


 <b>MOTOROLA SOLUTIONS</b>	 <b>TESTING CERT # 2518.01</b>
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**DECLARATION OF COMPLIANCE: MPE ASSESSMENT**


<b>EME Test Laboratory</b> 8000 West Sunrise Blvd Fort Lauderdale, FL. 33322	<b>Date of Report:</b> December 18, 2012 <b>Report Revision:</b> O <b>Report ID:</b> SR11057 Full PCII_MPE_Report: DVR_UHF_R2 with Companion Mobile APX_Dual bands_UHF_R2_VHF_MP Rev.O_121218
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<b>Responsible Engineer:</b> <b>Report author:</b> <b>Date(s) Tested:</b>  <b>Manufacturer/Location:</b> <b>Date submitted for test:</b> <b>DUT Description:</b>  <b>Test TX mode(s):</b> <b>Max. Power output:</b>  <b>TX Frequency Bands:</b>  <b>Signaling type:</b> <b>Model(s) Tested:</b>  <b>Model(s) Certified:</b> <b>Serial Number(s):</b> <b>Classification:</b> <b>FCC ID:</b>	Kim Uong (Principal Staff EME Test Engineer) Kim Uong (Principal Staff EME Test Engineer) DVR: 11/16/2012-11/17/2012 Companion Mobile: 11/9/2012 – 11/29/2012 (UHF R2 test dates) Futurecom Systems Group Inc., Concord, Ontario, Canada 11/2/2012 DVR: 450-470 MHz, 1-10 watt, vehicular repeater Companion Mobile: APX7500 Dual Band UHF R2 45W – VHF MP 50W CW DVR: 10W (100% duty cycle) Companion Mobile: 54Watts (450-485MHz), 48Watts (485-512MHz), 30Watts (512-520MHz); 60W (VHF MP); (50% duty cycle, PTT) DVR: 450-470 MHz, Companion Mobile: 450-520MHz & 136-174MHz FM; APCO 25 DQPMDVR5000P Companion Mobile: M30TSS9PW1AN(MHUT1010A) – (UHF R1: M30SSS9PW1AN) DQPMDVR5000P (DVR) 5101307 (DVR); QMKNJ033 (Companion Mobile) Occupational/Controlled Environment LO6-DVRSUHF Part 22 & 90: 450-512MHz; 150.8-173.4MHz; Results outside FCC bands are not applicable for FCC compliance demonstration.
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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.

 <b>Deanna Zakharia</b> EME Lab Senior Resource Manager and Laboratory Director  Approval Date: 12/18/2012	
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**Document Revision History**

Date	Revision	Comments
12/18/2012	0	Initial release

Part 1 of 2: MPE Assessment for UHF R2 (450-520 MHz) 45W  
Part 2 of 2: MPE Assessment for VHF MP (136-174 MHz) 50W

Part 1 of 2

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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 and Specific Absorption Rate (SAR) simulations for DVR product FCC ID: LO6-DVRSUHF (Model # DQPM DVR5000P) when used with Companion Mobile FCC ID: AZ492FT7047 (Model # M30TSS9PW1AN(MHUT1010A)).

## 2.0 Abbreviations / Definitions

APCO: Association of Public-Safety Communications Officials

BS: Bystander

C4FM: Compatible 4-Level Frequency Modulation

CNR: Calibration Not Required

CQPSK: Compatible Quadrature Phase Shift Keying

CW: Continuous Wave

DUT: Device Under Test

DVR: Digital Vehicular Repeater

EME: Electromagnetic Energy

F2: 2 slot Time Division Multiple Access

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
- 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 <sup>2</sup>	W/m <sup>2</sup>	mW/cm <sup>2</sup>	W/m <sup>2</sup>	W/m <sup>2</sup>
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 <sup>2</sup>	W/m <sup>2</sup>	mW/cm <sup>2</sup>	W/m <sup>2</sup>	W/m <sup>2</sup>
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<sub>c</sub> 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<sub>c</sub>* is the number of test channels, *f<sub>high</sub>* and *f<sub>low</sub>* are the highest and lowest frequencies within the transmission band, *f<sub>c</sub>* 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	8/15/2012	8/15/2013
Survey Meter Probe – E-Field	ETS Model HI-2200 ETS Model E100	00086887 00126277	6/11/2012	6/11/2013

E-field measurements are in mW/cm<sup>2</sup>.

**7.0 Measurement System Uncertainty Levels**

**Table 4 - Uncertainty Budget for Near Field Probe Measurements**

	Tol. (± %)	Prob. Dist.	Divisor	<i>u<sub>i</sub></i> (±%)	<i>v<sub>i</sub></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 (95% CONFIDENCE LEVEL)</b>		<i>k</i> =2		24	

## 8.0 Product and System Description

This device (FCC ID: LO6-DVRSUHF, Model # DQPMDVR5000P) is a MOBEXCOM Digital Vehicular Repeater (DVR) manufactured by FUTURECOM Systems Group. The DVR, in addition to standalone operation, is capable of interfacing to a companion mobile radio using serial data protocol for audio and control. The full duplex DVR provides local area coverage for portable to portable communication in the DVR's operating band while the Companion Mobile radio provides wide-area coverage extension.

The system can operate in the following modes: Mobile mode - where the vehicular repeat function is off but receives emergency and mode change commands from portable devices; Local mode - with portable to portable repeat and network monitoring capabilities; and System mode - with portable to portable repeat functions with full network interconnect. Furthermore, the DVRS offers a busy lockout feature where a simulcast prevention algorithm is used for seamless multi-vehicle operation on the same channel. Moreover, the system supports emergency calls in the MDC1200 signaling format. Other system features include field programmability, seamless interface to a mobile radio through the control head bus, controllability via a mobile radio control head, as well as remotely by a dispatcher or portable user. The DVR supports up to 64 channels and 255 talk groups, MDC1200, DTMF, EIA, CCIR signaling as well as PL and DPL. The DVR supports programmability of leading and/or trailing tones, and audio and TX priorities per mode as well as talk group steering.

This test report covers the RF Exposure performance of the DVR FCC ID: LO6-DVRSUHF (UHF R2, 10watts) interfaced with, and transmitting simultaneously with a Companion Mobile radio FCC ID: AZ492FT7047 (UHF R2, 45 watts), and with both units installed in a typical vehicle.

The DVR transmit frequency ranges are 450-470MHz at transmit duty cycle up to 100%. The Companion Mobile transmit frequency range is 450-520MHz; at transmit duty cycle up to 50% (PTT). The DVR antenna is limited to  $\frac{1}{4}$  wave (0dBd gain) mounted at the center of the trunk, and the Companion Mobile (UHF R2) antennas are limited to  $\frac{1}{4}$  wave (0dBd gain) and  $\frac{1}{2}$  wave (2dBd and 3.5dBd gain) mounted at the side of the roof (45cm from the center of the roof). The maximum conducted power delivered to the DVR antenna is 10Watts, due to the filter losses, while the maximum conducted power delivered to the Companion Mobile is 54Watts (450-485MHz), 48Watts (485-512MHz), and 30Watts (512-520MHz).

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 Options and Accessories**

The offered antennas for the DVR and the Companion Mobile are listed on the table 5.

**Table 5**

FCC ID	Model/Description	Antennas
LO6-DVRSUHF	DQPM DVR5000P 450-470 MHz, 1-10 watt, vehicular repeater	HAE4003A (450-470 MHz, 1/4 wave Trunk mount, 0dBd gain)
AZ492FT7047	M30TSS9PW1AN(MHUT1010A) Companion Mobile APX7500 Dual Band UHF R2 45W – VHF MP 50W (450-520MHz & 136-174MHz)	HAE4003A (450-470 MHz, 1/4 wave Roof mount, 0dBd gain) HAE4004A (470-512 MHz, 1/4 wave Roof mount, 0dBd gain) HAE4011A (445-470 MHz, 1/2 wave Roof mount, 3.5dBd gain) HAE6015A (450-520 MHz, 1/2 Wave Roof mount, 2dBd gain)

**10.0 Test Set-Up Description**

Assessments were performed with DVR and the companion 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.

- DVR: the ¼ wave 0dBd gain antenna (HAE4003A) was assessed while mounted at the trunk.
- Companion mobile: the ¼ wave 0dBd gain antennas (HAE4003A, HAE4004A), and ½ wave 2dBd and 3.5dBd gain (HAE6015A, HAE4011A) were assessed while mounted at the side of the roof (driver side) of the test vehicle.

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 for DVR with trunk mounted antenna(s)**

( Referenced Appendix A for illustration of antenna location and test distances).

**11.1. External/Bystander vehicle MPE measurements**

The DVR 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 (5) bystander test locations indicated in Appendix A with 20cm height increments at the test distance of 90cm from the test vehicle’s body, as stated in the user manual. 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.



## 11.2. Internal/Passenger vehicle MPE measurements

The DVR antenna is located toward the center of the trunk at a minimum 85cm from backseat passenger. 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 20cm 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 20cm 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 trunk mount position, 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 for Companion Mobile with roof mounted antenna(s)

( Referenced Appendix A for illustration of antenna location and test distances).

### 12.1. External/Bystander vehicle MPE measurements

The Companion Mobile antennas are located at the side of the roof (45cm from the center of the roof, along the width of the vehicle, driver side). 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 (5) bystander test locations indicated in Appendix A with 20cm height increments at the test distance of 90cm from the test vehicle's body, as stated in the user manual. 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.

### 12.2. Internal/Passenger vehicle MPE measurements

The Companion Mobile antennas are located at the side of the roof (45cm from the center of the roof, along the width of the vehicle, driver side). 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 20cm 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 20cm 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 roof mount position, 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 15.1 Tables 7 - 10. The results for the DVR are based on the 100% duty cycle while the results for the Companion Mobile 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.*)

$$\text{Calc.}_P.D. = (\text{Avg\_over\_body}) * (\text{probe\_frequency\_cal\_factor}) * (\text{duty\_cycle})$$

*Note 1: 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/cm<sup>2</sup>) 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/cm<sup>2</sup>) using the equation 3. H-field measurements are only applicable to frequencies below 300MHz.*

Equation 3 – Converting A/m to mW/cm<sup>2</sup>

$$mW / cm^2 = (A / m)^2 * 37.699$$

Equation 4 – Power Density Maximum Calculation

$$\text{Max\_Calc.}_P.D. = P.D._calc * \frac{\text{max\_output\_power}}{\text{initial\_output\_power}}$$

*Note 4: For initial output power > max\_output\_power; max\_output\_power / initial output power = 1*

**14.0 Antenna Summary**

Table 6 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<sub>c</sub>) and actual number of tested channels (Actual N<sub>c</sub>). This information was used to determine the test configurations presented in this report.

**Table 6**

#	DUT FCC ID (Model #)	Antenna Model	Frequency Range (MHz)	Physical Length (cm)	Gain (dBi)	Remarks	Mount Location (Roof/Trunk)	Overlap FCC Bands (MHz)	FCC N <sub>c</sub>	Actual N <sub>c</sub>
1	LO6-DVRSUHF (DQPM DVR5000P)	HAE4003A	450-470	16.0	2.15	1/4 wave, wire	Trunk (Center)	450-470	3	3
2	AZ492FT7047 (M30TSS9PW1AN). (MHUT1010A)	HAE4003A	450-470	16.0	2.15	1/4 wave, wire	Roof (45cm from center of the roof, Driver side)	450-470	3	3
3		HAE4004A	470-512	15.0	2.15	1/4 wave, wire		470-512	4	4
4		HAE4011A	445-470	73.2	5.65	1/2 wave trap-loaded		445-470	3	3
5		HAE6015A	450-520	26.2	4.15	1/2 wave trap-loaded		450-512	5	6

**15.0 Test Results Summary**

The following tables below summarize the MPE results for each test configuration: antenna location, test positions (BS1: Bystander test location # 1, BS2: Bystander test location # 2, BS3: Bystander test location # 3, BS4: Bystander test location # 4, BS5: Bystander test location # 5, PB-Passenger Backseat, PF-Passenger Front seat), E/H field measurements, 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.

**15.1. MPE Test Results**

**Table 7 – DVR (UHF R2, 10W)**  
**Bystander - MPE assessment for trunk mounted antenna**

Trunk/ Roof	Test Location	E/H Field	Ant. Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/ cm <sup>2</sup> )	FCC Limit	% To Spec Limit
Trunk	BS1	E	HAE4003A (450 - 470 MHz)	10.0	10.0	450.0000	0.01	0.30	2.6
						460.0000	0.01	0.31	2.2
						470.0000	0.01	0.31	1.8
	BS2	E	HAE4003A (450 - 470 MHz)	10.0	10.0	450.0000	0.01	0.30	3.5
						460.0000	0.02	0.31	5.5
						470.0000	0.02	0.31	5.3
	BS3	E	HAE4003A (450 - 470 MHz)	10.0	10.0	450.0000	0.03	0.30	8.3
						460.0000	0.02	0.31	7.2
						470.0000	0.02	0.31	6.4
	BS4	E	HAE4003A (450 - 470 MHz)	10.0	10.0	450.0000	0.02	0.30	6.3
						460.0000	0.03	0.31	8.5
						470.0000	0.03	0.31	8.4
	BS5	E	HAE4003A (450 - 470 MHz)	10.0	10.0	450.0000	0.03	0.30	10.4
						460.0000	0.04	0.31	11.9
						470.0000	0.03	0.31	9.8

**Table 8 – DVR (UHF R2, 10W)**  
**Passenger - MPE assessment for trunk mounted antenna**

Trunk/ Roof	Test Location	E/H Field	Ant. Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/ cm <sup>2</sup> )	FCC Limit	% To Spec Limit
Trunk	PB	E	HAE4003A (450 - 470 MHz)	10.0	10.0	450.0000	0.11	0.30	37.7
						460.0000	0.15	0.31	50.4
						470.0000	0.11	0.31	35.0
	PF	E	HAE4003A (450 - 470 MHz)	10.0	10.0	450.0000	0.02	0.30	8.2
						460.0000	0.02	0.31	7.6
						470.0000	0.04	0.31	12.4

**Table 9 – Companion Mobile (UHF R2, 45W)  
Bystander - MPE assessment for roofmounted antennas**

Trunk/ Roof	Test Location	E/H Field	Ant. Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/ cm^2)	FCC Limit	% To Spec Limit
Roof	BS1	E	HAE4003A (450-470MHz)	54.0	53.8	450.0125	0.05	0.30	16.9
				54.0	53.8	460.0000	0.06	0.31	18.2
				54.0	53.7	469.9875	0.05	0.31	16.2
			HAE4011A (445-470MHz)	54.0	53.8	450.0125	0.06	0.30	19.4
				54.0	53.8	460.0000	0.05	0.31	15.6
				54.0	53.7	469.9875	0.04	0.31	12.0
			HAE6015A (450 - 520MHz)	54.0	53.8	450.0125	0.05	0.30	16.8
				54.0	53.7	465.5000	0.06	0.31	18.6
				54.0	53.7	482.5000	0.06	0.32	18.0
				48.0	46.9	496.5000	0.05	0.33	15.7
				48.0	47.3	511.9875	0.05	0.34	15.9
				30.0	29.2	519.9875	0.03	0.35	9.1
			HAE4004A (470-512MHz)	54.0	53.7	470.0125	0.05	0.31	17.0
				54.0	53.7	482.5000	0.05	0.32	17.0
				48.0	46.9	498.0000	0.05	0.33	15.4
	48.0	47.3		511.9875	0.05	0.34	14.0		
	BS2	E	HAE4003A (450-470MHz)	54.0	53.8	450.0125	0.04	0.30	14.3
				54.0	53.8	460.0000	0.04	0.31	12.0
				54.0	53.7	469.9875	0.04	0.31	11.7
			HAE4011A (445-470MHz)	54.0	53.8	450.0125	0.05	0.30	15.2
				54.0	53.8	460.0000	0.04	0.31	13.9
				54.0	53.7	469.9875	0.03	0.31	9.4
			HAE6015A (450 - 520MHz)	54.0	53.8	450.0125	0.04	0.30	13.4
				54.0	53.7	465.5000	0.04	0.31	11.8
				54.0	53.7	482.5000	0.04	0.32	12.3
				48.0	46.9	496.5000	0.04	0.33	11.1
				48.0	47.3	511.9875	0.04	0.34	10.6
30.0			29.2	519.9875	0.02	0.35	5.9		
HAE4004A (470-512MHz)			54.0	53.7	470.0125	0.04	0.31	13.9	
			54.0	53.7	482.5000	0.04	0.32	12.4	
			48.0	46.9	498.0000	0.04	0.33	11.1	
	48.0	47.3	511.9875	0.03	0.34	9.2			

**Table 9 – Companion Mobile (UHF R2, 45W) (cont'd)  
Bystander - MPE assessment for roofmounted antennas**

Trunk/ Roof	Test Location	E/H Field	Ant. Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/ cm^2)	FCC Limit	% To Spec Limit
Roof	BS3	E	HAE4003A (450-470MHz)	54.0	53.8	450.0125	0.04	0.30	12.9
				54.0	53.8	460.0000	0.04	0.31	14.0
				54.0	53.7	469.9875	0.04	0.31	12.6
			HAE4011A (445-470MHz)	54.0	53.8	450.0125	0.04	0.30	12.0
				54.0	53.8	460.0000	0.03	0.31	10.9
				54.0	53.7	469.9875	0.03	0.31	8.9
			HAE6015A (450 - 520MHz)	54.0	53.8	450.0125	0.04	0.30	12.0
				54.0	53.7	465.5000	0.04	0.31	13.1
				54.0	53.7	482.5000	0.04	0.32	11.4
				48.0	46.9	496.5000	0.03	0.33	10.2
				48.0	47.3	511.9875	0.03	0.34	9.8
				30.0	29.2	519.9875	0.02	0.35	5.5
			HAE4004A (470-512MHz)	54.0	53.7	470.0125	0.04	0.31	13.9
				54.0	53.7	482.5000	0.04	0.32	11.7
				48.0	46.9	498.0000	0.03	0.33	10.1
				48.0	47.3	511.9875	0.03	0.34	9.5
	BS4	E	HAE4003A (450-470MHz)	54.0	53.8	450.0125	0.03	0.30	8.8
				54.0	53.8	460.0000	0.02	0.31	7.4
				54.0	53.7	469.9875	0.02	0.31	6.3
			HAE4011A (445-470MHz)	54.0	53.8	450.0125	0.03	0.30	8.7
				54.0	53.8	460.0000	0.02	0.31	7.0
				54.0	53.7	469.9875	0.01	0.31	4.7
			HAE6015A (450 - 520MHz)	54.0	53.8	450.0125	0.03	0.30	8.4
				54.0	53.7	465.5000	0.02	0.31	7.6
				54.0	53.7	482.5000	0.02	0.32	7.1
				48.0	46.9	496.5000	0.02	0.33	6.4
				48.0	47.3	511.9875	0.02	0.34	5.8
				30.0	29.2	519.9875	0.01	0.35	3.4
HAE4004A (470-512MHz)			54.0	53.7	470.0125	0.02	0.31	6.6	
			54.0	53.7	482.5000	0.02	0.32	6.6	
			48.0	46.9	498.0000	0.02	0.33	6.4	
			48.0	47.3	511.9875	0.02	0.34	5.4	

**Table 9 – Companion Mobile (UHF R2, 45W) (cont'd)  
Bystander - MPE assessment for roofmounted antennas**

Trunk/ Roof	Test Location	E/H Field	Ant. Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/ cm^2)	FCC Limit	% To Spec Limit
Roof	BS5	E	HAE4003A (450-470MHz)	54.0	53.8	450.0125	0.01	0.30	3.1
				54.0	53.8	460.0000	0.01	0.31	2.6
				54.0	53.7	469.9875	0.01	0.31	3.0
			HAE4011A (445-470MHz)	54.0	53.8	450.0125	0.01	0.30	4.9
				54.0	53.8	460.0000	0.01	0.31	3.7
				54.0	53.7	469.9875	0.01	0.31	3.1
			HAE6015A (450 - 520MHz)	54.0	53.8	450.0125	0.01	0.30	3.7
				54.0	53.7	465.5000	0.01	0.31	3.1
				54.0	53.7	482.5000	0.01	0.32	3.0
				48.0	46.9	496.5000	0.01	0.33	2.6
				48.0	47.3	511.9875	0.01	0.34	2.7
				30.0	29.2	519.9875	0.01	0.35	1.7
			HAE4004A (470-512MHz)	54.0	53.7	470.0125	0.01	0.31	3.4
				54.0	53.7	482.5000	0.01	0.32	2.7
				48.0	46.9	498.0000	0.01	0.33	2.3
				48.0	47.3	511.9875	0.01	0.34	2.5



**Table 10 – Companion Mobile (UHF R2, 45W)  
Passenger - MPE assessment for roofmounted antennas**

Trunk/ Roof	Test Location	E/H Field	Ant. Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/ cm^2)	FCC Limit	% To Spec Limit
Roof	PB	E	HAE4003A (450-470MHz)	54.0	53.8	450.0125	0.09	0.30	29.8
				54.0	53.8	460.0000	0.07	0.31	23.0
				54.0	53.7	469.9875	0.08	0.31	25.9
			HAE4011A (445-470MHz)	54.0	53.8	450.0125	0.07	0.30	24.5
				54.0	53.8	460.0000	0.05	0.31	17.2
				54.0	53.7	469.9875	0.04	0.31	11.8
			HAE6015A (450 - 520MHz)	54.0	53.8	450.0125	0.07	0.30	24.0
				54.0	53.7	465.5000	0.06	0.31	18.5
				54.0	53.7	482.5000	0.06	0.32	18.0
				48.0	46.9	496.5000	0.03	0.33	7.6
				48.0	47.3	511.9875	0.03	0.34	7.7
				30.0	29.2	519.9875	0.01	0.35	3.8
			HAE4004A (470-512MHz)	54.0	53.7	470.0125	0.08	0.31	24.2
				54.0	53.7	482.5000	0.08	0.32	24.7
				48.0	46.9	498.0000	0.04	0.33	11.5
	48.0	47.3		511.9875	0.03	0.34	9.4		
	PF	E	HAE4003A (450-470MHz)	54.0	53.8	450.0125	0.04	0.30	14.7
				54.0	53.8	460.0000	0.06	0.31	19.1
				54.0	53.7	469.9875	0.08	0.31	25.9
			HAE4011A (445-470MHz)	54.0	53.8	450.0125	0.02	0.30	7.9
				54.0	53.8	460.0000	0.03	0.31	10.1
				54.0	53.7	469.9875	0.03	0.31	8.0
			HAE6015A (450 - 520MHz)	54.0	53.8	450.0125	0.03	0.30	11.4
				54.0	53.7	465.5000	0.06	0.31	20.7
				54.0	53.7	482.5000	0.04	0.32	13.0
				48.0	46.9	496.5000	0.03	0.33	9.0
				48.0	47.3	511.9875	0.02	0.34	6.1
				30.0	29.2	519.9875	0.01	0.35	3.7
			HAE4004A (470-512MHz)	54.0	53.7	470.0125	0.09	0.31	27.7
				54.0	53.7	482.5000	0.06	0.32	17.2
48.0				46.9	498.0000	0.04	0.33	11.0	
48.0	47.3	511.9875		0.03	0.34	7.7			

**15.2. Combined MPE Results**

The combined MPE results for DVR and it’s Companion Mobile were calculated base on the percent of MPE limit for each of the applicable test channels according to the formula below. This is due to the signals emitted by each individual transmitter are statistically uncorrelated, the collective compliance of the transmitters is determined by summing the individual ratios between actual (S) and maximum allowed MPE exposure. Compliance is achieved if the total exposure level (T) is less than one.

Formula:

$$T = \frac{S_1}{MPE_1} + \frac{S_2}{MPE_2} + \dots < 1$$

The highest combined power density percentage of the FCC MPE limits using the methodology and formula are indicated in the table 11 (referenced data from tables 7 thru 10 for highest calculated MPE % of limit for DVR and the Companion Mobile).

**Table 11**

Test Position	Percentage of Limit (%)		
	DVR UHF R2 (FCC ID: LO6-DVRSUHF)	Companion Mobile (FCC ID: AZ492FT7047)	Combined Percentages
Passenger, Front seat (PF)	12.4	27.7	40.1
Passenger, Back seat (PB)	50.4	29.8	80.2
By-Stander #1 (BS-1)	2.6	19.4	22.0
By-Stander #2 (BS-2)	5.5	15.2	20.7
By-Stander #3 (BS-3)	8.3	14.0	22.3
By-Stander #4 (BS-4)	8.5	8.8	17.3
By-Stander #5 (BS-5)	11.9	4.9	16.8

**16.0 Conclusion**

The DVR assessments were performed with an output power of 10 watts across the DVR transmit band. As for the Companion Mobile, Depending on the test frequency, the Companion Mobile assessments were performed with an output power range as indicated in section 15.1, Tables 9-10. The highest power density results for DVR and the Companion Mobile devices scaled to the applicable maximum allowable power outputs are indicated in the Tables 12 and 13 for internal/passenger to the vehicle, and external/bystander for to the vehicle.

**Table 12: Maximum MPE RF Exposure Summary for DVR (FCC ID: LO6-DVRSUHF)**

Designator	Frequency (MHz)	Passenger (mW/cm <sup>2</sup> )	Bystander (mW/cm <sup>2</sup> )
Overall	450-470	0.15	0.04
FCC	450-470	0.15	0.04

**Table 13: Maximum MPE RF Exposure Summary for Companion Mobile (FCC ID: AZ492FT7047)**

Designator	Frequency (MHz)	Passenger (mW/cm <sup>2</sup> )	Bystander (mW/cm <sup>2</sup> )
Overall	450-520	0.09	0.06
FCC	450-512	0.09	0.06

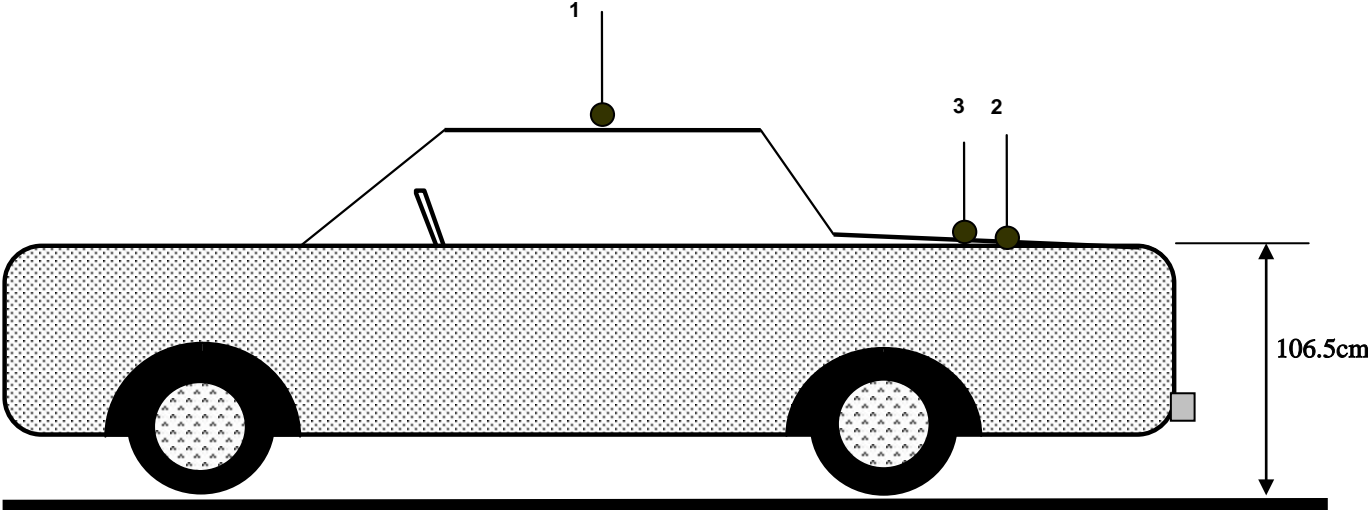
**Table 14: Maximum Combined Calculated MPE % of limit**

Designator	Frequency (MHz)		Percentage of Limit (%)	
	DVR UHF R2 (FCC ID: LO6-DVRSUHF)	Companion Mobile (FCC ID: AZ492FT7047)	Passenger	Bystander
Overall	450-470	450-520	80.2	22.3
FCC	450-470	450-512	80.2	22.3

The MPE results presented herein demonstrate compliance to the applicable FCC Occupational/Controlled exposure limits. The FCC Occupational/Controlled exposure limits are calculated by  $f/300$  for the frequency range of 300-1500MHz.

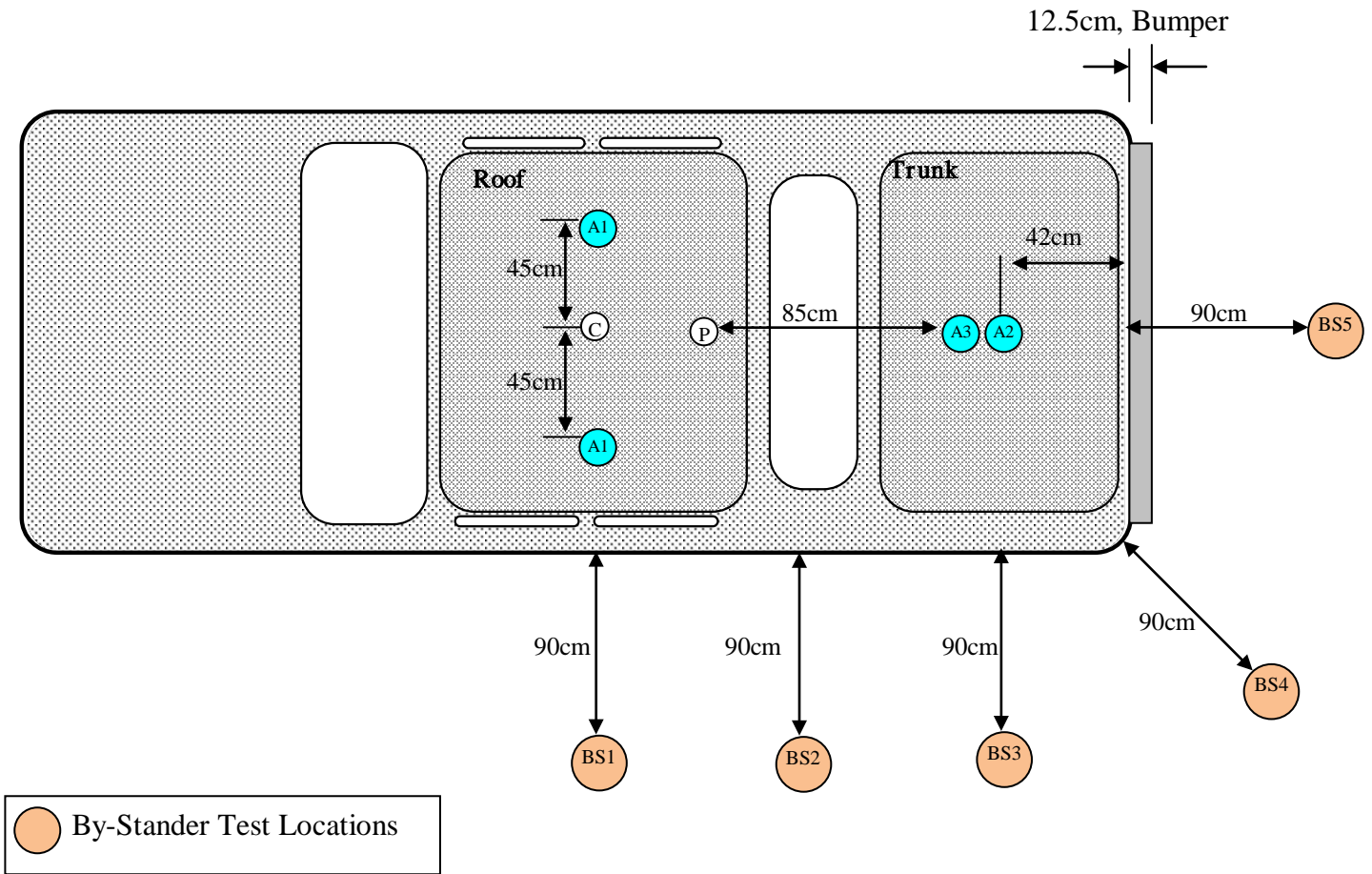
The MPE results presented herein also presented herein demonstrate compliance to the applicable FCC General Population/Uncontrolled limits as required by FCC rules for passengers and bystanders. The FCC General Population/Uncontrolled exposure limits are calculated by  $f/1500$  for the frequency range of 300-1500MHz.

**Appendix A - Antenna Locations and Test Distances**



- 1 - Roof (45cm from center)
- 2 - Trunk (center)
- 3 - Trunk (85cm from back of the back seat)

Bystander Antenna mounting and test locations




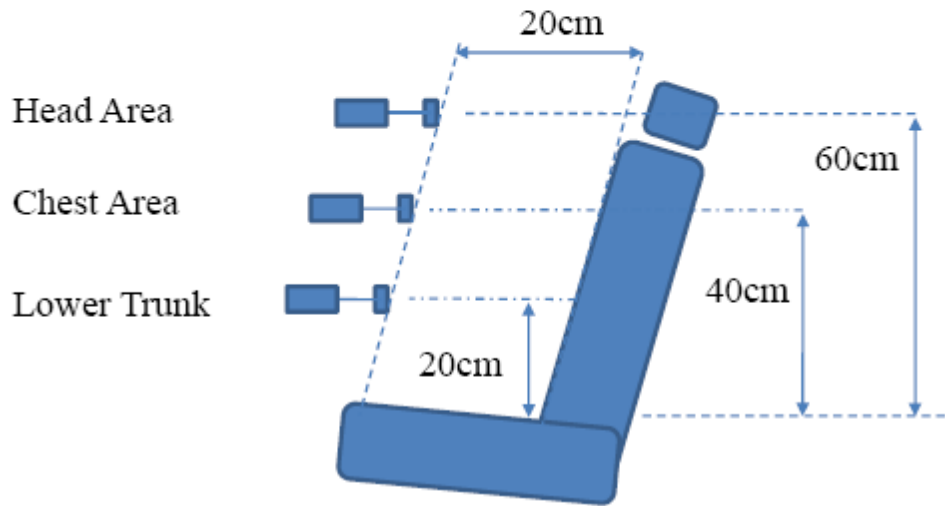
Notes:

- 1) Antenna location A1: APX7500 antenna mounting location(s) for Bystander and Passenger testing
- 2) Antenna location A2: DVR antenna mounting location for Bystander testing
- 3) Antenna location A3: DVR antenna mounting location for Passenger testing
- 4) Bystander test location #2 (BS2): Center point of the By-stander test location #1 and test location #3, which is by 88cm.
- 5) Bystander test location #3 (BS3): 90 degree angle from the trunk mount antenna
- 6) Bystander test location #4 (BS4): 45 degree angle from the trunk mount antenna
- 7) Assessments were performed at each test position for each of the offered antennas
- 8) Bystander positions (1-5) are 90cm from the vehicle body.
- 9) Total distance between bystander position 1 and roof mount antenna is 141cm
- 10) Total distance between bystander position 5 and trunk mount antenna is 131cm
- 11) Total distance between trunk mount antenna and rear passenger is 85cm

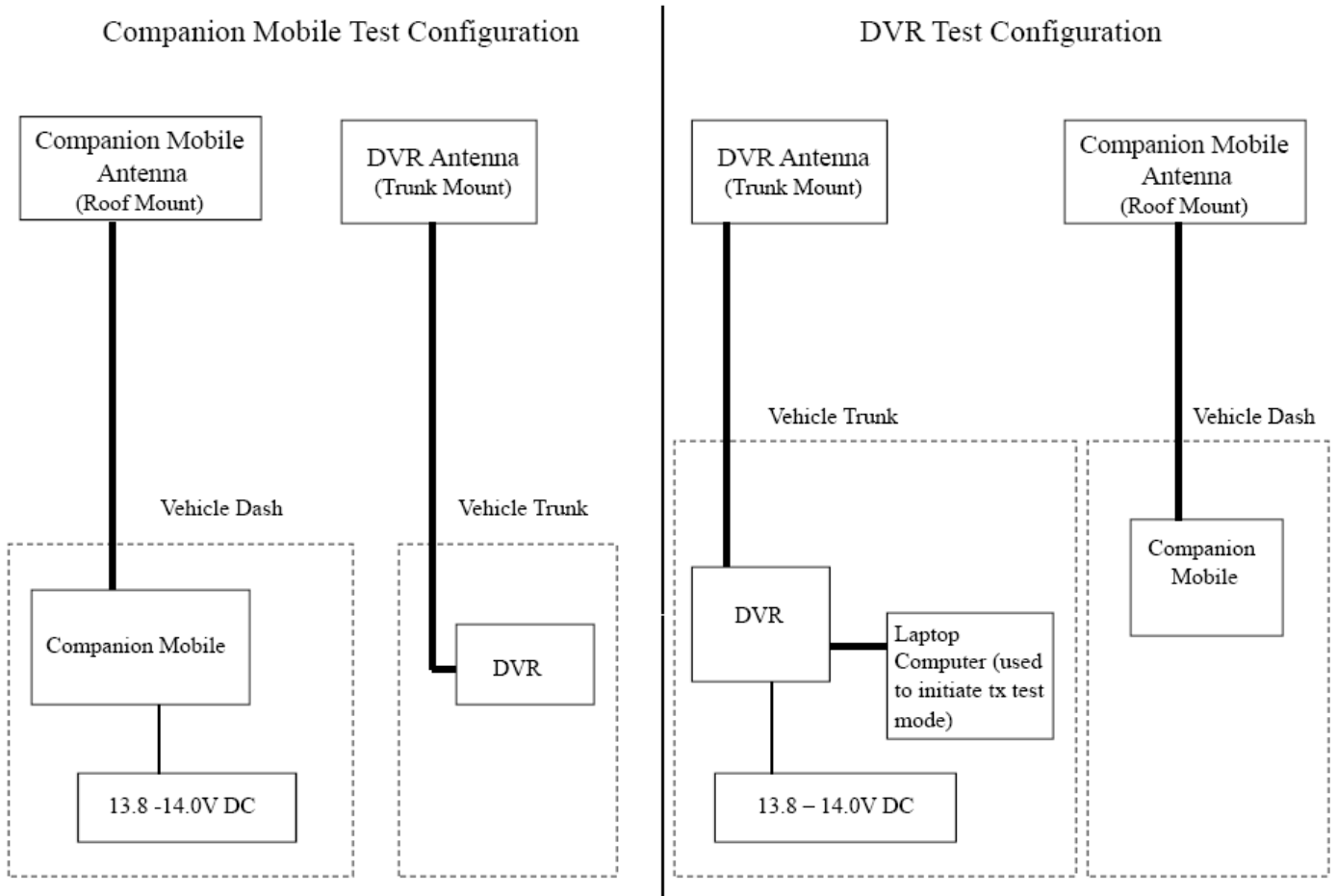
Seat scan areas  
(Applicable to both front and back seats)

Meter - Probe

 Probe diameter is 5.5cm



MPE Test Configuration



**Appendix B - Probe Calibration Certificates**



**LOCKHEED MARTIN**



**Stennis Integrated Metrology Center  
Certificate of Calibration**

<b>Certificate No.</b>	AGIL700472/2571209	<b>Description</b>	ELECTRICAL FIELD PROBE
<b>Manufacturer</b>	ETS-LINDGREN	<b>LMTO No.</b>	AGIL700472
<b>Model</b>	E100	<b>Asset No</b>	1-4081386628A
<b>Serial No</b>	00109011	<b>Cycle</b>	12 Months
<b>Customer</b>	AGILENT TECHNOLOGIES INC. MOTOROLA-PLANTATION 8000 WEST SUNRISE BLVD PLANTATION, FL 33322	<b>PO No.</b>	
<b>As Found</b>	IN TOLERANCE	<b>Performed By</b>	SP9597
<b>As Shipped</b>	IN TOLERANCE	<b>Temperature</b>	23 ± 3° C
<b>Date Calibrated</b>	15-AUG-2012	<b>Humidity</b>	
<b>Date Cal due</b>	15-AUG-2013		
<b>Procedure</b>	VENDOR - CALIBRATED BY VENDOR		
<b>Comments</b>	REFER TO ETS LINDGREN CERTIFICATE OF CALIBRATION CONFORMANCE # 92745 DATED 8/15/12.		

**STANDARDS USED**

**TRACEABILITY**

All measurements were performed using standards traceable to the National Institute of Standards and Technology, an internationally recognized standard, an intrinsic standard or ratio method. Calibration was performed in compliance with our Laboratory Quality System that is based upon conformance to ISO/IEC 17025:2005. Unless otherwise noted, the accuracy ratios are equal or greater than 4:1 in accordance with ANSI/NCSL Z540-1-1994, paragraph 10.2.b.

*This certificate may not be reproduced, except in full, without written permission from this laboratory.*

**MAIL:** Stennis Integrated Metrology Center  
Building 5100  
Stennis Space Center, MS 39529  
**PHONE:** (228) 813-2069  
**EMAIL:** john.a.boyce@lmco.com

**SHIP:** Stennis Integrated Metrology Center  
Building 5100  
Stennis Space Center, MS 39529  
**FAX:** (228) 813-2073



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.

<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>	S 000025310	<b>Alternate ID:</b>	
<b>Date Completed:</b>	15-Aug-12	<b>Customer:</b>	LOCKHEED MARTIN (MS)
<b>Test Type:</b>	Standard Field, Field Strength		

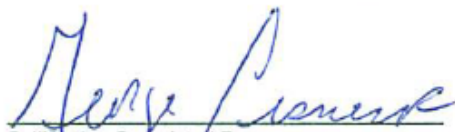
**Calibration Uncertainty:** Std Field Method 10kHz - 18000 MHz, +/-0.7 dB, 26.5GHz - 40GHz, +/- 0.95 dB  
k=2, (95% Confidence Level)

**Test Remarks:** Special Calibration - Additional frequency points provided per customer request. Probe calibrated with HI-2200 s/n 00086316.

Calibration Traceability: All Measuring and Test Equipment (M/TE) 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/NCCL Z540-1-1994.

**Standards and Equipment Used:**

Make / Model / Name / S/N / Recall Date					Condition of Instrument
Agilent/HP	8648C	Signal Generator	3623A03573	01-Feb-13	<b>Upon Receipt:</b>
Agilent	E4419B	Power Meter	MY45104171	29-Sep-12	In Tolerance to Internal Quality Standards
Agilent/HP	8648C	Signal Generator	3847A04406	01-Feb-13	<b>On Release:</b>
Agilent	E4419B	Power Meter	MY45103242	01-Feb-13	In Tolerance to Internal Quality Standards
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	

  
 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/NCCL Z540-1-1994. QAF 1127 (03/11)

## CALIBRATION REPORT

**Electric Field Sensor**

<i>Model</i>	<i>S/N</i>
E100	00109011
HI-2200	00086316

Date: 15 Aug 2012

- New Instrument
- Other
- Out of Tolerance
- Within Tolerance

**Frequency Response**

<i>Frequency Response</i>	<i>MHz</i>	<i>Nominal Field</i> <i>V/m</i>	<i>Cal Factor*</i> <i>(Applied/Indicated)</i>	<i>Deviation</i> <i>dB</i>
1	1	20	1.04	-0.33
2	15	20	1.00	0.03
3	30	20	1.00	0.03
4	75	20	1.00	0.04
5	100	20	0.99	0.07
6	150	20	0.98	0.14
7	200	20	0.96	0.38
8	250	20	0.97	0.25
9	300	20	0.97	0.28
10	400	20	0.97	0.26
11	500	20	1.00	-0.02
12	600	20	1.05	-0.44
13	700	20	1.07	-0.55
14	800	20	1.04	-0.37
15	900	20	1.03	-0.28
16	1000	20	0.96	0.36
17	2000	20	0.99	0.07
18	2450	20	1.01	-0.06
19	3000	20	1.03	-0.22
20	3500	20	0.99	0.10
21	4000	20	1.00	-0.01
22	5000	20	1.28	-2.14
23	5500	20	1.31	-2.35
24	6000	20	1.32	-2.43

\* 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

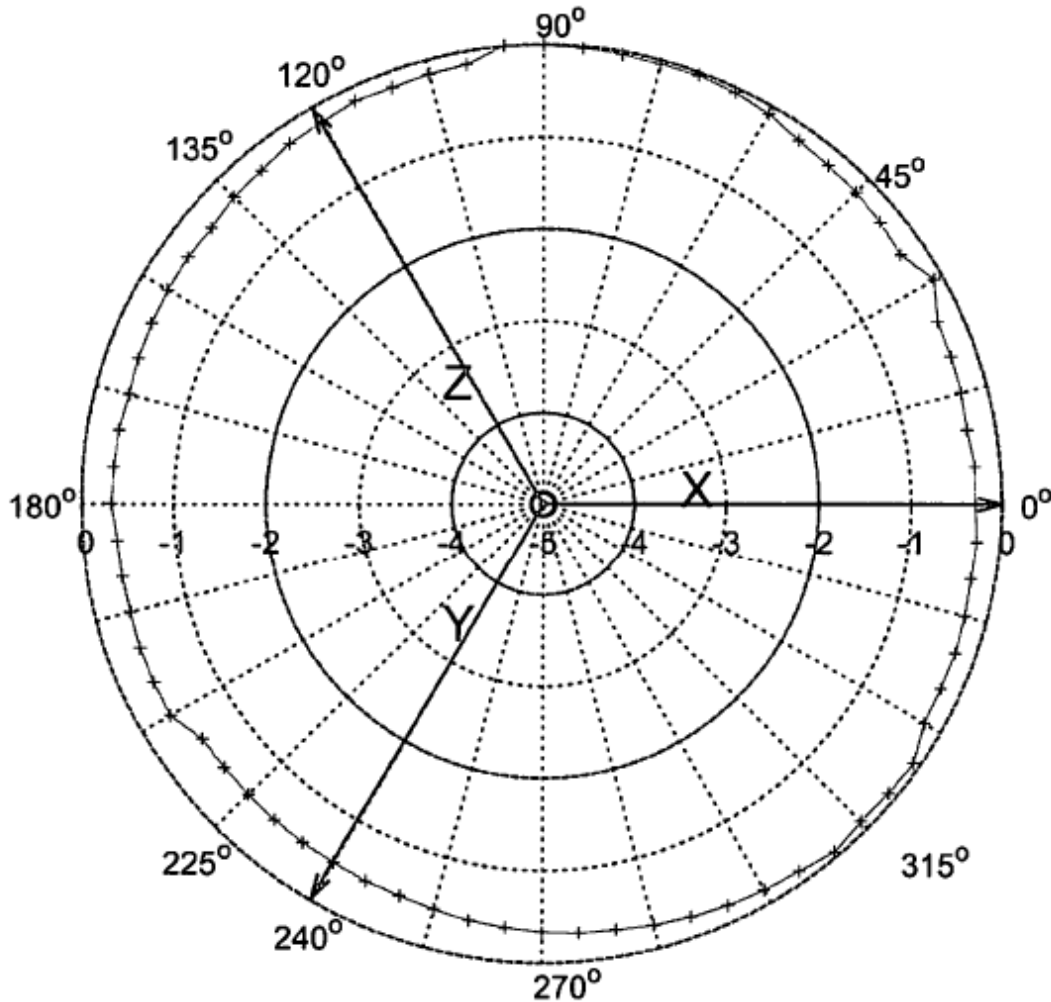


Figure 1: Probe Isotropic Response Chart.

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.



Cert I.D.: 91609

**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 80%. 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>	00126277	<b>Date Code:</b>	
<b>Tracking Number:</b>	S 000025288	<b>Alternate ID:</b>	
<b>Date Completed:</b>	11-Jun-12	<b>Customer:</b>	AGILENT/MOTOROLA (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:** Probe tested with HI-2200 s/n 00086887. Special Calibration - Additional frequency points added per customer request.

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/NCCL 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
Fluke	6060B	RF Signal Generator	5690204	28-Jun-12

**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 11-Jun-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/NCCL Z540-1-1994, QAF 1127 (03/11)

## CALIBRATION REPORT

**Electric Field Sensor**

<i>Model</i>	<i>S/N</i>
E100	00126277
HI-2200	86887

Date: 11 June 2012

- New Instrument
- Other
- Out of Tolerance
- Within Tolerance

**Frequency Response**

	<i>Frequency Response</i>	<i>Nominal Field</i>	<i>Cal Factor*</i>	<i>Deviation</i>
	<i>MHz</i>	<i>V/m</i>	<i>(Applied/Indicated)</i>	<i>dB</i>
1	1	20	1.40	-2.93
2	15	20	1.10	-0.80
3	30	20	1.02	-0.21
4	75	20	0.98	0.14
5	100	20	0.99	0.05
6	150	20	1.00	0.00
7	200	20	1.00	0.00
8	250	20	0.98	0.15
9	300	20	0.99	0.05
10	400	20	1.00	0.00
11	500	20	1.00	-0.04
12	600	20	1.01	-0.06
13	700	20	1.01	-0.10
14	800	20	1.02	-0.15
15	900	20	1.02	-0.15
16	1000	20	0.98	0.21
17	2000	20	0.95	0.48
18	2450	20	1.01	-0.09
19	3000	20	1.02	-0.17
20	3500	20	0.97	0.30
21	4000	20	1.01	-0.11
22	5000	20	1.37	-2.76
23	5500	20	1.41	-2.95
24	6000	20	1.43	-3.10

\* 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 600 V/m at 27.12 MHz)

**Test Conditions**

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



### PROBE ROTATIONAL RESPONSE

Model E100  
S/N 00126277  
Date Date of Calibration 11 June 2012  
Time 12:55:30 PM  
Isotropy \* + 0.304 dB/ -0.304 dB

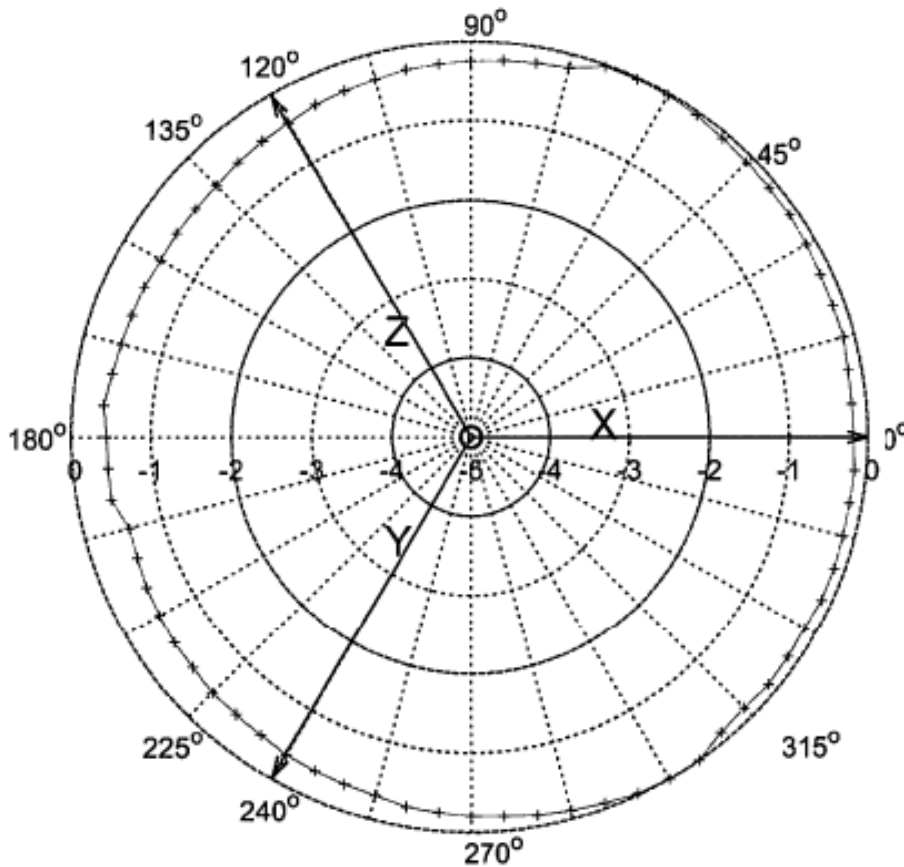


Figure 1: Probe Isotropic Response Chart.

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**



DVR antenna HAE4003A





Companion Mobile antennas (left to right):  
HAE4003A, HAE4011A, HAE6015A, HAE4004A

**Appendix D – MPE Measurement Results**

DVR (UHF R2, 10W) - MPE measurement data for Bystander

D.U.T. Info.							Probe Info.			MPE Measurements										DUT Max. TX Factor	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> )
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	Test Pos.	20 cm	40 cm	60 cm	80 cm	100 cm	120 cm	140 cm	160 cm	180 cm	200 cm				
Trunk	HAE4003A (450 - 470 MHz)	2.15	450.0000	10.0	10.0	CW	E	1.00	BS1	0.001	0.002	0.004	0.006	0.007	0.010	0.011	0.012	0.012	0.012	1.0	0.008	0.008	0.01
Trunk	HAE4003A (450 - 470 MHz)	2.15	460.0000	10.0	10.0	CW	E	1.00	BS1	0.001	0.003	0.004	0.006	0.007	0.009	0.010	0.010	0.009	0.008	1.0	0.007	0.007	0.01
Trunk	HAE4003A (450 - 470 MHz)	2.15	470.0000	10.0	10.0	CW	E	1.00	BS1	0.00	0.002	0.003	0.004	0.005	0.006	0.008	0.008	0.009	0.010	1.0	0.006	0.006	0.01
Trunk	HAE4003A (450 - 470 MHz)	2.15	450.0000	10.0	10.0	CW	E	1.00	BS2	0.001	0.001	0.003	0.004	0.006	0.009	0.012	0.018	0.024	0.028	1.0	0.011	0.011	0.01
Trunk	HAE4003A (450 - 470 MHz)	2.15	460.0000	10.0	10.0	CW	E	1.00	BS2	0.002	0.005	0.007	0.009	0.014	0.018	0.021	0.025	0.031	0.036	1.0	0.017	0.017	0.02
Trunk	HAE4003A (450 - 470 MHz)	2.15	470.0000	10.0	10.0	CW	E	1.00	BS2	0.003	0.004	0.006	0.010	0.017	0.022	0.024	0.025	0.026	0.028	1.0	0.017	0.017	0.02
Trunk	HAE4003A (450 - 470 MHz)	2.15	450.0000	10.0	10.0	CW	E	1.00	BS3	0.008	0.010	0.013	0.017	0.023	0.026	0.030	0.036	0.044	0.043	1.0	0.025	0.025	0.03
Trunk	HAE4003A (450 - 470 MHz)	2.15	460.0000	10.0	10.0	CW	E	1.00	BS3	0.008	0.009	0.008	0.011	0.016	0.021	0.029	0.037	0.041	0.042	1.0	0.022	0.022	0.02
Trunk	HAE4003A (450 - 470 MHz)	2.15	470.0000	10.0	10.0	CW	E	1.00	BS3	0.006	0.005	0.004	0.008	0.011	0.017	0.030	0.040	0.043	0.037	1.0	0.020	0.020	0.02
Trunk	HAE4003A (450 - 470 MHz)	2.15	450.0000	10.0	10.0	CW	E	1.00	BS4	0.004	0.005	0.007	0.011	0.014	0.022	0.031	0.034	0.033	0.029	1.0	0.019	0.019	0.02
Trunk	HAE4003A (450 - 470 MHz)	2.15	460.0000	10.0	10.0	CW	E	1.00	BS4	0.004	0.005	0.009	0.015	0.022	0.033	0.044	0.049	0.044	0.035	1.0	0.026	0.026	0.03
Trunk	HAE4003A (450 - 470 MHz)	2.15	470.0000	10.0	10.0	CW	E	1.00	BS4	0.004	0.005	0.010	0.014	0.022	0.032	0.045	0.050	0.045	0.036	1.0	0.026	0.026	0.03
Trunk	HAE4003A (450 - 470 MHz)	2.15	450.0000	10.0	10.0	CW	E	1.00	BS5	0.007	0.009	0.017	0.021	0.028	0.037	0.045	0.053	0.051	0.045	1.0	0.031	0.031	0.03
Trunk	HAE4003A (450 - 470 MHz)	2.15	460.0000	10.0	10.0	CW	E	1.00	BS5	0.009	0.011	0.018	0.022	0.029	0.039	0.053	0.063	0.065	0.056	1.0	0.037	0.037	0.04
Trunk	HAE4003A (450 - 470 MHz)	2.15	470.0000	10.0	10.0	CW	E	1.00	BS5	0.007	0.012	0.017	0.018	0.023	0.031	0.046	0.054	0.053	0.047	1.0	0.031	0.031	0.03

MPE calculations are defined in section 13.0.

DVR (UHF R2, 10W) - MPE measurement data for Passenger

D.U.T. Info.							Probe Info.		Test Pos.	MPE Measurements			DUT Max. TX Factor	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> )
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	HAE4003A (450 - 470 MHz)	2.15	450.0000	10.0	10.0	CW	E	1.00	PB	0.187	0.075	0.077	1.0	0.113	0.113	0.11
Trunk	HAE4003A (450 - 470 MHz)	2.15	460.0000	10.0	10.0	CW	E	1.00	PB	0.280	0.045	0.139	1.0	0.155	0.155	0.15
Trunk	HAE4003A (450 - 470 MHz)	2.15	470.0000	10.0	10.0	CW	E	1.00	PB	0.200	0.072	0.057	1.0	0.110	0.110	0.11
Trunk	HAE4003A (450 - 470 MHz)	2.15	450.0000	10.0	10.0	CW	E	1.00	PF	0.030	0.024	0.020	1.0	0.025	0.025	0.02
Trunk	HAE4003A (450 - 470 MHz)	2.15	460.0000	10.0	10.0	CW	E	1.00	PF	0.026	0.022	0.022	1.0	0.023	0.023	0.02
Trunk	HAE4003A (450 - 470 MHz)	2.15	470.0000	10.0	10.0	CW	E	1.00	PF	0.028	0.018	0.071	1.0	0.039	0.039	0.04

MPE calculations are defined in section 13.0.

Companion Mobile (UHF R2, 45W) - MPE measurement data for Bystander

D.U.T. Info.							Probe Info.		Test Pos.	MPE Measurements										DUT Max. TX Factor	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> )
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	HAE4003A (450-470MHz)	2.15	450.0125	54.0	53.8	CW	E	1.00	BS1	0.032	0.033	0.081	0.090	0.108	0.136	0.136	0.147	0.126	0.121	0.5	0.101	0.051	0.05
Roof	HAE4003A (450-470MHz)	2.15	460.0000	54.0	53.8	CW	E	1.00	BS1	0.036	0.040	0.077	0.104	0.138	0.183	0.144	0.149	0.120	0.119	0.5	0.111	0.056	0.06
Roof	HAE4003A (450-470MHz)	2.15	469.9875	54.0	53.7	CW	E	1.00	BS1	0.049	0.055	0.111	0.087	0.113	0.157	0.107	0.117	0.107	0.108	0.5	0.101	0.051	0.05
Roof	HAE4011A (445-470MHz)	5.65	450.0125	54.0	53.8	CW	E	1.00	BS1	0.002	0.001	0.016	0.045	0.049	0.160	0.237	0.295	0.233	0.120	0.5	0.116	0.058	0.06
Roof	HAE4011A (445-470MHz)	5.65	460.0000	54.0	53.8	CW	E	1.00	BS1	0.006	0.005	0.018	0.037	0.081	0.112	0.220	0.205	0.177	0.093	0.5	0.095	0.048	0.05
Roof	HAE4011A (445-470MHz)	5.65	469.9875	54.0	53.7	CW	E	1.00	BS1	0.010	0.014	0.014	0.052	0.063	0.113	0.122	0.165	0.119	0.076	0.5	0.075	0.037	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	450.0125	54.0	53.8	CW	E	1.00	BS1	0.027	0.038	0.058	0.087	0.106	0.127	0.152	0.149	0.134	0.125	0.5	0.100	0.050	0.05
Roof	HAE6015A (450 - 520MHz)	4.15	465.5000	54.0	53.7	CW	E	1.00	BS1	0.035	0.050	0.093	0.101	0.146	0.146	0.169	0.137	0.134	0.138	0.5	0.115	0.057	0.06
Roof	HAE6015A (450 - 520MHz)	4.15	482.5000	54.0	53.7	CW	E	1.00	BS1	0.056	0.057	0.111	0.116	0.136	0.133	0.129	0.144	0.142	0.127	0.5	0.115	0.058	0.06
Roof	HAE6015A (450 - 520MHz)	4.15	496.5000	48.0	46.9	CW	E	1.00	BS1	0.059	0.054	0.088	0.110	0.101	0.105	0.100	0.127	0.126	0.148	0.5	0.102	0.051	0.05
Roof	HAE6015A (450 - 520MHz)	4.15	511.9875	48.0	47.3	CW	E	1.00	BS1	0.071	0.062	0.109	0.092	0.101	0.113	0.104	0.128	0.156	0.133	0.5	0.107	0.053	0.05
Roof	HAE6015A (450 - 520MHz)	4.15	519.9875	30.0	29.2	CW	E	1.00	BS1	0.038	0.038	0.058	0.055	0.050	0.048	0.061	0.089	0.096	0.081	0.5	0.061	0.031	0.03
Roof	HAE4004A (470-512MHz)	2.15	470.0125	54.0	53.7	CW	E	1.00	BS1	0.054	0.049	0.092	0.118	0.143	0.117	0.123	0.135	0.113	0.113	0.5	0.106	0.053	0.05
Roof	HAE4004A (470-512MHz)	2.15	482.5000	54.0	53.7	CW	E	1.00	BS1	0.063	0.062	0.112	0.138	0.140	0.112	0.117	0.100	0.119	0.122	0.5	0.109	0.054	0.05
Roof	HAE4004A (470-512MHz)	2.15	498.0000	48.0	46.9	CW	E	1.00	BS1	0.071	0.059	0.110	0.113	0.092	0.104	0.095	0.092	0.116	0.144	0.5	0.100	0.050	0.05
Roof	HAE4004A (470-512MHz)	2.15	511.9875	48.0	47.3	CW	E	1.00	BS1	0.069	0.069	0.101	0.097	0.091	0.071	0.097	0.099	0.120	0.125	0.5	0.094	0.047	0.05

MPE calculations are defined in section 13.0.

Companion Mobile (UHF R2, 45W) - MPE measurement data for Bystander

D.U.T. Info.							Probe Info.		MPE Measurements											DUT Max. TX Factor	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> )
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	Test Pos.	20 cm	40 cm	60 cm	80 cm	100 cm	120 cm	140 cm	160 cm	180 cm	200 cm				
Roof	HAE4003A (450-470MHz)	2.15	450.0125	54.0	53.8	CW	E	1.00	BS2	0.032	0.031	0.045	0.074	0.076	0.108	0.123	0.128	0.122	0.115	0.5	0.085	0.043	0.04
Roof	HAE4003A (450-470MHz)	2.15	460.0000	54.0	53.8	CW	E	1.00	BS2	0.041	0.033	0.048	0.069	0.072	0.086	0.089	0.093	0.106	0.095	0.5	0.073	0.037	0.04
Roof	HAE4003A (450-470MHz)	2.15	469.9875	54.0	53.7	CW	E	1.00	BS2	0.027	0.018	0.046	0.062	0.060	0.090	0.103	0.123	0.109	0.089	0.5	0.073	0.036	0.04
Roof	HAE4011A (445-470MHz)	5.65	450.0125	54.0	53.8	CW	E	1.00	BS2	0.004	0.005	0.013	0.035	0.070	0.130	0.176	0.200	0.174	0.103	0.5	0.091	0.046	0.05
Roof	HAE4011A (445-470MHz)	5.65	460.0000	54.0	53.8	CW	E	1.00	BS2	0.008	0.006	0.020	0.048	0.082	0.150	0.148	0.148	0.151	0.088	0.5	0.085	0.042	0.04
Roof	HAE4011A (445-470MHz)	5.65	469.9875	54.0	53.7	CW	E	1.00	BS2	0.005	0.005	0.016	0.031	0.036	0.068	0.100	0.137	0.117	0.073	0.5	0.059	0.029	0.03
Roof	HAE6015A (450 - 520MHz)	4.15	450.0125	54.0	53.8	CW	E	1.00	BS2	0.032	0.023	0.040	0.065	0.094	0.093	0.118	0.115	0.125	0.098	0.5	0.080	0.040	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	465.5000	54.0	53.7	CW	E	1.00	BS2	0.033	0.023	0.045	0.049	0.057	0.071	0.098	0.116	0.124	0.112	0.5	0.073	0.036	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	482.5000	54.0	53.7	CW	E	1.00	BS2	0.033	0.031	0.063	0.058	0.082	0.105	0.082	0.112	0.112	0.107	0.5	0.079	0.039	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	496.5000	48.0	46.9	CW	E	1.00	BS2	0.024	0.027	0.052	0.054	0.083	0.093	0.086	0.110	0.096	0.095	0.5	0.072	0.036	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	511.9875	48.0	47.3	CW	E	1.00	BS2	0.025	0.029	0.046	0.062	0.093	0.094	0.103	0.097	0.087	0.077	0.5	0.071	0.036	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	519.9875	30.0	29.2	CW	E	1.00	BS2	0.018	0.022	0.034	0.037	0.049	0.050	0.052	0.047	0.043	0.045	0.5	0.040	0.020	0.02
Roof	HAE4004A (470-512MHz)	2.15	470.0125	54.0	53.7	CW	E	1.00	BS2	0.032	0.060	0.052	0.062	0.067	0.113	0.132	0.120	0.114	0.112	0.5	0.086	0.043	0.04
Roof	HAE4004A (470-512MHz)	2.15	482.5000	54.0	53.7	CW	E	1.00	BS2	0.036	0.038	0.069	0.065	0.082	0.084	0.116	0.111	0.096	0.096	0.5	0.079	0.040	0.04
Roof	HAE4004A (470-512MHz)	2.15	498.0000	48.0	46.9	CW	E	1.00	BS2	0.029	0.022	0.050	0.061	0.101	0.108	0.092	0.076	0.094	0.088	0.5	0.072	0.036	0.04
Roof	HAE4004A (470-512MHz)	2.15	511.9875	48.0	47.3	CW	E	1.00	BS2	0.027	0.027	0.045	0.051	0.081	0.079	0.090	0.086	0.066	0.064	0.5	0.062	0.031	0.03

MPE calculations are defined in section 13.0.

Companion Mobile (UHF R2, 45W) - MPE measurement data for Bystander

D.U.T. Info.							Probe Info.			MPE Measurements										DUT Max. TX Factor	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> )
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	Test Pos.	20 cm	40 cm	60 cm	80 cm	100 cm	120 cm	140 cm	160 cm	180 cm	200 cm				
Roof	HAE4003A (450-470MHz)	2.15	450.0125	54.0	53.8	CW	E	1.00	BS3	0.025	0.046	0.050	0.071	0.068	0.075	0.104	0.107	0.109	0.114	0.5	0.077	0.038	0.04
Roof	HAE4003A (450-470MHz)	2.15	460.0000	54.0	53.8	CW	E	1.00	BS3	0.033	0.058	0.070	0.088	0.096	0.098	0.101	0.110	0.105	0.098	0.5	0.086	0.043	0.04
Roof	HAE4003A (450-470MHz)	2.15	469.9875	54.0	53.7	CW	E	1.00	BS3	0.034	0.039	0.060	0.081	0.085	0.089	0.101	0.102	0.100	0.095	0.5	0.079	0.039	0.04
Roof	HAE4011A (445-470MHz)	5.65	450.0125	54.0	53.8	CW	E	1.00	BS3	0.005	0.013	0.023	0.049	0.059	0.087	0.122	0.139	0.127	0.092	0.5	0.072	0.036	0.04
Roof	HAE4011A (445-470MHz)	5.65	460.0000	54.0	53.8	CW	E	1.00	BS3	0.006	0.017	0.029	0.046	0.069	0.094	0.117	0.113	0.099	0.074	0.5	0.066	0.033	0.03
Roof	HAE4011A (445-470MHz)	5.65	469.9875	54.0	53.7	CW	E	1.00	BS3	0.008	0.016	0.023	0.036	0.050	0.072	0.096	0.102	0.085	0.065	0.5	0.055	0.028	0.03
Roof	HAE6015A (450 - 520MHz)	4.15	450.0125	54.0	53.8	CW	E	1.00	BS3	0.025	0.029	0.049	0.077	0.065	0.072	0.083	0.103	0.105	0.110	0.5	0.072	0.036	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	465.5000	54.0	53.7	CW	E	1.00	BS3	0.034	0.058	0.070	0.079	0.084	0.084	0.094	0.100	0.105	0.099	0.5	0.081	0.040	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	482.5000	54.0	53.7	CW	E	1.00	BS3	0.038	0.047	0.063	0.075	0.071	0.084	0.085	0.088	0.093	0.086	0.5	0.073	0.037	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	496.5000	48.0	46.9	CW	E	1.00	BS3	0.042	0.045	0.058	0.064	0.067	0.077	0.073	0.078	0.073	0.083	0.5	0.066	0.033	0.03
Roof	HAE6015A (450 - 520MHz)	4.15	511.9875	48.0	47.3	CW	E	1.00	BS3	0.040	0.040	0.053	0.074	0.079	0.079	0.076	0.077	0.075	0.069	0.5	0.066	0.033	0.03
Roof	HAE6015A (450 - 520MHz)	4.15	519.9875	30.0	29.2	CW	E	1.00	BS3	0.022	0.021	0.032	0.041	0.041	0.044	0.043	0.043	0.046	0.038	0.5	0.037	0.019	0.02
Roof	HAE4004A (470-512MHz)	2.15	470.0125	54.0	53.7	CW	E	1.00	BS3	0.041	0.048	0.063	0.098	0.088	0.090	0.107	0.114	0.114	0.101	0.5	0.086	0.043	0.04
Roof	HAE4004A (470-512MHz)	2.15	482.5000	54.0	53.7	CW	E	1.00	BS3	0.043	0.048	0.064	0.079	0.068	0.089	0.094	0.091	0.088	0.082	0.5	0.075	0.037	0.04
Roof	HAE4004A (470-512MHz)	2.15	498.0000	48.0	46.9	CW	E	1.00	BS3	0.046	0.045	0.050	0.061	0.061	0.075	0.072	0.076	0.090	0.081	0.5	0.066	0.033	0.03
Roof	HAE4004A (470-512MHz)	2.15	511.9875	48.0	47.3	CW	E	1.00	BS3	0.038	0.035	0.053	0.072	0.077	0.081	0.071	0.070	0.073	0.070	0.5	0.064	0.032	0.03

MPE calculations are defined in section 13.0.

Companion Mobile (UHF R2, 45W) - MPE measurement data for Bystander

D.U.T. Info.							Probe Info.			MPE Measurements										DUT Max. TX Factor	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> )
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	Test Pos.	20 cm	40 cm	60 cm	80 cm	100 cm	120 cm	140 cm	160 cm	180 cm	200 cm				
Roof	HAE4003A (450-470MHz)	2.15	450.0125	54.0	53.8	CW	E	1.00	BS4	0.036	0.054	0.039	0.051	0.067	0.074	0.070	0.057	0.041	0.039	0.5	0.053	0.026	0.03
Roof	HAE4003A (450-470MHz)	2.15	460.0000	54.0	53.8	CW	E	1.00	BS4	0.028	0.045	0.033	0.044	0.061	0.074	0.062	0.048	0.028	0.032	0.5	0.046	0.023	0.02
Roof	HAE4003A (450-470MHz)	2.15	469.9875	54.0	53.7	CW	E	1.00	BS4	0.024	0.038	0.028	0.037	0.050	0.058	0.057	0.046	0.031	0.024	0.5	0.039	0.020	0.02
Roof	HAE4011A (445-470MHz)	5.65	450.0125	54.0	53.8	CW	E	1.00	BS4	0.019	0.029	0.036	0.045	0.064	0.078	0.078	0.066	0.054	0.053	0.5	0.052	0.026	0.03
Roof	HAE4011A (445-470MHz)	5.65	460.0000	54.0	53.8	CW	E	1.00	BS4	0.015	0.026	0.025	0.032	0.052	0.062	0.056	0.057	0.050	0.051	0.5	0.043	0.021	0.02
Roof	HAE4011A (445-470MHz)	5.65	469.9875	54.0	53.7	CW	E	1.00	BS4	0.010	0.018	0.019	0.025	0.036	0.045	0.042	0.032	0.030	0.034	0.5	0.029	0.015	0.01
Roof	HAE6015A (450 - 520MHz)	4.15	450.0125	54.0	53.8	CW	E	1.00	BS4	0.032	0.049	0.036	0.046	0.067	0.069	0.073	0.064	0.036	0.033	0.5	0.051	0.025	0.03
Roof	HAE6015A (450 - 520MHz)	4.15	465.5000	54.0	53.7	CW	E	1.00	BS4	0.028	0.043	0.036	0.044	0.065	0.067	0.069	0.052	0.031	0.032	0.5	0.047	0.023	0.02
Roof	HAE6015A (450 - 520MHz)	4.15	482.5000	54.0	53.7	CW	E	1.00	BS4	0.029	0.039	0.031	0.042	0.054	0.056	0.057	0.050	0.042	0.054	0.5	0.045	0.023	0.02
Roof	HAE6015A (450 - 520MHz)	4.15	496.5000	48.0	46.9	CW	E	1.00	BS4	0.029	0.035	0.019	0.037	0.055	0.065	0.067	0.042	0.027	0.040	0.5	0.042	0.021	0.02
Roof	HAE6015A (450 - 520MHz)	4.15	511.9875	48.0	47.3	CW	E	1.00	BS4	0.023	0.029	0.017	0.043	0.059	0.060	0.054	0.037	0.028	0.037	0.5	0.039	0.019	0.02
Roof	HAE6015A (450 - 520MHz)	4.15	519.9875	30.0	29.2	CW	E	1.00	BS4	0.016	0.016	0.013	0.028	0.034	0.032	0.029	0.019	0.015	0.025	0.5	0.023	0.011	0.01
Roof	HAE4004A (470-512MHz)	2.15	470.0125	54.0	53.7	CW	E	1.00	BS4	0.025	0.042	0.030	0.037	0.054	0.062	0.059	0.049	0.031	0.025	0.5	0.041	0.021	0.02
Roof	HAE4004A (470-512MHz)	2.15	482.5000	54.0	53.7	CW	E	1.00	BS4	0.031	0.039	0.025	0.033	0.052	0.050	0.054	0.046	0.044	0.050	0.5	0.042	0.021	0.02
Roof	HAE4004A (470-512MHz)	2.15	498.0000	48.0	46.9	CW	E	1.00	BS4	0.026	0.034	0.017	0.035	0.050	0.062	0.075	0.056	0.029	0.032	0.5	0.042	0.021	0.02
Roof	HAE4004A (470-512MHz)	2.15	511.9875	48.0	47.3	CW	E	1.00	BS4	0.022	0.029	0.015	0.038	0.058	0.052	0.051	0.039	0.025	0.032	0.5	0.036	0.018	0.02

MPE calculations are defined in section 13.0.



Companion Mobile (UHF R2, 45W) - MPE measurement data for Bystander

D.U.T. Info.							Probe Info.			MPE Measurements										DUT Max. TX Factor	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> )
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	Test Pos.	20 cm	40 cm	60 cm	80 cm	100 cm	120 cm	140 cm	160 cm	180 cm	200 cm				
Roof	HAE4003A (450-470MHz)	2.15	450.0125	54.0	53.8	CW	E	1.00	BS5	0.008	0.005	0.008	0.015	0.019	0.030	0.033	0.030	0.018	0.021	0.5	0.019	0.009	0.01
Roof	HAE4003A (450-470MHz)	2.15	460.0000	54.0	53.8	CW	E	1.00	BS5	0.006	0.003	0.007	0.012	0.015	0.022	0.026	0.024	0.019	0.025	0.5	0.016	0.008	0.01
Roof	HAE4003A (450-470MHz)	2.15	469.9875	54.0	53.7	CW	E	1.00	BS5	0.007	0.004	0.009	0.016	0.021	0.025	0.032	0.028	0.021	0.027	0.5	0.019	0.010	0.01
Roof	HAE4011A (445-470MHz)	5.65	450.0125	54.0	53.8	CW	E	1.00	BS5	0.010	0.007	0.012	0.018	0.028	0.041	0.046	0.038	0.042	0.052	0.5	0.029	0.015	0.01
Roof	HAE4011A (445-470MHz)	5.65	460.0000	54.0	53.8	CW	E	1.00	BS5	0.007	0.005	0.008	0.016	0.029	0.030	0.032	0.031	0.028	0.041	0.5	0.023	0.011	0.01
Roof	HAE4011A (445-470MHz)	5.65	469.9875	54.0	53.7	CW	E	1.00	BS5	0.005	0.003	0.006	0.011	0.016	0.026	0.031	0.029	0.028	0.040	0.5	0.020	0.010	0.01
Roof	HAE6015A (450 - 520MHz)	4.15	450.0125	54.0	53.8	CW	E	1.00	BS5	0.010	0.006	0.010	0.020	0.024	0.030	0.040	0.032	0.025	0.024	0.5	0.022	0.011	0.01
Roof	HAE6015A (450 - 520MHz)	4.15	465.5000	54.0	53.7	CW	E	1.00	BS5	0.008	0.005	0.010	0.019	0.017	0.023	0.034	0.017	0.023	0.033	0.5	0.019	0.009	0.01
Roof	HAE6015A (450 - 520MHz)	4.15	482.5000	54.0	53.7	CW	E	1.00	BS5	0.009	0.006	0.009	0.012	0.017	0.027	0.037	0.028	0.017	0.028	0.5	0.019	0.010	0.01
Roof	HAE6015A (450 - 520MHz)	4.15	496.5000	48.0	46.9	CW	E	1.00	BS5	0.006	0.004	0.007	0.008	0.012	0.022	0.029	0.017	0.024	0.037	0.5	0.017	0.008	0.01
Roof	HAE6015A (450 - 520MHz)	4.15	511.9875	48.0	47.3	CW	E	1.00	BS5	0.006	0.003	0.007	0.010	0.019	0.025	0.027	0.021	0.027	0.039	0.5	0.018	0.009	0.01
Roof	HAE6015A (450 - 520MHz)	4.15	519.9875	30.0	29.2	CW	E	1.00	BS5	0.004	0.001	0.004	0.008	0.011	0.014	0.017	0.016	0.017	0.025	0.5	0.012	0.006	0.01
Roof	HAE4004A (470-512MHz)	2.15	470.0125	54.0	53.7	CW	E	1.00	BS5	0.008	0.004	0.010	0.015	0.023	0.029	0.040	0.034	0.021	0.029	0.5	0.021	0.011	0.01
Roof	HAE4004A (470-512MHz)	2.15	482.5000	54.0	53.7	CW	E	1.00	BS5	0.009	0.003	0.009	0.011	0.010	0.019	0.034	0.028	0.021	0.029	0.5	0.017	0.009	0.01
Roof	HAE4004A (470-512MHz)	2.15	498.0000	48.0	46.9	CW	E	1.00	BS5	0.007	0.003	0.006	0.007	0.013	0.020	0.019	0.017	0.017	0.038	0.5	0.015	0.007	0.01
Roof	HAE4004A (470-512MHz)	2.15	511.9875	48.0	47.3	CW	E	1.00	BS5	0.005	0.002	0.005	0.009	0.015	0.026	0.026	0.021	0.026	0.035	0.5	0.017	0.009	0.01

MPE calculations are defined in section 13.0.

Companion Mobile (UHF R2, 45W) - MPE measurement data for Passenger

Ant Loc.	Ant. Model/ Desc.	D.U.T. Info.					Probe Info.		Test Pos.	MPE Measurements			DUT Max. TX Factor	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> )
		Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		Passenger	Chest	Lower Trunk				
Roof	HAE4003A (450-470MHz)	2.15	450.0125	54.0	53.8	CW	E	1.00	PB	0.145	0.208	0.181	0.5	0.178	0.089	0.09
Roof	HAE4003A (450-470MHz)	2.15	460.0000	54.0	53.8	CW	E	1.00	PB	0.136	0.113	0.172	0.5	0.140	0.070	0.07
Roof	HAE4003A (450-470MHz)	2.15	469.9875	54.0	53.7	CW	E	1.00	PB	0.179	0.151	0.155	0.5	0.162	0.081	0.08
Roof	HAE4011A (445-470MHz)	5.65	450.0125	54.0	53.8	CW	E	1.00	PB	0.111	0.134	0.194	0.5	0.146	0.073	0.07
Roof	HAE4011A (445-470MHz)	5.65	460.0000	54.0	53.8	CW	E	1.00	PB	0.124	0.066	0.126	0.5	0.105	0.053	0.05
Roof	HAE4011A (445-470MHz)	5.65	469.9875	54.0	53.7	CW	E	1.00	PB	0.093	0.063	0.065	0.5	0.074	0.037	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	450.0125	54.0	53.8	CW	E	1.00	PB	0.103	0.156	0.171	0.5	0.143	0.072	0.07
Roof	HAE6015A (450 - 520MHz)	4.15	465.5000	54.0	53.7	CW	E	1.00	PB	0.109	0.095	0.139	0.5	0.114	0.057	0.06
Roof	HAE6015A (450 - 520MHz)	4.15	482.5000	54.0	53.7	CW	E	1.00	PB	0.149	0.107	0.089	0.5	0.115	0.058	0.06
Roof	HAE6015A (450 - 520MHz)	4.15	496.5000	48.0	46.9	CW	E	1.00	PB	0.021	0.071	0.056	0.5	0.049	0.025	0.03
Roof	HAE6015A (450 - 520MHz)	4.15	511.9875	48.0	47.3	CW	E	1.00	PB	0.053	0.037	0.066	0.5	0.052	0.026	0.03
Roof	HAE6015A (450 - 520MHz)	4.15	519.9875	30.0	29.2	CW	E	1.00	PB	0.028	0.023	0.025	0.5	0.025	0.013	0.01
Roof	HAE4004A (470-512MHz)	2.15	470.0125	54.0	53.7	CW	E	1.00	PB	0.179	0.122	0.151	0.5	0.151	0.075	0.08
Roof	HAE4004A (470-512MHz)	2.15	482.5000	54.0	53.7	CW	E	1.00	PB	0.212	0.163	0.099	0.5	0.158	0.079	0.08
Roof	HAE4004A (470-512MHz)	2.15	498.0000	48.0	46.9	CW	E	1.00	PB	0.048	0.096	0.080	0.5	0.075	0.037	0.04
Roof	HAE4004A (470-512MHz)	2.15	511.9875	48.0	47.3	CW	E	1.00	PB	0.073	0.048	0.068	0.5	0.063	0.032	0.03

MPE calculations are defined in section 13.0.

Companion Mobile (UHF R2, 45W) - MPE measurement data for Passenger

D.U.T. Info.							Probe Info.		Test Pos.	MPE Measurements			DUT Max. TX Factor	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> )
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		Passenger	Chest	Lower Trunk				
Roof	HAE4003A (450-470MHz)	2.15	450.0125	54.0	53.8	CW	E	1.00	PF	0.074	0.063	0.126	0.5	0.088	0.044	0.04
Roof	HAE4003A (450-470MHz)	2.15	460.0000	54.0	53.8	CW	E	1.00	PF	0.199	0.096	0.056	0.5	0.117	0.059	0.06
Roof	HAE4003A (450-470MHz)	2.15	469.9875	54.0	53.7	CW	E	1.00	PF	0.241	0.065	0.178	0.5	0.161	0.081	0.08
Roof	HAE4011A (445-470MHz)	5.65	450.0125	54.0	53.8	CW	E	1.00	PF	0.046	0.020	0.076	0.5	0.047	0.024	0.02
Roof	HAE4011A (445-470MHz)	5.65	460.0000	54.0	53.8	CW	E	1.00	PF	0.122	0.035	0.029	0.5	0.062	0.031	0.03
Roof	HAE4011A (445-470MHz)	5.65	469.9875	54.0	53.7	CW	E	1.00	PF	0.101	0.021	0.028	0.5	0.050	0.025	0.03
Roof	HAE6015A (450 - 520MHz)	4.15	450.0125	54.0	53.8	CW	E	0.97	PF	0.102	0.059	0.050	0.5	0.070	0.034	0.03
Roof	HAE6015A (450 - 520MHz)	4.15	465.5000	54.0	53.7	CW	E	1.00	PF	0.144	0.074	0.166	0.5	0.128	0.064	0.06
Roof	HAE6015A (450 - 520MHz)	4.15	482.5000	54.0	53.7	CW	E	1.00	PF	0.090	0.072	0.087	0.5	0.083	0.042	0.04
Roof	HAE6015A (450 - 520MHz)	4.15	496.5000	48.0	46.9	CW	E	1.00	PF	0.069	0.044	0.062	0.5	0.058	0.029	0.03
Roof	HAE6015A (450 - 520MHz)	4.15	511.9875	48.0	47.3	CW	E	1.00	PF	0.050	0.041	0.032	0.5	0.041	0.021	0.02
Roof	HAE6015A (450 - 520MHz)	4.15	519.9875	30.0	29.2	CW	E	1.00	PF	0.028	0.020	0.026	0.5	0.025	0.012	0.01
Roof	HAE4004A (470-512MHz)	2.15	470.0125	54.0	53.7	CW	E	1.00	PF	0.267	0.075	0.175	0.5	0.172	0.086	0.09
Roof	HAE4004A (470-512MHz)	2.15	482.5000	54.0	53.7	CW	E	1.00	PF	0.145	0.085	0.100	0.5	0.110	0.055	0.06
Roof	HAE4004A (470-512MHz)	2.15	498.0000	48.0	46.9	CW	E	1.00	PF	0.094	0.053	0.068	0.5	0.072	0.036	0.04
Roof	HAE4004A (470-512MHz)	2.15	511.9875	48.0	47.3	CW	E	1.00	PF	0.061	0.060	0.034	0.5	0.052	0.026	0.03

MPE calculations are defined in section 13.0.