MOTOROLA

ACCREDITED

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

MPE Compliance Test Report

Date of Report:	March 18, 2004
Report Revision(s):	Rev. O
Device Manufacturer:	Motorola
Device Description:	GM3688, EM400, CM300; 45W VHF (R1) 136-162 MHz; 32 channel Marlin + mini-UHF Display
Classification:	Occupational/Controlled Exposure
FCC ID:	ABZ99FT3049
Device Model:	PMUD1945A

Test Period:	2/27/04 & 3/1/04
Responsible Engineer:	Jim Fortier (Elect. Principle Staff Engineer)
Test Engineer:	Stephen Whalen (Sr. EME Engineer)
Author:	Michael Sailsman (Global EME Regulatory Affairs Liaison)

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

Signature on file — 3/18/04

Ken Enger
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Date Approved

TABLE OF CONTENTS

REVISION HISTORY

Date	Revision	Comments
3/18/04	O	Release of Pilot Results

1.0 Product Description

FCC ID: ABZ99FT3049, model PMUD1945A (GM3688, EM400, CM300) is a mobile transceiver that utilizes frequency modulation (FM) half duplex transmission technology. The intended use of the radio is Push-To-Talk (PTT) while the device is properly installed in a vehicle with the offered external antennas mounted at the center of the roof or trunk. This device will be marketed to and used by employees solely for work-related operations, such as public safety agencies, e.g. police, fire and emergency medical. User training is the responsibility of these agencies which can be expected to employ the usage instructions, safety information and operational cautions set forth in the user's manual, instructional sessions or other means. Motorola also makes available to its customers training classes on the proper use of two-way radios and wireless data devices. This device is classified as Occupational/Controlled Exposure. However, In accordance with FCC requirements, the passengers inside the vehicle and the bystanders external to the vehicle are evaluated to the General Population/Uncontrolled Exposure Limits. The transmit frequency band is 136-162 MHz. The nominal power of the device is 45 watts with a maximum conducted power output of 52 watts.

2.0 Offered Options and Accessories

Antenna

HAD4007A	144.0-150.8 MHz ¼ wave 2.15dBi antenna; 49.0cm (Fixed)
HAD4008A	150.8-162.0 MHz ¼ wave 2.15dBi antenna; 45.6cm (Fixed)
HAD4006A	136.0-144.0 MHz ¼ wave 2.15dBi antenna; 52.0cm (Fixed)
RAD4198A	136.0-144.0 MHz ¼ wave 2.15dBi antenna; 52.0cm (Fixed)
RAD4199A	144.0-150.8 MHz ¼ wave 2.15dBi antenna; 49.0cm (Fixed)
RAD4200A	150.8-162.0 MHz ¼ wave 2.15dBi antenna; 45.6cm (Fixed)
HAD4014A	140.0-174.0 MHz 5.65dBi gain antenna; 116.8cm (Trimmed)
RAD4000A	136.0-174.0 MHz 5.15dBi gain antenna; 118.5cm (Trimmed)

3.0 Measurement Standards

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

For frequencies ranging from 136-162 MHz the MPE (Maximum Permissible Exposure) limit to electromagnetic energy in equivalent plane wave free-space power density is 0.2 mW/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 14.0 volts.

5.0 Measurement System Uncertainty Levels

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

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

6.0 Method of Measurement

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

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

With the survey meter and probe, take ten (10) measurements, at the standard test distance of 90 cm to the antenna, from the back of the vehicle in a vertical line and then average the results. These measurements are taken and recorded at every twenty (20) centimeters over a range starting at twenty (20) centimeters above ground and ending at 2.0 meters; this would be representative of a person standing behind a vehicle during a mobile radio transmission.
Using the highest MPE configuration from above, repeat two additional MPE tests at the vehicle/trunk corner (45 degree radial) and on the side of the vehicle adjacent to the trunk (90 degree radial, directly opposite center trunk mounted antenna) while maintaining twenty (20) centimeter separation between the probe sensor and vehicle body.
For the current test vehicle, the antenna to probe sensor separation distance is 99.5 cm (45 degree radial) and 104 cm (90 degree radial)
Note: the distance from the trunk-mounted antenna to the edge of the vehicle is 26cm and the distance from the edge of the vehicle's trunk to the MPE vertical line assessment is 34cm (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, scan the inside of the vehicle, both front and back seating areas, for the highest level in each location. After the highest level is found, scan vertically making two (2) additional measurements within an area approximately 40 cm wide (representing the width of a person) so as to have a total of three (3) measured points as indicated below that will be averaged.

a) Head area

b) Chest area

c) Lower Trunk area

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

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

With the survey meter and probe, take ten (10) measurements, at the standard test distance of 90 cm from the vehicle-mounted antenna, in a vertical line and then average the results. These measurements are taken and recorded at every twenty (20) centimeters over a range starting at twenty (20) centimeters above ground and ending at 2.0 meters; this would be representative of a person standing next to a vehicle during a mobile radio transmission.

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, scan the inside of the vehicle, both front and back seating areas, for the highest level in each location. After the highest level is found, scan vertically making two (2) additional measurements within an area approximately 40 cm wide (representing the width of a person) so as to have a total of three (3) measured points as indicated below that will be averaged.

a) Head area

b) Chest area

c) Lower Trunk area

7.0 Test Site

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

8.0 Measurement System/Equipment

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

a) Automobile: 1991 Ford Taurus, 4-Door

b) E-Field Survey Meter - NARDA Model 8718 (01108); Cal. date: 4/14/03

c) E-Field (Electric Field) Probe - NARDA Model 8722B (13001); Cal. date: 5/6/03

d) H-Field (Magnetic field) Probe – NARDA Model 8731 (03006); Cal. Date: 3/21/03

e) Antennas - (1/4 wave 2.15dBi, 5.15dBi, and 5.65dBi gain antennas)

9.0 Test Unit Description

Power density measurements were performed on a representative sample of model number PMUD1945A. The serial number of the tested radio was 019TAA1231. The frequency band of the DUT is 136-162 MHz; the tested frequencies were 140.025, 149.0, 156.4, and 161.975 MHz. The ¼ wave 2.15dBi, 5.15dBi, and 5.65dBi gain mobile antennas listed in section 2.0 were used to assess compliance to the applicable MPE limits.

10.0 Test Set-Up Description

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

a) The ¼ wave 2.15dBi antenna models HAD4007A, HAD4008A, and HAD4006A, as well as 5.15dBi gain antenna model RAD4000A and 5.65dBi gain antenna model HAD4014A were mounted at the center of the roof and trunk of the test vehicle. Assessments were made internal and external to the test vehicle at the specified distances stated in sections 6.0, 11.0, and the APPENDIX. Note that the offered antenna models RAD4199A, RAD4200A, and RAD4198A were not tested due to their similarities in frequency band and antenna lengths to models HAD4007A, HAD4008A, and HAD4006A respectively.

11.0 Test Results

Below is the raw MPE data for all measured grid points. Results are based on a 50% duty cycle with the radio operating in accordance with the User Manual instructions. The bolded power density results represent the highest MPE results observed.

Raw MPE Data; Test Frequencies and measured Po (W):
140.025 MHz (Po=51.6), 149.000 MHz (Po=52.0), 156.400 MHz (Po=51.3), 161.975 MHz (Po=52.4),
Meter reads in % of controlled limit; controlled limit = 1.00 mW/cm^2 for 30-300 MHz
(Cal factors presented herein are automatically accounted for in the meter used for assessments)
General Population MPE limits = 0.20mW/cm^2 or 1.6mW/g (Bystanders & Passengers)
External Vehicle Power Density (Pwr. Den. (cal.)) = average over body/2
Internal Vehicle Power Density (Pwr. Den. (cal.)) = average over (head/chest/lower trunk)/2
Pwr Density Max Calc.= (RF Po Max/Initial Power)*Pwr Density Calc. (initial power > max power)

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

Table 1

External Vehicle MPE Assessment @ 149 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	0.82	0.369	52.0	0.185	0.185

Measurement Grid							
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	13.3%	6	120	57.9%	1	0.2
2	40	24.7%	7	140	51.2%		
3	60	34.6%	8	160	39.9%		
4	80	43.7%	9	180	32.4%		**RF Po (*Max)**
5	100	50.1%	10	200	21.3%		52.0

Table 2

Internal Vehicle MPE Assessment @ 149 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4007A	2.15	Highest Reading	E	0.82	1.644	0.037	52.0	0.822	**0.822**

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	291.3%	149.7%	52.1%	IEEE Uncontrolled Limit:	0.2
Front Seat	5.3%	3.4%	2.5%	**RF Po (*Max):**	52.0

Table 3

External Vehicle MPE Assessment @ 149 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)	HAD4007 A	2.15	90	H	0.98	0.193	52.0	0.097	0.097

Measurement Grid							
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.120	6	120	0.290	1.0	0.2
2	40	0.110	7	140	0.250		
3	60	0.150	8	160	0.180		
4	80	0.230	9	180	0.150		**RF Po (*Max)**
5	100	0.270	10	200	0.180		52.0

Table 4

Internal Vehicle MPE Assessment @ 149 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4007 A	2.15	Highest Reading	H	0.98	0.393	0.083	52.0	0.197	0.197

Measurement Grid					
Test Position	**Magnetic Field Strength Head**	**Magnetic Field Strength Chest**	**Magnetic Field Strength Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	0.600	0.240	0.340	IEEE Uncontrolled Limit:	0.2
Front Seat	0.090	0.080	0.080	**RF Po (*Max):**	52.0

Table 5

External Vehicle MPE Assessment @ 149 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)	HAD4007 A	2.15	110	H	0.98	0.201	52.0	0.101	0.101

Measurement Grid							
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.000	6	120	0.160	1.0	0.2
2	40	0.000	7	140	0.220		
3	60	0.110	8	160	0.310		
4	80	0.130	9	180	0.430		**RF Po (*Max)**
5	100	0.140	10	200	0.510		52.0

Table 6

Internal Vehicle MPE Assessment @ 149 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4007 A	2.15	Highest Reading	H	0.98	0.120	0.123	52.0	0.062	0.062

Measurement Grid					
Test Position	**Magnetic Field Strength Head**	**Magnetic Field Strength Chest**	**Magnetic Field Strength Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	0.130	0.110	0.120	IEEE Uncontrolled Limit:	0.2
Front Seat	0.120	0.130	0.120	**RF Po (*Max):**	52.0

Table 7

External Vehicle MPE Assessment @ 149 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)	HAD4007 A	2.15	110	E	0.82	0.194	52.0	0.097	0.097

Measurement Grid							
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	2.9%	6	120	20.1%	1	0.2
2	40	7.0%	7	140	31.2%		
3	60	8.4%	8	160	34.3%		
4	80	8.6%	9	180	36.7%		**RF Po (*Max)**
5	100	12.3%	10	200	32.5%		52.0

Table 8

Internal Vehicle MPE Assessment @ 149 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4007 A	2.15	Highest Reading	E	0.82	0.405	0.093	52.0	0.203	0.203

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	74.5%	37.6%	9.5%	IEEE Uncontrolled Limit:	0.2
Front Seat	8.0%	8.9%	11.0%	**RF Po (*Max):**	52.0

Table 9

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)	HAD4008 A	2.15	90	E	0.83	0.335	51.3	0.168	0.170

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	50.3%	1	0.2
2	40	25.3%	7	140	48.7%		
3	60	30.1%	8	160	37.5%		
4	80	37.8%	9	180	26.3%		**RF Po (*Max)**
5	100	45.7%	10	200	16.9%		52.0

Table 10

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4008 A	2.15	Highest Reading	E	0.83	0.939	0.138	51.3	0.470	0.476

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	130.8%	86.7%	64.3%	IEEE Uncontrolled Limit:	0.2
Front Seat	21.6%	10.5%	9.2%	**RF Po (*Max):**	52.0

Table 11

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)	HAD4008 A	2.15	90	H	0.98	0.330	51.3	0.165	0.167

Measurement Grid							
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.190	6	120	0.410	1.0	0.2
2	40	0.150	7	140	0.410		
3	60	0.220	8	160	0.380		
4	80	0.340	9	180	0.400		**RF Po (*Max)**
5	100	0.370	10	200	0.430		52.0

Table 12

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4008 A	2.15	Highest Reading	H	0.98	0.307	0.083	51.3	0.153	0.155

Measurement Grid					
Test Position	**Magnetic Field Strength Head**	**Magnetic Field Strength Chest**	**Magnetic Field Strength Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	0.510	0.200	0.210	IEEE Uncontrolled Limit:	0.2
Front Seat	0.120	0.090	0.040	**RF Po (*Max):**	52.0

Table 13

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)	HAD4008 A	2.15	110	H	0.98	0.238	51.3	0.119	0.121

Measurement Grid							
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.000	6	120	0.190	1.0	0.2
2	40	0.000	7	140	0.260		
3	60	0.090	8	160	0.430		
4	80	0.110	9	180	0.530		**RF Po (*Max)**
5	100	0.150	10	200	0.620		52.0

Table 14

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4008 A	2.15	Highest Reading	H	0.98	0.143	0.173	51.3	0.087	0.088

Measurement Grid					
Test Position	**Magnetic Field Strength Head**	**Magnetic Field Strength Chest**	**Magnetic Field Strength Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	0.210	0.120	0.100	IEEE Uncontrolled Limit:	0.2
Front Seat	0.250	0.130	0.140	**RF Po (*Max):**	52.0

Table 15

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)	HAD4008 A	2.15	110	E	0.83	0.240	51.3	0.120	0.122

Measurement Grid							
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	2.9%	6	120	24.7%	1	0.2
2	40	8.7%	7	140	41.8%		
3	60	8.4%	8	160	47.0%		
4	80	8.1%	9	180	46.1%		**RF Po (*Max)**
5	100	13.3%	10	200	39.4%		52.0

Table 16

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4008 A	2.15	Highest Reading	E	0.83	0.314	0.135	51.3	0.157	0.159

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	57.5%	26.9%	9.8%	IEEE Uncontrolled Limit:	0.2
Front Seat	18.5%	10.7%	11.3%	**RF Po (*Max):**	52.0

Table 17

External Vehicle MPE Assessment @ 140.025 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)	HAD4006 A	2.15	90	E	0.81	0.263	51.6	0.132	0.133

Measurement Grid							
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	11.2%	6	120	42.1%	1	0.2
2	40	18.4%	7	140	36.5%		
3	60	21.3%	8	160	28.3%		
4	80	28.1%	9	180	25.4%		**RF Po (*Max)**
5	100	38.2%	10	200	13.7%		52.0

Table 18

Internal Vehicle MPE Assessment @ 140.025 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4006 A	2.15	Highest Reading	E	0.81	0.419	0.094	51.6	0.210	0.211

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	64.5%	33.2%	28.1%	IEEE Uncontrolled Limit:	0.2
Front Seat	14.6%	8.1%	5.4%	**RF Po (*Max):**	52.0

Table 19

External Vehicle MPE Assessment @ 140.025 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)	HAD4006 A	2.15	90	H	0.99	0.260	51.6	0.130	0.131

Measurement Grid							
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.130	6	120	0.300	1.0	0.2
2	40	0.100	7	140	0.320		
3	60	0.140	8	160	0.330		
4	80	0.230	9	180	0.380		**RF Po (*Max)**
5	100	0.310	10	200	0.360		52.0

Table 20

Internal Vehicle MPE Assessment @ 140.025 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4006 A	2.15	Highest Reading	H	0.99	0.580	0.057	51.6	0.290	0.292

Measurement Grid					
Test Position	**Magnetic Field Strength Head**	**Magnetic Field Strength Chest**	**Magnetic Field Strength Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	0.650	0.590	0.500	IEEE Uncontrolled Limit:	0.2
Front Seat	0.060	0.070	0.040	**RF Po (*Max):**	52.0

Table 21

External Vehicle MPE Assessment @ 140.025 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	110	H	0.99	0.302	51.6	0.151	0.152

Measurement Grid							
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.090	6	120	0.260	1.0	0.2
2	40	0.090	7	140	0.360		
3	60	0.150	8	160	0.450		
4	80	0.160	9	180	0.570		**RF Po (*Max)**
5	100	0.240	10	200	0.650		52.0

Table 22

Internal Vehicle MPE Assessment @ 140.025 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4006A	2.15	Highest Reading	H	0.99	0.410	0.327	51.6	0.205	0.207

Measurement Grid					
Test Position	**Magnetic Field Strength Head**	**Magnetic Field Strength Chest**	**Magnetic Field Strength Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	0.520	0.420	0.290	IEEE Uncontrolled Limit:	0.2
Front Seat	0.280	0.350	0.350	**RF Po (*Max):**	52.0

Table 23

External Vehicle MPE Assessment @ 140.025 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	110	E	0.81	0.250	51.6	0.125	0.126

Measurement Grid							
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	6.9%	6	120	28.3%	1	0.2
2	40	12.4%	7	140	38.1%		
3	60	11.8%	8	160	43.5%		
4	80	12.3%	9	180	43.2%		**RF Po (*Max)**
5	100	18.9%	10	200	34.5%		52.0

Table 24

Internal Vehicle MPE Assessment @ 140.025 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4006A	2.15	Highest Reading	E	0.81	0.414	0.219	51.6	0.207	0.208

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	51.2%	32.9%	40.0%	IEEE Uncontrolled Limit:	0.2
Front Seat	30.1%	15.6%	20.1%	**RF Po (*Max):**	52.0

Table 25

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)	HAD4014 A	5.65	90	E	0.83	0.323	51.3	0.162	0.164

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	39.6%	1	0.2
2	40	4.9%	7	140	56.4%		
3	60	11.3%	8	160	61.7%		
4	80	15.7%	9	180	62.3%		**RF Po (*Max)**
5	100	21.4%	10	200	47.1%		52.0

Table 26

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4014 A	5.65	Highest Reading	E	0.83	0.178	0.024	51.3	0.089	0.090

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	29.7%	16.3%	7.4%	IEEE Uncontrolled Limit:	0.2
Front Seat	1.7%	2.3%	3.1%	**RF Po (*Max):**	52.0

Table 27

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)	HAD4014 A	5.65	90	H	0.98	0.319	51.3	0.160	0.162

Measurement Grid							
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.020	6	120	0.130	1.0	0.2
2	40	0.000	7	140	0.370		
3	60	0.000	8	160	0.770		
4	80	0.020	9	180	0.940		**RF Po (*Max)**
5	100	0.050	10	200	0.890		52.0

Table 28

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4014 A	5.65	Highest Reading	H	0.98	0.040	0.000	51.3	0.020	0.020

Measurement Grid					
Test Position	**Magnetic Field Strength Head**	**Magnetic Field Strength Chest**	**Magnetic Field Strength Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	0.060	0.040	0.020	IEEE Uncontrolled Limit:	0.2
Front Seat	0.000	0.000	0.000	**RF Po (*Max):**	52.0

Table 29

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)	HAD4014 A	5.65	110	H	0.98	0.216	51.3	0.108	0.109

Measurement Grid							
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.000	6	120	0.100	1.0	0.2
2	40	0.000	7	140	0.180		
3	60	0.080	8	160	0.340		
4	80	0.090	9	180	0.570		**RF Po (*Max)**
5	100	0.090	10	200	0.710		52.0

Table 30

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4014 A	5.65	Highest Reading	H	0.98	0.030	0.067	51.3	0.033	0.034

Measurement Grid					
Test Position	**Magnetic Field Strength Head**	**Magnetic Field Strength Chest**	**Magnetic Field Strength Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	0.090	0.000	0.000	IEEE Uncontrolled Limit:	0.2
Front Seat	0.100	0.000	0.100	**RF Po (*Max):**	52.0

Table 31

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)	HAD4014 A	5.65	110	E	0.83	0.167	51.3	0.084	0.085

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	7.2%	1	0.2
2	40	2.9%	7	140	15.4%		
3	60	5.0%	8	160	27.9%		
4	80	4.5%	9	180	45.1%		**RF Po (*Max)**
5	100	3.3%	10	200	54.8%		52.0

Table 32

Internal Vehicle MPE Assessment @ 156.4 MHz										
Antenna Location	**Antenna Model**	**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)	HAD4014 A	5.65	Highest Reading	E	0.83	0.055	0.026	51.3	0.027	0.028

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	8.1%	5.4%	2.9%	IEEE Uncontrolled Limit:	0.2
Front Seat	2.3%	2.4%	3.2%	**RF Po (*Max):**	52.0

Table 33

External Vehicle MPE Assessment @ 161.975 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)	RAD4000 A	5.15	90	E	0.84	0.223	52.4	0.112	0.112

Measurement Grid							
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	2.5%	6	120	22.7%	1	0.2
2	40	4.1%	7	140	36.3%		
3	60	7.3%	8	160	44.7%		
4	80	10.8%	9	180	44.5%		**RF Po (*Max)**
5	100	13.1%	10	200	37.3%		52.0

Table 34

Internal Vehicle MPE Assessment @ 161.975 MHz										
Antenna Location	**Antenna Model**	**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)	RAD4000 A	5.15	Highest Reading	E	0.84	0.138	0.047	52.4	0.069	0.069

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	18.1%	15.4%	7.8%	IEEE Uncontrolled Limit:	0.2
Front Seat	4.1%	3.5%	6.4%	**RF Po (*Max):**	52.0

Table 35

External Vehicle MPE Assessment @ 161.975 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)	RAD4000 A	5.15	90	H	0.98	0.246	52.4	0.123	0.123

Measurement Grid							
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.020	6	120	0.060	1.0	0.2
2	40	0.000	7	140	0.270		
3	60	0.000	8	160	0.510		
4	80	0.010	9	180	0.750		**RF Po (*Max)**
5	100	0.020	10	200	0.820		52.0

Table 36

Internal Vehicle MPE Assessment @ 161.975 MHz										
Antenna Location	**Antenna Model**	**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)	RAD4000 A	5.15	Highest Reading	H	0.98	0.060	0.013	52.4	0.030	0.030

Measurement Grid					
Test Position	**Magnetic Field Strength Head**	**Magnetic Field Strength Chest**	**Magnetic Field Strength Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	0.050	0.060	0.070	IEEE Uncontrolled Limit:	0.2
Front Seat	0.010	0.020	0.010	**RF Po (*Max):**	52.0

Table 37

External Vehicle MPE Assessment @ 161.975 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)	RAD4000 A	5.15	110	H	0.98	0.171	52.4	0.086	0.086

Measurement Grid							
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.000	6	120	0.090	1.0	0.2
2	40	0.000	7	140	0.130		
3	60	0.090	8	160	0.200		
4	80	0.080	9	180	0.410		**RF Po (*Max)**
5	100	0.090	10	200	0.620		52.0

Table 38

Internal Vehicle MPE Assessment @ 161.975 MHz										
Antenna Location	**Antenna Model**	**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)	RAD4000 A	5.15	Highest Reading	H	0.98	0.087	0.030	52.4	0.043	0.043

Measurement Grid					
Test Position	**Magnetic Field Strength Head**	**Magnetic Field Strength Chest**	**Magnetic Field Strength Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	0.090	0.080	0.090	IEEE Uncontrolled Limit:	0.2
Front Seat	0.090	0.000	0.000	**RF Po (*Max):**	52.0

Table 39

External Vehicle MPE Assessment @ 161.975 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)	RAD4000 A	5.15	110	E	0.84	0.102	52.4	0.051	0.051

Measurement Grid							
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**	IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	1.3%	6	120	6.7%	1	0.2
2	40	1.8%	7	140	10.3%		
3	60	1.7%	8	160	15.0%		
4	80	1.6%	9	180	25.7%		**RF Po (*Max)**
5	100	3.1%	10	200	34.5%		52.0

Table 40

Internal Vehicle MPE Assessment @ 161.975 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)	RAD4000 A	5.15	Highest Reading	E	0.84	0.050	0.022	52.4	0.025	0.025

Measurement Grid					
Test Position	**% of Control Limit Head**	**% of Control Limit Chest**	**% of Control Limit Lower Trunk**	IEEE Controlled Limit:	1.0
Back Seat	5.3%	4.8%	4.9%	IEEE Uncontrolled Limit:	0.2
Front Seat	2.9%	1.7%	2.0%	**RF Po (*Max):**	52.0

Table 41

External Vehicle MPE Assessment @						149 MHz		(90 ° assessment)	
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)	HAD4007 A	2.15	104	E	0.82	0.360	52.0	0.180	0.180
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**	**Test Position**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit	
1	20	26.1%	6	120	53.9%		1	0.2	
2	40	40.3%	7	140	53.5%				
3	60	32.4%	8	160	39.7%				
4	80	26.8%	9	180	26.3%			**RF Po (*Max)**	
5	100	45.3%	10	200	16.1%			52.0	

Table 42

External Vehicle MPE Assessment @						149 MHz		(90 ° assessment)	
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)	HAD4007 A	2.15	104	H	0.98	0.251	52.0	0.126	0.126
Measurement Grid									
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**		IEEE Controlled Limit	IEEE Uncontrolled Limit	
1	20	0.000	6	120	0.450		1.0	0.2	
2	40	0.000	7	140	0.450				
3	60	0.050	8	160	0.360				
4	80	0.150	9	180	0.340			**RF Po (*Max)**	
5	100	0.340	10	200	0.370			52.0	

Table 43

External Vehicle MPE Assessment @						156.4	MHz	(90 ° assessment)	
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)	HAD4014 A	5.65	104	E	0.83	0.208	51.3	0.104	0.105
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	20.2%		1	0.2
2	40	7.7%		7	140	31.4%			
3	60	8.2%		8	160	39.6%			
4	80	4.9%		9	180	42.5%			**RF Po (*Max)**
5	100	10.3%		10	200	35.7%			52.0

Table 44

External Vehicle MPE Assessment @						156.4	MHz	(90 ° assessment)	
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)	HAD4014 A	5.65	104	H	0.98	0.188	51.3	0.094	0.095
Measurement Grid									
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**		**Test Position**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.000		6	120	0.100		1.0	0.2
2	40	0.000		7	140	0.170			
3	60	0.060		8	160	0.300			
4	80	0.080		9	180	0.470			**RF Po (*Max)**
5	100	0.060		10	200	0.640			52.0

Table 45

External Vehicle MPE Assessment @						149 MHz		(45 º assessment)	
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)	HAD4007 A	2.15	99.5	E	0.82	0.409	52.0	0.204	0.204
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**	**Test Positio n**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit	
1	20	11.1%	6	120	63.7%		1	0.2	
2	40	23.5%	7	140	53.6%				
3	60	51.7%	8	160	43.4%				
4	80	53.9%	9	180	29.0%			**RF Po (*Max)**	
5	100	60.4%	10	200	18.6%			52.0	

Table 46

External Vehicle MPE Assessment @						161.975 MHz		(45 º assessment)	
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)	HAD4007 A	2.15	99.5	H	0.98	0.268	52.4	0.134	0.134
Measurement Grid									
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**	**Test Positio n**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**		IEEE Controlled Limit	IEEE Uncontrolled Limit	
1	20	0.040	6	120	0.430		1.0	0.2	
2	40	0.040	7	140	0.440				
3	60	0.190	8	160	0.320				
4	80	0.210	9	180	0.330			**RF Po (*Max)**	
5	100	0.360	10	200	0.320			52.0	

Table 47

External Vehicle MPE Assessment @						156.4	MHz	(45 ° assessment)	
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)	HAD4014 A	5.65	99.5	E	0.83	0.219	51.3	0.109	0.111
Measurement Grid									
Test Position	**Height (cm)**	**% of Control Limit**		**Test Positio n**	**Height (cm)**	**% of Control Limit**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	5.4%		6	120	22.6%		1	0.2
2	40	8.5%		7	140	35.4%			
3	60	11.8%		8	160	42.7%			
4	80	5.4%		9	180	43.1%			**RF Po (*Max)**
5	100	9.3%		10	200	34.6%			52.0

Table 48

External Vehicle MPE Assessment @						156.4	MHz	(45 ° assessment)	
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)	HAD4014 A	5.65	99.5	H	0.98	0.175	51.3	0.088	0.089
Measurement Grid									
Test Position	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**		**Test Positio n**	**Height (cm)**	**Meas. Pwr. Density (mW/cm^2)**		IEEE Controlled Limit	IEEE Uncontrolled Limit
1	20	0.000		6	120	0.040		1.0	0.2
2	40	0.000		7	140	0.140			
3	60	0.000		8	160	0.370			
4	80	0.000		9	180	0.600			**RF Po (*Max)**
5	100	0.040		10	200	0.560			52.0

12.0 Conclusion

Depending on the test frequency, compliance assessments were performed with an output power range of 51.3W to 52.4W. The maximum RF power allowable will be equal to the upper limit of the final test factory transmit power specification of 52W. The highest power density result scaled to the maximum allowable power output is 0.82mW/cm^2.

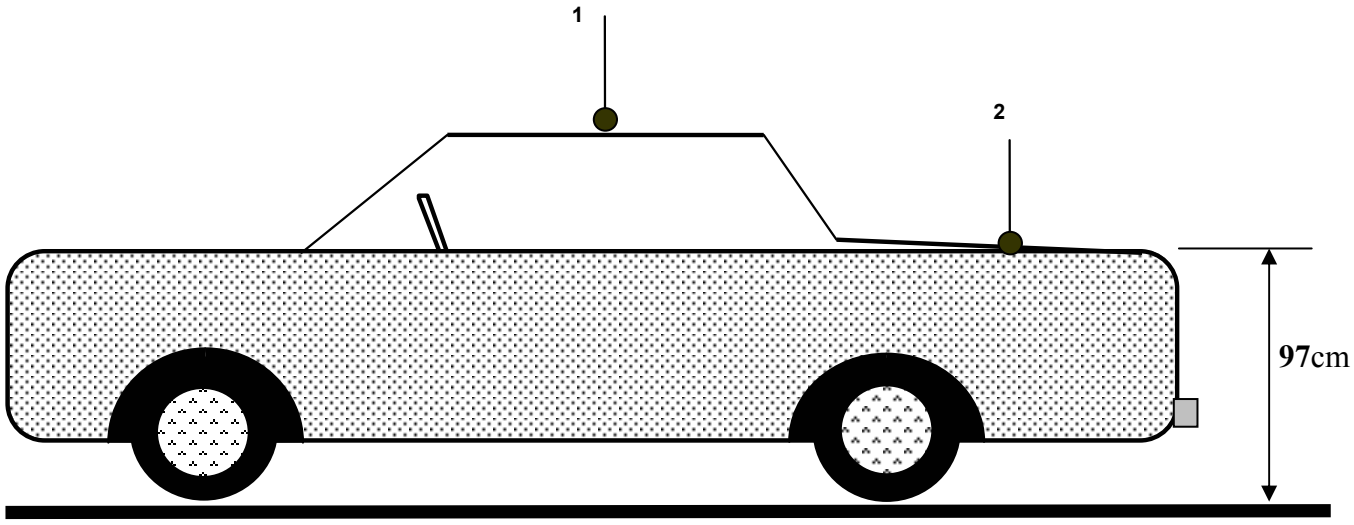
The MPE results presented herein demonstrate compliance to the applicable Occupational/Controlled exposure limits.
The computational assessment of the specific MPE non-compliant passenger and by-stander test conditions presented in APPENDIX D demonstrates compliance to the applicable General Population/Uncontrolled S.A.R. exposure limits.

Notes:
1) Tables 2, 8, 10, 18, 20, 22, 24, and 45 reflect the worst-case passenger test configuration conditions that exceed the applicable MPE power density specification limits. Each of these test conditions was analyzed computationally to assess performance to the applicable S.A.R. exposure specification limits. APPENDIX D of this report presents computational EME compliance assessment results for FCC ID: ABZ99FT3049 performed by the Motorola Corporate Research Lab located in Plantation Florida using a commercial code based on FDTD (Finite Difference Time Domain) methodology. The computational results are provided herein in order to demonstrate the EME compliance of this device with respect to the IEEE Std C95.1-1999 specific absorption rate (S.A.R.) exposure limits. The computational results show that this device, when used with the offered antennas in accordance with the user manual instructions, exhibits a maximum peak 1-g average S.A.R. of 0.73 mW/g for passengers internal to the vehicle.

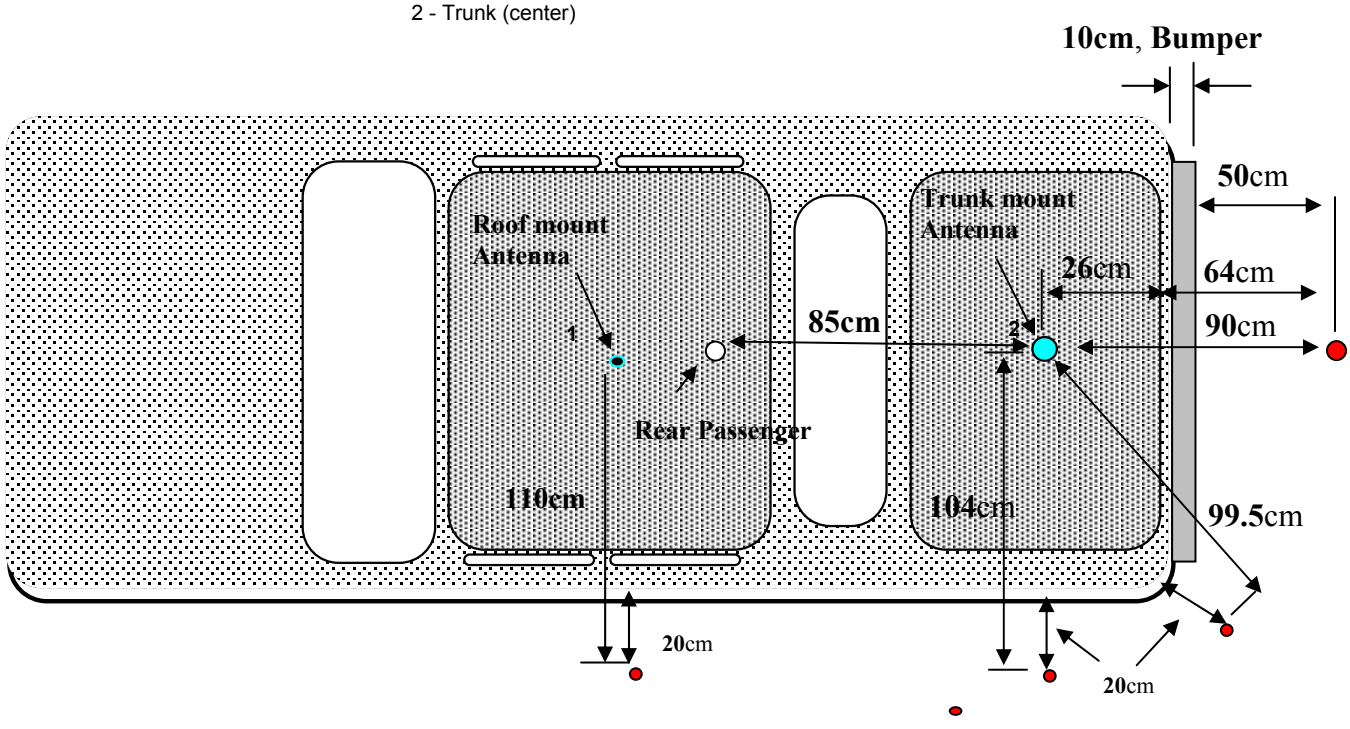
2) As presented in tables 41-48 in section 11.0 above MPE testing was performed at the trunk corners (45^O radial) and on the side of vehicle adjacent to trunk (90^O radial) in order to confirms that the worst case MPE test configuration is behind the vehicle.

APPENDIX A

Antenna Location Drawing with Test Locations Identified



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



Note: Test Locations

APPENDIX B

Calibration Certificates for E-Field and H-Field probes

E-FIELD PROBE CALIBRATION CERTIFICATE

L-3 communications
Narda Microwave-East

Certificate of Calibration

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

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

Certificate #: 35740 1

Customer: MOTOROLA
SCHAUMBURG, IL 60168-0429

Model #:	8722B	Serial #:	13001
Description:	RAD MONITOR 8722B	PO #:	NP776106
Date Calibrated:	05/06/2003	R.O. #:	35740

Vince Donovan
Manager of Instruments Assembly and Test

John C. Stine
Director of Quality Assurance

H-FIELD PROBE CALIBRATION CERTIFICATE

PRNRH003

L-3 communications
Narda Microwave-East

Certificate of Calibration

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

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

Customer: MOTOROLA
SCHAUMBURG, IL 60168-0429

Certificate #: 33484 1

Model #: 8731

Serial #: 03006

Description: RAD MONITOR

PO #: NP372037

Date Calibrated: 03/21/2003

R.O. #: 33484

Vince Donovan
Manager of Instruments Assembly and Test

John C. Stine
Director of Quality Assurance

APPENDIX C
Photos of Assessed Antennas

From left to right: HAD4014A, RAD4000A, HAD4006A, HAD4007A, HAD4008A

APPENDIX D
Computational EME SAR Compliance Assessment

COMPUTATIONAL EME COMPLIANCE ASSESSMENT OF THE GM3688 VHF MOBILE RADIO, MODEL # PMUD1945A, FCC ID ABZ99FT3049

March 15, 2004

Giorgi Bit-Babik and Antonio Faraone
Motorola Corporate EME Research Lab, Plantation, Florida

Introduction

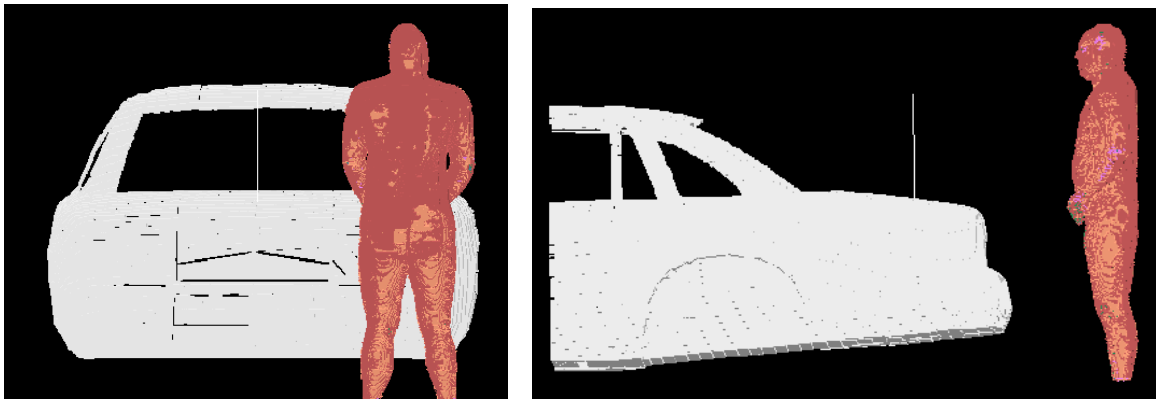
This report summarizes the computational [numerical modeling] analysis performed to document compliance of the GM3688 VHF, Model Number PMUD1945A, Mobile Radio and vehicle-mounted antennas with the Federal Communications Commission (FCC) guidelines for human exposure to radio frequency (RF) emissions. The radio operates in the 136 - 162 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 (seven in total) that did not conform with applicable MPE limits were subdivided into two groups — bystander exposures and passenger exposures — and analyzed to determine whether those conditions complied with the *specific absorption rate* (SAR) limits for general public exposure (1.6 W/kg averaged over 1 gram of tissue) set forth in FCC guidelines, which are based on the IEEE standard [1]. For both groups, a commercial code based on Finite-Difference-Time-Domain (FDTD) methodology was employed to carry out the computational analysis. It is well established and recognized within the scientific community that SAR is the primary dosimetric quantity used to evaluate the human body's absorption of RF energy and that MPEs are in fact derived from SAR. Accordingly, the SAR computations provide a scientifically valid and more accurate estimate of human exposure to RF energy.

Method

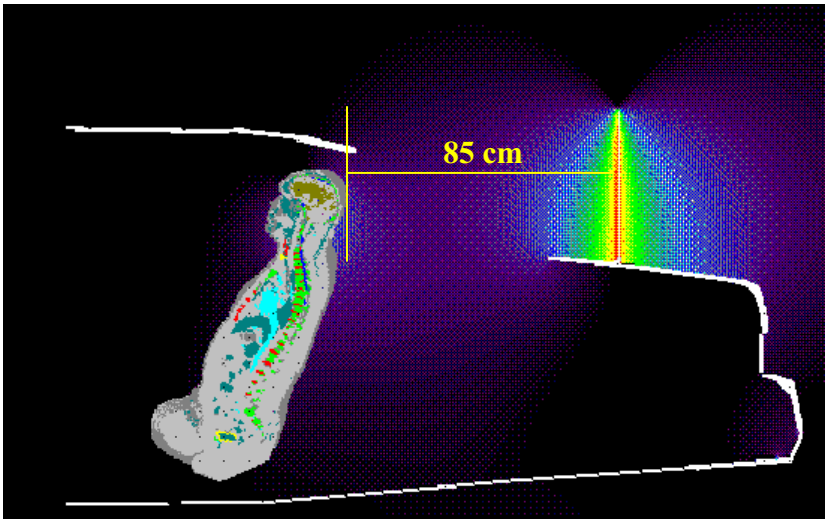
The simulation code employed is XFDTD™ v5.3, by Remcom Inc., State College, PA. This computational suite features a heterogeneous full body standing model (High Fidelity Body Mesh), derived from the so-called Visible Human [2], discretized in 5 mm voxels. The dielectric properties of 23 body tissues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

The car model has been imported into XFDTD™ from the CAD file of a sedan car having dimensions 4.98 m (L) x 1.85 m (W) x 1.18 m (H), and discretized in 5mm voxels. The wheels and part of the hood were omitted in order to fit within the computational memory (3 GB) available. These omissions would not be expected to affect the exposure calculations in any event. The antenna position is 26 cm from the end of the trunk, so as to replicate the experimental conditions used in MPE measurements. Figures 1 and 2 show images of the XFDTD™ computational models for bystander and passenger, respectively.

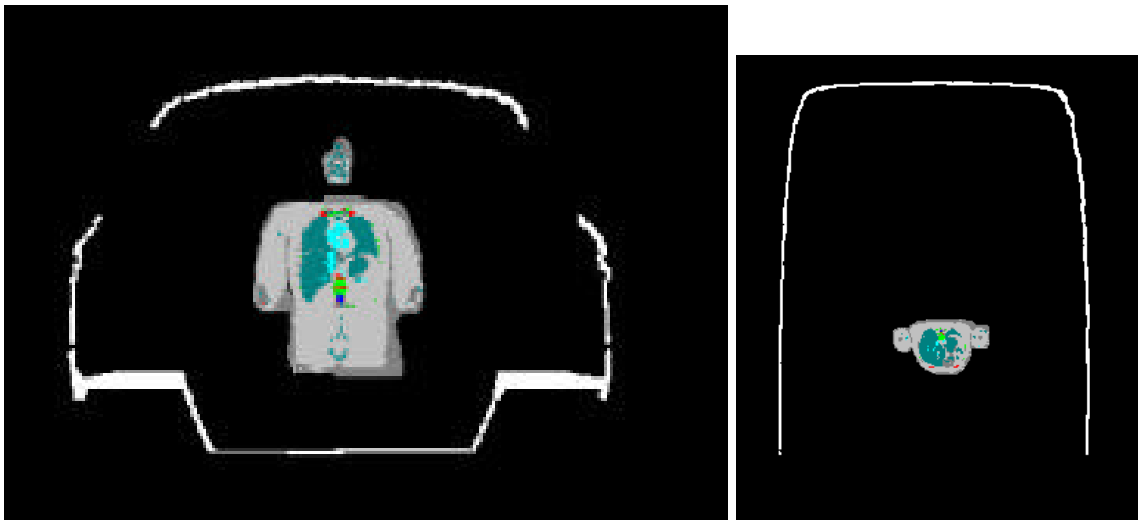


(a) (b)

Figure 1: Bystander model exposed to a trunk-mount quarter wave antenna operating at 149 MHz (a) back view and (b) side view. The antenna is mounted in the center of the trunk. The bystander model is positioned along a 45 deg. line with respect to the longitudinal centerline of the car.



(a)



(b)

Figure 2: Car passenger model exposed to a quarter wave antenna operating at 149 MHz. (a) Lateral view including a time snapshot of the E-field distribution. (b) Front and top views. The antenna is not centered in the trunk, but closer to the passenger at a distance of 85 cm from the head so as to replicate the condition that would be experienced in the car used for MPE measurements.

The computational code employs a time-harmonic excitation to produce a steady state electromagnetic field in the exposed body. Subsequently, the corresponding SAR distribution is automatically processed in order to determine the whole-body and 1-g average SAR. The product maximum output power is 52 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., 26 W *rms* net output power.

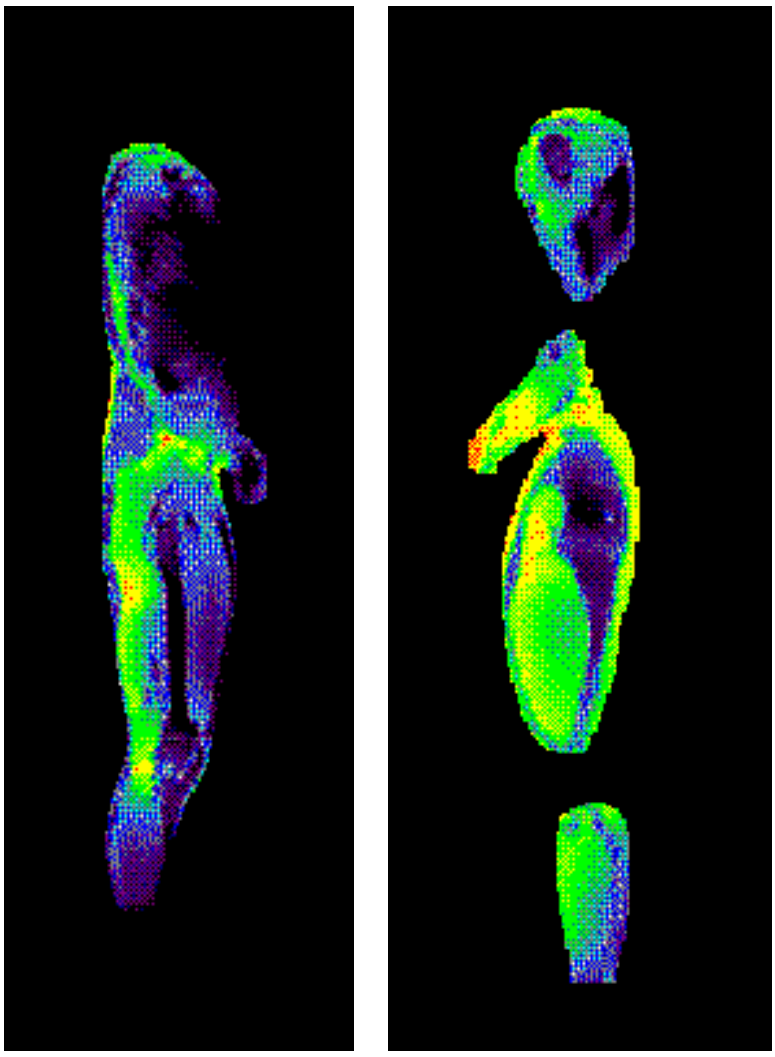
Results of SAR computations for bystanders

The test conditions requiring SAR computations are summarized in Table I, together with other relevant information and the SAR results. The bystander is placed behind the car along a 45 deg. line with respect to the longitudinal centerline of the car, with radial separation 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 front and back with respect to the antenna - were simulated individually.

Table I: Results of the SAR computations for bystander exposure (50% talk-time) behind the car along a 45 deg. line with respect to the longitudinal centerline of the car, with radial separation distance of 90 cm from the antenna while maintaining at least 20 cm from the vehicle body.

	Configuration			SAR	
Frequency	Kit #	Antenna length	Bystander position	1-g SAR	WB-SAR
149 MHz	HAD4007A	49 cm	Facing back	0.39 W/kg	0.0076 W/kg
149 MHz	HAD4007A	49 cm	Facing front	0.25 W/kg	0.0075 W/kg

The maximum peak 1-g SAR is 0.39 W/kg, about one-forth of the 1.6 W/kg limit, while the maximum whole-body average SAR is 0.0076 W/kg, i.e., about one-tenth of the 0.08 W/kg limit. Examples of SAR distributions in the bystander model are reported in Fig. 3.



(a) (b)

Figure 3: SAR distribution in the bystander produced by a quarter wave antenna operating at 149 MHz in the cross-sections containing the peak 1-g SAR. (a) bystander facing back, (b) facing front.

Results of SAR computations for car passengers

The five test conditions requiring SAR computations are summarized in Table II, together with the antenna data and the SAR results. Two of those conditions are for antenna mounted on the roof. The passenger is located in the center of the rear seat, where the maximum power density was measured. We also analyzed one case at 149 MHz with the passenger located near the door, corresponding to the highest SAR

condition found for the passenger in the center, to verify the exposure level. In this case the 1-g SAR is significantly lower than for the center position of the passenger and the whole body average is about 21% higher. All the transmit frequency, antenna length, and passenger location combinations reported in Table II have been simulated individually. The maximum peak 1-g SAR is 0.73 W/kg, while the maximum whole-body average SAR is 0.017 W/kg. An example of SAR distribution in the passenger model when it is located at the center of the rear seat is reported in Fig. 4. An example of the SAR distribution when the passenger is located on the side near the door is reported in Fig. 5a.

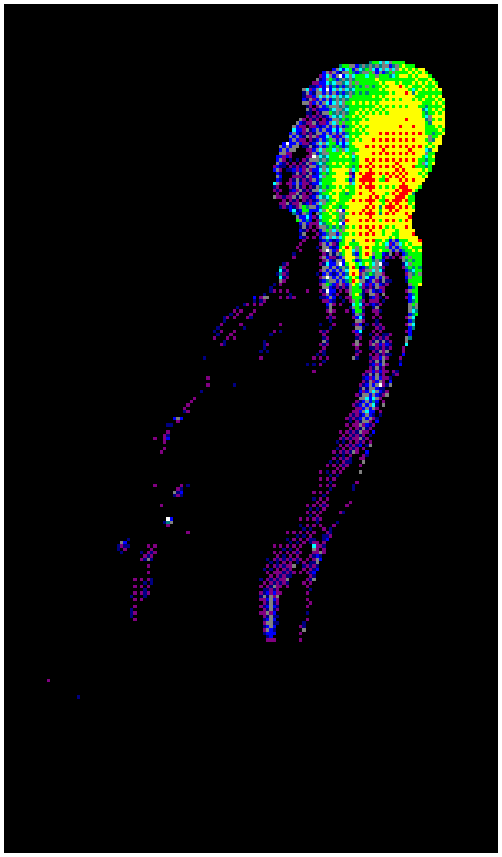
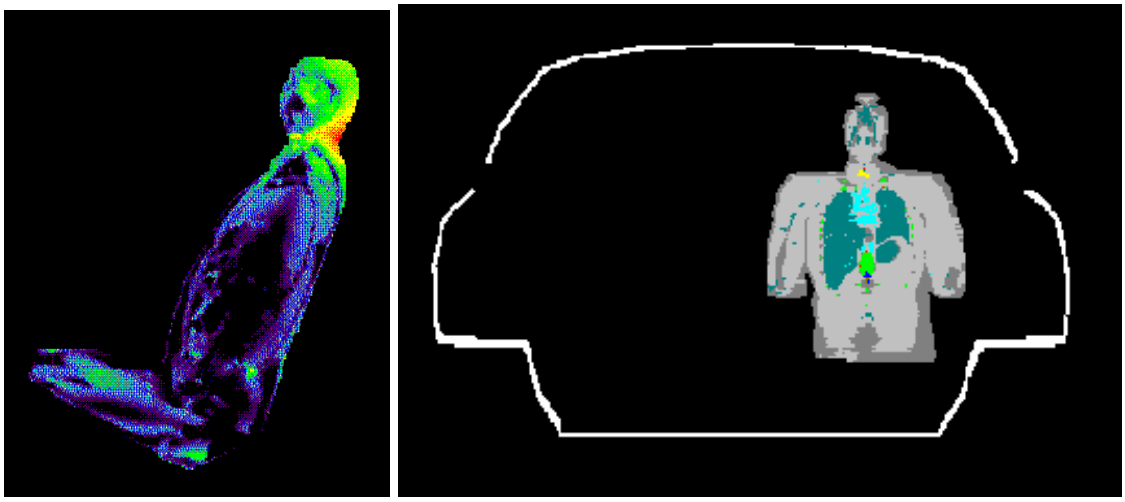


Figure 4: SAR distribution in the passenger model placed in the center of the rear seat, with a trunk-mount antenna operating at 149 MHz.

Table II: Results of SAR computations for passenger in the back seat exposed (50% talk-time) from a trunk and roof-mounted antenna.

Freq	Antenna		Passenger Centered		Passenger near Door	
MHz	Kit #	Act/Sim Length	1-g SAR	WB-SAR	1-g SAR	WB-SAR
140 MHz	HAD4006A (trunk)	52 cm	0.63 W/kg	0.013 W/kg		
149 MHz	HAD4007A (trunk)	49 cm	0.73 W/kg	0.014 W/kg	0.31 W/kg	0.017 W/kg
156.4 MHz	HAD4008A (trunk)	45.5 cm	0.63 W/kg	0.012 W/kg		
140 MHz	HAD4006A (roof)	52 cm	0.14 W/kg	0.0068 W/kg		
149 MHz	HAD4007A (roof)	49 cm	0.2 W/kg	0.0067 W/kg		



(a) (b)

Figure 5: SAR distribution in the passenger model through the plane where the peak SAR occurs (a) placed laterally in the back seat (b), with a trunk-mount antenna operating at 149 MHz.

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