



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. A |
| Device Manufacturer: | Motorola |
| Device Description: | 40W 4 channel Mobile Radio 438-470 MHz |
| Classification: | Occupational/Controlled Exposure |
| FCC ID: | ABZ99FT4048 |
| Device Model: | PMUE2006A |

| | |
|-----------------------|--|
| 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 – 454.025 MHz external E-field assessment at the trunk w/ antenna model HAE4011A |
| | Table 2 – 469.975 MHz external E-field assessment at the trunk w/ antenna model HAE4011A |
| | Table 3 – 454.025 MHz external E-field assessment at the roof w/ antenna model HAE4003A |
| | Table 4 – 469.975 MHz external E-field assessment at the roof w/ antenna model HAE4003A |
| | Table 5 – 438.025 MHz external E-field assessment at the roof w/ antenna model TAE6053A |
| | Table 6 – 454.025 MHz external E-field assessment at the roof w/ antenna model HAE4011A |
| | Table 7 – 469.975 MHz external E-field assessment at the roof w/ antenna model HAE4011A |
| | Table 8 – 454.025 MHz internal E-field assessment at the roof w/ antenna model HAE4003A |
| | Table 9 – 469.975 MHz internal E-field assessment at the roof w/ antenna model HAE4003A |
| | Table 10 – 438.025 MHz internal E-field assessment at the roof w/ antenna model TAE6053A |
| | Table 11 – 454.025 MHz internal E-field assessment at the roof w/ antenna model HAE4011A |
| | Table 12 – 469.975 MHz internal E-field assessment at the roof w/ antenna model HAE4011A |
| 12.0 | Conclusion |
| Appendix A: | Antenna Location Drawing |

REVISION HISTORY

| Date | Revision | Comments |
|---------|----------|--|
| 6/11/03 | O | Initial release of Prototype results |
| 6/19/03 | A | Reflect restrictions of $\frac{1}{4}$ wave antennas to roof mount only. Removed APPENDIX B: Passenger S.A.R. Computational Assessment Report. Restated final compliance results. |

1.0 Product Description



FCC ID: ABZ99FT4048, model PMUE2006A 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 model HAE4011A can be installed on the trunk.

The transmit frequency band is 438-470 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 |
| TAE6053A | 430-450 MHz ¼ wave 0dB antenna; 15.3cm |

3.0 Measurement Standards

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

For frequencies ranging from 438-470 MHz the MPE (Maximum Permissible Exposure) limit to electromagnetic energy in equivalent plane wave free-space power density is from 0.29-0.31 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 3.5dBi gain antennas)

9.0 Test Unit Description

Power density measurements were performed on a 40 watts mobile radio; model number PMUE2006A serial number 019TAA9998. The frequency band of the mobile was 438-470 MHz; the test frequencies were 438.025, 454.025, and 469.975 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 model HAE4011A mounted on the center of the trunk.
- b) 1/4 wave antenna models HAE4003A, TAE6053A, and 3.5dbi gain antenna model HAE4011A 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):

438.025 MHz (Po=48.0), 454.025 MHz (Po=48.0), 469.975 MHz (Po=45.0)

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 = 0.29-0.31 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 @ 454.025MHz | | | | | | |
|--|-----------------|---------------------|---------------|--------------------|---|------------------------------------|
| Antenna Location | Antenna /gain | Meas. Distance (cm) | E/H Field | Calibration Factor | Average over Body (mW/cm ²) | Pwr. Density (mW/cm ²) |
| Trunk | HAE4011A/3.5dBi | 60 | E | 0.94 | 0.303 | 0.15 |
| Measurement grid | | | | | | |
| Test position | Height (cm) | % of control limit | Test position | Height (cm) | % of control limit | |
| 1 | 20 | 1.9 | 6 | 120 | 53.0 | |
| 2 | 40 | 2.0 | 7 | 140 | 55.0 | |
| 3 | 60 | 3.5 | 8 | 160 | 26.0 | |
| 4 | 80 | 8.0 | 9 | 180 | 14.0 | |
| 5 | 100 | 20.0 | 10 | 200 | 16.5 | |

Table 2.

| External Vehicle MPE Assessment @ 469.975 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 | HAE4011A/3.5dBi | 60 | E | 0.94 | 0.197 | 0.10 |
| Measurement grid | | | | | | |
| Test position | Height (cm) | % of control limit | Test position | Height (cm) | % of control limit | |
| 1 | 20 | 2.0 | 6 | 120 | 32.0 | |
| 2 | 40 | 2.0 | 7 | 140 | 33.0 | |
| 3 | 60 | 3.5 | 8 | 160 | 14.0 | |
| 4 | 80 | 7.0 | 9 | 180 | 8.5 | |
| 5 | 100 | 14.0 | 10 | 200 | 10.0 | |

Table 3

| External Vehicle MPE Assessment @ 454.025 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 | HAE4003A/0dB | 110 | E | 0.94 | 0.170 | 0.09 |
| Measurement grid | | | | | | |
| Test position | Height (cm) | % of control limit | Test position | Height (cm) | % of control limit | |
| 1 | 20 | 0.5 | 6 | 120 | 7.0 | |
| 2 | 40 | 1.0 | 7 | 140 | 16.0 | |
| 3 | 60 | 2.5 | 8 | 160 | 26.0 | |
| 4 | 80 | 5.5 | 9 | 180 | 28.0 | |
| 5 | 100 | 5.0 | 10 | 200 | 21.0 | |

Table 4

| External Vehicle MPE Assessment @ 469.975 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 | HAE4003A/0dB | 110 | E | 0.94 | 0.138 | 0.07 |
| Measurement grid | | | | | | |
| Test position | Height (cm) | % of control limit | Test position | Height (cm) | % of control limit | |
| 1 | 20 | 0.50 | 6 | 120 | 5.90 | |
| 2 | 40 | 0.80 | 7 | 140 | 14.0 | |
| 3 | 60 | 1.60 | 8 | 160 | 21.0 | |
| 4 | 80 | 2.90 | 9 | 180 | 21.0 | |
| 5 | 100 | 2.20 | 10 | 200 | 18.0 | |

Table 5

| External Vehicle MPE Assessment @ 438.025 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 | TAE6053A/0dB | 60 | E | 0.95 | 0.186 | 0.09 |
| Measurement grid | | | | | | |
| Test position | Height (cm) | % of control limit | Test position | Height (cm) | % of control limit | |
| 1 | 20 | 1.0 | 6 | 120 | 13.0 | |
| 2 | 40 | 1.50 | 7 | 140 | 16.0 | |
| 3 | 60 | 4.0 | 8 | 160 | 25.0 | |
| 4 | 80 | 7.0 | 9 | 180 | 28.0 | |
| 5 | 100 | 10.0 | 10 | 200 | 22.0 | |

Table 6

| External Vehicle MPE Assessment @ 454.025 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 | 0.155 | 0.08 |
| Measurement grid | | | | | | |
| Test position | Height (cm) | % of control limit | Test position | Height (cm) | % of control limit | |
| 1 | 20 | 0.35 | 6 | 120 | 3.0 | |
| 2 | 40 | 0.30 | 7 | 140 | 12.0 | |
| 3 | 60 | 0.40 | 8 | 160 | 26.0 | |
| 4 | 80 | 1.00 | 9 | 180 | 34.0 | |
| 5 | 100 | 1.20 | 10 | 200 | 24.5 | |

Table 7

| External Vehicle MPE Assessment @ 469.975 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 | HAE4011A/3.5dBi | 110 | E | 0.94 | 0.099 | 0.05 |
| Measurement grid | | | | | | |
| Test position | Height (cm) | % of control limit | Test position | Height (cm) | % of control limit | |
| 1 | 20 | 0.35 | 6 | 120 | 2.0 | |
| 2 | 40 | 0.30 | 7 | 140 | 6.0 | |
| 3 | 60 | 0.50 | 8 | 160 | 16.0 | |
| 4 | 80 | 0.60 | 9 | 180 | 21.0 | |
| 5 | 100 | 0.60 | 10 | 200 | 16.0 | |

Table 8

| Internal Vehicle MPE Assessment @ 454.025 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 | 0.080/0.090 | 0.05 |
| Measurement grid | | | | | | |
| Test position | % of control limit Head | % of control limit Chest | % of control limit Leg | | | |
| Back seat | 8 | 7 | 1 | | | |
| Front seat | 7 | 6 | 5 | | | |

Table 9

| Internal Vehicle MPE Assessment @ 469.975 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 | HAE4003A/0dB | Highest reading | E | 0.94 | 0.051/0.076 | 0.04 |
| Measurement grid | | | | | | |
| Test position | % of control limit Head | % of control limit Chest | % of control limit Leg | | | |
| Back seat | 6 | 2 | 1.8 | | | |
| Front seat | 2.5 | 6.5 | 5.5 | | | |

Table 10

| Internal Vehicle MPE Assessment @ 438.025 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 | TAE6053A/0dB | Highest reading | E | 0.95 | 0.102/0.088 | 0.05 |
| Measurement grid | | | | | | |
| Test position | % of control limit Head | | % of control limit Chest | | % of control limit Leg | |
| Back seat | 9 | | 9 | | 3 | |
| Front seat | 9 | | 4 | | 5 | |

Table 11

| Internal Vehicle MPE Assessment @ 454.025 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 | 0.012/0.019 | 0.01 |
| Measurement grid | | | | | | |
| Test position | % of control limit Head | | % of control limit Chest | | % of control limit Leg | |
| Back seat | 0.8 | | 0.9 | | 0.7 | |
| Front seat | 1.4 | | 1.4 | | 0.9 | |

Table 12

| Internal Vehicle MPE Assessment @ 469.975 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 | HAE4011A/3.5dBi | Highest reading | E | 0.94 | 0.012/0.017 | 0.01 |
| Measurement grid | | | | | | |
| Test position | % of control limit Head | | % of control limit Chest | | % of control limit Leg | |
| Back seat | 1 | | 0.8 | | 0.5 | |
| Front seat | 1 | | 1.1 | | 1.1 | |

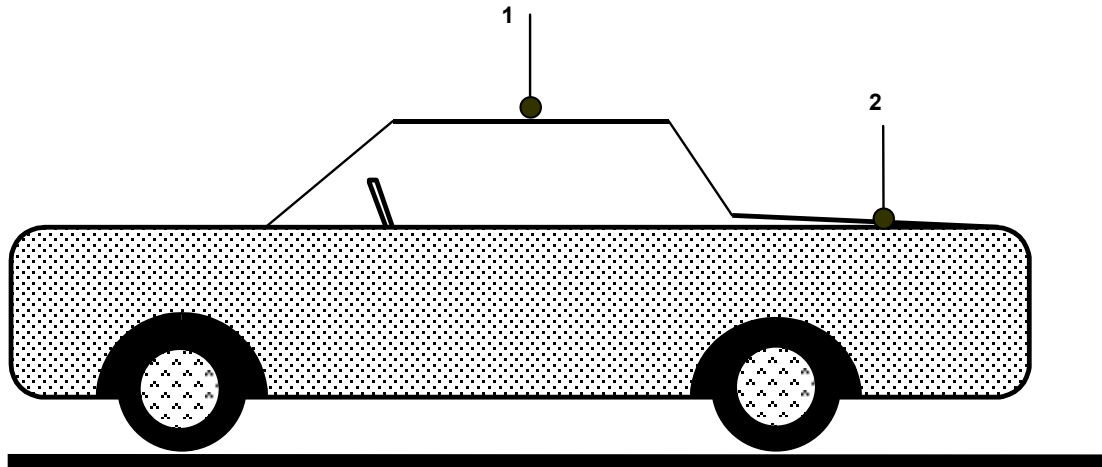
12.0 Conclusion

Depending on the test frequency, compliance assessments were performed with an output power range of 45.0W to 48.0W. 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 0.15 mW/cm².

**The measurement results clearly demonstrate compliance with the FCC limits
(frequency/300 = 0.29-0.31 mW/cm² for the frequency band of 438-470 MHz) Per 47 CFR
2.1091(d) for General Population/Uncontrolled RF Exposure**

APPENDIX A

ANTENNA LOCATION DRAWING



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

