Dataradio Paragon4
Data Base Station
UHF, 700, and 800 MHz with
Crescend Power Amplifier

User Manual
P/N 001-2019-500
Revision 0
June 2010

1. PREFACE

1.1 Copyright Notice

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This manual covers the operation of the CalAmp Dataradio Paragon4 data base station. Specifications described are typical only and are subject to normal manufacturing and service tolerances.

CalAmp reserves the right to modify the equipment, its specifications or this manual without prior notice, in the interest of improving performance, reliability, or servicing. At the time of publication all data is correct for the operation of the equipment at the voltage and/or temperature referred to. Performance data indicates typical values related to the particular product.

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Products offered may contain software which is proprietary to CalAmp. The offer or supply of these products and services does not include or infer any transfer of ownership.

1.2 User Manual Statement

Every effort is taken to provide accurate, timely product information in this user manual.

Product updates may result in differences between the information provided herein and the product shipped. The information in this document is subject to change without notice.

www.CalAmp.com

For additional information, please visit **http://www.calamp.com**

2. Definitions

Access Point	Communication hub for users to connect to a wired LAN. APs are important for providing heightened wireless security.
ADB	Agile Dual-Band - GeminiG3 radiomodem model that allows 700/800MHz automatic band switching capability during roaming.
AES	Advanced Encryption Standard (AES) - uses 128-bit encryption to secure data.
Airlink	Physical radio frequency connections used for communications between units.
ARP	Address Resolution Protocol – Maps Internet address to physical address.
AAVL	Autonomous Automatic Vehicle Location. Optional feature that involves using GPS (Global Positioning System) signals from the mobile unit by the Host PC.
Backbone	The part of a network that connects most of the systems and networks together, and handles the most data.
Bandwidth	The transmission capacity of a given device or network.
Base	Designates products used as base stations in VIS systems. They currently include the Paragon family of products up to the Paragon4 radiomodems.
Browser	An application program that provides a way to look at and interact with all the information on the World Wide Web.
BSC	Base Station Controller - An async controller-modem designed for the radio base station in mobile systems. A component of Paragon4 radiomodem base stations.
COM Port	RS-232 serial communications ports of the Paragon4 wireless radiomodem.
Cycle Mark	Signal transmitted on an E-DBA network that keeps the network synchronized.
Default Gateway	A device that forwards Internet traffic from your local area network.
DHCP	Dynamic Host Configuration Protocol - A networking protocol that allows administrators to assign temporary IP addresses to network computers by "leasing" an IP address to a user for a limited amount of time, instead of assigning permanent IP addresses.
DNS	Domain Name Server - The on-line distributed database system used to map human-readable machine names into IP addresses.
Domain	A specific name for a network of computers.
Dynamic IP Addr	A temporary IP address assigned by a DHCP server.
E-DBA	Enhanced Dynamic Bandwidth Allocation – Dataradio proprietary protocol that schedules all inbound and outbound Airlink traffic to minimize contention.
Ethernet	Ethernet is a frame-based computer networking technology for local area networks (LANs). It defines wiring and signaling for the physical layer, and frame formats and protocols for the media access control (MAC)/data link layer of the OSI model. Ethernet is mostly standardized as IEEEs 802.3.
Feature Key	Method used to implement customer's option(s) selected at the time of radiomodem purchase (*factory-installation*) or as add-on (*field-installation*).
Firewall	A set of related programs located at a network gateway server that protects the resources of a network from users from other networks.
Firmware	The programming code that runs a networking device.
Fragmentation	Breaking a packet into smaller units when transmitting over a network medium that cannot support the original size of the packet.
FTP	File Transfer Protocol - A protocol used to transfer files over a TCP/IP network.

Gateway	A device that interconnects two or more networks with different, incompatible communications protocols and translates among them.
GeminiG3	Third generation of Gemini^{PD} VIS products. High specs dual DSP mobile radiomodem with Data-radio Parallel Decode™ technology
HDX	Half Duplex. Data transmission that can occur in two directions over a single line, using separate Tx and Rx frequencies, but only one direction at a time.
HTTP	HyperText Transport Protocol - The communications protocol used to connect to servers on the World Wide Web.
IPCONFIG	A Windows 2000 and XP utility that displays the IP address for a particular networking device.
MAC ADDRESS	Media Access Control - The unique address that a manufacturer assigns to each networking device.
MIB	Management Information Base (MIB)-a logical, hierarchically organized database of network management information. Used in SNMP.
NAT	Network Address Translation - NAT technology translates IP addresses of a local area network to a different IP address for the Internet.
Network	A series of computers or devices connected for the purpose of data sharing, storage, and/or transmission between users.
Network speed	This is the *bit rate* on the RF link between units.
Node	A network junction or connection point, typically a computer or work station.
OID	An object identifier or OID is an identifier used to name an object and is the numerical equivalent of a path. In SNMP, an OID consists of numbers separated by decimal points. Structurally, an OID consists of a node in a hierarchically assigned namespace.
OIP	Optimized IP – Compresses TCP and UDP headers, and filters unnecessary acknowledgments. This makes the most use of the available bandwidth.
OTA	Over-The-Air - Standard for the transmission and reception of application-related information in a wireless communications system
Palette	Synchronization patterns used to identify the speed and coding of packets transmitted over-the-air in E-DBA.
Paragon4	IP-based data radio base station used in mobile networks and designed specifically to fit the needs of vehicular applications. Runs up to 128 kb/s
Parallel Decode	Technology featuring dual receivers for added data decode sensitivity in multi-path and fading environments. *(United States Patent No: 6,853,694 B1)*
PHY	A PHY chip (called PHYceiver) provides interface to the Ethernet transmission medium. Its purpose is digital access of the modulated link (usually used together with an MII-chip). *The PHY defines data rates and transmission method parameters.*
PDU	Protocol Data Unit - A PDU is a message of a given protocol comprising payload and protocol-specific control information, typically contained in a header. PDUs pass over the protocol interfaces that exist between the layers of protocols.
Ping	Packet INternet Groper - An Internet utility used to determine whether a particular IP address is online.
PLC	Programmable Logic Controller. An user-provided intelligent device that can make decisions, gather and report information, and control other devices.
Roaming	Movement of a wireless node (GeminiG3 radiomodems) amongst Multiple Access Points (Paragon4). Paragon4 radiomodems support seamless roaming.
Router	A networking device that connects multiple networks together.

RS-232	Industry–standard interface for data transfer.
Smart Combining	Digital processing method used to combine "Spatial Diversity" signals to optimize performance. (See Parallel Decode)
SNMP	Simple Network Management Protocol - Provides a means to monitor and control network devices, and to manage configurations, statistics collection, performance, and security.
Spatial Diversity	Composite information from independent diversity branches using antennas spaced apart is used with "Smart Combining" to minimize fading and other undesirable effects of multipath propagation. (See Parallel Decode)
SRRCnFSK	Square Root Raised Cosine (n = level) Frequency Shift Keying. Type of frequency modulation of data signals performed by the Paragon4 radiomodem.
Static IP Address	A fixed address assigned to a computer or device that is connected to a network.
Static Routing	Forwarding data in a network via a fixed path.
Subnet Mask	A bit mask used to select the bits from an IP address that correspond to the subnet. Each mask is 32 bits long, with one bits in the portion that identifies a network and zero bits in the portion that identifies a host.
Switch (Ethernet)	Computer-networking device that allows sharing a limited number of ports to connect computing devices to host computers. Replaces network hubs *(layer1),* switches *(layer2),* routers *(layer3).*
Sync	Data transmitted on a wireless network that keeps the network synchronized.
TCP/IP	Transmission Control Protocol/Internet Protocol - A transport *(layer4)* protocol for transmitting data that requires acknowledgement from the recipient of data sent. Handles retries and flow control.
Telnet	Network (layer5) protocol used on the Internet or on LAN connections.
TFTP	Trivial File Transfer Protocol - A version of the TCP/IP FTP protocol that has no directory or password capability.
Topology	The physical layout of a network.
Transparent	A transparent unit transmits all data without regard to special characters, etc.
UDP	User Datagram Protocol - A transport *(layer4)* protocol for transmitting data that does not require acknowledgement from the recipient of the data that is sent.
Upgrade	To replace existing software or firmware with a newer version.
URL	Universal Resource Locator - The address of a file located on the Internet.
VIS	Vehicular Information Solutions. Dataradio's name for a series of products specially designed for mobile data.
WLAN	Wireless Local Area Network - A group of computers and associated devices that communicate with each other wirelessly.

3. PRODUCT OVERVIEW

This document provides information required for the setting up, operation, testing and trouble-shooting of the Dataradio® Paragon4™ radio-modem base station.

3.1 Intended Audience

This document is intended for engineering, installation, and maintenance personnel.

3.2 General Description

The Paragon4 radio base station is a factory-integrated industrial-grade IP-based data product used in mobile networks and is designed specifically to fit the needs of vehicular applications. It features dual receivers for added data decode sensitivity in multi-path and fading environments.

When used with Dataradio's state-of-the-art GeminiG3 mobile IP data solution, the system delivers unequaled high-speed data performance and unmatched effective throughput.

All Paragon4 models are supplied in a standard 19-inch wide rackmount. The Paragon4 full-duplex radio-modem chassis assembly includes:

- A second generation high-speed Dataradio "Base Station Controller" module (BSC2) that uses an open architecture that simplifies the implementation process. The BSC2 module comes equipped with a built-in IP router with dual Ethernet 10/100 BaseT interfaces.
- Option for internally/externally generated high-stability (+/-0.1ppm) 10MHz reference source, factory installed.
- Dual, independently synthesized Receiver radio module.
- High-performance synthesized 0.2W Exciter radio module.

For all Paragon4 radio modem units:

- One Power Amplifier (PA) module is required for the regular usage.
- Duplexer and backup power units are custom furnished items.
- Wire line modem(s) are optional items.
- Laptop PC and its application software are user-supplied items.
- Optional Router – Adding a second router anywhere within a network is required to make it fault tolerant.

3.2.1 Features

- Parallel Decode™ technology featuring dual receivers for added decode sensitivity in multi-path and fading environments.
- Fully IP-based product models, using an Optimized IP layer that reduces IP overhead for the RF link
- Sophisticated dual DSP-based modem design provides added system performance, fewer retries and more effective throughput.
- Full duplex mode of operation
- Base Station with an RF Power Amplifier. The Power Amplifier is considered a stand-alone module.
- On-air data speeds and modulation types supported *(dependent on "Feature Key" selected[1])*:

Table 1 - On-air data speeds and modulation

Modulation type	Channel Type						
	UHF		700 MHz			800 MHZ	
	25 kHz	12.5 kHz	50 kHz	25 kHz	12.5 kHz	25 kHz	NPSPAC
SRC16FSK	64 kb/s	32 kb/s	128 kb/s	64 kb/s	32kb/s	64 kb/s	32kb/s
SRC8FSK	48 kb/s 43.2 kb/s	24 kb/s	96kb/s	48kb/s 43.2kb/s	24kb/s	48 kb/s 43.2 kb/s	24kb/s
SRC4FSK	32 kb/s	16 kb/s	64kb/s	32 kb/s	16kb/s	32 kb/s	16kb/s

- Uses Dataradio's Next generation high-efficiency Enhanced-DBA (E-DBA) over-the-air protocol
- Over-the-air compatible with GeminiG3 mobile products
- Out-of-band signaling enables transmission of GPS reports with no effect on system performance.
- Flash programmable firmware

3.2.2   Configuration

Paragon4 units are factory-configured based on each customer's individual system requirements. Network-specific installation and/or operating instructions should be prepared in conjunction with CalAmp System Engineering department, which also handles field deployment.

Instructions and examples given in this manual are based on Paragon4 operating software version current at the time of writing this document and may not apply to earlier or later software versions. Screen captures used throughout this document may vary from actual screens. Configuration changes or upgrades are web-based.

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[1] Method used to implement customer's option(s) selected at the time of radiomodem purchase *(factory-installation)* or as add-on *(field-installation)*.

3.3 Service and Support

3.3.1 Product, Warranty, RMA and Contact Information

CalAmp guarantees that every DataradioParagon4 base station will be free from physical defects in material and workmanship for one (1) year from the date of purchase when used within the limits set forth in the Specifications section of this manual. Extended warranty plans are available.

If the product proves defective during the warranty period, contact CalAmp Customer Service to obtain a Return Material Authorization (RMA).

3.3.1.1 RMA Request

Contact Customer Service:
CalAmp Wireless Networks
299 Johnson Avenue, Suite 110
Waseca, MN 59093-USA
phone: (1) 507.833.8819
fax: (1) 507.833.6748

BE SURE TO HAVE THE EQUIPMENT MODEL AND SERIAL NUMBER, AND BILLING AND SHIPPING ADDRESSES ON HAND WHEN CALLING.

When returning a product, mark the RMA clearly on the outside of the package. Include a complete description of the problem and the name and telephone number of a contact person. RETURN REQUESTS WILL NOT BE PROCESSED WITHOUT THIS INFORMATION.

For units in warranty, customers are responsible for shipping charges to CalAmp . For units returned out of warranty, customers are responsible for all shipping charges. Return shipping instructions are the responsibility of the customer.

3.3.2 Product Documentation

CalAmp reserves the right to update its products, software, or documentation without obligation to notify any individual or entity. Product updates may result in differences between the information provided in this manual and the product shipped. For the most current product documentation, visit www.calamp.com for spec sheets.

3.3.3 Technical Support

Technical support hours: Monday to Friday 9:00 AM to 5:00 PM, Eastern Time

CalAmp Wireless Networks
6160 Peachtree Dunwoody RD., suite C-200
Atlanta, Georgia 3032

phone: (1) 770.392.0002
fax: (1) 770.392.9199
Email address: PSMGsupport@calamp.com

3.4   Packaging

Each Paragon4 radio-modem base station – UHF, 700, or 800MHz – normally leaves the factory packaged as follows:

- A Dataradio base station "Radio-modem assembly".

- A Crescend 70W (for 700 and 800 MHz) or 100W (for UHF) rack-mount power amplifier module.

- An ICT 13.8VDC 34A AC/DC rack-mount power supply, if ordered that way.

- One six-foot 120VAC power cord (NEMA 5-15p plug to IEC 60320-C19 receptacle) for the AC/DC power supply.

- Two DC power cables to connect the radio-modem assembly and the power amplifier module to the DC power supply.

- Coax cable (24 inch) to connect the Exciter module to the power amplifier.

Frequently, Paragon4 product components are field-assembled prior to customer delivery.
The cabinetry may then be supplied in one of several custom rack-mount configurations that may also include fan, backhaul modems, duplexer/filters/combiners, and ancillary equipment.
If damage has occurred to the equipment during shipment, file a claim with the carrier immediately.

4. Installation
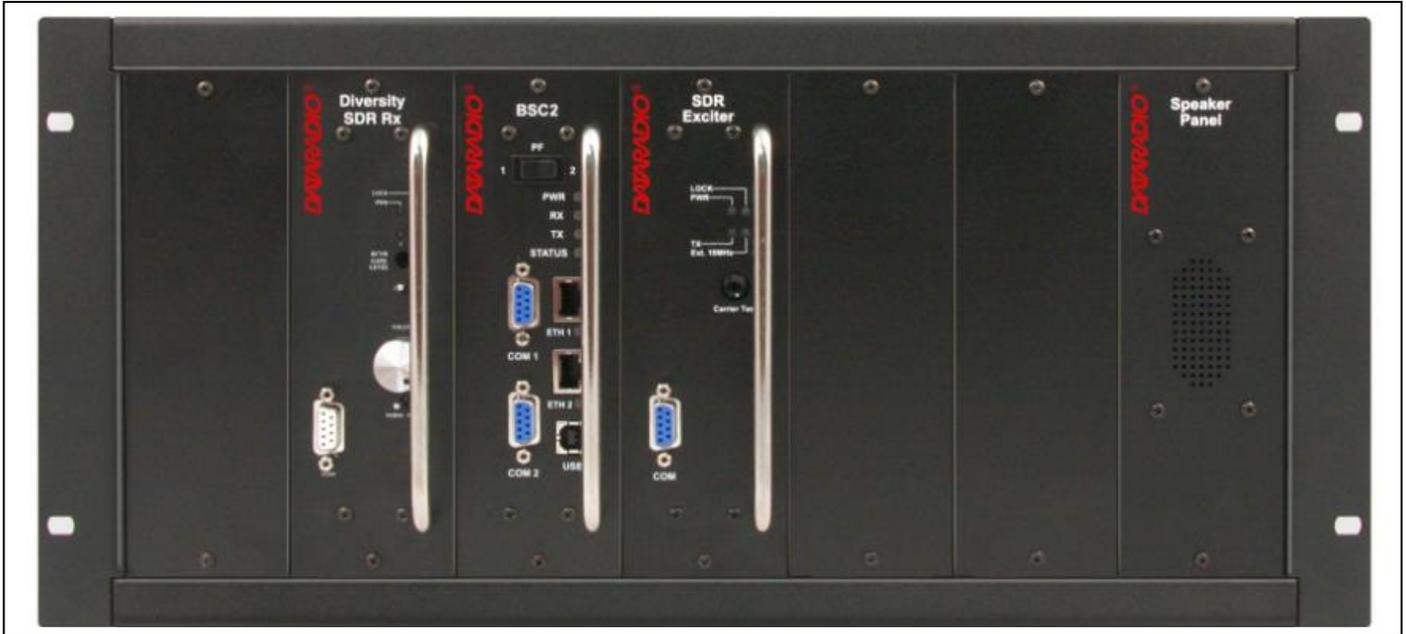
Figure 1 - Front view "Radio Assembly"

4.1   Overview

The cabinet and rack-mount housing the Paragon4's radio-modem and Power Amplifier is generally installed in a sheltered facility. Occasionally located adjacent to the nerve center of the user's network, it is often located near tower sites or at remote locations where it operates unattended.

Furnishings needed include power, cabling, and installation of antenna, landline or microwave modem, and host PC or portable computer. Details of these are outside the scope of this manual. This manual covers the radio-modem assembly. The power amplifier has its own user manual that is incorporated by reference at the moment of the order.

4.2   Location

Be sure to place the Paragon4 unit in such a way that:

- The LEDs can be seen (as an aid in troubleshooting)

- Access to the antenna connector and to the back connectors is possible without removing the unit

- Sufficient air may flow around the unit to provide adequate cooling.

Figure 2 - Typical rackmount installation of radio modem and Crescend PA
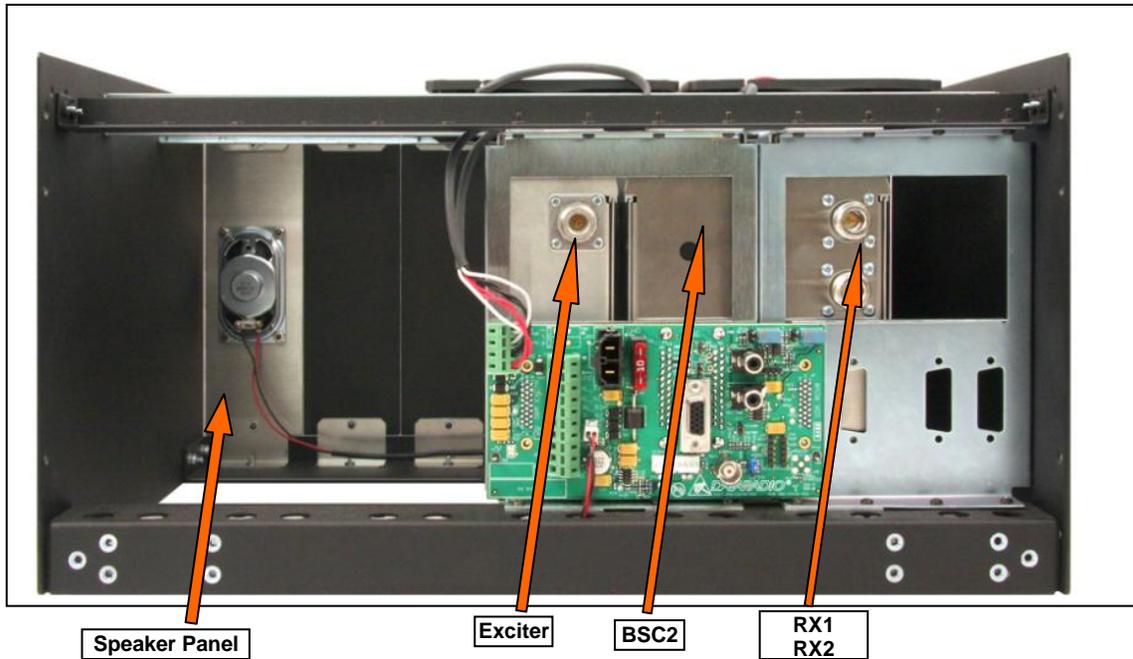
4.3 Rear Views

Figure 3 - Paragon4 unit rear view

Labels in Figure 3: Speaker Panel, Exciter, BSC2, RX1 RX2

Figure 4 - Backplane

Labels in Figure 4: 10-amp fuse, Access port J9, J18, J19
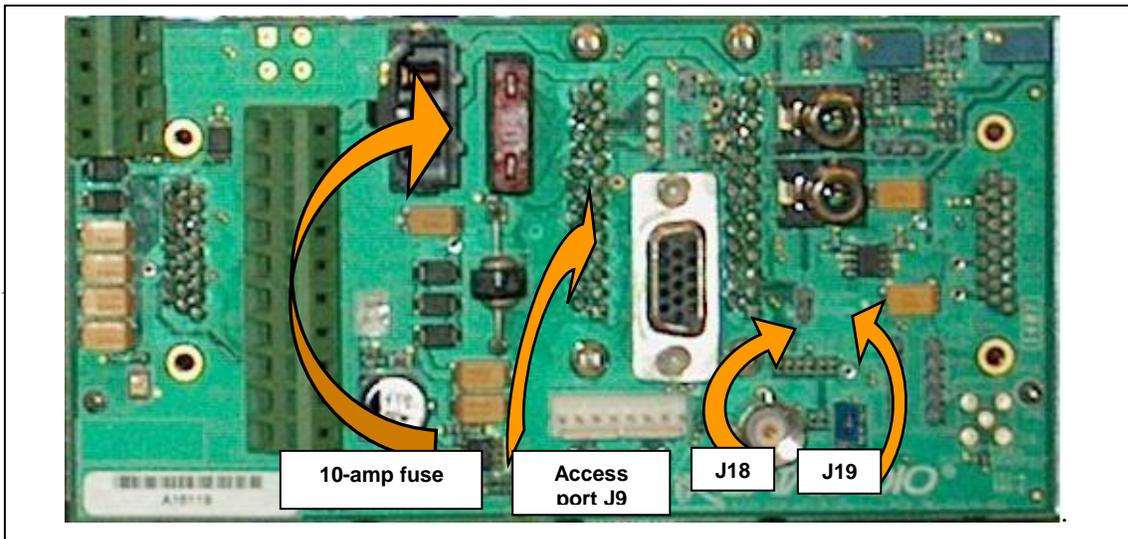
Table 2 - Test Points

Backplane Test Points Rx/Tx			
Test		**J9 Access port**	**Alternate Pinout**
Ground	GND	**Pin 14**	**J18, J19 – Pin 3**
SINAD & Distortion	**RX1 -Differential**	**1P-Pin3; 1N-Pin8**	**J18- Pins 1,2**
SINAD & Distortion	**RX2-Differential**	**2P-Pin4; 2N-Pin9**	**J19 – Pins 1,2**
RSSI	**RSSI 1 -Differential**	**1P-Pin1; 1N-Pin6**	**J18 – Pins 4,5**
RSSI	**RSSI 2-Differential**	**2P-Pin2; 2N-Pin7**	**J19 – Pins 4,5**
TX Audio	**TXAP-Differential (+ve side only)**	**1P-Pin 5**	
Key Transmitter	**/TXKEY-single ended**	**Pin 15**	

4.4   Electrical Configurations

Standard 120/240 VAC electrical power is required. It should be capable of providing at least 6A (120V) or 4A(240V) to power the Paragon4 base station.

4.4.1 Standard Power Supply Configurations

The standard configuration for supplying the required +13.8 VDC to the Paragon4 base station and the Crescend Power Amplifier is shown in the two figures below, a simple block diagram and a virtual rack-mount installation. The base station and the power amplifier module receive 13.8 VDC power inputs from the ICT22012-70N power supply module powered at 120 VAC.
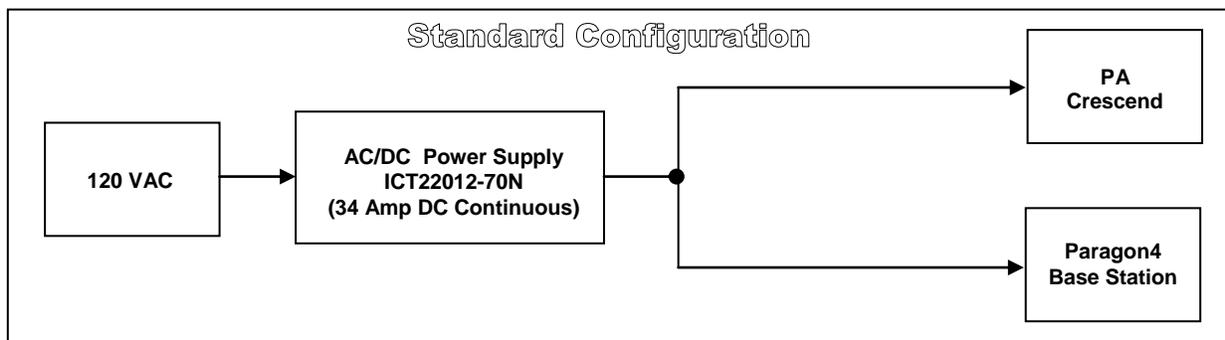
Figure 5 – Simple AC-to-DC power supply configurations: Block Diagram
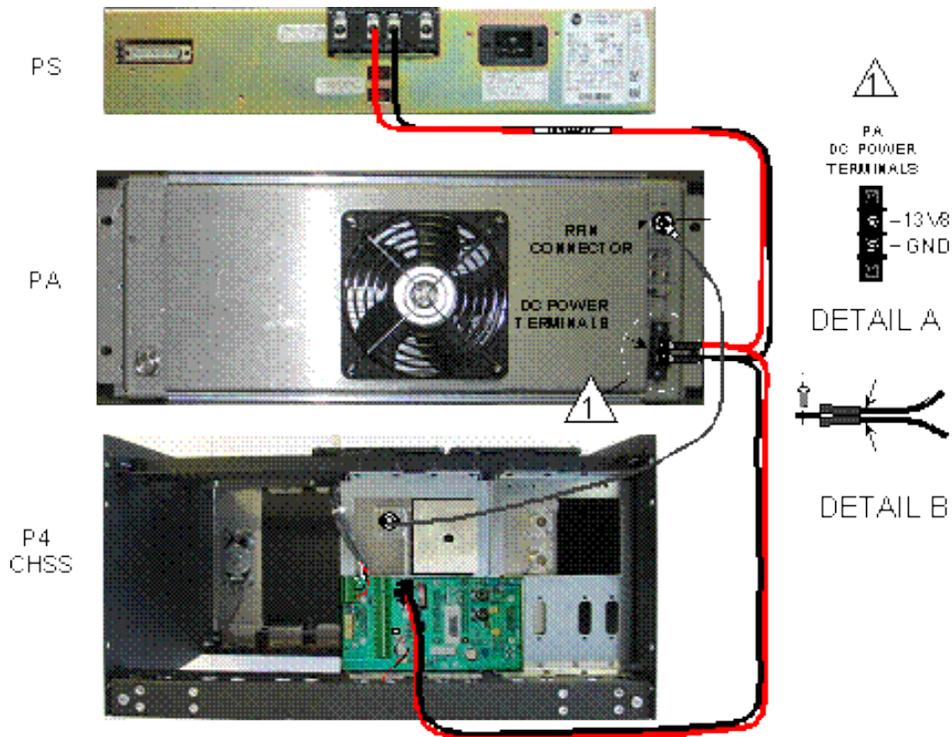
Figure 6 – Simple AC-to-DC power supply configurations: Virtual rack-mount installation

Normally used at room ambient temperatures, the ICT22012-70N can operate within its specifications over a range of -30 to +52 °C. Although it is a high efficiency switched mode power supply, a considerable amount of heat is generated during normal operation. While in use, ensure that an adequate flow of cooling air is able to circulate around the power supply, and that the air intake vents on the sides of the unit are not inadvertently covered.

> *Caution:*
>
> > *Do not operate this unit in a completely enclosed cabinet.*

4.4.2 ICT22012-70N DC Power Supply

The rack-mounted ICT 22012-70N power system components used consist of a backplane and two (-70 model) modules. Each provides 450 watts of continuous DC power. The system is designed with active sharing technology to distribute the load current among the modules. Each module is equipped with a high power Schottky OR-ing diode for true redundancy. If a module failure occurs, the other module(s) will continue to supply power.

Each unit is protected in several ways:

- Fuse against over current on the AC input.
- Current Limit and Foldback – Prevents the load from drawing current above the maximum allowed value.
- Sudden energy surges on each module – Thermistor against inrush current.

Prior to powering up, ensure that **both** voltage selection switches *(located on the back)* are set to the proper voltage for your operation. *Available settings are 120 or 220 volts.* The ICT 22012-70N metal enclosure is internally connected to earth ground via its individual, rear-connected, 120VAC (NEMA 5-15p plug to IEC 60320-C19 receptacle) power cord. Therefore, the system must be operated from an outlet with a proper grounding connection.

> *Cautions:*
>
> > *It is important that the side ventilation holes are unobstructed at all times. Do not operate this unit in a completely enclosed cabinet.*
> >
> > *High current leakage, use only the cord supplied with this equipment for power.*
> >
> > *If accessing modules, power at both the switch and the AC inlet must be disconnected to ensure operator safety.*

4.4.2.1   Fuse Replacement

To access the fuses, the ICT unit cover must be removed. Ensure that power (cable, battery or solar source) is removed. Remove eight side screws and washers (Figure 7). Slide the cover off. Referring to the illustrations in Figure 8, locate the two 32V 35A fuses and replace as needed. Once completed, reverse the above steps to re-install cover. Only finger tighten the eight screws.

Figure 7 - Screw removal detail

> *Caution:*
>
> > *To protect against fire or electrical shock, replace with only the same type and ratings of fuse.*

Figure 8 - Fuses Location

4.4.2.2 Power Supply Connections and Torque Settings

Warning:

> *Securing the DC Power Supply cable into the DC connector to provide a good electrical connection is essential. Over time, the wires tend to compress in the DC connector resulting in an increasingly poorer connection. Consequently, as high current is drawn, the connector heats up increasing the resistance thereby causing still more heat until the connector eventually burns up.*

Although screws securing DC cables to the Power Supply terminals are tightened to the torque settings given below prior to new system delivery, they must be re-tightened as part of the commissioning process and re-tightening is also part of the regular maintenance schedule.

Prior to replacing a Power Supply module into an existing system, inspect the cable and re-terminate the wires if the strands have previously been twisted together or show any sign of damage.

Cut the wire at the end of the insulation and then strip approximately 11mm (.43 inch) of insulation off the cable. DO NOT TWIST THE WIRE STRANDS. Insert the cable into the screw terminal and tighten the screw to secure the cable as per the torque settings given below.

Torque Settings:

The manufacturer recommends torque setting all power supply terminal screws to a minimum of:

- For the ICT 22012-70N Power Supply; 35 in-lb

  Note: CalAmp uses a Sturtevant Richmont 29-piece adjustable torque screwdriver model CAL36/4K.

  After tightening, pull on the cable to check the cable is secured tightly into the screw terminal.

4.4.3 Crescend Power Amplifier

The Crescend power amplifier receives its +13.8VDC power from the ICT DC power supply through a 10AWG DC power cable. In the standard configuration shown in Figure 3, there is no in-line fuse between the power supply and power amplifier, all the short-cct and foldback protection is done by the ICT power supply. In this configuration, the voltage drop through the power cable is minimize. Nonetheless, if required a DC power cable with an in-line fuse can be ordered from the factory.

The power amplifier is maintenance free, only LED indications are present on the front panel. The location of the DC power terminal block, the "RF In" as well as the "RF Out" N-type female connectors are all on the back side of the power amplifier module.

For the 700 and 800MHz models, the power output is normally set to 70W and for the UHF model, it is set to 100W *(or lower depending on the work order)* at time of manufacture or via RMA. However, to allow for field adjustment of the output power to meet the ERP granted by the transmission site license, a potentiometer is accessible via a small round opening on the underside of the power amplifier. Adjust using a small tuning screwdriver. *CalAmp does not recommend adjusting below 35 watts for the 700 and 800MHz models and 50W for the UHF model.*

As per Industry Canada Radio Standard Specification #131, paragraph 5.3:

> "For the 700 and 800MHz models, the amplifier module delivers 70W with 28dB gain at 100mW input over a large nominal bandwidth (500-1000MHz) designed platform. For the UHF model, the amplifier module delivers 100W with 30dB gain at 100mW input over a large nominal bandwidth (200-800MHz) designed platform The manufacturer's rated output power and power tolerance of this equipment is for single carrier operation in the specified frequency range. It should not be used for multiple carrier operations or outside its specified range."

Although a rear-mounted fan brings in air from the back and blows it across the heatsink fins, a considerable amount of heat is generated during normal operation. The amplifier must have a minimum of 3 inches of open space behind the rear fan to allow adequate ventilation. The air inlets and outlets should be checked every 30 days and cleaned if necessary. If dust and dirt are allowed to accumulate, the cooling efficiency will be diminished. Using either compressed air or a brush with soft bristles, loosen and remove accumulated dust and dirt from the air inlet panels.

Caution:

Do not operate this unit in a completely enclosed cabinet.

Crescend Terminal Block Torque Settings:

Although the manufacturer does not specify definite torque settings for its terminal block screws, the following values can be used:

- 8 In-lb (9 maximum).

4.4.4 Paragon4 Power and Ground Connections

4.4.4.1   Power Connections

The Paragon4 base station's modem-controller, radio (dual-RX & TX) and speaker panel modules receive their +13.8VDC power via the backplane PCB. A 12AWG DC power cable provides power to the backplane PCB at the heavy duty power connector J20.

4.4.4.2   Ground Connections

The Paragon4 base station chassis requires a secure ground connection. A grounding 8-32 threaded throughole pemstud fitted with a 8-32 screw, lockwasher and nut is provided on the bottom- rear of the chassis, behind the speaker panel.

- Install a 3-4ft 10AWG grounding wire, crimped on both sides with terminal rings. Place one side over the 8-32 screw on the non-exposed chassis side and firmly tighten with the lockwasher and nut.
- Place the other side on the rear side the power supply metal case, near the 25-pin connector. Use a ½ in 4-40 screw with lockwasher to secure the terminal ring to the metal case.
- If a –DC rail (0V) is installed as part of the system, the grounding lead may alternatively be fitted to the rail terminal.

Caution:

Improper grounding between power supply case and rack frame may result in harmful voltage potentials and/or miscellaneous power supply switching noise problems in both receivers and transmitter.

4.4.5 Backplane Fuses

Blade fuses (Maxi-Fuse) are used on the Radio assembly backplane:

Fuse Type	Dimensions – Inch (mm)		
	A	B	C
Maxi-Fuse	1.15 (29.21)	1.35 (34.29)	.35 (8.89)

Fuse #	F1
Values	10A
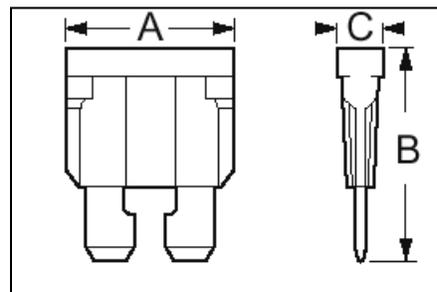
Figure 9 - Maxi-Fuse

4.5 Antenna

4.5.1 Overview

The Paragon4 unit commonly uses three antennas (one transmit and two receive) unless a duplexer is used with one of the receive antennas; then only two antennas would be needed. If the 10MHz Disciplined Clock option is sought, there is another GPS antenna in addition to the three already mentioned. They should be mounted according to any guidelines supplied with the antennas. For antennas placement and spacing, consult System Engineering.

 RF exposure warning:

To comply with IC, the antenna(s) must be installed to provide a seperation distance from nearby persons as determined by the following formula or 20 cm whichever results in the greatest separation distance. R > (PxG/6.5)^0.5 cm. P=transmitter power in milli-watts, G=numeric antenna gain."

4.5.2 Cabling and Connection

1- Route good quality 50-ohm double-shielded coaxial cable(s) (e.g. RG-214 or Heliax) from the selected antenna position(s) to the Paragon4 Radio assembly.

2- Referring to Figure 3 for locating modules, terminate the RX-1 and RX-2 cable-ends at their respective rear position of the receiver module with N-type connectors.

3- Similarly, terminate the TX cable-end at the rear position of the Power Amp's module with an N-type connector.

Caution:

When terminating RF cables use brand-name crimping tools (such as AMP, Jensen, Crimp-Master, etc…) of the correct size for the cable and type of connector used.

Common pliers are NOT acceptable.

4.6 Completing the physical Installation

Paragon4 products are factory-configured to user's requirements and are shipped ready to run.

After new installations:

- Re-check that all connections are secure on the radio-modem assemblies (antennas, PC, power cords etc.)
- Check that fuses are inserted.
- Turn power supply ON.

You are now ready to check for normal operation (as per paragraph 4.7) and to run the Dataradio web interface (described in section 6) for testing or trouble-shooting.

4.7 Checking out Normal Operation

1- Check that power is applied.

2- Check Radio assembly lights for proper operation as per section 5.1

3- Check for proper operation of the BSC2 LEDs.

4- Using the web interface program and an in-line wattmeter, check forward & reverse power to confirm main antenna installation.

5- Using the web interface, check the RF Data Link with a mobile that can be heard.

If user application and mobiles are available, test the installation by going through a normal sequence of transmitting and receiving messages.

5. Operating Description

5.1 Radio Assembly

The Radio assembly component of each Paragon4 product – UHF, 700 or 800 MHz – is made up of a high performance synthesized radio base station designed for single channel operation. The Radio Assembly's modules are commonly installed in a standard, 19-inch wide rack frame.

The complement of modules is:

- 1 x Receiver module
- 1 x Exciter module
- 1 x BSC2 (controller-modem)
- 1 x 70 or 100-Watt Power Amplifier 19" rack-mount assembly
- 1 x Power Supply
- 1 x Speaker panel

For locating each module, refer to Figure 3 above.

5.1.1 Receiver module

The receiver has several front panel controls and indicators. These are:

- Four LEDs:

PWR LED	Green	normal operation
	Amber	bootloader program running
	Red	malfunction / reset
LOCK LED	Green	PLL locked
	Red	PLL not locked
1 LED	Green	RF carrier signal on audio channel 1 is above manually adjusted mute threshold
	Off	RF carrier signal on audio channel 1 is below manually adjusted mute threshold
2 LED	Green	RF carrier signal on audio channel 2 is above manually adjusted mute threshold
	Off	RF carrier signal on audio channel 2 is below manually adjusted mute threshold

- RCVR GATE LEVEL - Mute threshold adjustment. It sets the RF signal level required to open the mute gate and allow audio to pass to the speaker.
- 1 / 2 Switch – Manual selection of Channel 1 or 2 audio

- Volume - The audio output delivers up to 1 watt to the speaker. Always set volume knob to minimum when not in use to reduce current consumption.
- NORM-MON Switch – Manual selection between *MONitor*: audio unmuted (continuous audio monitoring) and *NORMal*: audio unmuted only when above the manually adjusted mute threshold level
- one DE-9 RS-232 ports for setup

5.1.2 Exciter module

The Exciter's front panel controls and indicators are:

- LED indicators, according to the table below.

	Green	**Red**	**Flashing Amber**	**Off**
Power	Normal	Fault *	Warning *	
TX	Idle (un-keyed)	Normal Mode: Transmitting in normal mode	Test Mode: transmitting in test mode	Idle
10 MHz	10 MHz Locked	10 MHz con-nection bro-ken, unable to lock	Acquiring 10 MHz Lock	Idle if 10 MHz was never con-nected.
Lock	Synth lock, Normal	Synth unlock Fault	Programming mode	

*The cause of Fault or Warning conditions will be displayed on the Unit Status web page and recorded in the Maintenance→System Log.
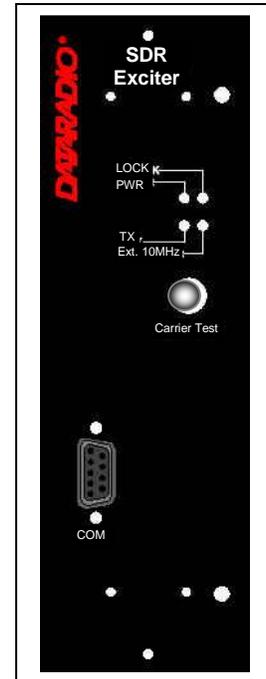
- Carrier test - momentarily keys the transmitter ON while pressed (used for test purposes only). If the Carrier is pressed for 4 seconds or more the exciter starts the test mode and keeps transmitting until the next press of the button.
- One DE-9 RS-232 ports for setup.

5.1.3 BSC2 Module

The BSC2's front panel connectors and indicators are:

	Green	Normal operation
PWR LED	Red	Bootstrap step 1 – lights for <5 sec.
	Amber	Bootstrap step 2 – lights for <5 sec.
	Red flashing	Hardware error, check Unit Status web page
RX LED	Green	Flashes for each data packets received
	Red	Discard RX packet (factory-use)
TX LED	Green	Flashes for each data packet transmitted
	Amber	Flashes for each data packet transmitted (check for lost Host connection on Unit Stat web page)
	Red	Continuously ON during TXON test (max. 20 sec) Flashes during CWID key-down
	Off	When AirLink down selected by PF rocker switch
STATUS	Green	Flashes each time PF1 or PF2 is pressed
	Amber	Flashes each second PF1 is kept pressed *Toggles "AirLink down mode" after 4 seconds*
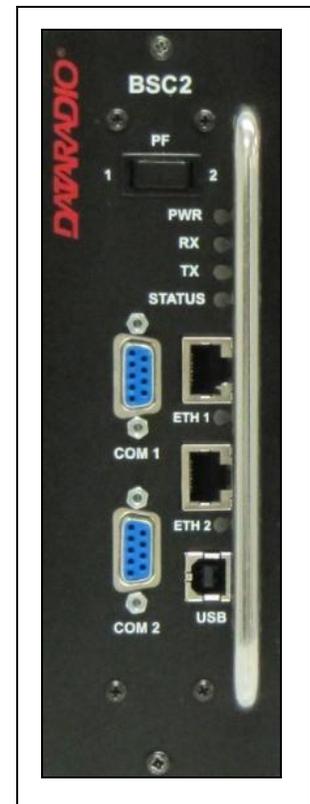
- 2x DE-9 RS-232 ports for setup and user data
- 1x rocker switch (positions PF 1 and 2) to select various test modes. See paragraph 5.3.2.
- 2x Ethernet ports – for setup and user data
- 2x Ethernet LEDs (status & activity)
- USB port – reserved.

5.1.4 Power Amplifier

Model using Crescend Technologies power amplifier *(Illustrations not drawn to scale)*. The location and function of the power amplifier's front panel status indicators are shown in Figure xx and described in the table below:

Table 3 - Power Amplifier indicators

LED	Function
DC ON	Lights green when DC power (+13.8 VDC) is applied
LOW OUTPUT	Lights red when output power drops to approximately 80-85% of set output power
HIGH VSWR	Lights red when VSWR exceeds approximately 2.5:1. At which point, the amplifier output is reduced. The higher the load VSWR, the more the output power is reduced.
HIGH TEMP	Lights red when the amplifier exceeds a safe operating temperature (Operating temperature range = -30 °C to +60 °C) When the heatsink reaches an unsafe level, the output power of the amplifier is reduced by approximately 50%. This keeps the channel on-air while providing some short-term protection. Address the underlying cooling issue as soon as possible.

5.1.5 Power Supply

The power supply modules are manufactured by ICT (Innovative Circuit Technology Ltd).

LED indicators are provided as standard feature. They provide module information as shown in figure above.

Table 4 - ICT N+1LED Module Status Display

GREEN	YELLOW
AC line voltage is present	Module is not present in the slot
DC output voltage is present	Module is not producing any output
Module voltage is present	

For more information on these power supply modules please refer to *ICT N+1 Redundant Power Supply Instruction Manual* from ICT.

5.1.6 Speaker Module

The speaker panel is fitted with an 8Ω speaker.
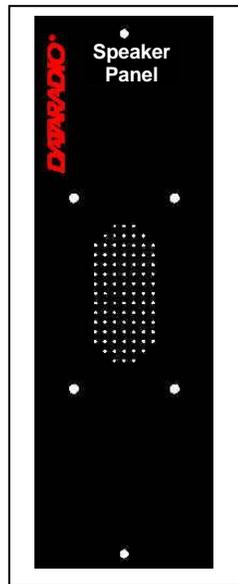
5.1.7 Hardware Options

5.1.7.1   GPS Receiver

Systems configured for Tower Steering or Disciplined Clock (see below) require the installation of the GPS receiver board inside the BSC2 module. With this option installed, there will be a GPS antenna SMA connector at the rear of the BSC2 module (see Figure 3.).

5.1.7.2   Disciplined Clock

For 700MHz Narrowband operation only, the FCC or other regulatory bodies impose strict limits on the frequency error of transmissions. Dataradio SDR radio modules minimize frequency error through the use of a *10MHz reference clock*. This clock can come from one of two sources:

-From an external 10MHz reference, supplied by the customer. It connects to the BNC1 connector on the P4 backplane PCB and with jumper JP1 set to position 2-3.

-From a Disciplined Clock board inside the BSC2 module.

Only one of the above options can be selected and the hardware to support the option must be installed by the factory.

The Disciplined Clock option also requires that the GPS Receiver option be installed. The Disciplined Clock uses the 1PPS (One Pulse per Second) output of the GPS receiver to produce the 10MHz reference clock. When 1PPS is being supplied, the reference clock has accuracy better than 1ppb (+/- 0.010 Hz at 10MHz). When 1PPS is unavailable, accuracy can fall to 5ppm (+/- 50Hz at 10MHz). In this situation, the Paragon4 can be configured to gracefully go off-the-air causing mobiles to roam to other base stations.

6. Operation & Configuration

Instructions and examples given in this manual are based on E-DBA operating software version current at the time of writing this document and may not apply to earlier or later software versions. Screen captures used throughout this document may vary from actual screens.

6.1   Browser-Based Interface

A built-in web server makes configuration and status monitoring possible from any browser-equipped computer, either locally or remotely. Status, configuration, and online help are available without requiring special client software. Setup is password-protected to avoid tampering or unauthorized changes.

Both the configuration parameters and operating firmware can be updated remotely, even over the RF network itself, using the standard File Transfer Protocol (FTP).
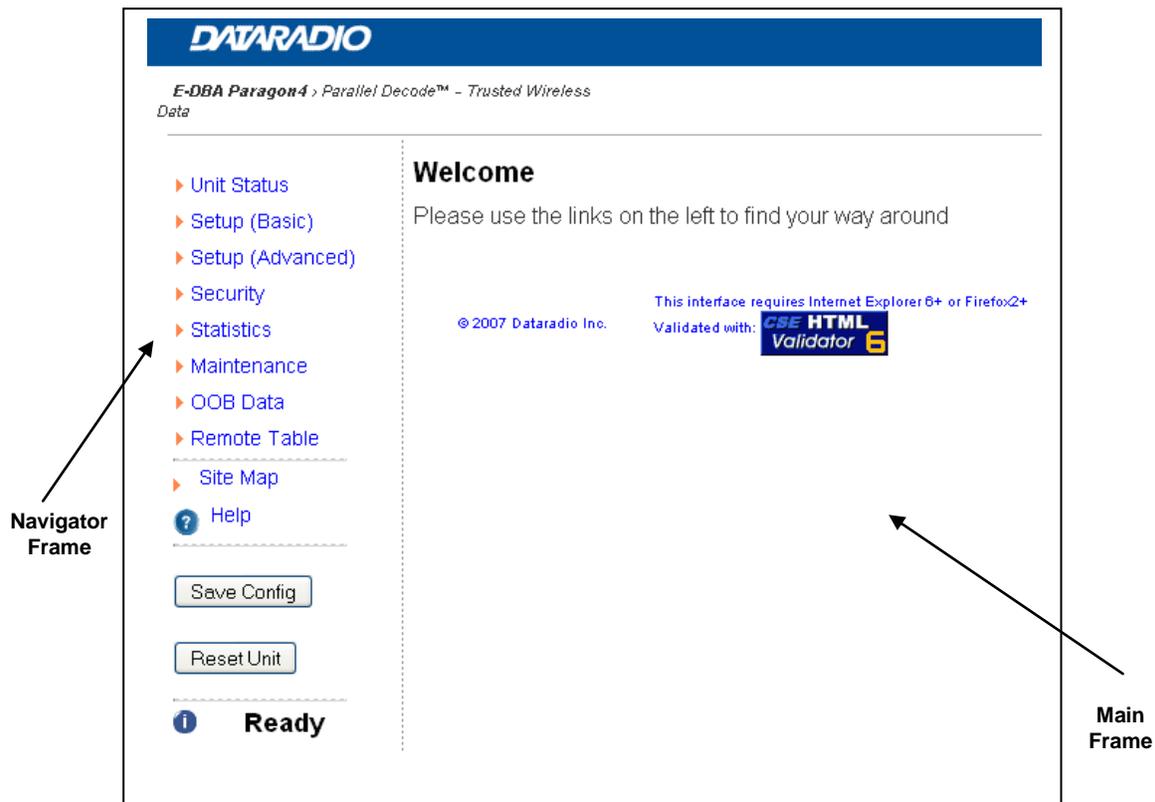
Figure 10 - Web Interface

6.1.1   Interface Setup and Status

The Paragon4 user interface is used to view and configure your network settings. Figure 10 shows the welcome screen of the Web Interface. The screen is subdivided in two frames: the frame on the left allows the user to navigate through the menus, while the main frame on the right displays the selected page. The menu system is two-leveled; some of the top-level menus expand to offer submenus. The *Site Map* link can be found right below the menus on the navigator pane. Help is available for each page displayed in the main frame. It can be accessed at all times by clicking the *Help* icon. The remaining buttons on the bottom of the Navigator frame are used to save your configurations and reset the unit.

6.3 IP Network Configuration

Paragon4 base stations feature two Ethernet interfaces (ETH1 and ETH2) and one RF interface. ETH1 is commonly connected over the backhaul to the Host network. ETH2 is commonly used for a local connection for setup purposes.

6.3.1 Default IP Settings

Paragon4 radio modem supports the Router (IP Forwarding) mode

6.3.1.1   ETH1

- MAC: 00:0A:99:XX:YY:ZZ
- IP ADDR: 192.168.202.1
- NETMASKS: 255.255.255.0
- Default Gateway: 0.0.0.0
- DHCP Client   Disabled
- RIPv2   Disabled

6.3.1.2   ETH2

- MAC: 00:0A:99:XX:YY:ZZ + 1
- IP ADDR: 192.168.203.1
- NETMASKS: 255.255.255.0
- DHCP Server   Disabled
- NAT   Disabled

6.3.1.3   RF Interface

- MAC: 00:XX:YY:ZZ
- IP ADDR: 10.XX:YY:ZZ
- NETMASK: 255.0.0.0
- Encryption   Disabled

Keep the RF IP setting as is, providing customer is not using the 10.0.0.0 IP network.

Enable RIPv2 on Base station.

6.3.2 Configuring Local PC

1. Click Start ➔ Settings ➔ Control Panel ➔ Network and Dial-up Connection
2. Click on the relevant Local Area Connection
3. On the Local Area Connection Status screen, click Properties
4. On the Local Area Connection Properties screen, scroll the List Box until "Internet Protocol (TCP/IP)" is highlighted, click Properties
5. On the Internet Protocol (TCP/IP) Properties screen, follow either method below:
6. If using ETH2 (Setup LAN), select "Obtain an IP address automatically"
7. Select "Use the following IP address" ➔ Enter 192.168.202.2 *(if ETH2 enter 192.168.203.2)* in the IP address field ➔ 255.255.255.0 in the Subnet mask ➔ Leave the Default gateway blank.
8. Click the OK button
9. *Steps above specifically apply to MS-Windows 2000. Modify as necessary for the OS you are running*

6.3.3 IP Network Settings (Paragon4 connected directly to Host)

Figure 11 below illustrates Paragon4 base station settings. In Setup (Advanced) ➜ LAN (IP), set ETH1 and ETH2 IP addresses and netmask of both Base and Mobile(s).

Keep the RF IP setting as is, providing customer is not using the 10.0.0.0 IP network.

Add routes in the Host to reach the RF Network (route add…)

In the illustration, Host and PC are part of different IP subnet
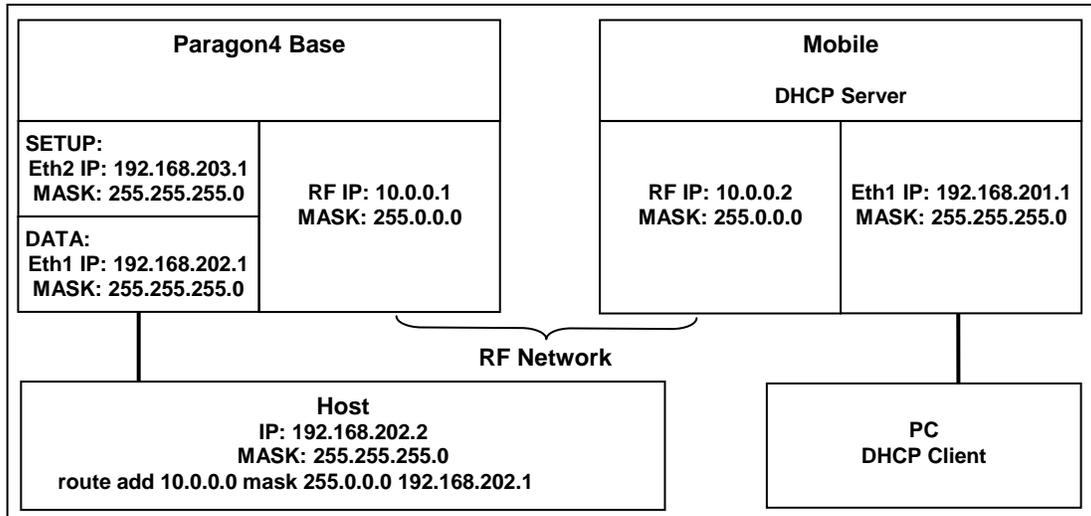
Figure 11 - IP Network Settings in Router Mode (with Host)

6.3.4 IP Network Settings (Paragon4 connection to Router)

Figure 12 below illustrates Paragon4 base station settings. In Setup (Advanced) ➜ LAN (IP), set the ETH1 and ETH2 IP addresses and netmask of both Base and Mobile(s).

In the illustration, Host and PC are part of different IP subnet.
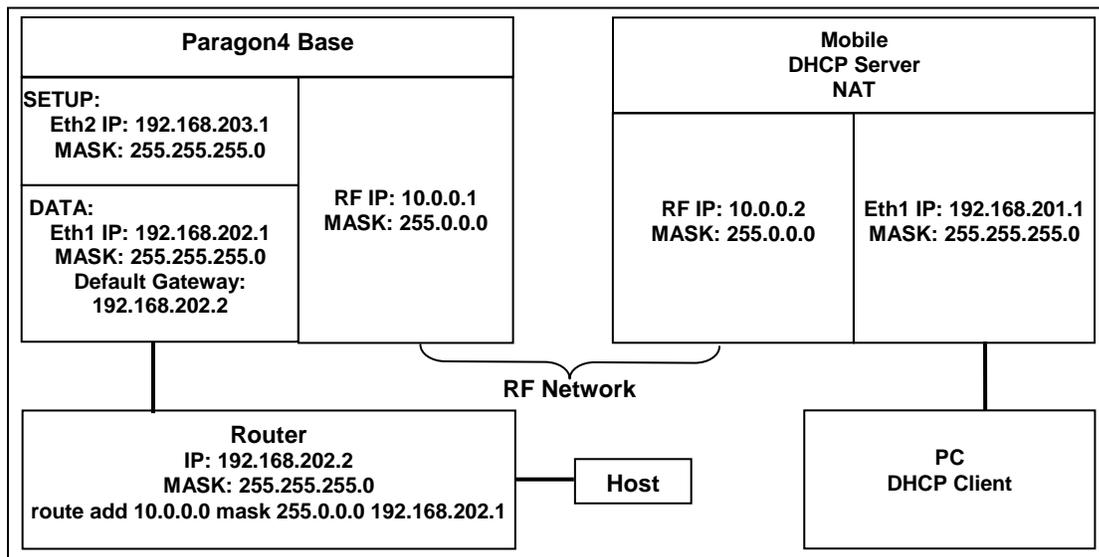
Figure 12 - IP Network Settings in Router Mode (with Router)

On a PC running MS-Windows with an existing LAN connection, connect either to the ETH1 or to ETH2 RJ-45 input of the Paragon4 base station.

6.4   Web Server Login

In an Internet browser, enter http://92.168.20*x*.1 *(where x is 2 for the ETH1 Data port and 3 for the ETH2 Setup port).* This will bring up the Paragon4 product login page (Note: It may take 30 seconds from initial power-up for the homepage to be available.) Login to the device.

For an initial installation, enter a User Name of 1 to 15 characters and the default Password ADMINISTRATOR *(upper case letters).* Click OK. The web interface "Welcome" screen opens (Figure 13).

For subsequent access to the Paragon4 unit, use the User Name and Password that you will have configured *(as detailed in section 6.9.1).*

> *Notes:*
>
> > *User Name field can be left blank. It only serves to identify the person gaining ace ss.*
> >
> > *Password is common and affects all User Name entries.*
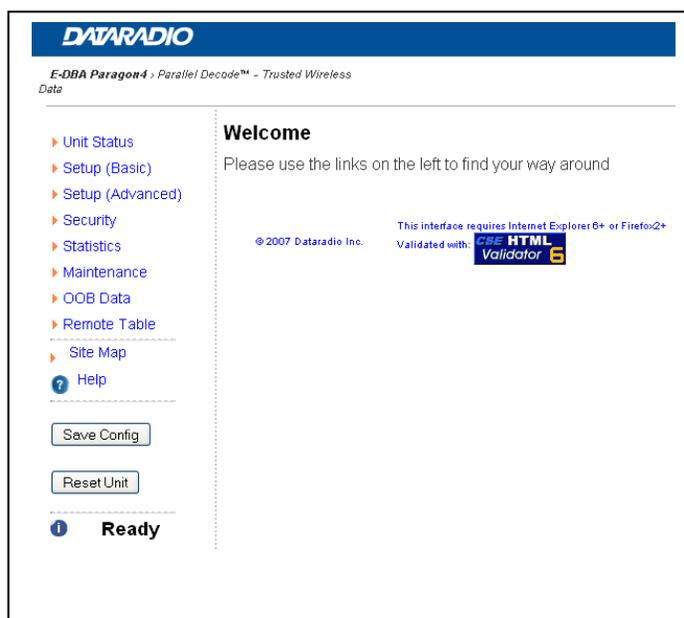
Figure 13 - Web User Interface – Welcome Screen

6.5   Web Interface

The Paragon4 user interface (Figure 13) is used to view and configure your network settings.

To navigate, use the top-level menus on the left, some of which expand to offer submenus, and display the first submenu in the right-hand frame. Click the current submenu entry to refresh the right-hand frame. The tables starting at section 6.6.1 below list action of each function. The interface main screen lists available selections for the selected menu or presents instructions.

Notes:

> *At any time, click the Help icon in the navigation pane to open a help text relating to the window being displayed.*

6.5.1 Apply, Cancel, Save Config, and Reset Unit Buttons & Help Icon

Several submenus have "Apply" and "Cancel" buttons.

The navigation area has "Save Config", "Reset Unit" buttons and a Help icon.

If you "Apply" changes to any parameters marked   you will need to do a "Save Config" and a "Reset Unit".

When making an entry into a dialog box, click on Apply when satisfied to temporarily apply the value(s) entered to the relevant parameter(s). If not satisfied, click on Cancel button to restore to the value(s) present before a change was made.

> *Note: Cancel command only affects the dialog boxes or option buttons in the opened window.*

If needed, go to other submenu(s) and make more entries. Click Apply before leaving each window. When finished, click the Save Config button to make all changed entries permanent.

Notes:

> *"Apply" writes to RAM, thus failure to use the "Apply" command button before leaving a web page will result in the loss of temporarily entered selections, addresses, and values.*

> *"Save Config" writes in flash, thus failure to use the "Save Config" command button will result in the loss of temporarily entered parameters. A "Reset" is required to make flash changes take effect.*

Click on Save Config button:
- If there are changes to be saved, saving occurs right away
- If there are no changes to be saved, a pop-up window prompts user to confirm saving anyway

Click on "Reset Unit" button:
- If there are changes to be saved, a window prompts user to confirm resetting.
- If there are no changes to be saved, resetting occurs right away

A "Station Reset" 20-second timer counts down while the status reports: "Working…"

When done, the status reports: "Ready".

6.6 Unit Status

6.6.1 Unit Status ► General

Displays values that identify the unit and show its basic operating condition.

Figure 14 - Unit Identification and Status

Item	Description
Banner	**Displays Paragon4 software revision information retrieved from the connected unit. Have this information handy if contacting CalAmp support.**
Station Name	**Displays name of connected unit.** **Configured under Setup Basic ➔ General ➔ Station Name**
System ID	**Displays System's unique identification number** **Configured under Setup Basic ➔ General ➔ System ID**
Local Time	**24-hour clock format display of the GMT time and date adjusted to the specified time zone.** **Configured under Setup Advanced ➔ Time Source ➔ SNTP**
CWID Callsign	**Continuous wave ID - Way of sending FCC license ID using Morse code.** **Continuous Wave Identification uses Morse Code to automatically send out the station ID periodically to identify the owner of the transmitting base station. This satisfies the requirements of the FCC.**
CWID Interval	**Interval between CWID messages in minutes.** **Zero = never.**
Unit Status	**Normally displays "Ok" in the message area.** **Displays various warnings or messages in the event of hardware failure,** **If indications persist, have the status information handy if contacting CalAmp support.**
Host Status	**Status of the link to the specified Host, if configured in Setup (Advanced) → Roaming → Host Link Active.** **Values displayed are Disabled, Reachable, and Unreachable.**
Acknowledge Unit Status	**Press this button to clear the Unit Status message area.**

6.6.2 Unit Status ►Radio Info & Status

Radio Information read-only table displays the Paragon4 radio information retrieved from the connected radio modules. Have this information handy if contacting CalAmp. *Paragon4 models that have both receivers combined into a single module will show the same information in the RX main and RX diversity rows.*

Radio Information

Radio Info	
Radio Device	P4_RADIOS
Status	OK

	Receiver	Transmitter
Model Number:	SDR-R-003	SDR-T-001
Serial Number:	000001	000001
Frequency Range (MHz):	793 - 824	851 - 869
Firmware:	4.00 (Build 57)	1.23
Hardware:	N/A	EEP=2 Dig=0 RF=0 DSP=2
CPLD Version:	SDR003R_9100514A	N/A
Unit Assembly Number:	D03003448005	N/A

Current Radio Settings	
RX Frequency	806.000000 MHz
TX Frequency	851.000000 MHz
Channel Type	25K-800

Detailed Radio Status

```
System:
    10 MHz Standard:              Inactive
    Disciplined Clock Status:     Fault
    Disciplined Clock Temperature: 0.0 C
    Current 10MHz Error Level:    0 (global)

Receiver Detailed Status:
    Temperature :                 48.0 C
    External 10 MHz detected:     No
    Using External 10 MHz:        No
    PLL Locked:                   Yes

Exciter Detailed Status:
    Temperature :                 55.6 C
    Transmit In Progress:         Yes
    10 MHz Standard In Use:       No
    10 MHz Standard Error:        No
    RF Synthesizer Locked:        Yes
    MOD Synthesizer Locked:       Yes
```

Figure 15 - Unit Status - Radio Information

Item	Description
Radio Info	
Radio Device	Identifies the installed radio module's model
Status	Identifies the status of the active radio (Ok or Fault –*module is down*)
Model Number	Indicates the model of the receiver/transmitter
Serial Number	Unique number assigned to the receiver/transmitter at time of manufacture
Frequency range	Shows the receive/transmit frequency range the unit can synthesize. For information on the frequency ranges for each radio model, see Section 8, Specifications.
Firmware	Identifies the version number of the firmware installed on the receiver/transmitter
Hardware	Identifies the version number of the hardware installed (receiver/transmitter)
CPLD Version	Identifies the version number of the CPLD (Complex Programmable Logic Device)
Unit Assembly Number	Identifies Unit Assembly Number
Current Radio Settings	
RX Frequency	Shows the current (or last) receive frequency
TX Frequency	Shows the current (or last) transmit frequency

Channel Type	Shows the current (or last) channel type
Detailed Radio Status	
System	10 MHz Standard **- 10 MHz reference-** Active **(10 MHz signal present) or** Inactive **(10 MHz signal not present or not within specification)**

Disciplined Clock Status	Internal 10 MHz reference status
	Locked = **The Disciplined Clock has acquired GPS lock and is providing a valid 10MHz source.**
	Unlocked = **The Disciplined Clock has lost its GPS lock and is waiting for GPS signal reacquisition. The 10 MHz source is still valid.**
	Never been locked yet = **After power up, the Disciplined Clock has not acquired its first GPS lock yet. The 10 MHz source is not valid.**
	Fault = **The Disciplined Clock cannot provide a valid 10 MHz source for one of the following reasons:**
	        1. There was a hardware or firmware initialization error.
	        2. The GPS has failed to acquire any satellite signal within the allowed time period (Check GPS antenna)
	10 MHz source unreliable = **The Disciplined Clock has lost its GPS lock for too long and cannot guaranty the accuracy of its 10MHz source anymore (check GPS antenna). This message can also appear if the VCO on the Disciplined Clock circuit is no longer within specification due to age, damage or extreme environmental conditions.**
	Disabled = **The Disciplined Clock is not active. The 10MHz source from this circuit is unreliable or an external source is provided.**

Disciplined Clock Temperature	**Displays Disciplined Clock temperature in degrees Celsius.** ***Note: Displays "N/A" if the Disciplined Clock's state is "Disabled".***
Receiver Detailed Status	
Temperature	**Receiver's temperature in degrees Celsius.**
External 10 MHz detected	**Yes (10 MHz signal in use by the receiver), No (10 MHz signal not in use by the receiver)**
Using External 10 MHz	**Yes, No (10 MHz signal is in use by the receiver)**
PLL Locked	**Yes, No (RF synthesizer is phase-locked-loop to internal 17.5MHz or external 10MHz reference signal.)**
Exciter Detailed Status	
Temperature	**Exciter's temperature in degrees Celsius**
Transmit in progress	**Yes, No**
10 MHz Standard in use	**Yes (10 MHz signal in use by the exciter), No (10 MHz signal not in use by the exciter)**
10 MHz Standard Error	**Yes, No (The exciter will report a failure when the 10 MHz signal is present initially and removed after system initialization.)**
RF Synthesizer Locked	**Yes, No (May signify RF synthesizer device error. Contact support for additional information.)**
MOD Synthesizer Locked	**Yes, No (May signify MOD synthesizer device error. Contact support for additional information.)**

6.6.3 Unit Status ►Diagnostics

Diagnostics values

Analog values

Item	Value	Status	Range
Chassis power supply	14.5 Volts	Normal	10.8 - 16.0 Volts
Power amplifier power supply	13.5 Volts	Normal	13.1 - 14.5 Volts
Forward power	45.1 dBm	Normal	41.8 - 48.9 dBm
Reverse power	19.2 dBm	Alarm conditions not monitored	
Standing Wave Ratio	2.88 :1	Normal	< 3.0
Chassis temperature	43 °C	Normal	15 - 50 °C
Analog monitoring 1	0.0	Normal	0.0 - 0.0
Analog monitoring 2	0.0	Normal	0.0 - 0.0
Fan 1	0	Normal	> 0
Fan 2	0	Normal	> 0

Digital values

Item	Status
Alarm A1 input	Normal
Alarm A2 input	Normal
Alarm B1 input	Fault
Alarm B2 input	Fault

Others

Item	Status
Receiver Comparison	Normal

Click **Refresh** to update values

Figure 16 - Unit Status – Diagnostics

Item	Description
Analog Values	
Chassis power supply	Displays chassis power supply voltage
Power amplifier power supply	Displays power amplifier power supply voltage. Available only if extra wires are added from the PA +/- supply terminals and the P4 backplane TB1-1 / TB1-2 terminals.
Forward power	Displays forward power when the optional external power sensor assembly (p/n 030-03547-xxx) is installed. Note: Power measurement units (dBm or Watts) are user defined under Setup Advanced ►User Settings
Reverse power	Displays reverse power when the optional external power sensor assembly (p/n 030-03547-xxx) is installed. Note: Power measurement units (dBm or Watts) are user defined under Setup Advanced ►User Settings

Standing Wave Ratio	**Displays Standing Wave Ratio. Standing Wave Ratio (SWR) is computed as follows:** $$\dfrac{1+\sqrt{\dfrac{Reverse\,Power}{Forward\,Power}}}{1-\sqrt{\dfrac{Reverse\,Power}{Forward\,Power}}}$$ **Note: SWR is always computed-based on the forward and reverse power values in Watt, regardless of the power measurement unit chosen for display.**
Chassis temperature	**Displays the internal unit chassis temperature. That temperature is usually 10 to 15°C higher than ambient room temperature. Default range: 15 to 40°C** **Note: Temperature measurement units are user defined under Setup Advanced ►User Settings**
Analog monitoring 1	**Generic Analog input (0 – 30VDC)** **Displays user supplied analog input's measurement values**
Analog monitoring 2	**Generic Analog input (0 – 30VDC)** **Displays user supplied analog input's measurement values**
Fan 1	**Fan speed monitoring signal. Analog sinusoidal input (0-5VDC) or digital TTL input (detection threshold, low = 0.4V max and high = 2.4V min).**
Fan 2	**Fan speed monitoring signal. Analog sinusoidal input (0-5VDC) or digital TTL input (detection threshold, low = 0.4V max and high = 2.4V min).**
Digital Values	
Alarm A1 input **Alarm A2 input** **Alarm B1 input** **Alarm B2 input**	**Generic Alarm inputs. Programmable active high or low polarity. Safe voltage range -0.1V to 30V.** **When active high (low):** **Voltage guaranteed to be detected as an alarm: 2.4V min (0.4V max).** **Voltage guaranteed not to be detected as an alarm: 0.4V max (2.4V min).**
Status	**For all digital and analog alarms displays alarm status: Normal or Fault.** **For Forward Power and Standing Wave Ratio (SWR) displays "Transmitter off" when the transmitter is off. Disregard the diagnostic value for SWR, Forward Power, and Reverse Power if the transmitter is off.**
Range	**Displays range of values for all monitored analog diagnostic parameters.** **User-configurable under Setup (Advanced) ►Diagnostics.** **Recommended nominal ranges are:** **Chassis Power Supply** 10.8-16.0 Volts **Power Amplifier Power Supply** 13.1-14.5 Volts (with Crescend PA) **Forward Power (700 & 800 MHz)** 15. 0-77.0 Watts **Forward Power (UHF)** 15. 0-110.0 Watts

6.6.3.1.1 External Analog/Digital Inputs Monitoring

The user can connect and monitor two external analog and four external digital inputs to the backplane TB1 connector terminals (

Figure 17 and Figure 18).
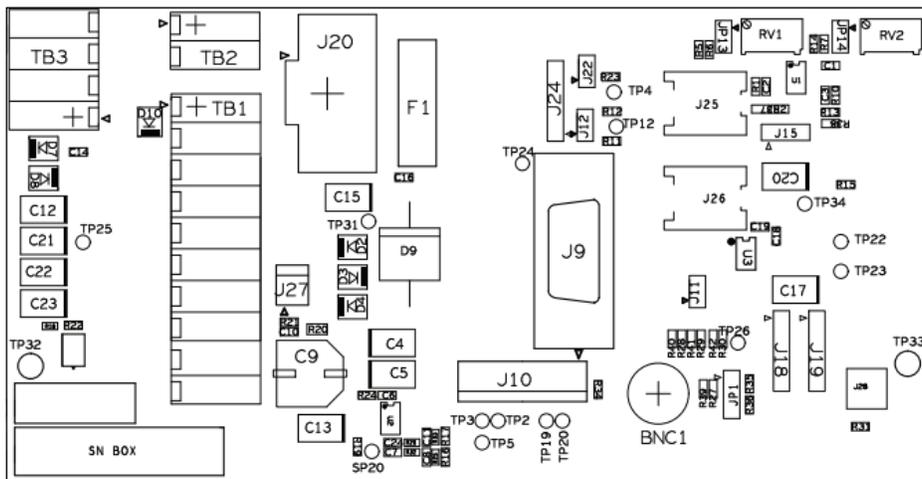
Figure 17 - Backplane -TB1 connector

TB1

Alarm A1 input

Alarm A2 input

Alarm B1 input

Alarm B2 input

Analog monitoring 1

Analog monitoring 2
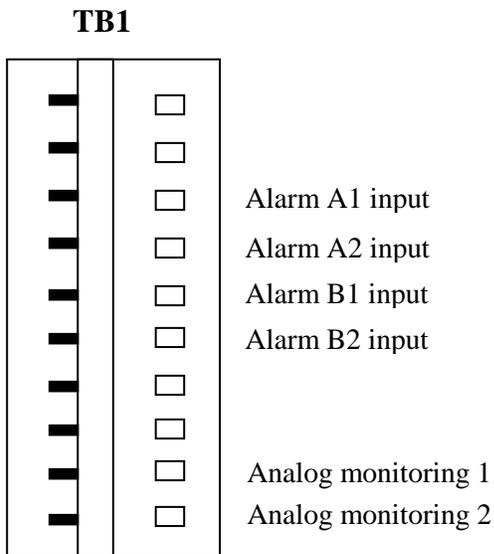
Figure 18 - TB1 connector

An external analog device's voltage must not exceed 30 Volts. The default units of measure used for monitoring an external device are volts. It is possible to change the default units by creating a look-up table for the desired unit of measure. This look-up table is created following the guidelines in section 6.8.10.1 and is uploaded into the Paragon4 unit using FTP transfer. Refer to section 6.8.10

Note 1: TB1 connector labeling differs from the actual backplane:

TB1 / Web page name(s)	TB1 / Backplane name
Power amplifier power supply	+13V8_PA
Alarm A1 input	AL_A1
Alarm A2 input	AL_A2
Alarm B1 input	AL_B1
Alarm B2 input	AL_B2
Analog monitoring 1	AN1
Analog monitoring 2	AN2

6.7   Setup (Basic)

6.7.1   Setup (Basic) ► General

Used to set four basic operating fields on the connected unit.

General Setup

Station Name	Pollux
System ID	0
CWID Call sign	DATARADIO
CWID Interval	0 minutes

Apply   Cancel

Figure 19 - Setup (Basic) – General Setup

Item	Description
Station Name	**Station name identifier – Enter string up to forty characters in length (letters and/or numbers)**
System ID	**Factory default ID is zero. To prevent collision and to minimize interference from remote systems that may be present on the same frequency, CalAmp recommends changing the System ID to some other value unique to each network.** **Upper limit is 255**
CWID Call sign	**Historically called "Continuous wave ID" – Way of sending FCC license ID using Morse code**
CWID Interval	**Interval between CWID messages in minutes** **Zero = never.**

6.7.2 Setup (Basic) ► IP (Basic IP Configuration)

Sets the IP characteristics of the primary, or only, Ethernet port (ETH1).

Figure 20 - Setup (Basic) – Basic IP Configuration

Item	Description
Use fixed IP settings	**Creates a fixed TCP/IP address connection.** ***You may need to ask your network administrator for the appropriate IP settings.***
IP Address	**Set to valid unique IP address for each individual unit.** **Factory default is 192.168.202.1 for all Paragon4 units connected to their ETH1 port.** **For ETH2 configuration, see Setup Advanced ➔ LAN IP**
Netmask	**Set to valid IP netmask for each individual unit** *(may be same or different depending on customer's IP network topology)*.
Default Gateway	**Set to valid Default Gateway.** **May change for different groups or locations**
Use DHCP Client	**Dynamic Host Configuration - Dynamically assigns an IP address**
IP Address **Netmask** **Default Gateway**	**These three read-only fields display the IP addresses obtained from the DHCP Server** **For ETH2 configuration, see Setup Advanced ➔ LAN IP**

6.7.3   Setup (Basic) ► RF (Frequencies)

Figure 21 - RF (Frequencies)

Item	Description
Radio Capabilities	
RX Frequency Range	**Shows the receive frequency range the unit can synthesize** **Typically: Rx 792 – 824**
TX Frequency Range	**Shows the transmit frequency range the unit can synthesize** **Typically: Tx 763 – 776**
Channels Table Set Up	
Active Channel	**Select one at a time (from 1 to 32)**
Status	**Displays channels setup status.** **OK or Invalid (invalid RX/TX selection or receiver/transmitter is down)**
RX (MHz) **TX (MHz)**	**Enter RX and TX frequency in MHz in the appropriate dialog box.** **Note: The RF frequencies entered must match the corresponding RF frequency on the GeminiG3 mobile radios.** **Entries must fall within the Min and Max indicated on top of the page (erroneous entries will be highlighted in red) and must be multiples of corresponding frequency step (6.25 KHz for 700/800 MHz frequency ranges or 5, 6.25, or 10 KHz for UHF frequency ranges).** **CalAmp recommends (in North America) offsetting the TX column frequency by +30 MHz for 700 MHz frequency ranges, by -45 MHz for 800 MHz frequency ranges, or by +/- 5MHz for UHF frequency ranges.** **E.g.:** **Assuming:** **Min Rx=851.000 000 MHz** **Max Rx=869.000 000 MHz** **Offset=-45.000 000 MHz** **If selection for a channel's RX was:** **Rx (MHz)=853.037 500** **then its corresponding TX would be computed as:** **Tx (MHz)=853.037 500+(-45.000 000)=808.037 500** **Note: Exercise caution when entering RF frequencies. Paragon4 base station will reject any entry with a wrong frequency step and will transmit at the previous correct entry or return to its default (factory-configured) RF frequency setting.**
Airlink Speed	**Lists the choice of Airlink speeds, the nominal speed at which data packets are transmitted over-the-air in E-DBA.** ***The mobile will automatically adapt to the base station.*** **e.g.: At 800 MHz Full Channel, the choices are:** **64kb/s short messages, medium messages, large messages** **48kb/s short messages, medium messages, large messages** **43.2kb/s short messages, medium messages, large messages** **32kb/s short messages, medium messages, large messages** **Airlink speeds available depend on the channel type selected (from 16 kb/s to 128 kb/s).** *Note: **The channel table settings take effect immediately after** Apply **is clicked.***

6.7.4 Setup (Basic) ► Serial Ports Setup

The Paragon4 base station serial ports can be logically connected to local and remote services to aid in configuration and troubleshooting, or they can be connected to a remote Host application or even to the serial port of a remote unit.


Figure 22 - Setup (Basic) – Serial Ports Setup

Item	Description
Enabled	Independent check boxes to activate COM-1 PORT and/or COM-2 PORT
Speed	Select 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud Rate
Data Bits	Number of bits making up the data word. Set according to Host configuration. Default is 8.
Stop Bits	Number of bits at the end of the data word. Default is 1.
Parity	Added to identify the sum of bits as odd or even. Default is None.
Flow Control	Select None or CTS-based *(depends on connected device)*
Connection Control	Select Permanent (3-wire) or Switched (DTR bringup/teardown) *(RTU dependent)*
IP Gateway Service	Select one of: CLI Service (Command line interface) RS-232 connection to Host PC (Default = SETUP) Custom – Choosing Custom enables the IP Gateway Transport configuration
IP Gateway Transport	Available only if IP Gateway Service selection is Custom, choose the socket connection mode from the drop-down list box choices of TCP Server, TCP Client, or UDP.
Local IP Address	Valid unicast or multicast IP address, including the local Loopback interface address. Default local IP address is set to 0.0.0.0 and can be changed dynamically without a unit reset.
Local IP Port	For TCP Client and UDP socket connections, set to any value between 1 and 65535. For TCP Server socket connections, set to any value between 1 and 65535 but must not be set to one of the following values or fall within the following ranges of values: 20, 21, 23, 123, 520, 5002, 6254 to 6299, 7000 to 7100. Otherwise, the parameter configuration will be accepted, but no socket connection will be established to accept connection from remote endpoints. Default local port value is set to 1024 and can be changed dynamically without a unit reset.
Remote IP Address	Default remote IP address is the Loopback interface address, 127.0.0.1 and can be changed dynamically without a unit reset
Remote IP Port	For socket connection modes (TCP active, UDP), set to any value between 1 and 65535. Default local port value is 23 and can be changed dynamically.
Status	Can be UP, READY, or DOWN. Click on the "Refresh" word in the "(Refresh this frame to confirm "Status") sentence to update Status condition.

6.8   Setup (Advanced)

6.8.1   Setup (Advanced) ► LAN (IP)

Allows the setting of IP characteristics beyond those set in Setup (Basic) ➔ IP

When a mobile registers with a new base, the base may send a message to each of its neighbor to assure that their Internet tables are up-to-date. Up to 32 neighbors can be entered. *An empty or incomplete table may cause IP routing problems when the mobile roams.*


Figure 23 - Advanced IP Configuration - LAN (IP)

	Item	Description
Interface 1 (ETH1)	**IP Address Netmask**	Read-only fields showing IP Address and Netmask defined earlier in Setup (Basic)➔ Basic IP.
	MTU	Ethernet Interface MTU - Default 1500. – For optimal performance, set at 1500. Entering a value lower than 1500 may reduce system performance. Flexibility of using lower values may be useful in testing or for particular operational conditions. Range is 576 to 1500.
	MAC address	Ethernet Interface MAC address in HEX format *(factory-set)*.
Interface 2 (ETH2)	**IP Address**	Set to valid unique IP address for each individual unit. Factory default is 192.168.203.1 for all Paragon4 units connected to their ETH2 port. For ETH1 configuration, see Setup Basic ➔ Basic IP Configuration
	Netmask	Set to valid IP netmask for each individual unit *(may be same or different depending on customer's IP network topology)*.
	MTU	Ethernet Interface MTU - Default 1500. – For optimal performance, set at 1500. Entering a value lower than 1500 may reduce system performance. Flexibility of using lower values may be useful in testing or for particular operational conditions. Range is 576 to 1500.
	MAC address	Ethernet Interface MAC address in HEX format *(factory-set)*.
Neighboring Bases	**Add**	Type in the "Neighboring Bases" field the IP address in dot decimal format of the base to be added to the neighboring "Base List" table.
	Delete	Type in the "Neighboring Bases" field the IP address in dot decimal format of the base to be deleted from the neighboring "Base List" table.
	Base List	Read-only listing. Dynamic window expands downward as needed to show all addresses added to the list or shrinks as addresses are removed. Shows "Table is empty" if no address is present in the Base List.

6.8.2 Setup (Advanced) ► RF (IP)

At the time of manufacture, each Paragon4 base station and GeminiG3 radio modem is provided with a unique MAC address for its Ethernet and RF interfaces. These addresses cannot be changed. The RF interface is also provided with a unique Factory RF IP address. If this IP address conflicts with any existing IP network, it can be overridden.

Figure 24 - Advanced IP Configuration - RF (IP)

Item	Description
RF MAC	RF Interface MAC address in HEX format *(factory-set)*.
RF IP Address	Displays factory-assigned address: nnn.nnn.nnn.nnn "Factory"
	Entering 0.0.0.0 sets the RF IP Address to the factory default and highlights the "Factory" name (active address)
	Entering nnn.nnn.nnn.nnn (RF IP Address of your choice) overrides the factory default and highlights the "Override" name (active address)
RF Net Mask	Set to valid common IP netmask for all units within a Paragon4 network
RF MTU	RF Interface MTU - Default 1242. – For optimal performance, set at 1242.
	Entering a value other than 1242 may reduce system performance, especially if set to a higher value. *Flexibility of using other values may be useful in testing or for particular operational conditions.*
	Range is 576 to 1500.

6.8.3 Setup (Advanced) ► Roaming

The "Host Link Active" feature allows a base to assure the communication backhaul is operating. If not, the base indicates to mobiles on the channel that they should promptly roam to another base

The "Base Loaded" feature monitors the amount of network traffic during the previous 10-second period. If there are more than a certain number of mobiles actively sending data and the channel is occupied above a certain percentage, then the base indicates that a portion of the registered mobiles should roam to other bases, until channel loading falls below the thresholds.

Roaming Setup

Host Link Active (on ETH1)

Link check is...	⊙ Disabled ○ Enabled
Host address	192.168.203.3
Ping failure threshold	3
Ping success threshold	2
Ping every	10 s
Host is...	

Base Loaded

Feature is...	○ Disabled ⊙ Enabled
⚠ Mobile Limit	5
⚠ Packet Limit	100
Base is...	Not loaded

Roaming

Mobiles roam if average RSSI is below ... dBm	-98.000000

Figure 25 - Advanced IP Configuration – Roaming

| Host Link Active (on ETH1)	
Link check is…	Disabled (Default), Enabled
Host address	IP address of a router/host to be pinged periodically
Ping failure threshold	This many failed pings in a row are needed to mark the "Host is…" field as "Unreachable"
Ping success threshold	This many successful pings in a row are needed to mark the "Host is…" field as" Reachable"
Ping every	How often to send a ping
Host is …	Current status of the host link (blank if disabled)
Base Loaded	
Feature is…	Disabled, Enabled
Mobile Limit	Minimum number of active mobile before channel can be considered "Loaded"
Packet Limit	Minimum percentage of data capacity before channel can be considered "Loaded"
Base is…	Current status of the base (blank if disabled)
Roaming	
Mobiles roam if average RSSI is below…	Currently registered mobiles will roam if average signal strength of all synchronization packets received in the last 20 seconds is below this value

6.8.4 Setup (Advanced) ► IP Services

Figure 26 - Advanced IP Configuration – IP Services Setup

Item	Description
Server	DHCP Server Disabled, Enabled (Default). The Dynamic Host Configuration Protocol provides a framework for passing configuration information e.g.: IP address to Hosts (i.e. PC/RTU) on a TCP/IP network.
Gateway	Gateway address handed out by the DHCP Server to the DHCP Client. The default value is set to the IP address of the Ethernet 2 interface. If the gateway is set to 0.0.0.0, no gateway address will be handed out by the DHCP Server.
Lease Start Address	Pool of addresses allocated for DHCP purpose. If a unit is configured as DHCP Server, this field represents the start IP address pool managed by the DHCP Server. Normally, Paragon4 automatically calculates the Lease Start Address (equal to Ethernet IP Address plus one).
Lease Duration	The period over which the IP Address allocated to a DHCP client is referred to as a "lease". Lease Duration is the amount entered in minutes. A value of "0" indicates an infinite lease.
Maximum number of leases	Maximum number of DHCP client(s) a unit can serve.
IPSD	IP Services Delivery – Disabled (Default), Enabled. Allows or disallows the generation of locally provided IP Services such as online diagnostics, alarms, etc…
NAT (ETH2 only)	Network Address Translation - Disabled, Enabled (Default) NAT technology is a method by which IP addresses are mapped from one address space to another. In Paragon4, it is normally used on the WAN side of an IP network to hide local IP addresses from an external IP network (i.e. Internet). See section 4.7.3.4.1 for a more detailed description.
RIPV2 (ETH1 only)	Router Information Protocol v2 - Disabled, Enabled (Default) When Enabled, mobile registration causes RIPv2 report to be sent to the backhaul router(s) so that the infrastructure will route all packets for this mobile through this base station.

Item	Description
SNMP	**Simple Network Management Protocol – Disabled, Enabled (Default)** **SNMP provides means to monitor, collect, and analyze diagnostic information. Enabling SNMP allows the MIB (Management Information Base) in the Paragon4 to be viewed using an external MIB browser or network management software.** **Trap IP List** **After reset, the Paragon4 sends a WARMSTART trap to all of the IP addresses defined in the Trap IP list. It signifies that the system has started.** **To add an address to the Trap IP List: Select** *Add* **and type the new IP address to be added to the read-only Trap IP list. The window will expand downward to show all addresses in the list.** **To delete an address to the Trap IP List: Select** *Delete* **and type the new IP address to be deleted from the read-only Trap IP list.**
MIBS	**Management Information Base -used to assemble and interpret SNMP messages.** **The Dataradio Paragon4 MIB is bundled with each unit's firmware. Click "Download mibs.zip" and a pop-up dialog box will appear in your browser asking you to open or save the file to your PC. Save the zip file to a desired location. Unzip the contents of mibs.zip file to a location where your SNMP manager can find it.** *Note: SNMP must be enabled in order for the host PC SNMP manager to work.*

6.8.4.1 NAT on the Base Unit (Paragon4)

The purpose of the "Network Address Translation" (NAT) protocol is to hide a private IP network from a public network. The mechanism serves both as a firewall function and to save IP address space.

When NAT is enabled on the P4, the private network (from the point of view of the Base station) is the IP network associated to the Ethernet 2 interface.
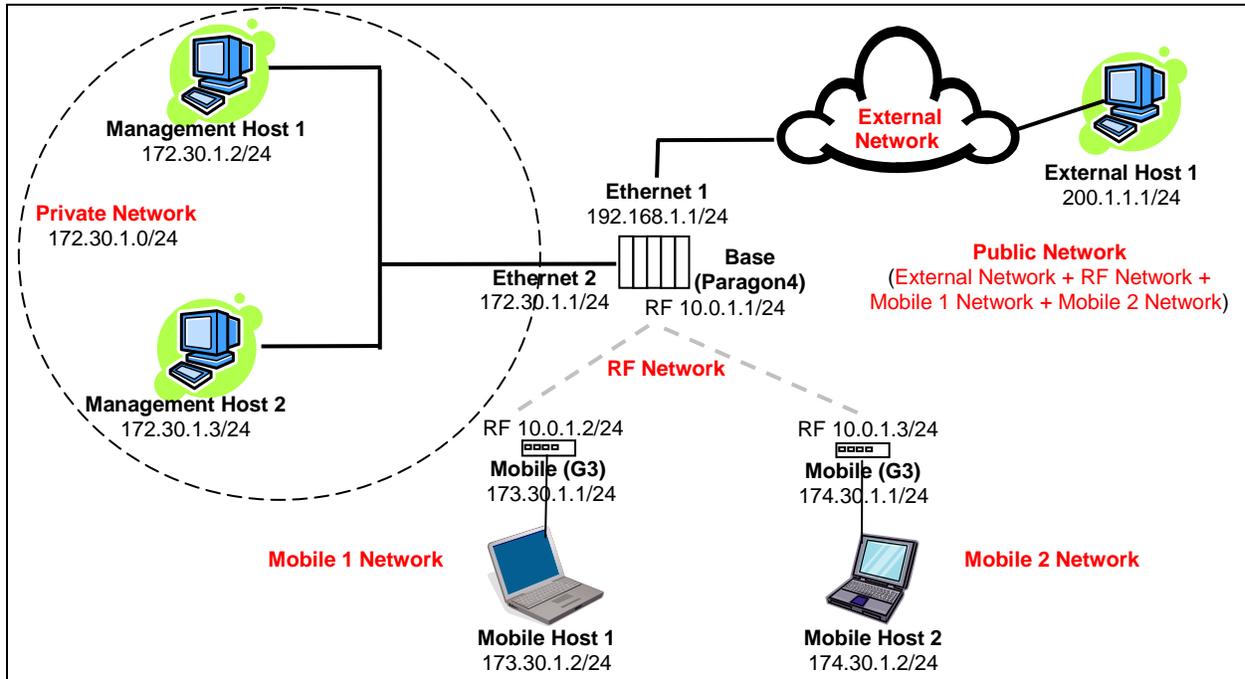

Figure 27 - NAT Enabled on Paragon4
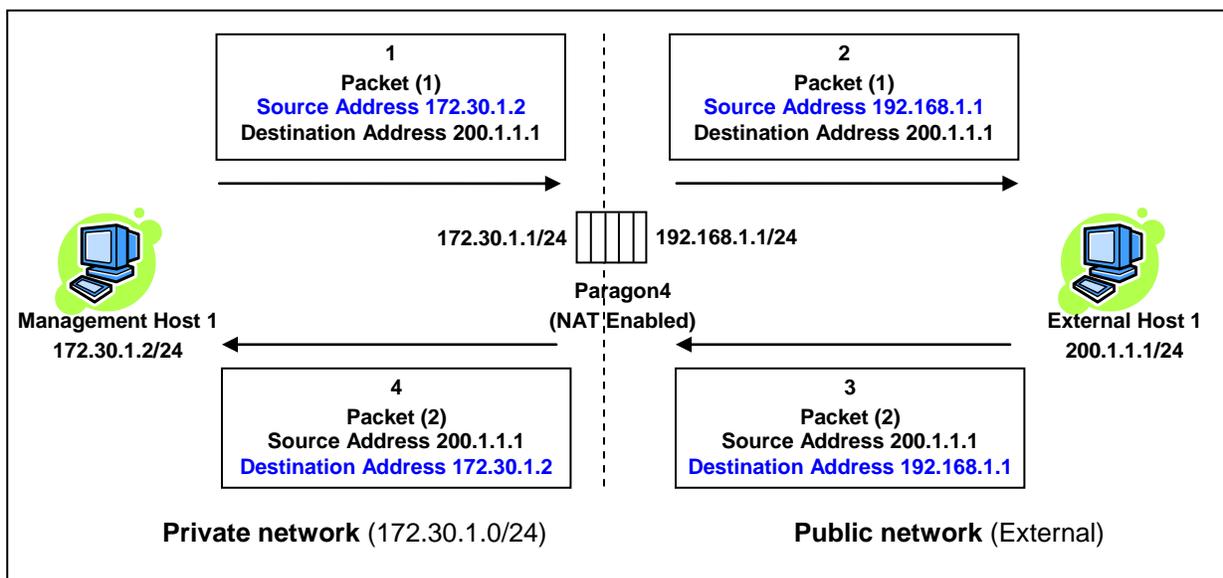
Figure 28 - Paragon4 - Example 1

In example 1, Management Host 1 sends Packet (1) to External Host 1. Since the source IP address of Packet (1) comes from the private network, it gets replaced by the IP address of the Ethernet 1 interface of the Base station.
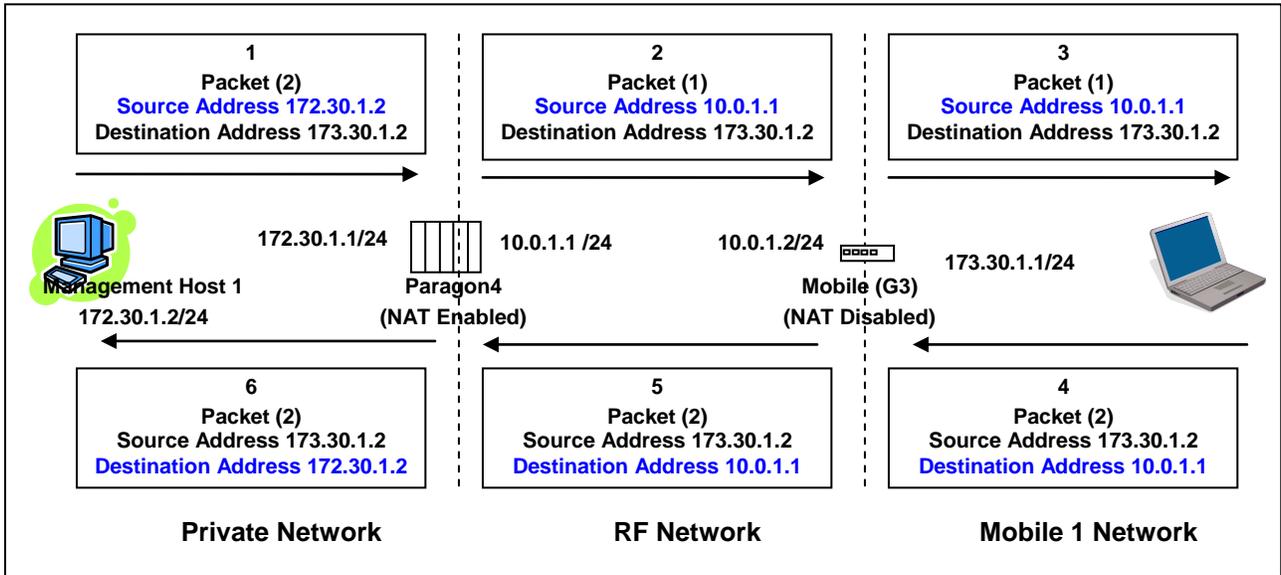
Figure 29 - Paragon4 - Example 2

In example 2, Management Host 1 sends Packet (1) to Mobile Host 1. Since the source IP address of Packet (1) comes from the private network, it gets replace by the IP address of the RF interface of the Base station.
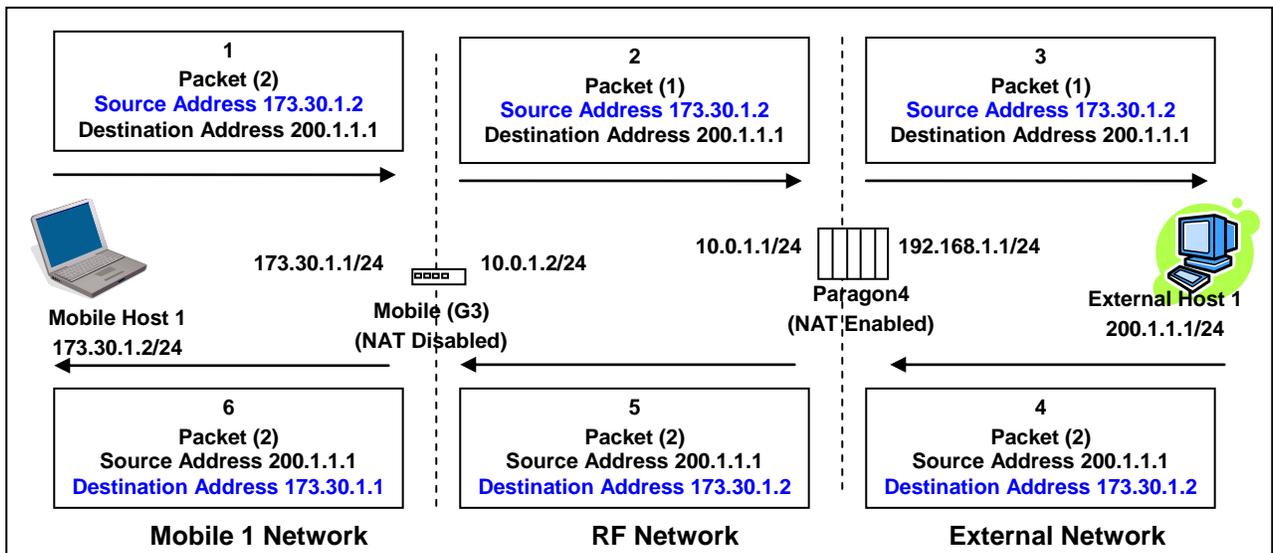
*Figure 30 - Paragon4 - Example 3*

In example 3, Mobile Host 1 sends Packet (1) to External Host 1. Since the source IP address of Packet (1) does not come from the private network, it doesn't get replaced by another IP address by the Base station.
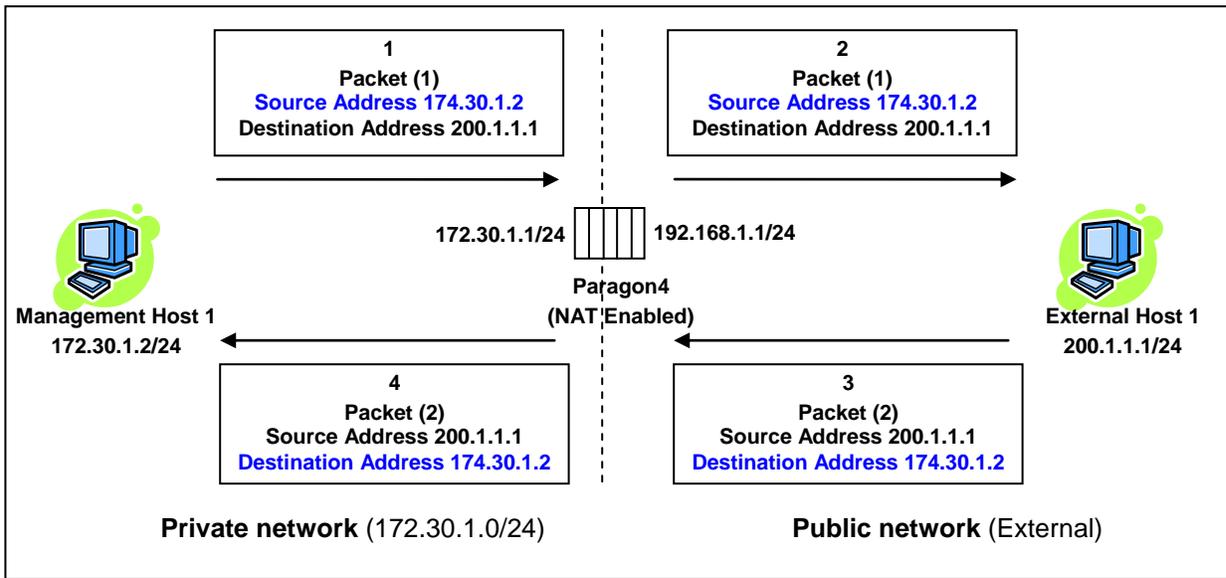
Figure 31 - Paragon4 - Example 4

In example 4, Management Host 1 sends Packet (1) to External Host 1. Even though the packet comes from the private network, the source IP address does not. The Base station does not replace the source IP address of Packet (1).

6.8.4.2 NAT on the Mobile Unit (GeminiG3)

When NAT is enabled on the Mobile Unit, the private network (from the point of view of the Mobile unit) is the IP network associated to the Ethernet 1 interface.
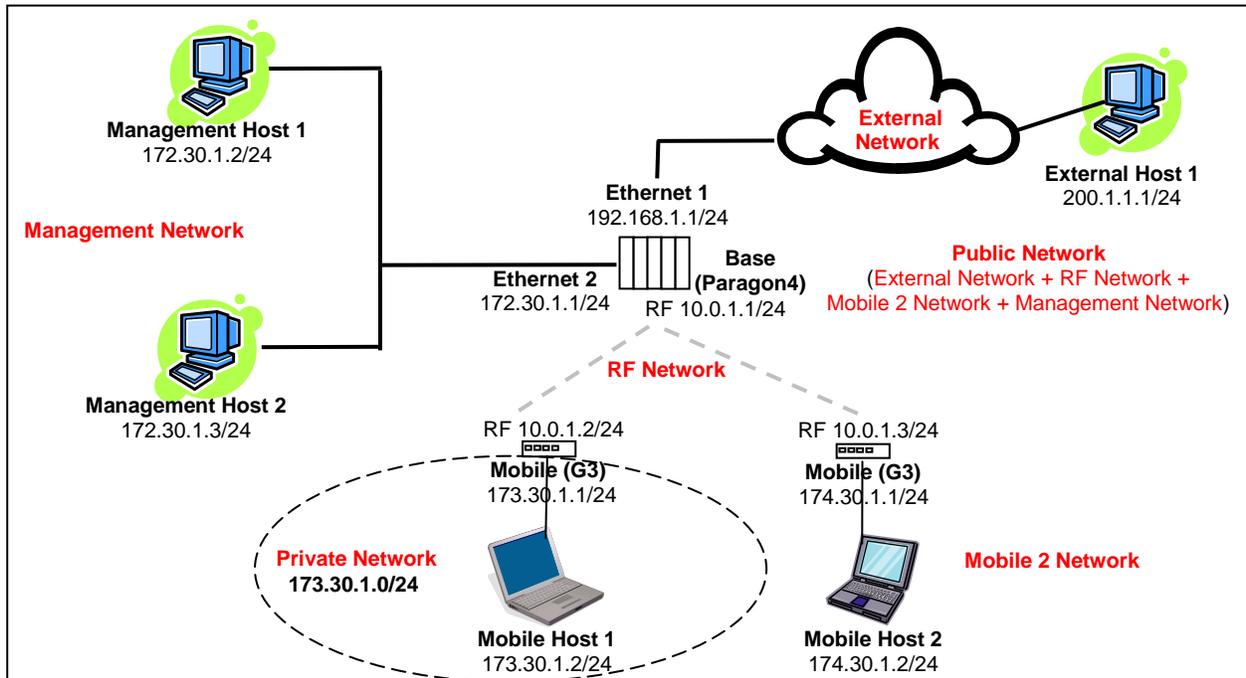
Figure 32 - NAT Enabled on GeminiG3
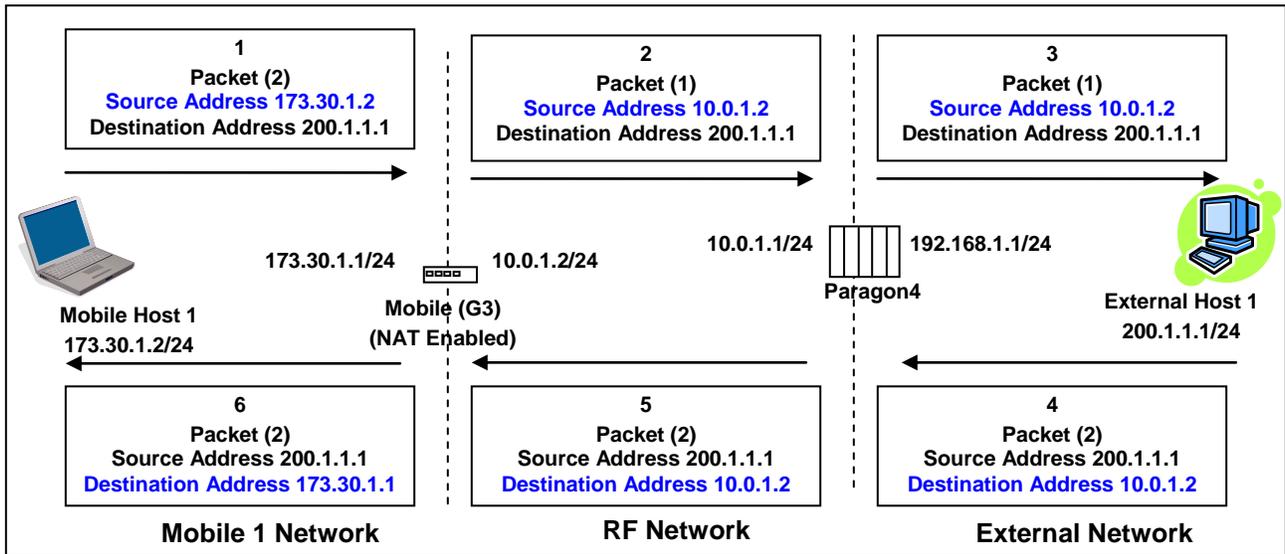
Figure 33 - GeminiG3 - Example 1

In example 1, Mobile Host 1 sends Packet (1) to External Host 1. Since the source IP address of Packet (1) comes from the private network, it gets replaced by the IP address of the RF interface of the Mobile unit.
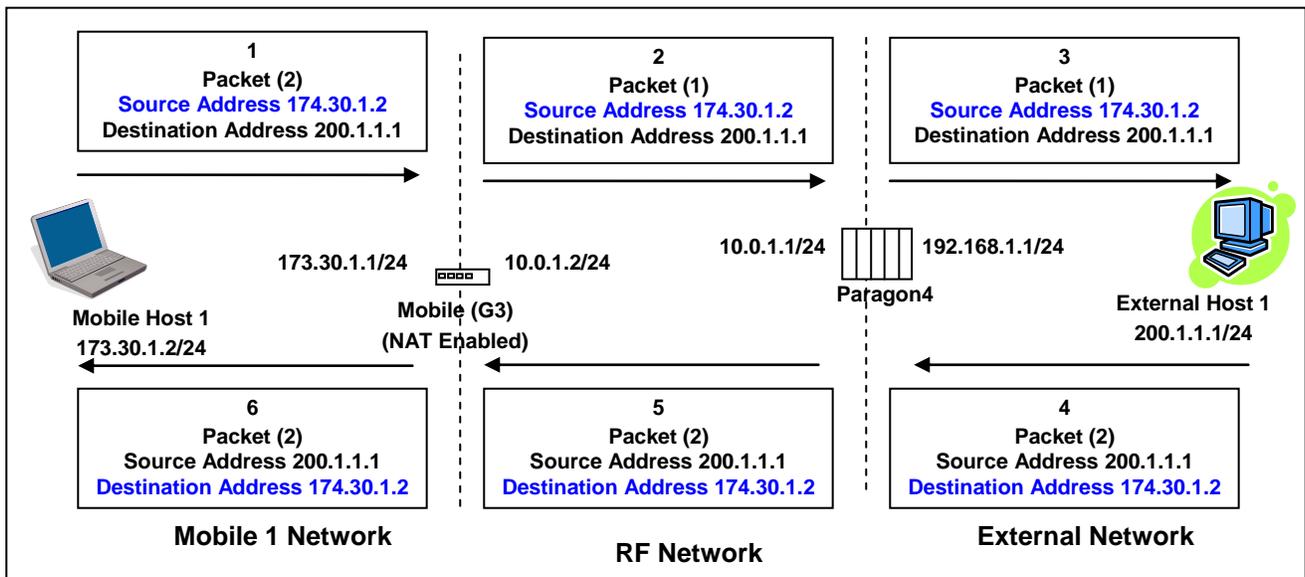

Figure 34 - GeminiG3 - Example 2

In this example, Mobile Host 1 sends Packet (1) to External Host 1. Even though the packet comes from the private network, the IP source address is not part of the private network. The source IP address of Packet (1) does not get replaced by the Mobile unit.

6.8.4.3   SNMP Overview

SNMP (Simple Network Management Protocol) is used by network management systems to manage and monitor network-attached devices. SNMP is based on the manager/agent model consisting of a manager, an agent, a database of management information, managed objects, and the network protocol. The manager provides the interface between the human network manager and the management system. The agent provides the interface between the manager and the physical devices being managed (Figure 35). SNMP uses basic messages (*such as GET, GET-NEXT, SET, and TRAP*) to communicate between the manager and the agent.
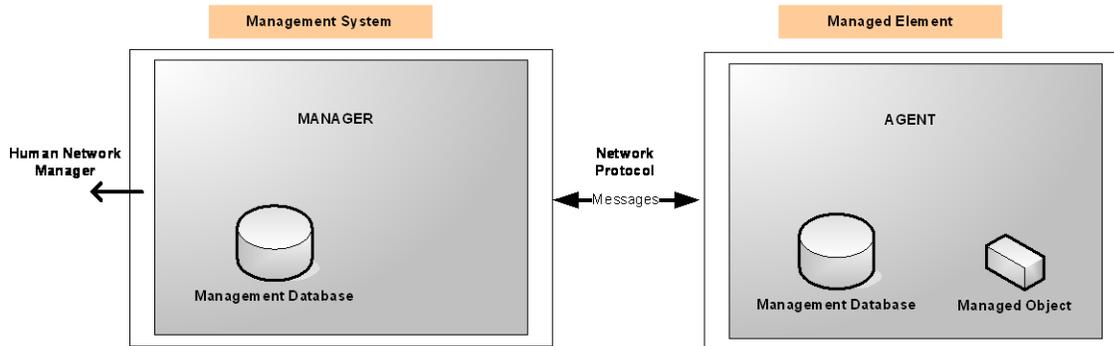
Figure 35 - SNMP: manager/agent model

6.8.4.3.1   MIB

The manager and agent use a Management Information Base (MIB), a logical, hierarchically organized database of network management information. MIB comprises a complete collection of objects used to manage entities in a network. A long numeric tag or object identifier (OID) is used to distinguish each variable uniquely in the MIB and SNMP messages.

6.8.4.3.1.1   ParagonP4 MIB File

Each ParagonP4 unit firmware package is bundled with three MIB files (found inside mibs.zip file):
- *dataradio-regs.mib*: contains a top level set of managed object definitions aimed at managing Dataradio products.
- *1213.mib*: contains a set of managed object definitions aimed at managing TCP/IP-based internets.
- *bsc.mib*: contains a set of managed object definitions aimed at managing Dataradio BSC radio base stations.

6.8.4.3.1.2   OID

In SNMP, each object has a unique OID consisting of numbers separated by decimal points. These object identifiers naturally form a tree. Figure 36 illustrates this tree-like structure for *1213.mib,* which comes bundled with every ParagonP4 unit package. A path to any object can be easily traced starting from the root (top of the tree). For example, object titled "SNMP" has a unique OID: 1.3.6.1.2.1.11. The MIB associates each OID with a label (e.g. "SNMP") and various other parameters. When an SNMP manager wants to obtain information on an object, it will assemble a specific message (e.g. GET packet) that includes the OID of the object of interest. If the OID is found, a response packet is assembled and sent back. If the OID is not found, a special error response is sent that identifies the unmanaged object.
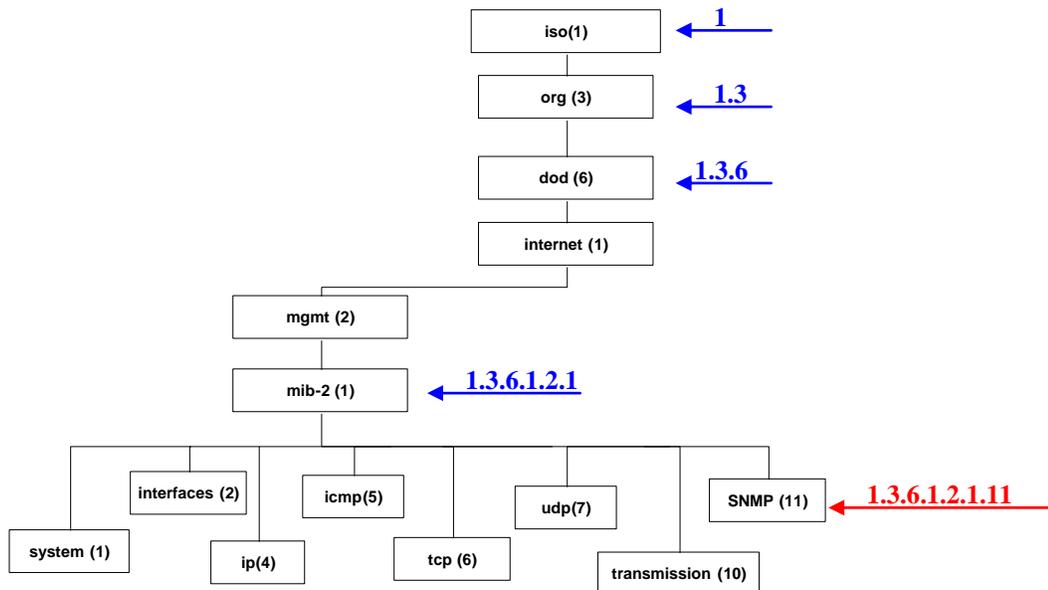
Figure 36 - Branch of the 1234.mib OID tree

6.8.4.3.1.3 **Viewing MIB files**

To view the hierarchy of SNMP MIB variables in the form of a tree and view additional information about each node, CalAmp recommends opening all MIB files with a MIB browser. In a MIB browser, each object (*or node*) can be selected and its properties (*including its OID*) can be observed.For simple networks, any MIB browser supporting SNMP v2c could be used. However, for managing complex networks, a more advanced SNMP Manager/Browser is recommended.

Refer to Dataradio Network Management using SNMP User Manual (Part no. 120 47001-nnn for more details).

Note: Both "Read Community" and "Read/Write Community" passwords are required to operate SNMP MIB. For all Paragon base stations the same password is used for both read and read/write. This password is the same password used to access the Paragon4 web pages.

6.8.4.3.1.4 **bsc.mib**

Figure 37 shows top-level objects of the bsc.mib file:

- *bscIdentity*
- *bscRadioIdentity*
- *bscStatistics*
- *bscDiagnostics*
- *bscControl*
- *bscMobileTable*

These six branches expand into additional branches and leaves. Again, all bsc.mib objects can be accessed through a MIB browser.
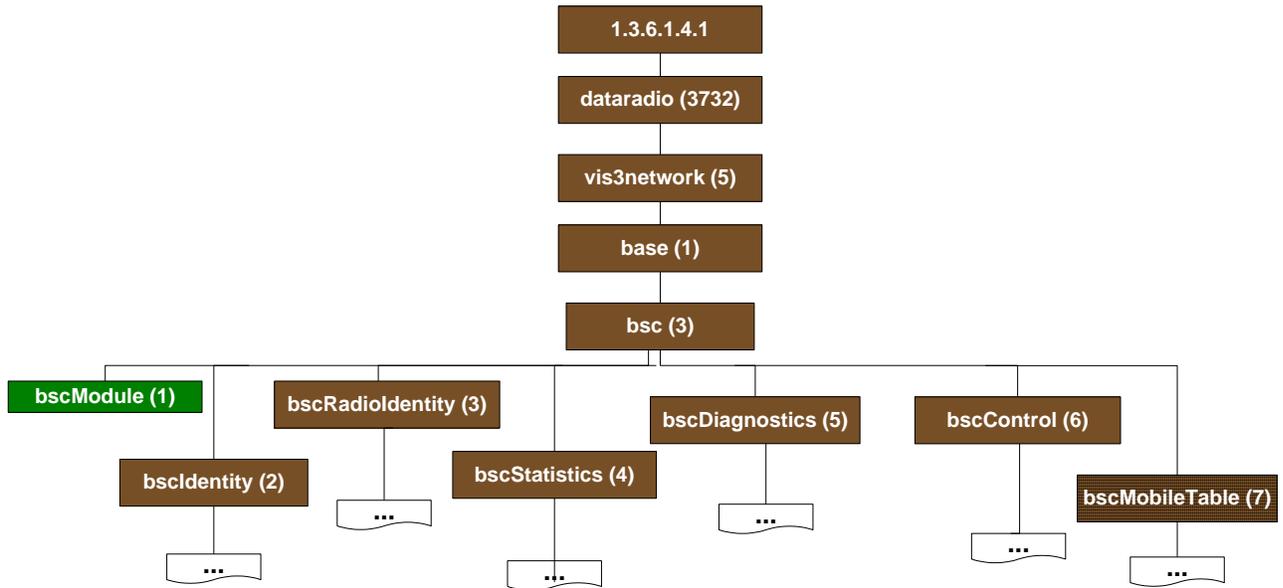
Figure 37 - bsc.mib Tree

Note: For more details on Network Management using SNMP refer to Dataradio Network Management using SNMP User Manual (Part no. 120 47001-nnn)

6.8.5 Setup (Advanced) ► IP addressing

For a description of the broadcast and multicast features of the Paragon4 radio modem, please refer to paragraph 5.7.3.5.1 below.

Figure 38 - Advanced IP Configuration – IP addressing modes

The IP Addressing web page contains two sections, the one on top controls the forwarding of IP broadcast packets and the other, on the bottom, controls IP multicast packets.

Each section acts independently.

Item		Description
Broadcast	**Directed Broadcast**	**Disabled, Enabled (Default) – Controls forwarding of Directed Broadcast packets**
	Limited Broadcast	**Disabled (Default), Enabled – Controls forwarding of Limited broadcast packets**

Multicast	**Multicast**	**Disabled (Default), Enabled – Controls forwarding of Multicast packets (based on the "Multicast Address List")** **Multicast can be used when "one-to-many" communication is required.**
	Mobile unit address	**This multicast address represents the "All Mobile" group. When a Base station receives an IP packet on its Ethernet interface and the destination IP address matches this multicast address, the IP packet is forwarded over the RF interface to all the Mobile units. The Mobile units will pass this packet to their internal applications.**
	Multicast Address List **Add / Delete Address**	**The multicast address list is used to enter multicast addresses for the various "Mobile Hosts" groups. When a Base station receives an IP packet on its Ethernet interface and the destination IP address matches one of these address, the IP packet is forwarded over the RF interface to all the Mobile units.** **If multicast forwarding is enabled on the Mobile units, the IP packet will be forwarded to the Mobile's Ethernet interface, Mobile Hosts will then be able to receive the packet.** **The Mobile units have some additional filtering capabilities.** **To add an address to the Multicast List:** **Select the "Add" option button and type in the dialog box the new address to be added to the read-only "Address List". Note that only valid multicast addresses will be accepted and displayed.** **To delete an address from the Multicast List: Select the "Delete" option button and type in the dialog box the address to be deleted from the "Address List".**
	Address List	**Read-only listing. Window expands downward as needed to show all addresses in the list.** **When an IP packet is received on the Ethernet side of the unit and the destination IP address matches one of the multicast IP addresses in this list, it is forwarded over the RF interface.** **Remote units will send it over their Ethernet interface.**

6.8.5.1 IP Broadcast/Multicast Overview

When an IP packet needs to reach more than one unit, the destination address can be set to either a broadcast address or a multicast address.

6.8.5.1.1 Broadcasts

Figure 39 - Broadcast Window Detail

There are two types of IP broadcast addresses:

- **Directed broadcast**

  A directed broadcast address is an IP address where the host portion is all ones (for instance 172.30.1.255 is the directed broadcast address for the network 172.30.1.0/24, 172.30.1.207 is the directed broadcast address for the network 172.30.1.192/28).

- **Limited broadcast**

  The limited broadcast address is 255.255.255.255.

  Note:

  Routing equipment (to prevent broadcast storms) do not by default forward limited broadcast packets (255.255.255.255). On the other hand, directed broadcast packets are by default forwarded because these packets are routable like any other unicast packets.

6.8.5.1.1.1 *Directed Broadcast*

Each interface of a unit has its own IP address and netmask. From the IP address and netmask, it is easy to calculate the broadcast address associated to the interface. For instance, if the Ethernet interface address of a GeminiG3 radiomodem is 172.30.1.1/24 and the RF interface address is 10.0.1.2/24, then the broadcast address of the Ethernet interface is 172.30.1.255 and the broadcast address of the RF interface is 10.0.1.255.

The "***Directed Broadcast***" option buttons let the user select whether the unit must forward (or not) *directed broadcast* packets. Upon reception of a *directed broadcast* packet, the unit takes the following actions:

If the directed broadcast address matches with one of the unit's interface broadcast addresses:

- Keep a copy for itself (pass to internal applications, if any).
- If directed broadcast packets can be forwarded (Directed Broadcast is enabled):
  Forwards the packet according to the routing table.

- If directed broadcast packets cannot be forwarded (Directed Broadcast is disabled):
  Silently discards the packet.

Note:

*Occasionally, the unit cannot determine that the packet is actually a **directed broadcast**. In such a case, the packet is normally routed.*

Example (Directed Broadcast forwarding enabled)
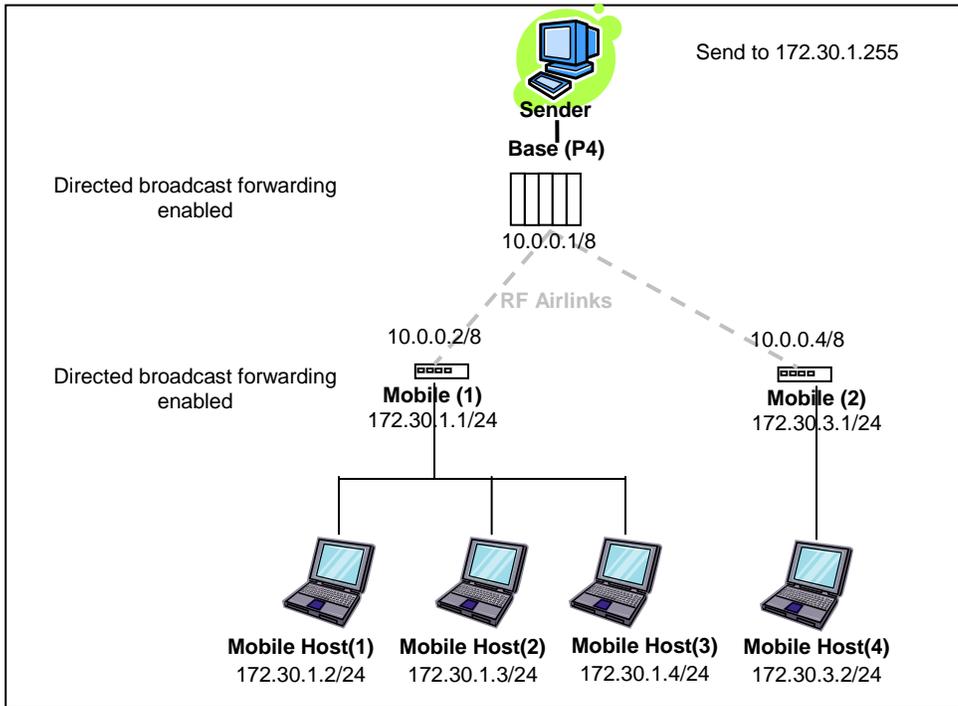
Figure 40 - Example of Directed broadcast forwarding enabled

In this example (Figure 40), directed broadcast forwarding is enabled on the **Base** unit and on **Mobile (1)** unit. If **Sender** wants to reach **Mobile Host (1)**, **Mobile Host (2)** and **Mobile Host (3)** with a single packet, he can send to destination address 172.30.1.255.

Example (Directed Broadcast forwarding disabled)
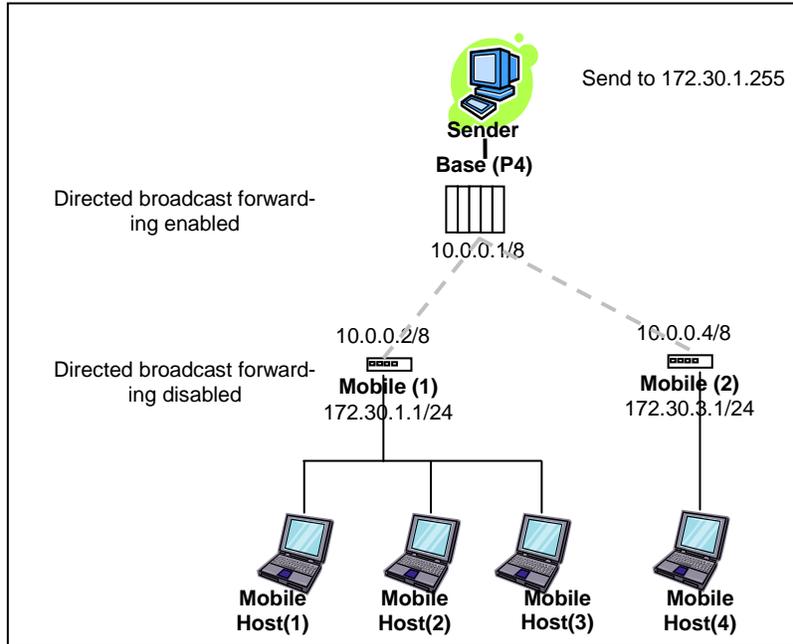
Figure 41 - Example of Directed broadcast forwarding disabled

In this example (Figure 41), directed broadcast forwarding is enabled on the **Base** unit and disabled on the **Mobile (1)** unit. If **Sender** sends a packet to destination address 172.30.1.255, the packet would be discarded by **Mobile (1),** it would not reach **Mobile Host (1), Mobile Host (2)** and **Mobile Host (3).**

If the user wants the **Base** unit to do the discarding of the directed broadcast packets, then the directed broadcast forwarding must be disabled on the **Base** unit itself.

6.8.5.1.1.2   Limited Broadcast

The "***Limited Broadcast***" enabled/disabled option buttons control *limited broadcast* packets forwarding. When enabled, the unit forwards *limited broadcast* packets.

Upon reception of a *limited broadcast* packet, the unit takes the following actions:

- Keeps a copy for itself (passes to internal applications, if any).

- If *limited broadcast* packets can be forwarded (Limited Broadcast is enabled):
  Sends a copy of the packet out to all the interfaces with the exception of the interface where the packet was received.

- If *limited broadcast* packets cannot be forwarded (Limited Broadcast is disabled):
  Silently discards the packet.

*Example (**Limited Broadcast forwarding enabled**)*
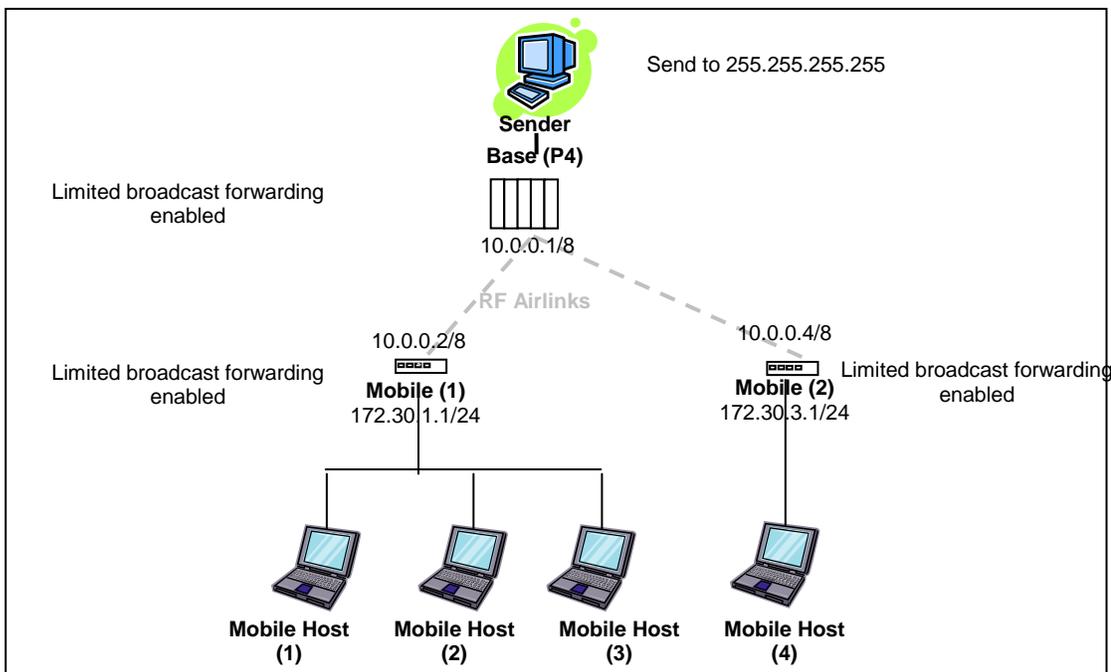
Figure 42 - Example of Directed broadcast forwarding enabled

In this example, (Figure 42) limited broadcast forwarding is enabled on the **Base** unit and on all **Mobile** units. **If Sender** wants to reach **Mobile Host (1)**, **Mobile Host (2) and Mobile Host (3)** and **Mobile Host (4)** with a single packet, he can send to destination address 255.255.255.255.

Notice that **Sender** and **Base** units are on the same LAN (routing equipment does not usually forward limited broadcast packets).

Example (Limited Broadcast forwarding disabled)
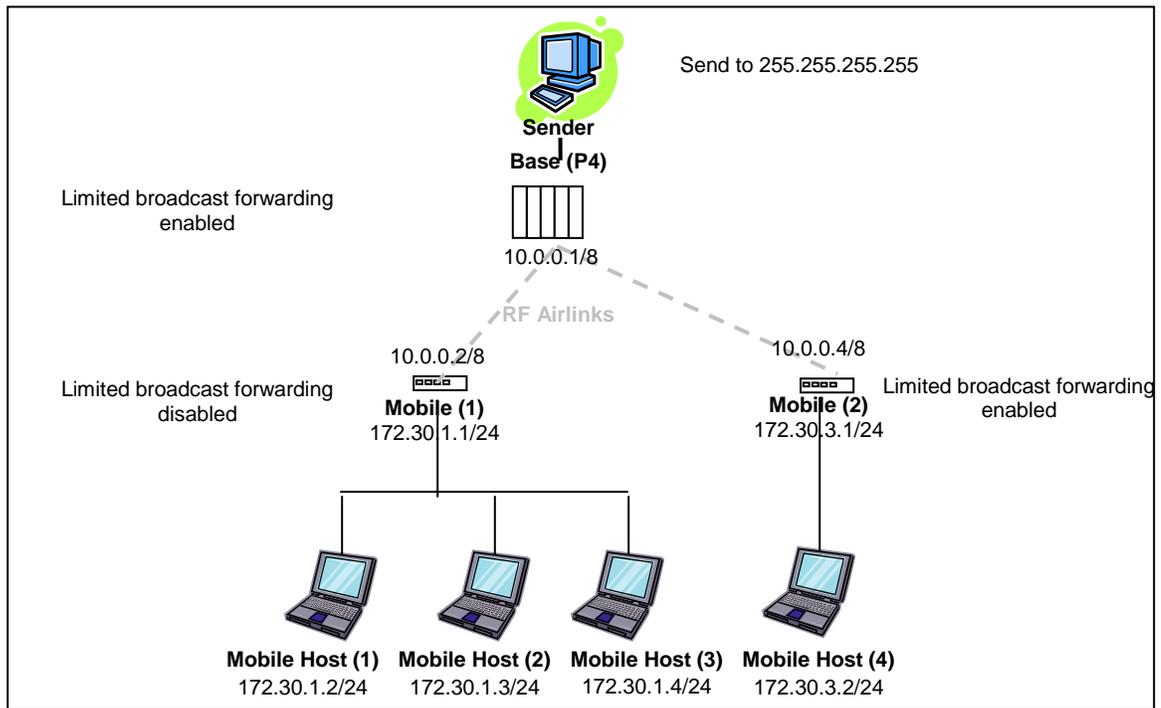
Figure 43 - Example of Limited broadcast forwarding disabled

In this example (Figure 43), limited broadcast forwarding is enabled on the **Base** unit, disabled on the **Mobile (1)** unit and enabled on the **Mobile (2)** unit. If **Sender** sends a packet to destination address 255.255.255.255, the packet would reach **Mobile Host (4)** only. The **Mobile (1)** unit would discard any limited broadcast packet it received from the **Base** unit.

If the user wants the **Base** unit to do the discarding of the limited broadcasting packets, then the limited broadcast forwarding must be disabled on the **Base** unit itself. Then no **Mobile Host** unit would ever be receiving a limited broadcast packet.

6.8.5.1.2 Multicast

IP multicast addresses are in the range 224.0.0.0 to 239.255.255.255. These addresses are used to represent logical groups of units that may or may not reside on the same networks.

Multicast is used when "one-to-many" communication is required. For instance, a radio station might offer a music channel on the Internet in real time. To receive the music a receiver-host must know the multicast group (multicast address) used by the radio station sender-host and add itself as a member of this group. In the IP realm, a host uses the IGMP protocol to do this. The routers inside the Internet are using IGMP and other multicast routing protocols to build the proper path from the sender to the receivers (a tree-like path is formed from the sender to the receivers).
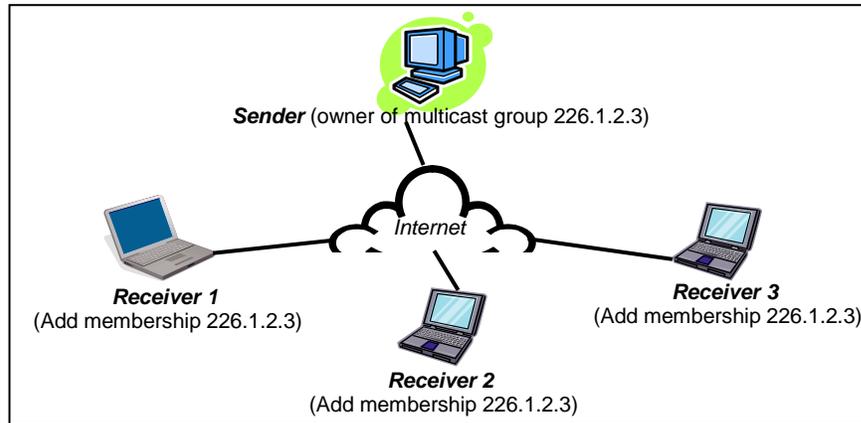
Figure 44 - Registration to multicast group (First step)
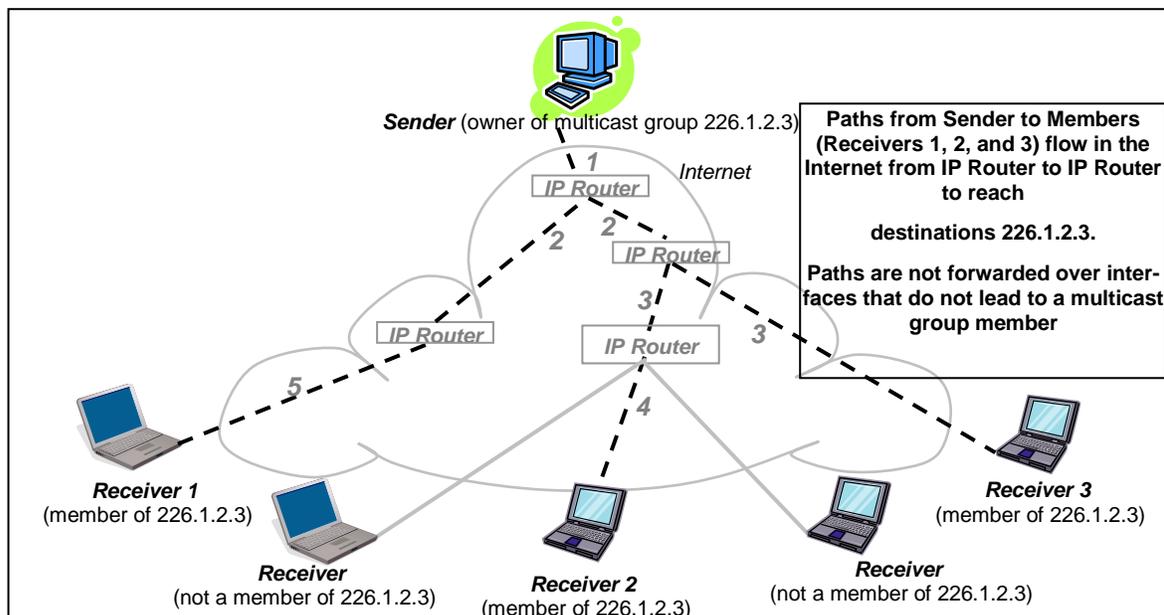
Figure 45 - Reception of multicast packets (Second step)

In the E-DBA environment, an outside sender-host might be interested in sending multicast packets to any one of the following groups:

- "All Mobile" group.
- Various "Mobile Host" groups.

The Base (P4 in the illustration) units are directly connected to the outside network. ALL multicast groups MUST be identified in the Base because the Base unit uses IGMP to register the memberships to the multicast groups on behalf of the other units (Mobile units, Mobile Host units).
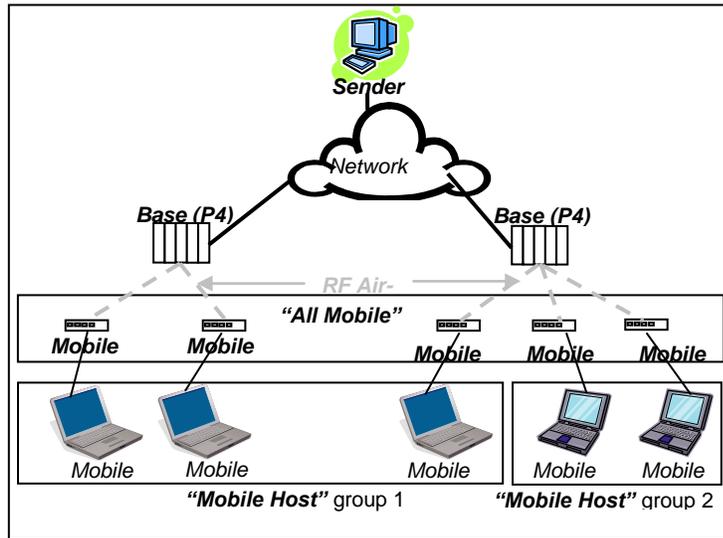
Figure 46 - Typical E-DBA Multicast Groups

The following setup example would allow the "Sender" unit to communicate with different multicast groups. The settings shown in Figure 47 below, and also represented in
Figure 48, would enable the Sender unit to reach all entities of the various groups.

Figure 47 - Multicast Window Details (On the Base station)

Multicast (Enabled/Disabled)	Enables or disables the registration of the multicast groups by the Base
Mobile address	Indicates the "All Mobile" multicast group
Multicast Address List	Indicates the various "Mobile Host" groups
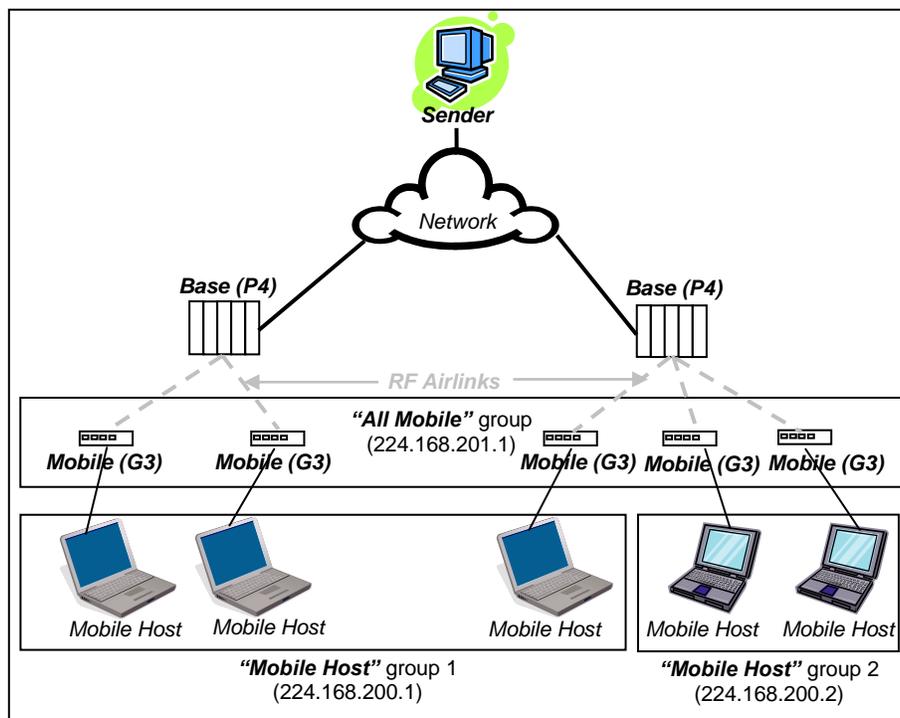
Figure 48 - Typical E-DBA Multicast Groups (with addresses)

6.8.6 Setup (Advanced) ► IP Optimization

Figure 49 - Setup (Advanced)-Optimized IP Settings

Item	Description
RF ACK	**Disabled (Default) - TCP packets are always RF acknowledged regardless of this option setting.** **Enabled - Use when packets need to be acknowledged at the RF level by the remote unit (destination unit). This option is applicable to all packet types other than TCP.**
OIP Retries	**Number of OIP retries. Default = 2**

6.8.7 Setup (Advanced) ► IP Route

Displays the table of IP routes that are active in the Paragon4 base station.

Typically, display shows routes for RF, ETH1, and ETH2.

Figure 50 - IP Routing

Item	Description
IP Address	The address portion of the destination network
Netmask	The mask portion of the destination network
Gateway	IP Address: The IP address of the gateway to use when trying to reach the given network
Type	Static: routes added by the user Connected: addresses that are directly reachable by one of the interfaces Proprietary: routes added internally by the Mobile registration process
Add / Delete	Allows the user to add or remove routes manually to/from the table. Warning: Manipulate this table with caution!

6.8.8 Setup (Advanced) ► Time Source

To facilitate tracking of events in a network, the Paragon4 base station and the GeminiG3 unit can initialize their real-time clocks using a number of protocols. At reset time, the Paragon4 unit can use the SNTP protocol (RFC2030) to pick up the current UTC (Universal) time. Setting the "TimeZone" and "Daylight Savings" options allows displaying the correct local time in the "Unit Identification and Status" page.

Figure 51 - Advanced IP Configuration – Time Source

Item		Description
SNTP	**Client**	Disabled (Default), Enabled
	Server address	IP of the SNTP Server in dot decimal format
	Period	Period at which the SNTP Server is polled
	SNTP UTC Time	SNTP UTC Time Last update received from the SNTP Server (in seconds) - Read-only field.
Time Zone	**TimeZone**	Select from drop-down list
	Daylight Savings	Disabled (Default), Enabled
Note: Due to transitional nature of Daylight Saving in many jurisdictions, we recommend that customers use UTC for consistent, unambiguous time reporting, setting TimeZone to UTC and Daylight Saving to Disabled.		

6.8.9 Setup (Advanced) ► Ethernet (PHY)

The Ethernet port(s) must be configured in a mode that is compatible with the other local devices.

Figure 52 - Advanced IP Configuration – Ethernet (PHY)

	Item	Description
ETH1 PHY	**PHY Bitrate**	**Auto Negotiate** **Force to 100 Mbps** **Force to 10 Mbps (Default)**
	PHY Duplex	**Displays factory configured mode of operation: Auto Negotiate**
ETH2 PHY	**PHY Bitrate**	**Auto Negotiate** **Force to 100 Mbps** **Force to 10 Mbps (Default)**
	PHY Duplex	**Displays factory configured mode of operation: Half Duplex**

6.8.10 Setup (Advanced) ►Diagnostic Settings

Diagnostics settings

⚠ **Analog alarms trap conditions**

Analog monitoring rate	500	ms

Chassis power supply Low Threshold High threshold	☑goes out of range ☑returns into range 10.8 Volts 16.0 Volts	**Power amplifier power supply** Low Threshold High threshold	☑goes out of range ☑returns into range 13.1 Volts 14.5 Volts
Forward power Low Threshold High threshold	☑goes out of range ☑returns into range 41.8 dBm 48.9 dBm	**Standing Wave Ratio** Threshold	☐goes above ☐returns below 3.00 :1
Analog 1 Low Threshold High threshold	☐goes out of range ☐returns into range 0.0 0.0	**Analog 2** Low Threshold High threshold	☐goes out of range ☐returns into range 0.0 0.0
Fan 1 Low Threshold	☐goes below ☐returns above 0	**Fan 2** Low Threshold	☐goes below ☐returns above 0
Chassis temperature Low Threshold High threshold	☑goes out of range ☑returns into range 15 ° C 20 ° C		

⚠ **Digital alarms trap conditions**

Alarm A1 input Asserted level is	☐Asserts ☐Unasserts ○high ◉low	**Alarm A2 input** Asserted level is	☐Asserts ☐Unasserts ○high ◉low
Alarm B1 input Asserted level is	☐Asserts ☐Unasserts ◉high ○low	**Alarm B2 input** Asserted level is	☐Asserts ☐Unasserts ◉high ○low

⚠ **Hardware fault trap conditions**

Receiver Comparison	☐Fault ☐Fault cleared

⚠ **Configuration Files**

Forward Power calibration
filename: Bird_45220021_800_F_1.pli
description: Bird 4522-002-1 800MHz FWD PWR $Revision: 1.4 $

Reverse Power calibration
filename: Bird_45220021_800_R_1.pli
description: Bird 4522-002-1 800MHz REV PWR $Revision: 1.4 $

Analog monitoring 1 calibration
filename:
description:

Analog monitoring 2 calibration
filename:
description:

[Apply] [Cancel]

Figure 53 - Advanced IP Configuration – Diagnostic Settings

Item	Description
Analog alarms trap conditions	
Analog Monitoring Rate	Frequency at which internal values are updated and checked against the alarm boundary conditions. Ranges from 100milliseconds to infinity. Default = 500ms

Analog alarms settings	For each diagnostic value displayed, the user can control alarms trap conditions in the following ways:
	  ▪ Set acceptable range of values by entering the low and high thresholds
	  ▪ Choose to be notified when the value goes out of acceptable range by selecting the "goes out of range" check box
	  ▪ Choose to be notified when the value returns into acceptable range by selecting the "returns into range" check box
	All monitoring combinations are possible

Digital Alarms trap conditions	

Digital Alarms settings	For all digital alarms, the traps can be sent when:
	  ▪ "Asserted:-The digital signal changes from low to high
	  ▪ "Unasserted"-The digital signal changes from high to low
	All monitoring combinations are possible

Hardware fault trap conditions	

Receiver Comparison	To diagnose a possible receiver malfunction
	  ▪ Choose to be notified when a Receiver Comparison fault occurs by selecting the "Fault" check box.
	  ▪ Choose to be notified when a Receiver Comparison fault has been corrected by selecting the "Fault cleared" check box.

Calibration Files	
Calibration Files	All Paragon4 unit firmware comes bundled with two interpolation files used for forward and reverse power calibration. These files are required to be used with the optional external power sensor assembly (p/n 030 03547-xxx). Caution: *Forward & reverse power readings will not be accurate without the optional external power sensor assembly* (p/n 030 03547-xxx)*.* *Refer to your CalAmp sales channel for details.* The file names entered in this section should match the file names in your unit *(Note: file names are case sensitive.)* These files are needed to properly display the Forward and Reverse power values.

6.8.10.1   Calibration Files

Special electrical sensors are used to measure the values of real world quantities such as forward or reverse RF power. These sensors represent all measurements in Volts and require a conversion to proper units where applicable. This conversion is achieved by use of mathematical transfer functions, which also provide a way of calibrating the sensor hardware.

The transfer function can be represented by a simple look-up table that approximates a continuous function by a series of data points. Each data point represents an {X_{in}, Y_{out}} pair, where X_{in} is the sensor's output-a measurement in Volts, and Y_{out} is the corresponding value in a desired unit of measurement. Linear interpolation is used to generate Y_{out} values for any given X_{in} value in between the data points supplied in the look-up table.

The series of data points in a look-up table are listed in a text calibration file and is read by the Piecewise Linear Interpolation Calibrated Conversion (PWLICC) software module, employed in Paragon4 radio base station to convert the sensor output into a desired value.

CalAmp supplies look-up tables for forward and reverse power measurements. These tables contain a set of values in Volts (X_{in}) with their corresponding values in Watts (Y_{out}). Similar look-up tables need be created for user-supplied external analog devices connected to the base station's backplane for diagnostics and monitoring if other than voltage measurement units are preferred.

An example of a look-up table is presented in Table 5 with a corresponding graph in Figure 54

Table 5 - Sample Interpolation endpoints

X_{in} (Volts)	Y_{out} (Desired Units)
0.0	0.0
0.2	1.0
0.375	2.0
0.530	3.0
0.530	4.0
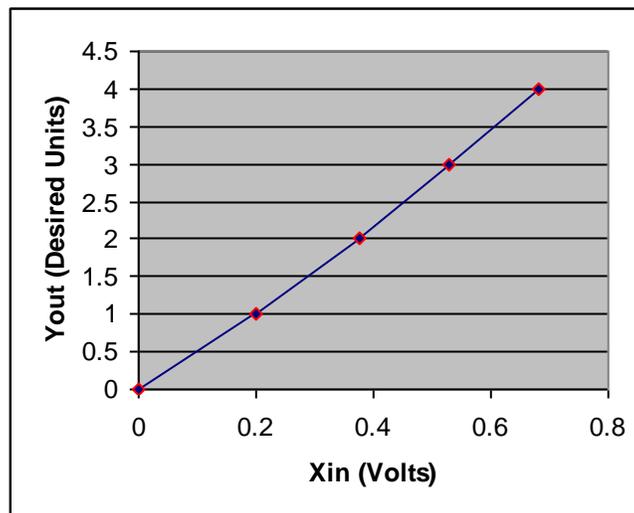
Figure 54 - Sample Interpolation curve

Values in-between the data points are calculated using a straight line between the closest two known data points. At least 2 data points are required; however 10 or 20 data points (up to 50) are usually necessary (depending on the curves behavior).

A look-up table can be created with a simple text editor, such as MS-Notepad, carefully following the guidelines presented below. The basic syntax is summarized in Table 5.

- // symbol preceding any entry denotes comments.
- [c] symbol preceding a string of up to 80 characters denotes file description. This string will be displayed under "description" field on the "Diagnostics Settings" page of the Pargon3 web interface.
- [u] symbol preceding a string of up to 15 characters denotes the desired unit of measure.
- [n] symbol preceding an integer denotes the number of entries in the look-up table.
- Data points are filled in as {X_{in}, Y_{out}} pairs. Each pair occupies a line and counts *one* space in between its elements:

  $X_{in1} Y_{out1}$
  $X_{in2}\ Y_{out2}$
  $X_{in3}\ Y_{out3}$
  ……..
- The number of {X_{in}, Y_{out}} pairs must correspond to the index ([n]) entered.
- Empty lines are not accepted-use comments for formatting.
- Duplicate X_{in} values are not accepted.

- When complete, use the "Save As" command.
- The file name is case-sensitive and spaces are not allowed.
- The file name should be saved under .pli extension.
- The file should be uploaded into a unit using FTP transfers.
- The file's name should be entered under "Analog monitoring 1 calibration" (and/or "Analog monitoring 2 calibration") field on the Diagnostic page of the Paragon4 web interface.

Table 6 - PLICC Syntax

Syntax	Description	
// <comment>	Comments.	Optional
[c] <name>	Descriptive name of the look-up table (string of 80 characters max). This field will appear under the "description" field on the Diagnostics Settings" page of the Pargon3 web interface.	Optional
[u] <unit>	Unit of measure (string of 16 char maximum).	Optional
[n] <index>	Number of entries in the table (2 minimum, 50 maximum).	Required

Failure to comply with the guidelines described above may result in the following errors:

Table 7 - Possible Error messages

Error	Description
No file found	The file name entered is not found on the unit.
Bad header or bad file format found.	Syntax Error .
No data found.	No data entered in the file (less than 2 data points).
More than 50 segments found in file.	The file counts more than 50 data points.
Duplicate X values found in data.	The file contains duplicate X_{in} values.

A sample calibration file is presented in Figure 55. Please note the following:

1. "V*olts to watts conversion*" will appear under the "description" field on the "Diagnostics Settings" page of the Pargon3 web interface.

2. This look-up table contains a set of values in Volts with their corresponding values in Watts.

3. This look-up table contains five data points.

4. The number of data points should correspond to the index (entered under [n]). All X_{in} entries (voltage values) must be unique.
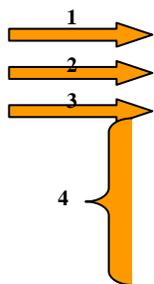

```
// file name: sample_calibration_file.pli
// Revision: N.NN
// Date: YYYY/MM/DD
// Other Comments
[c]Volts to watts conversion
[u]Watts
[n]5
0.000 0.0
0.200 1.0
0.375 2.0
0.530 3.0
0.530 4.0
```

Figure 55 - Sample calibration file

6.8.11 Setup (Advanced) ►User Settings
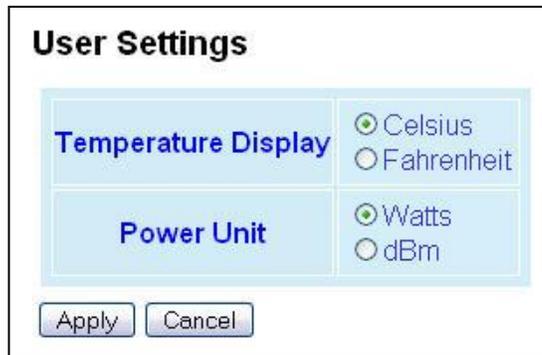
Figure 56 - Advanced IP Configuration - User Settings

Item		Description
Temperature Display	Celsius (default)/Fahrenheit	Select desired temperature scale. Where applicable, the temperature will be displayed in selected temperature scale.
Power Unit	Watts (default)/ dBm	Select desired power scale. Where applicable, the power will be displayed in selected power scale.

6.9   Security

6.9.1 Security ► Password and Encryption Control

The Setup web pages, the CLI (command line interface) and the FTP server all require a password to prevent unauthorized users from changing a unit's configuration. At the time of manufacture, the password is set to "ADMINISTRATOR" but CalAmp strongly suggests that the password be changed as units are installed.

Figure 57 - Security – Password and Encryption

Item	Description
User ID	Enter a string of any letters or numbers of at least 1 and not exceeding 15 characters *The User Name entry is currently not an access-limiting factor. It only serves to identify the person gaining access. User Name may be required by future versions.*
Old Password	For an initial installation, enter the default Password ADMINISTRATOR *(all upper case letters)*. For subsequent access, use the Password that you will have configured.
New Password	Enter a string of any letters or numbers of at least 8 and not exceeding 15 characters CAUTION: Do not lose the new password or you will not be able to gain access to the unit; you will need to contact CalAmp support.
New Password (confirm)	Re-enter the new password string
Encryption	Disabled, Enabled (Default)
Encryption Pass Phrase	String of characters used to create a 128-bit AES encryption key. The Pass Phrase can be up to 160 characters long. Using a length of at least 128 characters should provide an adequate security level for most users. *A good pass phrase mixes alphabetic and numeric characters, and avoids simple prose and simple names.*
Encryption Key	All units in a network must have the same key. *READ ONLY - Displayed in pairs separated with spaces*

6.9.2 Security ► Access Control

Figure 58 - Security - Access List

Item		Description
Access List Control	**Access List Control**	Access List is used to keep unauthorized unit(s) away from CalAmp RF network. Maximum number of Access List entries = 100. The Access List Control takes the following values: Disabled (Default) Allow or Deny – Authorized units only. Requests from any unit(s) outside this list will be rejected.
Access List Management	**Add Entry**	Adds entry in the Access Control List
	Delete Entry	Deletes entry in the Access Control List

	Import Access list from file	Imports Access List from file – Populates Access Control table from the file "`accesslist.acl`". It is basically a text file that contains a list of RF MAC addresses.
		E.g.:
		`0x1234`
		`abcd`
		`2345`
		where, `0x1234`, `abcd`, and `2345` represent RF MAC addresses in HEX
		To use this feature:
		-Create a text file "accesslist.acl" with a list of RF MAC addresses
		-Upload the file from a host PC via an FTP program
		-Click on "Import Access list from file" button
		-Click on "Display Access List" button to view the imported access list

	Clear Access List	Clears entire Access Control table
	Display Access List	Clicking this button opens the access list in the message window

6.10 Statistics

Statistics web pages allow the user to view data transmission statistics (Interfaces) and base station performance (Channel Utilization).

6.10.1 Statistics ► Interfaces

Figure 59 - Statistics – Interfaces

Item		Description
LAN(ETH1)	**RX Pkts**	**Total number of packets received by Ethernet 1 interface**
	TX Pkts	**Total number of packets transmitted by Ethernet 1 interface**
LAN(ETH2)	**RX Pkts**	**Total number of packets received by Ethernet 2 interface**
	TX Pkts	**Total number of packets transmitted by Ethernet 2 interface**
RF	**RX Pkts (RF-OIP)**	**Total number of packets received by RF-OIP interface**
	TX Pkts (RF-OIP)	**Total number of packets transmitted by RF-OIP interface**
	RX Ctrl Pkts (RF-Airlink)	**Total number of control packets received by RF-Airlink interface**
	RX Data Pkts (RF-Airlink)	**Total number of data packets received by RF- Airlink interface**
	TX Ctrl Pkts (RF-Airlink)	**Total number of control packets transmitted by RF- Airlink interface**
	TX Data Pkts (RF-Airlink)	**Total number of data packets transmitted by RF- Airlink interface**
Airlink error correction	**Packets with no error**	**Number of E-DBA packets, control or data, received over-the-air with zero error.**
	Packets corrected	**Number of E-DBA packets, control or data, received over-the-air with correctable errors.**
	Packets not correctable	**Number of E-DBA packets received over-the-air with errors that could not be corrected. These packets were discarded.**

6.10.1.1 Interface Statistics Conventions

To reduce their design complexity, most networks are organized as a series of layers or levels, each one built upon its predecessor. Layer *n* on one machine carries on a conversation with layer *n* on another machine. The rules and conventions used in this conversation are collectively known as the layer *n* protocol. The number of layers, the name of each layer, the contents of each layer, and the function of each layer differ from network to network.

Figure 60 below illustrates layers and protocols applicable to CalAmp network architecture implementation. The five basic layers are:

- Physical Layer
- Datalink Layer
- Network Layer
- Transport Layer
- Application Layer
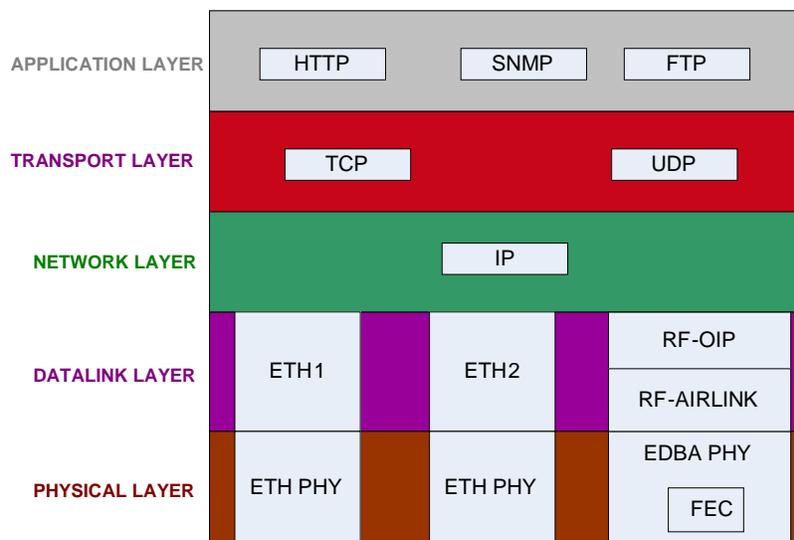
Figure 60 - Layers and protocols applicable to Dataradio implementation

In reality, no data are directly transferred from layer *n* on one machine to layer *n* on another machine. Instead, each layer passes data and control information to the layer immediately below it, until the lowest layer is reached (Figure 61).

Paragon4 radio base station web interface presents data transmission statistics for the Datalink layer. Network and Transport layers statistics are not accessible through the web interface; they are provided in 1213 MIB and can be accessed through a MIB browser or an SNMP manager (see section 6.8.4.3: SNMP Overview for more details on 1213 MIB).
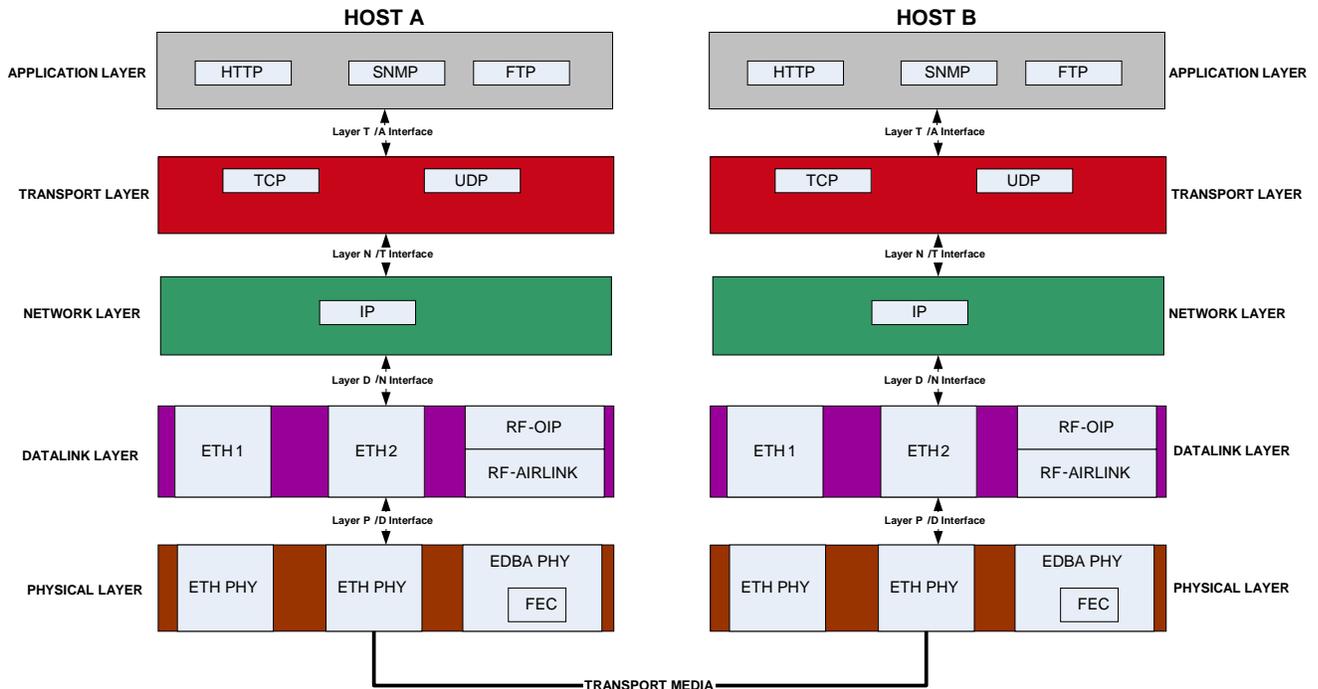
Figure 61 - Layer, protocols, and interfaces applicable to Dataradio implementation

All statistics presented by CalAmp follow a convention presented in Figure 62. Layer *n* statistics are given with respect to the layer immediately below it: layer *n-1*. RX (Receive) or IN refers to data received by layer *n* from layer *n-1*. Transmit (TX) or OUT refers to data transmitted by layer *n* to layer *n-1*.
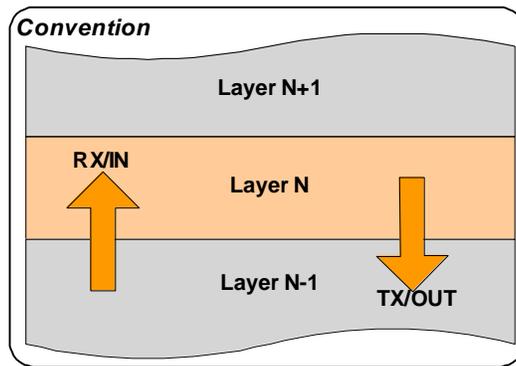
Figure 62 - RX and TX Convention

6.10.1.1.1   Datalink Layer Statistics

Datalink layer comprises two Ethernet interfaces (ETH1 and ETH2) and an RF interface. Ethernet1 and Ethernet2 interfaces statistics are illustrated in Figure 63.
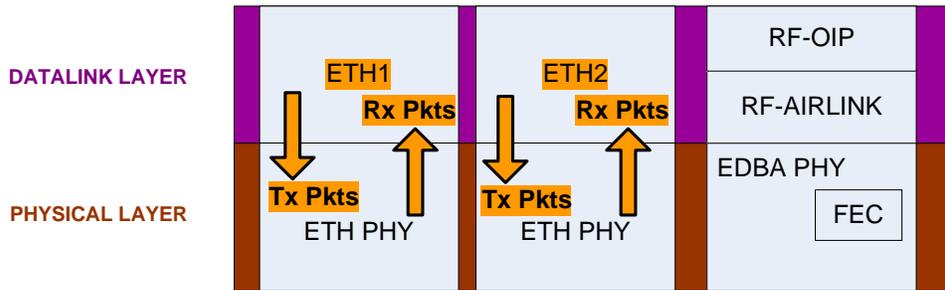
Figure 63 - Datalink Ethernet Statistics

RF interface is further subdivided into two sub-layers: OIP sub-layer and Airlink sub-layer. OIP (Optimized IP) sub-layer is concerned with compression, optimization, TCP proxy control, and IP roaming. Airlink sub-layer is where Dataradio's Enhanced Dynamic Bandwidth Allocation (E-DBA) Airlink protocol resides.

RF interface statistics are illustrated in Figure 64. Each E-DBA cycle consists of a fixed number of control packets (e.g.: Requests, Acknowledgements, etc...) and a dynamically allocated number of data packets. This is why both Data and Control packets count appear at the Air link sub-layer.

RF interface statistics also include error correction statistics for all incoming packets. The corrections are accomplished with a forward error correction (FEC) module. The advantage of forward error correction is that retransmission of data can often be avoided.
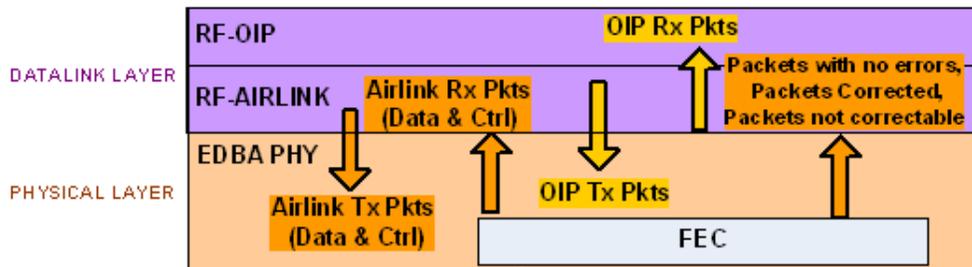
Figure 64 - Datalink RF Statistics

6.10.2 Statistics ► Performance
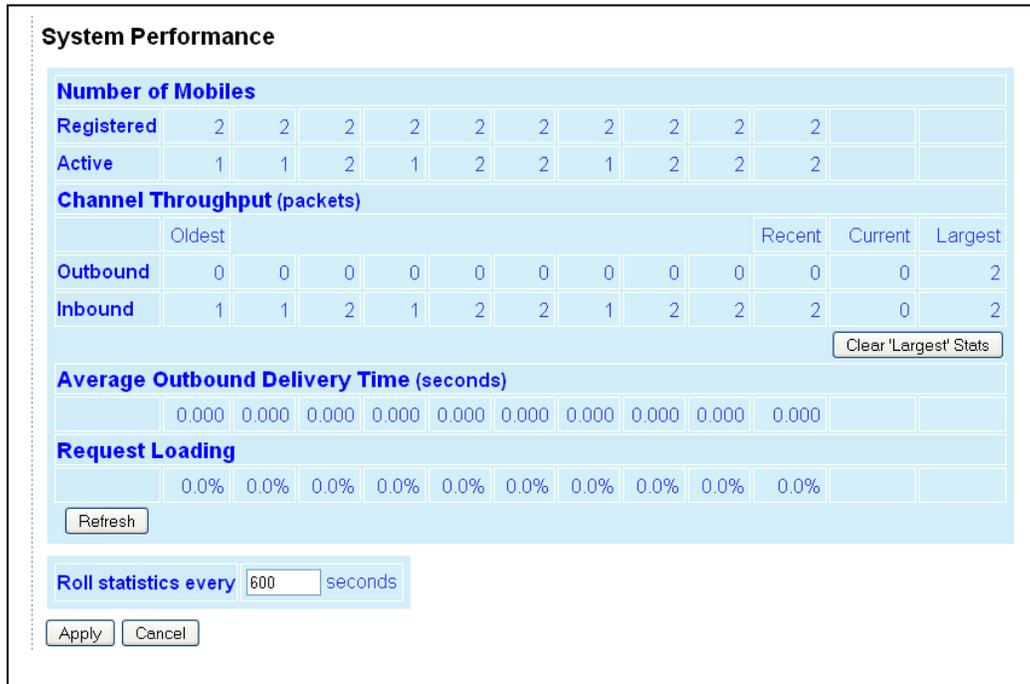
Figure 65 - Statistics - System Performance

| Item	Description
Number of Mobiles	**Registered:** Records the maximum number of mobiles registered at any time over the statistics period **Active:** Records the number of mobiles that have actively transmitted or received data during the statistics period. This value can be larger than the number of Registered mobiles for a period if enough mobiles have registered and then roamed away from the base during the statistic period.
Channel Throughput	**Outbound:** Records the number of data packets sent outbound during the statistics period. The number of packets sent so far during the Current period is shown, as is the Largest value recorded for any period. **Inbound:** Records the number of data packets scheduled for inbound during the statistics period. The number of packets scheduled so far during the Current period is shown, as is the Largest value recorded for any period. (The number of packets scheduled may not match the number of packets actually received. See *Statistics → Interfaces* page for counts of the number of packets received. The *Clear 'Largest' Stats* button clears the two values in the Largest column. The Largest values can be used to compare the current set of statistics with the busiest outbound & inbound periods.
Average Outbound Delivery Time	Records the average time from which an outbound IP message is presented to the airlink until the RF acknowledgement for that message is received. Broadcast/Multicast messages that are not acknowledged do not contribute to the statistic, nor are outbound messages that retry and fail to reach their destination mobile. An increasing Average Outbound Delivery Time is usually an indication of increasing traffic on the RF channel but Delivery Time can also be affected by an increase in the number of retries needed to reach distant mobiles. Note: The Average Delivery time for each registered mobile is also available on the *Remote Table* page.

Request Loading	**Records the percentage of occupied Request slots compared to the number of slots made available by the base during the statistics period. A loading of 40% or more would indicate a very busy channel.** **A network whose mobiles send data inbound in very short bursts (eg. license plate inquiries) may see a busy channel due to request loading even though the inbound channel throughput value is comparatively low.**
Roll statistics every ... seconds	**Sets the statistics period to the specified number of seconds. The change takes effect immediately and the existing history is not cleared so the history may appear inconsistent until values recorded using the old period have rolled off the table.**
Refresh	**This button refreshes the displayed statistics.**

6.11 Maintenance

6.11.1 Maintenance ► Ping Test

To aid in trouble-shooting IP connectivity issues, the Paragon4 base stations and the GeminiG3 mobiles can transmit ping packets to a given IP address. Four packets are sent and the time taken for each to reach the destination and return is displayed.
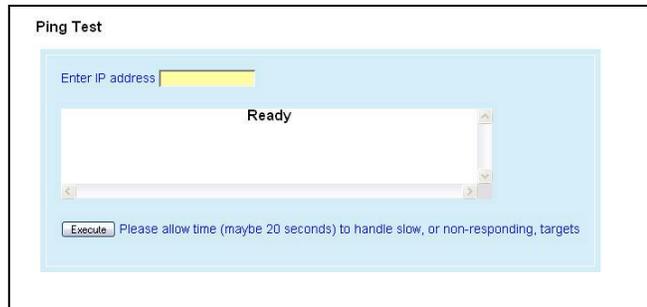
Figure 66 - Maintenance – Ping Test

Item	Description
Enter IP address	Enter IP address to ping, in dot decimal format
Execute	This button executes the ping command. Ready field displays the outcome of the ping command.

6.11.2 Maintenance ► Config Control

Figure 67 - Maintenance -Configuration Control (Initial screen)

Item	Description
User Configuration Settings	**Checkpoint User Configuration** -saves a set of the current user configuration settings in the Paragon4 base station. Click on the *Checkpoint User Configuration* radio button. Click *Proceed* to save the settings to the configuration file. The new configuration file's name will consist of *UserCfg_* and the Paragon4's ETH1 MAC address. (Example: UserCfg_000A99012345.drp). If a previous checkpoint had been saved to the UserCfg_*macaddress*.drp file then the new checkpoint will overwrite the existing file.
	Click "Export last Checkpoint to PC" link to save the configuration file to a PC. A save dialog box will appear. Select the file name and folder to save the configuration file to and click save. The configuration file may be renamed, if desired, (must keep the .drp extension) then reloaded back into the original Paragon4 or into another Paragon4 by using an FTP client. Do not load more than 5 separate configuration files into a single Paragon4. Loading many configuration files into a Paragon4 may use up an excessive amount of memory and may cause the Paragon4 to malfunction. After saving the configuration file back into the Paragon4 with an FTP Client, select *Import Configuration from* and follow the instructions below.
	Import Configuration from To restore a user configuration, click the Import Configuration from radio button. The drop down combo box will show all the .drp files (configuration files) in the Paragon4. Select the configuration file to load and click on Proceed. Click Save Config then Reset Unit to complete the process and store these settings to the unit.
Firmware Upgrade Settings	**Merge settings bundled in upgrade package with current configuration**-merges upgraded settings with the current configuration. Note: the "firmware update" process will end up replacing an existing configuration file with the one that came bundled with the firmware upgrade package.

Factory Settings	**Restore Factory Settings: restores all settings do default factory confi-guration.** **Upon performing the firmware upgrade, should you decide to restore to factory settings instead of to "merge with bundled settings", simply select the "Restore Factory Settings" option button right after perform-ing the firmware upgrade and click on "Proceed".** **Important note:** ***Activating "Restore Factory Settings" will reset the IP address of the unit. Have your record of all the original Paragon 3 factory settings handy before proceeding with restoring to factory settings.***

6.11.3 Maintenance ► Package Control
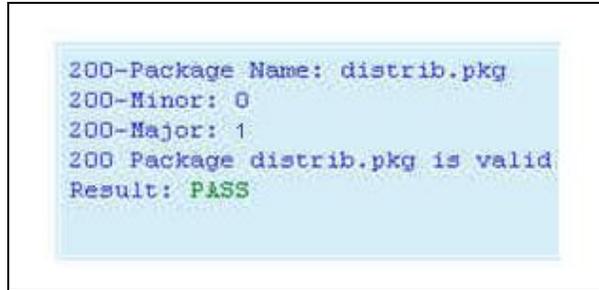

```
200-Package Name: distrib.pkg
200-Minor: O
200-Major: 1
200 Package distrib.pkg is valid
Result: PASS
```

Figure 68 - Maintenance – Package Control

Item	Description
Package Control	**Used for verifying the field upgrade of the Paragon4 radio modem firmware.** **The firmware transfer procedure outlined in section 7.5.1 instructs to "Click on** Maintenance / Package Control **to verify integrity and wait a few moments for the results to display".** **Figure 68 above shows a "Pass" result indication.** **If an upgrade problem arises and persists, click the "Package Control" once more and have the resulting indications handy if contacting CalAmp System Engineering.**

6.11.4 Maintenance ► RF Tests

Test Tones:

Select the desired test tone, press the "Execute" button to transmit a test signal on the current channel for 20 seconds or until the "Cancel current test" button is pressed.

The functions of all the other buttons are inoperative during test transmissions.
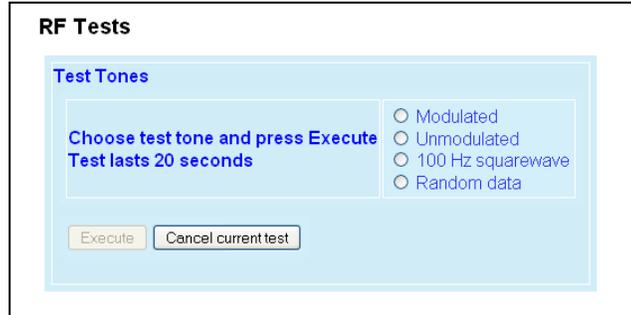
Figure 69 - Control - RF Tests

		Test transmission generates a carrier modulated with a 1 kHz test tone to check deviations. For specific deviation values, see

Test Tones	Modulated	**Carrier Modulation**					
		SRRC4FSK		**SRRC8FSK**		**SRRC16FSK**	
			Tone		**Tone**		**Tone**
		Network Speed (kb/s)	**Typical deviation in kHz** (1000Hz test tone)	**Network Speed** (kb/s)	**Typical deviation in kHz** (1000Hz test tone)	**Network Speed** (kb/s)	**Typical deviation in kHz** (1000Hz test tone)
		Full Channel (UHF) 25 kHz bandwidth					
		32	± 3.5	48	± 4.1	64	± 4.2
				43.2	± 4.2		
		Half Channel (UHF) 12.5 kHz bandwidth					
		16	± 1.5	24	± 2.1	32	± 2.2
		Wide Channel (700MHz) 50KHz bandwidth					
		64	± 5.8	96	± 6.7	128	± 6.7
		Full Channel (700MHz) 25KHz bandwidth					
		32	± 2.5	48	± 2.9	64	± 2.9
				43.2	± 3.0		
		Half Channel (700MHz) 12.5KHz bandwidth					
		16	± 1.3	24	± 1.4	32	± 1.5
		Full Channel (800MHz) 25KHz Bandwidth					
		32	± 2.4	48	± 2.8	64	± 2.8
				43.2	± 3.2		
		NPSPAC Channel (800MHz USA-only) 12.5KHz Bandwidth					
		16	± 2.1	24	± 2.5	32	± 2.5
		Table 10 - Carrier Deviations					

Unmodulated		Test tone is an unmodulated carrier that gives a clear carrier and used for checking: ♦ **Frequency error** ♦ **Forward and reverse power** **Power check:** Connect an in-line power meter between the radio and the antenna. Measure the forward (nominal 70W (700 & 800 MHz models) or 100W (UHF model)) and re-flected power levels by pressing the Execute button. For reflected power, never exceed 5% of forward power or as specified by System Engineering.
100 Hz square wave		Starts a test transmission of a carrier modulated by a square wave. Used to check low-frequency balance at a frequency of 100 Hz

Random Data		Starts a 20-second test transmission with a carrier modulated with random data
		Random data test transmissions are used for checking low-frequency balance and maxi-mum deviation over data.
		• **Low-frequency balance check:**
		  Helps to determine if the radio transmitter is well balanced for data transmission.
		  Refer to the User manual for values indicated in adjustment tables under "Low Fre-quency Balance" step.
		• **Maximum deviation check:**
		  Helps to verify if the unit is within FCC regulation emission masks.
		  Refer to the User manual for values.
		Random data test requires the use of an IFR COM-120B service monitor with option 03= 30 kHz IF filter and its DC coupled demodulator output selected.

6.11.5 Maintenance ► Feature Options

Refer to your CalAmp technical support or sales representative for options availability and cost.

Figure 70- Maintenance – Available Feature Options

6.11.6 Maintenance ► RSSI Display
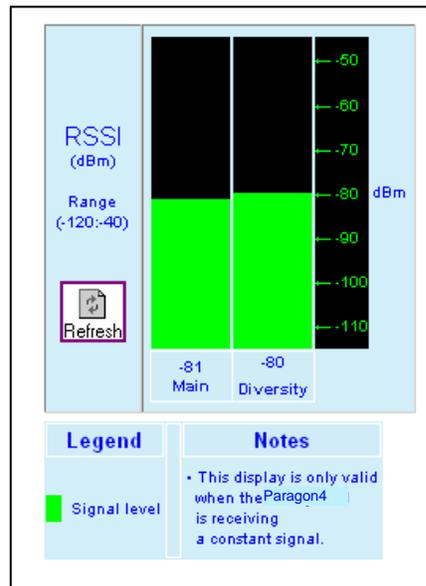
Figure 71 - Maintenance – RSSI Display

	Item	Description
RSSI	**RSSI Table**	**Main -120 = dBm value from main radio receiver** **Diversity -120 = dBm value from diversity radio**
	Range	**-120 to –40 dBm**
	Thresholds	**-90 to -60 dBm**

6.11.7 Maintenance ► System Log
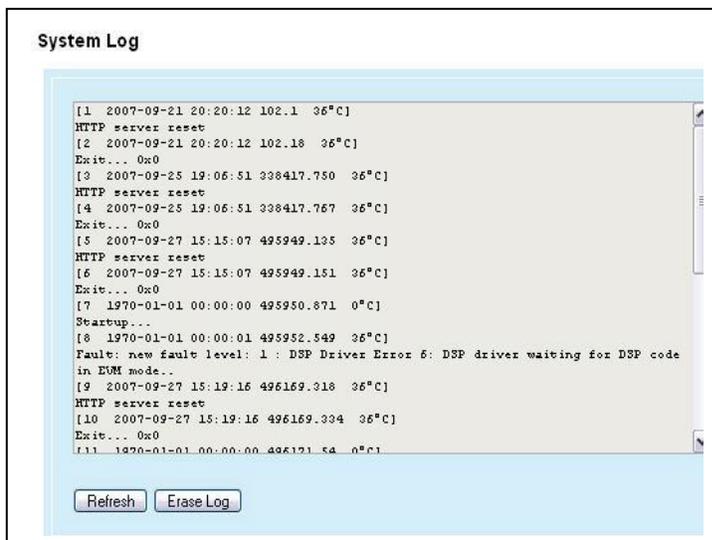
Figure 72 - Maintenance –System Log

Item	Description
System Log	Records critical events resulting from unexpected conditions during the unit operation.
Refresh	Updates the screen to reveal latest log entries.
Erase Log	Deletes all log entries (lost forever). Note: The system log is a limited reserved area of the flash memory. Once full, the new events will not get recorded. It is recommended to perform an Erase Log every so often.

6.11.7.1 Reading the Log Entries

The system log records critical events resulting from unexpected conditions during Paragon4 base station operation. Information from this system log can be useful in understanding specific issues. Have the resulting indications handy if contacting CalAmp support.

A system log entry contains the following parts (see Figure 73):

- A record number,
- A time stamp,
- Time in MSec since last unit rest,
- Chassis temperature, and
- The event itself
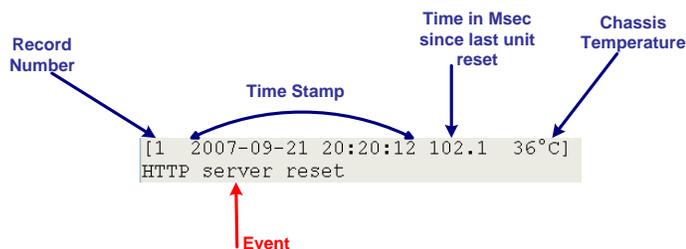
Figure 73 - A system Log Entry

Note:

Log information will be preserved across system restarts or faults.

The general categories of events that can be found in the system log are:

- Asserts: undesirable conditions (faults)
- Resets: reasons for various system resets
- Others: warnings, recovery from a fault, etc

6.11.7.1.1 Asserts

An Assert log entry will normally display an exit code, a module number, and a line number indicating where the error occurred. See Figure 74 for an example of an Assert log entry. This information will allow CalAmp support team to determine the component and the reason of an error so that a corrective action could be recommended.

```
[56  1970-01-04 04:39:28 275949.382  43°C]
Exit... 0x2a00b6 (MODULE 42 LINE 182)
              ↑           ↑        ↑
         Exit Code    Module   Line Number
                      Number
```

Figure 74 - An Assert type system log entry

Note:

"0x0" exit code signifies normal (non-faulty) system exit.

6.11.7.1.2 Resets

A Paragon4 unit may be reset manually (through the Web interface, a telnet shell, or SNMP control) or automatically (as a result of the unit's own monitoring facilities).

Below are some examples of Reset log entries:

Reset issued by a shell command:

```
[5  1970-01-01 01:03:45 3827.924  37 C]
stationReset: board hard reset
```

Reset issued through the WEB Interface:

```
[10  1970-01-10 21:49:00 856116.827  38 C]
HTTP server reset
[11  1970-01-10 21:49:00 856116.842  38 C]
Exit... 0x0
```

Reset issued by an SNMP MIB browser:

```
[14  2007-09-17 16:25:17 631.641  34 C]
SNMP: board hard reset
```

6.11.7.1.3 Other

Other log entries may be warnings, faults on temporary conditions that can later be recovered, recovery from faults, or other abnormal conditions.

6.12 OOB Data (Out of Band GPS delivery)

Figure 75 - Out-Of-Band

	Item	Description
GPS Delivery	**Delivery Options**	Drop-down box for selecting the desired format for the Local Port GPS data delivery
	UDP Hosts	Dynamic window expands as Hosts are added or shrinks as Hosts are deleted. *(Screen capture shows one UDP Host added – displayed as #1)*
	Add/Delete UDP Host	Up to five UDP Hosts may be added: ♦ Select the Add or the Delete option button. ♦ Enter dot decimal format address of the Host in the address field box. ♦ Enter port number in the Port field box. ♦ Click on the "Format" drop-down box and select appropriate format for the UDP Host being added or deleted. ♦ Click on Apply.

6.13 Remote Table

Figure 76 - Remote Table

| Item	Description
#	Index of the displayed entry. Up to 25 entries will be displayed at a time. "Previous" and "Next" buttons will appear as necessary.
RF MAC	RF MAC address of the mobile
RF IP addr	RF IP address of the mobile
Proxy	Indicates when the TCP Proxy has been enabled for that mobile (On/Off)
Status	Indicates the current state of the mobile. Most common values are: ♦ **Normal – Mobile is registered to this base** ♦ **Handoff – Mobile is roaming to another base**
Reg'd	Indicates the time the mobile registered on the base
Last TX	Indicates the time of last transmitted packet
TX Pkts	Count of data packets sent to the mobile
Tx Retrys	Count of RETRYs for packets transmitted to the mobile
Tx Bytes	Count of bytes transmitted to the mobile
Average Delivery Time	The average time from which an outbound IP message destined for the mobile is presented to the airlink layer until the RF acknowledgement for that message is received. Note: The Average Outbound Delivery Time for all mobiles over a period of time is also available on the *Statistics → Performance* page.
Last Rx	Indicates the time of the last received packet
Rx Pkts	Count of data packets received from the mobile
Rx Bytes	Count of bytes received from the mobile
P3 RSSI dBm	RSSI (in dBm) of the last data received from the mobile.
G3 RSSI dBm	RSSI (in dBm) of a recent data from the base by the mobile *(This information is transmitted to the base along with the GPS report)*
Local upgrade revision	Number of local updates (incremented when updated locally)
Remote upgrade revision	Number of remote parameter updates (incremented when updated over the air)
Last GPS Report: ♦ **UTC** ♦ **Latitude** ♦ **Longitude**	In normal operation, indicates the last Time & Position reports recently transmitted to the base from the mobile. Indicates "GPS report missing or not valid" when originally registered if reporting has not yet begun. Could last up to 3 – 4 minutes. Indicates "No Fix" when validly reporting and stops receiving valid information.

6.14 Site Map and Help

Site Map link and Help icon (Figure 77) features are designed to help the user navigate through the Web-Pages. They can be found on the bottom of the navigation pane.

Figure 77 - Help Icon

Item	Description
Site Map	Click Site Map link to display a page that hierarchically lists all Web-Pages on the site and provides a short description where applicable.
Help Icon	Click the Help Icon in the navigation pane to open a help text relating to the window being displayed.

7. Troubleshooting and Testing

The checks described below should be done at time of installation, annual intervals, or whenever deterioration in performance is noted. These checks are to be done by a CalAmp field service employee, a professional installer, or an accredited radio shop technician.

7.1 Equipment Required

- In-line RF power meter in the 0.5W range for the 150 mW exciter module power output*. Consider wattmeter in the -15W range for the reflected power and in the -150W range for the forward power of the power amplifier.

  Note: The Crescend PA requires an input power level ranging from 100 to 200mW. The exciter module is therefore adjusted at the factory for 150mW typical.

- Radio service monitor (IFR-120B with option 03: 30 kHz IF filter or equivalent).

- Short RG-223 cable (<2ft) with N-Type male connector to connect the exciter module to the service monitor if necessary. Short RG-214 cable (<1 foot) with N-Type male connector to connect the power amplifier module to the service monitor if necessary.

- RF load 50Ω 150W.

Important note: Before proceeding make sure that the service monitor has been calibrated recently and has warmed up for at least the time specified by its manufacturer.

Some reported frequency and deviation problems have actually been erroneous indications from service monitors that have not adequately warmed up. This is particularly likely when field service is done during winter months.

7.2 Recommended Checks

A) After an installation

1. Power-up LED Sequence
2. Transmit power output
3. Reflected power output
4. RF Link test between Paragon4 unit and mobile unit(s) (PING from a PC as per paragraph 7.4.1)

B) For annual maintenance & trouble-shooting

Same checks as A) plus:

5. Carrier frequency error
6. TX Deviation
7. 12dB SINAD
8. Receiver distortion
9. Main RX and Aux. RX RSSI
10. Verify power supply connections & terminals torque settings (see paragraph 4.4.4.2).

Table 8 - Checklist A (After installation)

	CHECKLIST A			
	(Paragon4)			
	Recommended Check out after Installation			
Step	**ACTION**	**EXPECTED RESULTS at 25°C**	**MEASURE WITH**	**IF NOT?**
1	**Normal Power-up Sequence**			
	BSC2	PWR LED lights red for up to 5 second, turns amber for up to 5 seconds second, and stays green thereafter. TX LED flashes green within 90 seconds after reset RX LED remains OFF STATUS LED remains OFF ETH 1 LED – if connection present – lights green. Flashes amber with activity ETH 2 LED – If connection present – lights green. Flashes amber with activity		
	RX	POWER and LOCK LEDs must remain steady green		
	TX	POWER and LOCK LEDs must remain steady green ON LED lights red for one second, turns OFF for 10 seconds, and stays red thereafter		
	For steps below, refer to Radio (RF Tests) Web Page			
2	**Power Amplifier Output Power** Under Test Tone section select ***Unmodulated*** and click ***Execute***	**UHF**: 100W (factory configurable from 50W) **700 or 800 MHz**: 70 watts (factory configurable from 35W) Tolerance: +15% -20%	Service monitor set to read power or 150W in-line wattmeter installed as close as possible to the unit antenna connector.	Verify if PA front panel LEDs are off, except PWR LED on green. If not [1]Check for bad connections, damaged coax cable, etc. Also check power at exciter module output. Should be in the range of 100-200mW. If OK, PA may be at fault. Contact CalAmp support.
3	**Transmitter Reflected Power** Under Test Tone section select ***Unmodulated*** and click ***Execute***	< 5% of forward power or as specified by System Engineering.	15W in-line wattmeter	Verify if PA front panel LEDs are all OFF except PWR LED (green) If not, check for bad connections, damaged coax cable, etc.
4	**RF Link test** between Paragon4 unit(s) and mobile unit(s) (PING test as per paragraph 7.4.1)			

[1] (unless unit has been set a lower value). Note that readings less than 100 watts for UHF or 70 watts for the 700 and 800 MHz models, may be due to losses in cables used for testing. Check also your wattmeter frequency calibration curve. Do not be too ready to condemn the transmitter or the RF feedline & antenna installation.

Table 9 - Checklist B (General)

CHECKLIST B (Paragon4)			
General Check out (part1 of 2)			

Paragon4 units are set and characterized at the factory to optimize performances.
It is **not recommended** to try readjusting units unless it is really required.
Misadjusting a unit may result in significant performance losses.
The proposed adjustments in the "IF NOT?" column below, should be tried ONLY if system data performance degradation is noticed combined with out-of-tolerance items.

Step	ACTION	Expected Results at 25°C	MEASURE WITH	IF NOT?
1	**Normal Power-up Sequence**			
	BSC2	PWR LED lights red for up to 5 second, turns amber for up to 5 seconds second, and stays green thereafter. TX LED flashes green within 90 seconds after reset RX LED remains OFF STATUS LED remains OFF ETH 1 LED – if connection present – lights green. Flashes amber with activity ETH 2 LED – If connection present – lights green. Flashes amber with activity		
	RX1 and RX2	PWR and LOCK LED must remain steady green		
	TX	PWR LED and LOCK LED remain steady green TX LED lights red after 10 seconds, and stays red thereafter		
	For steps below, on the Radio ➜ Set Up Web page, press the "test" button to enable Test Tone function			
2	**Transmitter Output Power** From the Maintenance unit WEB "Test Tone" page, Select ***Unmodulated –*** and click ***Execute***	**UHF**: 100W (factory configurable from 50W) **700 or 800 MHz**: 70 watts (factory configurable from 35W) Tolerance: +15% -20%	Service monitor set to read power or 150W in-line wattmeter installed as close as possible to the unit antenna connector.	Verify if PA front panel LEDs are off, except PWR LED on green. If not [1]Check for bad connections, damaged coax cable, etc. Also check power at exciter module output. Should be in the range of 100-200mW. If OK, PA may be at fault. Contact CalAmp support.

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[1] (unless unit has been set a lower value). Note that readings less than 100 watts for UHF or 70 watts for the 700 and 800 MHz models, may be due to losses in cables used for testing. Check also your wattmeter frequency calibration curve. Do not be too ready to condemn the transmitter or the RF feedline & antenna installation.

3	**Transmitter Reflected** Under Test Tone section select ***Unmodulated*** and click ***Execute***	< 5% of forward power or as specified by System Engineering.	15 W in-line wattmeter	Verify if PA front panel LEDs are all OFF except PWR LED (green) Check for bad connections, damaged coax cable, etc.
4	**RF Link test** between Paragon4 unit and mobile unit(s) (PING test from the unit Web page as per paragraph 6.11.1 or PING from a PC as per paragraph 7.4.1)			
5	**Carrier Frequency Error** Under Test Tone section select ***Unmodulated*** and click ***Execute***	< ±300 Hz @ 25°C ambient or < ±1 ppm from –30 to +60 ^{o}C < ±0.1$^{*)}$ ppm –30 to +60 ^{o}C	Service monitor set to read frequency error. *[*)]0.1 ppm requires the 10MHz reference option to be present and instrument's time gate set to 1s*	If the carrier frequency error is found to be out-of-specs, contact CalAmp support.
6	**TX Deviation (kHz)** Under Test Tone section select ***Modulated*** and click ***Execute*** Carrier will be modulated with a 1 kHz tone.	Refer to 7.3.1 for TX Deviation details. Tolerance is +5%, -10% for all bit rates.	Service monitor set to read deviation. (IF filter set to Mid or 30 kHz position)	If the TX deviation is found to be out-of-specs, contact CalAmp support.

	CHECKLIST B (**Paragon**4) cont'd General Check out (part 2 of 2)			
Step	**ACTION**	**Expected Results at 25°C**	**MEASURE WITH**	**IF NOT?**
7	**12 dB SINAD** (Wide band measurement method: no audio filtering) Using a 1KHz tone, set TX deviation to ±1.5 kHz for a 12.5KHz channel, ±3.0 kHz for a 25KHz channel and ±6.0 kHz for a 50KHz channel..	Better than -109 dBm for 12.5KHz channel, -110 dBm for 25KHz channel and -108 dBm for 50 KHz channel using a 2ft RG-223 coax cable.	- Backplane corresponding to the receiver being verified: J18 pin 1 for RX1 or J19 pin1 for RX2 (see Figure 425). GND pin available at TP33 - Service monitor (IFR) set to SINAD - IFR IF filter set to MID position or 30 kHz wide filter.	If the 12 dB SINAD is found to be out-of-specs, check for bad connections, damaged coax cable, etc. If not OK, contact CalAmp support.
8	**Receiver distortion** (Wide band measurement method: no audio filtering) Set service monitor RF Gen output to –70 dBm. Using a 1KHz tone, set TX deviation to ±1.5 kHz for a 12.5KHz channel, ±3.0 kHz for a 25KHz channel and ±6.0 kHz for a 50KHz channel.	≤ 3 %	- Backplane corresponding to the receiver being verified: J18 pin 1 for RX1 or J19 pin1 for RX2 (see Figure 4). GND pin available at TP33 - Service monitor (IFR) set to DISTORTION. - IFR IF filter set to MID position or 30 kHz wide filter.	If the Distortion is found to be out-of-specs, check for bad connections, damaged coax cable, etc. If not OK, contact CalAmp support.
9	**RSSI** Apply to each receiver input the following RF level: UHF, 700 & 800 MHz: -80dBm, unmodulated. -→ -110dBm, unmodulated. -→	**UHF, 700 & 800 MHz**: 2.75 VDC (±0.2VDC) 1.45 VDC (±0.2VDC) BSC2 must be connected to the radio during the measurements	- Backplane corresponding to the receiver being verified: J18 pin 4 for RSSI1 or J19 pin 4 for RSSI2 (see Figure 4). GND pin available at TP33 - DC Voltmeter measurement	Refer to factory technical support only if RX data performance degradation is noticed combined with out-of-tolerance RSSI readings.
10	Verify power supply connections & terminals torque settings (see paragraph **Error! Reference source not found.**)			

7.3 Additional test details

7.3.1 Carrier Deviations

Carrier Modulation					
SRRC4FSK		SRRC8FSK		SRRC16FSK	
	Tone		Tone		Tone
Network Speed (kb/s)	Typical deviation in kHz (1000Hz test tone)	Network Speed (kb/s)	Typical deviation in kHz (1000Hz test tone)	Network Speed (kb/s)	Typical deviation in kHz (1000Hz test tone)
Full Channel (UHF) 25 kHz bandwidth					
32	± 3.5	48	± 4.1	64	± 4.2
		43.2	± 4.2		
Half Channel (UHF) 12.5 kHz bandwidth					
16	± 1.5	24	± 2.1	32	± 2.2
Wide Channel (700MHz) 50KHz bandwidth					
64	± 5.8	96	± 6.7	128	± 6.7
Full Channel (700MHz) 25KHz bandwidth					
32	± 2.5	48	± 2.9	64	± 2.9
		43.2	± 3.0		
Half Channel (700MHz) 12.5KHz bandwidth					
16	± 1.3	24	± 1.4	32	± 1.5
Full Channel (800MHz) 25KHz Bandwidth					
32	± 2.4	48	± 2.8	64	± 2.8
		43.2	± 3.2		
NPSPAC Channel (800MHz USA-only) 12.5KHz Bandwidth					
16	± 2.1	24	± 2.5	32	± 2.5

Table 10 - Carrier Deviations

7.3.2 PF Switch

Nearly all test "Actions" described in tables 3 and 4 above can be done by selecting the relevant test tone via the "Radio ► Tests" page of the web interface. However, stopping the Airlink for a test is done in a different manner. It requires the use of the BSC's front-mounted PF key rocker switch *(detailed PF operation in the next paragraph)*. The PF switch can also be used as an alternate way of selecting Test Tones or if a web connection is unavailable.

7.3.2.1 Stopping the Airlink and Alternate Test Tone Selection Method

Located on the BSC module, the PF key is a horizontally mounted rocker switch with a center detent and spring-loaded positions "1" and "2". Pressing the switch to position "1" causes the "Status" LED to blink green once only followed by amber blinks at one-second intervals as long as it is held pressed. Pressing the switch to position "2" is used to select test tones as shown in Table 11 below.

Figure 78 - PF Switch Rocker Detail (one side pressed)

- If PF is pressed to position "1" for approximately four seconds *(visually count the amber blinks)* and released, it brings the Airlink down, PTT is released, no data traffic is scheduled, and CWID is suppressed. The Airlink will remain down for a maximum of one hour and automatically come back up, unless PF is pressed to position "1" once more for four seconds to force toggle the Airlink to "up" status.

- If PF is pressed to position "1" for approximately one amber blink, PF operation goes into "test mode" where "position 2" is monitored and each successive pressing of position "2" results in a different test tone selection as detailed in the table below.

- If PF is pressed to position "1" while a test is in progress, PF "test mode" operation is cancelled.

> *Note:*
> *If PF is not in "monitor mode" pressing to position "2" has no effect.*

Table 11 - Test Tones Generation

20-Second Test Tones - PF key generated
For a MODULATED test tone: **Press PF to "1" for approximately 1 amber blink and release. Immediately press PF to "2" one time. Test tone starts.** **To cancel test tone, press PF to "1" and release.**
For an UNMODULATED test tone: **Press PF to "1" for approximately 1 amber blink and release. Immediately press PF to "2" two times. Test tone starts.** **To cancel test tone, press PF to "1" and release.**
For a SQUARE WAVE test tone: **Press PF to "1" for approximately 1 amber blink and release. Immediately press PF to "2" three times. Test tone starts.** **To cancel test tone, press PF to "1" and release.**
For a RANDOM DATA test tone: **Press PF to "1" for approximately 1 amber blink and release. Immediately press PF to "2" four times. Test tone starts.** **To cancel test tone, press PF to "1" and release.**

Each pressing at position "2" must be made within one second.

E.g.: For Unmodulated, press twice within 2 seconds, for Random Data, press four times within 4 seconds.

7.4 Windows/Unix Tools

7.4.1 Network Connectivity

- PING (DOS/WINDOWS)

    The `ping` command determines whether a specific IP address is accessible. It works by sending a packet to the specified address and waiting for a reply. It is useful for troubleshooting "end-to-end" reachability, network connectivity, and network latency.

    The ping test is also convenient to verify more specifically the RF link between a mobile and a known base station

    EXAMPLE:

    `ping 192.168.204.1 -w 3000` displays the response with turn around time in milliseconds.

- TRACERT (WINDOWS)

    The `tracert` command is used to visually see a network packet being sent and received and the amount of hops required for that packet to get to its destination.

    Note:
    > *Users with MS-Windows 2000 or XP who need additional information on network latency and network loss may also use the* `pathping` *command.*

    EXAMPLE

    `tracert www.yahoo.com` at the command prompt displays the intermediate routers between local host to the www.yahoo.com site.

7.4.2 Configuration Information

- IPCONFIG

    `Ipconfig` is a DOS utility which can be used from Command Prompt or a Command Prompt shell to display the network settings currently assigned and given by a network. This command can be utilized to verify a network connection as well as to verify network settings.

    EXAMPLE

    `ipconfig/all` at the command prompt displays the Ethernet MAC address, IP address, IP netmask, default IP gateway, DNS server… information.

- ARP

    View and update the system ARP table

    The Address Resolution Protocol (ARP) is used with the IP protocol for mapping a 32-bit Internet Protocol address to a MAC address that is recognized in the local network specified in RFC 826. Once recognized the server or networking device returns a response containing the required address.

EXAMPLE

`arp-a` displays all entries in the ARP cache. *Useful in manipulating ARP caches.*

- ROUTE

  View and update the system routing table

  The function and syntax of the Windows ROUTE command is similar to the UNIX or Linux route command. Use the command to manually configure the routes in the routing table.

  EXAMPLE

  `route ?` displays help

  `route print` displays the routing table

7.4.3 Statistics Information

- NETSTAT (WINS & UNIX)

  The netstat command symbolically displays the contents of various network-related data structures, i.e. IP, TCP UDP …

  EXAMPLE

  `netstat ?`   displays help

  `netstat -a`   display TCP and UDP connections and listening ports information

For further information on TCP/IP troubleshooting, please visit:
http://www.windowsitlibrary.com/Content/466/14/1.html

7.5   BSC Firmware Upgrading

The Paragon4 radiomodem firmware is field-upgradable using the unit's Ethernet port. The process involves connecting to the IP address of the base from a host PC and transferring the firmware files via an FTP program.

7.5.1 Procedure

1. Using a file decompression program, such as WinZIP™ or WinXP's right-click & select the "Expand to…" option, expand the contents of the firmware upgrade package to a directory of your choice on the host PC.
   Warning:

   Be aware that base and mobile's firmware archives are often distributed at the same time. Files intended for the Paragon4 radiomodem are labeled in the form   Paragon4_edba_vx.x_Rx.xx.zip. Be careful not to transfer firmware into the wrong unit!
2. Using an FTP client program of your choice, establish a connection to the base IP address.
3. Transfer all the files in the upgrade package. Occasionally, long pauses, on the order of 30 to 45 seconds, are possible when storing the file in the unit's flash file system.

4. Once the file transfer is complete, cycle the base power and allow the unit to boot. The unit should return to the state it was in when the update was started.

Note:

After resetting, the PWR LED remaining lit steady amber or red indicates the FTP transfer was not successful or that the firmware is corrupt. Please contact CalAmp system engineering for assistance.
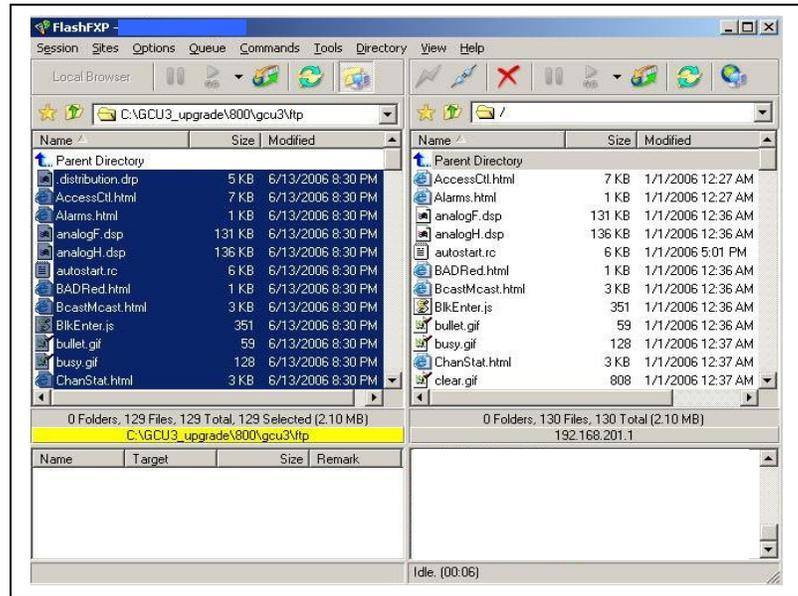

Figure 79 - Sample FTP program

5. Verify the integrity of the newly transferred files.

a) Connect to the base's IP address using an Internet browser

b) Enter the `user name` and `password` *(in the usual manner)* and allow the **Welcome** page to load.

c) In the left pane, click on **Unit Status**. The **Unit Identification and Status** pane should display the newly upgraded firmware in its **Banner** *(should correspond to the upgrade package version)* and the **H/W Status** should also show **Ok**.

d) In the left pane, click on **Maintenance**, then on **Package Control**. Wait a few moments for the results to display.

7.5.1.1　File Integrity Failure

If the message in the result screen points out that file(s) failed the integrity check, retry the FTP transfer for the failed files(s) again.

If the problem persists, please have the **Package Control** result screen indications handy and contact CalAmp system engineering for assistance.

8. Specifications

GENERAL	UHF	700MHz	800MHz
Frequency Range (MHz)	FCC = 406.1 - 512 Rx/Tx IC = 406.1 - 430 Rx/Tx IC = 450 - 470 Rx/Tx	FCC = 757 - 758, 763 - 775 Tx FCC = 787 - 788, 793 - 805 Rx IC = 764 - 776 Tx IC = 794 - 806 Rx	FCC = 851 - 869 Tx FCC = 806 - 824 Rx IC = 851 - 869 Tx IC = 806 - 824 Rx
	FCC Part 90 & 27 / IC RSS-119		
Channel Spacing	12.5 / 25 KHz	12.5 / 25 / 50 KHz	NPSPAC / 25 KHz
Mode of Operation	Full Duplex, 100% duty cycle		
Cabinet Size	22.06" W x 75.82" H (without leveling feet) x 27.06" D		
RF/Modem Assembly Size	(Rackmount) 19.0" W x 8.75" H x 12.5" D + 2.0" connector allowance		
AC/DC Power Supply Assembly Size	(Rackmount): 19.0" W x 3.5"H x 16.5" D		
Power Amplifier Assembly Size	(Rackmount): 19.0" W x 7"H x 6" D		
Frequency Stability	1.0 ppm (-30°C to +60°C)		
Supply Voltage	120 VAC / 6A max, 60 Hz to 13.8 VDC or 13.8 VDC nominal, negative ground (12.6 to 14.6 VDC range) (13.1 to 14.5 VDC range with Crescend PA at rated power o/p)		
Circuit protection	Radio backplane: Main fuse (F1) 10A Blade fuse & crowbar diodes for reverse polarity protection Power Amplifier: Fuse protected, overvoltage protected & current limited via AC/DC power supply or PA power cable with in-line 30A fuse for DC power supply application		
RX Current Consumption @ 13.8 VDC	3.0A max. (Two receivers with speaker monitoring)		
TX Current Consumption @ 13.8 VDC	24A DC typical @ 25C, 450 MHz & 100W (26.5A DC max for -30 to +60C, 406.1-512MHz & 100W)	22A DC typical @ 25C, 770MHz & 70W (25A DC max for -30 to +60C, 757-775MHz & 70W)	23A DC typical @ 25C, 860MHz & 70W (26A DC max for -30 to +60C, 851-869MHz & 70W)
Operating Temperature Range	-30°C to +60°C (deleted power supply, catalog number with 0 in second to last digit) -30°C to +50°C (with standard Heavy Duty Power Supply, catalog number with 2 in second to last digit)		

Modem / Network

User Interface	- Dual Ethernet RJ45 Auto MDIX 10-100/T with LED status indicators - Dual RS-232 DB-9F Serial Ports configured as Terminal Servers - USB Port (future use)		
Addressability	Native TCP/IP and built-in router		
Data Encryption	AES 128-bit		
Protocols	- Dataradio Proprietary E-DBA with OOB AAVL support - Ethernet IEEE 802.3, (ICMP, IGMP, TCP, UDP) - IP Fragmentation, Address Resolution Protocol (ARP) - IP directed broadcast, IP limited broadcast, IP multicast relay - DHCP client and server - Network Address Translation (NAT), Dynamic Routing (RIPv2)		
Data rates	12.5 kHz ch.:	25 kHz ch.:	50 kHz ch.:	NPSPAC ch.:
	32 kbps 24 kbps 16 kbps	64 kbps 48 kbps 43.2kbps 32 Kbps	128 kbps 96 kbps 64 Kbps	32 kbps 24 kbps 16 kbps

Radio	UHF		700MHz			800MHz		Data rates (kbps)
	25 kHz Channel	12.5 kHz Channel	50 kHz Channel	25 kHz Channel	12.5 kHz Channel	25 KHz Channels	NPSPAC Channels	
Receiver Sensitivity (For 1% Packet Error Rate (PER) with Parallel Decode at carrier frequency)			-96					128
			-102					96
	-98		-107	-96		-96		64
	-104			-103		-102		48
	-107			-105		-105		43.2
	-110	-101		-110	-99	-109	-105	32
		-107			-104		-111	24
		-112			-110		-115	16
Selectivity	>85 dB	>67 dB	>87 dB	>85 dB	>67 dB	>85 dB	>85 dB	
Spurious Response Rejection	100 dB (Typical)							
Intermodulation Rejection	>83 dB	>80 dB	>83 dB	>83 dB	>80 dB	>83 dB	>83 dB	
Receiver Frequency range	406.1 – 512 MHz		787 - 788, 793 - 805 MHz FCC, 794 - 806 MHz IC			806 – 824 MHz		
Transmitter Frequency range	406.1 – 512 MHz		757 - 758, 763 -775 MHz FCC, 764 - 776 MHz IC			851 – 869 MHz		
Power Output (field service adjustable)	(50-100W)		(35-70W)			(35-70W)		
Spurious Emissions:- transmit -standby	<-36 dBm to 1 GHz, <-30 dBm to 3.2GHz <-57 dBm to 1 GHz, <-47 dBm to 3.2GHz							
VSWR Stability	> 5:1 mismatch							

FCC / IC CERTIFICATIONS		FCC (Part 90 or 27)	IC (DOC, RSS119)
UHF	406.1 - 512 MHz	CWWUHFP10XXUL1 (PA, 100W, 403-470MHz) TBD (PA, 100W, 450-512MHz) EOTBDP4-EXCT403 (Exciter, 0.4W, 403-477MHz) EOTBDP4-EXCT438 (Exciter, 0.4W, 438-512MHz)	
	406.1 - 430 MHz 450 - 470MHz		7291A-UHFP10XXUL1 (PA, 100W, 403-470MHz) 731A-BDP4EXCT403 (Exciter, 0.4W, 403-477 MHz)
700 MHz	757-758 MHz	TBD (PA, 80W) TBD (Exciter, 0.4W)	
	769-775 MHz	EOTBDP3-CRE700 (PA, 70W, 764-776MHz) TDB (Exciter, 0.4W)	
	764 - 776 MHz		773-BDP3CRE7 (70W PA) TBD (0.4W Exciter)
800 MHz	851 - 869 MHz	EOTBDP3-CRE800 (70W PA) EOTBDD4-EXT8 (0.4W Exciter)	773A-BDP3CRE8 (70W PA) 773A-BDD4-EXT8 (0.4W Exciter)

EMISSION DESIGNATORS

Bit rate	Baud rate	Modulation	UHF	700MHz	800MHz
128000	32000	SRRC16FSK	-	27K0F1D (pending)	-
96000	32000	SRRC8FSK	-	27K0F1D (pending)	-
64000	32000	SRRC4FSK	-	27K0F1D (pending)	-
64000	16000	SRRC16FSK	16K1F1D (C)	14K0F1D (pending)	13K7F1D (G)
48000	16000	SRRC8FSK	15K8F1D (C)	14K0F1D (pending)	13K7F1D (G)
43200	14400	SRRC8FSK	15K8F1D (C)	14K8F1D (pending)	13K4F1D (G)
32000	16000	SRRC4FSK	16K1F1D (C)	14K0F1D (pending)	13K4F1D (G)
32000	8000	SRRC16FSK	8K30F1D (D)	7K20F1D (pending)	10K0F1D (H) 8K2F1D (D)
24000	8000	SRRC8FSK	8K30F1D (D)	7K20F1D (pending)	10K0F1D (H) 8K2F1D (D)
16000	8000	SRRC4FSK	7K80F1D (D)	7K20F1D (pending)	10K0F1D (H) 8K2F1D (D)

[1] FCC/IC mask G (800MHz, 25kHz ch.)

[2] FCC mask H (800MHz, NPSPAC ch.)

[3] IC mask D (800MHz, 12.5kHz ch.)

[4] FCC/IC mask C (UHF, 25kHz ch.)

[5] FCC/IC mask D (UHF, 12.5kHz ch.)