

Chapter 3

Installation

Introduction

This chapter contains unpacking, inspection and installation instructions for installing and powering up the WRH.

Site Survey

Powerwave recommends that a site survey be performed prior to equipment ordering or installation. Performing a detailed site survey reduces or eliminates installation and turn-up delays. Pay particular attention to power plant capacity, cooling needs, floor space, and RF/DC cabling/breaker requirements. Cabinet dimensions and weights are listed in Chapter 5.

Unpacking and Inspection

This equipment has been operated, tested, and calibrated at the factory. Carefully open containers to remove equipment. Retain all packing material that can be reassembled in the event unit must be returned to the factory. Perform the following steps:

- Visually inspect equipment for damage that may have occurred during shipment. If possible, in the presence of the delivery person.
- Check for evidence of water damage, bent or warped chassis, loose screws or nuts, or extraneous packing material in connectors.

If equipment is damaged, file a claim with the carrier once the extent of any damage is assessed.

If equipment must be returned to factory, please contact factory for a Return Material Authorization (RMA), see Chapter 4.

WRH-V Location

The WRH-V is designed with a weather proof outdoor cabinet that can be mounted without any kind of shelter from rain, snow or hail. The same unit can be installed indoors. A preferable site for the WRH-V is a location free of obstructions, easily accessible and allows for proper air-flow and ventilation.

If a WRH-V is installed outdoors and can be exposed to direct sunshine, it is essential that air circulates around the WRH-V with no obstacles. The operating temperature must not exceed 131°F (55°C). A shelter can be used to shade the WRH-V from direct sunshine.

Never open a WRH-V when rain, snow, hail, high humidity or high winds are present unless some kind of temporary shelter can be erected.

Mounting

The WRH-V is easy to mount using the provided mounting bracket, which has 9/16-inch (14mm) holes for 3/8-inch (10mm) or 1/2-inch (12mm) fixing screws. Clamps with C-C measurements of 3.5-inch (90mm), 5.3-inch (135mm), 5.7-inch (144mm), 8.1-inch (205mm), 9.8-inch (250mm), and 11.8-inch (300mm) can be used as well. The vertical C-C measurement for these is 16.2-inch (411mm). There is a 9/16-inch (14mm) single hole in the middle of the mounting bracket, marked 'A' in the figure, which is intended for a locking screw to lock the bracket into place.

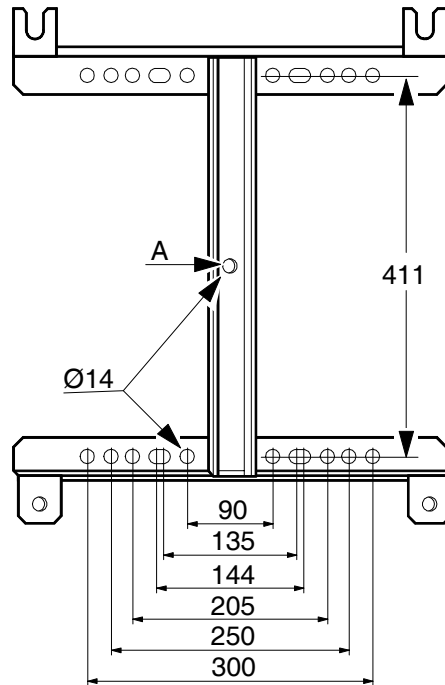


Figure 3-1 Mounting Bracket

Normally, the WRH-V is mounted on a wall, pole, or mast. Figure 3-2 illustrates the installation of the mounting bracket on a wall using four fixing screws and a locking screw.

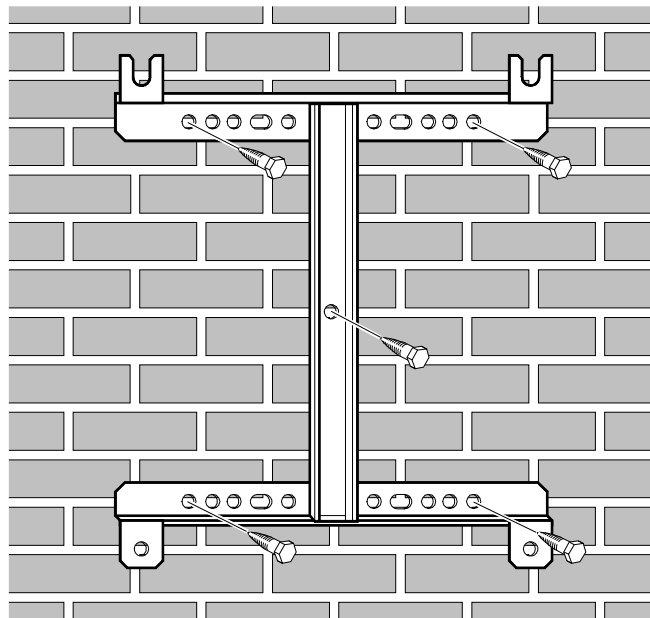


Figure 3-2 Mounting Bracket Installation on Wall

Figure 3-3 illustrates the installation of the mounting bracket on a pole using two 5.7-inch (144mm) U-shaped clamps and a locking screw.

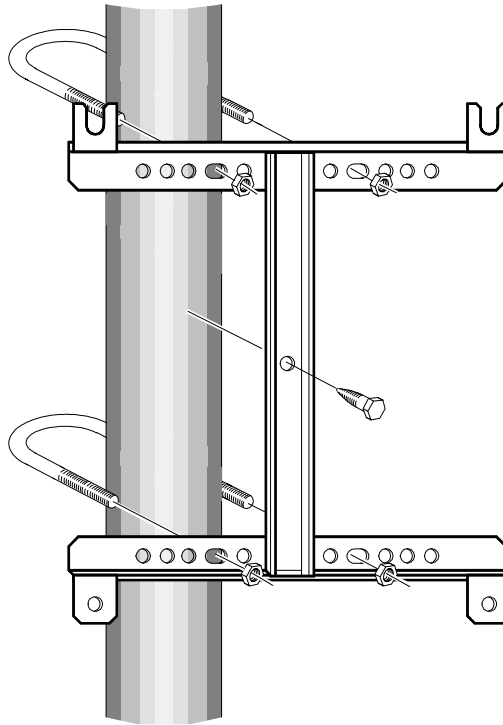


Figure 3-3 Attaching the Bracket to a Pole

Figure 3-4 illustrates a mast installation using two 11.8-inch (300mm) bar-shaped clamps and no locking screw.

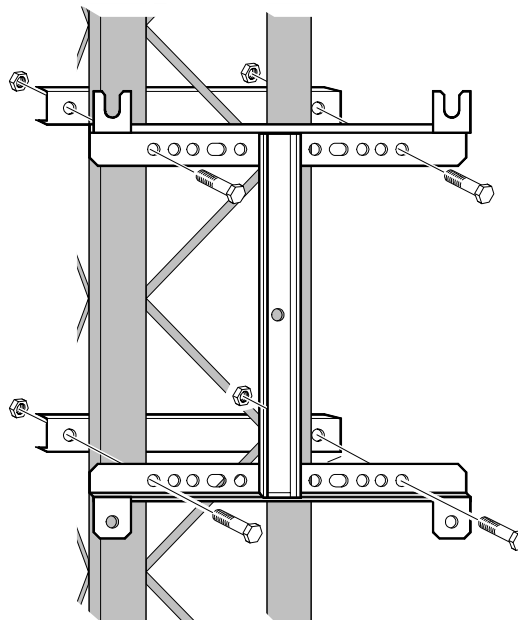


Figure 3-4 Attaching the Bracket to a Mast

After installing the mounting bracket, hang the WRH-V on the upper supports, as illustrated in Figure 3-5. Tighten the upper and lower mounting screws to secure it into place using the 6mm hex socket wrench. Locking cylinders, used to prevent unauthorized removal of the repeater, can be inserted and locked with a

key after the lower screws have been tightened. Make sure the donor antenna, directed towards the BTS antenna, and the service antenna, directed towards the area to be covered by the WRH, are mounted and installed properly.

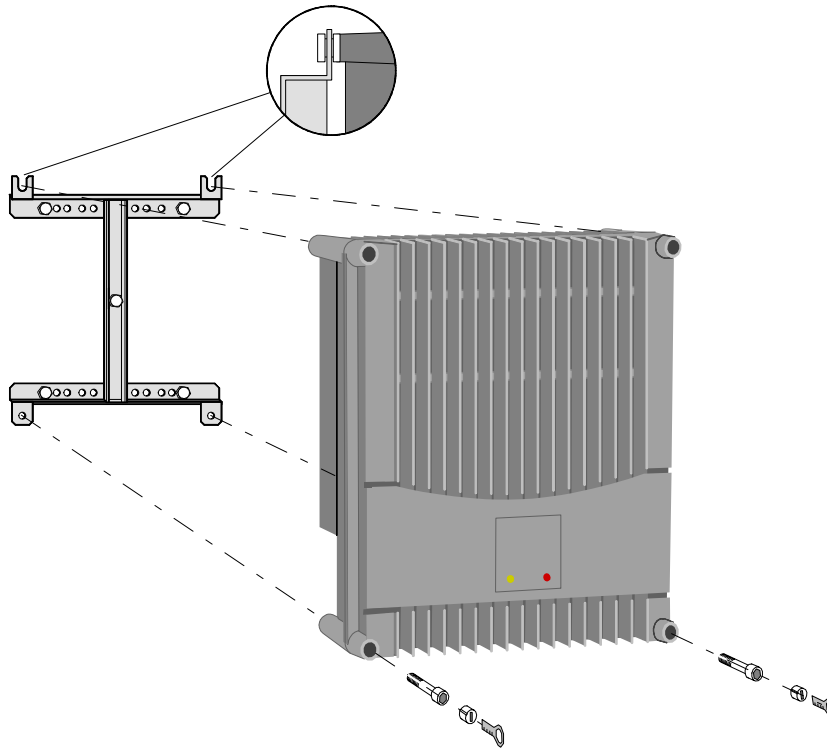


Figure 3-5 Attaching the WRH-V to the Bracket

Connections

This section describes general examples of how to connect the input and output ports on the WRH.

Main Power and Grounding

Local regulations need to be followed for the main power connection. WRH-Vs are approved in accordance with EN and UL/cUL regulations. This is, however, only valid if a classified power cord is used. For the WRH-V to meet these regulations you must select one of the following classified and approved cord types:

- EN – H 05 W5 - F HMR
- UL – AWM Style 2587
- CSA– AWM 1 A/B 11 A/B

For outdoor use, the power cord should meet at least IP65 encapsulation requirements. Do not turn the main power on until you are ready to commission the WRH.



WARNING: For WRH-Vs supplied from the main power source, the main outlet must be grounded.

Fiber Optic and RF Connections

Fiber optic and RF cable connections should be verified both internally and externally before powering up the equipment. This section illustrates the general internal connections of the WRH-V. Verify these connections with the as-built drawings and documents for your specific system configuration. Table 3-1 lists the steps to add the external connections to the WRH-V.

Table 3-1 Cable Connection Procedure

Step	Action
1	Connect service antenna coaxial cable to left-outside DIN connection on cabinet
2	Connect fiber optic cable from OCM or BMU to fiber optic cable demark on FOU
3	Connect station ground to appropriate ground point in cabinet
4	Mount main power plug to main power cord and insert into PSU

WRH-V

Figure 3-6 illustrates the cables and connections for the WRH-V.

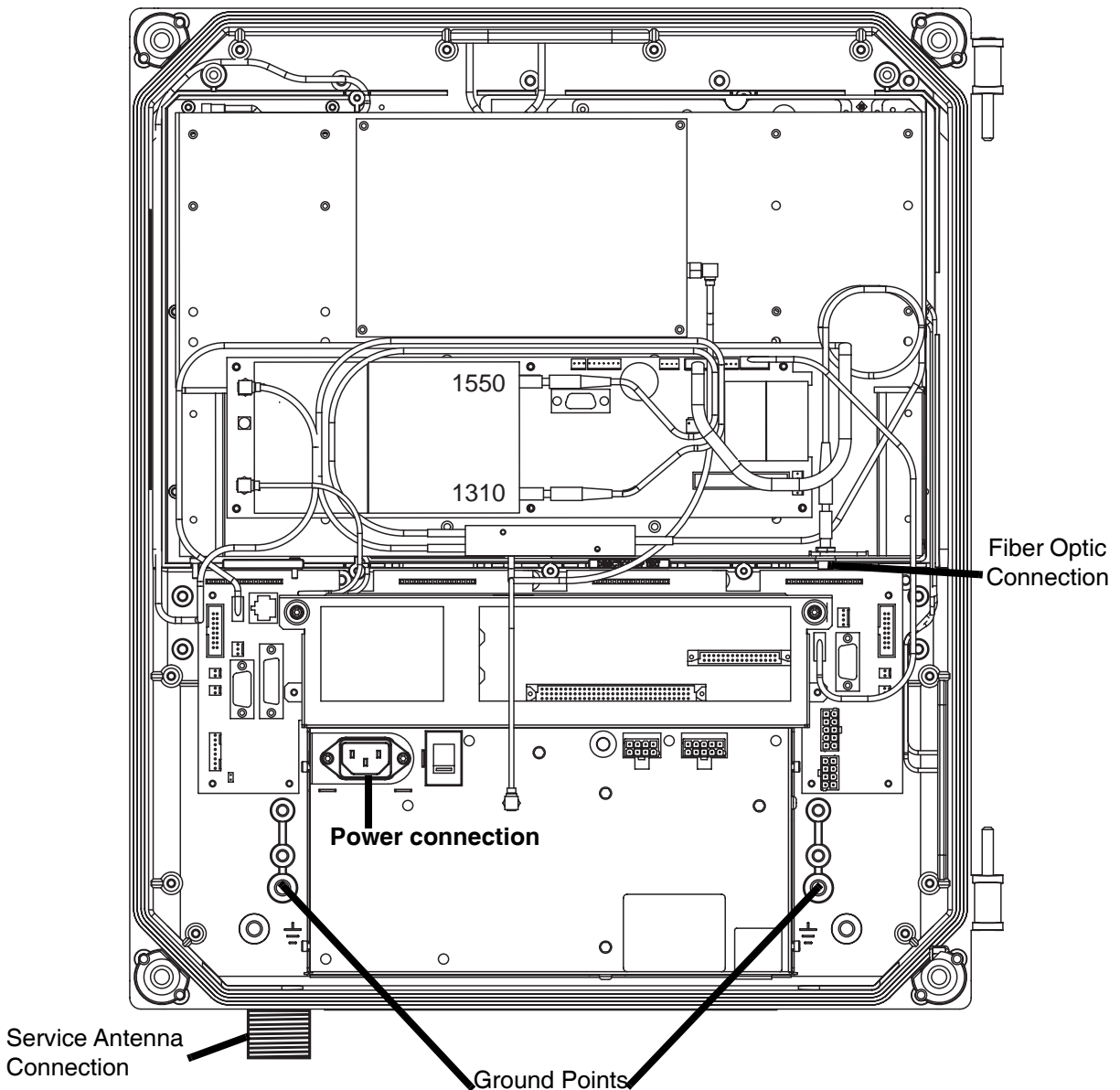


Figure 3-6 WRH-V Cable Connections

Optional Connections

Alarms

Alarm signals from external sensors are received by an ALI or RCI which forwards them to the CU. The RCI is used if the WRH-V has an RCU, otherwise the ALI is used. The software on the CU can activate acoustic or visual alarms or direct the alarm to the P33 alarm port for forwarding via an RCU through OM-Online. Alarms can also be handled by the FON. Alarms are configured through OM-Online.

External Alarm

Burglary, fire or other external alarms can be handled by the WRH-V. External alarm sensors and alarm signals are connected to the P33 alarm port located to the left in the cabinet, as illustrated in Figure 3-7. The P33 alarm port is described in Chapter 2. The cable for this installation is taken through a strain relief bushing at the bottom of the WRH-V cabinet.

Door Open Alarm

A door open alarm can be configured and installed in the WRH. This is arranged with a door switch connected to pin 8 (AI4) on P28, as described in chapter 2. The location of P28 is shown in Figure 3-7.

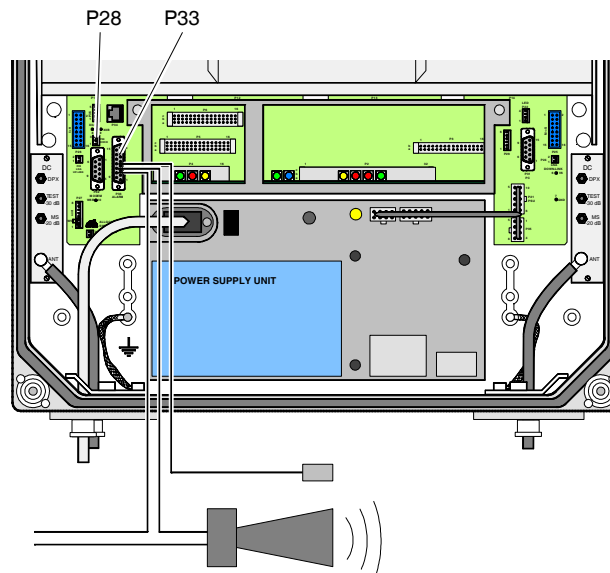


Figure 3-7 External Alarm Connection

Main Power Breakdown Relay

To be able to distinguish PSU faults from power failures, a main power breakdown relay can be used. This relay is not included in the WRH. It has to be mounted outside the WRH-V cabinet. The relay intended for this purpose must fulfil the following specifications:

Closing time:	Max. 30 milliseconds
Insulation coil/contact:	Min. 4KV

A main power connected relay must also be in compliance with valid local regulations. To install a main power breakdown relay connection, follow the steps listed in Table 3-2.

Table 3-2 Main Power Breakdown Relay Connection

Step	Action
1	Connect a currentless closed relay contact to pin AI1 and AIC on P33 alarm connector, as shown in Figure 3-8. Alarm is initiated when pins AI1 and AIC are shorted
2	Connect relay coil. Coil must be supplied from same fuse as WRH
3	After commissioning, select Mains Breakdown in alarm configuration window in OM-Online. For details on setting alarm configuration see OM-Online User Manual.

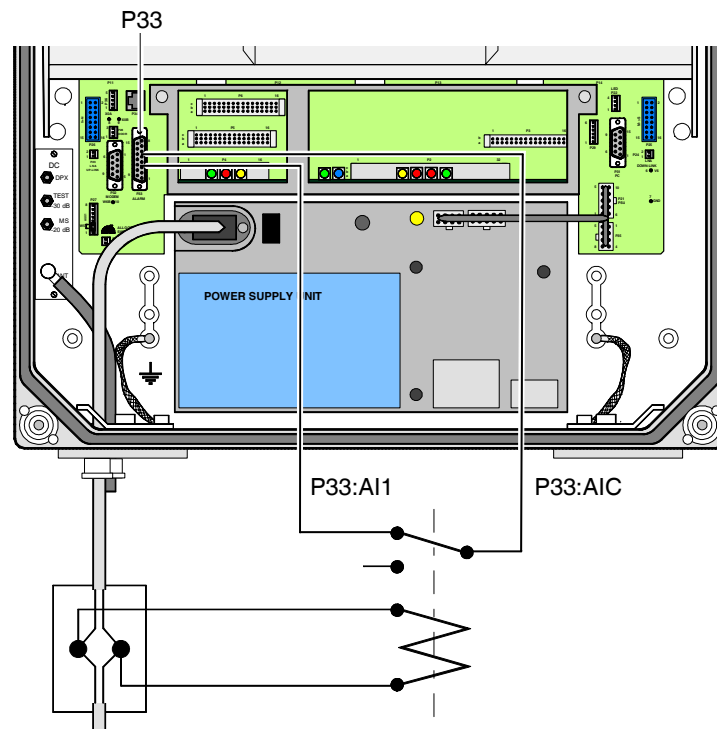


Figure 3-8 Main Power Breakdown Relay Connection

21-60 Volt DC PSU Installation

See the Field Replaceable Units, PSU section in Chapter 4 for details on replacing a 115/230 VAC PSU with a 21 to 60 Volt DC PSU.

Commissioning

Before proceeding, carefully read the Safety section and check all connections made during the installation. To fulfill the IP65 weather protective requirements, ensure cable strain relief bushings are properly tightened. Also, ensure gaskets at cable inlets and on the cabinet are properly fitted and not damaged.

A WRH-V can be configured locally with OM-Online by connecting a standard serial cable from the COM port on the PC to the P31 PC port (RS-232) located to the right in the cabinet as shown in Figure 3-9. The P31 PC port is described in Chapter 2. Details on using OM-Online are described in the OM-Online User Manual.

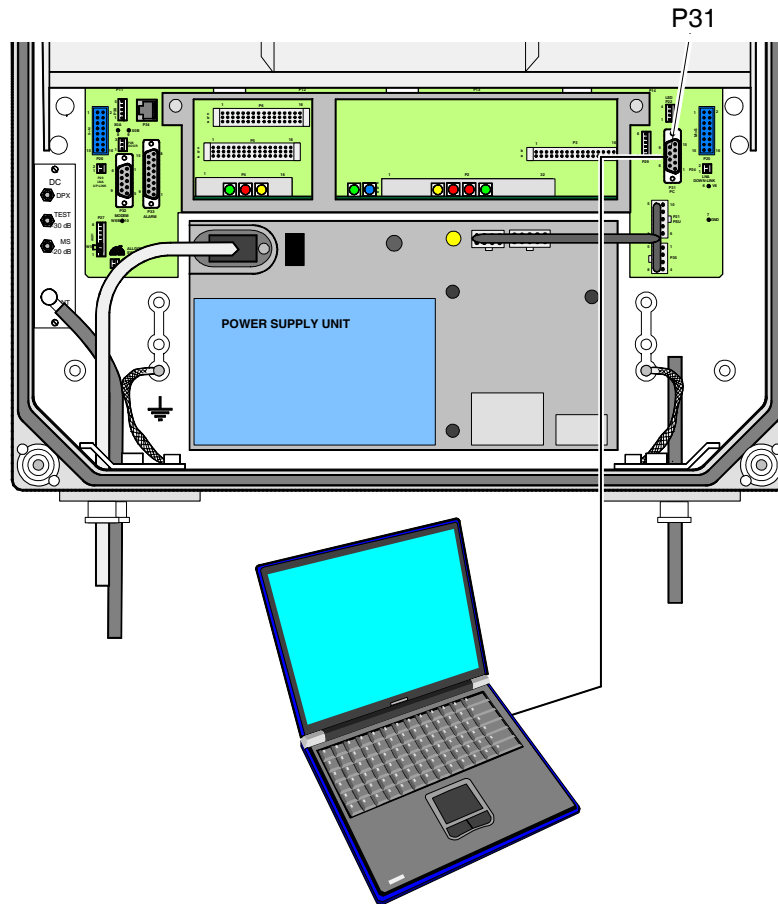


Figure 3-9 Connecting a PC for Local Access

Initial Startup

To complete the initial start-up of the WRH-V, follow the steps listed in Table 3-3.

Table 3-3 Initial Startup Procedure

Step	Action
1	Turn main power on
2	Check Yellow LED on power supply unit. Steadily lit = functioning correctly
3	Check the four CU PCBA LEDs. Refer to CU PCBA section in Chapter 2 for correct power up indications
4	Check the three ALI PCBA LEDs or corresponding LEDs on RCI PCBA. Refer to ALI or RCI PCBA section in Chapter 2 for correct power up indications

Passive Intermodulation (PIM) Testing

PIM is the non-linear effect of passive RF components in a desired RF transmission band. As higher per-carrier transmit power levels are applied to duplexed passive RF networks, PIM becomes an increasingly significant factor in potential receiver desensitization. A PIM tester may be used on the RF network prior to turn-on and commissioning of the unit, but if a PIM tester is not available, the following may be used:

The following equipment is required to test for PIM:

- Anritsu Site eMaster or equivalent RF Spectrum Analyzer
- Agilent ESG4432B or equivalent Multi-Signal Generator (or commissioned BTS)
- Guaranteed/calibrated PIM load capable of handling 20W composite power
- Low-PIM RF cable adaptors such as N-N female, Din male to N female, DIN-DIN, SMA-SMA female, and N male to SMA female
- Installed and operational WRH-V unit
- Installed passive RF network under test
- Torque wrenches for DIN and N connectors

Two different types of setup are available, depending on equipment availability and testing methods.

Figure 3-10 shows PIM testing with two carriers over one WRH-V, and Figure 3-11 shows PIM testing with one carrier over each of two WRH-Vs.

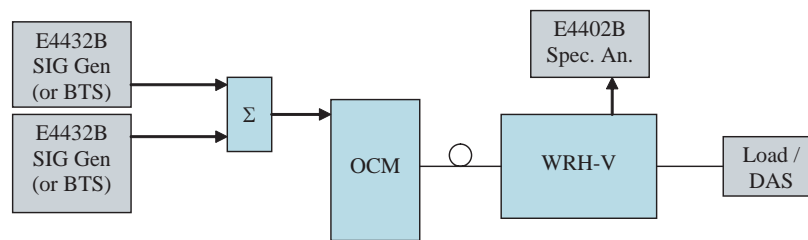


Figure 3-10 PIM testing two carriers and one WRH-V

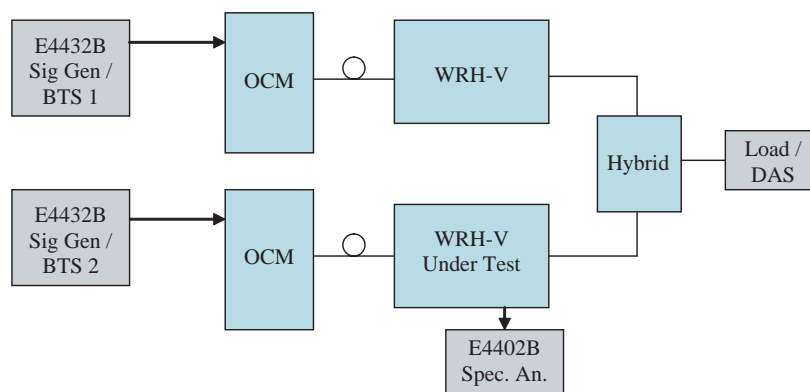


Figure 3-11 PIM testing one carrier over each of two WRH-Vs

The following PIM test uses the receive sensitivity and gain of the WRH-V under test to verify that the receive path is free of PIM noise. For PIM to be a problem at a particular site, TX signals must exist such that their products fall into the RX band using the formulae:

$$3^{\text{rd}} \text{ order product} = (2 * f_1) - f_2$$

and

$$3^{\text{rd}} \text{ order product} = (2 * f_2) - f_1$$

Where f_1 and f_2 are two TX signals entering a WRH-V. The specification for the maximum allowed PIM is -115 dBm per 100 kHz resolution bandwidth at rated output power. To test for PIM follow the steps listed in Table 3-4.

Table 3-4 PIM Testing Procedure

Step	Action
1	If BTS signals are present, continue with step 2. Otherwise, connect two signal generators to OCM and set frequencies such that products are in relevant receive band (see equations above)
2	Set WRH-V UL gain to 60 dB and DL gain such that desired per carrier power is presented at output port
3	Set Spectrum Analyzer to 100 kHz resolution bandwidth and view RX band at 3 rd order product frequency calculated in step 1
4	Loosen fastening screw in each corner on front cover of WRH-V under test, and open cover
5	Verify the noise floor specification for the Spectrum Analyzer. If the noise floor is higher than or equal to -85 dBm/100 kHz, locate FON, disconnect UL cable from port P101 and connect Spectrum Analyzer to the cable using an SMA female - female connector (noise limit becomes -115 dBm + 60 dB = -55 dBm). Continue with step 7.
6	If noise floor is lower than -85 dBm/100 kHz, locate the FON card and connect the Spectrum Analyzer to P117 (noise limit becomes -115 dBm + 60 dB - 30 dB = -85 dBm). If the FON only has three RF ports on the left side, port P117 will not be available, so follow instructions listed in step 5.
7	Enable WRH-V TX signal. For details on using OM-Online, see OM-Online user manual
8	Using Spectrum Analyzer, measure noise level. If no noise exists above calculated limit in step 5 (-55 dBm) or step 6 (-85 dBm) above, as appropriate, then test is passed and no other action is necessary
9	If a higher level of noise exists, disable the WRH-V TX signal and disconnect cable to DAS at bottom-left outside corner
10	Connect low PIM load onto WRH-V Service antenna connector at bottom-left outside corner. Tighten connectors securely
11	Remeasure noise level. If no noise exists above calculated limit in step 5 (-55 dBm) or step 6 (-85 dBm) as appropriate, then DAS has a PIM issue. Tighten all connections in DAS with torque wrenches, replace any crimped or severely bent cables, and retest. Repeat until all issues are solved
12	Otherwise, if noise is higher than limit, WRH-V is defective and must be replaced. See Chapter 4 for Replacement procedures