



Engineering and Testing for EMC and Safety Compliance

Class II Permissive Change Report

M/A-Com Inc.
221 Jefferson Ridge Parkway
Lynchburg, VA 24501
Contact: Daryl Popowitch
E-mail: popowitda@tycoelectronics.com
Phone: 434-455-9527
Fax: 434-455-6656

MODEL: M7100 800 MHz Mobile Radio

FCC ID: OWDTR-0022-E
IC: 3636B-0022

November 12, 2004

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 2003	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 90: 2003	PRIVATE LAND PORTABLE RADIO SERVICES
ANSI C63.4-2003	AMERICAN NATIONAL STANDARD FOR METHODS OF MEASUREMENT OF RADIO NOISE EMISSIONS FROM LOW -VOLTAGE ELECTRICAL AND ELECTRONIC EQUIPMENT IN THE RANGE OF 9 KHz – 40 GHz
ANSI/TIA/EIA603-2002	LAND PORTABLE FM OR PM COMMUNICATIONS EQUIPMENT - MEASUREMENT AND PERFORMANCE STANDARDS
ANSI/TIA/EIA – 102.CAAA; 2002	DIGITAL C4FM/CQPSK TRANSCEIVER MEASUREMENT METHODS
RSS-119; ISSUE 6; 2000	LAND PORTABLE AND FIXED RADIO TRANSMITTERS AND RECEIVERS 27.41 TO 960.0 MHz

Report Prepared by: Daniel Biggs

Document Number: 2004196/QRTL04-384

*This report may not be reproduced, except in full, without the full written approval of Rhein Tech Laboratories, Inc.
Test results relate only to the item tested.*



Engineering and Testing for EMC and Safety Compliance

CONFORMANCE STATEMENT

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 2003	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 90: 2003	PRIVATE LAND PORTABLE RADIO SERVICES
ANSI C63.4-2003	AMERICAN NATIONAL STANDARD FOR METHODS OF MEASUREMENT OF RADIO NOISE EMISSIONS FROM LOW -VOLTAGE ELECTRICAL AND ELECTRONIC EQUIPMENT IN THE RANGE OF 9 kHz – 40 GHz
ANSI/TIA/EIA603-2002	LAND PORTABLE FM OR PM COMMUNICATIONS EQUIPMENT - MEASUREMENT AND PERFORMANCE STANDARDS
ANSI/TIA/EIA – 102.CAAA; 2002	DIGITAL C4FM/CQPSK TRANSCEIVER MEASUREMENT METHODS
RSS-119; ISSUE 6; 2000	LAND PORTABLE AND FIXED RADIO TRANSMITTERS AND RECEIVERS 27.41 TO 960.0 MHz

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to or exclusions from the FCC Part 2, FCC Part 15, FCC Part 90, and ANSI C63.4.

Signature: _____

Typed/Printed Name: Desmond A. Fraser

Date: November 12, 2004

Position: President, Rhein Tech Laboratories

Signature: _____

Typed/Printed Name: Daniel Biggs

Date: November 12, 2004

Position: EMC Test Engineer

Table of Contents

1	GENERAL INFORMATION	5
1.1	SCOPE	5
1.2	TEST FACILITY	5
1.3	RELATED SUBMITTAL(S)/GRANT(S)	5
1.4	DESCRIPTION OF CHANGE IN DEVICE	5
1.5	PRODUCT DESCRIPTION	5
1.6	TEST SETUP DIAGRAM	6
2	RF POWER OUTPUT: FCC RULES AND REGULATIONS PART 2 §2.1046 (A), PART 90 §90.205(I), PART 90 §90.635(D), IC RSS-119 §6.2	7
2.1	TEST PROCEDURE	7
2.2	TEST LIMIT	7
2.3	TEST RESULTS	7
3	SPURIOUS EMISSIONS AT ANTENNA TERMINALS: FCC RULES AND REGULATIONS PART 2 §2.1051, IC RSS-119 §6.3	8
3.1	TEST PROCEDURE	8
3.2	TEST LIMIT	8
3.2	TEST RESULTS	8
4	FIELD STRENGTH OF SPURIOUS RADIATION: FCC RULES AND REGULATIONS PART 2 §2.1053 (A), IC RSS-119 §6.3	10
4.1	TEST PROCEDURE	10
4.2	TEST RESULTS	10
5	OCCUPIED BANDWIDTH, BANDWIDTH LIMITATIONS, AND EMISSIONS MASKS: FCC RULES AND REGULATIONS PART 2 §2.1049, PART §90.209(B), AND PART §90.210, IC RSS-119 §6.4	12
5.1	TEST PROCEDURE	12
5.2	TEST LIMITS	12
5.3	TEST RESULTS	12
6	CONCLUSION	17

TABLE INDEX

TABLE 1:	EQUIPMENT UNDER TEST (EUT).....	5
TABLE 2:	SUPPORT EQUIPMENT.....	5
TABLE 3:	RF OUTPUT POWER TEST DATA.....	7
TABLE 4:	TEST EQUIPMENT - RF POWER OUTPUT.....	7
TABLE 5:	CONDUCTED SPURIOUS EMISSIONS – 806.0 MHZ.....	8
TABLE 6:	CONDUCTED SPURIOUS EMISSIONS – 851.0 MHZ.....	9
TABLE 7:	CONDUCTED SPURIOUS EMISSIONS – 870.0 MHZ.....	9
TABLE 8:	TEST EQUIPMENT - CONDUCTED SPURIOUS EMISSIONS.....	9
TABLE 9:	RADIATED SPURIOUS EMISSIONS – 851.0 MHZ – HIGH POWER.....	10
TABLE 10:	TEST EQUIPMENT - RADIATED SPURIOUS EMISSIONS.....	11
TABLE 11:	TEST EQUIPMENT - BANDWIDTH LIMITATIONS.....	16

PLOT INDEX

PLOT 1:	806.0 MHZ NPS DATA – MASK G.....	12
PLOT 2:	806.0 MHZ NPS DATA – MASK EA.....	13
PLOT 3:	851.0 MHZ NPS DATA – MASK G.....	14
PLOT 4:	851.0 MHZ NPS DATA – MASK EA.....	15
PLOT 5:	870.0 MHZ NPS DATA – MASK H.....	16

APPENDIX INDEX

APPENDIX A:	AGENCY AUTHORIZATION LETTER.....	18
APPENDIX B:	CONFIDENTIALITY REQUEST.....	19
APPENDIX C:	DESCRIPTION OF CHANGE / OPERATIONAL DESCRIPTION.....	20
APPENDIX D:	BLOCK DIAGRAMS.....	21
APPENDIX E:	SCHEMATICS.....	22
APPENDIX F:	PARTS LIST.....	23
APPENDIX G:	TEST PHOTOGRAPHS.....	24
APPENDIX H:	INTERNAL PHOTOGRAPHS.....	27

PHOTOGRAPH INDEX

PHOTOGRAPH 1:	CONDUCTED SPURIOUS/EMISSIONS MASKS MEASUREMENTS.....	24
PHOTOGRAPH 2:	RADIATED EMISSIONS – FRONT VIEW.....	25
PHOTOGRAPH 3:	RADIATED EMISSIONS – BACK VIEW.....	26
PHOTOGRAPH 4:	TOP COVER AND INNER SHIELD REMOVED.....	27
PHOTOGRAPH 5:	AUDIO LOGIC BOARD COMPONENT SIDE COMPLETE VIEW.....	28
PHOTOGRAPH 6:	AUDIO LOGIC BOARD SOLDER SIDE COMPLETE VIEW.....	29
PHOTOGRAPH 7:	AUDIO LOGIC BOARD COMPONENT SIDE – LEFT.....	30
PHOTOGRAPH 8:	AUDIO LOGIC BOARD COMPONENT SIDE – RIGHT.....	31

1 GENERAL INFORMATION

1.1 SCOPE

FCC Rules Part 90: Private Land Mobile Radio Services that are in operation within the band of 806-870 MHz.

1.2 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.3 RELATED SUBMITTAL(S)/GRANT(S)

This is a Class II permissive change report for the original certification for FCC ID: OWDTR-0022-E, granted on June 28, 2004.

1.4 DESCRIPTION OF CHANGE IN DEVICE

This Class II application for the M7100 800 MHz, FCC ID: OWDTR-0022-E, Model # RU101188V131, is for a customized version, the M7100 800 MHz Data Unit, Model # RU102917V1. It utilizes the certified M7100 800 MHz with an A/D Option board installed. It has been designed to use an external modulation source with specific characteristics, which are defined in detail in Appendix C of this test report.

1.5 PRODUCT DESCRIPTION

The EUT is a mobile transceiver that operates in the 806-870 MHz band. The rated RF output power is programmable to 35 watts. The radio supports analog, digital voice, and digital data operation.

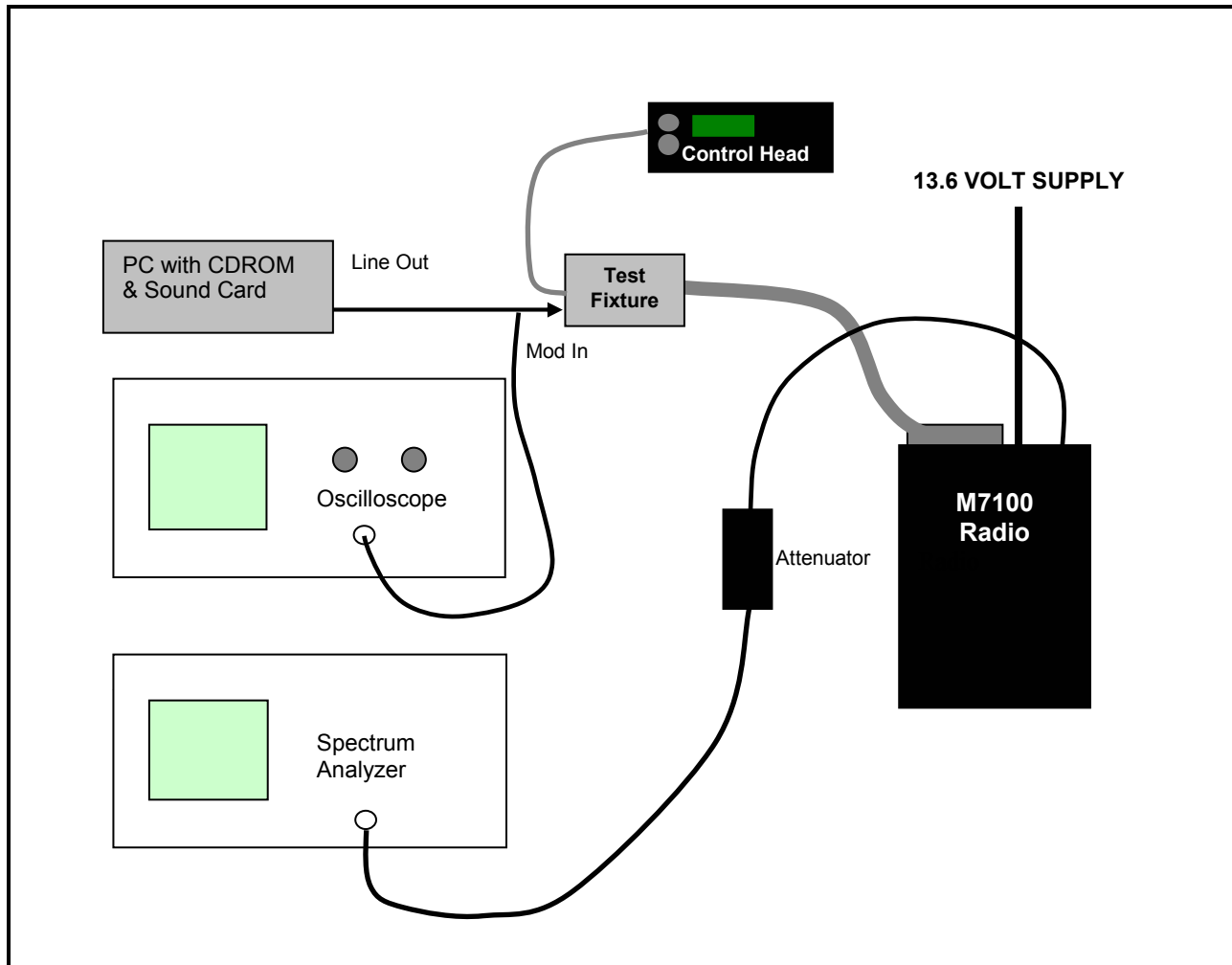
TABLE 1: EQUIPMENT UNDER TEST (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Barcode	Test Sample Received
800 MHz Mobile Radio	M/A Com, Inc.	M7100	ET28L22U	OWDTR-0022-E	802622P1	16273	11/5/04
Control Head	M/A Com, Inc.	KRY1011632/14	RP23694	N/A	DB-25 pin unshielded	16272	11/5/04

TABLE 2: SUPPORT EQUIPMENT

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Barcode	Test Sample Received
Test Fixture	M/A Com, Inc.	N/A	N/A	N/A	DB-37 unshielded data and coaxial audio cable	16268	11/5/04
Laptop PC	Gateway	N/A	N/A	N/A	N/A	N/A	N/A

1.6 TEST SETUP DIAGRAM



2 RF POWER OUTPUT: FCC RULES AND REGULATIONS PART 2 §2.1046 (A), PART 90 §90.205(I), PART 90 §90.635(D), IC RSS-119 §6.2

2.1 TEST PROCEDURE

The EUT was connected to a power meter through a calibrated coaxial attenuator having a 50 Ω load impedance. Power was measured with the EUT placed in an unmodulated state.

2.2 TEST LIMIT

Per FCC Part Rules §90.635(d): The maximum output power of the transmitter for mobile stations is 100 W (20 dBw).

2.3 TEST RESULTS

The following channels (in MHz) were tested: 806.0, 851.0, and 870.0. Peak and average output power levels are shown.

TABLE 3: RF OUTPUT POWER TEST DATA

Frequency (MHz)	Channel	Mode	Average Level (dBm)	Average Level (W)	Peak Level (dBm)	Peak Level (W)
806	1	High Power	45.60	36.30	45.67	36.90
851	2	High Power	45.68	36.98	45.73	37.41
870	3	High Power	45.68	36.98	46.73	37.41

*Measurement accuracy: +/- 3%

TABLE 4: TEST EQUIPMENT - RF POWER OUTPUT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	8/2/05
901186	Agilent Technologies	E9323A (50 MHz-6 GHz)	Peak & Average Power Sensor	US40410380	8/2/05

Daniel Biggs		November 8, 2004
Test Engineer	Signature	Date Of Test

3 SPURIOUS EMISSIONS AT ANTENNA TERMINALS: FCC RULES AND REGULATIONS PART 2 §2.1051, IC RSS-119 §6.3

3.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, Section 2.2.13

The transmitter was terminated with a 50 Ω load and interfaced with a spectrum analyzer. The transmitter was modulated with a

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

2.2 TEST LIMIT

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

Limits: Mask H (dBm): $P(\text{dBm}) - (50 + 10 \times \text{LOG } P(\text{W}))$

3.2 TEST RESULTS

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

The following channels (in MHz) were investigated: 806.0, 851.0, and 870.0. Emissions were checked in all modes and the worst case mode/emissions are provided. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

TABLE 5: CONDUCTED SPURIOUS EMISSIONS – 806.0 MHZ

25 kHz channel spacing; Conducted power = 38.1 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1612	85.47	58.67	-26.80
2418	87.87	58.67	-29.20
3224	93.09	58.67	-34.42
4030	74.07	58.67	-15.40
4836	81.69	58.67	-23.02
5642	84.16	58.67	-25.49
6448	112.04	58.67	-53.37
7254	98.69	58.67	-40.02
8060	109.92	58.67	-51.25

TABLE 6: CONDUCTED SPURIOUS EMISSIONS – 851.0 MHZ

25 kHz channel spacing; Conducted power = 39.1 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1702	88.73	58.68	-30.05
2553	86.85	58.68	-28.17
3404	82.53	58.68	-23.85
4255	70.33	58.68	-11.65
5106	74.97	58.68	-16.29
5957	111.39	58.68	-52.71
6808	109.14	58.68	-50.46
7659	100.42	58.68	-41.74
8510	90.72	58.68	-32.04

TABLE 7: CONDUCTED SPURIOUS EMISSIONS – 870.0 MHZ

12.5 kHz channel spacing; Conducted power = 39.9 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
1740	96.38	58.68	-37.70
2610	99.61	58.68	-40.93
3480	89.25	58.68	-30.57
4350	70.44	58.68	-11.76
5220	63.73	58.68	-5.05
6090	95.81	58.68	-37.13
6960	91.03	58.68	-32.35
7830	104.12	58.68	-45.44
8700	100.40	58.68	-41.72

TABLE 8: TEST EQUIPMENT - CONDUCTED SPURIOUS EMISSIONS

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	08/11/05
901215	Hewlett Packard	8596E M	Portable Spectrum Analyzer (9 kHz – 12.8 GHz)	3826A00144	09/08/05

Daniel Biggs		November 9, 2004
Test Engineer	Signature	Date Of Test

4 FIELD STRENGTH OF SPURIOUS RADIATION: FCC RULES AND REGULATIONS PART 2 §2.1053 (A), IC RSS-119 §6.3

4.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, 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.

4.2 TEST RESULTS

The following channel was investigated: 851.0 MHz. 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 9: RADIATED SPURIOUS EMISSIONS – 851.0 MHZ – HIGH POWER

Frequency	Raw S/A (dbuv)	S/G @ 0dbm	S/G (dBm)	Cable Loss (dB)	Ant gain (dBd)	Corrected S/G level (dBc)	Limit (dBc)	Margin (dB)
1702	34.15	89.20	-65.1	1.1	4.85	107.0	58.68	-48.3
2553	42.56	93.31	-60.8	1.4	7.15	100.7	58.68	-42.0
3404	49.55	93.84	-54.3	1.7	7.35	94.3	58.68	-35.6
4255	44.50	87.45	-53.0	1.8	7.35	93.1	58.68	-34.4
5106	55.44	87.71	-42.3	1.8	7.75	82.0	58.68	-23.4
5957	48.49	89.24	-50.8	2.1	8.65	89.9	58.68	-31.2
6808	36.55	88.24	-61.7	2.6	8.65	101.3	58.68	-42.7
7659	37.20	85.24	-58.0	3.0	8.55	98.2	58.68	-39.5
8510	54.56	81.00	-36.4	2.6	8.45	76.3	58.68	-17.6

TABLE 10: TEST EQUIPMENT - RADIATED SPURIOUS EMISSIONS

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	09/20/05
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	N/A
901215	Hewlett Packard	8596EM	Portable Spectrum Analyzer (9 kHz – 12.8 GHz)	3826A00144	09/08/05
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 - 20 GHz)	3610A00866	08/05/05
900814	Electrometrics	EM-6961 RGA-60	Double Ridge Horn Antenna	2310	02/17/06

Daniel Biggs		October 20, 2004
Test Engineer	Signature	Date Of Test

5 OCCUPIED BANDWIDTH, BANDWIDTH LIMITATIONS, AND EMISSIONS MASKS: FCC RULES AND REGULATIONS PART 2 §2.1049, PART §90.209(B), AND PART §90.210, IC RSS-119 §6.4

5.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, section 2.2.11

The EUT was connected to a spectrum analyzer through a calibrated coaxial attenuator sufficient to prevent overloading of the spectrum analyzer input. The spectrum analyzer was set to peak detector mode. The following channels were investigated: 806.0, 851.0, and 870.0 MHz.

The RBW and VBW were set to 300 Hz and 3000 Hz respectively per TIA 603-B Section 2.2.11.1 Table 16.

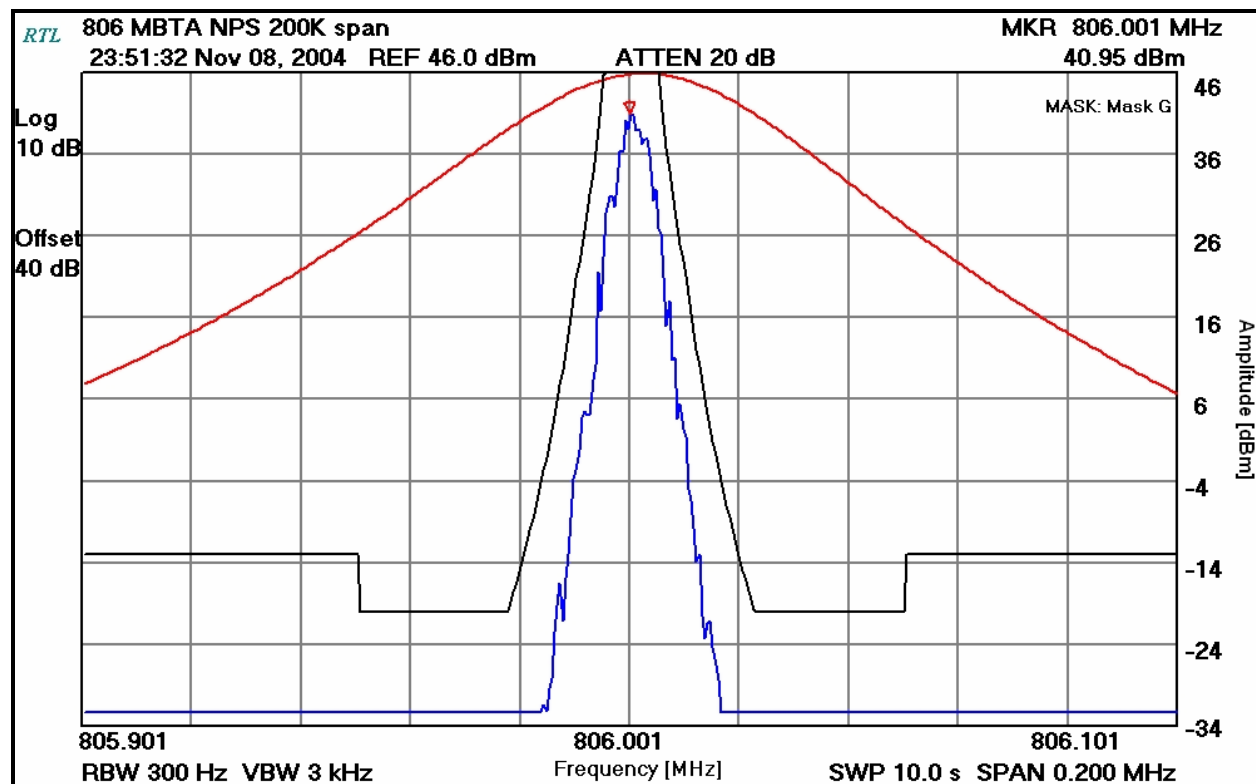
5.2 TEST LIMITS

Emissions must meet the following requirements for the modes tested:

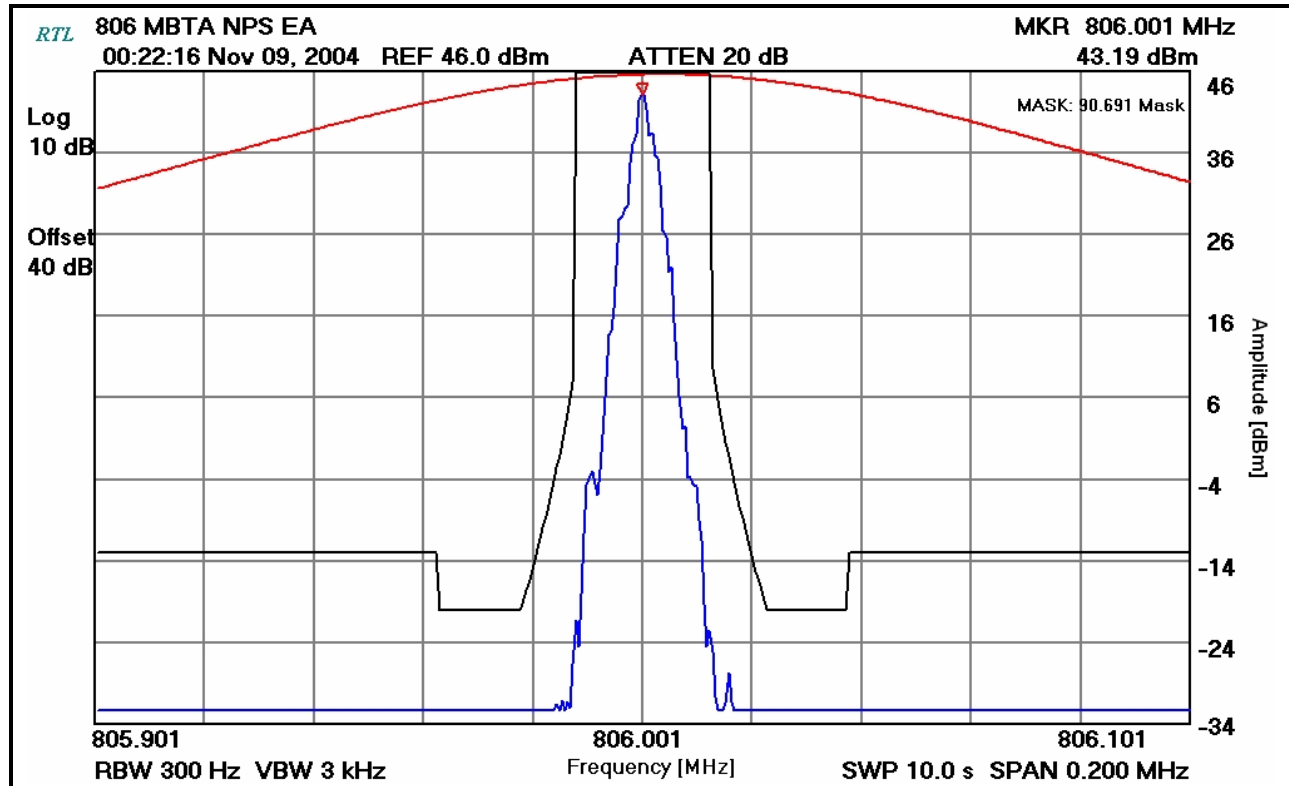
- Mask G for equipment without audio low pass filtering – 806-821/851-866 MHz
- Mask H for equipment without audio low pass filtering – 821-823/866-869 MHz

5.3 TEST RESULTS

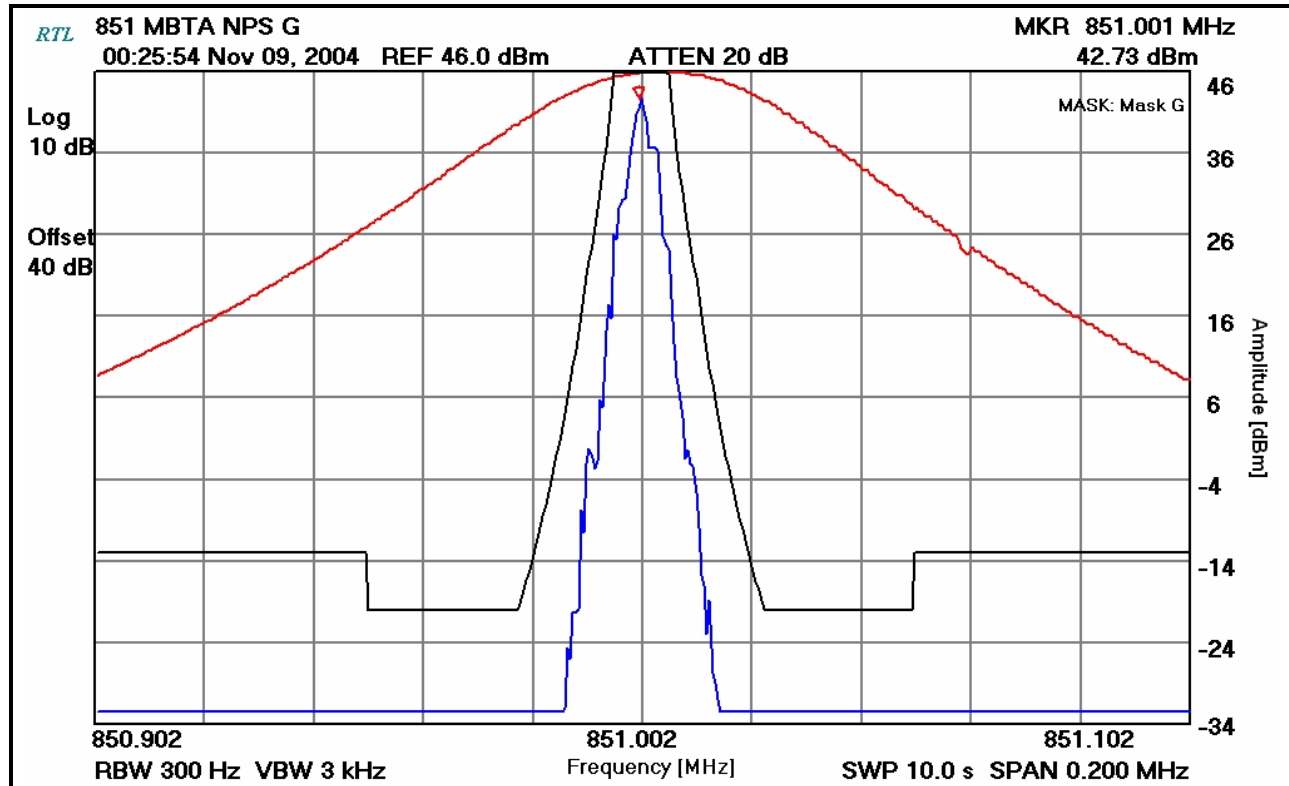
PLOT 1: 806.0 MHZ NPS DATA – MASK G



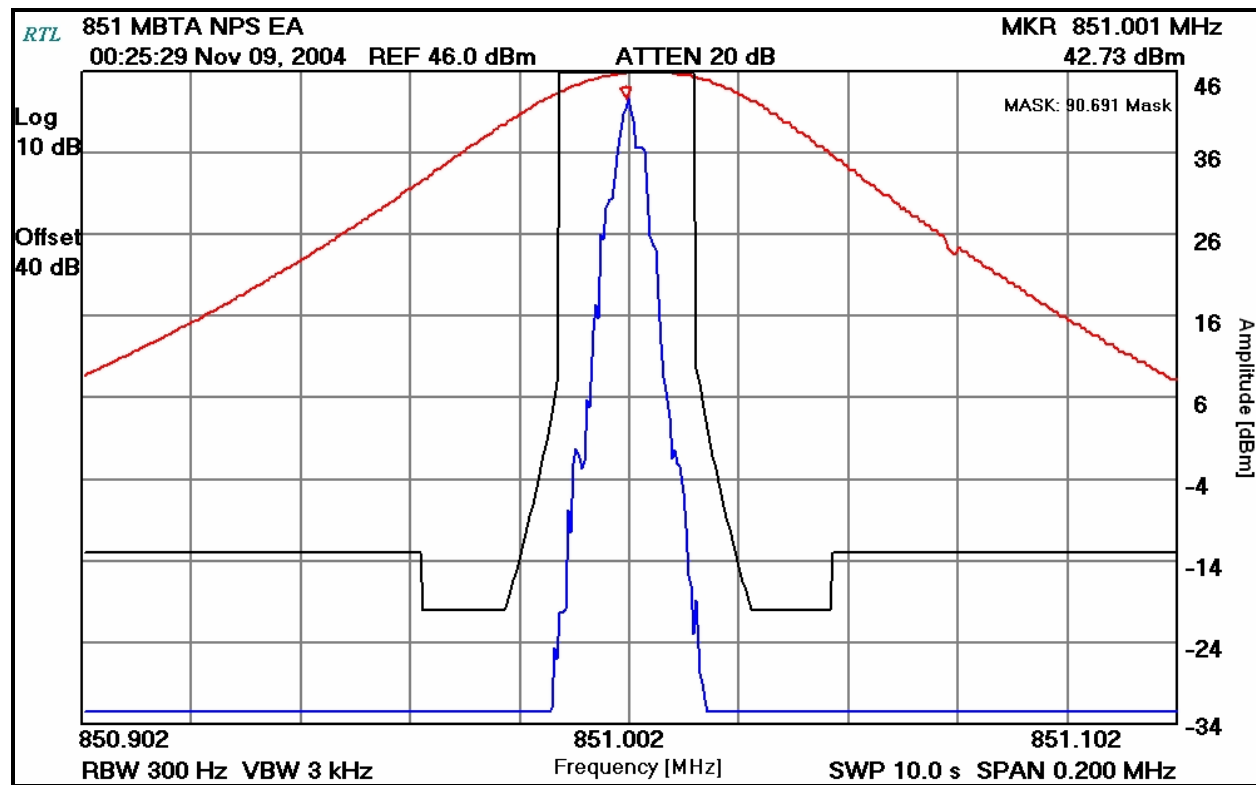
PLOT 2: 806.0 MHZ NPS DATA – MASK EA



PLOT 3: 851.0 MHZ NPS DATA – MASK G



PLOT 4: 851.0 MHZ NPS DATA – MASK EA



PLOT 5: 870.0 MHZ NPS DATA – MASK H

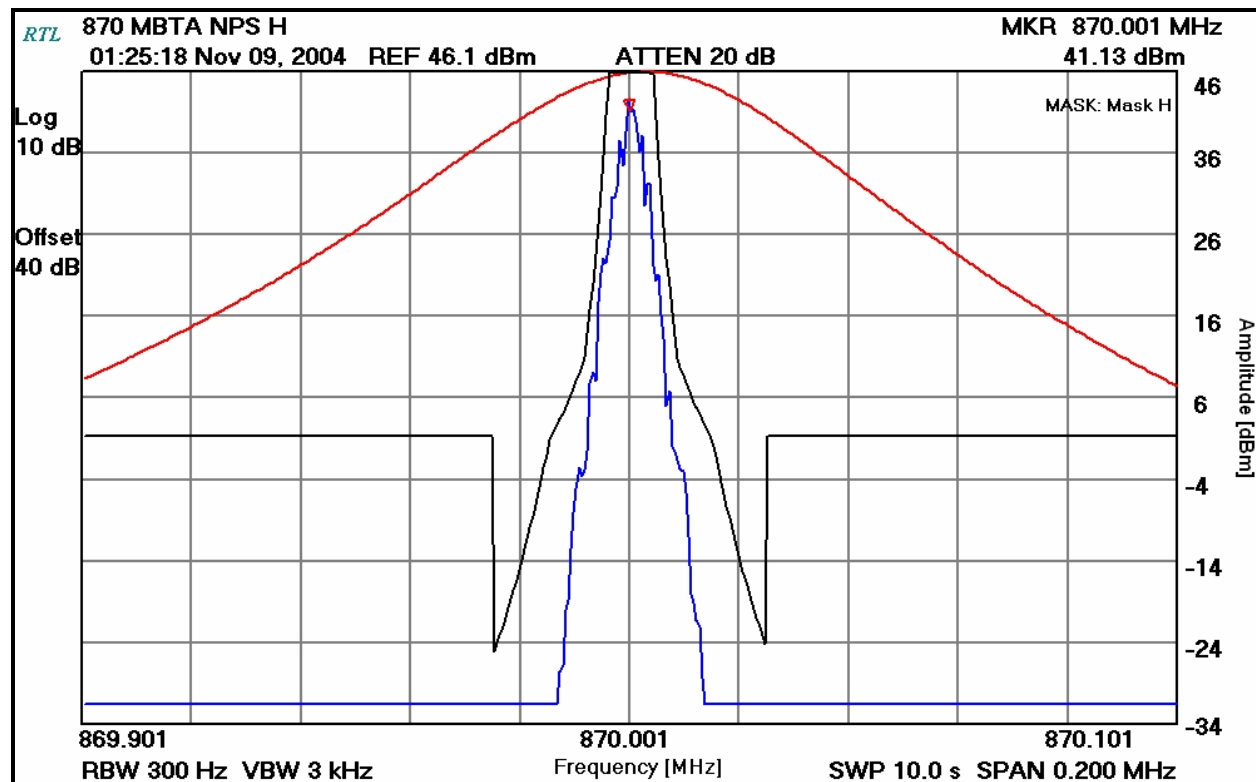


TABLE 11: TEST EQUIPMENT - BANDWIDTH LIMITATIONS

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	Portable Spectrum Analyzer (9 kHz – 12.8 GHz)	3826A00144	09/08/05

Daniel Biggs	<i>Daniel Biggs</i>	November 9, 2004
Test Engineer	Signature	Date Of Test

6 CONCLUSION

The data in this measurement report shows that the **M/A-COM, Inc. Model: M7100 800 MHz Mobile Radio; FCC ID: OWDTR-0022-E**, complies with all the requirements of a Class II Permissive Change under Parts 2 and 90 of the FCC Rules, and Industry Canada RSS-119.