EXTREME ENVIRONMENTS. EXTREMELY SIMPLE.

G6-DB

Satellite Data Transmitter

Operator's Manual

1.800.548.4264 | www.ftsinc.com

700-G6-DB-Man Rev2 26 Apr 2022

Contact Information

Canadian Headquarters:
1065 Henry Eng Place
Victoria, BC | V9B 6B2 | Canada
www.ftsinc.com

Toll-free: 1.800.548.4264
Local: 250.478.5561

Technical support portal: http://support.ftsinc.com

Email: service@ftsinc.com

Warranty Terms and Conditions
https://ftsinc.com/support/warranty/

Contents

Chapter 1 HANDLING AND SAFETY

1.1 HANDLING

Although G6-DB is rugged, it should be handled as a precision instrument, that is, with caution and attention.

Before powering up the transmitter, ensure the antenna is properly connected in accordance with general guidance contained in Section 4.3 and connection instructions in Section 5.2. Failure to properly connect or use the antenna cable can cause permanent damage to the transmitter circuits.

> **ATTENTION:** This product is for professional use only. It must be operated by qualified technicians and solely for the purpose for which it was designed.

1.2 SAFETY MEASURES AND GUIDELINES

Take all possible measures to ensure the safety of your work environment and avoid accidents. Before undertaking any work confirm every safety and health procedures are in place and applied. Be aware of all the instructions and information provided in the product manual. You are responsible for applying national and local codes and regulations relevant to the type of work to be performed.

The following are some basic guidelines:

- Prior to performing installation work, obtain required approvals and permits. It is your obligation to comply with all requirements.
- Use only qualified personnel for installation, usage, and maintenance of the equipment.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Always wear protective equipment while working.
- Use appropriate tools for the service performed.
- Always perform preventive or corrective maintenance. Doing this can prevent accidents, alleviate possible damages and avoid equipment failures.
- Have a plan of action to carry out, at minimum, all the guidelines described above. Additional safety measures can be applied as necessary. Always keep a timetable of the activities performed, in the installed equipment and in the workplace

Chapter 2 OVERVIEW

The **G6-DB** is a satellite data transmitter that operates with the **GOES** (Version 2.0 - CS2) and **METEOSAT** networks. The transmitter has a global positioning system (GPS) that provides accurate location and time synchronization information.

The **G6-DB** was designed to be used in Data Collection Platforms (DCPs), also called weather stations. It operates with a transmission data rate of 100, 300 or 1200 bps at 401.7 to 402.4MHz frequency. Its data transmission performance is excellent even in remote locations, is easy to integrate with multiple data loggers and has low power consumption. It features easy equipment start-up configuration, communication via RS-232, or USB serial port and front panel LEDs that indicate the transmitter operational status. The **G6-DB** is certified by **NESDIS**[1]/**NOAA**[2], **EUMETSAT**[3]and **ANATEL**[4].

The **G6-DB** is easy to integrate with the following data loggers.

CSI:

- CR6
- CR300 Series
- CR800 Series
- CR1000 Series
- CR3000
- CR5000

Vaisala:

- QML201

2.1 GOES SYSTEM

2.1.1 ORBIT

The G6-DB transmitter sends data via Geostationary Operational Environmental Satellites (GOES). GOES satellites have orbits that coincide with the Earth's rotation, allowing each satellite to remain above a specific region. This allows the user to point the transmitter GOES antenna at a fixed position in the sky.

There are two satellites, GOES East and GOES West. GOES East is located at 75° west longitude and GOES West is located at 135° west longitude. Both satellites are located over the equator. In the United States, odd-numbered channels are assigned to GOES East, and even- numbered channels are assigned to GOES West. Channels used outside the United States are assigned to either satellite.

[1] *National Environmental Satellite, Data, and Information Service*

[2] *National Oceanic and Atmospheric Administration*

[3] *European Organization for the Exploitation of Meteorological Satellites*

[4] *Agência Nacional de Telecomunicações*

2.1.2 NESDIS AND TRANSMIT WINDOW

The National Environmental Satellite Data Information Service (NESDIS) manages **GOES**. NESDIS assigns an ID to the platform and a designated transmission timeslot. The transmission can be self-timed or executed on a random transmission window. The transmission is received by a ground station via satellite and can then be retrieved by the customer. Self-timed transmissions allow data transmission only during a predetermined period (typically 10 seconds every hour). After each transmission, short duration data is erased from the transmitter's buffer, but random data is not. Some transmission windows are for critical applications (such as flood, landslides, storms, etc) and allows transmissions almost immediately after a threshold has been exceeded. In this case the transmission is repeated to ensure it is received.

2.1.3 DATA RETRIEVAL

Data retrieval is performed through the USER INTERFACE manual, provided by **NESDIS**; it describes the process of retrieving the data directly from the **NESDIS** ground station via DOMSAT, LRGS, or LRIT. The data is in ASCII format and can be converted. For more information about data retrieval access: noaasis.noaa.gov/DCS

2.1.4 ELIGIBILITY

To use the **GOES** Data Collection Platform, users are required to receive formal permission from **NESDIS**. Outside of the USA, the system can be used by state agencies, local government or users sponsored by one of those agencies. The data transmission via **GOES** to a data collection platform (DCP) is illustrated in Figure 1.

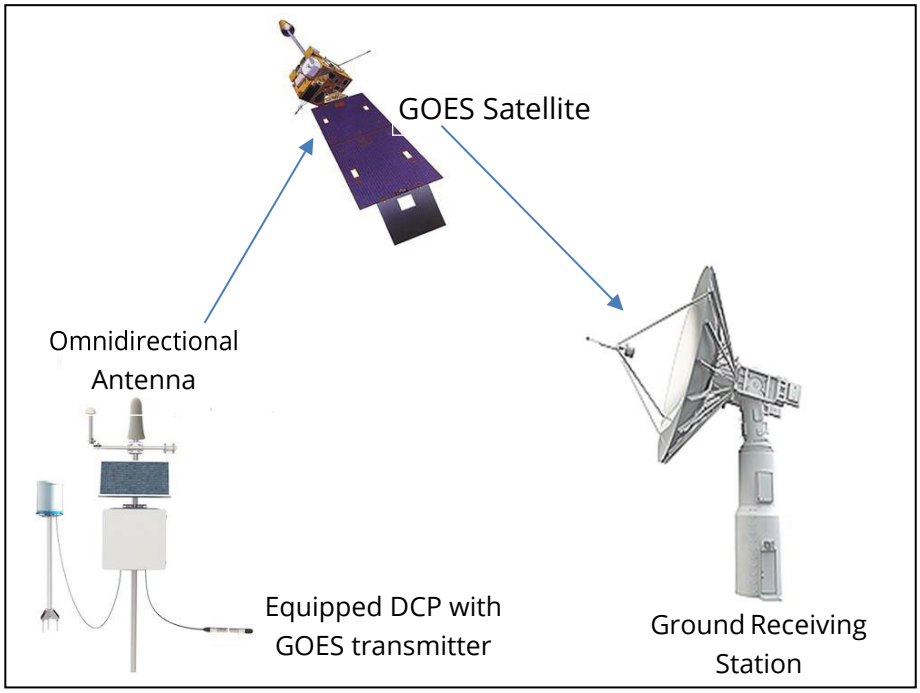


Figure 1: GOES system / DCP equipped with G6-DB

2.1.5 ACQUIRING PERMISSION

> **NOTE:** It is only possible to use a **GOES** platform through approval and certification of the transmitter by **NESDIS**.

You must submit a formal request to NOAA/NESDIS to obtain permission to transmit data via GOES. This can take up to three weeks.

1. Go to: https://dcs1.noaa.gov/
2. Apply for a Login.
3. Once logged in select “Submit an Application for a GOES DCS SUA”.
4. Complete and submit the application.

More information about the GOES Data Collection System can be found on the NOAA site.

Chapter 3 SPECIFICATIONS

Power Supply	
Supply voltage:	10.8 to 16.0 Vdc
Inverse voltage protection:	Yes, schottky diode
Overvoltage protection:	Yes, >20 Vdc, TVS diode
Current Draw:	Idle < 3 mA Transmitting < 2.6 A GPS on < 50 mA (default setting: once per day for 15 mins)
Connector:	Removable 2 pin screw terminal with 05 mm of pitch.
Satellite General	
Supports timed and random transmissions. Supports ASCII and binary message transmission. Transmit RF out connector: Type N jack.	
Satellite GOES	
Satellite GOES Version 2.0 (CS2) – High Transmission Rate - NOAA / NESDIS Certificate	
Baud Rates:	300 and 1200 bps
Transmit Power (default)	
300 bps:	31.5 dBm
1200 bps:	37.5 dBm
Maximum:	38 dBm
Frequency Range:	401.701 a 402.0985 MHz
Initial frequency stability:	±20 Hz disciplined to GPS; After this process, a GPS fix occurs after power up and once per day.
Channel Bandwidth	
300 bps:	750 Hz
1200 bps:	1.5 KHz
Satellite METEOSAT	
EUMETSAT METEOSAT SRD	
Baud Rates:	100 bps
Power Transmit (default)	
100 bps:	37.5 dBm
Maximum:	41.5 dBm
Frequency Range:	402.0355 a 402.4345 MHz
Initial frequency stability:	±20 Hz disciplined to GPS; After this process, a GPS fix occurs after power up and once per day.
Channel Bandwidth	
100 bps:	3 KHz
GPS Receiver	
Type:	3.3 V active
Connector:	SMA jack

Clock Accuracy:	
Initial Accuracy:	± 100 µs synchronized to GPS
Drift:	± 10 ms per day without GPS (drift applicable while the transmitter is operating within the temperature operating range)
GPS Chronometer:	One fix at power up (in the first GPS operation) and 1 fix per day afterwards.
Transmission Continuation without GPS Fix:	28 days
Interface Connectors	
USB:	Micro USB
RS-232:	DB9 F, DCE, RS-232 of 3 wires
RF antenna output:	Type N jack
GPS:	SMA jack
Power:	Removable 2 pins
Environmental	
Operating Temperature:	-40 a 60 °C
Storage Temperature:	-55 a 70 °C
Relative Humidity:	0-95%
Transmitter Size	
Maximum footprint including connectors:	21.88 x 13.15 x 4.4 cm (8.61” x 5.17” x 1.7”)
Weight:	955 g
Interface command protocols	
Binary command protocol:	Available on RS-232
ASCII command protocol:	Available on all ports

Chapter 4 INSTALLATION

4.1 FIELD SITE REQUIREMENTS

For proper operation of the **G6-DB** transmitter, the user must follow the following requirements:

- Install the antenna so that it has a clear view of the sky (view of the satellite).
- For directional antennas, the user must point it toward the satellite (Section 4.4.1).
- Omnidirectional antennas only require a positioning with clear view of the sky (Section 4.4.2).
- It must be installed in an enclosure that will protect it from any severe environment conditions, including condensation.
- The transmitter must be powered by a safe, noise-free power supply.

4.2 G6-DB FUNCTIONS

Figure 2 shows the main connector and transmitter indicators.

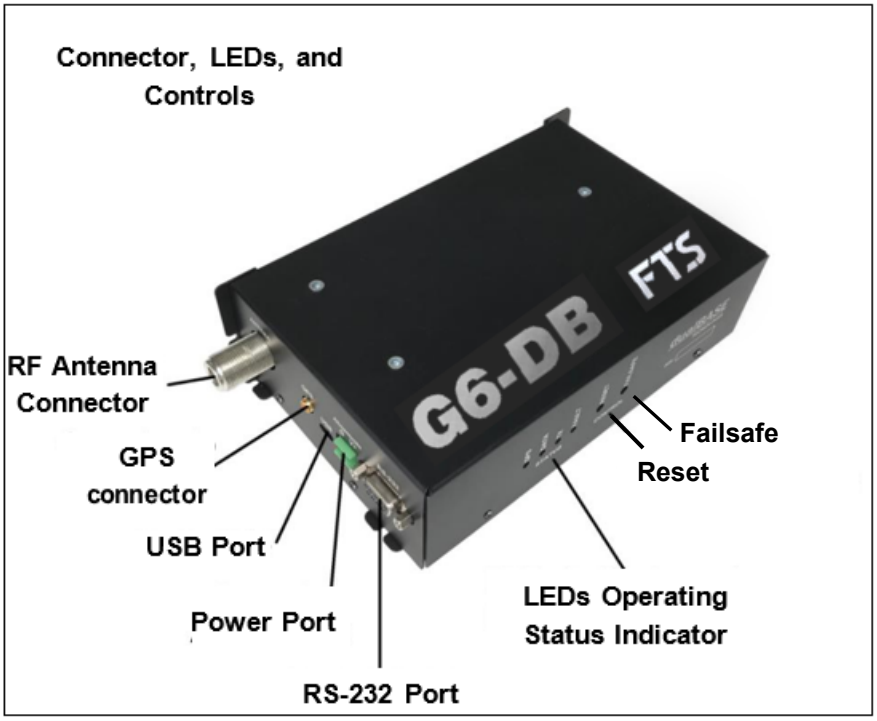


Figure 2: Connectors, LEDs and control indication of G6-DB

4.2.1 LED FUNCTION

The G6-DB has four LEDs in the case front panel, used to indicate the transmitter operational state. The LEDs may represent the following conditions:

- When the G6-DB is powered for the first time, the four LEDs quickly light up in a circular motion representing an auto test sequence, and then the GPS LED will light up.
- If there is data in the buffer waiting for the next transmission, the DATA LED will light up.
- During transmissions, the TX LED will light up.
- The FAULT LED is an indicator of failed transmissions (Section 4.2.2).
- As soon as it is powered up, the GPS LED will light up during the synchronization period with the GPS. The LED will turn off once the synchronization is complete.

NOTE: If the GPS antenna is not properly connected or the synchronization was not completed, the **GPS** LED will light for two seconds and then it will turn off for 90 seconds. This cycle will continue until the transmitter detects an antenna or completes the synchronization. Check the GPS antenna connectors.

NOTE: The GPS process of recognizing the antenna, synchronization and obtaining a position and time reference, may take up to 20 minutes. Watch the **GPS** LED, for at least two minutes to ensure that the transmitter has successfully completed the synchronization.

4.2.2 FAILSAFE FUNCTION

The transmitter has a built-in failsafe processor that will disable satellite transmissions should one of two events occur:

1) A transmission occurs too close in time to the previous transmission:
   - GOES – 30 second interval
   - METEOSAT – 30 second interval
2) A transmission continues for an excessive amount of time:
   - GOES – Exceeds 105 seconds
   - METEOSAT – Exceeds 90 seconds

The failsafe operation is independent of the main processor and cannot be disabled.

The failsafe can be re-enabled by using the ASCII clear failsafe command (Section 6.5.1) or following the next steps:

- Press the **FAILSAFE** button and hold for 2 seconds, if:
  - If the LED **FAULT** blinks one time, the failsafe is cleared
  - If the LED **FAULT** blinks two times, the failsafe has been tripped; a failure occurred.
- To restart, press the **FAILSAFE** button for 10 seconds.

> **NOTE:** The **FAILSAFE** will not be reset by power cycling the transmitter using the reset function (Section 4.2.3).

4.2.3 RESET FUNCTION

The RESET function is used to restart the transmitter. This function will start the transmitter the same way as an initial power up or power reset. To do this, perform the following steps:

- Press the RESET button for at least 1 second.

Note that the failsafe will not be restarted if has been previously tripped. In case this happens, follow the function procedures. After the RESET, the GPS may take up to 20 minutes to recognize the antenna, finish the synchronization and obtain a position and time reference.

4.2.4 GPS SYNCHRONIZATION

After power is first applied to the transmitter and the initialization sequence is completed, the LED GPS will illuminate indicating that the transmitter is acquiring a GPS fix and is trying to synchronize its clock to UTC time. This can take as long as twenty minutes as a complete list of satellites needs to be checked to ensure location and time synchronization. Once the transmitter is synchronized, it will be able to transmit on the specified time schedule.

After initial time synchronization, the transmitter will attempt a single resynchronization to UTC time every 24 hours to correct any potential time drifts in the clock. The transmitter is capable of operating for 28 days without a time resynchronization. After 28 days, if a time resynchronization is not achieved, the transmitter will disable transmissions. However, it will continue to attempt time resynchronization and, if successful, will re-enable transmissions.

> **NOTE:** If the transmitter cannot synchronize to UTC time during the first 20 minutes, the transmitter will switch off the GPS module for one minute and then will restart the synchronization cycle. This process continues until the transmitter successfully synchronizes to UTC time.

4.3 RF CONNECTORS

4.3.1 ANTENNA CONNECTOR

The G6-DB uses the type N female connector for RF power out. It must have a proper connection before any transmission occurs. Failure to use a properly matched cable and connector may cause permanent damage to the equipment. The nominal impedance is 50 ohms; the frequency range is approximately 400 to 403 MHz. For GOES, at 300 bps transmission rates, the default transmit power is 31.5 dBm. At 1200 bps, the default transmit power is 37.5 dBm. For METEOSAT the default transmit power is 37.5 dBm

4.3.2 GPS CONNECTOR

The GPS connector is a type SMA input. Operation without an antenna connected will not cause damage, but the transmitter will not transmit without a valid GPS position or if the time is not synchronized. The transmitter uses the GPS to ensure data transmissions occur at the proper time.

4.3.3 POWER SUPPLY

The G6-DB comes with a removable two-pin power terminal block for connecting to a power source. The two pins are ground and 12 V. The input power requirement is 10.8 to 16 Vdc. Because the transmitter can use up to 3 A, the power should be connected directly to the battery. Make sure the power supply that reaches the transmitter is within the specifications and that the power source is reliable. The supply wires connected to the transmitter must be appropriately sized to minimize their voltage drop when the DB-G6 is transmitting.

4.4 TRANSMISSION ANTENNA

> **NOTE:** Ensure any antenna selected is certified for use in the region/country of intended operation.

4.4.1 DIRECTIONAL ANTENNA

The recommended directional antenna is a Yagi with a Type N connector. The antenna is directional and must be aimed at the specific satellite so requires a pole or mast for mounting The site's coordinates (latitude, longitude and elevation) must be determined prior to installation as well as the satellite's position in order to determine the correct azimuth and inclination for mounting the antenna. A poorly positioned antenna will result in decreased signal strength and possibly failed transmissions.

For more information on Yagi Directional Antenna and its technical specifications, please contact FTS Support.

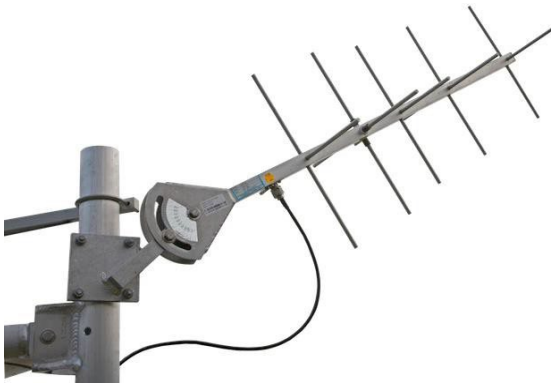


Figure 3: Yagi directional Antenna

4.4.2 EON2 OMNIDIRECTIONAL ANTENNA

An omnidirectional antenna is noted for its ease of use, lightness, and greater durability than a directional antenna. It requires no assembly and no aiming in most locations. It just needs to be mounted with a clear view of the sky., Additionally, the FTS EON2 antenna is dome-shaped for shedding snow and ice, is completely sealed for use in harsh environments, and has the option of an embedded GPS antenna.

For more information on the EON2 Omnidirectional Antenna and its technical specifications, please contact FTS Support.

Figure 4: EON2 Omnidirectional antenna

Chapter 5 CONFIGURING

5.1 COMMUNICATING WITH THE G6-DB

A method to communicate with the G6-DB transmitter must be established. There are two ways to communicate:

1) Connecting the transmitter to a PC (RS-232 or USB port) and run a terminal emulation program such as Windows HyperTerminal.
2) Connecting the transmitter to a compatible data logger via RS-232 serial port. Note the setting and limitation of the serial port data logger.

5.1.1 DATA LOGGERS

The G6-DB is easy to integrate with the following data loggers.

CSI:

- CR6
- CR300 Series
- CR800 Series
- CR1000 Series
- CR3000
- CR5000

Vaisala:

- QML201

5.1.2 RS-232 PORT

Data entry, system setup, calibration and diagnostic functions are performed by the main micro-controller using one of two possible serial interfaces, however the RS-232 port is the main port. This port supports both ASCII and binary commands. The RS-232 port is available in a DB9 connector which only three pins are used (RxD, TxD, and GND).

5.1.3 USB PORT

The transmitter also has a micro-USB port for connecting to a personal computer. Many newer computers only have these USB ports. The G6-DB can be configured via a terminal (for example: HyperTerminal or Putty terminal) if connected to a computer via USB.

The USB serial port is used to upgrade firmware and only supports ASCII commands.

The USB serial port is the secondary port, therefore the RS-232 serial port ends up being the most used.

5.1.4 SERIAL INTERFACE

The default G6-DB serial port settings to perform any interface communication are:

- Transmission rate: 9600 bps
- Data bits: 8Parity: None
- Stop bits: 1
- No flow control (in the terminal emulator

> **NOTE:** A three-wire connection (TXD, RXD and GND) is all that is supported in the transmitter serial port. An integrated control system permits each port a low power mode when not in use for 60 seconds

5.2 UPGRADING FIRMWARE

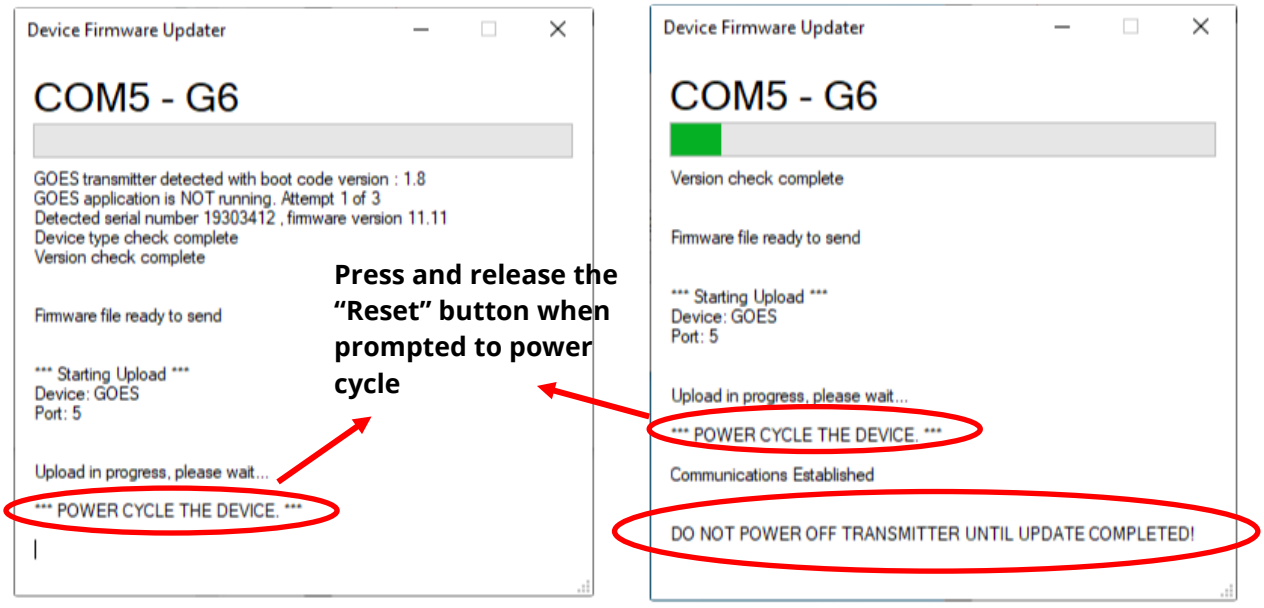
Firmware updates are conducted through the USB port with a connection to a PC. Instructions ("Device Firmware Updater PC for G5/G6 Firmware Update") for updating the firmware are found on the FTS Support site: https://s3.amazonaws.com/Product_Software/700-FirmwwareUpdaterPC-Inst.pdf

STEPS:

1) Connect the G6-DB to a PC using a micro-USB cable

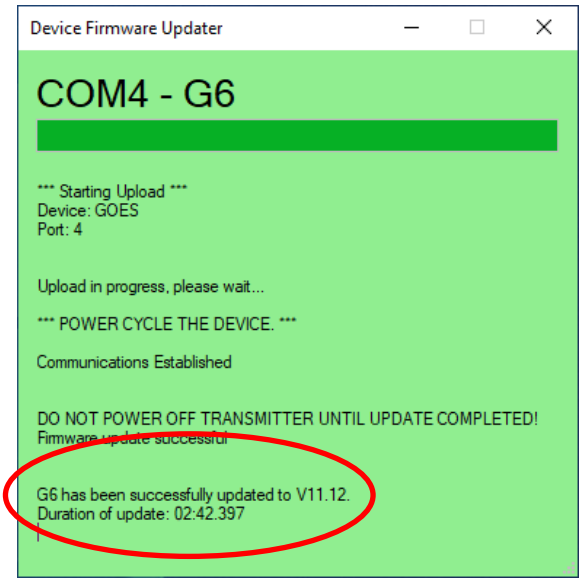
2) Follow the steps in the Firmware Updater Instructions: https://s3.amazonaws.com/Product_Software/700-FirmwwareUpdaterPC-Inst.pdf

3) When prompted to power cycle the unit, do so by pressing and releasing the "Reset" button on the side of the unit near the LEDs (see Figure 2, page 7). NOTE: You may be prompted to power cycle twice during the process.



First reset Second Reset

4) You will receive a successful upload message once the upgrade is complete.



Successful Upload

5.3 CONNECTING THE EQUIPMENT

Note that all required periphery equipment and cables are supplied by the customer. See Figure 5 for examples.

Before powering up, the antenna and communication cables must be connected.

1) GPS antenna;
2) Satellite antenna;
3) Power terminal block (wired to power source as per Section 4.4);
4) Communication cable:
   a) USB cable (to connect to a PC via terminal); or
   b) 9 pin R2S32 communication cable (to connect to a data logger with serial port or a PC)

Figure 5: Examples of cables and periphery equipment

Connect the cables as shown in Figure 6. Note that only one of either the USB cable or the communication serial cable may be required depending on the equipment in use. However, both can be used simultaneously.

Figure 6: 6-DB with interface connections with USB cable (left) and RS-232 cable (right).

When power is first applied to the transmitter, it will boot up and then, the front panel LEDs will light up in a circular form (Chapter 4.2.1) and the following dialogue will display if using a terminal emulator: **Self-Test Completed**

> **NOTE:** A startup message will only be displayed if using the RS-232 communication port (main port). If using the USB port the message will not be displayed.

Start a text file capture via, for example, HyperTerminal, so that you have a record of the session.

Press Enter, then wait some seconds and then press Enter again to activate the transmitter. The G6-DB should respond with a ">" prompt.

Details of communication protocols and configuration are in the following sections.

5.4 COMMUNICATION PROTOCOLS

The transmitter has a communication protocol with ASCII or binary command interface that allows configuration via a terminal program, such as Windows HyperTerminal or Putty Terminal. This interface is also suitable for connection to data loggers equipped with a serial port. It will automatically detect if ASCII or binary protocols are used.

> **NOTE:** Only the ASCII commands are described in this document as the binary commands are difficult to use with standard terminal programs

> **IMPORTANT:** Both serial ports can be used for ASCII command protocols, but for binary protocol commands only the serial communication RS-232 port will work

Communication with the transmitter is initiated by the (CR) command that is generated by pressing the Enter key. The transmitter responds with a ">" to indicate that it is ready to receive a command. Commands can then be entered and terminated by the **Enter** key (CR).

If no characters are entered for 60 seconds, the transmitter will enter low power mode. Any entered commands are deleted and the communication port will go to standby mode. Communication must be re-established by pressing the **Enter** key (CR) until the > prompt is returned.

Commands must be terminated with the **Enter** key (CR). Any character received, following an **Enter**, will be ignored. If you have message data with a CR in the line feeds (i.e. so data will be printed out in columns rather than a line), then the CR must be preceded with a tilde (~).

ASCII commands do not distinguish between uppercase and lowercase characters, but for the sake of clarity, in this document command characters will be in uppercase and bold.

> **NOTE:** If you choose to use binary commands, please contact us

5.5 COMMAND ACCESS LEVEL

All commands are subject to an access level. This is done to restrict access to factory calibration and test commands. Two access levels are defined: **USER** and **TECHNICIAN**.

USER level commands are always available including when operating at the **TECHNICIAN** command access level. However, an error will be returned if a **TECHNICIAN** level command is entered while at the **USER** command access level. After powering up or resetting the transmitter, the access level is always **USER**.

> **WARNING:** When operating at the **TECHNICIAN** level, caution must be used as changes made can permanently change the default settings or even damage the transmitter

As long as **>SAVE** or **>SAVECAL** is not entered after changes are made in the **TECHNICIAN** level, then the previously saved configuration can be recalled using the **>RSTR** command.

The access level of each command is noted in the command descriptions in Chapter 6. Some commands are only available when transmissions are disabled. This is also noted along with each command description.

5.6 CONFIGURATION FORMAT

The G6-DB will arrive with the factory default settings and the transmitter configuration will be displayed in the following format:

```
>RCFG
NESID=0000
TCH=0
TBR=0
TIN=00:00:00:00
FTT=00:00:00
TWL=0
CMSG=N
EBM=N
TPR=S
TDF=A
RCH=0
RBR=0
RIN=0
RPC=0
RRC=0
RDF=A
RMC=N
IRC=?
GIN=00:00:00
```

Mandatory parameters provided by NOAA

Additional parameters

Configure according with the setting parameters of each data-collecting platform (Sections 5.6 through 5.8) and run test transmissions (Sections 5.9 and 5.10).

5.7 NOAA / EUMETSAT TRANSMIT PARAMETERS

The first step in the configuration is to enter the transmit parameters which will have been provided by the NOAA or EUMETSAT. The transmit parameters consist of the following:

> **NOTE:** NOAA calls the GOES station identifier (address) as NESID; EUMETSAT identifies the address as DCPID. However, the format of these addresses is identical. The G6-DB can be set either as a NESID (GOES CS2 data collection platform) identifier or as a DCPID of EUMETSAT in its commands. In this manual, we will only use the term NESID identification address

- NESID: The address for your assignment (an eight character identifier)
- Channel: Your assigned PRIME CHANNEL (TCH)
- Bit Rate: Your assigned platform baud rate (TBR)
- Interval: Your assigned report rate (TIN)
- First Tx: Your assigned first transmission time (FTT)
- Window: Your assigned transmit window (TWL)

NOTE: Table 1 contains command examples. ASCII commands are in bold, parameters or values examples are in red. Ensure you input your assigned parameters/desired values. Do not copy the red examples.

NOAA/EUMETSAT Assigned Item	Command and Response Examples	Comments
Unique NES Identifier	**>NESID=12345678** **>OK**	This is a hexadecimal alphanumeric identifier for this GOES station (for this place, not for the transmitter). Must end in an even number.
NESID Channel	**>TCH=195** **>OK**	Channel number specified by NESID.
NESID Baud Rate	**>TBR=300** **>OK**	Baud rate varies between platforms. NOAA will assign you a baud rate based on the information provided.
Transmission Interval	**>TIN=00:01:00:00** **>OK**	The transmission interval is defined with how often transmissions are made and is specified in dd:hh:mm:ss format. Valid range is 00:00:05:00 to 30:23:59:59.
First Transmission Time	**>FTT=00:43:00** **>OK**	First time of transmission in hh:mm:ss format and in 24 hour clock. Valid range is 00:00:00 to 23:59:59.
Transmission Window Length	**>TWL=10** **>OK**	Window sizes can vary. The most common are 10 or 15 second windows.

Table 1: NOAA Transmit parameters setting examples

The transmitter will always return a "OK" message when the parameters above are entered correctly. Check the entered values if any parameter gives a different answer.

5.8 ADDITIONAL TRANSMIT PARAMETERS

The rest of the parameters are optional: some are user defined, some need to remain in the factory default, and others require further permissions from the NOAA. The following table briefly explains each item. Detailed explanations are found in Chapter 10.

Default setting	Item	Command and Response Example	Comments
CMSG=N	Center message in window	**>CMSG=Y** **>OK**	Y=Yes (Recommended). N=No. See Section 9.7.1 for details.
EBM=N	Empty buffer message	**>EBM=Y** **>OK**	Y=Yes. The **G6-DB** transmitter will transmit even if there is no data in the transmit buffer. N=No. There will be no transmission if there is no data in the buffer.
TPR=S	Transmit preamble length	**N/A**	N/A= Do not alter. Default setting.
TDF=A	Transmit data format.	**Default**	Default setting is A (ASCII). Other options are pseudo binary (P) and binary (B). See section 10.3.9 for details.
RCH=0	Random channel	**Default**	N/A= Do not alter. The transmitter does not transmit random messages. Keep default settings. .
RBR=0	Random Baud rate	**Default**	
RIN=0	Random interval	**Default**	
RPC=0	Random Tx random percentage	**Default**	
RRC=0	Random Tx repeat count	**Default**	
RDF=A	Random Tx data format	**Default**	
RMC=N	Random Tx message counter	**Default**	
IRC=?	ASCII Replacement character.	**Default**	See section 6.2.4 for details.
GIN=00:00:00	GPS Fix interval	**Default**	See section 6.2.13 for details.

Table 2: Additional transmit parameters

1) Enter the command for the additional transmit parameters with which you wish to configure the transmitter following the format in the table above.
2) Issue a >SAVE command to store the parameters in the transmitter nonvolatile memory.

>SAVE : save the current parameters to memory.
OK : The transmitter responds with the OK message.

3) Read the transmitter's configuration to confirm all parameters have been input correctly.

> RCFG : read the current configuration
NESID=012345 : the transmitter responds with the configuration
TCH=195
TBR=300
TIN=00:01:00:00
FTT=00:17:40
TWL=10
CMSG=Y
EBM=Y
TPR=S
TIL=N
TDF=A
RCH=0
RBR=0
RIN=0
RPC=0
RRC=0
RDF=A
RMC=N
IRC=?
GIN=00:00:00

5.8.1 MESSAGE CENTERING

If selected, Message Centering causes the transmitter to transmit its data centered in the middle of its transmission window instead of transmitting right at the start of its transmission time. The default setting is N (no) but NOAA's recommendation is to select message centering. Message centering takes into account the full length of the message and then places it in the middle of the window. This helps avoid message collisions due to a neighboring or rogue message going over its time in the window. If the data to be transmitted fills the entire transmit window some of it may be lost as some of the transmit window time is allotted for the time it takes the message to leave the site, reach the satellite, and be decoded by the ground station.

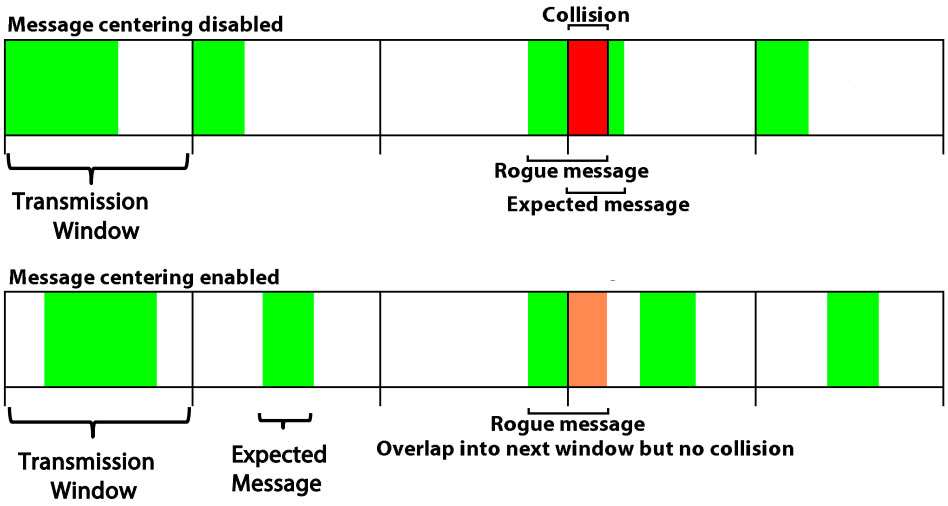


Figure 7: Message centering

5.9 SET RF POWER LEVELS

RF Power levels will differ depending on the antenna in use and site specifications such as latitude, antenna orientation, power loss due to length of cable and connectors, and terrain features which may inhibit a clear view of the satellite (for example: dense foliage). Power levels should be in accordance with data collection platform radio set (DCPRS) and the Effective Isotropic Radiated Power (EIRP) for NOAA[5] or EUMETSAT[6].

You must ensure that the DCPRS antenna transmit gain, when combined with the data collection platform's output power, does not exceed the maximum EIRP.

Bit rate (bps)	NOAA EIRP Maximum (dBm)	EUMETSAT EIRP Maximum (dBm)
100	N/A	52
300	37 – 41	N/A
1200	43 – 47	N/A

Table 3: Maximum effective isotropic radiated power

Refer to your antenna's specifications and operating manual to determine its gain and determine the required power output. Note that the transmitter maximum power output (38 dBm).

Once you have determined your required power level range, check the current power level settings and determine if they need to be changed.

[5] GOES Data Collection Platform Radio Set (DCPRS) CERTIFICATION STANDARDS, NOAA/NESDIS, June 2009; http://www.noaasis.noaa.gov/DCS/docs/DCPR_CS2_final_June09.pdf; Section 4.1.1

[6] EUMETSAT International Data Collection System Users' Guide, Edition 10 version 1, October 2009 https://www.eumetsat.int/website/home/Data/TechnicalDocuments/index.html

1) Switch the transmitter mode to TECHNICIAN

>techmode alpha (this is the only command that is case sensitive)
OK

> **WARNING:** When operating at the TECHNICIAN level, caution must be used as changes made can permanently change or damage the transmitter.
>
> As long as **>SAVE** or **>SAVECAL** is not entered after changes are made in the TECHNICIAN level, then the previously saved configuration can be recovered using the **>RSTR** command or by power cycling the transmitter.

2) Check the current power levels

>PWRLVL : Check power levels
PWRLVL=32,32,38 : Factory set default settings for 100, 300 and 1200 bps respectively.

3) If necessary, change the power levels. Refer to your antenna's specifications and operating manual. DO NOT USE the example values that appear in red font.

PWRLVL=**31.5,34,38** : Example values. Set output power levels to desired values (100, 300,and 1200 bps respectively). See section 5.8 for details.

4) Save the new power settings

>SAVECAL : Save the parameters to non-volatile memory.

5) Exit TECHNICIAN mode

6) Issue an Enable Transmission command to check if the configuration is valid.

>USERMODE
OK

> **NOTE:** If the message returns BAD PARAMETER instead of OK, an error was made inputting the transmit parameters. Review the configuration and then re-enter the erroneous command with the correct parameter.

5.10 CONFIRMING GPS SYNCHRONIZATION

Prior to transmitting, the GPS must have successfully completed its initial fix and time synchronization. Check the GPS LED. If it is off, observe it for at least two minutes to ensure the GPS has a fix and has completed time synchronization. If the GPS LED comes back on, then it is still attempting synchronization.

1) Once the GPS LED remains off, determine the GPS status by typing in the **Get GPS Status** command.

>GPS

a) If the transmitter is still attempting synchronization it will return a message similar to the two following examples

Fix Status: No Fix Almanac Available: N PPS Output Stable: N UTC Offset = 0.000000 Antenna OK	Fix Status: Waiting For GPS Time Almanac Available: N PPS Output Stable: N UTC Offset = 0.000000 Antenna OK
Satellite # | Signal Strength _____|_____ 32 | 32.00 4 | 34.00 1 | 33.00 14 | 27.00 11 | 27.00 51 | 31.00 22 | 29.00 3 | 25.00 0 | no lock 0 | no lock 0 | no lock 0 | no lock	Satellite # | Signal Strength ___ _____|_____ 32 | 39.00 31 | 39.00 1 | 41.00 3 | 38.00 4 | 36.00 48 | 38.00 14 | 38.00 11 | 33.00 23 | 33.00 25 | 30.00 17 | 36.00 22 | 27.00

b) If the transmitter returns a **GPS Off** message, then it either has completed synchronization, or is cycling on and off as it is still attempting synchronization.

>GPS
GPS Off

1) If a **GPS Off** message is returned, to confirm if synchronization has occurred type in the TIME command

a) No GPS synchronization

>TIME
Time=2000/01/01 00:00:11 : this return indicates synchronization has not occurred (wrong year/month/date). The running time count indicates time passed since the last synchronization attempt.

b) GPS synchronized

>TIME
Time=2015/03/24 18:27:43 : this return indicates the GPS has synchronized as is evident by a current year/month/day and time.

5.11 CONFIRM TIMED TRANSMISSION STATUS

Once the GPS is synchronized, in order to ensure the transmitter is fully functional and the antenna is correctly aligned, a timed transmission should be made.

1) Issue a ***Get Transmission Status*** command

>RST : Get transmission status

Transmitter: Enabled : the transmitter responds with the following information
GPS: On
RTC: Valid
Time To Next Tx: 00:00:46:39
Timed Message Length: 0 bytes
Next Timed Tx: 2015/03/19 18:00:20
Random Message Length: 0 bytes
Random Message Tx Count: 0
Next Random Tx: N/A
Failsafe: OK
Supply voltage: 15.7 V

This message indicates that all is ready to transmit except that there is no data at this point (Timed Message Length: 0 bytes). If there is data, the message length will indicate the number of bytes.

2) To confirm that data will be transmitted at the next transmission time (18:00:22 in the example), there must be data in the buffer. For test purposes, to ensure the data is transmitted correctly, disable the ***Self-Timed Buffer Empty Message*** if it is set to **Y** (yes).

>EBM=N : Self-Timed Buffer Empty Message
OK : the transmitter responds with the OK message

3) Provide data for transmission.

a) If data is being supplied by a piece of periphery equipment, ensure that the data collection time is in advance of the transmission time.

REMEMBER! Information is loaded into the transmit buffer approximately 2 minutes before transmission, so ensure the periphery equipment's offset time is calculated to have completed reading, logging and processing at least two minutes before the transmission.

b) If there is no direct source for providing data, test data can be entered manually using the ***Load Timed Transmission Message Buffer.***

>TDT=12232,12.00,33.98 : the message can be random values
>OK

4) Confirm the message details.

>TBD : Timed Transmission message buffer read
Timed Message Length = 18 bytes : transmitter returns number of bytes and content
Timed Message is:
12232,12.00,33.98
OK

Note: if data was manually entered, the timed message should match that data

5) Prior to the scheduled transmission time, check that the Data buffer LED is lit to indicate that data is in the message buffer. Once the data is loaded into the transmit buffer for encoding the LED will turn off.

6) At transmission time check the Transmission Indicator LED. It should light up when the transmission is underway.

7) Once the Transmission Indicator LED is extinguished, check the status of the transmitted message.

>LTXS : Get last transmission status
Tx Status: OK : transmitter returns the following information
Tx Type: Self Timed
Last Tx Length: 18 bytes
Last Tx Start Time: 2015/03/19 18:00:25
Last Tx Stop Time: 2015/03/19 18:00:26
Forward Power: 32.2 dBm
Reflected Power: 2.1 dBm
SWR: 1.06
Power Supply: 15.3 V

Note that message centering was enabled so the transmission start time is in the middle of the 18:00:20 ten second transmission window (Last Tx Start Time indicates 18:00:25)

8) Once you have confirmed that the transmission was successful and the data was transmitted correctly, ensure the EBM is returned to EBM=Y (if that is the desired setting).

9) Close the HyperTerminal text file capture and disconnect from the Communication Port.

5.12 FAILED TRANSMISSION

If the transmission failed, there are two ways to troubleshoot the issue.

1) Read the audit log. This will return a list of recent events. See Section 5.5.9 for details of possible audit log messages.
>RAL
2015/03/19 17:34:22 TX Aborted: Timed Tx Buffer Empty : example message

2) Get the status of the last failed transmission.
>LTXL

Example 1:
>LTXL
Tx Status: TX Aborted: Timed Tx Buffer Empty : example message
Tx Type: Self Timed
Last TX Length: 0 bytes
Last Tx Start Time: 2015/03/19 17:34:22
Last Tx Stop Time: N/A
Forward Power: N/A
Reflected Power: N/A
SWR: N/A
Power Supply: N/A

Note that some fields will be marked as N/A depending on the context of the failure which is described by 'Tx Status'.

Example 2:
>LTXL
Tx Status: Msg Truncated
Tx Type: Self Timed
Last Tx Length: 2214 bytes
Last Tx Start Time: 2012/06/13 21:36:59
Last Tx Stop Time: 2012/06/13 21:37:58
Forward Power: 32.0 dBm
Reflected Power: 16.3 dBm
SWR: 1.39
Power Supply: 10.9 V

Msg Truncated (message truncated) indicates that there was more data than could be transmitted within the transmission window.

5.13 COMMON COMMANDS

There are several commands which will be used frequently with the G6 transmitter. In addition to the following common commands, Chapter 4 contains a comprehensive list of other ASCII commands which are to be used with the G6 transmitter.

5.13.1 CHECK THE STATUS OF THE GPS

>GPS

Example:

>GPS : check the status of the GPS
Fix Status: Waiting For GPS Time
Almanac Available: N
PPS Output Stable: N
UTC Offset = 0.000000
Antenna OK

Satellite #	Signal Strength
32	39.00
31	39.00
1	41.00
3	38.00
4	36.00
48	38.00
14	38.00
11	33.00
23	33.00
25	30.00
17	36.00
22	27.00

5.13.2 TIMED TRANSMISSION DATA BUFFER LOADING COMMANDS

The following commands are used to manage and store timed transmission data in the G6 Transmission buffer

>TBD : read the timed transmission message

Example:

>TBD
Timed Message Length = 25 bytes
Timed Message is:
300,29.6,45.25 : this would return the actual data for your device; the returned values shown here are for example only

To overwrite data in the timed transmission message:

>TDT = : insert the timed message content after the =

Example: we want to change the data in the buffer with our own values

>TDT=1224,4455,439.0: this will overwrite the G6 Timed Buffer message (as seen in the preceding >TBD example) with the data provided

>TBD
Timed Message Length = 16 bytes
Timed Message is: :new timed message is indicated as input
1234,4455,439.0 above at the **>TDT** command (the previous
OK 300,29.6,45.25 data is replaced)

To add data to that already in the timed transmission buffer:

>TDTAPND =xxxxxxx : the new data (xxxxxxx) will be appended (added)

Example: we read the timed transmission message and receive the following response:

>TBD
Timed Message Length = 15 bytes
Timed Message is:
1234,4455,439.0
OK

We want to add additional data to the message:

>TDTAPND=,98.7 Now when we read the timed transmission buffer we see:

>TBD
Timed Message Length = 20 bytes
Timed Message is:
1234,4455,439.0,98.7 : the new data is appended to the data
OK in the buffer

5.13.3 RANDOM TRANSMISSION MESSAGE BUFFER COMMANDS

The following commands are used to manage and store random transmission data in the G6 Transmission buffer the same as Timed Transmission Data Buffer Loading Commands. Detailed

examples can be seen in Section 3.6.2 – just exchange the random transmission commands for the timed transmission commands.

>RBD : read the random transmission buffer
Random Message Length = 25 bytes
Random Message is:
300,29.6,45.25 : this would return the actual data for your device; the returned values shown here are for example only

To overwrite data into the random message buffer:

>RDT= : insert the random message content after the =

Example:
>RDT=1224,4455,439.0: this will overwrite the G6 Random Buffer message with the data provided

To add data to that already in the random transmission buffer:

>RDTAPND =xxxxxxx : the new data (xxxxxxx) will be appended (added)

5.13.4 TRANSMITTER CURRENT STATUS

Read the transmitter's current status

>RST
Example:

>RST
Transmitter: Enabled
GPS: On
RTC: Valid
Time To Next Tx: 00:00:37:52
Timed Message Length: 119 bytes
Next Timed Tx: 2010/05/13 23:17:40
Random Message Length: 119 bytes
Random Message Tx Count: 0
Next Random Tx: N/A
Failsafe: OK
Supply voltage: 11.9 V

Chapter 6 ASCII COMMANDS

6.1 GENERAL

The following sub sections describe the ASCII commands for the G6 transmitter module. These commands can be entered from a terminal connected to either one of the G6 serial ports.

For clarity, the commands described in the following sections are shown in upper case. However, the command protocol is not case sensitive and will accept any combination of upper and lower case.

Many commands are used to set or retrieve various configuration/calibration parameters. When setting parameters, the command is followed by an equals sign ('=') and a comma separated list of parameters. When retrieving parameters, the command is entered without the '=' or followed by a question mark ('?').

Some commands are used to direct the transmitter to execute a specific function (e.g. clear a buffer); in such cases, neither a '=' or a '?' is required. If the command has parameters associated with it they will appear as a comma separated list following the command itself. Note that when entering data no spaces are entered after commas.

All commands must be terminated by striking the Enter key or typing the CR command.

Unless otherwise noted, the transmitter will respond to all commands with one of the following:

"OK[CR][LF]>" if command was accepted,

"Bad parameter[CR][LF]>" if a command parameter was invalid,

"Unknown Format[CR][LF]>" if there are too many or too few parameters,

"Access Denied![CR][LF]>" if the command requires a higher access level,

"Unknown Command[CR][LF]>" if the command is unknown,

"Execution Error[CR][LF]>" if the command fails during execution,

"Transmitter Must Be Disabled [CR][LF]>" if the transmitter must be disabled prior to using this command.,

"Transmitter Must Be Enabled[CR][LF]>" if command must first be enabled,

"Configuration Not Recognized[CR][LF]>" if configuration is invalid,

If the command was a request for a configuration parameter the transmitter will respond with:

<cmd>=<data>**[CR][LF]>** When returning data parameters.

6.2 GENERAL CONFIGURATION COMMANDS

6.2.1 SERIAL PORT PARAMETERS SERIAL PORT1

Syntax: **SPP = Baud Rate, Data Bits, Parity, Stop Bits**
Access level: USER

The serial port settings; baud rate, number of data bits, parity, and stop bits, may be changed by the user. Once the serial port settings have been changed the user interface (I.e. HyperTerminal) will need to be changed to match.

6.2.2 SERIAL PORT PARAMETERS SERIAL PORT2

Syntax: **SPP2 = Baud rate, Data Bits, Parity, Stop Bits**
Access level: USER

The serial port settings; baud rate, number of data bits, parity, and stop bits, may be changed by the user. Once the serial port settings have been changed the user interface (i.e. HyperTerminal) will need to be changed to match.

6.2.3 SET OR GET THE CURRENT TIME

Syntax: **TIME= yyyy/mm/dd hh:mm:ss**
Access level: USER
Tx State: Enabled/Disabled

This command sets the date and time in the transmitter. The date and time will be overwritten when GPS time synchronization occurs. Self-timed transmissions will not occur until the time has been set either using this command or from the GPS. Random transmissions will occur with or without time being set.
The real time clock starts at 01/01/2000 00:00:00 at power up.

6.2.4 SET OR GET REPLACEMENT CHARACTER

Syntax: **IRC=c**
Access level: USER
Tx State: Enabled/Disabled

This command defines the ASCII character that will be substituted for any Prohibited ASCII character detected in the transmission data when operating in ASCII or Pseudo-Binary mode. The default character is '?'. Only printable ASCII characters, excluding space, are permitted.

6.2.5 SAVE CONFIGURATION

Syntax: **SAVE**
Access level: USER
Tx State: Enabled/Disabled

This command directs the transmitter to commit the entered configuration parameters to non-volatile memory. Until this command is entered, the previously saved configuration can be recalled using the RSTR command.

6.2.6 RESTORE CONFIGURATION

Syntax: **RSTR**
Access level: USER
Tx State: Enabled/Disabled

This command directs the transmitter to restore the configuration parameters from non-volatile memory. Changes made to the configuration are not automatically saved to non-volatile memory as they are entered. This allows changes to be made and verified before committing them to permanent storage, while providing the ability to recall the last saved settings, if necessary.

6.2.7 RESTORE DEFAULT CONFIGURATION

Syntax: **DEFAULT**
Access level: USER
Tx State: Enabled/Disabled

This command directs the transmitter to set the configuration parameters to their factory default (mostly invalid) values; this essentially clears the operation of the transmitter. However, it does not set the calibration data or serial number to factory defaults.
This command also does not automatically save the cleared parameters to non-volatile memory. In order to do so, the SAVE command must be issued to complete the sequence.

6.2.8 ENABLE TRANSMISSIONS

Syntax: **ETX**
Access level: USER
Tx State: Disabled

This command enables transmissions. The configuration parameters will be checked for validity. If valid, they are saved to non-volatile memory and the transmitter is enabled. The enabled/disabled state of the transmitter is also stored in non-volatile memory so that it will resume operation after a power cycle if it had been previously enabled.
Note that the factory default configuration is <u>not</u> valid. The factory default parameters must be explicitly overwritten with valid values before transmissions can be enabled.

6.2.9 DISABLE TRANSMISSIONS

Syntax: **DTX**
Access level: USER
Tx State: Enabled

This command disables transmissions. Normal scheduling of transmissions is suspended.

> ***NOTE:*** the transmitter is automatically disabled if configuration parameters are modified and must be re-enabled with the ETX command to resume transmitting

6.2.10 READ CONFIGURATION

Syntax: **RCFG**
Access level: USER
Tx State: Enabled/Disabled

This command lists all of the configuration parameters. Each parameter is listed in the same format as if its individual command had been executed.

Example:
RCFG
NESID=326d31d4
TCH=92

The output from the RCFG command can be captured by the host (in a text file) and used to duplicate the configuration in another unit.

6.2.11 ENABLE TECHNICIAN COMMAND MODE

Syntax: **TECHMODE password**
Access level: USER
Tx State: Enabled/Disabled

This command changes the command access level to TECHNICIAN. The access level will not change unless the password is correct.

6.2.12 ENABLE USER COMMAND MODE

Syntax: **USERMODE**
Access level: USER
Tx State: Enabled/Disabled

This command changes the command access level back to USER. No password is required. A power cycle of the transmitter will also return the command access level to USER.

6.2.13 SETTING THE GPS FIX INTERVAL

Syntax: **GIN=hh:mm:ss**
Access level: USER
Tx State: Disabled
Default value: 00:00:00

This command sets the GPS position fix interval to the hours, minutes, seconds specified in hh:mm:ss format. It can also be used without the '=' sign to report the current value. Valid range of hh:mm:ss is 00:05:00 to 24:00:00.

A value of 00:00:00 will disable periodic GPS position fixes although they will still occur at power up and every 24 hours as a side effect of the daily automatic OCXO calibration. The current value of the GPS fix interval is also reported by the RCFG command. The parameter is non-volatile when saved using the SAVE or ETX commands.

6.3 GOES TRANSMISSION CONFIGURATION COMMANDS

The following commands are used to set the configuration parameters for GOES transmissions. Unless otherwise specified, these parameters have invalid default values and must be set explicitly before transmissions can be enabled using the **ETX** command. These parameters are stored in non-volatile memory by issuing the **SAVE** command or will be automatically saved when the transmitter is enabled.

The transmitter is disabled automatically if any of these parameters are modified. Parameters can be read by entering the command without the '=' while transmissions are enabled or disabled. All parameters can be read at the same time using the **RCFG** command.

6.3.1 SET GOES DCP PLATFORM ID

Syntax: **NESID=xxxxxxxx**
Access level: USER
Tx State: Disabled

Sets the transmitter's GOES DCP Platform ID to the assigned[7] 8 character NESID hex value.

6.3.2 SET SELF-TIMED TRANSMISSION CHANNEL NUMBER

Syntax: **TCH=ccc**
Access level: USER
Tx State: Disabled

[7] Assigned by the satellite system's operator, specifically NOAA or EUMETSAT.

This command sets the channel number (**ccc**) for timed transmissions. **CCC** is the channel number and has a valid range of 0 – 266 for bit rates of 100 and 300 BPS, and a range of 0 – 133 for a bit rate of 1200 BPS.

For 100 BPS operations on channels 201-266, the transmitter will be configured for International operation. Specifically, the 31-bit International EOT will be used (0x63CADD04) in place of the ASCII EOT, and the preamble will be forced to Long.
Setting the channel number to 0 will disable timed transmissions.

6.3.3 SET SELF-TIMED TRANSMISSION BIT RATE

Syntax: **TBR=bbbb**
Access level: USER
Tx State: Disabled

This command sets the timed transmission bit rate where **bbbb** is the bit rate parameter and has valid values of 100, 300 and 1200 BPS.

6.3.4 SET SELF-TIMED TRANSMISSION INTERVAL

Syntax: **TIN=dd:hh:mm:ss**
Access level: USER
Tx State: Disabled

Set interval between timed transmissions to days, hours, minutes, seconds specified in dd:hh:mm:ss format. Valid range is 00:00:05:00 to 30:23:59:59.

6.3.5 SET SELF-TIMED TRANSMISSION FIRST TRANSMISSION TIME

Syntax: **FTT=hh:mm:ss**
Access level: USER
Tx State: Disabled

Set the time for the first timed transmission of the day. Valid range is 00:00:00 to 23:59:59.

6.3.6 SET SELF-TIMED TRANSMISSION TRANSMIT WINDOW LENGTH

Syntax: **TWL=xxx**
Access level: USER
Tx State: Disabled

Set the length of the timed transmit window. Length is specified in seconds. Valid range is 5 to 240 seconds.

6.3.7 ENABLE OR DISABLE SELF-TIMED TRANSMISSION MESSAGE CENTERING

Syntax: **CMSG=Y/N**
Access level: USER
Tx State: Disabled

Center the timed transmission in the assigned window if Y, otherwise transmit at beginning of assigned window.

6.3.8 ENABLE OR DISABLE SELF-TIMED BUFFER EMPTY MESSAGE

Syntax: **EBM=Y/N**
Access level: USER
Tx State: Disabled

If EBM is Y, send "BUFFER EMPTY" message if the buffer is empty at time of transmission. If EBM is N do not transmit if the buffer is empty.

6.3.9 SET SELF-TIMED TRANSMISSION DATA FORMAT

Syntax: **TDF =A/P/B**
Access level: USER
Tx State: Disabled

This command sets the timed transmission format to ASCII, Pseudo-Binary or Binary. Valid values are **A** for ASCII, **P** for pseudo binary, or **B** for binary. This parameter is used to determine the flag word in 300 and 1200 BPS transmissions.
Note: It is the responsibility of the host to ensure the data provided for transmission is in the proper format.

6.3.10 SET RANDOM TRANSMISSION CHANNEL NUMBER

Syntax: **RCH=ccc**
Access level: USER
Tx State: Disabled
This command sets the channel number for random transmissions. **CCC** is the channel number and has a valid range of 0 – 266 for bit rates of 100 and 300 BPS and a valid range of 0 – 133 for a bit rate of 1200 BPS.
For 100 BPS operations on channels 201-266, the transmitter will be configured for International operation. Specifically, the 31-bit International EOT will be used (0x63CADD04) in place of the ASCII EOT.
Setting the channel number to 0 will disable random transmissions.

6.3.11 SET RANDOM TRANSMISSION BITRATE

Syntax: **RBR=bbbb**
Access level: USER
Tx State: Disabled

This command sets the random transmission bit rate where **bbbb** is the bit rate parameter and has valid values of 100, 300 and 1200.

6.3.12 SET RANDOM TRANSMISSION INTERVAL

Syntax: **RIN=mm**
Access level: USER
Tx State: Disabled

Set the random transmission randomizing interval to mm minutes. The randomizing interval is the interval in which a random transmission will occur if there is data in the random transmission buffer. The actual transmission time will be random, but on average will occur at this rate. Valid range is 5 to 99 minutes.

6.3.13 SET RANDOM TRANSMISSION RANDOMIZING PERCENTAGE

Syntax: **RPC=mm**
Access level: USER
Tx State: Disabled

This value determines the range of randomization as a percentage of the randomizing interval. Random transmissions will occur at a uniformly distributed random time within this range and on average occur at the randomizing interval rate. Valid range is 10 to 50%.
For example, for a randomizing interval =15 (minutes) and a randomizing percentage =20 (%), then the time between any two random transmissions will be 12 to 18 minutes (15 ± 3 minutes).

6.3.14 SET RANDOM TRANSMISSION REPEAT COUNT

Syntax: **RRC=xx**
Access level: USER
Tx State: Disabled

The random transmission repeat count is the number of times a random transmission will be repeated. The random transmissions will occur once every random transmission interval as specified by the randomizing interval. The valid range of this parameter is 0 – 99. For example, a value of 3 will direct the transmitter to send the data in the Random buffer 3 times before clearing it. A value of 0 indicates that random transmissions will occur every random transmission interval until the random buffer is cleared by the host.

6.3.15 SET RANDOM MESSAGE FORMAT

Syntax: **RDF=x**
Access level: USER
Tx State: Disabled

This sets or prints the random message format to 'A' for ASCII, 'B' fir binary or 'P' for pseudo binary.

>RDF=A (command)	:set random message format to ASCII
OK (response)	
>RDF (command)	:check random message format
RDF=A (response)	:random message format is ASCII

6.3.16 ENABLE OR DISABLE RANDOM TRANSMISSION MESSAGE COUNTER

Syntax: **RMC=Y/N**
Access level: USER
Tx State: DisabledIf RMC is Y a random message counter will be included at the beginning of the message, ahead of the user data. If it is N the random message count will not be included.

6.4 DATA BUFFER LOADING COMMANDS

The following commands are used to manage and store data in the GOES Transmission buffers.

6.4.1 TIMED TRANSMISSION MESSAGE BUFFER READ

Syntax: **TBD**
Access level: USER
Tx State: Enabled

This command returns the number of bytes in the message and the message as it was sent to the GOES transmitter.

Timed Message Length = 119 bytes
Timed Message is:
eeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeee
tttttttttttttttttttttttttttttttttttttttttttttttt
OK

6.4.2 LOAD TIMED TRANSMISSION MESSAGE BUFFER

Syntax: **TDT =xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx**
Access level: USER
Tx State: Enabled

This command overwrites the data in the Timed Buffer with the data provided. The G6 transmitter will insert the 31 bit GOES ID, any header information (e.g. HDR Flag byte), and append the EOT so these should not be included in the TDT data. If the timed data format is ASCII or pseudo-binary, the transmitter will also insert the correct parity bit for each message character and replace illegal characters with the character specified by the **IRC=c** command before transmission.

Characters that have meaning for the command interface (CR, LF, BS, ESC,'~') must be preceded by a '~' character if they appear in the message data.

The maximum length of the formatted data can be up to 126000 bits, or 15750 bytes.

If there is more data loaded into the buffer than can be transmitted in the assigned transmit window the message will be truncated.

One minute prior to transmission data is removed from the transmit buffer and encoded for transmission the Data In Buffer LED will go out. If this command is received within 1 minute of the transmission time or during a timed transmission, the data will not be included in the current transmission but will be buffered for the next interval.

6.4.3 APPEND TO SELF-TIMED TRANSMISSION MESSAGE BUFFER (VER 6.02 FIRMWARE OR GREATER)

Syntax: **TDTAPND =xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx**
Access level: USER
Tx State: Enabled

This command appends the data provided to the data in the Timed Buffer. The G6 transmitter will insert the 31 bit GOES ID, any header information (e.g. HDR Flag byte), and append the EOT so these should not be included in the TDT data. If the timed data format is ASCII or pseudo-binary, the transmitter will also insert the correct parity bit for each message character and replace illegal characters with the character specified by the **IRC=c** command before transmission.

Characters that have meaning for the command interface (CR, LF, BS, ESC,'~') must be preceded by a '~' character if they appear in the message data.

The maximum length of the formatted data can be up to 126000 bits, or 15750 bytes. If there is more data loaded into the buffer than can be transmitted in the assigned transmit window the message will be truncated.

One minute prior to transmission data is removed from the transmit buffer and encoded for transmission (The Data In Buffer LED will go out). If this command is received within 1 minute of the transmission time or during a timed transmission, the data will not be included in the current transmission but will be buffered for the next interval.

6.4.4 GET THE LENGTH OF THE MESSAGE IN THE TIMED TRANSMISSION BUFFER

Syntax: **TML**
Access level: USER
Tx State: Enabled/Disabled

Returns the number of bytes stored in the timed transmission buffer.

6.4.5 GET THE MAXIMUM TIMED MESSAGE LENGTH

Syntax: **MTML**
Access level: USER
Tx State: Enabled

Returns the maximum number of bytes that can be transmitted with the current timed transmission bit rate, window length and preamble type.

6.4.6 CLEAR THE TIMED TRANSMISSION BUFFER

Syntax: **CTB**
Access level: USER
Tx State: Enabled/Disabled

Clears the timed transmission buffer.

6.4.7 RANDOM TRANSMISSION MESSAGE BUFFER READ

Syntax: **RBD**
Access level: USER
Tx State: Enabled

This command returns the number of bytes in the message and the message as it was sent to the GOES transmitter.

Random Message Length = 119 bytes
Random Message is:
eeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeee
ttttttttttttttttttttttttttttttttttttttttttttttt
OK

6.4.8 LOAD RANDOM TRANSMISSION MESSAGE BUFFER

Syntax: **RDT =xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx**
Access level: USER
Tx State: Enabled

This command overwrites the data in the GOES Random Buffer. The G6 transmitter will insert the 31 bit GOES ID, any header information (e.g. HDR Flag byte), and append the EOT so these should not be included in the RDT data. If the random data format is pseudo-binary the transmitter will also insert the correct parity bit for each message character and replace illegal characters with the character specified by the IRC=c command before transmission.

Characters that have meaning for the command interface (CR, LF, BS, ESC,'~') must be preceded by a '~' character if they appear in the message data.

Loading data into the Random Transmission Buffer triggers the random reporting sequence. Once triggered, the random reporting mechanism will send the data loaded in the buffer for the number of transmissions as specified by the random repeat count. The buffer will be cleared automatically when the number of transmissions specified has occurred.

If the command is received within 1 minute or during a random transmission, the data will not be included in the current transmission but will be buffered for the next one.

If there is more data loaded into the buffer than can be transmitted at the assigned bitrate, the message will be truncated.

6.4.9 APPEND TO RANDOM TIMED TRANSMISSION MESSAGE BUFFER

Syntax: **RDTAPND =xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx**
Access level: USER
Tx State: Enabled

This command appends the data provided to the data in Random Buffer. The G6 transmitter will insert the 31 bit GOES ID, any header information (e.g. HDR Flag byte), and append the EOT so these should not be included in the RDT data. If the random data format is pseudo-binary the transmitter will also insert the correct parity bit for each message character and replace illegal characters with the character specified by the IRC=c command before transmission.

Characters that have meaning for the command interface (CR, LF, BS, ESC,'~') must be preceded by a '~' character if they appear in the message data.

Loading data into the Random transmission buffer triggers the random reporting sequence. Once triggered, the random reporting mechanism will send the data loaded in the buffer for the number of transmissions as specified by the random repeat count. The buffer will be cleared automatically when the number of transmissions specified has occurred.

If the command is received within 1 minute or during a random transmission the data will not be included in the current transmission but will be buffered for the next one.

If there is more data loaded into the buffer than can be transmitted at the assigned bitrate the message will be truncated.

6.4.10 GET THE LENGTH OF THE MESSAGE IN THE RANDOM TRANSMISSION BUFFER

Syntax: **RML**
Access level: USER
Tx State: Enabled/Disabled

Returns the number of bytes stored in the random transmission buffer.

6.4.11 GET THE MAXIMUM RANDOM MESSAGE LENGTH

Syntax: M**RML**
Access level: USER
Tx State: Enabled/Disabled

Returns the maximum number of bytes that can be transmitted with the current random transmission bit rate, window length and preamble type.

6.4.12 CLEAR THE RANDOM TRANSMISSION BUFFER

Syntax: **CRB**
Access level: USER
Tx State: Enabled/Disabled

Clear the random transmission buffer.

6.5 STATUS AND OTHER COMMANDS

The following commands are used by the host to determine the status of the transmitter for display and diagnostics purposes. These commands can be entered with transmissions enabled or disabled.

6.5.1 CLEAR FAILSAFE FUNCTION

Syntax: **CLRFS**
Access level: USER

The transmitter will respond: Failsafe reset by request
This command clears the transmitter failsafe functionality. It is still necessary to wait one minute between transmissions. If the failsafe is tripped by a transmission that was too early then cleared and a subsequent transmission is sent before the required time between transmissions then the failsafe will trip again.

6.5.2 TRIP FAILSAFE FUNCTION

Syntax: **TRPFS**
Access level: USER

The transmitter will respond: Failsafe tripped by request

The transmitter's failsafe may be tripped by request. No further transmissions will be allowed.

6.5.3 GET VERSION INFORMATION

Syntax: **VER**
Access level: USER
Tx State: Enabled/Disabled

This command returns the transmitter serial number, hardware version number, firmware version number and GPS module version numbers.

6.5.4 GET TRANSMISSION STATUS

Syntax: **RST**
Access level: USER
Tx State: Enabled/Disabled

This command returns the transmitter state, GPS state, time to next transmission, number of bytes in timed transmit buffer, number of bytes in random transmit buffer, number of times random data has been transmitted, failsafe status and supply voltage.
The transmitter responds with:

Transmitter: Enabled/Disabled[CR][LF]
GPS: On/Off[CR][LF]
RTC: Valid/Invalid[CR][LF]
Time To Next Tx: dd:hh:mm:ss[CR][LF]
Timed Message Length: nnnn[CR][LF]
Next Timed Tx: N/A or yyyy/mm/dd/hh:mm:ss[CR][LF]
Random Message Length: nnnn[CR][LF]
Random Message Tx Count: nnn[CR][LF]
Next Random Tx: N/A or yyyy/mm/dd/hh:mm:ss[CR][LF]
Fail-Safe: OK/Tripped[CR][LF]
Supply Voltage: xx.x V

6.5.5 GET LAST TRANSMISSION LOG

Syntax: **LTXL**
Access level: USER
Tx State: Enabled/Disabled

This command returns the status of the last failed transmission. The last transmission could have been a regularly scheduled timed transmission, a random transmission, or a test transmission triggered by a test command.

If a transmission has failed since the unit was last powered up, the transmitter responds to the command with:

Tx Status: Msg Truncated
Tx Type: Self Timed
Last Tx Length: 2214 bytes
Last Tx Start Time: 2012/06/13 21:36:59
Last Tx Stop Time: 2012/06/13 21:37:58
Forward Power: 32.0 dBm
Reflected Power: 16.3 dBm
SWR: 1.39
Power Supply: 10.9 V

Depending on the transmission failure mode then some fields will be marked as N/A depending on the context of the failure which is described by 'Tx Status'.

6.5.6 GET LAST TRANSMISSION STATUS

Syntax: **LTXS**
Access level: USER
Tx State: Enabled/Disabled

This command returns the status of the last transmission. The last transmission could have been a regularly scheduled timed transmission, a random transmission, or a test transmission triggered by a test command.
If a transmission has occurred since the unit was last powered up, the transmitter responds to the command with:

Tx Status: Failsafe Tripped/OK
Tx Type: Timed/Random/Test
Last Tx Length: 30 bytes
Last Tx Start Time: 2004/12/16 23:29:48
Last Tx Stop Time: 2004/12/16 23:29:49
Forward Power: -23.1 dBm
Power Supply: 12.0 V

If a transmission has not occurred since power up, the transmitter will respond with:

No Tx Has Occurred

6.5.7 GET GPS STATUS

Syntax: **GPS**
Access level: USER
Tx State: Enabled/Disabled

This command returns the current GPS status including satellite numbers and signal strengths in the following format if the GPS is on:

Fix Status: Full Accuracy
Almanac Available: N
PPS Output Stable: N
UTC Offset = 0.000000

Satellite #	Signal Strength
30	10.80
23	no lock
10	4.00
25	1.80
5	6.60
21	no lock
17	6.40
2	6.80

If the GPS is off the command returns: **GPS is off**

6.5.8 GET POSITION

Syntax: **POS**
Access level: USER
Tx State: Enabled/Disabled

This command returns the position obtained during the last GPS fix in the following format:

Time of fix: yyyy/dd/mm/ hh:mm:ss[CR][LF]
Lat: sxx.xxxxx[CR][LF]
Long: sxxx.xxxxx[CR][LF]
Alt: xxxxx[CR][LF]>

Where latitude is in degrees, + for N and - for S, longitude is in degrees, + for E and – for W and altitude is in meters.

If a GPS fix has not yet occurred the transmitter will respond with: **No GPS Fix[CR][LF]**>

6.5.9 READ AUDIT LOG

Syntax: **RAL**

Access level: USER

Tx State: Enabled/Disabled

The RAL command is used to retrieve the audit log information in the following format:

yyyy/mm/dd hh:mm:ss event message 1[CR][LF]
yyyy/mm/dd hh:mm:ss event message 2 [CR][LF]
.
yyyy/mm/dd hh:mm:ss event message N[CR][LF]>

Where: yy**yy/mm/dd hh:mm:ss** are the date and time that the message was created.

Event message x is a short text string describing the event detected.

This list of possible messages is:

"Restart",
"GPS Synchronization Timeout",
"Failsafe Tripped",
"Failsafe Cleared",
"Clock Valid",
"Clock In-Valid",
"TX Aborted: No OCXO Calibration",
"TX Aborted: Timed Tx Preparation failure",
"TX Aborted: Random Tx Preparation failure",
"Msg Truncated",
"TX Aborted: Supply Voltage Too Low",
"G4: Invalid State",
"EEPROM calibration data read failure",
"TX Aborted: VSWR Too High",
"TX Aborted: Timed Tx Buffer Empty",
"OCXO Calibration Failure",
"TCXO Calibration Failure",
"Illegal CSI port state",
"CSI Port rx error",
"Invalid NESID",
"Invalid ST channel number",
"Invalid ST bitrate",
"Invalid window length",
"Invalid centering option",
"Invalid empty buffer message option",
"Invalid preamble option",
"Invalid interleaver option",

"Invalid ST format",
"Invalid ST interval",
"Invalid ST first tx time",
"Invalid random channel number",
"Invalid random bitrate",
"Invalid random interval",
"Invalid random message counter option",
"Invalid random message format",
"Invalid random repeat count",
"Invalid randomizing percentage",
"Invalid parameter set",
"SDI command failed",
"SDI reply buffer overflow",
"SDI CRC failed",
"SDI error in reply",
"SDI too few values returned",
"Port set to SDI",
"Port set to SDC",
"GPS antenna shorted",
"GPS antenna disconnected",
"Command port USART overrun",
"Command port USART framing",
"Command port USART parity",
"Command port buffer overflow",
"TX Aborted: TX Prep time error",
"TX Successful",
"No Tx Has Occurred",
"Port set to RS232",
"GPS 28 days stale",
"Message buffer full. Append failed"

6.5.10 CLEAR AUDIT LOG

Syntax: **CAL**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

This clears the audit log. Once this command is called it cannot be undone.

>CAL (command)
OK (response)

6.5.11 READ FORWARD POWER

Syntax: **RFWD**
Access level: USER
Tx State: Enabled/Disabled

Returns the current forward power in dBm. This value is updated at the bit rate when transmitting and every 30 seconds when not transmitting.

6.5.12 READ REFLECTED POWER

Syntax: **RRFL**
Access level: USER
Tx State: Enabled/Disabled

Returns the reflected power in dBm. This value is updated at the bit rate when transmitting and every 30 seconds when not transmitting.

6.5.13 READ POWER SUPPLY

Syntax: **RPS**
Access level: USER
Tx State: Enabled/Disabled

Returns the power supply voltage in Volts. This value is updated at the bit rate when transmitting and every 30 seconds when not transmitting.

6.5.14 READ TCXO TEMPERATURE

Syntax: **RTEMP**
Access level: USER
Tx State: Enabled/Disabled

Returns the TCXO temperature (PCB temperature) in degrees Celsius. This value is updated at the bit rate when transmitting and every 30 seconds when not transmitting.

6.5.15 READ MEASURED FREQUENCY

Syntax: **RMF**
Access level: TECHNICIAN
Tx State: Enabled/Disabled

This command returns the last measured OCXO and TCXO frequencies in the following format:

F-OCXO: 10000005.9000

F-TCXO: 43199.9166

Units are Hz.

6.6 CALIBRATION COMMANDS

The following commands are used for calibrating the transmitter.

> WARNING! Using them incorrectly and without the proper test equipment can prevent the transmitter from operating properly.

6.6.1 SET RF POWER LEVELS

Syntax: **PWRLVL=aa, bb, cc**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

This command sets the output power level used for 100, 300 and 1200 BPS respectively. Parameters aa, bb, and cc are in dBm. Factory defaults are: aa=32.0 dBm, bb=32.0 dBm and cc=38.0 dBm. Output power levels between 30 and 50 dBm are accepted. If the power level is set higher than the maximum output of the transmitter, the RF power level will be the maximum output not the setting.

6.6.2 SET RF POWER LEVELS

Syntax: **PWRLVL=aa, bb, cc**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

This command sets the output power level used for 100, 300 and 1200 BPS respectively. Parameters aa, bb, and cc are in dBm. Factory defaults are: aa=32.0 dBm, bb=32.0 dBm and cc=38.0 dBm. Output power levels between 30 and 50 dBm are accepted. If the power level is set higher than the maximum output of the transmitter, the RF power level will be the maximum output not the setting.

Rate (bps)	Minimum (dBm)	Maximum (dBm)
100	26.00	40.5
300	26.00	38.5
1200	26.00	38.5

6.6.3 SAVE CALIBRATION

Syntax: **SAVECAL**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

This command directs the transmitter to save the calibration parameters to non-volatile memory. Until this command is entered, the previously saved calibration can be recalled using the RSTRCAL command.

6.6.4 RESTORE CALIBRATION

Syntax: **RSTRCAL**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

This command directs the transmitter to restore the calibration parameters from non-volatile memory. Changes made to the calibration are not automatically saved to non-volatile memory as they are entered. This allows changes to be made and verified before committing them to permanent storage, but provides the ability to recall the last saved settings, if necessary.

6.7 TEST COMMANDS

The following commands are used for testing the transmitter during troubleshooting and calibration. These commands can only be entered when transmissions are disabled. The test results are returned using the status commands listed in the previous section.

6.7.1 STOP TRANSMISSION

Syntax: **STX**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

Stops a transmission if one is in progress.

6.7.2 TURN THE OCXO ON

Syntax: **OCXOON**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

Turns the OCXO and synthesizer on if they are not already ON. 10MHz OCXO output will appear on TP4 and 1.25MHz reference frequency will appear on TP6. They will stay on until OCXOOFF command is issued or the G5 is power cycled.

6.7.3 TURN THE OCXO OFF

Syntax: **OCXOOFF**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

Turns the OCXO and synthesizer off if they have been turned on previously by the OCXOON command. The OCXO and synthesizer may remain on for some time after the command is issued if they are required by a calibration or transmission task.

6.7.4 DISABLE AUTOMATIC CALIBRATION TASK

Syntax: **DAS**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

Disable automatic synchronization to GPS. This command is used during testing to prevent automatic GPS fix and OCXO/TCXO calibrations. An automatic synchronization will be stopped if this command is entered while it is in progress.

6.7.5 ENABLE AUTOMATIC CALIBRATION TASK

Syntax: **EAS**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

Enables automatic synchronization to GPS if they were previously disabled by DAS.

6.7.6 DISABLE AUTOMATIC CALIBRATION TASK

Syntax: **DAS**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

Disable automatic synchronization to GPS. This command is used during testing to prevent automatic GPS fix and OCXO/TCXO calibrations. An automatic synchronization will be stopped if this command is entered while it is in progress.

6.7.7 ENABLE AUTOMATIC CALIBRATION TASK

Syntax: **EAS**

Access level: TECHNICIAN

Tx State: Enabled/Disabled

Enables automatic synchronization to GPS if they were previously disabled by DAS.

Appendix A GOES TRANSMIT FREQUENCY TABLES

A.1 DCP GOES Transmit Frequencies – Standard Certificate 1.0

Channel – 100 & 300 bps		1200 bps	Channel		Channel – 100 & 300 bps		1200 bps	Channel
Channel	Frequency	Channel	Frequency		Channel	Frequency	Channel	Frequency
Number	MHz	Number +A	MHz		Number	MHz	Number	MHz
1	401.701000	1	401.701750		37	401.755000	19	401.755750
2	401.702500				38	401.756500		
3	401.704000	2	401.704750		39	401.758000	20	401.758750
4	401.705500				40	401.759500		
5	401.707000	3	401.707750		41	401.761000	21	401.761750
6	401.708500				42	401.762500		
7	401.710000	4	401.710750		43	401.764000	22	401.764750
8	401.711500				44	401.765500		
9	401.713000	5	401.713750		45	401.767000	23	401.767750
10	401.714500				46	401.768500		
11	401.716000	6	401.716750		47	401.770000	24	401.770750
12	401.717500				48	401.771500		
13	401.719000	7	401.719750		49	401.773000	25	401.773750
14	401.720500				50	401.774500		
15	401.722000	8	401.722750		51	401.776000	26	401.776750
16	401.723500				52	401.777500		
17	401.725000	9	401.725750		53	401.779000	27	401.779750
18	401.726500				54	401.780500		
19	401.728000	10	401.728750		55	401.782000	28	401.782750
20	401.729500				56	401.783500		
21	401.731000	11	401.731750		57	401.785000	29	401.785750
22	401.732500				58	401.786500		
23	401.734000	12	401.734750		59	401.788000	30	401.788750
24	401.735500				60	401.789500		
25	401.737000	13	401.737750		61	401.791000	31	401.791750
26	401.738500				62	401.792500		
27	401.740000	14	401.740750		63	401.794000	32	401.794750
28	401.741500				64	401.795500		
29	401.743000	15	401.743750		65	401.797000	33	401.797750
30	401.744500				66	401.798500		
31	401.746000	16	401.746750		67	401.800000	34	401.800750
32	401.747500				68	401.801500		
33	401.749000	17	401.749750		69	401.803000	35	401.803750
34	401.750500				70	401.804500		
35	401.752000	18	401.752750		71	401.806000	36	401.806750
36	401.753500				72	401.807500		

DCP GOES Transmit Frequencies – Standard Certificate 1.0 (continued)

Channel – 100 & 300 bps		1200 bps	Channel		Channel – 100 & 300 bps		1200 bps	Channel
73	401.809000	37	401.809750		115	401.872000	58	401.872750
74	401.810500				116	401.873500		
75	401.812000	38	401.812750		117	401.875000	59	401.875750
76	401.813500				118	401.876500		
77	401.815000	39	401.815750		119	401.878000	60	401.878750
78	401.816500				120	401.879500		
79	401.818000	40	401.818750		121	401.881000	61	401.881750
80	401.819500				122	401.882500		
81	401.821000	41	401.821750		123	401.884000	62	401.884750
82	401.822500				124	401.885500		
83	401.824000	42	401.824750		125	401.887000	63	401.887750
84	401.825500				126	401.888500		
85	401.827000	43	401.827750		127	401.890000	64	401.890750
86	401.828500				128	401.891500		
87	401.830000	44	401.830750		129	401.893000	65	401.893750
88	401.831500				130	401.894500		
89	401.833000	45	401.833750		131	401.896000	66	401.896750
90	401.834500				132	401.897500		
91	401.836000	46	401.836750		133	401.899000	67	401.899750
92	401.837500				134	401.900500		
93	401.839000	47	401.839750		135	401.902000	68	401.902750
94	401.840500				141	401.911000	71	401.911750
95	401.842000	48	401.842750		142	401.912500		
96	401.843500				143	401.914000	72	401.914750
97	401.845000	49	401.845750		144	401.915500		
98	401.846500				145	401.917000	73	401.917750
99	401.848000	50	401.848750		146	401.918500		
100	401.849500				147	401.920000	74	401.920750
101	401.851000	51	401.851750		148	401.921500		
102	401.852500				149	401.923000	75	401.923750
103	401.854000	52	401.854750		150	401.924500		
104	401.855500				151	401.926000	76	401.926750
105	401.857000	53	401.857750		152	401.927500		
106	401.858500				153	401.929000	77	401.929750
107	401.860000	54	401.860750		154	401.930500		
108	401.861500				155	401.932000	78	401.932750
109	401.863000	55	401.863750		156	401.933500		
110	401.864500				157	401.935000	79	401.935750
111	401.866000	56	401.866750		158	401.936500		
112	401.867500				159	401.938000	80	401.938750
113	401.869000	57	401.869750		160	401.939500		
114	401.870500				161	401.941000	81	401.941750

DCP GOES Transmit Frequencies – Standard Certificate 1.0 (continued)

Channel – 100 & 300 bps		1200 bps	Channel		Channel – 100 & 300 bps		1200 bps	Channel
162	401.942500				208	402.011500		
163	401.944000	82	401.944750		209	402.013000	105	402.013750
164	401.945500				210	402.014500		
165	401.947000	83	401.947750		211	402.016000	106	402.016750
166	401.948500				212	402.017500		
167	401.950000	84	401.950750		213	402.019000	107	402.019750
168	401.951500				214	402.020500		
169	401.953000	85	401.953750		215	402.022000	108	402.022750
170	401.954500				216	402.023500		
171	401.956000	86	401.956750		217	402.025000	109	402.025750
172	401.957500				218	402.026500		
173	401.959000	87	401.959750		219	402.028000	110	402.028750
174	401.960500				220	402.029500		
175	401.962000	88	401.962750		221	402.031000	111	402.031750
176	401.963500				222	402.032500		
177	401.965000	89	401.965750		223	402.034000	112	402.034750
178	401.966500				224	402.035500		
179	401.968000	90	401.968750		225	402.037000	113	402.037750
180	401.969500				226	402.038500		
181	401.971000	91	401.971750		227	402.040000	114	402.040750
182	401.972500				228	402.041500		
183	401.974000	92	401.974750		229	402.043000	115	402.043750
184	401.975500				230	402.044500		
185	401.977000	93	401.977750		231	402.046000	116	402.046750
191	401.986000	96	401.986750		232	402.047500		
192	401.987500				233	402.049000	117	402.049750
193	401.989000	97	401.989750		234	402.050500		
194	401.990500				235	402.052000	118	402.052750
195	401.992000	98	401.992750		241	402.061000	121	402.061750
196	401.993500				242	402.062500		
197	401.995000	99	401.995750		243	402.064000	122	402.064750
198	401.996500				244	402.065500		
199	401.998000	100	401.998750		245	402.067000	123	402.067750
200	401.999500				246	402.068500		
201	402.001000	101	402.001750		247	402.070000	124	402.070750
202	402.002500				248	402.071500		
203	402.004000	102	402.004750		249	402.073000	125	402.073750
204	402.005500				250	402.074500		
205	402.007000	103	402.007750		251	402.076000	126	402.076750
206	402.008500				252	402.077500		
207	402.010000	104	402.010750		253	402.079000	127	402.079750

DCP GOES Transmit Frequencies – Standard Certificate 1.0 (continued)

Channel – 100 & 300 bps		1200 bps	Channel
254	402.080500		
255	402.082000	128	402.082750
256	402.083500		
257	402.085000	129	402.085750
258	402.086500		
259	402.088000	130	402.088750
260	402.089500		
261	402.091000	131	402.091750
262	402.092500		
263	402.094000	132	402.094750
264	402.095500		
265	402.097000	133	402.097750
266	402.098500		

A.2 DCP GOES Transmit Frequencies Standard Certificate 2.0

NOTE: Channels and Frequencies in **BOLD** are assigned to **1200 bps** channels.

Channel Number	Frequency	Channel Number	Frequency	Channel Number	Frequency
1	401.701000	20	401.729500	**39**	**401.758000**
301	**401.701750**	320	401.730250	339	401.758750
2	401.702500	**21**	**401.731000**	40	401.759500
302	401.703250	321	401.731750	**340**	**401.760250**
3	**401.704000**	22	401.732500	41	401.761000
303	401.704750	**322**	**401.733250**	341	401.761750
4	401.705500	23	401.734000	**42**	**401.762500**
304	**401.706250**	323	401.734750	342	401.763250
5	401.707000	**24**	**401.735500**	43	401.764000
305	401.707750	324	401.736250	**343**	**401.764750**
6	**401.708500**	25	401.737000	44	401.765500
306	401.709250	**325**	**401.737750**	344	401.766250
7	401.710000	26	401.738500	**45**	**401.767000**
307	**401.710750**	326	401.739250	345	401.767750
8	401.711500	**27**	**401.740000**	46	401.768500
308	401.712250	327	401.740750	**346**	**401.769250**
9	**401.713000**	28	401.741500	47	401.770000
309	401.713750	**328**	**401.742250**	347	401.770750
10	401.714500	29	401.743000	**48**	**401.771500**
310	**401.715250**	329	401.743750	348	401.772250
11	401.716000	**30**	**401.744500**	49	401.773000
311	401.716750	330	401.745250	**349**	**401.773750**
12	**401.717500**	31	401.746000	50	401.774500
312	401.718250	**331**	**401.746750**	350	401.775250
13	401.719000	32	401.747500	**51**	**401.776000**
313	**401.719750**	332	401.748250	351	401.776750
14	401.720500	**33**	**401.749000**	52	401.777500
314	401.721250	333	401.749750	**352**	**401.778250**
15	**401.722000**	34	401.750500	53	401.779000
315	401.722750	**334**	**401.751250**	353	401.779750
16	401.723500	35	401.752000	**54**	**401.780500**
316	**401.724250**	335	401.752750	354	401.781250
17	401.725000	**36**	**401.753500**	55	401.782000
317	401.725750	336	401.754250	**355**	**401.782750**
18	**401.726500**	37	401.755000	56	401.783500
318	401.727250	**337**	**401.755750**	356	401.784250
19	401.728000	38	401.756500	**57**	**401.785000**
319	**401.728750**	338	401.757250	357	401.785750

DCP GOES Transmit Frequencies – Standard Certificate 2.0 (continued)

Channel Number	Frequency	Channel Number	Frequency	Channel Number	Frequency
58	401.786500	**78**	**401.816500**	98	401.846500
358	**401.787250**	378	401.817250	398	401.847250
59	401.788000	79	401.818000	**99**	**401.848000**
359	401.788750	**379**	**401.818750**	399	401.848750
60	**401.789500**	80	401.819500	100	401.849500
360	401.790250	380	401.820250	**400**	**401.850250**
61	401.791000	**81**	**401.821000**	101	401.851000
361	**401.791750**	381	401.821750	401	401.851750
62	401.792500	82	401.822500	**102**	**401.852500**
362	401.793250	**382**	**401.823250**	402	401.853250
63	**401.794000**	83	401.824000	103	401.854000
363	401.794750	383	401.824750	**403**	**401.854750**
64	401.795500	**84**	**401.825500**	104	401.855500
364	**401.796250**	384	401.826250	404	401.856250
65	401.797000	85	401.827000	**105**	**401.857000**
365	401.797750	**385**	**401.827750**	405	401.857750
66	**401.798500**	86	401.828500	106	401.858500
366	401.799250	386	401.829250	**406**	**401.859250**
67	401.800000	**87**	**401.830000**	107	401.860000
367	**401.800750**	387	401.830750	407	401.860750
68	401.801500	88	401.831500	**108**	**401.861500**
368	401.802250	**388**	**401.832250**	408	401.862250
69	**401.803000**	89	401.833000	109	401.863000
369	401.803750	389	401.833750	**409**	**401.863750**
70	401.804500	**90**	**401.834500**	110	401.864500
370	**401.805250**	390	401.835250	410	401.865250
71	401.806000	91	401.836000	**111**	**401.866000**
371	401.806750	**391**	**401.836750**	411	401.866750
72	**401.807500**	92	401.837500	112	401.867500
372	401.808250	392	401.838250	**412**	**401.868250**
73	401.809000	**93**	**401.839000**	113	401.869000
373	**401.809750**	393	401.839750	413	401.869750
74	401.810500	94	401.840500	**114**	**401.870500**
374	401.811250	**394**	**401.841250**	414	401.871250
75	**401.812000**	95	401.842000	115	401.872000
375	401.812750	395	401.842750	**415**	**401.872750**
76	401.813500	**96**	**401.843500**	116	401.873500
376	**401.814250**	396	401.844250	416	401.874250
77	401.815000	97	401.845000	**117**	**401.875000**
377	401.815750	**397**	**401.845750**	417	401.875750

DCP GOES Transmit Frequencies – Standard Certificate 2.0 (continued)

Channel Number	Frequency	Channel Number	Frequency	Channel Number	Frequency
118	401.876500	**138**	**401.906500**	458	401.937250
418	**401.877250**	438	401.907250	**159**	**401.938000**
119	401.878000	139	401.908000	459	401.938750
419	401.878750	**439**	**401.908750**	160	401.939500
120	**401.879500**	140	401.909500	**460**	**401.940250**
420	401.880250	440	401.910250	161	401.941000
121	401.881000	**141**	**401.911000**	461	401.941750
421	**401.881750**	441	401.911750	**162**	**401.942500**
122	401.882500	142	401.912500	462	401.943250
422	401.883250	**442**	**401.913250**	163	401.944000
123	**401.884000**	143	401.914000	**463**	**401.944750**
423	401.884750	443	401.914750	164	401.945500
124	401.885500	**144**	**401.915500**	464	401.946250
424	**401.886250**	444	401.916250	**165**	**401.947000**
125	401.887000	145	401.917000	465	401.947750
425	401.887750	**445**	**401.917750**	166	401.948500
126	**401.888500**	146	401.918500	**466**	**401.949250**
426	401.889250	446	401.919250	167	401.950000
127	401.890000	**147**	**401.920000**	467	401.950750
427	**401.890750**	447	401.920750	**168**	**401.951500**
128	401.891500	**448**	**401.922250**	468	401.952250
428	401.892250	149	401.923000	169	401.953000
129	**401.893000**	449	401.923750	**469**	**401.953750**
429	401.893750	**150**	**401.924500**	170	401.954500
130	401.894500	450	401.925250	470	401.955250
430	**401.895250**	151	401.926000	**171**	**401.956000**
131	401.896000	**451**	**401.926750**	471	401.956750
431	401.896750	152	401.927500	172	401.957500
132	**401.897500**	452	401.928250	**472**	**401.958250**
432	401.898250	**153**	**401.929000**	173	401.959000
133	401.899000	453	401.929750	473	401.959750
433	**401.899750**	154	401.930500	**174**	**401.960500**
134	401.900500	**454**	**401.931250**	474	401.961250
434	401.901250	155	401.932000	175	401.962000
135	**401.902000**	455	401.932750	**475**	**401.962750**
435	401.902750	**156**	**401.933500**	176	401.963500
136	401.903500	456	401.934250	476	401.964250
436	**401.904250**	157	401.935000	**177**	**401.965000**
137	401.905000	**457**	**401.935750**	477	401.965750
437	401.905750	158	401.936500	178	401.966500

DCP GOES Transmit Frequencies – Standard Certificate 2.0 (continued)

Channel Number	Frequency	Channel Number	Frequency	Channel Number	Frequency
478	**401.967250**	**198**	**401.996500**	**517**	**402.025750**
179	401.968000	498	401.997250	218	402.026500
479	401.968750	199	401.998000	518	402.027250
180	**401.969500**	**499**	**401.998750**	**219**	**402.028000**
480	401.970250	200	401.999500	519	402.028750
181	401.971000	200	401.999500	220	402.029500
481	**401.971750**	500	402.000250	**520**	**402.030250**
182	401.972500	**201**	**402.001000**	221	402.031000
482	401.973250	501	402.001750	521	402.031750
183	**401.974000**	202	402.002500	**222**	**402.032500**
483	401.974750	**502**	**402.003250**	522	402.033250
184	401.975500	203	402.004000	223	402.034000
484	**401.976250**	503	402.004750	**523**	**402.034750**
185	401.977000	**204**	**402.005500**	224	402.035500
485	401.977750	504	402.006250	524	402.036250
186	**401.978500**	205	402.007000	**225**	**402.037000**
486	401.979250	**505**	**402.007750**	525	402.037750
187	401.980000	206	402.008500	226	402.038500
487	**401.980750**	506	402.009250	**526**	**402.039250**
188	401.981500	**207**	**402.010000**	227	402.040000
488	401.982250	507	402.010750	527	402.040750
189	**401.983000**	208	402.011500	**228**	**402.041500**
489	401.983750	**508**	**402.012250**	528	402.042250
190	401.984500	209	402.013000	229	402.043000
490	**401.985250**	509	402.013750	**529**	**402.043750**
191	401.986000	**210**	**402.014500**	230	402.044500
491	401.986750	510	402.015250	530	402.045250
192	**401.987500**	211	402.016000	**231**	**402.046000**
492	401.988250	**511**	**402.016750**	531	402.046750
193	401.989000	212	402.017500	232	402.047500
493	**401.989750**	512	402.018250	**532**	**402.048250**
194	401.990500	**213**	**402.019000**	233	402.049000
494	401.991250	513	402.019750	533	402.049750
195	**401.992000**	214	402.020500	**234**	**402.050500**
595	401.992750	**514**	**402.021250**	534	402.051250
196	401.993500	215	402.022000	235	402.052000
496	**401.994250**	515	402.022750	**535**	**402.052750**
197	401.995000	**216**	**402.023500**	236	402.053500
497	401.995750	516	402.024250	536	402.054250

DCP GOES Transmit Frequencies – Standard Certificate 2.0 (continued)

Channel Number	Frequency	Channel Number	Frequency
237	**402.055000**	**556**	**402.084250**
537	402.055750	257	402.085000
238	402.056500	557	402.085750
538	**402.057250**	**258**	**402.086500**
239	402.058000	558	402.087250
539	402.058750	259	402.088000
240	**402.059500**	**559**	**402.088750**
540	402.060250	260	402.089500
241	402.061000	560	402.090250
541	**402.061750**	**261**	**402.091000**
242	402.062500	561	402.091750
542	402.063250	262	402.092500
243	**402.064000**	**562**	**402.093250**
543	402.064750	263	402.094000
244	402.065500	563	402.094750
544	**402.066250**	**264**	**402.095500**
245	402.067000	564	402.096250
545	402.067750	265	402.097000
246	**402.068500**	**565**	**402.097750**
546	402.069250	266	402.098500
247	402.070000	566	402.099250
547	**402.070750**		
248	402.071500		
548	402.072250		
249	**402.073000**		
549	402.073750		
250	402.074500		
550	**402.075250**		
251	402.076000		
551	402.076750		
252	**402.077500**		
552	402.078250		
253	402.079000		
553	**402.079750**		
254	402.080500		
554	402.081250		
255	**402.082000**		
555	402.082750		
256	402.083500		

Appendix B DCP METEOSAT Transmit Frequencies

Ch No.	Frequency	Bandwidth	Ch No.	Frequency	Bandwidth
1	402035500	1500	36	402088000	1500
2	402037000	1500	37	402089500	1500
3	402038500	1500	38	402091000	1500
4	402040000	1500	39	402092500	1500
5	402041500	1500	40	402094000	1500
6	402043000	1500	41	402095500	1500
7	402044500	1500	42	402097000	1500
8	402046000	1500	43	402098500	1500
9	402047500	1500	44	402100000	1500
10	402049000	1500	45	402101500	1500
11	402050500	1500	46	402103000	1500
12	402052000	1500	47	402104500	1500
13	402053500	1500	48	402106000	1500
14	402055000	1500	49	402107500	1500
15	402056500	1500	50	402109000	1500
16	402058000	1500	51	402110500	1500
17	402059500	1500	52	402112000	1500
18	402061000	1500	53	402113500	1500
19	402062500	1500	54	402115000	1500
20	402064000	1500	55	402116500	1500
21	402065500	1500	56	402118000	1500
22	402067000	1500	57	402119500	1500
23	402068500	1500	58	402121000	1500
24	402070000	1500	59	402122500	1500
25	402071500	1500	60	402124000	1500
26	402073000	1500	61	402125500	1500
27	402074500	1500	62	402127000	1500
28	402076000	1500	63	402128500	1500
29	402077500	1500	64	402130000	1500
30	402079000	1500	65	402131500	1500
31	402080500	1500	66	402133000	1500
32	402082000	1500	67	402134500	1500
33	402083500	1500	68	402136000	1500
34	402085000	1500	69	402137500	1500
35	402086500	1500	70	402139000	1500

DCP METEOSAT Transmit Frequencies (continued)

Ch No.	Frequency	Bandwidth	Ch No.	Frequency	Bandwidth
71	402140500	1500	108	402196000	1500
72	402142000	1500	109	402197500	1500
73	402143500	1500	110	402199000	1500
74	402145000	1500	111	402200500	1500
75	402146500	1500	112	402202000	1500
76	402148000	1500	113	402203500	1500
77	402149500	1500	114	402205000	1500
78	402151000	1500	115	402206500	1500
79	402152500	1500	116	402208000	1500
80	402154000	1500	117	402209500	1500
81	402155500	1500	118	402211000	1500
82	402157000	1500	119	402212500	1500
83	402158500	1500	120	402214000	1500
84	402160000	1500	121	402215500	1500
85	402161500	1500	122	402217000	1500
86	402163000	1500	123	402218500	1500
87	402164500	1500	124	402220000	1500
88	402166000	1500	125	402221500	1500
89	402167500	1500	126	402223000	1500
90	402169000	1500	127	402224500	1500
91	402170500	1500	128	402226000	1500
92	402172000	1500	129	402227500	1500
93	402173500	1500	130	402229000	1500
94	402175000	1500	131	402230500	1500
95	402176500	1500	132	402232000	1500
96	402178000	1500	132	402232000	1500
97	402179500	1500	133	402233500	1500
98	402181000	1500	134	402235000	1500
99	402182500	1500	135	402236500	1500
100	402184000	1500	136	402238000	1500
101	402185500	1500	137	402239500	1500
102	402187000	1500	138	402241000	1500
103	402188500	1500	139	402242500	1500
104	402190000	1500	140	402244000	1500
105	402191500	1500	141	402245500	1500
106	402193000	1500	142	402247000	1500
107	402194500	1500	143	402248500	1500

DCP METEOSAT Transmit Frequencies (continued)

Ch No.	Frequency	Bandwidth	Ch No.	Frequency	Bandwidth
144	402250000	1500	181	402305500	1500
145	402251500	1500	182	402307000	1500
146	402253000	1500	182	402307000	1500
147	402254500	1500	183	402308500	1500
148	402256000	1500	184	402310000	1500
149	402257500	1500	185	402311500	1500
150	402259000	1500	186	402313000	1500
151	402260500	1500	187	402314500	1500
152	402262000	1500	188	402316000	1500
153	402263500	1500	189	402317500	1500
154	402265000	1500	190	402319000	1500
155	402266500	1500	191	402320500	1500
156	402268000	1500	192	402322000	1500
157	402269500	1500	193	402323500	1500
158	402271000	1500	194	402325000	1500
159	402272500	1500	195	402326500	1500
160	402274000	1500	196	402328000	1500
161	402275500	1500	197	402329500	1500
162	402277000	1500	198	402331000	1500
163	402278500	1500	199	402332500	1500
164	402280000	1500	200	402334000	1500
165	402281500	1500	201	402335500	1500
166	402283000	1500	202	402337000	1500
167	402284500	1500	203	402338500	1500
168	402286000	1500	204	402340000	1500
169	402287500	1500	205	402341500	1500
170	402289000	1500	206	402343000	1500
171	402290500	1500	207	402344500	1500
172	402292000	1500	208	402346000	1500
173	402293500	1500	209	402347500	1500
174	402295000	1500	210	402349000	1500
175	402296500	1500	211	402350500	1500
176	402298000	1500	212	402352000	1500
177	402299500	1500	213	402353500	1500
178	402301000	1500	214	402355000	1500
179	402302500	1500	215	402356500	1500
180	402304000	1500	216	402358000	1500

DCP METEOSAT Transmit Frequencies (continued)

Ch No.	Frequency	Bandwidth	Ch No.	Frequency	Bandwidth
217	402359500	1500	254	402415000	1500
218	402361000	1500	255	402416500	1500
219	402362500	1500	256	402418000	1500
220	402364000	1500	257	402419500	1500
221	402365500	1500	258	402421000	1500
222	402367000	1500	259	402422500	1500
224	402370000	1500	260	402424000	1500
225	402371500	1500	261	402425500	1500
226	402373000	1500	262	402427000	1500
227	402374500	1500	263	402428500	1500
228	402376000	1500	264	402430000	1500
229	402377500	1500	265	402431500	1500
230	402379000	1500	266	402433000	1500
231	402380500	1500	267	402434500	1500
232	402382000	1500	268	402002500	1500
233	402383500	1500	269	402004000	1500
234	402385000	1500	270	402005500	1500
235	402386500	1500	271	402007000	1500
236	402388000	1500	272	402008500	1500
237	402389500	1500	274	402011500	1500
238	402391000	1500	275	402013000	1500
239	402392500	1500	276	402014500	1500
240	402394000	1500	277	402016000	1500
241	402395500	1500	278	402017500	1500
242	402397000	1500	279	402019000	1500
243	402398500	1500	280	402020500	1500
244	402400000	1500	281	402022000	1500
245	402401500	1500	282	402023500	1500
246	402403000	1500	283	402025000	1500
247	402404500	1500	284	402026500	1500
248	402406000	1500	285	402028000	1500
249	402407500	1500	286	402029500	1500
250	402409000	1500	287	402031000	1500
251	402410500	1500	288	402032500	1500
252	402412000	1500	289	402034000	1500
253	402413500	1500			1500

DOCUMENT REVISION HISTORY

Revision	Date	Description
1	13 Jan 2021	Original
2	26 April 2022	Updated Firmware Update instructions (CST-1470). Added compatible DLs (PM-379)