RedCONNEX™
&
RedACCESS™

AN-80i System
PTP & PMP

User Manual

Copyright Information

Contact Information:
Redline Communications Inc.
302 Town Centre Blvd. Suite 100
Markham, ON
Canada L3R 0E8
Web site:　　　http://www.redlinecommunications.com
Sales Inquiries:
North American　　　nainfo@redlinecommunications.com
Toll-free sales　　　1-866-633-6669
International　intlinfo@redlinecommunications.com
Support: www.redlinecommunications.com/support/support_portal.html
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Disclaimer

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1.1 Safety Warnings

PoE power adapter caution:

Warning to Service Personnel: 48 VDC
Customer equipment including personal computers, routers, etc., must be connected only to the INPUT (DATA) port on the PoE unit.
Only the outdoors Ethernet interface cable connecting to the AN-80i can be safely connected to the OUTPUT (DATA & POWER) connector. Connecting customer premises Ethernet equipment directly to the OUTPUT (DATA & POWER) connector on the Power-over-Ethernet power adapter may damage customer equipment.

1. Installation of the system must be contracted to a professional installer.

2. Read this user manual and follow all operating and safety instructions.

3. Keep all product information for future reference.

4. The power requirements are indicated on the product-marking label. Do not exceed the described limits.

5. Use only a damp cloth for cleaning. Do not use liquid or aerosol cleaners. Disconnect the power before cleaning.

6. Disconnect power when unit is stored for long periods.

7. The AN-80i must not be located near power lines or other electrical power circuits.

8. The system must be properly grounded to protect against power surges and accumulated static electricity. It is the user's responsibility to install this device in accordance with the local electrical codes: correct installation procedures for grounding the AN-80i, mast, lead-in wire and discharge unit, location of discharge unit, size of grounding conductors and connection requirements for grounding electrodes.

1.2   Important Warning Symbols

The following symbols may be encountered during installation or troubleshooting. These warning symbols mean danger. Bodily injury may result if you are not aware of the safety hazards involved in working with electrical equipment and radio transmitters. Familiarize yourself with standard safety practices before continuing.

Electro-Magnetic Radiation   High Voltage

1.3   Important Service Information

1. Refer all repairs to qualified service personnel. Do not remove the covers or modify any part of this device, as this action will void the warranty.

2. Locate the serial numbers and record these on your registration card for future reference. Use the space below to affix serial number stickers. Also, record the MAC address located on the AN-80i.

3. Redline does not endorse or support the use of outdoor cable assemblies: i) not supplied by Redline, ii) third-party products that do not meet Redline's cable and connector assembly specifications, or iii) cables not installed and weatherproofed as specified in the Installation Guidelines manual (70-00073-01-XX). Refer to the Redline Limited Standard Warranty and RedCare service agreements.

1.4   Lightning Protection

WARNING: The following notes are general recommendations for the system. The wireless equipment should be installed by a qualified professional installer who must follow local and national codes for electrical grounding and safety. Failure to meet safety requirements and/or use of non-standard practices and procedures could result in personal injury and damage to equipment. A direct lightning strike may cause serious damage even if these guidelines are followed.

All outdoor wireless equipment is susceptible to lightning damage from a direct hit or induced current from a near strike. Lightning protection and grounding practices in local and national electrical codes serve to minimize equipment damage, service outages, and serious injury. Reasons for lightning damage are summarized as:

a) Poorly grounded antenna sites that can conduct high lightning strike energy into equipment.

b) Lack of properly installed lightning protection equipment that can cause equipment failures from lightning induced currents.

A lighting protection system provides a means by which the energy may enter earth without passing through and damaging parts of a structure. A lightning protection system does not prevent lightning from striking; it provides a means for controlling it and preventing damage by providing a low resistance path for the discharge of energy to travel safely to ground. Improperly grounded connections are also a source of noise that can cause sensitive equipment to malfunction.

A good grounding system disperses most of the surge energy from a lightning strike away from the building and equipment. The remaining energy on the Ethernet cable shield and center conductor can be directed safely to ground by using a lightning arrestor in series with the cable.

If you have determined that it is appropriate to install lightning protection for your system, the following general industry practices are provided as a guideline only:

1. The AC wall outlet ground for the indoor POE adapter should be connected to the building grounding system.

2. Install a lightning arrestor in series with the Ethernet cable at the point of entry to the building. The grounding wire should be connected to the same termination point used for the tower or mast.

3. Install a lightning arrestor in series with the Ethernet cable as close to the AN-80i as practical. The grounding wire should be connected to the same termination point used for the tower or mast.

4. Provide direct grounding from the AN-80i, the mounting bracket, the antenna, and the Ethernet cable surge protection to the same ground bus on the building. Use the grounding screws provided for terminating the ground wires.

1.5   Deployment in the USA -- FCC Notices

1.5.1   FCC & IC Notice

1. The Model AN-80i and its antenna <u>must</u> be professionally installed.

2. ⚠️WARNING -- FCC & IC RF Exposure Warnings

   To satisfy FCC and IC RF exposure requirements for RF transmitting devices, the following distances should be maintained between the antenna of this device and persons during device operation:

Table 1: FCC & IC RF Recommended Safe Separation Distances		
Frequency (GHz)	**Mode**	**Separation Distance**
3.650 - 3.675	PTP / PMP	130 cm (52 in) or more
3.3 - 3.8	PTP / PMP	130 cm (52 in) or more
4.9 - 5.3	PTP / PMP	255 cm (101 in) or more
5.4	PTP / PMP	40 cm (16 in) or more
5.8	PMP	20 cm (8 in) or more
	PTP	310 cm (122 in) or more

   To ensure compliance, operation at closer than these distances is not recommended. The antenna used for this transmitter must not be collocated in conjunction with any other antenna or transmitter.

3. High power radars are allocated as primary users (meaning they have priority) of 5250-5350 MHz and 5650-5850 MHz and these radars could cause interference and/or damage to LE-LAN devices.

4. FCC Information to Users @ FCC 15.21 & 15.105:

   This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the 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.

5. <u>Warning</u>: Changes or modifications not expressly approved by Redline Communications could void the user's authority to operate the equipment.

6. Refer to section 7.6: FCC & IC Certified Antennas for additional information.

7. Where DFS is required by regional regulations, this function is permanently enabled at the factory and can <u>not</u> be disabled by the installer or end-user. Refer to section 7.7: Regional Codes for additional information.

1.5.2 Installation and Operation

FCC Part 90 guidelines for deployment of AN-80i systems in the frequency band of 3650-3700 MHz for "restricted" CBP (Contention Based Protocol) in USA includes restrictions on the maximum EIRP.

To comply with these guidelines, the following EIRP limitations are applied for deployment in this band:

i) Max EIRP of 25 Watts/25 MHz (equivalent to 1 Watt/1 MHz)

ii) Peak EIRP Power Density of 1 Watt in any 1 MHz slice of spectrum.

To ensure compliance with these restrictions, refer to the following important notices:

1. *The 3650-3700 MHz frequency range is a licensed band in the USA and operators must have a valid spectrum license to operate AN-80i equipment using this band.*

2. *The AN-80i requires a Redline FCC-specific options key that is mandatory for operation within the USA. This options key enforces the FCC approved operating range of 3650-3700 MHz.*

3. *The AN-80i outdoor transceiver and antenna must be professionally installed.*

4. *Changes or modifications not expressly approved by Redline Communications could void the user's authority to operate the equipment.*

5. *Do not operate an AN-80i outdoor transceiver until you have confirmed the FCC-specific options key is loaded and active (operating range restricted to 3650-3700 MHz). When the FCC-specific options key is installed, the operator is not able to set an RF frequency that exceeds the allowed range of 3650-3700 MHz.*

6. *The AN-80i transmit power settings must not exceed values stated in the AN-80i User Manual.*

1.5.3 FCC Power Settings

FCC regulation part 90.1321 (governing operation in the 3650-3700 MHz band in the US) states that base station transmissions are limited to a maximum transmit power of 1 Watt/MHz (peak EIRP). Refer to the section on FCC antennas at the end of this manual..

1.6 UL Information

1. The suitability of the supplied Ethernet cable is subject to the approval of Authority Having Jurisdiction and must comply with the local electrical code.

2. The equipment must be properly grounded according with NEC and other local safety code and building code requirements

3. To meet the over-voltage safety requirements on the telecommunications cables, a minimum 26 AWG telecommunication line cord must be used.

4. "Pour être en conformance avec les exigences finies de sûreté de sur-tension sur les câbles de télécommunications un fil de télécommunication ayant un calibre minimum de 26 AWG doit être utilisé."

5. Reminder to all the BWA system installers: Attention to Section 820-40 of the NEC which provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building, as close to the point of cable entry as is practical.

6. AN-80i must be installed in compliance with relevant articles in National Electrical Code-NEC (and equivalent Canadian Code-CEC) including referenced articles 725, 800 and 810 in NEC.

7. RF coaxial cable connecting an antenna to the AN-80i must comply with the local electrical code.

1.7 Product Information

Use the following table to record important system information:

Product Information
AN-80i SN: _____ MAC Address _____
PoE SN: _____ Model #: _____
Antenna Model No.: _____ Antenna SN: _____
Serial Number Stickers

Chapter

2

2 System Overview

The Access Node 80i system is manufactured by Redline Communications -- a world leader in design and production of Broadband Fixed Wireless (BFW) systems.
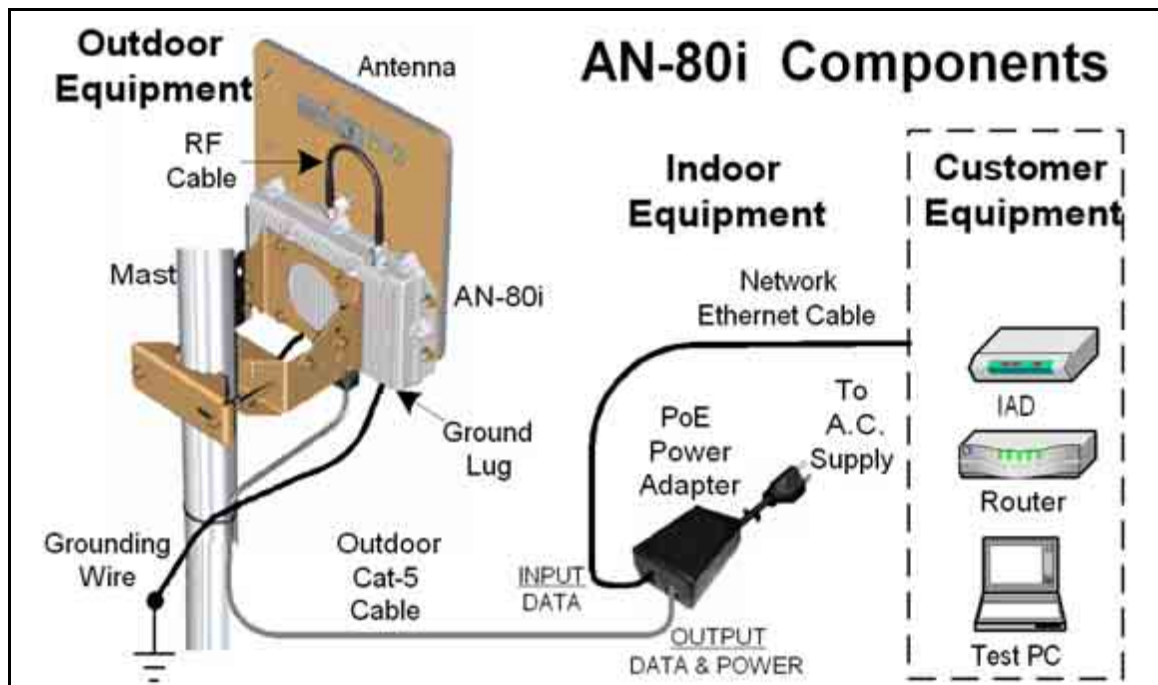
Figure 1: Intro - AN-80i Components

The AN-80i is a high-performance, high-speed wireless Ethernet bridge for use in a commercial, industrial, business, or government environment. The system can operate with a 3.3-3.8, 4.9, 5.3/5.4, or 5.8 GHz radio (factory installed) using a time division duplexing (TDD) RF transceiver to transmit and receive on the same RF channel. The main AN-80i features include: advanced technologies to address inter-cell interference, enhanced security features through a proprietary over-the-air encryption scheme, and Automatic Transmitter Power Control (ATPC) to automatically achieve and maintain optimum performance.

The AN-80i outdoor unit is housed in a weatherproof aluminum alloy case. The outdoor unit can be used with a selection of available external antennas. When equipped with a narrow beam antenna, the AN-80i supports long-range operations of over 50 miles (80 km) in clear line of sight (LOS) conditions. An indoor PoE power adapter provides operational power for the AN-80i and connection to the Ethernet network.

Each wireless link requires two AN-80i units. One AN-80i is configured as the PTP Master (or PMP Sector Controller) and controls the wireless link. This function is transparent to all Ethernet operations. The sector controller AN-80i uses a scheduled request/grant mechanism to arbitrate requests for bandwidth from the remote unit -- providing non contention-based traffic with predictable transmission characteristics. The remote AN-80i operates as a PTP Slave (or PMP Subscriber).
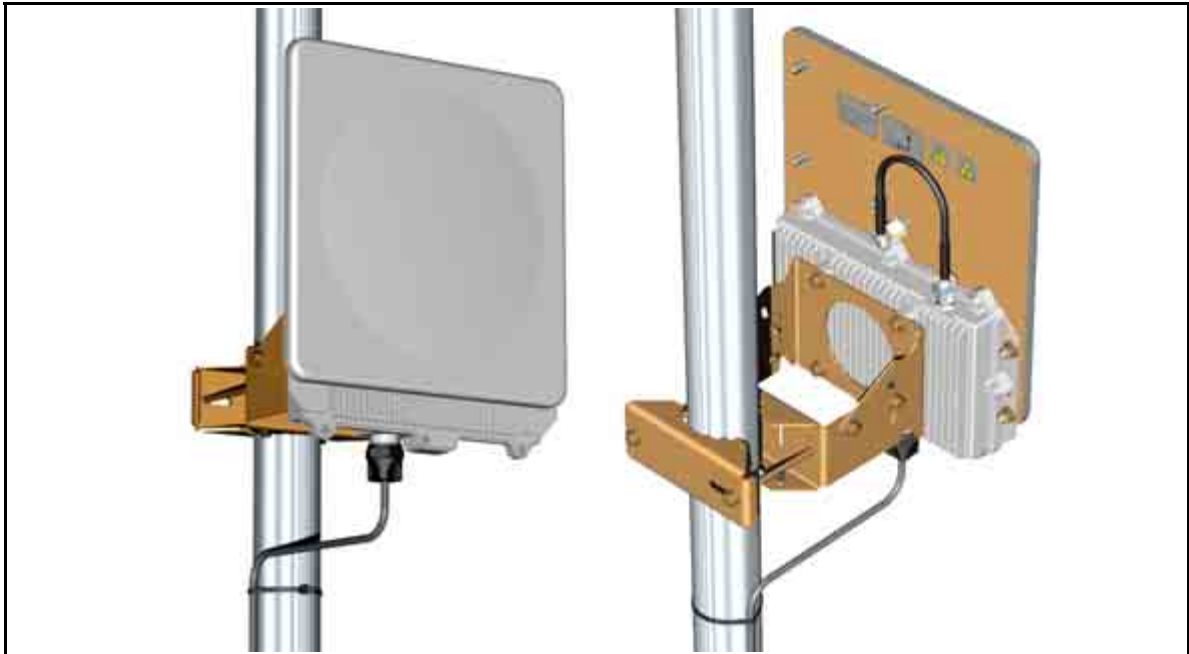
Figure 2: Intro - AN-80i with Integrated Antenna

2.1 Ethernet Port

The AN-80i receives DC power and exchanges data with the indoor network through the Ethernet port. The AN-80i Ethernet port connects to the PoE Adapter using a weatherproof Cat. 5e Ethernet cable. The Ethernet port is a female RJ-45 connector.

2.2 RF Port

The RF port is used to send and receive RF signal to/from the antenna. A short coaxial cable is provided to connect the transceiver to an external antenna. The RF port is a female N-type connector.

2.3 Mounting Brackets

There are two mounting brackets available for the AN-80i. The lightweight (two-point) antenna bracket provides convenient mounting of one foot flat panel antennas. The heavy-duty (four-point) antenna mounting bracket is available for mounting two foot flat panel and parabolic antennas.

2.4 Grounding Connection

A ground-lug is provided on the AN-80i chassis. Use this connection to terminate a grounding wire.

2.5   Indoor Power Block (PoE Power Adapter)

The PoE power adapter provides power and connection to a local Ethernet network.

2.5.1   AC Power Adapter

The AC power adapter input is auto-sensing 110/220/240 VAC 50/60 Hz.

INPUT	OUTPUT
DATA	DATA & POWER

J1	J2

J1 Pins		J2 Pins
1 Data Pair 1	←→	1 Data Pair 1
2 Data Pair 1	←→	2 Data Pair 1
3 Data Pair 2	←→	3 Data Pair 2
4 No Connection		4 + VDC
5 No Connection		5 + VDC
6 Data Pair 2	←→	6 Data Pair 2
7 No Connection		7 - VDC
8 No Connection		8 - VDC
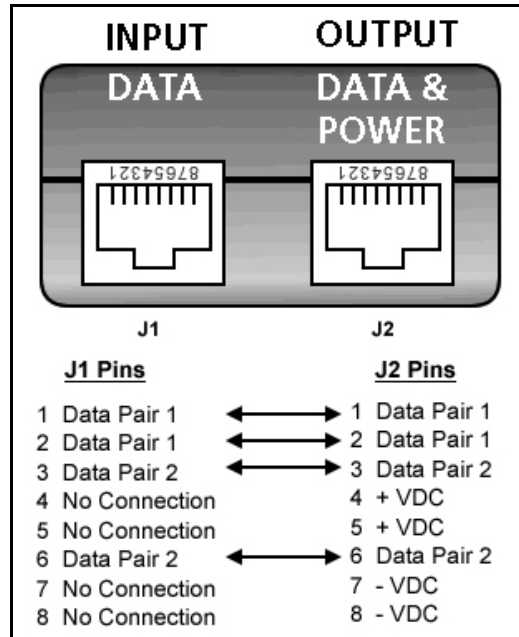
Figure 3: Intro - Indoor Power-over-Ethernet (PoE) Module - AC Model

2.5.2   DC Power Adapter

The DC power adapter input is auto-sensing 18 - 60 VDC.

PIN CONNECTION		
Pin	Data in	Data out
1.	TX(+)	TX(+)
2.	TX(-)	TX(-)
3.	RX(+)	RX(+)
4.	NC	DC+
5.	NC	DC+
6.	RX(-)	RX(-)
7.	NC	DC-
8.	NC	DC-
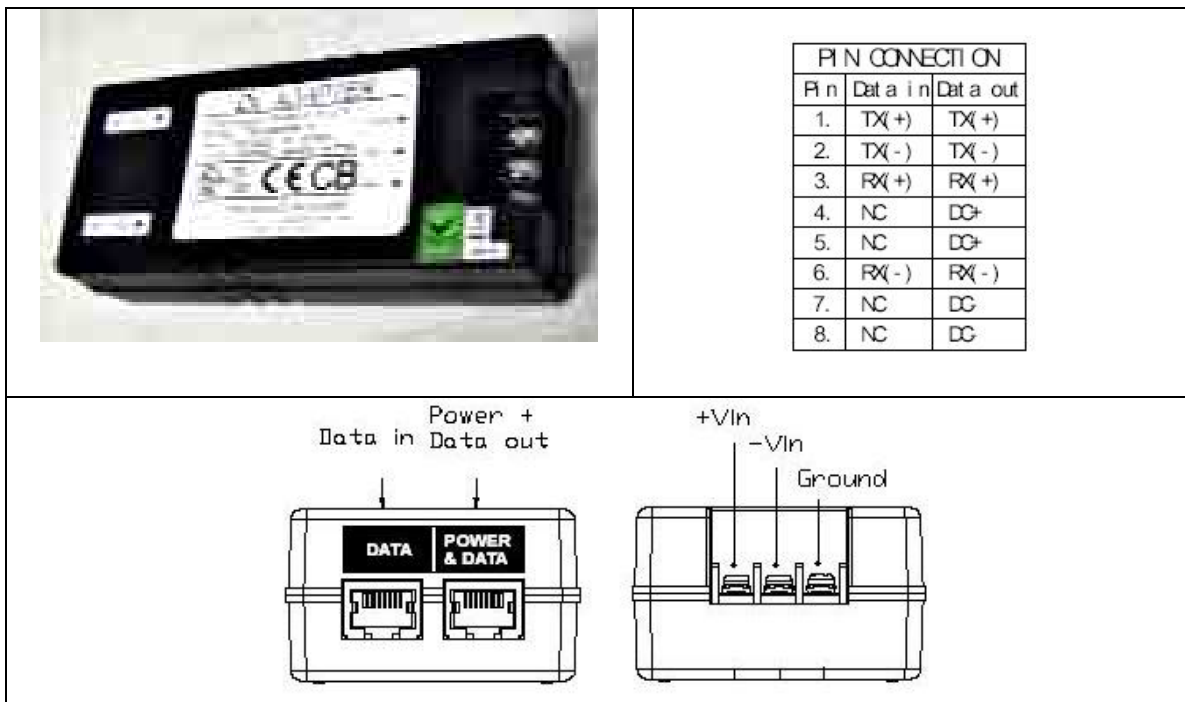
Figure 4: Intro - Indoor Power-over-Ethernet (PoE) Module - DC Model

> ***Warning to Service Personnel: 48 VDC***
>
> Customer equipment including personal computers, routers, etc., must be connected only to the INPUT (DATA) port on the PoE unit.
>
> Only the outdoors Ethernet interface cable connecting to the AN-80i can be safely connected to the OUTPUT (DATA & POWER) connector. Connecting customer premises Ethernet equipment directly to the OUTPUT (DATA & POWER) connector on the Power-over-Ethernet power adapter may damage customer equipment.

2.6 Antenna Alignment

The AN-80i includes both an audible alignment tool and a web-based alignment tool to assist in pointing the antenna.

2.6.1 Web Page Alignment

The most reliable method for obtaining optimum performance from a wireless link is to align the antenna to the position providing the highest RSSI value and the best SINADR ratio. The web page alignment tool provides continuous updates (1 second intervals) of the measured RSSI (received signal strength indication) and SINADR (Signal to noise and distortion ratio). This web page can be accessed from a laptop computer and most web-enabled handheld devices.

Use the following URL to access the AN-80i alignment web page:

> http:// [AN-80i IP Address] / usr / aa.html

For example:

> *http://192.168.20.30/usr/aa.html*

2.6.2 Audible Alignment

The signal will sound infrequently when a low signal is detected, and more often as the signal strength increases. The audible signal is enabled and disabled through the user interface:

Web: See *Antenna Alignment Buzzer Enable* under Wireless Configuration on page 33.

Telnet: See *buzzer* in CLI Set commands under Set on page 73.

The audible antenna alignment tool provides only rough adjustment for the subscriber antennas. It is recommended to monitor the RSSI measurements to achieve maximum signal strength when performing fine adjustments to the subscriber antenna. Refer to the AN-80i Installation Guidelines for detailed instructions.

Chapter

3

3   Web Interface - PTP

The Web Interface provides all required settings and statistics necessary to configure and monitor the operation of the AN-80i using a standard web browser. An operator can access and control the AN-80i remotely from any geographical location with HTTP connectivity to that unit.

3.1   System Login

On the PC, open a browser (Internet Explorer 6 or higher recommended). For new systems, enter the default IP address (192.168.25.2). The following dialog should be displayed:

Figure 5: Web - Login Screen

Login to the AN-80i using your user name and password. See Table 13**:** Web - Default System Users on page 40 for the factory default usernames and passwords.

If the IP address, username and/or password have been modified since installation, contact the network administrator to determine the current settings. If the IP address, or the user name and password cannot be determined. See section 6.2: Procedure to Restore Factory Settings on page 85.

3.2   System Menu

Following a successful login, the General Information screen is displayed. On the left is a menu of all available screens. Point and click on the blue text of the menu to display that screen.

Figure 6: Web - System Menu

The administrator (admin) has unrestricted access to all screens. All other users have viewing access only. See 3.7: Users Management on page 39 for details.

3.3   System Information

3.3.1   General Information

Click General Information to view the system overview screen (read-only). Refer to the System Configuration screen for information about changing these settings.

Dashboard

The dashboard display at the top of the General Information screen shows summary of important operational information including: the unit IP address, operating frequency, current time (web user's platform), wireless status, Ethernet status, Received Signal Strength Indication (RSSI), Signal to Interference, Noise, and Distortion Ratio (SINADR), and the radio temperature.

Figure 7: Web - General Information Dashboard

IP Address (top left of screen): Current IP address setting of this unit.

Wireless Frequency (top center of screen): User-assigned RF channel frequency.

Time (top right of screen): Displays time obtained from user's Web browser.

<u>Wireless Link LED</u>

The Wireless Link LED lights solid green when the wireless link is established. If the LED is off, it may indicate one of the problems listed in the following table:

Table 2: Wireless Link LED Diagnostics		
Symptom	**Possible Problem**	**Solution**
No wireless link	Link name does not match. A PTP wireless link can be established only between pairs of AN-80i systems having identical Link Name settings.	Enter identical Link Name field settings on master and slave units. To establish a PTP wireless link between an AN-50e and AN-80i system, the AN-80i Link Name field must be blank (delete all characters).
	Remote system is malfunctioning or is not powered-on.	Verify operation of remote system.
	The propagation path is blocked.	Clear path or re-locate unit.
	The transceiver is malfunctioning.	Repair/replace unit.
	Antenna is not aligned with the remote system.	Re-align the antenna.

<u>Wireless Signal LED</u>

The wireless signal LED lights when a wireless link is established. Signal indications are different based on the Adaptive Modulation setting:

Table 3: Wireless Signal LED Indication	
Adaptive Modulation	
Enabled	The Wireless Signal LED lights solid green when the wireless link is operating at the rate equal to the Uncoded Burst Rate setting, and blinks when operating at a lower rate.
Disabled	The Wireless Signal LED lights solid green when the wireless link is established.

If the LED is off, it may indicate one of the problems listed in the following table:

Table 4: Wireless Signal LED Diagnostics		
Symptom	**Possible Problem**	**Solution**
Weak RF Link	Obstructions in the propagation path causing signal degradation.	Try to remove obstacles or re-locate antenna.
	Antenna moved, due to high winds.	Re-align the antenna.

Ethernet Link LED

The Link LED lights solid green when there is an Ethernet connection and no traffic, and blinks when traffic is detected. If the LED is off, it may indicate one of the problems listed in the following table:

Table 5: Ethernet Link/Act LED Diagnostics		
Symptom	**Possible Problem**	**Solution**
No Ethernet Link	Poor cable connection to Ethernet equipment.	Carefully check all cable connections.
	Wrong type of cable to Ethernet equipment.	If the Ethernet is connected to a router, a straight-through cable is required. If the Ethernet is connected to a switch, a crossover cable is required.
	System processor malfunction.	Apply short reset or long reset.
	The connected Ethernet equipment may be malfunctioning.	Repair or replace faulty equipment.

Ethernet 100 LED

The Ethernet 100 LED lights solid green when the Ethernet port is operating at 100 Mb/s and is off when operating at 10 Mb/s. If the LED is off, it may indicate one of the problems listed in the following table:

Table 6: Ethernet 100 LED Diagnostics		
Symptom	**Possible Problem**	**Solution**
Ethernet 10 Mbps	AN-80i is manually set for 10Base-T operation and connected device is operating at 100Base-T or auto-negotiate.	It is strongly recommended to manually configure all devices to matching speed and duplex settings. If manual settings are not available, both devices must be set to auto-negotiate.
	The connected Ethernet device is operating at 10Base-T.	If the AN-80i is connected to a host computer or server operating at 10Base-T, this is normal operation.

Ethernet FD LED

The FD LED lights solid green when the Ethernet connection is operating in full duplex mode and blinks when collisions are detected on the Ethernet port. When connected to a hub, it is typical to have intermittent packet collisions. If the LED is blinking, it may indicate one of the problems listed in the following table:

Table 7: Ethernet Link/Collision LED Diagnostics		
Symptom	**Possible Problem**	**Solution**
Link Collision (*FD* LED blinks)	Collisions are normal for half duplex links.	It is strongly recommended to manually configure all devices to matching speed and duplex settings. If manual settings are not available, both devices must be set to auto-negotiate.
	Incompatible Ethernet port speed.	

3.3.2 General Information

The General Information table provides additional detail about the unit.

Figure 8: Web - General Information Screen

General

System Name: User-assigned name for this AN-80i.

System Details: User-assigned system details information.

Contact: User-assigned contact information.

Hardware Version: Displays the hardware version of the AN-80i.

System Mode: The system designated as PTP Master establishes and manages the bi-directional data link with a remote end AN-80i. Only one system in a wireless link must be set for PTP Master mode.

> **PTP Master**: AN-80i begins transmitting automatically, sends poll messages to locate the remote AN-80i Slave, and negotiates operating settings for the link.

> **PTP Slave**: AN-80i waits passively, monitoring the selected channel(s) until polled by the PTP Master.

Software Version: Displays the software version in use.

Time Since System Start: Time since the system was last reset/powered-on.

Start Up Time: Time and date the system was last reset/powered-on.

Ethernet

Ethernet MAC Address: Hardware (MAC) address of this AN-80i. This address is also recorded on a label on the AN-80i chassis.

IP Address: User-assigned IP address of this AN-80i.

IP Subnet Mask: User assigned IP subnet mask.

Default Gateway Address: User-assigned IP address of the default router or gateway.

Wireless

RF Link Established: Status of the wireless link.

> **Yes** - RF link successfully established with remote-end AN-80i.

> **No** - RF link not established with remote-end AN-80i.

Uncoded Burst Rate: The current uncoded burst rate for the link.

3.4   System Status

Click System Status in the menu to view system, Ethernet statistics, and wireless interface statistics.

System Status			Reset Statistics	
General Information			**Wireless Statistics**	
System Name	AN80i-Master		Link ID	13309
Software Version	2.20.007		Received Signal Strength - Min.	-55.38 dBm
RF Link Established	Yes		Received Signal Strength - Mean	-55.00 dBm
Uncoded Burst Rate	54 Mb/s		Received Signal Strength - Max.	-54.25 dBm
System Mode	PTP Master		SINADR	25.80 dB
RF Channel Frequency	4990.0 MHz		Rx Packets	3228363
Tx Power	16 dBm		Rx Packets - Retransmitted	0
DFS enabled	Yes		Rx Packets - Discarded	0
DFS action	Chg Freq		Tx Packets	3231163
Link Distance	0 Km		Tx Packets - Retransmitted	0
Status Code	0		Tx Packets - Discarded	0
Ethernet MAC Address	00:09:02:01:21:3d			
IP Address	192.168.63.2			
IP Subnet Mask	255.255.255.0			
Default Gateway Address	192.168.63.1			
Ethernet LAN Statistics				
Rx Packets	17957364			
Rx Packets - Discarded	0			
Tx Packets	6800089			

Figure 9: Web - System Status Screen

General information

System Name: Displays the user-assigned system name.

Software Version: Displays the software version in use.

RF Link Established: Status for the wireless link connection.

> **Yes** - RF link has been successfully established with the remote-end AN-80i.

> **No** - RF link has not been established with the remote-end AN-80i.

Uncoded Burst Rate: The negotiated uncoded burst rate (UBR) for the link.

System Mode: The PTP Master establishes and manages the wireless link with the remote end AN-80i. Each wireless link must have only one PTP Master.

> **PTP Master**: An-80i transmits automatically; sending poll messages to the remote AN-80i and negotiating the UBR (modulation and coding) for the wireless link.

> **PTP Slave**: This unit waits passively until polled by the PTP Master.

RF Channel Frequency: User-assigned RF channel.

Tx Power: The current transmit power level. If ATPC is enabled, this value may be different than the Tx Power setting in the System Configuration screen.

DFS Enabled: Indicate the status of the DFS feature. Refer to the Wireless Configuration section on page 33 for a complete description of the DFS feature.

Enabled: The DFS feature is activated. See DFS Action below.

Disabled: The DFS feature is disabled.

DFS Action: Indicates the last DFS action taken by the AN-80i equipment. All DFS actions are recorded in the event log.

None: The DFS feature is disabled.

Tx Off: Transmitter was switched off for 30 minutes.

Chg Freq: Transmitter was switched to a different frequency.

Link Distance [Miles or Km]: Distance between wireless systems. This may be the calculated or user-assigned distance (System Configuration screen).

Status Code: Code indicating the condition of the AN-80i system. Status indications are specific for PMP and PTP operation.

Ethernet MAC Address: System hardware address (also printed on product label).

IP Address: User-assigned IP address of the AN-80i.

IP Subnet Mask: User-assigned IP subnet mask.

Default Gateway Address: User-assigned IP for the default router or gateway.

Ethernet LAN Statistics

Rx Packets: Total packets received on the Ethernet port.

Rx Packets: **Discarded**: Total valid Ethernet frames received on the Ethernet port that are discarded due to lack of buffer space.

Tx Packets: Number of packets transmitted on the Ethernet port (including Ethernet frames and error correction bytes).

Wireless Statistics

Link ID: A unique Link ID value is generated automatically when a new link is added.

Received Signal Strength: **Min**: Minimum measured RSSI value.

Received Signal Strength: **Mean**: Average measured RSSI value.

Received Signal Strength: **Max**: Maximum measured RSSI value.

SINADR: Ave. signal to interference, noise, and distortion ratio measured since last refresh.

Rx Packets: Total number of packets received over the wireless interface.

Rx Packets: **Retransmitted** Number of wireless packets received that were retransmitted by the remote-end system (ARQ mechanism re-transmitting unacknowledged packets).

Rx Packets - **Discarded**: Number of received packets discarded due to errors.

Tx Packets: Number of packets transmitted over the wireless interface.

Tx Packets - Retransmitted: Number of packets re-transmitted over the wireless interface (ARQ mechanism re-transmitting unacknowledged packets).

Tx Packets: **Discarded**: Total number of packets transmitted over the wireless interface that were not acknowledged (discarded by remote-end due to errors).

Controls

Reset Statistics: Click this button to zero the counters for the wireless and Ethernet LAN Statistics displayed on this page.

3.5   System Logs Screen

Click System Log in the menu to view the system activity and error messages recorded by the AN-80i.
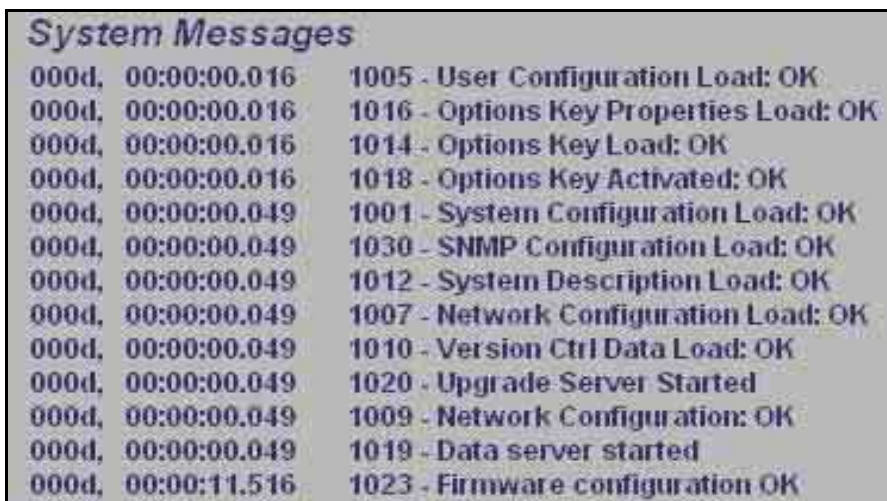
Figure 10: Web - System Log Messages

The following table provides a brief description of the key messages recorded in the logs by the system.

Table 8: Web - System Log Messages	
Log Message	**Description**
1001	System Configuration Load: OK
1002	System Configuration Save: OK
1003	EEPROM Directory Load: OK
1004	EEPROM Directory Save: OK
1005	User Configuration Load: OK
1006	User Configuration Save: OK
1007	Network Configuration Load: OK
1008	Network Configuration Save: OK
1009	Network Configuration: OK
1010	Version Ctrl Data Load: OK
1011	Version Ctrl Data Save: OK
1012	System Description Load: OK
1013	System Description Save: OK
1014	Options Key Load: OK
1015	Options Key Save: OK
1016	Options Key Properties Load: OK
1017	Options Key Properties Save: OK
1018	Options Key Activated: OK
1019	Data server started: OK
1021	Upgrade: OK
1023	Firmware configuration: OK

Table 8: Web - System Log Messages	
Log Message	**Description**
1026	Factory Data Save: OK
1029	HTTP(User Mgm): Chg User Attributes: OK
1030	SNMP Configuration Load: OK
1031	SNMP Configuration Save: OK
1032	SNTP: Time received: OK
1033	DFS: Event Detected
1033	MAC Initialization: OK
1034	DFS: Event Detected
1035	ID deleted: OK
1036	Restart freq scan (RSSI)
1037	Restart freq scan (TimeOut)
1038	Reg Req (step 1)
1039	Reg Req (step 2
1040	Reg Req (step 2)
1041	Restart freq scan (!act links)
1042	ID tables saved: OK
1043	ID defined: OK
1044	ID tables not changed: OK
1045	ID modified: OK
1046	RF frequency validation: OK
2001	System Configuration Load: Error
2002	System Configuration Save: Error
2003	EEPROM Directory Load: Error
2004	EEPROM Directory Save: Error
2005	User Configuration Load: Error
2006	User Configuration Save: Error
2007	Network Configuration Load: Error
2008	Network Configuration Save: Error
2009	Network Configuration: Error
2010	Version Ctrl Data Load: Error
2011	Version Ctrl Data Save: Error
2012	System Description Load: Error
2013	System Description Save: Error
2014	Options Key Load: Error
2015	Options Key Save: Error
2016	Options Key Properties Load: Error
2017	Options Key Properties Save: Error
2018	Options Key Activated: Error
2019	No Options Key
2020	Fail to start the data server
2021	Data server
2022	Data server

Table 8: Web - System Log Messages	
Log Message	**Description**
2023	Upgrade client start: Error
2024	Upgrade in progress
2025	Upgrade: FAIL
2026	Upgrade: Error
2028	Factory Data Corrupted (use fallback values)
2028	TFTP: Error
2029	Firmware configuration: Error
2031	Factory Data Save: Error
2034	HTTP(User Mgm): Invalid password
2035	HTTP(User Mgm): Invalid User
2036	HTTP(User Mgm): Chg User Attributes: Error
2037	SNMP Configuration Load: Error
2038	SNMP Configuration Save: Error
2039	Invalid Options Key
2039	SNTP: Time received: Error
2040	MAC Initialization: Error
2041	MAC Busy
2042	ID database corrupted
2043	Invalid ID
2044	Max. ID number reached
2045	Int Procs programming: Error
2046	Int Procs start: Error
2047	ID action not possible
2048	ID validation: Error
2049	HW validation: Error
2050	FTP: Error
2051	RF frequency validation: Error
2099	Unknown Message

3.6   System Configuration Screen

Click Configure System in the menu to view and adjust configuration settings for general system identification, Ethernet, and the wireless interface.

Ethernet Configuration	
System Name:	AN-80i
System Details:	
System Location:	
Contact:	
IP Address:	192.168.25.4
IP Subnet Mask:	255.255.255.0
Default Gateway Address:	192.168.25.250
Flow Control Enable:	☐
Prioritized Low Latency Mode Enable:	☐
SNTP Enable:	☑
SNTP Server IP Address:	192.168.25.1
Polling interval [hours]:	24
Time Zone (GMT) [hh:mm]:	+0:00
SysLog Enable:	☐
SysLog Server IP Address:	192.168.25.1
Ethernet Mode:	Auto
HTTP Enable:	☑
Telnet Enable:	☑
Telnet Port:	23
SNMP Enable:	☑ [Configure SNMP]
Mgmt. Tag Enable:	☐
Mgmt. VID:	0

Figure 11: Web - System and Network Configuration Screen

Ethernet Configuration

System Name: Enter the name for this AN-80i. The name may be up to thirty (30) alpha-numeric characters including a-z, A-Z, 0-9, dash (-), and underscore (_).

System Details: Enter additional descriptive details about this AN-80i. The name may be up to thirty (30) alpha-numeric characters including a-z, A-Z, 0-9, dash (-), and underscore (_).

System Location: Enter additional descriptive details about this AN-80i. The name may be up to thirty (30) alpha-numeric characters including a-z, A-Z, 0-9, dash (-), and underscore (_).

Contact: Enter additional descriptive details about this AN-80i. The name may be up to thirty (30) alpha-numeric characters including a-z, A-Z, 0-9, dash (-), and underscore (_).

IP Address: Enter the IP address for this AN-80i. The IP address is routable through the Ethernet port and over the wireless interface.

IP Subnet Mask: Enter the IP subnet mask.

Default Gateway Address: Enter the IP address of the default gateway or router on the Ethernet segment connected to the AN-80i Ethernet port.

Flow Control Enable: Check this box ☑ to enable flow control functions (802.3x) on the AN-80i Ethernet port. Enabling this feature allows the AN-80i to request Ethernet devices to pause transmissions during busy periods.

Prioritized Low Latency Mode Enable: Check this box ☑ to enable priority handling of 802.1p tagged traffic. When enabled, this ensures prioritized traffic is transmitted with the lowest achievable latency, even under conditions of high IP data traffic loading.

Table 9: Web - 802.1p Priority Settings	
Priority	Setting
Highest	6, 7
	4, 5
	0, 3, no tag
Lowest	1, 2

SNTP Enable: Check this box ☑ to enable the SNTP protocol support. This feature allows AN-80i systems to time-stamp log messages using a network time server. When enabled, you must enter the network address of the SNTP server in the SNTP Server IP Address field.

SNTP Server IP Address: Enter the network address of the SNTP server. Valid only when the SNTP Enable field is checked.

Polling Interval: Enter the SNTP polling interval (hours).

Time Zone (GMT): Enter the hours offset from GMT for this time zone. Valid only when the SNTP Enable field is checked.

Syslog Enable: Check this box ☑ to enable the Syslog protocol support. This feature allows AN-80i log messages to be saved in a central repository. When enabled, you must enter the network address of the Syslog server in the Syslog Server IP Address field.

Syslog Server IP Address: Enter the network address of the Syslog server. Valid only when the Syslog Enable field is checked.

Ethernet Mode: Select the operating mode of the Ethernet port.

Auto - Auto-negotiate the speed connection speed.

10 - Operate at 10Base-T only.

100 - Operate at 100Base-T only.

HD - Operate at half-duplex only.

FD - Operate in full duplex only.

> *Important: The auto-negotiate feature does not detect the speed and duplex of manually set Ethernet equipment. The auto-negotiate feature works correctly only when both communicating Ethernet devices are configured for auto-negotiate. Duplex mismatches may result in an unexpected loss of communications.*
>
> *It is recommended to manually configure Ethernet devices to 100Base-T / full duplex.*

HTTP Enable: Check this box ☑ to enable the HTTP (Web) interface. If the option is deselected, only CLI commands will be available.

Telnet Enable: Check this box ☑ to enable a Telnet access (CLI) to the AN-80i. Refer to the CLI commands in CLI Interface on page 66.

Telnet Port: Enter Telnet port address (default is 23).

SNMP Enable: Check this box ☑ to enable the Simple Network Management Protocol (SNMP) agent. When this item is checked, click on the blue text [Configure SNMP] adjacent to the check box to display the SNMP Configuration screen.

Mgmt. Tag Enable: Check ☑ this box to enable VLAN tagged traffic.

The Mgmt Tag Enable setting is disabled (factory default) when shipped from the factory or following a long-reset operation. In this mode the PTP Master and PTP Slave can be managed through the local Ethernet port using untagged traffic. Over-the-air management is possible only after creating a pass-through group and pass-through connections for each PTP Slave.

When Mgmt Tag Enable is enabled, this PTP Master or PTP Slave can be managed only using VLAN traffic tagged with the value specified in the Mgmt. VID field. Over-the-air management is possible only after creating a VLAN tagged group and VLAN tagged connections for each PTP Slave.

It is recommended to create and test a VLAN group for tagged management traffic before activating the Mgmt Tag Enable function. Set the associated QoS and priority values to ensure management traffic has adequate priority and bandwidth during system operation.

Mgmt. VID: Enter the VLAN ID. When Mgmt. Tag Enable is selected, the system recognizes only management commands with this VLAN ID.

> *Important*: *The VLAN network support should be verified before enabling this feature to ensure the AN-80i system will be reachable using the VLAN tagged traffic.*

Wireless Configuration

Use settings on the following screen to configure the AN-80i wireless interface.

Figure 12: Web - Wireless Configuration Screen

RF Freq. [MHz]: Enter the center frequency for the RF channel. This setting must be identical for both AN-80i systems operating as a wireless link. The options key controls channel availability. Refer to Table 63: Spec. - Regional Identification Codes on page 99 for available channels. Use the Autoscan feature to enable use of multiple channels.
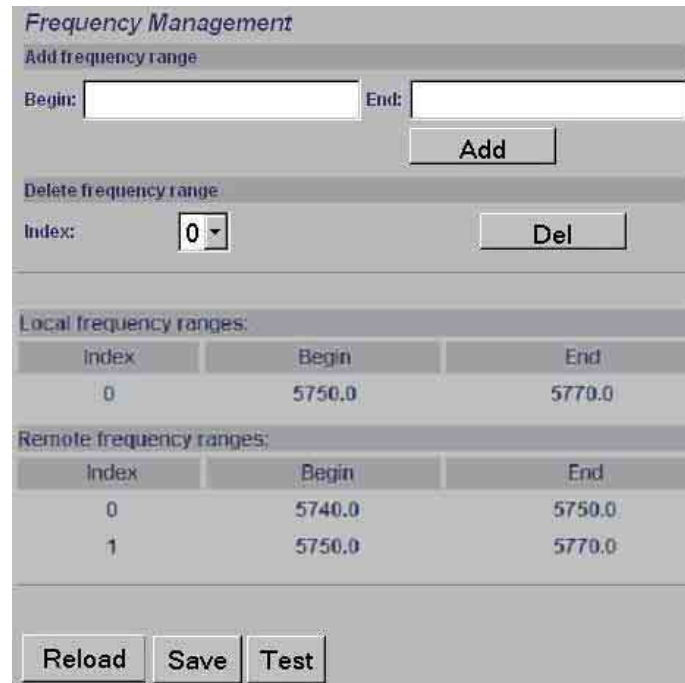
When the Auto Scan field is <u>not</u> checked, the PTP Slave will only register with a PTP Master operating at the frequency specified in the RF Freq. [MHz] field.

Important: To minimize interference, the channel frequencies for AN-80i links operating in close proximity should be separated by a minimum of the channel size in use (to avoid overlapping bands).

Auto scan: Check this box ☑ to enable the PTP Slave automatically scan available channels to locate and register with an AN-80i PTP Master. When the Auto Scan field is checked, click on the blue text [Frequency Ranges] adjacent to the check box to display

the Frequency Management screen. Up to 32 frequency ranges may be specified. Frequency ranges may be entered on the PTP Master and the PTP Slave. Settings entered on the PTP Master will be downloaded and used by the PTP Slave.

Figure 13: Web - Wireless Configuration Screen

Add Frequency Range

Begin: Enter the lower limit of the frequency scan interval (MHz). The scan interval must be a subset of the region frequency range. The AN-80i compensates for channel size when selecting the center frequency.

End: Enter the upper limit of the frequency scan interval (MHz). The scan interval must be a subset of the region frequency range. The AN-80i compensates for channel size when selecting the center frequency.

Add: Click to check the range settings and add these to the Local Frequency Range list (if valid). To save changes to non-volatile memory, return to the Configuration Screen and click the Save button at the bottom of the screen.

Delete Frequency Range

Index: Select the index value for the scan interval delete from the Local Ranges table.

Delete: Click the Delete button to permanently remove the selected scan interval.

Local Frequency Ranges:

These are the (optional) scan intervals for this PTP Slave. The last settings saved in non-volatile memory will be loaded when the PTP Slave is rebooted.

Remote Frequency Ranges:

When settings are displayed in this table, the frequency scan intervals have been downloaded from the PTP Master. Setting scan intervals in the PTP Master is optional. When present, these settings override the local settings and are used whenever the PTP Slave has deregistered and is scanning for a PTP Master. This list is not saved permanently, and is discarded when the PTP Slave is rebooted.

Reload: Display the saved (Local) scan intervals.

Save: If settings are valid, the ranges are added to the Local Frequency Range list. An event message is logged indicating the results of the test.

> ***Important***: *Clicking the Save button does not permanently save changes. You must click Save at the bottom of the* System Configuration screen.

Test: Click to check the range settings and add these to the Local Frequency Range list (if valid). This action does not save the changes to non-volatile memory.

Operating Notes

If no scan intervals are defined, the PTP Slave will scan all frequency ranges for the enabled region. If scan intervals are defined, only the listed channels will be scanned for a PTP Master. If the PTP Slave checks all scan intervals three times without locating and registering with a PTP Master, the scanning mode is changed to include all frequency ranges for the enabled region (until registration or reboot).

The PTP Master can also be programmed with a list of scan intervals. When the PTP Slave registers with a PTP Master that has frequency ranges defined, the list is transmitted to the PTP Slave and is displayed as Remote Frequency Ranges. When present, the scan intervals in the Remote Frequency Ranges table are used exclusively during autoscan (Local Frequency Ranges are ignored). The Remote Frequency Ranges remain in effect until the PTP Slave is rebooted.

Tx Power [dBm]: Enter the transmit power level (dBm). This setting is for the transceiver output only. The actual EIRP depends on the gain of the connected antenna.

Refer to the following tables to determine the maximum transmit power level available at each modulation setting. When ATPC is enabled, the Tx power is automatically adjusted to achieve optimum performance. When DFS is enabled, the subscriber Tx power may be automatically adjusted (regardless of ATPC setting) to avoid false DFS triggering.

Table 10: Maximum TX Power Settings (dBm) for AN-80i Radio								
Modulation	**BPSK**		**QPSK**		**16 QAM**		**64 QAM**	
Code Rate	**1/2**	**3/4**	**1/2**	**3/4**	**1/2**	**3/4**	**2/3**	**3/4**
Max. Tx Power: **T35 Radio**	25	25	25	25	25	23	22	21
Max. Tx Power: **T49 / T54 / T58 Radio**	25	25	23	22	21	20	18	17

PTP: v3.00 or higher / PMP: v11.0 or higher

Note: In PMP mode, setting the Tx power too high may reduce the SINADR value. If the SINADR is less than expected, re-test the link using a lower Tx power setting.

> ***Important***: ***EIRP Levels: Where required by local regulations, the maximum operational power per channel for a specific antenna must not exceed the maximum allowable EIRP levels. Refer to the FCC and CE notices in this manual. The RF output power settings must be professionally programmed by the manufacturer or a trained professional installer. See section 7:*** Appendices *for a list the maximum transmit power setting based on the antenna gain for a series of frequency settings.*

DFS Action: Select the mode of operation for DFS.

The system set to PTP Master monitors for interference from radar devices and other equipment using the same channel frequency. When interference is detected, the system automatically takes the action selected using the drop-down menu.

None: The DFS function is disabled.

Tx Off: When radar signals are detected the transmitter is switched off for 30 minutes. This action is recorded in the message log and an SNMP trap message is sent (if SNMP enabled).

Following an interval of thirty minutes, the same channel is monitored for one minute and if there are no DFS triggering events, the system resumes normal operation. If DFS trigger conditions are still detected, operation is suspended for an additional thirty minutes. This cycle continues until no DFS trigger events are detected or the operator manually reconfigures the system.

Chg Freq: When radar signals are detected the transmitter is switched to a different frequency. This action is recorded in the message log and a trap message is sent (if SNMP enabled).

The new channel is selected based on allowable frequencies for the regulatory region of that installation. The channel is monitored for one minute before the system is allowed to transmit. If DFS triggering events are detected, the next available channel is selected and monitored. The system is not allowed to return to a channel on which DFS trigger events were detected for a period of thirty minutes. If DFS trigger events are detected on all channels, operation is suspended until the thirty-minute time interval expires for at least one channel.

Important: Where DFS is required by regional regulations, this feature is permanently enabled at the factory and can <u>not</u> be disabled by the installer or end-user.

Antenna Gain: Enter the gain (dBm) for the system antenna.

It is important that the Antenna Gain setting matches the actual antenna gain. If the antenna gain is set higher than the true antenna gain, the system is less sensitive to detecting interference, and is <u>not</u> operating in compliance with the UK/ETSI standard. If the antenna gain is set lower than the true antenna gain, the system is more sensitive to interference and this may result in false DFS triggers.

ATPC Enable: Check this box ☑ to enable the AN-80i to monitor the received signal and request that the remote system adjustment its transmit level for optimum performance. The ATPC feature must be enabled on both AN-80i units.

Important: *When ATPC is enabled, best results are obtained by enabling adaptive modulation.*

Adaptive Modulation: Check this box ☑ to enable the AN-80i to automatically adjust the transmission modulation and code settings to achieve the highest UBR that will operate with a packet error rate (PER at layer 2) of less than 1x10e-6. If the PER exceeds 1x10e-6, the AN-80i automatically adjusts the modulation and code settings downwards (i.e., from 16 QAM 3/4 to 16 QAM 1/2) to operate at a lower UBR where the PER is acceptable. When disabled, the modulation and code settings are entered manually using the Uncoded Burst Rate setting. See Table 10: Maximum TX Power Settings (dBm) for AN-80i Radio.

Modulation Reduction Level: Enter the number of modulation/coding levels to step down during re-transmission of errored wireless packets. Each step down lowers the UBR. The level can be set from 0 to 7 (recommended value = 2).

Uncoded Burst Rate [Mb/s]: Select the desired UBR for the link. If Adaptive Modulation is disabled, the AN-80i will transmit using only the specified settings. See Table 10: Maximum TX Power Settings (dBm) for AN-80i Radio.

Channel Width [MHz]: Select the channel bandwidth. Refer to Table 63: Spec. - Regional Identification Codes on page 99 for available channel widths.

Ethernet Follows Wireless: Check this box ☑ to have the AN-80i disable and enable the Ethernet port function based on the status of the wireless interface. This feature allows switches and routers to trigger configuration changes based on changes to the AN-80i Ethernet port status.

Disabled (☐): The AN-80i Ethernet port is always enabled.

Enabled (☑):Ethernet port is controlled based on the status of the wireless interface.

Table 11: Web - Ethernet Status Indication	
Wireless interface Status	**Ethernet Port Status**
Link Up	Enabled
Link Down	Disabled

Important: The Ethernet Follows Wireless setting affects <u>all</u> data and management traffic (HTTP, TELNET, and SNMP). While activated, it is <u>not</u> possible to manage the AN-80i using the Ethernet port.

Ethernet follows wireless timeout [sec]: Enter the period (in seconds) the Ethernet port will remain disabled following loss of connectivity on the wireless interface. Following this interval, the Ethernet port will be automatically re-enabled to allow management of the AN-80i.

Important: When Ethernet Follows Wireless Timeout is enabled, external switches/routers monitoring the Ethernet port must be programmed to <u>not</u> switch automatically when the Ethernet port function is restored -- the wireless interface may <u>not</u> be operational.

System Mode: Set the operating mode for each AN-80i system.

PTP Master: This unit begins transmitting automatically; sends poll messages to the remote AN-80i, and negotiates the wireless link.

PTP Slave: This unit waits passively, monitoring the selected channel(s) until polled by the PTP Master, and participates in negotiating the wireless link.

Software Version: Select the version of system software to load when the AN-80i is rebooted. The system holds two independent software images.

Encryption Type: Select an encryption type for data transmitted over the wireless interface. When encryption is enabled, no Ethernet packets can be transferred over-the-air unless encryption is enabled on the remote-end AN-80i and the correct Encryption Key is entered on both AN-80i units.

None: Encryption is disabled.

Redline 64-bit: Redline proprietary encryption scheme, compatible with AN-50e.

AES 128-bit: Advanced Encryption Standard using 128-bit encryption.

AES 192-bit: Advanced Encryption Standard using 192-bit encryption.

AES 256-bit: Advanced Encryption Standard using 256-bit encryption.

Encryption Key: The key is used to encrypt data in a way that can be decoded by the remote-end AN-80i. Enter the MAC address of the communicating AN-80i.

Link Name: Enter the name to be used for both the local and remote-end system. A PTP wireless link can be established only between pairs of AN-80i systems having identical Link Name settings. This feature ensures that on power-up, reboot, or auto scan (following deregistration or DFS event), wireless links will only register with designated remote-end units. The name may be up to thirty (30) alpha-numeric characters including a-z, A-Z, 0-9, dash (-), and underscore (_).

> *Important*: *To establish a PTP wireless link between an AN-50e and AN-80i system, the AN-80i Link Name field must be blank (delete all characters).*

Link Length Measurement Mode: Select the mode for setting/measuring the distance between this and the remote-end AN-80i.

> **Auto**: Distance is calculated automatically by the AN-80i.
>
> **Manual**: Enter the link distance manually in the Link Length field.

Link Length: Enter the actual length of the path that the radio wave travels between the two AN-80i units. The link length is used to calculate the transmission-to-response interval and reject reflections of the transmitted signal. This setting is valid only when the Link Length Mode is set to Manual.

Link Length Measurements Unit: Select the units for the Link Length field.

> **Mile**: Link length distance is displayed in miles.
>
> **Km**: Link length distance is displayed in kilometers.

Antenna Alignment Buzzer Enable: Check this box ☑ to enable the antenna alignment audible tone generator in the transceiver. The rate of the tone is proportional to the receive signal strength (faster = stronger signal).

Radio Enable: Check this box ☑ to enable the radio transmitter. If this box is unchecked (☐), it will <u>not</u> be possible to establish a wireless link.

Controls

Save: Click to save settings currently displayed in the configuration screen. Changes to some parameters cause a system reset when the Save button is selected.

Test: Click this button to load the current settings displayed in the configuration screen. The AN-80i will operate with these settings for a period of five minutes. During the 'test' period, you may click the Save button at any time to save this configuration permanently (also terminating the five minute timer). If the Save button is <u>not</u> selected, the previous saved settings are reloaded.

Reboot: Click this button to immediately reboot the AN-80i. All statistics counters are reset.

Def Cfg: Click this button to change all configuration settings to factory default values.
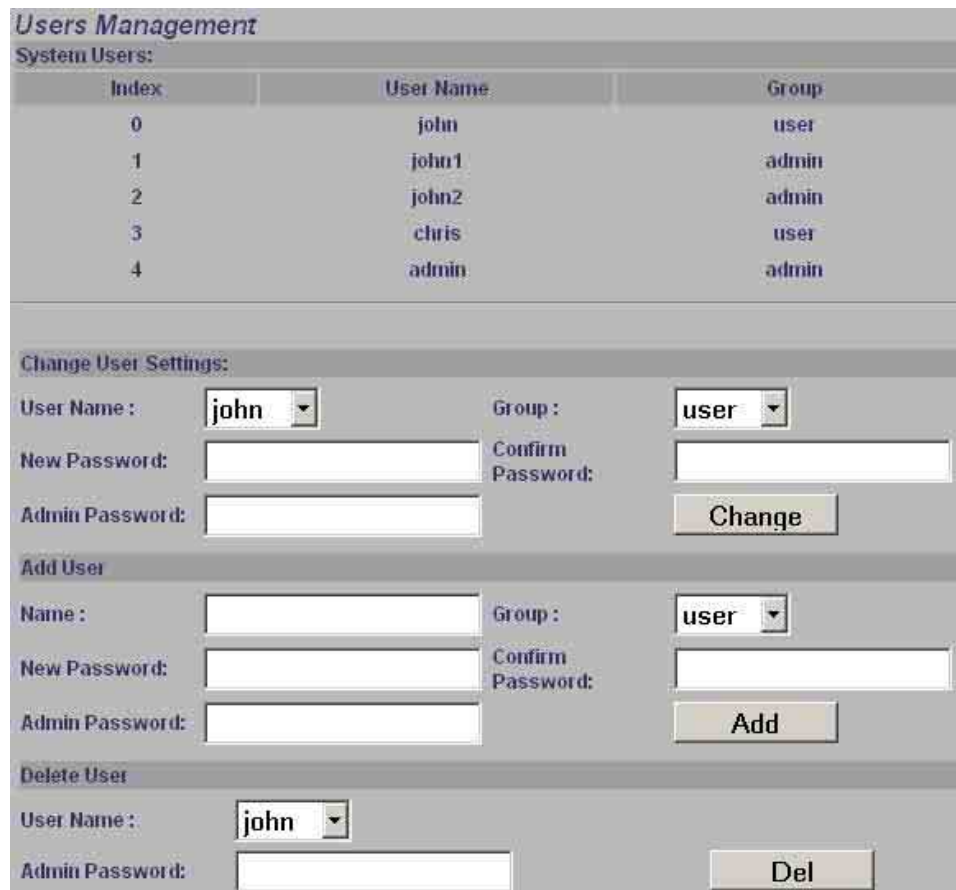
Chg Ver: Click this button to toggle between software versions (on next reboot).

3.7   Users Management

Click Users Management in the left hand menu to display the System Password screen. This screen allows the operator to modify the system passwords.

The AN-80i supports two groups of users: admin and user. See Table 13: Web - Default System Users on 40 for the factory default login values. See Table 12: Web - Screens and User Access on page 40 for permissions associated with each group.

> **Important**: *There must always be at least one 'administrator' account active on the AN-80i. You can __not__ manage the AN-80i if all accounts are 'user'.*

Figure 14: Web - System Password Screen

Change User Settings

Use this dialog to change the settings for an existing user.

User name: Select an existing user to be modified.

Group: Select the group to be associated with this username.

New Password: Enter the new password for this user.

Confirm Password: Re-enter new password for this user.

Admin Password: Enter the administrator password (security feature).

Change: Click the Change button to make these changes effective.

Add User

Use this dialog to add a new user.

User name: Enter a name for the new user (15 characters max.).

Group: Select a group for the new user.

New Password: Enter a password for the new user (15 characters max.).

Confirm Password: Re-enter the password for the new user.

Admin Password: Enter the administrator password (security feature).

Add: Click the Add button to make these changes effective.

Delete User

Use this dialog to delete an existing user.

User name: Select an existing user.

Admin Password: Enter the administrator password (security feature).

Del: Click the Del button to make these changes effective.

Group Permissions

The following table lists the permissions associated with each group.

Table 12: Web - Screens and User Access			
Screen	**Admin Access**	**User Access**	**Description**
General Information	X	X	View general system identification and configuration settings.
System Status	X	X	View system information, Ethernet statistics, and wireless statistics.
System Log	X	X	View the system status messages recorded by the AN-80i.
Configure System	X		View and adjust configuration system, IP address, management, and wireless settings.
Upload Software	X		Upload a new software binary file.
Users Management	X X	X	Change your login password. Add and delete users.
Product Options	X		View and change the product options key.
Spectrum Sweep	X		Scan a range of frequencies to detect other RF sources (interference).
Links	X		Display user-defined Links.
Groups	X		Display user-defined Groups.
New Link	X		Create a new Link.
New Group	X		Create a new Group.
New Connection	X		Create a new Connection.
Save	X		Save changes to ID table (Links, Groups, etc).
Clear All	X		Clear all entries in the ID table.

The following table lists the default login names and passwords.

Table 13: Web - Default System Users		
Group	**User Name**	**Default Password**
user	user	user
admin	admin	admin

3.8 AN-80i Product Options Screen

Click Product Options in the left hand menu to display the Product Options screen. The options keys (a string of numbers, letters, and dashes) enable AN-80i features including the maximum uncoded burst rate and frequency ranges (region codes). Options key are unique to a specific AN-80i (keyed to MAC address).

At least one valid permanent options key <u>must</u> be purchased and installed before the AN-80i is placed in-service. A second options key (permanent or temporary key) may be added to trial new options without deleting the current key.

> *Important: If the AN-80i is placed in-service without first entering a purchased permanent Options Key -- you will experience a <u>service outage</u> on the wireless link.*

Product Options

Options Key 1: `VPJ78DWG-HBBTPNA8-6VKIBEQR-Q4F3JM9L` (Temp)

Options Key 2: _____ (none)

Active options key: `Options Key 1 ▼`

`Activate`

Figure 15: Web - Product Options Screen

Options Key 1: Enter a valid permanent or temporary options key.

Options Key 2: Enter a valid permanent or temporary options key.

Active Options Key: The Active Options Key field selects the preferred key. If valid, the selected key will be activated immediately when the Activate button is clicked. This selection is <u>not</u> affected by switching software versions. If the selected key expires (temp) or the mode is changed (PTP/PMP) the AN-80i will switch to the standby key (if valid).

> *Important: If the active options key is a temporary key -- always enter and activate a purchased permanent options key before the temporary key expires -- otherwise you will experience a <u>service outage</u> on the wireless link.*

Activate: Click the Activate button to validate, save, and activate new options keys or changes to the Active Options Key setting. All keys are validated when the Activate button is clicked. Invalid keys are discarded and an error message is recorded in the event log. If two keys are entered in the same session (before clicking Activate), values are saved only if <u>both</u> keys are valid.

Notes:
1. Keys are shared between PMP and PTP operation.
2. PTP mode has the following restricted operation when both options keys are invalid: 10 MHz channel, 3 Mbps UBR, DFS permanently enabled, region based common frequency range, no enhanced options (i.e., AES).
3. A valid options key <u>must</u> be entered to enable PMP mode operation.

3.9 Upload Software

Click Upload Software in the left hand menu to display the Upload Software screen. This screen is used to upgrade the AN-80i with new software. The AN-80i contains non-volatile storage for two versions of the software. The upload overwrites the non-operational (unselected) version.

Figure 16: Web - Upload Software Screen

Transfer Protocol: Select the type of server:

    TFTP: Use Trivial File Transfer Protocol for file upload.

    FTP: Use File Transfer Protocol for file upload.

Server IP Address: Enter the IP address of the computer with the software upgrade file. The designated computer must be running a TFTP/FTP server.

Software File Name: Name of the software binary file (including file extension).

FTP User Name: Enter the user account name on the FTP server.

FTP Password: Enter the password for the user account name on the FTP server.

<u>**Upgrade Steps**</u>

A TFTP/FTP server is used to upload the new software image file from your computer to the AN-80i. TFTP/FTP server software must be installed and running on the computer you are using to upload the new software file. In addition, the AN-80i software binary file <u>must</u> be located in the default upload directory for the TFTP/FTP server.

1. Enter the IP Address of the computer running the TFTP/FTP server.

2. Enter the full name of the binary file (including the .bin extension).

3. Click Upload File to begin the file transfer. The upgrade file size is approximately four Megabytes and takes a minimum of four to eight minutes to transfer. Slower network connections may take longer. <u>Do not interrupt the transfer process</u>.

4. When the transfer is complete, the AN-80i verifies the integrity of the new file. If errors were introduced during the transfer process, the software file is rejected and a warning message is registered in the event log, and you must repeat the upload.

5. When the transfer has completed successfully, use the System Configuration screen to select which software version to load on the next system reboot (does not switch automatically following upload).

3.10 SNMP Settings Screen

Click Configure SNMP (blue text) on the System Configuration screen to view and edit the SNMP settings. The hyperlink appears only if the SNMP Enable box is checked.

The SNMP protocol allows an application to interrogate the AN-80i for information saved in the MIB an to change enabled fields within the MIB. When the SNMP Agent in the AN-80i detects an error condition, a special message known as a trap can be sent (if enabled). A Trap Host is an IP system/server that is set up to receive SNMP trap messages. The SNMP Configuration screen displays a list of the current communities. The Chg buttons can be used to add, edit, or delete community settings.
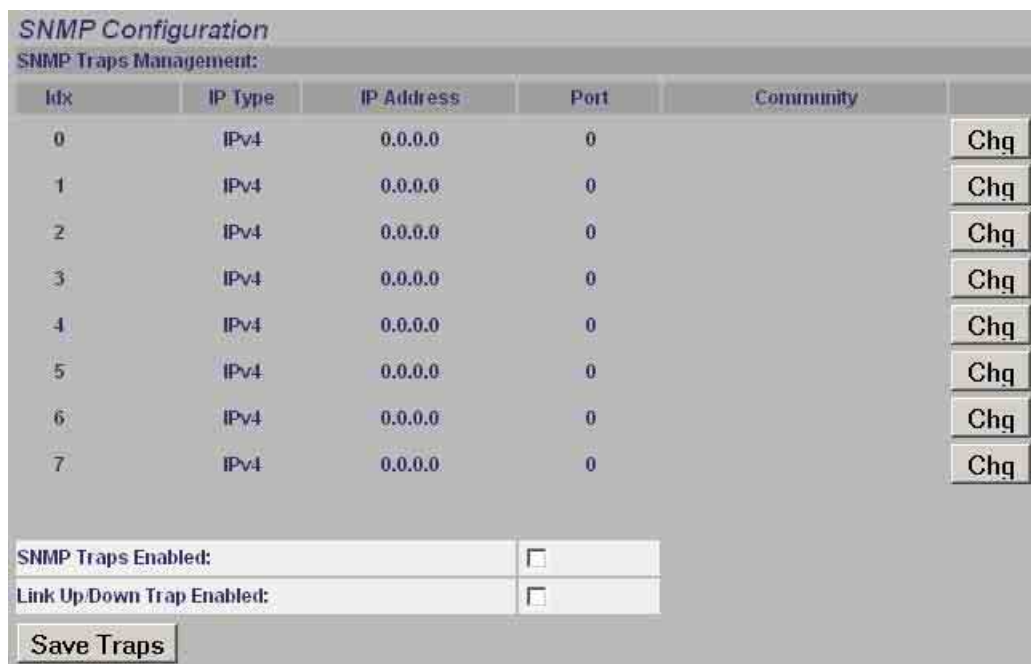
Figure 17: Web - SNMP Configuration Screen

SNMP Community Management

Community Name: Displays the SNMP community name for each entry (maximum of eight entries).

Access: Displays the access permissions for each SNMP community.

   None: Deny read and write permission for this community.

   Read: Grant read access permission only for this community. Deny write permission.

   Write: Grant write access permission only for this community. Deny read permission.

   Read&Write: Grant read and write access permission for this community.

Chg: Click the Chg button to modify the settings for the adjacent entry.

Save Comm: Click the Save Comm button to save changes to the community settings.

SNMP Traps Management

IP Address(IPv4): IP address associated with this SNMP alarm.

Port: Destination port address associated with this SNMP alarm.

Community: Community associated with this SNMP alarm.

Chg: Click the Chg button to modify the settings for the adjacent entry.
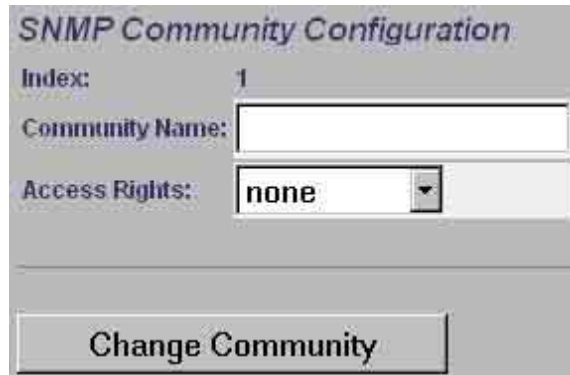
SNMP Traps Enabled: Check this box ☑ to enable SNMP traps to be sent. If the box is not checked, all SNMP traps are disabled.

Link **Up/Down Trap Enabled**: Check this box ☑ to enable an SNMP trap to be generated for each link up and link down event.

Save Traps: Click the Save Traps button to save changes to the SNMP trap settings.

3.10.1 Change SNMP Community

Each entry in the SNMP Community Management table may be changed individually. Click the Chg button adjacent to any entry to modify the settings.

Figure 18: Web - SNMP Community Configuration Screen

Index: Display the unique reference number for this entry.

Community Name: Enter or modify the SNMP community name for this entry.

Access Rights: Select the access permissions for this entry.

None: Deny read and write permission for this entry.

Read: Grant read access permission only for this entry. Deny write permission.
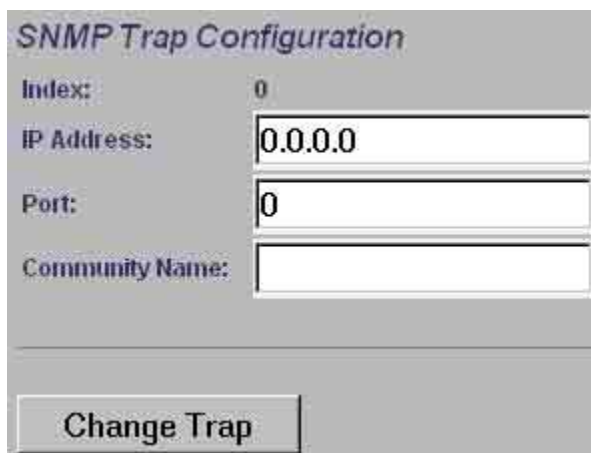
Write: Grant write access permission only for this entry. Deny read permission.

Read&Write: Grant read and write access permission for this entry.

Change Community: Click the Change Community button to copy these settings to the community settings table. This action does not permanently save changes. To save changes to the community settings you must also click the Save Comm button in the SNMP Configuration screen.

3.10.2 Change SNMP Trap Configuration

Each of the eight entries in the SNMP Traps Management table may be changed individually. Click the Chg button to modify the settings for the adjacent entry.

Figure 19: Web - SNMP Trap Configuration Screen

Index: Display the table position number for this entry. Position 0 is the first entry.

IP Address: Enter the IP address (IPv4) associated with this SNMP alarm.

Port: Enter the destination port address associated with this SNMP alarm.

Community Name: Enter the SNMP community name for this entry.

Change Trap: Click the Change Trap button to copy these settings to the community settings table. This action does not permanently save changes. To save changes to the SNMP trap settings you must click the Save Traps button in the SNMP Configuration screen.

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3.11   Spectrum Sweep

Click Spectrum Sweep in the left hand menu to display the Spectrum Sweep configuration screen. The spectrum sweep feature is an off-line RF survey tool to detect interference and evaluate spectrum availability. Configurable survey parameters include the high and low frequency limits, the step size, and the number of samples at each step. The output graph displays the maximum (red) and average (blue) RSSI for each step.

Figure 20: Web - Spectrum Sweep Screen

Start Frequency (MHz): Enter center frequency of the lowest channel to be scanned. See Table 63: Spec. - Regional Identification Codes on page 99.

End Frequency (MHz): Enter center frequency of the highest channel to be scanned. See Table 63: Spec. - Regional Identification Codes on page 99.

Step (MHz): Enter the frequency step (MHz) to use when scanning from the lowest to the highest frequency. The step selection must be a multiple of 2.5 MHz (i.e., 2.5, 5, etc).

No. of acquisitions: Enter the number of times the frequency will be sampled at each step. The recommended range is 10 to 100 samples. When a potentially clear channel is identified, reduce the frequency range and step size while increasing the sample size to monitor the channel over a longer period.

Start: Left-click the Start button to begin the scan.

Performing a Sweep

The PTP Master or PMP Sector Controller transmitter is automatically disabled during the spectrum scan. If the scan is being performed from a PTP Slave or PMP Subscriber, the transmitter on the remote AN-80i for this link should be disabled for the duration of the test. Use the configuration Test feature (system configuration screen) to remotely (over-the-air) disable the remote transmitter for 5 minutes (uncheck ☐ the Radio Enable field) and then recover automatically.

Table 14: Web - Performing a Spectrum Sweep	
Setting	**Description**
System Mode: PTP Slave / PMP Subscriber	No action required: Remote end will remain passive during sweep.
System Mode: PTP Master /PMP Sector Controller	Use Web/CLI to disable radio on remote-end. Use 'test' function to save and remote end will restore radio operation automatically after 5 minutes.
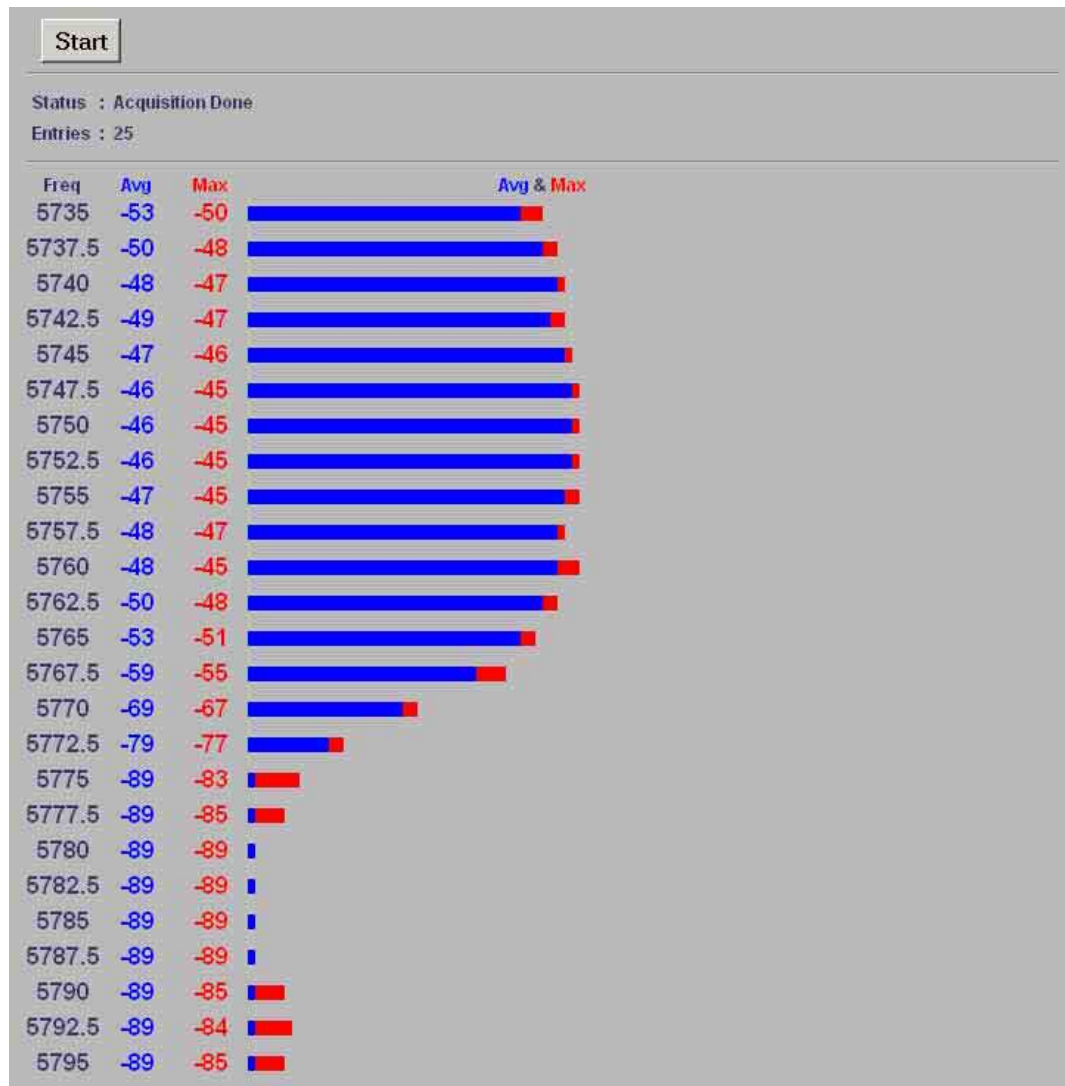
Figure 21: Web - Spectrum Sweep Results

Chapter

4

4 PMP Operation

4.1 Introduction

This section describes only the additional parameters required for configuring PMP support, and an overview about defining and using VLAN and pass-through groups.

The AN-80i PMP software provides the following main features:

- IEEE 802.1Q standard compliance
- VLAN Groups span subscribers
- Multiple VLAN Connections per subscriber
- Multiple TLS transport based on VLAN ID classification
- QoS provisioning with individual CIR setting per connection
- VLAN trunking with tag insert/delete/re-map
- VLAN tagged management traffic

4.2 PMP Menu

The following menu items are available for configuring and monitoring the PMP functions. See Table 13: Web - Default System Users on page 40 for the factory default usernames and passwords.

Figure 22: PMP - Main Menu

4.3 Functional Description

4.3.1 Overview

The AN-80i can operate as a VLAN-aware wireless switch, as a standard wireless bridge (pass-through mode), or a combination of both. The following figure illustrates a simple pass-though configuration. This configuration does not use VLAN tagging or filter the Ethernet traffic.
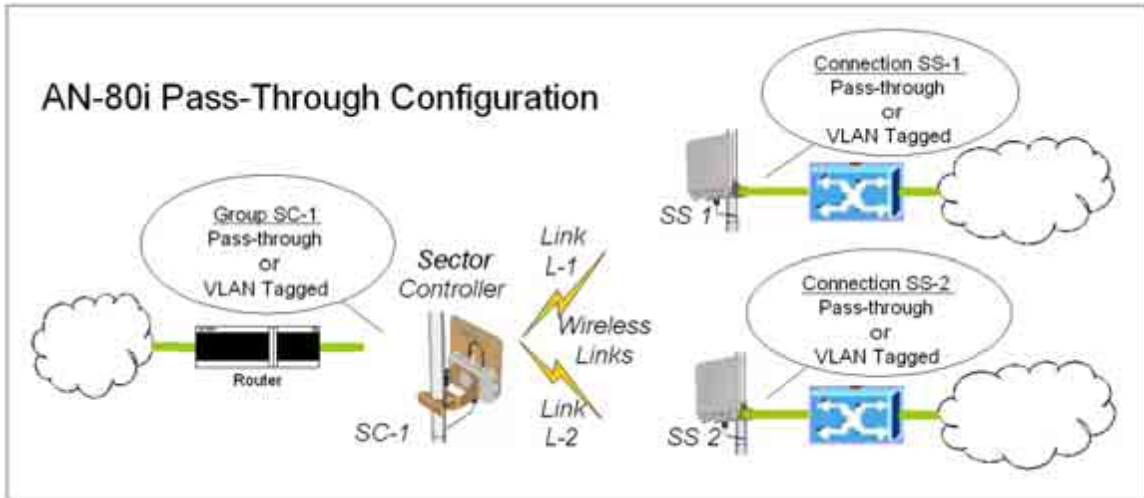
Figure 23: PMP - Basic Pass-through Group Configuration

The following diagram illustrates a network implementation using two VLAN groups. The packets tagged with VID=107 are classified as data traffic, while the packets tagged with VID=108 are classified as voice traffic.
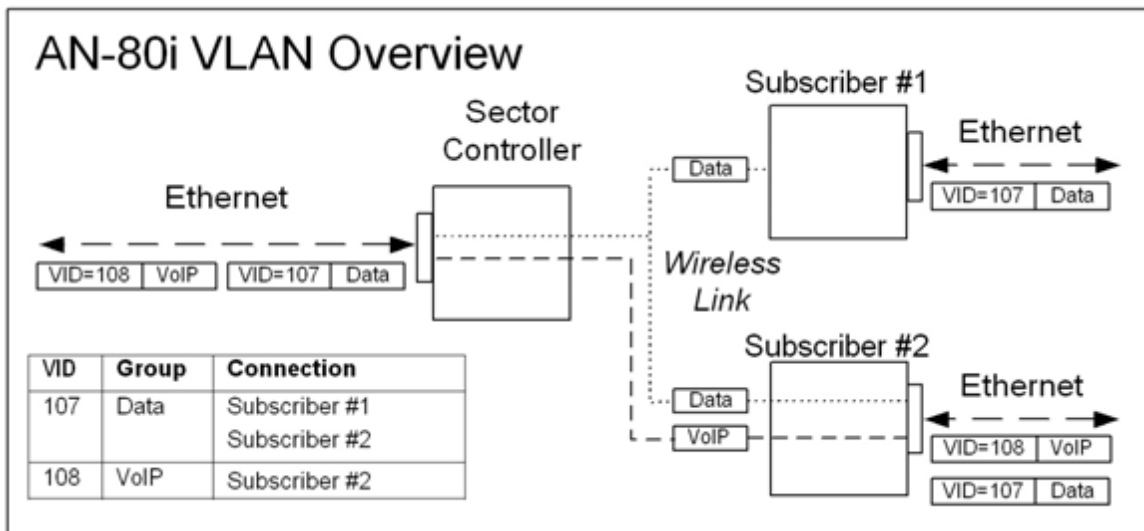
Figure 24: PMP - VLAN Tagged Traffic Example

4.3.2   Minimum Setup Requirements

A minimum set of parameters must be configured to enable data and management traffic on any PMP deployment:

1. Create one or more Links to identify each subscriber in the sector, and set the wireless link operating characteristics, including the maximum uplink and downlink modulation.

2. Create one or more Groups (VLAN or pass-through) and set the operating characteristics of this group.

3. Create one or more Connections (to Groups) for each subscriber, to assign membership to at least one Group.

The following table provides a summary of the configuration shown in the pass-through configuration diagram above. The actual Group ID and Link ID values are not available until these items have been created during configuration of the system. This configuration passes all data traffic as a standard PMP configuration.

Table 15: PMP - Basic Pass-Through Group Settings							
Group Configuration (Sector Controller)			Connection Configuration (Subscriber)				
Group Name	Port Tagging	Group VID	Connection Name	Port Tagging	Link ID	Group ID	Connection VID
SC-1	Pass Through	NA	SS-1	Pass Through	[L-1]	[SC-1]	NA
			SS-2	Pass Through	[L-2]	[SC-1]	NA

Notes: 1. The *Group* ID, Conn ID, and Link ID values are assigned automatically and must be read from the screen after items are created.
2. The QoS settings must be determined using the PMP Configuration Tool.

4.3.3   Packet Classification

The AN-80i PMP deployment can be configured for use with VLAN tagged traffic, untagged traffic, or a combination these two types. Ingress packets received on the Ethernet port are classified into tagged or pass-through groups according to the criteria in the following table. The Group settings apply to packets processed at the sector controller, while Connection settings apply to packets processed at the subscriber.

Table 16: PMP - Packet Classification	
Type	Description
Tagged Traffic	Packet has a VLAN tag and there is a Group/Connection configured for this VID. Sector Controller: Packets are forwarded over the wireless link to all subscribers with Connections to this VLAN Group. Subscribers: Packets are forwarded to the sector controller. The sector controller forwards the packets to the local Ethernet port and subscribers with Connections to this VLAN Group.
Pass-Through Traffic	The packet does not have a VLAN tag, or no Group/Connection exists for this VID. If a pass-through Group has not been defined, unclassified packets are discarded. If a pass-through Group has been defined, classified packets are forwarded based on the rules for tagged traffic. The packet VLAN information is not modified.

4.4 PMP Screens

This section describes the configuration screens used to setup a PMP deployment.

4.4.1 Configuration Screen

Click Configure System in the menu to view and adjust configuration settings for general system identification, Ethernet, and the wireless interface (partial screen shown below). The highlighted wireless settings are specific to PMP deployments.

Figure 25: PMP - Wireless Settings

System Mode: The system designated as sector controller establishes and manages the bi-directional data link with a remote end AN-80i. Only one system in a wireless link must be set for Sector Controller mode.

> **PTP Sector Controller**: AN-80i begins transmitting automatically, sends poll messages to locate remote AN-80i subscribers, and negotiates operating settings for the link.
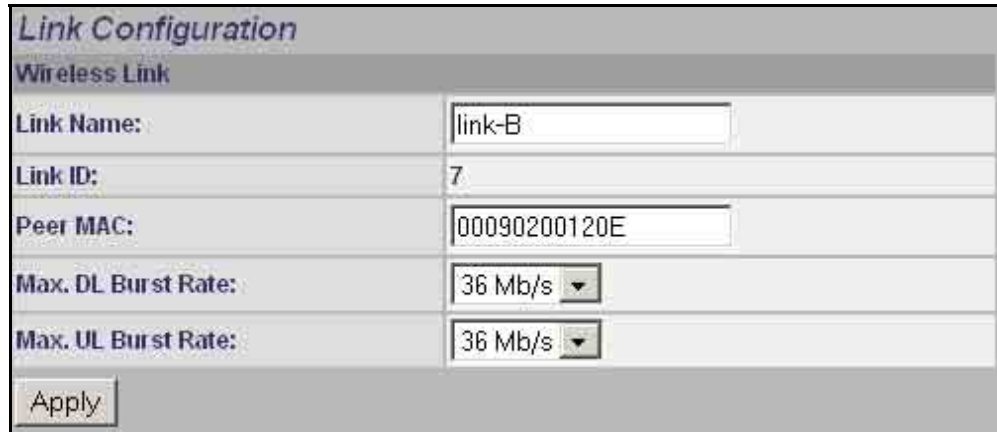
> **PTP Subscriber**: AN-80i waits passively, monitoring the selected channel(s) until polled by the PTP Sector Controller.

Registration Period: The polling period for detecting new subscribers. Period is based on the number of wireless frames transmitted. Permitted values are 1 to 400. The recommended default registration period is 4.

Max. Distance [km]: Enter the distance to the subscriber located farthest away from the sector controller (outer boundary of sector). This parameter is used to optimize communications with the subscribers.

4.4.2   Link Screen

Click New Link in the menu to add a new subscriber and choose the wireless parameters.

Figure 26: PMP - Link Configuration Screen

Link Name: Enter a name for this Link (15 characters max.). This Link name is displayed with the Link ID on information and statistics screens.

Link ID: (Read only) A unique Link ID is generated automatically when a new link is added.

Peer MAC: Enter the MAC address of the subscriber station. The sector controller only registers a subscriber station if the MAC address has been entered using the link configuration screen.
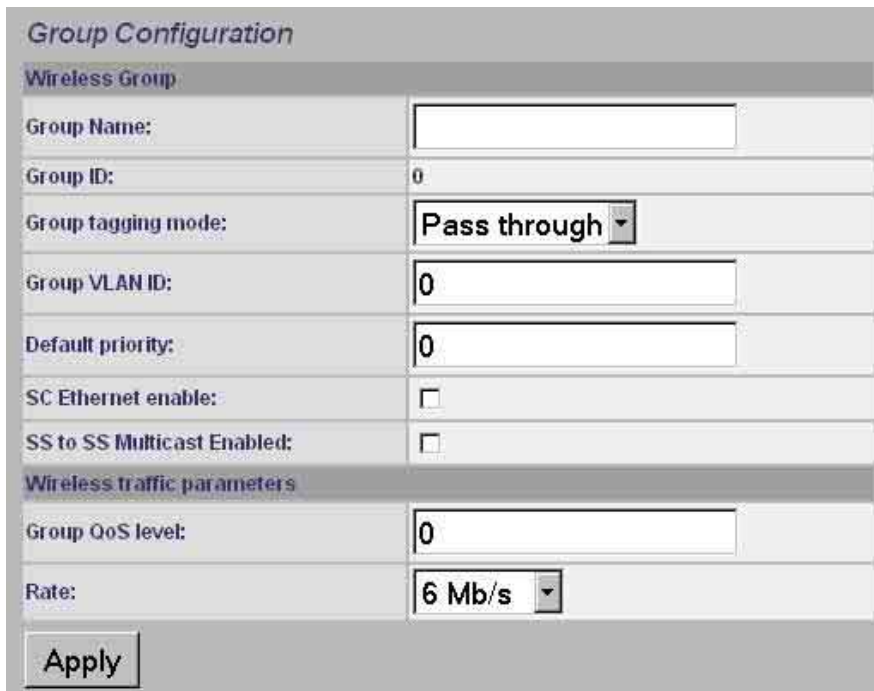
Max. DL Burst Rate: Select the downlink burst rate for unicast traffic from the sector controller to the subscriber (based on link budget calculations).

Max UL Burst Rate: Select the uplink burst rate for unicast traffic from the subscriber to the sector controller (based on link budget calculations).

Table 17: PMP Maximum Achievable UBR	
Uncoded Burst Rate (Mbps)	**SINADR (dB)**
54	25
48	23
36	18
24	15
18	11
12	9
9	9
6	7

4.4.3   Group Screen

Click New Group in the left-hand menu to display a blank Group configuration screen. The Group configuration defines how Ethernet packets are handled on the sector controller. A Group must be created for each VLAN to be transported across the wireless interface.

Figure 27: PMP - Group Configuration Screen

Group

Group Name: Enter a name for this Group (15 characters max.). The Group name is displayed on configuration and statistics screens.

Group ID: (Read only) A unique Group ID is generated automatically when a new Group is created. The Group ID number is required when associating Connections to this Group.

Group Tagging Mode: Select the packet processing performed at the sector controller. Packets are forwarded unicast (known address) or multicast (unknown address). Further processing is performed at the subscriber based on the Connection configuration.

Tagged: Select tagged to associate a unique VID with this Group.

Packet received at sector controller Ethernet interface:

A packet with this VID has the matching (outermost only) VLAN tag removed. The packet is forwarded over the wireless to all subscribers in this Group.

Packet received at sector controller wireless interface (from subscriber):

The packet belonging to this Group is forwarded unmodified over the wireless to all subscribers belonging to this Group.

If the sector controller Ethernet port is enabled, a VLAN tag is added (outermost) and set to the VID (Group VLAN ID field) for this Group and the packet is forwarded to the sector controller Ethernet Port.

Pass-through: Select pass-through to create a Group to process all packets that do not have a VLAN ID, or the outermost VLAN ID tag does not match the VLAN ID for any Group. Only one pass-through Group can be defined for each sector controller. If

a pass-through Group is not configured, all untagged packets received at the sector controller Ethernet ingress port are discarded.

<u>Packet received at sector controller Ethernet interface</u>: The packet is forwarded unmodified over the wireless to all subscribers in this Group.

<u>Packet received at sector controller wireless interface (from subscriber)</u>: The packet is forwarded unmodified over the wireless to all subscribers in this Group.

If the sector controller Ethernet port is enabled, the packet is also forwarded to the sector controller Ethernet port.

Group VLAN ID: Enter the VID associated with this Group definition.

This field is used only when 'Tagged' is selected in the Group Tagging Mode field.

Default Priority: Enter the default 802.1p priority setting.

The default priority setting is used only when the Group Tagging Mode is set to 'pass-through' mode <u>and</u> the associated Connection Tagging Mode is set to 'Tagged'. The Group Default Priority value is used when adding the 802.1Q tag (Connection VLAN ID) to the packet being forwarded.

SC Ethernet Enable: Controls the sector controller Ethernet port.

Check this box ☑ to allow ingress and egress data traffic on the sector controller Ethernet interface. Uncheck this box (☐) to block all data traffic on the sector controller Ethernet interface. The sector controller Ethernet port remains available for management traffic.

SS To SS Multicast Enable:

Check this box ☑ to enable group multicast traffic between subscribers.

Uncheck this box (☐) to block all multicast traffic between subscribers.

Wireless Traffic Parameters

Changes to these settings affect the CIR and PIR for all groups and connections on the wireless link.

Group QoS Level: This setting represents the range of CIR available to Group members for downlink multicast/broadcast traffic.
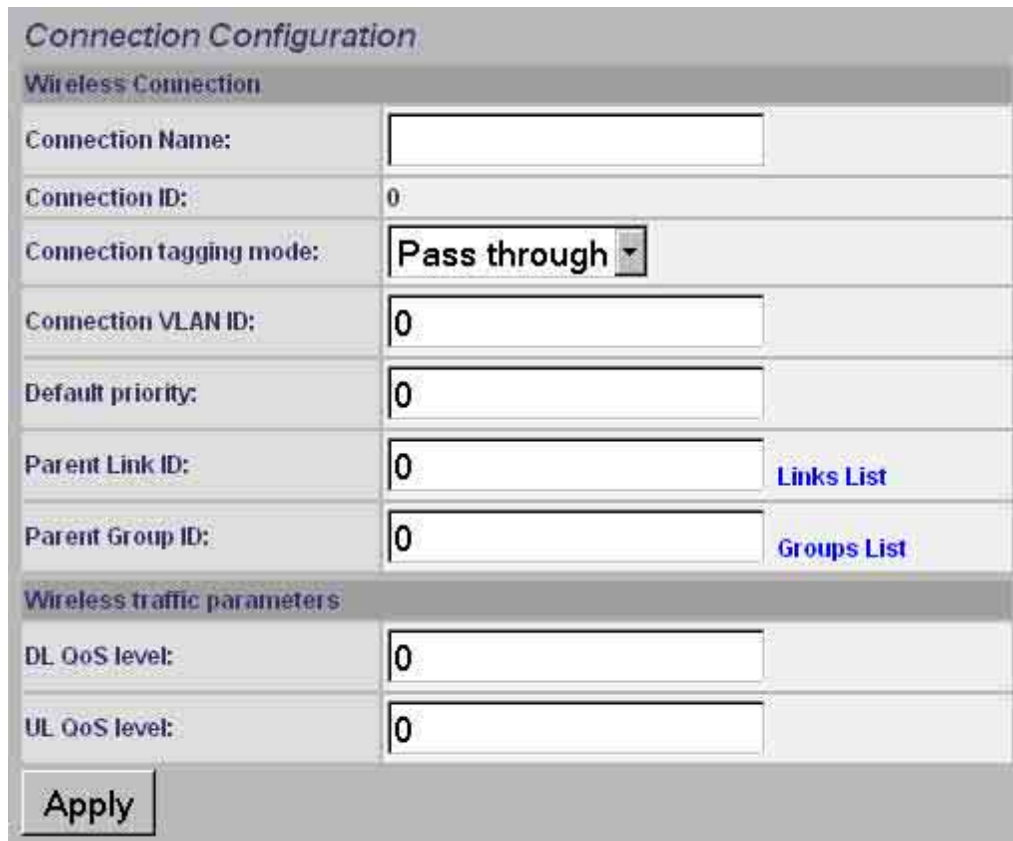
It is strongly recommended to calculate the Group QoS Level using the Redline AN-80i PMP Configuration Tool -- the Group QoS level can be read from the QoS column in the Group ID Configuration section. To manually determine this setting, identify the member Link having the lowest UBR and calculate the Group QoS Level using the formula: Burst Rate - 1. A zero setting disables all DL broadcast and multicast traffic for this group.

Rate: Enter the maximum downlink burst rate for this Group.

It is recommended to use the 'auto' setting where the AN-80i selects the most reliable rate. To manually determine this value, identify the Group member having the lowest DL burst rate, and then set the Rate using the formula: Max DL Burst Rate - 1. For applications requiring a higher broadcast/multicast rate (e.g., video), a higher setting can be used at the risk of less reliable retransmissions.

4.4.4   Connection Screen

Click New Connection in the left-hand menu to display a blank Connection configuration screen. To view an existing Connection, click Groups or Links, and then click Expand to display the Connections for that Group/link, and then click Config for the desired Connection. At least one Connection must be created for each VLAN to be transported across the wireless switch. The Connection configuration defines how Ethernet packets are handled on the subscribers. Each subscriber can participate in multiple VLANs.

Figure 28: PMP - Connection Configuration Screen

Connection Configuration

Connection Name: Enter a name for this Connection (15 characters max.). The Connection name is displayed on configuration and statistics screens.

Connection ID: (Read only) A unique Connection ID is generated automatically when a new link is created. The Connection ID number is required when assigning this Connection to a Group.

Connection Tagging Mode: Select the packet processing at the subscriber.

   Tagged: Select tagged to associate a unique VID with this Connection. Further processing is performed at the sector controller based on the Group configuration associated with this Connection.

Packet received at subscriber Ethernet interface:

Each packet with this VID (Connection VLAN ID field) has the matching VLAN tag (outermost only) removed and is forwarded over the wireless interface to the sector controller.

Packet received at subscriber wireless interface (from sector controller):

A VLAN tag is added (outermost) and set to the VID (Connection VLAN ID field) for this Connection. The packet is forwarded to the subscriber Ethernet port.

Pass-through: Select pass-through to create a Connection to process all untagged packets and packets where the outermost VLAN ID tag does not match the VID (Connection VLAN ID field) for with this Connection. Only one pass-through Connection can be defined for each subscriber. If a pass-through Group is <u>not</u> configured, all untagged packets received at the subscriber Ethernet ingress port are discarded.

Packet received at subscriber Ethernet interface:

The packet is forwarded unmodified over the wireless to the sector controller.

Packet received at subscriber wireless interface (from sector controller):

The packet is forwarded unmodified to the subscriber Ethernet port.

Connection VLAN ID: Enter the VLAN ID tag associated with this Connection definition. This field is used only when 'Tagged' is selected in the Connection Tagging Mode field.

Default priority: Enter the default 802.1p priority setting.

The default priority setting is used only when the Connection Tagging is set to 'pass-through' mode <u>and</u> the associated Group Tagging Mode is set to 'Tagged'. The Connection Default Priority value is used when adding the 802.1Q tag (Group VLAN ID) to the packet being forwarded.

Parent Link ID: Enter the Link ID for this Connection. This is the unique identification value created automatically when the subscriber Link was added. See Links List below.

Links List: Click this text (right side of screen) to display a list of existing Link IDs.

Parent Group ID: Enter the Group ID for this Connection. This is the unique identification value created automatically when the subscriber Link was added. See Groups List below.

Groups List: Click this text (right side of screen) to display a list of existing Group IDs.

Wireless Traffic Parameters

The sector controller allocates bandwidth for all subscribers using the Weighted Round Robin algorithm with the combined total of all QoS levels acting as weights. The aggregate QoS settings affect packet delay and jitter values for the entire sector.

It is *strongly* recommended to calculate DL QoS and UL QoS levels using the Redline AN-80i PMP Configuration Tool -- the QoS levels for each Connection can be read directly from the QoS column in the Connection ID Configuration section. To manually determine these settings, identify the maximum UL and DL burst rate for the associated Link and calculate the highest available level using the formula: Burst Rate - 1.

DL QoS Level: Enter the QoS level for downlink unicast traffic for this connection.

UL QoS Level: Enter the QoS level for uplink unicast traffic for this connection.

4.5 Browse Screens

4.5.1 Links Screen

Click Links in the menu to display the links browse screen. This is a list of all configured wireless links.

Figure 29: PMP - Links Browse Screen

ID: Unique number identifying each link.

Name: User-assigned name for each link.

Config: Click Config on any line to display the Link Configuration screen associated with that Link.

Status: Click Status on any line to display the Link Statistics screen associated with that Link. This includes uplink and downlink statistics for the link.

Expand: Click Expand on any line to display the Connections browse screen showing all Connections associated with that Link.

Delete: Click Delete on any line to delete that Link. A link can <u>not</u> be deleted until all Connections referencing this link are deleted.

4.5.2   Groups Screen

Click Groups in the menu to display the Groups browse screen. This is a list of all configured Groups.

Figure 30: PMP - Groups Browse Screen

ID: Unique number identifying each Group.

Name: User-assigned name for each Group.

Config: Click Config on any line to display the Group Configuration screen associated with that Group.
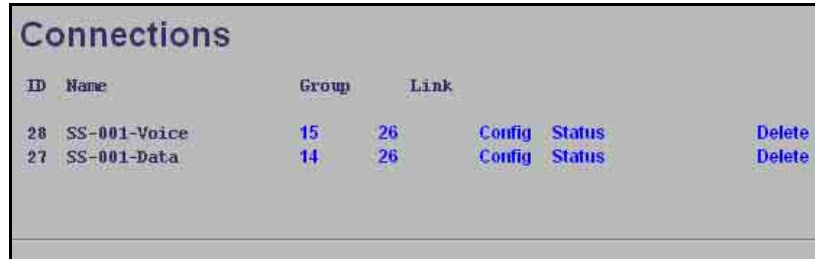
Status: Click Status on any line to display the Group Statistics screen associated with that Group. This includes uplink and downlink statistics for the Group.

Expand: Click Expand on any line to display the Connections browse screen showing all Connections associated with that Group.

Delete: Click Delete on any line to delete that Group. A Group can <u>not</u> be deleted until all Connections referencing this Group are deleted.

4.5.3 Connections Screen

The Connections browse screen is accessible only from the Groups or Links browse screens. Click Groups or Links in the menu and then click Expand for any Group or Link.

Figure 31: PMP - Connections Browse Screen

ID: Unique number identifying each Connection.

Name: User-assigned name for each Connection.

Group: Click the Group number (i.e., 4) on any line to display the Group associated with this Connection.

Link: Click the link number (i.e., 5) on any line to display all Connections configuration for that link.

Config (Configure): Click Config on any line to display the Link configuration screen for that item.

Status (Statistics): Click Status on any line to display uplink and downlink statistics for that Connection.

Expand: Click Expand on any line to display the Connections browse screen.

Delete (Delete): Click Delete on any line to delete that Connection.

4.6 Statistics Screens

4.6.1 Link Statistics

The Link Statistics screen is accessible only from the Links browse screen. Click Links in the menu and then click Status to display the statistics screen.

Figure 32: PMP - Link Statistics Screen

<u>General</u>

Link Name: User-assigned name for this link.

Link ID: Unique number identifying this link.

Peer MAC: MAC Address of the subscriber.

Active: Indicates if wireless link is operational (Active=YES).

Link Up Time: Total time the wireless link has been operational.

Link lost Count: Number of times link has been out of service.

Status Code: Code indicating the condition of the AN-80i system. Status indications are specific for PMP and PTP operation.

Configured Connections: The number of Connections configured on this link.

<u>Wireless</u>

The following statistics are displayed for both uplink and downlink.

Burst Rate: The current uncoded burst rate for the link.

RSSI: RSSI measured since the last screen refresh.

SINADR: Average signal to interference, noise, and distortion ratio measured since the last screen refresh.

Lost Frames: Number of frames lost.

Blocks

Blocks Total: Total number of blocks retransmitted over the wireless interface.

Blocks Retransmitted: Number of blocks retransmitted over the wireless interface.

Blocks Discarded: Number of blocks discarded (could not be sent over the wireless).
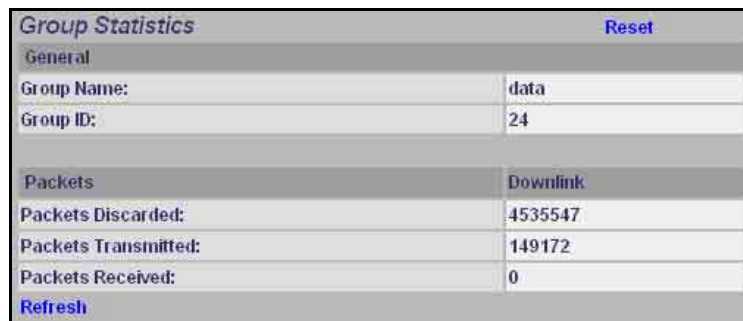
Controls

Refresh: Click Refresh to update the statistics display.

Reset Statistics: Click this button to zero the counters for the wireless and Ethernet LAN Statistics displayed on this page.

4.6.2   Group Statistics

Use the Group statistics screen to view statistics for all downlink traffic on Connections to this Group. Click Groups in the menu to display the Groups browse screen. Click Status to display downlink statistics for the selected Group.

Figure 33: PMP - Group Statistics Screen

General

Group Name: Name assigned to this Group.

Group ID: Unique numeric identifier for this Group.

Packet (Downlink)

Packets Discarded: Number of Ethernet packets discarded (could not be sent over the wireless interface).

Packets Transmitted: Number of Ethernet packets transmitted over the wireless interface.

Packets Received: Number of Ethernet packets received over the wireless interface.
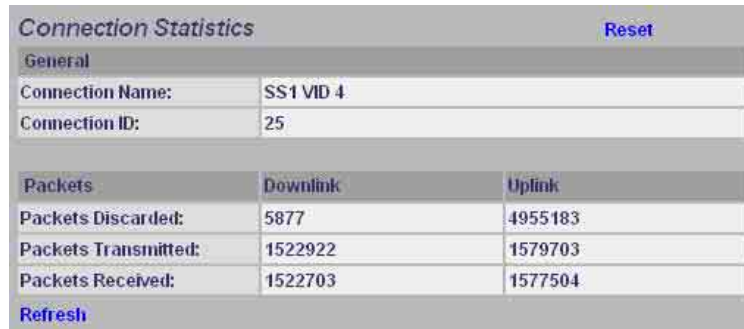
Controls

Reset: Click Reset to zero the statistics values.

Refresh: Click Refresh to update the statistics display.

4.6.3 Connection Statistics

Use the Connection statistics screen to view statistics for all uplink and downlink traffic on the selected Connection. Click Groups in the menu to display the Groups browse screen. Click Expand to display a list of Connections. Click Status to display statistics for the selected Group.

Figure 34: PMP - Connection Statistics Screen

General

Name: Name assigned to this Connection.

ID: Unique numeric identifier for this Connection.

Packet

Packets Discarded: Number of Ethernet packets discarded (could not be sent over the wireless interface).

Packets Transmitted: Number of Ethernet packets transmitted over the wireless interface.

Packets Received: Number of Ethernet packets received over the wireless interface.

Controls

Reset: Click Reset to zero the statistics values.

Refresh: Click Refresh to update the statistics display.

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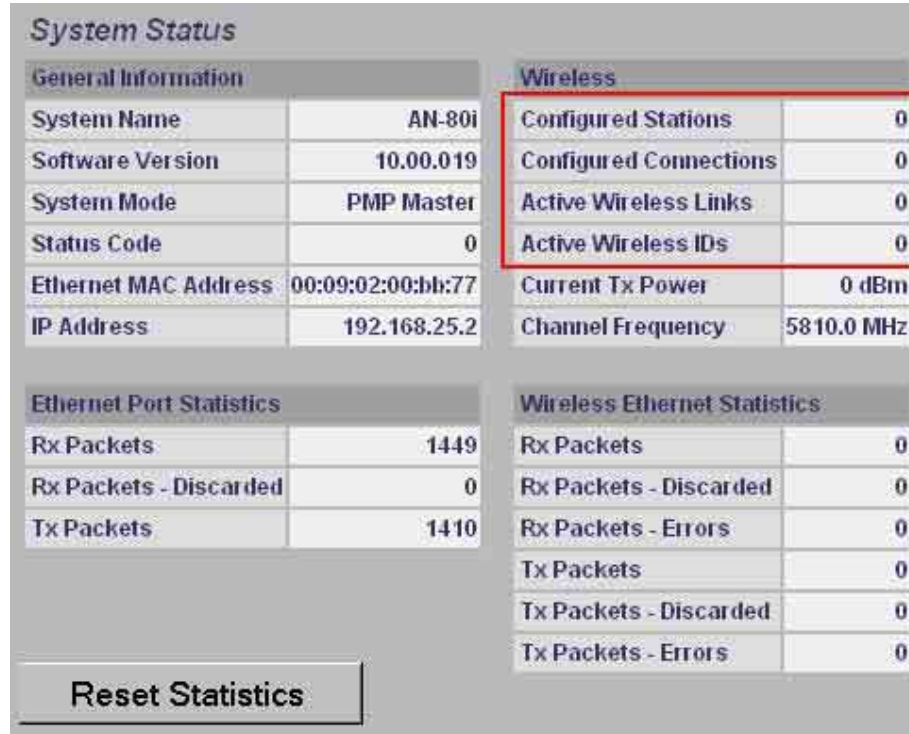
4.6.4 System Status - PMP Wireless Statistics

Click System Status in the menu to view system, Ethernet statistics, and wireless interface statistics. The sector controller status screen includes information about the PMP deployment.

Figure 35: PMP - System Status Screen

Configured Stations: This is the number of Links defined (to subscribers).

Configured Connections: The number of Connections defined for all subscribers.

Active Wireless Links: The number of registered subscribers.

Active Wireless Connections: The number of connections to registered subscribers.

For all other statistics, refer to Wireless Statistics on page 26.

4.7 Quick Configuration Guide

This procedure is to aid configuring point-to-multipoint (PMP) operation on AN-80i systems. For complete installation and operational procedures. refer to the *AN-80i System User Manual*, the *AN-80i Quick Install Guide,* and the *Installation Guidelines* provided on CD-ROM.

The VLAN tagging feature allows the user to configure and operate an AN-80i deployment as a VLAN-aware wireless switch. A 'group' is created at the sector controller for each VLAN to be transported, and 'connections' are added to enable data flow with any subscriber station participating in that VLAN. If VLAN is not required, a default group and set of connections must be setup to define the traffic characteristics. Prior to completing this setup, no Ethernet data traffic can be transmitted over the wireless interface.

The procedures provided below include steps to setup a basic working configuration for initial testing, and then to introduce VLAN traffic controls.
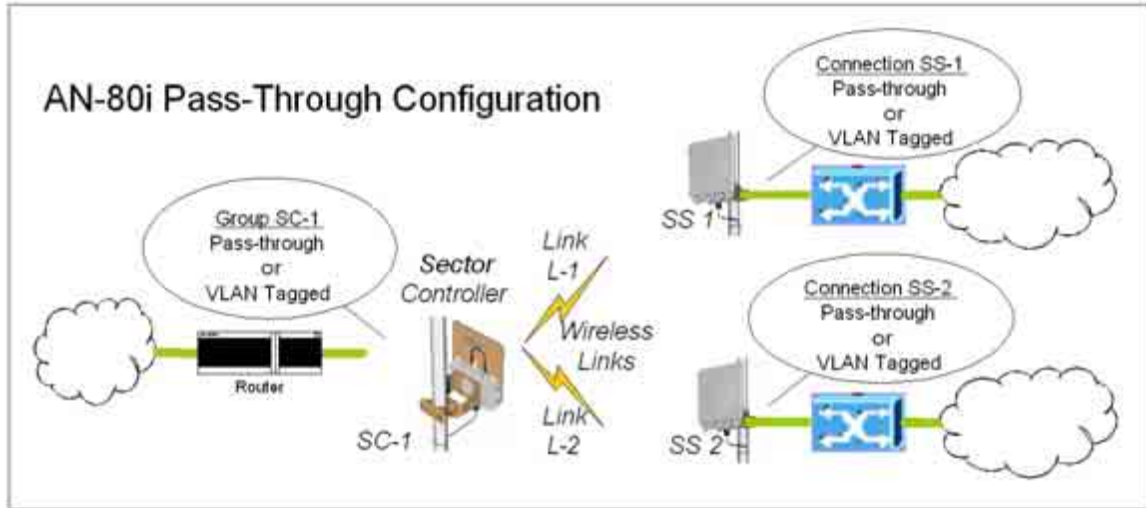
Figure 36: PMP - Pass-through Only Deployment

4.7.1 Configure Pass-Through Operation

For initial installation and testing, it is recommended to setup a PMP configuration <u>without</u> VLAN support. Use the following steps to configure a PMP pass-through link.

Step 1: Create New Link for Each Subscriber

1. Click New Link to display the Link Configuration screen.
2. Enter a unique name for this link in the Link Name field.
3. Enter the MAC address of the subscriber station in the Peer MAC field.
4. Enter the UBR for this link (based on link budget calculations).
5. Use the default values for all other fields.
6. Click the Apply button to save and activate these settings.
7. Repeat steps 1 - 6 for each subscriber station.

Step 2: Create Single Pass-through Group

1. Click New Group to display the Group Configuration screen.
2. Enter a unique name for this group in the Group Name field.
3. Set the Group Tagging Mode to Pass-through.
4. Check the SC Ethernet Enable box ☑.
5. Set the Group QoS value for sending multicasts (i.e., 5). A value of zero (0) disables all traffic.
6. Use the default values for all other fields.
7. Click the Apply button to save and activate these settings.

Step 3: Create Connections

1. Click New Connection to display the Connection Configuration screen.
2. Enter a unique name for this connection in the Connection Name field.
3. Set the Connection Tagging Mode to Pass-through.
4. Enter the Link ID of a subscriber station in the Link ID field.
5. Enter the Group ID in the Group ID field.
6. Set the DL QoS Level and UL QoS Levels. Default is 'MAX Burst Rate Value - 1'. Setting the value to zero (0) disables all traffic.

7. Click the Apply button to save and activate these connection settings.
8. Repeat steps 1 - 7 to add a connection for each subscriber station.

Step 4: Save Configuration

Click Save in the left-hand menu to permanently save all settings. The system will pass all tagged and untagged data and management traffic.

The following table provides sample settings for a pass-though group at the sector controller and connections to two subscriber stations.

Table 18: PMP - Basic Pass-Through Group Configuration Settings							
Group Configuration (SC)			**Connection Configuration (SS)**				
Group Name	**Group Tagging Mode**	**Group VLAN ID**	**Connection Name**	**Connection Tagging Mode**	**Link ID**	**Group ID**	**Connection VLAN ID**
SC-1	Pass Through	NA	SS-1	Pass Through	[L-1]*	[SC-1]*	NA
			SS-2	Pass Through	[L-2]*	[SC-1]*	NA

*The group ID and link ID are numbers generated automatically by the AN-80i.

4.7.2   VLAN Configuration

Use these steps to convert the system from pass-through operation to VLAN tagged connections.

Step 1: Change Group to VLAN Tagged

1. Click Groups to display the Groups Configuration screen.
2. Click Config to edit the Group configuration.
3. Set the mode to Tagged in the Group Tagging Mode field.
4. Enter the VID for this group in the Group VLAN ID field.
5. Click the Apply button to save and activate these settings.

Step 2: Change Connections to VLAN Tagged

1. Click Groups in the menu to display the Groups Configuration screen.
2. Click Expand to view all connections for that Group.
3. Choose a connection and click Config to edit the Connection Configuration.
4. Set the mode to Tagged in the Connection Tagging Mode field.
5. Enter the VLAN ID for this connection in the Connection VLAN ID field.
6. Click the Apply button to save and activate these settings.
7. Repeat steps 1 through 6 for each Connection in the Group.

Step 3: Save Configuration

Click Save in the left-hand menu to permanently save and activate all settings. The system will now pass only VLAN tagged traffic.

5 CLI Interface

This section describes the procedures for configuring and operating the AN-80i using CLI over a Telnet Connection.

5.1 CLI Command Summary

All commands are case-sensitive. Use the following general format:

command <Enter>

Online help is available for all commands, and the Tab key can be used for auto-complete functions. The following table lists all AN-80i commands available from root mode (default mode when you login).

Table 19: CLI - Command Summary			
PTP	**PMP**	**Command**	**Description**
√	√	**chgver**	Change default version of software and reboot.
	√	**clear**	Clear commands.
	√	**del**	Delete an ID.
	√	**enable**	Enable an ID.
√		**freq**	Enter frequency ranges for autoscan and DFS.
√		**generate**	Create DSA/RSA keys for SSH locally on AN-80i.
√	√	**get**	Display the value of a statistic or parameter.
√	√	**load**	Load commands.
√		**logout**	End the current Telnet session.
	√	**new**	Create a new ID.
√		**ping**	Send a ping message from the AN-80i system.
√		**reboot**	Reboot the AN-80i.
√	√	**reset**	Reset the AN-80i statistics values.
√	√	**save**	Save the selected configuration settings.
	√	**script**	Generate a configuration script.
√	√	**set**	View/modify a system parameter value.
√	√	**show**	View system compound objects (i.e., configuration).
√	√	**snmpcommunity**	View/modify the SNMP community settings.
√	√	**snmptrap**	View/modify the SNMP trap settings.
√	√	**test**	Activate edited changes to the system configuration for a test period of five minutes.
√	√	**upgrade**	Upload a software binary image to the AN-80i.
√	√	**user**	View/modify the user/password configuration.
√		**whoami**	Display login name for this Telnet session.

	Table 20: CLI - Root Mode Commands		
PTP	**PMP**	**Command**	**Description**
√	√	**Tab**	When entering a command, hit the Tab key at any time to perform auto-complete or view available options.
√	√	**?**	Use the '?' character to display help for any command or mode. <u>Example</u>: From the root directory, enter the following command to list all parameters that can be changed using the 'set' command: set ?
√	√	**CTRL-Z**	Return to root mode. Cancel command entry (alternative to backspace delete).
√	√	**exit**	Return to parent node / mode. all (exit all) Return to root mode.
√	√	**logout**	Terminate this telnet session. May be entered from any mode.

5.2   Connecting with Telnet

To connect to the AN-80i, open a Telnet session to the IP address of the AN-80i. On a Windows™ PC, open the Run command and type 'telnet' followed by the IP address of the AN-80i. When the command prompt screen appears, login to the AN-80i. The AN-80i may now be controlled using a set of CLI commands.
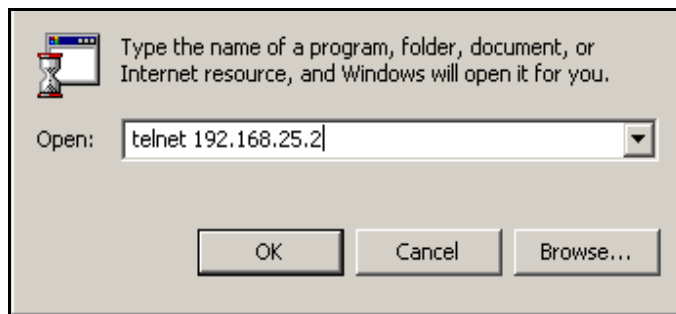
Figure 37: CLI - Connecting via Telnet

The system will logout users automatically if no commands are received (idle) for five minutes. To exit immediately from the CLI, type the following command:

    logout [ENTER]

The AN-80i supports two concurrent Telnet sessions. One session has full capabilities and the second session is read-only (e.g., monitor or show parameter settings).

5.3   CLI Command Set

5.3.1   Chgver

Use the *chgver* command to change the software version loaded when the AN-80i is rebooted.

	Table 21: CLI - chgver	
PTP	**PMP**	**Parameter/Description**
√	√	Enter this command to toggle between software versions. The setting will alternate between the two banks of memory (no parameters). **chgver** <Enter>

5.3.2 Clear

Use the *clear* command to delete all IDs from an ID table.

Table 22: CLI - clear		
PTP	**PMP**	**Parameter/Description**
	√	Enter this command to delete all IDs from an ID table. **clear <idtable>** **idtable** - Clear all the IDs

5.3.3 Del

Use the *del* command to delete a specific ID or security key/certificate.

Table 23: CLI - del		
PTP	**PMP**	**Parameter/Description**

	√	**del <id>**
		Remove a group, connection, or link id.
		    id number <integer>
		    Unique number for group, connection, or link.

√		**Del <file>**
		    file <name> <mode>
		    Remove a file from flash and runtime memory.
		    <name> File name on server. File name must be one of the following:
		      dsa_key_<mac>.pem DSA key used for SSH.
		      rsa_key_<mac>.pem RSA Key used for SSH.
		      ssl_cert_<mac>.pem SSL Certificate.
		      ssl_key_<mac>.pem SSL Key.
		      usr_wcert_<mac>.der* User wireless certificate.
		      usr_wkey_<mac>.der* User wireless key.
		      usr_wacert_<mac>.der* User wireless authority certificate
		      The <mac> portion is the MAC address of the board.
		      For example: dsa_key_00-09-02-00-01-02.pem
		    <mode> Can be 'usr' or 'factory'. Defaults to 'usr' if mode is not specified.
		    *Not used in v3.00 software release.

5.3.4 Enable

Use the *enable* command to re-enable a specific ID (that was disabled).

Table 24: CLI - enable		
PTP	**PMP**	**Parameter/Description**
	√	**enable** <id> - [id number]

5.3.5 Freq

Use the *freq* command to configure frequency ranges when using autoscan or DFS.

		Table 25: CLI - freq
PTP	**PMP**	**Parameter/Description**

√		**freq**
		 add Add a frequency range (up to 32 ranges).
		                 <begin> - start frequency (MHz)
		                 <end> - end frequency (MHz)
		 del Delete a frequency validation range
		                 <index> - Frequency validation range index
		 print Print the list of frequency validation ranges.
		             Local frequency ranges:
		             <index> <begin> <end>
		 reload Reload the active list of frequency validation ranges.

5.3.6 Generate

Use the *generate* command to generate a DSA or RSA key for use with SSH.

		Table 26: CLI - generate
PTP	**PMP**	**Parameter/Description**
√		**generate sshkey <type>** Create keys of the specified type. The keys are saved in flash and runtime memory. <type> Can be dsa or rsa.

5.3.7 Get

Use the *get* command to view system parameters. Use the following general format to view a parameter:

    get [field] <Enter>

		Table 27: CLI - get
PTP	**PMP**	**Parameter/Description**
√		**calcdst**: Calculated link distance between units.
√	√	**erxpkt**: Number of Ethernet packets received.
√	√	**erxpktd**: Number of Ethernet packets received that were discarded.
√	√	**etxpkt**: Number of Ethernet packets transmitted.
√	√	**mac**: AN-80i MAC address.
√	√	**radiotype**: Radio type.
√	√	**rffreq**: Current RF frequency setting.
√		**rflink**: Status of the RF link.
√	√	**rfstatus**: Status RF transmitter.
√		**rssimax**: Maximum RSSI.
√		**rssimean**: Mean RSSI.
√		**rssimin**: Minimum RSSI.

		Table 27: CLI - get		
PTP	**PMP**	**Parameter/Description**
√		**sinadr**: Ration of signal to interference + noise.
√	√	**swver**: List the downloaded software versions.
√	√	**sysuptime**: Display the time since the last reboot.
√	√	**txpower**: Current Tx power setting.
√		**ubrate**: Current UBR value.
√		**wrxpkt**: Number of wireless packets received.
√		**wrxpktd**: Number of wireless packets received that were discarded.
√		**wrxpktr**: Number of wireless packets that were retransmitted.
√		**wtxpkt**: Number of wireless packets transmitted.
√		**wtxpktd**: Number of wireless packets transmitted that were discarded.
√		**wtxpktr**: Number of wireless packets that were retransmitted.
	√	**activeids**: Number of active IDs.
	√	**activelinks**: Number of the active links.
	√	**boardtype**: Board type.
	√	**dldpkt**: Downlink discarded packets counter.
	√	**dlrpkt**: Downlink Rx packets counter.
	√	**dltpkt**: downlink Tx packets counter.
	√	**idenable**: ID status.
	√	**lactive**: Link active status.
	√	**ldlblk**: Downlink total blocks counter.
	√	**ldlbr**: Downlink burst rate.
	√	**ldldblk**: Downlink discarded blocks counter.
	√	**ldllfr**: Downlink lost frames counter.
	√	**ldlrblk**: Downlink retransmitted blocks counter.
	√	**ldlrssi**: Downlink RSSI.
	√	**ldlsnr**: Downlink SINADR.
	√	**llostc**: Link lost Connection counter.
	√	**lrcon**: Number of link registered Connections.
	√	**lscode**: Link status code.
	√	**lulblk**: Uplink total blocks counter.
	√	**lulbr**: Uplink burst rate.
	√	**luldblk**: Uplink discarded blocks counter.
	√	**lullfr**: Uplink lost frames counter.
	√	**lulrblk**: Uplink retransmitted blocks counter.
	√	**lulrssi**: Uplink RSSI.
	√	**lulsnr**: Uplink SINADR.
	√	**luptime**: Link up-time.
	√	**regconn**: Number of configured Connections.
	√	**regstations**: Number of configured stations.

	Table 27: CLI - get	
PTP	**PMP**	**Parameter/Description**
	√	**uldpkt**: Uplink discarded packets counter.
	√	**ulrpkt**: Uplink Rx packets counter.
	√	**ultpkt**: Uplink Tx packets counter.
	√	**werxpkt**: Wireless Eth Rx packets counter.
	√	**werxpktdis**: Wireless Eth Rx discarded packets counter.
	√	**werxpkterr**: Wireless Eth Rx packets with errors counter.
	√	**wetxpkt**: Wireless Eth Tx packets counter.
	√	**wetxpktdis**: Wireless Eth Tx discarded packets counter.
	√	**wetxpkterr**: Wireless Eth Tx packets with errors counter.

5.3.8 Load

Use the *load* command to load an ID table from non-volatile memory.

	Table 28: CLI - load	
PTP	**PMP**	**Parameter/Description**
	√	**load idtable** - Load all IDs from flash memory.
√		**load file <server> <name> <mode>** Load saved security keys information from file on FTP server. <server> IP address of the TFTP server. Files must be stored in the TFTP server default download directory. <name> File name on server. File name must be one of the following: dsa_key_<mac>.pem DSA key used for SSH. rsa_key_<mac>.pem RSA Key used for SSH. ssl_cert_<mac>.pem SSL Certificate. ssl_key_<mac>.pem SSL Key. usr_wcert_<mac>.der User wireless certificate. usr_wkey_<mac>.der User wireless key. usr_wacert_<mac>.der User wireless authority certificate. Where, <mac> is the MAC address of the board. For example: dsa_key_00-09-02-00-01-02.pem <mode> Defaults to 'usr' if mode is not specified. run - Display keys currently in-use. usr - Display the user-specified keys and certificates.
√	√	**load script<server> <name>** Use the *script* command to load the AN-80i configuration information from a file (created using script command) from a remote TFTP server. The file must be located in the TFTP default directory. <server> - [server IP address] <name> - [script file name]

5.3.9 Logout

Use the *logout* command to terminate the current Telnet session.

Table 29: CLI - logout
PTP	**PMP**	**Parameter/Description**
√		**new** Terminate the current Telnet session.

5.3.10 New

Use the *new* command to create a new link, group, or connector ID.

Table 30: CLI - new
PTP	**PMP**	**Parameter/Description**
	√	**new** <id_type> - [link | group | conn] <id> - <id number>

5.3.11 Ping

Use the *ping* command to initiate an ICMP ping command from the AN-80i.

Table 31: CLI - ping
PTP	**PMP**	**Parameter/Description**
√		**ping** <address> - Target IP address <count> - Number of ICMP packets to send [1..16].

5.3.12 Reboot

Use the *reboot* command to reboot the AN-80i.

Table 32: CLI - reboot
PTP	**PMP**	**Parameter/Description**
√	√	**reboot** <seconds> Time to reboot the AN-80i.
		<seconds> Time in seconds (0 cancels previous reboot command).

5.3.13 Reset

Use the *reset* command to set all AN-80i statistics values to zero.

Table 33: CLI - reset
PTP	**PMP**	**Parameter/Description**
√	√	stats: Reset the AN-80i statistics counters.
		reset stats <Enter>

5.3.14 Save

Use the *save* command to copy edited parameter settings into non-volatile memory.

     save [option] <Enter>

		Table 34: CLI - save
PTP	**PMP**	**Parameter/Description**
√	√	**config**: Save Ethernet, wireless, and user configuration settings.
		snmp: Save SNMP settings.
		defaultconfig: Overwrite parameters with the factory default settings. The following settings are not affected: system name, location, details and contact, frequency list, SNMP configuration, IDs table (PMP only).

5.3.15 Script

Use the *script* command to save a file containing a string of CLI commands that can be used to restore the current (active) configuration of the AN-80i. Saved configuration files can be viewed, copied, and/or modified using a text editor.

The file will be saved in the TFTP default directory. The filename may be any name and extension valid for the TFTP server platform. It is recommended use a filename that uniquely identifies the An-80i unit and the current date (e.g., Red80-AD0023-080723.cfg).

See also 'loadscript' command.

		Table 35: CLI - script
PTP	**PMP**	**Parameter/Description**
√	√	**script** <server>　　　　- [TFTP server IP address] <name>　　　　- [script file name]

5.3.16 Set

Use the *set* command to view and/or change a parameter.

View a parameter:

    set [field] <Enter>

Change a parameter:

    set [field] [value] <Enter>

		Table 36: CLI - set
PTP	**PMP**	**Parameter/Description**
	√	**activekey**: Current active options key. <active_idx>　　- [0 | 1]

√		**adaptmod**: Enable or disable the adaptive modulation function.
		     off - Disable
		     on - Enable
		 When enabled, the AN-80i will automatically change the modulation to the highest setting that can sustain a packet error rate lower than 1x10e-6. If the packet error rate exceeds 1x10e-6, the system automatically steps down modulation/code rate (i.e., from 16 QAM 3/4 to 16 QAM 1/2) to maintain the wireless link quality.

Table 36: CLI - set		
PTP	PMP	Parameter/Description
√		**antgain**: Enter value for antenna gain (dBi). When DFS is enabled, it is important that the Antenna Gain setting matches the true antenna gain. If the antenna gain is set higher incorrectly, the AN-80i is less sensitive to detecting interference, and is <u>not</u> operating in compliance with the UK/ETSI standard.

√		**atpc**: Enable or disable the ATPC function. Both AN-80i units monitor Rx signal and automatically adjust the Tx level of the transmitting system to optimize system performance. The ATPC feature must be enabled on both ends of the link.
		     off - Disable
		     on - Enable
		 This mode can be changed only if allowed by the options key. If the options key does not allow changes: 1) value is specified by the options key, 2) executing a set command for this field will generate an error message.

√	√	**autoscan**: Enable or disable the Autoscan function.
		     off - Disable
		     on - Enable
		 When enabled, the PTP Subscriber (system mode) AN-80i automatically scans available channels to locate the current operating frequency of the PTP Sector Controller system. Executing a set command this field on a PTP Sector Controller will generate an error message.

	√	**bsporten**: Sector controller Ethernet port enable.
		   <id> - [id number]
		   <mode> - <on/off>

√	√	**buzzer**: Enable or disable the audible alignment buzzer.
		     off - Disable
		     on - Enable
		 When enabled, the rate of the tone is proportional to the receive signal strength (faster = stronger signal).

√	√	**chwidth**: Enter the channel bandwidth in MHz. Valid entries are 10, 20, and 40.

	√	**congid**: Connection's group ID.
		   <id> - [id number]
		   <gid> - <gid>

	√	**conlid**: Connection's Link ID.
		   <id> - [id number]
		   <lid> - <lid>

	√	**conpri**: Connection priority.
		   <id> - [id number]
		   <pri> - <VLAN priority>

	√	**convid**: Connection VLAN ID.
		   <id> - [id number]
		   <vid> - <VLAN ID>

	√	**conviden**: Connection VLAN enable.
		   <id> - [id number]
		   <mode> - <on/off>

		Table 36: CLI - set		
PTP	PMP	Parameter/Description		

√		**dfsaction**: Select the mode of operation for DFS. The system set to master-mode monitors for interference from radar devices and other equipment using the same channel frequency. When interference is detected, the system automatically takes the action selected using the drop-down menu:
		
		  <action> - [none=0 | txoff=1 | chgfreq=2]
		    None: The DFS function is disabled.
		    Tx Off: Transmission is immediately disabled when radar signals are detected. This action is recorded in the message log and an SNMP trap message is sent (if SNMP enabled).
		    Chg Freq: Relocate transmission to an alternative frequency immediately when radar signals are detected. This action is recorded in the message log and a trap message is sent (if SNMP enabled).		

	√	**dlqos**: Downlink QoS. <id> - [id number] <qos> - <QoS>		
	√	**dlrate**: Downlink rate. <id> - [id number] <rate> - <rate>		
√		**dst**: Enter the actual length of the path that the wave travels in order to establish the link. Units are defined by dstmu setting. This value is used to calculate the transmission-to-response interval and disregard reflections of the transmitted signal. Used only if dstmod is set to 'manual'.		

√		**dstmode**: Select the mode for determining the distance of the wireless link.
		    auto: Distance is calculated automatically by the AN-80i.
		    manual: Operator enters link distance.		

√		**dstmu**: Select the measurement unit for the link length (dstmode).
		    mile - dstmode units are miles
		    km - dstmode units are kilometers		

√		**efw**: Enable or disable the Ethernet Follows Wireless function.
		    off - Disable
		    on - Enable
		When Ethernet Follows Wireless is enabled the Ethernet port status is controlled to reflect the status of the wireless interface. When the AN-80i detects that the wireless interface has failed (or is manually disabled), the local Ethernet port is immediately disabled. The Ethernet port is enabled when the AN-80i registers on the wireless link.		

√		**efwtimeout**: Enter the period (in seconds) the Ethernet port will remain disabled following loss of connectivity on the wireless interface. Following this interval, the Ethernet port will be automatically re-enabled to allow management of the AN-80i.		

√		**encmode**: Enable or disable the encryption function.
		    off - Disable
		    on - Enable
		If encryption is enabled, the correct encryption keys must be entered on both communicating systems.		

		Table 36: CLI - set
PTP	**PMP**	**Parameter/Description**
√		**enckey**: Enter the encryption key. If encryption is enabled, the correct encryption keys must be entered on both communicating systems. Used only if encmode is set to 'on'. <mac>　　　　- <MAC address>
√	√	**ethmode**: Enter the Ethernet speed and duplex setting. 　　**auto** - Auto-negotiate 　　**10hd** - 10Base-T Half Duplex 　　**10fd** - 10Base-T Full Duplex 　　**10hd** - 100Base-T Half Duplex 　　**100fd** - 100Base-T Full Duplex
√		**exit**: Exit from the current mode (go up one level).
√	√	**flowctrl**: Enable or disable the flow control function. The Flow control feature enables the AN-80i to request other Ethernet devices to pause transmission during busy periods. 　　**off** - Disable 　　**on** - Enable
√	√	**gateway**: Enter the IP address of the default gateway on this segment.
√	√	**gmt**: Enter the time offset from GMT (i.e., -5 for EST).
	√	**grppri**: Group priority. <id>　　　　- [id number] <pri>　　　　- <VLAN priority>
	√	**grpqos**: Group QoS. <id>　　　　- [id number] <qos>　　　　- <QoS>
	√	**grprate**: Group rate. <id>　　　　- [id number] <rate>　　　　- <group rate>
	√	**grpvid**: Group VLAN ID. <id>　　　　- [id number] <vid>　　　　- <VLAN ID>
	√	**grpviden**: Group VLAN enable. <id>　　　　- [id number] <mode>　　　　- <on/off>
√	√	**http**: Enable or disable the HTTP function. When disabled, the Web interface will not be available. 　　**off** - Disable 　　**on** - Enable
	√	**idname**: ID name. <id>　　　　- [id number] <name>　　　　- <id name> - maximum 15 characters
√		**lkname**: Link name. <name>　　　　- <id name> - maximum 15 characters
√	√	**ipaddr**: Enter the IP address and subnet mask of the AN-80i. Address　　　　- IP Address Mask　　　　- Subnet Mask Yes　　　　- Confirmation to proceed

		Table 36: CLI - set
PTP	**PMP**	**Parameter/Description**
	√	**maxdst**: Maximum distance to a subscriber [Km]. <distance> - Maximum distance from SC to SS [Km].
√	√	**maxtxpower**: Enter the Tx power level (dBm). This setting is for the transceiver output only. The actual EIRP depends on the gain of the connected antenna. See section 7: Appendices for a list the maximum transmit power setting based on the antenna gain for a series of frequency settings. The maximum value for this field is determined by the options key.
	√	**mgmtag**: Management VLAN enable. <mode> - [on | off]
	√	**mgmvid**: Management VLAN ID. <vlan_id> - <VLAN ID>

√		**mrate**: Enter the maximum uncoded burst rate (Mbps). Entry values are dependant on the channel bandwidth (chwidth).
		        10 MHz: 3, 4.5, 6, 9, 12, 18, 24 or 27
		        20 MHz: 6, 12, 18, 24, 30, 36, 48, or 54
		        40 MHz: 12, 24, 36, 48, 60, 72, 96, or 108
		The maximum value for this field is determined by the options key.

√	√	**netmask**: Enter the IP netmask.
√	√	**optionskey**: Enter the options key string. <kIdx> - Index of the options key [0 | 1] <kStr> - [<options_key_string>]
	√	**peermac**: Peer MAC address. <id> - [id number] <mac> - <MAC address>

√		**pllm:** Enable or disable prioritized low latency mode;
		        off - Disable
		        on - Enable

√	√	**radio**: Enable or disable the radio transmitter.
		        off - Disable
		        on - Enable

√		**ratedif**: Enter the number of modulation levels to step down during re-transmission of errored wireless packets. The level can be set from 0 to 7 (recommended value = 2).
	√	**regper**: Frames number between registrations. <frames> - The number of frames between registrations [4..100].
√	√	**rffreq**: Enter the center frequency for the RF channel. When operating multiple links in close proximity, channel frequencies should be separated by a minimum of the channel size to minimize interference. For example, when operating in with 20 MHz channels, the separation must be greater than 20 MHz.

√	√	**snmp**: SNMP enable setting.
		        off - Disable the SNMP agent.
		        on - Enable the SNMP agent.

√	√	**snmptraplink**: Enable or disable sending an SNMP trap message for each link-up and link-down event. <setting> - [on | off]

		Table 36: CLI - set
PTP	**PMP**	**Parameter/Description**
	√	**snmptraps**: Status of the SNMP traps flag. <mode> - [on | off]
√		**snmptraps**: Enable or disable sending all SNMP traps. <setting> - [on | off]

√	√	**sntp**: SNTP enable setting.
		        off - Disable SNTP protocol support.
		        on - Enable SNTP protocol support.

√	√	**sntpip**: Enter the SNTP server IP address. Valid only if sntp is enabled.
√	√	**sntppoll**: Enter the interval to synchronize with the sntp server. <polltime> - SNTP polling interval [hours].
	√	**sstoss**: Status of packet routing between SSs. <id> - [id number] <mode> - <on/off> - Route broadcast packets from SS to SS
√	√	**syscontact**: Enter additional descriptive details about this AN-80i. The description can be any combination of up to 20 letters and numbers.
√	√	**sysdescr**: Enter descriptive details about this AN-80i. The description can be any combination of up to 20 letters and numbers.
√	√	**sysloc**: Enter descriptive details about the location of this AN-80i. The description can be any combination of up to 20 letters and numbers.

√	√	**syslog**: Syslog enable setting.
		        off - Disable syslog server protocol support.
		        on - Enable syslog server protocol support.

√	√	**syslogip**: Enter the syslog server IP address. Valid only if syslog is enabled.

√	√	**sysmode**:
		PTP Operation:
		        ptpsector controller - The sector controller (base station) begins transmitting automatically; sending poll messages to locate the remote subscribers (ptpsubscriber).
		        ptpsubscriber - Subscriber waits passively, monitoring the selected channel(s) until polled by the ptpsector controller (base station).
		PMP Operation:
		        pmpsc - The sector controller (base station) begins transmitting automatically; sending poll messages to locate the remote subscribers (pmpss).
		        pmpss - Subscribers wait passively, monitoring the selected channel(s) until polled by the pmpsc (sector controller).
		 <SysMode> - [pmpss | pmpsc]

√	√	**sysname**: Enter the name for this AN-80i. The name can be any combination of up to 20 letters and numbers.

√	√	**telnet**: Enable or disable the Telnet port. If the Telnet port is disabled, it will not be possible to use the CLI interface.
		        off - Disable
		        on - Enable
		Changes to this field are effective only following reboot.

√	√	**telnetport**: Enter Telnet port address (default is 23).

Table 36: CLI - set		
PTP	PMP	Parameter/Description
	√	**ulqos**: Uplink QoS. <id> - [id number] <qos> - <QoS>
	√	**ulrate**: Set the uplink rate. <id> - [id number] <rate> - <rate>

5.3.17 Show

Use the *show* command to display system statistics.

show <Enter>   Change to 'show' mode.

show [field] <Enter> Display values for the selected parameter.

Table 37: CLI - show		
PTP	PMP	Description
	√	**config**: list all system configuration information.
		Example: 192.168.25.2(show)# config

System Information:

sysname = 1234567890	telnetport = 23
sysdescr = b	snmp = On
sysloc = c	snmptraps = On
syscontact = d	snmptraplink = On
	mgmtag = Off
	mgmvid = 0

Ethernet Configuration:	Wireless Configuration:
ipaddr = 192.168.25.2	rffreq = 5610.0
netmask = 255.255.255.0	autoscan = Off maxtxpower = 15
gateway = 192.168.25.1	chwidth = 20 MHz
flowctrl = Off	sysmode = pmpsc swver = 10.00.027 (other: 2.00.004)
sntp = On	buzzer = On
sntpip = 192.168.25.1	regper = 18
sntppoll = 24	maxdst = 2
gmt = +0:00	radio = Off = 2
syslog = Off	radio = Off
syslogip = 192.168.25.1	
ethmode = auto	
http = On	
telnet = On	

| | √ | **conns**: list all Connections.
<id>   - [id number]
Example:
192.168.25.2(show)# conns 14
 27 SS-001-Data Conn |

Table 37: CLI - show		
PTP	**PMP**	**Description**

√		**files \<mode\>** List the key and certificate files.
		  \<mode\> Defaults to 'usr' if mode is not specified.
		    run - Display keys currently in use.
		    usr - Display the user-specified keys and certificates.

	√	**groups**: list all Groups. *Example:* 192.168.25.2(show)# groups 14 Data Group 15 Voice Group
	√	**idtable**: list all system IDs. *Example:* 192.168.25.2(show)# idtable ID Name Type Status -- 4 Link Not Enabled 5 Link Not Enabled 14 Data Group Enabled 15 Voice Group Enabled 24 Conn Not Enabled 25 Conn Not Enabled 26 Subscriber-001 Link Enabled 27 SS-001-Data Conn Enabled 28 SS-001-Voice Conn Enabled
	√	**links**: list of links. *Example:* 192.168.25.2(show)# links 26 Subscriber-001 Link
√	√	**log**: list the system log. *Example:* 192.168.25.2(show)# log 000d, 00:00:00 1005 - User Configuration Load: OK 000d, 00:00:00 1016 - Options Key Properties Load: OK 000d, 00:00:00 1014 - Options Key Load: OK 000d, 00:00:00 1018 - Options Key Activated: OK 000d, 00:00:00 1001 - System Configuration Load: OK 000d, 00:00:00 1030 - SNMP Configuration Load: OK 000d, 00:00:00 1012 - System Description Load: OK 000d, 00:00:00 1007 - Network Configuration Load: OK 000d, 00:00:00 1010 - Version Ctrl Data Load: OK 000d, 00:00:02 1009 - Network Configuration: OK 000d, 00:00:11 1023 - Firmware configuration: OK 000d, 00:00:26 1033 - MAC Initialization: OK 000d, 00:13:29 2039 - SNTP: Time received: OK 000d, 02:15:00 1006 - User Configuration Save: OK

PTP	PMP	Description	
√	√	**snmp**: list the SNMP Configuration. *Example:* Trap Configuration: SNMP Enabled: On Traps Enabled: On Trap Link Up/Down Enabled: On 0: 192.168.23.254 : 162 : public	
√	√	**stats** <id> - <id> *Example:* (show)# stats 14 *General Information*: sysname = abcdef sysdescr = b sysloc = c syscontact = d mac = 00:09:02:00:bb:77 boardtype = AN-80i Rev 1.0 radiotype = T54i swver = 10.00.023 (other: 10.00.019) sysuptime = 8 day(s), 20 hr, 19 min sysstarttime = N/A sysmode = pmpsc rffreq = 5490.0 txpower = 10 chwidth = 20 MHz rfstatus = 0 *	*Ethernet Statistics*: erxpkt = 3081 erxpktd = 0 etxpkt = 8089 *Wireless Statistics*: regstations = 0 regconn = 0 activelinks = 0 activeids = 0 *Wireless Ethernet Statistics*: werxpkt = 4592 werxpktdis = 0 werxpkterr = 0 wetxpkt = 0 wetxpktdis = 0 wetxpkterr = 0

* Status codes are displayed in binary format. See section 6.4: Status Codes on page 88 for details of the RF status codes.

5.3.18 Snmpcommunity

Use the *snmpcommunity* command to configure SNMP community permissions.

PTP	PMP	Description
√	√	**add**: add a new snmp community to the snmp community table. The index value is assigned automatically. Up to eight community entries can be entered in the table.
		snmpcommunity add <name> <string> <Enter>
		snmpcommunity add <rights> 0 | r | w | rw <Enter>
		Where.
		0 (zero):Deny read and write permission.
		r: Grant read access permission only. Deny write permission.
		w: Grant write access permission only. Deny read permission.
		rw: Grant read and write access permission for this community.
		default: Set all snmp parameters to factory default settings.
		snmpcommunity default <idx> <Enter>
		del: Delete the specified community entry.
		snmpcommunity del <idx> <Enter>
		print: List all SNMP communities and associated permissions.
		snmpcommunity print <Enter>

Table 38: CLI - snmpcommunity

5.3.19 Snmptrap

Use the *snmptrap* command to configure the SNMP trap message reporting.

PTP	PMP	Description
√	√	**add**: add a new snmp trap to the snmp trap table. The index value is assigned automatically. Up to eight settings can be entered.
		snmptrap add <ipaddr> <port> <community> <Enter>
		change: Modify the specified snmp setting.
		snmptrap change <idx> [-p <port>] [-i <ip_add>] [-c <community] <Ent>
		del: Delete the specified snmp setting.
		snmptrap del <idx> <Enter>
		print: List all SNMP trap settings.
		snmptrap print <Enter>

Table 39: CLI - snmptrap

5.3.20 Test

Use the *test* command to load the current edited (but not permanently saved) configuration settings.

PTP	PMP	Parameter/Description
√	√	**config** - AN-80i configuration settings
		test config <Enter>

Table 40: CLI - test

The AN-80i will operate with these settings for a period of five minutes. During the 'test' period, you may click the Save button at any time to save this configuration permanently (also terminating the five minute timer). If the Save button is <u>not</u> selected, the previous saved settings are reloaded.

5.3.21 Upgrade

Use the *upgrade* command to upload a new software binary file to the AN-80i.

<table>
<tr><td colspan="3" align="center">Table 41: CLI - upgrade</td></tr>
<tr><td>PTP</td><td>PMP</td><td>Description</td></tr>
<tr><td>√</td><td>√</td><td>ipaddr: Enter the IP address of the TFTP server.</td></tr>
<tr><td></td><td></td><td>filename: Enter the name of the binary file to be uploaded to the AN-80i.

upgrade <ipaddr> <filename> <Enter></td></tr>
<tr><td></td><td></td><td>You must specify the TFTP server address and the full name of the binary file (including .bin extension). The AN-80i software binary file <u>must</u> be located in the default directory of the TFTP server.</td></tr>
</table>

5.3.22 User

Use the *user* command to manage user accounts, passwords, and user Groups. When in user mode, only the <chgpasswd> field is available, since the user can change only his own password. The other commands are available only for members of the administrator Group.

<table>
<tr><td colspan="3" align="center">Table 42: CLI - user</td></tr>
<tr><td>PTP</td><td>PMP</td><td>Description</td></tr>
<tr><td>√</td><td>√</td><td>add: Administrators can use this command to add new user accounts. This option is available only for administrators.

user add <username> <usertype> <Enter></td></tr>
<tr><td></td><td></td><td>chgpasswd: For the user accounts, the chgpasswd command must be executed without the <username> parameter -- user's can change only their own password.

user chgpasswd [<username>] <Enter>

Administrators can change their own password, or specify a <username> to change the password of the specified user account.

user chgpasswd [<username>] <Enter></td></tr>
<tr><td></td><td></td><td>del: Administrators can use this command to delete user accounts. This option is available only for administrators.

user del <username> <Enter></td></tr>
<tr><td></td><td></td><td>print: Administrators can use this command to display a list of user accounts. This option is available only for administrators.

user print <Enter></td></tr>
</table>

5.3.23 Whoami

Use the *whoami* command to display the username of the current Telnet session. This command is <u>not</u> available when logged in as administrator.

<table>
<tr><td colspan="3" align="center">Table 43: CLI - whoami</td></tr>
<tr><td>PTP</td><td>PMP</td><td>Parameter/Description</td></tr>
<tr><td>√</td><td></td><td>whoami - Display username for this session.</td></tr>
</table>

6 Diagnostics and Troubleshooting

This section provides basic diagnostic and troubleshooting procedures to help solve problems that may occur with the system. If the system is not operating correctly after applying the suggestions in this section, please contact your local Redline representative. Include the model name and serial number of the system in your communications.

6.1 Factory Default Settings

The following parameters are the factory default settings for the AN-80i.

Table 44: Diag. - Factory Default Settings		
Section	**Item**	**Factory Default Setting**
System	User Name	admin
	Password	admin
Ethernet	IP Address	192.168.25.2
	Subnet Mask	255.255.255.0
	Gateway	0.0.0.0
Wireless	RF Channel	Set by factory key.
	Tx power	14 dBm
	Encryption	Enabled / no key

Note: Factory defaults can only be restored using the CLI 'save' command.

6.2 Procedure to Restore Factory Settings

The AN-80i features a method to gain access to the CLI command prompt for a unit where the IP address, username, and/or password is unknown. This method requires local access to the AN-80i PoE power adapter, the ability to power-cycle the AN-80i, a PC with a telnet client, and an Ethernet cable.
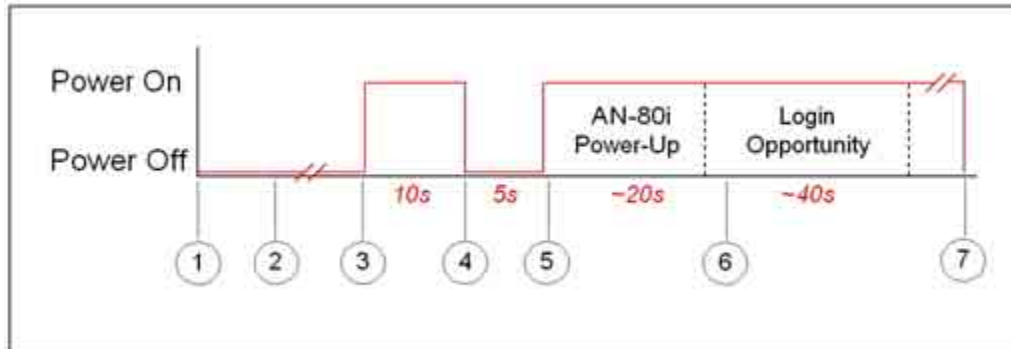
Figure 38: CLI - Recovering Lost IP Address

Use the following steps to gain access to the CLI command prompt:

1. Power-off the AN-80i PoE adapter. Remove the local network Ethernet cable and connect your computer directly to the PoE adapter DATA (INPUT) Ethernet port.

2. Open a command prompt window on the PC and enter the command:

   telnet 192.168.25.2   <Do not press Enter key at this time>

3. Restore power to the AN-80i PoE adapter and wait for 10 seconds.

4. Power-off the AN-80i PoE adapter for 5 seconds (7 seconds maximum).

5. Restore power to the AN-80i PoE adapter and wait for approximately 20 seconds.

6. Press the Enter key on the PC (start the Telnet session). When the login prompt appears, you have approximately 30 seconds to login using 'admin' as the user name and 'admin' as password. After login, all AN-80i CLI commands are available.

   If the login prompt does not appear, re-enter the Telnet command (up to 60 seconds from power-on). If this is not successful, repeat steps 2 to 6 using a wait time in step 5 (30 to 40 seconds).

7. Use the following command to restore the default IP address, username and password:

   save defaultconfig <Enter>

   The following parameters are not affected by the 'save defaultconfig' command:
   - System Name, System Location, System Details and Contact
   - Frequency list
   - SNMP configuration
   - ID table (PMP only)

8. Power-off the PoE adapter and re-connect the network cable. Restore power to the PoE adapter.

6.3   Testing and Saving System Parameters

The AN-80i is a highly configurable communications device. All user settings are saved in non-volatile RAM. The system configuration and snmp settings are saved separately.

6.3.1   CLI Interface

Use the 'test' command to have the AN-80i load the edited settings. The AN-80i will operate with these settings for a period of five minutes. During the test period, you may click the Save button at any time to save this configuration permanently. Otherwise, after five minutes, the AN-80i will reboot and load the previously saved settings.

Note: Factory defaults can only be restored using the CLI commands.
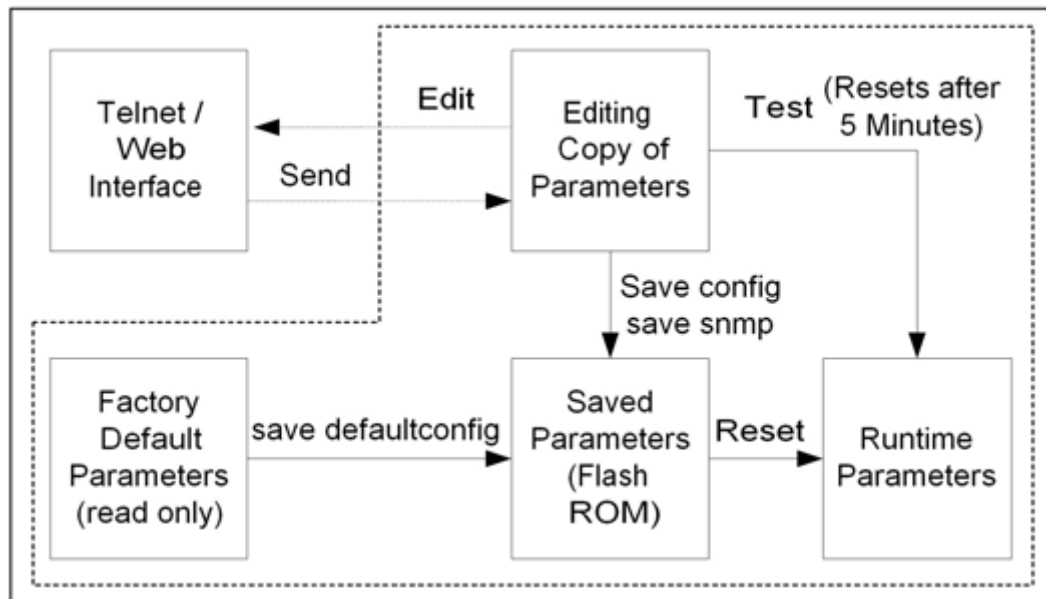
Figure 39: Diag: - Saving Parameters in NVRAM

6.3.2   Web Interface

The Test button is located on the System Configuration page. Click this button to have the AN-80i load the current settings displayed in the configuration screen. The AN-80i will operate with these settings for a period of five minutes. During the test period you may click the Save button at any time to save this configuration permanently (also terminating the five minute timer). After five minutes, if the Save function button has not been applied, the AN-80i will reboot and load the previously saved settings.

Attempt to login to the AN-80i using a Web browser. Microsoft Internet Explorer is recommended. If the AN-80i does not respond by displaying the login dialog box, check that the correct IP address is being used. The value 192.168.25.2 is the factory default value and may have been changed during installation.

Test is to verify the IP address is reachable from the computer. Use the ping command to test the Connection between the AN-80i and host computer.

>*ping 192.168.25.2*

If the ping test is successful, the host computer was able to send and receive packets to/from the AN-80i. The problem may be with the Internet browser or related settings on the host computer. Reboot the host computer to try to resolve the problem.

If the ping is unsuccessful, there may be problems using that IP address; the IP address may be incorrect, or there may be a duplicate address. For correct operation the host computer and the AN-80i must be on the same subnet. For example, if the AN-80i is using the factory default settings, the host computer could be set for an IP of *192.168.25.3 and a subnet mask of 255.255.255.0.*

If the correct IP address of the AN-80i cannot be determined, it is recommended to perform the IP recovery procedure.

The following table lists some common troubleshooting tips for the web interface.

Table 45: Diag. - Web Interface Diagnostics		
Symptom	**Possible Problem**	**Solution**
General Information screen is not displayed	Incorrect IP address and/or Subnet Mask.	Perform a ping test from the host computer command line. If the ping test is unsuccessful, then the problem is with the IP address. Perform a long reset to apply the default address (192.168.25.2) and Subnet Mask (255.255.255.0)
	Problems with host computer, or AN-80i.	If the ping is successful, reset the AN-80i, and/or reset the host computer.
	Host PC ARP table is incorrectly configured	Run 'arp -d' whenever the AN-80i is swapped. Check that the subnet mask for the host PC matches the subnet mask of the AN-80i. Check that the host PC's address is 192.168.25.n, where 'n' is not equal to 0,2, or 255.

6.4 Status Codes

6.4.1 PTP Status Codes

The PTP status code is displayed in a series of decimal characters representing the status of six different alarm conditions. The value '1' indicates the associated condition is active. All unused bits are set to zero.

To determine the status, the decimal number must be converted to binary notation. It is recommended to use a scientific calculator that supports binary notation (i.e., Windows on-screen calculator). Set the mode for decimal and enter the status code. Change the mode to binary and match active bits (1) to the following table.

For example, if 'RF High Temp. Warning' (2) and ' PHY lock error' (1 0000) were active, the status code value would be 34 (binary 100010) (leading zeros are not displayed).

Table 46: Diag. - PTP Status Codes			
Error Type	Error # Decimal*	Error # (binary)	Description
Tx Power	1	1	Power output is less than 10 dBm. This message may appear before the RF link is established.
RF High Temp. Warning	2	10	The transceiver internal temperature rose above 185F / 85C. The transceiver will shut down for 30 seconds to allow cooling.
RF PLL Lock Error	16	1 0000	The PLL (Phase Locked Loop) section within the AN-80i experienced an error. Reset the AN-80i.
PHY lock error	32	10 0000	The PLL (Phase Locked Loop) section within the AN-80i experienced an error. Reset the AN-80i.
80 MHz PLL lock error	64	100 0000	The PLL (Phase Locked Loop) section within the AN-80i experienced an error. Reset the AN-80i.
Firmware Configuration Error	128	1000 0000	Error detected in the AN-80i configuration file.

*Displayed decimal value if this is the only active error condition.

6.4.2   PMP Status Codes

The PMP status code is displayed in a series of hexadecimal characters representing the status of different alarm conditions. The value '1' indicates the associated condition is active. All unused bits are set to zero.

To determine the status, the hexadecimal number must be converted to binary notation. It is recommended to use a scientific calculator that supports binary notation (i.e., Windows on-screen calculator). Set the mode for Hex and enter the status code. Change the mode to binary and match active bits (1) to the PMP Status Codes table.

For example, if 'Radio Over Temperature' bit 1 and 'PLL Error' bit 4 were active, the status code value would be Hex '12' (binary 1 0010).

Table 47: Diag. - PMP Status Code Bits																														
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	9	8	7	6	5	4	3	2	1	0

Table 48: Diag. - PMP Status Codes	
Bit	**Description**
1	Radio over-temperature
4, 5, 6	PLL Errors
8	Firmware Error
16	No Ethernet packets received by the wireless MAC
17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28	MAC Internal Errors

7 Appendices

7.1 AN-80i Technical Specifications

Table 49: Spec. - AN-80i Technical Specifications

T35 Radio:
RF Band:	3.320 - 3.798 GHz (TDD) [1]
Rx Sensitivity:	-95 dBm @ 3 Mbps max.
Center Freq. Steps:	1 MHz [2]
Channel Size:	PTP: 5, 7, 10, 14, 20, 28 MHz (software selectable) [1]
	PMP: 10, 20 MHz (software selectable) [1]

T49 Radio:
RF Band:	4.900 - 5.350 GHz (TDD) [1]
Rx Sensitivity:	-88 dBm @ 3 Mbps max.
Center Freq. Steps:	2.5 MHz [2]
Channel Size:	PTP: 10, 20, 40 MHz (software selectable) [1]
	PMP: 10, 20 MHz (software selectable) [1]

T54 Radio:
RF Band:	5.470 - 5.725 GHz (TDD) [1]
Rx Sensitivity:	-85 dBm @ 3 Mbps max.
Center Freq. Steps:	2.5 MHz [2]
Channel Size:	PTP: 10, 20, 40 MHz (software selectable) [1]
	PMP: 10, 20 MHz (software selectable) [1]

T58 Radio:
RF Band:	5.725 - 5.850 GHz (TDD) [1]
Rx Sensitivity:	-85 dBm @ 3 Mbps max.
Center Freq. Steps:	2.5 MHz [2]
Channel Size:	PTP: 10, 20, 40 MHz (software selectable) [1]
	PMP: 10, 20 MHz (software selectable) [1]

System Capability:	LOS, Optical-LOS, and Non-LOS
RF:	> 50 dB Rx Dynamic Range
	Maximum Tx Power: 25 dBm (Ave. Max.) [3,8]
	Minimum Tx Power: -10 dBm
	Automatic Transmit Power Control (ATPC)
	Dynamic Frequency Selection (DFS)
	Automatic link distance ranging
	Up to 80 km (50 mi) line-of-sight @ 48 dBm EIRP [3]
Data Rate:	Up to 90 Mbps average Ethernet rate (40 MHz channel) [4]
Rx Sensitivity:	-88 dBm @ 3 Mbps max.
PoE Cable:	Up to 91 m (300 ft) [5]
Network Attributes:	802.3x Ethernet flow control

Table 49: Spec. - AN-80i Technical Specifications	
	DHCP pass-through, transparent bridge
	802.1p network traffic prioritization [6]
	802.1Q VLAN classification [7]
Modulation/Coding Rates:	BPSK 1/2, BPSK 3/4, QPSK 1/2, QPSK 3/4, 16 QAM 1/2, 16 QAM 3/4, 64 QAM 2/3 and 64 QAM 3/4
Over The Air Encryption:	Proprietary private key encryption, X.509 certificates
	AES-128 and AES-256 options [6]
MAC:	Concatenation
	Time Division Multiple Access (TDMA)
	Automatic Repeat Request (ARQ) error correction
	Dynamic adaptive modulation (bi-dir. burst to burst auto select) [6]
	Packet fragmentation [7]
Network Services:	Transparent to 802.3 services and applications
Duplex Technique:	Dynamic TDD (time division duplex)
Wireless Transmission:	OFDM (orthogonal frequency division multiplexing)
Network Connection:	10/100 Ethernet (RJ-45)
System Configuration:	HTTP/HTTPS (Web) interface, SNMP, SSH, Telnet (CLI), TFTP
Network Management:	SNMP V2: standard and proprietary MIBs
Power Requirements:	Standard IEEE 802.3af (15.4 W Max.)
Operating Temperature:	-40 C to 60 C
Dimensions/Weight:	289 mm x 190 mm x 51.5 mm (11.38 in x 7.50 in x 2.03 in)
Humidity:	0% to 95% Non-condensing
Weight:	2 Kg (4.4 lb) without bracket or antenna
Storage Temperature:	-50 C to 70 C
Compliance:	Safety: IEC, EN, and UL/CSA 60950
	EMC: EN 301 489-1, EN 301 489-17
	5.8 GHz Radio: Industry Canada RSS 210, FCC part 15, ETSI EN 302 502
	5.4 GHz Radio (w/DFS): Industry Canada RSS 210, FCC part 15, ETSI EN 301 893
	4.9 GHz Radio (w/DFS): Industry Canada RSS 210, FCC part 90, ETSI EN 301 893
	Ingress Protection: IP67

FCC part 15, ETSI EN 302 502;
FCC part 90, ETSI EN 301 893

[1]   Actual RF Band limited by regional regulations.
     Refer to Table 63: Spec. - Regional Identification Codes on page 99 for available channels.
[2]   Center frequency is dependent on region.
[3]   Maximum operational power per channel with a given antenna is limited in accordance to maximum allowable EIRP levels for the region.
[4]   Actual Ethernet data throughput is dependent on: protocols, packet size, burst rate, transmission latency, and link distance.
[5]   With lightning arrestor installed.
[6]   PTP Only
[7]   PMP Only
[8]   Maximum power based on radio type.
     Specifications are subject to change without notice.

7.2 AN-80i PoE Power Adapter Specifications

Table 50: Spec. - AN-80i PoE Power Adaptor Specifications	
PoE Power Block:	CINCON Model TR60A-POE-L
Input:	Auto-sensing 110/220/240 VAC 50/60 Hz
Output:	48 VDC 1.2A Max. Load
Environmental:	Operating temperature: 0 to 60 C
	Storage Temperature: -50 to 70 C
	Operating Humidity: 5% to 95%
Dimensions:	35 x 70 x 150 mm (1.38 x 2.76 x 5.91 in)
Specifications are subject to change without notice.	

7.3 Antenna / Mounting Bracket Matrix

Table 51: Spec. - AN-80i Antenna / Mounting Bracket Matrix								
Redline Order (Part) Number	Gain (dBi)	Type	Freq.	(GHz)				Mounting Bracket
			3.3 - 3.8	4.9 - 5.0	5.15 - 5.35	5.25 - 5.35	5.4	5.8	
A12015EAS (48-00065-00)	15	120° panel		✓	✓	✓	✓	✓	80i-HD-MNT (13-00043-00)
A1815MTF (48-00012-00)	18	15° panel	✓						80i-HD-MNT (13-00043-00)
A2014ARF (48-00054-00)	20	13.8° panel	✓						80i-HD-MNT (13-00043-00)
A2209MTFD (48-00021-02)	22	9° panel			✓	✓	✓	✓	80i-LW-MNT (13-00052) 80i-HD-MNT (13-00043-00)
A2212RWP (48-00030-00)	22	12° parabolic				✓	✓	✓	80i-SA-MNT (13-00052)
A2408MTF (48-00009-00)	24	8° panel	✓						80i-HD-MNT (13-00043-00)
A2510PWP (48-00056-00)	25	10° panel	✓						80i-HD-MNT (13-00043-00)
A2804MTF (48-00024-00)	28	4.5° panel			✓	✓	✓	✓	80i-HD-MNT (13-00043-00)
A2808PWP	28	8° panel	✓						
A2906PWP (48-00063-00)	29	6° parabolic		✓	✓	✓	✓	✓	80i-SA-MNT (13-00052)
A3204PWP (48-00064-00)	32	4° parabolic		✓	✓	✓	✓	✓	80i-SA-MNT (13-00052)
A3403RWP (48-00033-00)	34.6	3.4° parabolic				✓	✓	✓	80i-SA-MNT (13-00052)
A36009MMO (48-00048-01)	9	360° omni			✓	✓	✓	✓	80i-SA-MNT (13-00052)

Table 51: **Spec. - AN-80i Antenna / Mounting Bracket Matrix**

Redline Order (Part) Number	Gain (dBi)	Type	Freq. (GHz)						Mounting Bracket
			3.3 - 3.8	4.9 - 5.0	5.15 - 5.35	5.25 - 5.35	5.4	5.8	
A6017EAS (48-00067-00)	17.5	62° panel		✓	✓	✓	✓	✓	80i-HD-MNT (13-00043-00)
A9016EAS (48-00066-00)	16.6	90° panel		✓	✓	✓	✓	✓	80i-HD-MNT (13-00043-00)
PA14120EAS (48-00059-00)	14	120° panel	✓						80i-HD-MNT (13-00043-00)
PA14120EASH (48-00060-00)	14	120° panel	✓						80i-HD-MNT (13-00043-00)
PA1590EAS (48-00052-00)	15	90° panel	✓						80i-HD-MNT (13-00043-00)
PA1590EASH (48-00053-00)	15	90° panel	✓						80i-HD-MNT (13-00043-00)
PA1660EASH (48-00051-00)	16	60° panel	✓						80i-HD-MNT (13-00043-00)
PA1760EAS (48-00050-00)	17	60° panel	✓						80i-HD-MNT (13-00043-00)

7.4   Legacy Products (Not Available to Order)

Table 52: **Spec. - AN-80i Legacy Antenna / Mounting Bracket Matrix**

Redline Order (Part) Number	Gain (dBi)	Type	Freq. (GHz)						Mounting Bracket
			3.3 - 3.8	4.90 - 5.00	5.15 - 5.35	5.25 - 5.35	5.4	5.8	
A12015MTS (48-00047-00)	15	120° panel			✓	✓	✓	✓	80i-HD-MNT
A2806RWP (48-00031-00)	28	6.2° parabolic				✓	✓	✓	80i-SA-MNT
A3104RWP (48-00032-00)	31.2	4.2° parabolic				✓	✓	✓	80i-SA-MNT
A6015MTS (48-00014-00)	16	60° panel			✓	✓	✓	✓	80i-HD-MNT
A6017RWS (48-00028-00)	17	60° panel				✓	✓	✓	80i-HD-MNT
A9014MTS (48-00017-00)	14	90° panel			✓	✓	✓	✓	80i-HD-MNT
A9016RWS (48-00029-00)	16	90° panel				✓	✓	✓	80i-HD-MNT

7.5 ETSI Certified Antennas

The RF output power and selection must be professionally programmed and installed by the manufacturer or a trained professional installer.

7.5.1 3.3 - 3.8 GHz Radio: ETSI Certified Antennas

The following table lists ETSI certified 3.3 - 3.8 GHz antennas. Operation is restricted to 10 MHz and 20 MHz channel operation only.

Redline Part Number	Gain (dBi)	Description
Table 53: Spec. - Antenna/Tx Power Setting Combinations for ETSI		
A2014ARF (48-00054-00)	20	*13.8°, 3.3-3.8 GHz, horizontal or vertical polarization*
A2408MTF (48-00009-00)	24	*8°, 3.3-3.8 GHz, horizontal or vertical polarization*
A1815MTF (48-00012-00)	18	*15°, 3.3-3.8 GHz, horizontal or vertical polarization*
A2510PWP (48-00056-00)	25	*10°, 3.3-3.6 GHz, horizontal or vertical polarization*
A2808PWP	28	*8°, 3.3-3.8 GHz, horizontal or vertical polarization*
PA1760EAS (48-00050-00)	17	*60°, 3.3-3.8 GHz, vertical polarization only*
PA1660EASH (48-00051-00)	16	*60°, 3.3-3.8 GHz, horizontal polarization only*
PA1590EAS (48-00052-00)	15	*90°, 3.3-3.8 GHz, vertical polarization only*
PA1590EASH (48-00053-00)	15	*90°, 3.3-3.8 GHz, horizontal polarization only*
PA14120EAS (48-00059-00)	14	*120°, 3.3-3.8 GHz, vertical polarization only*
PA14120EASH (48-00060-00)	14	*120°, 3.3-3.8 GHz, horizontal polarization only*

7.5.2 5.8 GHz Radio: ETSI Certified Antennas

The following table lists ETSI certified 5.8 GHz antennas. Operation is restricted to 10 MHz and 20 MHz channel operation only.

Redline Part Number	Gain (dBi)	Antenna Type	App.	Tx Power Setting (dBm)
Table 54: Spec. - ETSI Certified Antennas: 5.8 GHz Operation				
A36009MMO (48-00048-01)	9	360°, 5.0 - 6.0 GHz, omni directional	PMP	13
A12015EAS (48-00065-00)	15	120°, 4.9-5.9 GHz, sector flat panel	PMP	9
A9016EAS (48-00066-00)	16.6	90°, 4.9-5.9 GHz, sector flat panel	PMP	7
A6017EAS (48-00067-00)	17.5	62°, 4.9-5.9 GHz, sector flat panel	PMP	5
A2209MTFD (48-00021-02)	22	9°, 5.15-5.875 GHz, flat panel	PTP	-1
A2212RWP (48-00030-00)	22	12°, 5.250-5.850 GHz, parabolic	PTP	-1

7.5.3 5.4 GHz Radio: ETSI Certified Antennas

The following table lists ETSI certified 5.4 GHz antennas.

Table 55: Spec. - ETSI Certified Antennas: 5.4 GHz Operation				
Redline Part Number	Gain (dBi)	Antenna Type	App.	Tx Power Setting (dBm)
A36009MMO (48-00048-01)	9	360°, 5.0 - 6.0 GHz, omni	PMP	10
A12015EAS (48-00065-00)	15	120°, 4.9-5.9 GHz, sector flat panel	PMP	5
A9016EAS (48-00066-00)	16.6	90°, 4.9-5.9 GHz, sector flat panel	PMP	3
A6017EAS (48-00067-00)	17.5	62°, 4.9-5.9 GHz, sector flat panel	PMP	2
A2209MTFD (48-00021-02)	22	9°, 5.15-5.875 GHz, flat panel	PTP	8
A2212RWP (48-00030-00)	22	12°, 5.250-5.850 GHz, parabolic	PTP	8
A2804MTF (48-00024-00)	28	4.5°, 5.15-5.875 GHz, flat panel	PTP	1
A2806RWP (48-00031-00)	28	6.2°, 5.250-5.850 GHz, parabolic	PTP	1
A2906PWP (48-00063-00)	29	6°, 4.900-5.875 GHz, parabolic	PTP	10
A3104RWP (48-00032-00)	31.2	4.2°, 5.250-5.850 GHz, parabolic	PTP	-1
A3204PWP (48-00064-00)	32	4°, 4.900-5.875 GHz, 3 ft, parabolic	PTP	-3

7.5.4 5.15 - 5.35 GHz Radio: ETSI Antennas

The following table lists ETSI certified 5.15-5.35 GHz antennas.

Table 56: Spec. - ETSI Certified Antennas: 5.15 - 5.35 GHz Operation				
Redline Order (Part) Number	Gain (dBi)	Antenna Type	App.	Tx Power Setting (dBm)
A12015EAS (48-00065-00)	15	120°, 4.9-5.9 GHz, sector flat panel	PMP	3
A9016EAS (48-00066-00)	16.6	90°, 4.9-5.9 GHz, sector flat panel	PMP	2
A6017EAS (48-00067-00)	17.5	62°, 4.9-5.9 GHz, sector flat panel	PMP	0
A2209MTFD (48-00021-02)	22	9°, 5.15-5.875 GHz, flat panel	PTP	-4

7.6   FCC & IC Certified Antennas

7.6.1   5.8 GHz Radio: FCC & IC Certified Antennas

This device has been designed to operate with the antennas listed below, and having a maximum gain of 34.6 dBi. Antennas having a gain greater than 34.6 dBi are strictly prohibited for use with this device. The RF output power and selection must be professionally programmed and installed by the manufacturer or a trained professional installer. The required antenna impedance is 50 ohms. The following tables list FCC and IC certified antennas.

Table 57: Spec. - FCC & IC Certified Antennas: 5.8 GHz PTP Operation						
Redline Order (Part) Number	Gain (dBi)	Description	App.	Ave. GUI Power Display (dBm)	Minimum Conducted Power (dBm)	Max Conducted Power (dBm)
A2209MTFD (48-00021-02)	22	9°, 5.15-5.875 GHz, flat panel	PTP	20	-12.7	26.2
A2212RWP (48-00030-00)	22	12°, 5.250-5.850 GHz, parabolic	PTP	20	-12.7	26.2
A2804MTF (48-00024-00)	28	4.5°, 5.15-5.875 GHz, flat panel	PTP	20	-12.7	26.2
A2806RWP (48-00031-00)	28	6.2°, 5.250-5.850 GHz, parabolic	PTP	20	-12.7	26.2
A2906PWP (48-00063-00)	29	6°, 4.900-5.875 GHz, parabolic	PTP	20	-12.7	26.2
A3104RWP (48-00032-00)	31.2	4.2°, 5.250-5.850 GHz, parabolic	PTP	20	-12.7	26.2
A3204PWP (48-00064-00)	32	4°, 4.900-5.875 GHz, parabolic	PTP	20	-12.7	26.2
A3403RWP (48-00033-00)	34.6	3.4°, 5.250-5.850 GHz, parabolic	PTP	20	-12.7	26.2

Table 58: Spec. - FCC & IC Certified Antennas: 5.8 GHz PMP Operation					
Redline Part Number	Gain (dBi)	Description	App.	Tx Power Setting (dBm)	Tx Peak Conducted Power (dBm)
A36009MMO (48-00048-01)	9	360°, 5.0 - 6.0 GHz, omni directional	PMP	13	20.3
A12015EAS (48-00065-00)	15	120°, 4.9-5.9 GHz, sector flat panel	PMP	9	19.4
A9016EAS (48-00066-00)	16.6	90°, 4.9-5.9 GHz, sector flat panel	PMP	7	17.2
A6017EAS (48-00067-00)	17.5	62°, 4.9-5.9 GHz, sector flat panel	PMP	5	14.9
A9014MTS (48-00017-00)	14	90°, 5.150-5.875 GHz, sector flat panel	PMP	10	20.5
A12015MTS (48-00047-00)	15	120°, 5.15-5.875 GHz, sector, flat panel	PMP	9	19.4
A6015MTS (48-00014-00)	16	60°, 5.150-5.875 GHz, sector flat panel	PMP	8	18.3
A9016RWS (48-00029-00)	16	90°, 5.250-5.850 GHz, sector, flat panel	PMP	8	18.3
A6017RWS (48-00028-00)	17	60°, 5.250-5.850 GHz, sector, flat panel	PMP	7	17.1

7.6.2 5.4 GHz Radio: FCC & IC Certified Antennas

This device has been designed to operate with the antennas listed below, and having a maximum gain of 22 dBi. Antennas not included in this list or having a gain greater than 22 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. The following table lists FCC and IC certified antennas:

Table 59: Spec. - FCC & IC Certified Antennas: 5.4 GHz Operation				
Redline Order (Part) Number	Gain (dBi)	Description	App.	Tx Power Setting (dBm)
A36009MMO (48-00048-01)	9	360°, 5.0 - 6.0 GHz, omni directional	PMP	13
A12015EAS (48-00065-00)	15	120°, 4.9-5.9 GHz, sector flat panel	PMP	9
A9016EAS (48-00066-00)	16.6	90°, 4.9-5.9 GHz, sector flat panel	PMP	7
A6017EAS (48-00067-00)	17.5	62°, 4.9-5.9 GHz, sector flat panel	PMP	5
A2209MTFD (48-00021-02)	22	9°, 5.15-5.875 GHz, sector, flat panel	PTP	-1

7.6.3 5.25 - 5.35 GHz Radio: FCC & IC Antennas

This device has been designed to operate with the antennas listed below, and having a maximum gain of 22 dBi. Antennas not included in this list or having a gain greater than 22 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. The RF output power and selection must be professionally programmed and installed by the manufacturer or a trained professional installer. The following table lists FCC* and IC certified antennas:

Table 60: Spec. - FCC & IC Antennas: 5.25 - 5.35 GHz Operation									
Redline Order (Part) Number	Gain (dBi)	Description	App.	Tx Power Setting (dBm)			Tx Peak Conducted Power (dBm)		
				Channel Size (MHz)			Channel Size (MHz)		
				10	20	40	10	20	40
A36009MMO (48-00048-01)	9	360°, 5.0 - 6.0 GHz, omni directional	PMP	12	14	N/A	20	21	N/A
A12015EAS (48-00065-00)	15	120 deg., .9-5.9 GHz, sector flat panel	PMP	6	8	N/A	21	22	N/A
A9016EAS (48-00066-00)	16.6	90 deg., 4.9-5.9 GHz, sector flat panel	PMP	5	7	N/A	21	22	N/A
A6017EAS (48-00067-00)	17.5	62 deg., 4.9-5.9 GHz, sector flat panel	PMP	4	6	N/A	20	22	N/A
A2209MTFD (48-00021-02)	22	9°, 5.15-5.875 GHz, sector, flat panel	PTP	-4	-2	-1	17	19	20

* FCC regulations require the DFS function be permanently enabled at the factory and can not be disabled by the installer/end-user when operating in the 5.25-5.35 GHz range.

7.6.4 4.94 - 4.99 GHz Radio: FCC & IC Antennas

This device has been designed to operate with the antennas listed below, and having a maximum gain of 32 dBi. Antennas not included in this list or having a gain greater than 32 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. The RF output power and selection must be professionally programmed and installed by the manufacturer or a trained professional installer. The following table lists FCC and IC certified antennas:

Table 61: Spec. - FCC & IC Antennas: 4.94 - 4.99 GHz Operation									
Redline Order (Part) Number	Gain (dBi)	Description	App.	GUI Settings (dBm)			Tx Peak Conducted Power (dBm)		
				Channel Size (MHz)			Channel Size (MHz)		
				10	20	40*	10	20	40*
A12015EAS (48-00065-00)	15	120 deg., .9-5.9 GHz, sector flat panel	PMP	18	20	N/A	42	43	N/A
A9016EAS (48-00066-00)	16.6	90 deg., 4.9-5.9 GHz, sector flat panel	PMP	18	20	N/A	43	44	N/A
A6017EAS (48-00067-00)	17.5	62 deg., 4.9-5.9 GHz, sector flat panel	PMP	18	20	N/A	44	45	N/A
A2906PWP (48-00063-00)	29	6 deg., 4.900-5.875 GHz, 2 ft parabolic	PMP	15	19	N/A	53	57	N/A
A3204PWP (48-00064-00)	32	4 deg., 4.900-5.875 GHz, 3 ft parabolic	PMP	13	16	19	54	58	60

* Industry Canada (IC) only -- FCC regulations do <u>not</u> allow use of 40 MHz channels.

7.6.5 3.650 - 3.675 GHz Radio: FCC & IC Antennas

This device has been designed to operate with the antennas listed below, and having a maximum gain of 32 dBi. Antennas not included in this list or having a gain greater than 32 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. The RF output power and selection must be professionally programmed and installed by the manufacturer or a trained professional installer. The following table lists FCC and IC certified antennas:

Table 62: Spec. - Antenna/Tx Power Setting Combinations for FCC									
Redline Order (Part) Number	Gain (dBi)	Description	GUI Setting for Channel (dBm)						
			3.5 MHz	5 MHz	7 MHz	10 MHz	14 MHz	20 MHz	28 MHz
A2014ARF (48-00054-00)	20	13.8 deg., 3.3-3.8 GHz horizontal or vertical polarization	15	17	18	20	21	23	24
A2408MTF (48-00009-00)	24	8 deg., 3.3-3.8 GHz horizontal or vertical polarization	11	13	14	16	17	19	20
A1815MTF (48-00012-00)	18	15 deg., 3.3-3.8 GHz horizontal or vertical polarization	17	19	20	22	23	25	25
A2510PWP (48-00056-00)	25	10 deg., 3.3-3.6 GHz horizontal or vertical polarization	10	12	13	15	16	18	19
A2808PWP	28	8 deg., 3.3-3.8 GHz horizontal or vertical polarization	7	9	10	12	13	15	16
PA1760EAS (48-00050-00)	17	60 deg., 3.3-3.8 GHz vertical polarization only	18	20	21	23	24	25	25
PA1660EASH (48-00051-00)	16	60 deg., 3.3-3.8 GHz horizontal polarization only	19	21	22	24	25	25	25
PA1590EAS (48-00052-00)	15	90 deg., 3.3-3.8 GHz vertical polarization only	20	22	23	25	25	25	25

Table 62: Spec. - Antenna/Tx Power Setting Combinations for FCC									
Redline Order (Part) Number	Gain (dBi)	Description	GUI Setting for Channel (dBm)						
			3.5 MHz	5 MHz	7 MHz	10 MHz	14 MHz	20 MHz	28 MHz
PA1590EASH (48-00053-00)	15	90 deg., 3.3-3.8 GHz horizontal polarization only	20	22	23	25	25	25	25
PA14120EAS (48-00059-00)	14	120 deg., 3.3-3.8 GHz vertical polarization only	20	23	24	25	25	25	25
PA14120EASH (48-00060-00)	14	120 deg., 3.3-3.8 GHz horizontal polarization only	20	23	24	25	25	25	25

7.7   Regional Codes

The regional code is incorporated into the options key. This feature enforces compliance to regional regulatory statutes.

Table 63: Spec. - Regional Identification Codes					
Regions	Band	DFS/CBP Required [1]	Channel Size (MHz)	Channel Step (MHz)	Start - End [2] (MHz)
Region 01					
CALA, Canada, China, Middle-East, US	US 5.8 ISM	No	10	2.5	5730 - 5845
			20	2.5	5735 - 5840
			40	2.5	5745 - 5830
Region 02					
UK, Jersey, Norway	UK 5.8G	Yes [3]	10	2.5	5730 - 5790 5820 - 5845
			20	2.5	5735 - 5785 5825 - 5840
Region 03					
EU	CE 5.4G	Yes [4]	10	20	5500 - 5700
			20	20	5500 - 5700
			40	20	5500 - 5700
Region 04					
US	US 5.4 ICM	Yes [5]	10	2.5	5475 - 5720
			20	2.5	5480 - 5715
			40	2.5	5490 - 5705
Region 05					
Canada	IC 5.4G	Yes [6]	10	2.5	5475 - 5595 5655 - 5720
			20	2.5	5480 - 5590 5660 - 5715
			40	2.5	5490 - 5580 5670 - 5705
Region 06					
India	IN 5.8 G	No	10	2.5	5830 - 5870
			20	2.5	5735 - 5865
			40	2.5	5845 - 5855
Region 07					
Denmark	DE 5.8 G	Yes [8]	10	2.5	5750 - 5870
			20	2.5	5765 - 5865
Region 08					
US	US 4940 - 4990	No	10	2.5	4945 - 4985
			20	2.5	4950 - 4980
	US 5.250 - 5.350	Yes [5]	10	2.5	5260 - 5340
			20	2.5	5265 - 5335

Table 63: Spec. - Regional Identification Codes					
Regions	Band	DFS/CBP Required [1]	Channel Size (MHz)	Channel Step (MHz)	Start - End [2] (MHz)
Region 09					
Canada	IC 4.9 G	No [7]	10	2.5	4945 - 4985
			20	2.5	4950 - 4980
			40	2.5	4960 - 4970
	IC 5.3 G	No [6]	10	2.5	5260 - 5340
			20	2.5	5265 - 5335
			40	2.5	5280 - 5320
Region 10					
Japan	JP 4.9 G	No	10	2.5	4905 - 5085
			20	2.5	4910 - 5080
Region 11					
EU	CE .2 G 5.155 - 5.245	No	10	2.5	5155 - 5245
			20	2.5	5160 - 5240
			40	2.5	5170 - 5230
	CE 5.255 - 5.345	Yes [4]	10	2.5	5255 - 5345
			20	2.5	5260 - 5340
			40	2.5	5270 - 5330
Region 12					
US	US 5.260 - 5.350	Yes [5]	10	2.5	5260 - 5340
			20	2.5	5265 - 5335
			40	2.5	5280 - 5320
Region 13					
Canada	IC 5.3 G	No [6]	10	2.5	5260 - 5340
			20	2.5	5265 - 5335
			40	2.5	5280 - 5320
Region 14					
		No	5	1	3302.5 - 3797.5
			7	1	3303.5 - 3796.5
			10	1	3305 - 3795
			14	1	3307 - 3793
			20	1	3310 - 3790
			28	1	3314 - 3786
Region 15					
US	FCC 3.6 G	Yes [9]	3.5	1	3652 - 3673
			5	1	3653 - 3672
			7	1	3654 - 3671
			10	1	3655 - 3670
			14	1	3657 - 3668
			20	1	3660 - 3665

Notes:

1. Where DFS is required by regional regulations, this function is permanently enabled at the factory and can <u>not</u> be disabled by the installer or end-user.

2. Center frequencies.

3. UK VNS 2107/ EN302 502

4. ETSI EN301893 v1.3.1

5. FCC Part 15

6. IC RSS-210

7. IC RSS-111

8. TKG § 55/EN302 502

9. CBP (Contention Based Protocol) as per FCC regulation CFR Part 90.1321

7.8 Security Keys and Certificates

The certificates and keys required by the cryptographic modules are saved in non-volatile memory. The certificates and keys are checked and loaded at each reboot. User (usr) settings take precedence over factory (factory) settings. The following table lists the methods for using CLI to configure operation with SSH or SSL.

Using SSH

When the software is first upgraded, the SSH 'usr' fields for DSA and RSA are blank. The operator may download a customer-defined RSA and DSA key pair, or use the 'generate' command to create keys locally on the AN-80i. Note that customer-defined key files <u>must</u> conform to the filename format described in Table 66: Security -- User Key and Certificate Files. For example, the DSA key file for AN-80i with MAC address 00-09-02-00-01-02 may be named: dsa_key_00-09-02-00-01-02.pem.

Using SSL (TLS)

When the software is first upgraded, the SSL 'usr' fields are blank. The operator may download a customer-defined RSA and DSA key pair, or use the default (embedded) certificate and private key (identical for all AN-80i units). Note that customer-defined certificate and key files must conform to the filename format described in Table 66: Security -- User Key and Certificate Files. For example, SSL certificate file for AN-80i with MAC address 00-09-02-00-01-02 may be named: ssl_cert_00-09-02-00-01-02.pem.

Table 64: Security -- Keys and Certificates			
Feature	**Parameters**	**Field Upgrade**	**Factory 3.00 Unit (Future)**
SSH: Secure CLI	dsa_key_<mac>.pem rsa_key<mac>.pem.	1. Use 'generate' command to create RSA and DSA key pair locally on AN-80i and save in 'usr' settings. --- or --- 2. Use 'load' command to save customer-defined RSA and DSA key pair in 'usr' settings.	(1) and (2) as in field upgrade plus: 3. Factory supplied RSA and DSA key pair may be pre-loaded into factory settings for out-of-box SSH functionality.
SSL: Secure Web	ssl_cert<mac>.pem ssl_key<mac>.pem	1. Use the default (embedded) certificate and private key. --- or --- 2. Use 'load' command to save customer-defined certificate and private key in 'usr' settings.	(1) and (2) as in field upgrade.

Note: Use the 'minus' character to delimit the MAC address.

7.9 Security Certificate and Key CLI Commands

The following table lists keys and certificates loaded into runtime settings at reboot. Use the CLI command '**show files run**' to display the runtime settings.

Table 65: Security -- Runtime Keys and Certificates	
dsa_key_<mac>.pem	DSA key used for SSH.
rsa_key_<mac>.pem	RSA Key used for SSH.
ssl_cert<mac>.pem	SSL X.509 certificate.
ssl_key<mac>.pem	SSL RSA key.
fact_wacert_<mac>.der*	Factory X.509 authority certificate for the wireless cryptographic module. Can not be changed by the end-user.
fact_wcert_<mac>.der*	Factory X.509 certificate for the wireless cryptographic module.
fact_wkey_<mac>.der*	Factory RSA key for the wireless cryptographic module.
usr_wacert_<mac>.der*	User X.509 authority certificate for the wireless cryptographic module.
usr_wcert_<mac>.der*	User X.509 certificate for the wireless cryptographic module.
usr_wkey_<mac>.der*	User RSA key for the wireless cryptographic module.

*Not used in v3.00 software release.

The following table lists the keys and certificates entered by the operator (administrator). Use the CLI commands **'load'** and '**del**' to add and remove files. Use the CLI command '**generate**' to update the DSA and RSA key files locally on the AN-80i.

Table 66: Security -- User Key and Certificate Files	
dsa_key_<mac>.pem	DSA key used for SSH.
rsa_key_<mac>.pem	RSA Key used for SSH.
ssl_cert<mac>.pem	SSL Certificate.
ssl_key<mac>.pem	SSL Key.
usr_wacert_<mac>.der*	User wireless authority certificate
usr_wcert_<mac>.der*	User wireless certificate.
usr_wkey_<mac>.der*	User wireless key.

*Not used in v3.00 software release.

Use the following CLI commands to view and modify the security certificates and keys.

show files <mode>

   List the key and certificate files.

   <mode>   run - displays keys currently in use.
             usr - displays user-specified keys and certificates (default if mode not specified).

generate sshkey <type>

Create keys of the specified type. The keys are saved in flash and runtime memory.

<type>   Can be dsa or rsa.

load file <server> <name> <mode>

Save specified file in flash memory and runtime settings.

<server>   IP address of the TFTP server. Files must be stored in the TFTP server default download directory.

<name>   File name on server. File name must be one of the following:

dsa_key_<mac>.pem	DSA key used for SSH.
rsa_key_<mac>.pem	RSA Key used for SSH.
ssl_cert_<mac>.pem	SSL Certificate.
ssl_key_<mac>.pem	SSL Key.
usr_wcert_<mac>.der	User wireless certificate.
usr_wkey_<mac>.der	User wireless key.
usr_wacert_<mac>.der	User wireless authority certificate

The <mac> portion is the MAC address of the board.

For example: dsa_key_00-09-02-00-01-02.pem

<mode>   Can be 'usr' or 'factory'. Defaults to 'usr' if mode is not specified.

del file <name> <mode>

Remove a file from flash and runtime memory.

<name>   File name on server. File name must be one of the following:

dsa_key_<mac>.pem	DSA key used for SSH.
rsa_key_<mac>.pem	RSA Key used for SSH.
ssl_cert_<mac>.pem	SSL Certificate.
ssl_key_<mac>.pem	SSL Key.
usr_wcert_<mac>.der*	User wireless certificate.
usr_wkey_<mac>.der*	User wireless key.
usr_wacert_<mac>.der*	User wireless authority certificate

The <mac> portion is the MAC address of the board.

For example: dsa_key_00-09-02-00-01-02.pem

<mode>   Can be 'usr' or 'factory'. Defaults to 'usr' if mode is not specified.

*Not used in v3.00 software release.

7.10 Glossary Of Terms

	Table 67: Spec. - Glossary
Term	**Definition**
Antenna Gain	The measure of antenna performance relative to a theoretical antenna called an isotropic antenna.
ARQ	Automatic Repeat Request. This is the protocol used over the air for error correction.
ATPC	Automatic Transmission Power Control. The sector controller-end system automatically adjusts the RF transmit level of both systems to optimize performance of the link.
Beamwidth	The angle of signal coverage provided by an antenna.
BFW	Broadband Fixed Wireless
Bps	Bits Per Second. Unit of measurement for the rate at which data is transmitted.
BPSK	Binary Phase Shift Keying
Channel	A communications path wide enough to permit a single RF transmission.
CIR	Committed information rate
dB	A ratio expressed in decibels.
dBi	A ratio, measured in decibels, of the effective gain of an antenna compared to an isotropic antenna.
dBm	Decibels above a milliwatt.
DFS	Dynamic Frequency Selection (DFS) can detect interference from other devices using the same frequency (especially radar) and automatically take a pre-selected action such as disable transmission or use alternative frequency.
DHCP	Dynamic Host Configuration Protocol. A DHCP server automatically issues IP addresses within a specified range to devices on a network.
Directional Antenna	An antenna that concentrates transmission power into one direction.
Encryption	For the purposes of privacy, the transformation of data into an unreadable format until reformatted with a decryption key.
Ethernet	A LAN architecture using a bus or star topology.
FD	Full Duplex. Refers to the transmission of data in two directions simultaneously.
FWA	Fixed Wireless Access
Gain	The ratio of the output amplitude of a signal to the input amplitude of a signal. Typically expressed in decibels (dB).
Gateway	A network point that acts as an entrance to another network.
GHz	Gigahertz. 1,000,000,000 Hz, or 1,000 MHz
GUI	Graphical User Interface
IP	Internet Protocol. See TCP/IP.
Isotropic	A theoretic construct of an antenna that radiates its signal 360 degrees both vertically and horizontally—a perfect sphere. Generally used as a reference.
IXC	Inter-exchange Carrier. A long-distance phone company.
LEC	Local Exchange Carriers. The traditional local wired phone company.
LED	Light Emitting Diode
LOS	Line Of Sight. A clear direct path between two antennas, with no obstructions within the first Fresnel zone.
MAC	Media Access Control. A unique number assigned to a network device.

Table 67: Spec. - Glossary	
Term	**Definition**
	Corresponds to ISO Network Model Layer 2 data link layer.
MHz	Megahertz. 1,000,000 Hz
Modem	MOdulator/DEModulator. A hardware device that converts digital data into analog and vice versa.
Modulation	Any of several techniques for combining user information with a transmitter carrier signal.
Multipath	The radio echoes created as a radio signal bounces off objects.
NVRAM	Non-volatile RAM. System parameters are stored in NVRAM. This data is not affected by powering off the system.
NLOS	Non Line Of Sight. Completely obstructed path between two antennas.
OFDM	Orthogonal Frequency Division Multiplexing. OFDM spreads data to be transmitted over a large number of orthogonal carriers.
OLOS	Optical Line Of Sight. A clear direct path between two antennas, with obstructions within the first Fresnel zone.
Packet	A bundle of data organized in a specific way for transmission. The three principal elements of a packet include the header, the text, and the trailer (error detection and correction bits).
PHY	Physical Layer. Provides for the transmission of data through a communications channel by defining the electrical, mechanical, and procedural specifications.
PIR	Peak Information Rate
PMP	Point to Multipoint
PTP	Point to Point
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
Receiver Sensitivity	A measurement of the weakest signal a receiver can receive and still correctly translate it into data.
RF	Radio Frequency
RSSI	Received Signal Strength Indication
Rx	Receiver
S/N	Signal to Noise Ratio
SINADR	Signal to noise and distortion ratio.
SSL	Secure Sockets Layer, a communications protocol, superceded by Transport Layer Security (TLS).
TCP/IP	Transmission Control Protocol/Internet Protocol The standard set of protocols used by the Internet for transferring information between computers, handsets, and other devices.
TFTP	Trivial File Transfer Protocol
TLS	Transport Layer Security (TLS) and its predecessor, Secure Sockets Layer (SSL), are cryptographic protocols that provide secure communications on the Internet for web browsing, e-mail, Internet faxing, instant messaging and other data transfers.
Tx	Transmitter
UBR	Uncoded Burst Rate
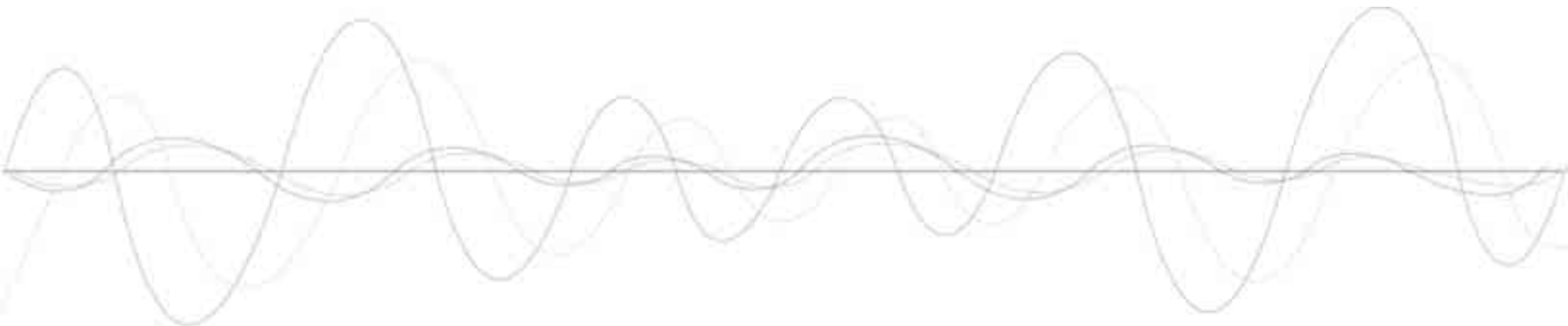
302 Town Centre ● Suite 100 ● Markham, Ontario ● Canada ● L3R 0E8

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