MOTOROLA

ACCREDITED
TESTING CERT: 2518.01

FCC ID: ABZ99FT3082
DECLARATION OF COMPLIANCE MPE ASSESSMENT

Networks & Enterprise
EME Test Laboratory
8000 West Sunrise Blvd
Fort Lauderdale, FL. 33322

Date of Report:	**March 19, 2007**
Report Revision:	**Rev. A**
Report ID:	**FCC MPE rpt_XPR VHF Rev A_070319_SR4759**

Responsible Engineer:	Stephen Whalen (EME Principle Staff Eng.)
Date/s Tested:	2/8/2007-2/14/2007 & 2/20/2007-2/21/2007
Manufacturer/Location:	Motorola / Penang
Date submitted for test:	1/26/2007
DUT Description:	VHF, 25-45W, w/ GPS and a mini-U connector.
Test TX mode(s):	CW
Max. Power output:	54W, 50% Duty Cycle
TX Frequency Bands:	136-174MHz
Signaling type:	FM and TDMA 2:1
Model(s) Tested:	PMUD2043A
Model(s) Certified:	PMUD2043A
Serial Number(s):	038THA0020
Classification:	Occupational Controlled (Operator); General Population/Uncontrolled (Passengers/Bystanders)
Rule Part(s):	2.1091 (d)

Approved Accessories:
Antenna(s):
HAD4006A (136-144MHz ¼ wave roof mount antenna; 0dBd gain, Mini U Connector)
HAD4007A (146-150.8MHz ¼ wave roof mount antenna; 0dBd gain, Mini U Connector)
HAD4008A (150.8-162MHz ¼ wave roof mount antenna; 0dBd gain, Mini U Connector)
HAD4009A (162-174MHz ¼ wave roof mount antenna; 0dBd gain, Mini U Connector)
HAD4014A (146-172MHz 5/8 wave roof mount antenna; 3.0dBd gain, Mini U Connector)
RAD4198A (136-144MHz ¼ wave roof mount antenna; 0dBd gain, BNC Connector)
RAD4199A (146-150.8MHz ¼ wave roof mount antenna; 0dBd gain, BNC Connector)
RAD4200A (150.8-162MHz ¼ wave roof mount antenna; 0dBd gain, BNC Connector)
RAD4201A (162-174MHz ¼ wave roof mount antenna; 0dBd gain, BNC Connector)

RAD4214A (136-144MHz ¼ wave roof mount GPS Combo antenna; 0dBd gain, Mini U Connector)
RAD4215A (146-150.8MHz ¼ wave roof mount GPS Combo antenna; 0dBd gain, Mini U Connector)
RAD4216A (150.8-162MHz ¼ wave roof mount GPS Combo antenna; 0dBd gain, Mini U Connector)
RAD4217A (162-174MHz ¼ wave roof mount GPS Combo antenna; 0dBd gain, Mini U Connector)
RAD4218A (146-172MHz 5/8 wave roof mount GPS Combo antenna; 3.0dBd gain, Mini U Connector)
RAD4219A (136-144MHz ¼ wave roof mount GPS Combo antenna; 0dBd gain, BNC Connector)
RAD4220A (146-150.8MHz ¼ wave roof mount GPS Combo antenna; 0dBd gain, BNC Connector)
RAD4221A (150.8-162MHz ¼ wave roof mount GPS Combo antenna; 0dBd gain, BNC Connector)
RAD4222A (162-174MHz ¼ wave roof mount GPS Combo antenna; 0dBd gain, BNC Connector)

Final RF Exposure Results:
Mobile max calculated 1-g Avg. SAR: 0.708mW/g

Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 3.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola EME Laboratory.

Signature on file
Deanna Zakharia N&E EME Lab Senior Resource Manager,
Laboratory Director,

Approval Date: 3/19/2007

Certification Date:

Certification No.:

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REVISION HISTORY

Date	Revision	Comments
03/14/07	O	Original release
3/19/07	A	Changed nominal power range from 27.5-45W to 25-45W under DUT description and changed 1:2 to 2:1 under signaling type.

1.0 Product and System Description

FCC ID: ABZ99FT3082, model PMUD2043A is a mobile transceiver that utilizes both analog and digital two-way radio communications and also includes GPS capability. The modulation scheme used for analog is narrowband Frequency Modulation (FM). The modulation scheme used for digital is 4 Level Frequency Shift Keying (4FSK) and Time Division Multiple Access (TDMA). TDMA is used to allocate portions of the RF signal by dividing time into two slots. Transmission from a unit or base station is accommodated in time-slot lengths of 30 milliseconds and frame lengths of 60 milliseconds.

The intended use of the radio is Push-To-Talk (PTT) while the device is properly installed in a vehicle with an external antenna mounted at the center of the roof or trunk.

This device will be marketed to and used by employees solely for work-related operations, such as public safety agencies, e.g. police, fire and emergency medical. User training is the responsibility of these agencies which can be expected to employ the usage instructions, safety information and operational cautions set forth in the user's manual, instructional sessions or other means.

Accordingly this product is classified as Occupational/Controlled Exposure. However, In accordance with FCC requirements, the passengers inside the vehicle and the bystanders external to the vehicle are evaluated to the General Population/Uncontrolled Exposure Limits.

(Note that “By-standers” as used herein mean people other than operator)

2.0 Additional Options and Accessories:

Antennas listed on front cover page;
Note 1 - Antennas have optional mini-U and BNC radio termination connectors and therefore only mini-U was tested.
Note 2 – Antennas are described as roof mount however trunk installations are an acceptable alternative for this product and therefore antennas were tested for both roof and trunk mount installations.

3.0 Measurement and Limit Standards

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

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

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 13.8 volts.

5.0 Measurement System Uncertainty Levels

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

Uncertainty Budget for Near Field Probe Measurements

	Tol. (± %)	Prob. Dist.	Divisor	u_i (±%)
Measurement System				
Survey Meter Calibration	3.0	N	1.00	3.0
Repeatability Accuracy	7.0	N	1.00	7.0
Combined Standard Uncertainty		RSS		7.6
Expanded Uncertainty		*k*=2		15

6.0 Method of Measurement

6.1 EME measurements made with trunk mounted antenna(s)

(For reference, see Illustration of antenna location and test distances in appendix A)

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 for each of the (3) test locations indicated in appendix A with 20cm increments at the test distance of 90cm from the antenna under test. The measurement probe 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 at the rear of the vehicle while maintaining a twenty (20) centimeter separation distance between the probe sensor and vehicle body. The worst case antenna was then tested at a 45º radial at the corner of the trunk, and 90º radial at the side of the trunk.

For the current test vehicle, the antenna to probe sensor separation distance is 90cm (directly behind vehicle), 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, at both front and back seating areas, across the TX band to ascertain the highest level at the head. After the highest level is found, scans were performed vertically making two (2) additional measurements within an area approximately 40cm 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 with roof mounted antenna(s)

(For reference, see Illustration of antenna location and test distances in appendix A).

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 for the test location indicated in appendix A with 20cm increments at the test distance of 90cm from the antenna under test. The measurement probe 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, across the TX band to ascertain the highest level in each location. After the highest level is found, two (2) additional measurements were performed vertically within an area approximately 40cm 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 open area test site located at 8000 W. Sunrise Blvd., Plantation, FL. 33322.

8.0 Measurement System/Equipment

Equipment Type	Model #	SN	Calibration Due Date
Automobile	1991 Ford Taurus, 4-Door		
Survey Meter	NARDA Model 8718	01108	7/11/07, 10/30/07
Probe - E-Field (Electric Field)	NARDA Model 8722B	13001	7/11/07
Probe - H-Field (Magnetic Field)	NARDA Model 8732	06007	10/30/07

Note – Survey meter and probes are calibrated together.

9.0 Test Unit Description

Power density measurements were performed on PMUD2043A with serial numbers 038THA0020. The tested frequencies and associated power outputs are presented below.

Frequency (MHz)	Po (W)
136.0	50.5
148.4	53.8
156.4	51.5
159.0	50.5
172.0	49.2
174.0	49.3

10.0 Test Set-Up Description

The following are the mobile antenna test configurations used for this product.
(for reference, see Illustration of antenna location and test distances in the appendix A)

a) The ¼ wave 0dBd gain antennas (HAD4006A, HAD4007A, HAD4008A, HAD4009A, RAD4214A, RAD4215A, RAD4216A and RAD4217A) and 5/8 wave 3.0dBd gain antennas (HAD4014A and RAD4218A) were assessed while mounted at the center of the roof of the test vehicle.

b) The ¼ wave 0dBd gain antennas (HAD4006A, HAD4007A, HAD4008A, HAD4009A, RAD4214A, RAD4215A, RAD4216A and RAD4217A) and 5/8 wave 3.0dBd gain antennas (HAD4014A and RAD4218A) were assessed while mounted at the center of the trunk of the test vehicle.

Assessments were made internal and external to the test vehicle at the specified distances and test locations indicated in sections 6.0, 11.0, and appendix A.

11.0 Test Results Summary

Appendix D presents detailed MPE measurement information for each test configuration; person external or internal to the vehicle, TX frequency, antenna (location, model and gain), distance from antenna to probe sensor, E/H field measurements, calibration factor, MPE average over body, initial power, power density calc, power density max calc, IEEE/FCC controlled and uncontrolled limits, and maximum output power.

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

MPE results are based on a 50% duty cycle which is in accordance with the User Manual instructions.

External to vehicle - 10 measurements are averaged over the body (*Body_Avg*).
Internal to vehicle - 3 measurements are averaged over the body (*Body_Avg*).
Narda Survey Meter measures in percent of the controlled limit. Therefore the averages over the body used in the calculations below reflect percentages.

MPE results are based on a Push-To-Talk (PTT) 50% duty cycle in CW mode.

Therefore;

$$Average\_over\_Body = Body\_Avg * Controlled\_Limit$$

$$Pwr\_Density\_Calc = Average\_over\_Body * \_Duty\_Cycle$$

$$Pwr\_Density\_Max\_Calc = Pwr\_Density\_Calc * \frac{Max\_Output\_Power}{Initial\_Output\_Power}$$

Note; For *Initial Output Power> Max_Output_Power, Max_Output_Power* / *Initial Output Power* = 1

The table below summarizes the MPE results of the E/H field test configurations for the PMUD2043A mobile radio. See appendices A and D respectively for test positions and detailed MPE measurement data.

Tables	Antenna Model	Antenna Location	Test Frequency (MHz)	E/H Field	Passenger / By-stander	Max Calc Pwr Density (mW/cm^2)	% of Uncontrolled Limit
Roof E-Field							
1	HAD4006A	Roof	136	E	By-stander	0.08	40.0%
2	HAD4006A	Roof	136	E	Passenger	0.07	35.0%
3	HAD4007A	Roof	148.4	E	By-stander	0.08	40.0%
4	HAD4007A	Roof	148.4	E	Passenger	0.1	50.0%
5	HAD4008A	Roof	156.4	E	By-stander	0.09	45.0%
6	HAD4008A	Roof	156.4	E	Passenger	0.06	30.0%
7	HAD4009A	Roof	174	E	By-stander	0.08	40.0%
8	HAD4009A	Roof	174	E	Passenger	0.05	25.0%
9	HAD4014A	Roof	148.4	E	By-stander	0.01	5.0%
10	HAD4014A	Roof	148.4	E	Passenger	0.01	5.0%
11	HAD4014A	Roof	159	E	By-stander	0.05	25.0%
12	HAD4014A	Roof	159	E	Passenger	0.03	15.0%
13	HAD4014A	Roof	172	E	By-stander	0.01	5.0%
14	HAD4014A	Roof	172	E	Passenger	0.00	0.0%
15	RAD4214A	Roof	136	E	By-stander	0.04	20.0%
16	RAD4214A	Roof	136	E	Passenger	0.11	55.0%
17	RAD4215A	Roof	148.4	E	By-stander	0.07	35.0%
18	RAD4215A	Roof	148.4	E	Passenger	0.06	30.0%
19	RAD4216A	Roof	156.4	E	By-stander	0.06	30.0%
20	RAD4216A	Roof	156.4	E	Passenger	0.06	30.0%
21	RAD4217A	Roof	174	E	By-stander	0.05	25.0%
22	RAD4217A	Roof	174	E	Passenger	0.04	20.0%
23	RAD4218A	Roof	148.4	E	By-stander	0.05	25.0%
24	RAD4218A	Roof	148.4	E	Passenger	0.05	25.0%
25	RAD4218A	Roof	159	E	By-stander	0.05	25.0%
26	RAD4218A	Roof	159	E	Passenger	0.03	15.0%
27	RAD4218A	Roof	172	E	By-stander	0.04	20.0%
28	RAD4218A	Roof	172	E	Passenger	0.03	15.0%

Table continued

Tables	Antenna Model	Antenna Location	Test Frequency (MHz)	E/H Field	Passenger / By-stander	Max Calc Pwr Density (mW/cm^2)	% of Uncontrolled Limit
Roof H-Field							
29	HAD4006A	Roof	136	H	By-stander	0.08	40.0%
30	HAD4006A	Roof	136	H	Passenger	0.07	35.0%
31	HAD4007A	Roof	148.4	H	By-stander	0.07	35.0%
32	HAD4007A	Roof	148.4	H	Passenger	0.06	30.0%
33	HAD4008A	Roof	156.4	H	By-stander	0.07	35.0%
34	HAD4008A	Roof	156.4	H	Passenger	0.06	30.0%
35	HAD4009A	Roof	174	H	By-stander	0.07	35.0%
36	HAD4009A	Roof	174	H	Passenger	0.07	35.0%
37	HAD4014A	Roof	148.4	H	By-stander	0.06	30.0%
38	HAD4014A	Roof	148.4	H	Passenger	0.05	25.0%
39	HAD4014A	Roof	159	H	By-stander	0.07	35.0%
40	HAD4014A	Roof	159	H	Passenger	0.06	30.0%
41	HAD4014A	Roof	172	H	By-stander	0.08	40.0%
42	HAD4014A	Roof	172	H	Passenger	0.06	30.0%
43	RAD4214A	Roof	136	H	By-stander	0.08	40.0%
44	RAD4214A	Roof	136	H	Passenger	0.06	30.0%
45	RAD4215A	Roof	148.4	H	By-stander	0.07	35.0%
46	RAD4215A	Roof	148.4	H	Passenger	0.05	25.0%
47	RAD4216A	Roof	156.4	H	By-stander	0.07	35.0%
48	RAD4216A	Roof	156.4	H	Passenger	0.07	35.0%
49	RAD4217A	Roof	174	H	By-stander	0.08	40.0%
50	RAD4217A	Roof	174	H	Passenger	0.05	25.0%
51	RAD4218A	Roof	148.4	H	By-stander	0.07	35.0%
52	RAD4218A	Roof	148.4	H	Passenger	0.05	25.0%
53	RAD4218A	Roof	159	H	By-stander	0.07	35.0%
54	RAD4218A	Roof	159	H	Passenger	0.06	30.0%
55	RAD4218A	Roof	172	H	By-stander	0.07	35.0%
56	RAD4218A	Roof	172	H	Passenger	0.06	30.0%

Table continued

Tables	Antenna Model	Antenna Location	Test Frequency (MHz)	E/H Field	Passenger / By-stander	Max Calc Pwr Density (mW/cm^2)	% of Uncontrolled Limit
Trunk E-Field							
57	HAD4006A	Trunk	136	E	By-stander	0.13	65.0%
*58	HAD4006A	Trunk	136	E	Passenger	0.36	180.0%
59	HAD4007A	Trunk	148.4	E	By-stander	0.13	65.0%
*60	HAD4007A	Trunk	148.4	E	Passenger	0.47	235.0%
61	HAD4008A	Trunk	156.4	E	By-stander	0.11	55.0%
*62	HAD4008A	Trunk	156.4	E	Passenger	0.35	175.0%
63	HAD4009A	Trunk	174	E	By-stander	0.06	30.0%
*64	HAD4009A	Trunk	174	E	Passenger	0.24	120.0%
65	HAD4014A	Trunk	148.4	E	By-stander	0.02	10.0%
66	HAD4014A	Trunk	148.4	E	Passenger	0.01	5.0%
67	HAD4014A	Trunk	159	E	By-stander	0.12	60.0%
68	HAD4014A	Trunk	159	E	Passenger	0.03	15.0%
69	HAD4014A	Trunk	172	E	By-stander	0.03	15.0%
70	HAD4014A	Trunk	172	E	Passenger	0.01	5.0%
71	RAD4214A	Trunk	136	E	By-stander	0.12	60.0%
*72	RAD4214A	Trunk	136	E	Passenger	0.3	150.0%
73	RAD4215A	Trunk	148.4	E	By-stander	0.11	55.0%
*74	RAD4215A	Trunk	148.4	E	Passenger	0.35	175.0%
75	RAD4216A	Trunk	156.4	E	By-stander	0.12	60.0%
*76	RAD4216A	Trunk	156.4	E	Passenger	0.22	110.0%
77	RAD4217A	Trunk	174	E	By-stander	0.07	35.0%
*78	RAD4217A	Trunk	174	E	Passenger	0.46	230.0%
79	RAD4218A	Trunk	148.4	E	By-stander	0.11	55.0%
*80	RAD4218A	Trunk	148.4	E	Passenger	0.33	165.0%
81	RAD4218A	Trunk	159	E	By-stander	0.11	55.0%
*82	RAD4218A	Trunk	159	E	Passenger	0.24	120.0%
83	RAD4218A	Trunk	172	E	By-stander	0.08	40.0%
*84	RAD4218A	Trunk	172	E	Passenger	0.25	125.0%
45 Degree							
*85	HAD4007A	Trunk	148.4	E	By-stander	0.20	100.0%
90 Degree							
86	HAD4007A	Trunk	148.4	E	By-stander	0.17	85.0%

*** Equals or Exceeds MPE Limit**

Table continued

Tables	Antenna Model	Antenna Location	Test Frequency (MHz)	E/H Field	Passenger / By-stander	Max Calc Pwr Density (mW/cm^2)	% of Uncontrolled Limit
Trunk H-Field							
87	HAD4006A	Trunk	136	H	By-stander	0.05	25.0%
88	HAD4006A	Trunk	136	H	Passenger	0.06	30.0%
89	HAD4007A	Trunk	148.4	H	By-stander	0.04	20.0%
90	HAD4007A	Trunk	148.4	H	Passenger	0.04	20.0%
91	HAD4008A	Trunk	156.4	H	By-stander	0.04	20.0%
92	HAD4008A	Trunk	156.4	H	Passenger	0.05	25.0%
93	HAD4009A	Trunk	174	H	By-stander	0.04	20.0%
94	HAD4009A	Trunk	174	H	Passenger	0.05	25.0%
95	HAD4014A	Trunk	148.4	H	By-stander	0.05	25.0%
96	HAD4014A	Trunk	148.4	H	Passenger	0.04	20.0%
97	HAD4014A	Trunk	159	H	By-stander	0.04	20.0%
98	HAD4014A	Trunk	159	H	Passenger	0.05	25.0%
99	HAD4014A	Trunk	172	H	By-stander	0.05	25.0%
100	HAD4014A	Trunk	172	H	Passenger	0.05	25.0%
101	RAD4214A	Trunk	136	H	By-stander	0.06	30.0%
102	RAD4214A	Trunk	136	H	Passenger	0.05	25.0%
103	RAD4215A	Trunk	148.4	H	By-stander	0.04	20.0%
104	RAD4215A	Trunk	148.4	H	Passenger	0.03	15.0%
105	RAD4216A	Trunk	156.4	H	By-stander	0.05	25.0%
106	RAD4216A	Trunk	156.4	H	Passenger	0.03	15.0%
107	RAD4217A	Trunk	174	H	By-stander	0.05	25.0%
108	RAD4217A	Trunk	174	H	Passenger	0.04	20.0%
109	RAD4218A	Trunk	148.4	H	By-stander	0.05	25.0%
110	RAD4218A	Trunk	148.4	H	Passenger	0.03	15.0%
111	RAD4218A	Trunk	159	H	By-stander	0.05	25.0%
112	RAD4218A	Trunk	159	H	Passenger	0.03	15.0%
113	RAD4218A	Trunk	172	H	By-stander	0.05	25.0%
114	RAD4218A	Trunk	172	H	Passenger	0.03	15.0%
45 Degree							
115	RAD4214A	Trunk	136	H	By-stander	0.07	35.0%
90 Degree							
116	RAD4214A	Trunk	136	H	By-stander	0.05	25.0%

12.0 Conclusion

Depending on the test frequency, the PMUD2043A mobile assessments were performed with an output power range of 49.2W – 53.8W. The highest power density results for the PMUD2043A VHF mobile device scaled to the maximum allowable power output is 0.47mW/cm^2 internal to the vehicle and 0.20mW/cm^2 external to the vehicle.

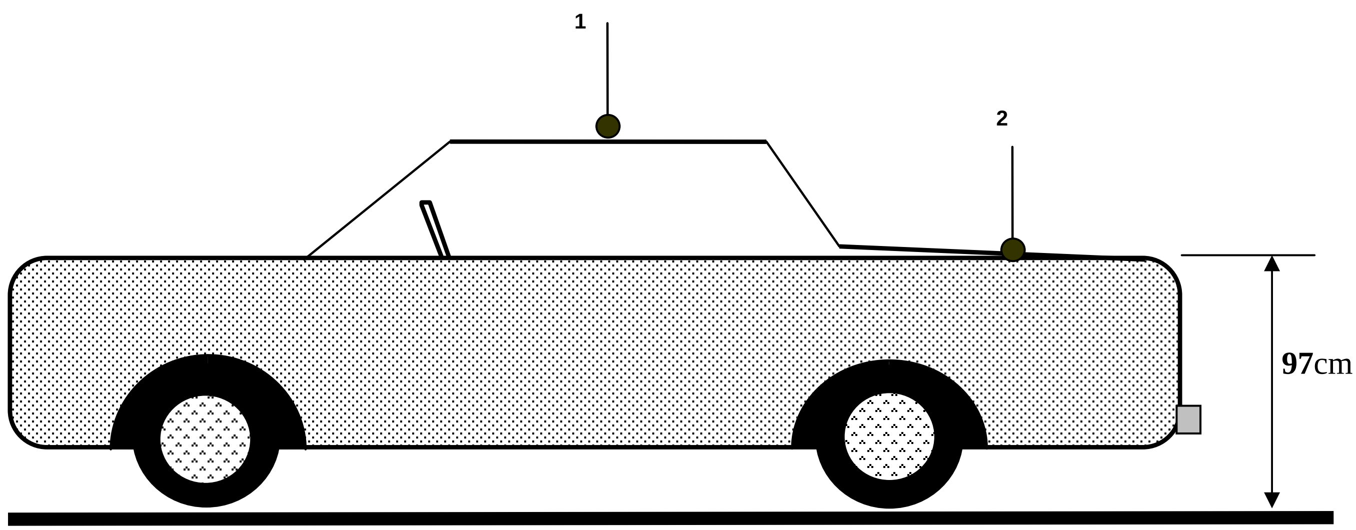
These MPE results demonstrate compliance to the FCC/IEEE Occupational/Controlled Exposure limit.

FCC rules require compliance for passengers and bystanders to the FCC General Population/Uncontrolled limits. Although MPE is a convenient method of demonstrating compliance, SAR is recognized as the "basic restriction". For those configurations exceeding the MPE limit noted in section 11.0 table, compliance to the FCC SAR General Population/Uncontrolled limit of 1.6mW/g is demonstrated in Appendix E via SAR computational analysis.

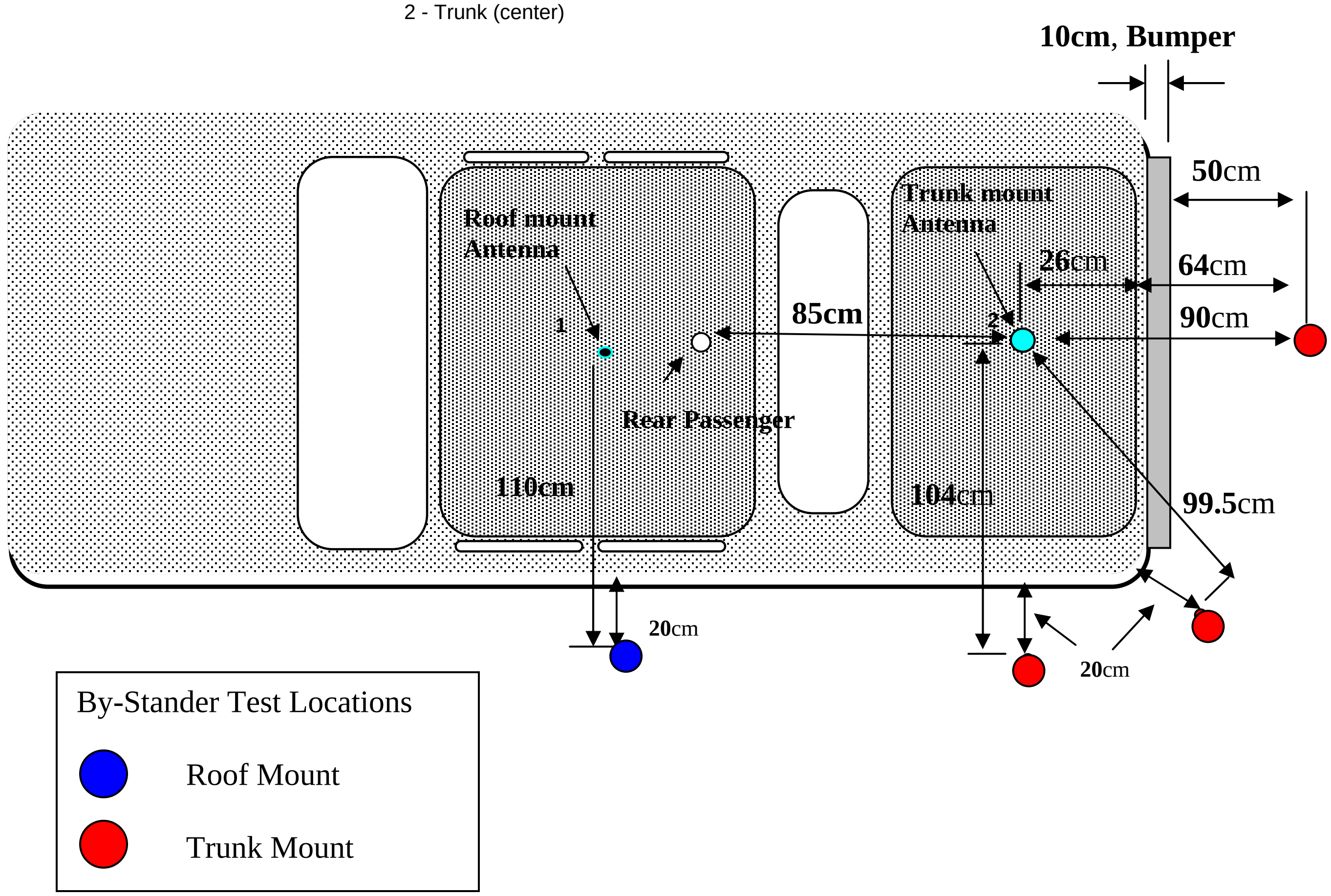
The computation results show that this device, when used with the specified antennas, exhibit a maximum combined peak 1-g average S.A.R. of 0.708mW/g.

APPENDIX A

Illustration of Antenna Locations and Test Distances



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



APPENDIX B

Meter/Probe Calibration Certificates

CERTIFICATION OF CALIBRATION CONFORMANCE

LIBERTY LABS, INC. 1346 Yellowwood Road Kimballton, IA 51543
EMAIL: mhoward@liberty-labs.com TEL: (712) 773-2199 FAX: (712)773-2299

This probe has been individually calibrated using IEEE Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9 kHz to 40 GHz; IEEE Std. 1309-1996. All results of this calibration relate only to the items that were calibrated.

ACCREDITATION NOTES:
A complete copy of the scope of our A2LA accreditation is available upon request.

Instrumentation Environment: TEMP: 23°C RH: 41%
Calibration Environment: TEMP: 23°C RH: 41%
Barometric Pressure (inches): 29.82
CERTIFICATE NO.: 2006061922
CLIENT: Motorola, Inc., 8000 W. Sunrise Blvd., Plantation, FL, 33322-9947, USA
MANUFACTURER: Narda
MODEL NUMBER: 8722B & 8718
SERIAL NUMBER: 13001 & 01108
ASSET NUMBER:
DATE OF CALIBRATION: Tuesday, July 11, 2006
NAME OF CALIBRATING ORGANIZATION Liberty Labs, Inc.
CALIBRATED BY: DSG *DSG*
RE-CERTIFICATION DATE: Re-Certification interval is at customer discretion.

RECEIVED STATUS
Received in tolerance: ☑

RETURNED STATUS
Returned in tolerance: ☑
Returned limited cal.: ☐

NOTES: We have deviated from IEEE 1309 with the use of a tri-plate line as a transfer standard for frequencies at and/or below 1GHz. Client declined isotropic response testing. In/Out of tolerance based on alignment/mounting position and not on manufacturer's specifications. A probe position document is included with this certificate.

LL, Inc.

Michael W. Howard

ENGINEER IN CHARGE
MICHAEL W. HOWARD
NARTE CERTIFIED EMC ENGINEER, NO. EM C-000102-NE

ACCREDITED
Certificate Number: 2123.01

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Probe01.txt

Date of Calibration: 11-July-2006
Date Printed: Tuesday, July 11, 2006
Customer Name: Motorola, Inc.
Probe Manufacturer: Narda
Probe Model: 8722B & 8718
Probe Serial No.: 13001 & 01108
Temperature (Deg C): 23
Humidity (%): 41
Notes: Calibrated with 8718 Monitor, s/n 01108.
CAL CERT #: 2006061922

Correction Factors

Frequency in MHz	Mutiplier	dB
1	1.91	5.62
15	1.23	1.82
30	0.89	-1.04
75	0.82	-1.74
100	0.71	-3.02
150	1.04	0.36
200	0.90	-0.88
300	0.73	-2.79
400	0.92	-0.75
500	1.08	0.70
600	1.35	2.62
700	0.86	-1.29
800	1.06	0.47
900	1.58	3.97
1000	0.68	-3.38
2000	1.10	0.80
2450	0.95	-0.49
3000	0.90	-0.91
4000	1.29	2.22
5000	0.90	-0.92
6000	0.84	-1.52
7000	0.98	-0.15

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CERTIFICATION OF CALIBRATION CONFORMANCE

LIBERTY LABS, INC. 1346 Yellowwood Road Kimballton, IA 51543
EMAIL: mhoward@liberty-labs.com TEL: (712) 773-2199 FAX: (712)773-2299

This probe has been individually calibrated using IEEE Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9 kHz to 40 GHz; IEEE Std. 1309-1996. All results of this calibration relate only to the items that were calibrated.

ACCREDITATION NOTES:
A complete copy of the scope of our A2LA accreditation is available upon request.

Instrumentation Environment:	TEMP: 23°C	RH: 29%
Calibration Environment:	TEMP: 23°C	RH: 29%

Barometric Pressure (inches): 29.48
CERTIFICATE NO.: 2006061921
CLIENT: Motorola, Inc., 8000 W. Sunrise Blvd., Plantation, FL, 33322-9947, USA
MANUFACTURER: Narda
MODEL NUMBER: 8732 & 8718
SERIAL NUMBER: 06007 & 01108
ASSET NUMBER:
DATE OF CALIBRATION: Monday, October 30, 2006
NAME OF CALIBRATING ORGANIZATION Liberty Labs, Inc.
CALIBRATED BY: DSG DSG
RE-CERTIFICATION DATE: Re-Certification interval is at customer discretion.

RECEIVED STATUS	RETURNED STATUS
Received in tolerance: ☑	Returned in tolerance: ☑
	Returned limited cal.: ☐

NOTES: Below 1 GHz Liberty Labs uses a transfer standard calibrated to IEEE1309 Standards. Liberty Labs uses this transfer standard via the substitute method outlined in IEEE 1309 in a triplate test cell to calibrate probes. The uncertainty between the TEM and Triplate is minimal in this application. Client declined isotropic response testing. In/Out of tolerance based on alignment/mounting position and not on manufacturer's specifications. A probe position document is included with this certificate.

LL, Inc.

Michael W. Howard

ENGINEER IN CHARGE
MICHAEL W. HOWARD
NARTE CERTIFIED EMC ENGINEER, NO. EM C-000102-NE

ACCREDITED
Certificate Number: 2123.01

ispb-position Page 1 of 4 Rev. D: Issue Date 12/12/03

Probe01.txt

Date of Calibration: 30-October-2006
Date Printed: Monday, October 30, 2006
Customer Name: Motorola, Inc.
Probe Manufacturer: Narda
Probe Model: 8732 & 8718
Probe Serial No.: 06007 & 01108
Temperature (Deg C): 23
Humidity (%): 29
Notes:
CAL CERT #: 2006061921

Correction Factors

Frequency in MHz	Mutiplier	dB
0.3	1.07	0.59
1	0.95	-0.48
3	1.06	0.49
10	1.03	0.29
30	1.21	1.63
100	1.22	1.71
200	1.18	1.45

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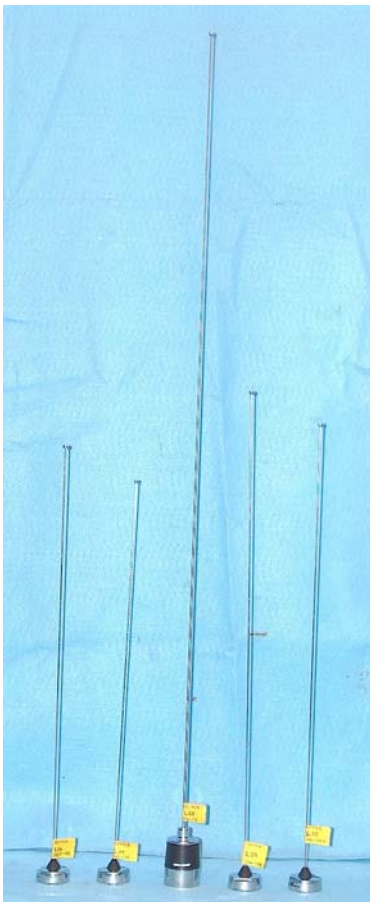
APPENDIX C

Photos of Assessed Antennas

Antenna kit numbers, from left to right;
HAD4006A, HAD4007A, HAD4008A, HAD4009A and HAD4014A



GPS Base – Side View

GPS Base – Top View

Antenna kit numbers, from left to right (all antenna kit numbers below include GPS Base PMAN4004A);
RAD4216A, RAD4217A, RAD4218A, RAD4214A and RAD4215A

APPENDIX D

Detailed MPE Measurement Data

Table 1

External Vehicle MPE Assessment @ 136 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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 (actual 110)	E	0.95	0.146	50.5	0.073	0.08
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	2.6%		6	120	13.4%		1.00	0.20
2	40	2.9%		7	140	24.8%			
3	60	3.0%		8	160	33.2%			
4	80	3.6%		9	180	29.6%			RF Po (*Max)
5	100	8.9%		10	200	23.9%			54.0

Table 2

Internal Vehicle MPE Assessment @ 136 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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	0.95	0.128	0.096	50.5	0.064	0.07
Measurement Grid										
Test Position		% of Control Limit Head		% of Control Limit Chest		% of Control Limit Lower Trunk		IEEE Controlled Limit:		1.00
Back Seat		12.7%		6.4%		19.3%		IEEE Uncontrolled Limit:		0.20
Front Seat		4.0%		14.5%		10.2%			RF Po (*Max):	54.0

Table 3

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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	1.03	0.155	53.8	0.077	0.08
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	2.3%		6	120	16.5%		1.00	0.20
2	40	1.2%		7	140	25.3%			
3	60	1.7%		8	160	36.3%			
4	80	3.0%		9	180	33.9%			RF Po (*Max)
5	100	8.6%		10	200	25.8%			54.0

Table 4

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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	1.03	0.190	0.158	53.8	0.095	0.10
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		36.3%		13.3%		7.5%		IEEE Uncontrolled Limit:		0.20
Front Seat		9.1%		20.1%		18.2%			**RF Po (*Max):**	54.0

Table 5

External Vehicle MPE Assessment @ 156.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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 (actual 110)	E	1.02	0.171	51.5	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	1.9%		6	120	17.3%		1.00	0.20
2	40	1.9%		7	140	26.2%			
3	60	3.3%		8	160	40.9%			
4	80	5.4%		9	180	34.4%			**RF Po (*Max)**
5	100	11.5%		10	200	27.8%			54.0

Table 6

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4008A	2.15	Highest Reading	E	1.02	0.118	0.096	51.5	0.059	0.06
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		17.6%		8.9%		9.0%		IEEE Uncontrolled Limit:		0.20
Front Seat		8.1%		7.5%		13.2%			**RF Po (*Max):**	54.0

Table 7

External Vehicle MPE Assessment @ 174 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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	0.97	0.138	49.3	0.069	0.08
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	1.9%		6	120	11.6%		1.00	0.20
2	40	1.7%		7	140	17.4%			
3	60	2.9%		8	160	21.8%			
4	80	5.0%		9	180	35.0%			**RF Po (*Max)**
5	100	8.6%		10	200	32.2%			54.0

Table 8

Internal Vehicle MPE Assessment @ 174 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4009A	2.15	Highest Reading	E	0.97	0.085	0.051	49.3	0.043	0.05
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**			IEEE Controlled Limit:	1.00
Back Seat		9.1%		8.8%		7.6%			IEEE Uncontrolled Limit:	0.20
Front Seat		6.4%		4.5%		4.3%			**RF Po (*Max):**	54.0

Table 9

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	90 (actual 110)	E	1.03	0.016	53.8	0.008	0.01
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.6%		6	120	1.2%		1.00	0.20
2	40	0.5%		7	140	1.6%			
3	60	0.8%		8	160	2.1%			
4	80	1.1%		9	180	2.8%			**RF Po (*Max)**
5	100	1.1%		10	200	4.4%			54.0

Table 10

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	Highest Reading	E	1.03	0.007	0.010	53.8	0.005	0.01
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		0.8%		0.7%		0.5%		IEEE Uncontrolled Limit:		0.20
Front Seat		1.0%		1.2%		0.9%			**RF Po (*Max):**	54.0

Table 11

External Vehicle MPE Assessment @ 159 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	90 (actual 110)	E	1.01	0.090	50.5	0.045	0.05
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	1.0%		6	120	5.5%		1.00	0.20
2	40	1.7%		7	140	8.7%			
3	60	1.5%		8	160	15.4%			
4	80	1.7%		9	180	21.0%			**RF Po (*Max)**
5	100	2.2%		10	200	31.5%			54.0

Table 12

Internal Vehicle MPE Assessment @ 159 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	Highest Reading	E	1.01	0.028	0.058	50.5	0.029	0.03
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		3.7%		2.8%		1.9%		IEEE Uncontrolled Limit:		0.20
Front Seat		4.8%		8.1%		4.5%			**RF Po (*Max):**	54.0

Table 13

External Vehicle MPE Assessment @ 172 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	90 (actual 110)	E	0.98	0.017	49.2	0.009	0.01
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.5%		6	120	1.3%		1.00	0.20
2	40	0.4%		7	140	1.9%			
3	60	0.5%		8	160	2.6%			
4	80	0.9%		9	180	2.9%			**RF Po (*Max)**
5	100	1.0%		10	200	5.0%			54.0

Table 14

Internal Vehicle MPE Assessment @ 172 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	Highest Reading	E	0.98	0.007	0.003	49.2	0.003	0.00
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		1.0%		0.6%		0.4%		IEEE Uncontrolled Limit:		0.20
Front Seat		0.3%		0.5%		0.2%			**RF Po (*Max):**	54.0

Table 15

External Vehicle MPE Assessment @ 136 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4214A	2.15	90 (actual 110)	E	0.95	0.073	50.5	0.037	0.04
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.7%		6	120	7.9%		1.00	0.20
2	40	1.3%		7	140	13.3%			
3	60	1.6%		8	160	14.8%			
4	80	2.3%		9	180	13.1%			**RF Po (*Max)**
5	100	3.1%		10	200	15.0%			54.0

Table 16

Internal Vehicle MPE Assessment @ 136 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4214A	2.15	Highest Reading	E	0.95	0.209	0.079	50.5	0.105	0.11

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	32.9%	18.7%	11.2%	IEEE Uncontrolled Limit:	0.20
Front Seat	11.1%	9.9%	2.7%	**RF Po (*Max):**	54.0

Table 17

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4215A	2.15	90 (actual 110)	E	1.03	0.132	53.8	0.066	0.07

Measurement Grid							
Test Position	Height (cm)	% of Control Limit	Test Position	Height (cm)	% of Control Limit	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.6%	6	120	12.4%	1.00	0.20
2	40	1.6%	7	140	19.8%		
3	60	2.9%	8	160	25.2%		
4	80	2.9%	9	180	26.4%		**RF Po (*Max)**
5	100	6.0%	10	200	34.1%		54.0

Table 18

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4215A	2.15	Highest Reading	E	1.03	0.117	0.031	53.8	0.059	0.06

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	23.8%	10.4%	1.0%	IEEE Uncontrolled Limit:	0.20
Front Seat	1.9%	4.7%	2.7%	**RF Po (*Max):**	54.0

Table 19

External Vehicle MPE Assessment @ 156.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4216A	2.15	90 (actual 110)	E	1.02	0.121	51.5	0.060	0.06
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.9%		6	120	12.7%		1.00	0.20
2	40	1.8%		7	140	20.0%			
3	60	1.9%		8	160	23.9%			
4	80	3.2%		9	180	26.3%			RF Po (*Max)
5	100	7.3%		10	200	22.6%			54.0

Table 20

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4216A	2.15	Highest Reading	E	1.02	0.120	0.024	51.5	0.060	0.06
Measurement Grid										
Test Position		% of Control Limit Head		% of Control Limit Chest		% of Control Limit Lower Trunk		IEEE Controlled Limit:		1.00
Back Seat		17.5%		7.9%		10.5%		IEEE Uncontrolled Limit:		0.20
Front Seat		2.1%		3.2%		2.0%			RF Po (*Max):	54.0

Table 21

External Vehicle MPE Assessment @ 174 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4217A	2.15	90 (actual 110)	E	0.97	0.084	49.3	0.042	0.05
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.9%		6	120	7.7%		1.00	0.20
2	40	1.0%		7	140	11.6%			
3	60	1.2%		8	160	15.6%			
4	80	1.7%		9	180	18.0%			RF Po (*Max)
5	100	4.4%		10	200	21.6%			54.0

Table 22

Internal Vehicle MPE Assessment @ 174 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4217A	2.15	Highest Reading	E	0.97	0.077	0.021	49.3	0.038	0.04

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	5.3%	8.0%	9.7%	IEEE Uncontrolled Limit:	0.20
Front Seat	3.3%	1.6%	1.3%	**RF Po (*Max):**	54.0

Table 23

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	90 (actual 110)	E	1.03	0.096	53.8	0.048	0.05

Measurement Grid							
Test Position	Height (cm)	% of Control Limit	Test Position	Height (cm)	% of Control Limit	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.6%	6	120	8.0%	1.00	0.20
2	40	0.8%	7	140	13.0%		
3	60	1.0%	8	160	19.5%		
4	80	1.5%	9	180	20.9%		**RF Po (*Max)**
5	100	4.4%	10	200	25.8%		54.0

Table 24

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	Highest Reading	E	1.03	0.094	0.025	53.8	0.047	0.05

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	16.9%	7.0%	4.3%	IEEE Uncontrolled Limit:	0.20
Front Seat	1.1%	4.2%	2.2%	**RF Po (*Max):**	54.0

Table 25

External Vehicle MPE Assessment @ 159 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	90 (actual 110)	E	1.01	0.095	50.5	0.048	0.05
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.5%		6	120	8.5%		1.00	0.20
2	40	0.7%		7	140	13.6%			
3	60	1.0%		8	160	17.5%			
4	80	2.0%		9	180	20.0%			RF Po (*Max)
5	100	5.1%		10	200	26.3%			54.0

Table 26

Internal Vehicle MPE Assessment @ 159 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	Highest Reading	E	1.01	0.061	0.029	50.5	0.031	0.03
Measurement Grid										
Test Position		% of Control Limit Head		% of Control Limit Chest		% of Control Limit Lower Trunk			IEEE Controlled Limit:	1.00
Back Seat		11.1%		4.2%		3.1%			IEEE Uncontrolled Limit:	0.20
Front Seat		2.3%		2.6%		3.8%			RF Po (*Max):	54.0

Table 27

External Vehicle MPE Assessment @ 172 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	90 (actual 110)	E	0.98	0.069	49.2	0.035	0.04
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.6%		6	120	4.4%		1.00	0.20
2	40	1.3%		7	140	7.7%			
3	60	1.4%		8	160	11.4%			
4	80	1.5%		9	180	15.7%			RF Po (*Max)
5	100	3.6%		10	200	21.8%			54.0

Table 28

Internal Vehicle MPE Assessment @ 172 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	Highest Reading	E	0.98	0.061	0.024	49.2	0.031	0.03

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	6.0%	9.0%	3.4%	IEEE Uncontrolled Limit:	0.20
Front Seat	1.9%	2.9%	2.4%	**RF Po (*Max):**	54.0

Table 29

External Vehicle MPE Assessment @ 136 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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 (actual 110)	H	1.21	0.149	50.5	0.075	0.08

Measurement Grid							
Test Position	Height (cm)	% of Control Limit	Test Position	Height (cm)	% of Control Limit	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	19.0%	6	120	14.9%	1.00	0.20
2	40	13.9%	7	140	13.1%		
3	60	16.0%	8	160	12.9%		
4	80	15.3%	9	180	13.6%		**RF Po (*Max)**
5	100	15.0%	10	200	15.3%		54.0

Table 30

Internal Vehicle MPE Assessment @ 136 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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	1.21	0.123	0.109	50.5	0.062	0.07

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	12.8%	12.2%	12.0%	IEEE Uncontrolled Limit:	0.20
Front Seat	11.0%	10.5%	11.1%	**RF Po (*Max):**	54.0

Table 31

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	H	1.20	0.146	53.8	0.073	0.07
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	14.5%		6	120	14.3%		1.00	0.20
2	40	14.1%		7	140	14.5%			
3	60	15.4%		8	160	14.0%			
4	80	14.3%		9	180	15.0%			**RF Po (*Max)**
5	100	14.4%		10	200	15.7%			54.0

Table 32

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4007A	2.15	Highest Reading	H	1.20	0.125	0.104	53.8	0.062	0.06
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		12.8%		12.3%		12.3%		IEEE Uncontrolled Limit:		0.20
Front Seat		10.5%		10.2%		10.4%			**RF Po (*Max):**	54.0

Table 33

External Vehicle MPE Assessment @ 156.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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 (actual 110)	H	1.20	0.125	51.5	0.062	0.07
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	12.9%		6	120	12.6%		1.00	0.20
2	40	11.4%		7	140	12.2%			
3	60	14.3%		8	160	12.5%			
4	80	11.2%		9	180	12.8%			**RF Po (*Max)**
5	100	12.0%		10	200	12.8%			54.0

Table 34

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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	1.20	0.118	0.104	51.5	0.059	0.06
Measurement Grid										
Test Position		% of Control Limit Head		% of Control Limit Chest		% of Control Limit Lower Trunk		IEEE Controlled Limit:		1.00
Back Seat		11.9%		11.8%		11.6%		IEEE Uncontrolled Limit:		0.20
Front Seat		10.6%		10.5%		10.2%			RF Po (*Max):	54.0

Table 35

External Vehicle MPE Assessment @ 174 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	H	1.19	0.129	49.3	0.064	0.07
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	14.6%		6	120	13.0%		1.00	0.20
2	40	13.5%		7	140	12.4%			
3	60	14.3%		8	160	11.8%			
4	80	12.2%		9	180	12.0%			RF Po (*Max)
5	100	12.7%		10	200	12.4%			54.0

Table 36

Internal Vehicle MPE Assessment @ 174 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4009A	2.15	Highest Reading	H	1.19	0.125	0.101	49.3	0.062	0.07
Measurement Grid										
Test Position		% of Control Limit Head		% of Control Limit Chest		% of Control Limit Lower Trunk		IEEE Controlled Limit:		1.00
Back Seat		12.8%		12.6%		12.0%		IEEE Uncontrolled Limit:		0.20
Front Seat		10.6%		9.9%		9.9%			RF Po (*Max):	54.0

Table 37

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	90 (actual 110)	H	1.20	0.127	53.8	0.063	0.06
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	12.9%		6	120	12.6%		1.00	0.20
2	40	13.0%		7	140	12.6%			
3	60	14.1%		8	160	11.4%			
4	80	13.3%		9	180	11.9%			**RF Po (*Max)**
5	100	13.3%		10	200	11.7%			54.0

Table 38

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	Highest Reading	H	1.20	0.100	0.097	53.8	0.050	0.05
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**			IEEE Controlled Limit:	1.00
Back Seat		9.7%		9.9%		10.5%			IEEE Uncontrolled Limit:	0.20
Front Seat		9.6%		9.7%		9.8%			**RF Po (*Max):**	54.0

Table 39

External Vehicle MPE Assessment @ 159 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	90 (actual 110)	H	1.20	0.138	50.5	0.069	0.07
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	13.8%		6	120	14.8%		1.00	0.20
2	40	14.0%		7	140	13.7%			
3	60	15.0%		8	160	12.2%			
4	80	13.7%		9	180	12.2%			**RF Po (*Max)**
5	100	15.0%		10	200	13.1%			54.0

Table 40

Internal Vehicle MPE Assessment @ 159 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	Highest Reading	H	1.20	0.109	0.103	50.5	0.055	0.06

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	11.0%	11.1%	10.6%	IEEE Uncontrolled Limit:	0.20
Front Seat	10.4%	10.2%	10.2%	RF Po (*Max):	54.0

Table 41

External Vehicle MPE Assessment @ 172 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	90 (actual 110)	H	1.19	0.145	49.2	0.073	0.08

Measurement Grid							
Test Position	Height (cm)	% of Control Limit	Test Position	Height (cm)	% of Control Limit	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	14.4%	6	120	14.4%	1.00	0.20
2	40	14.5%	7	140	14.1%		
3	60	16.6%	8	160	13.6%		
4	80	15.2%	9	180	14.3%		RF Po (*Max)
5	100	14.3%	10	200	13.6%		54.0

Table 42

Internal Vehicle MPE Assessment @ 172 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	Highest Reading	H	1.19	0.114	0.099	49.2	0.057	0.06

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	11.5%	11.3%	11.3%	IEEE Uncontrolled Limit:	0.20
Front Seat	9.6%	9.7%	10.3%	RF Po (*Max):	54.0

Table 43

External Vehicle MPE Assessment @ 136 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4214A	2.15	90 (actual 110)	H	1.21	0.142	50.5	0.071	0.08
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	16.7%		6	120	12.8%		1.00	0.20
2	40	13.3%		7	140	12.9%			
3	60	15.4%		8	160	13.1%			
4	80	12.3%		9	180	15.2%			**RF Po (*Max)**
5	100	12.6%		10	200	17.2%			54.0

Table 44

Internal Vehicle MPE Assessment @ 136 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4214A	2.15	Highest Reading	H	1.21	0.110	0.109	50.5	0.055	0.06
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**			IEEE Controlled Limit:	1.00
Back Seat		11.1%		10.8%		11.0%			IEEE Uncontrolled Limit:	0.20
Front Seat		10.8%		11.0%		10.8%			**RF Po (*Max):**	54.0

Table 45

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4215A	2.15	90 (actual 110)	H	1.20	0.142	53.8	0.071	0.07
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	14.8%		6	120	14.2%		1.00	0.20
2	40	13.6%		7	140	14.2%			
3	60	15.6%		8	160	14.1%			
4	80	14.0%		9	180	14.1%			**RF Po (*Max)**
5	100	13.5%		10	200	14.1%			54.0

Table 46

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4215A	2.15	Highest Reading	H	1.20	0.097	0.092	53.8	0.048	0.05
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		10.1%		9.4%		9.5%		IEEE Uncontrolled Limit:		0.20
Front Seat		9.4%		9.2%		9.0%			**RF Po (*Max):**	54.0

Table 47

External Vehicle MPE Assessment @ 156.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4216A	2.15	90 (actual 110)	H	1.20	0.132	51.5	0.066	0.07
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	13.7%		6	120	14.3%		1.00	0.20
2	40	13.2%		7	140	12.6%			
3	60	14.6%		8	160	11.9%			
4	80	14.6%		9	180	11.8%			**RF Po (*Max)**
5	100	13.4%		10	200	12.1%			54.0

Table 48

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4216A	2.15	Highest Reading	H	1.20	0.127	0.108	51.5	0.063	0.07
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		12.9%		12.8%		12.3%		IEEE Uncontrolled Limit:		0.20
Front Seat		10.8%		10.9%		10.6%			**RF Po (*Max):**	54.0

Table 49

External Vehicle MPE Assessment @ 174 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4217A	2.15	90 (actual 110)	H	1.19	0.137	49.3	0.069	0.08
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	13.9%		6	120	13.2%		1.00	0.20
2	40	13.8%		7	140	13.1%			
3	60	16.8%		8	160	13.3%			
4	80	12.8%		9	180	14.0%			**RF Po (*Max)**
5	100	12.7%		10	200	13.8%			54.0

Table 50

Internal Vehicle MPE Assessment @ 174 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4217A	2.15	Highest Reading	H	1.19	0.095	0.094	49.3	0.048	0.05
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		9.8%		9.3%		9.5%		IEEE Uncontrolled Limit:		0.20
Front Seat		8.8%		8.9%		10.4%			**RF Po (*Max):**	54.0

Table 51

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4218A	5.15	90 (actual 110)	H	1.20	0.140	53.8	0.070	0.07
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	13.6%		6	120	14.1%		1.00	0.20
2	40	13.3%		7	140	13.0%			
3	60	18.5%		8	160	12.5%			
4	80	13.8%		9	180	13.4%			**RF Po (*Max)**
5	100	13.4%		10	200	14.6%			54.0

Table 52

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	Highest Reading	H	1.20	0.108	0.098	53.8	0.054	0.05

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	10.8%	10.8%	10.8%	IEEE Uncontrolled Limit:	0.20
Front Seat	10.2%	9.6%	9.6%	**RF Po (*Max):**	54.0

Table 53

External Vehicle MPE Assessment @ 159 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	90 (actual 110)	H	1.20	0.134	50.5	0.067	0.07

Measurement Grid							
Test Position	Height (cm)	% of Control Limit	Test Position	Height (cm)	% of Control Limit	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	14.5%	6	120	13.0%	1.00	0.20
2	40	12.9%	7	140	12.8%		
3	60	16.4%	8	160	12.1%		
4	80	13.6%	9	180	13.5%		**RF Po (*Max)**
5	100	12.2%	10	200	13.0%		54.0

Table 54

Internal Vehicle MPE Assessment @ 159 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	Highest Reading	H	1.20	0.112	0.105	50.5	0.056	0.06

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	11.1%	11.4%	11.2%	IEEE Uncontrolled Limit:	0.20
Front Seat	10.5%	10.3%	10.7%	**RF Po (*Max):**	54.0

Table 55

External Vehicle MPE Assessment @ 172 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4218A	5.15	90 (actual 110)	H	1.19	0.131	49.2	0.065	0.07
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	14.6%		6	120	12.8%		1.00	0.20
2	40	13.0%		7	140	12.0%			
3	60	15.4%		8	160	11.6%			
4	80	13.6%		9	180	11.2%			**RF Po (*Max)**
5	100	13.5%		10	200	12.8%			54.0

Table 56

Internal Vehicle MPE Assessment @ 172 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4218A	5.15	Highest Reading	H	1.19	0.115	0.103	49.2	0.057	0.06
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		11.5%		11.3%		11.6%		IEEE Uncontrolled Limit:		0.20
Front Seat		10.3%		10.4%		10.1%			**RF Po (*Max):**	54.0

Table 57

External Vehicle MPE Assessment @ 136 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4006A	2.15	90	E	0.95	0.244	50.5	0.122	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	7.2%		6	120	29.0%		1.00	0.20
2	40	8.6%		7	140	49.4%			
3	60	12.8%		8	160	46.2%			
4	80	19.2%		9	180	33.9%			**RF Po (*Max)**
5	100	21.5%		10	200	16.4%			54.0

Table 58

Internal Vehicle MPE Assessment @ 136 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4006A	2.15	Highest Reading	E	0.95	0.668	0.166	50.5	0.334	0.36

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	118.0%	39.9%	42.4%	IEEE Uncontrolled Limit:	0.20
Front Seat	23.8%	17.8%	8.1%	RF Po (*Max):	54.0

Table 59

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4007A	2.15	90	E	1.03	0.265	53.8	0.133	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	9.1%	6	120	34.8%	1.00	0.20
2	40	12.6%	7	140	35.1%		
3	60	21.1%	8	160	36.0%		
4	80	26.0%	9	180	29.9%		RF Po (*Max)
5	100	31.0%	10	200	29.5%		54.0

Table 60

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4007A	2.15	Highest Reading	E	1.03	0.928	0.195	53.8	0.464	0.47

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	192.0%	62.6%	23.9%	IEEE Uncontrolled Limit:	0.20
Front Seat	15.3%	26.2%	17.1%	RF Po (*Max):	54.0

Table 61

External Vehicle MPE Assessment @ 156.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4008A	2.15	90	E	1.02	0.204	51.5	0.102	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	11.0%		6	120	24.9%		1.00	0.20
2	40	14.7%		7	140	26.6%			
3	60	18.9%		8	160	25.3%			
4	80	20.5%		9	180	21.6%			**RF Po (*Max)**
5	100	20.1%		10	200	20.3%			54.0

Table 62

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4008A	2.15	Highest Reading	E	1.02	0.660	0.308	51.5	0.330	0.35
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**			IEEE Controlled Limit:	1.00
Back Seat		117.5%		50.3%		30.3%			IEEE Uncontrolled Limit:	0.20
Front Seat		20.8%		36.2%		35.5%			**RF Po (*Max):**	54.0

Table 63

External Vehicle MPE Assessment @ 174 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4009A	2.15	90	E	0.97	0.106	49.3	0.053	0.06
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	4.0%		6	120	12.9%		1.00	0.20
2	40	4.6%		7	140	14.2%			
3	60	5.8%		8	160	14.3%			
4	80	8.0%		9	180	14.9%			**RF Po (*Max)**
5	100	11.1%		10	200	15.8%			54.0

Table 64

Internal Vehicle MPE Assessment @ 174 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4009A	2.15	Highest Reading	E	0.97	0.446	0.108	49.3	0.223	0.24
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		61.3%		34.7%		37.9%		IEEE Uncontrolled Limit:		0.20
Front Seat		9.3%		19.3%		3.9%			**RF Po (*Max):**	54.0

Table 65

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	90	E	1.03	0.030	53.8	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	0.2%		6	120	3.7%		1.00	0.20
2	40	0.3%		7	140	4.9%			
3	60	0.6%		8	160	5.6%			
4	80	1.1%		9	180	5.7%			**RF Po (*Max)**
5	100	2.4%		10	200	5.9%			54.0

Table 66

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	Highest Reading	E	1.03	0.012	0.002	53.8	0.006	0.01
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		2.2%		1.0%		0.3%		IEEE Uncontrolled Limit:		0.20
Front Seat		0.2%		0.2%		0.1%			**RF Po (*Max):**	54.0

Table 67

External Vehicle MPE Assessment @ 159 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	90	E	1.01	0.218	50.5	0.109	0.12
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**			IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	1.6%	6	120	27.1%			1.00	0.20
2	40	2.0%	7	140	32.8%				
3	60	3.5%	8	160	36.5%				
4	80	9.0%	9	180	45.4%				**RF Po (*Max)**
5	100	15.4%	10	200	45.0%				54.0

Table 68

Internal Vehicle MPE Assessment @ 159 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	Highest Reading	E	1.01	0.059	0.064	50.5	0.032	0.03
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**			IEEE Controlled Limit:	1.00
Back Seat		4.1%		6.6%		6.9%			IEEE Uncontrolled Limit:	0.20
Front Seat		4.7%		7.0%		7.4%			**RF Po (*Max):**	54.0

Table 69

External Vehicle MPE Assessment @ 172 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	90	E	0.98	0.048	49.2	0.024	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	1.0%	6	120	4.6%			1.00	0.20
2	40	1.2%	7	140	6.1%				
3	60	1.7%	8	160	7.3%				
4	80	2.9%	9	180	8.8%				**RF Po (*Max)**
5	100	3.1%	10	200	10.8%				54.0

Table 70

Internal Vehicle MPE Assessment @ 172 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	Highest Reading	E	0.98	0.017	0.010	49.2	0.009	0.01

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	2.1%	1.2%	1.8%	IEEE Uncontrolled Limit:	0.20
Front Seat	1.5%	0.7%	0.7%	**RF Po (*Max):**	54.0

Table 71

External Vehicle MPE Assessment @ 136 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4214A	2.15	90	E	0.95	0.215	50.5	0.108	0.12

Measurement Grid							
Test Position	Height (cm)	% of Control Limit	Test Position	Height (cm)	% of Control Limit	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	8.1%	6	120	18.6%	1.00	0.20
2	40	8.8%	7	140	27.5%		
3	60	19.8%	8	160	36.1%		
4	80	21.9%	9	180	33.6%		**RF Po (*Max)**
5	100	13.6%	10	200	27.3%		54.0

Table 72

Internal Vehicle MPE Assessment @ 136 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4214A	2.15	Highest Reading	E	0.95	0.557	0.247	50.5	0.279	0.30

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	73.8%	36.2%	57.1%	IEEE Uncontrolled Limit:	0.20
Front Seat	32.7%	32.1%	9.4%	**RF Po (*Max):**	54.0

Table 73

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4215A	2.15	90	E	1.03	0.218	53.8	0.109	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	9.5%	6	120	24.7%		1.00	0.20	
2	40	13.4%	7	140	32.1%				
3	60	16.2%	8	160	30.8%				
4	80	20.1%	9	180	23.8%			**RF Po (*Max)**	
5	100	22.8%	10	200	25.0%			54.0	

Table 74

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4215A	2.15	Highest Reading	E	1.03	0.696	0.073	53.8	0.348	0.35
Measurement Grid										
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.00					
Back Seat	134.5%	54.5%	19.9%	IEEE Uncontrolled Limit:	0.20					
Front Seat	5.6%	10.5%	5.7%	**RF Po (*Max):**	54.0					

Table 75

External Vehicle MPE Assessment @ 156.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4216A	2.15	90	E	1.02	0.229	51.5	0.115	0.12
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit	
1	20	14.5%	6	120	28.8%		1.00	0.20	
2	40	21.6%	7	140	28.5%				
3	60	20.2%	8	160	25.5%				
4	80	20.4%	9	180	21.1%			**RF Po (*Max)**	
5	100	27.8%	10	200	20.7%			54.0	

Table 76

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4216A	2.15	Highest Reading	E	1.02	0.427	0.214	51.5	0.214	0.22

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.00
Back Seat	80.1%	31.2%	16.9%	IEEE Uncontrolled Limit:	0.20
Front Seat	15.5%	23.8%	24.9%	**RF Po (*Max):**	54.0

Table 77

External Vehicle MPE Assessment @ 174 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4217A	2.15	90	E	0.97	0.131	49.3	0.066	0.07

Measurement Grid							
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	4.9%	6	120	17.0%	1.00	0.20
2	40	5.0%	7	140	18.5%		
3	60	6.1%	8	160	18.5%		
4	80	8.3%	9	180	18.7%		**RF Po (*Max)**
5	100	13.3%	10	200	20.7%		54.0

Table 78

Internal Vehicle MPE Assessment @ 174 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4217A	2.15	Highest Reading	E	0.97	0.845	0.086	49.3	0.422	0.46

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.00
Back Seat	98.0%	81.4%	74.0%	IEEE Uncontrolled Limit:	0.20
Front Seat	5.8%	11.8%	8.3%	**RF Po (*Max):**	54.0

Table 79

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4218A	5.15	90	E	1.03	0.211	53.8	0.106	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	3.7%	6	120	27.8%			1.00	0.20
2	40	6.5%	7	140	32.9%				
3	60	9.8%	8	160	34.2%				
4	80	13.9%	9	180	31.0%				**RF Po (*Max)**
5	100	20.0%	10	200	31.6%				54.0

Table 80

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4218A	5.15	Highest Reading	E	1.03	0.660	0.061	53.8	0.330	0.33
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**			IEEE Controlled Limit:	1.00
Back Seat		122.8%		52.5%		22.6%			IEEE Uncontrolled Limit:	0.20
Front Seat		5.8%		8.8%		3.7%			**RF Po (*Max):**	54.0

Table 81

External Vehicle MPE Assessment @ 159 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4218A	5.15	90	E	1.01	0.212	50.5	0.106	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	4.4%	6	120	26.3%			1.00	0.20
2	40	6.5%	7	140	32.4%				
3	60	9.3%	8	160	35.9%				
4	80	12.8%	9	180	34.9%				**RF Po (*Max)**
5	100	18.8%	10	200	30.3%				54.0

Table 82

Internal Vehicle MPE Assessment @ 159 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	Highest Reading	E	1.01	0.451	0.173	50.5	0.226	0.24

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	83.5%	33.3%	18.5%	IEEE Uncontrolled Limit:	0.20
Front Seat	12.0%	20.7%	19.1%	RF Po (*Max):	54.0

Table 83

External Vehicle MPE Assessment @ 172 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	90	E	0.98	0.146	49.2	0.073	0.08

Measurement Grid							
Test Position	Height (cm)	% of Control Limit	Test Position	Height (cm)	% of Control Limit	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	2.7%	6	120	17.9%	1.00	0.20
2	40	3.6%	7	140	23.0%		
3	60	4.9%	8	160	24.1%		
4	80	7.0%	9	180	25.4%		RF Po (*Max)
5	100	13.1%	10	200	23.8%		54.0

Table 84

Internal Vehicle MPE Assessment @ 172 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	Highest Reading	E	0.98	0.450	0.022	49.2	0.225	0.25

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	56.2%	45.7%	33.1%	IEEE Uncontrolled Limit:	0.20
Front Seat	2.7%	2.6%	1.3%	RF Po (*Max):	54.0

****************45 degree *******************

Table 85

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4007A	2.15	90 (actual 99.5)	E	1.03	0.3996	53.8	0.200	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	12.7%		6	120	48.8%		1.00	0.20
2	40	25.9%		7	140	54.7%			
3	60	36.5%		8	160	50.1%			
4	80	42.3%		9	180	49.4%			**RF Po (*Max)**
5	100	42.4%		10	200	36.8%			54.0

****************90 degree *******************

Table 86

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4007A	2.15	90 (actual 104)	E	1.03	0.348	53.8	0.174	0.17
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	47.9%		1.00	0.20
2	40	27.0%		7	140	54.7%			
3	60	27.3%		8	160	47.2%			
4	80	27.9%		9	180	34.7%			**RF Po (*Max)**
5	100	37.8%		10	200	28.2%			54.0

Table 87

External Vehicle MPE Assessment @ 136 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4006A	2.15	90	H	1.21	0.101	50.5	0.051	0.05
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	10.7%		1.00	0.20
2	40	9.3%		7	140	10.7%			
3	60	9.3%		8	160	10.8%			
4	80	9.8%		9	180	10.4%			**RF Po (*Max)**
5	100	10.5%		10	200	10.0%			54.0

Table 88

Internal Vehicle MPE Assessment @ 136 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4006A	2.15	Highest Reading	H	1.21	0.103	0.088	50.5	0.052	0.06

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	10.3%	10.1%	10.5%	IEEE Uncontrolled Limit:	0.20
Front Seat	8.5%	8.4%	9.5%	RF Po (*Max):	54.0

Table 89

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4007A	2.15	90	H	1.20	0.085	53.8	0.043	0.04

Measurement Grid							
Test Position	Height (cm)	% of Control Limit	Test Position	Height (cm)	% of Control Limit	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	8.4%	6	120	8.9%	1.00	0.20
2	40	8.0%	7	140	8.0%		
3	60	7.8%	8	160	8.6%		
4	80	7.7%	9	180	10.0%		RF Po (*Max)
5	100	8.0%	10	200	9.7%		54.0

Table 90

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4007A	2.15	Highest Reading	H	1.20	0.083	0.078	53.8	0.042	0.04

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	8.8%	8.0%	8.1%	IEEE Uncontrolled Limit:	0.20
Front Seat	7.8%	7.7%	7.8%	RF Po (*Max):	54.0

Table 91

External Vehicle MPE Assessment @ 156.4 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4008A	2.15	90	H	1.20	0.077	51.5	0.038	0.04
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	8.0%		6	120	7.1%		1.00	0.20
2	40	7.6%		7	140	7.2%			
3	60	6.8%		8	160	7.2%			
4	80	7.1%		9	180	8.8%			**RF Po (*Max)**
5	100	8.8%		10	200	8.1%			54.0

Table 92

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4008A	2.15	Highest Reading	H	1.20	0.090	0.083	51.5	0.045	0.05
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**		IEEE Controlled Limit:		1.00
Back Seat		9.3%		8.8%		8.8%		IEEE Uncontrolled Limit:		0.20
Front Seat		8.3%		8.2%		8.5%			**RF Po (*Max):**	54.0

Table 93

External Vehicle MPE Assessment @ 174 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4009A	2.15	90	H	1.19	0.075	49.3	0.037	0.04
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	7.6%		1.00	0.20
2	40	6.8%		7	140	7.7%			
3	60	6.6%		8	160	7.6%			
4	80	6.7%		9	180	8.6%			**RF Po (*Max)**
5	100	7.0%		10	200	8.6%			54.0

Table 94

Internal Vehicle MPE Assessment @ 174 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4009A	2.15	Highest Reading	H	1.19	0.086	0.082	49.3	0.043	0.05

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	8.5%	8.6%	8.6%	IEEE Uncontrolled Limit:	0.20
Front Seat	8.3%	8.1%	8.2%	**RF Po (*Max):**	54.0

Table 95

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	90	H	1.20	0.092	53.8	0.046	0.05

Measurement Grid							
Test Position	Height (cm)	% of Control Limit	Test Position	Height (cm)	% of Control Limit	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	8.4%	6	120	9.0%	1.00	0.20
2	40	8.6%	7	140	8.4%		
3	60	9.6%	8	160	8.9%		
4	80	9.9%	9	180	9.7%		**RF Po (*Max)**
5	100	9.6%	10	200	9.5%		54.0

Table 96

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	Highest Reading	H	1.20	0.075	0.070	53.8	0.038	0.04

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	7.7%	7.1%	7.7%	IEEE Uncontrolled Limit:	0.20
Front Seat	7.2%	7.0%	6.9%	**RF Po (*Max):**	54.0

Table 97

External Vehicle MPE Assessment @ 159 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	90	H	1.20	0.082	50.5	0.041	0.04
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	7.3%		1.00	0.20
2	40	8.9%		7	140	8.5%			
3	60	9.0%		8	160	8.4%			
4	80	7.1%		9	180	8.5%			**RF Po (*Max)**
5	100	7.2%		10	200	9.2%			54.0

Table 98

Internal Vehicle MPE Assessment @ 159 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	Highest Reading	H	1.20	0.084	0.079	50.5	0.042	0.05
Measurement Grid										
Test Position		**% of Control Limit Head**		**% of Control Limit Chest**		**% of Control Limit Lower Trunk**			IEEE Controlled Limit:	1.00
Back Seat		8.4%		8.4%		8.5%			IEEE Uncontrolled Limit:	0.20
Front Seat		7.7%		7.8%		8.1%			**RF Po (*Max):**	54.0

Table 99

External Vehicle MPE Assessment @ 172 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	HAD4014A	5.15	90	H	1.19	0.085	49.2	0.043	0.05
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	8.0%		6	120	8.2%		1.00	0.20
2	40	8.0%		7	140	8.2%			
3	60	8.2%		8	160	8.6%			
4	80	8.1%		9	180	9.6%			**RF Po (*Max)**
5	100	7.6%		10	200	10.8%			54.0

Table 100

Internal Vehicle MPE Assessment @ 172 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	HAD4014A	5.15	Highest Reading	H	1.19	0.083	0.072	49.2	0.042	0.05

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	8.6%	8.2%	8.1%	IEEE Uncontrolled Limit:	0.20
Front Seat	7.2%	7.3%	7.0%	RF Po (*Max):	54.0

Table 101

External Vehicle MPE Assessment @ 136 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4214A	2.15	90	H	1.21	0.106	50.5	0.053	0.06

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	11.0%	1.00	0.20
2	40	8.3%	7	140	12.3%		
3	60	10.2%	8	160	11.3%		
4	80	10.6%	9	180	12.6%		RF Po (*Max)
5	100	9.2%	10	200	13.5%		54.0

Table 102

Internal Vehicle MPE Assessment @ 136 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4214A	2.15	Highest Reading	H	1.21	0.088	0.067	50.5	0.044	0.05

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	9.0%	9.0%	8.4%	IEEE Uncontrolled Limit:	0.20
Front Seat	6.8%	6.6%	6.6%	RF Po (*Max):	54.0

Table 103

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4215A	2.15	90	H	1.20	0.087	53.8	0.043	0.04
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	6.6%		6	120	8.8%		1.00	0.20
2	40	7.2%		7	140	9.5%			
3	60	8.4%		8	160	10.1%			
4	80	8.5%		9	180	10.5%			RF Po (*Max)
5	100	7.5%		10	200	9.8%			54.0

Table 104

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4215A	2.15	Highest Reading	H	1.20	0.064	0.060	53.8	0.032	0.03
Measurement Grid										
Test Position		% of Control Limit Head		% of Control Limit Chest		% of Control Limit Lower Trunk			IEEE Controlled Limit:	1.00
Back Seat		6.5%		6.3%		6.5%			IEEE Uncontrolled Limit:	0.20
Front Seat		6.3%		5.6%		6.2%			RF Po (*Max):	54.0

Table 105

External Vehicle MPE Assessment @ 156.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4216A	2.15	90	H	1.20	0.097	51.5	0.049	0.05
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	7.5%		6	120	10.0%		1.00	0.20
2	40	8.1%		7	140	9.0%			
3	60	10.2%		8	160	9.2%			
4	80	10.3%		9	180	13.8%			RF Po (*Max)
5	100	9.5%		10	200	9.8%			54.0

Table 106

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4216A	2.15	Highest Reading	H	1.20	0.064	0.053	51.5	0.032	0.03

Measurement Grid

Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**		
				IEEE Controlled Limit:	1.00
Back Seat	6.6%	6.5%	6.2%	IEEE Uncontrolled Limit:	0.20
Front Seat	5.1%	5.5%	5.4%	**RF Po (*Max):**	54.0

Table 107

External Vehicle MPE Assessment @ 174 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4217A	2.15	90	H	1.19	0.096	49.3	0.048	0.05

Measurement Grid

Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	8.0%	6	120	10.2%	1.00	0.20
2	40	10.1%	7	140	8.3%		
3	60	10.4%	8	160	8.5%		
4	80	11.8%	9	180	9.1%		**RF Po (*Max)**
5	100	10.6%	10	200	9.1%		54.0

Table 108

Internal Vehicle MPE Assessment @ 174 MHz										
Antenna Location	**Antenna**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4217A	2.15	Highest Reading	H	1.19	0.066	0.055	49.3	0.033	0.04

Measurement Grid

Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**		
				IEEE Controlled Limit:	1.00
Back Seat	6.4%	6.4%	6.9%	IEEE Uncontrolled Limit:	0.20
Front Seat	5.7%	5.4%	5.4%	**RF Po (*Max):**	54.0

Table 109

External Vehicle MPE Assessment @ 148.4 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	90	H	1.20	0.093	53.8	0.046	0.05
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	7.5%		6	120	10.4%		1.00	0.20
2	40	9.1%		7	140	7.5%			
3	60	10.6%		8	160	8.8%			
4	80	11.0%		9	180	8.7%			RF Po (*Max)
5	100	11.5%		10	200	7.4%			54.0

Table 110

Internal Vehicle MPE Assessment @ 148.4 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	Highest Reading	H	1.20	0.056	0.046	53.8	0.028	0.03
Measurement Grid										
Test Position		% of Control Limit Head		% of Control Limit Chest		% of Control Limit Lower Trunk			IEEE Controlled Limit:	1.00
Back Seat		6.1%		5.3%		5.5%			IEEE Uncontrolled Limit:	0.20
Front Seat		4.3%		4.8%		4.6%			RF Po (*Max):	54.0

Table 111

External Vehicle MPE Assessment @ 159 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	90	H	1.20	0.090	50.5	0.045	0.05
Measurement Grid									
Test Position	Height (cm)	% of Control Limit		Test Position	Height (cm)	% of Control Limit		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	8.2%		6	120	8.6%		1.00	0.20
2	40	8.9%		7	140	8.1%			
3	60	9.2%		8	160	9.7%			
4	80	9.8%		9	180	8.9%			RF Po (*Max)
5	100	10.3%		10	200	8.1%			54.0

Table 112

Internal Vehicle MPE Assessment @ 159 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	Highest Reading	H	1.20	0.058	0.048	50.5	0.029	0.03

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	6.1%	5.6%	5.8%	IEEE Uncontrolled Limit:	0.20
Front Seat	4.9%	4.8%	4.8%	RF Po (*Max):	54.0

Table 113

External Vehicle MPE Assessment @ 172 MHz									
Antenna Location	Antenna Model	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	90	H	1.19	0.093	49.2	0.047	0.05

Measurement Grid							
Test Position	Height (cm)	% of Control Limit	Test Position	Height (cm)	% of Control Limit	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	7.7%	6	120	9.7%	1.00	0.20
2	40	8.9%	7	140	9.2%		
3	60	9.4%	8	160	9.7%		
4	80	10.2%	9	180	10.0%		RF Po (*Max)
5	100	8.3%	10	200	10.0%		54.0

Table 114

Internal Vehicle MPE Assessment @ 172 MHz										
Antenna Location	Antenna	Gain (dBi)	Meas. Distance (cm)	E/H Field	Calibration 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)	RAD4218A	5.15	Highest Reading	H	1.19	0.051	0.043	49.2	0.025	0.03

Measurement Grid					
Test Position	% of Control Limit Head	% of Control Limit Chest	% of Control Limit Lower Trunk	IEEE Controlled Limit:	1.00
Back Seat	5.1%	5.0%	5.1%	IEEE Uncontrolled Limit:	0.20
Front Seat	4.0%	4.2%	4.6%	RF Po (*Max):	54.0

****************45 degree *******************

Table 115

External Vehicle MPE Assessment @ 136 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4214A	2.15	90 (actual 99.5)	H	1.21	0.133	50.5	0.066	0.07
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	11.1%		6	120	13.7%		1.00	0.20
2	40	10.9%		7	140	13.8%			
3	60	13.3%		8	160	13.4%			
4	80	13.3%		9	180	15.0%			**RF Po (*Max)**
5	100	12.3%		10	200	15.9%			54.0

****************90 degree *******************

Table 116

External Vehicle MPE Assessment @ 136 MHz									
Antenna Location	**Antenna Model**	**Gain (dBi)**	**Meas. Distance (cm)**	**E/H Field**	**Calibration 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)	RAD4214A	2.15	90 (actual 104)	H	1.21	0.090	50.5	0.045	0.05
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	10.2%		6	120	8.0%		1.00	0.20
2	40	8.9%		7	140	9.2%			
3	60	9.4%		8	160	9.1%			
4	80	9.4%		9	180	9.2%			**RF Po (*Max)**
5	100	7.4%		10	200	9.3%			54.0

APPENDIX E

SAR Simulation Results

MOTOROLA LABS

COMPUTATIONAL EME COMPLIANCE ASSESSMENT OF THE VHF MOBILE RADIO, MODEL #PMUD2043A

March 12, 2007

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Motorola Corporate EME Research Lab, Plantation, Florida

Introduction

This report summarizes the computational [numerical modeling] analysis performed to document compliance of the VHF, Model Number PMUD2043A, 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 (12 in total) that did not conform with applicable MPE limits were 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]. In total 24 independent simulations have been performed. Twenty two simulations are addressing exposure of passenger to VHF mobile radios with trunk-mount antennas, and another two are addressing exposure of bystander to the VHF mobile radios with trunk-mount quarter wavelength and gain antennas. For all simulations 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 relevant estimate of human exposure to RF energy.

Method

The simulation code employed is XFDTD™ v6.3, 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 the car model the wheels and part of the hood were omitted in order to fit within the computational memory available. 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 and 2 show one of the XFDTD™ computational models used for bystander exposure. According to the latest IEEE 1528.2 draft standard (February 19, 2007) for bystander exposure simulations from vehicle mount antennas the lossy dielectric slab with 30 cm thickness, dielectric constant of 8 and conductivity of 0.01 S/m has been introduced in the computational model to properly account for the effect of the ground (pavement) on exposure. Figure 3 shows some of the XFDTD™ computational models used for passenger exposure to trunk mounted antennas.

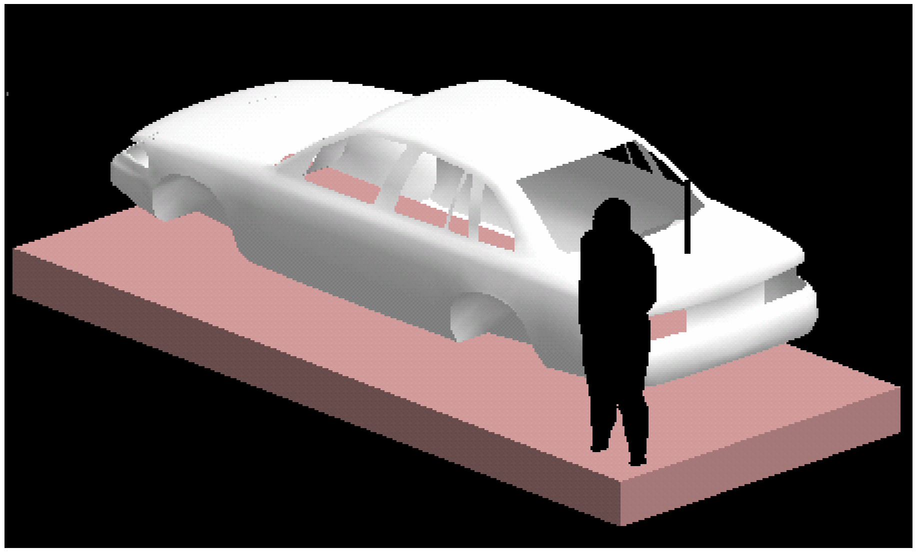


Figure 1: Bystander model exposed to a trunk-mount VHF antenna operating: Bystander is located at the corner of the car replicating the measurement condition. The antenna is mounted in the center of the trunk.

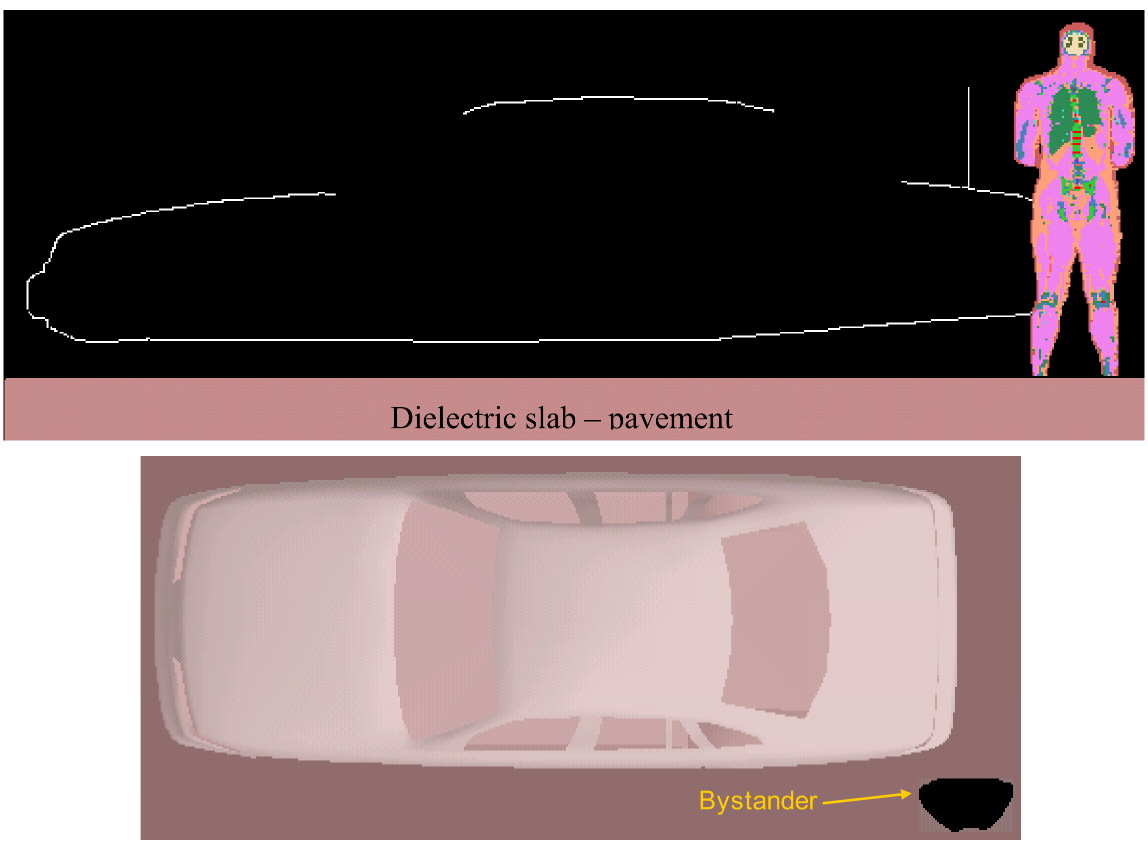


Figure 2: Side and top view of bystander exposure model. The dielectric slab under the car is introduced to model the ground (pavement) effect on exposure.

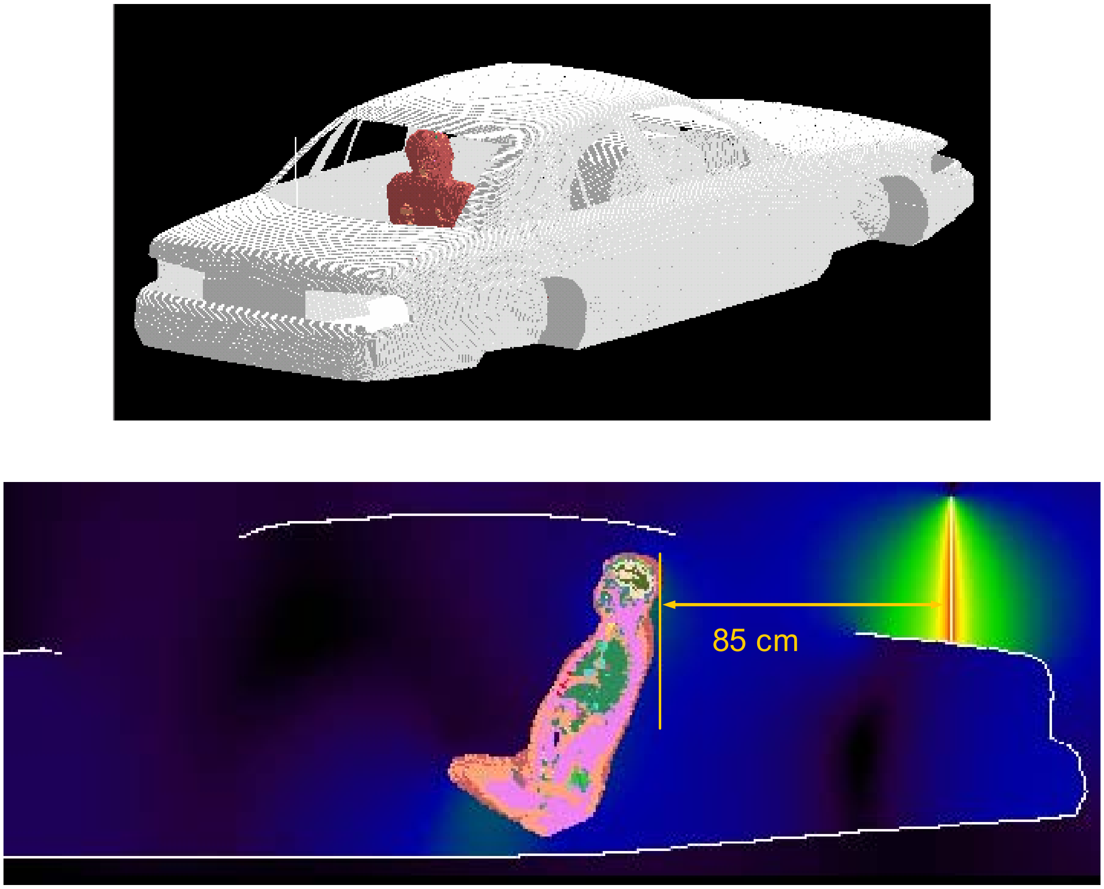


Figure 3: Passenger model exposed to a trunk-mount antenna operating: XFDTD geometry and H-field distribution. The antenna is mounted at 85 cm from the passenger.

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 maximum output power from mobile radio antenna is 54 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., 27 W *rms* net output power.

Results of SAR computations for car passengers

The test condition requiring SAR computations is summarized in Table I, together with the antenna data and the SAR results. The condition is for antenna mounted 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 I have been simulated individually.

Table I: 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
Trunk	HAD4006A	52.0 cm	52.0 cm	136	center	0.316	0.009
Trunk	HAD4007A	49.0 cm	49.0 cm	148.4	center	0.542	0.0236
Trunk	HAD4008A	45.6 cm	45.5 cm	156.4	center	0.535	0.0236
Trunk	HAD4009A	43.0 cm	43.0 cm	174	center	0.468	0.0209
Trunk	RAD4214A	52.5 cm	52.5 cm	136	center	0.384	0.0102
Trunk	RAD4215A	50 cm	50 cm	148.4	center	0.708	0.0265
Trunk	RAD4216A	46.5 cm	46.5 cm	156.4	center	0.566	0.0251
Trunk	RAD4217A	43.5 cm	43.5 cm	174	center	0.516	0.0226
Trunk	RAD4218A	89.5 cm	89.5 cm	148.4	center	0.692	0.0243
Trunk	RAD4218A	89.5 cm	89.5 cm	159	center	0.533	0.0231
Trunk	RAD4218A	89.5 cm	89.5 cm	172	center	0.354	0.0175
Trunk	HAD4006A	52.0 cm	52.0 cm	136	side	0.216	0.0144
Trunk	HAD4007A	49.0 cm	49.0 cm	148.4	side	0.329	0.0201
Trunk	HAD4008A	45.6 cm	45.5 cm	156.4	side	0.232	0.0144
Trunk	HAD4009A	43.0 cm	43.0 cm	174	side	0.206	0.0115
Trunk	RAD4214A	52.5 cm	52.5 cm	136	side	0.222	0.0152
Trunk	RAD4215A	50 cm	50 cm	148.4	side	0.396	0.0218
Trunk	RAD4216A	46.5 cm	46.5 cm	156.4	side	0.291	0.0173
Trunk	RAD4217A	43.5 cm	43.5 cm	174	side	0.245	0.0142
Trunk	RAD4218A	89.5 cm	89.5 cm	148.4	side	0.367	0.0199
Trunk	RAD4218A	89.5 cm	89.5 cm	159	side	0.297	0.0155
Trunk	RAD4218A	89.5 cm	89.5 cm	172	side	0.212	0.0098

The SAR distribution in the passenger model in the exposure condition that gave highest 1-g SAR is reported in Figure 4 (148.4 MHz, passenger in the center of the back seat, RAD4215A antenna). The same condition produced highest whole body average SAR.

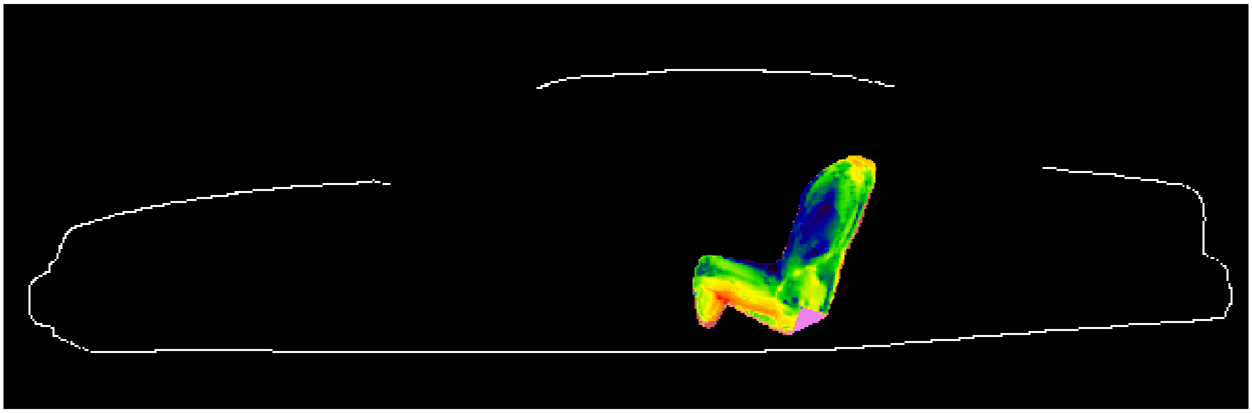
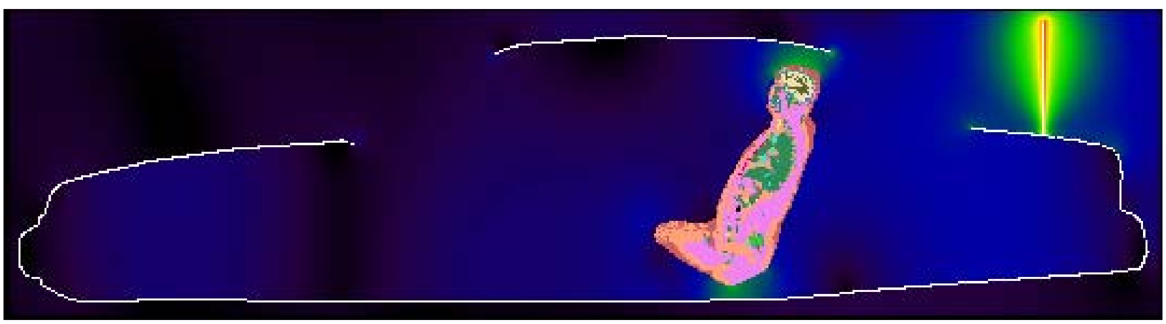
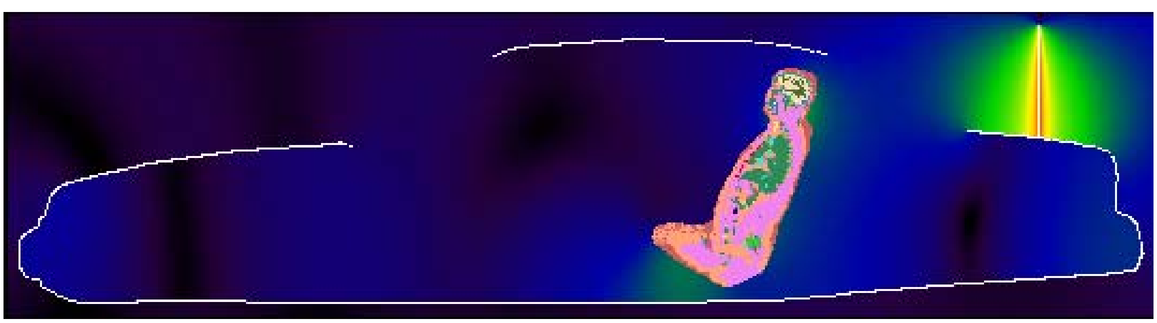


Figure 4. SAR distribution at 148.4 MHz in the passenger located in the center of the back seat, produced by the trunk-mount RAD4215A antenna (50 cm). The contour plot in the figure is relative to the plane where the peak 1-g average SAR for this exposure condition occurs.

The two pictures below show the E and H field distributions in the plane of the antenna corresponding to the condition with quarter wave antenna represented in Figure 4.



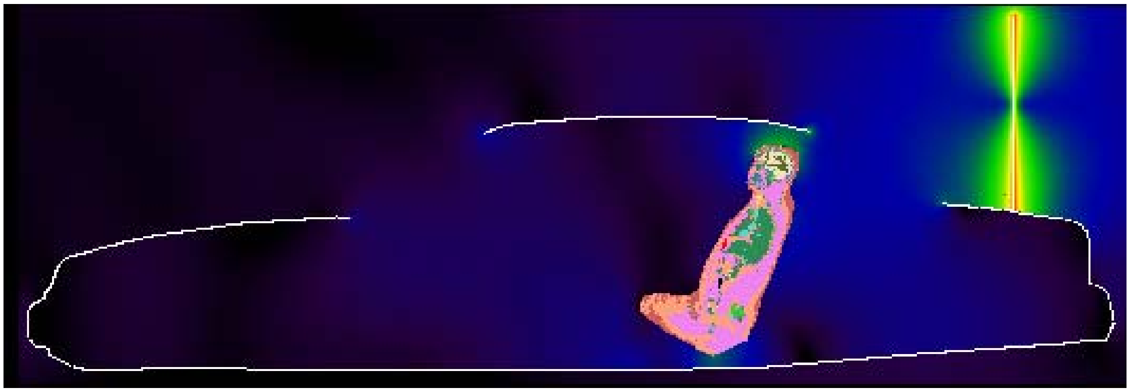
a)



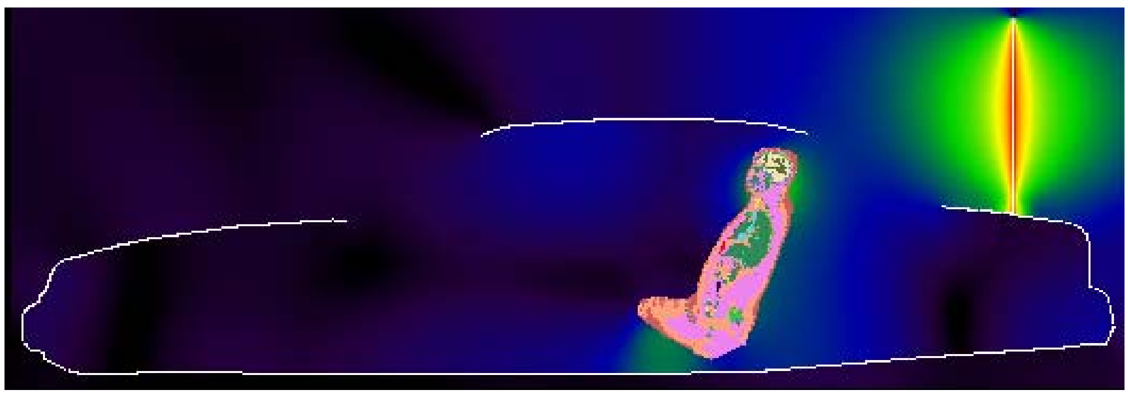
b)

Figure 5. (a) E-field distribution corresponding to exposure condition of Figure 4, and (b) H-field distribution corresponding to exposure condition of Figure 4.

Another example of E and H field distribution of the gain trunk mounted antenna (RAD4218A) in the condition of passenger exposure at 172 MHz is shown in Figure 6.



a)



b)

Figure 6. (a) E-field distribution and (b) H-field distribution corresponding to the exposure condition with RAD4218A gain antenna.

Results of SAR computations for bystanders

The test conditions requiring SAR computations are summarized in Table II, together with other relevant information and the SAR results. With trunk mount antennas, the bystander is placed at the corner of the trunk 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. Two cases of bystander - facing towards to or away from the car - were simulated individually.

Table II: Results of the SAR computations for bystander exposure (50% talk-time) at the corner of the trunk 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	SAR [W/kg]	
	Physical	XFDTD			1-g	WB
HAD4007A	49.0 cm	49 cm	148.4	Front	0.235	0.0114
HAD4007A	49.0 cm	49 cm	148.4	Back	0.182	0.0110

The SAR distribution in the bystander model in the exposure condition that gave highest 1-g SAR is reported in Figure 7 (148.4 MHz, bystander facing the car, HAD4007A antenna). The same condition produced highest whole body average SAR.

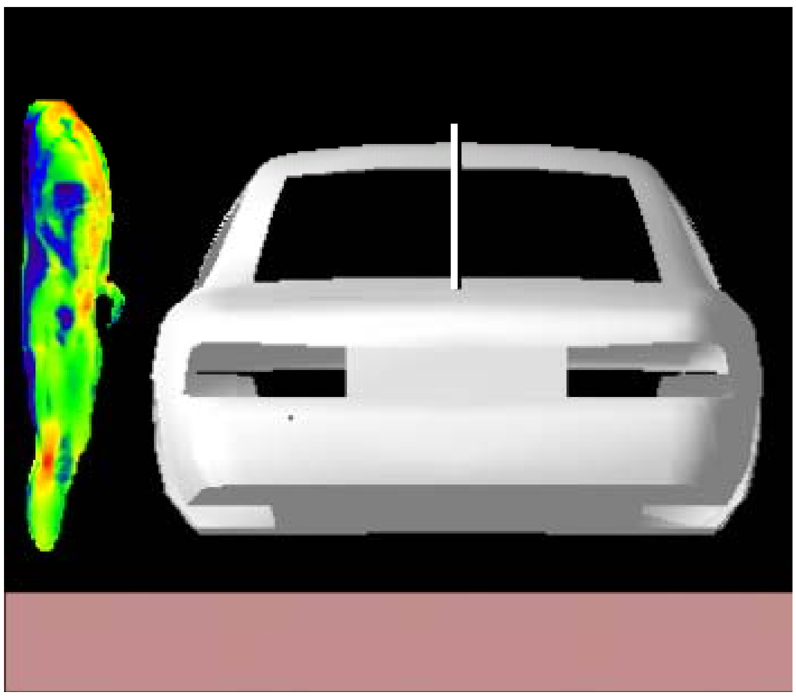
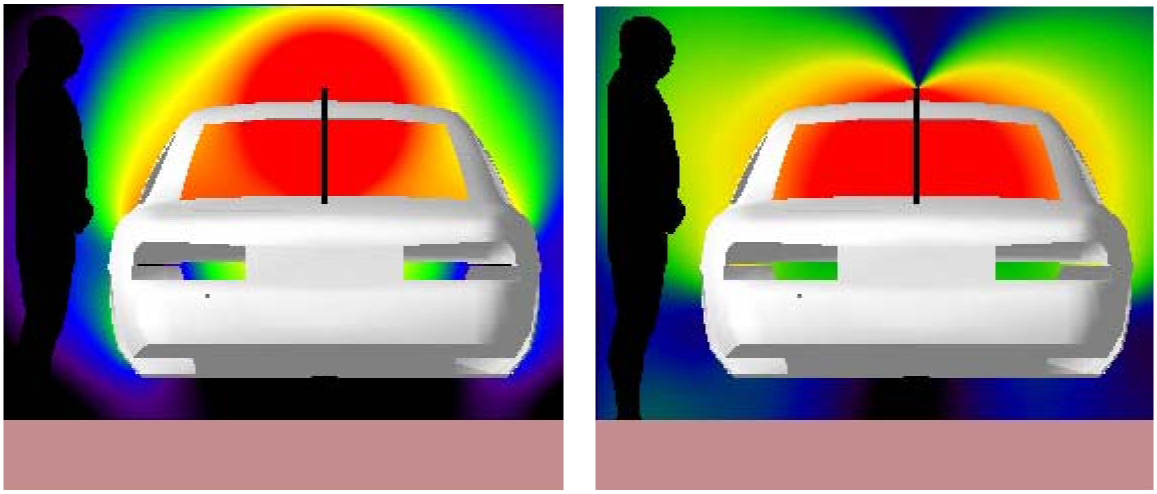


Figure 7. SAR distribution at 148.4 MHz in the bystander located at the corner of the trunk, produced by the trunk-mount HAD4007A antenna. The contour plot for SAR distribution in the figure is relative to the plane where the peak 1-g average SAR for this exposure condition occurs.

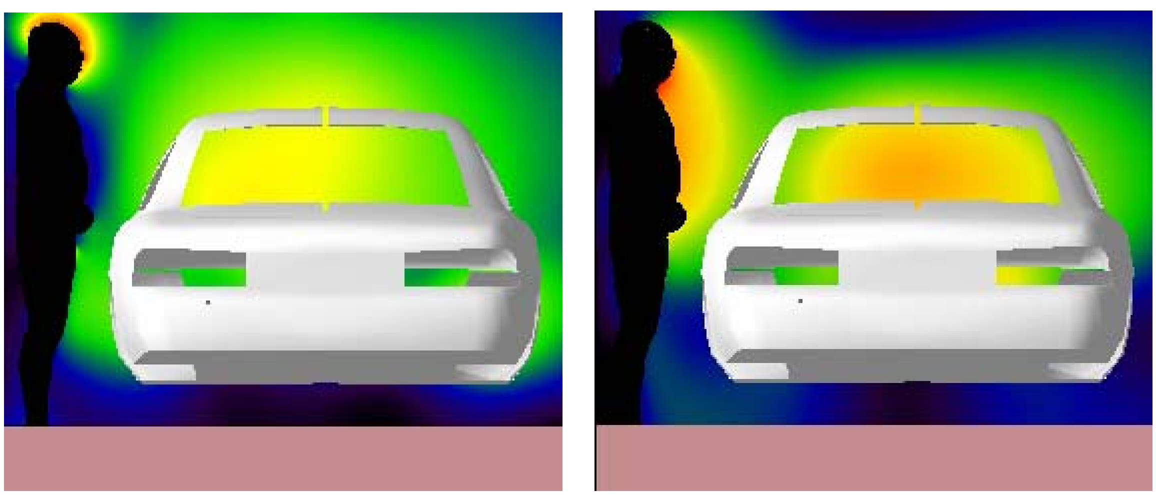
The two pictures below show the E and H field distributions in the plane of the antenna corresponding to the condition represented in Figure 7.



a) b)

Figure 8. (a) E-field distribution in the plane of the antenna corresponding to exposure condition of Figure 7, and (b) H-field distribution corresponding to exposure condition of Figure 7.

Additional two pictures below show E and H field distributions in the mid cross section of the bystander.



a) b)

Figure 9. (a) E-field distribution in the mid cross section of the bystander corresponding to exposure condition of Figure 7, and (b) H-field distribution corresponding to exposure condition of Figure 7.

The overall maximum peak 1-g SAR in all simulated conditions is 0.708 W/kg, less than the 1.6 W/kg limit, while the maximum whole-body average SAR is 0.0265 W/kg, less than the 0.08 W/kg limit.

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 and v6.3 User Manuals. Remcom Inc., owner of XFDTD™, is kindly acknowledged for the help provided.

1) Computational resources

a) A distributed Linux based multi-CPU computer cluster equipped with AMD 64-bit Opteron processors was employed for all simulations.

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

2) FDTD algorithm implementation and validation

a) We employed a commercial code (XFDTD™ v6.3, by Remcom Inc.) that implements the 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.

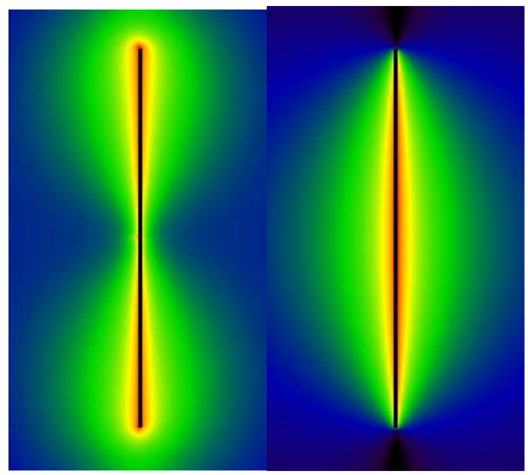
b) XFDTD™ is one of the most widely employed commercial codes for electromagnetic simulations. It has gone through extensive validation and has proven its accuracy over time in many different applications. One example is provided in [3].

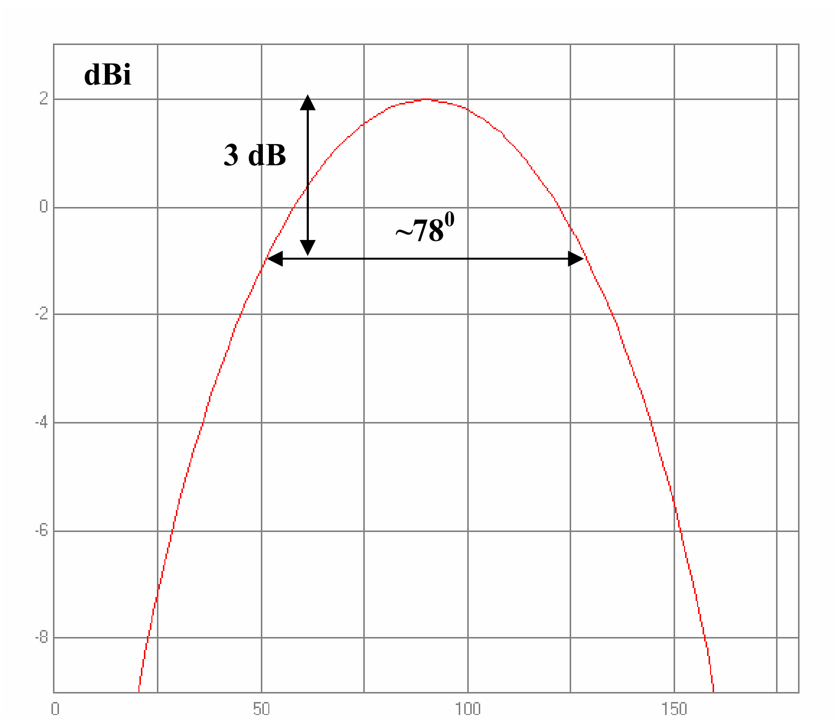
We carried out a validation of the code algorithm by running the canonical test case involving a half-wave wire dipole. The dipole is 0.475 times the free space wavelength at 160 MHz, i.e., 88.5 cm long. The discretization used in the model was uniform in all directions and equal to 5 mm, so the dipole 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 11.6 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**

Complex Feed Point Impedance (Ohms)

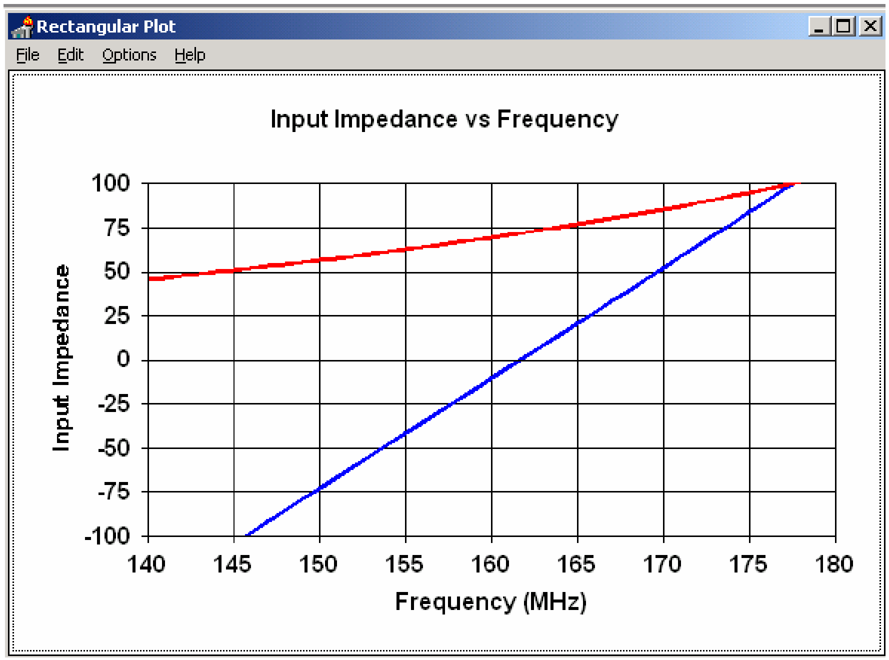
Feed	Real	Imaginary	
1	72.553001	-11.623300	





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 passenger computations with the trunk-mount antennas	387	1015	347
Maximum domain dimensions employed for bystander computations with the trunk-mount antennas	475	1092	491
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 VHF frequencies	At least 6000 in all simulations		
Number of time steps for bystander at VHF frequencies	At least 8000 in all simulations		
Excitation	Sinusoidal (not less than 9-10 periods)		

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).

a) 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.

b) 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 450 MHz.

#	Tissue	ε_r	σ (S/m)	Density (kg/m^3)
1	skin	41.5	0.57	1125
2	tendon, pancreas, prostate, aorta, liver, other	50.3	0.76	1151
3	fat, yellow marrow	5.02	0.05	943

4	cortical bone	13.4	0.11	1850
5	cancellous bone	21.0	0.23	1080
6	blood	57.2	1.72	1057
7	muscle, heart, spleen, colon, tongue	63.5	0.99	1059
8	gray matter, cerebellum	54.1	0.88	1035.5
9	white matter	39.7	0.54	1027.4
10	CSF	68.9	2.32	1000
11	sclera/cornea	54.4	1.04	1151
12	vitreous humor	68.3	1.56	1000
13	bladder	17.6	0.31	1132
14	nerve	35.5	0.50	1112
15	cartilage	43.4	0.66	1171
16	gall bladder bile	76.5	1.62	928
17	thyroid	59.8	0.82	1035.5
18	stomach/esophagus	74.4	1.13	1126
19	lung	52.8	0.72	563
20	kidney	57.0	1.16	1147
21	testis	65.2	1.13	1158
22	lens	51.9	0.71	1163
23	small intestine	73.7	2.07	1153

Similarly, the table below reports the tissue dielectric properties at 155 MHz (mid-band for this VHF mobile radio product).

#	Tissue	ε_r	σ (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

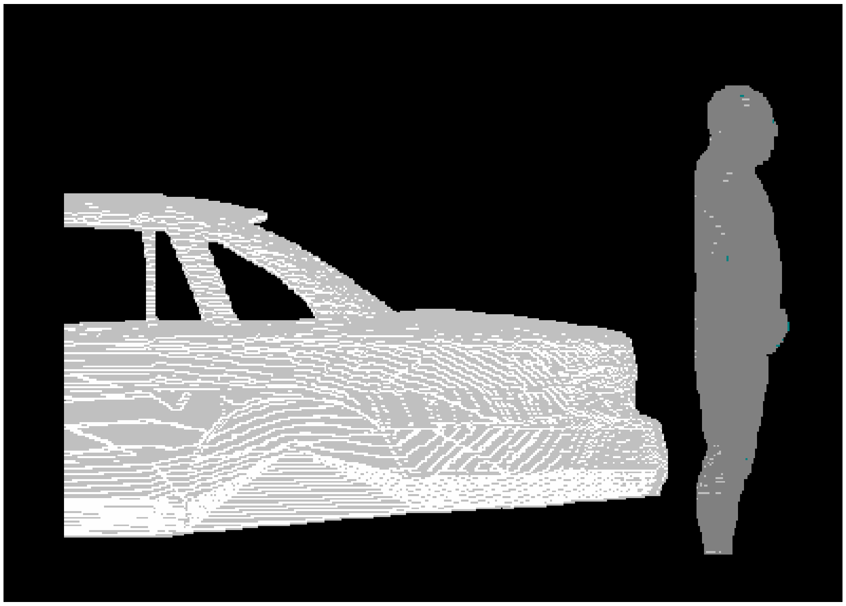
b) The tissue types and dielectric parameters used in the SAR computation are appropriate for determining the highest exposure expected for normal device operation, because they are derived from measurements performed on real biological tissues (http://www.brooks.af.mil/AFRL/HED/hedr/reports/dielectric/home.html).

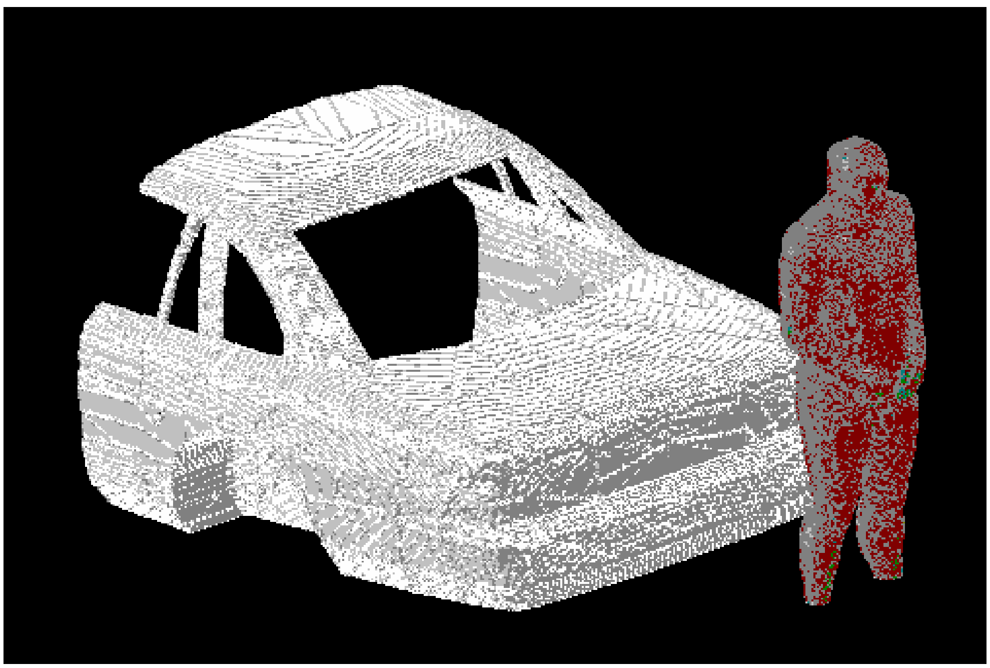
c) The tabulated list of the dielectric parameters used in phantom models is provided at point 5(a). As regards the device (car plus antenna), we used perfect electric conductors.

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, even when 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. In case of low profile vertical monopole antenna (HAE6016A) which has an additional horizontal metal circular disk at the tip, the disk was included in the model and well represented in 5 mm resolution mesh.
- 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).



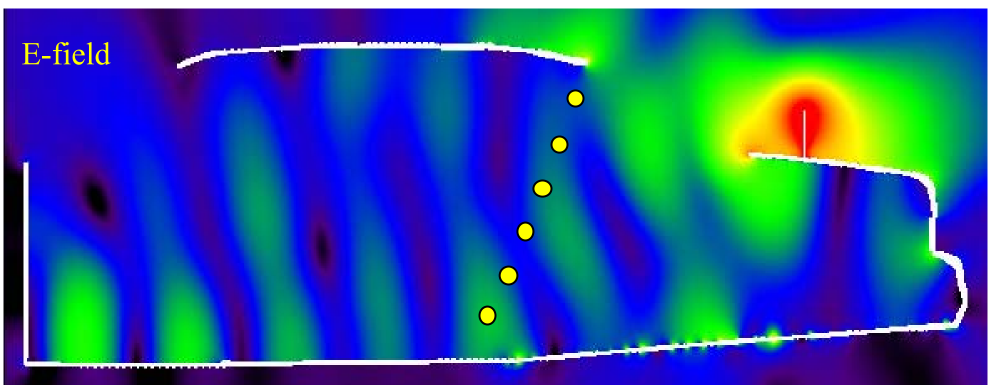


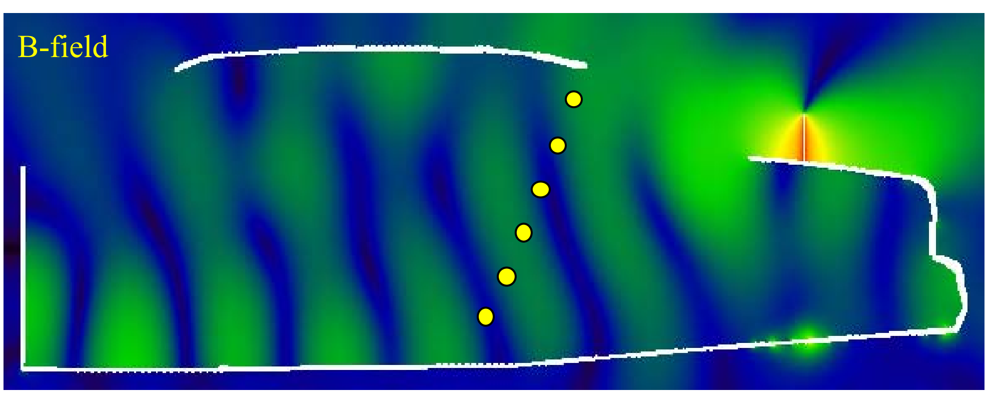
The car model is constituted by perfect electric conductor and does not include wheels in order to reduce its complexity. The passenger model is surrounded by air, as the seat, which is made out of poorly conductive fabrics, is not included in the computational model. The pavement has not been included 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):

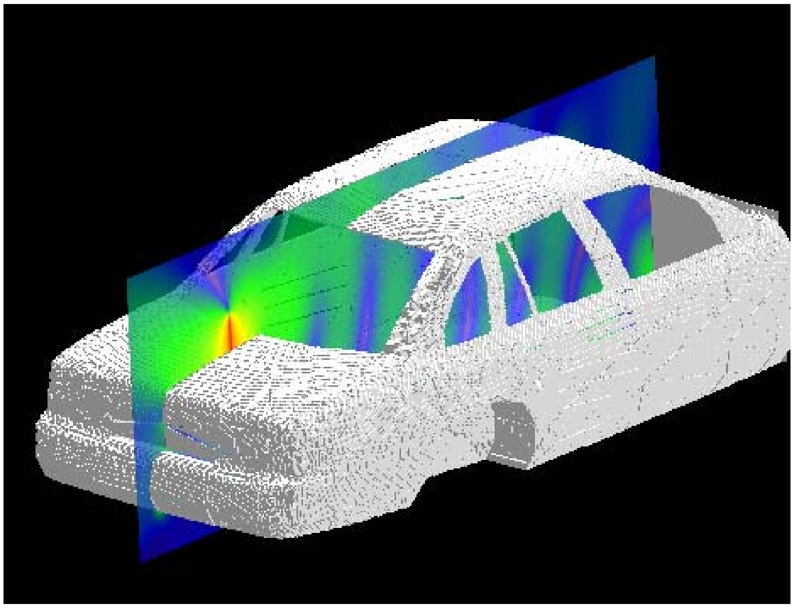
$$S_E = \frac{|\mathbf{E}|^2}{2\eta}, \quad S_H = \frac{\eta}{2}|\mathbf{H}|^2, \quad \eta = 377\,\Omega$$

Passenger with 17.5 cm monopole antenna (HAE4002A 421.5 MHz)

The following figure of the test model shows the car model, where the yellow dots individuate the back seat, as it can be observed from the other figure showing the cross section of the passenger. The comparison has been performed by taking the average of the computed steady-state field values at the six dotted locations, corresponding to the head, chest, and legs along the yellow dots line, and comparing them with the average of the MPE measurements performed at the head, chest and legs locations. Such a comparison is carried out at the same rms power level (22 W, including the 50% duty factor) used in the MPE measurements.







The equivalent power density (S) is computed from the E-field and the H-field separately. The following table reports the E-field values computed by XFDTD™ at the six locations, and the corresponding power density.

Location Number	E-field, V/m	Eq. Power Density 1.0 V source	Scaled Power Dens. 22 W output, mW/cm^2
1	5.83E-01	4.51E-04	4.41E-01
2	6.31E-01	5.28E-04	5.16E-01
3	6.50E-01	5.60E-04	5.48E-01
4	5.50E-01	4.01E-04	3.92E-01
5	4.50E-01	2.69E-04	2.63E-01
6	7.80E-01	8.07E-04	7.89E-01
Equivalent average Power Density			**4.92E-01**

Location Number	B-field, Weber/m2	Eq. Power Density 1.0 V source	Scaled Power Dens. 22 W output, mW/cm^2
1	2.26E-09	0.00061	5.96E-01
2	9.00E-10	0.00010	9.45E-02
3	1.20E-09	0.00017	1.68E-01
4	2.20E-09	0.00058	5.65E-01
5	1.90E-09	0.00043	4.21E-01
6	9.00E-10	0.00010	9.45E-02
Equivalent average Power Density			**3.23E-01**

The input impedance is 36.2+j24.8 ohm, therefore the radiated power (considering the mismatch to the 50 ohm unitary voltage source) is 2.25E-3 W, therefore a factor equal to 9779 is required to scale up to 22 W radiated. The corresponding scaled-up power densities are reported in the tables above, which show that the simulation overestimates the average power density from the MPE measurements (0.29 mW/cm^2), as derived from the measured E-field reported in the following table:

Position	SE (meas), 22 W output mW/cm^2
Head	0.38
Chest	0.33
Lower Trunk	0.16

The simulations tend to overestimate the average power density levels, which is understandable since there are no ohmic losses and perfect impedance matching is enforced in the computational models. Based on these results, we conclude that the simulation will produce slight exposure overestimates (about12%).

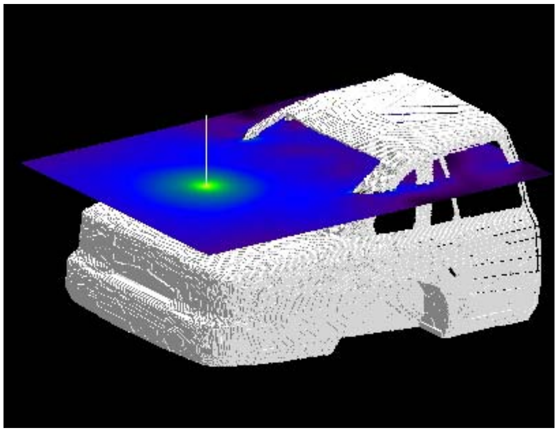
b) Descriptions and illustrations showing the correspondence between the modeled test device and the actual device, with respect to shape, size, dimensions and near-field radiating characteristics, are found in the main report.

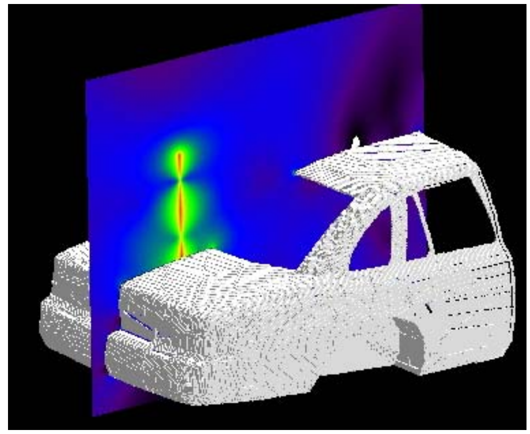
c) Verification that the test device model is equivalent to the actual device for predicting the SAR distributions descends from the fact that the car and antenna size and location in the numerical model correspond to those used in the measurements.

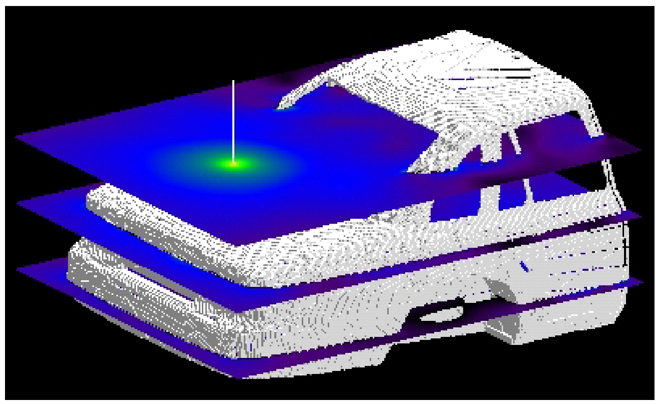
d) The peak SAR is in the neck region for the passenger, which is in line with MPE measurements and predictions.

Passenger with 63.5 cm monopole antenna (HAE6010A 425 MHz)

The following figures show the car model with the field distribution in the horizontal planes where the MPE measurements have been performed. The comparison has been performed by taking the average of the computed steady-state field values at the three locations, corresponding to the head, chest, and lower trunk, and comparing them with the average of the MPE measurements performed at the head, chest and lower trunk locations. Such a comparison is carried out at the same rms power level (61.5 W, including the 50% duty factor) used in the MPE measurements.







The equivalent power density (S) is computed from the E-field. The following table reports the E-field values computed by XFDTD™ at the three locations, and the corresponding power density.

Location Number	E-field, V/m	Eq. Power Density 1.0 V source	Scaled Power Dens. 61.5 W output, mW/cm^2
1	2.10E-01	5.85E-05	0.561
2	3.66E-01	1.78E-04	1.70
3	1.72E-01	3.92E-04	0.376
Equivalent average Power Density			**0.88**

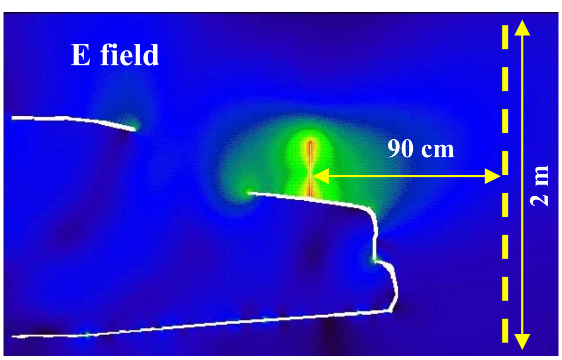
The corresponding scaled-up power densities are reported in the tables above, which show that the simulation overestimates the average power density from the MPE measurements (0.52 mW/cm^2), as derived from the measured E-field reported in the following table:

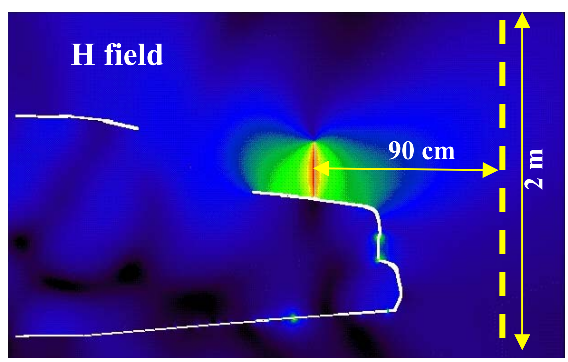
Position	SE (meas), 60 W output mW/cm^2
Head	0.72
Chest	0.64
Lower Trunk	0.19

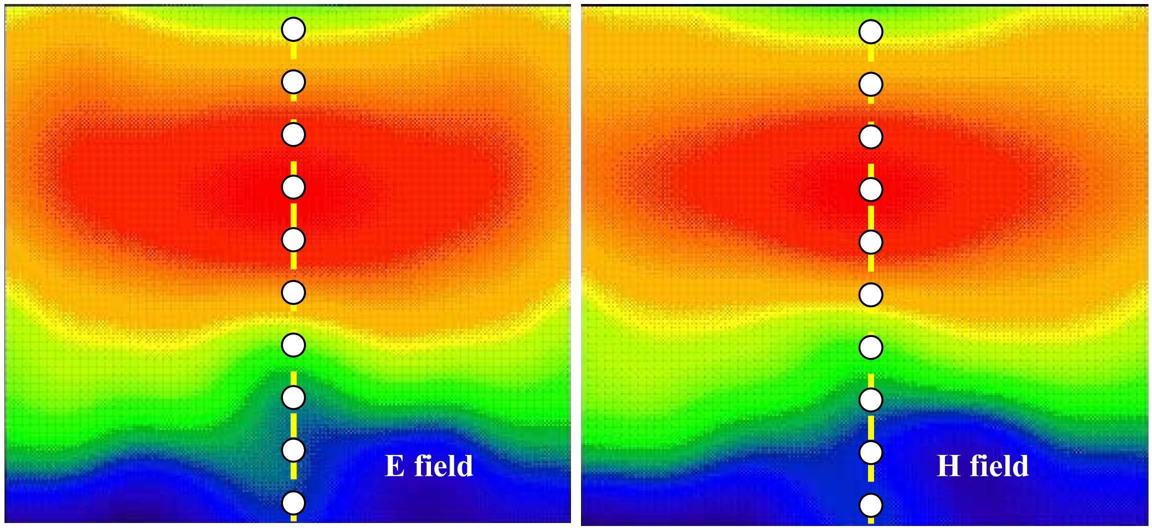
The simulations tend to overestimate the average power density levels, which is understandable since there are no ohmic losses and perfect impedance matching is enforced in the computational models. Based on these results, we conclude that the simulation will produce exposure overestimates (about 69%).

Bystander with 29 cm monopole antenna (HAE6013A 425 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 90 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 HAE6013A.



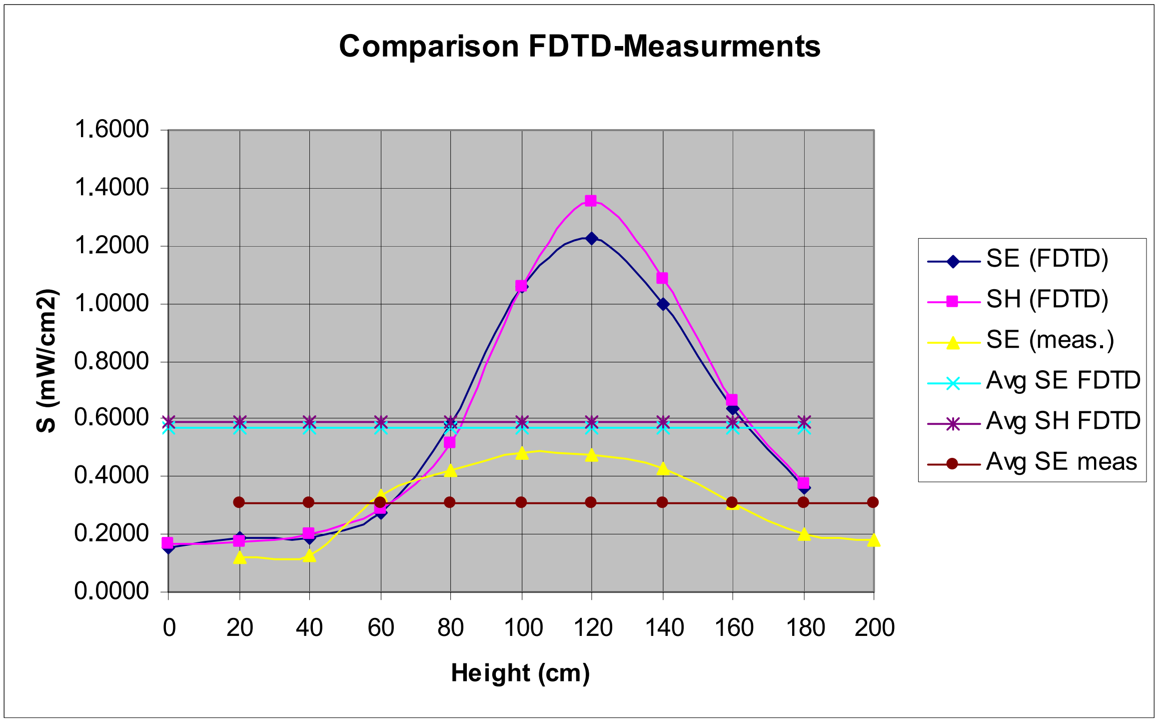




The following table reports the field values computed by XFDTD™ and the corresponding power density values. The average exposure levels are computed as well.

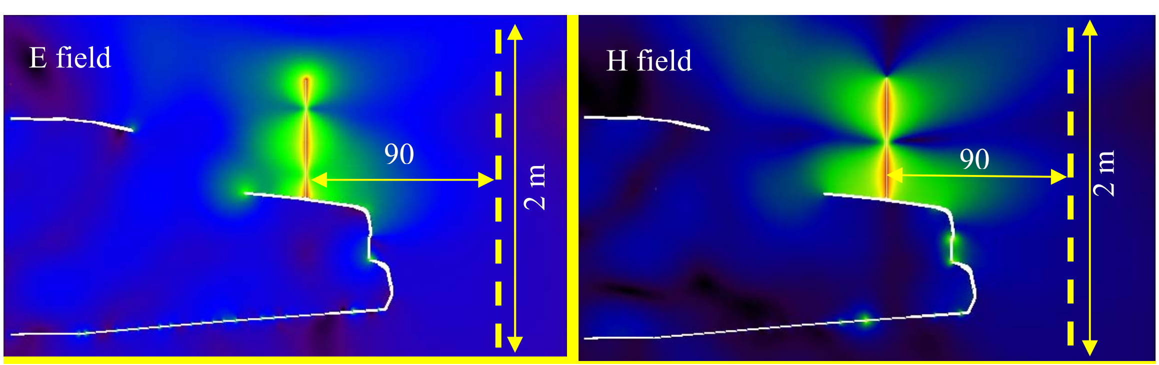
Height (cm)	E (V/m)	S_E (W/m^2)	H (A/m)	S_H (W/m^2)
0	1.05E-01	1.46E-05	2.90E-05	1.589E-05
20	1.14E-01	1.72E-05	2.90E-05	1.598E-05
40	1.16E-01	1.78E-05	3.14E-05	1.871E-05
60	1.39E-01	2.56E-05	3.75E-05	2.669E-05
80	2.03E-01	5.47E-05	5.03E-05	4.795E-05
100	2.73E-01	9.88E-05	7.23E-05	9.923E-05
120	2.94E-01	1.15E-04	8.17E-05	1.266E-04
140	2.65E-01	9.31E-05	7.32E-05	1.016E-04
160	2.12E-01	5.96E-05	5.73E-05	6.219E-05
180	1.60E-01	3.40E-05	4.32E-05	3.531E-05
Average S_E		**5.302E-05**	**Average S_H**	**5.501E-05**

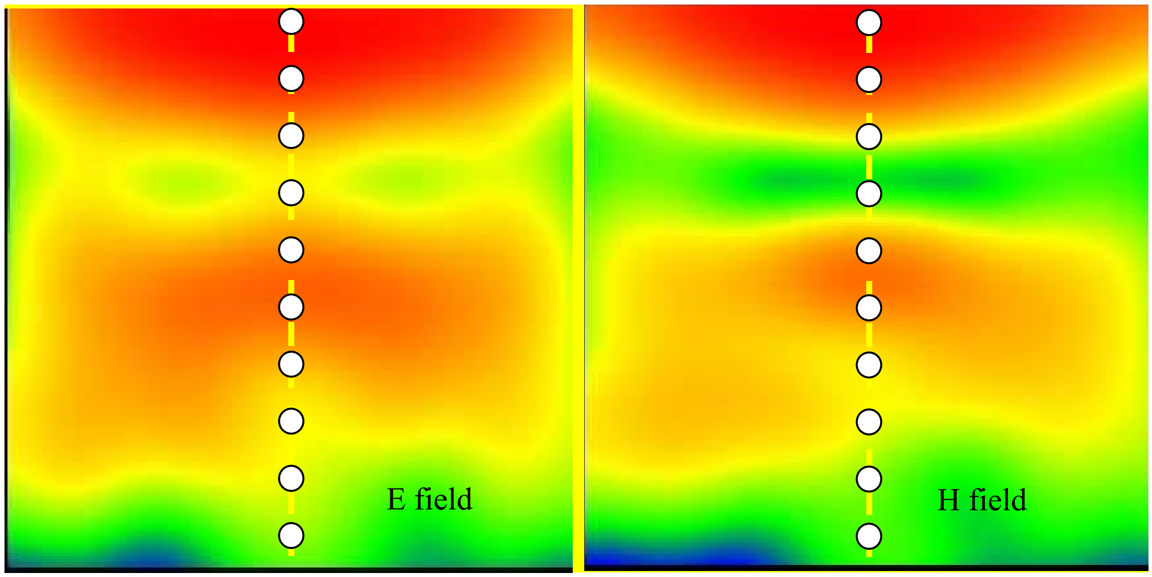
Since the conducted power during the MPE measurement was 123 W the calculated power density was then scaled up for 61.5 W radiated power (taking into account 50% talk time). This model does not include the mismatch loss, loss in the cable and finite conductivity of the car surface and as represents a conservative model for exposure assessment. The scaled-up power density values for 61.5 W radiated power are 5.67 W/m^2 (E), and 5.88 W/m^2 (H), that correspond to 0.57 mW/cm^2 (E), and 0.59 mW/cm^2 (H). Measurements yielded average power density of 0.309 mW/cm^2 (E), which shows that the calculated power density is overestimated. The following graph shows a comparison between the measured power density and the simulated one, based on E or H fields, normalized to 61.5 W radiated power.



Bystander with 63.5 cm monopole antenna (HAE6010A 425 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 90 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 HAE6010A.

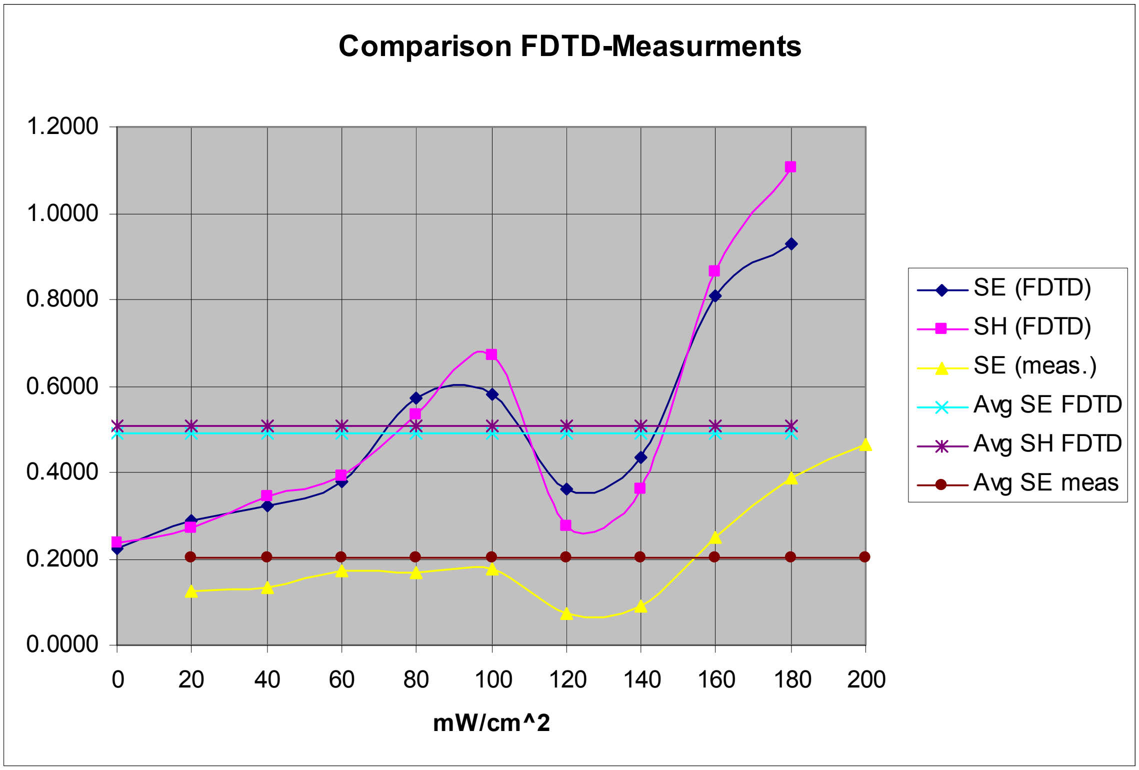




The following table reports the field values computed by XFDTD™ and the corresponding power density values. The average exposure levels are computed as well.

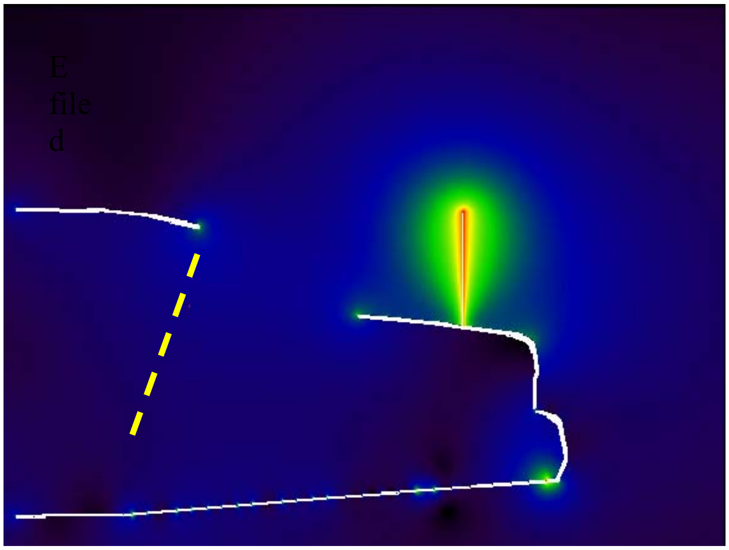
Height (cm)	E (V/m)	S_E (W/m^2)	H (A/m)	S_H (W/m^2)
0	1.32E-01	2.31E-05	4.51E-10	2.43E-05
20	1.49E-01	2.94E-05	4.82E-10	2.77E-05
40	1.58E-01	3.31E-05	5.44E-10	3.53E-05
60	1.71E-01	3.88E-05	5.79E-10	4.00E-05
80	2.10E-01	5.85E-05	6.78E-10	5.48E-05
100	2.12E-01	5.96E-05	7.60E-10	6.89E-05
120	1.67E-01	3.70E-05	4.86E-10	2.82E-05
140	1.83E-01	4.44E-05	5.57E-10	3.70E-05
160	2.50E-01	8.29E-05	8.62E-10	8.86E-05
180	2.68E-01	9.53E-05	9.75E-10	1.13E-04
Average S_E		**5.38E-05**	**Average S_H**	**5.18E-05**

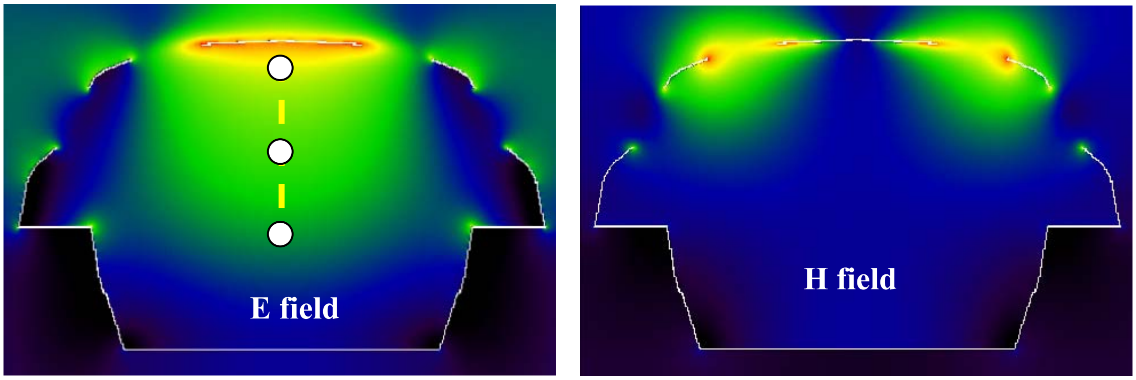
Since the conducted power during the MPE measurement was 123 W the calculated power density was then scaled up for 61.5 W radiated power (taking into account 50% talk time). This model does not include the mismatch loss, loss in the cable and finite conductivity of the car surface and as represents a conservative model for exposure assessment. The scaled-up power density values for 61.5 W radiated power are 5.25 W/m^2 (E), and 5.06 W/m^2 (H), that correspond to 0.52 mW/cm^2 (E), and 0.51 mW/cm^2 (H). Measurements yielded average power density of 0.204 mW/cm^2 (E), which shows that the calculated power density is overestimated. The following graph shows a comparison between the measured power density and the simulated one, based on E or H fields, normalized to 61.5 W radiated power.



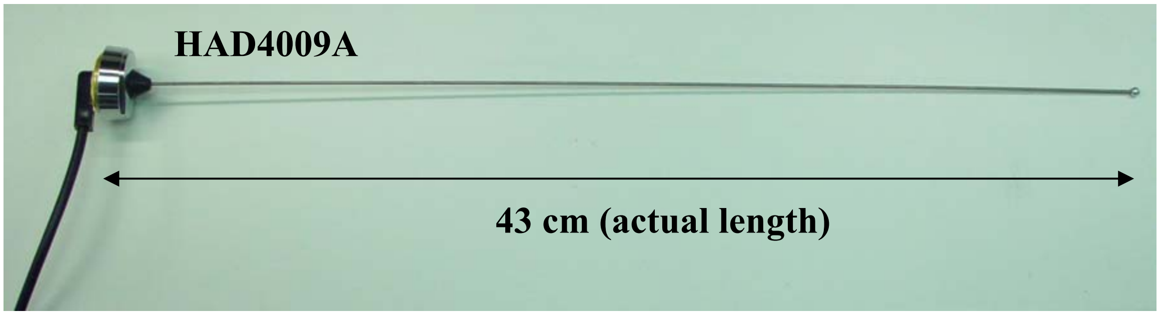
Passenger with 43 cm monopole antenna (HAD4009A 164 MHz)

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.



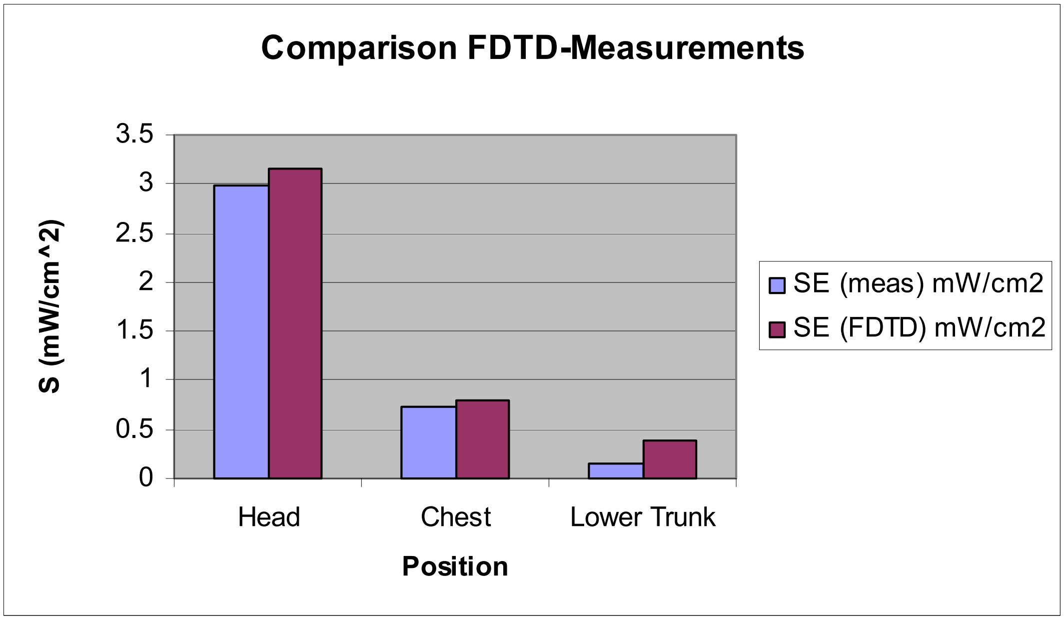
Because the peak exposure occurs in the center of the back seat, that was where we placed the passenger model to perform the SAR evaluations presented in the report. However, it can be observed that the H-field distribution features peaks near the lateral edges of the rear window. That is the reason 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	1.10	1.33E-03
Chest	0.70	3.32E-04
Lower Trunk area	0.52	1.62E-04
	Average S	**6.07E-04**

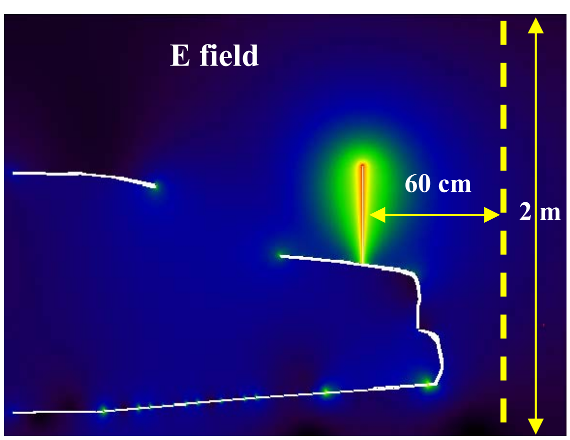
The input impedance is 32.4-j4.8 ohm, therefore the radiated power (considering the mismatch to the 50 ohm unitary voltage source) is 2.38E-3 W. The scaled-up power density for 56.5 W radiated power is 14.4 W/m^2, corresponding to 1.44 mW/cm^2. Measurements gave an average of 1.29 mW/cm^2, which is in agreement considering conservativeness of simulations model. The following table and the graph show a comparison between the simulated power density and the measured one (see also MPE report in FCC ID#ABZ99FT3046, Table 43), normalized to 56.5 W radiated.

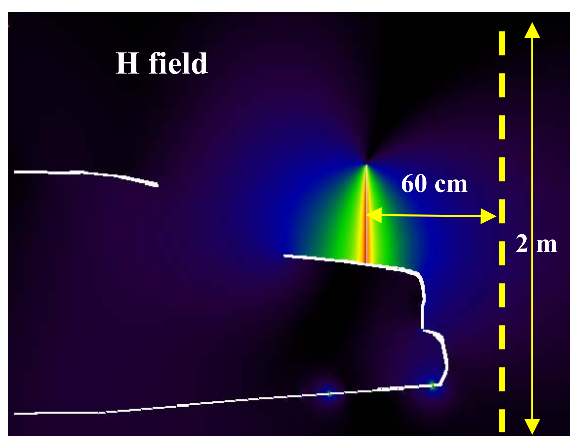
Position	SE (meas) mW/cm^2	SE (FDTD) mW/cm^2
Head	2.98	3.15
Chest	0.74	0.79
Lower Trunk	0.14	0.39

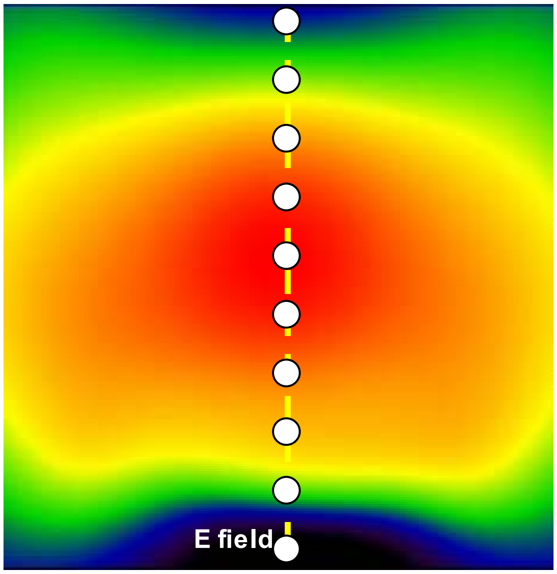


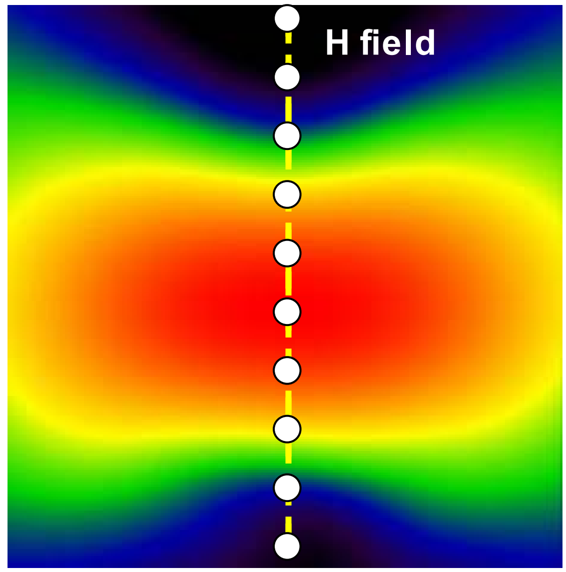
Bystander with 48 cm monopole antenna (HAD4007A 146 MHz)

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.







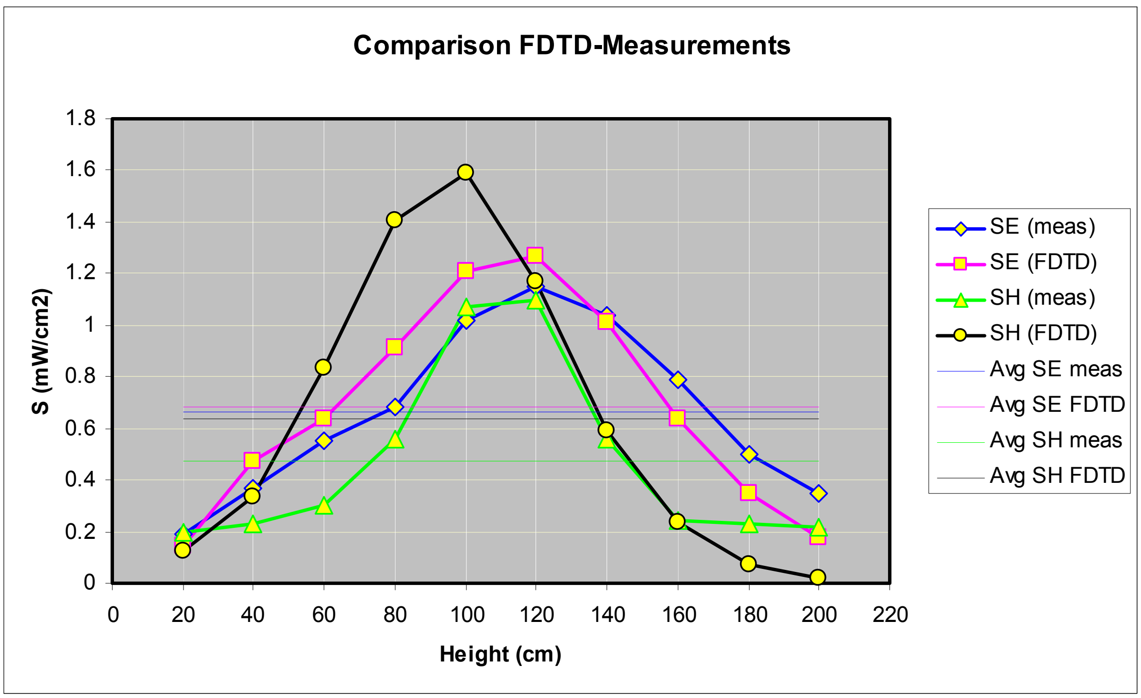


The following table reports the field values computed by XFDTD™ and the corresponding power density values. The average exposure levels are computed as well.

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	5.21E-04	5.12E-05
40	3.86E-01	1.98E-04	8.59E-04	1.39E-04
60	4.48E-01	2.66E-04	1.36E-03	3.49E-04
80	5.36E-01	3.81E-04	1.77E-03	5.88E-04
100	6.17E-01	5.05E-04	1.88E-03	6.65E-04
120	6.32E-01	5.30E-04	1.61E-03	4.87E-04
140	5.65E-01	4.23E-04	1.15E-03	2.48E-04
160	4.47E-01	2.65E-04	7.21E-04	9.80E-05
180	3.30E-01	1.44E-04	4.07E-04	3.13E-05
200	2.35E-01	7.32E-05	1.93E-04	6.99E-06
	Average S_E	2.85E-04	**Average S_H**	2.66E-04

The input impedance is 27.9-j14.3 ohm, therefore the radiated power (considering the mismatch to the 50 ohm unitary voltage source) is 2.22E-3 W. The scaled-up power density values for 53.2 W radiated power are 6.81 W/m^2 (E), and 6.38 W/m^2 (H), that correspond to 0.68 mW/cm^2 (E), and 0.64 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 table and 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.

Height (cm)	SE (meas) mW/cm^2	SE (FDTD) mW/cm^2	SH (meas) mW/cm^2	SH (FDTD) mW/cm^2	Avg SE meas mW/cm^2	Avg SE FDTD mW/cm^2	Avg SH meas mW/cm^2	Avg SH FDTD mW/cm^2
20	0.19	0.14	0.2	0.12	0.664	0.681	0.471	0.638
40	0.37	0.47	0.23	0.33				
60	0.55	0.64	0.3	0.84				
80	0.68	0.91	0.56	1.41				
100	1.02	1.21	1.07	1.59				
120	1.15	1.27	1.1	1.17				
140	1.04	1.01	0.56	0.59				
160	0.79	0.63	0.24	0.23				
180	0.5	0.35	0.23	0.07				
200	0.35	0.18	0.22	0.02				



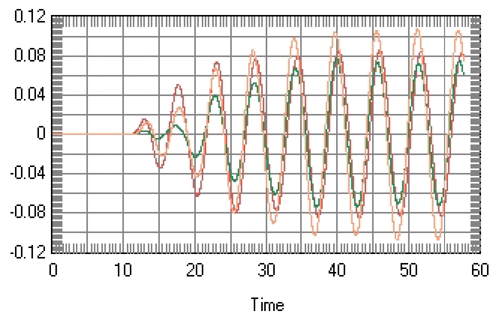
7) Test device positioning

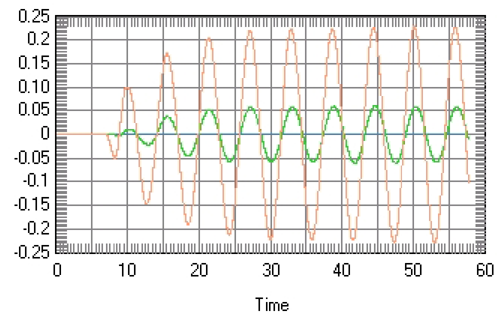
a) A description of the device test positions used in the SAR computations is provided in the SAR report.

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 in two opposite points in the computational domain. 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.





b) 6000 time steps were used, with a time step approximately equal to 10 *ps* (meeting the Courant criterion), which corresponds to 10 wave periods at 146 MHz. 4000 time steps were used, with a time step approximately equal to 10 *ps* (meeting the Courant criterion), which corresponds to 18 wave periods at 450 MHz.

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

$$P_{XFDTD} = \frac{1}{2}\mathrm{Re}\left\{VI^*\right\}$$

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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