

**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.

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). 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*

A copy of the multi-lingual document, "General Safety Precautions and Installation Standards and Guidelines", is included with each base radio shipped. This document gives general safety precautions pertaining to installation and RF exposure. The English and French sections are included, below, as part of this filing package.

**English:****General Safety Precautions and Installation Standards and Guidelines**

**WARNING:** For safe installation, operation, service and repair of this equipment, follow the safety precautions and instructions described below, as well as any additional safety information in Motorola's product service and installation manuals and the Motorola R56 Standards and Guidelines for Communications Sites manual (6881089E50). To obtain copies of these materials, please contact Motorola as directed at the end of this document. After installation, these instructions should be retained and readily available for any person operating or servicing this base station or working near it.

Failure to follow these safety precautions and instructions could result in serious injury or property damage.

The installation process requires preparation and knowledge of the site before installation begins. Review installation procedures and precautions in the Motorola R56 manual before performing any site or component installation. Personnel must use safe work practices and good judgment, and always follow applicable safety procedures, such as requirements of the Occupational Safety and Health Administration (OSHA), the National Electrical Code (NEC), and local codes.

The following are additional general safety precautions that must be observed:

- To continue compliance with any applicable regulations and maintain the safety of this equipment, do not install substitute parts or perform any unauthorized modifications.
- All equipment must be serviced by Motorola trained personnel.
- If troubleshooting the equipment while the power is on, be aware of the live circuits which could contain hazardous voltage.
- Do not operate the radio transmitters unless all RF connectors are secure and all connectors are properly terminated.
- All equipment must be properly grounded in accordance with the Motorola R56 and specified installation instructions for safe operation.
- Slots and openings in the cabinet are provided for ventilation. Do not block or cover openings that protect the devices from overheating.
- Some equipment components can become extremely hot during operation. Turn off all power to the equipment and wait until sufficiently cool before touching.
- Maintain emergency first aid kits at the site.
- Never store combustible materials in or near equipment racks. The combination of combustible material, heat and electrical energy increases the risk of a fire hazard.
- Equipment shall be installed in site that meets the requirements of a "restricted access location", per (UL60950-1 & EN60950-1), which is defined as follows: "Access can only be gained by service persons or by users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location."
- Burn hazard. The metal housing of the product may become extremely hot. Use caution when working around the equipment.
- RF energy burn hazard. Disconnect power in the cabinet to prevent injury while disconnecting and connecting antennas.
- Shock hazard. The outer shields of all TX and RX cables must be grounded per Motorola R56 manual.
- Shock hazard. DC input voltage shall be no higher than 60VDC. This maximum voltage shall include consideration of the battery charging "float voltage" associated with the intended supply system, regardless of the marked power rating of the equipment.
- All TX and RX RF cables shall be connected to a surge protection device according to Motorola R56 manual. Do not connect TX and RX RF cables directly to an outside antenna.
- Compliance with National and International standards and guidelines for human exposure to Electromagnetic Energy (EME) at Transmitter Antenna sites generally requires that persons having access to a site shall be aware of the potential for exposure to EME and can exercise control of exposure by appropriate means, such as adhering to warning sign instructions. See this installation manual and Appendix A of Motorola R56.

Refer to product specific manuals for detailed safety and installation instructions. Manuals can be obtained with product orders, downloaded from <https://businessonline.motorola.com>, or purchased through the Motorola Aftermarket & Accessory Department.

## User / Operational Manual

## Manual Front Matter

## Français Canadien:

**Consignes générales de sécurité et d'installation**

**AVERTISSEMENT :** pour une installation, un fonctionnement, un entretien et des réparations de cet équipement sans risque, respectez les mesures de sécurité et instructions décrites ci-dessous ainsi que les consignes de sécurité supplémentaires présentées dans les guides d'entretien et d'installation des produits Motorola et dans le manuel de Motorola intitulé Standards and Guidelines for Communications Sites, R56 (6881089E50). Pour obtenir des copies de ces documents, adressez-vous à Motorola selon la procédure indiquée à la fin de ce document. Après l'installation, conservez ces instructions pour que toute personne utilisant ou réparant cette station de base ou travaillant à proximité puisse s'y référer facilement.

Ne pas suivre ces mesures de sécurité et ces instructions peut entraîner des blessures graves ou des dommages matériels.

Le processus d'installation exige une préparation et une connaissance préalable du site. Passez en revue les procédures d'installation et les consignes de sécurité en consultant le manuel Motorola R56 avant de procéder à toute installation sur le site ou à toute installation d'un composant. Le personnel doit adopter des pratiques professionnelles sécuritaires et faire preuve de bon sens et toujours respecter les procédures de sécurité applicables, telles que les exigences des norms Occupational Safety and Health Administration (OSHA), celles du Code national de l'électricité ou de tout autre code en vigueur dans votre région.

Les consignes de sécurité générales supplémentaires suivantes doivent également être respectées:

- Pour continuer à respecter toute réglementation applicable et assurer la sécurité de cet équipement, n'installez aucune pièce de rechange et ne modifiez aucune pièce de l'équipement sans autorisation.
- Tout équipement doit être entretenu par le personnel formé de Motorola.
- Si vous tentez une procédure de dépannage de l'équipement alors qu'il est sous tension, portez attention aux circuits alimentés qui pourraient présenter un danger électrique.
- N'utilisez pas d'émetteurs-récepteurs radio à moins que tous les connecteurs RF soient solidement branchés et que tous les connecteurs soient adéquatement protégés d'un embout.
- Tout équipement doit comporter un dispositif de mise à la terre adéquat, conformément au manuel Motorola R56 et aux instructions détaillées d'installation assurant une utilisation sans risque.
- Les fentes et les ouvertures du caisson servent à l'aération. Évitez d'obstruer ou de recouvrir ces ouvertures qui empêchent les appareils de surchauffer.
- Certains composants peuvent devenir très chauds durant l'utilisation. Mettez l'équipement hors tension et attendez qu'il refroidisse suffisamment avant de le toucher.
- Veillez à ce que le site dispose d'une trousse d'urgence et de premiers soins en tout temps.
- Ne rangez jamais des matières combustibles sur ou près des étagères destinées à l'équipement. La combinaison matières combustibles- chaleur-énergie électrique augmente le risque d'incendie.
- Tout équipement doit être installé sur les sites conformément aux exigences relatives aux « emplacements à accès restreint » (voir UL60950-1 et EN60950-1) qui se définissent comme suit : « L'accès est uniquement donné au personnel d'entretien ou à toute autre personne informée des raisons justifiant les restrictions touchant l'accès au lieu et de toutes les précautions à prendre; l'accès est restreint à l'aide d'outils, de cadenas, d'une clé ou de tout autre dispositif de sécurité et est contrôlé par l'autorité responsable du site. »
- Risques de brûlure. Le boîtier métallique du produit peut devenir extrêmement chaud. Faites attention lorsque vous travaillez près de l'équipement.
- Risques de brûlure causée par l'énergie de radiofréquence. Coupez le courant du caisson pour éviter les blessures lors du débranchement et du branchement des antennes.
- Risques de décharge électrique. Le blindage de tous les câbles d'émission et de réception doit comporter un dispositif de mise à la terre conforme aux exigences décrites dans le manuel Motorola R56.
- Risques de décharge électrique. La tension d'entrée de courant continu ne doit pas dépasser 60 V c.c. Cette tension maximale doit tenir compte de la « tension d'annonciation » du chargement de la batterie associée au système d'alimentation voulu, peu importe le type de puissance de l'équipement indiqué.
- Le blindage de tous les câbles RF d'émission et de réception doit comporter un dispositif de protection contre les surtensions conformément au manuel Motorola R56. Ne branchez pas les câbles RF d'émission et de réception directement sur l'antenne extérieure.
- Les normes et directives nationales et internationales en matière d'exposition à l'énergie électromagnétique à proximité des antennes émettrices exigent, en général, que les personnes ayant accès à de tels sites soient conscientes du risque d'être exposées à l'énergie électromagnétique et de la possibilité de contrôler ces risques d'exposition en respectant strictement les instructions figurant sur les panneaux d'avertissement. Référez-vous à ce manuel d'installation et à l'annexe A du manuel Motorola R56.

Consultez les manuels spécifiques au produit pour des instructions détaillant les mesures de sécurité et la procédure d'installation. Ces manuels peuvent accompagner le produit commandé, être téléchargés du site <https://businessonline.motorola.com> ou être achetés auprès du service Accessoires et pièces de rechange de Motorola.

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Manual Front Matter (Draft)

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## Disclaimer

Please note that certain features, facilities, and capabilities described in this document may not be applicable to or licensed for use on a particular system, or may be dependent upon the characteristics of a particular mobile subscriber unit or configuration of certain parameters. Please refer to your Motorola contact for further information.

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## European Union (EU) Waste of Electrical and Electronic Equipment (WEEE) directive



The European Union's WEEE directive requires that products sold into EU countries must have the crossed out trash bin label on the product (or the package in some cases).

As defined by the WEEE directive, this cross-out trashbin label means that customers and end-users in EU countries should not dispose of electronic and electrical equipment or accessories in household waste.

Customers or end-users in EU countries should contact their local equipment supplier representative or service centre for information about the waste collection system in their country.

## FCC Requirements

Radio frequency (RF) transmitters installed at sites within the US must be in compliance with the following FCC regulations:

- The station licensee shall be responsible for the proper operation of the station at all times and is expected to provide observations, servicing, and maintenance as often as may be necessary to ensure proper operation.
- The transmitter ERP shall not exceed the maximum power specified on the current station authorization.
- The frequency of the transmitter must be checked during initial installation of the transmitter, when replacing modules, or when making adjustments that affect the carrier frequency or modulation characteristics.

This equipment has been tested and found to comply with the limits for a Class A digital device, according to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference to radio communications when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy. If not installed properly and used in accordance with the instruction manuals, the equipment may cause harmful interference to radio communications. Operation of some compliant equipment in a residential area may cause harmful interference to radio communications, in which case the user is required to correct the interference.

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*Manual Front Matter (Draft, Continued)*

**About GTR 8000 Base Radio - What Is Covered In This Manual?**

This manual contains the following chapters:

- [Chapter 1 GTR 8000 Base Radio Description](#) provides a high-level description of the GTR 8000 Base Radio and the function it serves on your system.
- [Chapter 2 GTR 8000 Base Radio Theory of Operation](#) explains how the GTR 8000 Base Radio works in the context of your system.
- [Chapter 3 GTR 8000 Base Radio Installation](#) details installation procedures relating to the GTR 8000 Base Radio.
- [Chapter 4 GTR 8000 Base Radio Configuration](#) details configuration procedures relating to the GTR 8000 Base Radio.
- [Chapter 5 GTR 8000 Base Radio Optimization](#) contains optimization procedures and recommended settings relating to the GTR 8000 Base Radio.
- [Chapter 6 GTR 8000 Base Radio Maintenance](#) describes periodic maintenance procedures relating to the GTR 8000 Base Radio.
- [Chapter 7 GTR 8000 Base Radio Operation](#) details tasks that you will perform once the GTR 8000 Base Radio is installed and operational on your system.
- [Chapter 8 GTR 8000 Base Radio Troubleshooting](#) provides fault management and troubleshooting information relating to the GTR 8000 Base Radio.
- [Chapter 9 GTR 8000 Base Radio FRU Procedures](#) lists the Field Replaceable Units (FRUs) and Field Replaceable Entities (FREs) and includes replacement procedures applicable to the GTR 8000 Base Radio.
- [Chapter 10 GTR 8000 Base Radio Reference](#) contains supplemental reference information relating to the GTR 8000 Base Radio indicator LEDs.
- [Chapter 11 GTR 8000 Base Radio Disaster Recovery](#) provides references and information that enables you to recover a GTR 8000 Base Radio in the event of failure.

**Useful Background Information**

Motorola offers various courses designed to assist in learning about the system. For information, go to <http://www.motorolasolutions.com/training> to view the current course offerings and technology paths.

**Related Information**

In addition to the information in the table below, see the Related Information Guide.

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Manual Front Matter (Draft, Continued)

**General Safety Precautions****CAUTION**

Compliance with FCC guidelines for human exposure to Electromagnetic Energy (EME) at Transmitter Antenna sites generally requires that Personnel working at a site shall be aware of the potential for exposure to EME and can exercise control of exposure by appropriate means, such as adhering to warning sign instructions, using standard operating procedures (work practices), wearing personal protective equipment, or limiting the duration of exposure. For more details and specific guidelines, see Appendix A of the Motorola Standards and Guidelines for Communications Sites manual.

Observe the following general safety precautions during all phases of operation, service, and repair of the equipment described in this manual. Follow the safety precautions listed and all other warnings and cautions necessary for the safe operation of all equipment. Refer to the appropriate section of the product service manual for additional pertinent safety information. Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modifications of equipment.

**NOTE**

The installation process requires preparation and knowledge of the site before installation begins. Review installation procedures and precautions in the Motorola *Standards and Guidelines for Communications Sites* manual before performing any site or component installation.

Always follow all applicable safety procedures, such as Occupational Safety and Health Administration (OSHA) requirements, National Electrical Code (NEC) requirements, local code requirements, safe working practices. Also, good judgment must be made by personnel. General safety precautions include the following:

- 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.
- If troubleshooting the equipment while power is on, be aware of the live circuits.
- Do not operate the radio transmitters unless all RF connectors are secure and all connectors are properly terminated.
- All equipment must be properly grounded in accordance with the Motorola Standards and Guidelines for Communications Sites manual and specified installation instructions for safe operation.
- Slots and openings in the cabinet are provided for ventilation. Do not block or cover openings that protect the devices from overheating.
- 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.
- Maintain emergency first aid kits at the site.
- Have personnel call in with their travel routes to help ensure their safety while traveling between remote sites.
- Institute a communications routine during certain higher risk procedures where the on-site technician continually updates management or safety personnel of the progress so that help can be dispatched if needed.
- Never store combustible materials in or near equipment racks. The combination of combustible material, heat, and electrical energy increases the risk of a fire safety hazard.
- Equipment shall be installed in site meeting the requirements of a "restricted access location," per UL60950-1, which is defined as follows: "Access can only be gained by service persons or by user who has been warned about the possible burn hazard on equipment metal housing. Access to the equipment is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location."

**WARNING**

**Burn hazard.** The metal housing of the product may become extremely hot. Use caution when working around the equipment.

Manual Front Matter (Draft, Continued)

**Warning Label on Hot Modules**



warning\_hot



**CAUTION**

All Tx and Rx RF cables' outer shields must be grounded per Motorola Standards and Guidelines for Communications Sites manual requirements.



**CAUTION**

DC input voltage shall be no higher than 60VDC. This maximum voltage shall include consideration of the battery charging "float voltage" associated with the intended supply system, regardless of the marked power rating of the equipment. Failure to follow this guideline may result in electric shock.



**CAUTION**

All Tx and Rx RF cables shall be connected to a surge protection device according to the Motorola Standards and Guidelines for Communications Sites manual. Do not connect Tx and Rx RF cables directly to outside antenna.



**WARNING**

RF energy burn hazard. Disconnect power in the cabinet to prevent injury while disconnecting and connecting antennas.



**IMPORTANT**

All equipment must be serviced by Motorola trained personnel.

**GTR 8000 Base Radio Supplemental Safety Installation Requirements**

The Supplemental Safety and Installation Requirements include the following:

- The GTR 8000 Base Radio must be installed in a suitable, in-building enclosure. A restricted access location is required when installing this equipment into the end system.
- The base radio contains a Class 1 built-in power supply component. This component is equipped with an appliance inlet for connecting to an AC input, as well as DC input terminals which meet SELV DC circuit requirements.
- When installing the equipment, all requirements of relevant standards and local electrical codes must be fulfilled.
- The maximum operating ambient temperature of this equipment is 60°C. The maximum operating altitude is 3000 meters above sea level.
- The 28.6 VDC output from the power supply to the PA is at an energy hazard level (exceeds 240 VA). When installing into the end system, care must be taken so as not to touch the output wires.
- When the GTR 8000 Base Radio / Repeater is used in a DC reverting system, the DC power supply must be located in the same building as the GTR 8000 Base Radio, and it must meet the requirements of a SELV circuit.

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Specifications (Draft)

<b>General Performance</b>			
Model	T7039 (GTR 8000 Base Radio)		
H x W x D	5.25" x 19" x 18" (133x483x457mm)		
Weight	46 lbs (21 kg)		
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC		
Temperature Range	-30 to 60C (-22 to 140F)		
Input / Output Impedance	50 ohms		
Antenna Connectors	Transmit: N female Receive: BNC female (without preselector) N female (with preselector)		
Frequency Stability	Capable of External Reference Frequency and Time		
Frequency Stability: Internal Reference (Transceiver Option Card)	Aging: 30 ppb/yr 100ppb/5yr Temperature: 40 ppb		
Frequency Generation	Synthesized		
Channel Spacing	Digital - C4FM, Linear Modulations: 12.5 kHz Analog Frequency Modulation: 12.5 kHz, 25 kHz		
<b>Transmitter</b>			
Frequency Range	435-524 MHz		
Power output	C4FM Digital and Analog: 2-110 Watts Linear Digital Modulations: 2-110 Watts (Average)		
Electronic Bandwidth	Full Bandwidth		
Modulation	C4FM, LSM, H-DQPSK, FM		
Modulation Fidelity	5%		
Spurious and Harmonic Emissions Attenuation	90 dB		
Analog FM Hum and Noise	45 dB (12.5 kHz), 50 dB (25 kHz)		
Analog Audio Distortion	Less than 2% at 1000 Hz		
Emission Designators	8K70D1W, 8K10F1E, 8K10F1D, 9K80D7W 16K0F3E, 11K0F3E, 16K0F1D, 10K0F1D		
Adjacent Channel Power Ratio	67 dB (12.5 kHz offset, 6 kHz BW)		
Intermodulation Attenuation	65 dB		
<b>FCC Type Acceptance</b>			
<b>FCC Designation:</b>	<b>Frequency Range</b>	<b>Type</b>	<b>Power Output</b>
ABZ89FC4819B	435-512 MHz	Transmitter (FM)	Variable 2-110 W
		Transmitter (Linear)	Variable 2-110 W (Avg)
ABZ89FR4820B	435-524 MHz	Receiver	N/A



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Field Replaceable Units and Orderable Parts (Draft)

**GTR 8000 Base Radio FRU Procedures**

GTR 8000 Base Radios are comprised of numerous field replaceable units (FRUs) and field replaceable parts. If you need to replace a FRU or part, it is essential to obtain the precise FRU Kit Number or Part Number and to review the replacement procedures provided, including all safety precautions and system impact information.

This chapter lists the Field Replaceable Units (FRUs) and Field Replaceable Entities (FREs) and includes replacement procedures applicable to GTR 8000 Base Radio.

**Field Replaceable Units (FRUs) and Parts**

When ordering field replaceable units (FRUs), you will need the FRU Kit Number. When ordering field replaceable parts, you will need the Part Number. Contact Motorola System Support Center (SSC) as needed for numbers not provided here (for cables that are internal to a GTR 8000 Base Radio, the part numbers are not listed in this documentation, but you can locate the part number on the cable itself before contacting Motorola Support). See 8.5 Using Motorola System Support Center (SSC), page 8-8.



**WARNING**

To guard against personal injury and/or damage to equipment, switch a trunked base radio to Service Mode when performing service. The GTR 8000 Base Radio periodically keys up to pseudo train its linear transmitter autonomously when it is not assigned by the zone controller. Tx Inhibiting the base radio also prevents the transmitter from keying. Remember to switch the base radio back to Normal Mode when service is complete.

**GTR 8000 Base Radio Field Replaceable Units**

Component Type	FRU Kit Number
Transceiver Module (700/800 MHz)	DLN6566A
Transceiver Module (UHF R1, 380–435 MHz)	DLN1395A
Transceiver Module (UHF R2, 435–524 MHz)	DLN1346A
Transceiver Module (VHF, 136–174 MHz)	DLN1376A
Power Efficiency Transceiver Module (UHF R1, 380–435 MHz)	DLN6786A
Power Efficiency Transceiver Module (UHF R2, 435–524 MHz)	DLN6789A
Transceiver Module w/OCXO Transceiver Option Card (700/800 MHz)	DLN1430A
Transceiver Module w/OCXO Transceiver Option Card (UHF R1, 380–435 MHz)	DLN1432A
Transceiver Module w/OCXO Transceiver Option Card (UHF R2, 435–524 MHz)	DLN1433A
Transceiver Module w/OCXO Transceiver Option Card (VHF 136–174 MHz)	DLN1431A
Power Efficiency Transceiver Module w/TCXO* Transceiver Option Card (UHF R1, 380–435 MHz)	DLN6787A
Power Efficiency Transceiver Module w/TCXO* Transceiver Option Card (UHF R2, 435–524 MHz)	DLN6790A
Fan Module	DLN1338A
Power Efficiency Fan Module	DLN6804A
AC/48V DC Power Supply	DLN6568B (0182516W12) DLN6781A (0182516W14)
Power Efficiency AC/48V DC Power Supply	DLN6793A
Power Supply Fan Module	5985167Y02
Mid-Power (Power Amplifier Module) 700/800 MHz	DLN6567A

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

**GTR 8000 Base Radio Field Replaceable Units (Continued)**

<u>Component Type</u>	<u>FRU Kit Number</u>
Mid-Power (Power Amplifier Module) UHF R1, 380–435 MHz	DLN1396A
Mid-Power (Power Amplifier Module) UHF R2, 435–524 MHz	DLN1347A
Power Efficiency Power Amplifier Module UHF R1, 380–435 MHz	DLN6788A
Power Efficiency Power Amplifier Module UHF R2, 435–524 MHz	DLN6792A
Mid-Power (Power Amplifier Module) VHF, 136–174 MHz	DLN1377A

**GTR 8000 Base Radio Field Replaceable Parts**

<u>Component Type</u>	<u>Part Number</u>
GTR 8000 Base Radio Backplane	0180706H88
Preselector 700 MHz	0185171Y02
Preselector 800 MHz	0185171Y01
Preselector Mounting Bracket	0785024Y01
Preselector QMA Cable End	3085664Y01
Preselector BNC to QMA Cable	3085665Y01
Preselector Mini UHF N-Bulkhead Cable	3085664Y02
Preselector Mini UHF BNC Cable	3085664Y03
Preselector UHF 380–433 MHz	CFX1075A
Preselector UHF 435–470 MHz	TLE5992A
Preselector UHF 470–524 MHz	TLE5993A
Preselector VHF 136–154 MHz	TFD6511A
Preselector VHF 150–174 MHz	TFD6512A
Transmit Post Filter 700 MHz	9184680Y01
Transmit Post Filter 800 MHz	9184680Y02
External Dual Circulator Tray	DLN1317A
External Dual Circulator Tray UHF 380–435 MHz	CLE6203A
Duplexer 700 MHz	9184718Y01
Duplexer 800 MHz	9184718Y02
Duplexer UHF 380–403 MHz	0185417U10
Duplexer UHF 403–435 MHz	0185417U04
Duplexer UHF 435–470 MHz	0185417U05
Duplexer UHF 470–494 MHz	0185417U06
Duplexer UHF 494–512 MHz	0185417U07
Duplexer VHF 136–146 MHz	0185417U01
Duplexer VHF 144–160 MHz	0185417U02
Duplexer VHF 158–174 MHz	0185417U03
Antenna Relay kit including relay, cable, screws	CLN8636A
Antenna Relay	40009272002
External Speaker Kit	HSN1006A
Microphone Kit	GMMN4063B

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

**Individual Replaceable Parts on External Dual Circulator Tray**

<u>Component Type</u>	<u>Part Number</u>
Dual Circulator 700/800 MHz	0185172Y01
Dual Circulator UHF 380–435 MHz	0185416U09
Dual Circulator UHF 435–470 MHz	0185416U05
Dual Circulator UHF 470–524 MHz	0185416U06
Dual Circulator VHF 136–146 MHz	0185416U01
Dual Circulator VHF 144–160 MHz	0185416U02
Dual Circulator VHF 158–174 MHz	0185416U03
Circulator Load 700/800 MHz	TLN3391A
Circulator Load UHF/VHF	TLN3391A
Low Pass/Harmonic Filter 700/800 MHz	9185202U04
Low Pass/Harmonic Filter UHF	9185856Y01
Low Pass/Harmonic Filter VHF	9185856Y03

**GTR 8000 Base Radio Cables**

<u>Component Type</u>	<u>Part Number</u>
System Connector Cable – SCSI2 Base Radio to Champ	30009301004
Antenna Relay Control Cable	3084848Y01
Antenna Relay Mini UHF Cable	3085664Y04
Antenna Relay QMA Cable	3085664Y05
Antenna Relay BNC Cable	3013943J08
Antenna Relay 75 CM Cable	3013942M23
Antenna Relay 32 CM Cable	3013942M11
Antenna Relay 25 CM Cable	3013943E08
External Speaker Cable	0185180U01
Cable DC Red/Black 2806mm	3084869Y02
Cable DC Black/Blue 2806mm	3084869Y06
Battery Temp Sensor 3000mm	0184833Y01
Cable Battery Temp Extension 15500mm	3084827Y04

**User / Operational Manual**

*Tune-Up Procedure*

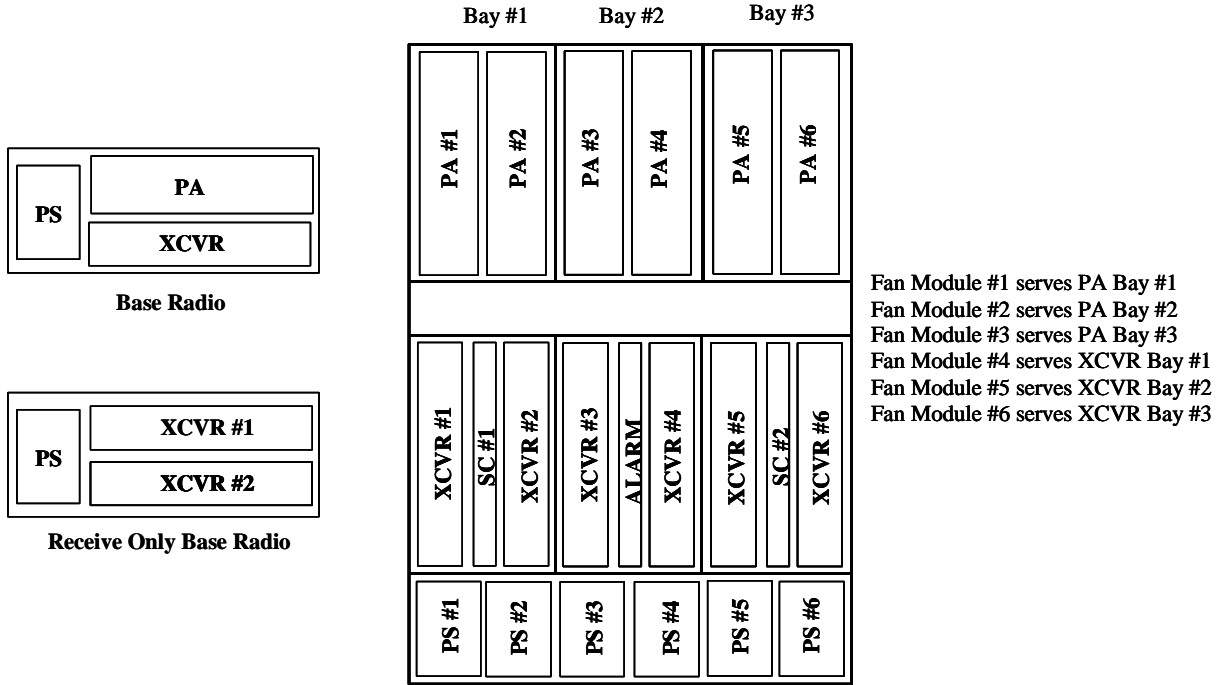
There is no field tune-up procedure. All adjustments are software controlled and are pre-set at the factory. Certain station operating parameters can be changed via man-machine interface (MMI) commands, within predetermined limits. Examples include transmit / receiver operating frequencies and transmitter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

Functions of the GTR 8000 Base Radio Modules

The following lists GTR 8000 Base Radio modules:

- Transceiver (XCVR) module (with or without transceiver option card)
- Power amplifier module (not applicable in a GPW 8000 Receiver)
- Fan module
- Power supply module

Transceiver Module Overview

The transceiver module provides the control, exciter, receiver, and optional transceiver option card for the base radio/receiver.



Transceiver Module (Front View)

The transceiver generates the station reference, which typically needs to be locked on to one of many possible external sources. The external source can be either the site controller TDM clocks or the external reference operating at 5 or 10 MHz. An internal frequency reference operating at 10 MHz is available in an optional transceiver option card.

The transceiver SPI bus allows communication with its receiver and exciter circuitry, as well as the power supply and power amplifier modules.

There are two or three circuit boards in the transceiver:

- **Transceiver Control Board:** Performs the control management, digital signal processing, and transmit and receive data formatting for the base radio.
- **Transceiver RF Board:** Contains DC power conversion/regulation and performs receiver and exciter functions.
- **Transceiver Option Card:** An optional board that attaches to the control board. Provides an internal 10 MHz frequency reference. For conventional base radio/receiver operation it also provides the analog interfaces and wildcard I/Os. The transceiver option card requires an internal frequency reference oscillator alignment at different intervals that is mandated by its category and frequency band. See Base Radio Service Help > Service Screens > Alignment Screens in the *CSS Online Help* for the alignment procedures and mandated intervals. The transceiver option card is available in two categories:
  - **OCXO (Oven Controlled Crystal Oscillator)** – operates at 0.1 ppm which is inclusive to temperature and aging. The OCXO Transceiver Option Card is available in 700/800 MHz, UHF R1/R2, and VHF frequency bands.
  - **TCXO (Temperature Compensated Crystal Oscillator)** – operates at 1.5 ppm, of which 0.5 ppm is allocated to temperature and 1.0 ppm is allocated to aging. Reference precision with the TCXO is traded for lower power consumption. The TCXO mandates shorter maintenance intervals. The TCXO transceiver option card is available in UHF R1/R2 frequency bands. The TXCO is only available for non-simulcast conventional systems.

Transceiver Control Board

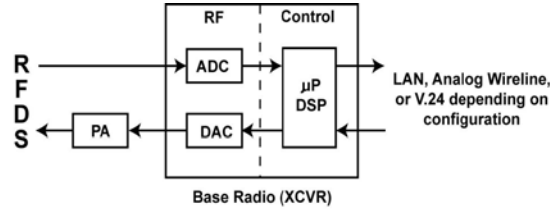
The main operating software for the base radio is loaded in the transceiver (XCVR) control section. As the main manager for the base radio, the XCVR control board provides operational control over the other station modules. It handles three types of information flow, in the following ways:

- 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.

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The following figure shows the information flow through the transceiver control and RF sections for trunked and conventional operation.



GTR8000\_RF\_Ethernet\_Flow

Transceiver Control Board Information Flow

Transceiver RF Board

In addition to DC power conversion/regulation, the XCVR RF board provides circuitry for the following exciter and receiver functions.

Exciter

The exciter on the XCVR RF board provides the transmitter functions for the base radio. The exciter circuitry generates a low-level, modulated RF signal that passes to the power amplifier. It supports various modulation types as well as bandwidths up to 25 kHz, through software programming.

The exciter also provides a controlled output power level to the power amplifier.

Receiver

The receiver provides either single receiver input or dual (HPD or TDMA) receiver inputs for dual diversity. The receiver also provides enhanced diagnostic capabilities using an on board noise source generator. It includes a wide tuning range (electronic varactor-tuned) preselector. The preselector is electronically tuned to the desired receive frequency anywhere between 792–825 MHz, UHF R1 380–435 MHz, UHF R2 435–524 MHz, or VHF 136–174 MHz.

Transceiver External Interfaces

The transceiver external interfaces include seven external ports, a switch and LEDs. If a transceiver option card is part of the transceiver, there are four additional external ports. See 3.4.7 Connections – Front, page 3-28 for the port connections. See 10.1 LEDs, page 10-1 for information on the LEDs.

Transceiver Switch

There is one multifunction Reset switch on the front of the transceiver module, accessible through the drop-down door to the left of the fans. The Reset switch has two functions:

User Action	Result
Press switch for less than 1 second	Service Mode (LED3 lights amber)
Press switch for more than 3 seconds	Transceiver Control Module Reset



GTR8000\_XCVR\_LED\_Closeup\_1

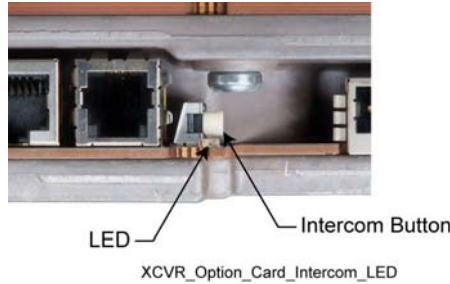
Transceiver Reset Switch (viewable through drop-down door)

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Functional Description / Operation of Modules (Draft)

Transceiver Option Card Intercom Button

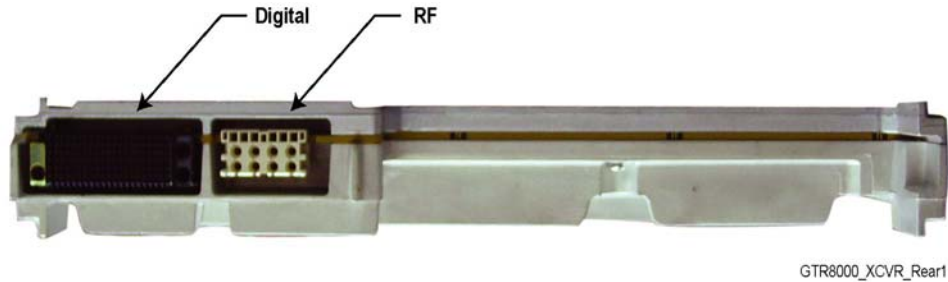
There is one intercom button on the front of the transceiver option card, accessible behind the fan module. Pressing the intercom button toggles the intercom function between the ON and OFF states



Transceiver Option Card Intercom Button (behind fan module)

Transceiver Ports (Rear)

The transceiver interconnects to the backplane using a 120-pin HVDML digital connector and 8-pack RF connector, as shown in the figure. These connections handle multiple signals including power supply communications, power amplifier communications, fan interface, and peripheral interface. The digital connection receives alarm data and the site controllers' TDM signals, which are used to pass reference and control data to the base radio.



Transceiver Module (Backplane Connections)

- **Single Receiver Input:** An RJ-45 Ethernet port on the base radio backplane is cabled to a site LAN switch for this channel. The backplane also provides an RF connection to the transceiver for receive (Rx) path A.
- **Dual Receiver Input:** RJ-45 Ethernet ports on the base radio backplane are cabled to corresponding ports on the site controller backplanes (HPD). The backplane also provides RF connections to the transceiver for receive (Rx) paths A and B (HPD and TDMA).



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Functional Description / Operation of Modules (Draft)

Function of the Power Amplifier Module

Note: The PA module is not applicable in a GPW 8000 Receiver.

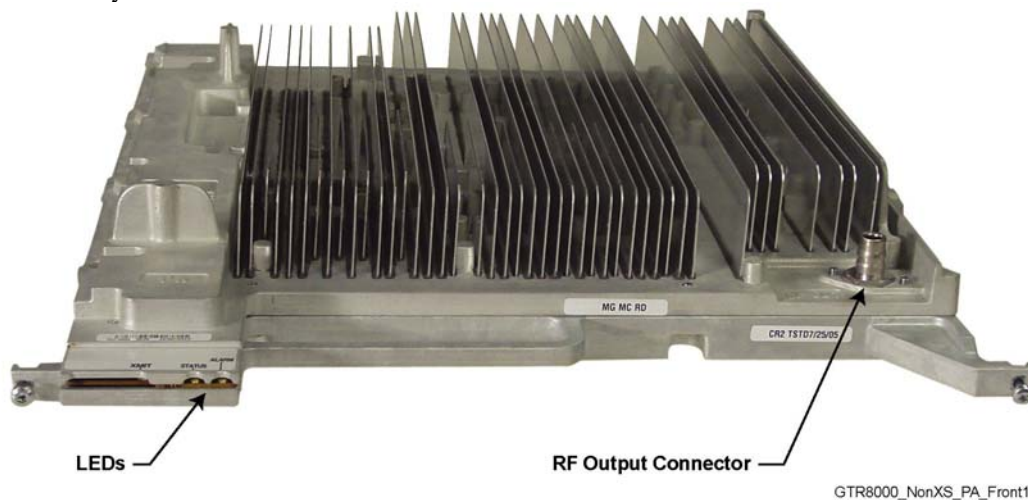
The power amplifier (PA) is a forced convection-cooled RF power amplifier. It accepts a low-level modulated RF signal from the transceiver module, and amplifies it for transmission through the site transmit antenna. Also, to complete the Cartesian correction loop (linearization method), it provides a low level RF feedback signal to the transceiver module to achieve the required transmitter linearity.

Transmit power output can be set using Configuration/Service Software (CSS). See 4.4.10 Configuring Tx Power Values and Battery Type, page 4-32.

The power amplifier also performs functions related to the fan module, including reporting of the fan module status and supplying power to the fan power bus.

The power amplifier is comprised of six internal modules:

- Core Board
- Converter Board
- Driver Amplifier Board
- Final Amplifier Board
- Distribution Board
- Output Circuitry



Power Amplifier Module

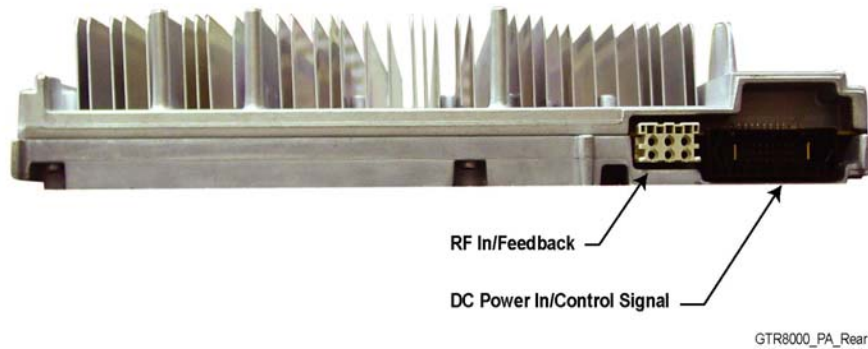
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Functional Description / Operation of Modules (Draft)

Power Amplifier Input / Output Connections

There are three electrical connection assemblies on the power amplifier:

- RF output (front QN "quick-N" connector) on front of power amplifier module. This is cabled to the N-type female bulkhead connection at the rear of the base radio housing
- DC power supply/control signal (backplane connection)
- RF input/feedback (backplane connection)



Power Amplifier (Backplane Connections)

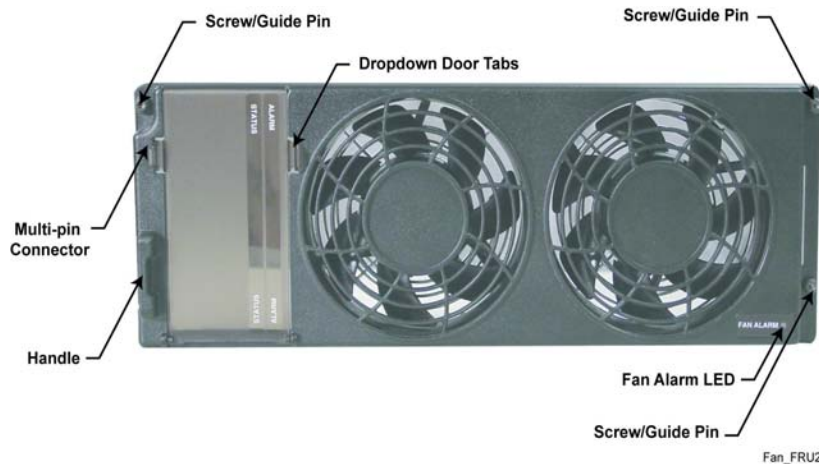
Function of the Fan Module

The fan module provides intermittent forced air cooling for the power amplifier and transceiver modules. The fans are controlled by a thermostat in the modules behind the fan module. The fan module houses two 119 mm axial fans which deliver a total of approximately 160 cubic feet per minute of airflow. Nominal fan speed is 4100 revolutions per minute. Each fan has a built-in speed sensor which turns on the red Fan Alarm LED if the fan speed for either fan falls below 30% of the rated speed.

If the fan module is used for the Power Efficiency Package, the following must be configured in the CSS in order to take full advantage of the Power Efficiency Package:

- Optional fan holdover time (length of time the base radio/receiver fan stays ON after transmission).
- Disabling one of the fans within the fan module. See 9.3.1 How To Replace the Fan Assembly, page 9-11 for instructions on how to disable one of the fans.
- Configuring the base radios Tx Power Out in the CSS should be limited to 50 W.

The fan module connects to the base radio backplane through a 4pin port on the front of the base radio chassis. The power supply module has its own fan which provides independent airflow.



Fan Module

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*Functional Description / Operation of Modules (Draft)*

*Function of the Power Supply Module*

The power supply, with front-to-rear air flow, operates from either an AC or DC input and provides the DC operating voltage for the base radio. However, the power supply prioritizes an AC source (if present) over that of a DC source.

If the power supply module is used for the Power Efficiency Package, the power supply must be used in DC mode in order to obtain the 35 W standby power consumption performance.

When operating from an AC source (90 to 264 VAC, 47-63 Hz), the supply generates two DC output voltages of 29 V with respect to output ground. The power supply automatically adjusts to AC input ranges and supplies a steady output.

In AC mode, the power supply provides a separate battery charger which can be used to maintain the charge on a 48 VDC nominal system, positive or negative ground, if installed. The supply generates two DC output voltages of 29 V with reference to output ground, when operating from a DC source (43.2 VDC to 60VDC maximum, positive or negative ground). This voltage limit includes consideration of the battery charging "float voltage" associated with the intended supply system, regardless of the marked power rating of the equipment.

The battery charger is not usable when operating from a DC input power source. This DC source must be located in the same building as the base radio / repeater, and it must meet the requirements of a SELV circuit.

The power supply contains several switching-type power supply circuits as follows:

- Power factor correction circuitry
- Battery charging circuitry
- Diagnostics and monitoring circuitry

The power supply controls its own continuously running fan, changing its speed to fast or slow as needed.

GTR 8000 Base Radio: If the power supply module is used for the Power Efficiency Package, the power supply fan does not run below a 40 °C air inlet temperature in DC mode with the transmitter in a de-keyed state.

GPW 8000 Receiver: If the power supply module is used for the Power Efficiency Package, the power supply fan does not run below a 40 °C air inlet temperature.



HPD\_Power\_Supply\_FRU.jpg

**Power Supply Module**