Paragon-III (700MHz)
Data Base Station
(With Amplifier Technologies 70W PA)
User Manual
Version 1.00a

Preliminary – For Internal Use Only

April 2005

Part no.: 120 20191-100a

History

Version 1.00a: April 2005 – Preliminary,
- With optional Amplifier Technologies 70W PA

Version 0.02: October 2004 – issue 0.02, preliminary.
- With optional Aethercomm 50W PA as Annex A.

Version 0.01: April 2004 –first issue, preliminary

About Dataradio

Dataradio is a leading designer and manufacturer of advanced wireless data products and systems for mission critical applications. Our products are found at the heart of mobile data and SCADA networks around the world.
With over 20 years dedicated to data technology and innovation, Dataradio is the premier source for wireless data solutions. Our products include mobile data products, telemetry devices, integrated wireless modems for fixed point-to-point and point to multi-point applications, and OEMs. Our product line is one of the broadest in the industry covering the most often-used frequency bands.

www.dataradio.com

Dataradio provides product brochures, case studies software downloads and product information on our website. 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.

Definitions

Access Point	**C**ommunication hub for users to connect to a wired LAN. APs are important for providing heightened wireless security.
AES	Advanced Encryption Standard (AES) - uses 128-bit encryption to secure data.
Airlink	Physical radio frequency connections used for communications between units.
ARP	Address Resolution Protocol – Maps Internet address to physical address.
Asynchronous	Information that can be sent at random times, and not synchronized to a clock. Transmission characters begin with a “start” bit and end with a “stop” bit.
AVL	Automatic Vehicle Location. Optional feature that involves using GPS (Global Positioning System) signals from the mobile unit by the Host PC.
Backbone	The part of a network that connects most of the systems and networks together, and handles the most data.
Bandwidth	The transmission capacity of a given device or network.
Browser	An application program that provides a way to look at and interact with all the information on the World Wide Web.
BSC	Base Station Controller - An async controller-modem designed for the radio base station in mobile systems. A component of Paragon-III™.
CDip	Windows based "Commands & Data over IP" radio-modem Software. This software allows basic tests, unit configuration, and troubleshooting.
COM Port	RS-232 serial communications ports of the Paragon-III wireless radiomodem.
Default Gateway	A device that forwards Internet traffic from your local area network.
DHCP	Dynamic Host Configuration Protocol - A networking protocol that allows administrators to assign temporary IP addresses to network computers by "leasing" an IP address to a user for a limited amount of time, instead of assigning permanent IP addresses.
DNS	Domain Name Server - translates the domain name into an IP address.
Domain	A specific name for a network of computers.
Dynamic IP Addr	A temporary IP address assigned by a DHCP server.
E-DBA	Dataradio’s Enhanced Dynamic Bandwidth Allocation airlink protocol.
Ethernet	IEEE standard network protocol that specifies how data is placed on and retrieved from a common transmission medium.
Firewall	A set of related programs located at a network gateway server that protects the resources of a network from users from other networks.
Firmware	The programming code that runs a networking device.
Fragmentation	Breaking a packet into smaller units when transmitting over a network medium that cannot support the original size of the packet.
FTP	File Transfer Protocol - A protocol used to transfer files over a TCP/IP network.

Gateway	A device that interconnects networks with different, incompatible communications protocols.
Gemini-G3	High specs dual DSP mobile radiomodem with Dataradio Parallel Decode™ technology
HDX	Half Duplex. Data transmission that can occur in two directions over a single line, using separate Tx and Rx frequencies, but only one direction at a time.
HTTP	HyperText Transport Protocol - The communications protocol used to connect to servers on the World Wide Web.
IPCONFIG	A Windows 2000 and XP utility that displays the IP address for a particular networking device.
MAC	Media Access Control - The unique address that a manufacturer assigns to each networking device.
NAT	Network Address Translation - NAT technology translates IP addresses of a local area network to a different IP address for the Internet.
Network	A series of computers or devices connected for the purpose of data sharing, storage, and/or transmission between users.
Network speed	This is the *bit rate* on the RF link between units.
Node	A network junction or connection point, typically a computer or work station.
OIP	Optimized IP – Compresses TCP and UDP headers, and filters unnecessary acknowledgments. This makes the most use of the available bandwidth.
OTA	Over-The-Air - Standard for the transmission and reception of application-related information in a wireless communications system
Paragon-III	IP-based data radio base station used in mobile networks and designed specifically to fit the needs of vehicular applications. Runs up to 128 kb/s
Parallel Decode	Technology featuring dual receivers for added data decode sensitivity in multipath and fading environments.
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.
Router	A networking device that connects multiple networks together.
RS-232	Industry–standard interface for data transfer.
Static IP Address	A fixed address assigned to a computer or device that is connected to a network.
Static Routing	Forwarding data in a network via a fixed path.
Subnet Mask	An address code that determines the size of the network.
Switch	A data switch that connects computing devices to host computers, allowing a large number of devices to share a limited number of ports.
Sync	Data transmitted on a wireless network that keeps the network synchronized.
TCP	Transmission Control Protocol - A network protocol for transmitting data that requires acknowledgement from the recipient of data sent.
TCP/IP	Transmission Control Protocol/Internet Protocol - A set of instructions PCs use to communicate over a network.
Telnet	A user command and TCP/IP protocol used for accessing remote PCs.

TFTP	Trivial File Transfer Protocol - A version of the TCP/IP FTP protocol that has no directory or password capability.
Topology	The physical layout of a network.
Transparent	A transparent unit transmits all data without regard to special characters, etc.
UDP	User Datagram Protocol - A 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.
VPN	Virtual Private Network - A security measure to protect data as it leaves one network and goes to another over the Internet.
WINIPCFG	A Windows 98 and Me utility that displays the IP address 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 information required for the setting up, operation, testing and trouble-shooting of the Dataradio® Paragon-III™ radio-modem base station.

1.1 Intended Audience

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

1.2 General Description

The Paragon-III product is a factory-integrated industrial-grade IP-based data radio base station used in mobile networks and is designed specifically to fit the needs of vehicular applications. The 700MHz version features diversity Software Defined Radio (SDR) receivers for added data decode sensitivity in multi-path and fading environments.

When used with Dataradio's state-of-the-art Gemini-G3 mobile IP data solution, the system delivers unequaled high-speed data performance and unmatched effective throughput.

All Paragon-III models are supplied in a rackmount configuration that includes:

- A Paragon-III full-duplex radio-modem assembly that includes a Next generation high-speed Dataradio third generation "Base Station Controller" module (BSC) fitted in the radio chassis assembly.
- A 70W power amplifier (model SRA7070B) manufactured by Amplifier Technologies Inc. supplied in a stand-alone rackmount configuration. It is DC-powered by the Paragon-III.
- Duplexer and backup power units are custom furnished items.
- Wire line modem(s) are optional items.
- Laptop PC and its application software are user-supplied items.

1.2.1 Features

- Parallel Decode (PD) technology featuring a diversity SDR receiver module for added decode sensitivity in multi-path and fading environments.
- Fully IP based product line, using an optimized IP layer that reduces IP overhead for the RF link
- Sophisticated dual DSP-based modem design provides added system performance, fewer retries and more effective throughput.
- 700MHz / 50kHz channels for the Public Safety band of operation:

  766-773 MHz TX (under FCC part 90) and 762-764 MHz TX (under FCC part 27)
- Full duplex operation in the 700MHz frequency band
- Base Station with 70W RF Power Amplifier (user adjustable from 35W)
- On-air data speeds and modulation types supported:

Table 1 - On-air data speeds and modulation types

Modulation type	Channel spacing – 50kHz
SRC4FSK	64 kb/s
SRC8FSK	96 kb/s
SRC16FSK	128 kb/s

- Uses the Next generation high-efficiency Dataradio Enhanced-DBA over-the-air protocol
- Over-the-air compatible with Gemini-G3 mobile products
- Out-of-band signaling enables transmission of GPS reports with no effect on system performance.
- Flash programmable firmwares, including over-the-air programming capability
- Paragon-III units are factory-configured based on each customer's network system requirements

1.2.2 Configuration

Paragon-III units are factory-configured to default settings. Configuration changes or upgrades are web-based.

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:

For Canada and International customers:

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

or

For U.S. customers:

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 usually not field-serviceable, except by the replacement of individual radio modules. Specialized equipment and training is required to repair logic, modem boards, and radio modules.

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 a question 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 Packaging

Each Paragon-III – 700MHz product normally leaves the factory packaged as follows:

- A Dataradio base station “Radio-modem assembly”
- A rackmount 70W power amplifier assembly
- One standard seven-foot 120VAC power cord
- DC power harness to connect the radio assembly to the power amplifier rackmount assembly.

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

2. Installation

2.1 Overview

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

Furnishings needed include power, cabling, and installation of antenna, landline or microwave modem, and host PC or portable computer. Details of these are outside the scope of this manual. This manual covers the radio-modem assembly and the power amplifier.

2.2 Location

Be sure to place the Paragon-III in such a way that:

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

2.3 Front View

Model using Amplifier Technologies Inc power amplifier.

Figure 1 - Typical rack-mount multi-modules "Radio Assembly"

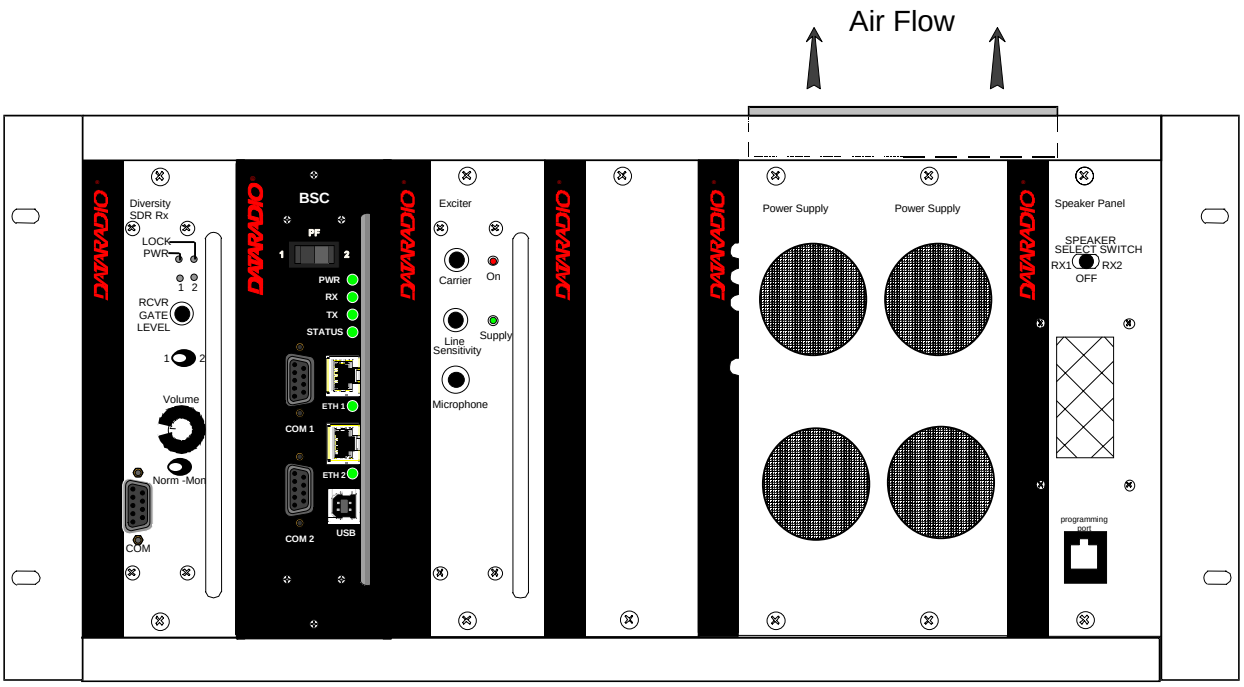


Figure 2 – Amplifier Technologies Inc 70W Power Amplifier

Figure 3 - Indicators and Power Adjustment Control

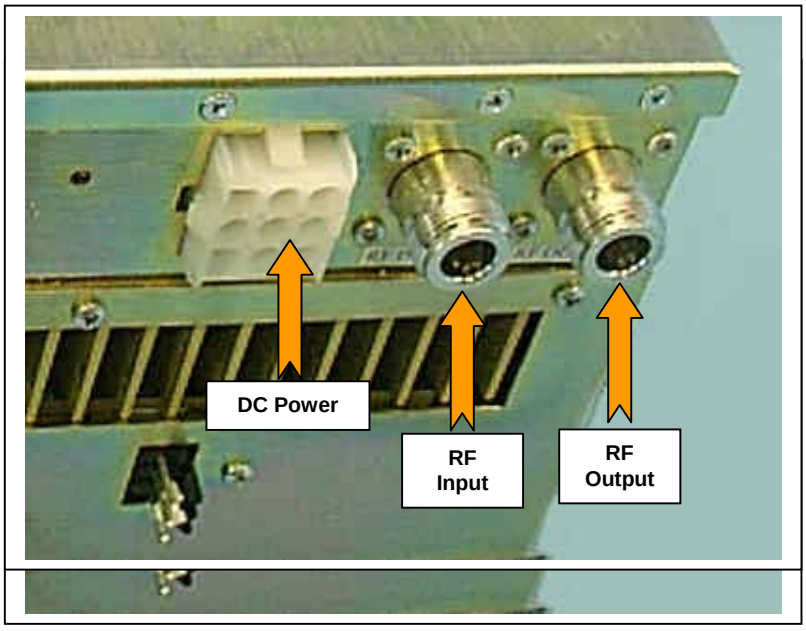


Figure 4 – Power Amplifier's DC Power and RF Connectors

2.4 Rear Views

Figure 5 - Paragon-III rear view

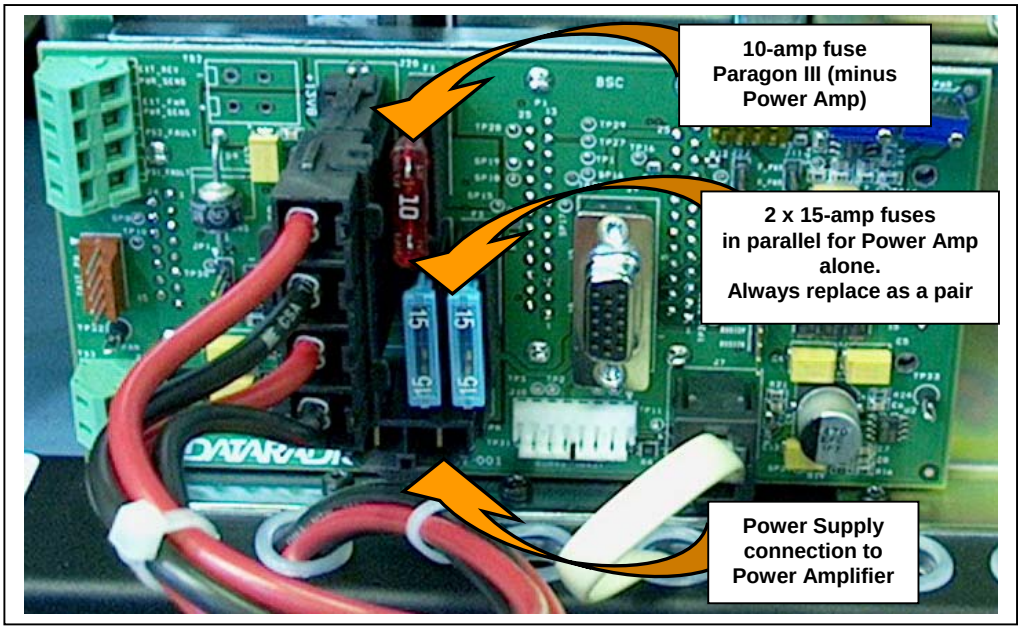


Figure 6 - Backplane

2.5 Electrical

Standard 120 VAC electrical power is required. It should be capable of providing at least 10A to power Paragon-III (<6A) and ancillary equipment.

2.5.1 Paragon-III Assembly Power

Two distinct power configurations (rear views) are shown in the preceding pages. They are:

- Paragon-III Base Station Standard Assembly.
  This configuration is described in paragraph 2.5.1.1 below.
- Paragon-III Base Station Assy. with 3rd party DC supply.
  This configuration illustrates typical wiring variation required when using both a third-party power supply and an optional DC-powered BSC setup. Refer to Dataradio System Engineering for further details.

2.5.1.1 Standard Power Supply Configuration

The Radio assembly unit receives 13.8 VDC power inputs from two "T809 " power supply modules powered at 120 VAC. Normally used at room ambient temperatures, it can operate within its specifications over a range of –10 to +60 °C.

Note: Internal over-temperature protection shuts down the main transformer above 105 degrees Celsius.

Both power supply modules are internally connected to ground via their individual, rear-connected, seven-foot standard 120 VAC power cords. The Radio Assembly chassis requires a secure ground connection. A threaded grounding binding post fitted with a knurled binding-nut is provided on the chassis next to DC input 2.

- For the Radio Assembly chassis, install the grounding lead's lug over the binding post and firmly hand-tighten the binding-nut.
- If a –DC rail (0V) is installed as part of the system, the grounding leads may alternatively be fitted to the rail terminal.

Caution:

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

2.5.1.1.1 DC Power Supply Connection & Torque Settings

Warning:

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

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

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

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

Torque Settings:

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

- 1.5 Nm (or 13.28 In/lb or to 1.107 ft/lb)

  Note: Dataradio uses a Sturtuvan Richmond 29-pieces adjustable torque screwdriver model CAL36/4K.

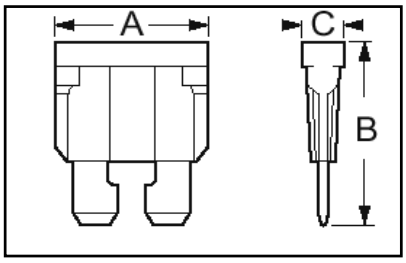
  After tightening, pull on the cable to check the cable is secured tightly into the screw terminal.

2.5.1.1.2 Power Indications

Both red-colored translucent power switches located on the front of the power supply modules illuminate when AC power is available. Toggle both to ON to distribute power to the Radio Assembly and to the Power Amplifier. The LED immediately below the switches light green indicating normal DC power operation.

2.5.1.2 Backplane Fuses

Blade fuses (Maxi-Fuse) are used on the Radio assembly backplane (see Figure 7):



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

Fuse #	F1	F2	F3
Values	10A	15A*	15A*

* Always replace the two 15A fuses as a pair.

Figure 7 - Maxi-Fuse

2.6 Power Amplifier

Although the T809-10 is a high efficiency switched mode power supply, a considerable amount of heat is generated during normal operation. While in use, ensure that an adequate flow of cooling air is able to circulate around the power supply, and that the air intake vents on the rear and sides of the unit are not inadvertently covered.

Caution:

Do not operate this unit in a completely enclosed cabinet.

Refer to Figure 4 on page 6 for the location of DC power and RF in and out connectors.

Connect the T881 Tx module output to the power amplifier's input using the Dataradio (p/n 727 03468-001) RG223 provided cable.

For the power amplifier output, Dataradio recommends a 50-ohm, low-loss, double-shielded grade RF cable such as RG214 or 1/4" Heliax.

Power adjustments can be made using the front panel trim potentiometer. Dataradio does not recommend setting an output lower than 35 watts.

2.7 Antenna

2.7.1 Overview

Paragon-III commonly uses three antennas (one transmit and two receive) unless a duplexer is used with one of the receive antennas; then only two antennas would be needed. They should be mounted according to any guidelines supplied with the antennas. For antennas placement and spacing, consult System Engineering.

2.7.2 Cabling and Connection

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

2- Terminate the RX-1 (top) and RX-2 (bottom) cable-ends at the SDR module rear position with N-type connectors.

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

Caution:

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

Common pliers are NOT acceptable.

2.8 Completing the physical Installation.

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

After new installations:

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

You are now ready to check for normal operation (as per paragraph 2.9) and to run the Dataradio CDip program for testing or trouble-shooting.

Any change(s) to the settings must be done via files saved on diskette and loaded into the unit using the CDip program.

2.9 Checking out Normal Operation

1- Check that power is applied.

2- Check Radio assembly lights for proper operation as per section 3.1.1

3- Check for proper operation of the BSCs LEDs.

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

5- Using CDip, check the RF Data Link with a mobile that can be heard (as per section 5.3.1)

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

3. Operating Description

3.1 Radio Assembly

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

The complement of modules is:

- 1 x SDR module
- 1 x 5W Transmitter
- 1 x BSC (controller-modem)
- 1 x Speaker panel
- 2 x Power Supplies
- 1 x 70-Watt Power Amplifier rackmount assembly

3.1.1 Diversity SDR Rx module

The Diversity SDR Rx module front panel controls and indicators are:

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

- RCVR GATE LEVEL - Mute threshold adjustment.
- 1 / 2 Switch – Manual selection of Channel 1 or 2 audio.
- Monitor Volume – Audio level adjustment. Always set volume knob to minimum when not in use.
- NORM-MON Switch – Manual selection between audio unmuted (continuous monitor) or when audio is above the manually adjusted mute threshold.
- COM – For factory use.

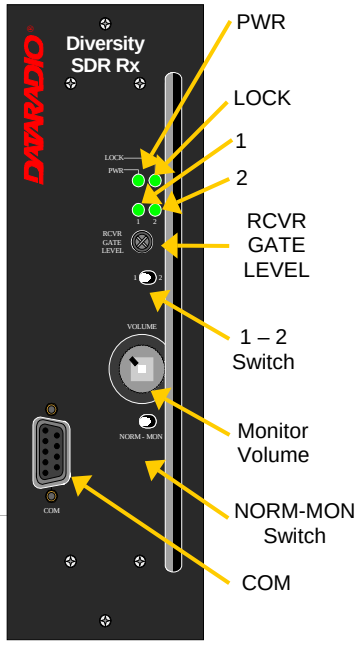


Figure 8 - Receiver module

3.1.2 5W Transmitter module

The Exciter's front panel controls and indicators are:

- Carrier Switch - momentarily keys the transmitter ON while pressed (used for test purposes only).
- On LED - is lit when transmitting
- Line Sensitivity – not used.
- Supply LED - is lit when DC power is applied. Fast Flashes when linked with PGM800Win. Slow Flashes indicates VCO (synthesizer) out of lock. Unequal Flashes indicates internal communication error.
- Microphone Socket – not used.

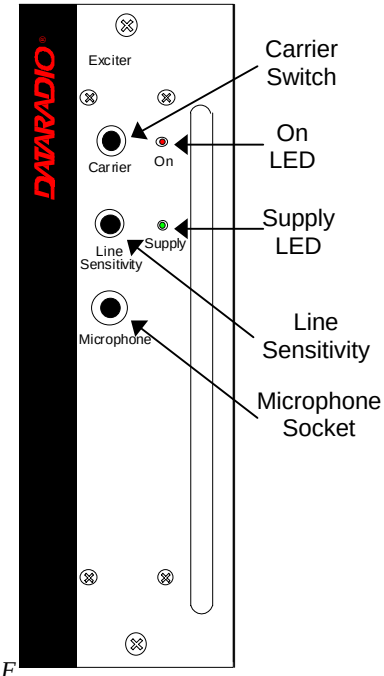


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Figure 9 – 5W Exciter module

3.1.3 70W Power Amplifier

The power amplifier is maintenance free, only LED indications and a front panel adjustment are provided for the user.

Refer to Figure 3 on page 6 above, for the locations of the indicators and the power adjustment.

Table 2 - 70W Power Amplifier indicators

LED	Function
DC / ON	Lights green when power is applied
RF / ON	Lights yellow when input RF power is applied
OVER / TEMP	Lights red when temperature-based shutdown is triggered

3.1.4 BSC module

The BSC's front panel connectors and indicators are:

PWR LED	**Green**	**Normal operation**
	Amber	**Step 2 in uMon boot-up – lights for <1 sec.**
	Red	**Step 1 in uMon boot-up – lights for <1 sec.**
RX LED	**Green**	**Flashes for each data packets received**
	Red	**Discard RX packet (factory-use)**
TX LED	**Green**	**Flashes for each data packets transmitted**
	Amber	**Flashes for each data packets transmitted (check for lost Host connection)**
	Red	**Continuoulsy ON for TXON test (max. 20 secs.) Flashes ON for CWID key-up event**
	Off	**Check if in "AirLink down mode"**
STATUS	**Green**	**Flashes each time PF1 or PF2 is pressed**
	Amber	**Flashes each second PF1 is kept pressed *Toggles "AirLink down mode" after 4 seconds***

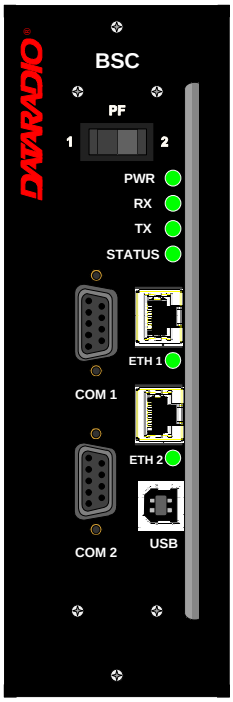

Figure 10 - BSC module

- 2x DE-9 RS-232 ports for setup and user data
- 1X rocker switch (positions PF 1 and 2) to select various test modes
- 2x Ethernet ports – for setup and user data
- 2x Ethernet LEDs (status & activity)
- USB port – reserved.

3.1.5 Speaker panel

The speaker panel is fitted with a four-Ω speaker.
All series of radio assemblies share the same front panel fitted with an RJ11 connector. This connector is used to allow programming the radio transmitter module (only) from the front of the unit via a programming lead. This feature is exclusive to the Series II and Paragon III modules.
If the speaker panel needs to be removed, a mirror programming port connector is provided on the backplane.

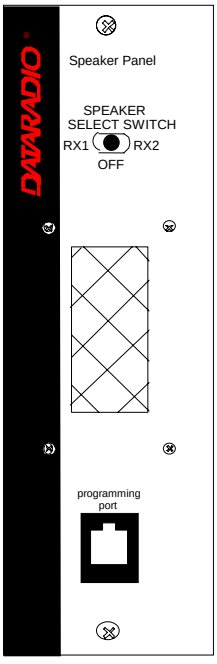

Figure 11 - Speaker module

3.1.6 Power Supply Modules

Two switched mode pulse width modulated T-809 power supply modules are used but not connected in parallel.

Both power supply units have ON-OFF control and remote sensing via a rear mounted DE-9 connector, and an output voltage adjust potentiometer (13.5 to 18 VDC).

Their circuit protection features are:

- Inrush current limiting
- Over-current (short-circuit)
  - 37 to 48A constant current limiting
  - Reset = auto recovery
- Over-voltage
  - 18 to 21 VDC = shutdown
  - Reset = Power OFF and ON
- Over-temperature
  - shutdown of output voltage
  - auto recovery with temperature reduction
  - temperature sensed on transistors and diodes

Front Panel Indications	
Power Switch	Illuminates when the unit is connected to AC power and voltage is available
ON LED	- Lights bright green when voltage output is normal - Lights faint green when module has entered over-current mode - Green LED is OFF, but power switch is ON indicates module has shut down due to over-temperature or over-voltage conditions.

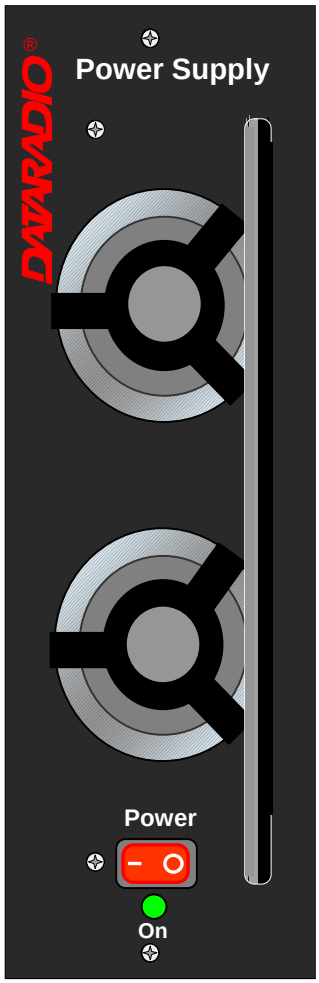

Figure 12 - T-809 Power Supply Module

3.1.6.1 Power Supply Rear Connections

The rear panel connections are:

- Auxiliary Inputs –

  The DE-9 connector on the T809-10 rear panel provides access to the remote control and remote sense functions of the power supply.

- Output Voltage Adjust –

  The output voltage of the power supply can be increased (up to 18V approximately) to compensate for the voltage drop lost along the cable. Access the trim-pot through a small hole on the rear panel.

  To adjust the output voltage use a trimmer tool with a Phillips head or 3mm blade *(do not use a standard flat blade screwdriver to make the adjustment)*:

  • To increase the output voltage, turn the trim-pot clockwise.

  • To decrease the output voltage, turn the trim-pot counterclockwise.

  If the output voltage is increased on a power supply operating at, or close to, full load, the power supply loading must be reduced accordingly or the module may overheat and shut down.

- Feedthrough Terminal Block –

  The DC Output Terminal block on the rear of the T809-10 is a Phoenix Contact HDFKV 10. This is a screw-type terminal connector that uses a cage mechanism to clamp the conductor(s). *See section 2.5.1.1.1 for recommended torque settings.*

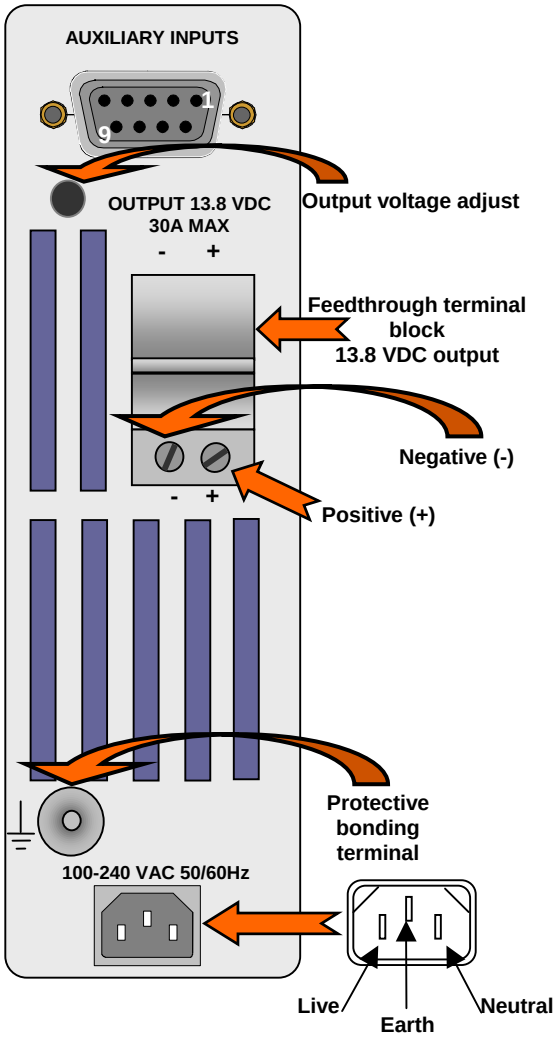

Figure 13 - T809 Rear panel

- Protective Bonding Terminal –

  The Radio Assembly requires a secure ground connection. See section 2.5.1.1 for connection details.

- 120 VAC Connector –

  Use the supplied 10A-rated IEC type power cord.

3.1.7 Radio Backplane Assembly

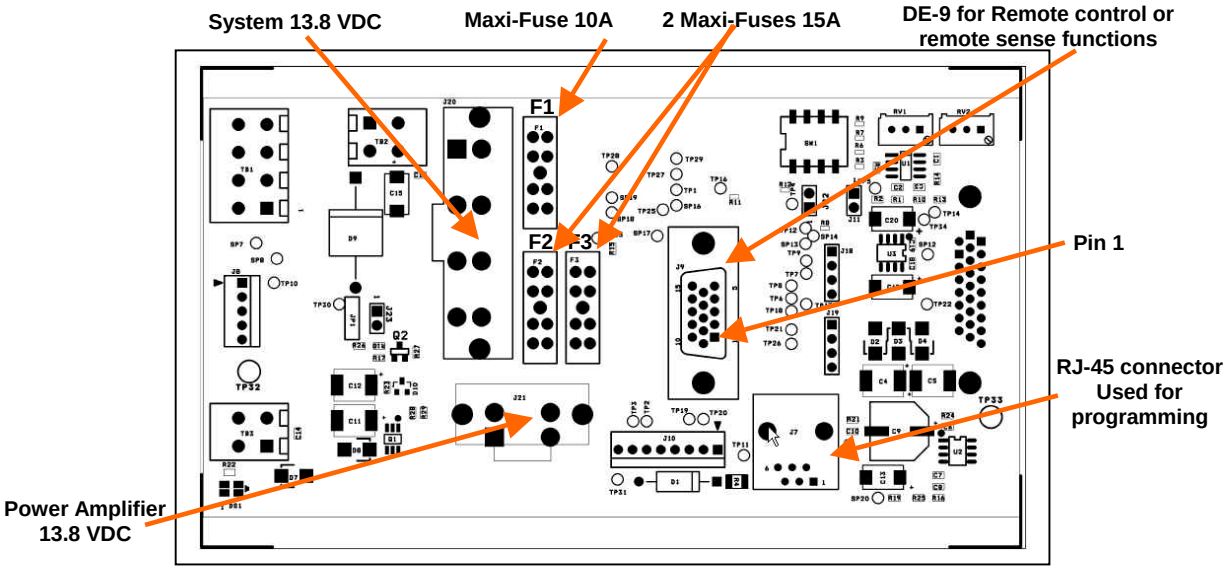

Figure 14 - Radio Backplane Assembly

3.2 Online & Offline Diagnostics

Paragon-III units continually monitor and report on their environmental and operating conditions. Each transmission carries online diagnostic information which can be monitored remotely or even sent to a designated host for logging and later analysis. Transmission of online diagnostics may be enabled or disabled at any station or stations without affecting their ability to communicate with other stations

Additional information, statistics, and offline test facilities are available via the browser. RF paths can be monitored and checked from either end of a link, without travelling to the other station.

4. Operation & Configuration

4.1 Browser-Based Setup and Status

A built-in web server makes configuration and status monitoring possible from any browser-equipped computer, both 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 FTP protocol.

4.2 Default IP Settings

- Paragon-III radio modem supports the Router (IP Forwarding) mode

4.2.1 Ethernet Interface 1 (DATA)

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

4.2.2 Ethernet Interface 2 (SETUP)

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

4.2.3 RF Interface

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

4.3 IP Network Settings

4.3.1 IP Network Settings (with Host)

Referring to Figure 15 below, set the Paragon-III base station. Set the “Data” port Eth1 IP addresses (for “Setup” port set Eth2) and IP netmask of both Base and Mobile(s).

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

Add routes in the Host (route add…)

In the illustration, Host and PC are part of different IP subnet.

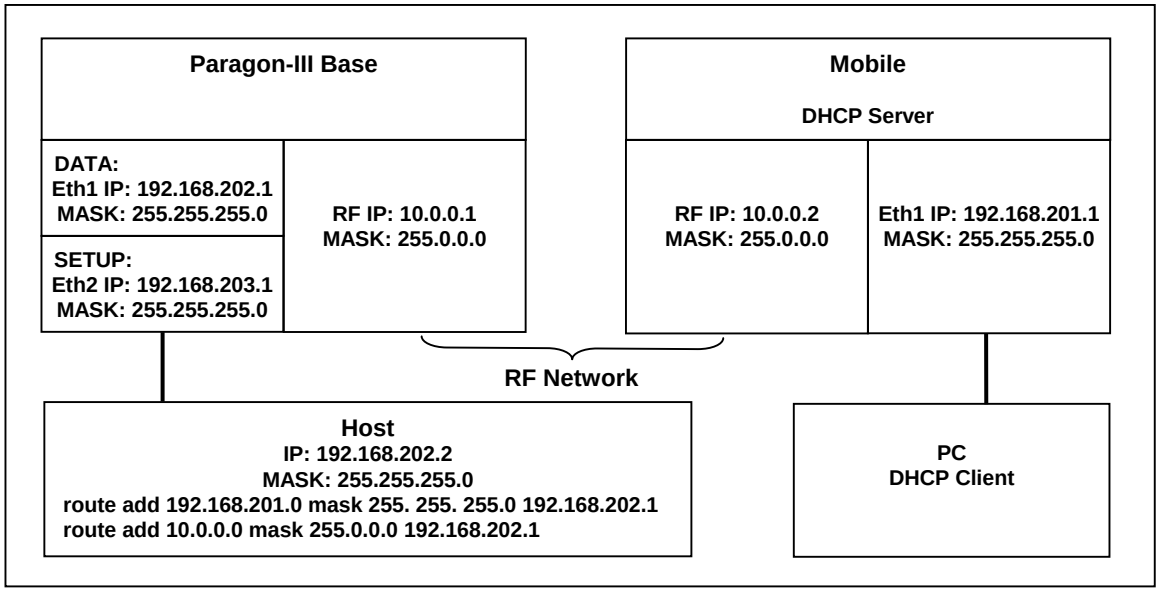

Figure 15 - IP Network Settings in Router Mode (with Host)

4.3.2 IP Network Settings (with Router)

Referring to Figure 19 below, set the Paragon-III base station. Set the “Data” port Eth1 IP addresses (for “Setup” port set Eth2) and IP netmask of both Base and Mobile(s).

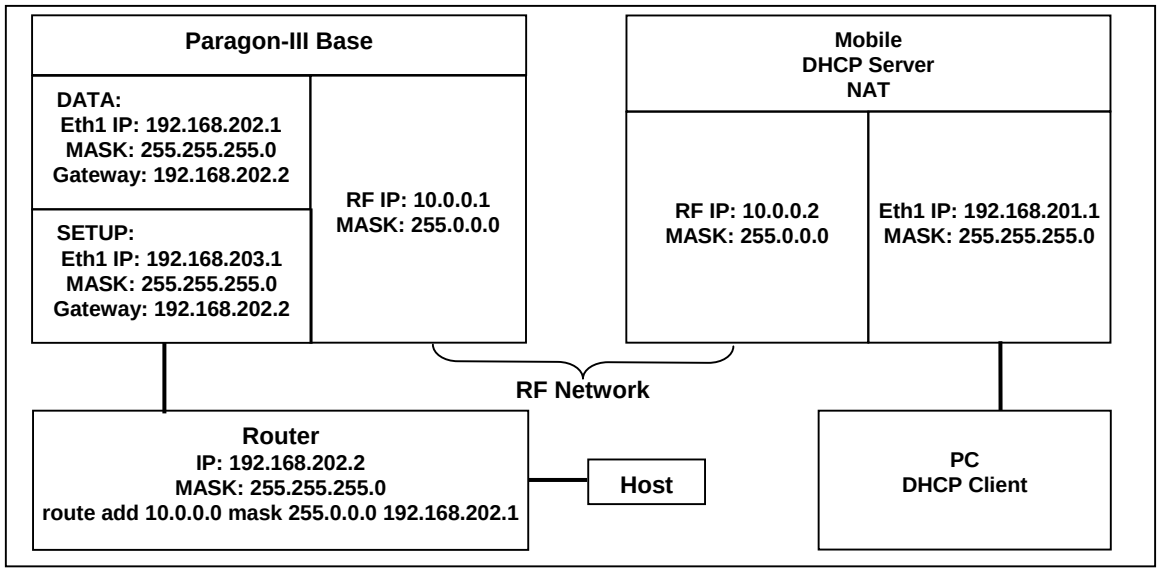

Figure 16 - IP Network Settings in Router Mode (with Router)

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

Enable RIPv2 on Base station

In the illustration, Host and PC are part of different IP subnet.

4.4 LAN Setup

On a PC running MS-Windows with an existing LAN connection, connect either to the ETH1 (Data) or to ETH2 (Setup) RJ-45 input of the Paragon-III.

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 192.168.202.2 *(if ETH2 enter 192.168.203.2)* in the IP address field ➔ 255.255.255.0 in the Subnet mask ➔Leave the Default gateway blank.
6. Click the OK button

   Note: On computers running Windows 9X, reboot to complete the connection process.

4.5 Login Screen

On the Address line of the Internet browser of your choice, type the factory-default IP addresses given to all Paragon-III radiomodem units: 192.168.20*x*.1 *(where x is 2 for the ETH1 Data port and 3 for the ETH2 Setup port)*. Press Enter. The Enter Network Password screen opens.

Figure 17 - Enter Network Password screen – ETH1 Data port shown

4.5.1 Initial Installation Login

For an initial installation, enter a User Name 1 to 15 characters and a Password 8 to 15 characters. Do not place a check mark in the "Save this password in your password list" box. Click OK to access the Web Interface (Figure 18).

Dataradio recommends to immediately change the Paragon-III unit's IP address as well as set your own login password as part of the initial configuration *(See 4.7.2.2 and 4.7.2.10)*.

For subsequent access to the Paragon-III unit, use the User Name and Password you configured.

Note:

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.

4.6 Security Setup

1. Navigate the web interface to the “Security” menu.
   - Set User ID (optional in a basic setup)
   - Set Password (optional in a basic setup)
   - At Encryption, click the Enabled button
   - Enter Encryption Key
2. Click Apply Parameters
3. Click Save Parameters

4.7 Interface

The Paragon-III user interface (Figure 18) provides easy access to the various menus used to configure and view your network settings.

The Navigation Area lists seven top-level menus, four of which expand to offer submenu. The tables starting at section 4.7.2 below list action of each function.

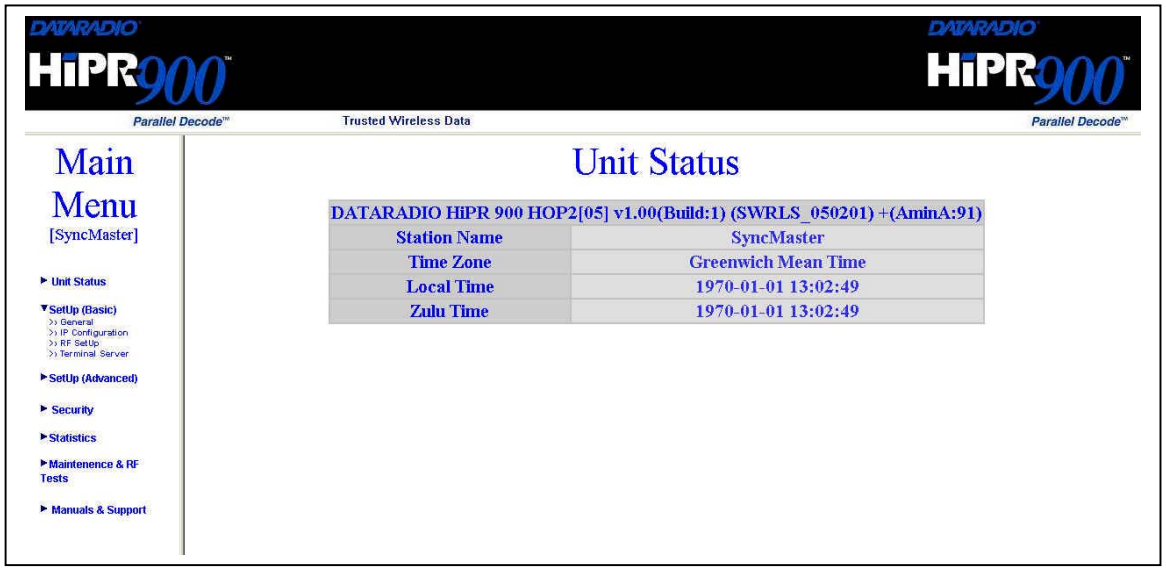

Figure 18 - Web User Interface (Preliminary – HiPR-900 model shown)

4.7.1 Apply Parameters & Save Parameters Buttons Behavior

Submenus which have Dialog boxes also have Command Buttons to Apply, Reset, and Save Parameters in addition to Station Reset.

Referring to the example in Figure 19 below, make entries into the Dialog boxes. When satisfied, click on Apply Parameters to temporarily make the parameters active. If not satisfied, click on Reset values button to restore to the values present before changes were made.

Notes:

Reset values commands affect all Dialog boxes or radio buttons only in the opened window.

If needed, go to other Submenu(s) and make more entries. Click Apply Parameters before leaving each window. When finished, click a Save Parameters button in any of the Submenus to make changed entries permanent *(along with any other entries made in other submenus).*

The Station Reset command button only appears when a parameter requires a Station Reset, otherwise it is unavailable. Use the Save Parameters command button before Station Reset otherwise temporarily entered parameters are lost. Pressing the Station Reset button opens the Confirm Station Reset (Figure 20) as a reminder to first save.

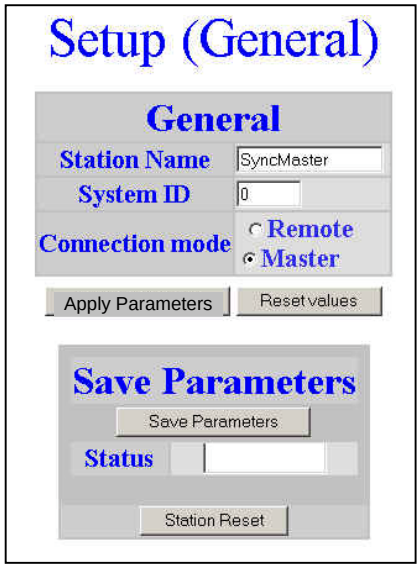

Figure 19 - Parameter Command Buttons behavior

Figure 20 - Station Reset Confirmation

4.7.2 Unit Status

Table 3 - Unit Status

Item	Description
Banner	Displays Paragon-III information retrieved from the connected unit. Have this information handy if contacting Dataradio support.
Station Name	Displays name of connected unit. Configured under Setup Basic ➔ General ➔ StationID
Time Zone	Displays local time zone. Configured under Setup Advanced ➔ SNTP➔ TimeZone
Local Time	Displays local time computed using UTC time and Time Zone
Zulu Time	Displays UTC time. Configured under Setup Advanced ➔ SNTP➔ SNTP UTC Time

4.7.2.1 Setup (General)

Table 4 - Setup (General)

Item	Description
Station Name	Station name identifier – Enter string up to forty characters in length
Connection mode	Mobile/Base
IP Forwarding mode	Router mode –

4.7.2.2 Basic IP Configuration

Table 5 - Basic IP Configuration

Item	Description
IP Address	Set to valid unique IP address for each individual unit
Network Mask	Set to valid IP netmask for each individual unit *(may be same or different depending on customer's IP network topology)*.
IP Default Gateway	Set to valid Default Gateway. May change for different groups or locations

4.7.2.3 RF Setup

Table 6 - RF Setup

Item	Description
Power Level	Sets power level between 0.1 and 1.0 watt (Default 1.0)
Airlink speed	256000, 512000 *(Default)* - Sets the maximum speed the HiPR900 will use for data packet transmissions. *Slower speed preferred for longer range.*
SubBand Mask	Indicates which channels are to be used in the shared band.

4.7.2.4 Terminal Server Configuration

Table 7 - Terminal Server Configuration

Item	Description
Baud Rate	Port 1 - 2400, 4800, 9600, 19200, 38400, 57600, 115200
	Port 2 - 2400, 4800, 9600, 19200, 38400, 57600, 115200
Connection Mode	Port 1 - Inactive, TCP Passive, TCP Active, UDP
	Port 2 - Inactive, TCP Passive, TCP Active, 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 Port	**For TCP active and UDP socket connections, set to any values between 1 and 65536.** **For TCP passive socket connections, set to any value between 1 and 65536 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 Port	**For all socket connection modes (TCP passive, TCP active, UDP), set to any value between 1 and 65536.** **Default local port value is 23 and can be changed dynamically.**

4.7.2.5 Advanced IP Configuration

Table 8 - Advanced IP Configuration

Item	Description
MTU	**Ethernet Interface 1 IP MTU - Default 1500. *Range 576 to 1500 bytes***
Factory MAC address	**Ethernet Interface 1 factory (Dataradio) MAC address in HEX format**
DHCP Server	**Disabled, Enabled (Default). Ethernet Interface 2**
DHCP Client	**Disabled(Default), Enabled. Ethernet Interface 1**
NAT	**Disabled(Default), Enabled. Ethernet Interface 2**
RIPV2	**Disabled(Default), Enabled,**

4.7.2.6 RF Network Setup

Table 9 - RF Network Setup

Item	Description
RF MAC	**Unit's RF MAC address**
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 HiPR network**
RF MTU	**Default 1500. *Range 576 to 1500 bytes***

4.7.2.7 Broadcast / Multicast

Table 10 - Broadcast / Multicast

Item	Description
Broadcast Outbound mobile address	
Broadcast Directed Enable	**Disabled, Enabled**
Broadcast Limited Enable	**Disabled, Enabled**
Multicast Addresses	
Multicast Add / Delete Address	**Add, Delete and Relevant address**
Multicast Enable	**Disabled, Enabled**

4.7.2.8 IP Optimization & Tuning

Table 11 - IP Optimization & Tuning

Item	Description
Optimization Data Compression	Disabled, Enabled (Default). Applies data compression over the IP payload
OIP RF ACK enable	Disabled (Default), Enabled.
OIP Retries	Enter number of retries. Default is 3, range 0-255

4.7.2.9 Simple Network Time Protocol

Table 12 - Simple Network Time Protocol

Item	Description
SNTP – Server addr	
SNTP – Enable	Disabled, Enabled
SNTP – Period	
SNTP – UTC Time	
SNTP – TimeZone	
SNTP – Daylight Savings	Off, On
Time Control – Time Sources	AirLink, SNTP
Time Control Refresh Period	
Time Control Refresh TimeOut	

4.7.2.10 Security

Table 13 - Security

Item	Description
User ID	Enter a string of any letters or numbers of at least 1 and not exceeding 15 characters
Old Password	For initial installation, enter a string of any letters or numbers of at least 8 and not exceeding 15 characters. For subsequent access, enter the old password.
New Password	Enter a string of any letters or numbers of at least 8 and not exceeding 15 characters
New Password	Re-enter the new password string
Encryption	Disabled, Enabled
Encryption Key	All units in a network must have the same key. Enter a string of 32 *(16bytes = 128 bits)* hexadecimal characters *(0 to F)*. *Displayed in pairs separated with spaces*

4.7.2.11 Network Statistics

Table 14 - Network

Item	Description
Data bytes presented	
Control Acks Rx'd	
Data packets sent	
Data bytes delivered	
Control Nacks Rx'd	
Data packets Rx'd	

4.7.2.12 Packet Statistics

Table 15 - Packet Statistics

Item		Description
IP Stats	Total RX packets	
	Total TX packets	
	Total Packets Forwarded	
UDP Stats	Total RX packets	
	Total TX packets	
Eth 1 Stats	Total RX packets	
	Total TX packets	
ICMP Stats	Total RX packets	
	Total TX packets	
TCP Stats	Total RX packets	
	Total TX packets	
Eth 1 ARP Stats	Total RX packets	
	Total TX packets	

4.7.2.13 RF Test

Table 16 - RF Test

Item	Description
Ping	
Test Tones	

4.7.2.14 FTP Transfer

Table 17 - FTP Transfer

Item	Description
Server Address	
User Name	
Password	
File Name	
Operation	Send (Put), Receive (Get)
Mode	ASCII, Binary
Request Transfer	
Reset values	
Status	

4.7.2.15 RSSI Table

Table 18 - RSSI Table

Item	Description
RSSI Table	RSSI Table illustration, see figure nn

4.7.2.16 Support

Table 19 - Manuals & Support

Item	Description
Support	Show link(s)

5. Trouble-Shooting and Testing

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

5.1 Equipment Required

- In-line watt meter (10 W range) for the 5W transmitter module and for reflected power and (100W range) for the power amplifier.
- Radio service monitor (IFR-120B with option 03: 30KHz IF filter or equivalent).
- RG-214 or RG-223 cable with N-Type male connector to connect Paragon-III to the service monitor.
- CDip 1.0 or later[1]

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

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

5.2 Recommended Checks

A) After an installation

1. LED Indications
2. Using CDip, Save "unit config" to a file
3. Transmitter Output Power
4. Transmitter Reflected Power
5. RF Link test between Paragon-III and mobile unit(s)

B) For annual maintenance & trouble-shooting

Same checks as A) plus:

6. Carrier Frequency Error
7. TX Deviation
8. 12 dB SINAD
9. Receiver distortion
10. RSSI check
11. Verify power supply connections & terminals torque settings (see paragraph 2.5.1.1.1)

---

1 To learn how to launch the Windows-based software alignment and system-testing tool CDip, please refer to the readme.txt file on the application's installation diskette.

For functional details of the numerous buttons and menu-selectable items available, please refer to the program's context sensitive help. It is also possible to access the help information via the F1 key.

Table 20 - Checklist A (After installation)

CHECKLIST A (Paragon-III) Recommended Check out after Installation				
Step	**ACTION**	**EXPECTED RESULTS at 25°C**	**MEASURE WITH**	**IF NOT?**
1	**Normal Power-up Sequence**	PWR LED lights red for one second, turns amber for one second, and stays green thereafter. TX LED flashes green once about eight seconds after power-up then keeps flashing in-tune to the cycle marker RX and STATUS LEDs remain OFF		
2	**Connect and save unit config** Press CDip ***Get*** button	as per CDip Help content		
3	**Power Amplifier Output Power** Press ***TXON (Unmod)***	**70** watts ±10%	Service monitor set to read power or 100W in-line watt-meter installed as close as possible to the unit antenna connector.	Check for bad connections, damaged coax cable, etc.
4	**Transmitter Reflected Power** Press ***TXON (Unmod)***	< 5% of forward power or as specified by System Engineering.	10W in-line wattme-ter	Check for bad connections, damaged coax cable, etc.
5	**RF Link test** Use the mobile address function and "Send" but-ton to dynamically test the link	Look for "Delivery confirmed" on the Status bar	Refer to 5.3.1 and to CDip Help content.	Mobile is out of range Refer to factory technical support.

Table 21 - Checklist B (General)

CHECKLIST B (Paragon-III) General Check out (part1 of 2)				
Paragon-III units are set and characterized at the factory to optimize performances. It is **not recommended** to try readjusting units unless it is really required. Misadjusting a unit may result in significant performance losses. **The proposed adjustments in the "IF NOT?" column below, should be tried ONLY if system data performance degradation is noticed combined with out-of-tolerance items.**				
Step	**ACTION**	**Expected Results at 25°C**	**MEASURE WITH**	**IF NOT?**
1	**Normal Power-up Sequence**	PWR LED lights red for one second, turns amber for one second, and stays green thereafter. TX LED flashes green once about eight seconds after power-up then keeps flashing in-tune to the cycle marker RX and STATUS LEDs remain OFF		
2	**Connect and save unit config** Press CDip ***Get*** button	as per CDip Help content		
3	**Transmitter Output Power** Press ***TX ON (Unmod)***	**70** watts ±10%	Service monitor set to read power or 100W in-line wattmeter installed as close as possible to the unit antenna connector.	Adjust "Power" on the front panel of the "Power Amp"
4	**Transmitter Reflected Power** Press ***TXON (Unmod)***	< 5% of forward power or as specified by System Engineering.	10 W in-line wattmeter	Check for bad connections, damaged coax cable, etc.
5	**Carrier Frequency Error** Press ***TX (Unmod)***	< ±300 Hz	Service monitor set to read frequency error	Adjust TCXO (IC700) (see inside Exciter module at, Figure 24
6	**TX Deviation (KHz)** Press ***TX (modulated)*** Carrier will be modulated with a 1 kHz tone.	±8.0 kHz **Tolerance is +5%, -10%**	Service monitor set to read deviation. (IF filter set to Mid or 30 kHz position)	Refer to tech support

CHECKLIST B (Paragon-III) General Check out (part2 of 2)				
Paragon-III units are set and characterized at the factory to optimize performances. It is **not recommended** to try readjusting units unless it is really required. Misadjusting unit may result in significant performance losses. **The proposed adjustments in the "IF NOT?" column below, should be tried ONLY if system data performance degradation is noticed combined with out of tolerance items.**				
Step	**ACTION**	**EXPECTED RESULTS at 25°C**	**MEASURE WITH**	**IF NOT?**
Set the service monitor to generate on the selected receive frequency. Verify alternately for both receivers. The carrier should be modulated with a 1.0 kHz tone at deviation level specified below:				
8	**12 dB SINAD** (Dataradio wide band measurement method: no audio filtering) Set deviation to ±8 kHz.	Better than -108 dBm including cable loss (Typically -109 to -110 dBm)	- Backplane corresponding to the receiver being verified: J1 (RX1) or J5 (RX2), Pin 6 Service monitor (IFR) set to SINAD - IFR IF filter set to MID position or 300 kHz wide filter.	Refer to section **Error! Reference source not found.**
9	**Receiver distortion** (Dataradio wide band measurement method: no audio filtering) - Set service monitor RF Gen output to –70 dBm - *Deviation level as per SINAD above.*	≤ 5.5 % (Typically < 3.5 %)	- Backplane corresponding to the receiver being verified: J1 (RX1) or J5 (RX2), Pin 6 Service monitor (IFR) set to DISTORTION. - IFR IF filter set to MID position or 300 kHz wide filter.	Refer to section **Error! Reference source not found.**
10	**RSSI** Apply to each receiver input the following RF level of -110dBm	2.0 VDC (+/- 0.3VDC)	- Backplane corresponding to the receiver being verified: J1 (RX1) or J5 (RX2), Pin 5 - DC Voltmeter measurement	Refer to section x for all models. Refer to factory technical support only if RX data performance degradation is noticed combined with out of tolerance RSSI readings.

5.3 Additional test details

5.3.1 RF Data Link Test

A link test between a mobile and a known base station can be done using the CDip "Address" and "Send" functions. The “Address” and “Device” fields, the “Send” button and the “Chat” message screen are used to send messages to specific mobile or base or to carry out RF test. Start by entering the address of the mobile (or base station) you wish to send a test message to or test:

1- Specify the address:

Addresses may be entered by typing directly in the “Address” field in two ways:

- Numerically, the valid address range is 1-126.
- As an “Alpha-Mapped-Nibble” (AMN) address, consisting of upper case letters in the range A-P.

The valid address range is A to GN.

- The base address is usually: 1.
- The program may display one of the following messages on the status bar:
- **For Paragon-III products:**

  “address is not in AMN or number format”
- **For mobile products:**

  “address is not in the range A – GN”

In either case, check that the address entered is within the acceptable range, is of a valid format and correctly typed.

2- Enter the Device number for mobile (or base station).

3- Press the Send button.

The Chat window reports “Sent to xx mobile” *(where xx is mobile name)*.
If test is successful:
Status line reports “Delivery confirmed.
If test unsuccessful:
Chat window reports “Waiting”,
Then the Status line reports “Delivery Failed”.

5.4 Windows/Unix Tools

5.4.1 Network Connectivity

- PING

  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 amount 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 ww.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

6. Radio Programming and Adjustments

6.1 T881-10 Radio Transmitter Programming

This procedure describes the steps needed to program the Paragon-III radio transmitter module.

6.1.1 Recommended Items

- 486 PC or better, MS-Windows 98 © or later
- T800win programming kit for Series II:
- PGM800Win programming software user's manual
- PGM800Win Windows based programming software version 3.0 or later
- T800-01-0002 programming cable (DB-25 to RJ-45 cable)
- Standard 25-pin parallel cable (terminated Male/Female)

6.1.2 T881-10 Module Programming

Before starting programming, have a PC running MS-Windows © and the Tait PGM800Win software for Series II Base station.

This program supports the use of a mouse but may be used without one if required. Keyboard access follows the conventional MS-Windows © method as briefly described below:

- Press and hold the “Alt” key while pressing at the same time the relevant hotkey as indicated by an underlined letter on the menu command.
- On a drop-down menu, press only the hotkey without pressing the “Alt” key.
- Use the “Tab” key to cycle available fields and the “Enter” key to validate entries. *E.g. Pressing “Alt”+F opens the File drop-down menu and pressing “A” opens the Save As directory service box.*

The transmitter VCO alignment will be required when new transmitter frequency is programmed outside the radio tuning range: ± 4.0 MHz from previous center frequency. The legal frequency ranges for this transmitter are:

762-764 MHz and 767-773 MHz. The retuning of the VCO will normally only be required when passing from one range to the other.

1. Connect the PC, via the supplied programming lead, to the speaker panel’s front-mounted RJ11 connector.
2. Run Tait PGM800Win program and follow instructions found in the T800 Programming Software User’s Manual to select the proper module to be programmed.
3. Program required channel's frequencies.
   – Do not program any CTCSS tones on channels.
   – Do not change any other parameters.
   – Refer to Figure 21 and Figure 22 for screen program examples.
4. Save the base station programming info to a file for further reference.

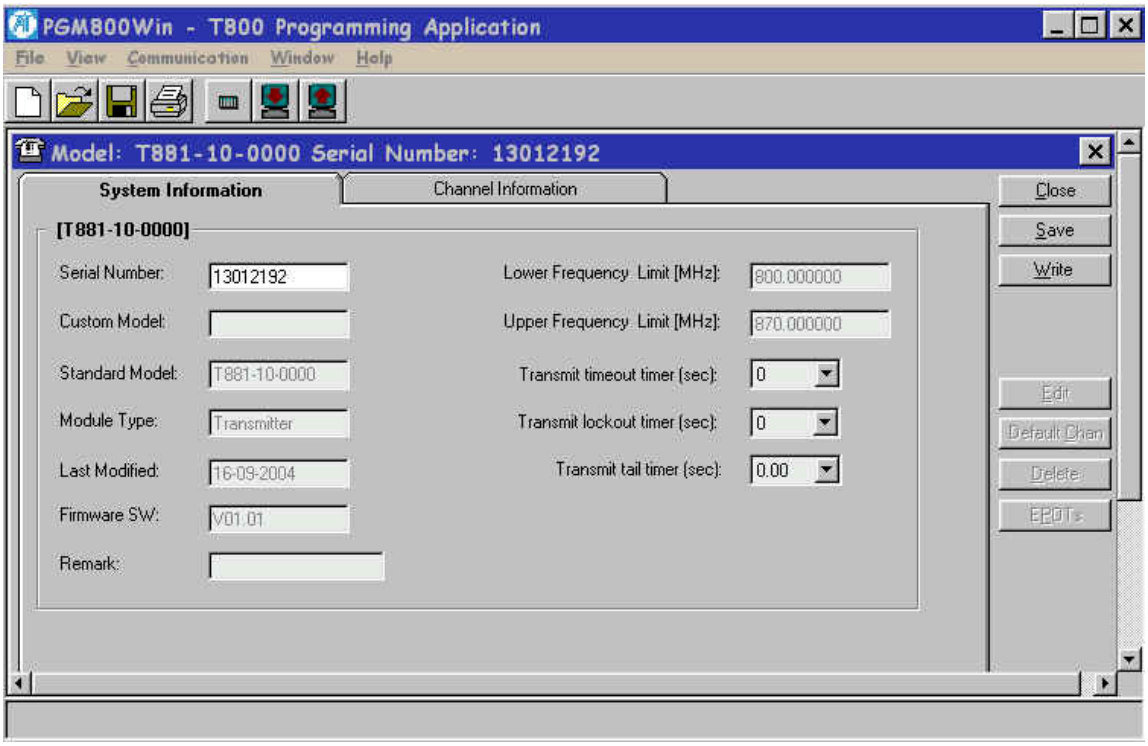

Figure 21 - Exciter System Infomation Sample

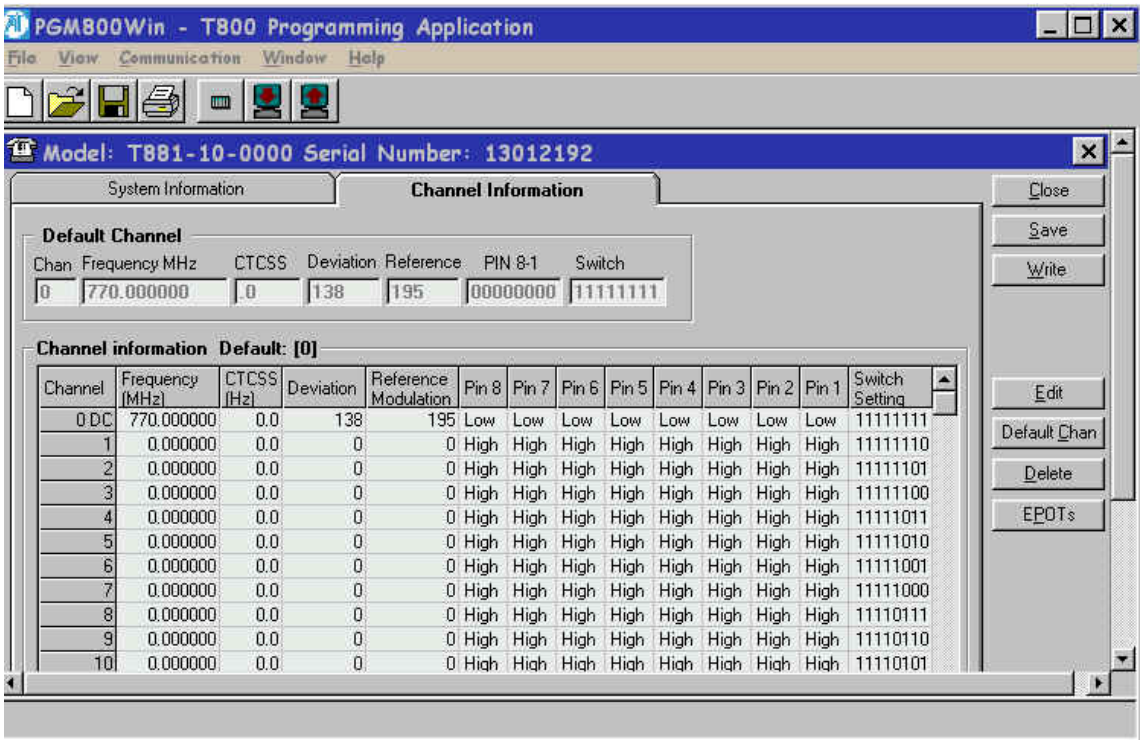

Figure 22 - Exciter Channel Information Sample

6.1.3 Channel Selection via DIP Switches

The backplane-mounted DIP switch settings override the default channel programmed by PGM800Win.

To set a default channel via the software, all DIP switches must be set to “OFF” (i.e. 00000000).

When a switch is “Off”, its binary count is active; when a switch is “ON” its binary count is inactive. The various DIP switch combinations of ON or OFF make up a binary total, which identifies the channel number.

To select a channel, set the appropriate DIP switch or switches to “OFF” to make the binary count total the channel number you want. Set all other switches to “ON”.

Example: To select channel 1, set the DIP switches as shown below:

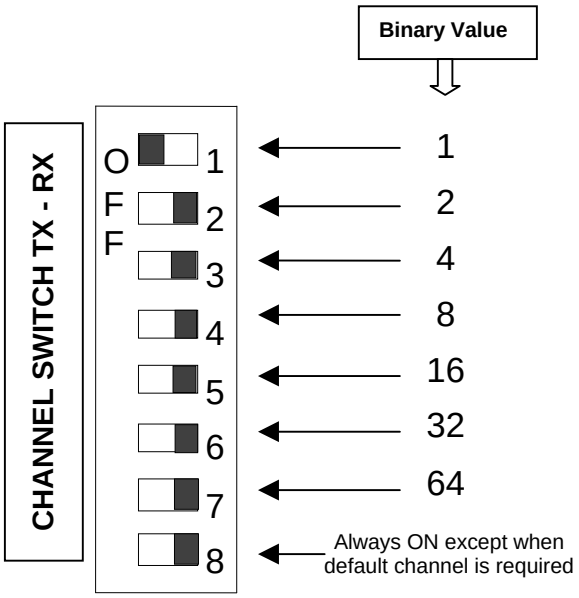

Figure 23 - Backplane DIP switches example - Channel 1 selected

6.2 Transmitter Radio Tuning

- This section covers the basic Series II base station 700MHz transmitter radio module and PA radio tuning and verification.

Note: Usually, this section is never done unless called for in section 6.1 "Series II - Radio Programming" or in Table 21 - Checklist B (General)**"Checklist B" (General).**

6.2.1 Test Equipment

- Digital Multimeter & probes (e.g. Fluke 77)
- 1 HP 34330A Shunt 30A (UHF only, used for transmitter current measurement)
- Digital or Analog calibrated Oscilloscope & scope probes (X1, X10 selectable)
- Calibrated COM-120B (.001ppm OCXO and 30kHz IF options)
- 3-foot length of double-shielded N-M to BNC-M cable (RG-214 or RG-223)
- 2x 'BNC' to 'N' type adapters (e.g. Amphenol, Greenpar).
- Bird RF power meter with 150W / 50 ohm dummy load (optional)
- 3dB 150–watt attenuator
- 1x Torx screwdriver #T-10 and #T-20
- Pozidriv screwdriver #1 & #2
- 1x Six-inch adjustable wrench
- RF tuning/trimming tools.
- Extender Rail Kit for Series II chassis (T800-13-0000)
- 1x 6" coax cable N-M to BNC-M (comes with the radio to connect the exciter to the PA)

6.2.2 Transmitter Module (T881-10-02200)

Note 1: Refer to Figure 24 (T881).

Note 2: When the synthesizer is unlocked, the front panel green LED called "Supply" will flash indicating that it needs re-tuning.

Warning:

The LED will also flash when the unit is in setup mode while connected to the PGM800win program.

6.2.2.1 Initial Setup

1. Shut down power to the base station.
2. Prepare the Multimeter to DC Volts.
3. Remove the exciter (T881) module from the base station rack frame.
4. Remove the exciter top cover (nearest the handle).
5. Connect a 3 feet long double shielded cable (N-M to BNC-M) between the IFR T/R output and the exciter antenna connector.
6. Connect the Paragon-III Extender Rail Kit to the empty chassis exciter slot.
7. Apply power to the base station.

6.2.2.2 Synthesizer Alignment

Single channel: Connect the Multimeter to either side of L309 (T881).

- T881 (700 MHz) Tune VCO trimmer CV300 for a synthesizer loop voltage of 10V DC.

Multiple channels (adjusting as shown for single channel above):

- T881 (700 MHz) Adjust the VCO loop to 10V using the middle frequency channel.

All channels should lie within the upper and lower limits of 16V and 3V respectively for the T881.

Note:

Normally, the fast TX key option is installed and the synthesizer is always energized. In the case where that option was not fitted, key the transmitter by pressing the front panel Carrier button to make the above adjustment possible.

6.2.2.3 TX Frequency Error Adjustment

1. Apply the following settings to the IFR:
   - Receiver mode
   - IFR RX frequency to match the main radio TX frequency
   - IF Filter set to 30KHz
   - Zoom the RF Error window: select 10Khz range
2. Key the transmitter by pressing the front panel TX-Key button and measure the carrier output frequency. It should be within ±300 Hz. If it is not, adjust the TCXO (IC700) to trim to meet the requirement, preferably within 100Hz.

6.2.2.4 Exciter Power Output

1. Apply the following settings to the IFR:
   - Receiver mode, Output T/R
   - IFR RX frequency to match the main radio TX frequency
   - IF Filter set to 30KHz
   - Select auto range in the *Power reading* window
   - Connect the coaxial cable from the IFR T/R to the Exciter output connector
2. Key the Exciter by pressing the module PTT button. The output power at the coaxial cable end connecting to the power amplifier should be:
   - T881 = 5W +0/-300mW (RV502, Figure 24)

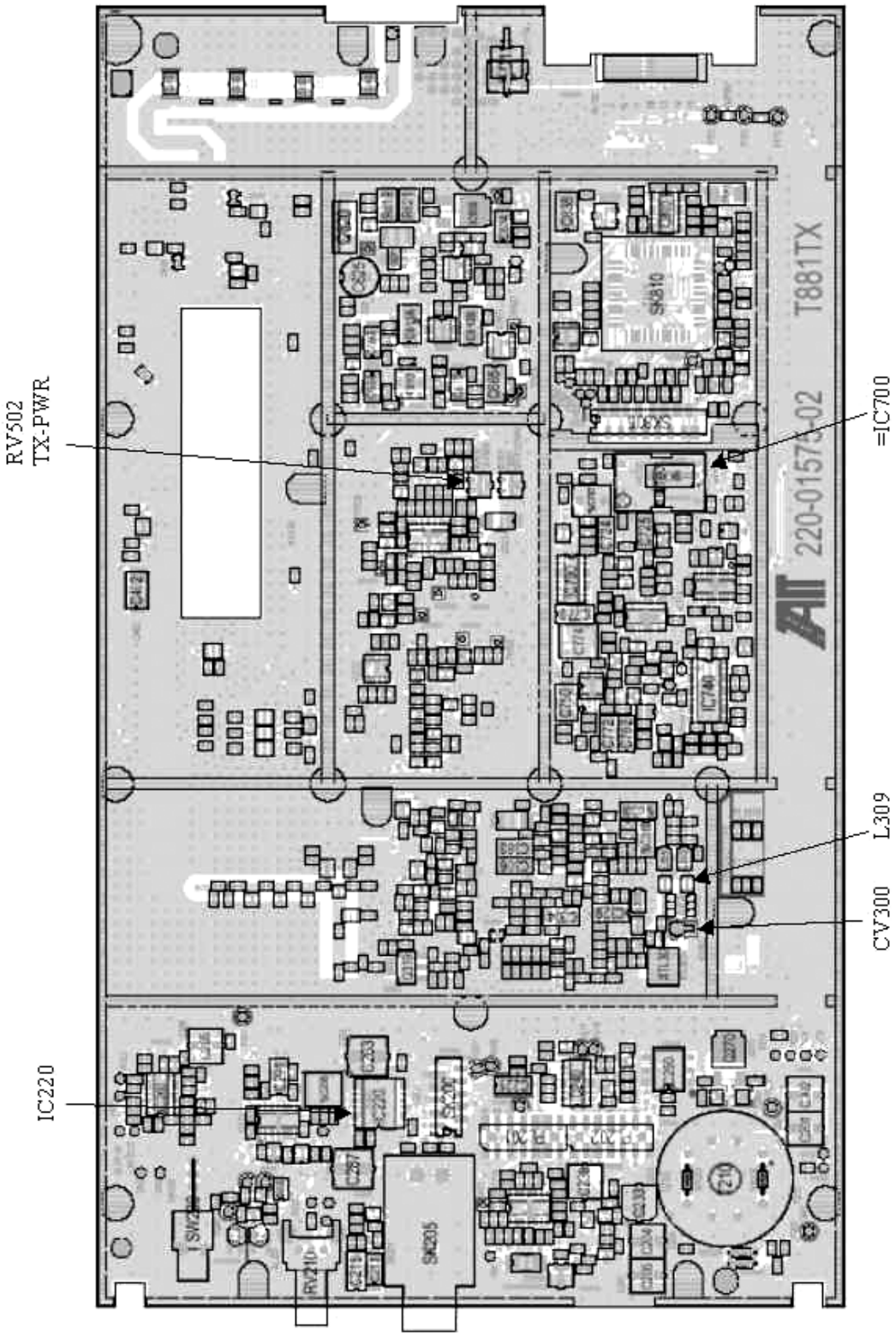

Figure 24 - T881-0200 Transmitter Tuning Controls location

7. Specifications

GENERAL

Frequency	762 -764 MHz Tx/ 792-794 MHz Rx and 767- 773MHz Tx/797-803MHz Rx
RF/Modem Assembly Size	19.0" W x 17.5.0" H x 12.5" D + 2.0" connector allowance
Frequency Stability	1.0 ppm (-20 to +60°C)
Supply Voltage	13.8 VDC nominal (negative ground), 10.8 - 16 VDC or 120 VAC
Circuit protection (radio backplane)	Main fuse (F1): Blade fuse (Maxi-Fuse) 10A : Power amp. fuse (F2 & F3): Blade fuses (Maxi-Fuse) 2 x 15A (30A total) Crowbar diodes for reverse polarity protection
RX Current Consumption @ 13.8 VDC	1.5A max. (Two receivers with speaker monitoring)
TX Current Consumption @ 13.8 VDC	1.7A max –5W Exciter T881, 25A – 50W PA AET
Base Station Power Consumption @ 120 VAC	TBD
Channel spacing	50 kHz
Operating Temperature Range	-30°C to +60°C (deleted power supply, catalog number with 0 in second to last digit) -10°C to +60°C (with standard Dual Power Supply assy., catalog number with 2 in second to last digit)

RECEIVER

Selectivity @ 25 kHz @ 12.5 kHz	85 dB min, 88 dB (Typical) 79 dB min, 80 dB (Typical)
Sensitivity @ 12 dB SINAD	-116 dBm*
Spurious Response Rejection	100 dB (Typical)
Intermodulation Rejection - EIA (25 kHz) - EIA 300-096 (12.5 kHz)	 80 dB (Typical) 75 dB (Typical)
Hum and Noise - EIA (25 kHz) - ETS 300-096 (12.5 kHz)	 47 dB* 45 dB*

***** Psophometrically weighted (De-emphasis response)

TRANSMITTER –5W

Rated Continuous RF Power	70W nominal
Range of Adjustment	35W – 70 W (user adjustable)
Spurious Emissions: - transmit - standby	-36 dBm to 1GHz, -30 dBm to 3.2GHz -57 dBm to 1GHz, -47 dBm to 3.2GHz
VSWR Stability	3:1 mismatch
Transmitter Sideband Noise (ACP) @ +/-50 kHz @ +/- 1 MHz	 -40 dBc -100 dBc

Operation	Full duplex
Protocol	Dataradio Proprietary E-DBA with OOB AAVL support

Data rates and Modulation type	xRC16FSK (128 kb/s) xRC8FSK (92 kb/s)* xRC4FSK (64 kb/s)*

* Operating under Class I permissive change, subset of 16-Level FSK

POWER AMPLIFIER – 70W

Frequency Range	762-776 MHz
Operative Voltage	13.8 VDC
Current Draw	18-21 Amperes (typical)
Duty Cycle	100% (Continuous)
Power Input	5W
Power Output	70 Watts CW
RF Power Adjustment	-3dB (Nominal)
Spurious & Harmonics	-70 dBc
input/output Impedance	50 ohms
Load VSWR Tolerance	20:1 (Max) 30 seconds
input/output connectors	Type N female
Operating Temperature Range	-30 degrees C. to +60 degrees C.
Storage & Transport	-40 degrees C. to +70 degrees C.
Humidity	80% at +40 degree C. (non-condensing)
Altitude	10,000 feet maximum
Size	5.25"W x 10.5"H x 13"D
Weight	18 pounds (Nominal)

FCC CERTIFICATIONS **762-764MHz and 767-773MHz**	FCC	IC (DOC)
	EOTBDP3-T881 -5W exciter T881 EOTBDP3-AMP – 70W PA option AMP	NA

EMISSION DESIGNATORS

Bit rate	***Baud rate***	***Modulation***	***700MHz***
128 kb/s	32000	xRC16FSK	30K0F1D
96 kb/s	32000	xRC16FSK	30K0F1D
64 kb/s	32000	xRC16FSK	30K0F1D