



Engineering and Testing for EMC and Safety Compliance



Accredited under NVLAP Lab Code 200061-0

## Class II Permissive Change Report

M/A-Com, Inc.  
221 Jefferson Ridge Parkway  
Lynchburg, VA 24501  
Daryl Popowitch  
Phone: (434) 455-9527  
E-Mail: popowitda@tycoelectronics.com

**Model: OpenSky® 800 MHz Cell Site**

FCC ID: BV8CS800

IC: 3670A-CS800

May 25, 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 9 June 2007	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
851-869	31.5 (non-duplex mode)	0.06	11K3F1D (OTP)
851-869	31.5 (non-duplex mode)	0.06	11K3F9W (OTP)
851-869	31.5 (non-duplex mode)	0.06	12K1F9W (OTP)
851-869	31.5 (non-duplex mode)	0.06	13K1F9W (OTP)
851-869	31.5 (non-duplex mode)	0.06	8K40F9W (NBOTP)
851-869	25.0 (duplex mode)	0.06	11K3F1D (OTP)
851-869	25.0 (duplex mode)	0.06	11K3F9W (OTP)
851-869	25.0 (duplex mode)	0.06	12K1F9W (OTP)
851-869	25.0 (duplex mode)	0.06	13K1F9W (OTP)
851-869	25.0 (duplex mode)	0.06	8K40F9W (NBOTP)

Report Prepared by Test Engineer: Daniel W. Baltzell

Document Number: 2007171

*This report may not be reproduced, except in full, without the written approval of Rhein Tech Laboratories, Inc.  
Test results relate only to the product tested.*

360 Herndon Parkway  
Suite 1400  
Herndon, VA 20170  
Ph: 703-689-0368 Fax: 703-689-2056

## Table of Contents

1	General Information.....	4
1.1	Test Facility.....	4
1.2	Related Submittal(s)/Grant(s).....	4
2	Tested System Details .....	5
3	FCC Rules and Regulations Part 2 §2.1033(c)(8) Voltages and Currents Through The Final Amplifying Stage.....	6
4	FCC Rules and Regulations Part 90 §90.1215(a) and Part 2 §2.1046(a): Peak Output Power.....	7
4.1	Test Procedure .....	7
4.2	Test Data .....	7
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 .....	9
5.1	Test Procedure .....	9
5.2	Test Data .....	9
6	FCC Rules and Regulations Part 2 §2.1049: Occupied Bandwidth; Part 90 §90.210(g): Emissions Masks; RSS-119 §5.8: Transmitter Unwanted Emissions .....	11
6.1	Test Procedure .....	11
6.2	Test Data .....	12
7	FCC Rules and Regulations Part 90 §90.210(g) and Part 2 §2.1053(a): Field Strength of Spurious Radiation; RSS-119 §5.8: Transmitter Unwanted Emissions .....	14
7.1	Test Procedure .....	14
7.2	Test Data .....	14
7.2.1	CFR 47 Part 90.210 Requirements .....	14
8	FCC Rules and Regulations Part 2 §2.202: Necessary Bandwidth and Emission Bandwidth .....	16
9	Conclusion.....	16

## Table of Tables

Table 2-1: Test System Details .....	5
Table 2-2: Equipment Under Test (EUT) .....	5
Table 2-3: Ports and Cabling (EUT).....	5
Table 2-4: Support Equipment .....	5
Table 4-1: RF Power Output: Carrier Output Power – Duplex Mode .....	7
Table 4-2: RF Power Output: Carrier Output Power – Non-Duplex Mode.....	7
Table 4-3: RF Power Output (Rated Power).....	7
Table 4-4: Test Equipment for Testing RF Power Output - Conducted.....	8
Table 5-1: Conducted Spurious Emissions – 861.5000 MHz; Duplex Mode.....	9
Table 5-2: Conducted Spurious Emissions – 861.5000 MHz; Non-Duplex Mode .....	10
Table 5-3: Test Equipment for Testing Conducted Spurious Emissions .....	10
Table 6-1: Test Equipment for Testing Occupied Bandwidth .....	13
Table 7-1: Field Strength of Spurious Radiation: 861.5000 MHz – Non-Duplex Mode .....	14
Table 7-2: Test Equipment for Testing Field Strength of Spurious Radiation .....	15

## Table of Plots

Plot 6-1: Occupied Bandwidth – 851.0125 MHz; Mask H; Bn – 8.4 kHz Non-Duplex .....	12
Plot 6-2: Occupied Bandwidth – 861.5000 MHz; Mask G; Bn – 8.4 kHz Non-Duplex.....	13

## Table of Figures

Figure 2-1: Configuration of Tested System .....	6
--	---

## Table of Appendixes

Appendix A: Description of Change.....	17
Appendix B: Agency Authorization Letter .....	18
Appendix C: IC Letters .....	19
Appendix D: Test Configuration Photographs.....	20

## Table of Photographs

Photograph 1: Radiated Emissions (Front View).....	20
Photograph 2: Radiated Emissions (Rear View) .....	21

## 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 Cell Site, FCC ID: BV8CS800, IC: 3670A-CS800**. 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 a Class II Permissive Change which adds an emission designator, 8K40F9W for the Narrow Band OpenSky Trunking Protocol (NBOTP). The original FCC grant and IC certificate were issued October 20, 2006.

## 2 Tested System Details

The test sample was received on May 3, 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**

<b>Model Tested</b>	OpenSky Cell Site
<b>Frequency Band</b>	851-869 MHz
<b>Modulation Type</b>	4-level Frequency Shift Keying (FSK)
<b>Channel Step Size</b>	12.5 kHz
<b>Channel Bandwidth</b>	25 kHz
<b>Primary Power</b>	27 VDC
<b>Rated Transmitter Output Power</b>	Continually variable 5-25 W in duplex configuration, 5-31.5 W non-duplex configuration
<b>Duty Cycle</b>	100% maximum

**Table 2-2: Equipment Under Test (EUT)**

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Cell Site	M/A-Com, Inc.	OpenSky	MACS-CS800	BV8CS800	17510

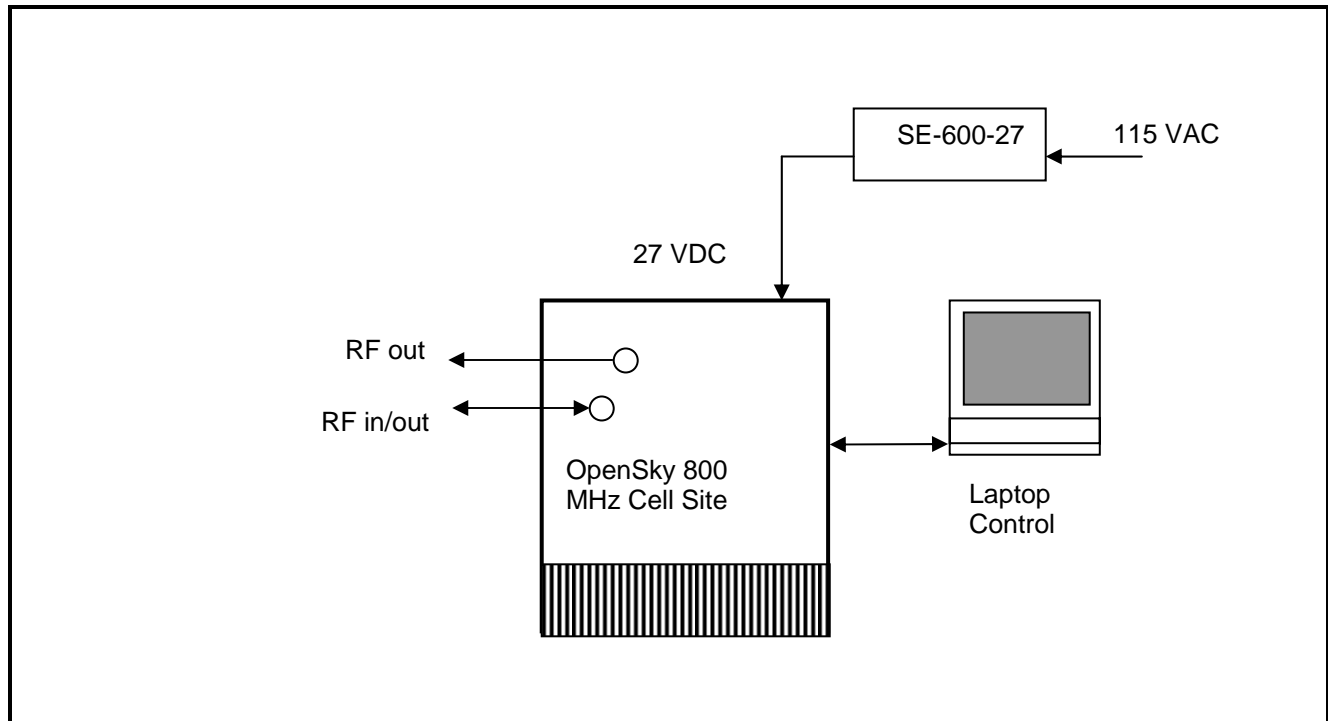
**Table 2-3: Ports and Cabling (EUT)**

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	Dell	Inspiron 6400	N/A	N/A	901465
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 A

#### 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  $\Omega$  load impedance.

##### 4.2 Test Data

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

Frequency	Mode	High Power RF Power Measured (W)*
851.0125	NBOTP	25.06
853.9875	NBOTP	24.95
854.0125	NBOTP	24.89
861.5000	NBOTP	24.83
868.9875	NBOTP	25.12

\*Measurement accuracy: +/- .3 dB

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

Frequency	Mode	High Power RF Power Measured (W)*
851.0125	NBOTP	32.14
853.9875	NBOTP	32.06
854.0125	NBOTP	32.06
861.5000	NBOTP	31.77
868.9875	NBOTP	31.77

\*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	10/03/07
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	10/03/07
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/02/08

**Test Personnel:**

Daniel W. Baltzell		May 4, 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  $\Omega$  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 NBOTP (Narrow Band OpenSky Trunking Protocol) mode.

### 5.2 Test Data

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

Limit:  $P(\text{dBm}) - (43 + 10 \times \text{LOG } P(\text{W}))$

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.

**Table 5-1: Conducted Spurious Emissions – 861.5000 MHz; Duplex Mode**

Limit =  $43 + 10 \log (24.8) = 57 \text{ dBc}$

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Insertion Losses (dB)	Level (dBc)	Limit (dBc)	Margin (dB)
1723.0000	-91.1	41.9	93.2	57.0	-36.2
2584.5000	-92.2	45.2	91.0	57.0	-34.0
3446.0000	-64.9	12.6	96.3	57.0	-39.3
4307.5000	-90.9	23.6	111.3	57.0	-54.3
5169.0000	-90.0	11.5	122.5	57.0	-65.5
6030.5000	-91.3	13.0	122.3	57.0	-65.3
6892.0000	-84.6	18.8	109.8	57.0	-52.8
7753.5000	-82.3	12.7	113.6	57.0	-56.6
8615.0000	-83.3	16.9	110.4	57.0	-53.4

**Table 5-2: Conducted Spurious Emissions – 861.5000 MHz; Non-Duplex Mode**

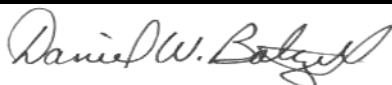
Limit =  $43 + 10 \log (31.8) = 58 \text{ dBc}$

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Insertion Losses (dB)	Level (dBc)	Limit (dBc)	Margin (dB)
1723.0000	-99.2	41.9	102.3	58.0	-44.3
2584.5000	-92.3	45.2	92.1	58.0	-34.1
3446.0000	-73.1	12.6	105.5	58.0	-47.5
4307.5000	-90.2	23.6	111.6	58.0	-53.6
5169.0000	-85.9	11.5	119.4	58.0	-61.4
6030.5000	-90.9	13.0	122.9	58.0	-64.9
6892.0000	-84.6	18.8	110.8	58.0	-52.8
7753.5000	-82.5	12.7	114.8	58.0	-56.8
8615.0000	-83.2	16.9	111.3	58.0	-53.3

**Table 5-3: 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	12/05/07
900948	Weinschel Corporation	47-10-43	Attenuator DC-18 GHz 10dB 50W	BH1487	12/05/08
901132	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	2/01/09
901138	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40dB	BK5883	1/13/09

**Test Personnel:**

Daniel W. Baltzell		May 7, 2007
Test Engineer	Signature	Date Of Tests

## **6 FCC Rules and Regulations Part 2 §2.1049: Occupied Bandwidth; Part 90 §90.210(g): Emissions Masks; RSS-119 §5.8: Transmitter Unwanted Emissions**

### **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 NBOTP (Narrow Band OpenSky Trunking Protocol) mode.

Limit Mask G:

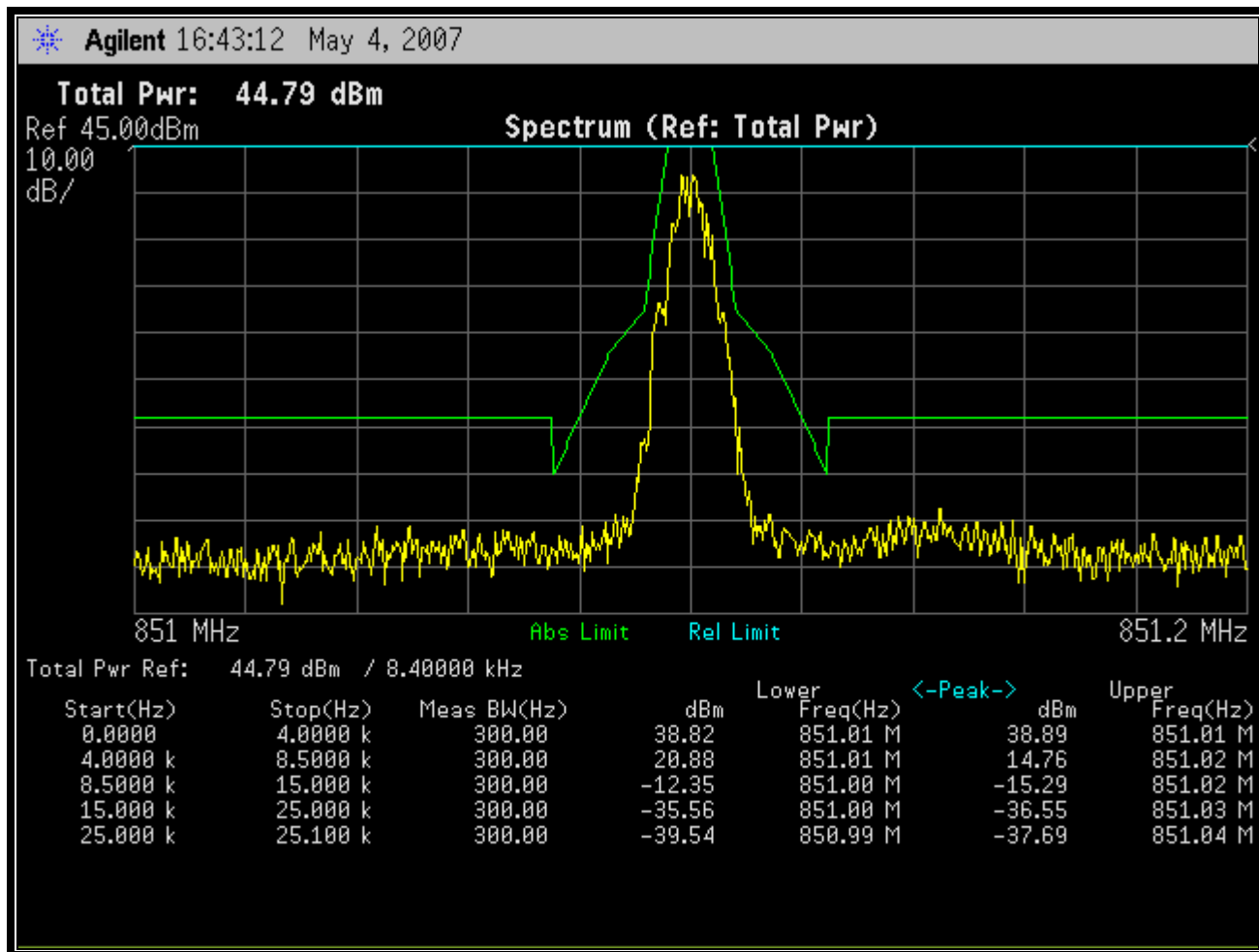
- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: at least  **$116 (f_d/6.1)$  dB**, or  **$50 + 10 \log (P)$  dB**, or **70 dB**, whichever is the lesser attenuation;
- (2) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: at least  **$43 + 10 \log (P)$  dB**.

Limit Mask H:

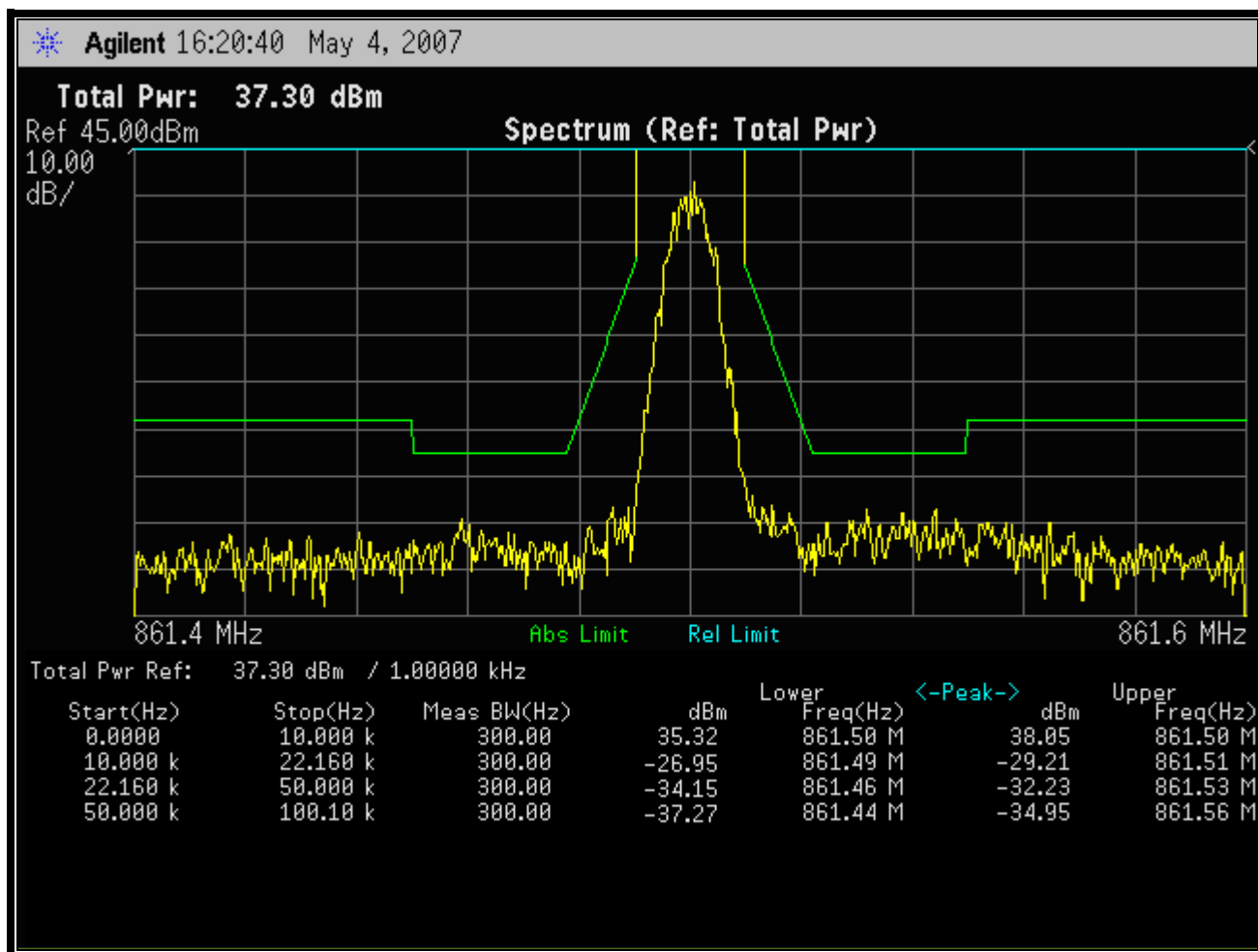
- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of 4 kHz or less: **zero dB**;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 4 kHz, but not more than 8.5 kHz: At least  **$107 \log (f_d/4)$  dB**;
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 8 kHz, but not more than 15 kHz: At least  **$40.5 \log (f_d/1.16) (P)$  dB**.
- (4) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 15 kHz, but not more than 25 kHz: At least  **$116 \log (f_d/6.1) (P)$  dB**.
- (5) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 25 kHz: at least  **$43 + \log (P)$  dB**.

## 6.2 Test Data

**Plot 6-1: Occupied Bandwidth – 851.0125 MHz; Mask H; Bn – 8.4 kHz Non-Duplex**




**Plot 6-2: Occupied Bandwidth – 861.5000 MHz; Mask G; Bn – 8.4 kHz Non-Duplex**



**Table 6-1: Test Equipment for Testing Occupied Bandwidth**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	12/14/07
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/02/08
901138	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40dB	BK5883	1/13/09

**Test Personnel:**

Daniel W. Baltzell		May 4, 2007
Test Technician/Engineer	Signature	Date of Test

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

### 7.1 Test Procedure

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

The EUT was tested in both duplex and non-duplex configurations.

The device uses digital modulation modulated to its maximum extent using a pseudo-random data sequence of 9600 bps for NBOTP (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 maximized 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.

Limit:  $P(\text{dBm}) - (43 + 10 \times \log P(\text{W}))$

**Table 7-1: Field Strength of Spurious Radiation: 861.5000 MHz – Non-Duplex Mode**

Limit =  $43 + 10 \log (31.8) = 58 \text{ dBc}$


Frequency (MHz)	Polarization (H/V)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to transmit Antenna (dB)	Antenna Gain (dBd)	EIRP (dBc)	Limit (dBc)	Margin (dB)
1723.0	V	73.6	-24.0	6.0	5.4	68.6	57.0	-11.6
2584.5	V	64.5	-30.8	7.4	7.5	74.7	57.0	-17.7
3446.0	V	59.2	-36.4	8.7	7.7	81.4	57.0	-24.4
4307.5	V	31.1	-60.2	9.6	8.0	105.8	57.0	-48.8
5169.0	V	28.2*	-64.2	10.7	8.2	110.7	57.0	-53.7
6030.5	V	28.2*	-62.8	11.4	8.9	109.3	57.0	-52.3
6892.0	V	28.3*	-62.7	12.3	9.3	109.7	57.0	-52.7
7753.5	V	27.9*	-61.4	13.0	8.9	109.5	57.0	-52.5
8615.0	V	27.1*	-56.0	13.5	9.1	104.4	57.0	-47.4

Note: \* Spectrum analyzer noise floor

**Table 7-2: Test Equipment for Testing Field Strength of Spurious Radiation**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901413	Agilent Technologies	E4448	Spectrum Analyzer	US44020346	12/14/07
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01–20 GHz)	3610A00866	11/30/07
901053	Schaffner Chase	CBL6112B	Bi-Log Antenna (20 MHz-2 GHz)	2648	11/01/07
900772	EMCO	3161-02	Horn Antenna (2-4 GHz)	9804-1044	5/20/07
900321	EMCO	3161-03	Horn Antenna (4.0-8.2 GHz)	9508-1020	5/20/07
900323	EMCO	3160-07	Horn Antenna (8.2-12.4 GHz)	9605-1054	5/20/07
901262	ETS	3160-9	Double ridged Guide Antenna (1-18 GHz)	6748	4/19/08
901426	Insulated Wire Inc.	KPS-1503-3600-KPS	RF cable, 30'	NA	12/5/07
901425	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	12/5/07
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/5/07
901364	MITEQ	JS4-00102600-41-5P	Amplifier, 0.1-26 GHz, 28 dB gain	N/A	3/12/08

**Test Personnel:**

Daniel W. Baltzell		May 7, 2007
Test Engineer	Signature	Date Of Test

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

**FCC Mask 90.210(g):**

**Type of Emission: F9W**

**Digital Voice and Data: 9600 BPS**

**Calculations:**

$$B(n) = (R/\log_2(S) + 2DK)$$

8K40F9W:

where

R = 9.6 kilobits per second [raw data rate]

S = 4 [4-level FSK]

D = 2.77 [Peak FM Deviation]

K = 0.65

B(n) = 8.4 kHz

FCC Emission Designator: 8K40F9W

## 9 Conclusion

The data in this measurement report shows that the **M/A-COM, Inc. Model Opensky Cell Site, FCC ID: BV8CS800, IC: 3670A-CS800**, complies with all the applicable requirements of FCC Parts 90, 15 and 2 and Industry Canada RSS-119.