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CERTIFICATE OF COMPLIANCE
R&D SAR EVALUATION

Privoro, LLC 3100 W. Ray Rd. #201 Chandler, AZ 85226	Dates of Test: Test Report Number:	June 18-21, 2018 SAR.20180614

FCC ID:	2APWUPM02SC
IC Certificate:	23953-PM02SC
Model(s):	M0002 with iPhone 7 (FCC ID: BCG-E3085A) & iPhone 8 (FCC ID: BCG-E3159A)
Test Sample:	Engineering Unit Same as Production
Equipment Type:	Smart Phone SafeCase
Classification:	Portable Transmitter Next to Head and Body
TX Frequency Range:	777 – 787 MHz; 824 – 849 MHz; 1710 – 1755 MHz; 1850 – 1910 MHz; 2412 – 2462 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	See Data Sheets
Signal Modulation:	QPSK, WCDMA, GMSK, 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:	1.11 W/kg Reported Head; 1.21 W/kg Reported Body
Max. Simultaneous SAR Value:	1.51 W/kg Reported Head; 1.60 W/kg Reported 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

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1. Introduction

This measurement report shows the result of the Privoro Model M0002 with iPhone 7 & iPhone 8 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 M0002 with iPhone 7 & iPhone 8 and 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.

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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)

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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.

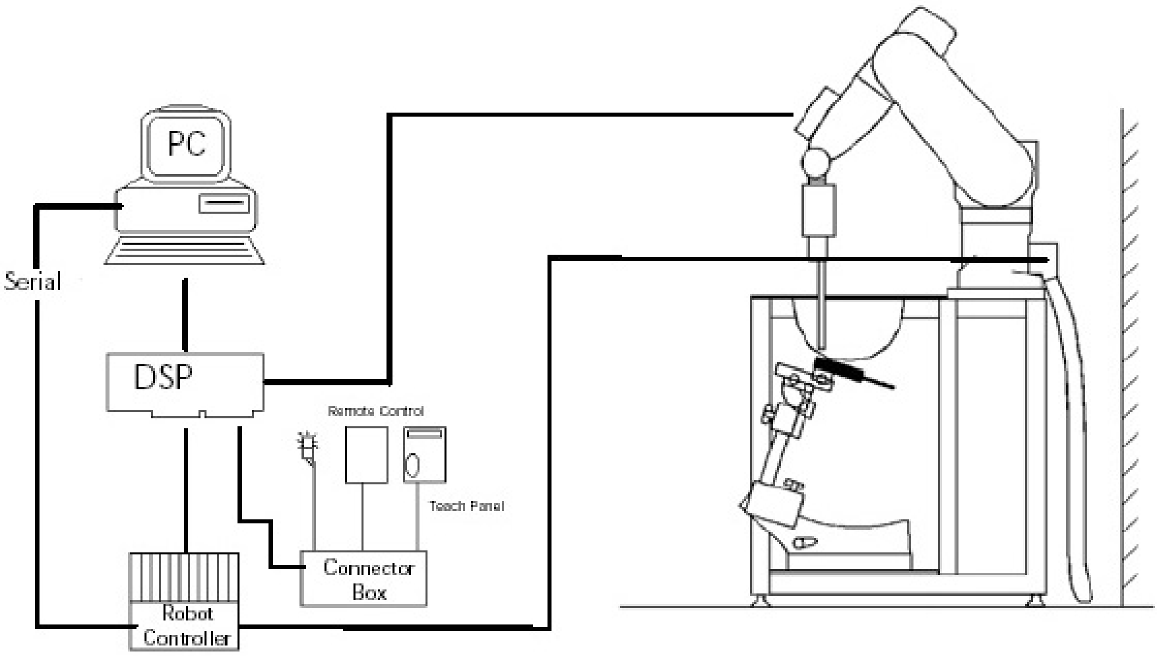

Figure 2.1 SAR Measurement System Setup

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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

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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

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

Application: SAR Dosimetry Testing
Compliance tests of wireless device

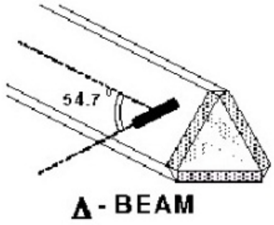

Figure 2.2 Triangular Probe Configurations

Figure 2.3 Probe Thick-Film Technique

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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

$$SAR = C\frac{\Delta T}{\Delta t} \qquad\qquad SAR = \frac{|E|^2 \cdot \sigma}{\rho}$$

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;

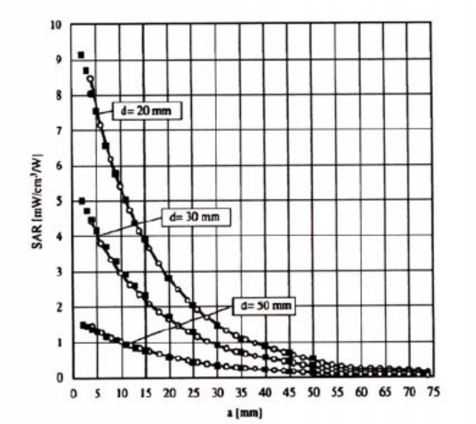

Figure 2.4 E-Field and Temperature Measurements at 900MHz

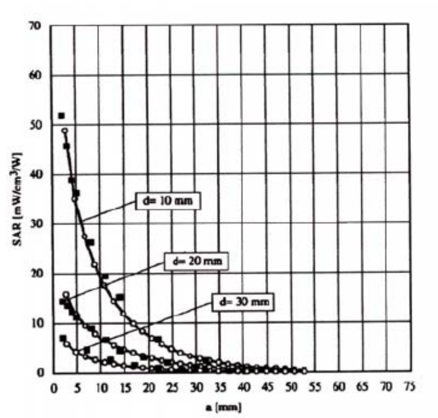

Figure 2.5 E-Field and Temperature Measurements at 1800MHz

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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/cm^3

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/cm^2
E_{tot} = total electric field strength in V/m

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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.

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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.

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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

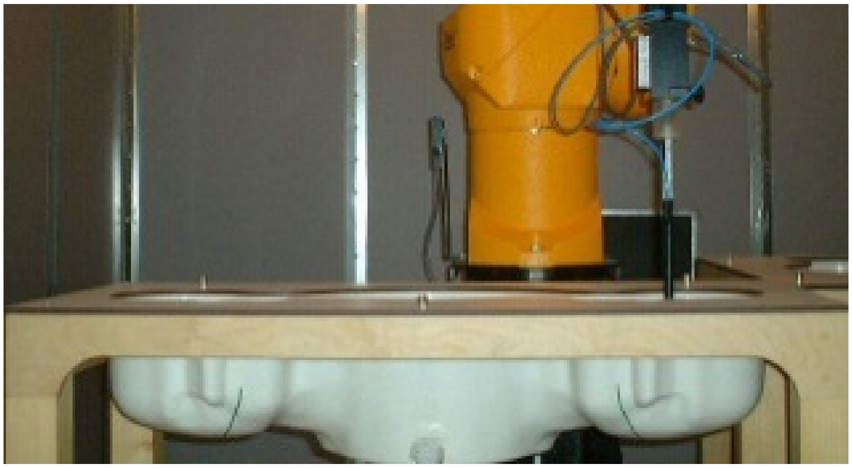

Figure 2.6 SAM Twin Phantom

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.

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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].

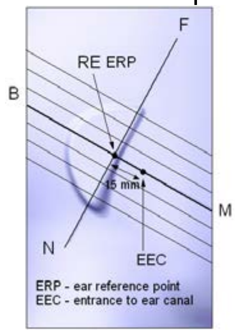

Figure 3.1 Close-up side view of ERP's

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].

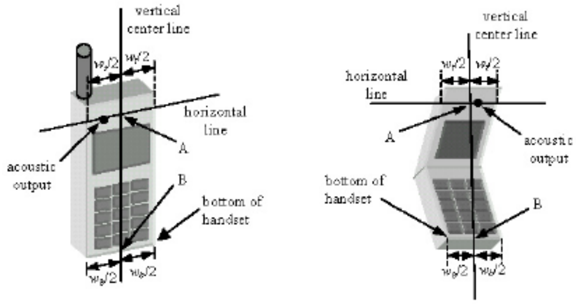

Figure 3.3 Handset Vertical Center & Horizontal Line Reference Points

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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.

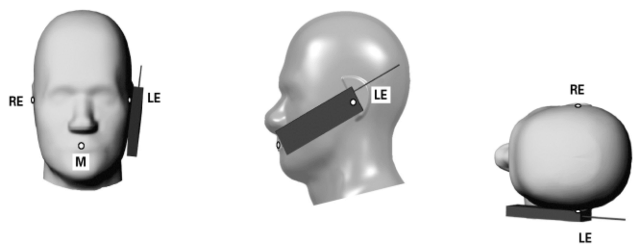

Figure 4.1 Front, Side and Top View of Cheek/Touch Position

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.

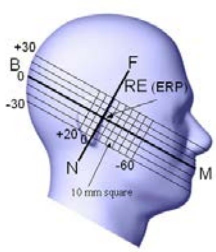

Figure 4.2 Side view w/ relevant markings

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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).

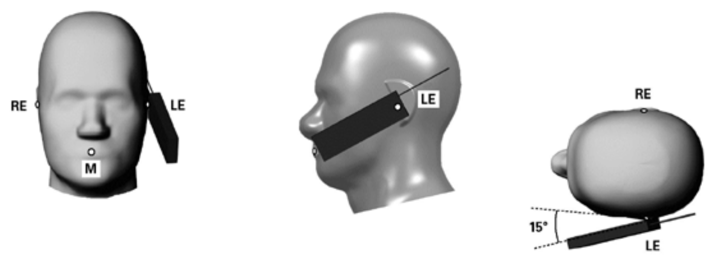

Figure 4.3 Front, Side and Top View of Ear/15˚ Tilt Position

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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.

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5. Probe and Dipole Calibration

See Appendix D and E.

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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			
		850 MHz Head	850 MHz Body	1900 MHz Head	1900 MHz Body
Mixing Percentage					
Water		40.92	52.50	54.88	69.91
Sugar		56.65	45.00	0.00	0.00
Salt		1.49	1.40	0.21	0.13
HEC		1.00	1.00	0.00	0.00
Bactericide		0.10	0.10	0.00	0.00
DGBE		0.00	0.00	44.91	29.96
Dielectric Constant	Target	41.50	55.20	40.00	53.30
Conductivity (S/m)	Target	0.91	0.97	1.40	1.52
Ingredients		Simulating Tissue			
		750 MHz Head	750 MHz Body	1750 MHz Head	1750 MHz Body
Mixing Percentage					
Water		Proprietary Mixture Procured from Speag	Proprietary Mixture Procured from Speag	Proprietary Mixture Procured from Speag	Proprietary Mixture Procured from Speag
Sugar					
Salt					
HEC					
Bactericide					
DGBE					
Dielectric Constant	Target	41.49	55.53	40.08	53.43
Conductivity (S/m)	Target	0.89	0.96	1.37	1.49

Ingredients		Simulating Tissue	
		2450 MHz Head	2450 MHz Body
Mixing Percentage			
Water		Proprietary Mixture Procured from Speag	73.20
Sugar			0.00
Salt			0.04
HEC			0.00
Bactericide			0.00
DGBE			26.70
Dielectric Constant	Target	39.20	52.70
Conductivity (S/m)	Target	1.80	1.95

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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

[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.

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8. Measurement Uncertainty

Exposure Assessment Measurement Uncertainty

Relative DASY5 Uncertainty Budget for SAR Tests								
According to IEC62209-2/2010 (30 MHz - 6 GHz range)								
Error Description	Uncertainty Value	Probability Distribution	Divisor	c_i (1g)	c_i (10g)	Standard Uncertainty ± %, (1g)	Standard Uncertainty ± %, (10g)	v_i^2 or v_{eff}
Measurement System								
Probe calibration	± 6.6%	Normal	1	1	1	± 6.6%	± 6.6%	∞
Axial isotropy	± 4.7%	Rectangular	√3	0.7	0.7	± 1.9%	± 1.9%	∞
Hemispherical isotropy	± 9.6%	Rectangular	√3	0.7	0.7	± 3.9%	± 3.9%	∞
Boundary effects	± 2.0%	Rectangular	√3	1	1	± 1.2%	± 1.2%	∞
Probe linearity	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	∞
System detection limits	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Modulation response	± 2.4%	Rectangular	√3	1	1	± 1.4%	± 1.4%	∞
Readout electronics	± 0.3%	Normal	1	1	1	± 0.3%	± 0.3%	∞
Response time	± 0.8%	Rectangular	√3	1	1	± 0.5%	± 0.5%	∞
Integration time	± 2.6%	Rectangular	√3	1	1	± 1.5%	± 1.5%	∞
RF ambient noise	± 3.0%	Rectangular	√3	1	1	± 1.7%	± 1.7%	∞
RF ambient reflections	± 3.0%	Rectangular	√3	1	1	± 1.7%	± 1.7%	∞
Probe positioner	± 0.8%	Rectangular	√3	1	1	± 0.5%	± 0.5%	∞
Probe positioning	± 6.7%	Rectangular	√3	1	1	± 3.9%	± 3.9%	∞
Post-processing	± 4.0%	Rectangular	√3	1	1	± 2.3%	± 2.3%	∞
Test Sample Related								
Device positioning	± 2.9%	Normal	1	1	1	± 2.9%	± 2.9%	145
Device holder uncertainty	± 3.6%	Normal	1	1	1	± 3.6%	± 3.6%	5
Power drift	± 5.0%	Rectangular	√3	1	1	± 2.9%	± 2.9%	∞
Phantom and Setup								
Phantom uncertainty	± 7.9%	Rectangular	√3	1	1	± 4.6%	± 4.6%	∞
SAR algorithm correction	± 1.9%	Normal	1	1	0.84	± 1.9%	± 1.9%	∞
Liquid conductivity (meas.)	± 5.0%	Rectangular	√3	0.78	0.71	± 0.1%	± 0.1%	∞
Liquid permittivity (meas.)	± 5.0%	Rectangular	√3	0.26	0.26	± 0.1%	± 0.1%	∞
Temp. Unc. – Conductivity	± 3.4%	Rectangular	√3	0.78	0.71	± 1.5%	± 1.5%	∞
Temp. Unc. – Permittivity	± 0.4%	Rectangular	√3	0.23	0.26	± 0.1%	± 0.1%	∞
Combined Uncertainty						± 12.4%	± 12.3%	330
Expanded Std. Uncertainty						± 24.8%	± 24.6%	

Worst case uncertainty budget for DASY5 assessed according to IEC62209-2/2010 standard. The budget is valid for the frequency range 30 MHz – 6 GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerable smaller.

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9. System Validation

Tissue Verification

Table 9.1 Measured Tissue Parameters

		750 MHz Head		750 MHz Body		835 MHz Head	
Date(s)		June 20, 2018		June 21, 2018		June 18, 2018	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		41.94	41.46	55.53	54.69	41.50	41.40
Conductivity: σ		0.89	0.90	0.96	0.94	0.90	0.93
		835 MHz Body		1750 MHz Head		1750 MHz Body	
Date(s)		June 18, 2018		June 21, 2018		June 21, 2018	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		55.20	54.93	40.08	40.01	53.43	53.32
Conductivity: σ		0.97	0.99	1.37	1.39	1.49	1.52
		1900 MHz Head		1900 MHz Body		2450 MHz Head	
Date(s)		June 19, 2018		June 20, 2018		June 21, 2018	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		40.00	39.56	53.30	52.07	39.20	38.97
Conductivity: σ		1.40	1.44	1.52	1.47	1.80	1.85
		2450 MHz Body					
Date(s)		June 21, 2018					
Liquid Temperature (˚C)	20.0	Target	Measured				
Dielectric Constant: ε		52.70	52.64				
Conductivity: σ		1.95	1.96				

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
20-Jun-2016	750 MHz	8.03	8.13	Head	+ 1.25	1
21-Jun-2016	750 MHz	8.48	8.65	Body	+ 2.01	2
18-Jun-2016	835 MHz	9.23	9.27	Head	+ 0.43	3
18-Jun-2016	835 MHz	9.28	9.51	Body	+ 2.48	4
21-Jun-2016	1750 MHz	36.80	37.20	Head	+ 1.09	5
21-Jun-2016	1750 MHz	37.70	37.50	Body	- 0.53	6
19-Jun-2016	1900 MHz	41.50	41.70	Head	+ 0.48	7
20-Jun-2016	1900 MHz	40.40	40.20	Body	- 0.50	8
21-Jun-2016	2450 MHz	53.50	53.90	Head	+ 0.94	9
21-Jun-2016	2450 MHz	52.10	52.00	Body	- 0.19	10

See Appendix A for data plots.

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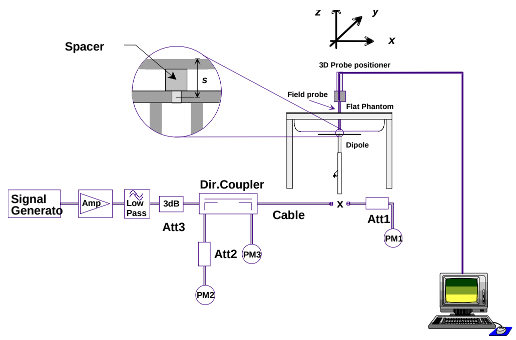

Figure 9.1 Dipole Validation Test Setup

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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.

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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.

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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

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- 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.

12.3 SAR Measurement Conditions for GSM

Configure the 8960 box to support GMSK and 8PSK call respectively, and set one timeslot and two timeslot transmission for GMSK GSM/GPRS and 8PSK EDGE. Measure and record power outputs for both modulations.

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Phone	Mode	Channel	Power	Max. Power	Configuration
iPhone 7	WCDMA	4183	22.50	25.00	Head & Body
		9400	24.90	25.20	Head
		9400	18.90	19.50	Body
iPhone 8		4183	24.10	24.80	Head
		4233	24.10	24.80	Body
		9538	24.50	25.00	Head
		9538	19.70	19.80	Body

Phone	Config.	Mod.	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power	Max.
iPhone 7	Head/Body	QPSK	10 MHz	1	24	23230	782	22.60	24.50
	Head		20 MHz	1	49	20300	1745	22.90	24.50
	Body		20 MHz	1	49	20300	1745	18.30	19.70
iPhone 8	Head/Body		10 MHz	1	24	23230	782	24.00	24.80
	Head		20 MHz	1	49	19100	1900	23.20	24.80
	Body		20 MHz	1	49	18900	1880	19.70	19.80

GSM-GMSK/1 slot				
Phone	Config.	Channel	Peak Power	Max. Peak
iPhone 7	Head/Body	190	31.40	32.50
	Head	661	28.10	29.50
	Body	661	25.20	25.50
iPhone 8	Head	190	31.50	32.30
	Body	251	31.50	32.30
	Head	661	28.60	30.30
	Body	810	24.50	25.00

Phone	Mode	Channel	Power	Max. Power	Configuration
iPhone 7	CDMA	384	23.30	25.00	Head & Body
		1175	24.90	25.00	Head
		1175	19.40	19.80	Body
iPhone 8		384	24.30	24.80	Head
		777	24.30	24.80	Body
		1175	23.80	25.00	Head
		1175	19.20	19.80	Body

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Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Data Rate	Antenna	Avg Power (dBm)	Tune-up Pwr (dBm)
2450 MHz	802.11b	20	1	2412	1 Mbps	Chain A	17.14	17.30
			6	2437			17.28	17.30
			11	2462			17.15	17.30
	802.11g	20	1	2412	6 Mbps	Chain A	16.81	17.30
			6	2437			16.83	17.30
			11	2462			16.75	17.30
	802.11n	20	1	2412	HT0	Chain A	16.65	17.30
			6	2437			16.69	17.30
			11	2462			16.67	17.30
	802.11n	40	3	2422	HT0	Chain A	16.63	17.30
			6	2437			16.64	17.30
			9	2452			16.62	17.30

Band	Mode	Channel	Frequency (MHz)	Data Rate	Antenna	Avg Power (dBm)	Tune-up Pwr (dBm)
2450 MHz	Bluetooth	0	2402	Basic Rate GFSK	Main	7.11	7.20
		39	2441			7.15	7.20
		78	2480			7.10	7.20

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SAR Data Summary – 750/850 MHz for iPhone 7

MEASUREMENT RESULTS											
Gap	**Plot**	**Frequency**		**Modulation**	**Position**	**Power [dBm]**	**RMC/RB**	**Test Setup/ Offset**	**Measured SAR (W/kg)**	**Scaled SAR (W/kg)**	**Original SAR (W/kg)**
		MHz	**Ch.**								
0 mm	1	836.6	4183	WCDMA	Left Touch	22.50	12.2 kbps	Test Loop 1	0.323	0.57	0.56
	-----	836.6	4183	WCDMA	Left Touch with Case	22.50	12.2 kbps	Test Loop 1	0.124	0.22	-----
5 mm	2	836.6	4183	WCDMA	Front Body	22.50	12.2 kbps	Test Loop 1	0.493	0.88	0.92
	-----	836.6	4183	WCDMA	Front Body with Case	22.50	12.2 kbps	Test Loop 1	0.156	0.28	-----
0 mm	3	782.0	23230	LTE	Right Touch	22.60	1	24	0.224	0.35	0.31
	-----	782.0	23230	LTE	Right Touch with Case	22.60	1	24	0.0353	0.06	-----
5 mm	4	782.0	23230	LTE	Front Body	22.60	1	24	0.416	0.64	0.60
	-----	782.0	23230	LTE	Front Body with Case	22.60	1	24	0.0977	0.15	-----
0 mm	5	836.6	190	GSM	Left Touch	31.40	1 Slot	5	0.437	0.56	0.59
	-----	836.6	190	GSM	Left Touch with Case	31.40	1 Slot	5	0.205	0.26	-----
5 mm	6	836.6	190	GSM	Front Body	31.40	1 Slot	5	0.779	1.00	0.98
	-----	836.6	190	GSM	Front Body with Case	31.40	1 Slot	5	0.321	0.41	-----
0 mm	7	836.6	384	CDMA	Left Touch	23.30	TDSO	SO32 RC3	0.349	0.39	0.40
	-----	836.6	384	CDMA	Left Touch with Case	23.30	TDSO	SO32 RC3	0.132	0.15	-----
5 mm	8	836.6	384	CDMA	Front Body	23.30	TDSO	SO32 RC3	0.634	0.71	0.63
	-----	836.6	384	CDMA	Front Body with Case	23.30	TDSO	SO32 RC3	0.181	0.20	-----
							Head & Body **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

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Vice President

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SAR Data Summary – 1750/1900 MHz for iPhone 7

MEASUREMENT RESULTS

Gap	Plot	Frequency		Modulation	Position	Power [dBm]	RMC/RB	Test Setup/ Offset	Measured SAR (W/kg)	Scaled SAR (W/kg)	Original SAR (W/kg)
		MHz	Ch.								
0 mm	9	1880	9400	WCDMA	Right Touch	24.90	12.2 kbps	Test Loop 1	0.775	0.83	0.98
	-----	1880	9400	WCDMA	Right Touch with Case	24.90	12.2 kbps	Test Loop 1	0.625	0.67	-----
5 mm	10	1880	9400	WCDMA	Front Body	18.90	12.2 kbps	Test Loop 1	0.622	0.71	0.79
	-----	1880	9400	WCDMA	Front Body with Case	18.90	12.2 kbps	Test Loop 1	0.318	0.37	-----
0 mm	11	1745	20300	LTE	Right Touch	22.90	1	49	0.594	0.86	0.87
	-----	1745	20300	LTE	Right Touch with Case	22.90	1	49	0.435	0.63	-----
5 mm	12	1745	20300	LTE	Front Body	18.30	1	49	0.652	0.90	0.91
	-----	1745	20300	LTE	Front Body with Case	18.30	1	49	0.367	0.51	-----
0 mm	13	1880	661	GSM	Right Touch	28.10	1 Slot	0	0.412	0.57	0.55
	-----	1880	661	GSM	Right Touch with Case	28.10	1 Slot	0	0.382	0.53	-----
5 mm	14	1908.8	810	GSM	Front Body	25.20	1 Slot	0	1.02	1.09	1.06
	-----	1908.8	810	GSM	Front Body with Case	25.20	1 Slot	0	0.809	0.87	-----
0 mm	14	1908.8	1175	CDMA	Right Touch	24.90	TDSO	SO32 RC3	0.841	0.86	0.84
	-----	1908.8	1175	CDMA	Right Touch with Case	24.90	TDSO	SO32 RC3	0.721	0.74	-----
5 mm	16	1908.8	1175	CDMA	Front Body	19.40	TDSO	SO32 RC3	1.03	1.05	1.05
	-----	1908.8	1175	CDMA	Front Body with Case	19.40	TDSO	SO32 RC3	0.737	0.75	-----

Head & Body
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

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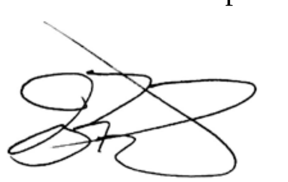
SAR Data Summary – 750/850 MHz for iPhone 8

MEASUREMENT RESULTS

Gap	Plot	Frequency		Modulation	Position	Power [dBm]	RMC/RB	Test Setup/ Offset	Measured SAR (W/kg)	Scaled SAR (W/kg)	Original SAR (W/kg)
		MHz	Ch.								
0 mm	17	836.6	4183	WCDMA	Left Touch	24.10	12.2 kbps	Test Loop 1	0.311	0.37	0.49
	-----	836.6	4183	WCDMA	Left Touch with Case	24.10	12.2 kbps	Test Loop 1	0.147	0.17	-----
5 mm	18	846.6	4233	WCDMA	Back Body	24.10	12.2 kbps	Test Loop 1	1.03	1.21	1.00
	-----	846.6	4233	WCDMA	Back Body with Case	24.10	12.2 kbps	Test Loop 1	0.179	0.21	-----
0 mm	19	782.0	23230	LTE	Left Touch	24.00	1	24	0.317	0.38	0.37
	-----	782.0	23230	LTE	Left Touch with Case	24.00	1	24	0.087	0.11	-----
5 mm	20	782.0	23230	LTE	Back Body	24.00	1	24	0.622	0.75	0.88
	-----	782.0	23230	LTE	Back Body with Case	24.00	1	24	0.168	0.20	-----
0 mm	21	836.6	190	GSM	Left Touch	31.5	1 Slot	5	0.362	0.48	0.59
	-----	836.6	190	GSM	Left Touch with Case	31.5	1 Slot	5	0.166	0.22	-----
5 mm	22	848.8	251	GSM	Back Body	31.5	1 Slot	5	0.794	1.05	1.03
	-----	848.8	251	GSM	Back Body with Case	31.5	1 Slot	5	0.245	0.32	-----
0 mm	23	836.6	384	CDMA	Left Touch	24.30	TDSO	SO32 RC3	0.310	0.35	0.46
	-----	836.6	384	CDMA	Left Touch with Case	24.30	TDSO	SO32 RC3	0.200	0.22	-----
5 mm	24	848.3	777	CDMA	Front Body	24.30	TDSO	SO32 RC3	0.804	0.90	0.87
	-----	848.3	777	CDMA	Front Body with Case	24.30	TDSO	SO32 RC3	0.196	0.22	-----

Head & Body
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



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SAR Data Summary – 1750/1900 MHz for iPhone 8

MEASUREMENT RESULTS

Gap	Plot	Frequency		Modulation	Position	Power [dBm]	RMC/RB	Test Setup/ Offset	Measured SAR (W/kg)	Scaled SAR (W/kg)	Original SAR (W/kg)
		MHz	Ch.								
0 mm	25	1907.6	9538	WCDMA	Right Touch	24.50	12.2 kbps	Test Loop 1	0.949	1.07	1.03
	-----	1907.6	9538	WCDMA	Right Touch with Case	24.50	12.2 kbps	Test Loop 1	0.756	0.85	-----
5 mm	26	1907.6	9538	WCDMA	Back Body	19.70	12.2 kbps	Test Loop 1	0.963	0.99	0.98
	-----	1907.6	9538	WCDMA	Back Body with Case	19.70	12.2 kbps	Test Loop 1	0.189	0.19	-----
0 mm	27	1900	19100	LTE	Right Touch	23.20	1	49	0.765	1.11	1.03
	-----	1900	19100	LTE	Right Touch with Case	23.20	1	49	0.721	1.01	-----
5 mm	28	1880	18900	LTE	Back Body	19.70	1	49	1.01	1.03	1.05
	-----	1880	18900	LTE	Back Body with Case	19.70	1	49	0.151	0.16	-----
0 mm	29	1880	661	GSM	Right Touch	28.60	1 Slot	0	0.576	0.85	0.86
	-----	1880	661	GSM	Right Touch with Case	28.60	1 Slot	0	0.565	0.84	-----
5 mm	30	1908.8	810	GSM	Back Body	24.50	1 Slot	0	1.02	1.14	1.07
	-----	1908.8	810	GSM	Back Body with Case	24.50	1 Slot	0	0.156	0.18	-----
0 mm	31	1908.8	1175	CDMA	Right Touch	23.80	TDSO	SO32 RC3	0.747	0.98	1.07
	-----	1908.8	1175	CDMA	Right Touch with Case	23.80	TDSO	SO32 RC3	0.652	0.86	-----
5 mm	32	1908.8	1175	CDMA	Back Body	19.20	TDSO	SO32 RC3	0.928	1.07	1.08
	-----	1908.8	1175	CDMA	Back Body with Case	19.20	TDSO	SO32 RC3	0.143	0.16	-----

Head & Body
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

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SAR Data Summary – 2450 MHz Body 802.11b & BT

MEASUREMENT RESULTS								
Plot	**Gap**	**Position**	**Frequency**		**Modulation**	**End Power**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**
			MHz	**Ch.**		**(dBm)**		
33	0 mm	Right Touch	2437	6	DSSS	17.28	0.0146	0.02
-----		Right Tilt	2437	6	DSSS	17.28	0.00632	0.01
-----		Left Touch	2437	6	DSSS	17.28	0.00214	0.01
-----		Left Tilt	2437	6	DSSS	17.28	0.0109	0.01
-----		Front Body	2437	6	DSSS	17.28	0.0301	0.03
34		Back Body	2437	6	DSSS	17.28	0.0412	0.04

Body
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

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SAR Data Summary – Simultaneous Evaluation

MEASUREMENT RESULTS						
Highest Simultaneous Value from Original Grant Report	Frequency		Modulation	SAR_1 Original Report	SAR_2 Case	SAR Total
	MHz	Ch.				
iPhone 7 Head – 1.41 W/kg	2437	6	DSSS	1.41	0.02	1.43
iPhone 7 Body – 1.56 W/kg	2437	6	DSSS	1.56	0.04	1.60
iPhone 8 Head – 1.49 W/kg	2437	6	DSSS	1.49	0.02	1.51
iPhone 8 Body – 1.56 W/kg	2437	6	DSSS	1.56	0.04	1.60
			Body **1.6 W/kg (mW/g)** averaged over 1 gram			

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

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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	04/13/2019	04/13/2018	1416
SPEAG E-Field Probe EX3DV4	04/20/2019	04/20/2018	3662
Speag Validation Dipole D750V2	08/10/2018	08/10/2015	1053
Speag Validation Dipole D835V2	08/10/2018	08/10/2015	4d131
Speag Validation Dipole D1750V2	08/13/2018	08/13/2015	1061
Speag Validation Dipole D1900V2	08/13/2018	08/13/2015	5d147
Speag Validation Dipole D2450V2	08/10/2018	08/10/2015	881
Agilent N1911A Power Meter	05/20/2019	03/20/2017	GB45100254
Agilent N1922A Power Sensor	06/21/2019	06/21/2017	MY45240464
Advantest R3261A Spectrum Analyzer	03/26/2019	03/20/2017	31720068
Agilent (HP) 8350B Signal Generator	03/26/2019	03/20/2017	2749A10226
Agilent (HP) 83525A RF Plug-In	03/26/2019	03/20/2017	2647A01172
Agilent (HP) 8753C Vector Network Analyzer	03/26/2019	03/20/2017	3135A01724
Agilent (HP) 85047A S-Parameter Test Set	03/26/2019	03/20/2017	2904A00595
Agilent (HP) 8960 Base Station Sim.	03/30/2019	03/30/2017	MY48360364
Anritsu MT8820C	07/27/2019	07/27/2017	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
Body Equivalent Matter (750 MHz)	N/A	N/A	N/A
Head Equivalent Matter (835 MHz)	N/A	N/A	N/A
Body Equivalent Matter (835 MHz)	N/A	N/A	N/A
Head Equivalent Matter (1750 MHz)	N/A	N/A	N/A
Body Equivalent Matter (1750 MHz)	N/A	N/A	N/A
Head Equivalent Matter (1900 MHz)	N/A	N/A	N/A
Body Equivalent Matter (1900 MHz)	N/A	N/A	N/A
Head Equivalent Matter (2450 MHz)	N/A	N/A	N/A
Body Equivalent Matter (2450 MHz)	N/A	N/A	N/A

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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.

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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.

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Appendix A – System Validation Plots and Data

```
***********************************************************
Test Result for UIM Dielectric Parameter
Wed 20/Jun/2018
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
0.7300	42.05	0.89	41.57	0.89
0.7400	41.99	0.89	41.51	0.89
0.7500	41.94	0.89	41.46	0.90
0.7600	41.89	0.89	41.40	0.91
0.7700	41.84	0.89	41.34	0.92
0.7800	41.75	0.90	41.27	0.92
0.7820	41.746	0.90	41.26	0.92*
0.7900	41.73	0.90	41.22	0.92
0.8000	41.68	0.90	41.18	0.93
0.8100	41.63	0.90	41.14	0.93

* value interpolated

```
***********************************************************
Test Result for UIM Dielectric Parameter
Thu 21/Jun/2018
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
FCC_eB Limits for Body Epsilon
FCC_sB Limits for Body Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
***********************************************************
```

Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.7000	55.73	0.96	54.98	0.89
0.7100	55.69	0.96	54.92	0.90
0.7200	55.65	0.96	54.87	0.91
0.7300	55.61	0.96	54.81	0.92
0.7400	55.57	0.96	54.77	0.93
0.7500	55.53	0.96	54.69	0.94
0.7600	55.49	0.96	54.62	0.95
0.7700	55.45	0.96	54.58	0.96
0.7800	55.41	0.97	54.57	0.97
0.7820	55.404	0.97	54.556	0.972*
0.7900	55.38	0.97	54.50	0.98
0.8000	55.34	0.97	54.45	0.98

* value interpolated

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****
Test Result for UIM Dielectric Parameter
Mon 18/Jun/2018
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
0.7950	41.71	0.90	41.59	0.90
0.8050	41.66	0.90	41.53	0.90
0.8150	41.60	0.90	41.48	0.91
0.8250	41.55	0.90	41.44	0.92
0.8350	41.50	0.90	41.40	0.93
0.8365	41.50	0.902	41.396	0.932*
0.8366	41.50	0.902	41.395	0.932*
0.8450	41.50	0.91	41.37	0.94
0.8550	41.50	0.92	41.35	0.95
0.8650	41.50	0.93	41.33	0.96

* value interpolated

****
Test Result for UIM Dielectric Parameter
Mon 18/Jun/2018
Freq Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
FCC_eB Limits for Body Epsilon
FCC_sB Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.8050	55.32	0.97	55.07	0.96
0.8150	55.28	0.97	55.02	0.97
0.8250	55.24	0.97	54.98	0.98
0.8350	55.20	0.97	54.93	0.99
0.8365	55.196	0.972	54.924	0.992*
0.8366	55.195	0.972	54.924	0.992*
0.8450	55.17	0.98	54.89	1.00
0.8466	55.165	0.982	54.885	1.003*
0.8483	55.16	0.983	54.88	1.007*
0.8488	55.159	0.984	54.879	1.008*
0.8550	55.14	0.99	54.86	1.02
0.8650	55.11	1.01	54.83	1.03

* value interpolated

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```
*************************************************************
Test Result for UIM Dielectric Parameter
Thu 21/Jun/2018
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
1.7100	40.14	1.35	40.11	1.36
1.7200	40.13	1.35	40.09	1.36
1.7300	40.11	1.36	40.06	1.37
1.7400	40.09	1.37	40.03	1.38
1.7450	40.085	1.37	40.02	1.385*
1.7500	40.08	1.37	40.01	1.39
1.7600	40.06	1.38	39.98	1.40

* value interpolated

```
*************************************************************
Test Result for UIM Dielectric Parameter
Thu 21/Jun/2018
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
FCC_eB Limits for Body Epsilon
FCC_sB Limits for Body Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
*************************************************************
```

Freq	FCC_eB	FCC_sB	Test_e	Test_s
1.7100	53.53	1.47	53.55	1.48
1.7200	53.51	1.47	53.52	1.49
1.7300	53.48	1.48	53.38	1.50
1.7400	53.46	1.48	53.36	1.51
1.7450	53.445	1.485	53.34	1.515*
1.7500	53.43	1.49	53.32	1.52
1.7600	53.41	1.49	53.30	1.53
1.7700	53.38	1.50	53.27	1.55
1.7800	53.35	1.51	53.23	1.55

* value interpolated

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```
************************************************************
Test Result for UIM Dielectric Parameter
Tue 19/Jun/2018
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
1.8700	40.00	1.40	39.62	1.41
1.8800	40.00	1.40	39.59	1.42
1.8900	40.00	1.40	39.58	1.43
1.9000	40.00	1.40	39.56	1.44
1.9076	40.00	1.40	39.545	1.44*
1.9088	40.00	1.40	39.542	1.44*
1.9100	40.00	1.40	39.54	1.44
1.9200	40.00	1.40	39.52	1.45
1.9300	40.00	1.40	38.49	1.46

* value interpolated

```
************************************************************
Test Result for UIM Dielectric Parameter
Wed 20/Jun/2018
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
FCC_eB Limits for Body Epsilon
FCC_sB Limits for Body Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
```

Freq	FCC_eB	FCC_sB	Test_e	Test_s
1.8400	53.30	1.52	52.04	1.43
1.8500	53.30	1.52	52.03	1.44
1.8600	53.30	1.52	52.03	1.44
1.8700	53.30	1.52	52.14	1.45
1.8800	53.30	1.52	52.10	1.45
1.8900	53.30	1.52	52.17	1.46
1.9000	53.30	1.52	52.07	1.47
1.9076	53.30	1.52	52.108	1.493*
1.9088	53.30	1.52	52.114	1.496*
1.9098	53.30	1.52	52.119	1.499*
1.9100	53.30	1.52	52.12	1.50
1.9200	53.30	1.52	52.00	1.50

* value interpolated

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```
************************************************************
Test Result for UIM Dielectric Parameter
Thu 21/Jun/2018
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
2.4100	39.26	1.76	39.09	1.78
2.4200	39.25	1.77	39.06	1.80
2.4300	39.24	1.78	39.04	1.82
2.4370	39.226	1.787	39.012	1.827*
2.4400	39.22	1.79	39.00	1.83
2.4500	39.20	1.80	38.97	1.85
2.4600	39.19	1.81	38.94	1.87
2.4700	39.17	1.82	38.91	1.88
2.4800	39.15	1.83	38.89	1.89

* value interpolated

```
************************************************************
Test Result for UIM Dielectric Parameter
Thu 21/Jun/2018
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
FCC_eB Limits for Body Epsilon
FCC_sB Limits for Body Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
```

Freq	FCC_eB	FCC_sB	Test_e	Test_s
2.4100	52.75	1.91	52.71	1.92
2.4200	52.74	1.92	52.69	1.93
2.4300	52.73	1.93	52.68	1.94
2.4370	52.716	1.937	52.666	1.947*
2.4400	52.71	1.94	52.66	1.95
2.4500	52.70	1.95	52.64	1.96
2.4600	52.69	1.96	52.63	1.98
2.4700	52.67	1.98	52.61	1.99
2.4800	52.66	1.99	52.60	2.00

* value interpolated

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RF Exposure Lab

Plot 1

DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN 1053

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 750 MHz; σ = 0.9 S/m; ε_r = 41.46; ρ = 1000 kg/m^3
Phantom section: Flat Section

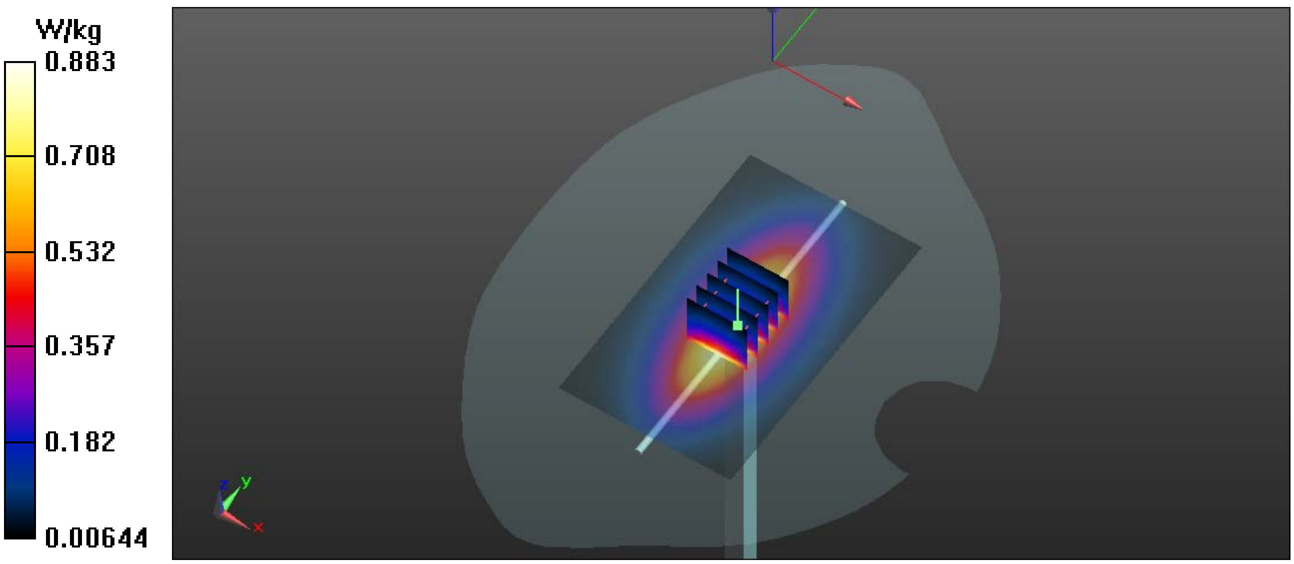
Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.8, 9.8, 9.8); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
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) = 0.883 W/kg

750 MHz Head/Verification /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.949 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.691 mW/g
P_{in}= 100 mW
SAR(1 g) = 0.813 mW/g; SAR(10 g) = 0.528 mW/g
Maximum value of SAR (measured) = 0.888 W/kg



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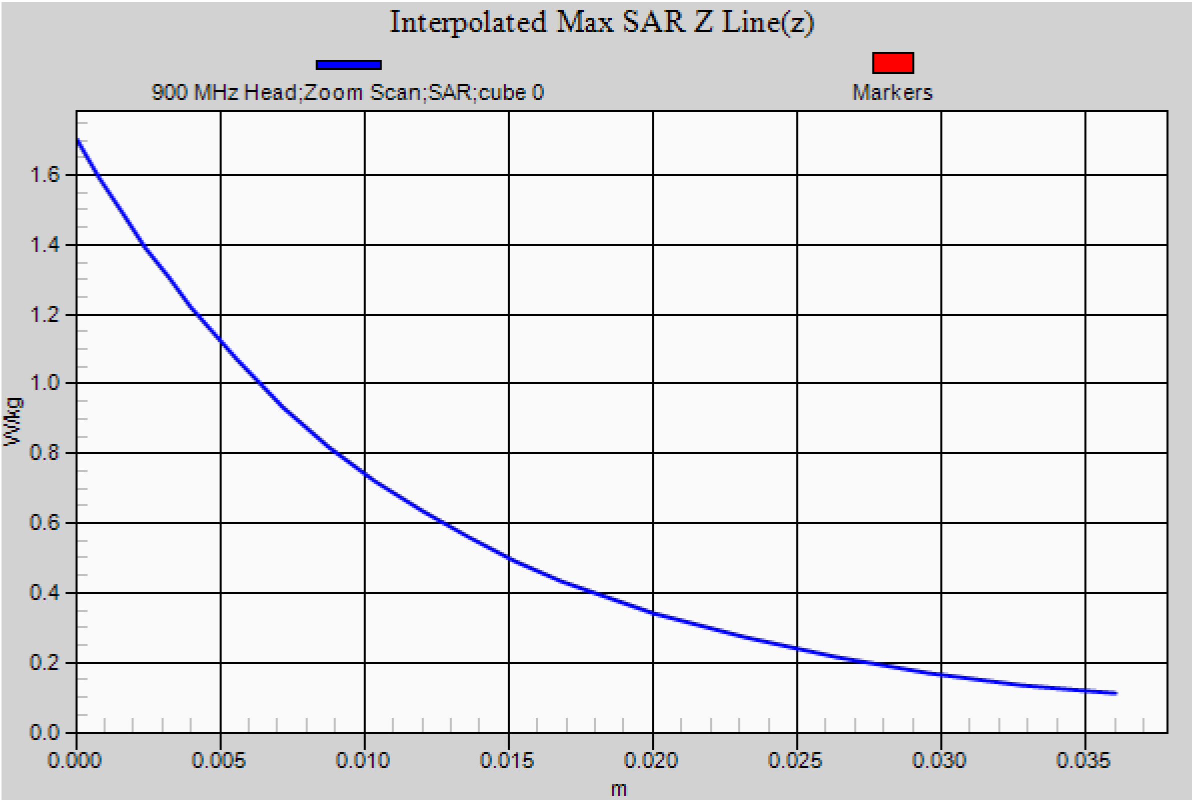

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RF Exposure Lab

Plot 2

DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN:1053

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: MSL750; Medium parameters used: f = 750 MHz; σ = 0.94 S/m; ε_r = 54.69; ρ = 1000 kg/m^3
Phantom section: Flat Section

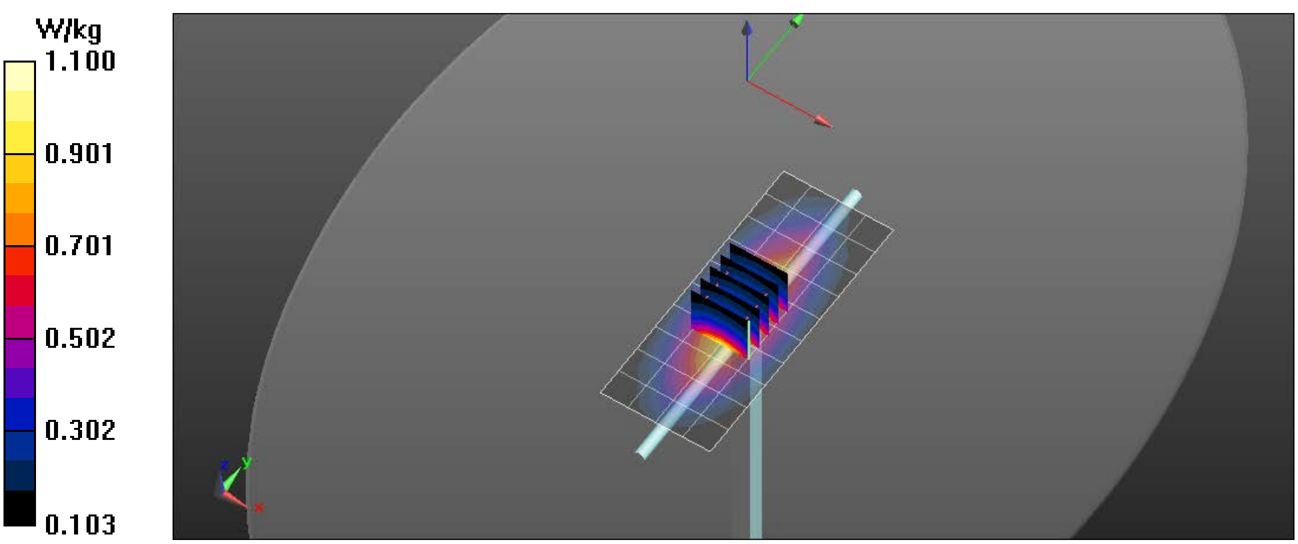
Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.62, 9.62, 9.62); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
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/Verification/Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.08 W/kg

750 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.227 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.30 W/kg
SAR(1 g) = 0.865 W/kg; SAR(10 g) = 0.569 W/kg
Maximum value of SAR (measured) = 1.10 W/kg



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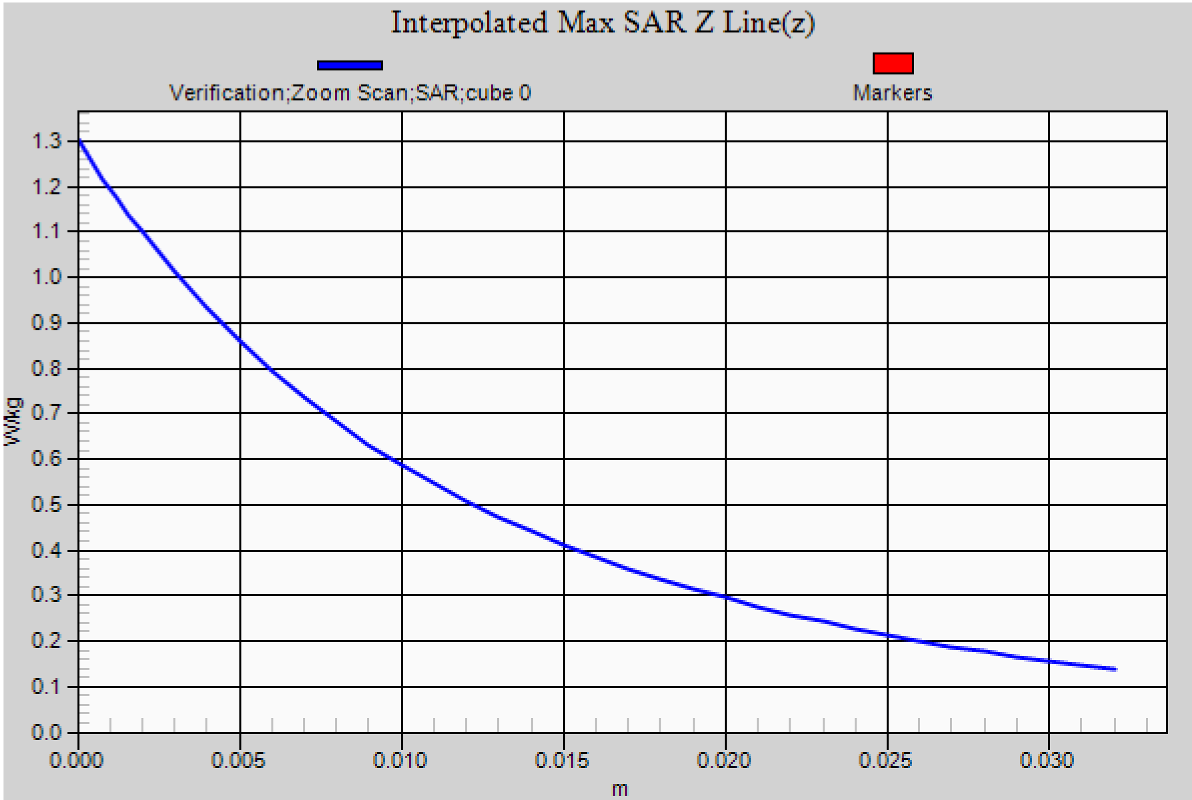

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RF Exposure Lab

Plot 3

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:4d131

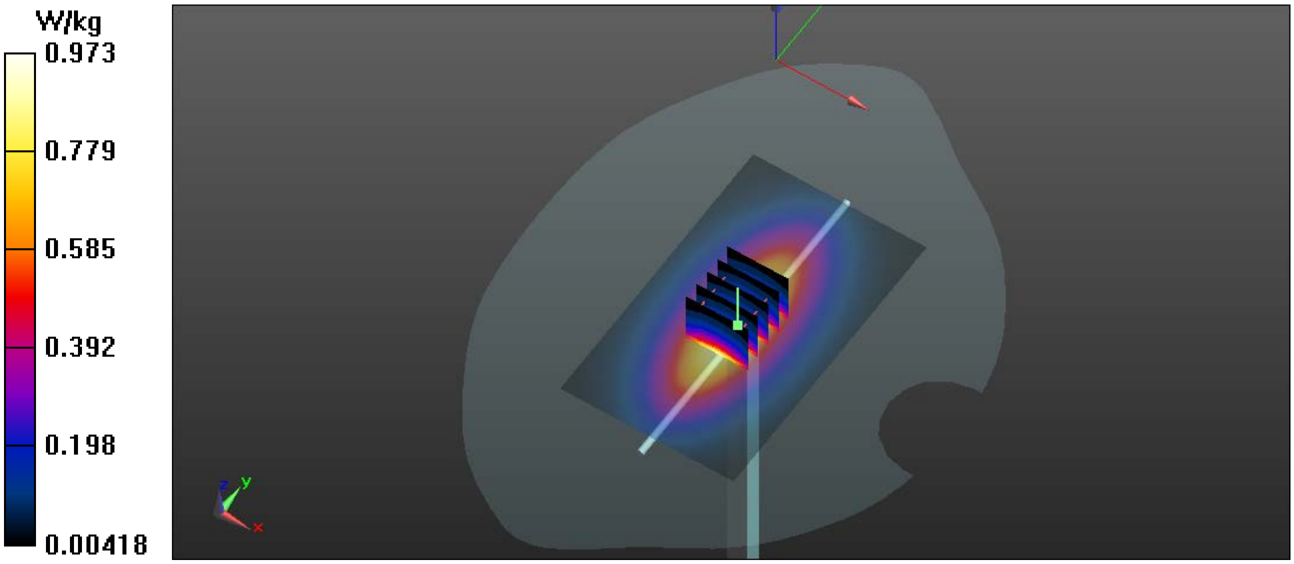
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL835; Medium parameters used: f = 835 MHz; σ = 0.93 mho/m; ε_r = 41.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3662; ConvF(9.29, 9.29, 9.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

835 MHz Verification/Head/Area Scan (61x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.973 W/kg

835 MHz Verification/Head/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 55.385 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.432 mW/g
SAR(1 g) = 0.927 mW/g; SAR(10 g) = 0.605 mW/g
Maximum value of SAR (measured) = 1.25 W/kg



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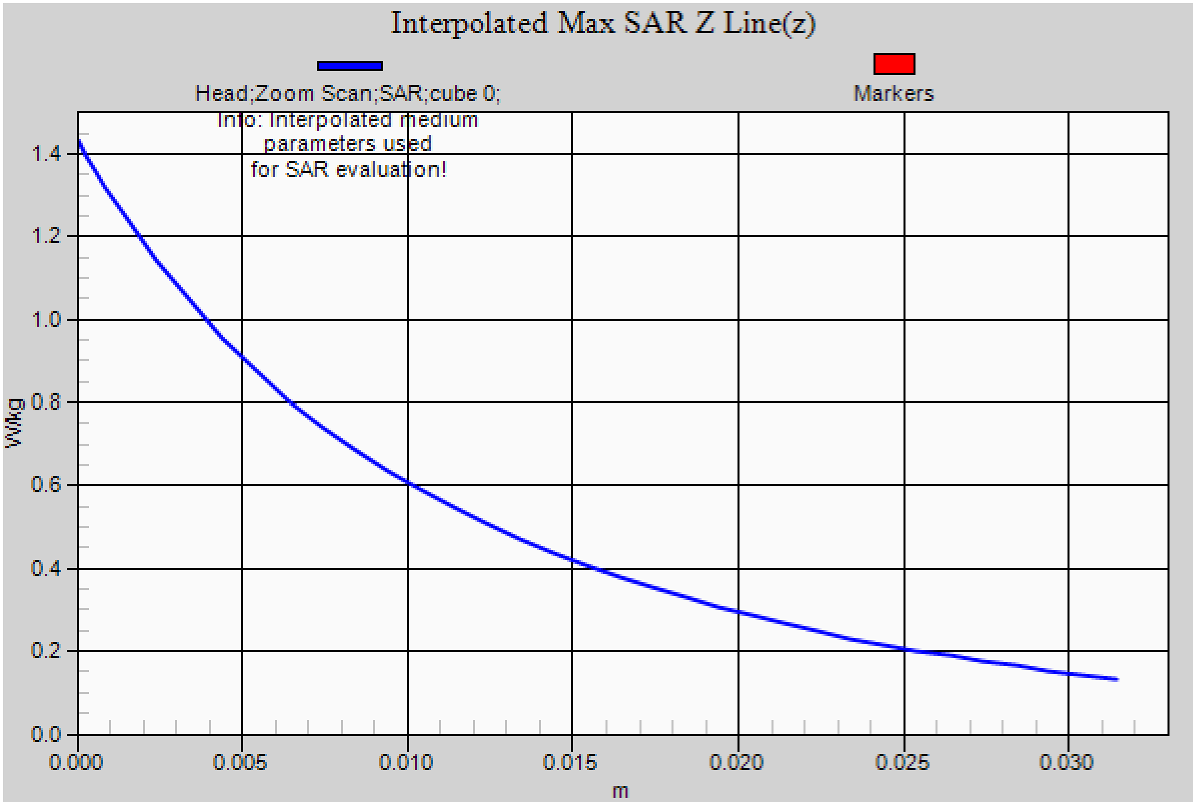

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RF Exposure Lab

Plot 4

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:4d131

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium parameters used: f = 835 MHz; σ = 0.99 S/m; ε_r = 54.93; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

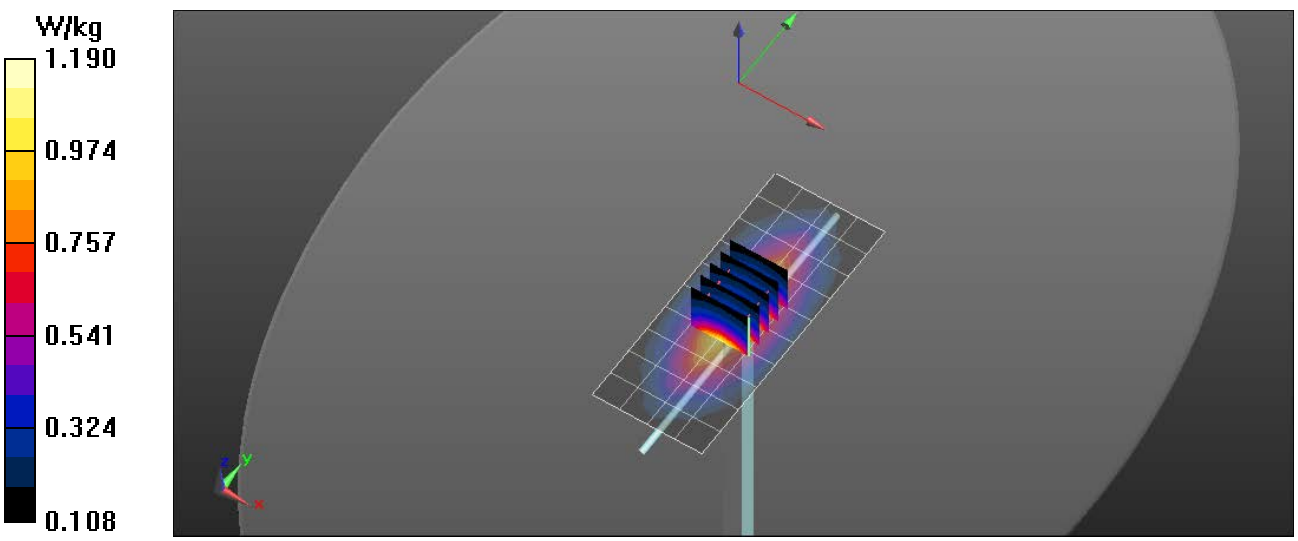
Probe: EX3DV4 - SN3662; ConvF(9.21, 9.21, 9.21); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

835 MHz/Verification/Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.19 W/kg

835 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.468 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.48 W/kg
SAR(1 g) = 0.951 W/kg; SAR(10 g) = 0.625 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.20 W/kg



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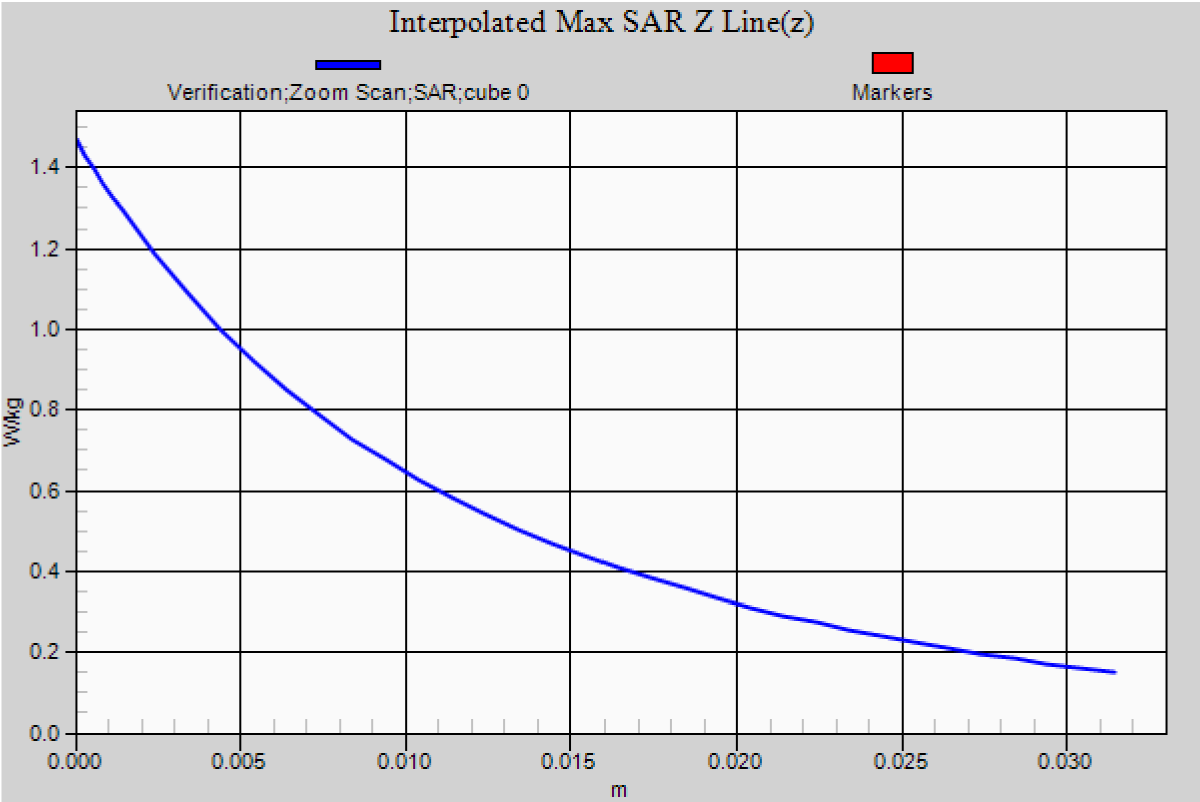

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RF Exposure Lab

Plot 5

DUT: Dipole 1750 MHz D1750V2; Type: D1750V2; Serial: D1750V2 - SN:1061

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used: f = 1750 MHz; σ = 1.39 S/m; ε_r = 40.01; ρ = 1000 kg/m^3
Phantom section: Flat Section

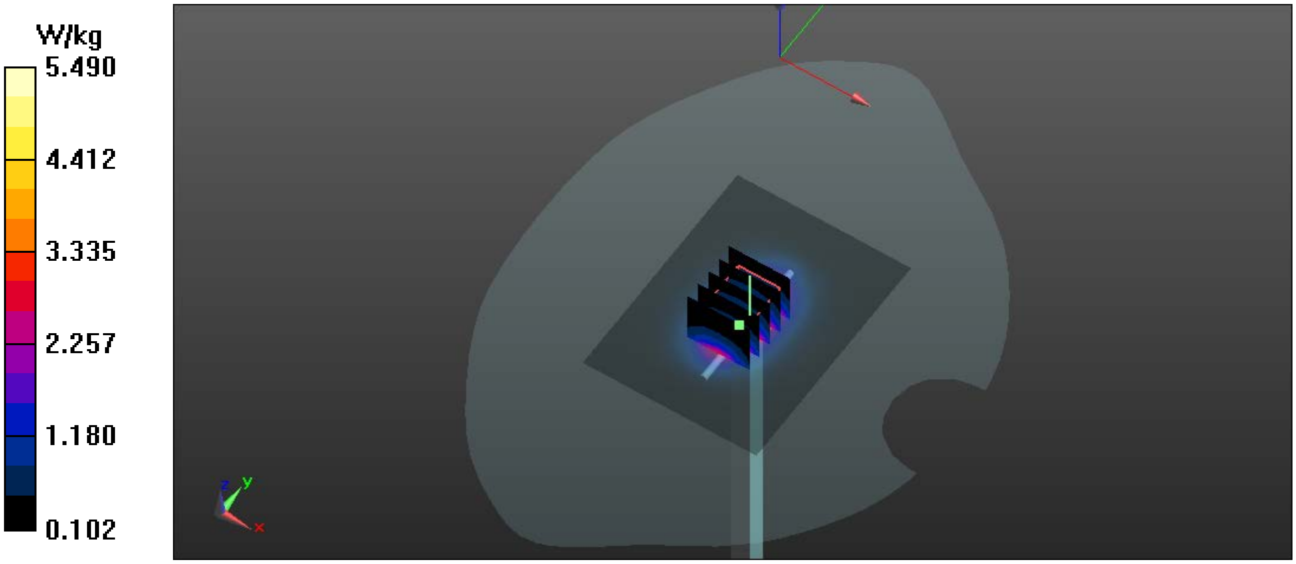
Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.29, 8.29, 8.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
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) = 5.37 W/kg

1750 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.158 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 6.92 W/kg
SAR(1 g) = 3.72 W/kg; SAR(10 g) = 1.96 W/kg
Maximum value of SAR (measured) = 5.47 W/kg



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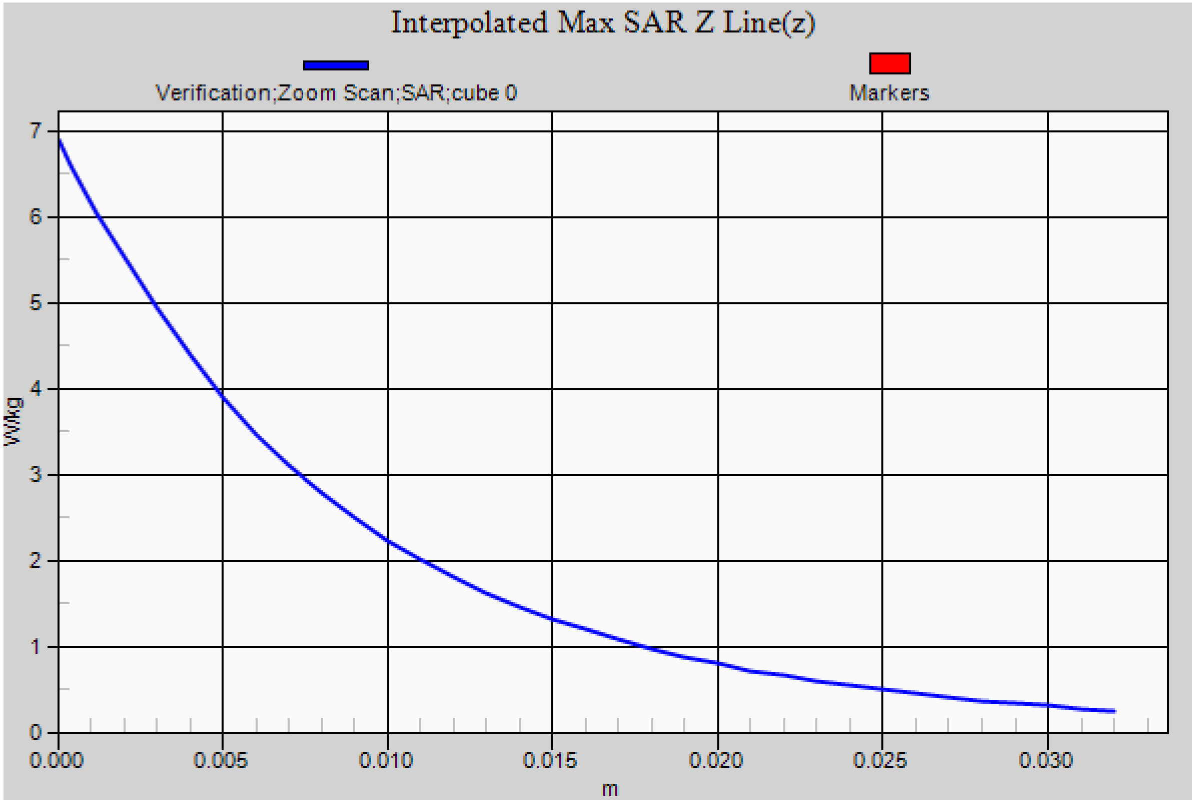

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RF Exposure Lab

Plot 6

DUT: Dipole 1750 MHz D1750V2; Type: D1750V2; Serial: D1750V2 - SN:1061

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: MSL1750; Medium parameters used: f = 1750 MHz; σ = 1.52 S/m; ε_r = 53.32; ρ = 1000 kg/m^3
Phantom section: Flat Section

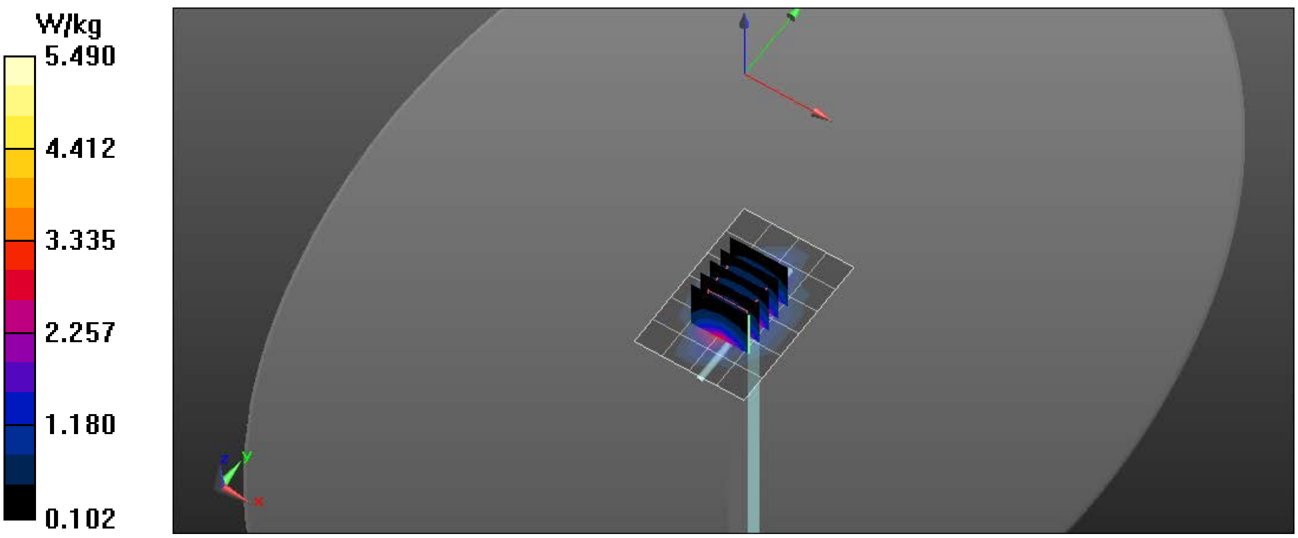
Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.96, 7.96, 7.96); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
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) = 5.33 W/kg

1750 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.227 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 6.89 W/kg
SAR(1 g) = 3.75 W/kg; SAR(10 g) = 2.03 W/kg
Maximum value of SAR (measured) = 5.49 W/kg



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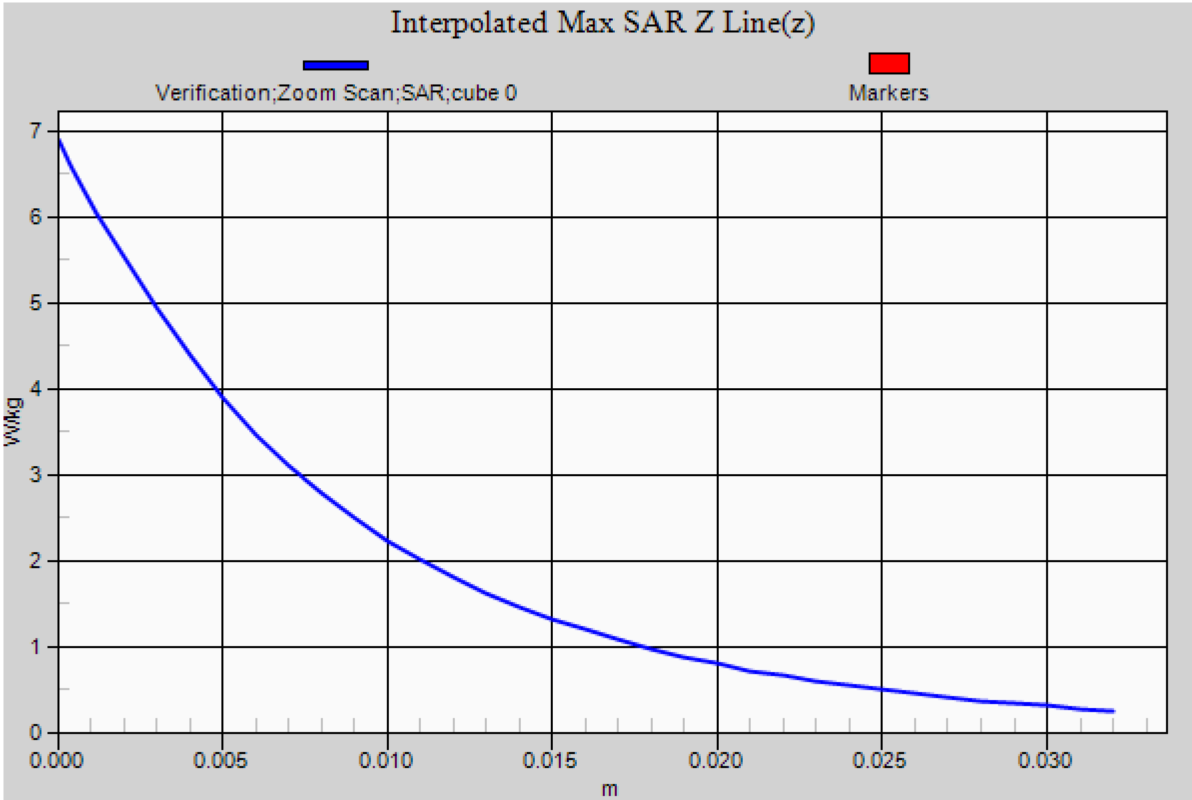

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RF Exposure Lab

Plot 7

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: 5d147

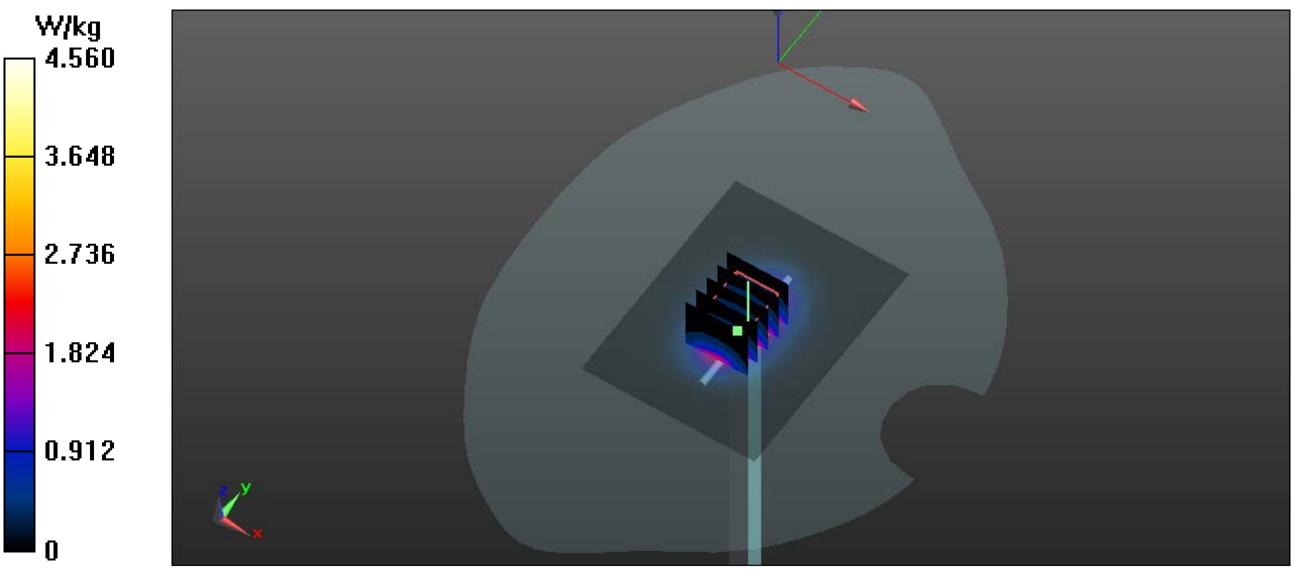
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1900 MHz; σ = 1.44 mho/m; ε_r = 39.56; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3662; ConvF(8.01, 8.01, 8.01); Calibrated: 1/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
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/Head/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 4.56 W/kg

1900 MHz Verification/Head/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 55.385 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 7.437 mW/g
SAR(1 g) = 4.17 mW/g; SAR(10 g) = 2.19 mW/g
Maximum value of SAR (measured) = 6.14 W/kg



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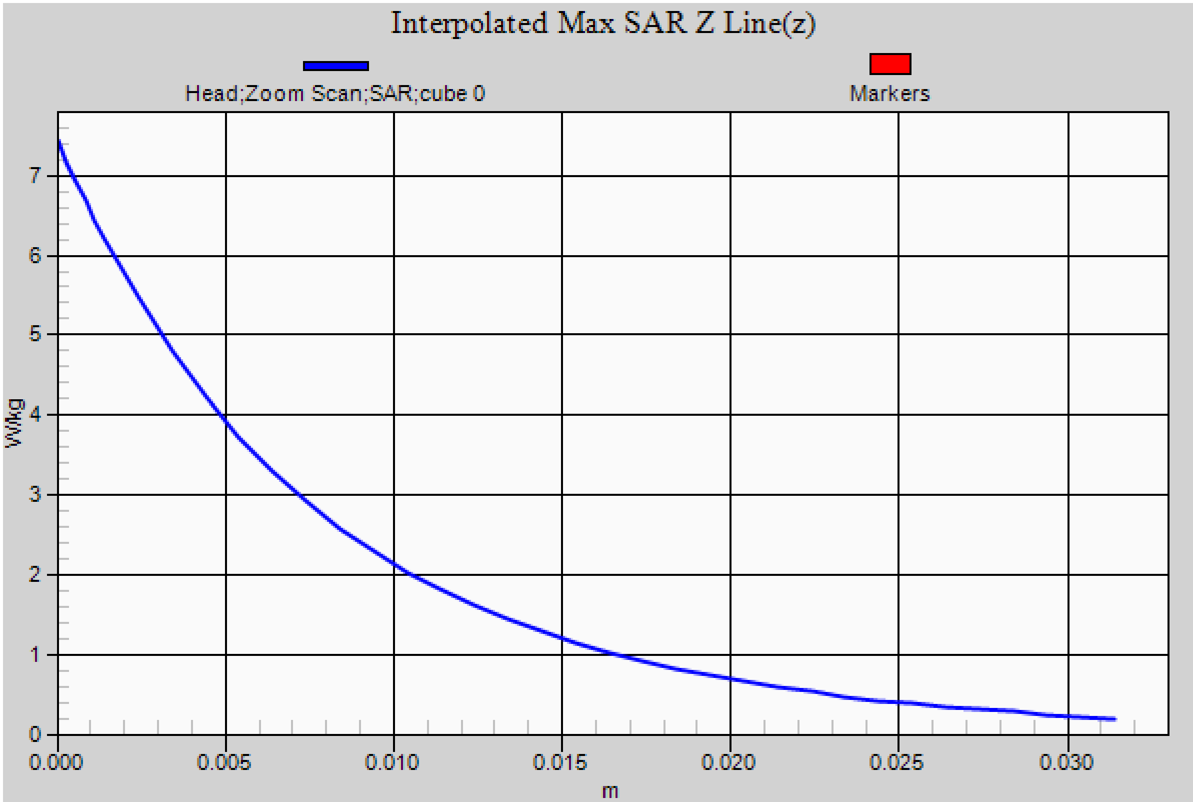

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RF Exposure Lab

Plot 8

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:5d147

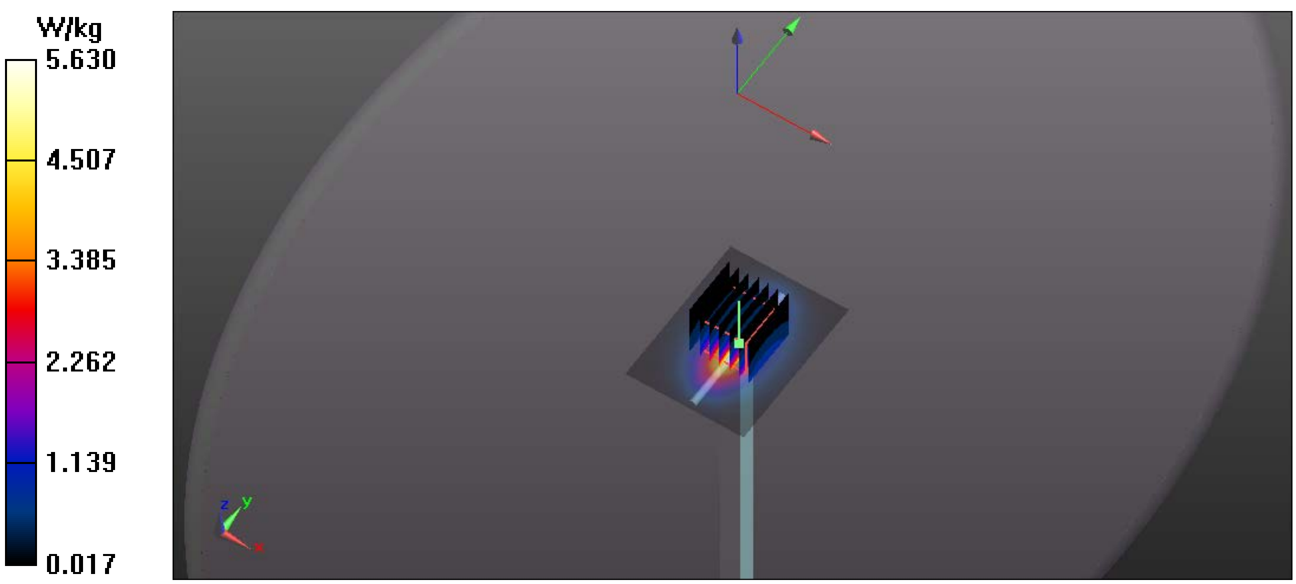
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: MSL1900; Medium parameters used: f = 1900 MHz; σ = 1.47 S/m; ε_r = 52.07; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3662; ConvF(7.61, 7.61, 7.61); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
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 Body/Verification/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 5.63 W/kg

1900 MHz Body/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.612 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 6.68 W/kg
SAR(1 g) = 4.02 W/kg; SAR(10 g) = 1.92 W/kg
Maximum value of SAR (measured) = 5.63 W/kg



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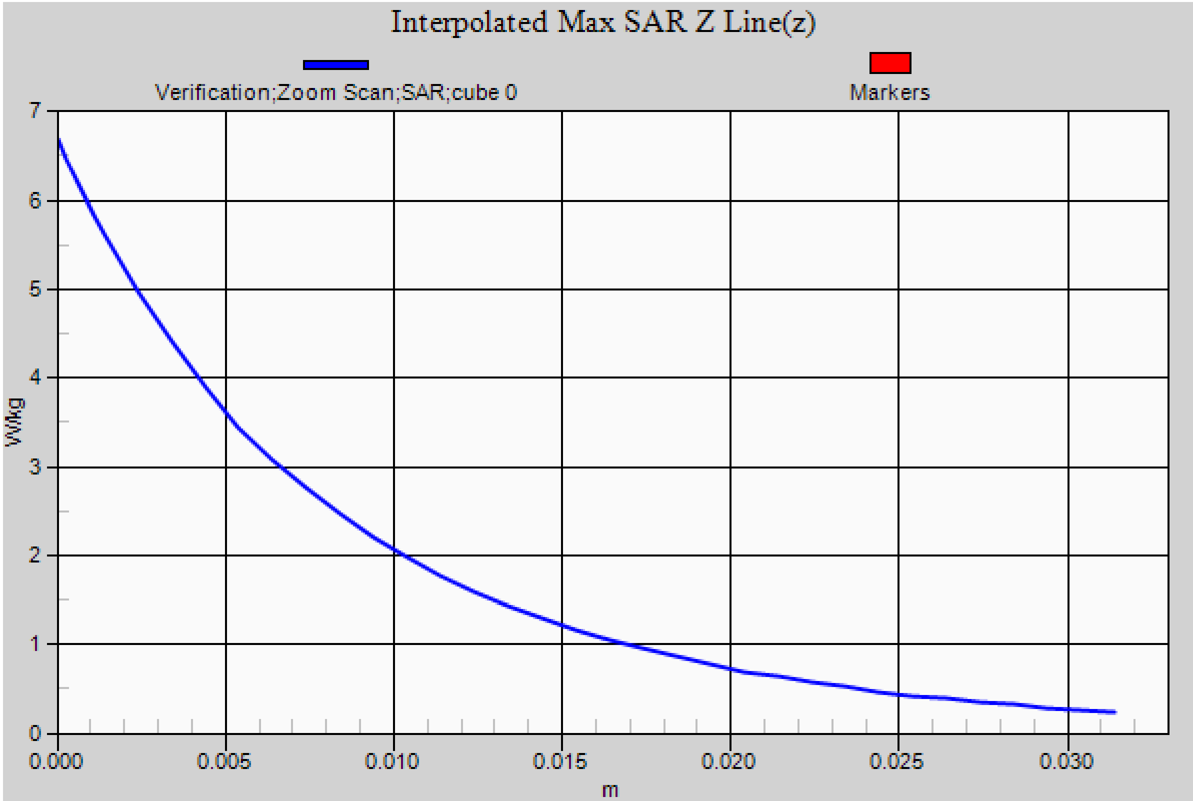

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RF Exposure Lab

Plot 9

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:881

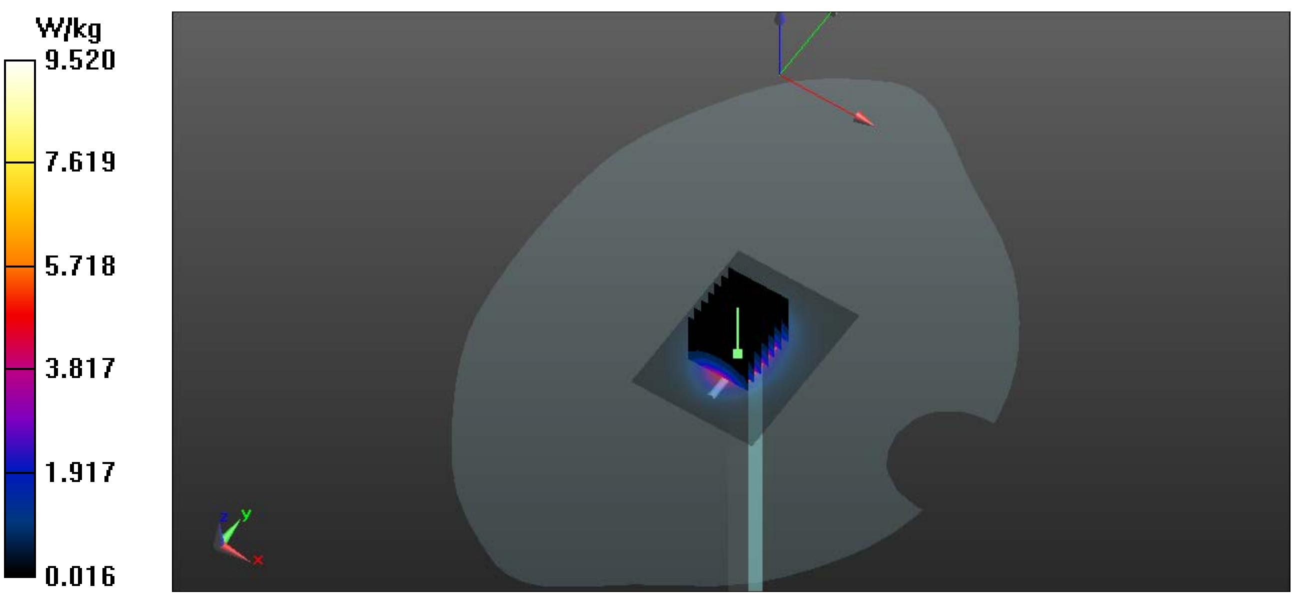
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium parameters used: f = 2450 MHz; σ = 1.85 S/m; ε_r = 38.97; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3662; ConvF(7.39, 7.39, 7.39); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2450 MHz Head/Verification/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 9.52 W/kg

2450 MHz Head/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.846 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 12.2 W/kg
SAR(1 g) = 5.39 W/kg; SAR(10 g) = 2.39 W/kg
Maximum value of SAR (measured) = 6.05 W/kg



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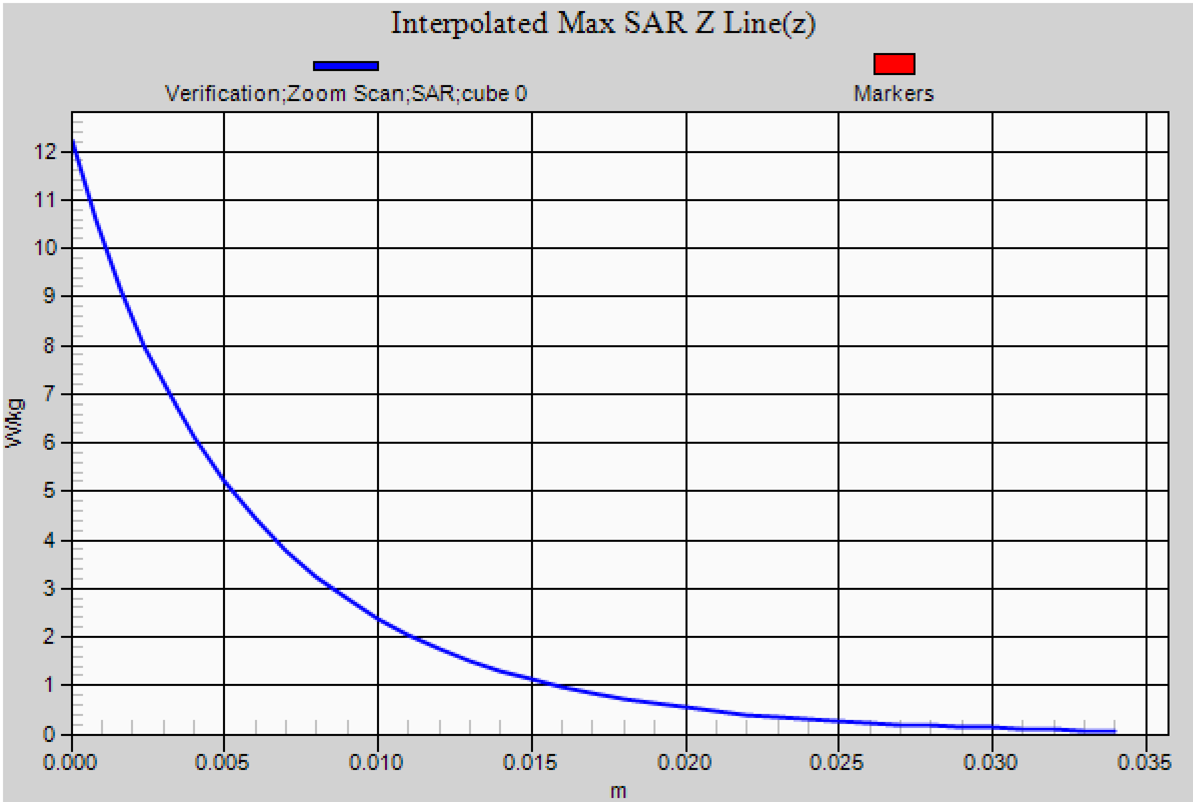

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RF Exposure Lab

Plot 10

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:881

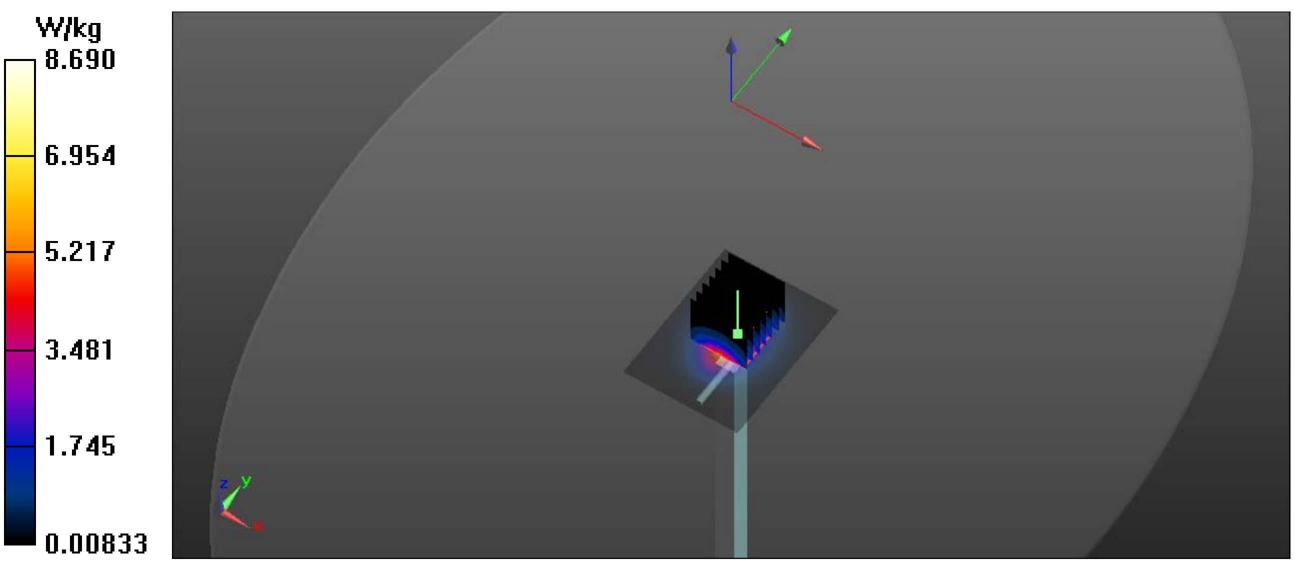
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL2450; Medium parameters used: f = 2450 MHz; σ = 1.96 S/m; ε_r = 52.64; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3662; ConvF(7.29, 7.29, 7.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2450 MHz Body/Verification/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 8.68 W/kg

2450 MHz Body/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.751 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 10.7 W/kg
SAR(1 g) = 5.2 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 5.91 W/kg



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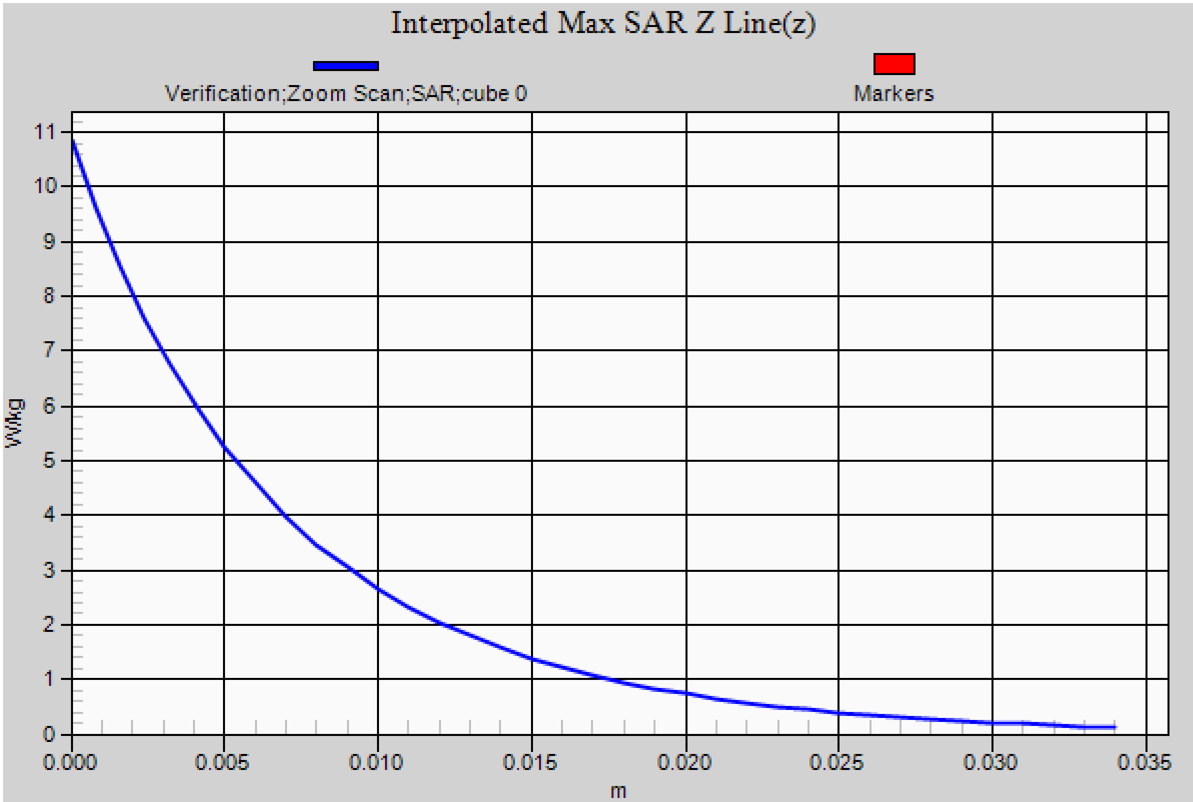

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Appendix B – SAR Test Data Plots

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RF Exposure Lab

Plot 1

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: HSL835; Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.932 S/m; ε_r = 41.395; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.29, 9.29, 9.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

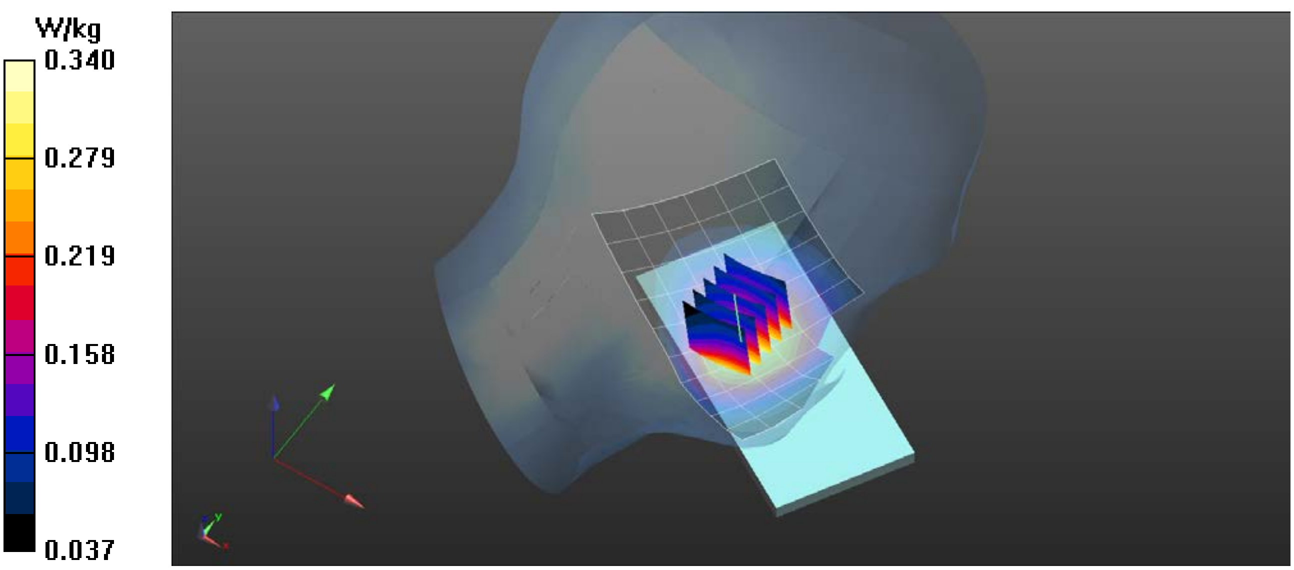
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.329 W/kg

WCDMA 850 Head/iPhone 7 Left 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.452 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.402 W/kg
SAR(1 g) = 0.323 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.340 W/kg



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RF Exposure Lab

Plot 2

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.992 S/m; ε_r = 54.924; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.21, 9.21, 9.21); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

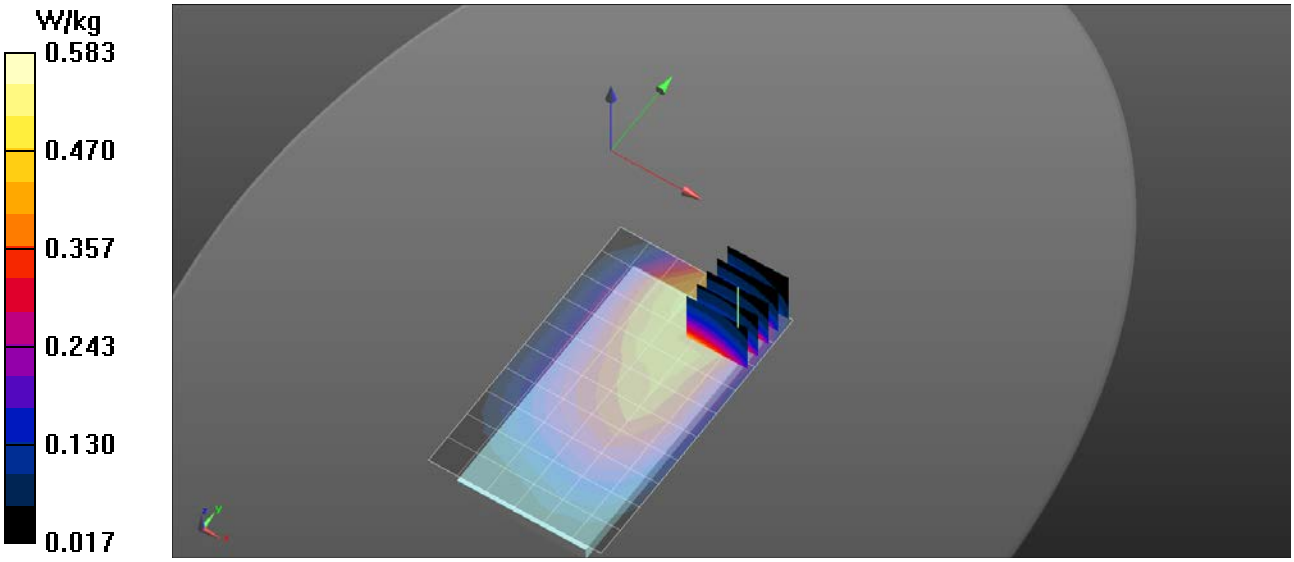
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.454 W/kg

WCDMA 850 Body/iPhone 7 Front 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.06 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.960 W/kg
SAR(1 g) = 0.493 W/kg

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



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Plot 3

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK) (0); Frequency: 782 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 782 MHz; σ = 0.92 S/m; ε_r = 41.26; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.8, 9.8, 9.8); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

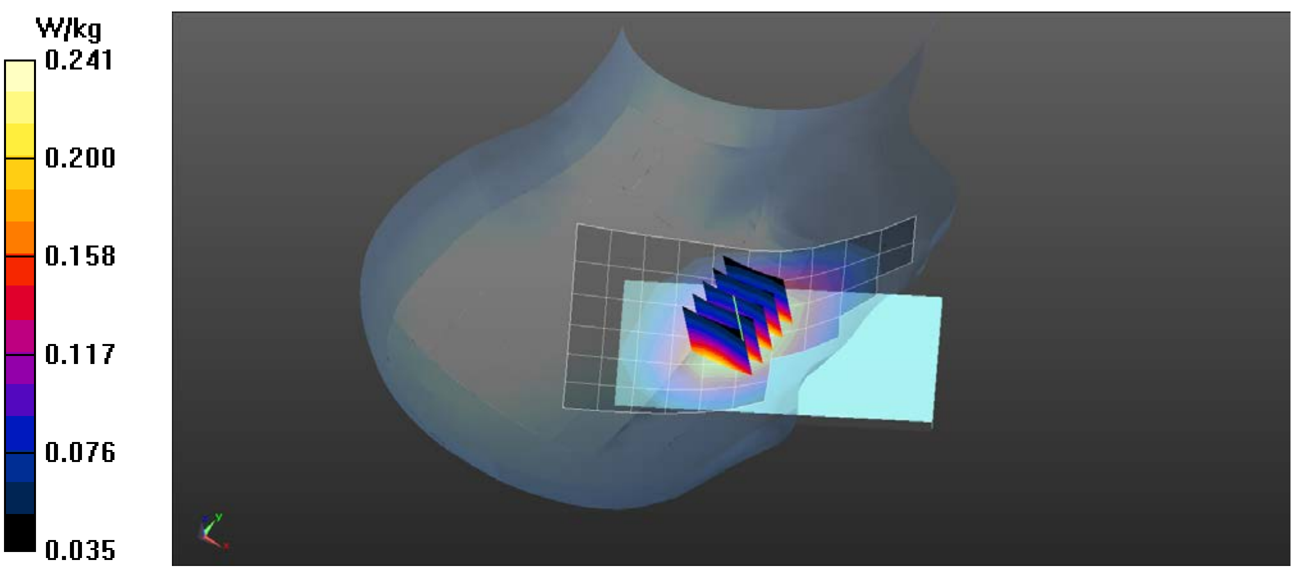
Procedure Notes:

LTE 750 Right Head/iPhone 7 Right 750 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.234 W/kg

LTE 750 Right Head/iPhone 7 Right 750 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.726 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.294 W/kg
SAR(1 g) = 0.224 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.241 W/kg



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Plot 4

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 782 MHz; Duty Cycle: 1:1
Medium: MSL750; Medium parameters used (interpolated): f = 782 MHz; σ = 0.972 S/m; ε_r = 54.556; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.8, 9.8, 9.8); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

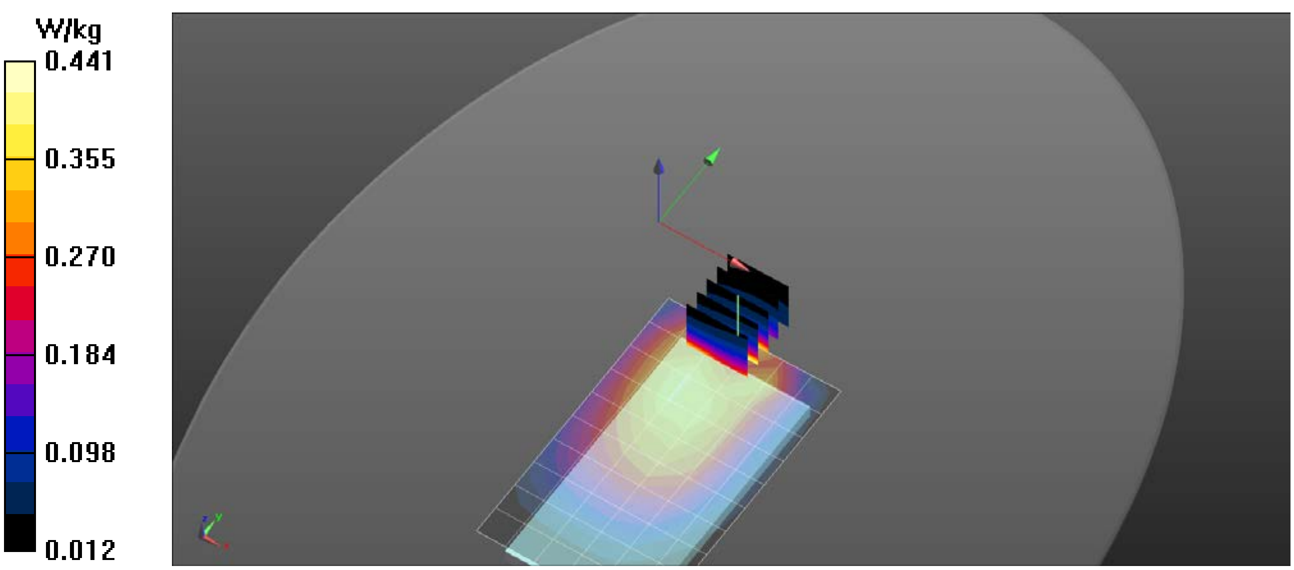
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.392 W/kg

LTE 750 Body/iPhone 7 Front 1 RB Offset 24 750 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.31 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.774 W/kg
SAR(1 g) = 0.416 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.441 W/kg



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Plot 5

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: GSM 1-Slot (GMSK); Frequency: 836.6 MHz; Duty Cycle: 1:8.30042
Medium: HSL835; Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.932 S/m; ε_r = 41.395; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.29, 9.29, 9.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

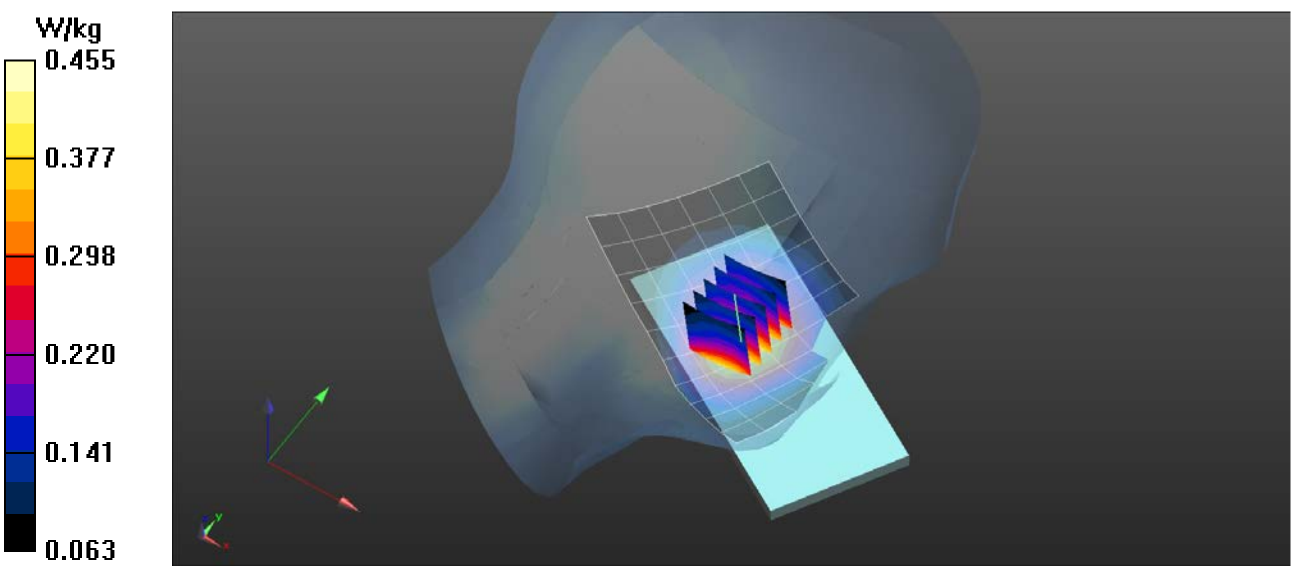
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.415 W/kg

GSM 850 Head/iPhone 7 Left 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.190 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.532 W/kg
SAR(1 g) = 0.437 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.455 W/kg



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Plot 6

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: GSM (GMSK) (0); Frequency: 836.6 MHz; Duty Cycle: 1:8.30042
Medium: MSL835; Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.992 S/m; ε_r = 54.924; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.21, 9.21, 9.21); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

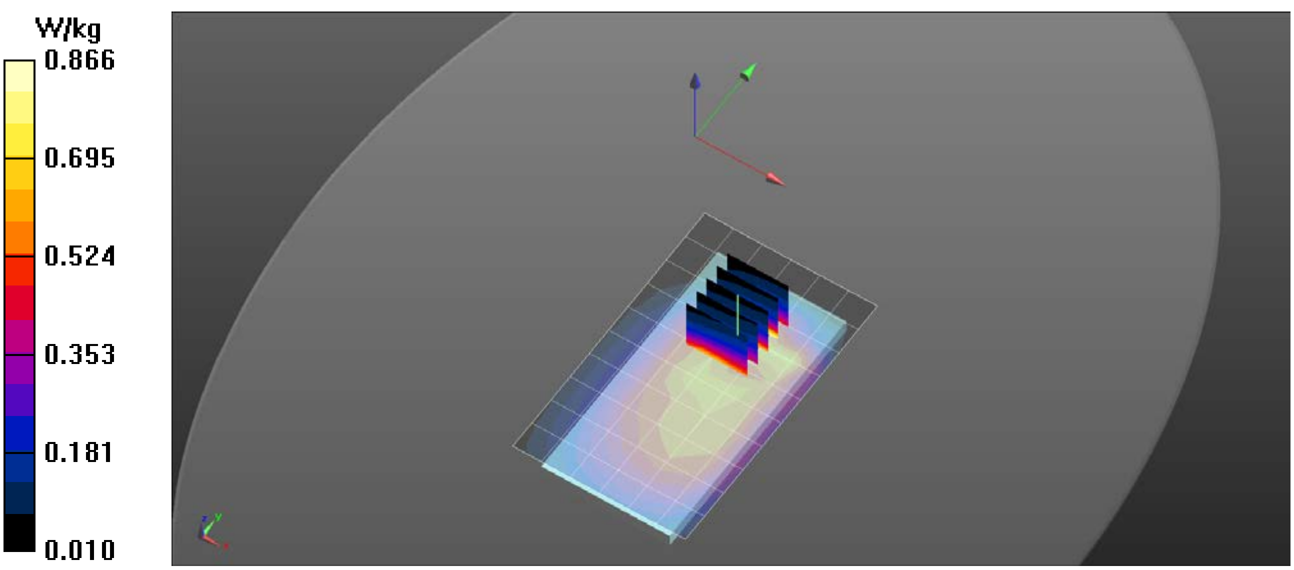
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.744 W/kg

GSM 850 Body/iPhone 7 Front 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.28 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.39 W/kg
SAR(1 g) = 0.779 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.866 W/kg



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Plot 7

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: HSL835; Medium parameters used (interpolated): f = 836.52 MHz; σ = 0.932 S/m; ε_r = 41.396; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.29, 9.29, 9.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

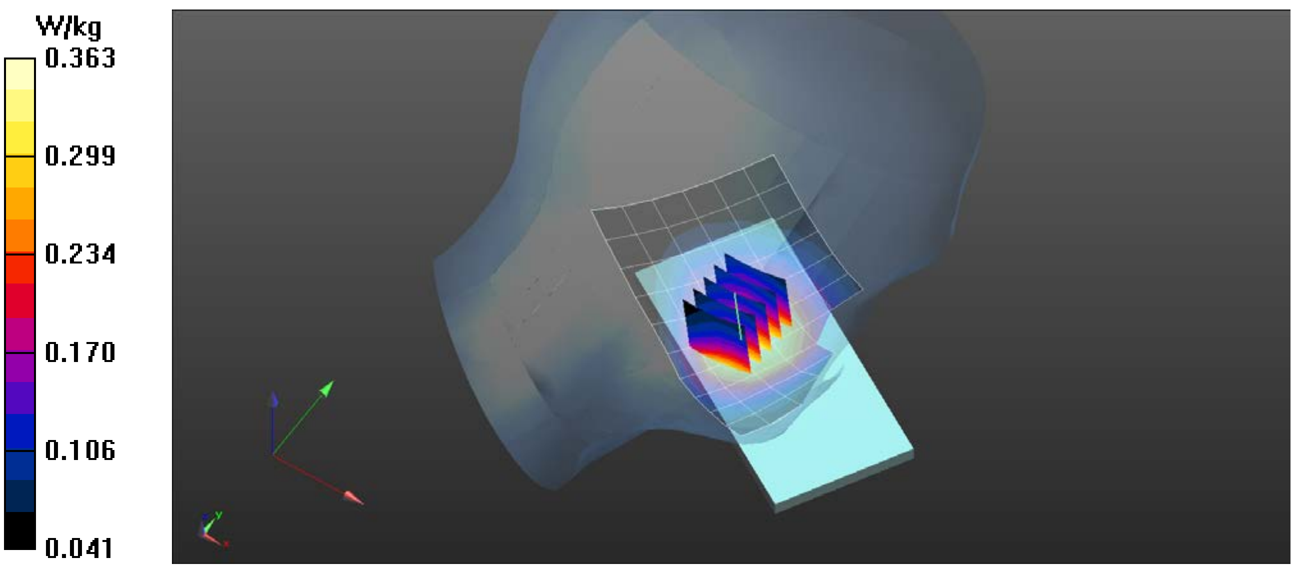
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.361 W/kg

CDMA 850 Head/iPhone 7 Left 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.918 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.434 W/kg
SAR(1 g) = 0.349 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.363 W/kg



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Plot 8

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium parameters used (interpolated): f = 836.52 MHz; σ = 0.992 S/m; ϵ_r = 54.924; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.21, 9.21, 9.21); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

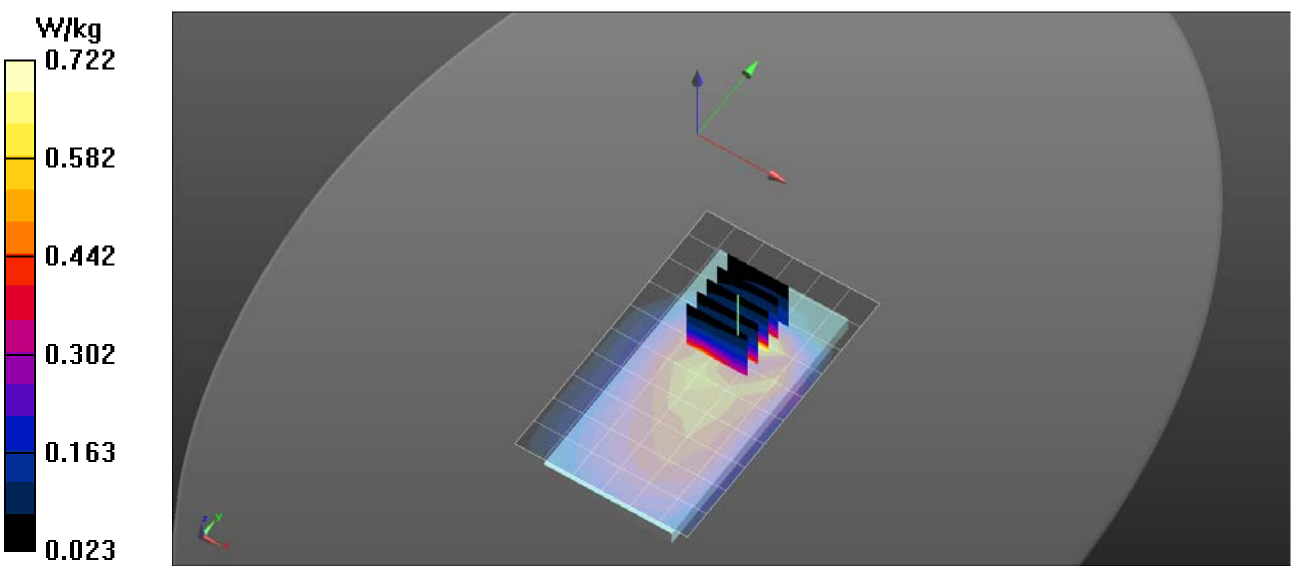
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.615 W/kg

CDMA 850 Body/iPhone 7 Front 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.10 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.634 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.722 W/kg



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Plot 9

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1880 MHz; σ = 1.42 S/m; ε_r = 39.59; ρ = 1000 kg/m^3
Phantom section: Right Section

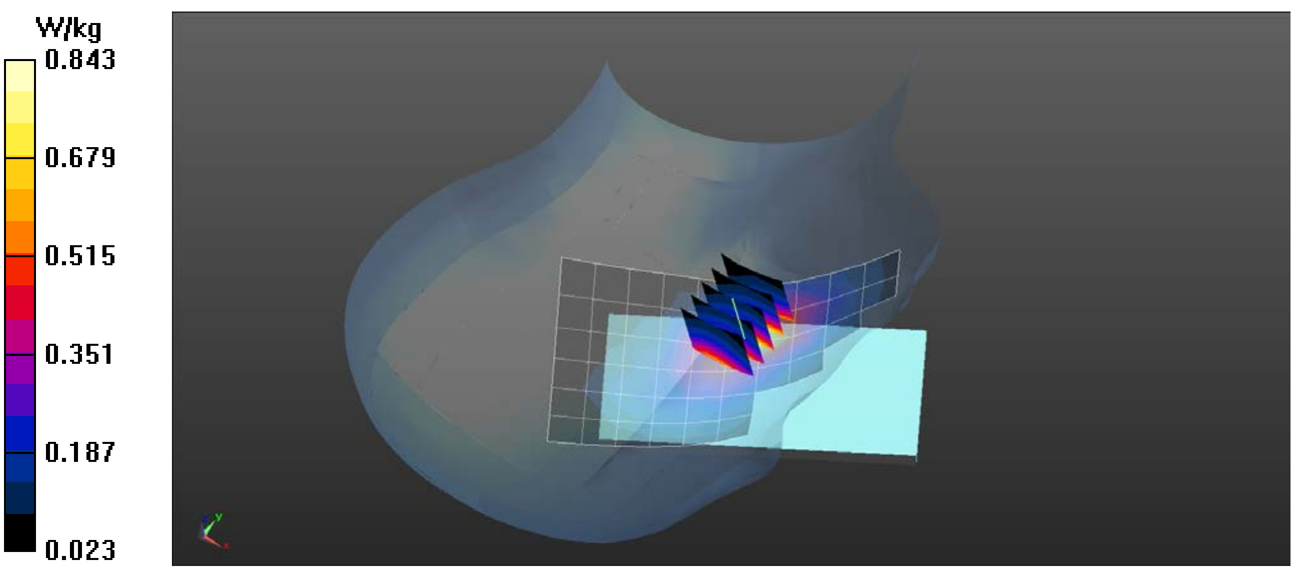
Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.01, 8.01, 8.01); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

WCDMA 1900 Head/iPhone 7 Right 1900 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.713 W/kg

WCDMA 1900 Head/iPhone 7 Right 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.163 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.17 W/kg
SAR(1 g) = 0.775 W/kg
Maximum value of SAR (measured) = 0.843 W/kg



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Plot 10

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: MSL1900; Medium parameters used: f = 1880 MHz; σ = 1.45 S/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

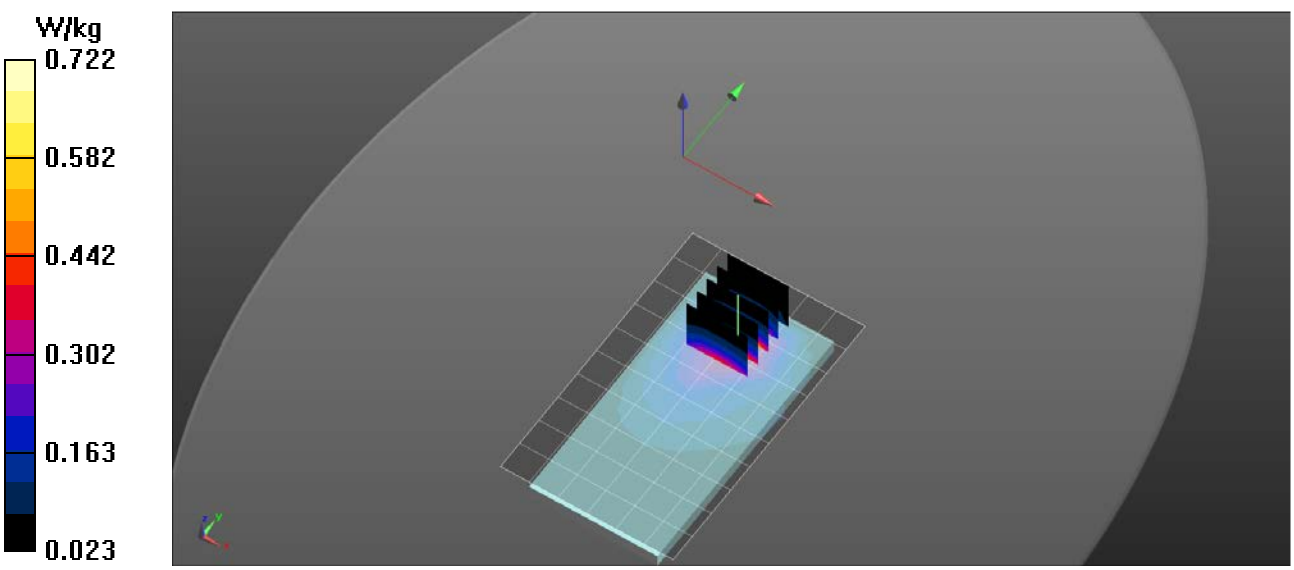
Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.61, 7.61, 7.61); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

WCDMA 1900 Body/iPhone 7 Front 1900 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.623 W/kg

WCDMA 1900 Body/iPhone 7 Front 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.73 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.19 W/kg
SAR(1 g) = 0.622 W/kg
Maximum value of SAR (measured) = 0.725 W/kg



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Plot 11

DUT: iPhone 7 & 8; 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 = 1.385 S/m; ε_r = 40.02; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.29, 8.29, 8.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

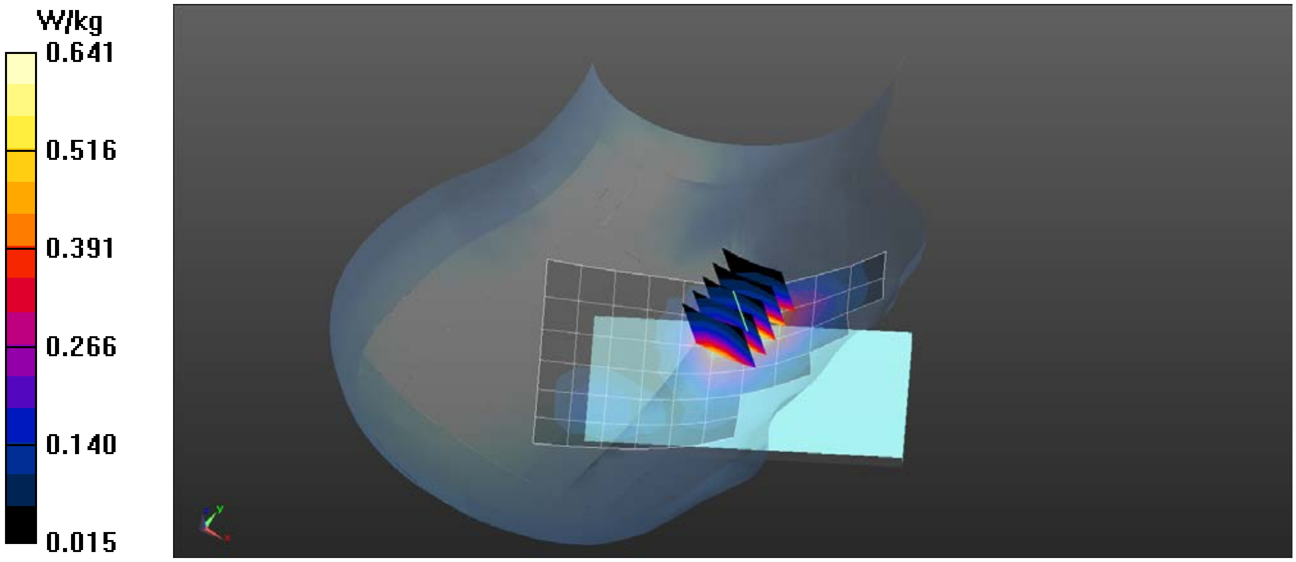
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.537 W/kg

LTE 1750 Head/iPhone 7 Right 1750 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.126 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.913 W/kg
SAR(1 g) = 0.594 W/kg

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



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Plot 12

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 1745 MHz; Duty Cycle: 1:1
Medium: MSL1750; Medium parameters used (interpolated): f = 1745 MHz; σ = 1.515 S/m; ε_r = 53.34; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.96, 7.96, 7.96); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

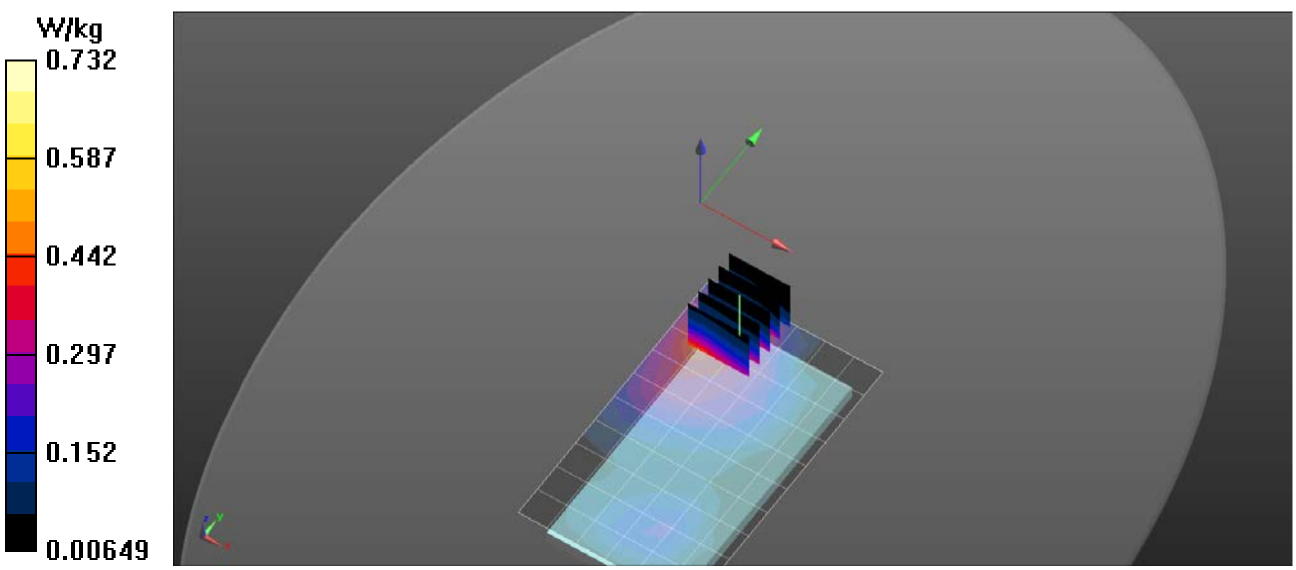
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.570 W/kg

LTE 1750 Body/iPhone 7 Front 1750 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.655 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.37 W/kg
SAR(1 g) = 0.652 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.732 W/kg



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Plot 13

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: GSM (GMSK); Frequency: 1880 MHz; Duty Cycle: 1:8.30042
Medium: HSL1900; Medium parameters used: f = 1880 MHz; σ = 1.42 S/m; ε_r = 39.59; ρ = 1000 kg/m^3
Phantom section: Right Section

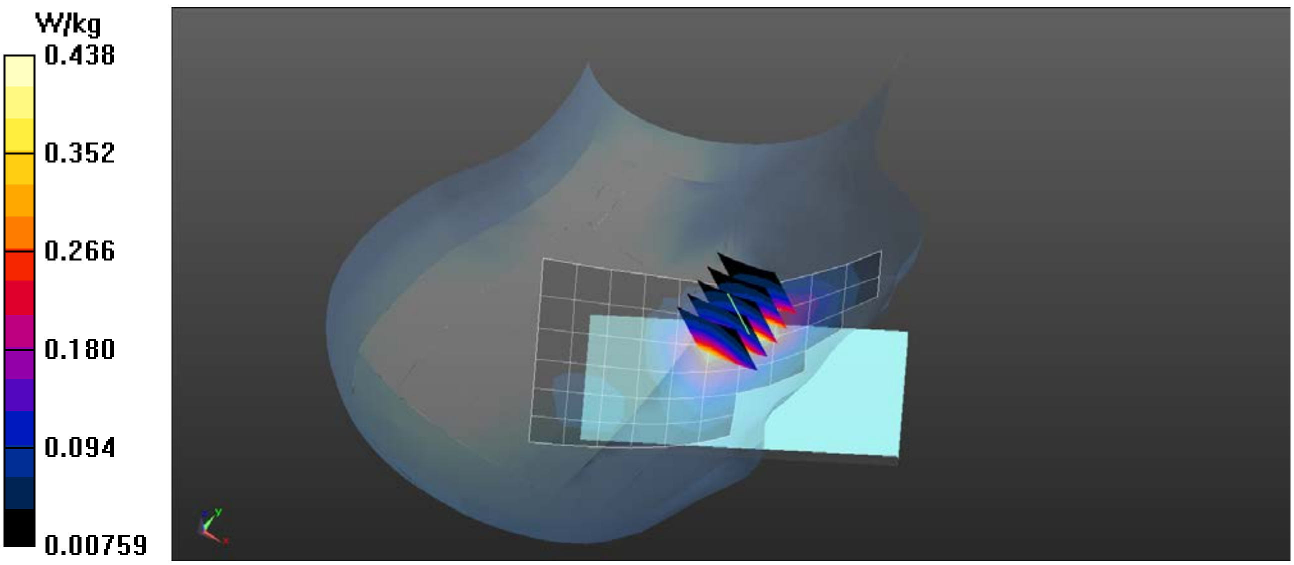
Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.01, 8.01, 8.01); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

GSM 1900 Head/iPhone 7 Right 1900 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.394 W/kg

GSM 1900 Head/iPhone 7 Right 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.446 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.665 W/kg
SAR(1 g) = 0.412 W/kg
Maximum value of SAR (measured) = 0.438 W/kg



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Plot 14

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: GSM (GMSK); Frequency: 1909.8 MHz; Duty Cycle: 1:8.30042
Medium: MSL1900; Medium parameters used (interpolated): f = 1909.8 MHz; σ = 1.499 S/m; ε_r = 52.119; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.61, 7.61, 7.61); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

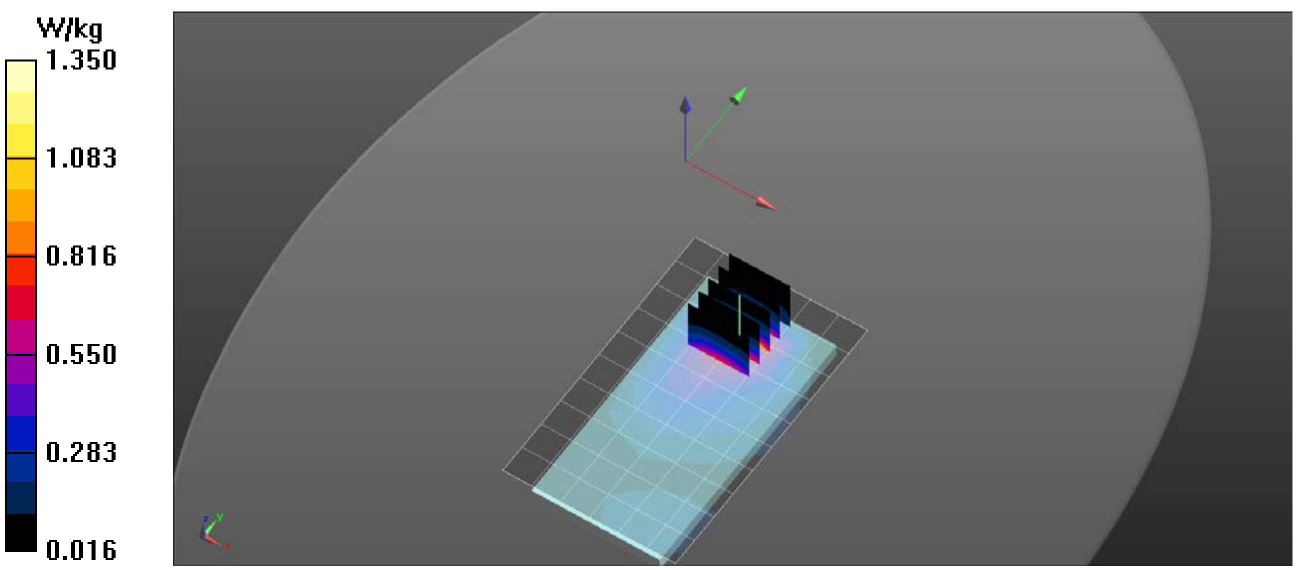
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.43 W/kg

GSM 1900 Body/iPhone 7 Front 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.57 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 2.66 W/kg
SAR(1 g) = 1.02 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.35 W/kg



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Plot 15

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used (interpolated): f = 1908.75 MHz; σ = 1.44 S/m; ε_r = 39.542; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.01, 8.01, 8.01); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

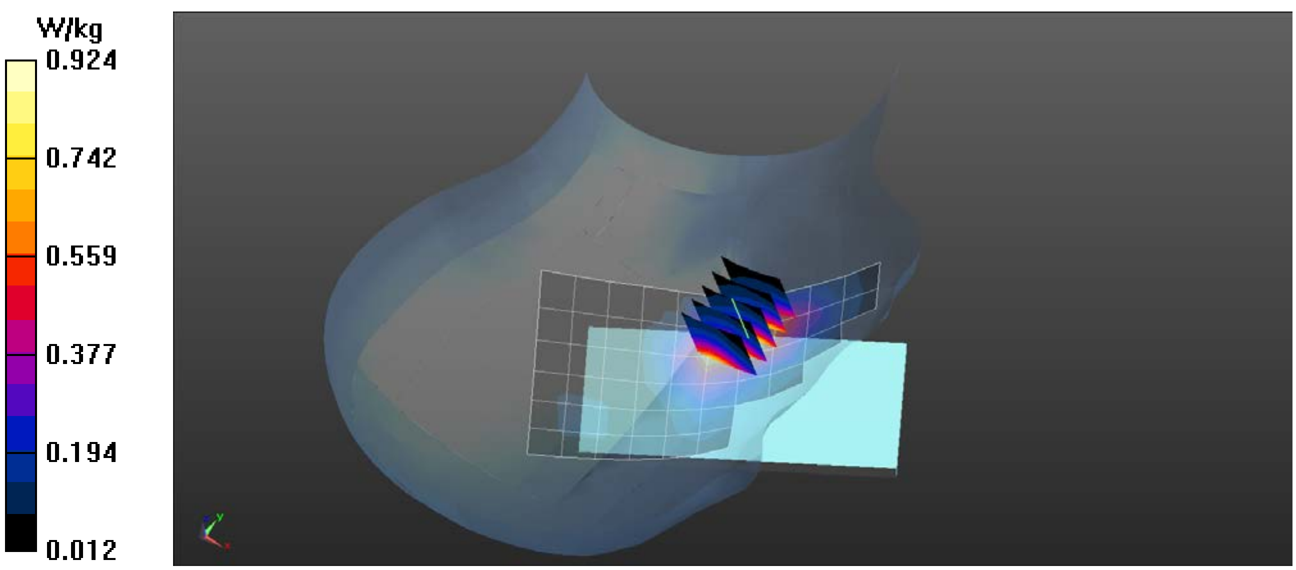
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.729 W/kg

CDMA 1900 Head/iPhone 7 Right 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.319 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.33 W/kg
SAR(1 g) = 0.841 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.924 W/kg



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Plot 16

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: MSL1900; Medium parameters used (interpolated): f = 1908.75 MHz; σ = 1.496 S/m; ε_r = 52.114; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.61, 7.61, 7.61); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

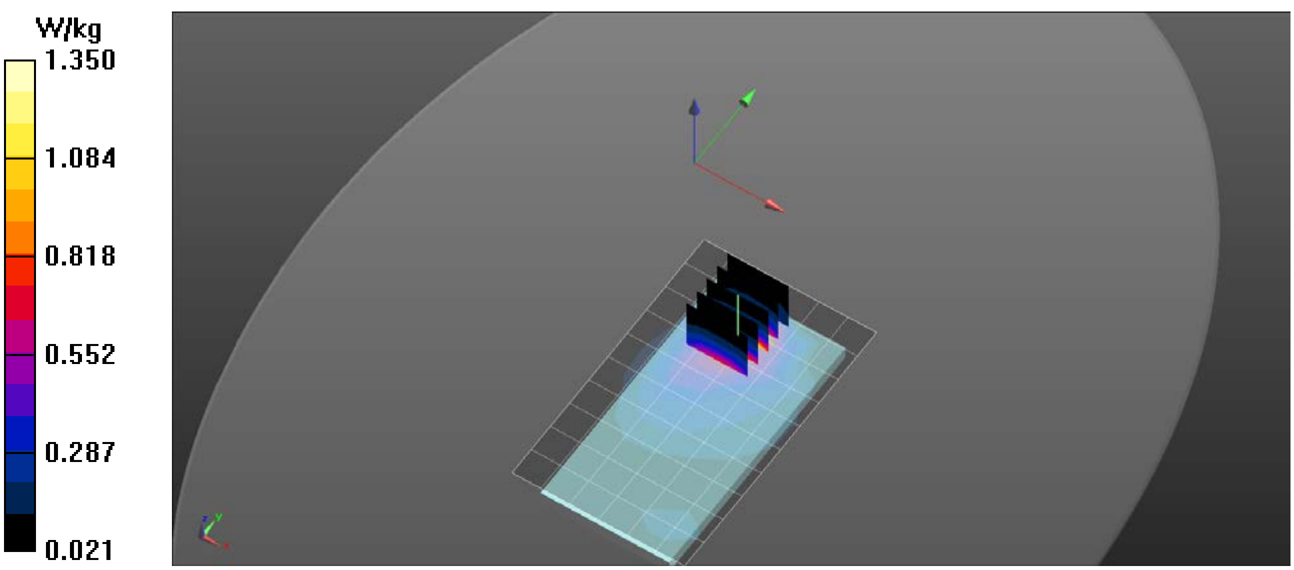
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.09 W/kg

CDMA 1900 Body/iPhone 7 Front 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.59 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 2.19 W/kg
SAR(1 g) = 1.03 W/kg

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



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Plot 17

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: HSL835; Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.932 S/m; ε_r = 41.395; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.29, 9.29, 9.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

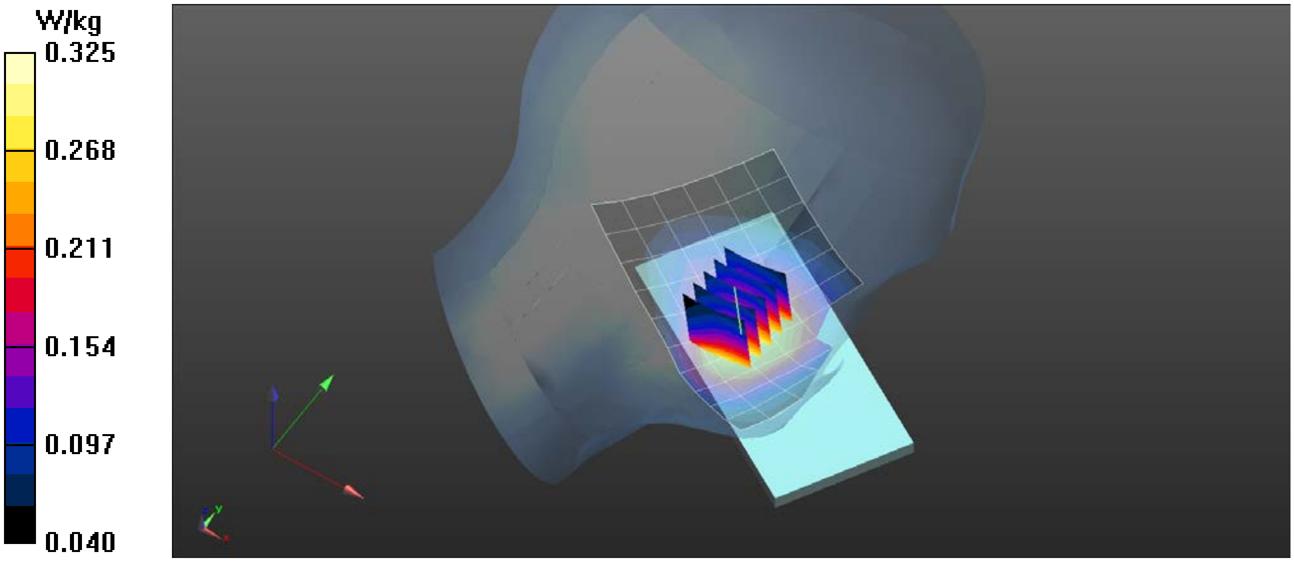
Procedure Notes:

WCDMA 850 Head/iPhone 8 Left 850 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.318 W/kg

WCDMA 850 Head/iPhone 8 Left 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.933 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.386 W/kg
SAR(1 g) = 0.311 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.325 W/kg



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Plot 18

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 846.6 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium parameters used (interpolated): f = 846.6 MHz; σ = 1.003 S/m; ε_r = 54.885; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.21, 9.21, 9.21); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

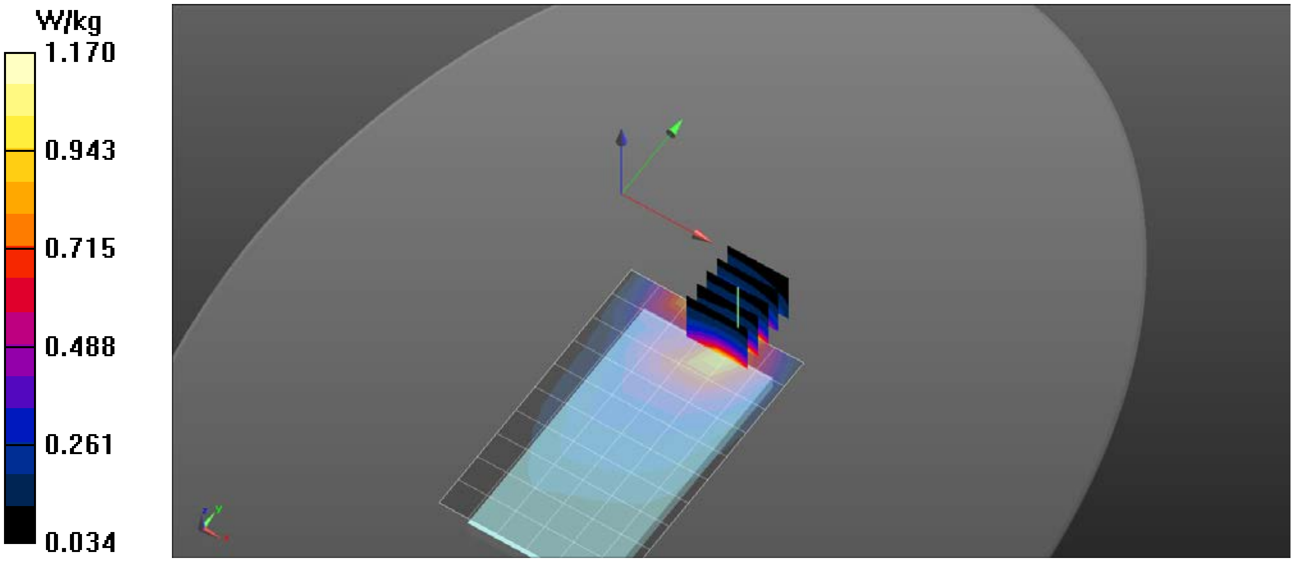
Procedure Notes:

WCDMA 850 Body/iPhone 8 Back 850 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

WCDMA 850 Body/iPhone 8 Back 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.91 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.86 W/kg
SAR(1 g) = 1.03 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.17 W/kg



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Plot 19

DUT: iPhone 7 & 8; 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 = 0.92 S/m; ε_r = 41.26; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.8, 9.8, 9.8); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

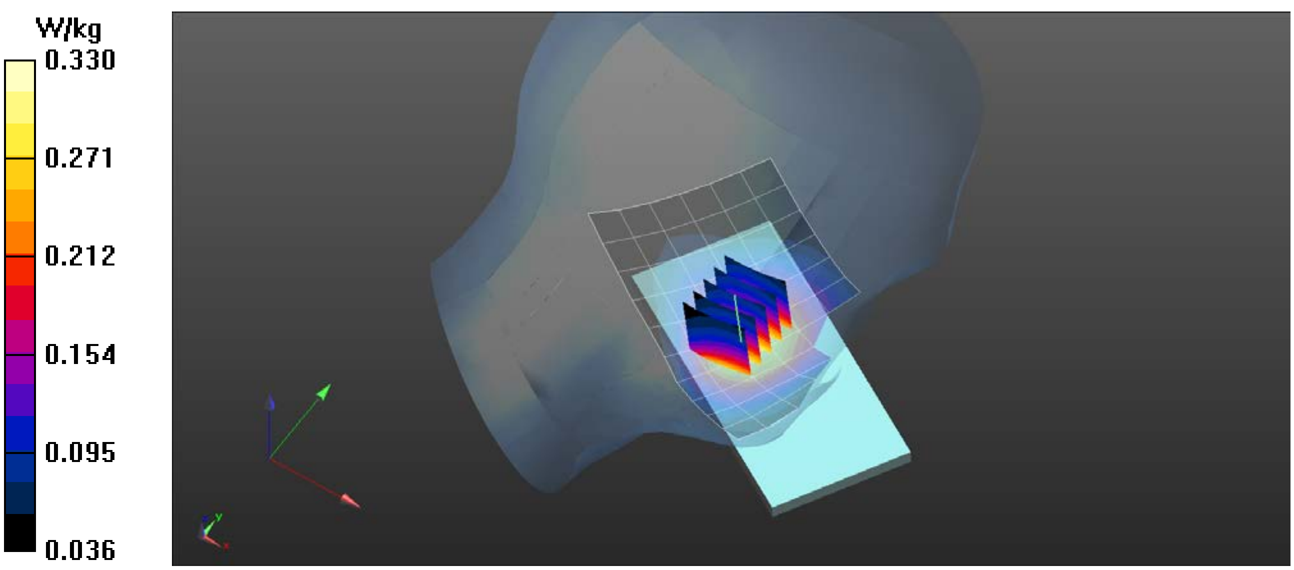
Procedure Notes:

LTE 750 Left Head/iPhone 8 Left 750 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.311 W/kg

LTE 750 Left Head/iPhone 8 Left 750 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.949 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.416 W/kg
SAR(1 g) = 0.317 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.330 W/kg



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Plot 20

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 782 MHz; Duty Cycle: 1:1
Medium: MSL750; Medium parameters used (interpolated): f = 782 MHz; σ = 0.972 S/m; ε_r = 54.556; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.8, 9.8, 9.8); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

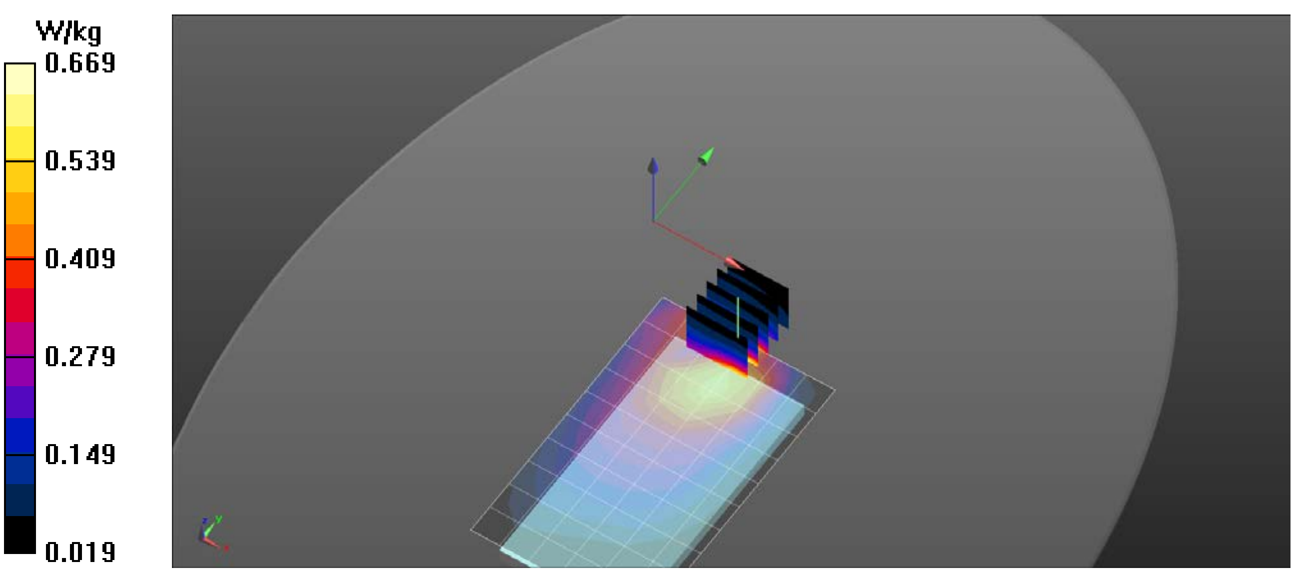
Procedure Notes:

LTE 750 Body/iPhone 8 Back 1 RB Offset 24 750 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

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

LTE 750 Body/iPhone 8 Back 1 RB Offset 24 750 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.56 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.14 W/kg
SAR(1 g) = 0.622 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.669 W/kg



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Plot 21

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: GSM 1-Slot (GMSK); Frequency: 836.6 MHz; Duty Cycle: 1:8.30042
Medium: HSL835; Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.932 S/m; ε_r = 41.395; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.29, 9.29, 9.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

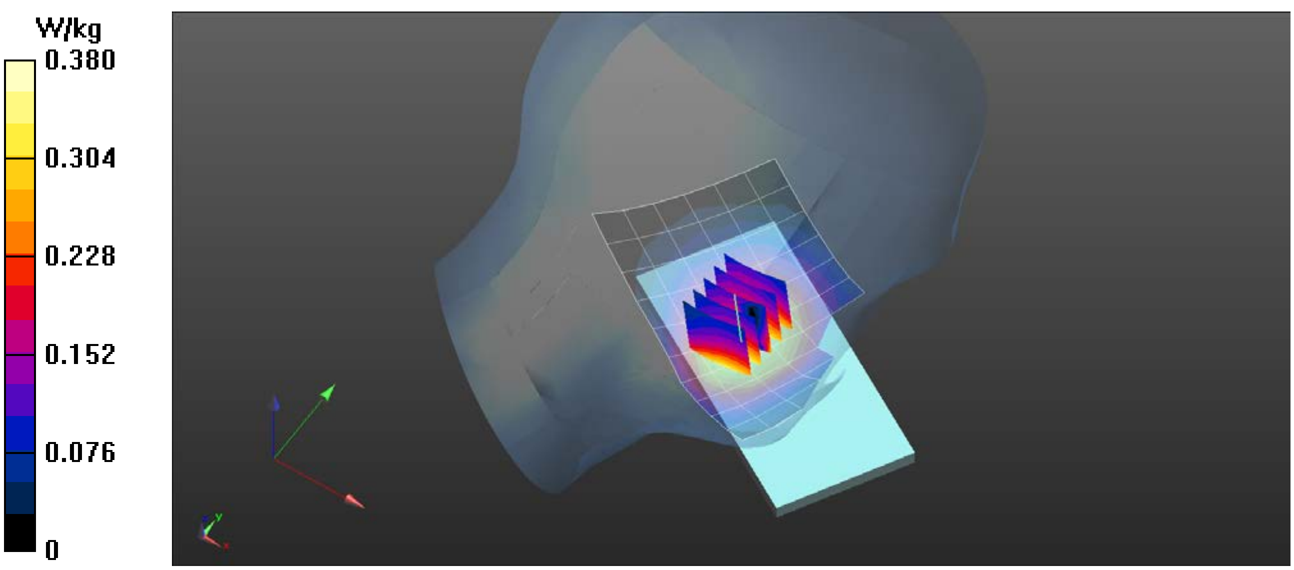
Procedure Notes:

GSM 850 Head/iPhone 8 Left 850 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.378 W/kg

GSM 850 Head/iPhone 8 Left 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.806 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.505 W/kg
SAR(1 g) = 0.362 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.380 W/kg



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Plot 22

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: GSM (GMSK); Frequency: 848.8 MHz; Duty Cycle: 1:8.30042
Medium: MSL835; Medium parameters used (interpolated): f = 848.8 MHz; σ = 1.008 S/m; ε_r = 54.879; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.21, 9.21, 9.21); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

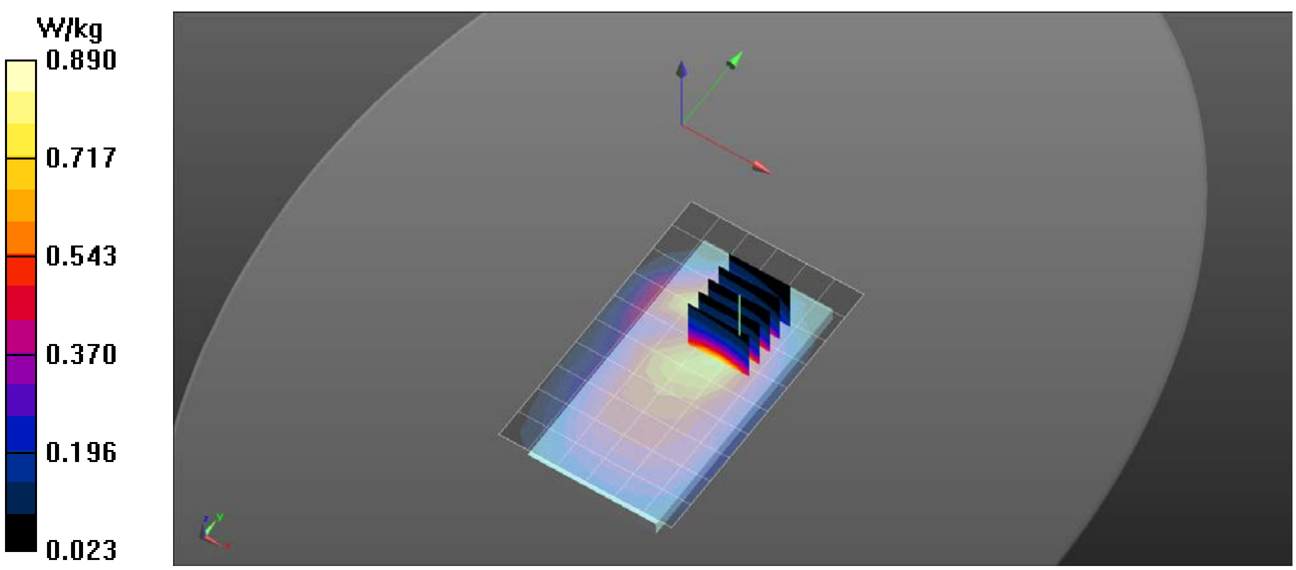
Procedure Notes:

GSM 850 Body/iPhone 8 Back 850 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.823 W/kg

GSM 850 Body/iPhone 8 Back 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.38 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.43 W/kg
SAR(1 g) = 0.794 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.890 W/kg



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Plot 23

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: HSL835; Medium parameters used (interpolated): f = 836.52 MHz; σ = 0.932 S/m; ε_r = 41.396; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.29, 9.29, 9.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

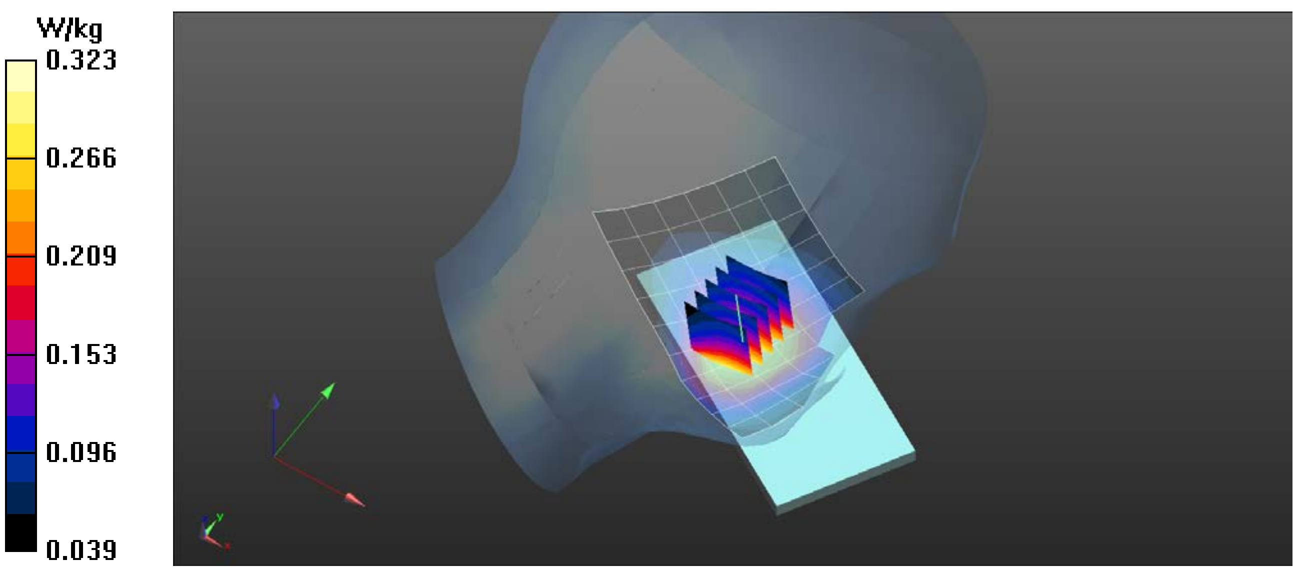
Procedure Notes:

CDMA 850 Head/iPhone 8 Left 850 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.316 W/kg

CDMA 850 Head/iPhone 8 Left 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.171 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.390 W/kg
SAR(1 g) = 0.310 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.323 W/kg



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Plot 24

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 848.31 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium parameters used (interpolated): f = 848.31 MHz; σ = 1.007 S/m; ε_r = 55.88; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(9.21, 9.21, 9.21); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

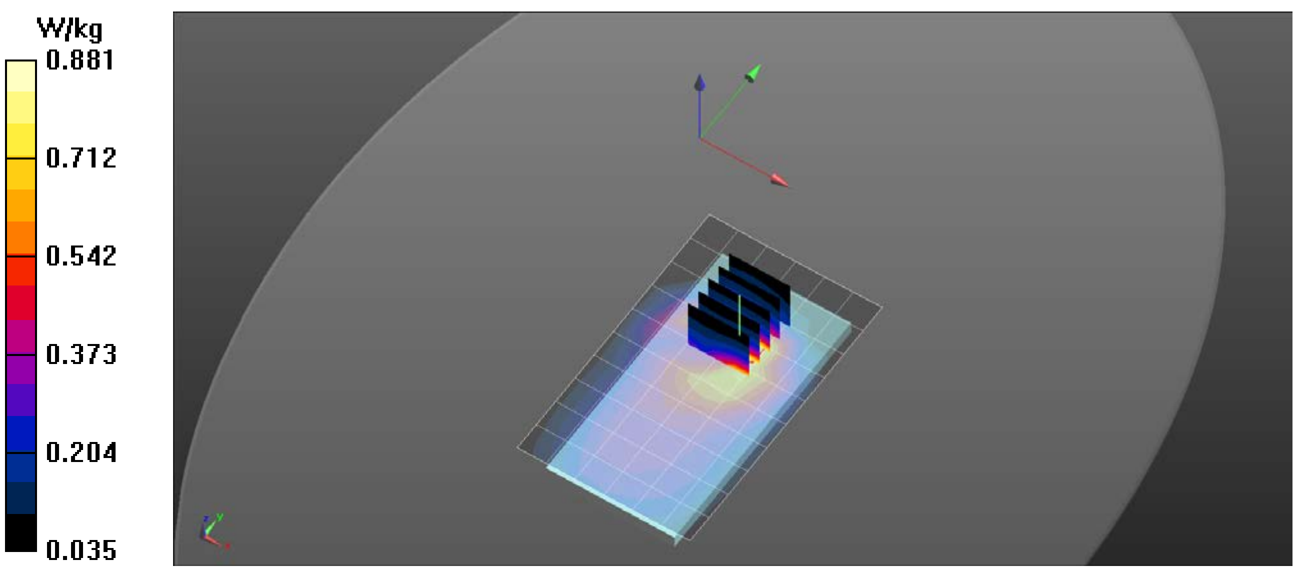
Procedure Notes:

CDMA 850 Body/iPhone 8 Back 850 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.840 W/kg

CDMA 850 Body/iPhone 8 Back 850 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.05 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.43 W/kg
SAR(1 g) = 0.804 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.881 W/kg



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Plot 25

DUT: iPhone 7 & 8; 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 = 1.44 S/m; ε_r = 39.545; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.01, 8.01, 8.01); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

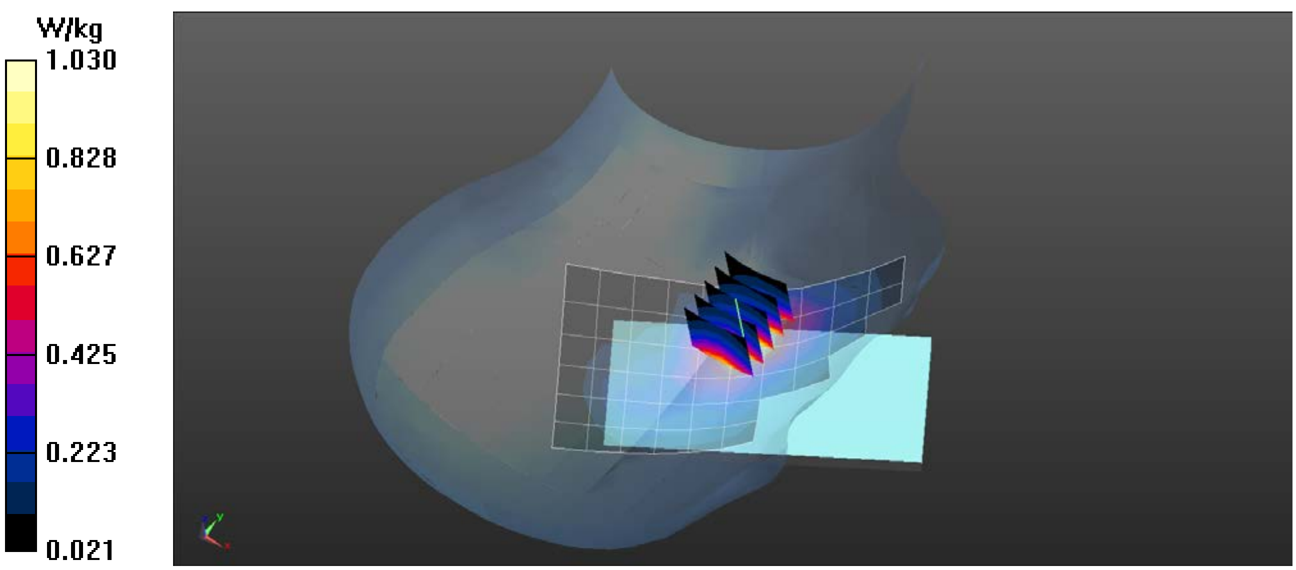
Procedure Notes:

WCDMA 1900 Head/iPhone 8 Right 1900 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.873 W/kg

WCDMA 1900 Head/iPhone 8 Right 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.082 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.44 W/kg
SAR(1 g) = 0.949 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.03 W/kg



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Plot 26

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: UMTS (WCDMA); Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: MSL1900; Medium parameters used (interpolated): f = 1907.6 MHz; σ = 1.493 S/m; ε_r = 52.108; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.61, 7.61, 7.61); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

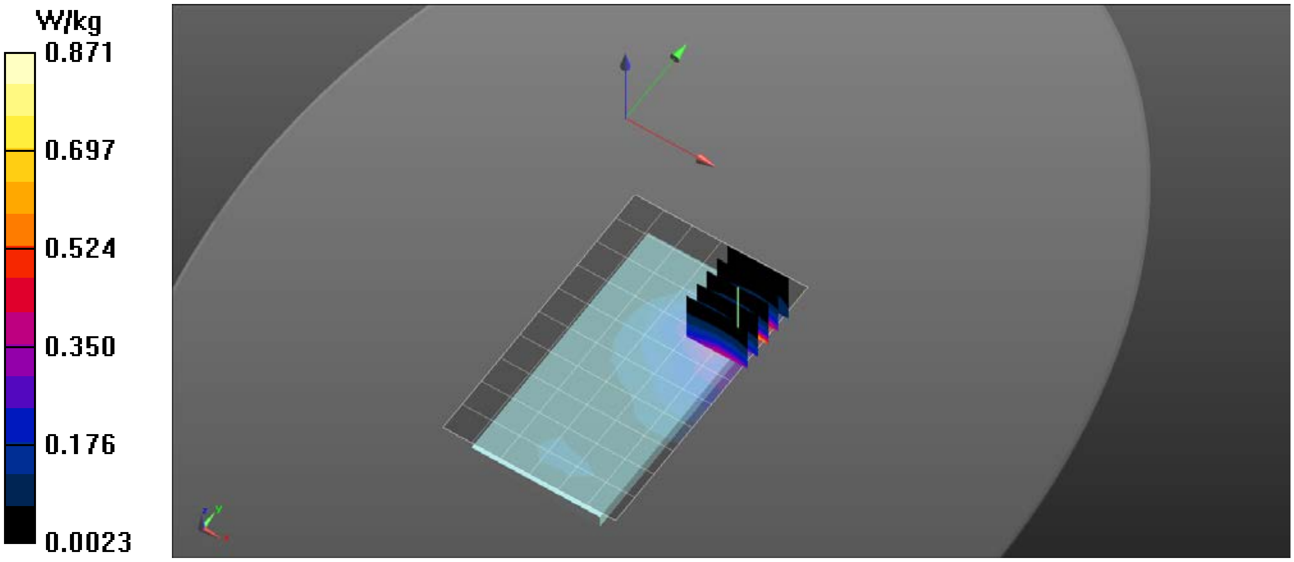
Procedure Notes:

WCDMA 1900 Body/iPhone 8 Back 1900 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.693 W/kg

WCDMA 1900 Body/iPhone 8 Back 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.38 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.80 W/kg
SAR(1 g) = 0.963 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.871 W/kg



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Plot 27

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1900 MHz; σ = 1.44 S/m; ε_r = 39.56; ρ = 1000 kg/m^3
Phantom section: Right Section

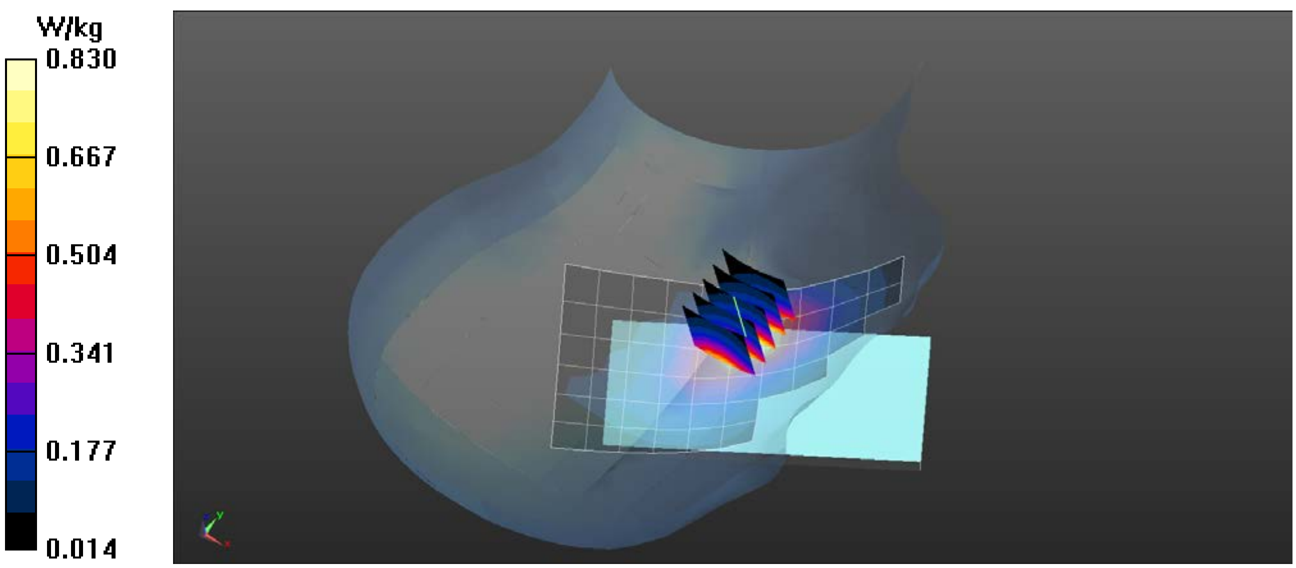
Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.01, 8.01, 8.01); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

LTE 1900 Head/iPhone 8 Right 1 RB Offset 49 1900 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.700 W/kg

LTE 1900 Head/iPhone 8 Right 1 RB Offset 49 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.911 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.17 W/kg
SAR(1 g) = 0.765 W/kg
Maximum value of SAR (measured) = 0.830 W/kg



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Plot 28

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: LTE (SC-FDMA, 100% RB, 20 MHz, QPSK); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: MSL1900; Medium parameters used: f = 1880 MHz; σ = 1.45 S/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

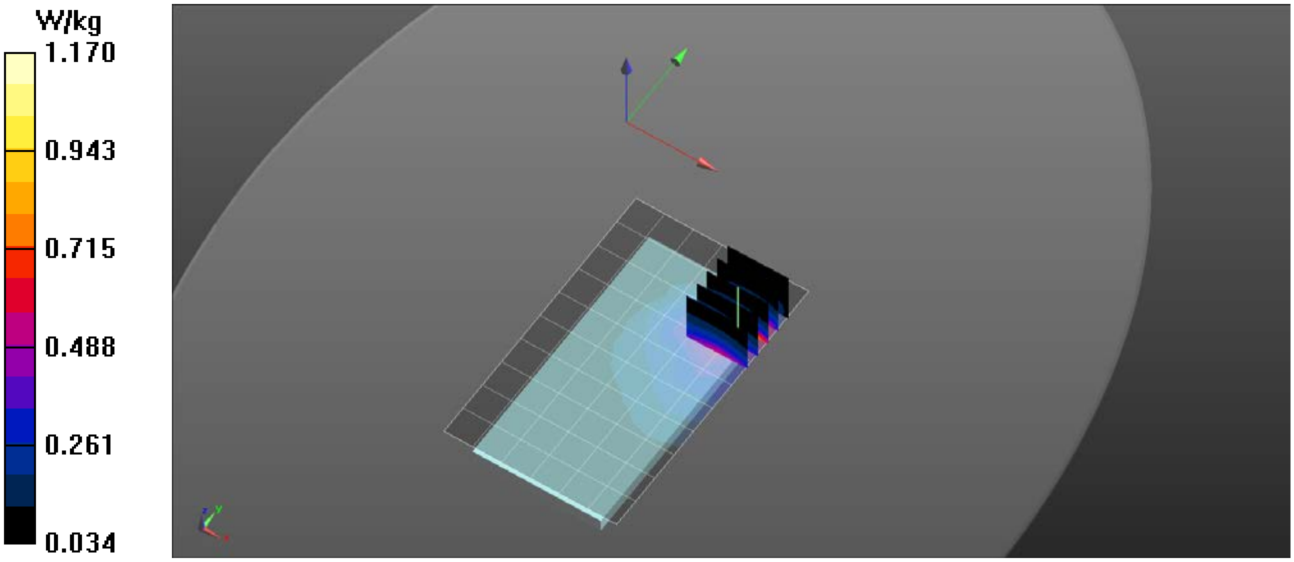
Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.61, 7.61, 7.61); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

LTE 1900 Body/iPhone 8 Back 100 RB Offset 0 1900 With Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.15 W/kg

LTE 1900 Body/iPhone 8 Back 100 RB Offset 0 1900 With Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.19 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.95 W/kg
SAR(1 g) = 1.01 W/kg
Maximum value of SAR (measured) = 1.16 W/kg



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Plot 29

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: GSM (GMSK); Frequency: 1880 MHz; Duty Cycle: 1:8.30042
Medium: HSL1900; Medium parameters used: f = 1880 MHz; σ = 1.42 S/m; ε_r = 39.59; ρ = 1000 kg/m^3
Phantom section: Right Section

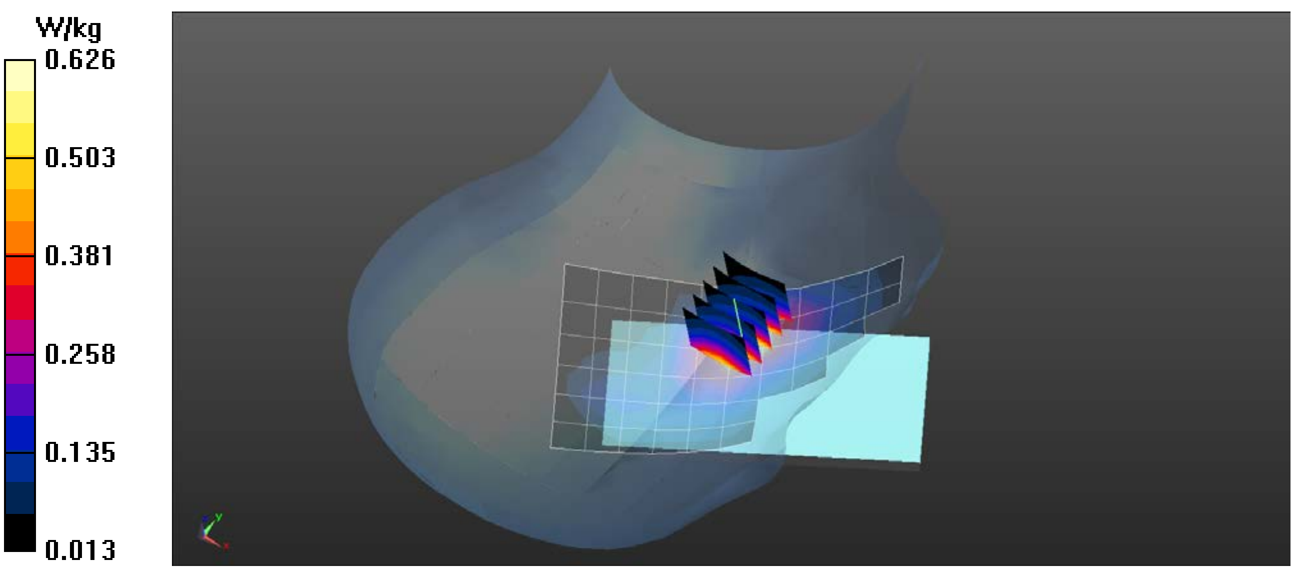
Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.01, 8.01, 8.01); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

GSM 1900 Head/iPhone 8 Right 1900 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.517 W/kg

GSM 1900 Head/iPhone 8 Right 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.668 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.873 W/kg
SAR(1 g) = 0.576 W/kg
Maximum value of SAR (measured) = 0.626 W/kg



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Plot 30

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: GSM (GMSK); Frequency: 1909.8 MHz; Duty Cycle: 1:8.30042
Medium: MSL1900; Medium parameters used (interpolated): f = 1909.8 MHz; σ = 1.499 S/m; ε_r = 52.119; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.61, 7.61, 7.61); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

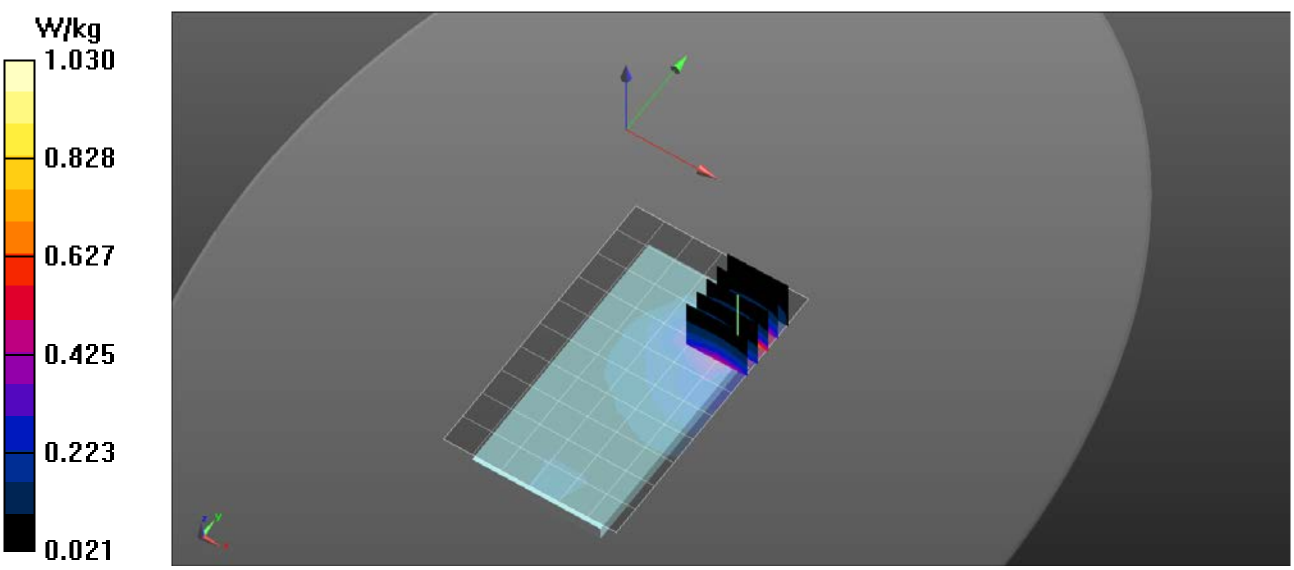
Procedure Notes:

GSM 1900 Body/iPhone 8 Back 1900 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.956 W/kg

GSM 1900 Body/iPhone 8 Back 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.69 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 1.02 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.03 W/kg



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Plot 31

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used (interpolated): f = 1908.75 MHz; σ = 1.44 S/m; ε_r = 39.542; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.01, 8.01, 8.01); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

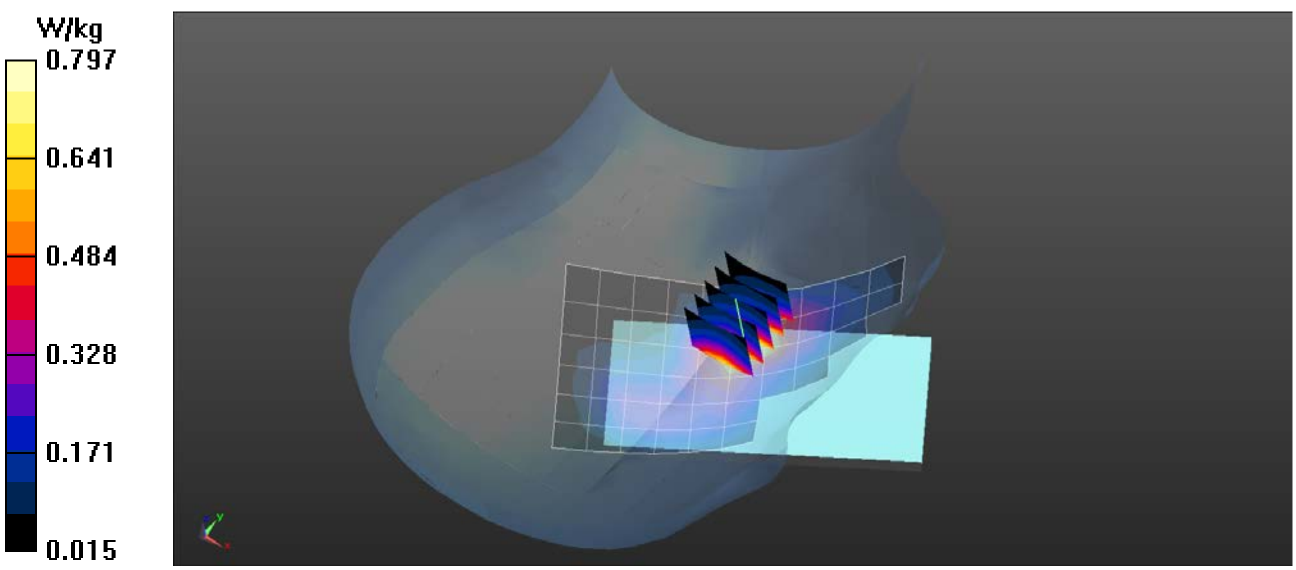
Procedure Notes:

CDMA 1900 Head/iPhone 8 Right 1900 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.703 W/kg

CDMA 1900 Head/iPhone 8 Right 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.529 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.12 W/kg
SAR(1 g) = 0.747 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.797 W/kg



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Plot 32

DUT: iPhone 7 & 8; Type: Cell Phone; Serial: Test

Communication System: CDMA2000 (1xRTT); Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: MSL1900; Medium parameters used (interpolated): f = 1908.75 MHz; σ = 1.496 S/m; ε_r = 52.114; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.61, 7.61, 7.61); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

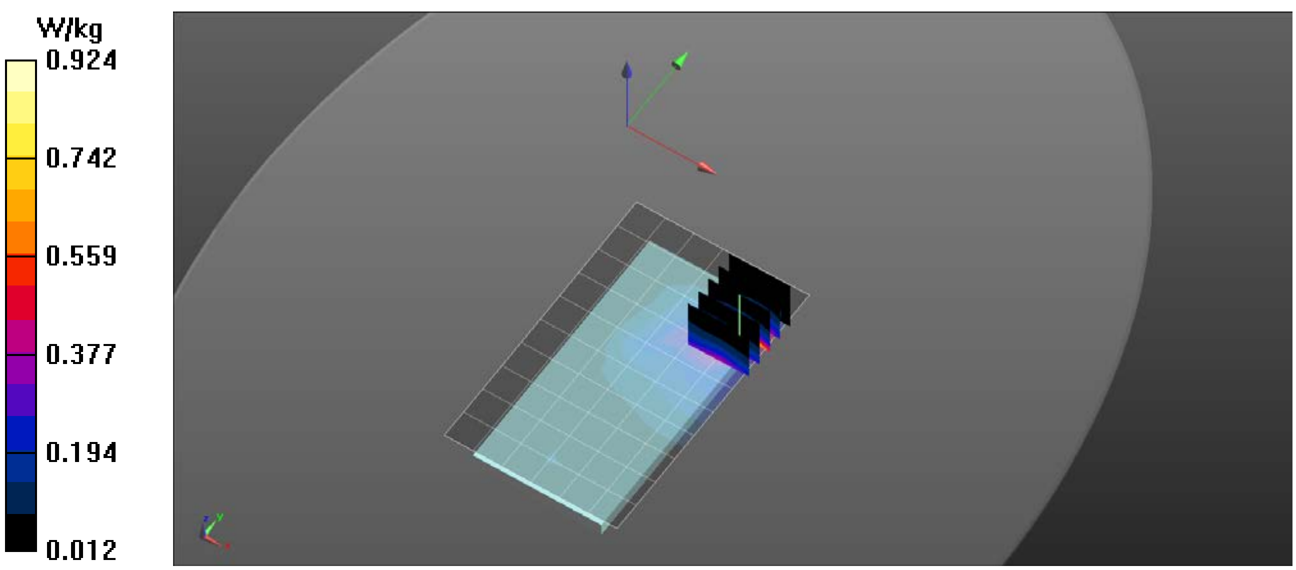
Procedure Notes:

CDMA 1900 Body/iPhone 8 Back 1900 Baseline/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.854 W/kg

CDMA 1900 Body/iPhone 8 Back 1900 Baseline/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.78 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.39 W/kg
SAR(1 g) = 0.928 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.924 W/kg



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Plot 33

DUT: Case; Type: Cell Phone; Serial: Test

Communication System: WiFi 802.11b (DSSS, 1 Mbps); Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium parameters used (interpolated): f = 2437 MHz; σ = 1.827 S/m; ε_r = 39.012; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.39, 7.39, 7.39); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: SAM with CRP; Type: SAM; Serial: 1416
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

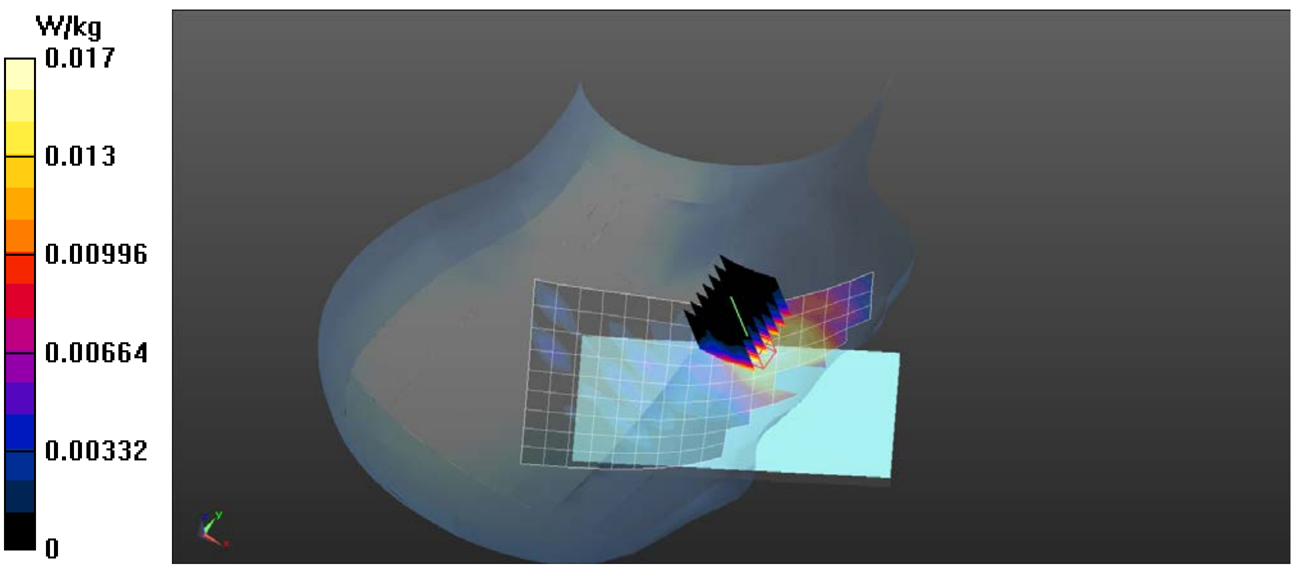
Procedure Notes:

2450 MHz Right Head/Touch Mid/Area Scan (10x16x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0164 W/kg

2450 MHz Right Head/Touch Mid/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.4360 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 0.0230 W/kg
SAR(1 g) = 0.014 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0166 W/kg



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RF Exposure Lab

Plot 34

DUT: Case; Type: Cell Phone; Serial: Test

Communication System: WiFi 802.11b (DSSS, 1 Mbps); Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: MSL2450; Medium parameters used (interpolated): f = 2437 MHz; σ = 1.947 S/m; ε_r = 52.666; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.29, 7.29, 7.29); Calibrated: 4/20/2018;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

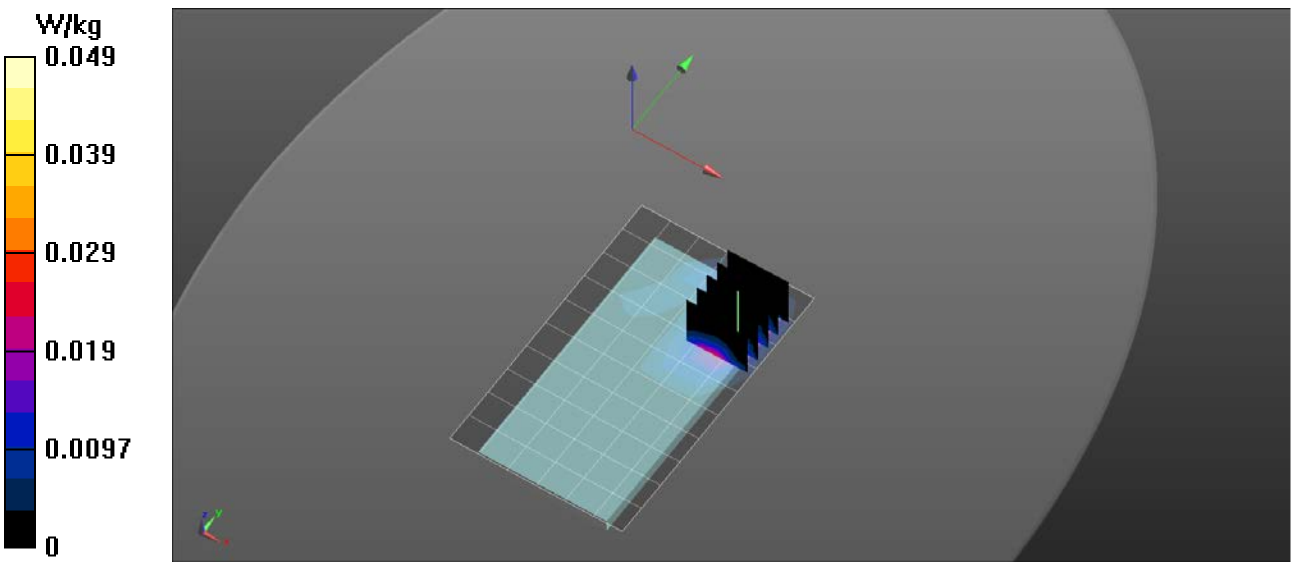
Procedure Notes:

2450 MHz Body/Back Mid/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0384 W/kg

2450 MHz Body/Back Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.127 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.115 W/kg
SAR(1 g) = 0.041 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0485 W/kg



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Appendix C – Test Setup Photos

Right Touch No Case

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Right Touch With Case

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Left Touch No Case

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Left Touch With Case

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Right Touch Case Only

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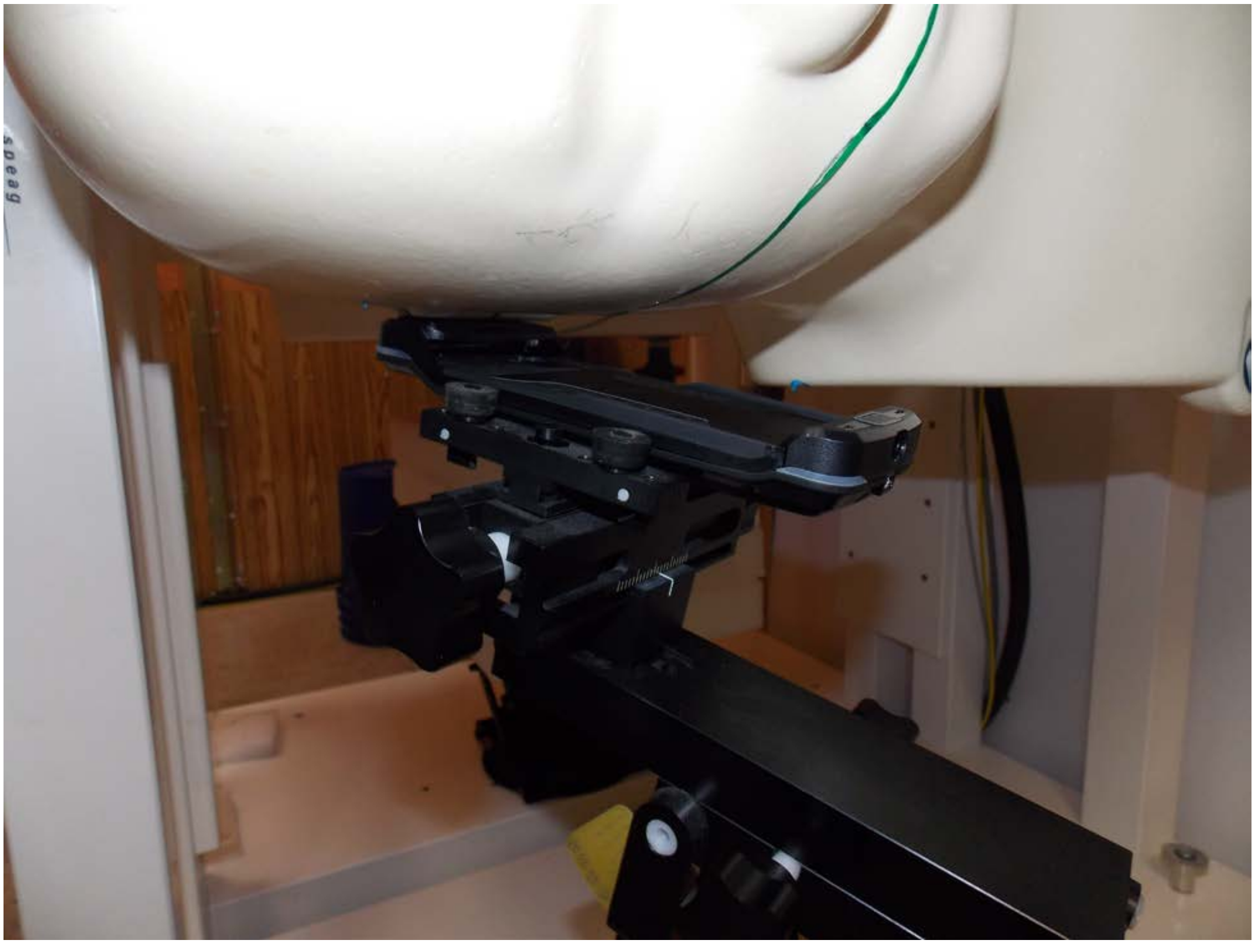

Right Tilt Case Only

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Left Touch Case Only

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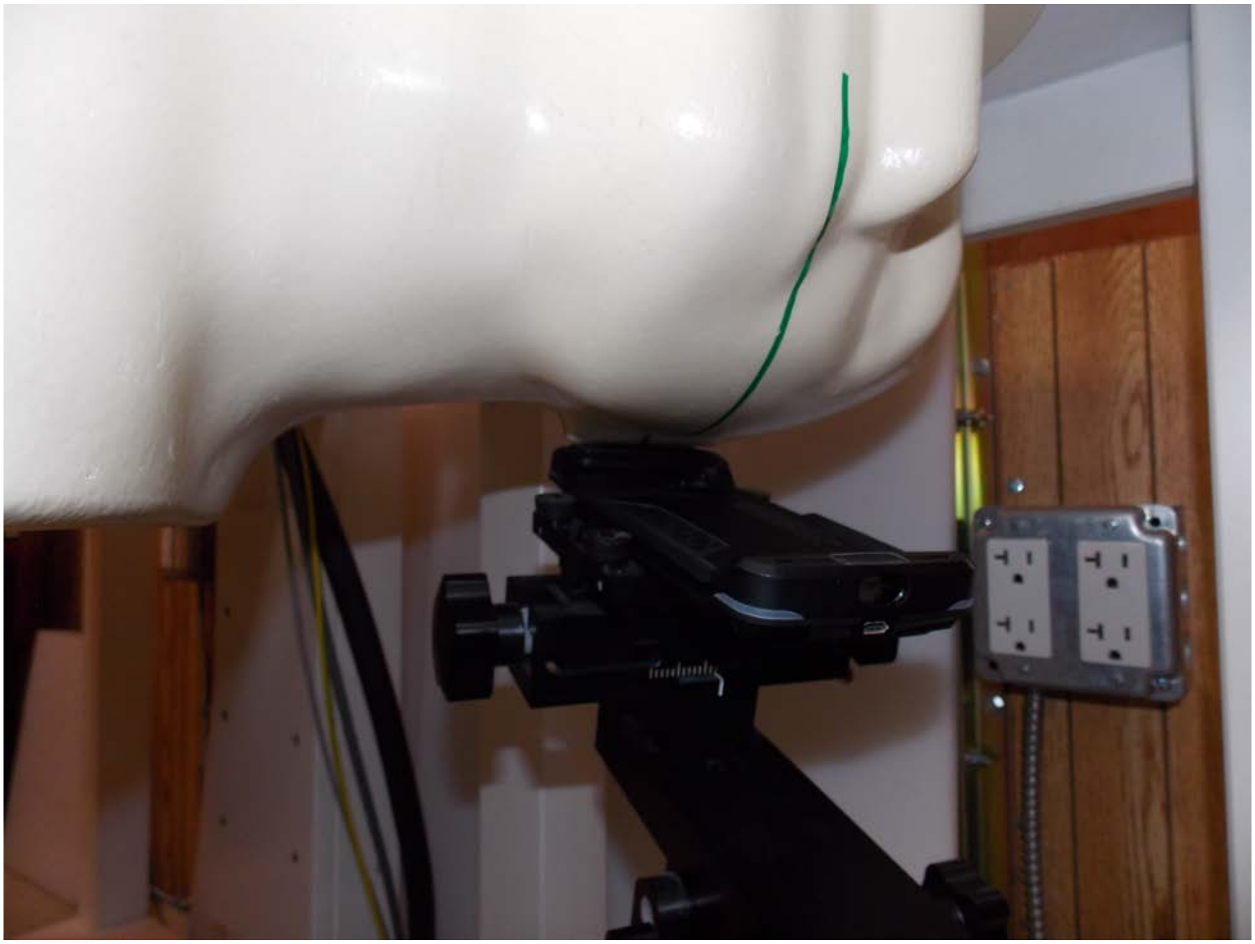

Left Touch Case Only

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Body Front Configuration No Case 5 mm Gap

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Body Front Configuration With Case 5 mm Gap

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Body Back Configuration No Case 5 mm Gap

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Body Back Configuration With Case 5 mm Gap

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Body Front Configuration Case Only 0 mm Gap

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Body Back Configuration Case Only 0 mm Gap

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Front of Device (Case)

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Back of Device (Case)

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Appendix D – Probe Calibration Data Sheets

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gm

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
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: EX3-3662_Apr18

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3662

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: April 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: S5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

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

Issued: April 20, 2018

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

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Accreditation No.: SCS 0108

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., ϑ = 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 ϑ = 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).

Probe EX3DV4

SN:3662

Manufactured: October 20, 2008
Calibrated: April 20, 2018

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3662

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.44	0.45	0.48	± 10.1 %
DCP (mV)[B]	102.6	97.6	96.4	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	136.8	±3.3 %
		Y	0.0	0.0	1.0		132.2	
		Z	0.0	0.0	1.0		148.8	

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 Pages 5 and 6).
[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:3662

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	9.80	9.80	9.80	0.43	0.90	± 12.0 %
900	41.5	0.97	9.29	9.29	9.29	0.40	0.91	± 12.0 %
1750	40.1	1.37	8.29	8.29	8.29	0.29	0.84	± 12.0 %
1900	40.0	1.40	8.01	8.01	8.01	0.37	0.80	± 12.0 %
2300	39.5	1.67	7.71	7.71	7.71	0.35	0.80	± 12.0 %
2450	39.2	1.80	7.39	7.39	7.39	0.28	0.91	± 12.0 %
2600	39.0	1.96	7.14	7.14	7.14	0.36	0.85	± 12.0 %
3500	37.9	2.91	7.08	7.08	7.08	0.25	1.20	± 13.1 %
3700	37.7	3.12	6.99	6.99	6.99	0.25	1.20	± 13.1 %
5250	35.9	4.71	5.04	5.04	5.04	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.81	4.81	4.81	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.89	4.89	4.89	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. 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.

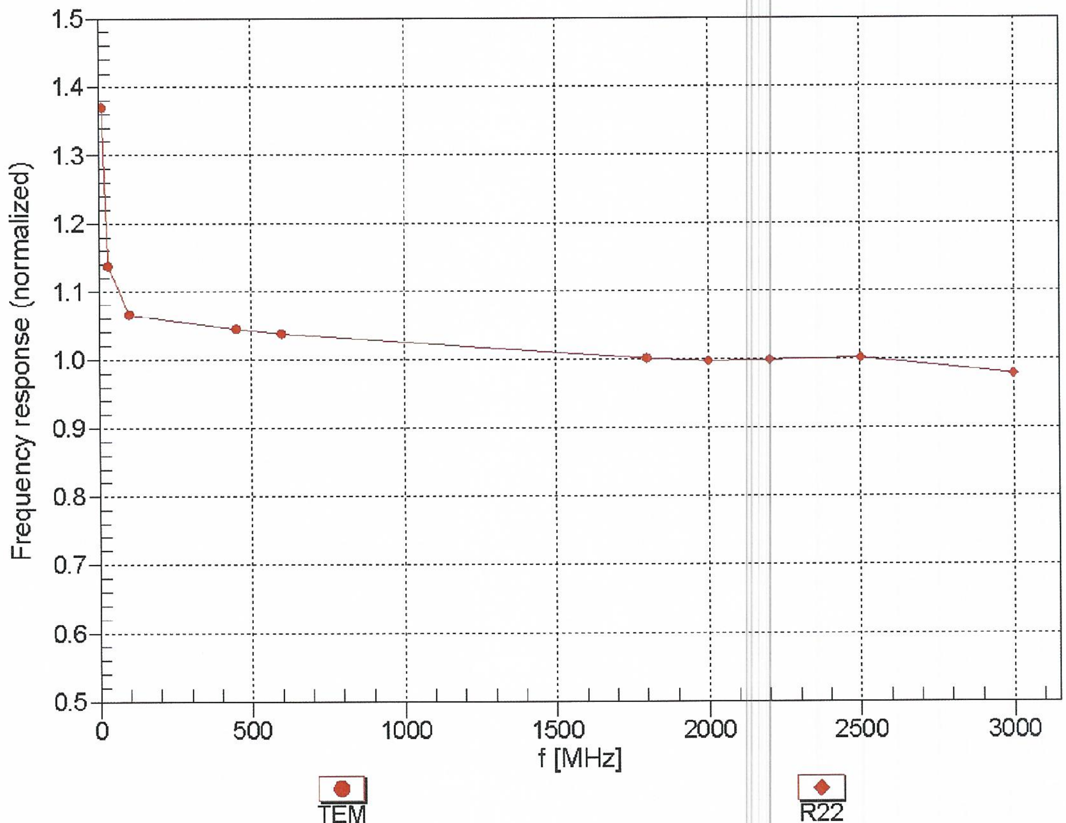
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3662

Calibration Parameter Determined in Body 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	55.5	0.96	9.62	9.62	9.62	0.37	0.98	± 12.0 %
900	55.0	1.05	9.21	9.21	9.21	0.44	0.84	± 12.0 %
1750	53.4	1.49	7.96	7.96	7.96	0.45	0.80	± 12.0 %
1900	53.3	1.52	7.61	7.61	7.61	0.44	0.80	± 12.0 %
2300	52.9	1.81	7.33	7.33	7.33	0.41	0.80	± 12.0 %
2450	52.7	1.95	7.29	7.29	7.29	0.36	0.87	± 12.0 %
2600	52.5	2.16	7.15	7.15	7.15	0.26	0.99	± 12.0 %
3500	51.3	3.31	7.00	7.00	7.00	0.25	1.20	± 13.1 %
3700	51.0	3.55	6.71	6.71	6.71	0.23	1.20	± 13.1 %
5250	48.9	5.36	4.46	4.46	4.46	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.91	3.91	3.91	0.50	1.90	± 13.1 %
5750	48.3	5.94	4.08	4.08	4.08	0.50	1.90	± 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. 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.

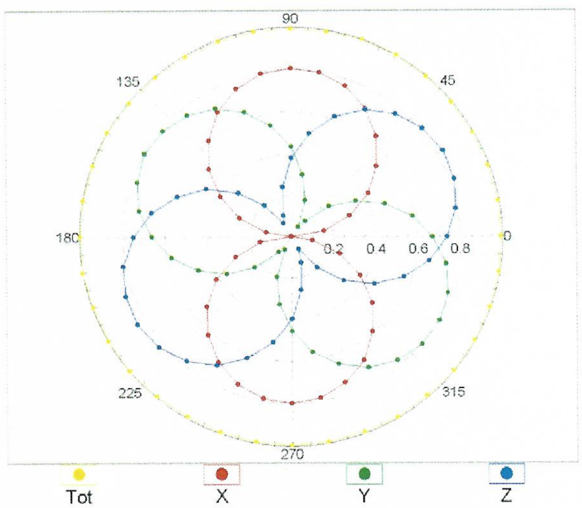
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



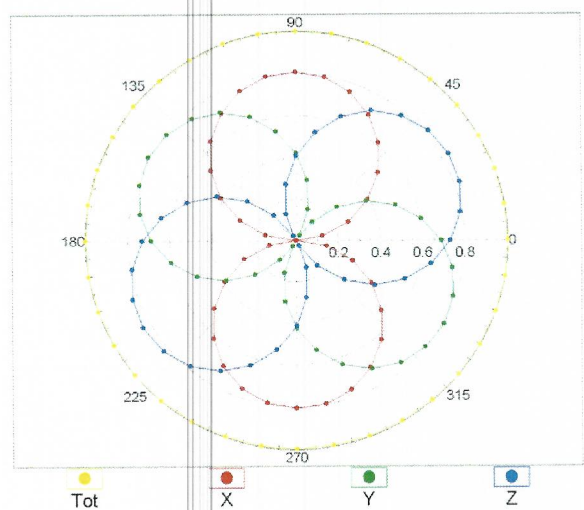
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

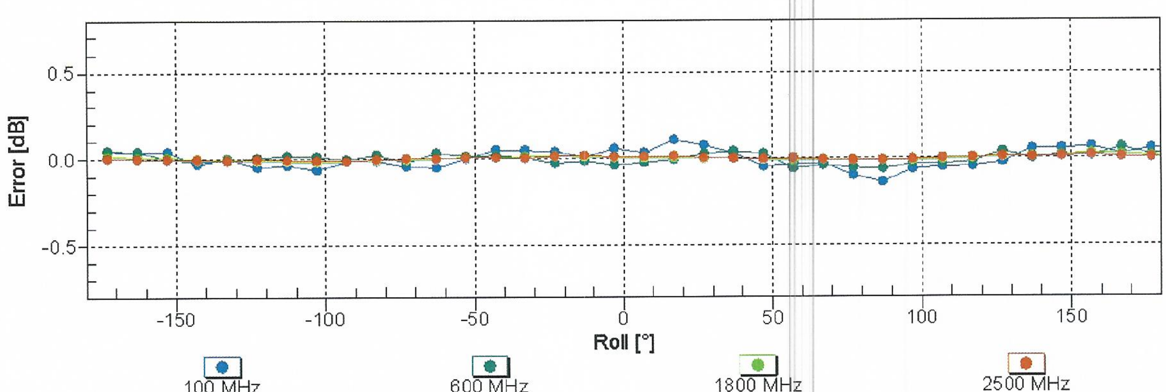
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

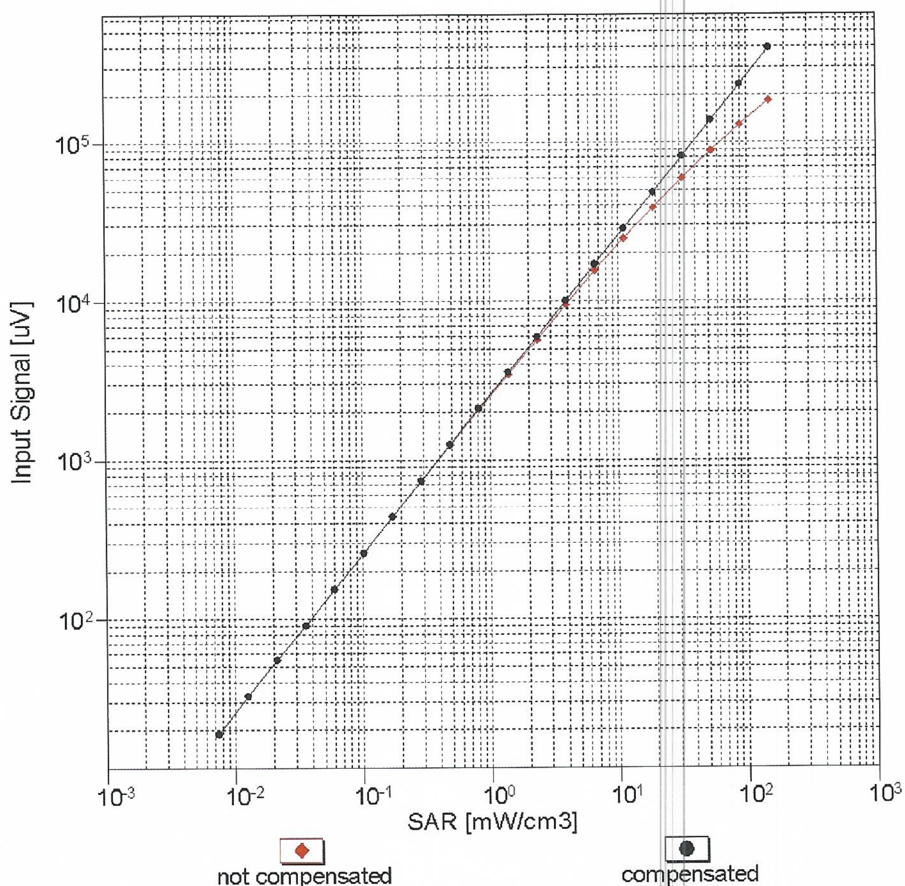


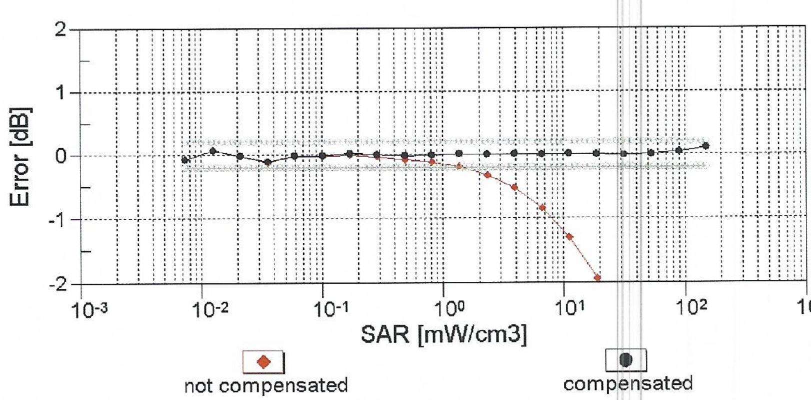


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)





Uncertainty of Linearity Assessment: ± 0.6% (k=2)