

ANNEX-1 to test report# EMC_624FCC-25_2004_SAT

MBS 1000-2

Frequency Accuracy and Stability Tests

050-801-0010 R01



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1 Purpose

The purpose of this test is to determine the MBS1000-2 transmitter frequency accuracy over the operating temperature of the unit.

2 Test Equipment

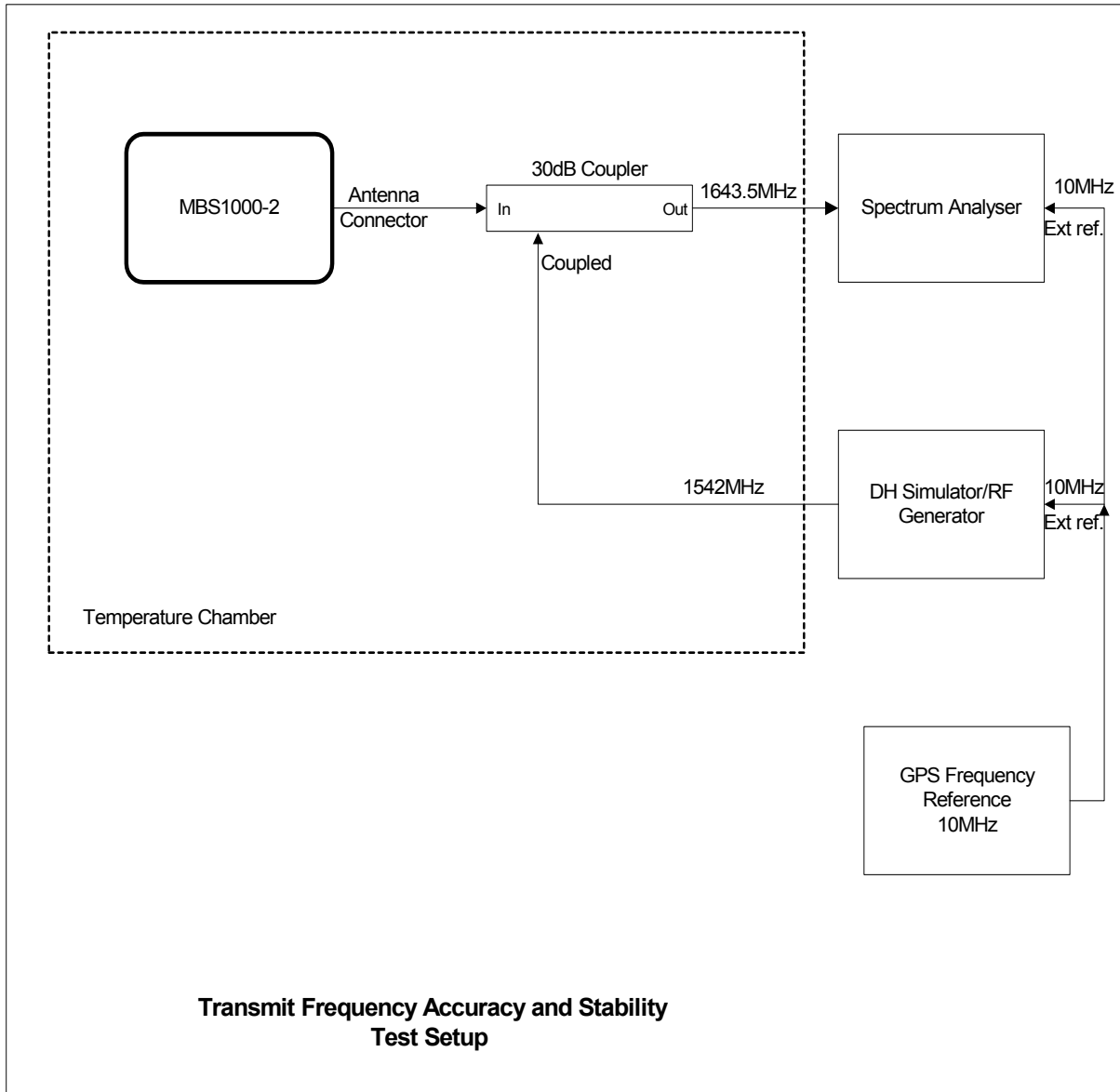
Following is a list of test equipment used.

- **HP Spectrum Analyzer 4396A** with frequency range from 2Hz to 1.8GHz.
Calibration Date: 21 July 2003 Calibration Due: 21 July 2004
- **HP Spectrum analyzer 70000 series** with IF and RF plug-ins for frequencies up to 22GHz.
Calibration Date: 2 Sept 2003 Calibration Due: 2 Sept 2005
- **Boonton 4220** digital RF power meter with ± 0.1 dB accuracy.
Calibration Date: 16 July 2003 Calibration Due: 16 July 2004
- **HP 8648B RF signal generator** with frequency range from 0.1 to 2000 MHz.
Calibration Date: 30 July 2003 Calibration Date: 30 July 2004
- **MDS Data Hub Simulator**, a Wireless Matrix propriety test set generating valid MDS frames for calibrating noise, fading, synchronization and frequency stability.
- **Narda Coaxial Directional Coupler** -30dB Model No. 3042B-30
- **K & L Microwave Tunable Band-reject Filter** Model 3TNF-1000/2000-N/N
- **Thermotron temperature chamber** for testing between -40°C to +60°C.
- **GW Dual Power Supply Model: GPC-1850**
- **HP GPS 10MHz high stability reference** Z3801A

3 Operation

The transmit frequency accuracy is initially controlled by a TCXO with a typical frequency stability of ± 1.5 ppm and max. of ± 2.5 ppm over the temperature range between -40 to +60 °C. Once the MSAT Satellite signal is received, the Software Automatic Frequency Control will compensate for any initial frequency offset and will frequency lock the transmitter frequency with the receive frequency.

For this test a Data Hub Simulator and a Spectrum Analyzer are used. A GPS high stability frequency reference is used for both the Data Hub simulator and the Spectrum Analyzer. The transmitter frequency accuracy therefore will be the same as the Data Hub received frequency to within ± 50 Hz. The MSAT specification for transmitter frequency error is ± 100 Hz (for closed loop frequency control option) relative to the satellite signal.



The transmitter frequency tracking to the DH frequency was tested using the DH test set over the MBS1000-2 operating temperature. The transmitter was activated and its frequency was tuned over the operating band and measured to ensure that TX frequency deviation is within the spec limits. The test results are shown in the tables below.
 Note: all frequency offsets are normalized to 20⁰C

Transmit frequency accuracy and stability

Transmitter on 1626.5MHz

Temperature [°C]	Carrier Frequency [Hz]	Frequency Offset [Hz]
-40	1626499995.30	-6.80
-30	1626499997.80	-4.30
-20	1626499994.20	-7.90
-10	1626500007.90	5.80
0	1626500003.10	1.00
10	1626499998.70	-3.40
20	1626500002.10	0.00
30	1626499996.80	-5.30
40	1626500012.70	10.60
50	1626499994.80	-7.30
60	1626500001.80	-0.30

Transmitter on 1643.5MHz

Temperature [°C]	Carrier Frequency [Hz]	Frequency Offset [Hz]
-40	1,643,499,987.23	1.17
-30	1,643,499,981.37	-4.69
-20	1,643,499,981.17	-4.88
-10	1,643,499,981.95	-4.10
0	1,643,499,982.34	-3.71
10	1,643,499,980.98	-5.08
20	1,643,499,986.06	0.00
30	1,643,499,979.02	-7.03
40	1,643,499,976.68	-9.38
50	1,643,499,975.90	-10.16
60	1,643,499,983.32	-2.74

Transmitter on 1660.5MHz

Temperature [°C]	Carrier Frequency [Hz]	Frequency Offset [Hz]
-40	1660500009.30	10.50
-30	1660500011.30	12.50
-20	1660500003.20	4.40
-10	1660499995.50	-3.30
0	1660499993.40	-5.40
10	1660500001.50	2.70
20	1660499998.80	0.00
30	1660499991.80	-7.00
40	1660499999.10	0.30
50	1660500004.50	5.70
60	1660500009.80	11.00

4 Results

The frequency error of the MBS1000-2 transmitter was within specification over the entire operating temperature.