PTP 600 Series User Guide

MOTOROLA POINT-TO-POINT WIRELESS SOLUTIONS

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MOTOROLA, Inc.

Point-to-Point Wireless Bridges – PTP 600 Series

Software Release PTP 600-08-xx

System User Guide

October 14th, 2008

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Copyright Information

http://www.motorola.com/ptp

Compliance

General

Changes or modifications not expressly approved by Motorola could void the user's authority to operate the system.

NOTE: This system has achieved Type Approval in various countries around the world. This means that the system has been tested against various local technical regulations and found to comply. The frequency bands in which the system operates may be 'unlicensed' and, in these bands, the system can be used provided it does not cause interference. Further, it is not guaranteed protection against interference from other products and installations.

The system has been tested for compliance to both US (FCC) and European (ETSI) specifications. It has been shown to comply with the limits for emitted spurious radiation for a Class B digital device[1], pursuant to Part 15 of the FCC Rules in the USA and appropriate European ENs. These limits have been designed to provide reasonable protection against harmful interference. However the equipment can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other radio communications. 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 Outdoor Unit (ODU).
- Increase the separation between the affected equipment and ODU.
- Connect the ODU/PIDU into a power outlet on a circuit different from that to which the receiver is connected.
- Consult your installer or supplier for help.

Deployment and Operation

The Radio Regulations of various countries' limits constrain the operation of radio products generally. In particular the local regulator may limit the amount of conducted or radiated transmitter power and may require registration of the radio link.

The power transmitted by the PTP 600 Series Bridge is controlled by the use of Region-specific License Keys.

The following examples show how the regulatory limits apply in some specific countries at the current time. Operators should note that regulations are subject to change.

Contact your supplier/installer to ensure that your product is set for the correct License Key for your Country/Region and to ensure that you have fulfilled all the local regulatory requirements, especially if you are intending to use a link with external antennas. Footnotes to the table below indicate countries where registration of the link is currently mandatory.

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[1] Class B Digital Device, A digital device that is marketed for use in a residential environment, notwithstanding use in commercial, business and industrial environments.

The system has been tested for compliance to both US (FCC) and European (ETSI) specifications. It has been shown to comply with the limits for emitted spurious radiation for a Class B digital device, pursuant to Part 15 of the FCC Rules in the USA and appropriate European ENs. These limits have been designed to provide reasonable protection against harmful interference. However the equipment can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other radio communications. There is no guarantee that interference will not occur in a particular installation.

Regulations applicable to PTP 25600 variant

	Examples of Regulatory Limits at 2.5GHz
FCC	Under FCC Regulations, operation of this product is only allowed with a License Key for Region 16 which ensures that the product will meet the requirements of FCC part 27. **Note**: Spectrum in this band (2496MHz to 2690MHz) is allocated on a Licensed basis in USA.

General Notice Applicable to Europe
N/A.

Regulations applicable to PTP 45600 variant

	Examples of Regulatory Limits at 4.5GHz
	Operation of this product is only allowed with a License Key for Region 23 which ensures that the product will meet the requirements for Military Use.

General Notice Applicable to Europe
N/A.

Regulations applicable to PTP 49600 variant

	Examples of Regulatory Limits at 4.9GHz
	Operation of this product is only allowed with a License Key for Region 14 (26 dBm EIRP), and for Region 23 which ensures that the product will meet the requirements for Military Use.

General Notice Applicable to Europe
N/A.

Regulations applicable to PTP 54600 variant

	Examples of Regulatory Limits at 5.4GHz
FCC	Under FCC Regulations, operation of this product is only allowed with a License Key for Region 12. This implements Radar Detection in accordance with FCC Regulations and limits the EIRP to the regulatory limits below: EIRP ≤ Max of [(17 +10 x Log(Channel BW)) and 30] dBm.
ETSI	Under ETSI Regulations, operation of this product is only allowed with a License Key for Region 24 (30dBm or 1W EIRP with Radar Detection)
Australia, Canada	Oeration of this product is only allowed with a License Key for Region 13. This implements Radar Detection, including barring of the band from 5600 MHz to 5650 MHz and limits the EIRP to the regulatory limits below: EIRP ≤ Max of [(17 +10 x Log(Channel BW)) and 30] dBm
Thailand	Operation of this product is only allowed with a License Key for Region 20 (30 dBm or 1W EIRP)
Korea	Operation of this product is only allowed with a License Key for Region 21 (28 dBm EIRP (15 MHz), 27 dBm EIRP (10 MHz), 24 dBm EIRP (5 MHz)).

General Notice Applicable to Europe
This equipment complies with the essential requirements for the EU R&E Directive 1999/5/EC.

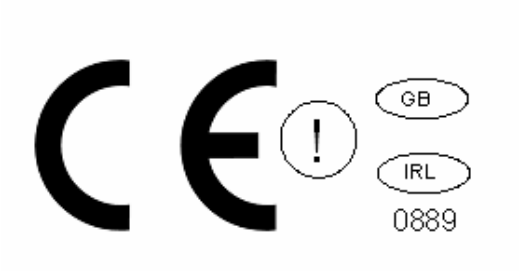
CE

NOTE: In regions other than EU/USA, specific local regulations may apply. It is the responsibility of the installer/user to check that the equipment as deployed meets local regulatory requirements.

Regulations applicable to PTP 58600 variant

	Examples of Regulatory Limits
USA/ Canada/ Taiwan/ Brazil	Equipment can be operated in any mode, best results will be obtained using Region 1 settings. There are some limitations on the use of antennas above 4ft diameter plus a band edge power reduction.
China	Operation of this product is only allowed with a License Key for Region 2 (33 dBm or 2W EIRP).
Australia	Operation of this product is only allowed with a License Key for Region 3 (36 dBm or 4W EIRP).
Hong Kong	Operation of this product is only allowed with a License Key for Region 3 (36 dBm or 4W EIRP).
UK	Operation of this product is allowed with a License Key for Region 4 . This implements Radar Detection with barring of the band from 5795 MHz to 5815 MHz and above 5850 MHz. It limits the EIRP to the Regulatory Limits below: EIRP ≤ Max of [(23 +10 x Log(Channel BW)) and 36] dBm
Singapore	Operation of this product is only allowed with a License Key for Region 5 (20 dBm or 100mW EIRP).
Eire	Operation of this product is only allowed with a License Key for Region 6 (33 dBm or 2W EIRP). The lower power limits are lower in narrower bandwidths.
Korea	Operation of this product is only allowed with a License Key for Region 11 (43 dBm or 20W EIRP).
India	Operation of this product is only allowed with a License Key for Region 19 (36 dBm or 4W EIRP at 15 MHz and 10 MHz and 33 dBm or 2 W EIRP at 5 MHz channel bandwidth).
Thailand	Operation of this product is only allowed with a License Key for Region 20 (30 dBm or 1W EIRP).
Germany	Operation of this product is only allowed with a License Key for Region 22. This limits the band of operation to 5755 MHz to 5875 MHz and limits the EIRP to the Regulatory Limits below: EIRP ≤ Max of [(23 +10 x Log(Channel BW)) and 36] dBm
Bahrain	Operation of this product is allowed with a License Key for Region 24 . This limits the EIRP to the Regulatory Limits below: EIRP ≤ Max of [(20 +10 x Log(Channel BW)) and 33] dBm
Norway	Under Norway Regulations, operation of this product is only allowed with a License Key for Region 7. This implements Radar Detection and limits the EIRP to the Regulatory Limits below: EIRP ≤ Max of [(40 +10 x Log(Channel BW)) and 53] dBm Spectral density at border between Norway and neighbouring countries shall not exceed -122,5 dBW/m2 measured with a reference bandwidth of 1 MHz.

General Notice Applicable to Europe
This equipment complies with the essential requirements for the EU R&E Directive 1999/5/EC.
The use of 5.8GHz for Point to Point radio links is not harmonized across the EU and currently the product may only be deployed in the UK, Eire (IRL) and Norway.
However, the regulatory situation in Europe is changing and the radio spectrum may become available in other countries in the near future. Please contact Motorola for the latest situation.



Regulations applicable to PTP 59600 variant

	Examples of Regulatory Limits
Russia	Operation of this product is only allowed with a License Key for Region 16 (no power limit)
India	Operation of this product is only allowed with a License Key for Regions 17 or 19 (36 dBm or 4W EIRP at 30 MHz, 15 MHz and 10 MHz; and 33 dBm or 2 W EIRP at 5 MHz channel bandwidth).

NOTES:

UK Registration of Links – OfCom, The application form may be found at:

http://www.ofcom.org.uk/radiocomms/isu

Eire Registration of Links – Commission for Communication Regulation, The application form may be found at:

http://www.comreg.ie/licensing_and_services

Disclaimer

The parameters quoted in this document must be specifically confirmed in writing before they become applicable to any particular order or contract. The company reserves the right to make alterations or amendments to the detail specification at its discretion. The publication of information in this document does not imply freedom from patent or other rights of Motorola, Inc. or others.

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1 About This User Guide

This guide covers the installation, commissioning, operation and fault finding of the Motorola PTP 600 Series of Point-to-Point Wireless Ethernet Bridges.

1.1 Interpreting Typeface and Other Conventions

This document employs distinctive fonts to indicate the type of information, as described in Table 1.

Table 1 - Font types

Font	Type of Information
variable width bold	Selectable option in a graphical user interface or settable parameter in a web-based interface.
`constant width regular`	Literal system response in a command-line interface.
`constant width italic`	Variable system response in a command-line interface.
`constant width bold`	Literal user input in a command-line interface.
`constant width bold italic`	Variable user input in a command-line interface.

This document employs specific imperative terminology as follows:

- Type means press the following characters.
- Enter means type the following characters and then press Enter.
- Highlight means click anywhere in a row of data to highlight the entire row.
- Select means use the mouse to click on or branch to the menu item that follows.

Use this table and the Glossary to aid in interpreting the technical acronyms used throughout this User Guide.

This document also employs a set of consistently used admonitions. Each type of admonition has a general purpose that underlies the specific information in the box. These purposes are indicated in Table 2.

Table 2 - Admonition types

Admonition Label	General Message
	**Note** Informative content that may: • Defy common or cursory logic. • Describe a peculiarity of the 600 Series solutions implementation. • Add a conditional caveat. • Provide a reference. • Explain the reason for a preceding statement or provide background for what immediately follows. **Recommendation** Suggestion for an easier, quicker, or safer action or practice.
	**Important** Informative content that may: • Identify an indication that you should watch for. • Advise that your action can disturb something that you may not want disturbed. • Reiterate something that you presumably know but should always keep in mind.
	**Caution!** A notice that the risk of harm to equipment or service exists.
	**Warning!** A notice that the risk of harm to person exists.

1.2 Getting Additional Help

To get information or assistance as soon as possible for problems that you encounter, follow this procedure:

1. Search this document, the user manuals that support the modules, and the software release notes of supported releases:
    a. In the Table of Contents for the topic.
    b. In the Adobe Reader® search capability for keywords that apply.[2]
2. Visit the Motorola website at www.motorola.com/ptp
3. Ask your Motorola products supplier to help.
4. Gather information from affected units such as:
    a. the IP addresses and MAC addresses
    b. the software releases
    c. the configuration of software features
    d. any available diagnostic downloads
5. Escalate the problem to Motorola Technical Support as follows. You may either:
    a. Send e-mail to support.ptp@motorola.com
    b. Call our 24x7 Technical Support Center on +1 (0) 877 515 0400 (Worldwide) or +44 (0) 808 234 4640 (UK Customers).

For warranty assistance, contact your reseller or distributor for the process.

1.3 Sending Feedback

We welcome your feedback on the PTP 600 Series Bridge system documentation. This includes feedback on the structure, content, accuracy, or completeness of our documents, and any other comments you have. Send feedback to support.ptp@motorola.com.

[2] Reader is a registered trademark of Adobe Systems, Incorporated.

2 Avoiding Hazards

2.1 Preventing Overexposure to RF Energy

WARNING: To protect from overexposure to RF energy, install the radios for the 600 family of PTP wireless solutions so as to provide and maintain the minimum separation distances from all persons as shown in Table 3.

When the system is operational, avoid standing directly in front of the antenna. Strong RF fields are present when the transmitter is on. The Outdoor Unit (ODU) must not be deployed in a location where it is possible for people to stand or walk inadvertently in front of the antenna.

At these and greater separation distances, the power density from the RF field is below generally accepted limits for the general population.

NOTE: These are conservative distances that include compliance margins.

2.1.1 Calculations for Separation Distances and Power Compliance Margins

Limits and guidelines for RF exposure come from:

- US FCC limits for the general population. See the FCC web site at http://www.fcc.gov, and the policies, guidelines, and requirements in Part 1 of Title 47 of the Code of Federal Regulations, as well as the guidelines and suggestions for evaluating compliance in FCC OET Bulletin 65.
- Health Canada limits for the general population. See the Health Canada web site at http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/limits-limites_e.html and Safety Code 6.
- EN 50383:2002 Basic standard for the calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base stations and fixed terminal stations for wireless telecommunication systems (110 MHz - 40 GHz).
- ICNIRP (International Commission on Non-Ionizing Radiation Protection) guidelines for the general public. See the ICNIRP web site at http://www.icnirp.de/ and Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields.

The applicable power density exposure limits from the documents referenced above are:

- 6 W/m^2 for RF energy in the 900-MHz frequency band in the US and Canada.
- 10 W/m^2 for RF energy in the 2.4-, 5.2-, 5.4-, 5.8- and 5.9 GHz frequency bands.

Peak power density in the far field of a radio frequency point source is calculated as follows:

$$S = \frac{P.G}{4\pi d^2}$$ Where

S = power density in W/m^2

P= Maximum Average transmit power capability of the radio, in W

G= total Tx gain as a factor, converted from dB

d = distance from point source, in m

Rearranging terms to solve for distance yields:

$$d = \sqrt{\frac{P.G}{4\pi.S}}$$

2.1.1.1 Calculated Distances and Power Compliance Margins

Table 3 shows calculated minimum separation distances d, recommended distances and resulting power compliance margins for each frequency band and antenna combination.

Table 3 - Power Compliance Margins

Band	Antenna	Max Average Transmit Power in Burst (Watt)	Variable			d (m)	Recom-mended Distance (m)	Power Compliance Margin
			P (Watt)	G	S (W/m^2)			
2.5 GHz	Integrated	0.25	0.125	63 (18dBi)	10	0.25	2	8.0
4.9 GHz	Integrated	0.25	0.125	63 (18dBi)	10	0.25	2	8.0
5.4 GHz	Integrated	0.005 (7dBm)	0.00250	200 (23dBi)	10	0.06	1	15.9
	External 4ft Dish	0.00035 (-4.6dBm)	0.00017	2884 (34.6dBi)	10	0.06		
5.8 GHz	Integrated	0.32 (25dBm)	0.16	200 (23dBi)	10	0.5	2	4.0
	External 2ft Flat Plate	0.32 (25dBm)	0.16	631 (28dBi)	10	0.9	4	4.5
	External 6ft Dish	0.32 (25dBm)	0.16	6310 (38dbi)	10	2.83	10	3.5
5.9 GHz	Integrated	0.32 (25dBm)	0.16	200 (23dBi)	10	0.5	2	4.0
	External 2ft Flat Plate	0.32 (25dBm)	0.16	631 (28dBi)	10	0.9	4	4.5
	External 6ft Dish	0.32 (25dBm)	0.16	6310 (38dbi)	10	2.83	10	3.5

Notes:

- The regulations require that the power used for the calculations is the maximum power in the transmit burst subject to allowance for source-based time-averaging.
- At 5.4GHz the product is generally to a fixed EIRP which can be achieved with the Integrated Antenna. If there are no EIRP limits, use the distance calculations for 5.8GHz.
- At 5.8GHz, for antennas between 0.6m (2ft) and 1.8m (6ft), alter the distance proportionally to the antenna gain.
- At 2.5 GHz, for antennas between 1.2m (4ft) and 3.6m (12ft) the safe distance is increased to between 0.8m (2.6 ft) and 2.4m (7.8 ft).

3 Getting Started

3.1 For Your Safety

WARNING: Use extreme care when installing antennas near power lines.

WARNING: Use extreme care when working at heights.

WARNING: The Outdoor Unit (ODU) for the PTP 600 Series Bridge must be properly grounded to protect against lightning. In the USA and Canada it is the user's responsibility to install the equipment in accordance with Section 810 of the National Electric Code, ANSI/NFPA No.70-1984 or Section 54 of the Canadian Electrical Code. These codes describe correct installation procedures for grounding the outdoor unit, mast, lead-in wire and discharge unit, size of grounding conductors and connection requirements for grounding electrodes. Other regulations may apply in different countries and therefore it is recommended that installation of the outdoor unit be contracted to a professional installer.

WARNING: The ODU for the PTP 600 Series Bridge must be grounded to a Protective Earth in accordance with the Local Electrical Regulations.

WARNING: It is recommended that the supplied Power Indoor Plus (PIDU Plus) – PTP 600 Series is used to power the PTP 600 Series Bridge ODU. The use of other power sources may invalidate safety approval and affect your warranty.

WARNING: When using alternative DC supplies (via the PIDU Plus DC in terminals as described in Section 3.3.3 "Redundancy and Alternative Powering Configurations"), such as battery-backed DC power source, the supply MUST comply with the following requirements:

- The voltage and polarity is correct and is applied to the correct terminals in the PIDU Plus
- The power source is rated as SELV
- The power source is rated to supply at least 1A continuously
- The power source cannot provide more than the Energy Hazard Limit as defined by IEC/EN/UL6090, Clause 2.5, Limited Power (The Energy Hazard Limit is 240VA)

WARNING: Users and installers should note that the main power supply is the primary disconnect device.

WARNING: Safety will be compromised if external quality cables are not used for connections that will be exposed to the weather.

WARNING: Safety will be compromised if a different power supply is used than the one supplied by Motorola as part of the system.

3.2 Welcome

Congratulations on the purchase of the PTP 600 Series Bridge from Motorola. The PTP 600 Series Bridge is the latest innovation in high-speed wireless networking that lets you deploy wireless networks in areas previously unattainable.

3.2.1 Who Should Use This Guide

The guide is for use by the system installer and the end user IT professional. The system installer will require expertise in the following areas:

- Outdoor radio equipment installation
- Network configuration
- Use of web browser for system configuration, monitoring and fault finding

3.2.2 Contact Information

Table 4 - Contact Information

Postal Address:	Motorola, Inc. Unit A1, Linhay Business Park, Eastern Road, Ashburton, Devon. TQ13 7UP United Kingdom
Web Site:	http://www.motorola.com/ptp
Sales Enquiries:	sales.ptp@motorola.com
Web Support:	http://www.motorola.com/ptp/
Email Support:	support.ptp@motorola.com
All Other Enquiries:	info.ptp@motorola.com
Telephone Enquiries and Global Support:	+1 (0) 877 515 0400 (Toll Free in the USA) and +44 (0) 808 234 4640 (Toll Free in the Uk).

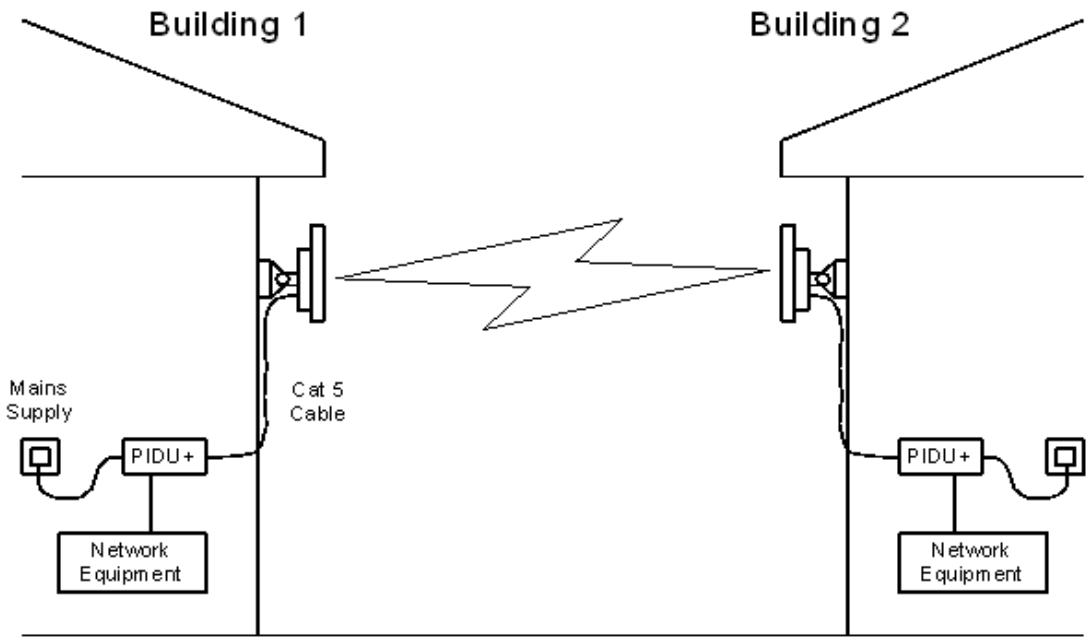
3.2.3 Repair and Service

For unit repair or service, contact your service provider or an authorized Motorola Point-to-Point Distributor for Return Material Authorization (RMA) and shipping instructions. Alternatively, contact the PTP Global Technical Support Center to process an RMA.

3.3 Product Description

This User Manual is specifically written for the 600 family of point-to-point broadband wireless solutions. The PTP 600 Series Bridge has been developed to provide Point-to-Point data connectivity via a 2.5 GHz, 4.5 GHz, 4.9 GHz, 5.4 GHz, 5.8 GHz or 5.9 GHz wireless Ethernet bridge operating at broadband data rates. The PTP 600 Series Bridge is aimed at a wide range of applications. An example application is an enterprise that has a requirement to connect together the Local Area Network (LAN) of two or more buildings as shown in Figure 1.

Figure 1 - Typical PTP 600 Series Bridge Deployment



The PTP 600 Series Bridge offers true non-line-of-sight (NLOS) operation by using a combination of Orthogonal Frequency Division Multiplexing (OFDM) modulation and Multiple-Input Multiple-Output (MIMO) techniques. These technologies enable the PTP 600 Series Bridge to drive through foliage and around buildings to such an extent that almost universal coverage can be expected at short range.

A PTP 600 Series Bridge system consists of a pair of identical devices that are deployed one at each end of the link. At installation, the user sets up one unit as the Master and the other as the Slave. Either unit can be configured as Master or Slave.

Each end of the link consists of:

- An integrated (or connectorized -see section 13) outdoor transceiver unit containing all the radio and networking electronics hereafter referred to as the Outdoor Unit (ODU).
- An indoor connection box containing a mains power supply, status indicators and network connection port. Hereafter referred to as the Power Indoor Unit Plus (PIDU Plus).

A pair of units is normally supplied pre-configured as a link.

The network connection to a PTP 600 Series Bridge is made via a 1000BaseT Ethernet connection. Power is provided to the ODU over the 1000BaseT Ethernet connection using a patented non-standard powering technique.

Previous releases of the PTP 600 Series Bridge platform used different powering and connection arrangements. Users of equipment prior to “Mod Record 1” should refer to the User Guide shipped with the original equipment. The “Mod Record” label can be found on the back of the ODU as shown in Figure 2.

Figure 2 - Mod Record Label

Alternatively, the network connection to a PTP 600 Series Bridge can be made using a 1000BaseSX Fiber Optic cable connected directly to the ODU. In this case power is still provided over the 1000BaseT Ethernet connection. In the case of Fiber Optic cable failure the PTP 600 Series Bridge will automatically fall back to the copper Ethernet connection (provided the cable length <=100m [330 ft]). “PTP 600 Series Optical Interface Upgrade Kits” can be obtained from your distributor, reseller or system integrator.

Power is fed into the PTP 600 Series Bridge PIDU Plus from the mains via a standard “figure of eight” mains plug. Connection between the ODU and PIDU Plus is made using standard CAT5e outdoor UV resistant cable. Connection between the PIDU Plus and the Network Equipment is made using standard CAT5e cable.

3.3.1 The Outdoor Unit (ODU)

The ODU is a self-contained unit. It houses both radio and networking electronics. The ODU for the PTP 600 Series Bridge should only be deployed using the supplied PTP 600 Series Bridge PIDU Plus. Figure 3 shows an installation example of a PTP 600 Series ODU with a Motorola lightning protection unit (PTP-LPU).

Figure 3 – PTP 600 Series Bridge Outdoor Unit (ODU) with PTP-LPU

3.3.2 PIDU Plus – PTP 600 Series Bridge

The PTP 600 Series Bridge PIDU Plus is used to generate the ODU supply voltage from the mains supply and inject this supply voltage into the 1000BaseT Ethernet connection to the ODU. Connection uses a CAT5e cable using standard RJ45 wiring.

CAUTION Care should be taken not to connect equipment other than an ODU for the PTP 600 Series Bridge to a PIDU Plus ODU port as equipment damage may occur. The PTP 600 Series Bridge PIDU Plus is not interchangeable with the PTP 400 Series PIDU Plus.

Figure 4 - Power Indoor Unit (PIDU Plus) – PTP 300/500/600 Series

The front panel contains indicators showing the status of the power and Ethernet connections.

The power indicator is illuminated when the PIDU Plus is receiving mains power.

The Ethernet indicator normally illuminates when the Ethernet link is working, flashing when there is Ethernet activity. The fact that it lights also indicates that the ODU is powered. At power up the LED will flash 10 times to indicate that a correct start up sequence has occurred. See Section 8 “Fault Finding” for further fault finding information.

At the bottom of the PIDU Plus is an entry point for the PIDU Plus to ODU cable, the 1000BaseT Ethernet network port and the Recovery switch.

Figure 5 – PIDU Plus Recovery Switch Location

The Recovery switch is used to recover the unit from configuration errors or software image corruption. To put a PTP 600 Series Bridge into Recovery mode the Recovery switch should be pressed then the power applied. The Recovery switch should be kept pressed for at least 20 seconds after the power has been applied. Full instruction on the recovery mode can be found in Section 9 “Recovery Mode”.

A simple reboot can be performed by removing and re-applying the mains power to the PTP 600 Series Bridge PIDU Plus.

On the left hand side of the PIDU Plus, 48V DC input and output connections can be found. These are used to power the PTP 600 Series Bridge from an external DC source or to provide a level of power supply redundancy, as shown in Section 3.3.3 “Redundancy and Alternative Powering Configurations”.

WARNING When using alternative DC supplies the supply MUST comply with the following requirements:

- The voltage and polarity is correct and is applied to the correct terminals in the PIDU Plus
- The power source is rated as SELV
- The power source is rated to supply at least 1A continuously
- The power source cannot provide more than the Energy Hazard Limit as defined by IEC/EN/UL6090, Clause 2.5, Limited Power (The Energy Hazard Limit is 240VA)

Also on the left hand side of the PTP 600 Series Bridge PIDU Plus, connectors and jumpers can be found that allow the remote connection of power LED, Ethernet LED and Recovery switch. The connection instructions can be found in Section 3.3.4 “Remote LEDs and Recovery Switch”.

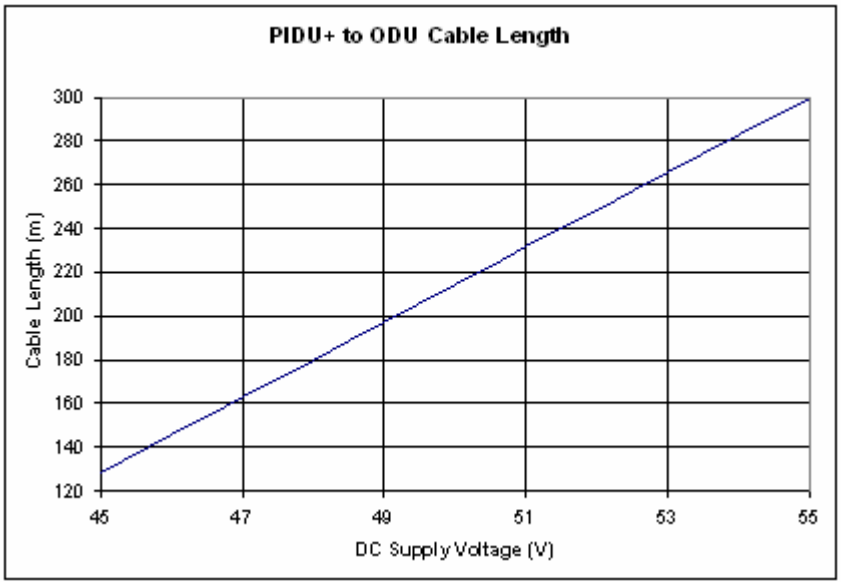
The input supply range for the 600 Series PIDU Plus is 90V-264V AC, 47-63Hz. Mains connection to the PIDU Plus is made using a standard “figure of eight” mains lead as shown in Figure 6.

Figure 6 –PTP 300/500/600 Series Bridge PIDU Plus Power Input

3.3.3 Redundancy and Alternative Powering Configurations

NOTE: The use of DC supplies of less than 55v will reduce the usable distance between the PIDU Plus and ODU see Figure 7.

Figure 7 – PTP 600 Series Bridge PIDU Plus to ODU Cable Length Graph

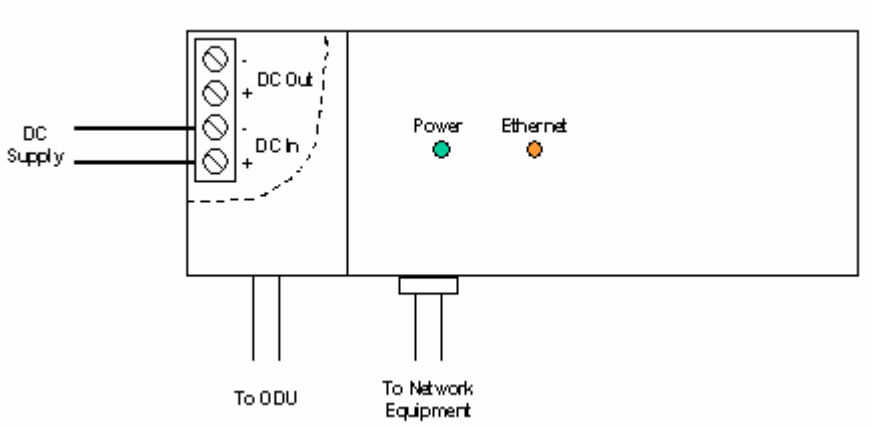


CAUTION: The maximum distance from the ODU to the connected network equipment is 100m (330 ft) when using 1000BaseT. Powering distances over 100m (330 ft) are only applicable when using a 1000BaseSX (Fiber Optic) connection.

3.3.3.1 External DC Supply Only

This configuration is for use where there is no mains supply.

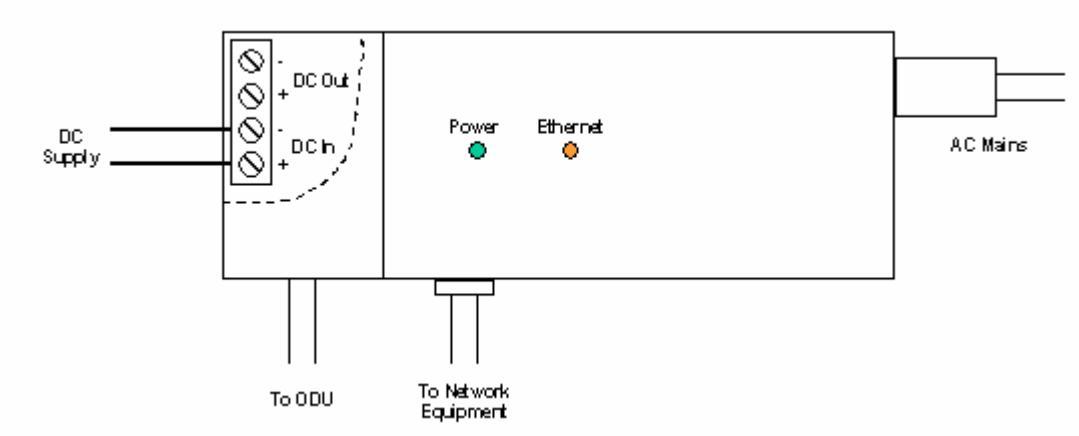
Figure 8 - External DC Supply Only



3.3.3.2 External DC Supply and AC Supply

This configuration provides redundancy through the use of mains and DC supply.

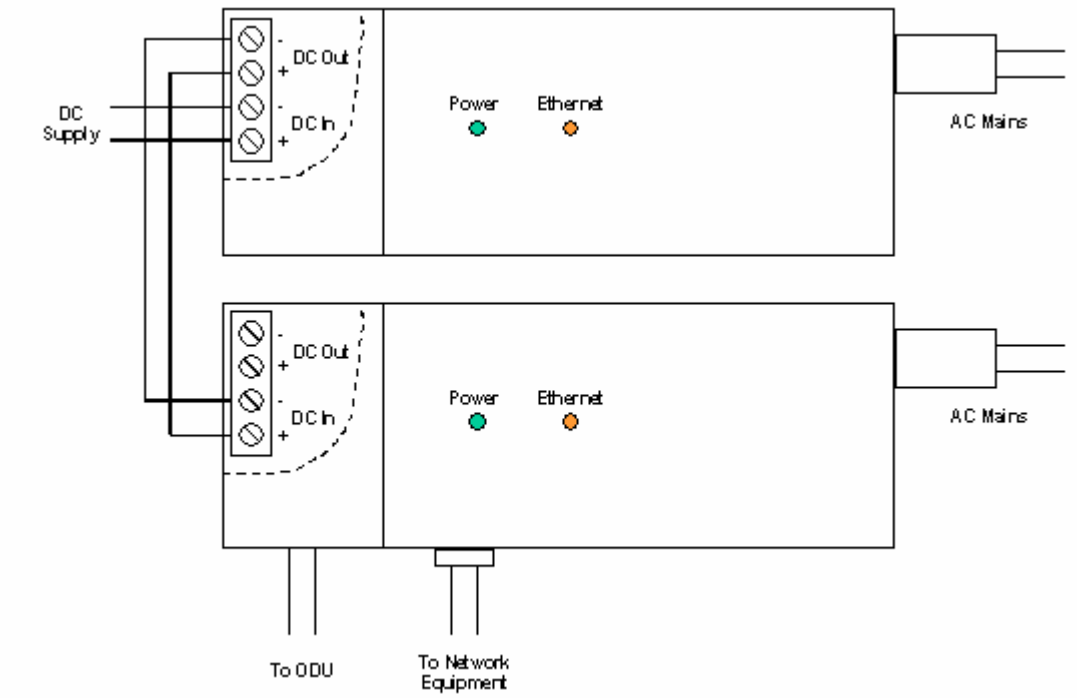
Figure 9 - External DC Supply and AC Supply



3.3.3.3 External DC Supply and Redundant AC Supply

This configuration guards against mains failure and failure of the DC output of single PTP 300/500/600 PIDU Plus.

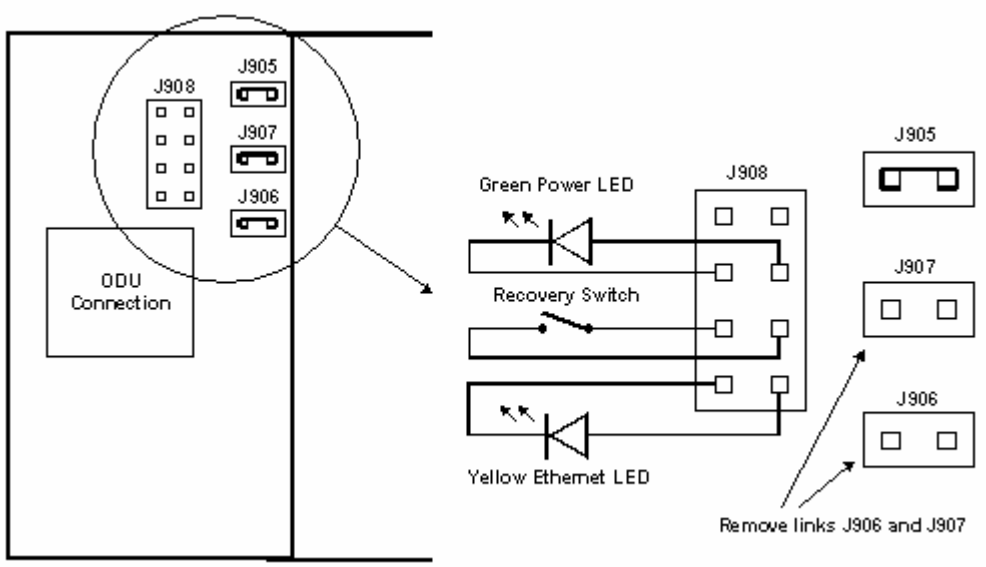
Figure 10 - External DC Supply and Redundant AC Supply



3.3.4 Remote LEDs and Recovery Switch

The PTP 600 Series Bridge PIDU Plus provides a facility to connect remote LEDs and Recovery switch allowing the PIDU Plus to be mounted inside an enclosure. At the left hand end of the PIDU Plus under the ODU connection cover can be found a PCB header and three jumpers. Jumpers J906 and J907 should be removed and connection to the remote LEDs and Recovery switch made to J908 as shown in Figure 11.

Figure 11 - Remote LED and Recovery Switch Wiring



3.3.5 Cables and connectors

The cable used to connect the PTP 600 Series Bridge PIDU Plus to the ODU can be any standard CAT5e type provided that it is suitable for outdoor deployment. Motorola recommends that cables to the specification below be used:

Cable:	**Superior Essex BBDGE CAT 5e**
Connector Type:	**Tyco, 5-569278**
Gland:	**Motorola WB1811**

CAUTION: Failure to use the recommended (or equivalent) standard of cable may invalidate the system's safety certification.

The cable used to connect the PTP 600 Series Bridge PIDU Plus to the users Network Equipment can be any standard CAT5e Cable.

The PIDU Plus to ODU and the PIDU Plus to Network Equipment cables may be unscreened (UTP) or screened (STP). However, unscreened cables reduce the system's ability to cope with nearby lightning strikes. If lightning activity is common in the area of deployment, the use of screened cable is highly recommended. See Section 11 "Lightning Protection".

The PIDU Plus provides screen continuity between the ODU and Network Equipment connections.

NOTE: The ODU network connection implements automatic MDI/MDI-X sensing and pair swapping allowing connection to networking equipment that require cross-over cables (MDI-X networks) or straight-through cables (MDI Networks).

3.3.6 PTP and Lightning Protection

The PTP 600 Series Bridge PIDU Plus meets the low level static discharge specifications identified in Section 20 "Specifications", but does not provide lightning or surge suppression. Installations will generally require lightning or surge suppression, a separate Ethernet surge suppressor must be used and appropriately earthed. Suitable surge suppressors can be sourced from your Motorola Point-to-Point Distributor or Solutions Provider. See Section 11 "Lightning Protection".

3.3.7 Mounting Brackets

The PTP 600 Series Bridge is supplied with a mounting bracket suitable for mounting the ODU to a pole of 50mm (2") to 75mm (3") in diameter. For more details on mounting, see Section 7 "Installation".

The bracket allows for adjustment in both azimuth and elevation. The bracket may be split allowing the pole mount section of the bracket to be mounted to the pole first. This allows the installer to take the weight of the unit and secure it, one handed, with a single mounting bolt.

The PIDU Plus can either be desk or wall mounted. The preference is wall mounted with the cables dressed to a cable channel. Wall mounting is achieved by screwing through the mounting lugs on either side of the unit. Remember to leave space for access to the Recovery button. See Section 3.3.2 "PIDU Plus – PTP 600 Series Bridge".

3.3.8 Configuration and Management

Configuration and Management of the PTP 600 Series Bridge is implemented using an inbuilt web server hosting a number of Configuration and Management web pages. This approach allows Configuration and Management to be carried out on any standard web browsing technology. The PTP 600 Series Bridge can also be managed remotely using the SNMP management protocol. Connection to the bridge is via the Ethernet connection carrying the bridge network traffic. Connection to the unit is via a preset IP address. This address can be changed via the Network Interface Configuration web page. A full explanation of the available web pages and their use can be found in Section 8 “Web Page Reference”.

3.4 Warranty

Motorola’s standard hardware warranty is for one (1) year from date of shipment from Motorola or a Motorola Point-to-Point Distributor. Motorola warrants that hardware will conform to the current relevant published specifications and will be free from material defects in material and workmanship under normal use and service. Motorola shall within this time, at its own option, either repair or replace the defective product within thirty (30) days of receipt of the defective product. Repaired or replaced product will be subject to the original warranty period but not less than thirty (30) days.

Motorola warranty for software is described in details in 19.7.1 “Motorola Inc. End User License Agreement”.

4 Product Architecture

4.1 Radio Link

The PTP 600 Series Bridge consists of an identical pair of units deployed one at each end of the link. The radio link operates on a single frequency channel in each direction using Time Division Duplex (TDD). One unit is deployed as a master and the other as a slave. The master unit takes responsibility for controlling the link in both directions.

The non-line-of-sight (NLOS) aspects of the product are provided by Multiple-Input Multiple-Output (MIMO), coupled with Orthogonal Frequency Division Multiplexing (OFDM) modulation.

4.2 Frequency Bands

The PTP 600 Series Bridge has been developed to operate within license exempt frequency bands as well as the licensed 2.5GHz band in the USA. The current product range supports:

- USA BRS-EBS Post-Transition band 2.5 GHz (2496 – 2690 GHz)
- ETSI 5.4 GHz band B (5.470-5.725 GHz)
- ETSI 5.8 GHz band C (5.725–5.850 GHz) and the USA 5 GHz ISM band (5.725-5.850 GHz)
- US Federal 4.5 GHz band (4.404-4.596 GHz)
- USA and Canada Public Safety 4.9 GHz band
- Military 4.9 GHz band
- 5.9 GHz band (5.825-5.925 GHz)

The PTP 600 Series Bridge has been designed to coexist with other users of the band in an optimal fashion using a combination of Transmit Power Control (TPC), Spectrum Management functionality and Antenna beam shape. In order to maintain link availability, the product employs adaptive modulation techniques that dynamically reduce the data rate in severe or adverse conditions.

4.3 Ethernet Frames

The PTP 600 series provides wireless Ethernet bridging between two fixed locations. To be more precise, it forwards Ethernet frames as a two-port transparent heterogeneous encapsulation bridge, meaning that each bridge forwards frames between two dissimilar interfaces (Ethernet and wireless), encapsulating Ethernet MAC frames within a PTP MAC frames for transmission at the wireless interface. A link consisting of a pair of back to back bridges appears to the data network to be very similar to a standard two-port Ethernet bridge.

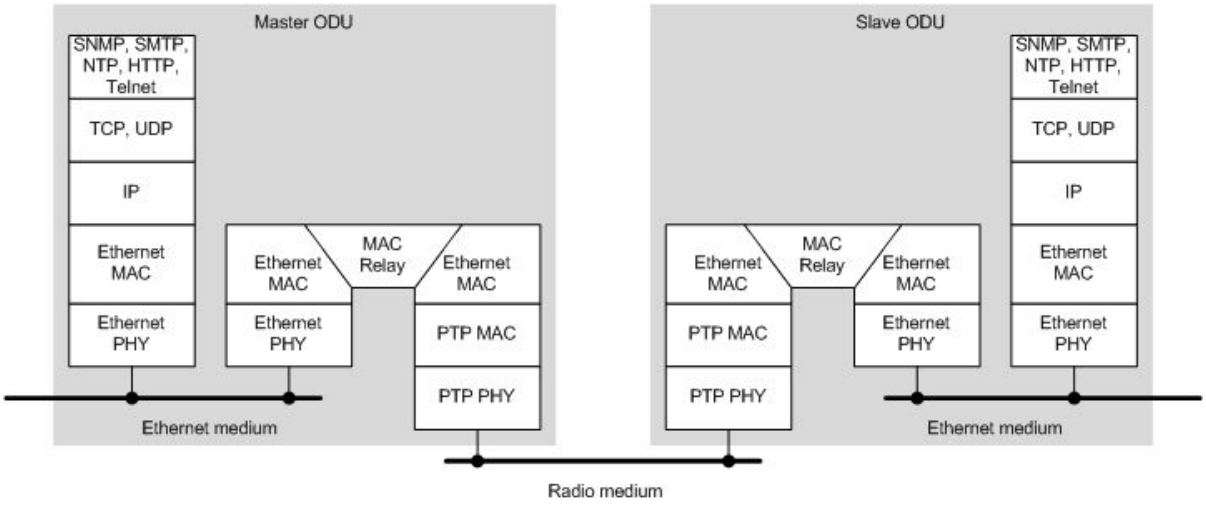
The PTP600 series provides two egress queues in each direction, classifying Ethernet frames into one of the two prioritised queues based on inspection of the user priority field (802.1p) in in a customer (IEEE802.1Q) VLAN tag or provider (IEEE802.1ad) VLAN tag. Untagged frames receive a default priority. The queuing method is strict priority. The bridge does not implement any VLAN functions for bridged frames apart from inspection of the priority field, and consequently the bridge forwards tagged and untagged Ethernet frames regardless of VLAN ID and without modification of any protocol header fields.

The PTP 600 series supports a maximum Ethernet frame size of 2000 bytes for bridged traffic.

4.4 Management Function

The management function of the PTP 600 Series Bridge is logically equivalent to a separate protocol stack with virtual point of attachment at the Ethernet interface. This is illustrated in Figure 12.

Figure 12 – PTP 600 Series Bridge Layer Diagram



Each unit in the link is manageable through an IP connection. Standard IP protocols are utilized for all management functions, for example, HP, SNMP, etc. The unit can be configured to use a VLAN with a single C-tag or S-tag on the management interfaces.

4.5 Channel Bandwidth and Link Symmetry Control

The PTP 600 series provides configurable channel bandwidth in the radio link (5 MHz, 10 MHz, 15 MHz and 30 MHz), and configurable fixed and adaptive link symmetry. Fixed link symmetry supports:

- 2:1
- 1:1
- 1:2

Channel bandwidth 5 MHz supports link symmetry 1:1 only.

4.6 Upgradeable Software

The PTP 600 Series Bridge is fully software upgradeable. New software images are first downloaded from the Motorola website http://www.motorola.com/ptp to a convenient computer. The image is then uploaded to the ODU via the web management page described in Section 8.3.6 “Software Upgrade”. The compressed image is first loaded into RAM and check-summed. If the compressed image transfer has completed successfully the image is decompressed and written to flash memory. On completion of this process the unit can be rebooted to use the newly uploaded image. Should this process fail, the unit will revert to a protected compressed image installed during manufacturing to allow the unit to be recovered.

5 General Considerations

5.1 Spectrum Planning

The PTP 600 Series Bridge has six frequency variants in its product range.

Table 5 - PTP 600 Series Bridge Frequency Variants

Variant	Definition	Frequency Coverage	Variable Channel Width	Channel Raster
PTP 25600	FCC BRS-EBS Post-Transition Band	2496-2568 MHz	5, 10, 15 and 30 MHz[3]	5.5 MHz
		2572-2614 MHz	5, 10, 15 and 30 MHz	6 MHz
		2618-2690 MHz	5, 10, 15 and 30 MHz	5.5 MHz
PTP 45600	Military	4404-4596 MHz	5, 10, 15 MHz	6 MHz
		4404-4596 MHz	30 MHz	10 MHz
PTP 49600	USA/Canada Public Safety	4940-4990 MHz	5, 10, 15 MHz	5 MHz
	Military	4710-5000 MHz	5, 10, 15 MHz	5 MHz
PTP 54600	ETSI 5 GHz Band B FCC UNII Band	5470-5725 MHz	5,10,15 MHz	6 MHz
		5470-5725 MHz	30 MHz	10 MHz
PTP 58600	ETSI 5 GHz Band C FCC ISM Band	5725-5850 MHz	5,10,15 MHz	6 MHz
		5725-5850 MHz	30 MHz	10 MHz
PTP 59600	Russia	5825-5925 MHz	5, 10, 15 MHz	6 MHz
			30 MHz	10 MHz
	India	5875-5925 MHz	5, 10, 15 MHz	6 MHz
			30 MHz	10 MHz

[3] 30 MHz channel widths are available where allowed by local regulations and subject to some restrictions on channel choice.

NOTE: For PTP 54600, PTP 58600 and PTP 59600, use of the product is allowed according to local regulations.

There are two alternative methods of spectrum planning:

- First an operator can utilize the default spectrum management mode i-DFS (intelligent Dynamic Frequency Selection). This mode uses the PTP 600 Series Bridge ability to measure the interference levels in all channels to build up a picture of the interference / noise levels in all channels. The PTP 600 Series Bridge uses statistical techniques to select the most appropriate transmit and receive channels. The i-DFS mode can be influenced in its channel decision process by selectively barring channels from use. The use of this functionality is described in detail in Section 8.3.7 “Spectrum Management”.
- Second, when detailed control of the spectrum allocation is required, it is recommended that the fixed frequency mode is used to statically allocate transmit and receive channels.

CAUTION: These methods must not be used when Radar Detection is enabled.

5.2 Licenses and Region Codes

The PTP 600 Series Bridge uses a system of Region Codes to control the operation of the radio link. The Region Code is set by a License Key.

CAUTION To meet the regulatory requirements of your region you should set the correct Region Code by obtaining a new License Key from your reseller or distributor.

Table 6 – PTP 25600 Licenses and Region Codes

Region Code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
16	FCC Upper	2624 - 2690 MHz		15, 30 MHz	63 dBm EIRP	
				10 MHz	63 dBm EIRP	
				5 MHz	63 dBm EIRP	
	FCC Middle	2572 - 2614 MHz		5, 10, 15 MHz	63 dBm EIRP	
	FCC Lower	2496 - 2568 MHz		5, 10, 15, 30 MHz	63 dBm EIRP	
18	Taiwan Upper	2660 - 2690 MHz		15 MHz	23 dBm	
				10 MHz	22 dBm	
				5 MHz	21 dBm	
	Taiwan Middle	2595 - 2625 MHz		5, 10, 15 MHz	23 dBm	
	Taiwan Lower	2565 - 2595 MHz		5, 10, 15 MHz	23 dBm	

Table 7 – PTP 45600 Licenses and Region Codes

Region Code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
23	USA Military	4400 - 4600 MHz		5, 10, 15, 30 MHz	25 dBm	

Table 8 – PTP 49600 Licenses and Region Codes

Region Code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
14	USA/Canada Public Safety	4940 - 4990 MHz		5, 10, 15 MHz	23 dBm	
23	USA Military	4400 - 5000 MHz		5, 10, 15 MHz	25 dBm	

Table 9 – PTP 54600 Licenses and Region Codes

Region Code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
7	Full Power + Radar	5470 - 5725 MHz	Yes	30 MHz	25 dBm	
8	Full Power	5470 - 5725 MHz		5, 10, 15, 30 MHz	25 dBm	
12	FCC	5470 - 5725 MHz	Yes	5, 10, 15, 30 MHz	30 dBm EIRP	
	ETSI	5470 - 5725 MHz	Yes	30 MHz	30 dBm EIRP	Before software 600-06-00
13	Australia, Canada	5470 - 5600 MHz 5650 - 5725 MHz	Yes	30 MHz	30 dBm EIRP	
20	Thailand	5470 - 5725 MHz		5, 10, 15, 30 MHz	30 dBm EIRP	
21	Korea	5470 - 5650 MHz		15 MHz	28 dBm EIRP	
				10 MHz	27 dBm EIRP	
				5 MHz	24 dBm EIRP	
26	ETSI	5470 - 5600 MHz 5650 - 5725 MHz	Yes	5, 10, 15, 30 MHz	30 dBm EIRP	The band 5600 MHz to 5650 MHz is reserved for the use of weather radars

Table 10 – PTP 58600 Licenses and Region Codes

Region Code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
1	FCC USA, Canada, Taiwan, Brazil	5725 - 5850 MHz		5, 10, 15, 30 MHz	25 dBm	Reduced TX power at band edges
2	China	5725 - 5850 MHz		5, 10, 15, 30 MHz	33 dBm EIRP	
3	Australia, Hong Kong	5725 - 5850 MHz		5, 10, 15, 30 MHz	36 dBm EIRP	
4	UK	5725 - 5795 MHz 5815 - 5850 MHz	Yes	30 MHz	35 dBm EIRP	5795 MHz to 5815 MHz is assigned for Road Transport and Traffic Telematics (RTTT).
	UK	5725 - 5795 MHz 5815 - 5850 MHz	Yes	30 MHz	33 dBm EIRP	Reduced power before software 600-06-00
5	Singapore	5725 - 5850 MHz		5, 10, 15, 30 MHz	20 dBm EIRP	
6	Eire	5725 - 5850 MHz		30 MHz	33 dBm EIRP	
				15 MHz	31 dBm EIRP	
				10 MHz	30 dBm EIRP	
				5 MHz	27 dBm EIRP	
7	Norway	5725 - 5795 MHz 5815 - 5850 MHz	Yes	30 MHz	53 dBm EIRP	
8	Full Power	5725 - 5850 MHz		5, 10, 15, 30 MHz	25 dBm	
11	Korea	5725 - 5825 MHz		30 MHz	44 dBm EIRP	
				15 MHz	41 dBm EIRP	
				10 MHz	40 dBm EIRP	
				5 MHz	37 dBm EIRP	
19	India	5825 - 5850 MHz		10, 15 MHz	36 dBm EIRP	
				5 MHz	33 dBm EIRP	

Region Code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
20	Thailand	5725 - 5850 MHz		5, 10, 15, 30 MHz	30 dBm EIRP	
22	Germany	5755 - 5850 MHz	Yes	30 MHz	35 dBm EIRP	
24	Bahrain	5725 - 5850 MHz	Yes	30 MHz	33 dBm EIRP	
25	ETSI	5725 - 5850 MHz	Yes	5, 10, 15, 30 MHz	35 dBm EIRP	1dB reduction required to achieve adjacent channel emmissions
27	Denmark	5725 - 5795 5815 - 5850 MHz	Yes	5, 10, 15, 30 MHz	35 dBm EIRP	5795 MHz to 5815 MHz is assigned for Road Transport and Traffic Telematics (RTTT)

Table 11 – PTP 59600 Licenses and Region Codes

Region Code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
15	Unrestricted	5825 - 5925 MHz		5, 10, 15, 30 MHz	25 dBm	
16	Russia	5825 - 5925 MHz		5, 10, 15, 30 MHz	25 dBm	
17	India	5875 - 5925 MHz		10, 15, 30 MHz	36 dBm EIRP	
				5 MHz	33 dBm EIRP	
19	India	5825 - 5875 MHz		10, 15, 30 MHz	36 dBm EIRP	
				5 MHz	33 dBm EIRP	

NOTE: For a PTP 25600 in Region Code 16, the EIRP limit is approximately 63 dBm + 10 x Log(360/Antenna Azimuth BW).

NOTE: The 5.8 GHz license for India is addressed using both PTP 58600 and PTP 59600 frequency variants.

When shipped from the factory units[4] are configured as follows:

- PTP 25600 – Region Code 16
- PTP 45600 – Region Code 23
- PTP 54600 – Region Code 26
- PTP 58600 – Region Code 1
- PTP 59600 – Region Code 16

The Deployment Guide for PTP 54600 also contains the license keys for region 12 and 13.

5.3 Operational Restrictions

5.3.1 Radar Avoidance

Radar Avoidance requires that equipment used in the region:

- Detects interference from other systems and avoids co-channel operation with these systems, notably radar systems.
- Provide on aggregate a uniform loading of the spectrum across all devices, that is, Fixed Frequency operation is not allowed.

Radar avoidance is not applicable to the PTP 25600 product or the PTP 45600 product.

To address the primary aims, the Spectrum Management algorithm implements a radar detection function which looks for impulsive interference on the operating channel only. If impulsive interference is detected, Spectrum Management will mark the current operating channel as having detected radar (unavailable channel) and initiate a channel hop to an available channel. The previous operating channel will remain in the unavailable state for thirty minutes after the last impulsive interference pulse was detected. After the thirty minutes have expired the channel will be returned to the usable channel pool.

[4] Note that PTP 25600, PTP 45600, PTP 54600, PTP 58600 and PTP 59600 are different products.

The equipment can only transmit on available channels, of which there are none at initial power up. The radar detection algorithm will always scan a usable channel for 60 seconds for radar interference before making the channel an available channel. This compulsory channel scan will mean that there is a 60 seconds service outage every time radar is detected and that the installation time is extended by 60 seconds even if there is found to be no radar on the channel.

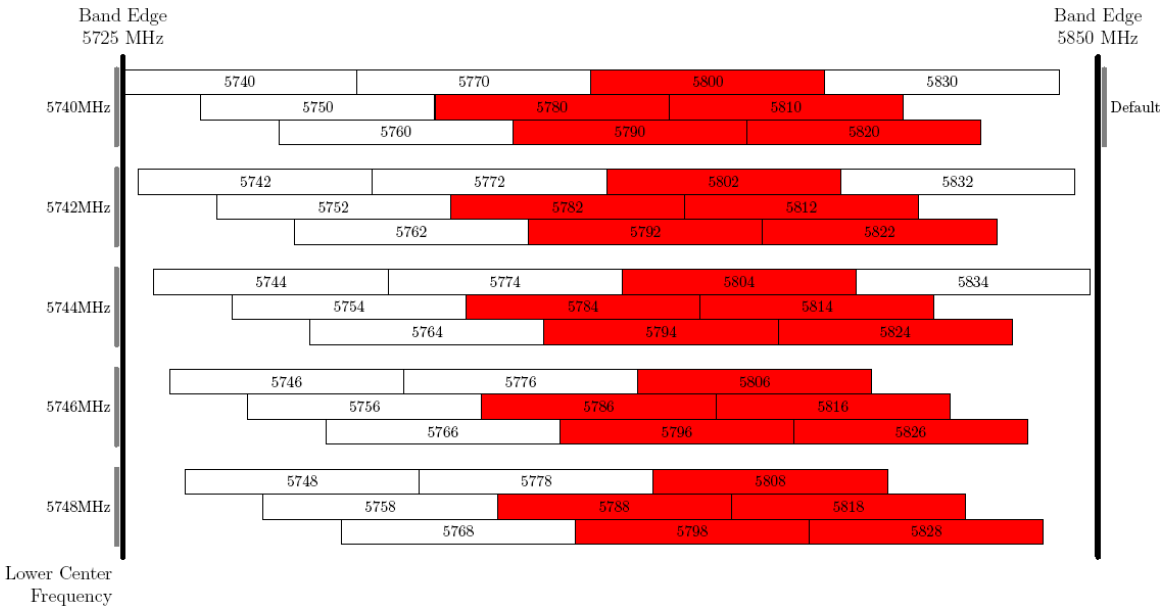
NOTE: On system installation or start-up this extends the initial scan time of the Master unit by 60 seconds. To address the "provide aggregate uniform loading of the spectrum across all devices" requirement, the channel selection algorithm will choose a channel at random from a list of available channels. The channel selection algorithm is initiated at link initialization and when radar interference is detected.

5.3.2 RTTT Avoidance and Other Channel Use Restrictions

Where regulatory restrictions apply to certain channels these channels are barred. The user should note that the number of channels barred is dependant on the channel raster selected. For example see the effect of the UK RTTT channel restrictions in Figure 13. Barred channels are indicated by a "No Entry" symbol displayed on the "Spectrum Management" web page, see Section 8.3.9 "Spectrum Management Control - With Operational Restrictions".

NOTE: "Radar Avoidance Enabled" is only valid with 30 MHz channel bandwidth.

Figure 13 - 5.8 GHz UK RTTT Channel Avoidance – 30 MHz Channel Bandwidth Only



5.3.3 Radar Avoidance, i-DFS and Variable (Narrow) Bandwidth Operation

PTP 600 Series bridges do not support operation with 5, 10 or 15 MHz channel bandwidth in regions where radar avoidance is enabled.

NOTE: Radar avoidance requirements in the 5.4GHz band in the EU is detailed in specification EN 301-893 version 1.4.1 and in the US in the specification FCC part 15.437. Radar avoidance at 5.8GHz is applicable to EU operation and the requirements are currently as defined in EN 302 502.

5.4 Variable Channel Bandwidth Operation

Channel bandwidths of 5, 10, 15 and 30MHz[5] are supported for Full versions of the PTP 600. Lite versions of the PTP 600 products support only channel bandwidths of 10, 15 and 30 MHz.

Configuration of the variable bandwidth operation must be symmetric, that is, the Transmit and receive channels must use identical channel bandwidths.

5.5 PTP 25600 Specific Frequency Planning Considerations

The supported 2.5GHz frequency range is split into three bands, according to the bands specified in the FCC BRS-EBS Post-Transition Band plan[6]:

- Lower: 2496 MHz to 2572 MHz with a 5.5MHz channel raster (76 MHz total).
- Middle: 2572 MHz to 2614 MHz with a 6 MHz channel raster (42 MHz total).
- Upper: 2618 MHz to 2690 MHz with a 5.5 MHz channel raster (76 MHz total).

NOTE: For the PTP 25600 product variant, the unit will only operate in Fixed Frequency mode, and the user is unable to select i-DFS.

[5] 30MHz channel widths are available where allowed by local regulations and subject to some restrictions on channel choice.

[6] Only for PTP 25600 and Region Code 16

The PTP 25600 product variant support channel centre frequencies as specified in Table 12.

Table 12 - PTP 25600 Product Variant Channel Plan - FCC BRS-EBS Post-Transition Band

Block	Channel Bandwidth (MHz)	Channel Centre Frequencies (MHz)
Lower Band Segment	5	2499.25, 2504.75, 2510.25, 2515.75, 2521.25, 2526.75, 2532.25, 2537.75, 2543.25, 2548.75, 2554.25, 2559.75, 2565.25
	10	2502, 2507.5, 2513, 2518.5, 2524, 2529.5, 2535, 2540.5, 2546, 2551.5, 2557, 2562.5
	15	2504.75, 2510.25, 2515.75, 2521.25, 2526.75, 2532.25, 2537.75, 2543.25, 2548.75, 2554.25, 2559.75
	30	2513, 2524, 2535, 2546
Middle Band Segment	5	2575, 2581, 2587, 2593, 2599, 2605, 2611
	10	2578, 2584, 2590, 2596, 2602, 2608
	15	2581, 2587, 2593, 2599, 2605
	30	Not supported
Upper Band Segment	5	2626.75, 2632.25, 2637.75, 2643.25, 2648.75, 2654.25, 2659.75, 2665.25, 2670.75, 2676.25, 2681.75, 2687.25
	10	2629.5, 2635, 2640.5, 2646, 2651.5, 2657, 2662.5, 2668, 2673.5, 2679, 2684.5
	15	2632.25, 2637.75, 2643.25, 2648.75, 2654.25, 2659.75, 2665.25, 2670.75, 2676.25, 2681.75
	30	2640.5, 2651.5, 2662.5, 2673.5

The channel centre frequencies listed above have been selected to align with the so-called post-transition BRS channels as shown in Figure 14.

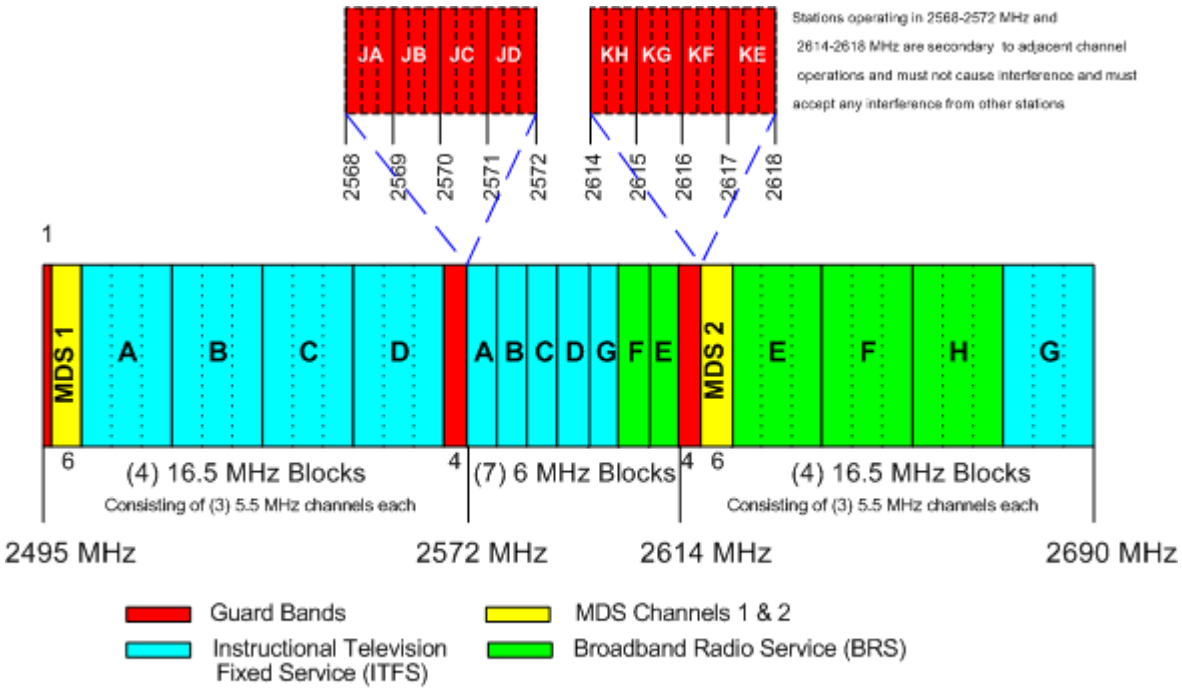
NOTE: The PTP 25600 frequency variant supports three portions of the BRS spectrum allocation. These are configurable at installation and constrain the wireless to operate in a limited portion of the Spectrum. The three frequency bands are as shown in Figure 14:

Band 1: channels A, B, C and D (16.5 MHz blocks)

Band 2: channels A through G (6 MHz blocks)

Band 3: channels E, F, G and H (16.5 MHz blocks)

Figure 14 - 2.5 GHz BRS Band Channel Assignments



5.5.1 Power Reduction in the Upper Band

Operation in the Upper Band Segment (Table 13) will result in a lower maximum transmit power and the reduction depends on the channel bandwidth. The maximum power levels produced are shown below.

Table 13 - Power Reduction in the Upper Band

Band	15MHz Channel	10MHz Channel	5MHz Channel
Lower Band Segment	23dBm	23dBm	23dBm
Middle Band Segment	23dBm	23dBm	23dBm
Upper Band Segment	23dBm	22dBm	21dBm

5.6 PTP 45600 Specific Frequency Planning Considerations

Adjustment of the lower centre frequency allows the operator to slide the available frequency settings up and down the 4.5 GHz band. See Figure 15 to Figure 18.

Figure 15 - 4.5 GHz Available Spectrum Settings – 30 MHz Channel Bandwidth

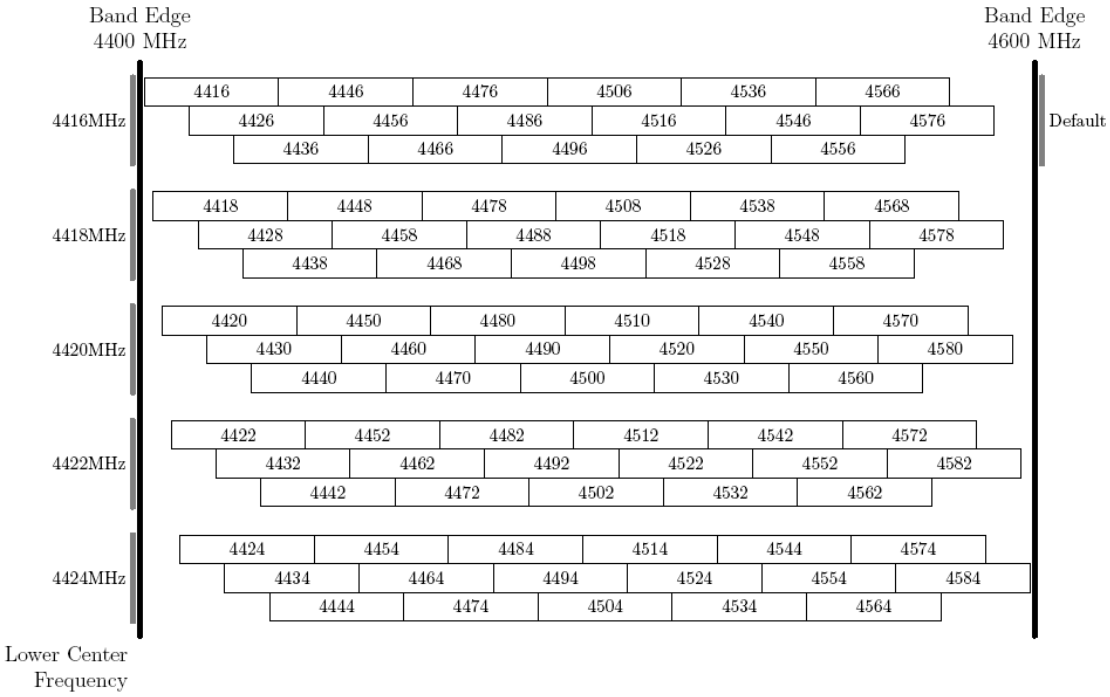


Figure 16 - 4.5 GHz Available Spectrum Settings – 15 MHz Channel Bandwidth

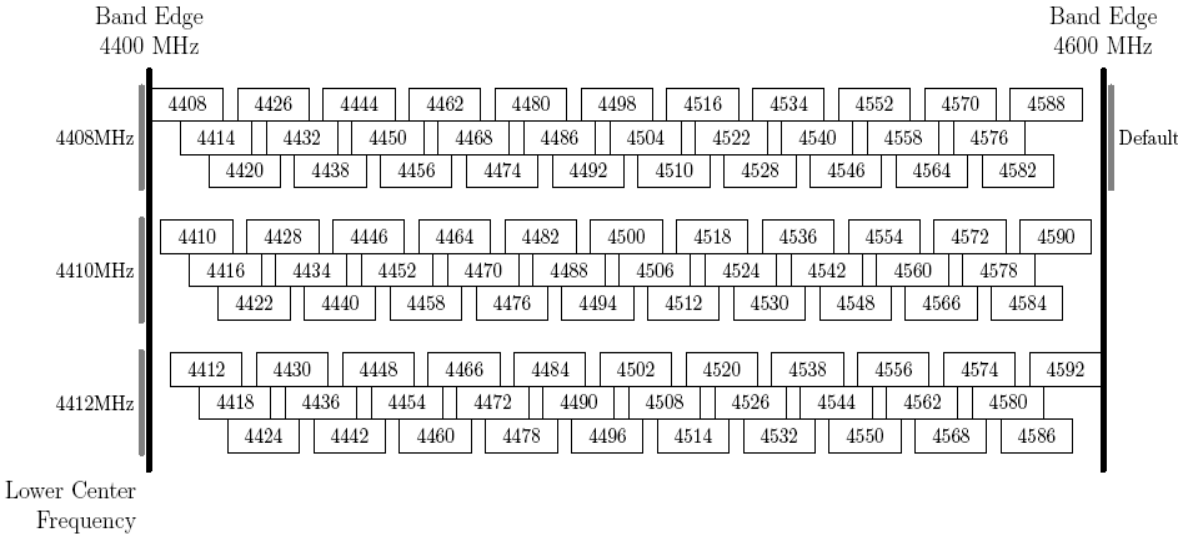


Figure 17 - 4.5 GHz Available Spectrum Settings – 10 MHz Channel Bandwidth

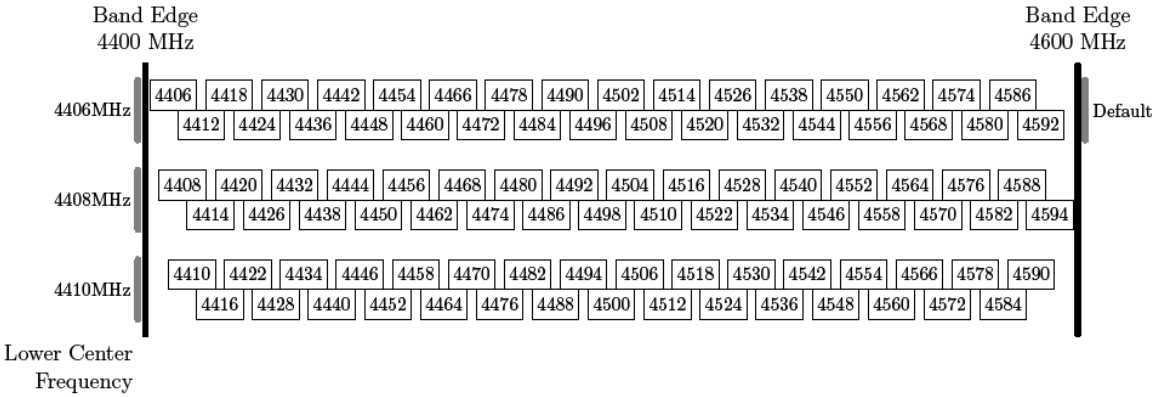
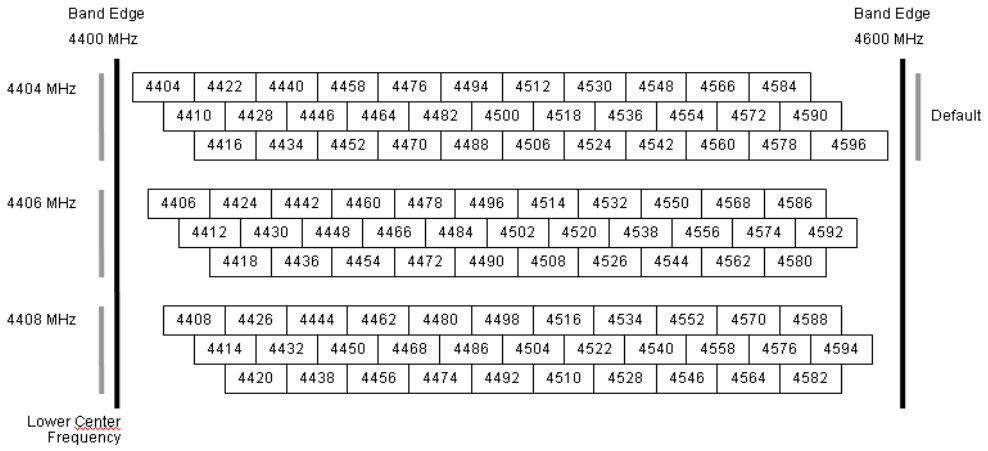


Figure 18 - 4.5 GHz Available Spectrum Settings – 5 MHz Channel Bandwidth



5.6.1 PTP 45600 Raster Considerations

The PTP 45600 variant operates on a 10 MHz channel raster (for 30 MHz channel bandwidth) and 6 MHz for the variant channel bandwidths 5, 10 and 15 MHz. The channel raster is set to even centre frequencies. See Figure 15 to Figure 18.

5.6.2 PTP 45600 Transmit Power Reduction at the Band Edges

The PTP 45600 product variant does not apply any band edge power reduction.

5.7 PTP 49600 Specific Frequency Planning Considerations

New section, to be completed.

5.8 PTP 54600 Specific Frequency Planning Considerations

Adjustment of the lower centre frequency allows the operator to slide the available frequency settings up and down the 5.4 GHz band. See Figure 19 to Figure 22.

NOTE: Not all channels are available in all Region Codes.

Figure 19 - 5.4 GHz Available Spectrum Settings - 30 MHz Channel Bandwidth

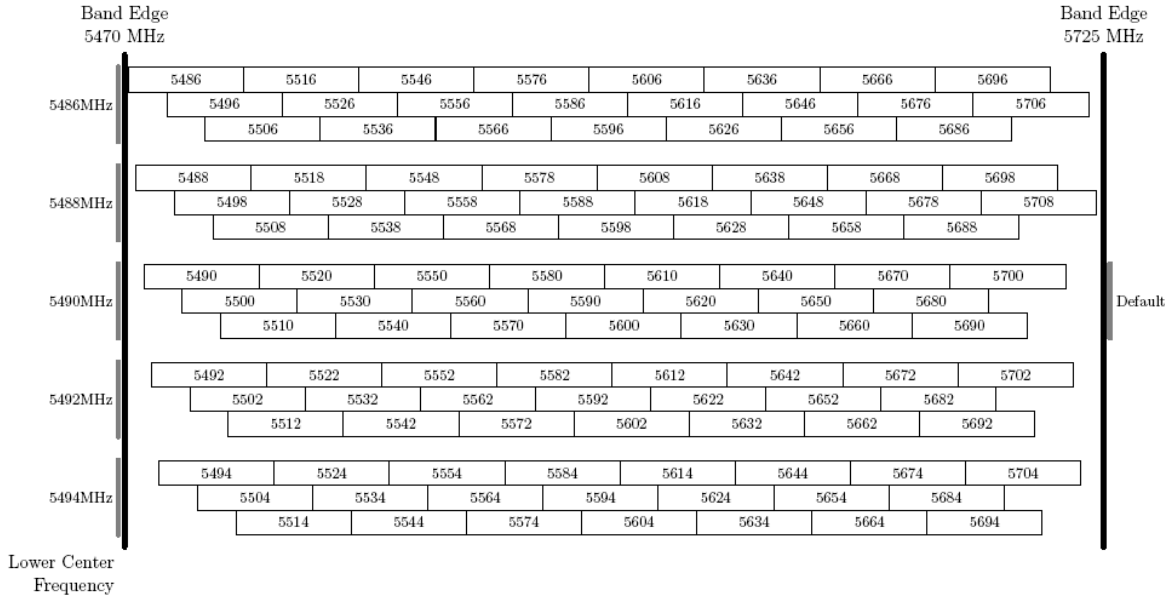


Figure 20 - 5.4 GHz Available Spectrum Settings - 15 MHz Channel Bandwidth

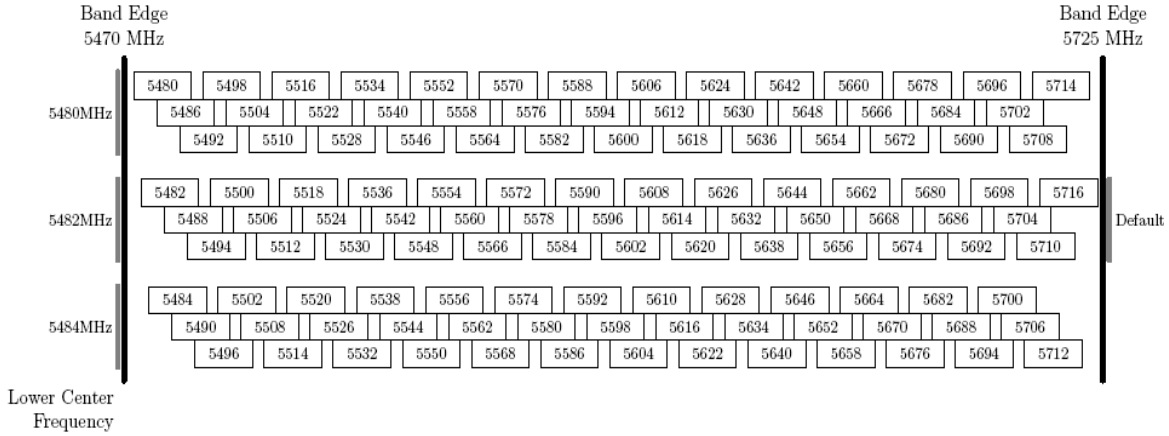


Figure 21 - 5.4 GHz Available Spectrum Settings - 10 MHz Channel Bandwidth

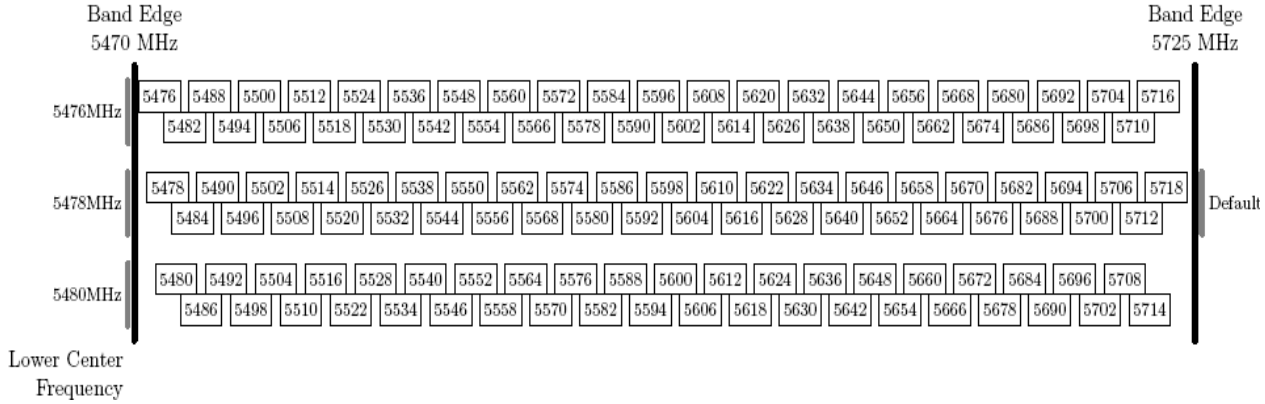
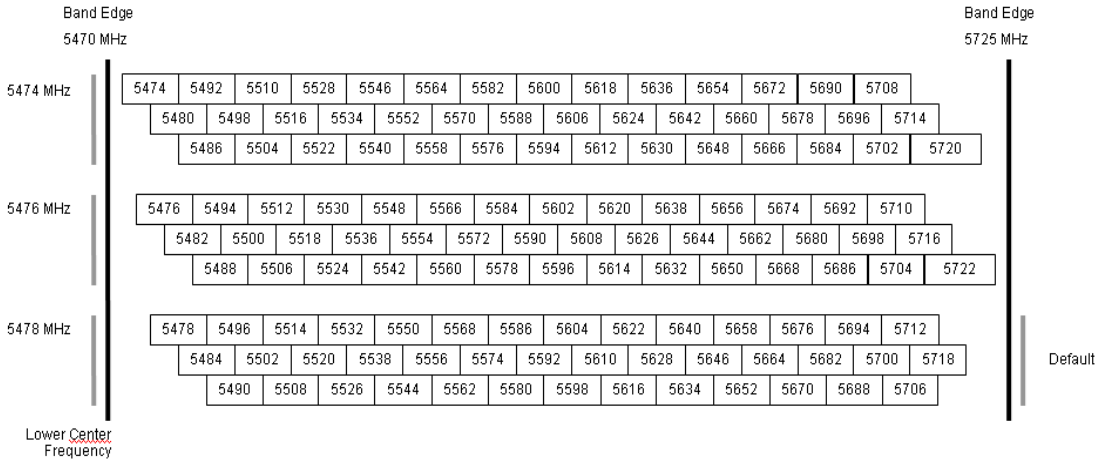


Figure 22 - 5.4 GHz Available Spectrum Settings - 5 MHz Channel Bandwidth



5.8.1 PTP 54600 Raster Considerations:

The PTP 54600 variant operates on a 10 MHz channel raster (for 30 MHz channel bandwidth) and 6 MHz for the variant channel bandwidths 5, 10 and 15 MHz. The channel raster is set to even centre frequencies. See Figure 19 to Figure 22.

5.8.2 Transmit Power Reduction at the Band Edges

The PTP 54600 product variant does not apply any band edge power reduction.

5.9 PTP 58600 Specific Frequency Planning Considerations

Adjustment of the lower center frequency allows the operator to slide the available frequency settings up and down the 5.8 GHz bands. Figure 23 to Figure 26 show the available spectrum depending on the channel width (30 MHz, 15 MHz, 10 MHz and 5 MHz respectively).

NOTE: Not all channels are available in all Region Codes.

Figure 23 - 5.8 GHz Available Spectrum Settings – 30 MHz Channel Bandwidth

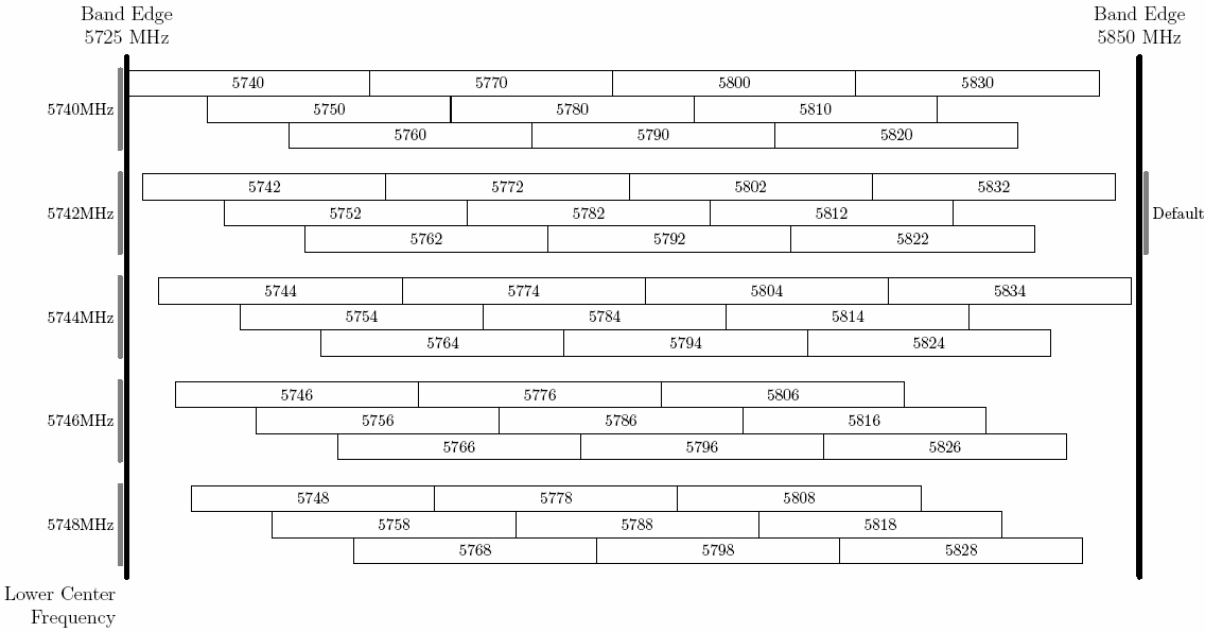


Figure 24 - 5.8 GHz Available Spectrum Settings - 15 MHz Channel Bandwidth

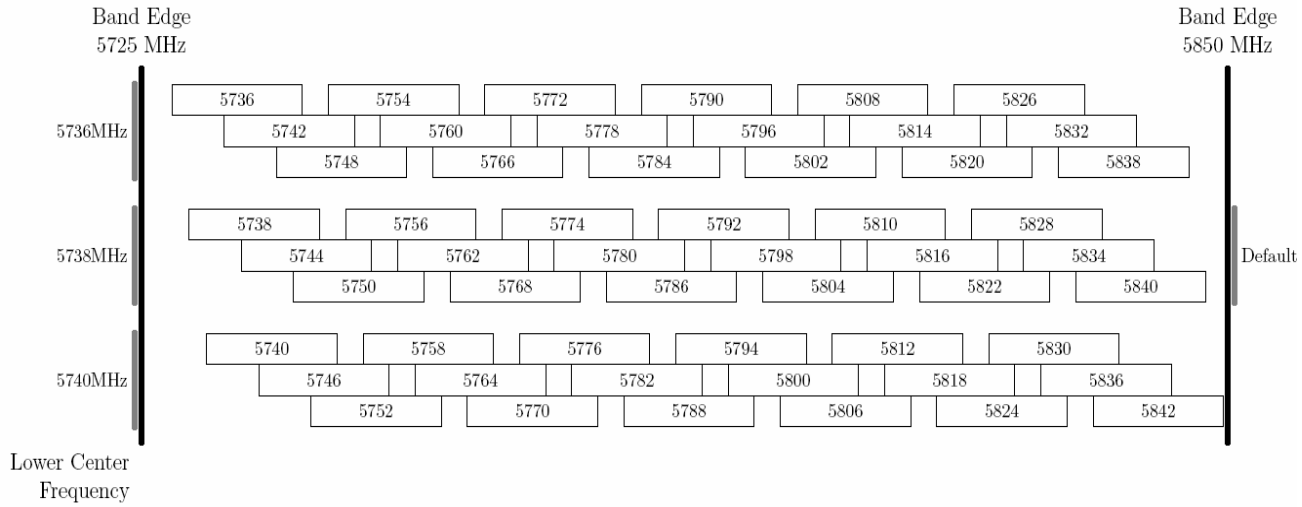


Figure 25 - 5.8 GHz Available Spectrum Settings - 10 MHz Channel Bandwidth

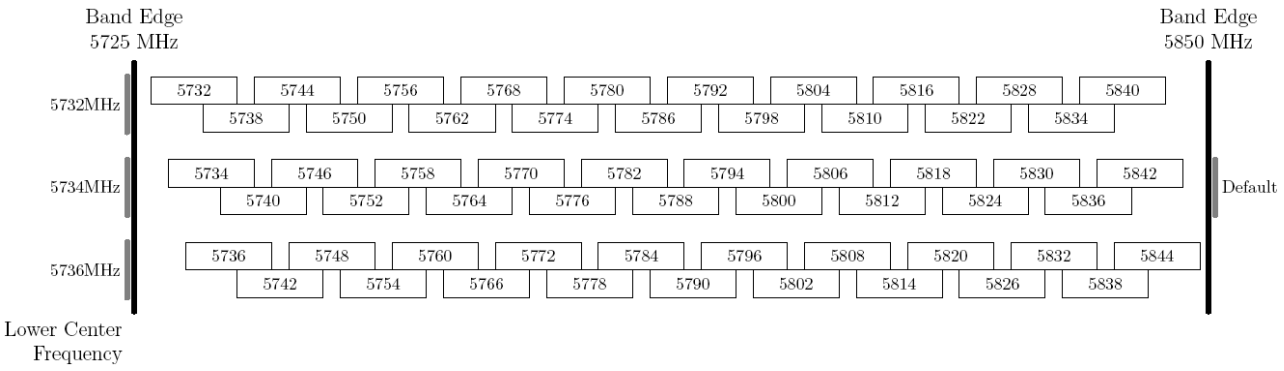
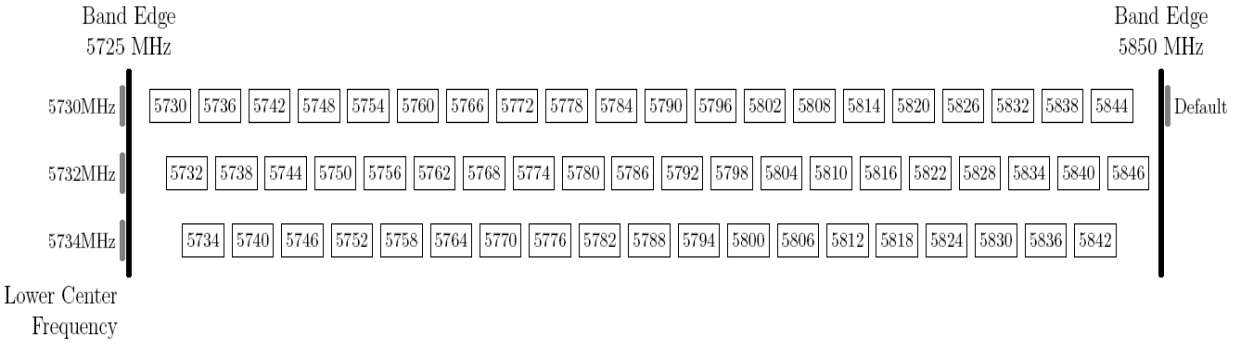


Figure 26 - 5.8 GHz Available Spectrum Settings - 5 MHz Channel Bandwidth



5.9.1 PTP 58600 Raster Considerations

The PTP 58600 variant operates on a 10 MHz channel raster (for 30 MHz channel bandwidth) and 6 MHz for the variant channel bandwidths 5, 10 and 15 MHz. The channel raster is set to even center frequencies. See Figure 23 to Figure 26.

5.9.2 PTP 58600 Transmit Power Reduction at the Band Edges

Operation at or near the 5.8 GHz band edges can results in a lower maximum transmit power. In some configurations the PTP 600 Series Bridge solution reduces the power when operating at the edge channels. The amount of reduction, if any, is dependant on the region code of the region of operation. This currently only affects systems configured with Region Code 1. The power reduction in the edge channels for 5 MHz, 10 MHz and 15 MHz is presented in Table 14 (for region code 1 ONLY).

Table 14 – PTP 58600 Band Edge Tx Power Reduction

Power Levels for Channel Centre	Channel Width (MHz)			
	5	10	15	30
5730	25	N/A	N/A	N/A
5732	25	23	N/A	N/A
5734	25	25	1N/A	N/A
5736	25	25	23	N/A
5738	25	25	25	N/A
5740	25	25	25	17
5742 -5832	25	25	25	21
5834	25	25	25	17
5840	25	25	23	N/A
5842	25	23	19	N/A
5844	25	19	N/A	N/A
5846	23	N/A	N/A	N/A

5.10 PTP 59600 Specific Frequency Planning Considerations

Adjustment of the lower center frequency allows the operator to slide the available frequency settings up and down the 5.9 GHz bands. Figure 27 to Figure 30 show the available spectrum depending on the channel width (30 MHz, 15 MHz, 10 MHz and 5 MHz respectively).

Figure 27 - 5.9 GHz Available Spectrum Settings – 30 MHz Channel Bandwidth

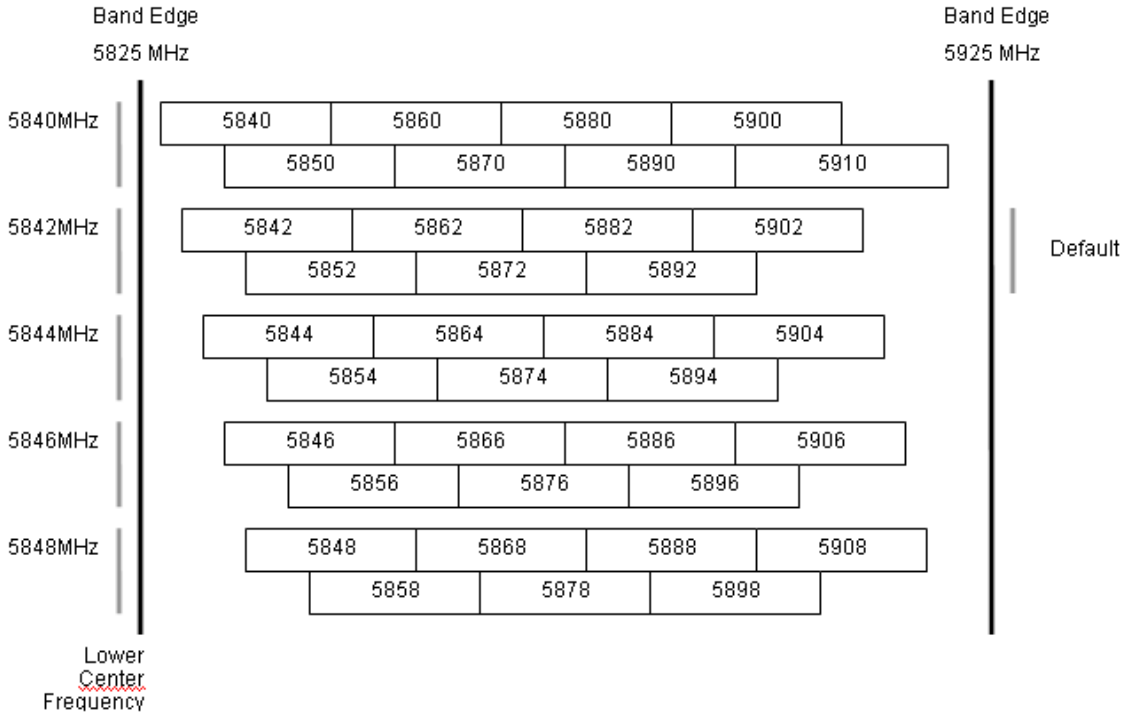


Figure 28 - 5.9 GHz Available Spectrum Settings - 15 MHz Channel Bandwidth

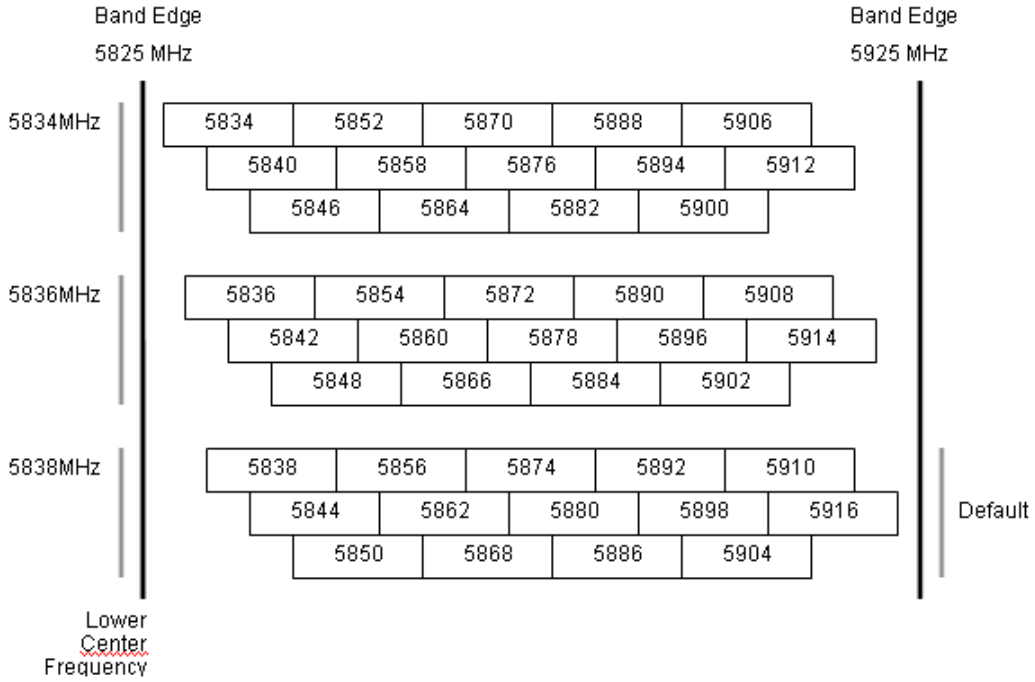


Figure 29 - 5.9 GHz Available Spectrum Settings - 10 MHz Channel Bandwidth

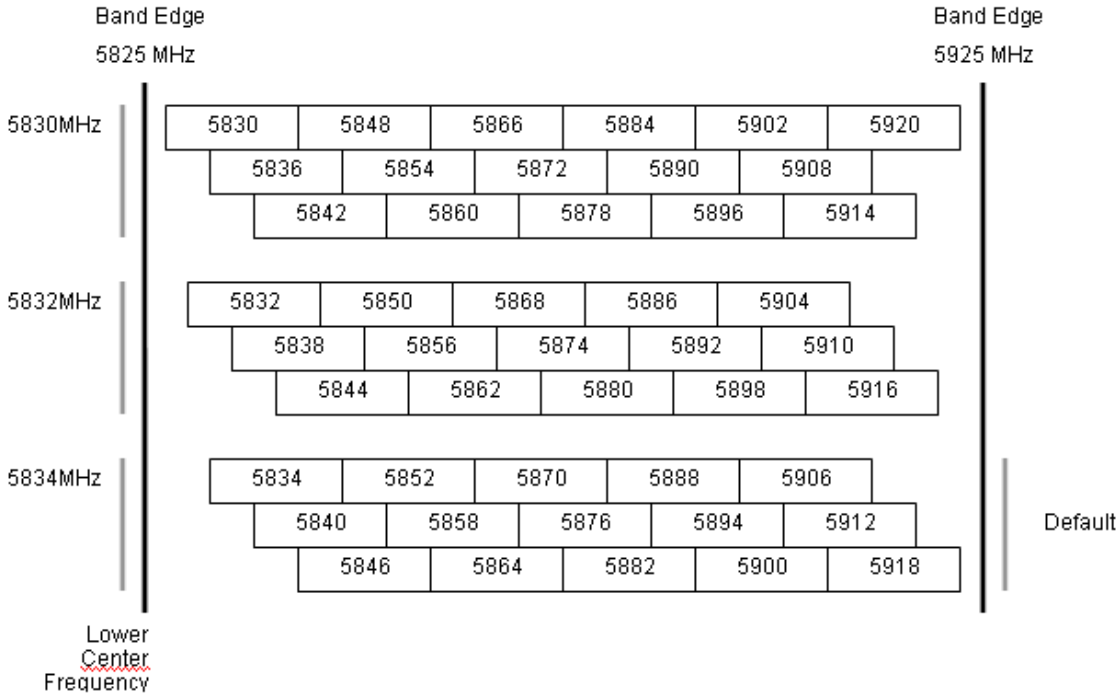
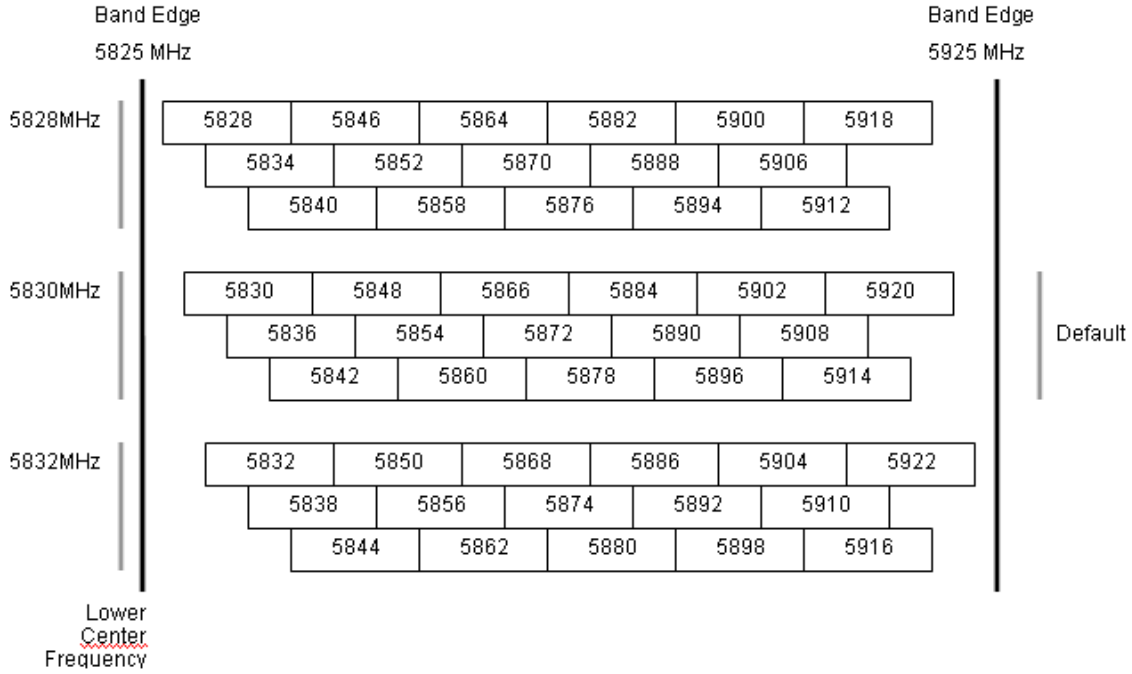


Figure 30 - 5.9 GHz Available Spectrum Settings - 5 MHz Channel Bandwidth



5.10.1 PTP 59600 Raster Considerations

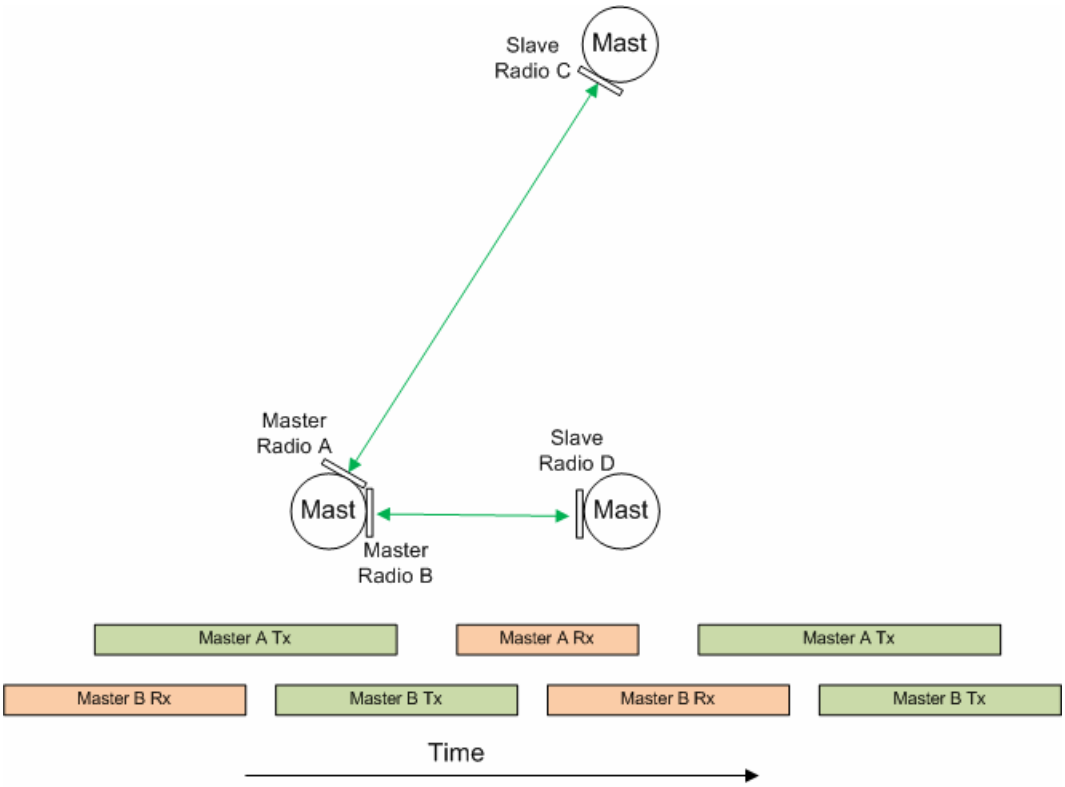
The PTP 59600 variant operates on a 10 MHz channel raster (for 30 MHz channel bandwidth) and 6 MHz for the variant channel bandwidths 5, 10 and 15 MHz. The channel raster is set to even center frequencies. See Figure 27 to Figure 30.

5.11 Time Division Duplex (TDD) Synchronization

5.11.1 Introduction

In a TDD system, a radio transmits for a portion of the radio frame and receives in a different portion of the frame. Motorola PTP600 links consist of a Master unit and a Slave unit with the Master transmitting for the rst part of the radio frame (Slave receiving) and the Slave transmitting in the remainder of the radio frame (Master receiving). The portion of the frame apportioned to each period can be dynamic, for example in IP optimisation mode where the split is a function of the offered traffic in each direction. However, if the frames of the two links are not aligned in time, then an interference mechanism exists where one Master unit may be transmitting when the Master unit from the other link is receiving. A similar mechanism exists for Slave units. The level of interference becomes very signicant when the units are located in close proximity, for example when units are located on the same mast. This problem is illustrated in Figure 31 where it can be seen that transmissions from Master unit A overlap with the receive portion of Master unit B and vice versa.

Figure 31 - Co-location of Links Interference Problem - A Simple Example

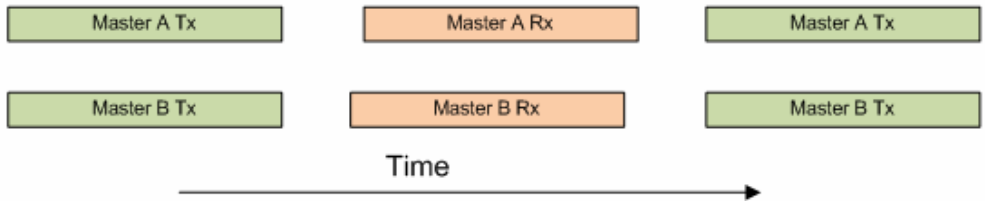


Interference can be minimised by increasing the radio channel separation between units which are in close proximity, for example for units on the same mast. This may not always be possible if the mast is hosting a large number of links and if spectrum is limited. Also, the achieved reduction may not always be sufficient. Another way to reduce interference is to reduce the transmit power of an interfering radio. Again, this may not always be possible if the link causing the interference does not itself have sufficient radio gain margin to allow the power of its radios to be reduced.

5.11.2 TDD Synchronization

TDD synchronization overcomes these issues by aligning the radio frame of all links in the network such that all Master units transmit at the same time and receive at the same time. This eliminates interference between units on the same mast if the units on the mast are configured as Master units. This illustrated in Figure 28 where the frames of the two links are aligned in time.

Figure 32 TDD Synchronization And Co location Example



Due to propagation delay, a mechanism exists where an interfering signal from a remote Master unit arrives at a victim Master delayed in time. This would occur when Master units are installed on different masts. Similarly, an interfering signal from a remote Slave unit will arrive at a victim Slave unit delayed in time. Correct configuration of TDD synchronization ensures that the delayed signals do not overlap with the receive portion of the victim frame. In order to eliminate the interference from delayed signals, the configuration and the resulting TDD frame structure will actually depend upon characteristics of the overall network such as the longest link and the maximum distance between interfering Master units and interfering Slave units. The installation wizard requests that these parameters are entered when TDD synchronization is enabled. This is covered in detail in Section 14 “TDD Synchronization Configuration and Installation Guide”.

5.11.3 Implementation of TDD Synchronization

TDD synchronization is achieved by connecting each Master unit to a GPS Synchronization Unit. Installation details are covered in Section 14 “TDD Synchronization Configuration and Installation Guide”. The GPS unit provides the Master unit with a precise 1Hz signal where the leading edge occurs at the same point in time for all units in the network which have been locked to the GPS Satellite system. The Master radio then aligns its radio frame to start on the leading edge of the 1Hz signal.

5.11.4 System Constraints with TDD Synchronization Enabled

The following constraints apply when TDD synchronization is enabled:

- As the radio frame needs to be aligned across the network, the apportioning of the frame between the two link directions can no longer be dynamic. The split is fixed at 50:50.
- In order that the start of the radio frame can always align with the leading edge of the 1Hz signal, the radio frame duration must be an integer fraction of 1s. The exact frame length is calculated by the installation wizard as a function of the network characteristics such as longest link, and longest distance between interfering masters and interfering slaves.
- TDD synchronisation is a feature which enables a network of links to co-exist. A major part of network design is concerned with frequency planning which is required in order to minimise interference between links. It is therefore reasonable that when TDD synchronisation is enabled, the radio is configured for a specific fixed frequency selected as part of the network design. As such, Intelligent Dynamic Frequency Selection (iDFS) is disabled.
- It is not possible to enable TDD synchronisation in regions where radar avoidance is enabled. This is because radar avoidance requires the random selection of frequency after detection, rather than a fixed frequency which is selected as part of a network design.

5.12 Distance

The PTP 600 Series Bridge will operate at ranges from 100 m (330 ft) to 200 km (124 miles), within 3 modes: 0-40km (0-25 miles), 0-100km (0-62 miles) and 0-200km (0-124 miles). Operation of the system will depend on obstacles in the path between the units. Operation at 40 km (25 miles) or above will require a near line-of-sight path. Operation at 100m (330 ft) could be achieved with one unit totally obscured from the other unit, but with the penalty of transmitting at higher power in a non-optimal direction, thereby increasing interference in the band. This subject is covered in more detail in Section 6.1.3 “Path Loss Considerations“.

5.13 Networking Information

The PTP 600 Series Bridge operates as a transparent Ethernet bridge. Although each unit requires an IP address, this IP address is for management purposes only, and it plays no part in the forwarding of bridged Ethernet frames. IP addresses are assigned during initial configuration as described in Section 7.2 “Installation Procedure”.

5.14 Lightning Protection

The amount of lightning protection is dependent on regulatory requirements and the end user requirements. The standard ODU for the PTP 600 Series Bridge is fitted with surge limiting circuits and other features to minimize the risk of damage due to nearby lightning strikes. These standard features may require some additional equipment to be configured as part of the system installation to be fully effective.

CAUTION: Motorola recommends the use of screened cable and Lightning Protection units to protect connected equipment from nearby strikes.

NOTE: The PTP 600 Series Bridge is not designed to survive direct lightning strikes. For this reason the unit should not be installed as the highest point in a localized area, unless specific precautions are taken. See Section 11 “Lightning Protection”.

5.15 Electrical Requirements

The PTP 600 Series Bridge requires one mains supply outlet at each end of the link to plug in the PIDU Plus units. See Section 3.3.2 “PIDU Plus – PTP 600 Series Bridge”.

6 Site Planning

6.1 Site Selection Criteria

The following are guidelines for selecting the installation location of the ODU and PIDU Plus for a PTP 600 Series Bridge.

6.1.1 ODU Site Selection

When selecting a site for the ODU the following should be taken into consideration:

- It is not possible for people to stand or walk inadvertently in front of the antenna
- Height and location to achieve the best radio path
- Height in relation to other objects with regard to lightning strikes
- Aesthetics and planning permission issues
- Distance from the ODU and connected Network equipment (Maximum cable run from the ODU to the connected equipment is 100m [330 ft])
- Distance from the PIDU Plus to the ODU (Maximum cable run from the PIDU Plus to the ODU is 300m [990 ft] when using the Fiber interface)
- If using the GPS Sync Unit, ensure that it is exposed to an unobstructed path to the sky. Please refer to the “GPS Synchronization Unit Kit” User Manual delivered with the kit.

6.1.2 PTP 600 Series Bridge PIDU Plus Site Selection

When selecting a site for the PIDU Plus the following should be taken into consideration:

- Availability of a mains electricity supply
- Accessibility for viewing status indicators and pressing Recovery switch.

6.1.3 Path Loss Considerations

The path loss is the amount of attenuation the radio signal undergoes between the two ends of the link. The path loss is the sum of the attenuation of the path if there were no obstacles in the way (Free Space Path Loss), the attenuation caused by obstacles (Excess Path Loss) and a margin to allow for possible fading of the radio signal (Fade Margin).

Equation 1 - Path Loss

$$L_{free\_space} + L_{excess} + L_{fade} + L_{seasonal} < L_{capability}$$

Where

L_{free_space}	Free Space Path Loss (dB)
L_{excess}	Excess Path Loss (dB)
L_{fade}	Fade Margin Required (dB)
$L_{seasonal}$	Seasonal Fading (dB)
$L_{capability}$	Equipment Capability (dB)

6.1.4 Definitions

The equipment capability is given in Table 15 to Table 24. Each table gives Link Loss, Output Power and System Thresholds for PTP 600 Series Bridge in all modulation modes for all channel bandwidths (5 MHz, 10 MHz, 15 MHz and 30 MHz). Adaptive Modulation will ensure that the highest throughput that can be achieved instantaneously will be obtained taking account of propagation and interference. The calculation of Equation 1 needs to be performed to judge whether a particular link can be installed. When the link has been installed, web pages provide information about the link loss currently measured by the equipment both instantaneously and averaged. The averaged value will require maximum seasonal fading to be added, and then the radio reliability of the link can be computed.

For minimum error rates on TDM links the maximum modulation mode should be limited to 64QAM 0.75.

The values for (BPSK) are static receive sensitivity measurements. The other values are static receive sensitivity measurements with an AMOD threshold applied. The AMOD threshold applied is for a benign radio channel.

Sensitivity: Sensitivity is defined as the combined receive input signal level on both horizontal and vertical inputs that produces a Null BER Error ratio of $3x10^{-7}$.

Output Power: The output power is for a centre channel in Region 1. The output power will be reduced on the edge channels and may vary if different region codes are selected.

AMOD Threshold: The AMOD threshold is the combined receive input signal level on both horizontal and vertical inputs that results in the link consistently entering the receive modulation mode under consideration as the signal level is increased.

System Threshold: Thresholds for all modes except BPSK are for the relevant link optimization AMOD thresholds. System threshold for BPSK is the RPSK receive sensitivity.

Max Link Loss: The maximum link loss for each modulation mode is derived from the AMOD threshold for that mode (sensitivity threshold for BPSK) and the maximum Region 1 centre channel output power. The figures assume integral antennas with 23 dBi (5.9 GHz, 5.8 GHz and 5.4 GHz) or 18 dBi (2.5 GHz) gain are used.

6.1.5 PTP 25600 Product Variant - Link Loss, Output Power and System Threshold versus Modulation Mode

Table 15 - PTP 25600 - IP Mode – Loss, Output Power and System Threshold Vs Modulation Mode

Modulation Mode	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
	Channel Bandwidth (MHz)								
	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-97.57	-95.14	-92.95	-90.39	+23	156.6	154.1	152.0	149.4
QPSK 0.63 single	-93.87	-90.66	-90.49	-86.65	+23	152.9	149.7	146.6	145.7
QPSK 0.87 single	-90.72	-87.60	-87.45	-83.94	+23	149.7	146.6	146.5	142.9
16QAM 0.63 single	-89.06	-85.98	-86.02	-82.11	+23	148.0	145.5	145.0	140.4
16QAM 0.63 dual	-86.71	-83.93	-83.96	-79.43	+23	145.7	142.9	143.0	138.4
16QAM 0.87 single	-84.21	-82.45	-80.52	-76.50	+23	143.2	141.4	139.5	135.5
16QAM 0.87 dual	-80.97	-77.65	-77.44	-72.92	+23	140.0	136.6	136.4	131.9
64QAM 0.75 single	-81.61	-79.24	-77.42	-73.45	+23	140.6	138.2	136.4	132.4
64QAM 0.75 dual	-77.83	-74.71	-74.34	-69.81	+23	136.8	133.7	133.3	128.8
64QAM 0.92 single	-78.80	-76.25	-74.42	-70.27	+23	137.8	135.2	133.4	129.3
64QAM 0.92 dual	-75.46	-71.32	-71.88	-66.51	+23	134.5	130.3	130.9	125.5
256QAM 0.81 single	-77.17	-74.94	-72.92	-68.81	+23	136.2	133.9	131.9	127.8
256QAM 0.81 dual	-73.53	-70.07	-69.68	-65.14	+23	132.5	129.1	128.7	124.1

Table 16 - PTP 25600 - TDM Mode – Loss, Output Power and System Threshold Vs Modulation Mode

Modulation Mode	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
	Channel Bandwidth (MHz)								
	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-97.57	-95.14	-92.95	-90.39	+23	156.6	154.1	152.0	149.4
QPSK 0.63 single	-91.55	-89.12	-88.20	-85.19	+23	150.6	148.1	147.2	144.2
QPSK 0.87 single	-88.28	-85.58	-85.12	-81.51	+23	147.3	144.6	144.1	140.5
16QAM 0.63 single	-86.37	-83.86	-83.45	-79.36	+23	145.4	142.9	142.5	138.4
16QAM 0.63 dual	-84.18	-80.79	-80.73	-76.62	+23	143.2	139.8	139.7	135.6
16QAM 0.87 single	-81.68	-78.11	-77.27	-73.64	+23	140.7	137.1	136.3	132.6
16QAM 0.87 dual	-78.64	-74.42	-74.30	-70.03	+23	137.6	133.4	133.3	129.0
64QAM 0.75 single	-78.76	-75.24	-74.19	-70.55	+23	137.8	134.2	133.2	129.6
64QAM 0.75 dual	-75.39	-70.99	-70.86	-66.72	+23	134.4	130.0	129.9	125.7
64QAM 0.92 single	-76.04	-73.44	-72.15	-68.64	+23	135.0	132.4	131.2	127.6
64QAM 0.92 dual	-73.49	-69.25	-68.92	-64.84	+23	132.5	128.2	127.9	123.8
256QAM 0.81 single	-73.39	-71.63	-69.11	-65.41	+23	132.4	130.6	128.1	124.4
256QAM 0.81 dual	-70.44	-67.58	-65.89	-61.62	+23	129.4	126.6	124.9	120.6

6.1.6 PTP 45600 Product Variant - Link Loss, Output Power and System Threshold versus Modulation Mode

Table 17 - PTP 45600 - IP Mode – Loss, Output Power and System Threshold Vs Modulation Mode

Modulation Mode	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
	Channel Bandwidth (MHz)								
	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-97.86	-95.25	-93.00	-89.56	+25	165.9	163.3	161.0	157.6
QPSK 0.63 single	-93.13	-90.51	-88.91	-84.62	+25	161.1	158.5	156.9	152.6
QPSK 0.87 single	-89.69	-86.28	-84.17	-81.34	+25	157.7	154.3	152.2	149.3
16QAM 0.63 single	-87.58	-84.00	-81.85	-79.06	+25	155.6	152.0	149.9	147.1
16QAM 0.63 dual	-84.34	-80.96	-79.19	-76.33	+25	152.3	149.0	147.2	144.3
16QAM 0.87 single	-81.26	-77.89	-75.92	-72.45	+25	149.3	145.9	143.9	140.5
16QAM 0.87 dual	-77.69	-73.70	-71.96	-69.10	+25	145.7	141.7	140.0	137.1
64QAM 0.75 single	-78.02	-74.28	-72.47	-69.24	+25	146.0	142.3	140.5	137.2
64QAM 0.75 dual	-74.18	-70.29	-68.62	-65.93	+25	142.2	138.3	136.6	133.9
64QAM 0.92 single	-74.27	-71.62	-69.63	-66.51	+25	142.3	139.6	137.6	134.5
64QAM 0.92 dual	-71.69	-68.04	-66.47	-63.27	+25	139.7	136.0	134.5	131.3
256QAM 0.81 single	N/A	N/A	N/A	-64.50	+25	N/A	N/A	N/A	132.5
256QAM 0.81 dual	N/A	N/A	N/A	-60.48	+25	N/A	N/A	NA	128.5

Table 18 - PTP 45600 - TDM Mode – Loss, Output Power and System Threshold Vs Modulation Mode

Modulation Mode	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
	Channel Bandwidth (MHz)								
	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-97.86	-95.25	-93.00	-89.56	+25	165.9	163.3	161.0	157.6
QPSK 0.63 single	-90.42	-88.78	-85.56	-82.82	+25	158.4	156.8	153.6	150.8
QPSK 0.87 single	-86.07	-84.02	-80.83	-78.67	+25	154.1	152.0	148.8	146.7
16QAM 0.63 single	-83.53	-81.83	-78.74	-76.39	+25	151.5	149.8	146.7	144.4
16QAM 0.63 dual	-80.70	-78.86	-75.74	-73.35	+25	148.7	146.9	143.7	141.4
16QAM 0.87 single	-77.12	-73.86	-72.03	-69.25	+25	145.1	141.9	140.0	137.2
16QAM 0.87 dual	-73.48	-71.50	-68.68	-66.77	+25	141.5	139.5	136.7	134.8
64QAM 0.75 single	-73.07	-70.39	-68.65	-66.06	+25	141.1	138.4	136.7	134.1
64QAM 0.75 dual	-69.60	-68.30	-65.37	-63.38	+25	137.6	136.3	133.4	131.4
64QAM 0.92 single	-70.51	-68.26	-66.52	-63.93	+25	138.5	136.3	134.5	131.9
64QAM 0.92 dual	-67.27	-66.03	-63.11	-60.04	+25	135.3	134.0	131.1	128.0
256QAM 0.81 single	N/A	N/A	N/A	-63.93	+25	N/A	N/A	N/A	131.9
256QAM 0.81 dual	N/A	N/A	N/A	-60.04	+25	N/A	N/A	N/A	128.0

6.1.7 PTP 54600 Product Variant - Link Loss, Output Power and System Thresholds versus Modulation Mode

Table 19 – PTP 54600 - IP Mode - Link Loss, Output Power, System Threshold Vs Modulation Mode

Modulation Mode	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
	Channel Bandwidth (MHz)								
	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-98.24	-94.58	-92.26	-88.90	+25	169.2	165.6	163.3	159.9
QPSK 0.63 single	-93.02	-89.99	-88.50	-82.86	+24	163.0	160.0	158.5	152.9
QPSK 0.87 single	-90.23	-86.68	-85.25	-80.10	+23	159.2	155.7	154.3	149.1
16QAM 0.63 single	-87.98	-83.75	-82.82	-78.33	+22	156.0	151.8	150.8	146.3
16QAM 0.63 dual	-84.29	-80.68	-79.32	-74.64	+22	152.3	148.7	147.3	142.6
16QAM 0.87 single	-82.44	-79.10	-78.20	-72.98	+20	148.4	145.1	144.2	139.0
16QAM 0.87 dual	-79.65	-75.74	-74.67	-70.58	+20	145.7	141.7	140.7	136.6
64QAM 0.75 single	-78.93	-76.44	-74.93	-70.28	+18	142.9	140.4	138.9	134.3
64QAM 0.75 dual	-76.45	-72.74	-71.55	-67.69	+18	140.5	136.7	135.6	131.7
64QAM 0.92 single	-74.40	-71.66	-70.42	-64.96	+18	138.4	135.7	134.4	129.0
64 QAM 0.92 dual	-70.65	-68.51	-66.88	-62.33	+18	134.7	132.5	130.9	126.3
256QAM 0.81 single	N/A	N/A	N/A	-63.63	+18	N/A	N/A	N/A	127.6
256QAM 0.81 dual	N/A	N/A	N/A	-60.46	+18	N/A	N/A	N/A	124.5

Table 20 – PTP 54600 - TDM Mode - Link Loss, Output Power, System Threshold Vs Modulation Mode

Modulation Mode	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
	Channel Bandwidth (MHz)								
	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-98.24	-94.58	-92.26	-88.90	+25	169.2	165.6	163.3	159.9
QPSK 0.63 single	-89.70	-88.28	-86.35	-81.35	+24	159.7	158.3	156.4	151.4
QPSK 0.87 single	-86.70	-84.30	-82.34	-78.42	+23	155.6	153.3	151.3	147.4
16QAM 0.63 single	-86.56	-81.81	-79.91	-75.99	+22	151.7	149.8	147.9	144.0
16QAM 0.63 dual	-83.70	-78.23	-76.54	-72.41	+22	148.8	146.3	144.5	140.4
16QAM 0.87 single	-78.75	-76.61	-75.47	-69.76	+20	144.8	142.6	141.5	135.8
16QAM 0.87 dual	-76.92	-73.85	-72.19	-68.70	+20	142.9	139.9	138.2	134.7
64QAM 0.75 single	-74.66	-72.21	-71.77	-66.59	+18	138.7	136.2	135.8	130.6
64QAM 0.75 dual	-73.00	-70.41	-68.79	-65.63	+18	137.0	134.4	132.8	129.6
64QAM 0.92 single	-70.91	-68.59	-67.40	-62.94	+18	134.9	132.6	131.4	126.9
64 QAM 0.92 dual	-68.15	-65.62	-64.23	-60.50	+18	132.1	129.6	128.2	124.5
256QAM 0.81 single	N/A	N/A	N/A	-65.36	+18	N/A	N/A	N/A	126.9
256QAM 0.81 dual	N/A	N/A	N/A	-60.50	+18	N/A	N/A	N/A	124.5

6.1.8 PTP 58600 Product Variant - Link Loss, Output Power and System Thresholds versus Modulation Mode

Table 21 - PTP 58600 - IP Mode - Link Loss, Output Power, System Threshold Vs Modulation Mode

Modulation Mode	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
	Channel Bandwidth (MHz)								
	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-95.05	-92.51	-90.78	-86.33	+25	166.1	163.5	161.8	157.3
QPSK 0.63 single	-91.86	-90.04	-87.73	-83.00	+24	161.9	160.0	157.7	153.0
QPSK 0.87 single	-88.69	-86.64	-84.84	-80.26	+23	157.7	155.6	153.8	149.3
16QAM 0.63 single	-85.99	-84.31	-82.44	-78.34	+22	154.0	152.3	150.4	146.3
16QAM 0.63 dual	-83.46	-80.36	-78.51	-75.34	+22	151.5	148.4	146.5	143.3
16QAM 0.87 single	-82.12	-79.50	-78.13	-72.47	+20	148.1	145.5	144.1	138.5
16QAM 0.87 dual	-79.24	-76.21	-73.92	-71.49	+20	145.2	142.2	139.9	137.5
64QAM 0.75 single	-78.82	-76.70	-75.20	-69.16	+18	142.8	140.7	139.2	133.2
64QAM 0.75 dual	-76.14	-73.14	-70.99	-67.67	+18	140.1	137.1	135.0	131.7
64QAM 0.92 single	-74.40	-72.48	-66.24	-64.98	+18	138.4	136.5	134.6	129.0
64 QAM 0.92 dual	-70.23	-69.07	-70.69	-61.53	+18	134.2	133.1	130.2	125.5
256QAM 0.81 single	N/A	N/A	N/A	-64.03	+18	N/A	N/A	N/A	128.0
256QAM 0.81 dual	N/A	N/A	N/A	-59.59	+18	N/A	N/A	N/A	123.6

Table 22 - PTP 58600 - TDM Mode - Link Loss, Output Power, System Threshold Vs Modulation Mode

Modulation Mode	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
	Channel Bandwidth (MHz)								
	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-95.05	-92.51	-90.78	-86.33	+25	166.1	163.5	161.8	157.3
QPSK 0.63 single	-88.70	-87.77	-85.95	-80.59	+24	158.7	157.8	155.9	150.6
QPSK 0.87 single	-85.51	-83.79	-81.56	-77.82	+23	154.5	152.8	150.6	146.8
16QAM 0.63 single	-81.98	-81.26	-79.06	-75.29	+22	150.0	149..3	147.1	143.3
16QAM 0.63 dual	-79.40	-77.58	-75.62	-71.72	+22	147.4	145.6	143.6	139.7
16QAM 0.87 single	-78.66	-76.32	-74.67	-71.21	+20	144.7	142.3	140.7	137.2
16QAM 0.87 dual	-75.05	-73.16	-71.03	-67.73	+20	141.0	139.2	137.0	133.7
64QAM 0.75 single	-74.44	-72.26	-70.64	-67.94	+18	138.4	136.3	134.6	131.9
64QAM 0.75 dual	-70.90	-69.52	-67.59	-64.02	+18	134.9	133.5	131.6	128.0
64QAM 0.92 single	-70.86	-68.01	-66.63	-63.07	+18	134.9	132.0	130.6	127.1
64 QAM 0.92 dual	-66.80	-64.62	-65.52	-58.65	+18	130.8	128.6	126.5	122.7
256QAM 0.81 single	N/A	N/A	N/A	-63.07	+18	N/A	N/A	N/A	127.1
256QAM 0.81 dual	N/A	N/A	N/A	-58.65	+18	N/A	N/A	N/A	122.7

6.1.9 PTP 59600 Product Variant - Link Loss, Output Power and System Thresholds versus Modulation Mode

Table 23 - PTP 59600 - IP Mode - Link Loss, Output Power, System Threshold Vs Modulation Mode

Modulation Mode	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
	Channel Bandwidth (MHz)								
	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-97.11	-94.07	-91.96	-88.66	+25.0	168.1	165.1	163.0	159.7
QPSK 0.63 single	-90.71	-88.06	-87.13	-82.53	+24.0	160.7	158.1	157.1	152.5
QPSK 0.87 single	-87.23	-84.38	-83.50	-79.29	+23.0	156.2	153.4	152.5	148.3
16QAM 0.63 single	-85.04	-81.89	-81.21	-77.10	+22.0	153.0	149.9	149.2	145.1
16QAM 0.63 dual	-81.90	-78.75	-77.47	-73.47	+22.0	149.9	146.8	145.5	141.5
16QAM 0.87 single	-80.90	-77.95	-76.72	-72.87	+20.0	146.9	143.9	142.7	138.9
16QAM 0.87 dual	-76.48	-73.92	-73.19	-70.03	+20.0	142.5	139.9	139.2	136.0
64QAM 0.75 single	-77.02	-74.56	-73.63	-70.28	+18.0	141.0	138.6	137.6	134.3
64QAM 0.75 dual	-73.14	-71.04	-70.40	-67.54	+18.0	137.1	135.0	134.4	131.5
64QAM 0.92 single	-72.09	-70.98	-68.90	-65.65	+18.0	136.1	135.0	132.9	129.7
64 QAM 0.92 dual	-70.20	-67.15	-66.11	-62.07	+18.0	134.2	131.1	130.1	126.1
256QAM 0.81 single	N/A	N/A	N/A	-63.91	+18.0	N/A	N/A	N/A	127.9
256QAM 0.81 dual	N/A	N/A	N/A	-59.88	+18.0	N/A	N/A	N/A	123.9

Table 24 - PTP 59600 - TDM Mode - Link Loss, Output Power, System Threshold Vs Modulation Mode

Modulation Mode	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
	Channel Bandwidth (MHz)								
	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-97.11	-94.07	-91.96	-88.66	+25.0	168.1	165.1	163.0	159.7
QPSK 0.63 single	-88.47	-86.12	-84.37	-79.38	+24.0	158.5	156.1	154.4	149.4
QPSK 0.87 single	-84.64	-81.89	-80.09	-76.00	+23.0	153.6	150.9	149.1	145.0
16QAM 0.63 single	-82.45	-79.60	-77.75	-73.66	+22.0	150.4	147.6	145.8	141.7
16QAM 0.63 dual	-78.81	-75.96	-74.12	-70.42	+22.0	146.8	144.0	142.1	138.4
16QAM 0.87 single	-78.27	-75.07	-73.66	-70.19	+20.0	144.3	141.1	139.7	136.2
16QAM 0.87 dual	-74.23	-71.63	-70.18	-66.89	+20.0	140.2	137.6	134.2	132.9
64QAM 0.75 single	-74.69	-71.38	-70.23	-67.31	+18.0	138.7	135.4	134.2	131.3
64QAM 0.75 dual	-70.85	-68.25	-66.75	-63.60	+18.0	134.8	132.2	130.8	127.6
64QAM 0.92 single	-71.20	-68.05	-66.99	-63.27	+18.0	135.2	132.0	131.0	127.3
64 QAM 0.92 dual	-66.66	-64.17	-62.71	-58.72	+18.0	130.7	128.2	126.7	122.7
256QAM 0.81 single	N/A	N/A	N/A	-63.27	+18.0	N/A	N/A	N/A	127.3
256QAM 0.81 dual	N/A	N/A	N/A	-58.72	+18.0	N/A	N/A	N/A	122.7

7 Installation

IMPORTANT Motorola recommends that only qualified personnel undertake the installation of a PTP 600 Series Bridge solution.

We recommend that the practices and procedures detailed in the Motorola manual R56 "STANDARDS AND GUIDELINES FOR COMMUNICATION SITES" (68P81089E50) be applied to all new site build activities. For a copy of the manual please see your local Motorola representative. The manual can be downloaded from the Motorola Intranet site http://compass.mot.com/go/190860869.

7.1 Preparation

Before proceeding with the installation you should:

- Check the contents of all packages against the parts lists shown in the packing list.
- Ensure that you have the correct tools for the job.
- Ensure that you are qualified to undertake the work.
- Ensure that you have taken the correct safety precautions.
- Have completed the site planning as described in Section 6 “Site Planning”.

7.2 Installation Procedure

The 600 Series installation procedure consists of the following steps:

- Mounting the ODUs, Section 7.6 “Mounting the ODUs”
- Connecting up, Section 7.7 “Connecting Up”
- Mounting the PIDU Plus units, Section 7.7.9 “Mounting the PTP 600 Series Bridge PIDU Plus”
- Mounting the Lightning Protection Units, Section 11.2 “Detailed Installation”.
- Mounting the GPS Sync Unit (if required), Section 14 “TDD Synchronization Configuration and Installation Guide” and refer to the “GPS Sync Unit Kit” User Manual available in your installation CD for specific information related to the GPS Sync Unit.
- Powering Up, Section 7.7.10 “Powering Up”.
- Aligning the ODUs, Section 7.7.11 “Aligning the PTP 600 Series Bridge ODUs”.

7.3 Tools Required

The following specific tools are required to install a PTP 600 Series Bridge in addition to general tools:

- 13mm Spanner / Wrench
- RJ45 Crimp Tool
- IBM Compatible Personal Computer (PC) running Windows 98 or later with 10, 100 or 1000 BaseT Ethernet (Ability to change IP settings easily is recommended)
- Either Internet Explorer version 6 or higher, or FireFox 1.5 or higher are recommended.
- Ethernet patch cable

7.4 Installation Support

Online installation support and contact details for your regional support can be found at http://www.motorola.com/ptp

A Frequently Asked Questions (FAQ) section can be found in Section 21 “FAQs”.

7.5 Legal Disclaimer

IN NO EVENT SHALL MOTOROLA, INC. BE LIABLE FOR ANY INJURY TO ANY PERSONS OR ANY DAMAGE CAUSED DURING THE INSTALLATION OF THE MOTOROLA PTP 600 SERIES PRODUCT.

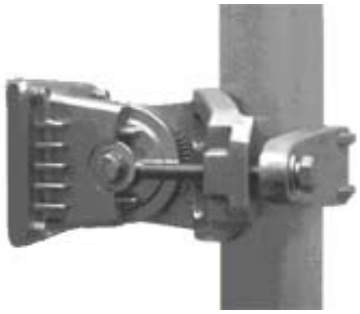
7.6 Mounting the ODUs

The ODU mounting bracket is designed to ease installation by fixing the bracket to a pole and then bringing the ODU into position using a single bolt fixing. The ODU should be mounted using the following steps ensuring that the cable entry is at the bottom.

The ODU mounting bracket is designed to work with poles with diameters in the range 50mm (2") to 75mm (3").

Figure 33 - Mounting to pole diameters 25mm (1") to 50mm (2")

Step 1: Mount the bracket to the pole.



Step 2: Mate the unit to the bracket together and tighten the nut and bolt.

Pole diameters of 25mm (1") to 50mm (2") can be accommodated by inverting the back of the bracket as shown in Figure 33.

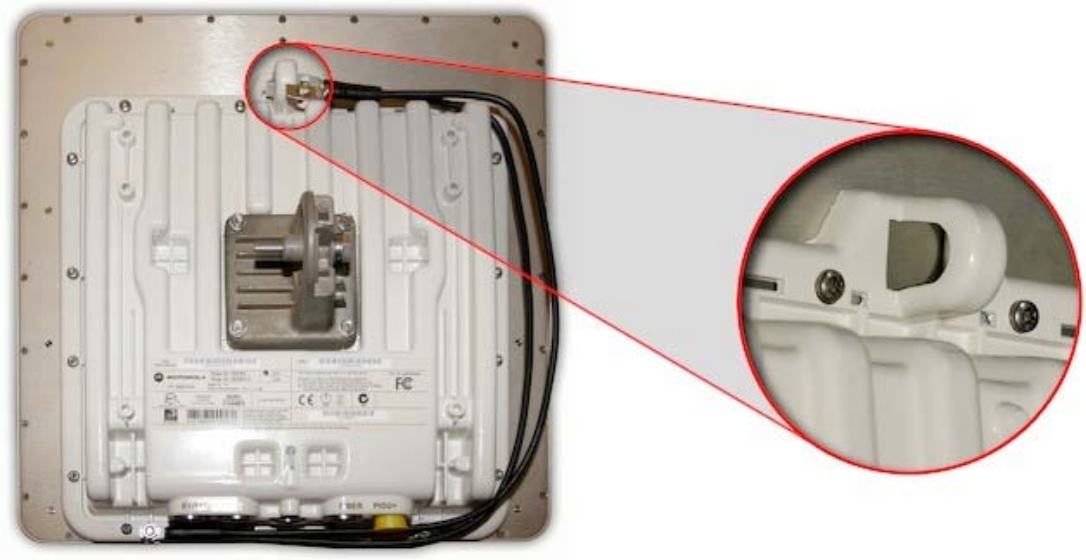
When adjustment is complete tighten all bolts to 14Nm (11lb ft).

CAUTION: Do not over tighten the bolts as bracket failure may occur.

The enclosure and mounting brackets of the PTP 600 Series Bridge product range are capable of withstanding wind speeds up to 151mph (242kph). The installer should ensure that the structure the bridge is fixed to is also capable of withstanding the prevalent wind speeds and loads. See Section 12 "Wind Loading".

WARNING: The integral safety loop should be used both for hoisting the ODU up a mast or building and into position, and also as a fixing point to secure a permanent safety lanyard from the tower/building to the ODU in case of mounting failure.

Figure 34 - Integral Safety Loop



The length of the safety lanyard must not exceed 1m (approx 3 ft) in length. The lanyard should be made from a material that does not degrade in an outdoor environment.

The safety lanyard must be fixed to a separate fixing point that is not part of the direct mounting system for the ODU.

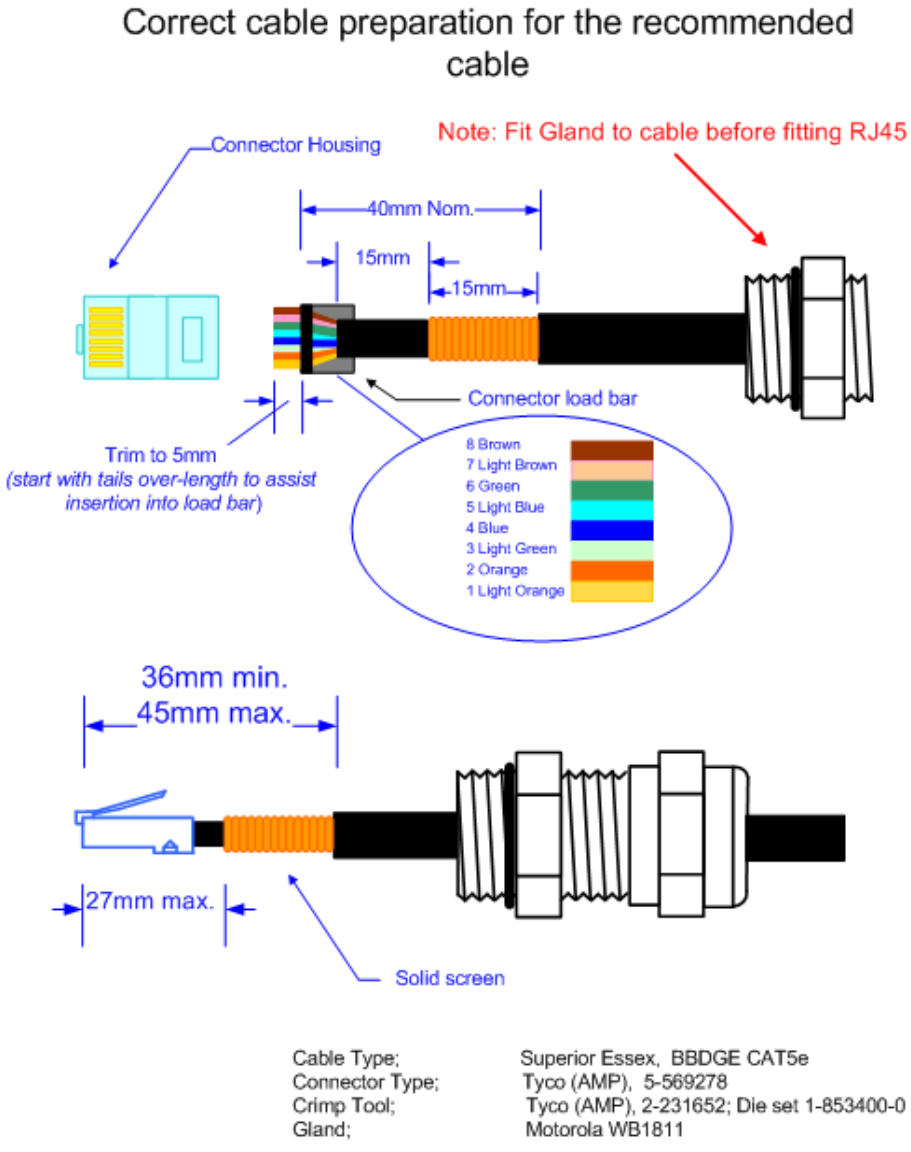
7.7 Connecting Up

7.7.1 Preparing the PIDU Plus To ODU Cable

NOTE: The maximum cable length between the ODU and the user's Network Equipment is 100m (330 ft). Cable lengths up to 300m (984 ft) can be used where the PIDU Plus to ODU cable is supplying power only, that is, when using the PTP 600 Series Bridge Optical Interface.

The cable should be assembled as shown in Figure 35:

Figure 35 - Correct Cable Preparation for the Recommended Cable



CAUTION: Check that the crimp tool matches the RJ45 connector being used.

Both ends of the ODU cable are terminated in the same way. The above procedure should be repeated for the PIDU Plus end of the cable when the cable routing process is complete. This assumes that the installation uses PTP LPUs. If not, then the PIDU Plus end of the cable does not require a Gland, but just the RJ45.

NOTE: The PIDU Plus end of the cable does not employ a cable gland.

Figure 36 shows a completed ODU to PIDU Plus cable.

Figure 36 - Completed ODU Connector

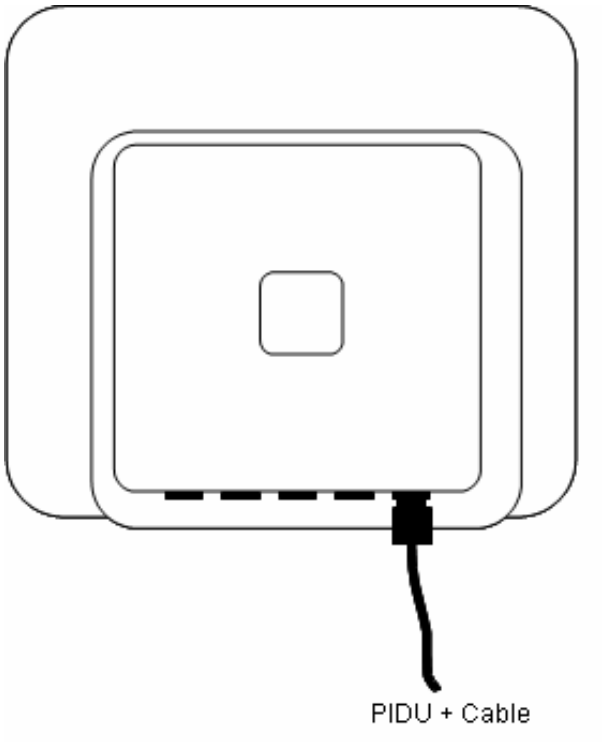
CAUTION: Do not over tighten the glands as the internal seal and structure may be damaged. See Figure 37 for an example of an over tightened cable gland.

Figure 37 - Correct and Incorrect Tightening of Cable Gland

7.7.2 Making the Connections at the ODU

Looking at the back of the unit with the cable entry at the bottom, the PTP 600 Series Bridge PIDU Plus connection is the first hole on the right (Figure 38) and is labeled “PIDU +”.

Figure 38 – PTP 600 Series Bridge PIDU Plus Connexion



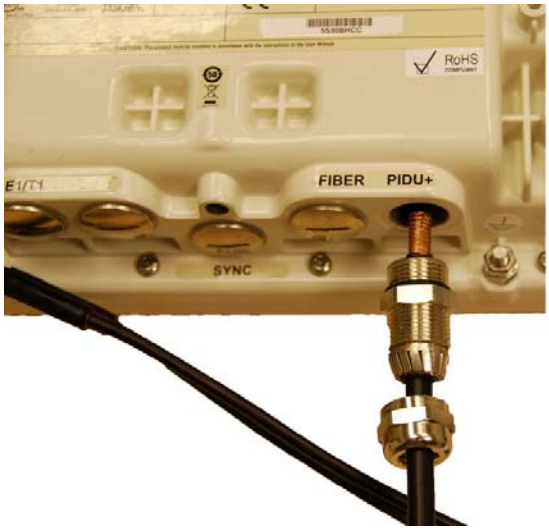
7.7.3 Making the PTP 600 Series Bridge PIDU Plus Connection At The ODU

The following procedure describes how connection is made at the ODU. It is often easier to carry out this procedure on the ground or a suitable surface prior to mounting the ODU.

Ensure that no power is connected to the PIDU Plus or present on the cable before connecting the ODU.

Figure 39 - Connecting the PIDU+ to the ODU

Step 1: Assemble the cable as described in 7.7.1 above



Step 2: Insert the RJ45 connector making sure that the locking tab snaps home

Step 3: Screw in the body of the weather proofing gland and tighten

Step 4: Screw on the clamping nut and tighten (Do not over tighten – see Figure 37)

Should it be necessary to disconnect the PIDU Plus to ODU cable at the ODU, this can be achieved by removing the weather proofing gland and depressing the RJ45 locking tab with a small screwdriver as shown below.

Figure 40 - Disconnecting the ODU

CAUTION: Ensure that power is removed from the system at the PIDU Plus to prevent damage to the ODU while making or breaking the connection.

7.7.4 Routing the Cable

After connecting the cable to the ODU it can be routed and secured using standard cable routing and securing techniques. When the cable is in place it can then be cut to the desired length at the PIDU Plus prior to connection to the PIDU Plus.

7.7.5 Fitting a Lightning Protection Unit

If you have opted to fit a Lightning Protection unit, this should be installed by following the manufacturer's instruction. For recommended types see Section 11 "Lightning Protection".

7.7.6 Grounding the Installation

The Outdoor Unit (ODU) must be properly grounded to protect against power surges. It is the user's responsibility to install the equipment in accordance with Section 810 of the National Electric Code, ANSI/NFPA No.70-1984 or Section 54 of the National Electrical Code in the country of installation. These codes describe correct installation procedures for grounding the outdoor unit, mast, lead-in wire and discharge unit, size of grounding conductors and connection requirements for grounding electrodes. It is recommended that installation of the outdoor unit be contracted to a professional installer.

7.7.7 Making the ODU Connection at the PTP 600 Series Bridge PIDU Plus

The ODU is connected to the PIDU Plus by means of a concealed RJ45 connector. The RJ45 connection has been placed inside the PIDU Plus hinged cover to prevent the user from inadvertently plugging other equipment into the ODU RJ45 socket.

CAUTION: Plugging other equipment into the ODU RJ45 socket may damage the equipment due to the non-standard techniques employed to inject DC power into the 1000BaseT connection between the PIDU Plus and the ODU. Plugging the ODU into other equipment may damage the ODU and/or the other equipment.

Step 1: Undo the retaining screw and hinge back the cover.

Step 2: Plug in the ODU into the PIDU Plus Cable ensuring that it snaps home

Step 3: Replace the cover and secure with the retaining screw

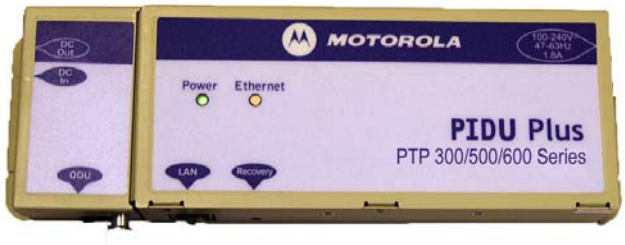
7.7.8 Making the Network Connection at The PIDU Plus – PTP 600 Series Bridge

The Network connection is made by connecting the user's Network Equipment directly to the PIDU Plus LAN port as shown in Figure 41.

Figure 41 - Making the Network Connection at the PIDU Plus

7.7.9 Mounting the PTP 600 Series Bridge PIDU Plus

This step is optional. Motorola recommends that you mount the PIDU Plus on a wall or other suitable mounting surface. This prevents the unit from being knocked or kicked and can help maintain link availability. Ensure that the Recovery switch can be accessed when mounting the unit.



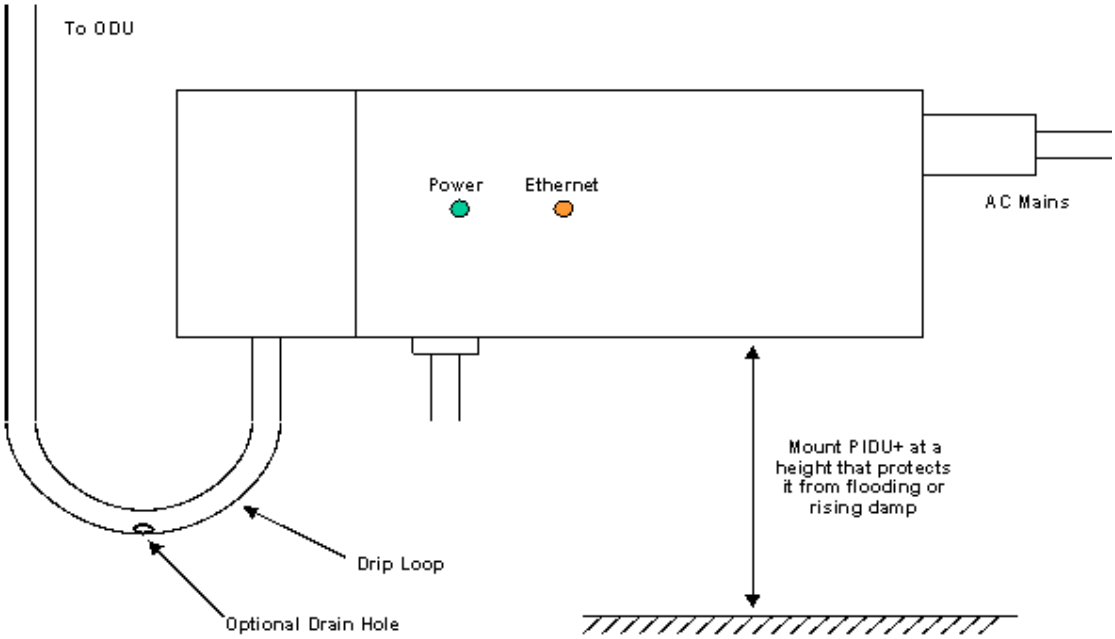
Step 1: Fix the PIDU Plus to the wall using the lugs provided.

Step 2: Make connections as per Section 7.7.7 “Making the ODU Connection at the PTP 600 Series Bridge PIDU Plus”

CAUTION: The PIDU Plus is not waterproof and should be mounted away from sources of moisture. If mounted outdoors, the unit should be mounted in a rain proof enclosure, preferably ventilated.

It is also recommended that you fit a drip loop on the PIDU Plus to ODU cable to ensure that any moisture that runs down the cable into the cabinet or enclosure cannot enter the PIDU Plus. This is shown in Figure 42. The network connection and mains cable should be treated in the same way if there is a risk that they can carry moisture to the PIDU Plus.

Figure 42 – PTP 600 Series PIDU Plus Drip Loop Configuration



CAUTION: It is possible for moisture to enter the cable due to damage to the outer protective layer. This moisture can track down the inside of the cable, filling up the drip loop and eventually finding its way into the PIDU Plus. To protect against this the outer protective layer of the cable can be opened up at the bottom of the drip loop to allow this moisture to escape.

7.7.10 Powering Up

The PTP 600 Series Bridge is supplied as a pair of matched Master/Slave units. The Master unit can now be powered up and accessed using the default URL http://169.254.1.2/; the Slave unit can be accessed using http://169.254.1.1/.

Prior to powering up the PTP 600 Series Bridge, a computer with web browsing capabilities should be configured with an IP address of 169.254.n.n and subnet mask of 255.255.0.0 where n is any value between 1 and 254 but excluding 1.1 or 1.2. If the default addresses of the unit 169.254.1.1/2 clashes with an address you are already using on your LAN, or you are not sure, you should set up an isolated LAN. As the LAN connection presented at the PIDU Plus has a default configuration as a hub/switch (and auto-sensing MDI/MDIX cross over is employed), connection can be made directly to the computer using a standard CAT 5 patch cable.

Before physical installation takes place the units to be installed should be set up as described in the Section 8.3.4 “Install Pages”. It is recommended that this procedure be carried out on the bench before physical installation commences. Providing it is safe to do so, the installer should take the process to the point where a radio link is established before proceeding to the installation site.

NOTE: It is possible that some units may not be accessed using the above default URL. This is because these units may have been previously configured with IP addresses 10.10.10.11 (Master) and 10.10.10.10 (Slave). Therefore, users must use the URL http://10.10.10.10/ and/or URL http://10.10.10.11/ to configure the units. Please ensure that a computer with web browsing capabilities is configured with an IP address of 10.10.10.n, where n is any value between 2 and 254 but excluding 10 and 11, to configure these units.

7.7.11 Aligning the PTP 600 Series Bridge ODUs

The following is a description of the steps taken to establish a radio link between the two units forming the bridge and align the units for the best signal strength.

The PTP 600 Series Bridge uses audible tones during installation to assist the installer with alignment. The installer should adjust the alignment of the ODU in both azimuth and elevation until highest pitch tone is achieved[7]. The tones and their meanings are as follows:

Table 25 - Audio indications from the ODU

State Name	Tone Description	State Description	Pitch Indication (Higher pitch = higher power)
Free Channel Search	Regular beep	Executing band scan	N/A
Scanning	Slow broken tone	Not demodulating the wanted signal	Rx Power
Synchronized	Fast broken tone	Demodulating the wanted signal	Rx Power
Registered	Solid tone	Both Master and Slave units exchanging Radio layer MAC management messages	Rx Power

The term ‘wanted signal’ refers to that of the peer unit being installed.

In each of the states detailed above, the unit should be aligned to give the highest pitch tone. It should be noted that if, when in the Synchronized or Registered state, the tone varies wildly, you may be suffering from interference or a fast fading link. Installing in this situation may not give a reliable link. The cause of the problem should be investigated.

[7] The pitch of the alignment tone is proportional to the received power of the wireless signals. The best results are usually achieved by making small incremental movement in angular alignment.

For the ease of alignment, both Master and Slave units use the install tones in the same way but with some small behavioral differences. This allows the installer to install the Slave unit first and carry out the initial alignment with the Master unit if desired. However, due to the behavioral differences of Master and Slave units, it is recommended that the Master unit is installed first and the initial alignment carried out at the Slave unit.

There is a graphical installation screen (section 8.3.5 “Graphical Install”) available using the web interface that displays the state of the link during the alignment process (up = green, down = red).

The following behavior should be noted:

- When first started up and from time to time, the Master unit will carry out a band scan to determine which channels are not in use. During this time, between 10 and 15 seconds, the Master unit will not transmit and as a consequence of this neither will the Slave unit. During this time the installation tone on the master unit will drop back to the band scan state, and the Slave unit will drop back to the Scanning state with the pitch of the tone set to the background noise level. Alignment of the unit should cease during this time.
- The master unit can take up to 60 seconds in 0-40km (0-25 miles) mode, 90 seconds in 0-130km (0-81 miles) mode and 120 seconds in 0-200km (0-124 miles) mode to determine the range of the link being installed[8]. The Master unit will remain in the Scanning state until the range of the link has been established. The Master unit will only move to the Synchronized state when the range of the link has been established.
- If, at the end of the ranging period, the Registered state is not achieved due to interference or other reasons, the Master unit will retry twice more on the same channel before moving to another available channel. Should this occur it might take a number of minutes to establish a link in the Registered state.
- The Slave unit does not have a ranging process. The slave unit will change to the Synchronized state as soon as the wanted signal is demodulated.

[8] If the unit is operating where mandatory radar avoidance algorithms are implemented the ranging behaviour for the PTP 600 Series Bridge may be affected. The Master has to monitor the initially chosen channel for 60 seconds to make sure it is clear of radar signals before transmitting. If a radar is detected during any of the installation phases a further compulsory 60 seconds channel scan will take place as the master unit attempts to locate a new channel that is free of radar interference

When the alignment process is complete the installer MUST REMEMBER TO DISARM[9] BOTH UNITS in the link as described in Section 8.3.4 “Install Pages”. This is necessary in order to:

- Turn off the audible alignment aid (section 8.3.4.5 “Disarm”)
- Enable Adaptive Modulation
- Fully enable Advanced Spectrum Management with i-DFS
- Clear unwanted installation information from the various systems statistics
- Store the link range for fast link acquisition on link drop
- Enable higher data rates

[9] After 24 hours, the units will be disarmed automatically provided that they are armed and that the link is UP.

8 Web Page Reference

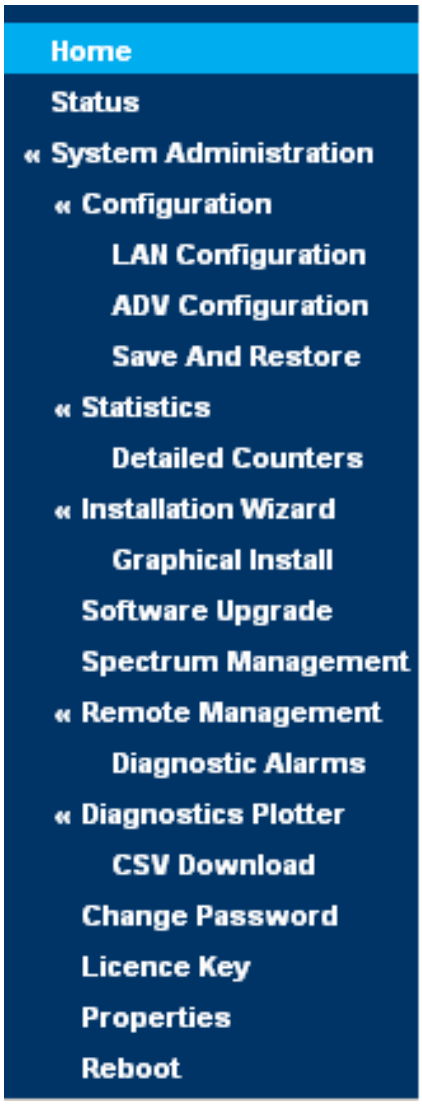
The web user interface has three main sections. The home page presents to the operator a high level summary of the PTP 600 Series Bridge point-to-point wireless link. The status page presents a more detailed set of system parameters describing the performance of the wireless link together with other key system performance metrics. The final section is the system administration section. This section is password protected and allows the system administrator to perform all the day-to-day administrative procedures, for example software upgrade and configuration changes.

The following subsections give a detailed usage guide for all the web user interfaces. The web pages are best viewed using a screen resolution of at least 1024 x 768 pixels on a PC using Microsoft Internet Explorer Version 6 or 7[10].

[10] The web pages have also been tested with Firefox 2.0.0.12. Other browsers have not been tested.

The navigation bar on the left hand side of the web page is used to move between the various management pages. The currently selected page is always highlighted with a light blue background. The menu is hierarchical. Selecting a menu item which has associated submenu options will automatically display all sub options. A sample web page with the navigation menu is shown in Figure 43 when the 'Home' Link is highlighted as the current page.

Figure 43 - Menu Navigation Bar



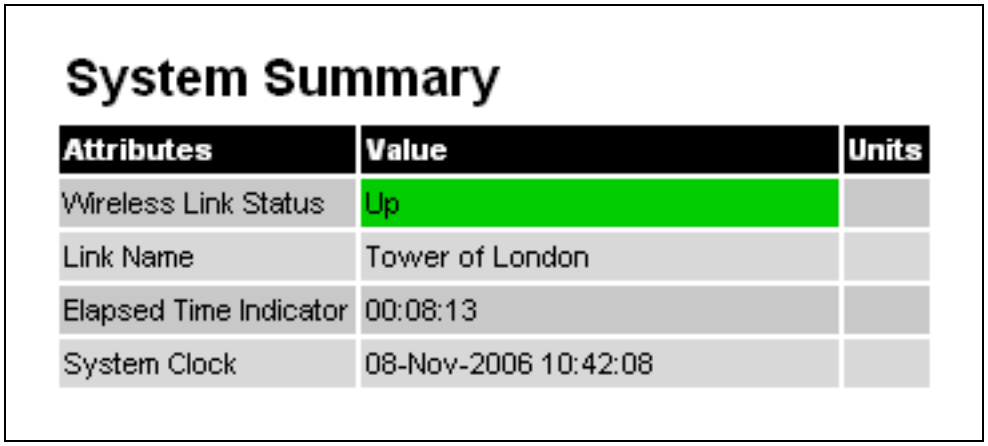
8.1 Home Page – PTP 600 Series Bridge

The home page for the PTP 600 Series Bridge has been designed to display a high level summary of the status of the wireless link and associated equipment. The home page (Figure 44) normally displays four key system attributes:

Wireless Link Status: The Wireless Link Status attribute displays the current status of the PTP 600 Series Bridge wireless link. A state of 'Up' on a green background indicates that a point-to-point link is established. A state of 'Down' on a red background indicates that the wireless link is not established. If the link is down for an unknown reason the system administrator should first consult the status web page for a more detailed summary of up to date system diagnostics.

Link Name: The link name attribute is a name and/or handle allocated by the system administrator to aid the identification of the unit, network or building.

Figure 44 - System Summary Page



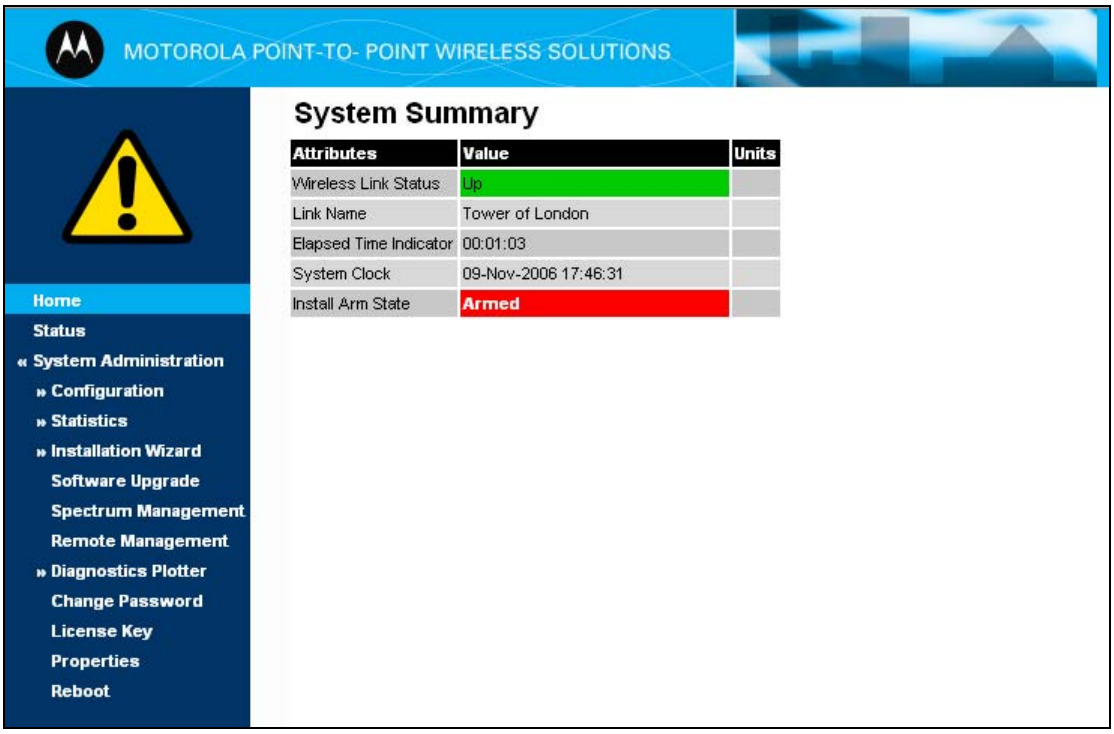
Elapsed Time Indicator: The elapsed time indicator attribute presents the total time in days, hours, minutes and seconds since the last system restart. The system can restart for several reasons, for example, commanded reboot from the system reboot webpage, or a power cycle of the equipment.

System Clock: If SNTP (Simple Network Time Protocol) is enabled, or the clock has been set, then a system clock attribute is displayed giving the date and time of the last page refresh. Section 8.3.11.8 "SNTP (Simple Network Time Protocol)" explains how to enable SNTP and Section 8.3.11.9 "Setting the clock" explains how to set the clock.

8.1.1 Home Page Alarm Display

The home page is also used to display all outstanding major system alarms. Whenever system alarms are asserted, a yellow warning triangle is displayed on web page navigation bar. The warning triangle will be visible from all web pages. Clicking the warning triangle will cause the web page to jump back to the system homepage. Figure 45 shows a sample alarm screen.

Figure 45 - Alarm Warning Triangle



The following system alarms are defined:

Ethernet Link Status: Current status of the Ethernet link. If there are any problems with the Ethernet interface, this alarm will be asserted. This alarm will most likely be seen if the unit has no Ethernet cable plugged into its Ethernet socket. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Telecoms Channel A Status (see section 8.3.4.3 “Telecoms Interface” for a description of the Telecoms Interface): Current status of telecoms channel A. Indicates that there is a problem with the telecoms channel A. Possible problems are "No Signal (local)", "No Signal (Remote)", and "No Signal (Local and Remote)". Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Telecoms Channel B Status (see section 8.3.4.3 for a description of the Telecoms Interface): Current status of telecoms channel B. Indicates that there is a problem with the telecoms channel B. Possible problems are "No Signal (local)", "No Signal (Remote)", and "No Signal (Local and Remote)". Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Telecoms Interface A Loopback (see section 8.3.4.3 for a description of the Telecoms Interface): The loopback status of telecoms channel A. This is intended for installation testing and should be set to 'None' for normal operation. The wire connections to a unit can be tested by applying a 'Copper' loopback to the local unit. The wireless connection to the remote unit can be tested by applying a 'Wireless' loopback to the remote unit with no loopback on the local unit. Note that a change of state may generate an SNMP trap and/or SMTP email alert. The loopback can be disabled from the telecoms configuration sub menu (see Section 8.3.1.6).

Telecoms Interface B Loopback (see section 8.3.4.3 for a description of the Telecoms Interface): The loopback status of telecoms channel B. This is intended for installation testing and should be set to 'None' for normal operation. The wire connections to a unit can be tested by applying a 'Copper' loopback to the local unit. The wireless connection to the remote unit can be tested by applying a 'Wireless' loopback to the remote unit with no loopback on the local unit. Note that a change of state may generate an SNMP trap and/or SMTP email alert. The loopback can be disabled from the telecoms configuration sub menu (see Section 8.3.1.6 “Telecoms Configuration Page”).

Region Code: The region code prohibits the wireless unit from operating outside the regulated limits. An invalid region code indicates a corrupted license key. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Install Status: A non-OK value indicates that signaling was received with the wrong MAC address. Note that it is very unusual to detect this, because units with wrongly configured Target MAC Address will normally fail to establish a wireless link. However, rare circumstances may establish a partial wireless link and detect this situation. NB: A non-OK value on start-up, or a change of value during operation, may generate an SNMP trap and/or SMTP email alert.

Install Arm State: This alarm warns when a wireless unit is in installation mode. After installation the wireless unit should be disarmed. This will increase the wireless link's data-carrying capacity and stop the installation tone generator. The wireless link is disarmed from the 'Installation Wizard' see Section 8.3.4.5 "Disarm". A change of state may generate an SNMP trap and/or SMTP email alert.

Unit Out Of Calibration: The unit is out of calibration and must be returned to the factory using the RMA process for re-calibration.

Encryption Enable Mismatch (see section 17 "AES Encryption Upgrade**"):** Encryption has been enabled on one end of the wireless link but not the other.

Incompatible Region Codes: The PTP 600 Series Bridge uses region codes to comply with local regulatory requirements governing the transmission of wireless signals in the 5.9 GHz, 5.8 GHz, 5.4 GHz, 4.5 GHz and 2.5 GHz bands. Region codes can only be changed by obtaining a new PTP600. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Series license key: If this alarm is encountered the appropriate license keys from the country of operation should be obtained from your distributor. Applying license keys containing the same region codes to both ends of the link will remove the alarm.

No Wireless Channel Available: Spectrum Management was unable to locate a suitable wireless channel to operate on. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Wireless Link Disable Warning: This warning is displayed if the Wireless link has been administratively disabled via the SNMP Interface (see Section 8.3.11 "Remote Management Page"). The Wireless Interface MIB-II ifAdminStatus attribute has been set to DOWN. To enable the Ethernet interface, set the ifAdminStatus attribute to UP. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Ethernet Link Disable Warning: This warning is displayed if the Ethernet link has been administratively disabled via the SNMP Interface (see section 8.3.11 “Remote Management Page”). The Ethernet Interface MIB-II ifAdminStatus attribute has been set to DOWN. To enable the Ethernet interface, set the ifAdminStatus attribute to UP. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Fiber Link Status: If the fiber link is not OK, there are two possible causes: Either the fiber link has been installed but disabled (because the license key does not include fiber support), or the link could not be established even though an optical carrier was detected (due perhaps to a broken TX fiber, or the link is disabled at the fiber link partner). Note that a change of status may generate an SNMP trap and/or SMTP email alert.

Ethernet Configuration Mismatch Alarm: The detection of Ethernet fragments (runt packets) when the link is in full duplex is an indication of an auto-negotiation or forced configuration mismatch. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Incompatible Master and Slave: A non-zero value indicates that the master and slave ends of the wireless link are different hardware products, or have different software versions. Note that it is very unusual to detect this because incompatible units will normally fail to establish a wireless link. However, some combinations may establish a partial wireless link and detect this situation. Note that a non-zero value may generate an SNMP trap and/or SMTP email alert.

TDD Synchronization Status: Current status of the TDD Synchronization (acquiring synchronization, no timing reference and timing system not connected). Note that a change of state may generate an SNMP trap and/or SMTP email alert.

SNTP Synchronization failed: This warning indicates that SNTP has been enabled but that the unit is unable to synchronize with the specified SNTP server. Section 8.3.11.8 “SNTP (Simple Network Time Protocol)” explains how to configure SNTP. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

8.2 Systems Status Page

The status page has been designed to give the system administrator a detailed view of the operation of the 600 Series Bridge from both the wireless and network perspectives.

The page is subdivided into four main categories Equipment, Wireless, Telecoms and Ethernet/Internet. The 'Equipment' section contains the unit's inventory and identification information. The 'Wireless' section presents the key wireless metrics, which are displayed as a series of measurements. The 'Ethernet/Internet' section describes the unit's network identity and connectivity. "Telecoms" controls the unit's E1/T1 telecoms interfaces.

The status page can be configured to refresh itself at an operator defined rate (if the user is logged in as system administrator). The refresh period defaults to 3600 seconds and can easily be changed to refresh at any period between 2 seconds and 3600 seconds. Pressing the 'Update Page Refresh Period' button causes a new page refresh period to be adopted by the system. The page refresh mechanism uses a HTML Meta refresh command. Therefore the refresh is always initiated by the local browser and not by the 600 Series Bridge at this interval.

The two PTP 600 Series bridges units are arranged in a master and slave relationship. The roles of the units in this relationship are displayed in the page title. The master unit will always have the title '- Master', and the slave will always have '- Slave' appended to the 'Systems Status' page title.

Figure 46 - Status Page

System Status - Master

Equipment

Attributes	Value	Units
Link Name	Master	
Link Location		
Software Version	58600-B1377+ wdog	
Hardware Version	D05-R02-C	
Region Code	Region Code 25	
Elapsed Time Indicator	00:05:16	
Ethernet / Internet		
Ethernet Link Status	Copper Link Up	
Ethernet Speed And Duplex	100 Mbps Full Duplex	
MAC Address	00:04:56:80:36:ba	
Remote IP Address	10.10.10.10	
Telecoms		
Channel A	Disabled	
Channel B	Disabled	
Automatic page refresh period in seconds	3600	Seconds

Wireless

Attributes	Value	Units
Wireless Link Status	Up	
Maximum Transmit Power	10	dBm
Remote Maximum Transmit Power	10	dBm
Transmit Power	6.0, -9.1, -30.0, 6.0	dBm
Receive Power	-47.9, -70.5, -110.0, -49.2	dBm
Vector Error	7.2, -18.2, -38.3, -31.5	dB
Link Loss	121.1, 86.7, 0.0, 121.1	dB
Transmit Data Rate	63.50, 40.32, 0.00, 63.50	Mbps
Receive Data Rate	63.50, 40.32, 0.00, 63.50	Mbps
Link Capacity	127.00	Mbps
Transmit Modulation Mode	64QAM 0.92 (Dual) (15 MHz)	
Receive Modulation Mode	64QAM 0.92 (Dual) (15 MHz)	
Link Symmetry	1:1	
Receive Modulation Mode Detail	Running At Maximum Receive Mode	
Range	0.1	km

Update Page Refresh Period | Reset form

The following section details all the attributes displayed on the status page:

Link Name: The link name is allocated by the system administrator and is used to identify the equipment on the network. The link name attribute is limited to a maximum size of 63 ASCII characters.

Link Location: The link location is allocated by the system administrator and can be used as a generic scratch pad to describe the location of the equipment or any other equipment related notes. The link location attribute is limited to a maximum size of 63 ASCII characters.

Software Version: The attribute describes the version of software installed on the equipment. The format of the attributes is *FFSSS*-XX-*YY* where *FF* is the frequency variant (2.5, 4.5, 5.4, 5.8 or 5.9 GHz), *SSS* is the System Release, *XX* is the major release version and *YY* is the minor release version.

Hardware Version: The hardware version attribute contains all the combined hardware version information. The attribute is formatted as D*XX*-R*YY*-*Z* where D*XX* contain the version of the digital card, R*YY* contains the version of the RF (radio frequency) card and *Z* describes the antenna type which can be I (integrated) or C (connectorized).

Region Code: The region code is used by the system to constrain the wireless to operate within regulatory regime of the particular country. The region code is encoded in the product license key. If the operator wishes to change region code, a new license key must be obtained from Motorola or the local point-to-point distributor / system integrator.

Elapsed Time Indicator: The elapsed time indicator attribute presents the total time in years, days, hours, minutes and seconds since the last system restart. The system can restart for several reasons, for example commanded reboot from the system reboot web page, or a power cycle of the equipment.

Ethernet Link Status: Current status of the Ethernet link. A state of ‘Up’ with a green background indicates that an Ethernet link is established. A state of ‘Down’ with a red background indicates that the Ethernet link is not established.

Ethernet Speed and Duplex: The negotiated speed and duplex setting of the Ethernet interface. The speed setting is specified in Mbps. Full Duplex data transmission means that data can be transmitted in both directions on a signal carrier at the same time. For example, on a local area network with a technology that has full duplex transmission; one workstation can be sending data on the line while another workstation is receiving data. Half Duplex data transmission means that data can be transmitted in both directions on a signal carrier, but not at the same time. For example, on a local area network using a technology that has half duplex transmission, one workstation can send data on the line and then immediately receive data on the line from the same direction in which data was just transmitted.

Remote IP Address: Hyperlink to the other side of the Link. The IP address of the peer link is displayed if the Link is UP, otherwise "unavailable" is displayed.

Channel A: The status of telecom interface A.

Channel B: The status of telecom interface B.

Refresh Page Period: The Status page refreshes automatically according to the setting entered here (in seconds). This attribute is only displayed when the user is logged on as System Administrator.

Wireless Link Status: As the attribute name suggests it displays the current status of the wireless link. A state of 'Up' on a green background indicates that a point-to-point link is established. A state of 'Down' on a red background indicates that the wireless link is not established.

Maximum Transmit Power: The maximum transmit power that the local wireless unit is permitted to use to sustain a link.

Remote Maximum Transmit Power: The maximum transmit power that the remote wireless unit is permitted to use to sustain a link.

Transmit Power: Transmit power histogram[11] is expressed in dBm and presented as: max, mean, min, and latest. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means.

[11] An histogram is calculated over a one hour period. If the equipment has been running for less than one hour then the histogram is calculated over the current elapsed time.
The data used to compute the histogram statistics can be downloaded in an ASCII comma separated value (CSV) format via the diagnostics CSV Download page, see Section 8.3.12.2 "Diagnostics Download".

Receive Power: Receive power histogram is expressed in dBm and presented as: max, mean, min, and latest. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. See footnote 11.

Vector Error: The vector error measurement compares the received signal's In phase / Quadrature (IQ) modulation characteristics to an ideal signal to determine the composite error vector magnitude. The results are stored in an histogram and expressed in dB and presented as: max, mean, min and latest. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. The expected range for Vector Error would be approximately -2dB (NLOS link operating at sensitivity limit on BPSK 0.67) to –33dB (short LOS link running 256 QAM 0.83). See footnote 11.

Link Loss: The link loss is the total attenuation of the wireless signal between the two point-to-point units. See footnote 11.

The link loss calculation presented below:

Equation 2 - Link Loss

$$P_{ll} = P_{T_x} - P_{R_x} + g_{T_x} + g_{R_x}$$

Where	is
P_{ll}	Link Loss (dB)
P_{T_x}	Transmit power of the remote wireless unit (dBm)
P_{R_x}	Received signal power at the local unit (dBm)
g_{T_x}, g_{R_x}	Antenna gain at the remote and local units respectively (dBi)[12].

Transmit Data Rate: The data rate in the transmit direction, expressed in Mbps and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means.

See footnote 11. Expected data rates can be found in Section 16 "Data Rate Calculations".

Receive Data Rate: The data rate in the receive direction, expressed in Mbps and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means.

12 The antenna gain of the 600 Series bridge (23.5 dBi) is used unless one or both of the units is a Connectorized version.

See footnote 11. Expected data rates can be found in Section 16 “Data Rate Calculations”.

Link Capacity: The maximum aggregate data rate capacity available for user traffic, assuming the units have been connected using Gigabit Ethernet. The link capacity is variable and depends of the prevailing wireless conditions as well as the distance (range) between the two wireless units..

Transmit Modulation Mode: The modulation mode currently being used on the transmit channel. List of all the modulation modes can be found in Section 16 “Data Rate Calculations” where data rate calculations plots are given for each available modulation mode..

Receive Modulation Mode: The modulation mode currently being used on the receive channel. List of all the modulation modes can be found in Section 16 “Data Rate Calculations” where data rate calculations plots are given for each available modulation mode.

Link Symmetry: The Link Symmetry control setting, expressed as a ratio of the number of OFDM symbols in each TDD frame where the first number represents the transmit direction and the second number represents the receive direction.

NOTE: If Link Symmetry is set to “2 to 1” at the master ODU, it will be displayed as “1 to 2” in the Status Page of the slave ODU, indicating that the master-slave direction has double the capacity of the slave-master direction.

Receive Modulation Mode Detail: This supplies the user with information regarding the receive modulation mode in use. Possible values are:

- Running at maximum receive mode
- Running at user-configured Max Modulation Mode
- Restricted due to byte errors on the wireless link or local Ethernet Tx Fifo Drops
- Restricted because a DFS channel change is in progress
- Restricted due to telecoms acquisition mode
- Restricted due to the low Ethernet link speed
- Limited by the wireless conditions

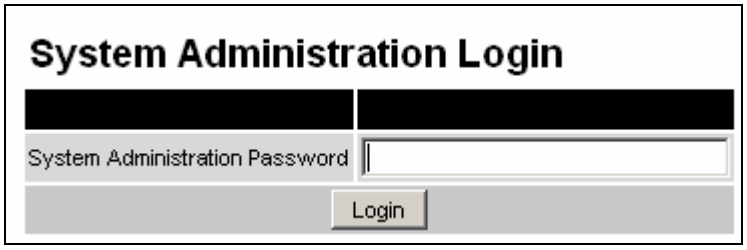
Range: The range[13] between the 600 Series bridge ODUs.

[13] The PTP 600 Series Bridge displays range in km by default, if the user would prefer to display range using Miles the ‘Distance Units’ attribute should be set to imperial, see the “ Properties” web page Section 8.3.15.

8.3 System Administration Pages

The following menu options are available for the system administrator and can be password protected. Figure 47 shows the system administration login page. By default a system administrator password is not set. Simply click the login button to access the system administration features.

Figure 47 - System Administration Login Page



Once the password has been set using the 'Change Password' menu item the system administration pages will only be available after the user has entered the correct password.

The features that are only available to the system administrator are:

- Configuration
- Statistics
- The Installation Wizard
- Software Upgrade
- Spectrum Management including DFS
- Remote management
- Diagnostics Plotter
- Password Management
- License Key Management
- Properties
- System Reboot

8.3.1 System Configuration

The configuration of the 600 Series Bridge is organized into three sections:

- General configuration
- LAN configuration
- Telecoms Configuration
- Save and Restore

The general configuration allows modification of high level administrative (descriptive) attributes and high level wireless configuration.

The LAN configuration sub menu allows the system administrator to modify the Ethernet and IP configuration of the 600 Series Bridge.

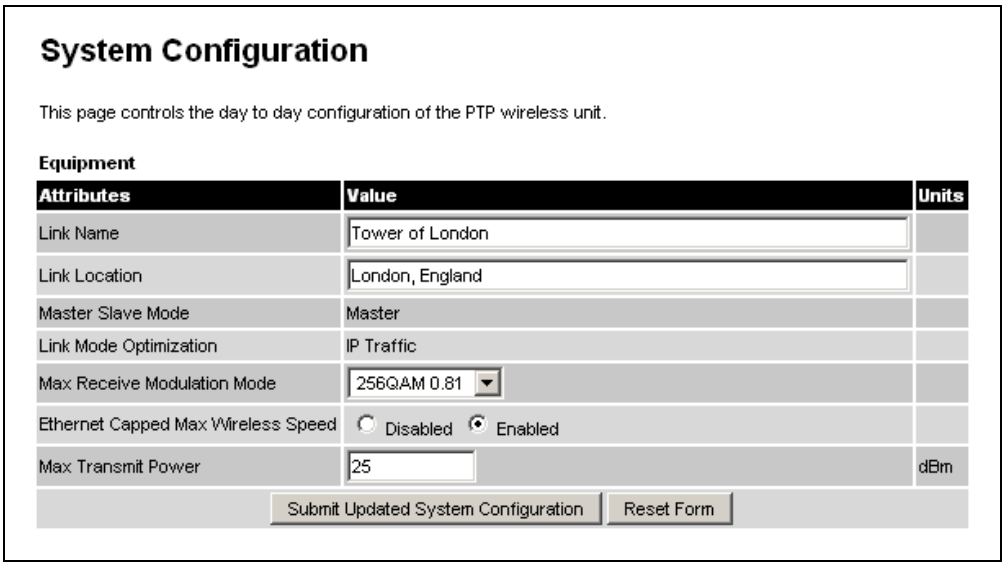
The telecoms submenu displays the current status of the telecoms interface and allows the configuration of interface loopbacks.

The save and restore submenu allows the system administrator to backup and restore the bridge configuration. It is recommended after a unit has been successfully installed; a copy of the active configuration is taken and archived by the system administrator.

8.3.1.1 General Configuration Page

The general configuration page (Figure 48) is used by the system administrator to configure the 600 Series Bridge's high level administrative (descriptive) attributes and high level wireless configuration.

Figure 48 - System Configuration Page



While the majority of the system configuration is entered during installation and should never require changing, this page offers the system administrator the ability to change the basic system parameters for both the wireless and Ethernet components.

Link Name: User defined identity for the unit (max 63 characters).

Link Location: Can be used as a generic scratch pad to describe the location of the equipment.

Master Slave Mode and Link Mode Optimization: Current settings are displayed and can be modified using the Installation Wizard pages 8.3.4 “Install Pages”.

Max Receive Modulation Mode: This is the maximum mode the unit will use as its adaptive modulation. By default the Max Receive Modulation Mode is the highest mode available.

For minimum error rates on TDM links the user should set the maximum modulation mode to 64QAM 0.75 at both ends of the link.

Ethernet Capped Max Wireless Speed: When enabled this option will cap the wireless speed to a mode that the connected Ethernet connection can sustain.

Maximum Transmit Power: This specifies the maximum transmit power in dBm of the system. It is country dependent and although the user can change this in 1dB steps, it will be limited to that country’s regulations[14].

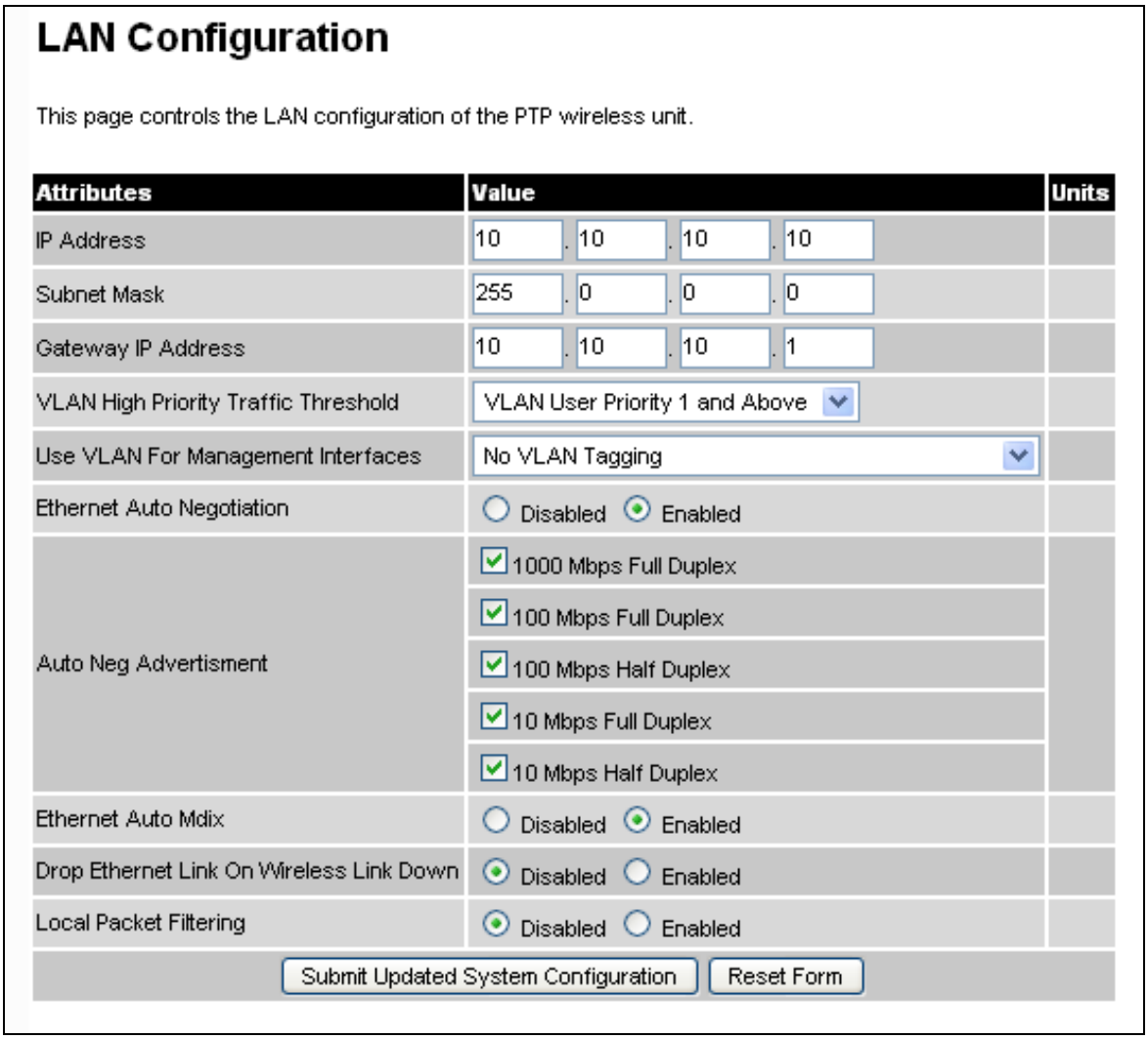
NOTE: Why Reduce Transmit Power? If the link losses are low and the link data rate and availability targets are being easily achieved, the transmitted power level may be reduced with a consequent benefit to other users of the band, such as fixed satellite links.

[14] In the UK there is a legal requirement to provide a minimum of 19dB of transmit power control range. When the equipment is operating with a UK Licence Key, an additional facility is provided on the configuration page that allows the transmitted power to be reduced by 19dB compared to the maximum allowed with a simple single step control.

8.3.1.2 LAN Configuration Page

The LAN configuration page (Figure 49) is used by the system administrator to configure the 600 Series Bridge's LAN interface.

Figure 49 - LAN Configuration Page



IP Address: Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.

Subnet Mask: A subnet allows the flow of network traffic between hosts to be segregated based on a network configuration.

Gateway IP Address: The IP address of a computer / router on the current network that acts as a gateway.

VLAN High Priority Traffic Threshold: All packets with an 802.1P priority tag greater than or equal to the indicated value will be treated as a high priority packet for transmission over the wireless link.

Use VLAN For Management Interfaces: This controls use of VLAN tags at the management interfaces (WWW/SNMP/SMTP/SNTP). See Section 8.3.1.3 “LAN Configuration Page – Use VLAN For Management Interfaces”.

Ethernet Auto Negotiation This enables the Ethernet configuration to be forced rather than auto negotiated.

CAUTION: The configuration should only be forced if you are having problems with auto negotiation. You must ensure that you configure both this unit and the Ethernet port to which it is connected identically. If you force a fixed Ethernet Configuration on the 600 Series bridge then you MUST also force the same fixed configuration on the equipment to which it is connected. If you fail to force the configuration of the connected equipment, its automatic configuration mechanisms will normally cause a duplex mismatch, and you will receive greatly reduced throughput!

When Ethernet Auto Negotiation is Disabled the format of the LAN configuration page will change see Section 8.3.1.4 “LAN Configuration Page – Manual Ethernet Configuration”.

Auto Neg Advertisement: This controls the rates that the auto negotiation mechanism will advertise as available.

CAUTION: Over the air throughput will be capped to the rate of the Ethernet interface at the receiving end of the link.

Ethernet Auto Mdix: This enables/disables the Auto Medium Dependent Interface (MDI)/Medium Dependent Interface Crossover (MDIX) capability. Default is “Enabled”.

Drop Ethernet Link On Wireless Link Down: When this option is enabled the Ethernet link is momentarily dropped when the wireless link goes down. This feature is used to indicate to the connected network equipment that this Ethernet link is no longer available, thus causing STP (Spanning Tree Protocol) to re-route packets through an alternative link.

Local Packet Filtering: When Local Packet Filtering is “Enabled”, the bridge learns the source MAC addresses of devices transmitting Ethernet packets on the local Ethernet network, and only bridges packets to the remote unit if the destination MAC address has not been learned as a 'local' device. When Local Packet Filtering is ‘Disabled’ the bridge does not learn the source MAC addresses of devices transmitting Ethernet packets on the local Ethernet network, and bridges ALL Ethernet packets received to the remote unit. Local Packet Filtering should be disabled when external Ethernet switching hardware or a router is present. The default setting for Local Packet Filtering is disabled.

All of the above attributes are non-volatile, once set they will be used by the unit even after a power on reboot. A number of attributes, such as IP Address, Subnet Mask and Gateway IP Address and VLAN settings will require a reboot before they are used. If any of these attributes are changed a reboot screen appears asking the user to verify the reboot (Figure 50 or Figure 51).

Figure 50 - Configuration Reboot Page

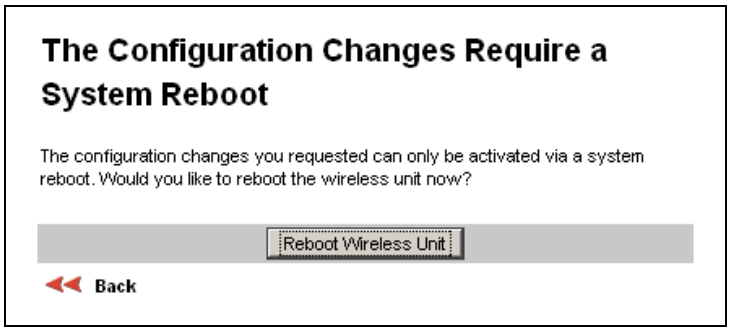
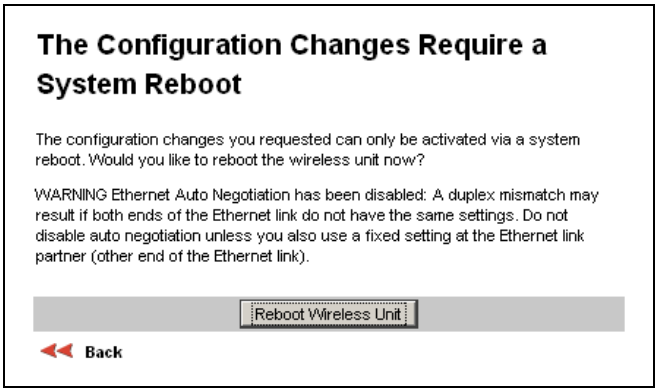


Figure 51 - Configuration Reboot Page - Ethernet Auto Negotiation Disabled



This will be followed by a pop-up dialogue box asking to confirm the action.

NOTE: At this point you will lose connection to the unit. If you have just changed the IP Address you now have to reconnect to the unit using the address just set.

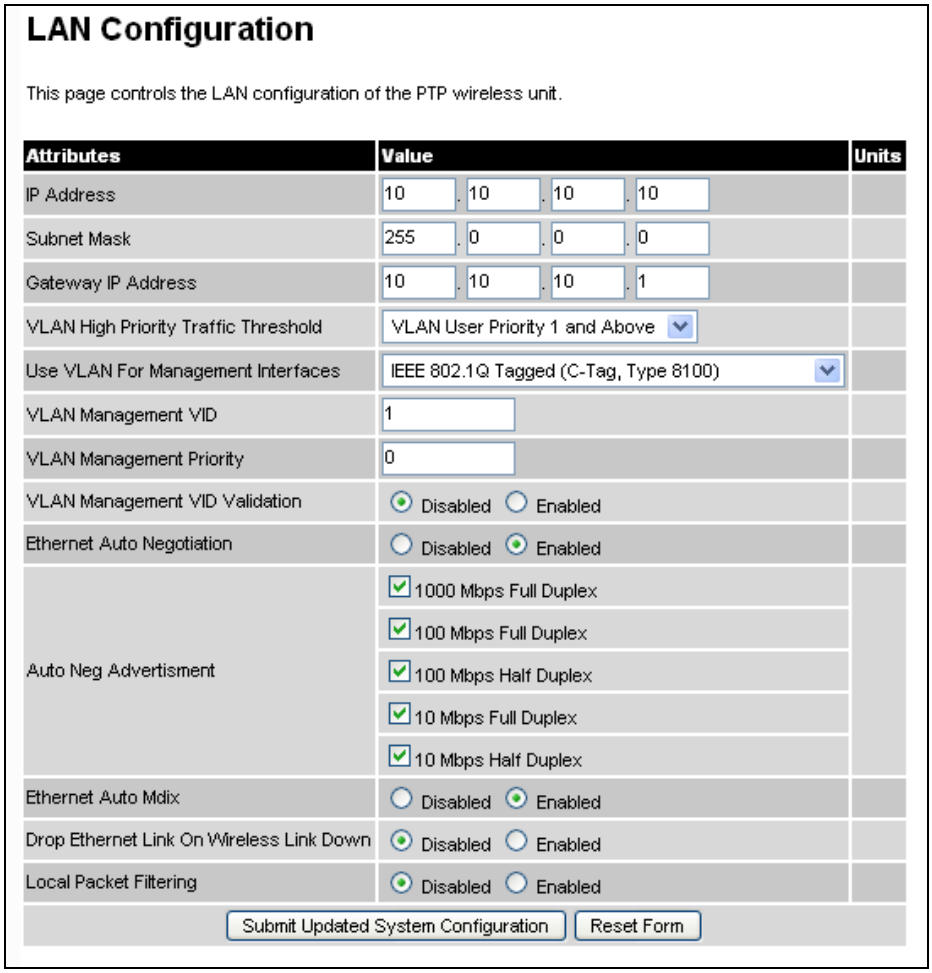
8.3.1.3 LAN Configuration Page – Use VLAN For Management Interfaces

The layout of the LAN Configuration page changes if this attribute is enabled in order to allow the VLAN VID and VLAN Priority to be set, see Figure 52. The VLAN settings are applied only after the unit is rebooted.

CAUTION: You must ensure that you can access the VLAN which you configure here, otherwise you will be unable to access the unit following the next reboot.

CAUTION: The PTP 600 management function is only compatible with single VLAN tagged packets. Any management packet with two or more packets will be ignored.

Figure 52 - VLAN Configuration Fields



Use VLAN For Management Interfaces: This control can be configured with one of the following three values:

- No VLAN Tagging
- IEEE 802.1Q Tagged (C-Tag, Type 8100)
- IEEE 802.1ad Tagged (S-Tag or B-Tag, Type 88a8)

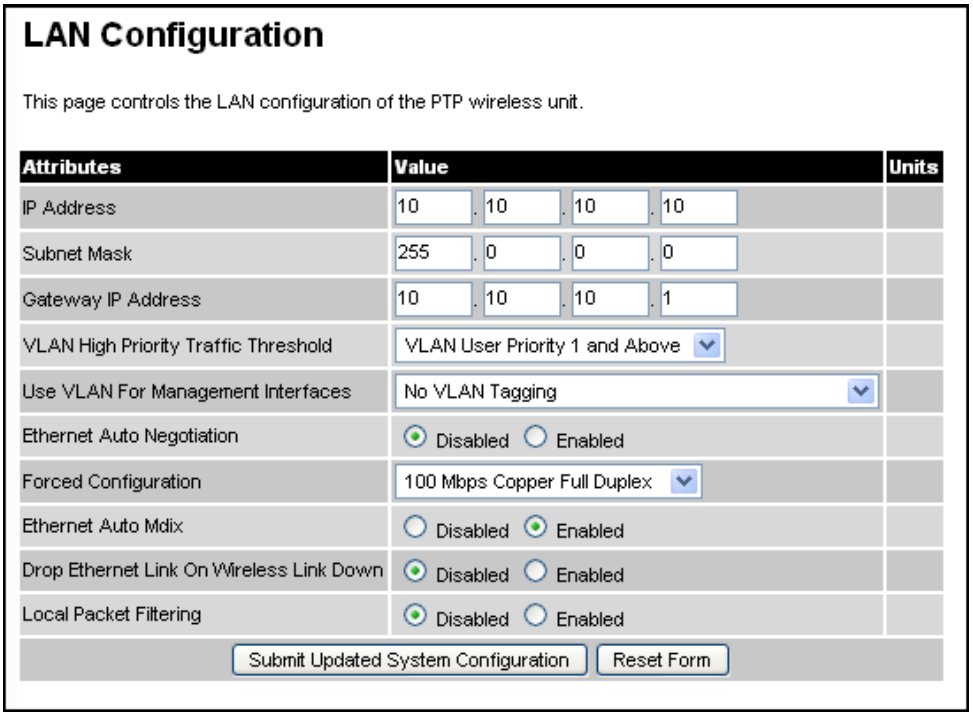
VLAN Management VID: This 802.1Q or 802.1ad VLAN ID (VID) will be included in packets generated by the management interfaces. Valid settings are in the range 0 to 4094.

VLAN Management Priority: This 802.1Q or 802.1ad VLAN Priority will be included in packets generated by the management interfaces. Valid settings are in the range 0 to 7.

VLAN Management VID Validation: If enabled, the management interfaces will only respond to Ethernet packets tagged with the configured Management VID; otherwise packets with any VID will be accepted.

8.3.1.4 LAN Configuration Page – Manual Ethernet Configuration

Figure 53 - LAN Configuration Page - Manual Ethernet Configuration



Force Configuration: This option allows the user to force the speed and duplex setting of the Ethernet interface.

CAUTION: Over the air throughput will be capped to the rate of the Ethernet interface at the receiving end of the link.

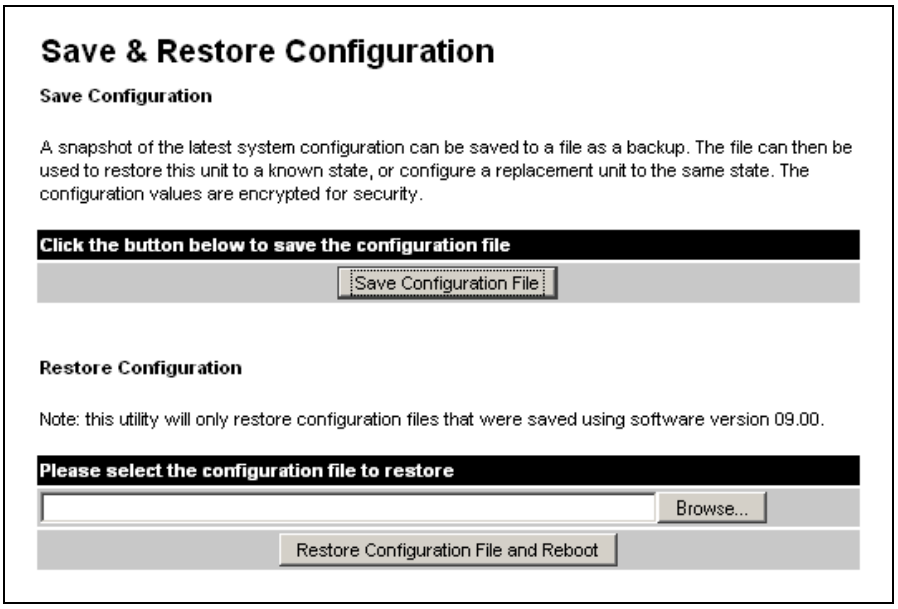
8.3.1.5 Save and Restore Configuration File

The save and restore feature of a PTP 600 Series Bridge allows the system administrator to backup the operation configuration of the wireless unit. It is recommended that this facility is used immediately after a successful PTP 600 Series Bridge installation or prior to any software upgrade. In the unlikely event that a unit has to be replaced in the field, the replacement unit can be reconfigured by simply playing back the saved configuration file.

8.3.1.5.1 Save Configuration File

To save the configuration file click on the 'Save Configuration File' button (Figure 54) and save the configuration file (.cfg) to the hard drive of your computer[15] [16].

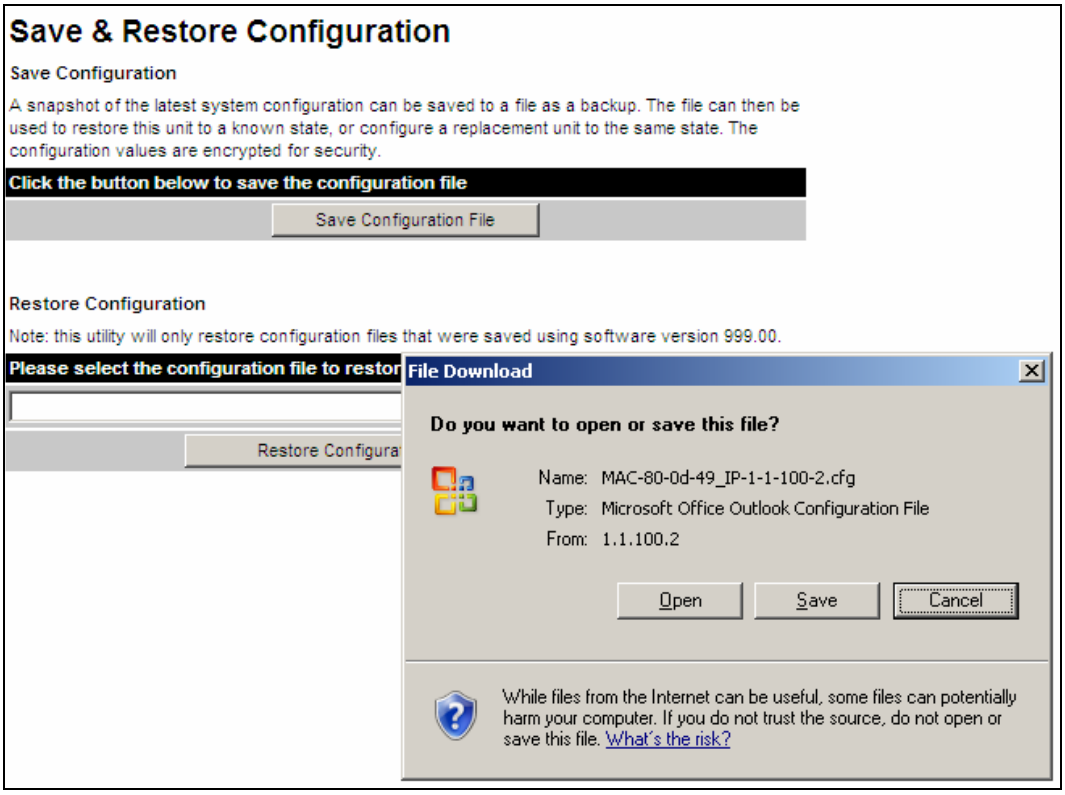
Figure 54 - Save and Restore Configuration Page



[15] There is a feature of Internet Explorer (all versions) that will always look at the content of any downloadable file as make an assessment whether to treat the file as an ASCII or binary file. Unfortunately the configuration file is always treated as ASCII and the browser attempts to display it instead of downloading it. Firefox (all versions) makes no such assumptions.

[16] The configuration file format is MAC-mm-mm-mm_IP-iii-iii-iii-iii.cfg where mm and iii are the lower 3 bytes of the MAC address and the unit IP address respectively.

Figure 55 - Save Configuration File Screen



The configuration file is encoded using an ASCII encoding scheme. An example is show in Figure 56.

Figure 56 – PTP 600 Example Configuration File

Motorola PTP 600 Series Configuration file
#
MAC Address :- 00:04:56:80:0f:ff
IP Address :- 169.254.1.1
License Key :- DCBD-A7AA-6851-4679
Software Version :- 09-01
Creation Date :- 07-Mar-07 20:03:23
#
To playback this configuration file into the unit, use the Save and Restore configuration webpage:
#
<config>+.BP9)7HC;O)DS.UNPAGUTLIHJ:",\K.]"3F6\0*XR14+>) !3-MZ-VF
...
</config>

CAUTION: The configuration file is currently restricted to a single software version and can only be restored into a wireless unit operating the software version indicated in the configuration file header.

8.3.1.5.2 Restore Configuration File

The configuration file can also be used when swapping out a faulty wireless unit. If one of the wireless units is replaced on a wireless link a configuration file captured from the faulty unit can be uploaded into the new unit to speed up replacement.

NOTE: The licence key of the faulty unit should be setup on the replacement unit before the configuration file is loaded. This can be obtained either from the Quick Start Guide supplied with the faulty wireless unit or directly from Motorola. The target MAC address at the other end needs to be changed to ensure that it is using the MAC address of the replaced unit.

The restoration of configuration files can be performed using the Restore configuration tool. Using the browser button to locate the configuration file you wish to restore then click the 'Restore Configuration File and Reboot' button (Figure 57). The user will then be prompted to confirm the action (Figure 58)

Figure 57 - Restore Configuration File Pop Up Screen

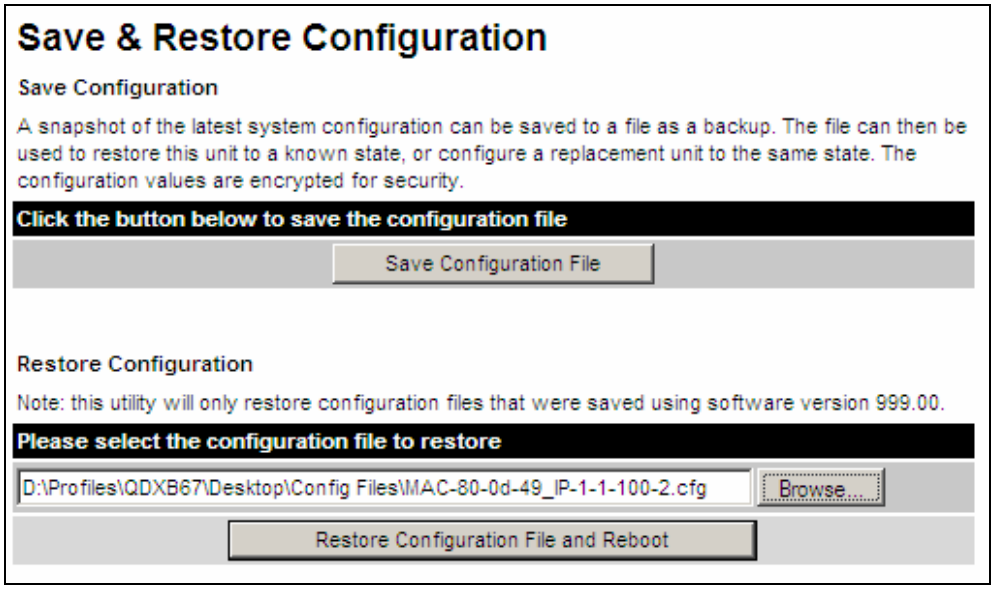
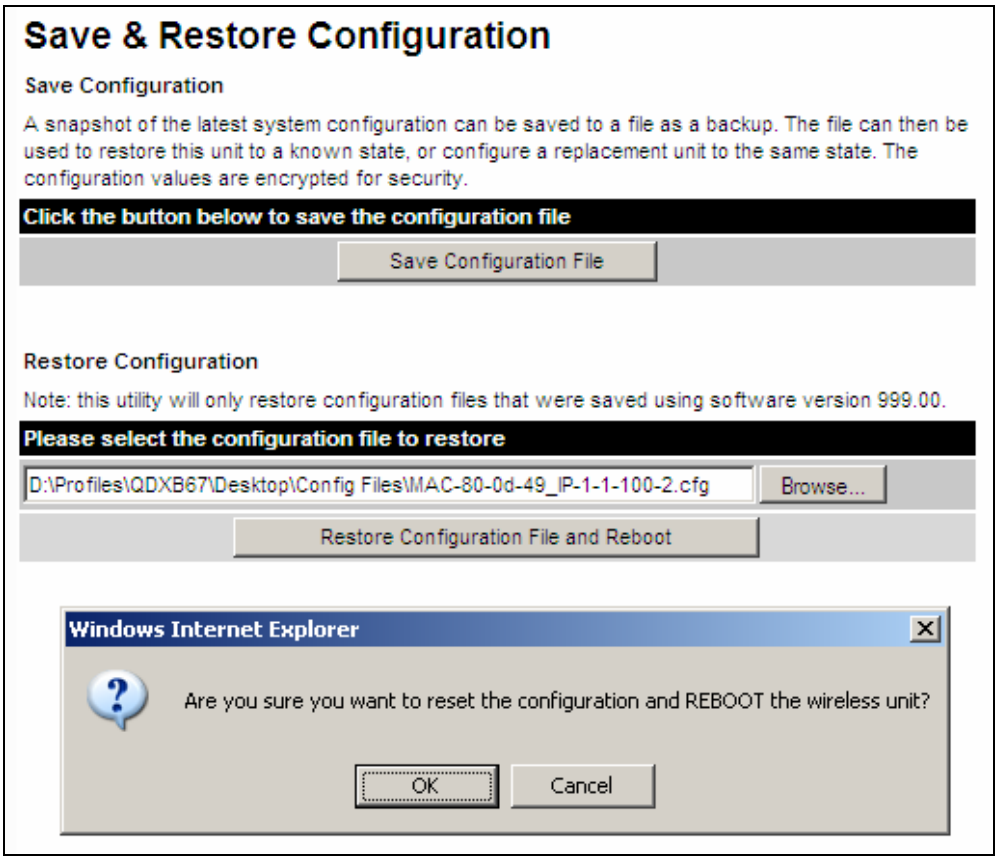


Figure 58 - Reset Configuration and Reboot Confirmation Pop-up



On confirmation the PTP 600 Series Bridge will:

- Upload the configuration file
- Perform data integrity checking
- Erase previous configuration
- Apply the new configuration
- Restart

After the unit has restarted the entire configuration from the configuration file will now be active. Note: The IP address of the unit may have also been changed. The user can check the new IP address by reading the header of the configuration file, Figure 56.

CAUTION: A reboot is always required to restore a configuration file.

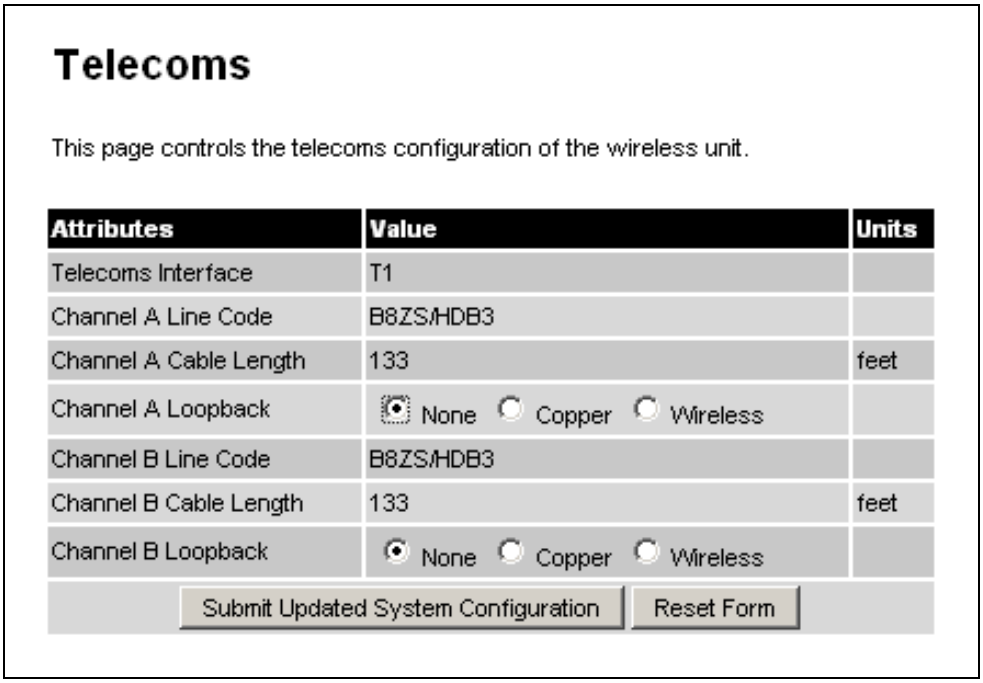
8.3.1.6 Telecoms Configuration Page

The Telecoms page is only available when the Telecoms Interface has been set to either T1 or E1 in the Installation Wizard.

It displays the interface setting and line code for the available telecoms channels. The PTP 600 Series Bridge is able to support two T1 or E1 channels. However, in the “Lite” configuration one of these channels is disabled. The channels are referred to as "Channel A" and "Channel B".

The "Channel B" configuration and controls will be displayed only when the second channel is enabled.

Figure 59 - Telecoms Data Entry



Telecoms Interface: May be either T1, E1 reflecting the Installation Wizard setting.

Line Code: Displays the Line Code setting for each channel. The Line Code configuration must match the configuration of the connected equipment and may be set using the Installation Wizard.

Cable Length: The Cable Length setting is applicable in T1 mode only and shows the cable length specified in the installation wizard.

Loopback: Allows the T1 or E1 data stream to be looped back at the copper or wireless interface. During normal operation the loopback must be set to "None".

It may be helpful during installation to test the telecoms links by performing loopback connections.

A "Copper" loopback connects the received data on a given telecoms interface to the Transmit. A "Copper" loopback may be used, in conjunction with an appropriate test unit, to confirm that the correct connections have been made to the ODU.

A "Wireless" loopback sends the telecoms data received across the wireless link back across the link on the same Telecom channel. The link may be checked using, for example, a Bit Error Rate Tester to ensure that no errors are detected.

A typical T1 or E1 installation might include a "Copper" loopback on the local unit followed by a "Wireless" loopback on the remote unit.

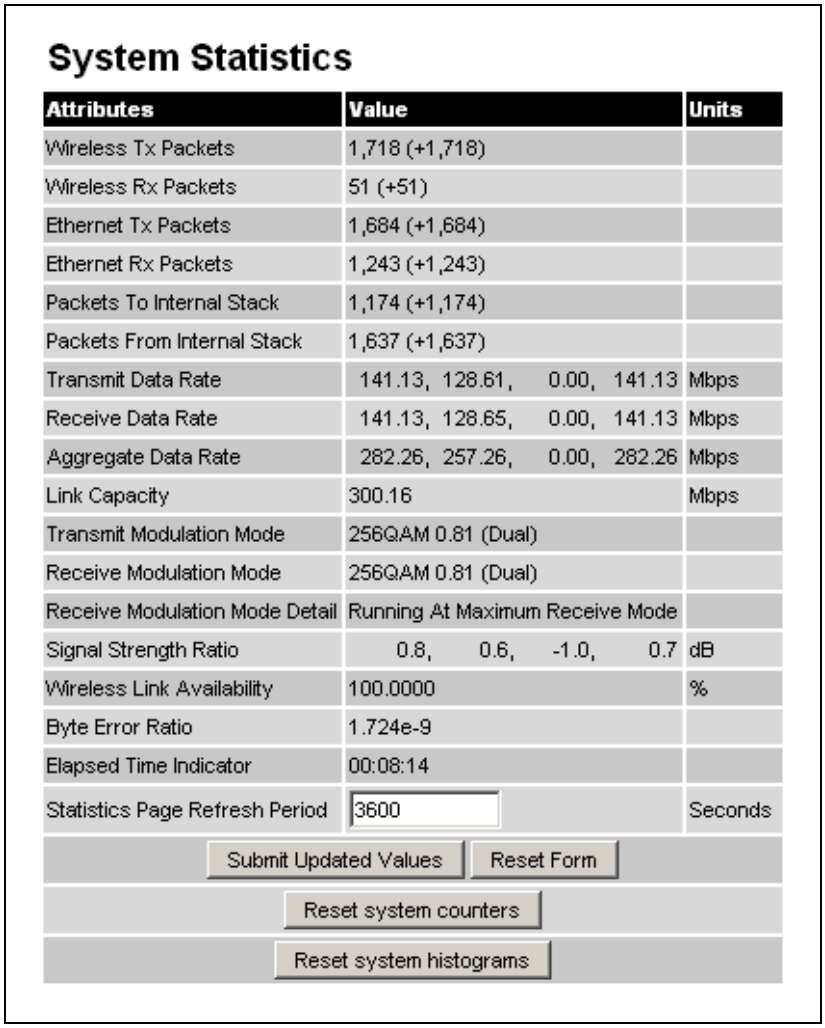
It is important to remove all loopbacks on channels for normal operation.

Alarms on the Home Page indicate the presence of loopbacks on either channel.

8.3.2 Statistics Page

The 600 Series bridge statistics page is designed to display some key statistics of the Ethernet Bridge and the underlying wireless performance.

Figure 60 - System Statistics



System Statistics

Attributes	Value	Units
Wireless Tx Packets	1,718 (+1,718)	
Wireless Rx Packets	51 (+51)	
Ethernet Tx Packets	1,684 (+1,684)	
Ethernet Rx Packets	1,243 (+1,243)	
Packets To Internal Stack	1,174 (+1,174)	
Packets From Internal Stack	1,637 (+1,637)	
Transmit Data Rate	141.13, 128.61, 0.00, 141.13	Mbps
Receive Data Rate	141.13, 128.65, 0.00, 141.13	Mbps
Aggregate Data Rate	282.26, 257.26, 0.00, 282.26	Mbps
Link Capacity	300.16	Mbps
Transmit Modulation Mode	256QAM 0.81 (Dual)	
Receive Modulation Mode	256QAM 0.81 (Dual)	
Receive Modulation Mode Detail	Running At Maximum Receive Mode	
Signal Strength Ratio	0.8, 0.6, -1.0, 0.7	dB
Wireless Link Availability	100.0000	%
Byte Error Ratio	1.724e-9	
Elapsed Time Indicator	00:08:14	
Statistics Page Refresh Period	3600	Seconds

Submit Updated Values | Reset Form

Reset system counters

Reset system histograms

Wireless Tx Packets: This displays the total number of good packets the bridge has sent for transmission by the wireless interface[17].

Wireless Rx Packets: This displays the total number of good packets the bridge has received from the wireless interface. See footnote 17.

[17] The number in between brackets displays the number of packets received since the last page refresh.

Ethernet Tx Packets: This displays the total number of good packets the bridge has sent for transmission by the local Ethernet interface. See footnote 17.

Ethernet Rx Packets: This displays the total number of good packets the bridge has received from the local Ethernet interface. See footnote 17.

Packets To Internal Stack: This displays the total number of good packets the bridge has transmitted to the internal stack (for example, ARP requests, PING requests, HTTP requests). See footnote 17.

Packets From Internal Stack: This displays the total number of good packets the bridge has received from the internal stack (for example ARP responses, PING replies, HTTP responses). See footnote 17.

Transmit Data Rate: The data rate in the transmit direction, expressed in Mbps and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. See footnote 11. Expected data rates can be found in Section 16 “Data Rate Calculations”.

Receive Data Rate: The data rate in the receive direction, expressed in Mbps and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. See footnote 11. Expected data rates can be found in Section 16 “Data Rate Calculations”.

Aggregate Data Rate: The sum of the data rate in the directions expressed in Mbps and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. See footnote 11. Expected data rates can be found in Section 16 “Data Rate Calculations”.

Link Capacity: The maximum aggregate data capacity available for user traffic under the current radio link conditions, assuming the units have been connected using Gigabit Ethernet. The sum of the displayed Transmit and Receive data rates may be lower than this figure if the link isn't fully loaded by the current traffic profile.

Transmit Modulation Mode: The modulation mode currently being used on the transmit channel. The number in brackets after the modulation mode and coding rate string is the effective data rate available to all MAC layer protocols. List of all the modulation modes can be found in Section 16 “Data Rate Calculations” where data rate calculations plots are given for each available modulation mode.

Receive Modulation Mode: The modulation mode currently being used on the receive channel. The number in brackets after the modulation mode and coding rate string is the effective data rate available to all MAC layer protocols. List of all the modulation modes can be found in Section 16 “Data Rate Calculations” where data rate calculations plots are given for each available modulation mode.

Receive Modulation Mode Detail: This supplies the user with information regarding the receive modulation mode in use. Possible values are:

- Running at maximum receive mode
- Running at user-configured Target Modulation Mode
- Restricted because Installation is armed
- Restricted because of byte errors on the wireless link
- Restricted because a DFS channel change is in progress
- Restricted due to the low Ethernet link speed
- Limited by the radio conditions

Signal Strength Ratio: The Signal Strength Ratio is the ratio of the power received by the Vertical / Horizontal receivers and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. See footnote 11.

Wireless Link Availability: Expresses the link availability as a percentage of time since the first successful registration after a system restart, expressed as a percentage to four decimal places.

Byte Error Ratio: The ratio of detected Byte errors to the total number of bytes since the last system reboot. This is a true measure of link quality as this measurement is made continually using null frames when there is no user data to transport.

Statistics Page Refresh Period: The statistics page refreshes automatically according to the setting entered here (in seconds).

Reset System Counters: By pressing this button all counters in the system are reset to zero.

Reset System Histograms: All histograms are reset, and the calculation period is restarted.

8.3.3 Detailed Counters Page

Figure 61 - Detailed Counters Page

Detailed Counters

Ethernet

Attributes	Value	Units
Ethernet Rx Octets	99,368 (+99,368)	
Ethernet Tx Octets	420,808 (+420,808)	
Ethernet Rx Drops	0 (+0)	
Ethernet Rx Packets	1,066 (+1,066)	
Ethernet Rx Broadcasts	395 (+395)	
Ethernet Rx Multicasts	32 (+32)	
Ethernet Rx Crc And Align	0 (+0)	
Ethernet Rx Undersize	0 (+0)	
Ethernet Rx Oversize	0 (+0)	
Ethernet Rx Fragments	0 (+0)	
Ethernet Rx Jabbers	0 (+0)	
Ethernet Rx 64 Bytes	841 (+841)	
Ethernet Rx 65 To 127 Bytes	143 (+143)	
Ethernet Rx 128 To 255 Bytes	17 (+17)	
Ethernet Rx 256 To 511 Bytes	49 (+49)	
Ethernet Rx 512 To 1023 Bytes	20 (+20)	
Ethernet Rx 1024 To Max Bytes	0 (+0)	
Ethernet Tx Drops	0 (+0)	
Ethernet Tx Packets	973 (+973)	
Ethernet Tx Broadcasts	1 (+1)	
Ethernet Tx Multicasts	0 (+0)	
Ethernet Tx Collisions	0 (+0)	
Ethernet Tx 64 Bytes	327 (+327)	
Ethernet Tx 65 To 127 Bytes	191 (+191)	
Ethernet Tx 128 To 255 Bytes	100 (+100)	
Ethernet Tx 256 To 511 Bytes	49 (+49)	
Ethernet Tx 512 To 1023 Bytes	97 (+97)	
Ethernet Tx 1024 To Max Bytes	217 (+217)	
Ethernet Tx Fifo Drops	0 (+0)	
Ethernet Rx Frames	1,087 (+1,087)	
Ethernet Tx Frames	996 (+996)	
Ethernet Rx Pause Frames	0 (+0)	
Ethernet Tx Pause Frames	0 (+0)	
Ethernet Rx Classified Drops	0 (+0)	

Wireless

Attributes	Value	Units
Wireless Rx Octets	0 (+0)	
Wireless Tx Octets	5,925 (+5,925)	
Wireless Rx Drops	0 (+0)	
Wireless Rx Packets	0 (+0)	
Wireless Rx Broadcasts	0 (+0)	
Wireless Rx Multicasts	0 (+0)	
Wireless Rx Crc And Align	0 (+0)	
Wireless Rx Undersize	0 (+0)	
Wireless Rx Oversize	0 (+0)	
Wireless Rx Fragments	0 (+0)	
Wireless Rx Jabbers	0 (+0)	
Wireless Rx 64 Bytes	0 (+0)	
Wireless Rx 65 To 127 Bytes	0 (+0)	
Wireless Rx 128 To 255 Bytes	0 (+0)	
Wireless Rx 256 To 511 Bytes	0 (+0)	
Wireless Rx 512 To 1023 Bytes	0 (+0)	
Wireless Rx 1024 To Max Bytes	0 (+0)	
Wireless Tx Drops	940 (+940)	
Wireless Tx Packets	36 (+36)	
Wireless Tx Broadcasts	3 (+3)	
Wireless Tx Multicasts	0 (+0)	
Wireless Tx Collisions	0 (+0)	
Wireless Tx 64 Bytes	8 (+8)	
Wireless Tx 65 To 127 Bytes	6 (+6)	
Wireless Tx 128 To 255 Bytes	4 (+4)	
Wireless Tx 256 To 511 Bytes	8 (+8)	
Wireless Tx 512 To 1023 Bytes	7 (+7)	
Wireless Tx 1024 To Max Bytes	17 (+17)	
Wireless Tx Fifo Drops	0 (+0)	
Wireless Rx High Priority Frames	0 (+0)	
Wireless Rx Low Priority Frames	0 (+0)	
Wireless Tx High Priority Frames	0 (+0)	
Wireless Tx Low Priority Frames	60 (+60)	
Wireless Rx Pause Frames	0 (+0)	
Wireless Tx Pause Frames	0 (+0)	
Wireless Rx Classified Drops	0 (+0)	

Internal Stack

Packets To Internal Stack	976 (+976)	
Packets From Internal Stack	1,009 (+1,009)	
Packets Ignored By Internal Stack	0 (+0)	
Detailed Counters Page Refresh Period	3600	Seconds

Update Page Refresh Period | Reset System Counters

The detailed counters page is subdivided into two columns. Column one presents the detailed statistics for the bridge's Ethernet interface. Column two relates to the wireless interface.

The Counters have the following definitions:

Tx & Rx Octets: Total number of octets (bytes) transmitted or received over the interface.

Rx Drops: Total number of frames dropped due to the lack of sufficient capacity in the receive buffer.

Rx Packets: Total number of packets received by the interface. This includes both good and bad packets.

Rx Broadcasts: Total number of good broadcast packets.

Rx Multicasts: Total number of good multicast packets.

Rx CRC and Align: Total number of packets with CRC or frame alignment errors.

Rx Undersize: Total number of packets received that are less than 64 bytes and have a valid CRC.

Rx Oversize: Total number of packets received that are greater than the maximum number of bytes with a valid CRC.

Rx Fragments: Total number of packets that are less than 64 bytes with an invalid CRC (these packet types are also known as runts).

Rx Jabbers: Total number of packets received that are greater than the maximum number of bytes with an invalid CRC.

Rx 64 Bytes: Total number 64 byte frames received

Rx 65 to 127 Bytes: Total number of frames received in the size range 65 to 127 bytes.

Rx 128 to 255 Bytes: Total number of frames received in the size range 128 to 255 bytes.

Rx 256 to 511 Bytes: Total number of frames received in the size range 256 to 511 bytes.

Rx 512 to 1023 Bytes: Total number of frames received in the size range 512 to 1023 bytes.

Rx 1024 to Max: Total number of frames received in the size range 1024 to Maximum bytes.

Tx Drops: Total number of frames dropped due excessive collisions, late collision and frame ageing.

Tx Packets: Total number of packets received by the interface. This includes both good and bad packets.

Tx Broadcasts: Total number of good broadcast packets.

Tx Multicasts: Total number of good multicast packets.

Tx Collisions: Total number frames experiencing collisions.

Tx 64 Bytes: Total number 64 byte frames transmitted

Tx 65 to 127 Bytes: Total number frames transmitted in the size range 65 to 127 bytes.

Tx 128 to 255 Bytes: Total number frames transmitted in the size range 128 to 255 bytes.

Tx 256 to 511 Bytes: Total number frames transmitted in the size range 256 to 511 bytes.

Tx 512 to 1023 Bytes: Total number frames transmitted in the size range 512 to 1023 bytes.

Tx 1024 to Max: Total number frames transmitted in the size range 1024 to Maximum bytes.

Tx FIFO Drops: Total number frames dropped due to lack of capacity in the transmit buffer, for example when the 600 Series bridge is connected to the local Ethernet at a connection speed of less than 1 Gbps.

Rx & Tx High Priority: Total number of received or transmitted frames marked as high priority.

Rx & Tx Low Priority: Total number of received or transmitted frames marked as low priority.

Rx & Tx Pause Frames: Total number of received or transmitted pause frames.

Rx Classifier Drops: Total number of received frames dropped due to the application of classifier rules.

Statistics Page Refresh Period: The statistics page refreshes automatically according to the setting entered here (in seconds).

8.3.4 Install Pages

These pages are used during system installation. There follows a description of the install pages along with their use during the installation configuration process. The actual installation process is described in Section 8.3.4.1 “Manually Configuring The Wireless Units”.

All wireless links are shipped as paired units. They are pre-configured at the factory so that they can be installed without the user supplying any configuration. Each wireless link is shipped with a quick start guide. Attached to the quick start guide is a summary of the pre-configured configuration data. Table 26 shows a sample link configuration. The values in red type have been committed to the wireless unit's non-volatile storage.

Table 26 – 600 Series Bridge Factory Configuration Values

Example PTP 600 Series Configuration Data	
For your convenience these two units have been pre-configured as a link	
Units:	
ODU serial number	ODU serial number
016780000FFF	016780000FC7
Ethernet MAC address	Ethernet MAC address
00:04:56:80:0F:FF	00:04:56:80:0F:C7
Configured as:	
Master	Slave
Target MAC address	Target MAC address
00:04:56:80:0F:C7	00:04:56:80:0F:FF
License Key	License Key
A471-FE88-428D-E1F3	534F-4F54-D1B0-E2DA
IP Address	IP Address
169.254.1.2	169.254.1.1

CAUTION: The factory default configuration is limited in range to 40 Km (25 miles). If you wish to install a wireless link with a range of > 40 Km (> 25 miles) and < 200 Km (< 124 miles) or < 5 Km (< 3 miles) you must follow the 'Manually Configuring The Wireless Units' in Section 8.3.4.1.

CAUTION: The factory default configuration is set to Region 1. Region 1 allows the 600 Series bridge a maximum transmit power of 25 dBm. If the local regulatory regime limits the maximum transmit power (EIRP) to less than 25 dBm you should obtain a new license key containing the correct region code from your local distributor or direct from Motorola. Alternatively in the short term, you should reduce the maximum transmit power by following the procedures in 'Manually Configuring The Wireless Units' in Section 8.3.4.1.

8.3.4.1 Manually Configuring The Wireless Units

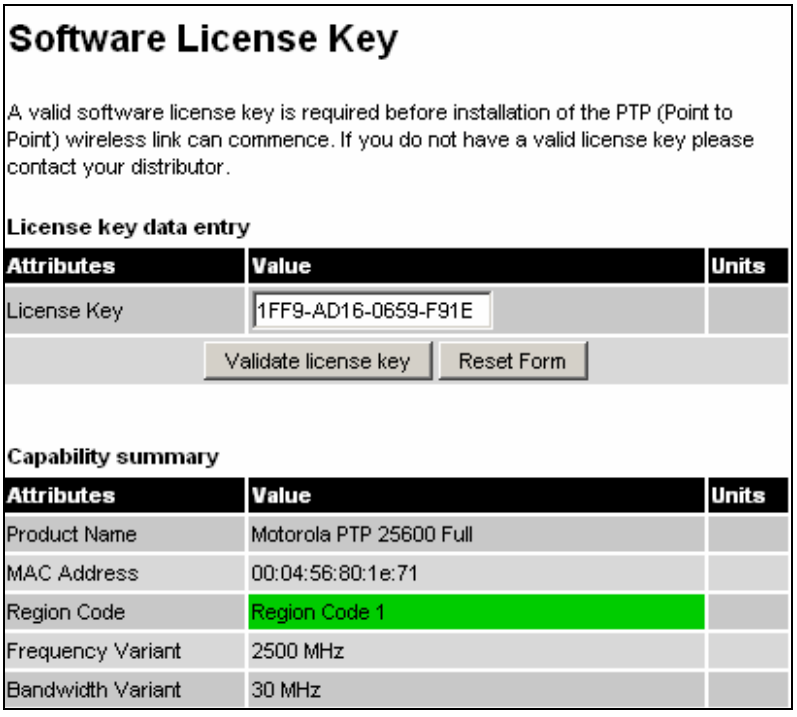
If the installer / system administrator wishes, they may modify the default installation configuration. If only the IP addresses (network configuration) are incorrect it is recommended that the values are changed via the configuration menu (Section 8.3.1.2 "LAN Configuration Page").

CAUTION: If any other parameters (for example Region Code) require modification, then it is recommended that the system administrator use the Installation Wizard.

A detailed description of the Installation Wizard follows:

The 600 Series bridge operational software requires a license key to enable the wireless bridging capability and programs region code specific parameters in to the unit.

Figure 62 - License Key Data Entry



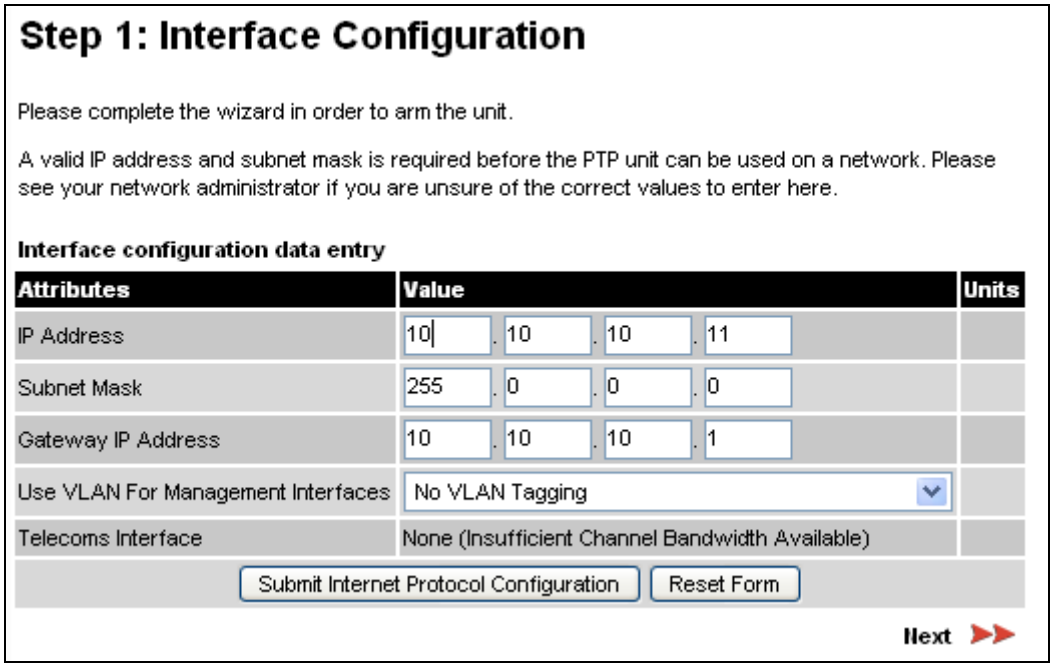
A license key is programmed into each unit during production and can be found written on the Configuration Data Summary Label which is attached to the Quick Install Guide. If subsequently the license key has been mislaid, replacement keys can be applied for online or via your distributor.

If a valid license key is not detected in the unit's non-volatile memory then the user is prompted to enter a valid key. It should be noted that 600 Series bridge units are shipped as link pairs and, as such, valid license keys are entered during the production process. To enter a license key simply type or paste the license key into the data entry box (Figure 62) and click the 'validate license key' button.

8.3.4.2 Internet Protocol Configuration

Step 1 of the installation wizard requires the installer to enter the Internet Protocol (IP) configuration.

Figure 63 - Installation Wizard Internet Protocol Configuration



IP Address: Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.

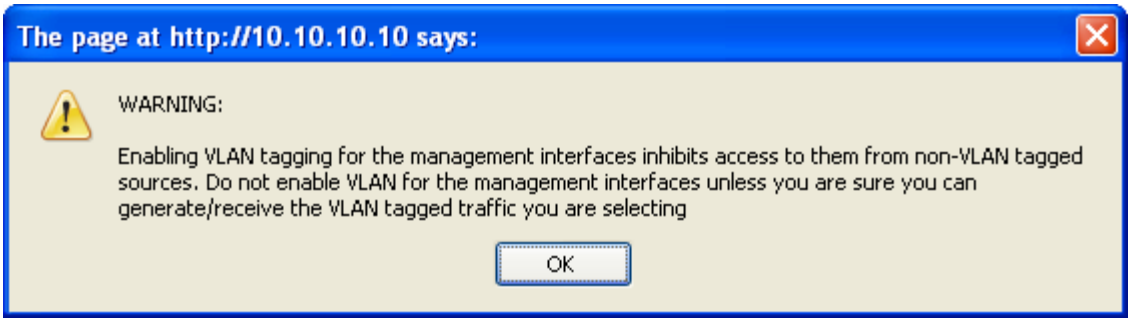
Subnet Mask: A subnet allows the flow of network traffic between hosts to be segregated based on a network configuration. By organizing hosts into logical groups, subnetting can improve network security and performance.

Gateway IP Address: The IP address of a computer / router on the current network that acts as a gateway. A gateway acts as an entrance / exit to packets from / to other networks.

Use VLAN Management Interface: Controls whether the management interfaces (HTTP/SNMP/SMTP/SNTP) use a VLAN. Selecting this option presents the user with extra fields in which to enter the Management VLAN ID, Priority and whether to validate the VLAN ID. If the user modifies this control, a warning dialog is displayed see Figure 64.

Telecoms Interface This allows the activation of the 600 Series bridge telecoms interface. The selection options are None, E1 or T1. Mixed T1/E1 configurations are not permitted.

Figure 64 - VLAN Warning

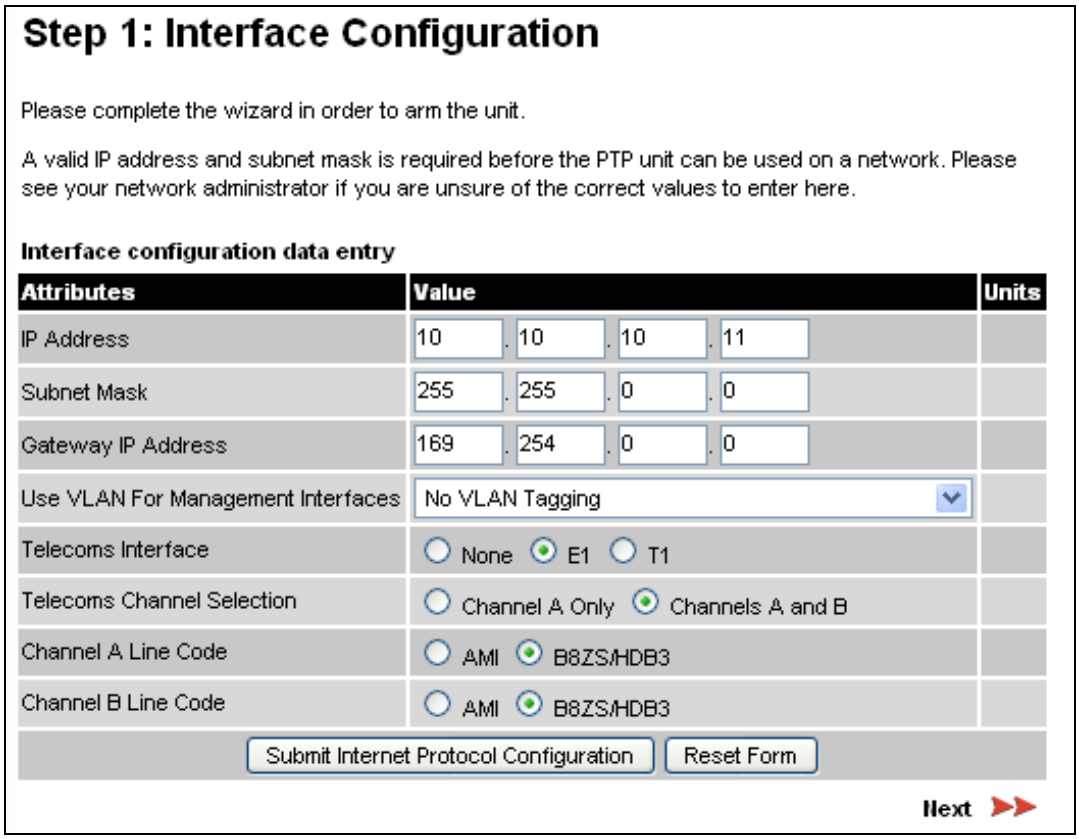


Once complete, click the ‘Submit Internet Protocol Configuration’ button or the ‘Next’ link.

8.3.4.3 Telecoms Interface

If the telecoms interface is configured to either T1 or E1 then the web page will reconfigure itself with the following additional configuration options.

Figure 65 - Telecoms Configuration Interface



Telecoms Channel Selection: This controls the selection of the telecoms interface standard supported options or T1 and E1.

Channel A Line Code: The line code setting of the telecoms interface. This must match the setting of the device connected to this interface.

Channel B Line Code: The line code setting of the telecoms interface. This must match the setting of the device connected to this interface.

Cable Length: This field is applicable to the T1 operating mode only. It configures the T1 transceiver to output a signal suitable for driving a cable of the specified length. This should be set to reflect the length of cable between the wireless unit and the connected equipment.

8.3.4.4 Wireless Configuration

Step 2 of the installation wizard requires the installer to enter the wireless configuration parameters.

Figure 66 – PTP 59600, PTP 58600 and PTP 54600 Variants - Installation Wizard Wireless Configuration

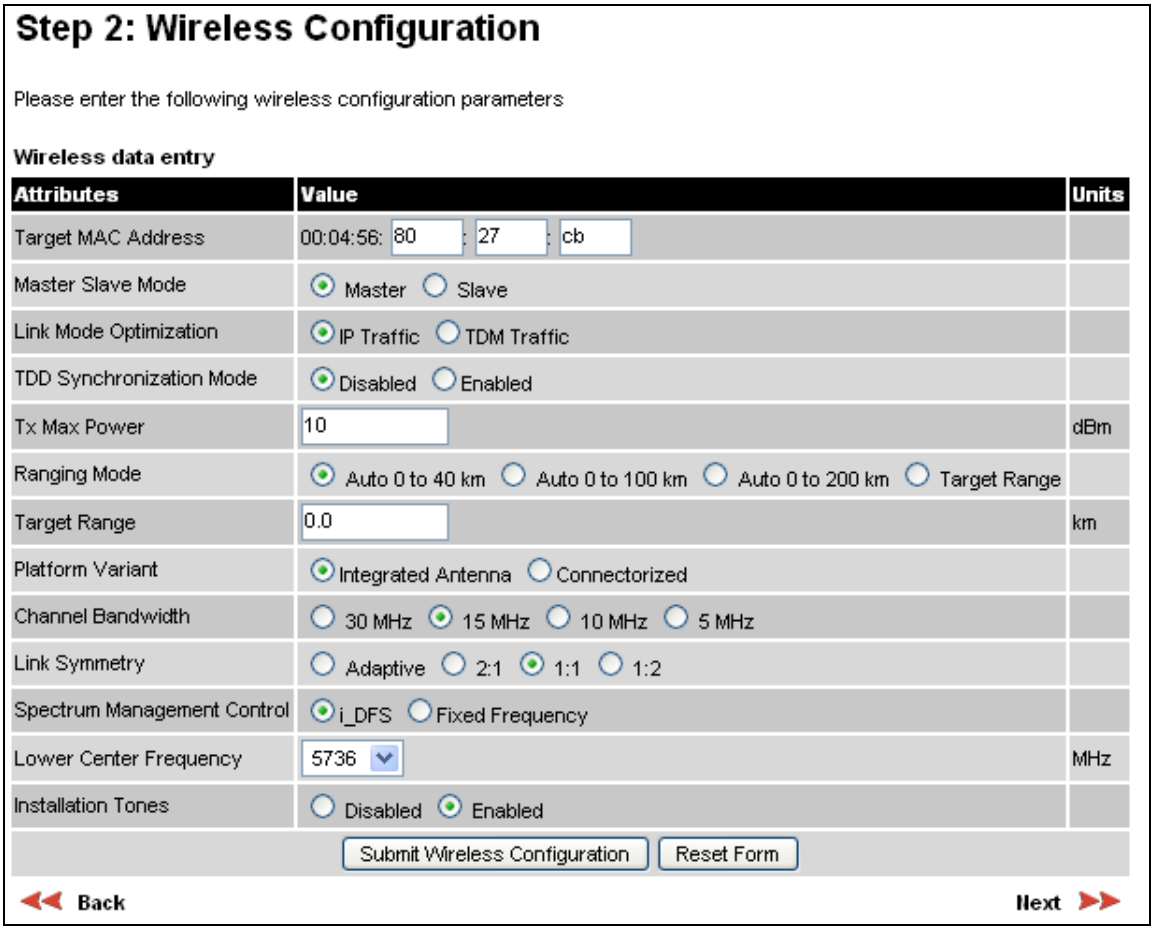
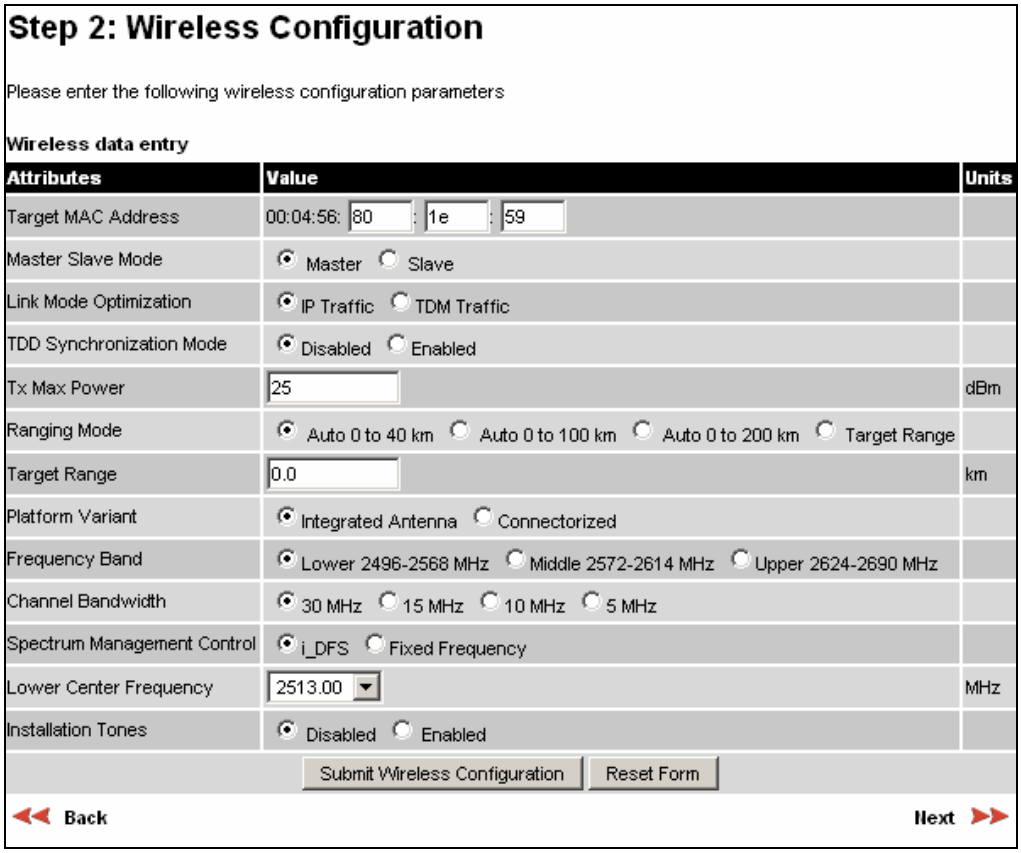


Figure 67 - PTP 25600 Variant - Installation Wizard Wireless Configuration



Step 2: Wireless Configuration

Please enter the following wireless configuration parameters

Wireless data entry

Attributes	Value	Units
Target MAC Address	00:04:56: 80 : 1e : 59	
Master Slave Mode	(•) Master ( ) Slave	
Link Mode Optimization	(•) IP Traffic ( ) TDM Traffic	
TDD Synchronization Mode	(•) Disabled ( ) Enabled	
Tx Max Power	25	dBm
Ranging Mode	(•) Auto 0 to 40 km ( ) Auto 0 to 100 km ( ) Auto 0 to 200 km ( ) Target Range	
Target Range	0.0	km
Platform Variant	(•) Integrated Antenna ( ) Connectorized	
Frequency Band	(•) Lower 2496-2568 MHz ( ) Middle 2572-2614 MHz ( ) Upper 2624-2690 MHz	
Channel Bandwidth	(•) 30 MHz ( ) 15 MHz ( ) 10 MHz ( ) 5 MHz	
Spectrum Management Control	(•) i_DFS ( ) Fixed Frequency	
Lower Center Frequency	2513.00	MHz
Installation Tones	(•) Disabled ( ) Enabled	

Submit Wireless Configuration | Reset Form

◀◀ Back Next ▶▶

Target MAC Address: It is the MAC Address of the peer unit that will be at the other end of the wireless link. This is used by the system to ensure the unit establishes a wireless link to the correct peer.

The MAC Address can be found embedded within the serial number of the unit. The last six characters of the serial number are the last three bytes of the unit's MAC address.

NOTE: A PTP 600 Series system is shipped as a pair of units with pre-loaded correct MAC addresses. Target MAC addresses will only need to be entered if an existing unit has to be replaced in the field or the units configuration has been erased.

Master Slave Mode: At this point it is necessary to decide which end will designate a Master. The Master unit is the controlling unit with respect to the point-to-point link and its maintenance. The master transmits until the link is made, while the Slave listens for its peer and only transmits when the peer has been identified.

Link Mode Optimization: Optimizes the link behavior according to the type of traffic that will be bridged. There are two modes to choose from: IP and TDM.

In IP Mode, the PTP 600 product runs an Adaptive TDD scheme. Basically an unloaded link runs 10:10 mode (10 OFDM bursts alternately in each direction). A sustained traffic load in one direction for example may cause a threshold to be reached where the TDD mode automatically adapts to say 20:10. If the load continues to increase, then the TDD structure may adapt even further through 30:10 to 40:10. This is a state of maximum link asymmetry (40 OFDM bursts in one direction compared with 10 in the other). If the load increases in BOTH directions, then the TDD structure can adapt from 10:10, through 20:20, 30:30 and finally 40:40. This is a state of maximum aggregate throughput. So if three out of these combinations are considered; 10:10, 40:10 and 40:40 they would give the following characteristics:

- **10:10** equal performance in each direction, lowest aggregate throughput and lowest Latency.
- **40:10** achieves maximum one way throughput performance, to the detriment of both latency and throughput in the opposite direction.
- **40:40** Maximum link aggregate rate, balanced performance in each direction, higher latency.

NOTE: There is an engineering trade-off between the flexibility of ATDD and Latency as follows: When the TDD structure changes, there will be a short term impact on Latency for a few Frames. This would not affect the steady state long term average latency, but could be recorded as a Maximum latency. This affect may be amplified for short Latency tests or if the traffic loading is oscillating either side of a boundary condition. As the TDD burst length increases, Traffic in each direction will have to wait longer before a Transmit window is available, but more data can be sent during the burst. There is an impact on latency but it varies depending upon installation range, Frame size and modulation mode.

In TDM mode, two major differences in link behavior occur compared with IP mode. First the TDD structure is fixed symmetrically. Either 10:10, 20:20, 30:30 or 40:40 based upon the installed range, as shown in Table 27.

Table 27 – TDD Structure in TDM Mode

OFDM Bursts	Radar Avoidance Range (km)	30 MHz Band Range (km)	15 MHz Band Range (km)	10 MHz Band Range (km)	5 MHz Band Range (km)
10:10	1-20	1-43	1-60	1-94	1 -200
20:20	21-63	44-95	61-130	95-200	N/A
30:30	64 -145	96 -150	131 -200	N/A	N/A
40:40	146 -200	151 -200	N/A	N/A	N/A

Secondly, the point at which a modulation mode changes for given RF conditions is more conservative. In practice, this means that the link will typically stay in a lower modulation mode, but with increased tolerance to RF variability.

Depending upon the link characteristic that the customer requires, this may very well be the best choice. It increases consistency of link performance and equality in each direction as a trade-off against maximum throughput.

TDD Synchronization Mode: Enables the TDD Synchronization feature (see Section 5.11 “Time Division Duplex (TDD) Synchronization” for basic description and Section 14 “TDD Synchronization Configuration and Installation Guide” for installation and configuration details).

Tx Max Power: This attribute controls the maximum transmit power the unit is permitted to use when installing and executing the wireless link. The maximum setting for a particular region or country is controlled by the License Key.

Ranging Mode: During installation, the wireless units perform “Automatic Ranging”. The ranging mode allows the installer to control the behavior of the system’s automatic ranging algorithms. The default value is 0 to 40 km[18] (0 to 25 miles). If the installer is required to install a link of greater than 40 km (25 miles) then the ranging mode attribute MUST be configured to ‘0 to 100km’ (0 to 62 miles) or ‘0 to 200km’ (0 to 124 miles) mode depending on the range of the link.

Target Range: Installers that know the range between the two wireless units to within ± 1 km can use the target range mode. The main advantage of the target range mode is that it reduces the time taken by the units to range. To use the target range mode the installer MUST select Target Range as the ranging mode and enter the approximate range in km in the Target range data entry field at both ends of the link.

Platform Variant: Chooses between an integrated unit or a connectorized unit that requires an external antenna.

Frequency Band: This is for the PTP 25600 product variant which operates in one of three bands as described in Section 5.4 “Variable Channel Bandwidth Operation”.

Channel Bandwidth: Users can choose a variable channel bandwidth for the available spectrum. Values of 5 MHz, 10 MHz, 15 MHz and 30 MHz can be selected.

Link Symmetry: (Master only) Values of Adaptive, 2:1, 1:1 and 1:2 can be selected. In fixed symmetric mode, the master spends an equal amount of time transmitting and receiving whereas in fixed asymmetric mode, the master transmit and receive times have a fixed ratio.

NOTE: (a) "Adaptive" is not supported in regions where radar avoidance is in use, (b) "Adaptive" is not supported when link optimization is set to "TDM", (c) "Adaptive" is not supported in 5 MHz channel bandwidth, (d) "2:1" and "1:2" are not supported in 5 MHz channel bandwidth.

[18] If preferred PTP 600 Series Bridge range functions can be configured to operate in miles, see the Properties page in Section 8.3.15.

Spectrum Management Control: Is used to configure the PTP 600 Series Bridge's Spectrum Management features, see Section 8.3.7 "Spectrum Management" for more details. i-DFS is the abbreviation for intelligent Dynamic Frequency Selection. This feature continually monitors the spectrum looking for the channel with the lowest level of on channel and co-channel interference. Fixed frequency mode allows the installer to fix transmit and receive frequencies on the units. The frequencies may be configured symmetrically or asymmetrically. Only 30MHz channels are available in regions that mandate DFS (Radar Detection), and the Spectrum Management Control may not be available because the regulations for some regions force DFS, others force fixed frequency (for example 2.5 GHz).

Lower Center Frequency: The software for the PTP 600 Series Bridge allows a user to optionally adjust the channel center frequencies. Changing the Lower Center Frequency attribute causes all channel center frequencies to be offset. It effectively slides the channelization up or down. See Sections 5.5 or 5.6, 5.9 and 5.10 depending on the frequency variant.

CAUTION: The lower center frequency attribute must be configured to the same value for both the master and slave. Failure to do so will cause the wireless link to fail reestablishment. The only way to recover from this situation is to modify the Lower Center Frequency attribute so that they are identical on both the master and slave unit.

Default Raster: If this is set to "On", the list of options presented in the fixed Tx frequency box is limited by the default raster.

Fixed Tx Frequency, Fixed Rx Frequency: The software for the PTP 600 Series Bridge allows a user to optionally fix the Transmit and the Receive frequencies for a wireless link. The settings must be compatible at each end of the link. Once configured the spectrum management software will not attempt to move the wireless link to a channel with lower co or adjacent channel interference. Therefore this mode of operation is only recommended for deployments where the installer has a good understanding of the prevailing interference environment. Figure 68 shows a sample fixed frequency configuration for a 30 MHz channel bandwidth. In the example the lower center frequency is set to its default values and the Fixed Transmit Frequency is set to 5742 MHz and the Fixed Receive Frequency is set to 5742 MHz. Care must be taken when configuring the Fixed Transmit and Receive Frequencies to ensure that both frequencies are on the same 10 MHz channel raster as the Lower Center Frequency. For example both the Fixed Transmit and Receive Frequencies must be a multiple of 10 MHz from the Lower Center Frequency (5752 = 5742 + 10 MHz) and (5782 = 5742 + 10 MHz $\times$ 3).