

**User / Operational Manual**

*Operational or User's Manual*

The manual should include instruction, installation, operator, or technical manuals with required 'information to the users'. This manual should include a statement that cautions the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. The manual shall include RF Hazard warning statements, if applicable.

The instruction and service manual for this base radio are not published at this time. However, draft copy of some of the manual information has been assembled and has been included as part of this filing package.

Upon request, published and/or printed manuals will be sent to the commission and/or telecommunication certification body (TCB) as soon as they become available. All of the descriptions, block diagrams, and schematics that are included in this filing package are current as of the package submittal date.

**EXHIBIT DESCRIPTION**

- D1-1 Manual Front Matter (Draft)
- D1-2 Specifications (Draft)
- D1-3 Field Replaceable Units and Orderable Parts (Draft)
- D1-4 Tune-Up Procedure
- D1-5 Racking Configurations
- D1-6 Functional Description / Operation of Modules (Draft)

## User / Operational Manual

Manual Front Matter (Draft)

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EPS-34440-B

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- a. the product is used in other than its normal and customary manner;
- b. the product has been subject to misuse, accident, neglect or damage;
- c. unauthorized alterations or repairs have been made, or unapproved parts used in the equipment.

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In order to obtain performance of this warranty, purchaser must contact its Motorola salesperson or Motorola at the address first above shown, attention Quality Assurance Department.

This warranty applies only within the United States.

EPS-48759-O

**FCC INTERFERENCE WARNING**

The FCC Requires that manuals pertaining to Class A and Class B computing devices must contain warnings about possible interference with local residential radio and TV reception. This warning reads as follows:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial or residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

## FOREWORD

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### Product Maintenance Philosophy

Due to the high percentage of surface-mount components and multi-layer circuit boards, the maintenance philosophy for this product is one of Field Replaceable Unit (FRU) substitution. The station is comprised of self-contained modules (FRUs) which, when determined to be faulty, may be quickly and easily replaced with a known good module to bring the equipment back to normal operation. The faulty module must then be shipped to the Motorola System Support Center for further troubleshooting and repair to the component level.

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### Scope of Manual

This manual is intended for use by experienced technicians familiar with similar types of equipment. In keeping with the maintenance philosophy of Field Replaceable Units (FRU), this manual contains functional information sufficient to give service personnel an operational understanding of all FRU modules, allowing faulty FRU modules to be identified and replaced with known good FRU replacements.

The information in this manual is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMRs are added to the manuals as the engineering changes are incorporated into the equipment.

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Manual Front Matter (Draft, Continued)

## GENERAL SAFETY INFORMATION

The following general safety precautions must be observed during all phases of operation, service, and repair of the equipment described in this manual. The safety precautions listed below represent warnings of certain dangers of which we are aware. You should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

### General Safety Precautions

- ▶ Read and follow all warning notices and instructions marked on the product or included in this manual before installing, servicing or operating the equipment. Retain these safety instructions for future reference. Also, all applicable safety procedures, such as Occupational, Safety, and Health Administration (OSHA) requirements, National Electrical Code (NEC) requirements, local code requirements, safe working practices, and good judgement must be used by personnel.
- ▶ Refer to appropriate section of the product service manual for additional pertinent safety information.
- ▶ Because of danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modifications of equipment.
- ▶ Identify maintenance actions that require two people to perform the repair. Two people are required when:
  - A repair has the risk of injury that would require one person to perform first aid or call for emergency support. An example would be work around high voltage sources. A second person may be required to remove power and call for emergency aid if an accident occurs to the first person.  
**Note** Use the National Institute of Occupational Safety and Health (NIOSH) lifting equation to determine whether a one or two person lift is required when a system component must be removed and replaced in its rack.
- ▶ If troubleshooting the equipment while power is applied, be aware of the live circuits.
- ▶ DO NOT operate the transmitter of any radio unless all RF connectors are secure and all connectors are properly terminated.
- ▶ All equipment must be properly grounded in accordance with Motorola Standards and Guideline for Communications Sites "R56" 68P81089E50 and specified installation instructions for safe operation.
- ▶ Slots and openings in the cabinet are provided for ventilation. To ensure reliable operation of the product and to protect it from overheating, these slots and openings must not be blocked or covered.
- ▶ Only a qualified technician familiar with similar electronic equipment should service equipment.
- ▶ Some equipment components can become extremely hot during operation. Turn off all power to the equipment and wait until sufficiently cool before touching.

### Human Exposure Compliance

This equipment is designed to generate and radiate radio frequency (RF) energy by means of an external antenna. When terminated into a non-radiating RF load, the base station equipment is certified to comply with Federal Communications Commission (FCC) regulations pertaining to human exposure to RF radiation in accordance with the FCC Rules Part 1 section 1.1310 as published in title 47 code of federal regulations and procedures established in TIA/EIA TSB92, Report On EME Evaluation for RF Cabinet Emissions Under FCC MPE Guidelines. Compliance to FCC regulations of the final installation should be assessed and take into account site specific characteristics

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*Manual Front Matter (Draft, Continued)*

such as type and location of antennas, as well as site accessibility of occupational personnel (controlled environment) and the general public (uncontrolled environment). This equipment should only be installed and maintained by trained technicians. Licensees of the FCC using this equipment are responsible for insuring that its installation and operation comply with FCC regulations Part 1 section 1.1310 as published in title 47 code of federal regulations.

Whether a given installation meets FCC limits for human exposure to radio frequency radiation may depend not only on this equipment but also on whether the "environments" being assessed are being affected by radio frequency fields from other equipment, the effects of which may add to the level of exposure. Accordingly, the overall exposure may be affected by radio frequency generating facilities that exist at the time the licensee's equipment is being installed or even by equipment installed later. Therefore, the effects of any such facilities must be considered in site selection and in determining whether a particular installation meets the FCC requirements.

FCC OET Bulletin 65 provides materials to assist in making determinations if a given facility is compliant with the human exposure to RF radiation limits. Determining the compliance of transmitter sites of various complexities may be accomplished by means of computational methods. For more complex sites direct measurement of the power density may be more expedient. Additional information on the topic of electromagnetic exposure is contained in the Motorola Standards and Guideline for Communications Sites publication. Persons responsible for installation of this equipment are urged to consult the listed reference material to assist in determining whether a given installation complies with the applicable limits.

In general the following guidelines should be observed when working in or around radio transmitter sites:

- ▶ All personnel should have electromagnetic energy awareness training
- ▶ All personnel entering the site must be authorized
- ▶ Obey all posted signs
- ▶ Assume all antennas are active
- ▶ Before working on antennas, notify owners and disable appropriate transmitters
- ▶ Maintain minimum 3 feet clearance from all antennas
- ▶ Do not stop in front of antennas
- ▶ Use personal RF monitors while working near antennas
- ▶ Never operate transmitters without shields during normal operation
- ▶ Do not operate base station antennas in equipment rooms

For installations outside of the U.S., consult with the applicable governing body and standards for RF energy human exposure requirements and take the necessary steps for compliance with local regulations.

**References**

TIA/EIA TSB92 "Report On EME Evaluation for RF Cabinet Emissions Under FCC MPE Guidelines," Global Engineering Documents: <http://global.ihs.com/>

FCC OET Bulletin 65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields": <http://www.fcc.gov/oet/rfsafety/>.

Motorola Standards and Guideline for Communications Sites, Motorola manual 68P81089E50.

IEEE Recommended Practice for the Measure of Potentially Hazardous Electromagnetic Fields – RF and Microwave, IEEE Std C95.3 – 1991, Publication Sales, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855–1331

IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300GHz, IEEE C95.1 – 1991, Publication Sales, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855–1331.

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Specifications (Draft)

<b>General Performance</b>			
Model	T7039		
H x W x D	5.25" x 19" x 18" (133x483x457mm)		
Weight	45 lbs (20 kg)		
Power Requirements			
	AC:	90-264 VAC, 47-63 Hz	
	DC:	43-60 VDC	
Temperature Range	-22 to 140F (-30 to 60C)		
Input / Output Impedance	50 ohms		
Antenna Connectors			
	Transmit:	N female	
	Receive:	N female	
Modulation			
	IV&D Transmit / Receive:	C4FM, LSM	
Frequency Stability	External Reference		
Channel Spacing			
	C4FM / LSM:	12.5 kHz	
<b>Transmitter</b>			
Frequency Range	136-174 MHz		
Power output			
	C4FM:	2-100 Watts	
	LSM:	2-60 Watts (Average)	
Electronic Bandwidth	Full Bandwidth		
Intermodulation Attenuation	40 dB		
Spurious and Harmonic Emissions Attenuation	90 dB		
<b>FCC Type Acceptance</b>			
	<b>FCC Designation:</b>	<b>Frequency Range</b>	<b>Type</b>
	ABZ89FC3790	136-174 MHz	Transmitter, C4FM
			Transmitter, LSM
	ABZ89FR3791	136-174 MHz	Receiver
			Power Output
			Variable 2-100 W
			Variable 2-60 W
			N/A

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Field Replaceable Units and Orderable Parts (Draft)

Field replaceable units, or FRUs, include special packaging to allow shipment to customers. Parts and FRUs available for customer order are listed in this section. All parts and FRUs are sourced through the Radio Products and Service Division (RPSD).

VHF Product Offering P/N VHF PA – Power Amplifier CLD1303A

LPF – Low Pass Filter	CLD6109A
LDM – Linear driver module	CLD6107A
Distribution	CLD6108A
LFM – Final Module	CLD6104A
VHF XCVR – Transceiver	CUD1000A
XCVR VHF RF kit	CUD6000A
RMC Pass Through Module	MCLD6106A
RMC Pass Through Module	MCLD1309A
VHF BR – Base Radio	T7039A
VHF – 6 pack includes expansion rack	T7054A
PMU – Power Monitoring Unit	0171259H01 and H02

<u>Model/Option</u>	<u>Description</u>	<u>FRU</u>	<u>Description</u>
CA00290AC	INC: VHF 150-174 TRANSCEIVER	DLN6568A	FRU: AC / 48V DC Power Supply
CA00292AC	INC: VHF 136-174 PA	DLN1327A	FRU: Power Supply Fan Module
X530BG	ADD: VHF MID POWER (136-174 MHZ)	DLN6569A	FRU: Site Controller
CA01170AA	ADD: PMU VHF (136-174 MHZ)	DLN6636A	FRU: Expansion HUB
CA01164AA	CABINET RMC PASS THROUGH MOD	DLN1380A	FRU: Cabinet RMC Pass Through Module
X265AN	NARROW PRESELECTOR, 132-154 MHZ	DLN1338A	FRU: Fan Module
X265AM	NARROW PRESELECTOR, 150-174 MHZ	DLN1329A	FRU: Site Controller Backplane
X182CC	DUPLEXER, 132-146 MHZ	DLN1330A	FRU: Base Radio Backplane
X182CB	DUPLEXER, 144-160 MHZ	DLN1343A	FRU: Expandable Site Subsystem Backplane
X182CA	DUPLEXER, 158-174 MHZ	DLN1339A	FRU: AC Power Distribution Module
X676BJ	EXT DUAL CIRCULATOR, 132-146		
X676BI	EXT DUAL CIRCULATOR, 144-160		
X676BH	EXT DUAL CIRCULATOR, 158-174		
CA01182AA	VHF DUPLEXER HARDWARE KIT		
DLN1380A	FRU: CABINET RMC PASS THROUGH MODULE		
DLN1376A	FRU: TRANSCEIVER VHF 136-174		
DLN1377A	FRU: VHF 136-174 PA		
T7321A	GCM 8000 COMPARATOR		
CA01183AA	GCM 8000 COMPARATOR		
X153AW	Rack Mount Hardware		

*Customer Replaceable Power Cables for Standalone Base Radio*

<u>Part Number</u>	<u>Description</u>
TRN7663A	Power Cable, North America
TRN7755A	Power Cable, Continental Europe
TTN5049A	Power Cable, UK / Ireland
TTN5103A	Power Cable, Australia

*Other Customer Replaceable Parts*

<u>Part Number</u>	<u>Description</u>
3084827Y01	Battery Temperature Sensor Extension Cable
6484850Y01	Junction Panel (Cabinet Mounting)
6485367Y01	Junction Panel (Rack Mounting)

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Field Replaceable Units and Orderable Parts (Draft) (Continued)

Table 10-5 GTR 8000 – Other Customer Replaceable Parts (Continued)

Component Type	Part Number
Rack Mount Hardware	TTN5028A
Fan Filler Panel	CLN8253A
PS Filler Panel	CLN8238A
PS Panel	9184680Y01
Housing, Fan Module	1584949Y01
Cover, Fan Module Display	1584950Y01
Connector RJ45 Coupler	0904347X02
Sub-panel, Network Expansion	0180706H20
Sub-panel, RX Expansion	0180706H26
Sub-panel, Expansion #1	0180706H25
Sub-panel, Primary #1	0180706H19

## Quick Connect RF Coaxial Adapters for GTR 8000 Support

Table 10-6 Quick Connect RF Coaxial Adapters for GTR 8000 Support

Type	Adapter / Connector description	Motorola Part Number
"N"/QN	Female "N" to Male QN	5886055Y01
"N"/QN	Female "N" to Female QN	5886055Y10
"N"/QN	Male "N" to Male "QN"	5886055Y05
QN	Right Angle Male QN cable plug for RG-400 coax	2871002H01
QN	Right Angle Male QN cable plug for RG-213 coax	2886067Y01
N/QMA	Female "N" to Male QMA	5886055Y06
N/QMA	Female "N" to Female QMA	5886055Y07
QMA/QMA	Female QMA to Female QMA	5886055Y08
QMA/QMA	Male QMA to Male QMA	5886055Y09
7/16/QN	Female 7/16 to male QN	5886055Y03
7/16/QN	Male 7/16 to Male QN	5886055Y02
7/16/QN	"Female 7/16 to female QN Intermod test adaptor"	5886055Y04
7/16/QN	"Male 7/16 to female QN Intermod test adaptor"	5886055Y11



**NOTE**

For cables that are internal to a GTR 8000 subsystem, the part numbers are not listed in this documentation, but you can locate the part number on the cable itself before contacting Motorola Support.



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*Tune-Up Procedure*

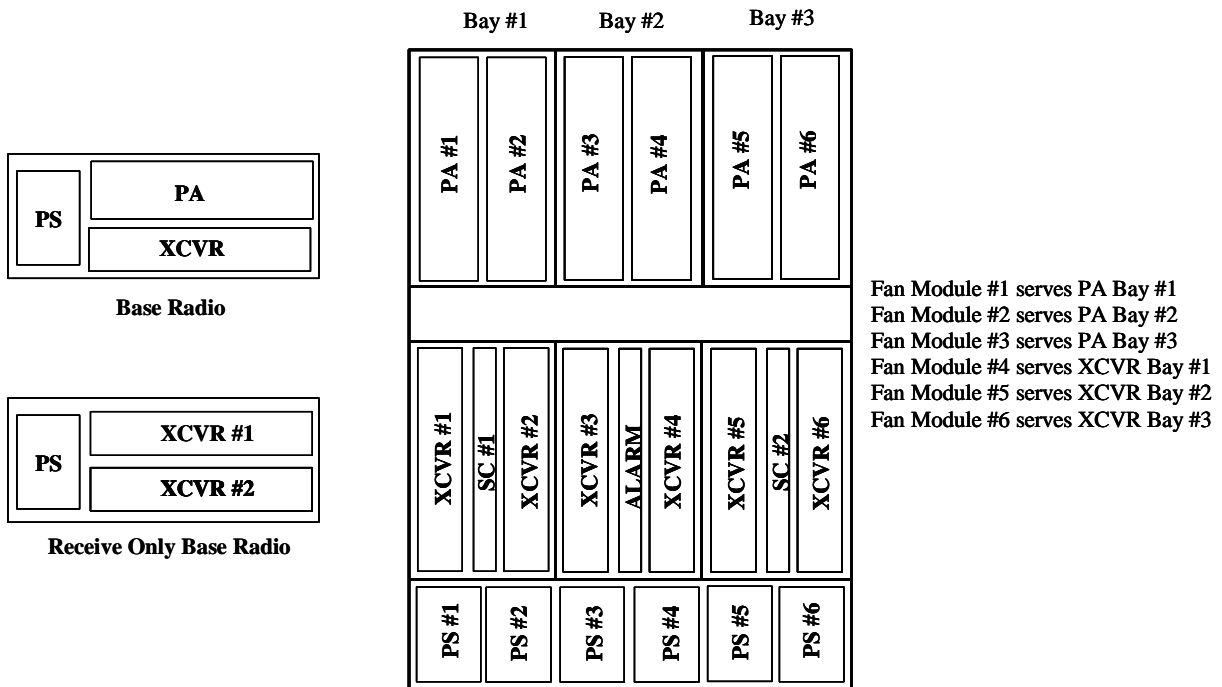
There is no field tune-up procedure. All adjustments are software controlled and are pre-set at the factory. Certain station operating parameters can be changed via man-machine interface (MMI) commands, within predetermined limits. Examples include transmit / receiver operating frequencies and transmitter power level.

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*Racking Configurations*

There are various equipment racking configurations available to customers. The following section includes sketches which depict many of the racking alternatives.

**Configuration Layout**



GTR 8000 Expandable Site Sub-system Layout

**User / Operational Manual***Functional Description / Operation of Modules (Draft)**Transceiver Module Overview*

The transceiver (XCVR) module provides receiver, exciter and base radio control functions.

*Receiver Overview*

The Receiver, which supports three-branch diversity, provides the receiver functions for the Base Radio. The receiver is a part of the 'transceiver' RF board and consists of a front end low noise amplifier section, an on board pre-selector section, an IF filter section, and a baseband converter section. The receiver Voltage Controlled Oscillator (VCO) and frequency synthesis circuitry blocks are also part of the receiver section. A digital decoding section for interface to the control section microprocessor also exists as part of the receiver module.

The receiver interconnects to the control module using an 84-pin flex cable connector. There are no user controls or indicators on the receiver. For IV&D, only single branch is supported. The receiver also provides enhanced diagnostic capabilities. This includes receiver sensitivity checking, using on board calibrated noise generator. The receiver first local oscillator is high side injection.

*Exciter Overview*

The exciter, in conjunction with the Power Amplifier or PA, provides the transmitter functions for the Base Radio. The exciter, which is a part of 'transceiver' RF board, consists of a baseband circuit block, a baseband modulator circuit block, a pre-amplifier circuit block, and a final amplifier circuit block. The transmitter Voltage Controlled Oscillator (VCO) and frequency synthesis circuitry blocks are also part of the exciter. Other functional blocks in the exciter include the various DC voltage regulators which drive the different circuits, the digital decoding circuitry block which interfaces the exciter circuits to the microprocessor in the control section, metering capability, and exciter to receiver loopback capability for diagnostic purposes.

The exciter interconnects to the control module using an 84-pin flex cable connector. There are no user controls or indicators on the exciter. The exciter uses a Cartesian feedback linearization scheme. The complete Cartesian feedback loop includes exciter and PA. The exciter includes an internal loop back feature which is used to perform exciter self diagnostic testing. The exciter also provides controlled output power level to power amplifier.

*Control Overview*

The Transceiver Control circuitry performs the control management, digital signal processing, and transmit and receive data formatting for the base radio (BR). The Host Processor is a Freescale MPC8250 and the main DSP is a Freescale MSC8101. A second DSP is a Texas Instrument device (TMS320VC5502) and is used for Block Encoding/Decoding. It also provides the various external interfaces described below.

**User / Operational Manual***Functional Description / Operation of Modules (Draft)*

The main operating software for the base radio is loaded in the transceiver's control section. As the main manager for the base radio, the XCVR control board provides operational control over the other station modules. It handles three types of information flow, in the following ways:

- Serves as a gateway between the network and RF functionality, by distributing the RF payload to and from the network
- Supports operational and diagnostic functions with digital control data (for example: site information, channel assignments, and identification numbers for call processing)
- Ensures the flow of other network management configuration information

The External interfaces include three Ethernet ports per Transceiver. Two of the Ethernet ports on the Transceiver are used to communicate with the site controller. On single base radios these two Ethernet ports go to RJ45 connectors on the backplane. In the GTR 8000 Expandable Site Subsystem the site controller and transceiver connect directly via the backplane. These two Ethernet interfaces also contain TDM signals which are used to pass time reference, frequency reference and control data to the station. The third Ethernet port is located on the front panel of the Transceiver and is used as a Dedicated CSS Port. A RS232 port also resides on the front panel and is also used as a Dedicated CSS Port.

Additional connections located behind the Fan Module are an asynchronous port, a synchronous port, and an alignment reference port. The synchronous port is used for V.24 application.

Inter-module communication is achieved using a Serial Peripheral Interface (SPI) bus. The SPI bus allows communication with the slave devices consisting of the Power Supply, Receiver, Exciter and Power Amplifier modules.

The Transceiver generates the station frequency reference which needs to be locked to one of many possible external sources of various frequencies. The external sources can be one of the site controller 20 MHz TDM clocks or an external reference operating at 5 or 10 MHz or 5 MHz/1pps composite signal.

*Status Indicators and Buttons*

There is one button on the Front Panel of the GTR 8000 Transceiver Module. This multifunction button can be used to reset the module or to place the transceiver in an access disable mode.

The number and color scheme of the LEDs is application specific. The LEDs indicate the following states: Online, Failure, Impaired, Booting, Lamp Test, Receiver Inhibited, Receiver Active, Illegal Carrier, Control Channel (Operating), Control Channel (Failsoft), Service Mode, Transmitter Inhibited, Infrastructure Line Connected,

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Functional Description / Operation of Modules (Draft)

Infrastructure Link Disconnected, Software Download, VLAN, Detection, VLAN Split, Warning, Minor Hardware Failure, Major Hardware Failure, Critical Hardware Failure, Ethernet link status.

Front Panel RS-232 / Ethernet (DB9) / RJ45 Interface

The Front Panel port supports 2-wire RS-232 on a DB9 connector and 10/100BaseT Ethernet on a RJ45 connector. See tables below for connector pinout.

Only the TXD and RXD signals are supported, no other handshake signals are provided. The table below shows the signals supported along with the Host hardware resource responsible the RS232 signals.

The front panel also supports a 10/100BaseT Ethernet port. The connector is configured and an MDI-X port that can be connected to a laptop using a standard cable. In essence, the transmit and receive signal pairs are reversed on the BRC front panel compared to that defined in IEEE Std. 802.3 Clause 14.5.1. The Ethernet PHY is a Broadcom BCM5221. Its address (4:0) is '00100'. Both the Front Panel Ethernet PHY and the CP2 PHY (BCM5222) communicate to the Host via the "bit -based" GPIO MDC and MDIO signals.

Front Panel Port Signals

RJ45 Pin #	RS-232 Signal
1	RD+ (Ethernet)
2	RD- (Ethernet)
3	TD+ (Ethernet)
4	NC
5	NC
6	TD- (Ethernet)
7	NC
8	NC

Front Panel RS232 Cable Adapter

RJ45 Pin #	RS232 DB9 / Female
1	NC
2	TXD (RS232) (Host PA9)
3	RXD (RS232) (Host PA8)
4	NC
5	GND
6	Ext_Trigger_In (DSP IRQ1)
7	NC
8	GND
9	Ext_Trigger_Out (DSP PA20)

Power Amplifier Module Overview

The GTR 8000 Power Amplifier (PA) is a hot-swap capable, forced convection cooled RF power amplifier. It accepts a low-level modulated RF signal from the transceiver module, and amplifies it for transmission via the site transmit antenna. Also, to complete the Cartesian correction loop (GTR 8000's linearization method), it provides a low level RF feedback signal to the transceiver module to achieve the required transmitter linearity. The power amplifier consists of the several sub-circuits and boards including core, driver, final, isolator, low pass filter, power converter and distribution.

*Functional Description / Operation of Modules (Draft)*

There are three electrical connection assemblies on the PA:

- Power supply/communications connector (backplane connection)
- RF input/feedback connector (backplane connection)
- RF output connector (front “quick-N” or QN connection)

The PA is secured to the card cage with 2 TORX screws (T20 bit size required).

The PA has 3 front panel LED indicators that work in concert with each other. Their meaning is as follows when the BR is powered:

1) PA TRANSMIT LED (Bi-Colored):

- RED LIGHT indicates that the PA is transmitting at less than full requested power
- GREEN LIGHT indicates that the PA is transmitting at full requested output power
- NO LIGHT indicates that the PA is not in a transmitting state

2) PA STATUS LED:

- GREEN LIGHT (on) indicates the PA is functioning normally
- GREEN LIGHT (off) indicates a PA failure
- GREEN LIGHT (blinking) the base radio is booting

3) PA ALARM LED:

- RED LIGHT (on) indicates a PA failure
- RED LIGHT (off) indicates that the PA is functioning normally
- RED LIGHT (blinking) the PA is impaired

The power amplifier (PA) module is a forced convection cooled RF power amplifier that operates to the following electrical performance specifications:

- Maximum Rated Average Power Out: 110 Watt
- Rated Peak Power Out: 200 Watt
- Minimum Rated Average Power Out: 2 Watt
- Nominal RF Gain: 42 dB
- Nominal Input Supply Voltage: 29 Volts DC
- Maximum Modulation Bandwidth: 25 kHz
- Operational Frequency Range: 136 MHz to 174 MHz

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*Functional Description / Operation of Modules (Draft)*

The Power Amplifier is comprised of six internal modules. These are described briefly in the following paragraphs.

1. The Core Board provides the following functionality:
  - Routes DC to the Converter and Driver Boards
  - Routes RF to the Driver Board
  - Provides gain and FB power control
  - Provides for diagnostic sensors
  - Provides for intermediate voltages used by itself and other modules in the PA
  - Provides the PA's digital interface to the rest of the Base Radio
  - Provides for cooling measures control
  - Provides for control of subordinate modules
2. The Power Converter Board provides the following functionality:
  - Provides 29 Volts DC and an intermediate voltage to the Distribution Board
3. The Driver Amplifier Board provides the following functionality:
  - Provides the first RF gain stage of the PA
  - Provides supporting bias circuits for the Driver Amplifier
4. The Final Amplifier Board provides the following functionality:
  - Provides the second RF gain stage of the PA (parallel stage)
  - Provides supporting bias circuits for the Final Amplifier
  - Provides for RF power splitting
  - Provides for RF power combining
  - Provides diagnostics
5. The Distribution Board provides the following functionality:
  - Provides for RF routing from the Driver Amplifier to the Final Amplifier
  - Provides for RF routing from the Final Amplifier to the Output Module
  - Provides for DC power routing from the Core Board to the Output Module
  - Provides for DC power routing from the Power Converter Board to the Final Amplifier
  - Provides for Forward and Reverse Power routing from the Output Module to the Core Board
  - Provides for feedback power coupling to the Core Board
  - Routes module control from the Core Board to the Final Module
  - Routes diagnostics from the Final Module to the Core Board
6. The Output Module provides the following functionality:
  - Provides output isolation to the PA
  - Provides for harmonic attenuation
  - Provides for forward and reverse power detection

*Power Supply Module Overview*

The power supply module operates from either an AC or DC input and provides the DC operating voltages for the other Base Radio modules. These modules are sometimes also referred to as field replaceable units (FRU).

When operating from an AC source (90 to 264 VAC, 47 to 63 Hz), the supply generates two DC output voltages of 28.94 Volts with reference to output ground. The power supply automatically adjusts to AC input ranges and supplies a steady output. In AC mode, the power supply contains a separate battery charger which can be used to maintain the charge on a 48 Volt DC nominal system, positive or negative ground (if installed).

**User / Operational Manual***Functional Description / Operation of Modules (Draft)*

When operating from a DC source (43.2 VDC to 60 VDC, positive or negative ground), the supply generates two DC output voltages of 28.94 Volts with reference to output ground. The battery charger is not useable when operating from a DC input power source.

When both AC and DC sources are available, the power supply operates from the AC source. When the AC source is lost, the power supply automatically shifts to DC operating mode. When the AC source is restored, the power supply automatically shifts to AC operating mode. Output is not interrupted when switching between AC and DC sources.

The power supply contains several switching-type power supply circuits, power factor correction circuitry, battery charging circuitry, diagnostics and monitoring circuitry.

The power supply module interconnects to the chassis backplane using a multi-pin power connector. Two Torx screws on the front panel of the power supply module secure it in the chassis.

*Power Supply Controls and Indicators*

The power supply module has three front panel light emitting diode (LED) indicators:

- 1) ALARM: a RED LED that when illuminated indicates the power supply is no longer operating within its design specifications
- 2) STATUS: a GREEN LED that when illuminated indicates the power supply is operating within its design specifications
- 3) FAN: a RED LED that when illuminated indicates the power supply fan is no longer functioning per its design specifications.

The front panel ON/OFF switch is used to enable or disable the DC outputs of the power supply module.



**User / Operational Manual**

*Functional Description / Operation of Modules (Draft)*

*Power Supply Performance Specifications*

Operating Temperature:	-30 to +60 °C
Input Voltage: AC:	90 to 264 Volts AC
DC:	43.2 to 60 Volts DC
Input Frequency Range (AC operation):	47 to 63 Hz
Input Current: AC:	10 Amps Maximum (120 VAC), 5 Amps Max (220/240 VAC)
DC:	18A maximum
Steady-State Output Voltage:	
Main DC Output:	28.94 Volts DC +/- 2.7%
Aux DC Output:	28.94 Volts DC +/- 3.0%
Total Output Power Rating:	
DC Outputs:	600 Watts
Battery Charger:	150 Watts
Battery Charger Output Voltage Range:	45 to 58 Volts DC
Battery Charger Output Current:	3 Amps maximum
Output Ripple:	All outputs 50 mV p-p (measured with 20 MHz BW oscilloscope at 25°C)
Short Circuit Current:	0.5 Amp average (maximum)