ITS Intertek Testing Services
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FCC Part 90 Test Report
for
M/A-Com, Inc.
on the
RF Exposure Testing
of the
M-803 Vehicular Tactical Radio
Model: MAMROS0070

FCC ID: BV8M803VTAC

Test Report #: 3061720.VTAC
Date of Report: September 29, 2004

Project #: 3061720
Dates of Test: July 2, 2004

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1.0 Summary of Tests

FCC ID: BV8M803VTAC
Model No.: MAMROS0070

FCC RULE	DESCRIPTION OF TEST	RESULTS	REPORT PAGE
1.1310, 2.1091	RF Exposure	Passed	6

2.0 General Description

2.1 Product Description

The M-803 Vehicular Tactical (VTAC) Unit is a versatile voice and data radio designed for the mobile environment. The M-803 operates in the 800 MHz SMR and NPSPAC frequency bands and is comprised of a VRM radio operating from 806 – 824 MHz and a VRB radio operating from 851 – 869 MHz through an RF Combiner. A production version of the M-803 Vehicular Tactical (VTAC) Unit was received on July 1, 2004 in good condition. The purpose of testing is to perform a routine RF Exposure evaluation for five antennas which are being added to the existing filing. Only the OpenSky digital modulation (OTP/ORP which employs a GFSK modulation) software was provided and tested. This radio has been tested and complies with the FCC RF exposure limits for Controlled Exposure.

The EUT has been tested at the request of

Company: M/A-Com
1011 Pawtucket Blvd.
Lowell, MA, 01853-2395
Name of contact: Benjamin George
Telephone: (978) 442-5008
Fax: (978) 442-5353

Overview of M-803 VTAC Unit

Applicant	M/A-Com
Trade Name	M-803 Vehicular Tactical Unit (VTAC)
FCC Identifier	BV8M803VTAC
Use of Product	Voice and Data Communication
Type of Modulation	GFSK and FM
Bit Rate	19200 bps
Baud Rate	9600
Occupied Bandwidth	15.8 kHz measured
RF Output	18 Watts measured at the VRM, 17 Watts measured at the VRB
The dc voltage applied to and current into the several elements of the final RF amplifying device	Voltage: 12VDC Current: 9A
Frequency Range	806 – 824 MHz and 851 – 869 MHz
Transmitter L.O. Frequency	736 – 754 MHz, 921 – 939 MHz, 966 – 984 MHz
Max. Number of Channels	830
Antenna(e) & Gain	3 dBd (5 dBi)
Detachable Antenna?	[X] Yes [ ] No
Receiver L.O. Frequency	58 MHz, 70.455 MHz, 736 – 754 MHz, 921 – 939 MHz, 966 – 984 MHz
External Input	[X] Audio [X] Digital Data

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

Site 2C (Middle Site) is a 3m and 10m sheltered emissions 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 a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets 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. The 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.

FCC Site Registration #: 91658
Industry Canada Site Registration #: IC4585-2

3.0 RF Exposure

FCC §1.1310, §2.1091

3.1 Test Procedure

Description	Manufacturer	Model Number	Serial Number	Cal Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK-30	100225	06/04/05
High Frequency Cable	Megaphase	TM40 K1K1 197	CBL028	11/11/04
Antenna	Compliance Design, Inc.	B300	3352	09/19/04

Support Equipment			
Description	**Manufacturer**	**Model Number**	**Serial Number**
Laptop	IBM	Thinkpad 2647	78-GPZ99
DC Power Supply	Samlex America	SEC1223	03061-3J04-00763
Test Vehicle	Oldsmobile	1994 Cutlass Supreme	1G3WH55M2RD302262
Fan	Electrix	K128	N/L
Equipment Under Test			
Vehicular Tactical Radio	M/A-Com, Inc.	VTAC: MAMROS0070 VRM: MAMROS0006 VRB: MAMROS0007 Combiner: MAMROS0016	VRM: A40070000236 VRB: A4008016E521
3 dBd Gain Tri-Band Roof Mount Antenna	Antenex	OEM2322	#1
3 dBd Gain Tri-Band Roof Mount Antenna	Andrew (Antenna Specialists)	L239R-A	#2
3 dBd Gain Tri-Band Roof Mount Antenna	Maxrad	MAX7603	#3
3 dBd Gain Dual-Band Trunk-Lip Mount Antenna	Maxrad	MUF7603	#4
3 dBd Gain Dual-Band Low-Profile Roof Mount Antenna	Maxrad	MLPV700	#5

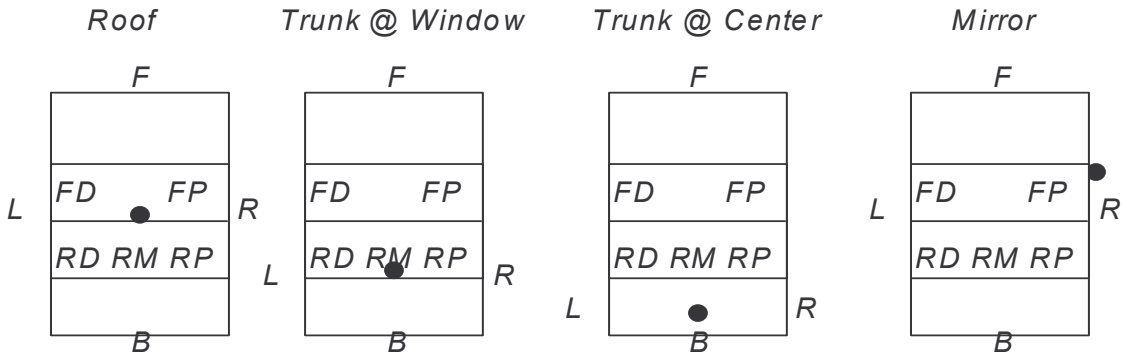
The EUT was activated at full power, and connected to each of the antennas listed in this report. Each antenna was placed at a typical mounting point. At the request of M/A-Com, the roof mounted antennas were connected to an 8"x8" flat metal panel which was 3mm thick. The metal panel the roof mounted antennas were mounted on was grounded to the chassis of the vehicle at the sun visor attachment screw via a 195 cm 14-gauge ground wire. A measurement antenna was connected to a spectrum analyzer, and peak readings of the field strength were taken at various test points outside and inside of the vehicle. Measurement antenna height and polarization were varied at each point to produce the worst-case value. Below are diagrams showing the transmit antenna mounting point and the corresponding test point locations and designations. Note that for this set of antennas, only the trunk @ window and roof mounting points were tested as they fully represent the intended use of these antennas.

The readings at the spectrum analyzer are in dBuV/m. The limits are expressed in mW/cm^2. An equation that relates these two values is

$$E = 20 \text{ LOG } (1x10^6 (377*10*P)^{1/2})$$

where E is the measured voltage in dBuV/m, and P is the power density in mW/cm^2. The factor

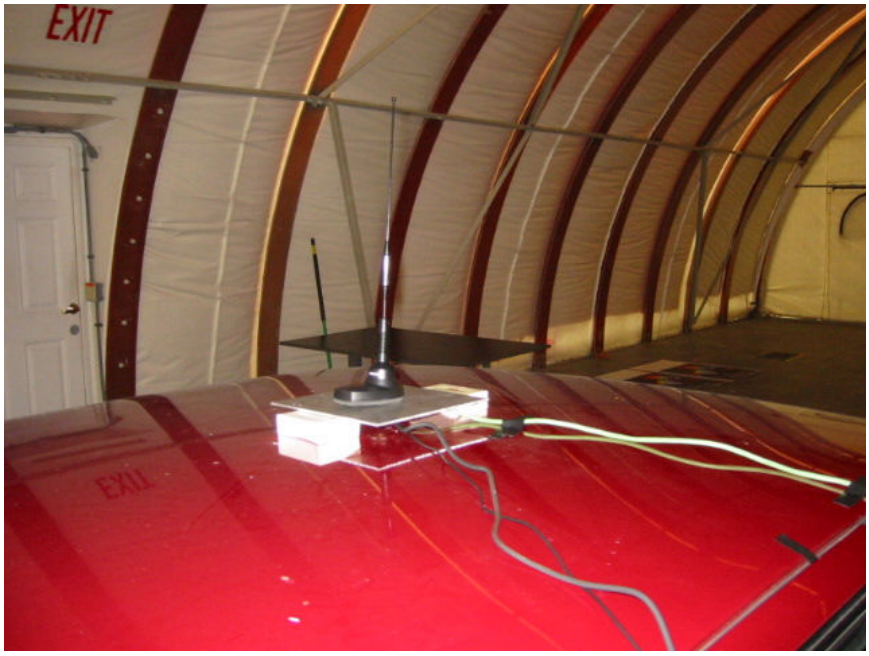
377 is the impedance of free space, a constant. The obtained power density can then be compared to the limits. The power density limit for controlled exposure is f/300, where f is the transmit frequency. The worst case limits are at the lowest transmit frequency, and the measured RF output power of the EUT at the antenna port was maximum at the lowest transmit frequency. Therefore the lowest transmit frequency of 806.0125 MHz was selected as the worst case frequency for the VRM and the limit for Maximum Permissible Exposure (MPE) in controlled environments for the VTAC system was determined to be 2.687 mW/cm^2. Since the VTAC system transmits both in the 806 – 824 and 851 – 869 MHz bands simultaneously, the frequency 851.0125 MHz was selected for measurement at the same time as the 806.0125 MHz signal, with the measured power densities at both frequencies being summed and compared to the overall limit.



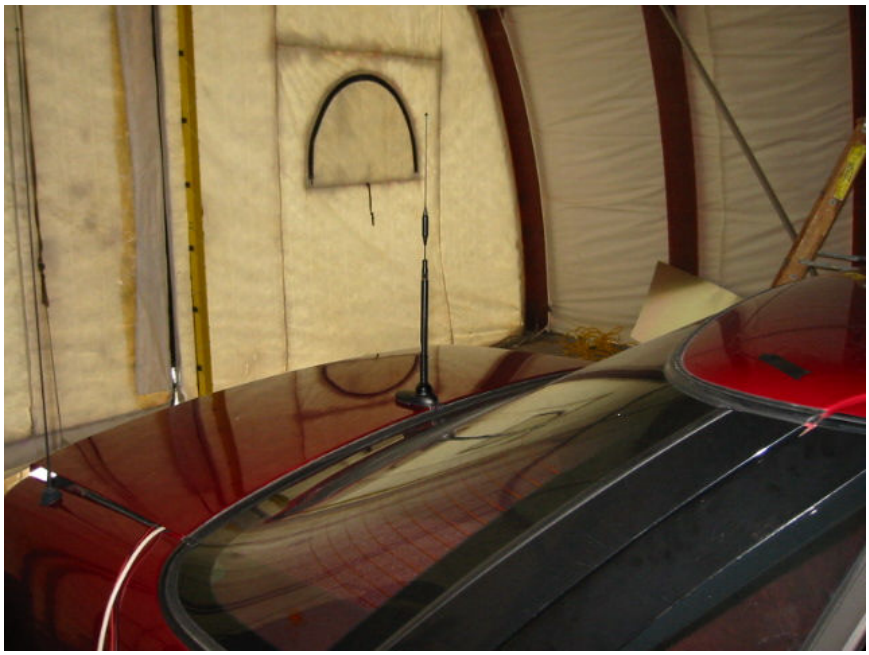
F = Front
L = Left
R = Right
B = Back
FD = Front Driver Side
FP = Front Passenger Side
RD = Rear Driver Side
RM = Rear Middle
RP = Rear Passenger Side
● = Transmit Antenna

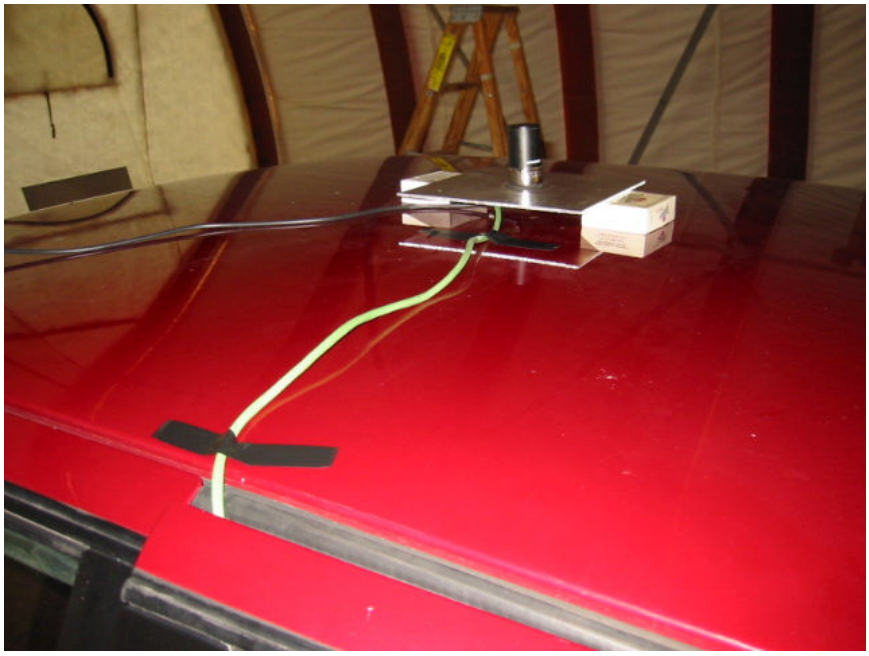
Roof Mounting on Test Vehicle, #1 Antenna

Roof Mounting on Test Vehicle, #2 Antenna



Roof Mounting on Test Vehicle, #3 Antenna


Trunk Mounting on Test Vehicle, #4 Antenna



Roof Mounting on Test Vehicle, #5 Antenna

3.2 Test Results

The data format is low/high frequency; low frequency = 806.0125 and high frequency = 851.0125 MHz.

Antenex OEM2322 3dBd Gain Roof Mount on Oldsmobile

Test Point	Field Strength Reading (dBuV/m)	Power Density Reading (mW/cm^2)	Total Power Density Reading (mW/cm^2)	Controlled MPE Limit (mW/cm^2)	Test Point Distance (cm)	Interpolated Power Density at 43 cm (mW/cm^2)†
Front	137.91/135.45	0.016/0.009	0.026	2.687	294.0	1.215
Back	140.99/138.23	0.033/0.018	0.051	2.687	203.0	1.137
Left	145.45/143.85	0.093/0.064	0.157	2.687	97.0	0.799
Right	146.14/143.65	0.109/0.061	0.170	2.687	110.0	1.112
Front Driver	138.52/132.37	0.019/0.005	0.023	2.687	55.0	0.038
Front Passenger	138.06/131.80	0.017/0.004	0.021	2.687	54.0	0.033
Rear Driver	136.79/132.57	0.013/0.005	0.017	2.687	55.0	0.028
Rear Middle	135.66/131.70	0.010/0.004	0.014	2.687	48.0	0.017
Rear Passenger	139.28/131.31	0.022/0.004	0.026	2.687	60.0	0.051

Andrew (Antenna Specialists) L239R-A 3dBd Gain Roof Mount on Oldsmobile

Test Point	Field Strength Reading (dBuV/m)	Power Density Reading (mW/cm^2)	Total Power Density Reading (mW/cm^2)	Controlled MPE Limit (mW/cm^2)	Test Point Distance (cm)	Interpolated Power Density at 43 cm (mW/cm^2)†
Front	137.39/135.99	0.015/0.011	0.025	2.687	294.0	1.169
Back	140.08/137.87	0.027/0.016	0.043	2.687	203.0	0.958
Left	145.26/142.99	0.089/0.053	0.142	2.687	97.0	0.723
Right	144.53/142.93	0.075/0.052	0.127	2.687	110.0	0.831
Front Driver	134.38/131.55	0.007/0.004	0.011	2.687	55.0	0.018
Front Passenger	135.63/134.93	0.010/0.008	0.018	2.687	54.0	0.028
Rear Driver	137.40/130.21	0.015/0.003	0.017	2.687	55.0	0.028
Rear Middle	131.68/129.45	0.004/0.002	0.006	2.687	48.0	0.007
Rear Passenger	137.07/131.26	0.014/0.004	0.017	2.687	60.0	0.033

Maxrad MAX7603 3dBd Gain Roof Mount on Oldsmobile

Test Point	Field Strength Reading (dBuV/m)	Power Density Reading (mW/cm^2)	Total Power Density Reading (mW/cm^2)	Controlled MPE Limit (mW/cm^2)	Test Point Distance (cm)	Interpolated Power Density at 43 cm (mW/cm^2)†
Front	136.39/136.37	0.012/0.011	0.023	2.687	294.0	1.075
Back	138.02/133.02	0.017/0.005	0.022	2.687	203.0	0.490
Left	144.76/142.18	0.079/0.044	0.123	2.687	97.0	0.626
Right	142.62/144.11	0.048/0.068	0.117	2.687	110.0	0.766
Front Driver	134.66/135.09	0.008/0.009	0.016	2.687	55.0	0.026
Front Passenger	134.19/133.18	0.007/0.006	0.012	2.687	54.0	0.019
Rear Driver	140.20/136.44	0.028/0.012	0.039	2.687	55.0	0.064
Rear Middle	138.90/140.09	0.021/0.027	0.048	2.687	48.0	0.060
Rear Passenger	140.33/139.54	0.029/0.024	0.052	2.687	60.0	0.101

Maxrad MUF7603 3dBd Gain Trunk@Window Mount on Oldsmobile

Test Point	Field Strength Reading (dBuV/m)	Power Density Reading (mW/cm^2)	Total Power Density Reading (mW/cm^2)	Controlled MPE Limit (mW/cm^2)	Test Point Distance (cm)	Interpolated Power Density at 43 cm (mW/cm^2)†
Front	131.24/130.28	0.004/0.003	0.006	2.687	429.0	0.597
Back	148.22/144.12	0.176/0.068	0.245	2.687	73.0	0.706
Left	145.12/143.56	0.086/0.060	0.146	2.687	100.0	0.790
Right	144.89/143.53	0.082/0.060	0.141	2.687	100.0	0.763
Front Driver	141.00/138.52	0.033/0.019	0.052	2.687	165.0	0.766
Front Passenger	139.44/138.42	0.023/0.018	0.042	2.687	165.0	0.618
Rear Driver	145.17/139.37	0.087/0.023	0.110	2.687	85.0	0.430
Rear Middle	142.98/142.00	0.053/0.042	0.095	2.687	75.0	0.289
Rear Passenger	143.70/140.89	0.062/0.033	0.095	2.687	85.0	0.371

Maxrad MLPV700 3dBd Gain Roof Mount on Oldsmobile

Test Point	Field Strength Reading (dBuV/m)	Power Density Reading (mW/cm^2)	Total Power Density Reading (mW/cm^2)	Controlled MPE Limit (mW/cm^2)	Test Point Distance (cm)	Interpolated Power Density at 43 cm (mW/cm^2)†
Front	137.25/136.08	0.014/0.011	0.025	2.687	294.0	1.169
Back	138.08/136.79	0.017/0.013	0.030	2.687	203.0	0.669
Left	143.17/141.80	0.055/0.040	0.095	2.687	97.0	0.483
Right	146.05/143.67	0.107/0.062	0.169	2.687	110.0	1.106
Front Driver	134.46/131.35	0.007/0.004	0.011	2.687	55.0	0.018
Front Passenger	135.05/132.59	0.008/0.005	0.013	2.687	54.0	0.021
Rear Driver	136.05/131.34	0.011/0.004	0.014	2.687	55.0	0.023
Rear Middle	131.54/131.51	0.004/0.004	0.008	2.687	48.0	0.010
Rear Passenger	137.18/133.02	0.014/0.005	0.019	2.687	60.0	0.037

† $P_{43cm} = P_{meas} * (\text{Test Point Distance}/43)^2$

This radio has been tested and complies with the FCC RF exposure limits for Controlled Exposure.

Results: Passed