ALCOMA

Microwave data link

# ALxxF MPR360

## Installation and operation manual

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# Content

# 1 INTRODUCTION

The ALxxF MPR360 - All-Outdoor IP Radio fully supports next generation mobile and backhaul IP networks, including LTE and WiMax. The ALxxF MPR360 integrates ALCOMAs leading ODU technology that has successfully proven its reliability and flexibility in installations worldwide.

The radio relay link ALxxF MPR360 as a whole or as parts is not intended to be used by untrained personnel. Installation, adjustments and maintenance must be performed only by a person with electrical qualifications trained by the manufacturer.

Please read this operation manual carefully before installation and operation of the duplex microwave link for data transmission ALCOMA ALxxF MPR360. Please pay increased attention to the safety instructions that are marked like this in the text:

**WARNING**

Violating of this marked safety instructions can cause serious injury to personnel.

**CAUTION**

Violating of this marked instruction can cause damage to the equipment.

## 1.1 MAIN FEATURES

- All-outdoor point-to-point microwave IP radio with POE
- 7-to-38 GHz frequency bands, supporting ETSI standards
- Supports QPSK – 256 QAM modulations
- Supports bandwidths 7 to 56 MHz (ETSI)
- Hitless Adaptive Modulation
- QoS and VLAN support
- Built-in web based management
- SNMP based remote management

## 1.2 ODU INPUT CONNECTORS

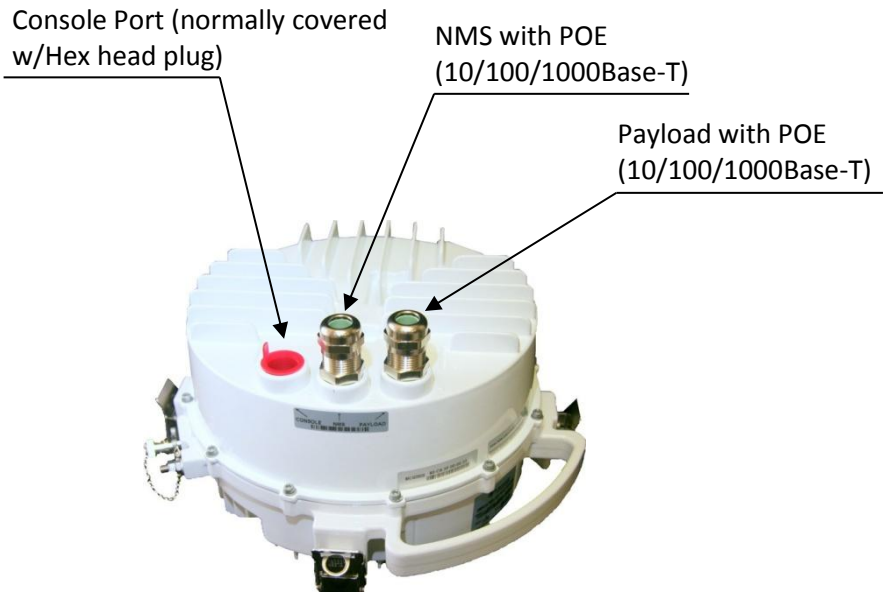



**Figure 1 ODU input connectors**

## 1.3 RADIO PACKAGING

All parts of the ALCOMA ALxxF MPR360 are contained in a shipping box, ready for assembly and hook-up.

### 1.3.1 Packaged parts are as follows

**ODU**

The Outdoor IP Radio unit (shown with ports equipped with one dust plug and 2 weatherproof hex plugs)

**POE Assembly**

Power over Ethernet Unit, with Pole (or wall)- mounting hardware

**CAUTION**

Link ALxxF MPR use only with protected terminal box marked **ALR1-GEth** (121/516*37)
It is important to keep proper link of all connecting cable conductors in ALR1 and RJ pins in ODU. There is danger of equipment damage in case that the links are not connected properly.

**Installation components**

User-installable glands: provided to terminate external Ethernet connections between the ALxxF MPR360 and the POE Unit. The number of glands provided with the ALxxF MPR360 or POE varies according to the unit/component ordered, as follows:

A set of weatherproof hex plugs: for sealing any unused connections on the ALxxF MPR360. These plugs may be pre-installed

An RJ-45 to DB-9 Serial Cable. Serial Cable may be provided, as an option, to connect to the Console port of the ALxxF MPR360.

| Nr. of Glands | ALxxF MPR360 | ALR1-GEth | System Type |
|---|---|---|---|
| 1 | 1-port | Line3 | In-band management: one cable supporting data and management |
| 2 | 2-port | Line3 + Line2 | Out-of-band management: separate cables for data and management |

(Please refer to Chapter 2 for more information on the various configurations of the ALxxF MPR360)

**Note**
Glands and weatherproof hex plugs may be purchased as spare components.

## 1.4 UNPACKING PROCEDURE

1. Check all packaging for external damage; report any such damage to the carrier.
2. Open and check the package against the Bill of Material. If any items are missing, please contact ALCOMA Customer Service.
3. If applicable, do not remove any component from its antistatic packaging until immediately before installation.
4. Ensure that
    - Connection ports are capped (as applicable), and not damaged, and
    - Cable glands are sound and secure in their packaging.

## 1.5 TECHNICAL SPECIFICATIONS

| Specification | Value |
|---|---|
| **Frequency Bands** | 7 to 38 GHz |
| **Channel Bandwidth** | ETSI: 7, 14, 28, 56 MHz |
| **Transmit Power** | Up to 30 dBm |
| **Supported Modulations** | QPSK, 16 QAM, 64 QAM, 128 QAM, 256 QAM<br>ACM - Hitless |
| **Max. Throughput per ALxxF MPR360** | 364 Mbps (56 MHz, 256 QAM) |
| **Interfaces** | GigE (RJ-45): Data, PoE, In-band NMS;<br>GigE (RJ-45): PoE, Out-of-band NMS |
| **Temperature Range** | -33 °C to +55 °C |
| **QoS** | 802.1 p/q; Supports Jumbo Frames; Prioritization (VLAN, DiffServ), Traffic classification; Queuing Options (Strict Priority and WRR), Egress capacity limitation on port. |
| **Latency** | ~ 200 microsec (depends on traffic type) |
| **NMS Support** | In-band and Out-of-band NMS |
| **SNMP Support** | SNMP v2, v3 (Private and Enterprise MIBs) |
| **Flow Control** | IEEE 802.3x supported |
| **Software Features** | Web GUI enabled, Radio configuration changes, TFTP, Radio and Modem alarms, switch configuration/status (Enable/Disable jumbo frames, In-band/Out-of-band selection, traffic classification, queuing options, broadcast traffic control, basic RMON) |
| **Maintenance** | S/W update from Web GUI or CLI (throughSSH/Serial/Telnet) |
| **Access** | • SNMP<br>• Web Gui for Configuration control and monitoring<br>• Limited configuration through CLI (Serial/SSH/Telnet) |

# 2 CONNECTIONS AND SETUP

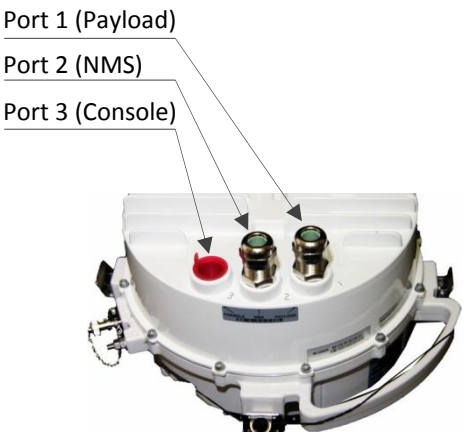
This Chapter identifies the main radio Ports and their functions. It also provides cautionary information on Polarity, Interchangeability and Cable gland connections

**Note**

Cable connections' setup illustrated in the following Figures applies to Bench testing and radio configuration only. Final outdoor installations require the following:

1. Installing Cable Glands on all used Ethernet ports of the ALxxF MPR360 and POE
2. Installing a Hex Plug on all unused Ethernet ports, as well as the Console port of the ALxxF MPR360; and
3. Carrying out bench testing before commissioning the ALxxF MPR360 — strongly recommended.

## 2.1 IDENTIFYING THE PORTS




**Note**

Ethernet weather- proof glands shown installed on Port 1 and Port 2.

Dust plug shown installed on Port 3 (Console). Any unused port must be capped with weatherproof hex plugs.

**Figure 2 Identifying the ports (All RJ-45 Type)**

| Port Nr. | Function | Connects to |
|---|---|---|
| **1**[1] | Payload data (10/100/1000Base-T) | External computer or data network through the POE |
| **2**[1] | Network Management System to control the ALxxF MPR360 (10/100/1000Base-T) | External computer or management network through the POE |
| **3** | Console: Serial communications (RS-232) to set the ALxxF MPR360's basic IP parameters | External computer |

**CAUTION**

Do not apply DC power to Port 3 (Console).

[1] - 48 VDC power is provided through POE Unit to Port 1 and Port 2, when the ALxxF MPR360 is configured for Out-of-band management. For In-band management, power can be provided through POE to either Port 1 or Port 2; except in certain configurations, (e.g. very long cable lengths), where power is provided through POE to Port 1 and Port 2.

## 2.2 CONNECTING EXTERNAL EQUIPMENT

| Tool / Exuipment | Description | Section where used |
|---|---|---|
| Crimp tool | for RJ-45 cables | Preparing the Cable |
| Ethernet cables | Straight through shielded all-outdoor UV-protected Cat 5E or Cat 6 cable with nominal outer diameter of 6-12 mm | |
| RJ-45 jacks | Tyco: 5-558530-1 or equiv. | |
| Screwdriver | Phillips tip, medium (on POE) | Cable Connections Procedure |
| Screwdriver | flat tip, 6 mm (within POE, for DC power line attachment) | |
| PC | laptop or desktop | |
| Power Supply | -48 $V_{DC}$ | |
| Torque wrench | 13 mm and 22 mm | Installing a Gland, and Installing a Hex Plug |
| Screwdriver | flat tip, 6 mm | If Disconnecting a Cable |

**Table 1 Tools Required – (Not provided)**

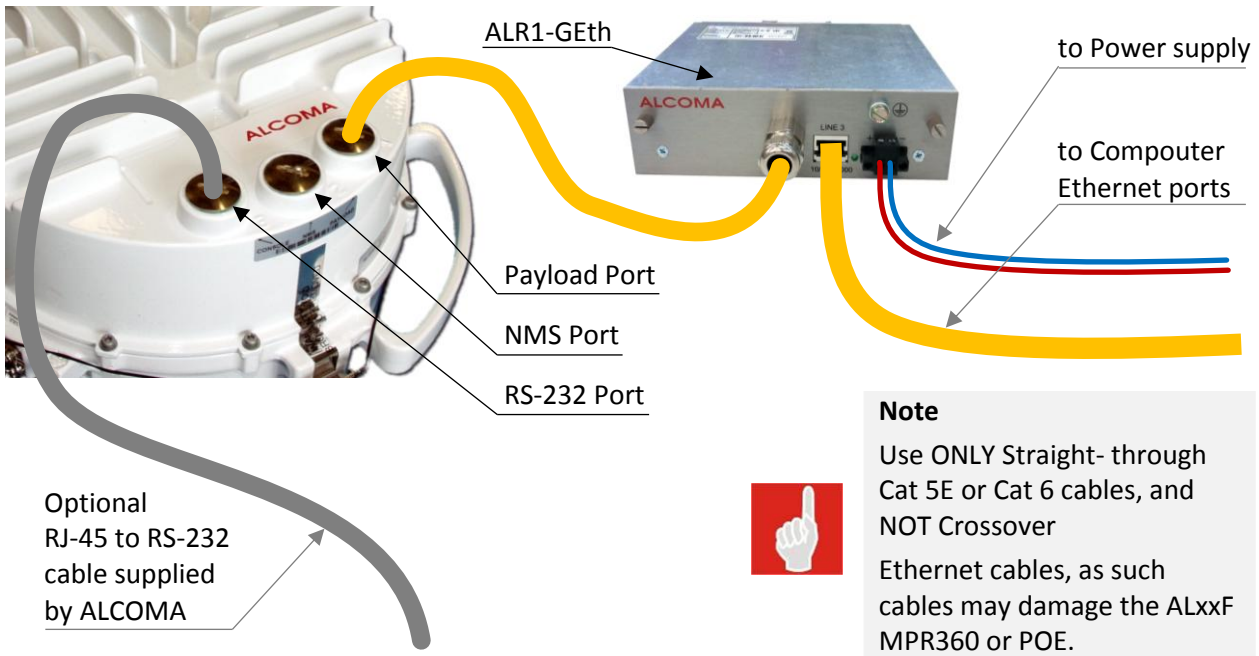



**Figure 3 Cable connections ALxxF MPR360, POE and Computer**

## 2.3 CABLE CONNECTIONS PROCEDURE

1. Loosen the 2 bolts on the front panel, keeping them in a secure place for reuse, and then remove the front panel with PCB.

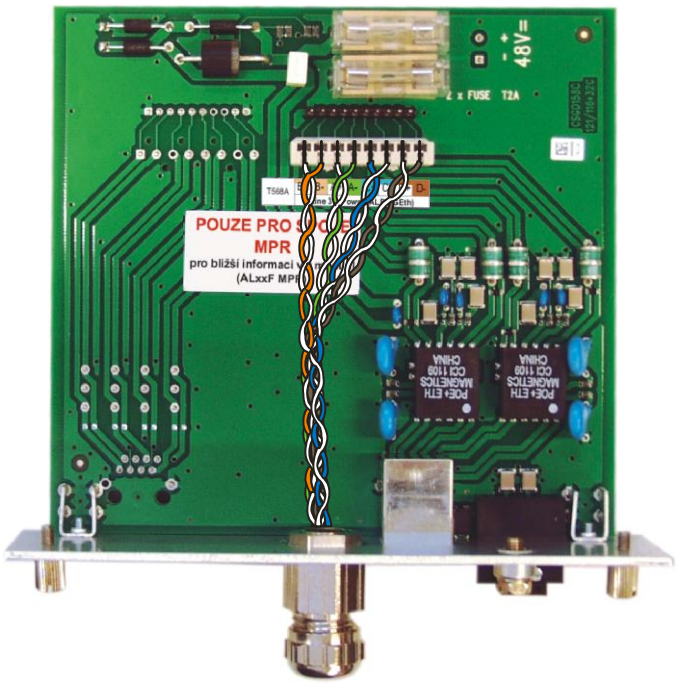



**Figure 4 Wiring in the terminal box ALR1-GEth**

2. Connect an Ethernet cable into the cutting box (located inside of POE Unit).

**NOTE**

The POE'S Payload and NMS ports are interchangeable. If using only one external port, ensure using the POE's corresponding internal port.

**NOTE**

When using In-Band network management, Payload and NMS data are carried on a single Ethernet cable between the POE Unit and the ALxxF MPR360. This cable is connected to the Payload port of the ALxxF MPR360

3. Connect the twisted-pair wire ends to the POE's screw terminals by:
   - attaching the red wire to the (+) terminal
   - attaching the blue wire to the (-) -48 V terminal.
4. Connect the other ends of the wires to an external -48 VDC power supply — with 12-18 AWG (recommended) — by:
   - attaching the red wire to the "+" positive connector, and
   - the blue wire to the "-" minus connector.

**CAUTION**

Observe correct polarity when connecting wires to the power supply. Ensure limiting the power supply current to slightly above that drawn by the ALxxF MPR360 (approx. 1A). Connect only the internal ports of the POE to the test computer, to avoid applying -48 VDC to the computer's Ethernet ports.

**NOTE**
The POE includes an LED that illuminates when polarity is correct, even without connecting the POE to the ALxxF MPR360. If polarity is reversed, the LED will not illuminate. Please ensure that the LED is lit prior to connecting the POE to the ALxxF MPR360.

Connect an Ethernet cable from each of the RJ-45 connectors (located outside of the POE Unit) to the corresponding connectors located inside the ALxxF MPR360's Payload and NMS ports.

**CAUTION**
In this step, use ONLY Straight-through Cat 5E or Cat 6 cables, and NOT Crossover Ethernet cables, as such cables may damage the ALxxF MPR360 or POE.

Optional test computer connection: RS-232 serial port RJ-45 to D-sub, or USB adapter. Connect this optional cable (supplied by ALCOMA) to run a terminal program for communicating with the ALxxF MPR360.

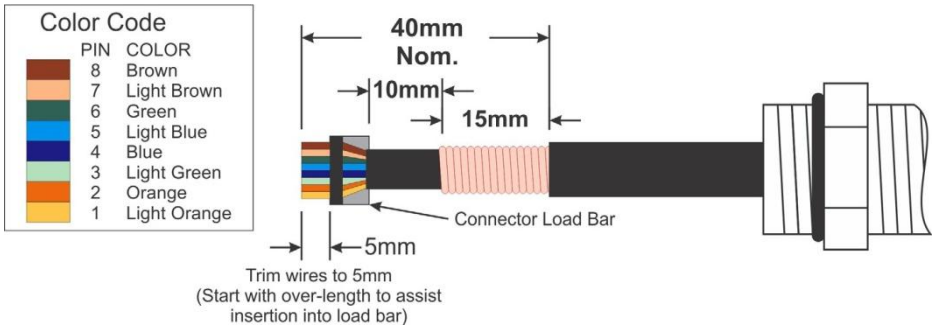
## 2.4 INSTALLING CABLE GLANDS

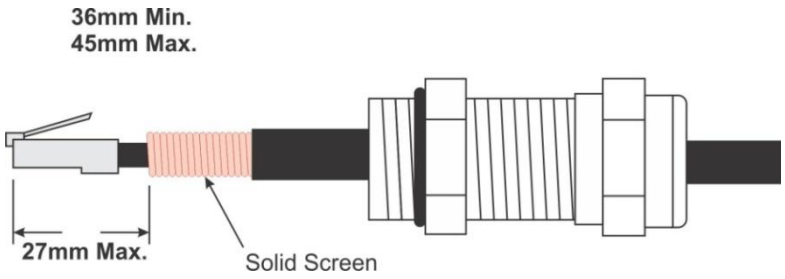
**NOTE**
Cable glands are required for external connection of the Ethernet cables between the ALxxF MPR360 and the POE Unit for final installations. Ensure that the maximum cable length between the ODU and the user's network equipment is 100 m (330 ft).

**CAUTION**
Any unused ports must be sealed with the provided weatherproof hex plugs. Dust plugs delivered pre-installed on the units are not weatherproof.

## 2.5 PREPARING THE CABLE

Refer to the following Figure for preparing each cable (Payload and NMS). Recommended Ethernet cable type is a straight through shielded all-outdoor UV-protected Cat 5E or Cat 6 cable, with nominal outer diameter of 6-12 mm.






## 2.6 INSTALLILNG A GLAND

1. In the following order, fit the Back shell, Gland body and the O-ring onto the cable end that is to be prepared for the RJ-45 plug.
2. Install the RJ-45 plug on the prepared end of the cable.
3. Insert the RJ-45 plug into the RJ-45 jack of the appropriate port of the unit.
4. While supporting the drop cable, screw by hand the Gland body into the ODU until the O-ring seals against the ODU body.

**CAUTION**. Secure the Gland body before fitting the Back shell.

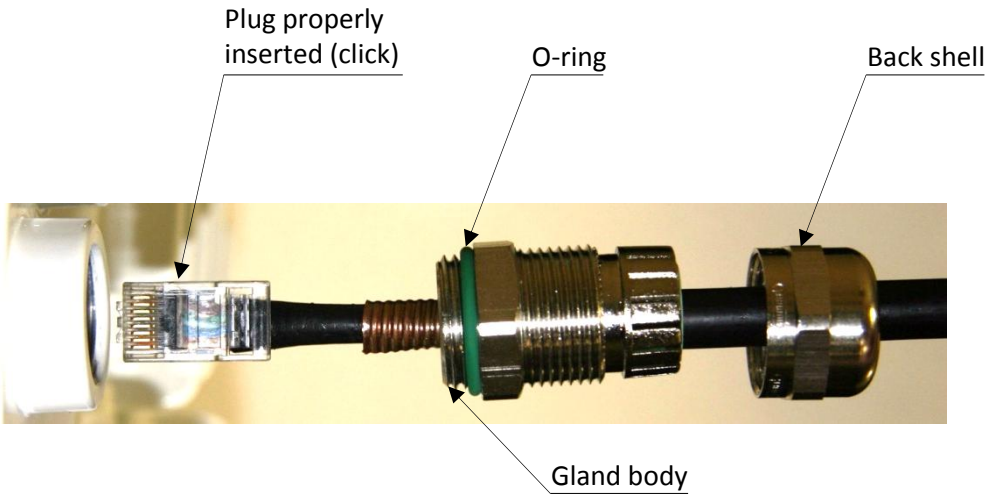



**Figure 5 Securing the cable gland body**

5. Once the Gland body is fully seated into the ODU, tighten it to a torque of 7 ft•lbs (10 N•m), with a 22 mm wrench.

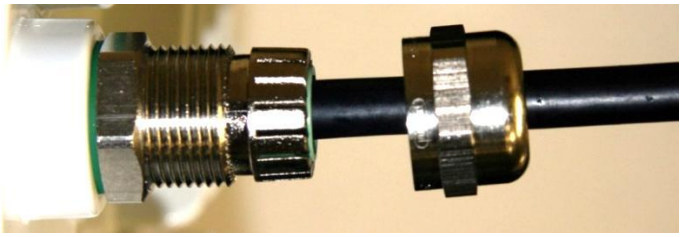


**Figure 6 Tightening the gland body**

6. Finally, hand-tighten the gland's Back shell. Do not overtighten.

**Note**

The Back shell may also be tightened by a torque wrench set to 6.2 ft-lbs (8.4 N•m)

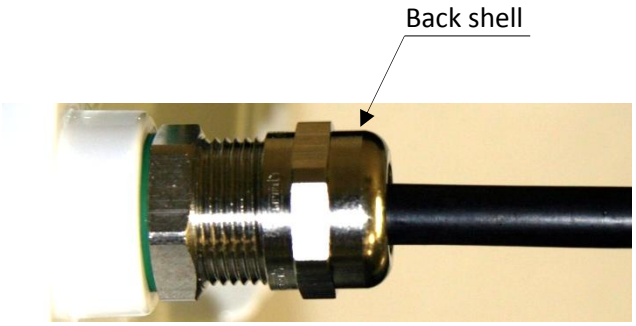



**Figure 7 Back shell properly tightened**

## 2.7 IF DISCONNECTING A CABLE

1. If disconnecting a cable at the ODU is warranted, remove the gland Back shell first. Then, slightly shake the cable to and fro to release the tension of the Gland body as shown in Figure 7.
2. Unscrew the Gland body then, using a small screwdriver, depress the RJ-45 locking tab to free the cable.

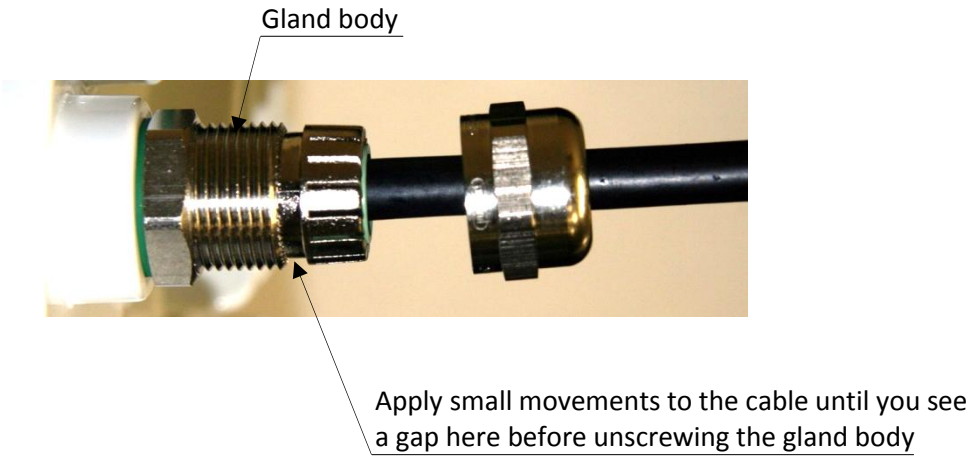



**Figure 8 Disconnecting a Cable**

## 2.8 INSTALLING A HEX PLUG

1. Seat the weatherproof hex plug into any unused port of the ALxxF MPR360 or POE.
2. Screw by hand the hex plug into the ODU until the O-ring seals against the ODU body.
3. Tighten the hex plug to a torque of 2 ft-lbs (3 N•m).Do not overtighten.

# 3 CONFIGURING THE RADIO

This Chapter provides configuration procedures using the radio's integrated Web GUI. These procedures include setting up Network management connections (Out-of-band and In-band), as well as configuring the optional Serial connection.

## 3.1 CONFIGURATION DEFAULTS

### 3.1.1 Default Configuration

- ALxxF MPR360s shipping with 2 ports can operate with In-Band NMS or Out- of-Band NMS.
- ALxxF MPR360s shipping with 1 port can only operate with In-Band NMS.
- By default, both 1-port and 2-port ALxxF MPR360s are factory configured for In-Band NMS, and fitted with a weatherproof hex plug on the NMS port (Port 2).
- To operate with Out-of-Band NMS, where Payload Data is separated from NMS Data, remove the hex plug from the NMS port (Port 2), and install the supplied weatherproof Ethernet gland on that port.
    - Payload Data and NMS are carried on separate cables to their respective ports.
    - The local PC can access the ALxxF MPR360's Web configuration interface and Command line interface only through the NMS port (Port 2).
- When the radio is configured for In-Band Management, the local PC can access the ALxxF MPR360's Web configuration interface and Command line interface through either the NMS port (Port 2) or the Payload port (Port 1).
    - Only one port is required to carry both NMS and Payload. This can be either the NMS port (Port 2) or the Payload port (Port 1).
    - The unused Ethernet port in this mode can be used as an additional Payload connection (as of ALxxF MPR360 1.3).
- The IP Address of the PC should be on the same sub-net as the ALxxF MPR360.
- Regardless of the Network Access Configuration mode, Command Line Interface (CLI) access is available through the RS-232 Console port (Port 3).
    - The Console port is available for bench-top testing of the ALxxF MPR360.
    - The Console port is not to be used in normal or deployed operation of the ALxxF MPR360.

### 3.1.2 Default IP Addresses

The default IP Addresses are assigned as follows:

| Unit Model Number | Unit Type | Assigned IP Address |
|---|---|---|
| RACH-231200-**0**0641-A003-20 | Low Band | 192.168.1.237 |
| RACH-231200-**1**0641-A003-20 | High Band | 192.168.1.238 |

**Table 2 Default IP Addresses**

You can change these IP Addresses through the Web interface or the Serial interface, as described in the following sections.

**Note**

IP Addresses must be unique for each instance of an Ethernet device within a network.

## 3.2 USER INTERFACE

### 3.2.1 Accessing the Configuration Web Pages

1. Power up the ALxxF MPR360 (applying DC power); then, using a PC connected to the NMS port, as show in Figure 12, for Out-of- Band Management or Figure 14, for In-Band-Management, open a Web browser.
2. In the address bar, type the IP address of the connected radio. (e.g 192.168.1.237)
3. The Web interface is password protected:
    - Default user name (as shipped) is “admin”.
    - Password is <blank>, as shown in Figure 9


**Figure 9 Login Screen**

### 3.2.2 Configuring the Serial Connection (Optional)

The ALxxF MPR360 provides a Serial interface for few basic configurations.

**Use the Serial interface for setting the IP Address for network management as follows.**

1. Connect the serial port of a PC with a terminal program such as Tera term or Hyperterm.
2. Use the following settings:
    - 115200,N,8,1 Disable local echo.

### 3.2.3 Changing the IP Address through the Command Line Interface (Optional)

**After configuring the serial connection:**

1. Log in to access the Command line menu.
2. Use cli for user name, and password for password.
3. In Main menu, select (1) Network.
4. In Network menu, select (2) IP Address, and enter new IP Address.

### 3.2.4 Changing the IP Address through the Web Interface

1. In Main menu on the left panel, select Administration and, from the sub menu, select Network Configuration, as shown in Figure 10.
2. Enter a new IP Address in the text field.
3. Click Submit.
4. When prompted, confirm that you want to change the IP Address.
5. Type the new IP Address into the address bar of the web browser.

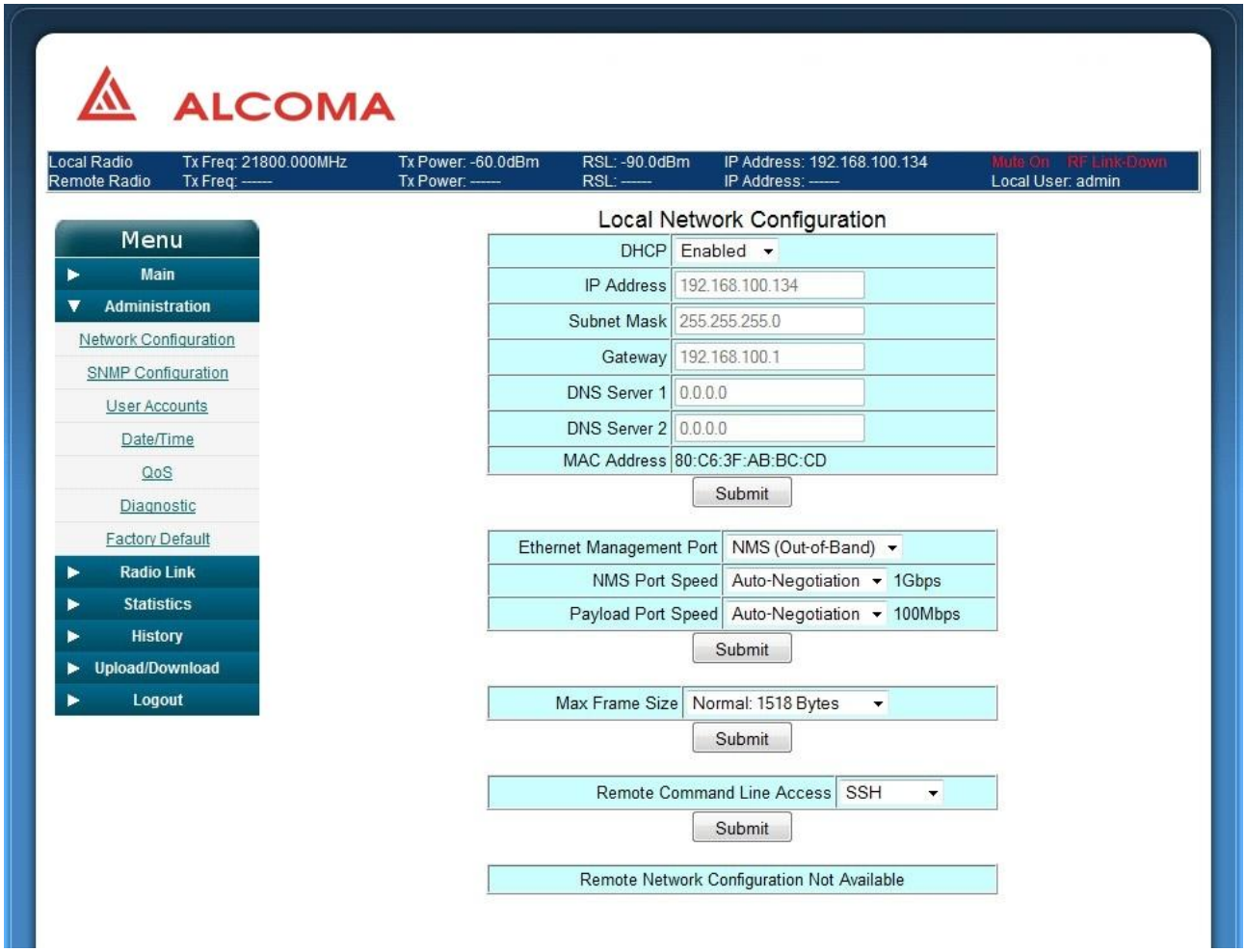



**Figure 10 Changing an IP Address**

## 3.3 NETWORK CONNECTIONS FOR TESTING

### 3.3.1 Out-of-Band Network Configuration (optional)

1. From the main menu on the left panel, select Administration and, from the sub menu, select Network configuration, as seen in Figure 10.
2. Select NMS as the management port, and click Submit.

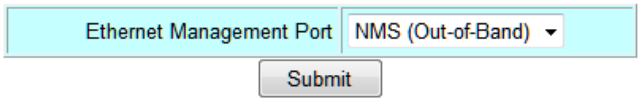



**Figure 11 Out of Band management**

3. Confirm the selection when prompted.
4. Configure the network cabling as shown in Figure 11, so that the network management PC connects to the NMS port of the ALxxF MPR360.

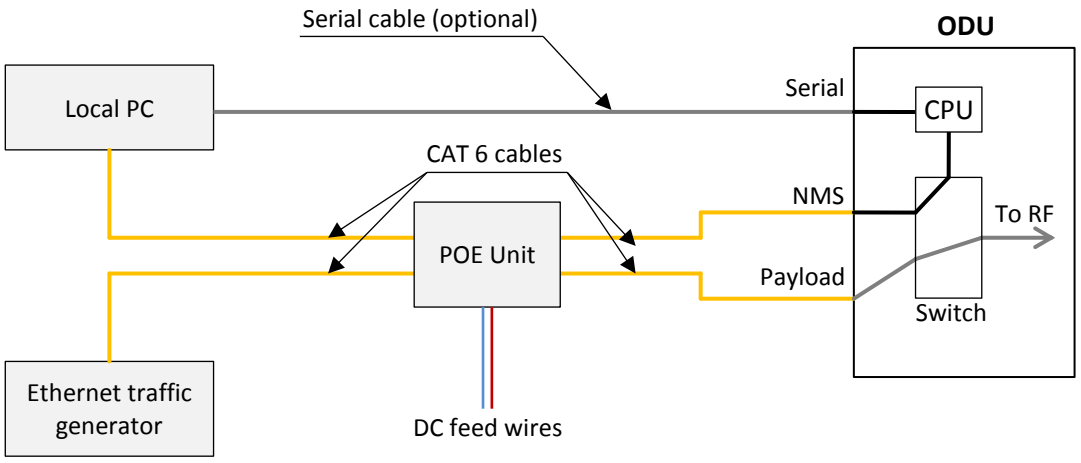



**Figure 12 Out-of-Band Network Management Diagram**

### 3.3.2 In-Band Network Configuration

1. From the main menu on the left panel, select Administration and, from the sub menu, select Network configuration, as seen in Figure 10 above.
2. Select Payload as the management port, and click Submit.

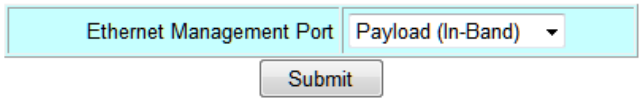



**Figure 13 In Band management**

3. Confirm the selection when prompted.
4. Reconfigure the network cabling as shown in Figure 13, so that the network management PC connects through a hub or switch to the Payload port of the ALxxF MPR360.

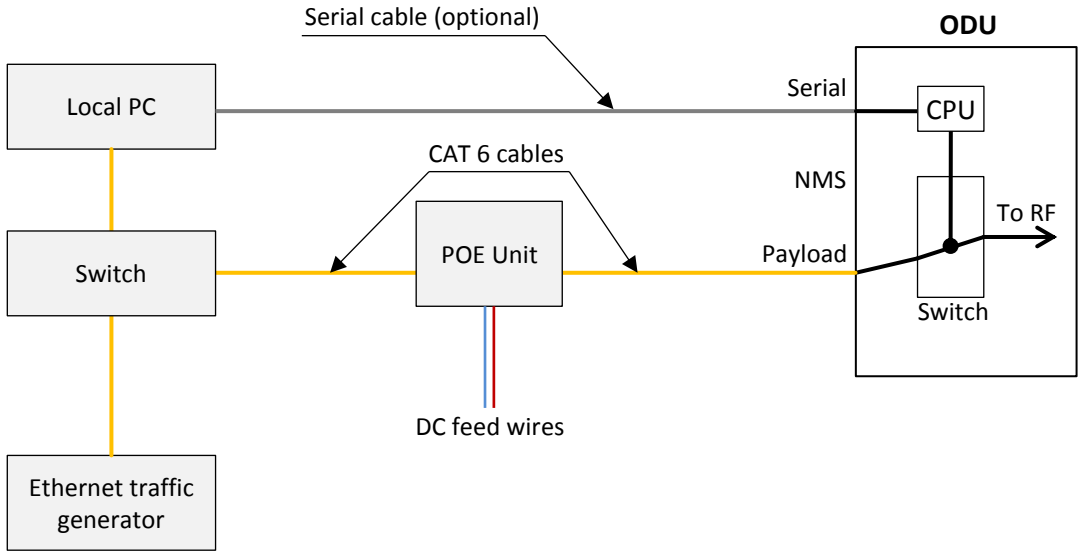



**Figure 14 In-Band Network Management Diagram**

**Note**

When configured for In-band NMS, the NMS data is transmitted on the wireless port and can be mixed with the payload data. Browsing the internal Web pages adds traffic that may affect the measurements of the traffic generator. The local PC can access the local ALxxF MPR360 Web-page, and — if the IP addresses are correct — it can also access the remote ALxxF MPR360 Web-page.

## 3.4 ALxxF MPR360 FIRMWARE LOADING

**Note**

This section provides general instructions for loading or updating the ALxxF MPR360's firmware.

**Procedure**

1. Obtain the new UpDate Package file from ALCOMA, (required later in step 5 below). For example: (1.3v2994_X.udp). Software may be customer-specific.
2. Refer to previous sections for setting up PC connections to the ALxxF MPR360, to allow for web browsing of the ALxxF MPR360 user interface. Use a PC with a web browser installed, (such as Internet Explorer). Enter the IP address of the ALxxF MPR360 into the address bar of the web browser. For example http://192.168.1.237.
3. Login to the ALxxF MPR360, using "Admin" credentials. Default user name as shipped is "admin". Default password as shipped is <blank>.
4. Referring to Figure 15, on the screen's left side menu, select Upload/Download, then below that, Software Update.
5. On the Software Update page, click on the Browse button to locate the update package file, from step 1 above.
6. Click on the Upload File button. Loading begins. This may take up to several minutes. Wait while the software is unpacked and installed.
7. When the Software Update page returns, click on button Switch Software Version on Next Reboot. Wait for the software to activate.
8. Reboot the ALxxF MPR360 by selecting the Reboot button.

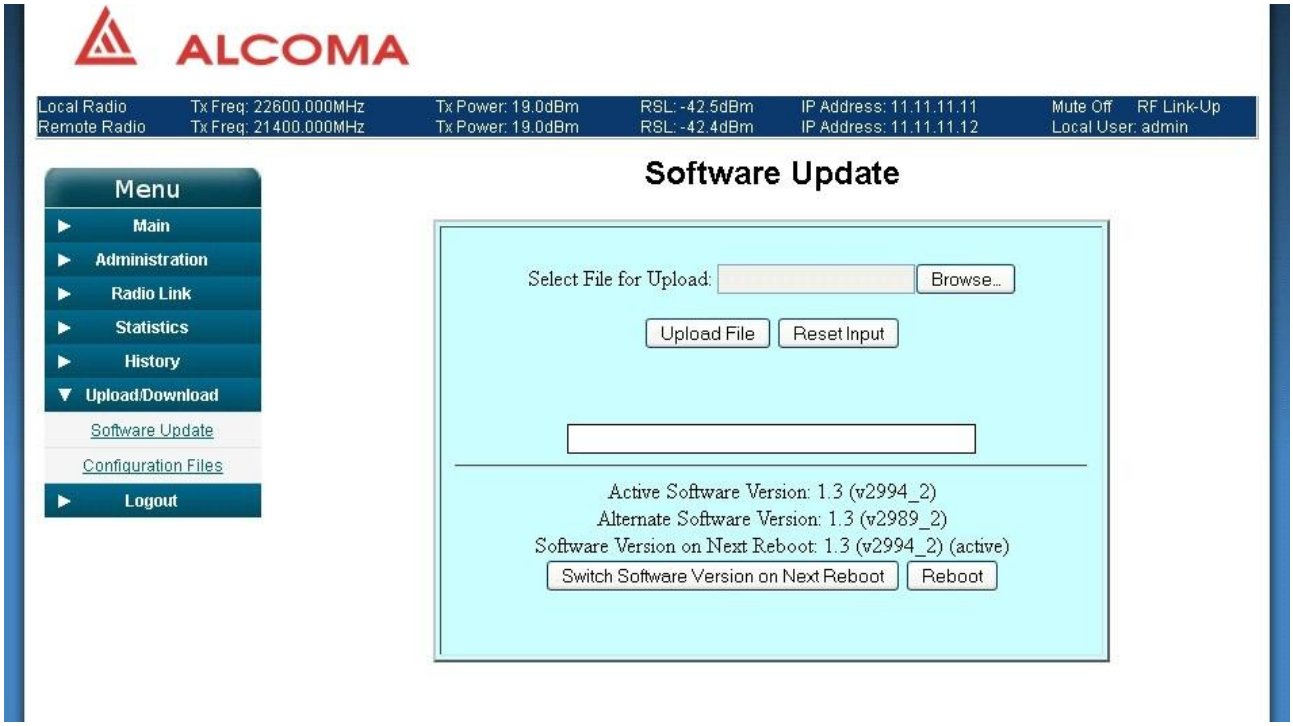



**Figure 15 Firmware Loading**

# 4 TESTING THE RADIO ON THE AIR

This Chapter provides information on configuring parameter values that are allowable for controlling Modulation and Tx Power, for each of the following 4 user-selectable transmitting modes:

- Fixed (Default mode)
- ATPC
- RTPC
- ACM

## 4.1 RADIO CAPABILITIES

**Note**

In the following section, TxPower Min and TxPower Max refer to the absolute capabilities of the radio. These parameters cannot be modified by the user. The term limit refers to a restriction that has been configured for the radio to transmit within a Tx power range that is narrower than the radio's capability. Refer to Figure 16 for an example.

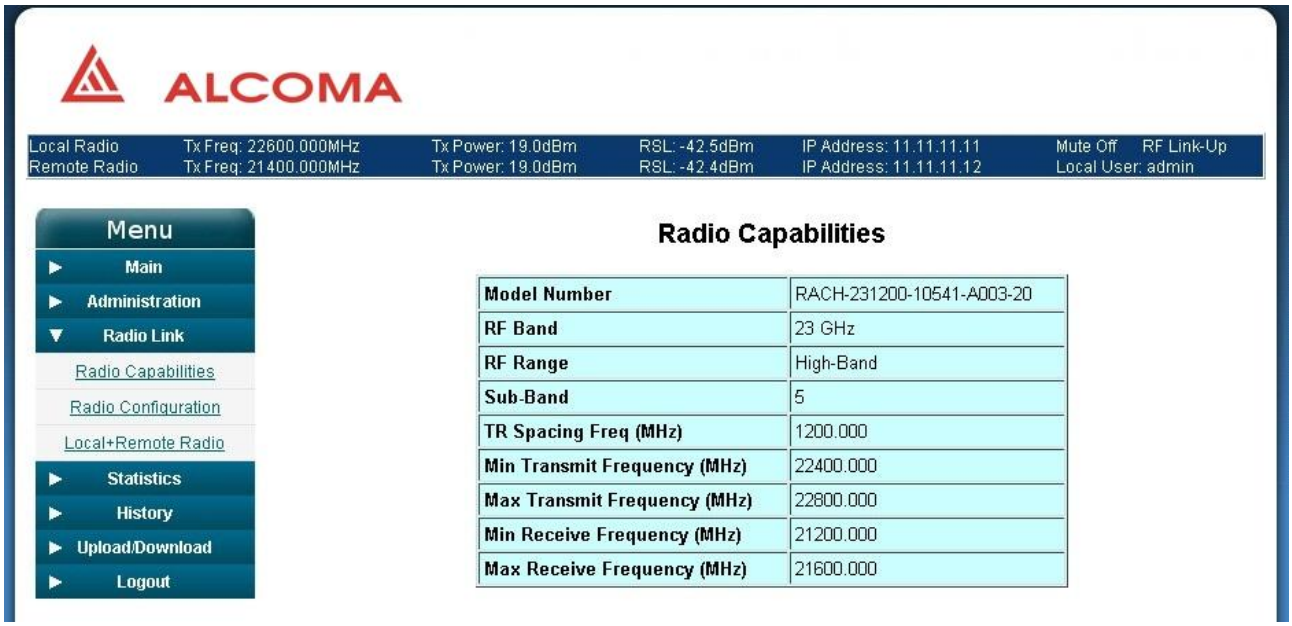



**Figure 16 Radio Capabilities Screen**

## 4.2 MODULATION SELECTIONS

Selecting a modulation is restricted according to the selected channel size, as shown in Table 3.

| | ETSI CHannel Size (MHz) | | | |
|---|---|---|---|---|
| **Modulation** | **7** | **14** | **28** | **56** |
| **QPSK** | ✓ | ✓ | ✓ | **N/A** |
| **16 QAM** | ✓ | ✓ | ✓ | ✓ |
| **32 QAM** | ✓ | ✓ | ✓ | ✓ |
| **64 QAM** | ✓ | ✓ | ✓ | ✓ |
| **128 QAM** | ✓ | ✓ | ✓ | ✓ |
| **256 QAM** | **N/A** | **N/A** | ✓ | ✓ |

**Table 3 Modulation Selection According to Channel Size[2]**

## 4.3 RADIO LINK SETUP

Each ALxxF MPR360 is shipped with the following default configuration that will establish a link after un-muting the Tx power.

| | |
|---|---|
| **TX Power Mode** | Fixed |
| **Modulation** | QPSK |
| **Bandwidth** | 28 MHz (ETSI) |
| **TX Freq** | Center of range |
| **RX Freq** | Center of range |
| **TX Mute** | Enabled |

### 4.3.1 Radio Configuration

**Radio configurations can be changed before un-muting the Transmit power as follows:**

1. Use the navigation panel on the left to select Radio link and from the sub menu, Radio Configuration. The Radio Configuration Screen displays.
2. Select a TX Power Mode = Fixed (default), RTPC, ATPC, or ACM.
3. Set Frequencies. As shipped, each radio is set to it's center frequency. If changing frequencies, ensure that
    - TxFreq of the low-band radio is set to RxFreq of the high- band radio.
    - TxFreq of the high-band radio is set to RxFreq of the low- band radio.
4. Unmute by clicking on Mute Off.

[2] Channel size is equivalent to Bandwidth in the Web GUI

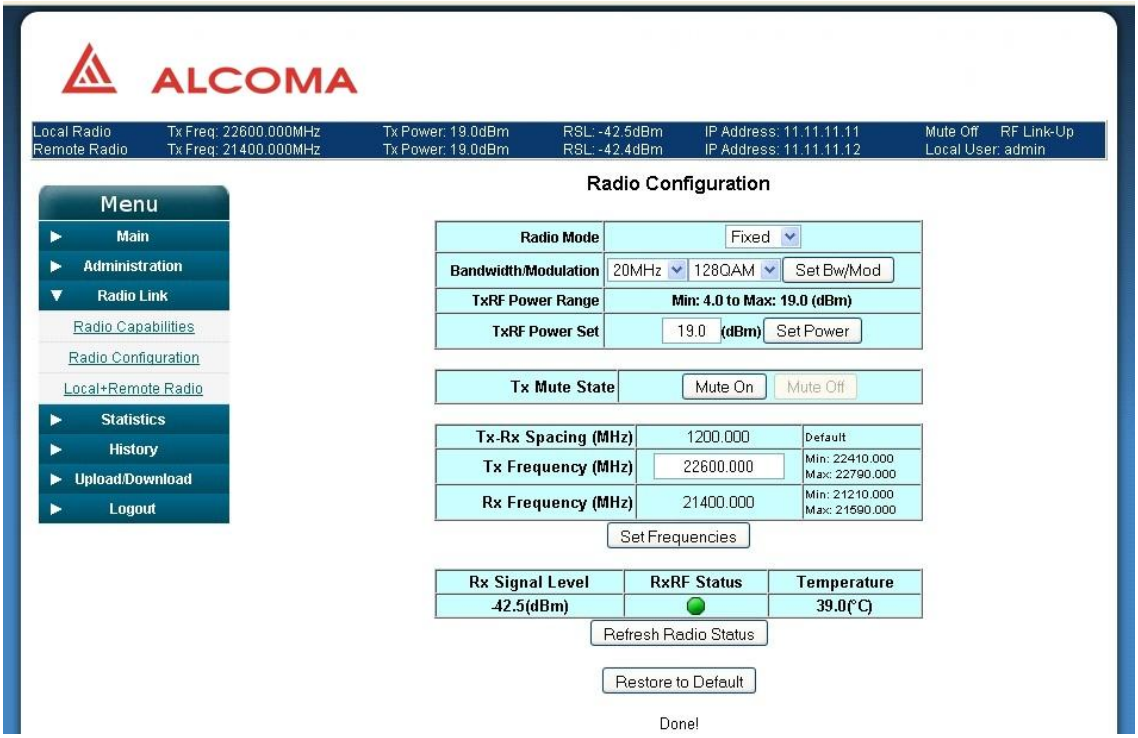



**Figure 17 Radio Configuration Screen**

**Note**

The Radio Configuration steps described above apply to each of the 4 radio transmitting modes. Invalid options or values will cause a parameter field to display in Yellow or Red. You must then select/enter a new valid option or value.

### 4.3.2 Fixed

**This mode allows you to:**

1. Select a Modulation, per Table 3.
2. Set a Tx Power level in tenth dB increments.
3. Set Tx Frequency within the radio's frequency limits.

**Note**

Power settings that are outside the radio's TxPower Min and TxPower Max are rejected, and previously selected power settings maintained. Typical power range for this mode is 15 dB. Refer to Allowable Parameter Values/Options in Fixed Mode.

**Allowable Parameter Values/Options in Fixed Mode**

| Parameter | Value / Option |
|---|---|
| Modulation/Bandwidth | Set by user, per Table 3 |
| TX RF Power Range (dBm) | Set by software |
| TX RF Power Set (dBm) | Set by user within range displayed |
| TX-RX Spacing (MHz)<br>TX Frequency (MHz) | Set by user within limits displayed |
| Rx Frequency (MHz) | Set by software |

**Note**

TX-RX Spacing is only changeable for a few frequencies, as described in the ALxxF MPR360 Product Description. This includes ETSI 18 GHz ALxxF MPR360s with 1010 T/R spacing that can be changed to 1008 T/R spacing. Similarly, ANSI 11 GHz ALxxF MPR360s with 490 T/R spacing can be changed to 500 T/R spacing.

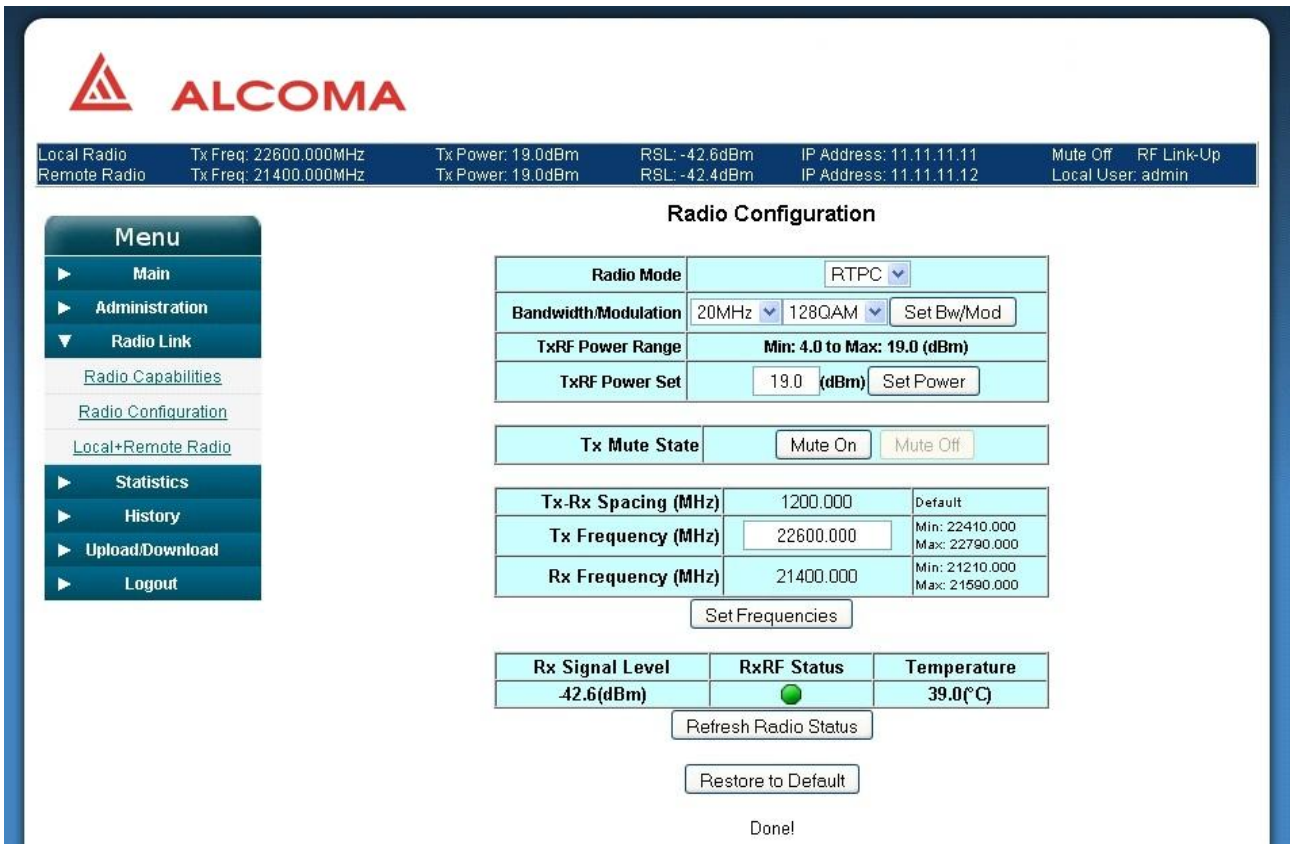



**Figure 18 Radio Configuration Screen — RTPC Mode**

### 4.3.3 RTPC

Although similar to the Fixed, this mode is often used for ETSI radios, and presents the following characteristics:

- The range of allowable TX Power settings is reduced to the limits imposed by RTPC.
- In this mode, the TX Power Lower Limit is likely to be higher than the TX Power Min level of the radio.
- TX Power Limits for RTPC cannot be modified by the user, and may vary for different modulation levels.

**Note**

Power settings that are outside the radio's TX Power Limits are rejected, and previously selected power settings maintained. Typical power range for this mode is 6 dB. Refer to Allowable Parameter Values/Options in RTPC Mode.

**Allowable Parameter Values/Options in RTPC Mode**

| Parameter | Value / Option |
|---|---|
| Modulation/Bandwidth | Set by user, per Table 3 |
| TX RF Power Range (dBm) | Set by software |
| TX RF Power Set (dBm) | Set by user within range displayed |
| TX-RX Spacing (MHz)<br>TX Frequency (MHz) | Set by user within limits displayed |
| Rx Frequency (MHz) | Set by software |

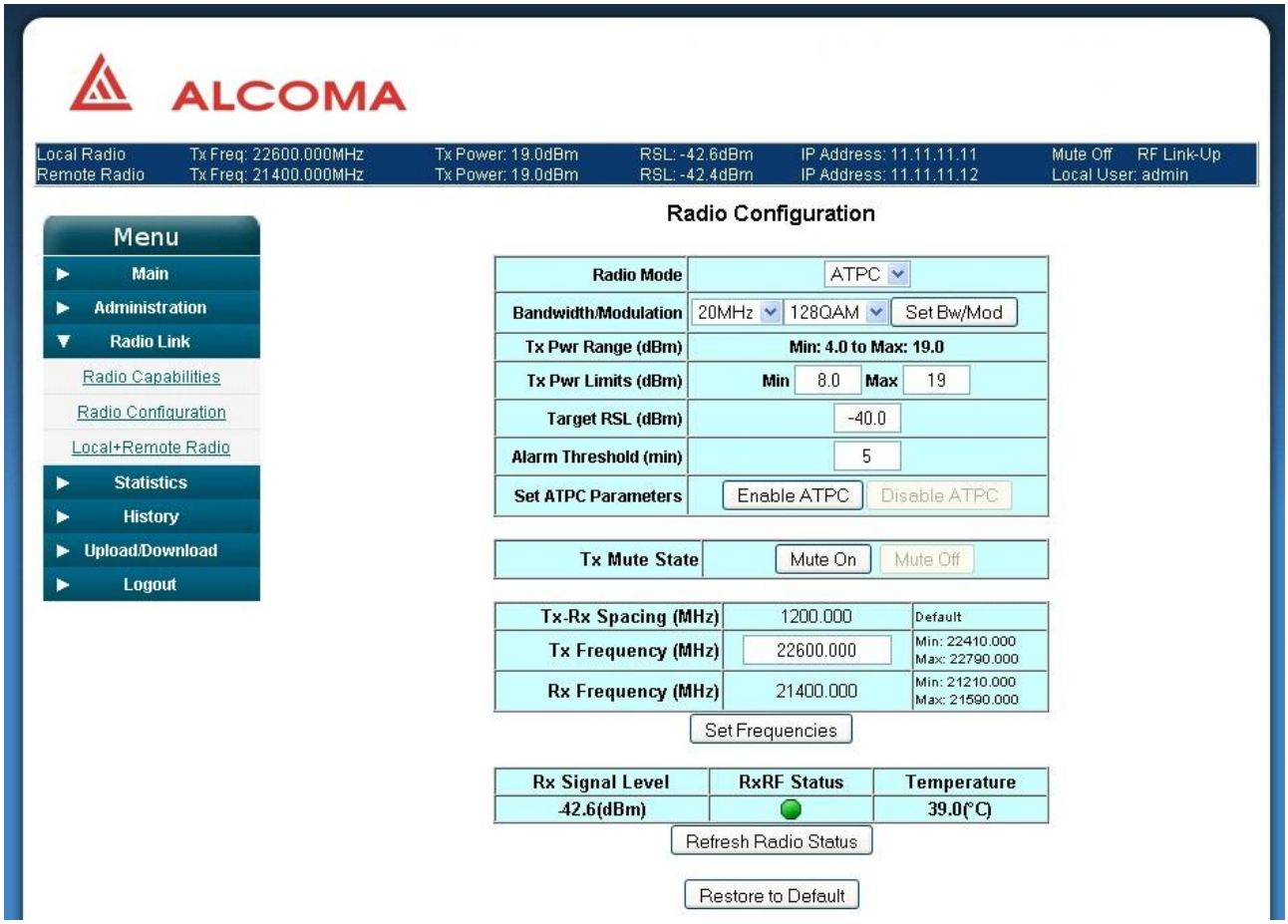



**Figure 19 Radio Configuration Screen — RTPC Mode**

### 4.3.4 ATPC

**Characteristics of this mode:**

- Tx power is adjusted to maintain a specified Rx level at the remote end of the link.
- Current Rx level of the remote radio is compared to the target Rx level to determine the adjustment to be made to the local Tx power.
- If the remote RSL exceeds the target RSL by more than 1 dBm, the Tx Power is adjusted in discrete increments.

**This mode allows you to**

1. Select a Modulation/Bandwidth, per Table 3.
2. Set a target RSL value to maintain at the remote radio.
3. Enable ATPC parameters to set Tx Power Lower Limit and a Tx Power Upper Limit within the radio's Min/Max Capabilities, for the selected modulation level.

**Note**

Tx Power is automatically adjusted, within the limits specified, to maintain the target RSL at the remote radio. ATPC power limit settings that are outside the radio's Min/Max Tx Power capabilities are rejected. Refer to the Allowable Parameter Values/Options in ATPC Mode.

**Allowable Parameter Values/Options in ATPC Mode**

| Parameter | Value / Option |
|---|---|
| Modulation/Bandwidth | Set by user, per Table 3 |
| TxRF Power Range (dBm) | Set by software |
| Tx Pwr Min Limit (dBm) | Automatically adjusted within limits displayed, once ATPC enabled |
| Tx Pwr Max Limit (dBm) | |
| Target RSL (dBm) | Set by user within range displayed |
| Tx-Rx Spacing (MHz) | Set by user within limits displayed |
| Tx Frequency (MHz) | |
| Rx Frequency (MHz) | Set by software |

**Note**

To use this mode in a link, you must set both radios to ATPC.

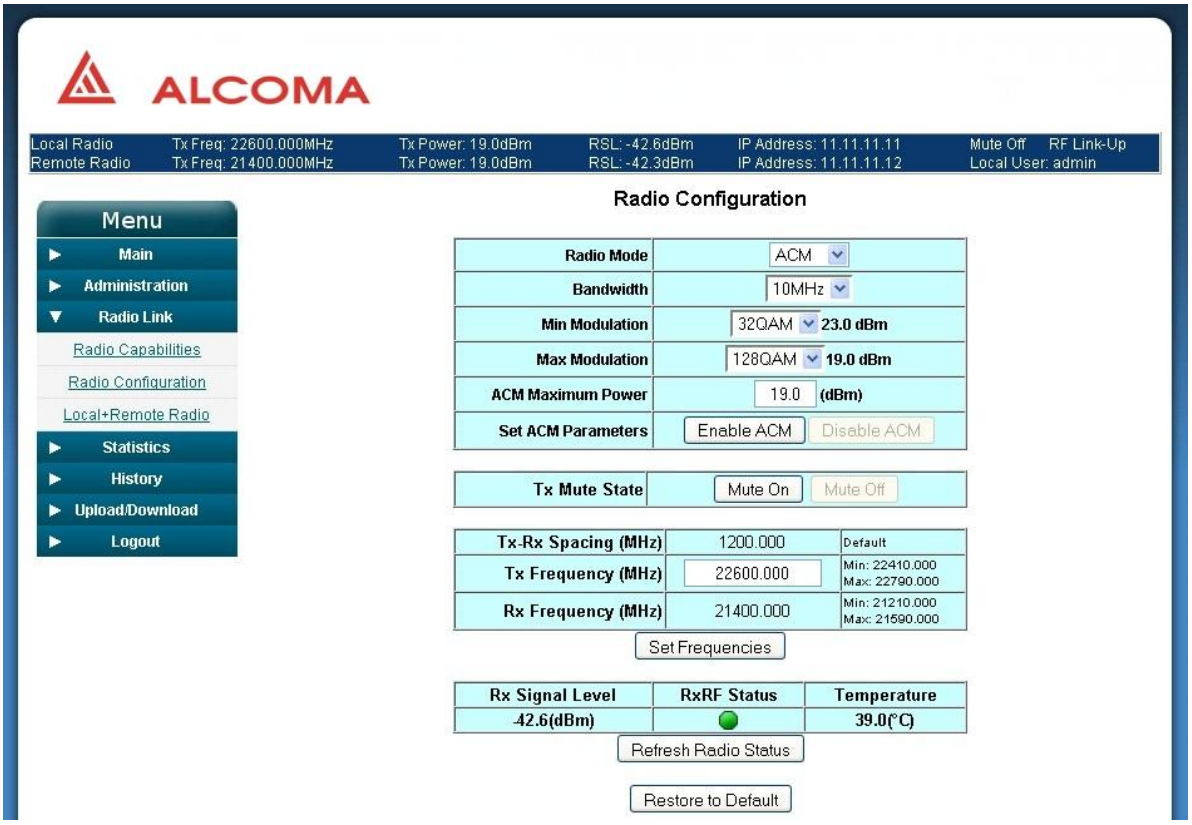



**Figure 20 Radio Configuration Screen — ACM Mode**

### 4.3.5 ACM

**Characteristics of this mode:**

- Adjusts Modulation level to the highest configured level in order to maintain a reliable link.

**This mode allows you to:**

1. Select a range of allowable modulation levels — QSPK to 256 QAM, per Table 3.
2. View the Tx Power Max capability for each modulation level.
3. Select the radio's Class, (2, 4, 5, 6), in case of an ETSI radio.

**Note**

Tx Power settings are limited to the Max Tx Power for the selected Class, even when operating at a modulation level that is lower than that of the selected Class.

**Allowable Parameter Values/Options in ACM Mode**

| Parameter | Value / Option |
|---|---|
| Bandwidth | Set by user, per Table 3 |
| Min Modulation | Highest level adjusted within limits, once ACM enabled |
| Max Modulation | |
| ETSI Class | Set by user |
| Target RSL (dBm) | Set by user within range displayed |
| Tx-Rx Spacing (MHz) | Set by user within limits displayed |
| Tx Frequency (MHz) | |
| Rx Frequency (MHz) | Set by software |

# 5 ALARMS AND TROUBLESHOOTING

This Chapter provides basic information on identifying and resolving potential equipment alarms.

## 5.1 RADIO STATUS AND BANNER

Radio Status is available on the Main Menu and summarizes the running state of the radio on a single page, as shown in Figure 21.

Each web page of the ALxxF MPR360 also includes a banner at the top that describes the running state of both the Local Radio and the Remote Radio. The banner includes information such as, Transmit and Receive frequencies, Transmission performances, RSL values, IP addresses, and the State of the Link.

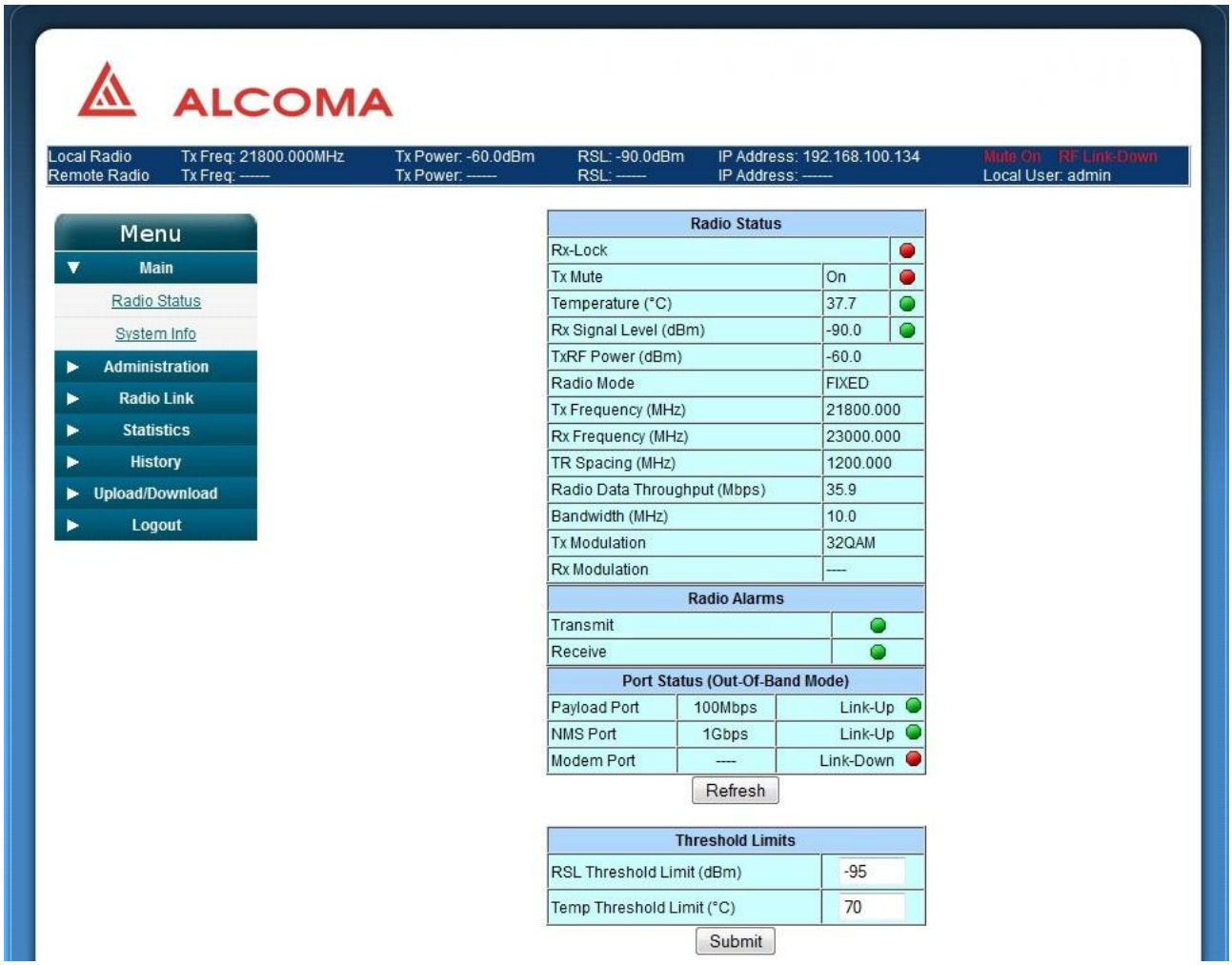



**Figure 21 Radio status**

## 5.2 POTENTIAL ALARMS

**Note**

In each of the 4 radio configuration mode screens displayed in Figure 17 through Figure 20, a potential alarm is declared through a red RxRF Status LED. Table 4 provides a brief look into the corrective action to take for such alarms.

| RX RF Status | Potentially invalid parameters in mode | | | | Action |
|---|---|---|---|---|---|
| | Fixed | RTPC | ATPC | ACM | |
| Green | Normal operation | | | | Do nothing |
| Red | Mod/Bandwidth | Mod/Bandwidth | Mod/Bandwidth | Bandwidth | Table 3 |
| | TxRF Power Set | TxRF Power Set | TxRF Power Set | ETSI Class | Review and correct selection or value |
| | Tx-Rx Spacing | Tx-Rx Spacing | Tx-Rx Spacing | Target RSL | |
| | Tx Frequency | Tx Frequency | Tx Frequency | Tx-Rx Spacing | |
| | | | | Tx Frequency | |

**Table 4 Potential Alarms and Troubleshooting**

Local and Remote Link Status LEDs, in Figure 22, provide the same status functions as those described above.

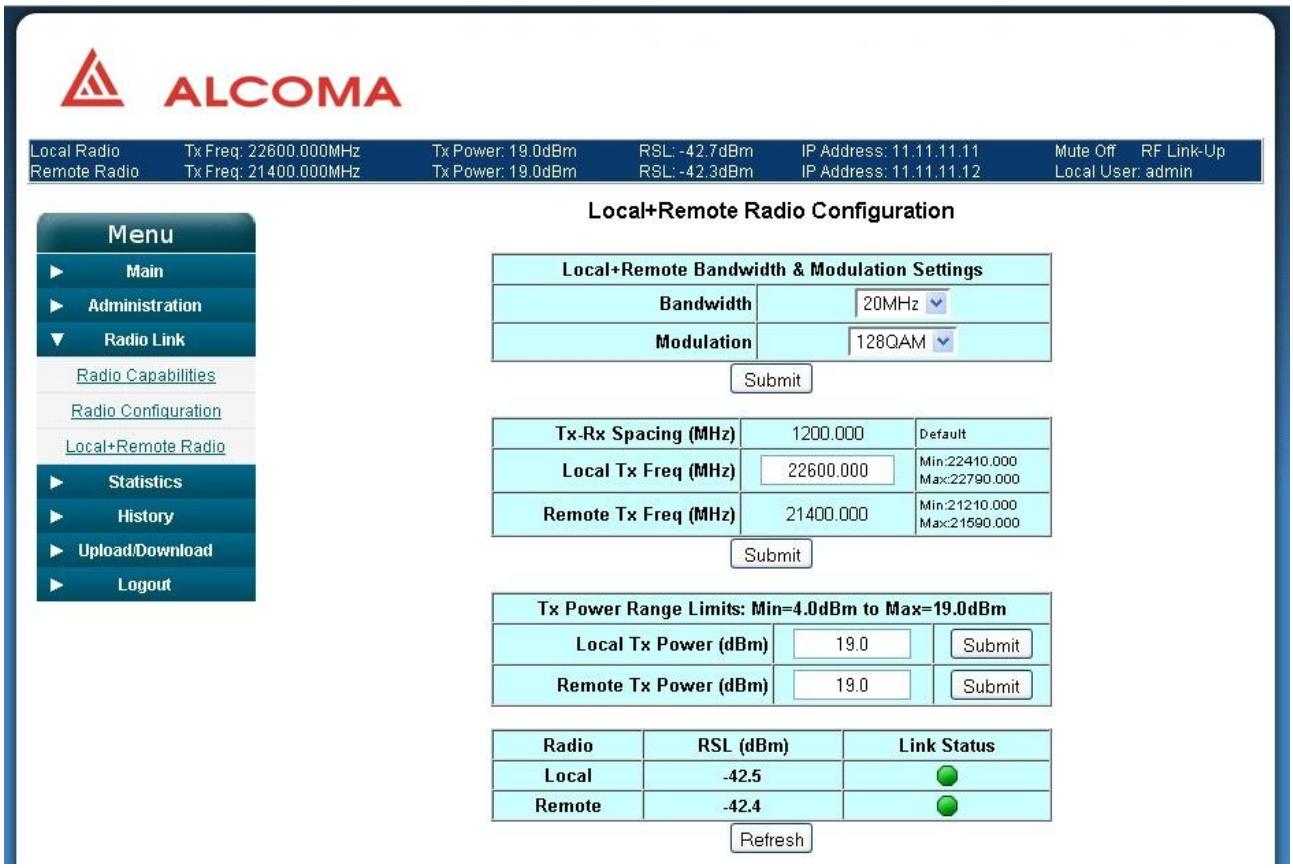
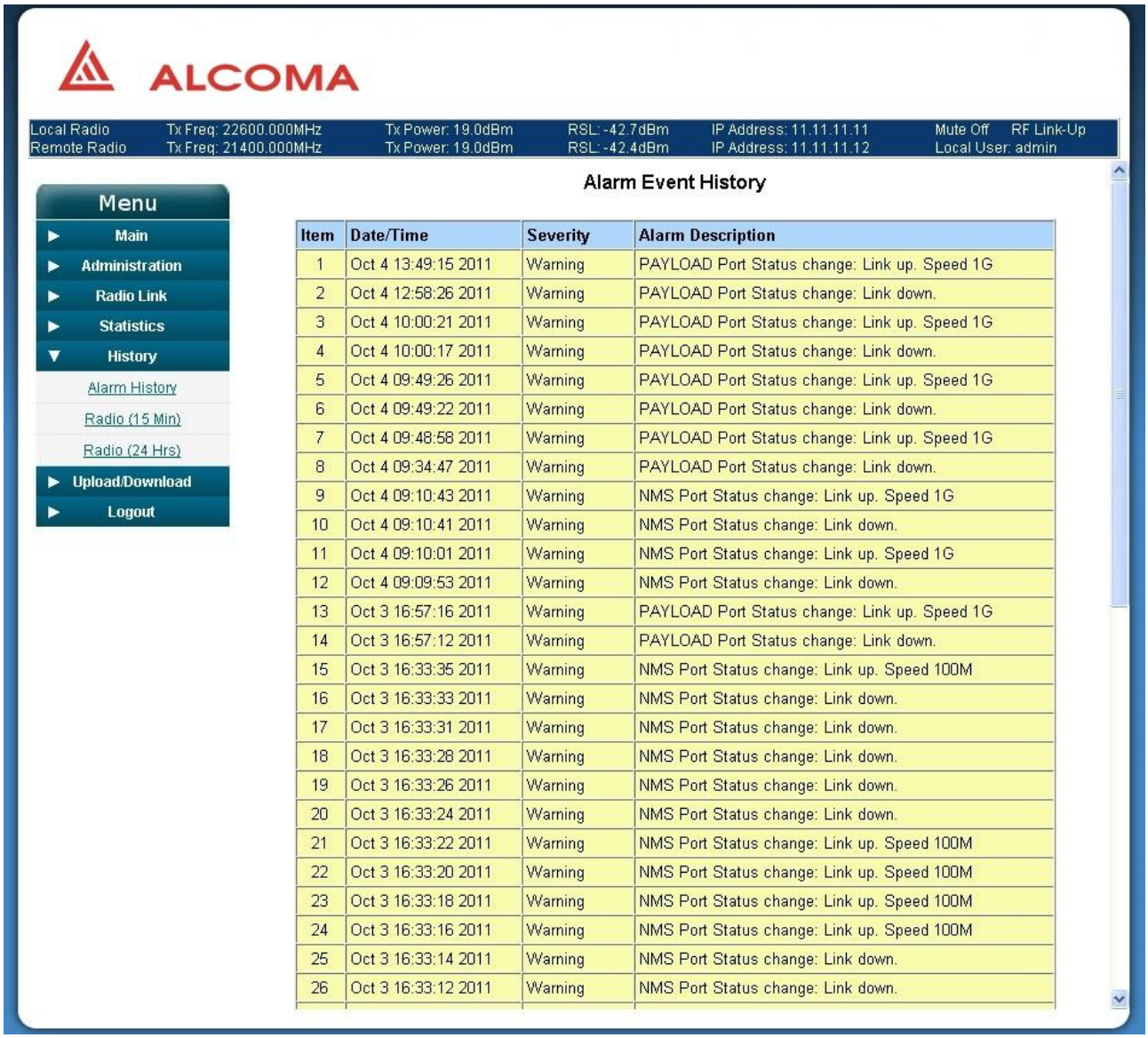



**Figure 22 Local and Remote Configuration Screen**

## 5.3 ALARM AND EVENT HISTORY

The radio's software provides an Alarm/Event log, available from the History sub-menu. Providing information for troubleshooting, this tool features textual data describing the event, a date and time stamp, and a severity field. Figure 23 provides a general example.




| Item | Date/Time | Severity | Alarm Description |
|---|---|---|---|
| 1 | Oct 4 13:49:15 2011 | Warning | PAYLOAD Port Status change: Link up. Speed 1G |
| 2 | Oct 4 12:58:26 2011 | Warning | PAYLOAD Port Status change: Link down. |
| 3 | Oct 4 10:00:21 2011 | Warning | PAYLOAD Port Status change: Link up. Speed 1G |
| 4 | Oct 4 10:00:17 2011 | Warning | PAYLOAD Port Status change: Link down. |
| 5 | Oct 4 09:49:26 2011 | Warning | PAYLOAD Port Status change: Link up. Speed 1G |
| 6 | Oct 4 09:49:22 2011 | Warning | PAYLOAD Port Status change: Link down. |
| 7 | Oct 4 09:48:58 2011 | Warning | PAYLOAD Port Status change: Link up. Speed 1G |
| 8 | Oct 4 09:34:47 2011 | Warning | PAYLOAD Port Status change: Link down. |
| 9 | Oct 4 09:10:43 2011 | Warning | NMS Port Status change: Link up. Speed 1G |
| 10 | Oct 4 09:10:41 2011 | Warning | NMS Port Status change: Link down. |
| 11 | Oct 4 09:10:01 2011 | Warning | NMS Port Status change: Link up. Speed 1G |
| 12 | Oct 4 09:09:53 2011 | Warning | NMS Port Status change: Link down. |
| 13 | Oct 3 16:57:16 2011 | Warning | PAYLOAD Port Status change: Link up. Speed 1G |
| 14 | Oct 3 16:57:12 2011 | Warning | PAYLOAD Port Status change: Link down. |
| 15 | Oct 3 16:33:35 2011 | Warning | NMS Port Status change: Link up. Speed 100M |
| 16 | Oct 3 16:33:33 2011 | Warning | NMS Port Status change: Link down. |
| 17 | Oct 3 16:33:31 2011 | Warning | NMS Port Status change: Link down. |
| 18 | Oct 3 16:33:28 2011 | Warning | NMS Port Status change: Link down. |
| 19 | Oct 3 16:33:26 2011 | Warning | NMS Port Status change: Link down. |
| 20 | Oct 3 16:33:24 2011 | Warning | NMS Port Status change: Link down. |
| 21 | Oct 3 16:33:22 2011 | Warning | NMS Port Status change: Link up. Speed 100M |
| 22 | Oct 3 16:33:20 2011 | Warning | NMS Port Status change: Link up. Speed 100M |
| 23 | Oct 3 16:33:18 2011 | Warning | NMS Port Status change: Link up. Speed 100M |
| 24 | Oct 3 16:33:16 2011 | Warning | NMS Port Status change: Link up. Speed 100M |
| 25 | Oct 3 16:33:14 2011 | Warning | NMS Port Status change: Link down. |
| 26 | Oct 3 16:33:12 2011 | Warning | NMS Port Status change: Link down. |

**Figure 23 Alarm and Event History — Example**

The Alarm/Event log has the following features:

- The log contains textual data describing the event, a date and time stamp, and a severity field.
- The log is stored in non-volatile memory and so, is maintained on power loss.
- The Alarm/Event log is not user configurable – i.e. alarm events are logged in the log, regardless of SNMP trap configuration or other settings.
- The user can download the log as a text file.
- The log has a minimum of 100 entries before it wraps around.
- The log can be viewed through the Web GUI.
- The log can be erased through the Web GUI.

- Events are given a severity of “informational”, if the event is part of normal operation and, no action is required. Examples of “informational” events are:
    - user-commanded Reboot
    - user-commanded Reset to factory defaults
    - Key installation
    - User login/out
    - Time change
    - Software upload
- Events are given a severity of “warning” if the event is not an error.A warning is an indication that an error may occur if action is not taken. Examples of “warning” events are:
    - RSL Alarm
    - Temperature alarm
- Events are given a severity of “critical” to indicate a failure in a primary system. An example of a “critical” event includes
    - Tx-Power Fail alarm

## 5.4 MONITORING POINTS

**Note**

This section serves as a reference for identifying the radio’s monitoring points.
The ALxxF MPR360 includes two other main monitoring features:

- Network Statistics
- Radio Performance History

**Network Statistics**

On each available port, the Web GUI displays current network statistics similar to RMON or the IF MIB.
For a unit with an NMS port there are 4 available ports:

- Radio
- Payload
- CPU
- NMS

For a unit without an NMS port there are 3 available ports:

- Radio
- Payload
- CPU

As a minimum, the following performance statistics are recorded for each of the available ports:

- Rx Octets
- Rx Unicast Pkts
- Rx Discards
- Rx Errors
- Rx BroadCastPkts
- Rx MultiCastPkts
- Tx Octets
- Tx Unicast Pkts
- Tx Discards
- Tx Errors
- Tx BroadCastPkts
- Tx MultiCastPkts

These statistics correspond to the statistics available in the IF table of MIB II. The GUI allows for statistics to be zeroed.
The current implementation supports cumulative statistics and does not record interval periods for network statistics. Interval statistics are available for RF statistics.

**Radio Performance History**

The Radio performance history includes the following parameters:

- Average Temperature,
- Min RSL,
- Max Tx Power (may be recorded only when ATPC is in operation)
- Min Modulation (may be recorded only when ACM is in operation)

The Web GUI keeps statistics in 15 minute intervals for the previous 24hr period. Fewer than 96 intervals of statistics will be available if the ALxxF MPR360 has been restarted within the last 24 hours.

The 15-minute intervals start when the unit is powered ON. The intervals are not aligned with quarter hours so there is no relationship between the start of a 15-minute interval and a wall clock. When the uptime for the radio is less than 24 hours, there will be less than 96 entries for the 15-minute interval statistics.

The Web GUI displays statistics on each 24-hour interval for the previous 7 day period.
Statistics are cleared on power cycle or reboot.

# 6 MODULATION, THRESHOLD SENSITIVITY AND TRANSFER CAPACITY

## 6.1 LINKS 6/7/8 GHz

| Total bit speed [Mbps] | Modulation | Typical Threshold sensitivity for BER = $10^{-6}$ [dBm] | max TX power [dB] | Width of transmitted spectrum in [MHz] |
|---|---|---|---|---|
| 10 | QPSK | -91.0 | 30.0 | 7 |
| 20 | 16 QAM | -85.0 | 28.0 | |
| 25 | 32 QAM | -81.0 | 28.0 | |
| 32 | 64 QAM | -79.0 | 24.0 | |
| 37 | 128 QAM | -75.0 | 24.0 | |
| 21 | QPSK | -88.0 | 30.0 | 14 |
| 42 | 16 QAM | -82.0 | 28.0 | |
| 52 | 32 QAM | -78.0 | 28.0 | |
| 65 | 64 QAM | -76.0 | 24.0 | |
| 77 | 128 QAM | -72.0 | 24.0 | |
| 42 | QPSK | -85.5 | 30.0 | 28 |
| 85 | 16 QAM | -80.5 | 28.0 | |
| 106 | 32 QAM | -76.0 | 28.0 | |
| 133 | 64 QAM | -74.0 | 24.0 | |
| 156 | 128 QAM | -70.5 | 24.0 | |
| 180 | 256 QAM | -66.5 | 22.0 | |
| 172 | 16 QAM | -77.5 | 28.0 | 56 |
| 215 | 32 QAM | -73.0 | 28.0 | |
| 268 | 64 QAM | -71.0 | 24.0 | |
| 316 | 128 QAM | -67.5 | 24.0 | |
| 364 | 256 QAM | -63.5 | 22.0 | |

## 6.2 LINKS 11 GHz

| Total bit speed [Mbps] | Modulation | Typical Threshold sensitivity for BER = $10^{-6}$ [dBm] | max TX power [dB] | Width of transmitted spectrum in [MHz] |
|---|---|---|---|---|
| 10 | QPSK | -91.5 | 28.0 | 7 |
| 20 | 16 QAM | -85.5 | 26.0 | |
| 25 | 32 QAM | -81.5 | 26.0 | |
| 32 | 64 QAM | -79.5 | 22.0 | |
| 37 | 128 QAM | -75.5 | 22.0 | |
| 21 | QPSK | -88.5 | 28.0 | 14 |
| 42 | 16 QAM | -82.5 | 26.0 | |
| 52 | 32 QAM | -78.5 | 26.0 | |
| 65 | 64 QAM | -76.5 | 22.0 | |
| 77 | 128 QAM | -72.5 | 22.0 | |
| 42 | QPSK | -86.0 | 28.0 | 28 |
| 85 | 16 QAM | -81.0 | 26.0 | |
| 106 | 32 QAM | -76.5 | 26.0 | |
| 133 | 64 QAM | -74.5 | 22.0 | |
| 156 | 128 QAM | -71.0 | 22.0 | |
| 180 | 256 QAM | -67.0 | 20.0 | |
| 172 | 16 QAM | -78.0 | 26.0 | 56 |
| 215 | 32 QAM | -73.5 | 26.0 | |
| 268 | 64 QAM | -71.5 | 22.0 | |
| 316 | 128 QAM | -68.0 | 22.0 | |
| 364 | 256 QAM | -64.0 | 20.0 | |

## 6.3 LINKS 13/15 GHZ

| Total bit speed [Mbps] | Modulation | Typical Threshold sensitivity for BER = $10^{-6}$ [dBm] | max TX power [dB] | Width of transmitted spectrum in [MHz] |
|---|---|---|---|---|
| 10 | QPSK | -91.5 | 26.0 | 7 |
| 20 | 16 QAM | -85.5 | 23.0 | |
| 25 | 32 QAM | -81.5 | 23.0 | |
| 32 | 64 QAM | -79.5 | 19.0 | |
| 37 | 128 QAM | -75.5 | 19.0 | |
| 21 | QPSK | -88.5 | 26.0 | 14 |
| 42 | 16 QAM | -82.5 | 23.0 | |
| 52 | 32 QAM | -78.5 | 23.0 | |
| 65 | 64 QAM | -76.5 | 19.0 | |
| 77 | 128 QAM | -72.5 | 19.0 | |
| 42 | QPSK | -86.0 | 26.0 | 28 |
| 85 | 16 QAM | -81.0 | 23.0 | |
| 106 | 32 QAM | -76.5 | 23.0 | |
| 133 | 64 QAM | -74.5 | 19.0 | |
| 156 | 128 QAM | -71.0 | 19.0 | |
| 180 | 256 QAM | -67.0 | 17.0 | |
| 172 | 16 QAM | -78.0 | 23.0 | 56 |
| 215 | 32 QAM | -73.5 | 23.0 | |
| 268 | 64 QAM | -71.5 | 19.0 | |
| 316 | 128 QAM | -68.0 | 19.0 | |
| 364 | 256 QAM | -64.0 | 17.0 | |

## 6.4 LINKS 18 GHz

| Total bit speed [Mbps] | Modulation | Typical Threshold sensitivity for BER = $10^{-6}$ [dBm] | max TX power [dB] | Width of transmitted spectrum in [MHz] |
|---|---|---|---|---|
| 10 | QPSK | -91.5 | 25.5 | 7 |
| 20 | 16 QAM | -85.5 | 22.0 | |
| 25 | 32 QAM | -81.5 | 22.0 | |
| 32 | 64 QAM | -79.5 | 18.0 | |
| 37 | 128 QAM | -75.5 | 18.0 | |
| 21 | QPSK | -88.5 | 25.5 | 14 |
| 42 | 16 QAM | -82.5 | 22.0 | |
| 52 | 32 QAM | -78.5 | 22.0 | |
| 65 | 64 QAM | -76.5 | 18.0 | |
| 77 | 128 QAM | -72.5 | 18.0 | |
| 42 | QPSK | -86.0 | 25.5 | 28 |
| 85 | 16 QAM | -81.0 | 22.0 | |
| 106 | 32 QAM | -76.5 | 22.0 | |
| 133 | 64 QAM | -74.5 | 18.0 | |
| 156 | 128 QAM | -71.0 | 18.0 | |
| 180 | 256 QAM | -67.0 | 16.0 | |
| 172 | 16 QAM | -78.0 | 22.0 | 56 |
| 215 | 32 QAM | -73.5 | 22.0 | |
| 268 | 64 QAM | -71.5 | 18.0 | |
| 316 | 128 QAM | -68.0 | 18.0 | |
| 364 | 256 QAM | -64.0 | 16.0 | |

## 6.5 LINKS 23 GHz

| Total bit speed [Mbps] | Modulation | Typical Threshold sensitivity for BER = $10^{-6}$ [dBm] | max TX power [dB] | Width of transmitted spectrum in [MHz] |
|---|---|---|---|---|
| 10 | QPSK | -91.0 | 25.0 | 7 |
| 20 | 16 QAM | -85.0 | 22.0 | |
| 25 | 32 QAM | -81.0 | 22.0 | |
| 32 | 64 QAM | -79.0 | 18.0 | |
| 37 | 128 QAM | -75.0 | 18.0 | |
| 21 | QPSK | -88.0 | 25.0 | 14 |
| 42 | 16 QAM | -82.0 | 22.0 | |
| 52 | 32 QAM | -78.0 | 22.0 | |
| 65 | 64 QAM | -76.0 | 18.0 | |
| 77 | 128 QAM | -72.0 | 18.0 | |
| 42 | QPSK | -85.5 | 25.0 | 28 |
| 85 | 16 QAM | -80.5 | 22.0 | |
| 106 | 32 QAM | -76.0 | 22.0 | |
| 133 | 64 QAM | -74.0 | 18.0 | |
| 156 | 128 QAM | -70.5 | 18.0 | |
| 180 | 256 QAM | -66.5 | 16.0 | |
| 172 | 16 QAM | -77.5 | 22.0 | 56 |
| 215 | 32 QAM | -73.0 | 22.0 | |
| 268 | 64 QAM | -71.0 | 18.0 | |
| 316 | 128 QAM | -67.5 | 18.0 | |
| 364 | 256 QAM | -63.5 | 16.0 | |

## 6.6 LINKS 26 GHz

| Total bit speed [Mbps] | Modulation | Typical Threshold sensitivity for BER = $10^{-6}$ [dBm] | max TX power [dB] | Width of transmitted spectrum in [MHz] |
|---|---|---|---|---|
| 10 | QPSK | -91.0 | 25.0 | 7 |
| 20 | 16 QAM | -85.0 | 22.0 | |
| 25 | 32 QAM | -81.0 | 22.0 | |
| 32 | 64 QAM | -79.0 | 18.0 | |
| 37 | 128 QAM | -75.0 | 18.0 | |
| 21 | QPSK | -88.0 | 25.0 | 14 |
| 42 | 16 QAM | -82.0 | 22.0 | |
| 52 | 32 QAM | -78.0 | 22.0 | |
| 65 | 64 QAM | -76.0 | 18.0 | |
| 77 | 128 QAM | -72.0 | 18.0 | |
| 42 | QPSK | -85.5 | 25.0 | 28 |
| 85 | 16 QAM | -80.5 | 22.0 | |
| 106 | 32 QAM | -76.0 | 22.0 | |
| 133 | 64 QAM | -74.0 | 18.0 | |
| 156 | 128 QAM | -70.5 | 18.0 | |
| 180 | 256 QAM | -66.5 | 16.0 | |
| 172 | 16 QAM | -77.5 | 22.0 | 56 |
| 215 | 32 QAM | -73.0 | 22.0 | |
| 268 | 64 QAM | -71.0 | 18.0 | |
| 316 | 128 QAM | -67.5 | 18.0 | |
| 364 | 256 QAM | -63.5 | 16.0 | |

## 6.7 LINKS 32 GHz

| Total bit speed [Mbps] | Modulation | Typical Threshold sensitivity for BER = $10^{-6}$ [dBm] | max TX power [dB] | Width of transmitted spectrum in [MHz] |
|---|---|---|---|---|
| 10 | QPSK | -90.0 | 23.0 | 7 |
| 20 | 16 QAM | -84.0 | 21.0 | |
| 25 | 32 QAM | -80.0 | 21.0 | |
| 32 | 64 QAM | -78.0 | 17.0 | |
| 37 | 128 QAM | -74.0 | 17.0 | |
| 21 | QPSK | -87.0 | 23.0 | 14 |
| 42 | 16 QAM | -81.0 | 21.0 | |
| 52 | 32 QAM | -77.0 | 21.0 | |
| 65 | 64 QAM | -75.0 | 17.0 | |
| 77 | 128 QAM | -71.0 | 17.0 | |
| 42 | QPSK | -84.5 | 23.0 | 28 |
| 85 | 16 QAM | -79.5 | 21.0 | |
| 106 | 32 QAM | -75.0 | 21.0 | |
| 133 | 64 QAM | -73.0 | 17.0 | |
| 156 | 128 QAM | -69.5 | 17.0 | |
| 180 | 256 QAM | -65.5 | 15.0 | |
| 172 | 16 QAM | -76.5 | 21.0 | 56 |
| 215 | 32 QAM | -72.0 | 21.0 | |
| 268 | 64 QAM | -70.0 | 17.0 | |
| 316 | 128 QAM | -66.5 | 17.0 | |
| 364 | 256 QAM | -62.5 | 15.0 | |

## 6.8 LINKS 38 GHz

| Total bit speed [Mbps] | Modulation | Typical Threshold sensitivity for BER = $10^{-6}$ [dBm] | max TX power [dB] | Width of transmitted spectrum in [MHz] |
|---|---|---|---|---|
| 10 | QPSK | -89.0 | 23.0 | 7 |
| 20 | 16 QAM | -83.0 | 20.0 | |
| 25 | 32 QAM | -79.0 | 20.0 | |
| 32 | 64 QAM | -77.0 | 16.0 | |
| 37 | 128 QAM | -73.0 | 16.0 | |
| 21 | QPSK | -86.0 | 23.0 | 14 |
| 42 | 16 QAM | -80.0 | 20.0 | |
| 52 | 32 QAM | -76.0 | 20.0 | |
| 65 | 64 QAM | -74.0 | 16.0 | |
| 77 | 128 QAM | -70.0 | 16.0 | |
| 42 | QPSK | -83.5 | 23.0 | 28 |
| 85 | 16 QAM | -78.5 | 20.0 | |
| 106 | 32 QAM | -74.0 | 20.0 | |
| 133 | 64 QAM | -72.0 | 16.0 | |
| 156 | 128 QAM | -68.5 | 16.0 | |
| 180 | 256 QAM | -64.5 | 14.0 | |
| 172 | 16 QAM | -75.5 | 20.0 | 56 |
| 215 | 32 QAM | -71.0 | 20.0 | |
| 268 | 64 QAM | -69.0 | 16.0 | |
| 316 | 128 QAM | -65.5 | 16.0 | |
| 364 | 256 QAM | -61.5 | 14.0 | |

# 7 THE RSSI CALIBRATION GRAPH

The value of received level can be determined by direct reading in the WEB GUI or by calculation using the calibration graph for RSSI. The RSSI voltage can be measured at the BNC connector.

To check for the proper pointing, it is good to calculate the signal level that should be measured. The maximum allowed deviation between the calculated and measured signal levels is ±3 dB. If the negative deviation is higher the connection needs to be better pointed.

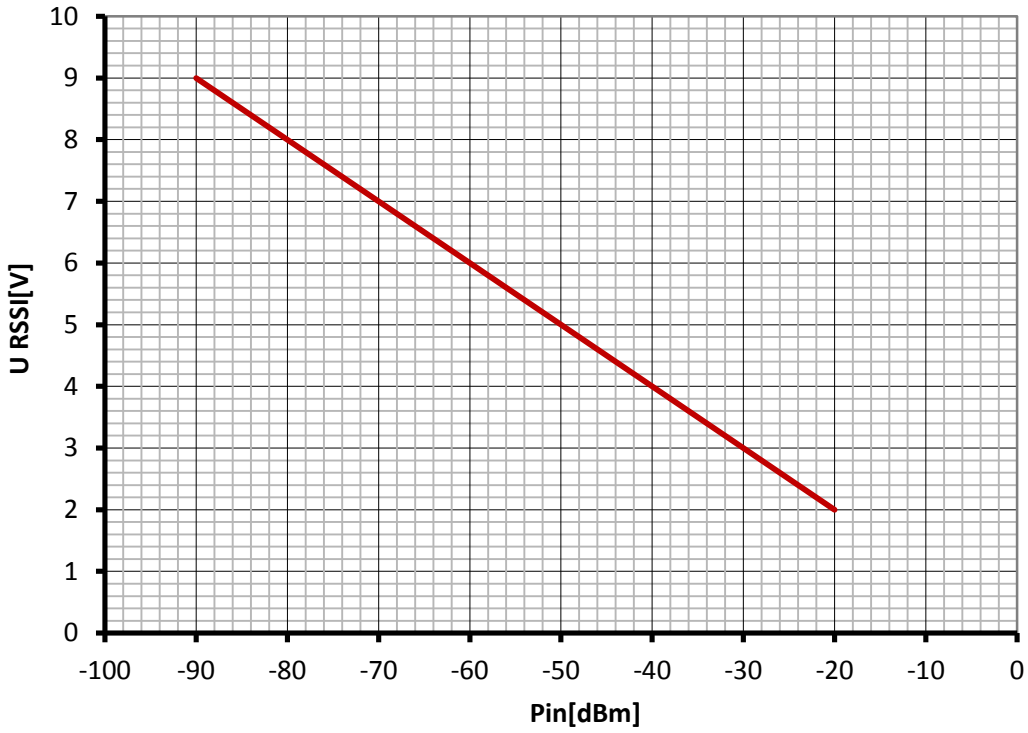



**Figure 24 The RSSI Calibration graph**

# 8 ODU POLARIZATION

The used polarization for left hand or right hand ODU installation can be determined according to the position of the ODU holder. If the ODU holder **points up**, the used **polarization is horizontal**, **if to the side**, then **it is vertical polarization**.

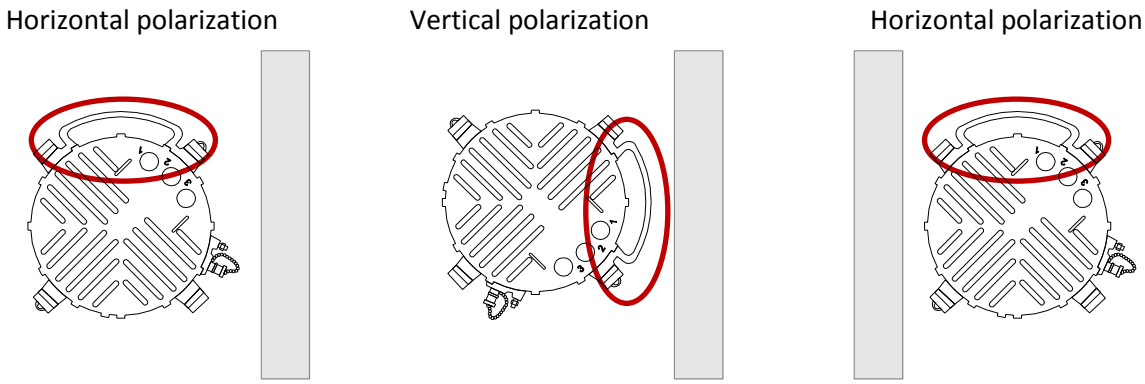



**Figure 25 ODU polarization**

# 9 INTERFACE FOR CONNECTING ODU TO ANTENNA

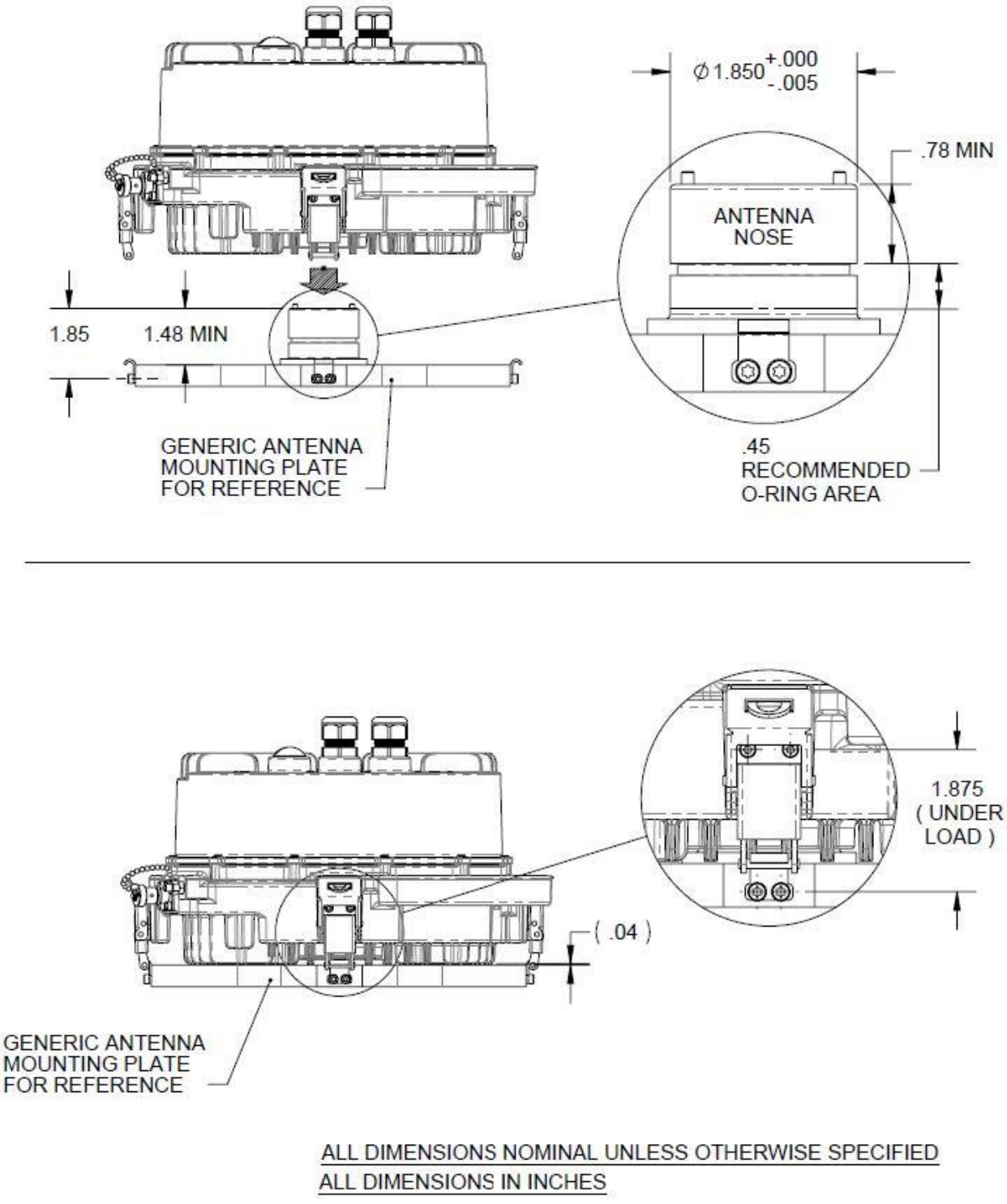



**Figure 26 Interface for connecting ODU to Antenna**

# 10 APPENDIX

## List of figures



## List of tables

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