G3
Narrow band
Mobile Radiomodem
Installation Guide
Version 1.00
(Preliminary)

April, 2004

Part no.: 122 20130- 00A

Table of Contents

What's New in this version

History

Version 1.00 Prelim, April 2004

- Introduction of narrow band G3 product. Released as part of FCC reports.

Definitions

The following terms are used throughout this document.

Item	Definition
DCE	Data Communications Equipment. This designation defines the direction (input or output) of the various RS-232 interface signals. Modems are always wired as DCE.
DTE	Data Terminal Equipment. This designation defines the direction (input or output) of the various RS-232 interface signals. Most user equipment, as well as PCs, are wired as DTE.
GCU-III	Gemini (G3) Control Unit board
G3	Third generation of Gemini/PD products. Runs up to 64 kb/s in 25kHz channel.
HDX	Half Duplex. A unit that uses separate transmit and receive frequencies, but which may not transmit and receive simultaneously.
RS-232	Industry–standard interface for data transfer.
WinRIS	Windows © Radio Installation Software. This software allows basic tests and unit configuration.

1. PRODUCT OVERVIEW

This document provides the information required for the installation, operation, and verification of the DATARADIO G3.

1.1 Intended Audience

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

1.2 General Description

G3 is a mobile radiomodem aimed at the public safety and public utility markets to meet demand for high speed and high throughput. It integrates all the necessary hardware for data-only vehicular installations up to but not including the laptop PC and its application software.

Example of applications are:

1. Database inquiry systems.

   Small number of brief messages, (usually from the mobile station) with fairly long responses.

2. Computer-aided dispatch (CAD).

   Large number of messages, (usually from the base station) with very brief responses.

3. Automatic Vehicle Location (AVL).

   Using built-in GPS receiver, determines position, speed and direction of fleet members.

G3 is made-up of:

- A main transceiver
- An auxiliary receiver for Parallel Decode (PD)
- A power amplifier (40-Watt for UHF, 35-Watt for 800 MHz, 25-Watt for 900MHz models)
- A Gemini Control Unit (GCU) with DSP driven modem
- An integrated OEM GPS receiver.[1]

[1] The Gemini $^{PD+}$ Lite model has no GPS.

1.2.1 Features

- One-piece integrated design in a rugged die-cast aluminum chassis.
- Parallel Decode (PD) technology featuring dual receivers for added decode sensitivity in multi-path and fading environments.
- Sophisticated DSP-based modem design provides added system performance, fewer retries and more effective throughput.
- Automatic channel changing for improved roaming capabilities.
- Built–in, up to 16-channel flash-programmable synthesized radio transceiver with automatic channel selection.
- Models with on-air data speeds and modulation types as follows:

Modulation type	Channel spacing		
	12.5 kHz	NPSPAC & 900 MHz	25 kHz
SRC16FSK	TBD	TBD	64 kb/s
	TBD	TBD	57.6 kb/s
SRC8FSK	21.6 kb/s	24.0 kb/s	43.2 kb/s
	24.0 kb/s	28.8 kb/s	48 kb/s

- One Ethernet port
- Two available user ports using standard RS-232 interface via built-in multiplexer.
- One USB port
- Half-duplex operation.
- Out-of-band signaling enables transmission of GPS reports with no effect on system performance.
- Next generation high efficiency airlink E-DBA protocol

1.2.2 Configuration

G3 is factory configured based on each customer network system requirements, usually by Dataradio System Engineering. Configuration is not changeable in the field without notifying Dataradio.

1.3 Factory Technical Support

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

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

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

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

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

Technical support hours: Monday to Friday 8:30 AM to 5:30 PM, Eastern Time

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

Email address: drctech@dataradio.com

1.4 Product Warranty

Warranty information may be obtained by contacting your sales representative.

1.5 Replacement Parts

This product is not field-serviceable, except by the replacement of a complete unit. Specialized equipment and training is required to repair the GCU board 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 questions arise during servicing of the unit.

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

1.6 Unpacking

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

- One G3
- Installation mounting bracket
- Power cable – 22 feet (6.7 meters)
- Small parts kit

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

2. Installation

2.1 Planning the Installation

2.1.1 Overview

To ensure trouble-free, efficient installation, start by inspecting the vehicle to determine the optimum position for G3 and its antennas as well as the routing of all associated cabling and wiring.

2.1.2 Location

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

Be sure to place the G3 unit in such a way that:

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

G3 is not fully waterproof, therefore it should be mounted sufficiently away from an opened trunk lid or opened tailgate, windows or doors to avoid exposure to rain and/or snow. It also minimizes the chance that material can be accidentally thrown on the unit or of someone bumping against it.

2.1.3 Cable Path

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

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

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

2.2 Warnings

Before starting installation, review all of the following warnings.

2.2.1 RF Radiation warning

Recommended safety guidelines for the human exposure to radio frequency electromagnetic energy are contained in the Canadian Safety Code 6 and the Federal Communications Commission (FCC) Bulletin 65. Proper installation of the transceiver antenna of G3 as summarized in section 2.5 will result in user exposure substantially below the recommended limits for the general public.

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

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

2.2.2 Interference with vehicular electronics

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

It includes, and is not limited to:

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

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

2.2.3 Secure mounting

For vehicle occupant(s) safety, mount G3 securely so that the unit will not break loose in case of an accident or violent maneuvers.

2.2.4 Explosive environments

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

- Transmitting while fuelling the vehicle. Do not carry fuel containers in the same compartment as G3.
- Dynamite blasting caps may explode when transmitting radio operation takes place within 500 feet. Always obey the ***"Turn Off Two-Way Radios"*** signs posted at sites where dynamite is being used.

If transporting blasting caps:

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

Check applicable local bylaws.

2.2.5 Installation in vehicles powered by liquefied gas.

G3 installations in vehicles powered by liquefied petroleum gas with the LP-gas container in the trunk or other sealed-off space within the interior of the vehicle must conform to the National Fire Protection Association Standard NFPA 58 which requires:

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

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

2.3 Physical Unit

2.3.1 Recommended tools and supplies

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

2.3.2 Physical mounting of G3

a) Start by running all the cables (DC power, PC RS-232 as well as all antennas cabling) prior to mounting G3 to assure the feasibility of the planned cable routing.

b) Be sure to leave sufficient slack in each cable so the G3 may be removed from the mounting bracket for servicing with the power applied and the antenna attached.

c) G3 is ready for installation.

Cautions:

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

1. Once you have found a suitable mounting position for G3, hold the unit and the unattached mounting bracket in the proposed mounting position and check that there is clearance behind the unit for the heatsink, cables, etc. Check that the position provides a large enough flat surface that the bracket will not be distorted when installed.

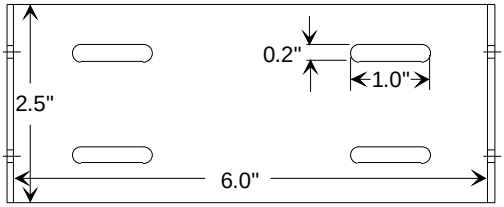


Figure 1 - Mounting plate and slot dimensions

2. Using the installation bracket as a template, mark the four locations for drilling (see Figure 1). Again, ensure that drilling at the selected points is safe and will not cause damage.
3. Indent the drilling positions with a center punch.
4. Drill holes sized for the self-tapping screws or for the nuts, bolts and lock washers used.

Caution: *Slightly reduce the size of the drilled holes when using self-tapping screws in thin metal.*

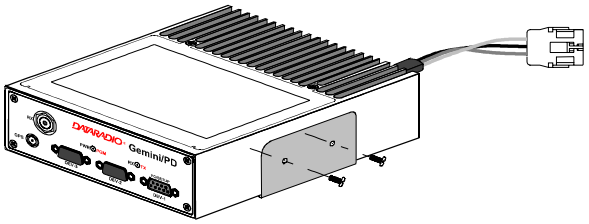


Figure 2 - Bracket installation

5. Install the bracket without distorting (see Figure 2).
6. Securely mount G3 to the installed bracket using the four supplied 8x40 black machine screws.
7. Drill any additional holes as required for routing all cables and fit holes with suitable grommets or bushings whenever required.

2.4 Electrical installation

2.4.1 Electrical requirements

G3 is designed to operate from a 13.8Vdc nominal car battery (negative ground) and requires currents up to 12.0A. It will tolerate a supply voltage range of 10.9 volts to 16.3 volts.
In vehicles with a 24 VDC electrical system (mostly in trucks), it is essential to provide a suitably rated 24/12 VDC converter to isolate the unit from the battery and protect it against excessive voltage.

Warnings:

Always disconnect G3's DC power lead before connecting a second battery, using power from another vehicle or power boosting (e.g. when "jump starting" the vehicle).

2.4.2 Routing of power cable

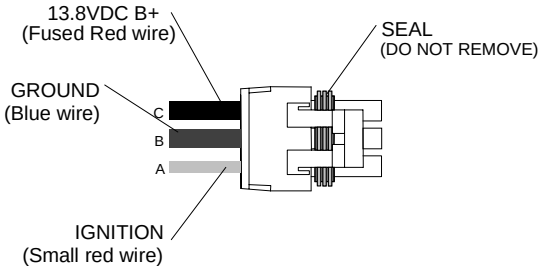
1. Start by disconnecting the vehicle's battery unless specifically prohibited from doing so by the customer, vehicle manufacturer, agent or supplier.

   Note:

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

2. The 22 feet (6.7 meters) long power cable consists of three wires attached to a Packard Electric "Weather-Pack" connector (DC power Connector, see Figure 3).

Figure 3 - DC Power Connector



The DC Power connector has:

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

3. Place this connector at G3's radio power input location. Do not connect at this time. See paragraph 2.6, "Completing the physical installation".
4. Carefully route both the B and the C wires to where the in-line fuse holder will be installed, usually as close to the vehicle's battery as practicable. Ensure that leads do not chafe on any metal part(s). Secure the wires at several locations along their length.

   Caution:

   Use proper crimping tool. Common pliers are NOT acceptable.

   Warning:

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

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

   Ensure tight and secure connections.
8. Fasten the fuse holder and leads.
9. Carefully route the "A" wire to where the connection will be made for switch sensing.
   - Connect to "Ignition" if you wish to have G3 turning ON and OFF dependent on the vehicle's ignition key.
   - Connect to "Accessory" if you wish G3 to be available when the engine is not running, but still dependent on the ignition key.
   - Connect to a user-supplied control switch.
   - In installations equipped with a "ChargeGuard", connect to the controlled-side of the ChargeGuard (remembering that the DC Power lead must NOT be switched).
10. Make appropriate connections.

    Cautions:

    Where scraping to bare metal was required, and at the battery posts where wire ends and lugs may be exposed, apply anti-corrosion compound.
    Insert the fuse only when installation is complete and ready to test.
11. At the G3 position, neatly coil cable slack and attach securely.

2.5 Antenna

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

2.5.1 Recommended tools and supplies

- circle cutter, hole saw or socket punch for antenna
- Mini-UHF Crimp tool

2.5.2 Planning

Referring to Figure 4, G3 commonly uses three separate antennas:

- "T" - Main transceiver -

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

- "R" - Auxiliary receiver –

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

- "G" - Global Positioning System (GPS)

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

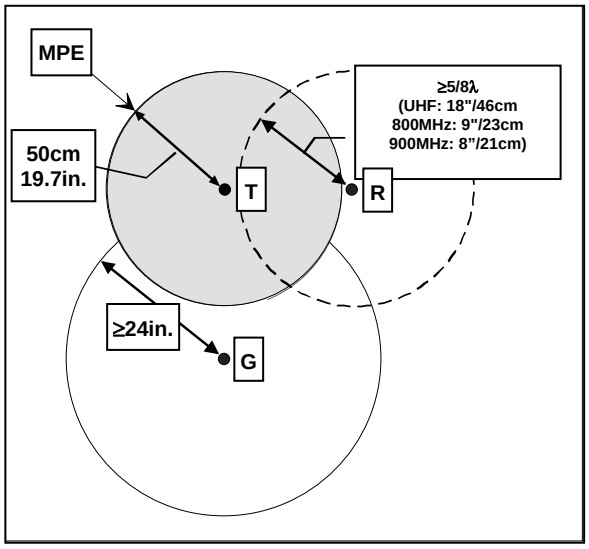


Figure 4 - Antenna spacing

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

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

Install the antennas in one of the following positions:

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

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

2.5.3 Antenna Installation

1. Route good quality 50-ohm coaxial cables (e.g. RG-223) from each of the selected antenna positions to the position where the G3 unit is mounted.
2. Terminate the end at each of the antenna positions with the appropriate connector for the antenna used and make the connection.
3. At the G3 position, cut the three cables to length and terminate with the appropriate plug. For the transceiver and the auxiliary cables, use a Mini-UHF crimp plug using an appropriate crimping tool. For the GPS, use a SMA connector.
4. ***Positively identify*** the transceiver mini-UHF plug and connect to the left rear of G3.
5. ***Positively identify*** the auxiliary receiver mini-UHF plug and connect to the front left of G3 to the RX position.
6. Connect the SMA connector to the GPS* position below the auxiliary connector position.
7. *Do not skip this last step, trust us; it is an important one.* To complete the installation, tie-wrap together the auxiliary and the GPS antenna cables at a point about two inches in front of the unit. It will be much easier hereafter to correctly identify which mini-UHF plug goes where. You DO NOT want to cross the auxiliary plug with the transceiver plug.

2.6. Completing the physical Installation.

To complete the physical installation and prior to testing G3:

- Connect DC Power cable's connector to G3's until you hear a click as the two parts snap together.
- Re-check that all other connections are secure (antennas, PC, etc.)
- Switch vehicle ignition ON.

You are now ready to check for normal operation and to run the Radio Installation Software (WinRIS) program for testing or trouble-shooting.

2.7. Checking out Normal operation

Check that the vehicle ignition is ON.

1. Check for proper operation of the G3's LEDs as per Table 1 on page 17.
2. Using the WinRIS program and an in-line wattmeter, check forward & reverse power to confirm main antenna installation (as per section 4).
3. Using WinRIS, check the RF Data Link with a base station that can be heard (see section 4.3.3).

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

3. Operating Description

3.1 Front & Rear Panels

The front panel includes:

- One mini-UHF type female antenna connector for the auxiliary receiver
- One SMA type female connector for the GPS receiver (not installed on G3 Lite model)
- Three LED indicators
- Two DE-9F RS232 ports
- One Ethernet 10/100BaseT port
- One USB port (future use)

The rear panel includes:

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

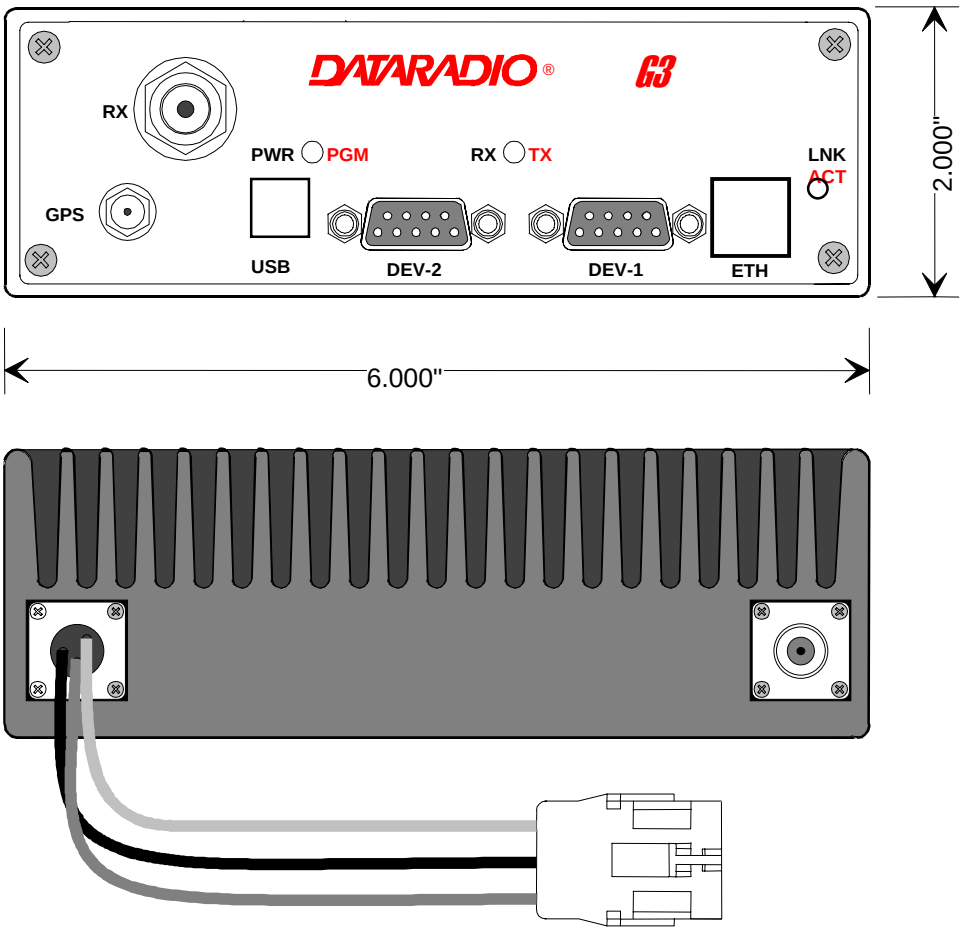


Figure 5 - Front and rear panels

Table 1 - G3 LEDs indications

G3 LEDs indications							
Power-on Sequence (LEDs are paired)				***Normal Operation (LEDs are independent)***			
	PWR	**RX / TX**	**Indication**	**PWR**	**Indication**	**RX / TX**	**Indication**
Normal	Red	Red	Normal boot-up start (10 to 27 sec.)	Green*	Normal ready state	Off	No network activity
	Amber	Off	Then 8 seconds to completing boot-up	Amber*	1 Pulse per sec (1 pps) Sufficient satellites acquired by GPS	Green	Receiving packets "DBA sync" allows transmit
	Green	Off	Normal state				
Errors	Red	Off	Hardware failure			Amber	Receiving packets "DBA out-of-sync" prevents transmit
	flashing Red	-	Missing DSP RSSI calibration				
	Slow Red/Green	Red	Software failure (firmware erased)			Red	Transmitting
Special	Fast Red/Green	Red	Programming in progress	* For 800 & 900 MHz US models (using Transmit duty cycle limit firmware) : - PWR lit Green = normal indication or Flashing Amber = normal + 1pps - PWR lit Amber = exceeded duty-cycle or Flashing Green = exceeded d-c + 1pps			

3.2 DTE Port Interface

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

Table 2 - DTE port pin functions

DE-9 F pin #	Function
1	DCD – from G3, normally asserted
2	RXD – data from G3
3	TXD – data to G3
4	DTR – to G3, handshaking
5	Ground
6	DSR – from G3, tied to VCC through current limiting resistor
7	RTS - to G3, handshaking
8	CTS – from G3, handshaking
9	AUX - auxiliary input to G3, (for port 2: **"Officer requires assistance"** Alarm input) It may be activated by (normally open) dry contact pull-up to the port's DSR output. It may also tolerate user pull-up to external +12 VDC (car battery), but an isolated dry contact is preferred due to the risk of noise-related false alarms caused by the vehicle's electrical system. A +3 to +12 V signal at this pin will send a DMP *"x"* (On) message to the base. An open or ground signal will send a DMP *"y"* (Off) message. Messages are only sent when a signal transition occurs. *See Appendix "A" on page 24 for further details.*

3.2.1 RS-232 Interface Signal Levels

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

Table 3 - RS-232 Signal Levels

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

4. Trouble-Shooting and Testing

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

4.1 Equipment Required

- 13.8 VDC (nominal) car battery, or
  13.8 VDC/20A regulated power supply (In the case the unit is not installed in a vehicle)
- In-line watt meter (50W range)
- Radio service monitor (IFR or equivalent).
- Cable with mini-UHF male connector to connect G3 to the service monitor.
- WinRIS version 4.0 or later*

4.2 Basic Tests

Recommended checks:

1. Transmit and Reverse power output
2. Carrier frequency error
3. Frequency deviation
4. Receivers RSSI Check
5. RF Data Link test between a Gemini and a base station.
6. GPS test (not required on G3 Lite model).

- For checks 1 to 5, refer to Table 4 – Test Checklist below.
- For check 6, refer to paragraph 4.3.2 - GPS Test.

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

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

* To find out how to launch the Windows-based software alignment and system-testing tool ***WinRIS***, 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 4 – Test Checklist

TEST CHECKLIST				
STEP	**ACTION**	**EXPECTED RESULTS at 25°C**	**MEASURE WITH**	**IF NOT?**
G3 units are set and characterized at the factory to optimize performances. It is not recommended to try to readjust the units.				
1	**Power-up LED Sequence**	as per **Table 1 - G3 LEDs indications**		
2	**Connect and save config** Press WinRIS *Get* button	as per WinRIS Help content		
3	**Main transceiver Output Power** Press *TX (Unmod)*	**UHF**: 40 watts **800MHz**: 35 watts **900MHz**: 25 watts all +10%, -10%; Factory-settable down to 10 watts as per customer request	Service monitor set to read power or 50W in-line watt-meter	Refer to factory technical support.
4	**Main transceiver Reflected Power** Press *TXON (Unmod)*	< 5% of forward power or as specified by System Eng.	10W in-line watt-meter	Check for bad connections, damaged coax cable, etc.
5	**Carrier Frequency Error** Press *TX (Unmod)*	± 300 Hz	Service monitor set to read frequency error	Refer to factory technical support.
6	**TX Deviation (in kHz)** Press *TXON (Modulated)* Carrier will be modulated with a 1 kHz tone.	Refer to Table 5 for TX Deviation details	Service monitor set to read deviation (IF filter set to Mid or 30 kHz position)	Refer to factory technical support.
7	**RF Data Link test** Use the base station address function and "Send" button to dynamically test the link	Look for "Delivery confirmed" on the WinRIS Status bar.	Refer to section 4.3.3 and to WinRIS Help content.	Check on the WinRIS RSSI bar graph if the base station is within range (i.e. better than -107dBm) or Refer to factory technical support.
8	Set the service monitor to generate at the unit antenna jack the **RF levels** mentioned below. The carrier generated should be modulated with a 1.0 kHz tone at deviation as per step 4 above.			
9	**Main Rec. RSSI checks** -70dBm -110dBm -120dBm	- 70 dBm +/-3 typical -110 dBm +/-3 typical -120 dBm +/- 3 typical	WinRIS bar graph	*The RSSI checks give a general indication of receivers' health* Refer to factory technical support only if RX data performance degradation is noticed combined to out-of- tolerance RSSI readings.
10	**Aux Receiver** repeat as per step 9	same as step 9 above	WinRIS bar graph	

1 (unless you have set a lower value). Note that readings less than 40 watts (UHF model), 35 watts (800MHz model) and 25 watts (900MHz model) may be due to losses in cables used for testing. Check also your wattmeter frequency calibration curve. Do not be too ready to condemn the transmitter.

4.3 Additional test details

4.3.1 TX Deviation

G3 is per unit factory-calibrated. Deviation values listed below serve as reference only.

Table 5 - TX Deviation

TX Deviation								
Full Channel Units			**Special Channel Units**			**Half Channel Units**		
SRC8FSK	**UHF**	**800**	**SRC8FSK**	**800 US *(NPSPAC)***	**900 US**	**SRC8FSK**	**UHF**	**800**
48.0kb/s	±4.5	±3.7	28.8kb/s	±2.9	±2.8	24.0kb/s	±2.2	±2.2
43.2kb/s	±4.5	±3.7	24.0kb/s	±2.9	±2.8	21.6kb/s	±2.2	±2.2
SRC16FSK	**UHF**	**800**	**SRC16FSK**	**800 US**	**900 US**	**SRC16FSK**	**UHF**	**800**
64.0 kb/s	±4.5	±3.2	TBD	TBD	TBD	TBD	TBD	TBD
57.6 kb/s	±4.5	±3.2	TBD	TBD	TBD	TBD	TBD	TBD
Tolerance is +5%, -10% for all bit rates.								

4.3.2 GPS Test

About three minutes after ignition is turned-on, the PWR LED on the G3 front panel should flash in amber color at the rate of one pulse per second.[1] This indicates that the GPS has acquired the sky position of a sufficient number of satellites to arrive at a ground position solution.

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

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

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

3) Connect the new antenna to Gemini and wait about three minutes for the POSITION ACQUIRED indicator to start flashing on G3, if not, the Gemini radio or its GPS receiver is defective.

[1] **Lit green and flashing amber for the 800MHz & 900MHz models under transmitter duty cycle limit.**

4.3.3 RF Data Link Test

A link test between a mobile and a known base station can be done using the WinRIS "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 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. Specifications

GENERAL

	UHF	800 MHz	900 MHz[1]
Frequency	403 - 460MHz[2], 450 - 512 MHz	TX 806 - 824 MHz, RX 851 - 869 MHz	TX 896 - 902 MHz, RX 935 - 941 MHz
Channel spacing	12.5, 20 or 25 kHz		
Frequency Control	Digital Synthesizer / uController		
Frequency Stability	1.5 ppm		
Operating temperature	-30°C to +60°C (25°C nominal) @ 95% non-cond. RH		
Mode of Operation	Half Duplex		
Number of channels	16 internally stored, flash-EEPROM programmable		
Supply voltage	13.6Vdc nominal (negative ground) 10.9 – 16.3 VDC		
Circuit Protection	15 Amp fuse external, Internal crowbar diode for reverse polarity protection		
RX Current at 13.6 VDC	< 650 mA Standby (with GPS receiver)		
TX Current at 13.6 VDC	< 12 A	< 12 A	< 10 A
TX/RX separation	any, 5 MHz typical	45 MHz typical	39 MHz typical
Nominal Dimensions	7.1” D x 6.0” W x 2.0” H		
Weight:	< 4.5 lbs.		
RF input/output Impedance	50 ohms nominal		
RF connector	Main TX/RX: mini-UHF female Auxiliary RX: mini-UHF female GPS RX: SMA female (Not installed for G3 Lite version)		
Interface connector	3x DE-9F D-subminiature		

RECEIVER

Sensitivity (12 dB SINAD)	-116 dBm (< 0.35 µV) *	
Adjacent channel rejection (Selectivity)	75 dB @ 25 kHz, 65 dB @ 12.5 kHz	63 dB @ 12.5 kHz
Intermodulation rejection	75 dB	
FM hum & noise ratio	>40 dB @ 12.5 kHz, >45 dB @ 25 kHz *	>40 dB @ 12.5 kHz *
Spurious Response Rejection	>80 dB	
Conducted spurious	-57 dBm	

* psophometrically weighted filter

TRANSMITTER

Power output	UHF = 10-40 watts	800 MHz = 10-35 watts	900 MHz = 10-25 watts
Duty cycle	20% @ full power, 30 sec. max. TX time (subject to FCC MPE limit)		
Conducted Spurious	> -80 dBc		
Frequency stability	1.5 ppm		
FM hum and noise ratio	>40dB @ 1.5 kHz deviation, >45 dB @ 3.0 kHz deviation		
Attack time	< 10 ms		

[1] **WARNING: 901 - 902 MHz is reserved for use outside US and Canada**

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

Data rates and Modulation type	SRRC8FSK (21600 b/s, 24000 b/s, 43200 b/s); SRRC16FSK (21600 b/s, 24000 b/s, 57600 b/s, 64000 b/s);			
Rx Sensitivity for 1% Packet Error Rate with Parallel Decode, at carrier frequency	UHF (Full channel)	UHF (Half channel)	800 MHz (full channel)	800 MHz & 900 MHz (NPSPAC channel)
	TBD@64kbps		TBD@64kbps	
	TBD@57.6kbps		TBD@57.6kbps	
	–106 dBm @ 43.2 kb/s	–110 dBm @ 21.6 kb/s	–106 dBm @ 43.2 kb/s	–110 dBm @ 24 kb/s
Protocol	Dataradio Proprietary E-DBA with OOB AAVL support			

DISPLAY and CONTROLS

2 status LEDs	RX/TX, PWR

Environmental MIL. spec.

Environment	Categories	MIL Spec. 810E		Other
		Method	*Procedure*	
Low Pressure	Operations	500.3	II	
High Temperature	Operations, Storage	501.3	I(A1), II	
Low Temperature	Operations, Storage	502.3	I(C3), II (C1)	
Temperature Shock	Transfer of equipment	503.3	I(AI,C2)	
Solar Radiation	Heat effects	505.3	I	
Rain	Drip rain	506.3	II	IEC IP54 only II
Humidity	Induced, Aggravated	507.3	II,III	
Dust	Blowing dust	510.3	I	IEC IP54
Vibration	Ground Mobile	514.4	I(8)	EIA RS-204C Forestry
Shock	Functional, Bench handling	516.4	I,VI	EIA RS-204C

FCC / IC CERTIFICATIONS

Band	FCC	IC (DOC)
UHF	EOTGPDA	773195525A
800	EOTGPDB	773195643A
900	EOTGPD9	773A-GPD9

EMISSION DESIGNATORS

Bit rate	Baud rate	Modulation	UHF (FCC Mask)	800MHz (FCC Mask)	900MHz (FCC Mask)
19200	19200	DGMSK	15K0F1D (C)	15K0F1D (G)	-
9600	9600	DGMSK	*15K0F1D (C)	*15K0F1D (G)	
9600	9600	DGMSK	8K60F1D (D)	8K60F1D (H)	10K2F1D (J)
8000	8000	DGMSK	*8K60F1D (D)	*8K60F1D (H)	8K75F1D (J)
64000	16000	SRRC16FSK	16K4F1D(C)	14K4F1D(G)	-
57600	14400	SRRC16FSK	16K9F1D(C)	14K1F1D(G)	-
43200	14400	SRRC8FSK	16K4F1D (C)	14K7F1D (G)	-
32000	16000	RC4FSK	16K5F1D (C)	15K6F1D (G)	
25600	12800	SRRC4FSK	15K6F1D (C)	15K6F1D (G)	
24000	8000	SRRC8FSK	-	11K0F1D (H)	11K4F1D (J)
21600	7200	SRRC8FSK	9K67F1D (D)	-	-
19200	9600	SRRC4FSK	-	10K2F1D (H)	9K92F1D (J)
16000	8000	SRRC4FSK	8K17F1D (D)	10K0F1D (H)	10K7F1D (J)
14400	7200	SRRC4FSK	8K67F1D (D)	-	-

* Under class 1 permissive change