



**MOTOROLA**



TESTING CERT # 2518.01

**DECLARATION OF COMPLIANCE: MPE ASSESSMENT**

**Enterprise Mobility Solutions**  
**EME Test Laboratory**  
 8000 West Sunrise Blvd  
 Fort Lauderdale, FL. 33322

**Date of Report:** August 17, 2010  
**Report Revision:** 0  
**Report ID:** SR8729-8731\_MPE PCII rpt\_APX7500\_UHFR1\_VHF Mobile\_Rev O\_100817

**Responsible Engineer:** Stephen C. Whalen (Principal Staff EME Test Engineer)  
**Report author:** Kim Uong (Principal Staff EME Test Engineer)  
**Date/s Tested:** 5/27/2010, 6/2/2010, 6/3/2010, 6/22/2010, 6/25/2010 & 7/1/2010  
**Manufacturer/Location:** Motorola Penang  
**Date submitted for test:** 8/16/2010  
**DUT Description:** Mackinaw Mobile UHFR1 (40W) & VHF (50W)  
**Test TX mode(s):** CW  
**Max. Power output:** UHF 48 Watts & VHF 60Watts  
**TX Frequency Bands:** UHF 380-470MHz & VHF 136-174MHz  
**Signaling type:** Analog, APCO 25, and TDMA 1:2 (F2)  
**Model(s) Tested:** M30QSS9PW1AN  
**Model(s) Certified:** M30TSS9PW1AN  
**Serial Number(s):** 123ABC4567  
**Classification:** Occupational/Controlled Environment



**Regulatory Identifications:**

**FCC ID:** AZ492FT4895 – Part 22 & 90 (406.1-470 MHz), MPE results outside of Part 90 are not applicable for FCC compliance demonstration.  
**IC:** 109U-92FT4895 (RSS-102, 406.1-470 MHz)

**Approved Accessories:**

**Antenna(s):**  
 HAE6010A (Vehicular Mount, 380-433 MHz, 1/2 Wave, 5.65dBi)  
 HAE6013A (Vehicular Mount, 380-470 MHz, 1/2 Wave, 4.15dBi)  
 HAE6031A (Vehicular Mount, 380-520 MHz, 1/2 Wave, 4.15dBi)

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 the national and international reference standards and guidelines listed in section 4.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola EME Laboratory.

I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements.  
 This reporting format is consistent with the suggested guidelines of the TIA TSB-159 April 2006  
 The results and statements contained in this report pertain only to the device(s) evaluated herein.

*Signature on file – Deanna Zakharia*  
 Deanna Zakharia EMS EME Lab Senior Resource Manager,  
 Laboratory Director,

**Approval Date: 8/17/2010**

**Certification Date:**  
**Certification No.:**

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**REVISION HISTORY**

Date	Revision	Comments
8/17/2010	O	Initial release of PCII report, addendum to the original report to include data for additional offered antennas.

## 1.0 Product and System Description

Model M30QSS9PW1AN is a mobile transceiver that utilizes analog, APCO 25 & F2 digital two-way radio communications. The analog modulation scheme uses Frequency Modulation (FM). APCO 25 & F2 digital modes use C4FM of CQPSK family of modulation (Compatible 4-Level Frequency Modulation of Compatible Quadrature Phase Shift Keying). F2 is a TDMA 1:2 protocol that allocates portions of the RF signal by dividing time into two slots (2 slots TDMA). Transmission from a unit or base station is accommodated in time-slot lengths of 30 milliseconds and frame lengths of 60 milliseconds. This product supports voice in analog mode, and both voice and data modes in digital mode.

The maximum duty cycle for TDMA is 1:2 (50%) and is controlled by software. The FM signal is continuous. However, because of hand shaking or Push-To-Talk (PTT) between users and/or base stations a conservative 50% duty cycle is applied. The TDMA mode was not tested because its duty cycle is inherently 50% and would include an additional 50% duty cycle for PTT.

The intended use of the radio is PTT while the device is properly installed in a vehicle with an external antenna 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 which 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.

Accordingly this product 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 that "Bystanders" as used herein mean people other than operator)

## 2.0 Abbreviations / Definitions

APCO: Association of Public-Safety Communications Officials

C4FM: Compatible 4-Level Frequency Modulation

CNR: Calibration Not Required

CQPSK: Compatible Quadrature Phase Shift Keying

CW: Continues Wave

DUT: Device Under Test

F2: 2 slot Time Division Multiple Access

FM: Frequency Modulation

NA: Not Applicable

PTT: Push to Talk

TDMA: Time Division Multiple Access

MPE: Maximum Permissible Exposure

EME: Electromagnetic Energy

### 3.0 Additional Options and Accessories

Refer to previous MPE reports for additional offered antennas.

### 4.0 Measurement and Limit Standards

Measurements were performed according to the recommended guidelines in ICNIRP, IEEE/ANSI C95.3-2002 and compared to FCC Limits Per 47 CFR 2.1091 (d) for General Population/ Uncontrolled RF Exposure.

For test frequencies ranging from 406.1 - 470 MHz the MPE (Maximum Permissible Exposure) limits to electromagnetic energy in equivalent plane wave free-space power density are 0.27 – 0.31mW/cm<sup>2</sup> (FCC) for General Population, and 1.35 – 1.57mW/cm<sup>2</sup> (FCC) for Occupational.

### 5.0 Measurement System Uncertainty Levels

#### Uncertainty Budget for Near Field Probe Measurements

	Tol. (± %)	Prob Dist.	Divisor	$u_i$ (±%)	$v_i$
<b>Measurement System</b>					
Probe Calibration	6.0	N	1.00	6.0	∞
Survey Meter Calibration	3.0	N	1.00	3.0	∞
Hemispherical Isotropy	8.0	R	1.73	4.6	∞
Linearity	5.0	R	1.73	2.9	∞
Pulse Response	1.0	R	1.73	0.6	∞
RF Ambient Noise	3.0	R	1.73	1.7	∞
RF Reflections	8.0	R	1.73	4.6	∞
Probe Positioning	10.0	R	1.73	5.8	∞
<b>Test sample Related</b>					
Antenna Positioning	3.0	N	1.00	3.0	∞
Power drift	5.0	R	1.73	2.9	∞
<b>Combined Standard Uncertainty</b>		RSS		12.2	∞
<b>Expanded Uncertainty</b> (95% CONFIDENCE LEVEL)		$k=2$		24	

### 6.0 Method of Measurement

#### 6.1 EME measurements made with trunk mounted antenna(s) (Refer to APPENDIX A for antenna location and test distances)

### **6.1.1 External/Bystander vehicle EME measurement** (Antenna mounted at trunk center)

MPE measurements for bystander conditions are determined by taking the average of (10) measurements in a 2m vertical line for each of the (3) test locations indicated in appendix A with 20cm increments at the test distance of 90cm from the antenna under test. The measurement probe is positioned orthogonal to antenna (typically parallel to ground with a vertically mounted antenna) and aimed directly at the antenna's axis. These measurements are representative of persons other than the operator standing next to the vehicle.

Each of the offered antennas mounted at the center of the trunk were assessed at the rear of the vehicle while maintaining a twenty (20) centimeter separation distance between the probe sensor and vehicle body. The worst case antenna was then tested at a 45° radial at the corner of the trunk, and 90° radial at the side of the trunk.

For the current test vehicle, the antenna to probe sensor separation distance is 90cm (directly behind vehicle), 104 cm (45 degree radial) and 110.5 cm (90 degree radial).

**Note: The distance from the trunk-mounted antenna to the edge of the vehicle is 42cm and the distance from the edge of the vehicle's trunk to the Survey Probe Sensor is 48cm.**

### **6.1.2 Internal/Passenger vehicle EME measurement** (Antenna mounted at trunk center)

MPE measurements for passenger conditions are determined by taking the average of the (3) measurements (Head, Chest, and Lower Trunk) inside the vehicle for both the front and back seats. The measurement probe is positioned orthogonal to antenna (typically parallel to ground with a vertically mounted antenna), and aimed directly at the antenna's axis while the antenna is at 85cm from the back of the backseat passenger's head. These measurements are representative of operator and passengers sitting in the front and back seat of the vehicle.

## **6.2 EME measurements made with roof mounted antenna(s)** (Refer to APPENDIX A for antenna location and test distances)

### **6.2.1 External/Bystander vehicle EME measurement** (Antenna mounted at roof center)

MPE measurements for bystander conditions are determined by taking the average of (10) measurements in a 2m vertical line for the test location indicated in APPENDIX A with 20cm increments at the test distance of 90cm from the antenna under test. The measurement probe is positioned orthogonal to antenna (typically parallel to ground with a vertically mounted antenna) and aimed directly at the antenna's axis. These measurements are representative of persons other than the operator standing next to the vehicle.

**Note: Actual test distance was approximately 117cm from antenna to probe element (97cm from antenna 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/Passenger vehicle EME measurement (Antenna mounted at roof center)

MPE measurements for passenger conditions are determined by taking the average of the (3) measurements (Head, Chest, and Lower Trunk) inside the vehicle for both the front and back seats. The measurement probe is positioned orthogonal to antenna (typically parallel to ground with a vertically mounted antenna) and aimed directly at the antenna's axis. These measurements are representative of operator and passengers sitting in the front and back seat of the vehicle.

## 7.0 Test Site

The test site is the Motorola open area test site located at 8000 W. Sunrise Blvd., Plantation, FL. 33322.

## 8.0 Measurement System/Equipment

Equipment Type	Model #	SN	Calibration Date
Automobile	2003 Ford Crown Victoria, 4-Door	NA	NA
Survey Meter / Probe – E-Field (Electric Field)	ETS Model HI-2200 / ETS Model E100	00086316 / 00109011	10/22/09

ETS equipments measured for E-field is in mW/cm<sup>2</sup> for E-field.

## 9.0 DUT Output Power

Power density measurements were performed with the test frequencies and associated power levels presented in the table below.

Test Frequencies (MHz)	Measured Initial Power (W)
406.5	47.8
432.9875	47.0
425.0125	47.5
469.9875	46.6

## 10.0 Test Set-Up Description

All antennas listed on the cover page of this report were considered in order to develop the test plan for this product.

- a) The ½ wave 5.65dBi gain antenna (HAE6010A) and 4.15dBi gain antennas (HAE6013A & HAE6031A) were assessed while mounted at the center of the roof of the test vehicle.
- b) The ½ wave 5.65dBi gain antenna (HAE6010A) and 4.15dBi gain antennas (HAE6013A & HAE6031A) were assessed while mounted at the center of the trunk of the test vehicle.

Assessments were performed with DUT (Device Under Test) installed on a test vehicle, while engine was at idle, at the specified distances and test locations indicated in section 5.0 and APPENDIX A.

## 11.0 Test Results Summary

The tables below summarized the MPE measurement results for each test configuration: antenna (model and description), antenna gain, TX frequency, maximum output power, initial power, E/H field measurements, probe frequency cal factor, test positions (BS-Bystander, PB-Passenger Back, PF-Passenger Front), average over body results, calculated power density results, max calculated power density results, % of the applicable specification limit, and applicable FCC specification limits.

MPE results for this mobile radio are based on 50% duty cycle which is in accordance with the User Manual instructions.

Below is an explanation of how the MPE results are calculated.

External to vehicle (Bystander) - 10 measurements are averaged over the body (*body\_avg*).

Internal to vehicle (Passengers) - 3 measurements are averaged over the body (*body\_avg*).

The Average over Body test methodology is consistent with IEEE/ANSI C95.3-2002 guidelines.

Therefore;

$$Pwr\_density\_calc = body\_avg * (probe\_frequency\_cal\_factor)^2 * duty\_cycle$$

$$Pwr\_density\_max\_calc = pwr\_density\_calc * \frac{max\_output\_power}{initial\_output\_power}$$

*Note 1; For initial output power > max\_output\_power; max\_output\_power / initial output power = 1*

*Note 2: The probe frequency cal factors used for MPE evaluation of this product are based on the worse case.*

*Note 3: The calibration certificate's frequency cal factors were determined by measuring V/m for E-field probe and A/m for H-field probe. The results presented herein are power density (mW/cm<sup>2</sup>) and therefore the cal factors were squared as indicated in the formula above.*

*Note 4: The H-field measurements were done in A/m. Therefore the calculated power density results were converted to mW/cm<sup>2</sup> using the formula: mW/cm<sup>2</sup> = (A/m)<sup>2</sup>\*37.699.*

Table 1: E-field - MPE assessment data with antenna mounted on the trunk

Ant Location	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	E/H Field	Probe Cal. Factor	Test Pos.	Avg. over Body (mW/cm <sup>2</sup> )	Calc. P.D. (mW/cm <sup>2</sup> )	Max Calc. P.D. (mW/cm <sup>2</sup> )	% of FCC Spec Limit	FCC Spec limit (mW/cm <sup>2</sup> )
<b>MPE assessment for antenna HAE6010A</b>													
Trunk	HAE6010A, 1/2W (380-433MHz)	5.65	406.5	48	47.8	E	0.94	BS	0.173	0.081	0.08	30	0.27
Trunk	HAE6010A, 1/2W (380-433MHz)	5.65	406.5	48	47.8	E	0.94	PB	0.487	0.229	0.23	85	0.27
Trunk	HAE6010A, 1/2W (380-433MHz)	5.65	406.5	48	47.8	E	0.94	PF	0.107	0.050	0.05	19	0.27
Trunk	HAE6010A, 1/2W (380-433MHz)	5.65	432.9875	48	47	E	0.95	BS	0.161	0.076	0.08	27	0.29
Trunk	HAE6010A, 1/2W (380-433MHz)	5.65	432.9875	48	47	E	0.95	PB	0.200	0.095	0.10	34	0.29
Trunk	HAE6010A, 1/2W (380-433MHz)	5.65	432.9875	48	47	E	0.95	PF	0.050	0.024	0.02	8	0.29
<b>MPE assessment for antenna HAE6013A</b>													
Trunk	HAE6013A, 1/2W (380-470MHz)	4.15	425.0125	48	47.5	E	0.95	BS	0.297	0.141	0.14	50	0.28
Trunk	HAE6013A, 1/2W (380-470MHz)	4.15	425.0125	48	47.5	E	0.95	PB	0.383	0.182	0.18	65	0.28
Trunk	HAE6013A, 1/2W (380-470MHz)	4.15	425.0125	48	47.5	E	0.95	PF	0.083	0.040	0.04	14	0.28
Trunk	HAE6013A, 1/2W (380-470MHz)	4.15	469.9875	48	46.6	E	0.97	BS	0.142	0.069	0.07	23	0.31
Trunk	HAE6013A, 1/2W (380-470MHz)	4.15	469.9875	48	46.6	E	0.97	PB	0.277	0.134	0.14	44	0.31
Trunk	HAE6013A, 1/2W (380-470MHz)	4.15	469.9875	48	46.6	E	0.97	PF	0.107	0.052	0.05	17	0.31
<b>MPE assessment for antenna HAE6031A</b>													
Trunk	HAE6031A, 1/2W (380-520 MHz)	4.15	425.0125	48	47.5	E	0.95	BS	0.264	0.125	0.13	45	0.28
Trunk	HAE6031A, 1/2W (380-520 MHz)	4.15	425.0125	48	47.5	E	0.95	PB	0.403	0.192	0.19	68	0.28
Trunk	HAE6031A, 1/2W (380-520 MHz)	4.15	425.0125	48	47.5	E	0.95	PF	0.090	0.043	0.04	15	0.28
Trunk	HAE6031A, 1/2W (380-520 MHz)	4.15	469.9875	48	46.6	E	0.97	BS	0.194	0.094	0.10	31	0.31
Trunk	HAE6031A, 1/2W (380-520 MHz)	4.15	469.9875	48	46.6	E	0.97	PB	0.387	0.188	0.19	62	0.31
Trunk	HAE6031A, 1/2W (380-520 MHz)	4.15	469.9875	48	46.6	E	0.97	PF	0.120	0.058	0.06	19	0.31
----- 45 Degree -----													
Trunk	HAE6013A, 1/2W (380-470MHz)	4.15	425.0125	48	47.5	E	0.95	BS	0.209	0.099	0.10	35	0.28
----- 90 Degree -----													
Trunk	HAE6013A, 1/2W (380-470MHz)	4.15	425.0125	48	47.5	E	0.95	BS	0.236	0.112	0.11	40	0.28

Table 2: E field – MPE assessment data with antenna mounted on the Roof

Ant Location	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	E/H Field	Probe Cal. Factor	Test Pos.	Avg. over Body (mW/cm <sup>2</sup> )	Calc. P.D. (mW/cm <sup>2</sup> )	Max Calc. P.D. (mW/cm <sup>2</sup> )	% of FCC Spec Limit	FCC Spec limit (mW/cm <sup>2</sup> )
<b>MPE assessment for antenna HAE6010A</b>													
Roof	HAE6010A, 1/2W (380-433MHz)	5.65	406.5	48	47.8	E	0.94	BS	0.068	0.032	0.03	12	0.27
Roof	HAE6010A, 1/2W (380-433MHz)	5.65	406.5	48	47.8	E	0.94	PB	0.277	0.130	0.13	48	0.27
Roof	HAE6010A, 1/2W (380-433MHz)	5.65	406.5	48	47.8	E	0.94	PF	0.060	0.028	0.03	10	0.27
Roof	HAE6010A, 1/2W (380-433MHz)	5.65	432.9875	48	47	E	0.95	BS	0.064	0.030	0.03	11	0.29
Roof	HAE6010A, 1/2W (380-433MHz)	5.65	432.9875	48	47	E	0.95	PB	0.057	0.027	0.03	10	0.29
Roof	HAE6010A, 1/2W (380-433MHz)	5.65	432.9875	48	47	E	0.95	PF	0.020	0.010	0.01	3	0.29
<b>MPE assessment for antenna HAE6013A</b>													
Roof	HAE6013A, 1/2W (380-470MHz)	4.15	425.0125	48	47.5	E	0.95	BS	0.116	0.055	0.06	20	0.28
Roof	HAE6013A, 1/2W (380-470MHz)	4.15	425.0125	48	47.5	E	0.95	PB	0.077	0.036	0.04	13	0.28
Roof	HAE6013A, 1/2W (380-470MHz)	4.15	425.0125	48	47.5	E	0.95	PF	0.037	0.017	0.02	6	0.28
Roof	HAE6013A, 1/2W (380-470MHz)	4.15	469.9875	48	46.6	E	0.97	BS	0.062	0.030	0.03	10	0.31
Roof	HAE6013A, 1/2W (380-470MHz)	4.15	469.9875	48	46.6	E	0.97	PB	0.023	0.011	0.01	4	0.31
Roof	HAE6013A, 1/2W (380-470MHz)	4.15	469.9875	48	46.6	E	0.97	PF	0.020	0.010	0.01	3	0.31
<b>MPE assessment for antenna HAE6031A</b>													
Roof	HAE6031A, 1/2W (380-520 MHz)	4.15	425.0125	48	47.5	E	0.95	BS	0.124	0.059	0.06	21	0.28
Roof	HAE6031A, 1/2W (380-520 MHz)	4.15	425.0125	48	47.5	E	0.95	PB	0.080	0.038	0.04	14	0.28
Roof	HAE6031A, 1/2W (380-520 MHz)	4.15	425.0125	48	47.5	E	0.95	PF	0.037	0.017	0.02	6	0.28
Roof	HAE6031A, 1/2W (380-520 MHz)	4.15	469.9875	48	46.6	E	0.97	BS	0.101	0.049	0.05	16	0.31
Roof	HAE6031A, 1/2W (380-520 MHz)	4.15	469.9875	48	46.6	E	0.97	PB	0.040	0.019	0.02	6	0.31
Roof	HAE6031A, 1/2W (380-520 MHz)	4.15	469.9875	48	46.6	E	0.97	PF	0.047	0.023	0.02	7	0.31

## 12.0 Conclusion

The assessments for this device were performed with an output power range as indicated in section 8.0. The maximum allowable output power is equal to the upper limit of the final test factory transmit power specification of 48W for frequency range of 380 – 470 MHz. The highest power density results for the mobile device, at frequency range of 406.1 – 470 MHz, was scaled to the maximum allowable power output is 0.23mW/cm<sup>2</sup> for internal/passenger to the vehicle, and 0.14mW/cm<sup>2</sup> for external/bystander to the vehicle.

### RF Exposure Results for FCC Part 90 (406.1-470 MHz)

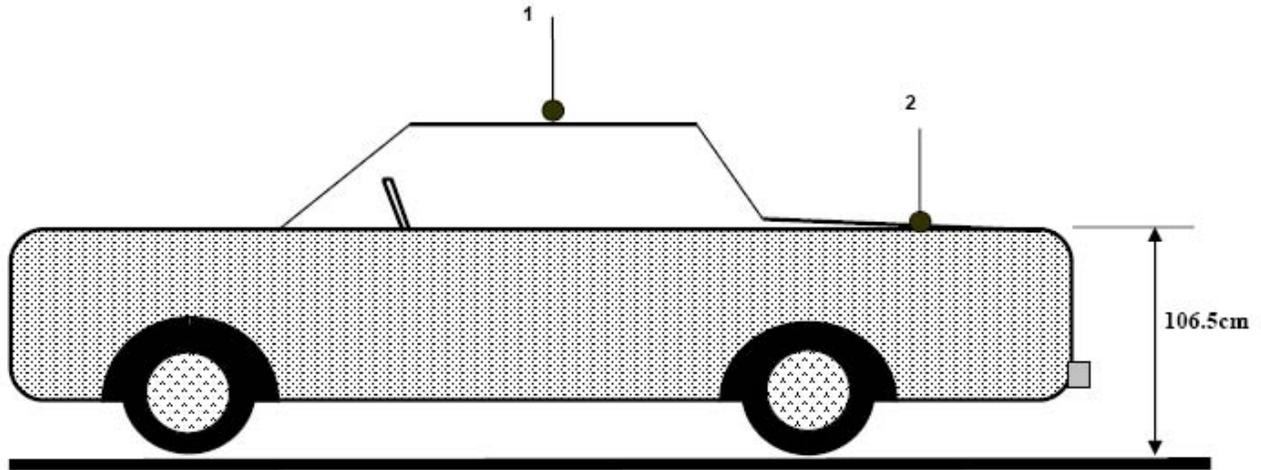
	UHFR1 Band
Passenger - Max Calculated Power Density	0.23 mW/cm <sup>2</sup>
Bystander - Max Calculated Power Density	0.14 mW/cm <sup>2</sup>

These MPE results demonstrate compliance to the FCC General Population/Uncontrolled limits as required by FCC rules for passengers and bystanders.

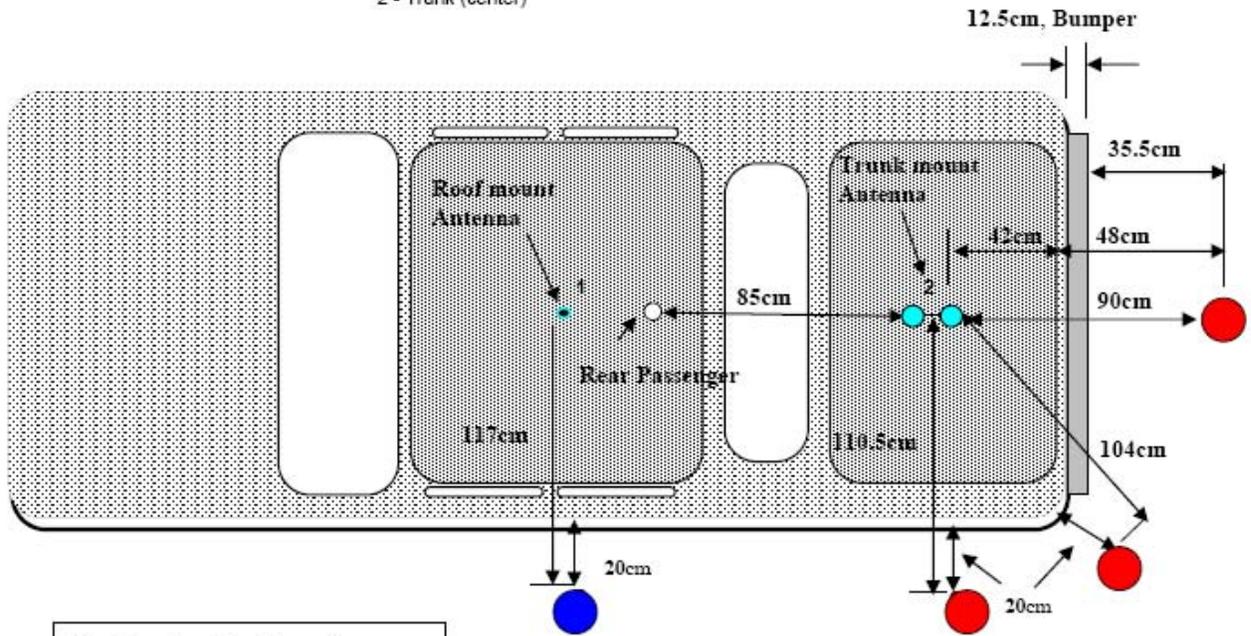
These MPE results demonstrate compliance to the FCC Occupational/Controlled Exposure limits.

**APPENDIX A**  
**Illustration of Antenna Locations and Test Distances**

**Antenna Location Drawing with Test Locations Identified**



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



**By-Stander Test Locations**

- Roof Mount
- Trunk Mount

**APPENDIX B**  
**Meter/Probe Calibration Certificates**



Cert I.D.: 75742

*Certificate of Calibration Conformance*

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The instrument identified below has been individually calibrated in compliance with the following standard(s):

IEEE 1309 - 2005, Institute of Electrical and Electronics Engineers, Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas from 9 kHz to 40 GHz

Environment: Laboratory MTE is maintained in a temperature controlled environment with ambient conditions from 18 to 28 C, relative humidity less than 90%. The instrument under test has been calibrated in a suitable environment using an EMCO TEM Cell 5101C, GTEM! 5305 and an RF Shielded EMC Chamber which is conducive to maintaining accurate and reliable measurement quality.

<b>Manufacturer:</b>	ETS-Lindgren	<b>Operating Range:</b>	100kHz - 5GHz
<b>Model Number:</b>	E100	<b>Instrument Type:</b>	Isotropic Probe > 1 GHz
<b>Serial Number/ ID:</b>	00109011	<b>Date Code:</b>	
<b>Tracking Number:</b>	S000017735	<b>Alternate ID:</b>	
<b>Date Completed:</b>	22-Oct-09	<b>Customer:</b>	MOTOROLA INC. (FL)
<b>Test Type:</b>	Standard Field, Field Strength		

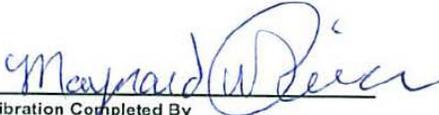
**Calibration Uncertainty:** Std Field Method 10kHz - 18000 MHz, +/-0.7 dB, 26.5GHz - 40GHz, +/- 0.95 dB  
k=2, (95% Confidence Level)

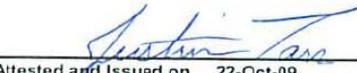
**Test Remarks:** Special calibration - Additional field levels added.

Calibration Traceability: All Measuring and Test Equipment (M/TE) identified below are traceable to the National Institute for Standards and Technology (NIST). Calibration Laboratory and Quality System controls are compliant with ISO/IEC 17025-2005.

**Standards and Equipment Used:**

Make / Model / Name / S/N / Recall Date	Condition of Instrument Upon Receipt:
Rohde & Schwarz 857.8008.0 Power Meter NRVD 828110/019 10-Feb-10	In Tolerance to Internal Quality Standards
Hewlett Packard 437B HP Power Meter 3110A03972 09-Jan-10	
Fluke 6060B RF Signal Generator 5690204 11-Jun-10	On Release:
Marconi 2022 Signal Generator 119019/077 25-Sep-10	
Rohde & Schwarz 857.8008.0 Power Meter NRVD 100451 18-Nov-09	
Hewlett Packard 83620B Signal Generator 3722A00541 25-Sep-10	In Tolerance to Internal Quality Standards

  
 Calibration Completed By  
 Maynard Reich, Calibration Technician

  
 Attested and Issued on 22-Oct-09  
 Justin Terr, Calibration Supervisor

This document provides traceability of measurements to recognized national standards using controlled processes at the ETS-Lindgren Calibration Laboratory. Uncertainties listed are derived from the methods described by NIST Tech Note 1297. This certificate and report may not be reproduced, except in full, without the written approval of ETS-Lindgren Calibration Laboratory in accordance with ISO/IEC 17025-2005. QAF 1127 (06/07)



**Frequency Response Calibration Factors**  
**Model E100 Serial Number 00109011**  
**Date of Calibration 21 Oct 2009**

Frequency (MHz)	Applied V/m	Probe Reading			Correction Factor			
		X	Y	Z	X	Y	Z	Avg
1.00	7.64	7.02	7.79	6.94	1.14	1.04	0.98	1.05
1.00	19.82	16.71	17.11	16.74	1.18	1.16	1.18	1.18
1.00	71.15	57.93	59.53	58.16	1.23	1.19	1.22	1.22
1.00	125.11	100.56	104.03	102.13	1.24	1.20	1.23	1.22
15.00	7.95	8.17	8.28	8.18	0.98	0.96	0.97	0.97
15.00	19.94	19.63	19.98	19.65	1.02	1.00	1.01	1.01
15.00	70.00	67.78	68.81	67.94	1.03	1.02	1.03	1.03
15.00	124.61	120.61	122.69	121.30	1.03	1.02	1.03	1.03
30.00	7.95	8.49	8.59	8.45	0.93	0.93	0.94	0.93
30.00	19.81	19.99	20.29	20.08	1.00	0.97	0.98	0.98
30.00	69.87	69.71	70.67	70.11	1.00	0.99	1.00	1.00
30.00	124.31	124.11	125.93	125.11	1.00	0.99	0.99	0.99
75.00	8.06	8.62	8.75	8.77	0.94	0.93	0.91	0.92
75.00	19.92	20.32	20.71	20.76	0.97	0.96	0.96	0.97
75.00	69.19	71.16	72.25	72.19	0.97	0.96	0.96	0.96
75.00	123.17	126.65	128.70	128.37	0.97	0.96	0.96	0.96
100.00	7.99	8.30	8.54	8.58	0.96	0.95	0.92	0.94
100.00	19.72	20.02	20.31	20.50	0.98	0.97	0.96	0.97
100.00	70.01	70.85	71.90	72.15	0.99	0.97	0.97	0.98
100.00	126.58	128.59	130.29	130.10	0.98	0.97	0.97	0.98
150.00	8.05	8.13	8.26	8.36	0.99	0.98	0.95	0.98
150.00	19.93	20.03	20.39	20.66	0.99	0.98	0.96	0.98
150.00	69.87	70.30	71.46	71.94	0.99	0.98	0.97	0.98
150.00	124.91	126.00	127.53	128.17	0.99	0.98	0.97	0.98
200.00	8.07	8.50	8.67	8.69	0.95	0.94	0.92	0.94
200.00	19.86	20.80	21.21	21.58	0.96	0.94	0.92	0.94
200.00	69.73	73.51	74.90	75.46	0.95	0.93	0.92	0.93
200.00	125.11	132.11	134.58	134.95	0.95	0.93	0.93	0.93
250.00	8.00	8.33	8.42	8.60	0.96	0.95	0.93	0.95
250.00	20.02	20.72	21.00	21.43	0.97	0.95	0.93	0.95
250.00	70.08	72.35	73.13	74.05	0.97	0.96	0.95	0.96
250.00	123.93	128.09	129.47	130.20	0.97	0.96	0.95	0.96
300.00	8.02	8.27	8.40	8.57	0.97	0.95	0.94	0.95
300.00	19.96	20.48	20.79	21.31	0.98	0.96	0.94	0.96
300.00	69.80	71.54	72.40	73.40	0.98	0.96	0.95	0.96
300.00	125.31	129.68	131.16	131.92	0.97	0.96	0.95	0.96
400.00	7.97	8.30	8.34	8.56	0.97	0.95	0.93	0.95
400.00	20.00	20.54	20.92	21.48	0.97	0.96	0.93	0.95
400.00	70.16	71.90	72.88	73.99	0.98	0.96	0.95	0.96
400.00	126.35	129.28	131.06	132.12	0.98	0.96	0.96	0.97
500.00	7.99	8.01	8.18	8.39	1.00	0.98	0.95	0.97
500.00	20.01	20.00	20.41	20.98	1.00	0.98	0.95	0.98
500.00	69.97	69.80	71.05	72.15	1.00	0.98	0.97	0.99
500.00	124.82	125.16	127.11	128.22	1.00	0.98	0.97	0.98
600.00	8.05	8.00	8.13	8.36	1.01	0.99	0.96	0.99
600.00	19.91	19.62	19.99	20.62	1.01	1.00	0.97	0.99
600.00	70.04	68.89	69.92	71.17	1.02	1.00	0.98	1.00
600.00	126.51	124.61	126.45	127.20	1.02	1.00	0.99	1.00



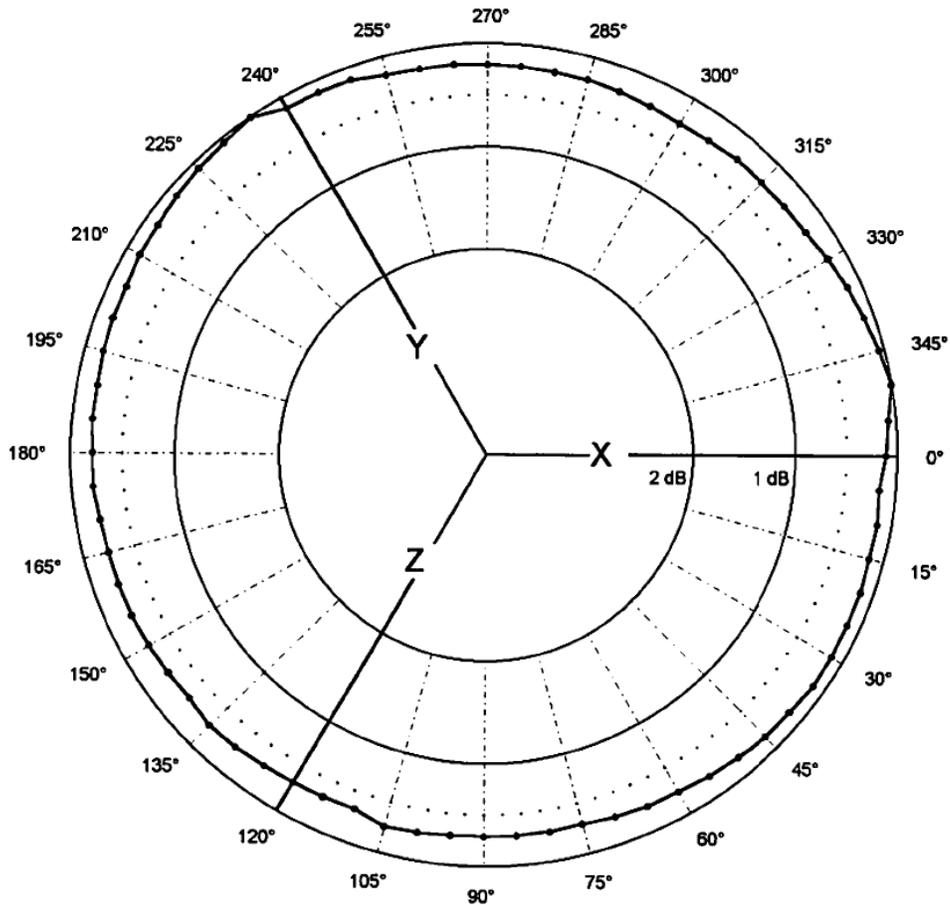
**Frequency Response Calibration Factors**  
**Model E100 Serial Number 00109011**  
**Date of Calibration 21 Oct 2009**

Frequency (MHz)	Applied V/m	Probe Reading			Correction Factor			
		X	Y	Z	X	Y	Z	Avg
700.00	8.00	7.97	8.10	8.33	1.00	0.99	0.96	0.98
700.00	19.96	19.73	20.08	20.70	1.01	0.99	0.96	0.99
700.00	70.92	70.15	71.10	72.40	1.01	1.00	0.98	1.00
700.00	126.17	124.81	126.29	127.81	1.01	1.00	0.99	1.00
800.00	8.03	7.80	7.94	8.18	1.03	1.01	0.98	1.01
800.00	20.00	19.25	19.67	20.30	1.04	1.02	0.99	1.01
800.00	70.11	67.44	68.66	69.87	1.04	1.02	1.01	1.02
800.00	124.80	120.51	122.51	123.68	1.04	1.02	1.01	1.02
900.00	8.00	7.62	7.82	8.04	1.05	1.02	1.00	1.02
900.00	20.12	19.05	19.57	20.18	1.06	1.03	1.00	1.03
900.00	69.94	66.19	67.78	68.96	1.06	1.03	1.01	1.03
900.00	124.54	118.24	120.95	121.59	1.05	1.03	1.02	1.04
1000.00	7.99	8.48	8.65	9.01	0.94	0.92	0.89	0.92
1000.00	19.88	21.08	21.49	22.22	0.94	0.92	0.89	0.92
1000.00	70.09	74.27	75.51	76.80	0.94	0.93	0.91	0.93
1000.00	126.71	134.43	136.66	137.97	0.94	0.93	0.92	0.93
2000.00	20.27	19.59	20.78	20.88	1.03	0.98	0.97	0.99
2450.00	19.89	18.55	19.38	19.12	1.07	1.03	1.04	1.05
3000.00	20.20	19.52	20.35	21.43	1.03	0.99	0.94	0.99
3500.00	19.95	20.73	22.23	21.00	0.96	0.90	0.95	0.94
4000.00	20.49	21.32	21.67	21.70	0.96	0.95	0.94	0.95
5000.00	20.26	16.24	17.62	17.17	1.25	1.15	1.18	1.19
5500.00	19.77	15.77	16.06	14.83	1.25	1.23	1.33	1.27
6000.00	19.99	14.67	16.77	16.40	1.36	1.19	1.22	1.26



### PROBE ROTATIONAL RESPONSE

**Model** E100  
**S/N** 00109011  
**Date** 22-Oct-2009  
**Time** 07:40:55  
**Variation** 0.39 dB



• Isotropic response measured in a 20 V/m field at 400 MHz

**Service Test Report**  
 QAF 1126, 06/07  
 Report ID: 75744



**Certificate of Test Conformance**  
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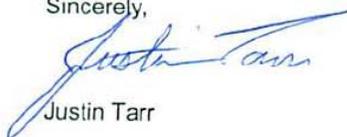
**Reference:** S 000017735  
**Customer:** MOTOROLA INC. (FL)

The instrument listed below has been tested and verified to Internal Quality Standards. Test data is Not Applicable. Equipment used during instrument testing is controlled by laboratory compliance with ISO/IEC 17025-2005 using ETS-Lindgren Quality Management System internal procedures.

<u>Manufacturer</u>	ETS-Lindgren	<u>Status In</u>	Other
<u>Instrument Type</u>	RF Survey Meter	<u>Date Completed</u>	22-Oct-09
<u>Model</u>	HI-2200	<u>Status Out</u>	Compliant with Internal Quality Standards
<u>Serial Number/ID</u>	00086316		

Remarks  
 Secured mounting screw on LCD to remove lines - Functional Test Performed.

I would like to take this opportunity to express our appreciation for using ETS-Lindgren for your EMI test equipment services and I am looking forward to continued business with your organization. Please feel free to contact our offices at (512) 531-6400, if you have any questions regarding this report.

Sincerely,  
  
 Justin Tarr  
 Calibration Supervisor

**Date Attested:** 22-Oct-09

**APPENDIX C**  
**Photos of Assessed Antennas**



From left to right: HAE6010A, HAE6013A, HAE6031A