7 FCC Rules and Regulations Part 90 §90.543(c) and Part 2 §2.1053(a): Field Strength of Spurious Radiation

7.1 Test Procedure

ANSI/TIA/EIA-603-2002, Section 2.2.12.

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600 bps for P25 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.

Table 7-1: Field Strength of Spurious Radiation Channel A300N – 813.4875 MHz; SMR; High Power

Limit = 43 + 10 Log P = 56.8 dBc   Conducted Power = 43.78 dBm = 23.9 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1626.975	56.33	-28.7	1.3	4.94	68.8	-12.0
2440.4625	51.00	-41.2	1.5	6.64	79.8	-23.1
3253.95	45.80	-46.7	1.7	7.49	84.7	-27.9
4067.4375	42.50	-44.5	1.5	7.34	82.4	-25.7
4880.925	33.20	-54.2	1.8	7.84	91.9	-35.2
5694.4125	41.00	-46.3	2.2	8.24	84.0	-27.3
6507.9	31.30	-56.8	2.2	8.84	93.9	-37.2
7321.3875	33.20	-53.9	2.1	8.34	91.4	-34.7
8134.875	30.20	-56.4	2.5	7.44	95.2	-38.5

*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 Channel A715N – 822.5125 MHz; NPS; High Power

Limit = 43 + 10 Log P = 56.5 dBc Conducted Power = 43.5 dBm = 22.3 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1645.025	53.17	-31.4	1.0	4.94	71.0	-14.5
2467.5375	46.70	-44.8	1.3	6.64	82.9	-26.5
3290.05	42.20	-50.0	1.5	7.54	87.4	-31.0
4112.5625	42.20	-45.1	1.5	7.54	82.5	-26.1
4935.075	34.70	-52.9	1.5	7.74	90.1	-33.7
5757.5875	36.20	-50.8	2.0	8.44	87.8	-31.4
6580.1	30.20	-57.6	2.2	8.64	94.6	-38.2
7402.6125	33.50	-54.5	2.3	8.54	91.7	-35.3
8225.125	33.30	-49.9	2.8	7.94	88.2	-31.8

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

Table 7-3: Field Strength of Spurious Radiation Channel A300T – 858.4875 MHz; SMR; High Power

Limit = 43 + 10 Log P = 56.1 dBc Conducted Power = 43.1 dBm = 20.5 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1716.975	57.70	-27.4	1.2	4.94	66.8	-10.7
2575.4625	43.50	-47.5	1.2	7.04	84.8	-28.7
3433.95	53.30	-39.1	1.5	7.54	76.2	-20.1
4292.4375	55.70	-31.8	1.4	7.94	68.4	-12.3
5150.925	55.30	-31.1	2.0	7.74	68.5	-12.4
6009.4125	64.20	-22.5	1.7	8.64	58.7	-2.6
6867.9	59.50	-28.0	2.2	8.34	65.0	-8.9
7726.3875	59.80	-27.4	2.4	8.34	64.6	-8.5
8584.875	45.00	-38.0	2.3	8.44	75.0	-18.9

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

Table 7-4: Field Strength of Spurious Radiation Channel A715T – 867.5125 MHz; NPS; High Power

Limit = 43 + 10 Log P = 55.9 dBc   Conducted Power = 42.8 dBm = 19.4 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1735.025	58.30	-26.9	1.0	5.04	65.7	-9.9
2602.5375	50.30	-40.8	1.7	7.04	78.3	-22.5
3470.05	59.70	-32.6	1.8	7.54	69.7	-13.9
4337.5625	51.00	-36.6	1.5	7.84	73.1	-17.3
5205.075	62.50	-23.9	1.8	7.84	60.7	-4.9
6072.5875	57.50	-29.3	2.2	8.74	65.6	-9.8
6940.1	57.70	-30.5	2.2	7.84	67.7	-11.9
7807.6125	50.00	-37.4	2.3	7.84	74.7	-18.9
8675.125	42.70	-39.7	2.2	8.34	76.4	-20.6

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

Table 7-5: 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	09/20/06
900814	Electro-Metrics	EM-6961 (RGA-60)	Double Ridge Guide Antenna (1 - 18 GHz)	2310	2/17/06
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	N/A
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	09/14/06

TEST PERSONNEL:

Daniel Biggs		Sept. 30, 2005
Test Technician/Engineer	Signature	Date Of Test

8 FCC Rules and Regulations Part 90 §90.210(b, g, h): Emissions Masks and Part 2 §2.1049(c)(1): Occupied Bandwidth

Occupied Bandwidth: Provided that the ACCP requirements are met, the applicant may request any authorized bandwidth that does not exceed the channel size.

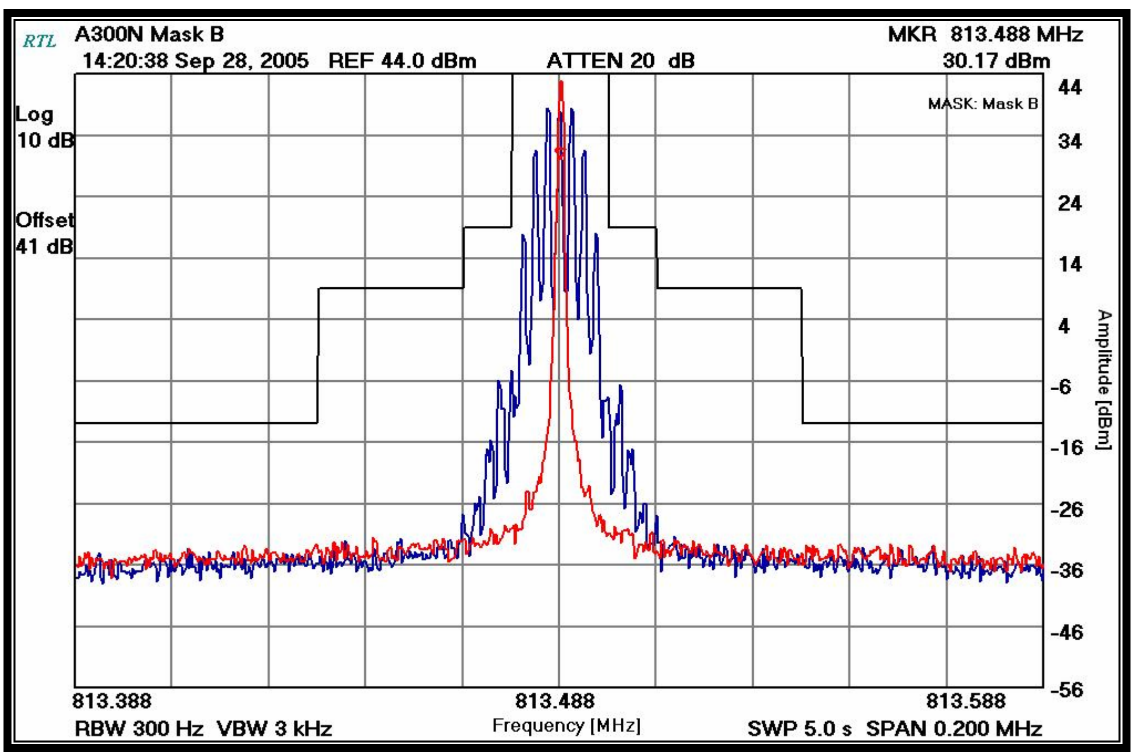
8.1 Test Procedure

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600 bps for P25 mode.

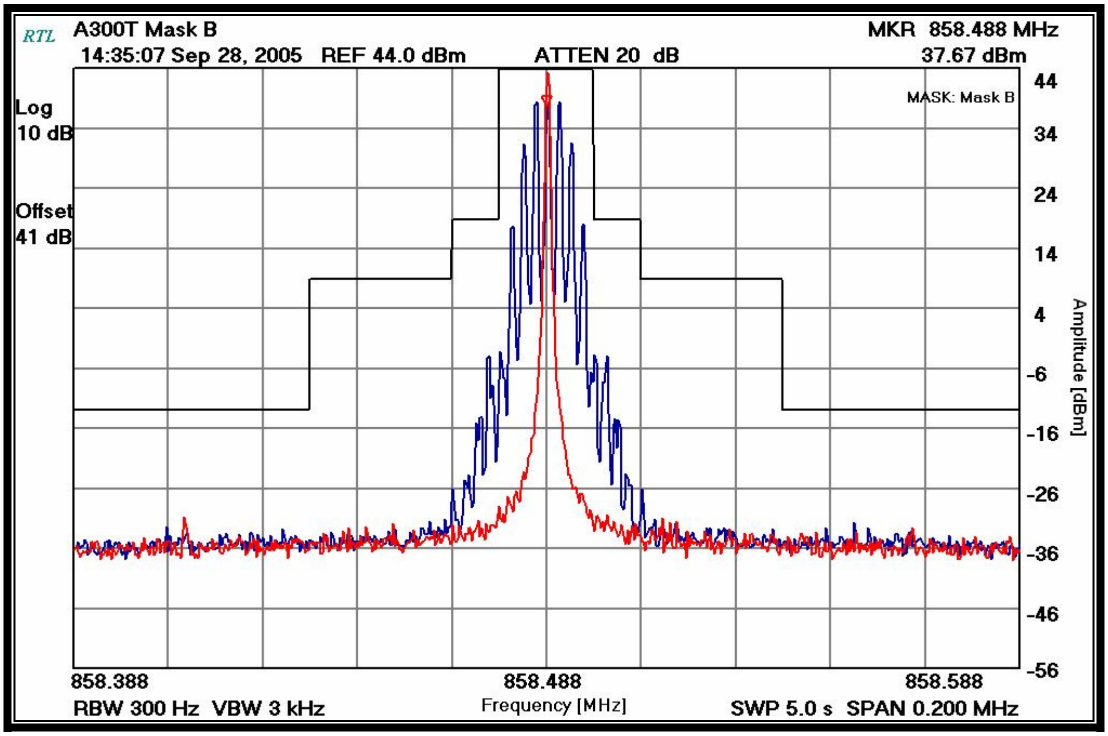
ANSI/TIA/EIA-603-2002, Section 2.2.11.

8.2 Test Data

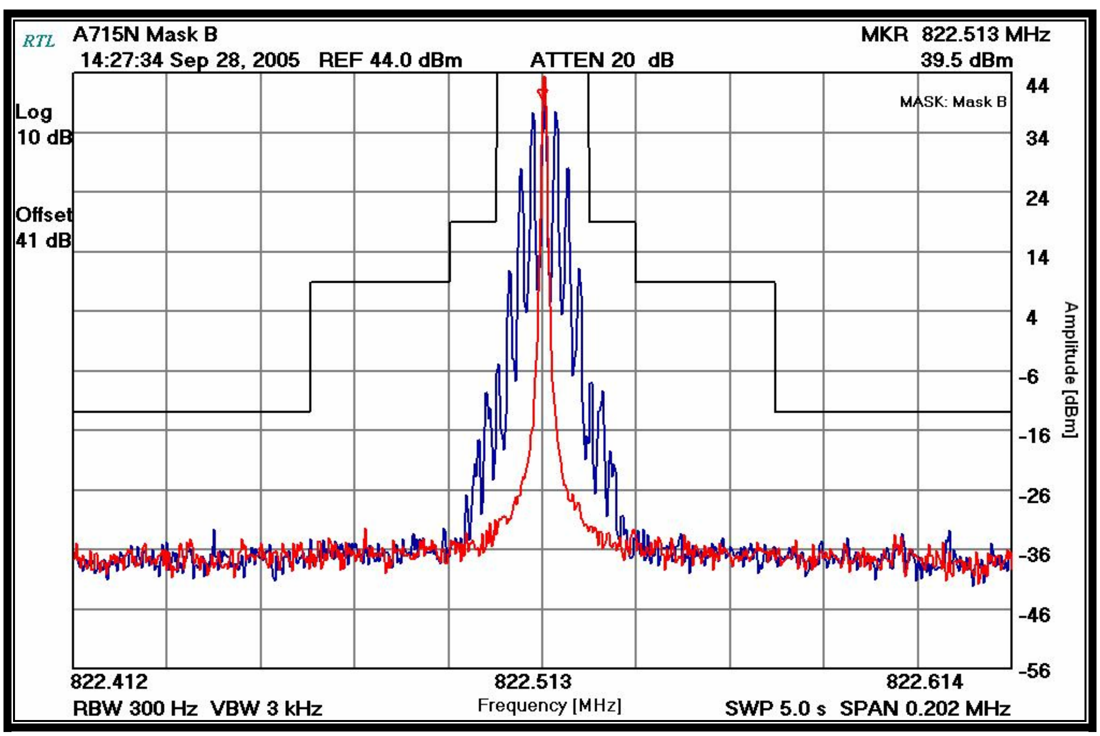
Plot 8-1: Occupied Bandwidth; SMR; Channel A300N



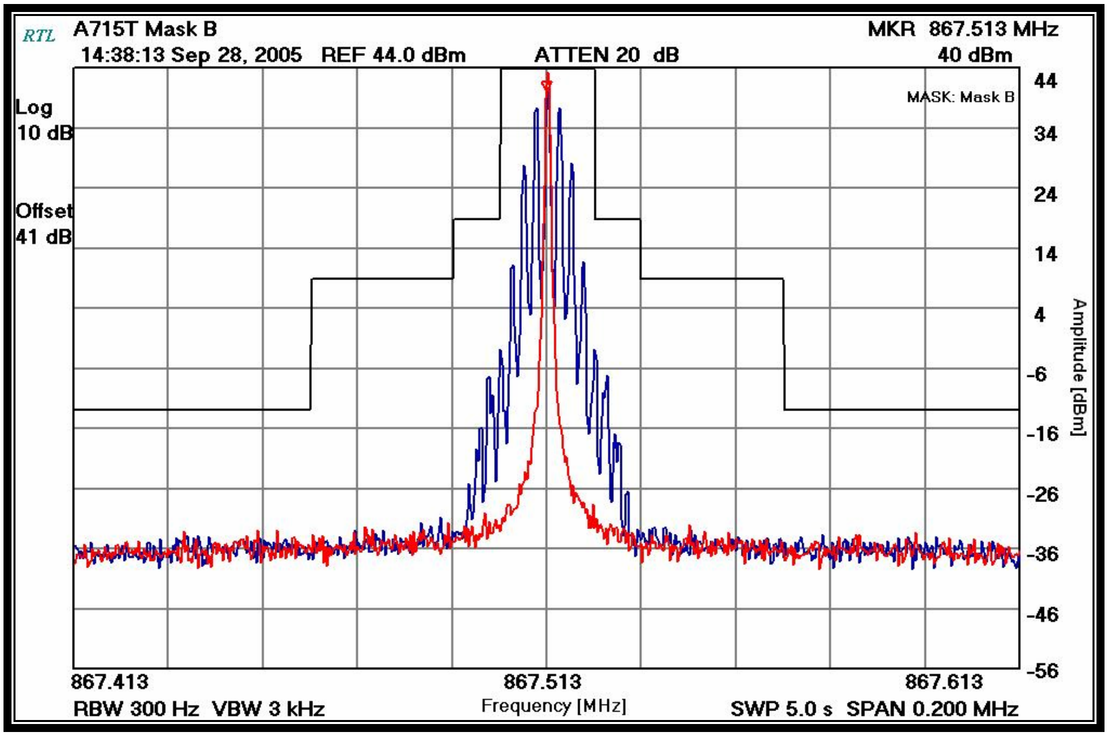
Plot 8-2: Occupied Bandwidth; SMR; Channel A300T



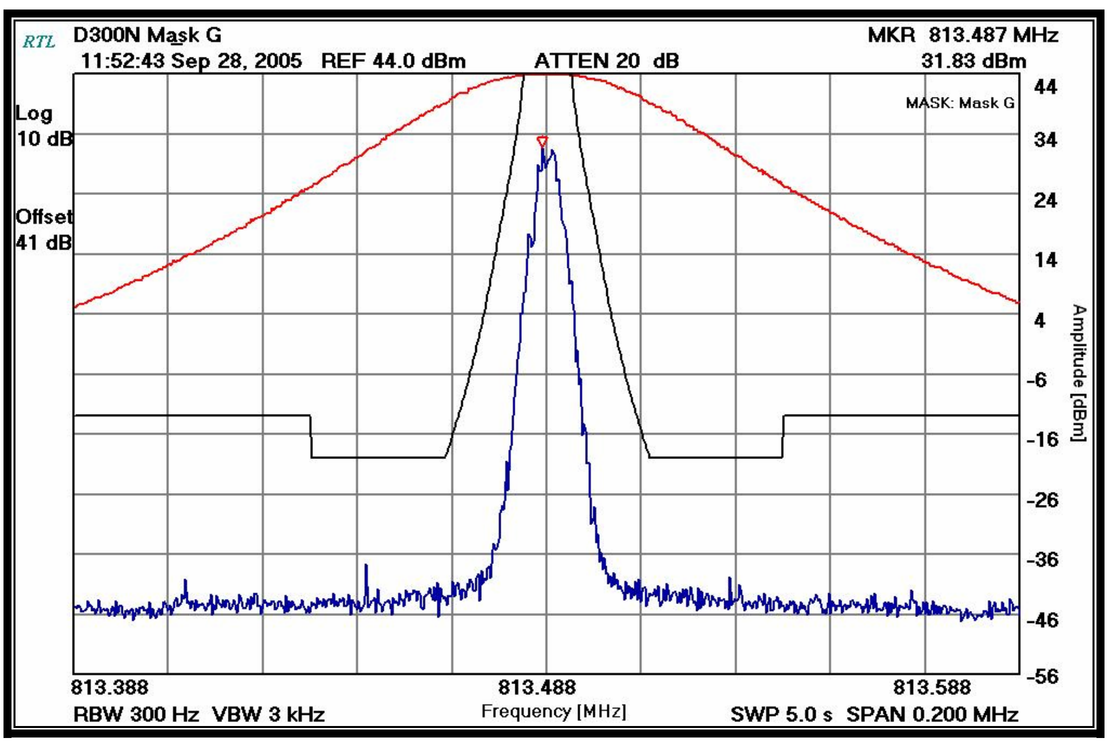
Plot 8-3: Occupied Bandwidth; NPSPAC; Channel A715N



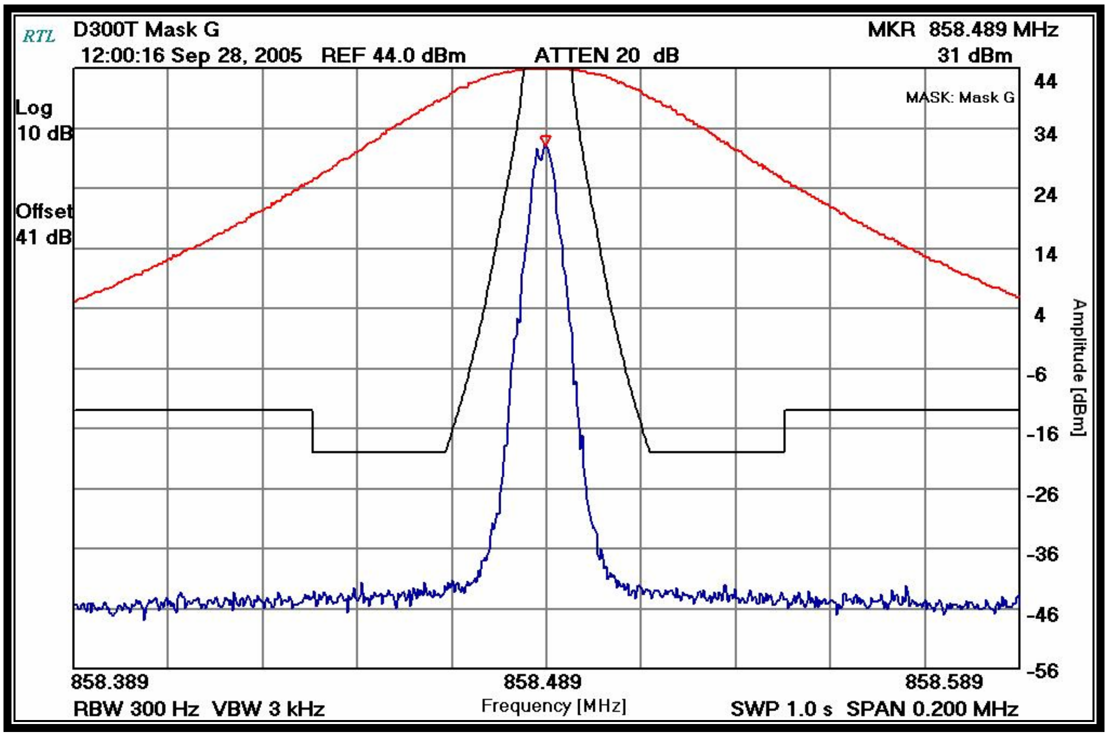
Plot 8-4: Occupied Bandwidth; NPSPAC; Channel A715T



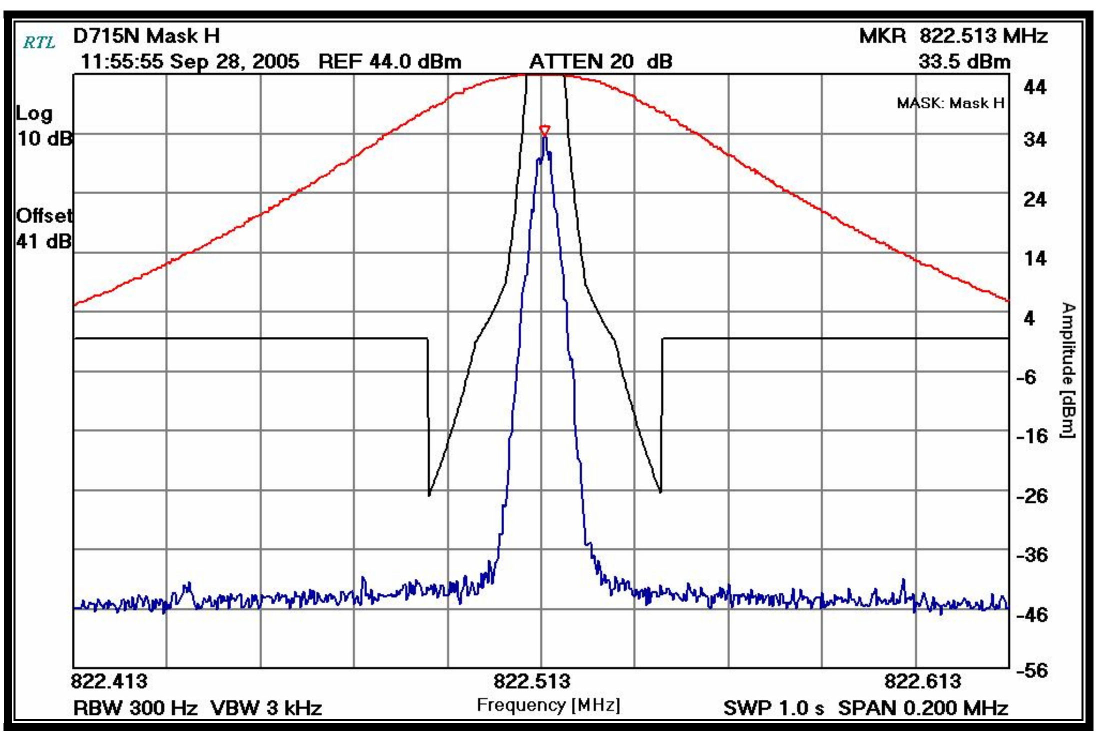
Plot 8-5: Occupied Bandwidth; SMR; Channel D300N



Plot 8-6: Occupied Bandwidth; SMR; Channel D300T



Plot 8-7: Occupied Bandwidth; NPSPAC; Channel D715N



Plot 8-8: Occupied Bandwidth; NPSPAC; Channel D715T

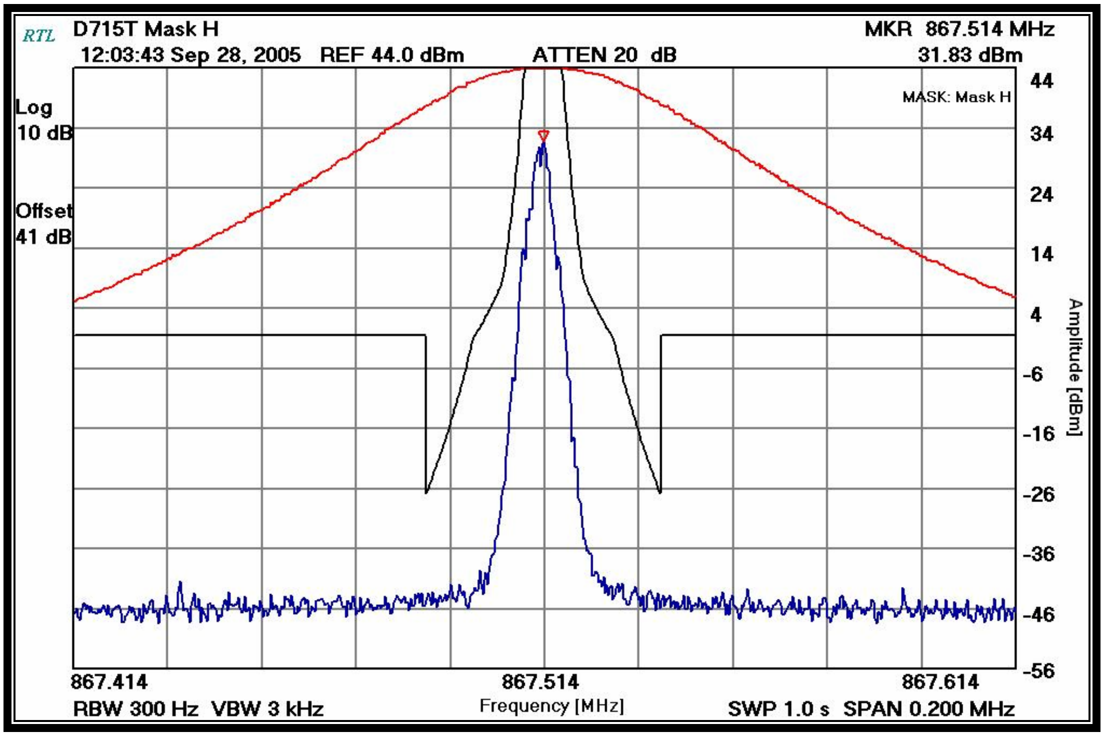


Table 8-1: Test Equipment for Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz - 12.8 GHz)	3826A00144	09/22/06

TEST PERSONNEL:

Daniel Biggs	Daniel Biggs	Sept. 28, 2005
Test Technician/Engineer	Signature	Date Of Test

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

Type of Emission: F3E

OCF SMR Voice – 25 kHz channel spacing - (806-821/861-866 MHz)
Calculation:
Max modulation (M) in kHz: 3.0
Max deviation (D) in kHz: 5
Constant factor (K): 1 (assumed)
Bn = 2xM+2xDK = 16.0 kHz
Emission designator: 16K0F3E

OCF NPSPAC Voice – 12.5 kHz channel spacing - (821-824/866-869 MHz)
Calculation:
Max modulation (M) in kHz: 3.0
Max deviation (D) in kHz: 4
Constant factor (K): 1 (assumed)
Bn = 2xM+2xDK = 14.0 kHz
Emission designator: 14K0F3E

Type of Emission: F1D, F1E

P25 – SMR -9600 bps:
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1800
Bn = [9600/$\log_2(4)$ + 2 (1800) (1) = 8.400 kHz
Emission designator: 8K4F1D, 8K4F1E

P25 – NPSPAC - 9600 bps:
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1800
Bn = [9600/$\log_2(4)$ + 2 (1800) (1) = 8.400 kHz
Emission designator: 8K4F1D, 8K4F1E

10 FCC Rules and Regulations Part 15 §15.109: Radiated Emissions Limits

10.1 Amendments to Emissions Test Methodology

10.1.1 Deviations from Test Methodology

There was no deviation from, additions to, or exclusions from, ANSI C63.4: 2003.

10.2 Radiated Emissions Measurements

10.2.1 Site and Test Description

Before final radiated emissions measurements were made on the OATS, the EUT was scanned indoors at both one and three meter distances. This was done in order to determine its emission spectrum signal. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emission measurements on the OATS, at each frequency, in order to ensure that maximum emission amplitudes were measured.

Final radiated emissions measurements were made on the OATS at a distance of 3 meters. The EUT was placed on a nonconductive turntable at a height of 1 meter.

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emissions maximum levels. Measurements were taken using both horizontal and vertical antenna polarization. The spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

10.2.2 Field Strength Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FI(dB\mu V/m) = SAR(dB\mu V) + SCF(dB/m)$$

FI = Field Intensity

SAR = Spectrum Analyzer Reading

SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

$$SCF(dB/m) = -PG(dB) + AF(dB/m) + CL(dB)$$

SCF = Site Correction Factor

PG = Pre-Amplifier Gain

AF = Antenna Factor

CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(\mu V/m) = 10^{FI(dB\mu V/m)/20}$$

For example, assume a signal frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is –11.5 dB/m. The actual radiated field strength is calculated as follows:

$$49.3 dB\mu V - 11.5 dB/m = 37.8 dB\mu V/m$$

$$10^{37.8/20} = 10^{1.89} = 77.6 \mu V/m$$

10.2.3 Measurement Uncertainty

Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech Quality Manual, Section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

10.2.4 Test Limits

FCC Class B Radiated Emissions	
Frequency (MHz)	**At 3m (dBμV/m)**
30-88	40.0
88-216	43.5
216-960	46.0
> 1000	54

10.2.5 Radiated Emissions Data – Mode RX/Standby, Limit/Distance FCC B/3M

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
57.600	Qp	V	270	1.0	50.7	-25.8	24.9	40.0	-15.1
80.011	Qp	V	30	1.0	63.0	-24.8	38.2	40.0	-1.8
80.025	Qp	H	180	2.0	58.5	-24.3	34.2	40.0	-5.8
180.020	Qp	H	270	1.5	45.4	-20.8	24.6	43.5	-18.9
240.025	Qp	H	270	1.0	53.7	-17.6	36.1	46.0	-9.9
300.045	Qp	H	310	1.5	50.2	-15.8	34.4	46.0	-11.6
300.050	Qp	H	160	1.0	53.8	-15.8	38.0	46.0	-8.0
400.063	Qp	H	160	1.0	47.6	-12.2	35.4	46.0	-10.6
500.076	Qp	H	180	1.5	42.7	-9.5	33.2	46.0	-12.8
700.107	Qp	H	180	1.0	42.5	-6.4	36.1	46.0	-9.9
700.107	Qp	V	30	1.5	43.2	-7.2	36.0	46.0	-10.0
900.138	Qp	H	30	1.0	35.4	-2.9	32.5	46.0	-13.5
921.012	Qp	H	0	1.0	34.8	-2.9	31.9	46.0	-14.1
935.998	Qp	H	0	1.0	37.1	-2.8	34.3	46.0	-11.7
935.998	Qp	H	0	1.0	37.1	-2.8	34.3	46.0	-11.7

TEST PERSONNEL:

Daniel Biggs		Sept. 30, 2005
Test Technician/Engineer	Signature	Date Of Test

11 Conclusion

The data in this measurement report shows that the **M/A-COM, Inc**. Model **OpenSky M-803 Mobile Radio; FCC ID: BV8M803M** complies with all the requirements of Parts 90, 15 and 2 of the FCC Rules.