Engineering and Testing for EMC and Safety Compliance

Certification Report

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Model: OpenSky 900 MHz Cell Site

FCC ID: BV8CS900
IC: 3670A-CS900

March 13, 2007

Standards Referenced for this Report	
Part 2: 2006	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 90: 2006	Private Land Mobile Radio Services
ANSI/TIA-603-C-2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA/EIA – 102.CAAA; 2002	Digital C4FM/CQPSK Transceiver Measurement Methods
Industry Canada RS-119 Issue 7 April 2006	Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41- 960 MHz

Frequency Range (MHz)	Rated Transmit Power (W) Conducted	Frequency Tolerance (ppm)	Emission Designator
935-940	31.5 (non-duplex mode)	0.09	8K5F9W
935-940	25.0 (duplex mode)	0.09	8K5F9W

Report Prepared by Test Engineer: Daniel Biggs

Document Number: 2007126

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1 General Information

The following Certification Report is prepared on behalf of **M/A-COM, Inc**. in accordance with the Federal Communications Commission and Industry Canada. The Equipment Under Test (EUT) was the **OpenSky 900 MHz Cell Site, FCC ID: BV8CS900**, **IC: 3670A-CS900**. 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 the applicable FCC Rules and Regulations in CFR 47. 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 submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

1.2 Related Submittal(s)/Grant(s)

This is an original application report.

2 Tested System Details

The test sample was received on February 27, 2007. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable. The cell site station is offered in duplex and non-duplex versions, allowing one or two antennas to be used. The duplex version has conducted power of 5 to 25 W. The non-duplex version has conducted power of 5 to 31.5 W.

Table 2-1: Test System Details

Model Name/# Tested	OpenSky 900 MHz Cell Site/MACS-MC900
Frequency Band	935-940 MHz
Modulation Type	4-level FM
Channel Step Size	12.5 KHz
Channel Bandwidth	13.6 KHz
Primary Power	27 VDC
Rated Transmitter Output Power	Continually variable 5-25 W in duplex configuration, 5-31.5W non-duplex configuration
Duty Cycle	100% maximum

Table 2-2: Equipment Under Test (EUT)

Part	Manufacturer	Model #	PN/SN	FCC ID	RTL Bar Code
900 MHz Cell Site	M/A-Com, Inc.	MACS-MC900	AD-010931	BV8CS900	17806

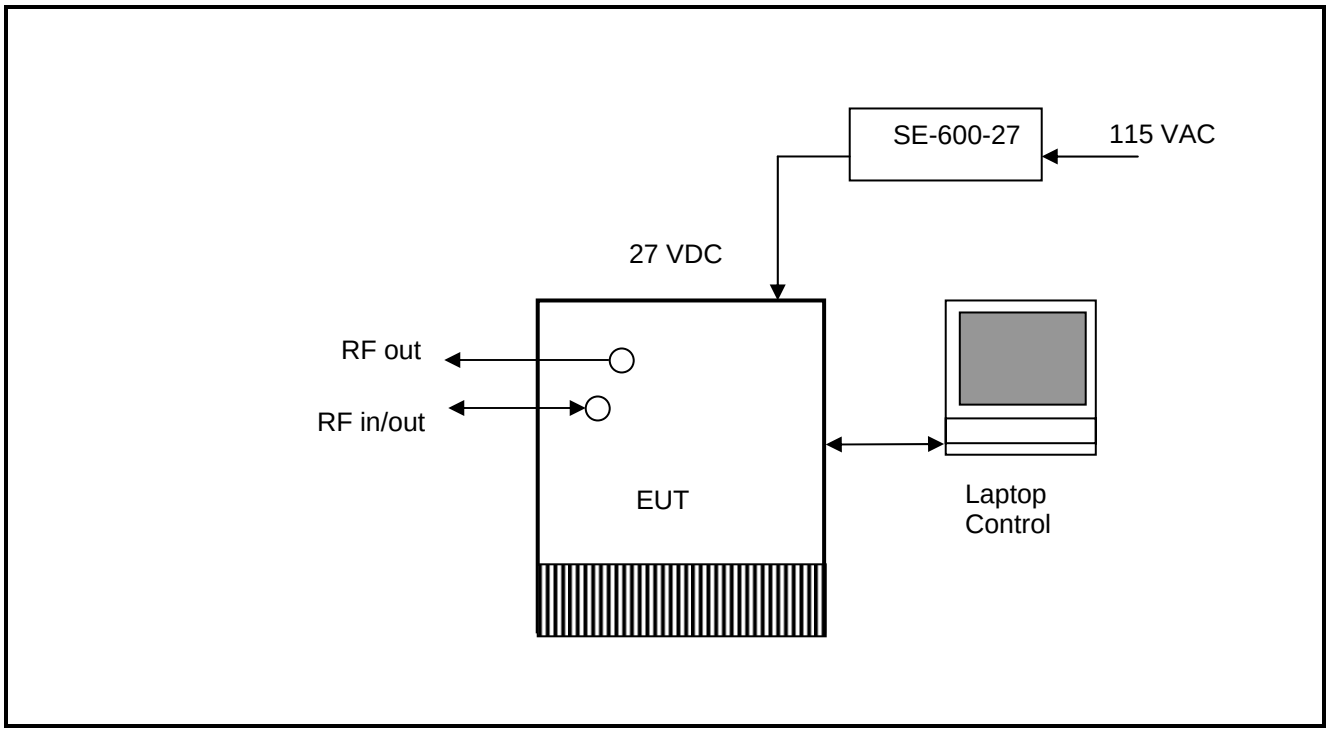
Table 2-3: Ports and Cabling (EUT)

Port	Cable Type	Quantity	Length (feet)	Shield
RF In/Out	N type	1	N/A	Yes
RF Out	N type	1	N/A	Yes
Terminal	DB-9	1	N/A	No

Table 2-4: Support Equipment

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Notebook Computer	Compaq	Armada M700	N/A	N/A	17807
Serial Interface Cable	N/A	DB-9	N/A	N/A	N/A
Power Supply	Mean Well	SE-600-27	N/A	N/A	N/A

Figure 2-1: Configuration of Tested System



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

Nominal DC Voltage: 27 VDC
Current: 5 AMPS

4 FCC Rules and Regulations Part 90 §90.1215(a) and Part 2 §2.1046(a): Peak Output Power

4.1 Test Procedure

ANSI TIA-603-2004, section 2.2.1.

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

4.2 Test Data

Table 4-1: RF Power Output: Carrier Output Power – Duplex Mode

Frequency	Mode	High Power RF Power Measured (Watt)*
935.0125	NB OTP	25.1
937.5000	NB OTP	25.4
939.9875	NB OTP	25.3

*Measurement accuracy: +/-.3 dB

Table 4-2: RF Power Output: Carrier Output Power – Non-Duplex Mode

Frequency	Mode	High Power RF Power Measured (Watt)*
935.0125	NB OTP	31.7
937.5000	NB OTP	31.4
939.9875	NB OTP	31.4

*Measurement accuracy: +/-.3 dB

Table 4-3: RF Power Output (Rated Power)

Rated Power - Duplex Mode
25.0 W

Rated Power - Non-Duplex Mode
31.5 W

Table 4-4: Test Equipment for Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901184	Agilent Technologies	E4416A	Power Meter	GB41050573	10/3/07
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	10/3/07
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/02/08

Test Personnel:

Daniel Biggs		March 5, 2007
Test Engineer	Signature	Date Of Tests

5 FCC Rules and Regulations Part 2 §2.1051: Spurious Emissions at Antenna Terminals; Part 90 §90.210: Emissions Masks; RSS-119 §5.8: Transmitter Unwanted Emissions

5.1 Test Procedure

ANSI TIA-603-C-2004, Section 2.2.13.

The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer. The EUT was tested in non-duplex configuration with a conducted power rating of 31.5 W. The device uses digital modulation modulated to its maximum extent using a pseudo random data sequence of 9600 bps for NB OTP (Narrow Band OpenSky Trunking Protocol) mode.

5.2 Test Data

Frequency range of measurement per Part 2.1057: 9 kHz to 10xFc.

Limit: P(dBm) – (50 + 10xLOG P(W)). 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.

5.2.1 Duplex Mode

Table 5-1: Conducted Spurious Emissions – 935.0125 MHz; Duplex Mode; Wide Band; NB OTP

Limit = 50 + 10 log (25.1) = 64 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1870.025	107.2	64.0	-43.2
2805.038	102.2	64.0	-38.2
3740.05	111.4	64.0	-47.4
4675.063	108.2	64.0	-44.2
5610.075	111.9	64.0	-47.9
6545.088	100.7	64.0	-36.7
7480.1	96.2	64.0	-32.2
8415.113	101.9	64.0	-37.9
9350.125	101.1	64.0	-37.1

Table 5-2: Conducted Spurious Emissions – 937.5000 MHz; Duplex Mode; Wide Band; NB OTP

Limit = 50 + 10 log (25.4) = 64 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1875	103.1	64.0	-39.1
2812.5	101.8	64.0	-37.8
3750	103.8	64.0	-39.8
4687.5	102.7	64.0	-38.7
5625	104.0	64.0	-40.0
6562.5	96.7	64.0	-32.7
7500	92.8	64.0	-28.8
8437.5	96.5	64.0	-32.5
9375	91.6	64.0	-27.6

Table 5-3: Conducted Spurious Emissions – 939.9875 MHz; Duplex Mode; Wide Band; NB OTP

Limit = 50 + 10 log (31.4) = 65 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1879.975	104.4	65.0	-39.4
2819.963	102.3	65.0	-37.3
3759.95	105.5	65.0	-40.5
4699.938	104.5	65.0	-39.5
5639.925	105.6	65.0	-40.6
6579.913	97.2	65.0	-32.2
7519.9	97.0	65.0	-32.0
8459.888	98.5	65.0	-33.5
9399.875	88.3	65.0	-23.3

5.2.2 Non-Duplex Mode

Table 5-4: Conducted Spurious Emissions – 935.0125 MHz; Non-Duplex Mode; Wide Band; NB OTP

Limit = 50 + 10 log (31.7) = 65 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1870.025	101.6	65.0	-36.6
2805.038	98.5	65.0	-33.5
3740.050	105.2	65.0	-40.2
4675.063	102.7	65.0	-37.7
5610.075	105.9	65.0	-40.9
6545.088	97.1	65.0	-32.1
7480.100	92.0	65.0	-27.0
8415.113	97.5	65.0	-32.5
9350.125	95.1	65.0	-30.1

Table 5-5: Conducted Spurious Emissions – 937.5000 MHz; Non-Duplex Mode; Wide Band; NB OTP

Limit = 50 + 10 log (31.4) = 65 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1875.000	105.1	65.0	-40.1
2812.500	100.4	65.0	-35.4
3750.000	105.8	65.0	-40.8
4687.500	104.0	65.0	-39.0
5625.000	105.0	65.0	-40.0
6562.500	98.2	65.0	-33.2
7500.000	93.2	65.0	-28.2
8437.500	96.6	65.0	-31.6
9375.000	93.2	65.0	-28.2

Table 5-6: Conducted Spurious Emissions – 939.9875 MHz; Non-Duplex Mode; Wide Band; NB OTP

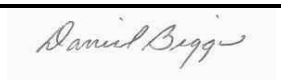
Limit = 50 + 10 log (25.3) = 64 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1879.975	105.2	64.0	-41.2
2819.963	104.5	64.0	-40.5
3759.950	104.6	64.0	-40.6
4699.938	103.3	64.0	-39.3
5639.925	105.2	64.0	-41.2
6579.913	96.1	64.0	-32.1
7519.900	94.6	64.0	-30.6
8459.888	98.5	64.0	-34.5
9399.875	87.3	64.0	-23.3

Table 5-7: Test Equipment for Testing Conducted Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz – 12.8 GHz)	3826A00144	10/16/07
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/02/08
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/12/07

Test Personnel:

Daniel Biggs		March 5, 2007
Test Engineer	Signature	Date Of Tests

6 FCC Rules and Regulations Part 90 §90.210(j) and Part 2 §2.1049(c): Occupied Bandwidth (Emissions Masks); RSS-119 §5.8.8: Emissions Masks

6.1 Test Procedure

ANSI TIA-603-C-2004, Section 2.2.11.

The EUT was tested in non-duplex configuration with a conducted power rating of 31.5 W.

The device uses digital modulation modulated to its maximum extent using a pseudo-random data sequence of 9600 bps for NB OTP (Narrow Band OpenSky Trunking Protocol) mode.

Limit Mask J:

Emission Mask J for transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) as follows:

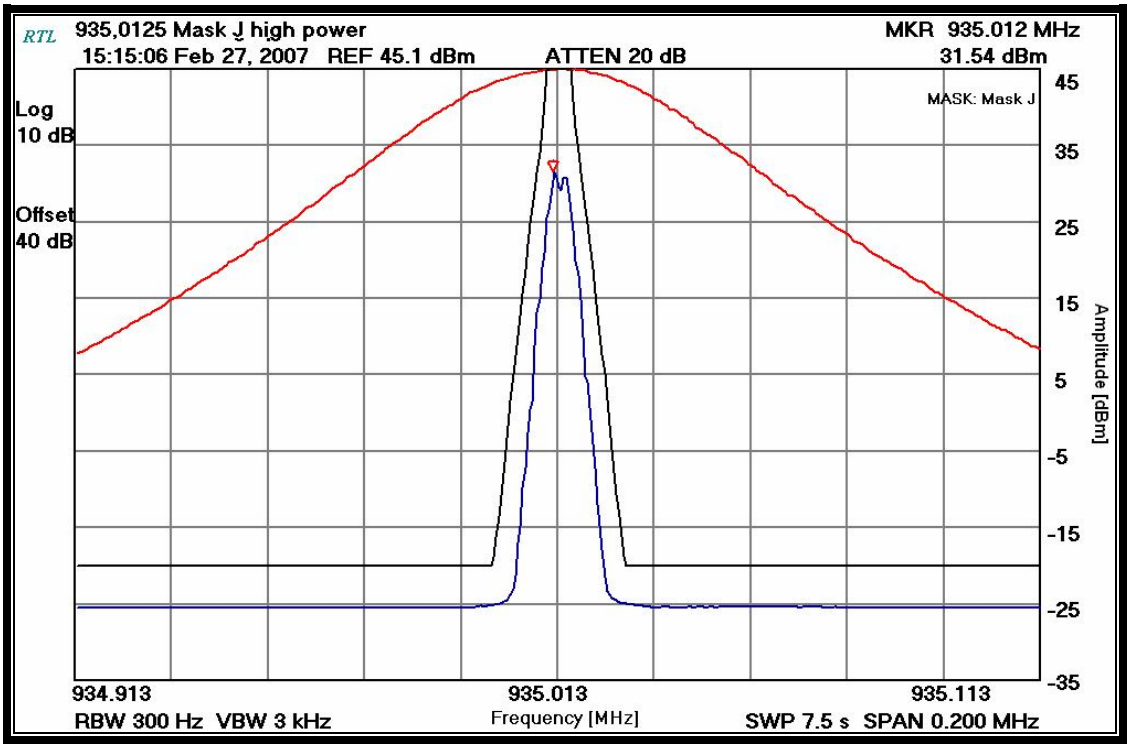
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 2.5 kHz, but not more than 6.25 kHz: at least 53 log (fd/2.5) dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 6.25 kHz, but not more than 9.5 kHz: at least 103 log (fd/3.9) dB;

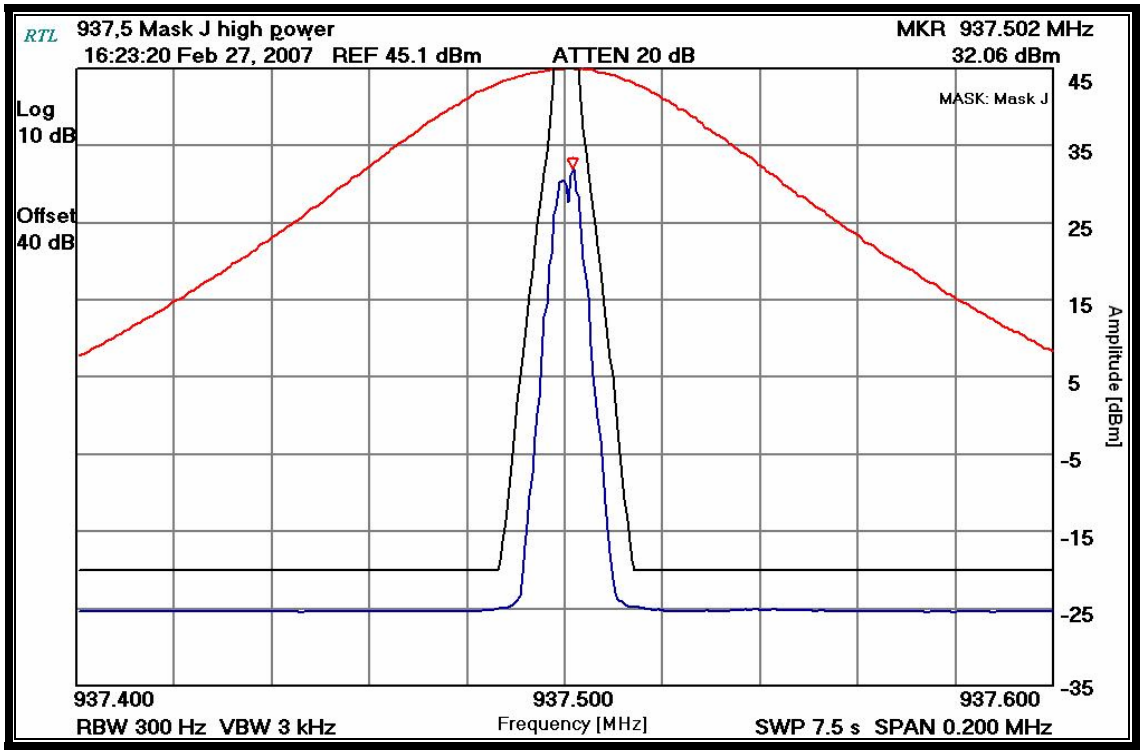
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 9.5 kHz: at least 157 log (fd/5.3) dB, or 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

6.2 Test Data

Plot 6-1: Occupied Bandwidth/Emissions Masks; Non-Duplex; 935.0125 MHz; NB OTP



Plot 6-2: Occupied Bandwidth/Emissions Masks; Non-Duplex; 937.5000 MHz; NB OTP



Plot 6-3: Occupied Bandwidth/Emissions Masks; Non-Duplex; 939.9875 MHz; NB OTP

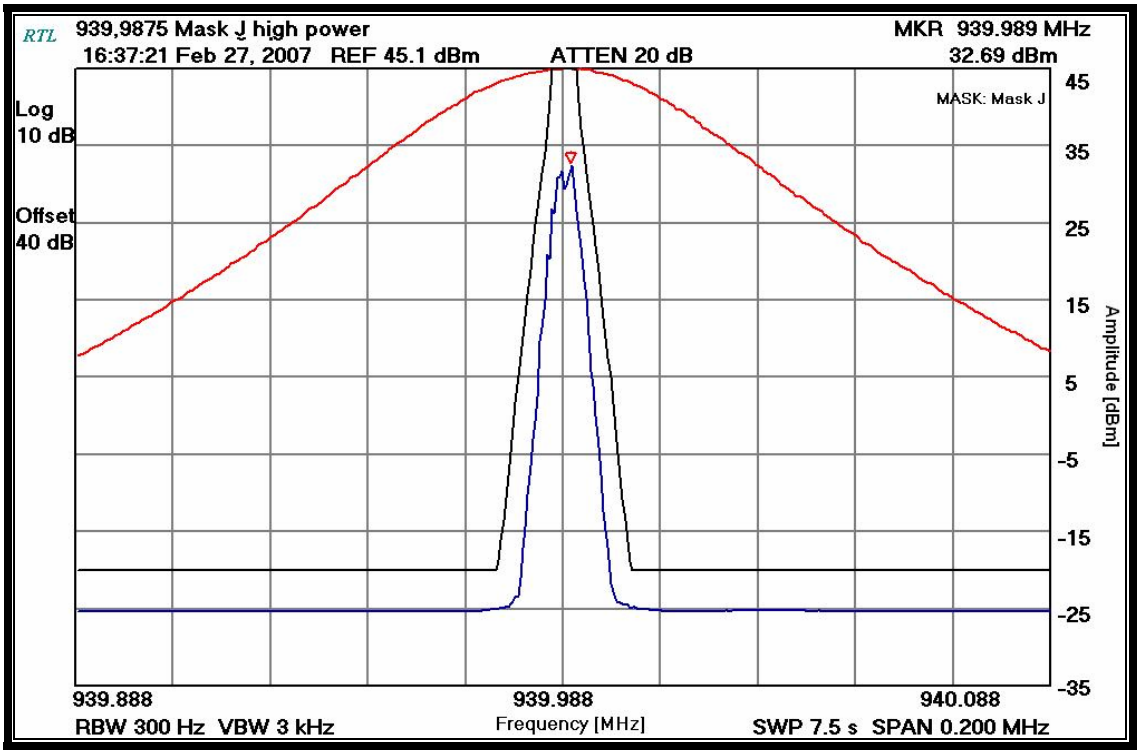


Table 6-1: Test Equipment for Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz – 12.8 GHz)	3826A00144	10/16/07
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/02/08

Test Personnel:

Daniel Biggs		February 27, 2007
Test Technician/Engineer	Signature	Date of Tests

7 FCC Rules and Regulations Part 90 §90.210(j) and Part 2 §2.1053(a): Field Strength of Spurious Radiation; RSS-119 §5.8: Unwanted Emissions

7.1 Test Procedure

ANSI TIA-603-C-2004, section 2.2.12.

The EUT was tested in non-duplex configuration with a conducted power rating of 31.4 W. This was the worst case mode.

The device uses digital modulation modulated to its maximum extent using a pseudo-random data sequence of 9600 bps for NB OTP (Narrow Band OpenSky Trunking Protocol) mode.

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 – non-duplex configuration at 31.5W.

The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

Limit: P(dBm) – (50 + 10xLOG P(W))

Table 7-1: Field Strength of Spurious Radiation: Non-Duplex; 937.5000 MHz (High Power)

Freq = 937.5 MHz
Limit = 50 + 10 Log P = 64.97 dBc
Conducted Power = 44.97 dBm = 31.4 W

Frequency (MHz)	Measured Level (dBuv)		Signal Gen. Level (db)		Cable Loss (dB)	Antenna Gain (dBd)		Corrected Level (dBc)		Limit (dBc)	Margin (dB)	
	H	V	H	V		H	V	H	V		H	V
1875.00	43.0	45.0	-25.3	-22.6	5.0	4.8	5.0	70.5	67.6	65	-5.5	-2.6
2812.50	75.3	78.6	-24.6	-23.7	6.5	6.9	7.1	69.2	68.1	65	-4.2	-3.1
3750.00	67.6	70.3	-29.0	-28.4	5.9	7.2	7.3	72.7	72.0	65	-7.7	-7.0
4687.50	37.5	37.6	-56.4	-55.8	5.8	7.8	7.8	99.4	98.8	65	-34.4	-33.8
5625.00	33.2	34.8	-58.8	-56.9	7.8	8.2	8.2	103.4	101.5	65	-38.4	-36.5
6562.50	36.6	36.2	-54.6	-55.7	8.3	8.6	8.8	99.3	100.2	65	-34.3	-35.2
7500.00	36.2	36.0	-51.7	-53.5	8.9	8.7	8.9	96.9	98.5	65	-31.9	-33.5
8437.50	36.4	36.2	-48.4	-49.4	9.4	8.0	8.3	94.8	95.5	65	-29.8	-30.5
9375.00	37.1	36.8	-44.1	-45.5	9.7	8.6	8.8	90.2	91.4	65	-25.2	-26.4

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

Table 7-2: 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	11/1/07
901364	MITEQ	JS4-01002600-36-5P	Preamplifier (1 - 26.5 GHz)	849863	N/A
901215	Hewlett Packard	8596EM	Portable Spectrum Analyzer (9 kHz – 12.8 GHz)	3826A00144	10/16/07
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 – 20 GHz)	3610A00866	11/30/07
900772	EMCO	3161-02	Horn Antennas (2 – 4 GHz)	9504-1044	5/20/07
900321	EMCO	3161-03	Horn Antennas (4 – 8 GHz)	9508-1020	5/20/07
900323	EMCO	3160-07	Horn Antennas (8.2 – 12 GHz)	9605-1054	7/31/09
900814	Electrometrics	RGA-60	Double ridge horn (1 – 18 GHz)	2310	3/30/09
901423	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	12/12/07
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/12/07

Test Personnel:

Daniel Biggs		March 7, 2007
Test Engineer	Signature	Date Of Tests

8 FCC Rules and Regulations Part 90 §90.213 and Part 2 §2.1055: Frequency Stability

8.1 Test Procedure

ANSI/TIA-603-C-2004, 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 EUT was then operated in standby mode for 15 minutes before proceeding. 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.

Limit for frequency block 935–940 MHz for Base Station: 0.1 ppm

The worst case test data are shown below in Table 8-1 and Table 8-3.

8.2 Test Data

8.2.1 Frequency Stability/Temperature Variation

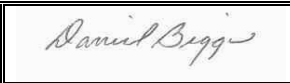
Table 8-1: Frequency Stability/Temperature Variation – 937.5000 MHz

Temperature °C	Channel Frequency	Measured Frequency (MHz)	ppm
-30	937.5	937.500085	0.09
-20	937.5	937.500071	0.08
-10	937.5	937.500034	0.04
0	937.5	937.500089	0.09
10	937.5	937.500063	0.07
20	937.5	937.500079	0.08
30	937.5	937.500088	0.09
40	937.5	937.500078	0.08
50	937.5	937.500015	0.02
60	937.5	937.500029	0.03

Table 8-2: 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	01/20/08
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	12/12/07

Test Personnel:

Daniel Biggs		March 6, 2007
Test Engineer	Signature	Date Of Test

8.2.2 Frequency Stability/Voltage Variation

Table 8-3: Frequency Stability/Voltage Variation – 937.5000 MHz

Voltage (VDC)	Channel Frequency	Measured Frequency (MHz)	ppm
22.95	937.5	937.500035	0.04
27.0	937.5	937.500034	0.04
31.05	937.5	937.500038	0.04

Table 8-4: Test Equipment for Testing Frequency Stability/Voltage

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
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	12/12/07
901247	Wavetek	DM25XT	Digital Multimeter	40804098	12/7/07

Test Personnel:

Daniel Biggs		March 6, 2007
Test Engineer	Signature	Date Of Test

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

FCC Mask 90.210(j):

Type of Emission: F9W
Digital Voice and Data: 9600 BPS

Calculation:

B(n) = (R/Log{2}S + 2KD), where Log{2} is Log base 2

where:

R = 9.6 kilobits per second [raw data rate]
S = 4 [4-level FSK]
D = 3 kHz [Peak FM Deviation]
K = 0.617
d = normalized deviation factor of 1.2

B(n) = 8.502 or 8K5

FCC Emission Designator: 8K5F9W

10 Conclusion

The data in this measurement report shows that the **M/A-COM, Inc**. Model **OpenSky 900 MHz Cell Site, FCC ID: BV8CS900, IC: 3670A-CS900,** complies with all the applicable requirements of FCC Parts 90, 15 and 2 and Industry Canada RSS-119.