



Digital Repeater Line

DSP95 Modular 255 Series Users Guide

PRODUCT MANUAL



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Preface

This Preface includes the following:

- **Purpose**
- **Application**
- **Document Organization**
- **References**
- **Document Conventions**
- **Product Registration Information**
- **Safety Notices**
- **Important Safety Information**
- **Radio and Television Interferences**
- **Industry Certifications/Registration Numbers**
- **Technical Support**
- **Acronyms and Abbreviations**

Purpose

The purpose of this document is to provide a step-by-step procedure to help the experienced technician/engineer install and commission an in-building wireless enhancement repeater system using Westell Technologies digital repeaters. Following the procedures outlined will minimize risks associated with modifying a live system and prevent service interruptions. This document assumes the technician/engineer understands the basic principles and functionality involved with repeater and in-building systems. It is geared to the practical concerns of the installer.

Application

This guide should be applied whenever a need exists to add digital repeater capability to an existing system or when this capability is being included with a new installation.

Document Organization

This manual includes the following chapters:

Chapter 1: Product Overview – Provides an Overview of the DSP95 Module 255

Chapter 2: System Optimization Installation Tips – Provides information for optimization of using the system

Chapter 3: Web-Based GUI – Provides information on using the system through a web-based graphical user interface

Chapter 4: Console Interface – Provides information on local access to the repeater through console interface

Appendix A: Attenuation and Dynamic Range Guidelines – Provides information on attenuation and dynamic range guidelines



Appendix B: Band Plans and Filter File Naming Conventions – Provides information on the band plans and filter file naming conventions

Appendix C: Mechanical Configurations – Provides mechanical drawings and mounting diagrams for the system

Appendix D: Mechanical and Electrical Specifications – Provides the mechanical and electrical specification for the system

Appendix E: Port Configuration – Provides the port configuration information for the system

Appendix F: Glossary – Provides a list of acronyms used in this manual

Reference

- Westell Technologies Power Supply Users Guide, part number 960-1152-MNL

Document Conventions

Table P-1 lists the conventions used throughout this document.

Table P-1: Document Conventions

Convention	Description
WARNING!	Indicates conditions or practices that could cause personal injury or death. Before you work on any equipment, be aware of the hazards involved with electrical and RF circuitry and be familiar with standard practices for preventing accidents.
CAUTION!	Indicates conditions or practices that could cause damage to equipment or property, for indicating information that is crucial to preventing loss of data or damage to hardware or software, and actions that could result in catastrophic equipment failure.
NOTE	Indicates additional information or comments that may be useful to the user.
Bold	Bold typeface indicates equipment labels and provides emphasis.
Click	Indicates for the user to press the primary (typically left) mouse button while the pointer is over the specified location.
Right-click	Indicates for the user to press the secondary (typically right) mouse button while the pointer is over the specified location.
Double-click	Indicates for the user to press the primary (typically left) mouse button twice, rapidly, while the pointer is over the specified location.
Select	Indicates for the user to perform a selection on the screen by clicking an active object.
Enter	Indicates for the user to type text using the keyboard.
>	Indicates a level in a menu. For example, Start>Programs prompts the user to click on Start, then locate and click Programs, under the Start menu.

Product Registration Information

The serial number may be found on the label on the bottom panel, near the power connectors. Write this number in the boxes shown below. Retain this manual, along with proof of purchase, to serve as a permanent record of your purchase.

MODEL NUMBER	SERIAL NUMBER	PURCHASE DATE
<input type="text"/>	<input type="text"/>	<input type="text"/>
POINT OF SALE COMPANY		
<input type="text"/>		

Safety Guidelines

The general safety information in this guideline applies to both operating and service personnel. Specific warnings and cautions will be found in other parts of this manual where they apply, but may not appear in this summary. Failure to comply with these precautions or specific warnings elsewhere in the manual violates safety standards of design, manufacture, and intended use of equipment. Westell Technologies assumes no liability for the customer's failure to comply with these requirements:

Grounding: This digital repeater system is designed to operate from 100 - 240 VAC and should always be operated with the ground wire properly connected. Do not remove or otherwise alter the grounding lug on the power cord.

Explosive atmospheres: To avoid explosion or fire, do not operate this product in the presence of flammable gases or fumes.

Lightning danger: Do not install or make adjustments to this unit during an electrical storm. Use of a suitable lightning arrester, such as Westell Technologies CSI-CAP, is strongly recommended.

No user serviceable parts inside. Hazardous voltages are present when the cover is removed. Opening the chassis will void your warranty. If you suspect a malfunction with this product, call your dealer or Westell Technologies technical support line at 1.877.844.4274

CAUTION!

Power off before connecting/disconnecting cables.

Important Safety Information

Antennas used for the purpose of radiating signals indoors are limited to a maximum gain of 3 dBi. The outdoor antenna used for the purpose of communicating to the wireless infrastructure is limited to 14 dBi gain, or any combination of gain and loss that equates to 14 dB at input. Each antenna must be positioned to observe minimum separation requirements from all users and bystanders. The following guidelines should be used when considering separation distances.



Indoor antennas must be placed such that, under normal conditions, personnel cannot come within 20 cm (~8 in) from any inside antenna. Adhering to this minimum separation will ensure that the employee or bystander cannot exceed RF exposures beyond the maximum permissible limit as defined by section 1.1310 i.e. limits for general population/uncontrolled exposure.

Outdoor antenna must be positioned such that, under normal conditions, personnel cannot approach closer than 183 cm (~6 ft). A directional antenna having a maximum gain of 14 dBi is used, precautions should be taken to prevent personnel from routinely passing through the main radiation beam at a distance closer than specified.

Radio and Television Interference

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the Federal Communications Commissions (FCC) rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. In order to maintain compliance with FCC regulations shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cabled is likely to result in interference to radio and television reception. Changes and modifications not expressly approved by Westell Technologies can void your authority to operate this equipment under FCC rules.

Industry Certifications/Registration Numbers

FCC

- NVRC SI-DSP25XH-CP

IC

- 4307A-DSP25XH-CP

UL

- Power supply 60950-1

Technical Support

If you suspect a malfunction with this product or have a technical question, call your dealer or the Cellular Specialties Support Line at: (603) 626-6677, Toll Free (USA) 1-877-844-4274, press option 2 then option 1. Also they can be reached at productsupport@cellularspecialties.com.

Acronyms and Abbreviations

Refer to the Glossary at the end of this manual for definitions of the acronyms and abbreviations used in this manual.

1 Product Overview

1.1 Product Information

Westell Technologies developed its digital repeaters for use within enclosed structures where sufficient signal from local cell sites to operate cell phones is unavailable. Adequate signal must be available outside the structure as a prerequisite to achieving in-building coverage. The digital repeater is connected to an external antenna, usually on the roof, and to one or more internal antennas placed strategically throughout the area where wireless service is desired.

The external antenna typically is directional, such as a yagi. Internal antennas are typically omnidirectional, although various other types may be used depending on the coverage application. The Westell Technologies Digital Signal Processing (DSP) repeater amplifies both the uplink (phone to tower) and downlink (tower to phone) signals thus facilitating communications to and from the intended wireless infrastructure.

With a maximum total of 90 dB nominal gain on both the uplink and downlink, gain can be adjusted over a range from 58.5 dB to 90 dB in 0.5 dB steps. Control of the repeater is achieved utilizing a computer connected to COM port or via a crossover Ethernet cable connected to the Ethernet port.

A specific filtering process modifies each amplification chain. This process digitally converts the assigned spectrum and then applies DSP techniques. DSP is used to create passbands that selects the RF energy passing through either the uplink or downlink paths. After the digital processing is complete, the information is converted back to an analog signal that is applied to the remaining stages of amplification. The resulting signals emitted by the repeater are specific to the network service providers' requirements. If these requirements change, only the DSP configuration parameters need change in order to adapt. Configuration parameters are created at the factory and supplied as files that may be downloaded to the repeater. The filter set configurations stored in memory determine the unit's adaptability to various field applications. The following pages describe the band plans as well as the convention Westell Technologies uses to identify and store the files that make up the filter set. All Westell Technologies repeaters are shipped with an active filter set that is programmed according to the ordering parties' specifications. In most cases, the installer will not be required to program a filter.

1.2 Functional Overview

Westell Technologies digital repeaters incorporate the following features for convenient operation, access, protection, and control.

- Network configuration and control using either a Web page style Graphical User Interface (GUI) through any standard browser or a menu driven user interface using the serial port. GUI does not require Internet access
- User gain control (affects all passbands)
- Automatic gain control
- Automatic power control
- Over drive protection (PA limiting)
- Under/over voltage protection
- Fault protection
- Alarm notification - local/remote



- Upgrade support - local/remote
- External interfaces - USB/Ethernet/serial
- Re-loadable Filters - local/remote
- Web-based monitoring and control - local/remote
- Persistent status and error information

1.3 LED Indicator

Westell Technologies automatic safety precautions are built into the amplifier system. In the case of a catastrophic system event, a shutdown circuit is incorporated that will disable all emissions should the uplink input or downlink input be over driven or should an oscillation or output overpower event occur. The amplifier will periodically attempt to recover from the detected condition automatically. Warning light indicators are as follows:

- Solid green: Unit is operational, PA is on
- Solid red: Unit has an error condition or PA is off

The user may check the status page of the GUI for the nature of the fault.

NOTE

On power up, the repeater will require approximately three (3) minutes for the internal computer to boot. During this time the LED labeled Power/Fault or Status will slowly blink green on and off at a rate of approximately 1 Hz. This will indicate that the unit is in the boot up process. Filter configuration file loading will show green light blink two (2) seconds on / three (3) seconds off until finished.

Do not unplug the unit while it is in the boot up process.

1.4 Local Communication Interface Ports

To allow monitoring and control, Westell Technologies repeaters are equipped with four ports that provide external communication access (one Ethernet CAT-5, one DB-9 serial, and two USB). The Ethernet, CAT-5 port is provided as a primary communications port to the PC. The serial interface provides communications to a PC and the USB interface provides a means to download files from a memory device. The DB-9 pin assignments conform to the standard Electronic Industries Association (EIA232) specification. A diagram of the pin descriptions is provided in Figure 1-1 for reference. Connecting a null modem cable to one of the COM ports and using a terminal emulation program with a PC will allow communication to the control processor's Text Menu Interface (TMI).



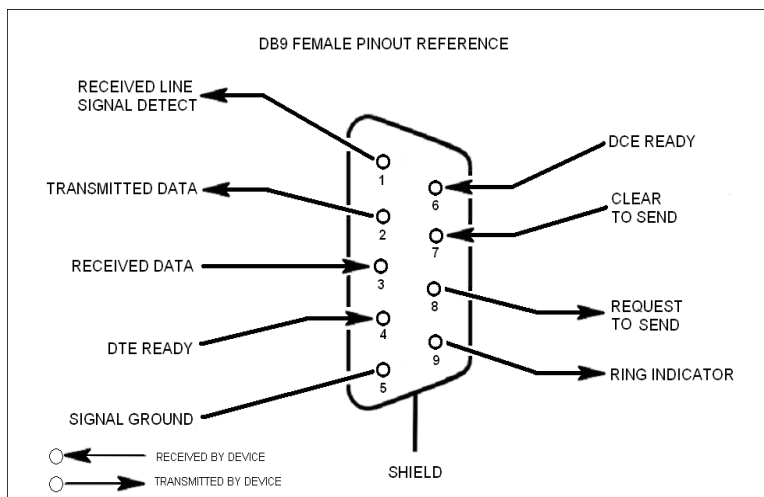


Figure 1-1: Pin Description

1.5 EIA232 Pin Specifications

Figure 1-1 is for reference only. It is intended to provide a quick source for pin out information in the event it should be necessary to adapt your serial cable because of an unusual connector configuration. In the vast majority of cases this information will not be needed.

1.6 USB Interface

The USB interface conforms to Intel's Universal Host Controller Interface (UHCI) version 1.1 dated March 21, 1996. This interface will support data transfer rates up to 12 Mbps and can be used for software updates and filter file uploads.

1.7 Ethernet

The Ethernet AUI conforms to IEEE 802.3 and is capable of supporting 10/100 Mbps communications speeds. This port is used to provide access to the GUI.

1.8 Monitoring and Alarms

The DSP 95 series can be monitored via an Ethernet connection using SNMP, SSH and/or HTTP protocols. Public Safety DSP models have dry contacts for traditional alarm panel monitoring as well.

1.9 Circuit Operational Description

The repeater uses a single down conversion/up conversion scheme. There are multiple RF amplifier stages prior to each down-converting mixer. The down-converting mixers are followed by a single IF amplifier. A DSP block then processes the resultant digitized IF signal that was previously generated by an analog-to-digital converter. The processed (filtered) digital signal is fed to a digital-to-analog converter and then up-converted to RF. A driver amplifier and a final power amplifier make up the final gain stages before application to the diplexer. The maximum total system gain (diplexer input to diplexer output) is nominally 90 dB for either the downlink or the uplink paths with both links having independent manual and Automatic Gain Controls (AGC).

AGC reacts to analog power detection on both the input and output of the uplink and downlink RF chains. A control algorithm continuously monitors these detected values and dynamically adjusts various gain stages such that the net system gain value, entered manually, is optimally maintained without either exceeding FCC parameters or over driving the A/D converters.

An LED on the front panel provide immediate visual indication of the unit's primary power alarm status. The repeater features automatic shutdown protection as a safety measure should excessive drive be applied to the input or an oscillation condition occur. When in a protected mode, a control algorithm determines the appropriate method of recovery to a normal, previously defined state, or maintains the protection until manually reset. If recovery has been established, the LED will be illuminated green or available to be reset. The events that trigger the error will be saved in the event log.

2 System Optimization Installation Tips

2.1 System Setup Considerations

All cables should be checked for shorts and opens. Also verify that there are no cables with loose or poor connections. RF leakage could cause oscillation to occur under some conditions.

The rooftop antenna (donor antenna), if directional, should be checked for proper alignment along the calculated compass heading. Typically, the directional antenna would be aimed at the same site that your handset uses, but it may not always be so. It is critical the installer contact the service provider for information on, and approval of, the cell site he or she has selected before the system is turned on.

If cables and alignment are acceptable and a problem persists, it may be necessary to use a spectrum analyzer to examine the signal environment in which the repeater is operating. The existence of strong adjacent channel signals within the frequency band(s) can cause the AGC to reduce the amplifier's gain or cause alarms. In some cases, additional filtering or attenuation might be required to reject these unwanted signals. In some instances, the donor antenna can be reoriented horizontally, to place the interference source in an antenna pattern null. There also may be some cases where the interference from outside signals is so great that they cannot be filtered or otherwise reduced or eliminated without expensive and possibly prohibitive measures. In these cases, it may not be practical to use the repeater for providing coverage to these sites.

2.2 Suggested Spectrum Analyzer Setting

When troubleshooting RF issues, and when surveying challenging RF environments, it is important to have a spectrum analyzer capable of measuring the frequency that you are working with. An attenuator should be used to protect the input when connected to a source of RF power such as the repeater or a powered DAS.

Both uplink and downlink should be measured. Downlink should be measured on the donor cable and at the output (server) port of the powered up repeater, and uplink at the lead from the DAS (on fiber-powered DAS, where the lead would connect to the server port on the repeater) and at the donor port with the repeater powered up. Measurements may also be necessary at server antenna locations. Your spectrum analyzer will need to be equipped with a whip antenna for this.

Resolution BandWidth (RBW) should be set at 200 kHz for GSM and 1 MHz for CDMA. If you cannot select these values, the closest available values should be used. Video filter should be about one-tenth of RBW.

If you cannot see an adjacent out of band signal when using the 1 MHz RBW filter, you can decrease the RBW to see the close-in-frequency signals. Be sure to set the RBW back when you want to measure the power level.

2.3 Important Installation Notes

Inadequate isolation between the outside and inside antennas may cause regenerative feedback in the system. This feedback can cause the amplifier to emit a continuous signal at maximum amplitude and, in some cases, interfere with normal operation of the cell site. Careful consideration of the layout and placement of the system is imperative.

The installer should refer to Section 0 Safety Guidelines and 0 Important Safety Information for proper antenna selection and installation. To avoid serious injury or death and damage to the repeater, do not install donor or server antennas near overhead power lines or high power components. Allow enough distance so that if antennas should fall they will not come in contact with those components.



Close proximity to the donor or server antennas with the repeater in operation may expose the user or installer to RF fields that exceed FCC limits for human exposure.

WARNING!

Amplifier or handset damage may occur if a handset is connected directly to the repeater or the coax that leads to the repeater.

2.4 Installation Tips

Donor Antenna

1. Accurately determine the azimuth to the donor cell site. Obtain the donor site information and approval from the service provider/carrier.
2. Ensure that the radiation path to the donor cell site is as unobstructed as possible.
3. Mount the donor antenna at or toward the edge of the roof, in the direction of the donor site. Try to avoid having the RF signal from the donor pass above the location(s) of the service antennas. Normally the service antennas will be behind and below the donor antenna if viewed from above. This approach will help avoid interference and feedback both to and from the service antennas.
4. Normally mounting the donor antenna higher will allow a less obstructed path to the donor site. However, in high traffic metro areas avoid mounting the donor antenna any higher than necessary as the quality of the donor signal may start to become less stable and it is more likely to encounter adjacent channel interference.
5. When possible, shield the donor antenna's backside by locating it so that any HVAC units and/or penthouse structures are behind the antenna relative to the donor cell site location.
6. System components should be grounded in accordance with NEC 810-15, 21 as required.

Antennas

1. Use omnidirectional antennas indoors, and locate them centrally with respect to the intended coverage area to minimize signal leakage to the outside. Use directional antennas indoors only in special cases when higher gain and directionality would be helpful and RF exposure limits will not be exceeded.
2. To avoid repeater uplink overload and gain limiting, mount the indoor antennas away from areas where mobile subscribers frequently use their phones such as desks or dispatch areas.
3. To determine the quantity and locations of indoor antennas, use an appropriate phone's signal meter to determine areas of weak signals. These are the approximate areas where indoor antennas may be needed. Also be aware the signal from an indoor antenna, in most cases, can be expected to penetrate about two standard office sheetrock-type walls to reach users. After two walls, or if the walls are made of other materials, it may be necessary to split the available signal and add more antennas.

2.5 Optional Accessories

A complete line of accessories is available from Westell Technologies. Check with your Westell Technologies distributor for any additional items needed. Below are just a few examples suitable for most in-building needs.

Outside donor antenna

- PCS - model number CSI-AY/1.85-1.99/10 dB
- Cellular - model number CSI-AY/806-960/14 dB
- LTE – model number CSI-AY/806-960/11 dB
- LTE – model number CSI-AY/806-960/14 dB

Inside omnidirectional antenna

- Quad-band - model number ClearLink™ - O/698-2.7K/N

Power dividers

- 2:1 - model number CSI-SPD2/700-2.7K/N
- 3:1 - model number CSI-SPD3/700-2.7K/N
- 4:1 - model number CSI-SPD4/700-2.7K/N

Directional couplers

- 6 dB - ClearLink™ -DC6/698-2.7K/N
- 10 dB - ClearLink™ -DC10/698-2.7K/N
- 15 dB - ClearLink™ -DC15/698-2.7K/N
- 20 dB - ClearLink™ -DC20/698-2.7K/N
- 30 dB - ClearLink™ -DC30/698-2.7K/N

19" Rack shelf - model number CSI-RMS-250

UPS

- Battery backup, two hour single-band, one hour dual-band - model number CS48-985-600
- Battery backup, four hour single-band, two hour dual-band - model number CS48-985-601

Cross band couplers

- Quad-band Rack Mount - model number CSI-CM250-7/C/AW/P (700 LTE, Cellular, AWS and PCS)
- Quad-band Wall Mount - model number CSI-CBC/696-2170/N (700 LTE, Cellular, AWS and PCS)
- Tri-band Rack Mount - model number CSI-CM250-U7C/C/P (700 Upper C LTE, Cellular and PCS)
- Tri-band Wall Mount - model number CSI-CBC21/740-1990/N (700 Upper C LTE, Cellular and PCS)
- Tri-band Rack Mount - model number CSI-CM250-L7ABC/C/P (700 Lower A/B/C LTE, Cellular and PCS)
- Tri-band Wall Mount - model number CSI-CBC21/696-1990/N (700 Lower A/B/C LTE, Cellular and PCS)



3 Web-Based GUI

3.1 Web-Based GUI Session

Primary access to the repeater is gained using a LAN connection and a Web browser program such as Firefox by Mozilla, or Internet Explorer from Microsoft (*Figure 4*). The repeater ships with the default IP address of 192.168.1.100, but can be changed later if required. If connecting directly to the repeater from a laptop or PC with a crossover CAT-5E cable or over a LAN, the user types the IP address of the repeater into the browser address line to connect.

Most users will need to update the TCP/IP settings on their computer to enable connection to a host that has a static IP. Select **Use the following IP Address** and enter the IP address as follows: **192.168.1.x**, where 'x' = any number from 2 to 254 inclusive other than 100. The subnet mask is 255.255.255.0. Questions pertaining to these settings should be referred to the user's IT department or refer to section 4.4 Additional Tips. When connection is made the user will be prompted for a user name and password. For the purpose of the GUI session, the default user name is **webuser** and the password is **CSI1234** as shown in Figure 3-1. This can also be changed as required. Internet access is not required to use the GUI. If you are connecting using a laptop, verify that your Ethernet port is plugged in. Some laptops will not allow Ethernet connection when operating on battery power.

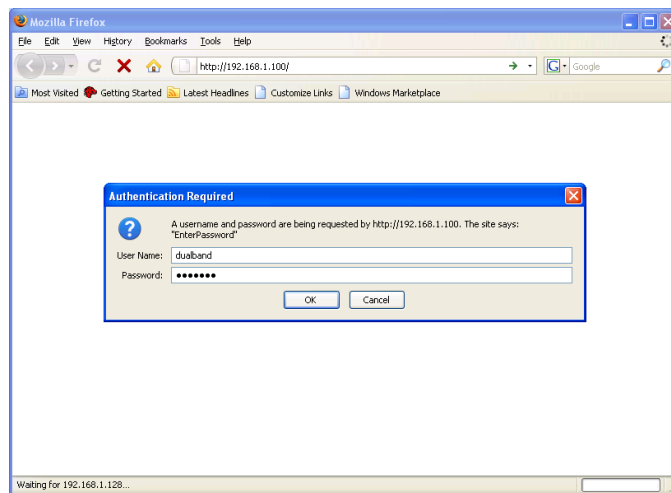


Figure 3-1: User Connection Login

3.2 System Status

When login is complete, the **System Status** page is displayed, as shown in Figure 3-2. The Navigation Box on the left hand side of the menu as shown in Figure 3-3 shows available operations. Selecting the operation will bring you to the page for that operation

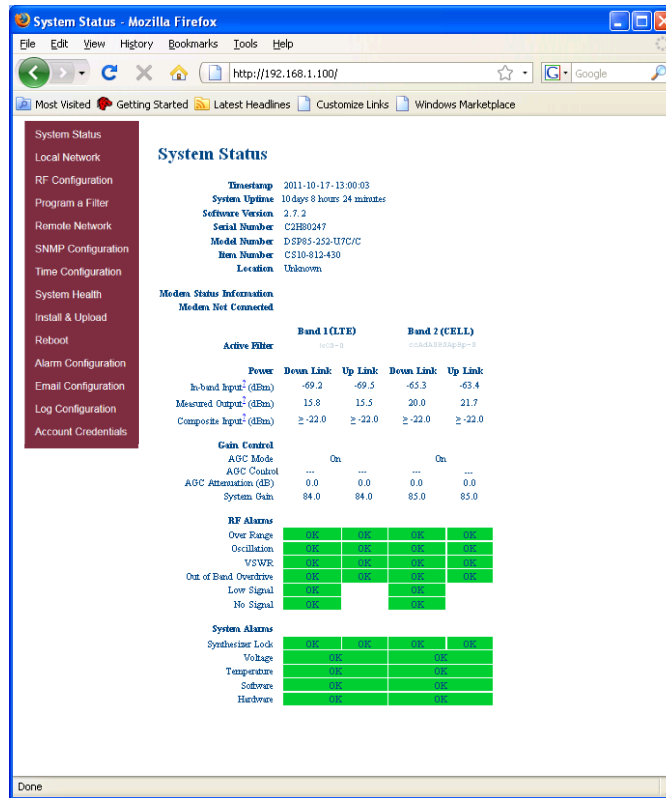


Figure 3-2: System Status

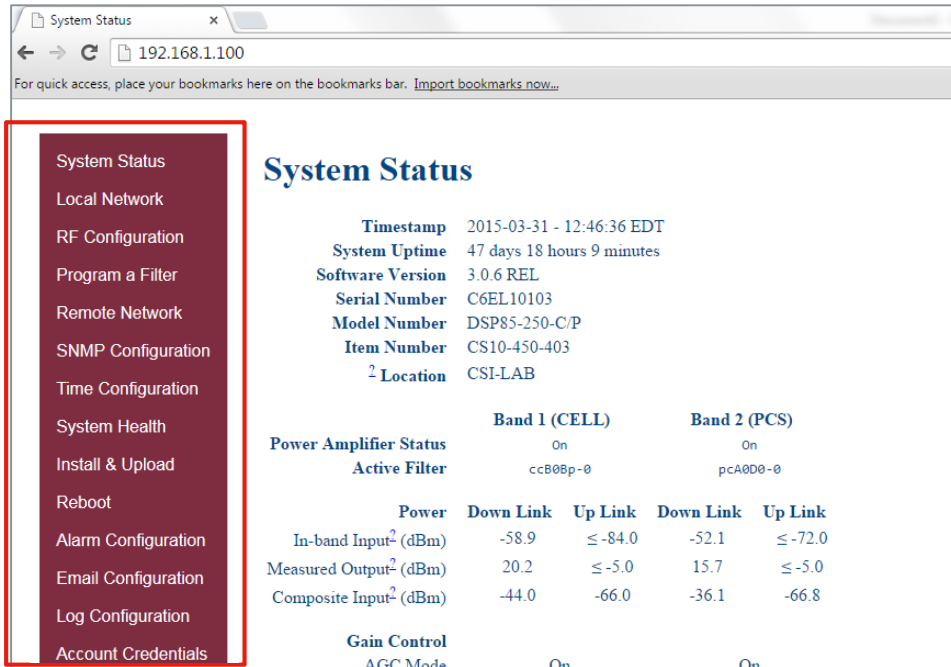


Figure 3-3: System Operations

3.3 Local Network

If the user selects **Local Network** from the **System Status** page, the Local Network screen as shown in Figure 3-4 is displayed. From here network configuration can be modified as required. The default is set to **Static**. Check with your IT department for explanation and approval of the DHCP and DHCP server options you plan to use before you select them.

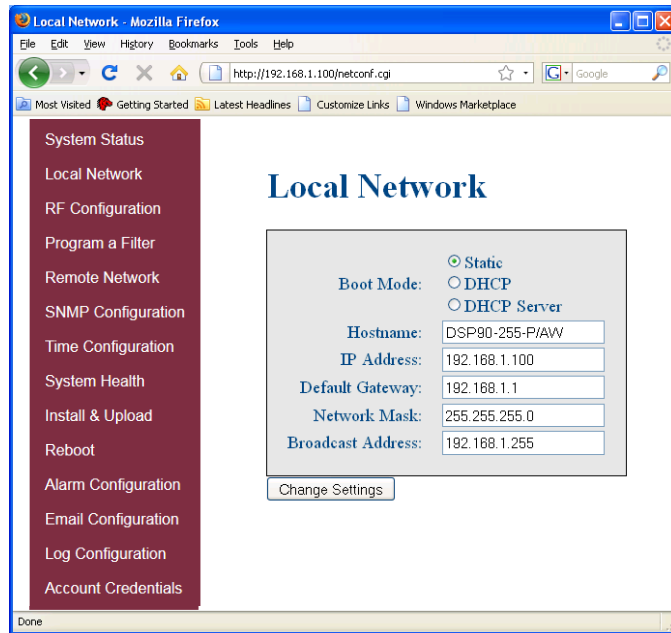


Figure 3-4: Local Network

NOTE

In units with software version 2.2.4 or prior, only letters, numbers and underscores are acceptable nomenclature. In units with software version 2.3.0 and up, underscores are not acceptable; however, hyphens are acceptable.

After changes are made, refresh the page to review the fields and ensure the change made is correct.

NOTE

Changing network settings will cause the current TCP/IP connection to fail because changes will take effect immediately. From here the user may return to the **System Status** page or click on the other options.

3.4 RF Configuration

If the user would like to modify the RF configuration, click on the words **RF Configuration** in the navigation box and the RF Configuration screen as shown in Figure 3-5 is displayed.

To change gain settings the user will select the **Uplink only** or **Uplink and downlink** radio buttons. The user then inputs the gain value desired. Gain values from 58.5 dB to 90 dB may be selected. The repeater will not allow values outside this range. The gain change is implemented by pressing the **Change Settings** button.

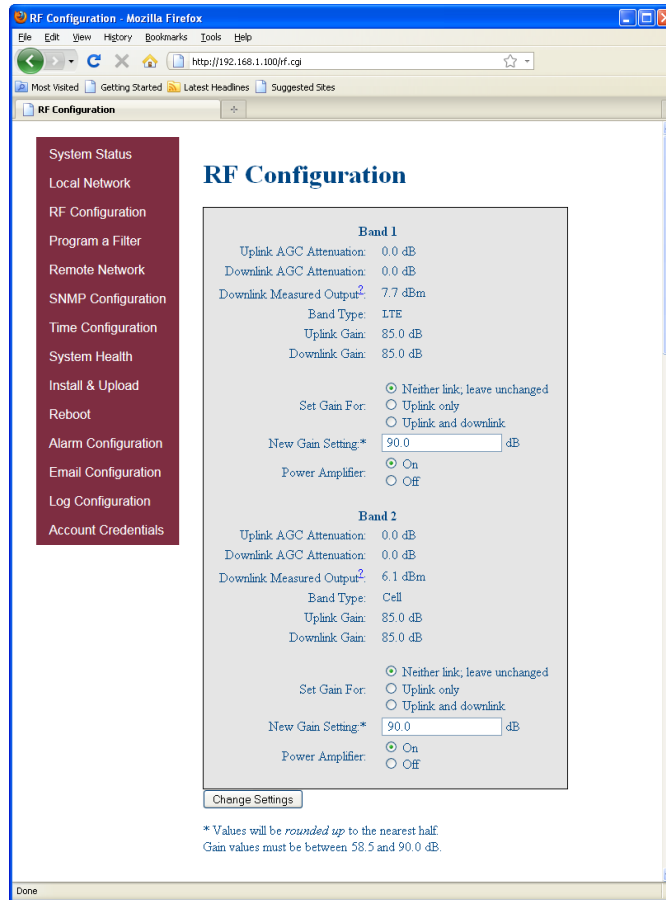


Figure 3-5: RF Configuration

3.5 Program a Filter

When a new filter set is required, it may be selected by clicking **Program a Filter** in the navigation box. The user may select the desired filter in the band/sub-band and modulation options as shown in Figure 3-6. Undesired bands/sub-bands, if lit, will require the user to manually deselect them before programming. To aid the user, a **Clear All** button is provided on the selected band and will deselect all band and sub-bands simultaneously. Pressing the **Program** button will complete the selection and load the desired filter. The time required to complete this process will take just a few moments. If the filter desired is not currently in the unit, additional filters along with instructions on how to load them, are available by contacting Westell Technologies.

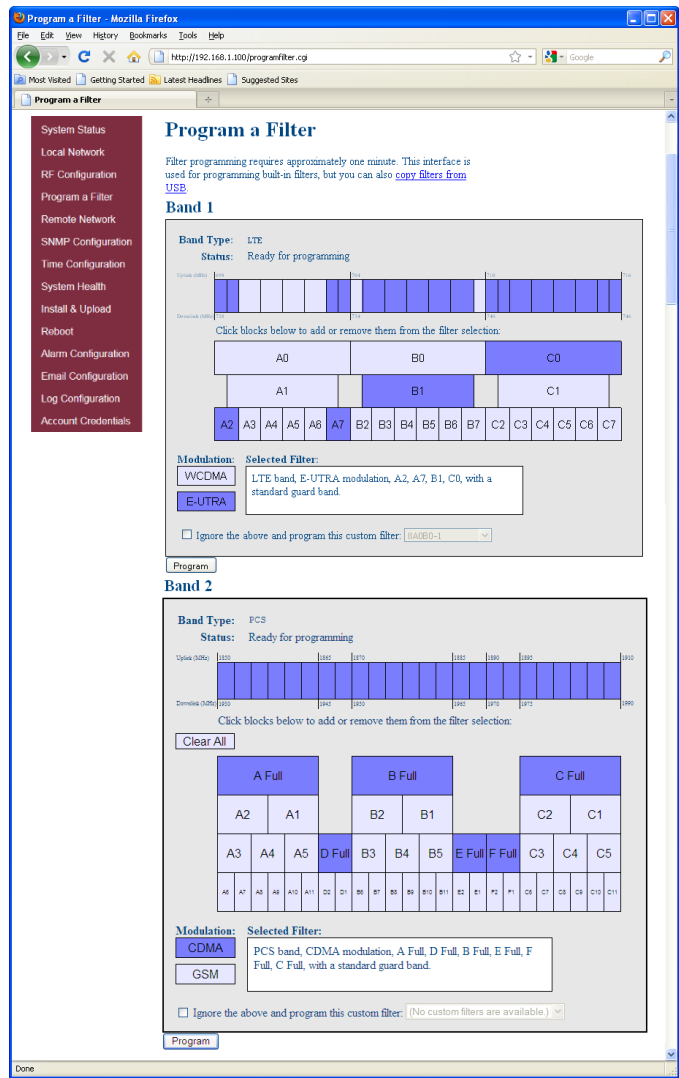


Figure 3-6: Program a Filter

3.6 Remote Network

If the repeater includes a USB modem kit, click on **Remote Network** in the navigation box and the screen is displayed as shown in Figure 3-7. Highlight the carrier on whose network the repeater and modem will be configured and click the **Change Settings** button. Refer to the documentation included with the modem kit for additional information on configuring the modem. If the repeater is connected to an Ethernet device for remote access and/or monitoring, this feature must be disabled.

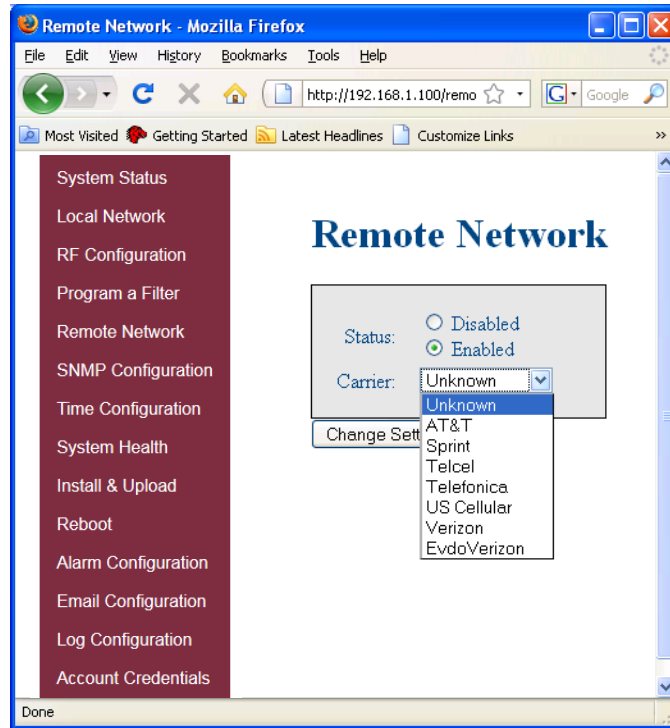


Figure 3-7: Remote Network

3.7 SNMP Configuration

To change SNMP settings, click **SNMP Configuration** in the navigation box, the screen will be displayed as shown in Figure 3-8. If the user is not well versed in SNMP, they should check with their IT professional for proper setting requirements.

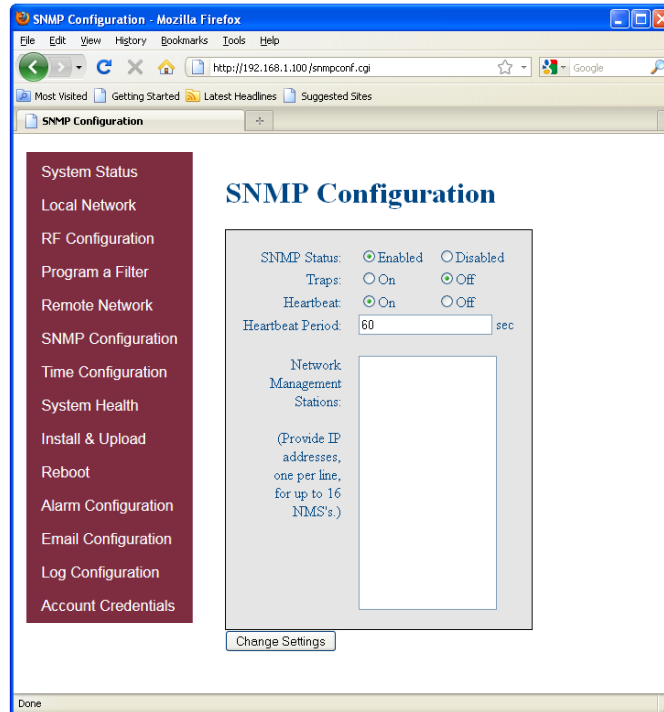


Figure 3-8: SNMP Configuration

3.8 Time Configuration

The **Time Configuration** page as shown in Figure 3-9 is reached by clicking on **Time Configuration** in the navigation box.

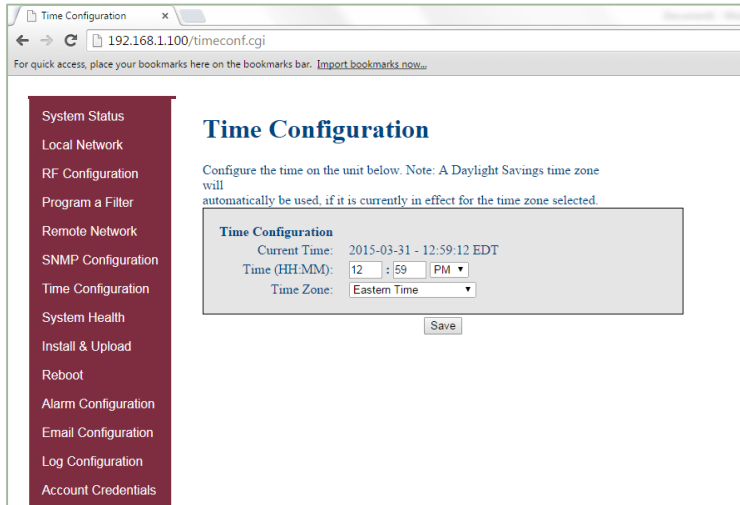


Figure 3-9: Time Configuration

3.9 System Health

By clicking **System Health** the current state of the repeater can be reviewed as shown in Figure 3-10. The user may clear LED indicators, alarms and the event log by clicking the **Clear Log** button. If required in your market, visit the **System Health** screen and click on **Trigger Test Alarm** and wait for confirmation that the WSP representative that is responsible for monitoring the repeater has been notified of the alarm. Be sure to click **Clear All Logs** prior to logging out of the Web interface.

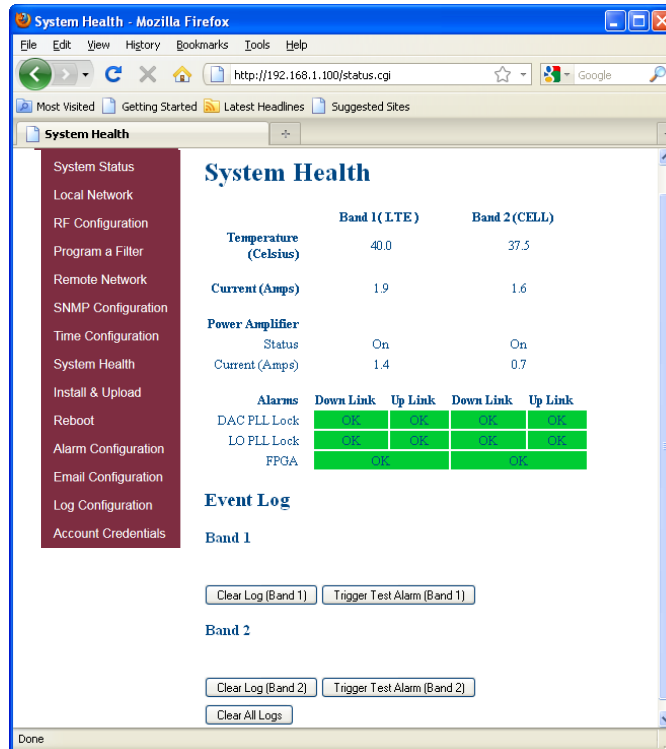


Figure 3-10: System Health

3.10 Install and Upload

Should a software install or upgrade be needed it can be done from the Install & Upload screen shown in Figure 3-11. As with the other screens it can be reached by clicking the words in the navigation box. Contact Westell Technologies for updates and instructions.

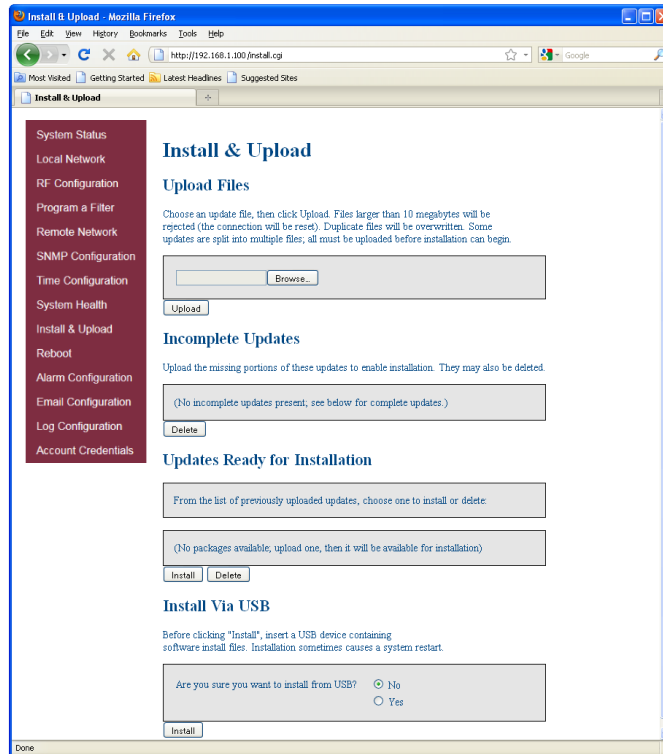


Figure 3-11: Install & Upload

3.11 Reboot

If a reboot of the repeater becomes necessary click on the **Reboot** option in the navigation box and the Reboot page is displayed as shown in Figure 3-12. A reboot will take three to five minutes to complete.

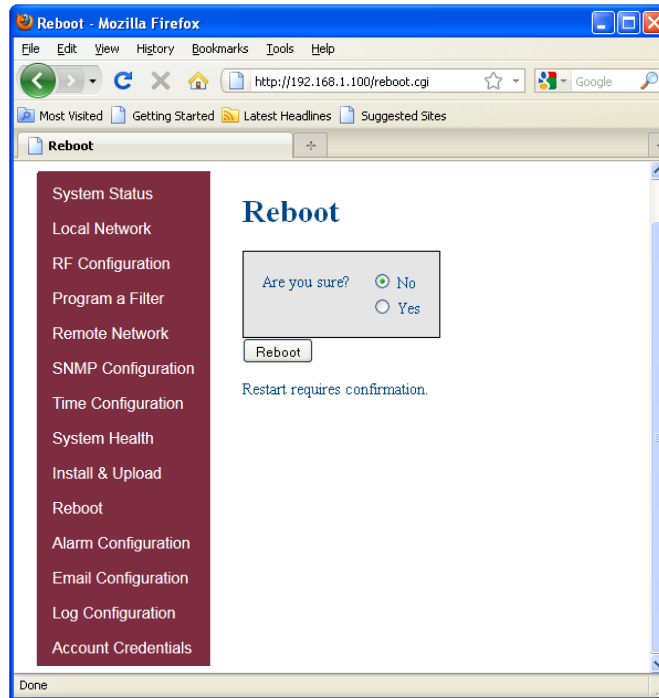


Figure 3-12: Reboot

3.12 Alarm Configuration

The alarm configuration page allows the user to specify what events will trigger an alarm as shown in Figure 3-13. Letters, numbers and hyphens are the only acceptable nomenclature for the location field and hyphens may not be used as the first or last character.

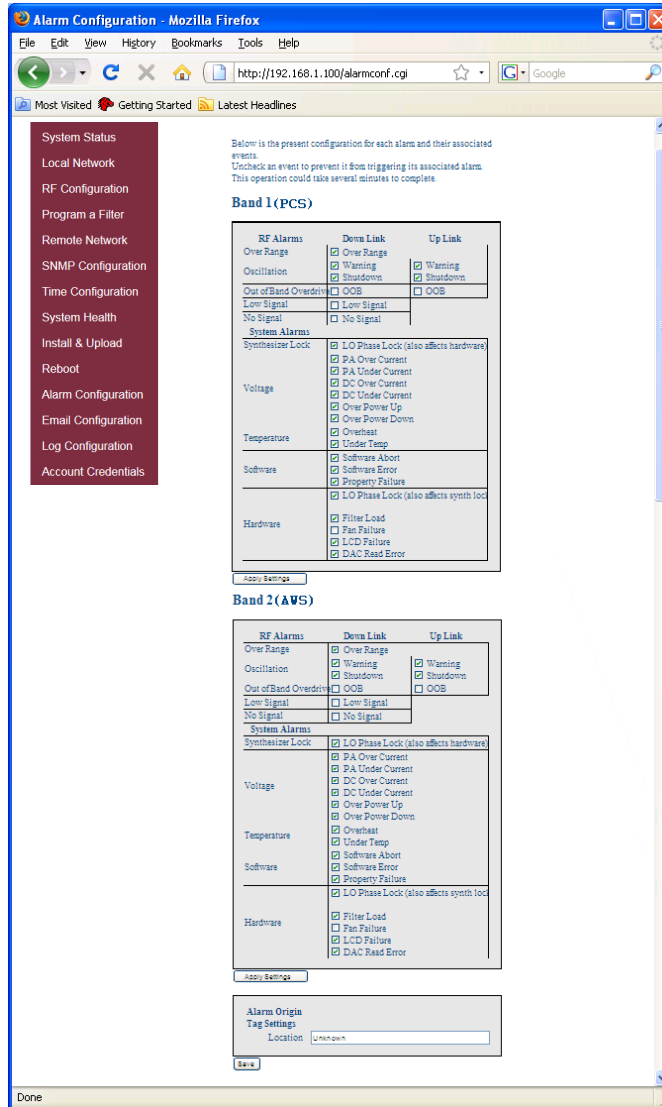


Figure 3-13: Alarm Configuration

3.13 Email Configuration

The Email Configuration page as shown in Figure 3-14 allows the user to enter up to five e-mail addresses to which the repeater can send specified alarm messages when the repeater is connected via Ethernet or wireless modem and e-mail alarm notification or remote networking are enabled. In all fields the software will not allow the user to enter invalid characters.

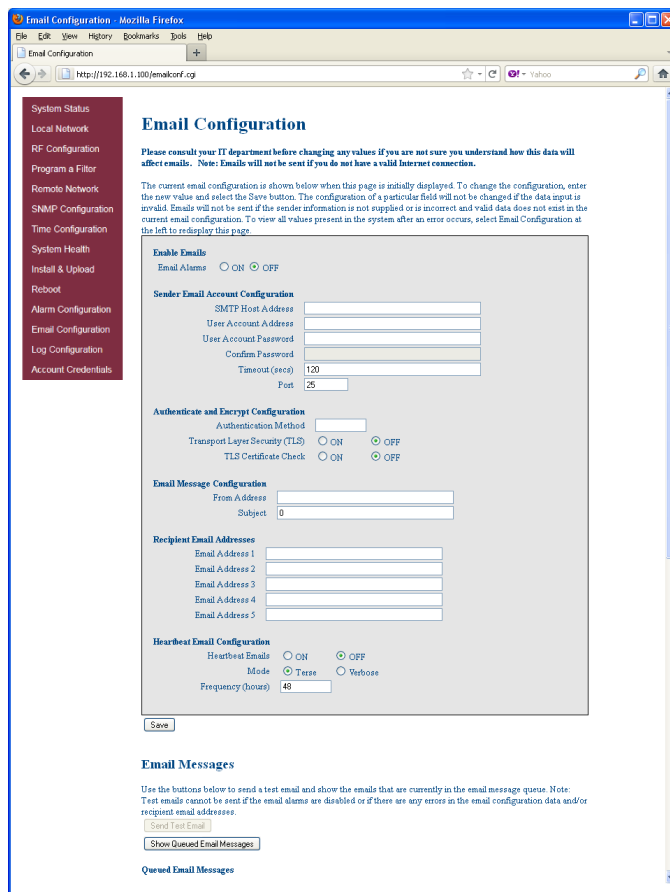


Figure 3-14: Email Configuration

3.14 Log Configuration

The Log Configuration page provides the user with the means to change three aspects of how log files are created and stored as shown in Figure 3-15.

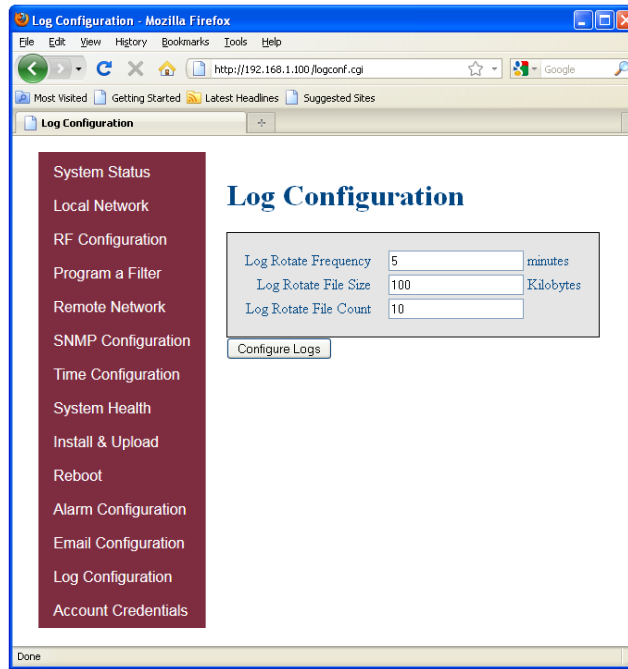


Figure 3-15: Log Configuration

3.15 Account Credentials

By clicking on the **Account Credentials** link the user is brought to the Account Credentials page as shown in Figure 3-16. From here the user can quickly and easily create a new account or reset the password for the unit. The old account will be removed when the new account is created. The user must be careful when setting the new password. If they forget what the password is set at they will need to contact Westell Technologies technical support line at 1.877.844.4274, Option 2 then Option 1 for assistance.

Account Credentials

A new account will be created and the old account will be removed.
The current configuration of the device will remain unchanged.

Account	dualband
Password	
Confirm Password	

Save

Figure 3-16: Account Credentials

4 Console Interface

4.1 Text Menu Interface (Local Access)

Local access to the repeater Text Menu Interface (TMI), also known as the console interface, is made by connecting a (Null Modem) serial cable (optional), as shown in Figure 18, from the serial connector of the laptop to either of the serial ports on the repeater. This connector is labeled COM. In some cases, if the gender of the connector is not the same as shown in Figure 18, a gender adaptor (optional) as shown in Figure 19 may also be required.



Figure 4-1: Null Modem Cable



Figure 4-2: Gender Adaptor

Many terminal emulation programs will work if properly configured. In the following description, Tera Term is used to establish the TMI session. This program is readily available via the Internet and is free from Ayera Technologies at: <http://www.ayera.com/teraterm/>. Tera Term Pro Web works on Windows 95/98, 2000, XP, Vista, 7, and 8. Here is the latest Tera Term Pro Web release: Version 3.1.3. tpro313.zip. Figure 4-3 is displayed When the program is started.



Figure 4-3: Ter Term Pro Web Start Up

Select the **Serial** radio button and press **OK** as shown in Figure 4-4.



Figure 4-4: Serial Radio Button

It may be necessary, in the system properties section of the control panel using device manager to determine what COM port your computer uses for the communications port. In this case it is COM 1. This is not to be confused with the serial port on the bottom panel of the repeater labeled COM 1.

Pressing **OK** will open up a blank dialog screen. Go to the **Setup** dropdown menu as shown in Figure 4-5 and select **Serial port** to make changes to the serial port setup.

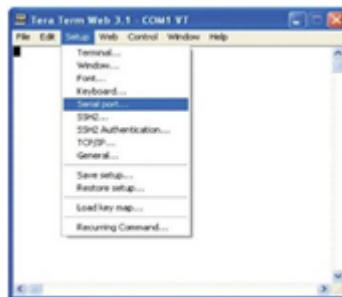


Figure 4-5: Setup

Configure the terminal program for the correct COM port, in this case COM 1 and 115200 baud rate, as shown in Figure 4-6.

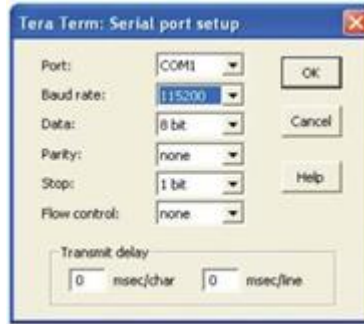


Figure 4-6: Serial Port Setup

After completing the serial port changes (pressing the **Enter** key will be required to complete the action) the user will be prompted for a user name and password. In dual- band units each band is changed independently and requires an independent login. To make changes to the first band, the default user name is **bandone**. The user name for changing the PCS band is **bandtwo**. The password for both bands is **CSI1234**. After entering the password and pressing **Enter**, the TMI Main Menu will appear as shown in Figure 4-7.

By default the set parameters option is disabled. To re-enable the user will press **1** and will be prompted for a user name and password. The default user name is **csi** and the password is **CSI1234**.

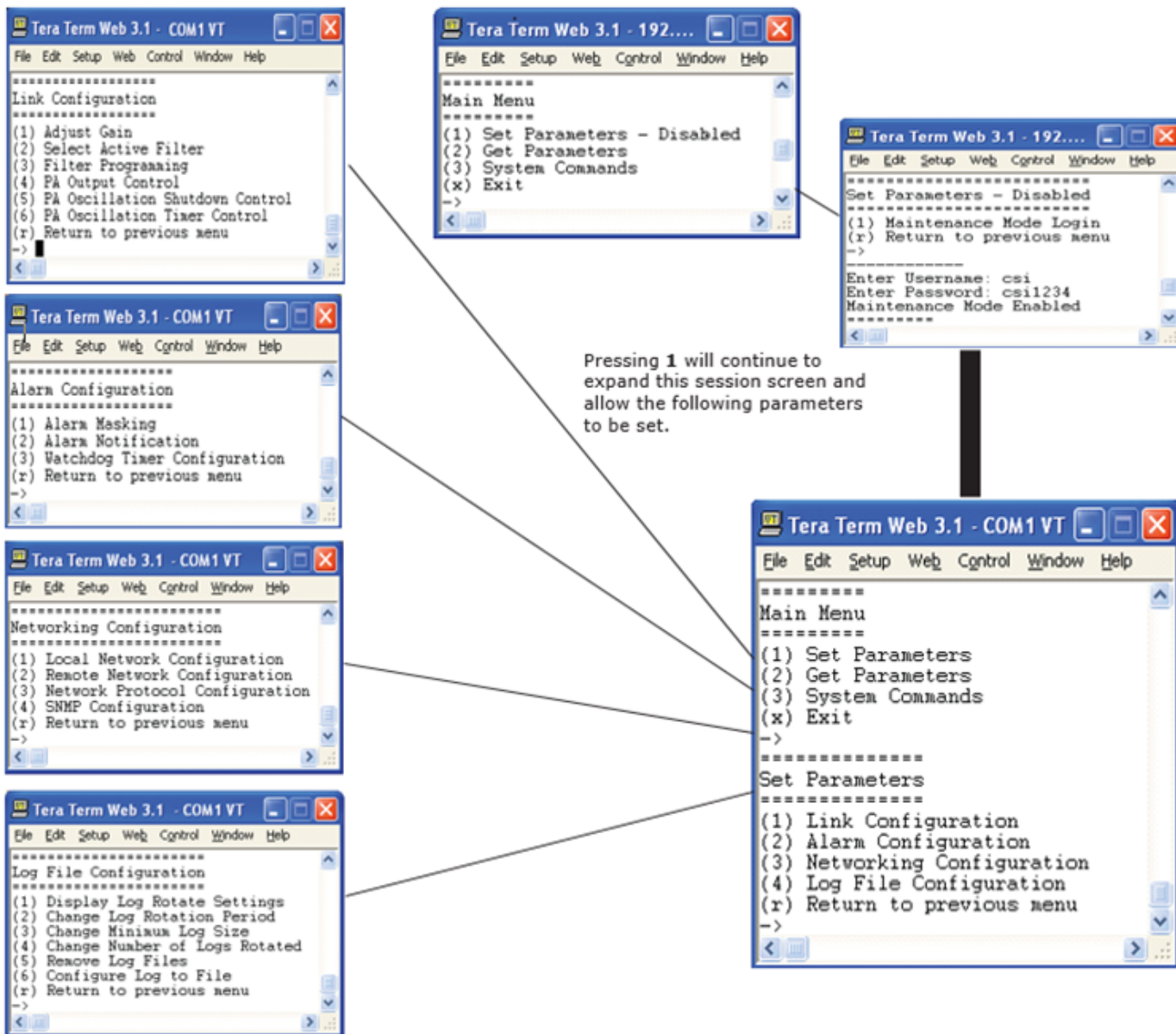


Figure 4-7: TMI Main Menu

Each Set Parameter selection, when chosen will be expanded to allow changing or setting of that parameter. For example, from the Link Configuration menu on the previous page, selecting **1 - Adjust Gain** will display the menu shown in Figure 4-8.



Figure 4-8: Adjust Gain

After selecting option **(1) downlink**, the current user gain is displayed and the option to change it is accomplished by typing the desired gain at the prompt. The user is then returned to the previous menu as shown in Figure 4-9.

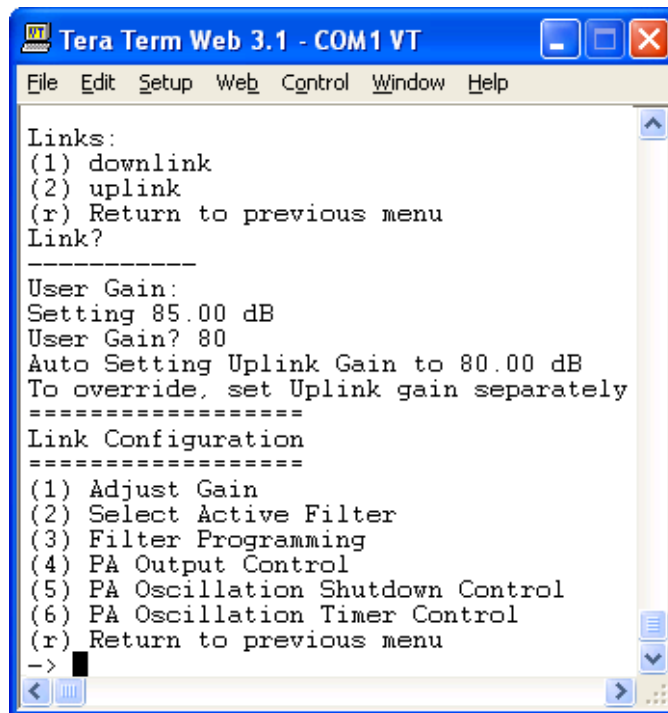


Figure 4-9: User Gain

All the other options operate in much the same way. Some of the options will offer the user additional selections and will be self-explanatory. Below is one example of these additional options, the one shown in Figure 4-10 is the result of selecting **(3) Filter Programming**.

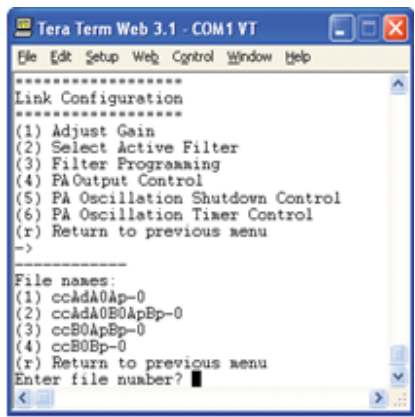


Figure 4-10: Selecting Filter Programs

Graceful session termination is important. Use Disconnect under the File dropdown menu to terminate a session, otherwise the port may become disabled and force the system to be rebooted.

4.2 Telnet Session (Remote Access)

Remote access to the repeater may be gained through a LAN connection and a terminal emulation program for TCP/IP. As with the serial connection, many terminal emulation programs will work, if properly configured.

In the following description, Tera Term is used to establish the telnet session. Also, it will be required that the network configuration of the computer and the repeater being controlled be set up with the same subnet and subnet mask in order to establish a link. In other words, the IP addresses of both the computer used and the repeater must use the same group of IP address number sets. For example, the repeater ships with the default IP address of 192.168.1.100 as shown in Figure 4-11 and a subnet mask of 255.255.255.0. In order to connect, the computer to be used for the link would normally need an IP address of something like 192.168.1.2 with a subnet mask of 255.255.255.0, the same subnet mask as the repeater. In this example the last digit of the IP address may be any number except 1,100 and 255. Configuring your PC is normally fairly straight forward but it does vary somewhat with the operating system involved. If you require assistance, contact your IT department and they will be able to set up your PC for you, or you may review the 5.4. Additional Tips section.



Figure 4-11: Default IP Address

When the Tera Term program is started, the following screen is displayed. Change the default host IP address to the IP address of the repeater to be controlled. In the case of a new install, the default address is 192.168.1.100 and has been assigned at the factory. Select **Service>Telnet**. The TCP port must be 23.

Pressing the **OK** button will bring the user to the screen seen in Figure 4-12, which will require the user to log in. In dual-band units, each band is changed independently and requires an independent login. To make changes to the low band the default user name is **bandone**. The default user name for changing the high band is **bandtwo**. In the field after the prompt type the user name for the band to be changed. The default password is **csi1234** for both bands. After typing the password press **Enter** and the main menu, as shown in Figure 4-13, will be displayed. Telnet and serial sessions both provide access to the same TMI.

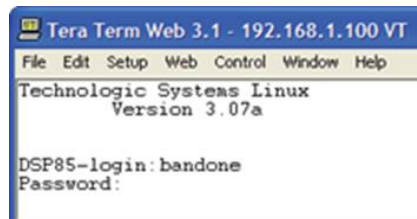


Figure 4-12: Log In Menu

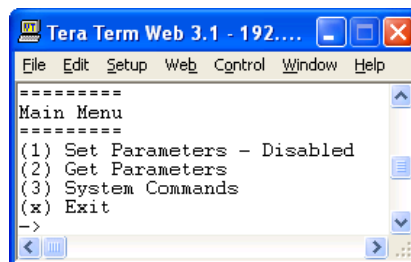


Figure 4-13: Main Menu

4.3 Modem Interface (Remote Access with Login)

A modem can also be used to gain remote access to the unit provided the repeater has been properly equipped. A selection of modems are available as an option.

Once the modem has been installed and activated, it can be accessed from any web browser. Access response time will depend on many factors, some of which are:

- Quality of the connection (RF signal in the case of wireless modems)
- Technology (CDMA, LTE, GPRS, etc.)
- Network congestion (throughput)

When a connection has been established, the login screen shown in both the GUI Serial and Telnet examples is presented.

4.4 Additional Tips

To change the TCP/IP settings on your Windows computer follow the steps below.

1. Open your computer's **Control Panel** as shown in Figure 4-14.



Figure 4-14: Control Panel

2. Click on **View network status and tasks**, under Network and Internet as shown in Figure 4-15.

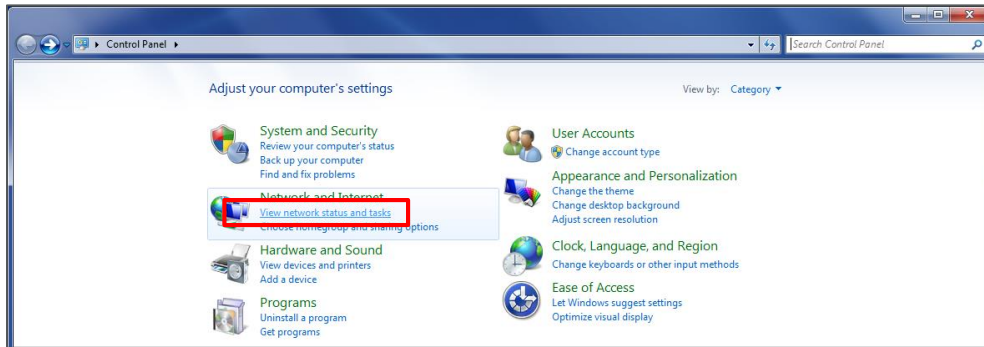


Figure 4-15: View Network Status and Tasks

3. On the left hand side, click **Change adapter settings** as shown in Figure 4-16.

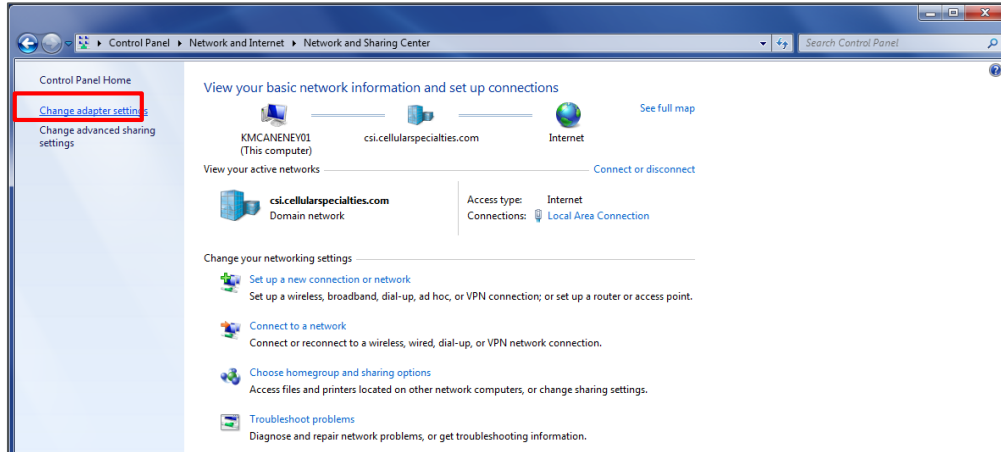


Figure 4-16: Change Adapter Settings

4. Right click on **Local Area Connections** and select **Properties** as shown in Figure 4-17.

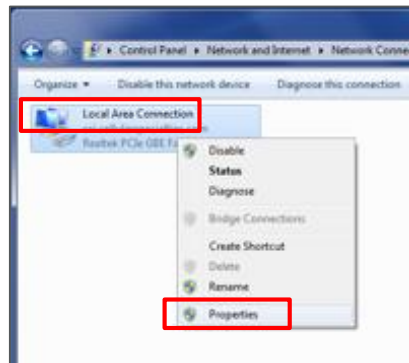


Figure 4-17: Local Area Network

5. Double click **Internet Protocol Version 4 (TCP/IPv4)**, or highlight **Internet Protocol Version 4 (TCP/IPv4)** and select **Properties** as shown in Figure 4-18.

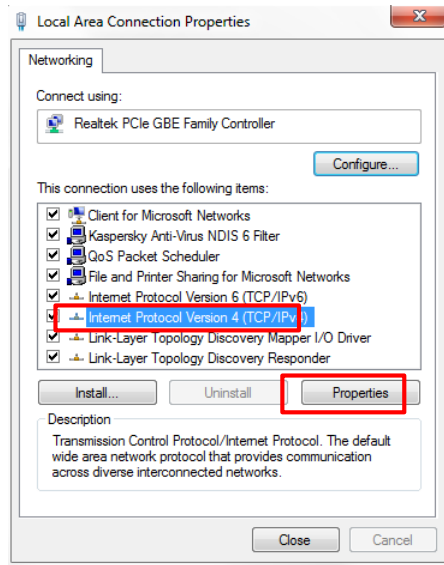


Figure 4-18: Internet Protocol Version 4 (TCP/IPv4)

6. Select the radial button next to **Use the following IP address**, which will allow you to populate the IP address and Subnet mask fields. In the **IP address** enter **192.168.1.2**, and click **OK** (Note the Subnet mask should automatically populate to 255.255.255.0) as shown in Figure 4-19.

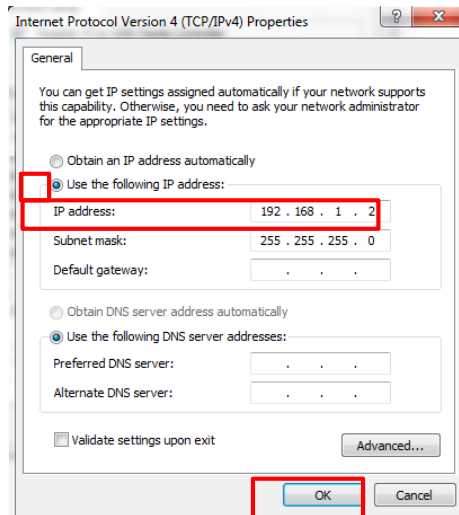


Figure 4-19: Enter IP Address

7. Nothing else will need to be chosen or entered. Click **OK**, then **OK** again and retry connection.

A crossover Ethernet cable (supplied) must be used for Web interface access. As a reminder, you must verify the Ethernet port on your laptop is powered. If your laptop is on battery power, the Ethernet port may be inactive by default. If this is the case simply plug in the laptop to a 110 VAC source or change the power settings to enable the Ethernet port when the laptop is using battery power.

In some cases DNS Server setup is required. To do this log in as **bandone** through a SSH or serial connection. Once logged in follow the setup. The **DNS Address** is the IP address of the modem (enter it in twice).



Appendix A Attenuation and Dynamic Range Guidelines

A.1 Donor Port

If a repeater is installed in an area with very strong desired and/or undesired signals, it is important to ensure that the overall signal levels are optimized to be within the best operating range of the repeater. Additionally, de-sensing of a nearby base station site must be avoided. These goals can be accomplished by properly attenuating the antenna port(s) in the path of the donor antenna(s). In effect, one can imagine that the particular repeater deployment is electrically moved farther from the base station using attenuators that are equivalent to increasing the path loss from the donor antenna to the base station. Gain levels that would result in exceeding the rated output power of the repeater, i.e. 65 dB of gain applied to an input signal of -30 dBm, will not result in ADC protection, but will result in AGC.

The following potential outcomes result from the use of attenuators on the donor port(s) of the repeater: Uplink output power, as reported by the unit, is reduced by the value of the attenuation, protecting nearby base stations. Downlink signal to noise ratio is high at the point of the attenuator, resulting in slight but negligible reduction in downlink performance. Other performance is essentially unchanged.

A.2 Server Port

Server port attenuation may also be necessary, particularly where a powered DAS is present. The selection guidelines below apply to both server and donor ports. In order to properly measure uplink signal strength, a signal generator should be used. If a signal generator is not available, placing a test call while under the server antenna with the least path loss to the repeater should provide reasonable data.

The following potential outcomes result from the use of attenuators on the server port(s) of the repeater: Downlink output power, as reported by the unit, is reduced by the value of the attenuation. Uplink incoming power from the DAS is reduced, along with potentially strong and/or harmful out-of-band signals (including noise) that are generated by the DAS.

A.3 Dynamic Range Thresholds

Input signal	Max gain	Input signal	Max gain
-45.0 dBm	90 dB	-32.0 dBm	77 dB
-44.0 dBm	89 dB	-31.0 dBm	76 dB
-43.0 dBm	88 dB	-30.0 dBm	75 dB
-42.0 dBm	87 dB	-29.0 dBm	74 dB
-41.0 dBm	86 dB	-28.0 dBm	73 dB
-40.0 dBm	85 dB	-27.0 dBm	72 dB
-39.0 dBm	84 dB	-26.0 dBm	71 dB
-38.0 dBm	83 dB	-25.0 dBm	70 dB*
-37.0 dBm	82 dB	-24.0 dBm	69 dB *
-36.0 dBm	81 dB	-23.0 dBm	68 dB *
-35.0 dBm	80 dB	-22.0 dBm	67 dB*
-34.0 dBm	79 dB	-21.0 dBm	66 dB*
-33.0 dBm	78 dB	-20.0 dBm	65 dB*

*We recommend padding (adding attenuation) this level due to potential for fluctuating signal.



-25 dBm is the maximum input signal level that should be applied to the repeater, even if the gain is lower than 65 dB. Input signals exceeding these thresholds will result in composite input attenuation, called analog to digital converter protection (ADC Protect). Output power is reduced whenever the above thresholds are exceeded by reducing the gain by 1 dB for each 1 dB that the threshold is exceeded. ADC Protect should not be confused with AGC (Automatic Gain Control), which reduces gain to prevent in-band (measured) output power from exceeding the specified maximum output level.

To determine the total power applied to the donor and server ports, please reference the composite input values as listed on the System Status page (found in the web based GUI).

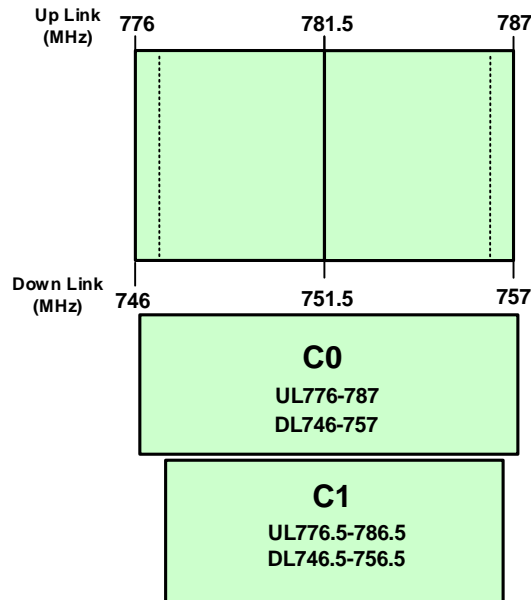
A.4 Large Deltas Between In-band and Composite Input Signals

Care should be taken to isolate the best donor site to ensure the least possible delta between in-band and composite downlink signals.

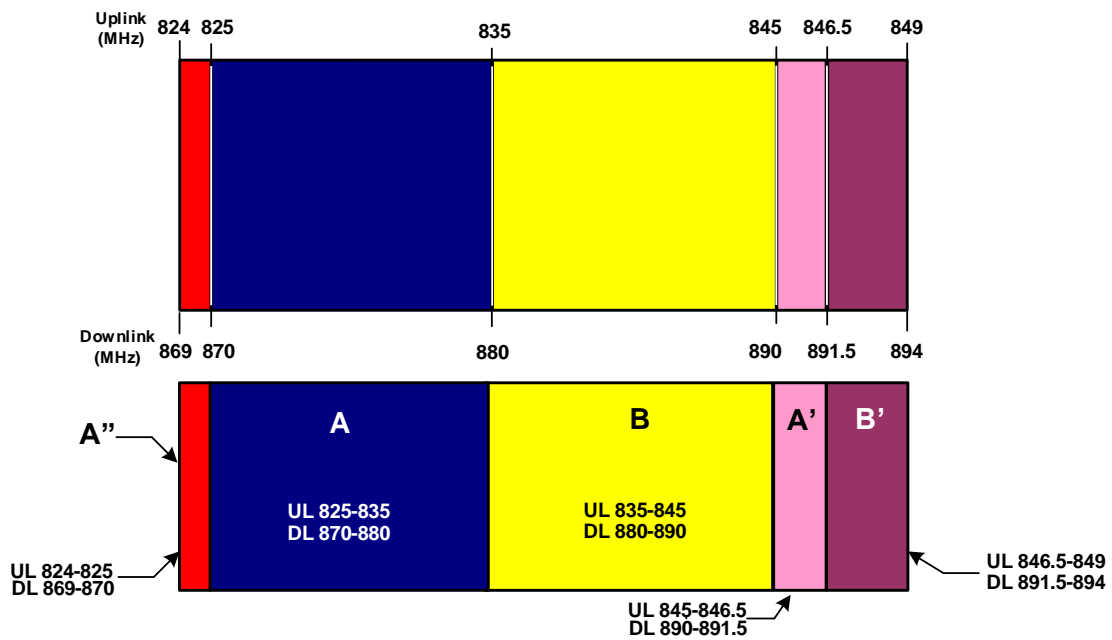
Appendix B Band Plans and Filter File Naming Conventions

B.1 Frequency Band Plans

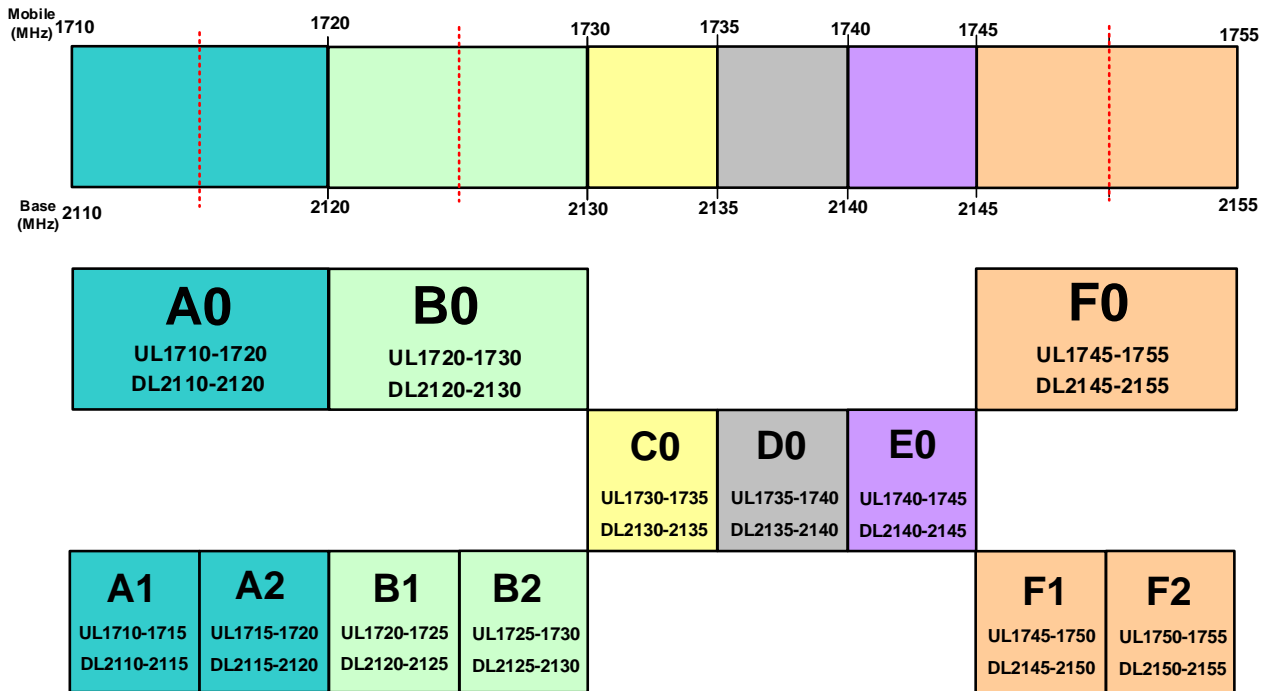
B.1.1 700 MHz Upper C Band Plan



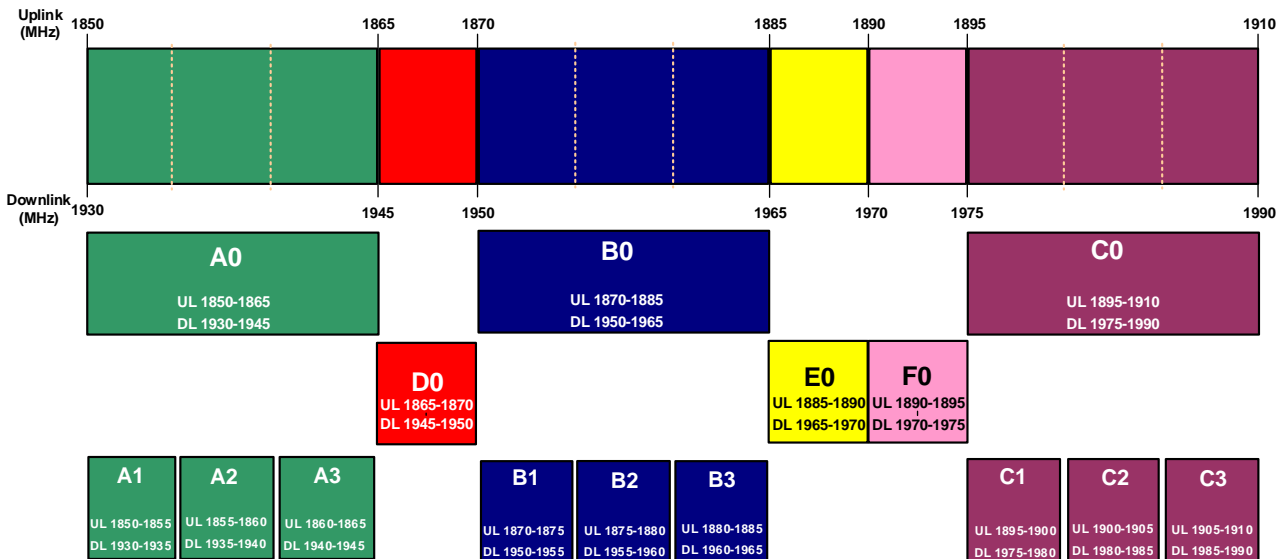
B.1.2 Cellular Frequency Band Plan



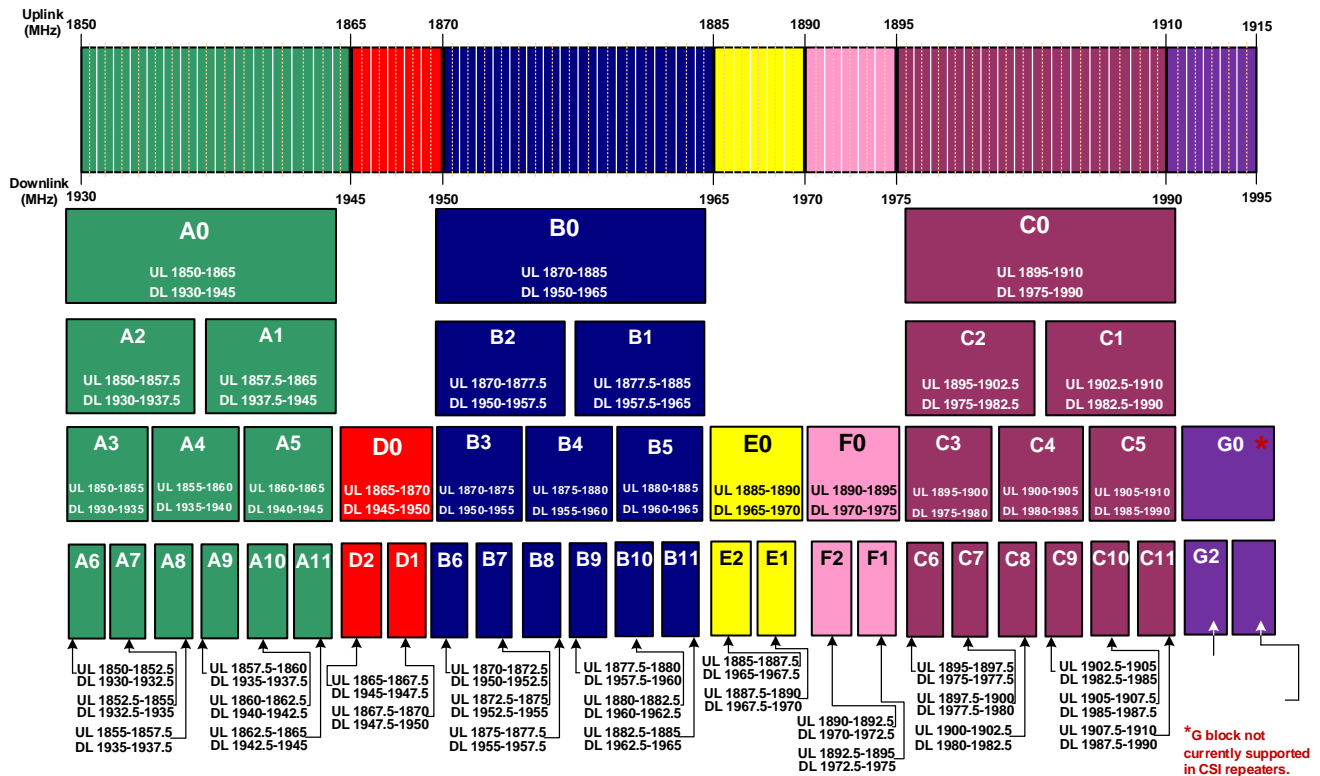
B.1.3 AWS Frequency Band Plan



B.1.4 Canadian PCS Frequency Band Plan



B.1.5 US PCS Frequency Band Plan



B.1.6 Public Safety Bands



B.2 Filter File Naming Conventions

B.2.1 700 MHz Filter Naming Convention

Westell Technologies digital repeaters use an alpha numeric file naming convention for its filter files. The descriptions below will allow the user to understand the methodology to determine the desired file for his application.

Column:	1	2	3	4	5	6	7	8	9	10	11	12
Definition:	Band	Mod type	Block 1	Sub-block 1	Block 2	Sub-block 2	Block 3	Sub-block 3	Block 4	Sub-block 4	Separator	Variant
	I= 700MHZ	e= E-UTRA (Upper) l= E-UTRA (Lower)	A - C	0=Full 1-7=Sub	A - C	0=Full 1-7=Sub	A - C	0=Full 1-7=Sub	A - C	0=Full 1-7=Sub	-	0=Standard

NOTE

Modulation type determines the guard band at the edges of each passband. The modulation type field will also be used to indicate a carrier who has a unique sub-block designation.



Up to four sub-blocks may be defined, resulting in a maximum filename length.

All variant/guard band designators other than 0 and F are user defined custom filters.

700 MHz examples

lIA1B1-0 = (700 MHz band, E-UTRA mod type, Lower A1, B1, with standard guard band). leC0-0 = (700MHz band, E-UTRA mod type, Upper C, with standard guard band).

lIC1-0 = (700 MHz band, E-UTRA mod type, Lower C1, with standard guard band).

700 MHz upper block

Uplink	Downlink
C0 776-787	46-757

700 MHz upper sub-block

Uplink	Downlink
C1 776.5-786.5	746.5-756.5

B.2.2 Cellular Filter File Naming Convention

Column:	1	2	3	4	5	6	7	8	9	10	11	12
Definition:	Band	Mod type	Block 1	Sub-block 1	Block 2	Sub-block 2	Block 3	Sub-block 3	Block 4	Sub-block 4	Separator	Variant
	c=Cell	g=GSM c=CDMA	A - B	0=Full p=Prime d=Double prime	A - B	0=Full p=Prime d=Double prime	A - B	0=Full p=Prime d=Double prime	A - B	0=Full p=Prime d=Double prime	-	0=Standard

Cell example

ccAdAp-0 = (Cellular band, CDMA mod type, A'' and A' with standard guard band).

Cellular blocks

Uplink	Downlink
A0 825-835	870-880
B0 835-845	880-890

Cellular sub-blocks

Uplink	Downlink
A' 845-846.5	890-891.5
A'' 824-825	869-870
B' 846.5-849	891.5-894



B.2.3 Canadian PCS Filter File Naming Convention

Column:	1	2	3	4	5	6	7	8	9	10	11	12
Definition:	Band	Mod type	Block 1	Sub-block 1	Block 2	Sub-block 2	Block 3	Sub-block 3	Block 4	Sub-block 4	Separator	Variant
	p=PCS	u=UMTS See note	A - F	0=Full 1-3=Sub	A - F	0=Full 1-3=Sub	A - F	0=Full 1-3=Sub	A - F	0=Full 1-3=Sub	-	can= Custom Canadian filter

Canadian PCS example

puE0F0-can = (PCS band, UMTS mod type, E full, F full, Canadian Custom filter).

Canadian PCS blocks

Uplink	Downlink
A0 1850-1865	1930-1945
D0 1865-1870	1945-1950
B0 1870-1885	1950-1965
E0 1885-1890	1965-1970
F0 1890-1895	1970-1975
C0 1895-1910	1975-1990

Canadian PCS sub-blocks

Uplink	Downlink
A1 1850-1855	1930-1935
A2 1855-1860	1935-1940
A3 1860-1865	1940-1945
B1 1870-1875	1950-1955
B2 1875-1880	1955-1960
B3 1880-1885	1960-1965
C1 1895-1900	1975-1980
C2 1900-1905	1980-1985
C3 1905-1910	1985-1990



B.2.4 US PCS Filter File Naming Convention

Column:	1	2	3	4	5	6	7	8	9	10	11	12
Definition:	Band	Mod type	Block 1	Sub-block 1	Block 2	Sub-block 2	Block 3	Sub-block 3	Block 4	Sub-block 4	Separator	Variant
	p=PCS	g=gsm	A - F	0=Full 1-11=Sub	A - F	0=Full 1-11=Sub	A - F	0=Full 1-11=Sub	A - F	0=Full 1-11=Sub	-	0=Standard

US PCS example

pcA1C0E0F2-0 = (PCS band, CDMA mod type, A1, C full, E full, F2 with standard guard band).

US PCS blocks

Uplink	Downlink
A0 1850-1865	1930-1945
D0 1865-1870	1945-1950
B0 1870-1885	1950-1965
E0 1885-1890	1965-1970
F0 1890-1895	1970-1975
C0 1895-1910	1975-1990

US PCS sub-blocks

Uplink	Downlink
A2 1850-1857.5	1930-1937.5
A1 1857.5-1865	1937.5-1945
A3 1850-1855	1930-1935
A4 1855-1860	1935-1940
A5 1860-1865	1940-1945
D2 1865-1867.5	1945-1947.5
D1 1867.5-1870	1947.5-1950
B2 1870-1877.5	1950-1957.5
B1 1877.5-1885	1957.5-1965
B3 1870-1875	1950-1955
B4 1875-1880	1955-1960
B5 1880-1885	1960-1965
E2 1885-1887.5	1965-1967.5



E1 1887.5-1890 1967.5-1970
 F2 1890-1892.5 1970-1972.5
 F1 1892.5-1895 1972.5-1975
 C2 1895-1902.5 1975-1982.5
 C1 1902.5-1910 1982.5-1990
 C3 1895-1900 1975-1980
 C4 1900-1905 1980-1985
 C5 1905-1910 1985-1990

NOTE

Modulation type determines the guard band at the edges of each passband. The modulation type field will also be used to indicate a carrier who has a unique sub-block designation.

Up to four sub-blocks may be defined, resulting in a maximum filename length.

All variant/guard band designators other than 0 and F are user defined custom filters.

B.2.5 AWS Filter Naming Convention

Column:	1	2	3	4	5	6	7	8	9	10	11	12
Definition:	Band	Mod type	Block 1	Sub-block 1	Block 2	Sub-block 2	Block 3	Sub-block 3	Block 4	Sub-block 4	Separator	Variant
	a=AWS	g=gsm c=CDMA w=WCDMA e=E-UTRA l=LTE u=UMTS	A - F	0=Full 1-2=Sub	A - F	0=Full 1-2=Sub	A - F	0=Full 1-2=Sub	A - F	0=Full 1-2=Sub	-	0=Standard

AWS example

acA1C0E0F2-0 = (AWS band, CDMA mod type, A1, C full, E full, F2 with standard guard band).

AWS blocks

Uplink	Downlink
A0 1710-1720	2110-2120
B0 1720-1730	2120-2130
C0 1730-1735	2130-2135
D0 1735-1740	2135-2140
E0 1740-1745	2140-2145
F0 1745-1755	2145-2155



AWS sub-blocks

Uplink	Downlink
A1 1710-1715	2110-2115
A2 1715-1720	2115-2120
B1 1720-1725	2120-2125
B2 1725-1730	2125-2130
F1 1745-1750	2145-2150
F2 1750-1755	2150-2155

NOTE

Modulation type determines the guard band at the edges of each passband. The modulation type field will also be used to indicate a carrier who has a unique sub-block designation.

Up to four sub-blocks may be defined, resulting in a maximum filename length of 12 characters. All variant/guard band designators other than 0 are user defined custom filters.

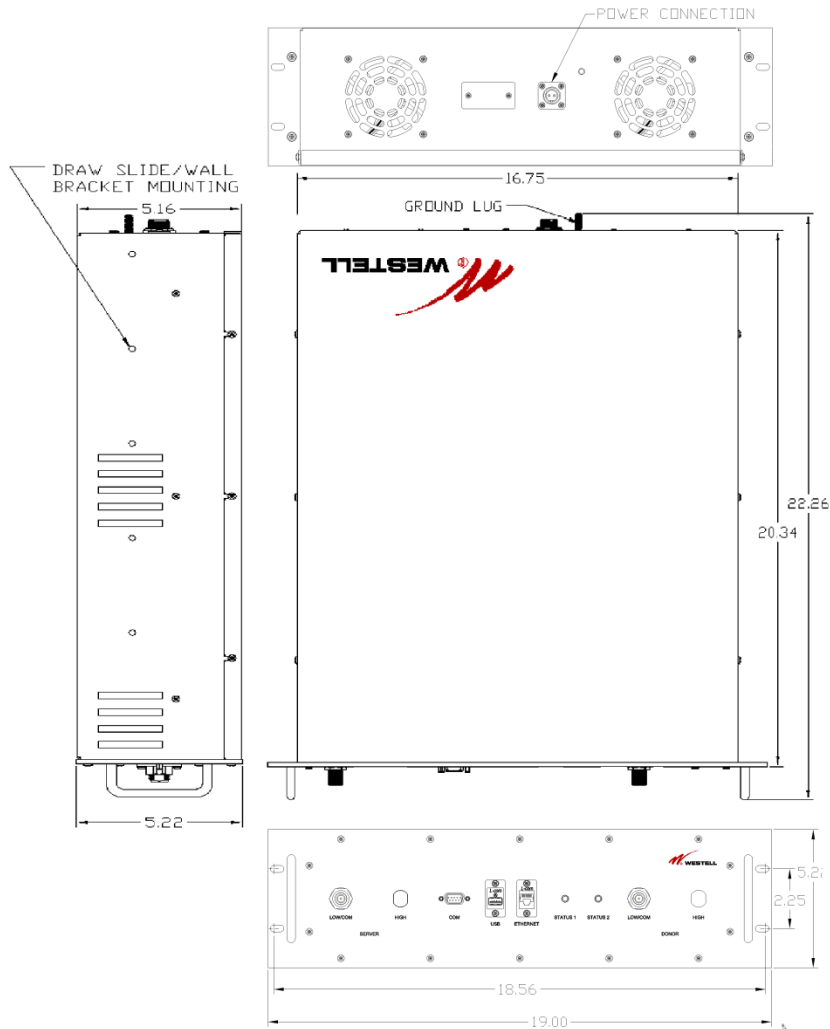
Appendix C Mechanical Configurations

C.1 Digital Repeater Mechanical Drawings

The repeater will have an FCC label as described in the FCC Label: Industrial or FCC Label: Public depending on application.

WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

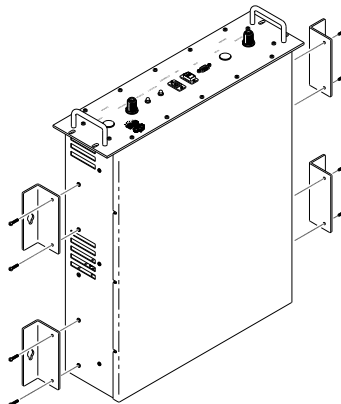


C.2 Digital Repeater Mounting Drawings, Modular Series High Power

The following diagrams illustrates the methods for mounting the repeater(s) in a typical wall mount and rack installation. Brackets are provided for both options.

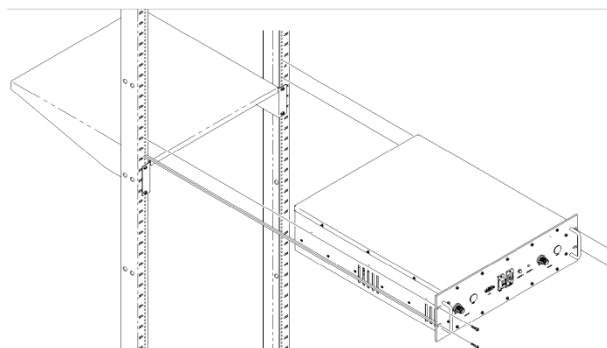
C.2.1 Wall Mounting

Install the wall mount brackets as shown in the drawing. Mark the location of the wall anchoring holes and drill. The wall anchoring system you use for the repeater will need to be able to support at least 46 lbs (21 kg). Install wall anchors and hang repeater as shown.



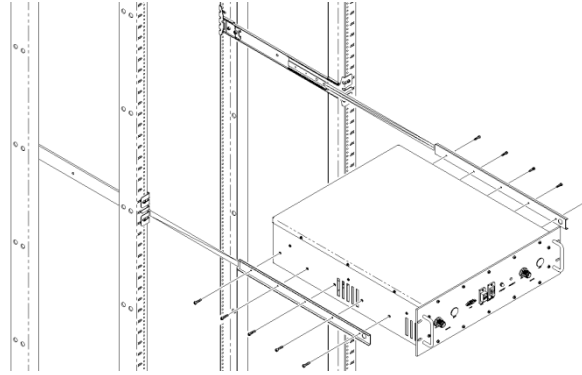
C.2.2 19" Relay Rack Mounting

Mount the repeater as shown and secure front panel with screws. NOTE: the Westell Technologies digital repeaters must be supported in the 19" relay rack system with a shelf. Do not rely on the front panel mount exclusively to support all of the unit.



C.2.3 19" Four Post Rack Mounting

Install slide brackets on repeater as shown in the tapped holes provided. Slide repeater into the receiving brackets and secure with screws. The repeater must be supported in the rack system with the slide rail. Do not rely on the front panel mount exclusively to support all the weight of the unit.



Appendix D Mechanical and Electrical Specifications

D.1 Mechanical Specifications

Parameters	Specifications	Notes
Repeater size		
Height	5.25 in	3 RU
Weight	19 in	
Depth	20 in	
Weight	31 lbs (14.1 kg)	
Thermal management	Fan cooled	
Surface coating	Powder coat	
Color	Satin black	

D.2 AC Power Specifications

Parameters	Specifications	Notes
AC voltage	100-240 VAC	External power supply
AC current	2.0 amps	@ 120 VAC
	1.0 amps	@ 230 VAC
AC power frequency	47-63 Hz	
Heat output	800 BTU/Hr	

D.3 Environmental Requirements

Parameters	Specifications	Notes
Temperature range	0° C to 50° C (32° F to 122° F)	
Relative humidity	5% to 95%	Non-condensing

D.4 Operating Power Parameters

Parameters	Specifications	Notes
Maximum RF input power without damage	10 dBm	
Linear gain	90 dB	Factory calibrated gain
Pass band ripple	±1.5 dB	
Automatic gain control (AGC)	30 dB max range	In 0.5 dB steps
Manual gain control	53.5 dB to 90 dB	In 0.5 dB steps

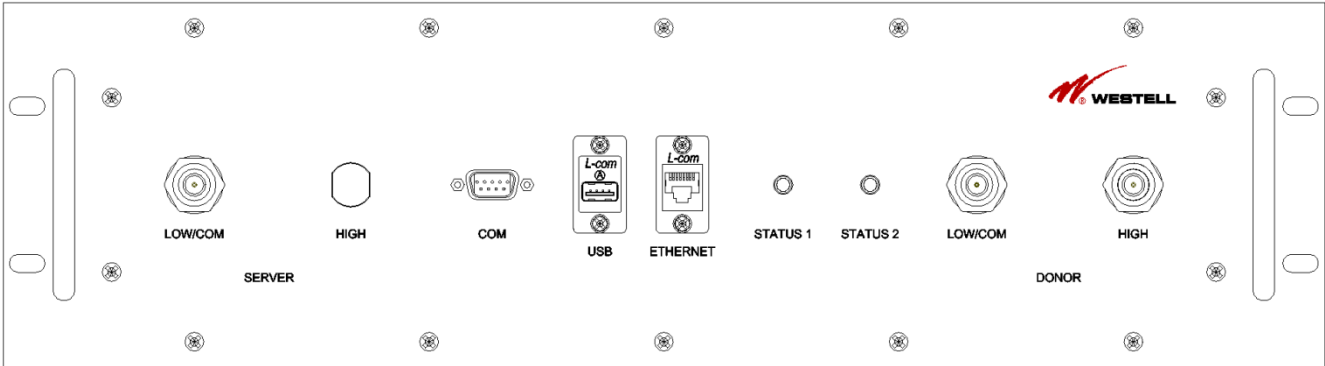
Parameters	Specifications	Notes
Linear output power U7C/Cell DL U7C/Cell UL Cell/PCS DL Cell/PCS UL PS8 DL PS8 UL AWS DL AWS UL LTE DL LTE UL	U7C 36 dBm/Cell 36 dBm U7C 29 dBm/Cell 29 dBm Cell 36 dBm/PCS 36 dBm Cell 29 PCS 28 dBm PS8 36 dBm PS8 29 dBm AWS 36 dBm AWS 29 dBm LTE 36	
OIP3 U7C/Cell DL U7C/Cell UL Cell/PCS DL Cell/PCS UL PS8 DL PS8 UL AWS DL AWS UL LTE DL LTE UL	57 dBm 41 dBm 57 dBm 41 dBm 57 dBm	Measured with two CW tones at 14 dBm/ tone
Noise figure (Avg)	6.0 dB	At maximum gain
Input VSWR (Typ)	<2.0:1	
Propagation delay	<2.5 usec	
RMS vector error (EVM) U7C/Cell Cell/PCS AWS LTE	3% max 3% max	TDMA, EDGE, W-CDMA, CDMA2000
CDMA RHO U7C/Cell Cell/PCS AWS LTE	0.98 min 0.98 min	CDMA2000, 1x-EVDO
Connectors	N-female	Two to four depending
Spurious emissions and applicable documents FCC Industry Canada	-13 dBm max -13 dBm max	Per FCC part 2, 22, 24

Appendix E Port Configurations

E.1 Dual-band D2:D1 Port Configuration

Input: Two single-band duplex ports, one from the low-band donor antenna and one from the high-band donor antenna.

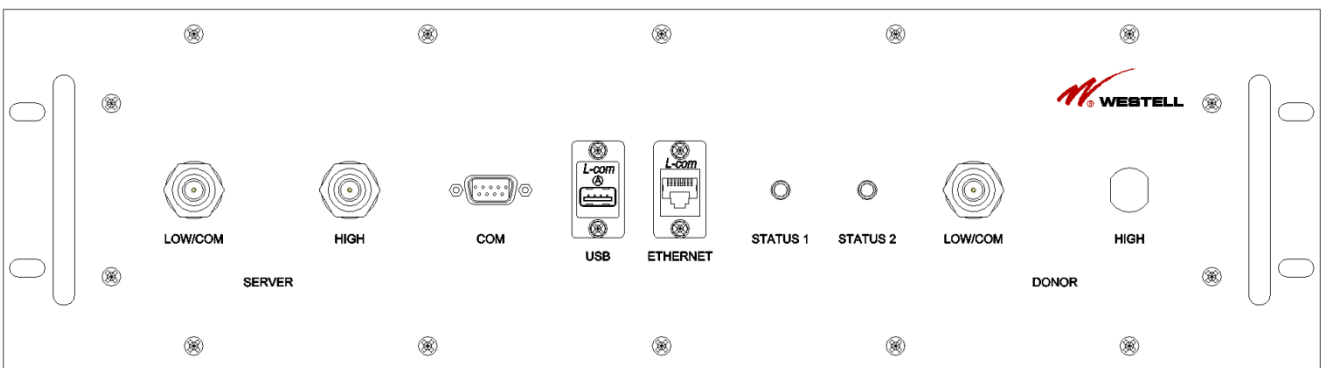
Output: One dual-band duplex port to the server antennas.



E.2 Dual-band D1:D2 Port Configuration

Input: One dual-band duplex port from dual-band donor antenna.

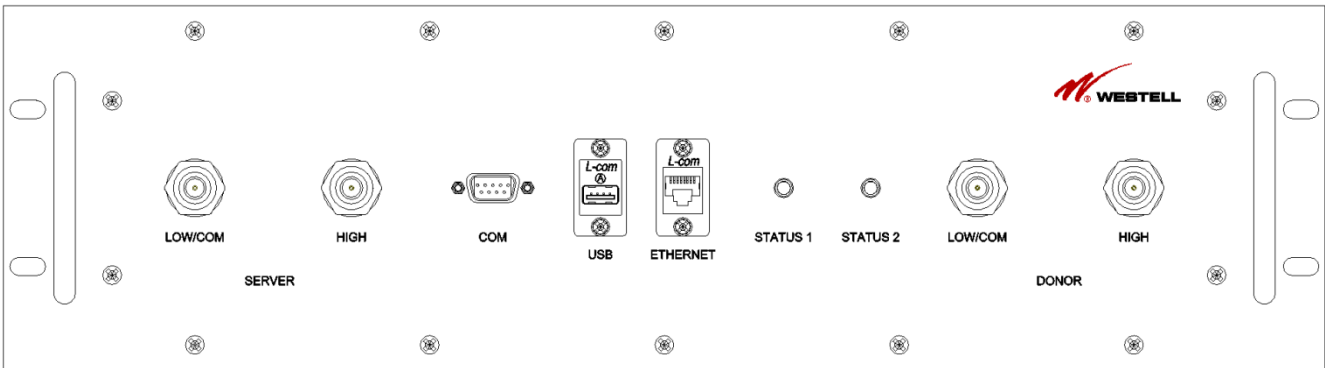
Output: Two single-band duplex ports, one to the low-band server antennas and one to the high-band server antennas.



E.3 Dual-band D2:D2 Port Configuration

Input: Two single-band duplex ports, one from the low-band donor antenna and one from the high-band donor antenna.

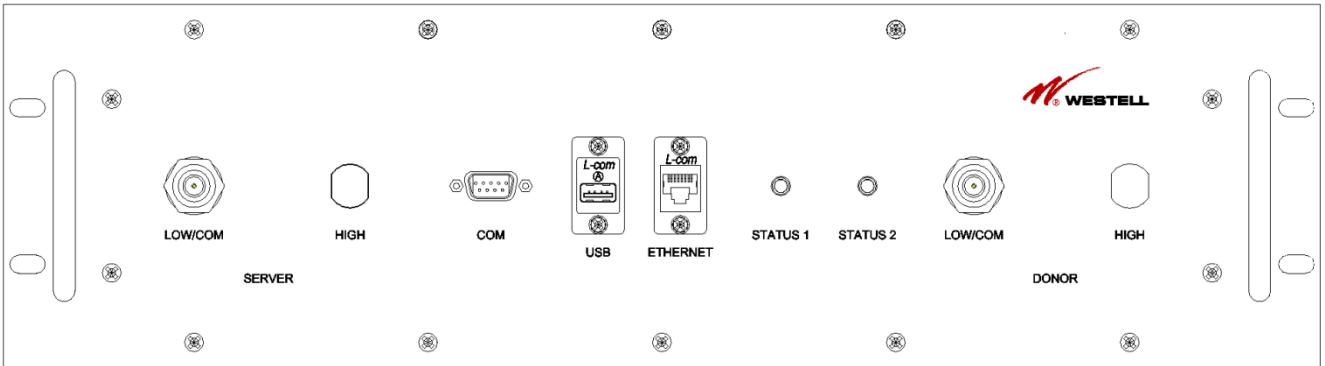
Output: Two single-band duplex ports, one to the low-band server antennas and one to the high-band server antennas.



E.4 Dual-band D1:D1 Port Configuration

Input: One dual-band duplex port from dual-band donor antenna.

Output: One dual-band duplex port to dual-band server antennas.



Appendix F Glossary

Table F-1 is a list of acronyms and abbreviations used in this manual.

Table F-1: Acronyms and Abbreviations

Acronym/Abbreviation	Meaning
AGC	Automatic Gain Control
APC	Automatic power control
AUI	Attachment Unit Interface
CPU	Central Processing Unit
DAS	Distributed Antenna System
DHCP	Dynamic Host Configuration Protocol
DSP	Digital Signal Processing
EEPROM	Electrically Erasable Programmable Read Only Memory
EIA	Electronic Industries Association
ERP	Effective Radiated Power
FCC	Federal Communications Commissions
FCS	Feedback
FPGA	Field Programmable Gate Array
GUI	Graphical User Interface
LED	Light Emitting Diode
OIP3	Third-Order Intercept Point
RF	Radio Frequency
RBW	Resolution BandWidth
SBC	Single Board Computer
SNMP	Simple Network Management Protocol
SSH	Secure Shell, Network Protocol
TMI	Text Menu Interface
UHCI	Universal Host Controller Interface
USB	Universal Serial Bus

