APPENDIX A: SPECIFIC INFORMATION FOR SAR COMPUTATIONS

This appendix provides additional details on simulations and the computational code. Most of the information regarding the code employed to perform the numerical computations has been adapted from the standard IEC/IEEE 62704-2:2017 and from the XFDTD™ User Manuals. Remcom Inc., owner of XFDTD™, is kindly acknowledged for the help provided.

1) Computational resources

a) A multiprocessor system equipped with two Intel Xeon E5-2697 v3 14-core CPUs and four NVIDIA Tesla K40 GPUs was employed for all simulations.

b) The memory requirement was from 7 GB to 20 GB. Using the above-mentioned system with 28-cores operating concurrently, the typical simulation would run for 6-10 hours and with all four GPUs activated by the XFDTD version 7.6 this time would be from 60-180 min.

2) FDTD algorithm implementation and validation

a) We employed a commercial code (XFDTD™ v7.6, by Remcom Inc.) that implements the Yee's FDTD formulation [1]. The solution domain was discretized according to a rectangular grid with an adaptive 3-8 mm step in all directions. Sub-gridding was not used. Seven-layer PML absorbing boundary conditions 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 since within the adaptive grid the minimum resolution of 3 mm was specified and used to model the antenna and the antenna wire radius was never smaller than one-fifth of the voxel dimension. In fact, the XFDTD™ manual specifies that "In most cases, standard PEC material will serve well as a wire. However, in cases where the wire radius is important to the calculation and is less than 1/4 the length of the average cell edge, the thin wire material may be used to accurately simulate the correct wire diameter." The maximum voxel dimension in the plane normal to the antenna in all our simulations was 3 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. Most importantly and as required by the standard IEC/IEEE-62704-2:2017, this code has been thoroughly validated according to the standard IEC/IEEE-62704-1:2017 as described and detailed in the XFDTD™ Validation for IEC/IEEE P62704-1 report accompanying this document.

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	3-8 mm	3-8 mm	1-8 mm
Maximum domain dimensions employed for passenger computations (cells)	479	1069	671
Maximum domain dimensions employed for bystander computations (cells)	936	992	780
Time step	About 0.7 of the Courant limit (typically 5 *ps*)		
Objects separation from FDTD boundary (mm)	>200	>200	>200
Number of time steps	Defined to reach -60 dB convergence		
Excitation	Sinusoidal (not less than 10 periods)		

4) Phantom model implementation and validation

a) The human body models (bystander and/or passenger) employed in our simulations are those defined in the IEC/IEEE 62704-2-2017 standard. They are originally derived from data of the *visible human project* sponsored by the National Library of Medicine (NLM) (http://www.nlm.nih.gov/research/visible/visible_human.html). The original 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. 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 final bystander and passenger model was generated for the IEC/IEEE 62704-2-2017 standard from the above dataset using the Varipose software, Remcom Inc., The body mesh contains 39 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.

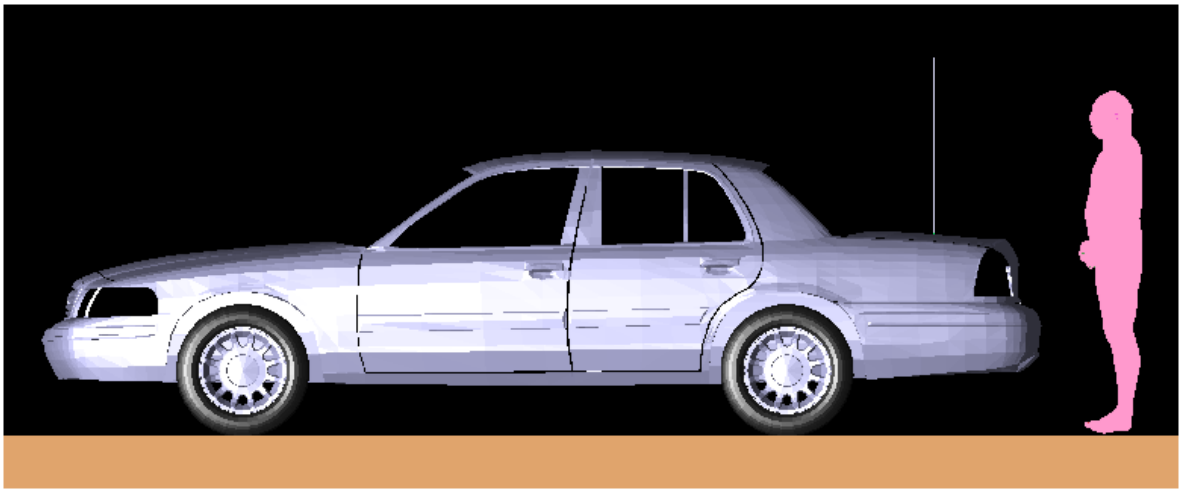
5) Tissue dielectric parameters

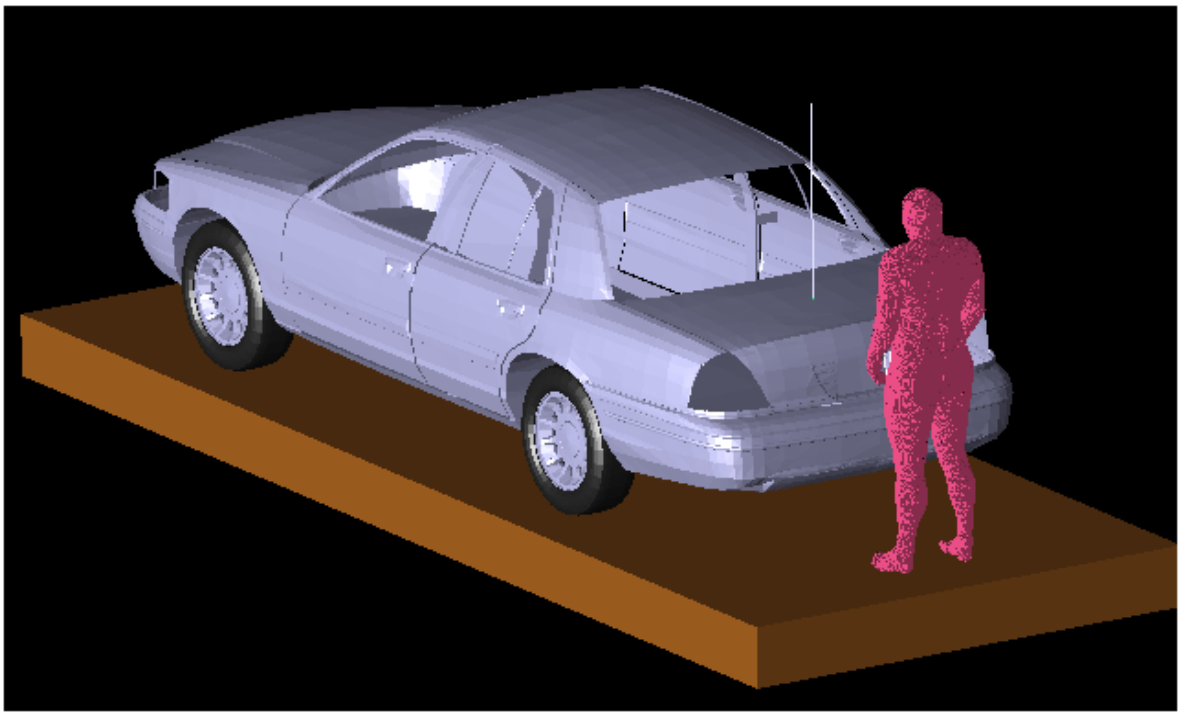
a) The tissue conductivity and permittivity variation *vs.* frequency is included in the XFDTD™ calculation by a multiple-pole approximation to the Cole-Cole approximated tissue parameters reported in [11]. These parameters along with the tissue mass density values are standardized in the IEC/IEEE-62704-2:2017 standard.

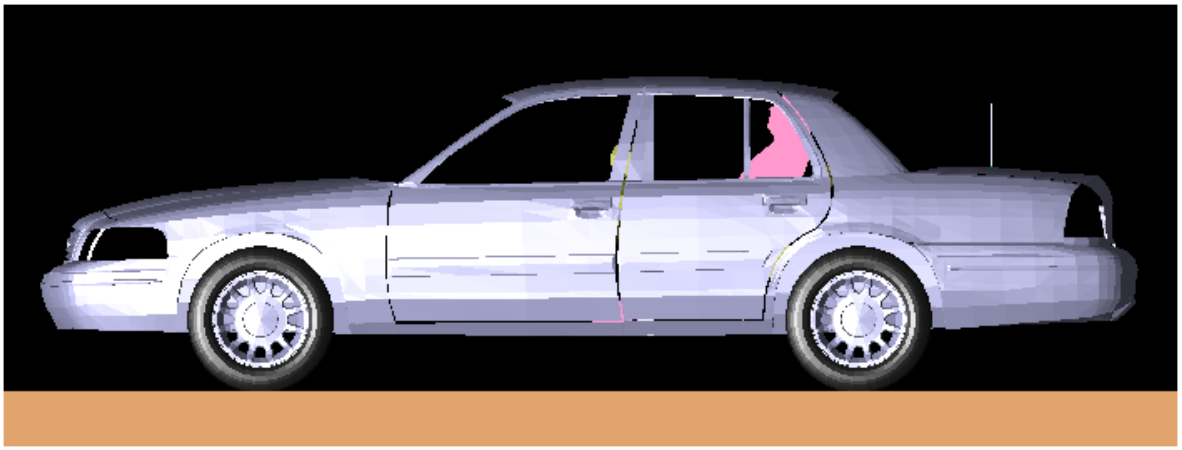
6) Transmitter model implementation and validation

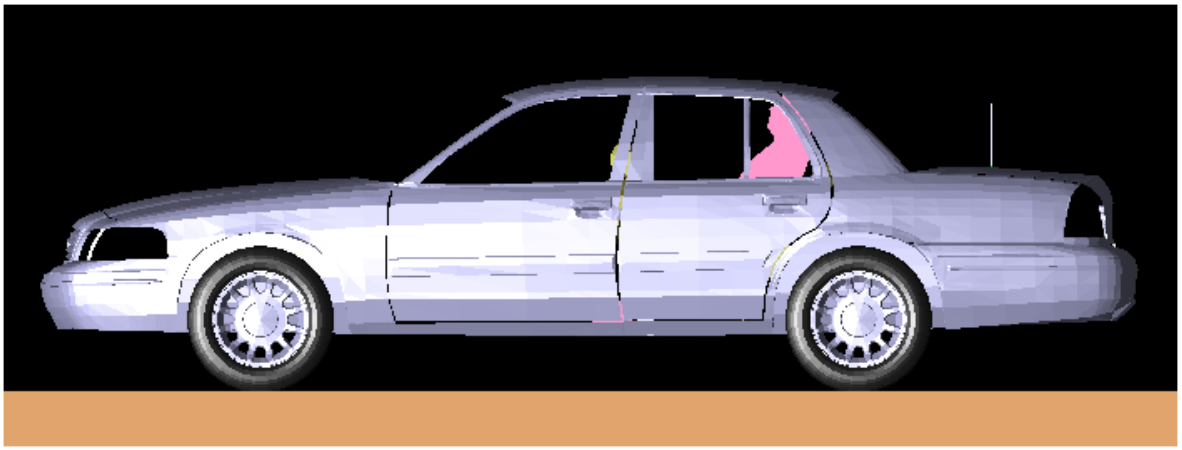
a) The essential features that must be modeled correctly for the particular test device model to be valid are:

- Car body. The standard car model developed and defined in the SAR computational standard IEC/IEEE 62704-2-2017 has been employed in simulations.
- 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. This simulation model was also validated by comparing the computed and measured near-field distributions in the condition with antenna mounted on the reference ground plane defined in the IEC/IEEE 62704-2-2017 standard.
- 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 bystander and passenger model.







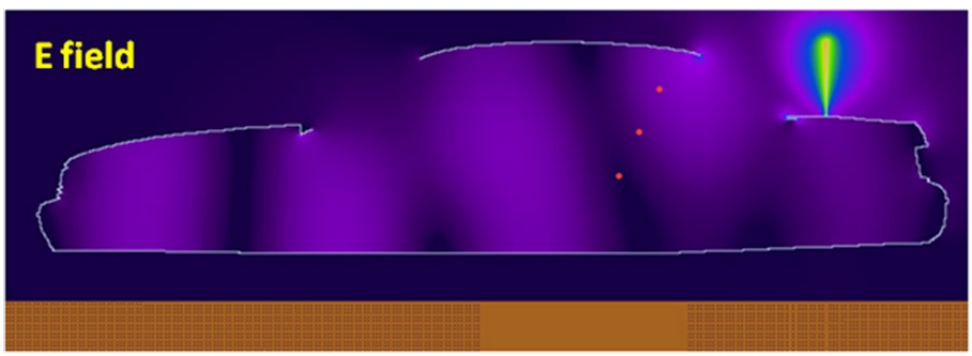


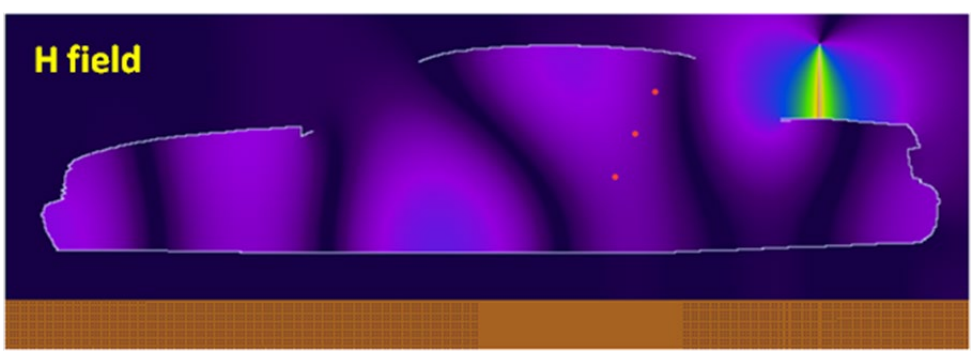
The car model is constituted by perfect electric conductor and does not include wheels in order to reduce its complexity. The passenger model is surrounded by air, as the seat, which is made out of poorly conductive fabrics, is not included in the computational model. The pavement has not been included 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. The comparison results are presented below, according to following definitions for the equivalent power densities (based on E or H-field):

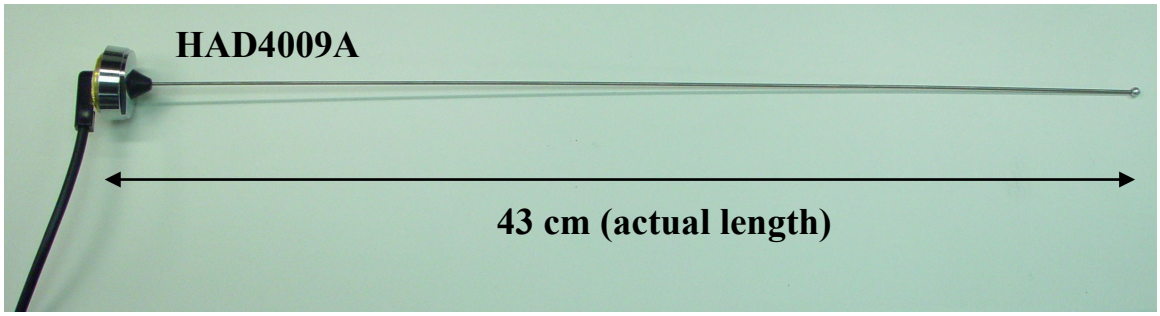
$$S_E = \frac{|\mathbf{E}|^2}{2\eta}, \quad S_H = \frac{\eta}{2}|\mathbf{H}|^2, \quad \eta = 377\ \Omega$$

<u>Passenger with 43 cm monopole antenna (HAD4009A, 164 MHz)</u>

The following figures of the test model show the empty car model, where the red dotted line represents the location of the passenger in the back seat, as it can be observed from the complete model picture above. The comparison has been performed by taking the computed steady-state field values at the red dots locations corresponding to the head, chest, and lower trunk area and comparing them with the corresponding measurements. Such a comparison is carried out at the same average power level (56.5 W) used in the measurements. Steady-state E-field and H-field distributions at a vertical crossing the passenger's head are displayed as well. Finally, a picture of the antenna is shown.

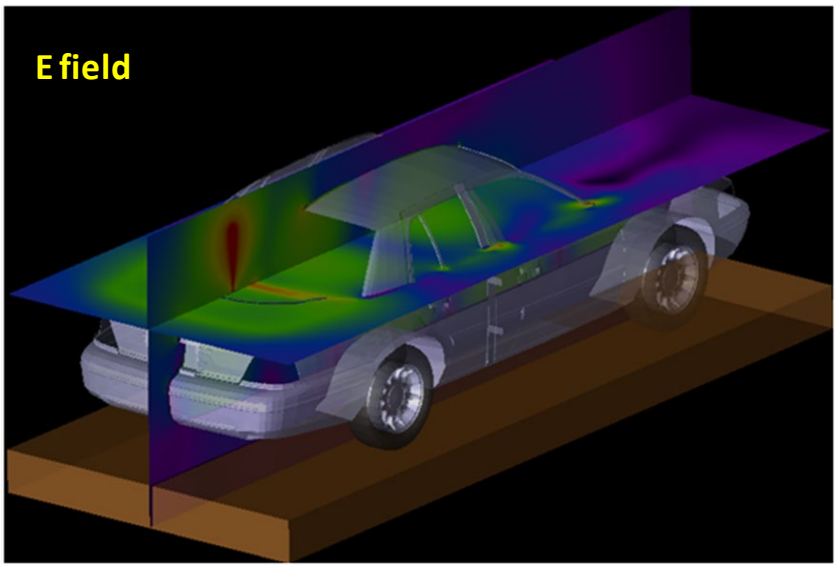


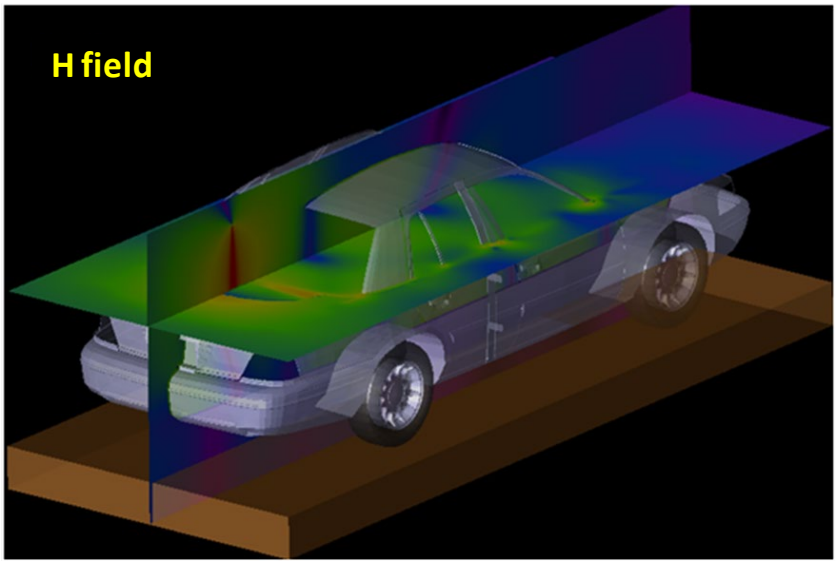




The highest exposure occurs in the middle of the backseat, which is also the case in the measurements. Therefore, the field values were determined on the yellow line centered at the middle of the backseat, approximately at the three locations that are shown by white dots. In actuality, the line is inclined 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.



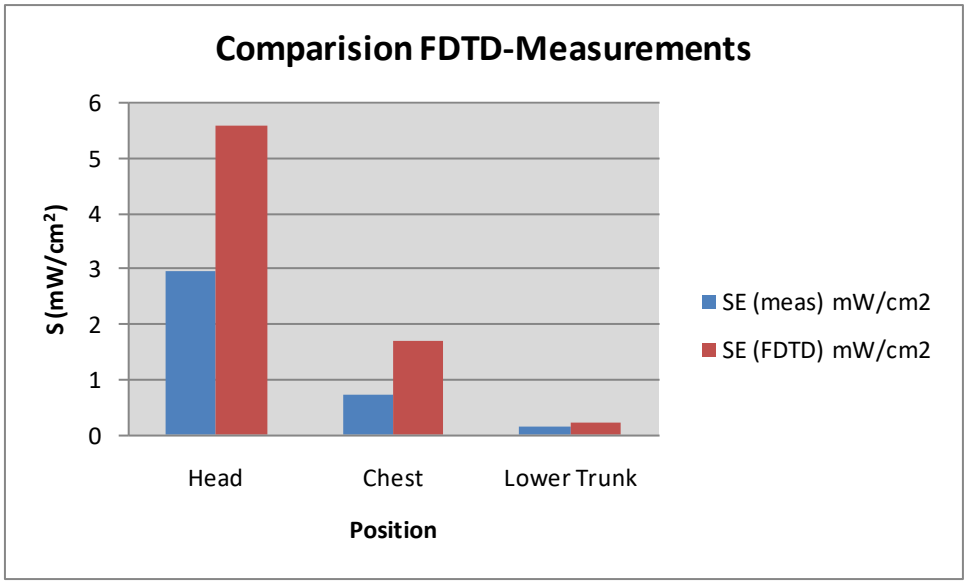


As done in the measurements, the equivalent power density (S) is computed from the E-field, the H-field being much lower. The following table reports the E-field values computed by XFDTD™ at the three locations, and the corresponding power density.

Location	E-field magnitude (V/m)	S (W/m^2)
Head	1.27	2.14E-03
Chest	0.70	6.55E-04
Lower Trunk area	0.20	7.70E-05
	Average S	**9.57E-04**

The input impedance is 24.8-j11.9 ohm, therefore the radiated power (considering the mismatch to the 50 ohm unitary voltage source) is 2.16E-3 W. The scaled-up power density for 56.5 W radiated power is 25.0 W/m^2, corresponding to 2.50 mW/cm^2. Measurements gave an average of 1.29 mW/cm^2, which is a reasonable overestimation considering conservativeness of simulations model. The following table and the graph show a comparison between the simulated power density and the measured one, normalized to 56.5 W radiated.

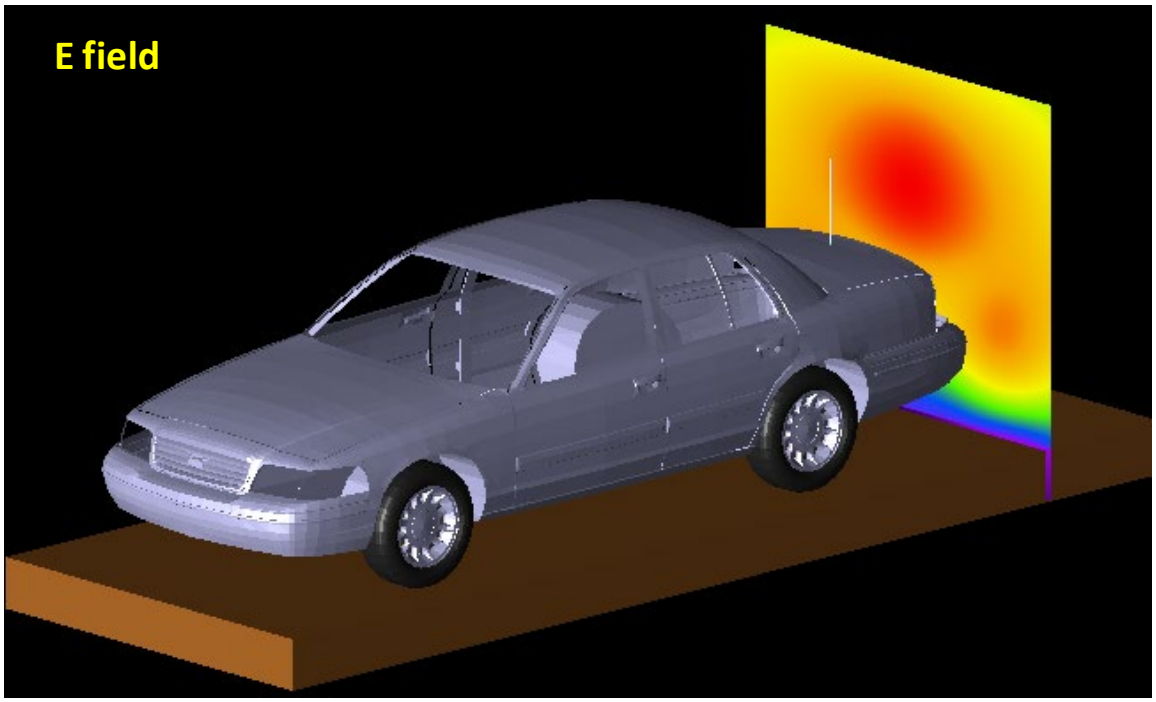
Position	SE (meas) mW/cm^2	SE (FDTD) mW/cm^2
Head	2.98	5.59
Chest	0.74	1.71
Lower Trunk	0.14	0.2

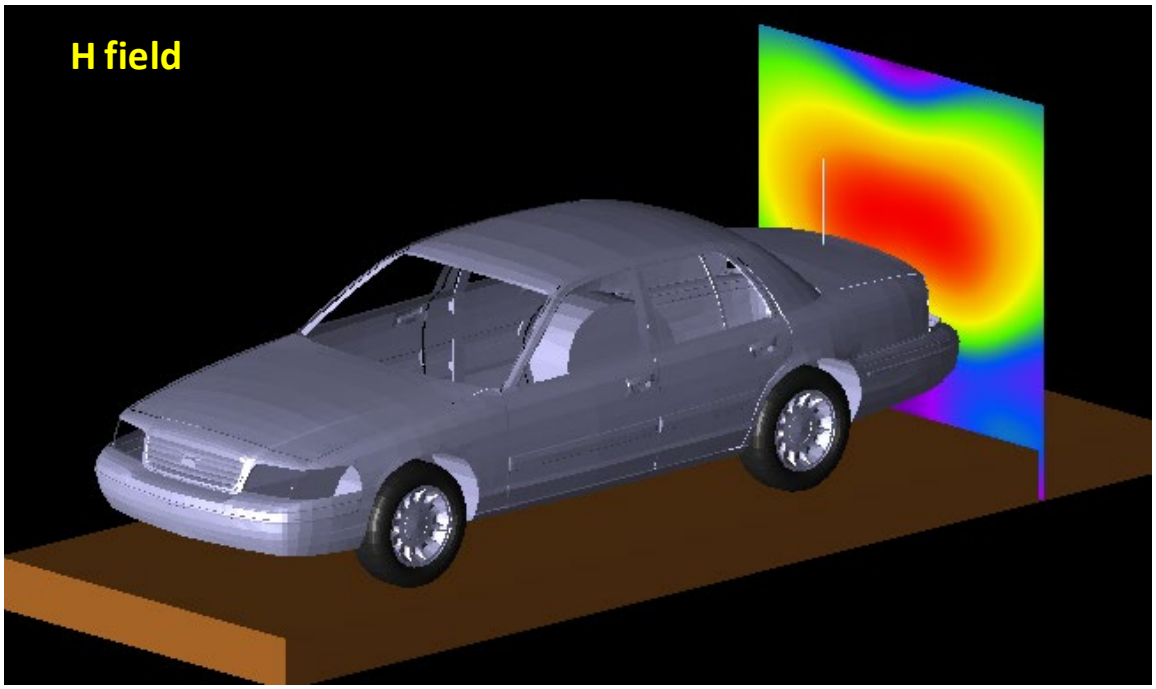


Bystander with 48 cm monopole antenna (HAD4007A 146 MHz)

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, 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.

H field
60 cm
(0 mm, 200 mm, 0 mm)


E field

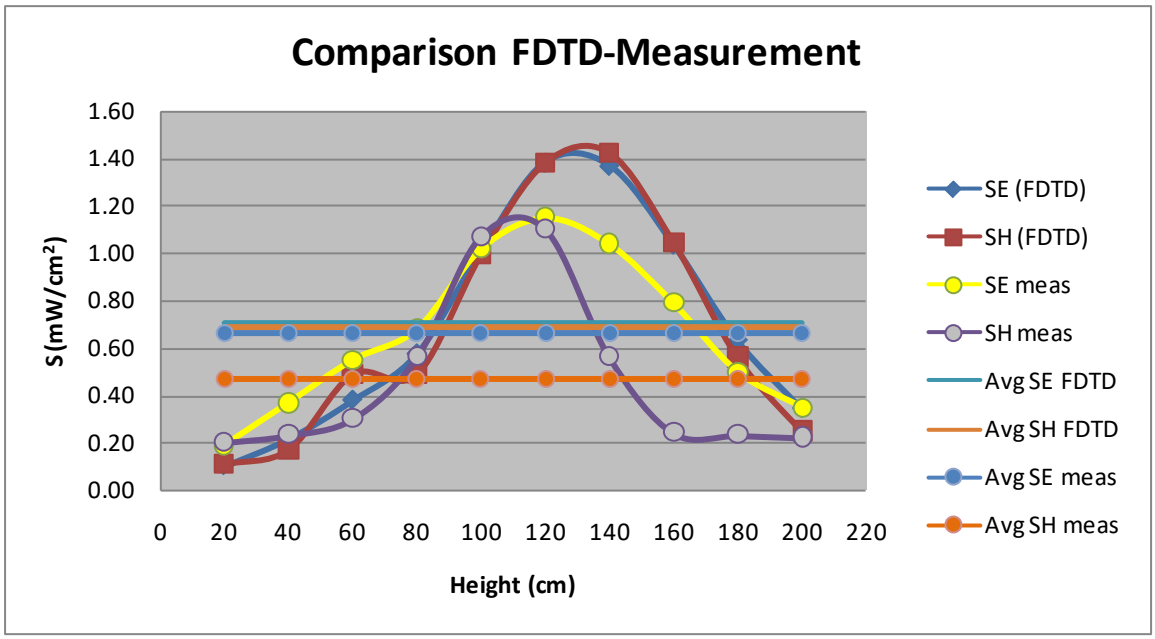


The following table reports the field values computed by XFDTD™ and the corresponding power density values. The average exposure levels are computed as well.

Height (cm)	E (V/m)	S_E (W/m^2)	H (A/m)	S_H (W/m^2)
20	1.84E-01	4.50E-05	5.10E-04	4.89E-05
40	2.71E-01	9.71E-05	6.38E-04	7.68E-05
60	3.58E-01	1.70E-04	1.08E-03	2.20E-04
80	4.42E-01	2.59E-04	1.54E-03	2.20E-04
100	5.85E-01	4.55E-04	1.82E-03	4.48E-04
120	6.86E-01	6.24E-04	1.85E-03	6.23E-04
140	6.82E-01	6.17E-04	1.58E-03	6.42E-04
160	5.93E-01	4.67E-04	1.16E-03	4.72E-04
180	4.63E-01	2.84E-04	7.67E-04	2.52E-04
200	3.41E-01	1.55E-04	4.94E-04	1.11E-04
	Average S_E	**3.17E-04**	**Average S_H**	**3.11E-04**

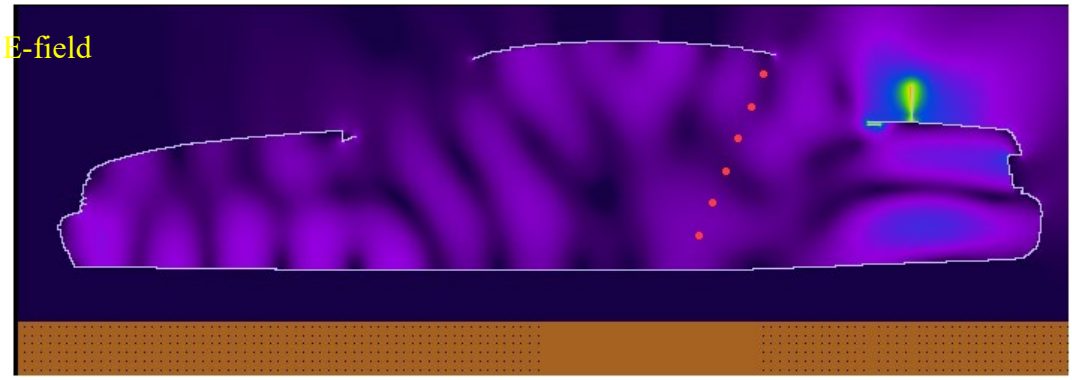
The input impedance is 33.7-j3.0 ohm, therefore the radiated power (considering the mismatch to the 50 ohm unitary voltage source) is 2.40E-3 W. The scaled-up power density values for 53.2 W radiated power are 7.03 W/m^2 (E), and 6.90 W/m^2 (H), that correspond to 0.70 mW/cm^2 (E), and 0.69 mW/cm^2 (H). 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 or H fields, normalized to 53.2 W radiated.

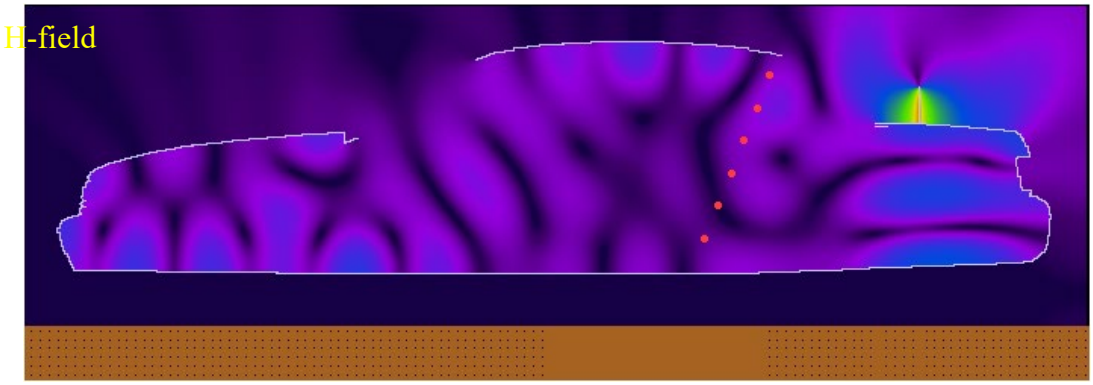
Height (cm)	SE (meas) mW/cm^2	SE (FDTD) mW/cm^2	SH (meas) mW/cm^2	SH (FDTD) mW/cm^2	Avg SE meas mW/cm^2	Avg SE FDTD mW/cm^2	Avg SH meas mW/cm^2	Avg SH FDTD mW/cm^2
20	0.19	0.10	0.2	0.11	0.664	0.703	0.471	0.690
40	0.37	0.22	0.23	0.17				
60	0.55	0.38	0.3	0.49				
80	0.68	0.57	0.56	0.49				
100	1.02	1.01	1.07	0.99				
120	1.15	1.38	1.1	1.38				
140	1.04	1.37	0.56	1.42				
160	0.79	1.03	0.24	1.05				
180	0.5	0.63	0.23	0.56				
200	0.35	0.34	0.22	0.25				

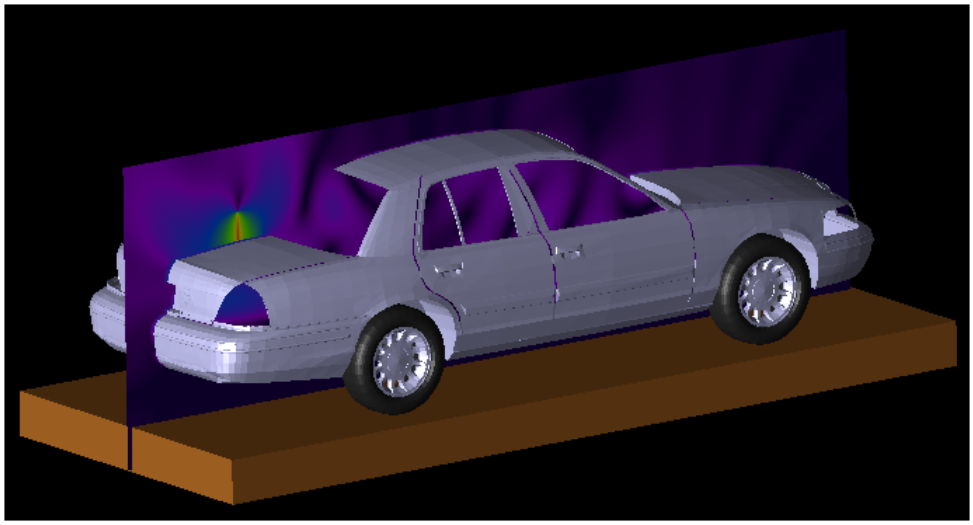


Passenger with 17.5 cm monopole antenna (HAE4002A 421.5 MHz)

The following figure of the test model shows the car model, where the red 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 red 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 average 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	3.11E-01	1.28E-04	1.56E-01
2	4.16E-01	2.29E-04	2.79E-01
3	5.25E-01	3.65E-04	4.45E-01
4	3.86E-01	1.98E-04	2.41E-01
5	3.84E-01	1.96E-04	2.39E-01
6	6.01E-01	4.80E-04	5.85E-01
Equivalent average Power Density			**3.24E-01**

Location Number	H-field, Weber/m2	Eq. Power Density 1.0 V source	Scaled Power Dens. 22 W output, mW/cm^2
1	1.34E-03	3.37E-04	4.11E-01
2	1.08E-03	2.21E-04	2.70E-01
3	5.59E-04	5.89E-05	7.18E-02
4	5.45E-04	5.60E-05	6.82E-02
5	5.45E-04	5.59E-05	6.82E-02
6	5.23E-04	5.16E-05	6.29E-02
Equivalent average Power Density			**1.59E-01**

The radiated power (considering the mismatch to the 50 ohm unitary voltage source) is 1.81E-3 W, therefore a factor equal to 12188 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 (0.297 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 (about 9%).

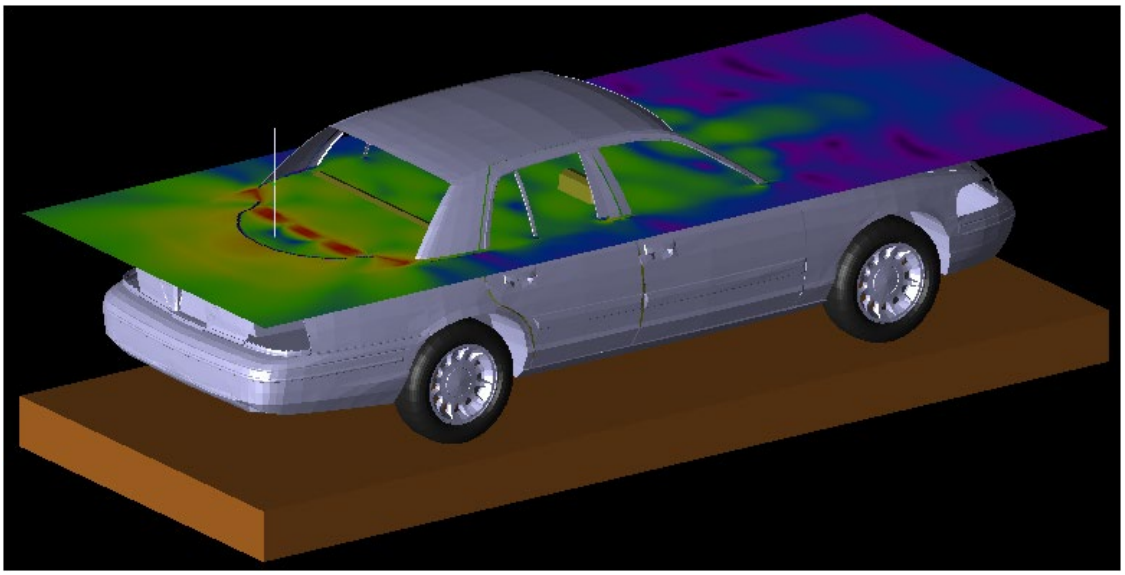
b) Descriptions and illustrations showing the correspondence between the modeled test device and the actual device, with respect to shape, size, dimensions and near-field radiating characteristics, are found in the main report.

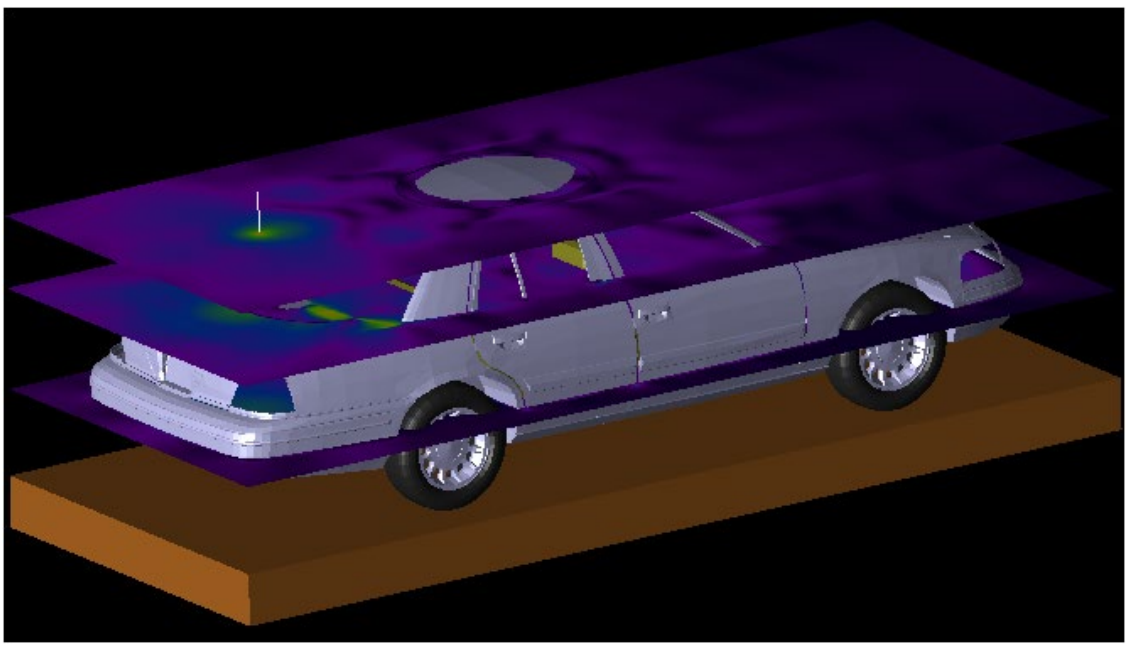
c) Verification that the test device model is equivalent to the actual device for predicting the SAR distributions descends from the fact that the car and antenna size and location in the numerical model correspond to those used in the measurements.

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 average 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	2.26E-01	6.76E-05	0.74
2	3.60E-01	1.72E-04	1.89
3	1.40E-01	2.59E-05	0.28
Equivalent average Power Density			**0.97**

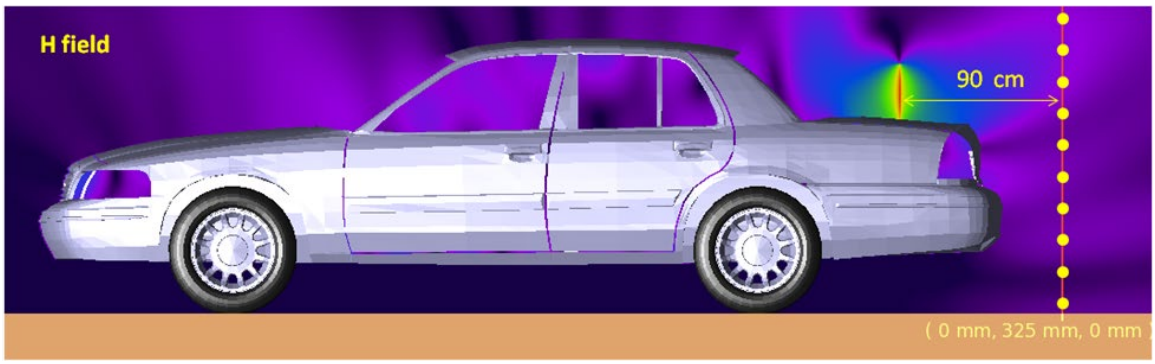
The corresponding scaled-up power densities are reported in the tables above, which show that the simulation overestimates the average power density from the MPE measurements (0.52 mW/cm^2), as derived from the measured E-field reported in the following table:

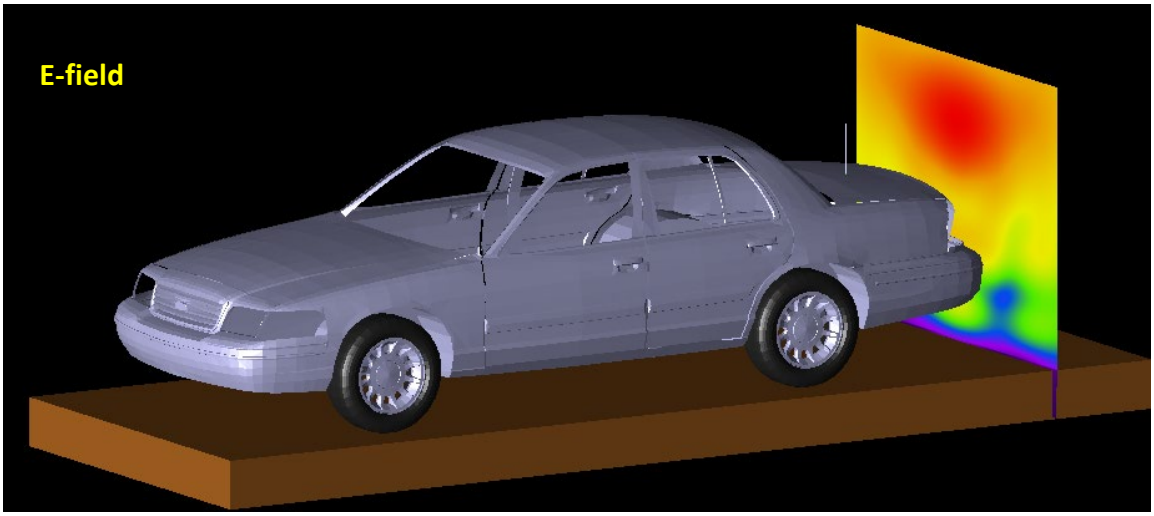
Position	SE (meas), 60 W output mW/cm^2
Head	0.72
Chest	0.64
Lower Trunk	0.19

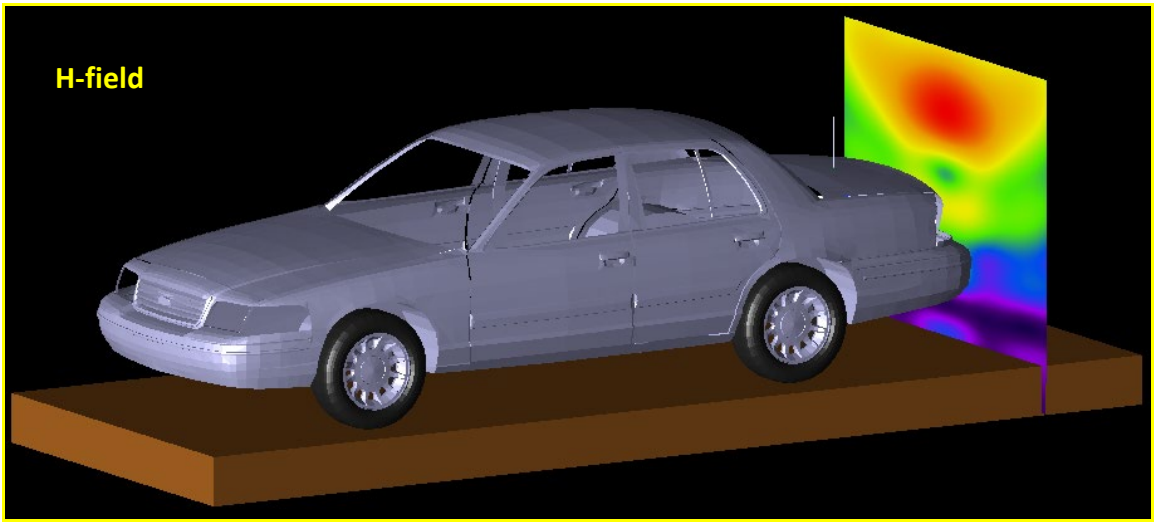
The simulations tend to overestimate the average power density levels, which is understandable since there are no ohmic losses and perfect impedance matching is enforced in the computational models. Based on these results, we conclude that the simulation will produce exposure overestimates (about 88%).

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.





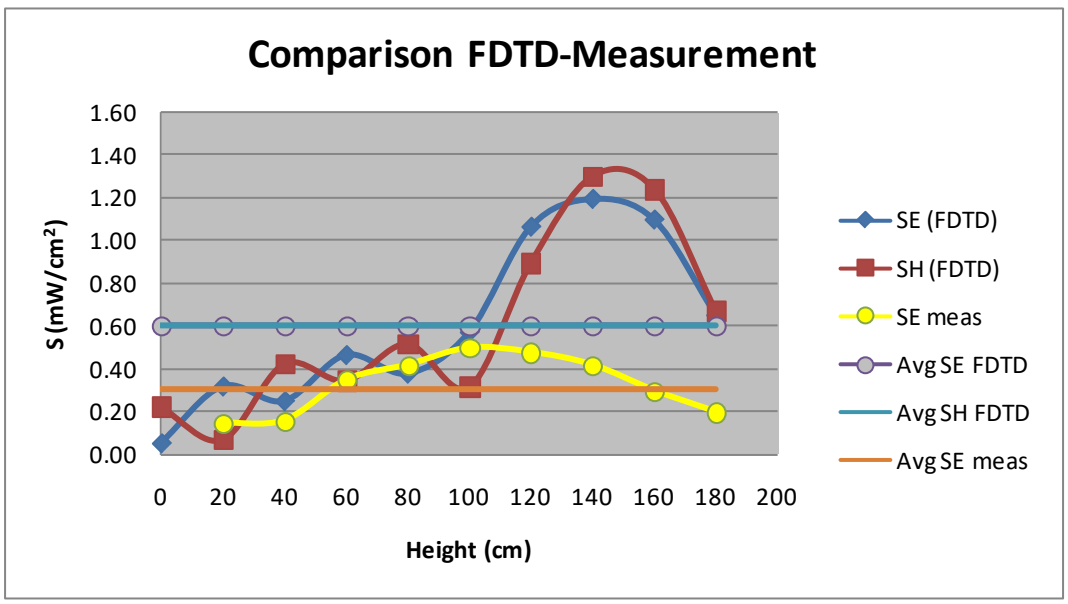


The following table reports the field values computed by XFDTD™ for the 1.0 V source and the corresponding power density values. The average exposure levels are computed as well.

Height (cm)	E (V/m)	S_E (W/m^2)	H (A/m)	S_H (W/m^2)
0	5.67E-02	4.27E-06	3.11E-04	1.83E-05
20	1.40E-01	2.59E-05	1.78E-04	5.96E-06

40	1.24E-01	2.03E-05	4.29E-04	3.47E-05
60	1.69E-01	3.79E-05	3.88E-04	2.84E-05
80	1.52E-01	3.08E-05	4.74E-04	4.24E-05
100	1.87E-01	4.65E-05	3.71E-04	2.59E-05
120	2.56E-01	8.67E-05	6.23E-04	7.31E-05
140	2.71E-01	9.73E-05	7.50E-04	1.06E-04
160	2.60E-01	8.94E-05	7.33E-04	1.01E-04
180	2.00E-01	5.31E-05	5.40E-04	5.50E-05
Average S_E		**4.92E-05**	**Average S_H**	**4.91E-05**

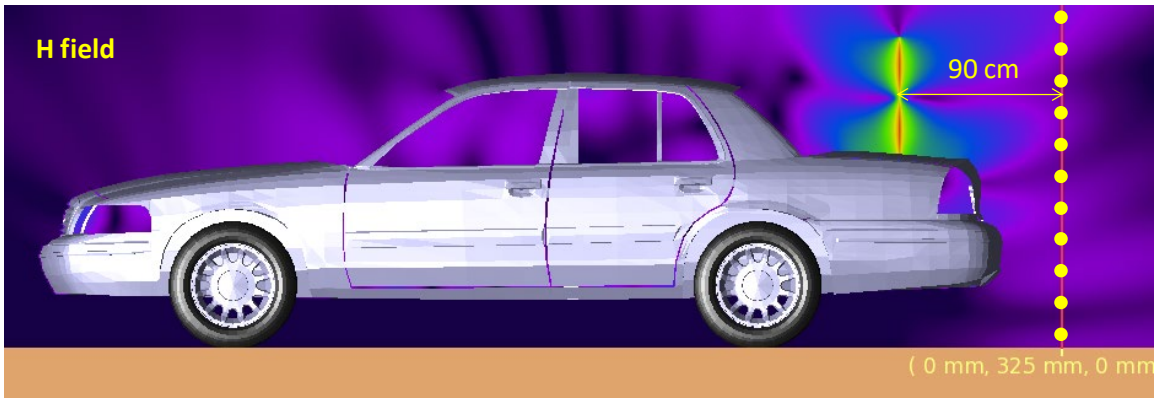
Since the conducted power during the MPE measurement was 123 W the calculated power density was then scaled for 61.5 W radiated power (taking into account 50% talk time). This model does not include the mismatch loss, loss in the cable and finite conductivity of the car surface and as represents a conservative model for exposure assessment. The scaled-up power density values for 61.5 W radiated power are 6.03 W/m^2 (E), and 6.02 W/m^2 (H), that correspond to 0.603 mW/cm^2 (E), and 0.602 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.

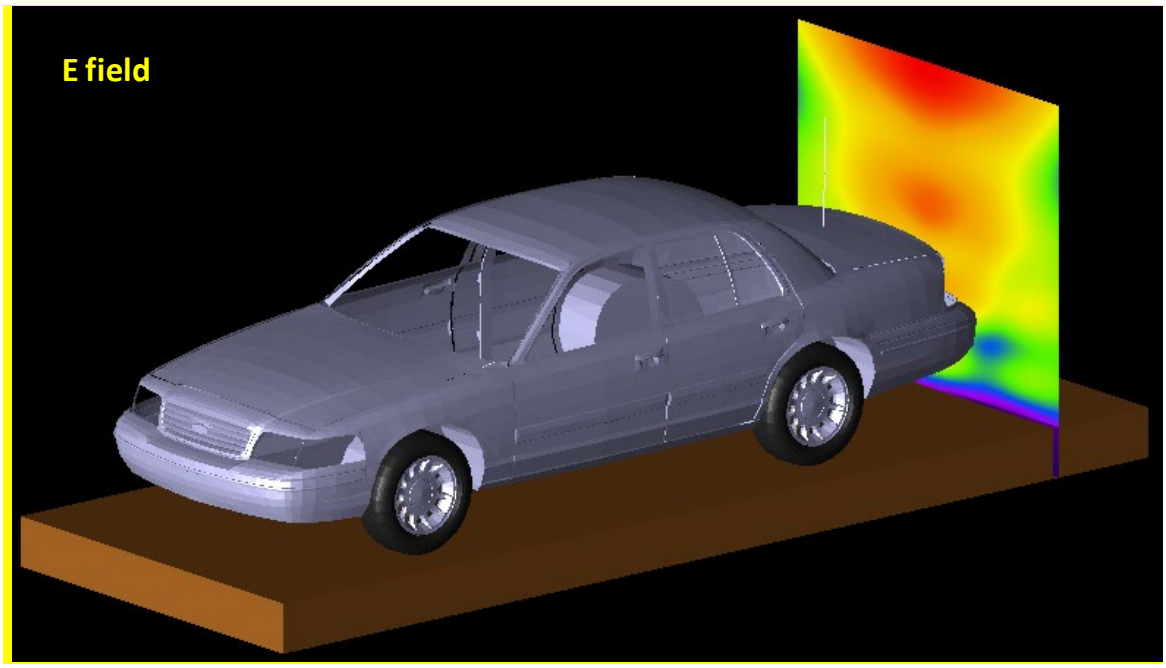


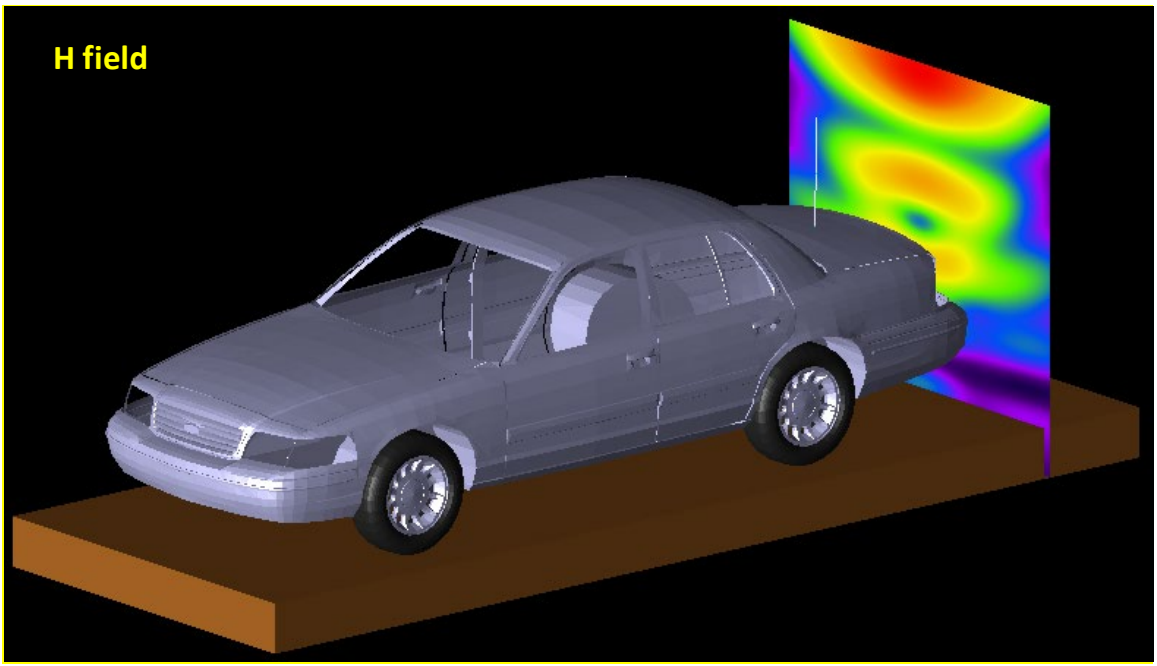
<u>Bystander with 63.5 cm monopole antenna (HAE6010A 425 MHz)</u>

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.



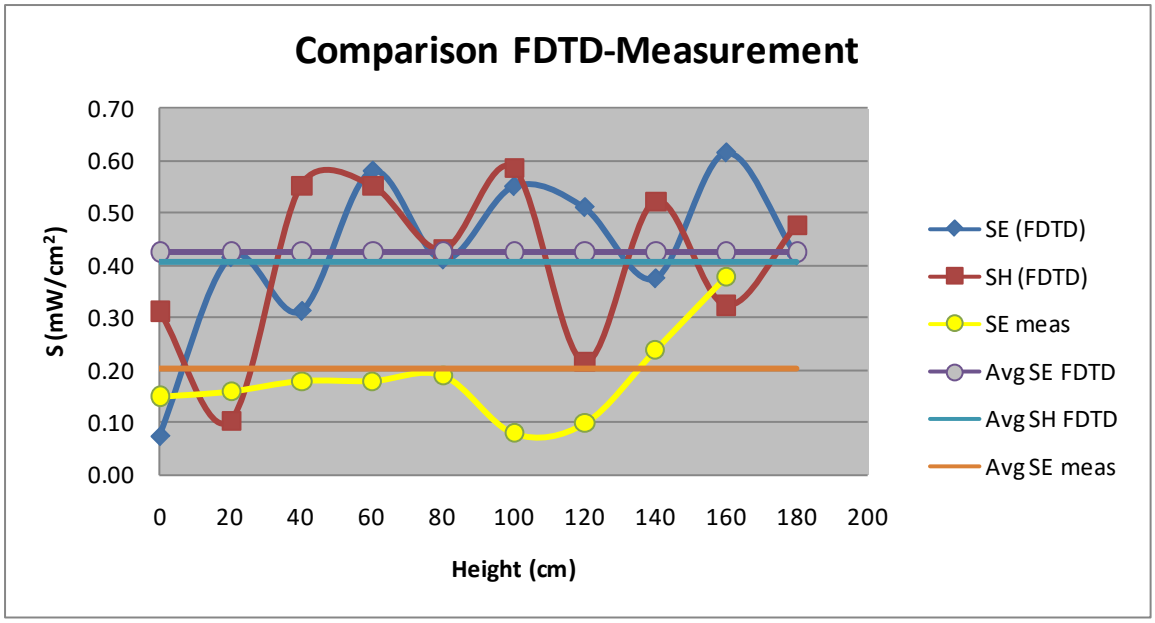




The following table reports the field values computed by XFDTD™ and the corresponding power density values. The average exposure levels are computed as well.

Height (cm)	E (V/m)	S_E (W/m^2)	H (A/m)	S_H (W/m^2)
0	7.55E-02	7.56E-06	4.13E-04	3.21E-05
20	1.79E-01	4.27E-05	2.37E-04	1.06E-05
40	1.56E-01	3.21E-05	5.49E-04	5.69E-05
60	2.12E-01	5.96E-05	4.84E-04	5.69E-05
80	1.78E-01	4.22E-05	5.65E-04	4.42E-05
100	2.07E-01	5.66E-05	3.43E-04	6.03E-05
120	1.99E-01	5.25E-05	5.34E-04	2.21E-05
140	1.70E-01	3.85E-05	4.20E-04	5.37E-05
160	2.18E-01	6.32E-05	5.10E-04	3.33E-05
180	1.80E-01	4.30E-05	8.15E-04	4.90E-05
Average S_E		**4.38E-05**	**Average S_H**	**4.19E-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 4.26 W/m^2 (E), and 4.07 W/m^2 (H), that correspond to 0.426 mW/cm^2 (E), and 0.407 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.


Comparison FDTD-Measurement
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
S (mW/cm²)
0
20
40
60
80
100
120
140
160
180
200
Height (cm)
SE (FDTD)
SH (FDTD)
SE meas
Avg SE FDTD
Avg SH FDTD
Avg SE meas

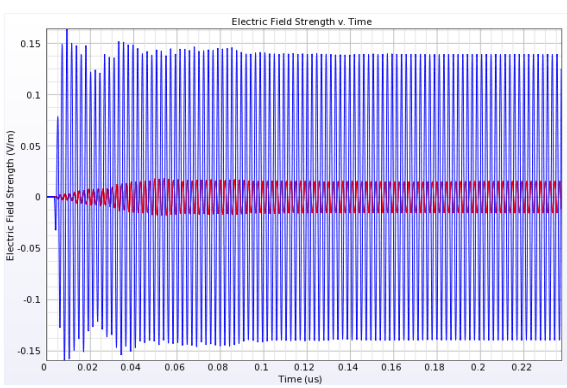
7) Test device positioning

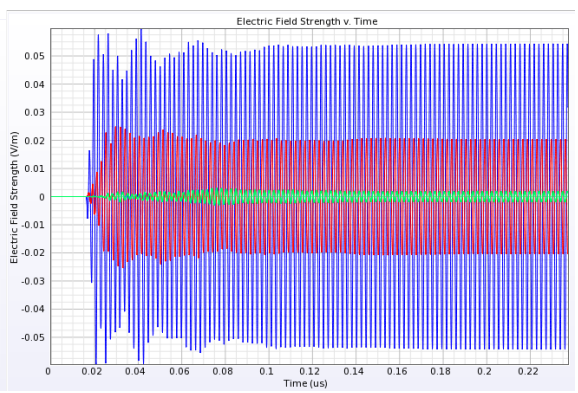
a) A description of the device test positions used in the SAR computations is provided in the SAR report.

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. The simulation projects were set to automatically track the field values throughout computational domain by means of XFDTD simulation control feature which ensures that "*convergence is reached when near-zone data shows a constant amplitude sine wave – when all transients have died down and the only variation left is sinusoidal. In this case "convergence" is tested on the average electric field in the space for its deviation from a pure sine wave. XFDTD automatically places points throughout the space for this purpose*." [XFDTD Reference Manual, version 7.6]. This convergence threshold was set to -60 dB.
In addition 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 sides 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 two points of the computational domain. We selected points close to antenna as well as furthest one. 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 condition.





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 SAR for an individual voxel is computed according to the FDIS IEC/IEEE 62704-1 standard. In particular, the three components of the electric field are computed in the center of each voxel and then the SAR is computed as below:

$$SAR = \sigma_{voxel} \frac{|E_x|^2 + |E_y|^2 + |E_z|^2}{2\rho_{voxel}},$$

where σ_{voxel} and ρ_{voxel} are the conductivity and the mass density of the voxel.

10) One-gram and ten-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. Using the SAR values computed for each voxel of the model the averaging calculation employs the method and specifications defined in the FDIS IEC/IEEE 62704-1 standard to generate one-gram and ten-gram average SAR.

11) Total computational uncertainty – We derived an estimate for the uncertainty of FDTD methods using the uncertainly budget defined in IEC/IEEE 62704-2-2017 standard. The details of uncertainty evaluation are provided in the Annex B.

In addition as discussed in 6(a), a conservative bias has been introduced in the evaluations 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%.

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 average radiated power is computed as

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

Both the input impedance and the net average 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.

d) The final SAR values used for compliance evaluation for each simulated configuration are obtained by applying the IEC/IEEE 62704-2-2017 standard adjustment factors to account for exposure variation in population.

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