



**MOTOROLA**



**CGISS EME Test Laboratory**  
8000 West Sunrise Blvd  
Fort Lauderdale, FL. 33322

**EME Compliance Test Report**

**Attention:** Federal Communication Commission  
**Date of Report:** January 13, 2003  
**Report Revision:** Rev. B  
**Device Manufacturer:** Motorola  
**Device Description:** 25-40 Watts Conventional MINI UHF  
1.5 PPM Mobile Transceiver 450-520 MHz  
**Classification:** Occupational/Controlled Exposure  
**FCC ID:** AZ492FT4859  
**Device Model:** PMUE1874A

**Test Period:** 11/25/02 – 11/27/02

**Test Engineer:** Jim Fortier (Sr. Staff Engineer)

**Author:** Michael Sailsman (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

1/13/03

Ken Enger

Date Approved

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

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## REVISION HISTORY

Date	Revision	Comments
12/4/02	O	Production release (1.5 PPM)
12/4/02	A	FCC ID correction
1/13/03	B	Revised table of content to include listing of results tables in section 11.0 Clarification of antenna installation guidelines in section 1.0 Updated MPE measurement distance in section 6.1.1 Revised section 11.0 to clarify specification limits, remove references to equivalent S.A.R. calculation, remove non-relevant results tables, and to number the results table for easy referencing. Updated section 12.0 to reflect the revised max. calculated performance.

## 1.0 Product Description



FCC ID: AZ492FT4859, model PMUE1874A is a conventional mini UHF mobile transceiver that operates using frequency modulation. This device is marketed to Commercial, Government, and Industrial Users and therefore is classified as Occupational/Controlled Exposure. The intended users of this device are informed and aware professionals operating this device in accordance with the User Manual instructions including maintaining a maximum operational transmit duty cycle of 50%. The intended use of the radio is Push-To-Talk (PTT) while the device is properly installed in a vehicle with an external antenna mounted at the center of the roof or trunk. Note: All offered antennas can be installed on the vehicle's roof. However, only antenna models HAE4012A, HAE4011A, HAE4019A can be installed on the trunk. The transmit frequency band for FCC ID: AZ492FT4859 is 450-520 MHz. The rated power of the device is 25 to 40 watts with a maximum conducted power output of 48 watts.

## 2.0 Offered Options and Accessories

### Antenna

HAE4003A	16cm ¼ wave UHF 450-470 MHz 0 dBi antenna
HAE4004A	14cm ¼ wave UHF 470-512 MHz 0 dBi antenna
HAE4011A	73cm 5/8 wave UHF 450-470 MHz 3.5dBi antenna
HAE4012A	68cm 5/8 wave UHF 470 – 494 MHz 3.5dBi antenna
HAE4013A	64cm 5/8 wave UHF 494 –512 MHz 3.5dBi antenna
HAE4019A	95cm UHF 450-470 MHz 5.0 dBi antenna

## 3.0 Measurement Standards

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

the vehicle and occupants of the vehicle.

For frequencies ranging from 450-520 MHz the MPE (Maximum Permissible Exposure) limit to electromagnetic energy in equivalent plane wave free-space power

density is 0.300 - 0.347 mW/cm<sup>2</sup>.

#### **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>
<b>NARDA Survey Meter</b>	<b>± 3%</b>
<b>Repeatability Accuracy</b>	<b>± 7%</b>

#### **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, at the back of the vehicle in a vertical line, take ten (10) measurements 60 cm separation distance from the antenna 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, in a vertical line, take ten (10) measurements, at the standard test distance of 60 cm from the vehicle-mounted antenna 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; 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 Probe, 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; Calibration date: 4/23/02
- c) E-Field (Electric Field) Probe - NARDA Model 8722B (300 kHz - 40 Ghz);  
Calibration date: 3/28/02

d) Antennas – see section 2.0

## 9.0 Test Unit Description

Power density measurements were performed on a 25-40 watt mobile radio; model number PMUE1874A serial number 103TCN9221. The frequency band is 450-520 MHz; the test frequencies were 450, 460, 470, 482, 491, 494, 503, 512 MHz. The mobile antennas listed in section 2.0 were used to assess MPE compliance.

## 10.0 Test Set-Up Description

The following is the mobile antenna test configurations used for this product.  
(for reference, see Antenna Location Layout drawings in Appendix)

- a) Assessment with the antenna mounted at the center of the trunk were performed using antennas HAE4003A, HAE4004A, HAE4013A, HAE4011A, HAE4012A, and HAE4019A.
- b) Assessment with the antenna mounted at the center of the roof was performed using antenna HAE4003A. This antenna was selected because it exhibited the highest MPE results during the trunk assessment.

## 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:

450 MHz (Po=45.7W), 460 MHz (Po=46.3W), 470 MHz (Po=46.3), 482 MHz (Po = 45.6W), 491 MHz (Po=46.0W), 494 MHz (46.1W), 503 MHz (Po=47.1), 512MHz (46.8W)

**Meter reads in % of controlled limit; controlled limit = 1.50 - 1.73 mW/cm<sup>2</sup> for 450-520 MHz**  
(Cal factors presented herein are automatically accounted for in the meter used for assessments)

**Spec. limits (Test Frequency / 1500) = 0.300 - 0.347 mW/cm<sup>2</sup>**

**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  
 Trunk assessment results using antennas HAE4003A, HAE4004A, and HAE4013A are included below as references and provides a rationale for selecting the antenna chosen for the external vehicle roof mounted assessment.

Table 1

External Vehicle MPE Assessment @ 450MHz						
Antenna Location (Reference only)	Antenna /gain	Meas. Distance	E/H Field	Calibration Factor	Average over Body (mW/cm <sup>2</sup> )	Pwr. Density (mW/cm <sup>2</sup> )
Trunk	HAE4003A/0dB	60	E	1.06	.580	0.289
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	16.5	6	120	93.0	
2	40	9.3	7	140	60.0	
3	60	21.0	8	160	30.0	
4	80	44.0	9	180	16.0	
5	100	86.0	10	200	8.9	

Table 2

External Vehicle MPE Assessment @460MHz						
Antenna Location (Reference only)	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm <sup>2</sup> )	Pwr. Density (mW/cm <sup>2</sup> )
Trunk	HAE4003A/0dB	60	E	1.06	.471	0.235
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	11.0	6	120	74.0	
2	40	8.5	7	140	51.0	
3	60	16.0	8	160	25.0	
4	80	31.0	9	180	15.0	
5	100	65.0	10	200	10.5	

Table 3

External Vehicle MPE Assessment @470 MHz						
Antenna Location (Reference only)	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm <sup>2</sup> )	Pwr. Density (mW/cm <sup>2</sup> )
Trunk	HAE4003A /0dB	60	E	1.05	0.458	0.229
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	9.9	6	120	74.0	
2	40	9.5	7	140	47.0	
3	60	15.0	8	160	22.0	
4	80	33.0	9	180	10.5	
5	100	64.0	10	200	7.5	

**Table 4**

<b>External Vehicle MPE Assessment @470MHz</b>						
<b>Antenna Location (Reference only)</b>	<b>Antenna /gain</b>	<b>Meas. Distance (cm)</b>	<b>E/H Field</b>	<b>Calibration Factor</b>	<b>Average over Body (mW/cm<sup>2</sup>)</b>	<b>Pwr. Density (mW/cm<sup>2</sup>)</b>
Trunk	HAE4004A /0dB	60	E	1.05	0.510	0.255
<b>Measurement grid</b>						
<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	
1	20	8.6	6	120	87.0	
2	40	8.5	7	140	52.0	
3	60	16.0	8	160	23.0	
4	80	35.0	9	180	11.0	
5	100	76.0	10	200	8.3	

**Table 5**

<b>External Vehicle MPE Assessment @491MHz</b>						
<b>Antenna Location (Reference only)</b>	<b>Antenna /gain</b>	<b>Meas. Distance (cm)</b>	<b>E/H Field</b>	<b>Calibration Factor</b>	<b>Average over Body (mW/cm<sup>2</sup>)</b>	<b>Pwr. Density (mW/cm<sup>2</sup>)</b>
Trunk	HAE4004A /0dB	60	E	1.03	0.498	0.249
<b>Measurement grid</b>						
<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	
1	20	11.5	6	120	83.0	
2	40	7.0	7	140	56.0	
3	60	14.5	8	160	23.0	
4	80	31.0	9	180	9.5	
5	100	65.0	10	200	4.0	

**Table 6**

<b>External Vehicle MPE Assessment @512MHz</b>						
<b>Antenna Location (Reference only)</b>	<b>Antenna /gain</b>	<b>Meas. Distance (cm)</b>	<b>E/H Field</b>	<b>Calibration Factor</b>	<b>Average over Body (mW/cm<sup>2</sup>)</b>	<b>Pwr. Density (mW/cm<sup>2</sup>)</b>
Trunk	HAE4004A /0dB	60	E	1.01	0.529	0.264
<b>Measurement grid</b>						
<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	
1	20	6.5	6	120	81.0	
2	40	4.2	7	140	55.0	
3	60	13.0	8	160	28.0	
4	80	37.0	9	180	12.7	
5	100	66.0	10	200	6.3	

Table 7

External Vehicle MPE Assessment @450MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm <sup>2</sup> )	Pwr. Density (mW/cm <sup>2</sup> )
Trunk	HAE4011A /3.5dB	60	E	1.06	0.403	<b>0.202</b>
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	2.9	6	120	69.0	
2	40	1.9	7	140	71.0	
3	60	4.5	8	160	30.0	
4	80	10.5	9	180	22.0	
5	100	29.0	10	200	28.0	

Table 8

External Vehicle MPE Assessment @460MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm <sup>2</sup> )	Pwr. Density (mW/cm <sup>2</sup> )
Trunk	HAE4011A /3.5dB	60	E	1.06	0.331	0.166
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	3.5	6	120	52.0	
2	40	2.0	7	140	52.0	
3	60	4.5	8	160	25.0	
4	80	9.5	9	180	19.0	
5	100	24.5	10	200	24.0	

Table 9

External Vehicle MPE Assessment @482MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm <sup>2</sup> )	Pwr. Density (mW/cm <sup>2</sup> )
Trunk	HAE4012A /3.5dB	60	E	1.04	0.370	0.185
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	4.3	6	120	67.0	
2	40	3.0	7	140	63.0	
3	60	4.8	8	160	23.0	
4	80	10.5	9	180	11.4	
5	100	28.0	10	200	15.5	

**Table 10**

<b>External Vehicle MPE Assessment @494MHz</b>						
<b>Antenna Location (Reference only)</b>	<b>Antenna /gain</b>	<b>Meas. Distance (cm)</b>	<b>E/H Field</b>	<b>Calibration Factor</b>	<b>Average over Body (mW/cm<sup>2</sup>)</b>	<b>Pwr. Density (mW/cm<sup>2</sup>)</b>
Trunk	HAE4013A /3.5dB	60	E	1.03	0.462	0.231
<b>Measurement grid</b>						
<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	
1	20	3.3	6	120	102.0	
2	40	2.2	7	140	75.0	
3	60	4.7	8	160	22.0	
4	80	8.5	9	180	8.5	
5	100	45.0	10	200	9.5	

**Table 11**

<b>External Vehicle MPE Assessment @ 503MHz</b>						
<b>Antenna Location (Reference only)</b>	<b>Antenna /gain</b>	<b>Meas. Distance (cm)</b>	<b>E/H Field</b>	<b>Calibration Factor</b>	<b>Average over Body (mW/cm<sup>2</sup>)</b>	<b>Pwr. Density (mW/cm<sup>2</sup>)</b>
Trunk	HAE4013A /3.5dB	60	E	1.02	0.456	0.228
<b>Measurement grid</b>						
<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	
1	20	2.3	6	120	96.0	
2	40	1.8	7	140	67.0	
3	60	5.4	8	160	16.0	
4	80	15.0	9	180	6.2	
5	100	53.0	10	200	9.0	

**Table 12**

<b>External Vehicle MPE Assessment @512MHz</b>						
<b>Antenna Location (Reference only)</b>	<b>Antenna /gain</b>	<b>Meas. Distance (cm)</b>	<b>E/H Field</b>	<b>Calibration Factor</b>	<b>Average over Body (mW/cm<sup>2</sup>)</b>	<b>Pwr. Density (mW/cm<sup>2</sup>)</b>
Trunk	HAE4013A /3.5dB	60	E	1.01	0.332	0.166
<b>Measurement grid</b>						
<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	<b>Test position</b>	<b>Height (cm)</b>	<b>% of control limit</b>	
1	20	2.6	6	120	65.0	
2	40	2.0	7	140	46.5	
3	60	5.3	8	160	13.0	
4	80	11.9	9	180	6.0	
5	100	35.0	10	200	7.5	

**Table 13**

External Vehicle MPE Assessment @460MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm <sup>2</sup> )	Pwr. Density (mW/cm <sup>2</sup> )
Trunk	HAE4019A /5.0dB	60	E	1.06	0.308	0.154
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	4.2	6	120	23.0	
2	40	3.3	7	140	50.0	
3	60	5.4	8	160	49.0	
4	80	8.2	9	180	29.0	
5	100	9.7	10	200	19.0	

**Table 14**

External Vehicle MPE Assessment @450MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm <sup>2</sup> )	Pwr. Density (mW/cm <sup>2</sup> )
Roof	HAE4003A / 0dB	110	E	1.06	0.204	0.102
Measurement grid						
Test position	Height (cm)	% of control limit	Test position	Height (cm)	% of control limit	
1	20	1.0	6	120	9.0	
2	40	1.8	7	140	15.0	
3	60	4.5	8	160	27.0	
4	80	7.7	9	180	32.0	
5	100	8.5	10	200	29.5	

**Table 15**

Internal Vehicle MPE Assessment @ 450 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm <sup>2</sup> )	Pwr. Density (mW/cm <sup>2</sup> )
Trunk	HAE4011A /3.5dB	Highest reading	E	1.06	0.398/0.265	0.20
Measurement grid						
Test position	% of control limit Head		% of control limit Chest		% of control limit Leg	
Back seat	53		20		6.5	
Front seat	17		18		18	

**Table 16**

<b>Internal Vehicle MPE Assessment @ 460 MHz</b>						
<b>Antenna Location</b>	<b>Antenna /gain</b>	<b>Meas. Distance (cm)</b>	<b>E/H Field</b>	<b>Calibration Factor</b>	<b>Average over Head, Chest, Leg Back/Front seats (mW/cm<sup>2</sup>)</b>	<b>Pwr. Density (mW/cm<sup>2</sup>)</b>
Trunk	HAE4011A /3.5dB	Highest reading	E	1.06	0.311/0.275	0.156
<b>Measurement grid</b>						
<b>Test position</b>	<b>% of control limit Head</b>		<b>% of control limit Chest</b>		<b>% of control limit Leg</b>	
Back seat	33		21		7	
Front seat	25		18		11	

**Table 17**

<b>Internal Vehicle MPE Assessment @ 482 MHz</b>						
<b>Antenna Location</b>	<b>Antenna /gain</b>	<b>Meas. Distance (cm)</b>	<b>E/H Field</b>	<b>Calibration Factor</b>	<b>Average over Head, Chest, Leg Back/Front seats (mW/cm<sup>2</sup>)</b>	<b>Pwr. Density (mW/cm<sup>2</sup>)</b>
Trunk	HAE4012A /3.5dB	Highest reading	E	1.04	0.488/0.209	0.244
<b>Measurement grid</b>						
<b>Test position</b>	<b>% of control limit Head</b>		<b>% of control limit Chest</b>		<b>% of control limit Leg</b>	
Back seat	48		25		18	
Front seat	21		7		11	

**Table 18**

<b>Internal Vehicle MPE Assessment @ 460 MHz</b>						
<b>Antenna Location</b>	<b>Antenna /gain</b>	<b>Meas. Distance (cm)</b>	<b>E/H Field</b>	<b>Calibration Factor</b>	<b>Average over Head, Chest, Leg Back/Front seats (mW/cm<sup>2</sup>)</b>	<b>Pwr. Density (mW/cm<sup>2</sup>)</b>
Trunk	HAE4019A /5dB	Highest reading	E	1.06	0.209/0.205	0.105
<b>Measurement grid</b>						
<b>Test position</b>	<b>% of control limit Head</b>		<b>% of control limit Chest</b>		<b>% of control limit Leg</b>	
Back seat	20		16		5	
Front seat	22		8.3		9.8	

Table 19

Internal Vehicle MPE Assessment @ 450 MHz						
Antenna Location	Antenna /gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Head, Chest, Leg Back/Front seats (mW/cm <sup>2</sup> )	Pwr. Density (mW/cm <sup>2</sup> )
Roof	HAE4003A /0dB	Highest reading	E	1.06	0.130/0.145	0.073
Measurement grid						
Test position	% of control limit Head		% of control limit Chest		% of control limit Leg	
Back seat	5.5		16		4.5	
Front seat	7		6		16	

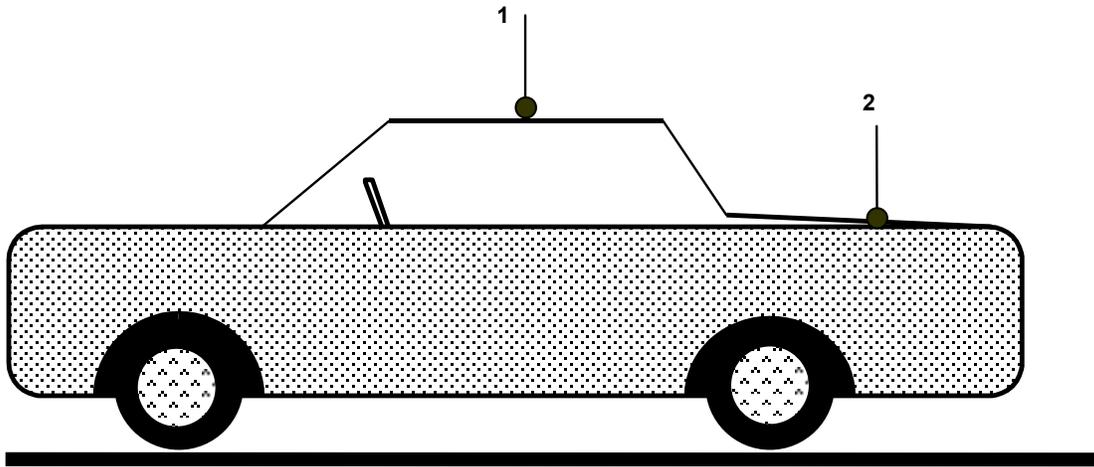
## 12.0 Conclusion

Depending on the test frequency, compliance assessments were performed with an output power range of 45.6W to 47.1W. The maximum RF power allowable will be equal to the upper limit of the final test factory transmit power specification of 48.0W. The highest power density result scaled to the maximum allowable power output with 60cm separation is 0.212 mW/cm<sup>2</sup>.

**The measurement results clearly demonstrate compliance with the FCC Limits (test frequency / 1500 = 0.300 - 0.347 mW/cm<sup>2</sup> for the frequency band of 450-520MHz) Per 47 CFR 2.1091 (d) for General Population/Uncontrolled RF Exposure.**

**APPENDIX**

**ANTENNA LOCATION DRAWING**



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

