MOTOROLA SOLUTIONS

STANDARDS MALAYSIA ACCREDITED LABORATORY
MS ISO/IEC 17025
TESTING
SAMM No.0826

DECLARATION OF COMPLIANCE: PCII report

Motorola Solutions
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Date of Report: 5/10/2018
Report Revision: B

Responsible Engineer:	Saw Sun Hock (EME Engineer)
Report author:	Saw Sun Hock (EME Engineer)
Date(s) Assessment:	2/27/2018-4/17/2018
Manufacturer:	Motorola Solutions
DUT Description:	VHF 136-174MHz, 1-25W, with an alphanumeric display control head
Test TX mode(s):	CW
Max. Power output:	30W
TX Frequency Bands:	136-174 MHz
Model(s) Tested:	PMUD3241A
Model(s) Certified:	AAM01JNC9JA1AN, AAM01JNC9JC1AN, AAM01JNH9JA1AN, AAM01JNH9JC1AN, AAM02JNH9JA1AN
Classification:	Occupational/Controlled Environment
FCC ID:	ABZ99FT3090
IC:	109AB-99FT3090

Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 3.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola Solutions Inc. EME Laboratory.
I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements.
This reporting format is consistent with the suggested guidelines of the TIA TSB-159 April 2006
The results and statements contained in this report pertain only to the device(s) evaluated herein.

Tiong Nguk Ing — Digitally signed by Tiong Nguk Ing Date: 2018.05.11 23:16:40 +08'00'

Tiong Nguk Ing
Deputy Technical Manager (Approved Signatory)
Approval Date: 5/11/2018

Document Revision History

Date	Revision	Comments
4/23/2018	A	Initial release of PCII report
5/10/2018	B	Update the highest SAR for ISED, Canada

Table of Contents

1.0 Introduction

Part changes on pre-driver, driver and final power amplifier for this device due to current parts End of Life. The new parts are pin-to pin compatible and have same function as previous part.

Transmitter characteristic has been assessed on this design changes, the performance are comparable with the device on filed. Hence, original filed MPE results still remains unchanged for this PCII filing.

SAR computational analysis was used in original filing to evaluate the compliance of SAR as the “basic restriction” for the configurations exceeding the MPE limits. The original filing SAR computation analysis according IEC/IEEE 62704-2 draft standard (February, 2012) and simulation code with XFDTD™ v7.2, by Remcom Inc., State College, PA.

There have been changes in the SAR simulation method according latest released IEC/IEEE 62704-2-2017 and the simulation code with XFDTD™ v7.6.0, by Remcom Inc., State College, PA. The original filed highest SAR simulated configuration will be evaluated with latest standard requirement.

2.0 Conclusion

The highest power density results reported in original filing still remains for this PCII filing.

Table 1: Maximum MPE RF Exposure Summary

Designator	Frequency (MHz)	Passenger (mW/cm^2)	Bystander (mW/cm^2)
FCC, US	150.8-174	0.52	0.17
ISED, Canada	138-174	0.52	0.18

The computational SAR simulation results according latest released IEC/IEEE 62704-2-2017 shown in table below.

Table 2: Maximum Average SAR Summary

Designator	Frequency (MHz)	SAR 1g (mW/g)	SAR 10g (mW/g)
FCC, US	150.8-174	1.56	1.46
ISED, Canada	138-174	1.56	1.46

Appendix – SAR Simulation Report

COMPUTATIONAL EME COMPLIANCE ASSESSMENT OF THE MODEL PMUD3241A MOBILE RADIO.

May 10, 2018

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Introduction

This report summarizes the computational [numerical modeling] analysis performed to document compliance of PMUD3241A mobile radio and vehicle-mounted antennas with the US Federal Communications Commission (FCC) and Innovation, Science and Economic Development (ISED) Canada guidelines for human exposure to radio frequency (RF) emissions.

This computational analysis supplements the measurements conducted to evaluate the compliance of the exposure from this mobile radio with respect to applicable maximum permissible exposure (MPE) limits. Previous filed highest SAR simulated configuration was analyzed with latest requirement 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]. The same test conditions were also analyzed to determine compliance with the SAR limits set forth in the ICNIRP [3] guidelines and IEEE Std. C95.1-2005 standard [4] (2.0 W/kg averaged over 10 gram of tissue and 0.08 W/kg averaged over the whole body). In total 2 independent simulations had been performed addressing exposure of back seat passenger to the VHF mobile radio with trunk-mounted antenna.

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 MPE limits 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™ v7.6.0, by Remcom Inc., State College, PA. This computational suite provides means to simulate the heterogeneous full human body model defined according to the IEC/IEEE 62704-2-2017 standard and derived from the so-called Visible Human [2], discretized in 3 mm voxels. The IEC/IEEE 62704-2-2017 standard dielectric properties of 39 body tissues are automatically assigned by XFDTD™ at any specific frequency. The standardized "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 A to this report. The evaluation of the computational uncertainties and results of the benchmark validations are provided in the Appendix B attached to this report. The XFDTD code validation performed according to IEEE/IEC 62704-1 draft standard by Remcom Inc., is provided in conjunction with this report.

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 with the minimum resolution of 3 mm and the maximum resolution of 8mm. The Figure 1 below show both the CAD model and the photo of the actual car This CAD model has been incorporated into the IEC/IEEE 62704-2-2017 standard.

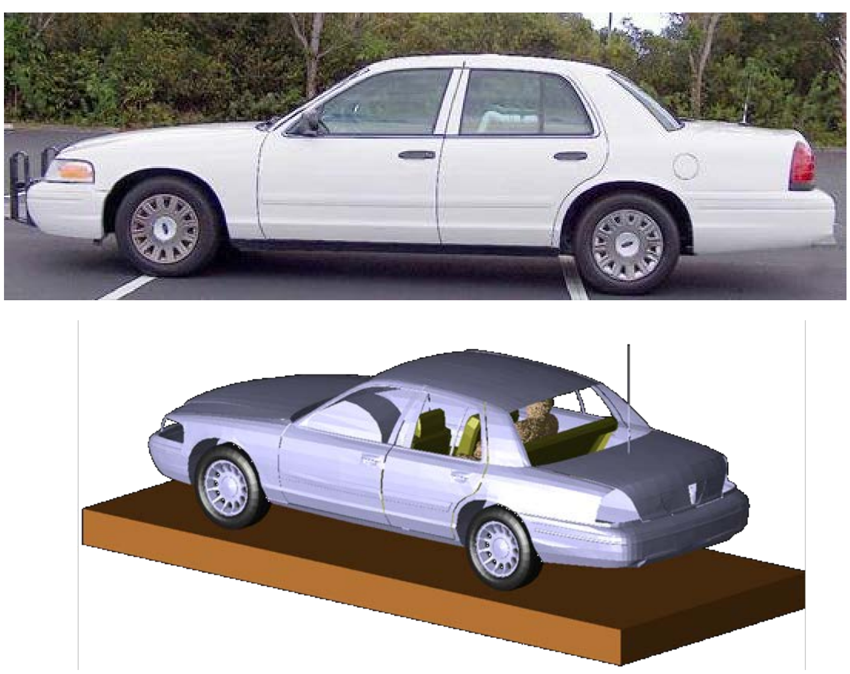


Figure 1: The photo picture of the car used in field measurements and the corresponding CAD model used in simulations

For passenger exposure, the antenna position is on the trunk and the distance of trunk mounted antenna from the passenger head when the passenger is located in the center of the back seat was set at 85 cm, to replicate the experimental conditions used in MPE measurements. Figure 2 shows some of the XFDTD™ computational models used for passenger exposure to trunk mounted antennas

According to the IEC/IEEE 62704-2-2017 standard for 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.

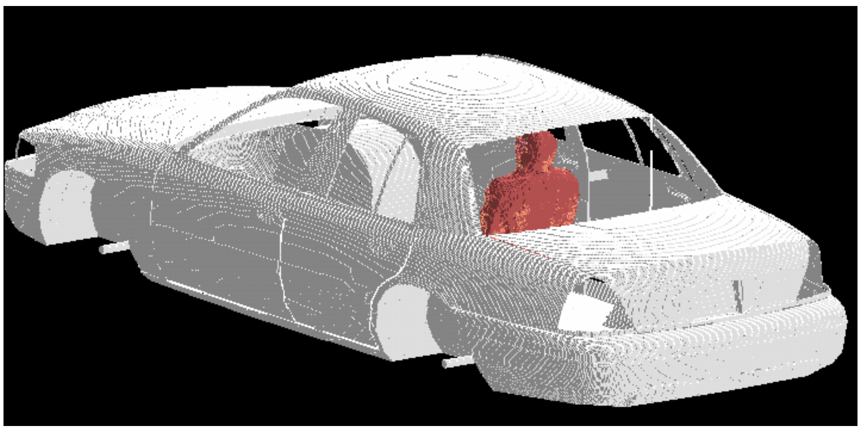


**Figure 2: Passenger model exposed to a trunk-mount antenna: XFDTD geometry.
The antenna is mounted at 85 cm from the passenger located in the center of the back seat.**

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, 1-g, and 10-g average SAR. The maximum average output power from VHF mobile radio is 30W. Since the ohmic losses 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) for VHF mobile radio were employed, all computational results are normalized full to VHF mobile radio is half of it, i.e., 15W average net output power; less the corresponding minimum insertion loss in excess of 0.5 dB of the feed cables supplied with the antennas. This power normalization is in accordance with the IEC/IEEE 62704-2-2017 standard.

Results of SAR computations for car passengers

The test conditions requiring SAR computations are summarized in Table 1 together with the antenna data, the SAR results, and power density (P.D.) as obtained from the measurements in the corresponding test conditions. The conditions are for antennas mounted on the trunk. The antenna length in Table 1 includes the 1.8 cm magnetic mount base used in measurements to position the antenna on the vehicle. The same length was used in simulation model.

The passenger is located in the center or on the side of the rear seat corresponding to the respective configurations defined in the IEC/IEEE 62704-2-2017 standard.

All the transmit frequency, antenna length, and passenger location combinations reported in Table 1 have been simulated individually. These tables also include the interpolated adjustment factor and corresponding SAR scaled values following requirement of the IEC/IEEE 62704-2-2017 standard.

Table 1

Results of the Computations and Adjusted SAR for passenger exposure of VHF mobile radio (50% talk-time)

Mount Location	Antenna Kit#	Antenna Length (cm)	Freq (MHz)	P.D. (mW/cm^2)	Exposure Location	Computations SAR (W/kg)			Interpolated Adjustment Factors			Adjusted SAR Results (W/kg)		
						1 g	10 g	WB	1 g	10 g	WB	1 g	10 g	WB
Trunk	HAD4009A, 1/4 Wave (162-174MHz)	44.8	167.7000	0.39	Back Side **Fig 3 & 4**	0.38	0.34	0.012	4.07	4.28	2.98	1.56	1.46	0.036
Trunk	HAD4006A, 1/4 Wave (136-144MHz)	53.8	140.0125	0.29	Back Center	0.15	0.06	0.012	1.77	1.86	2.26	0.27	0.18	0.014

The SAR distribution in the exposure condition that gave highest adjusted 1-g SAR for VHF mobile radio is reported in Figure 3. (167.7000 MHz, passenger on the side of the back seat, HAD4009A antenna).

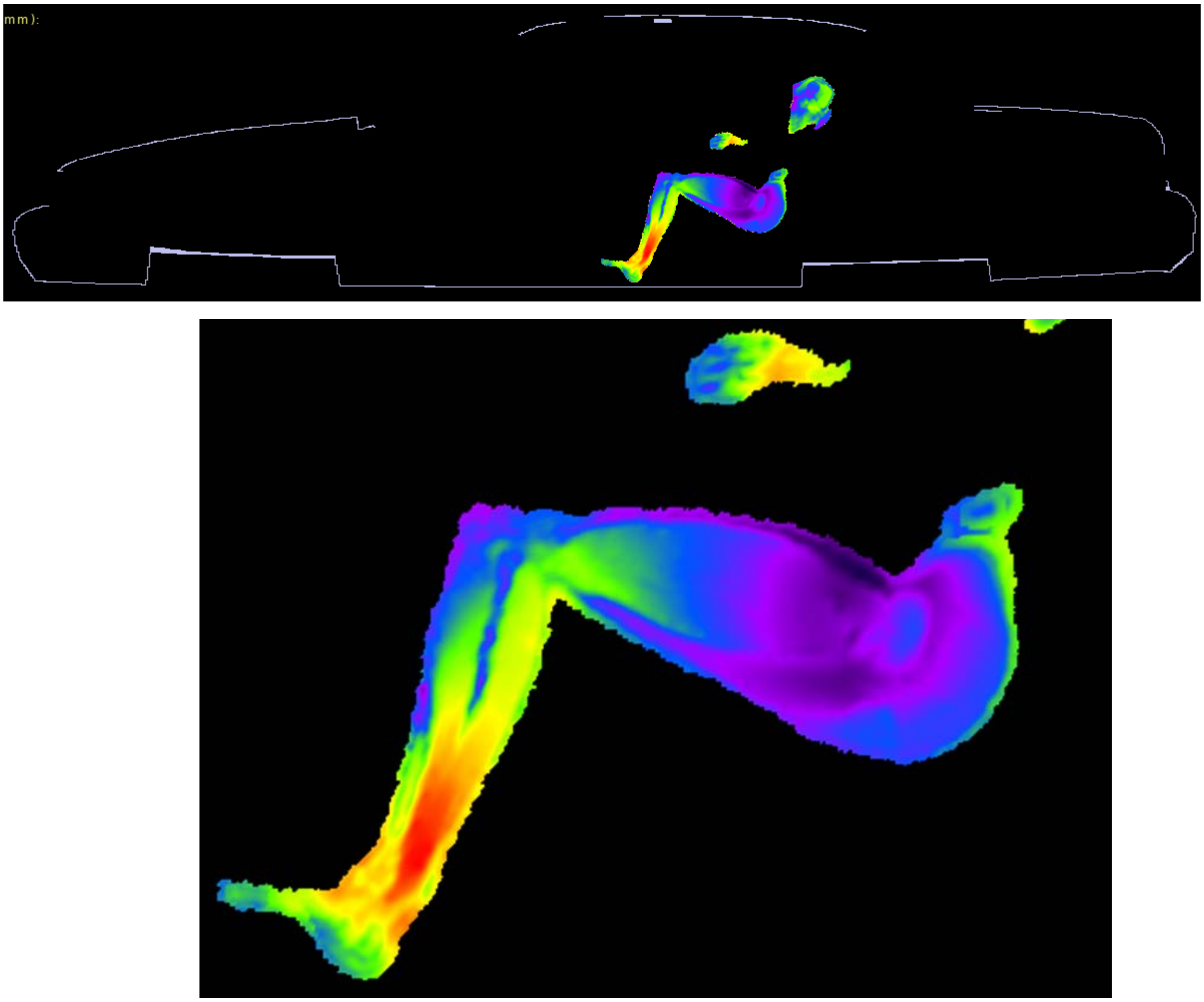
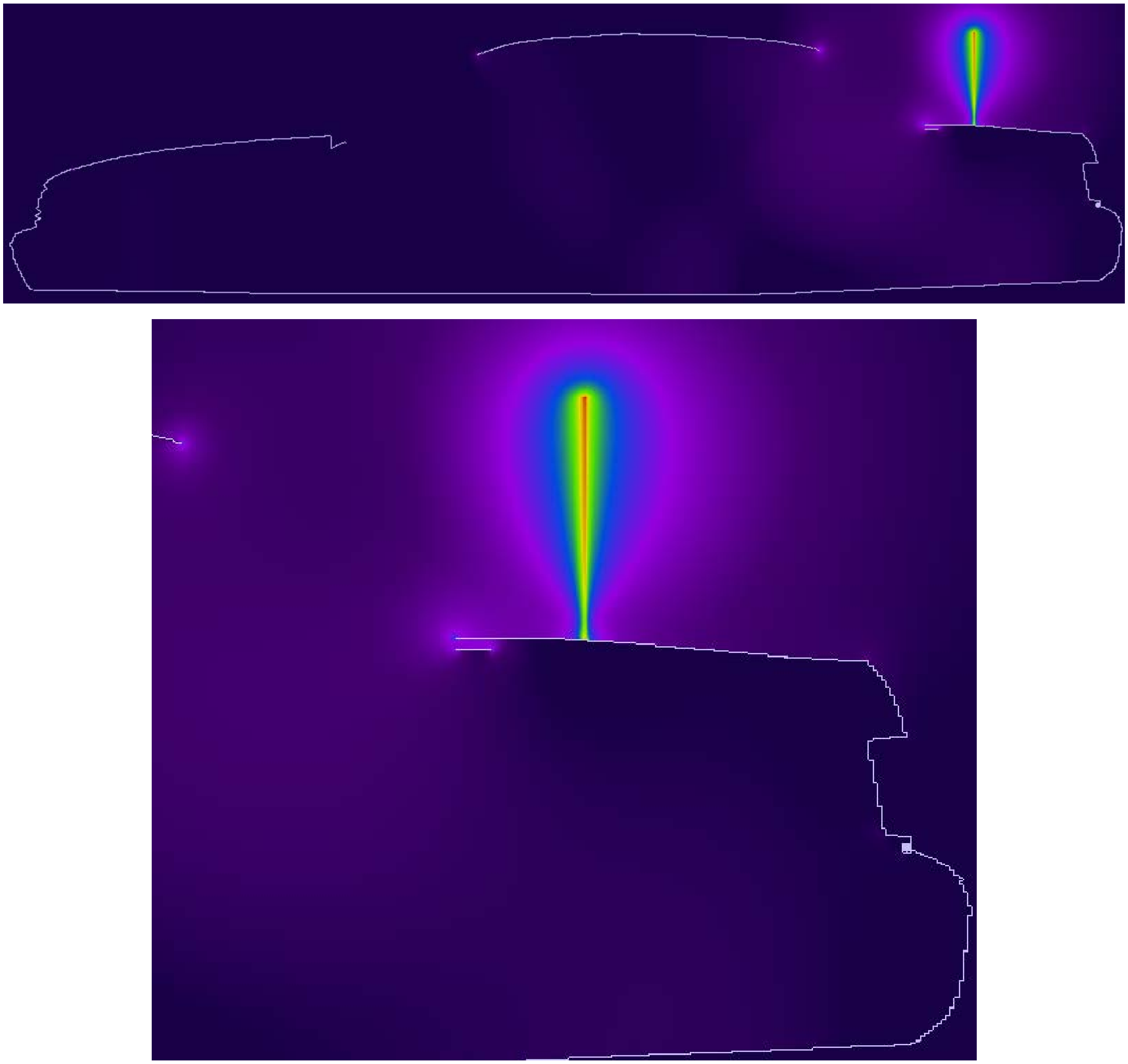
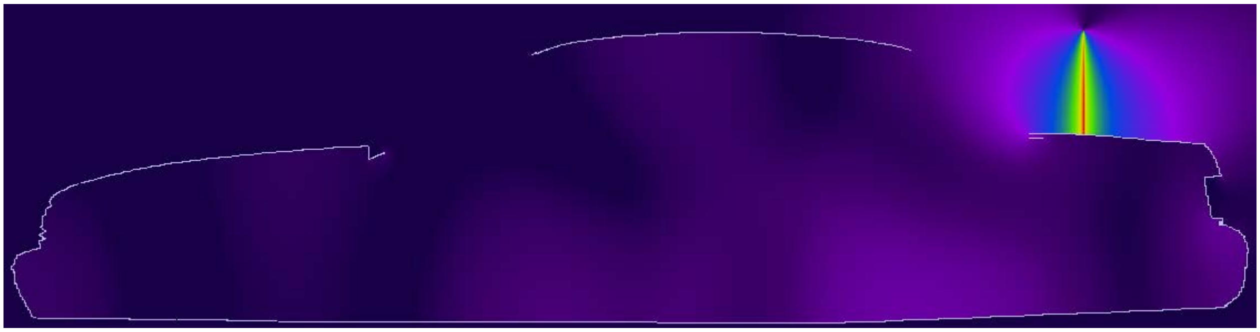


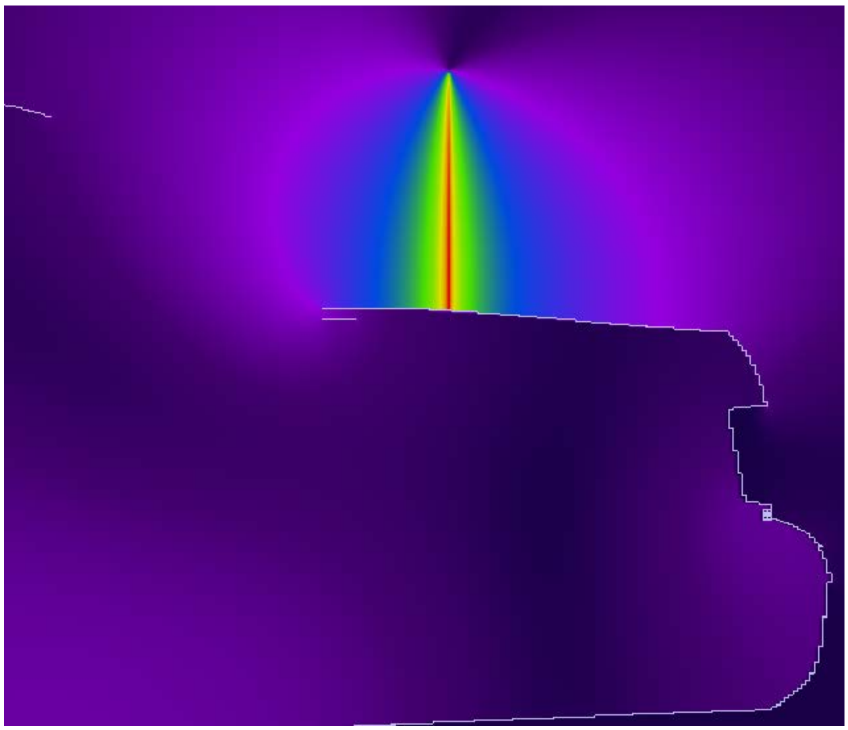
Figure 3. SAR distribution at 167.7000 MHz in the passenger model located on the center of the back seat, produced by the trunk-mount HAD4009A antenna. The contour plot is relative to the plane where the peak 1-g average SAR for this exposure condition occurs.

The two pictures below in Figure 4. show the E and H field distributions in the plane of the antenna corresponding to the condition in Figure 3.



a)





b)

Figure 4. (a) E-field magnitude distribution corresponding to exposure condition of Figure 3, and (b) H-field magnitude distribution corresponding to exposure condition of Figure 3.

The highest adjusted 1-g SAR was produced in the passenger exposure condition with HAD4009A antenna at 167.7000 MHz (passenger on the side of the back seat).

Results of SAR Computations

The overall maximum peak 1-g SAR in this simulated conditions adjusted using the IEC/IEEE 62704-2 standard adjustment factor for VHF Band is 1.56 W/kg, less than the 1.6 W/kg limit, while the overall adjusted maximum peak 10-g SAR for VHF Band is 1.46 W/kg, less than the 2.0 W/kg limit. The adjusted maximum whole-body average SAR for VHF Band is 0.036 W/kg, less than the 0.08 W/kg limit.

Conclusions

Under the test conditions described for evaluating passenger exposure to the RF electromagnetic fields emitted by vehicle-mounted antennas used in conjunction with these mobile radio products, the present analysis shows that the computed SAR values are compliant with the US FCC and ISED Canada exposure limits for the general public as well as with the corresponding ICNIRP and IEEE Std. C95.1-2005 SAR limits.

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

[3] ICNIRP (International Commission on Non-Ionising Radiation Protection). 1998. *Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz).* Health Phys. 74:494–522.

[4] IEEE. 2005. *IEEE standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz*, IEEE Std C95.1-2005

[5] Simon,W., Bit-Babik, G., “Effect of the variation in population on the whole-body average SAR of persons exposed to vehicle mounted antennas W. Simon”, ICEAA September 2-7, 2012, Cape Town.