RF Exposure Lab

CERTIFICATE OF COMPLIANCE
R&D SAR EVALUATION

Privoro, LLC	Dates of Test: September 28-October 6, 2020
3100 W. Ray Rd. #201	Test Report Number: SAR.20200904
Chandler, AZ 85226	

FCC ID:	2APWUPM03SC
IC Certificate:	23953-PM03SC
Model(s):	M0003 with iPhone SE (FCC ID: BCG-E3500A)
Test Sample:	Engineering Unit Same as Production
Equipment Type:	Smart Phone SafeCase
Classification:	Portable Transmitter Next to Head and Body
TX Frequency Range:	663 – 698 MHz; 699 – 716 MHz; 777 – 787 MHz; 788 – 798 MHz: 844 – 849 MHz; 1710 – 1780 MHz; 1850 – 1915 MHz; 2305 – 2315 MHz; 2496 – 2690 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	See Data Sheets
Signal Modulation:	QPSK, WCDMA, CDMA, DSSS, OFDM
Antenna Type:	Internal
Application Type:	Evaluation
FCC Rule Parts:	Part 2, 15, 22, 24, 27
KDB Test Methodology:	KDB 447498 D01 v06, KDB 648474 D04 v01r03, KDB 941225 D01 v03r01 & D05 v02r05
Max. Stand Alone SAR Value:	0.731 W/kg Measured Head; 1.01 W/kg Measured Body
Simultaneous SAR Value:	0.771 W/kg Measured Head; 1.05 W/kg Measured Body
Separation Distance:	0 mm Head; 5 mm Body

This wireless mobile and/or portable device has been shown to be compliant for localized specific absorption rate (SAR) for uncontrolled environment/general exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and IEC 62209-2:2010 (See test report).

I attest to the accuracy of the data. All measurements were performed by myself or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RF Exposure Lab, LLC certifies that no party to this application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

Jay M. Moulton
Vice President

ACCREDITED
Testing Cert. # 2387.01

Table of Contents

RF Exposure Lab

Comment/Revision	Date
Original Release	October 8, 2020

Note: The latest version supersedes all previous versions listed in the above table. The latest version shall be used.

1.   Introduction

This measurement report shows the result of the Privoro Model M0003 with iPhone SE FCC ID 2APWUPM02SC with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices and IC Certificate: 23953-PM02SC with RSS102 Issue 5 & Safety Code 6.   The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on August 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC regulated portable devices. [1], [6]

The test results recorded herein are based on a single type test of Privoro Model M0003 with iPhone SEand therefore apply only to the tested sample.

The test procedures, as described in ANSI C95.1 – 1999 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [2], ANSI C95.3 – 2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields [3], and IEC 62209 Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures[5] were employed.

SAR Definition [5]

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (*dW*) absorbed by (dissipated in) an incremental mass (*dm*) contained in a volume element (*dV*) of a given density (*ρ*).

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dV}\right)$$

SAR is expressed in units of watts per kilogram (W/kg). *SAR* can be related to the electric field at a point by

$$SAR = \frac{\sigma \mid E \mid^2}{\rho}$$

where:

σ = conductivity of the tissue (S/m)

ρ = mass density of the tissue (kg/m^3)

E = rms electric field strength (V/m)

2. SAR Measurement Setup

Robotic System

These measurements are performed using the DASY52 automated dosimetric assessment system. The DASY52 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, Intel Core2 computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 2.1).

System Hardware

A cell controller system contains the power supply, robot controller teach pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the HP Intel Core2 computer with Windows XP system and SAR Measurement Software DASY52, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.
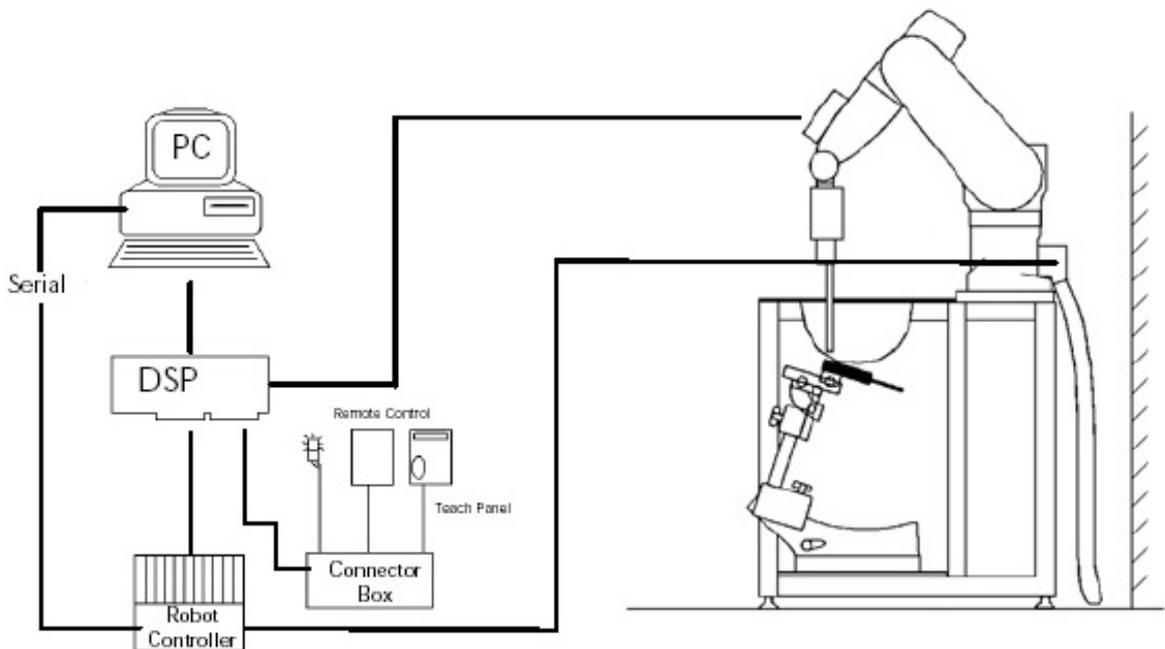
Figure 2.1 SAR Measurement System Setup

System Electronics

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in.

Probe Measurement System

The SAR measurements were conducted with the dosimetric probe EX3DV4, designed in the classical triangular configuration (see Fig. 2.2) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi fiber line ending at the front of the probe tip. (see Fig. 2.3) It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY52 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped at reaching the maximum.

DAE System

Report Number: SAR.20200904

Probe Specifications

Calibration: In air from 10 MHz to 6.0 GHz
In brain and muscle simulating tissue at Frequencies of 450 MHz, 835 MHz, 1750 MHz, 1900 MHz, 2450 MHz, 2600 MHz, 3500 MHz, 5200 MHz, 5300 MHz, 5600 MHz, 5800 MHz

Frequency: 10 MHz to 6 GHz

Linearity: ±0.2dB (30 MHz to 6 GHz)

Dynamic: 10 mW/kg to 100 W/kg

Figure 2.2 Triangular Probe Configurations

Range: Linearity: ±0.2dB

Dimensions: Overall length: 330 mm

Tip length: 20 mm

Body diameter: 12 mm

Tip diameter: 2.5 mm

Distance from probe tip to sensor center: 1 mm

Figure 2.3 Probe Thick-Film Technique

Application: SAR Dosimetry Testing
Compliance tests of wireless device

Probe Calibration Process

Dosimetric Assessment Procedure

Each probe is calibrated according to a dosimetric assessment procedure described in with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in and found to be better than +/-0.25dB. The sensitivity parameters (Norm X, Norm Y, Norm Z), the diode compression parameter (DCP) and the conversion factor (Conv F) of the probe is tested.

Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a waveguide above 1GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

Temperature Assessment *

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium, correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor based temperature probe is used in conjunction with the E-field probe

$$SAR = C\frac{\Delta T}{\Delta t}$$

$$SAR = \frac{|E|^2 \cdot \sigma}{\rho}$$

where:

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm^3 for brain tissue)

SAR is proportional to $\Delta T / \Delta t$, the initial rate of tissue heating, before thermal diffusion takes place.
Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;
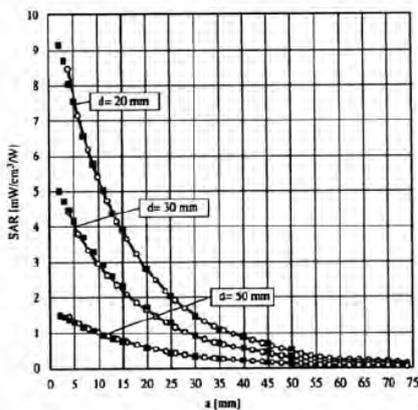

**Figure 2.4 E-Field and Temperature Measurements at 900MHz**
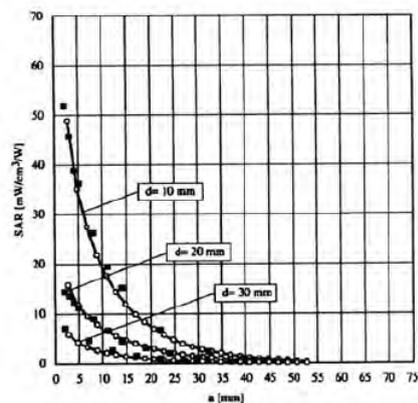
Figure 2.5 E-Field and Temperature Measurements at 1800MHz

Data Extrapolation

The DASY52 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given like below;

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with
- V_i = compensated signal of channel i   (i=x,y,z)
- U_i = input signal of channel i   (i=x,y,z)
- cf = crest factor of exciting field   (DASY parameter)
- dcp_i = diode compression point   (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes:

$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

with
- V_i = compensated signal of channel i (i = x,y,z)
- $Norm_i$ = sensor sensitivity of channel i   (i = x,y,z)
  $\mu V/(V/m)^2$ for E-field probes
- $ConvF$ = sensitivity of enhancement in solution
- E_i = electric field strength of channel i in V/m

The RSS value of the field components gives the total field strength (Hermetian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with
- SAR = local specific absorption rate in W/g
- E_{tot} = total field strength in V/m
- σ = conductivity in [mho/m] or [Siemens/m]
- ρ = equivalent tissue density in g/cm³

The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770}$$

with
- P_{pwe} = equivalent power density of a plane wave in W/cm²
- E_{tot} = total electric field strength in V/m

Scanning procedure

- The DASY installation includes predefined files with recommended procedures for measurements and system check. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

- The „reference" and „drift" measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT's output power and should vary max. +/- 5 %.

- The highest integrated SAR value is the main concern in compliance test applications. These values can mostly be found at the inner surface of the phantom and cannot be measured directly due to the sensor offset in the probe. To extrapolate the surface values, the measurement distances to the surface must be known accurately. A distance error of 0.5mm could produce SAR errors of 6% at 1800 MHz. Using predefined locations for measurements is not accurate enough. Any shift of the phantom (e.g., slight deformations after filling it with liquid) would produce high uncertainties. For an automatic and accurate detection of the phantom surface, the DASY5 system uses the mechanical surface detection. The detection is always at touch, but the probe will move backward from the surface the indicated distance before starting the measurement.

- The „area scan" measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The scan uses different grid spacings for different frequency measurements. Standard grid spacing for head measurements in frequency ranges ≤ 2GHz is 15 mm in x - and y-dimension. For higher frequencies a finer resolution is needed, thus for the grid spacing is reduced according the following table:

Area scan grid spacing for different frequency ranges	
Frequency range	Grid spacing
≤ 2 GHz	≤ 15 mm
2 – 4 GHz	≤ 12 mm
4 – 6 GHz	≤ 10 mm

Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation. Results of this coarse scan are shown in annex B.

- A „zoom scan" measures the field in a volume around the 2D peak SAR value acquired in the previous „coarse" scan. It uses a fine meshed grid where the robot moves the probe in steps along all the 3 axis (x,y and z-axis) starting at the bottom of the Phantom. The grid spacing for the cube measurement is varied according to the measured frequency range, the dimensions are given in the following table:

Zoom scan grid spacing and volume for different frequency ranges			
Frequency range	Grid spacing for x, y axis	Grid spacing for z axis	Minimum zoom scan volume
≤ 2 GHz	≤ 8 mm	≤ 5 mm	≥ 30 mm
2 – 3 GHz	≤ 5 mm	≤ 5 mm	≥ 28 mm
3 – 4 GHz	≤ 5 mm	≤ 4 mm	≥ 28 mm
4 – 5 GHz	≤ 4 mm	≤ 3 mm	≥ 25 mm
5 – 6 GHz	≤ 4 mm	≤ 2 mm	≥ 22 mm

DASY is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in annex B. Test results relevant for the specified standard (see section 3) are shown in table form in section 7.

Spatial Peak SAR Evaluation

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of all points in the three directions x, y and z. The algorithm that finds the maximal averaged volume is separated   into three different stages.

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 1 to 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting 'Graph Evaluated'.

- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the   bottom plane of the cube.

- All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.

Extrapolation

The extrapolation is based on a least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

Interpolation

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction)   [Numerical Recipes in C, Second Edition, p.123ff].

Volume Averaging

At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000   points (20x20x20) are interpolated to calculate the average.

Advanced Extrapolation

DASY uses the advanced extrapolation option which is able to compensate boundary effects on E-field probes.

SAM PHANTOM

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. (see Fig. 2.6)

Phantom Specification

Phantom: SAM Twin Phantom (V4.0)
Shell Material: Vivac Composite
Thickness: 2.0 ± 0.2 mm
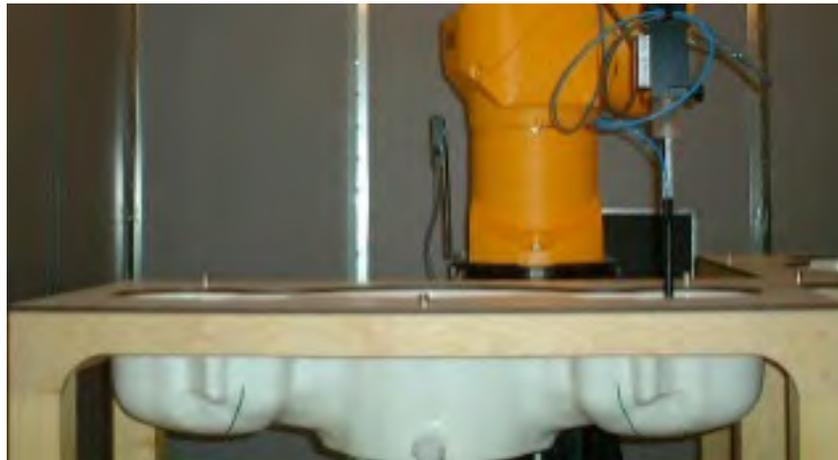
Figure 2.6 SAM Twin Phantom

Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0 the Mounting Device (see Fig. 2.7), enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation point is the ear opening. The devices can be easily, accurately, and repeat ably be positioned according to the FCC, CENELEC, IEC and IEEE specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

**Figure 2.7 Mounting Device**

Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produce infinite number of configurations. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

3. Definition of Reference Points

Ear Reference Point

Figure 3.2 shows the front, back and side views of the SAM Phantom. The point "M" is the reference point for the center of the mouth, "LE" is the left ear reference point (ERP), and "RE" is the right ERP. The ERPs are 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 3.1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 3.1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].
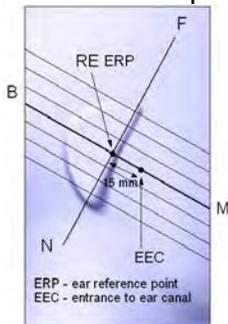
Figure 3.1 Close-up side view of ERP's

Figure 3.2 Front, back and side view of SAM

Device Reference Points

Two imaginary lines on the device need to be established: the vertical centerline and the horizontal line. The test device is placed in a normal operating position with the "test device reference point" located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (See Fig. 3.3). The "test device reference point" is than located at the same level as the center of the ear reference point. The test device is positioned so that the "vertical centerline" is bisecting the front surface of the device at it's top and bottom edges, positioning the "ear reference point" on the outer surface of both the left and right head phantoms on the ear reference point [5].
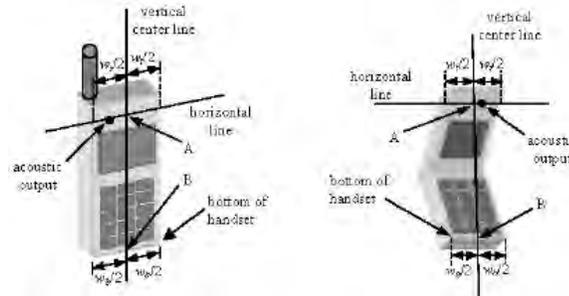
Figure 3.3 Handset Vertical Center & Horizontal Line Reference Points

4. Test Configuration Positions

Positioning for Cheek/Touch [5]

1. Position the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 4.1), such that the plane defined by the vertical center line and the horizontal line of the device is approximately parallel to the sagittal plane of the phantom.
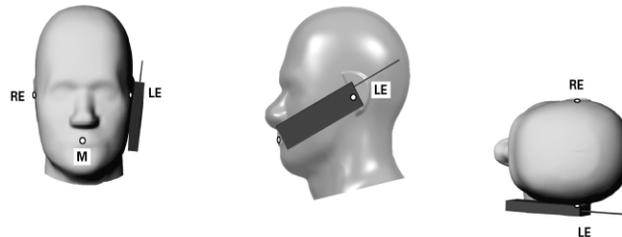
Figure 4.1 Front, Side and Top View of Cheek/Touch Position

2. Translate the device towards the phantom along the line passing through RE and LE until the device touches the ear.

3. While maintaining the device in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane).

4. Rotate the device around the vertical centerline until the device (horizontal line) is symmetrical with respect to the line NF.

5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE and maintaining the device contact with the ear, rotate the device about the line NF until any point on the device is in contact with a phantom point below the ear (cheek). See Figure 4.2.
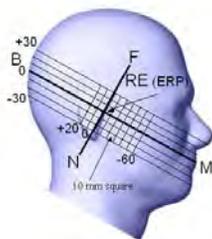
Figure 4.2 Side view w/ relevant markings

Positioning for Ear / 15° Tilt [5]

With the test device aligned in the Cheek/Touch Position":

1. While maintaining the orientation of the device, retracted the device parallel to the reference plane far enough to enable a rotation of the device by 15 degrees.

2. Rotate the device around the horizontal line by 15 degrees.

3. While maintaining the orientation of the device, move the device parallel to the reference plane until any part of the device touches the head. (In this position, point A is located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, the angle of the device shall be reduced. The tilted position is obtained when any part of the device is in contact with the ear as well as a second part of the device is in contact with the head (see Figure 4.3).
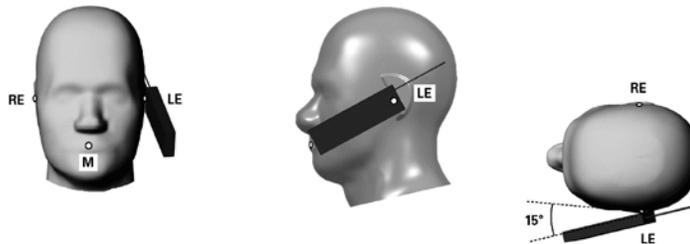
Figure 4.3 Front, Side and Top View of Ear/15° Tilt Position

Body Worn Configurations

Body-worn operating configurations are tested with the accessories attached to the device and positioned against a flat phantom in a normal use configuration. A device with a headset output is tested with a headset connected to the device. Body dielectric parameters are used.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then, when multiple accessories that contain metallic components are supplied with the device, the device is tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration where a separation distance between the back of the device and the flat phantom is used. All test position spacings are documented.

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessory(ies), including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning. Worst-case positioning is then documented and used to perform Body SAR testing.

In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and cautions statements are included in the user's manual.

5. Probe and Dipole Calibration

See Appendix D and E.

6. Phantom & Simulating Tissue Specifications

Head & Body Simulating Mixture Characterization

The head and body mixtures consist of the material based on the table listed below. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. Body tissue parameters that have not been specified in IEEE1528 – 2013 are derived from the issue dielectric parameters computed from the 4-Cole-Cole equations.

Table 6.1 Typical Composition of Ingredients for Tissue

Ingredients		Simulating Tissue			
		750 MHz Head	900 MHz Head	1750 MHz Head	1900 MHz Head
Mixing Percentage					
Water					
Sugar					
Salt		Proprietary Purchased From Speag	Proprietary Purchased From Speag	Proprietary Purchased From Speag	Proprietary Purchased From Speag
HEC					
Bactericide					
DGBE					
Dielectric Constant	Target	41.69	41.50	40.08	40.00
Conductivity (S/m)	Target	0.89	0.97	1.37	1.40

Ingredients		Simulating Tissue		
		2300 MHz Head	2550 MHz Head	3 GHz Head
Mixing Percentage				
Water				
Sugar				
Salt		Proprietary Purchased From Speag	Proprietary Purchased From Speag	Proprietary Purchased From Speag
HEC				
Bactericide				
DGBE				
Dielectric Constant	Target	39.47	39.07	Various
Conductivity (S/m)	Target	1.67	1.91	Various

7.   ANSI/IEEE C95.1 – 1992 RF Exposure Limits [2]

Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 7.1 Human Exposure Limits

	UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)	CONTROLLED ENVIROMENT Professional Population (W/kg) or (mW/g)
SPATIAL PEAK SAR [1] Head	1.60	8.00
SPATIAL AVERAGE SAR [2] Whole Body	0.08	0.40
SPATIAL PEAK SAR [3] Hands, Feet, Ankles, Wrists	4.00	20.00

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[1] The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

[2] The Spatial Average value of the SAR averaged over the whole body.

[3] The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

8.   Measurement Uncertainty

Measurement uncertainty table is not required per KDB 865664 D01 v01r04 section 2.8.2 page 12. SAR measurement uncertainty analysis is required in the SAR report only when the highest measured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR. The equivalent ratio (1.5/1.6) should be applied to extremity and occupational exposure conditions. The highest reported value is less than 1.5 W/kg. Therefore, the measurement uncertainty table is not required.

9.   System Validation

Tissue Verification

Table 9.1 Measured Tissue Parameters

|		750 MHz Head		900 MHz Head		1750 MHz Head	
Date(s)		Oct. 2, 2020		Oct. 2, 2020		Oct. 1, 2020	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		41.94	41.31	41.50	40.76	40.08	39.52
Conductivity: σ		0.89	0.91	0.97	1.00	1.37	1.40
		1900 MHz Head		2300 MHz Head		2550 MHz Head	
Date(s)		Oct. 1, 2020		Oct. 5, 2020		Oct. 5, 2020	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		40.00	39.68	39.47	39.21	39.07	38.49
Conductivity: σ		1.40	1.47	1.67	1.67	1.91	1.96
		3500 MHz Head		3700 MHz Head		750 MHz Head	
Date(s)		Oct. 6, 2020		Oct. 6, 2020		Sep. 29, 2020	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		37.93	37.11	37.70	36.64	41.94	41.55
Conductivity: σ		2.91	2.98	3.12	3.18	0.89	0.91
		900 MHz Head		1750 MHz Head		1900 MHz Head	
Date(s)		Sep. 29, 2020		Sep. 28, 2020		Sep. 28, 2020	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		41.50	41.14	40.08	39.63	40.00	39.46
Conductivity: σ		0.97	1.01	1.37	1.42	1.40	1.44
		2300 MHz Head		2550 MHz Head		3500 MHz Head	
Date(s)		Sep. 30, 2020		Sep. 30, 2020		Oct. 1, 2020	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		39.47	38.80	39.07	38.68	37.93	37.34
Conductivity: σ		1.67	1.69	1.91	1.94	2.91	2.94
		3700 MHz Head	
Date(s)		Oct. 1, 2020	
Liquid Temperature (˚C)	20.0	Target	Measured
Dielectric Constant: ε		37.70	36.87
Conductivity: σ		3.12	3.14

See Appendix A for data printout.

Test System Verification

Prior to assessment, the system is verified to the ±10% of the specifications at the test frequency by using the system kit.   Power is normalized to 1 watt.   (Graphic Plots Attached)

Table 9.2 System Dipole Validation Target & Measured

	Test Frequency	Targeted SAR$_{1g}$ (W/kg)	Measure SAR$_{1g}$ (W/kg)	Tissue Used for Verification	Deviation (%)	Plot Number
02-Oct-2020	750 MHz	8.23	8.25	Head	+ 0.24	1
02-Oct-2020	900 MHz	10.90	10.40	Head	- 4.59	2
01-Oct-2020	1750 MHz	36.10	36.90	Head	+ 2.22	3
01-Oct-2020	1900 MHz	40.60	41.10	Head	+ 1.23	4
05-Oct-2020	2300 MHz	49.60	48.90	Head	- 1.41	5
05-Oct-2020	2550 MHz	55.60	56.90	Head	+ 2.34	6
06-Oct-2020	3500 MHz	68.90	68.20	Head	- 1.02	7
06-Oct-2020	3700 MHz	70.00	69.20	Head	- 1.14	8
29-Sep-2020	750 MHz	8.23	8.26	Head	+ 0.36	9
29-Sep-2020	900 MHz	10.90	10.70	Head	- 1.83	10
28-Sep-2020	1750 MHz	36.10	36.70	Head	+ 1.66	11
28-Sep-2020	1900 MHz	40.60	40.90	Head	+ 0.74	12
30-Sep-2020	2300 MHz	49.60	49.20	Head	- 0.81	13
30-Sep-2020	2550 MHz	55.60	56.70	Head	+ 1.98	14
01-Oct-2020	3500 MHz	68.90	68.50	Head	- 0.58	15
01-Oct-2020	3700 MHz	70.00	70.10	Head	+ 0.14	16

See Appendix A for data plots.
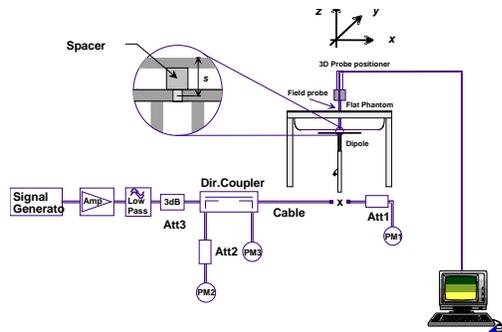
Figure 9.1 Dipole Validation Test Setup

10. SAR Test Data Summary

See Measurement Result Data Pages

See Appendix B for SAR Test Data Plots.
See Appendix C for SAR Test Setup Photos.

Procedures Used To Establish Test Signal

The device was either placed into simulated transmit mode using the manufacturer's test codes or the actual transmission is activated through a base station simulator or similar equipment. See data pages for actual procedure used in measurement.

Device Test Condition

In order to verify that the device was tested at full power, conducted output power measurements were performed before and after each SAR measurement to confirm the output power unless otherwise noted. If a conducted power deviation of more than 5% occurred, the test was repeated. The power drift of each test is measured at the start of the test and again at the end of the test. The drift percentage is calculated by the formula ((end/start)-1)*100 and rounded to three decimal places. The drift percentage is calculated into the resultant SAR value on the data sheet for each test.

All testing was conducted based on the test plan submitted by the client.

11. FCC 3G Measurement Procedures

Power measurements were performed using a base station simulator under average power.

12.1 Procedures Used to Establish RF Signal for SAR

The device was placed into a simulated call using a base station simulator in a screen room. Such test signals offer a consistent means for testing SAR and recommended for evaluating SAR. The SAR measurement software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5% occurred, the tests were repeated.

11.2 SAR Measurement Conditions for WCDMA/HSDPA/HSUPA

Configure the call box 8960 to support all WCDMA tests in respect to the 3GPP 34.121 (listed in Table below). Measure the power at Ch4132, 4182 and 4233 for US cell; Ch9262, 9400 and 9538 for US PCS band.

For Rel99

- Set a Test Mode 1 loop back with a 12.2kbps Reference Measurement Channel (RMC).
- Set and send continuously Up power control commands to the device
- Measure the power at the device antenna connector using the power meter with average detector.

For HSDPA Rel 6

- Establish a Test Mode 1 look back with both 1 12.2kbps RMC channel and a H-Set1 Fixed Reference Channel (FRC). With the 8960 this is accomplished by setting the signal Channel Coding to "Fixed Reference Channel" and configuring for HSET-1 QKSP.
- Set beta values and HSDPA settings for HSDPA Subtest1 according to Table below.
- Send continuously Up power control commands to the device
- Measure the power at the device antenna connector using the power meter with modulated average detector.
- Repeat the measurement for the HSDPA Subtest2, 3 and 4 as given in Table below.

For HSUPA Rel 6

- Use UL RMC 12.2kbps and FRC H-Set1 QPSK, Test Mode 1 loop back. With the 8960 this is accomplished by setting the signal Channel Coding to "E-DCH Test Channel" and configuring the equipment category to Cat5_10ms.
- Set the Absolute Grant for HSUPA Subtest1 according to Table below.
- Set the device power to be at least 5dB lower than the Maximum output power
- Send power control bits to give one TPC_cmd = +1 command to the device. If device doesn't send any E-DPCH data with decreased E-TFCI within 500ms, then repeat this process until the decreased E-TFCI is reported.
- Confirm that the E-TFCI transmitted by the device is equal to the target E-TFCI in Table below. If the E-TFCI transmitted by the device is not equal to the target E-TFCI, then send power control bits to give one TPC_cmd = -1 command to the UE. If UE sends any E-DPCH data with decreased E-TFCI within 500 ms, send new power control bits to give one TPC_cmd = -1 command to the UE. Then confirm that the E-TFCI transmitted by the UE is equal to the target E-TFCI in Table below.
- Measure the power using the power meter with modulated average detector.

12. FCC 3G Measurement Procedures

Power measurements were performed using a base station simulator under average power.

12.1 Procedures Used to Establish RF Signal for SAR

The device was placed into a simulated call using a base station simulator in a screen room. Such test signals offer a consistent means for testing SAR and recommended for evaluating SAR. The SAR measurement software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5% occurred, the tests were repeated.

12.2 SAR Measurement Conditions for CDMA2000, 1xEV-DO

12.2.1 Output Power Verification 1xRTT

Use CDMA2000 Rev 6 protocol in the call box.

1) Test for RC 3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC 3, 4 and 5.
    a. Set up a call using Supplemental Channel Test Mode 3 (RC 3, SO 32) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
    b. As per C.S0011 or TIA/EIA-98-F Table 4.4.5.2-2, set the test parameters.
    c. Send alternating '0' and '1' power control bit to the device
    d. Determine the active channel configuration. If the desired channel configuration is not the active channel configuration, increase Îor by 1 dB and repeat the verification. Repeat this step until the desired channel configuration becomes active.
    e. Measure the output power at the device antenna connector.
    f. Decrease Îor by 0.5 dB.
    g. Determine the active channel configuration. If the active channel configuration is the desired channel configuration, measure the output power at the device antenna connector.
    h. Repeat step f and g until the output power no longer increases or the desired channel configuration is no longer active. Record the highest output power achieved with the desired channel configuration active.
    i. Repeat step a through h ten times and average the result.

12.2.2 Output Power Verification 1xEvDo

1) Use 1xEV-DO Rel 0 protocol in the call box 8960.
    a. FTAP
        - Select Test Application Protocol to FTAP
        - Set FTAP Rate to 307.2 kbps (2 Slot, QPSK)
        - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots
        - Set Îor to -60 dBm/1.23 MHz
        - Send continuously '0' power control bits
        - Measure the power at device antenna connector
    b. RTAP
        - Select Test Application Protocol to RTAP
        - Set RTAP Rate to 9.6 kbps
        - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots

- Set Îor to -60 dBm/1.23 MHz
- Send continuously '0' power control bits
- Measure the power at device antenna connector
- Repeat above steps for RTAP Rate = 19.2 kbps, 38.4 kbps, 76.8 kbps and 153.6 kbps respectively
2) Use 1xEV-DO Rev A protocol in the call box 8960
   a. FETAP
      - Select Test Application Protocol to FETAP
      - Set FETAP Rate to 307.2 kbps (2 Slot, QPSK)
      - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots
      - Set Îor to -60 dBm/1.23 MHz
      - Send continuously '0' power control bits
      - Measure the power at device antenna connector
   b. RETAP
      - Select Test Application Protocol to RETAP
      - F-Traffic Format -> 4 (1024, 2, 128) Canonical (307.2k, QPSK) • Set R-Data Pkt Size to 128
      - Protocol Subtype Config -> Release A Physical Layer Subtype -> Subtype 2 ->PL Subtype 2 Access Channel MAC Subtype -> Default (Subtype 0)
      - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots ->ACK R-Data After -> Subpacket 0 (All ACK)
      - Set Îor to -60 dBm/1.23 MHz
      - Send continuously '0' power control bits
      - Measure the power at device antenna connector
      - Repeat above steps for R-Data Pkt Size = 256, 512, 768, 1024, 1536, 2048, 3072, 4096, 6144, 8192, 12288 respectively.

RF Exposure Lab

SAR Data Summary – Head Measurements

MEASUREMENT RESULTS

Gap	Plot	Frequency MHz	Frequency Ch.	Modulation	Position	RMC/RB	Test Setup/ Offset	Measured SAR (W/kg)	Original SAR (W/kg)
0 mm	1 -----	680.5	133297	LTE	Left Touch	1	49	0.264 / 0.103	0.264 / -----
	2 -----	707.5	23095	LTE	Right Touch	1	24	0.311 / 0.162	0.301 / -----
	3 -----	782.0	23230	LTE	Left Touch	1	24	0.356 / 0.174	0.410 / -----
	4 -----	793.0	23330	LTE	Left Touch	1	24	0.334 / 0.186	0.412 / -----
	5 -----	836.52	384	CDMA	Left Touch	TDSO	SO32 RC3	0.468 / 0.259	0.548 / -----
	6 -----	836.6	4183	WCDMA	Left Touch	12.2 kbps	Test Loop 1	0.399 / 0.211	0.456 / -----
	7 -----	831.5	26865	LTE	Left Touch	1	24	0.479 / 0.201	0.552 / -----
	8 -----	1732.6	1413	WCDMA	Right Touch	12.2 kbps	Test Loop 1	0.387 / 0.172	0.573 / -----
	9 -----	1745.0	132322	LTE	Right Touch	1	49	0.375 / 0.187	0.591 / -----
	10 -----	1880.0	600	CDMA	Right Touch	TDSO	SO32 RC3	0.510 / 0.154	0.771 / -----
	11 -----	1907.6	9538	WCDMA	Right Touch	12.2 kbps	Test Loop 1	0.731 / 0.259	1.02 / -----
	12 -----	1905.0	26590	LTE	Right Touch	50	24	0.594 / 0.228	0.817 / -----
	13 -----	2310.0	27710	LTE	Right Touch	1	24	0.341 / 0.197	0.480 / -----
	14 -----	2535.0	21100	LTE	Left Touch	1	49	0.581 / 0.316	0.655 / -----
	15 -----	2593.0	40620	LTE	Left Touch	1	49	0.396 / 0.159	0.420 / -----
	16 -----	3700.0	55990	LTE	Left Touch	1	49	0.108 / 0.0925	0.114 / -----

Head
1.6 W/kg (mW/g)
averaged over 1 gram

1. Battery is fully charged for all tests.
   Power Measured   ☒Conducted   ☐ERP   ☐EIRP
2. SAR Measurement
   Phantom Configuration   ☒Left Head   ☒Eli4   ☒Right Head
   SAR Configuration   ☒Head   ☒Body
3. Test Signal Call Mode   ☐Test Code   ☒Base Station Simulator
4. Test Configuration   ☐With Belt Clip   ☐Without Belt Clip   ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

RF Exposure Lab

SAR Data Summary – Body Measurements

MEASUREMENT RESULTS

Gap	Plot	Frequency		Modulation	Position	RMC/RB	Test Setup/ Offset	Measured SAR (W/kg)	Original SAR (W/kg)
		MHz	Ch.						
0 mm	17	680.5	133297	LTE	Left	1	49	0.366	0.488
	-----							0.0982	-----
	18	707.5	23095	LTE	Front	1	24	0.465	0.583
	-----							0.186	-----
	19	782.0	23230	LTE	Left	1	24	0.546	0.584
	-----							0.0173	-----
	20	793.0	23330	LTE	Left	1	24	0.747	0.636
	-----							0.408	-----
	21	836.52	384	CDMA	Back	TDSO	SO32 RC3	0.560	0.665
	-----							0.243	-----
	22	836.6	4183	WCDMA	Left	12.2 kbps	Test Loop 1	0.811	0.874
	-----							0.322	-----
	23	831.5	26865	LTE	Back	1	24	0.719	0.868
	-----							0.109	-----
	24	1732.6	1413	WCDMA	Back	12.2 kbps	Test Loop 1	0.877	1.08
	-----							0.312	-----
	25	1745.0	132322	LTE	Back	50	24	1.01	1.08
	-----							0.383	-----
	26	1880.0	600	CDMA	Back	TDSO	SO32 RC3	0.771	0.972
	-----							0.157	-----
	27	1907.6	9538	WCDMA	Back	12.2 kbps	Test Loop 1	1.01	1.08
	-----							0.207	-----
	28	1905.0	26590	LTE	Back	50	24	0.843	0.973
	-----							0.132	-----
	29	2310.0	27710	LTE	Back	25	12	0.879	0.917
	-----							0.181	-----
	30	2535.0	21100	LTE	Front	1	49	0.840	0.949
	-----							0.268	-----
	31	2593.0	40620	LTE	Front	1	49	0.792	1.01
	-----							0.148	-----
	32	3700.0	55990	LTE	Back	1	49	0.948	0.984
	-----							0.136	-----

Head
1.6 W/kg (mW/g)
averaged over 1 gram

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☒Left Head ☒Eli4 ☒Right Head
   SAR Configuration ☒Head ☒Body
3. Test Signal Call Mode ☐Test Code ☒Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – Simultaneous Evaluation

MEASUREMENT RESULTS						
Configuration	Frequency		Modulation	SAR$_1$	SAR$_2$ Case[1]	SAR Total
	MHz	Ch.				
Head	2441	39	GFSK	0.731	0.04	0.771
Body	2441	39	GFSK	1.01	0.04	1.05

	1.6 W/kg (mW/g) averaged over 1 gram

[1] – The Bluetooth transmitter is excluded from SAR testing due to the low power of the transmitter. The maximum power level is 4 dBm. Therefore, the SAR value was calculated. The following formula was used to calculate the SAR value for the Bluetooth transmitter.

[(max. power of channel, mW) / (min. test separation, mm)] * [$\sqrt{f_{(GHz)}}/x$] W/kg, where x = 7.5 for 1 gram SAR

[2.5 mW / 12 mm] * [$\sqrt{2.48}/7.5$] = 0.04 W/kg

The sum of all transmitters is less than or equal to the limit; therefore, the simultaneous transmission meets the requirements of KDB447498 D01 v06 section 4.3.2 page 11.

13. Test Equipment List

Table 13.1 Equipment Specifications

Type	Calibration Due Date	Calibration Done Date	Serial Number
Staubli Robot TX60L	N/A	N/A	F07/55M6A1/A/01
Measurement Controller CS8c	N/A	N/A	1012
Twin SAM Phantom	N/A	N/A	1416
ELI4 Flat Phantom	N/A	N/A	1065
Device Holder	N/A	N/A	N/A
Data Acquisition Electronics 4	07/10/2021	07/10/2020	1321
SPEAG E-Field Probe EX3DV4	01/21/2021	01/21/2020	7530
Speag Validation Dipole D750V2	07/13/2021	07/13/2018	1016
Speag Validation Dipole D900V2	07/13/2021	07/13/2018	1d044
Speag Validation Dipole D1750V2	07/20/2021	07/20/2018	1018
Speag Validation Dipole D1900V2	07/13/2021	07/13/2018	5d116
Speag Validation Dipole D2300V2	08/20/2021	08/20/2018	1060
Speag Validation Dipole D2550V2	07/12/2021	07/12/2018	1003
Speag Validation Dipole D3500V2	04/13/2021	04/13/2018	1061
Speag Validation Dipole D3700V2	04/13/2021	04/13/2018	1024
Agilent N1911A Power Meter	04/27/2021	04/27/2020	GB45100254
Agilent N1922A Power Sensor	04/27/2021	04/27/2020	MY45240464
Advantest R3261A Spectrum Analyzer	03/16/2021	03/16/2020	31720068
Agilent (HP) 8350B Signal Generator	03/16/2021	03/16/2020	2749A10226
Agilent (HP) 83525A RF Plug-In	03/16/2021	03/16/2020	2647A01172
Agilent (HP) 8753C Vector Network Analyzer	03/16/2021	03/16/2020	3135A01724
Agilent (HP) 85047A S-Parameter Test Set	03/17/2021	03/17/2020	2904A00595
Agilent (HP) 8960 Base Station Sim.	05/31/2021	05/31/2020	MY48360364
Anritsu MT8820C	04/27/2021	04/27/2020	6201176199
Agilent 778D Dual Directional Coupler	N/A	N/A	MY48220184
MiniCircuits BW-N20W5+ Fixed 20 dB Attenuator	N/A	N/A	N/A
MiniCircuits SPL-10.7+ Low Pass Filter	N/A	N/A	R8979513746
Aprel Dielectric Probe Assembly	N/A	N/A	0011
Head Equivalent Matter (750 MHz)	N/A	N/A	N/A
Head Equivalent Matter (900 MHz)	N/A	N/A	N/A
Head Equivalent Matter (1750 MHz)	N/A	N/A	N/A
Head Equivalent Matter (1900 MHz)	N/A	N/A	N/A
Head Equivalent Matter (2300 MHz)	N/A	N/A	N/A
Head Equivalent Matter (2550 MHz)	N/A	N/A	N/A
Head Equivalent Matter (3 GHz)	N/A	N/A	N/A

14. Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC/ISED. These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body is a very complex phenomena that depends on the mass, shape, and size of the body; the orientation of the body with respect to the field vectors; and, the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

15. References

[1]   Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radio Frequency Radiation, August 1996

[2]   ANSI/IEEE C95.1 – 1992, American National Standard Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300kHz to 100GHz, New York: IEEE, 1992.

[3]   ANSI/IEEE C95.3 – 1992, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, 1992.

[4]   International Electrotechnical Commission, IEC 62209-2 (Edition 1.0), Human Exposure to radio frequency fields from hand-held and body mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), March 2010.

[5]   IEEE Standard 1528 – 2013, IEEE Recommended Practice for Determining the Peak-Spatial Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques, June 2013.

[6]   ISED, RSS – 102 Issue 5, Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), March 2015.

[7]   Health Canada, Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz, 2009.

Appendix A – System Validation Plots and Data

```
************************************************************
Test Result for UIM Dielectric Parameter
Fri 02/Oct/2020
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq          FCC_eH FCC_sH Test_e Test_s
0.6600        42.39  0.88   41.79  0.87
0.6700        42.34  0.88   41.74  0.87
0.6800        42.29  0.88   41.69  0.87
0.6805        42.288 0.88   41.688 0.87*
0.6900        42.25  0.88   41.65  0.87
0.7000        42.20  0.89   41.61  0.87
0.7075        42.163 0.89   41.558 0.878*
0.7100        42.15  0.89   41.54  0.88
0.7200        42.10  0.89   41.49  0.89
0.7300        42.05  0.89   41.42  0.90
0.7400        41.99  0.89   41.36  0.90
0.7500        41.94  0.89   41.31  0.91
0.7600        41.89  0.89   41.25  0.92
0.7700        41.84  0.89   41.19  0.93
0.7800        41.79  0.90   41.13  0.93
0.7820        41.778 0.90   41.118 0.932*
0.7900        41.73  0.90   41.07  0.94
0.7930        41.715 0.90   41.058 0.94*
0.8000        41.68  0.90   41.03  0.94

* value interpolated
```

```
************************************************************
Test Result for UIM Dielectric Parameter
Fri 02/Oct/2020
Freq   Frequency(GHz)
eH     Limits for Head Epsilon
sH     Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq          eH    sH      Test_e Test_s
0.8000        41.68 0.90    40.93  0.91
0.8100        41.63 0.90    40.88  0.92
0.8200        41.58 0.90    40.82  0.93
0.8225        41.568 0.90   40.833 0.93*
0.8300        41.53 0.90    40.87  0.93
0.8315        41.526 0.902  40.866 0.932*
0.8350        41.515 0.905  40.855 0.935*
0.8365        41.511 0.907  40.851 0.937*
0.8366        41.51 0.907   40.85  0.937*
0.8375        41.508 0.908  40.848 0.938*
0.8400        41.50 0.91    40.84  0.94
0.8470        41.50 0.917   40.826 0.947*
0.8500        41.50 0.92    40.82  0.95
0.8600        41.50 0.93    40.80  0.96
0.8700        41.50 0.94    40.79  0.97
0.8800        41.50 0.95    40.78  0.98
0.8900        41.50 0.96    40.77  0.99
0.8975        41.50 0.968   40.763 0.998*
0.8976        41.50 0.968   40.762 0.998*
0.9000        41.50 0.97    40.76  1.00
0.9100        41.50 0.98    40.75  1.01


* value interpolated


************************************************************
Test Result for UIM Dielectric Parameter
Thu 01/Oct/2020
Freq   Frequency(GHz)
eH Limits for Head Epsilon
sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq          eH    sH      Test_e Test_s
1.7000        40.16 1.34    39.62  1.36
1.7100        40.14 1.35    39.60  1.37
1.7200        40.13 1.35    39.58  1.38
1.7300        40.11 1.36    39.56  1.38
1.7326        40.105 1.363  39.555 1.383*
1.7400        40.09 1.37    39.54  1.39
1.7450        40.085 1.37   39.53  1.395*
1.7475        40.083 1.37   39.525 1.398*
1.7500        40.08 1.37    39.52  1.40
1.7600        40.06 1.38    39.50  1.41
1.7700        40.05 1.38    39.48  1.42
1.7800        40.03 1.39    39.46  1.42
1.7900        40.02 1.39    39.44  1.43


* value interpolated
```

```
*************************************************************
Test Result for UIM Dielectric Parameter
Thu 01/Oct/2020
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
*************************************************************
Freq          FCC_eH FCC_sH Test_e Test_s
1.8500        40.00  1.40   39.74  1.42
1.8600        40.00  1.40   39.72  1.43
1.8700        40.00  1.40   39.70  1.44
1.8800        40.00  1.40   39.69  1.45
1.8900        40.00  1.40   39.68  1.45
1.9000        40.00  1.40   39.68  1.47
1.9050        40.00  1.40   39.67  1.475*
1.9076        40.00  1.40   39.665 1.478*
1.9100        40.00  1.40   39.66  1.48
1.9200        40.00  1.40   39.64  1.48
1.9300        40.00  1.40   39.63  1.49
1.9400        40.00  1.40   39.62  1.49
1.9500        40.00  1.40   39.60  1.50
1.9600        40.00  1.40   39.59  1.50
1.9700        40.00  1.40   39.58  1.51


*value interpolated


*************************************************************
Test Result for UIM Dielectric Parameter
Mon 05/Oct/2020
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
*************************************************************
Freq          FCC_eH FCC_sH Test_e Test_s
2.2900        39.48  1.66   39.23  1.66
2.3000        39.47  1.67   39.21  1.67
2.3100        39.45  1.68   39.19  1.68
2.3200        39.43  1.68   39.17  1.69
2.3300        39.41  1.69   39.15  1.70
2.3400        39.40  1.70   39.13  1.71
2.3500        39.38  1.71   39.11  1.72
2.3600        39.36  1.72   39.09  1.73
2.3700        39.34  1.73   39.08  1.74
2.3800        39.32  1.74   39.06  1.75
2.3900        39.31  1.75   39.04  1.76
2.4000        39.29  1.76   39.02  1.77
2.4100        39.27  1.76   39.01  1.78


* value interpolated
```

```
*************************************************************
Test Result for UIM Dielectric Parameter
Mon 05/Oct/2020
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
*************************************************************
Freq           FCC_eH FCC_sH Test_e Test_s
2.4900         39.15  1.84   38.63  1.88
2.5000         39.14  1.85   38.61  1.89
2.5100         39.12  1.87   38.58  1.90
2.5200         39.11  1.88   38.56  1.92
2.5300         39.10  1.89   38.54  1.93
2.5350         39.095 1.895  38.525 1.935*
2.5400         39.09  1.90   38.51  1.94
2.5500         39.07  1.91   38.49  1.96
2.5600         39.06  1.92   38.47  1.97
2.5700         39.05  1.93   38.44  1.98
2.5800         39.03  1.94   38.42  2.00
2.5900         39.02  1.95   38.39  2.01
2.5930         39.017 1.953  38.393 2.01*
2.5950         39.015 1.955  38.395 2.01*
2.6000         39.01  1.96   38.40  2.01
2.6100         39.00  1.97   38.38  2.02

* value interpolated
```

```
************************************************************
Test Result for UIM Dielectric Parameter
Tue 06/Oct/2020
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq          FCC_eH FCC_sH Test_e Test_s
3.4700        37.96  2.88   37.18  2.95
3.4800        37.95  2.89   37.16  2.96
3.4900        37.94  2.90   37.14  2.97
3.5000        37.93  2.91   37.11  2.98
3.5100        37.92  2.92   37.09  2.99
3.5200        37.91  2.93   37.07  3.00
3.5300        37.89  2.94   37.04  3.01
3.5400        37.88  2.95   37.01  3.02
3.5500        37.87  2.96   36.98  3.03
3.5600        37.86  2.97   36.96  3.04
3.5700        37.85  2.98   36.94  3.05
3.5800        37.84  2.99   36.92  3.06
3.5900        37.83  3.00   36.89  3.07
3.6000        37.81  3.02   36.87  3.08
3.6100        37.80  3.03   36.85  3.09
3.6200        37.79  3.04   36.84  3.10
3.6250        37.785 3.045  36.825 3.105*
3.6300        37.78  3.05   36.81  3.11
3.6400        37.77  3.06   36.78  3.12
3.6500        37.76  3.07   36.75  3.13
3.6600        37.75  3.08   36.73  3.14
3.6700        37.73  3.09   36.71  3.15
3.6800        37.72  3.10   36.69  3.16
3.6900        37.71  3.11   36.66  3.17
3.7000        37.70  3.12   36.64  3.18
3.7100        37.69  3.13   36.61  3.19
3.7200        37.68  3.14   36.59  3.20

* value interpolated
```

```
************************************************************
Test Result for UIM Dielectric Parameter
Tue 29/Sep/2020
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq         FCC_eH FCC_sH Test_e Test_s
0.6600       42.39  0.88   42.03  0.89
0.6700       42.34  0.88   41.98  0.89
0.6800       42.29  0.88   41.93  0.89
0.6805       42.288 0.88   41.928 0.89*
0.6900       42.25  0.88   41.89  0.89
0.7000       42.20  0.89   41.85  0.89
0.7075       42.163 0.89   41.798 0.898*
0.7100       42.15  0.89   41.78  0.90
0.7200       42.10  0.89   41.73  0.91
0.7300       42.05  0.89   41.66  0.91
0.7400       41.99  0.89   41.60  0.91
0.7500       41.94  0.89   41.55  0.91
0.7600       41.89  0.89   41.49  0.92
0.7700       41.84  0.89   41.43  0.92
0.7800       41.79  0.90   41.37  0.92
0.7820       41.778 0.90   41.358 0.922*
0.7900       41.73  0.90   41.31  0.93
0.7930       41.715 0.90   41.298 0.93*
0.8000       41.68  0.90   41.27  0.93

* value interpolated
```

```
************************************************************
Test Result for UIM Dielectric Parameter
Tue 29/Sep/2020
Freq   Frequency(GHz)
eH     Limits for Head Epsilon
sH     Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq          eH    sH      Test_e Test_s
0.8000        41.68 0.90    41.31  0.92
0.8100        41.63 0.90    41.26  0.93
0.8200        41.58 0.90    41.2   0.94
0.8225        41.568 0.90   41.213 0.94*
0.8300        41.53 0.90    41.25  0.94
0.8350        41.515 0.905  41.235 0.945*
0.8365        41.511 0.907  41.231 0.947*
0.8375        41.508 0.908  41.228 0.948*
0.8400        41.50 0.91    41.22  0.95
0.8440        41.50 0.914   41.212 0.954*
0.8466        41.50 0.917   41.207 0.957*
0.8470        41.50 0.917   41.206 0.957*
0.8500        41.50 0.92    41.2   0.96
0.8600        41.50 0.93    41.18  0.97
0.8700        41.50 0.94    41.17  0.98
0.8800        41.50 0.95    41.16  0.99
0.8900        41.50 0.96    41.15  1.00
0.8975        41.50 0.968   41.143 1.008*
0.8976        41.50 0.968   41.142 1.008*
0.9000        41.50 0.97    41.14  1.01
0.9100        41.50 0.98    41.13  1.02


* value interpolated


************************************************************
Test Result for UIM Dielectric Parameter
Mon 28/Sep/2020
Freq   Frequency(GHz)
eH Limits for Head Epsilon
sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq          eH    sH      Test_e Test_s
1.7000        40.16 1.34    39.73  1.38
1.7100        40.14 1.35    39.71  1.39
1.7200        40.13 1.35    39.69  1.40
1.7300        40.11 1.36    39.67  1.40
1.7400        40.09 1.37    39.65  1.41
1.7475        40.083 1.37   39.635 1.418*
1.7500        40.08 1.37    39.63  1.42
1.7526        40.075 1.373  39.625 1.423*
1.7600        40.06 1.38    39.61  1.43
1.7700        40.05 1.38    39.59  1.44
1.7800        40.03 1.39    39.57  1.44
1.7900        40.02 1.39    39.55  1.45


* value interpolated
```

```
************************************************************
Test Result for UIM Dielectric Parameter
Mon 28/Sep/2020
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq          FCC_eH FCC_sH Test_e Test_s
1.8500         40.00  1.40   39.52  1.41
1.8600         40.00  1.40   39.50  1.42
1.8700         40.00  1.40   39.48  1.42
1.8800         40.00  1.40   39.47  1.43
1.8900         40.00  1.40   39.46  1.43
1.9000         40.00  1.40   39.46  1.44
1.9050         40.00  1.40   39.45  1.445*
1.9076         40.00  1.40   39.445 1.448*
1.9100         40.00  1.40   39.44  1.45
1.9200         40.00  1.40   39.42  1.45
1.9300         40.00  1.40   39.41  1.46
1.9400         40.00  1.40   39.40  1.46
1.9500         40.00  1.40   39.39  1.47
1.9600         40.00  1.40   39.38  1.47
1.9700         40.00  1.40   39.37  1.47


*value interpolated


************************************************************
Test Result for UIM Dielectric Parameter
Wed 30/Sep/2020
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq          FCC_eH FCC_sH Test_e Test_s
2.2900         39.48  1.66   38.82  1.68
2.3000         39.47  1.67   38.80  1.69
2.3100         39.45  1.68   38.78  1.70
2.3200         39.43  1.68   38.76  1.71
2.3300         39.41  1.69   38.74  1.72
2.3400         39.40  1.70   38.72  1.73
2.3500         39.38  1.71   38.70  1.74
2.3600         39.36  1.72   38.68  1.75
2.3700         39.34  1.73   38.67  1.76
2.3800         39.32  1.74   38.65  1.77
2.3900         39.31  1.75   38.63  1.78
2.4000         39.29  1.76   38.61  1.79
2.4100         39.27  1.76   38.60  1.80


* value interpolated
```

```
************************************************************
Test Result for UIM Dielectric Parameter
Wed 30/Sep/2020
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq           FCC_eH FCC_sH Test_e Test_s
2.4900         39.15  1.84   38.82  1.86
2.5000         39.14  1.85   38.80  1.87
2.5100         39.12  1.87   38.77  1.88
2.5200         39.11  1.88   38.75  1.90
2.5300         39.10  1.89   38.73  1.91
2.5350         39.095 1.895  38.715 1.915*
2.5400         39.09  1.90   38.70  1.92
2.5445         39.081 1.905  38.691 1.929*
2.5500         39.07  1.91   38.68  1.94
2.5600         39.06  1.92   38.66  1.95
2.5700         39.05  1.93   38.63  1.96
2.5800         39.03  1.94   38.61  1.98
2.5900         39.02  1.95   38.58  1.99
2.5950         39.015 1.955  38.585 1.99*
2.6000         39.01  1.96   38.59  1.99
2.6100         39.00  1.97   38.57  2.00
2.6200         38.98  1.99   38.56  2.01

* value interpolated
```

```
************************************************************
Test Result for UIM Dielectric Parameter
Thu 01/Oct/2020
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq          FCC_eH FCC_sH Test_e Test_s
3.4800        37.95  2.89   37.39  2.92
3.4900        37.94  2.90   37.37  2.93
3.5000        37.93  2.91   37.34  2.94
3.5100        37.92  2.92   37.32  2.95
3.5200        37.91  2.93   37.30  2.96
3.5300        37.89  2.94   37.27  2.97
3.5400        37.88  2.95   37.24  2.98
3.5500        37.87  2.96   37.21  2.99
3.5600        37.86  2.97   37.19  3.00
3.5700        37.85  2.98   37.17  3.01
3.5800        37.84  2.99   37.15  3.02
3.5900        37.83  3.00   37.12  3.03
3.6000        37.81  3.02   37.10  3.04
3.6100        37.80  3.03   37.08  3.05
3.6200        37.79  3.04   37.07  3.06
3.6250        37.785 3.045  37.055 3.065*
3.6300        37.78  3.05   37.04  3.07
3.6400        37.77  3.06   37.01  3.08
3.6500        37.76  3.07   36.98  3.09
3.6600        37.75  3.08   36.96  3.10
3.6700        37.73  3.09   36.94  3.11
3.6800        37.72  3.10   36.92  3.12
3.6900        37.71  3.11   36.89  3.13
3.7000        37.70  3.12   36.87  3.14
3.7100        37.69  3.13   36.84  3.15

* value interpolated
```

RF Exposure Lab

Plot 1

DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN 1016

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 750 MHz; σ = 0.91 S/m; ε_r = 41.31; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 10/2/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(10.56, 10.56, 10.56); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

750 MHz Head/Verification/Area Scan (41x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.769 W/kg

**750 MHz Head/Verification /Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 35.259 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.702 mW/g
P_{in}= 100 mW
SAR(1 g) = 0.825 mW/g; SAR(10 g) = 0.536 mW/g
Maximum value of SAR (measured) = 0.884 W/kg

Interpolated Max SAR Z Line(z)

900 MHz Head;Zoom Scan;SAR;cube 0   Markers
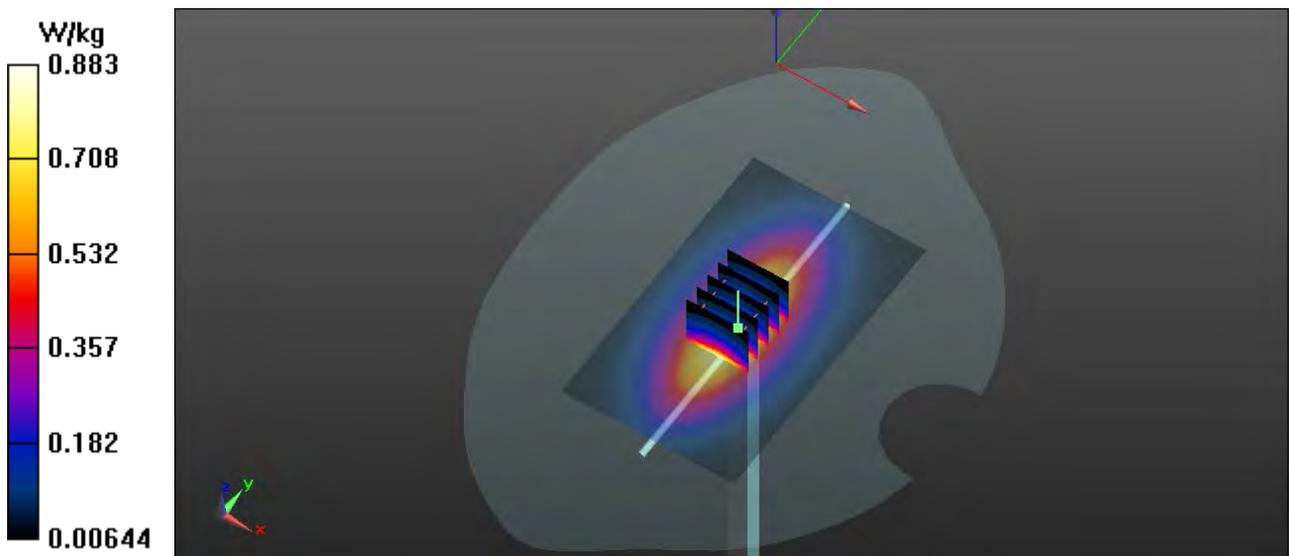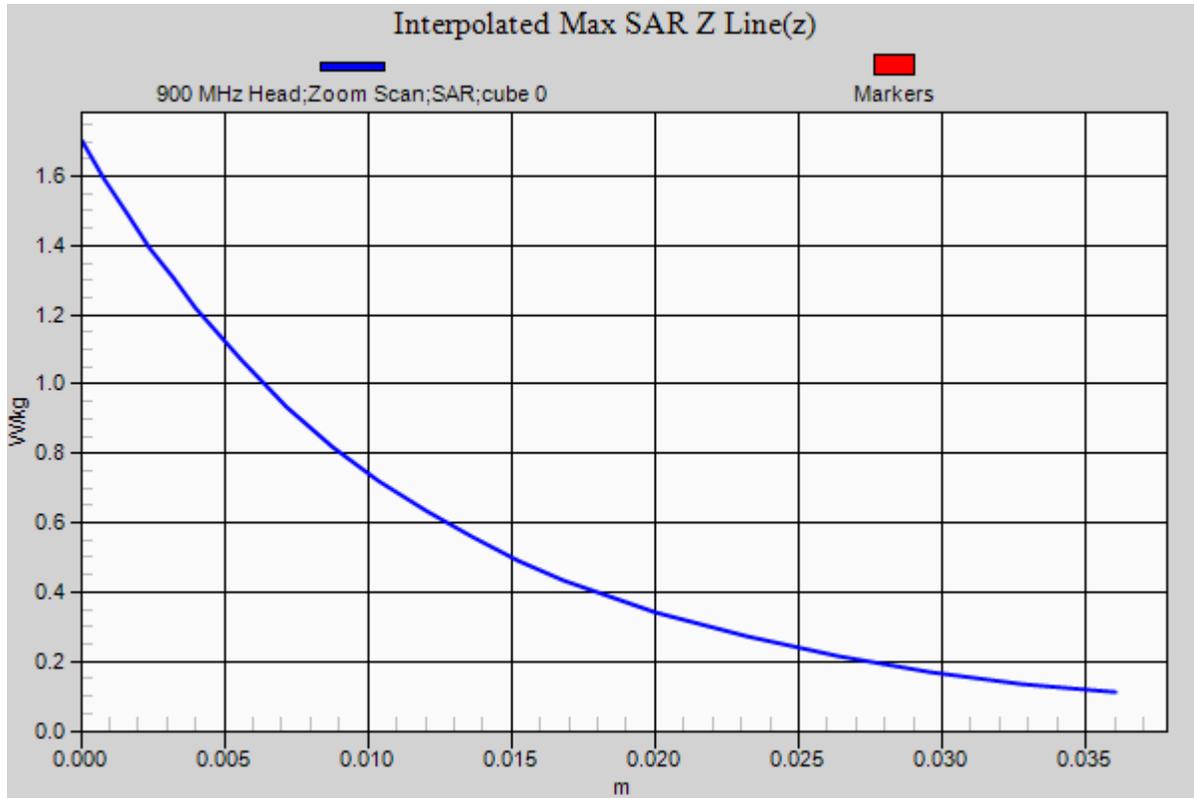
RF Exposure Lab

Plot 2

DUT: Dipole 900 MHz D900V2; Type: D900V2; Serial: D900V2 - SN:1d044

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used: f = 900 MHz; σ = 1 S/m; $ε_r$ = 40.76; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 10/2/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(10.14, 10.14, 10.14); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

900 MHz/Verification/Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.11 W/kg

900 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.867 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.71 W/kg
Pin=100 mW
SAR(1 g) = 1.04 W/kg; SAR(10 g) = 0.683 W/kg
Maximum value of SAR (measured) = 1.19 W/kg

RF Exposure Lab

Interpolated Max SAR Z Line(z)

Verification;Zoom Scan;SAR;cube 0   Markers
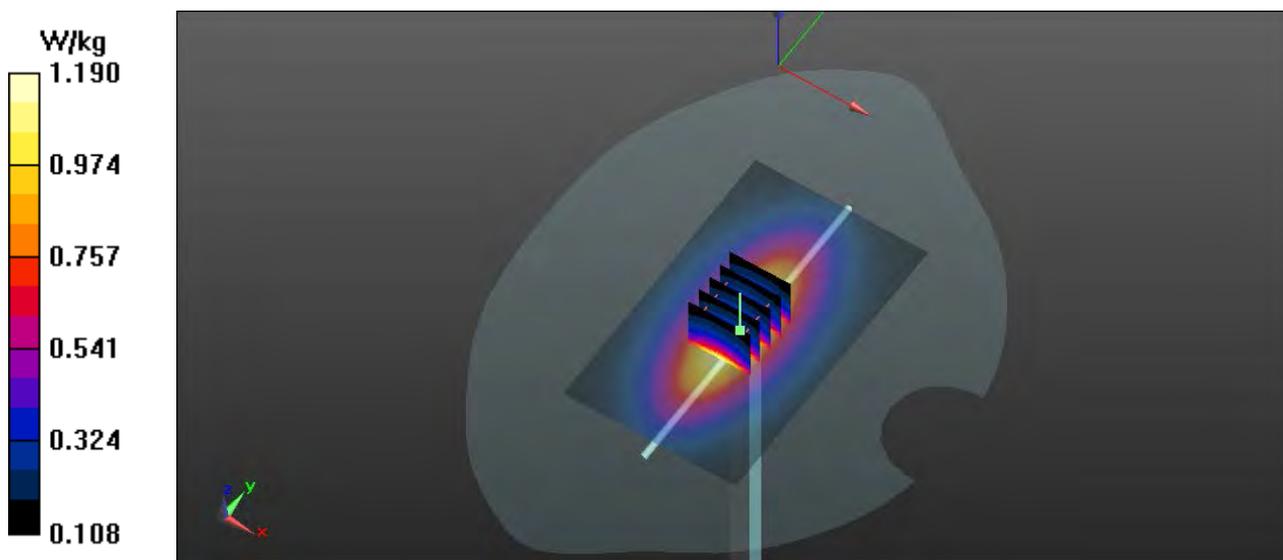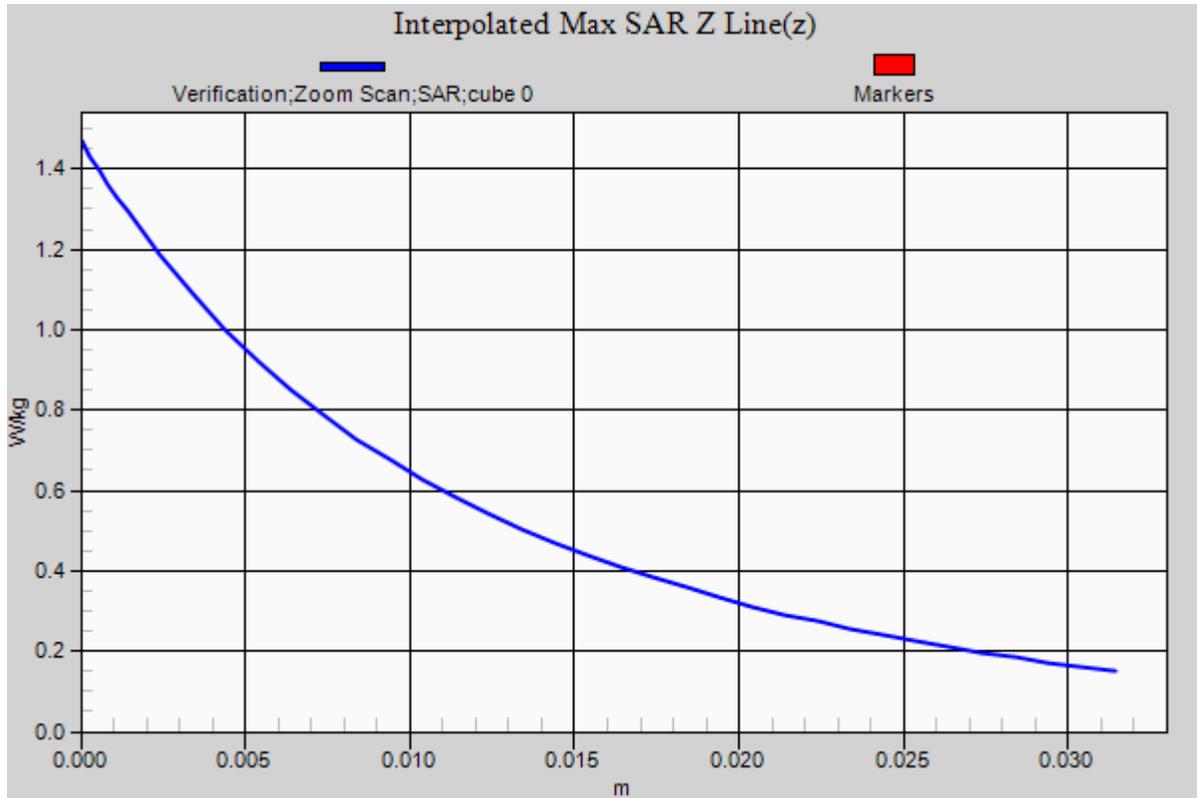
RF Exposure Lab

Plot 3

DUT: Dipole 1750 MHz D1750V2; Type: D1750V2; Serial: D1750V2 - SN: 1018

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used: f = 1750 MHz; σ = 1.4 S/m; $ε_r$ = 39.52; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 10/1/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(8.61, 8.61, 8.61); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1750 MHz/Verification/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.29 W/kg

**1750 MHz/Verification/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.428 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 6.91 W/kg
Pin=100 mW
SAR(1 g) = 3.69 W/kg; SAR(10 g) = 1.92 W/kg
Maximum value of SAR (measured) = 5.5 W/kg

Interpolated Max SAR Z Line(z)
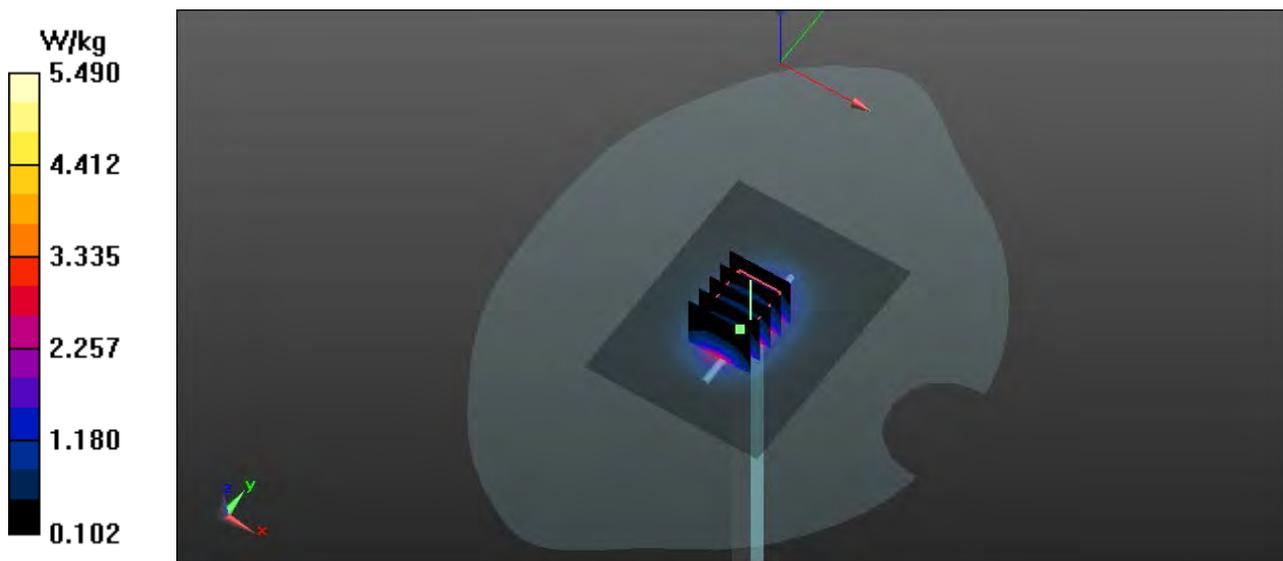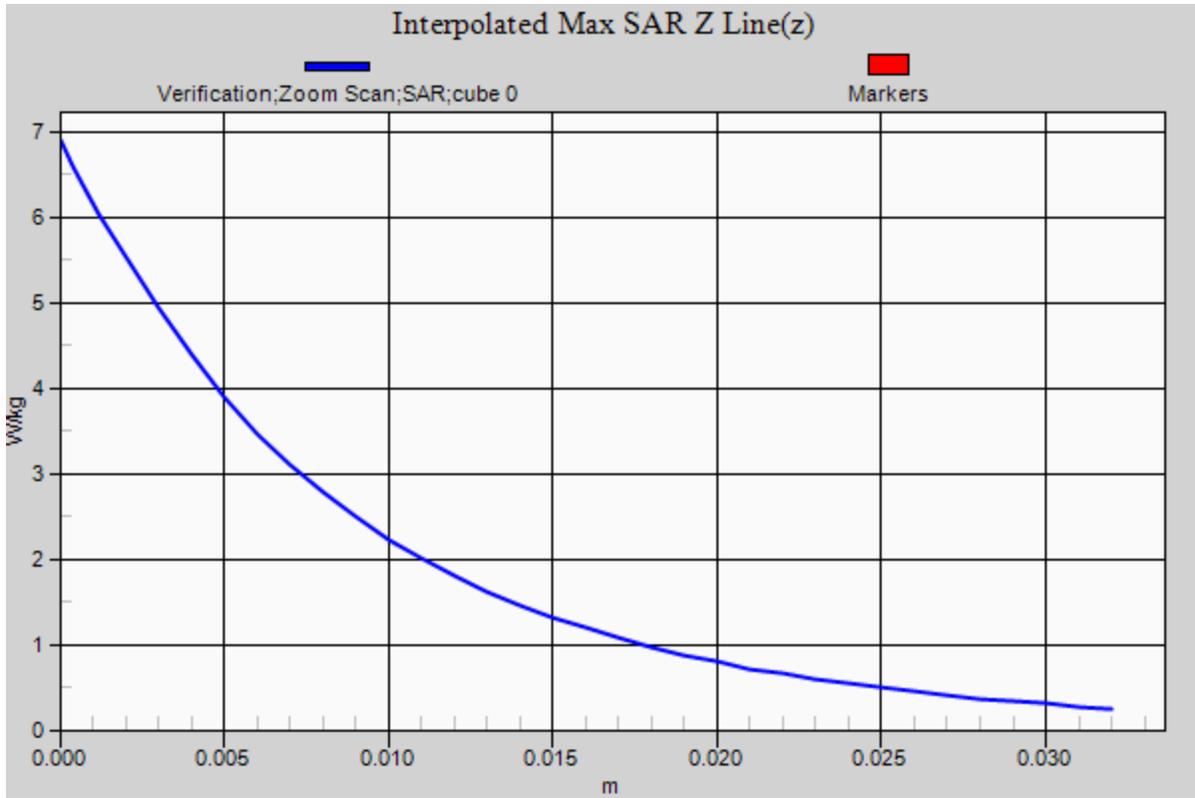
RF Exposure Lab

Plot 4

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN: 5d116

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1900 MHz; σ = 1.47 S/m; $ε_r$ = 39.68; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 10/1/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(8.31, 8.31, 8.31); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1900 MHz/Verification/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.56 W/kg

1900 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.957 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 7.21 W/kg
Pin=100 mW
SAR(1 g) = 4.11 W/kg; SAR(10 g) = 2.14 W/kg
Maximum value of SAR (measured) = 5.77 W/kg

Interpolated Max SAR Z Line(z)
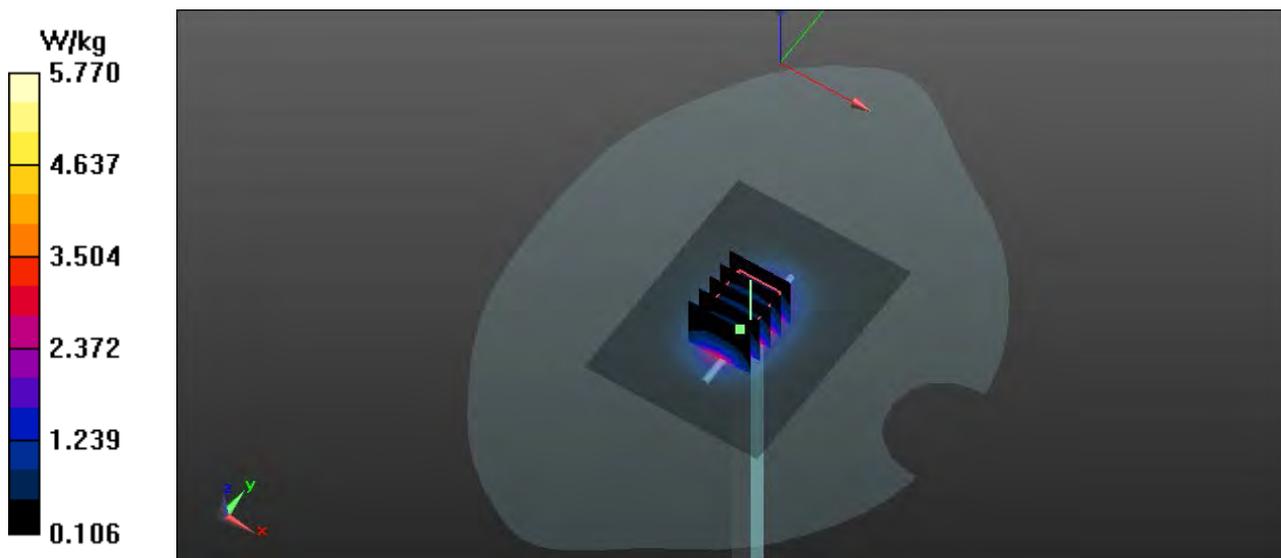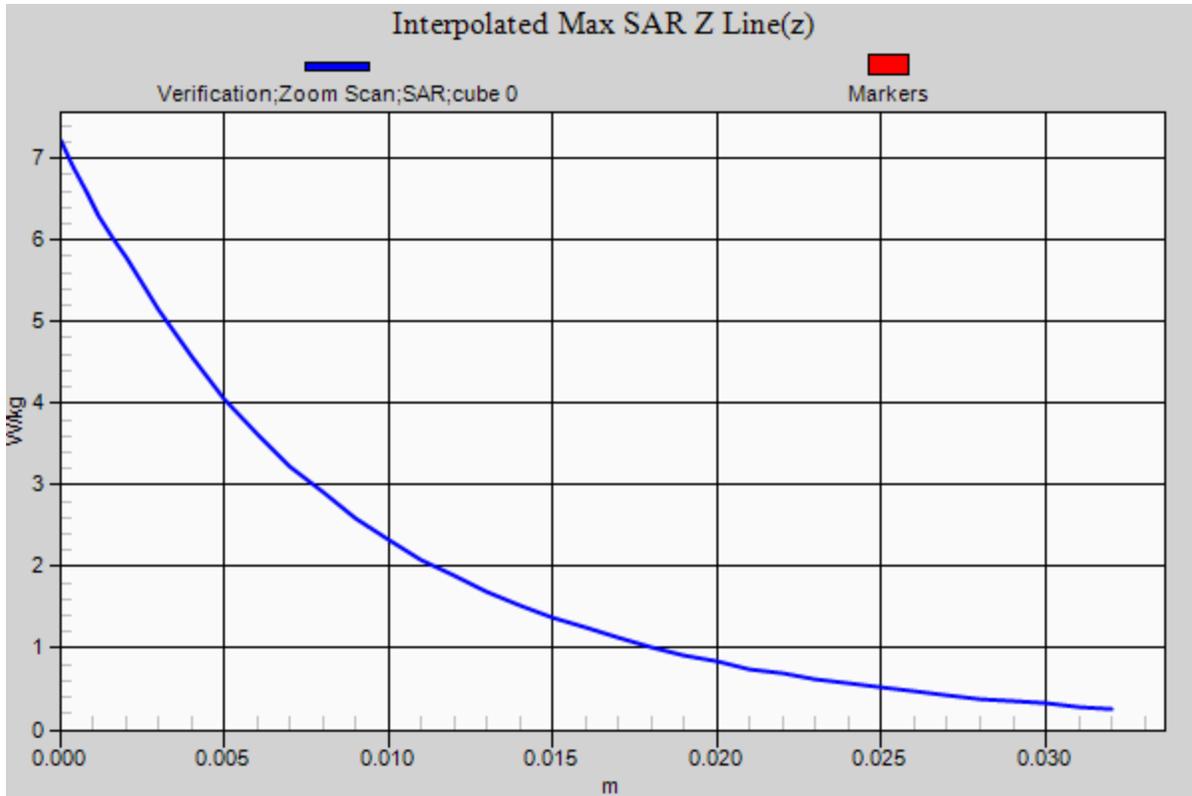
RF Exposure Lab

Plot 5

DUT: Dipole 2300 MHz D2300V2; Type: D2300V2; Serial: D2300V2 - SN: 1060

Communication System: CW; Frequency: 2300 MHz; Duty Cycle: 1:1
Medium: HSL2300; Medium parameters used: f = 2300 MHz; σ = 1.67 S/m; ε_r = 39.21; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 10/5/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(7.97, 7.97, 7.97); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2300 MHz Head/Verification/Area Scan (61x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.95 W/kg

2300 MHz Head/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.168 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 11.15 W/kg
P_{in}= 100 mW
SAR(1 g) = 4.89 W/kg; SAR(10 g) = 2.43 W/kg
Maximum value of SAR (measured) = 8.93 W/kg

Interpolated Max SAR Z Line(z)

2450 MHz Body;Zoom Scan;SAR;cube 0 — Markers
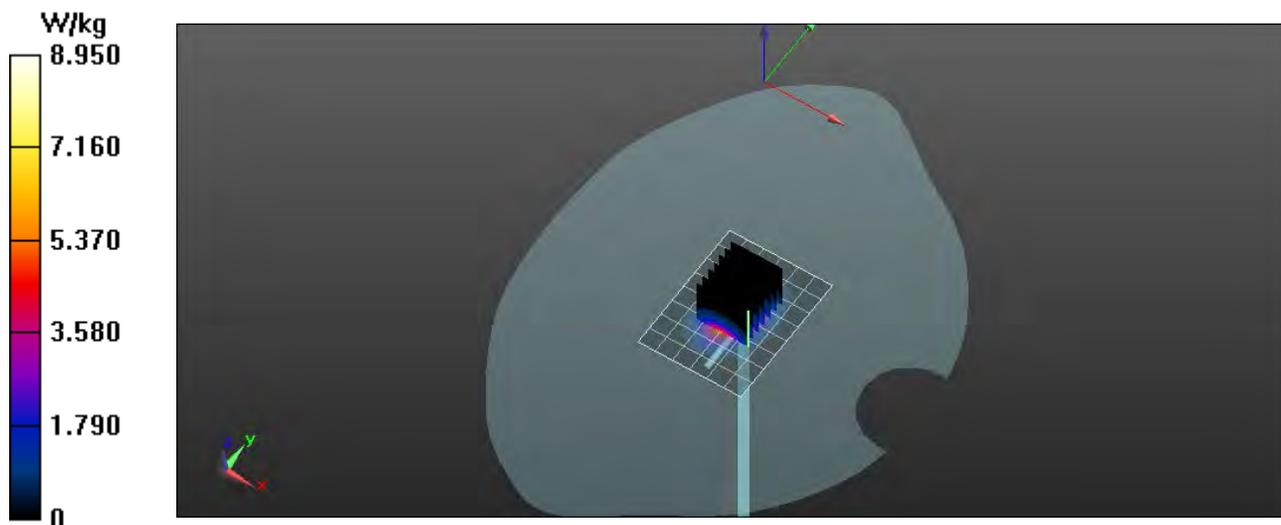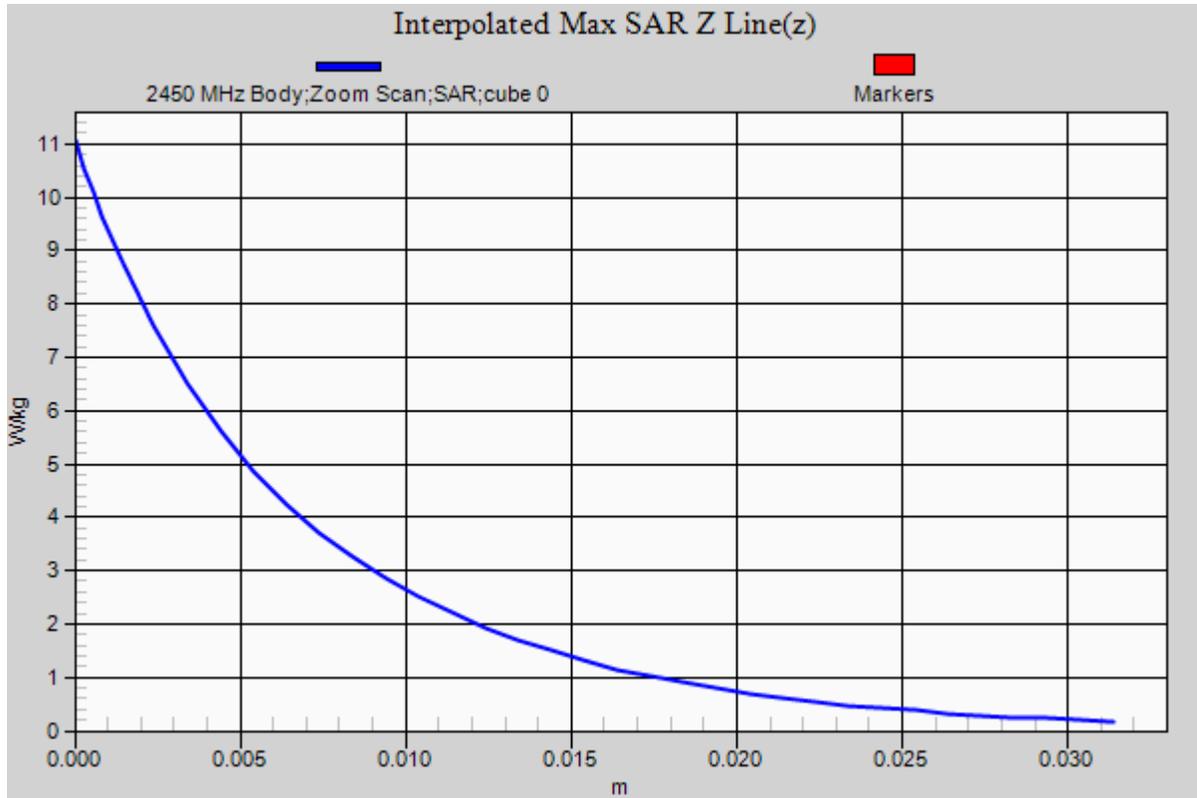
RF Exposure Lab

Plot 6

DUT: Dipole 2550 MHz D2550V2; Type: D2550V2; Serial: D2550V2 - SN:1003

Communication System: CW; Frequency: 2550 MHz; Duty Cycle: 1:1
Medium: HSL2550; Medium parameters used: f = 2550 MHz; σ = 1.96 S/m; $ε_r$ = 38.49; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 10/5/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(7.4, 7.4, 7.4); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2550 MHz Body/Verification/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 9.01 W/kg

2550 MHz Body/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.364 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 11.48 W/kg
Pin=100 mW
SAR(1 g) = 5.69 W/kg; SAR(10 g) = 2.52 W/kg
Maximum value of SAR (measured) = 9.18 W/kg

Interpolated Max SAR Z Line(z)
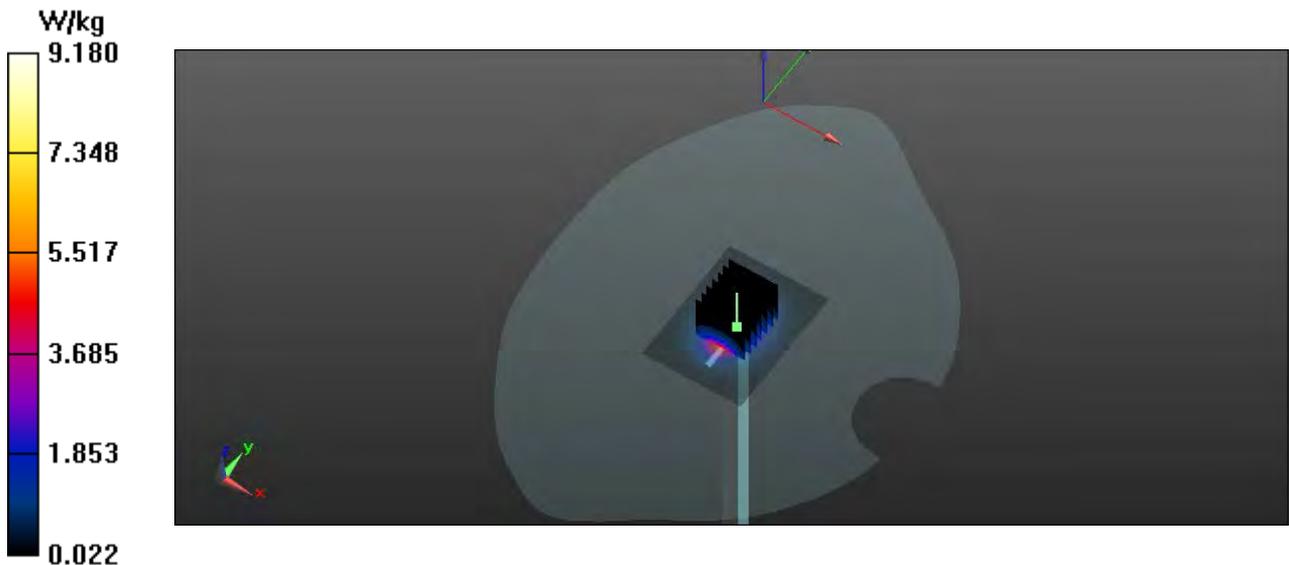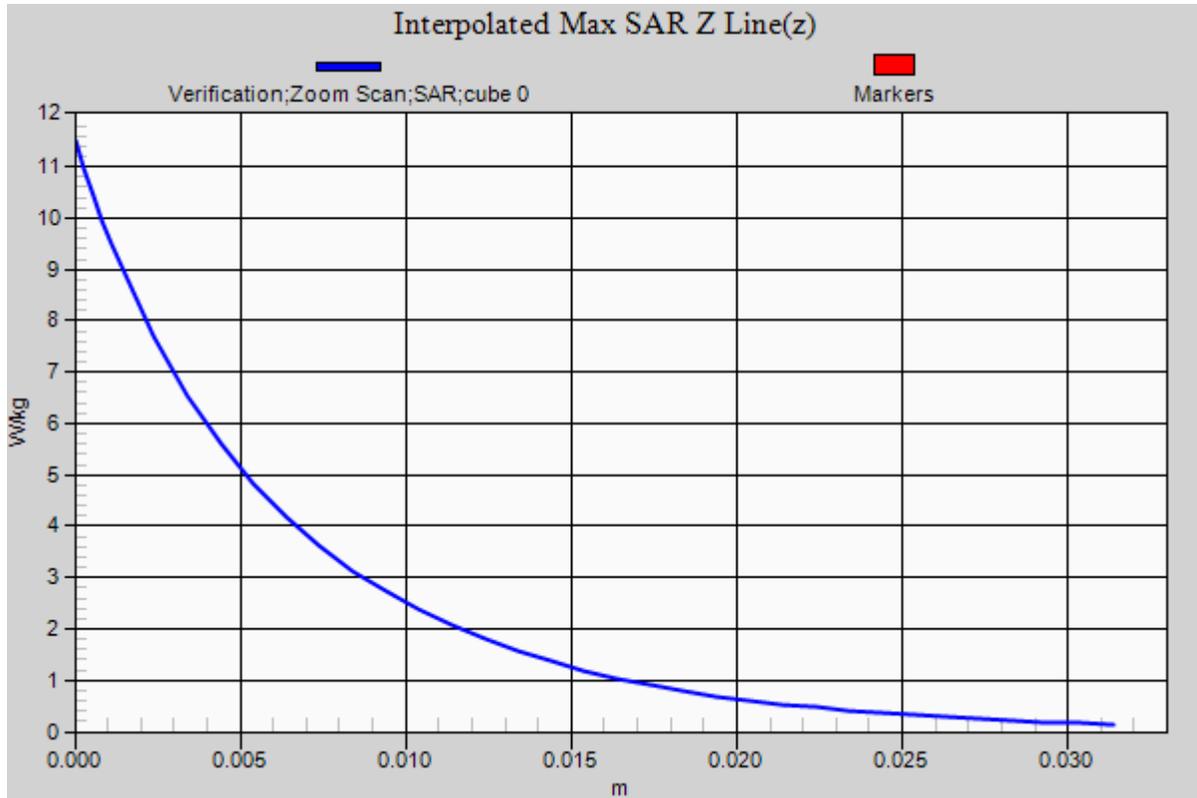
RF Exposure Lab
Plot 7
DUT: Dipole D3500V2; Type: D3500V2; Serial: D3500V2 - SN:1061

Communication System: CW; Frequency: 3500 MHz; Duty Cycle: 1:1
Medium: HSL3GHz; Medium parameters used: f = 3500 MHz; σ = 2.98 S/m; ε_r = 37.11; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 10/6/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(7.2, 7.2, 7.2); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

3500 MHz Head/Verification/Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.27 W/kg

3500 MHz Head/Verification/Zoom Scan (8x8x15)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 56.224 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.01 W/kg
Pin=10 mW
SAR(1 g) = 0.682 W/kg; SAR(10 g) = 0.261 W/kg
Maximum value of SAR (measured) = 1.57 W/kg

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Interpolated Max SAR Z Line(z)

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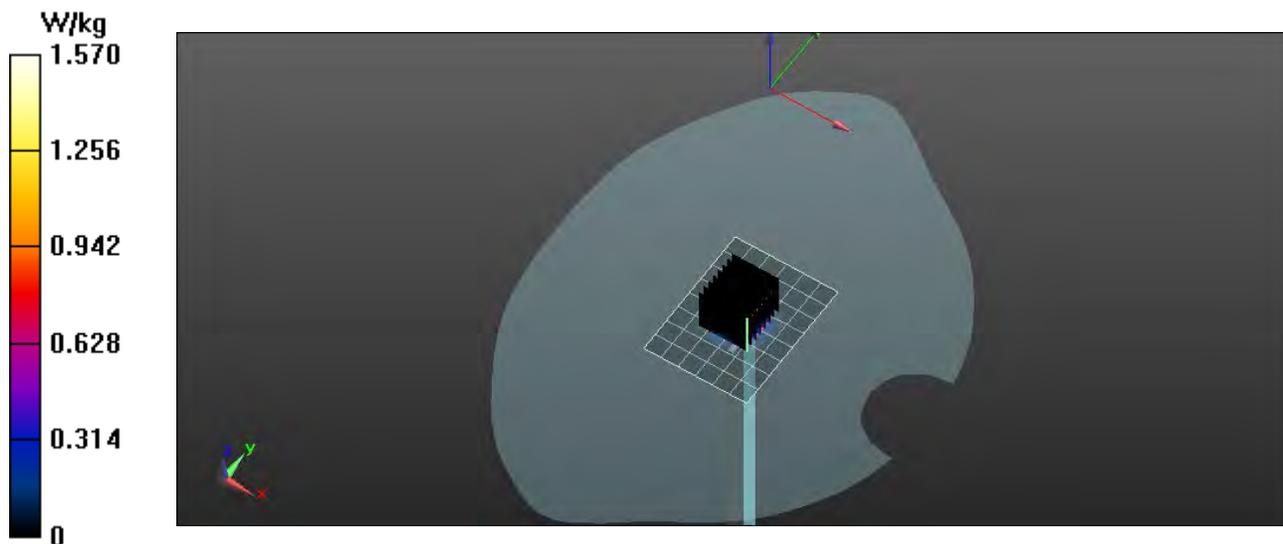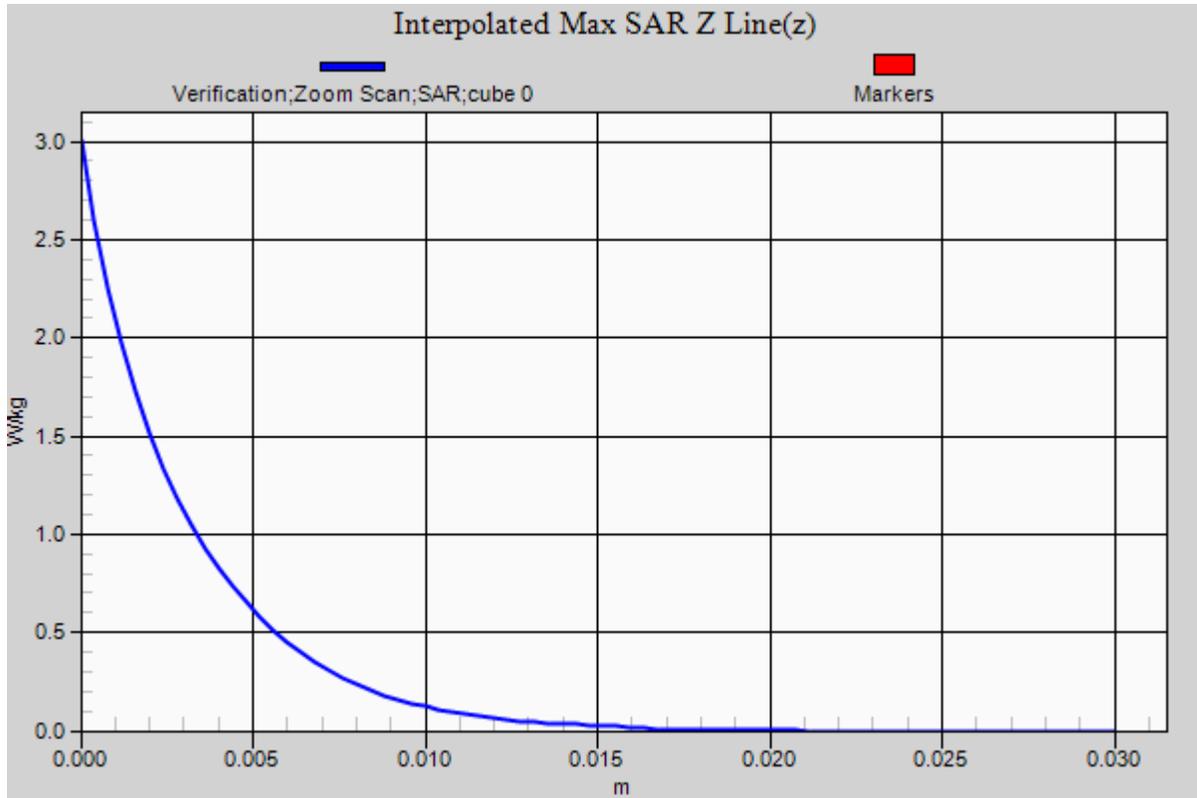
RF Exposure Lab

## Plot 8

DUT: Dipole D3700V2; Type: D3700V2; Serial: D3700V2 - SN:1024

Communication System: CW; Frequency: 3700 MHz; Duty Cycle: 1:1
Medium: HSL3-6GHz; Medium parameters used: f = 3700 MHz; σ = 3.18 S/m; ε_r = 36.64; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 10/6/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(6.96, 6.96, 6.96); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

3700 MHz Head/Verification/Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.24 W/kg

3700 MHz Head/Verification/Zoom Scan (8x8x15)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 54.368 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.32 W/kg
Pin=10 mW
SAR(1 g) = 0.692 W/kg; SAR(10 g) = 0.251 W/kg
Maximum value of SAR (measured) = 1.67 W/kg

RF Exposure Lab

Interpolated Max SAR Z Line(z)

Verification;Zoom Scan;SAR;cube 0 — Markers
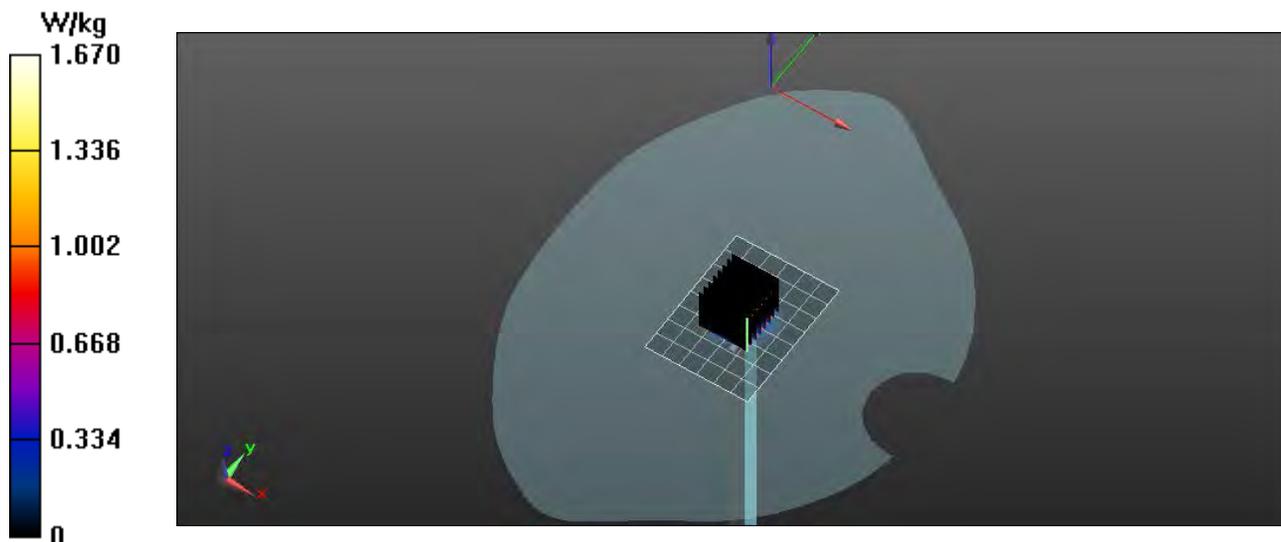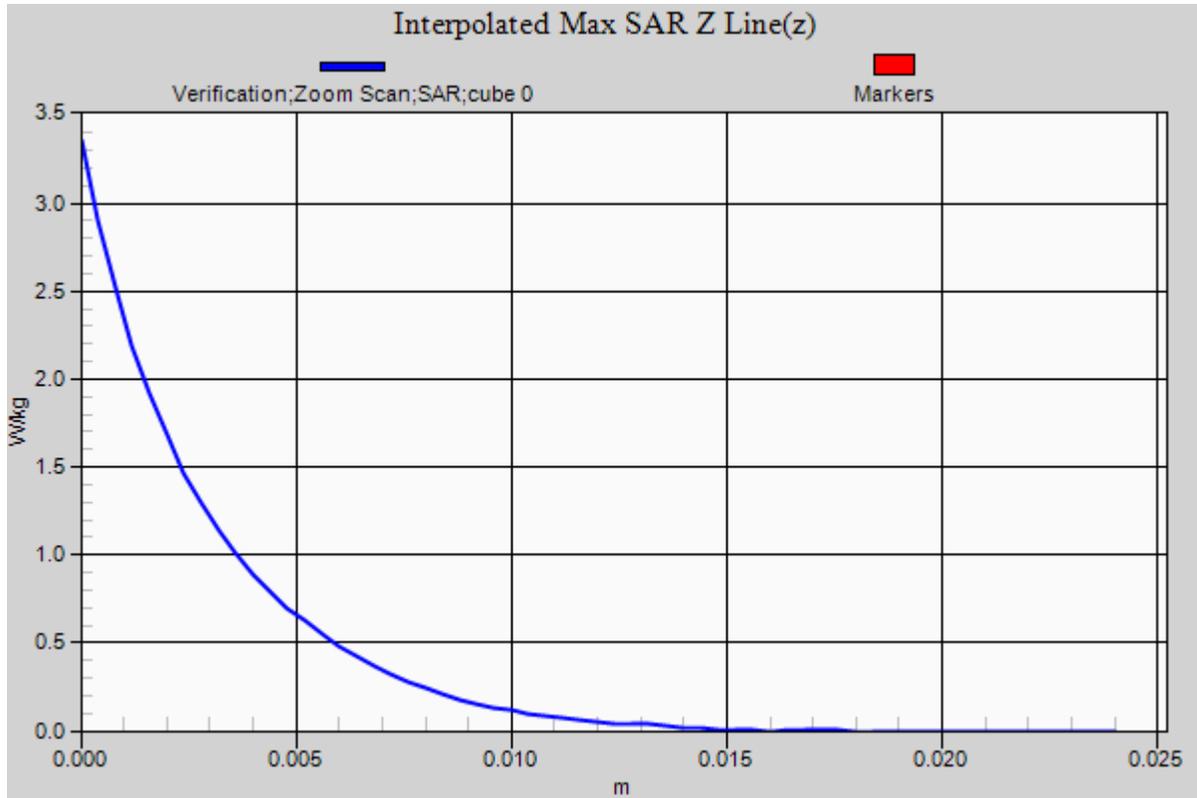
RF Exposure Lab

Plot 9

DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN 1016

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 750 MHz; σ = 0.91 S/m; $ε_r$ = 41.55; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 9/29/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(10.56, 10.56, 10.56); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

750 MHz Head/Verification/Area Scan (41x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.752 W/kg

750 MHz Head/Verification /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 35.839 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.693 mW/g
P_{in}= 100 mW
SAR(1 g) = 0.826 mW/g; SAR(10 g) = 0.535 mW/g
Maximum value of SAR (measured) = 0.883 W/kg

Interpolated Max SAR Z Line(z)

900 MHz Head;Zoom Scan;SAR;cube 0   Markers
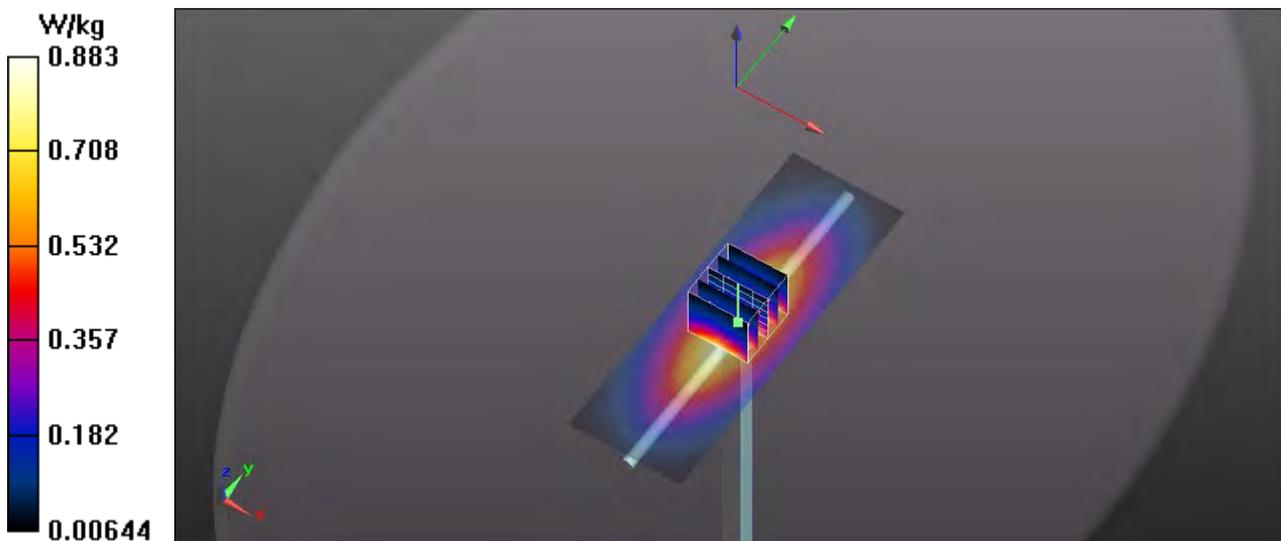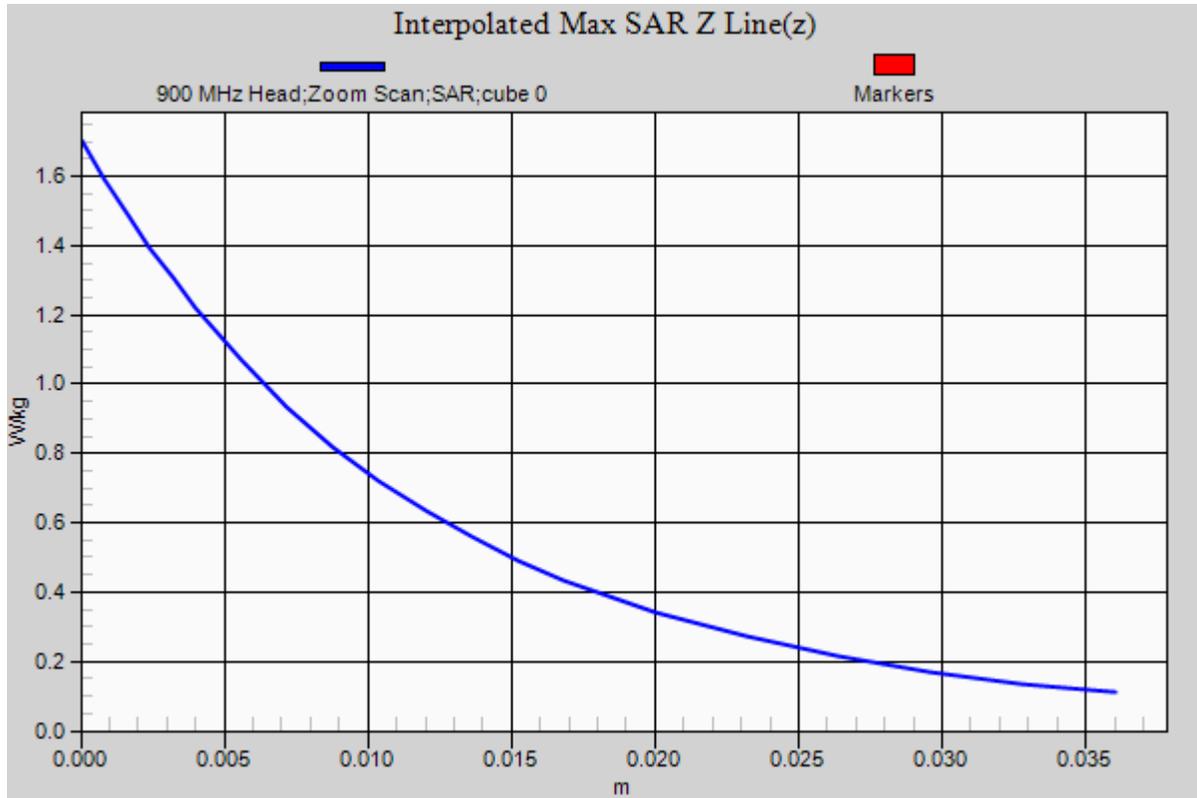
RF Exposure Lab

Plot 10

DUT: Dipole 900 MHz D900V2; Type: D900V2; Serial: D900V2 - SN:1d044

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used: f = 900 MHz; σ = 1.01 S/m; $ε_r$ = 41.14; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/29/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(10.14, 10.14, 10.14); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

900 MHz/Verification/Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.13 W/kg

900 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.125 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.46 W/kg
Pin=100 mW
SAR(1 g) = 1.07 W/kg; SAR(10 g) = 0.684 W/kg
Maximum value of SAR (measured) = 1.21 W/kg

RF Exposure Lab

Interpolated Max SAR Z Line(z)

Verification;Zoom Scan;SAR;cube 0   Markers
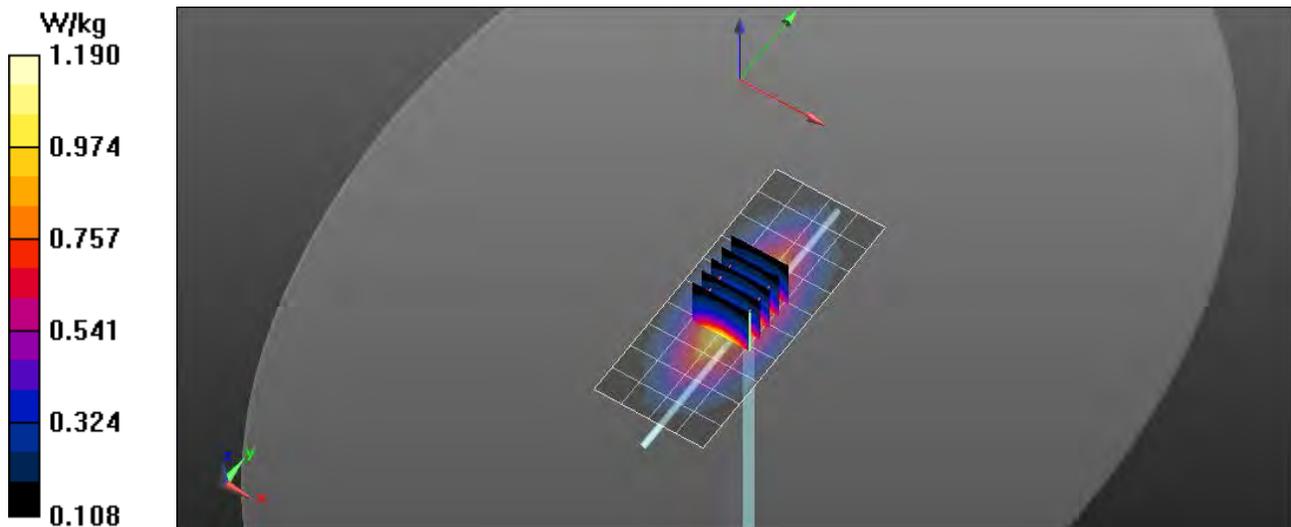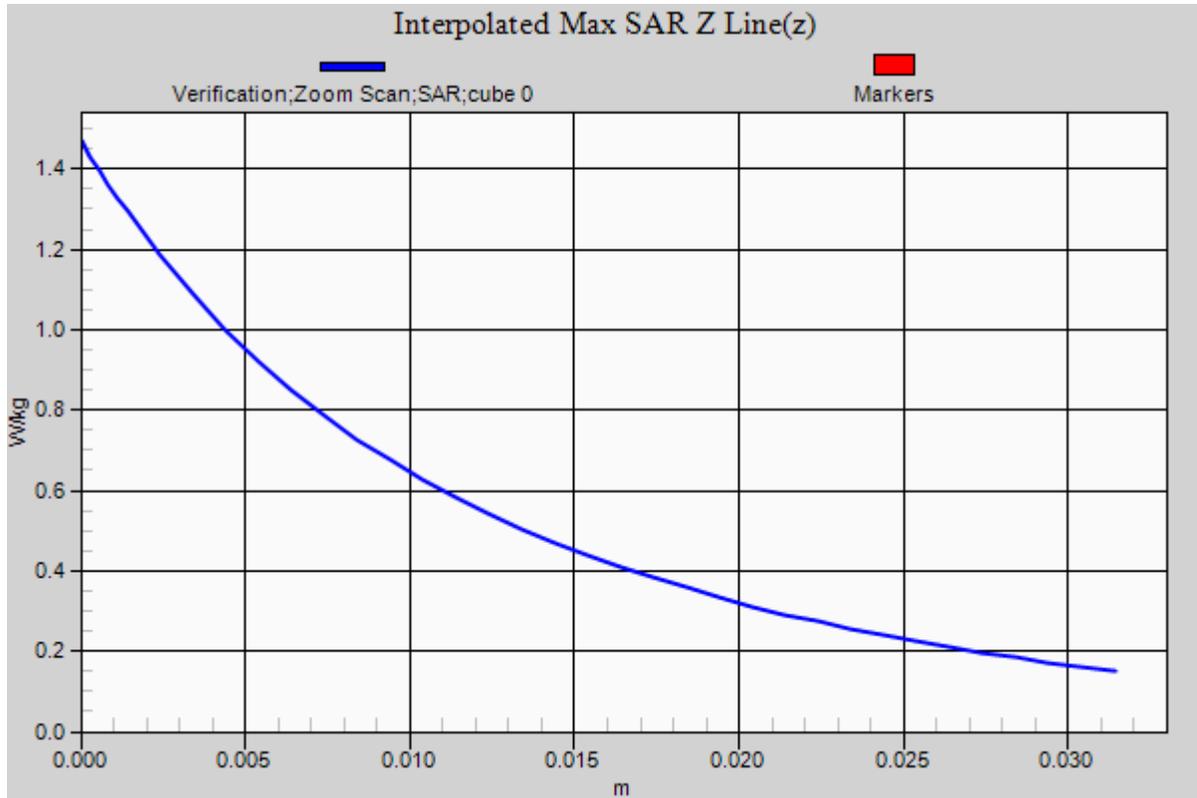
RF Exposure Lab

Plot 11

DUT: Dipole 1750 MHz D1750V2; Type: D1750V2; Serial: D1750V2 - SN: 1018

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used: f = 1750 MHz; σ = 1.42 S/m; ε_r = 39.63; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 9/28/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(8.61, 8.61, 8.61); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1750 MHz/Verification/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.22 W/kg

1750 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 35.426 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 6.88 W/kg
Pin=100 mW
SAR(1 g) = 3.67 W/kg; SAR(10 g) = 1.91 W/kg
Maximum value of SAR (measured) = 5.49 W/kg

Interpolated Max SAR Z Line(z)

Verification;Zoom Scan;SAR;cube 0   Markers
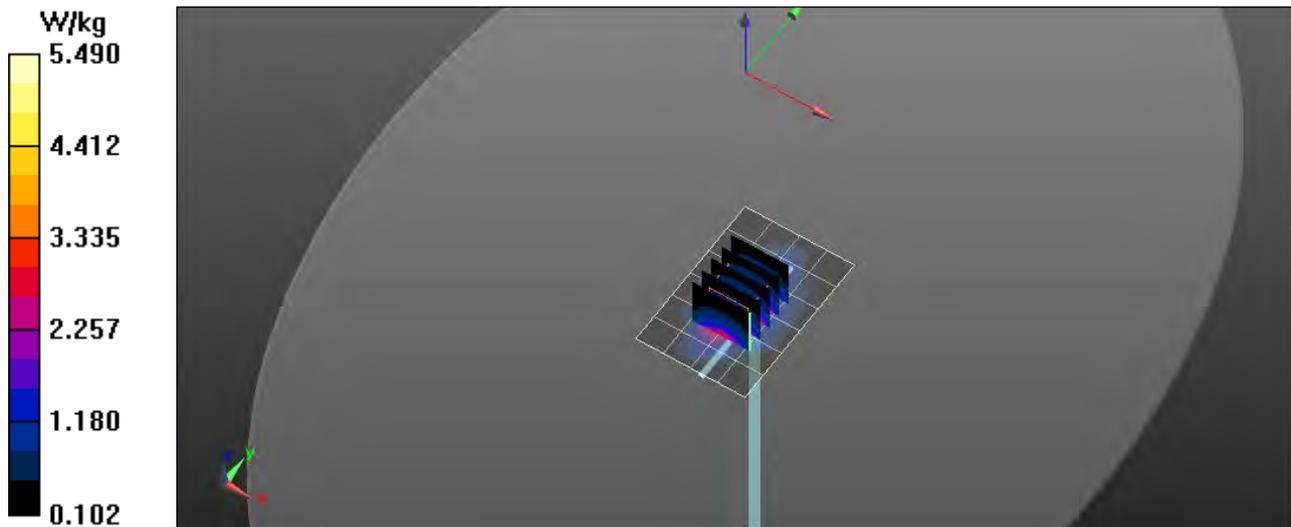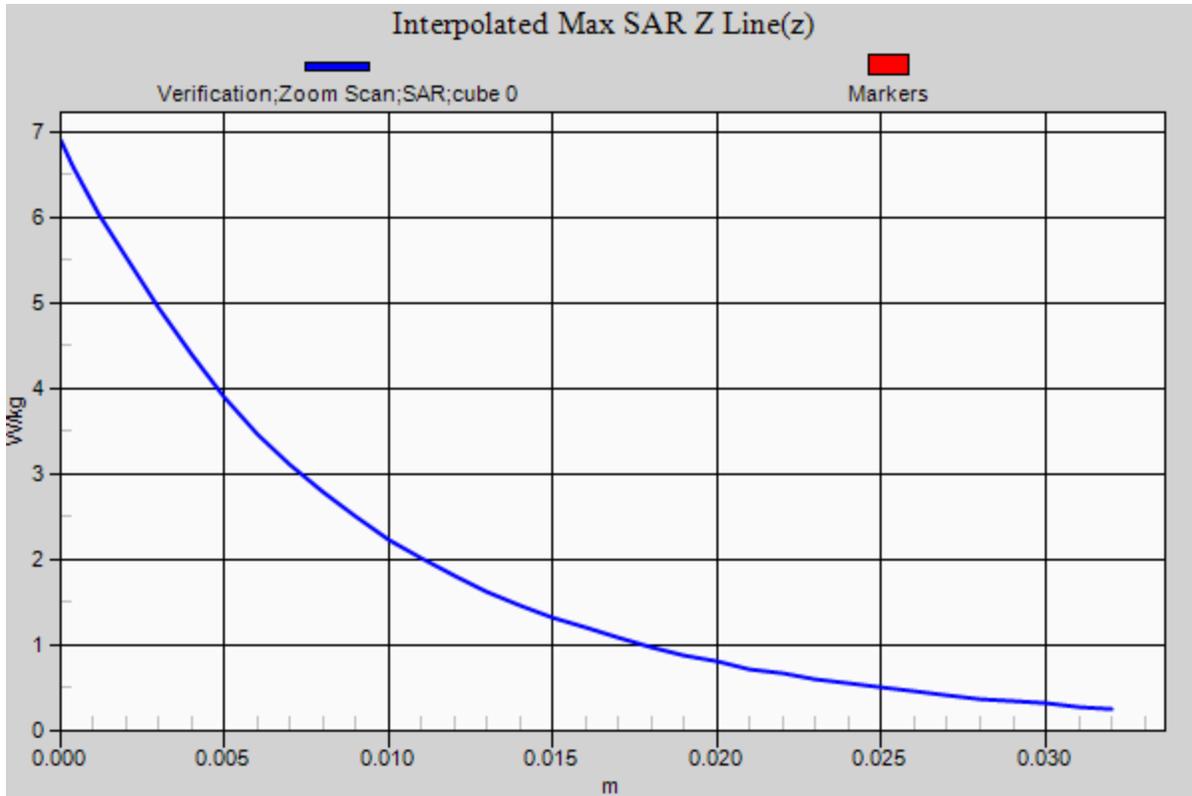
RF Exposure Lab

Plot 12

### DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN: 5d116

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1900 MHz; σ = 1.44 S/m; ε_r = 39.46; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/28/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(8.31, 8.31, 8.31); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1900 MHz/Verification/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.41 W/kg

1900 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.114 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 7.18 W/kg
Pin=100 mW
SAR(1 g) = 4.09 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 5.76 W/kg

Interpolated Max SAR Z Line(z)
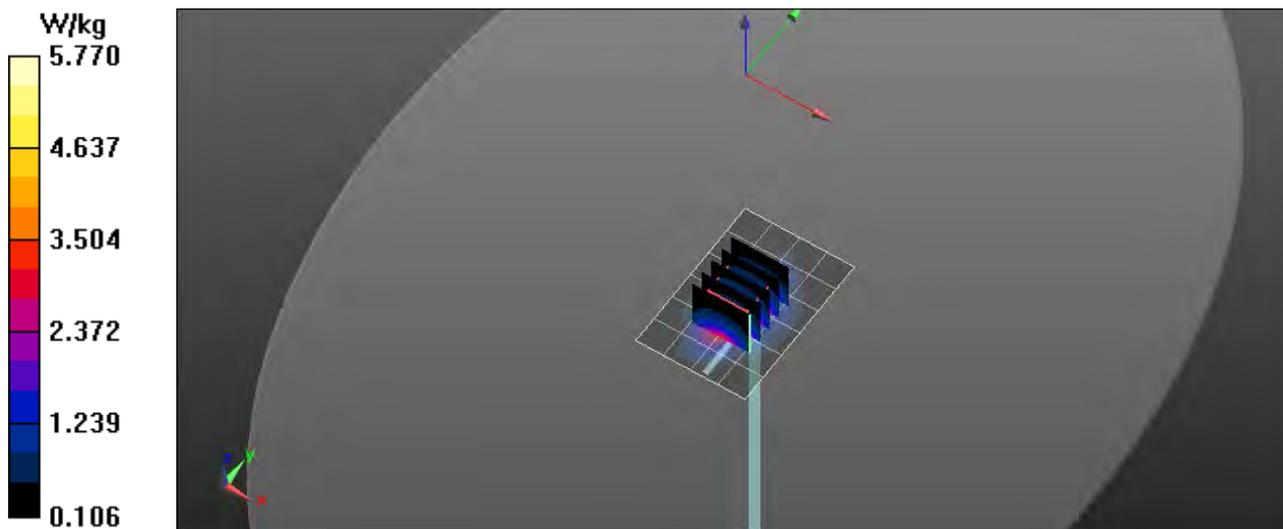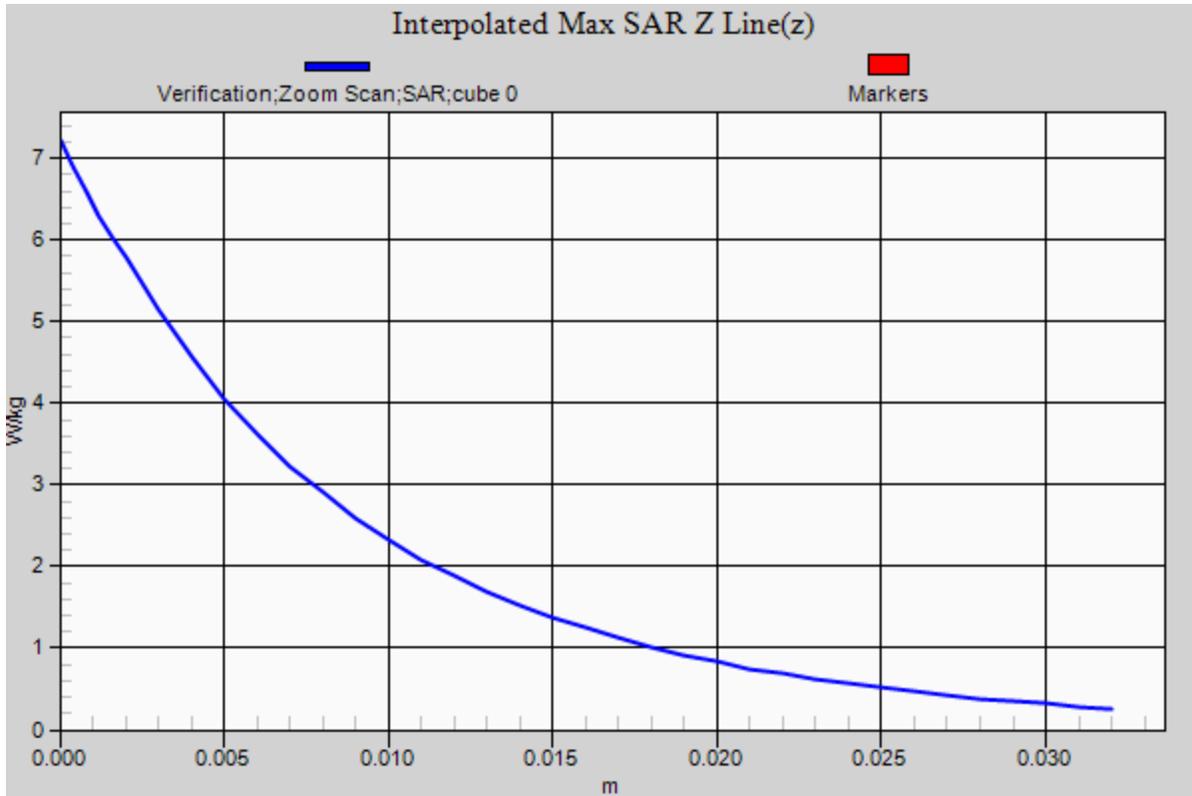
RF Exposure Lab

Plot 13

DUT: Dipole 2300 MHz D2300V2; Type: D2300V2; Serial: D2300V2 - SN: 1060

Communication System: CW; Frequency: 2300 MHz; Duty Cycle: 1:1
Medium: HSL2300; Medium parameters used: f = 2300 MHz; σ = 1.69 S/m; ε_r = 38.8; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 9/30/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(7.97, 7.97, 7.97); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2300 MHz Head/Verification/Area Scan (61x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.16 W/kg

2300 MHz Head/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.697 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 11.05 W/kg
P_{in}= 100 mW
SAR(1 g) = 4.92 W/kg; SAR(10 g) = 2.42 W/kg
Maximum value of SAR (measured) = 8.95 W/kg

Interpolated Max SAR Z Line(z)

2450 MHz Body;Zoom Scan;SAR;cube 0   Markers
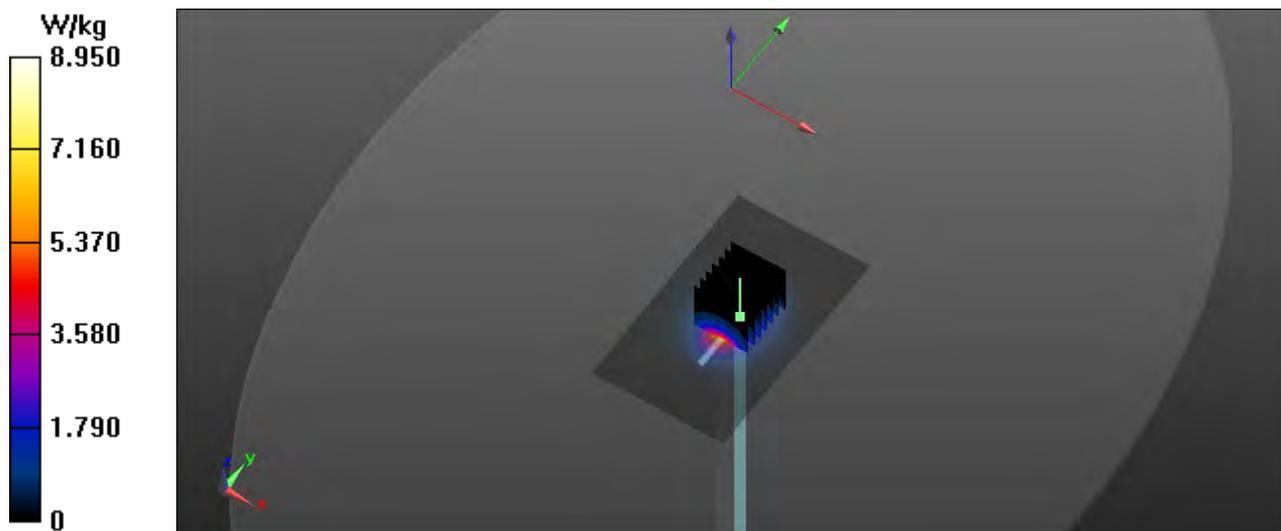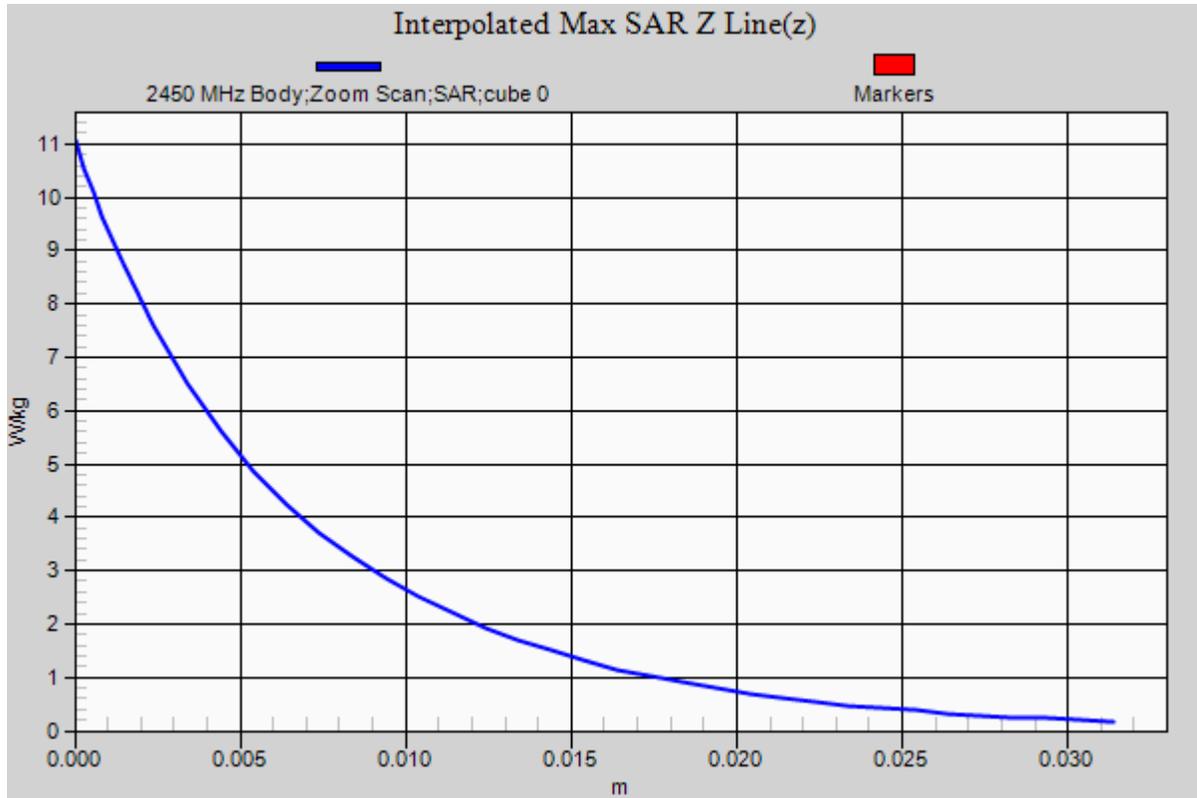
RF Exposure Lab

Plot 14

DUT: Dipole 2550 MHz D2550V2; Type: D2550V2; Serial: D2550V2 - SN:1003

Communication System: CW; Frequency: 2550 MHz; Duty Cycle: 1:1
Medium: HSL2550; Medium parameters used: f = 2550 MHz; σ = 1.94 S/m; ε_r = 38.68; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 9/30/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(7.4, 7.4, 7.4); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2550 MHz Body/Verification/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 8.95 W/kg

2550 MHz Body/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.249 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 11.43 W/kg
Pin=100 mW
SAR(1 g) = 5.67 W/kg; SAR(10 g) = 2.51 W/kg
Maximum value of SAR (measured) = 9.17 W/kg

W/kg
9.180
7.348
5.517
3.685
1.853
0.022

Interpolated Max SAR Z Line(z)
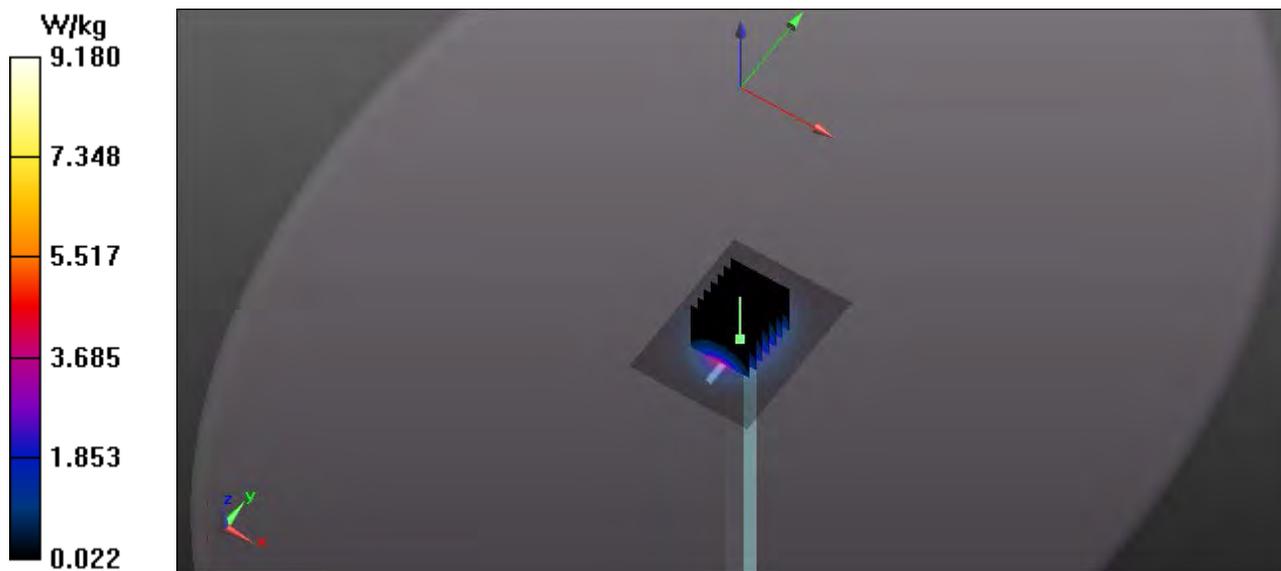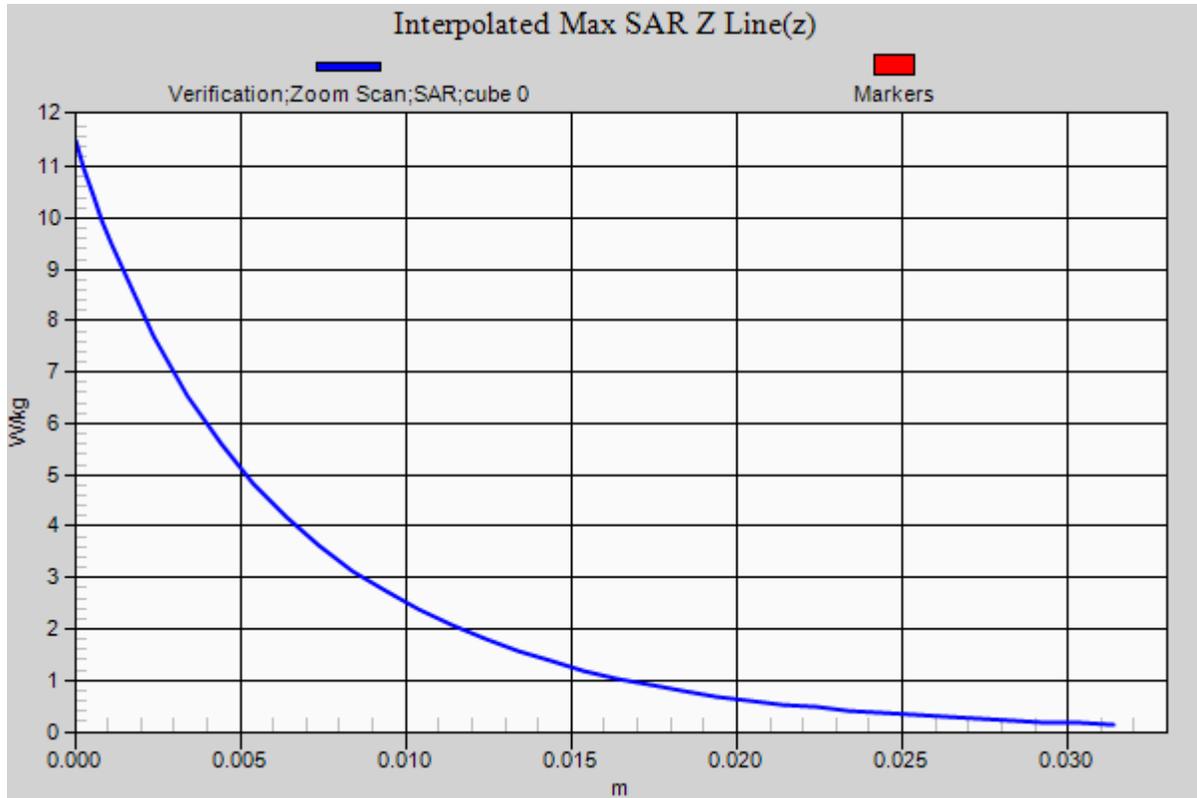
RF Exposure Lab

Plot 15

DUT: Dipole D3500V2; Type: D3500V2; Serial: D3500V2 - SN:1061

Communication System: CW; Frequency: 3500 MHz; Duty Cycle: 1:1
Medium: HSL3GHz; Medium parameters used: f = 3500 MHz; σ = 2.94 S/m; ε_r = 37.34; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 10/1/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(7.2, 7.2, 7.2); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

3500 MHz Head/Verification/Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.31 W/kg

3500 MHz Head/Verification/Zoom Scan (8x8x15)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 54.926 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.02 W/kg
Pin=10 mW
SAR(1 g) = 0.685 W/kg; SAR(10 g) = 0.262 W/kg
Maximum value of SAR (measured) = 1.56 W/kg

Interpolated Max SAR Z Line(z)

Verification;Zoom Scan;SAR;cube 0   Markers
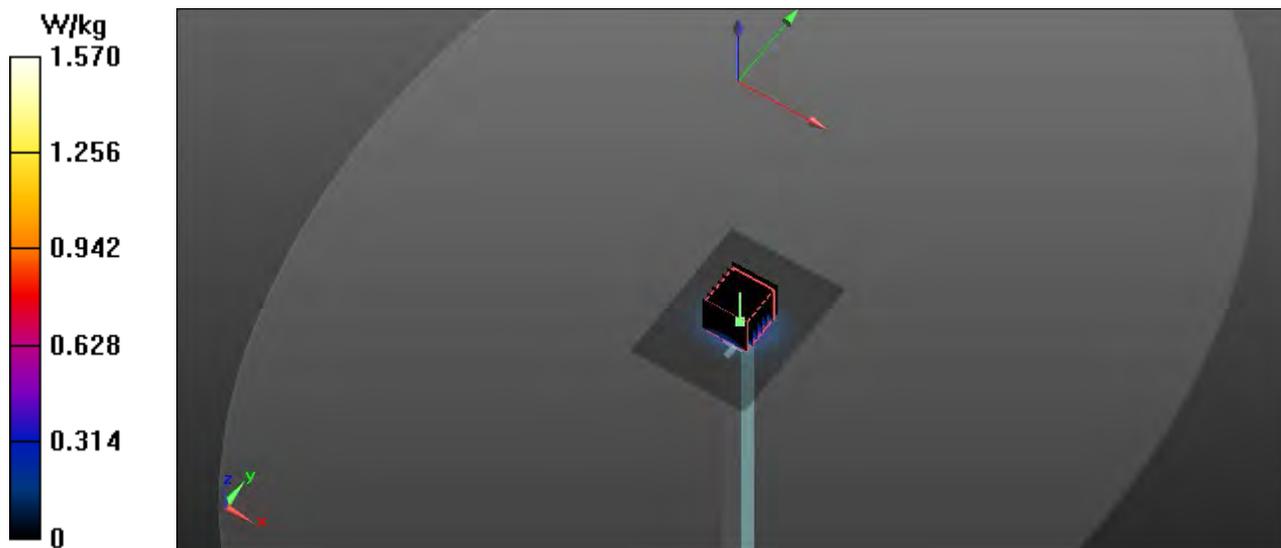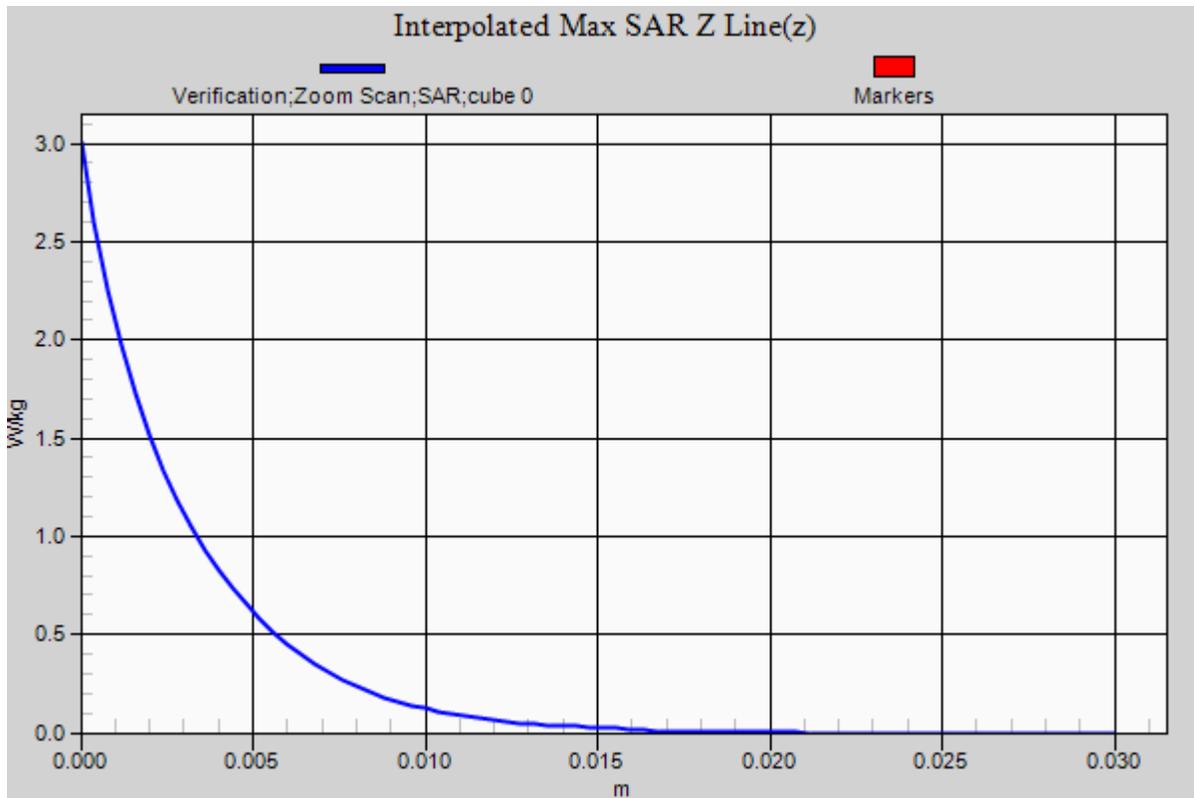
RF Exposure Lab

Plot 16

DUT: Dipole D3700V2; Type: D3700V2; Serial: D3700V2 - SN:1024

Communication System: CW; Frequency: 3700 MHz; Duty Cycle: 1:1
Medium: HSL3-6GHz; Medium parameters used: f = 3700 MHz; σ = 3.14 S/m; ε_r = 36.87; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 10/1/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(6.96, 6.96, 6.96); Calibrated: 1/21/2020;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 7/10/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

3700 MHz Head/Verification/Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.26 W/kg

3700 MHz Head/Verification/Zoom Scan (8x8x15)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 56.441 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.35 W/kg
Pin=10 mW
SAR(1 g) = 0.701 W/kg; SAR(10 g) = 0.254 W/kg
Maximum value of SAR (measured) = 1.68 W/kg
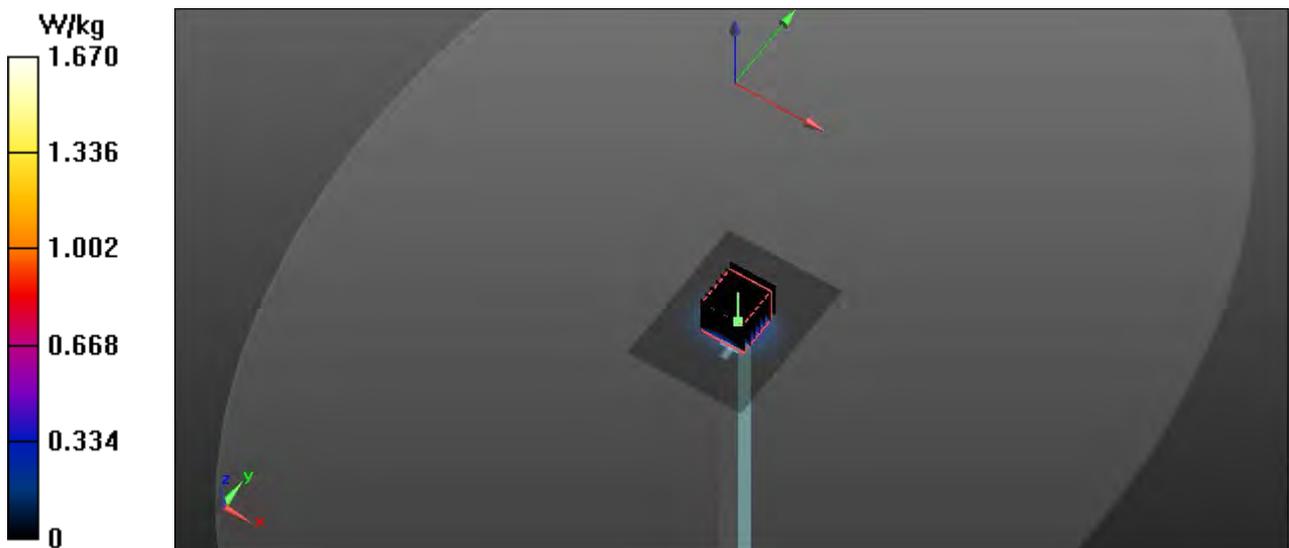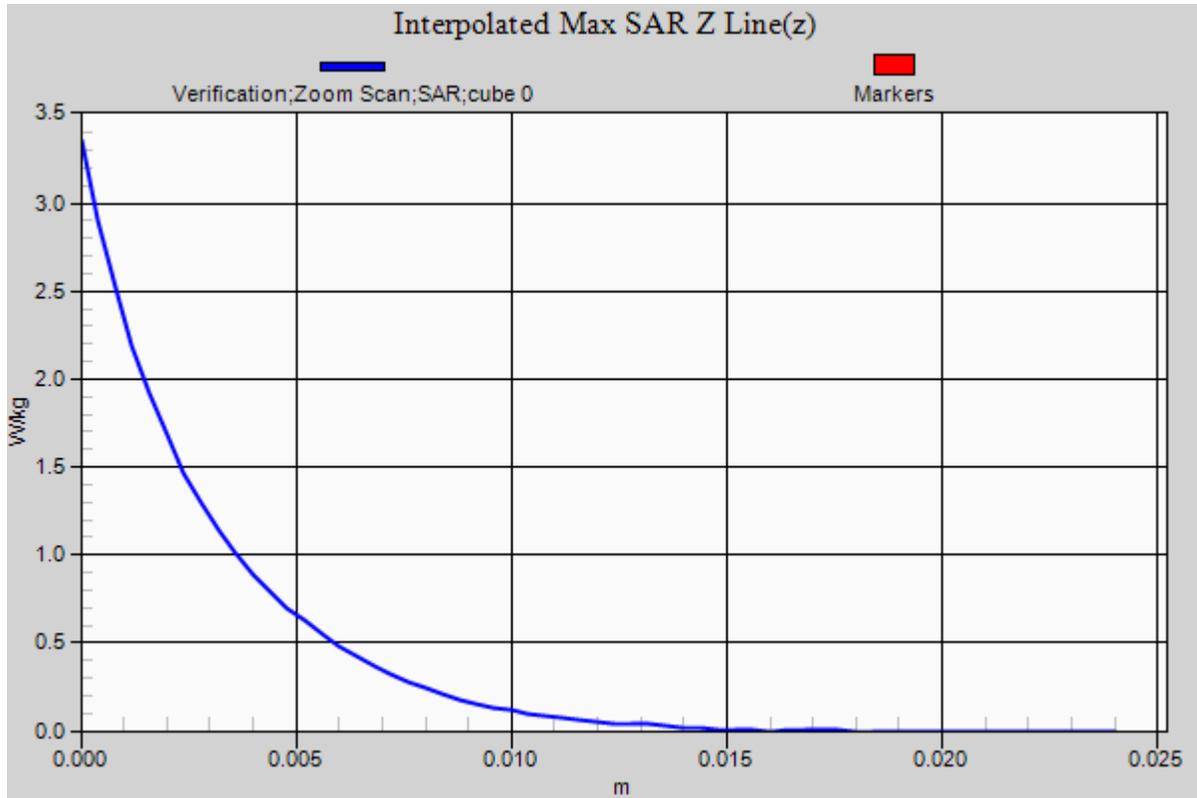
RF Exposure Lab

Appendix B – SAR Test Data Plots

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RF Exposure Lab

Plot 1

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 680.5 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 680.5 MHz; σ = 0.87 S/m; ε$_r$ = 41.688; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 10/2/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.56, 10.56, 10.56); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

600 Head/LTE B71 iPhone SE 1 RB 49 Offset Left Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.327 W/kg

600 Head/LTE B71 iPhone SE 1 RB 49 Offset Left Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.03 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.448 W/kg
SAR(1 g) = 0.264 W/kg; SAR(10 g) = 0.171 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.359 W/kg
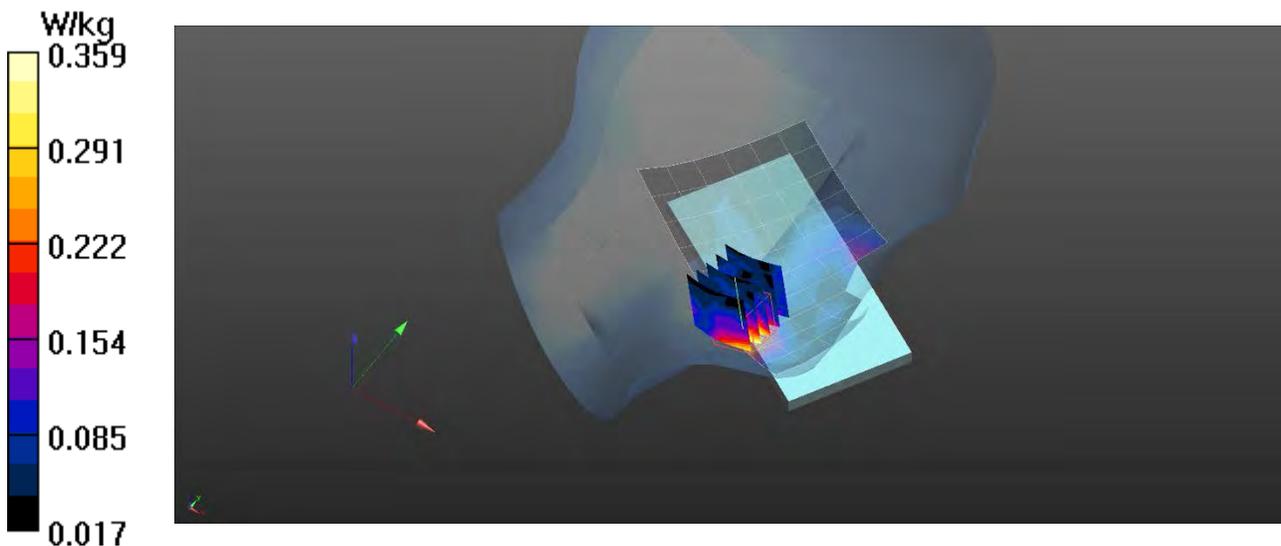
RF Exposure Lab

Plot 2

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 707.5 MHz; σ = 0.878 S/m; ε_r = 41.558; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 10/2/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.56, 10.56, 10.56); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

750 Right Head/LTE B12 iPhone SE Right 1 RB 24 Offset Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.389 W/kg

750 Right Head/LTE B12 iPhone SE Right 1 RB 24 Offset Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.49 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.447 W/kg
SAR(1 g) = 0.311 W/kg; SAR(10 g) = 0.204 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.397 W/kg
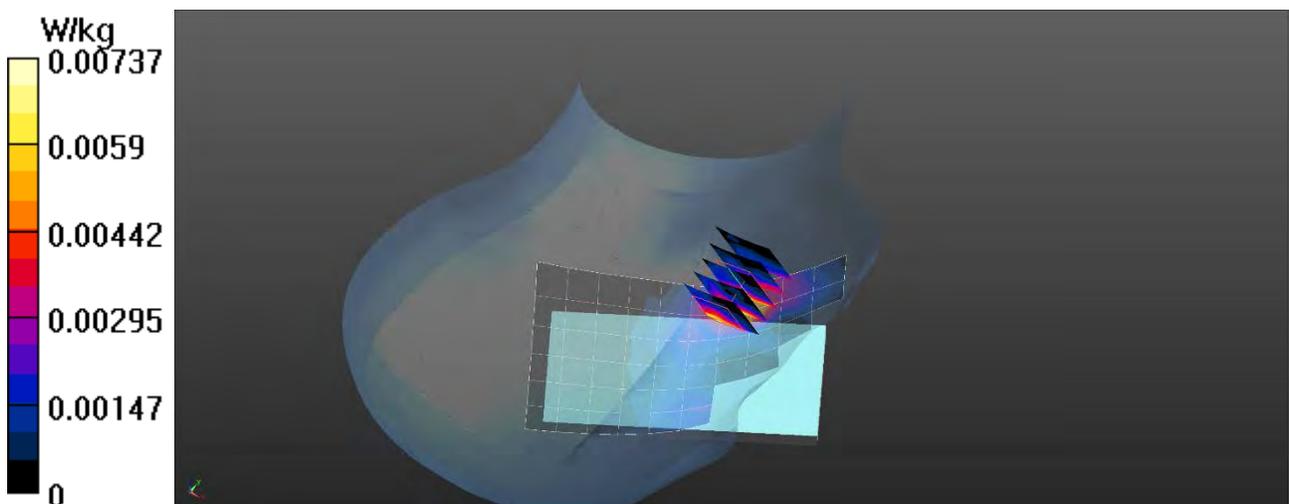
RF Exposure Lab

Plot 3

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 782 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 782 MHz; σ = 0.932 S/m; ε_r = 41.118; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 10/2/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.56, 10.56, 10.56); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

750 Left Head/LTE B13 iPhone SE 1 RB 24 Offset Left Baseline/Area Scan (7x11x1): Measurement grid:
dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.465 W/kg

750 Left Head/LTE B13 iPhone SE 1 RB 24 Offset Left Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid:
dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.09 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.612 W/kg
SAR(1 g) = 0.356 W/kg; SAR(10 g) = 0.202 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.473 W/kg
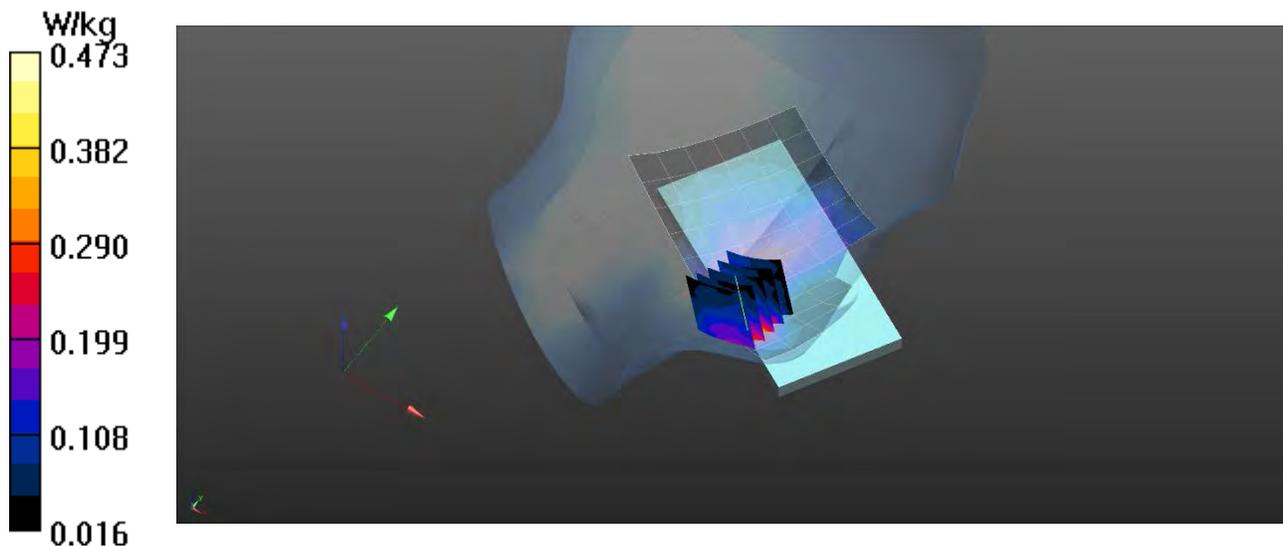
RF Exposure Lab

Plot 4

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 793 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 793 MHz; σ = 0.94 S/m; ε_r = 41.058; ρ = 1000 kg/m³
Phantom section: Left Section

Test Date: Date: 10/2/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.56, 10.56, 10.56); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

750 Left Head/LTE B14 iPhone SE 1 RB 24 Offset Left Baseline/Area Scan (7x11x1): Measurement grid:
dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.518 W/kg

750 Left Head/LTE B14 iPhone SE 1 RB 24 Offset Left Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid:
dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.58 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.655 W/kg
SAR(1 g) = 0.334 W/kg; SAR(10 g) = 0.218 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.460 W/kg

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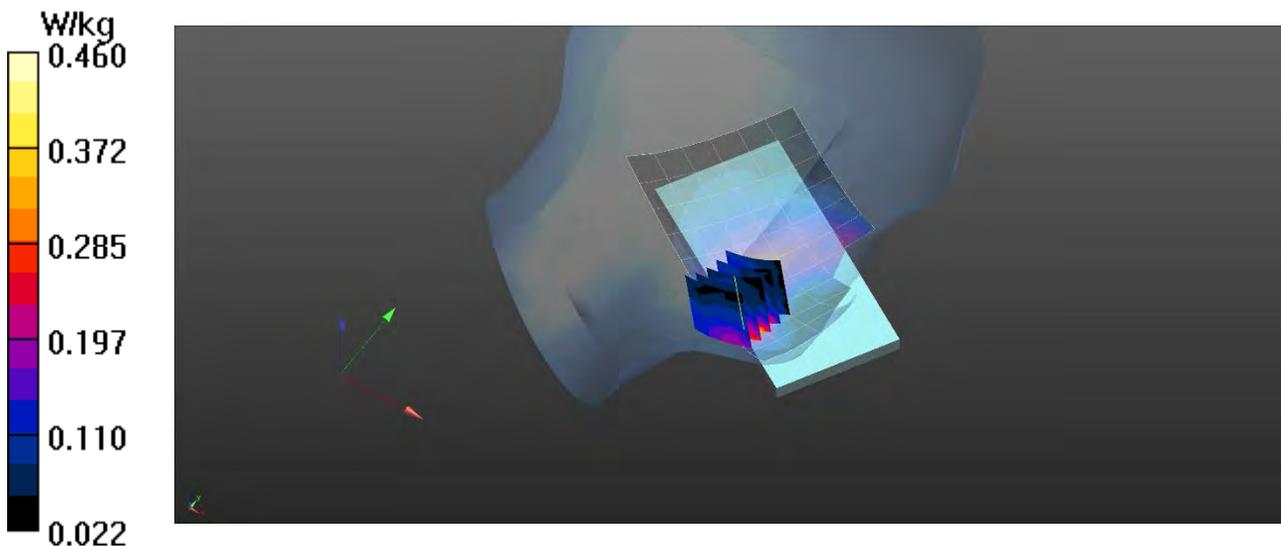
RF Exposure Lab

Plot 5

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used (interpolated): f = 836.52 MHz; σ = 0.937 S/m; ε_r = 40.851; ρ = 1000 kg/m³
Phantom section: Left Section

Test Date: Date: 10/2/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.14, 10.14, 10.14); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

850 Head/CDMA iPhone SE Left Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.584 W/kg

850 Head/CDMA iPhone SE Left Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.02 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.03 W/kg
SAR(1 g) = 0.468 W/kg; SAR(10 g) = 0.229 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.742 W/kg
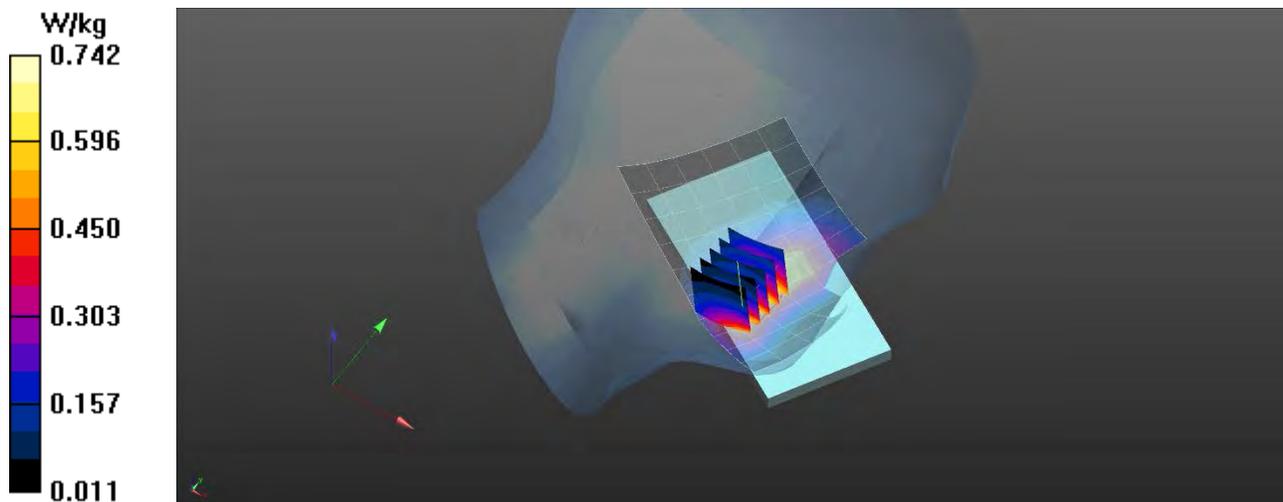
RF Exposure Lab

Plot 6

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.937 S/m; $ε_r$ = 40.85; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 10/2/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.14, 10.14, 10.14); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

850 Head/WCDMA iPhone SE Left Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.472 W/kg

**850 Head/WCDMA iPhone SE Left Baseline/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.47 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.694 W/kg
SAR(1 g) = 0.399 W/kg; SAR(10 g) = 0.257 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.531 W/kg
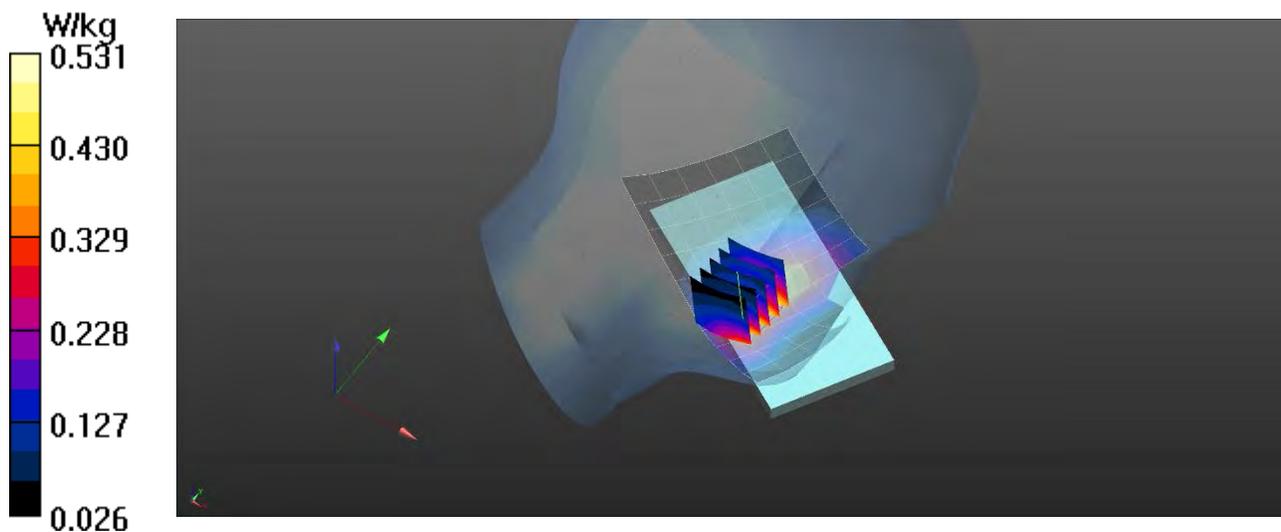
RF Exposure Lab

Plot 7

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 831.5 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used (interpolated): f = 831.5 MHz; σ = 0.932 S/m; ε_r = 40.866; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 10/2/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.14, 10.14, 10.14); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

850 Head/LTE B26 iPhone SE Left 1 RB 24 Offset Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.529 W/kg

850 Head/LTE B26 iPhone SE Left 1 RB 24 Offset Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid:
dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.912 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.716 W/kg
SAR(1 g) = 0.479 W/kg; SAR(10 g) = 0.274 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.641 W/kg
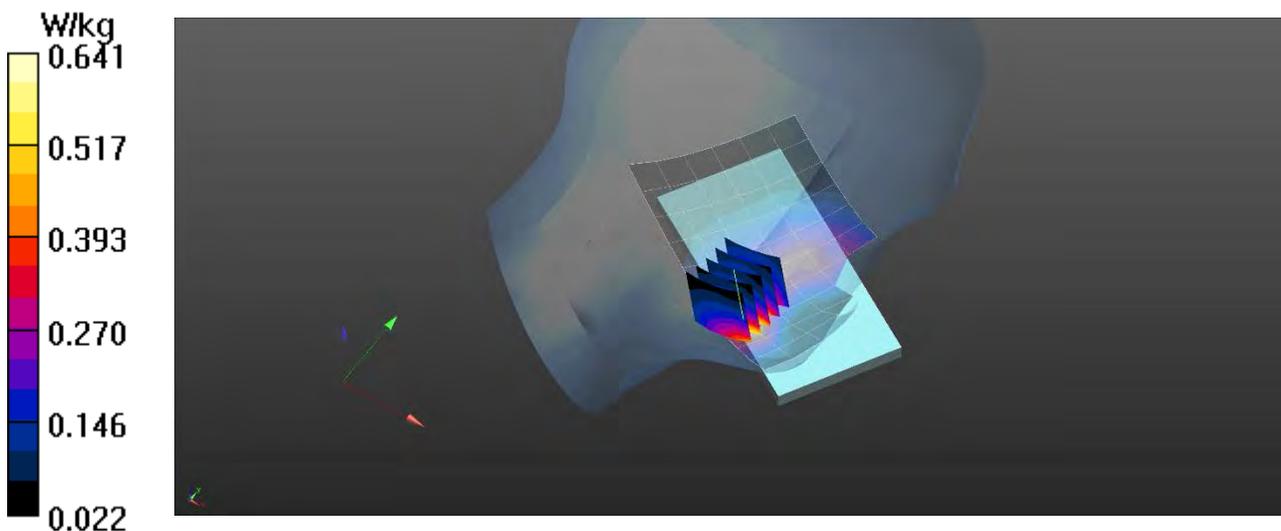
RF Exposure Lab

Plot 8

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 1732.6 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used (interpolated): f = 1732.6 MHz; σ = 1.383 S/m; $ε_r$ = 39.555; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 10/1/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(8.61, 8.61, 8.61); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1750 Head/WCDMA iPhone SE Right Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.437 W/kg

1750 Head/WCDMA iPhone SE Right Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.733 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.607 W/kg
SAR(1 g) = 0.387 W/kg; SAR(10 g) = 0.238 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.495 W/kg
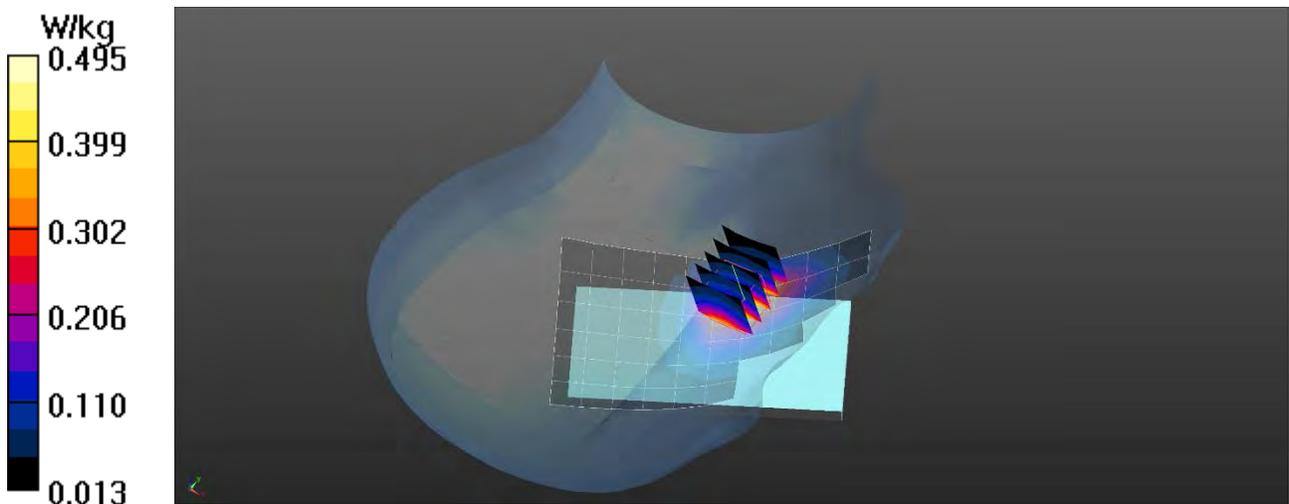
RF Exposure Lab

Plot 9

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 1745 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used (interpolated): f = 1745 MHz; σ = 1.395 S/m; $ε_r$ = 39.53; ρ = 1000 kg/m³
Phantom section: Right Section

Test Date: Date: 10/1/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(8.61, 8.61, 8.61); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1750 Head/LTE B66 iPhone SE Right 1 RB 49 Offset Baseline/Area Scan (7x11x1): Measurement grid:
dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.434 W/kg

1750 Head/LTE B66 iPhone SE Right 1 RB 49 Offset Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid:
dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.622 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.574 W/kg
SAR(1 g) = 0.375 W/kg; SAR(10 g) = 0.234 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.472 W/kg
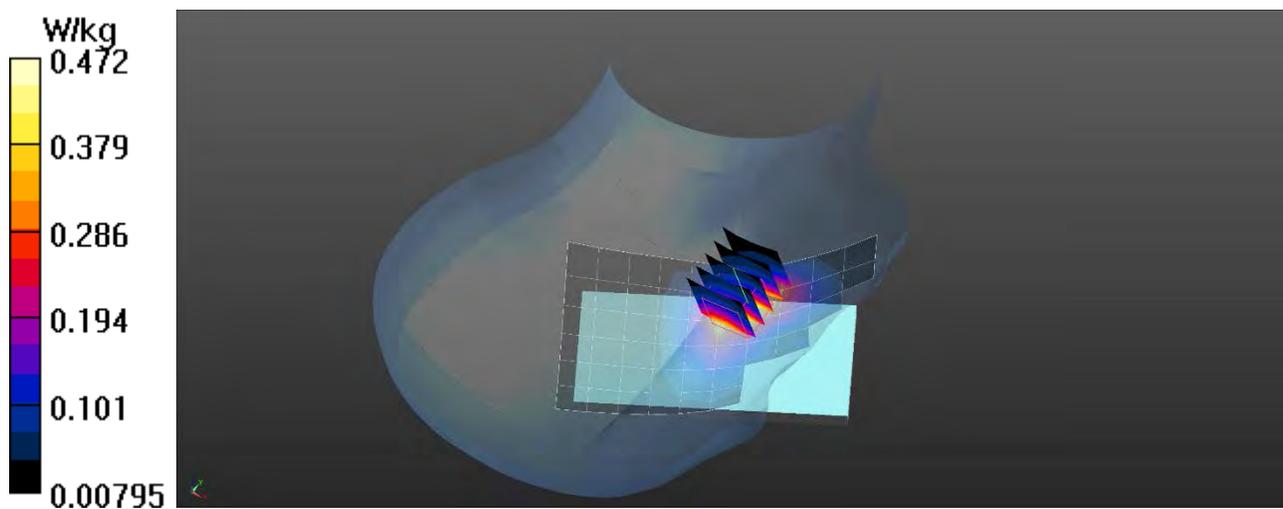
RF Exposure Lab

Plot 10

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1880 MHz; σ = 1.45 S/m; ε_r = 39.69; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 10/1/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(8.31, 8.31, 8.31) @ 1880 MHz; Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1900 Head/CDMA iPhone SE Right Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.617 W/kg

1900 Head/CDMA iPhone SE Right Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.049 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.837 W/kg
SAR(1 g) = 0.510 W/kg; SAR(10 g) = 0.303 W/kg
Maximum value of SAR (measured) = 0.667 W/kg
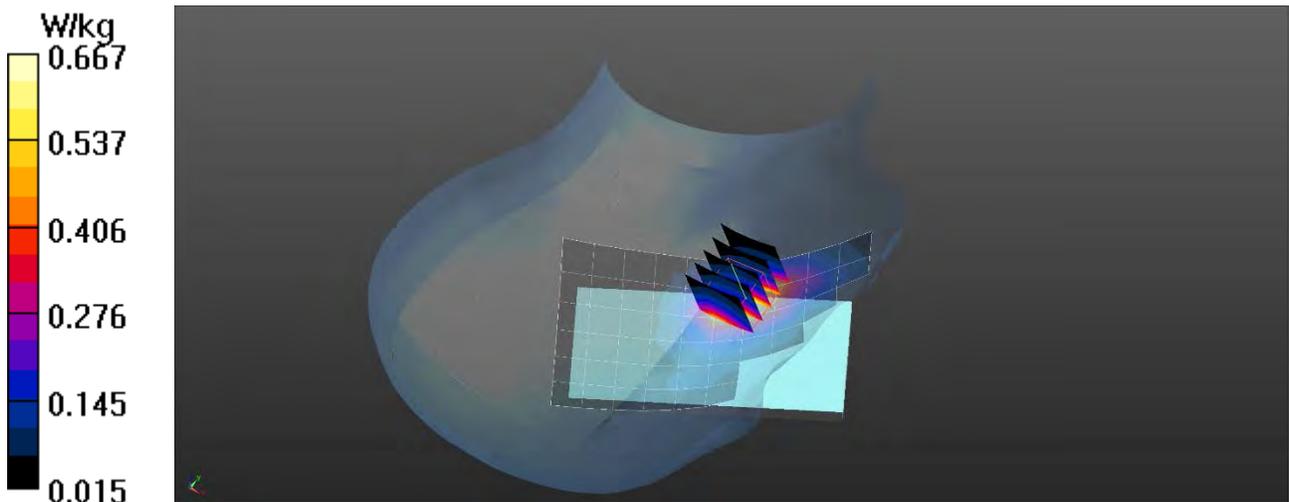
RF Exposure Lab

Plot 11

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used (interpolated): f = 1907.6 MHz; σ = 1.478 S/m; $ε_r$ = 39.665; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 10/1/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(8.31, 8.31, 8.31); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1900 Head/WCDMA iPhone SE Right Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.914 W/kg

1900 Head/WCDMA iPhone SE Right Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.961 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.19 W/kg
SAR(1 g) = 0.731 W/kg; SAR(10 g) = 0.433 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.969 W/kg

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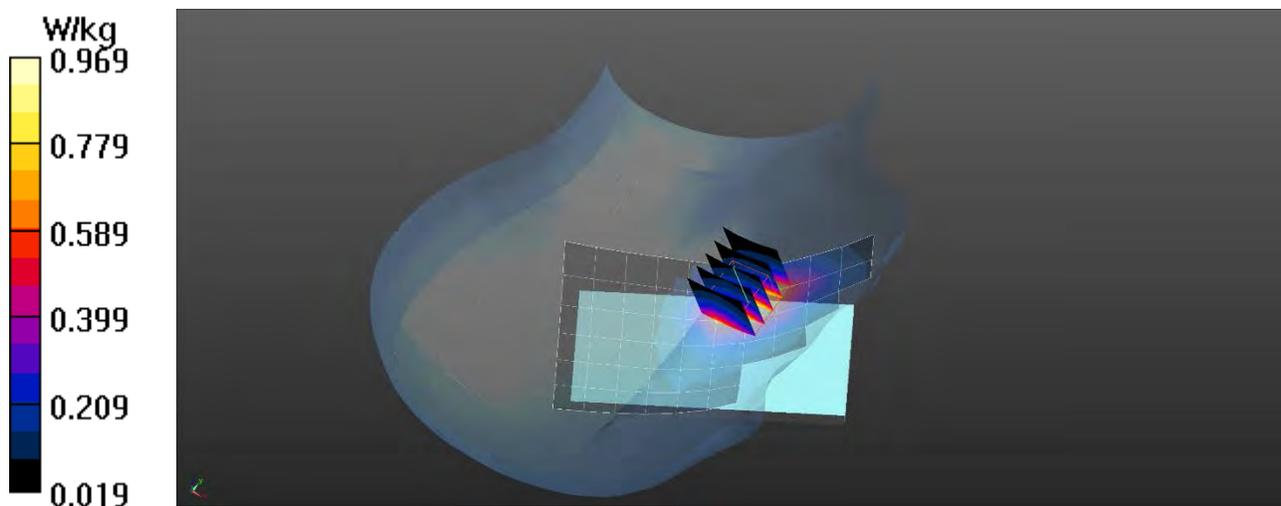
RF Exposure Lab

Plot 12

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 50% RB, 20 MHz, QPSK); Frequency: 1905 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used (interpolated): f = 1905 MHz; σ = 1.475 S/m; ε_r = 39.67; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 10/1/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(8.31, 8.31, 8.31); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1900 Head/LTE B25 iPhone SE Right 50 RB Offset 24 Baseline/Area Scan (7x11x1): Measurement grid:
dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.746 W/kg

1900 Head/LTE B25 iPhone SE Right 50 RB Offset 24 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid:
dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.845 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.937 W/kg
SAR(1 g) = 0.594 W/kg; SAR(10 g) = 0.360 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.776 W/kg

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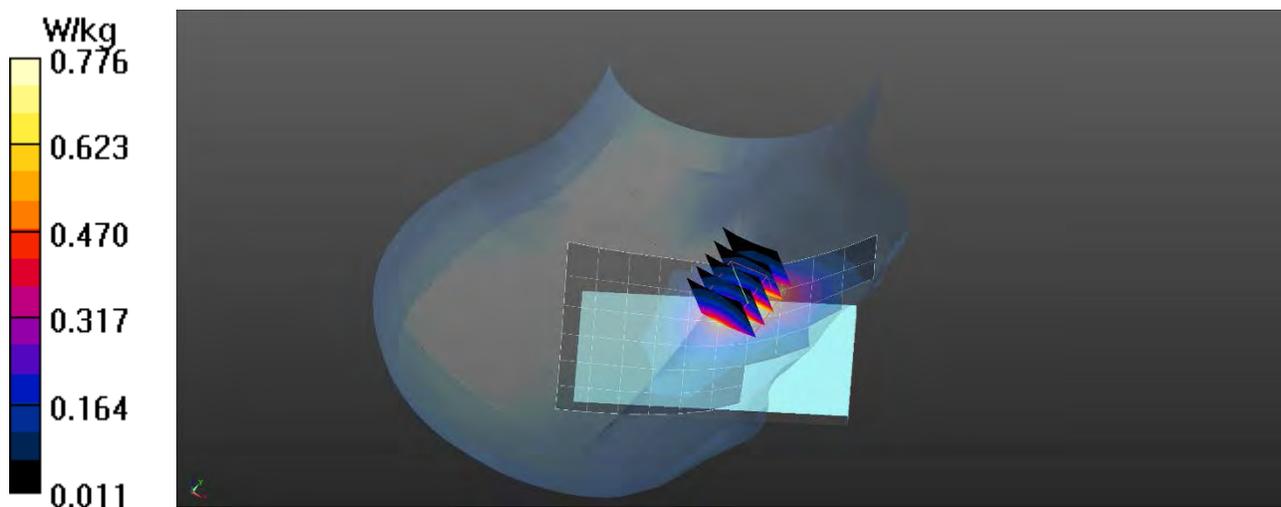
RF Exposure Lab
Plot 13
DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 2310 MHz; Duty Cycle: 1:1
Medium: HSL2300; Medium parameters used: f = 2310 MHz; σ = 1.68 S/m; ε_r = 39.19; ρ = 1000 kg/m³
Phantom section: Right Section

Test Date: Date: 10/5/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(7.97, 7.97, 7.97); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2300 Head/LTE B30 iPhone SE Right 1 RB 24 Offset Baseline/Area Scan (10x16x1): Measurement grid:
dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.400 W/kg

2300 Head/LTE B30 iPhone SE Right 1 RB 24 Offset Baseline/Zoom Scan (7x7x7)/Cube 0: Measurement grid:
dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.080 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.562 W/kg
SAR(1 g) = 0.341 W/kg; SAR(10 g) = 0.188 W/kg
Maximum value of SAR (measured) = 0.442 W/kg
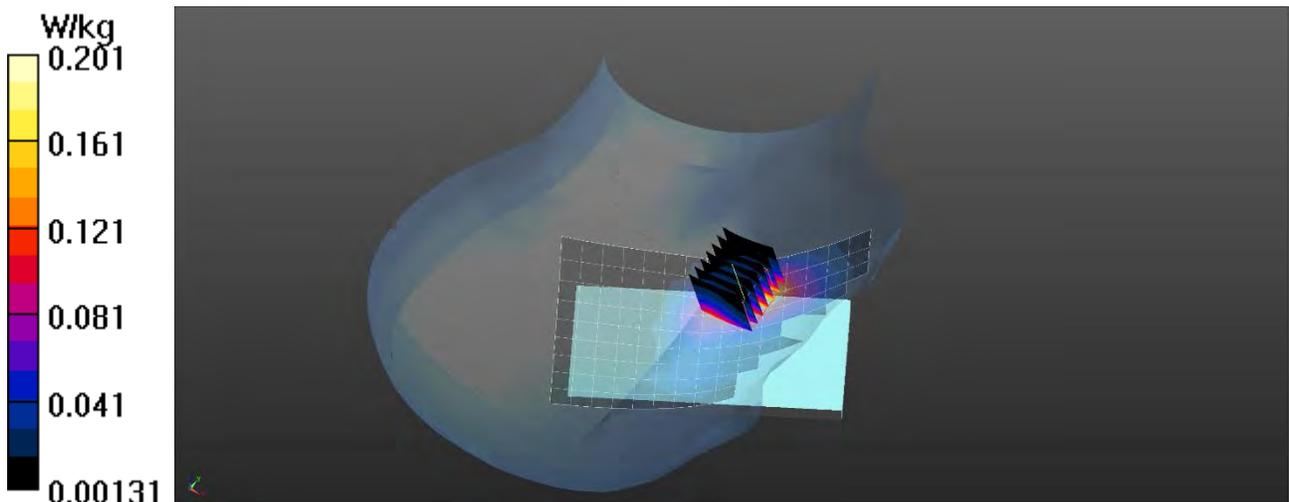
RF Exposure Lab

Plot 14

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 2535 MHz; Duty Cycle: 1:1
Medium: HSL2550; Medium parameters used (interpolated): f = 2535 MHz; σ = 1.935 S/m; ε_r = 38.525; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 10/5/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(7.4, 7.4, 7.4); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2550 Head/LTE B7 iPhone SE Left 1 RB Offset 49 Baseline/Area Scan (10x16x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.904 W/kg

2550 Head/LTE B7 iPhone SE Left 1 RB Offset 49 Baseline/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.60 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.935 W/kg
SAR(1 g) = 0.581 W/kg; SAR(10 g) = 0.342 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.780 W/kg
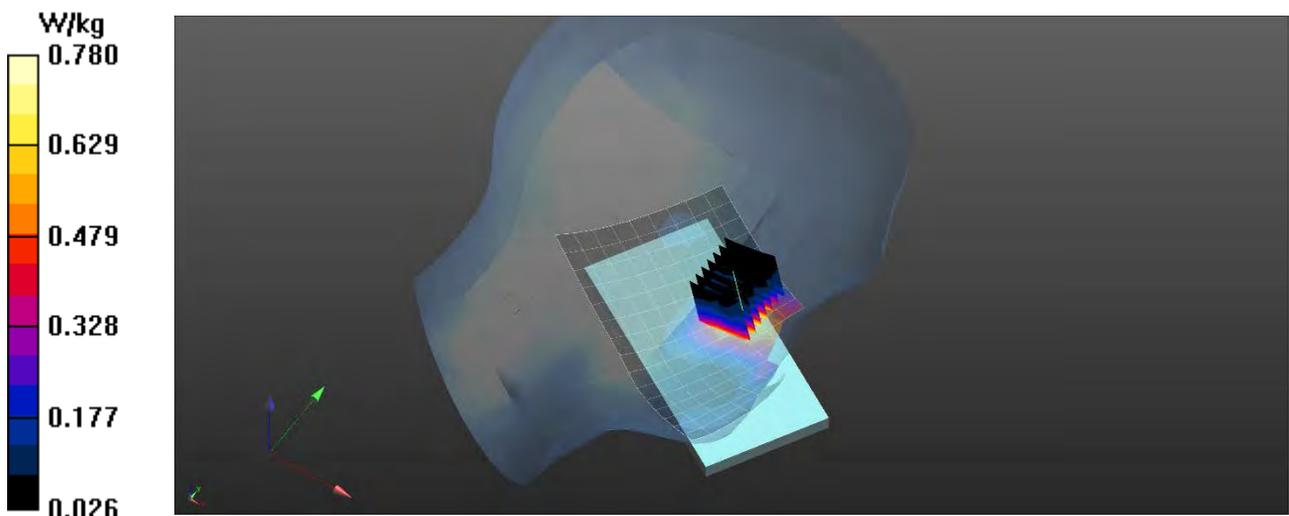
RF Exposure Lab

Plot 15

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 2593 MHz; Duty Cycle: 1:8.33681
Medium: HSL2550; Medium parameters used (interpolated): f = 2593 MHz; σ = 2.01 S/m; $ε_r$ = 38.393; ρ = 1000 kg/m³
Phantom section: Left Section

Test Date: Date: 10/5/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(7.4, 7.4, 7.4); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2550 Head/LTE B41 iPhone SE Left 1 RB Offset 49 Baseline/Area Scan (10x16x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.523 W/kg

2550 Head/LTE B41 iPhone SE Left 1 RB Offset 49 Baseline/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.185 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.760 W/kg
SAR(1 g) = 0.396 W/kg; SAR(10 g) = 0.216 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.564 W/kg
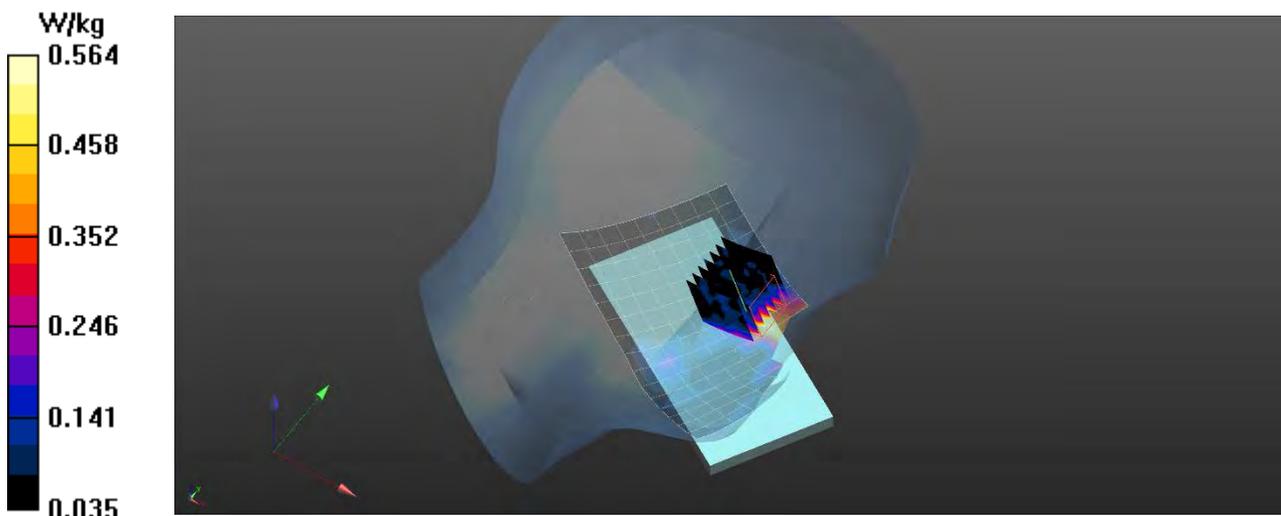
RF Exposure Lab

Plot 16

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 3625 MHz; Duty Cycle: 1:8.33681
Medium: HSL3-6GHz; Medium parameters used: f = 3700 MHz; σ = 3.18 S/m; $ε_r$ = 36.64; ρ = 1000 kg/m³
Phantom section: Left Section

Test Date: Date: 10/6/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(6.96, 6.96, 6.96); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

3600 Head/LTE B48 iPhone SE Left 1 RB Offset 49 Baseline/Area Scan (10x16x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.204 W/kg

3600 Head/LTE B48 iPhone SE Left 1 RB Offset 49 Baseline/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 5.166 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.498 W/kg
SAR(1 g) = 0.108 W/kg; SAR(10 g) = 0.0852 W/kg
Maximum value of SAR (measured) = 0.199 W/kg
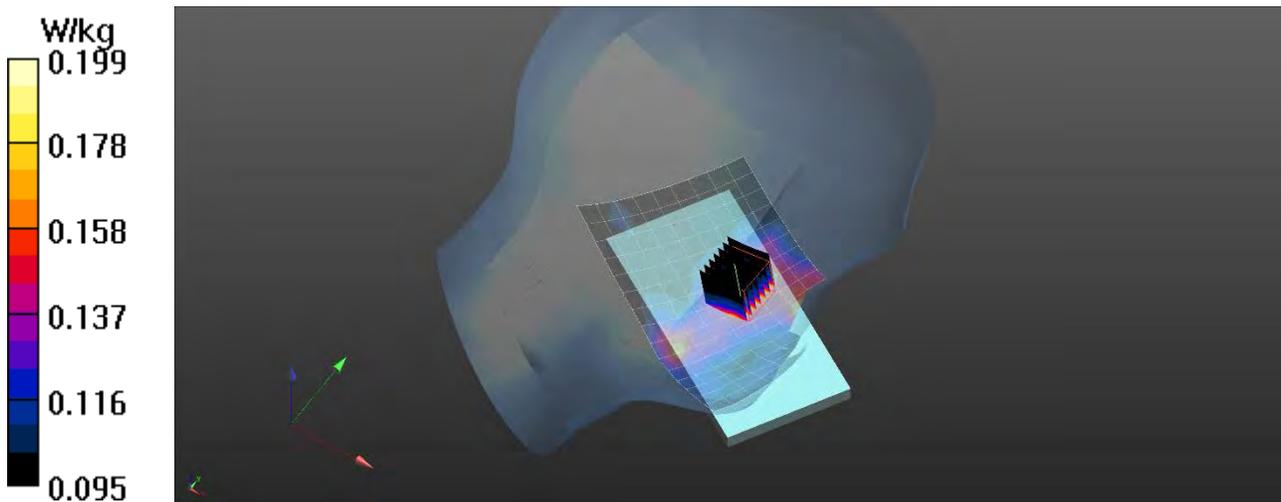
![RF Exposure Lab]

RF Exposure Lab
Plot 17
DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 680.5 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 680.5 MHz; σ = 0.89 S/m; $ε_r$ = 41.928; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 9/29/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.56, 10.56, 10.56); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

600 Body/LTE B71 iPhone SE Left 1 RB Offset 49 Baseline/Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.467 W/kg

600 Body/LTE B71 iPhone SE Left 1 RB Offset 49 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.58 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.537 W/kg
SAR(1 g) = 0.366 W/kg; SAR(10 g) = 0.243 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.462 W/kg
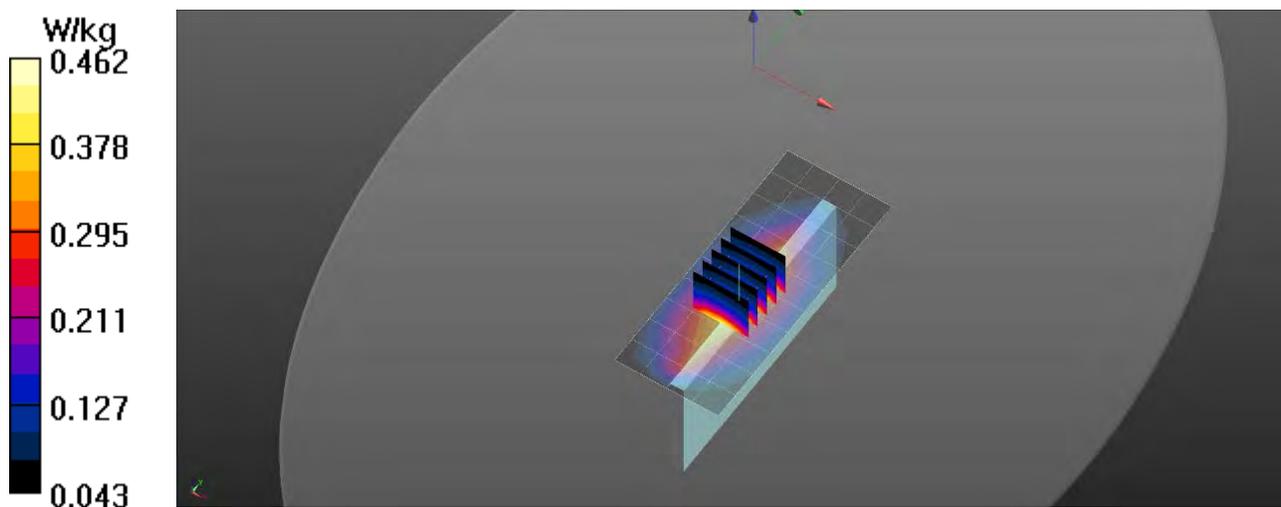
RF Exposure Lab

Plot 18

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 707.5 MHz; σ = 0.898 S/m; ε_r = 41.798; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 9/29/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.56, 10.56, 10.56); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

750 Body/LTE B12 iPhone SE Front 1 RB Offset 24 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.536 W/kg

750 Body/LTE B12 iPhone SE Front 1 RB Offset 24 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.97 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.695 W/kg
SAR(1 g) = 0.465 W/kg; SAR(10 g) = 0.337 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.578 W/kg

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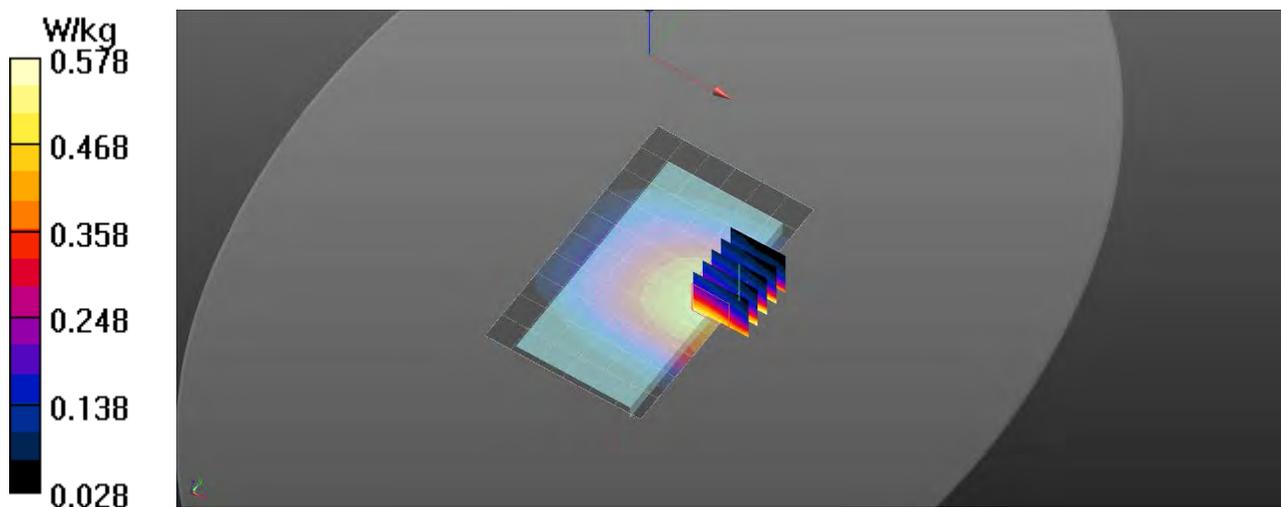
RF Exposure Lab

Plot 19

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 782 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 782 MHz; σ = 0.922 S/m; ε_r = 41.358; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/29/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.56, 10.56, 10.56); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

750 Body/LTE B13 iPhone SE Left 1 RB Offset 24 Baseline/Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.678 W/kg

750 Body/LTE B13 iPhone SE Left 1 RB Offset 24 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.65 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.07 W/kg
SAR(1 g) = 0.546 W/kg; SAR(10 g) = 0.224 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.583 W/kg

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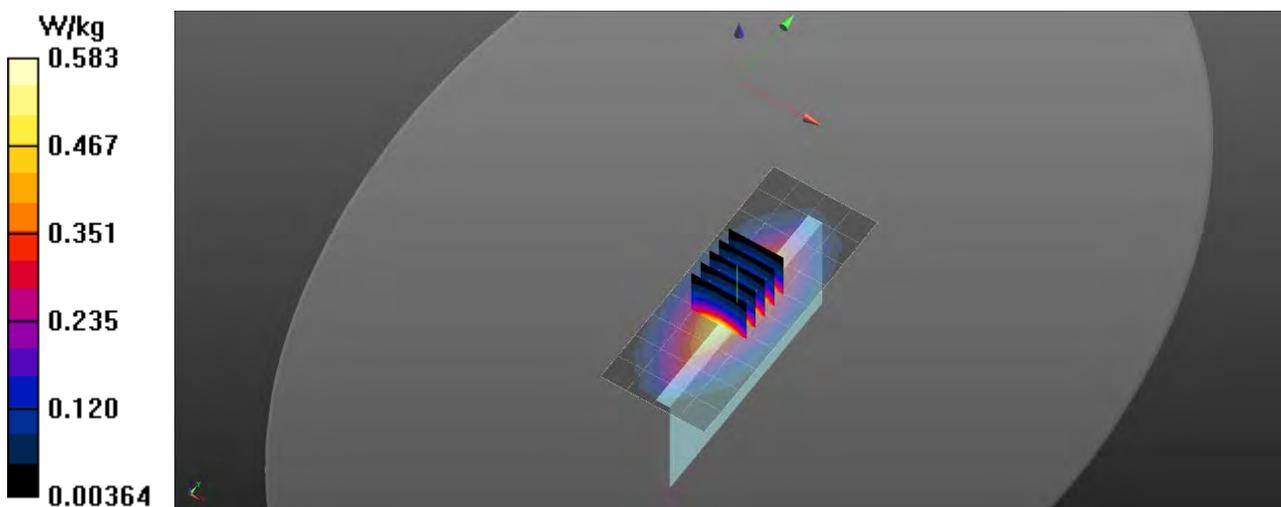
RF Exposure Lab

Plot 20

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 793 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 793 MHz; σ = 0.93 S/m; ε_r = 41.298; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/29/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.56, 10.56, 10.56); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

750 Body/LTE B14 iPhone SE Left 1 RB Offset 24 Baseline/Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.945 W/kg

750 Body/LTE B14 iPhone SE Left 1 RB Offset 24 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.67 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.10 W/kg
SAR(1 g) = 0.747 W/kg; SAR(10 g) = 0.491 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.945 W/kg

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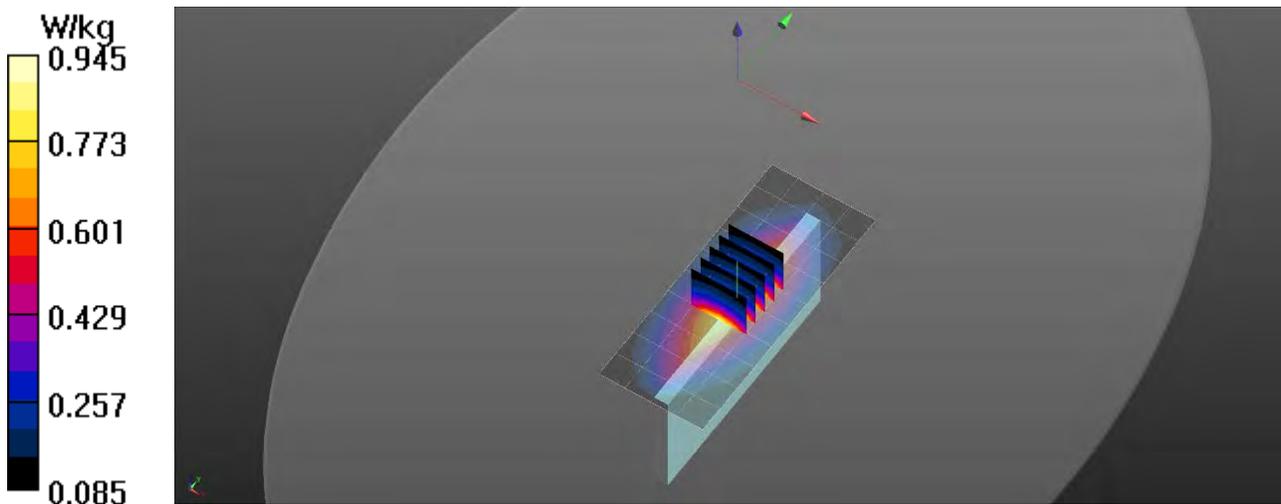
RF Exposure Lab

Plot 21

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used (interpolated): f = 836.52 MHz; σ = 0.947 S/m; ε_r = 41.231; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/29/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.14, 10.14, 10.14); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

850 Body/CDMA iPhone SE Back Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.619 W/kg

850 Body/CDMA iPhone SE Back Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.86 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.691 W/kg
SAR(1 g) = 0.560 W/kg; SAR(10 g) = 0.419 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.642 W/kg
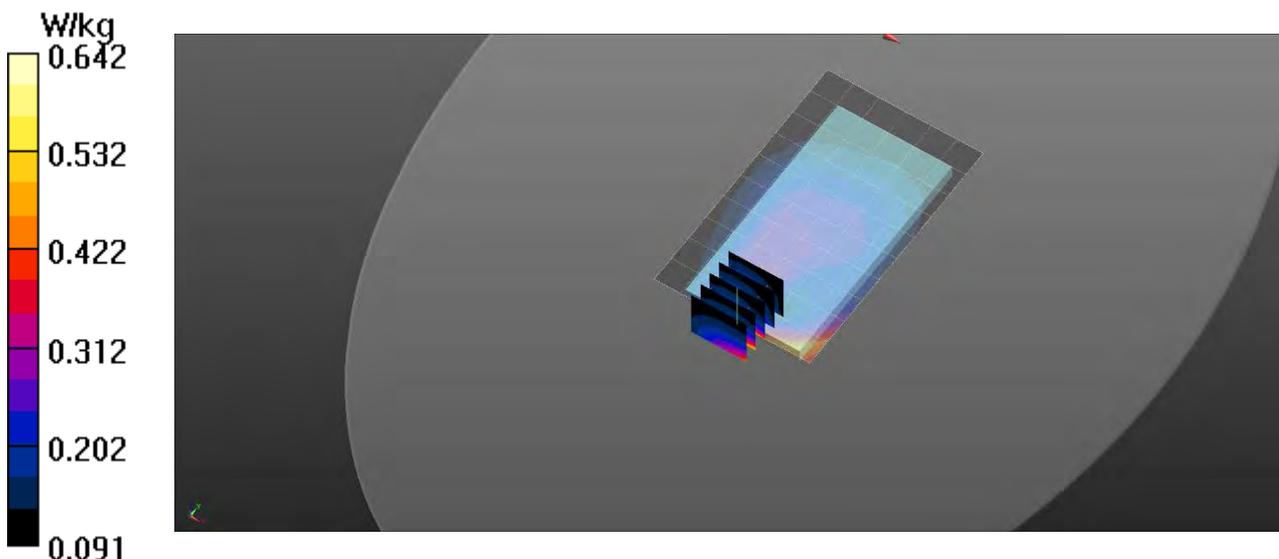
RF Exposure Lab

Plot 22

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 846.6 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used (interpolated): f = 846.6 MHz; σ = 0.957 S/m; ε_r = 41.207; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/29/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.14, 10.14, 10.14); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

850 Body/WCDMA iPhone SE Left Baseline/Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.910 W/kg

850 Body/WCDMA iPhone SE Left Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.46 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.995 W/kg
SAR(1 g) = 0.811 W/kg; SAR(10 g) = 0.526 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.920 W/kg
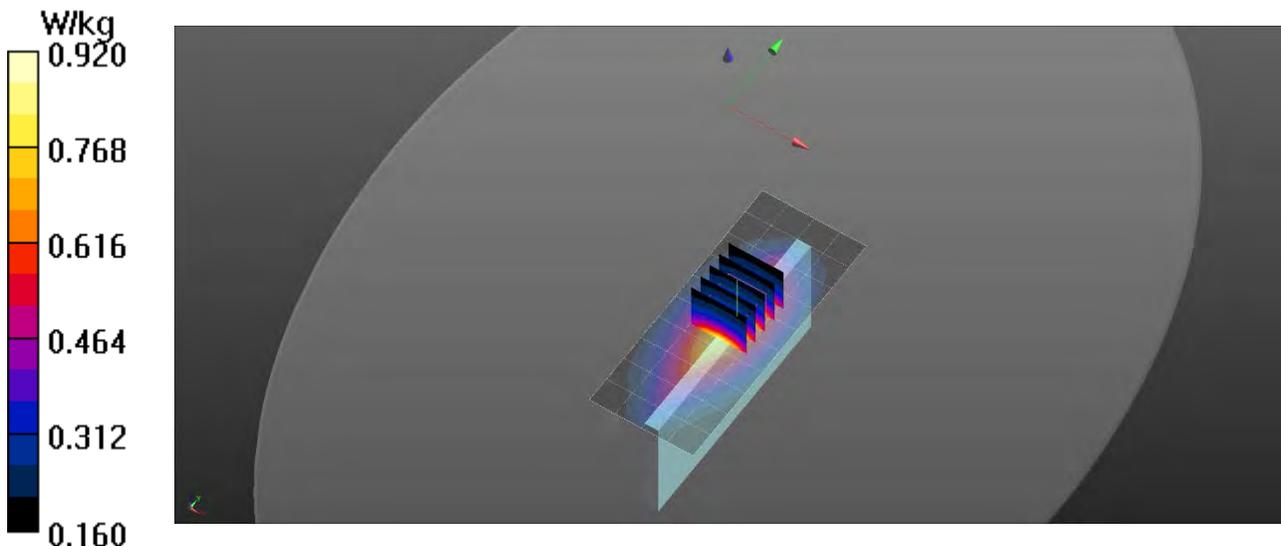
RF Exposure Lab

Plot 23

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 844 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used (interpolated): f = 844 MHz; σ = 0.954 S/m; $ε_r$ = 41.212; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 9/29/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(10.14, 10.14, 10.14); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

850 Body/LTE B26 iPhone SE Back 1 RB Offset 24 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.789 W/kg

850 Body/LTE B26 iPhone SE Back 1 RB Offset 24 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.47 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.23 W/kg
SAR(1 g) = 0.719 W/kg; SAR(10 g) = 0.447 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.982 W/kg
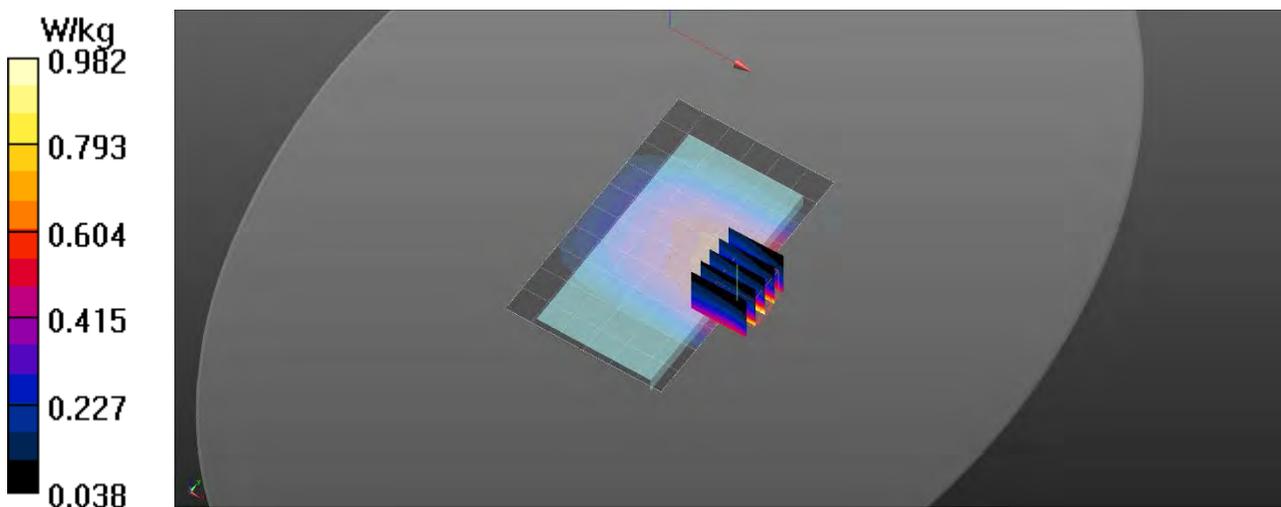
RF Exposure Lab

Plot 24

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 1752.6 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used (interpolated): f = 1752.6 MHz; σ = 1.423 S/m; ε_r = 39.625; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 9/28/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(8.61, 8.61, 8.61); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1750 Body/WCDMA iPhone SE Back Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.991 W/kg

1750 Body/WCDMA iPhone SE Back Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.323 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 1.81 W/kg
SAR(1 g) = 0.877 W/kg; SAR(10 g) = 0.427 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.26 W/kg

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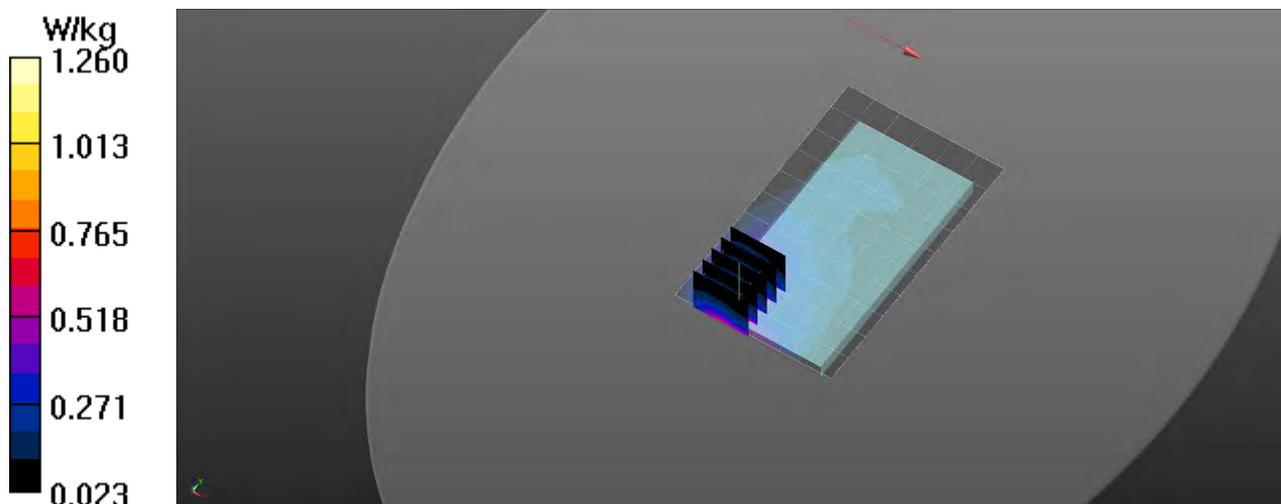
RF Exposure Lab

Plot 25

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 50% RB, 20 MHz, QPSK); Frequency: 1770 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used: f = 1770 MHz; σ = 1.44 S/m; $ε_r$ = 39.59; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 9/28/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(8.61, 8.61, 8.61); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1750 Body/LTE B66 iPhone SE Back 50 RB 24 Offset With Baseline/Area Scan (7x11x1): Measurement grid:
dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.06 W/kg

1750 Body/LTE B66 iPhone SE Back 50 RB 24 Offset With Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement
grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.12 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 2.81 W/kg
SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.423 W/kg
Maximum value of SAR (measured) = 2.07 W/kg
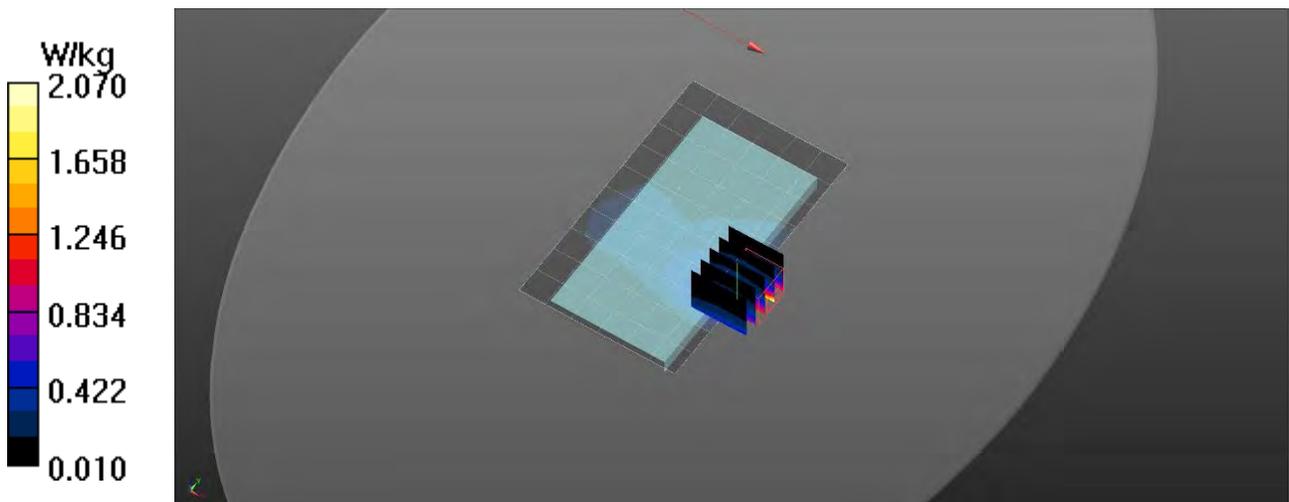
RF Exposure Lab

Plot 26

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1880 MHz; σ = 1.43 S/m; ε_r = 39.47; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/28/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(8.31, 8.31, 8.31); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1900 Body/CDMA iPhone SE Back Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.10 W/kg

**1900 Body/CDMA iPhone SE Back Baseline/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.47 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.72 W/kg
SAR(1 g) = 0.771 W/kg; SAR(10 g) = 0.372 W/kg
Maximum value of SAR (measured) = 1.19 W/kg
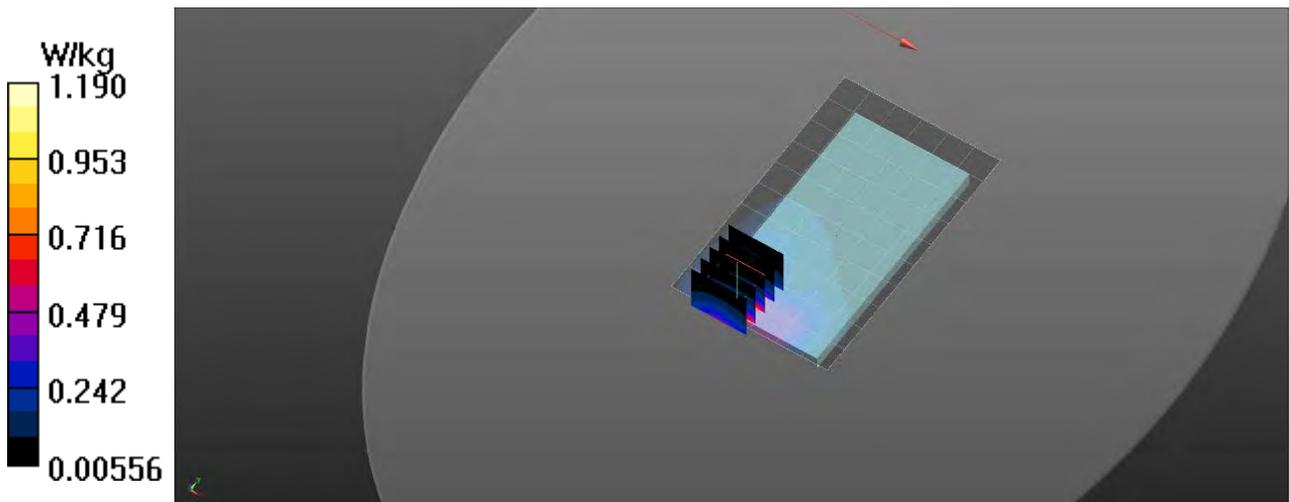
RF Exposure Lab

Plot 27

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used (interpolated): f = 1907.6 MHz; σ = 1.448 S/m; ε_r = 39.445; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/28/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(8.31, 8.31, 8.31); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1900 Body/WCDMA iPhone SE Back Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.15 W/kg

1900 Body/WCDMA iPhone SE Back Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm,
dy=8mm, dz=5mm
Reference Value = 14.18 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.80 W/kg
SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.551 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.37 W/kg

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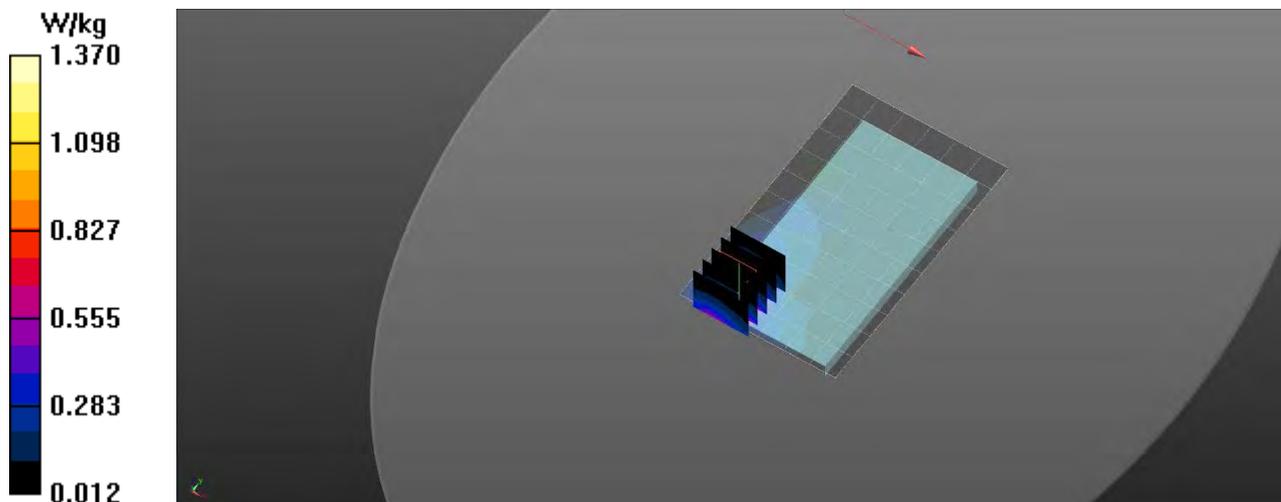
RF Exposure Lab

Plot 28

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 50% RB, 20 MHz, QPSK); Frequency: 1905 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used (interpolated): f = 1905 MHz; σ = 1.445 S/m; ε_r = 39.45; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/28/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(8.31, 8.31, 8.31); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1900 Body/LTE B25 iPhone SE Back 50 RB Offset 24 With Baseline/Area Scan (7x11x1): Measurement grid:
dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.11 W/kg

1900 Body/LTE B25 iPhone SE Back 50 RB Offset 24 With Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement
grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.485 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.75 W/kg
SAR(1 g) = 0.843 W/kg; SAR(10 g) = 0.403 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.08 W/kg

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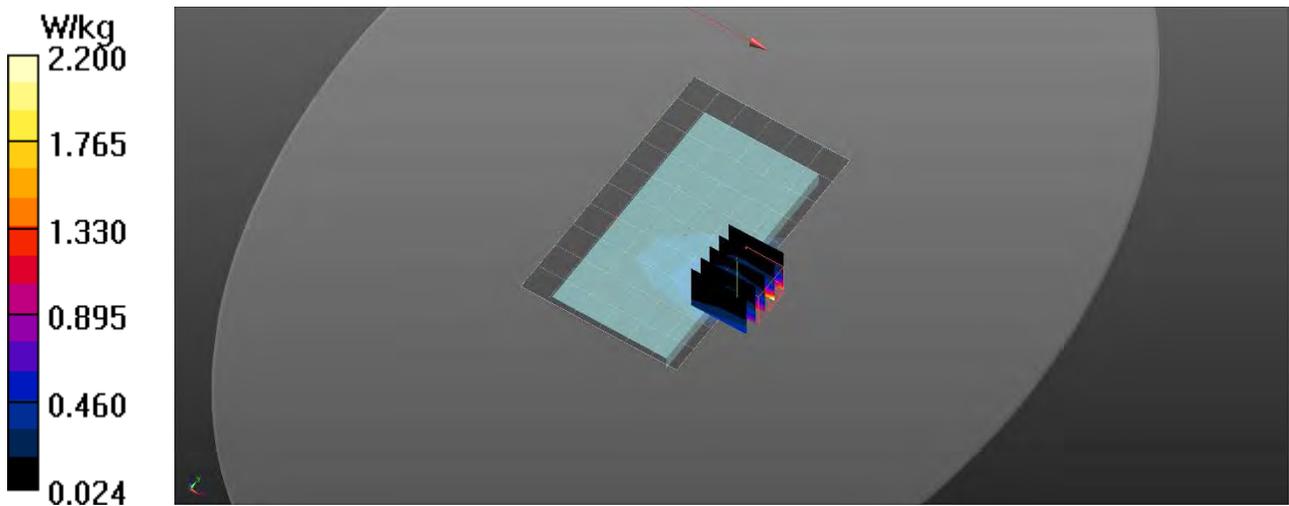
RF Exposure Lab

Plot 29

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 50% RB, 10 MHz, QPSK); Frequency: 2310 MHz; Duty Cycle: 1:1
Medium: HSL2300; Medium parameters used: f = 2310 MHz; σ = 1.7 S/m; $ε_r$ = 38.78; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/30/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(7.97, 7.97, 7.97); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2300 Body/LTE B30 iPhone SE Back 25 RB Offset 12 With Baseline/Area Scan (10x16x1): Measurement grid:
dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.18 W/kg

2300 Body/LTE B30 iPhone SE Back 25 RB Offset 12 With Baseline/Zoom Scan (7x7x7)/Cube 0: Measurement
grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.345 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.64 W/kg
SAR(1 g) = 0.879 W/kg; SAR(10 g) = 0.342 W/kg
Maximum value of SAR (measured) = 1.20 W/kg
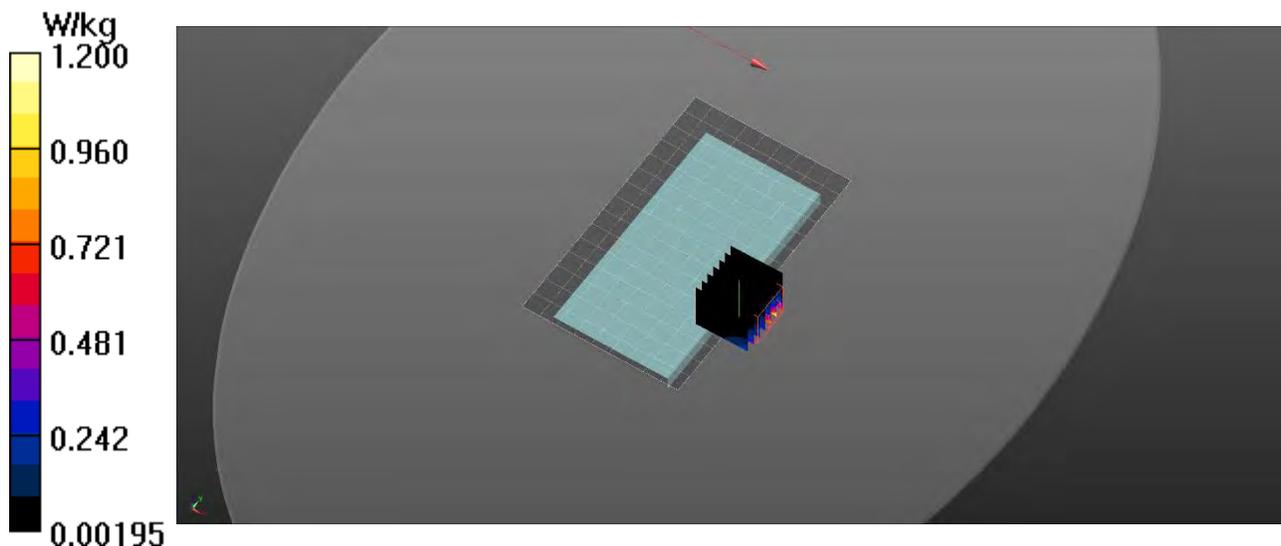
RF Exposure Lab

Plot 30

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 2535 MHz; Duty Cycle: 1:1
Medium: HSL2550; Medium parameters used (interpolated): f = 2535 MHz; σ = 1.915 S/m; ε_r = 38.715; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/30/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(7.4, 7.4, 7.4); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2550 Body/LTE B7 iPhone SE Front 1 RB Offset 49 With Baseline/Area Scan (10x16x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.34 W/kg

2550 Body/LTE B7 iPhone SE Front 1 RB Offset 49 With Baseline/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.039 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 2.10 W/kg
SAR(1 g) = 0.840 W/kg; SAR(10 g) = 0.324 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.30 W/kg
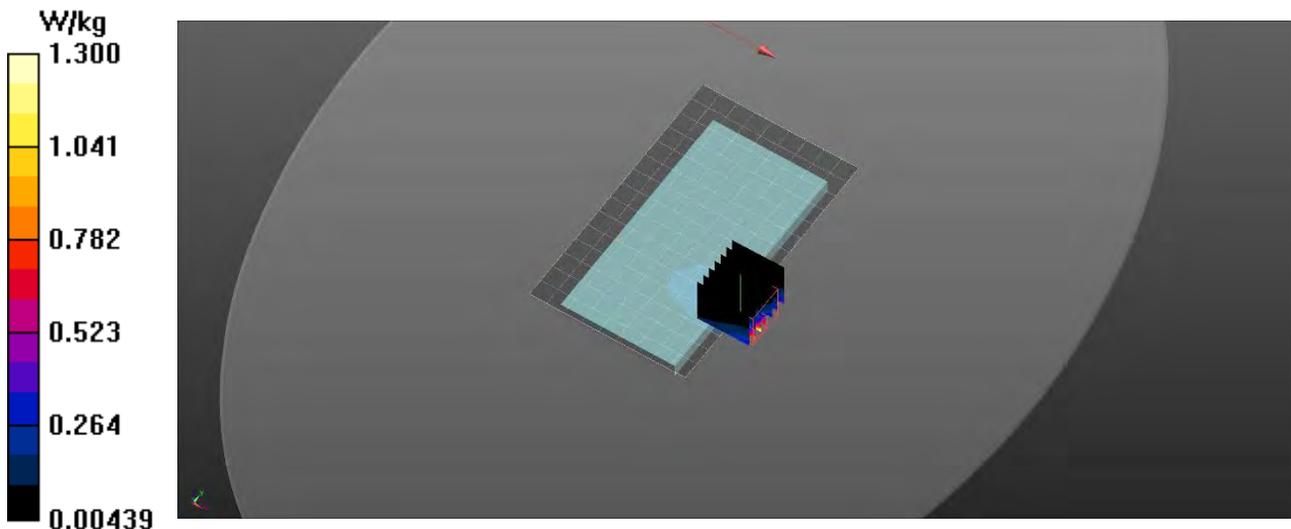
RF Exposure Lab

Plot 31

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 2544.5 MHz; Duty Cycle: 1:8.33681
Medium: HSL2550; Medium parameters used (interpolated): f = 2544.5 MHz; σ = 1.929 S/m; $ε_r$ = 38.691; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/30/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(7.4, 7.4, 7.4); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2550 Body/LTE B41 iPhone SE Front 1 RB Offset 49 With Baseline/Area Scan (10x16x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.992 W/kg

2550 Body/LTE B41 iPhone SE Front 1 RB Offset 49 With Baseline/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.706 V/m; Power Drift = 0.63 dB
Peak SAR (extrapolated) = 2.69 W/kg
SAR(1 g) = 0.792 W/kg; SAR(10 g) = 0.356 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.85 W/kg
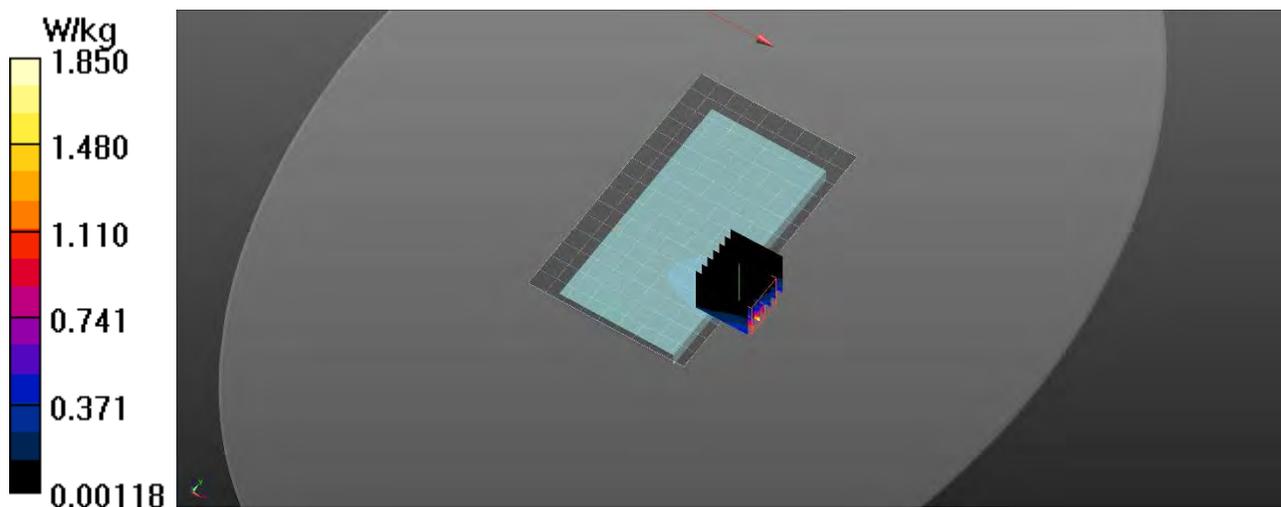
RF Exposure Lab

Plot 32

DUT: iPhone SE; Type: Cell Phone; Serial: Test

Communication System: LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 3625 MHz; Duty Cycle: 1:8.33681
Medium: HSL3-6GHz; Medium parameters used: f = 3700 MHz; σ = 3.14 S/m; $ε_r$ = 36.87; ρ = 1000 kg/m³
Phantom section: Flat Section

Test Date: Date: 10/1/2020; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7530; ConvF(6.96, 6.96, 6.96); Calibrated: 1/21/2020
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1321; Calibrated: 1/14/2020
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

3600 Body/LTE B48 iPhone SE Back 1 RB Offset 49 With Baseline/Area Scan (10x16x1): Measurement grid:
dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.59 W/kg

3600 Body/LTE B48 iPhone SE Back 1 RB Offset 49 With Baseline/Zoom Scan (7x7x12)/Cube 0: Measurement
grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 11.963 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 4.49 W/kg
SAR(1 g) = 0.948 W/kg; SAR(10 g) = 0.223 W/kg
Maximum value of SAR (measured) = 2.13 W/kg

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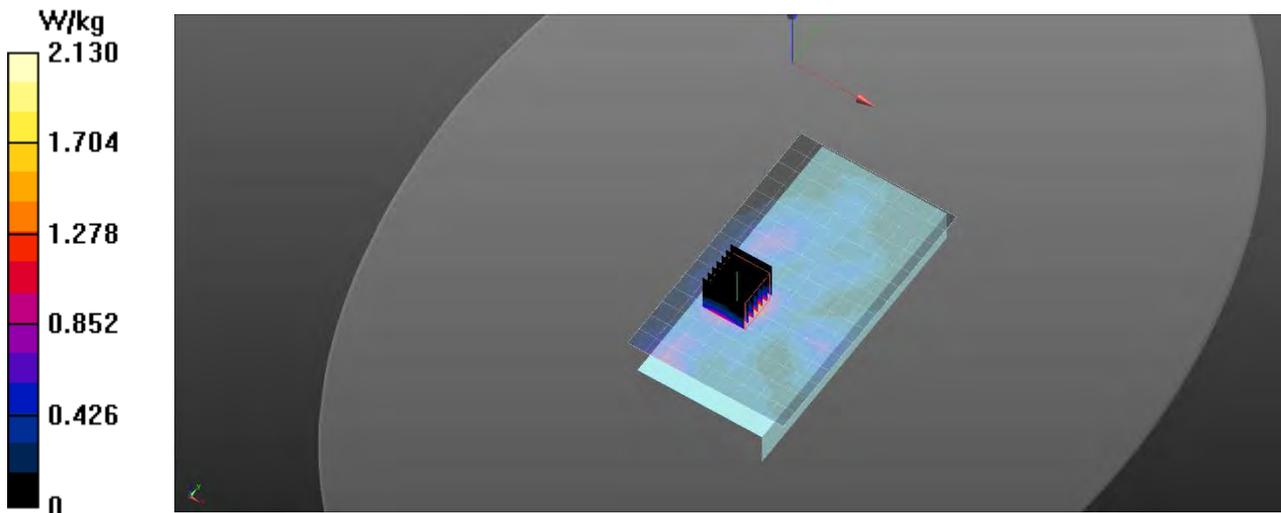
Appendix D – Probe Calibration Data Sheets

Calibration Laboratory of
Schmid & Partner
   Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: **SCS 0108**

Client   **RF Exposure Lab**   Certificate No: **EX3-7530_Jan20**

CALIBRATION CERTIFICATE

Object	**EX3DV4 - SN:7530**
Calibration procedure(s)	**QA CAL-01.v8, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7** **Calibration procedure for dosimetric E-field probes**
Calibration date:	**January 21, 2020**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-19 (No. 217-02894)	Apr-20
DAE4	SN: 660	27-Dec-19 (No. DAE4-660_Dec19)	Dec-20
Reference Probe ES3DV2	SN: 3013	31-Dec-19 (No. ES3-3013_Dec19)	Dec-20
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 21, 2020

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z:* A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7530

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.42	0.47	0.43	± 10.1 %
DCP (mV)[B]	100.4	98.8	99.4	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Max dev.	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	143.0	±3.5 %	± 4.7 %
		Y	0.0	0.0	1.0		140.8		
		Z	0.0	0.0	1.0		146.9		

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 5).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7530

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	36.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7530

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	10.56	10.56	10.56	0.53	0.97	± 12.0 %
900	41.5	0.97	10.14	10.14	10.14	0.61	0.80	± 12.0 %
1300	40.8	1.14	9.57	9.57	9.57	0.60	0.80	± 12.0 %
1450	40.5	1.20	9.37	9.37	9.37	0.55	0.80	± 12.0 %
1640	40.2	1.31	8.73	8.73	8.73	0.24	0.80	± 12.0 %
1750	40.1	1.37	8.61	8.61	8.61	0.29	0.80	± 12.0 %
1900	40.0	1.40	8.31	8.31	8.31	0.34	0.80	± 12.0 %
2300	39.5	1.67	7.97	7.97	7.97	0.39	0.80	± 12.0 %
2450	39.2	1.80	7.76	7.76	7.76	0.29	0.80	± 12.0 %
2600	39.0	1.96	7.40	7.40	7.40	0.39	0.84	± 12.0 %
3500	37.9	2.91	7.20	7.20	7.20	0.30	1.35	± 13.1 %
3700	37.7	3.12	6.96	6.96	6.96	0.30	1.35	± 13.1 %
5250	35.9	4.71	5.45	5.45	5.45	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.80	4.80	4.80	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.95	4.95	4.95	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)
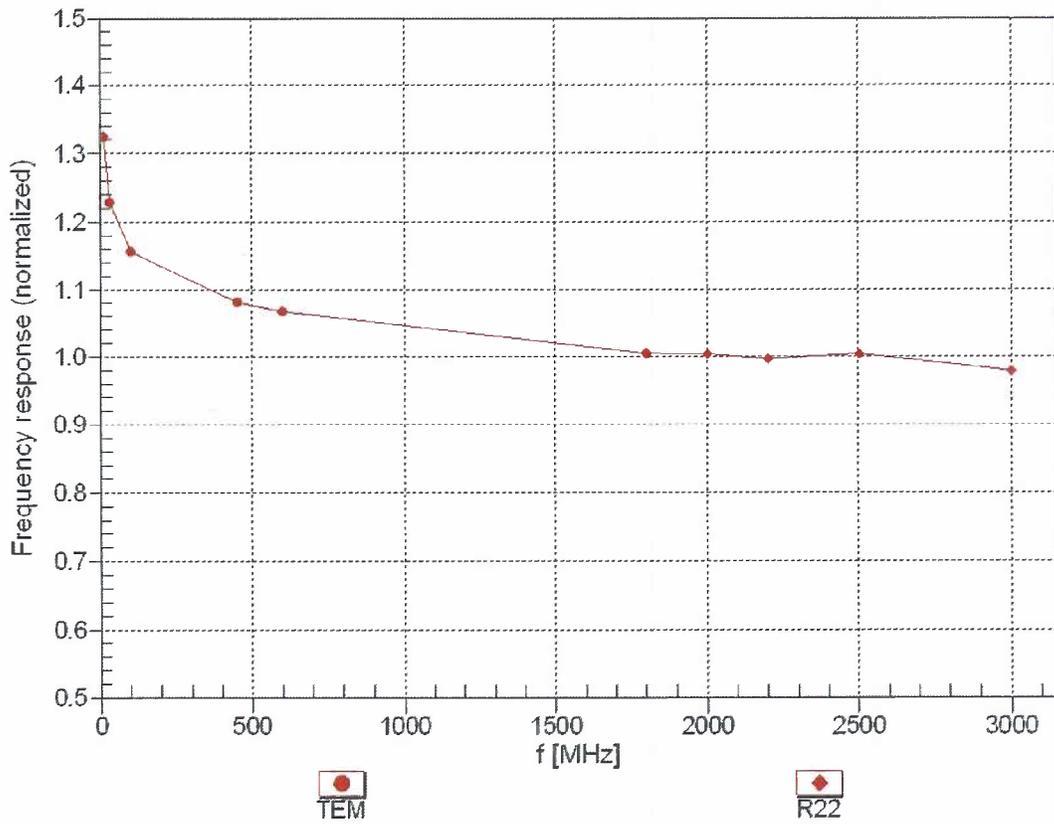
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (φ), θ = 0°

f=600 MHz,TEM

| Tot | X | Y | Z |

f=1800 MHz,R22

| Tot | X | Y | Z |

| 100 MHz | 600 MHz | 1800 MHz | 2500 MHz |
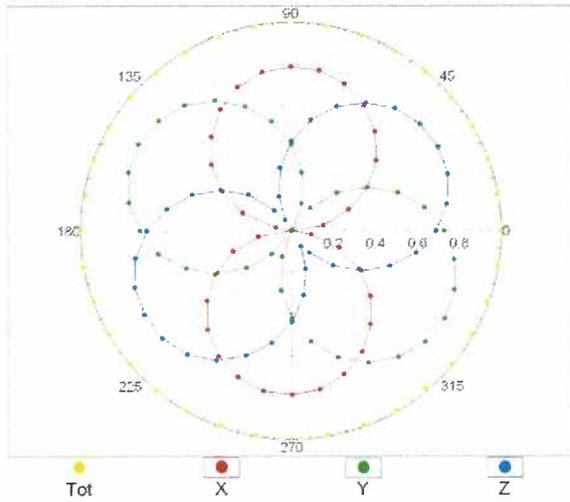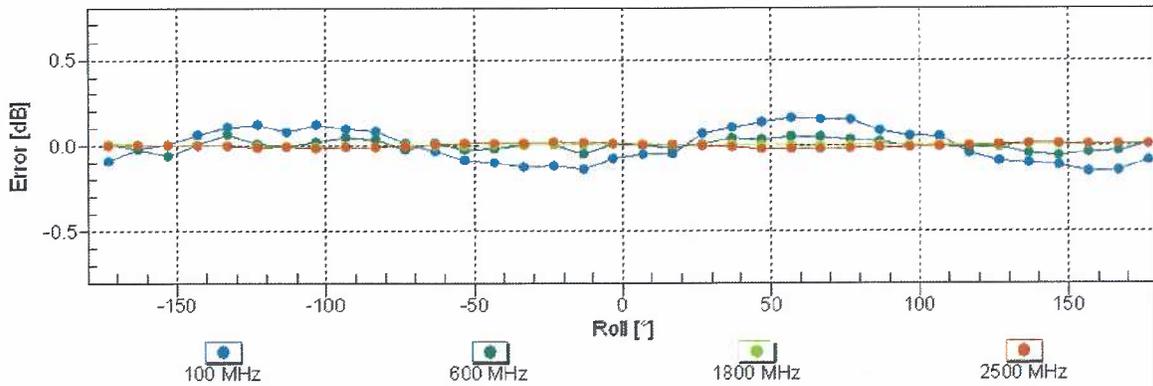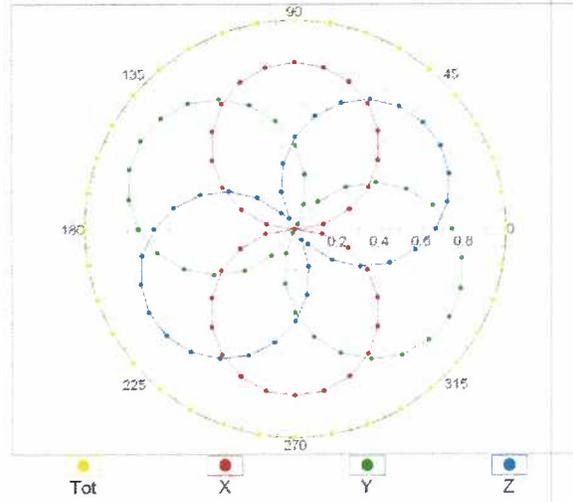
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)
(TEM cell , f$_{eval}$= 1900 MHz)
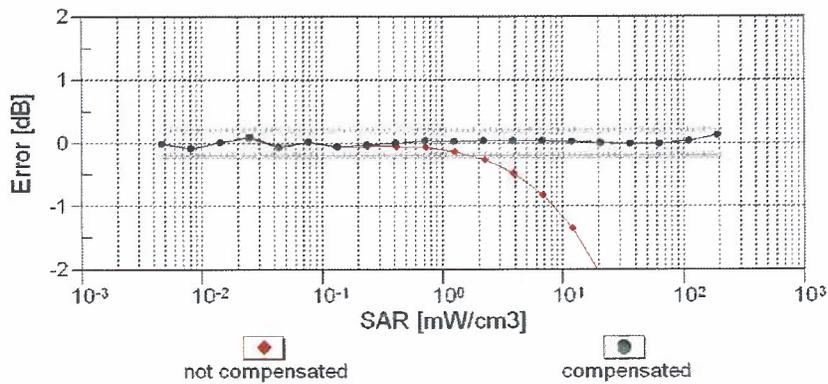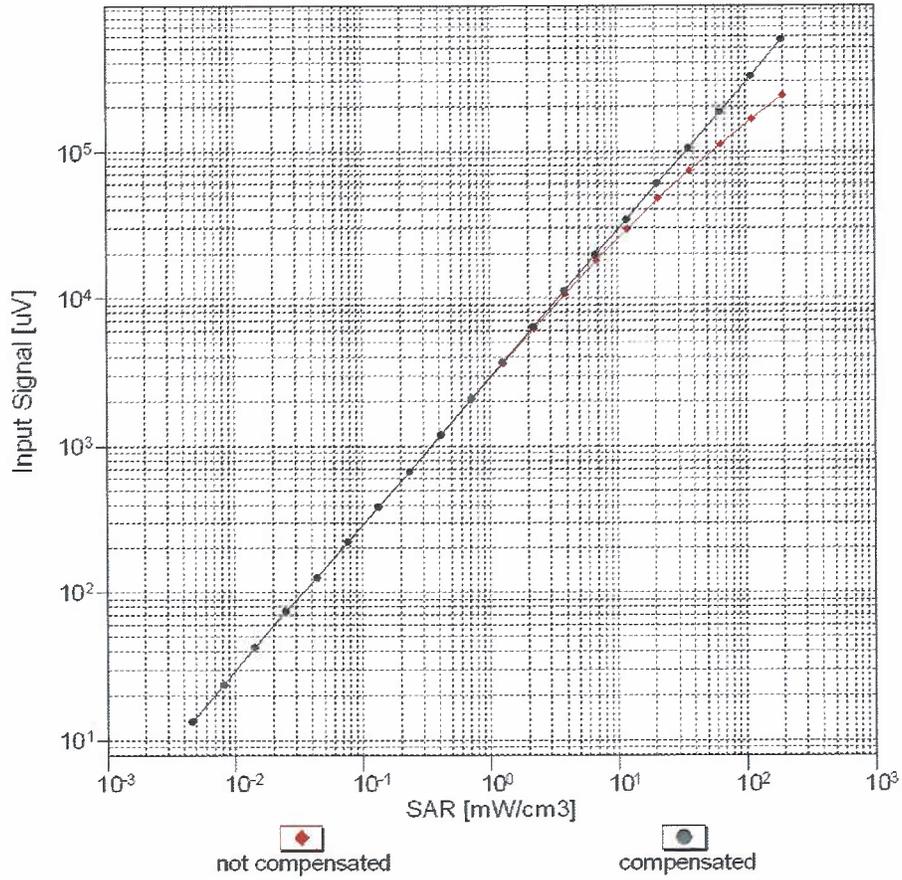
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz, WGLS R9 (H_convF)

f = 1900 MHz, WGLS R22 (H_convF)
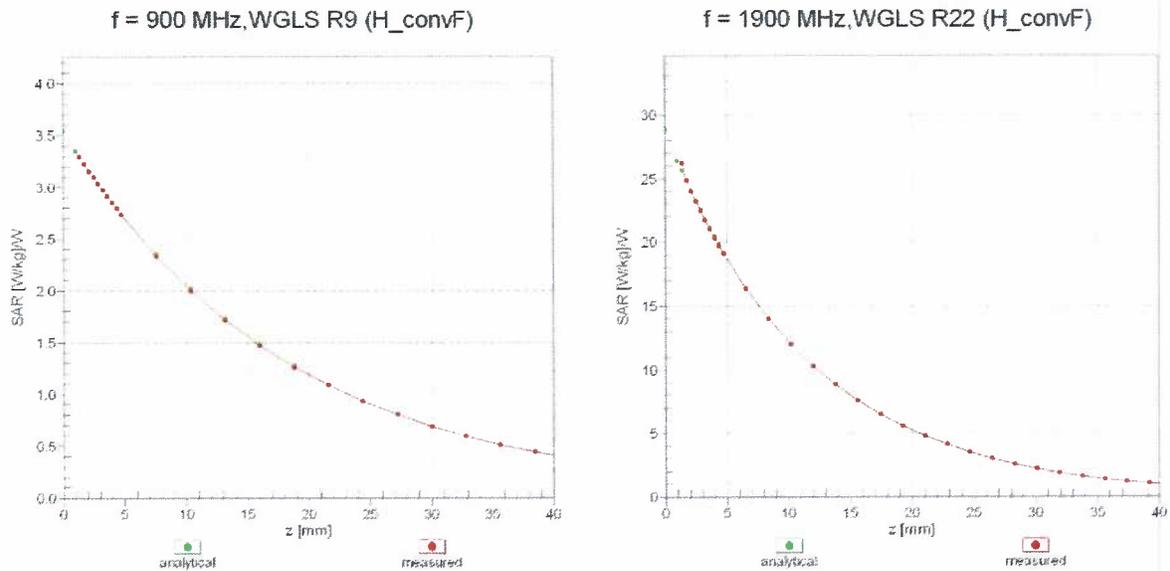
Deviation from Isotropy in Liquid
Error (ϕ, ϑ), f = 900 MHz

Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)
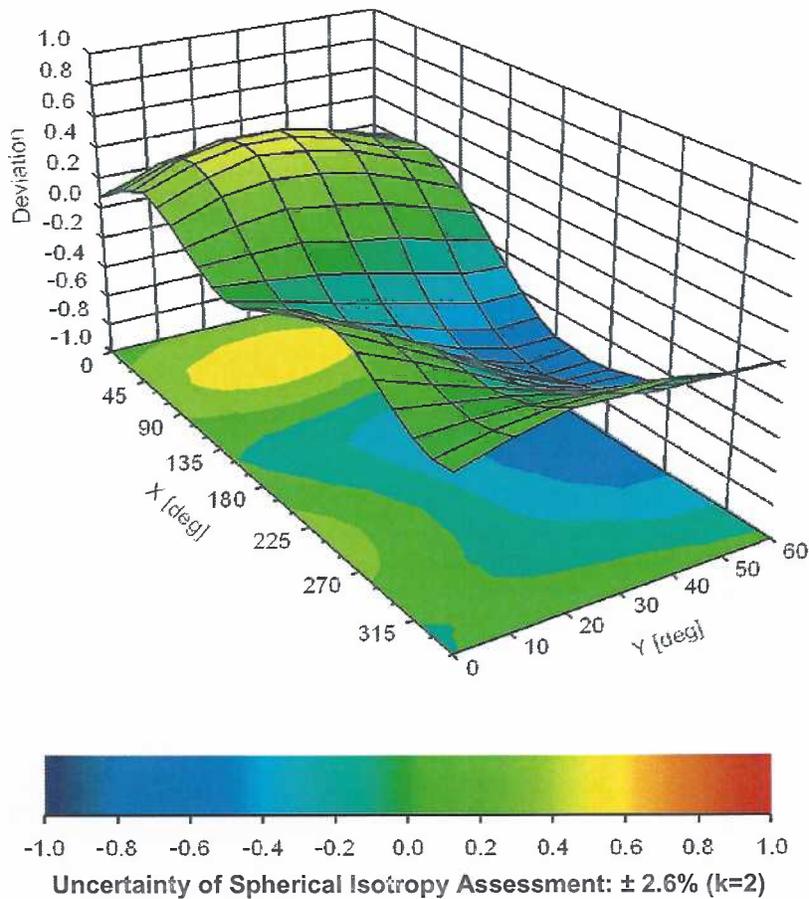
Appendix E – Dipole Calibration Data Sheets

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

ilac-MRA

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client	**RF Exposure Lab**	Certificate No: **D600V3-1012_Feb19**

CALIBRATION CERTIFICATE

Object	**D600V3 - SN: 1012**
Calibration procedure(s)	**QA CAL-15.v9** **Calibration Procedure for SAR Validation Sources below 700 MHz**
Calibration date:	**February 18, 2019**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 3877	31-Dec-18 (No. EX3-3877_Dec18)	Dec-19
DAE4	SN: 654	05-Jul-18 (No. DAE4-654_Jul18)	Jul-19

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 18, 2019

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Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	42.7	0.88 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.7 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.67 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.51 W/kg ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**4.31 W/kg ± 17.6 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.1	0.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.67 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.60 W/kg ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**4.36 W/kg ± 17.6 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.3 Ω - 5.5 jΩ
Return Loss	- 22.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	52.6 Ω - 7.3 jΩ
Return Loss	- 22.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

Extended Calibration
Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (<-20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D600V3 SN: 1012 - Head						
Date of Measurement	Return Loss (dB)	Δ%	Impedance (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
2/18/2019	-22.1		56.3		-5.5	
2/18/2020	-21.9	-0.9	56.8	0.5	-5.2	0.3
D600V3 SN: 1012 - Body						
Date of Measurement	Return Loss (dB)	Δ%	Impedance (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
2/18/2019	-22.4		52.6		-7.3	
2/18/2020	-22.6	0.9	53.2	0.6	-6.9	0.4

Date: 18.02.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 600 MHz; Type: D600V3; Serial: D600V3 - SN: 1012

Communication System: UID 0 - CW; Frequency: 600 MHz
Medium parameters used: f = 600 MHz; σ = 0.91 S/m; ε_r = 42.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.01, 10.01, 10.01) @ 600 MHz; Calibrated: 31.12.2018

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn654; Calibrated: 05.07.2018

- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003

- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 50.96 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 2.70 W/kg
SAR(1 g) = 1.67 W/kg; SAR(10 g) = 1.1 W/kg
Maximum value of SAR (measured) = 2.29 W/kg

0 dB = 2.29 W/kg = 3.60 dBW/kg

Impedance Measurement Plot for Head TSL

File View Channel Sweep Calibration Trace Scale Marker System Window Help

1:	600.000000 MHz	56.278 Ω
	48.244 pF	-5.4983 Ω
>2:	600.000000 MHz	78.419 mU
		-38.250 °

Ch 1 Avg = 20
Ch1: Start 400.000 MHz

Stop 800.000 MHz

dB S11

10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00

> 1: 600.000000 MHz -22.112 dB

Ch 1 Avg = 20
Ch1: Start 400.000 MHz

Stop 800.000 MHz

Status CH 1: S11 C* 1-Port Avg=20 Delay LCL
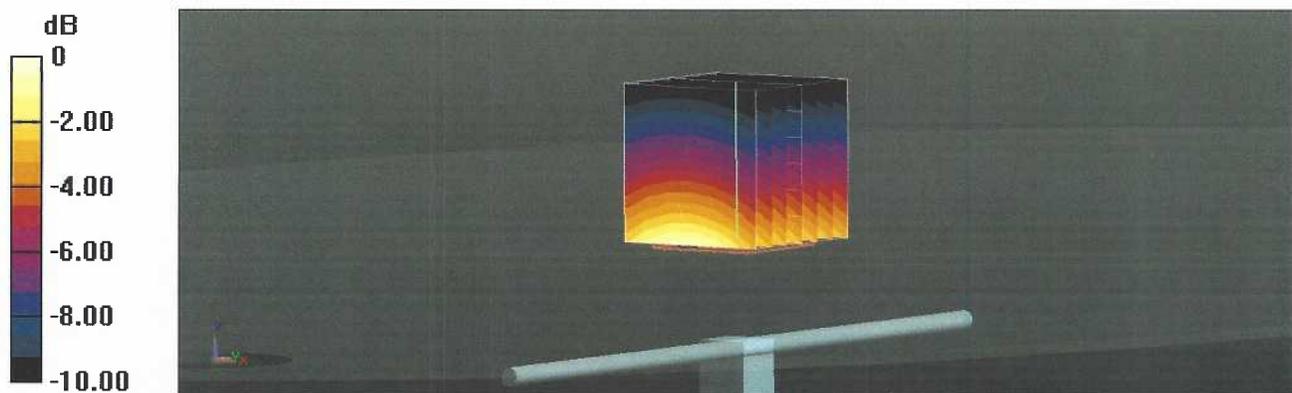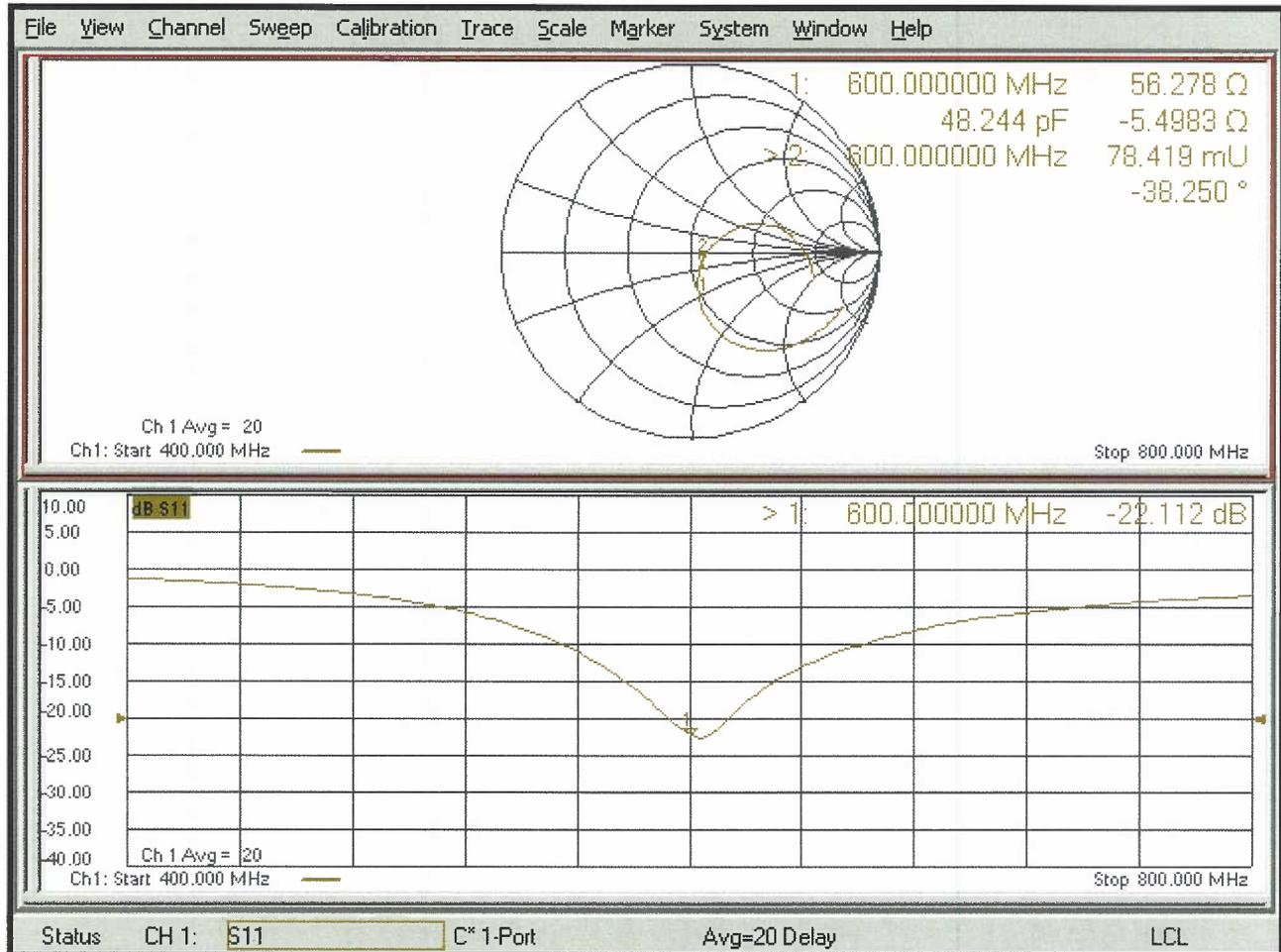
DASY5 Validation Report for Body TSL

Date: 18.02.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 600 MHz; Type: D600V3; Serial: D600V3 - SN: 1012

Communication System: UID 0 - CW; Frequency: 600 MHz
Medium parameters used: f = 600 MHz; σ = 0.96 S/m; ε_r = 55; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.2, 10.2, 10.2) @ 600 MHz; Calibrated: 31.12.2018

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn654; Calibrated: 05.07.2018

- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003

- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 49.63 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 2.67 W/kg
SAR(1 g) = 1.67 W/kg; SAR(10 g) = 1.1 W/kg
Maximum value of SAR (measured) = 2.29 W/kg
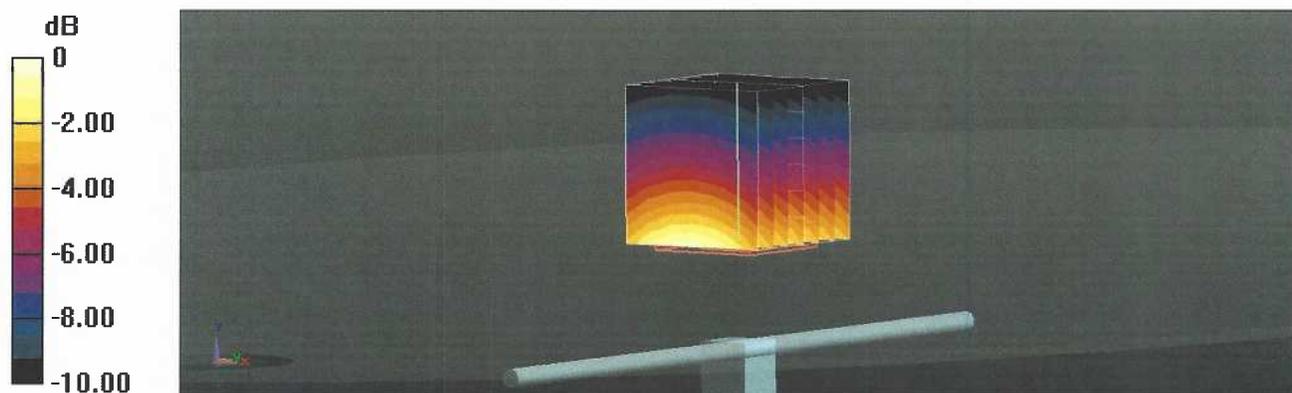
0 dB = 2.29 W/kg = 3.60 dBW/kg

Impedance Measurement Plot for Body TSL

Calibration Laboratory of
Schmid & Partner
  Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

ilac-MRA

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service
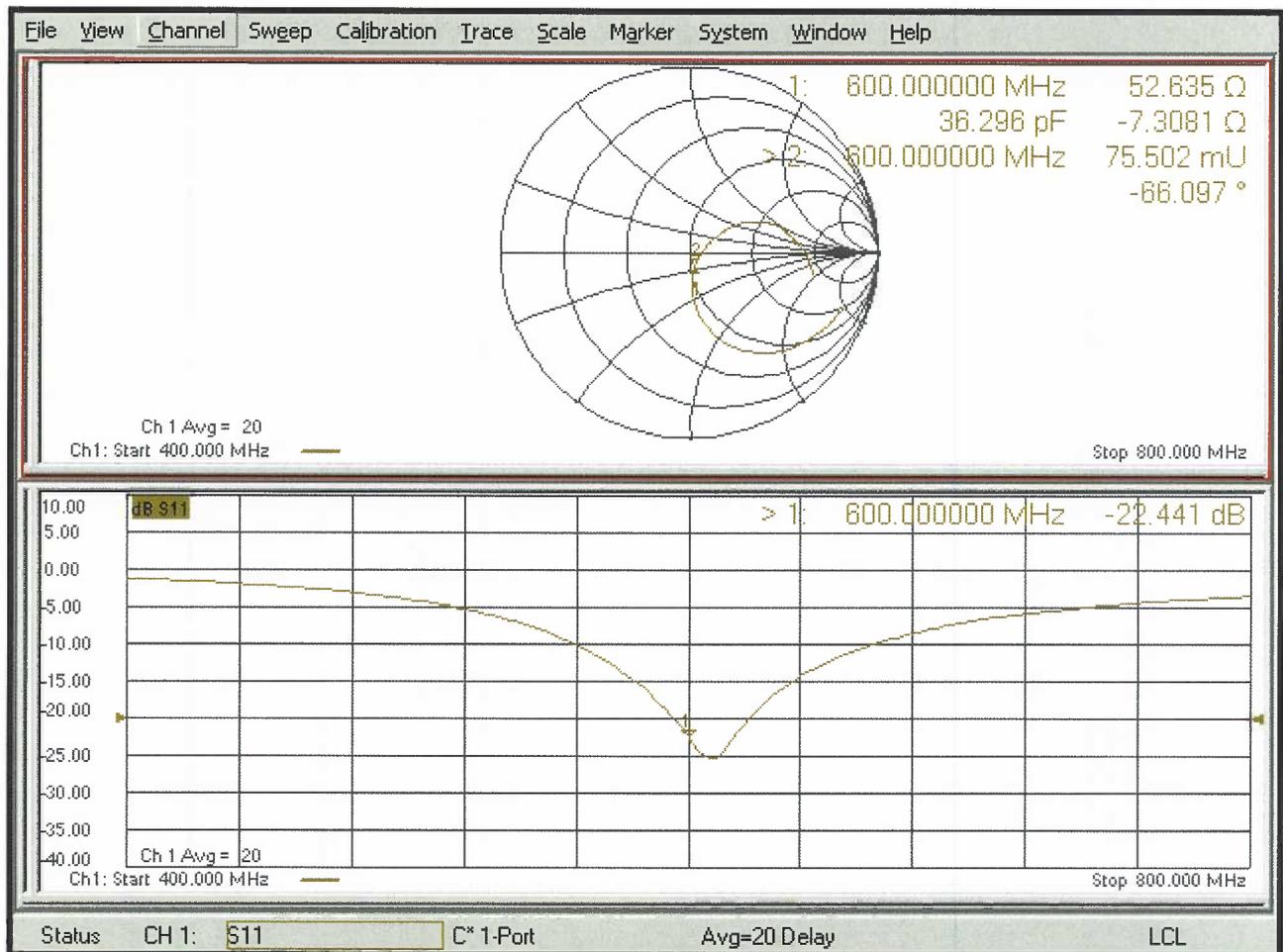
Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client   **RF Exposure Lab**

Certificate No: **D750V3-1016_Jul18**

CALIBRATION CERTIFICATE

Object	**D750V3 - SN:1016**
Calibration procedure(s)	**QA CAL-05.v10** **Calibration procedure for dipole validation kits above 700 MHz**
Calibration date:	**July 13, 2018**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Manu Seitz	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 16, 2018

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

	S	Schweizerischer Kalibrierdienst
	C	Service suisse d'étalonnage
		Servizio svizzero di taratura
	S	Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.23 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.38 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.3 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.55 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.64 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.4 Ω + 0.0 jΩ
Return Loss	- 29.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.8 Ω - 2.6 jΩ
Return Loss	- 30.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.038 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 22, 2010

Extended Calibration
Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (<-20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D750V3 SN: 1016 - Head						
Date of Measurement	Return Loss (dB)	Δ%	Impedance Real (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
7/13/2018	-29.6		53.4		0.0	
7/13/2019	-28.2	-4.7	54.9	1.5	-0.2	-0.2
7/13/2020	-30.1	1.7	52.8	-0.6	0.1	0.1
D750V3 SN: 1016 - Body						
Date of Measurement	Return Loss (dB)	Δ%	Impedance Real (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
7/13/2018	-30.7		48.8		-2.6	
7/13/2019	-29.8	-2.9	49.2	0.4	-2.7	-0.1
7/13/2020	-31.1	1.1	47.6	-1.2	-2.5	0.1

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1016

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.89 S/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.22, 10.22, 10.22) @ 750 MHz; Calibrated: 30.12.2017

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 26.10.2017

- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001

- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.03 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.10 W/kg
SAR(1 g) = 2.07 W/kg; SAR(10 g) = 1.35 W/kg
Maximum value of SAR (measured) = 2.76 W/kg
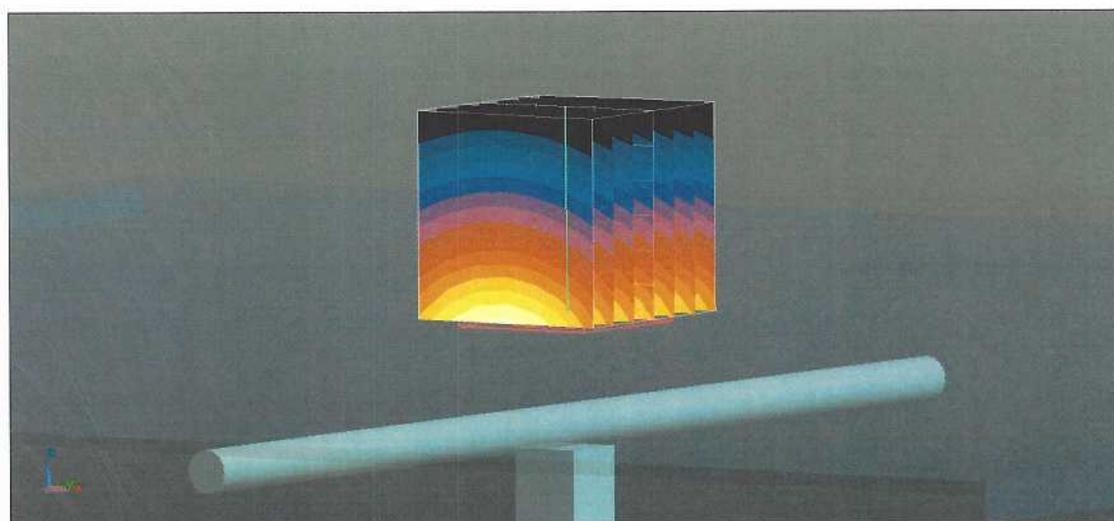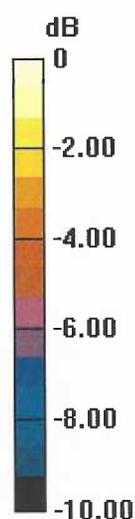
0 dB = 2.76 W/kg = 4.41 dBW/kg

Impedance Measurement Plot for Head TSL
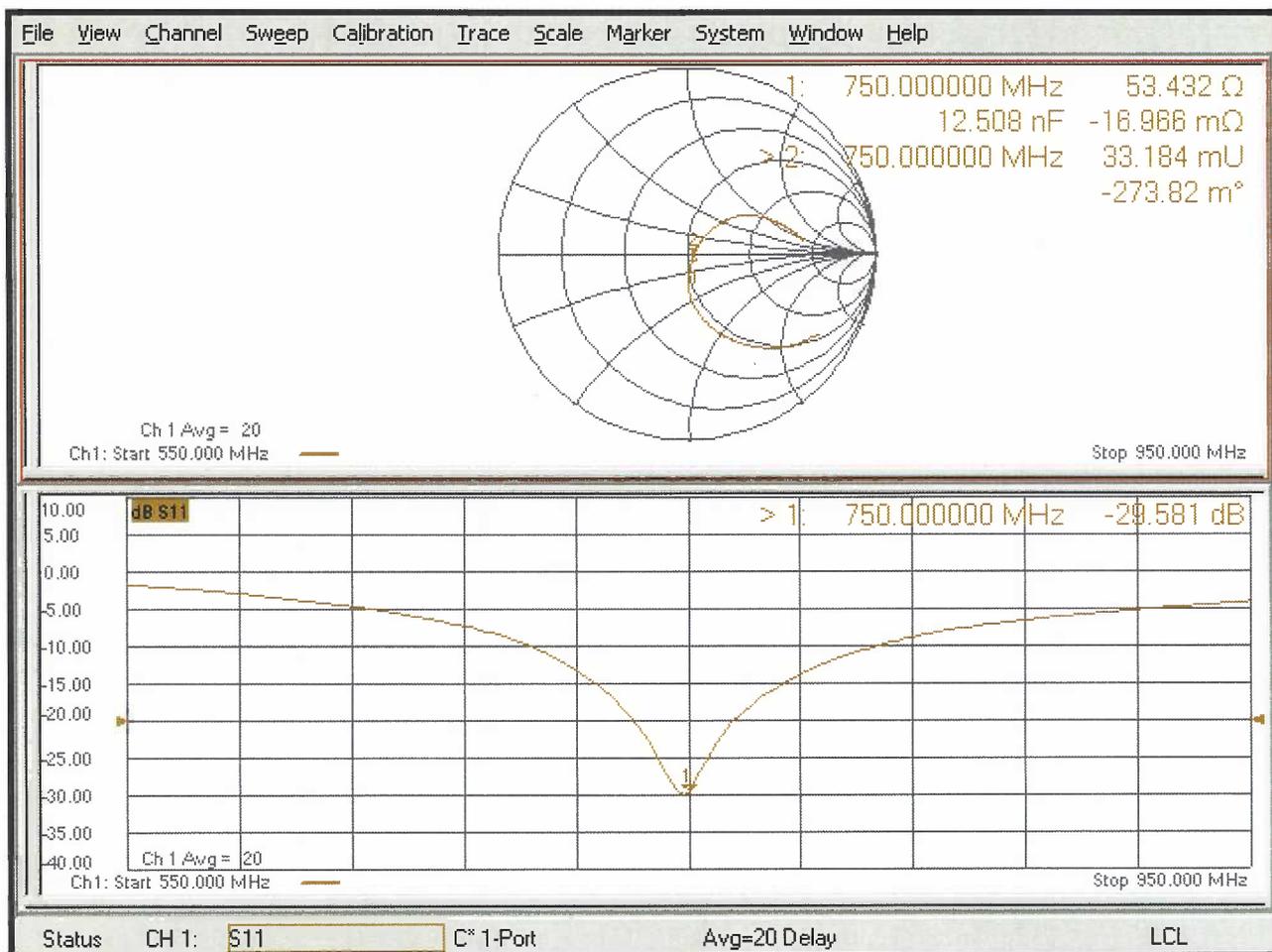
File View Channel Sweep Calibration Trace Scale Marker System Window Help

1:	750.000000 MHz	53.432 Ω
	12.508 nF	-16.966 mΩ
2:	750.000000 MHz	33.184 mU
		-273.82 m°

Ch 1 Avg = 20
Ch1: Start 550.000 MHz   Stop 950.000 MHz

dB S11

| > 1: | 750.000000 MHz | -29.581 dB |

Ch 1 Avg = 20
Ch1: Start 550.000 MHz   Stop 950.000 MHz

Status   CH 1:   S11   C* 1-Port   Avg=20 Delay   LCL

DASY5 Validation Report for Body TSL

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1016

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.96 S/m; ε_r = 55.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.19, 10.19, 10.19) @ 750 MHz; Calibrated: 30.12.2017

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 26.10.2017

- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005

- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

## Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.68 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.18 W/kg
SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.41 W/kg
Maximum value of SAR (measured) = 2.84 W/kg
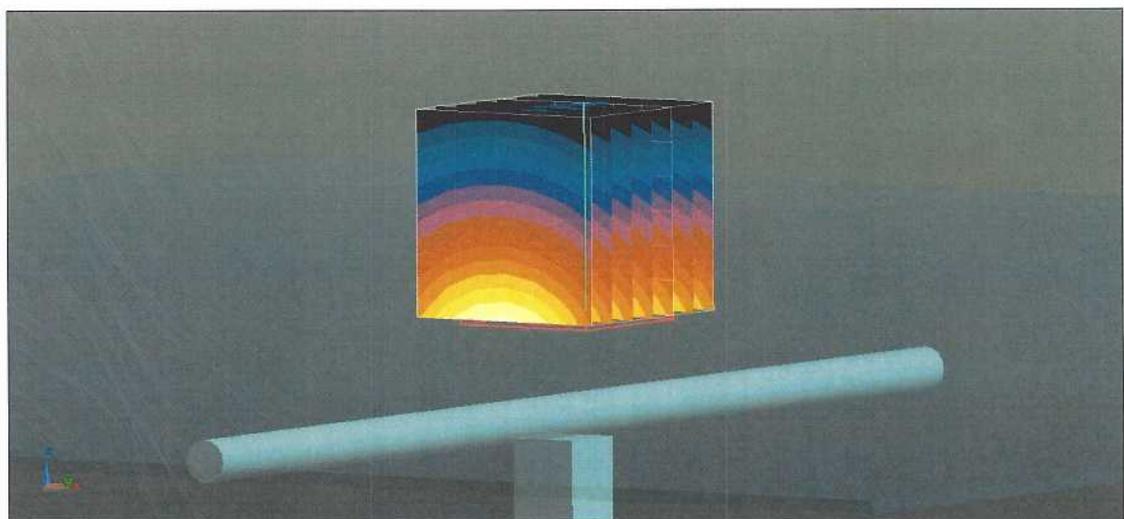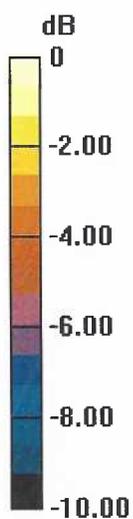
0 dB = 2.84 W/kg = 4.53 dBW/kg

Impedance Measurement Plot for Body TSL
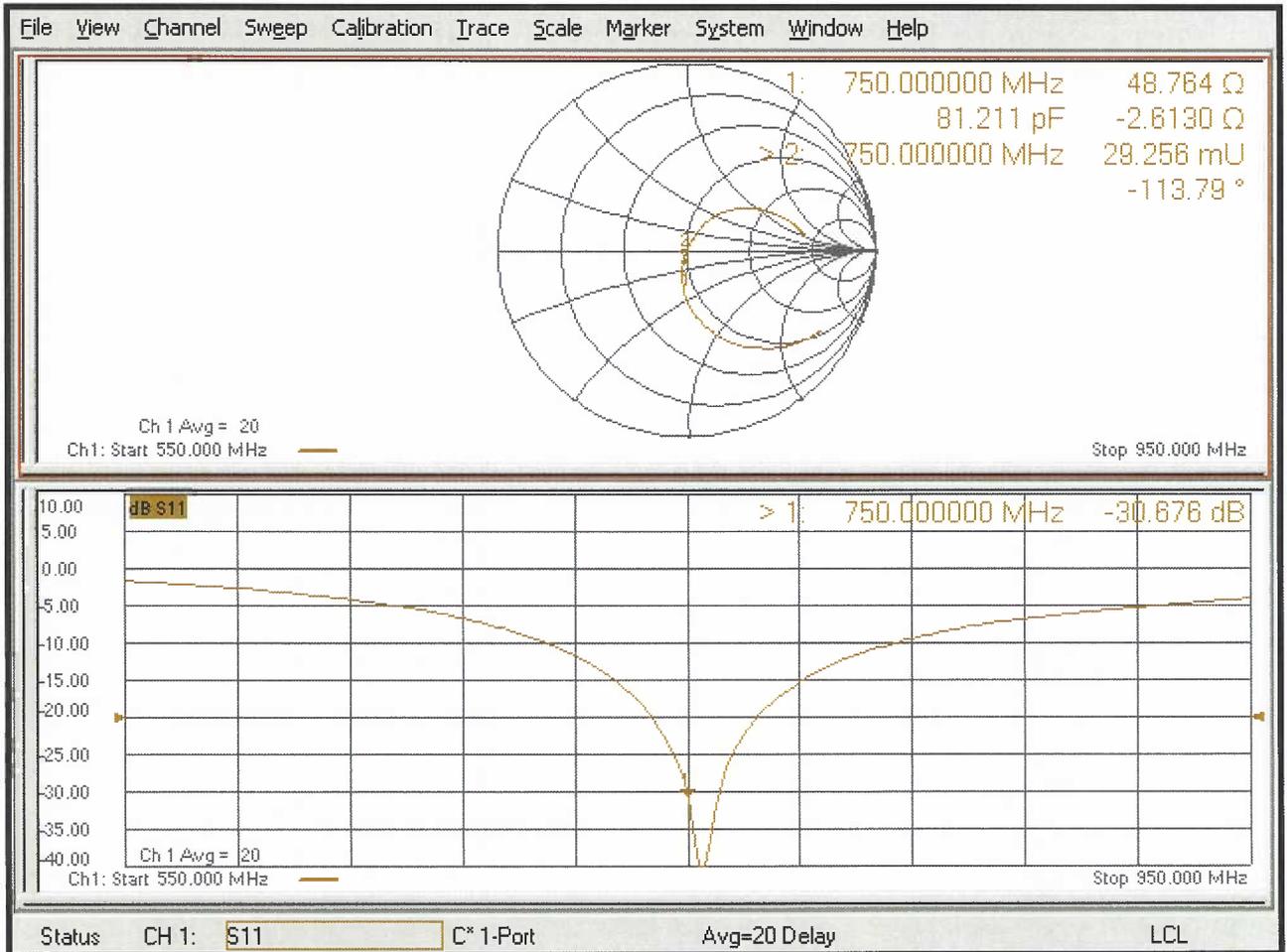
File   View   Channel   Sweep   Calibration   Trace   Scale   Marker   System   Window   Help

	1:	750.000000 MHz	48.764 Ω
		81.211 pF	-2.6130 Ω
	>2:	750.000000 MHz	29.256 mU
			-113.79 °

Ch 1 Avg = 20
Ch1: Start 550.000 MHz   Stop 950.000 MHz

dB S11   > 1:   750.000000 MHz   -30.676 dB

10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00

Ch 1 Avg = 20
Ch1: Start 550.000 MHz   Stop 950.000 MHz

Status   CH 1:   S11   C* 1-Port   Avg=20 Delay   LCL

Calibration Laboratory of
Schmid & Partner
 Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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C	Servizio svizzero di taratura
S	Swiss Calibration Service

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **RF Exposure Lab**

Certificate No: **D900V2-1d044_Jul18**

CALIBRATION CERTIFICATE

Object	D900V2 - SN:1d044

Calibration procedure(s)	**QA CAL-05.v10** **Calibration procedure for dipole validation kits above 700 MHz**

Calibration date:	**July 13, 2018**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Manu Seitz	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 16, 2018

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of
Schmid & Partner
  Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S   Schweizerischer Kalibrierdienst
C   Service suisse d'étalonnage
S   Servizio svizzero di taratura
S   Swiss Calibration Service

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The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.6 ± 6 %	0.95 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.69 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**10.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.72 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.94 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.0	1.05 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.68 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**11.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.74 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**7.12 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.7 Ω - 7.0 jΩ
Return Loss	- 23.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.0 Ω - 8.1 jΩ
Return Loss	- 20.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.410 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 26, 2006

Extended Calibration
Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (<-20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D900V2 SN: 1d044 - Head						
Date of Measurement	Return Loss (dB)	Δ%	Impedance Real (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
7/13/2018	-23.1		49.7		-7.0	
7/13/2019	-22.9	-0.9	50.2	0.5	-6.8	0.2
7/13/2020	-23.5	1.7	48.5	-1.2	-7.4	-0.4
D900V2 SN: 1d044 - Body						
Date of Measurement	Return Loss (dB)	Δ%	Impedance Real (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
7/13/2018	-20.0		45.0		-8.1	
7/13/2019	-21.3	6.5	46.5	1.5	-7.8	0.3
7/13/2020	-21.6	8.0	45.8	0.8	-7.5	0.6

Date: 13.07.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:1d044

Communication System: UID 0 - CW; Frequency: 900 MHz
Medium parameters used: f = 900 MHz; σ = 0.95 S/m; ε_r = 40.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.71, 9.71, 9.71) @ 900 MHz; Calibrated: 30.12.2017

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 26.10.2017

- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001

- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

**Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 65.57 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 4.07 W/kg
SAR(1 g) = 2.69 W/kg; SAR(10 g) = 1.72 W/kg
Maximum value of SAR (measured) = 3.60 W/kg
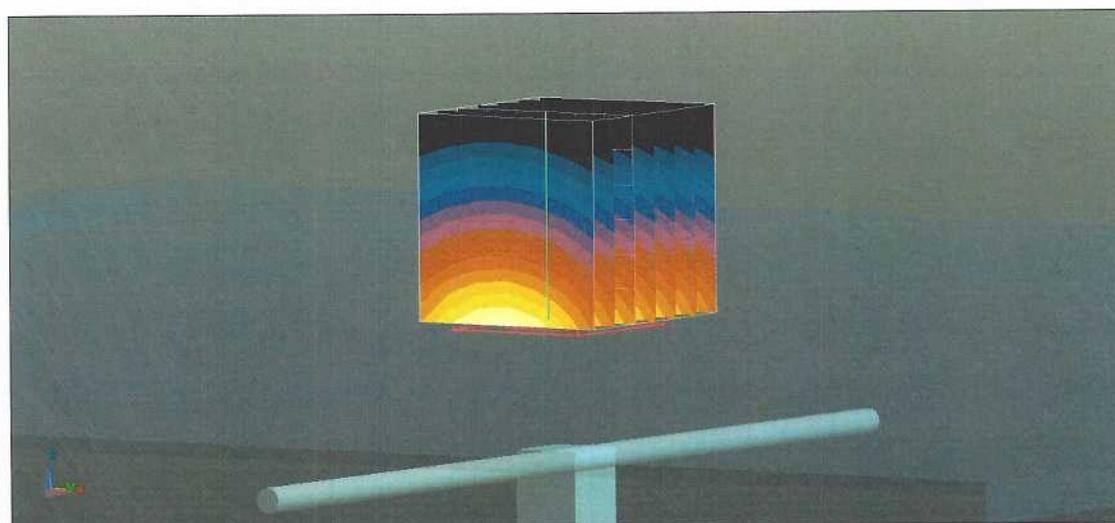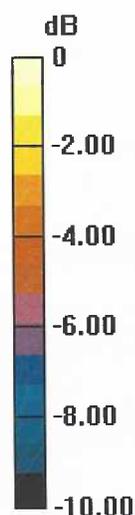
0 dB = 3.60 W/kg = 5.56 dBW/kg

Impedance Measurement Plot for Head TSL

File View Channel Sweep Calibration Trace Scale Marker System Window Help

1:    900.000000 MHz   49.688 Ω
              25.195 pF   -7.0188 Ω
>2:   900.000000 MHz   70.304 mU
                           -88.519 °

Ch 1 Avg = 20
Ch1: Start 700.000 MHz   Stop 1.10000 GHz

10.00 dB S11   > 1   900.000000 MHz   -23.060 dB
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00 Ch 1 Avg = 20
Ch1: Start 700.000 MHz   Stop 1.10000 GHz
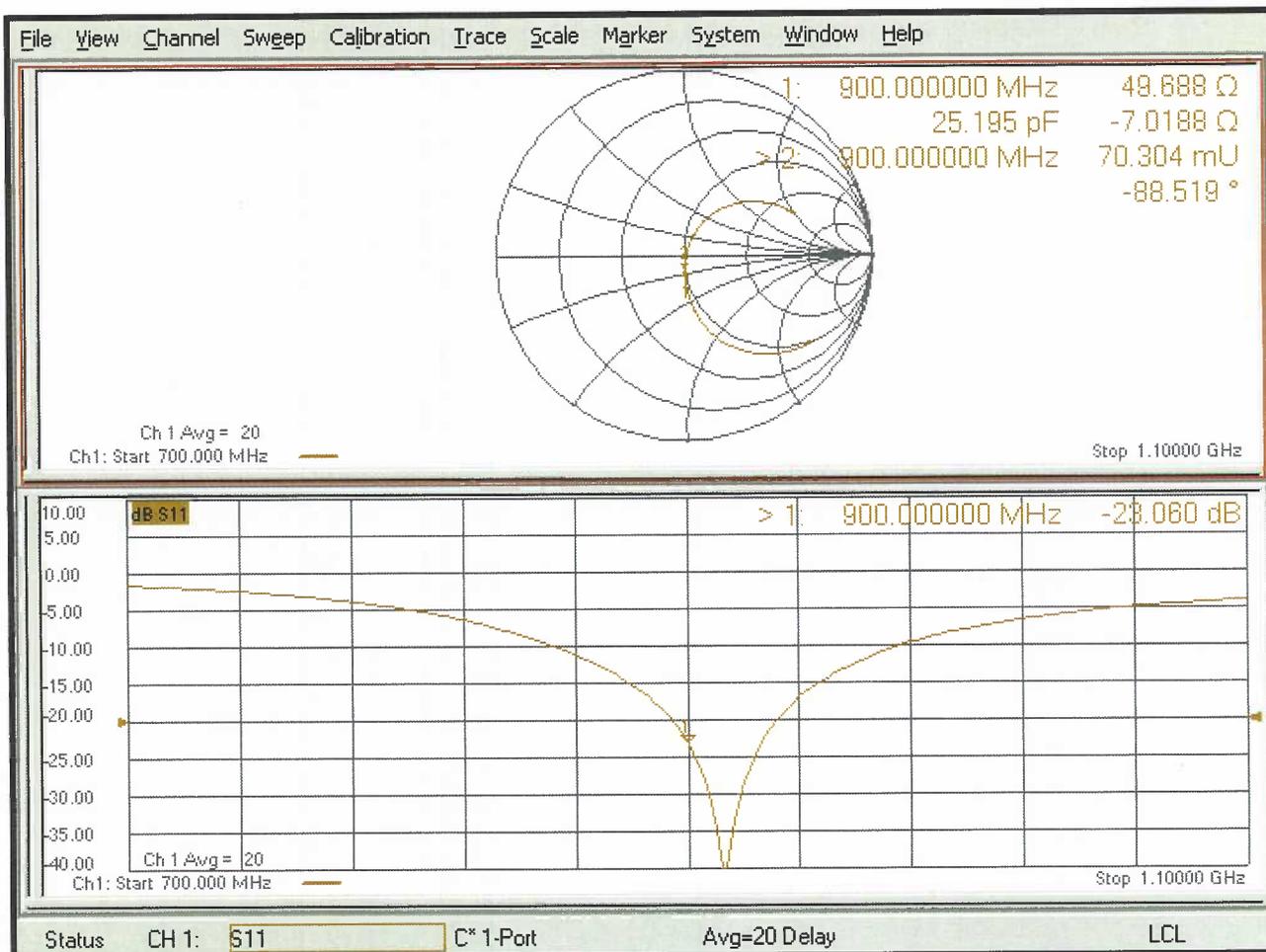
Status   CH 1:   S11   C* 1-Port   Avg=20 Delay   LCL

Date: 13.07.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:1d044

Communication System: UID 0 - CW; Frequency: 900 MHz
Medium parameters used: f = 900 MHz; σ = 1.01 S/m; ε_r = 55; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.83, 9.83, 9.83) @ 900 MHz; Calibrated: 30.12.2017

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 26.10.2017

- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005

- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 63.34 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.89 W/kg
SAR(1 g) = 2.68 W/kg; SAR(10 g) = 1.74 W/kg
Maximum value of SAR (measured) = 3.53 W/kg
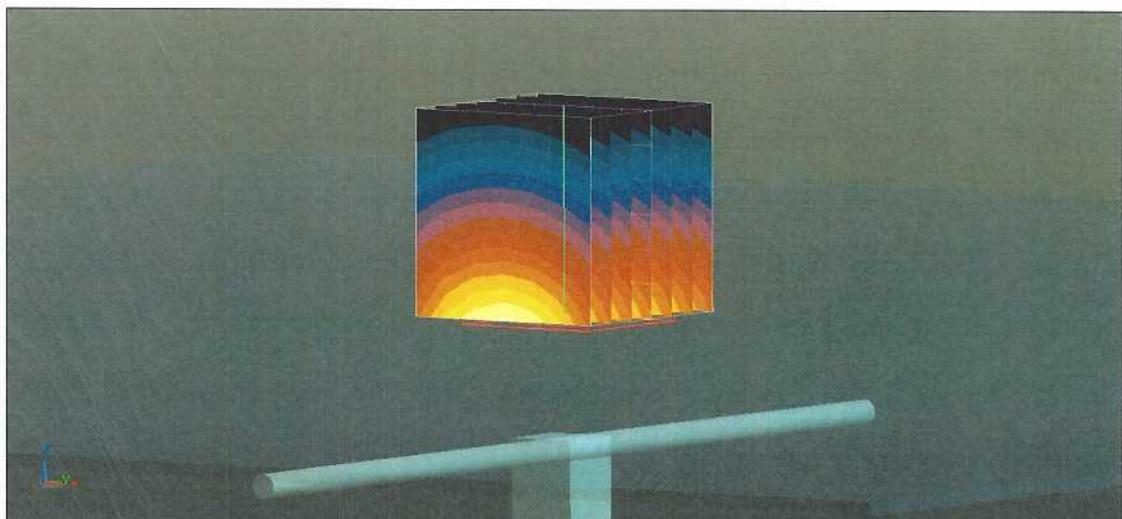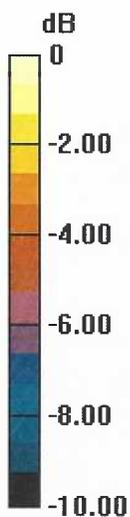
0 dB = 3.53 W/kg = 5.48 dBW/kg

Impedance Measurement Plot for Body TSL
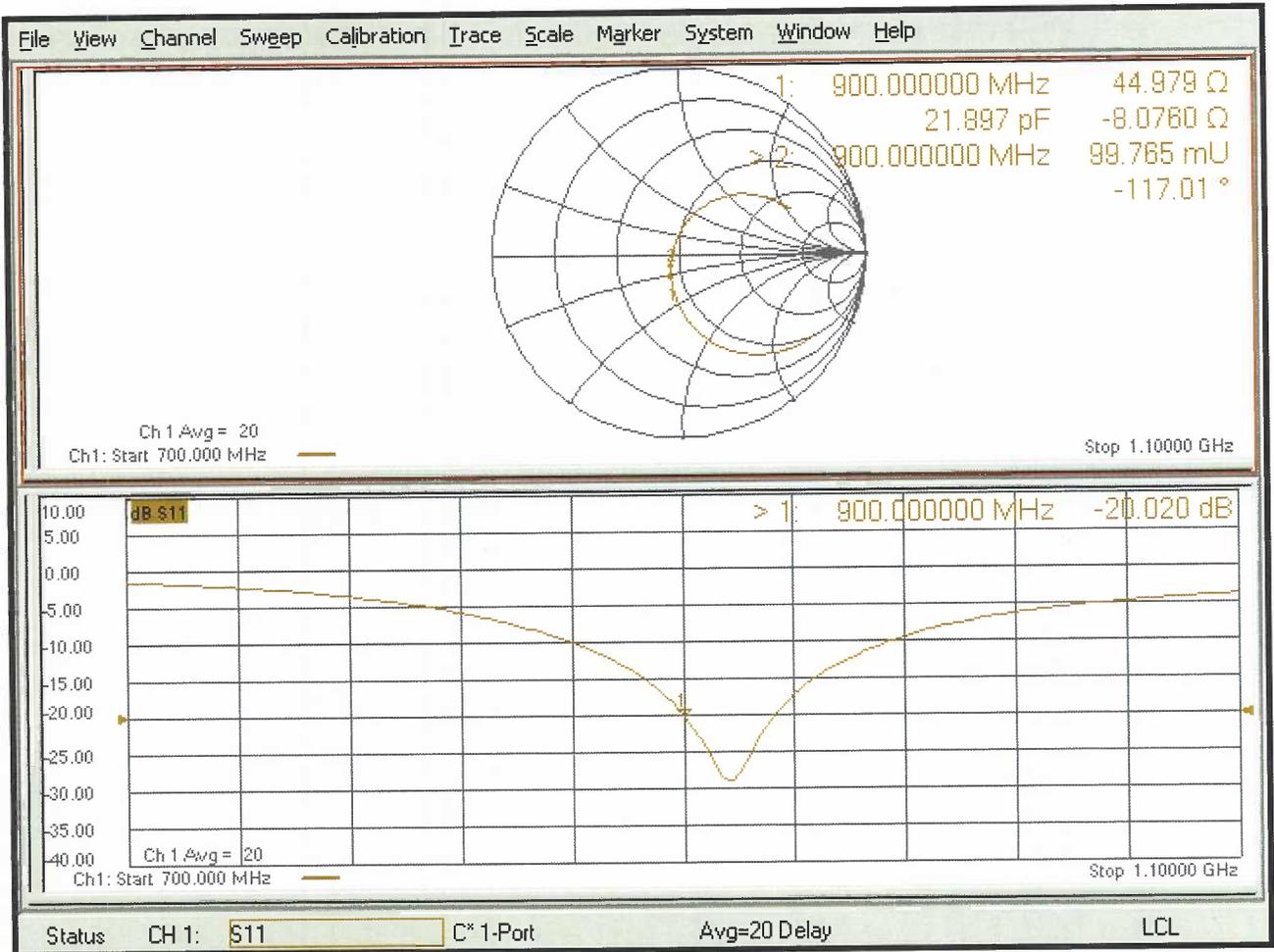
Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

ilac-MRA

S   **Schweizerischer Kalibrierdienst**
C   **Service suisse d'étalonnage**
S   **Servizio svizzero di taratura**
S   **Swiss Calibration Service**

Accredited by the Swiss Accreditation Service (SAS)   **Accreditation No.: SCS 0108**
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Client	**RF Exposure Lab**	Certificate No: **D1750V2-1018_Jul18**

CALIBRATION CERTIFICATE

Object	**D1750V2 - SN:1018**
Calibration procedure(s)	**QA CAL-05.v10** **Calibration procedure for dipole validation kits above 700 MHz**
Calibration date:	**July 20, 2018**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Manu Seitz	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 20, 2018

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

S   Schweizerischer Kalibrierdienst
C   Service suisse d'étalonnage
    Servizio svizzero di taratura
S   Swiss Calibration Service

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.0 ± 6 %	1.34 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.73 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.0 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.7 ± 6 %	1.46 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.00 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**36.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.80 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**19.4 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4 Ω - 1.3 jΩ
Return Loss	- 36.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.2 Ω - 0.1 jΩ
Return Loss	- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.221 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 11, 2009

Extended Calibration
Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (<-20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D1750V2 SN: 1018 - Head						
Date of Measurement	Return Loss (dB)	Δ%	Impedance Real (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
7/20/2018	-36.8		49.4		-1.3	
7/13/2019	-37.2	1.1	48.9	-0.5	-1.6	-0.3
7/20/2020	-36.1	-1.9	48.4	-1.0	-1.4	-0.1
D1750V2 SN: 1018 - Body						
Date of Measurement	Return Loss (dB)	Δ%	Impedance Real (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
7/20/2018	-25.9		45.2		-0.1	
7/13/2019	-26.5	2.3	45.8	0.6	-0.2	-0.1
7/20/2020	-26.1	0.8	44.9	-0.3	-0.1	0.0

Date: 20.07.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1018

Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.34 S/m; ε_r = 39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 MHz; Calibrated: 30.12.2017

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 26.10.2017

- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001

- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.7 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 8.95 W/kg; SAR(10 g) = 4.73 W/kg
Maximum value of SAR (measured) = 13.9 W/kg

0 dB = 13.9 W/kg = 11.43 dBW/kg
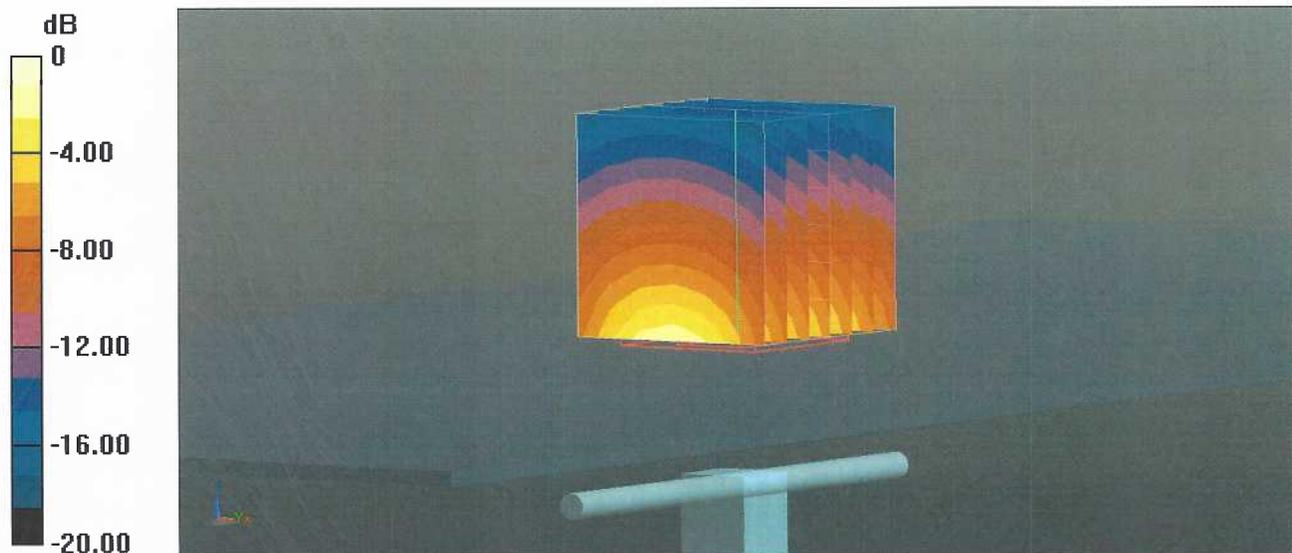
Impedance Measurement Plot for Head TSL

DASY5 Validation Report for Body TSL

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1018

Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.46 S/m; ε_r = 53.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.35, 8.35, 8.35) @ 1750 MHz; Calibrated: 30.12.2017

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 26.10.2017

- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002

- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

## Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.9 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 15.8 W/kg
SAR(1 g) = 9 W/kg; SAR(10 g) = 4.8 W/kg
Maximum value of SAR (measured) = 13.4 W/kg

0 dB = 13.4 W/kg = 11.27 dBW/kg