



MOTOROLA



CGISS EME Test Laboratory

8000 West Sunrise Blvd
Fort Lauderdale, FL. 33322

MPE Compliance Test Report

Date of Report: June 19, 2003
Report Revision(s): Rev. O
Device Manufacturer: Motorola
Device Description: 40W 4 channel Mobile Radio 465-495 MHz
Classification: Occupational/Controlled Exposure
FCC ID: ABZ99FT4049
Device Model: PMUE2012A

Test Period: 6/18/03

Test Engineer: Jim Fortier (Elect. Principle Staff Engineer)

Author: Michael Sailsman (Global EME Regulatory Affairs Liaison)

Note: Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with all applicable national and international reference standards and guidelines.

Signature on File

6/19/03

Ken Enger
Senior Resource Manager, Laboratory Director, CGISS EME Lab
Phone: 954-723-6299 Fax: 954-723-3803

Date Approved

Note: This report shall not be reproduced in part without written approval from an authorized representative of the Motorola CGISS EME Laboratory.

TABLE OF CONTENTS

1.0	Product Description
2.0	Offered Options and Accessories
3.0	Measurement Standards
4.0	Data Collection Consideration
5.0	Measurement System Uncertainty Levels
6.0	Method of Measurement
6.1	EME measurements made on trunk mounted antennas
6.1.1	External vehicle EME measurement
6.1.2	Internal vehicle EME measurement
6.2	EME Measurements made on center roof mounted antennas
6.2.1	External vehicle EME measurements
6.2.2	Internal vehicle EME measurement
7.0	Test Site
8.0	Measurement System/Equipment
9.0	Test Unit Description
10.0	Test Set-Up Description
11.0	Test Results
	Table 1 – 465.025 MHz external E-field assessment at the trunk w/ antenna model HAE4011A
	Table 2 – 480.025 MHz external E-field assessment at the trunk w/ antenna model HAE4012A
	Table 3 – 494.975 MHz external E-field assessment at the trunk w/ antenna model HAE4012A
	Table 4 – 494.975 MHz external E-field assessment at the roof w/ antenna model HAE4004A
	Table 5 – 480.025 MHz external E-field assessment at the roof w/ antenna model HAE4004A
	Table 6 – 465.025 MHz external E-field assessment at the roof w/ antenna model HAE4003A
	Table 7 – 465.025 MHz external E-field assessment at the roof w/ antenna model HAE4011A
	Table 8 – 480.025 MHz external E-field assessment at the roof w/ antenna model HAE4012A
	Table 9 – 494.975 MHz external E-field assessment at the roof w/ antenna model HAE4012A
	Table 10 – 465.025 MHz internal E-field assessment at the trunk w/ antenna model HAE4011A
	Table 11 – 480.025 MHz internal E-field assessment at the trunk w/ antenna model HAE4012A
	Table 12 – 494.975 MHz internal E-field assessment at the trunk w/ antenna model HAE4012A
	Table 13 – 494.975 MHz internal E-field assessment at the roof w/ antenna model HAE4004A
	Table 14 – 480.025 MHz internal E-field assessment at the roof w/ antenna model HAE4004A
	Table 15 – 465.025 MHz internal E-field assessment at the roof w/ antenna model HAE4003A
	Table 16 – 465.025 MHz internal E-field assessment at the roof w/ antenna model HAE4011A
	Table 17 – 480.025 MHz internal E-field assessment at the roof w/ antenna model HAE4012A
	Table 18 – 494.975 MHz internal E-field assessment at the roof w/ antenna model HAE4012A

12.0 Conclusion

Appendix A: Antenna Location Drawing

REVISION HISTORY

Date	Revision	Comments
6/19/03	O	Initial release of Prototype results

1.0 Product Description



FCC ID: ABZ99FT4049, model PMUE2012A is a mobile transceiver that utilizes frequency modulation (FM) half duplex transmission technology. The intended use of the radio is Push-To-Talk (PTT) while the device is properly installed in a vehicle with the offered external antennas mounted at the center of the roof or trunk.

This device will be marketed to and used by employees solely for work-related operations, such as public safety agencies, e.g. police, fire and emergency medical. User training is the responsibility of these agencies, who can be expected to employ the usage instructions, safety information and operational cautions set forth in the user's manual, instructional sessions or other means. Motorola also makes available to its customers training classes on the proper use of two-way radios and wireless data devices. This device is classified as Occupational/Controlled Exposure. However, In accordance with FCC requirements, the passengers inside the vehicle and the bystanders external to the vehicle are evaluated to the General Population/Uncontrolled Exposure Limits. Note: All offered antennas can be installed on the vehicle's roof. However, only antenna models HAE4011A and HAE4012A can be installed on the trunk.

The transmit frequency band is 465-495 MHz. The rated power of the device is 40 watts with a maximum conducted power output of 48 watts.

2.0 Offered Options and Accessories

Antenna

HAE4003A	450-470 MHz ¼ wave 0dB antenna; 14.9cm
HAE4011A	450-470 MHz 3.5dBi gain antenna; 71.8cm
HAE4004A	470-512 MHz ¼ wave 0dB antenna; 13.8cm
HAE4012A	470-494 MHz 3.5dBi gain antenna; 67.5cm

3.0 Measurement Standards

Measurements were performed according to FCC Limits Per 47 CFR 2.1091 (b) for General Population/Uncontrolled RF Exposure.

For frequencies ranging from 469-495 MHz the MPE (Maximum Permissible Exposure) limit to electromagnetic energy in equivalent plane wave free-space power density is from 0.31-0.33 mW/cm².

4.0 Data Collection Consideration

Power density testing was performed with DUT installed in a 1991 Ford Taurus (4-door). Measurement data was taken with the vehicle running at idle and the vehicle battery measuring 14.0 volts.

5.0 Measurement System Uncertainty Levels

The information below presents an estimate of the possible errors that are associated with the measurement system.

<u>Description</u>	<u>Error</u>
NARDA Survey Meter	$\pm 3\%$
Repeatability Accuracy	$\pm 7\%$

6.0 Method of Measurement

6.1 EME measurements made on trunk mounted antennas (for reference, see Antenna Location Layout drawings in Appendix)

6.1.1 External vehicle EME measurement (Antenna mounted at trunk center)

With the survey meter and probe, take ten (10) measurements, at the standard test distance of 60 cm to the antenna, from the back of the vehicle in a vertical line and then average the results. These measurements are taken and recorded at every twenty (20) centimeters over a range starting at twenty (20) centimeters above ground and ending at 2.0 meters; this would be representative of a person standing behind a vehicle during a mobile radio transmission.

Note: the distance from the trunk-mounted antenna to the edge of the vehicle is 26cm and the distance from the edge of the vehicle's trunk to the MPE vertical line assessment is 34cm.

6.1.2 Internal vehicle EME measurement (Antenna mounted at trunk center)

While rotating survey meter probe through 180 degrees to ensure that the highest level is found, scan the inside of the vehicle, both front and back seating areas, for the highest level in each location. After the highest level is found, scan vertically making two (2) additional measurements within an area approximately 40 cm wide (representing the width of a person) so as to have a total of three (3) measured points as indicated below that will be averaged.

- a) Head area
- b) Chest area

- c) Lower Trunk area

6.2 EME measurements made on center roof mounted antennas (for reference, see Antenna Location Layout drawings in Appendix)

6.2.1 External vehicle EME measurement

With the survey meter and probe, take ten (10) measurements, at the standard test distance of 60 cm from the vehicle-mounted antenna, in a vertical line and then average the results. These measurements are taken and recorded at every twenty (20) centimeters over a range starting at twenty (20) centimeters above ground and ending at 2.0 meters; this would be representative of a person standing next to a vehicle during a mobile radio transmission.

Note: Actual test distance was 110cm (60cm from antenna to roof edge; 30cm from roof edge to edge of car door; 20cm vertical test line to car door); this is the closest distance that can be achieved to an antenna mounted to the center of the vehicle used for MPE compliance assessment.

6.2.2 Internal vehicle EME measurement

While rotating survey meter probe through 180 degrees to ensure that the highest level is found, scan the inside of the vehicle, both front and back seating areas, for the highest level in each location. After the highest level is found, scan vertically making two (2) additional measurements within an area approximately 40 cm wide (representing the width of a person) so as to have a total of three (3) measured points as indicated below that will be averaged.

- a) Head area
- b) Chest area
- c) Lower Trunk area

7.0 Test Site

The test site is the Motorola Commercial Government Industrial Solution Sector (CGISS) world wide electromagnetic exposure (EME) open area test site located at 8000 W. Sunrise Blvd., Plantation, FL. 33322.

8.0 Measurement System/Equipment

The minimum equipment required will mainly consist of a test vehicle, radio frequency radiation test set consisting of an Electromagnetic Radiation Survey Meter, E-Field Test Probes, and typical antenna configurations.

Below are the test equipment used to assess compliance:

- a) Automobile: 1991 Ford Taurus, 4-Door
- b) E-Field Survey Meter - NARDA Model 8718 (01108); Calibration date: 4/14/03
- c) E-Field (Electric Field) Probe - NARDA Model 8722B (13001);

Calibration date: 5/6/03

d) Antennas - (1/4 wave 0dB; and 3.5 dBi gain antennas)

9.0 Test Unit Description

Power density measurements were performed on a 40 watts mobile radio; model number PMUE2012A serial number 019TAA9999. The frequency band of the mobile was 465-495 MHz; the test frequencies were 465.025, 480.025, and 494.975 MHz. The 1/4 wave 0dB, and 3.5dBi mobile antennas listed in section 2.0 were used to assess MPE compliance.

10.0 Test Set-Up Description

Following are the standard mobile antenna test configurations used for this product. (for reference, see Antenna Location Layout drawings in Appendix)

- a) 3.5dBi gain antenna models HAE4011A, and HAE4012A mounted on the center of the trunk.
- b) 1/4 wave antenna models HAE4004A, HAE4003A and 3.5dBi gain antenna models HAE4011A, and HAE4012A mounted on the center of the roof. Note: The 1/4 wave antennas are only for use while mounted on the roof.

11.0 Test Results

Measurements were taken with the antenna located in two areas: the roof center, and trunk center. Below is the raw MPE data for all measured grid points. Results are based on a 50% duty cycle with the radio operating in accordance with the User Manual instructions. The bolded power density results represents the highest MPE results observed.

Raw MPE Data; Test Frequencies and measured Po (W):

465.025 MHz (Po=48.0), 480.025 MHz (Po=48.5), 494.975 MHz (Po=48.5)

Meter reads in % of controlled limit; controlled limit = 1.46-1.57 mW/cm² for f/300

(Cal factors presented herein are automatically accounted for in the meter used for assessments)

General Population MPE limits = 0.31-0.33 mW/cm² / 1.6mW/g (Bystanders & Passengers)

External Vehicle Power Density (Pwr. Den. (cal.)) = average over body/2

Internal Vehicle Power Density (Pwr. Den. (cal.)) = average over (head/chest/leg)/2

Note: The average over the body test methodology is consistent with IEEE/ANSI C95.1-1999 guidelines

Table 1

External Vehicle MPE Assessment @ 465.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Pwr. Density (mW/cm ²)
Trunk	HAE4011A/3.5dBi	60	E	0.94	0.273	0.14
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	2.5	6	120	42.0	
2	40	3.0	7	140	42.0	
3	60	5.0	8	160	20.0	
4	80	9.5	9	180	14.0	
5	100	18.0	10	200	20.0	

Table 2

External Vehicle MPE Assessment @ 480.025MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Pwr. Density (mW/cm ²)
Trunk	HAE4012A/3.5dBi	60	E	0.93	0.300	0.15
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	2.20	6	120	53.0	
2	40	2.00	7	140	57.0	
3	60	3.50	8	160	21.0	
4	80	8.50	9	180	8.0	
5	100	22.0	10	200	10.0	

Table 3

External Vehicle MPE Assessment @ 494.975 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Pwr. Density (mW/cm ²)
Trunk	HAE4012A/3.5dBi	60	E	0.92	0.271	0.14
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	2.5	6	120	51.0	
2	40	2.0	7	140	49.0	
3	60	3.0	8	160	20.0	
4	80	9.0	9	180	3.5	
5	100	20.0	10	200	4.0	

Table 4

External Vehicle MPE Assessment @ 494.975 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm²)	Pwr. Density (mW/cm²)
Roof	HAE4004A/0dB	110	E	0.94	0.187	0.09
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	1.0	6	120	10.0	
2	40	1.0	7	140	23.0	
3	60	2.5	8	160	29.0	
4	80	2.0	9	180	23.0	
5	100	3.8	10	200	18.0	

Table 5

External Vehicle MPE Assessment @ 480.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm²)	Pwr. Density (mW/cm²)
Roof	HAE4004A/0dB	110	E	0.94	0.208	0.10
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	1.0	6	120	11.5	
2	40	1.0	7	140	21.	
3	60	2.5	8	160	31.0	
4	80	4.0	9	180	30.0	
5	100	5.0	10	200	23.0	

Table 6

External Vehicle MPE Assessment @ 465.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm²)	Pwr. Density (mW/cm²)
Roof	HAE4003A/0dB	110	E	0.94	0.193	0.10
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	0.6	6	120	9.0	
2	40	1.0	7	140	20.0	
3	60	2.0	8	160	29.0	
4	80	4.5	9	180	31.0	
5	100	4.5	10	200	23.0	

Table 7

External Vehicle MPE Assessment @ 465.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Pwr. Density (mW/cm ²)
Roof	HAE4011A/3.5dBi	110	E	0.94	0.147	0.07
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	0.2	6	120	3.0	
2	40	0.2	7	140	10.0	
3	60	0.5	8	160	23.0	
4	80	0.8	9	180	32.0	
5	100	1.0	10	200	24.0	

Table 8

External Vehicle MPE Assessment @ 480.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Pwr. Density (mW/cm ²)
Roof	HAE4012A/3.5dBi	110	E	0.94	0.154	0.08
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	0.3	6	120	5.0	
2	40	0.25	7	140	15.0	
3	60	0.6	8	160	26.0	
4	80	0.7	9	180	27.0	
5	100	1.2	10	200	20.0	

Table 9

External Vehicle MPE Assessment @ 494.975 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Pwr. Density (mW/cm ²)
Roof	HAE4012A/3.5dBi	110	E	0.94	0.151	0.08
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	0.35	6	120	5.00	
2	40	0.30	7	140	16.0	
3	60	0.50	8	160	26.0	
4	80	0.60	9	180	24.0	
5	100	1.50	10	200	17.0	

Table 10

Internal Vehicle MPE Assessment @ 465.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm ²)	Pwr. Density (mW/cm ²)
Trunk	HAE4011A/3.5dBi	Highest reading	E	0.94	0.295/0.279	0.15
Measurement grid						
Test position	% of control limit Head		% of control limit Chest		% of control limit Leg	
Back seat	33		15		9	
Front seat	27		15		12	

Table 11

Internal Vehicle MPE Assessment @ 480.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm ²)	Pwr. Density (mW/cm ²)
Trunk	HAE4012A/3.5dBi	Highest reading	E	0.94	0.416/0.261	0.21
Measurement grid						
Test position	% of control limit Head		% of control limit Chest		% of control limit Leg	
Back seat	42		25		11	
Front seat	21		8		20	

Table 12

Internal Vehicle MPE Assessment @ 494.975 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm ²)	Pwr. Density (mW/cm ²)
Trunk	HAE4012A/3.5dBi	Highest reading	E	0.94	0.347/0.144	0.17
Measurement grid						
Test position	% of control limit Head		% of control limit Chest		% of control limit Leg	
Back seat	37		11		15	
Front seat	15		8		3	

Table 13

Internal Vehicle MPE Assessment @ 494.975 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm ²)	Pwr. Density (mW/cm ²)
Roof	HAE4004A/0dB	Highest reading	E	0.94	0.100/0.080	0.05
Measurement grid						
Test position	% of control limit Head	% of control limit Chest		% of control limit Leg		
Back seat	8	6		4		
Front seat	5	5.5		4		

Table 14

Internal Vehicle MPE Assessment @ 480.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm ²)	Pwr. Density (mW/cm ²)
Roof	HAE4004/0dB	Highest reading	E	0.94	0.100/0.133	0.07
Measurement grid						
Test position	% of control limit Head	% of control limit Chest		% of control limit Leg		
Back seat	6.5	9		3		
Front seat	5	12		8		

Table 15

Internal Vehicle MPE Assessment @ 465.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm ²)	Pwr. Density (mW/cm ²)
Roof	HAE4003A/0dB	Highest reading	E	0.94	0.057/0.10	0.05
Measurement grid						
Test position	% of control limit Head	% of control limit Chest		% of control limit Leg		
Back seat	5	4		2		
Front seat	5	7		7.5		

Table 16

Internal Vehicle MPE Assessment @ 465.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm ²)	Pwr. Density (mW/cm ²)
Roof	HAE4011A/3.5dBi	Highest reading	E	0.94	0.017/0.02	0.01
Measurement grid						
Test position	% of control limit Head		% of control limit Chest		% of control limit Leg	
Back seat	2		0.6		0.6	
Front seat	1		2		1	

Table 17

Internal Vehicle MPE Assessment @ 480.025 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm ²)	Pwr. Density (mW/cm ²)
Roof	HAE4012A/3.5dBi	Highest reading	E	0.94	0.037/0.044	0.02
Measurement grid						
Test position	% of control limit Head		% of control limit Chest		% of control limit Leg	
Back seat	4.5		1.5		1	
Front seat	1.2		4		3	

Table 18

Internal Vehicle MPE Assessment @ 494.975 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm ²)	Pwr. Density (mW/cm ²)
Roof	HAE4012A/3.5dBi	Highest reading	E	0.94	0.029/0.033	0.02
Measurement grid						
Test position	% of control limit Head		% of control limit Chest		% of control limit Leg	
Back seat	2.2		2		1	
Front seat	1.5		2.5		2	

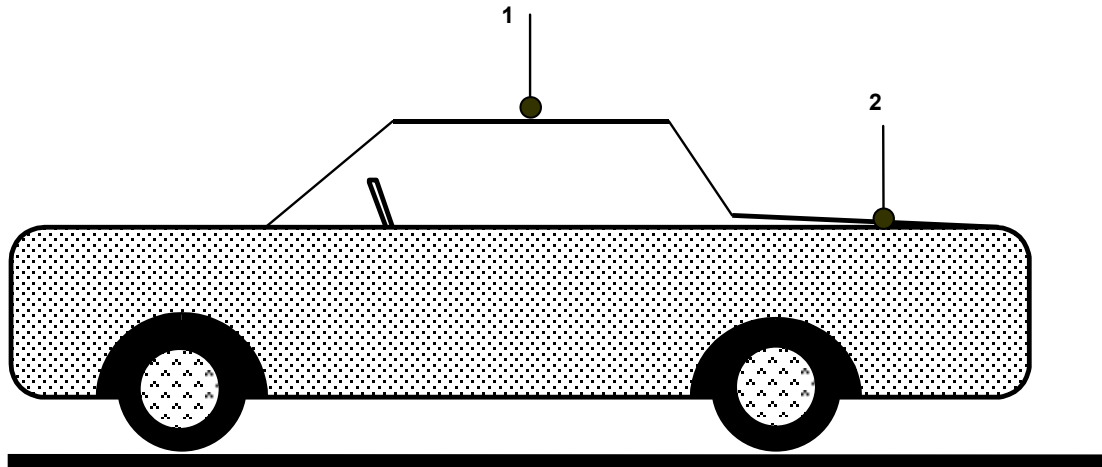
12.0 Conclusion

Depending on the test frequency, compliance assessments were performed with an output power range of 48.0W to 48.5W. The maximum RF power allowable will be equal to the upper limit of the final test factory transmit power specification of 48W. The highest power density result scaled to the maximum allowable power output is 0.21 mW/cm².

**The measurement results clearly demonstrate compliance with the FCC limits
(frequency/300 = 0.31-0.33 mW/cm² for the frequency band of 465-495 MHz) Per 47 CFR
2.1091(d) for General Population/Uncontrolled RF Exposure**

APPENDIX A

ANTENNA LOCATION DRAWING



- 1 - Roof (center)
- 2 - Trunk (center)

