beyondspot

BeyondSpot

Broadband Wireless Access Network

BeyondBridge

Point-to-Point Wireless System

Installation Manual

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1. Introduction

Modern network demands a great team work among various talents. Depending on the role, a typical network project is achieved through the cooperation from the following key personnel:

- **Project Manager** – Defines the system architecture based on service requirements and equipment capabilities. Usually such role requires high level RF and Network planning.
- **Network Engineer** – Follows the system architecture and selects appropriate network devices to achieve the functionality and capability. Usually such role conducts detailed RF and Network design verification.
- **Field Engineer** – Follows the RF and Network plans and installs each device to its specific location and configures the network based on the detail design plan. Usually such role is also responsible for the maintenance for the device post installation.

BeyondSpot Technology provides information and knowledge in the formats of Application Notes, Reference Manuals, Installation and Maintenance Manuals as described below. We recommended personnel carrying different functions maximize the usage of these documents based on the suggestion in Figure 1. Shall these document not able to answer your need, BeyondSpot provides technical consulting in all levels upon request, please contact BeyondSpot for further details.

Figure 1. BeyondSpot Document

1.1 Documentation Tree Summary

Documentation for BeyondBridge firmware (Rev 1.0) includes the following key components:

Reference Manual (this document)

Provides technical information about BeyondBridge from Physical to Application layers. It also provides background information of various networks through which services in different formats or can be offered by incorporating BeyondBridge wireless system.

Installation Manual

Provides detailed installation and configuration information for the less experienced installer, including information about site planning, pre-installation tasks, post-checkout configuration, and mounting the units.

Application Note

Provides more details in building business case through the usage of wireless network system by BeyondSpot. Available application notes include 1) broadband wireless access network, 2) high quality QoS VoIP network. More application notes in other business opportunities will be available in the future.

Datasheet

Provides complete product specification in both functionality and performance. It also provides a brief application discussion. BeyondSpot Inc. reserves the right to update the content of such information, please contact BeyondSpot for the latest update of data sheet.

1.2 Required Software and Firmware

The required software and firmware codes for this official release are:

- BeyondBridge Console Applicable Version : 1.X
- BeyondBridge Firmware Applicable Version: 1.X

2. Installation Planning

The installation of a wireless network requires different planning from any wired network. The main difference is that the wireless signal requires some additional consideration. This consideration includes RF propagation assessment, site preparation, and installation of outdoor components, such as radios, antennas, lightning protection devices, and cabling suitable for outdoor conditions.

Although the OFDM technology implemented in this broadband fixed wireless system can make use of multipath signals to reduce the effect of obstructions in the path, the signal quality and the link reliability post installation must be carefully examined. With this knowledge, components and network requirements can be correctly planned for your specific application. This session provides knowledge necessary to prepare your BeyondBridge Broadband Point-to-Point Wireless System.

Note: Users with experience installing Outdoor Wireless Equipment can skip ahead to the installation session, however, caution is recommended as every equipment has its specific environmental and RF propagation constraints.

2.1 RF Specific Considerations

A basic consideration is the physical location of the sites at each end of the link. Because microwave signals travel in a straight line, a clear line of sight between antennas is ideal. Frequently, however, the locations of the desired links are fixed. When a clear line of sight* cannot be achieved, you must plan accordingly. Other general site considerations include:

- Whether a tower must be constructed; and whether permits are required
- Possibility of future obstructions
- Availability of grounding
- Distance between the indoor portion of the system and the user's network.
- Whether the radio may potentially be interfering with other BeyondBridge system. Prior to installation, try to determine the best maintenance access and available sighting location.
- Whether strong RF interference, within or adjacent to the operating frequency, exists in the neighborhood

To get the most value from a wireless system, path planning is essential. In addition to the fact that radio signals dissipate as they travel, many other factors operate on a microwave signal as it moves through space. All of these must be taken into account, because any obstructions in the path can attenuate the signal.

*Note: In RF propagation, clear Line-of-sight (LOS) is not only achieving a clear visual line but a RF energy envelope as shown below. The Fresnel Zone refers to the radio beam. The radio signal's path length and frequency determine the Fresnel Zone's width and shape. When a large part of the Fresnel Zone is blocked, some of the radio signal's energy is lost.

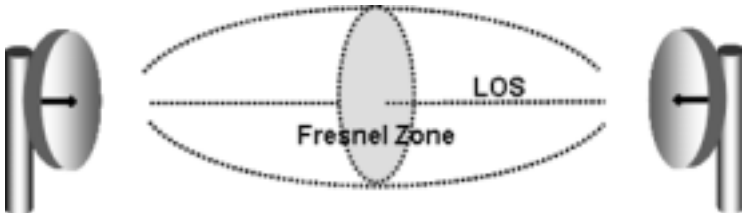


Figure 2. Fresnel Zones

2.1.1 Calculating a Link Budget

A link budget is a rough calculation of all known elements of the link to determine whether the signal will have the proper strength when it reaches the other end of the link. To make this calculation, the following information should be considered.

- A signal degrades as it moves through space. The longer the path, the more loss it experiences. This free-space path loss is a factor in calculating the link viability. Free-space path loss is easily calculated for miles or kilometers.
- Availability represents the quality of a link. It is the ratio of the time that the link is available to the total time. This serves as a guide to the service you can expect, on the average, over a period of one year. More details are provided in the following sections.
- In terrestrial communication, path loss does not necessarily follow 20dB per decade degradation as used in free-space loss. Instead 25-35 dB per decade is more common in a metropolitan near-line-of-sight environment.
- The table below provides a first-order recommendation for range calculation in a clean-line-of-sight condition with margin for channel fading. The range presented is in **km** as a function of frequency, modulation mode, and antenna gain (at both ends). It can be converted to mile by [mile] = [km] / 1.6

Data Rate \ Freq. / Gain	ISM 2.4 GHz (8 dB Fade Margin)				USA U-NII 5.1GHz				USA U-NII/ISM 5.8 GHz			
	18dBi	23dBi	28dBi	33dBi	18dBi	23dBi	28dBi	33dBi	18dBi	23dBi	28dBi	33dBi
54 Mbps	4	11	33	>50	2	6	16	47	2	5	15	42
36 Mbps	8	21	>50	>50	3.8	11	30	>50	3.5	10	27	>50
18 Mbps	21	>50	>50	>50	11	30	>50	>50	10	28	>50	>50

2.1.2 Co-Channel and Adjacent Channel Interference

Co-channel interference results when another RF link is using the same channel frequency. Adjacent-channel interference results when another RF link is using an adjacent channel frequency. In selecting a site, a spectrum analyzer can be used to determine whether any strong signals are present and, if present, determine how close they are to the desired frequency. The further removed from your proposed frequency, the less likely they are to cause a problem. An important part of planning your broadband fixed wireless system is the avoidance of interference. Interference can be caused by affects outside the system. Good RF planning can overcome most interference challenges.

Typical interference avoidance methodology includes:

- Change the carrier of usage – BeyondBridge provide multiple RF carriers, installer shall select the carrier with least interference if possible,
- Change the polarization of usage – installer shall the antenna orientation with the least interference between Vertical and Horizontal polarization

- Add antenna shield – If the interference source comes from other radiation device near by, BeyondSpot recommends using antenna shielding which provide additional 20~30 dB attenuation from co-located device.
- Change to more robust mode (reduce the burst rate)

2.2 Weather Specific Considerations

Installer should research any unusual weather conditions common to the site location. These conditions can include excessive amounts of rain, wind velocity, or extreme temperature ranges. If extreme conditions exist that may affect the integrity of the radio link, take these conditions into consideration early in the planning process. This session provides guideline for several key factors.

2.2.1 Rain

Except in extreme conditions, attenuation (weakening of the signal) due to rain does not require serious consideration for frequencies up to the range of 6 GHz. When microwave frequencies are at the 10-12 GHz range or higher, attenuation due to rain becomes much more of a concern, especially in areas where rainfall is of high density and long duration. The systems discussed in this manual operate at frequencies below 6 GHz, so rain is not a concern. Temperature can adversely affect the radio link when phenomena such as temperature inversion or very still air accompanied by stratification occur. Temperature inversion can negate clearances; still air, along with stratification, can cause severe refractive or reflective conditions, with unpredictable results.
Temperature inversions and stratification can also cause ducting, which may increase the potential for interference between systems that do not normally interfere with each other. Where these conditions exist, shorter paths and adequate clearances should be used.

2.2.2 Wind

Any system components mounted outdoors are subject to the effect of wind. You should know the direction and velocity of the wind common to the site. Antennas and their supporting structures must be able to prevent these forces from affecting the antenna or causing damage to the building or tower on which the components are mounted. Antenna designs react differently to wind forces. This is known as wind loading.

Note: For definitions of wind loading specifications for antennas and towers, refer to TIA/EIA-195 (for antennas) or TIA/EIA-222 (for towers) specifications.

Maximum operational wind speed during operation of BeyondBridge is 50 m/s (112mph). Survivable wind speed (tested to equivalent speed) is 90m/s (200mph). The wind loading effect of the radios on their respective mounting masts is provided in Table below. The units of force in pounds can be converted to metric units by multiplying by 4.45 to obtain newtons, or by 0.45 to obtain kilograms of force. Similarly, foot-pounds can be multiplied by 1.36 to obtain Newton-meters, or by 0.138 to obtain kgm-meters.

Wind Loading				
Model	Squire-Inch	100MPH	125MPH	100MPH & half-inch radial ice
19dB, 5GHz Flat Panel antenna	56	14 lbs	22 lbs	14 lbs
5GHz Outdoor Integrated Unit	64	16 lbs	25 lbs	16 lbs

2 GHz Outdoor Integrated Unit	110	27 lbs	43 lbs	27 lbs
24dB, 5GHz Flat Panel antenna	163	41 lbs	64 lbs	41 lbs

2.2.3 Lightning

You should always consider the potential for lightning damage to radio equipment when planning a wireless link. A variety of lightning protection and grounding devices are available for use on buildings, towers, antennas, cables, and equipment that could be damaged by a lightning strike, whether located inside or outside the site.
Lightning protection requirements are based upon the exposure at the site, the cost of link down time, and local building and electrical codes. If the link is critical and the site is in an active lightning area, attention to thorough lightning protection and grounding is critical.

2.2.4 Lightning Protection

To provide effective lightning protection, install antennas in locations that are unlikely to receive direct lightning strikes, or install lightning rods to protect antennas from direct strikes. Make sure that cables and equipment are properly grounded to provide low-impedance paths for lightning currents. Install surge suppressors on adjacent telephone lines and power lines.
Users should provide additional lightning protection for cables leading to the wireless radio as well as to and from the power supply in regions that have extreme lightning occurrences. This optional lightning protection should be placed at points close to where the cable passes through the bulkhead into the building, as well as near the radio.
For indoor applications, you can use the Erico LAN-RJ45 Local Area Network Protector (see Erico's web site, www.erico.com, for information); for outdoor applications, you can use lightning protectors from PolyPhaser (see the Polyphaser web site, www.polyphaser.com).

2.3 Electronic Components Specific Considerations

2.3.1 Category 5 Cable

When the entire power and Ethernet cable is encased in steel conduit from the building entrance to the radio, no surge arrestors are required. Otherwise, each power and Ethernet cable requires one surge arrestor within two feet of the building entrance.

2.4 Integrated Antennas

Antennas frequently play a key role in reducing the potential for interference. They come in a variety of configurations that have different performance characteristics in the areas of gain and directionality. Antennas that transmit/receive in all directions are known as **omni-directional**, while those that transmit/receive in one specific direction are categorized as **directional**. Antennas also vary in beamwidth, which is the aperture to which they can "see" signals. Larger antennas typically provide narrower beamwidth and can diminish interference from nearby transmitters by Focusing RF energy from the intended destination and reducing the power of interfering sources not directly aligned to the antenna

BeyondBridge use either integrated or external RF-cable connected directional antennas that transmit and receive a relatively narrow beamwidth of radio energy, improving system performance by reducing the likelihood that surrounding RF clutter will interfere with reception. Typical characteristics or external antenna are shown below: (Integrated unit is the same as PA58-19.

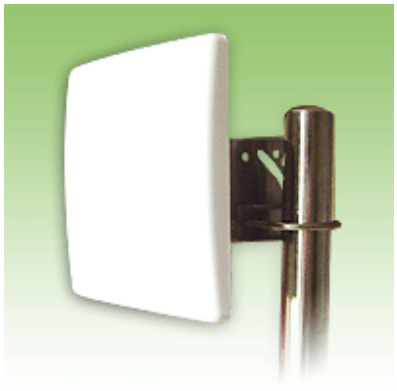
Antenna Characteristics

Parameter	Model	Min	Typical	Max	Units
Frequency Range		5150		5850	MHz
Gain	PA58-19		19		dBi
H- Beamwidth	PA58-19		16 / 8		Deg
V- Beamwidth	PA58-19		16 / 8		Deg
Front to Back	PA58-19	30 / 40			dB
Cross Polarization			25		dB
Input Return Loss			-14		dB
VSWR			1.5:1		
Impedance			50		OHM
Input Power				100	W
Operating Temp.	CPE/PA58	-30 / -40		+70	Deg C
Pole Size		1" (25)		2.5" (64)	In (mm)
Weight	PA58-19	17.6 (0.5)/60 (1.7)			Oz (kg)
Dimension	PA58-19	7.5" x 7.5" x 0.8" (190 x 190 x 20) / 15.5" x 10.6" x 0.8" (380 x 270 x 21)			In (mm)
Bracket Tilt			45		Deg

2.5 External Antennas

When BeyondBridge is planning to be install to provide higher reliability or longer range, it is often necessary to consider external antenna. BeyondSpot Technology suggests customers using the external antenna with appropriate gain, strength, reliability, and side lobe response.

(a) 2.4GHz Panel antenna.



(b) 5GHz Panel antenna.

Figure 3. Example External Antenna

2.5.1 Towers

When planning antenna placement, it might be necessary to build a free-standing tower for the antenna. Regulations and limitations define the height and location of these towers with respect to airports, runways, and airplane approach paths. These regulations are controlled by the FAA. In some circumstances, the tower installations must be approved by the FAA, registered with the FCC, or both.

To ensure compliance, review the current FCC regulations regarding antenna structures. These regulations (along with examples) are on the FCC web site at wireless.fcc.gov/antenna/.

2.6 BeyondBridge Radio Information

The following sections provide information about the BeyondBridge radio components. See "Pre-Installation Tasks" 如上. See "Specifications" for product technical specifications.

2.6.1 Unlicensed Frequencies-U-NII

The FCC has identified the frequencies from 5.725 to 5.825 GHz as Unlicensed National Information Infrastructure (U-NII). This band can be used by anyone without having to obtain a license. However, you must use radio equipment that is "type approved" by the FCC or local government for use within the specific band.

2.6.2 Channel/Frequency Plans

BeyondBridge offers extremely wide frequency band coverage to provide spectrum diversity or interference avoidance. Due to regulatory constraint, the current version limits the usage to high-UNII band and provide a total of 5 carriers in 5 GHz are provided to achieve frequency diversity. The available channel and center frequencies are presented in the table below

Frequency Channel	FR Frequency (MHz)
1	5745
2	5785
3	5825
4	5760
5	5800

If one part spectrum is occupied by either another BeyondBridge radio pair or by other wireless devices, the operator shall select the carrier with less interference. See "Frequency Plans" in the *BeyondBridge Reference Manual* for more information.

2.6.3 Bandwidth

The BeyondBridge offers multiple modulation/coding modes with a fixed carrier bandwidth of 15MHz (at -3dB) and 20MHz (-20dB).

2.6.4 Data Rate and Duplex

In either 2.4 or 5 GHz, BeyondBridge Wireless System applies **Time-Division-Duplex** (TDD) which allows both directions sharing the same 16MHz carrier. The percentage of Downlink and uplink periods are dynamically adjusted based on the traffic demand for both directions, thus, there is no clear segmentation in the duration at each direction but over-the-air RF conflict is avoided by novel TDD framing and TDMA-like accessing capability.

The available data rates that shall be set "manually" are 108, 96, 72, 54, 48, 36, 24, 18, 12, 9, and 6 Mbps. These modes need to be complied with the link situation addressed before.

3. Test The Link Before Installation

It is ~~always recommended to install the radios in a~~ short range outdoor environment to get familiar with the command and operation. Even it is designed to provide the highest user-friendliness, i.e. minimum maintenance is needed, BeyondBridge offers several advance

features requiring user setup to achieve its highest performance. If needed please refer BeyondBridge Reference Manual for further details.

3.1 Setup Procedure

Perform the steps in this section to install the system. Below is a short summary of the recommended steps for installing the system.

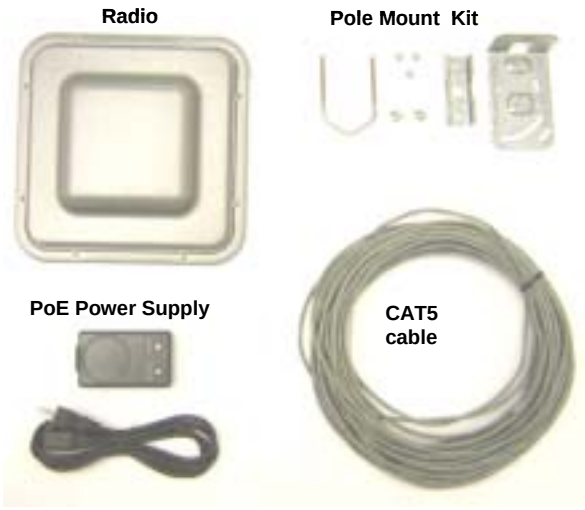
1. Unpack the system
2. Perform a pre-installation checkout, which includes:
    - Installing the BeyondBridge Configuration Software
    - Setting up the Master Unit hardware
    - Configuring the Master Unit
    - Installing the BeyondBridge Configuration Software
    - Setting up the Slave Unit hardware
    - Aiming the Slave Unit
    - Running system diagnostics to check the configuration and equipment
3. Configure the system for your network
4. Mount the units in long distance

3.2 Unpacking the System

3.2.1 Shipping Container and Components

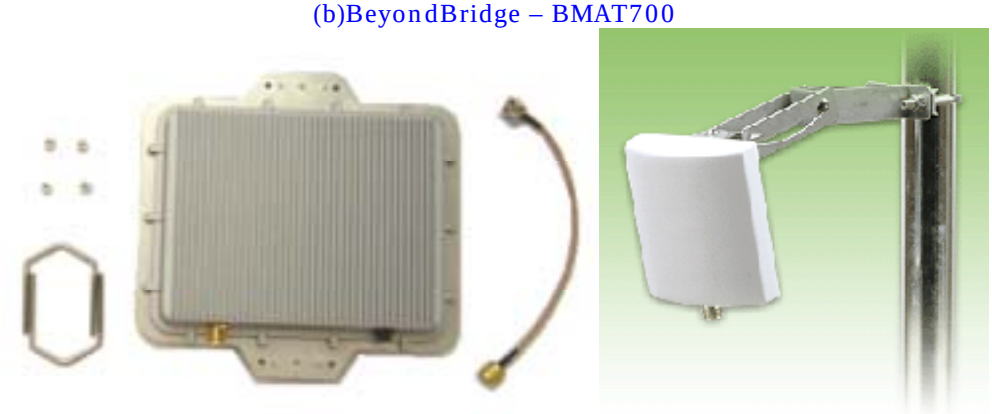
The product's shipping boxes should be left intact and sheltered until arrival at the installation site. If the shipping container shows signs of damage, immediately notify the transportation company. Upon receipt, inspect contents to make sure no parts are missing or damaged.
BeyondSpot recommends that you retain all the packaging materials (including all internal boxes). In the unlikely event that the equipment must be returned to the factory, use the original packing materials for return shipment. The packaging materials are also recommended for transporting the equipment from location to location. When unpacking the system, make sure that the following components are included. Figure below

- Two Power Supply units (one for each Beyondbridge Radio)
- Two Mounting Kits (bracket, bolts, washers, and so on)
- Power & Ethernet cables (Ethernet Cable may be excluded, depending on purchase order)
- Master and Slave units
- CD containing this manual and the configuration software



(a)BeyondBridge - BPAT700

(b)BeyondBridge – BMAT700



(c)BeyondBridge – BMBGT700

Figure 4. BeyondBridge Integrated (Top) and non-Integrated (Bottom) ODU Components

3.3 Pre-Installation Checkout

Prior to installation outdoors, you should operate the equipment in a test environment (short range) to become familiar with the operating configurations and performance. The following sections describe a procedure to setup a pre-installation testing environment for this purpose.

Review the following important warnings and considerations before turning on any BeyondBridge equipment indoors in your test environment:

- Place the antennas at least 50 feet apart, facing each other.
- Do not set up your laptop between the antennas or stand between the antennas.
- Try to minimize the movement of objects within the test environment to prevent changes in radio propagation patterns. Radio signals behave differently indoors than outdoors; using the devices indoors may have an unintended, negative effect on the performance of the BeyondBridge system.
- For best results, connect one computer each to the Master and the Slave Units.
- Install the Master Unit first before installing the Slave Unit.

3.4 Recommended System Requirements

Hardware	Pentium IV and above
Operating System	Microsoft Windows 2000, Windows XP, or above
Microsoft .Net Driver	.Net driver included or downloaded from Microsoft website
Memory	Windows® 2000 Professional, or Windows® XP Professional (256 MB RAM is recommended)
Hard Drive	At least 2 GB hard disk with up to 250 MB of available hard-disk space
ROM Drive	Double speed (2x) or faster CD-ROM/DVD-ROM
Network Interface Card	10/100/1000 Mbps NIC with RJ-45 input
Input Devices	Standard IBM-PC compatible 101-key style keyboard, PS2 or USB compatible mouse, or a compatible pointing device
Monitor	Super VGA 16-bit or higher monitor supporting 800 x 600 screen resolution Coordinated video driver for installed video card VGA not supported
Graphics Card	PCI, AGP, or on-board graphics card supporting 16-bit 640 x 480 video resolution or higher
Optional Hardware	16-bit sound card with speakers or headphones for audible alarm; 6 foot power strip with power surge protection
Optional Software	Microsoft Personal Web Server, Internet Information Server (IIS), or Apache 1.3.x can be served by VAR for over the Internet console installation

3.5 Master Unit Pre-Installation Checkout

Follow these steps to install the Base Station Unit in your test environment.

3.5.1 Installing the mpManager Configuration Software

The radio configurations are done using the mpManager operator console, which provides a user friendly graphical interface to facilitate the configuration process. The mpManger is a PC based program that runs on Windows NT, 2000 or XP. The installation procedure is summarized below:

5. Identify the computer on which you plan to run the **mpManager** Configuration Software. See “System Requirements” for operating system and hardware requirements.

6. Copying the entire folder contained in the **mpManager** CD to your local directory.

7. Install dot-net framework package by executing the **dotnetfx** install shield program contained in the directory where mpManager is installed

8. Install mpManager by clicking the mpConsole shortcut. The installation process will be fully automated in the next release

9. Launch the BeyondBridge Point-to-Point and Point-toMultipoint Radio operator console **(mpManager**) and verify the console is shown as the figure below. To do this, from the Windows **Start** menu, select **Programs → mpConsole** icon.

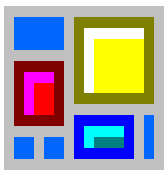


Figure 5. mpManager Icon

Figure 6. User Console (mpManager) Windows

3.5.2 Setting Up the Hardware

10. Unpack the following items from the shipping box. If your target cable length is 30m or less, CAT-5 cable is in installed and included. If not, replace the default cable and trim it to specific length per field situation. (Refer to replacing CAT-5 cable session).

11. Prepare an additional Cat 5 cross-over or straight-through cable and connect the radio to a computer or a switch respectively.

12. BeyondBridge s power supply is included, spare part can be ordered separately from BeyondSpot or typical off-the-shelf 48V PoE power supply).

13. Position the radios within your test environment and make sure the two radios are facing to each other.

    Note: Refer to the next chapter for detail mounting description.

14. Connect the supplied Cat 5 cable to the radio Power and Ethernet port as described in the following notes. Then screw on the outer ring to secure the cable in place and tighten it along the pole to release the stress from gravity.

15. Connect the radio (outdoor unit/ODU) to the PoE port of the Power Supply (indoor unit/IDU) as shown below. Should you select other Power over Ether (PoE) power supply, please refer to vender dependent for selecting the right port.

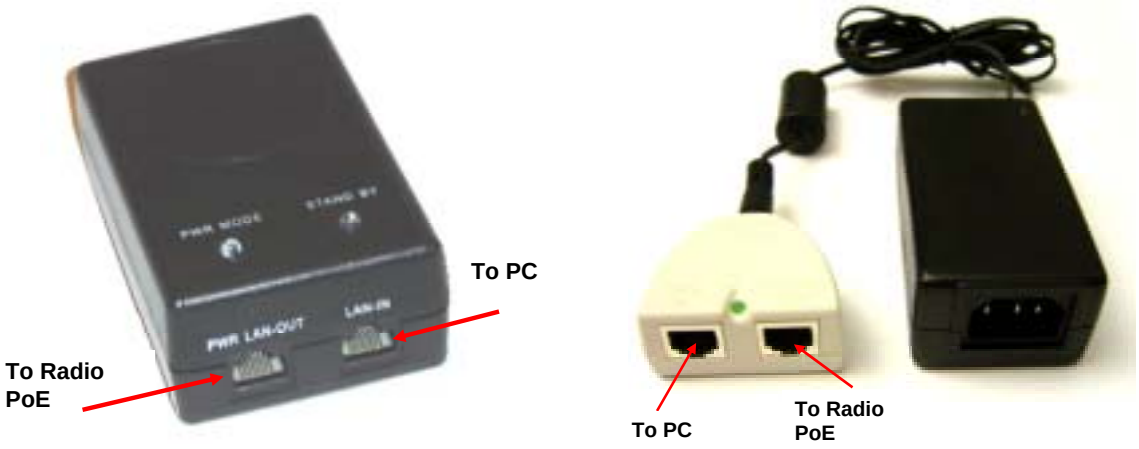


Figure 7. 802.3af Compatible PoE Power Supply Options

16. Connect one end of a Cat 5 cable to the power supply's RJ-45 port and the other end to a switch or directly to the computer on which you installed the mpConsole: See Figure below

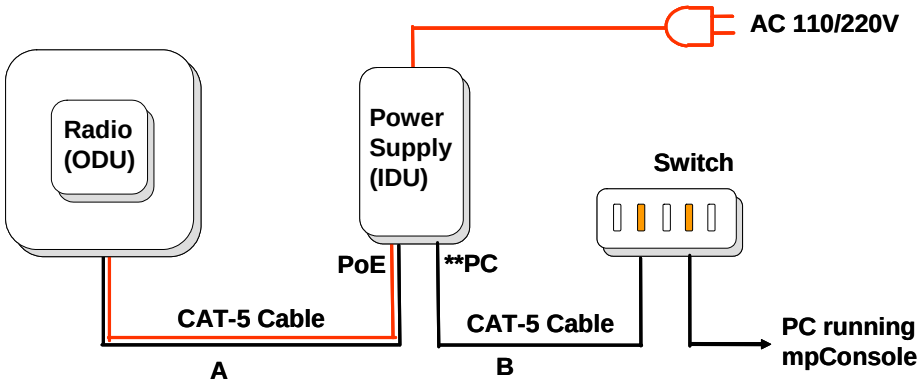


Figure 8. Power Supply (IDU) and Radio (ODU) Connection

17. Pay caution to the CAT5 cable type and length.

- Use a **cross-over** CAT 5 Ethernet cable to connect to a switch then to a PC.
- Use a **straight-through** CAT 5 cable to connect directly to a router or a single PC.
- For cable exposing to the sun, either PVC conduit is required or shielded cable shall be used
- BeyondBridge shall be complied with the 100BT length requirement. Cable Length A+B (together) shall be less than 100m from the Switch/PC Port to the Radio. The IDU is not a Data Termination Unit .

18. .Set all network devise to auto-negotiation in its Ethernet Port

Note: The Ethernet interface is designed to auto-negotiate. When attached to an interface that does not support auto-negotiation, the radio Ethernet interface correctly detects the link speed, but always defaults to half duplex.

For example, attaching a BeyondBridge radio to a device that is configured to a fixed 100 Mb/Full Duplex results in the Radio Ethernet interface being set at 100 Mb/Half Duplex. This can lead to excessive packet loss due to duplex mismatch.

19. Plug the power supply into an electrical outlet with 110/220V AC.

20. The operator shall observe the LED on the power supply turn to green

Note: the LEDs on the mother board of the radio are also good status indicator. They will turn to green post power up. However, the LEDs are not visible inside the radio enclosure. They may be helpful only during trouble-shooting.

3.5.3 Configuring the Master Unit

The following steps describe how to configure the BeyondBridge Master Unit in a lab environment for testing purposes.

21. To communicate with a master or slave Unit, the PC running mpManager must be connected to the radio via the Ethernet interface. Each radio comes with a default IP address of 192.168.0.200 which **cannot be changed**. As such, the operator must configure the IP address and subnet mask of the mpManager PC so that the IP addresses of the radio and the mpManager PC reside in the same subnet. The operator must also make sure that the mpManager is not connected to multiple radios at the same time.

22. Run the mpConsole (Point-to-Point or Point-to-Multipoint co-used. Configuration Software on the computer. Type in 192.168.0.200 and then click "**Connect to Radio**".

23. Verify the radio is connected by observing the "Welcome" message in the mpConsole as shown below.

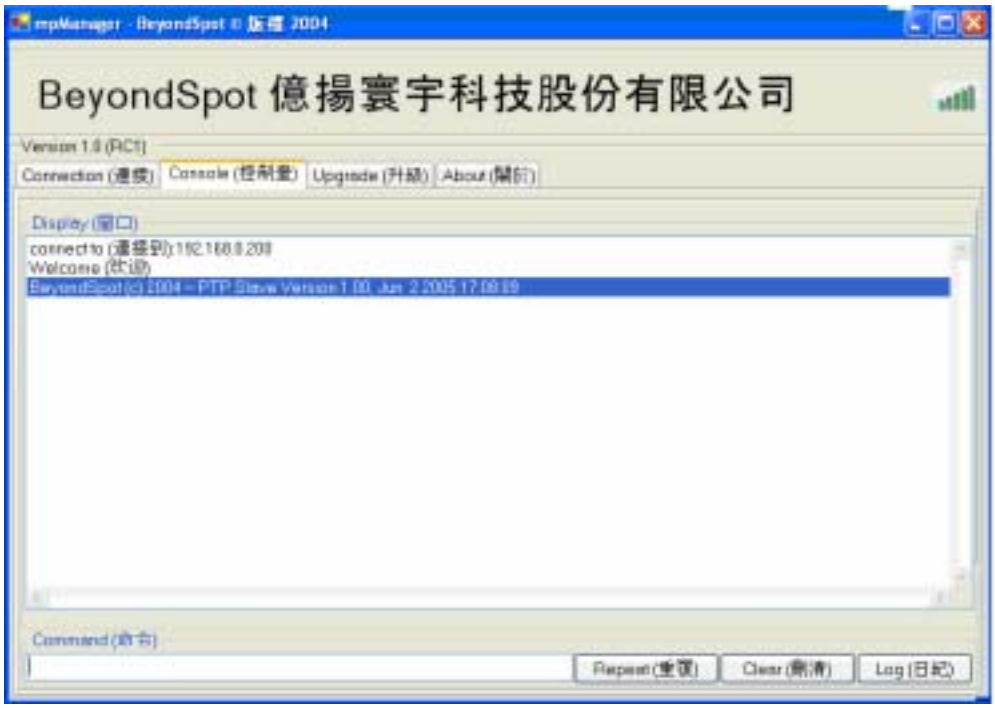


Figure 9. Welcome Message Indicates Successful Connection

24. Configure the radio to be a master unit by the following command [node 1]
    [**node 1**] for a master unit
    [**node 0**] for a slave unit

25. Configure the Modulation Mode and Frequency by the following commands
    [**Freq N**] to select frequency channel from 1, 2, 3, 4, 5, and 6 (refer to Chapter 2 site Planning)
    [**Rate X**] to select modulation mode X. Available X number is 6, 9, 12, 18, 24, 36, 48, 54, 72, 96, and 108

    Note: This two value must be identical for both Master and Slave Units.

3.6 Mounting the Slave Unit

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26. The procedure of mounting the Slave Unit is the same as mounting the Master Unit. Repeat all above steps (from Step 1)

27. Select a **separate** computer to connect the Slave unit and remember to et the radio to set the salve unit by command [**node 0**]

28. Set the Slave Unit to be the same mode as the Master Unit

3.6.1 Test Aiming the Slave Unit

29. Slowly adjust the position of the Slave until you have maximized the strength of the radio signal. shown below. The measured RSSI shall be compared against the recommended value which is used as an guideline to suggest the most appropriate mode (modulation and code rate) of operation. These modes are named by the burst data rate over the air and their relationship with RSSI are presented below as a guide line.

Data Rate [Mbps]	Recommended RSSI	Equivalent. RSL [dBm]	Minimum RSL [dBm]
108		–71dBm	–63dBm
96		–72dBm	–64dBm
72		–76dBm	–68dBm
54		–73dBm	–65dBm
48		–74dBm	–66dBm
36		–78dBm	–70dBm
24		–82dBm	–74dBm
18		–85dBm	–77dBm
12		–87dBm	–79dBm
9		–89dBm	–81dBm

6		–90dBm	–82dBm

3.6.2 Displaying Link Status

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30. Use **[stat]** command to display the current state of the node as well as other useful information such as node type, version number, frequency, traffic statistics and received signal strength indication (rrsi) at both the local and remote units. The received signal strength indicator as well as the signal bar display will be extremely helpful during physical link set up. It allows the operator to adjust the antenna until maximum received signal level is achieved

    Node Type
    If the radio is Master Unit, node type is 1, otherwise, it is a Slave Unit and node type is 0.

    Version Number
    The version of the firmware. It is used to compared with the webpage for the latest firmware. Both Master and Slave Units shall be identical

    Frequency
    The center frequency of the carrier. Both Master and Slave Units shall be identical.

    Traffic Statistics
    Indicates the number of the received packets and the missing packets.

    Received Signal Strength Indicator (RSSI)
    Indicates the RF signal strength established between the Master Unit and the Slave Unit.

    Note: Modulation Mode is not shown however it can be checked by typing [**rate**] command. Both Master and Slave Units shall be identical

3.6.3 Extend the Range

31. If the range is beyond the recommended distance by default mode or the RF signal is degrated by the terrain and foliage blockage, BeyondSpot recommends the following candidate solutions to achieve a reliable wireless connectivity. From top (the simplest) to bottom (the most complicated), they are:
    - Change modulation modes as specified in the above table
    - Change RF connection to external antenna (refer to later chapter) with increased gain compensated for the additional cable loss and impedance matching loss
    - Add an external Power Amplifier between the external antenna and the radio.
      Note: Many region has local regulation on maximum transmitting power or EIRP, please pay attention to the regulatory compliance constraints.

3.6.4 Confirm Network Activity

32. For the purposes of this test, these computers must be members of the same IP subnet as the Master and the Slave Unit.

- Attempt to ping from a computer connected to a Slave Unit to a computer connected to the Master Unit. If successful, attempt to ping in the other direction, using the same computers
- You can ping the Master Unit from a Computer connected to the it. Similarly, you can ping the Slave Unit from a Computer connected to it.
- You cannot ping a Master Unit or a Slave Unit from across the wireless link as they are using the same IP address (in current firmware version)
- A ping test is successful if fewer than one request-timed-out message is received within a 1-minute period when ARQ feature is turn off. A ping test is successful if fewer than one request-timed-out message is received within a 100-minute period when ARQ feature is turn on.

33. If the ping tests are unsuccessful, attempt the following:

- Perform the other diagnostic tests described in this section to evaluate the strength of the radio link.
- Adjust the network's IP settings, if necessary, to achieve local Ping connectivity first.

3.6.5 Setup Advance Feature for VoIP Application

BeyondBridge provides many advanced features on top of basic wireless-connectivity. After the setting up the radio, the operator can proceed to check out these features from the reference manual and seek their usage for the applications/services underline. Here we provide two most popular commands to conclude this chapter.

34. **tos** [**lowRange**] [**highRange**]

This command is only valid at the master unit. The value of the range can be from 0 to 255. If only the low range value is entered then the high range value will be set to be the same value as the low range. The tos feature is disabled if both high and low range values are set to 0.

Example:
tos 1 20 - set tos range to be from 1 to 20
tos 1 - set a single tos value of 1
tos 0 - disable tos feature

4. Install the Units to Final Locations

After you finish configuring and testing the Master Unit and Slave Unit in a lab or short range outdoor environment, you are ready to mount them in long distance. This chapter provides the details for outdoor mounting which was not included in the last session.

4.1 Mounting the Radio

35. You can mount the outdoor component of your BeyondBridge radio directly to a pole with an outside diameter of 1-½ to 4-½ inches. Preferable height allows the radio to have as much clear line-of-sight as possible (refer to definition of LOS in Chapter 2 Site Planning)

36. Mount the BeyondBridge Radio to a pole using the mounting components.

Title	Quantity
BeyondBridge Manual CD Assembly Cable, Cat 5, 30 M Mounting hardware (see the following table)	1 each 1 each 1 set

Figure 10. BeyondBridge Mounting Hardware (Integrated ODU)

37. Attach the L-shape Mounting Bracket to the backplate. Using the three stainless steel nuts to tighten it.

38. Connect the U-Shape Clamp through the pole, then the Pole Mounting Bracket to the assembled Radio with L-Shape Mounting Bracket.

39. Before mounting the radio to the pole, find out the antenna polarization direction and make sure the antenna polarization are identical between the Master and the Slave Units.
40. Slightly tighten the radio with the pole by two larger nuts.
41. Compare the mounted radio with the front and back figures shown below.

Figure 11. Front View: Integrated ODU (Left) and Non-Integrated ODU (Right)

Figure 12. Rear View: Integrated ODU (Left) and Non-Integrated ODU (Right)

42. Repeat the steps to achieve the highest RSSI by aiming the Slave Unit as before.

43. Adjust the azimuth and elevation angles by the U-shape clamp and the curved slot respectively as shown. Then tighten all the nuts to prevent movement.

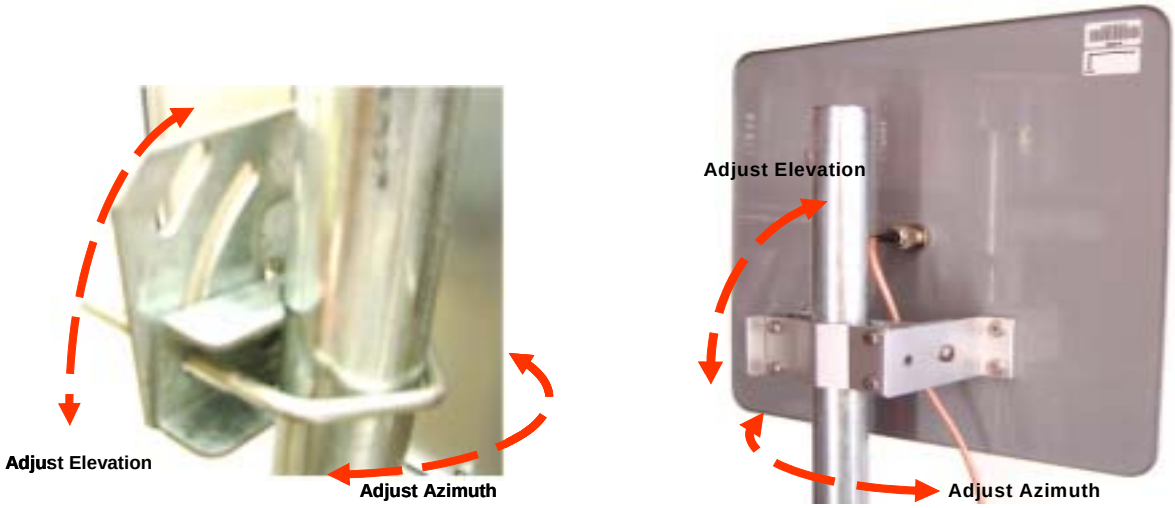

Figure 13. Adjust Pointing Angles: Integrated ODU (Left) & Non-Integrated ODU (Right)

44. Connect the supplied Cat 5 cable to the Radio as shown below. Then screw clockwise on the outer ring to secure the cable in place.

Figure 14. Tighten the Cable through Water Prof Connector: : Integrated ODU (Left) and Non-Integrated ODU (Right)

45. Double check all the connectors, nuts, and tighten the CAT 5 cable to the pole by tight-rape, to avoid stress or movement of the cable.

46. Repeat the same steps for indoor unit connection and repeat the testing procedures.

47. Refer to FCC Caution (Chapter 7.2) and Maximum RF Transmission Table (Appendix) for proper operation.

5. Upgrading BeyondBridge Firmware

BeyondSpot Technology Inc., like all other wireless device makers, is consistently improving its feature offered by BeyondBridge. Most of these features can be upgraded without cost by downloading the latest firmware from BeyondSpot Technology website www.beyondspot.com and then downloading such firmware to the radio.

Each BeyondBridge radio comes with a boot code that resides permanently in the radio's primary flash memory. In addition, newer version of code can be downloaded to the radio's secondary flash memory. When the radio is powered up the boot code will be executed. The boot code will check if a newer version of code resides in the secondary flash memory. If yes the boot code will transfer control to the secondary code and starts execution from there. A newer version of code can be downloaded to the secondary flash memory from the mpManager console. The process is described below

48. Download the software from BeyondSpot WebSite through the following steps.

- Connecting to www.beyondspot.com and then click "Literature" to available on-line information library.
- Click the product line of "BeyondBridge" to all the information available relating to BeyondBridge
- Click "Latest software" to explore if any updates are available for your device.
  Note: some update may be frequency specific, thus, check with your hardware setting before proceeding the downloading process.
- Store the updated code to a local directory in the PC running mpManager

49. Launch MpManger and make sure it is communicating with the radio.
50. Open the Upgrade window by clicking the upgrade button in the toolbar.

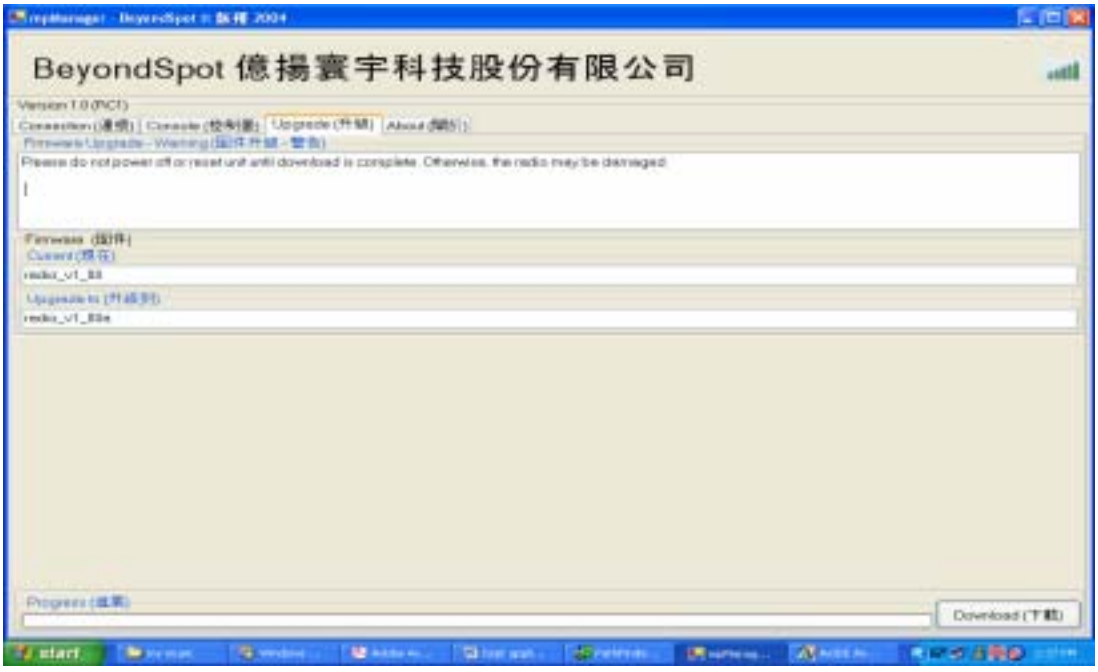

Figure 15 Upgrade Window

51. Click the Download button at the right bottom corner of the window. When prompted (Fig.4), enter the name of the file to be downloaded and hit return. The download process will start and the download button will change to abort button. Click the abort button if you want to cancel the download process.

Figure 16 Download Prompt

52. Go to the Console window by clicking the Console button in the toolbar. The Console window will display the progress of the download. You can restart the radio when the console message indicates the download has completed

6. Technical Assistance

If you are having a problem using a BeyondBridge Point-to-Point Radio or BeyondAcess Point-to-Multipoint Radios and cannot resolve it with the information in "Chapter 6. Troubleshooting", gather the following information and contact BeyondSpot Technical Support:

- What services are you providing?
- What kind of network are you using?
- What was the last command typed when the error occurred?
- What error message did you see?
- Can you reproduce the problem?

You can reach BeyondSpot Technical Support by e-mail:

E-mail: **support@BeyondSpot.com**

In addition, BeyondSpot offers technical information through its webpage www.beyondspot.com. These classes are taught by experienced BeyondSpot Systems Engineers and have a technical focus. For class and registration information, visit this Web site at http://www.BeyondSpot.com.
Be sure to obtain an RMA number before sending any equipment to BeyondSpot for repair.

7. Copyright and Service Marks

The information contained in this manual is subject to change without notice. BeyondSpot Technology Inc. shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this manual or equipment supplied with this manual. BeyondSpot Technology Inc. makes no warranty of any kind with regard to this manual or any equipment supplied with this manual, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

7.1 Regulatory Notice

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna. Increase the separation between the equipment and receiver. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. Consult the dealer or an experienced radio/TV technician for help.
Shielded cables and I/O cords must be used for this equipment to comply with the relevant FCC regulations. Changes or modifications not expressly approved in writing by BeyondSpot Technology Inc. may void the user's authority to operate this equipment.

7.2 FCC Caution:

1. This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.
2. FCC RF Radiation Exposure Statement: The equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.
3. This device and its antenna(s) must not be operating in conjunction with any other antenna or transmitter.
4. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user authority to operate the equipment.
5. 1) The antenna must be installed such that 20cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.

8. Warranty

General Terms

All Definitions contained in BeyondSpot Corporation's Conditions of Sale, apply to the Warranty Subject to the provisions of the Warranty, BeyondSpot Inc. warrants that the equipment described in Paragraph 1.3 shall conform to their specifications described in Paragraph 1.4 in all material respects and that the equipment shall be free from material defects in materials and workmanship. This Warranty applies to all original purchases of BeyondSpot Inc. manufactured equipment and accessories (collectively the "Equipment"). This Warranty applies to the specifications contained in the most recent version of the manual for the model of the Equipment purchased (the "Specifications"). This Warranty does not apply to the following items of Equipment which are covered by the Original Equipment Manufacturer's warranty: antenna systems including coax cable, waveguide, connectors flex-sections, mounts, other parts of the antenna system and installation material; non-BeyondSpot Inc. manufactured rack mounted equipment that is assembled, wired, and tested at BeyondSpot Inc. factory or supplied as part of a system, including order wire items, channel banks, multiplexers, fuse/alarm panels, remote alarm items; and equipment which is not listed in BeyondSpot Inc. price book. The effective period of this Warranty shall start on the date of shipment of the Equipment and shall end: for all spread spectrum unlicensed radio products and for all licensed digital microwave radio products, two (2) years later;
for all analog microwave radio products, three (3) years later; or
for all baseband products, five (5) years later (in each case the "Warranty Period"). The Customer acknowledges that BeyondSpot Inc. does not represent or warrant that the services provided by BeyondSpot Inc. under this Warranty will ensure uninterrupted or error-free operation of the Equipment.

Return of Equipment Under Warranty

If an item of Equipment malfunctions or fails in normal intended usage and maintenance within the applicable Warranty Period the Customer shall promptly notify BeyondSpot Inc. of the problem and the serial number of the defective item; BeyondSpot Inc. shall, at its sole option, either resolve the problem over the telephone or provide the Customer with a Returned Materials Authorization number (RMA #) and the address of the location to which the Customer may ship the defective item. If the problem is not resolved over the telephone, the Customer shall attach a label to each Returned item describing the fault and the Customer's Return address. The Customer shall, at its cost, properly pack the item to be Returned, prepay the insurance and shipping charges, and ship the item to the specified location. If the BeyondSpot Inc. product shall prove to be defective in material or workmanship upon examination by BeyondSpot Corporation, BeyondSpot Inc. shall either repair or replace the Returned item at its sole option. The replacement item may be new or refurbished; if refurbished, it shall be equivalent in operation to new Equipment. If a Returned item is replaced by BeyondSpot Corporation, the Customer agrees that the Returned item shall become the property of BeyondSpot Corporation.
BeyondSpot Inc. shall at its cost, ship the repaired item or replacement to any destination within the United States of America by carrier and method of delivery chosen by BeyondSpot Corporation. If the Customer has requested some other form of conveyance, such as express shipping, or is located beyond the USA borders, then the Customer shall pay to the cost of return shipment. Equipment that is repaired or replaced by BeyondSpot Inc. under this Warranty shall be covered under all of the provisions of this Warranty for the remainder of the applicable Warranty Period or ninety (90) days from the date of shipment of the repaired item or replacement, whichever period is longer.

Default and Termination

BeyondSpot Inc. may immediately terminate this Warranty and all of its performance under this Warranty, upon notification to the Customer, if the Customer makes any unauthorized modifications to the Equipment; assigns or transfers the Customer's rights or obligations under this Warranty without the written consent of BeyondSpot Corporation; becomes bankrupt or insolvent, or is put into receivership; or has not paid BeyondSpot Inc. all amounts for the Equipment, services, or other additional charges within thirty (30) days of receipt of written notice from BeyondSpot Corporation. If this Warranty is terminated by BeyondSpot Corporation, the Customer shall remain liable for all amounts due to BeyondSpot Corporation.

Limitations and Qualifications of Warranty

This Warranty does not apply to any damage, defect or failure caused by: any part of the Equipment having been modified, adapted, repaired, or improperly installed, operated, maintained, transported or relocated by any person other than BeyondSpot Inc. personnel or a BeyondSpot Inc. authorized service agent, without BeyondSpot Corporation's prior written consent; storage or environmental conditions which do not conform to the applicable sections of the appropriate BeyondSpot Inc. Equipment Manual; failure to conform with the Equipment Installation, Operating and Maintenance Instructions of the appropriate BeyondSpot Inc. Equipment Manual; external causes, including external electrical stress or lightning, or use in conjunction with incompatible equipment, unless such use was with BeyondSpot Corporation's prior written consent; cosmetic damage; accidental damage, negligence, neglect, mishandling, abuse or misuse, other than by BeyondSpot Inc. personnel or a BeyondSpot Inc. authorized service agent.

Limitations on Damages (North America)

The warranty stated in this document is the customer's exclusive warranty for the equipment; BeyondSpot Inc. specifically disclaims all other warranties of any kind, express or implied, including any warranties of fitness for a particular purpose and of merchantability.

BeyondSpot Inc. shall not be liable in tort, including liability in negligence or strict liability, and shall have no liability at all for injury to persons or property. BeyondSpot corporation's liability for failure to fulfill its obligations under this warranty or any other liability under or in connection with the equipment shall be limited to the amount of the purchase price of the equipment. The remedies stated in this warranty are the customer's exclusive remedies against BeyondSpot Inc. regarding the equipment. Even if BeyondSpot Inc. has been advised of the possibility of them, BeyondSpot Inc. shall not be liable for any indirect, incidental, special or consequential damages, including the cost of labor by the customer's own employees, agents or contractors in identifying, removing or replacing the defective item; lost profits, and revenues; failure to realize expected savings; any claim against a customer by a third party; or any other commercial or economic losses of any kind. These limitations and disclaimers are not made by BeyondSpot Inc. where prohibited by law.

Limitations On Damages (International)

The warranty stated in this document is the customer's exclusive warranty for the equipment; all other warranties of any kind, express or implied, including any warranties of fitness for a particular purpose and of merchantability are excluded to the fullest extent permitted by law.

BeyondSpot corporation's liability for failure to fulfill its obligations under this warranty or in tort or as a result of strict liability or any other liability under or in connection with the equipment or its supply shall be limited, except in respect of death and personal injury caused by BeyondSpot corporation's negligence, to the amount of the purchase price of the equipment. The remedies stated in this warranty are the customer's exclusive remedies against BeyondSpot Inc. regarding the equipment. Even if BeyondSpot Inc. has been advised of the possibility of them, BeyondSpot Inc. shall not be liable for any indirect, incidental, special or consequential damages, including the cost of labor by the customer's own employees, agents or contractors in identifying, removing or replacing the defective item; lost profits, and revenues; failure to realize expected savings; any claim against a customer by a third party; or any other commercial or economic losses of any kind.

Conditions of Sale Definitions

In these Conditions, unless there is something in the subject matter or context necessarily inconsistent:

“BeyondSpot Corporation" means BeyondSpot Inc.(d.b.a. BeyondSpot Corporation), Los Angeles, CA; "Equipment" means the equipment itemized on the Quotation/Order Acknowledgment; “International" means any location other than United States of America and Canada, including their territories and possessions; "North America" means any location in the United States of America and Canada, including their territories and possessions; "Order Acknowledgment" means the sales order acknowledgment provided by BeyondSpot Inc. to the Customer;

"Payment Instructions" means BeyondSpot Corporation's payment instructions, (BeyondSpot Inc. document P197-1); “Quotation" means the quotation signed by an authorized representative of BeyondSpot Inc. and provided to the Customer; "Shipping Date" means the actual date on which the Equipment left BeyondSpot Corporation's factory at Los Angeles, CA, U.S.A.; "Warranty" means BeyondSpot Corporation's warranty, document W97-1; "Invoice" means the bill of goods prepared by BeyondSpot Inc .for the equipment with the shipping and any insurance costs. Headings have been inserted in these Conditions for convenience of reference only and will not effect their construction.

Entire Agreement

The Quotation, these Conditions of Sale, the Order Acknowledgment, the Payment Instructions and the Warranty shall apply to all sales made by BeyondSpot Inc. and shall constitute the entire agreement by BeyondSpot Inc. and the Customer (the "Agreement ").

Any terms and/or conditions of sale, which may be included on the Customer's purchase order form or any communication from the Customer, that are not identical with the terms and conditions steed in this document shall NOT become a part of the agreement of sale unless expressly agreed to in writing in the Quotation. BeyondSpot Corporation's failure to object to any terms and/or conditions of sale contained in any communication from the Customer shall not be considered as acceptance of such terms and/or conditions or as a waiver of the terms and conditions of sale contained herein.

BeyondSpot Inc. shall sell to the Customer, and the Customer shall purchase from BeyondSpot Corporation, the Equipment in accordance with the Agreement. BeyondSpot Inc. accepts the Customer's purchase orders for Equipment and agrees to deliver the Equipment to the Customer only on the terms of the Agreement. No variation of the Agreement shall be binding unless agreed to in writing by authorized representatives of BeyondSpot Inc. and the Customer.

Pricing

All prices in the Quotation are exclusive of all shipping charges and all applicable taxes including but not limited to, federal, state, local, excise, sales and use taxes. All prices in the Quotation unless otherwise stated: for North American customers are FOB Los Angeles, CA, USA. or for international customers are Ex-Works, Los Angeles, CA, U.S.A. All prices in the Quotation include standard domestic packing, unless a separate line item is provided detailing export or special packing charges.

Shipping and Insurance

BeyondSpot Inc. shall arrange shipping and insurance when requested by the Customer, and shall bill the Customer for the Equipment with the shipping and any insurance costs as separate items, on an invoice (the "Invoice"). Delivery dates quoted by BeyondSpot Inc. are to be considered estimates only. In no event will BeyondSpot Inc. be liable for any loss or damage resulting from its failure to deliver products within a specified time.

Terms of Payment
The Customer shall pay for all Equipment, including shipping and insurance in accordance with the terms of the Invoice. All Invoices for North American Customers are due and payable in thirty (30) days from the date of the Invoice. International Customers shall make payments in accordance with BeyondSpot Corporation's Payment Instructions by either: providing a wire transfer (telegraphic transfer) for the full amount of the Equipment, shipping and insurance charges contained in the Quotation or the pro-forma Invoice sent to the Customer, prior to the Shipping Date; or establishing an acceptable Letter of Credit (LC) for the full amount of the Equipment, shipping and insurance charges contained in the Quotation prior to the order being booked and accepted by BeyondSpot Corporation. If a Customer fails to pay an Invoice when due, BeyondSpot Inc. may, without prejudice to am other remedy, postpone shipments, alter payment terms, terminate the Agreement and charge interest on all overdue amounts the rate of 1.5% per month compounded monthly (or if less, the maximum allowed by law). Upon demand, the Customer shall pay all such interest charges and all reasonable collection fees, including reasonable legal expenses.

Security for Payment
If the Customer is located in North America, the Customer grants to BeyondSpot Inc. a purchase money security interest in the Equipment to secure the payment of the purchase price of the Equipment and all other amounts due from the Customer. If the Customer is not located in North America: despite delivery and passing of risk in the Equipment and any other provision of these Conditions, the title in the Equipment shall not pass to the Customer until BeyondSpot Inc. has received payment in full of the purchase price of the Equipment and all other amounts then due from the Customer, and until the title in the Equipment passes to the Customer: the Customer shall hold the equipment as BeyondSpot Inc.'s fiduciary agent and bailee, and shall properly store, protect and insure the Equipment and shall identify the Equipment as BeyondSpot Inc. property; if the Customer fails to pay BeyondSpot Inc. in accordance with the agreed payment terms, BeyondSpot Inc. may require the Customer to deliver up the Equipment to BeyondSpot Corporation, and, if the Customer does not, BeyondSpot Inc. may enter on the premises where the Equipment is stored and repossess the Equipment; and the Customer shall not pledge the Equipment by way of security for any, indebtedness of the Customer, but if the Customer does so all moneys owed by the Customer to BeyondSpot Inc. shall, without prejudice to any other remedy of BeyondSpot Corporation, immediately become due.

Changes to Product Specifications
BeyondSpot Inc. may, without notice to the Customer, make changes to the specifications of Equipment which do not materially affect the quality or performance of the Equipment.

Equipment Configuration and Expediting Charges
At the Customer's request, BeyondSpot Inc. may, for a fee agreed in advance: reconfigure the Equipment; or expedite the Customer's order.

Shortages
The customer shall not make any claim for shortages (which are items that the Invoice does not show are on back-order) after twenty-one (21) days after the date of the Invoice.

Returns and Exchanges
The return of defective Equipment is covered by the Warranty.
The Customer may only return Equipment that is not defective if: the Equipment does not correspond with the Customer's purchase order; or the Equipment has been ordered in error by the Customer and BeyondSpot Inc. has permitted the Customer to remedy the mistake by ordering the correct equipment and resuming the Equipment and the Customer obtains a Returned Materials Authorization number ("RMA #") from BeyondSpot Inc. prior to returning any Equipment.
BeyondSpot Inc. reserves the right to charge a fee for returned equipment under Subparagraph 10.2(b) with the amount of the fee being determined prior to an RMA # being given by BeyondSpot Corporation. Authorized returns of equipment under Paragraph 10.2 must be in an undamaged condition, in the original configuration, in the original packing materials and within a time period agreed to when the RMA # was issued. If the Customer does not comply with the provisions of Paragraphs 10.2, 10.3, and 10.4, the Customer shall pay the full amount of the Invoice. The party liable for all shipping, insurance and any other expenses incurred by the Customer in returning the Equipment under Paragraph 10.2 and for all loss or damage to the Equipment until received by BeyondSpot Corporation, shall be: (a) for all items returned under Subparagraph 10.2(a), BeyondSpot Inc .and (b) for all items resumed under Subparagraph 10.2(b), the Customer.

Cancellation
If the Customer cancels an order before the Shipping Date, BeyondSpot Inc. reserves the right to charge the Customer a cancellation charge up to 100% of the amount of the order.
The Customer shall pay all cancellation charges within thirty (30) days from date of the Invoice.

Force Majeure
BeyondSpot Inc. shall not be liable if its performance of the Agreement becomes commercially impractical due to any contingency beyond BeyondSpot Corporation's reasonable control, including acts of God, fires, floods, wars, sabotage, civil unrest, accidents, labor disputes or shortages, government laws, rules and regulations, whether valid or invalid, inability to obtain material, equipment or transportation, incorrect, delayed or incomplete specifications, drawings or

data supplied by the Customer or others (collectively "Force Majeure"). In no event of Force Majeure shall BeyondSpot Inc. be required to purchase goods from others to enable it to deliver the Equipment under the Agreement.

Engineering and System Design
The Customer is solely responsible for the engineering, design, integration and normal preventative and remedial maintenance of the Customer's system for which BeyondSpot Inc. supplies Equipment.
BeyondSpot Inc. is not responsible for the satisfactory operation of the Equipment in conjunction with other manufacturer's equipment, nor for any losses which may occur as a result of a failure of the Equipment to operate in conjunction with other manufacturer's equipment.

Warranty
All Equipment is covered by the Warranty. The Warrant contains limitations on the customer's rights and remedies against BeyondSpot Inc. under the agreement. The Customer acknowledges having read, understood, and agree to those limitations.

Damages for Breach of Agreement
If either party is successful in any litigation between the parties based on the Agreement, the successful party shall recover from the other, in addition to direct damages, the successful party's reasonable attorney's fees and other costs of litigation.

Insolvency of Customer, etc.
BeyondSpot Inc. may cancel the agreement and suspend any further deliveries under the Agreement without any liability to the Customer, and, if Equipment has been delivered but not paid for, the price shall become immediately due and payable despite any other agreement to the contrary if:

any proceedings in bankruptcy, insolvency, receivership or liquidation are taken against the Customer;
the Customer makes an assignment for the benefit of creditors or commits an act of bankruptcy or insolvency;

the Customer ceases, or threatens to cease, to carry on the ordinary course of its business, or transfers all or substantially all of its property;
the Equipment is seized under any legal process or confiscated; or
BeyondSpot Inc. in good faith believes that the ability of the Customer to pay or perform any provision of the Agreement is impaired, or that any of the events mentioned above is about to occur.

Notice
All requests, instructions and notices from one party to the other must be in writing and may be given via registered post or facsimile transmission to the address of the parties shown on the Quotation or Order Acknowledgment.

Export Provisions
The Customer shall not, whether directly or indirectly (including facilitating a third party) export or re-export the Equipment outside the country in which the Customer has stated these items are to be used without obtaining the licenses required under ail applicable rules. The Customer shall indemnify BeyondSpot Inc. against any liability incurred by BeyondSpot Inc. due to any violation by the Customer of any of the provisions of this Section, but this indemnity shall not apply if the Customer reasonably relies on information supplied to it by BeyondSpot Inc. with respect to export licenses. Upon receipt of a governmental consent to export the receiving party shall immediately notify the other in writing.

No waiver by BeyondSpot Inc. of any breach of this Agreement shall be considered as a waiver of any subsequent breach of the same or any other provision.
Any provision of the Agreement which is, or is deemed to be, unenforceable in any jurisdiction shall be severable from the Agreement in that jurisdiction without in any way invalidating the remaining portions of the Agreement, and that unenforceability shall not make that provision unenforceable in any other jurisdiction.
The rights which accrue to BeyondSpot Inc. by virtue of the Agreement shall inure for the benefit of and be binding upon the successors and assigns of BeyondSpot Corporation.
The agreement shall be governed by the laws of the State of California including the California Uniform Commercial Code. However BeyondSpot Inc. may enforce the provisions of the Agreement in accordance with the laws of the jurisdiction in which the Equipment is situated. The United Nations Convention on the Sale of Goods (The Vienna Convention) shall not apply to the Agreement.

9. Specification

9.1 BPAT700

9.1.1 Antenna

Frequency	5745~5825MHz
Gain	19dBi
VSWR	Less than 1.5:1 N Female connector
Impedance	50 Ohm N Female connector
Polarization	Vertical
Horizontal Bandwidth (3dB)	16 deg
Vertical Bandwidth (3dB)	16 deg
Front to Back Ratio	30dB
Dimensions	267m x267mm x 67mm (W x D x H)
Weight	0.8Kg
Rated Wind Velocity	43.4lb (125MPH)
Operation Tempture	-40~70 degree C

9.1.2 System

Standard support	IEEE802.3&IEEE802.3u
Outside Interface	One 10/100 RJ-45 port
Data Rate	6, 9, 12, 18, 24, 36, 48, 54, 72, 96, 108Mbps
Modulation	OFDM
Media Access Technology	TDMA
Environmental Specification	Operating temperature: 0 - 60 degree C Storage temperature: -40 - 80 degree C Relative humidity: 10% - 90% (non-condensing)
Power Requirement	48V DC, 400mA (proprietary PoE)
Electromagnetic Compatibility	FCC, DGT

9.1.3 Peak Power

Channel	Channel Frequency (MHz)	Peak Power Output Reading (dBm)	Cable loss (dBm)	Peak Power Output (dBm)	Peak Power Limit (dBm)
Low	Base - 5745	14.02	0.5	**14.52**	30
Middle	Base - 5785	14.02	0.5	**14.52**	30
High	Base - 5825	14.00	0.5	**14.50**	30
Middle	Turbo - 5760	13.09	0.5	**13.59**	30
	Turbo - 5800	13.41	0.5	**13.91**	30

Note :	1.At finial test to get the worst-case emission at 6Mbps.(For Base mode)
	2.At finial test to get the worst-case emission at 12Mbps. (For Turbo mode)
	3.The result basic equation calculation as follow :
	Peak Power Output = Peak Power Reading + Cable loss

9.1.4 Average Power

Channel	Channel Frequency (MHz)	Average Power Output Reading (dBm)	Cable loss (dBm)	Average Power Output (dBm)
Low	Base - 5745	8.03	0.5	**8.53**
Middle	Base - 5785	8.48	0.5	**8.98**
High	Base - 5825	8.15	0.5	**8.65**
Low	Turbo - 5760	7.17	0.5	**7.67**
High	Turbo - 5800	7.82	0.5	**8.32**

Note :	1.At finial test to get the worst-case emission at 6Mbps.(For Base mode)
	2.At finial test to get the worst-case emission at 12Mbps. (For Turbo mode)
	3.The result basic equation calculation as follow :
	Peak Power Output = Peak Power Reading + Cable loss

9.2 BMAT700

9.2.1 Antenna

Frequency	5725~5850MHz
Gain	19dBi
VSWR	Less than 1.5:1 N Female connector
Impedance	50 Ohm N Female connector
Polarization	Vertical
Horizontal Bandwidth (3dB)	16 deg
Vertical Bandwidth (3dB)	16 deg
Front to Back Ratio	>=25dB
IMD	<=107dB
Dimensions	263m x193mm x 42mm (W x D x H)
Weight	1Kg
Rated Wind Velocity	210Km/h
Diameter of Installation Pole	35~75mm

9.2.2 System

Standard support	IEEE802.3&IEEE802.3u
Outside Interface	One 10/100 RJ-45 port
Internal Cable	N Male to R-N Male
Data Rate	6, 9, 12, 18, 24, 36, 48, 54, 72, 96, 108Mbps
Modulation	OFDM
Media Access Technology	TDMA
Dimensions	320m x 310mm x 48mm (W x D x H)
Weight	3.05kg
Environmental Specification	Operating temperature: -20 - 70 degree C Storage temperature: -40 - 80 degree C Relative humidity: 10% - 90% (non-condensing)
Power Requirement	48V DC, 400mA (proprietary PoE)
Electromagnetic Compatibility	FCC, DGT

9.2.3 Peak Power

Channel	Channel Frequency (MHz)	Peak Power Output Reading (dBm)	Cable loss (dBm)	Peak Power Output (dBm)	Peak Power Limit (dBm)
Low	Base - 5745	14.02	0.5	**14.52**	30
Middle	Base - 5785	14.02	0.5	**14.52**	30
High	Base - 5825	14.00	0.5	**14.50**	30
Middle	Turbo - 5760	13.09	0.5	**13.59**	30
	Turbo - 5800	13.41	0.5	**13.91**	30

Note :	1.At finial test to get the worst-case emission at 6Mbps.(For Base mode)
	2.At finial test to get the worst-case emission at 12Mbps. (For Turbo mode)
	3.The result basic equation calculation as follow :
	Peak Power Output = Peak Power Reading + Cable loss

9.2.4 Average Power

Channel	Channel Frequency (MHz)	Average Power Output Reading (dBm)	Cable loss (dBm)	Average Power Output (dBm)
Low	Base - 5745	8.03	0.5	**8.53**
Middle	Base - 5785	8.48	0.5	**8.98**
High	Base - 5825	8.15	0.5	**8.65**
Low	Turbo - 5760	7.17	0.5	**7.67**
High	Turbo - 5800	7.82	0.5	**8.32**

Note :	1.At finial test to get the worst-case emission at 6Mbps.(For Base mode)
	2.At finial test to get the worst-case emission at 12Mbps. (For Turbo mode)
	3.The result basic equation calculation as follow :
	Peak Power Output = Peak Power Reading + Cable loss

9.3 BMBGT700

9.3.1 Antenna

Frequency	2400~24835MHz
Gain	18dBi
VSWR	Less than 1.5:1 N Female connector
Impedance	50 Ohm N Female connector
Polarization	Vertical
Horizontal Bandwidth (3dB)	75 deg
Vertical Bandwidth (3dB)	45 deg
Dimensions	263m x263mm x 30mm (W x D x H)
Weight	0.8Kg

9.3.2 System

Standard support	IEEE802.3&IEEE802.3u
Outside Interface	One 10/100 RJ-45 port
Internal Cable	N Male to R-N Male
Data Rate	6, 9, 12, 18, 24, 36, 48, 54, 72, 96, 108Mbps
Modulation	OFDM
Media Access Technology	TDMA
Dimensions	320m x 310mm x 48mm (W x D x H)
Weight	3.05kg
Environmental Specification	Operating temperature: -20 - 70 degree C Storage temperature: -40 - 80 degree C Relative humidity: 10% - 90% (non-condensing)
Power Requirement	48V DC, 400mA (proprietary PoE)
Electromagnetic Compatibility	FCC, DGT

9.3.3 Peak Power

Channel	Channel Frequency (MHz)	Peak Power Output Reading (dBm)	Cable loss (dBm)	Peak Power Output (dBm)	Peak Power Limit (dBm)
Low	Base - 2412	19.88	0.5	**20.38**	**26**
Middle	Base - 2437	19.61	0.5	**20.11**	**26**
High	Base - 2462	19.23	0.5	**19.73**	**26**
Middle	Turbo - 2437	17.45	0.5	**17.95**	26

Note :	1.At finial test to get the worst-case emission at 6Mbps.(For Base mode)
	2.At finial test to get the worst-case emission at 12Mbps. (For Turbo mode)
	3.The result basic equation calculation as follow :
	Peak Power Output = Peak Power Reading + Cable loss

9.3.4 Average Power (b/g)

Channel	Channel Frequency (MHz)	Average Power Output Reading (dBm)	Cable loss (dBm)	Average Power Output (dBm)
Low	Base - 2412	14.47	0.5	**14.97**
Middle	Base - 2437	14.84	0.5	**15.34**
High	Base - 2462	13.96	0.5	**14.46**
Middle	Turbo - 2437	12.62	0.5	**13.12**

Note :	1.At finial test to get the worst-case emission at 6Mbps.(For Base mode)
	2.At finial test to get the worst-case emission at 12Mbps. (For Turbo mode)
	3.The result basic equation calculation as follow :
	Peak Power Output = Peak Power Reading + Cable loss

