Engineering and Testing for EMC and Safety Compliance

Type Certification Report

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Model: OpenSky 700 MHz Cell Site

FCC ID: BV8CS700
IC: 3670A-CS700

December 28, 2005

Standards Referenced for this Report	
Part 2: 2004	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 15: 2004	Radio Frequency Devices - §15.109: Radiated Emissions Limits
Part 90: 2004	Private Land Mobile Radio Services
ANSI C63.4-2003	Standard Format Measurement/Technical Report Personal Computer and Peripherals
ANSI/TIA-603-B-2002	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA/EIA 603-1-2002	Addendum to ANSI/TIA/EIA 603-1992
ANSI/TIA/EIA –102.CAAA; 2002	Digital C4FM/CQPSK Transceiver Measurement Methods
RSS-119; Issue 6; 2000	Land Portable and Fixed Radio Transmitters and Receivers 27.41 to 960.0 MHz
ICES-003: 1997	Spectrum Management; Interference-Causing Equipment Standard – Digital Apparatus

Frequency Range	Maximum Measured Output Power (W) Conducted	Measured Frequency Tolerance (ppm)	Emission Designator
764-767 MHz	31.6	0.01	12K1F9W (4-Level TDMA voice/data)
773-776 MHz	31.6	0.01	12K1F9W (4-Level TDMA voice/data)

Report Prepared by Test Engineer: Dan Baltzell

Document Number: 2005189

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1 General Information

The following Type Certification Report is prepared on behalf of **M/A-COM, Inc**. in accordance with the Federal Communications Commission and Industry Canada Rules and Regulations. The Equipment Under Test (EUT) was the **OpenSky 700 MHz Cell Site; FCC ID: BV8CS700, IC: 3670A-CS700**. The test results reported in this document relate only to the item that was tested.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47, and ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 2003. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.1 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia, 20170. This site has been fully described in a report dated March 3, 1994, submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.2 Related Submittal(s)/Grant(s)

This is an original application report.

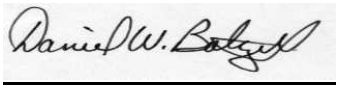
2 Conformance Statement

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made to the equipment during testing in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to, or exclusions from, the above standards for certification methodology.

Signature:  Date: December 23, 2005

Typed/Printed Name: Desmond A. Fraser Position: President

Signature:  Date: December 23, 2005

Typed/Printed Name: Dan Baltzell Position: Test Engineer

3 Tested System Details

The test sample was received on December 12, 2005. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

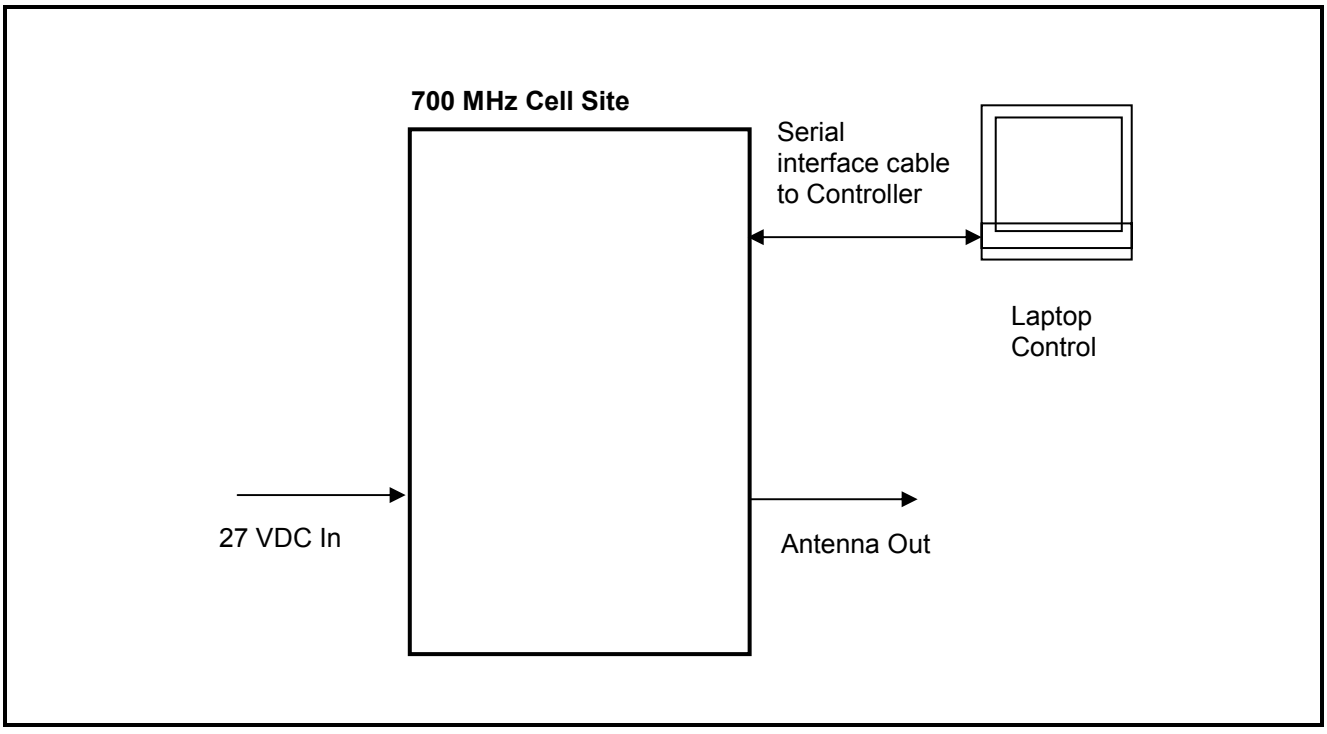
Table 3-1: Equipment Under Test (EUT)

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
OpenSky 700 MHz Cell Site	M/A-Com, Inc.	CS-700	N/A	BV8CS700	16949

Table 3-2: Support Equipment

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Notebook Computer	Dell	Latitude	N/A	N/A	16951
Serial interface cable/ USB adapter	N/A	N/A	N/A	N/A	16953

Figure 3-1: Configuration of Tested System



4 FCC Rules and Regulations Part 2 §2.1033(C)(8) Voltages and Currents Through The Final Amplifying Stage

Nominal DC Voltage: 27.2 VDC
Current: 6.0 AMPS

5 FCC Rules and Regulations Part 90 §90.541 and Part 2 §2.1046(a): RF Power Output: Conducted; RSS-119 §6.2: Output Power Test

The transmitting power of base, mobile, portable, and control stations operating in the 764-776 MHz and 794-806 MHz frequency band must not exceed the maximum limits in this section, and must also comply with any applicable effective radiated power limits in Section 90.545:

a) The transmitting power of base transmitters must not exceed the limits given in paragraphs (a), (b), and (c) of Section 90.635.
b) The transmitter output power of mobile and control transmitters must not exceed 30 Watts.
c) The transmitter output power of portable (hand-held) transmitters must not exceed 3 Watts.
d) Transmitters operating on the narrowband low power channels listed in Sections 90.531(b)(3) and 90.531(b)(4) must not exceed 2 Watts (ERP).

5.1 Test Procedure

ANSI/TIA-603-B-2002, section 2.2.1

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.

5.2 Test Data

The following channels (in MHz) were tested: 764.0125, 766.9875, 773.0125, and 775.9875.

Table 5-1: RF Power Output: Carrier Output Power

Frequency (MHz)	Full Duplex Version RF Power Measured (Watt)*	External Duplex Version RF Power Measured (Watt)*
764.0125	25	31.6
766.9875	25	31.6
773.0125	25	31.6
775.9875	25	31.6
764.0125	3.16	3.16
766.9875	3.16	3.16
773.0125	3.16	3.16
775.9875	3.16	3.16

* Measurement accuracy: +/-.02 dB (logarithmic mode)

Table 5-2: RF Power Output (Rated Power)

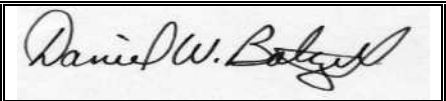
Full Duplex Version Rated Power (HP/LP W)
25/3.16

External Duplex Version Rated Power (HP/LP W)
31.6/3.16

Table 5-3: Test Equipment for Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901184	Agilent	E4416A	Power Meter	GB41050573	9/21/06
901356	Agilent	E9323A	Power Sensor	31764-264	9/21/06
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/2/08

Test Personnel:

Dan Baltzell		December 16 and 23, 2005
Test Engineer	Signature	Dates Of Tests

6 FCC Rules and Regulations Part 90 §90.543(c) and Part 2 §2.1051: Spurious Emissions at Antenna Terminals; RSS-119 §6.3: Unwanted Emissions

Out of band emission limit: on any frequency outside of the frequency ranges covered by the ACCP tables, the power of any emission must be reduced below the unmodulated carrier power (P) by at least 43+10log(P) dB.

6.1 Test Procedure

ANSI/TIA-603-B-2002, Section 2.2.13

The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer.

Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence – 19,200 bps.

6.2 Test Data

Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc

Limits: Mask D (dBm): P(dBm) – (43+10xLOG P(W))

The following channels (in MHz) were investigated: 764.0125 and 775.9875. The worst case (unwanted emissions) channels are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

Table 6-1: Conducted Spurious Emissions 764.0125 MHz Full Duplex Mode

25 kHz channel spacing; Conducted power = 25 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1528.0250	70.1	57.0	-13.1
2292.0375	74.8	57.0	-17.8
3056.0500	84.4	57.0	-27.4
3820.0625	84.8	57.0	-27.8
4584.0750	85.4	57.0	-28.4
5348.0875	85.2	57.0	-28.2

Table 6-2: Conducted Spurious Emissions Channel 1 – 764.0125 MHz – Low Power Full Duplex Mode

25 kHz channel spacing; Conducted power = 3.2 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1528.0250	64.4	48.0	-16.4
2292.0375	67.6	48.0	-19.6
3056.0500	67.0	48.0	-19.0
3820.0625	68.5	48.0	-20.5
4584.0750	69.6	48.0	-21.6
5348.0875	70.1	48.0	-22.1
6112.1000	68.6	48.0	-20.6
6876.1125	66.4	48.0	-18.4

Table 6-3: Conducted Spurious Emissions 775.9875 MHz Full Duplex Mode

25 kHz channel spacing; Conducted power = 25 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1551.9750	70.6	57.0	-13.6
2327.9625	79.0	57.0	-22.0
3103.9500	79.2	57.0	-22.2
3879.9375	80.2	57.0	-23.2
4655.9250	80.8	57.0	-23.8
5431.9125	81.3	57.0	-24.3

Table 6-4: Conducted Spurious Emissions Channel 4 – 775.9875 MHz – Low Power Full Duplex Mode

25 kHz channel spacing; Conducted power = 3.2 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1551.9750	64.6	48.0	-16.6
2327.9625	67.3	48.0	-19.3
3103.9500	67.2	48.0	-19.2
3879.9375	69.1	48.0	-21.1
4655.9250	69.4	48.0	-21.4
5431.9125	69.7	48.0	-21.7

Table 6-5: Conducted Spurious Emissions 764.0125 MHz External Duplex Mode

25 kHz channel spacing; Conducted power = 31.6 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1528.0250	71.9	58.0	-13.9
2292.0375	74.9	58.0	-16.9
3056.0500	108.2	58.0	-50.2
3820.0625	106.6	58.0	-48.6
4584.0750	109.9	58.0	-51.9
5348.0875	110.3	58.0	-52.3

Table 6-6: Conducted Spurious Emissions Channel 1 – 764.0125 MHz – Low Power External Duplex Mode

25 kHz channel spacing; Conducted power = 3.2 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1528.0250	72.2	48.0	-24.2
2292.0375	75.5	48.0	-27.5
3056.0500	98.3	48.0	-50.3
3820.0625	99.0	48.0	-51.0
4584.0750	99.9	48.0	-51.9
5348.0875	100.4	48.0	-52.4
6112.1000	99.0	48.0	-51.0
6876.1125	96.5	48.0	-48.5

Table 6-7: Conducted Spurious Emissions 775.9875 MHz External Duplex Mode

25 kHz channel spacing; Conducted power = 31.6 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1551.9750	71.5	58.0	-13.5
2327.9625	75.5	58.0	-17.5
3103.9500	108.2	58.0	-50.2
3879.9375	106.8	58.0	-48.8
4655.9250	109.8	58.0	-51.8
5431.9125	108.4	58.0	-50.4

Table 6-8: Conducted Spurious Emissions Channel 4 – 775.9875 MHz – Low Power External Duplex Mode

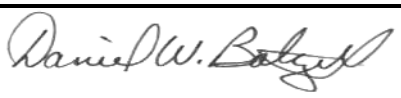
25 kHz channel spacing; Conducted power = 3.2 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1551.9750	71.8	48.0	-23.8
2327.9625	76.8	48.0	-28.8
3103.9500	98.1	48.0	-50.1
3879.9375	99.1	48.0	-51.1
4655.9250	99.8	48.0	-51.8
5431.9125	100.3	48.0	-52.3

Table 6-9: Test Equipment for Testing Conducted Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901413	Agilent	E4448A	Spectrum Analyzer	US44020346	11/2/06
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/2/08
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/12/06

Test Personnel:

Dan Baltzell		December 16 and 28, 2005
Test Engineer	Signature	Dates Of Tests

7 FCC Rules and Regulations Part 90 §90.543(c) and Part 2 §2.1053(a): Field Strength of Spurious Radiation; RSS-119 §6.3: Unwanted Emissions

Out of band emission limit: on any frequency outside of the frequency ranges covered by the ACCP tables, the power of any emission must be reduced below the unmodulated carrier power (P) by at least 43+10log(P) dB.

7.1 Test Procedure

ANSI/TIA-603-B-2002, section 2.2.12

Device with digital modulation: modulated to its maximum extent using a pseudo-random data sequence – 19,200 bps.

The spurious emissions levels were measured and the device under test was replaced by a substitution antenna connected to a signal generator. This signal generator level was then corrected by subtracting the cable loss from the substitution antenna to the signal generator, and the gain of the antenna was further corrected to a half-wave dipole.

7.2 Test Data

7.2.1 CFR 47 Part 90.210 Requirements

The worst-case emissions test data are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

Table 7-1: Field Strength of Spurious Radiation Channel 1 – 764.0125 MHz; Wide Band; High Power; Full Duplex Mode

Limit = 43 + 10 Log P = 57 dBc
Conducted Power = 44 dBm = 25 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1528.0250	36.8	-53.9	4.3	4.7	97.5	-40.5
2292.0375	70.0	-22.3	4.8	5.1	66.1	-9.1
3056.0500	44.5	-45.0	5.5	6.3	88.3	-31.3
3820.0625	35.8	-51.2	6.2	5.9	95.6	-38.6
4584.0750	28.2	-56.0	6.1	7.1	99.1	-42.1
5348.0875	28.5	-54.5	7.0	6.7	98.9	-41.9
6112.1000	29.7	-55.3	7.9	7.6	99.7	-42.7
6876.1125	30.3	-53.7	8.2	5.6	100.4	-43.4
7640.1250	31.2	-52.3	9.0	7.9	97.5	-40.5

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

Table 7-2: Field Strength of Spurious Radiation Channel 1 – 764.0125 MHz; Wide Band; Low Power; Full Duplex Mode

Limit = 43 + 10 Log P = 48 dBc
Conducted Power = 35 dBm = 3.16 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1528.0250	35.2	-55.5	4.3	4.7	99.1	-51.1
2292.0375	51.3	-41.0	4.8	5.1	84.8	-36.8
3056.0500	33.8	-55.7	5.5	6.3	99.0	-51.0
3820.0625	31.5	-55.5	6.2	5.9	99.9	-51.9
4584.0750	28.2	-56.0	6.1	7.1	99.1	-51.1
5348.0875	28.5	-54.5	7.0	6.7	98.9	-50.9
6112.1000	29.7	-55.3	7.9	7.6	99.7	-51.7
6876.1125	30.3	-53.7	8.2	5.6	100.4	-52.4
7640.1250	31.2	-52.3	9.0	7.9	97.5	-49.5

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

Table 7-3: Field Strength of Spurious Radiation Channel 4 – 775.9875 MHz; Wide Band; High Power; Full Duplex Mode

Limit = 43 + 10 Log P = 57 dBc
Conducted Power = 44 dBm = 25 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1551.9750	35.0	-55.5	4.3	4.7	99.2	-42.2
2327.9625	63.3	-28.9	4.9	5.1	72.8	-15.8
3103.9500	41.0	-48.7	5.5	6.2	92.1	-35.1
3879.9375	33.7	-53.6	6.2	5.9	98.0	-41.0
4655.9250	29.2	-52.6	5.9	7.1	95.5	-38.5
5431.9125	28.3	-55.9	7.3	6.6	100.7	-43.7
6207.9000	30.5	-52.8	7.8	7.2	97.5	-40.5
6983.8875	29.8	-55.7	8.2	7.7	100.3	-43.3
7759.8750	30.2	-54.1	9.1	8.1	99.2	-42.2

Table 7-4: Field Strength of Spurious Radiation Channel 4 – 775.9875 MHz; Wide Band; Low Power; Full Duplex Mode

Limit = 43 + 10 Log P = 48 dBc
Conducted Power = 35 dBm = 3.16 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1551.9750	35.0	-55.5	4.3	4.7	99.2	-51.2
2327.9625	45.8	-46.4	4.9	5.1	90.3	-42.3
3103.9500	34.7	-55.0	5.5	6.2	98.4	-50.4
3879.9375	33.3	-54.0	6.2	5.9	98.4	-50.4
4655.9250	29.2	-52.6	5.9	7.1	95.5	-47.5
5431.9125	28.3	-55.9	7.3	6.6	100.7	-52.7
6207.9000	30.5	-52.8	7.8	7.2	97.5	-49.5
6983.8875	29.8	-55.7	8.2	7.7	100.3	-52.3
7759.8750	30.2	-54.1	9.1	8.1	99.2	-51.2

Table 7-5: Field Strength of Spurious Radiation Channel 1 – 764.0125 MHz; Wide Band; External Power; Full Duplex Mode

Limit = 43 + 10 Log P = 58dBc
Conducted Power = 45dBm = 31.6 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1528.0250	41.5	-46.8	4.3	4.7	91.4	-33.4
2292.0375	73.3	-19.0	4.8	5.1	63.8	-5.8
3056.0500	48.7	-40.8	5.5	6.3	85.1	-27.1
3820.0625	42.5	-44.5	6.2	5.9	89.9	-31.9
4584.0750	39.0	-45.2	6.1	7.1	89.3	-31.3
5348.0875	39.3	-43.7	7.0	6.7	89.1	-31.1
6112.1000	40.2	-44.8	7.9	7.6	90.2	-32.2
6876.1125	41.2	-42.8	8.2	5.6	90.5	-32.5
7640.1250	41.5	-42.0	9.0	7.9	88.2	-30.2

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

Table 7-6: Field Strength of Spurious Radiation Channel 1 – 764.0125 MHz; Wide Band; Low Power; External Duplex Mode

Limit = 43 + 10 Log P = 48 dBc
Conducted Power = 35 dBm = 3.16 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1528.0250	74.7	-55.8	4.3	4.7	99.4	-51.4
2292.0375	56.5	-35.8	4.8	5.1	79.6	-31.6
3056.0500	43.2	-46.3	5.5	6.3	89.6	-41.6
3820.0625	41.0	-46.0	6.2	5.9	90.4	-42.4
4584.0750	39.0	-45.2	6.1	7.1	88.3	-40.3
5348.0875	39.2	-43.8	7.0	6.7	88.2	-40.2
6112.1000	40.3	-44.7	7.9	7.6	89.1	-41.1
6876.1125	41.2	-42.8	8.2	5.6	89.5	-41.5
7640.1250	41.5	-42.0	9.0	7.9	87.2	-39.2

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

Table 7-7: Field Strength of Spurious Radiation Channel 4 – 775.9875 MHz; Wide Band; High Power; External Duplex Mode

Limit = 43 + 10 Log P = 58 dBc
Conducted Power = 45 dBm = 31.6 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1551.9750	93.2	-36.5	4.3	4.7	81.2	-23.2
2327.9625	66.0	-26.2	4.9	5.1	71.1	-13.1
3103.9500	46.2	-43.5	5.5	6.2	87.9	-29.9
3879.9375	41.8	-45.5	6.2	5.9	90.9	-32.9
4655.9250	39.8	-42.0	5.9	7.1	85.9	-27.9
5431.9125	39.2	-45.0	7.3	6.6	90.8	-32.8
6207.9000	40.5	-42.8	7.8	7.2	88.5	-30.5
6983.8875	40.5	-45.0	8.2	7.7	90.6	-32.6

Table 7-8: Field Strength of Spurious Radiation Channel 4 – 775.9875 MHz; Wide Band; Low Power; External Duplex Mode

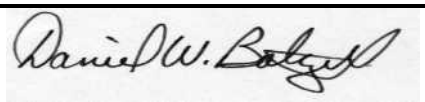
Limit = 43 + 10 Log P = 48 dBc
Conducted Power = 35 dBm = 3.16 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1551.9750	74.7	-47.2	4.3	4.7	90.9	-42.9
2327.9625	50.0	-42.2	4.9	5.1	86.1	-38.1
3103.9500	43.8	-45.9	5.5	6.2	89.3	-41.3
3879.9375	41.8	-45.5	6.2	5.9	89.9	-41.9
4655.9250	39.7	-42.1	5.9	7.1	85.0	-37.0
5431.9125	39.2	-45.0	7.3	6.6	89.8	-41.8
6207.9000	40.5	-42.8	7.8	7.2	87.5	-39.5
6983.8875	40.3	-45.2	8.2	7.7	89.8	-41.8
7759.8750	41.0	-43.3	9.1	8.1	88.4	-40.4

Table 7-9: Test Equipment for Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	11/1/06
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	8/3/06
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 – 20 GHz)	3610A00866	11/10/06
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	5/20/07
900321	EMCO	3161-03	Horn Antennas (4 - 8,2 GHz)	9508-1020	5/20/07
901426	Insulated Wire Inc.	KPS-1503-3600-KPS	RF cable, 30'	NA	12/12/06
901425	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	12/12/06
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/12/06
901128	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	5/13/06

Test Personnel:

Dan Baltzell		December 21 and 28, 2005
Test Engineer	Signature	Dates Of Tests

8 FCC Rules and Regulations Part 90 §90.543(a): Emission Limitations: ACCP Requirements

Transmitters designed to operate in the 764-776 MHz and 794-806 MHz frequency bands must meet the emission limitations of this section.

8.1 Test Procedure

Device with digital modulation: modulated to its maximum extent using a pseudo-random data sequence – 19,200 bps.

For a base transmitter designed to operate with a 25 kHz channel bandwidth, the ACCP shall be in accordance with the following table:

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Maximum ACCP (dBc)
15.625	6.25	-40
21.875	6.25	-60
37.5	25	-60
62.5	25	-65
87.5	25	-65
150	100	-65
250	100	-65
>400 to receive band	30(s)	(1)
In the receive band	30(s)	-100

[1] -80 (continues @-6dB/oct)

FCC Rules and Regulations Part 90 §90.543(b)

Setting Reference Level - Part 90 §90.543(b)(1): using a spectrum analyzer capable of ACCP measurements, set the measurement bandwidth to the channel size 25 kHz. Set the frequency offset of the measurement to zero and adjust the center frequency of the spectrum analyzer to give the power level in the measurement bandwidth. Record this power as the reference power level.

Measuring the power level at the frequency offset <600 kHz - Part 90 §90.543(b)(2): using a spectrum analyzer capable of ACCP measurements, set the measurement bandwidth as shown in the table. Measure ACCP in dBm. These measurements were made at maximum power. Calculate the coupled power by subtracting the measurements made in this step from the reference power level. The absolute ACCP values must be less than the values given in the table for each condition.

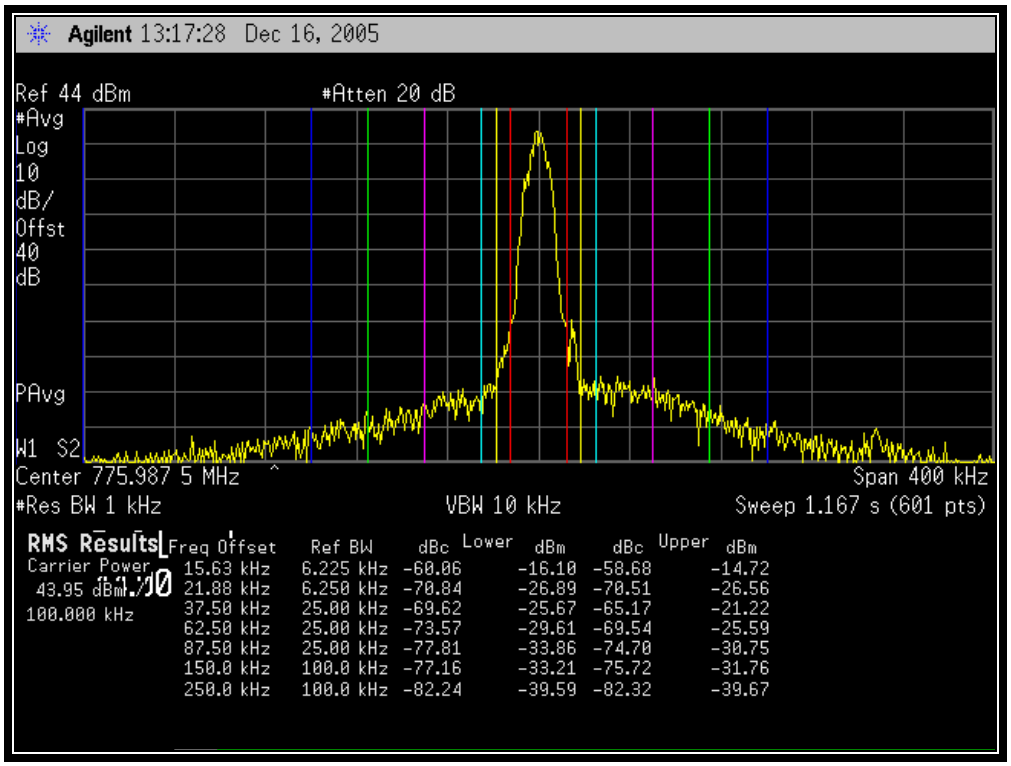
Measuring the power level at the frequency offset >600 kHz - Part 90 §90.543(b)(3): set the spectrum analyzer to 30 kHz resolution bandwidth, 1 MHz video bandwidth, and sample detection mode. Sweep +/-6 MHz from the carrier frequency. Set the reference level to the RMS value of the transmitter power and note the power. The response at frequencies >600 kHz must be less than the values listed in the table.

8.2 Test Data

Table 8-1: ACCP – Full Duplex Mode

			764.0125 MHz		775.9875 MHz	
Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)
(+/-)15.625	6.25	-40	-57.7	-57.1	-60.1	-58.7
(+/-)21.875	6.25	-60	-70.4	-69.7	-70.8	-70.5
(+/-)37.5	25	-60	-68.5	-64.9	-69.6	-65.2
(+/-)62.5	25	-65	-73.3	-68.6	-73.6	-69.5
(+/-)87.5	25	-65	-77.1	-74.4	-77.8	-74.7
(+/-)150	100	-65	-76.7	-75.2	-77.2	-75.7
(+/-)250	100	-65	-82.4	-82.3	-82.2	-82.3

Plot 8-1: ACCP - 775.9875 MHz; Full Duplex Mode



Plot 8-2: ACCP - 764.0125 MHz; Full Duplex Mode

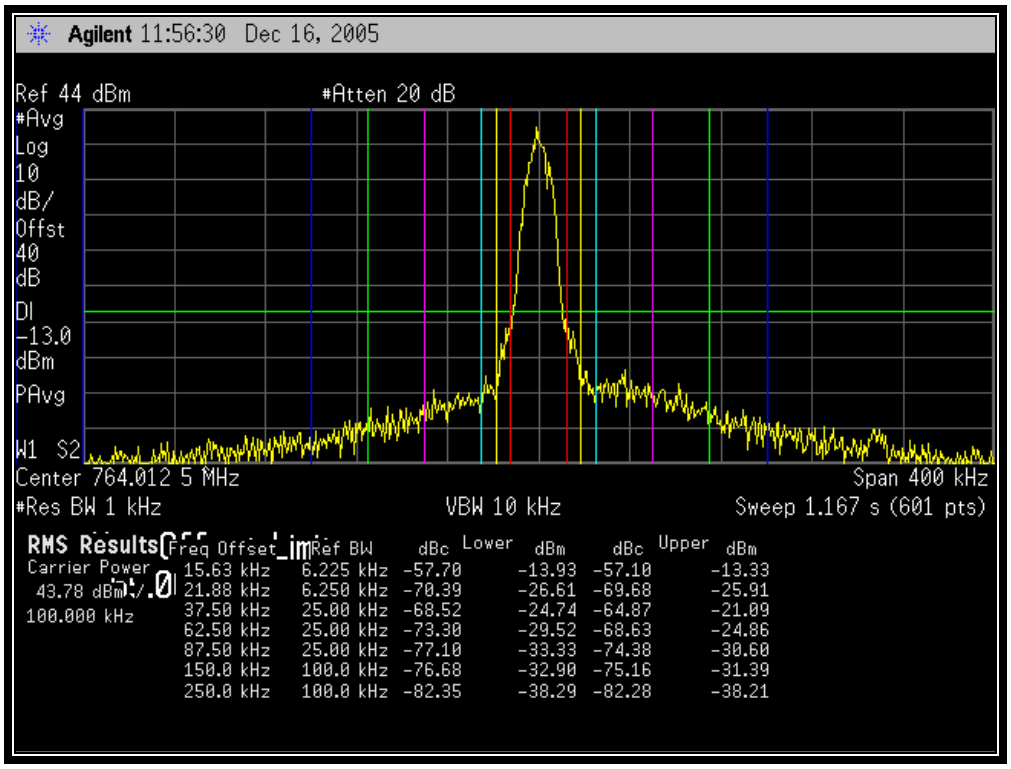


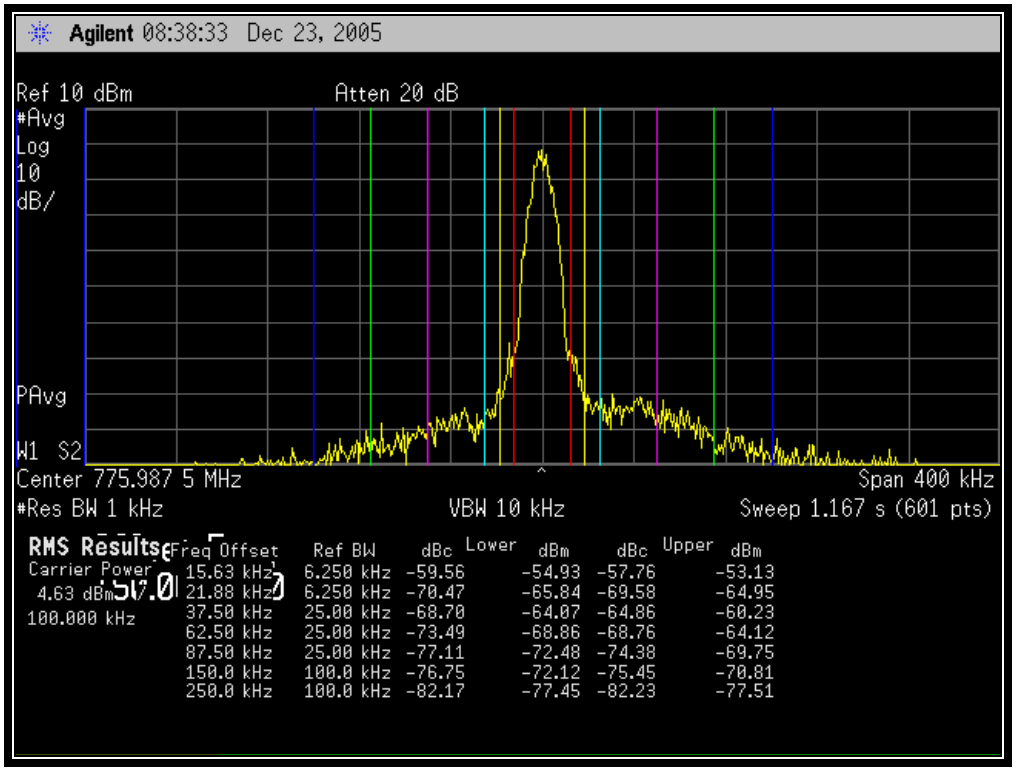
Table 8-2: ACCP Full Duplex Mode

			764.0125 MHz	775.9875 MHz
Offset from Center Frequency (kHz)	**Measurement BW (kHz)**	**Max ACP (dBc)**	**Max ACP (dBc)**	**Max ACP (dBc)**
>600 to receive band	30(s)	-80	-83.8	-87.7
In receive band	30(s)	-100	-110.3	-108.8

Table 8-3: ACCP - External Duplex Mode

			764.0125 MHz		775.9875 MHz	
Offset from Center Frequency (kHz)	**Measurement BW (kHz)**	**Max ACP (dBc)**	**Max ACP Low Offset (dBc)**	**Max ACP High Offset (dBc)**	**Max ACP Low Offset (dBc)**	**Max ACP High Offset (dBc)**
(+/-)15.625	6.25	-40	-57.5	-56.2	-59.6	-57.8
(+/-)21.875	6.25	-60	-70.3	-69.0	-70.5	-69.6
(+/-)37.5	25	-60	-68.8	-64.8	-68.7	-64.9
(+/-)62.5	25	-65	-73.0	-68.4	-73.5	-68.8
(+/-)87.5	25	-65	-77.0	-74.2	-77.1	-74.4
(+/-)150	100	-65	-76.7	-75.3	-76.8	-75.5
(+/-)250	100	-65	-82.2	-82.1	-82.2	-82.2

Plot 8-3: ACCP - 775.9875 MHz; External Duplex Mode



Plot 8-4: ACCP - 764.0125 MHz; External Duplex Mode

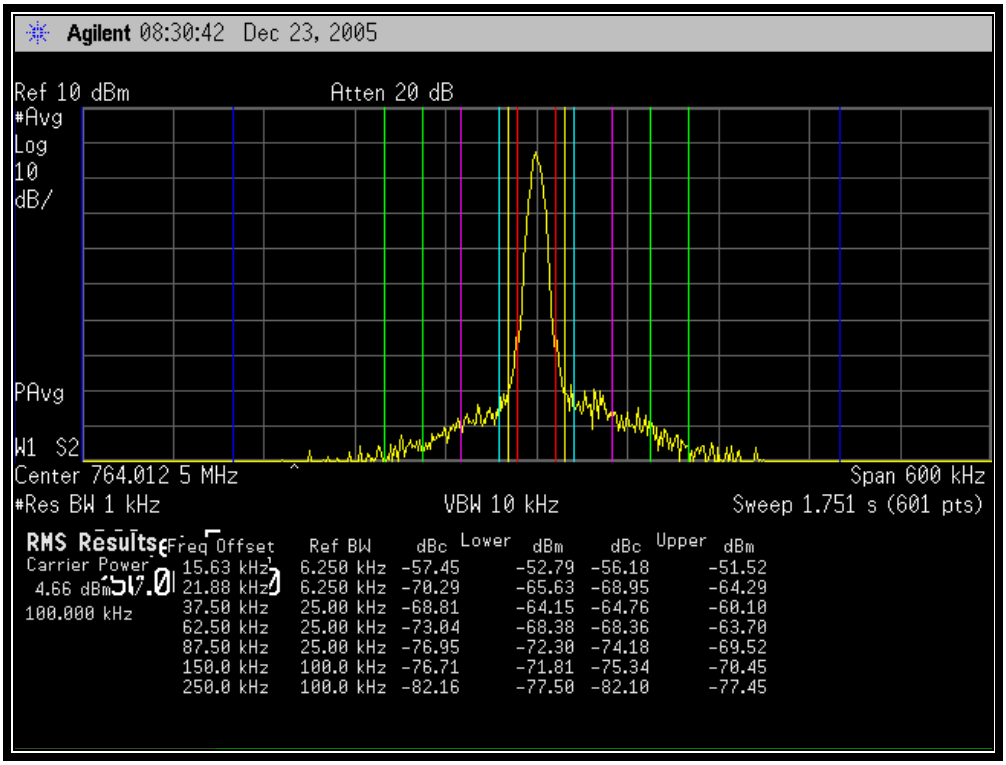


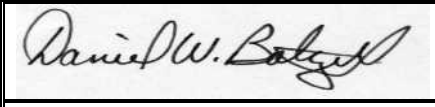
Table 8-4: ACCP External Duplex Mode

			764.0125 MHz	775.9875 MHz
Offset from Center Frequency (kHz)	**Measurement BW (kHz)**	**Max ACP dBc**	**Max ACP dBc**	**Max ACP dBc**
>600 to receive band	30(s)	-80	-92.4	-93.7
In receive band	30(s)	-100	-109.5	-111.9

Table 8-5: Test Equipment for Testing ACCP Requirements

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901413	Agilent	E4448A	Spectrum Analyzer	US44020346	11/2/06
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/2/08
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/12/06

Test Personnel:

Dan Baltzell		December 16 and 23, 2005
Test Engineer	Signature	Dates Of Tests

9 FCC Rules and Regulations Part 90 §90.543(a) and Part 2 §2.1049(c)(1): Occupied Bandwidth; RSS-119 §6.4: Emissions Masks

Occupied Bandwidth - provided that the ACCP requirements are met, the applicants may request any authorized bandwidth that does not exceed the channel size.

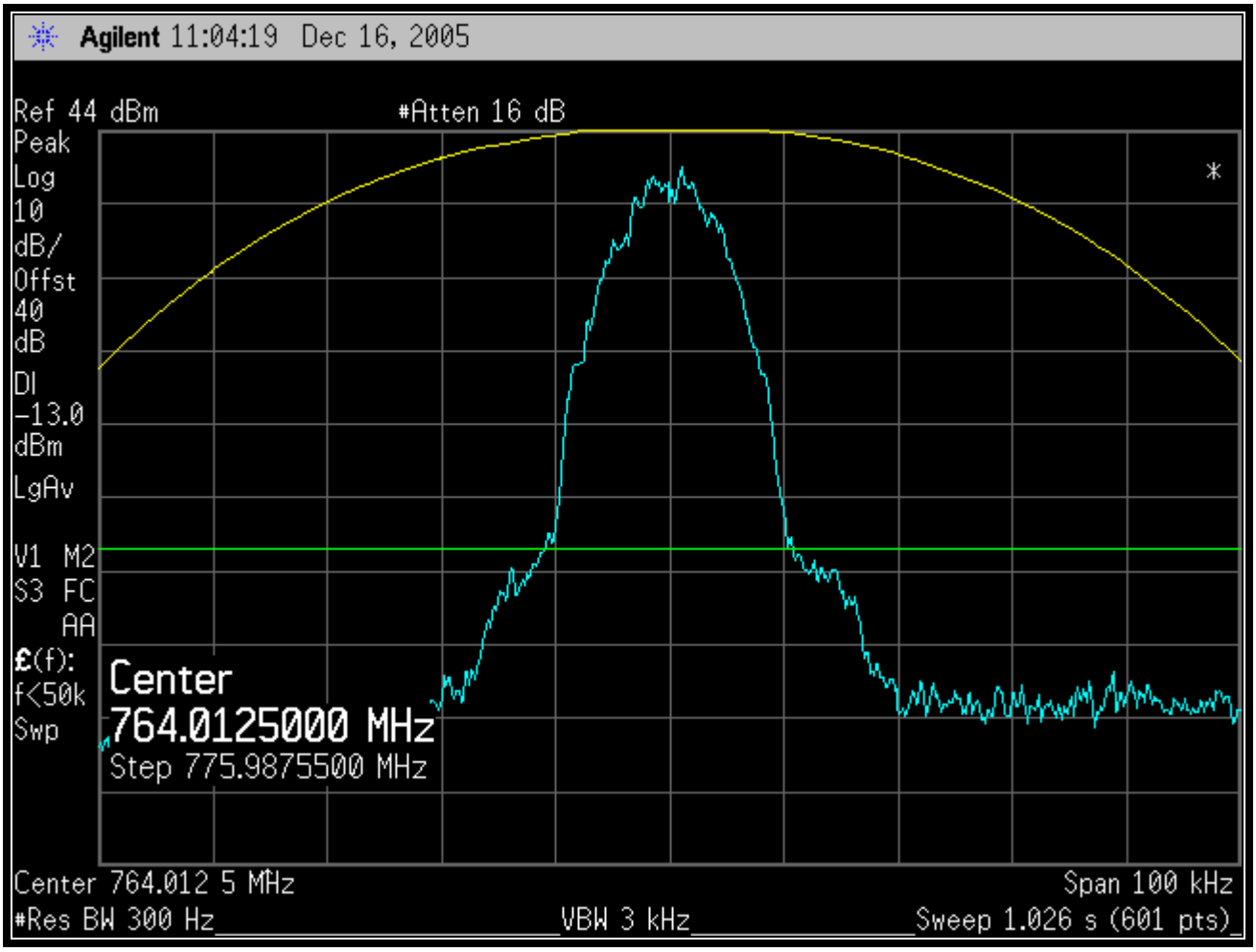
9.1 Test Procedure

Device with digital modulation: modulated to its maximum extent using a pseudo-random data sequence – 19,200 bps.

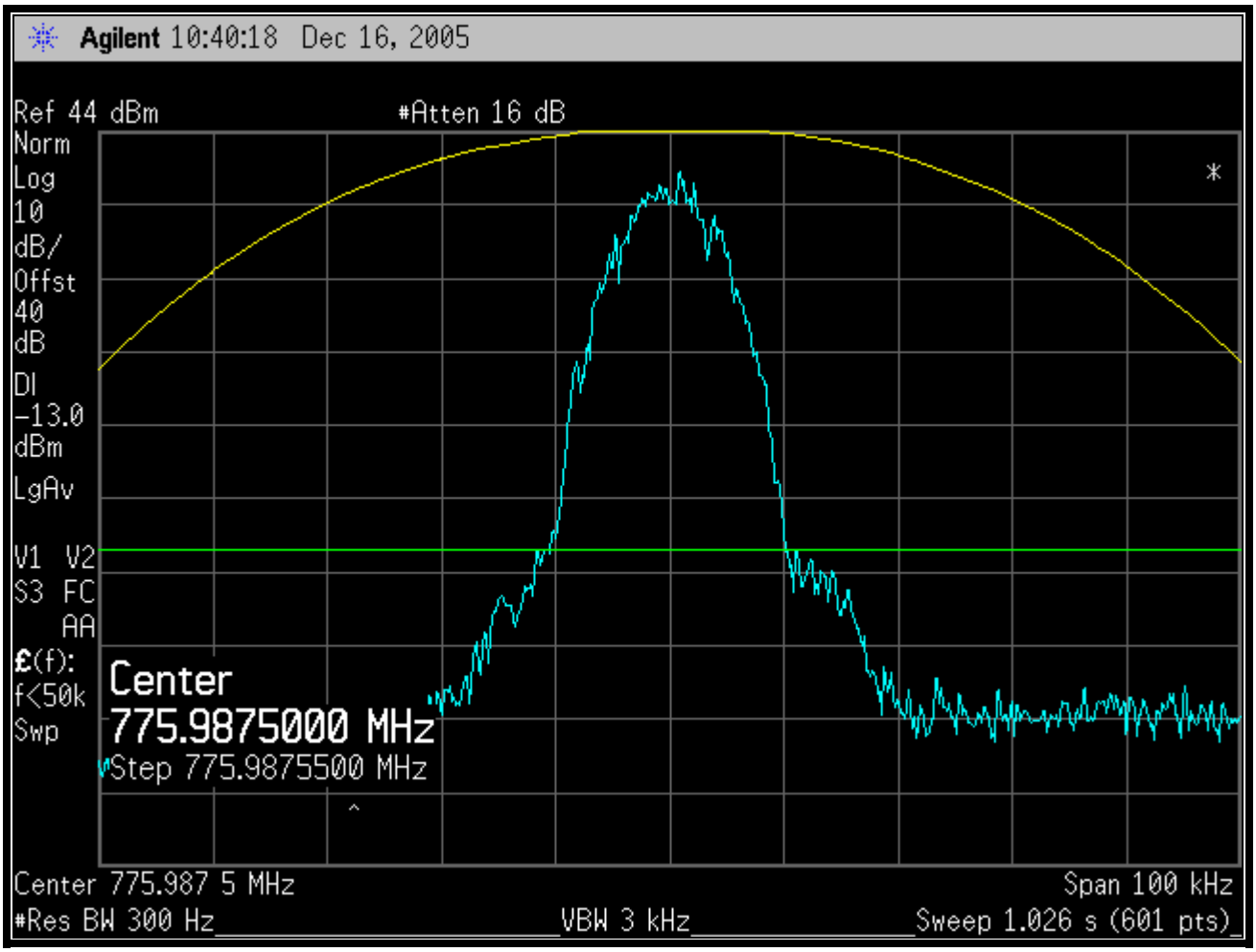
ANSI/TIA-603-B-2002, section 2.2.11

9.2 Test Data

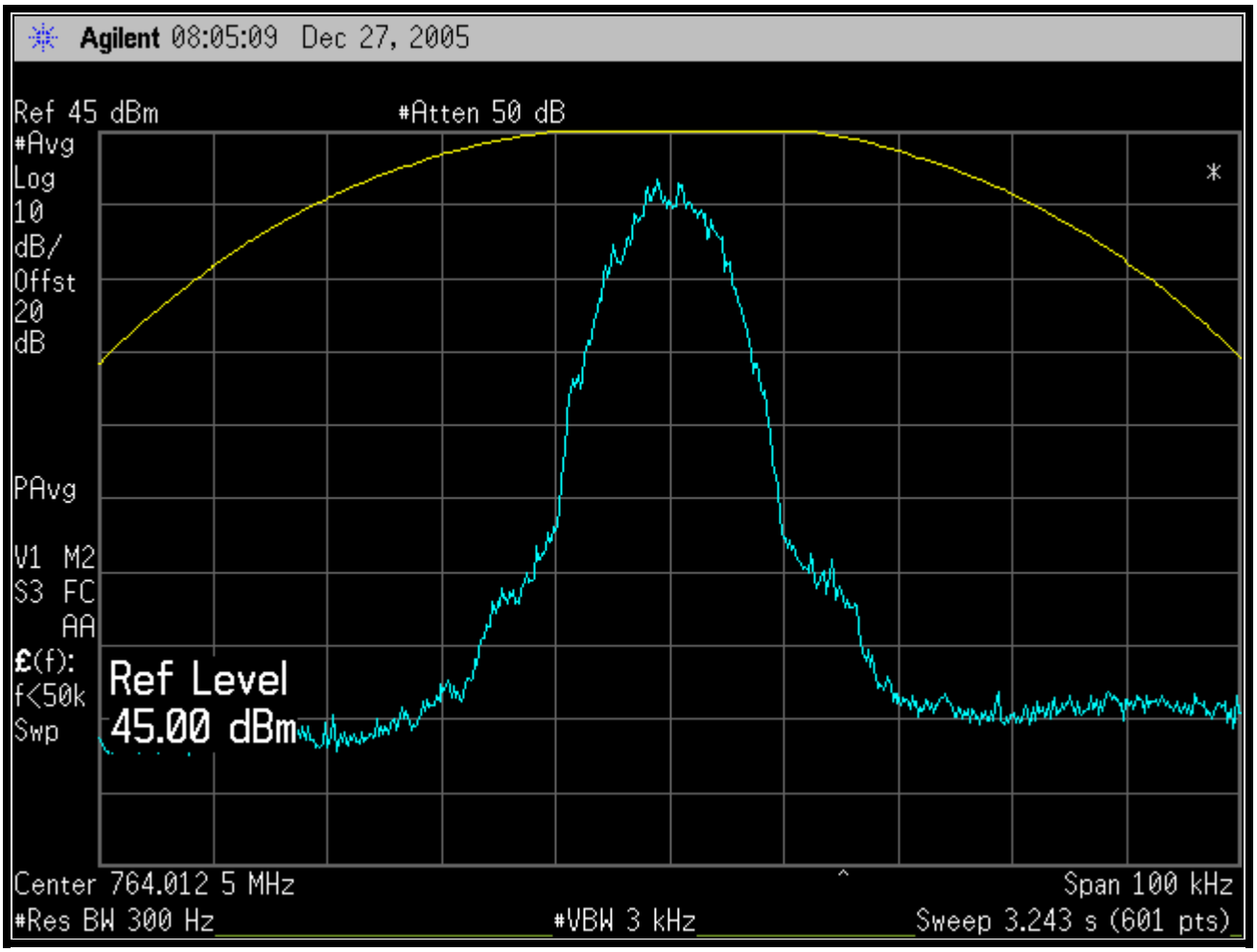
Plot 9-1: Occupied Bandwidth; Full Duplex Mode; 764.0125 MHz



Plot 9-2: Occupied Bandwidth; Full Duplex Mode; 775.9875 MHz



Plot 9-3: Occupied Bandwidth; External Duplex Mode; 764.0125 MHz



Plot 9-4: Occupied Bandwidth; External Duplex Mode; 775.9875 MHz

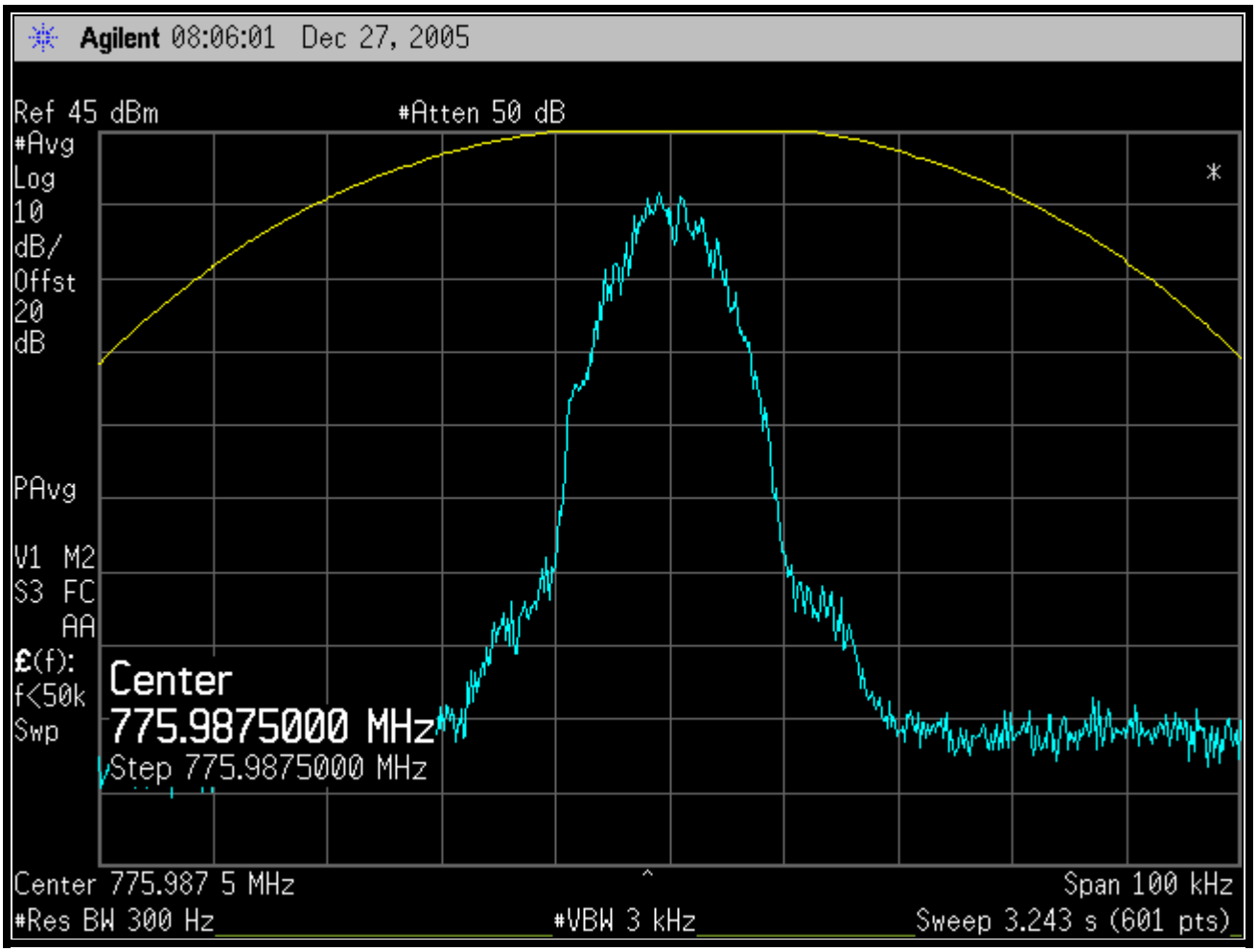
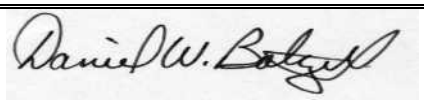


Table 9-1: Test Equipment for Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901413	Agilent	E4448A	Spectrum Analyzer	US44020346	11/2/06
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/2/08
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/12/06

Test Personnel:

Dan Baltzell		December 16 and 27, 2005
Test Engineer	Signature	Dates Of Tests

10 FCC Rules and Regulation Part 90 §90.539 and Part 2 §2.1055: Frequency Stability; RSS-119 §7: Frequency Stability

Transmitters designed to operate in the 764-776 MHz and 794-806 MHz frequency bands must meet the frequency stability requirements in this section.

a) Mobile, portable, and control transmitters must normally use automatic frequency control (AFC) to lock on to the base station signal.

b) The frequency stability of the base transmitters operating in the narrowband segment must be 100 parts per billion or better.

c) The frequency stability of mobile, portable, and control transmitters operating in the narrowband segment must be 400 parts per billion or better when AFC is locked to the base station. When AFC is not locked to the base station, the frequency stability must be at least 1.0 ppm for 6.25 kHz, 1.5 ppm for 12.5 kHz (2 channel aggregate), and 2.5 ppm for 25 kHz (4 channel aggregate).

d) The frequency stability of base transmitters operating in the wideband segment must be 1 part per million or better.

e) The frequency stability of mobile, portable, and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

10.1 Test Procedure

ANSI/TIA-603-B-2002, section 2.2.2

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +60°C.

The temperature was initially set to -30°C and a 2-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10°C through the range. A ½ hour period was observed to stabilize the EUT at each measurement step, and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied +/-15% nominal input voltage.

The worst-case test data are shown below in Table 10-1 and Table 10-3.

10.2 Test Data

10.2.1 Frequency Stability/Temperature Variation

Plot 10-1: Temperature Frequency Stability

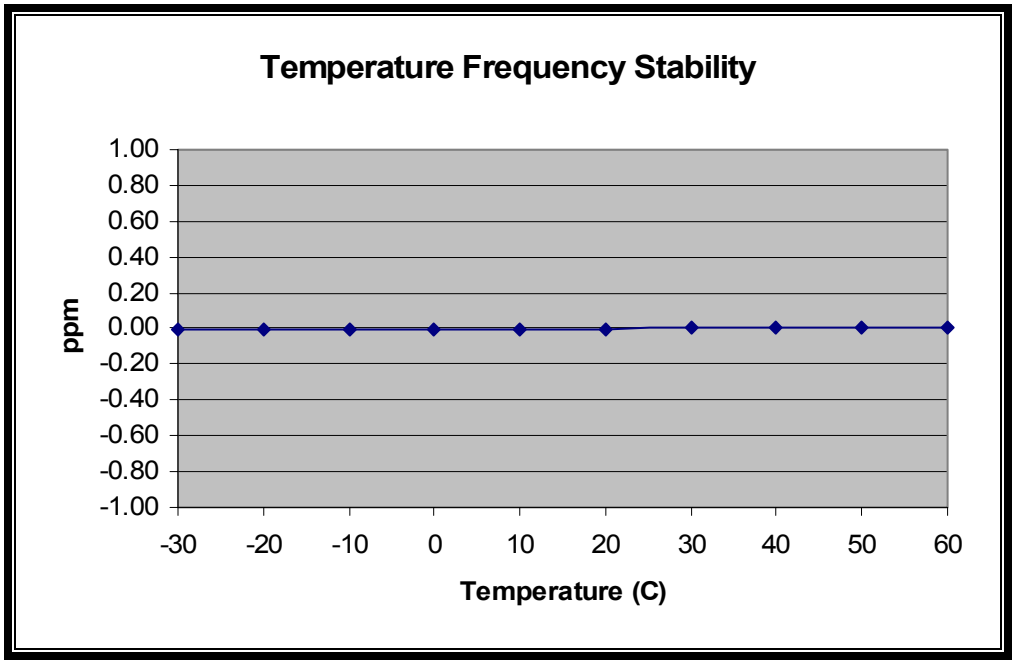


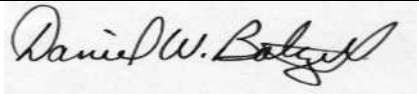
Table 10-1: Frequency Stability/Temperature Variation - 766.9875 MHz

Temperature °C	Measured Frequency (MHz)	ppm
-30	766.987496	-0.01
-20	766.987494	-0.01
-10	766.987494	-0.01
0	766.987496	-0.01
10	766.987497	0.00
20	766.987500	0.00
30	766.987502	0.00
40	766.987504	0.01
50	766.987506	0.01
60	766.987507	0.01

Table 10-2: Test Equipment for Testing Frequency Stability/Temperature

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	02/04/06
901413	Agilent	E4448A	Spectrum Analyzer	US44020346	11/2/06
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/2/08
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/12/06

Test Personnel:

Dan Baltzell		December 19, 2005
Test Engineer	Signature	Date Of Test

10.2.2 Frequency Stability/Voltage Variation

Plot 10-2: Voltage Frequency Stability

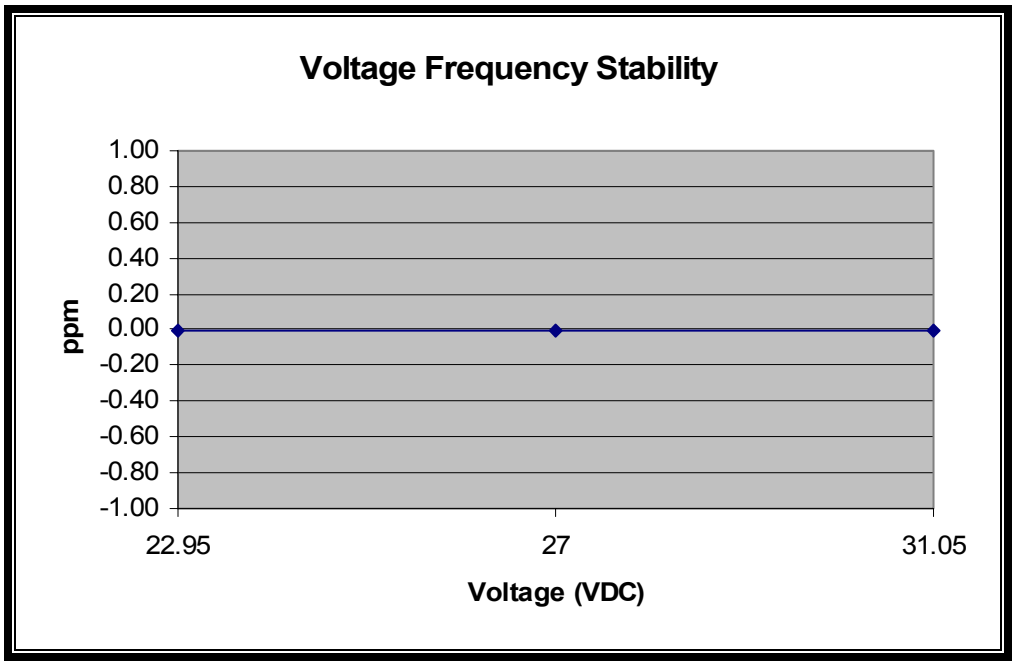


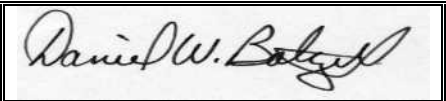
Table 10-3: Frequency Stability/Voltage Variation - 766.9875 MHz

Voltage (VDC)	Measured Frequency (MHz)	ppm
22.95	766.987499	0.0
27.00	766.987500	0.0
31.05	766.987499	0.0

Table 10-4: Test Equipment for Testing Frequency Stability/Voltage

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901413	Agilent	E4448A	Spectrum Analyzer	US44020346	11/2/06
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/2/08
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	N/A	12/12/06
901354	Meterman	37XR	Digital Multimeter	N/A	8/31/06

Test Personnel:

Dan Baltzell		December 19, 2005
Test Engineer	Signature	Date Of Test

11 FCC Rules and Regulations Part 90 §90.543(e): Protection of 1559-1610 MHz Band

For operations in the 764 to 776 MHz and 794 to 806 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to –70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and –80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

11.1 Test Procedure

Substitution Method:

The EUT was set up at an antenna-to-EUT distance of 3 meters on an open area test site. The EUT was placed on a nonconductive turntable 1.0 meter above the ground plane. The physical arrangement of the EUT was varied through three orthogonal planes in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The worst-case, maximum radiated emission was recorded and used as reference for the measurement. The EUT was then replaced by a ½ wave dipole antenna and polarized in accordance with the EUT's antenna polarization. The ½ wave dipole antenna was connected to a RF signal generator with a coaxial cable. The search antenna height and search antenna polarity were set to levels that produced the maximum reading obtained. The signal generator was adjusted to a level that produced that maximum radiated emission level. The signal generator level was recorded and corrected by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal ½ wave dipole antenna. The signal generator corrected level is the ERP level.

11.2 Test Data

Frequencies tested: 1559-1610 MHz
Carrier Frequencies: 764.0125 and 775.9875 MHz

The worst-case Output Power (highest) levels are shown. No discrete or wideband signals were found in the GNSS band.

Table 11-1: Test Results - EIRP in GNSS Band; Full Duplex Mode

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)*	Antenna Factor (dBd)	EIRP (dBm)	EIRP (dBW)
1590 (764.0125)	34.5	-55.2	4.4	4.9	-54.7	-84.7
1590 (775.9875)	34.5	-55.2	4.4	4.9	-54.7	-84.7

*Cable loss from transmitting antenna to signal generator
*Measurement accuracy is +/-.5 dB

Table 11-2: Test Results - EIRP in GNSS Band; External Duplex Mode

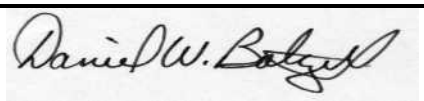
Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)*	Antenna Factor (dBd)	EIRP (dBm)	EIRP (dBW)
1590 (764.0125)	57.3	-55.7	4.4	4.9	-55.2	-85.2
1590 (775.9875)	48.5	-64.5	4.4	4.9	-64.0	-94.0

*Cable loss from transmitting antenna to signal generator
*Measurement accuracy is +/-.5 dB

Table 11-3: Test Equipment for Testing EIRP in GNSS Band

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	11/1/06
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	8/3/06
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 – 20 GHz)	3610A00866	11/10/06
901426	Insulated Wire Inc.	KPS-1503-3600-KPS	RF cable, 30'	NA	12/12/06
901425	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	12/12/06
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/12/06
901128	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	5/13/06

Test Personnel:

Dan Baltzell		December 22 and 28, 2005
Test Engineer	Signature	Dates Of Tests

12 FCC Rules and Regulations Part 2 §2.202: Necessary Bandwidth and Emission Bandwidth

Type of Emission: F9W

Necessary Bandwidth and Emission Bandwidth:

Digital voice and data – 25 kHz separation
19,200 BPS

Calculation:
B(n) = (R/Log{2}S) + 2DK (Log{2} is Log base 2)

where,
R = 19.2 kilobits per second (raw data rate)
S = 4 (4 level FSK)
D = 3.75 kHz (FM deviation)
K = .334 (K is calculated as a best fit quadratic to occupied BW measurements; where K = -0.256*d*d + 1.066*d - 0.576, and where d = normalized deviation of factor of 1.2)

Therefore,
B(n) = 12.1 or 12K1
FCC emission designator: 12K1F9W

13 Conclusion

The data in this measurement report shows that the **M/A-COM, Inc**. Model **OpenSky 700 MHz Cell Site, FCC ID: BV8CS700, IC: 3670A-CS700,** complies with all the applicable requirements of Parts 90, 15 and 2 of the FCC Rules, and Industry Canada RSS-119.