Engineering and Testing for EMC and Safety Compliance

Certification Report

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Model: SkyMASTR Base Station

FCC ID: BV8MBS800A100
IC: 3670A-MBS800

September 13, 2006

Standards Referenced for this Report	
Part 2: 2005	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 90: 2005	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	Rated Frequency Tolerance (ppm)	Emission Designator
851-869	100	.10	11K3F1D
851-869	100	.10	11K3F9W
851-869	100	.10	12K1F9W
851-869	100	.10	13K1F9W

Report Prepared by Test Engineer: Daniel Biggs

Document Number: 2006132

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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 an original application report.

2 Tested System Details

The test sample was received on August 24, 2006. 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 Gaussian Frequency Shift Keying (GFSK) with a symbol rate of 9600 Hz (19.2 kbps).

Model Tested	SkyMASTR Base Station
Frequency Band	851-869 MHz
Modulation Type	4-level Gaussian Frequency Shift Keying (GFSK)
Channel Step Size	12.5 KHz
Channel Bandwidth	25 KHz
Primary Power	-48 VDC
Rated Transmitter Output Power	100 W
Duty Cycle	100% maximum

Table 2-1: Equipment Under Test (EUT)

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Base Station	M/A-Com, Inc.	SkyMaster	MASK-800HD	BV8MBS800A100	17363

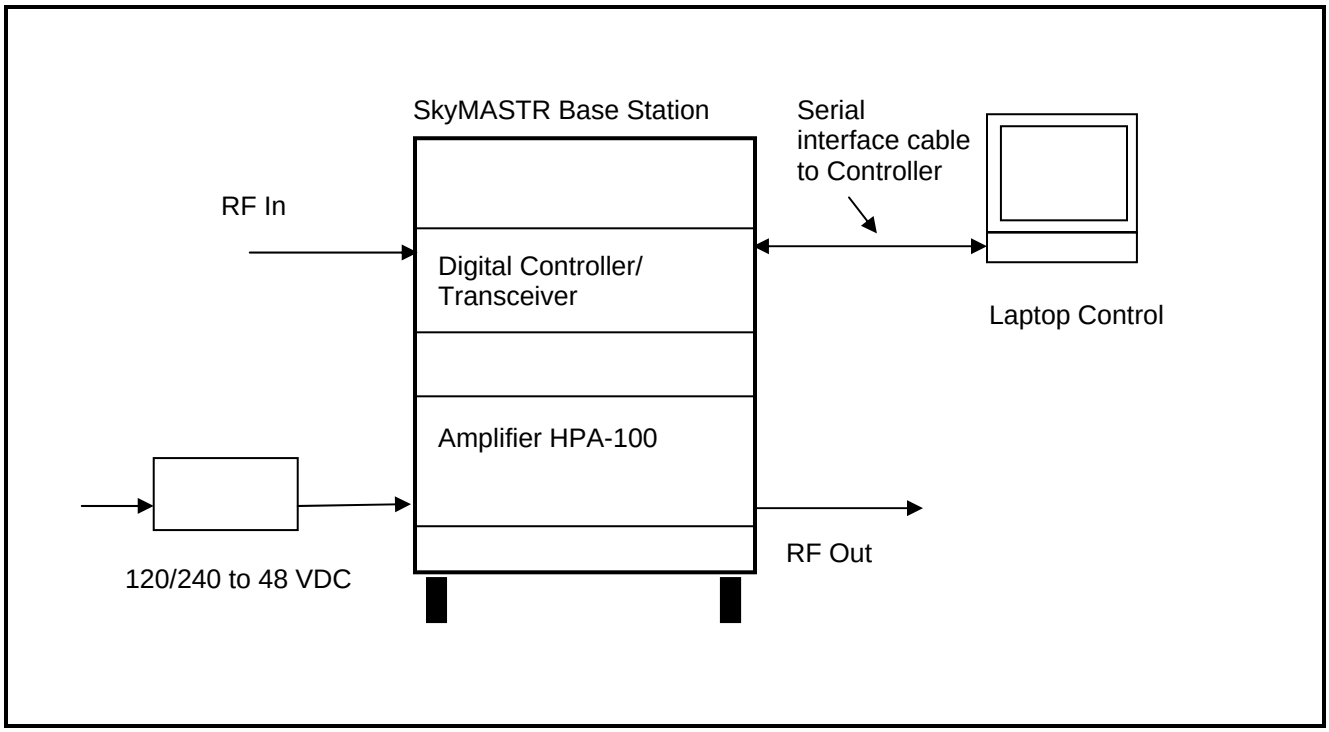
Table 2-2: Ports and Cabling Used for Testing(EUT)

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	Compaq	Armada M700	N/A	N/A	N/A
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 AMPS

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 Ω load impedance.

4.2 Test Data

Table 4-1: RF Power Output: Carrier Output Power

Frequency (MHz)	Mode	High Power RF Power Measured (Watt)*
851.0125	OTP	100
853.9875	OTP	99
854.0125	OTP	100
861.5000	OTP	100
868.9875	OTP	97

* Measurement accuracy: +/- .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	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	12/02/08

Test Personnel:

Daniel Biggs		August 30, 2006
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 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.

5.2 Test Data

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

Limit: P(dBm) – (43 + 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.

Table 5-1: Conducted Spurious Emissions – 851.0125 MHz; Wide Band; OTP

Limit = 43 + 10 log (99.8) = 63 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1702.0250	92.2	63.0	-29.2
2553.0375	101.9	63.0	-38.9
3404.0500	113.6	63.0	-50.6
4255.0625	107.0	63.0	-44.0
5106.0750	114.7	63.0	-51.7
5957.0875	109.5	63.0	-46.5
6808.1000	104.5	63.0	-41.5
7659.1125	111.9	63.0	-48.9
8510.1250	109.2	63.0	-46.2

Table 5-2: Conducted Spurious Emissions – 853.9875 MHz; Wide Band; OTP

Limit = 43 + 10 log (99.3) = 63 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1707.9750	92.6	63.0	-29.7
2561.9625	101.4	63.0	-38.4
3415.9500	112.4	63.0	-49.4
4269.9375	106.4	63.0	-43.4
5123.9250	113.7	63.0	-50.7
5977.9125	110.3	63.0	-47.3
6831.9000	106.5	63.0	-43.5
7685.8875	112.7	63.0	-49.7
8539.8750	108.0	63.0	-45.0

Table 5-3: Conducted Spurious Emissions – 854.0125 MHz; Wide Band; OTP

Limit = 43 + 10 log (97.6) = 62.9 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1708.0250	92.3	62.9	-29.4
2562.0375	101.5	62.9	-38.6
3416.0500	114.8	62.9	-51.9
4270.0625	106.6	62.9	-43.7
5124.0750	114.4	62.9	-51.5
5978.0875	110.9	62.9	-48.0
6832.1000	105.9	62.9	-43.0
7686.1125	112.6	62.9	-49.7
8540.1250	109.6	62.9	-46.7

Table 5-4: Conducted Spurious Emissions – 861.5000 MHz; Wide Band; OTP

Limit = 43 + 10 log (99.8) = 63 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1723.0000	92.4	63.0	-29.4
2584.5000	100.7	63.0	-37.7
3446.0000	114.0	63.0	-51.0
4307.5000	108.1	63.0	-45.1
5169.0000	114.2	63.0	-51.2
6030.5000	111.2	63.0	-48.2
6892.0000	108.3	63.0	-45.3
7753.5000	111.6	63.0	-48.6
8615.0000	107.3	63.0	-44.3

Table 5-5: Conducted Spurious Emissions – 868.9875 MHz; Wide Band; OTP

Limit = 43 + 10 log (97.7) = 62.9 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1737.975	92.6	62.9	-29.7
2606.9625	101.4	62.9	-38.5
3475.95	114.5	62.9	-51.6
4344.9375	108.1	62.9	-45.2
5213.925	114.7	62.9	-51.8
6082.9125	109.9	62.9	-47.0
6951.9	109.9	62.9	-47.0
7820.8875	113.9	62.9	-51.0
8689.875	100.9	62.9	-38.0

Table 5-6: Test Equipment for Testing Conducted Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901020	Hewlett Packard	8564E	Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	09/14/06
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	12/12/06

Test Personnel:

Daniel Biggs		August 30, 2006
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.

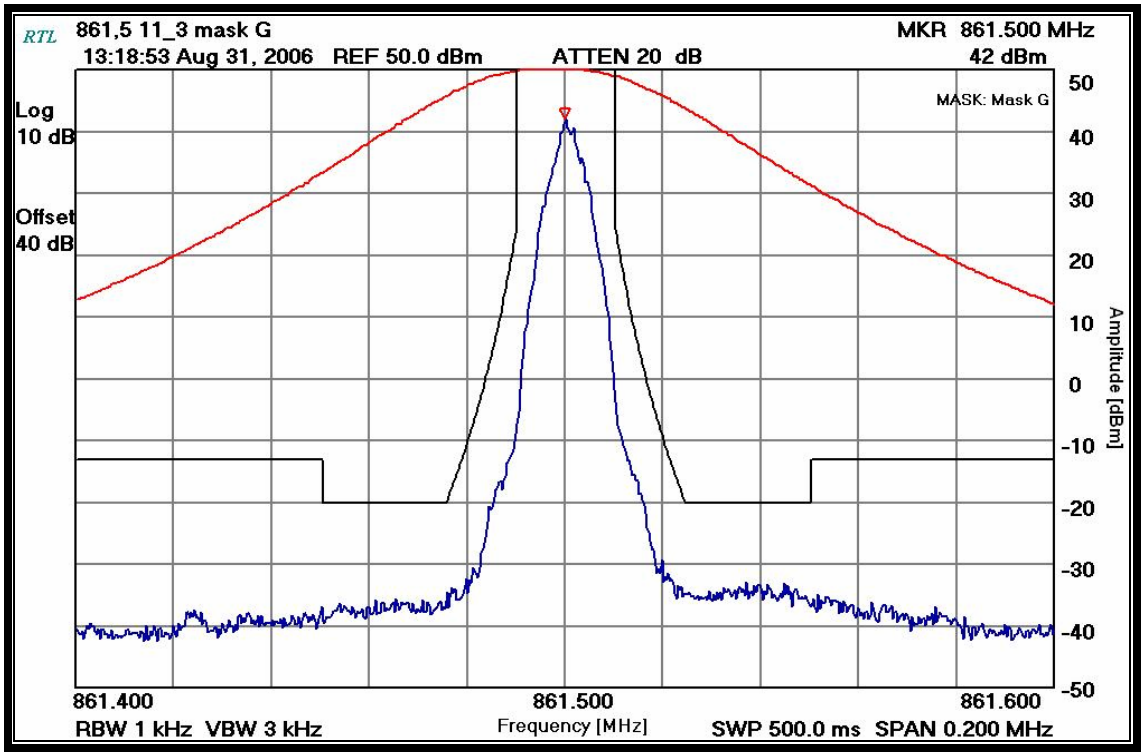
Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 19200 bps for OTP (OpenSky Trunking Protocol) mode.

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 10 kHz: 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 (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**.

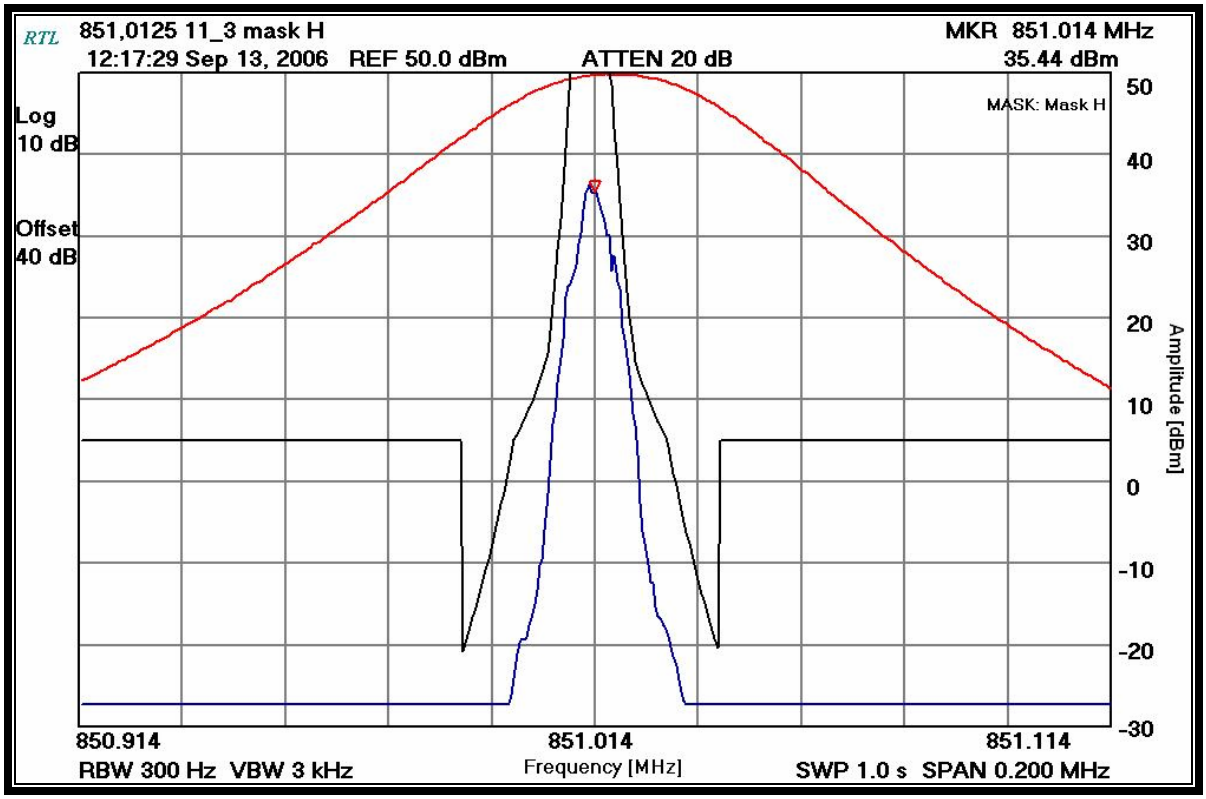
Limit Mask H:
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of 4 kHz or less: **zero dB**;
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 4 kHz, but not more 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 kHz, but not more than 15 kHz: At least **40.5 log (fd/1.16) (P) 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) (P) dB**.
(5) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 25 kHz: At least **43 + log (P) dB**.

6.2 Test Data

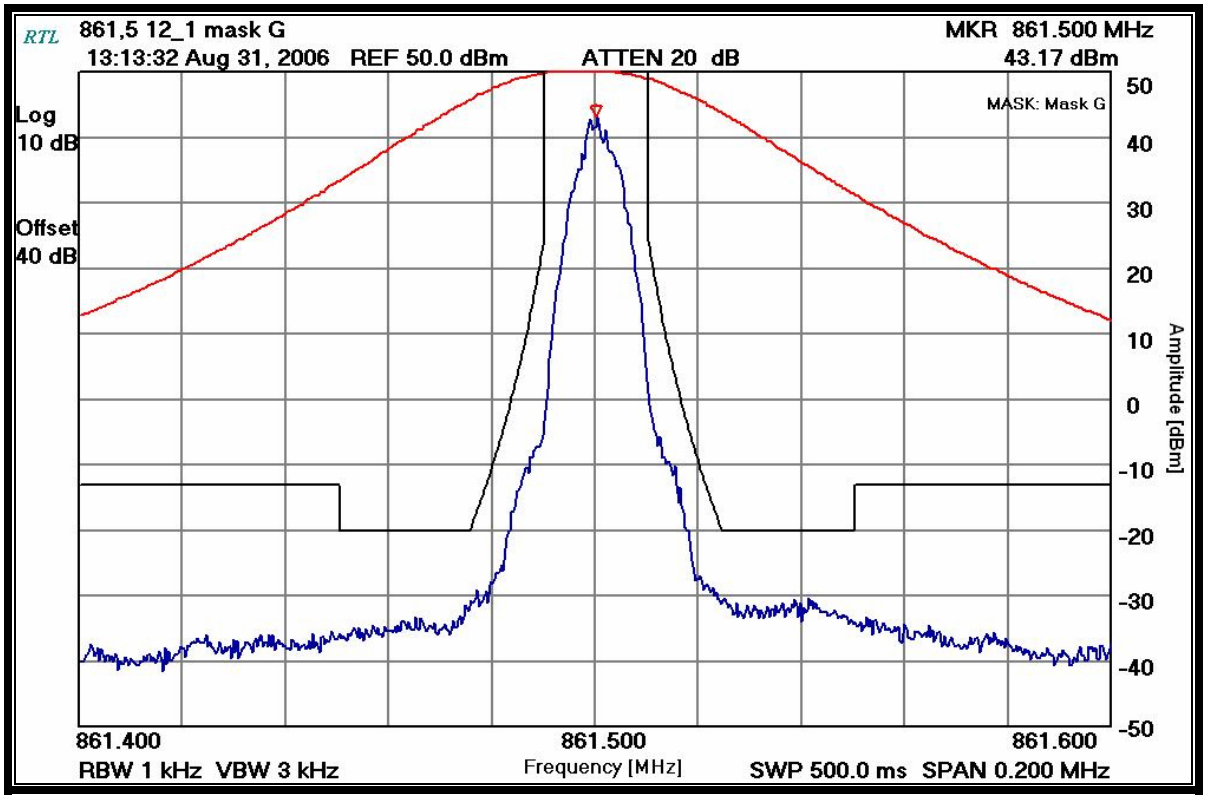
Plot 6-1: Occupied Bandwidth – 861.5000 MHz; Mask G; Bn - 11.3 KHz; Wideband; OTP



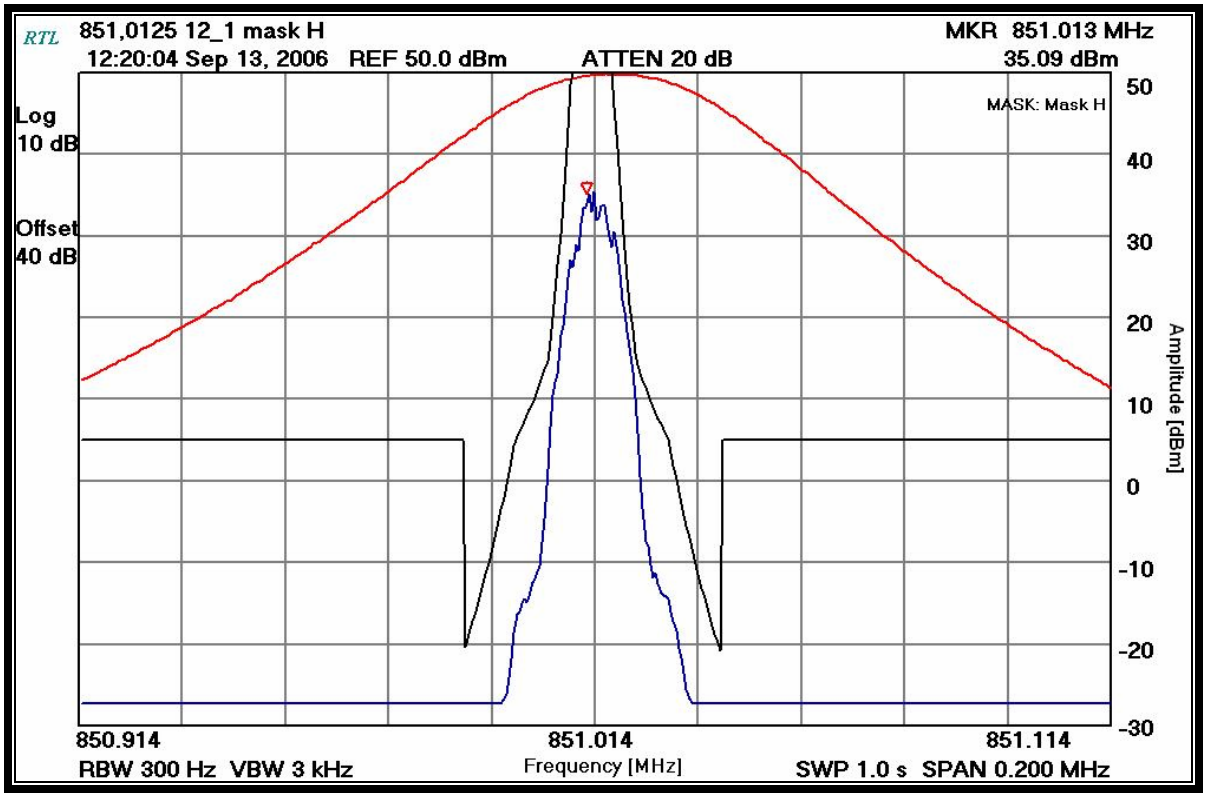
Plot 6-2: Occupied Bandwidth – 851.0125 MHz; Mask H; Bn - 11.3 KHz; Wideband; OTP



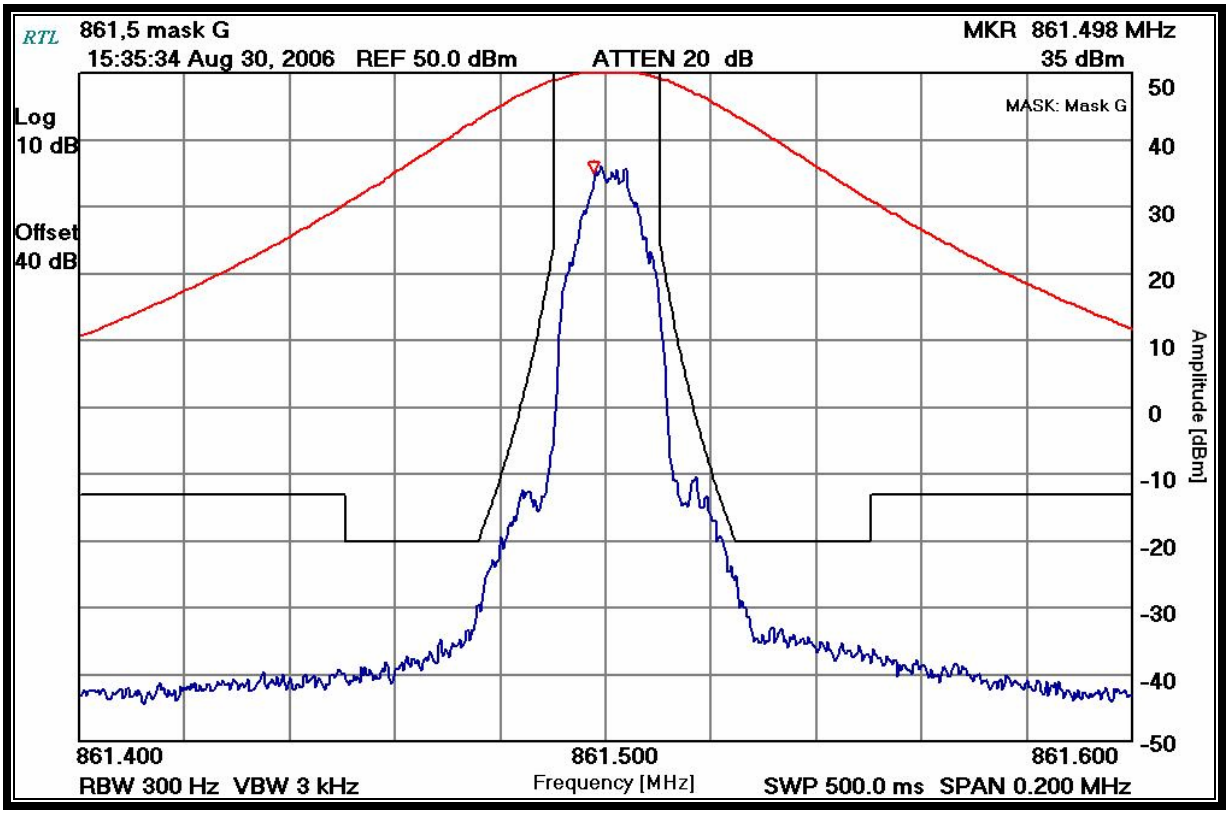
Plot 6-3: Occupied Bandwidth – 861.5000 MHz; Mask G; Bn - 12.1 KHz; Wideband; OTP



Plot 6-4: Occupied Bandwidth – 851.0125 MHz; Mask H; Bn - 12.1 KHz; Wideband; OTP



Plot 6-5: Occupied Bandwidth – 861.5000 MHz; Mask G; Bn - 13.1 KHz; Wideband; OTP



Plot 6-6: Occupied Bandwidth – 868.9875 MHz; Mask G; Bn - 13.1 KHz; Wideband; OTP

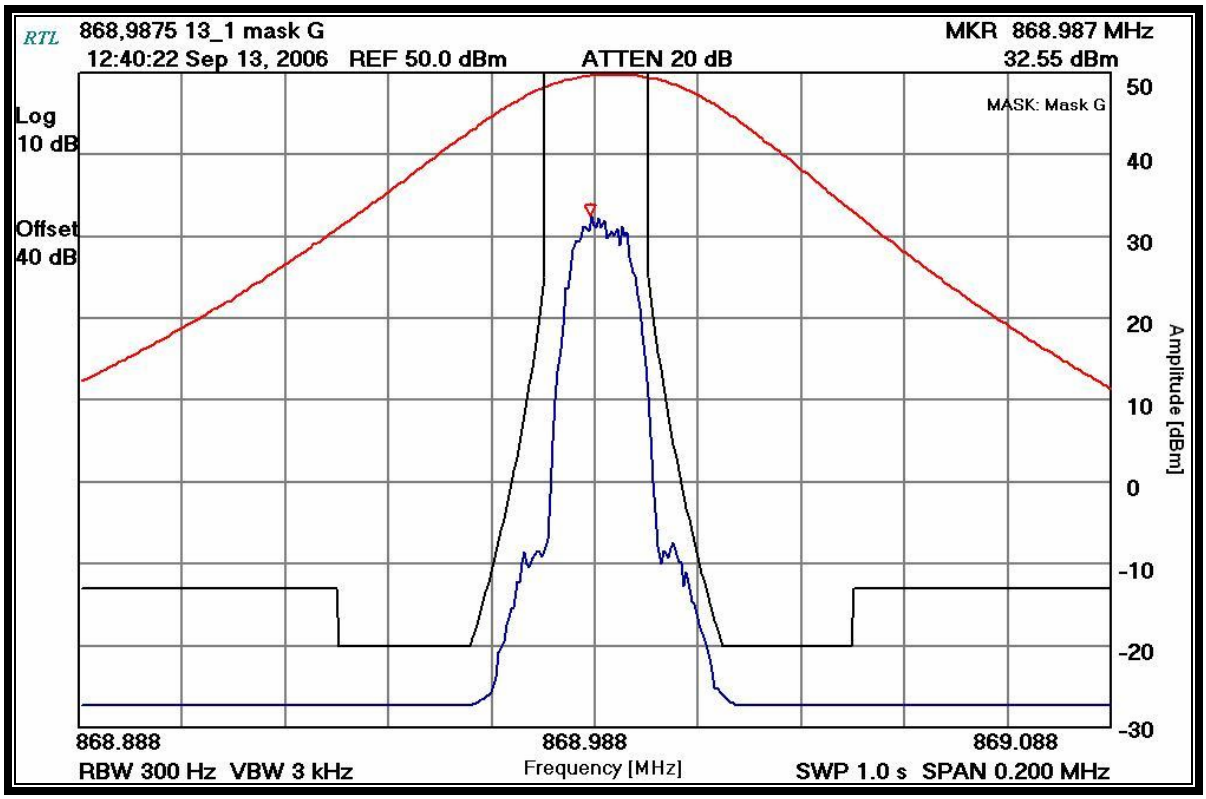


Table 6-1: Test Equipment for Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/02/08

Test Personnel:

Daniel Biggs	Daniel Biggs	August 30, 31 & September 13, 2006
Test Technician/Engineer	Signature	Dates 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 – 19200 bps for OTP (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. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

Limit: P(dBm) – (43 + 10xLOG P(W))

Table 7-1: Field Strength of Spurious Radiation: 861.5000 MHz (High Power)

Limit = 43 + 10 log (99.3) = 63 dBc

Frequency (MHz)	Polarization (H/V)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Level (dBc)	Limit	Margin (dB)
1723.0	H	86.5	-18.8	4.6	6.5	66.9	63.0	-4.0
2584.5	H	87.6	-16.9	5.8	7.3	65.4	63.0	-2.5
3446.0	H	76.5	-23.2	6.0	7.5	71.7	63.0	-8.8
4307.5	H	55.2	-41.6	6.0	8.4	89.2	63.0	-26.3
5169.0	V	40.0	-54.0	6.5	8.8	103.1	63.0	-38.8
6030.5	H	44.2	-47.6	7.7	8.9	100.7	63.0	-33.5
6892.0	H	37.0	-54.7	8.2	9.5	106.4	63.0	-40.5
7753.5	V	72.8	-55.0	9.0	9.2	104.8	63.0	-41.8
8615.0	V	70.3	-53.5	9.5	8.9	104.1	63.0	-41.2

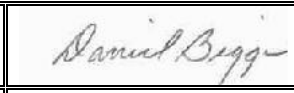
*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

Note: SNF = 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
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	11/1/06
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
901413	Agilent	E4448	Spectrum Analyzer	US44020346	11/2/06
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 – 20 GHz)	3610A00866	11/10/06
900321	EMCO	3161-03	Horn Antennas (4 – 8 GHz)	9508-1020	5/20/07
901262	ETS	3115	Double ridge horn (1 – 26 GHz)	6748	4/19/08
901422	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

Test Personnel:

Daniel Biggs		September 6, 2006
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. EUT was then operated in standby 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 851 – 854 MHz: 1.0 ppm

Limit for frequency block 854 – 869 MHz: 1.5 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 – 861.4993 MHz

Temperature °C	Channel Frequency	Measured Frequency (MHz)	ppm
-30	861.4993	861.499370	0.08
-20	861.4993	861.499363	0.07
-10	861.4993	861.499360	0.07
0	861.4993	861.499286	-0.02
10	861.4993	861.499286	-0.02
20	861.4993	861.499307	0.01
30	861.4993	861.499287	-0.02
40	861.4993	861.499285	-0.02
50	861.4993	861.499283	-0.02
60	861.4993	861.499282	-0.02

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	01/20/07
901300	Agilent	53131A	Frequency Counter	MY40001345	11/23/06
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:

Daniel Biggs		September 5, 2006
Test Engineer	Signature	Date Of Test

8.2.2 Frequency Stability/Voltage Variation

Table 8-3: Frequency Stability/Voltage Variation – 861.4993 MHz

Voltage (VDC)	Channel Frequency	Measured Frequency (MHz)	ppm
-40.80	861.4993	861.499295	-0.01
-48.00	861.4993	861.499295	-0.01
-55.20	861.4993	861.499295	-0.01

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

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901300	Agilent	53131A	Frequency Counter	MY40001345	11/23/06
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
901247	Wavetek	DM25XT	Digital Multimeter	40804098	12/7/06

Test Personnel:

Daniel Biggs		September 5, 2006
Test Engineer	Signature	Date Of Test

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

FCC Mask 90.210(g):
Type of Emission: F9W, F1D
Digital Voice and Data: 19,200 BPS

Calculations:

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

11K3F1D:
where
R = 19.2 kilobits per second [raw data rate]
S = 4 [4-level FSK]
D = 3.2 [FM Deviation]
K = 0.266
B(n) = 11,302 or 11K3
FCC Emission Designator: 11K3F1D

11K3F9W:
where
R = 19.2 kilobits per second [raw data rate]
S = 4 [4-level FSK]
D = 3.2 [FM Deviation]
K = 0.266
B(n) = 11,302 or 11K3
FCC Emission Designator: 11K3F9W

12K1F9W:
where
R = 19.2 kilobits per second [raw data rate]
S = 4 [4-level FSK]
D = 3.75 [FM Deviation]
K = 0.334
B(n) = 12,105 or 12K1
FCC Emission Designator: 12K1F9W

13K1F9W:
where
R = 19.2 kilobits per second [raw data rate]
S = 4 [4-level FSK]
D = 4.2 [FM Deviation]
K = 0.415
B(n) = 13,086 or 13K1
FCC Emission Designator: 13K1F9W

10 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.