

Beamreach Base Station Frequency Stability Test

Date: 10/16/03, Tested by: Steve Lin

Test Description:

The frequency stability of the Beamreach base station is set by a GPS time/frequency standard. This unit provides a 10MHz output that has been locked to the frequency references onboard the GPS satellites. The local oscillators within the base station are then locked to this very stable reference frequency.

The frequency vs temperature stability of the Beamreach base station was measured by putting the LO reference and LO generation circuitry in a temperature chamber, running them over the temperature range and measuring the frequency of the LO output. The required components of the base station consisted of the GPS time/frequency standard and the LO module. A spectrum analyzer was used to measure the output frequency of the LO.

Hardware Tested:

LO module S/N 007; and Starloc II GPS module manufactured by Datum Corporation (now Symmetricom).

Test Equipments:

Spectrum Analyzer, HP 8562E & HP8595E, cal due 4/30/04

Power Supply, Topward 66030-10, no calibration required

Test Results:

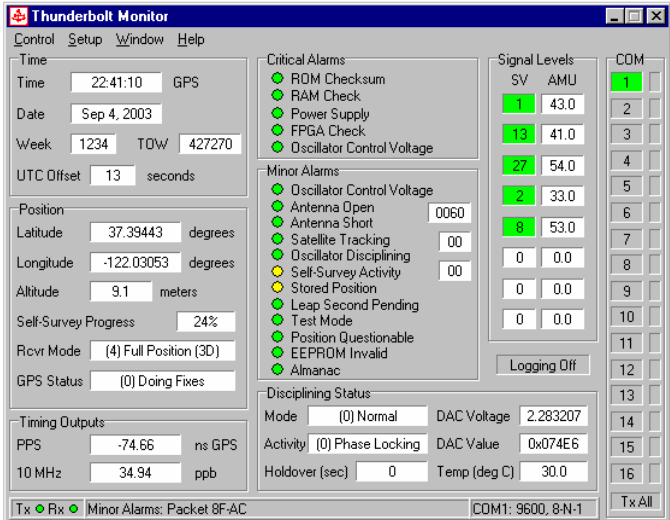
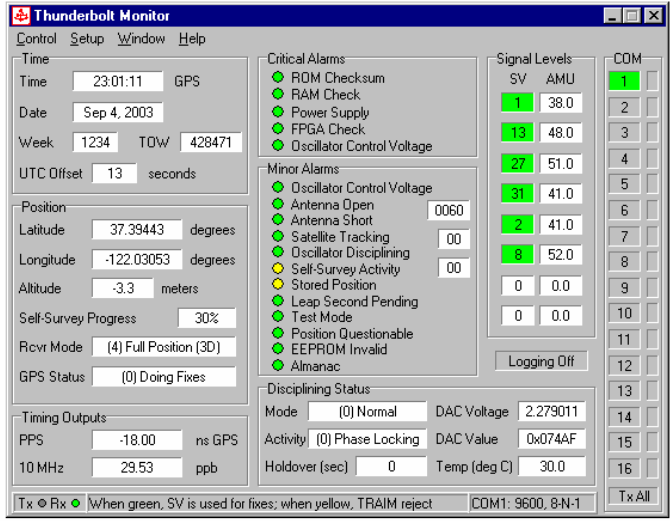
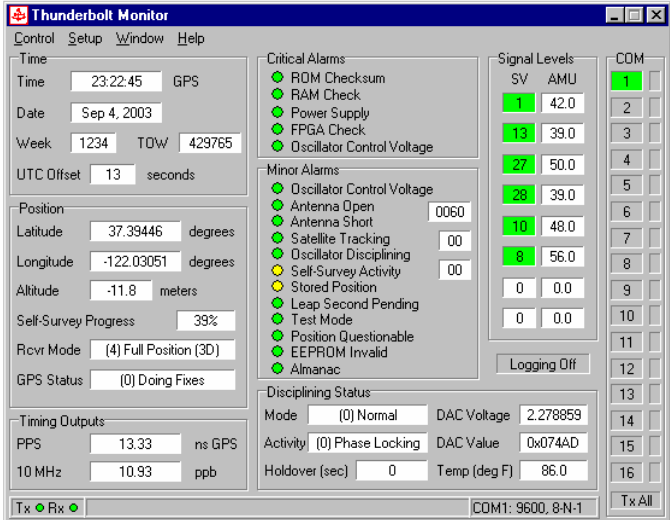
Temperature (deg C)	Measured LO Frequency (Hz)	Frequency Error (Hz)
-20	1,960,000,000	0
-10	1,959,999,994	-6
0	1,959,999,997	-3
10	1,959,999,994	-6
20	1,959,999,997	-3
30	1,959,999,997	-3
40	1,959,999,994	-6
50	1,959,999,994	-6
60	1,959,999,994	-6

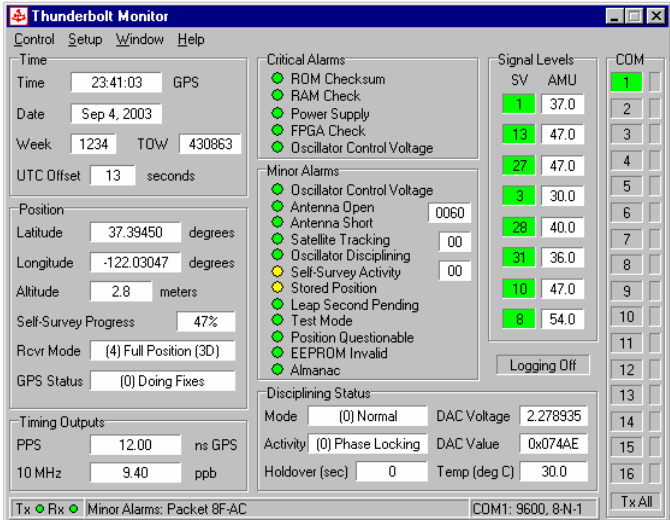
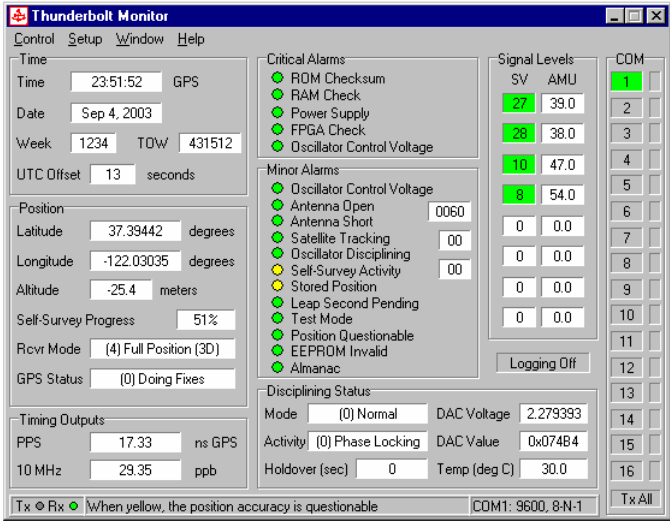
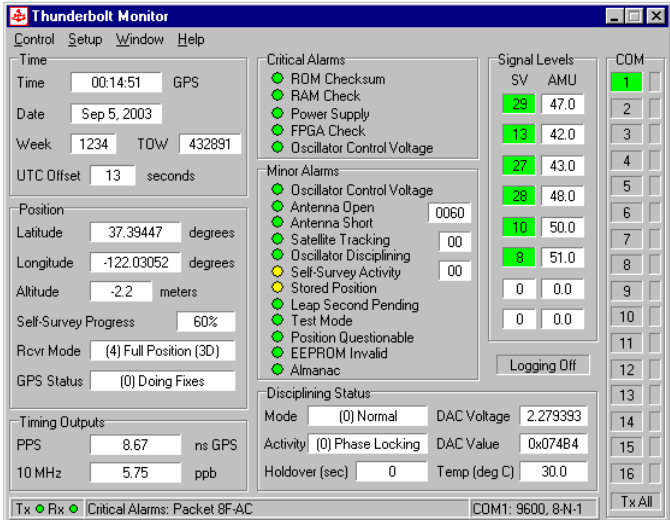
The LO was tuned to a center frequency of 1.96GHz.

The test data shows that the worst case frequency deviation was 6Hz. FCC part 27.54 states that the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation. The emission bandwidth is 3.75MHz within the 5MHz band resulting in 625kHz guard bands between the emissions and the band edges. The 6Hz frequency deviation over temperature is a very small number compared to the 625kHz guard band, ensuring that the FCC specification is met.

Test Data:

The complete set of test data, including the GPS unit status is given below.

Temp	Measured LO Frequency	GPS Unit Status
-20°C	1,960,000,000 Hz	 Thunderbolt Monitor Control Setup Window Help Time: 22:41:10 GPS Date: Sep 4, 2003 Week: 1234 TOW: 427270 UTC Offset: 13 seconds Position: Latitude: 37.39443 degrees Longitude: -122.03053 degrees Altitude: 9.1 meters Self-Survey Progress: 24% Rcvr Mode: (4) Full Position (3D) GPS Status: (0) Doing Fixes Timing Outputs: PPS: -74.66 ns GPS 10 MHz: 34.94 ppb Critical Alarms: ROM Checksum RAM Check Power Supply FPGA Check Oscillator Control Voltage Minor Alarms: Oscillator Control Voltage Antenna Open Antenna Short Satellite Tracking Oscillator Disciplining Self-Survey Activity Stored Position Leap Second Pending Test Mode Position Questionable EEPROM Invalid Almanac Signal Levels: SV AMU 1 43.0 13 41.0 27 54.0 2 33.0 8 53.0 0 0.0 0 0.0 0 0.0 Disciplining Status: Mode: (0) Normal DAC Voltage: 2.283207 Activity: (0) Phase Locking DAC Value: 0x074E6 Holdover (sec): 0 Temp (deg C): 30.0 Tx Rx Minor Alarms: Packet 8F-AC COM1: 9600, 8-N-1
-10°C	1,959,999,994 Hz	 Thunderbolt Monitor Control Setup Window Help Time: 23:01:11 GPS Date: Sep 4, 2003 Week: 1234 TOW: 428471 UTC Offset: 13 seconds Position: Latitude: 37.39443 degrees Longitude: -122.03053 degrees Altitude: -3.3 meters Self-Survey Progress: 30% Rcvr Mode: (4) Full Position (3D) GPS Status: (0) Doing Fixes Timing Outputs: PPS: -18.00 ns GPS 10 MHz: 29.53 ppb Critical Alarms: ROM Checksum RAM Check Power Supply FPGA Check Oscillator Control Voltage Minor Alarms: Oscillator Control Voltage Antenna Open Antenna Short Satellite Tracking Oscillator Disciplining Self-Survey Activity Stored Position Leap Second Pending Test Mode Position Questionable EEPROM Invalid Almanac Signal Levels: SV AMU 1 38.0 13 48.0 27 51.0 31 41.0 2 41.0 8 52.0 0 0.0 0 0.0 Disciplining Status: Mode: (0) Normal DAC Voltage: 2.279011 Activity: (0) Phase Locking DAC Value: 0x074AF Holdover (sec): 0 Temp (deg C): 30.0 Tx Rx When green, SV is used for fixes; when yellow, TRAIM reject COM1: 9600, 8-N-1
0°C	1,959,999,997 Hz	 Thunderbolt Monitor Control Setup Window Help Time: 23:22:45 GPS Date: Sep 4, 2003 Week: 1234 TOW: 429765 UTC Offset: 13 seconds Position: Latitude: 37.39446 degrees Longitude: -122.03051 degrees Altitude: -11.8 meters Self-Survey Progress: 39% Rcvr Mode: (4) Full Position (3D) GPS Status: (0) Doing Fixes Timing Outputs: PPS: 13.33 ns GPS 10 MHz: 10.93 ppb Critical Alarms: ROM Checksum RAM Check Power Supply FPGA Check Oscillator Control Voltage Minor Alarms: Oscillator Control Voltage Antenna Open Antenna Short Satellite Tracking Oscillator Disciplining Self-Survey Activity Stored Position Leap Second Pending Test Mode Position Questionable EEPROM Invalid Almanac Signal Levels: SV AMU 1 42.0 13 39.0 27 50.0 28 39.0 10 48.0 8 56.0 0 0.0 0 0.0 Disciplining Status: Mode: (0) Normal DAC Voltage: 2.278859 Activity: (0) Phase Locking DAC Value: 0x074AD Holdover (sec): 0 Temp (deg F): 86.0 Tx Rx COM1: 9600, 8-N-1

Temp	Measured LO Frequency	GPS Unit Status
10°C	1,959,999,994 Hz	
20°C	1,959,999,997 Hz	
30°C	1,959,999,997 Hz	

Temp	Measured LO Frequency	GPS Unit Status
40°C	1,959,999,994 Hz	
50°C	1,959,999,994 Hz	
60°C	1,959,999,994 Hz	