



Engineering and Testing for EMC and Safety Compliance

## Class II Permissive Change Test 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 Cell Site Base Station  
851-869 MHz**

**FCC ID: BV8MCS800A025  
IC: 3670195674A**

**December 20, 2006**

Standards Referenced for this Report	
Part 2: 2006	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 15: 2006	§15.109: Radiated Emissions Limits
Part 90: 2006	Private Land Mobile Radio Services
ANSI C63.4-2003	Standard Format Measurement/Technical Report Personal Computer and Peripherals
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
RSS-119; Issue 8 Sept. 2006	Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41-960 MHz

Frequency Range (MHz)	Measured Output Power (W) Conducted	Frequency Tolerance (ppm)	Emission Designator
851-854	25.9	0.1	12K1F9W
854-869	25.9	0.1	12K1F9W
851-869	25.9	0.1	11K3F1D
854-869	16.2	0.1	13K1F9W

**REPORT PREPARED BY TEST ENGINEER: DANIEL BIGGS**

*Document Number: 2006190/QRTL06-438*

*No part of this report may be reproduced without the full written approval of Rhein Tech Laboratories, Inc.*

360 Herndon Parkway  
Suite 1400  
Herndon, VA 20170  
Phone: 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
1.3	Description of Change in Device .....	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 2 §2.1046(a): RF Power Output: Conducted; RSS-119 §5.4: Output Power Test .....	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; RSS-119 §5.8: Transmitter Unwanted Emissions .....	8
5.1	Test Procedure .....	8
5.2	Test Data .....	8
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 2 §2.1053(a): Field Strength of Spurious Radiation; RSS-119 §5.8: Unwanted Emissions .....	16
7.1	Test Procedure .....	16
7.2	Test Data .....	16
8	Conclusion .....	18

## Table of Tables

Table 2-1:	Equipment Under Test (EUT) .....	5
Table 2-2:	Support Equipment .....	5
Table 4-1:	RF Power Output (High Power): Carrier Output Power (Unmodulated) .....	7
Table 4-2:	RF Power Output (Rated Power) .....	7
Table 4-3:	Test Equipment Used for Testing RF Power Output - Conducted .....	7
Table 5-1:	Conducted Spurious Emissions – 851.0125 MHz – High Power .....	8
Table 5-2:	Conducted Spurious Emissions – 854.0125 MHz – High Power .....	9
Table 5-3:	Conducted Spurious Emissions – 861.5000 MHz – High Power .....	9
Table 5-4:	Conducted Spurious Emissions – 868.9875 MHz – High Power .....	9
Table 5-5:	Test Equipment Used for Testing Conducted Spurious Emissions .....	10
Table 6-1:	Test Equipment Used for Testing Occupied Bandwidth .....	15
Table 7-1:	Field Strength of Spurious Radiation – 854.0 MHz; Wide Band; High Power .....	16
Table 7-2:	Test Equipment Used for Testing Field Strength of Spurious Radiation .....	17

### Table of Plots

Plot 6-1:	Occupied Bandwidth; Wide band; 851.0125 MHz.....	12
Plot 6-2:	Occupied Bandwidth; Wide band; 854.0125 MHz.....	13
Plot 6-3:	Occupied Bandwidth; Wide band; 861.5000 MHz.....	14
Plot 6-4:	Occupied Bandwidth; Wide band; 868.9875 MHz.....	15

### Table of Figures

Figure 2-1:	Configuration of Tested System .....	5
-------------	--------------------------------------	---

### Table of Appendices

Appendix A:	Agency Authorization .....	19
Appendix B:	Confidentiality Request Letter .....	20
Appendix C:	Change Description.....	21
Appendix D:	Industry Canada Letters .....	22
Appendix E:	Parts List .....	23
Appendix F:	Schematics.....	24
Appendix G:	Block Diagram .....	25
Appendix H:	Test Configuration Photographs.....	26
Appendix I:	Internal Photographs .....	28

### Table of Photographs

Photograph 1:	Radiated Emissions (Front View) .....	26
Photograph 2:	Radiated Emissions (Rear View) .....	27
Photograph 3:	800 MHz Cell Site Interior with Passive Duplexer.....	28
Photograph 4:	BSX Configured for Passive Duplexer.....	29
Photograph 5:	BSX PCB Top View .....	30
Photograph 6:	BSX PCB Bottom View.....	31

## 1 General Information

The following Class II Permissive Change 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 **Model MCS-0001, OpenSky Cell Site Base Station; FCC ID: BV8MCS800A025, IC: 3670195674A**. 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 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 a Class II permissive change report for FCC ID: BV8MCS800A025, originally certified by the FCC on April 28, 2000, and by Industry Canada on May 23, 2000. Class II permissive changes were approved on May 26, 2006 and August 1, 2006.

### 1.3 Description of Change in Device

Duplexer changed from a low noise amplifier type to a passive type. Low noise amplifier moved to the BCX board.

## 2 Tested System Details

The test sample was received 12/5/2006. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

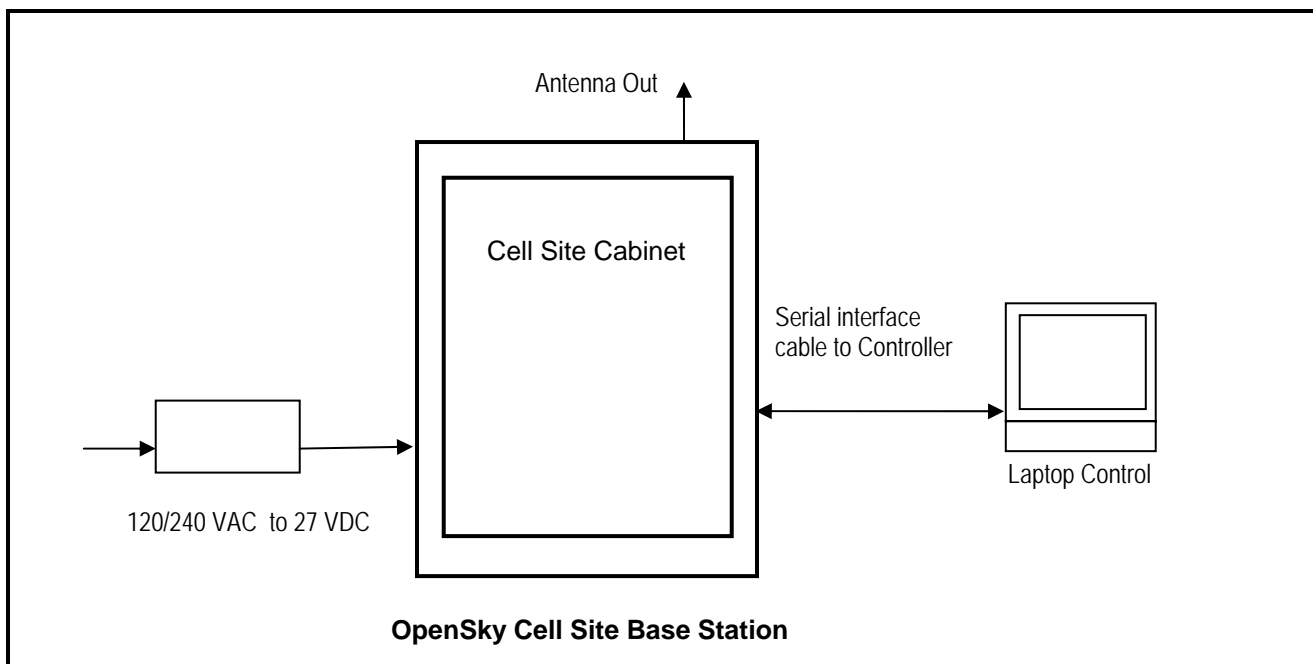
**Table 2-1: Equipment Under Test (EUT)**

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
OpenSky Cell Site Base Station	M/A-Com, Inc.	MCS-0001	1000019821-0001	BV8MCS800A025	17699
Power Supply	MW	SE-600-27	N/A	N/A	N/A

**Table 2-2: Support Equipment**

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Notebook Computer	Panasonic	Toughbook	N/A	N/A	N/A
Serial Interface Cable		DB-9	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:** 27.0 VDC

**Current:** 4.0 AMPS

#### 4 FCC Rules and Regulations Part 2 §2.1046(a): RF Power Output: Conducted; RSS-119 §5.4: Output Power Test

##### 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

The following channels (in MHz) were tested: 851.0125, 854.0125, 861.5000 and 868.9875.

**Table 4-1: RF Power Output (High Power): Carrier Output Power (Unmodulated)**

Channel	Frequency (MHz)	RF Power Measured (Watt)*
1	851.0125	25.7
2	854.0125	25.9
3	861.5000	25.5
4	868.9875	24.8

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

**Table 4-2: RF Power Output (Rated Power)**

Rated Power (W)
25

**Table 4-3: Test Equipment Used for Testing RF Power Output - Conducted**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901184	Agilent Technologies	E4416A	EPM-P Power Meter, Single Channel	GB41050573	10/3/07
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	10/3/07
901138	Weinschel Corp.	48-40-34	Attenuator, 100 W 40 dB, DC-18 GHz	BK5883	1/13/09

#### TEST PERSONNEL:

Daniel Biggs		December 11, 2006
Test Technician/Engineer	Signature	Date Of Test

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

### 5.1 Test Procedure

ANSI TIA-603-2004, Section 2.2.13.

The transmitter was interfaced with a spectrum analyzer through an appropriate 50 ohm attenuator and a notch filter. The transmitter was operated at maximum power. Attenuator and cable losses were accounted for.

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

The system loss was measured by using a signal generator and reference cable. The attenuation was first measured with a reference cable, then measured in combination with the attenuators and notch filter.

Loss (reference cable/attenuators/notch filter) – Loss (reference cable) = System Loss

### 5.2 Test Data

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

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

The following channels (in MHz) were investigated: 851.0125, 854.0125, 861.5000 and 868.9875. 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 5-1: Conducted Spurious Emissions – 851.0125 MHz – High Power**

25 kHz channel spacing; Conducted power = 25.7 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1702.025	99.90	57.10	-42.77
2553.038	103.00	57.10	-45.87
3404.05	109.00	57.10	-51.87
4255.063	107.20	57.10	-50.07
5106.075	111.40	57.10	-54.27
5957.088	108.00	57.10	-50.87
6808.1	95.00	57.10	-37.87
7659.113	103.60	57.10	-46.47
8510.125	101.80	57.10	-44.67



**Table 5-2: Conducted Spurious Emissions – 854.0125 MHz – High Power**

25 kHz channel spacing; Conducted power = 25.9 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1708.025	98.30	57.13	-41.17
2562.038	98.33	57.13	-41.20
3416.05	105.43	57.13	-48.30
4270.063	103.33	57.13	-46.20
5124.075	106.23	57.13	-49.10
5978.088	102.73	57.13	-45.60
6832.1	91.93	57.13	-34.80
7686.113	99.03	57.13	-41.90
8540.125	98.13	57.13	-41.00

**Table 5-3: Conducted Spurious Emissions – 861.5000 MHz – High Power**

25 kHz channel spacing; Conducted power = 25.5 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1723	99.56	57.06	-42.50
2584.5	104.76	57.06	-47.70
3446	110.86	57.06	-53.80
4307.5	108.86	57.06	-51.80
5169	110.56	57.06	-53.50
6030.5	107.96	57.06	-50.90
6892	100.16	57.06	-43.10
7753.5	103.56	57.06	-46.50
8615	98.76	57.06	-41.70

**Table 5-4: Conducted Spurious Emissions – 868.9875 MHz – High Power**

25 kHz channel spacing; Conducted power = 24.8 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1737.975	104.35	56.95	-47.40
2606.963	106.55	56.95	-49.60
3475.95	111.65	56.95	-54.70
4344.938	110.45	56.95	-53.50
5213.925	109.95	56.95	-53.00
6082.913	107.55	56.95	-50.60
6951.9	102.85	56.95	-45.90
7820.888	103.45	56.95	-46.50
8689.875	92.55	56.95	-35.60

**Table 5-5: Test Equipment Used 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
901132	Par Electronics	UHF SN(806-902)	UHF Notch Filter	N/A	02/1/09
900139	Weinschel Corp.	48-20-34	Attenuator, 100 W 20 dB, DC-18 GHz	BK5859	1/13/09

**TEST PERSONNEL:**

Daniel Biggs		December 11, 2006
Test Technician/Engineer	Signature	Date Of Test

## **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-603-2004, Section 2.2.11.

The transmitter was interfaced with a spectrum analyzer through an appropriate 50 ohm attenuator and a notch filter. The transmitter was operated at maximum power. Attenuator losses were accounted for.

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

The system loss was measured by using a signal generator and reference cable. The attenuation was first measured with a reference cable, and then measured in combination with the attenuators.

Loss (reference cable/attenuators) – Loss (reference cable) = System loss

#### **Limit Mask G:**

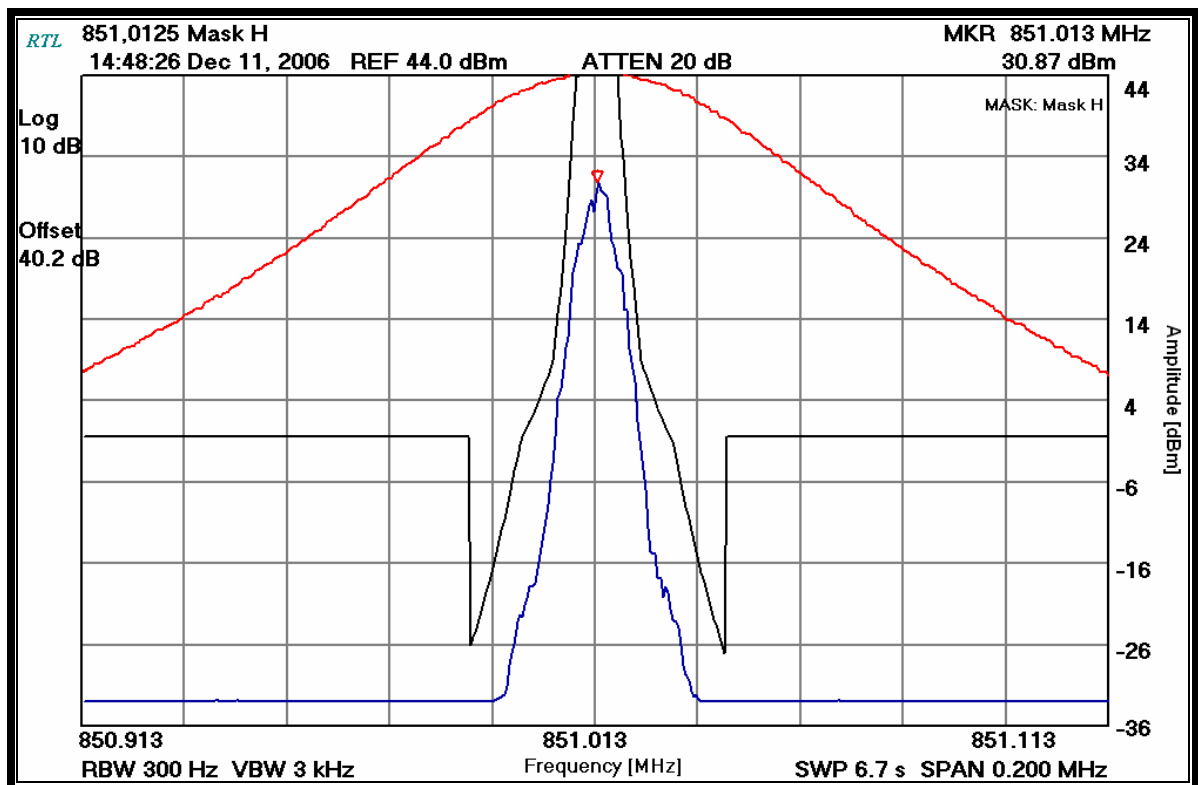
- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz, but not more than 10KHz: At least  **$83 \log (fd/5)$  dB**;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250%, of the authorized bandwidth: At least  **$116 \log (fd/6.1)$  dB or  $50 + 10 \log (P)$  dB, or 70 dB**, whichever is the lesser attenuation;
- (3) 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:**

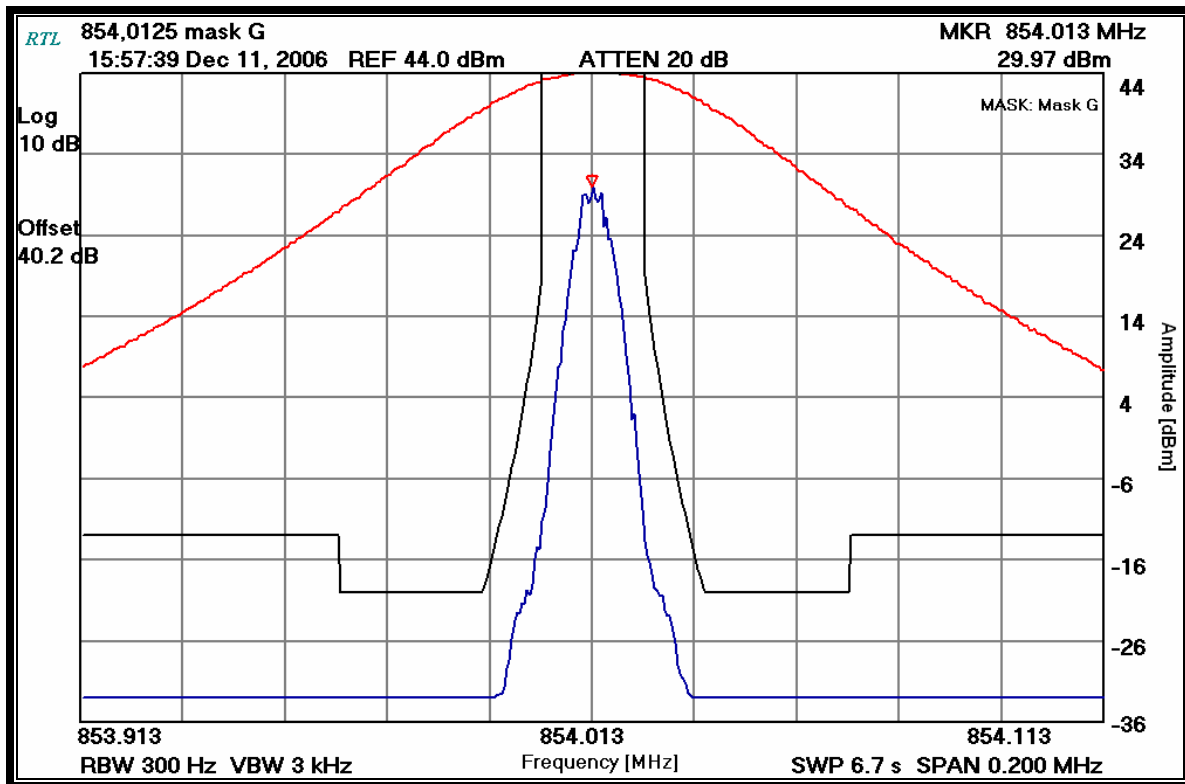
- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of 4 kHz or less, **Zero dB**;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 4 kHz, but not more than 8.5 kHz: At least  **$107 \log (fd/4)$  dB**;
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 8.5 kHz, but not more than 15 kHz: At least  **$40.5 \log (fd/1.16)$  dB**;
- (4) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 15 kHz, but not more than 25 kHz: At least  **$116 \log (fd/6.1)$  dB**;
- (5) On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: At least  **$43 + 10 \log (P)$  dB**.

## 6.2 Test Data

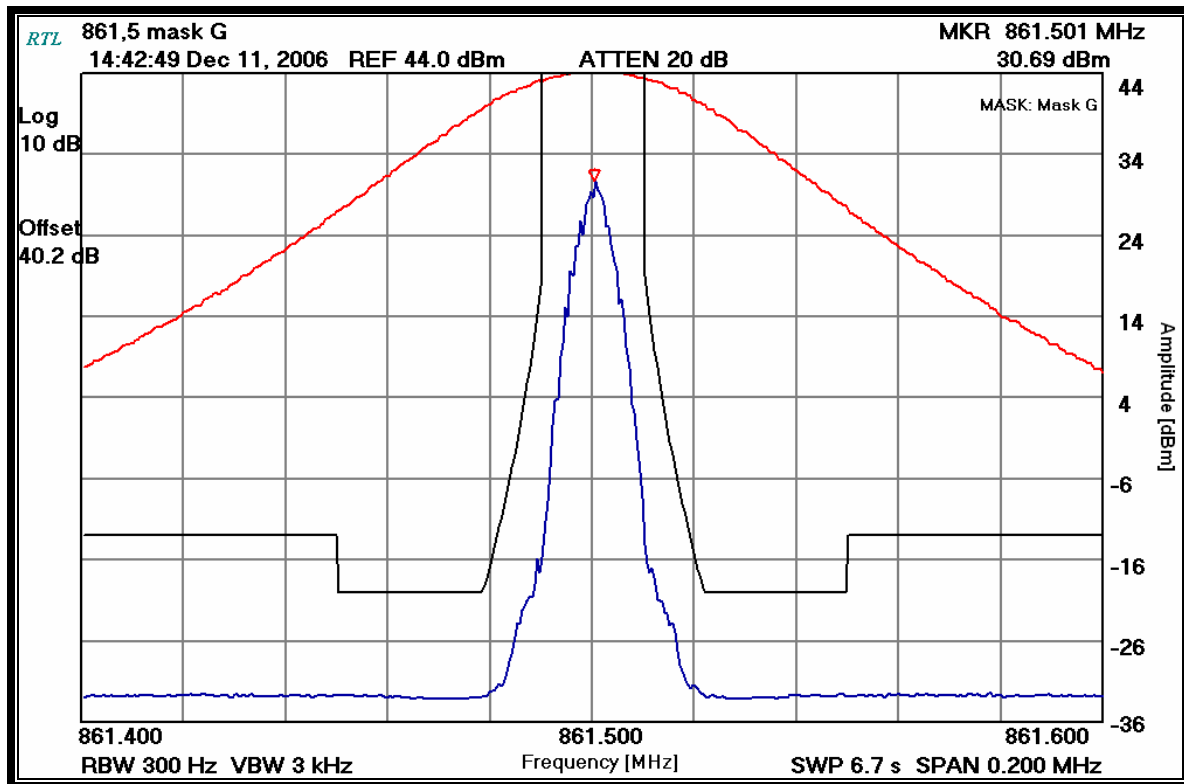
Plot 6-1: Occupied Bandwidth; Wide band; 851.0125 MHz



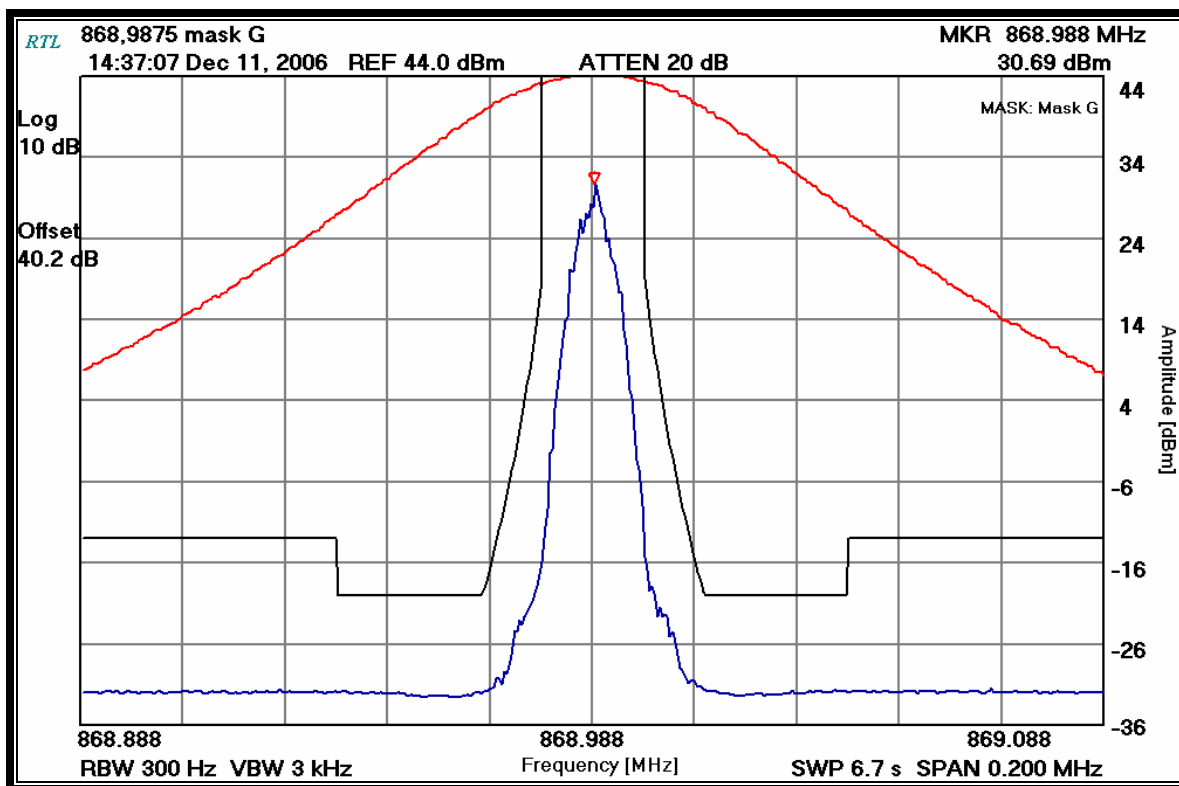
Plot 6-2: Occupied Bandwidth; 854.0125 MHz



**Plot 6-3: Occupied Bandwidth; 861.5000 MHz**




**Plot 6-4: Occupied Bandwidth; 868.9875 MHz**



**Table 6-1: Test Equipment Used 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
901138	Weinschel Corp.	48-40-34	Attenuator, 100 W 40 dB, DC-18 GHz	BK5883	1/13/09

**Test Personnel:**

Daniel Biggs		December 11, 2006
Test Technician/Engineer	Signature	Date Of Test

## 7 FCC Rules and Regulations 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

Digital Modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600 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.

$$P_d(\text{dBm}) = P_g(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

where:

$P_d$  is the dipole equivalent power

$P_g$  is the generator output power into the substitution antenna

### 7.2 Test Data

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 – 854.0 MHz; Wide Band; High Power**

Limit =  $43 + 10 \log P = 57.1 \text{ dBc}$

Conducted Power =  $44.1 \text{ dBm} = 25.9 \text{ W}$

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1708.03	43.5	-57.8	4.6	4.9	101.6	-44.5
2562.04	34.6	-65.2	4.6	6.9	107.0	-49.9
3416.05	33.4	-64.7	5.6	7.3	107.1	-50.0
4270.06	33.0	-57.2	6.0	7.7	99.6	-42.4
5124.08	32.2	-56.7	6.5	7.6	99.0	-41.9
5978.09	32.0	-54.4	7.5	8.5	97.5	-40.4
6832.10	39.4	-47.4	8.2	8.3	91.4	-34.3
7686.11	40.7	-43.8	9.0	8.0	88.9	-31.8
8540.13	38.6	-40.7	10.1	8.4	86.5	-29.4


\*This insertion loss corresponds to the cable connecting the RF Signal Generator to the  $\frac{1}{2}$  wave dipole antenna.



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

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900791	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2099	6/12/07
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	5/20/07
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	5/20/07
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	7/31/09
900814	Electro-Metrics	EM-6961 (RGA-60)	Double Ridges Guide Antenna (1 - 18 GHz)	2310	3/30/09
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz - 12.8 GHz)	3826A00144	10/16/07
900928	Hewlett Packard	83752A	Sweeper, (Signal generator, 0.01 - 20 GHz)	3610A00866	11/30/07
901365	MITEQ	JS4-00102600-41-5P	Amplifier, 15 V, 0.1-26 GHz, 28dB gain, power 5dB	1094152	3/24/07
901365	MITEQ	JS4-00102600-41-5P	Amplifier, 15 V, 0.1-26 GHz, 28 dB gain	1094152	3/24/07
901423	Insulated Wire Inc.	KPS-1503-3600-KPS	RF Cable, 30'	NA	12/12/07
901425	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		December 14, 2006
Test Engineer	Signature	Date Of Test

## 8 Conclusion

The data in this measurement report shows that the **M/A-COM, Inc. Model MCS-0001, OpenSky Cell Site Base Station; FCC ID: BV8MCS800A025, IC: 3670195674A**, complies with applicable requirements of Parts 90, 15 and 2 of the FCC Rules, and Industry Canada RSS-119.