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## Chapter 3 - Calibration/Verification

### 3.1 GENERAL INFORMATION

This chapter provides step-by-step instructions for performing Test Set Calibration and Verification Procedures.

#### 3.1.1 Testing Conditions

Calibration and Verification Procedures should be performed in an ESD environment at ambient room temperature (+20° C to +30° C).



<b>CAUTION</b>	<b>ONLY PERFORM CALIBRATION PROCEDURES IN AN ESD ENVIRONMENT. ALL PERSONNEL PERFORMING CALIBRATION PROCEDURES SHOULD HAVE KNOWLEDGE OF ACCEPTED ESD PRACTICES AND/OR BE ESD CERTIFIED.</b>
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#### 3.1.2 Required Equipment

Refer to Appendix C - Test Equipment Requirements for list of equipment required to perform Verification and Calibration Procedures.

#### 3.1.3 Safety Precautions

Use extreme caution when working with “live” circuits. Observe all precautions when performing the Verification and Calibration Procedures.

<b>WARNING</b>	<b>HEED ALL WARNINGS AND CAUTIONS CONCERNING MAXIMUM VOLTAGES AND POWER INPUTS.</b>
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## **3.2 TEST SET CALIBRATION**

This section provides instructions on accessing and using the GPSG-1000 Series Calibration Function. The Calibration Function is an optional feature that is only available when the GPSG-1000 Calibration Option is installed on the Test Set.

The GPSG-1000 Calibration Function is a user-friendly automated system that has been integrated into the Test Set. On-screen instructions guide the user through selecting, running and performing each calibration procedure.

After a calibration procedure is selected and initiated, status indicators and messages are displayed throughout the procedure which provide instructions, feedback and calibration information.

Calibration Procedures should only be performed by Technicians familiar with the setup and operation of the required test equipment.

### **3.2.1 Calibration Schedule**

System Calibration Procedure should be performed as a result of one or more of the following conditions:

<b>Failure to Meet Specifications</b>	If, during the course of normal operation, the Test Set or any major function thereof fails to meet the performance specifications.
<b>Module/Assembly Replacement</b>	If one or more of the Test Set assemblies are replaced.
<b>2 Year Calibration/Verification</b>	Aeroflex recommends Calibration/Verification on the Test Set every two years to maintain proper testing standards.

### **3.2.2 Preliminary Procedures**

Perform the calibration procedure in its entirety. The procedure should be performed in the order that the procedure specifies. Some of the steps are dependent on successful completion of previous steps.

### 3.2.3 Test Setup

Calibration times are approximate and may vary slightly per unit. Procedures are listed in the order they appear on the Calibration menu screen.

### 3.2.4 Test Equipment

The test equipment listed is suitable for performing any procedure contained in this manual.

Required Test Equipment	Model
Frequency Counter	Agilent 52132A or equivalent
Measuring Receiver	Rhode & Schwarz FSMR or equivalent
Power Sensor	Rhode & Schwarz NRP-Z11 or equivalent
Spectrum Analyzer (optional)	Agilent E4407B
10 MHz Time Base Standard	
Coaxial Cables	
Adapter (N-TNC)	

### 3.2.5 Test Set Calibration Procedure

EQUIPMENT:            Frequency Counter  
                              Measuring Receiver  
                              Coaxial Cables

STEP	PROCEDURE
1.	Allow the GPSG-1000 a 30 minute warm-up period before calibrating.
2.	Connect a 10 MHz source to both the Frequency Counter and the Measuring Receiver.
3.	Connect the Measuring Receiver to a calibrated signal source. Calibrate and save the Measuring Receiver in Tuned RF Levels at the following frequencies:

Frequency
1176.45 MHz
1207.14 MHz
1227.60 MHz
1278.75 MHz
1575.42 MHz

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STEP	PROCEDURE
4.	If an optional Spectrum Analyzer is used, setup the Spectrum Analyzer as follows:

Field	Setting
Center Frequency	Calibrated Frequency
Span	5 kHz
Attenuation	0 dB
Ref. Level	Calibrated Level Dependent
Log Scale	2 dB/div.
RBW	5 kHz
VBW	100 Hz
Sweep	10 ms
Display Average	On with # of averages = 10
Marker 1	On

5. If an external coaxial cable is used with the RF Output level calibration, record the coaxial cable loss at each of the frequencies listed in step 3.

### 3.2.6 Calibration Menu

The Calibration Window is enabled by pressing the Press the (symbol) key to scroll down to the Maintenance button on the Launch Bar and selecting Calibrations from the drop down menu.

STEP	PROCEDURE
1.	Press the Down Arrow key to scroll down to the Maintenance key. Press the Maintenance key to display both the Calibration and Diagnostics sub keys. Press the Calibration key.
2.	To enter the password touch the Password: rectangle box to display keyboard. Enter the password and press Enter key. Factory default password is <b>gpsg</b> .
3.	RF Level Cal and RF Freq Cal keys will be displayed.

### **3.2.7 Reference Frequency Calibration**

The Reference Frequency Calibration procedure is used to calibrate the INTERNAL 10 MHz OCXO. Specification: 10 MHz  $\pm$  1 Hz.

STEP	PROCEDURE
1.	Press the RF Freq Cal key.
2.	Press the Abort key to abort the calibration procedure without saving the calibration values and return to the main menu.
3.	Attach a coaxial cable from the REF OUT 10 MHz connector to the input of the Frequency Counter.
4.	Set the Frequency Counter to gate time of 500 mS and with an input impedance of 50 ohms.
5.	Press the Value: rectangle box to display keypad.
6.	Adjust the value using either the keypad enter or with the scroll bar and press Enter to review the change. Repeat as required until the 10 MHz reference frequency is within 10 MHz $\pm$ 1 Hz.
7.	Press the Done key to save the calibration value. The GPSG-1000 will exit back to the main menu.

### **3.2.8 Output Level Calibration**

The Output Level Calibration procedure calibrates the Antenna Coupler RF and Direct RF port output level. Specification: RF Level at  $\pm$  0.5 dB.

STEP	PROCEDURE
1.	Press the RF Level Cal key.
2.	Press the Abort key to abort the calibration procedure without saving the calibration values and return to the main menu.
3.	Press the Back key to return to the previous calibration menu.
4.	Connect the Measuring Receiver (or Spectrum Analyzer) to the GPS TX Coupler port.
5.	Set the Measuring Receiver (or Spectrum Analyzer) to 1176.45 MHz or desired output frequency.
6.	Press the Value: rectangle box to display keypad.
7.	Adjust the value using the keypad enter or scroll bar and press Enter to review the change. Repeat as required until the RF output level is within -55 dBm $\pm$ 0.5 dB.
8.	Press the Next key.
9.	Adjust the value using the keypad enter or the scroll bar and press Enter to review the change. Repeat as required until the RF output level is within -86 dBm $\pm$ 0.5 dB.
10.	Press the Next key.
11.	Connect the Measuring Receiver (or Spectrum Analyzer) to the GPS TX Direct port.
12.	Adjust the value using the keypad enter or the scroll bar and press Enter to review the change. Repeat as required until the RF output level is within -80 dBm $\pm$ 0.5 dB.
13.	Press the Next key.
14.	Repeat steps 1 thru 13, using the values 1227.60, 1278.75 and 1575.42 MHz to set the Measuring Receiver (or Spectrum Analyzer) in step 5.
15.	Press the Cal End key to save the calibration values. The GPSG-1000 will exit back to the main menu.

### 3.3 TEST SET VERIFICATION

#### 3.3.1 Verification Schedule

Verification Procedures should be performed as a result of one or more of the following conditions:

<b>Failure to Meet Specifications</b>	If, during the course of normal operation, the Test Set or any major function thereof fails to meet performance specifications.
<b>Assembly Replacement</b>	If one or more of the Test Set assemblies are replaced.
<b>Annual Calibration/Verification</b>	Aeroflex recommends Calibration/Verification on the Test Set every year to maintain proper testing standards.

#### 3.3.2 Precautions

The Verification Procedures are performed with the Test Set covers in place. No internal adjustments or probing points are required.

#### 3.3.3 Test Equipment

The test equipment listed is suitable for performing any procedure contained in this manual.

Required Test Equipment	Model
Frequency Counter	Agilent 52132A or equivalent
Measuring Receiver	Rhode & Schwarz FSMR or equivalent
Power Sensor	Rhode & Schwarz NRP-Z11 or equivalent
Network Analyzer	HP 8753D or equivalent
Spectrum Analyzer	Agilent E4407B or equivalent
Signal Generator	Aeroflex IFR-3412 or equivalent
Oscilloscope	Tektronix TDS 2024B or equivalent
ARB Generator	Agilent 33220A or equivalent
DMM	Fluke 73 or equivalent
RF Amplifier	Low Noise with 50 dB gain
10 MHz Time Base Standard	
Coaxial Cable	
Ethernet Cable	
Adapter (N-TNC)	

### **3.3.4 Test Setup**

The Test Setup lists the general requirements for verifying the GPSG-1000 operation.

EQUIPMENT:           Frequency Counter  
                          Measuring Receiver  
                          Coaxial Cable

STEP	PROCEDURE
1.	Verify the battery is fully charged before running the verification tests.
2.	Allow the GPSG-1000 a 30 minute warm-up period before running the tests.
3.	Connect a 10 MHz source to both the Frequency Counter and the Measuring Receiver.
4.	Connect the Measuring Receiver to a calibrated signal source. Calibrate and save the Measuring Receiver Tuned RF Levels at the following frequencies: 1176.45 MHz 1207.14 MHz 1227.60 MHz 1278.75MHz 1575.42 MHz
5.	If an external coaxial cable is used with the RF Output level calibration, record the coaxial cable loss at each of the frequencies listed in step 4.

**3.3.5 Preset Conditions**

Set the GPSG-1000 to factory default mode for product verification.

STEP	PROCEDURE
1.	Press File.
2.	Press Settings.
3.	Press Default.
4.	Verify the yellow bubble indicates Default Settings Loaded.

### 3.3.6 Remote Communication

The Remote Communication procedure checks the GPSG-1000 ethernet, USB port and internal drive operation.

EQUIPMENT: Ethernet Cable

STEP	PROCEDURE
1.	Connect an ethernet cable from the GPSG-1000 to a local area network hub.
2.	Setup the GPSG-1000 and press: System System Configuration Network Network Mode Select DHCP.
3.	In the Network screen, the GPSG-1000 will acquire and display the IP address. example: 10.123.456.789
4.	Using a network communication terminal program, such as PuTTY, enter the IP address displayed by the GPSG-1000. Select Telnet connection type and set the port to 5025.
5.	Send the command <b>*IDN?</b> twice to the GPSG-1000.
6.	The GPSG-1000 will respond with: Aeroflex,GPSG-1000,(test set serial number),(software version,date,time) example: Aeroflex,GPSG-1000,10002000901,201203271213
7.	Send the command <b>GPS:SET:RSRC?</b> to query the SPSG-1000 external reference source.
8.	The GPSG-1000 will reply INTERNAL.
9.	Send the command <b>GPS:SET:RSRC EXTERNAL</b> to the GPSG-1000 to set the external reference source to external.
10.	Send the query <b>GPS:SET:RSRC?</b> and verify response is <b>EXTERNAL</b> .
11.	Send the command <b>GPS:SET:RSRC INTERNAL</b> to the GPSG-1000 to set the external reference source to internal.
12.	Setup the GPSG-1000 and press: System System Configuration Network Network Mode Select DHCP Network Off.
13.	Check the USB port operation by plugging a USB Flash memory stick into either of the USB ports.
14.	Setup the GPSG-1000, press: File Settings Export to USB Yellow bubble indicates Settings Export Successful.
15.	Setup the GPSG-1000, press: File Settings Import to USB Yellow bubble indicates Settings Import Successful.

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STEP	PROCEDURE
16.	Unplug the USB flash memory drive stick from the USB port.
17.	Check the operation of the internal drive by saving and retrieving a file. Setup the GPSG-1000, press: File Settings Manage Press File Name and enter <b>test</b> using popup keyboard. Press Save to close Manage Setting popup. Current Settings File displays <b>test</b> . Press Manage then File name and enter <b>new1</b> using the popup keyboard. Press Save to close Manage Setting popup. Current Settings file displays <b>new1</b> .
18.	Setup the GPSG-1000, press: File Settings Load Select <b>test</b> in Load Settings Press Open to close Manage Setting popup. Current Settings file displays <b>test</b> .
19.	Setup the GPSG-1000, press: File Settings Manage Select <b>test</b> . Press Delete to display Yes, indicating the file <b>test</b> has been removed. Press Manage and select <b>test1</b> . Press Delete to display Yes, indicating the <b>new1</b> file has been removed. Close popup.
20.	Setup the GPSG-1000, press: File Settings EDefault Yellow bubble indicates Default Settings Loaded.

### 3.3.7 Static Simulation

The Static Simulation procedure checks the GPSG-1000 simulator operation.

EQUIPMENT: Coaxial Cable

- | STEP | PROCEDURE  |
|------|--|
| 1.   | Connect a coaxial cable from GPS TX COUPLER output port to GPS RX ANT input port.        |
| 2.   | From the Launch bar press the SETUP button and enter the following data into each field: |

Setup Field	Setup Data
<b>Simulation</b>	
GNSS	GPS
Carrier	L1
SBAS	Auto
Simulation	Static
Digital Noise	On
Fading	None
PRN Signal	Fixed
Position Source	User
Clock	User Setting
RF Level	-120.0 dBm
RF Port	Coupler
<b>Channels</b>	
Total SV's	12, then press Apply
<b>I/O</b>	
Coupler Loss	0.0 dB
Coupler Cable	0.0 dB
Direct Cable	0.0 dB
Ext Ref Out	OFF
Reference Source	INT
Trigger	Auto

3. Return to the Launch bar and press the Simulation button.

Setup Field	Setup Data
<b>GPS</b>	
Latitude	37°38.9966N
Longitude	39°25.9834W
Altitude	1333 ft
Run	

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PROCEDURE

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4. Verify the following results on the Simulation/GPS page functions:

<b>Simulation Field</b>	<b>Simulation Results</b>
<b>GPS</b>	
Running	Green light
Current Sim Date	Using starting date from Setup/Simulation page
Current Sim Time	Using starting time from Setup/Simulation page and counting up at one second rate
Latitude	Locked and cannot be changed
Longitude	Locked and cannot be changed
Altitude	Locked and cannot be changed
Visible SVs	Note quantity visible
SV PRN	Quantity of SV's indicated must equal Visible SVs
Elapsed Time	Counting up at one second rate
From	Blank
To	Blank
Heading	Blank
Speed	0 mph
Distance To Go	0 ft

### 3.3.8 GPS Receiver Test and Loopback Operation

The GPS Receiver Test and Loopback Operation procedure checks the built-in receiver operation.

EQUIPMENT: Coaxial Cable

- | STEP | PROCEDURE   |
|------|---|
| 1.   | Connect a coaxial cable from GPS TX COUPLER output port to GPS RX ANT input port. |
| 2.   | Press GPS RX, then press GPS Receiver Reset.                                      |
| 3.   | Wait one minute, then verify the following data:                                  |

Field	Data
Current Date	Displays the same date from the Setup/Simulation page
Current Time	Displays the same time from the Setup/Simulation page
Position Fix	3D solution
Latitude	Similar to Latitude on Simulation screen
Longitude	Similar to Longitude on Simulation screen
Altitude	Similar to Altitude on Simulation screen
Speed	<=0.1 Mph
Active Satellites	Identical to the satellites being simulated on Simulation screen
SNR	>45 dBc for each satellite (unit is dB-Hz Carrier-to-Noise Density C/No)

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STEP	PROCEDURE
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4. From the Launch bar select Simulation. Press the Stop button to stop the simulation. From the Launch bar select Setup and enter the following data into each field:

Setup Field	Setup Data
<b>Simulation</b>	
GNSS	GPS
Carrier	L1
SBAS	Off
Simulation	Static
Digital Noise	Off
Fading	None
PRN Signal	Fixed
Position Source	User
Clock	User Setting
RF Level	-125.0 dBm
RF Port	Direct
<b>Channels</b>	
Total SV's	12, then press Apply
<b>I/O</b>	
Coupler Loss	0.7 dB
Coupler Cable	1.0 dB
Direct Cable	2.2 dB
Ext Ref Out	OFF
Reference Source	INT
Trigger	Auto

5. From the Launch bar select Simulation.

Setup Field	Setup Data
<b>GPS</b>	
Latitude	33° 57.8884S
Longitude	18° 36.1000E
Altitude	151 ft
Run	

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- | STEP | PROCEDURE  |
|------|--|
| 6.   | Remove the coax cable for the GPS TX COUPLER port and connect it to the GPS TX DIRECT port. From the Launch bar select GPS RX. |
| 7.   | Wait one minute, then verify the following data:   |

Field	Data
Current Date/Time	Displays the same date from the Setup/Simulation page
Position Fix	3D solution
Latitude	Similar to Latitude on Simulation screen
Longitude	Similar to Longitude on Simulation screen
Altitude	Similar to Altitude on Simulation screen
Speed	<=0.1 Mph
Active Satellites	Identical to the satellites being simulated on Simulation screen
SNR	>45 for each satellite (unit is dB-Hz Carrier-to-Noise Density C/No)

8. From the Launch bar select Simulation. Press Stop to stop the simulation.
9. Disconnect the coaxial cable from the GPS RX ANT input port.
10. With the DMM, measure the GPS antenna bias voltage between the center conductor to the outside side housing. GPS antenna bias voltage should be  $2.85 \pm 0.1$  VDC

### 3.3.9 External Trigger Input

The External Trigger Input procedure verifies the External Trigger Input functionality.

EQUIPMENT: ARB Generator

STEP	PROCEDURE
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1. Setup the ARB Generator with the following data:

Setup Field	Setup Data
High Impedance Output	
Pulse Function	
Pulse Width	100 uS
Amplitude Level	low = 0 V; high = 3.3 V
Burst	1 cycle with manual trigger
Output	On

2. Connect the output from the ARB Generator to the AUX connector.  
Input: Pin 19  
Ground: Pin 26

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STEP	PROCEDURE
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3. From the Launch bar select Simulation. Press the Stop button to stop the simulation. From the Launch bar select Setup and enter the following data into each field.

Setup Field	Setup Data
<b>Simulation</b>	
GNSS	GPS
Carrier	L1
SBAS	Off
Simulation	Static
Digital Noise	Off
Fading	None
PRN Signal	Fixed
Position Source	User
Clock	User Setting
RF Level	-125.0 dBm
RF Port	Direct
<b>Channels</b>	
Total SV's	12, then press Apply
<b>I/O</b>	
Coupler Loss	0.7 dB
Coupler Cable	1.0 dB
Direct Cable	2.2 dB
Ext Ref Out	OFF
Reference Source	INT
Trigger	External

4. From the Launch bar select Simulation.

Setup Field	Setup Data
<b>GPS</b>	
Latitude	33° 57.8884S
Longitude	18° 36.1000E
Altitude	151 ft
Run	

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STEP

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5. Verify the following operations:

Field	Data
<b>Setup I/O</b>	
Trigger	External
<b>Simulation GPS</b>	
Configuring	Green light
Current Sim Date	Blank
Current Sim Time	Blank
Latitude	Locked, cannot be changed
Longitude	Locked, cannot be changed
Altitude	Locked, cannot be changed
Visible SVs	Blank
SV PRN	Blank
Elapsed Time	Blank
From	Blank
To	Blank
Heading	Blank
Speed	0 mph
Distance to go	0 ft

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- | STEP | PROCEDURE   |
|------|---|
| 6.   | Press the manual trigger button on the ARB Generator and verify the following operations: |

Field	Data
<b>Simulation GPS</b>	
Running	Green light
Current Sim Date	Using starting date from the Setup/Simulation page
Current Sim Time	Using starting date from the Setup/Simulation page and counting up at one second rate
Latitude	Locked and cannot be changed
Longitude	Locked and cannot be changed
Altitude	Locked and cannot be changed
Visible SVs	Note quantity visible
SV PRN	Quantity of SVs indicated must equal Visible SVs
Elapsed Time	Count up at one second rate
From	Blank
To	Blank
Heading	Blank
Speed	0 mph
Distance to go	0 ft

7. From the Lunch bar select Simulation. Press the Stop button to stop the simulation.
8. Disconnect the ARB Generator from the GPSG-1000.

### 3.3.10 Internal 10 MHz Reference

The Internal 10 MHz Reference procedure verifies the accuracy of the internal 10 MHz clock source.

EQUIPMENT:            Frequency Counter  
                              Coaxial Cable

STEP	PROCEDURE
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1.        Setup the Frequency Counter as follows:

Field	Setting
Input Port	CH1
Input Impedance	50 $\Omega$
Gate Time	500 mS
Pulse Width	100 $\mu$ S

2.        Connect a coaxial cable from the REF OUT 10 MHz connector on the GPSG-1000 to the channel 1 input on the Frequency Counter.
3.        Setup the GPSG-1000 and verify the following operations:  
          Setup I/O  
          Reference Source    INT  
          Ext Ref Out         ON
4.        Verify the measured frequency:  
          Spec = 10.0 MHz +/- 10 Hz
5.        Reconfigure the Frequency Counter as follows:

Field	Setting
Input Port	CH1
Input Impedance	50 $\Omega$
Other Meas	Volt Peaks 1
Input	DC

6.        Verify the measured amplitude output level:  
          Spec = 1.5 Vpp +/- 0.2 Vpp into 50  $\Omega$

### 3.3.11 External 10 MHz Reference

The External 10 MHz Reference procedure verifies the operation of the external 10 MHz input.

EQUIPMENT:            Frequency Counter  
                              Signal Generator  
                              Coaxial Cable

STEP	PROCEDURE
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1. Setup the Frequency Counter as follows:

Field	Setting
Input Port	CH1
Input Impedance	50 Ω
Gate Time	500 mS
Pulse Width	100 uS

2. Connect a coaxial cable from the REF OUT 10 MHz connector on the GPSG-1000 to the channel 1 input on the Frequency Counter.
3. From the Launch bar select Maintenance, then Diagnostics from the drop down menu. Press Maintenance and verify the following diagnostic operations:

Field	Setting	Indication
Reference Source	EXT	
EXT REF OUT	ON	
PLL Lock Status	LO	Green/Locked
PLL Lock Status	800 MHz	Green/Locked
PLL Lock Status	EXT.REF	No Light
PLL Lock Status	EXT.REF DET	Green/Locked

4. Setup the Signal Generator:  
    Frequency            10 MHz  
    Output Level        +/- 10 dBm
5. Connect a coaxial cable from the REF IN 10 MJHZ connector on the GPSG-1000 to the RF output port of the Signal Generator.

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- | STEP | PROCEDURE  |
|------|--|
| 6.   | Setup the GPSG-1000, press Maintenance and verify the following diagnostic operations: |

Field	Setting	Indication
Reference Source	EXT	
EXT REF OUT	ON	
PLL Lock Status	LO	Green/Locked
PLL Lock Status	800 MHz	Green/Locked
PLL Lock Status	EXT.REF	Green/Locked
PLL Lock Status	EXT.REF DET	Green/Locked

7. Verify the measured frequency:  
Spec = 10,000,000 Hz +/- 10 Hz
8. Change the output frequency on the Signal Generator to 10,000 010 Hz and verify the frequency increases by 10 Hz on the Frequency Counter.  
Spec = + 10 Hz +/- 0.1 Hz
9. Change the output frequency on the Signal Generator to 9,999,990 Hz and verify the frequency increases by 10 Hz on the Frequency Counter.  
Spec = + 10 Hz +/- 0.1 Hz
10. On the Diagnostics screen set the GPSG-1000 to the following:

Field	Setting
Reference Source	INT
EXT REF OUT	OFF

### 3.3.12 VSWR at Antenna Port

The VSWR at Antenna Port procedure verifies the VSWR of the Antenna Port.

EQUIPMENT:            Network Analyzer  
                             Coaxial Cable

STEP	PROCEDURE
1.	Setup the Network Analyzer and calibration port and coaxial cable together. Verify the following:

Field	Setting
Input Port	Port 1
Start Frequency	1.0 GHz
Stop Frequency	1.6 GHz
Meas	S <sub>11</sub>
Format	VSWR

2. Connect the coaxial cable to the GPS TX ANT COUPLER port.
3. From the Launch bar select Setup. On the Simulation screen set RF Output RF Port to Direct and verify the following operations:  
    Setup Simulation  
    RF Port    Coupler
4. Measure and verify that VSWR is below 1.5:1 across the frequency range.  
    Spec = VSWR < 1.5:1

### 3.3.13 VSWR at Direct Port

The VSWR at Direct Port procedure verifies the VSWR of the Direct Port.

EQUIPMENT:           Network Analyzer  
                          Coaxial Cable

STEP	PROCEDURE
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1.     Setup the Network Analyzer, calibration port and coaxial cable together. Verify the following:

Field	Setting
Input Port	Port 1
Start Frequency	1.0 GHz
Stop Frequency	1.6 GHz
Meas	S <sub>11</sub>
Format	VSWR

2.     Connect the coaxial cable to the GPS TX DIRECT port.
3.     Setup the GPSG-1000 and verify the following operations:  
          Setup Simulation  
          RF Port   Direct
4.     Measure and verify that VSWR is below 1.5:1 across the frequency range.  
          Spec = VSWR < 1.5:1

### 3.3.14 RF Output Frequency

The RF Output Frequency procedure measures the accuracy of the different frequencies generated by the GPSG-1000.

EQUIPMENT:            Measuring Receiver  
                              Coaxial Cable

STEP	PROCEDURE
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1. Setup the Measuring Receiver as follows:

Field	Setting
Mode	Spectrum Analyzer
Frequency	1176.45 MHz
Amplitude	-50 dBm
Span	10 kHz/div
Format Marker 1	On peak

2. Connect the Measuring Receiver to the GPS TX ANT COUPLER port.
3. From the Launch bar select Setup and verify the following operations:

Field	Data
<b>Setup Simulation</b>	
RF Port	Coupler

4. From the Launch bar select Maintenance, then Diagnostics from the drop down menu.

Field	Data
<b>Maintenance Diagnostics</b>	
Frequency	1176.45 MHz
Amplitude	-68 dBm
Mode	CW

5. Measure and verify the output frequency on the Measuring Receiver is within specifications.  
Spec = 1176.45 MHz +/- 1000 Hz
6. Measure and record the following output frequencies:

Spec
1207.14 MHz +/- 1000 Hz
1227.60 MHz +/- 1000 Hz
1278.75 MHz +/- 1000 Hz
1575.42MHz +/- 1000 Hz

7. Set Mode to Off.

### 3.3.15 RF Output Harmonics

The RF Output Harmonics procedure measures the accuracy of the different harmonics generated by the GPSG-1000.

EQUIPMENT:            Measuring Receiver  
                              Coaxial Cable

STEP	PROCEDURE
1.	Setup the Measuring Receiver as follows:

Field	Setting
Mode	Spectrum Analyzer
Frequency	1176.45 MHz
Amplitude	-50 dBm
Span	200 Hz/div
RBW	10 Hz
Sweep Time	20 S

2. Connect the Measuring Receiver to the GPS TX ANT COUPLER port.
3. From the Launch bar select Setup and verify the following operations:

Field	Data
<b>Setup Simulation</b>	
RF Port	Coupler

4. From the Launch bar select Maintenance, then Diagnostics from the drop down menu.

Field	Data
<b>Maintenance Diagnostics</b>	
Frequency	1176.45 MHz
Amplitude	-68 dBm
Mode	CW

5. Measure and verify that the 2nd and 3rd harmonic levels output from the GPSG-1000 on the Measuring Receiver is within specifications.  
Spec = 2nd and 3rd harmonics < -45 dBc

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STEP

PROCEDURE

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6. Measure and record the 2nd and 3rd harmonic levels at the following output frequencies:

<b>Spec</b>
1207.14 MHz at 2nd and 3rd harmonics < -45 dBc
1227.60 MHz at 2nd and 3rd harmonics < -45 dBc
1278.75 MHz at 2nd and 3rd harmonics < -45 dBc
1575.42MHz at 2nd and 3rd harmonics < -45 dBc

7. Set Mode to Off.

### 3.3.16 RF Output Spurious Levels

The RF Spurious Levels procedure measures the accuracy of the different spurious levels generated by the GPSG-1000.

EQUIPMENT:            Measuring Receiver  
                              RF Amplifier

STEP	PROCEDURE
1.	Setup the Measuring Receiver as follows:

Field	Setting
Mode	Spectrum Analyzer
Frequency	1176.45 MHz
Amplitude	-10 dBm
Span	4 Hz/div
RBW	500 Hz
VBW	2 kHz
Sweep Time	400 S

2.        Connect the Measuring Receiver to the output of the RF Amplifier. Connect the input of the RF Amplifier to the GPS TX ANT COUPLER port.
3.        From the Launch bar select Setup and verify the following operations:

Field	Data
<b>Setup Simulation</b>	
RF Port	Coupler

4.        From the Launch bar select Maintenance, then Diagnostics from the drop down menu.

Field	Data
<b>Maintenance Diagnostics</b>	
Frequency	1176.45 MHz
Amplitude	-68 dBm
Mode	CW

5.        Wait for the Measuring Receiver to complete the sweep. Measure and verify the spurious output levels are within specifications.  
                              Spec = 1176.45 MHz at < -35 dBc

**PRELIMINARY**  
**Calibration/Verification/**

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STEP

PROCEDURE

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6. Measure and record the spurious levels at the following output frequencies:

<b>Spec</b>
1207.14 MHz at 2nd and 3rd harmonics < -35 dBc
1227.60 MHz at 2nd and 3rd harmonics < -35 dBc
1278.75 MHz at 2nd and 3rd harmonics < -35 dBc
1575.42MHz at 2nd and 3rd harmonics < -35 dBc

7. Set Mode to Off.

### 3.3.17 RF Output Level at Antenna Port

The RF Output Level at Antenna Port procedure measures the accuracy of the RF output level from the GPSG-1000 across the operation frequency and level range.

EQUIPMENT:            Measuring Receiver  
                              Coaxial Cable

STEP	PROCEDURE
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1.        Setup the Measuring Receiver as follows:

Field	Setting
Mode	Measuring Receiver
Frequency	1176.45 MHz
10 MHz Reference	External
Averaging	8

2.        Connect a coaxial cable from the REF OUT 10 MHZ connector of the GPSG-1000 to the External Reference In on the Measuring Receiver. Connect the Measuring Receiver sensor head to GPS TX ANT COUPLER port on the GPSG-1000.
3.        From the Launch bar select Setup and verify the following operations:

Field	Data
<b>Setup Simulation</b>	
RF Port	Coupler

4.        From the Launch bar select Maintenance, then Diagnostics from the drop down menu.

Field	Data
<b>Maintenance Diagnostics</b>	
Frequency	1176.45 MHz
Amplitude	-68 dBm
Mode	CW

5.        Measure and record the spurious levels at the following output frequencies:

Spec
1207.14 MHz -68 dBm +/- 2 dB
1227.60 MHz -68 dBm +/- 2 dB
1278.75 MHz -68 dBm +/- 2 dB
1575.42MHz -68 dBm +/- 2 dB

**PRELIMINARY**  
**Calibration/Verification/**

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- | STEP | PROCEDURE   |
|------|---|
| 6.   | Set the GPSG-1000 for an RF output frequency of 1176.45 MHz and RF output level from -69 dBm to -73 dBm in 1 dB steps. Measure and record the output levels at the following frequencies: |

Spec
1176.45 MHz 1 dB steps +/- 0.2 d
1207.14 MHz 1 dB steps +/- 0.2 dB
1227.60 MHz 1 dB steps +/- 0.2 dB
1278.75 MHz 1 dB steps +/- 0.2 dB
1575.42MHz 1 dB steps +/- 0.2 dB

7. Set the GPSG-1000 for an RF output frequency of 1176.45 MHz and RF output level from -80 dBm to -130 dBm in 10 dB steps. Measure and record the output levels at the following frequencies:

Spec
1176.45 MHz Setting Level +/- 0.2 dB
1207.14 MHz Setting Level +/- 0.2 dB
1227.60 MHz Setting Level +/- 0.2 dB
1278.75 MHz Setting Level +/- 0.2 dB
1575.42MHz Setting Level +/- 0.2 dB

### 3.3.18 RF Output Level at Direct Port

The RF Output Level at Direct Port procedure measures the accuracy of the RF output level from the GPSG-1000 across the operation frequency and level range.

EQUIPMENT:            Measuring Receiver  
                              Coaxial Cable

STEP	PROCEDURE
1.	Setup the Measuring Receiver as follows:

Field	Setting
Mode	Measuring Receiver
Frequency	1176.45 MHz
10 MHz Reference	External
Averaging	8

2. Connect a Coaxial cable from the REF OUT 10 MHZ connector of the GPSG-1000 to the External Reference In on the Measuring Receiver. Connect the Measuring Receiver sensor head to GPS TX ANT COUPLER port on the GPSG-1000.
3. From the Launch bar select Setup and verify the following operations:

Field	Data
<b>Setup Simulation</b>	
RF Port	Coupler

4. From the Launch bar select Maintenance, then Diagnostics from the drop down menu.

Field	Data
<b>Maintenance Diagnostics</b>	
Frequency	1176.45 MHz
Amplitude	-68 dBm
Mode	CW

5. Set the GPSG-1000 for an RF output frequency of 1176.45 MHz and RF output level from -69 dBm to -73 dBm in 1 dB steps. Measure and record the output levels at the following frequencies:

Spec
1176.45 MHz 1 dB steps +/- 0.2 d
1207.14 MHz 1 dB steps +/- 0.2 dB
1227.60 MHz 1 dB steps +/- 0.2 dB
1278.75 MHz 1 dB steps +/- 0.2 dB
1575.42MHz 1 dB steps +/- 0.2 dB

**PRELIMINARY**  
**Calibration/Verification/**

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- | STEP | PROCEDURE   |
|------|---|
| 6.   | Set the GPSG-1000 for an RF output frequency of 1176.45 MHz and RF output level from -80 dBm to -130 dBm in 10 dB steps. Measure and record the output levels at the following frequencies: |

Spec
1176.45 MHz Setting Level +/- 0.2 dB
1207.14 MHz Setting Level +/- 0.2 dB
1227.60 MHz Setting Level +/- 0.2 dB
1278.75 MHz Setting Level +/- 0.2 dB
1575.42MHz Setting Level +/- 0.2 dB

### 3.3.19 1 PPS Output Signal

The 1 PPS Output Signal procedure verifies the 1 PPS Output Signal characteristics.

EQUIPMENT:           Oscilloscope  
                          Coaxial Cable

STEP	PROCEDURE
1.	Setup the Oscilloscope as follows:

Field	Setting
Vertical	1 V/div
Horizontal	20 mS/div
Trigger	2.5 V
Averaging	2

2.       Connect the Oscilloscope to the 1 PPS output on the AUX connector as follows:

Field	Setting
Input	Pin 25
Horizontal Ground	Pin 26

3.       From the Launch bar select Setup and enter the following data into each field:

Setup Field	Setup Data
<b>Simulation</b>	
GNSS	GPS
Carrier	L1
SBAS	Off
Simulation	Static
Digital Noise	Off
Fading	OFF
PRN Signal	Fixed
Position Source	User
Clock	User Setting
RF Level	-125.0 dBm
RF Port	Direct

4.       From the Launch bar select Simulation, then Run.

**PRELIMINARY**  
**Calibration/Verification/**

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STEP

PROCEDURE

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5. Measure and verify the Amplitude and Pulse Width of the 1 PPS signal:

Spec	Setting
Amplitude	3.3 +/- 0.1 V
Pulse Width	100 +/- 1 mS

6. Change the Oscilloscope horizontal sweep rate to 200 mS/div.
7. Measure and verify the period of the 1 PPS signal is 1.0 +/- 0.1 second.
8. Turn off CW RF output and restore factory default settings. Turn off the GPSG-1000 at the power switch; Maintenance, Diagnostics, Mode, Off.
9. Verify File Settings Default displays yellow bubble indicating Default Settings Loaded.

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