Engineering and Testing for EMC and Safety Compliance

Type II Permissive Change Report
FCC Part 15 & Part 90, and Industry Canada RSS-119

Test Lab:	Applicant:
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FCC ID:	OWDTR-0013-E	**GRANTEE FRN:**	0004-9458-12
PLAT FORM:	N/A	**RTL WORK ORDER #:**	2003177
MODEL(S):	P7100^{IP}	**RTL QUOTE #:**	QRTL03-150
DATE OF TEST REPORT:	October 20, 2003		

American National Standard Institute:	ANSI/TIA/EIA 603 and ANSI/TIA/EIA 603-1
FCC Classification:	TNF – Licensed Non-Broadcast Transmitter Held to Face
FCC Rule Part(s):	Part 90: Private Land Mobile Radio Services Part 15: Radio Frequency Devices §15.109: Radiated Emissions Limits
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	Emission Designator
136-174	5.14	1.5	16K0F3E (Voice)
136-174	5.14	1.5	11K0F3E (Voice)
136-174	5.14	1.5	15K6F1D (2 level WB)
136-174	5.14	1.5	15K6F1E (2 level WB)
136-174	5.14	1.5	10K8F1D (2 level NB 9600)
136-174	5.14	1.5	10K8F1E (2 level NB 9600)
136-174	5.14	1.5	7K8F1D (2 level NB 4800)
136-174	5.14	1.5	7K8F1E (2 level NB 4800)
136-174	5.14	1.5	8K4F1D (C4FM)
136-174	5.14	1.5	8K4F1E (C4FM)
136-174	5.14	1.5	16K0F3E (Voice)
136-174	5.14	1.5	11K0F3E (Voice)

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: _____ October 20, 2003

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

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Table of Contents

Table Index

Appendix Index

Photograph Index

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: P7100IP, FCC ID: OWDTR-0013-E**, VHF (136-174 MHz) Portable Radio.

The results of these tests will also serve to cover the P5100IP VHF (136-174 MHz) Portable Radio, which is a reduced feature/function type version of the P7100IP, and incorporates the same changes and additions as the P7100IP.

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.

1.2 Related Submittal(s)/Grant(s)

This is a Class II Permissive Change report for the original application for FCC ID: OWDTR-0013-E.

1.3 Description of Changes in Device

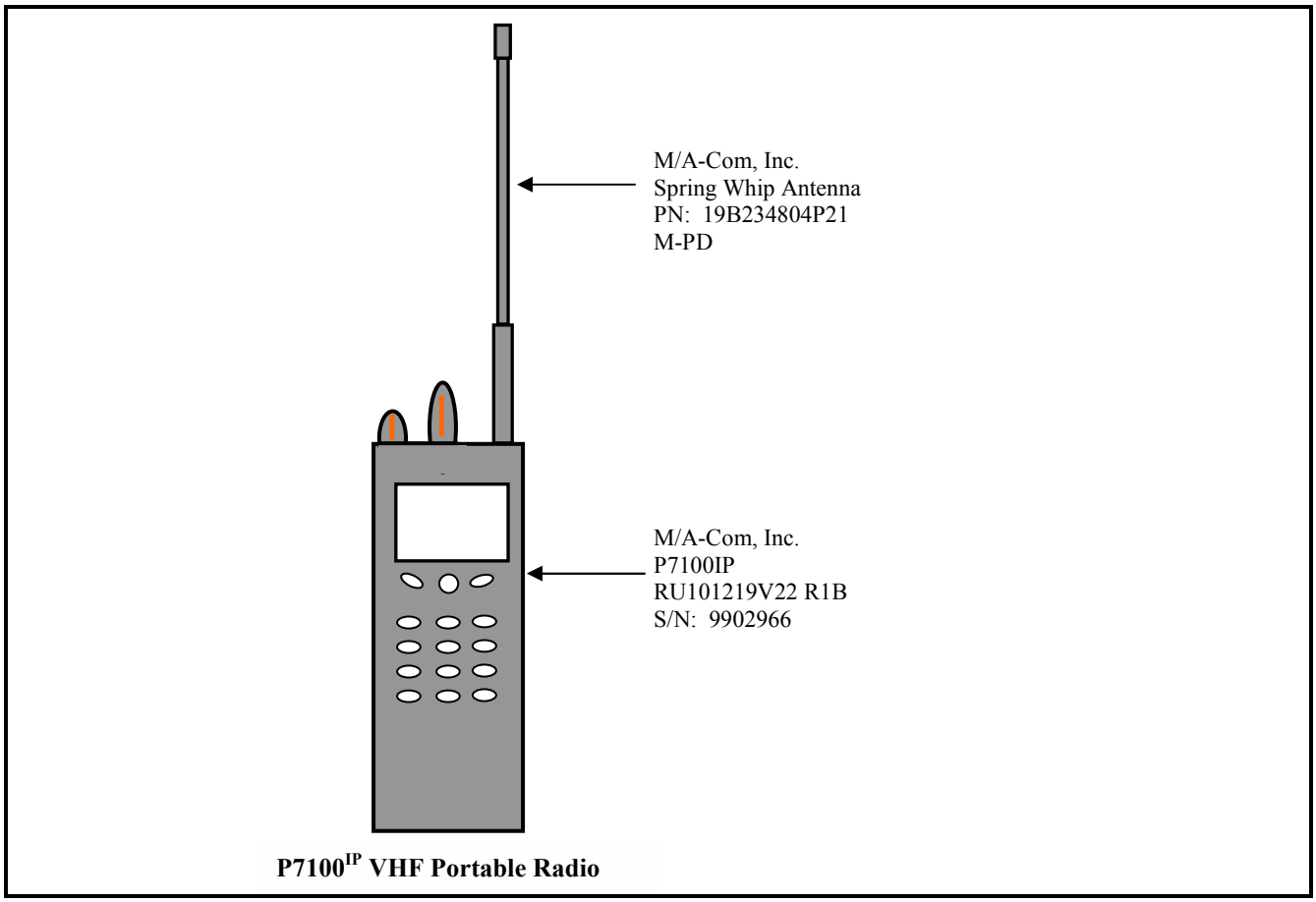
- Spring whip antenna - PN: 19B234804P21, Freq. Range: 150-174MHz. This antenna is an addition to the product offering.
- P7100 VHF RU101219V21 & V22 - R1A to R1B antenna grounding clip change:
  An antenna-grounding clip was added to the radio rear casting to improve the electrical connection of the radio rear casting to the main PWB in the antenna launch area. The metal grounding clip has less resistance than the dispensed RF gasket material around the perimeter of the casting; this improves the ground in the critical area where the antenna attaches to the radio.

2 Test System Details

2.1 System Components Table

Part	Manufacturer	Model	Serial Number/PN	FCC ID	Cable Description	RTL Bar Code
VHF Portable Radio	M/A-Com, Inc.	P7100IP	N/A	OWDTR-0013-E	N/A	15463
Spring Whip Antenna	M/A-Com, Inc.	M-PD	19B234804P21	N/A	N/A	15464
7.5V Nickel Cadmium Battery	M/A-Com, Inc.		BKB 191 210/5 R5A	N/A	N/A	14620

2.2 Tested Configuration Diagram



P7100IP VHF Portable Radio

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 Power Output (High Power): Carrier Output Power (Unmodulated)

Channel	Frequency (MHz)	RF Power Measured (Watt)*
1 (High Power)	136	5.12
2 (High Power)	155	5.11
3 (High Power)	174	5.14
1 (Low Power)	136	1.04
2 (Low Power)	155	1.05
3 (Low Power)	174	1.03

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

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

Rated Power (W)
1-5

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		October 17, 2003
Test Technician/Engineer	Signature	Date Of Test

3.2 FCC Rules and Regulations Part 2 §2.1046: Effective Radiated Power Output

3.2.1 Test Procedure

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

ERP Measurements by Substitution Method:

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. The generator level and substitute antenna gain factors are combined and referenced to the rated output of the transmitter. The forward power for the dipole was then determined and the ERP level was determined by adding the forward dipole power and the dipole gain in dB.

3.2.2 Test Data

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

Table 3-4: Power Output Data – High Power

Frequency Tuned	EUT Conducted Power	Max. Field Strength of EUT (Vert. Pol.)	Dipole Gain	Dipole Forward Conducted Power	ERP of EUT Dipole Gain + Dipole Forward Conducted Power	
(MHz)	(dBm)	(dBm)	(dBd)	(dBm)	(dBm)	Watts
136	37.09	5.5	-.06	27.4	27.34	.54
155	37.08	8.0	.44	27.8	28.24	.67
174	37.11	10.2	.44	29.4	29.84	.96

Table 3-5: Power Output Data – Low Power

Frequency Tuned	EUT Conducted Power	Max. Field Strength of EUT (Vert. Pol.)	Dipole Gain	Dipole Forward Conducted Power	ERP of EUT Dipole Gain + Dipole Forward Conducted Power	
(MHz)	(dBm)	(dBm)	(dBd)	(dBm)	(dBm)	Watts
136	30.16	-4.7	-.06	17.2	17.14	.05
155	30.23	0.3	.44	20.1	20.54	.11
174	30.14	4.8	.44	24.1	24.54	.28

Table 3-6: 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 - 20 GHz)	3610A00866	08/05/04

Test Personnel:

Daniel Biggs		October 17, 2003
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

3.3.3 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 3-7: Field Strength of Spurious Radiation Channel 2 – 150 MHz; Narrow Band; High Power

Radiated Spurious Emissions
Mid Band Channel 2 (155 MHz, Narrowband)
Limit = 50 + 10 Log P = 57.08 dBc
Conducted Power = 37.08 dBm = 5.12 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
310.0	52.9	-61.7	0.3	-0.4	99.4	-42.4
465.0	42.4	-68.3	0.6	-1.1	107.0	-50.0
620.0	38.6	-68.4	0.7	-1.5	107.6	-50.6
775.0	39.7	-64.8	1.2	-1.5	104.5	-47.5
930.0	33.5	-69.3	1.2	-1.8	109.3	-52.3
1085.0	35.6	-66.8	1.5	0.8	104.6	-47.6
1240.0	37	-64.7	1.5	2.9	100.4	-43.4
1395.0	37.7	-63.5	1.0	2.9	98.7	-41.7
1550.0	38.8	-62.1	1.5	5.0	95.7	-38.7
1705.0	45.3	-54.6	1.3	5.0	88.0	-31.0

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

Table 3-8: Field Strength of Spurious Radiation Channel 2 – 150 MHz; Narrow Band; Low Power

Radiated Spurious Emissions
Mid Band Channel 2 (155 MHz, Narrowband)
Limit = 50 + 10 Log P = 50.21 dBc
Conducted Power = 30.23 dBm = 1.05 W

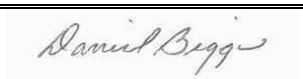
Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
310.0	49.3	-65.3	0.3	-0.4	96.2	-46.0
465.0	38.4	-72.3	0.6	-1.1	104.2	-54.0
620.0	37.5	-69.5	0.7	-1.5	101.9	-51.7
775.0	36.1	-68.4	1.2	-1.5	101.3	-51.1
930.0	33.6	-69.2	1.2	-1.8	102.4	-52.2
1085.0	35.9	-66.5	1.5	0.8	97.5	-47.3
1240.0	34.3	-67.4	1.5	2.9	96.3	-46.1
1395.0	35	-66.2	1.0	2.9	94.6	-44.4
1550.0	36.7	-64.2	1.5	5.0	91.0	-40.8
1705.0	41	-58.9	1.3	5.0	85.5	-35.3

*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		October 17, 2003
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

Table 3-10: 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)
120.000	Qp	V	0	1.0	39.3	-16.2	23.1	43.5	-20.4
224.900	Qp	V	0	1.0	32.1	-18.1	14.0	46.0	-32.0
251.650	Qp	V	0	1.0	32.8	-16.2	16.6	46.0	-29.4
270.650	Qp	V	0	1.0	38.5	-15.9	22.6	46.0	-23.4
289.650	Qp	V	0	1.0	37.7	-15.5	22.2	46.0	-23.8
460.800	Qp	V	0	1.0	31.9	-10.8	21.1	46.0	-24.9
541.300	Qp	V	0	1.0	35.7	-8.4	27.3	46.0	-18.7
754.900	Qp	V	0	1.0	30.6	-5.7	24.9	46.0	-21.1
754.950	Qp	V	0	1.0	34.3	-5.7	28.6	46.0	-17.4
811.950	Qp	V	0	1.0	36.0	-5.6	30.4	46.0	-15.6

Table 3-11: 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		October 22, 2003
Test Technician/Engineer	Signature	Date Of Test

4 Conclusion

The data in this measurement report shows that the M/A-Com, Inc., Model: P7100IP, FCC ID: OWDTR-0013-E, VHF FM Portable VHF Radio, complies with all the requirements of Parts 90 and 15 of the FCC Rules and Industry Canada RSS-119, Issue 1. The successful results of these tests also cover the P5100IP VHF (136-174 MHz) Portable Radio, which is a reduced feature/function type version of the P7100IP, and incorporates the same changes and additions as the P7100IP.