GeminiG3
Mobile Data Radiomodem
User Manual - Version 3.01

February 2008

Part no.: 120 20131-301

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What's New in this version

History

Versions 1.xx applicable to 700 MHz model

Versions 2.xx applicable to UHF/700/800 MHz models

Versions 3.xx applicable to UHF/700/800 MHz and Agile Dual-Band models

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Version 3.01, February 2008-Applies to E-DBA PROD V2.7_Rxxx

- Introduces Anti-Vibration bracket for all GeminiG3 radiomodem models
- Updates section 2.3.2 and related illustrations
- Updates section 4.7.3.3: Setup (Advanced) ► RF (Freq.) ► Radio Table Set Up
- Updates section 4.7.3.5 Setup (Advanced) ► IP Services
- Adds section 4.7.3.5.2 SNMP Overview
- Updates section 4.7.4.2: GPS Delivery Options
- Updates Figure 7, Figure 11, Figure 12, and Figure 19
- Updates Section 6: Specifications-*GeminiG3 and GeminiG3-ADB Rx Sensitivity*
- Updates **Appendix 1 - "Officer Requires Assistance" alarm function**-Operation

Version 3.00, September 2007- Applies to E-DBA PROD V2.6_Rxxx

- Adds GeminiG3 ADB model description and features
- Updates Web interface descriptions and several screen captures
- Updates Section 6, "Specifications"
- Adds UHF 12.5kHz channel specs

Version 2.03, March 2007- Applies to E-DBA PROD V2.2_Rxxx

- Adds Paragon3 radiomodem "Feature Key" optional functionality to section 1.2.1 and Table 1 - On-Air Data Speeds & Modulation
- Restructures Section 4:Operation & Configuration
- Updates screen captures in Sections:4.7.1.1, 4.7.1.2, 4.7.3.3, and 4.7.7.4

Version 2.02, January 2007

- Supports EDBA v2.1
- Rectifies typo on "About Dataradio" paragraph

- Rectifies typo on Figure 22 - Basic NAT Operations
- Rectifies caption and adds NPSPAC values to Table 1 - On-Air Data Speeds & Modulation
- Updates screen capture for Figure 21 - Advanced IP Configuration – IP Services Setup
- Updates screen capture for Figure 44 - Advanced IP Configuration - Ethernet (PHY)
- Updates section 4.7.2.3
- Updates section 4.7.3.5
- Updates section 4.7.3.6
- Updates section 4.7.3.9
- Updates section 4.7.7.2
- Updates section 4.7.7.4
- Adds NPSPAC values to Table 6 - Carrier Deviations
- Updates Section 6, Specifications with NPSPAC values
- Adds **Appendix 1 - "Officer Requires Assistance" alarm function**
- Adds **Appendix 2 - "GPS Data Collection" Instructions**
- Adds **Appendix 3 - E-DBA Throughput/Latency Measurements Methods**
- Adds **Appendix 4 - Time Synchronisation, and WEB Browser Cache - Instructions**
- Adds **Appendix 5 - Ethernet Configuration - Recommendation**

Version 2.01, October 2006

- Updates Definition pages
- Updates screen capture for Figure 16 - Setup (Basic) – Serial Ports Setup
- Updates Table 5 - Test Checklist
- Adds Table 6 - Carrier Deviations
- Revises RX sensitivity in Section 6 "Specifications"

Version 2.00, September 2006

- Initial release of common version of Dataradio GeminiG3 UHF / 700 / 800 MHz mobile data radiomodem User Manual.

Version 1.01a, April 2006

- Change of descriptive terminology from a specific "type of connection" and "type of crimping equipment" to "type of connection present on radiomodem" in the following Sections:
  - 2.5.1 "Recommended tools and supplies
  - 2.5.3 "Antenna Installation" steps 3, 4, and 5
  - 3.1 "Front & Rear Panels" listing
  - 5.1 "Equipment Required" for Trouble-Shooting and Testing
- Revision of terminology in Section 6 "Specifications" for Receiver "Sensitivity" entry.

- Revision of “Feature” list to reflect terminology used in “Specifications” section.

Version 1.00, December 2005

- Initial release of Dataradio GeminiG3 – 700 MHz, User Manual.

About Dataradio

For over 25 years, Dataradio has been a recognized and innovative supplier of advanced wireless data products and systems for mission-critical applications. Public safety organizations, utilities, local government, water management, and other critical infrastructure operations depend on Dataradio to ensure that vital wireless data reaches the people who need it, when they need it most. From mobile data systems and radio modems, to analog radios and telemetry devices, Dataradio products are found at the heart of private wireless networks around the world.

www.dataradio.com

Dataradio provides product brochures, case studies, software downloads, and product information on our website at http://www.dataradio.com

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.

About CalAmp Corp.

CalAmp is a leading provider of wireless equipment, engineering services and software that enable anytime/anywhere access to critical information, data and entertainment content. With comprehensive capabilities ranging from product design and development through volume production, CalAmp delivers cost-effective high quality solutions to a broad array of customers and end markets. CalAmp is the leading supplier of Direct Broadcast Satellite (DBS) outdoor customer premise equipment to the U.S. satellite television market. The Company also provides wireless connectivity solutions for the telemetry and asset tracking markets, public safety communications, the healthcare industry, and digital multimedia delivery applications.

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Definitions

Item	Definition
AAVL	Autonomous Automatic Vehicle Location. Feature that involves using GPS (Global Positioning System) signals from the mobile unit by the Host PC.
Access Point	**C**ommunication hub for users to connect to a LAN.
ADB	Agile Dual-Band. Gemini G3 model that allows 700/800MHz automatic band switching capability during roaming.
AES	Advanced Encryption Standard - Uses 128-bit encryption to secure data.
Airlink	Physical radio frequency connections used for communication between units and protocol (see E-DBA)
ARP	Address Resolution Protocol – Maps IP address to physical address.
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 Paragon3.
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 - Links to and controls the radio base station in Paragon3 equipped VIS systems.
Cycle Mark	Signal transmitted on an E-DBA network that keeps the network synchronized.
DEV Ports	RS-232 serial communications ports of the GeminiG3 wireless radiomodem
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 System – 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.
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).
Ethernet	IEEE standard network protocol that specifies how data is placed on and retrieved from a common transmission medium.
Firewall	A configuration of routers and networks placed between an organization's internal Internet and a connection to an external Internet to provide security.
Firmware	The programming code that runs a networking device.
Fragmentation	Breaking of 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} products. Runs up to 128 kb/s in 50 kHz channel.
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 browsers to servers on the World Wide Web.
IPCONFIG	A MS-Windows 2000 and XP utility that displays the IP information for a particular networking device.
LNK / ACT LED	Ethernet connection established / Ethernet activity taking place.
MAC ADDRESS	Media Access Control - The unique address that a manufacturer assigns to each networking interface.
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 airlink between units.
Node	A network junction or connection point, typically a computer or work station.
OIP	Dataradio's Optimized IP – Compresses TCP and UDP headers, and filters unnecessary acknowledgments. This makes the most use of the available bandwidth.
OTA	Over-The-Air - Convention for the transmission and reception of application-related information in a wireless communications system. E.g.: OTA upgrade.
Palette	Synchronization patterns used to identify the speed and coding of packets transmitted over-the-air in E-DBA.
Paragon3	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	Patented technology used by GeminiG3 and Paragon3 featuring dual receivers for added data decode sensitivity in multi-path and fading environments. *(United States Patent No: 6,853,694 B1)*
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.
PWR / PGM LED	Indicates presence of DC power input /
Roaming	Movement of a wireless node (GeminiG3) amongst Multiple Access Points (Paragon3). GeminiG3 supports seamless roaming.
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)
SRRC*n*FSK	Square Root Raised Cosine (*n* = level) Frequency Shift Keying. Type of frequency modulation of data signals performed by the GeminiG3 radiomodem.
Static IP Address	A fixed address assigned to a computer or an interface that is connected to a network.
Static Routing	The forwarding of 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. Replace network hubs.
TCP/IP	Transmission Control Protocol/Internet Protocol - A network protocol for transmitting data that requires acknowledgement from the recipient of data sent. Handles retries and flow control.
Telnet	A user command and TCP/IP protocol used for accessing remote PCs.
TFTP	Trivial File Transfer Protocol - A version of the protocol that has no directory or password capability. Depends on UDP and is used on local network.
Topology	The physical layout of a network.
Transparent	A transparent unit transmits all data without regard to special characters, etc.
Tx/Rx LED	Airlink data activity
UDP	User Datagram Protocol - A network 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.
WINIPCFG	A MS-Windows 98 or MS-ME utility that displays the IP information for a particular networking device.
WLAN	Wireless Local Area Network - A group of computers and associated devices that communicate with each other wirelessly.

1. PRODUCT OVERVIEW

This document provides the information required for the installation, operation, and verification of the Dataradio® GeminiG3™ wireless radiomodem.

1.1 Intended Audience

This document is designed for use by engineering design, installation, and maintenance personnel.

1.2 General Description

Available in 700 MHz, 800 MHz, or UHF and in 700-800 MHz Agile Dual-Band (ADB) model, GeminiG3 is a mobile radiomodem aimed at the public safety and public utility markets. It integrates all the necessary hardware for data-only vehicular installations up to but not including the laptop PC and its application software.

Examples of applications are:

1. Database inquiry systems.
   Small number of brief messages, (usually from the mobile station) with fairly long responses.
2. Computer-aided dispatch (CAD).
   Large number of messages, (usually from the base station) with very brief responses.
3. Autonomous Automatic Vehicle Location (AAVL).
   Using built-in GPS receiver, determines position, speed and direction of fleet members.

The GeminiG3 radiomodem is made-up of:

- A main transceiver
- An auxiliary receiver for Parallel Decode™
- A 10 to 25-Watt adjustable power amplifier (700 MHz), 10 to 35 (800 MHz), 10 to 40 (UHF)
- A Gemini Processor/Modem board with DSP modem
- An integrated OEM 12-channel GPS receiver.

1.2.1 Features

- ADB model allows 700/800 MHz automatic band and bandwidth switching capability during roaming.
- Parallel Decode™ (PD) technology featuring dual receivers for added decode sensitivity in multi-path and fading environments.
- Native IP mobile model having "Stateless Data Compression" and "Protocol Reduction", that works with TCP/IP and UDP, uses standard 10/100 BaseT Ethernet RJ-45, and automatic MDIX to get the most efficient use of user available bandwidth without requiring a dedicated server or gateway. It acts as a router, interfaces with any Ethernet device or Native TCP/IP application, and has two RS-232 ports that can be configured as terminal servers. Using an in-car hub or switch makes adding other peripherals, such as a camera, possible.
- Sophisticated DSP-based modem design provides added system performance, fewer retries and more effective throughput.
- On-air data speeds and modulation types supported *(dependent on "Feature Key" selected[1])*:

Table 1 - On-Air Data Speeds & Modulation

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

- Built as a one-piece integrated design in a rugged die-cast aluminum chassis.
- GeminiG3 units automatically adapt to the speed of the base station for maximum network flexibility.
- Built–in, up to 32 channels, synthesized half-duplex operating transceiver with automatic channel selection for improved roaming capabilities
- AES 128-bit encryption ensures that both data and network remain secure.
- Internal 12-channel WAAS capable GPS receiver. Out-of-band (OOB) signaling enables transmission of GPS reports with no effect on system throughput. AAVL enables periodic OOB reports based on time or distance.
- Embedded Web server provides browser access for status and configuration of network parameters. Additionally, for ease of maintenance or upgrades, all unit firmware can be re-programmed over-the-air.
- Diagnostics combined with the Dataradio optional SNMP-based Network Management System (NMS) package, gives network administrators a proactive tool to collect and analyze diagnostic information.

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

1.2.2 Configuration

The GeminiG3 product is factory-configured based on each customer network system requirements and finalized by Dataradio system engineering.

Note:

> *The department handling field deployment for Dataradio Corporation (Atlanta-based) is referred to as "System Engineering" while the equivalent department at Dataradio Incorporated (Montreal-based) is referred to as "System Solutions". For the purpose of this manual, and to avoid confusion, we shall use the generic Dataradio system engineering.*

Network-specific operating instructions should be prepared by the system administrators in conjunction with Dataradio system engineering.

Instructions and examples given in this manual are based on GeminiG3 operating software version 2.2x and may not apply to later software versions.

1.3 Factory Technical Support

The Technical Support departments of DATARADIO provide customer assistance on technical problems and serve as an interface with factory repair facilities. They can be reached in the following ways:

DATARADIO Inc.
5500 Royalmount Ave, suite 200
Town of Mount Royal
Quebec, Canada H4P 1H7

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

phone: +1 514 737-0020
fax: +1 514 737-7883
Email address: support@dataradio.com

DATARADIO Corp.
6160 Peachtree Dunwoody RD., suite C-200
Atlanta, Georgia 30328

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

phone: 1 770 392-0002
fax: 1 770 392-9199

Email address: drctech@dataradio.com

1.4 Product Warranty

Warranty information may be obtained by contacting your sales representative.

1.5 Replacement Parts

This product is not field-serviceable, except by the replacement of a complete unit. Specialized equipment and training is required to repair the processor and radio boards.

Contact Technical Support for service information before returning equipment. A Technical Support representative may suggest a solution eliminating the need to return equipment.

1.5.1 Factory Repair

When returning equipment for repair, you must request an RMA (Returned Material Authorization) number. The Tech Support representative will ask you several questions to clearly identify the problem. Please give the representative the name of a contact person, who is familiar with the problem, should questions arise during servicing of the unit.

Customers are responsible for shipping charges for returned units. Units in warranty will be repaired free of charge unless there is evidence of abuse or damage beyond the terms of the warranty. Units out of warranty will be subject to service charges. Information about these charges is available from Technical Support.

1.6 Unpacking

When ready for installation, carefully unpack your G3 kit (p/n 023 6000-101) shipping carton and identify each item as listed below:

- One GeminiG3 radiomodem
- Installation mounting bracket
- Power cable – 22 feet (6.7 meters)
- Small parts kit

If damage has occurred to the equipment during shipment, file a claim with the carrier immediately.

2. Installation

2.1 Planning the Installation

2.1.1 Overview

To ensure trouble-free, efficient installation, start by inspecting the vehicle to determine the optimum position for GeminiG3 unit and its antennas as well as the routing of all associated cabling and wiring.

2.1.2 Location

Often, installations in cars are done in the trunk, underneath the back window ledge or on the trunk floor. In vans and small trucks, it is usually done in the back of the vehicle. In large vehicles, it is often done in the front cabin.

Be sure to place the GeminiG3 unit in such a way that:

- The LEDs can be seen (as an aid in troubleshooting)
- Access to the antenna connectors is possible without removing the unit
- Sufficient air may flow around the unit to provide adequate cooling

The GeminiG3 unit is not fully waterproof, therefore it should be mounted sufficiently away from an opened trunk lid or opened tailgate, windows or doors to avoid exposure to rain and/or snow. It also minimizes the chance that material can be accidentally thrown on the unit or of someone bumping against it.

2.1.3 Cable Path

Try to route the cables away from locations where they would be exposed to heat (exhaust pipes, mufflers, tailpipes, etc.), battery acid, sharp edges, mechanical damage or where they would be a nuisance to automobile mechanics, the driver or the passengers.

Keep wiring away from automotive computer modules, other electronic modules and ignition circuits to help prevent interference between these components and radio equipment.

Try using existing holes in firewall and trunk wall and the channels above and below or beneath the doors, channels through doors and window columns that are convenient to run cables and wires.
Whenever possible, install conduit in which to run the cables.

2.2 Warnings

Before starting installation, review all of the following warnings.

2.2.1 RF Radiation warning

Recommended safety guidelines for the human exposure to radio frequency electromagnetic energy are contained in the Canadian Safety Code 6 and the Federal Communications Commission (FCC) Bulletin 65. Proper installation of the transceiver antenna of GeminiG3 radiomodem as summarized in section 2.5 will result in user exposure substantially below the recommended limits for the general public.

Qualified personnel must do all antenna installations. See paragraph 2.5.2 for recommended antenna positioning.

Transmissions when persons or animals outside the vehicle are within two feet of the antenna may result in radio energy radiation burns or related injuries.

2.2.2 Interference with vehicular electronics

Certain vehicle electronic devices may be prone to malfunction due to lack of protection from radio frequency energy present when transmitting.

It includes, and is not limited to:

- Electronic fuel injection systems
- Electronic anti-skid braking systems
- Electronic cruise control systems

If the installation vehicle contains such equipment, consult the dealer for the make of vehicle and enlist his aid in determining if such electronic circuits will perform normally when the radio is transmitting.

2.2.3 Secure mounting

For vehicle occupant(s) safety, mount the GeminiG3 radiomodem securely so that the unit will not break loose in case of an accident or violent maneuvers.

2.2.4 Explosive environments

Operation of vehicular radio transmitters in explosive environments may be hazardous and conventional safety precautions must prevail. These include and are not limited to:

- Transmitting while fuelling the vehicle. Do not carry fuel containers in the same compartment as the GeminiG3 unit.
- Dynamite blasting caps may explode when transmitting radio operation takes place within 500 feet. Always obey the ***"Turn Off Two-Way Radios"*** signs posted at sites where dynamite is being used.

If transporting blasting caps, *(check applicable local bylaws)* be aware to:

a) Carry the blasting caps in an appropriate metal container having a soft cushioning lining.
b) Suppress transmissions whenever the blasting caps container is being loaded or unloaded into or from the vehicle.

2.2.5 Installation in vehicles powered by liquefied gas.

GeminiG3 radiomodem installations in vehicles powered by liquefied petroleum gas with the LP-gas container in the trunk or other sealed-off space within the interior of the vehicle must conform to the National Fire Protection Association Standard NFPA 58 which requires:

- Space containing radio equipment shall be isolated by a seal from the space containing the LP-gas container and its fittings.
- Outside filling connections shall be used for the LP-gas container.

The LP-gas container space shall be vented to the outside of the vehicle.

2.3 Physical Unit

2.3.1 Recommended tools and supplies

- Electric drill for mounting holes
- Hammer and center punch
- Tie-wraps
- Drills and circle cutters as needed according the size of screws (or nuts and bolts) used.
- In-line "Power meter" capable of measuring forward and reflected power at the operating frequency of the radio.

2.3.2 Physical mounting

a) Start by running all the cables (DC power, CAT5 Ethernet and *optional PC RS-232* as well as all antennas cabling) prior to mounting the GeminiG3 unit to assure the feasibility of the planned cable routing.

b) Be sure to leave sufficient slack in each cable so the GeminiG3 unit may be removed from the mounting bracket for servicing with the power applied and the antenna attached.

c) GeminiG3 unit is ready for installation.

Cautions:

- *When drilling mounting holes, be careful to avoid damaging some vital part of the vehicle such as fuel tanks, transmission housing etc. Always check how far the mounting screws extend below the mounting surface prior to installation.*
- *Use of drill bit stops is highly recommended.*
- *After drilling, remove all metal shavings before installing screws.*
- *Do not overtighten self-tapping screws.*

1. Once you have found a suitable mounting position for GeminiG3 radiomodem, hold the unit and the unattached mounting bracket in the proposed mounting position and check that there is clearance behind the unit for the heatsink, cables, etc. Check that the position provides a large enough flat surface that the bracket will not be distorted when installed.

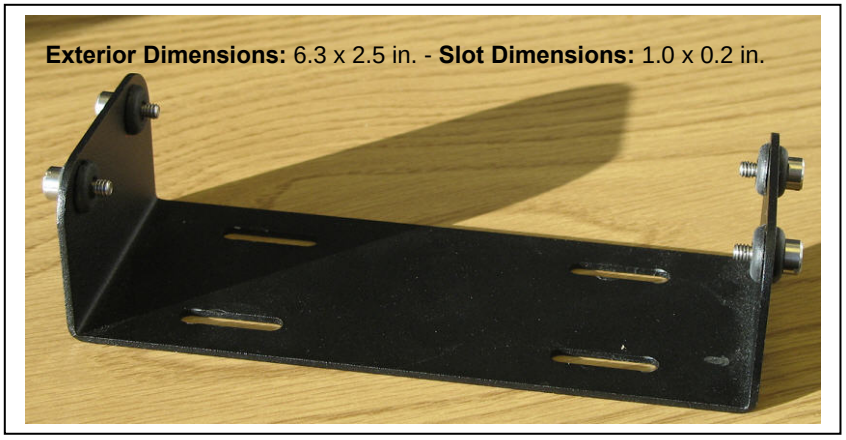


Figure 1 - Mounting plate and slot dimensions

2. Using the installation bracket as a template, mark the four locations for drilling (see Figure 1). Again, ensure that drilling at the selected points is safe and will not cause damage.
3. Indent the drilling positions with a center punch.
4. Drill holes sized for the self-tapping screws or for the nuts, bolts and lock washers used.
   Caution: *Slightly reduce the size of the drilled holes when using self-tapping screws in thin metal.*
5. Install the bracket without distorting (see Figure 2).

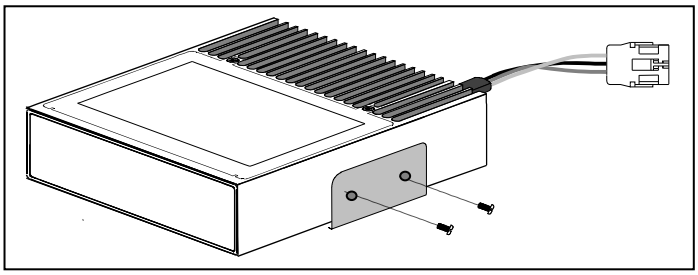


Figure 2 - Bracket installation

5. Securely mount GeminiG3 unit to the installed bracket using the four supplied metal shoulder screws as shown in Figure 2 above. Push the screws through the rubber grommet and fasten securely to the unit. Do not over tighten.

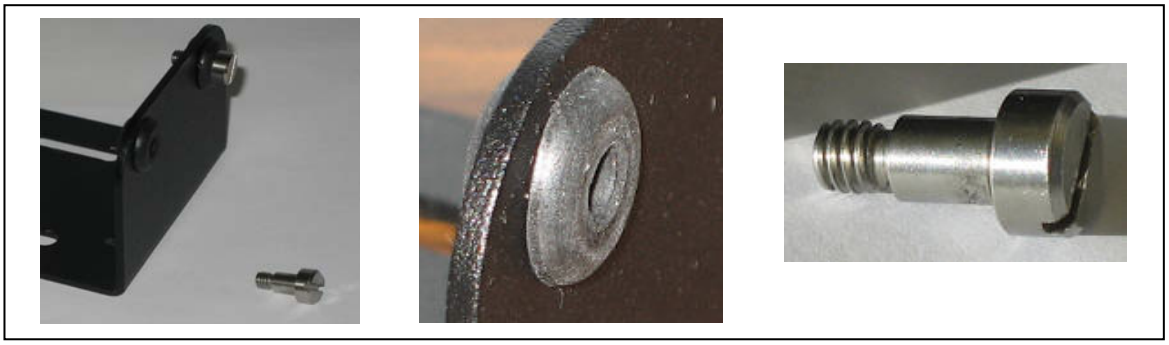


Figure 3 – Rubber grommet and shoulder screw details

6. Drill any additional holes as required for routing all cables and fit holes with suitable grommets or bushings whenever required.

2.4 Electrical installation

2.4.1 Electrical requirements

GeminiG3 radiomodem is designed to operate from a 13.8Vdc nominal car battery (negative ground) and requires currents up to 12.0A. It will tolerate a supply voltage range of 10.9 volts to 16.3 volts.
In vehicles with a 24 VDC electrical system (mostly in trucks), it is essential to provide a suitably rated 24/12 VDC converter to isolate the unit from the battery and protect it against excessive voltage.

Warnings:

Always disconnect GeminiG3 radiomodem's DC power lead before connecting a second battery, using power from another vehicle or power boosting (e.g. when "jump starting" the vehicle).

2.4.2 Routing of power cable

1. Start by disconnecting the vehicle's battery unless specifically prohibited from doing so by the customer, vehicle manufacturer, agent or supplier.

   Note:

   In this event, exercise extreme caution throughout the installation and fit the fuse only when the installation is complete.

2. The 22 feet (6.7 meters) long power cable consists of three wires attached to a Packard Electric "Weather-Pack" connector (DC power Connector, see Figure 4).

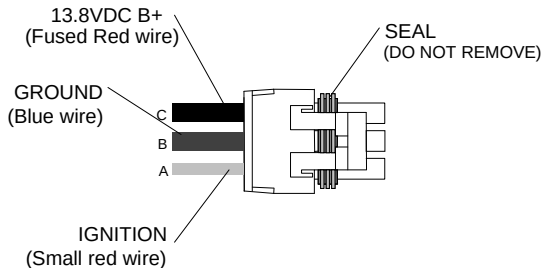


Figure 4 - DC Power Connector

   The DC Power connector has:

   - At position "A", the smaller red switch-sense wire (commonly to ignition)
   - At position "B", the blue ground wire
   - At position "C", a larger red B+ DC power wire (MUST be unswitched)

3. Place this connector at GeminiG3 unit's radio power input location. Do not connect at this time. See paragraph 2.6, "Completing the physical installation".

4. Carefully route both the B and the C wires to where the in-line fuse holder will be installed, usually as close to the vehicle's battery as practicable. Ensure that leads do not chafe on any metal part(s). Secure the wires at several locations along their length.

   Caution:

   Use proper crimping tool. Common pliers are NOT acceptable.

   Warning:

   The DC Power lead must be unswitched

5. Insert the negative (blue) lead into one of the appropriate connector lug and crimp solidly to force the metal contacts onto the wires.
6. Repeat the step above for connecting the red DC power lead.
7. Attach the positive lead at the battery positive terminal. Attach the negative wire at the vehicle end of the battery ground cable.

   If the negative cable is connected directly to the battery negative terminal, it should be fused in case of failure of the vehicle's ground cable.

   Ensure tight and secure connections.

8. Fasten the fuse holder and leads.
9. Carefully route the "A" wire to where the connection will be made for switch sensing.
   - Connect to "Ignition" if you wish to have GeminiG3 unit turning ON and OFF dependent on the vehicle's ignition key.
   - Connect to "Accessory" if you wish GeminiG3 unit to be available when the engine is not running, but still dependent on the ignition key.
   - Connect to a user-supplied control switch.

- In installations equipped with a “ChargeGuard”, connect to the controlled-side of the ChargeGuard (remembering that the DC Power lead must NOT be switched).

10. Make appropriate connections.

    Cautions:

    Where scraping to bare metal was required, and at the battery posts where wire ends and lugs may be exposed, apply anti-corrosion compound.
    Insert the fuse only when installation is complete and ready to test.

11. At the GeminiG3 radiomodem’s position, neatly coil cable slack and attach securely.

2.5 Antenna

The main transmitter antenna must be vehicle-mounted to provide a separation distance of 50 cm or more from all persons and the *antenna gain* must not exceed 5dBi (with a 1.6dB cable loss).

2.5.1 Recommended tools and supplies

- Circle cutter, hole saw or socket punch for antenna
- Appropriate crimping tool for type of connection present on the radiomodem unit

2.5.2 Planning

Referring to Figure 5, the GeminiG3 radiomodem commonly uses three separate antennas:

- "T" - Main transceiver -

  Constraints are the limit of 50 cm (see section 2.5 above) and omni-directional factors

- "R" - Auxiliary receiver –

  Constraints are the receiver spacing of at least 5/8 λ (wavelength) from transceiver antenna and omni-directional requirements

- "G" - Global Positioning System (GPS)

  Constraints are TX spacing of at least 24-in/60.96 cm from all transmitting antennas and a clear view of the sky.

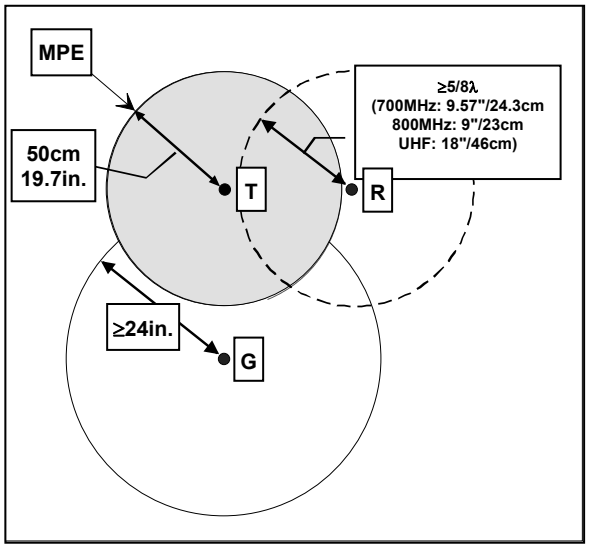


Figure 5 - Antenna spacing

For the optimum antenna spacing at the frequency you are using, consult System Engineering.

For installation of ground-plane dependent antennas, the center of the metal surface used for mounting is preferable for best omni-directional pattern. For ground-plane independent antennas, installation may be close to the edges of the surface.

Install the antennas in one of the following positions:

- Most preferred for all antennas: centerline of roof. For transmitter antenna, it is the ONLY acceptable position.
- Less preferred for receiver antenna: trunk lid, providing distance to transmitting antenna is respected whether lid is opened or closed.
- Much less preferred, but permissible for receiver antenna: left or right rear fenders, just in back of rear window
- Least preferred, but permissible for receiver antenna: left or right front fenders, ahead of windshield

Proximity to other vehicle-mounted antennas may cause mutual interference especially at higher frequencies.

2.5.3 Antenna Installation

1. Route good quality 50-ohm coaxial cables (e.g. RG-223) from each of the selected antenna positions to the position where the GeminiG3 unit is mounted.
2. Terminate the end at each of the antenna positions with the appropriate connector for the antenna used and make the connection.
3. At the GeminiG3 unit position, cut the three cables to length and terminate with the appropriate plug. For the transceiver and the auxiliary cables, use the proper crimp plug for the connections present on the radiomodem. For the GPS[1], use a SMA connector.
4. ***Positively identify*** the transceiver plug and connect to the left rear of GeminiG3 unit.
5. ***Positively identify*** the auxiliary receiver plug and connect to the front left of GeminiG3 unit to the RX position.
6. Connect the SMA connector to the GPS position below the auxiliary connector position.
7. *Do not skip this last step, trust us; it is an important one.* To complete the installation, tie-wrap together the auxiliary and the GPS antenna cables at a point about two inches in front of the unit. It will be much easier hereafter to correctly identify which plug goes where. You DO NOT want to cross the auxiliary plug with the transceiver plug.

2.6. Completing the physical Installation

To complete the physical installation and prior to testing the GeminiG3 radiomodem:

- Connect DC Power cable's connector to the GeminiG3 unit connector until you hear a click as the two parts snap together.
- Re-check that all other connections are secure (antennas, PC, etc.)
- Switch vehicle ignition ON.

You are now ready to check for normal operation and to run the GeminiG3 Web Interface program for testing or trouble-shooting

2.7. Checking out Normal operation

Check that the vehicle ignition is ON.

1. Check for proper operation of the GeminiG3 LEDs as per Table 2 on page 14.
2. Using the GeminiG3 Web Interface program and an in-line wattmeter, check forward & reverse power to confirm main antenna installation (as per section 4).
3. Check the RF Data Link with a base station that can be heard (see section 4.7.7.1).
4. If user application and its base station are available, test the installation by going through a normal sequence of transmitting and receiving messages.

3. Operating Description

3.1 Front & Rear Panels

The front panel includes:

- One female antenna connector for the auxiliary receiver
- One SMA type female connector for the GPS receiver
- Three LED indicators
- Two DE-9F RS232 ports
- One Ethernet 10/100BaseT port
- One USB port (future use)

The rear panel includes:

- One female antenna connector for the main transceiver
- One 3-pin pigtailed DC Power connector with ignition sense

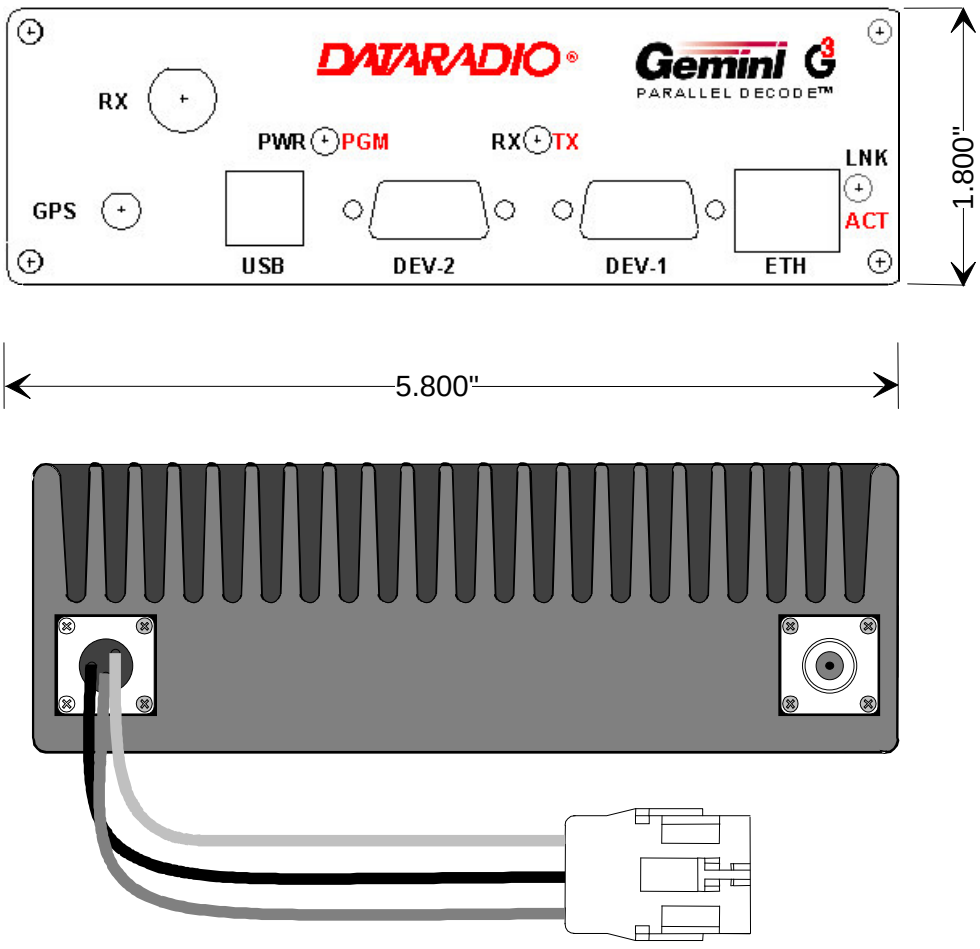


Figure 6 - Front and rear panels

Table 2 - G3 LEDs indications

G3 LEDs indications			
Power-on Sequence (LEDs are paired)			
	PWR / PGM	**RX / TX**	**Indication**
Off	Off	Off	GeminiG3 Off
Boot 1	Solid Red	Off	Boot in progress
	Blinking Red on Black (3 short red)	Off	RAM or Self Test Error
	Blinking Red on Black (Long / Short reds)	Off	Unable to proceed to next boot step
Boot 2	Solid Amber	Off	Boot in progress
	Blinking Amber on Black (Short amber blink)	Off	Exception error (Reboot in 10 secs)
	Blinking Red on Amber (Short red blink)	Off	Unable to complete boot process
Power ON (LEDs are paired)			
Special	**PWR / PGM**	**RX / TX**	**Indication**
	Blinking Green on Black (1/2 sec each)	Solid Red	TXON in progress (in test mode)
		Flashing Green on Black	Rx packet (in test mode)
	Solid Amber	Solid Amber	Test jumpers installed
Normal Operation (LEDs are independent)			

Normal	**PWR / PGM**	**Indication**
	Green	Normal state
	Blinking Amber on Green	GPS 1 pps
	Flashing Amber	MPE Throttled (Still Tx, Still Rx)
	Amber	MPE Exceeded (No Tx, Still Rx)

RX / TX	**Indication**
Solid Amber	Roaming
Flashing Green	Rx packet
Flashing Red	Tx packet

Note:

Blinking refers to the LEDs turning ON and OFF based on time (such as number of times per second)

Flashing refers to the LEDs turning ON and OFF in response to an event occurring (such as packets)

3.2 DTE Port Interface

For all three ports, we recommend the use of a shielded 9-wire cable with all pins connected. These ports can be used for unit configuration, maintenance, & adjustment as well to connect user applications.

Table 3 - DTE port pin functions

DE-9 F pin #	Function
1	DCD – from GeminiG3, normally asserted
2	RXD – data from GeminiG3
3	TXD – data to GeminiG3
4	DTR – to GeminiG3, handshaking
5	Ground
6	DSR – from GeminiG3, tied to VCC through current limiting resistor
7	RTS - to GeminiG3, handshaking
8	CTS – from GeminiG3, handshaking
9	AUX - auxiliary input to GeminiG3

3.2.1 RS-232 Interface Signal Levels

In the descriptions of data signals, the following conventions are used:

Table 4 - RS-232 Signal Levels

Term	Alternates	Signal level
ON	asserted, spacing	+3 to +15 V
OFF	dropped, marking	-3 to -15 V

4. Operation & Configuration

Instructions and examples given in this manual are based on E-DBA operating software version 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.

4.1 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 7 - Web Interface

4.1.1 Interface Setup and Status

The GeminiG3 radiomodem user interface is used to configure and view your network settings. Figure 7 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.

4.2 LAN Setup

Check that DC power is applied to the GeminiG3 radiomodem. On a PC running MS-Windows with an existing LAN connection, connect to the RJ-45 input of the GeminiG3 unit.

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:

A) Select "Obtain an IP address automatically"

B) Select "Use the following IP address" ➔ Enter 192.168.201.2 in the IP address field ➔ 255.255.255.0 in the Subnet mask ➔Leave the Default gateway blank.

6. Click the OK button

Notes: Certain OSes require rebooting to complete the connection process.

Steps above specifically apply to MS-Windows 2000. Modify as necessary for the OS you are running.

4.3 Default IP Settings

4.3.1 Ethernet Interface

- MAC: 00:0A:99:XX:YY:ZZ
- IP ADDR: 192.168.201.1
- NETMASK: 255.255.255.0
- Default Gateway: automatically set to current Base RF IP address
- DHCP Server Enabled
- NAT Enabled

4.3.2 RF Interface

- MAC: *00:XX:YY:ZZ*
- IP ADDR: *10.XX.YY.ZZ*
- NETMASK: *255.0.0.0*
- TCP Proxy *Enabled*

Notes:

XX:YY:ZZ refer to lower three bytes of Ethernet MAC address

4.4 IP Network Settings

For Advanced IP Settings, Web interface screen captures, and descriptions, see section 4.5 below.

4.4.1 IP Network Settings (with Host)

Figure 8 below illustrates GeminiG3 radiomodem settings. In Setup (Advanced) ➔ LAN (IP), set addresses and IP Netmask of both Base and Mobile(s).

Add routes in the Host (route add…) and add Default Gateway to PC

Note: Router, Host, and PC should not have other routes defined to other 10 segments.

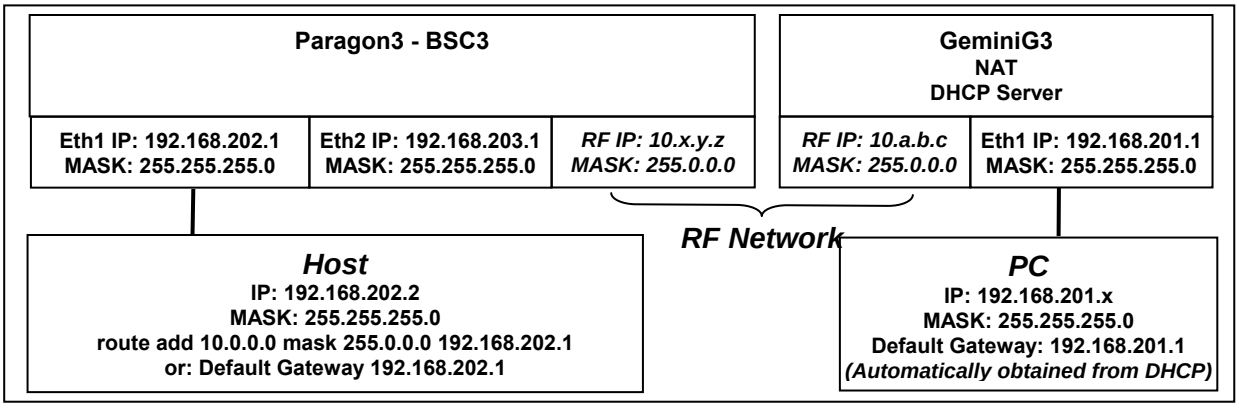


Figure 8 - IP Network Settings (with Host)

4.4.2 IP Network Settings (with Router)

Referring to Figure 9 below illustrates GeminiG3 radiomodem settings. In Setup (Advanced) ➔ LAN (IP), set addresses and IP Netmask of both Base and Mobile(s).

Add Default Gateway to the PC

Enable RIPv2 on BSC3 and on Router

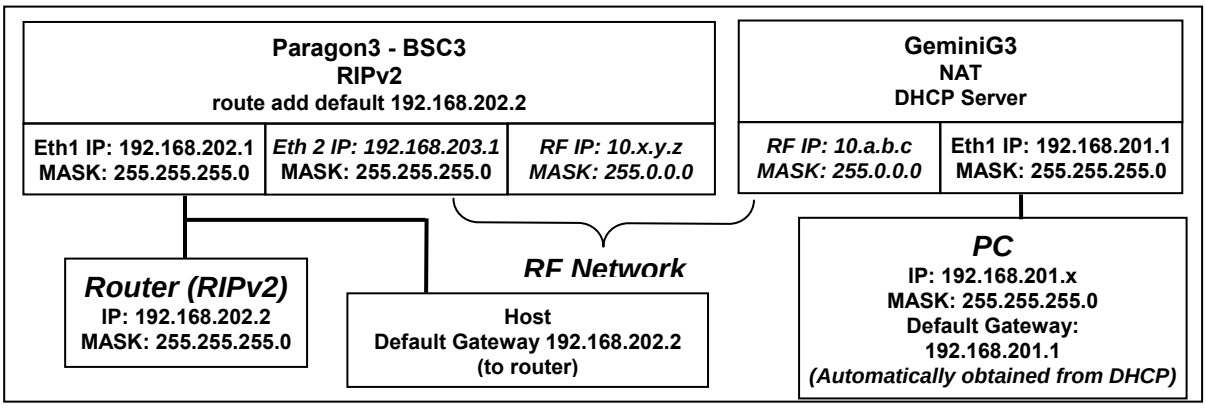


Figure 9 - IP Network Settings (with Router)

4.5 Login Screen

On your Internet browser address line, type the factory-default IP address given to all GeminiG3 radiomodem units: 192.168.201.1. Press Enter. The Enter Network Password screen opens.

Figure 10 - Enter Network Password screen

4.5.1 Initial Installation Login

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 (see Figure 11 below).

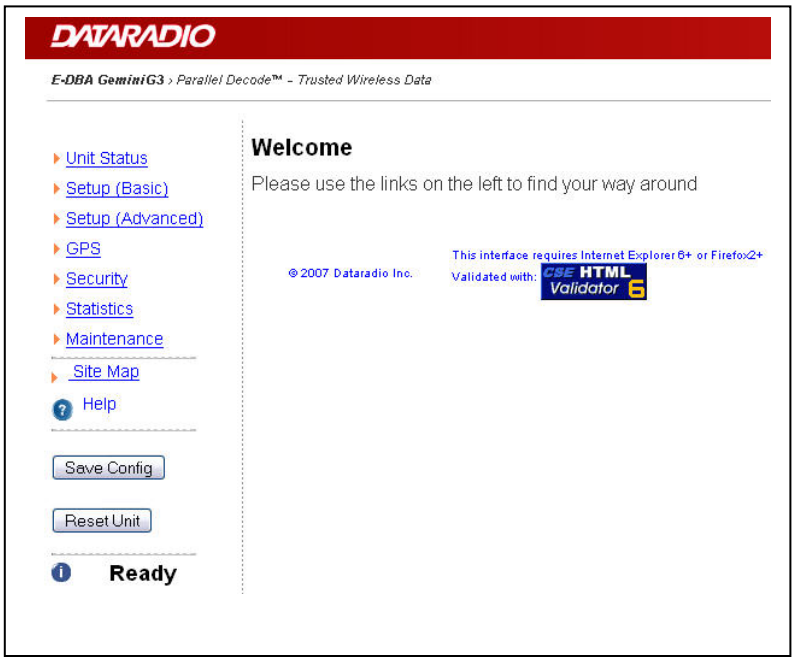


Figure 11 - Web User Interface – Welcome Screen

For subsequent access to the GeminiG3 unit, use the User Name and Password that you will have configured.

Notes:

User Name field can be left blank. It only serves to identify the person gaining access.

Password is common and affects all User Name entries.

4.6 Web Interface

The GeminiG3 user interface (Figure 11) is used to configure and view 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 4.7.1.1 below list action of each function. The interface main screen lists available selections for the selected menu or presents instructions.

Important note:

Record all original GeminiG3 radiomodem factory settings for possible future use.

4.6.1 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.

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 automatically.
- If there are no changes to be saved, a window prompts user to confirm saving.

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 automatically.

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

When done, the status reports: "Ready".

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

4.7 IP Settings

4.7.1 Unit Status

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

4.7.1.1 Unit Status

Figure 12- Unit Identification and Status

Item	Description
Banner	Displays GeminiG3 software revision information retrieved from the connected unit. Have this information handy if contacting Dataradio support. The Banner fields are deciphered as following: GeminiG3: — Product name EDBA (Enhanced Dynamic Bandwidth Allocation) — Protocol Name Multiband — Band(s) of operation PROD — Production build V2.7 — Vx.y Major.minor version number R07_R0712181200 — Rxx_R… Sequential Package Release Timestamp
Station Name	Displays name of the 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	Displays time of configured time zone computed using UTC time and configured Time Zone (If SNTP is enabled)
Position (GPS)	Global position in Longitude (East-West) and Latitude (North-South) displayed using information obtained from a GeminiG3 decoding a valid GPS input signal. If no previous position was obtained, display shows (Unknown). Positions are reported in degrees plus decimal minutes. E.g. : Longitude of 73 degrees, 39 minutes and 45 seconds West would appear as: 073 39.7500 W
Status	Displays "Initializing" at startup, "Registered" in normal operation and "Roaming" while attempting to register to another base station.
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 Dataradio support.
Acknowledge Unit Status	Press this button to clear the Unit Status message area.

4.7.1.2 Radio Info

Provides pertinent radio information retrieved from the connected GeminiG3 unit. Have this information handy if contacting Dataradio support.

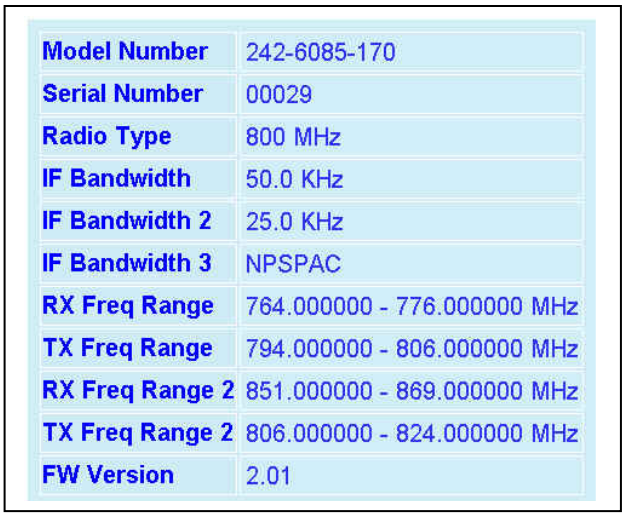


Figure 13 - Maintenance - Radio Personality

Item	Description
Model Number	Identifies the model of radio module installed
Serial Number	Unique number assigned to the radiomodem at time of manufacture
Radio Type	Identifies the unit as a model operating at 800 MHz
IF Bandwidth	Indicates the various bandwidths used by the radio. The model in the illustration is intended for use in 50.0 kHz channel spacing
RX Freq. Range	Shows the receiving frequency range (or ranges) the unit can synthesize.
TX Freq, Range	Shows the transmitting frequency range (or ranges) the unit can synthesize.
FW Version	Version number of the firmware installed on the radio module.

4.7.2 Setup (Basic)

4.7.2.1 Setup (Basic) ► General Setup

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

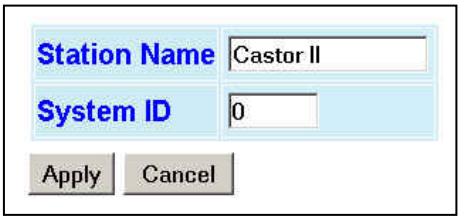


Figure 14 - General Setup

Item	Description
Station Name	**Station name identifier – Enter string up to forty characters in length**
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, Dataradio recommends changing the System ID to some other value unique to each network.** **Upper limit is 255**

4.7.2.2 Setup (Basic) ► Basic IP Configuration

Sets the IP characteristics of the Ethernet port.

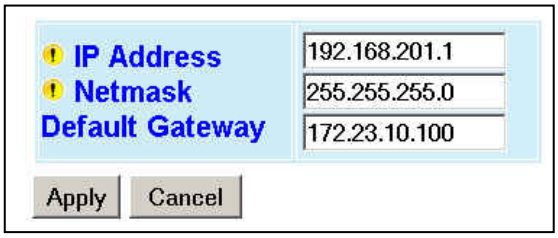


Figure 15 - Setup (Basic) – Basic IP Configuration

Item	Description
IP Address	**Set to valid unique IP address for each individual unit.** **Factory default is 192.168.201.1 for all GeminiG3 units.**
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**

4.7.2.3 Setup (Basic) ► Serial Ports Setup

The GeminiG3 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.

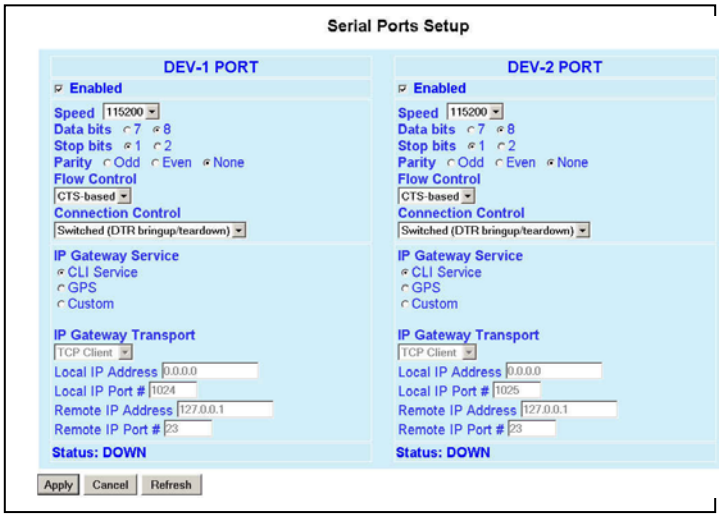


Figure 16 - Setup (Basic) – Serial Ports Setup

Item	Description
Enabled	**Independent check boxes to activate DEV-1 PORT and/or DEV-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	**Marks the end of the serial port data byte. 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 *(RTU dependent)***
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)** **GPS – Direct GPS reports (see GPS ► Delivery) to this serial port** **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 button to update Status condition.**

4.7.3 Setup (Advanced)

4.7.3.1 Setup (Advanced) ► LAN (IP)

Complements the setting of IP characteristics beyond those set in Setup (Basic) ➔ Basic IP Configuration.

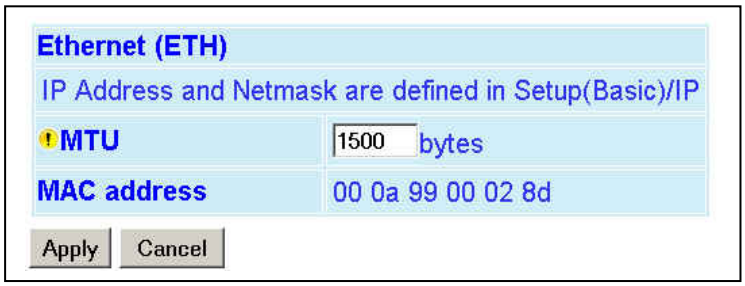


Figure 17 - Advanced IP Configuration - LAN (IP)

Item	Description
MTU	**Ethernet Interface MTU - Default 1500. – For optimal performance, set at 1500.** **Flexibility of using lower values may be useful in testing or for particular operational conditions. If a lower value is used, Dataradio suggests that the value present in Setup Advanced ➔ RF (IP) in the RF MTU dialog box be also changed to match the LAN MTU value.** **Range is 576 to 1500.**
MAC address	**Ethernet Interface MAC address in HEX format *(factory-set)*.**

4.7.3.2 Setup (Advanced) ► RF (IP)

At the time of manufacture, each Paragon3 base station and Gemini G3 radiomodem 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.

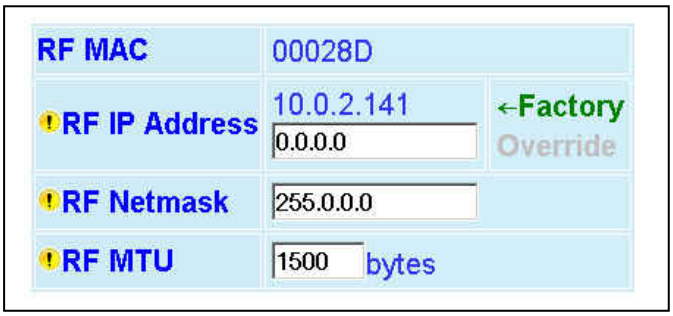


Figure 18 - Advanced IP Configuration - RF (IP)

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 GeminiG3 network**
RF MTU	**RF Interface MTU - Default 1500. – For optimal performance, set to 1500.** **Flexibility of using other values may be useful in testing or for particular operational conditions. If a lower value is used, Dataradio suggests that the value present in Setup Advanced ➔ LAN (IP) in the MTU dialog box be also changed to match the RF MTU value.** **Range is 576 to 1500.**

4.7.3.3 Setup (Advanced) ► RF (Freq.) ► Radio Table Set Up

Each Gemini G3 unit is provided with 32 internally stored over-the-air programmable channels. Use the table below to set up RX and TX frequencies for each channel. [1]

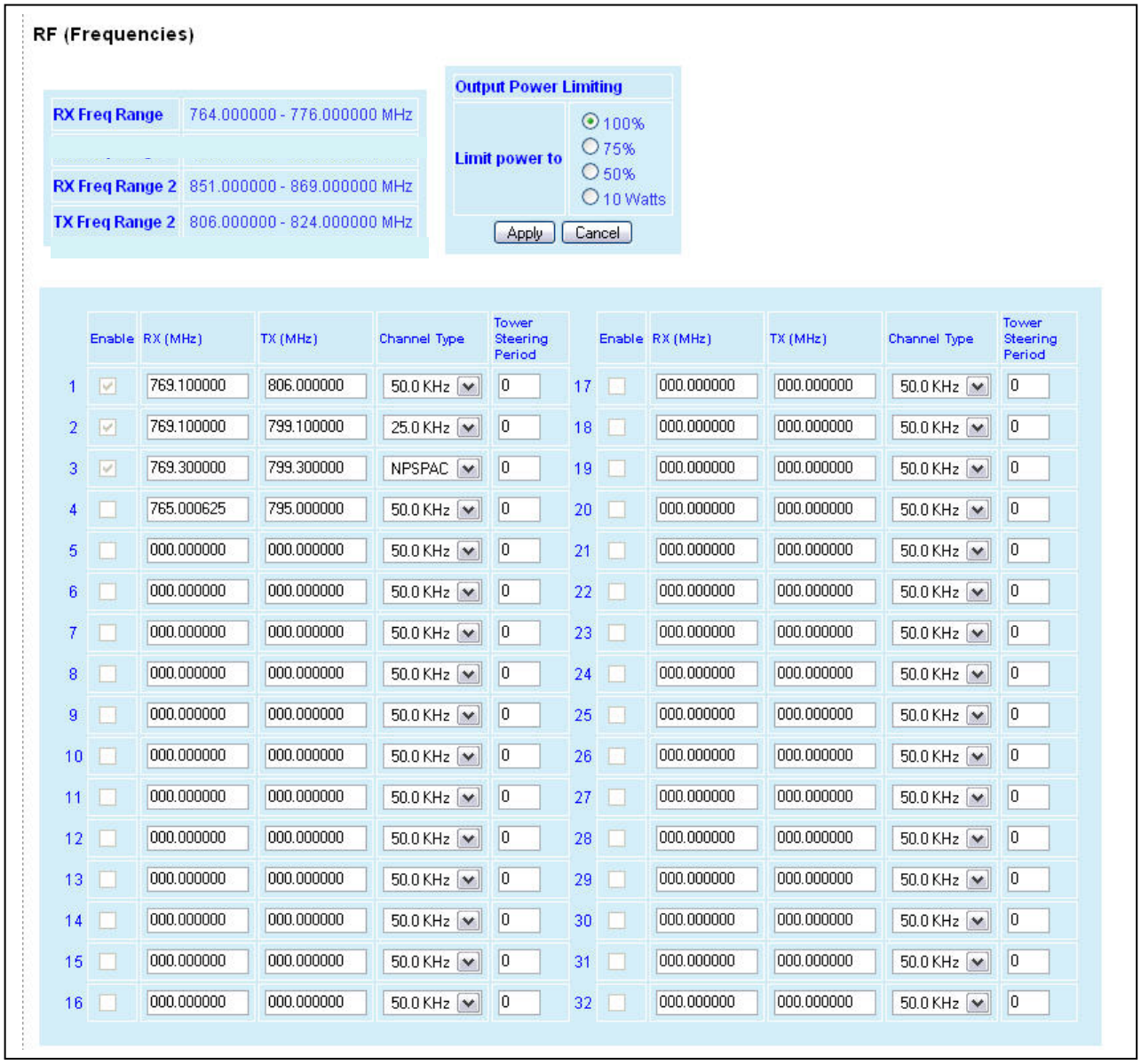


Figure 19 - Radio Table Set Up

Note: *Exercise caution when entering RF frequencies. GeminiG3 radio modem 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.*

[1] Actual web interface presentation may differ from the illustration used.

Item		Description
Radio Tables Setup		Enter RX and TX frequency in MHz in the appropriate dialog box. Entries must fall within the Min and Max indicated on top of the page 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). Dataradio recommends (in North America) offsetting the TX column frequency by +30 MHz for 700MHz frequency ranges, by –45 MHz for 800 MHz frequency ranges, or by ± 5 MHz 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
Output Power Limiting	Limit power to	100% = Sets Output Power to its maximum of 27W (700MHz) or 35W (800 MHz) 75% = Sets Output Power to 75% of its maximum 50% = Sets Output Power to 50% of its maximum 10 Watts = Sets Output Power to that minimum value After selecting power setting, click on the “Apply” button, then on “Save Config”
Channel Type		Channel types available are normally used as follows: “50.0 kHz” (Wideband – 700 MHz), “25.0 kHz” (Full Channel – UHF or 800 MHz), or “NPSPAC” (Channel used for NPSPAC – 800 MHz) as appropriate.
Tower Steering Period		Extends the time that a mobile will listen on a tower-steered channel to register with a base. Must match the tower steering period of the bases on that frequency. 0=No Tower Steering 1 to 255=Number of seconds

4.7.3.4 Setup (Advanced) ► Roaming Setup

Figure 20 - Roaming Setup

Item	Description
…roam across…cycles	When a base becomes congested and indicates that some mobiles should try to roam to another base, this value spreads the activity so that mobiles do not roam at the same time. Set this value large (in the hundreds) for systems with many active mobiles
…RSSI is below…dBm	Mobile will roam if the average signal strength of all synchronization packets re-served in the last 20 seconds is below this value

4.7.3.5 Setup (Advanced) ► IP Services

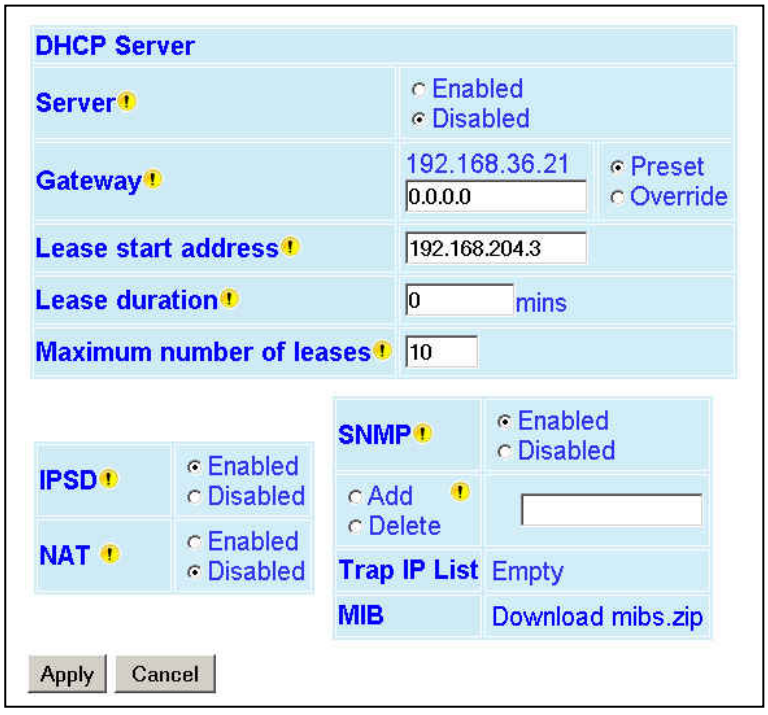


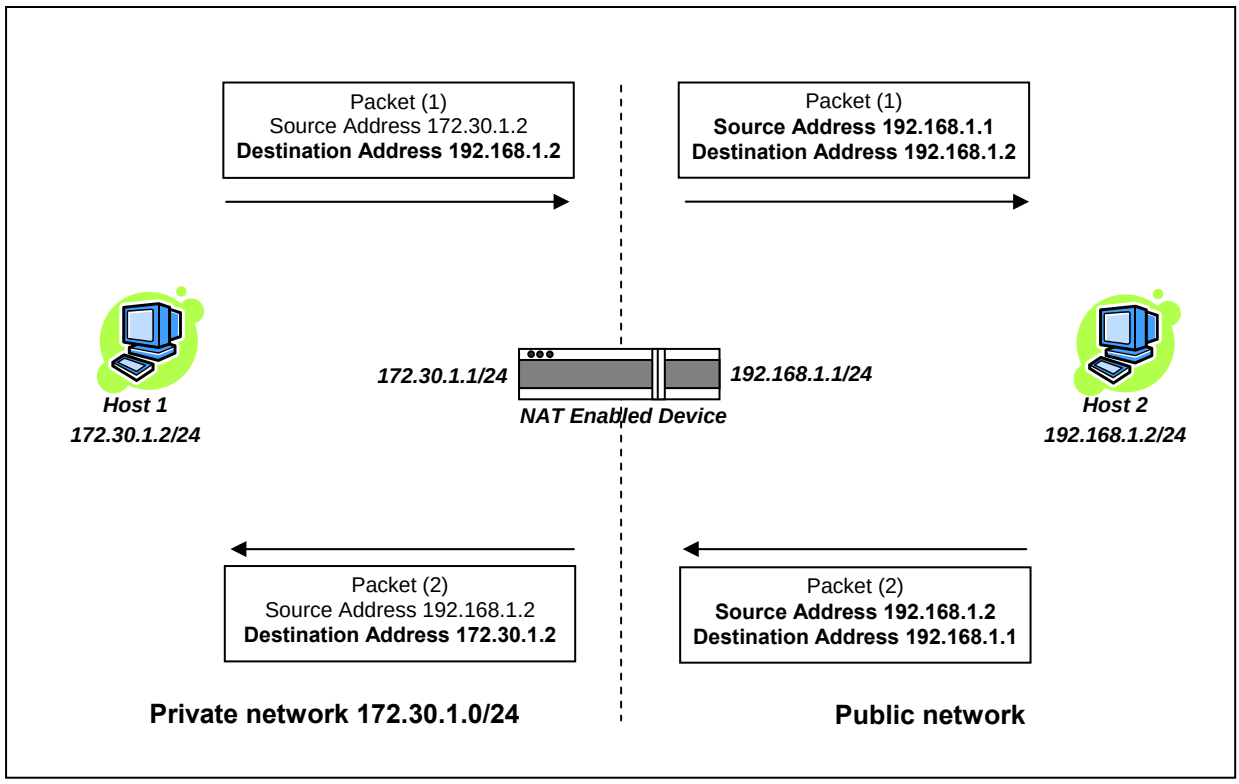
Figure 21 - Advanced IP Configuration – IP Services Setup

Item	Description
Server	DHCP Server Disabled, Enabled (Default). The Dynamic Host Configuration Pro-tocol 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 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, GeminiG3 radiomodem 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	**I/P Services Delivery – Disabled (Default), Enabled.** **Allows or disallows the generation of locally provided IP Services such as online diagnostics, alarms, etc…**
NAT	**Network Address Translation - Disabled, Enabled (Default)** **NAT technology is a method by which IP addresses are mapped from one address space to another. In GeminiG3, 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 4.6.3.5.1 on the next page for a more detailed description**
SNMP	**Simple Network Management Protocol- Disabled, Enabled (Default)** **SNMP provides means to monitor, collect and analyze diagnostic information. After reset, the GeminiG3 sends a WARMSTART trap to all of the local (those routed through the Ethernet interface) IP addresses.** **Trap IP List** **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 from the Trap IP List:** **Select *Delete* and type the IP address to be deleted from the read-only Trap IP List.** **Stop Current Trap Report** **A trap report will be re-sent repeatedly until the *Stop current trap report* check box is selected.** ***The main purpose of "Stop current trap report" option is to protect the network from being overloaded by excessive Trap reporting.***
MIBS	**Management Information Base -used to assemble and interpret SNMP messages.** **The Dataradio Paragon3 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.***

4.7.3.5.1 NAT Overview

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.

Figure 22 - Basic NAT Operations

The source address of packets transiting from the private network to the public network gets translated by the NAT enabled device. The original IP source address gets replaced by the NAT enabled device's own IP address (address of the outgoing interface). The NAT module creates an address translation table that is used when traffic is coming back from the public network to the private network.

In our example, Host 1 sends a packet to Host 2. The Host 2 device doesn't see the private IP address of Host 1. When Host 2 sends a reply to Host 1, Host 2 uses the destination IP address 192.168.1.1, this gets translated back to the appropriate destination IP address by the NAT enabled device.

NAT does a lot more than simple translation of the IP source address. NAT also carries out IP protocol dependant translation. For UDP and TCP protocols, NAT will also translate the source port numbers. Special handling is also done for other more specific protocols like FTP.

4.7.3.5.1.1 NAT on the Base Unit (Paragon3)

The Paragon3 unit is equipped with a management port (the Ethernet 2 interface). When NAT is enabled on the Paragon3 unit, the network covered by the Ethernet 2 interface is considered private.

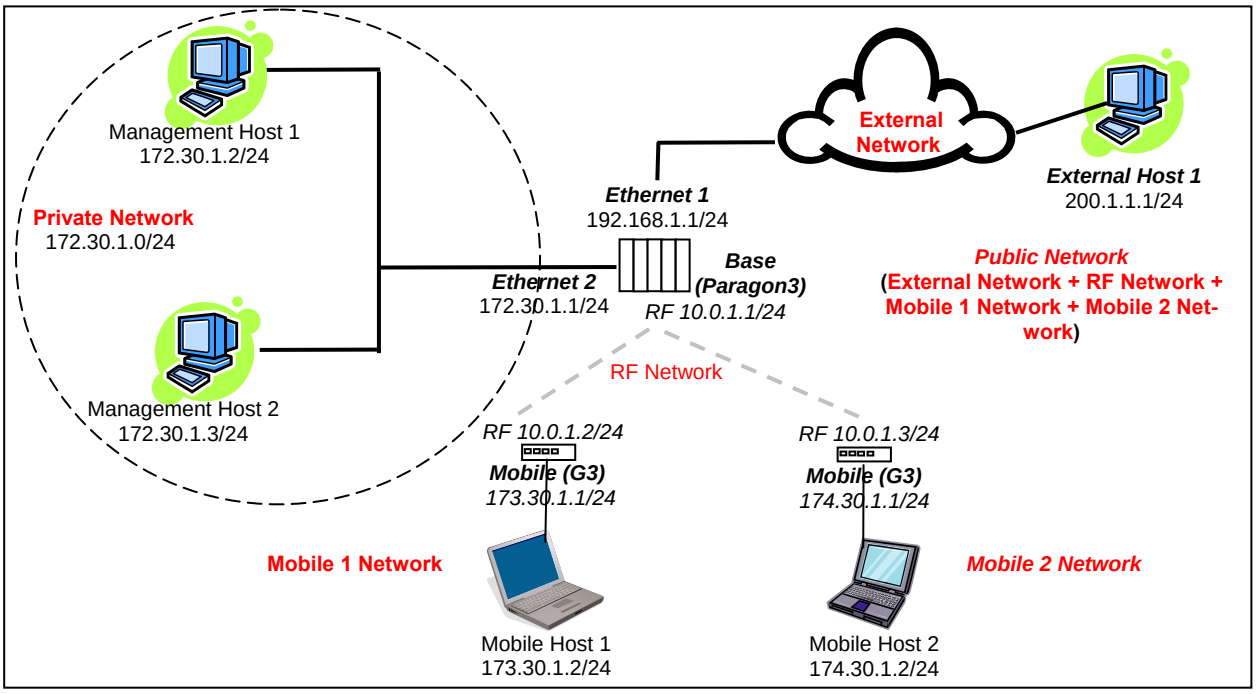


Figure 23 - NAT Enabled on Paragon3

An IP packet sent from the private network towards the External network would have its source IP address replaced by the Ethernet 1 IP address of the Paragon3 radiomodem.

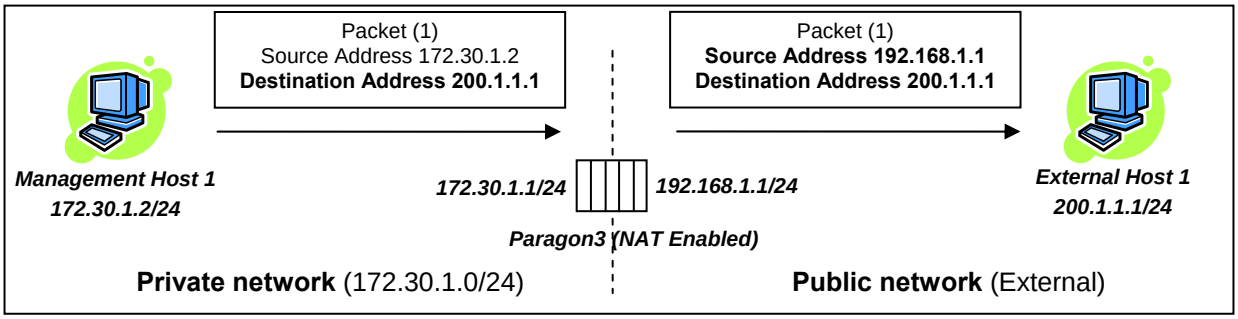


Figure 24 - Private to Public (External)

An IP packet sent from the private network towards the RF network will have its source IP address replaced by the RF IP address of the Paragon3 radiomodem.

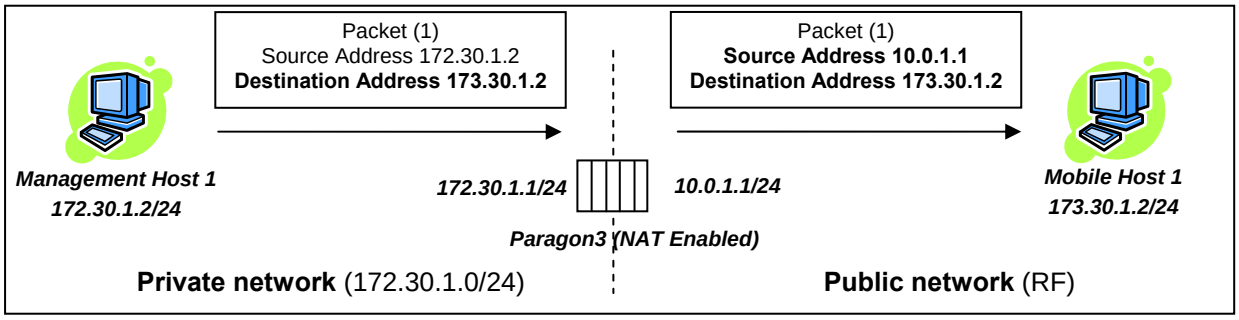


Figure 25 - Paragon3 - Private to Public Network (RF)

4.7.3.5.1.2 NAT on the Mobile Unit (GeminiG3)

When NAT is enabled on a GeminiG3 unit, the network covered by the Ethernet interface is considered private. In the following example, NAT is enabled on a single mobile.

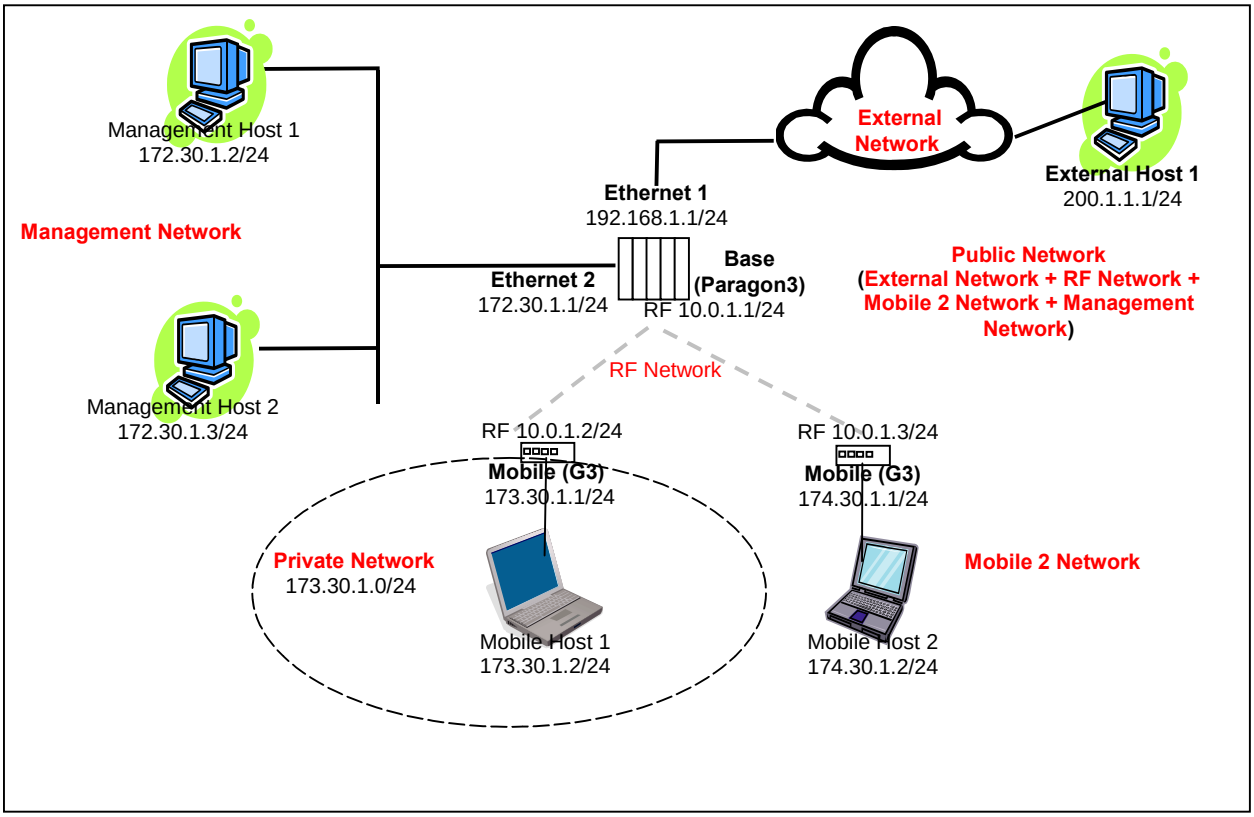


Figure 26 - NAT Enabled on GeminiG3

An IP packet sent from the private network towards the External network would have its source IP address replaced by the RF IP address of the GeminiG3 radiomodem.

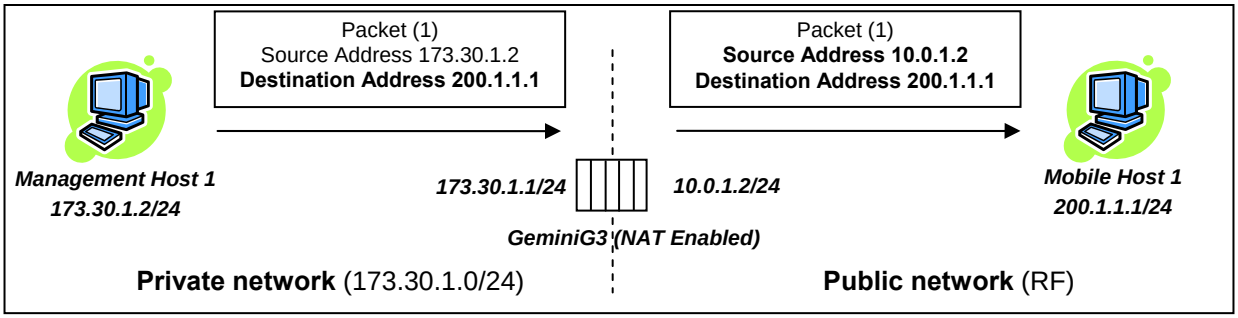


Figure 27 - GeminiG3 - Private to Public Network (RF)

4.7.3.5.2 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 28). SNMP uses basic messages (*such as GET, GET-NEXT, SET, and TRAP*) to communicate between the manager and the agent.

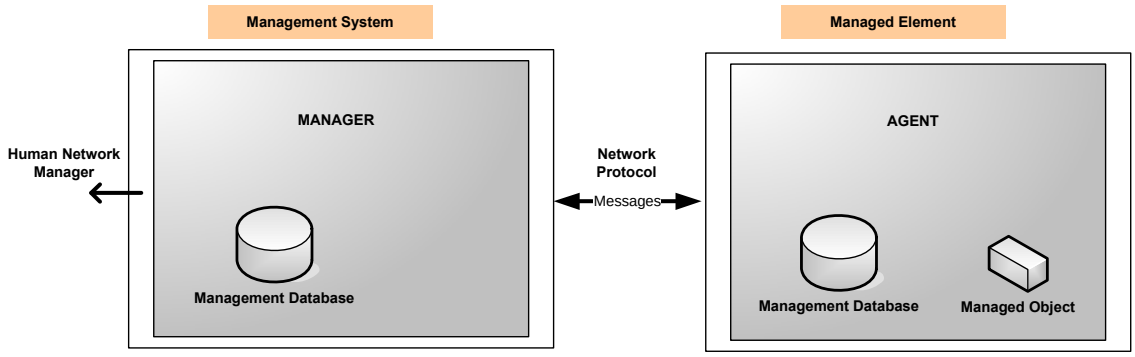


Figure 28 - SNMP: manager/agent model

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.

GeminiG3 MIB File

Each GeminiG3 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.
- *gcu3.mib*: contains a set of managed object definitions aimed at managing Dataradio mobile units.

OID

In SNMP, each object has a unique OID consisting of numbers separated by decimal points. These object identifiers naturally form a tree. Figure 29 illustrates this tree-like structure for *1213.mib,* which comes bundled with every ParagonP3 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.

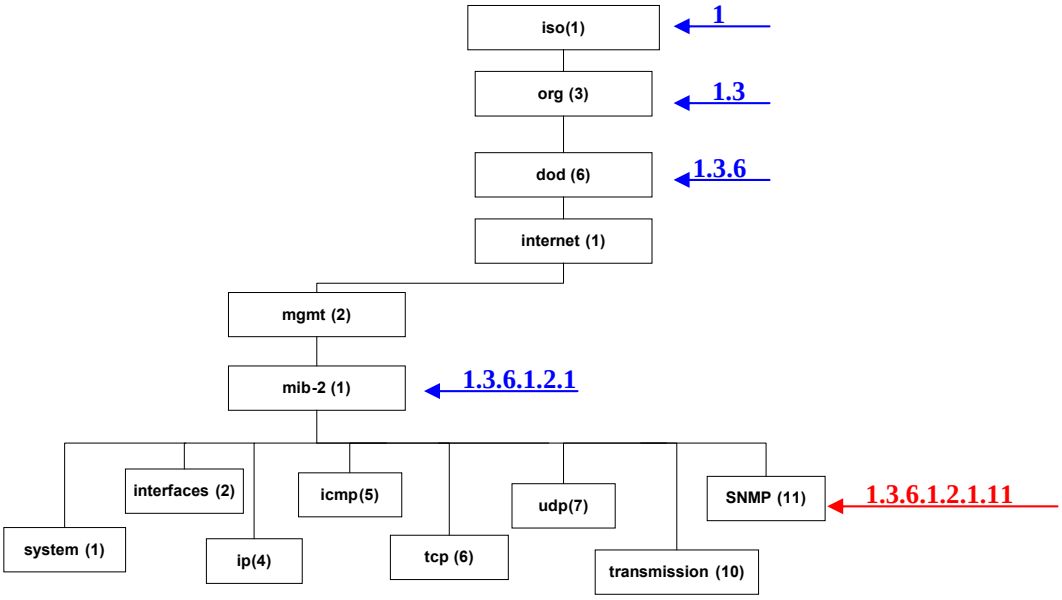


Figure 29 - Branch of the 1234.mib OID tree

Viewing MIB files

To view the hierarchy of SNMP MIB variables in the form of a tree and view additional information about each node, Dataradio 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, a basic, free application such as ”iReasoning MIB browser” could be used.

However, for managing complex networks, Dataradio recommends a more advanced software application, one capable of browser function as well as being a full-featured SNMP manager, such as the optional “Castle Rock SNMPc Network Manager”. Refer to Dataradio Network Management using SNMP User Manual (Part no. 120 47001-nnn for more details).

gcu3.mib

Figure 30 shows top-level objects of the gcu3.mib file:

- *gcu3Identity*
- *gcu3RadioIdentity*
- *gcu3NetStatistics*
- *gcu3Statistics*
- *gcu3Diagnostics*
- *gcu3LocationData*
- *gcu3RadioChannel*
- *gcu3Traps*

These eight branches expand into additional branches and leaves. Again, all gcu3.mib objects can be accessed through a MIB browser.

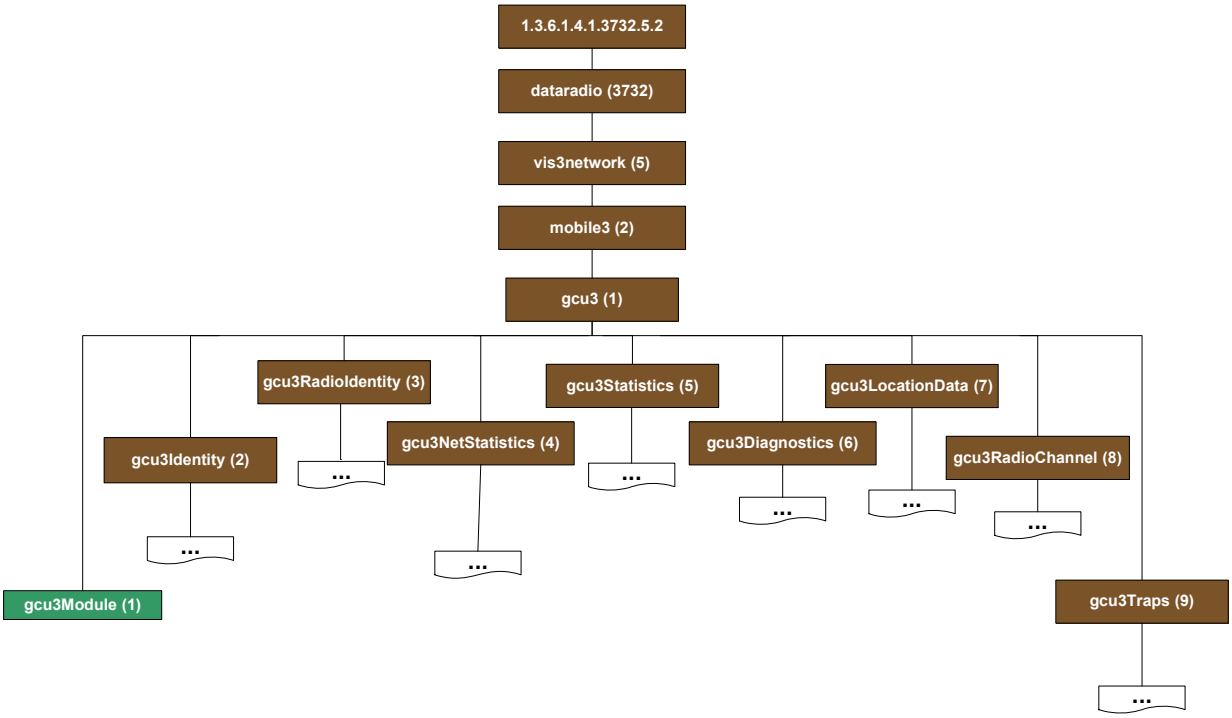


Figure 30 – gcu3.mib Tree

Note: Although each mobile is equipped with an SNMP agent, frequently requesting statistics and diagnostics from the mobiles can create traffic jams.
It is strongly recommended to access mobiles' diagnostics and statistics through the Mobile Tables on the base stations and to only use gcu3.mib for trap reporting.

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

4.7.3.6 Setup (Advanced) ► IP addressing

For a more detailed description of the broadcast and multicast features of the GeminiG3 radiomodem, please refer to paragraph 4.7.3.6.1 below.

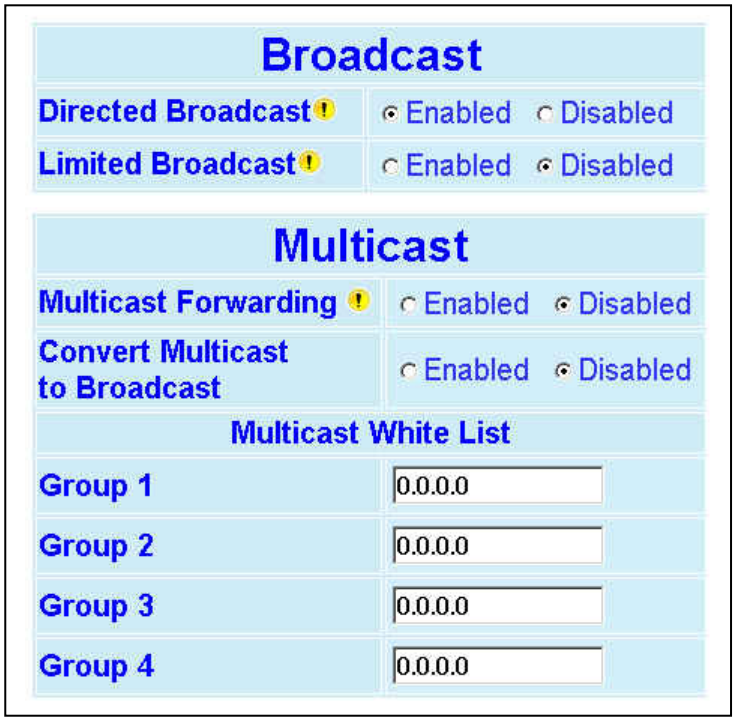


Figure 31 - Advanced IP Configuration – IP adressing modes

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 Forwarding	Disabled (Default), Enabled – Controls forwarding of multicast packets received on the RF interface to the "LAN".
	Convert Multicast to Broadcast	Disabled (Default), Enabled When this option is enabled, multicast packets are converted to broadcast packets. This option is only significant if "Multicast Forwarding" mode is enabled.
	Multicast White List	When the "Multicast Forwarding" mode is enabled and no multicast groups are specified in the "Multicast White List", all multicast packets received on the RF interface are passed to the "LAN". When "Multicast Forwarding" mode is enabled and some multicast groups are specified in the "Multicast White List", only the multicast packets identified in the list are passed to the "LAN".

4.7.3.6.1 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.

4.7.3.6.1.1 Broadcasts

Figure 32 - 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.

4.7.3.6.1.1.1 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)

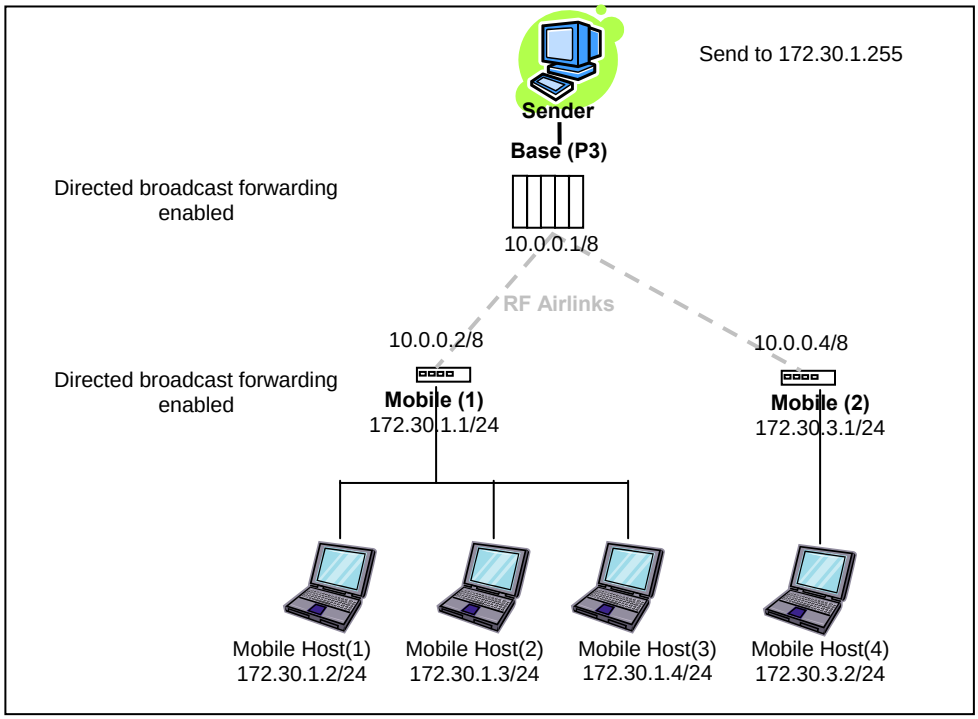


Figure 33 - Example of Directed broadcast forwarding enabled

In this example (Figure 33), 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)

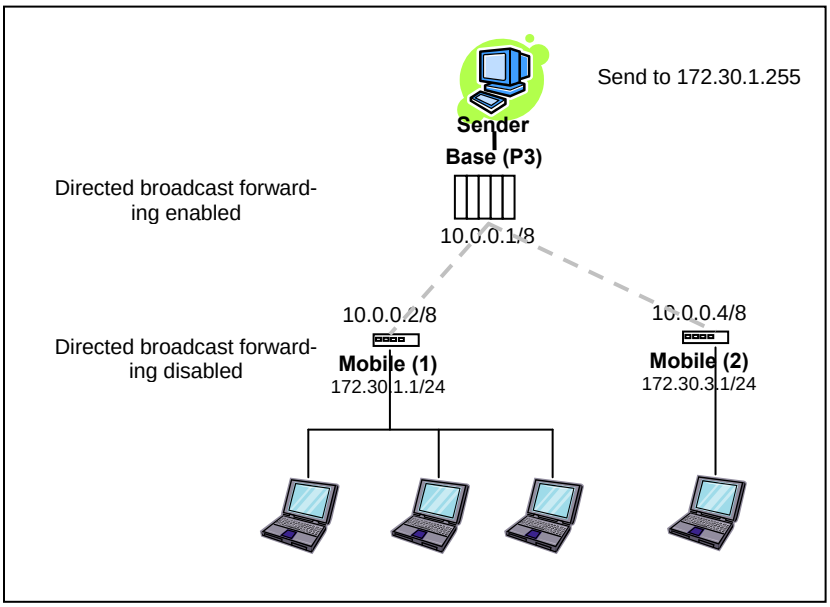


Figure 34 - Example of Directed broadcast forwarding disabled

In this example (Figure 34), 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.

4.7.3.6.1.1.2 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)

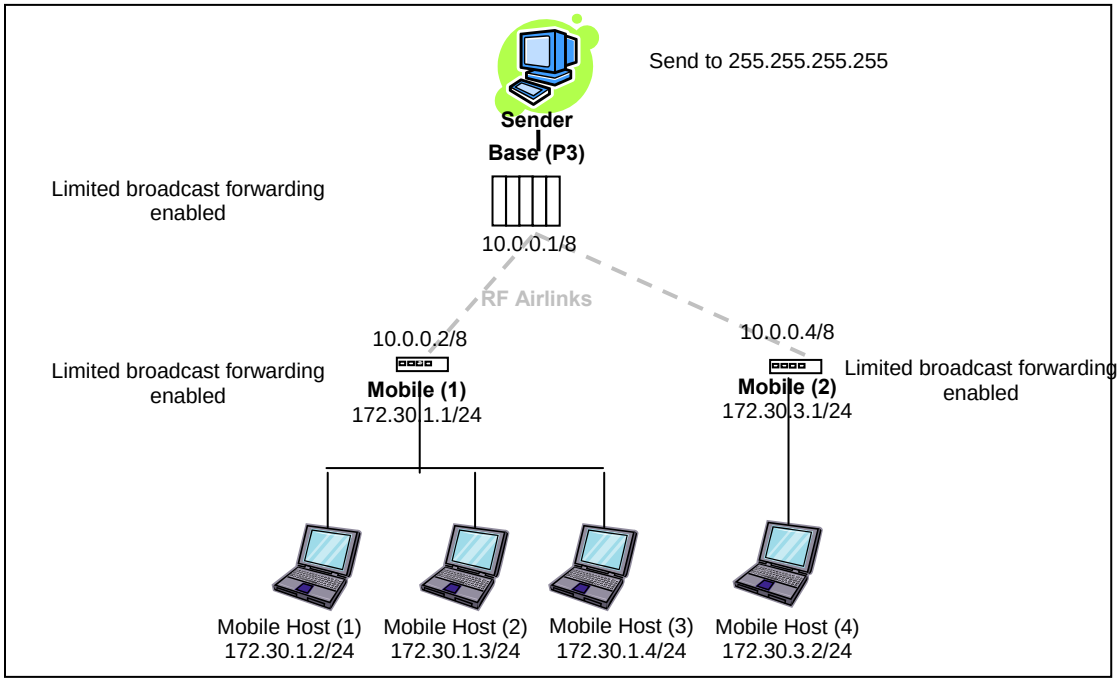


Figure 35 - Example of Directed broadcast forwarding enabled

In this example, (Figure 35) 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)

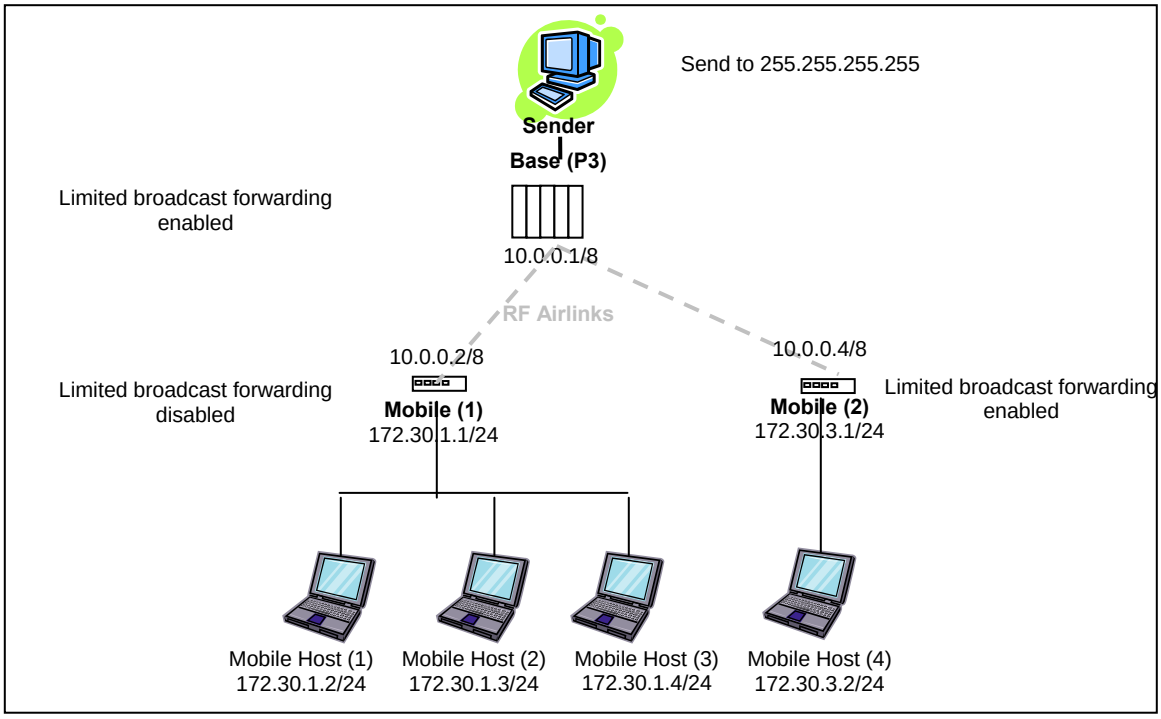


Figure 36 - Example of Limited broadcast forwarding disabled

In this example (Figure 36), 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.

4.7.3.6.1.2 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).

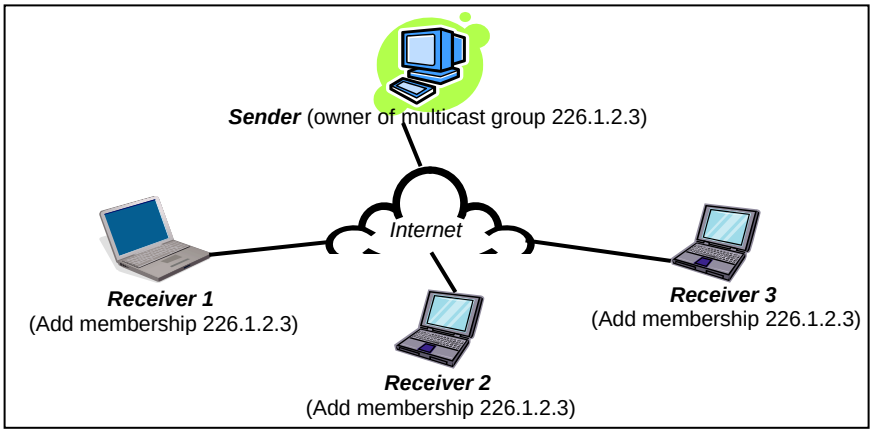


Figure 37 - Registration to multicast group (First step)

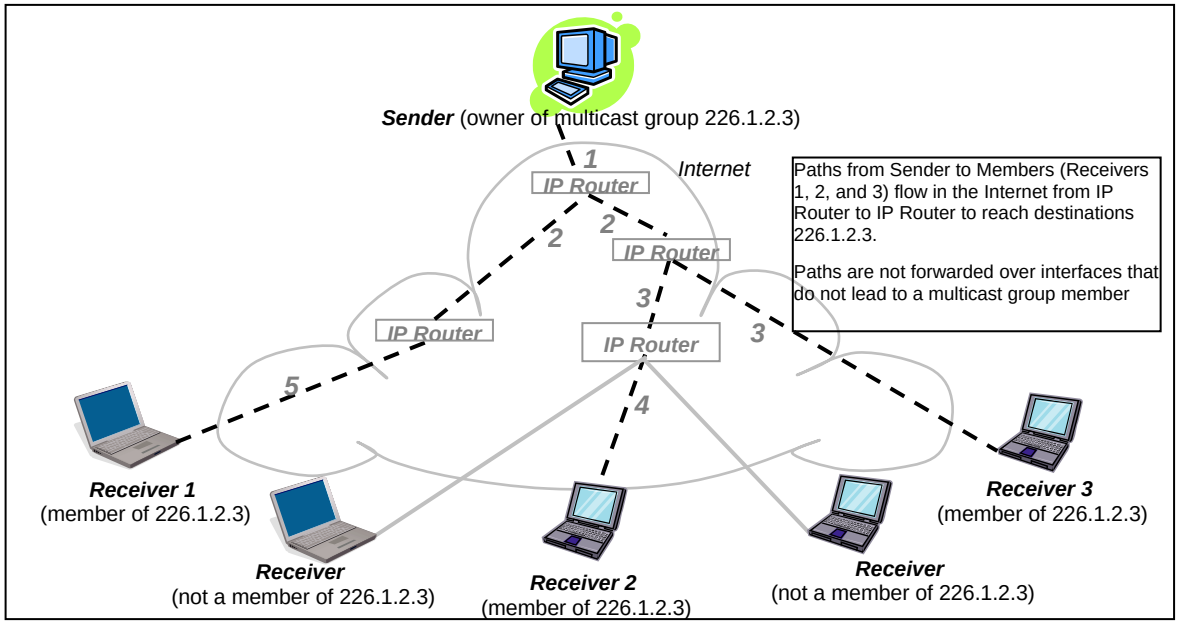


Figure 38 - Reception of multicast packets (Second step)

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

- "All Base" group (not currently supported)
- "All Mobile" group (DMP-IP only)
- Various "Mobile Host" groups.

The Base (P3 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).

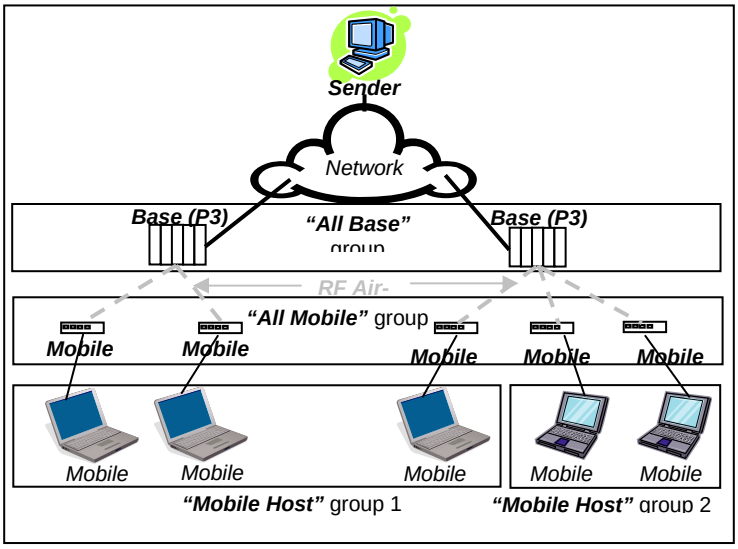


Figure 39 - Typical E-DBA Multicast Groups

The following setup example would allow the "Sender" unit to communicate with different multicast groups. The settings for mobile and base are shown in Figure 40 below. Also represented in Figure 41, it would enable the Sender unit to reach all entities of the various groups.

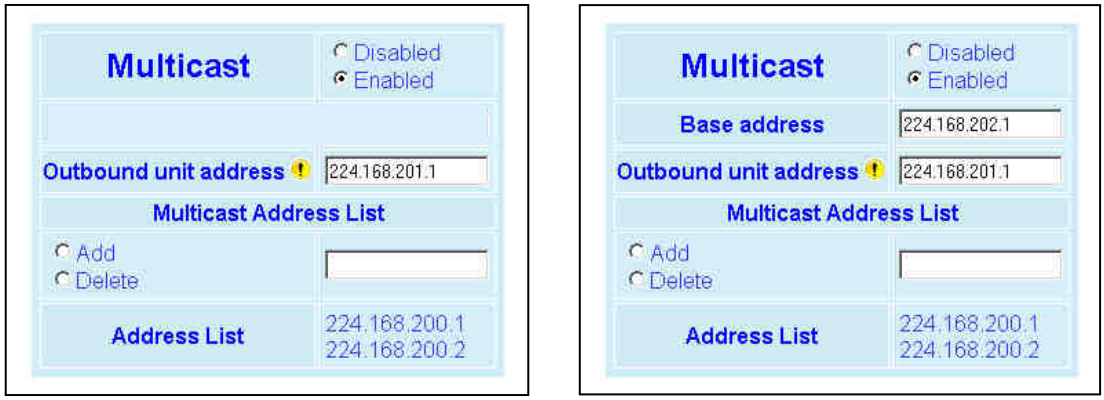


Figure 40 - Multicast Window Details (On the Mobile on the left and on the base on the right)

Multicast (Enabled/Disabled)	**Enables or disables the registration of the multicast groups by the Base** ***Must be enabled on both Base and Mobiles***
Base address	**Indicates the "All Base" multicast group *(Not currently supported)***
Outbound unit address	**Indicates the "All Mobile" multicast group *(Base side; DMP-IP only)***
Multicast Address List	**Indicates the various "Mobile Host" groups** ***Must be set on both Base and Mobiles***

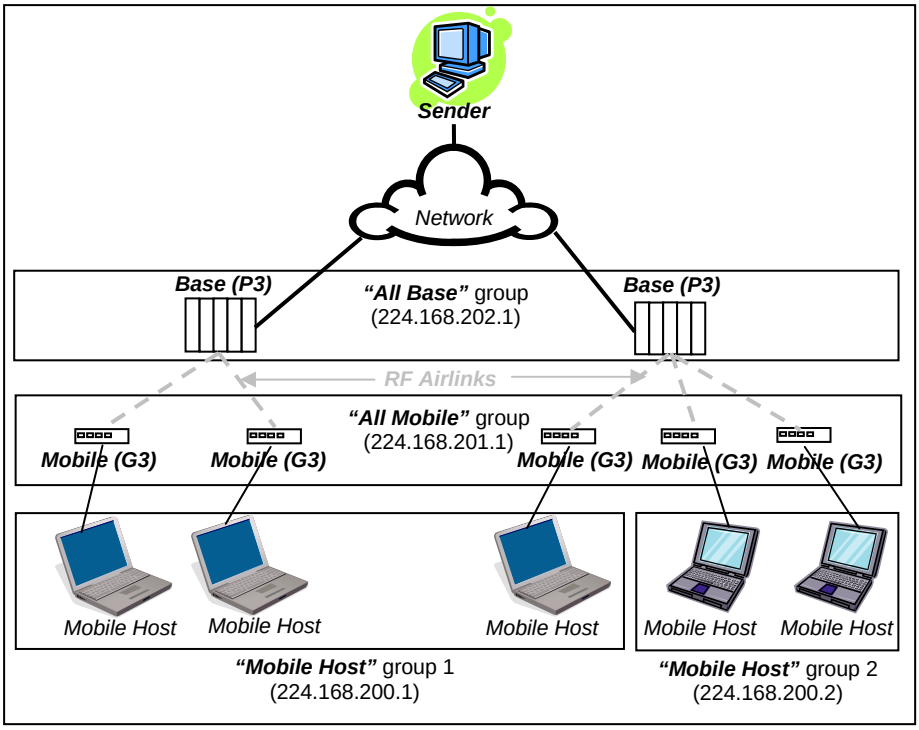


Figure 41 - Typical E-DBA Multicast Groups (with addresses)

4.7.3.7 Setup (Advanced) ► IP Optimization & Tuning

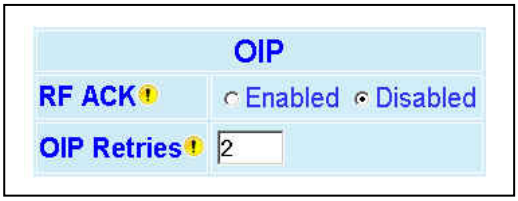


Figure 42 - Advanced IP Configuration - IP Optimization & Tuning - OIP

Item	Description
RF ACK	**Disabled, Enabled (Default)**
OIP Retries	**Number of OIP retries. Default = 2**

4.7.3.8 Setup (Advanced) ► Time Source

To facilitate tracking of events in a network, the Paragon3 base station and the GeminiG3 radiomodem can initialize their real-time clocks using a number of protocols. At reset time, the Paragon3 base station 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 Status" web page.

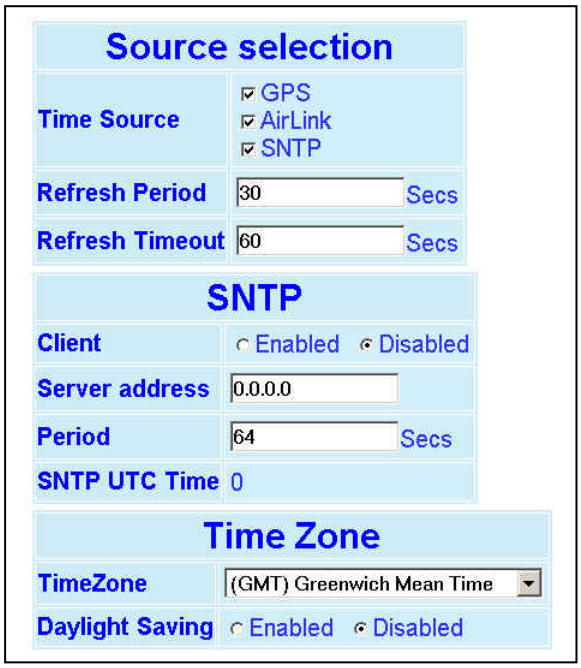


Figure 43 - Advanced IP Configuration - Time Source

Item		Description
Source Selection	Time Source	♦ GPS – No on-air penalty, very accurate ♦ Airlink – Light on-air penalty, least accurate ♦ SNTP – Medium on-air penalty, medium accuracy Place a check mark against each of the available time sources to be used on your network. *The preference order is GPS, Airlink, and SNTP. Source selection for time updates is always to the one with the least on-air penalty.* Airlink time source originates in the Paragon3 base *(providing the base is time-aware)* SNTP is a UDP/IP protocol that synchronizes the clocks of computer systems over packet-switched, variable-latency data networks.
	Refresh Period	Determines the interval in seconds before a time update will be accepted from the time source in use.
	Refresh Timeout	Determines the interval in seconds after which the source selection will switch to the next available time source in the preference order *(providing it has been selected).*
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	Time in seconds since Jan 1, 1970 00:00:00. Note: the correct local time is displayed in the "Unit Status" page.
Time Zone	TimeZone	Select from drop-down list
	Daylight Savings	Disabled (Default), Enabled

4.7.3.9 Setup (Advanced) ► Ethernet (PHY)

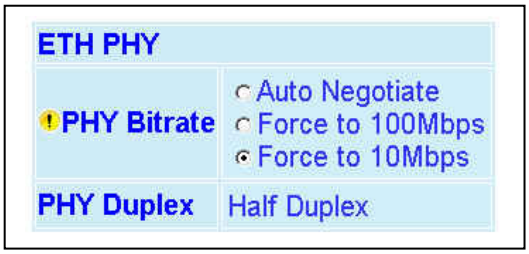


Figure 44 - Advanced IP Configuration - Ethernet (PHY)

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

4.7.4 GPS

All GeminiG3 radiomodems shipped from the Dataradio factory are fitted with a 12-channel high efficiency GPS receiver, equipped with WAAS feature for better location precision (<3 meters).

GPS "strings" are collected from embedded GPS receiver in the GeminiG3 mobile radiomodems. The strings are converted into DCF 2.0 ("Dataradio Compressed Format, version 2.0") reports and provided to both local and remote delivery services.

Programmers who need to decode the compressed information for their applications may contact Dataradio System Engineering for further information.

4.7.4.1 GPS ► Status

Figure 45 - GPS - Status

Item	Description
Condition	In normal operation, indicates “Differential”. Differential GPS corrects various inaccuracies in the GPS system to yield measurements accurate to a couple of meters when the mobile is moving and even better when stationary. Other indications are: Autonomous: GPS values use no additional correction information. Last known: Indicates GPS data is either old or not enough satellites are present to achieve a valid location computation. Invalid: When no GPS signal is present, displays the word “Invalid” and the # of Satellites indicates “0”.
Number SVs	The field “number of satellites” indicates the number of satellite signals being received and used to calculate position.
UTC (hhmmss)	Universal time - uses a 24-hour clock format.
Position	Global position in Longitude (East-West) and Latitude (North-South) displayed using information obtained from a GeminiG3 radiomodem decoding a valid GPS input signal. If no previous position was obtained, display shows (Unknown). Positions are reported in degrees plus decimal minutes. E.g.: Longitude of 73 degrees, 39 minutes and 45 seconds West would appear as: 073 39.7500 W
Altitude (meters)	The field “Altitude” indicates height above the WGS-84 (World Geodetic System) reference ellipsoid in meters.
True Course	Shows the current GPS-generated true course in degrees.
Ground Speed (km/h)	Shows travel speed (in km/h) from GPS-equipped GeminiG3 mobiles.

4.7.4.2 GPS ► Delivery Options

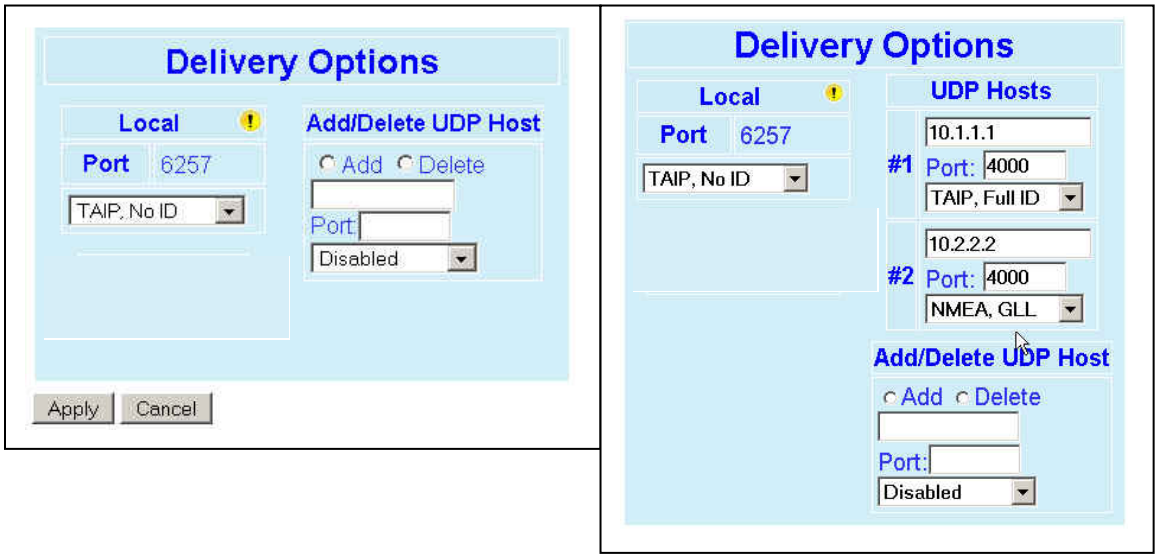


Figure 46 - GPS - Delivery Options (Initial screen on left - screen with 2 UDP Hosts on right)

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Local Port</td><td>Read-only field – Indicates port configured for the IPSD.
Note: IPSD should be enabled in Setup (Advanced)-> IP Services</td></tr>
<tr><td>Format field</td><td>Provides a Drop-down box for selecting the appropriate GPS report format for the Local IPSD. The possible choices are:
<table>
<tr><th>FORMAT</th><th>DEFINITION</th><th>MODE</th><th>EXAMPLE</th></tr>
<tr><td>TAIP, Full ID</td><td>Trimble ASCII Interface Protocol, Full ID</td><td>Text</td><td>>RPV72981+4549540-0736643100035822;ID=0000027B;*05<</td></tr>
<tr><td>TAIP, Short ID</td><td>Trimble ASCII Interface Protocol, Short ID</td><td>Text</td><td>>RPV73425+4549541-0736643100035822;ID=027B;*06<</td></tr>
<tr><td>TAIP, No ID</td><td>Trimble ASCII Interface Protocol, No ID</td><td>Text</td><td>>RPV73511+4549542-0736643100035822;*7F<</td></tr>
<tr><td>NMEA, GLL</td><td>NMEA (National Marine Electronics Association)-a standard protocol, used by GPS receivers to transmit data, GLL (Geographic Latitude & Longitude)</td><td>Text</td><td>$GPGLL,4529.7241,N,7339.8584,W,202645.0,A,D*7C</td></tr>
<tr><td>NMEA, GGA</td><td>NMEA (National Marine Electronics Association)-a standard protocol, used by GPS receivers to transmit data, GGA (GPS Fix Data)</td><td>Text</td><td>$GPGGA,202742.0,4529.7240,N,7339.8585,W,2,9,0.9,28,M,,,,*3E</td></tr>
<tr><td>DCF 2.0, Raw</td><td>Dataradio Compressed Format, version 2.0 Raw (binary) mode</td><td>Binary</td><td>NMEA=$GPGGA,191047.0,4529.7245,N,07339.8601,W,2,11,0.9,33,M,,,,*3C
$GPGLL,4529.7245,N,07339.8601,W,191047.0,A,D*4B
TAIP=>RPV69047+4549541-0736643300000022;*7D<</td></tr>
<tr><td>DCF 2.0, Hex</td><td>Dataradio Compressed Format, version 2.0 Raw (binary) mode</td><td>Text</td><td>D6FB5E1A582EB3823CF95F04660100091C00</td></tr>
</table></td></tr>
<tr><td>Add/Delete UDP Host</td><td>Up to five UDP Hosts may be added.
♦ Select the appropriate option button (Add or Delete).
♦ Enter dot decimal format address of the Host in the address field box.
♦ Add the port number in the Port box
♦ Click on the “Format” drop-down box and select appropriate format.
♦ Click on Apply.
Dynamic window expands as Hosts are added or shrinks as Hosts are deleted as shown on the right in the above illustration.</td></tr>
</table>

For more information on GPS data collection please contact Dataradio System Engineering.

4.7.4.3 GPS ►AAVL

The "Autonomous Automatic Vehicle Location" (AAVL) feature adds the ability for GPS-equipped GeminiG3 models to initiate "Here I am" position message transmissions. AAVL allows the system designer to specify the maximum distance or the time interval between position reports:

- If the vehicle moves more than a specified distance since its last report, a new position report will be generated.
- If no report has been sent for a specified amount of time, a new position report will be generated.
- AAVL inhibits excessive transmission of reports to prevent network overload.

The "Dynamic Bandwidth Allocation" (DBA) protocol's "Out Of Band" (OOB) mechanism is used to deliver these "Automatic Vehicle Location" (AVL) reports.

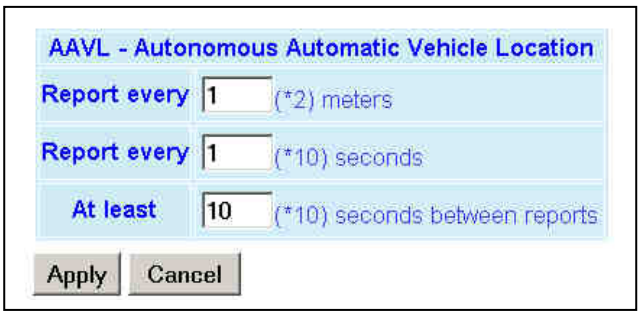


Figure 47 - GPS - AAVL

Item	Description
Report every (*2) meters	**MDBR – (Maximum Distance Between Reports)** **Distance interval - the vehicle sends a position update each time it has moved this distance (unless the minimum time interval has not yet elapsed).** **The mobile firmware saves the last-transmitted position, and compares it with the current (latest OOB update) position.**
Report every (*10) seconds	**This parameter controls the "Maximum Time interval between position Reports". Thus, the vehicle will send a position update every time "this interval has elapsed" guaranteeing delivery of position reports at least this often. Data traffic and ACKs will generate additional reports at shorter intervals.**
At least (*10) seconds between reports	**At most, the vehicle sends a position update every time this interval, in seconds, has elapsed.** ***The main purpose of this parameter is to protect the network from being overloaded by excessive AVL reporting from one or a few mobiles.***

4.7.5 Security

4.7.5.1 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" *(all uppercase)* but Dataradio strongly suggests that the password be changed as units are installed.

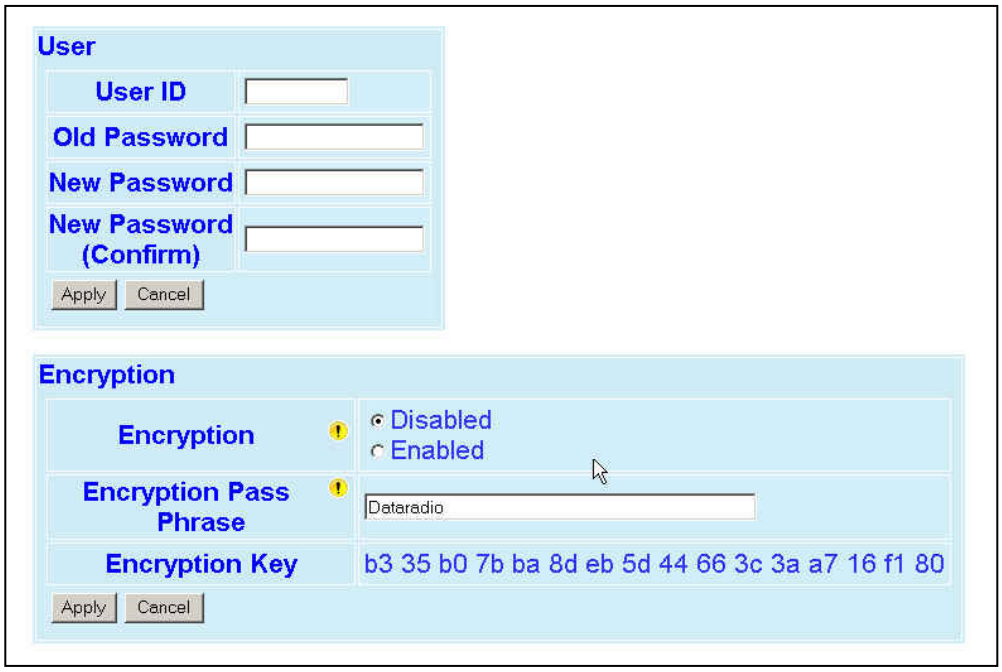


Figure 48 - Security- Password and Encryption Control

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 Dataradio for support as detailed in section 1.3 earlier.**
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***

4.7.6 Statistics

4.7.6.1 Statistics ► Interfaces

Note:

All definitions given below use the following convention:

- *RX (or Input) = data received from a lower network layer*
- *TX (or Output) = data transmitted to a lower network layer*

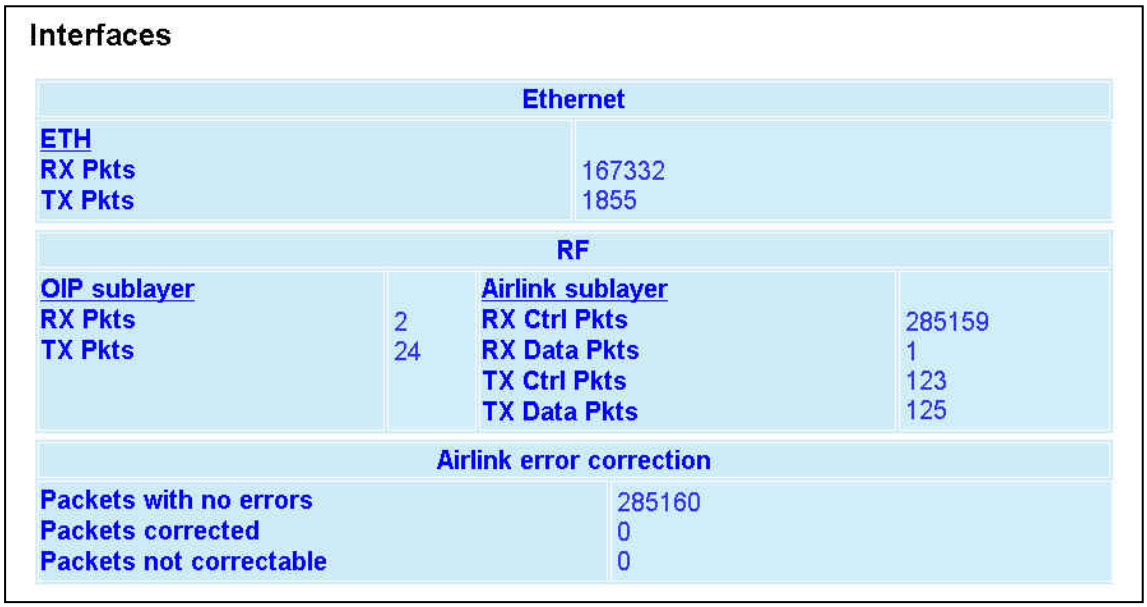


Figure 49 - Statistics - Interfaces

Item	Description
The LAN (Ethernet) Interface layer shows reception and transmission traffic counts.	
RX Pkts (ETH1)	The total number of input packets received by Ethernet 1 interface.
TX Pkts (ETH1)	The total number of output packets transmitted by Ethernet 1 interface.
The RF Interface layer shows reception and transmission traffic counts.	
RX Pkts (RF-OIP Sublayer)	The total number of input packets received by RF-OIP interface.
TX Pkts (RF-OIP Sublayer)	The total number of output packets transmitted by RF-OIP interface.
RX Ctrl Pkts (Airlink Sublayer)	The total number of control input packets received by the RF Airlink Sublayer.
RX Data Pkts (Airlink Sublayer)	The total number of data input packets received by the RF Airlink Sublayer.
TX Ctrl Pkts (Airlink Sublayer)	The total number of control output packets transmitted by the RF Airlink Sublayer.
TX Data Pkts (Airlink Sublayer)	The total number of data output packets transmitted by the RF Airlink Sublayer.
Airlink error correction	
Packets with no errors	Number of E-DBA packets, control or data, received over-the-air with correct Forward Error (FEC) checksum.
Packets corrected	Number of E-DBA packets, control or data, received over-the-air with correctable errors.
Packets not correct	Number of E-DBA packets received over-the-air with errors that could not be corrected . These packets were discarded.

Note: For Transport (TCP/UDP) and Network (IP) interface layers statistics refer to MIB 1213.

4.7.7 Maintenance

4.7.7.1 Maintenance ► Ping Test

To aid in trouble-shooting IP connectivity issues, the Paragon3 base station and the GeminiG3 radio-modem 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.

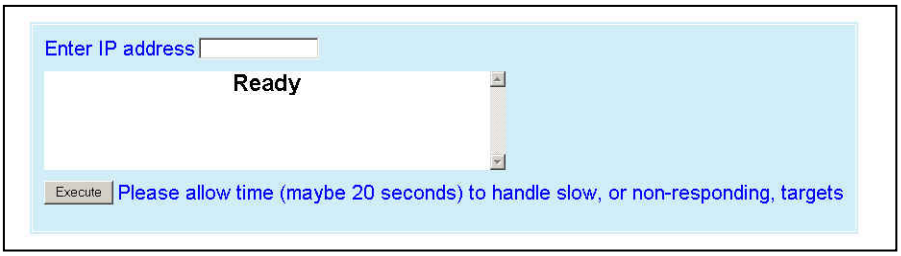


Figure 50 - Maintenance Ping Test

Item	Description
Enter IP address	**Enter IP address in dot decimal format**
Execute	**This button executes the ping command. Ready field displays the out-come of the ping command.**

4.7.7.2 Maintenance ► Config Control

Important note: *Record all original GeminiG3 radiomodem factory settings for possible future use.*

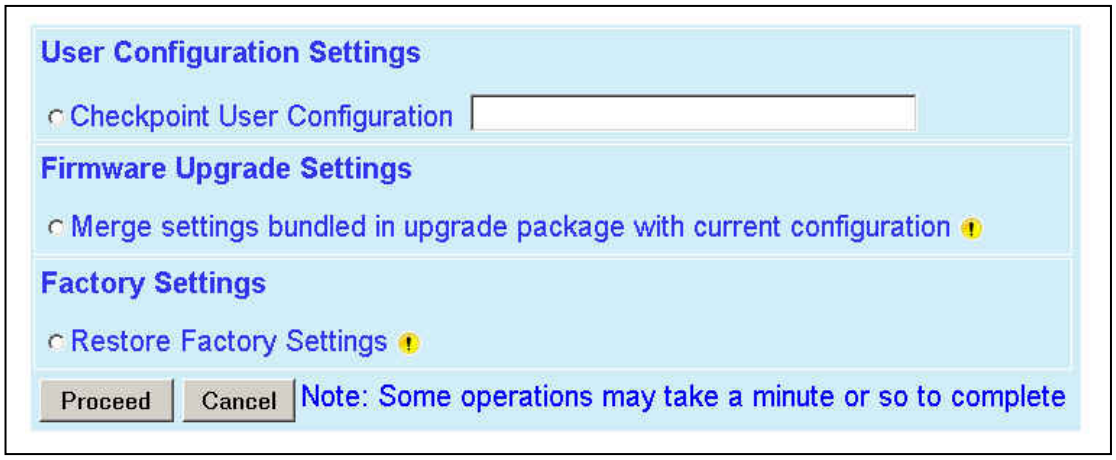


Figure 51 - Maintenance - Unit Configuration Control (Initial screen)

Item	Description
Active Configuration Description	**Active Configuration Description Field – available by selecting "Checkpoint User Configuration" option button in the "User Configuration Settings " portion of this window below.**
User Configuration Settings	**Checkpoint User Configuration (Save User Configuration) – saves a set of the current user configuration settings in the GeminiG3 unit.** **Click on the "Checkpoint User Configuration" option button to activate the "Active Configuration Description" field. Enter a descriptive title of up to 40 characters to help identify the configuration settings to be saved. Click on "Proceed" to save the settings to the unit. The new configuration set overwrites the factory (or previously user saved) configuration settings.**
	Restore User Configuration Checkpoint (Load User Configuration) – the option button is available if "User Configuration Settings" have been previously saved. To restore to user configuration, click the "Restore User Configuration" option button. Check the title of the settings about to be restored in the "Active Configuration Description" field and click on "Proceed" to restore the 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 to default factory configuration.** **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 performing 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 GeminiG3 unit factory settings handy before proceeding with restoring to factory settings.***

4.7.7.3 Maintenance ► Package Control

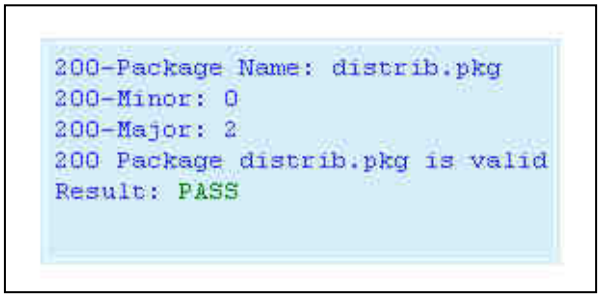


Figure 52 - Maintenance – Package Validation

Item	Description
Package Control	**Used for verifying the field upgrade of the GeminiG3 mobile radiomodem firmware.** **The firmware transfer procedure outlined in section 5.5.1 instructs to "Click on** Maintenance / Package Control **to verify integrity and wait a few moments for the results to display".** **Figure 52 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 Dataradio system engineering.**

4.7.7.4 Maintenance ► RF Tests

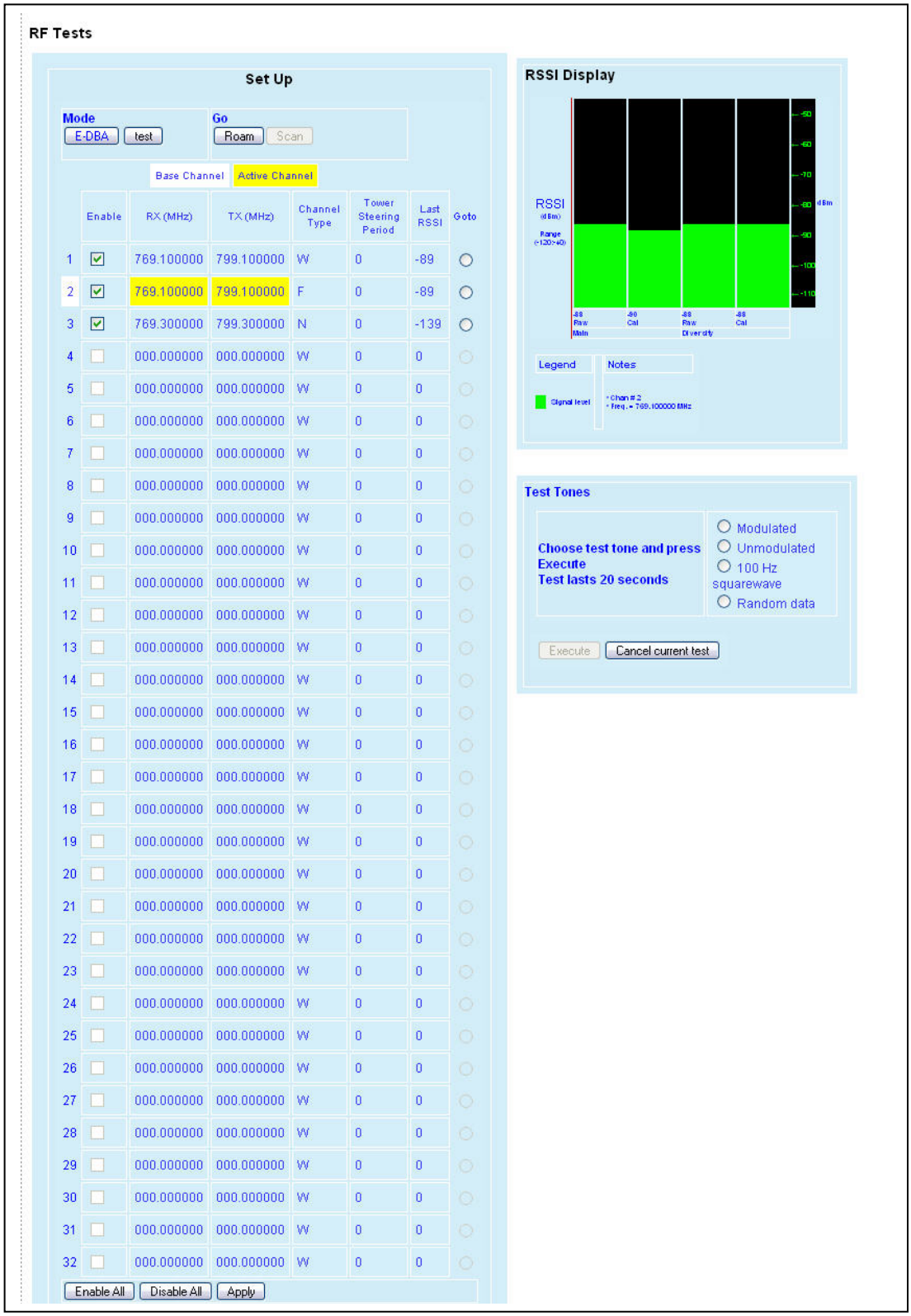


Figure 53 - Control - RF Tests

RF Tests:

Item		Description
Set UP	E-DBA	Sets the GeminiG3 radiomodem to its normal operating mode. The base channel may change as the mobile roams to a new base
	Test Mode	This mode is used to select the radio channel to be used for test transmissions. Placing the GeminiG3 radiomodem in test mode suspends roaming function.
	Scan	The Scan button forces the unit to scan all channels with valid frequencies *(enabled or not)* and update the last RSSI column.
	Roam	The Roam button forces the mobile to roam when in E-DBA mode. The unit will switch to the channel with the best last " RSSI". Button is inactive in Test Mode.
	Base Channel	This read-only field displays the radio channel number against a white square on a blue background. It indicates the base station to which the mobile is currently registered. To set frequency, see section 4.7.3.3
	Active Channel	These read-only fields display the active RX and TX radio frequencies (in MHz) with the frequency currently in-use (highlighted) If the active channel indications do not correspond to the base channel, it indicates either that roaming is in progress or that testing activity is taking place. To set frequency, see section 4.7.3.3
	Enable	Select as many non zero-frequency channels as desired for *Roam* option. Vertical scroll to see the fields for all 32 frequencies.
	RX (MHz) TX (MHz) Channel Type Tower Steering Period	Each of these field shows the corresponding value entered for that channel taken from the web page titled "Setup (Advanced) → RF(Freq)" Web Page (4.7.3.3).
	Last RSSI	Shows the last RSSI information obtained on that channel. *Information may be out-of-date if the mobile has been on a single channel for a long time.*
	GoTo	Available in Test Mode only. Forces the unit to the specified channel *(enabled or not)*.
	Enable All	Selects all non-zero frequency fields
	Disable All	Deselects all non-zero frequency fields
	Apply	Activates the "Enable All" or "Disable All" selection
RSSI	RSSI Table	Main Raw = Raw dBm value from main radio receiver Main Cal = Calibrated dBm value from main receiver DSP Diversity Raw = Diversity raw dBm value from diversity radio Diversity Cal = Calibrated dBm value from diversity receiver DSP
	Range	-120 to –40 dBm
	Thresholds	-90 to -60 dBm

Test tone:

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

The functions of all the other buttons are inoperative during test transmissions.

Test Tones	**Modulated**	**Test transmission generates a carrier modulated with a test tone to check deviations. For specific test tone and/or deviation values.**
	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 27W) and reflected power levels by pressing the Execute button. Never exceed 1W of reflected power.**
	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 transmission is not usually required.** **If low system performance is noticed, System Engineering may request the user to run this Random Data test for checking low-frequency balance and maximum deviation over data.** **Random data test requires the use of an IFR COM-120B service monitor with option 03= 30kHz IF filter and its DC coupled demodulator output selected.**

4.7.8 Feature Options

"Feature options" are used to implement customer's option(s) selected at the time of radiomodem purchase *(factory-installation*) or as add-on *(field-installation)*. Software options must match the sales/work order entries.

Further option information may be obtained by contacting your sales representative.

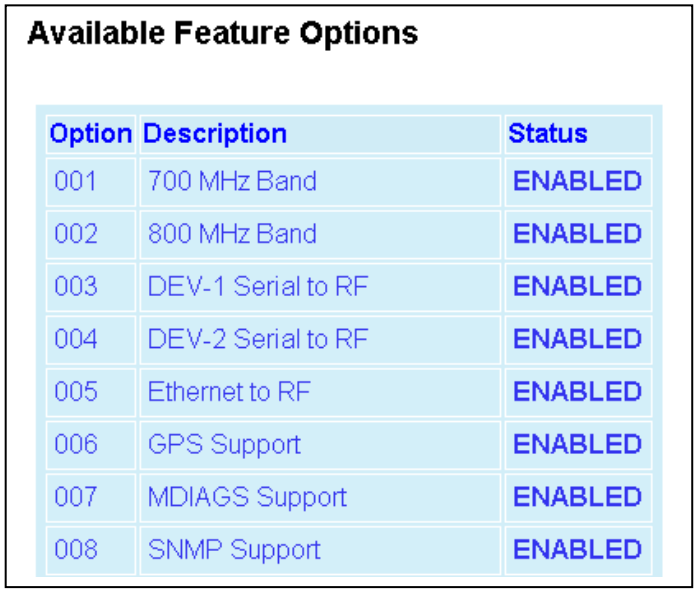


Figure 54 – Feature Option Icon

Item	Description
Option	**Sequential listing of the options available in the current firmware version of the GeminiG3 radiomodem.**
Description	**Describes the functionality associated to the option numbers.**
Status	**Shows the status of the functionality configured for this network.**

4.7.9 Site Map and Help

Site Map link and Help icon (Figure 55) features are designed to help the user navigate through the Web-Pages. They can be found on the bottom of the navigation pane.

Figure 55 - 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.**

5. Maintenance, Trouble-Shooting and Testing

The checks described below should be done at annual intervals or whenever deterioration in performance is noted.

5.1 Equipment Required

- 13.8 VDC (nominal) car battery, or
  13.8 VDC/20A regulated power supply (In the case the unit is not installed in a vehicle)
- In-line watt meter (50W range and 10W range)
- Radio service monitor (IFR-COM120B/C or equivalent).
- Cable with male connector *(check type of connection present on unit)* to connect G3 radiomodem to the service monitor.

5.2 Basic Tests

Recommended checks:

For checks 1 to 6, refer to Table 5 - Test Checklist next page.

1. Power-up LED Sequence
2. Transmit power output
3. Reflected power output
4. Carrier frequency error
5. TX Deviation
6. Main RX and Aux. RX RSSI
7. RF Link test between Paragon3 unit(s) and mobile unit (PING test from the unit's Web page as per paragraph 4.7.7.1 or PING from a PC as per paragraph 5.4.1)
8. GPS test as per 5.3.2.

Important note: Before proceeding make sure that the service monitor has been recently calibrated 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

Table 5 - Test Checklist

TEST CHECKLIST				
STEP	**ACTION**	**EXPECTED RESULTS at 25°C**	**MEASURE WITH**	**IF NOT?**
GeminiG3 units are set and characterized at the factory to optimize performances. It is not recommended to try to readjust the units.				
1	**Power-up LED Sequence**	as per **Table 2 - G3 LEDs indications**		
For steps below, refer to the Maintenance ► RF Tests WEB page				
2	**Transmitter Output Power**[1] In "Test Tone" section of the page Select ***Unmodulated –*** Press Execute *Note: Must be in Test Mode*	**UHF**: 40 watts **700MHz:** 27 watts **800MHz**: 35 watts Tolerance: all +10%, -10%; Factory-settable down to 10 watts as per customer request	Service monitor set to read power or 50W in-line wattmeter	Refer to factory technical support.
3	**Transmitter Reflected Power** In "Test Tone" section of the page Select ***Unmodulated –*** Press Execute *Note: Must be in Test Mode*	< 5% of forward power or as specified by System Eng.	10W in-line wattmeter	Check for bad connections, damaged coax cable, etc.
4	**Carrier Frequency Error** In "Test Tone" section of the page Select M***odulated –*** Press Execute *Note: Must be in Test Mode*	< ±300 Hz @ 25°C ambient or < ±1 ppm from –30 to +60 °C	Service monitor set to read frequency error	Refer to factory technical support.
5	**TX Deviation (in kHz)** In "Test Tone" section of the page Select M***odulated –*** Press Execute Carrier will be modulated with a 1 kHz tone.	Refer to 5.3.1for 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)	Refer to factory technical support.
Set the service monitor to generate at the unit's antenna jacks the **RF levels** mentioned below. The carrier generated should be modulated with a 1.0 kHz tone at a deviation specified in 5.3.1.				
6	**Main Rx** and **Aux Rx RSSI** Navigate to "RSSI Table" section. *Note: This test works in either Test or EDBA mode. The test will be executed for the currently active channel (activate channels using" "Go To" option buttons).*	- 70 dBm +/-3 typical - 90 dBm +/-3 typical -110 dBm +/-3 typical	RSSI Table bar graph See section 4.7.7.4	*The RSSI checks give a general indication of receivers' health* Refer to factory technical support only if RX data performance degradation is noticed combined with out-of-tolerance RSSI readings.

[1] (Unless you have set a lower value). Note that readings less than 40 watts (UHF model), 27 watts (700MHz model) and 35 watts (800MHz model) 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.

5.3 Additional test details

5.3.1 Carrier Deviations

GeminiG3 radiomodems make use of the carrier "AutoDeviation" feature. Therefore, the carrier deviations in the table below are given for reference only.

Table 6 - 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) 25kHz bandwidth					
32.0	± 3.7	**48.0**	± 4.0	**64.0**	± 4.1
		43.2	± 4.2		
Half Channel (UHF) 12.5kHz bandwidth					
16.0	± 1.7	**24.0**	± 2.0	**32.0**	± 2.1
Wide Channel (700MHz) 50kHz bandwidth					
64.0	± 5.3	**96.0**	± 6.2	**128.0**	± 6.5
Full Channel (800MHz) 25kHz bandwidth					
32.0	± 2.4	**48.0**	± 2.7	**64.0**	± 2.9
		43.2	± 3.3		
NPSPAC Channel (USA - 800MHz)					
16.0	± 2.4	**24.0**	± 2.7	**32.0**	± 2.9

5.3.2 GPS Test

About three minutes after ignition is turned-on, the PWR LED on the GeminiG3 unit front panel should flash in blinking amber on green color at the rate of one pulse per second (1pps). This indicates that the GPS has acquired the sky position of a sufficient number of satellites to arrive at a ground position solution.

If the GPS has a good view of the sky and still has not generated any position solution within three minutes (it may take up to 10 minutes or more if the sky view is partially blocked.), the following trouble-shooting procedures should be undertaken to isolate the fault:

1) Disconnect the GPS antenna cable connector from the Gemini radio and check for + 5 VDC on the center pin of the GPS antenna connector on the radio using a Digital voltmeter (DVM). If the voltage is present, do not reconnect the cable and proceed to step 2.

2) With the DVM, measure resistance between the shell and the center conductor of the GPS cable, resistance should be between 100 and 300 Ohms, if it measures open or short circuit the GPS antenna is either a passive antenna which is the WRONG type, or a defective active antenna, replace with a known good active antenna.

3) Connect the new antenna to Gemini and wait about three minutes for the "PWR/PGM LED to start flashing at a rate of 1 pulse per second *(amber on green)* on the GeminiG3 unit indicating that a position is acquired. If no position acquisition occurs, the modem and/or its GPS receiver may be defective.

The User's Interface GPS Web Pages are located starting at paragraph 4.7.4.

5.4 Troubleshooting Tools

5.4.1 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.

  Available for MS-Windows 9x, ME, NT, 2000, and XP as well as Unix & Free BSD.

  EXAMPLE:

  `ping 192.168.204.1` 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 number of hops required for that packet to get to its destination.

  Available for MS-DOS 6.2, MS-Windows 9x, ME, NT, 2000, and XP.

  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.

5.4.2 Configuration Information

- WINIPCFG (WIN95/98), IPCONFIG (WIN2K) or IFCONFIG (UNIX)

  `Ipconfig` is a DOS utility, which can be used from MS-DOS or a MS-DOS 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.

  Available for MS-DOS, MS-Windows 9x, ME, NT, 2000, and XP.

  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.

  Available for MS-Windows 9x, ME, NT, 2000, and XP.

  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.

Available for MS-Windows 9x, ME, NT, 2000, and XP.

EXAMPLE

`route ?` displays help

`route print` displays the routing table

5.4.3 Statistics Information

- NETSTAT (WINS & UNIX)

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

  Available for MS-Windows 9x, ME, NT, 2000, and XP.

  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

5.5 Firmware Upgrading

The GeminiG3 radiomodem firmware is field-upgradable using the unit's Ethernet port. The process involves connecting to the IP address of the mobile from a host PC and transferring the firmware files via an FTP program.

5.5.1 Procedure

1. Using a file decompression program, such as WinZIP™ or WinXP's right-click & select the "Expand to…" (or "Extract 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 GeminiG3 radiomodem are labeled in the form `GeminiG3_edba_Vx.x_Rx.xx.zip`. Be careful not to transfer firmware into the wrong unit!
2. Using an FTP program of your choice, establish a connection to the mobile IP address. Please refer to paragraph 4.7.5.1 for "Username" and "Password" usage.
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 mobile power and allow the unit to boot. The unit should return to the state that 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 Dataradio system engineering for assistance.

5. Verify the integrity of the newly transferred files.
   a) Connect to the mobile's IP address using an Internet browser such as IE (5.0 or later) or Mozilla.
   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. Figure 52 shows a "Pass" result indication.

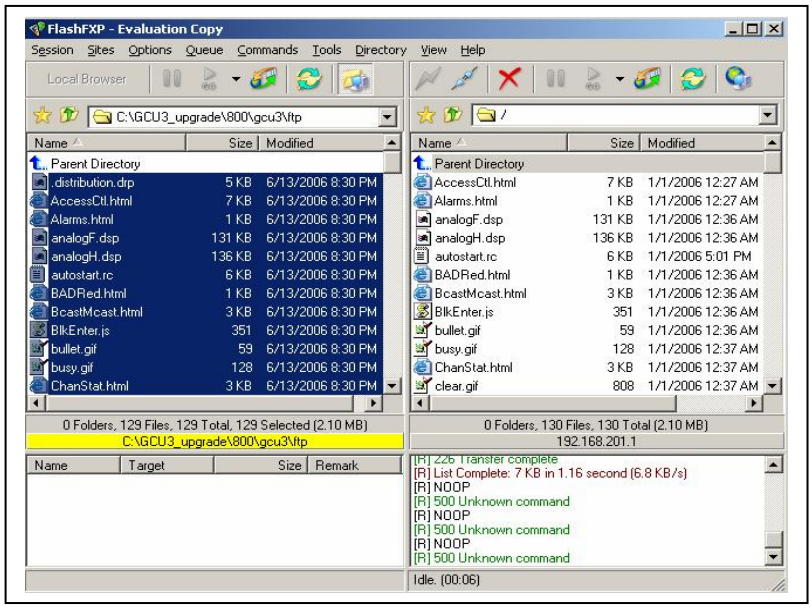


Figure 56 - Sample FTP program

5.5.1.1 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 Dataradio system engineering for assistance.

6. Specifications

GENERAL

	UHF	700MHz	800 MHz
Frequency Range (MHz)	FCC 403 - 512 Rx/Tx [1] IC 406 - 470 Rx/Tx	FCC (part 90) 796 - 803 TX 766 - 773 RX FCC (part 27) 792 - 794 TX 762-764 RX	FCC 809 - 824 TX 854 - 869 Rx IC 806 - 821 Tx 851 - 866 Rx
	FCC Part 90 I.C. RSS-119	FCC Part 90, 27	FCC Part 90 I.C. RSS-119
Channel spacing	**12.5 kHz / 25 kHz**	**50 kHz**	**25 kHz / NPSPAC**
Frequency Control	Digital Synthesizer / uController		
Frequency Stability	1.0 ppm		
Data Encryption	AES 128-bit		
Operating temperature	-30°C to +60°C (25°C nominal) @ 95% non-cond. RH		
Mode of Operation	Half Duplex		
Number of channels	32 internally stored, over-the-air programmable		
Power Supply voltage	13.6Vdc nominal (negative ground) 10.9 – 16.3 VDC		
Circuit Protection	15 Amp fuse external, Internal crowbar diode for reverse polarity protection		
RX Current at 13.6 VDC	< 750 mA Standby (with GPS receiver)		
TX Current at 13.6 VDC	< 12 A		
TX/RX separation	any, 5 MHz typical	30 MHz typical	45 MHz typical
Size	6.0" W x 2.0" H x 7.1" D		
Weight:	< 4.5 lbs.		
RF input/output Impedance	50 ohms nominal		
Antenna Connector	1 primary female Tx/Rx, 1 auxiliary female Rx		
GPS Connector	SMA		
User Interface	Ethernet RJ45 Auto-MDIX 10-100/T with LED status indicators Dual RS-232 DE-9F Serial Ports configured as Terminal Servers USB Port (future use)		

MODEM / NETWORK

Forward Error Correction	Hypercode		
Addressability	Native TCP/IP		
Encryption	AES 128-bit		
Protocols	Dataradio 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 Dynamic Routing (RIPv2), Network Address Translation (NAT)		
Data Rate	64, 48, 43.2 or 32 kbps / 32, 24, or 16 kbps	128, 96, or 64 kbps	64, 48, 43.2 or 32 kbps / 32, 24, or 16 kbps

[1] **WARNING**: **The frequency band 406 to 406.1 MHz is reserved for use by distress beacons and should not be programmed into the unit.**

RECEIVER

	UHF 25 kHz Channel	700 MHz 50 kHz Channel	800 MHz 25 kHz Channel	800 MHz NPSPAC Channel
Selectivity	77 dB typical >75 dB @ 25 kHz >65 dB @ 12.5 kHz	68 dB typical >65 dB @ 50kHz >60db for ADB model	77 dB typical >75 dBm @ 25kHz >70dB for ADB model	77 dB typical >75 dB @ 25kHz >70dB for ADB model
Offset Channel Selectivity (NPSPAC only)	n/a	n/a	n/a	20 dB (as per TIA 2.1.7)
Intermodulation	80 dB typical, >75 dB	78 dB typical, >75 dB >70 dB for ADB model	80 dB typical, >75 dB >70 dB for ADB model	80 dB typical, >75 dB >70 dB for ADB model
FM hum & noise ratio*	>45 dB @ 25 kHz	>50 dB @ 150 kHz	>45 dB @ 25 kHz	>45 dB @ NPSPAC
	UHF	700 MHz	800 MHz	
Spurious Response	>80 dB >75 dB for ADB model			
Receive Frequency Range	403-512 MHz	762 - 776 MHz	851-869 MHz	
Conducted spurious	< -57 dBm			

* Psophometrically weighted filter

GeminiG3 Rx Sensitivity (for 1% Packet Error Rate (PER) with Parallel Decode at carrier frequency)

UHF 12.5 kHz Channel	UHF 25 kHz Channel	700 MHz 50 kHz Channel	800 MHz 25 kHz Channel	800 MHz NPSPAC Channel
-100 dBm @ 32kbps -106 dBm @ 24kbps -109 dBm @ 16kbps	-97 dBm @ 64 kbps -103 dBm @ 48 kbps -107 dBm @ 43.2 kbps -109 dBm @ 32 kbps	-94 dBm @ 128 kbps -100 dBm @ 96 kbps -106 dBm @ 64 kbps	-94 dBm @ 64 kbps -100 dBm @ 48 kbps -104 dBm @ 43.2 kbps -106 dBm @ 32 kbps	-103 dBm @ 32 kbps -109 dBm @ 24 kbps -115 dBm @ 16 kbps

GeminiG3 - ADB model covers in a single unit 700MHz – 50 kHz, 800 MHz – 25 kHz & NPSPAC channels. The sensitivity specs for the ADB model are presented below:

GeminiG3-ADB model Rx Sensitivity (for 1% Packet Error Rate (PER) with Parallel Decode at carrier frequency)

700 MHz 50 kHz Channel	800 MHz 25 kHz Channel	800 MHz NPSPAC Channel
-93 dBm @ 128 kbps -99 dBm @ 96 kbps -104 dBm @ 64 kbps	-94 dBm @ 64 kbps -100 dBm @ 48 kbps -104 dBm @ 43.2 kbps -108 dBm @ 32 kbps	-103 dBm @ 32 kbps -109 dBm @ 24 kbps -115 dBm @ 16 kbps

TRANSMITTER

Transmit Frequency Range	403 - 512[1], MHz	792 - 806 MHz	806 - 824 MHz
Power output	10-40 W, adjustable in four steps	10-25 W, adjustable in four steps	10-35 W, adjustable in four steps
Duty cycle	20% @ Full Power	50% @ full power, 30 sec. max. TX time (subject to FCC MPE limit)	25% @ full power, 30 sec. max. TX time (subject to FCC MPE limit)
Transmitter Stability into VSWR	>6:1 (Power Foldback Allowed)		
Spurious Emissions	> 80 dBc		
Frequency stability	1.0 ppm		
FM hum and noise ratio*	>45 dB (25 kHz)	>50 dB (50 kHz)	>45 dB (25 kHz)
Attack time	< 10 ms with less than 1 ms variation		

* psophometrically weighted filter

Environmental MIL. spec.

Environment	Categories	MIL Spec. 810E		Other
		Method	*Procedure*	
Low Pressure	Operations	500.3	II	
High Temperature	Operations, Storage	501.3	I (A1), II	
Low Temperature	Operations, Storage	502.3	I (C3), II (C1)	
Temperature Shock	Transfer of equipment	503.3	I (AI, C2)	
Vibration	Ground Mobile	514.4	I (10)	EIA RS-204C Forestry
Shock	Functional, Bench handling	516.4	I, VI	EIA RS-204C

FCC / IC CERTIFICATIONS

Band	FCC	IC (DOC)
UHF	EOTGPDA	773195525A
700	EOTGPD7	773A-GPD7
800	EOTGPDB	773195643A

EMISSION DESIGNATORS

Bit rate	Baud rate	Modulation	UHF (FCC/IC Mask)	700 MHz (FCC/IC Mask)	800 MHz (FCC Mask)	800 MHz - NPSPAC (FCC Mask)
128000	32000	SRRC16FSK	-	28K0F1D	-	-
*96000	32000	SRRC8FSK	-	28K0F1D	-	-
*64000	32000	SRRC4FSK	-	28K0F1D	-	-
64000	16000	SRRC16FSK	16K4F1D(C)	-	14K4F1D(G)	-
*48000	16000	SRRC8FSK	16K4F1D(C)	-	14K4F1D(G)	-
*43200	14400	SRRC8FSK	16K4F1D(C)	-	14K4F1D(G)	-
32000	8000	SRRC16FSK	7K92 F1D (D)	-	-	10K0F1D(H)
*24000	8000	SRRC8FSK	7K92 F1D (D)	-	-	10K0F1D(H)
*16000	8000	SRRC4FSK	7K92 F1D (D)	-	-	10K0F1D(H)

* Under class 1 permissive change

[1] **WARNING**: **The frequency band 406 to 406.1 MHz is reserved for use by distress beacons and should not be programmed into the unit.**

Appendix 1 - "Officer Requires Assistance" alarm function

Overview

The DTE Port Interface pin 9 (AUX) on DEV-2 is used for the **"Officer Requires Assistance"** alarm function.

Intended Audience

This appendix is designed for use by System Integrators.

Physical Connection

This auxiliary input may be activated by (normally open) dry contact pull-up to the port's DSR output (pin 6). It can also tolerate user pull-up resistor via an external (+10.8 to 16 volts DC power supply). An isolated dry contact is preferred due to the risk of noise-related false alarms caused by the vehicle's electrical system.

Method 1: Using a dry contact only

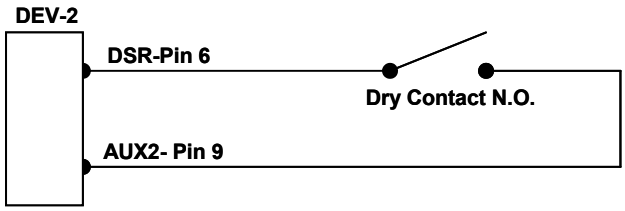


Figure 57 - Appendix 1 – Alarm Function, Dry Contact Connection

Method 2: Using an external supply and pull-up resistor

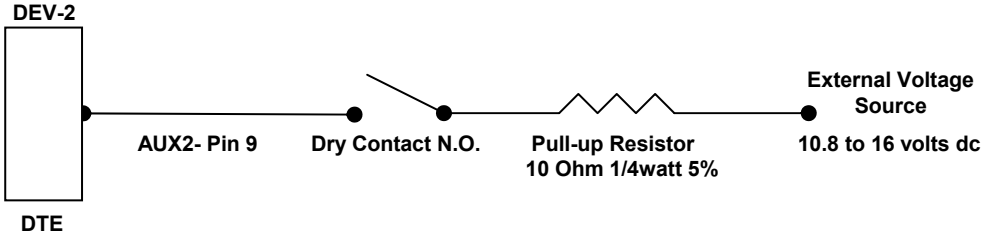


Figure 58 - Appendix 1 – Alarm Function, External Power Supply & Pull-up Resistor

The GeminiG3 radiomodem polls the AUX2 line every 50 msecs. After the GeminiG3 unit debounces a closed contact for approximately 1000 msecs, it triggers the alarm function.

Operation

When using GeminiG3 product running firmware version 2.1 or later, activating the **"Officer Requires Assistance"** alarm input starts emergency communications:

- On systems using DMP-transition facilities, the modem sends a DMP *"x"* or *"y"* message through to the MSC2 to the Host PC.
- The alarm generates an SNMP trap. The trap report is repeated at a factory-set rate (default is 15 seconds) for 1 minute. *Can also be manually cleared via the MIB Browser.*

Appendix 2 - "GPS Data Collection" Instructions

The extract in this appendix is taken from Technical Instruction Sheet 043 (TIS043), dated May 03, 2006.

Overview

The instructions in TIS043 are intended for application programmers and provide details on how to collect GPS data in VIS networks using GPS-equipped GeminiG3 radiomodems and Paragon3 base stations.

Data Flow

GPS "strings" are collected from the embedded GPS receiver in the GeminiG3 mobile radiomodems. The strings are converted into DCF 2.0 ("Dataradio Compressed Format, version 2.0") reports and provided to both local delivery and remote delivery services. The remote delivery service of the GeminiG3 sends reports Out of Band (OOB) in any unused portion of control & data packets, where they are passed to the Paragon3 local delivery service.

For diagnostic purposes, GPS data can be displayed on both the GeminiG3 and Paragon3 web pages:

- Using a browser, basic information can be read on the GeminiG3 "GPS Status" web page.
- Using a browser, data from the last GPS report received from each mobile can be read on the Paragon3 "Remote Table" web page.

GPS data is also available to external applications via TCP or UDP.

Application Programmers

For further information, please contact Dataradio system engineering.

Appendix 3 - E-DBA Throughput/Latency Measurements Methods

The contents of this appendix are also available in Technical Instruction Sheet 044 (TIS044), dated March 01, 2006.

Overview

The instructions in TIS044, intended for end-users, discuss the effectiveness of TCP/IP troubleshooting tools in E-DBA networks. It shows how to assess network performance in the E-DBA environment. It is reproduced here to complement the information given in section 5.4.

Performance Metrics

The following metrics are typically used to measure communication network performance:

- Latency — Also called "Response Time". In this context, latency measures the amount of time it takes for a response to return from a request. It takes into account the delays accumulated at every step of the round trip.
  Usually expressed in seconds or milliseconds.
- Throughput — The amount of information that can be transferred over a connection in a given period of time.
  Usually expressed in bits per second (bps), bytes per second (Bps) or packets per seconds (pps)

E-DBA Primer

E-DBA is a *scheduled air-link protocol* whose algorithms were designed to favor throughput over latency. To achieve that goal, the air-link uses adaptive timeslots called *cycles* to schedule traffic. These cycles dynamically vary in length (typically, between 200 to 1500 milliseconds) based on various factors, including network load.

Each packet of data transiting through an E-DBA network must therefore be scheduled for transmission, which introduces a *scheduling latency* of one or more cycles.

PING as a Performance Measuring Tool

Ping is a utility used to determine whether a particular IP address is reachable by sending out a packet and waiting for a response. It is therefore a good tool to measure network latency.

Because of E-DBA's cycle mechanism, a ping packet could take up to 3 cycles to make the round trip, producing an unexpectedly large ping time even when the radio channel is lightly loaded. For this reason, Dataradio recommends that ping should only be used to verify if a device is reachable, not as a measure of network performance.

On Ethernet-only networks, ping is normally set to timeout its request packets after 1 or 2 seconds. When using ping over an E-DBA network, Dataradio recommends setting the ping timeout to 5000 milliseconds or more.

PING Example

```
C:\>ping -w 5000 172.23.10.2

Pinging 172.23.10.2 with 32 bytes of data:

Reply from 172.23.10.2: bytes=32 time=641ms TTL=59
Reply from 172.23.10.2: bytes=32 time=703ms TTL=59
Reply from 172.23.10.2: bytes=32 time=593ms TTL=59
Reply from 172.23.10.2: bytes=32 time=641ms TTL=59

Ping statistics for 172.23.10.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 593ms, Maximum =  703ms, Average =  644ms
```

TRACEROUTE (TRACERT) as a Performance Measuring Tool

Traceroute, *named tracert in Windows™ environments,* is a utility that describes the path in real-time from the client machine to the remote host being contacted. It reports the IP addresses of all the routers in between. It also reports the latency delays encountered at each hop. As with ping, E-DBA's cycle mechanism may produce an unexpectedly large delay when traversing an E-DBA airlink.

A large timeout value is also recommended when using Traceroute.

TRACEROUTE Example

```
C:\>tracert -w 5000 172.23.10.2

Tracing route to 172.23.10.2 over a maximum of 30 hops

  1   <10 ms   <10 ms   <10 ms  192.168.36.37    (host→base)
  2   641 ms   734 ms   750 ms  172.23.10.2     (host→base→mobile)

Trace complete.
```

FTP as a Performance Measuring Tool

FTP is a protocol used to transfer files over a TCP/IP network. Applications that implement that protocol are good candidates for measuring the throughput of a link. Note that the FTP & TCP/IP software components in the server and client computers may have an adverse effect on performance – factors such as FTP buffer size, TCP window size and the TCP congestion-control algorithm may interact to produce throughput lower than that of the theoretical maximum. As well, be careful about inferring total system performance from the result of a single FTP transfer.

Conclusion

Although some standard tools such as the ones outlined above can be used to get a rough idea of an E-DBA system's performance, the best metric will always be to test the system in conditions that reproduce as closely as possible its real-life usage. For example, by using applications similar to wireless CAD systems and the appropriate traffic profile.

Appendix 4 - Time Synchronisation, and WEB Browser Cache - Instructions

The contents of this appendix are also available in Technical Instruction Sheet 051 (TIS051), dated November 10, 2006.

Overview

The instructions in TIS051, intended for maintenance technicians and for end-users, address a built-in web server synchronization and browser cache issue where web pages of a unit may contain information that does not seem to match the expected content, especially after a firmware upgrade.

The following paragraphs detail the cause of the problem and steps to prevent the problem.

Likely Cause

Most web browsers store the pages they display in a browser cache, so that the next time the same page is displayed, the browser does not have to download it all over again from the server. The browser instead displays the version of the page that was previously stored in the cache.

This process relies on a combination of factors to establish whether a page can be retrieved from the cache or must be freshly downloaded from the server. Typically, they are:

- The IP address of the server
- The time and date the page was last updated on the server.

Unless your unit was configured to pick up and maintain time-of-day (section 4.7.3.7), its time and date restarts from the same point (typically, 1970-01-01 00:00:00*) after each reset or power-up. In this condition, the timestamp applied to web pages during a firmware upgrade might predate the timestamp of the pages already in the browser's cache. When next accessing the pages in question, the browser will pickup the cached version, as it appears to be newer than that of the freshly upgraded unit.

** Encoded system time using the number of one-second ticks elapsed since the start of the "epoch" set at 1970-01-01 00:00:00 Z.*

Problem Prevention

In order to avoid picking up stale data, it is strongly recommended that you empty the browser's cache before starting to browse the web content of a unit, following a software update, and when going from one unit to another.

Enabling time-of-day synchronization *(on units that support it)* will also help prevent this problem.

Cache Clearing

If using Internet Explorer v6.0, select "Tools" in the menu bar, select "Internet Options", select the "General" tab and click on the "Delete Files" button in the "Temporary Internet files" pane; click on the "OK' button to confirm the deletion and on the OK button to exit.

If using Mozilla Firefox v1.5.0.4, select "Tools" in the menu bar and select the "Clear Private Data" option. Alternately, you can use the keystroke combination of "Ctrl+Shift+Delete".

Adjust the above methods according to your browser or to its version number.

Appendix 5 - Ethernet Configuration - Recommendation

The contents of this appendix are extracted from Technical Instruction Sheet 052 (TIS052), dated December 06, 2006.

Overview

The recommendation in TIS052, intended for maintenance technicians and for end-users, addresses an issue where communication fails when trying to connect, or attempting to FTP files to upgrade a unit.

Ethernet Network Port Setting

For GeminiG3 radiomodems, Dataradio recommends setting to half duplex and 10 BaseT.

FTP Connection Failure Indication

FTP transfer stops on one of the transfer steps and displays a message similar to:

```
>Netout: Connection reset by peer
 Connection closed by remote host.
 ftp>
```

FTP Recommendation

Certain Ethernet cards have *(as default)* the option to calculate the Rx/Tx checksum through the hardware on the Ethernet card instead of the OS. These cards can have bugs and sometimes get the wrong CRC result, resulting in dropped packets and connectivity failure. If having connectivity problems configuring an Ethernet card, change the following parameters to "Disable":

- `Rx Checksum Offload`
- `Tx Checksum Offload`

Even though this Ethernet card issue occurred when running Windows XP Professional SP2, as well as Windows 2000, we believe it could manifest itself under other (or older) operating systems, with a variety of network cards, and on other Dataradio radiomodem products.