Long Range & High Bandwidth GbE Connection

with Integrated DualPath™ Technology

AireBeam™ G80

(Models:G80, GE80PLUS, G80E, G80EPLUS)

Installation and User Manual

Rev. A

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Safety

Cautions and Warnings

The following symbols are used in this manual to indicate that the installer should take particular caution to prevent injury or damage to the equipment.

⚠️ *Exercise caution when you see this symbol. It indicates actions that could be harmful to the installer or to the equipment.*

⚠️ *Exercise extreme caution when you see this symbol. It indicates potentially lethal voltages!*

Note: *There are no serviceable parts within the units and the system should not be opened in the field.*

Observe Standard Precautions

All persons having access to this equipment must observe all standard precautions as defined in applicable national statutory health and safety legislation.

The outdoor equipment must be properly grounded to provide protection against voltage surges and prevent the built-up of static electric charges. In the event of a short circuit, grounding considerably reduces the risk of electrical shock.

For installations in the U.S.A., for information with respect to proper grounding and applicable lightning protection for DC cables please refer to Articles 810830 of the National Electrical Code, ANSI/NFPA No. 70.

In case the system is installed in a country outside of the U.S.A., implement protection in accordance with local safety standards and regulatory requirements.

Do not install or operate this equipment in the presence of or close to flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a potential safety hazard.

Qualified Personnel

Qualified personnel who understand and are trained to work with the equipment must perform all repair, modification, reconfiguration, and upgrading operations.

Note: *Always power the system down before moving or removing the system.*

FCC Notice on Exposure to Millimeter Wave Frequencies

Warning: This device is a high powered transceiver that operates at frequencies that could be potentially harmful to human tissue if the following precautions are not taken,

(1) Minimum safe operating distance must be observed at all times between unit and users*. See the table below for distance based on model and antenna combination.

(2) Unit shall be mounted so that minimum operating distance is not inadvertently impinged by the general public, or non user personnel.

*Please see exposure limits listed in FCC §1.1310

Model	Antenna	
	MX / 45 dBi	LX / 51 dBi
AireBeam G80	3.5	7.0
AireBeam G80 PLUS	6.3	12.5

Minimum Safe Operating Distance in meters

Service

There are no serviceable parts within the radio units. Only factory trained personnel can provide service on any internal components of the radio units.

Regulatory Information

North America

These devices have been type approved in accordance with 47 CFR Part 15 Subpart B and Part 101 Subpart Q of the Federal Communication Commission rules; and with Industry Canada ICES-003.

In the U.S. millimeter wave radio transmission equipment operating in the 71-76, 81-86, and 92-96 GHz frequency ranges must be registered with the FCC as provided for in Part 101 of the FCC regulations. Customers in the U.S. are responsible for obtaining proper operator licenses. For more information on how to get a license to install and operate millimeter wave radio transmission equipment contact LightPointe via E-mail techsupport@lightpointe.com or call the LightPointe office at +1-858-863-0338.

Europe

These devices are in compliance with the European Directive R&TTE 1999/5/EC on Radio Equipment and Telecommunications Terminal Equipment and have been assessed against the following Applicable Standards:

Spectrum: EN 302 217-2-2

EN 302 217-3

EN 302 217-4-2

EMC: EN 301 489-4

Safety: EN 60950-1:2006

Environmental: This product is RoHS compliant

R&TTE Declaration of Conformity (DoC)

Unique ID: REG-ABG80-DOC

We, **LightPointe Communications, Inc.** of 11696 Sorrento Valley Rd, Ste. 101, San Diego, CA 92121, declare under our sole responsibility that the products:
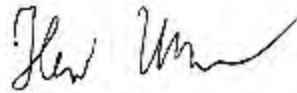
Description: 70/80 GHz Point-to-point millimeter wave data transmission system

Model:	SAB2-1250-83X-M8S	AireBeam G80 MM
Model:	SAB2-1250-83X-S3S	AireBeam G80 SM
Model:	SAB2-1250-83X-0ER	AireBeam G80 RJ45
Model:	SAB2-1250-83E-M8S	AireBeam G80E MM
Model:	SAB2-1250-83E-S3S	AireBeam G80E SM
Model:	SAB2-1250-83E-0ER	AireBeam G80E RJ45

to which this declaration relates is in conformity with the essential requirements and other relevant requirements of the R&TTE Directive (1999/5/EC). The products are in conformity with the following standards and/or other normative documents:

HEALTH & SAFETY (Art. 3(1)(a)):   60950-1:2006 + A1:2010

EMC (Art. 3(1)(b)):   EN 301 489-4 V1.4.1 (2009-05)

SPECTRUM (Art. 3(2)):   EN 302 217-2-2 V1.4.1 (2010-07)

                                   EN 302 217-3 V1.3.1 (2009-07)

                                   EN 302 217-4-2 V1.5.1 (2010-01)

Declaration by: ___Heinz Willebrand___   ___CEO & President___
                   Name   Title

                   _____   ___2011-11-02___
                   Signature   Date

R&TTE Declaration of Conformity (DoC)

Unique ID: REG-ABG80PLUS-DOC
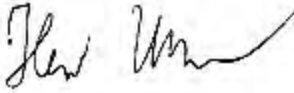
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Model:	SAB2-1250-93E-M8S	AireBeam G80E PLUS MM
Model:	SAB2-1250-93E-S3S	AireBeam G80E PLUS SM
Model:	SAB2-1250-93E-0ER	AireBeam G80E PLUS RJ45

to which this declaration relates is in conformity with the essential requirements and other relevant requirements of the R&TTE Directive (1999/5/EC). The products are in conformity with the following standards and/or other normative documents:

HEALTH & SAFETY (Art. 3(1)(a)):   60950-1:2006 + A12:2011

EMC (Art. 3(1)(b)):   EN 301 489-4 V2.1.1 (2012-11)

SPECTRUM (Art. 3(2)):   EN 302 217-2-2 V2.1.1 (2013-07)

                                 EN 302 217-3 V2.2.0 (2013-11) §UC.2.3.2, §UC.3.1

Declaration by: ___Heinz Willebrand___   ___CEO & President___
                       Name   Title

                       _____   ___2014-02-27___
                       Signature   Date

Warranty Information

LightPointe warrants this product against faulty materials or workmanship under the terms of a Standard Warranty and Support Agreement provided that the product was purchased directly from LightPointe or from one of our authorized resellers. Please contact LightPointe Customer Service for additional information or to obtain a copy of the Warranty Agreement.

Contacting LightPointe

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1   AireBeam G80 System Components

The HyBridge-LX/LXR system is shipped in three separate boxes. One box contains the ODUs and the standard installation accessories and, if ordered separately, the optional Site Alignment tool. The other two boxes contain one antenna each. Please verify that the shipment contains the following items:

- **Two detachable outdoor radio transmission units (ODU)**

- **Two antennas (either 12" or 24") w/attached side pole mounting bracket**

- **Bolts and wrenches for installation and alignment**

- **Two Power over Ethernet (PoE) injectors (optionally: Two 48 Vdc outdoor rated power supplies)**

- **Two RSSI Alignment cables for use with voltmeter**

- **One RJ12 to RS232C DB-9 serial converter kit**

- **Optional: Site Alignment Tool**

The pictures below show the content of each individual shipping box.

Figure 1-1: Content Shipping Box 1
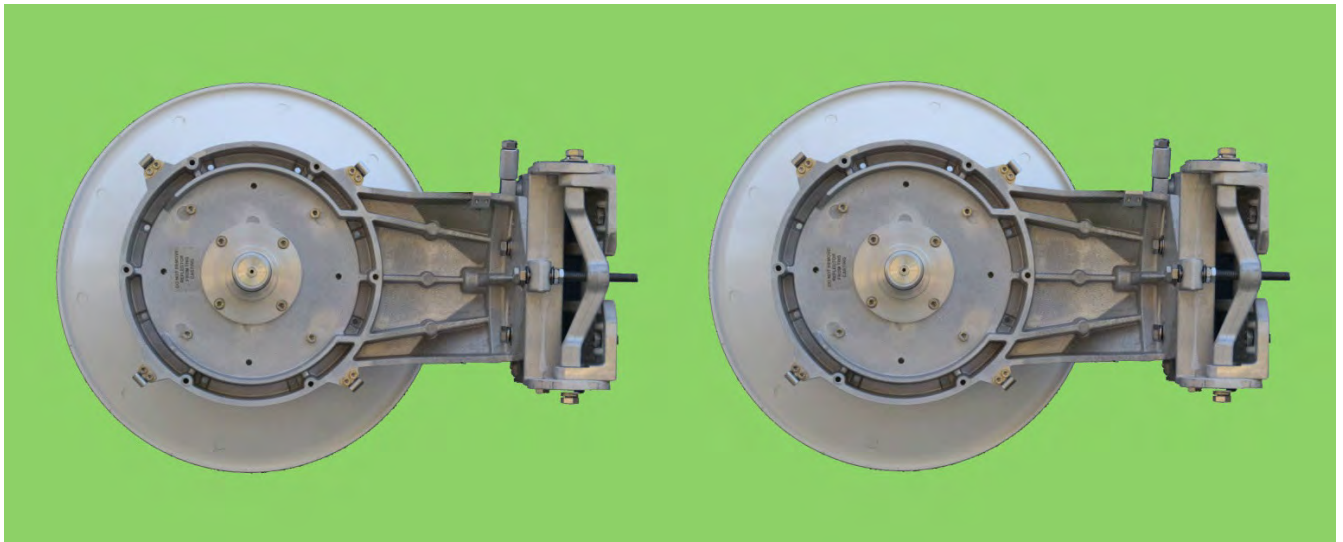
Figure 1-2: Content Shipping Boxes 2 + 3 (AireBeam G80-MX)
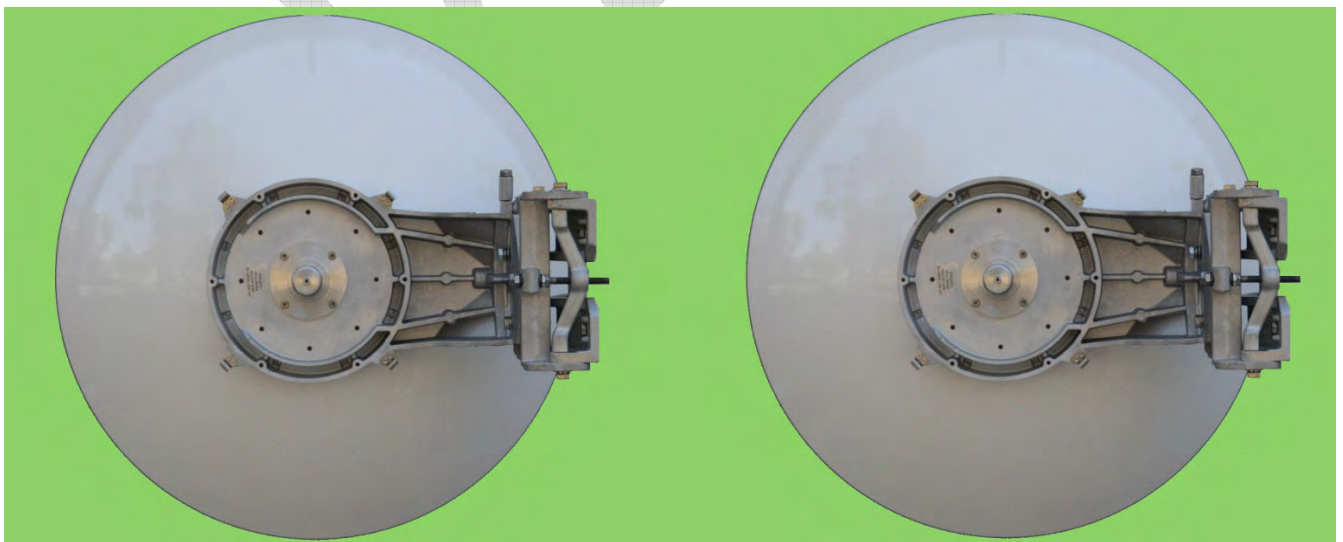
Figure 1-3: Content Shipping Boxes 2 +3 (AireBeam G80-LX)

In case the customer ordered the system with the dc power option rather than the standard PoE supplies, the PoE injectors shown in Figure 1-1 will be replaced with either the standard dc power supply (on left in Figure 1-3 below) or the ruggedized dual output power supply (on right in Figure 1-3 below)

Figure 1-4: Optional dc power supplies

1.1   Main Radio Components – ODU and Antenna

The radio transmission unit (ODU) is contained within an aluminum-based IP 66 rated outdoor housing to protect the electronics from rain, dust and other environmental conditions. The transmission equipment operates in full-duplex mode and in slightly different frequency bands. The lower band ODU transmits in the 71…76 GHz frequency band and the upper band ODU transmits in the 81...86 GHz frequency band. The serial numbers displayed on side of the ODU are nearly, but not exactly, the same. On the back panel and inside the ODU there is a **HIGH BAND** and **LOW BAND** sticker to distinguish between the radio ODUs.[1] Fig. 1-5 shows the ODU. It can be easily detached from the antenna by releasing the 4 spring loads latches and simply pulling the ODU of the antenna waveguide flange.

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[1] *When installing a licensed G80 GHz radio it is important to ensure that the individual radio units are installed according to the correct frequency allocation assigned at the specific deployment location.*
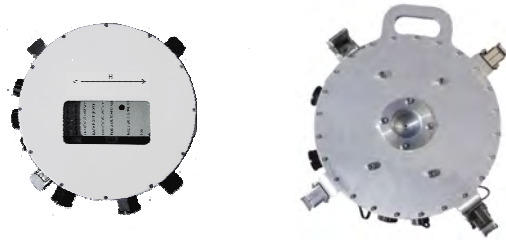
Figure 1-5 Top (left) and bottom view (right) of ODU

The ODU is fully IP 66 outdoor rated and all network/management and power connectors can be accessed for the outside with the need to open the ODU enclosure. All connectivity status indicators can be observed though a window on the back of the ODU. The ODU can be easily removed from the antenna waveguide by releasing 4 spring loaded latches. The ODU is the same for both, the 1 foot and the 2 foot antenna system. By rotating the ODU 90 degrees the polarization can be changed easily. Chapter 4. describes the ODU Networking, Service and Power Connections in more detail.

1.2   Antennas and Mounting Brackets

Depending on the system ordered, the AireBeam G80 is shipped either with a high performance high gain 12" (MX Series) or 24" (LX Series) antenna. The mounting and alignment bracket is the same for both antennas. The system is shipped with the bracket and ODU already attached to the antenna. Fig. 1-6 shows the G80-MX (top) and G80-LX (bottom) system. For illustrative purposes the systems are shown with and without the ODU attached.

Figure 1-6: AireBeam G80-MX (top) and G80- LX (bottom) systems

The antenna is equipped with a robust side pole mounting and alignment bracket. The bracket easily attaches to a vertical structure with pole diameters from 2.5…4.0 inches (60…110 mm). The pole mounted alignment bracket is shown in Fig. 1-7. Also shown are the locations of the horizontal and vertical alignment screws.
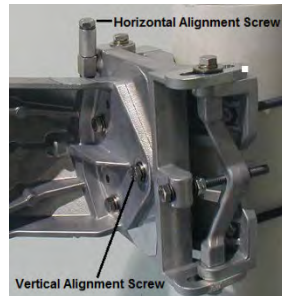
Figure 1-7: Alignment bracket and locations of alignment screws

1.3   Power over Ethernet (PoE) Modules

The AireBeam G80 system ships standard with two Power over Ethernet (PoE) injectors for powering the transmission units. The power provided to the AireBeam G80 unit travels over a separate CAT5E/CAT6 cable as the network data but shares a cable with the out-of-band management connection. The PoE modules accept universal 90-240 Vac input and provide 48Vdc to the AireBeam G80 units. The port labeled Output on the PoE should be connected to the RJ-45 port labeled Management/PoE on the AireBeam G80 unit. The port labeled Input on the PoE injector can be connected to your management network in case the customer prefers out-of-band management (See AireManager for AireBeam user manual). The PoE injector is shown in Fig. 1.8 below.

Figure 1-8: Power over Ethernet modules supplied with all AireBeam G80 systems

Alternatively, the AireBeam G80 system can be powered by a direct 48 Vdc power connection. A 2-wire fully waterproofed IP67 rated receptacle for a direct 48 Vdc connection is located on the side of the ODU. In case the system will be powered via a direct 48 Vdc please contact LightPointe. LightPointe can provide an outdoor rated single unit power supply (Fig. 1-9 left), and a ruggedized outdoor power supply that can power two separate antennas (Fig. 1-9 right). Both power supplies are shipped with connectorized power cable(s).

⚠️	*NOTE: DO NOT reverse the polarity of the 48 Vdc connections when using your own dc power cabling since it will result in the irreversible destruction of the link head.*

Figure 1-9: Direct 48Vdc Power Supply options

1.4 Miscellaneous

1.4.1 RSSI Alignment Cables

While the receive power LED bar on the AireBeam G80 indicator back panel can be used to align the units, this process is traditionally performed using a digital voltmeter. A digital voltmeter will have a better resolution and reacts faster to RSSI voltage changes of the receive signal level during alignment. Two cables, one for each AireBeam G80 transmission unit, are provided with the shipment. The cables are terminated on one side with a 2-pin female connector for attachment to the AireBeam G80 waterproofed IP67 RSSI voltage connector located on the side of the ODU and on the other side with banana plug connectors for attachment to a digital voltmeter (see Fig. 1-10).
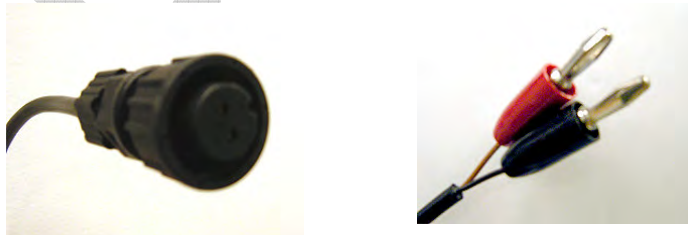
Figure 1-10: RSSI alignment cables included with AireBeam G80 systems

1.4.2   RJ12 to DB-9 Serial Conversion Kit

An RJ12 to DB-9 serial conversion kit is included with each AireBeam G80 system. The kit consists of one RJ12 to DB-9 adapter and one, six foot RJ11 cable (see Fig. 1-11). The RJ12 cable connects directly to the waterproofed and IP67 rated AireBeam G80 serial port located on the side of the ODU. The DB-9 connector is meant to connect to the serial port of your laptop or notebook. Another adapter may be necessary for laptops that do not have a DB-9 serial port (e.g. a USB to serial adapter). A terminal application, such as HyperTerminal, is used on the laptop for connecting to the radio over the properly configured COM port (See AireManager for AireBeam user manual).

Figure 1-11: RJ12 Cable and DB-9 Adapter

1.5   Optional: Site Alignment Tool

To ease the alignment of the narrow beam antennas, LightPointe can provide a simple alignment tool to correctly aim the antenna beam towards the remote antenna site. In particular when aligning the longer range 2 foot antenna and or when installing the antennas on a tower, this tool will reduce the time it takes to get the antennas aligned correctly. The alignment tool is attached to the antenna/antenna mount and can be easily removed after the alignment process is completed. It can therefore be easily re-used when multiple antennas need to be aligned. The function, installation and use of the alignment tool will be explained in detail in Chapter 4.

Figure 1-12: Antenna Alignment Tool

2   Surveying the Installation Site

Chapter 2 educates the user on millimeter wave transmission technology and the site survey/review process used in successful deployment of LightPointe AireBeam G80 systems. Please read this chapter before installing the system.

2.1   Tools

Please ensure that the following measures have been taken and that tools are available for surveying the installation site.

> ➢ Have permission of building owner to install the system
>
> ➢ Ensure that the installation meets any local requirements
>
> ➢ Use an accurately scaled map for locating sites and doing rough distance calculations
>
> ➢ Laser range finder or GPS for accurate distance measurement (optional)
>
> ➢ Binoculars to assist in locating opposite-end installation site
>
> ➢ Sketch or notepad to make rough drawings and notes
>
> ➢ Tape measure to determine approximate distance of fiber, power runs, etc.
>
> ➢ Camera to take pictures of the installation sites (optional)

2.2   Installation Site Review

When performing a site review certain measures must be taken to ensure the successful deployment of a millimeter wave transmission system.

Determine the appropriate system to meet the needs of each specific location:

> ▪ Measure point-to-point distance using a map, a laser range finder or GPS coordinates
>
> ▪ Refer to the ITU rain zone chart and locate the ITU rain zone where the system will be installed
>
> ▪ Determine what physical connections will be required (e.g. SM/MM fiber or CAT5E/6 copper cable, PoE or direct 48 Vdc)

Determine line-of-sight

- *Ensure that the antenna has sufficient path clearance. The **Fresnel Zone** is the area around the visual line-of-sight that radio waves spread out into after they leave the antenna (see Figure 2-1). To maintain good signal strength is important to maintain sufficient path clearance. Typically, a 20% **Fresnel Zone** blockage introduces little signal. However, nearing 40% blockage the signal loss will become significant.*

- *The Fresnel Zone formula shown below is based on a flat earth. In other words, it does not take the curvature of the earth into consideration. The effect of this is to budge the earth in the middle of the link. However, for relatively short distances, the effect of the earth's curvature and the specific topography of the terrain are negligible.*

- Table 2-1 shows the calculated minimum path clearance required for operation of a pt-to-pt millimeter wave operating in the 80 GHz band based on the Fresnel Zone formula shown below.

$$r_{(in\ mts)} = 17.32 \times \sqrt{\frac{d}{4f}} \frac{(in\ Km)}{(in\ GHz)} \qquad r_{(in\ ft)} = 72.05 \times \sqrt{\frac{d}{4f}} \frac{(in\ miles)}{(in\ GHz)}$$
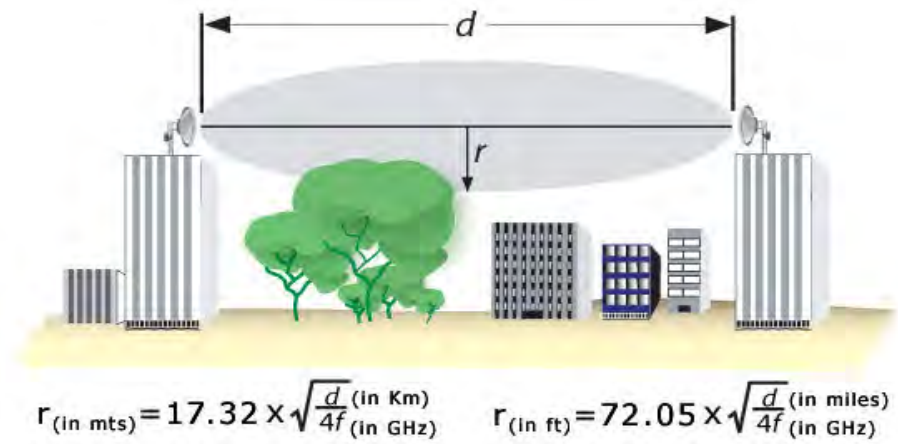
Figure 2-1: Fresnel Zone illustration.

Path length in meters	Path clearance radius r in meters
500	0.68
1000	0.96
2000	1.36
5000	2.16
10000	3.06

Table 2-1 Fresnel zone path clearance

- Can emissions, blowing or swaying trees, or other obstacles in the line of sight interrupt the connection?

- Is there a possibility of work activity or people passing in front of the transmission that could interfere with the clear line of sight

Evaluate environmental mounting conditions

- Only mount the radio transmission equipment to a stable and vibration-free mounting platform – this is a critical factor to successful performance.

- Evaluate that the foundation at the mounting location is not susceptible to change due to humidity or temperature (avoid wooden mounting platforms)

Evaluate mounting locations for human access

- Safe access to the radio transmission unit

- Stable location/platform to stand upon

- Safety considerations for installers and maintainers of the system in all weather conditions

Evaluate mounting locations to avoid interruptions of transmission

- Near roof edge to avoid people walking in front of the transmission unit

- Non-penetrating roof mount and at least 7 foot high to avoid people walking in front of the transmission unit

- Mounting the antenna in the middle of the roof and close to the roof surface can cause the antenna to experience undesirable multi-path reflections

- At the side or corner of a building wall without people being able to walk in front of the transmission unit

- Weather-protected location if possible

- Safe location that will not be subject to damage from vandals

Evaluate mount stability

- Solid concrete or steel structural building member

- Directly on a flat roof surface if using a non-penetrating mount

- Securely fastened to the side or top of parapet wall

2.3   Link Distance

Measurement of the link distance is important in estimating the link availability and calculating the expected Receive Signal Level (RSL). When using a Global Positioning System (GPS) device this measurement can be performed using the Latitude and Longitude coordinate readings from the proposed locations of the antennas. When a GPS device is not available, online tools like Google Earth are also very helpful to determine the link distance. However, GPS reading will be required in order to comply with the FCC registration process.

⚠	*To avoid receiver saturation the minimum deployment distances for the AireBeam G80-MX and AireBeam G80-LX are 100 meters (about 330 feet) and 500 meters (about 1600 feet), respectively.*

To estimate maximum distances and availabilities for a given product and region please use the LightPointe Fade Margin/Availability calculator.

2.4   Antenna Location

For proper operation and easy maintenance the optimum location for the antennas must be determined. The ideal location should provide for ease of erecting and mounting the antenna, as well as providing unimpeded LOS to the remote location. The following factors should be taken into account:

➢ *Type of mounting—fixed installation or non-penetrating roof pole mounting*

➢ *Access location of fiber/RJ-45 cables and power wiring of the building*

➢ *Length of cable runs*

➢ *Earth Grounding connection points*

➢ *Potential obstructions (also temporary), including allowances for tree growth*

➢ *Accessibility of the radio mounting location*

➢ *Accessibility of the site during and after working hours*

2.5   Atmospheric and Rain Attenuation of Millimeter Wave Beams

Millimeter wave systems operating in the 60/70/80 GHz frequency ranges are able to transmit and receive high data rates such as 1250 Mbps (Gigabit Ethernet) over distances exceeding several kilometers. The actual distance/availability performance of a specific system depends on parameters such as transmission power, antenna size, and receiver sensitivity. In general terms millimeter wave frequencies are attenuated by rain and additionally by oxygen absorption in the case of systems operating in the 60 GHz frequency range. Oxygen absorption plays a minor role in the higher 70/80/90 GHz frequency ranges and therefore these systems are typically better suited in establishing a connection over longer distances. Millimeter wave transmission does not suffer from attenuation in fog or during sand storms.   Figure 2-2 shows the typical atmospheric attenuation of signals in different frequency bands.
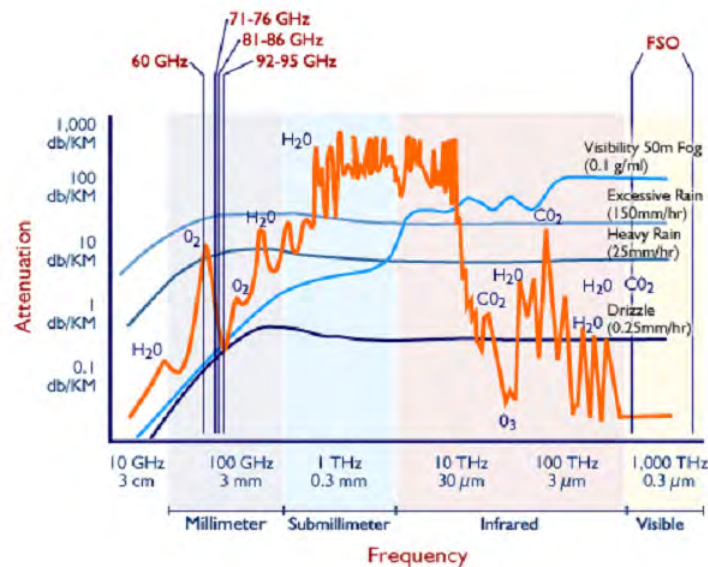
Figure 2-2: Atmospheric attenuation of signals at different frequencies.

Rain attenuation of millimeter wave signals has been studied extensively over several decades and models are available to reliably predict the availability of a millimeter wave transmission system in various rain zones around the world. Based on the actual rain rates collected in specific regions, the International Telecommunications Union (ITU) has published charts dividing the globe into separate rainfall regions. Similar charts with slightly different geographical breakdowns exist, based on the work of the researcher Crane. Both charts can be used to predict availability performance of millimeter wave transmission systems. Figure 2-3 shows the ITU chart of different rain rate regions of the United States and Europe. The regions are divided by using an alphanumerical notation with region A having the least and region N having the highest rain fall rates. The same rain charts exist for other regions of the world.

Please, contact LightPointe for more information about a specific region outside of the United States or Europe.
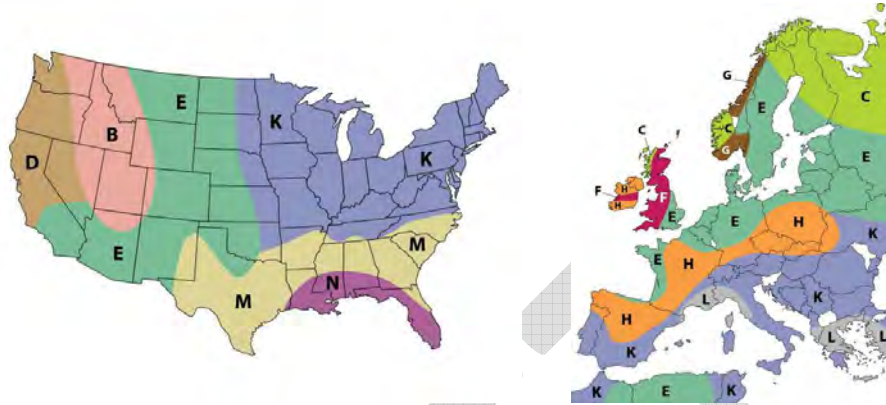
Figure 2-3: North American and European ITU rain zone chart

Using the ITU or Crane rain zone charts one can calculate the availability of a millimeter wave transmission system in a specific rain zone. When it comes to rain attenuation it is important to keep in mind that the rain fall rate and not the total amount of yearly rainfall determines the availability of a millimeter wave radio system. For example, it is well known that the number of rainy days in the North Western region of the United States and in cities like Seattle greatly exceeds the number of rainy days in the South Eastern areas like Florida. However, when looking at Table 2-2, representing the actual duration of peak rain fall rates in mm/hour in different rain zones, one finds that the rain fall rate (or rain intensity) in the North Western region of the United States is far less when compared to the rain fall rate in the south. Consequently, and using the same system availability figure, a millimeter wave system installed in the North West (rain zone D) can operate over a longer distance compared to a system installed in Florida (rain zone N), for example.

Outage/Year			ITU-R Rain Regions. (Rainfall rates in mm/hr)														
Percent (%)	Time	Availability (%)	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
0.001	5 Min	99.999	22	32	42	42	70	78	65	83	55	100	150	120	180	250	170
0.003	11 Min		14	21	26	29	41	54	45	55	45	70	105	95	140	200	142
0.01	1 Hr	99.99	8	12	15	19	22	28	30	32	35	42	60	63	95	145	115
0.03	1.8 Hr		5	6	9	13	12	15	20	18	28	23	33	40	65	105	96
0.1	9 Hr	99.9	2	3	5	8	6	8	12	10	20	12	15	22	35	65	75
0.3	18 Hr		0.8	2	2.8	4.5	2.4	4.5	7	4	13	4.2	7	11	15	34	49
1	88 Hr	99	<0.1	0.5	0.7	2.1	0.6	1.7	3	2	8	1.5	2	4	5	12	24

Table 2-2: Peak rain rates vs. Duration in different ITU rain zones

LightPointe can provide availability vs. distance charts for LightPointe products operating in different rain zones. Typical RSSI vs. Distance charts for the AireBeam G80-MX and AireBeam G80-LX systems is shown in Figure 2-4 below. These RSSI vs. Distance readings can slightly vary from system to system. The actual values can be slightly different due to the installation locations of the antennas and weather of course weather conditions at the time of reading. However, the RSSI readings provide a very good guideline of the expected receive signal level for the specific installation distance. Please, contact LightPointe or your Reseller to obtain the chart for your specific system.
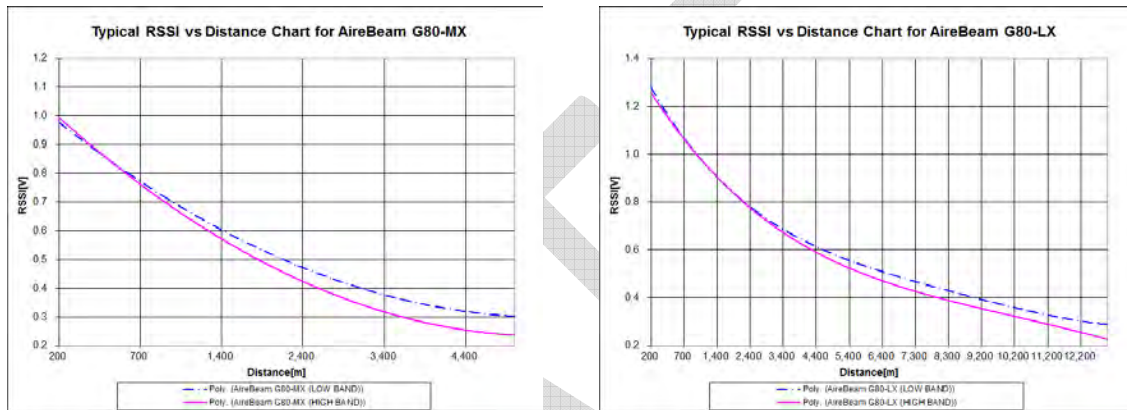

Figure 2-4: Typical AireBeam G80 RSSI vs. Distance charts

3   Networking, Power and Service Connections

At this point, and if not already done, we recommend removing the ODU from the antenna Base by releasing the 4 spring loaded ODU latches and pulling the ODU of the antenna waveguide flange. This allows the user taking a closer look at the ODU and start the process of preconfiguring the system before installing on the roof.

⚠	*We recommend pre-configuring the system before installing it on the roof. This relatively simple process requires powering up the system being familiar with the use of a serial interface program such as Windows based Hyperterminal.*

3.1   ODU

All networking and power connections are made via fully outdoor rated IP67 connectors located on the outside of the ODU. There is no need to open the ODU and the back of the ODU provides visible indications of the connectivity status. Fig. 3-1 shows the networking, power and service connections located on the outside of the ODU and Table 3-1 describes the functionality. To see the inside of the connector the waterproofed plugs were removed.

Figure 3-1: ODU Networking, Power and Service Connections

Management and PoE	10/100Base-TX RJ-45 Ethernet Management connection for Out-of-Band radio management and 48 Vdc PoE connection to power
Data (Prim.)	Primary 100/1000Base-TX RJ-45 Ethernet data connection

Data (Sec.)	Secondary Ethernet data connection
	Options:
	  1. None
	  2. 1000Base-TX RJ-45 copper connection
	  3. 1000Base-SX LC MM fiber connection
	  4. 1000Base-LX LC SM fiber connection

Power (48 Vdc)	Direct 48 Vdc power connection
RSSI	Receive Signal Strength Indicator (RSSI) connection for use with alignment cable shown in Fig. 1-6
RS232	RJ-12 based RS232 serial port for initial radio configuration. Use RJ-12 cable and RJ-12 to DB9 adapter provided by LightPointe and shown in Fig. 1-7.
Note: ⚠	Use water proof boots provided with the system and outdoor rated cables when attaching cables to the ODU!

Table 3-1: ODU Networking, Power and Service Connections

3.2   ODU Back Panel

The LightPointe ODU is industries exclusive system providing installer visual access to virtually all vital system parameters through the hermetically sealed back panel window. This allows the installer to easily see the system health status and observe parameters such as receive power levels, network link/activity status of all port connectors, etc. without having to log into the web browser/management system. Fig. 3-2 shows the ODU back panel and Table 3-2 the reported status parameters.

Figure 3-2: ODU Back Panel

PARAMETER	REPORTED STATUS
DATA (PRIM.)	LINK STATUS AND ACTIVITY
DATA (SEC.)	LINK STATUS AND ACTIVITY
POWER (48 VDC)	DIRECT 48 VDC POWER CONNECTION
RECEIVE SIGNAL STRENGTH	10 BAR RECEIVE SIGNAL STRENGTH INDICATOR (RSSI)
POE & MANAGEMENT PORT	LINK STATUS AND ACTIVITY
LOSS OF SIGNAL	ON/OFF
OVERLOAD	ON/OFF
POWER	ON/OFF

Table 3-2: ODU Networking, Power and Service Connections

3.3   Power Connections

There are two options to power the radio:
1. Power over Ethernet (PoE)
2. Direct 48 Vdc

⚠️	*Please DO NOT connect the PoE and 48 Vdc connections at the same time. This will destroy the power regulator circuitry inside the ODU.*

3.3.1   Powering via PoE

The PoE powering option is the LightPointe suggested standard way to power the system. The system ships with two indoor table top 48 Vdc PoE injectors (see Fig. 1-4). The ODU requires 20 Watts of electrical power for operation and the PoE injector is rated at 48 Watts, leaving plenty of ample power. Input to the PoE injector is 110/230 Vac.
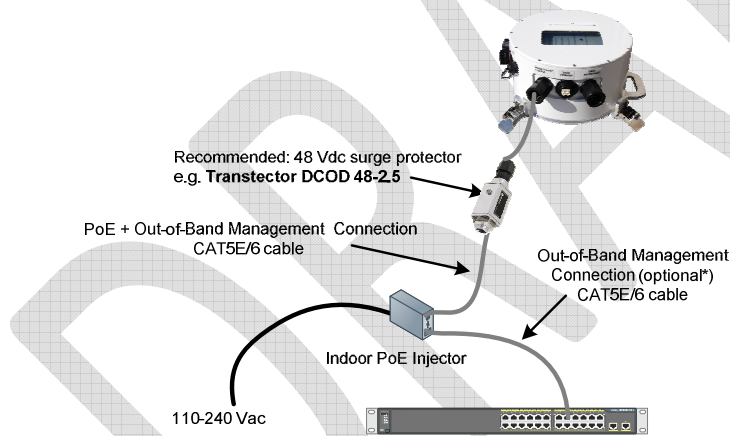
Figure 3-3: Powering via PoE

The PoE Injector is equipped with a powered and a non-powered 10/100 RJ-45 Port. Use the powered port (Output) to connect to the ODU Management and PoE port. We recommend placing a surge protector into the PoE line and close to the ODU (see Fig. 3-3). The PoE port also serves as Out-of-Band management port. To access the out-of-band management interface connect the non-powered port (Input) to an Ethernet switch or hub and the out-of-band management system. There is no need to connect to the (Input) port when using the In-Band management option. For more information on setting up the management system see the "AireManager - NMS Platform for Aire Product Series – Setup and User's Guide"

> *The radio ships standard with management functionality enabled on all networking ports. **DO NOT** connect the Out-of-Band management port and one of the ODU data port connections to the same switch without first re-assigning the management traffic to Out-of-Band operation. For more information see the "AireManager - NMS Platform for Aire Product Series – Setup and User's Guide"*

Caution: *The passive PoE Injector shipped with the system provides up to 48 Watts of electrical power @48 Vdc. Same as with the lower power 802.3af standard the injector provides power to pins 4,5 (+) and 7,8 (-). To comply with the Ethernet standard on maximum CAT5E/6 cable length, distance between the PoE output and the ODU input be not exceed 100 meters. For longer runs, please use a suitable repeater.*

Caution: *The PoE Injector shipped with the AireLite system has a built-in short circuit and overvoltage protection. However, to prevent damage to the indoor networking equipment from potential lightning strikes we recommend using an external PoE Surge Protector such as Transtector TB 10/100/PoE or similar.*

3.3.2 Powering via Direct 48 Vdc Power

Alternatively, the AireBeam G80 system can be powered by a direct 48 Vdc power connection. When using the direct powering method, it is possible to extend a 16 gauge power cable length to more than 1000 feet (330 meters) when using the LightPointe 48 Vdc power supply. A waterproofed IP67 receptacle for a direct 48 Vdc connection is located on the side of the ODU housing (see Fig. 4-1). In case the system will be powered via a direct 48 Vdc please contact LightPointe. LightPointe can provide an outdoor rated single unit power supply (Fig. 1-5 left), and a ruggedized outdoor power supply that can power two separate link heads (Fig. 1-5 right). Both power supplies are shipped with connectorized power cable(s). Fig. 3-4 shows how to connect the ODU to a 48 Vdc power supply. We recommend placing a surge protector into the power line and close to the ODU.

> ⚠️ *DO NOT reverse the polarity of the 48 Vdc connections when using your own dc power cabling since it will result in the irreversible destruction of the link head. Contact Reseller or LightPointe on how to make your own power cable.*

Recommended: 48 Vdc surge protector
e.g. **Transtector DCOD 48-2.5**

110-240 Vac

Indoor/Outdoor 48 Vdc Power Supply
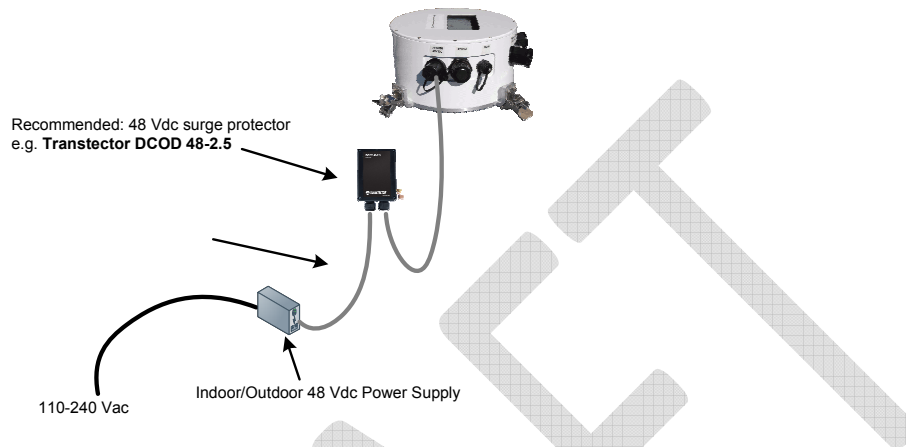
Figure 3-4: Direct 48 Vdc Power Connection

> ⚠️ **Caution:** To prevent damage to the building power infrastructure from potential lightning strikes we recommend using an external 48Vdc Surge Protector such as [Transtector DCOD 48-2.5](#) or similar.

3.4   Network Data Connections

The ODU has two network data connections.

Primary:

Standard connection is a twisted pair RJ-45 100/1000Base-TX interface connection. Auto-MDIX automatically detects the required cable connection type and configures the connection appropriately, removing the potential need for crossover cables. If required by the specific setup, the port speed and simplex/duplex operation can also be fixed via the web browser/ management software.

Secondary:

The secondary port is an optional networking port that is either equipped with a twisted pair RJ-45 1000Base-TX transceiver, a 1000Base-SX (850 nm, MM) or 1000Base-LX (1300 nm, MM) fiber transceiver.

The assignment of the primary or secondary port can be changed from within the software settings. Both ports are physically connected to the same layer 2 switch inside the ODU.

⚠	*Without taking any special pre-cautions on the software setting side, do not connect both data ports to the same switch. This will cause a MAC/address conflict and result in unstable system performance. For more information see the "AireManager - NMS Platform for Aire Product Series – Setup and User's Guide"*

Figure 3-5: Connecting the ODU to a Network Switch

Fig. 3-5 shows the connections between the ODU and an Ethernet switch. When using a CAT5E/6 cooper cable connection, please ensure that the direct cable length does not exceed 328 feet (100 meters) to be in compliance with the Ethernet specifications. Otherwise use a suitable Ethernet repeating device.
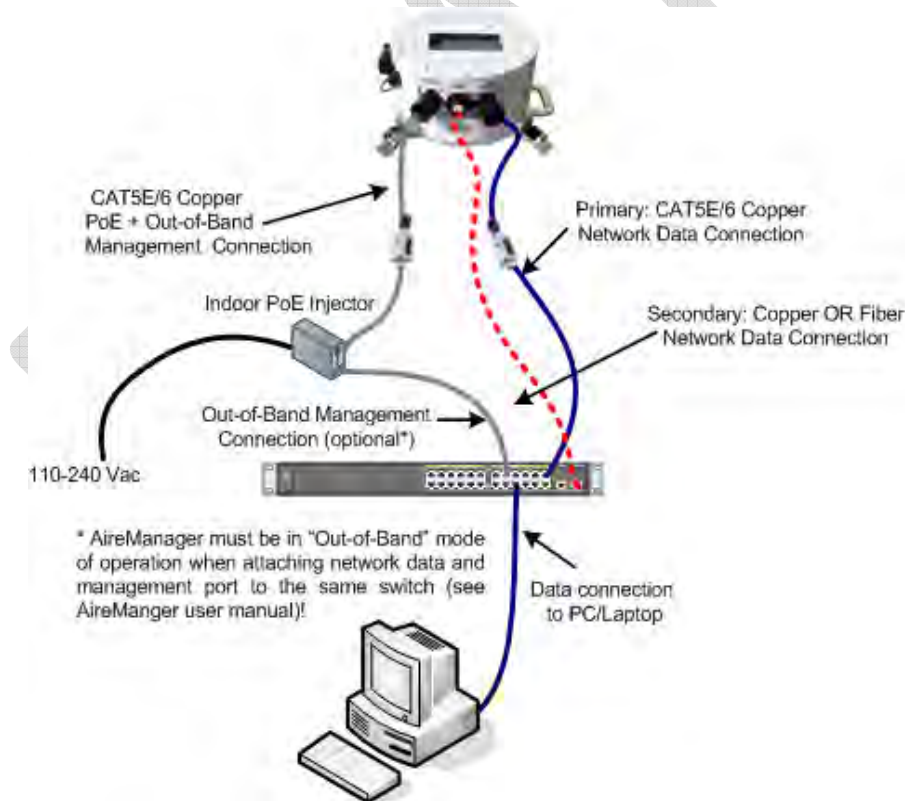
Fiber cable lengths can be much longer when using either 1000Base-SX (220 meters) or 1000Base-LX (550 meters) transceivers over MM optical fiber cables. For even longer distances of up to 5000 meters between the ODU and the customer premise networking switch use SM fiber.

3.5   Out-Of-Band Management Connection

The AireBeam G80 Out-of-Band management connection shares the RJ45 10/100Base-TX port, and therefore a twisted pair cable, with the power being provided to the device via PoE.

To enable access to the AireManager management software running on the AireBeam, the Input port of the PoE module should connect to your management network via a standard Cat5E twisted pair cable at 100Mbps.

The length of the management and PoE cable, from the AireBeam G80 ODU to the switch or router, should not exceed 100 meters due to Ethernet compliance issues. Otherwise use a suitable Ethernet repeating device.

The AireBeam G80 is shipped with management enabled on all ports. In other words, and after the alignment process is completed, the management system of the local and remote antenna can be reached via any Ethernet port. This is the easiest and most simple way to manage the system and does not require any additional knowledge of the user when it comes to security management and/or setting up a management VLAN.

However, when connecting one of the ODU data ports and the management port to the same Ethernet switch it is important to FIRST change the settings of the ODUs on either side of the link to "Out-of-Band" management. Otherwise the system will experience an address/MAC conflict and network performance of the system will be severely impacted.

The management status can be changed via the "Management" sub menu from within the web browser application. Fig. 3-6 shows a screen shot and the change procedure. For details please refer to the "AireManager - NMS Platform for Aire Product Series – Setup and User's Guide"
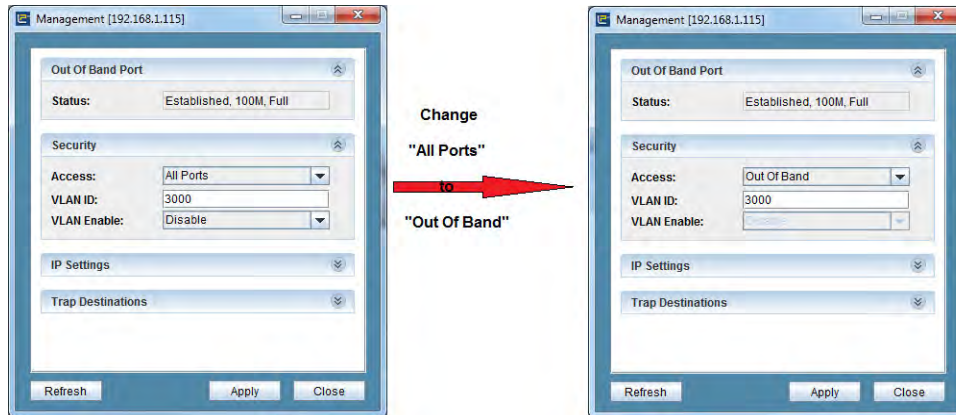
Figure 3-6: Changing the System Management Connection

⚠️	*DO NOT connect the data port and Out-of-Band management port to the switch/router without first placing both antennas into the "Out-of-Band" management mode of operation. We highly recommend configuring the ODU already accordingly before installing the system on the roof!*

3.6 Serial Port

The ODU serial port has a waterproof RJ12 connector and the system ships with a 10 foot RJ-12 cable and a RJ-12 to DB9 adapter (see Fig. 1-7). Since many laptops/PCs do not have a separate serial port anymore, a standard USB to RS232 converter might be required to access the system serial port via a serial port communications program such as HyperTerminal. The location of the Serial Port connector on the ODU is shown in Figure 3-7.

RJ-12 Serial Port Connection

Figure 3-7: ODU Serial Port Connector

The serial port is used to configure some initial setup parameters like IP address, subnet mask, etc. In general, it is not necessary to pull cable for the serial port as nearly all management functions can be performed over the AireManager Java web-console, SNMP, or telnet access.

⚠️	*The ONLY settings that can't be changed via the AireManager Java web-console, SNMP, or telnet access, but only via the serial connection, are the SNMP SET/GET COMMUNITY strings. Default settings are public/private and any other required setting should be changed before the system is installed on the roof. See Chapter 4. and the AireManager user manual.*

3.7   RSSI Voltage Connector

The RSSI reading can be seen on the system back panel and when looking at the 10 level bar graph indicator. However, for the actual alignment process we recommend using a digital voltmeter due to the more precise and faster readout of the RSSI voltage. The Alignment Cables, included with the AireBeam system and shown in Fig. 1-6, attach directly to the 2-pin waterproof male connector on the side of the radio housing (see Figure 3-8). The banana plug ends connect directly to a digital voltmeter, for taking RSSI readings used in achieving maximum alignment of the AireBeam system.

RSSI Voltage Port Connector

Figure 3-8: ODU RSSI Voltage Port Connector

| 4 | Recommended Software Pre-Configurations |

Before installing the radio on the roof, we recommend to perform a few simple software pre-configurations.

| 4.1 | Required Network Settings Info |

Please, ask the Network Administrator to provide the following information:

1. IP Address for both sides of the link (Pre-configured IP address is 192.168.1.115)

2. Subnet Mask (Pre-configured subnet mask is 255.255.255.0)

3. Default Gateway Address (Pre-configured gateway address is 192.168.1.1)

4. SNMP GET COMMUNITY string (Pre-configured GET community string is public)

5. SNMP SET COMMUNITY string (Pre-configured SET community string is private)

6. TFTP Server Address (Pre-configured Server Address is 192.168.1.1)

| ⚠️ | The entries above in BLUE can be entered later using the AireManager web browser, the SNMP management system or TELNET. The item in RED can only be entered via the Serial Port connection. Therefore, and if required, we recommend changing at least these two entries before installing the antennas on the roof. |

4.2   Connecting to the Serial Port

Please perform the following steps to connect the ODU to the serial port:

Step 1	*Connect the ODU Management and PoE Port to the Output of the PoE Injector using a straight-through Cat5E cable. Plug the PoE Injector into a 110 or 240VAC outlet. The ODU will now power up and wait for the AireManager platform to initialize. The process is completed when the bar graph LEDs on the back panel of the radio stop blinking. Depending on the software load this process can take up to 2 minutes.*
Step 2	*To connect the ODU to the serial port of your laptop/ computer, please locate the RJ-12 cable and the RJ-12 to DB-9 modular port adaptor shipped with the system. Connect the RJ-12 cable to the ODU's RJ-12 Serial Port. Connect the other end to the RJ-12 cable to the DB-9 modular adapter. Connect a serial cable to the modular adapter and connect the other end of the serial cable to the PC or laptop. An additional standard USB to serial converter is needed if the PC or laptop does not have a DB-9 port.*

Step 3	*Open HyperTerminal or another terminal application on the PC or laptop.*
	
	Select the correct COM port (settings: `19200 bps, 8 bit, parity None, 1 stop bit, flow control None`) and make the connection. Hit ENTER. The following message will be displayed:
	
	`For restoring factory defaults use 'restore'`
	`For setting new license key use 'setlic'`

Step 4	*The firmware must be rebooted to enter the setup dialogue* *Type ^^^ and hit ENTER to reboot the firmware* *The system will countdown from 7 and then reboot* *STOP the reboot process and hit any key within 3 seconds of startup to enter the setup dialogue*

Step 5	`Please enter CLI password:`
	
	Your default master password is LightPointe. This password is also valid for TELNET access (see "AireManager - NMS Platform for Aire Product Series – Setup and User's Guide").
	
	`Change password? [Y/N]:`
	Type Y and hit ENTER
	
	`Please enter new password:`
	Type your new password and hit ENTER
	
	`Storing updated bootrecord…done`

Step 6	`Please enter IP parameters`
	`Aquire IP configuration using DHCP? [N]`
	The default is no. Make your choice and hit ENTER
	
	`IP address [192.168.1.115]:`
	The number in brackets is the default. Make your change and hit ENTER
	
	`Netmask [255.255.255.0]:`
	Make your change and hit ENTER
	
	`Default gateway [192.168.1.1]:`
	Make your change and hit ENTER
	
	`Modify the above or continue? [M/C]`
	Hit C and then ENTER

Step 7	`Please enter new boot parameters`
	In this part of the dialogue one needs to setup the SNMP community environment. Standard is public/private and this is the ONLY place to cange to a different setting.
	`SNMP GET community [public] -`
	Specify/type SNMP GET community or hit ENTERR for Default "public"
	Can be changed via web browser/ SNMP but is easier to change via serial connection!
	`SNMP SET community [private] –`
	Specify/type SNMP SET community or hit ENTER for Default "private"
	Can ONLY be changed via serial connection!
	`TFTP server address [192.168.1.1]`
	Setting the TFTP server adress is optional and can be configured later using the browser-based AireManager management application.
	Enter new TFTP server address or accept the default for `TFTP address`
	`TFTP filename [   ]`
	No need to specify a TFTP fileneame, hit ENTER
	`Boot operation [1.Download image, 2.Download content, 3.Run]` Type 3 and hit ENTER
	`Modify the above or continue? [M/C]` Hit C and then ENTER
	Current boot parameters are then displayed. The firmware stores the updated boot record, initializes the TELNET interface, and verifies the checksum. When the `CIU system running…` message is displayed the unit can be powered off and installed at its permanent location
Step 8	Perform the same steps on the other AireBeam G80 unit

5   Antenna Installation

This Chapter describes the installation processes involved with successfully deploying the LightPointe AireBeam G80 system. Please read carefully and be certain to understand the necessary steps in deploying a high availability point-to-point wireless link. Contact LightPointe customer support if any clarification is needed.

5.1   Tools

Although the installation of the AireBeam G80 system requires only a 13 mm wrench (open-end or combination wrench) and a simple digital voltmeter, please consider having the following tools and supplies handy when installing the LightPointe AireBeam G80 system.

- Standard electro-mechanical tool kit with pliers, screwdrivers, wire cutters, wire strippers, etc.
- Two-way radio or cell phones to communicate when aligning transmission units
- Optical fiber connector cleaning kit - if using fiber to the network
- Plastic tie wraps to secure flexible conduits, etc.
- 13 mm open-end or combination wrench (one for each mounting location)
- 13 mm socket/ratchet wrench (one for each mounting location)
- 6 mm Allen wrench – when using the optional LightPointe Universal Mount
- Whatever tools may be needed for securing the mount to surfaces/platforms
- Electrical tape for securing and fastening
- Optical light source and fiber power meter to ensure fiber performance from/to transmission unit
- Digital voltmeter to check electrical system connection and measure the receive signal level (RSSI)
- Step or extension ladder, in needed, for access to elevated locations
- High quality rope to use for hoisting materials and/or to be used in conjunction with a safety harness to ensure installer safety
- Exterior rated extension cord
- Fish tape for pulling cable

5.2   Universal Mount Assembly

The antenna mounting bracket attaches to any solid vertical pole structure with a pole diameter between 2.5…4.0 inches (60…120 mm). If desired, and optionally, it is possible to use the LightPointe Universal Mount that was developed for FSO/radio solutions requiring a very stable operating platform. The fully assembled mount (without the radio link head attached) and the base plate hole mounting pattern are shown in Fig. 5-1. The 200 mm square Base Mounting Plate has four 15 mm screw holes with 160 mm center separation. During installation the Base Plate must be attached to a solid support structure (concrete parapet wall, concrete or brick wall, etc.) by using suitable heavy duty 3/8" or ½" masonry wall anchors (e.g. sleeve anchors).
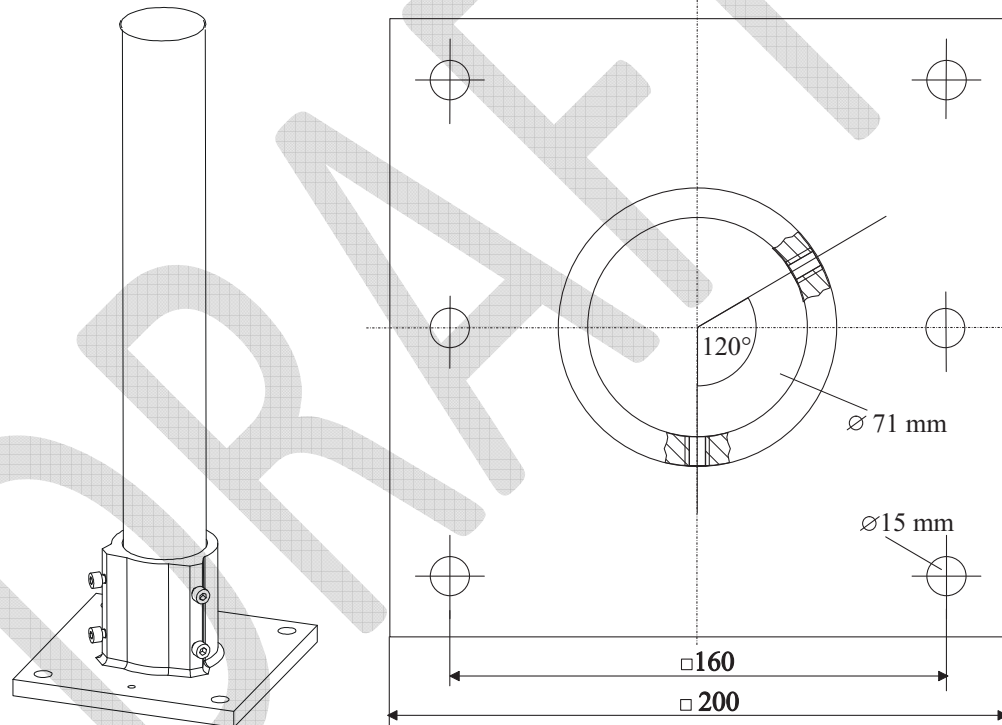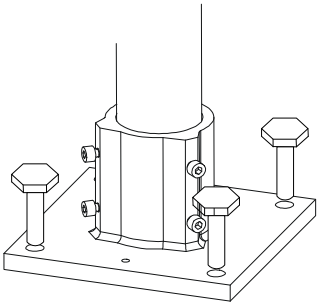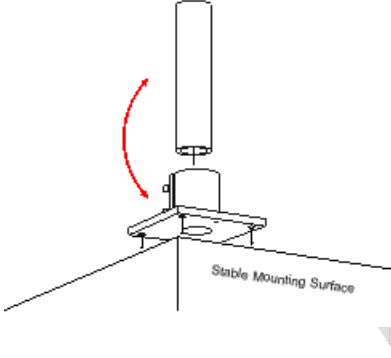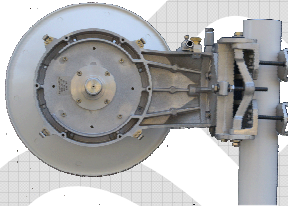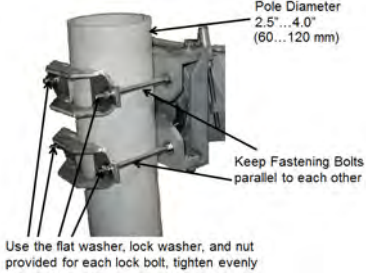

Figure 5-1: Assembled Universal Mount and Base Plate Hole Pattern

The pole can serve as the mounting pole for both the MX series and the LX series transmission units using the Side Mount assembly. If it is required for the specific installation, it is also possible to replace the standard 24" long pole of the Universal Mounting kit with a longer pole. However, it is **NOT** recommend that poles longer than 4 feet be used without stabilizing the mounting pole with guard wires.

	Step 1	Install the mounting base plate to a solid platform using 12 mm (1/2") bolts.
		❑ Anchor the mount in wall or concrete (recommend M12-screws)
		❑ Use bolts of hardness class not less than 6.6
		To ensure stability, keep the mounting post as short as possible. The maximum allowable mounting pole lengths are 4 feet (120 cm).
	Step 2	Attach and fasten the mounting post assembly to the base plate using the supplied fastening 8mm screws with 6mm Allen heads. Do not over tighten the mounting screws.
	Step 3	Attach the radio mounting/alignment bracket to the mounting pole. Roughly align the antenna towards the opposite radio location and tighten the bracket bolts using a 13 mm open-end or combination wrench. Ensure the bolts are EVENLY tightened.
	Step 4	When tightening the bolts ensure that 1) The antenna roughly points towards the opposite antenna location 2) The bolts are parallel to each other 3) Use flat washers, lock washers, and nuts provided with the lock bolts 4) Tighten the lock nuts evenly

Antenna pre-installation completed!

5.3   ODU Installation

After installing the antenna, please ensure that the radios on each side operate in the same polarization. In other words, the physical orientation of the radio enclosure (ODU) must be the same on both sides. There is an arrow symbol imprinted on the back of the ODU that must point in the same direction, either upwards (vertical polarization) or sideways (horizontal polarization), when looking at the back of ODU(see Figure 5-2). This ensures that both radio antennas operate in the same horizontal or vertical polarization plane. To attach the ODU to the antenna, simply guide the ODU onto the round metal flange on the back of the antenna. **Use a drop of silicone grease to lubricate the O-ring. This will ease the process of pushing the ODU onto the antenna waveguide flange.** Slightly rotate the ODU while pushing it towards the antenna base plate, and ensure to not destroy the rubber O-ring that serves as a seal/gasket between the antenna flange and the ODU housing.
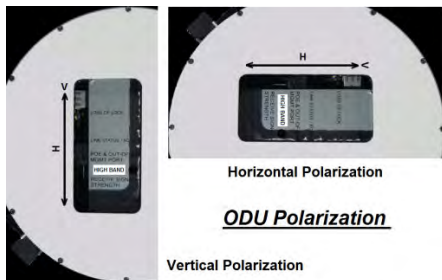
Figure 5-2: ODU Polarization Directions

Once the ODU it pushed all the way down onto the antenna baseplate and aligned correctly in either horizontal or vertical position, fasten the 4 spring loaded latches to finalize the attachment of the ODU to the antenna base. Fig. 5.3 shows the AireBeam G80–MX system with the ODU installed.

⚠	*A transmission link that uses a different polarization on each side will not function properly.*

It is also critically important that a high-band radio on one side is paired with a low band radio on the opposite side to ensure proper operation. Before installing the radio units check each radio to verify one is a high-band and the other is a low-band version. He sticker on the DU back panel indicates the HIGH BAND and LOW BAND unit (see Figure 5-2).   When installing a licensed 70/80 GHz radio transmission system, ensure that the low-band and the high-band radios are installed at each side according to the assigned and approved frequency allocation plan.

Figure 5-3: Radio installed on LightPointe Universal Mount

5.4   System Alignment Procedure

After finishing the mounting of the antennas, and connecting the cabling to the ODU as described in Chapter 3., the system is ready for alignment. At this point it is only required to power on the ODU, and actual active network traffic is not needed to align the system. RSSI power reading will however be slightly lower without active network traffic.

The alignment process itself will be eased if two people (one on each side) are involved in the alignment procedure. This is particularly true for the larger AireBeam G80-LX 2 foot antenna due to its narrower beam pattern when compared to the smaller AireBeam G80-MX 1 foot antenna. Two-way radios or cell phones are extremely helpful in exchanging information between the two parties performing the alignment. While it is possible for a single individual to align the units, walking or driving back and forth between the two mounting locations can be a cumbersome and time consuming process. The correct alignment of the system is crucial for ensuring proper performance of the system and no rush should be in play when aligning the system. Depending on the experience of the installer(s) in aligning narrow beam radio transmission equipment, this process can take anywhere from 15 to 90 minutes.

5.4.1   Installing the Optional Alignment Sight Tool

To ease the alignment process LightPointe provides an optional Alignment Sight Tool (see Fig. 5-3) that attaches to either the 1 foot or 2 foot antenna system. The Alignment Sight Tool does not eliminate the need for precise adjustment of the antennas but it shortens the time it takes to correctly point the antenna towards the remote antenna locations.

Figure 5-3: Alignment Sight Tool

AireBeam G80-MX

In case of the AireBeam G80 the Alignment Sight Tool attaches to the mounting/alignment bracket.

1) Determine the location to install the Alignment Sight Tool. The Alignment Sight Tool can be positioned on the top or bottom of the antenna mount (see Fig. 5-4, upper left). It is best to attach sight beside the azimuth adjustment screw to ensure adequate room for use of wrenches during alignment procedure. Note that antenna mount can be used in different orientations; therefore the azimuth adjustment screw may be on the top or bottom.

2) Slide sight onto the mount. It is very important to make sure that the ridge on the mount is engaged with the groove on the underside of the sight clamp. If the clamp does not fit as shown Fig. 5-4 (upper right), see Sight Setup instructions further.

3) Once the sight is in position on the mount tighten the knob to hold it in place.
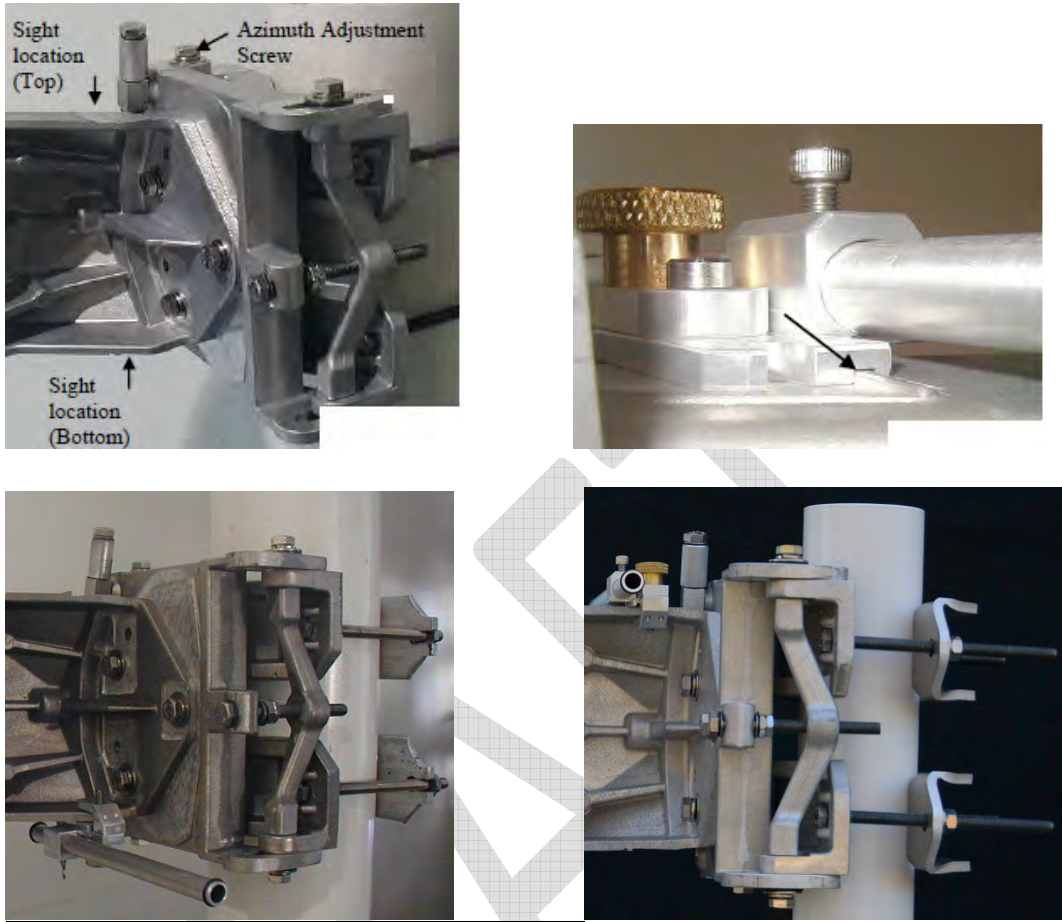
Figure 5-4: Attach Alignment Sight Tool to AireBeam G80-MX

AireBeam G80-LX

1) The sight clamp for the Alignment Sight Tool is on the top (bottom) of the 2 foot antenna.

2) Slide the Sight onto the mounting bracket as shown in Fig. 5-5 (right). It is very important to make sure that the ridge on the bracket is engaged with the groove on the sight clamp.

Figure 5-5: Attach Alignment Sight Tool to AireBeam G80-LX

Alignment Sight Tool Setup Instructions

The alignment sight clamp may need to be reconfigured for proper fit. Fig. 5-6 shows how to change the configurations. To re-configure, remove the brass knob, move to clamp the desired position and replace the knob.

Figure 5-6: Re-configuring Alignment Sight Tool

5.4.2 Elevation and Azimuth Adjustment

At this point during the installation process the antennas should be attached to the mounting pole in such a way that they roughly point towards each other. The alignment brackets fine adjust mechanisms are used to precisely tune the antenna elevation and azimuth

Elevation Adjustment

To adjust the elevation settings of the antenna see Fig. 5-7 and perform the following steps:

1. Slightly loosen the 3 Elevation locking bolts.

2. Determine if elevation adjustment must be performed in upwards or downward direction.

3. In case the elevation must be adjusted upwards, ensure that the two Elevation Locking Bolts marked **I/II** in Fig. 5-7 are both in position **I**. If not, keep the Pivot Bolt in place and unscrew these two locking bolts. Support the antenna when removing the last/second bolt to avoid the antenna sliding down. On the back of the alignment bracket is the lock bolt holder (see Fig. 5-7) and it needs to be put in place again before re-inserting the bolts in position **I**. Do not completely tighten the bolts to allow the antenna to move when turning the Elevation Adjustment Screw.
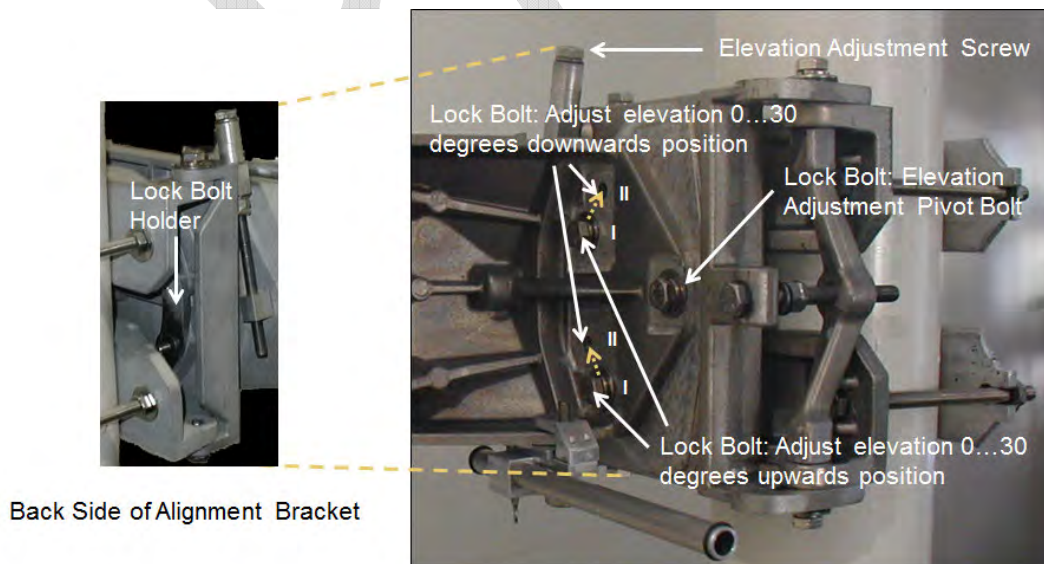

Figure 5-7: Elevation Adjustment

4. In case the antenna elevation needs to be adjusted downwards, take sure that the two Elevation Locking Bolts are both in position **II.** If not, perform steps as described under 3.

⚠️	*When re-arranging the antenna bracket for upwards/downwards elevation adjustment, it is helpful to have a second person assisting the process.*

5. To adjust the antenna elevation use a 13 mm combination or racket wrench and turn the Elevation Adjustment Screw either clock- or counter clock wise.

Azimuth Adjustment

To adjust the azimuth settings of the antenna see Fig. 5-8 and perform the following steps:

6. Slightly loosen the 4 Azimuth Adjustment Locking Bolts.

7. To adjust the antenna azimuth direction use a 13 mm combination or racket wrench and turn the Azimuth Adjustment Screw either clock- or counter clock wise.
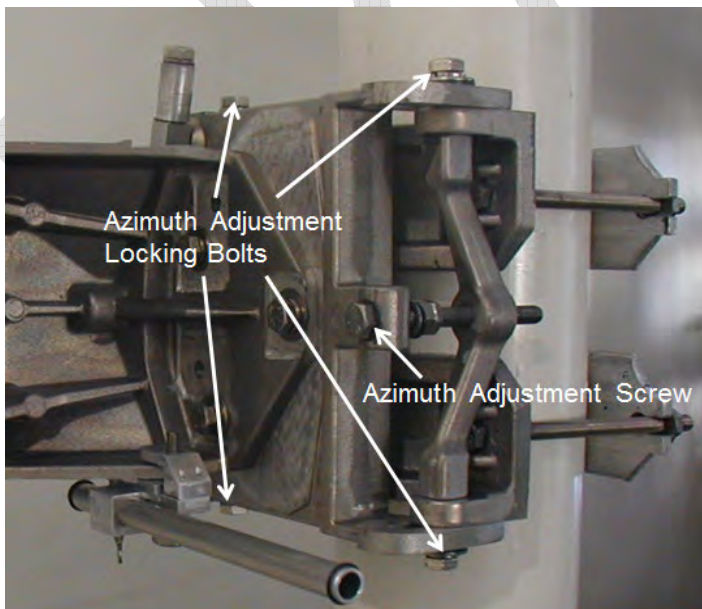

Figure 5-8: Azimuth Adjustment

5.4.3   Antenna Radiation Pattern and Side Lobes

When aligning a millimeter wave radio with a narrow beam directional antenna pattern, it is important to understand that besides the "antenna main lobe" that contains most of the energy, there are also "antenna side lobes".   A "perfect" antenna would contain all energy in the main lobe but this is physically impossible. Although these side lobes contain far less energy - in the case of a good directional Cassegrain antenna the power of the 1st side lobe is typically more than 20 dB lower when compared to the main lobe's peak power - one can "see" the 1st side lobe during the alignment process. This is mainly because the main lobe and the 1st antenna side lobe are separated by an angle of just 1-2 degrees. This small value for the angular separation is actually close to the radiation angle of the main lobe itself.

| **Note:**	*During the alignment process it is important to find the main lobe and not to align the system on a side. To ensure that the main lobe is found, move the system about 10 degrees in horizontal and vertical direction and away from the perceived highest readout voltage. While "scanning" through the beam pattern from the left to the right (or from the top to the bottom) one can find the higher RSSI voltage readings before the signal drops significantly. These two "local" voltage maxima to the left and the right of the main lobe are the 1st side lobe.*
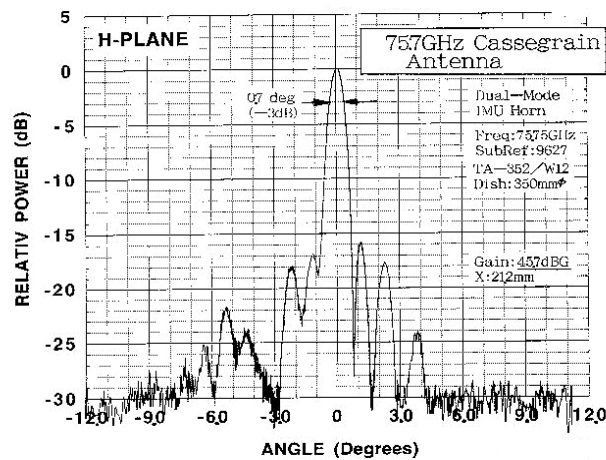
Figure 5-9: Millimeter wave radiation pattern of a Cassegrain antenna

For illustrative purposes Fig. 5-9 shows the typical pattern of a millimeter wave Cassegrain antenna[2]. When installing a millimeter wave radio transmission system it is important to keep in mind that the antenna main lobe and the 1st antenna side lobe point in virtually the same direction. Aligning the system on a side lobe instead of aligning it on the main lobe will negatively impact performance of the system.

5.4.4   Aligning the Antennas

In preparation for the actual alignment process, carry out the following steps:

1. Connect the digital voltmeter to the 2-pin connecter on the side of the radio housing using the RSSI Alignment Cables included with the system. Make sure that the digital voltmeter readout can be clearly seen during the installation process (e.g. Tape it to the installation pole).
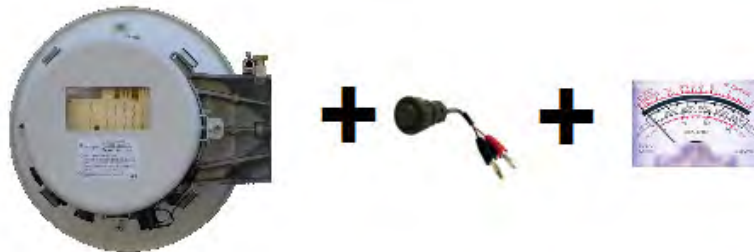
2. Power-on both radios and verify that the green power-LEDs on the PC board inside the radio housings are lit. Most likely at this point there is no connectivity to the opposite radio established and the LOS LED will be lit. Depending on the status and wiring of additional networking connections there might be other LEDs lit, too.

---

[2] *Although the antenna pattern shown in Figure -9 is the result of a real measurement it is just an example of an antenna pattern for illustrative purposes and not the actual radiation pattern of the antenna used in LightPointe products.*
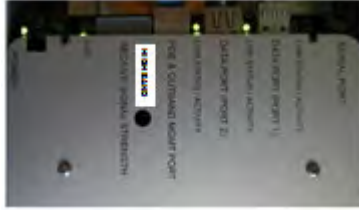
3. Look through the Alignment Sight Tool and turn the Elevation and Azimuth Adjustment Screws until the opposite antenna location shows in the middle of the Alignment Sight Tool. The inside of the tool is reflective and this helps to center the remote antenna site location. In case the opposite side is too far away to be clearly seen, please use binoculars to find an easy recognizable landmark close to the opposite antenna side. Perform the same procedure at both sides.

4. The alignment tool is meant to provide a rough alignment towards to opposite antenna location. It is however not an exact tool for finding the best alignment of the antennas. This is done via the digital voltmeter. In most cases and when the alignment tool was installed correctly, the voltmeter shows already a low voltage reading but most likely a value of less than 100 mV.

5. Turn the Azimuth and Elevation Adjustment Screws at each antenna left/right for best azimuth alignment and up/down for best elevation alignment and observe the voltmeter reading. The goal is to find the maximum RSSI voltage reading on both sides of the link. Using a meander-like scan pattern has proven to be the most efficient way to align the antennas. This is illustrated in Fig. 5-10.
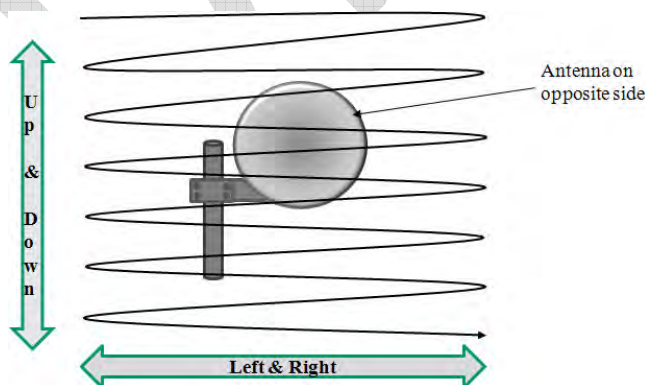

Figure 5-10: Antenna alignment scan

Note:	*Do NOT move both radios at the same time. Try to optimize the RSSI signal level first at one side and then repeat this process at the opposite side. Communicate changes in signal levels during the adjustment process to the person at the opposite side via a two-way radio or cell phone.*

6. Ensure that the antennas are not aligned on a side-lobe. When rotating the antenna a few degrees to each side of the perceived alignment center, both side-lobes can be detected as "local RSSI voltage minima". The main lobe which is located right in the middle between the two side lobes will have a much higher voltage reading. Fig. 5-11 shows a simple illustration of the alignment process and the location of the antenna side lobes in relation to the main lobe.

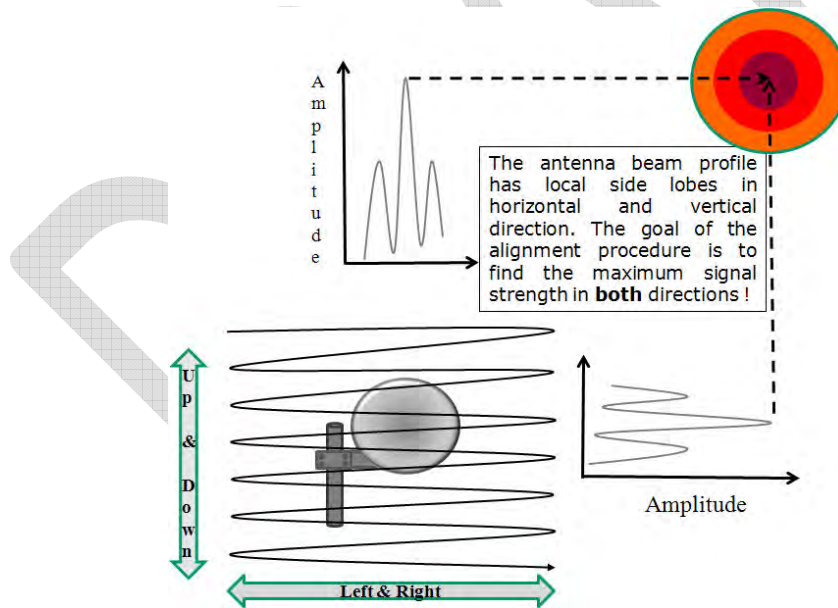|	
Note:	*For longer distances between the antennas the side lobes might not be visible due to the much lower signal power contained in a side lobe when compared to the main lobe.*

Figure 5-11: Simple illustration of the alignment process

⚠️	*Please ensure that the maximum RSSI voltage reading for both, the G80-MX and G80-LX systems, does not exceed 1100 mV.*
	Prolonged operation of the system at voltage levels beyond 1100 mV will destroy the radio receiver!

7. When aligning the system it is important to take a look at the Receive Signal Strength Indicator (RSSI) shown in Fig. 5-12. The RSSI chart shows the RSSI signal voltage as a function of the deployment distance in clear weather conditions. Therefore, and when the system is installed under non-clear weather conditions, the values can be lower during the actual installation process. The RSSI values are different for the low band and the high band radio and the values vary slightly and within a few percent from one radio system to another due to manufacturing tolerances. However, the chart provides a very good indication of expected RSSI values as a function of deployment distance. The overall goal of the alignment process is to align the system as close as possible to the RSSI value provided in the RSSI chart.
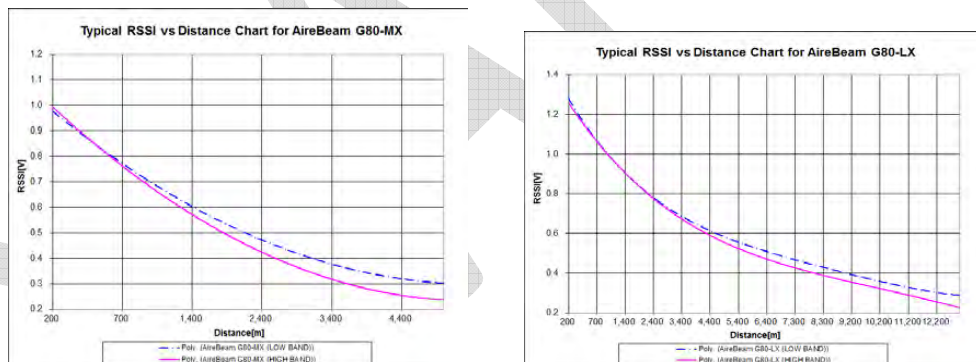
Figure 5-12: Typical AireBeam G80 RSSI vs. Distance Charts

8. After maximizing the RSSI signal levels on both sides of the link, do not forget tightening the Elevation and Azimuth Locking Bolts (see Fig. 5-7 and Fig. 5-8).

9. When looking at the ODU back panel (see Fig. 5-13) several LED bars should be lit on the RSSI signal bar graph. The actual number of the bars lit will of course depend on the received signal level. The bar graph has 10 bars, and the first bar turns on at a received RSSI voltage of 300 mV. The 10th bar turns on at roughly 1000 mV. In other words, each bar corresponds to about 80 mV of receive signal voltage starting at 300 mV. Depending on the status of the networking connections additional LEDs might be lit.

Figure 5-13: Normal ODU Back Panel Status

The installation and alignment procedures are now completed and the system is ready for use!

6   AireManager – Network Management Platform

Operation of the AireBeam™ G80-2.5G system can be monitored/managed via a web browser based interface or SNMP. Changes of system status are also communicated via Syslog messages. The web browser interface can be easily accessed via the http protocol using a standard web browser (IE, Firefox, Safari). SNMP and/or Syslog operation require to set up a SNMP Management System and/or a Syslog Server. Since there a a total of 4 ODUs installed with the 2.5G system, one needs 4 separate IP addresses to monitor each ODU separately. This chapter provides just a quick overview of the NMS capabilities. For details, please refer to the "AireManager - NMS Platform for Aire Product Series – Setup and User's Guide"

6.1   Web Browser Interface

To connect to the AireManager browser-based management application, open a web-browser on the same network as the Aire unit and enter the IP address of the Aire unit in the address/URL field. There are three available logins:
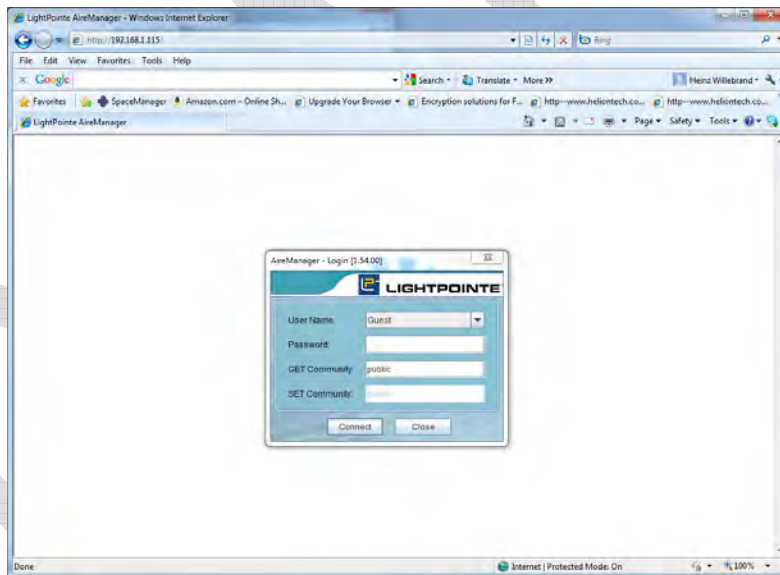
User Name	Default Password
Guest	guest
Admin	admin
Technician	tech

These default passwords can only be changed via telnet (refer to section "Telnet Access"). If the SNMP community strings were changed from their defaults at any point, using serial connection or this management application, they will need to be entered correctly at login from this point forward. Otherwise the defaults will remain and won't have to be entered as part of the login.

When first logging into the AireManager management application you are presented with the registration screen. This screen will appear every time you log into the application, until the registration process has been completed. Please complete the registration process.

On the left side of the AireManager browser-based management application you will see a window with several navigation icons. When using the AireManager, there are five navigation icons: System, FSO, MMW, Software, and Management.

Note: The FSO icon will be grayed out and can't be selected.

Clicking on an icon will open a new window. The values and options displayed are a function of SNMP GET and SET commands send to the ODU.

Figure 6-1: AireManager main screen (AireBeam™ G80-2.5G-LX)

A complete and very detailed description of the management functionality, setup examples, as well as examples on how to integrate the system into an existing management platform are provided in the "AireManager - NMS Platform for Aire Product Series – Setup and User's Guide"

6.2   Telnet Access

This chapter covers the following main topics:

Connecting with Telnet to change passwords

Overview of other Telnet command line options

6.2.1   Connecting with Telnet to Change Passwords

Telnet access to the AireManager firmware is provided for purposes of changing or viewing Administrator, Guest and Technician passwords. Guest access to the AireManager browser-based management application is limited to read only privileges, while Administrator and Technician accounts have full access.

To change http Admin, Guest or Technician passwords:

Step 1

Open a Command Prompt on any computer connected to the same network as the Aire unit's Management interface. This must be a different physical or virtual network than the Aire unit's data interface/s.

Step 2

Type telnet, enter a space, and type the IP that you assigned to the Aire unit. Then hit enter. You are presented with the following screen:
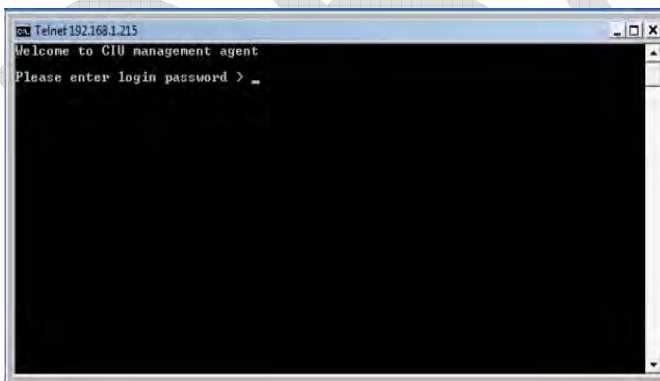
Your default telnet password is LightPointe

*The telnet password can only be changed via direct serial port connection and using a terminal application such as HyperTerminal (see chapter 4.)

Step 3

Once you've entered the password and hit enter you are presented with a CIU> prompt. Type help and hit enter to see a list of command line options:

Step 4

To change the Admin, Guest, or Technician passwords type set http password <user> <new_password> and hit enter or type set http password ? and hit enter for an example of the proper syntax. After changing passwords you will need to reboot the firmware. Type reboot and hit enter. Wait several minutes for the AireManager platform to reinitialize

6.2.2   Overview of Other Telnet Command Line Options

Show Version	Displays version number, date and time
Show IP	Displays MAC Address, DHCP Status, IP Address, Netmask and Gateway values
Show HTTP Password	Displays https users and passwords
Set HTTP Password	Allows change of http passwords
Reboot	Reboots the AireManager firmware
Logoff	Logs off the telnet session

6.3   SNMP

6.3.1   Basics

The AireBeam™ G80-2.5G system supports the Simple Network Management Protocol (SNMP), an Internet-standard protocol for managing devices on IP networks. The AireBeam™ system support SNMPv.1 & SNMPv.2c versions. In typical SNMP implementations, one or more administrative computers, called managers, have the task of monitoring or managing a group of hosts or devices such as the AireBeam™ system on a computer network. Each managed system executes, at all times, a software component called an agent which reports information via SNMP to the manager. An agent is a network-management software module that resides on a managed device such as the AireBeam™ system. The agent has local knowledge of management information and translates that information to or from an SNMP specific form. SNMP itself does not define which information/variables a managed system should offer. Rather, SNMP uses an extensible design, where the available information is defined by management information bases (MIBs). MIBs describe the structure of the management data of a device subsystem; they use a hierarchical namespace containing object identifiers (OID). Each OID identifies a variable that can be read or set via SNMP. For the SNMP system to function properly, the MIBs of monitored components must be compiled into an SNMP Management System such as NET-SNMP, HP OPENVIEW, SNMPC or similar commercially available programs. For illustrative purposes we are using the MG-SOFT Software

6.3.2   LightPointe MIB Files

LightPointe provides two MIBs to monitor all AireLite/Strata, AireBeam™ and AireBeam™ wireless point to point communication systems. The two MIBs, **LIGHTPOINTE-AMG-MIB and LIGHTPOINTE-GEN-MIB**, must be compiled into the management system using the appropriate compiler function. After the MIBs are compiled correctly they must both show as part of the loaded MIB modules. See the example in Figure 6-2 below.
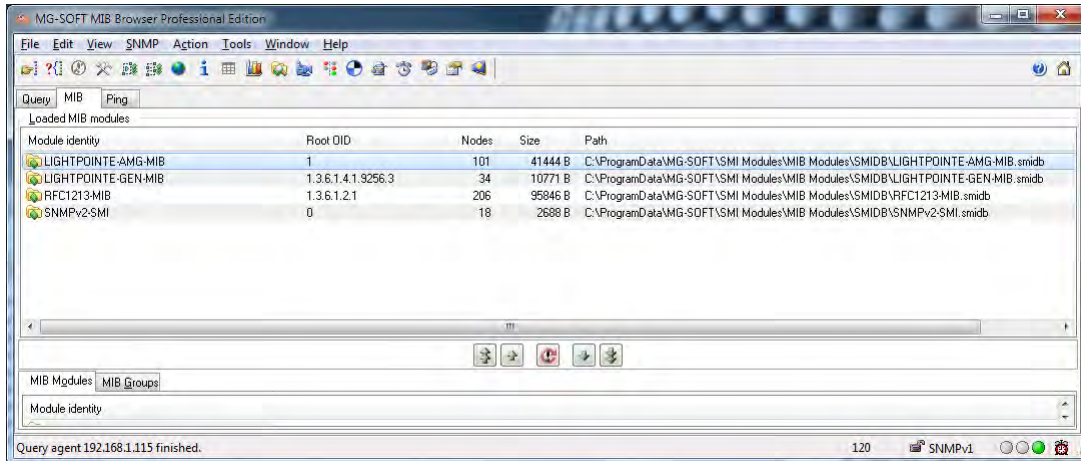
Figure 6-2: LightPointe MIB modules

6.3.3   LightPointe MIB tree

After successful compilation the LightPointe MIBs and corresponding variables are shown under the following MIB tree structure:

iso/org/dod/internet/private/enterprises/lightpointe/lightpointeProducts (see Figure 6-3)

iso/org/dod/internet/private/enterprises/lightpointe/lightpointeGeneral (see Figure 6-4)

The variables with a ☀ in front of the variable name can be polled via SNMP command. Some variables are READ ONLY and others have a READ/WRITE status. Most SNMP programs allow highlighting a specific variable and open a property description window similar to the one shown in Figure 6-3 below. The MIB file is actually a readable ASCII Text file and the meaning of a specific variable is documented in the MIB file.
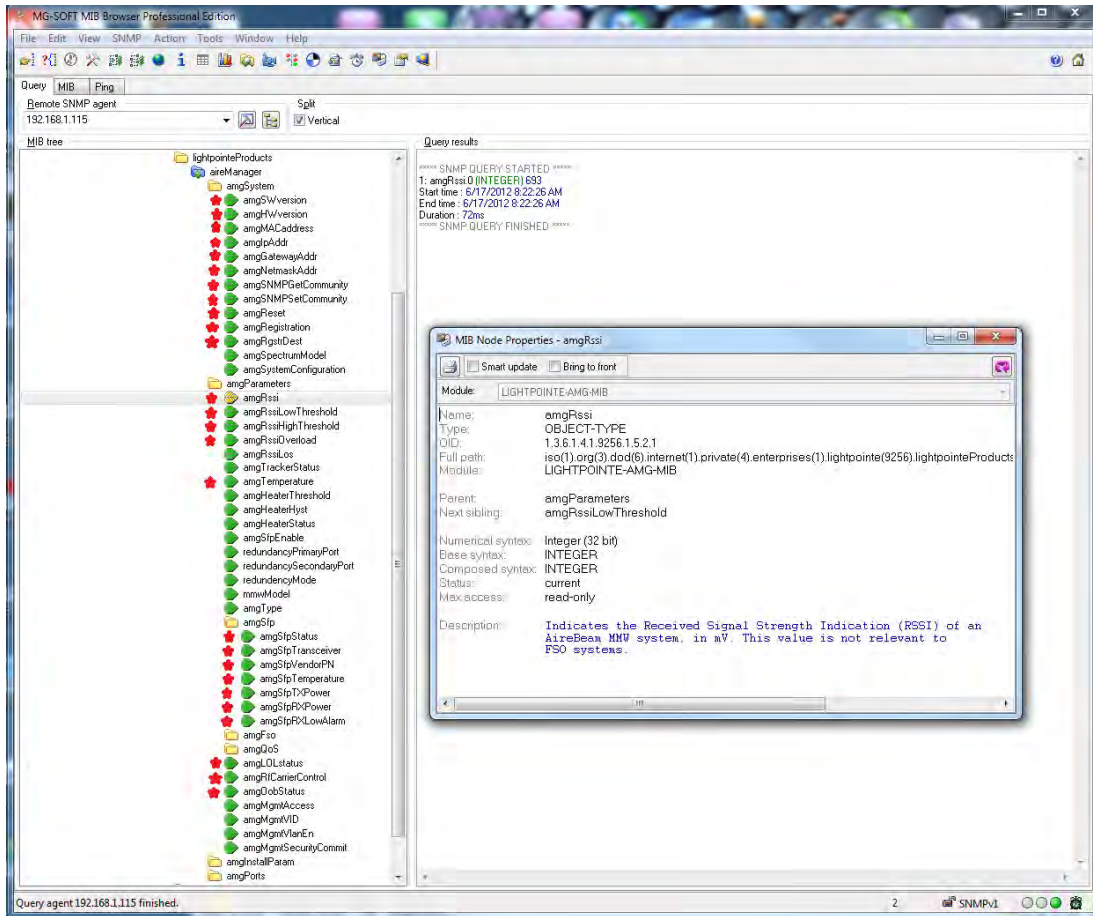
Figure 6-3: MIB tree iso/org/dod/internet/private/enterprises/lightpointe/lightpointeProducts
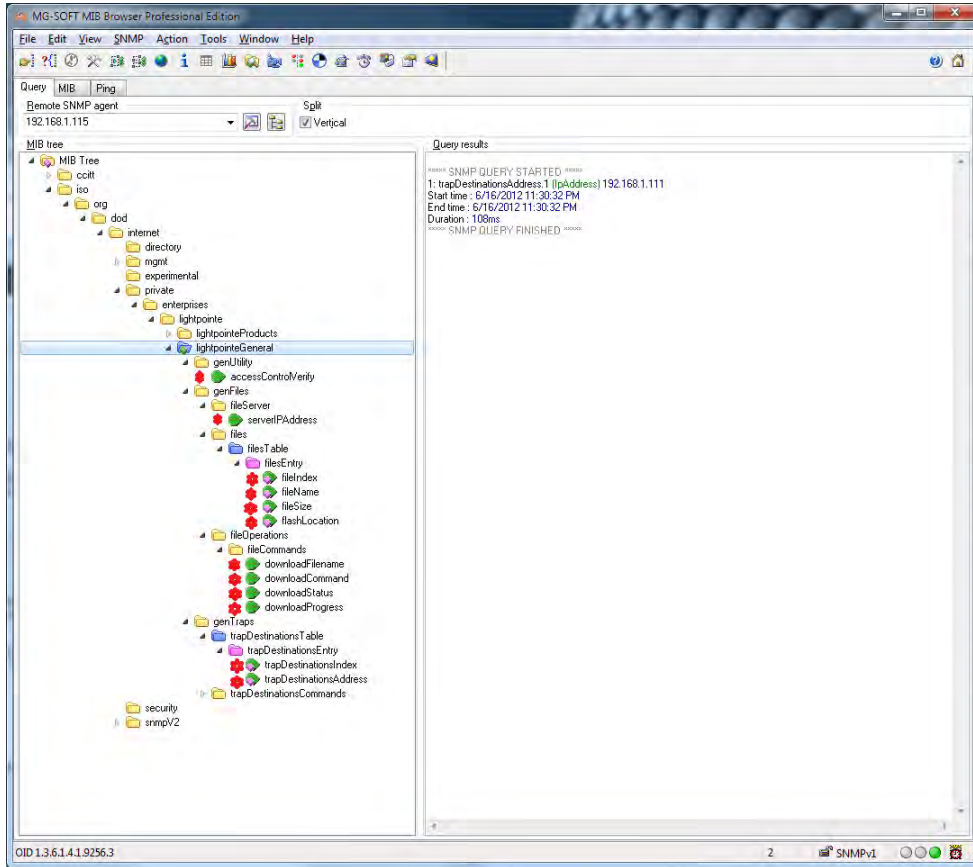
Figure 6-4: MIB tree iso/org/dod/internet/private/enterprises/lightpointe/lightpointeGeneral

Most SNMP programs allow monitoring/polling specific variables over time and display the values graphically or write the values to a file. Such a performance graph can be very useful during troubleshooting. Figure 6-5 shows an illustration of RSSI values polled from an AireBeam™ unit.

Figure 6-5: Performance Graph

6.3.4   SNMP Trap Monitoring

An SNMP trap allows an element, such as the AireBeam™ system, to contact network management when there is a significant event. This is done via unsolicited SNMP messages. For example, if the AireBeam™ unit reaches a critical RSSILow threshold value, an SNMP trap will be sent to the computer with the message that the unit has reached the RSSILow value. When the RSSILow conditions resolves the montoring computer will receive an RSSIClear message via a different trap message.

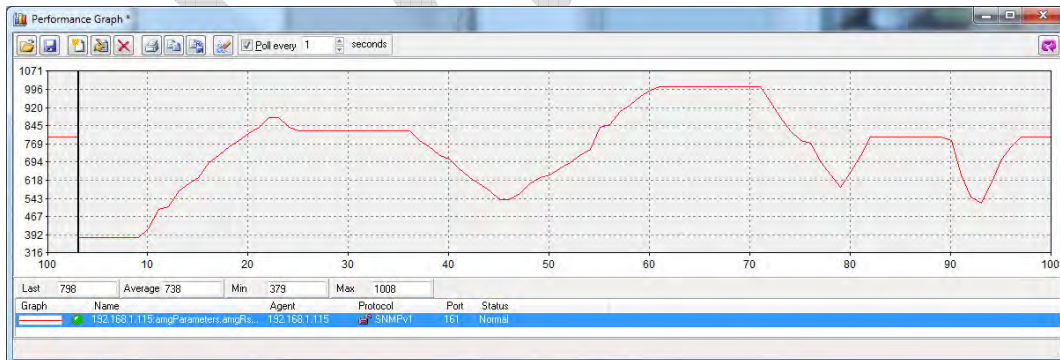The AireBeam™ system sends 4 different SNMP trapsand they are shown in Figure 6-6:

1. **RSSILow Alarm trap** (Notification: 30)→ This trap is send when the RSSI Low threshold is reached. This threshold can be changed from within the web browser an/or by chnaging the value of the amgRssiLow Threshold variable (see Figure 6-3)

2. **RSSIClear Alarm trap** (Notification: 31)→ This trap is send when the RSSI High threshold is reached. This threshold can be changed from within the web browser an/or by chnaging the value of the amgRssiHigh Threshold variable (see Figure 6-3)

3. **LOL Alarm trap** (Notification: 42)→ This trap is send when the internal CDR chip has lost the signal lock.

4. **LOLClear Alarm trap** (Notification: 43)-→ This trap is send when the internal CDR chip has regained the signal lock.
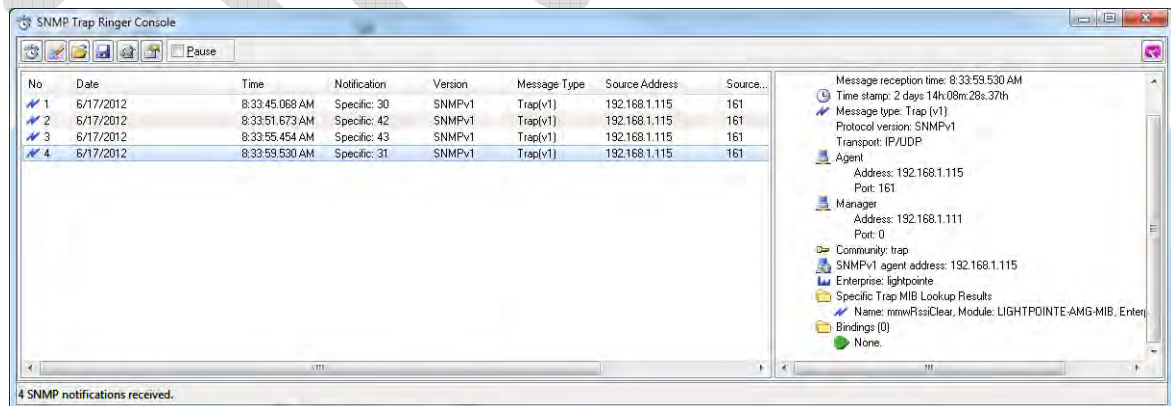
Figure 6-6: SNMP Traps

6.4   Syslog

Syslog is a standard for computer data logging. It separates the software that generates messages from the system that stores them and the software that reports and analyzes them. Syslog can be used for computer system management and security auditing as well as generalized informational, analysis, and debugging messages.

The LightPointe AireBeam™ system supports Syslog messaging and messages can be received when a Syslog Server is installed and configured on the management computer. Syslog messages are same as SNMP trap messages send out by the SNMP agent. Figure 6-7 shows example of Syslog messages received by the free Tftpd32 program. To download please visit http://tftpd32.jounin.net/

Figure 6-7: Syslog messages

7   Troubleshooting and Diagnostics

This chapter provides helpful tips on troubleshooting the equipment and covers the following topics:

> Types of Failure
>
> Fault isolation troubleshooting charts
>
> Additional troubleshooting methods

The radio units provide a Layer 2 Ethernet connection between remote locations. If the radio units are correctly aligned and data is transmitted, the problem is usually outside the system.

7.1   Failure Types

Three different kinds of failures can affect system performance:

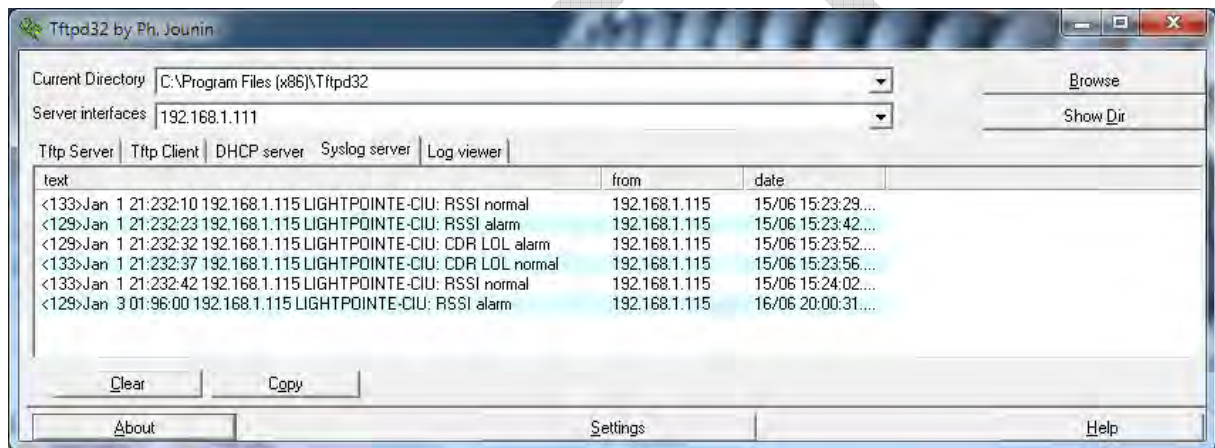> Failures caused by attached network components
>
> Failures caused by the environment
>
> System failure of one of the radio units

The use of the AireManager program is highly recommended during the troubleshooting process. Although the AireManager is not needed to transmit information through the system, the program is an essential component in monitoring and managing the AireBeam G80 system. For details please refer to the "AireManager - NMS Platform for Aire Product Series – Setup and User's Guide"

Troubleshooting Charts

The following troubleshooting charts are meant to guide the user through some simple failure analysis procedures. Following these procedures will greatly help to ease the troubleshooting process and many problems can be solved on short notice by the user of the equipment and consequently minimize the downtime of the system in case of a malfunction. Please consult the AireManager for AireBeam User's Guide and use the following charts to locate the problem before contacting LightPointe or your reseller.

Observation: Network connection cannot be established with the opposite radio.
Received power is "low" or signal status is "off"

Problem	*Cause*	*Action*
Power Source	The equipment power supply at the opposite side is switched off.	Turn power supply on. Check that the green LED inside the radio unit is turned on.
	Broken power supply	Replace power supply. Call LightPointe or reseller in case the power supply was part of the shipment.
System Setup	System is misaligned.	Realign system. See chapter 5.4 in this manual.
	Distance between locations exceeds specific system specification.	System can still be used but availability will be lower.
	Antenna is mounted incorrectly and the polarization is crossed.	Re-install the antenna and ensure that both antennas transmit at the same polarization. See chapter 5.3 in this manual.
Environment	High signal attenuation due to heavy rain	Wait until the rain stops and observe if this resolves the problem.
	Antenna covered with snow.	Remove snow from antenna.

Table 7-1: Troubleshooting Chart I

Observation: 'Optic Status' reports "OFF", OSD LED is off

Problem	Cause	Action
Optic Cables or Transceiver	*TX and RX terminal connection error*	*Check fiber cables and ensure that transceivers are connected correctly.*
	Optical transceiver standards do not match	*Use AireManager and verify that the correct transceiver is installed.*
	Dirt or dust or breakage of optical fiber	*Clean fiber output or replace the cable with a new one. Use AireManager software to verify correct optical receive power at ODU fiber port.*
	Broken transceiver at the network premise equipment side	*Replace transceiver*
	Broken transceiver at the radio side	*Call LightPointe or reseller.*
Premise Equipment Connection	*The network premise equipment at the opposite side is turned off*	*Power on premise equipment*
	Network port of premise equipment is de-activated	*Activate network port*

Table 7-2: Troubleshooting Chart II

8 Advanced Troubleshooting Methods

8.1 Performing a PING test

A ping test is not a particularly sophisticated networking test but it does provide the user with an easy method to check the connectivity of IP based network equipment. When performing a ping test between two laptops and without other network equipment in the circuit, the ping test provides valuable information about the performance of the radio transmission link itself. Other tests may involve additional network equipment and therefore complicate the issue, making it difficult to find the root cause of a potential problem. The following equipment and software are needed to perform a ping test:

❑ Two laptops or PCs with Ethernet cards

❑ Two Ethernet cables with RJ45 connectors

Additionally, if performing the test over ODU fiber connection:

❑ Two media converters

▪ Depending on SFP transceiver installed in ODU use either multimode 1000Base-SX (850 nm) or 1000Base-LX (1300 nm) media converter. When using an older laptop that does not have a RJ45 (Gigabit Ethernet) connection, a 100/1000 switched media converter will be required.

❑ Four simplex (or two duplex) optical fiber patch cords with correct termination. The radio transceiver has a LC type connector and the other termination will depend on the termination of the media converter.

8.1.1 Equipment connection and network settings

To perform a ping test directly connect the two laptops/PCs to the radio link heads using either Cat5E/6 cables or additionally with a media converter on each side, if connecting via fiber. It is important to know which port of the radio unit is active. For details please refer to the "AireManager - NMS Platform for Aire Product Series – Setup and User's Guide". Ensure that the radio units are aligned and that all status indicators show that the system is physically connected.

Note:	*This ping test is based on using two computers. It is possible to do a ping test with just one laptop if the remote radio side is connected to network equipment (switch/router) with a known IP. However, by doing so it might be difficult to isolate a potential networking problem and draw a definitive conclusion.*

8.1.2   Step-By Step instructions to perform a ping test

Step 1   Locate the required equipment listed above.

Step 2   On each side, attach an RJ-45 cable to the ODU port labeled DATA (Prim.) or optical fiber cables to the DATA (SEC.) port. Connect the opposite ends of the RJ-45 cable to a laptop or fiber cables to the TX/RX ports of the media converters.

Step 3   Connect an Ethernet cable between the PC RJ45 network port and the media converter RJ45 port on each laptop/PC and complete the following setup instructions on each laptop. The exact procedure will depend on the actual Windows operating system installed but the procedure is basically the same for any Windows operating system.

Step 4   From Windows click the **Start** button.

Step 5   Click on **Settings.**

Step 6   Click on **Control Panel.**

Step 7   Click on the **Network And Dial-Up Connector** icon.

Step 8   Click on **Incoming Connection.**

Step 9   Click on the **Network** tab**.**

Step 10   Double click on **Internet** Protocol **TCP/IP**.

Step 11   Select the **Specify TCP/IP Address** radio button.

Step 12   The local side should type **192.168.1.1** in the IP Address Box. The remote side should type **192.168.1.10** in the IP address box. The Subnet address will automatically generate.

Step 13   Click the **Okay** button.

Step 14   Exit all dialog boxes.

Step 15   Click on the **Start** button.
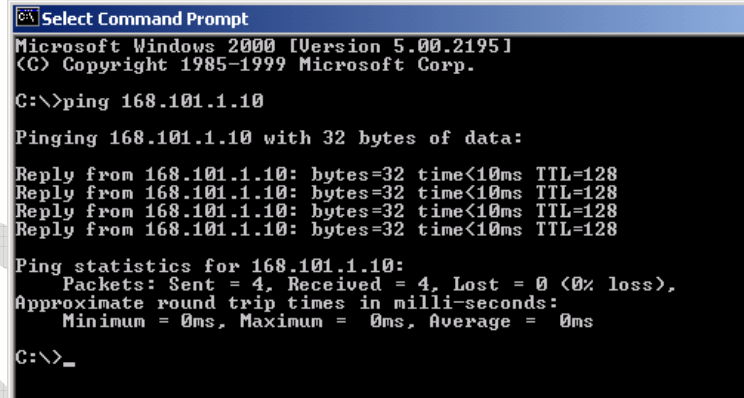
Step 16   Select **Programs**.

Step 17   *Select the* **MS-DOS** *Prompt.*

Step 18   *Type the word* **ping** *and the different* **ping** *command options will be displayed.*

Step 19   *To perform the ping test, the local laptop has to ping the IP address of the laptop and the other way around. From C:\> Type:* **ping -t 192.168.1.1** *on the local laptop*. *The remote side laptop can ping by typing:* **ping -t 192.168.1.10**.

To stop the ping tests, type **<Ctrl> C**.

Step 20   *A successful* **ping** *will display the following information on the PC screen.*

```
Select Command Prompt

Microsoft Windows 2000 [Version 5.00.2195]
(C) Copyright 1985-1999 Microsoft Corp.

C:\>ping 168.101.1.10

Pinging 168.101.1.10 with 32 bytes of data:

Reply from 168.101.1.10: bytes=32 time<10ms TTL=128
Reply from 168.101.1.10: bytes=32 time<10ms TTL=128
Reply from 168.101.1.10: bytes=32 time<10ms TTL=128
Reply from 168.101.1.10: bytes=32 time<10ms TTL=128

Ping statistics for 168.101.1.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum =  0ms, Average =  0ms

C:\>_
```

Step 21   *Let the* **ping** *program run for several minutes and then type* **<Ctrl> C** *to stop the program. Take a look at the lost ping counter to verify that the system operates correctly. We using two laptops, no packet should be lost during the transmission.*

8.1.3   BER Testing

Bit Error Rate (BER) testing is the most advanced way to check on the performance of a communication link. The radio transmission link operates as a transparent layer 2 Ethernet connection. The radio operates in full-duplex mode at real network throughput speed and extremely low latency of typically < 50 microseconds. Higher protocol layer performance is not determined by the radio but by the attached networking equipment. There are several vendors in the market that provide BER testing equipment. In case you are interested in performing a BER test and do not have a BER tester, please contact LightPointe for information on test equipment companies that lease BER Testers.

9   Specifications

System	AireBeam™ G80-xx AireBeam™ G80PLUS-xx	AireBeam™ G80E-xx AireBeam™ G80EPLUS-xx
Frequency of Operation	74.875/84.875 GHz	72.375/82.375 GHz
Transmission Power	Standard: +20dBm max. (100mW) PLUS: +23dBm max. (200mW)	
Modulation	Digitally modulated	
Supply Voltage	Direct 48Vdc or Power over Ethernet	
Power Consumption	20 Watts	
Primary Network Interface	Copper: RJ45 100/1000Base-TX and/or Fiber: SFP	
Secondary/DualPath Interface	RJ45 100/1000Base-TX	
Data Rate	1250 Mbps/ Full duplex	
Data Format	802.3z (Gigabit Ethernet)	
OSI Layer	Layers 2 per IEEE 802.3 Ethernet Specification	
QoS Support	Flow control, tagged a protocol based priority	
Management Interface	Out-of-Band: 10/100 BaseTx or In-Band (VLAN capable)	
Management	Web based AireBeam™ Manager Program, SNMP, TELNET, SYSLOG	
Operating Temperature	-30°C ... +70°C	
Environmental / IP Rating	IP66	

Standards Compliance	North America: FCC 47 CFR Part 15 Subpart B Class A
	
	                   FCC 47 CFR Part 101 Subpart Q
	
	                   IC ICES-003 Class A
	
	Europe: CE MARK
	
	                   EN 302 217-2-2
	
	                   EN 302 217-3
	
	                   EN 302 217-4-2
	
	                   EN 301 489-4
	
	                   EN 60950-1:2006	

Size (DxH)	220(D)x120(H) mm (enclosure w/o antenna)	
Weight (Enclosure with Antenna)	11.3 kg	15.9 kg

Antenna	Type	Cassegrain (MX Version)	Cassegrain (LX Version)
	Size	1 foot	2 feet
	Gain	45dBi	51 dBi
	Polarization	Horizontal/Vertical	Horizontal/Vertical
	HPBW	0.7°	0.5°

10   Technical Support

Be sure to fill out the following checklist before calling your reseller on contacting LightPointe Technical Support.

General Information	Your Installation
❑ Application (Fast Ethernet or GbE)?	
❑ Distance?	
❑ How long has system been in operation?	
How does the error show up?	
❑ Temporary/permanent error?	
❑ Is error observed for the first time?	
How was the weather when error showed up?	
❑ Light or Dark?	
❑ Weather conditions (rain, fog, snowfall)	
❑ Outside temperature	
Status of LEDs (inside radio unit)	
❑ Is the power LED on (green)?	Yes/No
❑ Is the LOS LED on (red)?	Yes/No
❑ Do you see the network link/activity LED ON?	Yes/No
❑ Does the LED bar graph show LEDs lit?	Yes/No If yes, what is the reading?
Status in AireManager™	
❑ AireManager ™connection ok?	Yes/No
❑ Is RF receive power value displayed?	Yes/No If yes, what is the reading in mV?
❑ Is temperature value displayed?	Yes/No If yes, what is the reading in ^{O}C?
❑ Can you see the RMON counter status?	Yes/No If yes, do you see any CRC errors?
What type of system is installed?	
❑ Model number	
❑ Serial number	

10.1 Return Material Authorization (RMA) Procedure

Please contact LightPointe before returning any system components for repair or replacement.

RMA products include:

Link head

Standard power supply

Contacting LightPointe

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