Engineering and Testing for EMC and Safety Compliance

Type II Permissive Change Report
FCC Part 90 and Industry Canada RSS-119

Test Lab:	Applicant:
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FCC ID:	OWDTR-0019-E	**GRANTEE FRN:**	0004-9458-12
PLAT FORM:	N/A	**RTL WORK ORDER #:**	2004016
MODEL(S):	M7100^{IP}	**RTL QUOTE #:**	QRTL04-031
DATE OF TEST REPORT:	February 27, 2004		

American National Standard Institute:	ANSI/TIA/EIA 603 and ANSI/TIA/EIA 603-1
FCC Classification:	TNB – Licensed Non-Broadcast Station Transmitter
FCC Rule Part(s):	Part 15: Radio Frequency Devices §15.109: Radiated Emissions Limits Part 22: Public Mobile Services Part 80: Stations in Maritime Services Part 90: Private Land Mobile Radio Services
Industry Canada Standard:	RSS-119: Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz
Digital Interface Information	Digital Interface was found to be compliant
Receiver Information	Receiver was found to be compliant

Frequency Range (MHz)	Output Power (W) Conducted	Frequency Tolerance (ppm)	Emission Designator
136-174	114.8	+/-2.0	16K0F3E (Voice)
136-174	114.8	+/-2.0	11K0F3E (Voice)
136-174	114.8	+/-2.0	10K0F1D (2 level WB)
136-174	114.8	+/-2.0	10K0F1E (2 level WB)
136-174	114.8	+/-2.0	7K7F1D (2 level NB 9600)
136-174	114.8	+/-2.0	7K7F1E (2 level NB 9600)
136-174	114.8	+/-2.0	4K8F1D (2 level NB 4800)
136-174	114.8	+/-2.0	4K8F1E (2 level NB 4800)
136-174	114.8	+/-2.0	8K0F1D (C4FM)
136-174	114.8	+/-2.0	8K0F1E (C4FM)

Engineering and Testing for EMC and Safety Compliance

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, Industry Canada RSS-119, ANSI C63.4, ANSI/TIA/EIA603 and ANSI/TIA/EIA 603-1.

Signature: _____ February 27, 2004

Typed/Printed Name: Desmond A. Fraser Position: President

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1 General Information

The following report of a Class II Permissive Change application is prepared on behalf of **M/A-Com, Inc.**, in accordance with Part 2, and Part 15, Subparts A and B of the Federal Communications Commission rules and regulations and Industry Canada RSS-215. The Equipment Under Test (EUT) was **Model: M7100IP, FCC ID: OWDTR-0019-E**, VHF (136-174 MHz) Mobile Radio.

All measurements contained in this application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. These are explained in the appendix of this report. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier and cables.

All radiated and conducted emissions measurements were performed manually at Rhein Tech Laboratories, Inc. The radiated emissions measurements required by the rules were performed on the (three/ten) meter open field test range. Complete description and site attenuation measurement data has been placed on file with the Federal Communications Commission. Rhein Tech Laboratories is accepted by the FCC as a facility available to do measurement work for others on a contract basis.

Note: 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 in 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 errors.

1.1 Modifications

No modifications were made during testing in order to achieve compliance.

1.2 Related Submittal(s)/Grant(s)

This is a Class II Permissive Change report for the original application for FCC ID: OWDTR-0019-E.

1.3 Description of Changes in Device

1) A New PA Module - Internal to the PA module, components have altered per the following:

- Output coil (L2): Change for the High-Q coil performance.
- Capacitor (C24): Change for the High-Q capacitor performance (UCM series by TAIYO YUDEN. And, separate to two capacitors (150pF + 150pF).

2) Parts value change of the Radio circuit. These four components are now adjustable capacitors to be tuned on production floor with center value listed below. (Fixed capacitors changed to variable type devices.)

- C122 and C124: Change to 9pF from 6pF. 5pF ~ (9pF) ~ 10pF
- C123 and C125: Change to 9pF from 6pF. 5pF ~ (9pF) ~ 10pF
- C127: Change to 8pF from 9pF. 5pF ~ (8pF) ~ 10pF

3) Added Zener Diode to Audio Logic Board to correct Dual Radio Coexistence Problem -- Not related to TX.

2 Test System Details

2.1 System Components Table

Table 2-1: Dual Radio Configuration

Part	Manufacturer	Model	Serial Number/PN	FCC ID	Cable Description	RTL Bar Code
VHF Mobile Radio	M/A-Com, Inc.	M7100IP	N/A	OWDTR-0019-E	N/A	015684
VHF Mobile Radio	M/A-Com, Inc.	M7100IP	N/A	OWDTR-0019-E	N/A	015697
Remote Mount System Control Head	M/A-Com, Inc.	N/A	KRY1011632/14	N/A		015685
Dual Radio Adaptor	M/A-Com, Inc.	N/A	CA101288V10	N/A		015674
Remote Control Cable	M/A-Com, Inc.	N/A	CA101288V4	N/A		015673
Microphone	M/A-Com, Inc.	N/A	MC101616V1	N/A		015678

Table 2-2: Dual Controller Configuration

Part	Manufacturer	Model	Serial Number/PN	FCC ID	Cable Description	RTL Bar Code
VHF Mobile Radio	M/A-Com, Inc.	M7100IP	N/A	OWDTR-0019-E	N/A	015684
Dual Control Cable	M/A-Com, Inc.	N/A	19B802554P9	N/A		015689
Remote Control Cable	M/A-Com, Inc.	N/A	CA101288V4	N/A		015673
Remote Mount System Control Head	M/A-Com, Inc.	N/A	KRY1011632/14	N/A		015672
Handheld Controller	M/A-Com, Inc.	N/A	CU101239V1	N/A		015681
Speaker	M/A-Com, Inc.	N/A	LS102824V1	N/A		015690
Accessory Cable	M/A-Com, Inc.	N/A	19B802554P7	N/A		015675
Noise Canceling Microphone	M/A-Com, Inc.	N/A	344A4611P51	N/A		015680
Handheld Controller Cable	M/A-Com, Inc.	N/A	CA101619V5	N/A		015682

Other audio accessories and control heads:

- DTMF Microphone M/A-Com Part Number: 344A4611P1
- Front Mount System Control Head M/A Com Part Number: KRY1011632/13
- Front Mount Scan Control Head M/A-Com Part Number: KRY1011632/11
- Remote Mount Scan Control Head M/A-Com Part Number: KRY10116332/12

2.2 Tested Configuration Diagram

Figure 1: Dual Radio Configuration

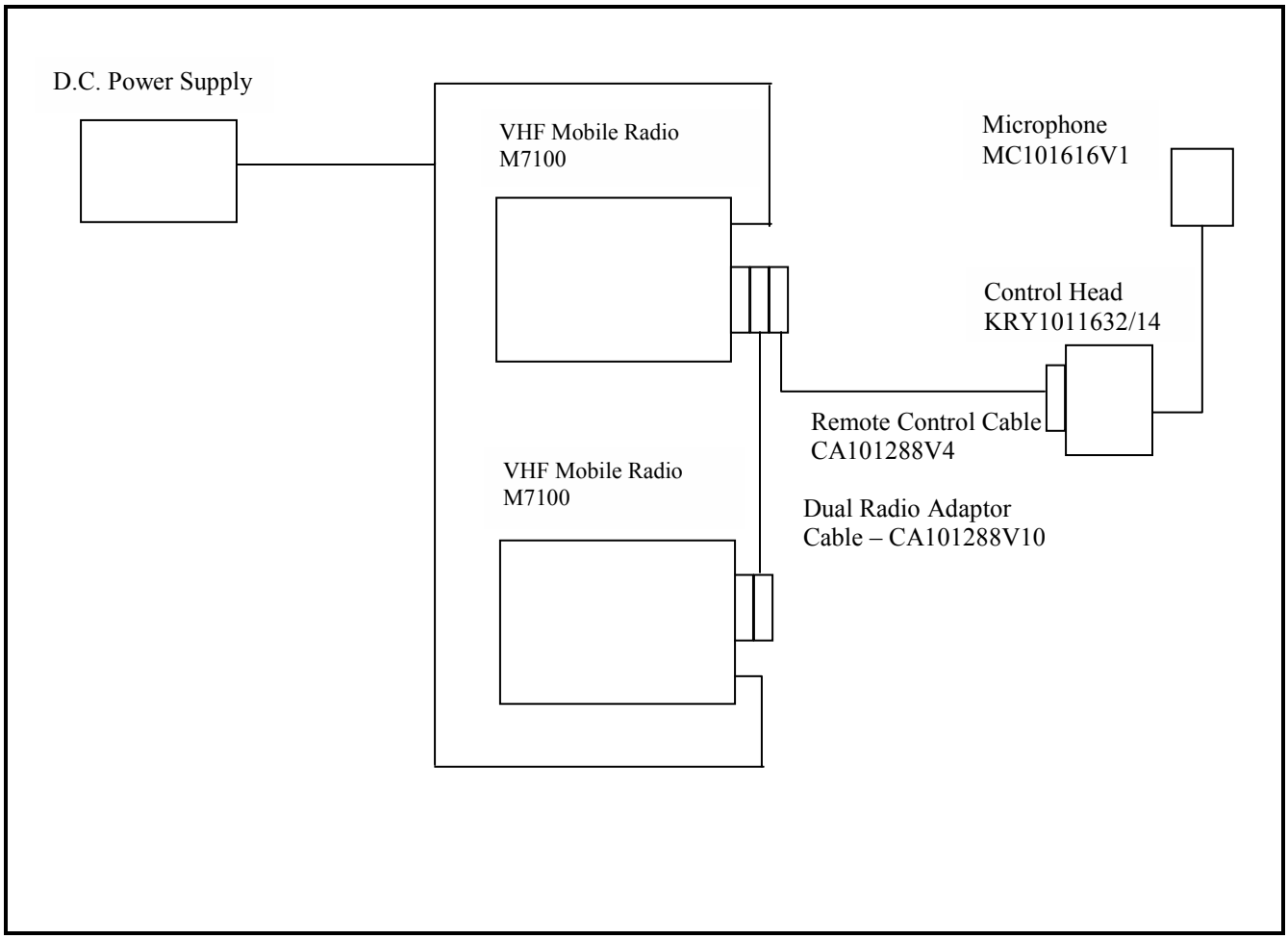
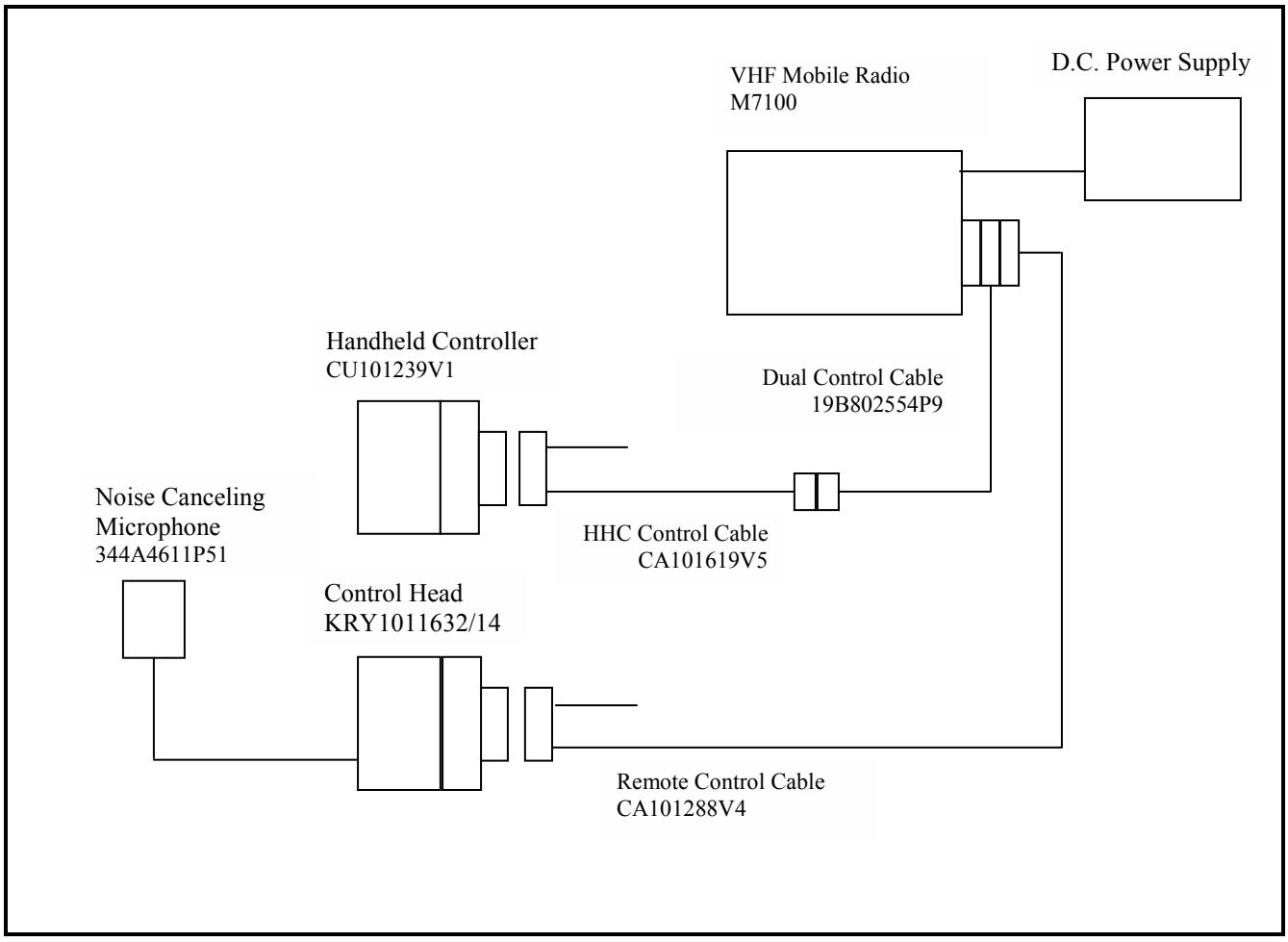


Figure 2: Dual Controller Configuration



3 Test Results

3.1 FCC Rules and Regulations Part 2 §2.1046 (a): RF Power Output: Conducted

3.1.1 Test Procedure

ANSI/TIA/EIA-603-1992, section 2.2.1

The EUT was connected to a coaxial attenuator having a 50Ω load impedance.

3.1.2 Test Data

The following channels (in MHz) were tested: 136, 150, and 174.

Table 3-1: RF Carrier Output Power (High Power)

Channel	Frequency (MHz)	RF Power Measured (Watt)*
1 High	136	114.8
2 High	155	112.2
3 High	174	107.9
1 Low	136	53.0
2 Low	155	51.9
3 Low	174	51.2

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

Table 3-2: RF Power output (Rated Power)

Rated Power (W)
50-110

Table 3-3: Test Equipment Used: RF Power Output – Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901184/901186	Agilent	E4416A/E9323A	Power Meter / Sensor	GB41050573/US420.52510380	07/30/04

Test Personnel:

Daniel Biggs		February 12, 2004
Test Technician/Engineer	Signature	Date Of Test

3.2 FCC Rules and Regulations Part 2 §2.1051: Spurious Emissions at Antenna Terminals

3.2.1 Test Procedure

ANSI/TIA/EIA-603-1992, Section 2.2.13

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

3.2.2 Test Data

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

Limits: Mask D (dBm): P(dBm) – (50+10xLOG P(W))

The following channels (in MHz) were investigated: 136.0, 154.0, and 174.0. 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. High power mode was determined to be worse case emissions.

Table 3-4: Conducted Spurious Emissions Channel 1 – 136.0 MHz

(136.0 MHz); 12.5 kHz channel spacing; Mask D; Conducted power = 114.8W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
272	104.27	70.60	-33.67
408	98.77	70.60	-28.17
544	106.76	70.60	-36.16
680	102.77	70.60	-32.17
816	104.27	70.60	-33.67
952	107.60	70.60	-37.00
1088	85.27	70.60	-14.67
1224	101.10	70.60	-30.50
1360	95.60	70.60	-25.00
1496	85.76	70.60	-15.16

Table 3-5: Conducted Spurious Emissions Channel 2 – 154.0 MHz

(154.0 MHz); 12.5 kHz channel spacing; Mask D; Conducted power = 112.2W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
308.0	91.00	70.50	-20.50
462.0	98.50	70.50	-28.00
616.0	107.16	70.50	-36.66
770.0	100.00	70.50	-29.50
924.0	106.50	70.50	-36.00
1078.0	101.50	70.50	-31.00
1232.0	98.66	70.50	-28.16
1386.0	91.83	70.50	-21.33
1540.0	98.00	70.50	-27.50
1694.0	96.83	70.50	-26.33

Table 3-6: Conducted Spurious Emissions Channel 3 – 174.0 MHz

(174.0 MHz); 12.5 kHz channel spacing; Mask D; Conducted power = 107.9W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
348	88.83	70.33	-18.50
522	100.16	70.33	-29.83
696	107.33	70.33	-37.00
870	106.50	70.33	-36.17
1044	98.99	70.33	-28.66
1218	97.33	70.33	-27.00
1392	91.17	70.33	-20.84
1566	96.16	70.33	-25.83
1740	95.17	70.33	-24.84
1914	95.00	70.33	-24.67

Table 3-7: Test Equipment Used: Effective Radiated Power Output

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	07/03/04
900154	Compliance Design, Inc.	Roberts Dipole	Adjustable element Dipole Antenna (30 - 1000 MHz)		10/06/04
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	05/12/04
900930	Hewlett Packard	85662A	Spectrum Analyzer Display	3144A20839	05/12/04
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 - 20GHz)	3610A00866	08/05/04

Test Personnel:

Daniel Biggs		February 13, 2004
Test Technician/Engineer	Signature	Date Of Test

3.3 FCC Rules and Regulations Part 2 §2.1053 (a): Field Strength of Spurious Radiation

3.3.1 Test Procedure

ANSI/TIA/EIA-603-1992, 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 EUT was placed on a turntable 3-meters from the receive antenna. The field of maximum intensity was found by rotating the EUT approximately 360 degrees and changing the height of the receive antenna from 1 to 4 meters. The field strength was recorded from a calibrated spectrum analyzer for each channel being tested. The EUT was then replaced by a substitute half-wave dipole antenna connected to a signal generator. The generator was set to produce an output matching the previously measured radiated-emission level. 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.

3.3.2 Test Data – *Dual Radio Configuration*

3.3.2.1 CFR 47 Part 90.210 Requirements

The worst-case ERP emissions test data are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded. High power mode was determined to be worse case emissions.

Table 3-8: Field Strength of Spurious Radiation Channel 2 – 154 MHz; Narrow Band; High Power

Radiated Spurious Emissions
Mid Band Channel 2 (154 MHz, Narrowband)
Limit = 50 + 10 Log P = 70.5 dBc
Conducted Power = 50.5 dBm = 112.2 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
308.0	58.8	-47.8	0.4	-1.2	96.8	-26.3
462.0	50.8	-60.9	0.4	2.9	113.9	-43.4
616.0	40.4	-71.4	0.6	4.8	126.1	-55.6
770.0	60.3	-52.3	0.6	5.0	107.2	-36.7
924.0	50.7	-67.1	0.7	5.4	122.3	-51.8
1078.0	50.2	-69.8	0.8	6.2	125.7	-55.2
1232.0	55.8	-62.8	0.8	6.0	118.5	-48.0
1386.0	51.1	-66.4	0.8	6.0	122.1	-51.6
1540.0	43.8	-74.0	0.9	6.8	130.4	-59.9
1694.0	38.0	-79.7	1.0	7.0	136.2	-65.7

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

Table 3-9: Test Equipment Used: Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	07/03/04
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	07/15/04
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 kHz - 3200 MHz)	3537A01741	05/02/04
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 – 20 GHz)	3610A00866	08/05/04

Test Personnel:

Daniel Biggs		February 13, 2004
Test Technician/Engineer	Signature	Date Of Test

3.3.3 Test Data - *Dual Control Configuration*

3.3.3.1 CFR 47 Part 90.210 Requirements

The worst-case ERP emissions test data are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

Table 3-10: Field Strength of Spurious Radiation Channel 2 – 154 MHz; Narrow Band; High Power

Radiated Spurious Emissions
Mid Band Channel 2 (154 MHz, Narrowband)
Limit = 50 + 10 Log P = 70.5 dBc
Conducted Power = 50.5 dBm = 112.2 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
308.0	61.20	-45.4	0.3	-0.4	94.4	-23.9
462.0	56.20	-55.5	0.6	-1.1	108.5	-38.0
616.0	45.70	-66.1	0.7	-1.5	120.8	-50.3
770.0	63.80	-48.8	1.2	-1.5	103.7	-33.2
924.0	43.00	-74.8	1.2	-1.8	130.0	-59.5
1078.0	40.40	-79.6	1.5	0.8	135.5	-65.0
1232.0	48.40	-70.2	1.5	2.9	125.9	-55.4
1386.0	42.70	-74.8	1.0	2.9	130.5	-60.0
1540.0	40.20	-77.6	1.5	5.0	134.0	-63.5
1694.0	39.00	-78.7	1.3	5.0	135.2	-64.7

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

Table 3-11: Test Equipment Used: Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	07/03/04
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	07/15/04
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 kHz - 3200 MHz)	3537A01741	05/02/04
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 – 20 GHz)	3610A00866	08/05/04

Test Personnel:

Daniel Biggs		February 13, 2004
Test Technician/Engineer	Signature	Date Of Test

3.4 FCC Rules and Regulations Part 15 §209: Radiated Emission Limits; General Requirements

3.4.1 Test Procedure

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 1m. 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.

The receiver was connected to an external antenna, which receives a signal from a signal generator output. With the antenna installed, the receiver indicator was used to determine optimal reception. The EUT's Intermediate Frequencies (IF), Local Oscillators (LO), 2nd Local Oscillators (LO), crystal oscillators and harmonics of each were investigated. All modes were investigated and tested including standby mode. The final radiated data was taken with the EUT locked to a set frequency.

3.4.2 Test Data – *Dual Radio Configuration*

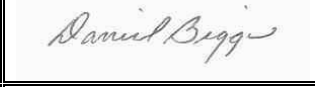
Table 3-12: Radiated Emissions Results

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)
181.093	Qp	V	30	1.0	35.6	-18.9	16.7	43.5	-26.8
199.098	Qp	V	0	1.0	42.9	-18.9	24.0	43.5	-19.5
219.096	Qp	V	0	1.0	43.3	-18.7	24.6	46.0	-21.4
724.400	Qp	V	0	1.0	38.0	-6.2	31.8	46.0	-14.2
796.400	Qp	V	90	1.0	34.4	-5.7	28.7	46.0	-17.3
876.400	Qp	V	0	1.0	36.1	-4.8	31.3	46.0	-14.7

Table 3-13: Test Equipment Used: Radiated Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
900969	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	2412A00414	05/12/04
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	05/12/04
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	07/03/04
900930	Hewlett Packard	85662A	Spectrum Analyzer Display	3144A20839	05/12/04
900889	Hewlett Packard	85685A	RF Preselector 20 Hz-2GHz	3146A01309	03/05/04

Test Personnel:

Daniel Biggs		February 13, 2004
Test Technician/Engineer	Signature	Date Of Test

3.4.3 Test Data – *Dual Control Configuration*

Table 3-14: Radiated Emissions Results

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)
181.093	Qp	V	0	1.0	39.4	-18.9	20.5	43.5	-23.0
199.098	Qp	V	0	1.0	38.7	-18.9	19.8	43.5	-23.7
219.096	Qp	V	0	1.0	34.8	-18.7	16.1	46.0	-29.9
265.395	Qp	H	160	1.0	39.4	-14.7	24.7	46.0	-21.3
309.653	Qp	V	0	1.0	40.1	-14.9	25.2	46.0	-20.8
344.025	Qp	V	0	1.0	41.8	-13.7	28.1	46.0	-17.9

Table 3-15: Test Equipment Used: Radiated Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
900969	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	2412A00414	05/12/04
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	05/12/04
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	07/03/04
900930	Hewlett Packard	85662A	Spectrum Analyzer Display	3144A20839	05/12/04
900889	Hewlett Packard	85685A	RF Preselector (20 Hz – 2 GHz)	3146A01309	03/05/04

Test Personnel:

Daniel Biggs		February 19, 2004
Test Technician/Engineer	Signature	Date Of Test

4 Conclusion

The data in this measurement report shows that the M/A-Com, Inc., Model: M7100IP, FCC ID: OWDTR-0019-E, VHF Mobile Radio, complies with all the requirements of Parts 15, 22, 80, and 90 of the FCC Rules and Industry Canada RSS-119, Issue 1.