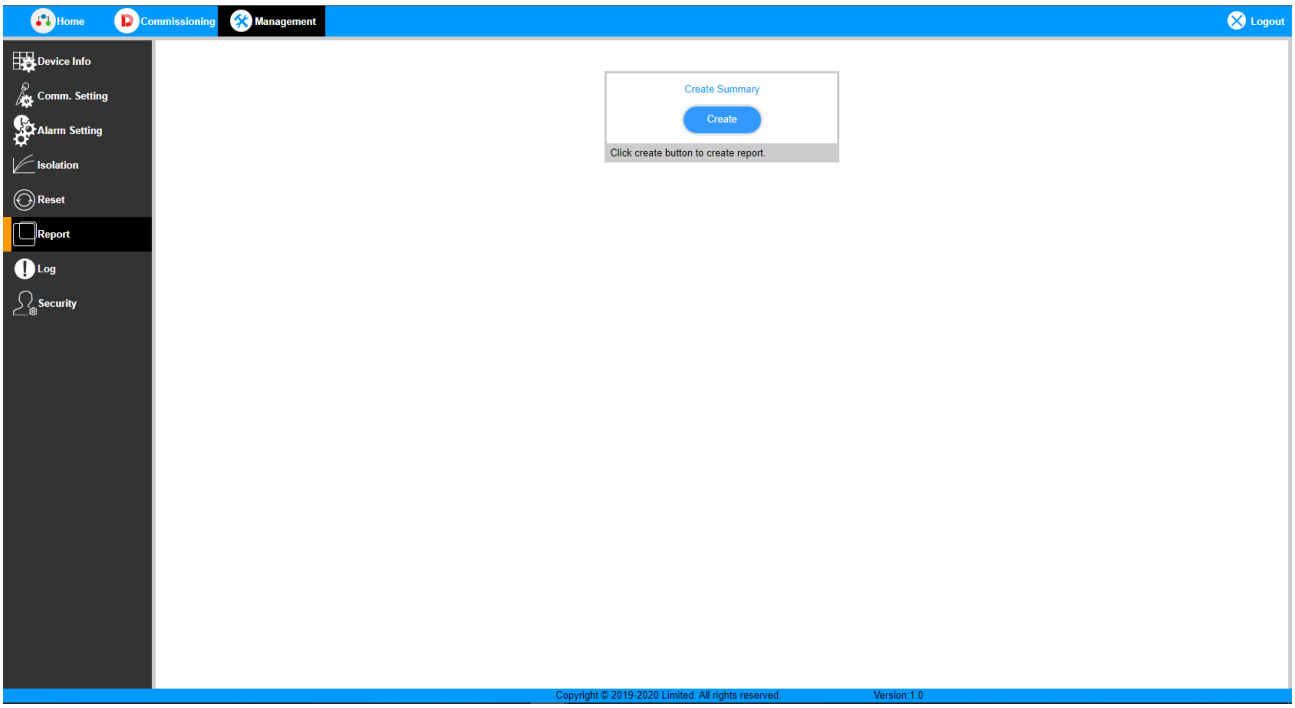


Figure 24: Management – Report

After commissioning, PS BDA can create the summary report about the setting of all the parameters. The report includes all current alarm and RF status, as well as the firmware version and device information.

If using Chrome, navigate to Settings ➔ Content ➔ PDF Documents (or chrome://settings/content/pdfDocuments) and select “Download PDF files instead of automatically opening them in Chrome” for proper report download.

A sample report is located in the appendix of this manual.

➢ Log

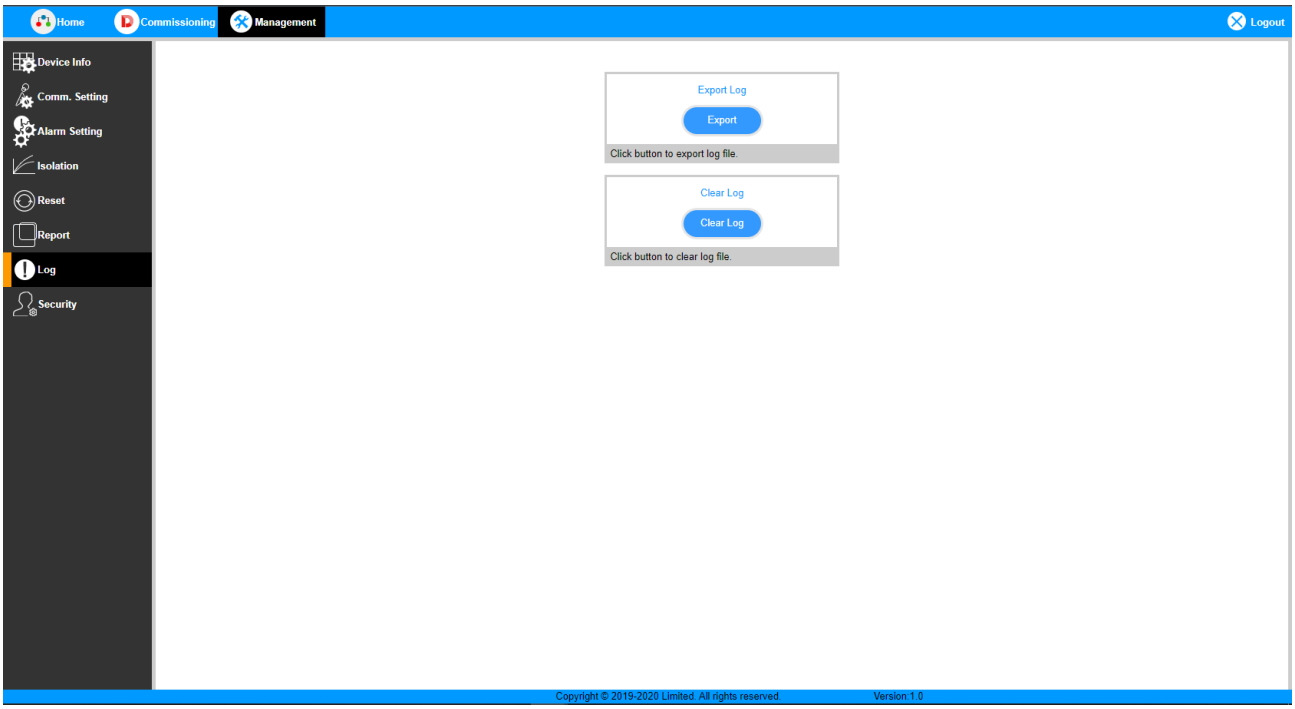


Figure 25: Management – Log

The log is the alarm log of the BDA. This saves all alarms the BDA has experienced since the last “Clear Alarm History” was done.
To export the log, click on “Export”. You will need to extract the alarm file in csv format from the exported zip tar.gz file using a file extracting software. Most .zip software will unzip the tar.gz file.

➢ Security

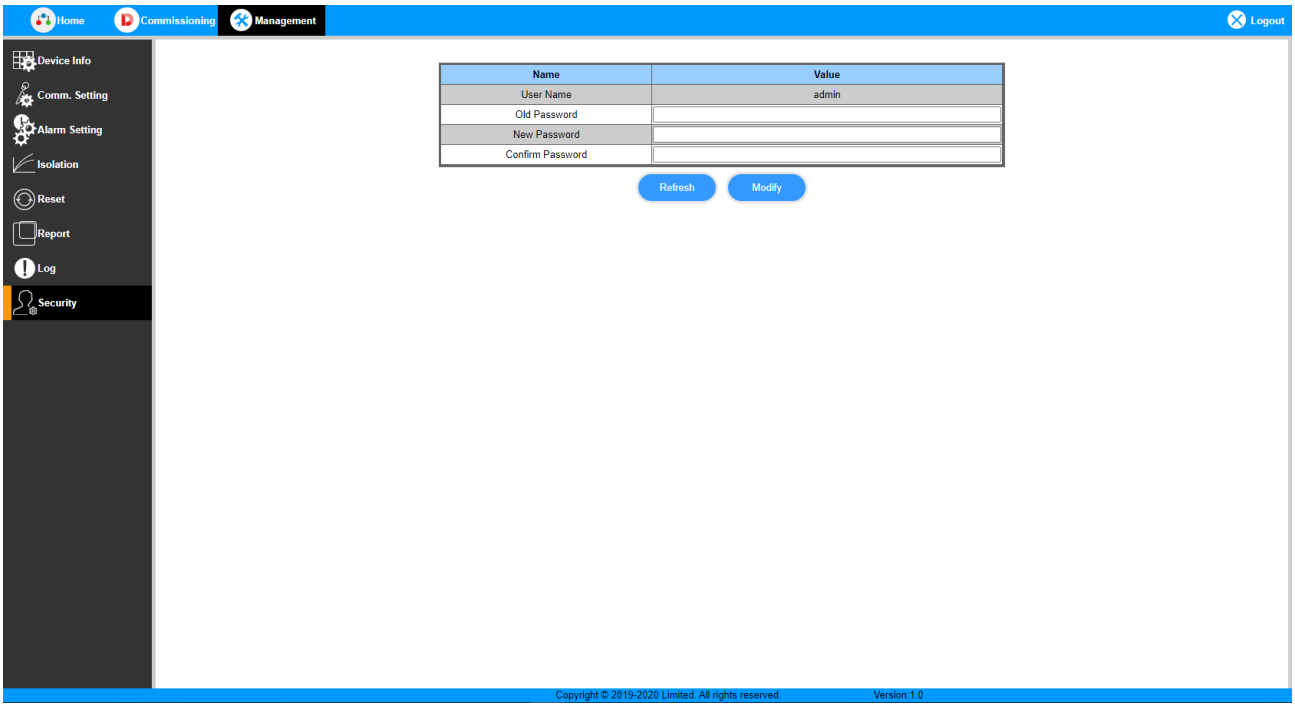


Figure 26: Management – Security

Defualt User Name and Password is “admin” and “admin”

WEB GUI login password can be changed from the security screen.

Note: After changing the password, please remember the new password for the next login. This cannot be reset quickly by tech support, so if it is not required to switch, please leave this as is.

5.3 COMMISSIONING PROCEDURE

5.3.1 Initial Commissioning

To complete the installation and commissioning, users need to follow the steps below.

Step 1: Click the Menu bar [Commissioning] on home screen, a **Work Flow** will be displayed.

Figure 27: Commissioning Procedure – Start

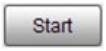
Step 2: Click  to start the process.

Figure 28: Commissioning Procedure – Site Info. Setting

Step 3: Click Modify, to set the site information.

It is mainly used to record device location and Date/Time provides a time reference. Clicking the Config Value of Date/Time will update the Date/Time automatically.

NOTE: Make sure the device is connected with appropriate donor and service antennas before proceeding to step 4.

Step 4: Click Next to enter to Isolation Detection Screen.

Figure 29: Commissioning Procedure – Isolation Detection

- Select a frequency band that needs to be commissioned. It is recommended to select all bands that are going to be used.
- Click Next to start Isolation Detecting, then a [Confirm] window will pop-up. Confirm that the donor and service antennas are all connected, then click on “OK”.

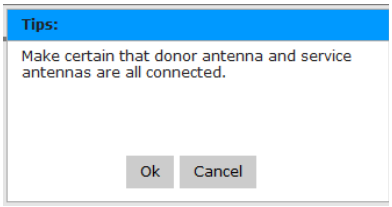


Figure 30: Commissioning Procedure – Isolation Detection Confirm

- Click Ok to continue. If isolation detection passes, the process will go to the RF Settiing Screen shown as Figure 38. If failed, a Tips window will pop-up, users need to check whether the system isolation is adequate.

Step 5: After checking the isolation, Click Next to finish the commissioning. In this window, a summary of the device settings are shown.

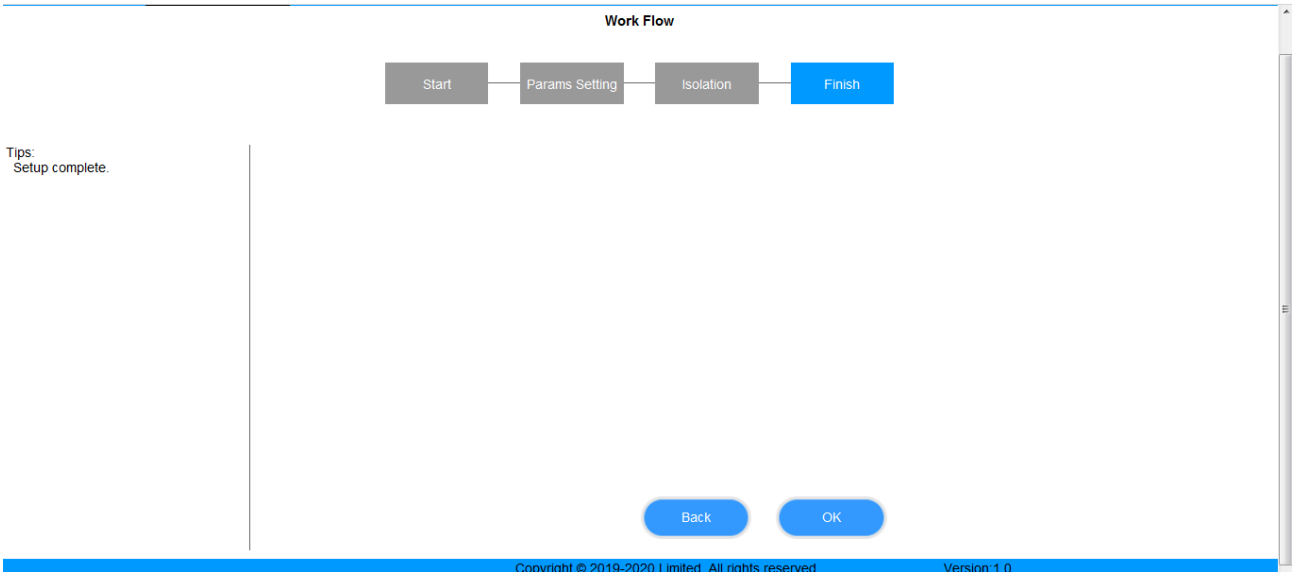


Figure 31: Commissioning Procedure – Finish

5.3.2 Turning Amplifiers On/Off

Step 1: Click on the “800MHz” or “700MHz” frequency tab. Click “Modify” to the righthand side of the screen to set frequency parameters and turn on/off the RF “Switch” for each frequency being used individually, or you can use “Batch” to active all frequency sets at the same time. Individual frequency centers must be set individually with “Modify”.

Figure 32: Individual Modify

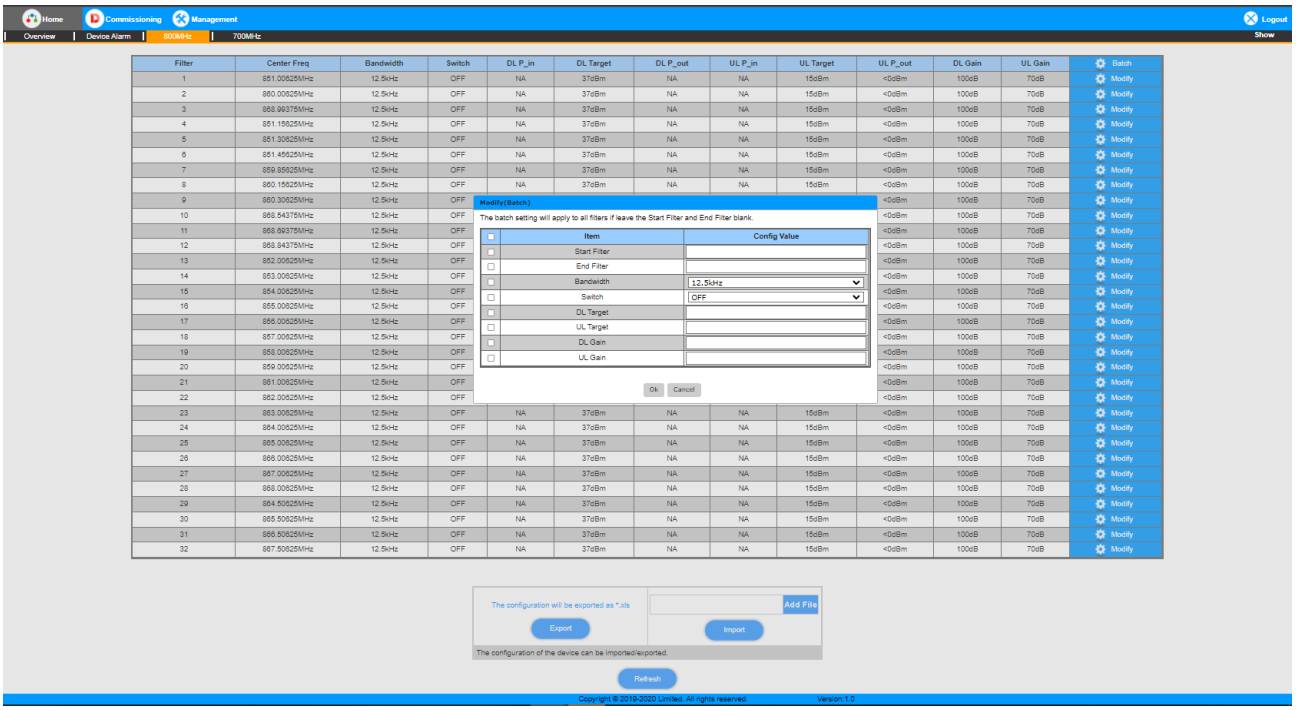


Figure 33: Batch Modify

Step 2: Click on the “Overview” page. Click “Modify” to the right of “RF Switch”. Turn on the corresponding RF amplifier(s) to the frequency band(s) being used.

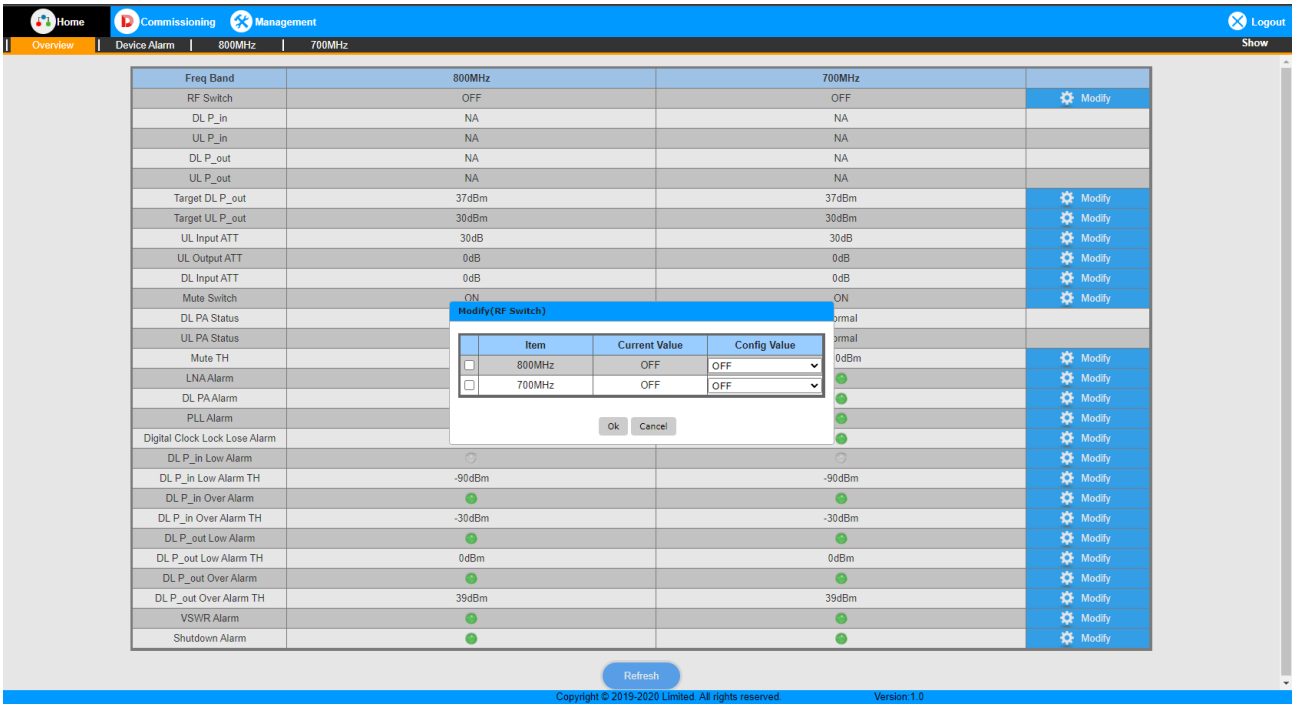


Figure 34: Modify RF Switch

End of Section

6 MAINTENANCE

The PS BDA is designed for trouble-free operation and generally does not need maintenance. Maintenance activities should only be carried out by trained personnel.

Periodic inspection of the repeater equipment(s) is recommended, the recommended tasks include:

- Verify the direction and position of antennas. Re-align if necessary.
- Make sure the cable connector and sealing on the RF cable connectors are not damaged.
- Verify lightning and grounding protection is in good condition.

End of Section

7 APPENDICES

7.1 APPENDIX A:

Antenna installation:

Installation of an antenna must comply with the FCC RF exposure requirements. The antenna used for this transmitter must be mounted on permanent structures.

The FCC regulations mandate that the ERP of type B signal boosters should not exceed 5W, this is equivalent to 8.2W EIRP (39.1dBm).

Therefore, the max antenna gain allowed for this type of signal booster should be limited to the values given by equation 1 (below) for the service antenna.

Equation (1) – Max Service antenna gain Max Service antenna gain (dBi) = 39.1- (37dBm-# of antennas in dB – cable losses in dB).

For example:

No. of Antennas	Cable losses	Max Allowed Antenna Gain
4	3	39.1-(37-6-3)=11.1dBi
1	3	39.1-(37-0-3)=5.1dBi
10	3	39.1-(37-10-3)=15.1dBi

Compliance with FCC deployment rule regarding the radiation of noise

Good engineering practice must be used in regard to the signal booster's noise radiation. Thus, the gain of the signal booster should be set so that the ERP of the output noise from PS BDA should not exceed the level of -43 dBm in 10 kHz measurement bandwidth.

In the event that the noise level measured exceeds the aforementioned value, the PS BDA gain should be decreased accordingly.

In general, the ERP of noise on a spectrum more than 1 MHz outside of the pass band should not exceed -70 dBm in a 10 kHz measurement bandwidth.

RX-7W22 PS BDA has a noise level of -49.8 dBm in 10 kHz measurement at 1MHz spectrum outside the pass band of BDA and an in-band noise level at around -23.64 dBm in a 10 kHz
bandwidth. Therefore, the noise at the antenna input port should be calculated based on equation (2).

Equation (2) – Input Noise to service antenna Input Noise to service antenna: -23.64dBm – antenna splitter losses in dB – cable loss in dB

For example: in band noise

RX-7W22 PS BDA connected to 10 service antennas with a 100m long ½ inch cable.
Losses of such a cable with the connectors = 12dB
Assuming 10 service antennas: antenna splitter losses = 10 dB
Based on equation (2) Input antenna noise (to the antenna) = – 23.64 – 12 –11=-46.64 dBm ERP

For example: Out of band noise
RX-7W22 PS BDA connected to 10 service antennas with a 100m long ½ inch cable.
Losses of such a cable with the connectors = 12dB
Assuming 10 service antennas: antenna splitter losses = 10 dB
Based on equation (2) Input antenna noise (to the antenna) = – 49.8 – 12 – 11= – 72.8dBm ERP

Conclusion:

Good engineering practice requires that in general when the out of band noise measured at the service antenna input is more than -70 dBm per 10 kHz measurement bandwidth, an external band pass filter should be added to attenuate the out of band noise level or decrease the system gain to low the noise level.

All Comba BDAs include high selectivity duplexers and filters to attenuate the out of band noise.

Compliance with FCC Part 90.219 (d)(6)(i)

The deployment rules require that the ERP of intermodulation products should in general not exceed -30dBm. This is not a formidable task since in the vast majority of the passive DAS installations, the signal loss in the DAS due to splitting multiple antenna and cable losses is significant, as well as the above RX-7W22 PS BDA is more likely to be used in a multicarrier environment (more than 2 carriers), which in turn will reduce the intermodulation products produced by the device. The following statement is already in the user manual to highlight the requirement to the installer for the instances where the above does not reduce the ERP of the intermodulation products to -30dBm.The installation procedure must result in RX-7W22 PS BDA complying with FCC requirements 90.219(d). In order to meet FCC requirements 90.219(d), it may be necessary for the installer to reduce the UL and/or DL output power for certain installations.

7.2 APPENDIX B: TOOLS

The following are the recommended list of tools for new installation and routine maintenance.

- Slotted Screwdriver
- Philips Screwdriver
- Ring Spanner (Assorted size: 12~20mm)
- Electrically operated drill and masonry drill bits ∅12mm
- Anti-static Wrist Strap
- Side Cutter
- Frequency Counter (e.g., FLUKE PM6685R)
- RF Power Meter (e.g., Bird 5000)

7.3 APPENDIX C: DECLARATION OF HARMFUL SUBSTANCES AND CONTENT

Product Name: Public Safety BDA

Model: RX-7W22

Harmful substance and content of this product as below table shown:

Part Name	Harmful Substance					
	Pb	Hg	Cd	Cr (VI)	PBB	PBDE
A	×	○	○	○	○	○
B	×	○	○	○	○	○

Note: Above table complies with SJ/T 11364.

○: Indicates that the harmful substance content in all homogeneous materials for corresponding part is under the limited requirement of GB/T 26572.

×: Indicates that the harmful substance content in at least one single homogeneous material for the corresponding part exceeds the limited requirement of GB/T 26572.

Remark: The content of the parts marked with "×" above exceeds the requirement as there is still no mature alternative technologies to achieve the replacement of poisonous and harmful materials or elements.

7.4 APPENDIX D: TROUBLESHOOTING QUICK GUIDE

Alarm list:

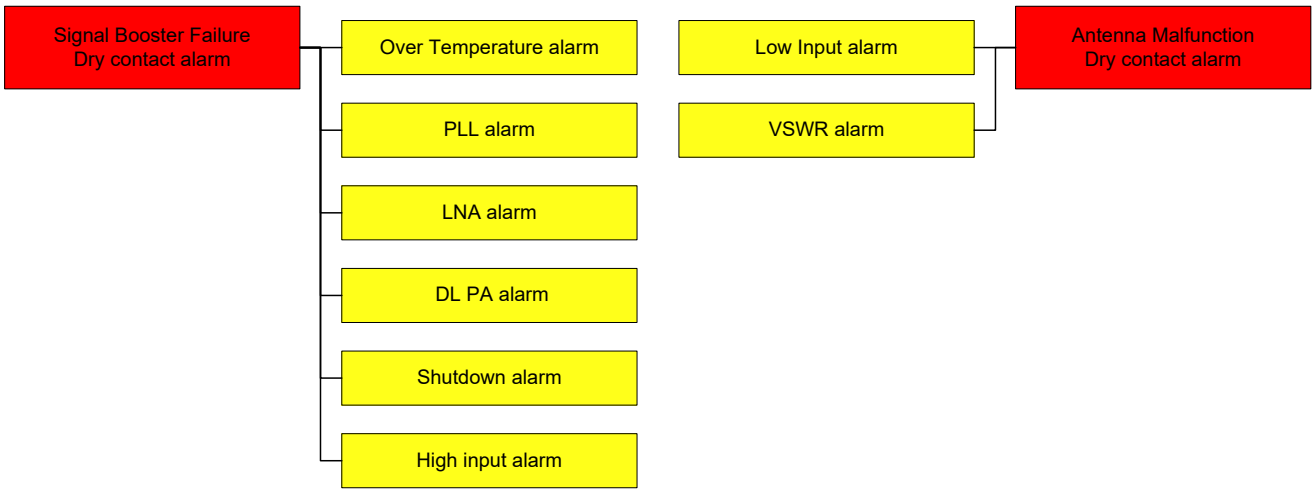


Figure 36: Alarm list

Troubleshooting:

Alarms	Causes and actions
Low input (For DT port)	DT composite input power lower than -80dBm will trigger the alarm 1. Donor antenna/passive system failure 2. Wrong channel frequency setting 3. Site is not commissioned yet
VSWR	Service antenna/passive system failure between BDA and first couple passive devices.
Over temperature	Environment temperature shall be lower than 140degF (60degC).
PLL (Phase lock loop)	Hardware failure, RMA the equipment.
LNA (Low noise amp.)	Hardware failure, RMA the equipment 1. Handling RF connectors when RF power is ON may damage LNA 2. High power injection to DT/MT port may damage LNA
DL PA (Downlink amp.)	Fix any other existing alarms first, then reset PA (see next page) If alarm still exists, RMA the equipment
Shutdown	Other critical alarm causes the equipment shutdown. Follow instructions to fix other alarms first.
High input (for DT port)	Check input power to DT port, the power shall be lower than -30dBm 1. Avoid other inference 2. Put attenuator between antenna and PS BDA, if donor signal is high

Reset PA:
The Downlink PA will try to automatically reboot during the first 2 hours after alarms occur and then may shutdown permanently if alarms still exist. Users need to manually reset the PA in WEBOMT after fixing the alarm.

Go to Management -> Device Reset: Click the Reset button at the lower table to reset DL PA for 800MHz or 700MHz. Refer to Figure 23 on page 28

Power detection:

- The power detection can be done from the reading number in WEBOMT, available in:
  - Downlink input power (per channel)
  - Downlink output power (composite)
  - Uplink input power (per channel)
- Or from the test ports for DT/MT, which are 27dB lower than the DT/MT port respectively, the test ports are able to detect both DL and UL signals

Isolation:

The system doesn't allow users to set a gain higher than **isolation-20dB**. The PS BDA has a mandatory process to check the isolation during commissioning, when isolation is not good (lower than 120dB, even though the PS BDA passes the commissioning process), a check on isolation (between donor and service antennas) is always recommended.

The maximum system gain that can be set must be 20dB lower than the isolation. (For example, if the isolation is 110dB, then the maximum gain that can be set is 90dB.) The PS BDA has an automatic process that prevents the gain being set to a value that does not follow this parameter.

If this gain is insufficient, then the isolation situation must be corrected to provide a higher isolation value.

Safety operation to protect the LNA (low noise amplifier):

1. Connect RF cables before powering on.
2. Any changes or handling of the RF connection requires user to switch off RF power (RF switch off in WEBOMT) or power off the unit first.

7.5 APPENDIX E: DEVICE REPORT EXAMPLE

Device Report

Created Time: 10:47:37 08/17/16

Table1 Basic Info

Dev Model	RX-7W22	Dev Info	
Site ID	00000000	Firmware Version	M75RX7W22FH10V8201
Uptime	1:41:44 0/0/0	RF Unit Alm	Normal
Temperature	37	Over Temperature Alm	Normal
Serial Num	T201605190001		

Table2 Overview RF Info

Slave	Freq Band	DL P_out	RF Switch	PLL	LNA	DL PA	VSWR	High Input	Low Input	Shutdown	PA Status	Isolation
1	800(MHz)	-2dBm	ON	Normal	Normal	Normal	Normal	Normal	Disable	Normal	Normal	120dB
2	700(MHz)	26dBm	ON	Normal	Normal	Normal	Normal	Normal	Disable	Normal	Normal	120dB

Table3 Sub Band RF Info

Freq Band	Sub Band	Center Freq	BandWidth	DL P_in	UL P_in	Switch	UL ATT	DL ATT	UL Gain	DL Gain
800(MHz)	1	851.00625MHz	25KHz	-64.8dBm	-112dBm	ON	28dB	28dB	62dB	62dB
	2	860.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	3	868.99375MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	4	851.15625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	5	851.30625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	6	851.45625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	7	859.85625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	8	860.15625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	9	860.30625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	10	868.54375MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	11	868.69375MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	12	868.84375MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	13	852.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	14	853.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	15	854.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	16	855.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	17	856.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	18	857.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	19	858.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	20	859.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	21	861.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	22	862.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	23	863.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	24	864.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	25	865.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	26	866.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	27	867.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	28	868.00625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	29	864.50625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	30	865.50625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	31	866.50625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB
	32	867.50625MHz	12.5KHz	-106dBm	-112dBm	OFF	30dB	30dB	60dB	60dB

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7.6 APPENDIX F: RMA (RETURN MATERIAL AUTHORIZATION)

Comba

Comba Telecom Ltd.

611 East Wing, No. 8 Science Park West Avenue, Hong Kong Science Park,Tai Po, Hong Kong
Tel: +852 2636 6861 Fax: +852 2637 0966

RMA Request Form

Date: _____

From: _____
Address:
Tel: Fax:
E-Mail:
ATTN:

Product Information:

Item	Model	Serial Number	Return Category	Qty	Problem Description
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Notes:

1. For 'Return Category' column, please select from **A**: Return of Defective Product, **B**: Return of Trial Sample, or **C**: Return of New and Unused Product.
2. If **A** or **C** category of return product is chosen, please give short description of the problem or reason for returning.

Transportation Information:

Location of Product: _____
Transportation Method: _____
Shipping Forwarder: _____

Note: **Location of Product'** must be stated, while '**Transportation Method**' or '**Shipping Forwarder**' can be left blank if not determined.

Signature:

_____

For Comba Use (Only)
Return Merchandise Authorization Number (RMA#):
Recommended Action:
Shipment and Handling Cost to be paid by:

Approved by:

_____ **Date:** _____

7.7 TARGET OUTPUT POWER TABLE

Number of Channels	Offset (dB)	Downlink Target Output Power / Channel (dBm)
1	0.0	37.0
2	3.0	34.0
3	4.8	32.2
4	6.0	31.0
5	7.0	30.0
6	7.8	29.2
7	8.5	28.5
8	9.0	28.0
9	9.5	27.5
10	10.0	27.0
11	10.4	26.6
12	10.8	26.2
13	11.1	25.9
14	11.5	25.5
15	11.8	25.2
16	12.0	25.0
17	12.3	24.7
18	12.6	24.4
19	12.8	24.2
20	13.0	24.0
21	13.2	23.8
22	13.4	23.6
23	13.6	23.4
24	13.8	23.2
25	14.0	23.0
26	14.1	22.9
27	14.3	22.7
28	14.5	22.5
29	14.6	22.4
30	14.8	22.2
31	14.9	22.1
32	15.1	21.9

End of Section

End of Document

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