

**MOTOROLA SOLUTIONS**

TESTING CERT # 2518.01

DECLARATION OF COMPLIANCE: MPE ASSESSMENT**EME Test Laboratory**8000 West Sunrise Blvd
Fort Lauderdale, FL. 33322**Date of Report:** June 25, 2013**Report Revision:** O**Report ID:** SR11319 MPE Auto rpt XPR 2500 UHF R1 Rev O
130625

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Date(s) Tested: 5/8/2013 - 5/11/2013; 5/13/2013; 6/4/2013; 6/14/2013
Manufacturer/Location: Motorola Solutions, Penang, Malaysia
Date submitted for test: 3/25/2013
DUT Description: XPR 2500 UHF R1 403-470 MHz, 25-40 W, Radio with
 Alphanumeric Display Control Head
Test TX mode(s): CW
Max. Power output: 48W
TX Frequency Bands: 403-470 MHz
Signaling type: Analog [FM] and TDMA 1:2 [4FSK]
Model(s) Tested: PMUE4164A
Model(s) Certified: PMUE4164A
Serial Number(s): 776TPF0217 and 776TPF0232
Classification: Occupational/Controlled Environment
FCC ID: ABZ99FT4093
 Part 22 & 90 UHF (406.1 – 470 MHz)

IC: 109AB-99FT4093
 IC bands; UHF (406.1– 430 MHz; 450 – 470 MHz)
 Results outside IC bands are not applicable for IC compliance
 demonstration.

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 3.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola Solutions Inc. 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.

Deanna Zakharia
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Laboratory Director

Approval Date: 6/26/2013

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Document Revision History

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1.0 Introduction

This report details the test setup, test equipment and test results of Maximum Permissible Exposure (MPE) performed at Motorola Solutions' outside test site for product model PMUE4164A.

2.0 Abbreviations / Definitions

BS: Bystander
CNR: Calibration Not Required
CW: Continuous Wave
DUT: Device Under Test
EME: Electromagnetic Energy
4FSK: 4 Level Frequency Shift Keying
FM: Frequency Modulation
MPE: Maximum Permissible Exposure
NA: Not Applicable
PB: Passenger Backseat
PF: Passenger Front seat
PTT: Push to Talk
TDMA: Time Division Multiple Access

3.0 Referenced Standards and Guidelines

This product is designed to comply with the following applicable national and international standards and guidelines.

- United States Federal Communications Commission, Code of Federal Regulations; Rule Part 47CFR § 1.1310, § 2.1091 (d) and § 2.1093 for RF Exposure, where applicable.
- Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.
- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1999
- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1992. Specific to FCC rules and regulations.
- Institute of Electrical and Electronics Engineers (IEEE) C95.3-2002
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6 (2009), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz

4.0 Power Density Limits

Table 1 – Occupational / Controlled Exposure Limits

Frequency Range (MHz)	FCC OET Bulletin 65 Supplement C	ICNIRP	IEEE C95.1 1992/1999	IEEE C95.1 2005	RSS 102 issue 4 - 2010
	mW/cm ²	W/m ²	mW/cm ²	W/m ²	W/m ²
30 - 300	1.0				*10.0
10 - 400		10.0			
100 - 300			1.0	10.0	
300 - 1,500	f/300				f/30
300 - 3,000			f/300	f/30	
400 - 2,000		f/40			
1,500 - 15,000					50.0
1,500 - 100,000	5.0				
2,000 – 300,000		50.0			
3,000 - 300,000			10.0	100.0	

*Power density limit is applicable at frequencies greater than 100MHz

Table 2 – General Population / Uncontrolled Exposure Limits

Frequency Range (MHz)	FCC OET Bulletin 65 Supplement C	ICNIRP	IEEE C95.1 1992/1999	IEEE C95.1 2005	RSS 102 issue 4 – 2010
	mW/cm ²	W/m ²	mW/cm ²	W/m ²	W/m ²
30 – 300	0.2				*2.0
10 – 400		2.0			
100 – 300			0.2		
100 – 400				2.0	
300 – 1,500	f/1,500				f/150
400 – 2,000		f/200		f/200	
300 – 15,000			f/1,500		
1,500 – 15,000					10.0
1,500 – 100,000	1.0				
2,000 – 100,000				10.0	
2,000 – 300,000		10.0			

*Power density limit is applicable at frequencies greater than 100MHz

5.0 N_c Test Channels

The number of test channels are determined by using Equation 1 below. This equation is available in FCC's KDB 447498. The test channels are appropriately spaced across the antenna's frequency range.

Equation 1 – Number of test channels

$$N_c = \text{Round} \{ [100(f_{\text{high}} - f_{\text{low}})/f_c]^{0.5} \times (f_c / 100)^{0.2} \}$$

where N_c is the number of test channels, f_{high} and f_{low} are the highest and lowest frequencies within the transmission band, f_c is the mid-band frequency, and frequencies are in MHz.

6.0 Measurement Equipment

Table 3 – Equipment

Equipment Type	Model #	SN	Calibration Date	Calibration Due Date
Automobile	2003 Ford Crown Victoria, 4-Door	NA	NA	NA
Survey Meter Probe – E-Field	ETS Model HI-2200 ETS Model E100	00086316 00109011	08/15/2012	08/15/2013

E-field measurements are in mW/cm².

H-field measurements are in A/m.

7.0 Measurement System Uncertainty Levels

Table 4 - Uncertainty Budget for Near Field Probe Measurements

	Tol. (± %)	Prob. Dist.	Divisor	u_i (± %)	v_i
Measurement System					
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	∞
Test sample Related					
Antenna Positioning	3.0	N	1.00	3.0	∞
Power drift	5.0	R	1.73	2.9	∞
Combined Standard Uncertainty		RSS		12.2	∞
Expanded Uncertainty (95% CONFIDENCE LEVEL)		$k=2$		24	

8.0 Product and System Description

Model PMUE4164A is a mobile transceiver that utilizes analog and digital two-way radio communications. The analog modulation scheme uses Frequency Modulation (FM). Digital modes use 4FSK modulation (4-Level Frequency Shift Keying) and 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 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 are people other than operator)

9.0 Additional Options and Accessories

Refer to Table 5 for complete list of tested antennas.

10.0 Test Set-Up Description

Assessments were performed with mobile radio installed in the test vehicle while engine was at idle, at the specified distances and test locations indicated in sections 11.0, 12.0 and Appendix A.

All antennas described in Table 5 were considered in order to develop the test plan for this product. Antennas were installed and tested per their appropriate mount locations (Roof / Trunk) and defined test channels.

11.0 Method of Measurement with trunk mounted antenna(s)

11.1 External/Bystander vehicle MPE measurements

Antenna is located at the center of the trunk. Refer to Appendix A for antenna location and distance.

MPE measurements for bystander (BS) conditions are determined by taking the average of (10) measurements in a 2 m vertical line for each of the (3) bystander test locations indicated in Appendix A with 20 cm height increments, with antenna to probe sensor separation distances of 90 cm directly behind vehicle, 104 cm (45 degree radial) and 110.5 cm (90 degree radial). The separation distance used for testing is defined from the antenna where as the RF safety booklet defines the same distance from the vehicle body to ensure that the assessment is applicable to other vehicles. The measurement probe is positioned orthogonal to the 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 minimum of 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.

Note: The distance from the centered trunk-mounted antenna to the rear edge of the vehicle is 42cm and the distance from the rear edge of the vehicle to the survey probe sensor is 48 cm.

11.2 Internal/Passenger vehicle MPE measurements

Antenna is located toward the center of the trunk at a minimum 85cm from backseat passenger. Users are instructed, per installation manual, to mount antennas on the roof only if a minimum 85cm cannot be achieved. Refer to Appendix A for antenna location and distance.

MPE measurements for passenger front seat (PF) and backseat (PB) 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 backseat is a bench seat and therefore each position (Head, Chest & Lower Trunk) were scanned across (horizontally) the seat starting from the middle of the seat to the edge of the seat stopping 20 cm from the vehicle door. Similar process was used in the front bucket seat.

The probe handle is oriented parallel (horizontal) to the ground and pointed towards the back of the vehicle. The probe handle is not oriented normal to the seat surface. The probe head (incorporating the field sensors) is scanned continuously (using the max-hold function available in the meter) along three test axes which are parallel to the seat angle (intended as the line determined by the intersection of the plane of the seat and the plane of the backrest) and are 20 cm from the seat surface. One test axis is at the Head height, another is at the Chest height, and another is at the Lower Trunk height. The maximum field level value recorded for each test axis is logged. The MPE is determined by averaging these three maximum values regardless of the geometrical location where they were observed. For instance, the locations of the three maxima may lie on different vertical (relative to

ground) lines.

This approach leads to results that are representative of the exposure of vehicle occupants since it is based on an average across the body portions closest to the antenna for both trunk and roof mount positions, and is conservatively biased because the highest results for each test axis are combined, e.g. the highest head exposure could be in the middle of the seat while the highest lower trunk exposure could be closer to the door.

12.0 Method of Measurement with roof mounted antenna(s)

12.1 External/Bystander vehicle MPE measurements

Antenna is located at the center of the roof. Refer to Appendix A for antenna location and distance.

MPE measurements for bystander (BS) 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 117cm 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 centered roof-mounted antenna to the probe element (97cm from antenna to edge of car door and 20cm from the edge of the car door to the survey probe sensor); this is the closest distance that can be achieved to a centered roof-mounted antenna used for MPE compliance assessment herein.

12.2 Internal/Passenger vehicle MPE measurements

Antenna is located at the center of the roof. Refer to Appendix A for antenna location and distance.

MPE measurements for passenger front seat (PF) and backseat (PB) 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 backseat is a bench seat and therefore each position (Head, Chest & Lower Trunk) were scanned across (horizontally) the seat starting from the middle of the seat to the edge of the seat stopping 20 cm from the vehicle door. Similar process was used in the front bucket seat.

The probe handle is oriented parallel (horizontal) to the ground and pointed towards the back of the vehicle. The probe handle is not oriented normal to the seat surface. The probe head (incorporating the field sensors) is scanned continuously (using the max-hold function available in the meter) along three test axes which are parallel to the seat angle (intended as the line determined by the intersection of the plane of the seat and the plane of the backrest) and are 20 cm from the seat surface. One test axis is at the Head height, another is at the Chest height, and another is at the Lower Trunk height. The maximum field level value recorded for each test axis is logged. The MPE is determined by averaging these three maximum values regardless of the geometrical location where they were observed. For instance, the locations of the three maxima may lie on different vertical (relative to ground) lines.

This approach leads to results that are representative of the exposure of vehicle occupants since it is based on an average across the body portions closest to the antenna for both trunk and roof mount positions, and is conservatively biased because the highest results for each test axis are combined, e.g. the highest head exposure could be in the middle of the seat while the highest lower trunk exposure could be closer to the door.

13.0 MPE Calculations

The final MPE results for this mobile radio are presented in section 15.0 Tables 6 - 9. These results are based on 50% duty cycle for PTT.

Below is an explanation of how the MPE results are calculated. Refer to Appendix D for MPE measurement results and calculations.

External to vehicle (Bystander) - 10 measurements are averaged over the body (*Avg_over_body*).
Internal to vehicle (Passengers) - 3 measurements are averaged over the body (*Avg_over_body*).

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

Therefore;

Equation 2 – Power Density Calculation (*Calc._P.D.*)

$$\text{Calc._P.D.} = (\text{Avg_over_body}) * (\text{probe_frequency_cal_factor}) * (\text{duty_cycle})$$

Note1: The highest “average” cal factors from the calibration certificates were selected for the applicable frequency range. Linear interpretation was used to determine “probe_frequency_cal_factor” for the specific test frequencies.

Note 2: The E-field probe calibration certificate’s frequency cal factors were determined by measuring V/m. The survey meter’s results were measured in power density (mW/cm²) and therefore the “probe_frequency_cal_factor” was squared in equation 2 to account for these results.

Note 3: The H-field probe calibration certificate’s frequency cal factors were determined by measuring A/m. The survey meter’s results were measured in A/m and therefore the “Avg_over_body” A/m results were converted to power density (mW/cm²) using the equation 3. H-field measurements are only applicable to frequencies below 300MHz.

Equation 3 – Converting A/m to mW/cm²

$$\text{mW / cm}^2 = (\text{A / m})^2 * 37.699$$

Equation 4 – Power Density Maximum Calculation

$$\text{Max_Calc._P.D.} = \text{P.D._calc} * \frac{\text{max_output_power}}{\text{initial_output_power}}$$

Note 4: For initial output power > max_output_power; max_output_power / initial output power = 1

14.0 Antenna Summary

Table 5 below summarizes the tested antennas and their descriptions, mount location (roof/trunk), overlap of FCC bands, number of test channels per FCC KDB 447498 (FCC N_c) and actual number of tested channels (Actual N_c). This information was used to determine the test configurations presented in this report.

Table 5

#	Antenna Model	Frequency Range (MHz)	Physical Length (cm)	Gain (dBi)	Remarks	Mount Location (Roof/Trunk)	Overlap FCC Bands	FCC N_c	Actual N_c
1	HAE4002A	403-430	17.7	2.15	1/4 wave, wire	R	406.1-430	3	3
2	HAE4003A	450-470	16.0	2.15	1/4 wave, wire	R	450-470	3	3
3	HAE4010A	406-420	84.3	5.65	5/8 wave, wire	R/T	406.1-420	3	3
4	HAE4011A	450-470	73.2	5.65	5/8 wave, wire	R/T	450-470	3	3
5	RAE4004ARB	445-470	*95.3 91.2 89.0	7.15	5/8 wave, wire	R/T	450-470	3	3
6	HAE6022A	403-527	27.7	4.15	1/2 wave, wire	R/T	406.1-470	5	5

* Antennas trimmed to frequency of test channel (3)

15.0 Test Results Summary

The following tables below summarize the MPE results for each test configuration: antenna location, test positions (BS-Bystander, PB-Passenger Backseat, PF-Passenger Front seat), E/H field measurements, angle, antenna model & freq. range, maximum output power, initial power, TX frequency, max calculated power density results, applicable FCC specification limits and % of the applicable specification limits.

Table 6
Bystander MPE assessment for trunk mounted antennas

Trunk/ Roof	Test Position	E/H Field	Angle (Degree)	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/cm ²)	FCC Limit	% To FCC Spec Limit
Trunk	BS	E	0	HAE4010A (406 - 420 MHz)	48	47.7	406.1250	0.061	0.27	23
						46.9	413.1000	0.066	0.28	24
						47.0	420.0000	0.040	0.28	14
				HAE4011A (450 - 470 MHz)	48	47.1	450.1250	0.084	0.30	28
						46.9	460.1250	0.066	0.31	21
						46.8	470.0000	0.055	0.31	18
				RAE4004ARB (445 - 470 MHz)	48	47.9	445.0000	0.062	0.30	21
						47.9	457.5000	0.087	0.31	29
						47.7	470.0000	0.079	0.31	25
				HAE 6022A (403 - 527 MHz)	48	47.7	406.1250	0.096	0.27	36
						47.4	422.0938	0.129	0.28	46
						47.5	438.0625	0.124	0.29	43
						47.3	454.0313	0.117	0.30	39
						47.7	470.0000	0.110	0.31	35
			45	HAE 6022A (403 - 527 MHz)	48	47.4	422.0938	0.093	0.28	33
			90	HAE 6022A (403 - 527 MHz)	48	47.4	422.0938	0.116	0.28	41

Table 7

Passenger MPE assessment for trunk mounted antennas

Trunk/ Roof	Test Position	E/H Field	Angle (Degree)	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/cm ²)	FCC Limit	% To FCC Spec Limit
Trunk	PB	E	NA	HAE4010A (406 - 420 MHz)	48	47.7	406.1250	0.064	0.27	24
						46.9	413.1000	0.074	0.28	27
						47.0	420.0000	0.049	0.28	18
				HAE4011A (450 - 470 MHz)	48	47.1	450.1250	0.178	0.30	59
						46.9	460.1250	0.140	0.31	46
						46.8	470.0000	0.091	0.31	29
				RAE4004ARB (445 - 470 MHz)	48	47.9	445.0000	0.030	0.30	10
						47.9	457.5000	0.069	0.31	23
						47.7	470.0000	0.070	0.31	22
				HAE 6022A (403 - 527 MHz)	48	47.7	406.1250	0.218	0.27	81
						47.4	422.0938	0.200	0.28	71
						47.5	438.0625	0.256	0.29	88
						47.3	454.0313	0.168	0.30	56
						47.7	470.0000	0.151	0.31	48
	PF	E	NA	HAE4010A (406 - 420 MHz)	48	47.7	406.1250	0.027	0.27	10
						46.9	413.1000	0.014	0.28	5
						47.0	420.0000	0.007	0.28	3
				HAE4011A (450 - 470 MHz)	48	47.5	450.1250	0.035	0.30	12
						47.6	460.1250	0.025	0.31	8
						47.7	470.0000	0.015	0.31	5

Table 7 (continued)

Passenger MPE assessment for trunk mounted antennas

Trunk/ Roof	Test Position	E/H Field	Angle (Degree)	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/cm ²)	FCC Limit	% To FCC Spec Limit
Trunk	PF	E	NA	RAE4004ARB (445 - 470 MHz)	48	47.9	445.0000	0.008	0.30	3
						47.9	457.5000	0.024	0.31	8
						47.7	470.0000	0.020	0.31	6
				HAE 6022A (403 - 527 MHz)	48	47.7	406.1250	0.069	0.27	25
						47.4	422.0938	0.039	0.28	14
						47.5	438.0625	0.071	0.29	24
						47.3	454.0313	0.083	0.30	28
						47.7	470.0000	0.056	0.31	18

Table 8
Bystander MPE assessment for roofmounted antennas

Trunk/ Roof	Test Position	E/H Field	Angle (Degree)	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/cm ²)	FCC Limit	% To FCC Spec Limit
Roof	BS	E	0	HAE4002A (403 - 430 MHz)	48	47.7	406.1250	0.051	0.27	19
						47.3	418.0625	0.056	0.28	20
						47.4	430.0000	0.052	0.29	18
				HAE4003A (450 - 470 MHz)	48	47.1	450.1250	0.063	0.30	21
						46.9	460.1250	0.067	0.31	22
						46.8	470.0000	0.057	0.31	18
				HAE4010A (406 - 420 MHz)	48	47.7	406.1250	0.035	0.27	13
						46.9	413.1000	0.038	0.28	14
						47.0	420.0000	0.022	0.28	8
				HAE4011A (450 - 470 MHz)	48	47.5	450.1250	0.052	0.30	17
						47.6	460.1250	0.047	0.31	15
						47.7	470.0000	0.033	0.31	11
				RAE4004ARB (445 - 470 MHz)	48	47.9	445.0000	0.028	0.30	10
						47.9	457.5000	0.043	0.31	14
						47.7	470.0000	0.046	0.31	15

Table 8 (continued)

Bystander MPE assessment for roof mounted antennas

Trunk/ Roof	Test Position	E/H Field	Angle (Degree)	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/cm ²)	FCC Limit	% To FCC Spec Limit
Roof	BS	E	0	HAE 6022A (403 - 527 MHz)	48	47.7	406.1250	0.054	0.27	20
						47.4	422.0938	0.053	0.28	19
						47.5	438.0625	0.058	0.29	20
						47.3	454.0313	0.060	0.30	20
						47.7	470.0000	0.061	0.31	20

Table 9

Passenger MPE assessment for roof mounted antennas

Trunk/ Roof	Test Position	E/H Field	Angle (Degree)	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/cm ²)	FCC Limit	% To FCC Spec Limit
Roof	PB	E	NA	HAE4002A (403 - 430 MHz)	48	47.7	406.1250	0.051	0.27	19
						47.3	418.0625	0.054	0.28	19
						47.4	430.0000	0.037	0.29	13
				HAE4003A (450 - 470 MHz)	48	47.5	450.1250	0.035	0.30	12
						47.6	460.1250	0.038	0.31	12
						47.7	470.0000	0.022	0.31	7
				HAE4010A (406 - 420 MHz)	48	47.7	406.1250	0.003	0.27	1
						46.9	413.1000	0.006	0.28	2
						47.0	420.0000	0.006	0.28	2

Table 9 (continued)

Passenger MPE assessment for roof mounted antennas

Trunk/ Roof	Test Position	E/H Field	Angle (Degree)	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/cm ²)	FCC Limit	% To FCC Spec Limit
Roof	PB	E	NA	HAE4011A (450 - 470 MHz)	48	47.5	450.1250	0.007	0.30	2
						47.6	460.1250	0.009	0.31	3
						47.7	470.0000	0.006	0.31	2
				RAE4004ARB (445 - 470 MHz)	48	47.9	445.0000	0.003	0.30	1
						47.9	457.5000	0.005	0.31	2
						47.7	470.0000	0.004	0.31	1
				HAE 6022A (403 - 527 MHz)	48	47.7	406.1250	0.051	0.27	19
						47.4	422.0938	0.046	0.28	16
						47.5	438.0625	0.043	0.29	15
						47.3	454.0313	0.037	0.30	12
						47.7	470.0000	0.016	0.31	5
	PF	E	NA	HAE4002A (403 - 430 MHz)	48	47.7	406.1250	0.018	0.27	6
						47.3	418.0625	0.017	0.28	6
						47.4	430.0000	0.010	0.29	3
				HAE4003A (450 - 470 MHz)	48	47.5	450.1250	0.018	0.30	6
						47.6	460.1250	0.023	0.31	7
						47.7	470.0000	0.020	0.31	7

Table 9 (continued)

Passenger MPE assessment for roof mounted antennas

Trunk/ Roof	Test Position	E/H Field	Angle (Degree)	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/cm ²)	FCC Limit	% To FCC Spec Limit
Roof	PF	E	NA	HAE4010A (406 - 420 MHz)	48	47.7	406.1250	0.001	0.27	0
						46.9	413.1000	0.001	0.28	1
						47.0	420.0000	0.002	0.28	1
				HAE4011A (450 - 470 MHz)	48	47.5	450.1250	0.005	0.30	2
						47.6	460.1250	0.006	0.31	2
						47.7	470.0000	0.004	0.31	1
				RAE4004ARB (445 - 470 MHz)	48	47.9	445.0000	0.002	0.30	1
						47.9	457.5000	0.006	0.31	2
						47.7	470.0000	0.005	0.31	2
				HAE 6022A (403 - 527 MHz)	48	47.7	406.1250	0.022	0.27	8
						47.4	422.0938	0.017	0.28	6
						47.5	438.0625	0.016	0.29	6
						47.3	454.0313	0.028	0.30	9
						47.7	470.0000	0.027	0.31	9

16.0 Conclusion

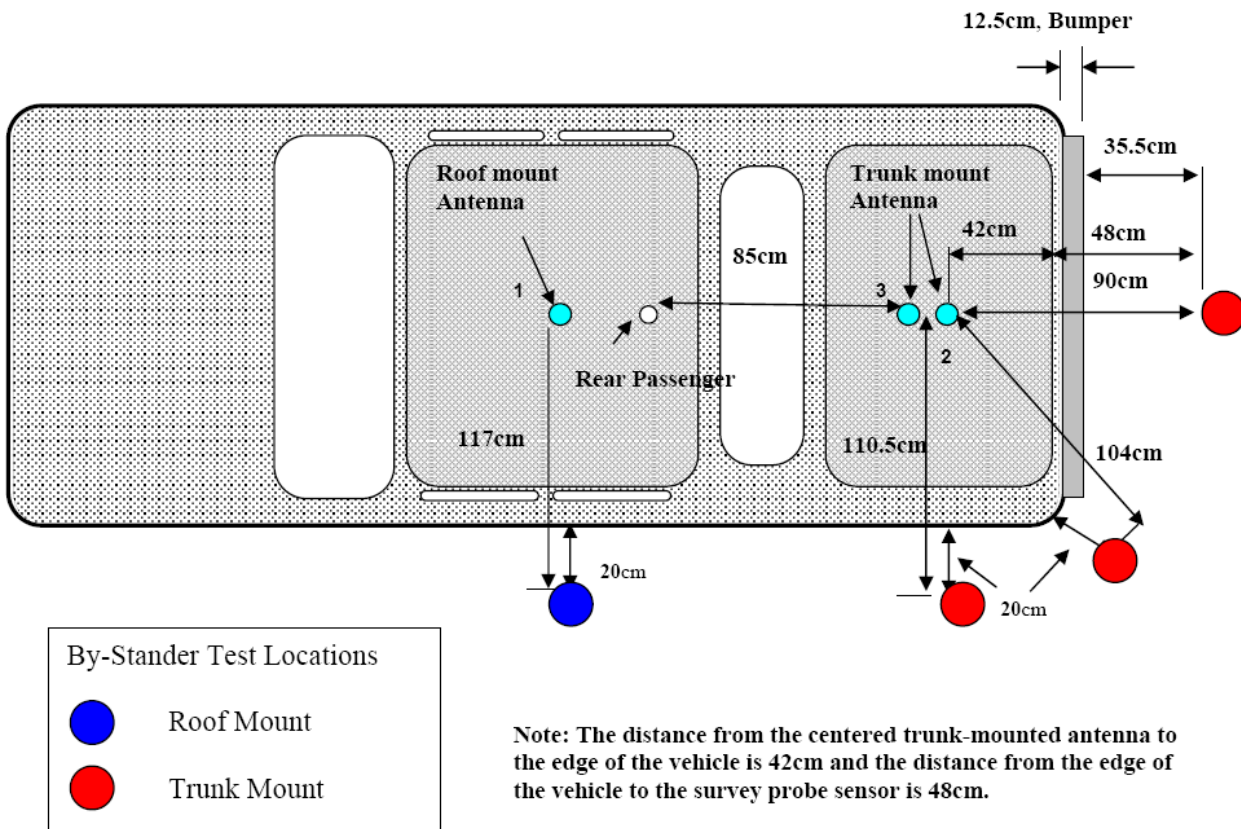
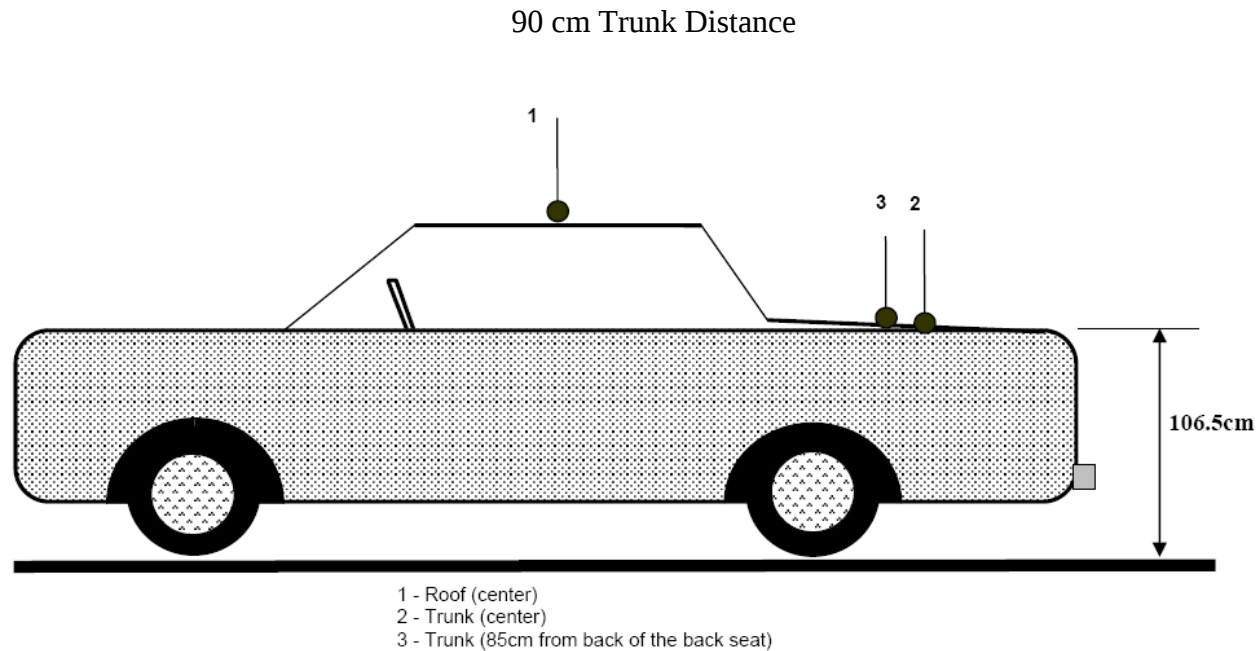
The assessments for this device were performed with an output power range as indicated in section 15.0 Tables 6 – 9. The maximum allowable output power is equal to the upper limit of the final test factory transmit power specification of 48W .The highest power density results for the mobile device scaled to the maximum allowable power output are indicated in Table 10 for internal/passenger to the vehicle, and external/bystander to the vehicle.

Table 10: Maximum MPE RF Exposure Summary

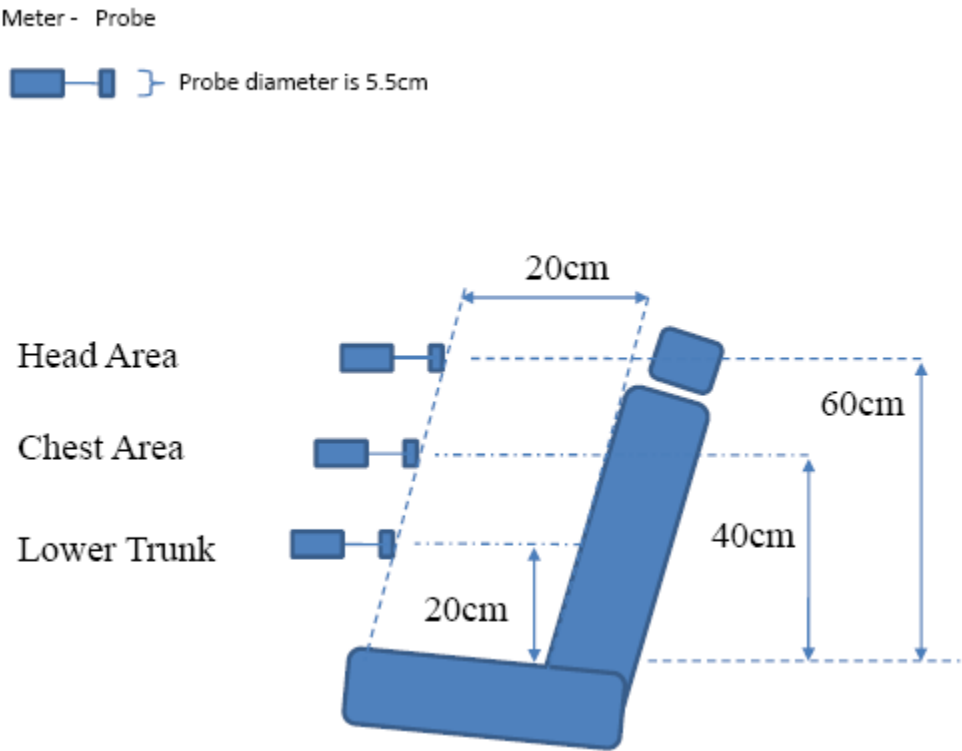
Designator	Frequency (MHz)	Passenger (mW/cm ²)	Bystander (mW/cm ²)
Overall	406.1 - 470	0.26	0.13
FCC	406.1 - 470	0.26	0.13
IC	406.1 – 430 450 - 470	0.22	0.13

These MPE results herein demonstrate compliance to the FCC Occupational/Controlled Exposure limit. FCC rules require compliance for Passengers and Bystanders to the FCC General Population/Uncontrolled limits.

Appendix A - Illustration of Antenna Locations and Test Distances



Seat scan areas
(Applicable to both front and back seats)



Appendix B - Probe Calibration Certificates

Service Test Report

QAF 1126, 03/11

Report ID: 92746



An ESCO Technologies Company

1301 Arrow Point Drive
Cedar Park, Texas 78613
(512) 531-6498

Tracking # S000025310

Equipment Check
Attested by TDO Date: 15-Aug-12
www.ets-lindgren.com**Certificate of Test Conformance**

Page 1 of 1

Reference: S 000025310**Customer:** LOCKHEED MARTIN (MS)

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 and ANSI/NCSL Z540-1-1994 using ETS-Lindgren Quality Management System internal procedures.

Manufacturer ETS-Lindgren**Instrument Type** RF Survey Meter**Model** HI-2200**Serial Number/ID** 00086316**Status In**

In Tolerance

Date Completed

15-Aug-12

Status Out

Compliant with Internal Quality Standards

Remarks

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,

A handwritten signature in blue ink, appearing to read "T. O'Neill".
Terry D. O'Neill**Date Attested:** 15-Aug-12



Cert I.D.: 92745

Certificate of Calibration Conformance

Page 1 of 3

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.

Manufacturer:	ETS-Lindgren	Operating Range:	100kHz - 5GHz
Model Number:	E100	Instrument Type:	Isotropic Probe > 1 GHz
Serial Number/ ID:	00109011	Date Code:	
Tracking Number:	S 000025310	Alternate ID:	
Date Completed:	15-Aug-12	Customer:	LOCKHEED MARTIN (MS)
Test Type:	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 frequency points provided per customer request. Probe calibrated with HI-2200 s/n 00086316.

Calibration Traceability: All Measuring and Test Equipment (MTE) identified below are traceable to the SI units through the National Institute for Standards and Technology (NIST) or other recognized National Metrology Institute. Calibration Laboratory and Quality System controls are compliant with ISO/IEC 17025-2005 and ANSI/NCSL Z540-1-1994.

Standards and Equipment Used:**Make / Model / Name / S/N / Recall Date**

Agilent/HP	8648C	Signal Generator	3623A03573	01-Feb-13
Agilent	E4419B	Power Meter	MY45104171	29-Sep-12
Agilent/HP	8648C	Signal Generator	3847A04406	01-Feb-13
Agilent	E4419B	Power Meter	MY45103242	01-Feb-13
Rohde & Schwarz	857.8008.02	Power Meter NRVD	100451	28-Mar-13
Hewlett Packard	83620B	Signal Generator	3722A00541	01-Feb-13
Rohde & Schwarz	SMB 100A	Signal Generator	101558	14-Mar-13

Condition of Instrument Upon Receipt:

In Tolerance to Internal Quality Standards

On Release:

In Tolerance to Internal Quality Standards

Calibration Completed By
George Cisneros, Calibration Technician

Attested and Issued on 15-Aug-12
Terry D. O'Neill, Calibration Manager

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 and ANSI/NCSL Z540-1-1994. QAF 1127 (03/11)

CALIBRATION REPORT

Electric Field Sensor

Model	S/N
E100	00109011
HI-2200	00086316

Date: 15 Aug 2012

New Instrument

_ Other

_ Out of Tolerance

☒ Within Tolerance
Frequency Response

Frequency Response	Nominal Field	Cal Factor*	Deviation
MHz	V/m	(Applied/Indicated)	dB
1	1	20	1.04
2	15	20	1.00
3	30	20	1.00
4	75	20	1.00
5	100	20	0.99
6	150	20	0.98
7	200	20	0.96
8	250	20	0.97
9	300	20	0.97
10	400	20	0.97
11	500	20	1.00
12	600	20	1.05
13	700	20	1.07
14	800	20	1.04
15	900	20	1.03
16	1000	20	0.96
17	2000	20	0.99
18	2450	20	1.01
19	3000	20	1.03
20	3500	20	0.99
21	4000	20	1.00
22	5000	20	1.28
23	5500	20	1.31
24	6000	20	1.32

* Corrected electric field values (V/m) can be obtained by multiplying the Cal Factor with the indicated E field readings.

Linearity

maximum linearity deviation is 0.1 dB

(measurements taken from 0.3 V/m to 800 V/m at 27.12 MHz)

Test Conditions

Calibration performed at ambient room temperature: 23 ±3°C



PROBE ROTATIONAL RESPONSE

Model E100
S/N 00109011
Date Date of Calibration 15 August 2012
Time 03:54:44 PM
Isotropy * + 0.272 dB/ -0.272 dB

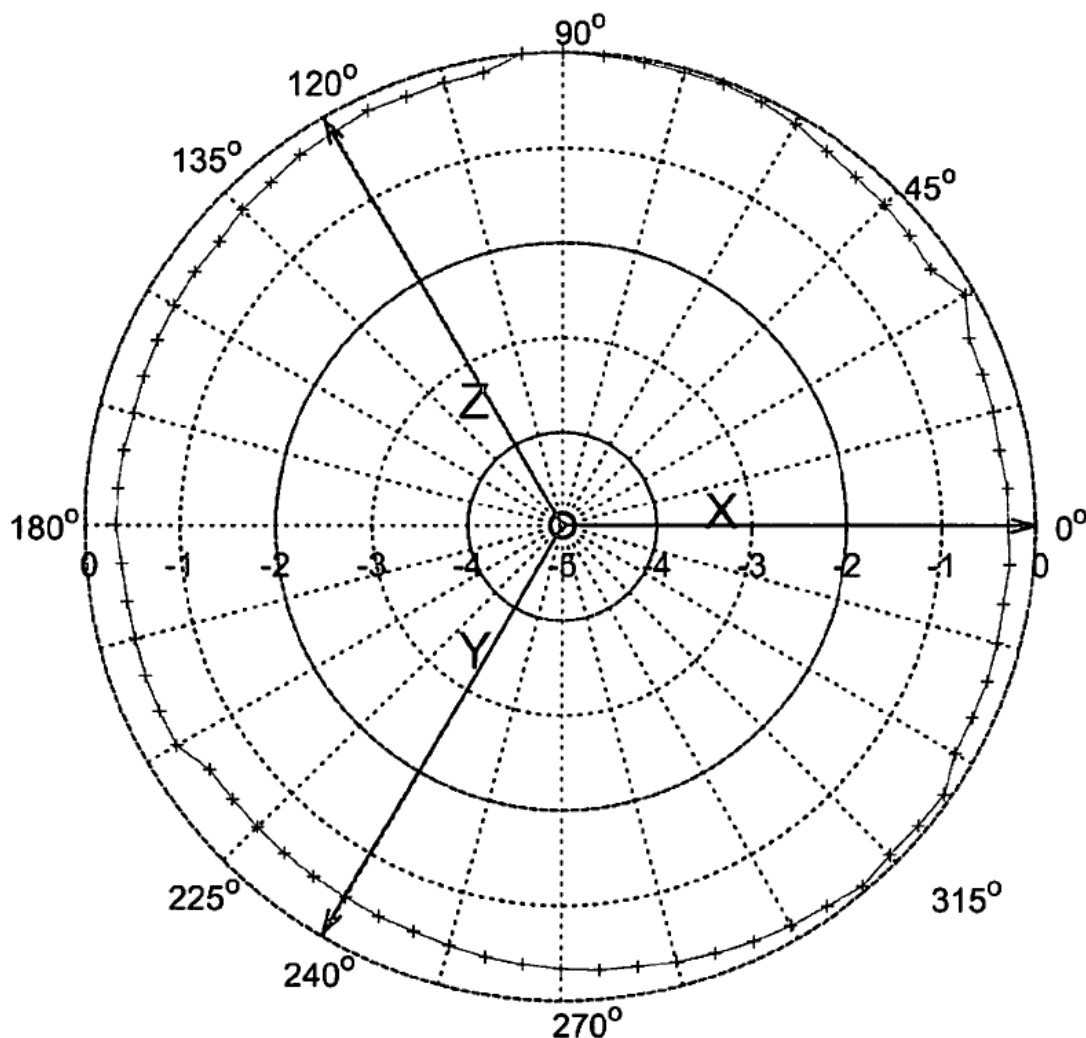


Figure 1: Probe Isotropic Response Chart.

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

*Isotropy is the maximum deviation from the geometric mean as defined by IEEE 1309-2005.

Appendix C - Photos of Assessed Antennas

(Refer to Exhibit 7B)

Appendix D – MPE Measurement Results

MPE measurement data for Bystander

D.U.T. Info.							Probe Info.		Test Pos.	Bystander (BS) Positions									DUT Max. TX Factor	Avg. over Body (mW/cm2)	Calc. P.D. (mW/cm2)	Max Calc. P.D. (mW/cm2)	
Ant Loc.	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		20 cm	40 cm	60 cm	80 cm	100 cm	120 cm	140 cm	160 cm	180 cm					200 cm
Trunk	HAE4010A (406 - 420 MHz)	5.65	406.1250	48	47.7	CW	E	0.94	BS	0.009	0.007	0.012	0.013	0.063	0.240	0.410	0.305	0.145	0.087	0.5	0.129	0.061	0.06
Trunk	HAE4010A (406 - 420 MHz)	5.65	413.1000	48	46.9	CW	E	0.95	BS	0.016	0.008	0.015	0.010	0.066	0.278	0.428	0.322	0.127	0.089	0.5	0.136	0.065	0.07
Trunk	HAE4010A (406 - 420 MHz)	5.65	420.0000	48	47.0	CW	E	0.95	BS	0.010	0.006	0.011	0.007	0.047	0.166	0.254	0.199	0.070	0.053	0.5	0.082	0.039	0.04
Trunk	HAE4011A (450 - 470 MHz)	5.65	450.1250	48	47.1	CW	E	0.97	BS	0.004	0.005	0.013	0.041	0.189	0.436	0.517	0.320	0.094	0.073	0.5	0.169	0.082	0.08
Trunk	HAE4011A (450 - 470 MHz)	5.65	460.1250	48	46.9	CW	E	0.98	BS	0.004	0.005	0.013	0.036	0.139	0.318	0.390	0.257	0.092	0.065	0.5	0.132	0.064	0.07
Trunk	HAE4011A (450 - 470 MHz)	5.65	470.0000	48	46.8	CW	E	0.98	BS	0.003	0.007	0.016	0.032	0.118	0.257	0.318	0.201	0.073	0.071	0.5	0.110	0.054	0.06
Trunk	RAE4004ARB (445 - 470 MHz)	7.15	445.0000	48	47.9	CW	E	0.97	BS	0.011	0.008	0.012	0.013	0.018	0.183	0.372	0.376	0.194	0.099	0.5	0.129	0.062	0.06
Trunk	RAE4004ARB (445 - 470 MHz)	7.15	457.5000	48	47.9	CW	E	0.97	BS	0.014	0.016	0.030	0.035	0.113	0.339	0.517	0.439	0.200	0.082	0.5	0.179	0.087	0.09
Trunk	RAE4004ARB (445 - 470 MHz)	7.15	470.0000	48	47.7	CW	E	0.98	BS	0.010	0.015	0.034	0.054	0.150	0.345	0.460	0.349	0.134	0.052	0.5	0.160	0.079	0.08
Trunk	HAE 6022A (403 - 527 MHz)	4.15	406.1250	48	47.7	CW	E	0.94	BS	0.084	0.049	0.084	0.106	0.249	0.376	0.402	0.330	0.216	0.131	0.5	0.203	0.096	0.10
Trunk	HAE 6022A (403 - 527 MHz)	4.15	422.0938	48	47.4	CW	E	0.95	BS	0.081	0.044	0.093	0.158	0.381	0.543	0.553	0.433	0.253	0.135	0.5	0.267	0.128	0.13
Trunk	HAE 6022A (403 - 527 MHz)	4.15	438.0625	48	47.5	CW	E	0.96	BS	0.066	0.038	0.103	0.190	0.357	0.469	0.507	0.415	0.262	0.147	0.5	0.255	0.123	0.12
Trunk	HAE 6022A (403 - 527 MHz)	4.15	454.0313	48	47.3	CW	E	0.97	BS	0.039	0.043	0.096	0.199	0.363	0.432	0.461	0.362	0.234	0.143	0.5	0.237	0.115	0.12
Trunk	HAE 6022A (403 - 527 MHz)	4.15	470.0000	48	47.7	CW	E	0.98	BS	0.028	0.052	0.112	0.207	0.317	0.409	0.426	0.313	0.218	0.149	0.5	0.223	0.110	0.11
45 Deg																							
Trunk	HAE 6022A (403 - 527 MHz)	4.15	422.0938	48	47.4	CW	E	0.95	BS	0.061	0.046	0.137	0.122	0.215	0.331	0.369	0.306	0.223	0.119	0.5	0.193	0.092	0.09
90 Deg																							
Trunk	HAE 6022A (403 - 527 MHz)	4.15	422.0938	48	47.4	CW	E	0.95	BS	0.078	0.055	0.151	0.152	0.256	0.407	0.489	0.413	0.261	0.147	0.5	0.241	0.115	0.12

MPE calculations are defined in section 13.0.

MPE measurement data for Passenger

D.U.T. Info.							Probe Info.		Test Pos.	Passenger Positions			DUT Max. TX Factor	Avg. over Body (mW/cm2)	Calc. P.D. (mW/cm2)	Max Calc. P.D. (mW/cm2)
Ant Loc.	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		Head	Chest	Lower				
Trunk	HAE4010A (406 - 420 MHz)	5.65	406.1250	48	47.7	CW	E	0.94	PB	0.223	0.099	0.084	0.5	0.135	0.064	0.06
Trunk	HAE4010A (406 - 420 MHz)	5.65	413.1000	48	46.9	CW	E	0.95	PB	0.279	0.104	0.073	0.5	0.152	0.072	0.07
Trunk	HAE4010A (406 - 420 MHz)	5.65	420.0000	48	47.0	CW	E	0.95	PB	0.155	0.101	0.049	0.5	0.102	0.048	0.05
Trunk	HAE4011A (450 - 470 MHz)	5.65	450.1250	48	47.1	CW	E	0.97	PB	0.446	0.360	0.276	0.5	0.361	0.175	0.18
Trunk	HAE4011A (450 - 470 MHz)	5.65	460.1250	48	46.9	CW	E	0.98	PB	0.222	0.233	0.386	0.5	0.280	0.137	0.14
Trunk	HAE4011A (450 - 470 MHz)	5.65	470.0000	48	46.8	CW	E	0.98	PB	0.243	0.143	0.156	0.5	0.181	0.089	0.09
Trunk	RAE4004ARB (445 - 470 MHz)	7.15	445.0000	48	47.9	CW	E	0.97	PB	0.066	0.082	0.040	0.5	0.063	0.030	0.03
Trunk	RAE4004ARB (445 - 470 MHz)	7.15	457.5000	48	47.9	CW	E	0.97	PB	0.201	0.143	0.079	0.5	0.141	0.069	0.07
Trunk	RAE4004ARB (445 - 470 MHz)	7.15	470.0000	48	47.7	CW	E	0.98	PB	0.157	0.144	0.126	0.5	0.142	0.070	0.07
Trunk	HAE 6022A (403 - 527 MHz)	4.15	406.1250	48	47.7	CW	E	0.94	PB	0.578	0.162	0.638	0.5	0.459	0.217	0.22
Trunk	HAE 6022A (403 - 527 MHz)	4.15	422.0938	48	47.4	CW	E	0.95	PB	0.650	0.330	0.264	0.5	0.415	0.198	0.20
Trunk	HAE 6022A (403 - 527 MHz)	4.15	438.0625	48	47.5	CW	E	0.96	PB	0.663	0.571	0.346	0.5	0.527	0.254	0.26
Trunk	HAE 6022A (403 - 527 MHz)	4.15	454.0313	48	47.3	CW	E	0.97	PB	0.495	0.337	0.191	0.5	0.341	0.166	0.17
Trunk	HAE 6022A (403 - 527 MHz)	4.15	470.0000	48	47.7	CW	E	0.98	PB	0.389	0.293	0.236	0.5	0.306	0.150	0.15

MPE calculations are defined in section 13.0.

MPE measurement data for Passenger

D.U.T. Info.							Probe Info.		Test Pos.	Passenger Positions			DUT Max. TX Factor	Avg. over Body (mW/cm2)	Calc. P.D. (mW/cm2)	Max Calc. P.D. (mW/cm2)
Ant Loc.	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		Head	Chest	Lower Trunk				
Trunk	HAE4010A (406 - 420 MHz)	5.65	406.1250	48	47.7	CW	E	0.94	PF	0.031	0.050	0.087	0.5	0.056	0.026	0.03
Trunk	HAE4010A (406 - 420 MHz)	5.65	413.1000	48	46.9	CW	E	0.95	PF	0.024	0.031	0.031	0.5	0.029	0.014	0.01
Trunk	HAE4010A (406 - 420 MHz)	5.65	420.0000	48	47.0	CW	E	0.95	PF	0.016	0.017	0.011	0.5	0.015	0.007	0.01
Trunk	HAE4011A (450 - 470 MHz)	5.65	450.1250	48	47.5	CW	E	0.97	PF	0.046	0.051	0.119	0.5	0.072	0.035	0.04
Trunk	HAE4011A (450 - 470 MHz)	5.65	460.1250	48	47.6	CW	E	0.98	PF	0.028	0.036	0.089	0.5	0.051	0.025	0.03
Trunk	HAE4011A (450 - 470 MHz)	5.65	470.0000	48	47.7	CW	E	0.98	PF	0.025	0.026	0.043	0.5	0.031	0.015	0.02
Trunk	RAE4004ARB (445 - 470 MHz)	7.15	445.0000	48	47.9	CW	E	0.97	PF	0.016	0.020	0.016	0.5	0.017	0.008	0.01
Trunk	RAE4004ARB (445 - 470 MHz)	7.15	457.5000	48	47.9	CW	E	0.97	PF	0.037	0.055	0.055	0.5	0.049	0.024	0.02
Trunk	RAE4004ARB (445 - 470 MHz)	7.15	470.0000	48	47.7	CW	E	0.98	PF	0.040	0.052	0.028	0.5	0.040	0.020	0.02
Trunk	HAE 6022A (403 - 527 MHz)	4.15	406.1250	48	47.7	CW	E	0.94	PF	0.109	0.114	0.211	0.5	0.145	0.068	0.07
Trunk	HAE 6022A (403 - 527 MHz)	4.15	422.0938	48	47.4	CW	E	0.95	PF	0.080	0.052	0.112	0.5	0.081	0.039	0.04
Trunk	HAE 6022A (403 - 527 MHz)	4.15	438.0625	48	47.5	CW	E	0.96	PF	0.152	0.084	0.202	0.5	0.146	0.070	0.07
Trunk	HAE 6022A (403 - 527 MHz)	4.15	454.0313	48	47.3	CW	E	0.97	PF	0.088	0.157	0.262	0.5	0.169	0.082	0.08
Trunk	HAE 6022A (403 - 527 MHz)	4.15	470.0000	48	47.7	CW	E	0.98	PF	0.107	0.122	0.113	0.5	0.114	0.056	0.06

MPE calculations are defined in section 13.0.

Form-MPE Auto Vehicle rpt. Rev 7.6

MPE measurement data for Bystander

D.U.T. Info.							Probe Info.		Test Pos.	Bystander (BS) Positions									DUT Max. TX Factor	Avg. over Body (mW/cm2)	Calc. P.D. (mW/cm2)	Max Calc. P.D. (mW/cm2)	
Ant Loc.	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		20 cm	40 cm	60 cm	80 cm	100 cm	120 cm	140 cm	160 cm	180 cm					200 cm
Roof	HAE4002A (403 - 430 MHz)	2.15	406.1250	48	47.7	CW	E	0.94	BS	0.009	0.008	0.013	0.023	0.047	0.101	0.168	0.215	0.248	0.251	0.5	0.108	0.051	0.05
Roof	HAE4002A (403 - 430 MHz)	2.15	418.0625	48	47.3	CW	E	0.95	BS	0.006	0.009	0.016	0.039	0.064	0.115	0.169	0.217	0.260	0.274	0.5	0.117	0.056	0.06
Roof	HAE4002A (403 - 430 MHz)	2.15	430.0000	48	47.4	CW	E	0.96	BS	0.008	0.009	0.019	0.038	0.064	0.088	0.132	0.187	0.254	0.268	0.5	0.107	0.051	0.05
Roof	HAE4003A (450 - 470 MHz)	2.15	450.1250	48	47.1	CW	E	0.97	BS	0.005	0.010	0.021	0.053	0.029	0.118	0.165	0.299	0.273	0.295	0.5	0.127	0.062	0.06
Roof	HAE4003A (450 - 470 MHz)	2.15	460.1250	48	46.9	CW	E	0.98	BS	0.041	0.010	0.024	0.058	0.078	0.087	0.130	0.232	0.328	0.347	0.5	0.134	0.065	0.07
Roof	HAE4003A (450 - 470 MHz)	2.15	470.0000	48	46.8	CW	E	0.98	BS	0.003	0.007	0.018	0.048	0.054	0.071	0.140	0.213	0.283	0.289	0.5	0.113	0.055	0.06
Roof	HAE4010A (406 - 420 MHz)	5.65	406.1250	48	47.7	CW	E	0.94	BS	0.001	0.001	0.000	0.001	0.002	0.012	0.059	0.143	0.254	0.272	0.5	0.075	0.035	0.04
Roof	HAE4010A (406 - 420 MHz)	5.65	413.1000	48	46.9	CW	E	0.95	BS	0.000	0.000	0.001	0.001	0.003	0.015	0.065	0.150	0.262	0.280	0.5	0.078	0.037	0.04
Roof	HAE4010A (406 - 420 MHz)	5.65	420.0000	48	47.0	CW	E	0.95	BS	0.000	0.000	0.001	0.001	0.004	0.011	0.039	0.088	0.146	0.155	0.5	0.045	0.021	0.02
Roof	HAE4011A (450 - 470 MHz)	5.65	450.1250	48	47.5	CW	E	0.97	BS	0.001	0.002	0.004	0.008	0.019	0.054	0.126	0.255	0.319	0.270	0.5	0.106	0.051	0.05
Roof	HAE4011A (450 - 470 MHz)	5.65	460.1250	48	47.6	CW	E	0.98	BS	0.001	0.002	0.004	0.011	0.023	0.041	0.103	0.212	0.288	0.268	0.5	0.095	0.047	0.05
Roof	HAE4011A (450 - 470 MHz)	5.65	470.0000	48	47.7	CW	E	0.98	BS	0.001	0.001	0.003	0.008	0.011	0.021	0.072	0.144	0.217	0.194	0.5	0.067	0.033	0.03

MPE calculations are defined in section 13.0.

MPE measurement data for Bystander

D.U.T. Info.							Probe Info.		Test Pos.	Bystander (BS) Positions									DUT Max. TX Factor	Avg. over Body (mW/cm2)	Calc. P.D. (mW/cm2)	Max Calc. P.D. (mW/cm2)	
Ant Loc.	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		20 cm	40 cm	60 cm	80 cm	100 cm	120 cm	140 cm	160 cm	180 cm					200 cm
Roof	RAE4004ARB (445 - 470 MHz)	7.15	445.0000	48	47.9	CW	E	0.97	BS	0.002	0.001	0.002	0.005	0.006	0.004	0.015	0.077	0.197	0.276	0.5	0.059	0.028	0.03
Roof	RAE4004ARB (445 - 470 MHz)	7.15	457.5000	48	47.9	CW	E	0.97	BS	0.001	0.002	0.004	0.010	0.011	0.011	0.044	0.143	0.306	0.344	0.5	0.088	0.043	0.04
Roof	RAE4004ARB (445 - 470 MHz)	7.15	470.0000	48	47.7	CW	E	0.98	BS	0.001	0.001	0.004	0.008	0.012	0.013	0.061	0.180	0.331	0.321	0.5	0.093	0.046	0.05
Roof	HAE 6022A (403 - 527 MHz)	4.15	406.1250	48	47.7	CW	E	0.94	BS	0.009	0.006	0.009	0.024	0.054	0.119	0.178	0.214	0.250	0.266	0.5	0.113	0.053	0.05
Roof	HAE 6022A (403 - 527 MHz)	4.15	422.0938	48	47.4	CW	E	0.95	BS	0.006	0.006	0.013	0.039	0.056	0.120	0.161	0.199	0.246	0.250	0.5	0.110	0.052	0.05
Roof	HAE 6022A (403 - 527 MHz)	4.15	438.0625	48	47.5	CW	E	0.96	BS	0.006	0.008	0.012	0.040	0.068	0.105	0.138	0.217	0.293	0.306	0.5	0.119	0.057	0.06
Roof	HAE 6022A (403 - 527 MHz)	4.15	454.0313	48	47.3	CW	E	0.97	BS	0.004	0.007	0.016	0.039	0.076	0.107	0.149	0.239	0.289	0.295	0.5	0.122	0.059	0.06
Roof	HAE 6022A (403 - 527 MHz)	4.15	470.0000	48	47.7	CW	E	0.98	BS	0.003	0.007	0.015	0.050	0.060	0.084	0.169	0.264	0.306	0.283	0.5	0.124	0.061	0.06

MPE calculations are defined in section 13.0.

MPE measurement data for Passenger

D.U.T. Info.							Probe Info.		Test Pos.	Passenger Positions			DUT Max. TX Factor	Avg. over Body (mW/cm2)	Calc. P.D. (mW/cm2)	Max Calc. P.D. (mW/cm2)
Ant Loc.	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		Head	Chest	Lower Trunk				
Roof	HAE4002A (403 - 430 MHz)	2.15	406.1250	48	47.7	CW	E	0.94	PB	0.105	0.096	0.123	0.5	0.108	0.051	0.05
Roof	HAE4002A (403 - 430 MHz)	2.15	418.0625	48	47.3	CW	E	0.95	PB	0.091	0.127	0.117	0.5	0.112	0.053	0.05
Roof	HAE4002A (403 - 430 MHz)	2.15	430.0000	48	47.4	CW	E	0.96	PB	0.032	0.124	0.072	0.5	0.076	0.036	0.04
Roof	HAE4003A (450 - 470 MHz)	2.15	450.1250	48	47.5	CW	E	0.97	PB	0.061	0.082	0.073	0.5	0.072	0.035	0.04
Roof	HAE4003A (450 - 470 MHz)	2.15	460.1250	48	47.6	CW	E	0.98	PB	0.091	0.098	0.041	0.5	0.077	0.037	0.04
Roof	HAE4003A (450 - 470 MHz)	2.15	470.0000	48	47.7	CW	E	0.98	PB	0.034	0.086	0.016	0.5	0.045	0.022	0.02
Roof	HAE4010A (406 - 420 MHz)	5.65	406.1250	48	47.7	CW	E	0.94	PB	0.006	0.007	0.008	0.5	0.007	0.003	0.00
Roof	HAE4010A (406 - 420 MHz)	5.65	413.1000	48	46.9	CW	E	0.95	PB	0.012	0.014	0.014	0.5	0.013	0.006	0.01
Roof	HAE4010A (406 - 420 MHz)	5.65	420.0000	48	47.0	CW	E	0.95	PB	0.009	0.015	0.012	0.5	0.012	0.006	0.01
Roof	HAE4011A (450 - 470 MHz)	5.65	450.1250	48	47.5	CW	E	0.97	PB	0.012	0.013	0.015	0.5	0.013	0.006	0.01
Roof	HAE4011A (450 - 470 MHz)	5.65	460.1250	48	47.6	CW	E	0.98	PB	0.017	0.025	0.012	0.5	0.018	0.009	0.01
Roof	HAE4011A (450 - 470 MHz)	5.65	470.0000	48	47.7	CW	E	0.98	PB	0.008	0.017	0.009	0.5	0.011	0.006	0.01
Roof	RAE4004ARB (445 - 470 MHz)	7.15	445.0000	48	47.9	CW	E	0.97	PB	0.006	0.009	0.006	0.5	0.007	0.003	0.00
Roof	RAE4004ARB (445 - 470 MHz)	7.15	457.5000	48	47.9	CW	E	0.97	PB	0.008	0.012	0.011	0.5	0.010	0.005	0.01
Roof	RAE4004ARB (445 - 470 MHz)	7.15	470.0000	48	47.7	CW	E	0.98	PB	0.008	0.011	0.007	0.5	0.009	0.004	0.00

MPE calculations are defined in section 13.0.

MPE measurement data for Passenger

D.U.T. Info.							Probe Info.		Test Pos.	Passenger Positions			DUT Max. TX Factor	Avg. over Body (mW/cm ²)	Calc. P.D. (mW/cm ²)	Max Calc. P.D. (mW/cm ²)
Ant Loc.	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		Head	Chest	Lower Trunk				
Roof	HAE 6022A (403 - 527 MHz)	4.15	406.1250	48	47.7	CW	E	0.94	PB	0.108	0.094	0.118	0.5	0.107	0.050	0.05
Roof	HAE 6022A (403 - 527 MHz)	4.15	422.0938	48	47.4	CW	E	0.95	PB	0.068	0.138	0.079	0.5	0.095	0.045	0.05
Roof	HAE 6022A (403 - 527 MHz)	4.15	438.0625	48	47.5	CW	E	0.96	PB	0.057	0.136	0.074	0.5	0.089	0.043	0.04
Roof	HAE 6022A (403 - 527 MHz)	4.15	454.0313	48	47.3	CW	E	0.97	PB	0.054	0.099	0.074	0.5	0.076	0.037	0.04
Roof	HAE 6022A (403 - 527 MHz)	4.15	470.0000	48	47.7	CW	E	0.98	PB	0.031	0.050	0.014	0.5	0.032	0.016	0.02
Roof	HAE4002A (403 - 430 MHz)	2.15	406.1250	48	47.7	CW	E	0.94	PF	0.018	0.046	0.047	0.5	0.037	0.017	0.02
Roof	HAE4002A (403 - 430 MHz)	2.15	418.0625	48	47.3	CW	E	0.95	PF	0.026	0.029	0.053	0.5	0.036	0.017	0.02
Roof	HAE4002A (403 - 430 MHz)	2.15	430.0000	48	47.4	CW	E	0.96	PF	0.016	0.018	0.028	0.5	0.021	0.010	0.01
Roof	HAE4003A (450 - 470 MHz)	2.15	450.1250	48	47.5	CW	E	0.97	PF	0.046	0.019	0.046	0.5	0.037	0.018	0.02
Roof	HAE4003A (450 - 470 MHz)	2.15	460.1250	48	47.6	CW	E	0.98	PF	0.063	0.016	0.059	0.5	0.046	0.022	0.02
Roof	HAE4003A (450 - 470 MHz)	2.15	470.0000	48	47.7	CW	E	0.98	PF	0.055	0.042	0.027	0.5	0.041	0.020	0.02

MPE calculations are defined in section 13.0.

MPE measurement data for Passenger

D.U.T. Info.							Probe Info.		Test Pos.	Passenger Positions			DUT Max. TX Factor	Avg. over Body (mW/cm2)	Calc. P.D. (mW/cm2)	Max Calc. P.D. (mW/cm2)
Ant Loc.	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		Head	Chest	Lower Trunk				
Roof	HAE4010A (406 - 420 MHz)	5.65	406.1250	48	47.7	CW	E	0.94	PF	0.003	0.002	0.002	0.5	0.002	0.001	0.00
Roof	HAE4010A (406 - 420 MHz)	5.65	413.1000	48	46.9	CW	E	0.95	PF	0.003	0.003	0.003	0.5	0.003	0.001	0.00
Roof	HAE4010A (406 - 420 MHz)	5.65	420.0000	48	47.0	CW	E	0.95	PF	0.003	0.002	0.007	0.5	0.004	0.002	0.00
Roof	HAE4011A (450 - 470 MHz)	5.65	450.1250	48	47.5	CW	E	0.97	PF	0.015	0.006	0.011	0.5	0.011	0.005	0.01
Roof	HAE4011A (450 - 470 MHz)	5.65	460.1250	48	47.6	CW	E	0.98	PF	..016	0.005	0.021	0.5	0.013	0.006	0.01
Roof	HAE4011A (450 - 470 MHz)	5.65	470.0000	48	47.7	CW	E	0.98	PF	0.012	0.005	0.010	0.5	0.009	0.004	0.00
Roof	RAE4004ARB (445 - 470 MHz)	7.15	445.0000	48	47.9	CW	E	0.97	PF	0.002	0.003	0.006	0.5	0.004	0.002	0.00
Roof	RAE4004ARB (445 - 470 MHz)	7.15	457.5000	48	47.9	CW	E	0.97	PF	0.008	0.010	0.019	0.5	0.012	0.006	0.01
Roof	RAE4004ARB (445 - 470 MHz)	7.15	470.0000	48	47.7	CW	E	0.98	PF	0.013	0.007	0.011	0.5	0.010	0.005	0.01
Roof	HAE 6022A (403 - 527 MHz)	4.15	406.1250	48	47.7	CW	E	0.94	PF	0.030	0.036	0.075	0.5	0.047	0.022	0.02
Roof	HAE 6022A (403 - 527 MHz)	4.15	422.0938	48	47.4	CW	E	0.95	PF	0.034	0.025	0.046	0.5	0.035	0.017	0.02
Roof	HAE 6022A (403 - 527 MHz)	4.15	438.0625	48	47.5	CW	E	0.96	PF	0.049	0.019	0.032	0.5	0.033	0.016	0.02
Roof	HAE 6022A (403 - 527 MHz)	4.15	454.0313	48	47.3	CW	E	0.97	PF	0.033	0.041	0.097	0.5	0.057	0.028	0.03
Roof	HAE 6022A (403 - 527 MHz)	4.15	470.0000	48	47.7	CW	E	0.98	PF	0.060	0.030	0.074	0.5	0.055	0.027	0.03

MPE calculations are defined in section 13.0.