

# PSR VU 9537 Installation and Operating Manual

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Version 0.2



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## Change List

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# Terms and Abbreviations

The following is a list of abbreviations and terms used throughout this document.

Abbreviation/Term	Definition
<b>AGC</b>	Automatic Gain Control
<b>ALC</b>	Automatic Level Control
<b>AROMS</b>	ADRF' Repeater Operation and Management System
<b>BCU</b>	Band Combiner Unit
<b>BTS</b>	Base Transceiver Station
<b>BDA</b>	Bi-directional Amplifier
<b>CDMA</b>	Code Division Multiple Access
<b>CHC</b>	Channel combiner
<b>CW</b>	Continuous Wave (un-modulated signal)
<b>DAS</b>	Distributed Antenna System
<b>DL</b>	Downlink
<b>Downlink</b>	The path covered from the Base Transceiver Station (BTS) to the subscribers' service area via the repeater
<b>HE</b>	Head End
<b>HPA</b>	High Power Amplifier
<b>HW</b>	Hardware
<b>IF</b>	Intermediate Frequency
<b>LNA</b>	Low Noise Amplifier
<b>LTE</b>	Long Term Evolution
<b>MS</b>	Mobile Station
<b>NMS</b>	Network Management System
<b>ODU</b>	Optical Donor Unit which is located in ADXV-HE.
<b>OEU</b>	Optic Expansion Unit
<b>PLL</b>	Phased Locked Loop
<b>POI</b>	Point Of Interface
<b>PSU</b>	Power Supply Unit
<b>RF</b>	Radio Frequency
<b>RU</b>	Remote Unit which is composed of master RU and multiple slaves RU
<b>RM</b>	Remote Module
<b>SW</b>	Software
<b>UL</b>	Uplink
<b>Uplink</b>	The path covered from the subscribers' service area to the Base Transceiver Station (BTS) via the repeater
<b>VSWR</b>	Voltage Standing Wave Ratio

## 1. INTRODUCTION

PSR-VU-9537 bi-directional amplifier (BDA) extends the coverage area of radio communications in buildings and RF shadow environments.

The unit features low noise figure and wide dynamic range.

### 1.1 Highlights

- Single band choosable between VHF or UHF band by GUI
- Simultaneous Filter Supporting 1 Wide Band and Up to 8 Non-Contiguous Narrow Bands
- Fanless
- Significant Filter Roll-off performance (Wide: 65dBc@Filter Bandwidth Edge + 500KHz | Narrow: 60dBc@Filter Bandwidth Edge + (Filter BW / 2))
- Supports SNMP v1, v2, v3 (get, set & traps)
- Web-based GUI Interface; No 3rd party GUI software required
- Web-GUI connectivity via DHCP in host mode
- External Alarm Function supporting dry contacts 8 outputs and 2 inputs

1.2 Quick View

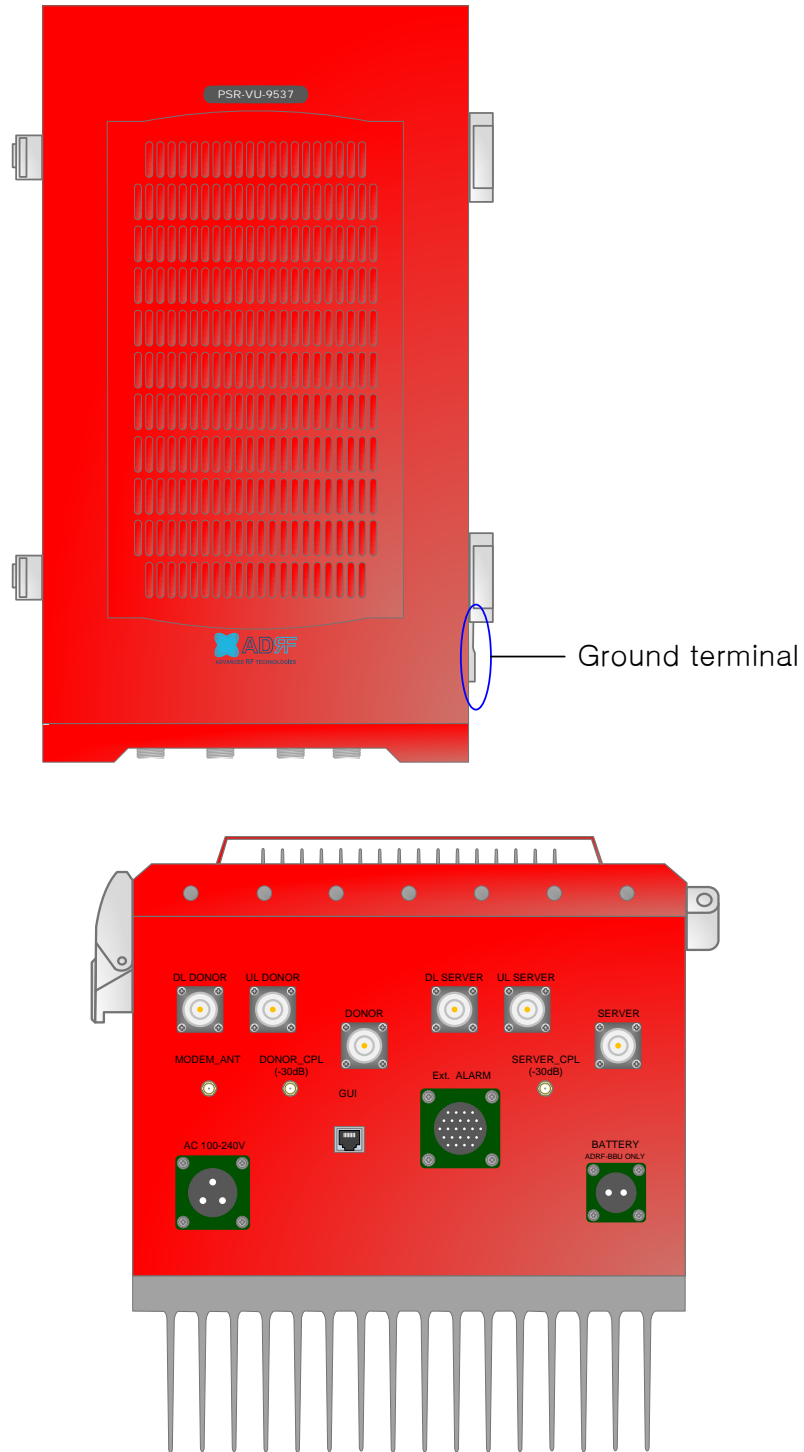


Figure 1-1 PSR-VU-9537 Quick View (front and bottom)

### 1.3 Warnings and Hazards



#### WARNING! ELECTRIC SHOCK

Opening the PSR-VU-9537 could result in electric shock and may cause severe injury.



#### WARNING! EXPOSURE TO RF

Working with the PSR-VU-9537 while in operation, may expose the technician to RF electromagnetic fields that exceed FCC rules for human exposure. Visit the FCC website at [www.fcc.gov/oet/rfsafety](http://www.fcc.gov/oet/rfsafety) to learn more about the effects of exposure to RF electromagnetic fields.

#### RF EXPOSURE & ANTENNA PLACEMENT Guidelines

Actual separation distance is determined upon gain of antenna used.

Please maintain a minimum safe distance of at least 500 cm while operating near the donor and the server antennas.

#### WARRANTY

Opening or tampering the PSR-VU-9537 will void all warranties.

**Lithium Battery: CAUTION. RISK OF EXPLOSION IF BATTERY IS REPLACED BY INCORRECT TYPE. DISPOSE OF USED BATTERIES ACCORDING TO INSTRUCTIONS.**



Preclude indications that Home/ personal use are prohibited.

Use of unauthorized antennas, cables, and/or coupling devices not conforming with ERP/EIRP is prohibited.

### FCC Part 15 Class A

**NOTE:** 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 their own expense.

### FCC Part 20

**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. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

### FCC Part 90 Class A

**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. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at [www.fcc.gov/signal-boosters/registration](http://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.

### FCC Part 15.21

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

### RSS-GEN, Sec. 7.1.2– (transmitters)

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada.

Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

### RSS-GEN, Sec. 7.1.2– (detachable antennas)

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

### **RF Radiation Exposure**

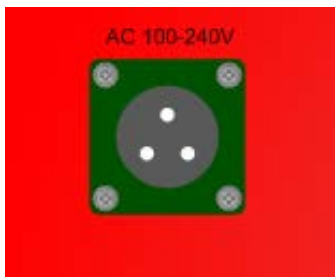
This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 500 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. RF exposure will be addressed at time of installation and the use of higher gain antennas require larger separation distances.

### **RSS-102 RF Exposure**

L'antenne (ou les antennes) doit être installée de façon à maintenir à tout instant une distance minimum de au moins 500 cm entre la source de radiation (l'antenne) et toute personne physique. Cet appareil ne doit pas être installé ou utilisé en conjonction avec une autre antenne ou émetteur.

## 2. CABLE CONNECTION

### 2.1 AC Power

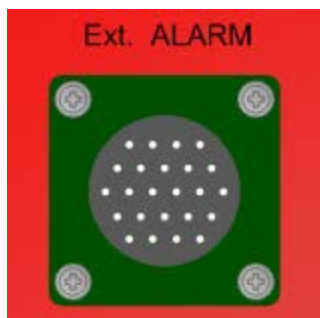


**Figure 2-1 AC Power port**

AC power is accepted through a standard 3-wire male plug (MS3106A-22-2S) with phase, neutral and ground leads. The AC power is wired to a high efficiency DC switching power supply which is UL approved. The power supply runs the amplifiers and device including RF Module, controller, LED, etc.

The metal enclosure of the BDA is connected to ground.

### 2.2 External Alarm



**Figure 2-2 External Alarm port**

This port should be connected only to ADRF External Alarm Box.

### 2.3 RF

The RF connections are made via two type “4.3-10” female connectors. The RF connector labeled “DONOR” must be connected to the antenna pointing towards the base station. The RF connection labeled “SERVER” must be connected to the antenna facing the area to be covered by the BDA.

The RF connections must be made through cables with characteristic impedance of 50 ohms.

Separation between the antennas is necessary to prevent oscillation. Oscillation occurs when the signal entering the system continually reenters, due to the lack of separation between the donor and server antennas. In other words,

the signal is being fed back into the system. This creates a constant amplification of the same signal. As a result, the noise level rises above the signal level.

To prevent feedback, the donor and server antennas must be separated by an appropriate distance to provide sufficient isolation. Isolation is attained by separating antennas a sufficient distance so that the output of one antenna does not reach the input of the other. This distance is dependent on the gain of the repeater.

## 2.4 Battery

This port should be connected to ADRF 48VDC BBU(Battery back-up unit) via dedicated cable provided by ADRF.

## 2.5 Grounding

A ground cable is included in the box. The grounding terminals are located at lower right-hand side of the BDA. The grounding cable should be properly connected before powering on the equipment.



**Figure 2-3 Protective Earthing Conductor**

Ground terminals located on the side consisted of a 1.25mm<sup>2</sup>(16AWG) and should be permanently connected to earth(Protective earthing conductor).

### 3. RF EXPOSURE WARNING

In order to comply with the FCC RF exposure requirements, the BDA's antenna installation must comply with the following:

The outdoor antenna (Yagi type or similar directional antenna if off air donor signal used) must be installed so as to provide a minimum separation distance of 0.3 meters (60 cm) between the antenna and persons within the area. (This assumes a typical antenna with gain of [10.1 dBi, VSWR  $\leq$  1.5:1,  $Z_0=$  50 ohms, and a cable attenuation between 1-10 dB).

The indoor antenna (Omni directional or leaky cable) must be installed so as to provide a minimum separation distance of at least 8 inches (20 cm) between the indoor antenna connected to the RF booster and the human user's body within the area. (This assumes a typical wide beam type antenna with gain of 0-2 dBi, VSWR  $\leq$  2:1,  $Z_0=$  50 ohms, and a cable attenuation of between 1-10 dB).

### 4. INSTALLATION



**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. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

### **DO NOT APPLY A.C. POWER TO THE BDA UNTIL CABLES ARE CONNECTED TO BOTH PORTS OF THE BDA AND THE ANTENNAS.**

1. To mount on a wall. Using appropriate screws and anchors, attach the BDA to the wall at the four mounting holes
  2. Ensure that the isolation between the donor antenna and the service antenna is at least 15 dB greater than the BDA gain.
  3. Connect the cable from the donor antenna to the BDA connector labeled "DONOR" and the cable from the service antennas to the BDA connector labeled "SERVER".
  4. Connect the AC power cord to the BDA and turn on the switch at the left-hand of PSU.
  5. Installation of the BDA is now complete. Adjust the gain controls to suit the specific signal environment through GUI on your PC.
- To prevent feedback, the donor and server antennas must be separated by an appropriate distance to provide sufficient isolation. Isolation is attained by separating antennas a sufficient distance so that the

output of one antenna does not reach the input of the other. This distance is dependent on the gain of the repeater.

- 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>)

## 5. DEFAULT ITEMS

Items	Model name
Antenna	
Cable	
Coupling device	

## 6. SPECIFICATION

Parameters		Specification		Remarks
		DL	UL	
Frequency Range (Nominal Bandwidth) (MHz)	VHF	FCC: 150~174 (24) IC: 138~144 (6), 148~174 (26)		
	UHF	FCC: 406.1~470 (64.1), 470~512 (42) IC: 406.1~430 (24.1), 450~470(20)		
Composite Output Power	VHF	28 dBm	24 dBm	
	UHF	37 dBm	27 dBm	
Rated Mean Output Power	VHF	28 dBm	24 dBm	Rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, 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.
	UHF	37 dBm	27 dBm	
Nominal Pass Band Gain (dB)	VHF	85	85	
	UHF	95(LMR450) 85(APCO25)	95(LMR450) 85(APCO25)	
Filter selection		Wide or Narrow	Wide or Narrow	
Support Filter numbers	Wide	1		
	Narrow	Up to 8(Noncontiguous)		
Filter Bandwidth	Wide(MHz)	1/2/4/5		Future update available by custom filter
	Narrow(kHz)	6.25 ~75 (6.25 x n , n= 1~12)		Noncontiguous
Filter Roll-off		Wide: 65dBc@Filter Bandwidth Edge + 500KHz Narrow: 60dBc@Filter Bandwidth Edge + (Filter BW / 2)		
Spurious		FCC meet		
Passband Ripple		±2 dB		Any 15MHz BW
ALC Dynamic Range		60dB		
Gain Dynamic Range		45dB		

Channel Setting Resolution	0.5 kHz	
Noise Figure @ Max. gain	3.5 dB	Without Duplexer
System Group Delay	5-240us	dependent on filter bandwidth and required adjacent channel rejection
Power Supply	110 -240 VAC, 60 Hz (Free Voltage)	
Power Consumption	< 216Watt	
Max RF Input Power	-20dBm	
No damage Max Input Power	+10 dBm	
Impedance	Input : 50 Ohm Output: 50 Ohm	
RF Connector	4.3-10(Female)	
VSWR	< 1.3:1	
Operating Temperature	-40°F to +140°F (-40°C to +60°C)	
Humidity	10% - 90% RH Condensed	
Dimensions W x D x H	12.0 x 13.0 x 21.7 in (w/out mount bracket)	
Weight	65lbs (w/out mount bracket)	
Enclosure	IP66	