Engineering and Testing for EMC and Safety Compliance

Class II Permissive Change Test Report

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OpenSky® CS-803 Control Station

FCC ID: BV8CS803

January 9, 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

Report Prepared by Test Engineer: Daniel Biggs

Document Number: 2006094

Frequency Range (MHz)	Power (W) Conducted*	Rated Frequency Tolerance (ppm)	Modulation Mode	Emission Designator
806-824	17.4*	1.5	OTP	16K5F7D
806-824	17.4*	1.5	OTP	16K5F7E
809–824	17.4	1.5	OTP	16K0F1D
854-869	11.0	1.5	OTP	16K0F1D
806-809	17.4*	1.5	OTP	14K0F1D
851-854	11.0	1.5	OTP	14K0F1D
809–824	17.4*	1.5	OTP	16K0F1E
854-869	11.0	1.5	OTP	16K0F1E
806-809	17.4*	1.5	OTP	14K0F1E
851-854	11.0	1.5	OTP	14K0F1E
809–824	17.4*	1.5	OCF	16K0F3E
854-869	11.0	1.5	OCF	16K0F3E
806-809	17.4*	1.5	OCF	14K0F3E
851-854	11.0	1.5	OCF	14K0F3E
806–824	17.4*	1.5	P25	8K4F1D
851-869	11.0	1.5	P25	8K4F1D
806–824	17.4*	1.5	P25	8K4F1E
851-869	11.0	1.5	P25	8K4F1E

* granted power on original filing

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1 General Information

This Class II Permissive Change Report is prepared on behalf of **M/A-COM, Inc**. in accordance with the Federal Communications Commission. The Equipment Under Test (EUT) was the **CS-803 Control Station, FCC ID: BV8CS803**. 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 application for FCC ID: BV8CS803, originally certified by the FCC on May 27, 2003.

1.3 Description of Change in Device

The HPA board assembly was redesigned, due to obsolete component issues; the result is a new PCB assembly. Also, an improved version of the power supply replaces that in the original certification. Both are intended to be used for future production, and for service parts on existing field units.

Additionally, the applicant is requesting talk around emission designators/frequencies to be added to the grant.

1.4 Product Description

The CS-803 is a component of the OpenSky network, an integrated voice and data communications system. The EUT operates in the 800 MHz SMR band. The rated RF power is 18 W/11 W and is digitally modulated using a 4-level Gaussian Frequency Shift Keying (GFSK) with a symbol rate of 9600 Hz (19.2 kbps). The EUT is programmed using OpenSky OTP S/W. The CS-803 can be used in Voice mode using the SP-103 Desk Set (CANBus based), or a tone based desk set, and was tested using three SP-103 Desk Sets in a daisy-chain configuration, and three tone desk sets.

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.

Model Tested	CS-803 Control Station
Frequency Band	806-824 MHz, 851-869 MHz
Modulation Type	4-level Gaussian Frequency Shift Keying (GFSK), FM
Channel Step Size	12.5 KHz
Bit Rate	19,200
Baud Rate	9,600
Channel Bandwidth	25 KHz
Primary Power	115 VAC
Rated Transmitter Output Power	11 W Talk Around Mode, 18 W Conventional mode
Duty Cycle	100% maximum
Antenna	Detachable

Table 2-1: Equipment Under Test (EUT)

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Control Station	M/A-Com, Inc.	CS-803	A4005800005	BV8CS803	17491
Desk Set	M/A-Com, Inc.	SP-103	A4000F003325	N/A	17492
Desk Set	M/A-Com, Inc.	SP-103	A4000F003337	N/A	17493
Desk Set	M/A-Com, Inc.	SP-103	A4000F100000	N/A	17494
Microphone	M/A-Com, Inc.	Dynamic Mic	A4000F003325	N/A	17495
Tone Remote Control Module	M/A-Com, Inc.	TRCM-103	1000014297-0001	N/A	N/A
Tone Remote Desk Set	M/A-Com, Inc.	24-66M	MACDOS0007	N/A	N/A
Microphone	M/A-Com, Inc.	MC-851086-020	19C851086	N/A	N/A
Cable	M/A-Com, Inc.	N/A	MACDOS0006	N/A	N/A

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

Port	Port/Cable Type	Quantity	Length (feet)	Shield
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	Panasonic	ToughBook	N/A	N/A	N/A
Serial Interface Cable	N/A	DB-9	N/A	N/A	N/A

Figure 2-1: Configuration of Tested System – Desk Set

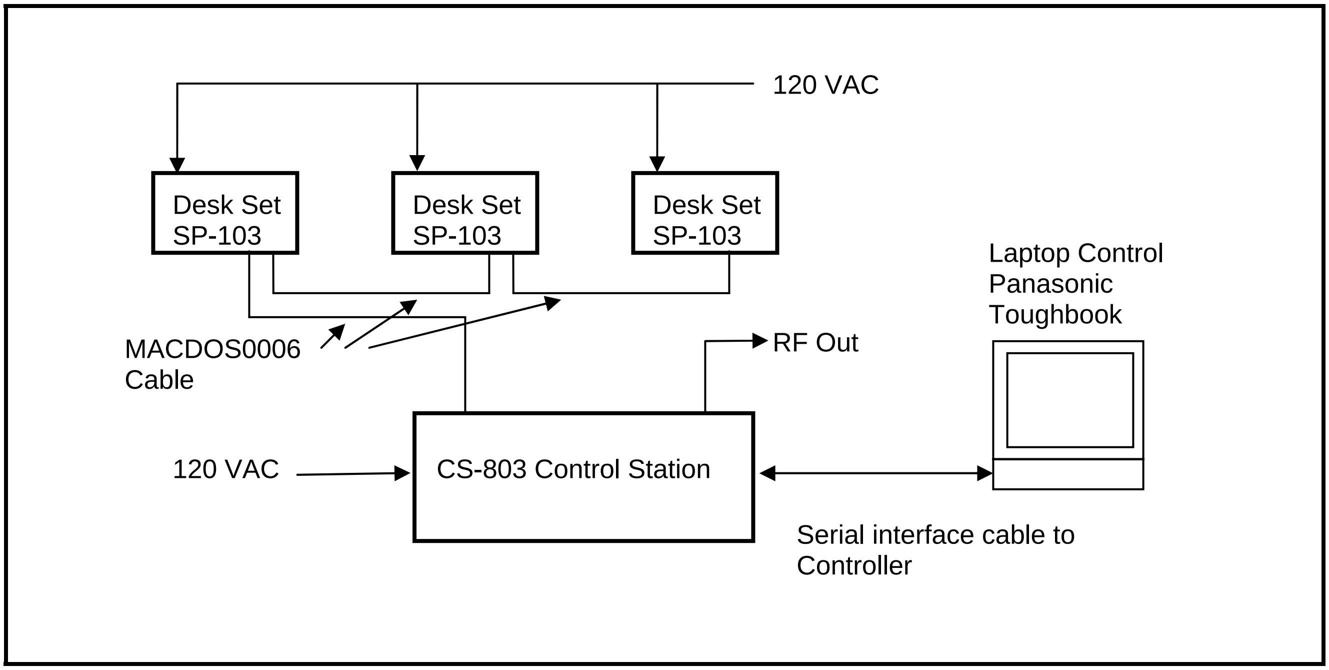
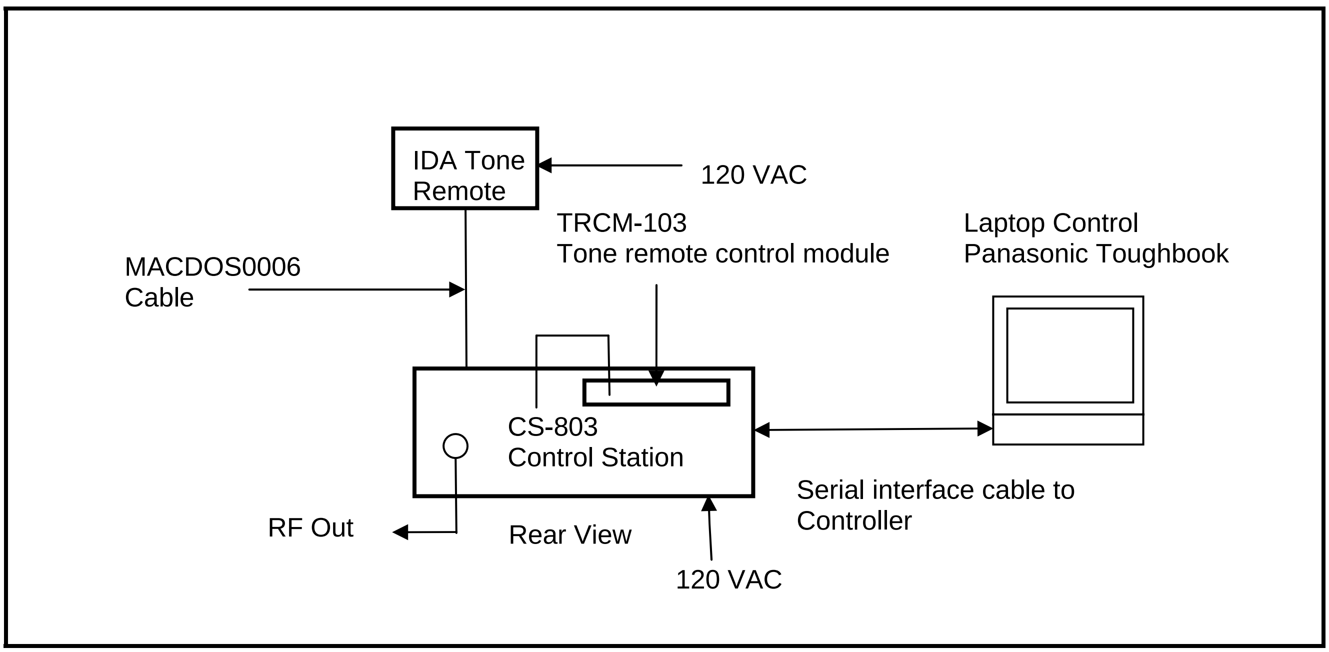


Figure 2-2: Configuration of Tested System – Tone Remote



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

Nominal DC Voltage: 12.0 VDC
Current: 9.0 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 with a power sensor/meter through an appropriate 50 ohm attenuator. Attenuator loss was accounted for.

4.2 Test Data

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

Channel	Frequency (MHz)	Mode	RF Power Measured (Watt)*
A300N	813.4875	CW	18.6
A600N	820.9875	CW	18.4
A715N	822.5125	CW	18.2
A300T	858.4895	CW	11.4
A600T	865.9875	CW	12.7
A715T	867.5125	CW	12.3

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

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

Rated Power
18 W (Normal)
11 W (Talk around)

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	10/3/07
901356	Agilent	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	Daniel Biggs	September 19, 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 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.

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 – 813.4875 MHz; Wide Band; Normal

Limit = 43 + 10 log (18.6) = 55.7 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin (dB)
1626.975	100.6	55.7	-44.9
2440.4625	104.8	55.7	-49.1
3253.95	104.1	55.7	-48.4
4067.4375	106.1	55.7	-50.4
4880.925	110.6	55.7	-54.9
5694.4125	106.0	55.7	-50.3
6507.9	103.2	55.7	-47.5
7321.3875	107.0	55.7	-51.3
8134.875	99.0	55.7	-43.3

Table 5-2: Conducted Spurious Emissions – 820.9875 MHz; Wide Band; Normal

Limit = 43 + 10 log (18.6) = 55.7 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1641.975	100.7	55.7	-45.0
2462.9625	102.4	55.7	-46.7
3283.95	93.0	55.7	-37.3
4104.9375	103.0	55.7	-47.3
4925.925	104.3	55.7	-48.6
5746.9125	105.3	55.7	-49.6
6567.9	93.6	55.7	-37.9
7388.8875	103.9	55.7	-48.2
8209.875	98.4	55.7	-42.7

Table 5-3: Conducted Spurious Emissions – 822.5125 MHz; Wide Band; Normal

Limit = 43 + 10 log (18.0) = 55.6 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1645.025	102.8	55.6	-47.1
2467.5375	106.9	55.6	-51.2
3290.05	97.6	55.6	-41.9
4112.5625	108.4	55.6	-52.7
4935.075	111.4	55.6	-55.7
5757.5875	110.2	55.6	-54.5
6580.1	103.9	55.6	-48.2
7402.6125	105.9	55.6	-50.2
8225.125	92.9	55.6	-37.2

Table 5-4: Conducted Spurious Emissions – 858.4895 MHz; Wide Band; Talk Around

Limit = 43 + 10 log (11.4) = 53.6 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1716.979	103.6	53.6	-47.9
2575.4685	108.3	53.6	-52.6
3433.958	96.0	53.6	-40.3
4292.4475	107.7	53.6	-52.0
5150.937	111.5	53.6	-55.8
6009.4265	108.4	53.6	-52.7
6867.916	103.1	53.6	-47.4
7726.4055	103.7	53.6	-48.0
8584.895	93.4	53.6	-37.7

Table 5-5: Conducted Spurious Emissions – 865.9875 MHz; Wide Band; Talk Around

Limit = 43 + 10 log (12.7) = 54.0 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1731.975	103.1	54.0	-47.4
2597.9625	106.3	54.0	-50.6
3463.95	108.9	54.0	-53.2
4329.9375	109.3	54.0	-53.6
5195.925	113.5	54.0	-57.8
6061.9125	107.0	54.0	-51.3
6927.9	103.6	54.0	-47.9
7793.8875	104.0	54.0	-48.3
8659.875	93.8	54.0	-38.1

Table 5-6: Conducted Spurious Emissions – 867.5125 MHz; Wide Band; Talk Around

Limit = 43 + 10 log (12.3) = 53.9 dBc

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1735.025	105.3	53.9	-49.6
2602.5375	103.8	53.9	-48.1
3470.05	109.8	53.9	-54.1
4337.5625	107.6	53.9	-51.9
5205.075	112.9	53.9	-57.2
6072.5875	105.6	53.9	-49.9
6940.1	102.9	53.9	-47.2
7807.6125	104.0	53.9	-48.3
8675.125	92.4	53.9	-36.7

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

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 40 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	12/12/06

Test Personnel:

Daniel Biggs	Daniel Biggs	September 20, 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.

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.

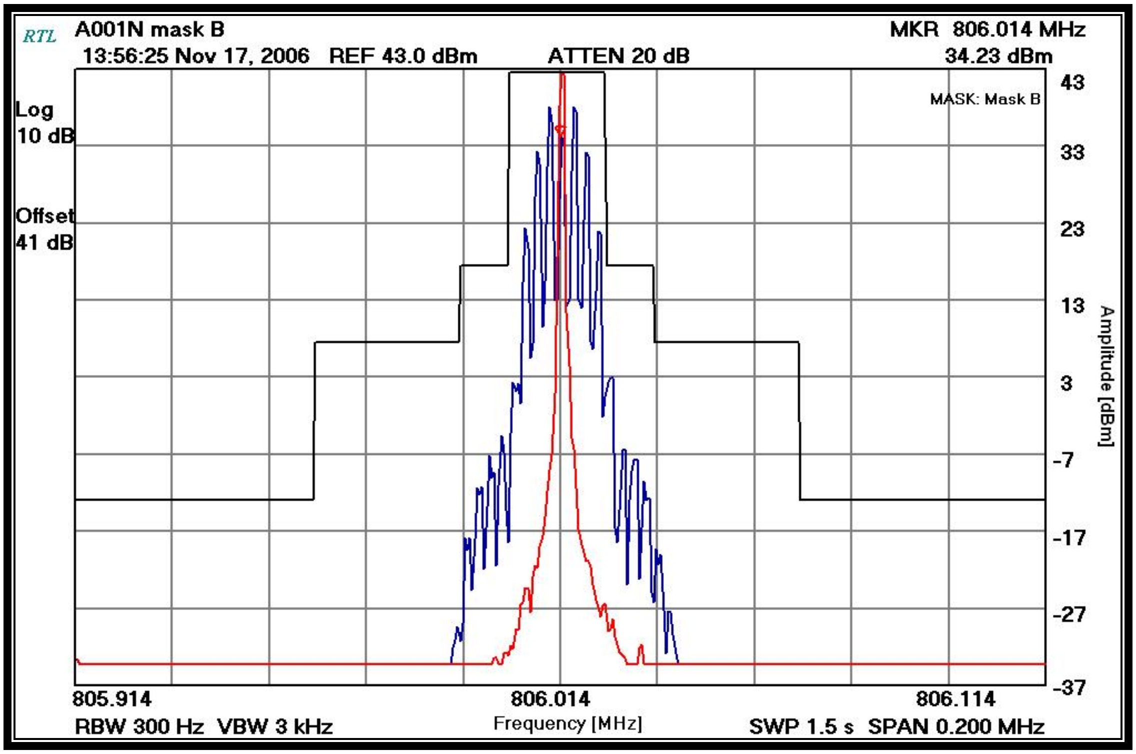
Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 19200 bps for OTP (OpenSky Trunking Protocol) mode.

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**.

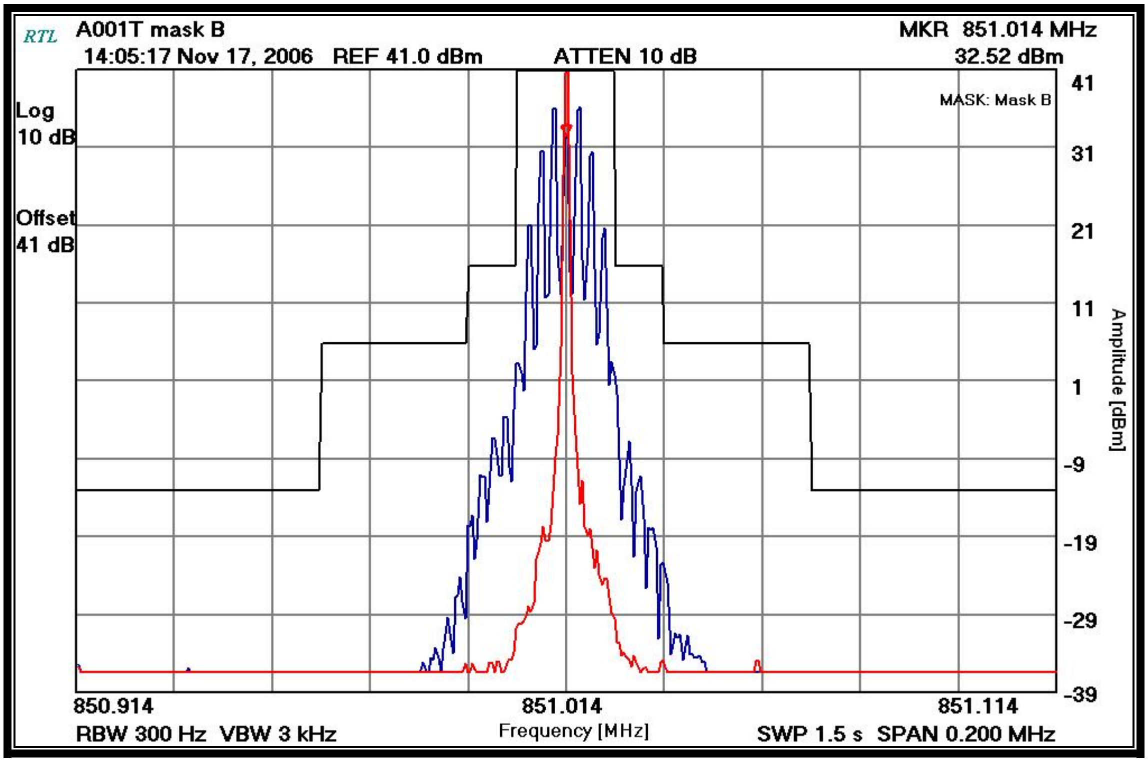
Limit Mask H:
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of 4 kHz or less: **zero dB**;
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 4 kHz, but not more 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 8.5 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

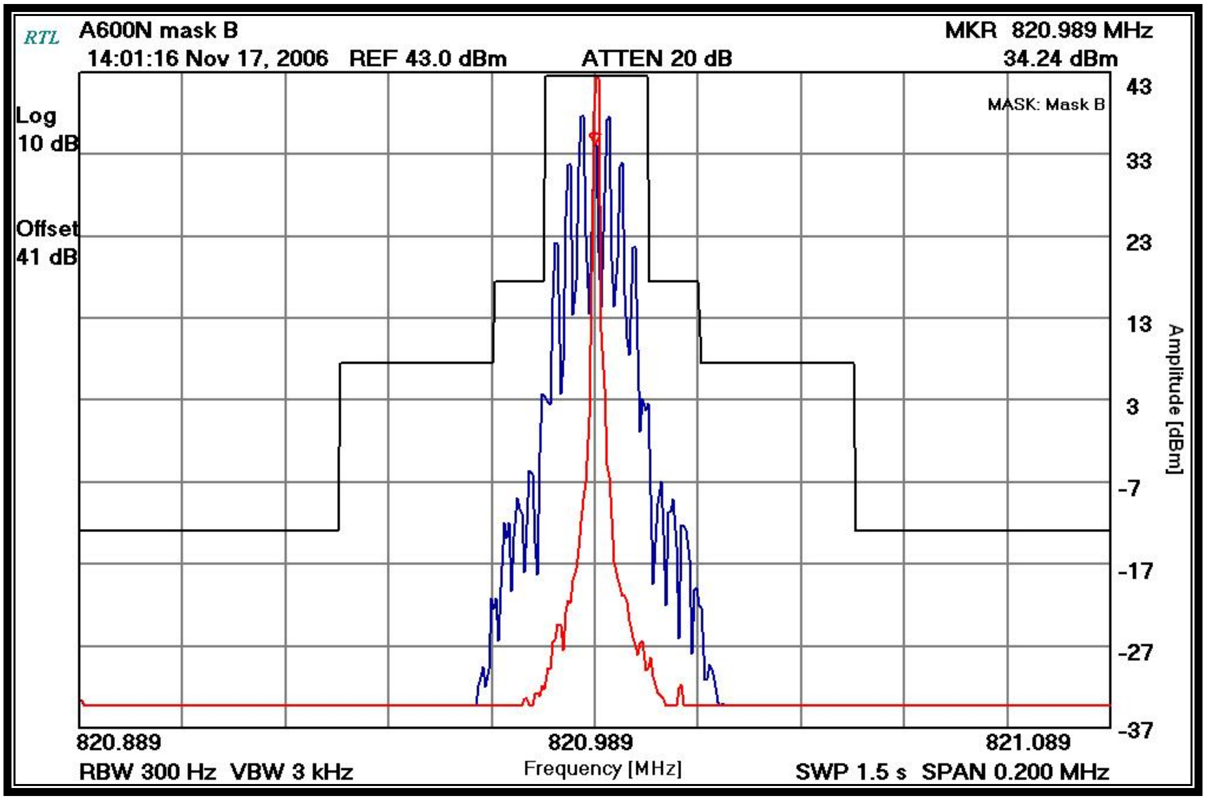
Plot 6-1: Occupied Bandwidth – 806.0125 MHz; Mask B; Analog; Normal



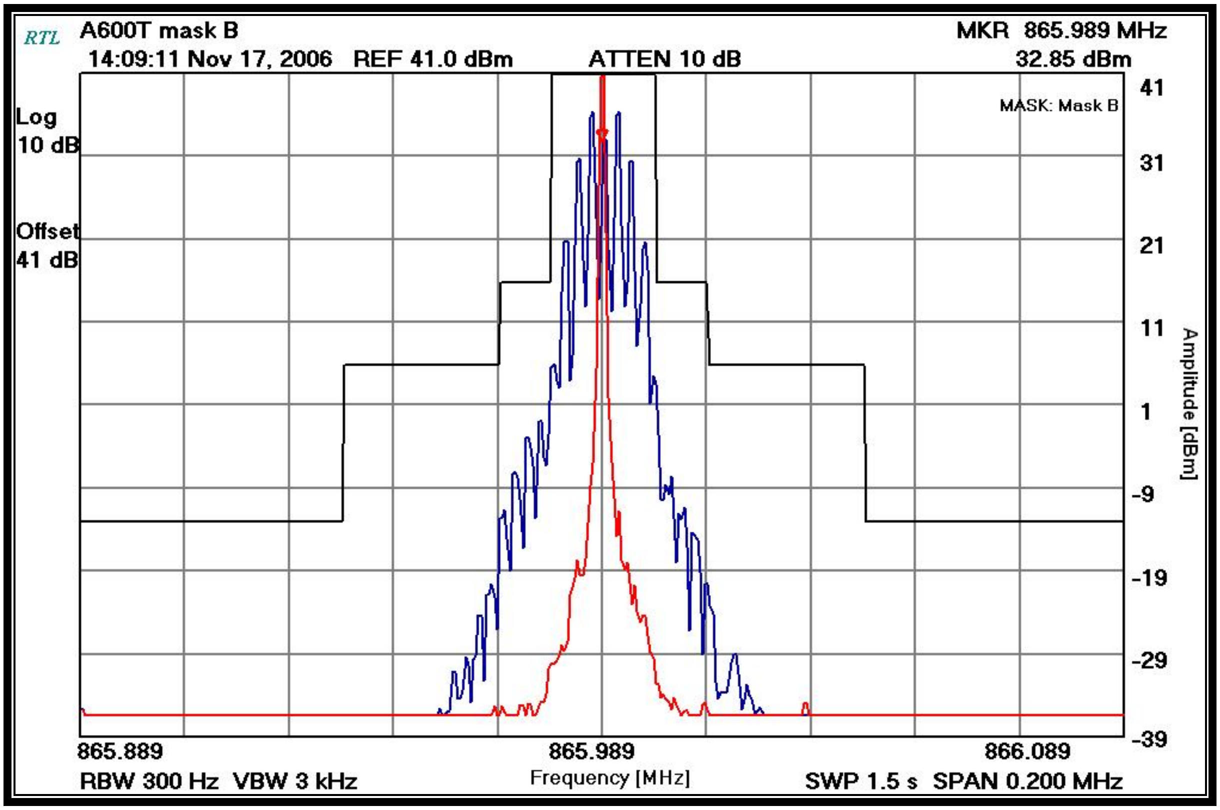
Plot 6-2: Occupied Bandwidth – 851.0125 MHz; Mask B; Analog; Talk Around



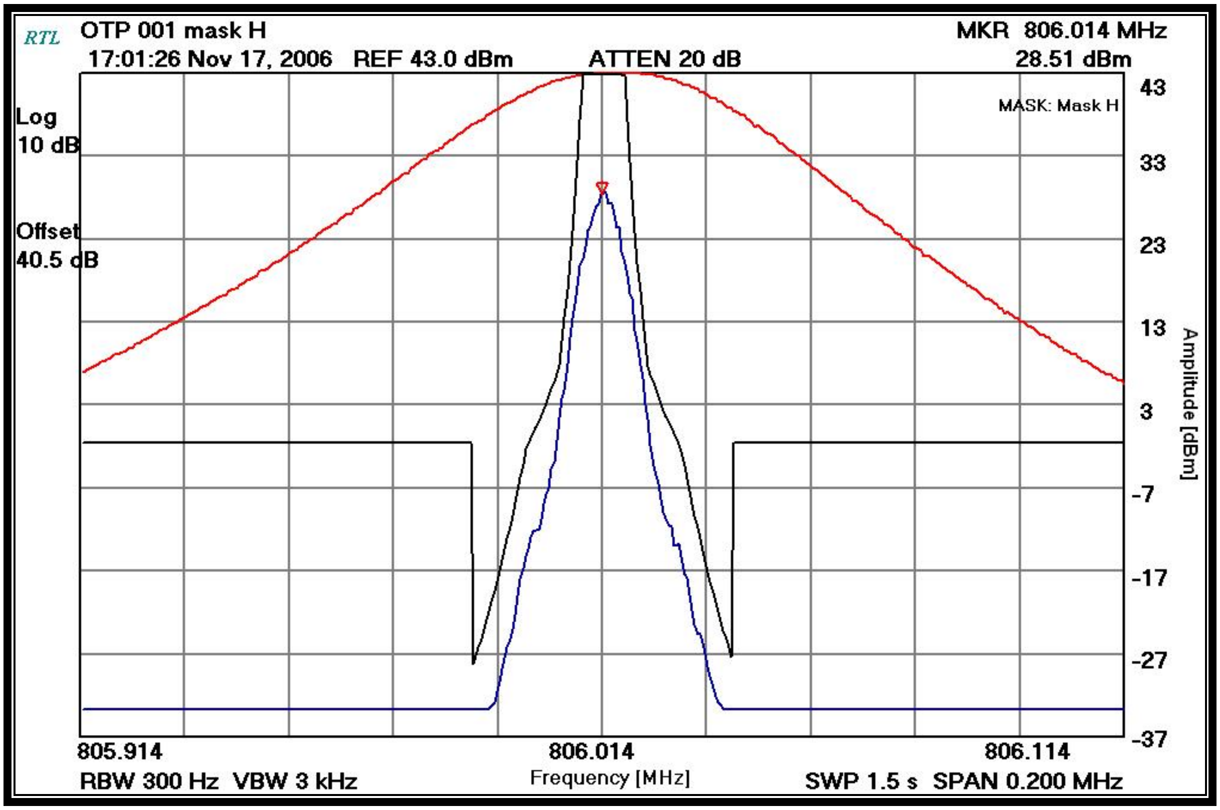
Plot 6-3: Occupied Bandwidth – 820.9875 MHz; Mask B; Analog; Normal



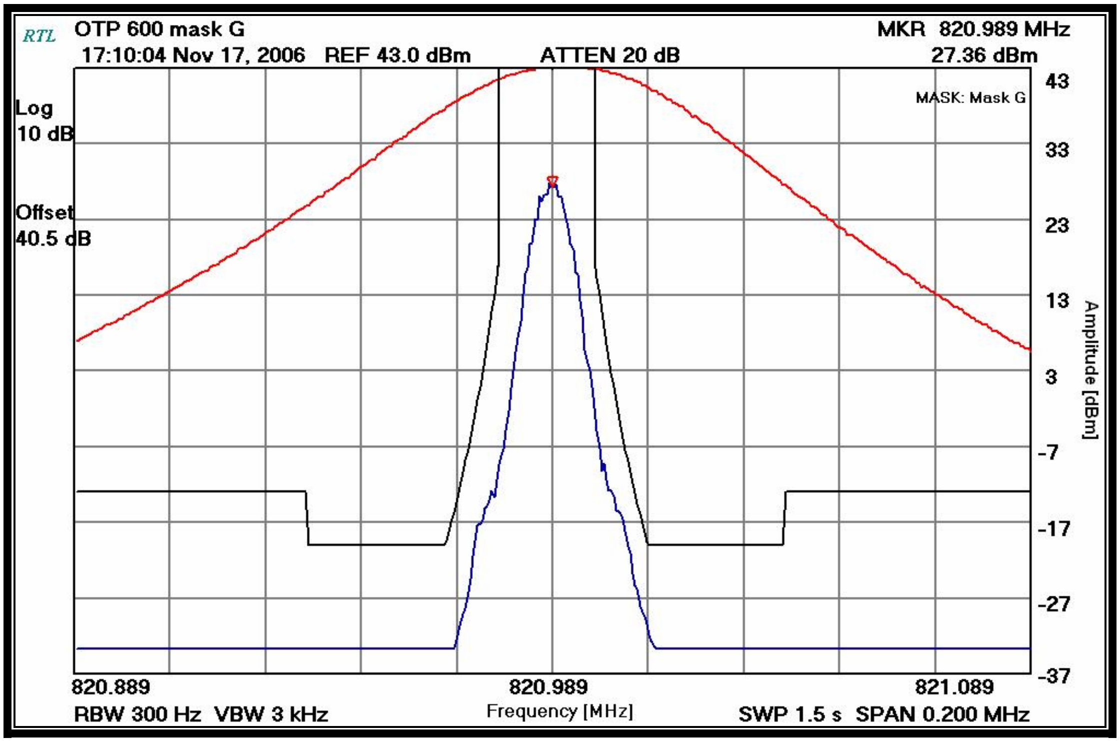
Plot 6-4: Occupied Bandwidth – 865.9875 MHz; Mask B; Analog; Talk Around



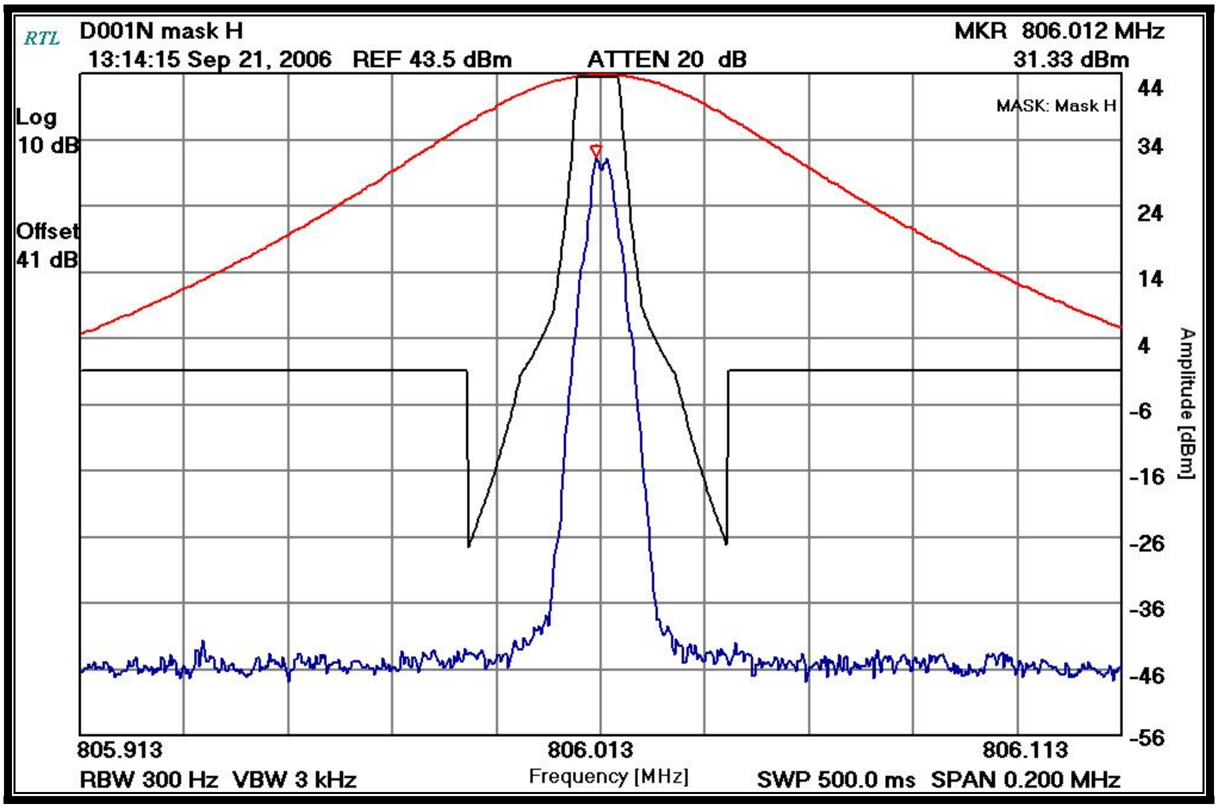
Plot 6-5: Occupied Bandwidth – 806.0125 MHz; Mask H; OTP; Normal



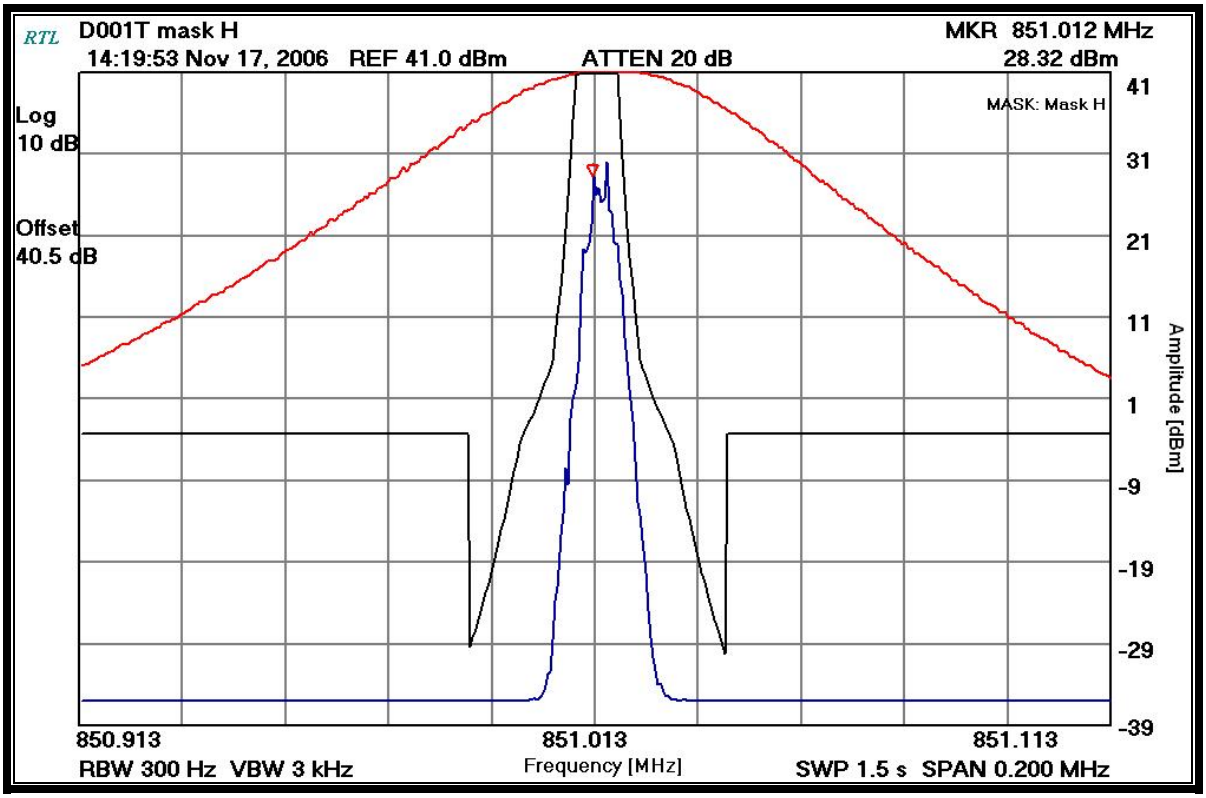
Plot 6-6: Occupied Bandwidth – 820.9875 MHz; Mask G; OTP; Normal



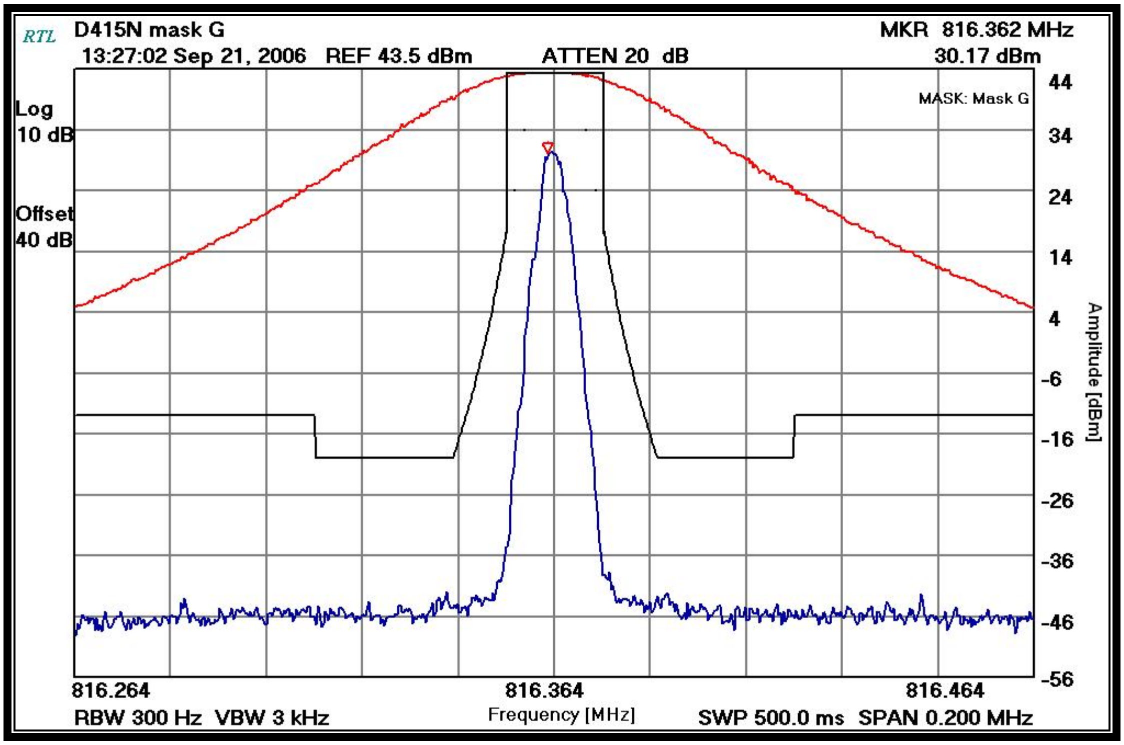
Plot 6-7: Occupied Bandwidth – 806.0125 MHz; Mask H; P25; Normal



Plot 6-8: Occupied Bandwidth – 851.0125 MHz; Mask H; P25; Talk Around



Plot 6-9: Occupied Bandwidth – 816.3635 MHz; Mask G; P25; Normal



Plot 6-10: Occupied Bandwidth – 865.9875 MHz; Mask G; P25; Talk Around

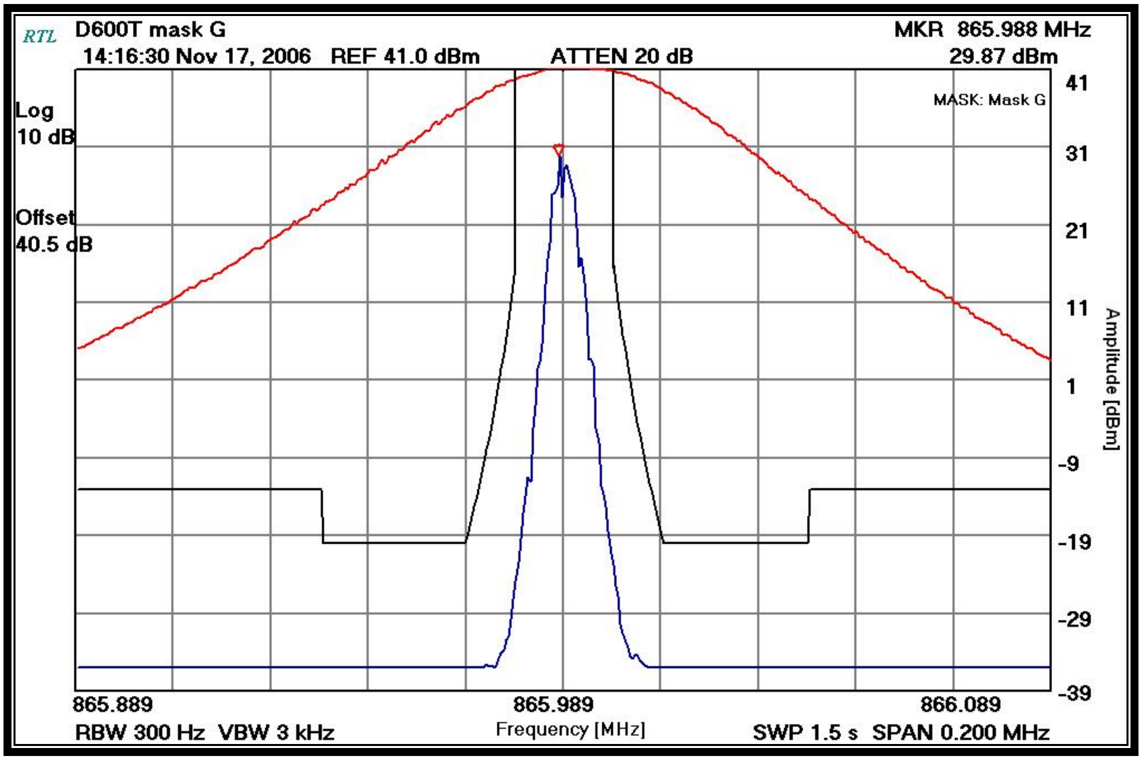


Table 6-1: Test Equipment for Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 40 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	Daniel Biggs	September 21 & November 17, 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.

P_d(dBm) = P_g(dBm) – cable loss (dB) + 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

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: 816.3635 MHz (High Power)

Limit = 43 + 10 log (19.8) = 56.0 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)
1632.8	V	59.9	-38.9	4.6	6.5	80.0	56.0	-24.0
2449.1	V	51.2	-46.5	5.8	7.5	87.8	56.0	-31.8
3265.5	V	57.8	-36.0	6.0	7.5	77.5	56.0	-21.5
4081.9	H	52.9	-39.4	6.0	8.4	80.0	56.0	-24.0
4898.3	H	53.0	-33.3	6.5	8.5	74.2	56.0	-18.3
5714.7	V	42.7	-42.3	7.7	9.3	83.7	56.0	-27.7
6531.1	H	46.3	-39.7	8.2	9.5	81.4	56.0	-25.4
7347.5	V	36.6	-45.9	9.0	9.2	88.7	56.0	-32.7
8163.9	H	34.6	-45.2	9.5	8.7	89.0	56.0	-33.0

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

Table 7-2: Field Strength of Spurious Radiation: 861.5000 MHz (High Power)

Limit = 43 + 10 log (12.5) = 54.0 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)
1722.7	V	52.7	-45.8	4.6	6.5	84.9	54.0	-31.0
2584.1	H	57.0	-42.5	5.8	7.3	84.0	54.0	-30.0
3445.5	H	50.3	-44.4	6.0	7.5	85.9	54.0	-31.9
4306.8	H	45.7	-46.1	6.0	8.4	86.7	54.0	-32.7
5168.2	H	47.8	-40.9	6.5	8.5	81.8	54.0	-27.9
6029.5	V	40.2	-47.1	7.7	9.3	86.5	54.0	-32.6
6890.9	V	45.4	-41.4	8.2	9.8	80.8	54.0	-26.8
7752.3	H	42.7	-40.3	9.0	8.9	83.4	54.0	-29.4
8613.6	V	34.8	-45.5	9.5	8.9	87.1	54.0	-33.2

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

Table 7-3: 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
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 40 GHz)	3826A00144	10/16/07
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	Daniel Biggs	October 5, 2006
Test Engineer	Signature	Date Of Tests

8 Conclusion

The data in this measurement report shows that the **M/A-COM, Inc**. Model: **M-803 Control Station, FCC ID: BV8MC803,** complies with all the applicable requirements of FCC Parts 90, 15 and 2 and Industry Canada RSS-119.