



Engineering and Testing for EMC and Safety Compliance



Accredited under NVLAP Lab Code 200061-0

## Class II Permissive Change Report

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**Model: SkyMASTR Base Station**

**FCC ID: BV8MBS800A100**  
**IC: 3670A-MBS800**

**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	Rated Frequency Tolerance (ppm)	Emission Designator
851-869	100	0.10	11K3F1D (OTP)
851-869	100	0.10	11K3F9W (OTP)
851-869	100	0.10	12K1F9W (OTP)
851-869	100	0.10	13K1F9W (OTP)
851-869	100	0.10	8K40F9W (NBOTP)

**Report Prepared by Test Engineer: Daniel W. Baltzell**

Document Number: 2007170

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Test results relate only to the product tested.*

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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. The Equipment Under Test (EUT) was the **SkyMASTR Base Station, FCC ID: BV8MBS800A100, IC: 3670A-MBS800**. 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 was issued September 21, 2006; the IC certificate was issued September 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 EUT is a base station radio that operates in the 851-869 MHz band. The rated RF power is configurable from 10 to 100 W. The EUT is digitally modulated using a 4-level Frequency Shift Keying (FSK) with a symbol rate of 4800 and 9.6 kHz (9.6 kbps).

<b>Model Tested</b>	SkyMASTR Base Station
<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>	-48 VDC
<b>Rated Transmitter Output Power</b>	100 W
<b>Duty Cycle</b>	100% maximum

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

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Base Station (including parts below)	M/A-Com, Inc.	SkyMaster	A40CD0000009	BV8MBS800A100	17363
Base Station	M/A-Com	SkyMASTR Base Station	MASK-800HD	N/A	N/A
Digital Controller/Transceiver	M/A-Com	SkyMASTR DCX	EA-009221-002	N/A	N/A
Amplifier	M/A-Com	SkyMASTR HPA	EA-009222-002	N/A	N/A

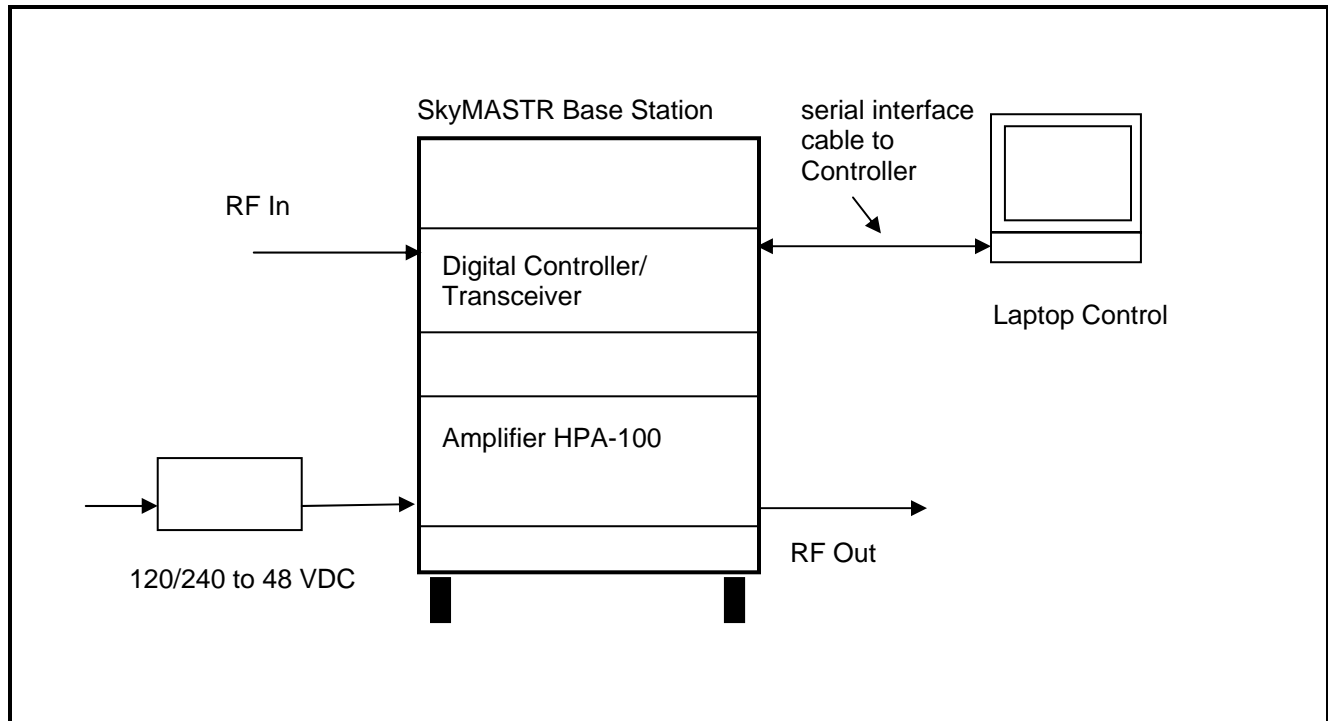
**Table 2-2: Ports and Cabling Used for Testing EUT**

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

**Table 2-3: 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-600-48	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:** 28.0 VDC

**Current:** 10.0 A

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

Frequency (MHz)	Mode	High Power RF Power Measured (W)*
851.0125	NBOTP	100
853.9875	NBOTP	101
854.0125	NBOTP	100
861.5000	NBOTP	100
868.9875	NBOTP	101

\* Measurement accuracy: +/- 0.02 dB (logarithmic mode)


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

Rated Power
100 W

**Table 4-3: 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
901355	JFW Industries	50FH-003-300	300 W 3 dB DC1000 MHz Attenuator	N/A	1/11/08
901235	IW Microwave Products	KPS-1503-360-KPS	High Frequency RF Cables	36"	5/16/08
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/05/07

##### Test Personnel:

Daniel W. Baltzell		May 8, 2007
Test Engineer	Signature	Date Of Test

## 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.

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600 bps.

### 5.2 Test Data

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

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; Bn - 8.4 kHz; NBOTP**

Limit =  $43 + 10 \log(100) = 63 \text{ dBc}$


Frequency (MHz)	Spectrum Analyzer Level (dBm)	Cables, attenuators, notch insertion loss (dB)	Corrected Level (dBc)	Limit (dBc)	Margin (dB)
1723.0000	-70.3	26.3	94.0	63.0	-31.0
2584.5000	-72.4	30.8	91.6	63.0	-28.6
3446.0000	-90.6	27.1	113.5	63.0	-50.5
4307.5000	-89.7	28.5	111.2	63.0	-48.2
5169.0000	-91.3	27.8	113.5	63.0	-50.5
6030.5000	-90.9	30.3	110.6	63.0	-47.6
6892.0000	-88.5	41.5	97.0	63.0	-34.0
7753.5000	-89.0	33.9	105.1	63.0	-42.1
8615.0000	-89.4	52.4	87.0	63.0	-24.0



**Table 5-2: Test Equipment for Testing Conducted Spurious Emissions**

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	MCE Weinschel	48-20-34	Attenuator, 20 dB, DC-18 GHz, 100 W	BK5859	12/09/08
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 10 dB 50 W	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, 100 W 40 dB	BK5883	1/13/09
901355	JFW Industries	50FH-003-300	300 W 3 dB DC 1000 MHz Attenuator	N/A	1/11/08

**Test Personnel:**

Daniel W. Baltzell		May 8, 2007
Test 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-C-2004, Section 2.2.11.

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600 bps for NBOTP (Narrow Band OpenSky Trunking Protocol) mode.

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

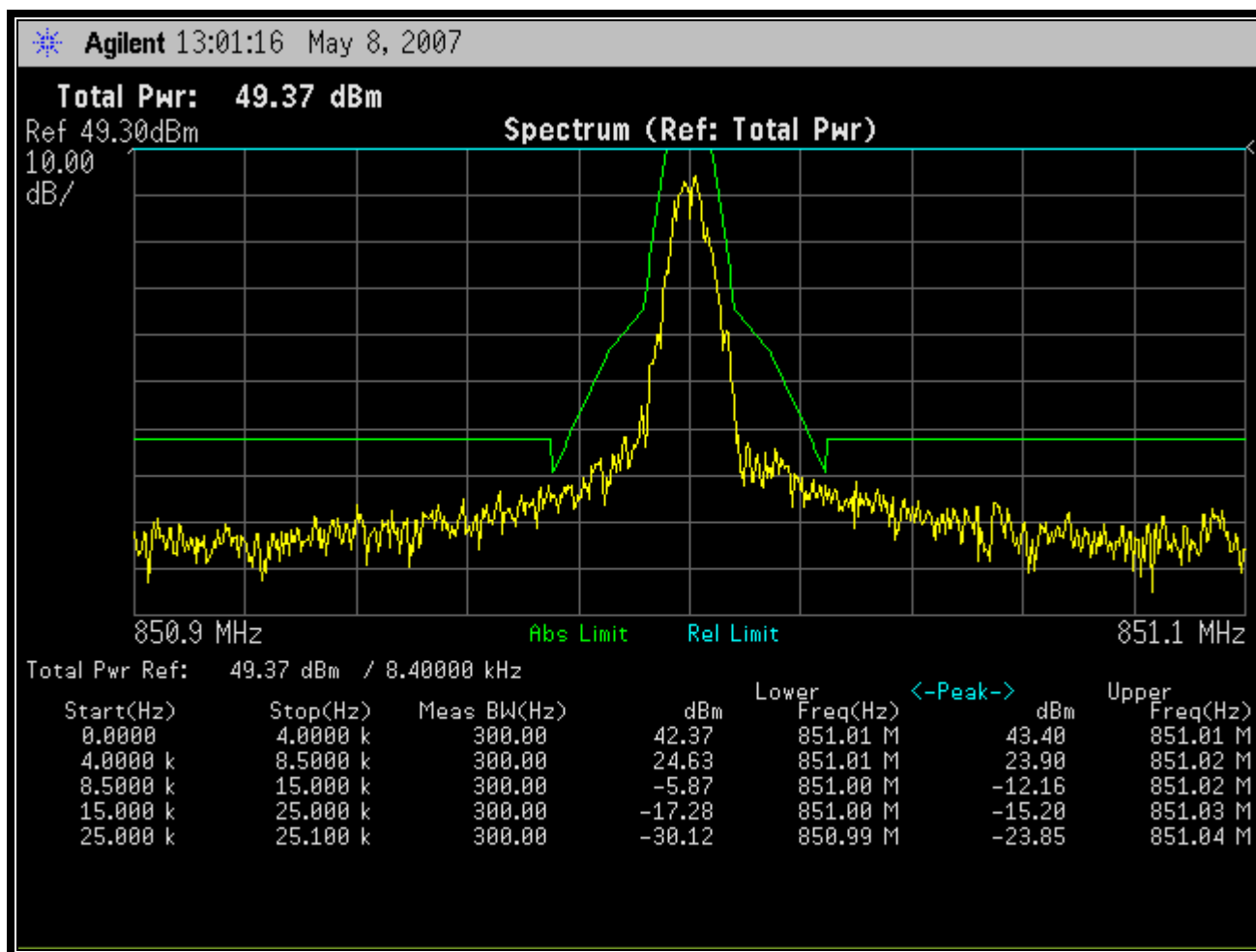
- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: at least  **$116 (f_d/6.1)$  dB**, or  **$50 + 10 \log (P)$  dB**, or **70 dB**, whichever is the lesser attenuation;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

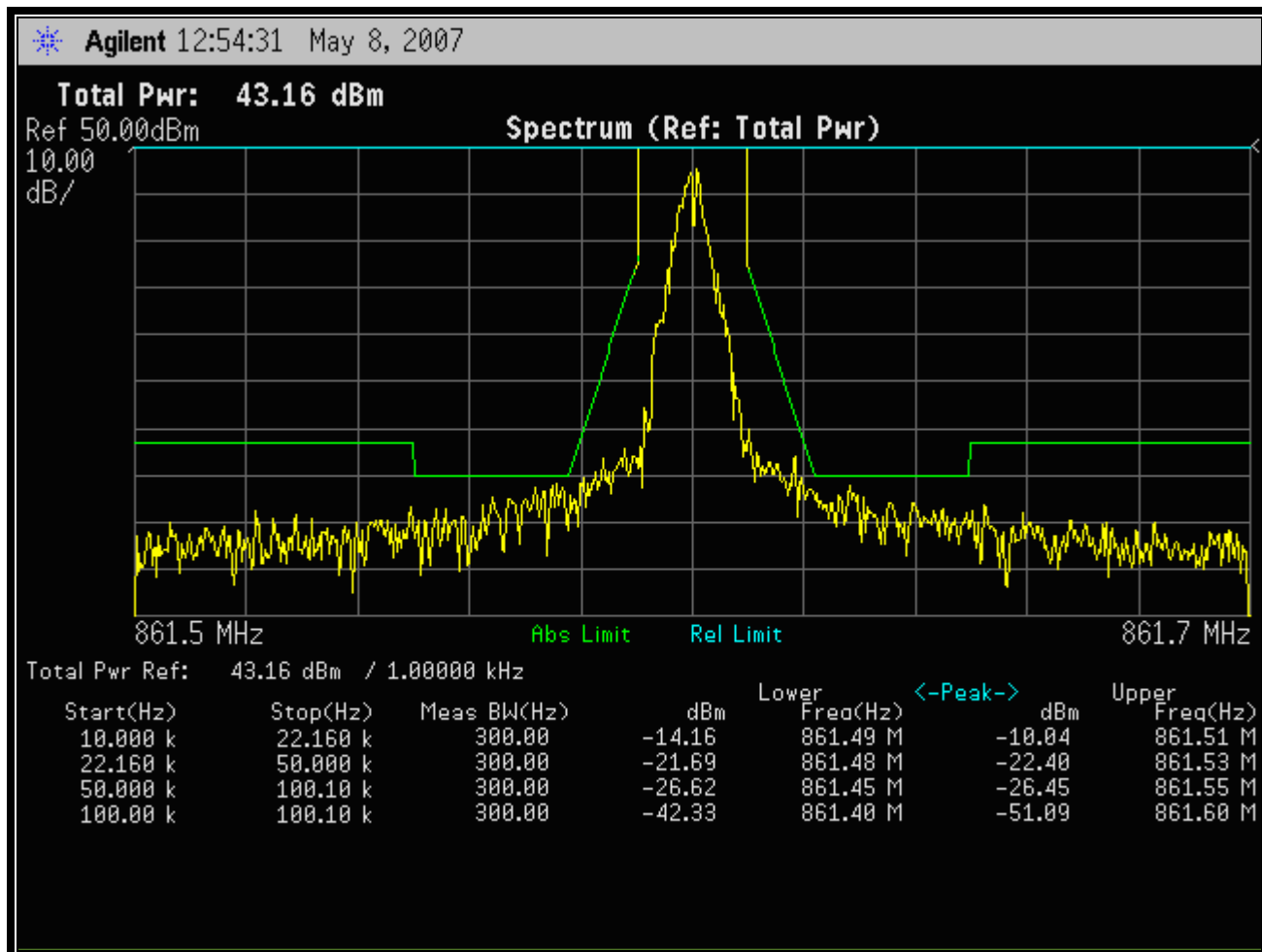
- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of 4 kHz or less: **zero dB**;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 4 kHz, but not more 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; NBOTP




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



**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
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/05/07
901138	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40dB	BK5883	1/13/09
901355	JFW Industries	50FH-003-300	300W 3DB DC1000 MHz Attenuator	N/A	1/11/08

**Test Personnel:**

Daniel W. Baltzell		May 8, 2007
Test Technician/Engineer	Signature	Date Of Tests

## 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.

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600 bps for NBOTF (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 (High Power)**

Limit =  $43 + 10 \log (100) 63 \text{ dBc}$


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	H	78.2	-23.3	6.0	5.4	73.9	63.0	-10.9
2584.5	H	87.5	-16.7	7.4	7.5	66.6	63.0	-3.6
3446.0	H	73.0	-27.6	8.7	7.7	78.6	63.0	-15.6
4307.5	H	47.2	-48.3	9.6	8.0	99.9	63.0	-36.9
5169.0	H	31.4	-62.5	10.7	8.2	115.0	63.0	-52.0
6030.5	H	39.9	-52.4	11.4	8.9	104.9	63.0	-41.9
6892.0	V	29.9	-61.1	12.3	9.3	114.1	63.0	-51.1
7753.5	H	29.1*	-59.7	13.0	8.9	113.8	63.0	-50.8
8615.0	H	27.6*	-55.0	13.5	9.1	109.4	63.0	-46.4

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 9, 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:

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

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: SkyMASTR Base Station, FCC ID: BV8MBS800A100, IC: 3670A-MBS800**, complies with all the applicable requirements of FCC Parts 90, 15 and 2 and Industry Canada RSS-119.