

Test Report
for
M/A-Com, Inc.
on the
Handheld Portable Radio
Model: P800
to
FCC Part 90
FCC ID: BV8P800

Deleted: M-803

Test Report #: 3049668
Date of Report: November 4, 2003

Project #: 3049668
Dates of Test: November 3-4, 2003

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FCC Part 90 Certification

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1.0 Summary of Tests

Handheld Portable Radio

FCC ID: BV8P800
Serial #: A40007100074
Model: P800

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FCC RULE	DESCRIPTION OF TEST	RESULTS	REPORT PAGE
2.1046, 90.205(i), 90.635(d)	RF Power Output	Passed	7
2.1049, 90.209(b)(5), 90.210	Occupied Bandwidth, Bandwidth Limitation, Emission Masks	Passed	8
2.1051, 90.210	Out-of-Band Emissions at Antenna Terminals	Passed	12
2.1047	Modulation Characteristics	N/A	--
2.1055	Frequency Stability vs. Temperature	Not Tested*	--
2.1055	Frequency Stability vs. Voltage	Not Tested*	--
2.914	Transient Frequency Behavior	N/A	--
2.1091, 2.1093	RF Exposure	Not Tested*	--
2.1053, 90.205, 90.635	Field Strength of Spurious Radiation	Passed	15

*Not Tested means the test was not performed as the results are not expected to change based on the device modifications since the last filing

2.0 General Description**2.1 Product Description**

The EUT is a hand held mobile radio operating in the 806 to 824 and 851 to 869 MHz bands. It has a rated output power of 3W. The intended FCC ID is BV8P800. The purpose of testing is to explore the effects of adding P25 C4FM modulation to the device.

The EUT has been tested at the request of

Company: M/A-Com
1011 Pawtucket Blvd.
Lowell, MA, 01853-2395
Name of contact: Roman Makarewicz
Telephone: (978) 442-5151
Fax: (978) 442-5353

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

Site 2C (Middle Site) is a 3m and 10m sheltered EMI measurement range located in a light commercial environment in Boxborough, Massachusetts. It meets the technical requirements of ANSI C63.4-1992 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets of metal are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. A copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

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2.4 Test Equipment and Support Equipment

Test Equipment

Description	Manufacturer	Model Number	ITS ID	Serial Number	Cal Due Date
Antenna	EMCO	3142	LOG4	9711-1225	02/18/2004
EMI Receiver Set	Hewlett Packard	8542E	REC2	3520A00125	12/05/2003
RF Filter	Hewlett Packard	85420E	RECFL2	3427A00126	12/05/2003
High Frequency Cable	Megaphase	TM40 K1K1 197	CBL030	CBL030	11/13/2003
High Frequency Cable	Megaphase	TM40 K1K1 80	CBL027	CBL027	11/13/2003
High Frequency Cable	Megaphase	TM40 K1K1 80	CBL029	CBL029	11/13/2003
Spectrum Analyzer	Rohde & Schwarz	FSEK-30	ROS001	100225	05/26/2004
Signal Generator	Hewlett Packard	AT-83640B/1	TMP001	3844A00757	10/05/2005
Horn Antenna	EMCO	3115	HORN3	9610-4980	09/16/2004
Digital 4 Line Barometer	Mannix	0ABA116	BAR2	BAR2	07/09/2004
20 dB Attenuator	Mini Circuits	20 dB, 50 Ohm	DS28	DS28	01/07/2004
20 dB Attenuator	Mini Circuits	20 dB, 50 Ohm	DS24	DS24	01/07/2004
10 dB Attenuator	Mini Circuits	10 dB, 50 Ohm	DS11	DS11	01/08/2004
Horn Antenna	EMCO	3115	HORN2	9602-4675	09/03/2004
Preamplifier 1-40 GHz	Miteq	NSP4000-NF	PRE8	507145	10/22/2004
30 dB Attenuator	Weinschel	23-30-34	WEI4	AY9076	02/15/2004

No support equipment was used during testing.

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3.0 RF Power Output

FCC § 2.1046, § 90.205(i), § 90.635(d)

3.1 Test Procedure

The transmitter output was connected to a calibrated coaxial attenuator, the other end of which was connected to a spectrum analyzer.

Requirement: The RF Power Output must be below 20 dBW.

3.2 Test Results

Results: Passed

11/03/2003

Equipment: REC2, RECFL2, WEI4, DS28

Frequency (MHz)	Description	Value (dBm)	Value (dBW)	Limit (dBW)
806.0125	Channel 1 Low Normal Band	33.37	3.37	20
816.3625	Channel 415 Mid Normal Band	33.63	3.63	20
823.9875	Channel 830 High Normal Band	33.82	3.82	20
851.0125	Channel 1 Low TalkAround Band	34.06	4.06	20
861.3625	Channel 415 Mid TalkAround Band	34.29	4.29	20
868.9875	Channel 830 High TalkAround Band	34.82	4.82	20

4.0 Occupied Bandwidth, Bandwidth Limitation, Emission Masks

FCC §2.1049, 90.209(b)(5), 90.210

4.1 Test Procedure

The antenna was disconnected from the transmitter and a spectrum analyzer was connected to the transmitter RF output through sufficient attenuation to prevent overloading of the analyzer. The resolution bandwidth of the spectrum analyzer was set up to 300 Hz in the 100 kHz span around the transmit frequency, and the spectrum of the transmitting signal was recorded. This spectrum was compared to the required emission mask. The measured RF output power was used to determine the upper limit for the applicable emissions masks.

Occupied bandwidth was measured using the 99% power function on the spectrum analyzer.

Requirement: The Transmit Waveform must stay within the confines of Emissions Mask B and the Occupied Bandwidth must not exceed 20 kHz.

4.2 Test Results

Results: Passed

11/03/2003

Equipment: REC2, RECFL2, DS24, DS28, DS11

Frequency (MHz)	Description	Occupied Bandwidth (kHz)	Authorized Bandwidth (kHz)
806.0125	Channel 1 Low Normal Band	11.8	20
816.3625	Channel 415 Mid Normal Band	11.5	20
823.9875	Channel 830 High Normal Band	12.3	20
851.0125	Channel 1 Low TalkAround Band	12.3	20
861.3625	Channel 415 Mid TalkAround Band	12.3	20
868.9875	Channel 830 High TalkAround Band	10.3	20

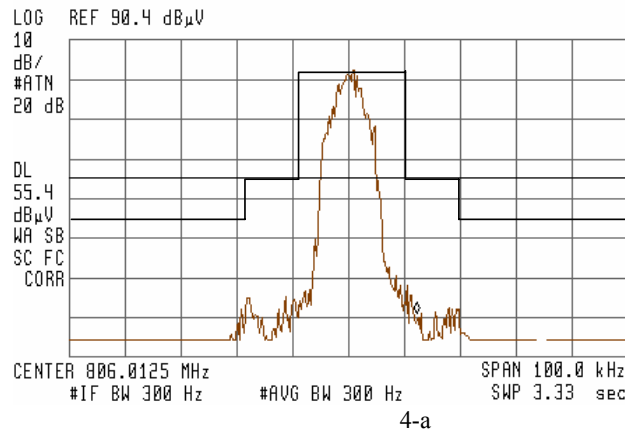
11/03/2003

Equipment: REC2, RECFL2, DS24, DS28, DS11

Plot Number	Description
4-a	Channel 1 Low Normal Band
4-b	Channel 415 Mid Normal Band
4-c	Channel 830 High Normal Band
4-d	Channel 1 Low TalkAround Band
4-e	Channel 415 Mid TalkAround Band
4-f	Channel 830 High TalkAround Band

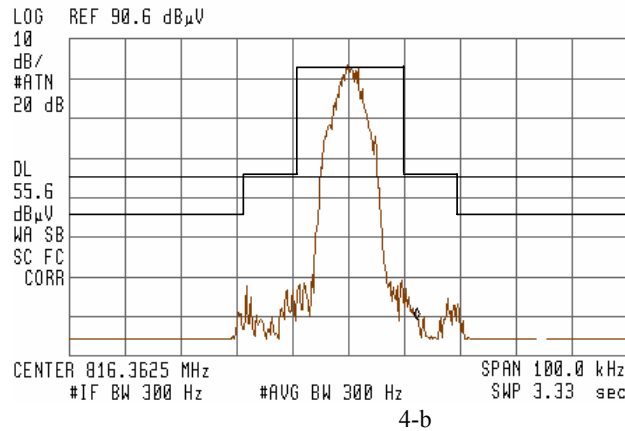
11:13:30 03 NOV 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 806.0248 MHz
21.31 dBμV



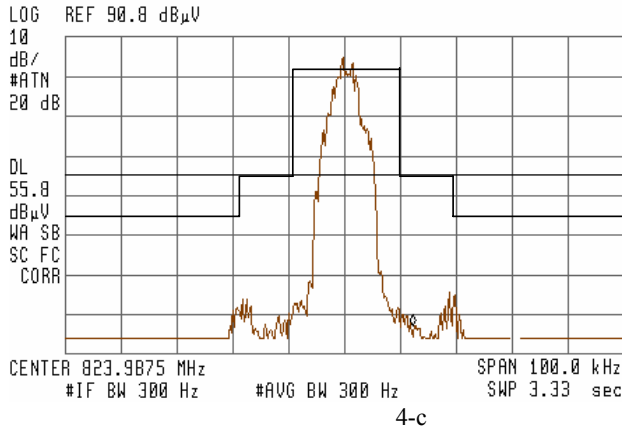
11:08:27 03 NOV 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 816.3748 MHz
19.92 dBμV



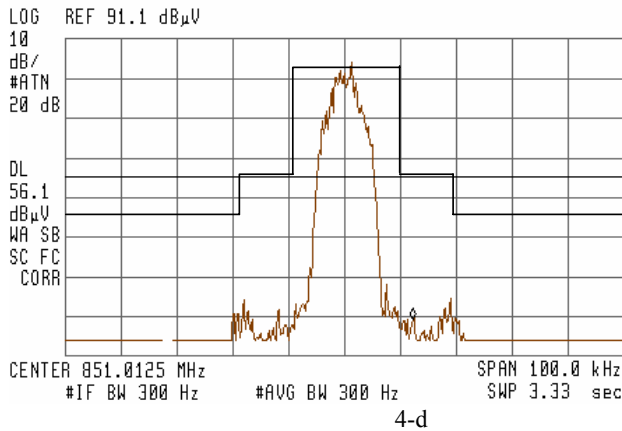
11:02:25 03 NOV 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 823.9998 MHz
17.80 dBμV



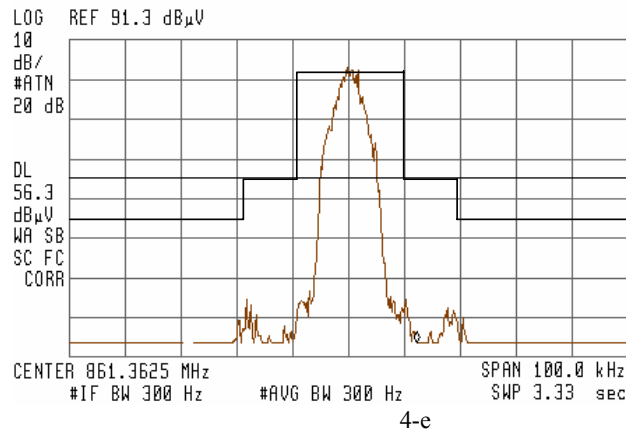
10:52:34 03 NOV 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 851.0248 MHz
20.32 dBμV



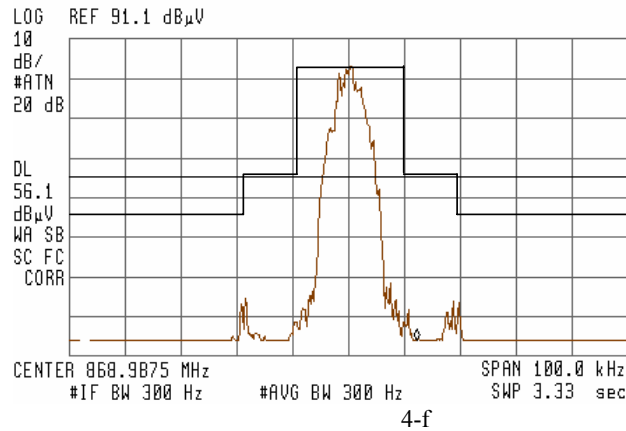
10:41:53 03 NOV 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 861.3748 MHz
14.85 dBμV



10:33:29 03 NOV 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 868.9998 MHz
14.88 dBμV



5.0 Out-of-Band Emissions at Antenna Terminals

FCC §2.1051, FCC §90.210

5.1 Test Procedure

The RF output of the radio was connected to a spectrum analyzer through 50 dB of attenuation to prevent overloading the analyzer. The resolution bandwidth of the spectrum analyzer was set at 100 kHz below 1 GHz. Above 1 GHz the bandwidth was set to 1 MHz. The frequency range from 30 MHz to 8.1 GHz was investigated.

Requirement: The power of emissions must be attenuated below the power of the unmodulated carrier (P) on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth at least $(43 + 10 \log P)$ dB. This corresponds to a limit on the output power of spurious emissions of -13 dBm. Since the measurement was performed through 50 dB of attenuation, the display line is set at -63 dBm.

5.2 Test Results

Results: Passed

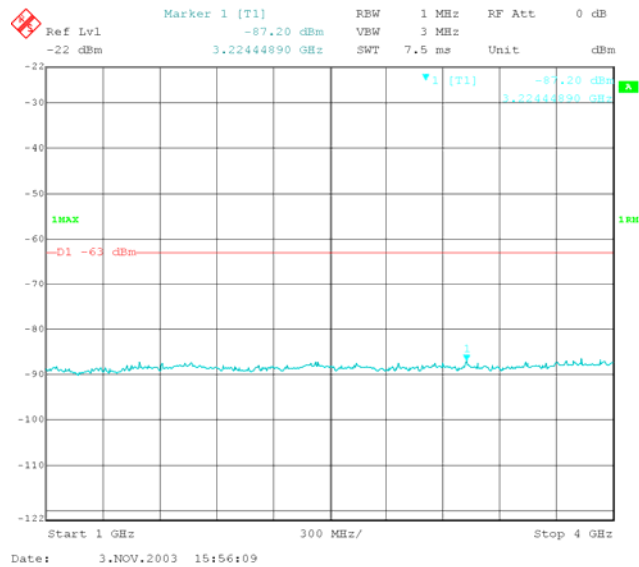
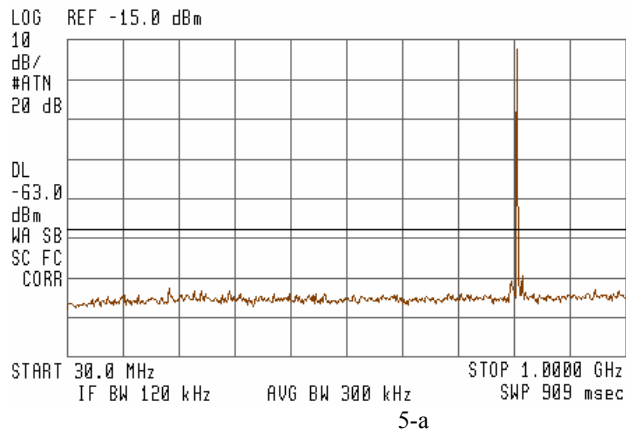
11/03/2003

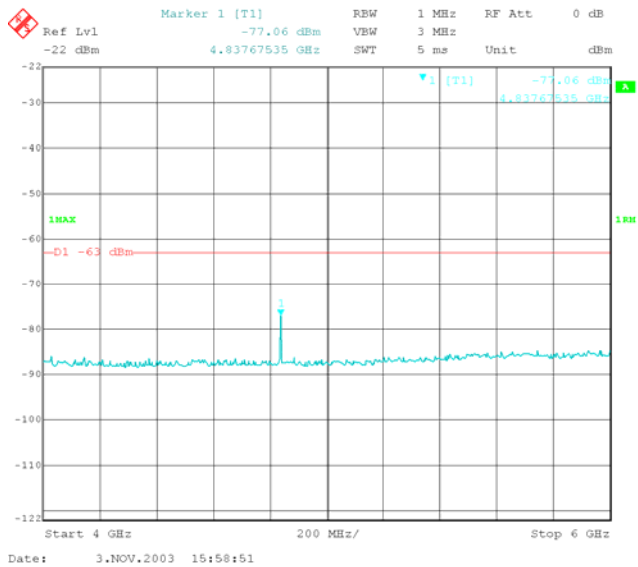
Equipment: ROS001, REC2, RECFL2, WEI4, DS28

Plot Number	Description
5-a	30 MHz – 1 GHz
5-b	1 GHz – 4 GHz
5-c	4 GHz – 6 GHz
5-d	6 GHz – 8.1 GHz

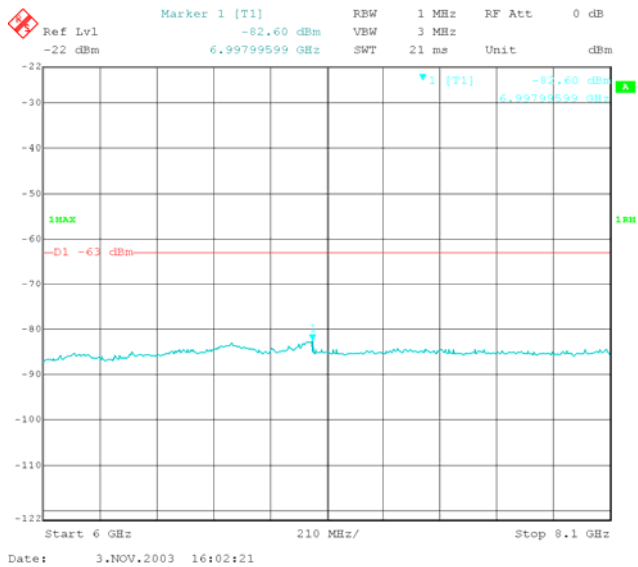
09:35:11 03 NOV 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG





5-c



5-d

6.0 Field Strength of Spurious Radiation

FCC §2.1053, §90.210

Deleted: 15.109

6.1 Test Procedure

The transmitter was placed on a wooden turntable. The measurement antenna was placed at a distance of 10 meters from the EUT below 1 GHz, and 3 meters from the EUT above 1 GHz. During the tests, the antenna height and polarization were varied, and the EUT was rotated through 360 degrees in order to identify the maximum level of emissions. A max hold function was used to determine maximum field strength levels.

The Radiated Power was measured by the substitution method using a horn antenna connected to a signal generator. Power P (in dBm) was calculated as follows:

$$P = P_{sg} + dB_{adj} - L + G_H - G_d$$

Where G_H is the gain of the transmit horn/biconical antenna attached to the signal generator

L is the loss in the cable between the signal generator and the transmit antenna

P_{sg} is the generator output power

G_d is 2.14 dBi – the gain of the half-wave dipole.

dB_{adj} is the adjustment in dB used to correct for the difference between the observed field strengths of the EUT and of the signal generator signal, respectively.

Requirement: The power into a dipole required to duplicate the chassis emission must be below –13 dBm.

6.2 Test Results

Results: Pass

11/04/2003

Equipment: REC2, RECFL2, ROS001, PRE8, HORN2, HORN3, LOG4, TMP001, CBL027, CBL029, CBL030

Frequency (MHz)	Description	Power (dBm)	Power Limit (dBm)
1612	Harmonic	-43.7	-13
1842	Spurious	-78.6	-13
2418	Harmonic	-33.0	-13
3224	Harmonic	-21.8	-13
3684	Spurious	-45.1	-13
4030	Harmonic	-20.6	-13
4605	Spurious	-48.8	-13
4836	Harmonic	-17.0	-13
5526	Spurious	-49.0	-13
5642	Harmonic	-26.2	-13
6448	Harmonic	-38.6	-13
7254	Harmonic	-39.3	-13

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8060	Harmonic	-47.6	-13
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6.3 Configuration Photographs – Radiated Emissions



Spurious Test Setup, Front View



Deleted: The Part 15 requirements for this device are addressed in a separate report.

Deleted: 7.0 Emissions

Line Conducted

FCC § 15.107

7.1 Test Procedure

The test procedure is outlined in ANSI C63.4:1992S.

7.2 Test Results

The Part 15 requirements for this device are addressed in a separate report.

Results: Not required for Part 90. ... [1]

Spurious Test Setup, Back View

7.0 Line Conducted Emissions
FCC § 15.107

7.1 Test Procedure

The test procedure is outlined in ANSI C63.4:1992S.

7.2 Test Results

The Part 15 requirements for this device are addressed in a separate report.

Results: Not required for Part 90.
