



Engineering and Testing for EMC and Safety Compliance

Class II Permissive Change Report

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MODEL: P7100 UHF-L Portable Radio

FCC ID: OWDTR-0016-E
IC: 3636B-0016

November 2, 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

Frequency Range *	Maximum Measured Output Power (W) Conducted	Emission Designator
378-430 MHz	4.01	16K0F3E
378-430 MHz	4.01	11K0F3E
378-430 MHz	4.01	14K2F1D/F1E
378-430 MHz	4.01	11K1F1D/F1E
378-430 MHz	4.01	7K1F1D/F1E
378-430 MHz	4.01	8K4F1D/F1E

* Industry Canada permits a frequency range of 406.1-430 MHz only

Report Prepared by: Daniel Biggs

Document Number: 2004155/QRTL04-323

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Test results relate only to the item tested.*



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CONFORMANCE STATEMENT

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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 2, 2004

Position: President, Rhein Tech Laboratories


Signature: _____

Typed/Printed Name: Daniel Biggs

Date: November 2, 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
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	6
2.1	TEST PROCEDURE	6
2.2	TEST LIMIT	6
2.3	TEST RESULTS	6
3	SPURIOUS EMISSIONS AT ANTENNA TERMINALS: FCC RULES AND REGULATIONS PART 2 §2.1051, IC RSS-119 §6.3	7
3.1	TEST PROCEDURE	7
2.2	TEST LIMIT	7
3.2	TEST RESULTS	7
4	FIELD STRENGTH OF SPURIOUS RADIATION: FCC RULES AND REGULATIONS PART 2 §2.1053 (A), IC RSS-119 §6.3	9
4.1	TEST PROCEDURE	9
4.2	TEST RESULTS	9
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	11
5.1	TEST PROCEDURE	11
5.2	TEST LIMITS	11
5.3	TEST RESULTS	11
6	FCC RULES AND REGULATIONS PART 2 §2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH	17
7	CONCLUSION	18

TABLE INDEX

TABLE 1-1:	EQUIPMENT UNDER TEST (EUT)	5
TABLE 2-1:	RF OUTPUT POWER TEST DATA	6
TABLE 2-2:	TEST EQUIPMENT - RF POWER OUTPUT	6
TABLE 3-1:	CONDUCTED SPURIOUS EMISSIONS – 380.0 MHZ	7
TABLE 3-2:	CONDUCTED SPURIOUS EMISSIONS – 406.2 MHZ	8
TABLE 3-3:	CONDUCTED SPURIOUS EMISSIONS – 429.0 MHZ	8
TABLE 3-4:	TEST EQUIPMENT - CONDUCTED SPURIOUS EMISSIONS	8
TABLE 4-1:	RADIATED SPURIOUS EMISSIONS – 406.2 MHZ – HIGH POWER	9
TABLE 4-2:	RADIATED SPURIOUS EMISSIONS - 406.2 MHZ – LOW POWER	10
TABLE 4-3:	TEST EQUIPMENT - RADIATED SPURIOUS EMISSIONS	10
TABLE 5-1:	TEST EQUIPMENT - BANDWIDTH LIMITATIONS	16

PLOT INDEX

PLOT 5-1:	406.2 MHZ WIDEBAND VOICE – MASK B	11
PLOT 5-2:	406.2 MHZ NARROWBAND VOICE – MASK D	12
PLOT 5-3:	406.2 MHZ WIDEBAND 9600 DIGITAL DATA/VOICE – MASK C	13
PLOT 5-4:	406.2 MHZ NARROWBAND 9600 DIGITAL DATA/VOICE – MASK D	14
PLOT 5-5:	406.2 MHZ NARROWBAND 4800 DIGITAL DATA/VOICE – MASK D	15
PLOT 5-6:	406.2 MHZ NARROWBAND P25 C4FM DIGITAL DATA/VOICE – MASK D	16

APPENDIX INDEX

APPENDIX A:	AGENCY AUTHORIZATION LETTER	19
APPENDIX B:	CONFIDENTIALITY REQUEST	20
APPENDIX C:	DESCRIPTION OF CHANGE	21
APPENDIX D:	SCHEMATICS	22
APPENDIX E:	PARTS LIST	23
APPENDIX F:	RF EXPOSURE	24
APPENDIX G:	EXTERNAL PHOTOGRAPHS	25
APPENDIX H:	INTERNAL PHOTOGRAPHS	26
APPENDIX I:	TEST PHOTOGRAPHS	29

PHOTOGRAPH INDEX

PHOTOGRAPH 1:	NEW MICROPHONE ACCESSORY	25
PHOTOGRAPH 2:	MAIN PCB TOP VIEW	26
PHOTOGRAPH 3:	MAIN PCB BOTTOM VIEW LEFT SIDE	27
PHOTOGRAPH 4:	MAIN PCB BOTTOM VIEW RIGHT SIDE	28
PHOTOGRAPH 5:	CONDUCTED POWER MEASUREMENTS	29
PHOTOGRAPH 6:	CONDUCTED SPURIOUS/EMISSIONS MASKS MEASUREMENTS	30
PHOTOGRAPH 7:	RADIATED EMISSIONS - FRONT	31
PHOTOGRAPH 8:	RADIATED EMISSIONS - BACK	32

1 GENERAL INFORMATION

1.1 SCOPE

FCC Rules Part 90: Private Land Mobile Radio Services that are in operation within the band of 378-430 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-0016-E, granted May 21, 2003.

1.4 DESCRIPTION OF CHANGE IN DEVICE

The change consists of the replacement of the power amplifier circuitry, and the addition of a microphone to the product accessories. See Appendix C for a detailed description of the change.

1.5 PRODUCT DESCRIPTION

The EUT is a handheld transceiver that operates in the 378-430 MHz band. The rated RF output power is programmable to 4 watts.

TABLE 1-1: EQUIPMENT UNDER TEST (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Barcode	Test Sample Received
UHF Portable Radio	M/A Com, Inc.	P7100	T1PA-UL07	OWDTR-0016-E	N/A	16212	10/19/04

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 analog voice mode, 2-level digital data/voice mode, and 4-level digital data/voice mode.

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: 380.0, 406.2, and 429.0. Peak and average output power levels are shown.

TABLE 2-1: RF OUTPUT POWER TEST DATA

Frequency (MHz)	Channel	Mode	Average Level (dBm)	Average Level (W)	Peak Level (dBm)	Peak Level (W)
378.0	1	High Power	36.0	3.98	36.03	4.01
406.2	2	High Power	35.87	3.86	35.91	3.90
429.0	3	High Power	35.84	3.84	35.88	3.87
378.0	1	Low Power	30.06	1.01	30.24	1.06
406.2	2	Low Power	30.0	1.00	30.18	1.04
429.0	3	Low Power	29.93	0.98	30.02	1.00

*Measurement accuracy: +/- 3%

TABLE 2-2: 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		October 20, 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 2,500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of the rated system deviation at 1,000 Hz.

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

2.2 TEST LIMIT

Limits: Mask D (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: 380.0, 406.2, and 429.0. 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 3-1: CONDUCTED SPURIOUS EMISSIONS – 380.0 MHZ

12.5 kHz channel spacing; Conducted power = 4.01 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
760	80.44	56.03	-24.44
1140	79.78	56.03	-23.78
1520	105.58	56.03	-49.58
1900	100.52	56.03	-44.52
2280	90.58	56.03	-34.58
2660	108.71	56.03	-52.71
3040	109.27	56.03	-53.27
3420	97.57	56.03	-41.57
3800	107.10	56.03	-51.10

TABLE 3-2: CONDUCTED SPURIOUS EMISSIONS – 406.2 MHZ

12.5 kHz channel spacing; Conducted power = 3.90 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
812.4	79.94	55.91	-24.03
1218.6	84.18	55.91	-28.27
1624.8	106.58	55.91	-50.67
2031	103.12	55.91	-47.21
2437.2	105.04	55.91	-49.13
2843.4	109.76	55.91	-53.85
3249.6	103.95	55.91	-48.04
3655.8	99.00	55.91	-43.09
4062	108.53	55.91	-52.62

TABLE 3-3: CONDUCTED SPURIOUS EMISSIONS – 429.0 MHZ

12.5 kHz channel spacing; Conducted power = 3.87 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
858	80.13	55.88	-24.25
1287	89.90	55.88	-34.02
1716	102.77	55.88	-46.89
2145	88.16	55.88	-32.28
2574	102.95	55.88	-47.07
3003	109.31	55.88	-53.43
3432	97.24	55.88	-41.36
3861	107.72	55.88	-51.84
4290	105.78	55.88	-49.90

TABLE 3-4: 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		October 20, 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

Analog Modulation: The transmitter is terminated with a 50 Ω load and is modulated with a 2,500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of the rated system deviation at 1,000 Hz.

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: 406.2 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 4-1: RADIATED SPURIOUS EMISSIONS – 406.2 MHZ – HIGH POWER

Frequency	Raw S/A (dbuv)	S/G @ -10dbm	S/G (dBm)	Cable Loss (dB)	Ant gain (dBd)	Corrected S/G level (dBc)	Limit (dBc)	Margin (dB)
812.4	56.7	112.6	-55.9	0.6	-1.3	93.8	55.91	-37.9
1218.6	41.3	104	-62.7	0.4	1.9	97.2	55.91	-41.3
1624.8	41.6	101.6	-60.0	0.5	4.7	91.8	55.91	-35.9
2031	33.1	79.1	-46.0	0.6	4.9	77.7	55.91	-21.8
2437.2	31.8	82.3	-50.5	0.6	5.1	82.0	55.91	-26.1
2843.4	32.4	78.2	-45.8	0.8	5.9	76.7	55.91	-20.8
3249.6	32.5	77.6	-45.1	0.8	6.1	75.8	55.91	-19.9
3655.8	32.5	77.7	-45.2	0.8	5.9	76.1	55.91	-20.2
4062	33.5	69.6	-36.1	0.9	6	67.0	55.91	-11.1

TABLE 4-2: RADIATED SPURIOUS EMISSIONS - 406.2 MHZ – LOW POWER

Frequency	Raw S/A (dbuv)	S/G @ -10dbm	S/G (dBm)	Cable Loss (dB)	Ant gain (dBd)	Corrected S/G level (dBc)	Limit (dBc)	Margin (dB)
812.4	56	112.6	-56.6	0.6	-1.3	88.7	50.17	-38.5
1218.6	37.9	104	-66.1	0.4	1.9	94.8	50.17	-44.6
1624.8	40.4	101.6	-61.2	0.5	4.7	87.2	50.17	-37.0
2031	31.7	79.1	-47.4	0.6	4.9	73.3	50.17	-23.1
2437.2	33	82.3	-49.3	0.6	5.1	75.0	50.17	-24.8
2843.4	32	78.2	-46.2	0.8	5.9	71.3	50.17	-21.1
3249.6	31.7	77.6	-45.9	0.8	6.1	70.8	50.17	-20.6
3655.8	31.5	77.7	-46.2	0.8	5.9	71.3	50.17	-21.1
4062	31.3	69.6	-38.3	0.9	6.0	63.4	50.17	-13.2

TABLE 4-3: 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

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 RBW and VBW were set to 300 Hz and 300 Hz respectively for wideband testing, and 100 Hz and 100 Hz respectively for narrowband testing.

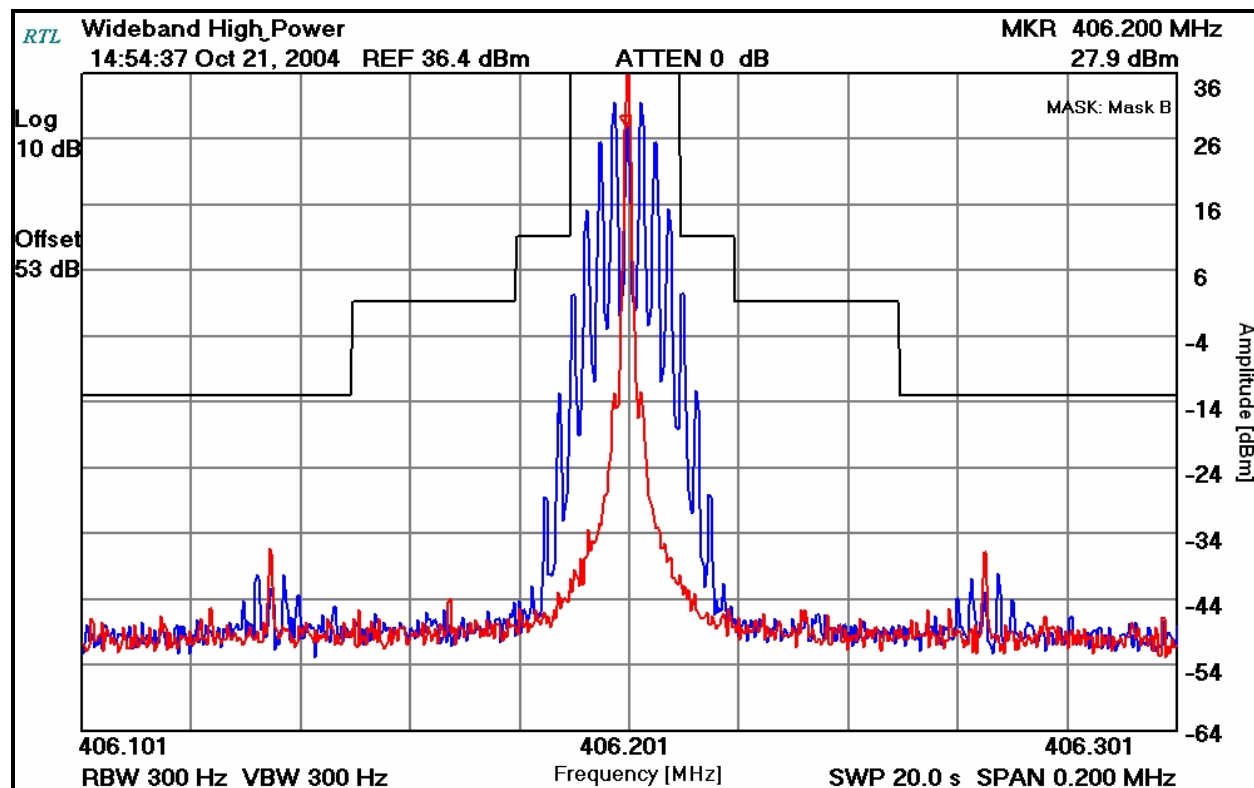
5.2 TEST LIMITS

Emissions must meet the following requirements for the modes tested:

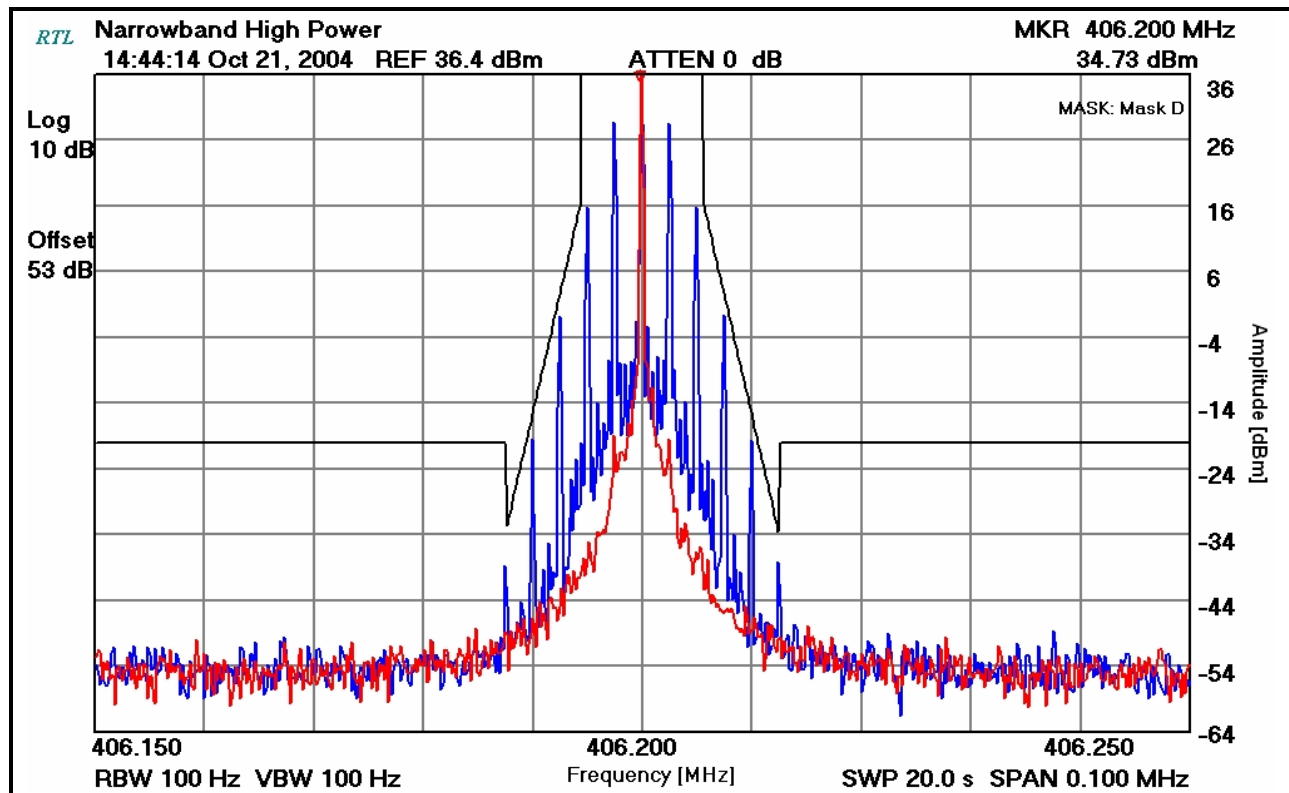
- Mask B for wideband voice mode with audio low pass filtering
- Mask D for narrowband voice mode with audio low pass filtering
- Mask C for wideband 2-level digital data/voice mode
- Mask D for narrowband 2-level digital data/voice mode
- Mask D for 4-level C4FM

5.3 TEST RESULTS

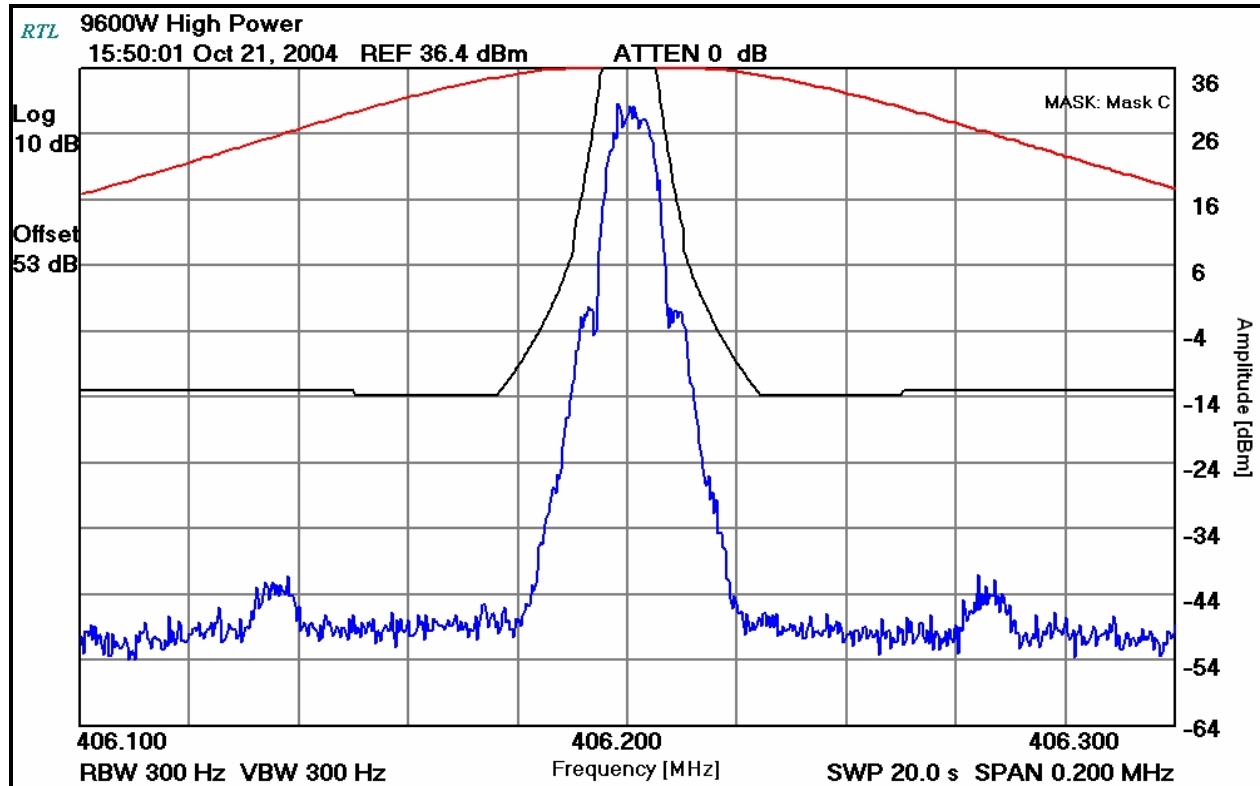
PLOT 5-1: 406.2 MHZ WIDEBAND VOICE – MASK B



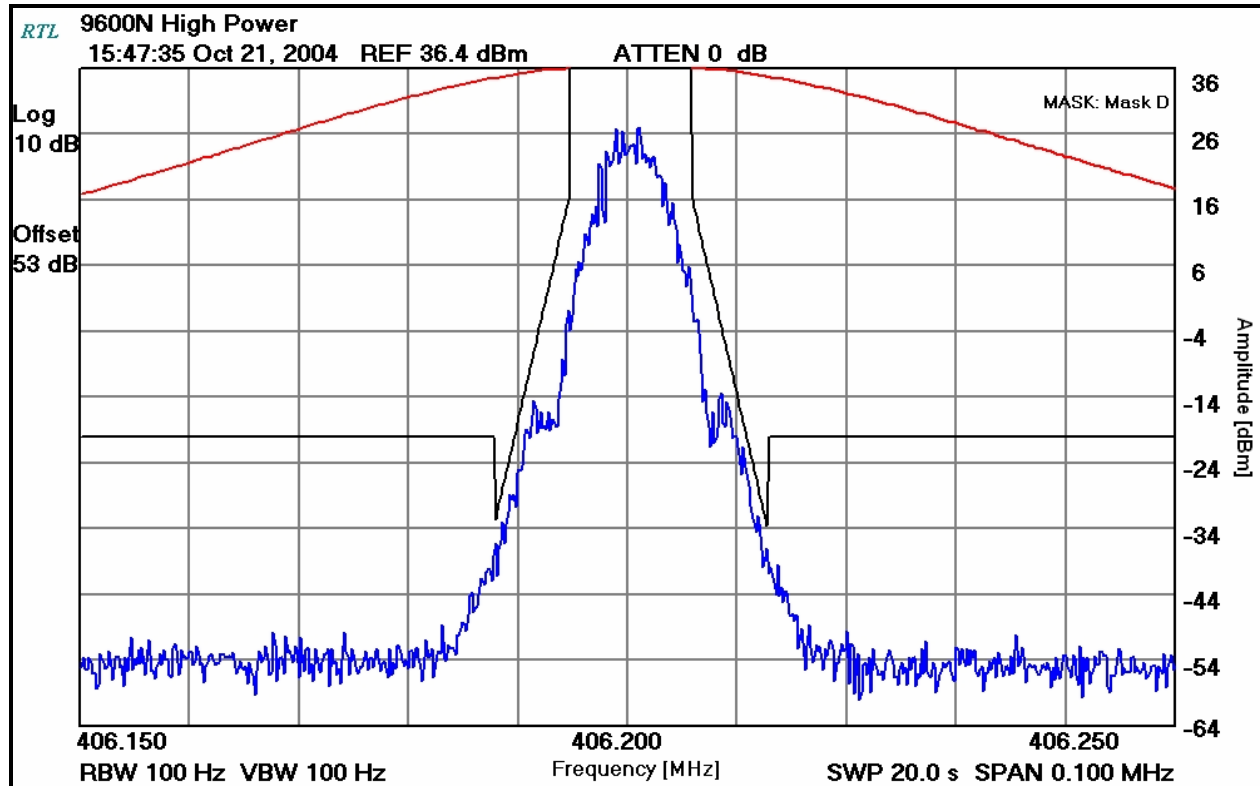
PLOT 5-2: 406.2 MHZ NARROWBAND VOICE – MASK D



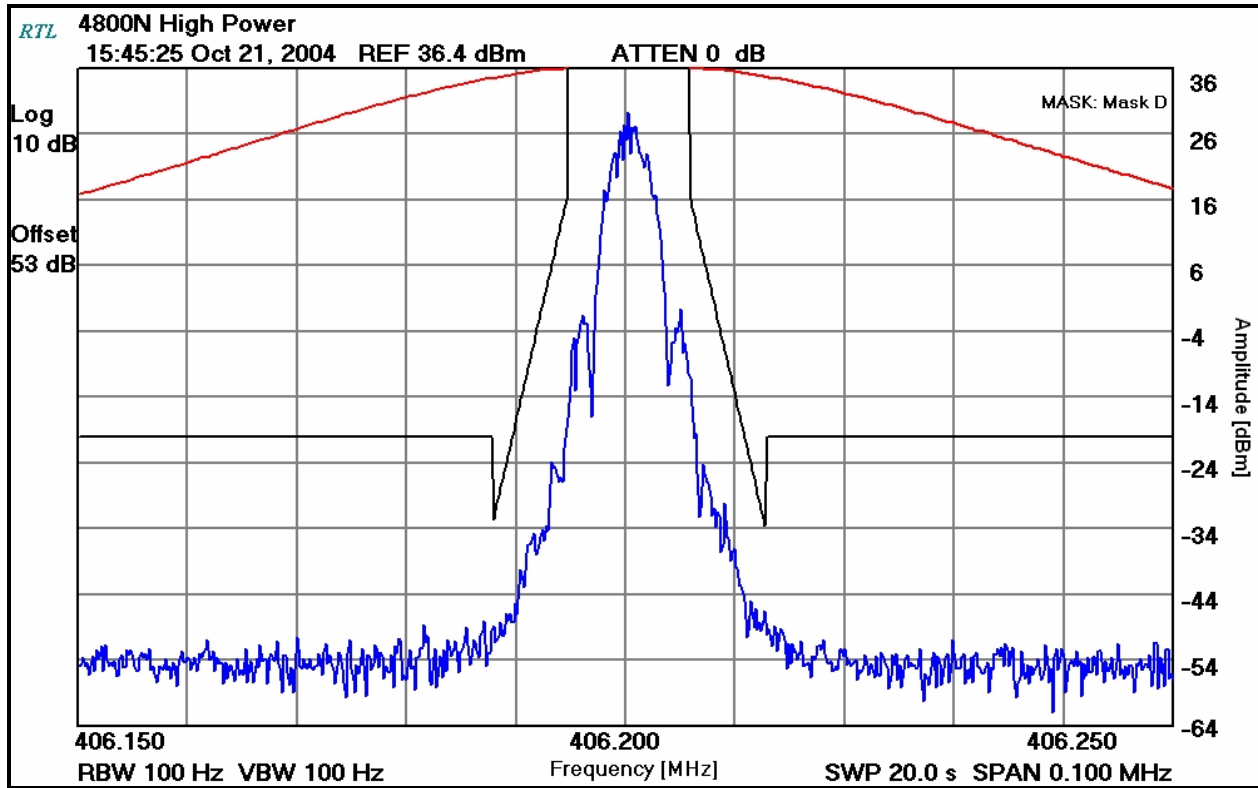
PLOT 5-3: 406.2 MHZ WIDEBAND 9600 DIGITAL DATA/VOICE – MASK C



PLOT 5-4: 406.2 MHZ NARROWBAND 9600 DIGITAL DATA/VOICE – MASK D



PLOT 5-5: 406.2 MHZ NARROWBAND 4800 DIGITAL DATA/VOICE – MASK D



PLOT 5-6: 406.2 MHZ NARROWBAND P25 C4FM DIGITAL DATA/VOICE – MASK D

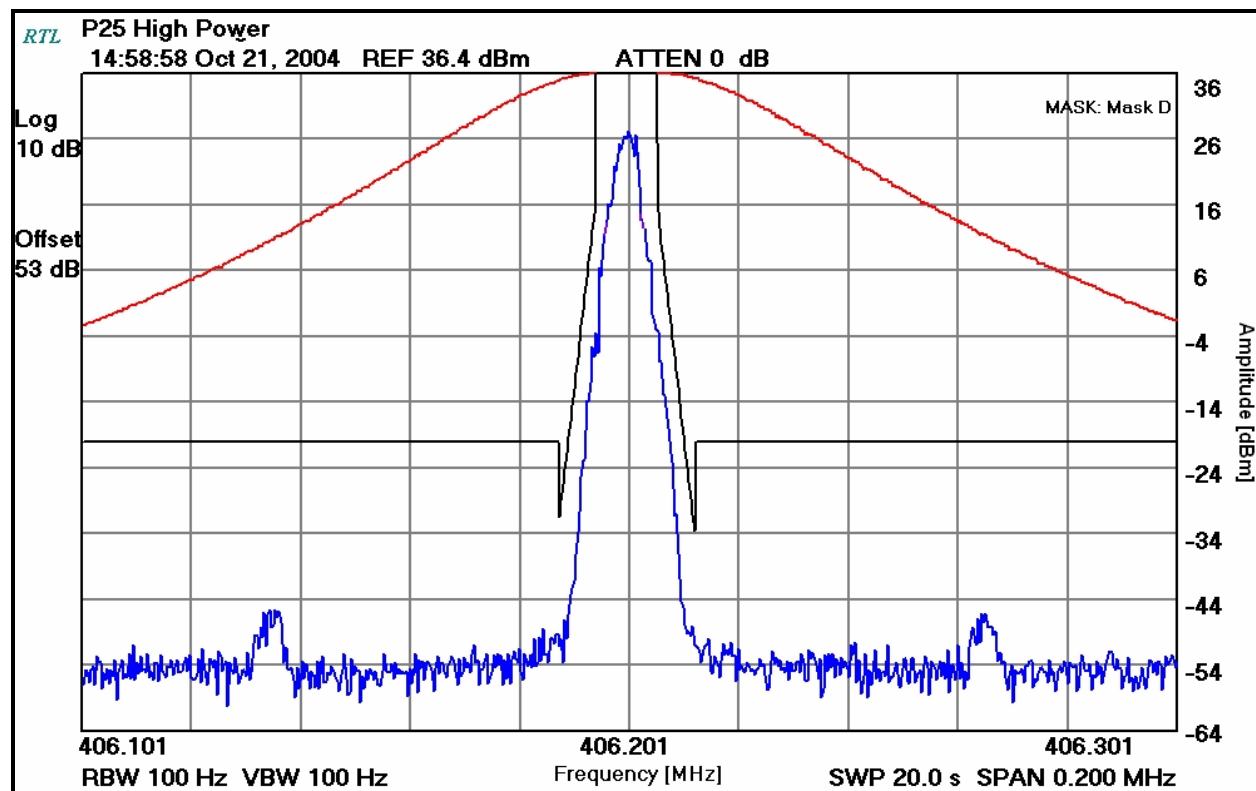


TABLE 5-1: TEST EQUIPMENT - BANDWIDTH LIMITATIONS

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
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	07/07/05

Daniel Biggs	<i>Daniel Biggs</i>	October 21, 2004
Test Engineer	Signature	Date Of Test

6 FCC RULES AND REGULATIONS PART 2 §2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

Type of Emission: F3E, F1D, F1E

Voice – 25 kHz channel spacing

Calculation:

Max modulation (M) in kHz: 3.0

Max deviation (D) in kHz: 5

Constant factor (K): 1 (assumed)

$B_n = 2 \times M + 2 \times DK = 16.0 \text{ kHz}$

Emission designator: 16K0F3E

Voice – 12.5 kHz channel spacing

Calculation:

Max modulation (M) in kHz: 3.0

Max deviation (D) in kHz: 2.5

Constant factor (K): 1 (assumed)

$B_n = 2 \times M + 2 \times DK = 11.0 \text{ kHz}$

Emission designator: 11K0F3E

Digital voice and data (9600W) – 25 kHz channel spacing

Calculation:

Data rate in bps (R) = 9600

Peak deviation of carrier (D) = 3000

$2D/R = 0.625$

$B_n = 3.86D + 0.27R = 3.86(3000) + 0.27(9600) = 14.172 \text{ kHz}$

Emission designator: 14K2F1D, 14K2F1E

Digital voice and data (9600N) – 12.5 kHz channel spacing

Calculation:

Data rate in bps (R) = 9600

Peak deviation of carrier (D) = 2350

$2D/R = 0.245$

$B_n = 3.86D + 0.27R = 3.86(2350) + 0.27(9600) = 11.086 \text{ kHz}$

Emission designator: 11K1F1D, 11K1F1E

Digital voice and data (4800N) – 12.5 kHz channel spacing

Calculation:

Data rate in bps (R) = 4800

Peak deviation of carrier (D) = 1500

$2D/R = 0.625$

$B_n = 3.86D + 0.27R = 3.86(1500) + 0.27(4800) = 7.086 \text{ kHz}$

Emission designator: 7K1F1D, 7K1F1E

C4FM – 9600 bps 12.5 kHz channel spacing: (P25 Standard)

Calculation:

Data rate in bps (R) = 9600

Peak deviation of carrier (D) = +/-1.8 kHz

Number of states in each symbol (S) = 4

$B_n = [9600/\log_2(4) + 2(1800)(1)] = 8.400 \text{ kHz}$

Emission designator: 8K4F1D, 8K4F1E

7 CONCLUSION

The data in this measurement report shows that the **M/A-COM, Inc. Model: P7100 UHF-L Portable Radio; FCC ID: OWDTR-0016-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.