**MOTOROLA**

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

# MPE/SAR Compliance Test Report

**Date of Report:**    **August 31, 2004**
**Report Revision(s):**    Rev. A
**Device Manufacturer:**    Motorola
**Device Description:**    XTL5000; VHF 136-174 MHz automobile mobile transceiver;
25-100watts
**Classification:**    Occupational/Controlled Exposure
**FCC ID:**    AZ492FT3808
**Device Model:**    M20KTS9PW1AN

**Test Period:**    6/14/04 – 6/16/04, 6/18/04, 6/30/04

**Responsible Engineer:**    Stephen Whalen (Sr. EME Engineer)

**Test Engineer:**    Stephen Whalen (Sr. EME Engineer)

**Author:**    Michael Sailsman (Global EME Regulatory Affairs Liaison)

**Note: Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with all applicable national and international reference standards and guidelines.**

Signature on file                  9/1/04

_____    _____

Ken Enger                       Date Approved
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# REVISION HISTORY

| Date | Revision | Comments |
|:---:|:---:|:---|
| 8/23/04 | O | Release of Prototype Results |
| 8/31/04 | A | Added MPE and applicable SAR computational results for additional offered antennas to sections 11.0, 11.1, and Appendix D.<br><br>Corrected incorrect results presented in row 2 of Table 1 page 4 of Appendix D.<br><br>Revised language in sections 6.1.1, 6.1.2, 6.2, 6.2.1, 6.2.2. |

## 1.0    Product Description



FCC ID: AZ492FT3808, model M20KTS9PW1AN is a mobile transceiver that utilizes frequency modulation (FM) half duplex transmission technology. The modulation could be conventional analog voice, trunked analog voice, tone PL or C4FM modulation. The control data rates are 3600 and 9600 baud on the C4FM constant envelope carrier. The maximum duty cycle varies dependent on the loading of the system. The data mode characteristic of the device is packet based with a maximum packet size of 1500 bytes. The actual duty cycle performance will always be less than 10% due to the system's design restrictions and normal operating parameters of the device. Note that the device and the systems in which it operates do not allow streaming data as an intended functionality. Furthermore, the transmission signal in data mode uses standard APCO signaling as specified in TIA/EIA 102.CAAA paragraph 1.3.3.5 with C4FM modulation.
The intended use of the radio is Push-To-Talk (PTT) while the device is properly installed in a vehicle with the offered external antennas mounted at the center of the roof or trunk. This device will be marketed to and used by employees solely for work-related operations, such as public safety agencies, e.g. police, fire and emergency medical. User training is the responsibility of these agencies 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. Motorola also makes available to its customers training classes on the proper use of two-way radios and wireless data devices. This device is classified as Occupational/Controlled Exposure. However, In accordance with FCC requirements, the passengers inside the vehicle and the bystanders external to the vehicle are evaluated to the General Population/Uncontrolled Exposure Limits. The transmit frequency band is 136-174 MHz. The nominal power of the device is 25-100 watts with a maximum conducted power output of 120 watts.
(Note that "By-standers" as used herein mean people other than operator)

## 2.0 Offered Options and Accessories

**Antenna**

| | |
|---|---|
| HAD4006A | 136.0-144.0 MHz ¼ wave 2.15dBi antenna; 52.0cm |
| HAD4007A | 144.0-150.8 MHz ¼ wave 2.15dBi antenna; 49.0cm |
| HAD4008A | 150.8-162.0 MHz ¼ wave 2.15dBi antenna; 45.6cm |
| HAD4009A | 162.0-174.0 MHz ¼ wave 2.15dBi antenna; 43.0cm |
| HAD4014AR | 140.0-174.0 MHz ½ wave 5.15dBi antenna; 116.8cm |
| RAD4000A | 136.0-174.0 MHz ½ wave 5.15dBi antenna; 138.0cm |
| RAD4010ARB | 136.0-174.0 MHz ½ wave 5.15dBi antenna; 143.5cm |
| HAD4016A | 136.0-162.0 MHz ¼ wave 2.15dBi antenna; 50.5cm |
| HAD4017A | 146.0-174.0 MHz ¼ wave 2.15dBi antenna; 47.5cm |

## 3.0 Measurement Standards

Measurements were performed according to FCC Limits Per 47 CFR 2.1091 (d) for General Population/Uncontrolled RF Exposure as well as with the recommended guidelines in IEEE/ANSI C95.1-1999.

For frequencies ranging from 136-174 MHz the MPE (Maximum Permissible Exposure) limit to electromagnetic energy in equivalent plane wave free-space power density is  0.20mW/cm$^2$ for the frequency range of 30-300MHz.

## 4.0 Data Collection Consideration

Power density testing was performed with DUT installed in a 1991 Ford Taurus (4-door). Measurement data was taken with the vehicle running at idle and the vehicle battery measuring 14.0 volts.

## 5.0 Measurement System Uncertainty Levels

The information below presents an estimate of the possible errors that are associated with the measurement system.

| Description | Error |
|---|---|
| **NARDA Survey Meter** | **± 3%** |
| **Repeatability Accuracy** | **± 7%** |

## 6.0 Method of Measurement

### 6.1 EME measurements made on trunk mounted antennas
(for reference, see Antenna Location Layout drawings in Appendix)

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

MPE measurements for by-stander conditions are determined by taking the average of (10) measurements in a 2m vertical line directly behind the vehicle with 20cm increments at the standard test distance of 90cm from each of the ½ wave antennas. The measurement probe sensor is rotated 180º at each of the ten incremental measurements to ensure the highest result is captured.  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 for the following (3) by-stander conditions while maintaining a twenty (20) centimeter separation distance between the probe sensor and vehicle body: (1) directly behind the vehicle, (2) 45º radial at the corner of the vehicle, and (3) 90º radial at the side of the trunk. The worst case test condition from above was then assessed at the transmit band edges.
For the current test vehicle, the antenna to probe sensor separation distance is 99.5 cm (45 degree radial) and 104 cm (90 degree radial)
**Note: the distance from the trunk-mounted antenna to the edge of the vehicle is 26cm and the distance from the edge of the vehicle's trunk to the MPE vertical line assessment is 64cm (trunk to edge of bumper is 10cm). The radial distance measured at 45˙ from corner of trunk to vertical test line is 99.5cm. The radial distance measured at 90˙ from the side of the trunk is 104cm.**

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

While rotating survey meter probe through 180 degrees to ensure that the highest level is found, scans were performed inside of the vehicle, both front and back seating areas, using each of the antennas tested herein at the trunk, to ascertain the highest level in each location. After the highest level is found, scans were performed vertically making two (2) additional measurements within an area approximately 40 cm wide (representing the width of a person) so as to have a total of three (3) measured points, indicated below, that are averaged.

> a)  Head area
>
> b)  Chest area
>
> c)  Lower Trunk area

## 6.2   EME measurements made on center roof mounted antennas
(for reference, see Antenna Location Layout drawings in Appendix)

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

MPE measurements for by-stander conditions are determined by taking the average of (10) measurements in a 2m vertical line directly beside the vehicle with 20cm increments at the standard test distance of 90cm from each of the applicable antennas. The measurement probe sensor is rotated 180º at each of the ten

incremental measurements to ensure the highest result is captured. These measurements are representative of persons other than the operator standing next to the vehicle.

**Note: Actual test distance was 110cm (60cm from antenna to roof edge; 30cm from roof edge to edge of car door; 20cm vertical test line to car door); this is the closest distance that can be achieved to an antenna mounted to the center of the vehicle used for MPE compliance assessment.**

### 6.2.2   Internal vehicle EME measurement
(Antenna mounted at roof center)

While rotating survey meter probe through 180 degrees to ensure that the highest level is found, scans were performed inside of the vehicle, both at the front and back seating areas, using each of the antennas tested herein at the roof, to ascertain the highest level in each location. After the highest level is found, scans were performed vertically making two (2) additional measurements within an area approximately 40 cm wide (representing the width of a person) so as to have a total of three (3) measured points as indicated below that are averaged.

a)  Head area

b)  Chest area

c)  Lower Trunk area

## 7.0   Test Site

The test site is the Motorola Commercial Government Industrial Solution Sector (CGISS) world wide electromagnetic exposure (EME) open area test site located at 8000 W. Sunrise Blvd., Plantation, FL. 33322.

## 8.0   Measurement System/Equipment

The minimum equipment required will mainly consist of a test vehicle, radio frequency radiation test set consisting of an Electromagnetic Radiation Survey Meter, E/H-Field Test Probes, and typical antenna configurations.
Below are the test equipment used to assess compliance:

a) Automobile: 1991 Ford Taurus, 4-Door

b) Survey Meter - NARDA Model 8718 (01108); Cal. date: 4/7/04

c) E-Field (Electric Field) Probe - NARDA Model 8722B (12023); Cal. date: 11/5/03

d) H-Field (Magnetic Field) Probe – NARDA Model 8371 (03006); Cal date: 4/7/04

d) Antennas – (¼ wave 2.15dBi, and ½ wave 5.15dBi gain antennas)

### 9.0 Test Unit Description

Power density measurements were performed on a representative sample of model number M20KTS9PW1AN. The serial number of the tested radio was VHF P1 EME#46. The frequency band of the DUT is 136-174 MHz; the tested frequencies were 136.0125, 146.00, 149.00, 155.00, 160.00, 162.00, 173.9875 MHz. The ¼ wave 2.15dBi antennas, and ½ wave 5.15dBi gain antennas listed in section 2.0 were used to assess compliance to the applicable MPE limits.

### 10.0 Test Set-Up Description

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

a) The ¼ wave 2.15dBi antenna models HAD4006A, HAD4007A, and HAD4008A, HAD4009A, HAD4016A, HAD4017A, and ½ wave 5.15dBi gain antenna models HAD4014AR, RAD4000A, and RAD4010ARB were mounted at the center of the roof of the test vehicle.
b) The ½ wave 5.15dBi gain antenna models HAD4014AR, RAD4000A, RAD4010ARB were assessed while mounted at the trunk.
Assessments were made internal and external to the test vehicle at the specified distances and locations stated in sections 6.0, 11.0, and the APPENDIX A. Note that the ¼ wave antennas are restricted to roof mount operations for this filing.

### 11.0 Test Results Summary

**Table A**

| Tables | Antenna Model | Antenna Location | Test Frequency (MHz) | E/H Field | Int./Ext. | Max Calc Pwr Density | % of Uncontrolled limit |
|---|---|---|---|---|---|---|---|
| Table 1 | HAD4006A | Roof | 136.0125 | E | Ext | 0.20 | 100.00 |
| Table 2* | HAD4006A | Roof | 136.0125 | E | Int. | 0.25 | 125.00 |
| Table 3 | HAD4006A | Roof | 136.0125 | H | Ext | 0.17 | 85.00 |
| Table 4* | HAD4006A | Roof | 136.0125 | H | Int. | 0.37 | 185.00 |
| Table 5* | HAD4007A | Roof | 146.00 | E | Ext | 0.21 | 105.00 |
| Table 6* | HAD4007A | Roof | 146.00 | E | Int. | 0.45 | 225.00 |
| Table 7 | HAD4007A | Roof | 146.00 | H | Ext | 0.12 | 60.00 |
| Table 8 | HAD4007A | Roof | 146.00 | H | Int. | 0.13 | 65.00 |
| Table 9* | HAD4008A | Roof | 155.00 | E | Ext | 0.21 | 105.00 |
| Table 10* | HAD4008A | Roof | 155.00 | E | Int. | 0.27 | 135.00 |

## Table A (continued)

| Tables | Antenna Model | Antenna Location | Test Frequency (MHz) | E/H Field | Int./Ext. | Max Calc Pwr Density | % of Uncontrolled limit |
|---|---|---|---|---|---|---|---|
| Table 11 | HAD4008A | Roof | 155.00 | H | Ext | 0.13 | 65.00 |
| Table 12 | HAD4008A | Roof | 155.00 | H | Int. | 0.16 | 80.00 |
| Table 13 | HAD4009A | Roof | 173.9875 | E | Ext | 0.17 | 85.00 |
| Table 14 | HAD4009A | Roof | 173.9875 | E | Int. | 0.17 | 85.00 |
| Table 15 | HAD4009A | Roof | 173.9875 | H | Ext | 0.15 | 75.00 |
| Table 16 | HAD4009A | Roof | 173.9875 | H | Int. | 0.10 | 50.00 |
| Table 17 | HAD4014AR | Roof | 155.00 | E | Ext | 0.13 | 65.00 |
| Table 18 | HAD4014AR | Roof | 155.00 | E | Int. | 0.06 | 30.00 |
| Table 19 | HAD4014AR | Roof | 155.00 | H | Ext | 0.11 | 55.00 |
| Table 20 | HAD4014AR | Roof | 155.00 | H | Int. | 0.05 | 25.00 |
| Table 21 | RAD4000A | Roof | 155.00 | E | Ext | 0.11 | 55.00 |
| Table 22 | RAD4000A | Roof | 155.00 | E | Int. | 0.05 | 25.00 |
| Table 23 | RAD4000A | Roof | 155.00 | H | Ext | 0.10 | 50.00 |
| Table 24 | RAD4000A | Roof | 155.00 | H | Int. | 0.04 | 20.00 |
| Table 25 | RAD4010ARB | Roof | 155.00 | E | Ext | 0.13 | 65.00 |
| Table 26 | RAD4010ARB | Roof | 155.00 | E | Int. | 0.07 | 35.00 |
| Table 27 | RAD4010ARB | Roof | 155.00 | H | Ext | 0.12 | 60.00 |
| Table 28 | RAD4010ARB | Roof | 155.00 | H | Int. | 0.17 | 85.00 |
| Table 29 | RAD4010ARB | Roof | 136.0125 | E | Ext | 0.05 | 25.00 |
| Table 30 | RAD4010ARB | Roof | 136.0125 | E | Int. | 0.04 | 20.00 |
| Table 31 | RAD4010ARB | Roof | 136.0125 | H | Ext | 0.05 | 25.00 |
| Table 32 | RAD4010ARB | Roof | 136.0125 | H | Int. | 0.04 | 20.00 |
| Table 33 | RAD4010ARB | Roof | 173.9875 | E | Ext | 0.02 | 10.00 |
| Table 34 | RAD4010ARB | Roof | 173.9875 | E | Int. | 0.02 | 10.00 |
| Table 35 | RAD4010ARB | Roof | 173.9875 | H | Ext | 0.05 | 25.00 |
| Table 36 | RAD4010ARB | Roof | 173.9875 | H | Int. | 0.03 | 15.00 |
| Table 37* | HAD4016A | Roof | 149.00 | E | Ext | 0.21 | 105.00 |

## Table A (continued)

| Tables | Antenna Model | Antenna Location | Test Frequency (MHz) | E/H Field | Int./Ext. | Max Calc Pwr Density | % of Uncontrolled limit |
|---|---|---|---|---|---|---|---|
| Table 38* | HAD4016A | Roof | 149.00 | E | Int. | 0.30 | 150.00 |
| Table 39 | HAD4016A | Roof | 149.00 | H | Ext | 0.14 | 70.00 |
| Table 40 | HAD4016A | Roof | 149.00 | H | Int. | 0.12 | 60.00 |
| Table 41 | HAD4016A | Roof | 136.0125 | E | Ext | 0.11 | 55.00 |
| Table 42 | HAD4016A | Roof | 136.0125 | E | Int. | 0.19 | 95.00 |
| Table 43* | HAD4016A | Roof | 136.0125 | H | Ext | 0.21 | 105.00 |
| Table 44* | HAD4016A | Roof | 136.0125 | H | Int. | 0.28 | 140.00 |
| Table 45 | HAD4016A | Roof | 162.00 | E | Ext | 0.165 | 0.17 |
| Table 46 | HAD4016A | Roof | 162.00 | E | Int. | 0.247 | 0.25 |
| Table 47 | HAD4016A | Roof | 162.00 | H | Ext | 0.119 | 0.12 |
| Table 48 | HAD4016A | Roof | 162.00 | H | Int. | 0.083 | 0.08 |
| Table 49 | HAD4017A | Roof | 160.00 | E | Ext | 0.17 | 85.00 |
| Table 50* | HAD4017A | Roof | 160.00 | E | Int. | 0.22 | 110.00 |
| Table 51 | HAD4017A | Roof | 160.00 | H | Ext | 0.12 | 60.00 |
| Table 52 | HAD4017A | Roof | 160.00 | H | Int. | 0.15 | 75.00 |
| Table 53 | HAD4017A | Roof | 146.00 | E | Ext | 0.14 | 70.00 |
| Table 54* | HAD4017A | Roof | 146.00 | E | Int. | 0.30 | 150.00 |
| Table 55* | HAD4017A | Roof | 146.00 | H | Ext | 0.22 | 110.00 |
| Table 56* | HAD4017A | Roof | 146.00 | H | Int. | 0.25 | 125.00 |
| Table 57 | HAD4017A | Roof | 173.9875 | E | Ext | 0.10 | 50.00 |
| Table 58 | HAD4017A | Roof | 173.9875 | E | Int. | 0.07 | 35.00 |
| Table 59 | HAD4017A | Roof | 173.9875 | H | Ext | 0.11 | 55.00 |
| Table 60 | HAD4017A | Roof | 173.9875 | H | Int. | 0.13 | 65.00 |
| Table 61* | HAD4014AR | Trunk | 155.00 | E | Ext | 0.32 | 160.00 |
| Table 62 | HAD4014AR | Trunk | 155.00 | E | Int. | 0.16 | 80.00 |
| Table 63* | HAD4014AR | Trunk | 155.00 | H | Ext | 0.30 | 150.00 |
| Table 64 | HAD4014AR | Trunk | 155.00 | H | Int. | 0.07 | 35.00 |

## Table A (continued)

| Tables | Antenna Model | Antenna Location | Test Frequency (MHz) | E/H Field | Int./Ext. | Max Calc Pwr Density | % of Uncontrolled limit |
|---|---|---|---|---|---|---|---|
| Table 65* | RAD4000A | Trunk | 155.00 | E | Ext | 0.26 | 130.00 |
| Table 66 | RAD4000A | Trunk | 155.00 | E | Int. | 0.17 | 85.00 |
| Table 67* | RAD4000A | Trunk | 155.00 | H | Ext | 0.23 | 115.00 |
| Table 68 | RAD4000A | Trunk | 155.00 | H | Int. | 0.07 | 35.00 |
| Table 69* | RAD4010ARB | Trunk | 155.00 | E | Ext | 0.37 | 185.00 |
| Table 70 | RAD4010ARB | Trunk | 155.00 | E | Int. | 0.16 | 80.00 |
| Table 71** | RAD4010ARB | Trunk | 155.00 | H | Ext | 0.39 | 195.00 |
| Table 72 | RAD4010ARB | Trunk | 155.00 | H | Int. | 0.10 | 50.00 |
| **Band edge assessment using worst case configuration at the trunk from above** | | | | | | | |
| Table 73 | RAD4010ARB | Trunk | 136.0125 | E | Ext | 0.09 | 45.00 |
| Table 74* | RAD4010ARB | Trunk | 136.0125 | E | Int. | 0.24 | 120.00 |
| Table 75 | RAD4010ARB | Trunk | 136.0125 | H | Ext | 0.15 | 75.00 |
| Table 76* | RAD4010ARB | Trunk | 136.0125 | H | Int. | 0.24 | 120.00 |
| Table 77 | RAD4010ARB | Trunk | 136.0125 | E | Ext | 0.03 | 15.00 |
| Table 78 | RAD4010ARB | Trunk | 173.9875 | E | Int. | 0.05 | 25.00 |
| Table 79 | RAD4010ARB | Trunk | 173.9875 | H | Ext | 0.05 | 25.00 |
| Table 80 | RAD4010ARB | Trunk | 173.9875 | H | Int. | 0.09 | 45.00 |
| **90º radial assessment using worst case antenna and frequency** | | | | | | | |
| Table 81* | RAD4010ARB | Trunk | 155.00 | E | Ext | 0.21 | 105.00 |
| Table 82* | RAD4010ARB | Trunk | 155.00 | H | Ext | 0.27 | 135.00 |
| **45º radial assessment using worst case antenna and frequency** | | | | | | | |
| Table 83* | RAD4010ARB | Trunk | 155.00 | E | Ext | 0.22 | 110.00 |
| Table 84* | RAD4010ARB | Trunk | 155.00 | H | Ext | 0.26 | 130.00 |

Note: * = Results exceeding applicable limits; ** = Worst case configuration external to vehicle

## 11.1 Test Results

Presented below is a summary of the tested frequencies and associated power outputs, measurement probe parameters and exposure conditions, results calculation methodology, applicable reference standards, as well as tables of the raw MPE data for all measured grid points.

The maximum calculated final results presented in the tables are based on a 50% duty cycle with the radio operating in accordance with the User Manual instructions. The bolded power density results represent the highest MPE results observed.

**Raw MPE Data test frequencies and measured Po (W):**
**136.0125 MHz (Po=121.0), 146.00 MHz (Po=120.0), 149.00 MHz (Po=120.0), 155.00 MHz (Po=120.0), 160.00 MHz (Po=120.0), 162.00 MHz (Po=120.0), 173.9875 MHz (Po=120.0)**

**Meter reads in % of controlled limit; controlled limit = 1.0mW/cm^2 for 30-300 MHz (Cal factors presented herein are automatically accounted for in the meter used for assessments) General Population MPE limits = 0.20 mW/cm^2**

**External Vehicle Power Density (Pwr. Den. (cal.)) = average over body/2**
**Internal Vehicle Power Density (Pwr. Den. (cal.)) = average over (head/chest/lower trunk)/2**
If initial power < RF Po max then Pwr Density Max Calc.= (RF Po Max/Initial Power)*Pwr Density Calc.

**Note: The average over the body test methodology is consistent with IEEE/ANSI C95.1-1999 guidelines**

**Table 1**

| | External Vehicle MPE Assessment @ | | | | | 136.0125 | MHz | | |
|---|---|---|---|---|---|---|---|---|---|
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4006A | 2.15 | 90 | E | 0.78 | 0.394 | 121.0 | 0.197 | **0.20** |

| Measurement Grid | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test Position** | **Height (cm)** | **% of Control Limit** | **Test Position** | **Height (cm)** | **% of Control Limit** | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 15.5% | 6 | 120 | 47.3% | 1 | 0.200 |
| 2 | 40 | 20.6% | 7 | 140 | 70.2% | | |
| 3 | 60 | 23.5% | 8 | 160 | 74.6% | | |
| 4 | 80 | 13.7% | 9 | 180 | 62.4% | | **RF Po (*Max)** |
| 5 | 100 | 25.3% | 10 | 200 | 40.8% | | 120 |

**Table 2**

| | | Internal Vehicle MPE Assessment @ | | | | 136.0125 | MHz | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2)** Back | Front | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4006A | 2.15 | Highest Reading | E | 0.78 | 0.505 | 0.291 | 121.0 | 0.252 | **0.25** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| **Test Position** | **% of Control Limit Head** | **% of Control Limit Chest** | **% of Control Limit Lower Trunk** | IEEE Controlled Limit: | 1.0 |
| Back Seat | 78.4% | 37.6% | 35.4% | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 48.6% | 22.2% | 16.4% | **RF Po (*Max):** | 120 |

**Table 3**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **External Vehicle MPE Assessment @** | | | | | | 136.0125 | **MHz** | | |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4006A | 2.15 | 90 | H | 1.01 | 0.339 | 121.0 | 0.170 | **0.17** |

| **Measurement Grid** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | **IEEE Controlled Limit** | **IEEE Uncontrolled Limit** |
| 1 | 20 | 0.063 | 6 | 120 | 0.456 | 1.0 | 0.2 |
| 2 | 40 | 0.056 | 7 | 140 | 0.551 | | |
| 3 | 60 | 0.074 | 8 | 160 | 0.693 | | |
| 4 | 80 | 0.059 | 9 | 180 | 0.725 | | **RF Po (*Max)** |
| 5 | 100 | 0.112 | 10 | 200 | 0.602 | | 120 |

**Table 4**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Internal Vehicle MPE Assessment @** | | | | | | 136.0125 | **MHz** | | | |
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2)** Back | Front | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4006A | 2.15 | Highest Reading | H | 1.01 | 0.733 | 0.390 | 121.0 | 0.367 | **0.37** |

| **Measurement Grid** | | | | | |
|---|---|---|---|---|---|
| **Test Position** | **Magnetic Field Strength Head** | **Magnetic Field Strength Chest** | **Magnetic Field Strength Lower Trunk** | | |
| Back Seat | 0.853 | 0.712 | 0.634 | IEEE Controlled Limit: | 1.0 |
| Front Seat | 0.512 | 0.457 | 0.201 | IEEE Uncontrolled Limit: | 0.2 |
| | | | | **RF Po (*Max):** | 120 |

**Table 5**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| External Vehicle MPE Assessment @      146    MHz |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4007A | 2.15 | 90 (actual 110) | E | 0.79 | 0.415 | 120.0 | 0.207 | **0.21** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Measurement Grid |
| **Test Position** | **Height (cm)** | **% of Control Limit** | **Test Position** | **Height (cm)** | **% of Control Limit** | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 11.2% | 6 | 120 | 47.5% | 1 | 0.200 |
| 2 | 40 | 14.3% | 7 | 140 | 71.9% | | |
| 3 | 60 | 20.3% | 8 | 160 | 76.8% | | |
| 4 | 80 | 15.6% | 9 | 180 | 74.2% | | **RF Po (*Max)** |
| 5 | 100 | 28.3% | 10 | 200 | 54.7% | | 120 |

**Table 6**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Vehicle MPE Assessment @     146    MHz |
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | | **Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| | | | | | | **Back** | **Front** | | | |
| Roof (cnt) | HAD4007A | 2.15 | Highest Reading | E | 0.79 | 0.901 | 0.240 | 120.0 | 0.451 | **0.45** |

| | | | | | |
|---|---|---|---|---|---|
| Measurement Grid |
| **Test Position** | **% of Control Limit Head** | **% of Control Limit Chest** | **% of Control Limit Lower Trunk** | | |
| Back Seat | 158.7% | 83.4% | 28.3% | IEEE Controlled Limit: | 1.0 |
| Front Seat | 18.9% | 32.4% | 20.7% | IEEE Uncontrolled Limit: | 0.2 |
| | | | | RF Po (*Max): | 120 |

**Table 7**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | External Vehicle MPE Assessment @ | | 146 | MHz | | |
| Roof (cnt) | HAD4007A | 2.15 | 90 | H | 1 | 0.245 | 120.0 | 0.123 | **0.12** |

| | | Measurement Grid | | | | | | | |

| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 0.000 | 6 | 120 | 0.234 | 1.0 | 0.2 |
| 2 | 40 | 0.000 | 7 | 140 | 0.391 | | |
| 3 | 60 | 0.010 | 8 | 160 | 0.493 | | |
| 4 | 80 | 0.052 | 9 | 180 | 0.605 | | **RF Po (*Max)** |
| 5 | 100 | 0.132 | 10 | 200 | 0.533 | | 120 |

**Table 8**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Internal Vehicle MPE Assessment @ | | 146 | MHz | | | |
| Roof (cnt) | HAD4007A | 2.15 | Highest Reading | H | 1 | 0.242 | 0.254 | 120.0 | 0.127 | **0.13** |

| | Measurement Grid | | | | |

| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | | |
|---|---|---|---|---|---|
| Back Seat | 0.335 | 0.184 | 0.206 | IEEE Controlled Limit: | 1.0 |
| Front Seat | 0.243 | 0.331 | 0.187 | IEEE Uncontrolled Limit: | 0.2 |
| | | | | RF Po (*Max): | 120 |

**Table 9**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | External Vehicle MPE Assessment @ | | 155 | MHz | | |
| Roof (cnt) | HAD4008A | 2.15 | 90 | E | 0.8 | 0.412 | 120.0 | 0.206 | **0.21** |

| | | | Measurement Grid | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | | | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 6.7% | 6 | 120 | 55.3% | | | 1 | 0.200 |
| 2 | 40 | 8.1% | 7 | 140 | 78.1% | | | | |
| 3 | 60 | 13.4% | 8 | 160 | 71.6% | | | | |
| 4 | 80 | 16.7% | 9 | 180 | 72.4% | | | | **RF Po (*Max)** |
| 5 | 100 | 29.8% | 10 | 200 | 60.3% | | | | 120 |

**Table 10**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Internal Vehicle MPE Assessment @ | | 155 | MHz | | | | |
| Roof (cnt) | HAD4008A | 2.15 | Highest Reading | E | 0.8 | 0.540 | 0.205 | 120.0 | 0.270 | **0.27** |

| | | | | | |
|---|---|---|---|---|---|
| | | Measurement Grid | | | |
| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | IEEE Controlled Limit: | 1.0 |
| Back Seat | 73.4% | 52.3% | 36.4% | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 21.3% | 19.4% | 20.7% | RF Po (*Max): | 120 |

**Table 11**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | External Vehicle MPE Assessment @ | | | | 155 | MHz | | | |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4008A | 2.15 | 90 | H | 1 | 0.261 | 120.0 | 0.130 | **0.13** |

| | | Measurement Grid | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | | **IEEE Controlled Limit** | **IEEE Uncontrolled Limit** |
| 1 | 20 | 0.000 | 6 | 120 | 0.272 | | 1.0 | 0.2 |
| 2 | 40 | 0.000 | 7 | 140 | 0.453 | | | |
| 3 | 60 | 0.000 | 8 | 160 | 0.596 | | | |
| 4 | 80 | 0.071 | 9 | 180 | 0.573 | | | **RF Po (*Max)** |
| 5 | 100 | 0.143 | 10 | 200 | 0.501 | | | 120 |

**Table 12**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Internal Vehicle MPE Assessment @ | | | | | 155 | MHz | | | |
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2)** Back | Front | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4008A | 2.15 | Highest Reading | H | 1 | 0.191 | 0.315 | 120.0 | 0.157 | **0.16** |

| | | Measurement Grid | | | | |
|---|---|---|---|---|---|---|
| **Test Position** | **Magnetic Field Strength Head** | **Magnetic Field Strength Chest** | **Magnetic Field Strength Lower Trunk** | | IEEE Controlled Limit: | 1.0 |
| Back Seat | 0.342 | 0.183 | 0.049 | | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 0.401 | 0.386 | 0.157 | | **RF Po (*Max):** | 120 |

**Table 13**

| External Vehicle MPE Assessment @ | | | 173.9875 | **MHz** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4009A | 2.15 | 90 (actual 110) | E | 0.82 | 0.335 | 120.0 | 0.167 | **0.17** |

| Measurement Grid | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Test Position** | **Height (cm)** | **% of Control Limit** | **Test Position** | **Height (cm)** | **% of Control Limit** | | **IEEE Controlled Limit** | **IEEE Uncontrolled Limit** |
| 1 | 20 | 4.8% | 6 | 120 | 42.5% | | 1 | 0.200 |
| 2 | 40 | 5.0% | 7 | 140 | 54.8% | | | |
| 3 | 60 | 4.8% | 8 | 160 | 63.6% | | | |
| 4 | 80 | 10.7% | 9 | 180 | 65.3% | | | **RF Po (*Max)** |
| 5 | 100 | 27.6% | 10 | 200 | 55.7% | | | 120 |

**Table 14**

| Internal Vehicle MPE Assessment @ | | | | | | 173.9875 | **MHz** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2)** | | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| | | | | | | **Back** | **Front** | | | |
| Roof (cnt) | HAD4009A | 2.15 | Highest Reading | E | 0.82 | 0.212 | 0.331 | 120.0 | 0.165 | **0.17** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| **Test Position** | **% of Control Limit Head** | **% of Control Limit Chest** | **% of Control Limit Lower Trunk** | **IEEE Controlled Limit:** | 1.0 |
| Back Seat | 25.7% | 18.7% | 19.3% | **IEEE Uncontrolled Limit:** | 0.2 |
| Front Seat | 37.6% | 34.3% | 27.3% | **RF Po (*Max):** | 120 |

**Table 15**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| External Vehicle MPE Assessment @ 173.9875 MHz |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4009 A | 2.15 | 90 (actual 110) | H | 0.98 | 0.306 | 120.0 | 0.153 | **0.15** |

| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| Measurement Grid |
| 1 | 20 | 0.000 | 6 | 120 | 0.301 | 1.0 | 0.2 |
| 2 | 40 | 0.000 | 7 | 140 | 0.612 | | |
| 3 | 60 | 0.031 | 8 | 160 | 0.720 | | |
| 4 | 80 | 0.049 | 9 | 180 | 0.620 | | **RF Po (*Max)** |
| 5 | 100 | 0.150 | 10 | 200 | 0.580 | | 120 |

**Table 16**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Vehicle MPE Assessment @ 173.9875 MHz |
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2)** Back | Front | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4009 A | 2.15 | Highest Reading | H | 0.98 | 0.167 | 0.200 | 120.0 | 0.100 | **0.10** |

| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | | |
|---|---|---|---|---|---|
| Measurement Grid |
| Back Seat | 0.170 | 0.190 | 0.140 | IEEE Controlled Limit: | 1.0 |
| Front Seat | 0.180 | 0.210 | 0.209 | IEEE Uncontrolled Limit: | 0.2 |
| | | | | **RF Po (*Max):** | 120 |

**Table 17**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| External Vehicle MPE Assessment @ 155 MHz ||||||||||
| Roof (cnt) | HAD4014AR | 5.15 | 90 (actual 110) | E | 0.8 | 0.252 | 120.0 | 0.126 | **0.13** |

| Measurement Grid | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 4.8% | 6 | 120 | 15.3% | 1 | 0.200 |
| 2 | 40 | 5.0% | 7 | 140 | 25.6% | | |
| 3 | 60 | 7.5% | 8 | 160 | 40.7% | | |
| 4 | 80 | 5.8% | 9 | 180 | 61.5% | | RF Po (*Max) |
| 5 | 100 | 8.9% | 10 | 200 | 76.8% | | 120 |

**Table 18**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Vehicle MPE Assessment @ 155 MHz |||||||||||
| | | | | | | Back | Front | | | |
| Roof (cnt) | HAD4014AR | 5.15 | Highest Reading | E | 0.8 | 0.121 | 0.047 | 120.0 | 0.061 | **0.06** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | | |
| Back Seat | 14.5% | 12.3% | 9.5% | IEEE Controlled Limit: | 1.0 |
| Front Seat | 5.7% | 4.9% | 3.4% | IEEE Uncontrolled Limit: | 0.2 |
| | | | | RF Po (*Max): | 120 |

**Table 19**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **External Vehicle MPE Assessment @** | | | | | 155 | **MHz** | | | |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | HAD4014AR | 5.15 | 90 | H | 1 | 0.228 | 120.0 | 0.114 | **0.11** |
| **Measurement Grid** | | | | | | | | | |
| **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | | | **IEEE Controlled Limit** | **IEEE Uncontrolled Limit** |
| 1 | 20 | 0.000 | 6 | 120 | 0.080 | | | 1.0 | 0.2 |
| 2 | 40 | 0.000 | 7 | 140 | 0.190 | | | | |
| 3 | 60 | 0.030 | 8 | 160 | 0.401 | | | | |
| 4 | 80 | 0.050 | 9 | 180 | 0.660 | | | | **RF Po (*Max)** |
| 5 | 100 | 0.040 | 10 | 200 | 0.831 | | | | 120 |

**Table 20**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Internal Vehicle MPE Assessment @** | | | | | | 155 | **MHz** | | | |
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2)** | | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| | | | | | | **Back** | **Front** | | | |
| Roof (cnt) | HAD4014AR | 5.15 | Highest Reading | H | 1 | 0.106 | 0.100 | 120.0 | 0.053 | **0.05** |
| **Measurement Grid** | | | | | | | | | | |
| **Test Position** | **Magnetic Field Strength Head** | | **Magnetic Field Strength Chest** | | **Magnetic Field Strength Lower Trunk** | | **IEEE Controlled Limit:** | | 1.0 | |
| Back Seat | 0.131 | | 0.106 | | 0.081 | | **IEEE Uncontrolled Limit:** | | 0.2 | |
| Front Seat | 0.111 | | 0.101 | | 0.089 | | **RF Po (*Max):** | | 120 | |

**Table 21**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **External Vehicle MPE Assessment @** | | | | | | **155** | **MHz** | | |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | RAD4000 A | 5.15 | 90 | E | 0.8 | 0.210 | 120.0 | 0.105 | **0.11** |
| **Measurement Grid** | | | | | | | | | |
| **Test Position** | **Height (cm)** | **% of Control Limit** | | **Test Position** | **Height (cm)** | **% of Control Limit** | | **IEEE Controlled Limit** | **IEEE Uncontrolled Limit** |
| 1 | 20 | 3.8% | | 6 | 120 | 13.2% | | 1 | 0.200 |
| 2 | 40 | 4.1% | | 7 | 140 | 23.3% | | | |
| 3 | 60 | 5.6% | | 8 | 160 | 34.6% | | | |
| 4 | 80 | 4.9% | | 9 | 180 | 49.9% | | | **RF Po (*Max)** |
| 5 | 100 | 7.9% | | 10 | 200 | 62.3% | | | 120 |

**Table 22**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Internal Vehicle MPE Assessment @** | | | | | | **155** | **MHz** | | | |
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2)** | | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| | | | | | | **Back** | **Front** | | | |
| Roof (cnt) | RAD4000 A | 5.15 | Highest Reading | E | 0.8 | 0.095 | 0.042 | 120.0 | 0.048 | **0.05** |
| **Measurement Grid** | | | | | | | | | | |
| **Test Position** | **% of Control Limit Head** | | **% of Control Limit Chest** | **% of Control Limit Lower Trunk** | | | IEEE Controlled Limit: | | 1.0 | |
| Back Seat | 11.7% | | 9.7% | 7.1% | | | IEEE Uncontrolled Limit: | | 0.2 | |
| Front Seat | 4.6% | | 4.1% | 3.8% | | | **RF Po (*Max):** | | 120 | |

**Table 23**

| | | | | | | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| **External Vehicle MPE Assessment @** | | | | **155** | **MHz** | | | | |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | RAD4000A | 5.15 | 90 | H | 1 | 0.208 | 120.0 | 0.104 | **0.10** |
| **Measurement Grid** | | | | | | | | | |
| **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | | | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 0.031 | 6 | 120 | 0.133 | | | 1.0 | 0.2 |
| 2 | 40 | 0.027 | 7 | 140 | 0.180 | | | | |
| 3 | 60 | 0.081 | 8 | 160 | 0.320 | | | | |
| 4 | 80 | 0.110 | 9 | 180 | 0.450 | | | | **RF Po (*Max)** |
| 5 | 100 | 0.120 | 10 | 200 | 0.630 | | | | 120 |

**Table 24**

| | | | | | | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Internal Vehicle MPE Assessment @** | | | | **155** | **MHz** | | | | | |
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Back** | **Front** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | RAD4000A | 5.15 | Highest Reading | H | 1 | 0.071 | 0.064 | 120.0 | 0.036 | **0.04** |
| **Measurement Grid** | | | | | | | | | | |
| **Test Position** | **Magnetic Field Strength Head** | **Magnetic Field Strength Chest** | **Magnetic Field Strength Lower Trunk** | | | | IEEE Controlled Limit: | | 1.0 | |
| Back Seat | 0.080 | 0.072 | 0.061 | | | | IEEE Uncontrolled Limit: | | 0.2 | |
| Front Seat | 0.071 | 0.064 | 0.058 | | | | **RF Po (*Max):** | | 120 | |

**Table 25**

| | | | | | | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| **External Vehicle MPE Assessment @** | | | | | | | **155** | **MHz** | |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | RAD4010ARB | 5.15 | 90 | E | 0.8 | 0.261 | 120.0 | 0.131 | **0.13** |
| **Measurement Grid** | | | | | | | | | |
| **Test Position** | **Height (cm)** | **% of Control Limit** | **Test Position** | **Height (cm)** | **% of Control Limit** | | IEEE Controlled Limit | IEEE Uncontrolled Limit | |
| 1 | 20 | 5.1% | 6 | 120 | 15.4% | | 1 | 0.200 | |
| 2 | 40 | 5.8% | 7 | 140 | 23.1% | | | | |
| 3 | 60 | 7.9% | 8 | 160 | 39.5% | | | | |
| 4 | 80 | 6.4% | 9 | 180 | 65.7% | | | **RF Po (*Max)** | |
| 5 | 100 | 9.8% | 10 | 200 | 82.6% | | | 120 | |

**Table 26**

| | | | | | | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Internal Vehicle MPE Assessment @** | | | | | | **155** | **MHz** | | | |
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Back** | **Front** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Roof (cnt) | RAD4010ARB | 5.15 | Highest Reading | E | 0.8 | 0.142 | 0.056 | 120.0 | 0.071 | **0.07** |
| **Measurement Grid** | | | | | | | | | | |
| **Test Position** | **% of Control Limit Head** | **% of Control Limit Chest** | **% of Control Limit Lower Trunk** | | | | IEEE Controlled Limit: | 1.0 | | |
| Back Seat | 16.9% | 15.3% | 10.3% | | | | IEEE Uncontrolled Limit: | 0.2 | | |
| Front Seat | 7.6% | 4.9% | 4.3% | | | | **RF Po (*Max):** | 120 | | |

**Table 27**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| ... External Vehicle MPE Assessment @ 155 MHz | | | | | | | | | |
| Roof (cnt) | RAD4010ARB | 5.15 | 90 | H | 1 | 0.233 | 120.0 | 0.116 | **0.12** |

**Measurement Grid**

| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 0.051 | 6 | 120 | 0.140 | 1.0 | 0.2 |
| 2 | 40 | 0.083 | 7 | 140 | 0.221 | | |
| 3 | 60 | 0.111 | 8 | 160 | 0.384 | | |
| 4 | 80 | 0.130 | 9 | 180 | 0.449 | | **RF Po (*Max)** |
| 5 | 100 | 0.138 | 10 | 200 | 0.619 | | 120 |

**Table 28**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Vehicle MPE Assessment @ 155 MHz | | | | | | | | | | |
| Roof (cnt) | RAD4010ARB | 5.15 | Highest Reading | H | 1 | 0.322 | 0.335 | 120.0 | 0.167 | **0.17** |

**Measurement Grid**

| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | | |
|---|---|---|---|---|---|
| Back Seat | 0.143 | 0.092 | 0.730 | IEEE Controlled Limit: | 1.0 |
| | | | | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 0.145 | 0.109 | 0.750 | RF Po (*Max): | 120 |

**Table 29**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Roof (cnt) | RAD4010ARB | 5.15 | 90 | E | 0.78 | 0.097 | 121.0 | 0.049 | **0.05** |

External Vehicle MPE Assessment @ 136.0125 MHz

**Measurement Grid**

| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 3.5% | 6 | 120 | 7.8% | 1 | 0.200 |
| 2 | 40 | 3.8% | 7 | 140 | 11.7% | | |
| 3 | 60 | 4.2% | 8 | 160 | 16.8% | | |
| 4 | 80 | 3.1% | 9 | 180 | 20.1% | | **RF Po (*Max)** |
| 5 | 100 | 3.6% | 10 | 200 | 22.6% | | 120 |

**Table 30**

Internal Vehicle MPE Assessment @ 136.0125 MHz

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Back | Front | | | |
| Roof (cnt) | RAD4010ARB | 5.15 | Highest Reading | E | 0.78 | 0.071 | 0.036 | 121.0 | 0.036 | **0.04** |

**Measurement Grid**

| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | | |
|---|---|---|---|---|---|
| Back Seat | 11.3% | 5.7% | 4.3% | IEEE Controlled Limit: | 1.0 |
| | | | | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 5.6% | 2.7% | 2.4% | RF Po (*Max): | 120 |

**Table 31**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | External Vehicle MPE Assessment @ | | 136.0125 | MHz | | |
| Roof (cnt) | RAD4010ARB | 5.15 | 90 | H | 1.01 | 0.089 | 121.0 | 0.045 | **0.05** |

| Measurement Grid | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 0.000 | 6 | 120 | 0.051 | 1.0 | 0.2 |
| 2 | 40 | 0.000 | 7 | 140 | 0.092 | | |
| 3 | 60 | 0.000 | 8 | 160 | 0.160 | | |
| 4 | 80 | 0.000 | 9 | 180 | 0.260 | | **RF Po (*Max)** |
| 5 | 100 | 0.000 | 10 | 200 | 0.330 | | 120 |

**Table 32**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Internal Vehicle MPE Assessment @ | | 136.0125 | MHz | | | |
| Roof (cnt) | RAD4010ARB | 5.15 | Highest Reading | H | 1.01 | 0.063 | 0.086 | 121.0 | 0.043 | **0.04** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | | |
| Back Seat | 0.053 | 0.074 | 0.062 | IEEE Controlled Limit: | 1.0 |
| Front Seat | 0.109 | 0.077 | 0.071 | IEEE Uncontrolled Limit: | 0.2 |
| | | | | **RF Po (*Max):** | 120 |

**Table 33**

| | | | | | | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| **External Vehicle MPE Assessment @** | | | | **173.9875** | **MHz** | | | | |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | | | | |
| Roof (cnt) | RAD4010ARB | 5.15 | 90 | E | 0.82 | 0.030 | 120.0 | 0.015 | **0.02** |

| **Measurement Grid** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test Position** | **Height (cm)** | **% of Control Limit** | **Test Position** | **Height (cm)** | **% of Control Limit** | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 1.7% | 6 | 120 | 3.7% | 1 | 0.200 |
| 2 | 40 | 1.6% | 7 | 140 | 4.4% | | |
| 3 | 60 | 1.7% | 8 | 160 | 3.4% | | |
| 4 | 80 | 1.8% | 9 | 180 | 3.7% | | **RF Po (*Max)** |
| 5 | 100 | 2.8% | 10 | 200 | 4.8% | | 120 |

**Table 34**

| | | | | | | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Internal Vehicle MPE Assessment @** | | | | **173.9875** | **MHz** | | | | | |
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Back** | **Front** | | | |
| Roof (cnt) | RAD4010ARB | 5.15 | Highest Reading | E | 0.82 | 0.030 | 0.032 | 120.0 | 0.016 | **0.02** |

| **Measurement Grid** | | | | | |
|---|---|---|---|---|---|
| **Test Position** | **% of Control Limit Head** | **% of Control Limit Chest** | **% of Control Limit Lower Trunk** | | |
| Back Seat | 3.6% | 2.8% | 2.6% | IEEE Controlled Limit: | 1.0 |
| | | | | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 3.3% | 3.6% | 2.8% | **RF Po (*Max):** | 120 |

**Table 35**

| | | | | | | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | | | | |
| Roof (cnt) | RAD4010ARB | 5.15 | 90 | H | 0.98 | 0.096 | 120.0 | 0.048 | **0.05** |

| | | External Vehicle MPE Assessment @ | | | 173.9875 | MHz | | | |

| Measurement Grid | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 0.000 | 6 | 120 | 0.111 | | 1.0 | 0.2 |
| 2 | 40 | 0.000 | 7 | 140 | 0.128 | | | |
| 3 | 60 | 0.033 | 8 | 160 | 0.130 | | | |
| 4 | 80 | 0.042 | 9 | 180 | 0.190 | | | RF Po (*Max) |
| 5 | 100 | 0.071 | 10 | 200 | 0.250 | | | 120 |

**Table 36**

Internal Vehicle MPE Assessment @ 173.9875 MHz

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Back | Front | | | |
| Roof (cnt) | RAD4010ARB | 5.15 | Highest Reading | H | 0.98 | 0.056 | 0.066 | 120.0 | 0.033 | **0.03** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | IEEE Controlled Limit: | 1.0 |
| Back Seat | 0.061 | 0.055 | 0.051 | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 0.071 | 0.062 | 0.065 | RF Po (*Max): | 120 |

**Table 37**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **External Vehicle MPE Assessment @** | | **149** | **MHz** | | |
| Roof (cnt) | HAD4016A | 2.15 | 90 | E | 0.8 | 0.419 | 120.0 | 0.209 | **0.21** |

| | | | | | **Measurement Grid** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Test Position** | **Height (cm)** | **% of Control Limit** | **Test Position** | **Height (cm)** | **% of Control Limit** | | IEEE Controlled Limit | IEEE Uncontrolled Limit | |
| 1 | 20 | 9.6% | 6 | 120 | 44.8% | | 1 | 0.200 | |
| 2 | 40 | 11.5% | 7 | 140 | 73.3% | | | | |
| 3 | 60 | 13.9% | 8 | 160 | 86.5% | | | | |
| 4 | 80 | 14.4% | 9 | 180 | 79.7% | | | **RF Po (*Max)** | |
| 5 | 100 | 26.5% | 10 | 200 | 58.6% | | | 120 | |

**Table 38**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Internal Vehicle MPE Assessment @** | | **149** | **MHz** | | | |
| Roof (cnt) | HAD4016A | 2.15 | Highest Reading | E | 0.8 | 0.595 | 0.190 | 120.0 | 0.297 | **0.30** |

| | | | | **Measurement Grid** | |
|---|---|---|---|---|---|
| **Test Position** | **% of Control Limit Head** | **% of Control Limit Chest** | **% of Control Limit Lower Trunk** | IEEE Controlled Limit: | 1.0 |
| Back Seat | 89.4% | 58.9% | 30.1% | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 15.9% | 20.1% | 21.0% | **RF Po (*Max):** | 120 |

**Table 39**

| | | | | | | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | | | | |

<table>
<tr><td colspan="10" align="center"><b>External Vehicle MPE Assessment @     149   MHz</b></td></tr>
<tr><td>Roof (cnt)</td><td>HAD4016A</td><td>2.15</td><td>90</td><td>H</td><td>1</td><td>0.280</td><td>120.0</td><td>0.140</td><td><b>0.14</b></td></tr>
</table>

**Measurement Grid**

| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 0.000 | 6 | 120 | 0.253 | 1.0 | 0.2 |
| 2 | 40 | 0.000 | 7 | 140 | 0.435 | | |
| 3 | 60 | 0.032 | 8 | 160 | 0.604 | | |
| 4 | 80 | 0.071 | 9 | 180 | 0.676 | | **RF Po (*Max)** |
| 5 | 100 | 0.126 | 10 | 200 | 0.601 | | 120 |

**Table 40**

<table>
<tr><td colspan="11" align="center"><b>Internal Vehicle MPE Assessment @     149   MHz</b></td></tr>
<tr>
<td rowspan="2"><b>Antenna Location</b></td>
<td rowspan="2"><b>Antenna</b></td>
<td rowspan="2"><b>Gain (dBi)</b></td>
<td rowspan="2"><b>Meas. Distance (cm)</b></td>
<td rowspan="2"><b>E/H Field</b></td>
<td rowspan="2"><b>Cal. Factor</b></td>
<td colspan="2" align="center"><b>Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2)</b></td>
<td rowspan="2"><b>Initial Power (W)</b></td>
<td rowspan="2"><b>Pwr. Density Calc. (mW/cm^2)</b></td>
<td rowspan="2"><b>Pwr. Density Max Calc. (mW/cm^2)</b></td>
</tr>
<tr><td><b>Back</b></td><td><b>Front</b></td></tr>
<tr>
<td>Roof (cnt)</td><td>HAD4016A</td><td>2.15</td><td>Highest Reading</td><td>H</td><td>1</td><td>0.228</td><td>0.244</td><td>120.0</td><td>0.122</td><td><b>0.12</b></td>
</tr>
</table>

**Measurement Grid**

| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | | |
|---|---|---|---|---|---|
| Back Seat | 0.321 | 0.250 | 0.113 | IEEE Controlled Limit: | 1.0 |
| Front Seat | 0.342 | 0.285 | 0.104 | IEEE Uncontrolled Limit: | 0.2 |
| | | | | **RF Po (*Max):** | 120 |

**Table 41**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | External Vehicle MPE Assessment @ | | 136.0125 | MHz | | |
| Roof (cnt) | HAD4016 A | 2.15 | 90 | E | 0.78 | 0.222 | 121.0 | 0.111 | **0.11** |

| | | | **Measurement Grid** | | | | | | |

| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 7.8% | 6 | 120 | 26.4% | 1 | 0.200 |
| 2 | 40 | 9.4% | 7 | 140 | 39.3% | | |
| 3 | 60 | 11.1% | 8 | 160 | 42.7% | | |
| 4 | 80 | 8.7% | 9 | 180 | 33.6% | | **RF Po (*Max)** |
| 5 | 100 | 15.3% | 10 | 200 | 27.4% | | 120 |

**Table 42**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Internal Vehicle MPE Assessment @ | | 136.0125 | MHz | | | |
| Roof (cnt) | HAD4016 A | 2.15 | Highest Reading | E | 0.78 | 0.375 | 0.176 | 121.0 | 0.188 | **0.19** |

| | | **Measurement Grid** | | | |
|---|---|---|---|---|---|

| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | | |
|---|---|---|---|---|---|
| Back Seat | 49.7% | 37.1% | 25.8% | IEEE Controlled Limit: | 1.0 |
| | | | | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 32.1% | 12.1% | 8.7% | RF Po (*Max): | 120 |

**Table 43**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| External Vehicle MPE Assessment @ | | | | 136.0125 | MHz | | | | |
| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
| Roof (cnt) | HAD4016A | 2.15 | 90 | H | 1.01 | 0.422 | 121.0 | 0.211 | **0.21** |
| Measurement Grid | | | | | | | | | |
| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | | | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 0.177 | 6 | 120 | 0.480 | | | 1.0 | 0.2 |
| 2 | 40 | 0.180 | 7 | 140 | 0.596 | | | | |
| 3 | 60 | 0.240 | 8 | 160 | 0.680 | | | | |
| 4 | 80 | 0.261 | 9 | 180 | 0.690 | | | | RF Po (*Max) |
| 5 | 100 | 0.290 | 10 | 200 | 0.630 | | | | 120 |

**Table 44**

| | | | | | | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Vehicle MPE Assessment @ | | | | 136.0125 | MHz | | | | | |
| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
| Roof (cnt) | HAD4016A | 2.15 | Highest Reading | H | 1.01 | 0.555 | 0.533 | 121.0 | 0.278 | **0.28** |
| Measurement Grid | | | | | | | | | | |
| Test Position | Magnetic Field Strength Head | | Magnetic Field Strength Chest | | Magnetic Field Strength Lower Trunk | | | | | |
| Back Seat | 0.555 | | 0.531 | | 0.580 | | IEEE Controlled Limit: | | | 1.0 |
| Front Seat | 0.600 | | 0.620 | | 0.380 | | IEEE Uncontrolled Limit: | | | 0.2 |
| | | | | | | | RF Po (*Max): | | | 120 |

**Table 45**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | External Vehicle MPE Assessment @ 162 MHz | | | | |
| Roof (cnt) | HAD4016A | 2.15 | 90 (actual 110) | E | 0.81 | 0.331 | 120.0 | 0.165 | **0.17** |

| Measurement Grid | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 7.3% | 6 | 120 | 42.7% | 1 | 0.200 |
| 2 | 40 | 5.5% | 7 | 140 | 58.5% | | |
| 3 | 60 | 6.5% | 8 | 160 | 63.5% | | |
| 4 | 80 | 8.1% | 9 | 180 | 63.3% | | RF Po (*Max) |
| 5 | 100 | 24.3% | 10 | 200 | 51.1% | | 120 |

**Table 46**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Internal Vehicle MPE Assessment @ 162 MHz | | | | | |
| | | | | | | Back | Front | | | |
| Roof (cnt) | HAD4016A | 2.15 | Highest Reading | E | 0.81 | 0.493 | 0.169 | 120.0 | 0.247 | **0.25** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | IEEE Controlled Limit: | 1.0 |
| Back Seat | 62.5% | 50.1% | 35.4% | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 18.3% | 20.1% | 12.4% | RF Po (*Max): | 120 |

**Table 47**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **External Vehicle MPE Assessment @ 162 MHz** | | | |
| Roof (cnt) | HAD4016A | 2.15 | 90 (actual 110) | H | 0.99 | 0.238 | 120.0 | 0.119 | **0.12** |

| Measurement Grid | | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 0.000 | 6 | 120 | 0.192 | 1.0 | 0.2 |
| 2 | 40 | 0.000 | 7 | 140 | 0.363 | | |
| 3 | 60 | 0.021 | 8 | 160 | 0.485 | | |
| 4 | 80 | 0.053 | 9 | 180 | 0.591 | | **RF Po (*Max)** |
| 5 | 100 | 0.101 | 10 | 200 | 0.573 | | 120 |

**Table 48**

Internal Vehicle MPE Assessment @ 162 MHz

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Roof (cnt) | HAD4016A | 2.15 | Highest Reading | H | 0.99 | 0.118 | 0.166 | 120.0 | 0.083 | **0.08** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | IEEE Controlled Limit: | 1.0 |
| Back Seat | 0.190 | 0.120 | 0.045 | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 0.208 | 0.210 | 0.081 | RF Po (*Max): | 120 |

**Table 49**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| External Vehicle MPE Assessment @ | | | | | 160 MHz | | | | |
| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
| Roof (cnt) | HAD4017A | 2.15 | 90 | E | 0.81 | 0.337 | 120.0 | 0.168 | **0.17** |

| Measurement Grid | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 6.0% | 6 | 120 | 38.4% | 1 | 0.200 |
| 2 | 40 | 6.2% | 7 | 140 | 53.3% | | |
| 3 | 60 | 9.8% | 8 | 160 | 59.6% | | |
| 4 | 80 | 9.1% | 9 | 180 | 72.1% | | RF Po (*Max) |
| 5 | 100 | 23.3% | 10 | 200 | 58.8% | | 120 |

**Table 50**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Vehicle MPE Assessment @ | | | | | | 160 MHz | | | | |
| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
| Roof (cnt) | HAD4017A | 2.15 | Highest Reading | E | 0.81 | 0.435 | 0.193 | 120.0 | 0.218 | **0.22** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | IEEE Controlled Limit: | 1.0 |
| Back Seat | 50.6% | 43.1% | 36.9% | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 18.7% | 21.5% | 17.8% | RF Po (*Max): | 120 |

**Table 51**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | **External Vehicle MPE Assessment @** | | | **160** | **MHz** | | |
| Roof (cnt) | HAD4017A | 2.15 | 90 | H | 0.99 | 0.232 | 120.0 | 0.116 | **0.12** |

| | | | | **Measurement Grid** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | | IEEE Controlled Limit | IEEE Uncontrolled Limit | |
| 1 | 20 | 0.000 | 6 | 120 | 0.183 | | 1.0 | 0.2 | |
| 2 | 40 | 0.000 | 7 | 140 | 0.423 | | | | |
| 3 | 60 | 0.000 | 8 | 160 | 0.512 | | | | |
| 4 | 80 | 0.000 | 9 | 180 | 0.624 | | | **RF Po (*Max)** | |
| 5 | 100 | 0.091 | 10 | 200 | 0.491 | | | 120 | |

**Table 52**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Internal Vehicle MPE Assessment @** | | | **160** | **MHz** | | | |
| Roof (cnt) | HAD4017A | 2.15 | Highest Reading | H | 0.99 | 0.248 | 0.294 | 120.0 | 0.147 | **0.15** |

| | | | | **Measurement Grid** | | | |
|---|---|---|---|---|---|---|---|
| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | | IEEE Controlled Limit: | 1.0 | |
| Back Seat | 0.301 | 0.290 | 0.154 | | IEEE Uncontrolled Limit: | 0.2 | |
| Front Seat | 0.384 | 0.319 | 0.180 | | RF Po (*Max): | 120 | |

**Table 53**

| | | | | | | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | | | | |
| Roof (cnt) | HAD4017A | 2.15 | 90 | E | 0.79 | 0.279 | 120.0 | 0.140 | **0.14** |

External Vehicle MPE Assessment @ 146 MHz

Measurement Grid

| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 7.4% | 6 | 120 | 31.3% | 1 | 0.200 |
| 2 | 40 | 8.0% | 7 | 140 | 47.5% | | |
| 3 | 60 | 10.5% | 8 | 160 | 49.9% | | |
| 4 | 80 | 8.9% | 9 | 180 | 53.4% | | RF Po (*Max) |
| 5 | 100 | 19.8% | 10 | 200 | 42.6% | | 120 |

**Table 54**

Internal Vehicle MPE Assessment @ 146 MHz

| | | | | | | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Back | Front | | | |
| Roof (cnt) | HAD4017A | 2.15 | Highest Reading | E | 0.79 | 0.589 | 0.165 | 120.0 | 0.295 | **0.30** |

Measurement Grid

| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | | |
|---|---|---|---|---|---|
| Back Seat | 91.1% | 59.0% | 26.7% | IEEE Controlled Limit: | 1.0 |
| Front Seat | 11.3% | 20.4% | 17.8% | IEEE Uncontrolled Limit: | 0.2 |
| | | | | RF Po (*Max): | 120 |

**Table 55**

| | | | | | | | | Pwr. Density Calc. (mW/cm^2) | |
|---|---|---|---|---|---|---|---|---|---|
| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |

*(Header: External Vehicle MPE Assessment @ 146 MHz)*

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| Roof (cnt) | HAD4017A | 2.15 | 90 | H | 1 | 0.445 | 120.0 | 0.223 | **0.22** |

**Measurement Grid**

| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 0.221 | 6 | 120 | 0.470 | 1.0 | 0.2 |
| 2 | 40 | 0.220 | 7 | 140 | 0.541 | | |
| 3 | 60 | 0.280 | 8 | 160 | 0.690 | | RF Po (*Max) |
| 4 | 80 | 0.260 | 9 | 180 | 0.800 | | |
| 5 | 100 | 0.330 | 10 | 200 | 0.642 | | 120 |

**Table 56**

*(Header: Internal Vehicle MPE Assessment @ 146 MHz)*

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Roof (cnt) | HAD4017A | 2.15 | Highest Reading | H | 1 | 0.417 | 0.505 | 120.0 | 0.252 | **0.25** |

**Measurement Grid**

| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | | |
|---|---|---|---|---|---|
| | | | | IEEE Controlled Limit: | 1.0 |
| Back Seat | 0.540 | 0.330 | 0.380 | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 0.673 | 0.561 | 0.280 | RF Po (*Max): | 120 |

**Table 57**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| External Vehicle MPE Assessment @ | | | | 173.9875 | MHz | | | | |
| Roof (cnt) | HAD4017 A | 2.15 | 90 | E | 0.82 | 0.205 | 120.0 | 0.103 | **0.10** |

**Measurement Grid**

| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 2.9% | 6 | 120 | 23.6% | 1 | 0.200 |
| 2 | 40 | 3.2% | 7 | 140 | 34.4% | | |
| 3 | 60 | 3.3% | 8 | 160 | 38.5% | | |
| 4 | 80 | 6.9% | 9 | 180 | 40.3% | | **RF Po (*Max)** |
| 5 | 100 | 15.5% | 10 | 200 | 36.5% | | 120 |

**Table 58**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Vehicle MPE Assessment @ | | | | 173.9875 | MHz | | | | | |
| Roof (cnt) | HAD4017 A | 2.15 | Highest Reading | E | 0.82 | 0.125 | 0.137 | 120.0 | 0.069 | **0.07** |

**Measurement Grid**

| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | | |
|---|---|---|---|---|---|
| Back Seat | 15.9% | 11.1% | 10.4% | IEEE Controlled Limit: | 1.0 |
| | | | | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 16.1% | 12.3% | 12.8% | **RF Po (*Max):** | 120 |

**Table 59**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| External Vehicle MPE Assessment @ | | | 173.9875 | MHz | | | | | |
| Roof (cnt) | HAD4017A | 2.15 | 90 | H | 0.98 | 0.222 | 120.0 | 0.111 | **0.11** |

| Measurement Grid | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 0.041 | 6 | 120 | 0.268 | | 1.0 | 0.2 |
| 2 | 40 | 0.043 | 7 | 140 | 0.376 | | | |
| 3 | 60 | 0.083 | 8 | 160 | 0.450 | | | |
| 4 | 80 | 0.055 | 9 | 180 | 0.429 | | | RF Po (*Max) |
| 5 | 100 | 0.140 | 10 | 200 | 0.330 | | | 120 |

**Table 60**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Vehicle MPE Assessment @ | | | 173.9875 | MHz | | | | | | |
| Roof (cnt) | HAD4017A | 2.15 | Highest Reading | H | 0.98 | 0.251 | 0.250 | 120.0 | 0.126 | **0.13** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | IEEE Controlled Limit: | 1.0 |
| Back Seat | 0.256 | 0.278 | 0.220 | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 0.260 | 0.300 | 0.190 | RF Po (*Max): | 120 |

**Table 61**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Trunk (cnt) | HAD4014AR | 5.15 | 90 | E | 0.8 | 0.630 | 120.0 | 0.315 | **0.32** |

External Vehicle MPE Assessment @ 155 MHz

**Measurement Grid**

| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 5.8% | 6 | 120 | 72.8% | 1 | 0.200 |
| 2 | 40 | 6.5% | 7 | 140 | 116.3% | | |
| 3 | 60 | 14.6% | 8 | 160 | 126.7% | | |
| 4 | 80 | 24.7% | 9 | 180 | 128.5% | | RF Po (*Max) |
| 5 | 100 | 35.4% | 10 | 200 | 98.9% | | 120 |

**Table 62**

Internal Vehicle MPE Assessment @ 155 MHz

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Trunk (cnt) | HAD4014AR | 5.15 | Highest Reading | E | 0.8 | 0.324 | 0.055 | 120.0 | 0.162 | **0.16** |

**Measurement Grid**

| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | | |
|---|---|---|---|---|---|
| Back Seat | 45.6% | 31.5% | 20.1% | IEEE Controlled Limit: | 1.0 |
| Front Seat | 6.1% | 5.5% | 4.8% | IEEE Uncontrolled Limit: | 0.2 |
| | | | | RF Po (*Max): | 120 |

**Table 63**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| External Vehicle MPE Assessment @ | | | | | | 155 | MHz | | |
| Antenna Locatio n | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2 ) | Initial Powe r (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
| Trunk (cnt) | HAD4014A R | 5.15 | 90 | H | 1 | 0.601 | 120.0 | 0.300 | **0.30** |
| Measurement Grid | | | | | | | | | |
| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Positio n | Height (cm) | Meas. Pwr. Density (mW/cm^2) | | | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 0.101 | 6 | 120 | 0.300 | | | 1.0 | 0.2 |
| 2 | 40 | 0.090 | 7 | 140 | 0.804 | | | | |
| 3 | 60 | 0.220 | 8 | 160 | 1.325 | | | | |
| 4 | 80 | 0.290 | 9 | 180 | 1.513 | | | | RF Po (*Max) |
| 5 | 100 | 0.245 | 10 | 200 | 1.121 | | | | 120 |

**Table 64**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Vehicle MPE Assessment @ | | | | | | 155 | MHz | | | |
| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
| | | | | | | Back | Front | | | |
| Trunk (cnt) | HAD4014AR | 5.15 | Highest Reading | H | 1 | 0.137 | 0.000 | 120.0 | 0.069 | **0.07** |
| Measurement Grid | | | | | | | | | | |
| Test Position | Magnetic Field Strength Head | | Magnetic Field Strength Chest | | Magnetic Field Strength Lower Trunk | | | | | |
| Back Seat | 0.140 | | 0.131 | | 0.141 | | IEEE Controlled Limit: | | | 1.0 |
| | | | | | | | IEEE Uncontrolled Limit: | | | 0.2 |
| Front Seat | 0.000 | | 0.000 | | 0.000 | | RF Po (*Max): | | | 120 |

**Table 65**

| External Vehicle MPE Assessment @ | | | | | | 155 | MHz | | |
|---|---|---|---|---|---|---|---|---|---|
| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
| Trunk (cnt) | RAD4000A | 5.15 | 90 | E | 0.8 | 0.527 | 120.0 | 0.264 | **0.26** |
| Measurement Grid | | | | | | | | | |
| Test Position | Height (cm) | % of Control Limit | | Test Position | Height (cm) | % of Control Limit | | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 4.8% | | 6 | 120 | 60.3% | | 1 | 0.200 |
| 2 | 40 | 5.5% | | 7 | 140 | 93.9% | | | |
| 3 | 60 | 8.3% | | 8 | 160 | 111.5% | | | |
| 4 | 80 | 14.2% | | 9 | 180 | 113.4% | | | **RF Po (*Max)** |
| 5 | 100 | 29.8% | | 10 | 200 | 85.7% | | | 120 |

**Table 66**

| Internal Vehicle MPE Assessment @ | | | | | | 155 | MHz | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
| Trunk (cnt) | RAD4000A | 5.15 | Highest Reading | E | 0.8 | 0.340 | 0.046 | 120.0 | 0.170 | **0.17** |
| Measurement Grid | | | | | | | | | | |
| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | | | IEEE Controlled Limit: | | | 1.0 | |
| Back Seat | 49.1% | 32.5% | 20.3% | | | IEEE Uncontrolled Limit: | | | 0.2 | |
| Front Seat | 5.9% | 4.8% | 3.2% | | | RF Po (*Max): | | | 120 | |

**Table 67**

| External Vehicle MPE Assessment @ | | | | | | 155 | MHz | | |
|---|---|---|---|---|---|---|---|---|---|
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Trunk (cnt) | RAD4000A | 5.15 | 90 | H | 1 | 0.462 | 120.0 | 0.231 | **0.23** |

| Measurement Grid | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | | **IEEE Controlled Limit** | **IEEE Uncontrolled Limit** |
| 1 | 20 | 0.051 | 6 | 120 | 0.224 | | 1.0 | 0.2 |
| 2 | 40 | 0.023 | 7 | 140 | 0.560 | | | |
| 3 | 60 | 0.113 | 8 | 160 | 1.081 | | | |
| 4 | 80 | 0.084 | 9 | 180 | 1.223 | | | **RF Po (*Max)** |
| 5 | 100 | 0.098 | 10 | 200 | 1.161 | | | 120 |

**Table 68**

| Internal Vehicle MPE Assessment @ | | | | | | 155 | MHz | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2)** Back | Front | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Trunk (cnt) | RAD4000A | 5.15 | Highest Reading | H | 1 | 0.131 | 0.000 | 120.0 | 0.066 | **0.07** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| **Test Position** | **Magnetic Field Strength Head** | **Magnetic Field Strength Chest** | **Magnetic Field Strength Lower Trunk** | | |
| Back Seat | 0.170 | 0.114 | 0.110 | IEEE Controlled Limit: | 1.0 |
| Front Seat | 0.000 | 0.000 | 0.000 | IEEE Uncontrolled Limit: | 0.2 |
| | | | | **RF Po (*Max):** | 120 |

**Table 69**

| | | | | | | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| **External Vehicle MPE Assessment @** | | | | | | **155** | **MHz** | | |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | | | | |
| Trunk (cnt) | RAD4010ARB | 5.15 | 90 | E | 0.8 | 0.743 | 120.0 | 0.372 | **0.37** |

| Measurement Grid | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test Position** | **Height (cm)** | **% of Control Limit** | **Test Position** | **Height (cm)** | **% of Control Limit** | **IEEE Controlled Limit** | **IEEE Uncontrolled Limit** |
| 1 | 20 | 7.1% | 6 | 120 | 82.3% | 1 | 0.200 |
| 2 | 40 | 6.7% | 7 | 140 | 138.7% | | |
| 3 | 60 | 14.6% | 8 | 160 | 160.5% | | |
| 4 | 80 | 21.5% | 9 | 180 | 148.7% | | **RF Po (*Max)** |
| 5 | 100 | 34.7% | 10 | 200 | 128.3% | | 120 |

**Table 70**

| | | | | | | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Internal Vehicle MPE Assessment @** | | | | | | **155** | **MHz** | | | |
| **Antenna Location** | **Antenna** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Back** | **Front** | | | |
| Trunk (cnt) | RAD4010ARB | 5.15 | Highest Reading | E | 0.8 | 0.325 | 0.056 | 120.0 | 0.163 | **0.16** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| **Test Position** | **% of Control Limit Head** | **% of Control Limit Chest** | **% of Control Limit Lower Trunk** | IEEE Controlled Limit: | 1.0 |
| Back Seat | 49.5% | 30.3% | 17.8% | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 6.6% | 5.3% | 4.8% | **RF Po (*Max):** | 120 |

**Table71**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | External Vehicle MPE Assessment @ | | 155 | MHz | | |
| Trunk (cnt) | RAD4010ARB | 5.15 | 90 | H | 1 | 0.785 | 120.0 | 0.392 | **0.39** |

**Measurement Grid**

| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 0.118 | 6 | 120 | 0.280 | 1.0 | 0.2 |
| 2 | 40 | 0.140 | 7 | 140 | 0.860 | | |
| 3 | 60 | 0.220 | 8 | 160 | 1.473 | | |
| 4 | 80 | 0.310 | 9 | 180 | 2.261 | | **RF Po (*Max)** |
| 5 | 100 | 0.330 | 10 | 200 | 1.853 | | 120 |

**Table 72**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Internal Vehicle MPE Assessment @ | | 155 | MHz | | | |
| Trunk (cnt) | RAD4010ARB | 5.15 | Highest Reading | H | 1 | 0.196 | 0.060 | 120.0 | 0.098 | **0.10** |

**Measurement Grid**

| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | | |
|---|---|---|---|---|---|
| Back Seat | 0.220 | 0.180 | 0.187 | IEEE Controlled Limit: | 1.0 |
| Front Seat | 0.030 | 0.140 | 0.010 | IEEE Uncontrolled Limit: | 0.2 |
| | | | | RF Po (*Max): | 120 |

**Table 73**

| External Vehicle MPE Assessment @ | | | | | | 136.0125 | MHz | | |
|---|---|---|---|---|---|---|---|---|---|
| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
| Trunk (cnt) | RAD4010ARB | 5.15 | 90 | E | 0.78 | 0.171 | 121.0 | 0.085 | **0.09** |

| Measurement Grid | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 2.2% | 6 | 120 | 19.5% | 1 | 0.200 |
| 2 | 40 | 2.4% | 7 | 140 | 33.8% | | |
| 3 | 60 | 5.6% | 8 | 160 | 36.7% | | |
| 4 | 80 | 6.8% | 9 | 180 | 32.3% | | **RF Po (*Max)** |
| 5 | 100 | 11.3% | 10 | 200 | 20.2% | | 120 |

**Table 74**

| Internal Vehicle MPE Assessment @ | | | | | | 136.0125 | MHz | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
| Trunk (cnt) | RAD4010ARB | 5.15 | Highest Reading | E | 0.78 | 0.486 | 0.074 | 121.0 | 0.243 | **0.24** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | IEEE Controlled Limit: | 1.0 |
| Back Seat | 97.1% | 34.8% | 13.8% | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 10.6% | 6.9% | 4.8% | RF Po (*Max): | 120 |

**Table 75**

| | | | | | | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| External Vehicle MPE Assessment @        136.0125    MHz |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Trunk (cnt) | RAD4010ARB | 5.15 | 90 | H | 1.01 | 0.296 | 121.0 | 0.148 | **0.15** |

| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| Measurement Grid |
| 1 | 20 | 0.039 | 6 | 120 | 0.233 | 1.0 | 0.2 |
| 2 | 40 | 0.041 | 7 | 140 | 0.413 | | |
| 3 | 60 | 0.112 | 8 | 160 | 0.546 | | |
| 4 | 80 | 0.103 | 9 | 180 | 0.731 | | **RF Po (*Max)** |
| 5 | 100 | 0.125 | 10 | 200 | 0.620 | | 120 |

**Table 76**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) | | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Vehicle MPE Assessment @      136.0125     MHz |
| | | | | | | **Back** | **Front** | | | |
| Trunk (cnt) | RAD4010 ARB | 5.15 | Highest Reading | H | 1.01 | 0.483 | 0.150 | 121.0 | 0.242 | **0.24** |

| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | | |
|---|---|---|---|---|---|
| Measurement Grid |
| Back Seat | 0.630 | 0.390 | 0.430 | IEEE Controlled Limit: | 1.0 |
| Front Seat | 0.163 | 0.141 | 0.145 | IEEE Uncontrolled Limit: | 0.2 |
| | | | | **RF Po (*Max):** | 120 |

**Table 77**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | External Vehicle MPE Assessment @ | | | 173.9875 | MHz | | |
| Trunk (cnt) | RAD4010ARB | 5.15 | 90 | E | 0.82 | 0.051 | 120.0 | 0.025 | **0.03** |

**Measurement Grid**

| Test Position | Height (cm) | % of Control Limit | Test Position | Height (cm) | % of Control Limit | IEEE Controlled Limit | IEEE Uncontrolled Limit |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 1.8% | 6 | 120 | 4.4% | 1 | 0.200 |
| 2 | 40 | 2.0% | 7 | 140 | 6.2% | | |
| 3 | 60 | 2.2% | 8 | 160 | 8.3% | | |
| 4 | 80 | 2.3% | 9 | 180 | 9.7% | | RF Po (*Max) |
| 5 | 100 | 3.8% | 10 | 200 | 10.1% | | 120 |

**Table 78**

Internal Vehicle MPE Assessment @ 173.9875 MHz

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Trunk (cnt) | RAD4010ARB | 5.15 | Highest Reading | E | 0.82 | 0.092 | 0.025 | 120.0 | 0.046 | **0.05** |

**Measurement Grid**

| Test Position | % of Control Limit Head | % of Control Limit Chest | % of Control Limit Lower Trunk | | |
|---|---|---|---|---|---|
| Back Seat | 8.9% | 10.1% | 8.6% | IEEE Controlled Limit: | 1.0 |
| Front Seat | 2.1% | 2.7% | 2.8% | IEEE Uncontrolled Limit: | 0.2 |
| | | | | RF Po (*Max): | 120 |

**Table 79**

| Antenna Location | Antenna Model | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | External Vehicle MPE Assessment @ | | 173.9875 | MHz | | |
| Trunk (cnt) | RAD4010ARB | 5.15 | 90 | H | 0.98 | 0.104 | 120.0 | 0.052 | **0.05** |

| Measurement Grid | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | Test Position | Height (cm) | Meas. Pwr. Density (mW/cm^2) | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 0.000 | 6 | 120 | 0.100 | 1.0 | 0.2 |
| 2 | 40 | 0.000 | 7 | 140 | 0.113 | | |
| 3 | 60 | 0.000 | 8 | 160 | 0.121 | | |
| 4 | 80 | 0.000 | 9 | 180 | 0.280 | | RF Po (*Max) |
| 5 | 100 | 0.111 | 10 | 200 | 0.310 | | 120 |

**Table 80**

| Antenna Location | Antenna | Gain (dBi) | Meas. Distance (cm) | E/H Field | Cal. Factor | Average over Head, Chest, Lower Trunk Back/Front seats (mW/cm^2) Back | Front | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Internal Vehicle MPE Assessment @ | | 173.9875 | MHz | | | | |
| Trunk (cnt) | RAD4010ARB | 5.15 | Highest Reading | H | 0.98 | 0.178 | 0.000 | 120.0 | 0.089 | **0.09** |

| Measurement Grid | | | | | |
|---|---|---|---|---|---|
| Test Position | Magnetic Field Strength Head | Magnetic Field Strength Chest | Magnetic Field Strength Lower Trunk | | |
| Back Seat | 0.180 | 0.173 | 0.182 | IEEE Controlled Limit: | 1.0 |
| | | | | IEEE Uncontrolled Limit: | 0.2 |
| Front Seat | 0.000 | 0.000 | 0.000 | RF Po (*Max): | 120 |

**Table 81**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **External Vehicle MPE Assessment @** | | **155** | **MHz** | **(90 degree assessment)** | |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Trunk (cnt) | RAD4010ARB | 5.15 | 104 | E | 0.8 | 0.419 | 120.0 | 0.209 | **0.21** |
| **Measurement Grid** | | | | | | | | | |
| **Test Position** | **Height (cm)** | **% of Control Limit** | | **Test Position** | **Height (cm)** | **% of Control Limit** | | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 13.3% | | 6 | 120 | 29.8% | | 1 | 0.200 |
| 2 | 40 | 17.2% | | 7 | 140 | 63.5% | | | |
| 3 | 60 | 29.5% | | 8 | 160 | 77.6% | | | |
| 4 | 80 | 12.7% | | 9 | 180 | 86.5% | | | **RF Po (*Max)** |
| 5 | 100 | 14.3% | | 10 | 200 | 74.4% | | | 120 |

**Table 82**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **External Vehicle MPE Assessment @** | | **155** | **MHz** | **(90 degree assessment)** | |
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Trunk (cnt) | RAD4010ARB | 5.15 | 104 | H | 1 | 0.539 | 120.0 | 0.269 | **0.27** |
| **Measurement Grid** | | | | | | | | | |
| **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | | **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | | IEEE Controlled Limit | IEEE Uncontrolled Limit |
| 1 | 20 | 0.191 | | 6 | 120 | 0.320 | | 1.0 | 0.2 |
| 2 | 40 | 0.207 | | 7 | 140 | 0.610 | | | |
| 3 | 60 | 0.220 | | 8 | 160 | 1.000 | | | |
| 4 | 80 | 0.240 | | 9 | 180 | 1.203 | | | **RF Po (*Max)** |
| 5 | 100 | 0.272 | | 10 | 200 | 1.124 | | | 120 |

**Table 83**

| | | | | | | Average over Body (mW/cm^2) | Initial Power (W) | Pwr. Density Calc. (mW/cm^2) | Pwr. Density Max Calc. (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|---|
| \* \* \* | | | | | | | | | |

| External Vehicle MPE Assessment @ | | | | | | 155 | MHz | (45 degree assessment) | |
|---|---|---|---|---|---|---|---|---|---|
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Trunk (cnt) | RAD4010ARB | 5.15 | 99.5 | E | 0.8 | 0.434 | 120.0 | 0.217 | **0.22** |
| **Measurement Grid** | | | | | | | | | |
| **Test Position** | **Height (cm)** | **% of Control Limit** | | **Test Position** | **Height (cm)** | **% of Control Limit** | | **IEEE Controlled Limit** | **IEEE Uncontrolled Limit** |
| 1 | 20 | 12.3% | | 6 | 120 | 27.3% | | 1 | 0.200 |
| 2 | 40 | 17.4% | | 7 | 140 | 63.5% | | | |
| 3 | 60 | 24.3% | | 8 | 160 | 85.4% | | | |
| 4 | 80 | 9.6% | | 9 | 180 | 100.1% | | **RF Po (\*Max)** | |
| 5 | 100 | 11.1% | | 10 | 200 | 82.8% | | | 120 |

**Table 84**

| External Vehicle MPE Assessment @ | | | | | | 155 | MHz | (45 degree assessment) | |
|---|---|---|---|---|---|---|---|---|---|
| **Antenna Location** | **Antenna Model** | **Gain (dBi)** | **Meas. Distance (cm)** | **E/H Field** | **Cal. Factor** | **Average over Body (mW/cm^2)** | **Initial Power (W)** | **Pwr. Density Calc. (mW/cm^2)** | **Pwr. Density Max Calc. (mW/cm^2)** |
| Trunk (cnt) | RAD4010ARB | 5.15 | 99.5 | H | 1 | 0.510 | 120.0 | 0.255 | **0.26** |
| **Measurement Grid** | | | | | | | | | |
| **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | | **Test Position** | **Height (cm)** | **Meas. Pwr. Density (mW/cm^2)** | | **IEEE Controlled Limit** | **IEEE Uncontrolled Limit** |
| 1 | 20 | 0.150 | | 6 | 120 | 0.203 | | 1.0 | 0.2 |
| 2 | 40 | 0.130 | | 7 | 140 | 0.480 | | | |
| 3 | 60 | 0.171 | | 8 | 160 | 1.013 | | | |
| 4 | 80 | 0.230 | | 9 | 180 | 1.245 | | **RF Po (\*Max)** | |
| 5 | 100 | 0.200 | | 10 | 200 | 1.278 | | | 120 |

## 12.0    Conclusion

Depending on the test frequency, compliance assessments were performed with an output power range of 120.0W to 121.0W. The maximum RF power allowable will be equal to the upper limit of the final test factory transmit power specification of 120.0W. The highest power density result scaled to the maximum allowable power output is 0.45mW/cm$^2$ internal to the vehicle and 0.39mW/cm$^2$  external to the vehicle.

The MPE results presented herein demonstrate compliance to the applicable Occupational/Controlled exposure limit of 1.0mW/cm$^2$ for the frequency range of 30-300MHz

Compliance to the General population/Uncontrolled limits is demonstrated by S.A.R. computational assessments of specific MPE non-compliant passenger and by-stander test conditions* (see section 11.0). APPENDIX D presents computational S.A.R. results demonstrating compliance to the applicable General Population/Uncontrolled S.A.R. exposure limit of 1.6mW/g and therefore also demonstrates compliance to the MPE General Population/Uncontrolled limits.

The computational results show that this device, when used with the offered antennas in accordance with the user manual instructions, exhibits a maximum peak 1-g average S.A.R. of 0.50mW/g for passengers internal to the vehicle and a maximum peak 1-g average S.A.R. of 1.14mW/g for by-standers external to the vehicle.

Notes:
1) Tables 2, 4, 5, 6, 9, 10, 37, 38, 43, 44, 46, 50, 54, 55, 56, 61, 63, 65, 67, 69, 71, 74, 76, 81, 82, 83, and 84 reflect the worst-case passenger and by-stander test configuration conditions that exceed the applicable MPE power density specification limits. The test conditions were analyzed computationally to assess performance to the applicable S.A.R. exposure specification limit. APPENDIX D of this report presents computational EME compliance assessment results for FCC ID: AZ492FT3808 performed by the Motorola Corporate Research Lab located in Plantation Florida using a commercial code based on FDTD (Finite Difference Time Domain) methodology. The computational results are provided herein in order to demonstrate the EME compliance of this device with respect to the IEEE Std C95.1-1999 specific absorption rate (S.A.R.) exposure limit.

**Antenna Location Drawing with Test Locations Identified**



**97**cm
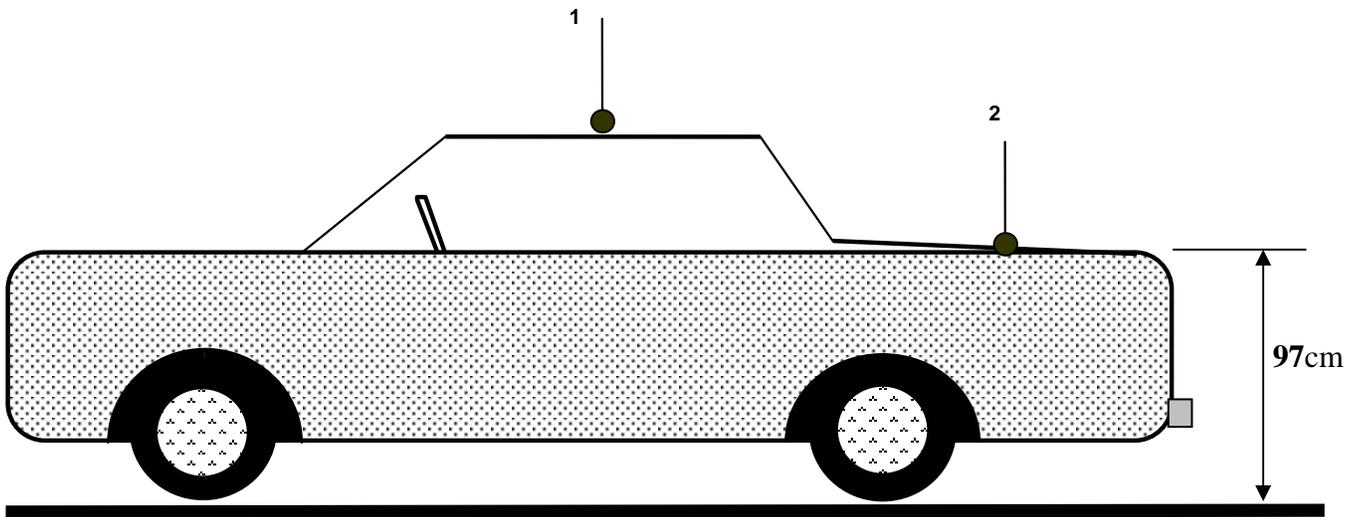
1 - Roof (center)
2 - Trunk (center)
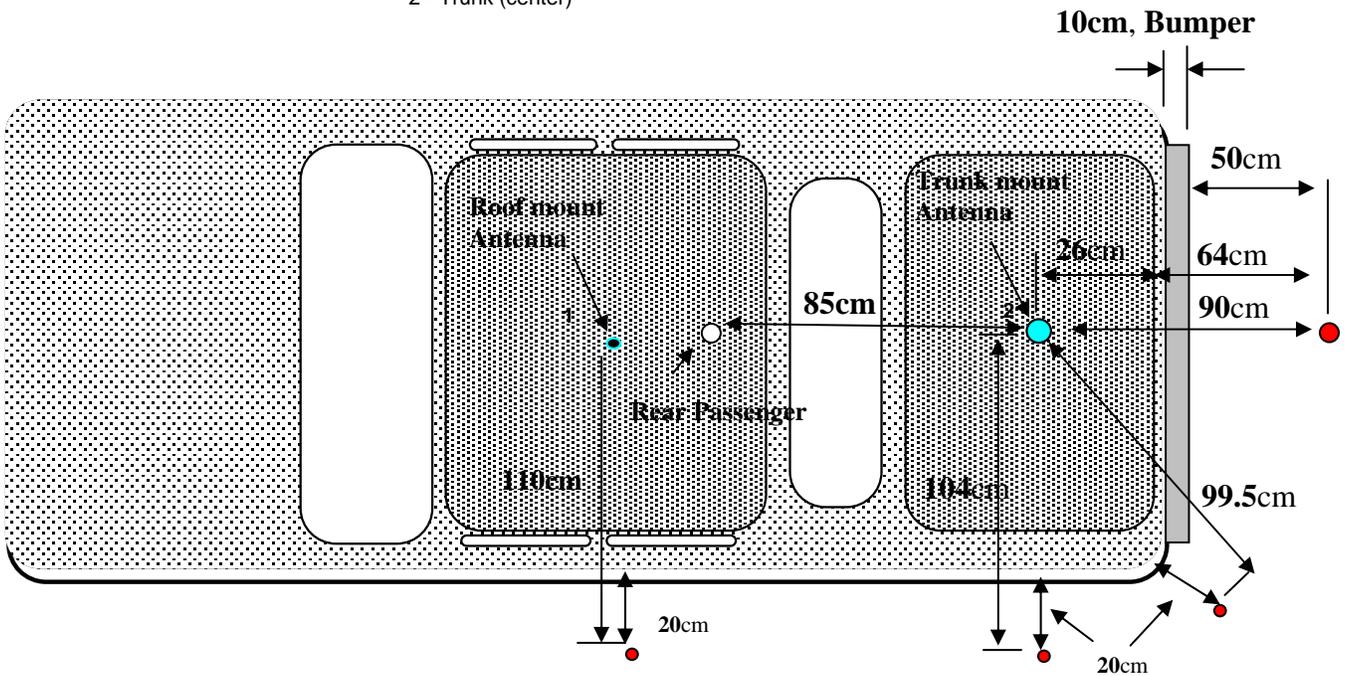
**10cm, Bumper**

**50**cm

**64**cm

**90**cm

**85cm**

**26cm**

Roof mount Antenna

Trunk mount Antenna

Rear Passenger

**110cm**

**104cm**

**99.5cm**

**20**cm

**20**cm

Note: • Test Locations

# APPENDIX B

## Meter/Probe Calibration Certificates

RFNRA002

# Certificate of Calibration

**L3 communications**
Narda Microwave-East

L-3 Communications, Narda Microwave-East, hereby certifies that the referenced RF Radiation Hazard monitoring equipment has been calibrated in accordance with MIL-STD-45662A, ANSI Z540, ISO 10012 and ISO 9001:2000.

The measured values were determined by comparison with our standards, which are traceable to the National Institute of Standards and Technology to the extent allowed by NIST's calibration facilities.

Customer:    MOTOROLA INC
FORT LAUDERDALE, FL 33322

Model #:    8718-10        Serial #:    01108      Certificate #: 44172 1
Description:    METER W/CABLE      PO #:    NP116429-V3
Date Calibrated:    04/07/2004      R.O.#: 44172

Vince Donovan
Manager of Instruments Assembly and Test
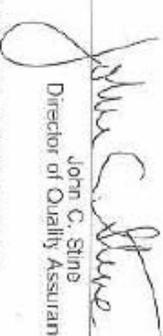
John C. Stine
Director of Quality Assurance

This certificate shall not be reproduced, except in full, without written approval from L-3 Communications, Narda Microwave-East

PKM18002
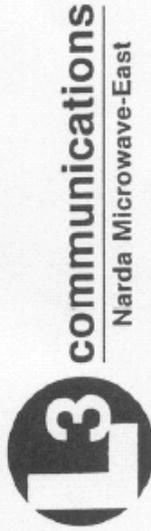
NARDA MICROWAVE-EAST
CALIBRATED IN ACCORDANCE
WITH ANSI Z540
CAL DATE 11-5-03 BY M
CAL DUE 11-5-05
MOD 8722B S/N 12023

# Certificate of Calibration

L3 communications
Narda Microwave-East

L-3 Communications, Narda Microwave-East, hereby certifies that the referenced RF Radiation Hazard monitoring equipment has been calibrated in accordance with MIL-STD-45662A, ANSI Z540, ISO 10012 and ISO 9001.

The measured values were determined by comparison with our standards, which are traceable to the National Institute of Standards and Technology to the extent allowed by NIST's calibration facilities.

Certificate #: 40348 2

Customer: MOTOROLA
SCHAUMBURG, IL 60168-0429

Model #: 8722B                    Serial #: 12023
Description: RAD MONITOR    8722B    PO #: NP984832
Date Calibrated: 11/05/2003          R.O. #: 40348

Vince Donovan
Manager of Instruments Assembly and Test

John C. Stine
Director of Quality Assurance

This certificate shall not be reproduced, except in full, without written approval from L-3 Communications, Narda Microwave-East.

PRNRH003

# Certificate of Calibration

L-3 communications
Narda Microwave-East

L-3 Communications, Narda Microwave-East, hereby certifies that the referenced RF Radiation Hazard monitoring equipment has been calibrated in accordance with MIL-STD-45662A, ANSI Z540, ISO 10012 and ISO 9001:2000.

The measured values were determined by comparison with our standards, which are traceable to the National Institute of Standards and Technology to the extent allowed by NIST's calibration facilities.

Customer:     MOTOROLA INC
              FORT LAUDERDALE, FL 33322

Model #:      8731                              Certificate #: 44172 2

Description:  RAD MONITOR                       Serial #:     03006

Date Calibrated:  04/07/2004                    PO #:         NP116042P-V3
                                                R.O. #: 44172

Vince Donovan
Manager of Instruments Assembly and Test

John C. Stine
Director of Quality Assurance

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DATE    06-May-2003                                      RELEASE # R35740
REL HUMIDITY  26%                                        TEMP 25 DEG. C

NARDA MICROWAVE - EAST

MODEL #  8722B
SERIAL # 13001

Recal Probe - Date of Previous Probe Data = 03/28/2002

| FREQ MHZ | PRE-CAL DATA | FINAL CAL DATA | ELLIPSE RATIO, dB | FINAL CORR. FACTOR | DEVIATION DELTA DB | PREVIOUS FINAL CORR |
|---|---|---|---|---|---|---|
| .30 | 0.72 | 0.77 | +/- 0.40 | 1.30 | -2.58 | * 0.77 |
| 3.00 | 1.24 | 1.33 | +/- 0.21 | 0.75 | -0.43 | 0.73 |
| 10.00 | 0.86 | 0.92 | +/- 0.20 | 1.08 | -0.04 | 1.15 |
| 30.00 | 0.70 | 0.75 | +/- 0.09 | 1.34 | +0.06 | 1.46 |
| 100.00 | 1.23 | 1.32 | +/- 0.14 | 0.76 | -0.04 | 0.80 |
| 300.00 | 0.91 | 0.98 | +/- 0.14 | 1.02 | +0.38 | 1.20 |
| 750.00 | 1.16 | 1.24 | +/- 0.19 | 0.80 | -0.35 | 0.80 |
| 1000.00 | 1.25 | 1.34 | +/- 0.24 | 0.75 | -0.67 | 0.69 |
| 1700.00 | 0.97 | 1.04 | +/- 0.45 | 0.96 | +1.09 | 1.33 |
| 2450.00 | 1.09 | 0.99 | +/- 0.40 | 1.01 | +1.16 | 1.20 |
| 4000.00 | 1.03 | 0.93 | +/- 0.21 | 1.07 | +1.35 | 1.33 |
| 8200.00 | 1.21 | 1.09 | +/- 0.69 | 0.91 | +1.08 | 1.06 |
| 10000.00 | 1.16 | 1.05 | +/- 0.63 | 0.96 | +0.90 | 1.07 |
| 18000.00 | 1.38 | 1.25 | +/- 0.83 | 0.80 | +0.18 | 0.75 |
| 26500.00 | 1.25 | 1.13 | +/- 0.98 | 0.89 | +0.45 | 0.89 |
| 40000.00 | 0.89 | 0.80 | +/- 0.92 | 1.25 | +0.06 | 1.15 |

LOW FREQUENCY MULTIPLIER = 1.073    HIGH FREQUENCY MULTIPLIER = 0.905
FREQ. DEV. (3-40000 MHZ) = 2.549 DB
FREQ. DEV. (0.3-40000 MHZ) = 2.55 DB
MAX. ELLIPSE RATIO (0.3-40000 MHZ) = +/- 0.98 DB
PRE-CAL DATA REFLECTS THE MEAN ELLIPSE RATIO OF PROBE AS RECEIVED BY
NARDA CALIBRATION DEPARTMENT, OR IS THE INITIAL, UN-ADJUSTED RATIO.
(PRE-CAL x OLD CORR. FACTOR) - 1 = DEVIATION FROM PREVIOUS (OLD)
CALIBRATION DATA. NOTE: NOT APPLICABLE FOR NEW PROBES.
FINAL CAL DATA IS THE RATIO OF THE DISPLAYED TO THE APPLIED FIELD STRENGTH.
FINAL CORR. FACTOR IS THE RECIPROCAL OF FINAL CAL DATA.
FINAL CORR. FACTOR MULTIPLIED BY THE DISPLAYED FIELD STRENGTH READING
GIVES THE ACTUAL ("CORRECTED") FIELD STRENGTH.
ELLIPSE RATIO IS EXPRESSED IN dB DEVIATION FROM THE MEAN DATA
RMS Uncertainty = +/- 0.5db.  ATP # = 502120 REV J

TESTER    *V. VY*          Q.A. APPROVAL

narda
microwave-east
an [k] communications company
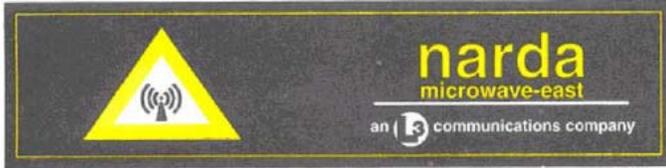
DATE    21-Mar-2003                                    RELEASE # R33484
REL HUMIDITY  37%                                      TEMP 24 DEG. C

NARDA MICROWAVE - EAST

MODEL #  8731
SERIAL # 03006

| FREQ MHZ | PRE-CAL DATA | FINAL CAL DATA | ELLIPSE RATIO, dB | FINAL CORR FACTOR |
|----------|--------------|----------------|-------------------|-------------------|
| 10.00    | 0.97         | 0.92           | +/- 0.02          | 1.09              |
| 13.56    | 1.01         | 0.96           | +/- 0.02          | 1.05              |
| 27.12    | 1.03         | 0.97           | +/- 0.02          | 1.03              |
| 40.68    | 1.02         | 0.97           | +/- 0.02          | 1.04              |
| 50.00    | 1.02         | 0.97           | +/- 0.04          | 1.03              |
| 75.00    | 1.02         | 0.97           | +/- 0.02          | 1.04              |
| 100.00   | 1.02         | 0.97           | +/- 0.04          | 1.03              |
| 150.00   | 1.08         | 1.02           | +/- 0.02          | 0.98              |
| 200.00   | 1.10         | 1.05           | +/- 0.08          | 0.96              |
| 250.00   | 1.10         | 1.04           | +/- 0.06          | 0.96              |
| 300.00   | 1.12         | 1.06           | +/- 0.18          | 0.94              |

MULTIPLIER = 0.951
FREQ. DEV. (13-200 MHZ) = 0.392 DB
FREQ. DEV. (10-300 MHZ) = 0.63 DB
MAX. ELLIPSE RATIO (10-300 MHZ) = +/- 0.18 DB
ORIGINAL RESISTANCE = 619 OHMS
FINAL RESISTANCE = 589 OHMS
THERMOCOUPLE OUTPUT AT FULL SCALE POWER DENSITY = V = 105.09 mV


PRE-CAL DATA REFLECTS THE MEAN ELLIPSE RATIO OF PROBE AS RECEIVED BY
NARDA CALIBRATION DEPARTMENT, OR IS THE INITIAL, UN-ADJUSTED RATIO.
(PRE-CAL x OLD CORR. FACTOR) - 1 = DEVIATION FROM PREVIOUS (OLD)
CALIBRATION DATA. NOTE: NOT APPLICABLE FOR NEW PROBES.
FINAL CAL DATA IS THE RATIO OF THE DISPLAYED TO THE APPLIED FIELD STRENGTH.
FINAL CORR. FACTOR IS THE RECIPROCAL OF FINAL CAL DATA.
FINAL CORR. FACTOR MULTIPLIED BY THE DISPLAYED FIELD STRENGTH READING
GIVES THE ACTUAL ("CORRECTED") FIELD STRENGTH.

ELLIPSE RATIO IS EXPRESSED IN dB DEVIATION FROM THE MEAN DATA
RMS Uncertainty = +/- 0.5db.  ATP # = 503195 REV D

TESTER _____ L.V _____        Q.A. APPROVAL _____ _____

# APPENDIX C
## Photos of Assessed Antennas
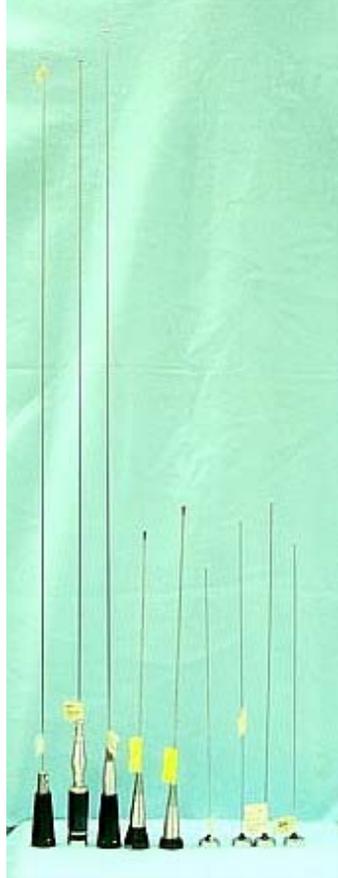
**Antenna kit numbers, from left to right; RAD4000A, HAD4014AR, RAD4010ARB, HAD4017A, HAD4006A, HAD4009A, HAD4007A, HAD4016A, HAD4008A,**

# APPENDIX D
## Computational EME SAR Compliance Assessment

**COMPUTATIONAL EME COMPLIANCE ASSESSMENT OF THE XTL5000**

**VHF MOBILE RADIO, MODEL # M20KTS9PW1AN, FCC ID AZ492FT3808**

**July 19, 2004 – Revised August 26, 2004**

Giorgi Bit-Babik and Antonio Faraone

Motorola Corporate EME Research Lab, Plantation, Florida

**Introduction**

This report summarizes the computational [numerical modeling] analysis performed to document compliance of the XTL5000 VHF, Model Number M20KTS9PW1AN, Mobile Radio and vehicle-mounted antennas with the Federal Communications Commission (FCC) guidelines for human exposure to radio frequency (RF) emissions. The radio operates in the 136 - 174 MHz frequency band.

This computational analysis supplements the measurements conducted to evaluate the FCC *maximum permissible exposure* (MPE) limits for this mobile device. All test conditions (26 in total) that did not conform with applicable MPE limits were subdivided into two groups — bystander exposures and passenger exposures — and analyzed to determine whether those conditions complied with the *specific absorption rate* (SAR) limits for general public exposure (1.6 W/kg averaged over 1 gram of tissue and 0.08 W/kg averaged over the whole body) set forth in FCC guidelines, which are based on the IEEE C95.1-1999 standard [1]. For both groups, a commercial code based on Finite-Difference-Time-Domain (FDTD) methodology was employed to carry out the computational analysis. It is well established and recognized within the scientific community that SAR is the primary dosimetric quantity used to evaluate the human body's absorption of RF energy and that MPEs are in fact derived from SAR. Accordingly, the SAR computations provide a scientifically valid and more accurate estimate of human exposure to RF energy.

**Method**

The simulation code employed is XFDTD™ v5.3, by Remcom Inc., State College, PA. This computational suite features a heterogeneous full body standing model (High Fidelity Body Mesh), derived from the so-called Visible Human [2], discretized in 5 mm voxels. The dielectric properties of 23 body tissues are automatically assigned by XFDTD™ at any specific frequency. The "seated" man model was obtained from the standing model by modifying the articulation angles at the hips and the knees. Details of the computational method and model are provided in the Appendix to this report, following the structure outlined in Appendix B.III of the Supplement C to the FCC OET Bulletin 65.

The car model has been imported into XFDTD™ from the CAD file of a sedan car having dimensions 4.98 m (L) x 1.85 m (W) x 1.18 m (H), and discretized in 5mm voxels. For trunk mounted antennas, the wheels and part of the hood were omitted in order to fit within the computational memory (3 GB) available. For roof mounted antennas, part of the trunk had to be removed while maintaining the integrity of the roof connection with the car body. These omissions would not be expected to affect the exposure calculations in any event.

For bystander exposure, the antenna position is 26 cm from the end of the trunk, so as to replicate the experimental conditions used in MPE measurements. For passenger exposure, the distance of trunk mounted antennas from the passenger head was set at 85 cm, so as to replicate the experimental conditions used in MPE measurements. Figures 1 shows one of the XFDTD™ computational models used for bystander exposure. Figures 2 and 3 show some of the XFDTD™ computational models used for passenger exposure to trunk and roof mounted antennas, respectively.
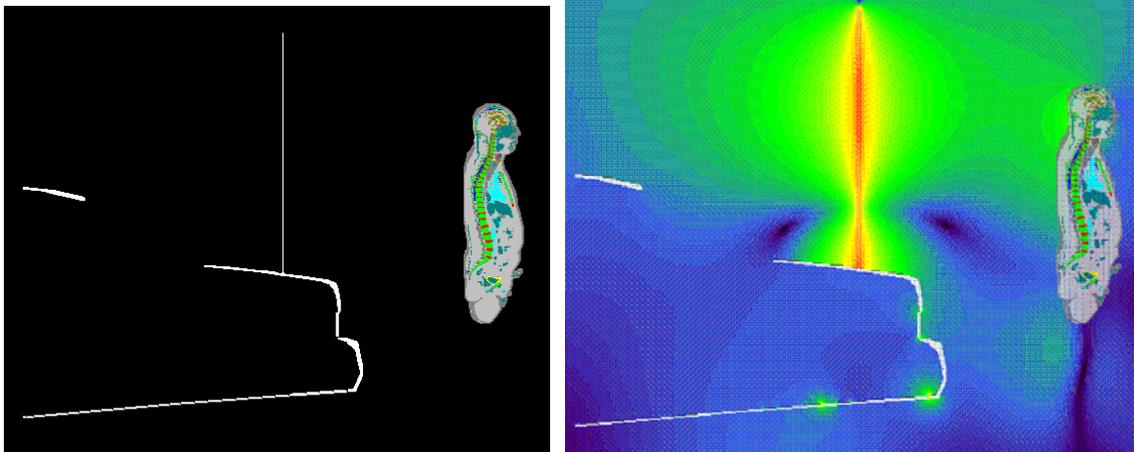
**Figure 1: Bystander model exposed to a trunk-mount gain antenna (121.5 cm) operating at 155 MHz: XFDTD geometry and H-field distribution. The antenna is mounted in the center of the trunk.**
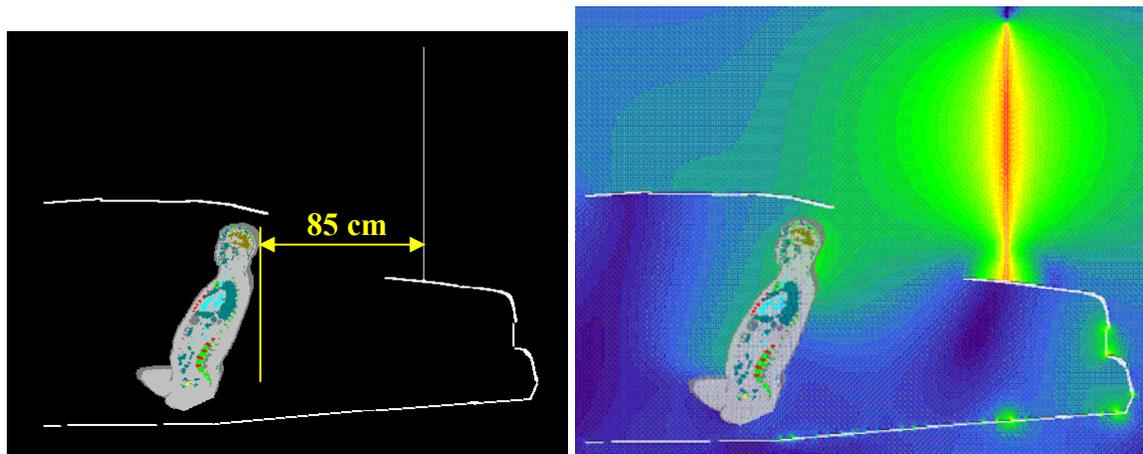


85 cm

**Figure 2: Passenger model exposed to a trunk-mount gain antenna (121.5 cm) operating at 155 MHz: XFDTD geometry and H-field distribution. The antenna is mounted at 85 cm from the passenger.**
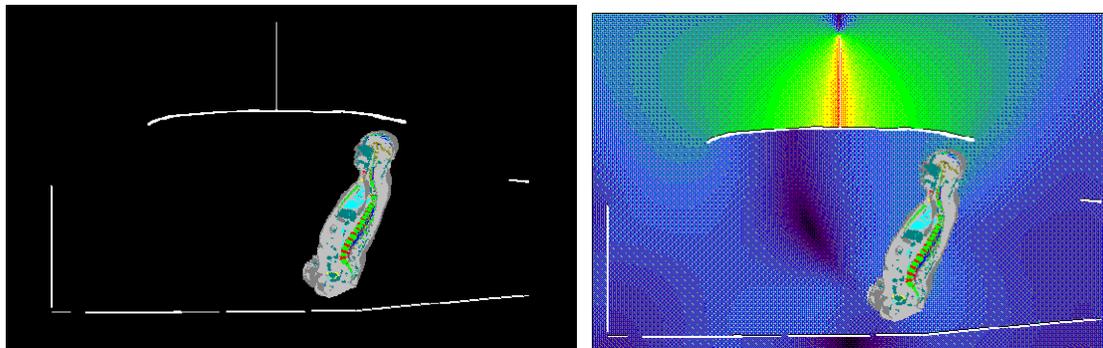


**Figure 3: Passenger model exposed to a roof-mount quarter-wave antenna operating at 136 MHz: XFDTD geometry and H-field distribution. The antenna is mounted in the center of the roof.**

The computational code employs a time-harmonic excitation to produce a steady state electromagnetic field in the exposed body. Subsequently, the corresponding SAR distribution is automatically processed in order to determine the whole-body and 1-g average SAR. The product maximum output power is 120 W rms. Since the ohmic losses in the cable and in the car materials, as well as the mismatch losses at the antenna feed-point, are neglected, and source-based time averaging (50% talk time) is employed, all computational results are normalized to half of it, i.e., 60 W *rms* net output power.

**Results of SAR computations for bystanders**

The test conditions requiring SAR computations are summarized in Tables I and II, together with other relevant information and the SAR results. With trunk mount antennas, the bystander is placed next to the trunk of the car, straight back, at 45 degrees from the longitudinal car centerline, and at 90 degrees from it, at a distance of 90 cm from the antenna while maintaining at least 20 cm from the vehicle body, so as to replicate the conditions used in MPE measurements. With roof mount antennas, the bystander is placed on the side of the car, facing or looking away from the antenna, at a distance of 90 cm from the antenna while maintaining at least 20 cm from the vehicle body. Twenty cases of bystander - facing towards to or away from the car - were simulated individually.

Table I: Results of the SAR computations for bystander exposure (50% talk-time) behind the car at a separation distance of 90 cm from the trunk-mount antenna while maintaining at least 20 cm from the vehicle body.

| Antenna Kit # | Antenna length | | Freq [MHz] | Bystander exposure | Exposure angle | SAR [W/kg] | |
|---|---|---|---|---|---|---|---|
| | Physical | XFDTD | | | | 1-g | WB |
| **HAD4014A** | 116.8 cm | 117 cm | 155 | Front | 0 deg | 1.14 | 0.018 |
| **HAD4014A** | 116.8 cm | 117 cm | 155 | Back | 0 deg | 0.75 | 0.018 |
| **RAD4000A** | 118.5 cm | 118.5 cm | 155 | Front | 0 deg | 1.08 | 0.017 |
| **RAD4000A** | 118.5 cm | 118.5 cm | 155 | Back | 0 deg | 0.96 | 0.017 |
| **RAD4010ARB** | 121.4 cm | 121.5 cm | 155 | Front | 0 deg | 1.00 | 0.016 |
| **RAD4010ARB** | 121.4 cm | 121.5 cm | 155 | Back | 0 deg | 0.98 | 0.017 |
| **RAD4010ARB** | 121.4 cm | 121.5 cm | 155 | Front | 45 deg | 0.94 | 0.017 |
| **RAD4010ARB** | 121.4 cm | 121.5 cm | 155 | Back | 45 deg | 0.98 | 0.017 |
| **RAD4010ARB** | 121.4 cm | 121.5 cm | 155 | Front | 90 deg | 0.73 | 0.015 |
| **RAD4010ARB** | 121.4 cm | 121.5 cm | 155 | Back | 90 deg | 0.69 | 0.016 |

Table II: Results of the SAR computations for bystander exposure (50% talk-time) on the side of the car at a separation distance of 90 cm from the roof-mount antenna while maintaining at least 20 cm from the vehicle body.

| Antenna Kit # | Antenna length | | Freq [MHz] | Bystander exposure | SAR [W/kg] | |
|---|---|---|---|---|---|---|
| | Physical | XFDTD | | | | |
| HAD4007A | 49 cm | 49 cm | 146 | Front | 0.57 | 0.012 |
| HAD4007A | 49 cm | 49 cm | 146 | Back | 0.46 | 0.012 |
| HAD4008A | 45.6 cm | 45.5 cm | 155 | Front | 0.81 | 0.018 |
| HAD4008A | 45.6 cm | 45.5 cm | 155 | Back | 0.61 | 0.019 |
| HAD4016A | 50.5 cm | 50.5 cm | 136 | Front | 0.32 | 0.012 |
| HAD4016A | 50.5 cm | 50.5 cm | 136 | Back | 0.47 | 0.013 |
| HAD4016A | 50.5 cm | 50.5 cm | 149 | Front | 0.71 | 0.014 |
| HAD4016A | 50.5 cm | 50.5 cm | 149 | Back | 0.53 | 0.014 |
| HAD4017A | 47.5 cm | 47.5 cm | 146 | Front | 0.59 | 0.012 |
| HAD4017A | 47.5 cm | 47.5 cm | 146 | Back | 0.47 | 0.012 |

Limited to the cases of the trunk-mount antennas analyzed, the SAR distribution for the exposure condition (155 MHz, bystander at 0 degrees facing the car, trunk-mount HAD4014A antenna) that produced the highest peak 1-g and whole body SAR averages is shown in Fig. 4.

Limited to the cases of the roof-mount antennas analyzed, the SAR distribution for the exposure condition (155 MHz, bystander facing the car, HAD4008A antenna) that produced the highest peak 1-g SAR averages is shown in Fig. 5, while the condition that produced the highest whole body SAR averages is shown in Fig. 6 (155 MHz, bystander facing away from the car, HAD4008A antenna).

The overall maximum peak 1-g SAR is 1.14 W/kg, less than the 1.6 W/kg limit, while the maximum whole-body average SAR is 0.019 W/kg, less than the 0.08 W/kg limit.
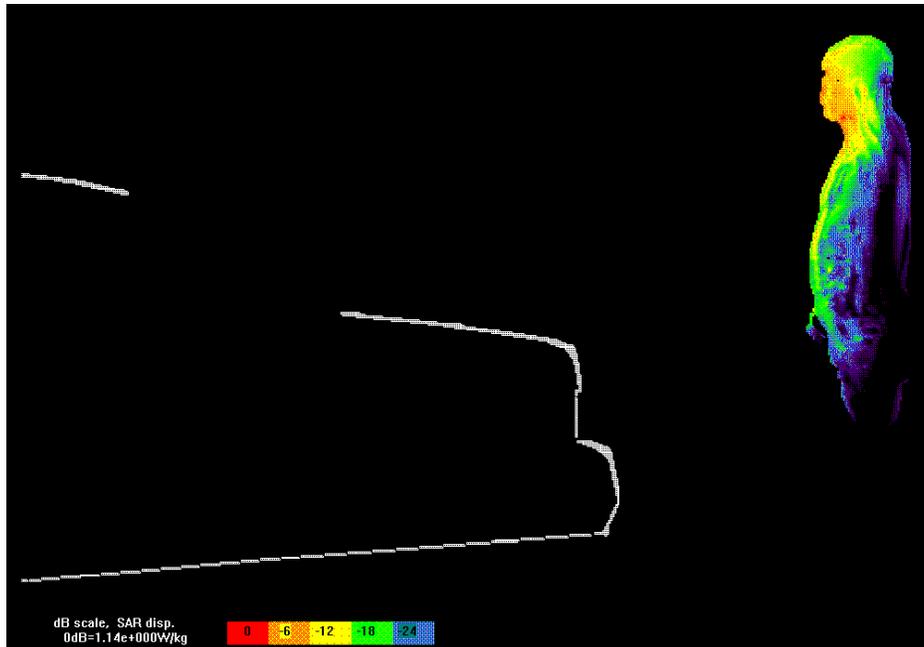
**Figure 4. SAR distribution at 155 MHz for the bystander at 90 cm from the 117 cm gain antenna, placed in the center of the trunk, when facing the car at 0 degrees. The contour plot in the figure is relative to the plane where the peak 1-g average SAR for this exposure condition occurs.**
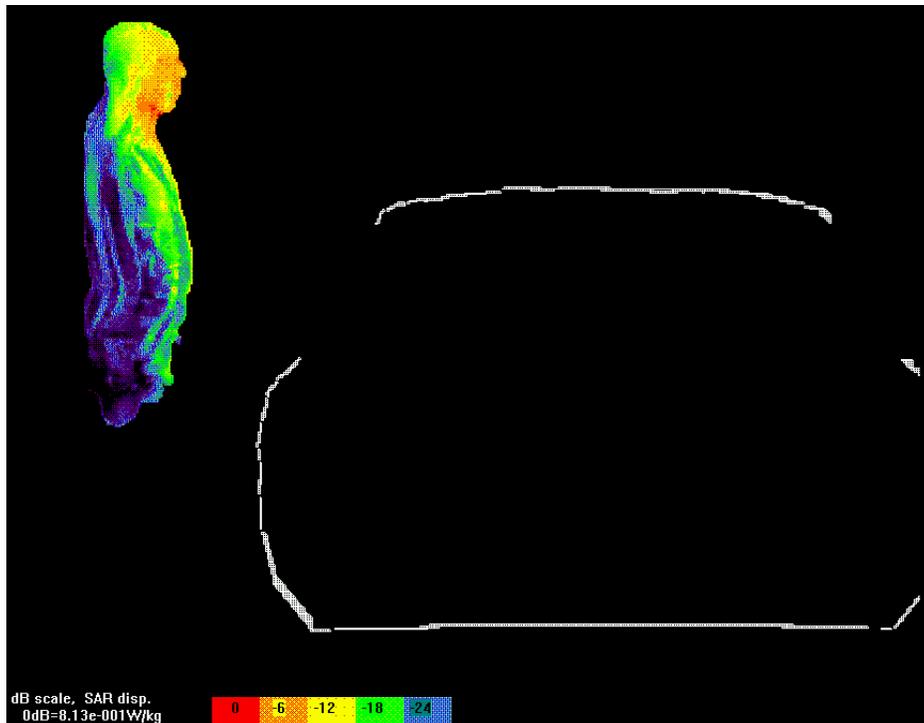


**Figure 5. SAR distribution at 155 MHz for bystander at 20 cm from the side of the car (108 cm from the antenna), with the antenna at the roof center, when facing the car. The contour plot in the figure is relative to the plane where the peak 1-g average SAR for this exposure condition occurs**
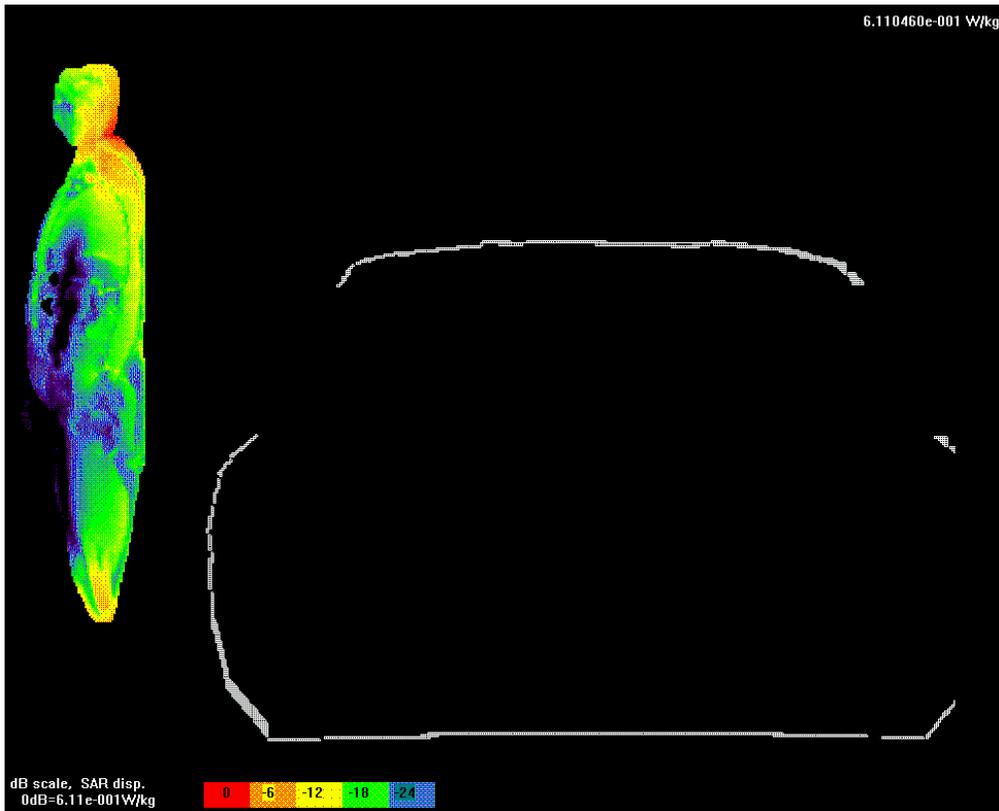
**Figure 6. SAR distribution at 155 MHz for bystander at 20 cm from the side of the car (108 cm from the antenna), with the HAD4008A antenna at the roof center, when facing away from the car. The contour plot in the figure is relative to the plane where the peak 1-g average SAR for this exposure condition occurs**

## Results of SAR computations for car passengers

The 18 test conditions requiring SAR computations are summarized in Table III, together with the antenna data and the SAR results. The conditions are for antenna mounted on the roof and on the trunk. The passenger is located in the center or on the side of the rear seat. The passenger model is surrounded by air, as the seat, which is made out of poorly conductive fabrics, is not included in the computational model. All the transmit frequency, antenna length, and passenger location combinations reported in Table II have been simulated individually. The maximum peak 1-g SAR is 0.50 W/kg, while the maximum whole-body average SAR is 0.018 W/kg.

Table III: Results of the SAR computations for passenger exposure (50% talk-time).

| Mount location | Antenna Kit # | Antenna length | | Freq [MHz] | Exposure location | SAR [W/kg] | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | Physical | XFDTD | | | 1-g | WB |
| Roof | HAD4006A | 52 cm | 52 cm | 136 | center | 0.17 | 0.010 |
| Roof | HAD4006A | 52 cm | 52 cm | 136 | side | 0.23 | 0.013 |
| Roof | HAD4007A | 49 cm | 49 cm | 146 | center | 0.50 | 0.015 |
| Roof | HAD4007A | 49 cm | 49 cm | 146 | side | 0.47 | 0.018 |
| Roof | HAD4008A | 45.6 cm | 45.5 cm | 155 | center | 0.30 | 0.008 |
| Roof | HAD4008A | 45.6 cm | 45.5 cm | 155 | side | 0.36 | 0.010 |
| Roof | HAD4016A | 50.5 cm | 50.5 cm | 162 | center | 0.18 | 0.006 |
| Roof | HAD4016A | 50.5 cm | 50.5 cm | 162 | side | 0.22 | 0.008 |
| Roof | HAD4016A | 50.5 cm | 50.5 cm | 136 | center | 0.20 | 0.011 |
| Roof | HAD4016A | 50.5 cm | 50.5 cm | 136 | side | 0.23 | 0.013 |
| Roof | HAD4016A | 50.5 cm | 50.5 cm | 149 | center | 0.49 | 0.013 |
| Roof | HAD4016A | 50.5 cm | 50.5 cm | 149 | side | 0.50 | 0.016 |
| Roof | HAD4017A | 47.5 cm | 47.5 cm | 160 | center | 0.22 | 0.006 |
| Roof | HAD4017A | 47.5 cm | 47.5 cm | 160 | side | 0.23 | 0.008 |
| Roof | HAD4017A | 47.5 cm | 47.5 cm | 146 | center | 0.48 | 0.014 |
| Roof | HAD4017A | 47.5 cm | 47.5 cm | 146 | side | 0.48 | 0.018 |
| Trunk | RAD4010ARB | 121.4 cm | 121.5 cm | 136 | center | 0.47 | 0.009 |
| Trunk | RAD4010ARB | 121.4 cm | 121.5 cm | 136 | side | 0.46 | 0.012 |

Limited to the cases of roof-mount antennas analyzed, the SAR distribution in the passenger model in the exposure condition that gave highest 1-g SAR is reported in Fig. 7 (146 MHz, passenger in the center of the back seat, HAD4007A antenna), while that for the exposure condition that gave highest whole-body average SAR is reported in Fig. 8 (146 MHz, passenger in the side of the back seat, HAD4017A antenna).

Finally, limited to the cases of the trunk-mount antennas analyzed, the SAR distribution in the passenger model in the exposure condition that gave highest 1-g SAR is reported in Fig. 9 (136 MHz, passenger in the center of the back seat, RAD4010ARB antenna), while that for the exposure condition that gave highest whole-body average SAR is reported in Fig. 10 (136 MHz, passenger in the side of the back seat, RAD4010ARB antenna).
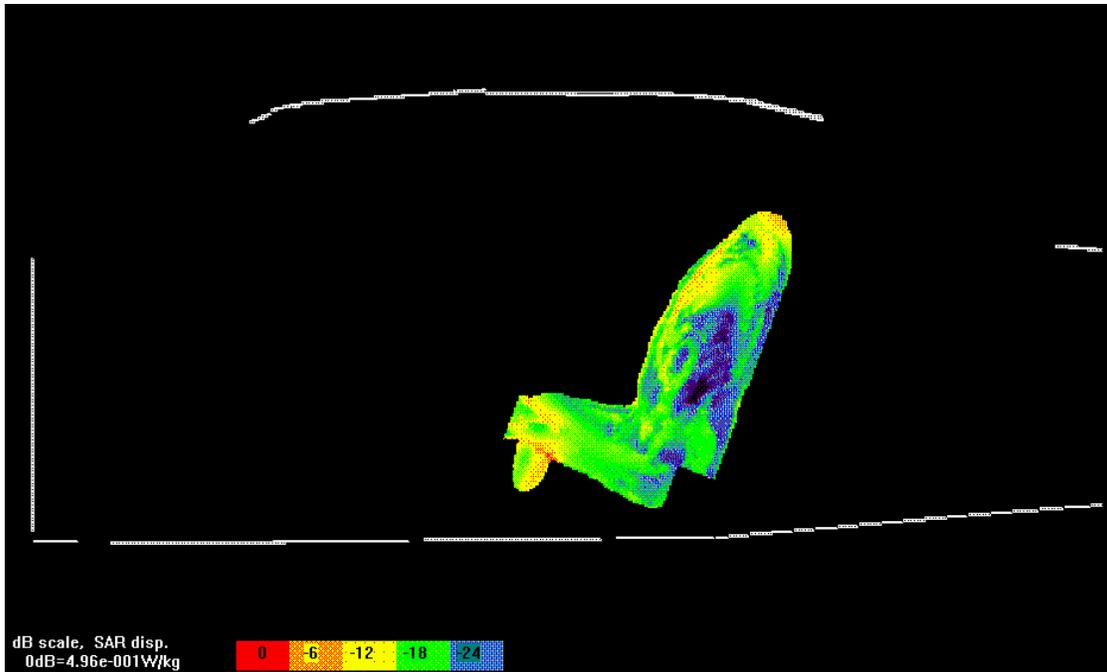
**Figure 7. SAR distribution at 146 MHz in the passenger located in the center of the back seat, produced by the roof-mount HAD4007A antenna. The contour plot in the figure is relative to the plane where the peak 1-g average SAR for this exposure condition occurs**
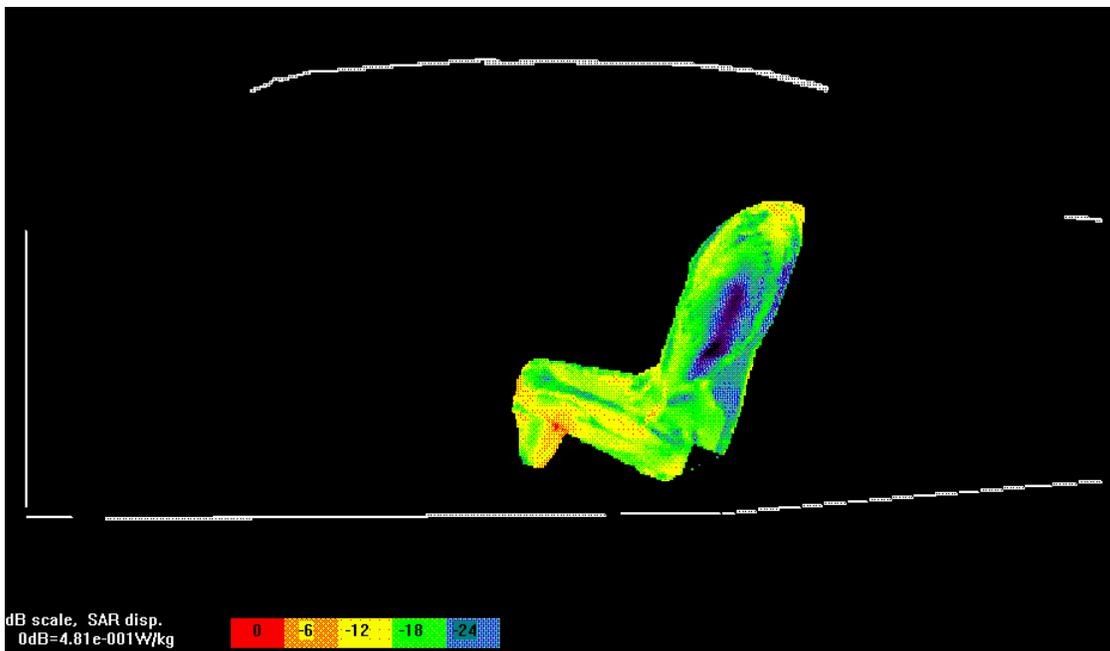


**Figure 8. SAR distribution at 146 MHz in the passenger located in the side of the back seat, produced by the roof-mount HAD4017A antenna. The contour plot in the figure is relative to the plane where the peak 1-g average SAR for this exposure condition occurs**
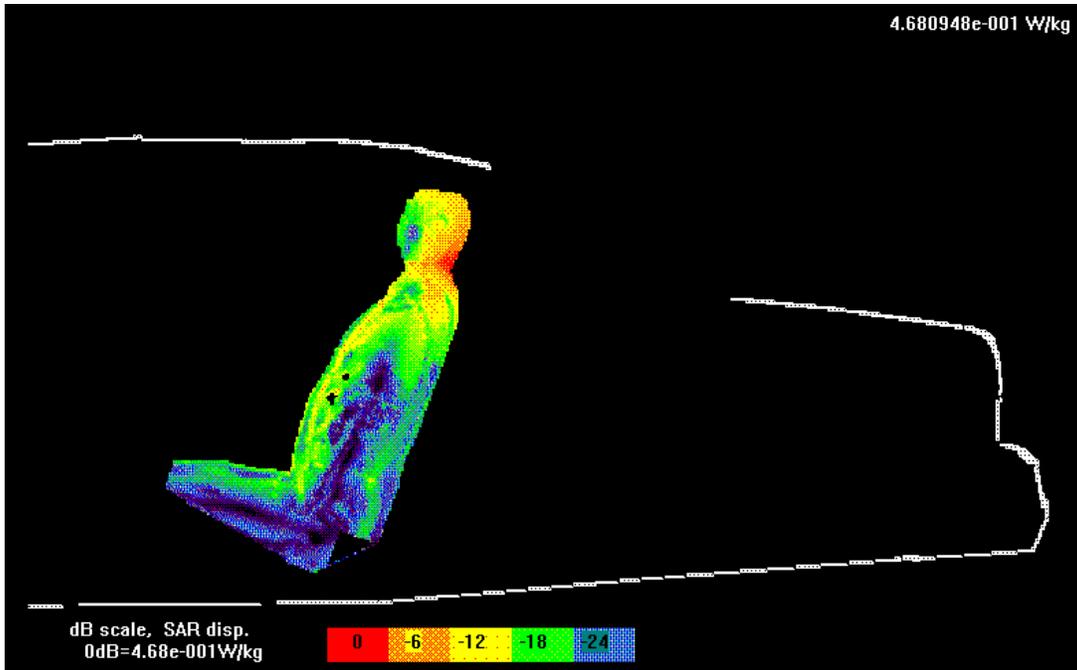
**Figure 9. SAR distribution at 136 MHz in the passenger located in the center of the back seat, produced by the trunk-mount RAD4010ARB antenna. The contour plot in the figure is relative to the plane where the peak 1-g average SAR for this exposure condition occurs**
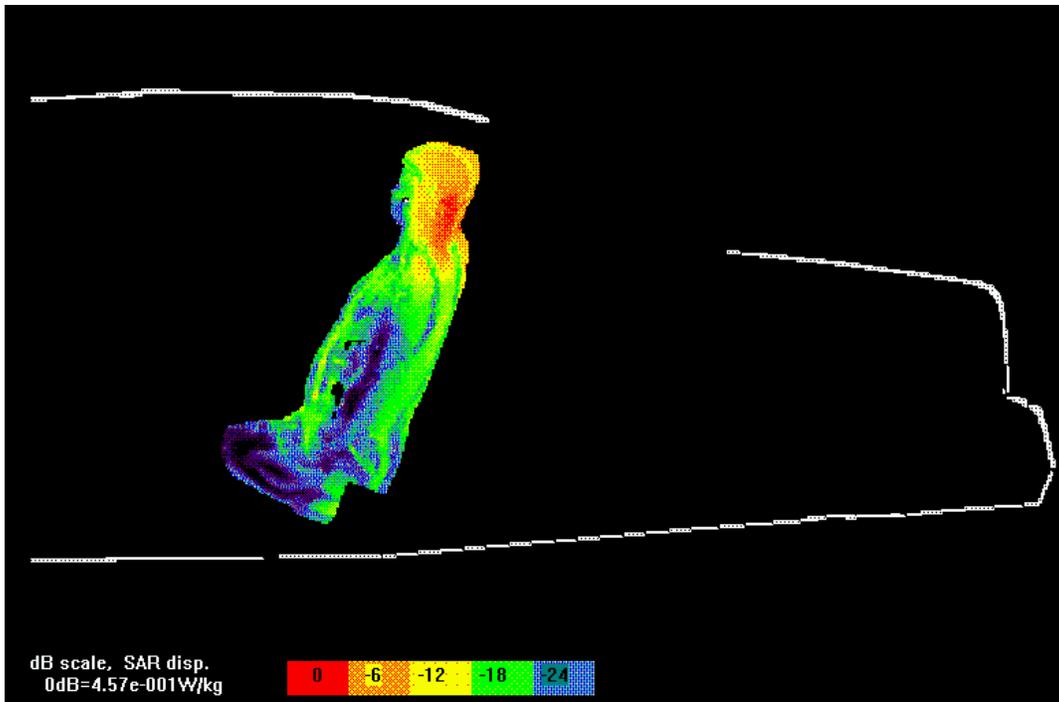


**Figure 10. SAR distribution at 136 MHz in the passenger located in the side of the back seat, produced by the trunk-mount RAD4010ARB antenna. The contour plot in the figure is relative to the plane where the peak 1-g average SAR for this exposure condition occurs**

**Conclusions**

Under the test conditions described for evaluating passenger and bystander exposure to the RF electromagnetic fields emitted by vehicle-mounted antennas used in conjunction with this mobile radio product, the present analysis shows that the computed SAR values are compliant with the FCC exposure limits for the general public.

**References**

[1]  IEEE Standard C95.1-1999. *IEEE Standard for Safety Levels with Respect to Human Exposure to RF Electromagnetic Fields*, 3 kHz to 300 GHz.

[2]  http://www.nlm.nih.gov/research/visible/visible_human.html

# APPENDIX: SPECIFIC INFORMATION FOR SAR COMPUTATIONS

This appendix follows the structure outlined in Appendix B.III of the Supplement C to the FCC OET Bulletin 65. Most of the information regarding the code employed to perform the numerical computations has been adapted from the XFDTD™ v5.3 User Manual. Remcom Inc., owner of XFDTD™, is kindly acknowledged for the help provided.

## 1) Computational resources

a) A four-processor server (Mod. PowerEdge 6650, by Dell Computers Inc.) equipped with four 1.4 GHz Xeon microprocessors and 4 GB D-RAM (3 GB available for running applications) was employed for all simulations.

b) The memory requirement was between 2 GB and 3 GB in all cases. Using the above-mentioned server with all four processors operating concurrently, the typical simulation would run for 22 hours.

## 2) FDTD algorithm implementation and validation

a) We employed a commercial code (XFDTD™ v5.3, by Remcom Inc.) that implements the classical Yee's FDTD formulation [1]. The solution domain was discretized according to a rectangular grid with a uniform 5 mm step in all directions. Sub-gridding was not used. Liao's absorbing boundary conditions [2] are set at the domain boundary to simulate free space radiation processes. The excitation is a lumped voltage generator with 50-ohm source impedance. The code allows selecting *wire objects* without specifying their radius. We used a wire to represent the antenna. The car body is modeled by solid metal. We did not employ the "thin wire" algorithm in XFDTD™ since the antenna radius was never smaller than one-fifth the voxel dimension. In fact, the XFDTD™ manual specifies that "Thin Wire materials may be used in special situations where a wire with a radius much smaller than the cell size is required… in cases where the wire radius is important to the calculation and is less than approximately 1/5 the cell size, the thin wire material may be used to accurately simulate the correct wire dimensions." The voxel size in all our simulations was 5 mm, and the antenna radius is always at least 1 mm (1 mm for the short quarter-wave antennas and 1.5 mm for the long gain antennas), so there was no need to specify a "thin wire" material. Because the field impinges on the bystander or passenger model at a distance of several tens of voxels from the antenna, the details of antenna wire modeling are not expected to have significant impact on the exposure level.

b) XFDTD™ is one of the most widely employed commercial codes for electromagnetic simulations. It has gone through extensive validation and has proven its accuracy over time in many different applications. One example is provided in [3].

We carried out a validation of the code algorithm by running the canonical test case involving a half-wave wire dipole. The dipole is 0.475 times the free space wavelength at

160 MHz, i.e., 88.5 cm long. The discretization used in the model was uniform in all directions and equal to 5 mm, so the dipole was 177 cells long. Also in this case, the "thin wire" model was not needed. The following picture shows XFDTD™ outputs regarding the antenna feed-point impedance (72.6 – j 11.8 ohm), as well as qualitative distributions of the total E and H fields near the dipole. The radiation pattern is shown as well (one lobe in elevation). As expected, the 3 dB beamwidth is about 78 degrees.



**Total E-field**    **Total H-field**



**Elevation Angle [degrees]**
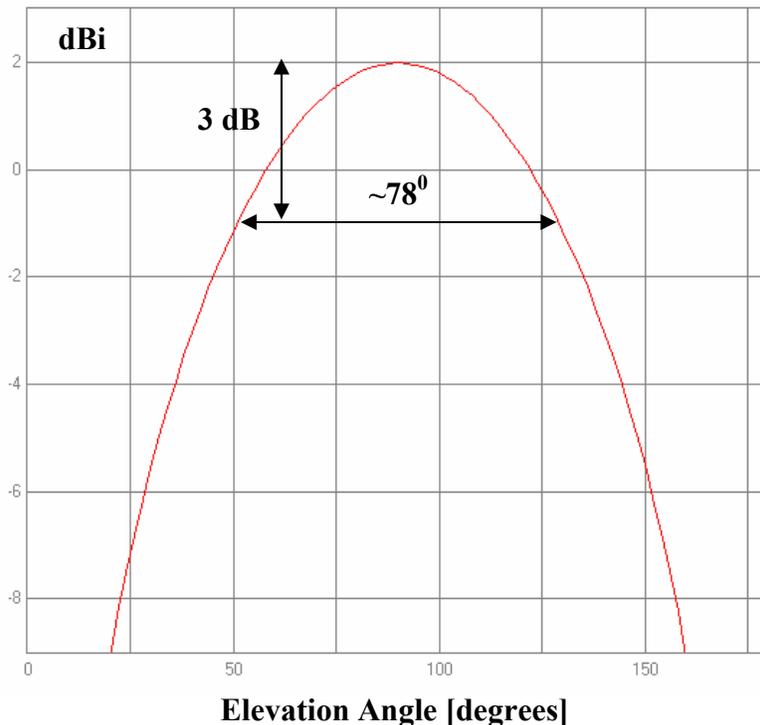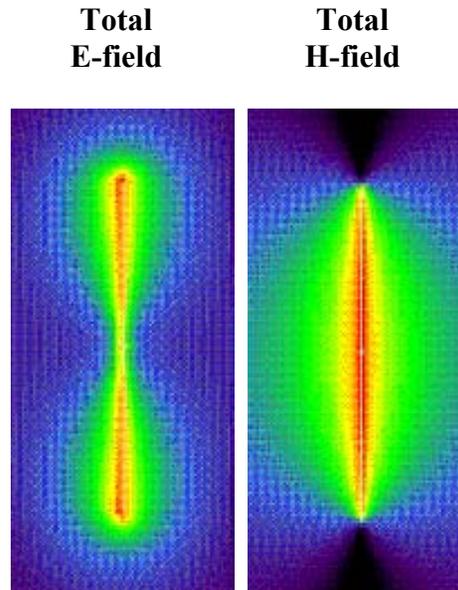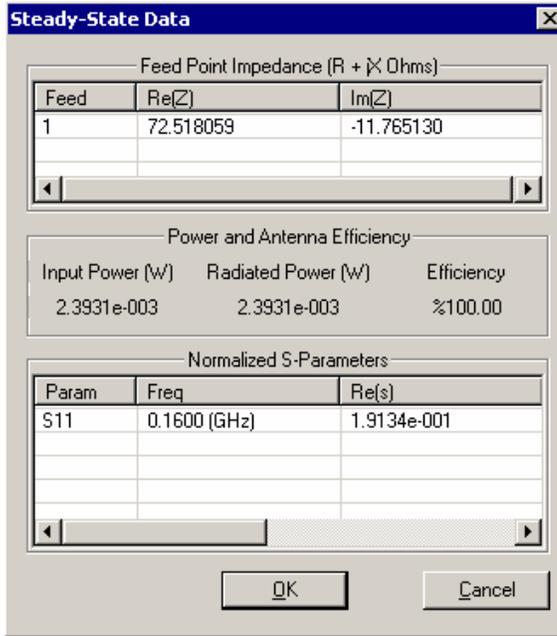
We also compared the XFDTD™ result with the results derived from NEC [4], which is a code based on the method of moments. In this case, we used a dipole with radius 1 mm, length 88.5 cm, and the discretization is 5 mm. The corresponding input impedance at 160 MHz is 69.5-j10.5 ohm. Its frequency dependence is reported in the following figure.
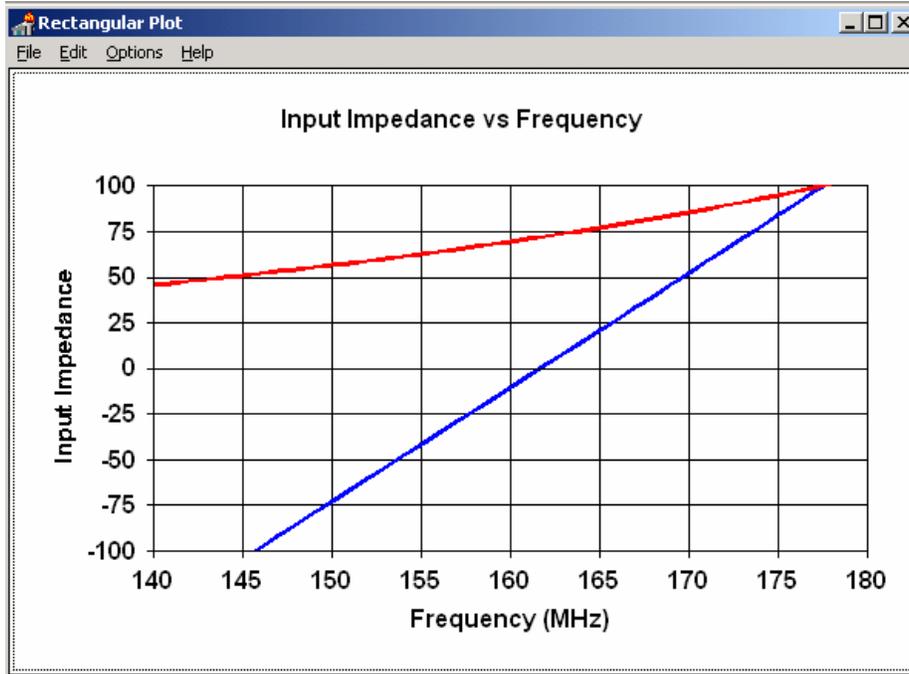


This validation ensures that the input impedance calculation is carried out correctly in XFDTD™, thereby enabling accurate estimates of the radiated power. It further ensures that the wire model employed in XFDTD™, which we used to model the antennas, produces physically meaningful current and fields distributions. Both these aspects ensure that the field quantities are correctly computed both in terms of absolute amplitude and relative distribution.

## 3) Computational parameters

a) The following table reports the main parameters of the FDTD model employed to perform our computational analysis:

| PARAMETER | X | Y | Z |
|---|---|---|---|
| Voxel size | 5 mm | 5 mm | 5 mm |
| Maximum domain dimensions employed for bystander computations (in voxels) | 507 | 530 | 432 |
| Maximum domain dimensions employed for passenger computations (in voxels) | 400 | 579 | 430 |
| Time step | Exactly equal to Courant limit (typically 10 *ps* at this frequency, with the body model) | | |

| Objects separation from FDTD boundary (voxels) | >10 | >10 | >10 |
|---|---|---|---|
| Number of time steps for passenger | At least 7000 in all simulations | | |
| Number of time steps for bystander | At least 6000 in all simulations | | |
| Excitation | Sinusoidal (approx. 9-10 periods) | | |

b) In order to fit the model within a grid size that would not use up the available memory, we chopped the hood of the car and the feet of the human model.

**4) Phantom model implementation and validation**

a) The FDTD mesh of a male human body was created using digitized data in the form of transverse color images.  The data is from the *visible human project* sponsored by the National Library of Medicine (NLM) and is available via the Internet (http://www.nlm.nih.gov/research/visible/visible_human.html). The male data set consists of MRI, CT and anatomical images.  Axial MRI images of the head and neck and longitudinal sections of the rest of the body are available at 4 mm intervals.  The MRI images have 256 pixel by 256 pixel resolution.  Each pixel has 12 bits of gray tone resolution.  The CT data consists of axial CT scans of the entire body taken at 1 mm intervals at a resolution of 512 pixels by 512 pixels where each pixel is made up of 12 bits of gray tone.  The axial anatomical images are 2048 pixels by 1216 pixels where each pixel is defined by 24 bits of color.  The anatomical cross sections are also at 1 mm intervals and coincide with the CT axial images.  There are 1871 cross sections.  The XFDTD™ High Fidelity Body Mesh uses 5x5x5 mm cells and has dimensions 136 x 87 x 397.  Dr. Michael Smith and Dr. Chris Collins of the Milton S. Hershey Medical Center, Hershey, Pa, created the High Fidelity Body mesh.  Details of body model creation are given in the *methods* section in [5]. The body mesh contains 23 tissues materials. Measured values for the tissue parameters for a broad frequency range are included with the mesh data.  The correct values are interpolated from the table of measured data and entered into the appropriate mesh variables. The tissue conductivity and permittivity variation *vs*. frequency is included in the XFDTD™ calculation by a multiple-pole approximation to the Cole-Cole approximated tissue parameters reported by Camelia Gabriel, Ph.D., and Sami Gabriel, M. Sc. (http://www.brooks.af.mil/AFRL/HED/hedr/reports/dielectric/home.html).

In order to fit the car and bystander model within the volume allowed by the available RAM, the feet of the XFDTD™ High Fidelity Body Mesh were cut away, thereby reducing the model length by about 16 cm (32 voxels). Notice that the original model's feet are not flat and parallel to ground as if he were standing, but are inclined downwards. Therefore, we estimated that the actual reduction in body length is 9 cm. The following figure shows the cross section of the model used in the bystander computations, compared with the original XFDTD™ High Fidelity Body Mesh.
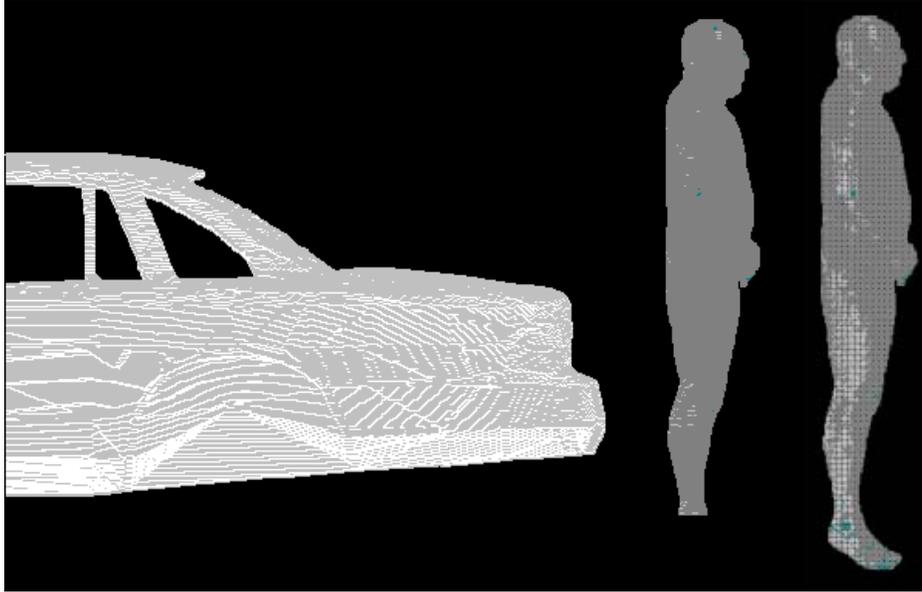
b) The XFDTD™ High Fidelity Body Mesh model correctly represents the anatomical structure and the dielectric properties of body tissues, so it is appropriate for determining the highest exposure expected for normal device operation.

c) One example of the accuracy of XFDTD™ for computing SAR has been provided in [6]. The study reported in [6] is relative to a large-scale benchmark of measurement and computational tools carried out within the IEEE Standards Coordinating Committee 34, Sub-Committee 2.

**5) Tissue dielectric parameters**

a) The following table reports the dielectric properties used by XFDTD™ for the 23 body tissue materials in the High Fidelity Body Mesh at 155 MHz (mid-band for this VHF mobile radio product).

| # | Tissue | $\varepsilon_r$ | $\sigma$ (S/m) | Density (kg/m$^3$) |
|---|--------|------|----------|------------------|
| 1 | skin | 50.5 | 0.49 | 1125 |
| 2 | tendon, pancreas, prostate, aorta, liver, other | 59.3 | 0.63 | 1151 |
| 3 | fat, yellow marrow | 5.8 | 0.04 | 943 |
| 4 | cortical bone | 15.5 | 0.08 | 1850 |
| 5 | cancellous bone | 26.0 | 0.17 | 1080 |
| 6 | blood | 64.5 | 1.65 | 1057 |
| 7 | muscle, heart, spleen, colon, tongue | 73.6 | 0.84 | 1059 |
| 8 | gray matter, cerebellum | 71.5 | 0.73 | 1035.5 |
| 9 | white matter | 51.4 | 0.41 | 1027.4 |
| 10 | CSF | 73.9 | 2.29 | 1000 |
| 11 | sclera/cornea | 61.8 | 0.94 | 1151 |

| 12 | vitreous humor | 68.6 | 1.52 | 1000 |
|----|----------------|------|------|------|
| 13 | bladder | 19.1 | 0.28 | 1132 |
| 14 | nerve | 44.0 | 0.41 | 1112 |
| 15 | cartilage | 53.8 | 0.53 | 1171 |
| 16 | gall bladder bile | 86.6 | 1.49 | 928 |
| 17 | thyroid | 65.9 | 0.71 | 1035.5 |
| 18 | stomach/esophagus | 78.5 | 1.03 | 1126 |
| 19 | lung | 52.3 | 0.59 | 563 |
| 20 | kidney | 72.9 | 1.02 | 1147 |
| 21 | testis | 72.6 | 0.99 | 1158 |
| 22 | lens | 57.3 | 0.61 | 1163 |
| 23 | small intestine | 89.5 | 1.85 | 1153 |

b) The tissue types and dielectric parameters used in the SAR computation are appropriate for determining the highest exposure expected for normal device operation, because they are derived from measurements performed on real biological tissues (http://www.brooks.af.mil/AFRL/HED/hedr/reports/dielectric/home.html).

c) The tabulated list of the dielectric parameters used in phantom models is provided at point 5(a). As regards the device (car plus antenna), we used perfect electric conductors.

**6) Transmitter model implementation and validation**

a) The essential features that must be modeled correctly for the particular test device model to be valid are:

- Car body. We developed one very similar to the car used for MPE measurements, so as to be able to correlate measured and simulated field values. The model was imported in XFDTD™ from a CAD model that is commercially available at http://www.3dcadbrowser.com/
- Antenna. We used a straight wire in all cases, even though the gain antenna has a base coil for tuning. All the coil does is compensating for excess capacitance due to the antenna being slightly longer than half a wavelength. We do not need to do that in the model, as we used normalization with respect to the net radiated power, which is determined by the input resistance only. In this way, we neglect mismatch losses and artificially produce an overestimation of the SAR, thereby introducing a conservative bias in the model.
- Antenna location. We used the same location, relative to the edge of the car trunk, the backseat, or the roof, used in the MPE measurements. The following pictures show a lateral and a perspective view of the whole model (XFDTD™ does not show wires in this type of view, that is why the antenna is not visible).
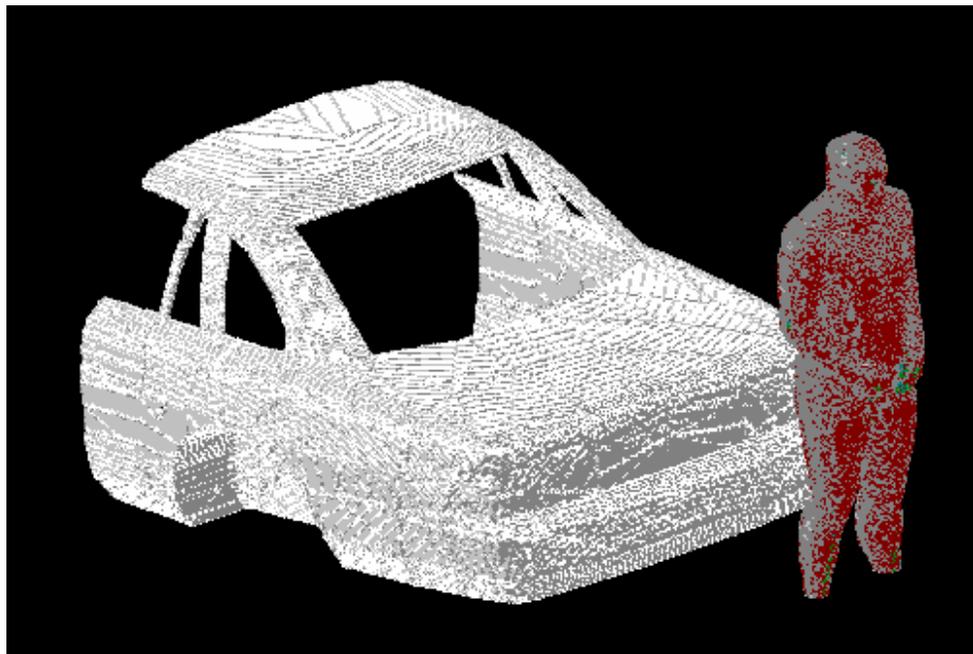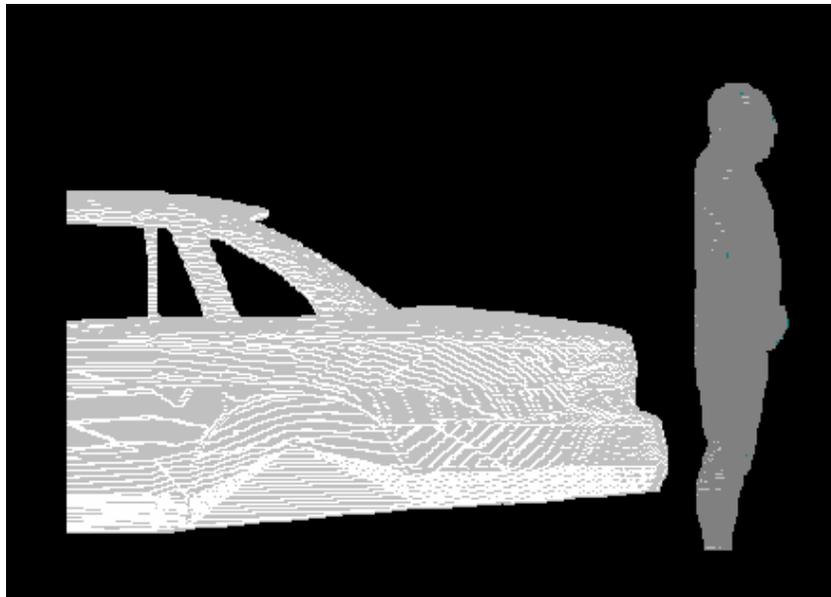
The car model is constituted by perfect electric conductor and does not include wheels in order to reduce its complexity. The passenger model is surrounded by air, as the seat, which is made out of poorly conductive fabrics, is not included in the computational model. The pavement has not been included in the model. The passenger and bystander models were validated for similar antenna and frequency conditions by comparing the MPE measurements at two VHF frequencies (146 MHz and 164 MHz) for antennas used for a VHF mobile radio analyzed  previously in 2003 (FCC ID#ABZ99FT3046). The corresponding MPE measurements are reported in the compliance report relative to FCC ID#ABZ99FT3046. The comparison results are presented below, according to following definitions for the equivalent power densities (based on E or H-field):

$$S_E = \frac{|\mathbf{E}|^2}{2\eta}, \quad S_H = \frac{\eta}{2}|\mathbf{H}|^2, \quad \eta = 377\,\Omega$$

Passenger with 43 cm monopole antenna (HAD4009A 164 MHz)

The following figures of the test model show the empty car model, where the yellow dotted line represents the back seat, as it can be observed from the right-hand side figure showing the passenger. The comparison has been performed by taking the computed steady-state field values at the locations corresponding to the head, chest, and legs along the yellow line and comparing them with the corresponding measurements. Such a comparison is carried out at the same rms power level (56.5 W) used in the measurements. Steady-state E-field and H-field distributions at a vertical plane transverse to the car and crossing the passenger's head are displayed as well. Finally, a picture of the antenna is shown.
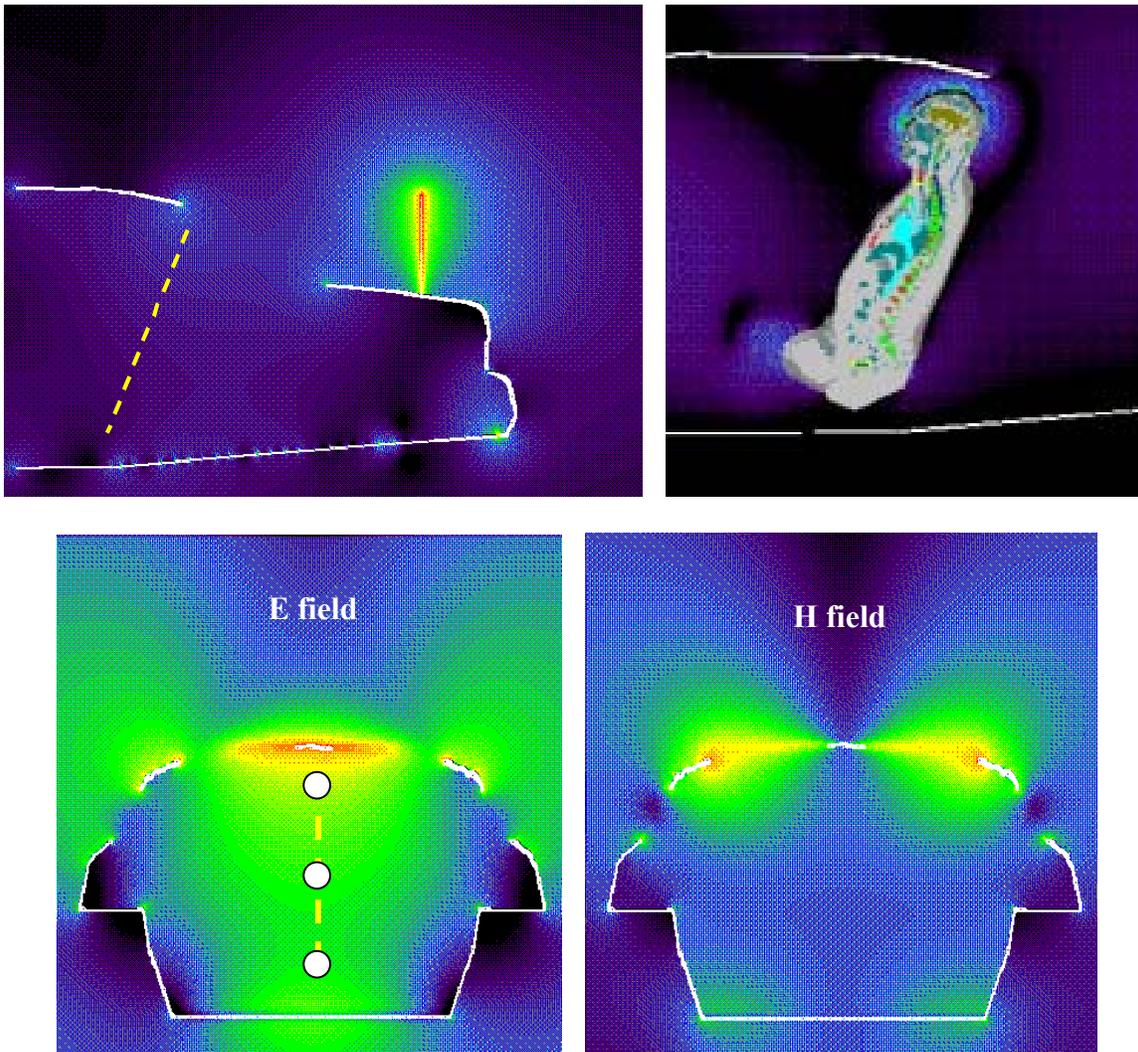
The highest exposure occurs in the middle of the backseat, which is also the case in the measurements. Therefore, the field values were determined on the yellow line centered at the middle of the backseat, approximately at the three locations that are shown by white dots. In actuality, the line is inclined so as to follow the inclination of the passenger's back, as shown previously.



**HAD4009A**

**43 cm (actual length)**
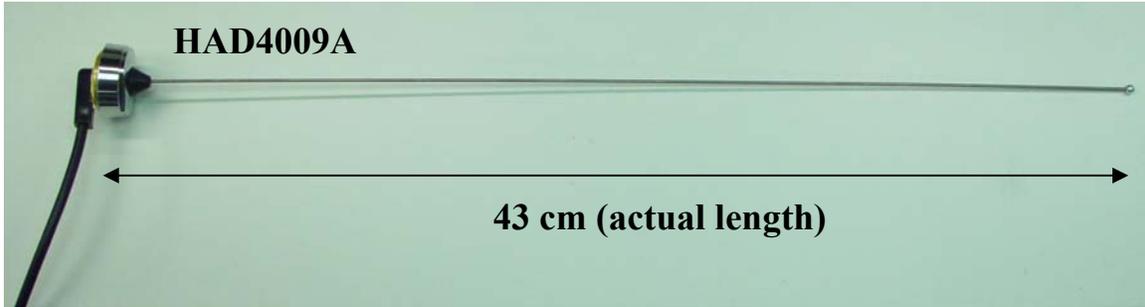
Because the peak exposure occurs in the center of the back seat, that was where we placed the passenger model to perform the SAR evaluations presented in the report. However, it can be observed that the H-field distribution features peaks near the lateral edges of the rear window. That is the reason why we also carried out one SAR computation by placing the passenger laterally in the back seat, in order to determine whether the SAR would be higher in this case.

As done in the measurements, the equivalent power density (S) is computed from the E-field, the H-field being much lower. The following table reports the E-field values computed by XFDTD™ at the three locations, and the corresponding power density.

| Location | E-field magnitude (V/m) | S (W/m$^2$) |
|---|---|---|
| Head | 1.0 | 1.33E-03 |
| Chest | 0.45 | 2.69E-04 |
| Lower Trunk area | 0.32 | 1.36E-04 |
| | **Average S** | **5.77E-04** |

The input impedance is 28.2-j27 ohm, therefore the radiated power (considering the mismatch to the 50 ohm unitary voltage source) is 2.06E-3 W. The scaled-up power density for 56.5 W radiated power is 15.8 W/m$^2$, corresponding to 1.58 mW/cm$^2$. Measurements gave an average of 1.29 mW/cm$^2$, which is in good agreement. The following graph show a comparison between the simulated power density and the measured one (see MPE report in FCC ID#ABZ99FT3046, Table 43), normalized to 56.5 W radiated.

**Comparison FDTD-Measurements**
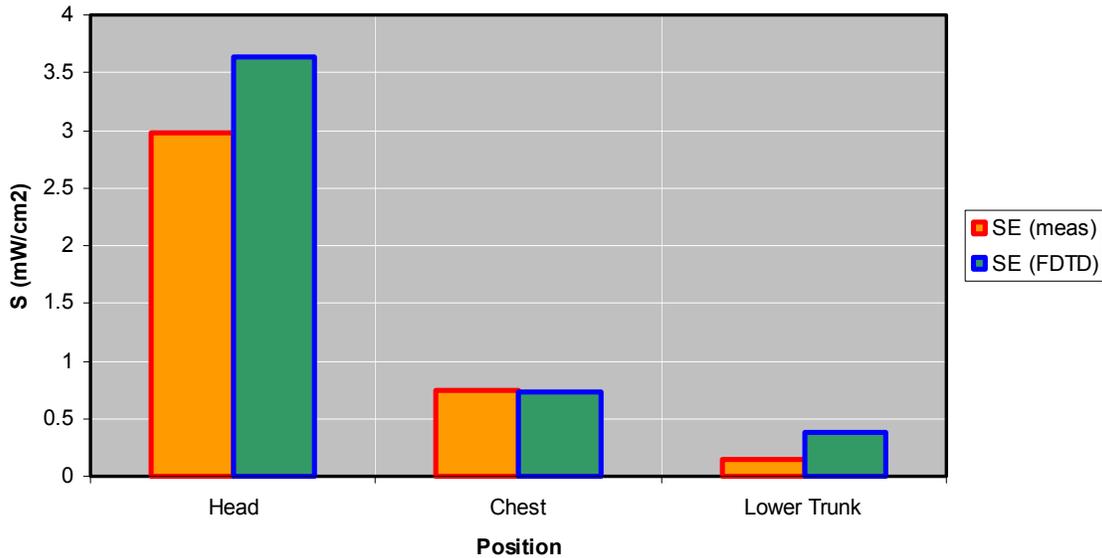


Bystander with 48 cm monopole antenna (HAD4007A 146 MHz)

The following figures show the E-field and H-field distributions across a vertical plane passing for the antenna and cutting the car in half. As done in the measurements, the MPE is computed from both E-field and H-field distributions, along the yellow dotted line at 10 points spaced 20 cm apart from each other up to 2 m in height. These lines and the field evaluation points are approximately indicated in the figures. The E-field and H-field distributions in the vertical plane placed at 60 cm from the antenna, behind the case, are shown as well. The points where the fields are sampled to determine the equivalent power density (S) are approximately indicated by the white dots. A picture of the antenna is not reported because it is identical to the HAD4009A except for the length.
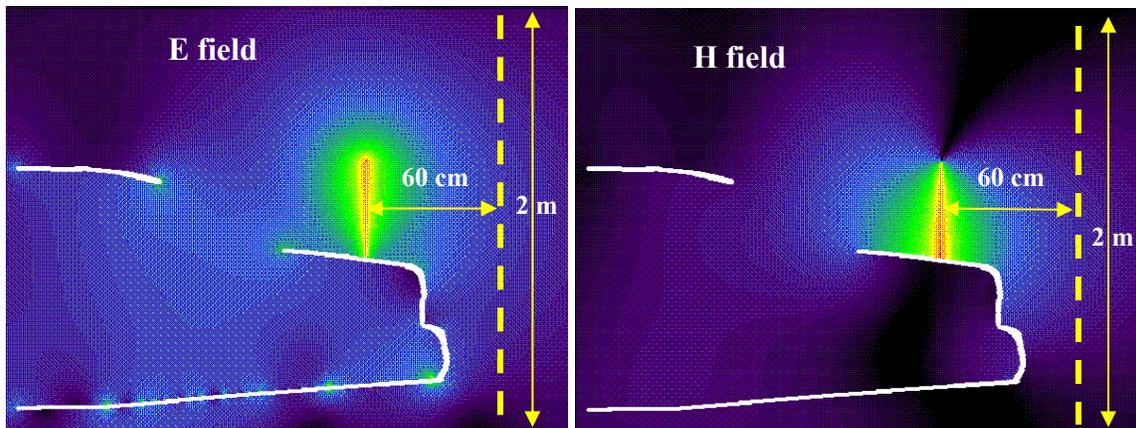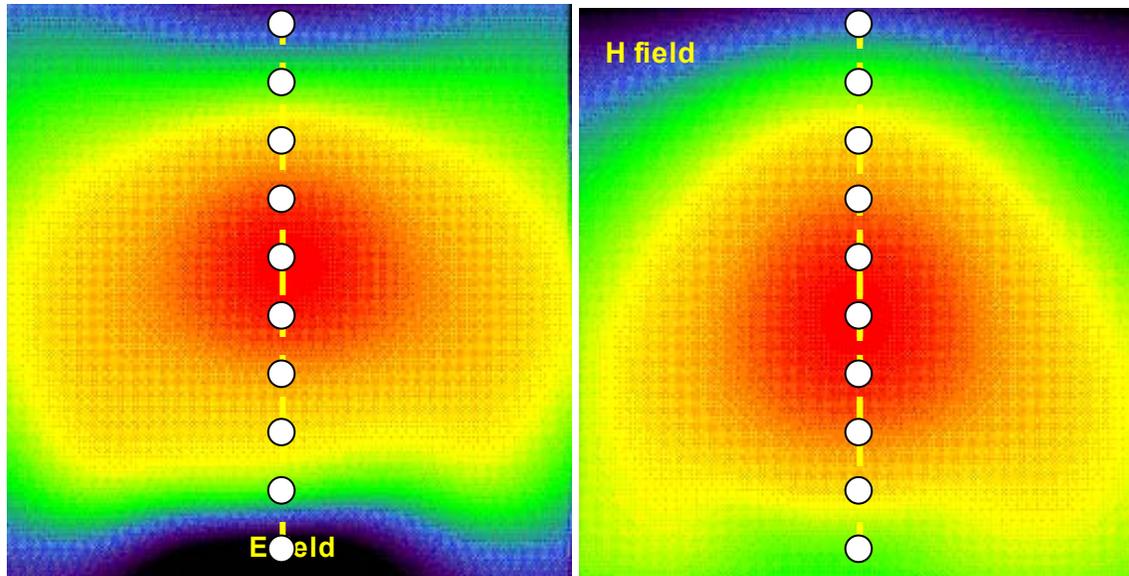
The following table reports the field values computed by XFDTD™ and the corresponding power density values. The average exposure levels are computed as well.

| Height (cm) | E (V/m) | $S_E$ (W/m$^2$) | H (A/m) | $S_H$ (W/m$^2$) |
|---|---|---|---|---|
| 20 | 2.12E-01 | 5.96E-05 | 5.14E-04 | 4.98E-05 |
| 40 | 3.81E-01 | 1.93E-04 | 8.67E-04 | 1.42E-04 |
| 60 | 4.43E-01 | 2.60E-04 | 1.35E-03 | 3.45E-04 |
| 80 | 5.36E-01 | 3.81E-04 | 1.73E-03 | 5.67E-04 |
| 100 | 6.17E-01 | 5.05E-04 | 1.84E-03 | 6.37E-04 |
| 120 | 6.28E-01 | 5.23E-04 | 1.57E-03 | 4.63E-04 |
| 140 | 5.59E-01 | 4.14E-04 | 1.11E-03 | 2.34E-04 |
| 160 | 4.41E-01 | 2.58E-04 | 6.99E-04 | 9.20E-05 |
| 180 | 3.24E-01 | 1.39E-04 | 3.73E-04 | 2.63E-05 |
| 200 | 2.31E-01 | 7.08E-05 | 1.86E-04 | 6.54E-06 |
| **Average $S_E$** | | **2.80E-04** | **Average $S_H$** | **2.56E-04** |

The input impedance is 27.3-j19.5 ohm, therefore the radiated power (considering the mismatch to the 50 ohm unitary voltage source) is 2.15E-3 W. The scaled-up power density values for 53.2 W radiated power are 6.93 W/m$^2$ (E), and 6.533 W/m$^2$ (H), that correspond to 0.69 mW/cm$^2$ (E), and 0.63 mW/cm$^2$ (H). Measurements yielded average power density of 0.664 mW/cm$^2$ (E), and 0.471 mW/cm$^2$ (H), i.e., which are in good agreement with the simulations. The following graph show a comparison between the simulated power density and the measured one, based on E  (see MPE report in FCC ID#ABZ99FT3046, Table 1) or H fields (see MPE report in FCC ID#ABZ99FT3046, Table 13), normalized to 53.2 W radiated.

**Comparison FDTD-Measurements**
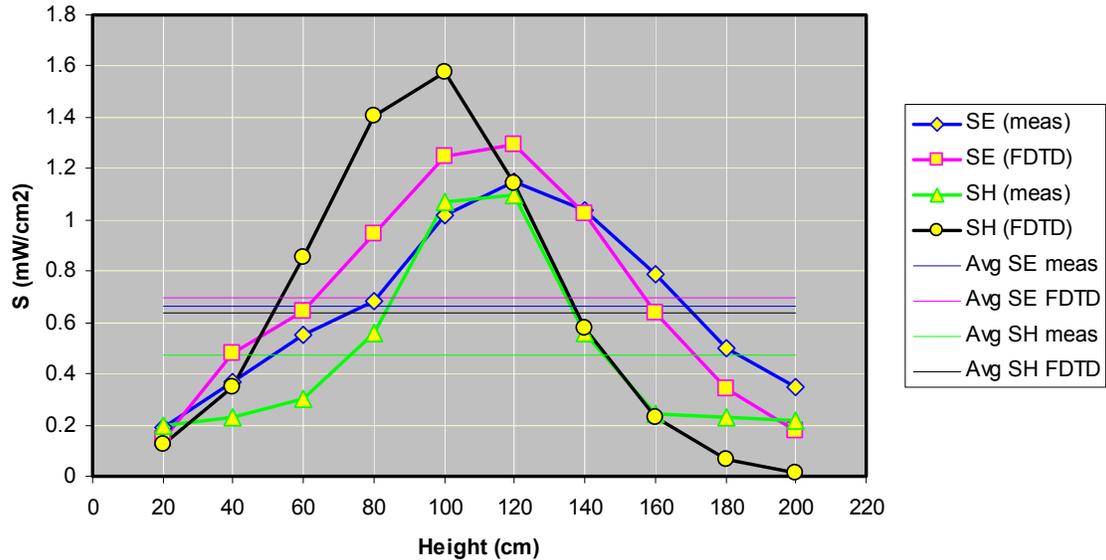


**7) Test device positioning**

a) A description of the device test positions used in the SAR computations is provided in the SAR report.

b) Illustrations showing the separation distances between the test device and the phantom for the tested configurations are provided in the SAR report.

**8) Steady state termination procedures**

a) The criteria used to determine that sinusoidal steady-state conditions have been reached throughout the computational domain for terminating the computations are based on the monitoring of field points to make sure they converge. For at least one passenger and one bystander exposure condition, we placed one "field sensor" near the antenna, others between the body and the domain boundary at different locations, and one inside the head of the model. In all simulations, isotropic E-field sensors were placed at opposite corners of the computational domain. We used isotropic E and H field "sensors", meaning that all three components of the fields are monitored at these points. The following figures show an example of the time waveforms at the field point sensors in the head and in two opposite points in the computational domain. In the latter case, we selected points near the lowest and highest grid index points. They are shown together in the figure. The highest field levels are observed for the higher index point, as it is closer to the antenna. In all cases, the field reaches the steady-state after a few cycles.

In the head

corner with highest grid values

corner with lowest grid values
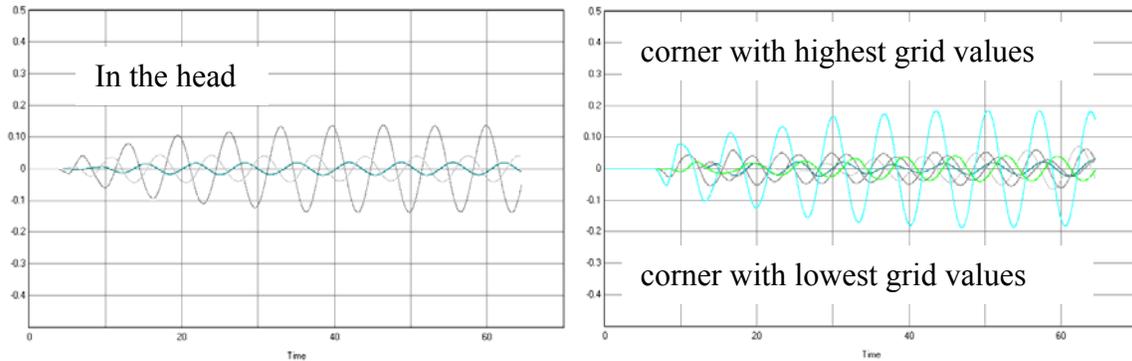
b) 6000 to 7500 time steps were used, with a time step approximately equal to 10 *ps* (meeting the Courant criterion), which corresponds to 9-11 wave periods at 149 MHz. Bystander case involves more steps because the simulation domain is larger.

c) The XFDTD™ algorithm determines the field phasors by using the so-called "two-equations two-unknowns" method. Details of the algorithm are explained in [7].

## 9) Computing peak SAR from field components

a) The twelve E-field phasors at the edges of each Yee voxel are combined to yield the SAR associated to that voxel. In particular, the average is performed on the SAR values computed at the 12 edges of each voxel. Notice that in XFDTD™ the dielectric tissue properties are assigned to the voxel edges, thereby allowing said averaging procedure.

b) The IEEE Standards Coordinating Committee 34, Sub-Committee 2 draft standard P1529 (June 2000) discusses several algorithms for volumetric SAR averaging. It states that "It is observed that while the 12 components algorithm is the most appropriate from the mathematical point of view, the differences in 1g SAR calculated with either the 12 or 6 component methods are negligible for practical mesh resolutions (below 5mm). On the other hand, it is shown that the 3 components approach may lead to significant errors." XFDTD™ employs the 12-component method, which is the one recommended in the draft standard, thus providing the best achievable accuracy.

## 10) One-gram averaged SAR procedures

a) XFDTD™ computes the Specific Absorption Rate (SAR) in each complete cell containing lossy dielectric material and with a non-zero material density. To be considered a complete cell, the twelve cell edges must belong to lossy dielectric materials. The averaging calculation uses an interpolation scheme for finding the averages. Cubical spaces centered on a cell are formed and the mass and average SAR of the sample cubes are found. The size of the sample cubes increases until the total mass of the enclosed exceeds either 1 or 10 grams. The mass and average SAR value of each cube is saved and used to interpolate the average SAR values at either 1 or 10 grams. The interpolation is performed using two methods (polynomial fit and rational function fit) and the one with the lowest error is chosen. The sample cube must meet some

conditions to be considered valid.  The cube may contain some non-tissue cells, but some checks are performed on the distribution of the non-tissue cells.  A valid cube will not contain an entire side or corner of non-tissue cells.

b) The sample cube increases in odd-numbered steps (1x1x1, 3x3x3, 5x5x5, etc) to remain centered on the desired cell. Since the visible human model employed herein has 5 mm resolution, the one-gram SAR is computed by averaging first over 1x1x1 voxels, corresponding to 0.125 cm$^3$ (not enough yet), and then over a 3x3x3 voxel cube, corresponding to about 3.4 cm$^3$, which is enough to include 1-g, and finally over a 5x5x5 voxel cube, corresponding to about 15.6 cm$^3$, which includes 10-g. The 1-g average SAR is computed by interpolating these three data points. This procedure is repeated in the surroundings of each voxel that is constituted by lossy materials, so as to determine the 1-g and/or 10-g SAR distributions.

c) As mentioned at points 10(a) and 10(b), the 1- gram average SAR is determined by interpolating the average SAR for the 1x1x1 , 3x3x3, and the 5x5x5 data points, corresponding to 0.125 cm$^3$, 3.4 cm$^3$, and 15.6 cm$^3$, respectively. Because the interpolation is carried out across three data points, the error introduced should be negligible because the interpolating curve crosses exactly the data points.

**11) Total computational uncertainty** – We derived an estimate for the uncertainty of FDTD methods in evaluating SAR by referring to [6]. In Fig. 7 in [6] it is shown that the deviation between SAR estimates using the XFDTD™  code and those measured with a compliance system are typically within 10% when the probe is away from the phantom surface so that boundary effects are negligible. In that example, the simulated SAR always exceeds the measured SAR.

As discussed in 6(a), a conservative bias has been introduced in the model so as to reduce concerns regarding the computational uncertainty related to the car modeling, antenna modeling, and phantom modeling. The results of the comparison between measurements and simulations presented in 6(a) suggest that the present model produces an overestimate of the exposure between 4% and 36%. Such a conservative bias should eliminate the need for including uncertainty considerations in the SAR assessment.

**12) Test results for determining SAR compliance**

a) Illustrations showing the SAR distribution of dominant peak locations produced by the test transmitter, with respect to the phantom and test device, are provided in the SAR report.

b) The input impedance and the total power radiated under the impedance match conditions that occur at the test frequency are provided by XFDTD™. XFDTD™ computes the input impedance by following the method outlined in [8], which consists in performing the integration of the steady-state magnetic field around the feed point edge to compute the steady-state feed point current ($I$), which is then used to divide the feed-gap steady-state voltage ($V$). The net *rms* radiated power is computed as

$$P_{XFDTD} = \frac{1}{2}\text{Re}\{VI^*\}$$

Both the input impedance and the net rms radiated power are provided by XFDTD™ at the end of each individual simulation.

We normalize the SAR to such a power, thereby obtaining SAR per radiated Watt (*normalized SAR*) values for the whole body and the 1-g SAR. Finally, we multiply such normalized SAR values times the max power rating of the device under test. In this way, we obtain the exposure metrics for 100% talk-time, i.e., without applying source-based time averaging.

c) For mobile radios, 50% source-based time averaging is applied by multiplying the SAR values determined at point 12(b) times a 0.5 factor.

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