

# RF Exposure Lab

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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



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.

## 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 ( $\rho$ ).

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

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

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

where:

$\sigma$  = conductivity of the tissue (S/m)

$\rho$  = mass density of the tissue (kg/m<sup>3</sup>)

$E$  = rms electric field strength (V/m)

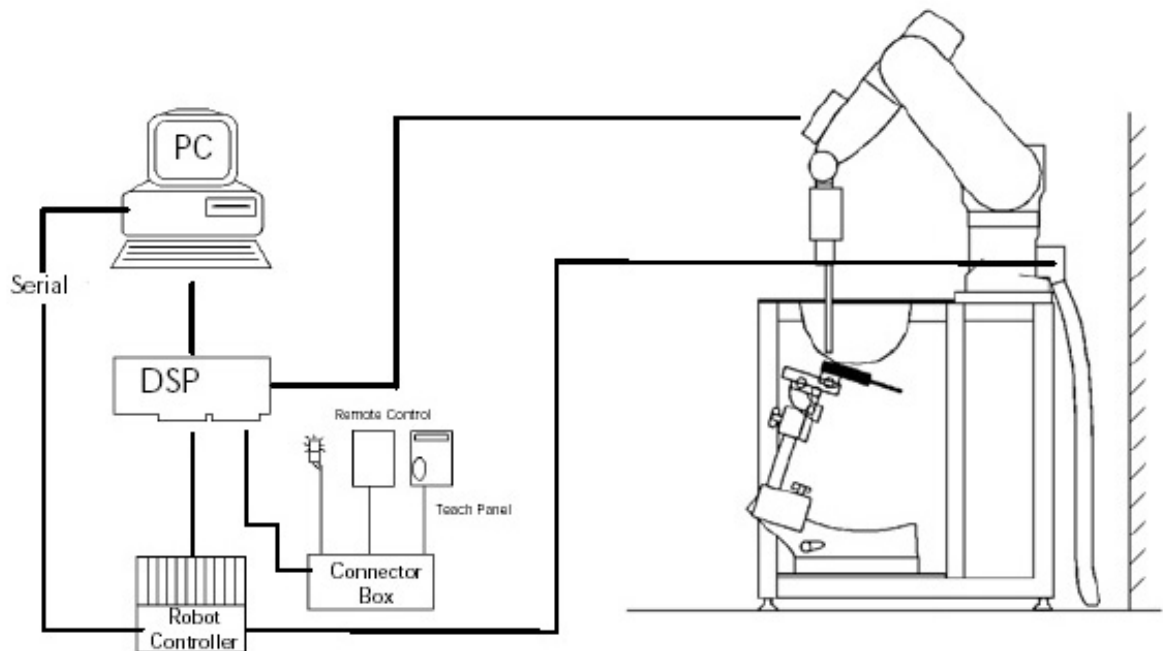
## 2. SAR Measurement Setup

### Robotic System

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

### System Hardware

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



**Figure 2.1 SAR Measurement System Setup**

## System Electronics

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

## Probe Measurement System

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



**DAE System**

## 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:**  $\pm 0.2\text{dB}$  (30 MHz to 6 GHz)

**Dynamic:** 10 mW/kg to 100 W/kg

**Range:** Linearity:  $\pm 0.2\text{dB}$

**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

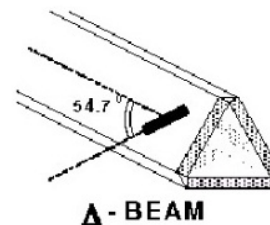


Figure 2.2 Triangular Probe Configurations



Figure 2.3 Probe Thick-Film Technique



## 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<sup>2</sup>.

### 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

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

where:

$\Delta t$  = exposure time (30 seconds),

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

$\Delta T$  = temperature increase due to RF exposure.

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

where:

$\sigma$  = simulated tissue conductivity,

$\rho$  = Tissue density (1.25 g/cm<sup>3</sup> for brain tissue)

SAR is proportional to  $\Delta T / \Delta t$ , the initial rate of tissue heating, before thermal diffusion takes place.

Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;

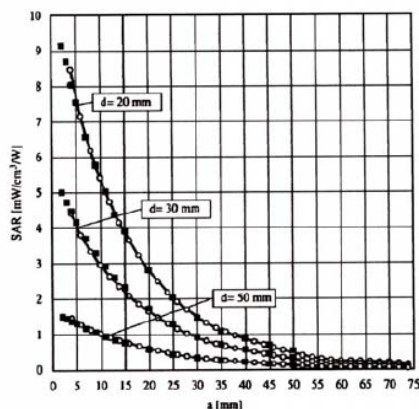


Figure 2.4 E-Field and Temperature Measurements at 900MHz

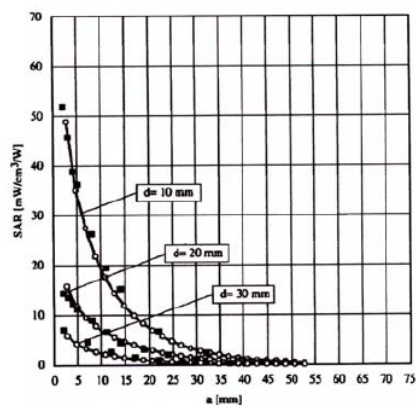


Figure 2.5 E-Field and Temperature Measurements at 1800MHz



## Data Extrapolation

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

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

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

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

E-field probes:

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

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

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

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

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

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

with  $SAR$  = local specific absorption rate in W/g  
 $E_{tot}$  = total field strength in V/m  
 $\sigma$  = conductivity in [mho/m] or [Siemens/m]  
 $\rho$  = equivalent tissue density in g/cm<sup>3</sup>

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

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

with  $P_{pwe}$  = equivalent power density of a plane wave in W/cm<sup>2</sup>  
 $E_{tot}$  = total electric field strength in V/m

## Scanning procedure

- The DASY installation includes predefined files with recommended procedures for measurements and system check. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.
- The „reference“ and „drift“ measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT's output power and should vary max. +/- 5 %.
- The highest integrated SAR value is the main concern in compliance test applications. These values can mostly be found at the inner surface of the phantom and cannot be measured directly due to the sensor offset in the probe. To extrapolate the surface values, the measurement distances to the surface must be known accurately. A distance error of 0.5mm could produce SAR errors of 6% at 1800 MHz. Using predefined locations for measurements is not accurate enough. Any shift of the phantom (e.g., slight deformations after filling it with liquid) would produce high uncertainties. For an automatic and accurate detection of the phantom surface, the DASY5 system uses the mechanical surface detection. The detection is always at touch, but the probe will move backward from the surface the indicated distance before starting the measurement.
- The „area scan“ measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The scan uses different grid spacings for different frequency measurements. Standard grid spacing for head measurements in frequency ranges  $\leq 2$ GHz 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 |
| $\leq 2$ GHz                                          | $\leq 15$ mm |
| 2 – 4 GHz                                             | $\leq 12$ mm |
| 4 – 6 GHz                                             | $\leq 10$ 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 |
| $\leq 2$ GHz                                                     | $\leq 8$ mm                | $\leq 5$ mm             | $\geq 30$ mm             |
| 2 – 3 GHz                                                        | $\leq 5$ mm                | $\leq 5$ mm             | $\geq 28$ mm             |
| 3 – 4 GHz                                                        | $\leq 5$ mm                | $\leq 4$ mm             | $\geq 28$ mm             |
| 4 – 5 GHz                                                        | $\leq 4$ mm                | $\leq 3$ mm             | $\geq 25$ mm             |
| 5 – 6 GHz                                                        | $\leq 4$ mm                | $\leq 2$ mm             | $\geq 22$ mm             |

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

## Spatial Peak SAR Evaluation

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

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 1 to 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting 'Graph Evaluated'.
- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.
- All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.

## Extrapolation

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

## Interpolation

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

## Volume Averaging

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

## Advanced Extrapolation

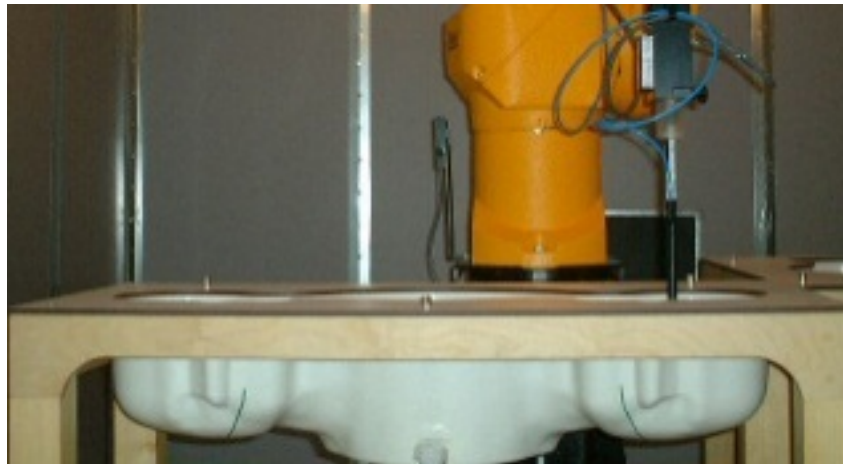
DASY uses the advanced extrapolation option which is able to compensate boundary effects on E-field probes.

**SAM PHANTOM**

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

**Phantom Specification**

**Phantom:** SAM Twin Phantom (V4.0)  
**Shell Material:** Vivac Composite  
**Thickness:**  $2.0 \pm 0.2$  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 repeatedly be positioned according to the FCC, CENELEC, IEC and IEEE specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).



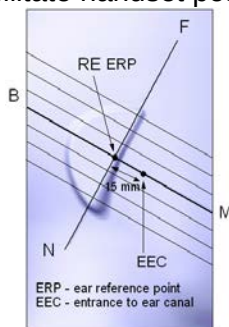
**Figure 2.7 Mounting Device**

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

### 3. Definition of Reference Points

#### Ear Reference Point

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



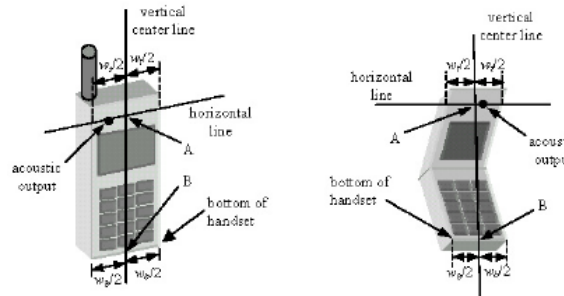
**Figure 3.1 Close-up side view of ERP's**



**Figure 3.2 Front, back and side view of SAM**

#### Device Reference Points

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

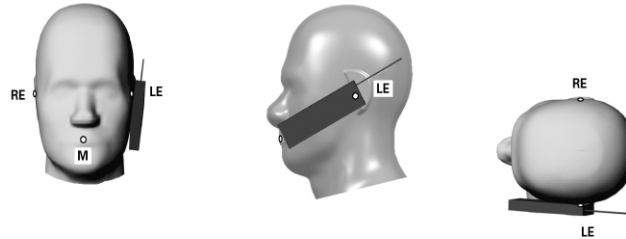


**Figure 3.3 Handset Vertical Center & Horizontal Line Reference Points**

## 4. Test Configuration Positions

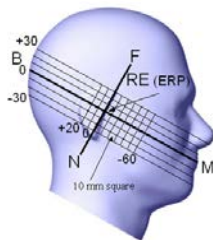
### Positioning for Cheek/Touch [5]

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



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

2. Translate the device towards the phantom along the line passing through RE and LE until the device touches the ear.
3. While maintaining the device in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane).
4. Rotate the device around the vertical centerline until the device (horizontal line) is symmetrical with respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE and maintaining the device contact with the ear, rotate the device about the line NF until any point on the device is in contact with a phantom point below the ear (cheek). See Figure 4.2.



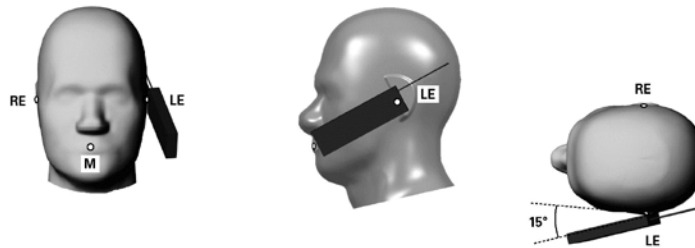
**Figure 4.2 Side view w/ relevant markings**



## Positioning for Ear / 15° Tilt [5]

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

1. While maintaining the orientation of the device, retracted the device parallel to the reference plane far enough to enable a rotation of the device by 15 degrees.
2. Rotate the device around the horizontal line by 15 degrees.
3. While maintaining the orientation of the device, move the device parallel to the reference plane until any part of the device touches the head. (In this position, point A is located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, the angle of the device shall be reduced. The tilted position is obtained when any part of the device is in contact with the ear as well as a second part of the device is in contact with the head (see Figure 4.3).



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



## Body Worn Configurations

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

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

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

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

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

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

## **5. Probe and Dipole Calibration**

**See Appendix D and E.**

## 6. Phantom & Simulating Tissue Specifications

### Head & Body Simulating Mixture Characterization

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

**Table 6.1 Typical Composition of Ingredients for Tissue**

| Ingredients         |        | Simulating Tissue                             |                                               |                                               |                                               |
|---------------------|--------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
|                     |        | 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<br>Procured from<br>Speag | Proprietary Mixture<br>Procured from<br>Speag | Proprietary Mixture<br>Procured from<br>Speag | Proprietary Mixture<br>Procured from<br>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<br>Procured from<br>Speag | 73.20                                         |                                               |                                               |
| Sugar               |        |                                               | 0.00                                          |                                               |                                               |
| Salt                |        |                                               | 0.04                                          |                                               |                                               |
| HEC                 |        |                                               | 0.00                                          |                                               |                                               |
| Bactericide         |        |                                               | 0.00                                          |                                               |                                               |
| DGBE                |        |                                               | 26.70                                         |                                               |                                               |
| Dielectric Constant | Target |                                               | 39.20                                         |                                               |                                               |
| Conductivity (S/m)  | Target | 1.80                                          | 1.95                                          |                                               |                                               |

## 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<br>General Population<br>(W/kg) or (mW/g) | CONTROLLED ENVIROMENT<br>Professional Population<br>(W/kg) or (mW/g) |
|--------------------------------------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------|
| SPATIAL PEAK SAR <sup>1</sup><br>Head                        | 1.60                                                               | 8.00                                                                 |
| SPATIAL AVERAGE SAR <sup>2</sup><br>Whole Body               | 0.08                                                               | 0.40                                                                 |
| SPATIAL PEAK SAR <sup>3</sup><br>Hands, Feet, Ankles, Wrists | 4.00                                                               | 20.00                                                                |

<sup>1</sup> 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.

<sup>2</sup> The Spatial Average value of the SAR averaged over the whole body.

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

## 8. Measurement Uncertainty

### Exposure Assessment Measurement Uncertainty

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

Worst case uncertainty budget for DASYS 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.

## 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: $\epsilon$ |      | 41.94         | 41.46    | 55.53         | 54.69    | 41.50         | 41.40    |
| Conductivity: $\sigma$          |      | 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: $\epsilon$ |      | 55.20         | 54.93    | 40.08         | 40.01    | 53.43         | 53.32    |
| Conductivity: $\sigma$          |      | 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: $\epsilon$ |      | 40.00         | 39.56    | 53.30         | 52.07    | 39.20         | 38.97    |
| Conductivity: $\sigma$          |      | 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: $\epsilon$ |      | 52.70         | 52.64    |               |          |               |          |
| Conductivity: $\sigma$          |      | 1.95          | 1.96     |               |          |               |          |

See Appendix A for data printout.

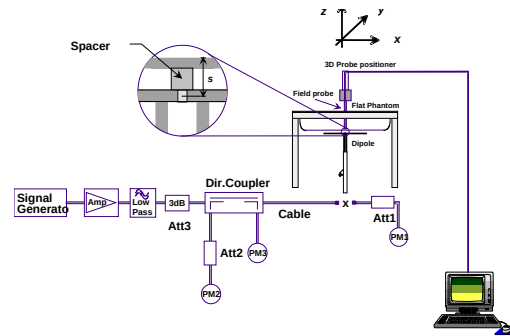
### Test System Verification

Prior to assessment, the system is verified to the  $\pm 10\%$  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 <sub>1g</sub> (W/kg) | Measure SAR <sub>1g</sub> (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.



**Figure 9.1 Dipole Validation Test Setup**



## **10. SAR Test Data Summary**

### **See Measurement Result Data Pages**

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

### **Procedures Used To Establish Test Signal**

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

### **Device Test Condition**

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

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

## 11. FCC 3G Measurement Procedures

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

### 12.1 Procedures Used to Establish RF Signal for SAR

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

### 11.2 SAR Measurement Conditions for WCDMA/HSDPA/HSUPA

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

For Rel99

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

For HSDPA Rel 6

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

For HSUPA Rel 6

- Use UL RMC 12.2kbps and FRC H-Set1 QPSK, Test Mode 1 loop back. With the 8960 this is accomplished by setting the signal Channel Coding to "E-DCH Test Channel" and configuring the equipment category to Cat5\_10ms.
- Set the Absolute Grant for HSUPA Subtest1 according to Table below.
- Set the device power to be at least 5dB lower than the Maximum output power
- Send power control bits to give one TPC\_cmd = +1 command to the device. If device doesn't send any E-DPCH data with decreased E-TFCI within 500ms, then repeat this process until the decreased E-TFCI is reported.
- Confirm that the E-TFCI transmitted by the device is equal to the target E-TFCI in Table below. If the E-TFCI transmitted by the device is not equal to the target E-TFCI, then send power control bits to give one TPC\_cmd = -1 command to the UE. If UE sends any E-DPCH data with decreased E-TFCI within 500 ms, send new power control bits to give one TPC\_cmd = -1 command to the UE. Then confirm that the E-TFCI transmitted by the UE is equal to the target E-TFCI in Table below.
- Measure the power using the power meter with modulated average detector.

## 12. FCC 3G Measurement Procedures

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

### 12.1 Procedures Used to Establish RF Signal for SAR

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

### 12.2 SAR Measurement Conditions for CDMA2000, 1xEV-DO

#### 12.2.1 Output Power Verification 1xRTT

Use CDMA2000 Rev 6 protocol in the call box.

- 1) Test for RC 3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC 3, 4 and 5.
  - a. Set up a call using Supplemental Channel Test Mode 3 (RC 3, SO 32) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
  - b. As per C.S0011 or TIA/EIA-98-F Table 4.4.5.2-2, set the test parameters.
  - c. Send alternating '0' and '1' power control bit to the device
  - d. Determine the active channel configuration. If the desired channel configuration is not the active channel configuration, increase  $\hat{I}_{or}$  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  $\hat{I}_{or}$  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  $\hat{I}_{or}$  to -60 dBm/1.23 MHz
    - Send continuously '0' power control bits
    - Measure the power at device antenna connector
  - b. RTAP
    - Select Test Application Protocol to RTAP
    - Set RTAP Rate to 9.6 kbps
    - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots

- Set  $\hat{I}$ or 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  $\hat{I}$ or 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  $\hat{I}$ or 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.

| 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          |

| 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              |

## 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

- Battery is fully charged for all tests.

Power Measured ☒ Conducted

☐ ERP

☐ EIRP

- SAR Measurement

Phantom Configuration ☒ Left Head

☒ Eli4

☒ Right Head

SAR Configuration ☒ Head

☒ Body

- Test Signal Call Mode

☐ Test Code

☒ Base Station Simulator

- Test Configuration

☐ With Belt Clip

☐ Without Belt Clip ☒ N/A

- Tissue Depth is at least 15.0 cm



Jay M. Moulton  
 Vice President



# 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

- Battery is fully charged for all tests.

Power Measured

☒ Conducted

☐ ERP

☐ EIRP

- SAR Measurement

Phantom Configuration

☒ Left Head

☒ Eli4

☒ Right Head

SAR Configuration

☒ Head

☒ Body

- Test Signal Call Mode

☐ Test Code

☒ Base Station Simulator

- Test Configuration

☐ With Belt Clip

☐ Without Belt Clip ☒ N/A

- Tissue Depth is at least 15.0 cm



Jay M. Moulton  
 Vice President

## 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

- Battery is fully charged for all tests.

Power Measured ☒ Conducted

☐ ERP

☐ EIRP

- SAR Measurement

Phantom Configuration ☒ Left Head

☒ Eli4

☒ Right Head

SAR Configuration ☒ Head

☒ Body

- Test Signal Call Mode

☐ Test Code

☒ Base Station Simulator

- Test Configuration

☐ With Belt Clip

☐ Without Belt Clip ☒ N/A

- Tissue Depth is at least 15.0 cm



Jay M. Moulton  
 Vice President

# 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

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



Jay M. Moulton  
 Vice President

## 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<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |           |                     |                     |

1. Battery is fully charged for all tests.

Power Measured ☒ Conducted ☐ ERP ☐ EIRP

2. SAR Measurement

Phantom Configuration ☐ Left Head ☒ Eli4 ☐ Right Head

SAR Configuration ☐ Head ☒ Body

3. Test Signal Call Mode ☒ Test Code ☐ Base Station Simulator

4. Test Configuration ☐ With Belt Clip ☐ Without Belt Clip ☒ N/A

5. Tissue Depth is at least 15.0 cm



Jay M. Moulton  
Vice President

## SAR Data Summary – Simultaneous Evaluation

| MEASUREMENT RESULTS                                   |           |     |            |                                                               |                       |           |
|-------------------------------------------------------|-----------|-----|------------|---------------------------------------------------------------|-----------------------|-----------|
| Highest Simultaneous Value from Original Grant Report | Frequency |     | Modulation | SAR <sub>1</sub> Original Report                              | SAR <sub>2</sub> 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      |
|                                                       |           |     |            | <b>Body</b><br><b>1.6 W/kg (mW/g)</b><br>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.

## 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     |
| Apriel 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             |

## 14. Conclusion

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

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

## 15. References

- [1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radio Frequency Radiation, August 1996
- [2] ANSI/IEEE C95.1 – 1992, American National Standard Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300kHz to 100GHz, New York: IEEE, 1992.
- [3] ANSI/IEEE C95.3 – 1992, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, 1992.
- [4] International Electrotechnical Commission, IEC 62209-2 (Edition 1.0), Human Exposure to radio frequency fields from hand-held and body mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), March 2010.
- [5] IEEE Standard 1528 – 2013, IEEE Recommended Practice for Determining the Peak-Spatial Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques, June 2013.
- [6] ISED, RSS – 102 Issue 5, Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), March 2015.
- [7] Health Canada, Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz, 2009.



## Appendix A – System Validation Plots and Data

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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

\*\*\*\*\*

# 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

\*\*\*\*\*

# 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

\*\*\*\*\*

# 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

\*\*\*\*\*

# 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

# 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;  $\sigma = 0.9$  S/m;  $\epsilon_r = 41.46$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section

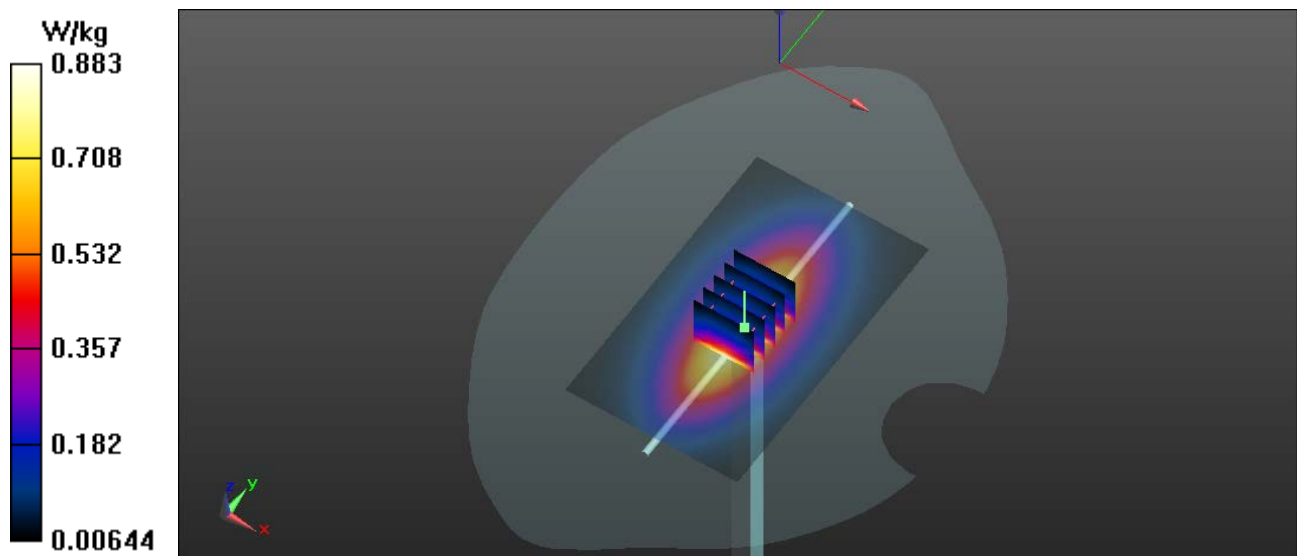
Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

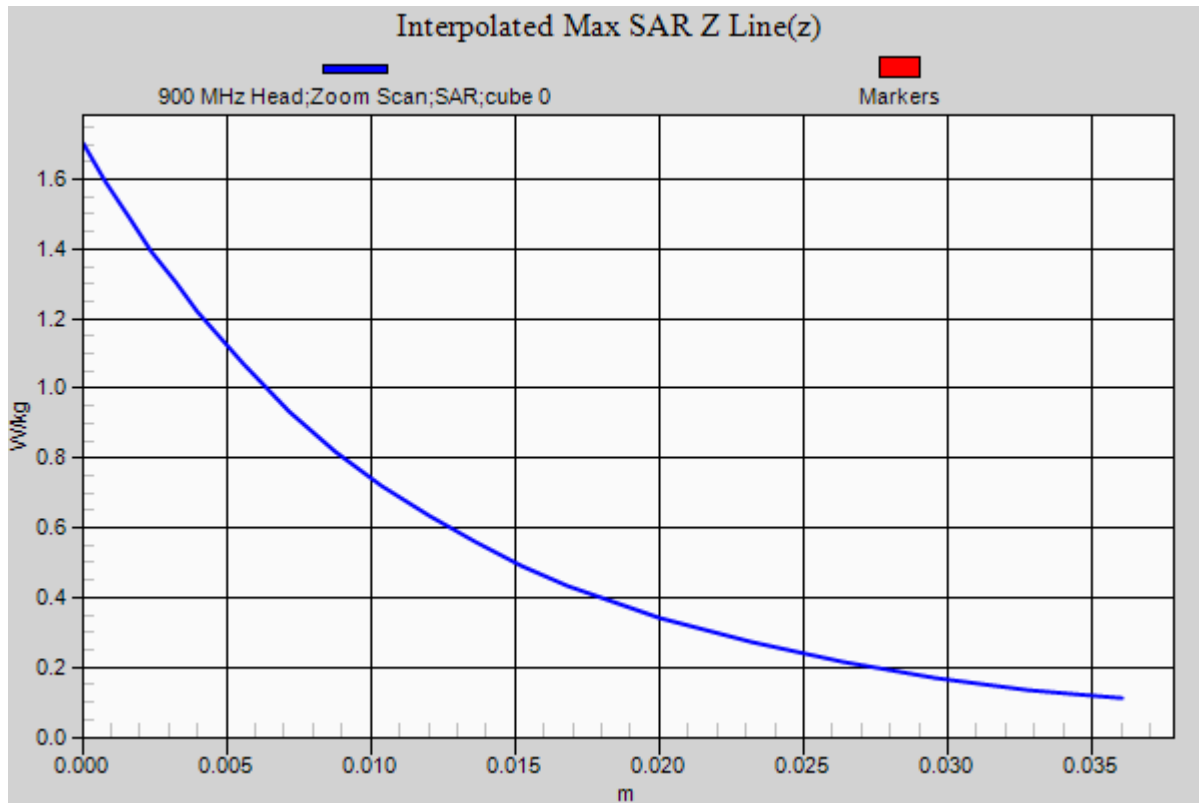
Probe: EX3DV4 - SN3662; ConvF(9.8, 9.8, 9.8); Calibrated: 4/20/2018;  
Sensor-Surface: 2mm (Mechanical Surface Detection)  
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018  
Phantom: SAM with CRP; Type: SAM; Serial: 1416  
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

### 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





# 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:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.94 \text{ S/m}$ ;  $\epsilon_r = 54.69$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section

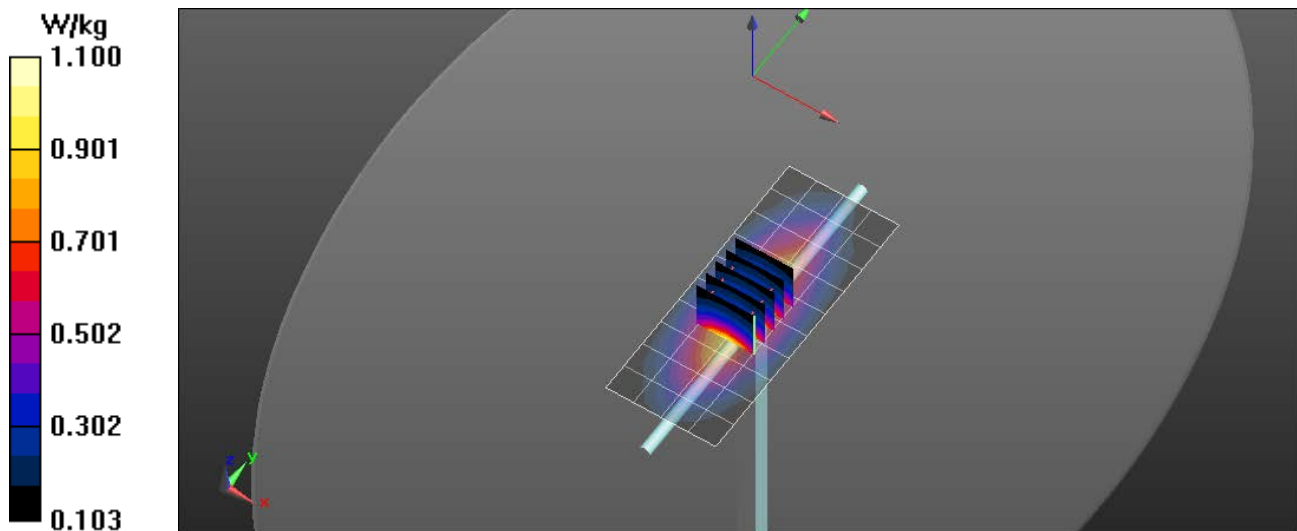
Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

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)

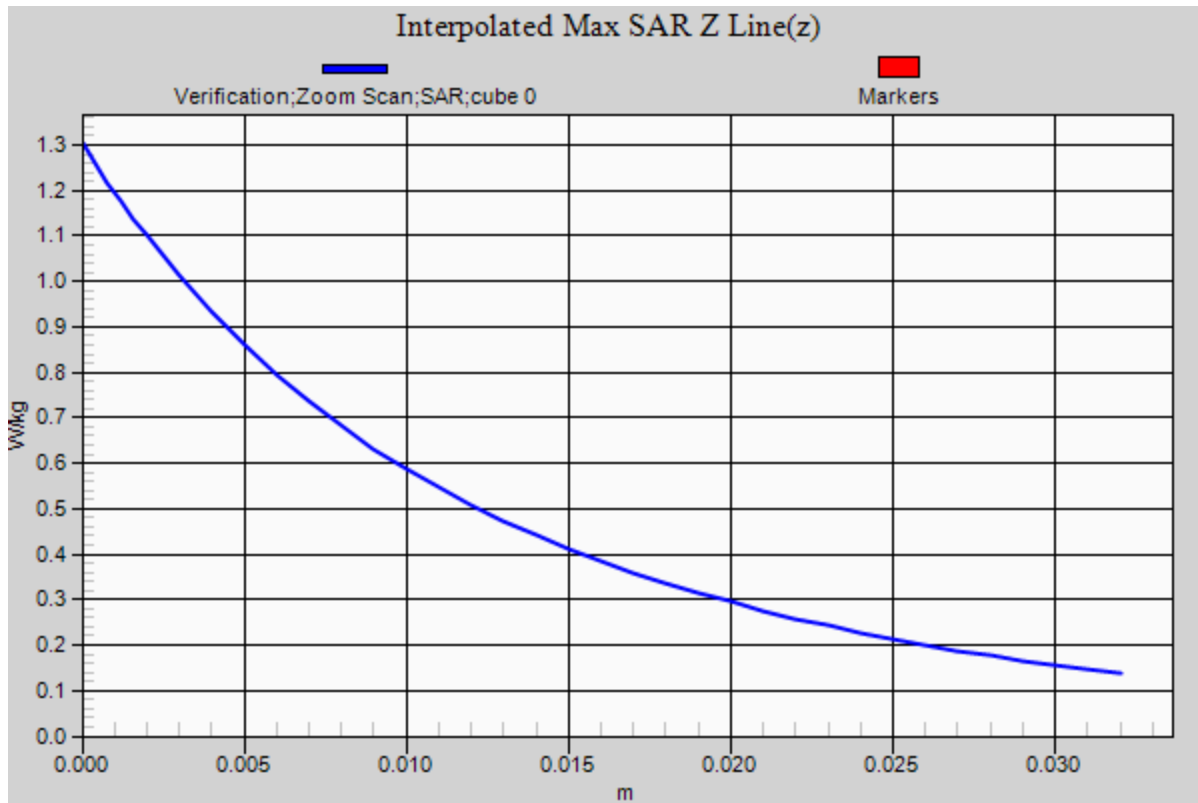
### Procedure Notes:

**750 MHz/Verification/Area Scan (5x11x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
Maximum value of SAR (measured) = 1.08 W/kg

**750 MHz/Verification/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$   
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







# RF Exposure Lab

## Plot 3

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

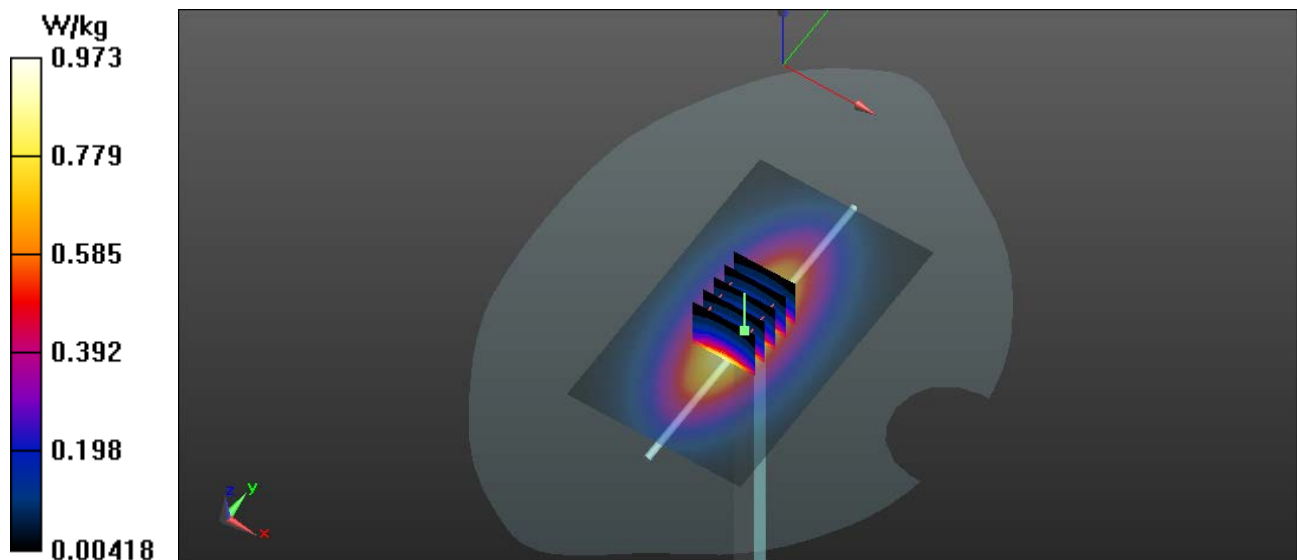
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1  
Medium: HSL835; Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.93 \text{ mho/m}$ ;  $\epsilon_r = 41.4$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section

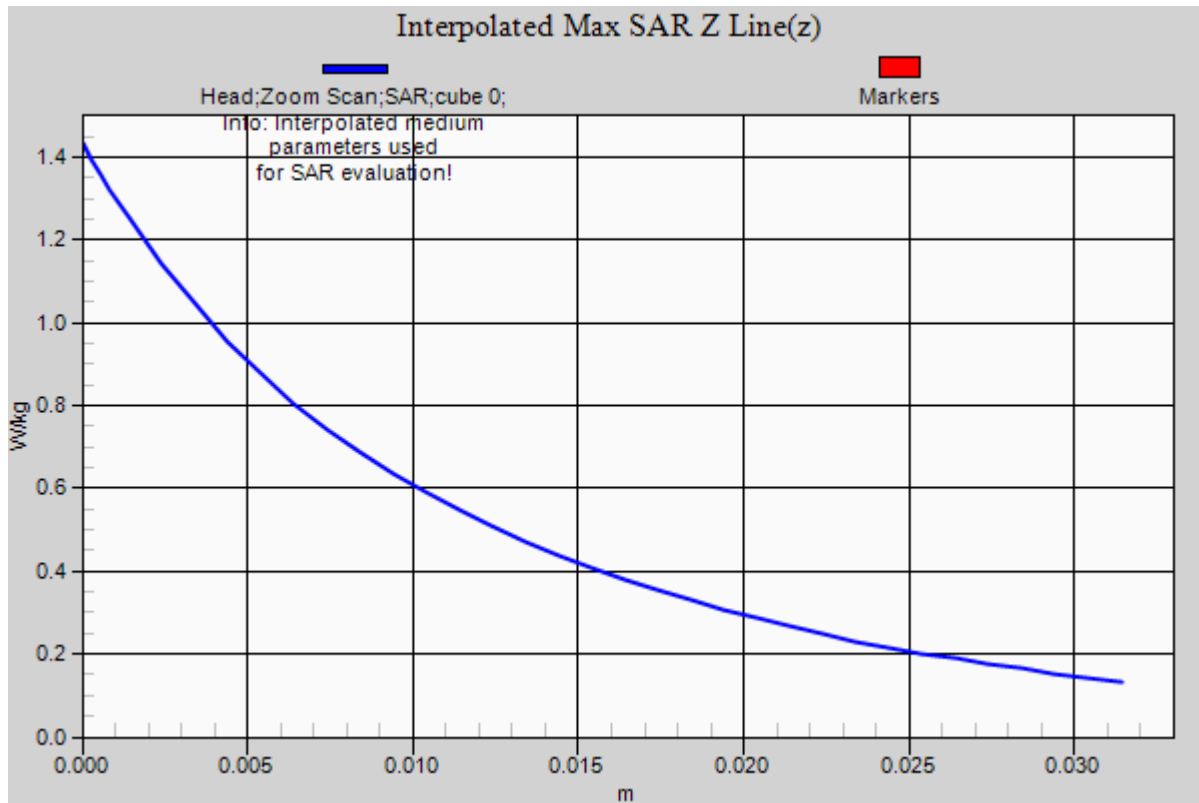
Test Date: Date: 6/18/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C  
Probe: EX3DV4 - SN3662; ConvF(9.29, 9.29, 9.29); Calibrated: 4/20/2018;  
Sensor-Surface: 2mm (Mechanical Surface Detection)  
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018  
Phantom: SAM with CRP; Type: SAM; Serial: 1416  
Measurement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

### Procedure Notes:

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

**835 MHz Verification/Head/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$   
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





# 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:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.99 \text{ S/m}$ ;  $\epsilon_r = 54.93$ ;  $\rho = 1000 \text{ kg/m}^3$

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:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (measured) = 1.19 W/kg

**835 MHz/Verification/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

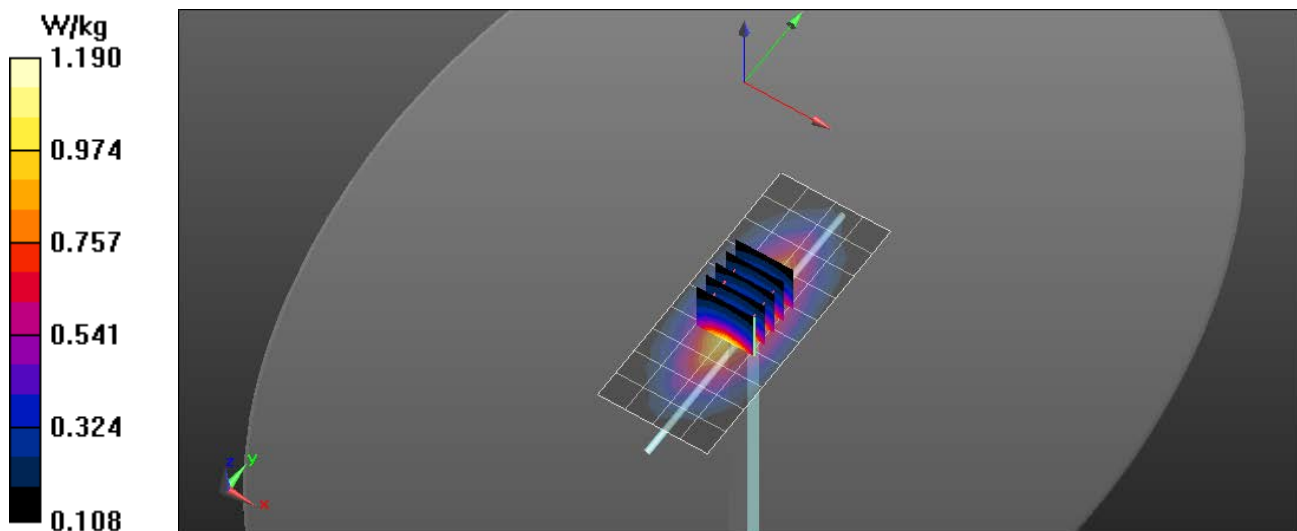
Reference Value = 31.468 V/m; Power Drift = -0.02 dB

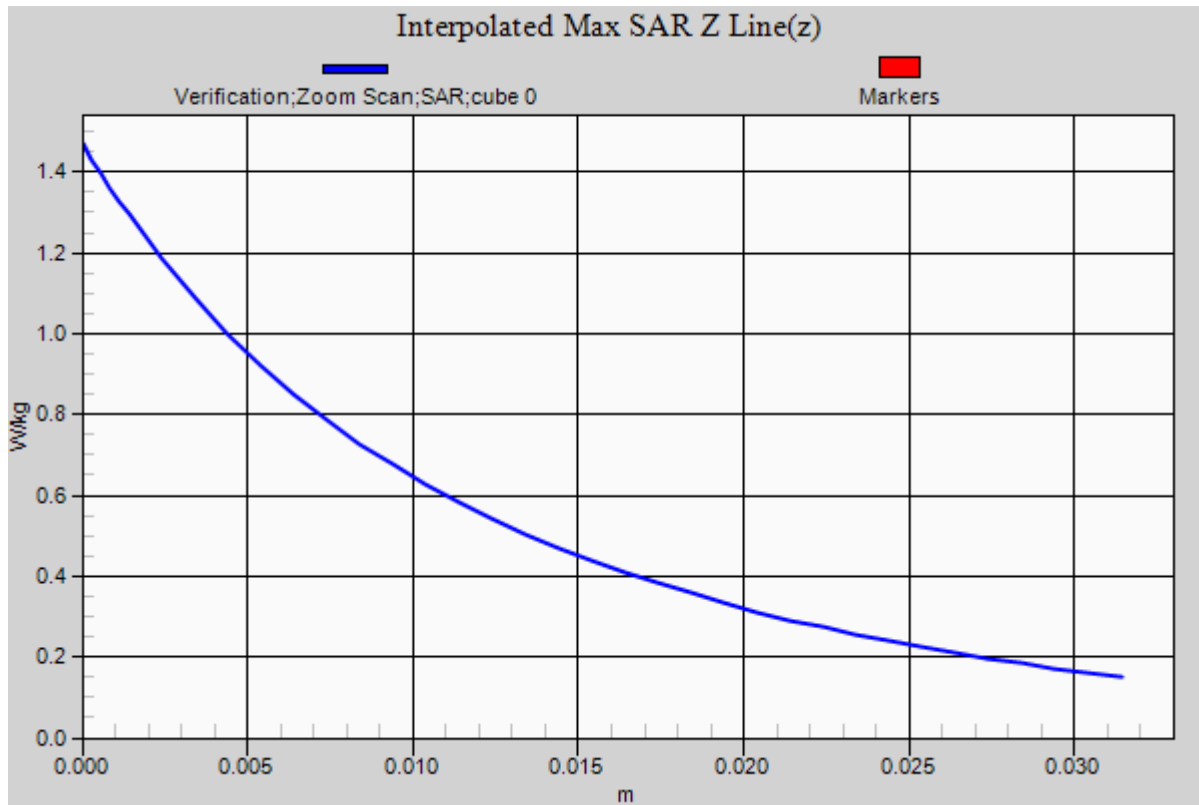
Peak SAR (extrapolated) = 1.48 W/kg

**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





# 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;  $\sigma = 1.39$  S/m;  $\epsilon_r = 40.01$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section

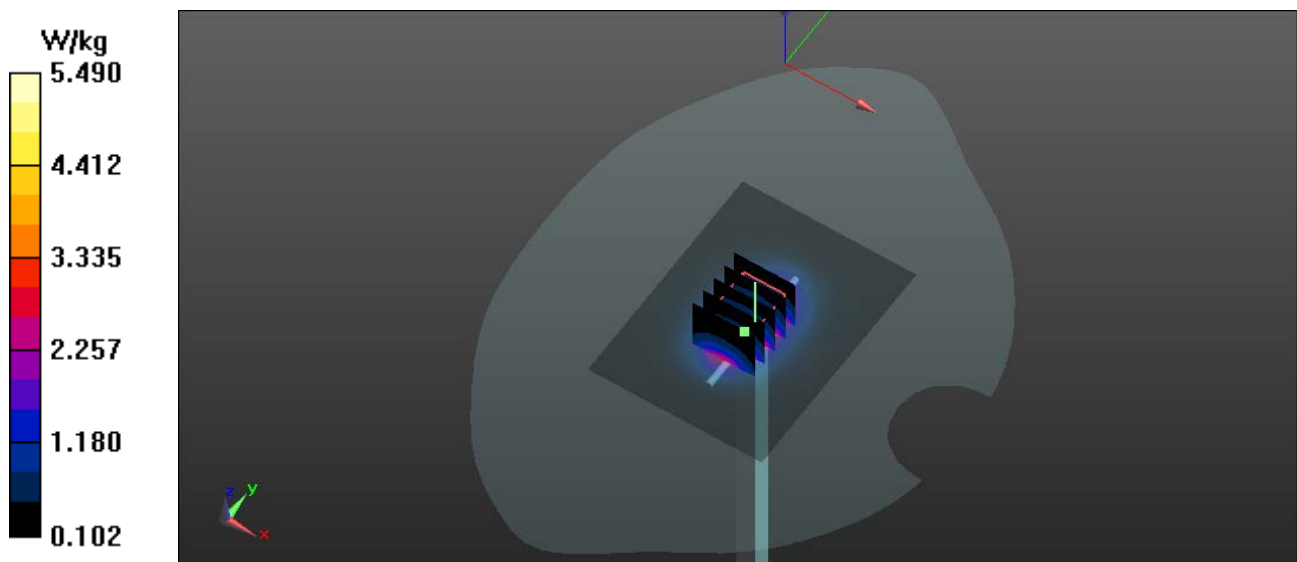
Test Date: Date: 6/21/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

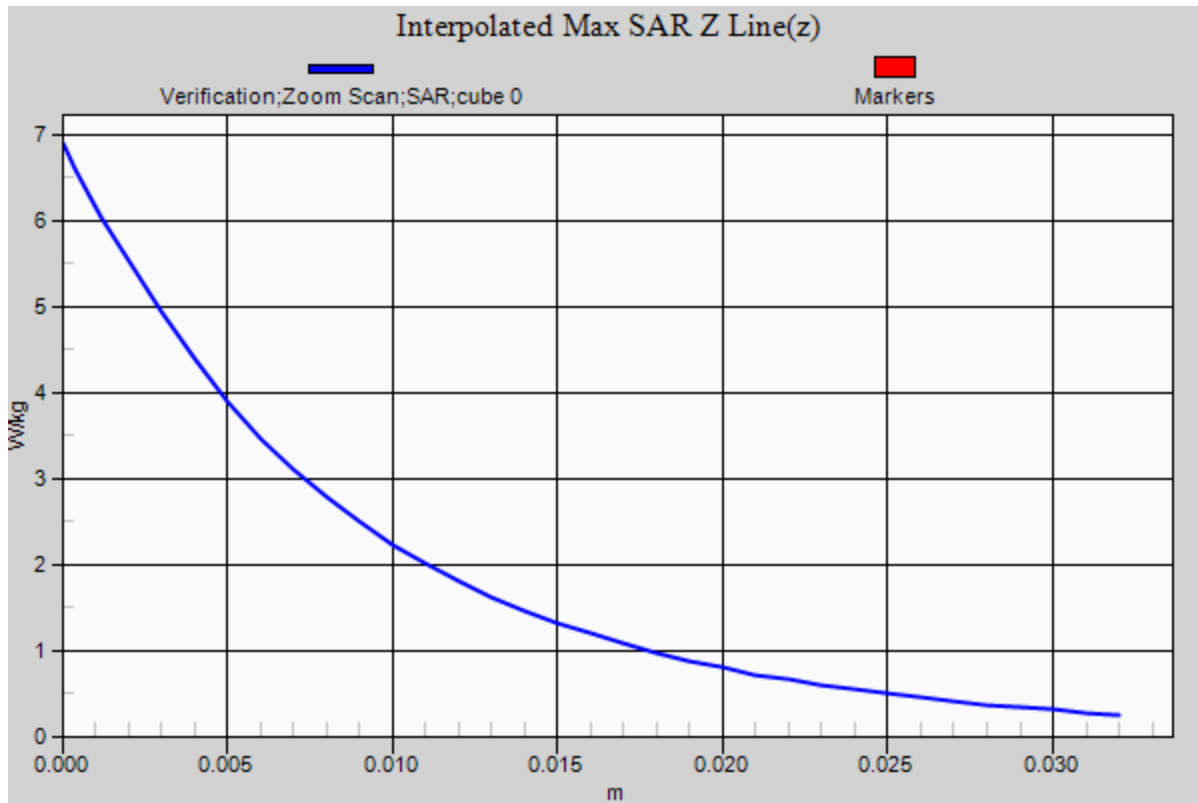
Probe: EX3DV4 - SN3662; ConvF(8.29, 8.29, 8.29); Calibrated: 4/20/2018;  
Sensor-Surface: 2mm (Mechanical Surface Detection)  
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018  
Phantom: SAM with CRP; Type: SAM; Serial: 1416  
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

### 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





# 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;  $\sigma = 1.52$  S/m;  $\epsilon_r = 53.32$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

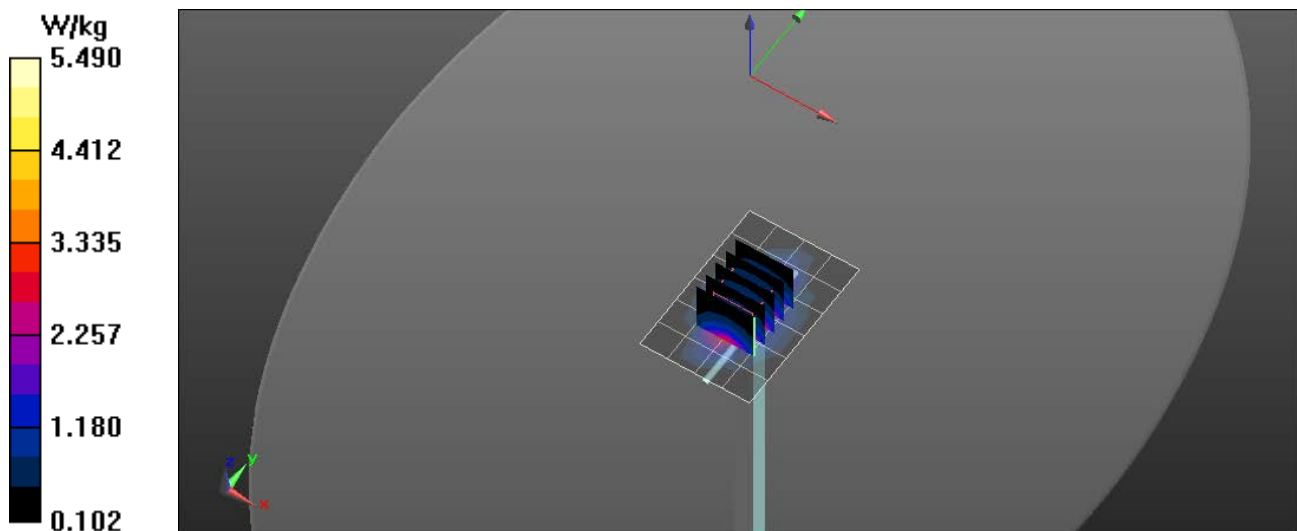
**1750 MHz/Verification/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 31.227 V/m; Power Drift = -0.01 dB

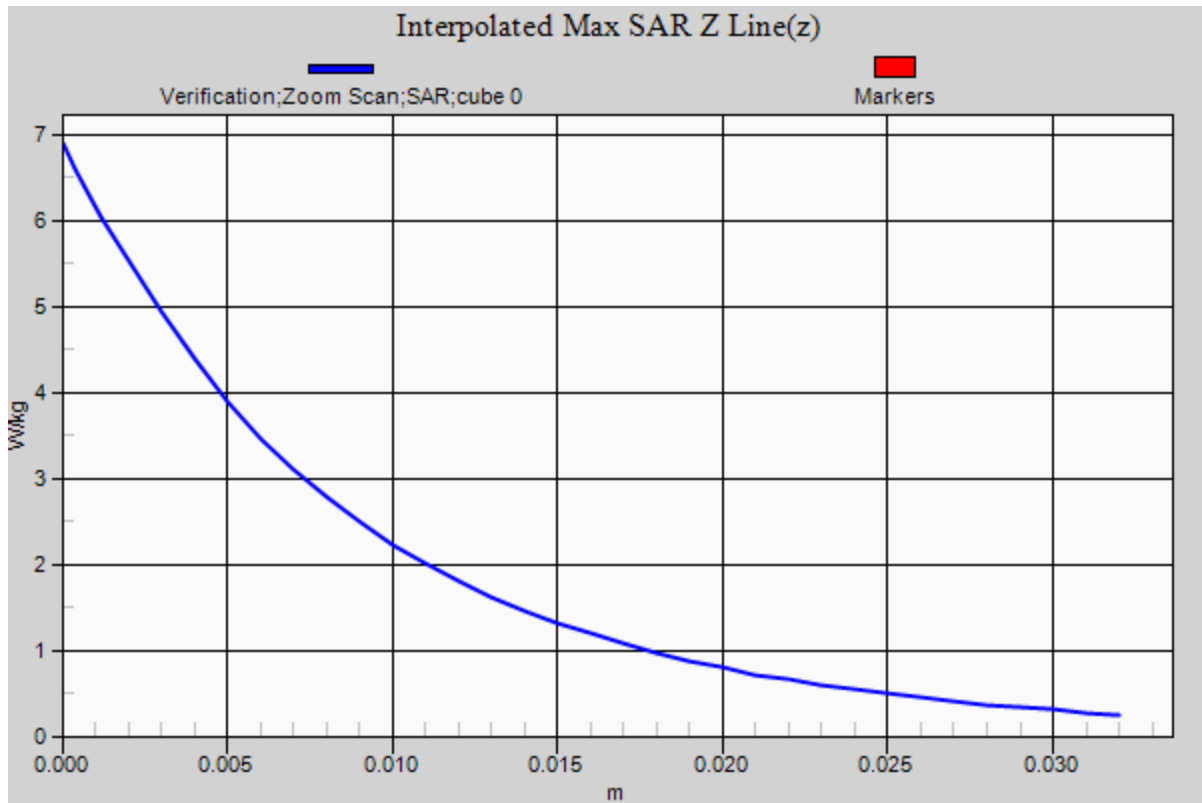
Peak SAR (extrapolated) = 6.89 W/kg

**SAR(1 g) = 3.75 W/kg; SAR(10 g) = 2.03 W/kg**

Maximum value of SAR (measured) = 5.49 W/kg







# RF Exposure Lab

## Plot 7

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

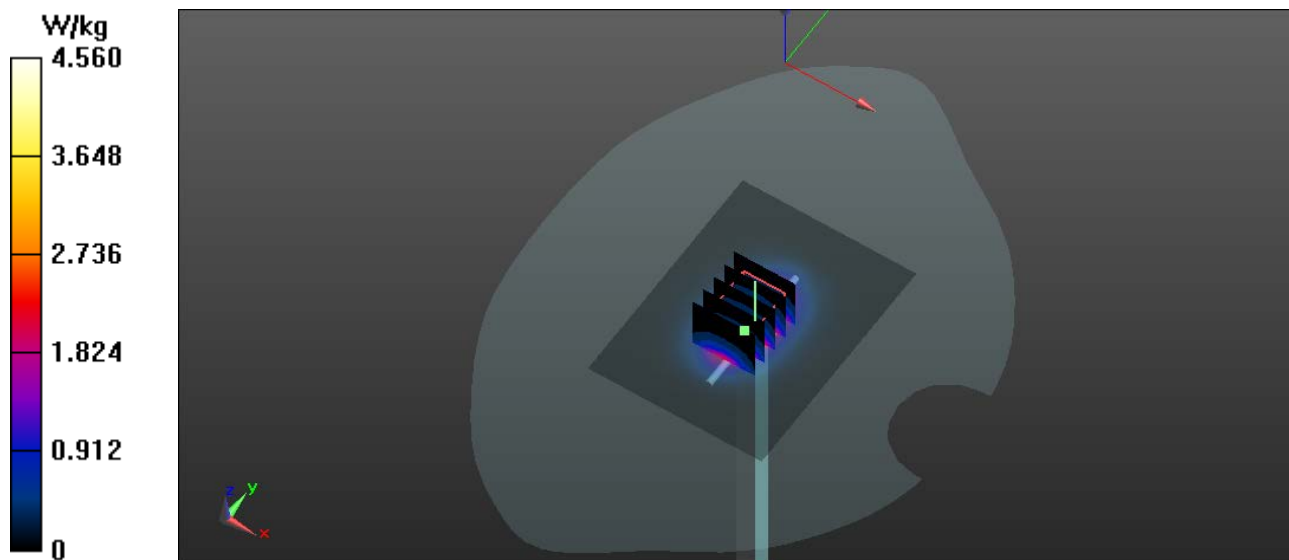
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1  
Medium: HSL1900; Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.44$  mho/m;  $\epsilon_r = 39.56$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section

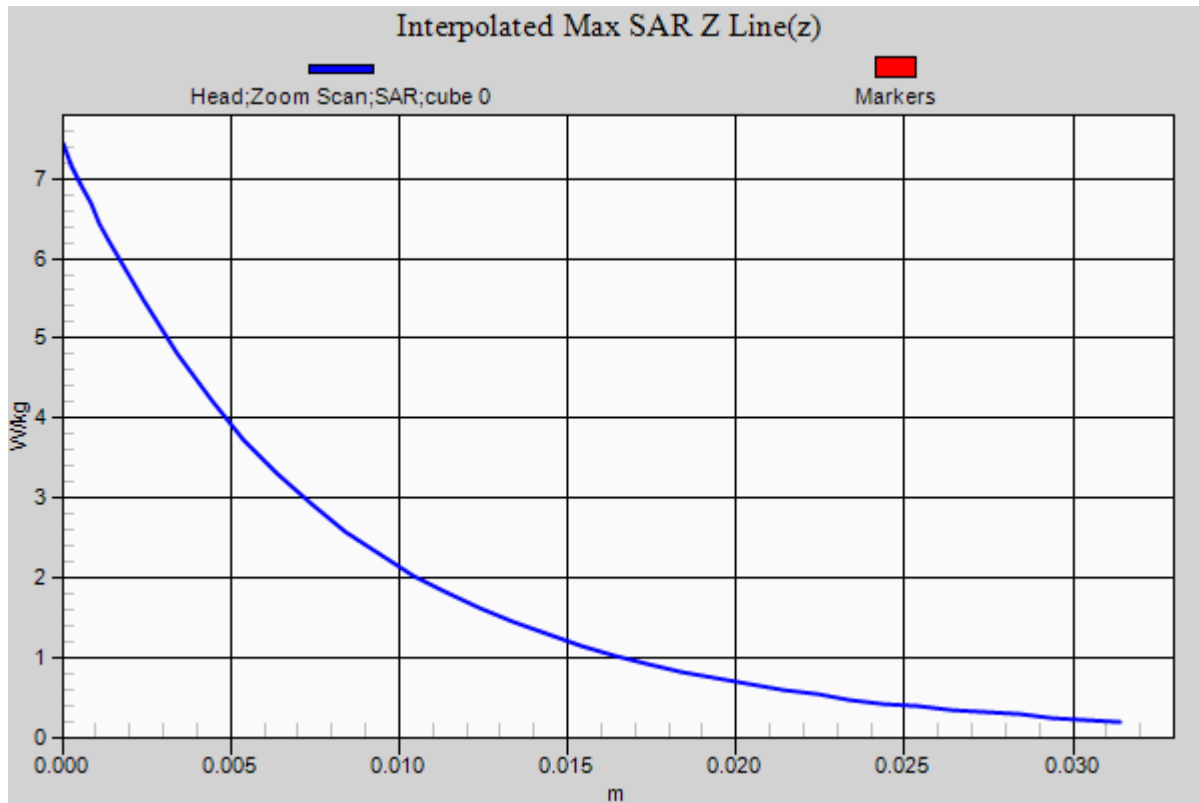
Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C  
Probe: EX3DV4 - SN3662; ConvF(8.01, 8.01, 8.01); Calibrated: 1/20/2018;  
Sensor-Surface: 2mm (Mechanical Surface Detection)  
Electronics: DAE4 Sn1416; Calibrated: 4/13/2018  
Phantom: SAM with CRP; Type: SAM; Serial: 1416  
Measurement 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





# 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;  $\sigma = 1.47$  S/m;  $\epsilon_r = 52.07$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

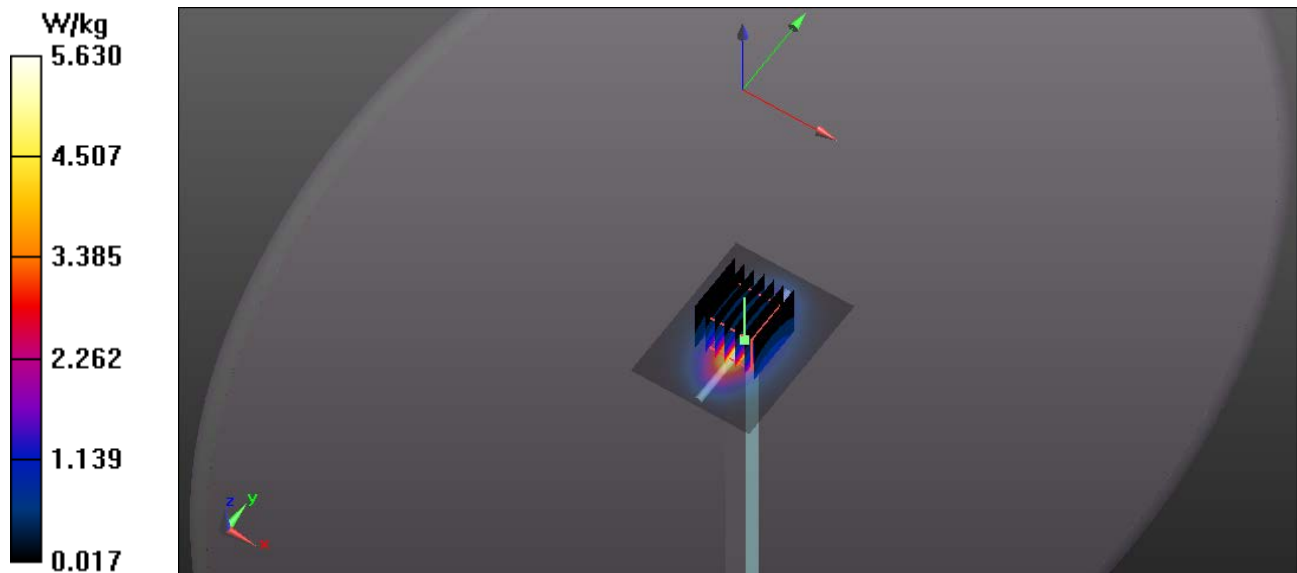
**1900 MHz Body/Verification/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

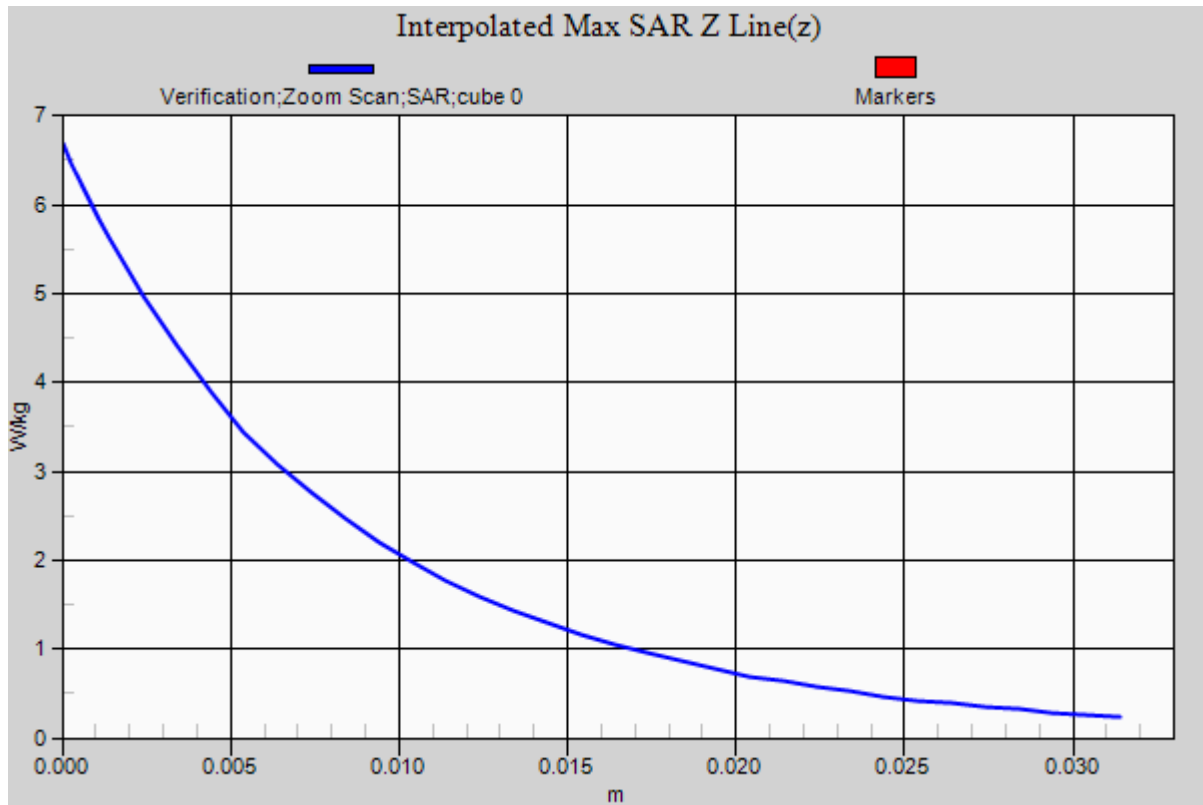
Reference Value = 52.612 V/m; Power Drift = -0.02 dB

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





# 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;  $\sigma = 1.85$  S/m;  $\epsilon_r = 38.97$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

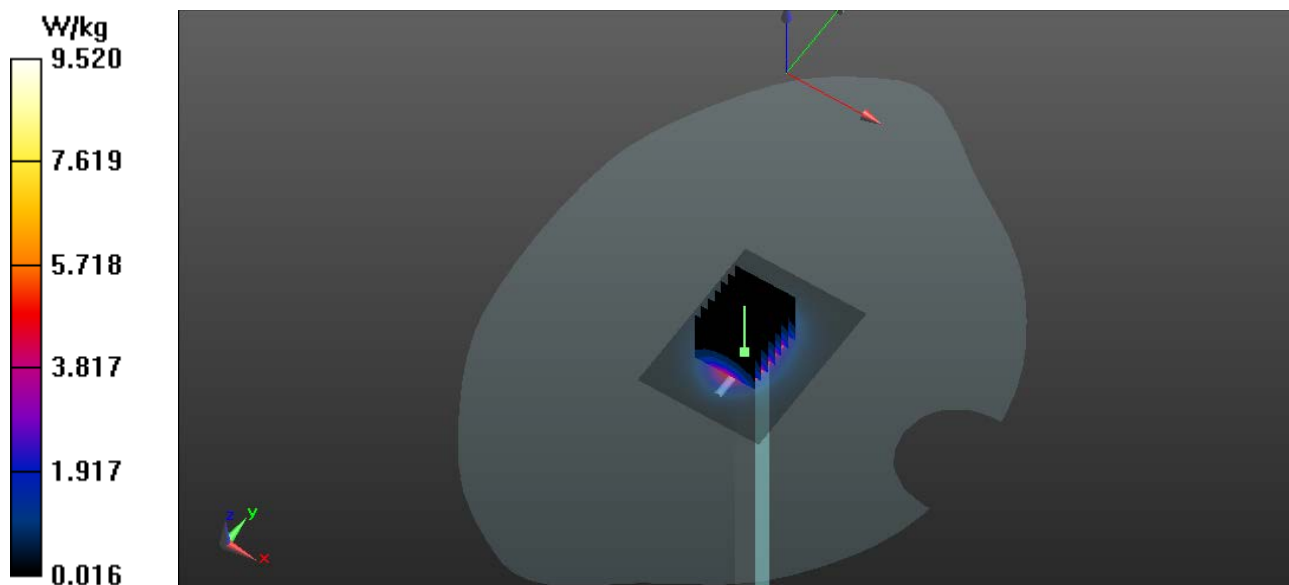
**2450 MHz Head/Verification/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

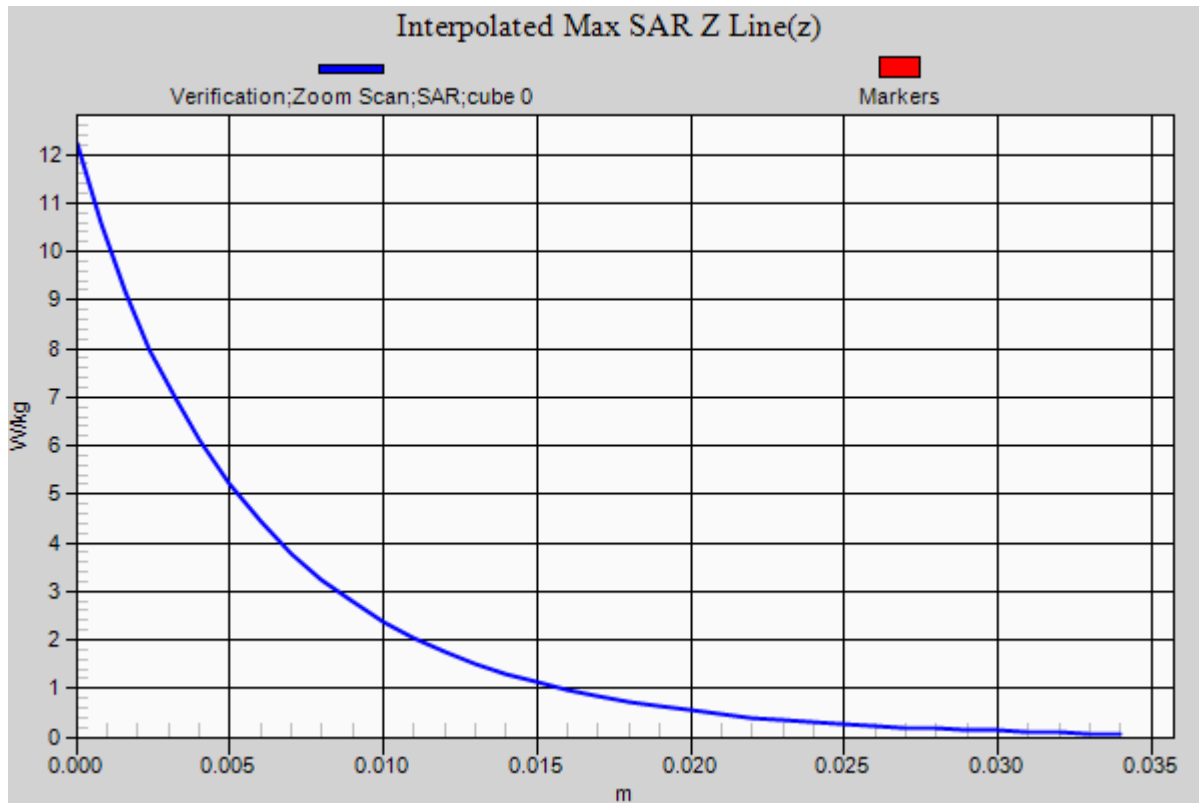
Reference Value = 57.846 V/m; Power Drift = -0.08 dB

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





# 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;  $\sigma = 1.96$  S/m;  $\epsilon_r = 52.64$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

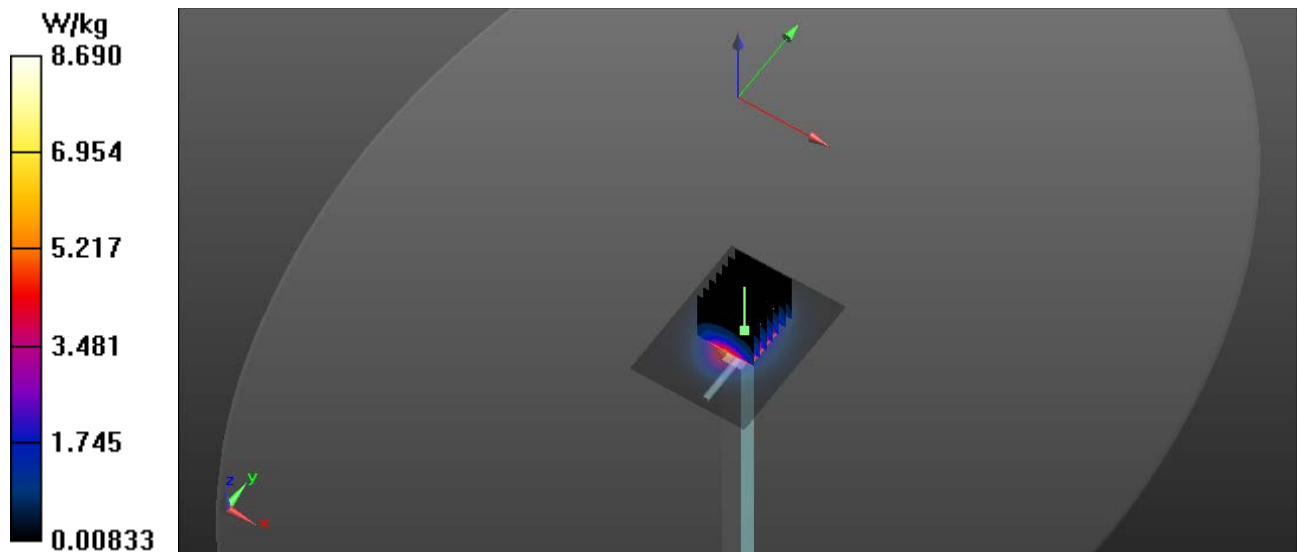
**2450 MHz Body/Verification/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.751 V/m; Power Drift = -0.01 dB

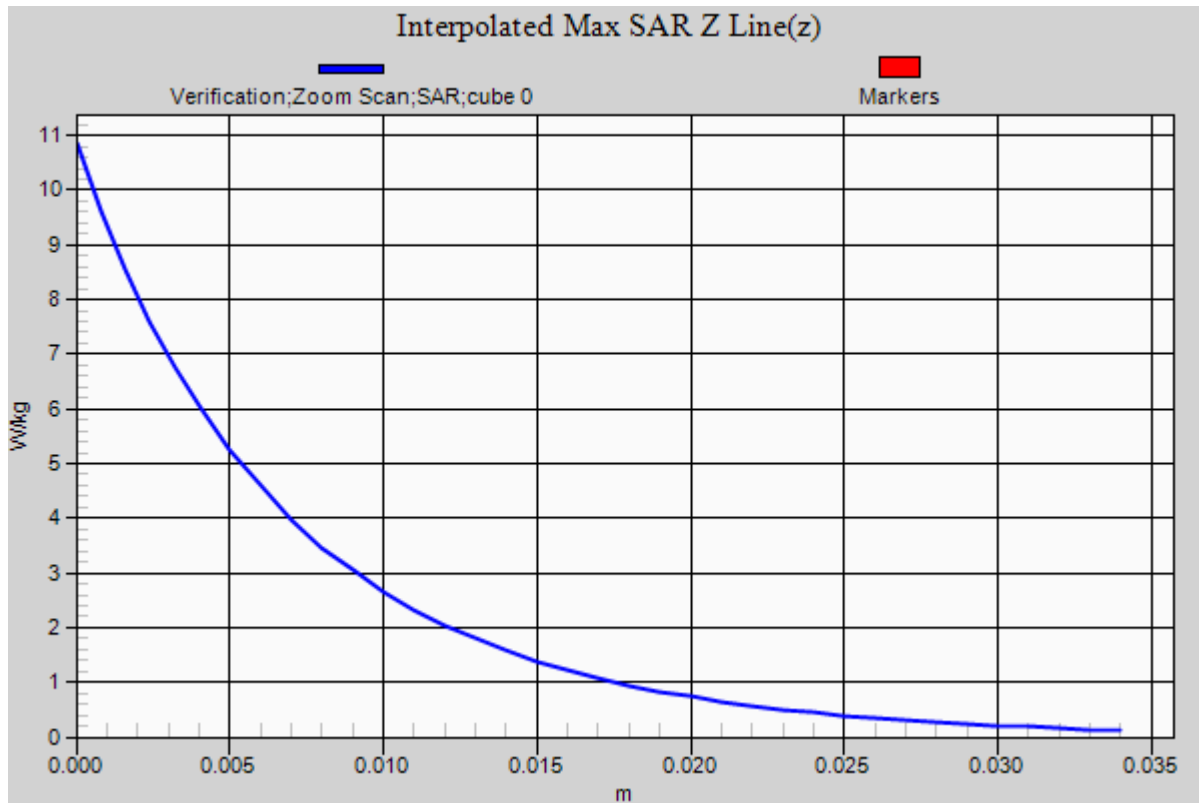
Peak SAR (extrapolated) = 10.7 W/kg

**SAR(1 g) = 5.2 W/kg; SAR(10 g) = 2.4 W/kg**

Maximum value of SAR (measured) = 5.91 W/kg







## Appendix B – SAR Test Data Plots

# 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;  $\sigma = 0.932$  S/m;  $\epsilon_r = 41.395$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

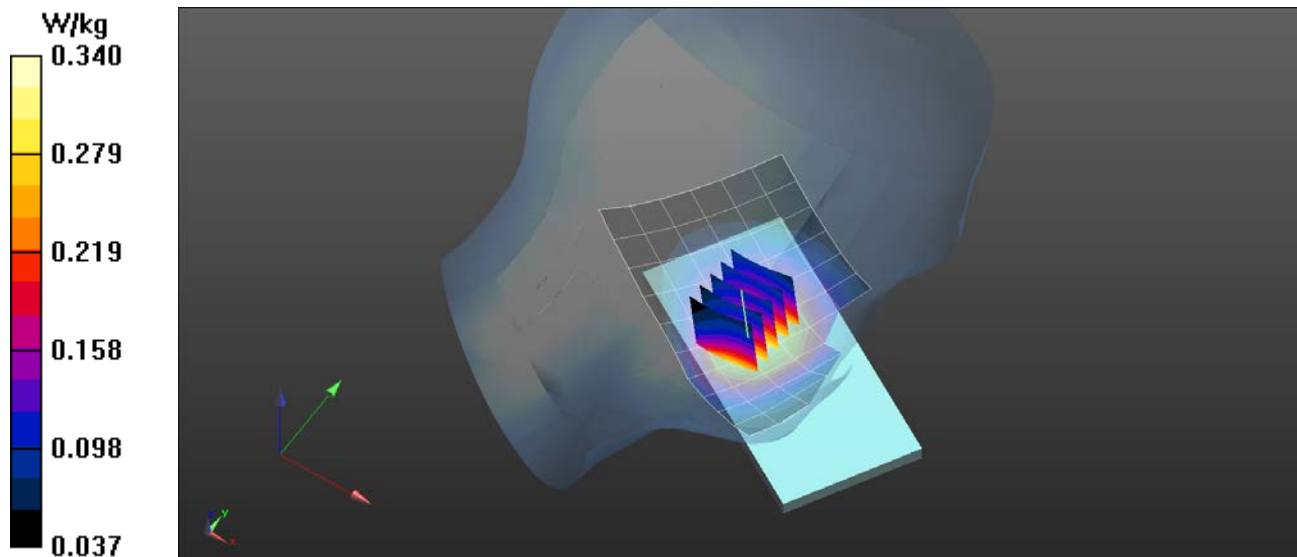
Reference Value = 7.452 V/m; Power Drift = -0.03 dB

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



# 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;  $\sigma = 0.992$  S/m;  $\epsilon_r = 54.924$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

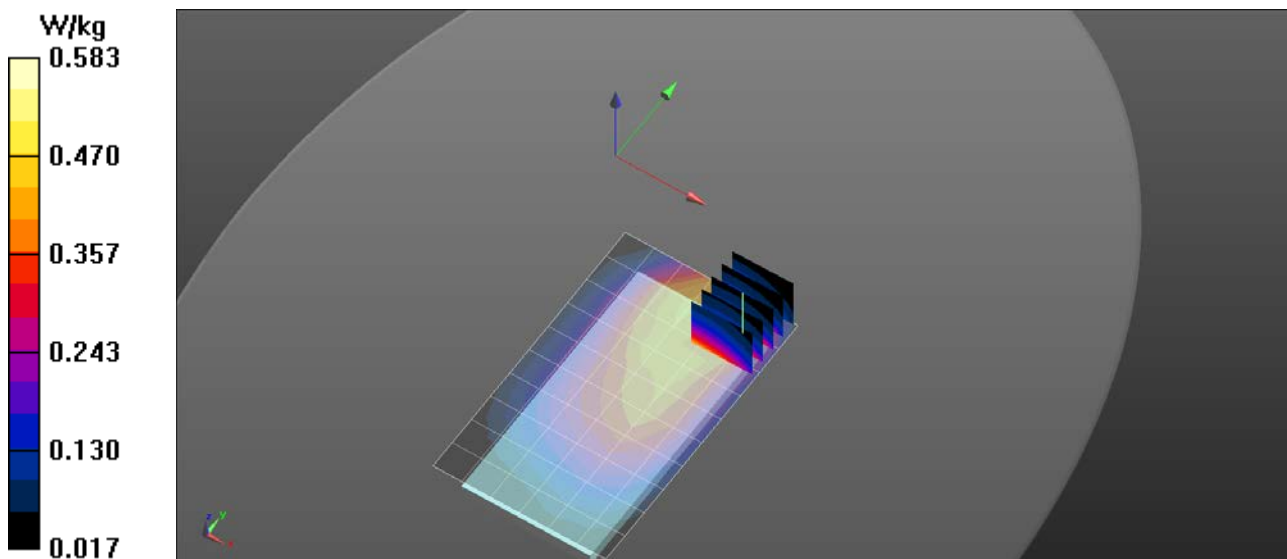
Reference Value = 19.06 V/m; Power Drift = -0.02 dB

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



# RF Exposure Lab

## 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):  $f = 782 \text{ MHz}$ ;  $\sigma = 0.92 \text{ S/m}$ ;  $\epsilon_r = 41.26$ ;  $\rho = 1000 \text{ kg/m}^3$   
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

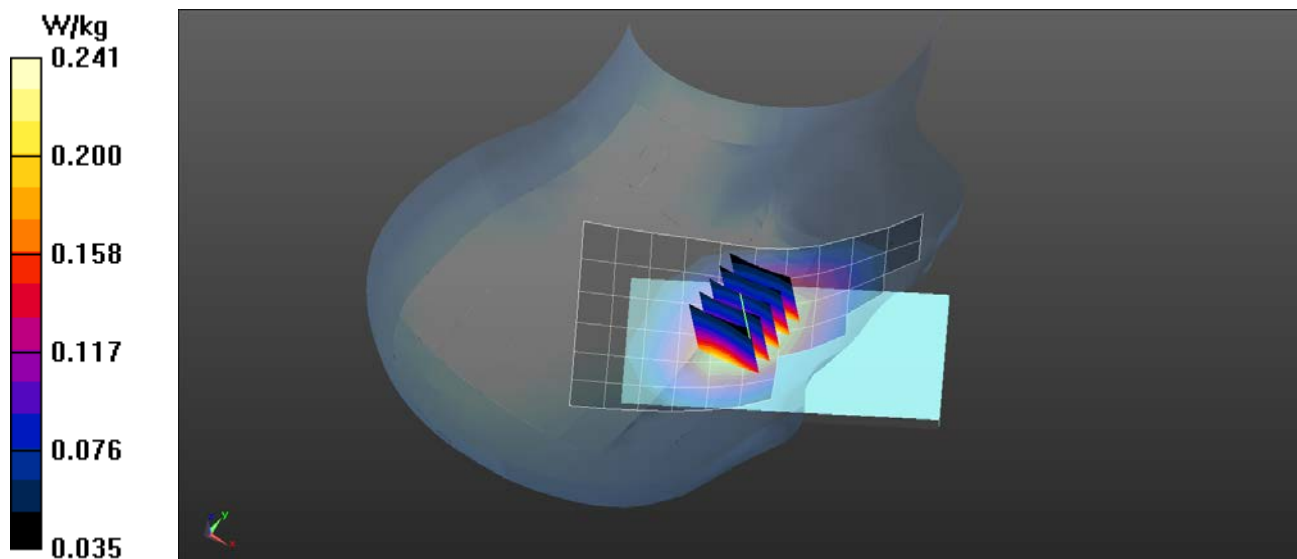
Reference Value = 5.726 V/m; Power Drift = -0.01 dB

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



# RF Exposure Lab

## 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):  $f = 782 \text{ MHz}$ ;  $\sigma = 0.972 \text{ S/m}$ ;  $\epsilon_r = 54.556$ ;  $\rho = 1000 \text{ kg/m}^3$   
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

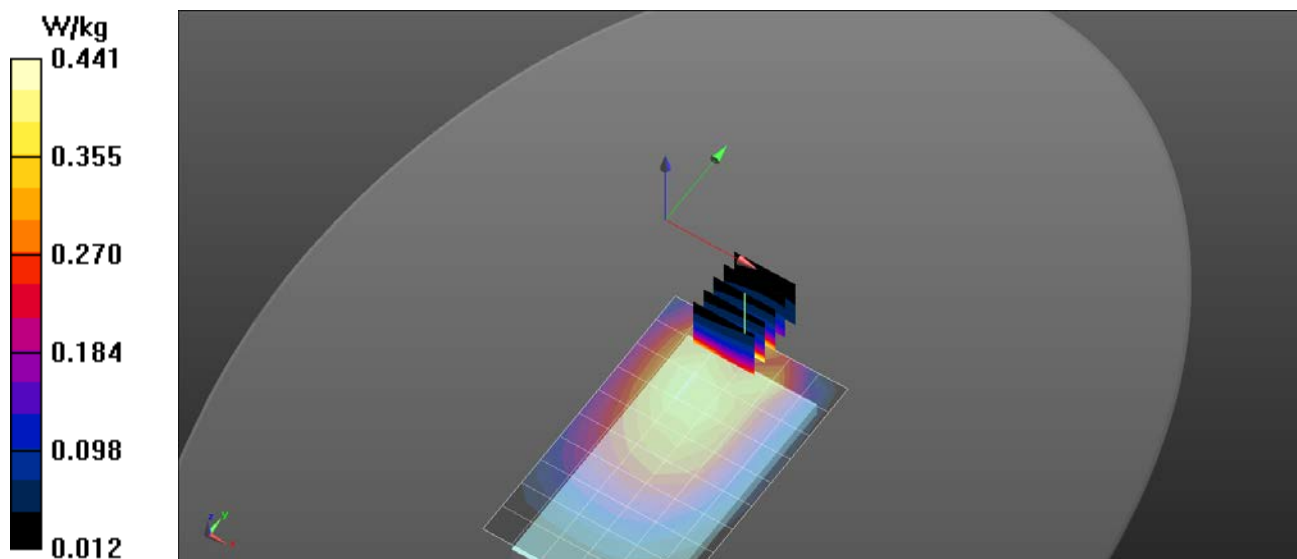
Reference Value = 18.31 V/m; Power Drift = -0.01 dB

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



# RF Exposure Lab

## 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;  $\sigma = 0.932$  S/m;  $\epsilon_r = 41.395$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

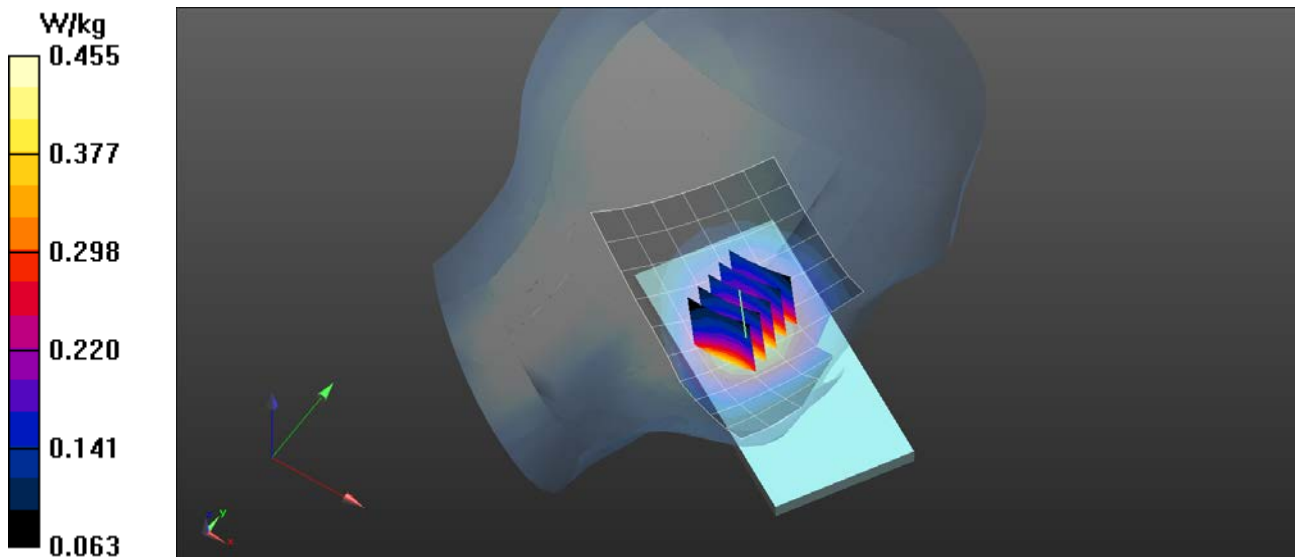
Reference Value = 9.190 V/m; Power Drift = 0.02 dB

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



# RF Exposure Lab

## 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;  $\sigma = 0.992$  S/m;  $\epsilon_r = 54.924$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

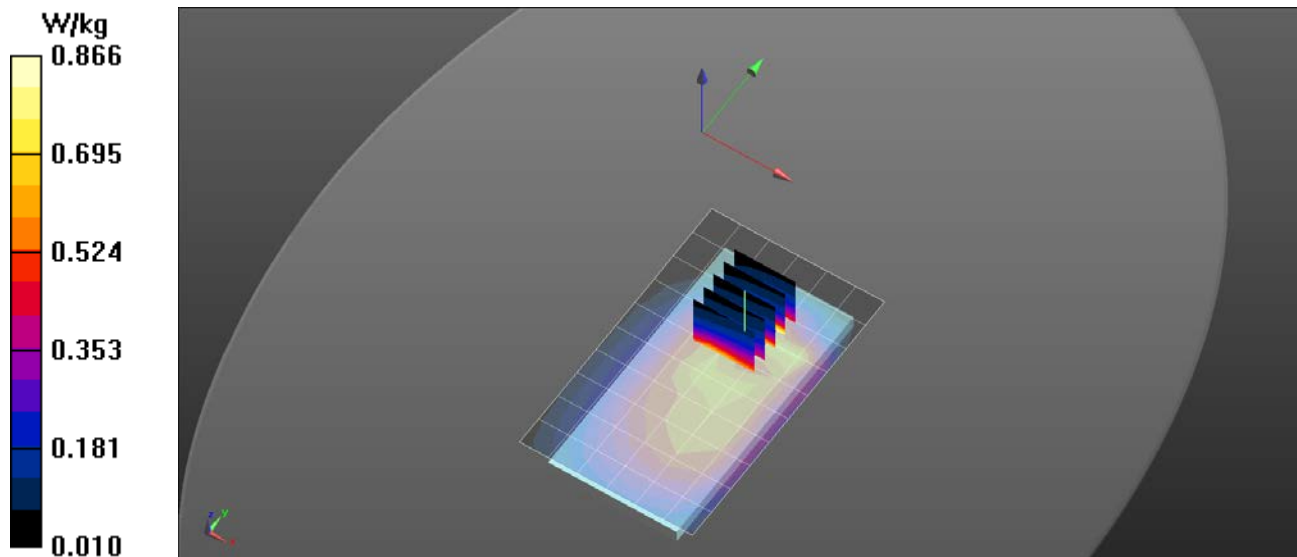
Reference Value = 25.28 V/m; Power Drift = 0.02 dB

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





# RF Exposure Lab

## 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;  $\sigma = 0.932$  S/m;  $\epsilon_r = 41.396$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

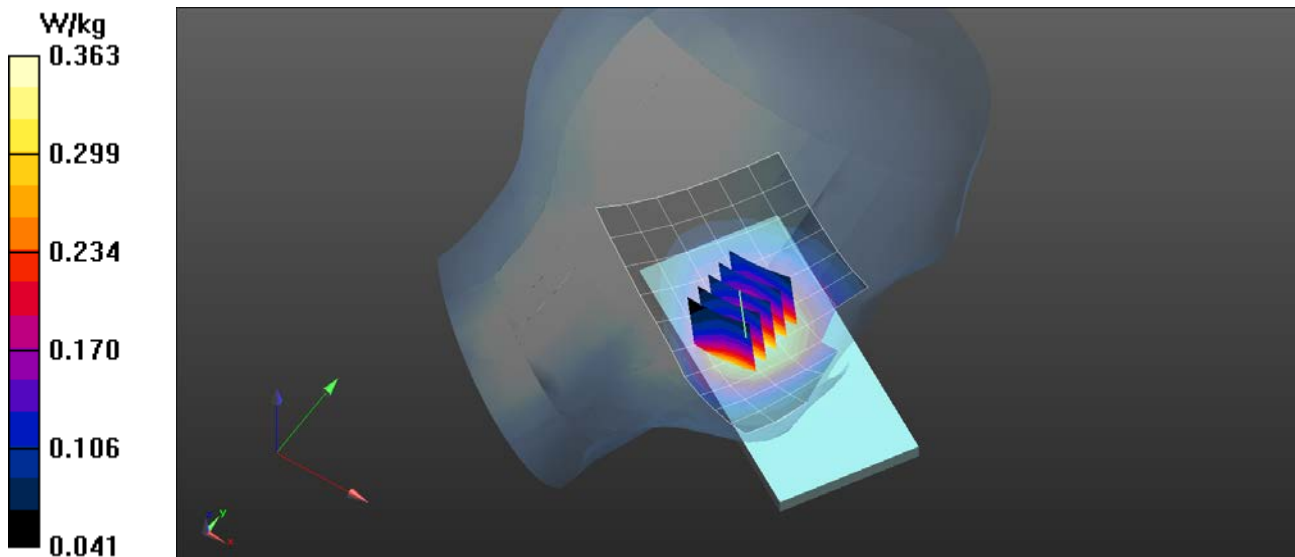
Reference Value = 7.918 V/m; Power Drift = -0.02 dB

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



# RF Exposure Lab

## 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;  $\sigma = 0.992$  S/m;  $\epsilon_r = 54.924$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

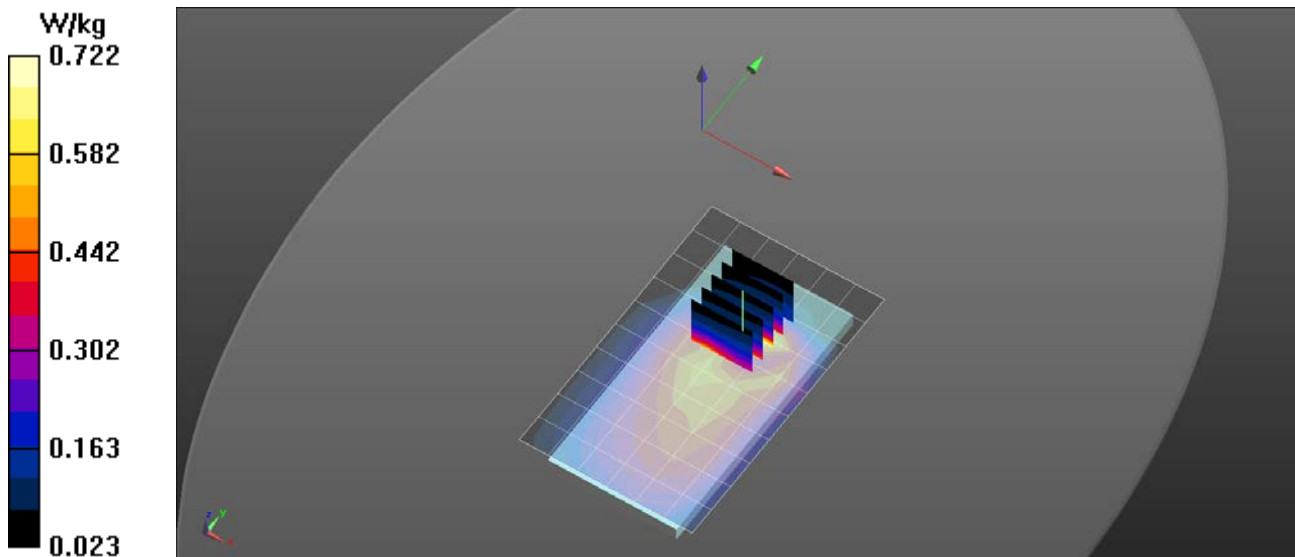
Reference Value = 23.10 V/m; Power Drift = 0.01 dB

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



# RF Exposure Lab

## 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:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.42 \text{ S/m}$ ;  $\epsilon_r = 39.59$ ;  $\rho = 1000 \text{ kg/m}^3$   
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:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
Maximum value of SAR (measured) = 0.713 W/kg

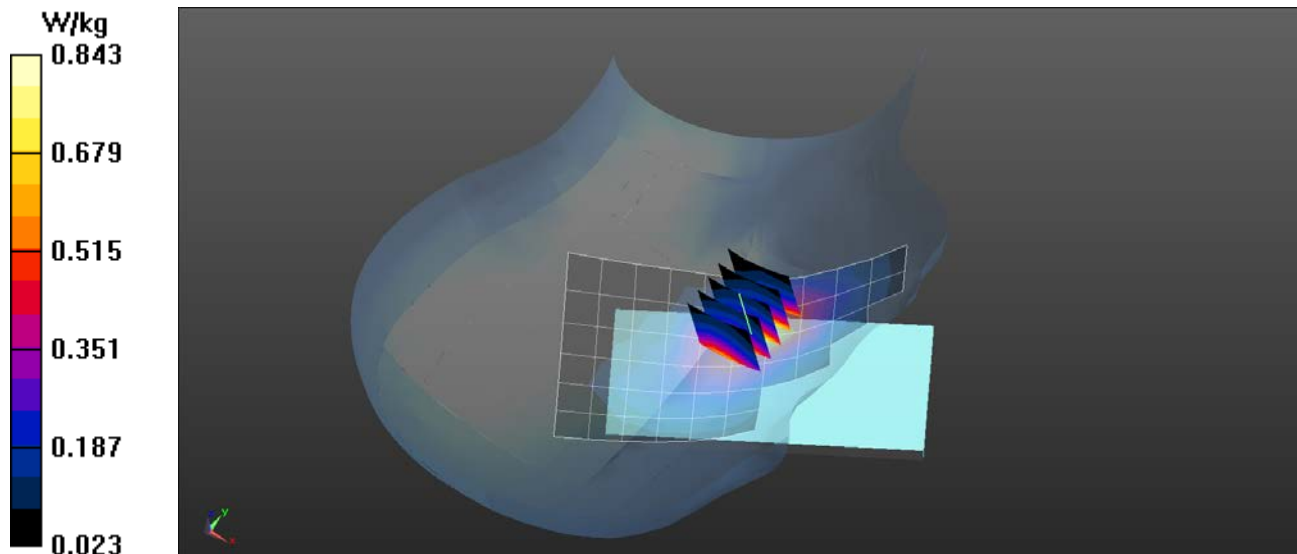
**WCDMA 1900 Head/iPhone 7 Right 1900 Baseline/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

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



# RF Exposure Lab

## 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;  $\sigma = 1.45$  S/m;  $\epsilon_r = 52.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

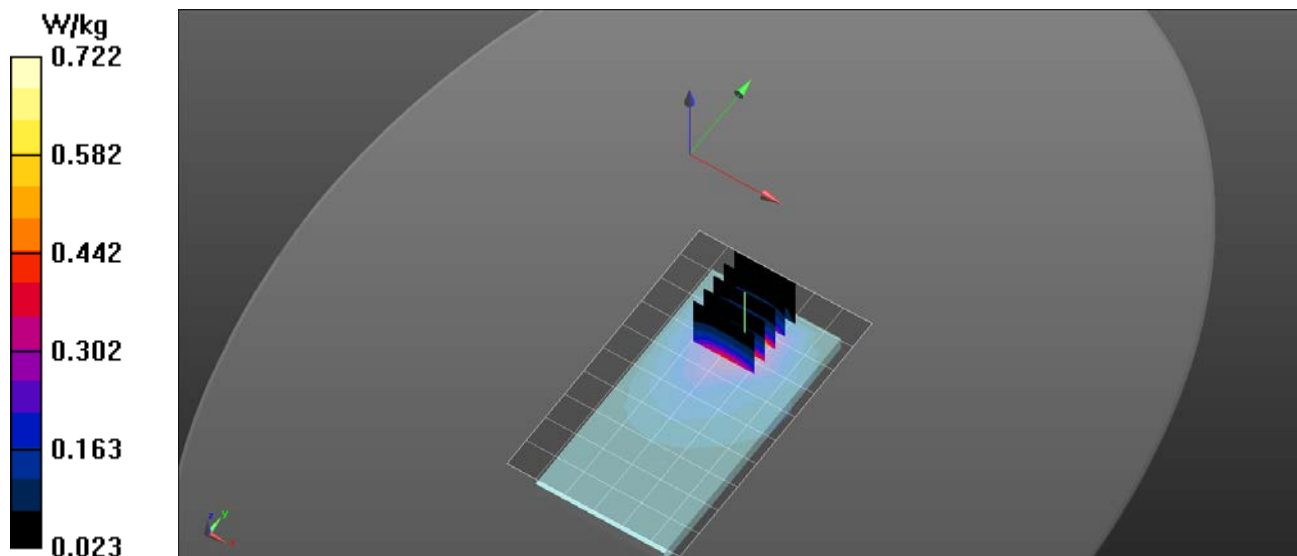
**WCDMA 1900 Body/iPhone 7 Front 1900 Baseline/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

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



# RF Exposure Lab

## 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;  $\sigma = 1.385$  S/m;  $\epsilon_r = 40.02$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

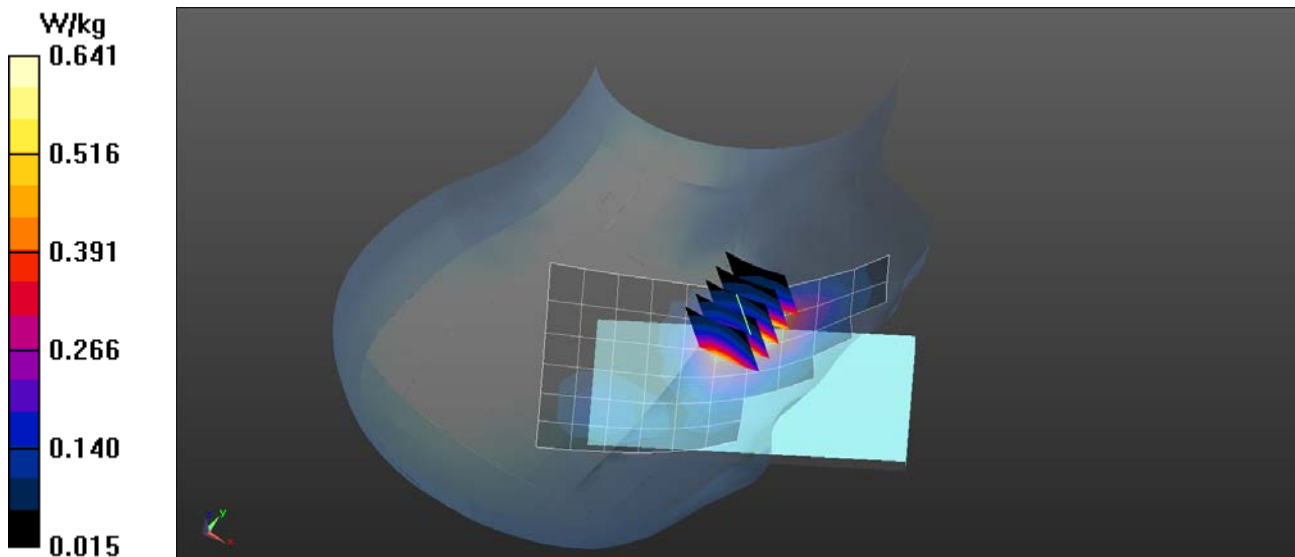
Reference Value = 6.126 V/m; Power Drift = 0.03 dB

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



# RF Exposure Lab

## 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;  $\sigma = 1.515$  S/m;  $\epsilon_r = 53.34$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

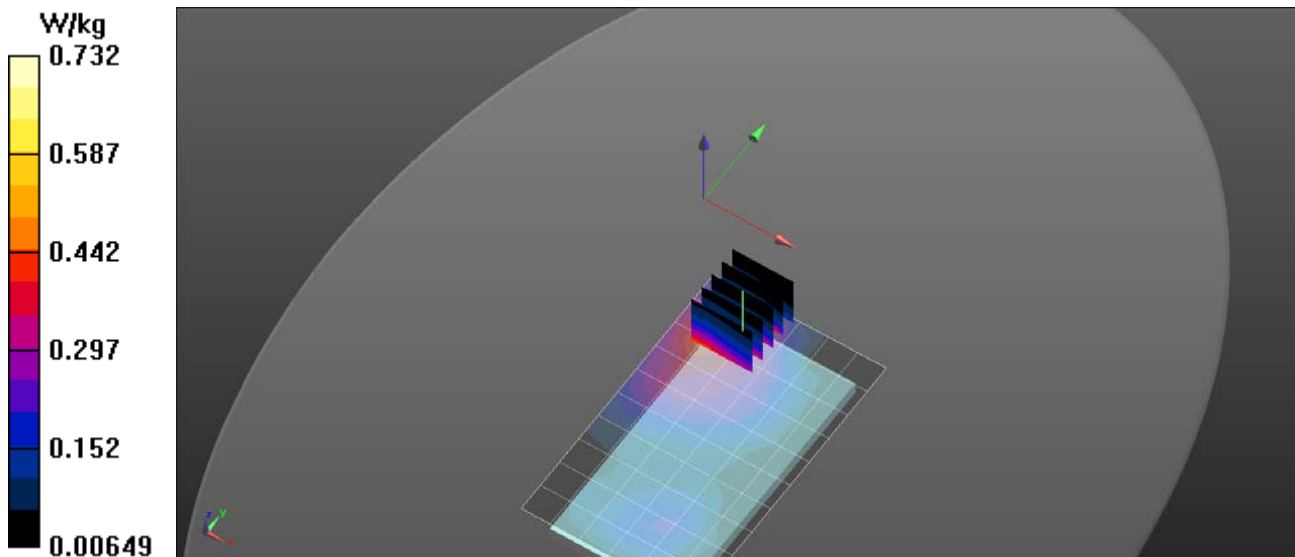
Reference Value = 9.655 V/m; Power Drift = -0.02 dB

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



# RF Exposure Lab

## 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:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.42 \text{ S/m}$ ;  $\epsilon_r = 39.59$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Right Section

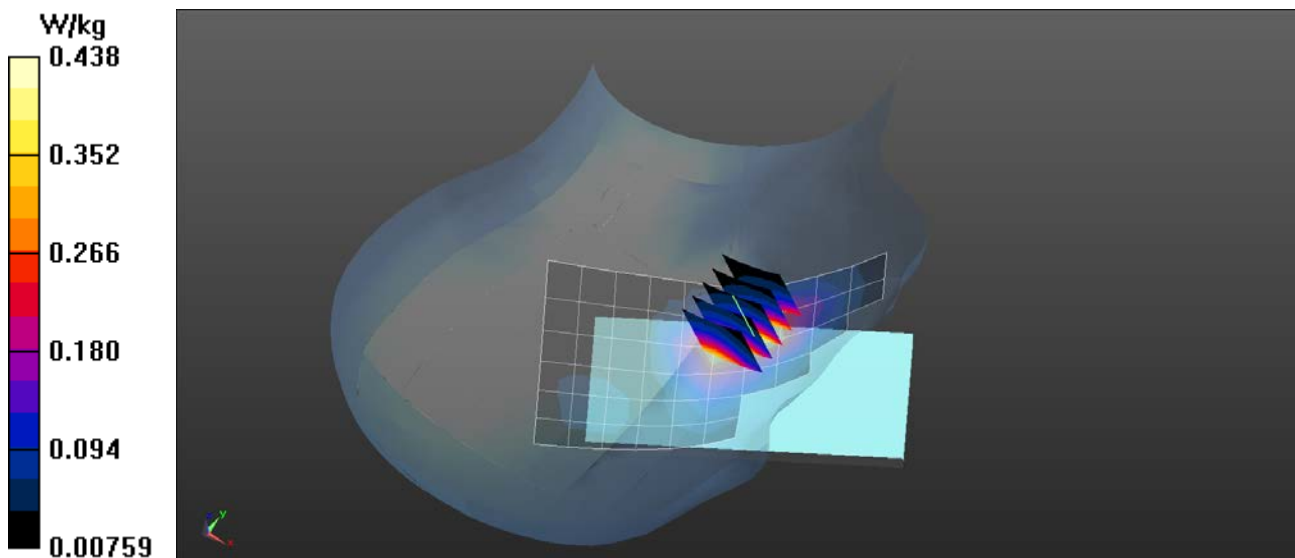
Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

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





# RF Exposure Lab

## 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;  $\sigma = 1.499$  S/m;  $\epsilon_r = 52.119$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

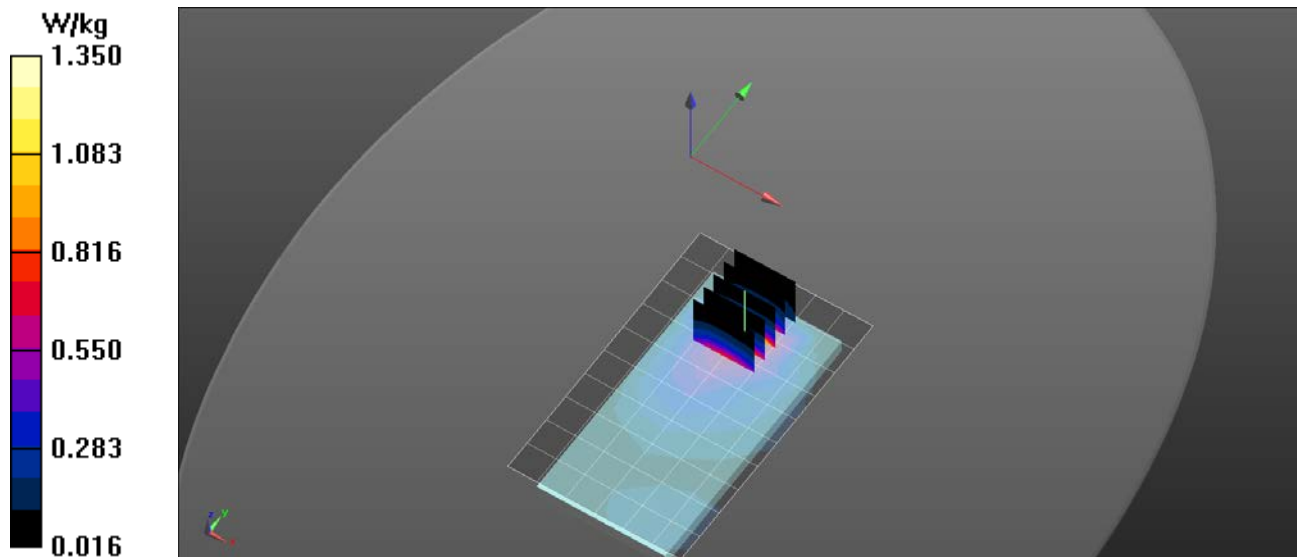
Reference Value = 15.57 V/m; Power Drift = -0.01 dB

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





# RF Exposure Lab

## 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;  $\sigma = 1.44$  S/m;  $\epsilon_r = 39.542$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

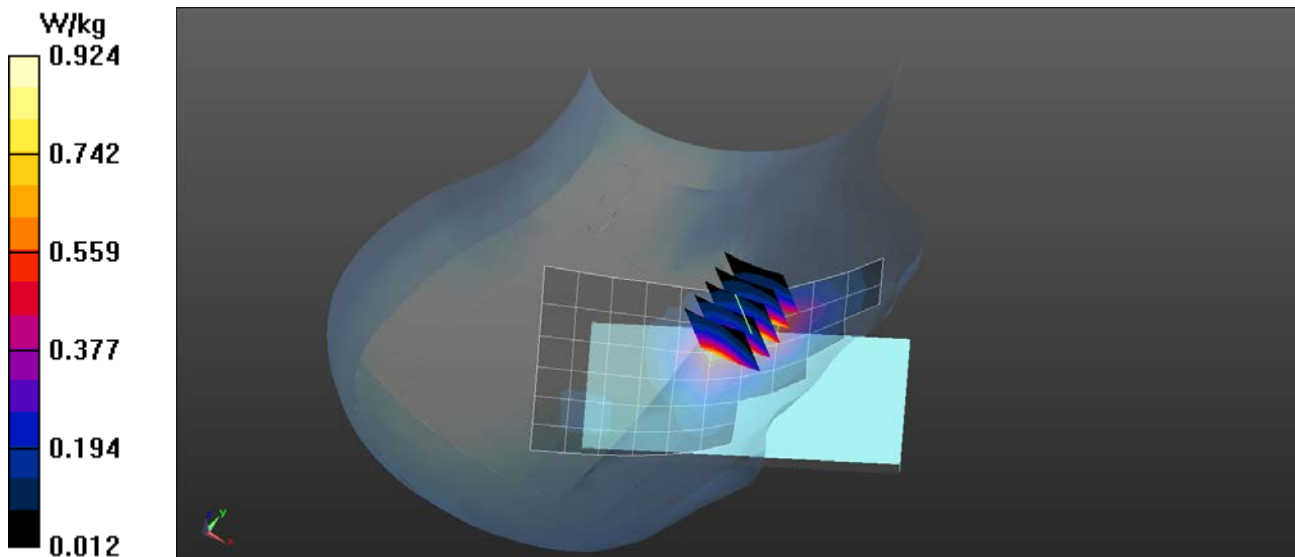
Reference Value = 5.319 V/m; Power Drift = 0.03 dB

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



# RF Exposure Lab

## 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;  $\sigma = 1.496$  S/m;  $\epsilon_r = 52.114$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

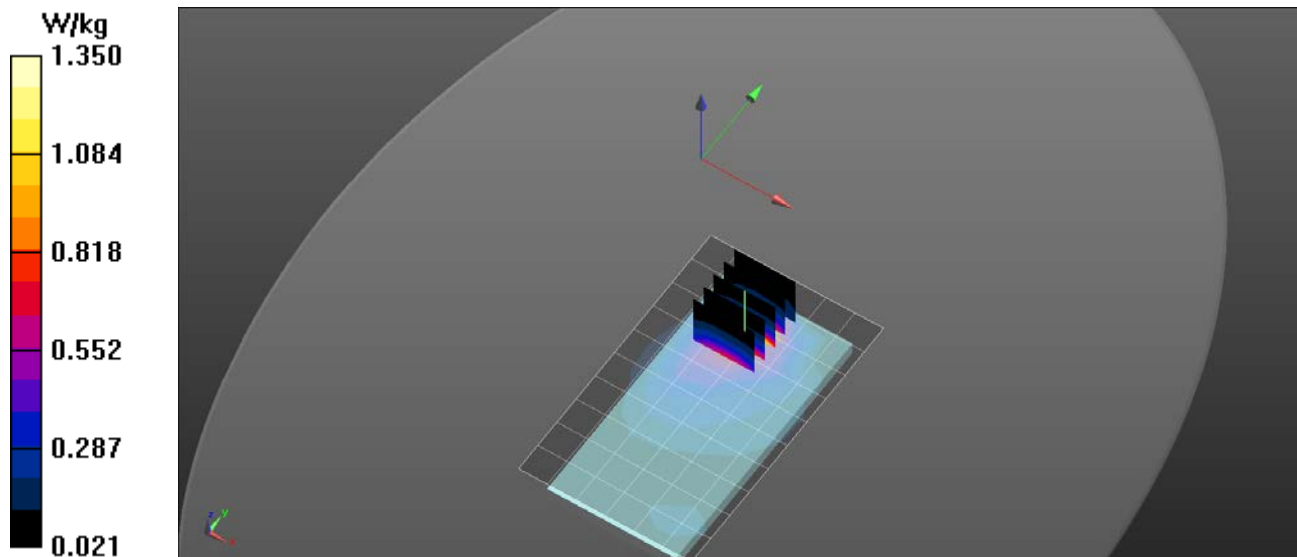
Reference Value = 18.59 V/m; Power Drift = -0.01 dB

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



# RF Exposure Lab

## 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;  $\sigma = 0.932$  S/m;  $\epsilon_r = 41.395$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

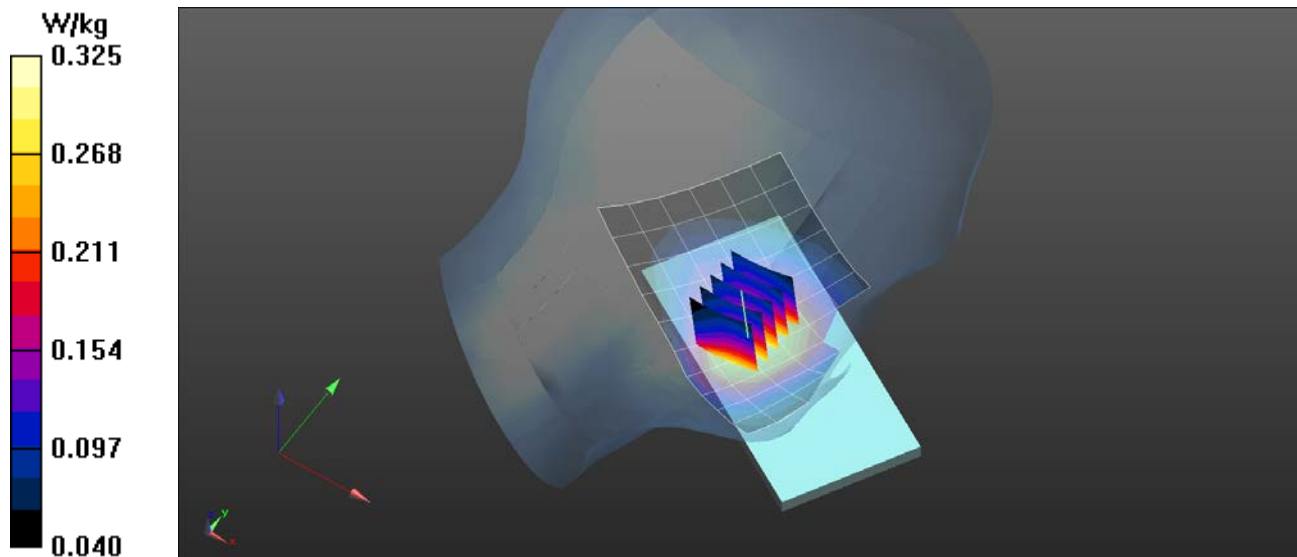
Reference Value = 7.933 V/m; Power Drift = -0.02 dB

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



# RF Exposure Lab

## 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):  $f = 846.6 \text{ MHz}$ ;  $\sigma = 1.003 \text{ S/m}$ ;  $\epsilon_r = 54.885$ ;  $\rho = 1000 \text{ kg/m}^3$   
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

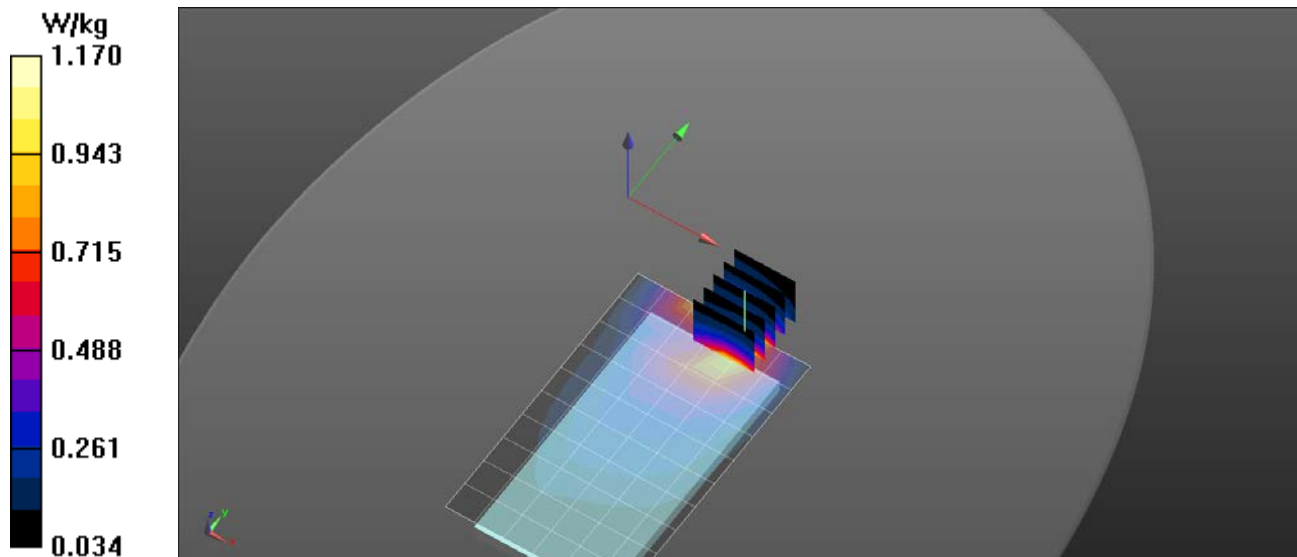
Reference Value = 15.91 V/m; Power Drift = -0.01 dB

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



# RF Exposure Lab

## 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):  $f = 782 \text{ MHz}$ ;  $\sigma = 0.92 \text{ S/m}$ ;  $\epsilon_r = 41.26$ ;  $\rho = 1000 \text{ kg/m}^3$   
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

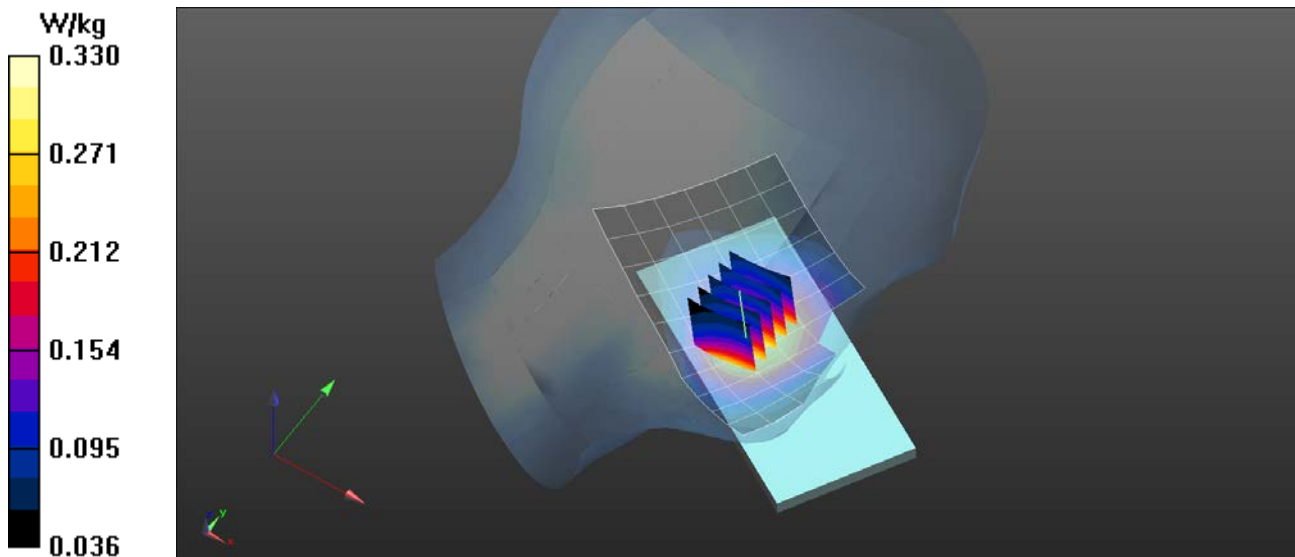
Reference Value = 6.949 V/m; Power Drift = 0.01 dB

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



# RF Exposure Lab

## 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):  $f = 782 \text{ MHz}$ ;  $\sigma = 0.972 \text{ S/m}$ ;  $\epsilon_r = 54.556$ ;  $\rho = 1000 \text{ kg/m}^3$   
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

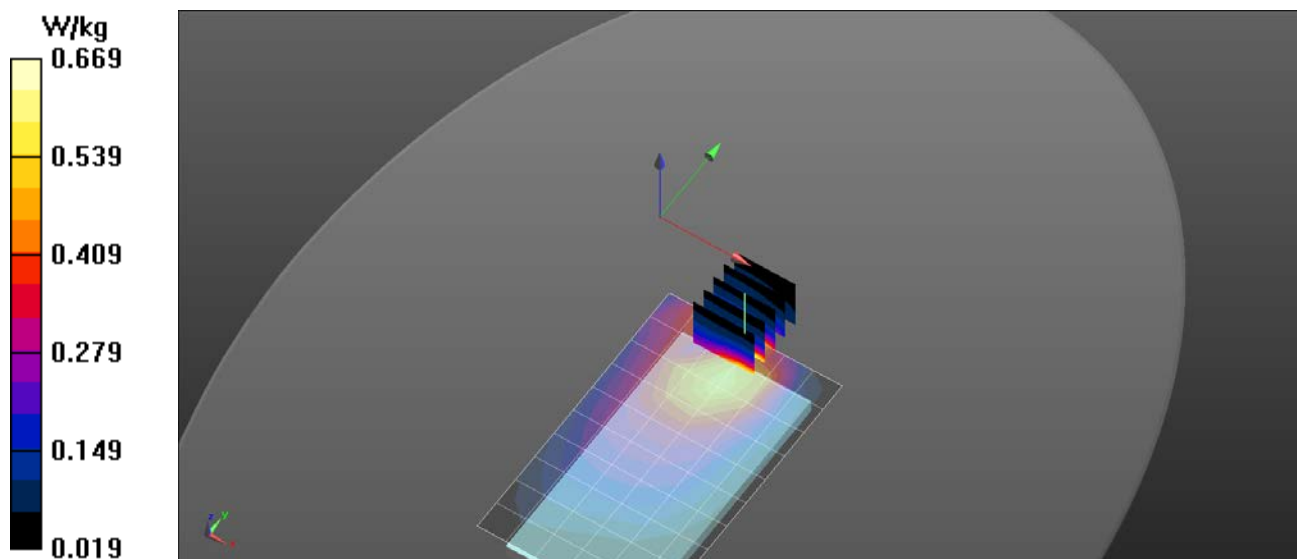
Reference Value = 16.56 V/m; Power Drift = 0.03 dB

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



# RF Exposure Lab

## 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;  $\sigma = 0.932$  S/m;  $\epsilon_r = 41.395$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

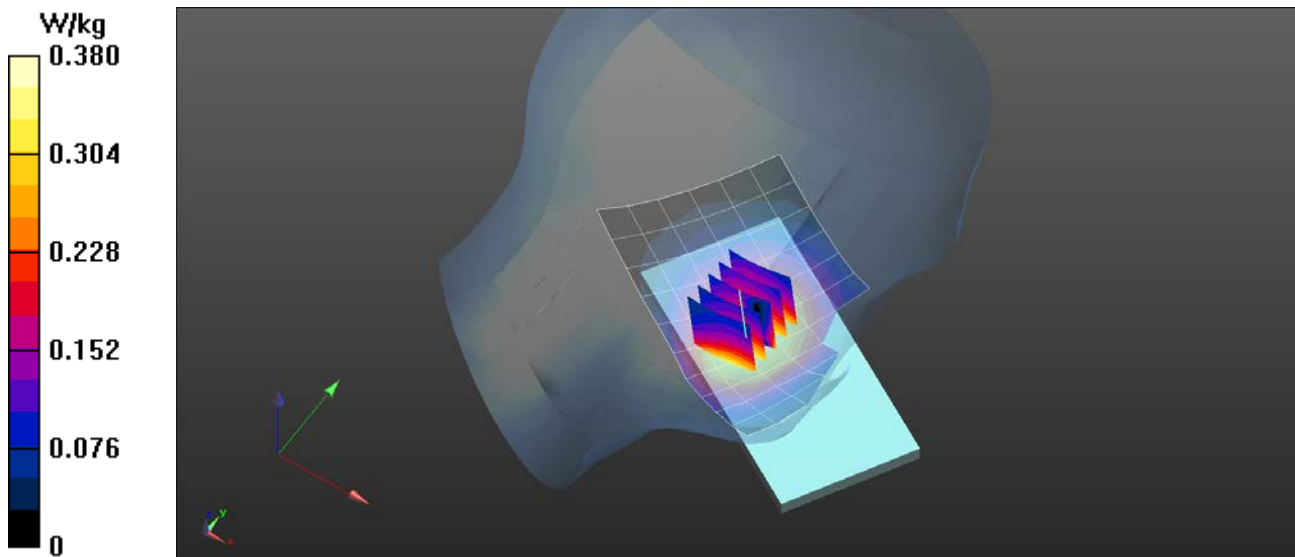
Reference Value = 6.806 V/m; Power Drift = -0.03 dB

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





# RF Exposure Lab

## 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;  $\sigma = 1.008$  S/m;  $\epsilon_r = 54.879$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

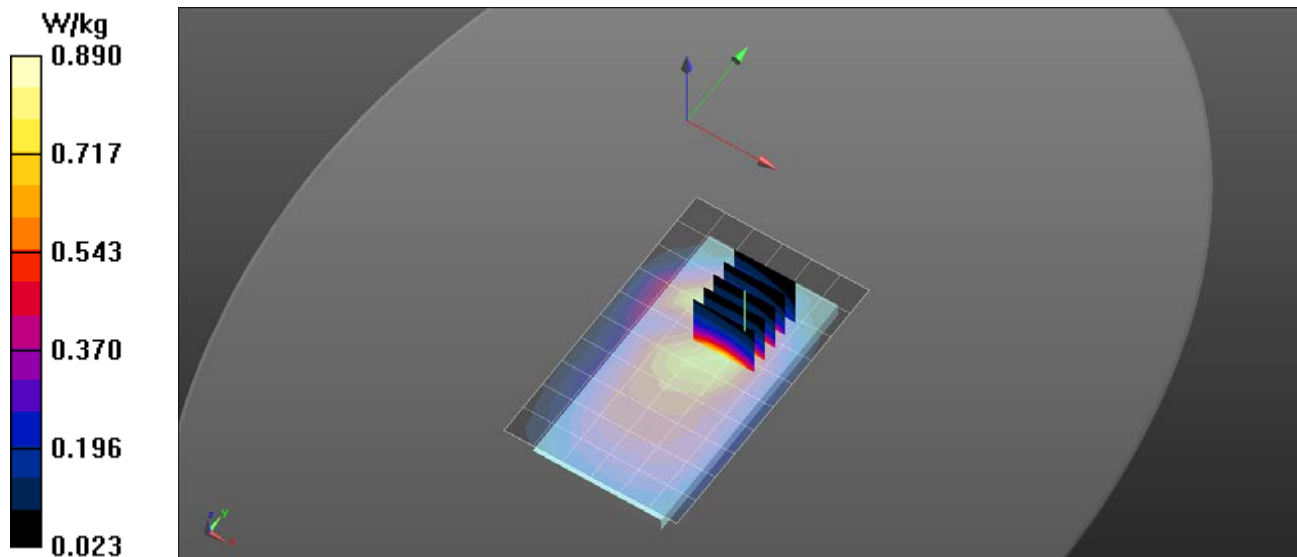
Reference Value = 26.38 V/m; Power Drift = -0.02 dB

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





# RF Exposure Lab

## 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;  $\sigma = 0.932$  S/m;  $\epsilon_r = 41.396$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

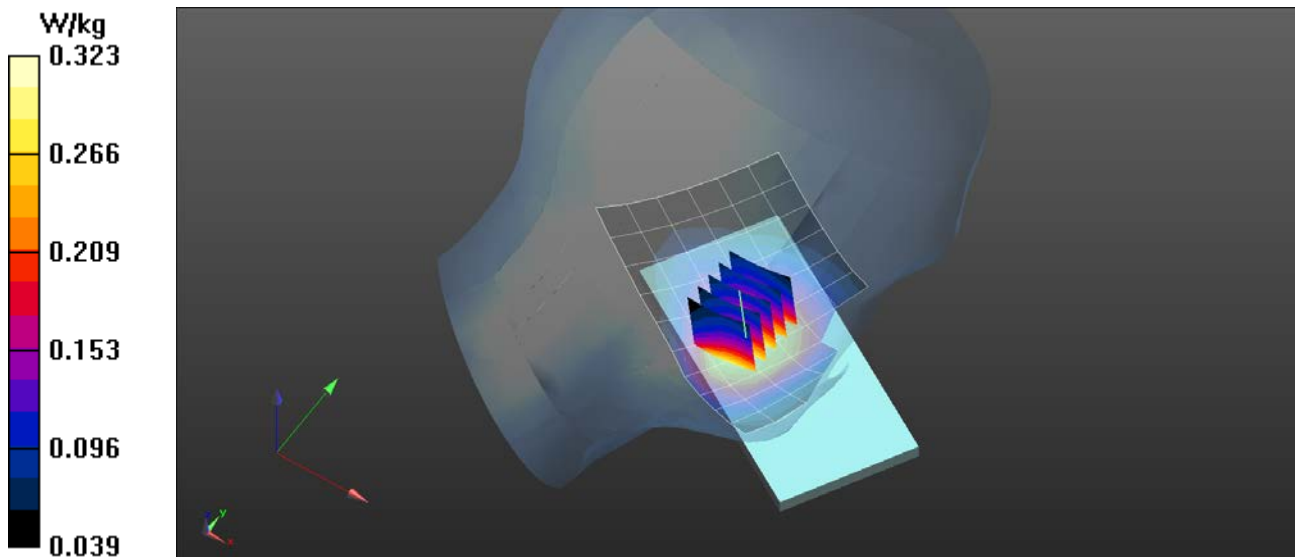
Reference Value = 7.171 V/m; Power Drift = -0.02 dB

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



# RF Exposure Lab

## 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;  $\sigma = 1.007$  S/m;  $\epsilon_r = 55.88$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

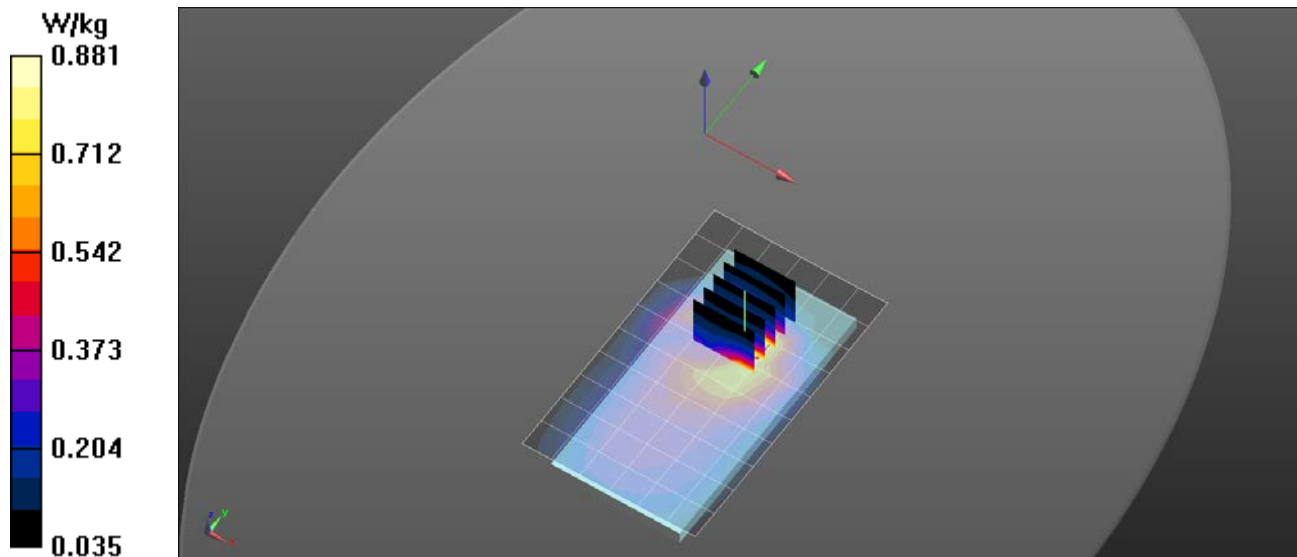
Reference Value = 25.05 V/m; Power Drift = -0.02 dB

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



# RF Exposure Lab

## 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;  $\sigma = 1.44$  S/m;  $\epsilon_r = 39.545$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

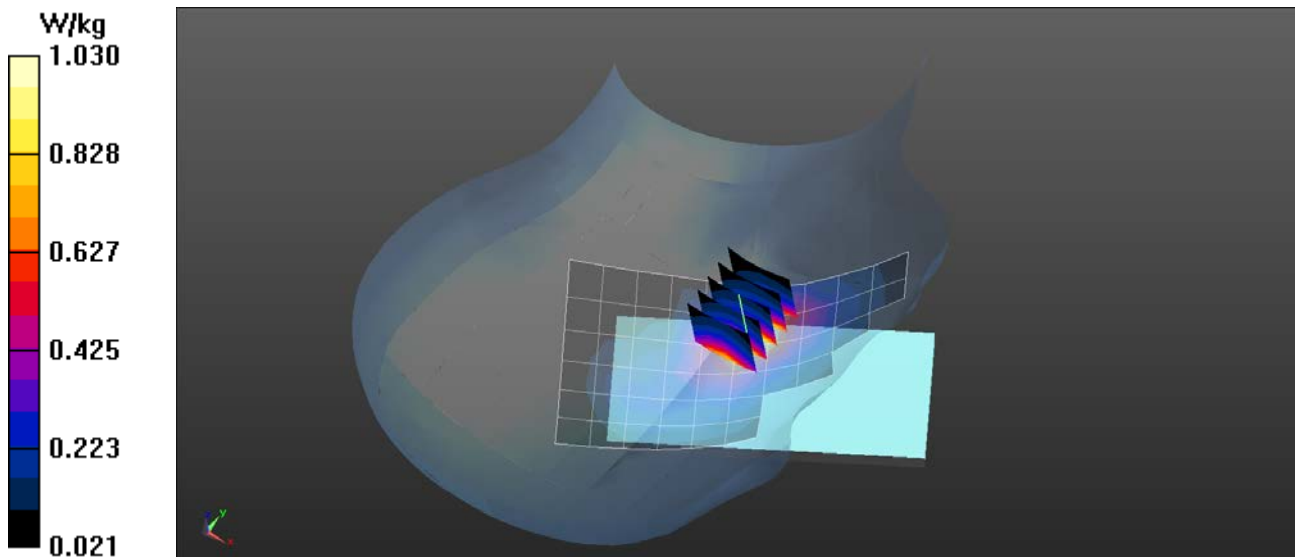
Reference Value = 9.082 V/m; Power Drift = 0.01 dB

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



# RF Exposure Lab

## 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;  $\sigma = 1.493$  S/m;  $\epsilon_r = 52.108$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

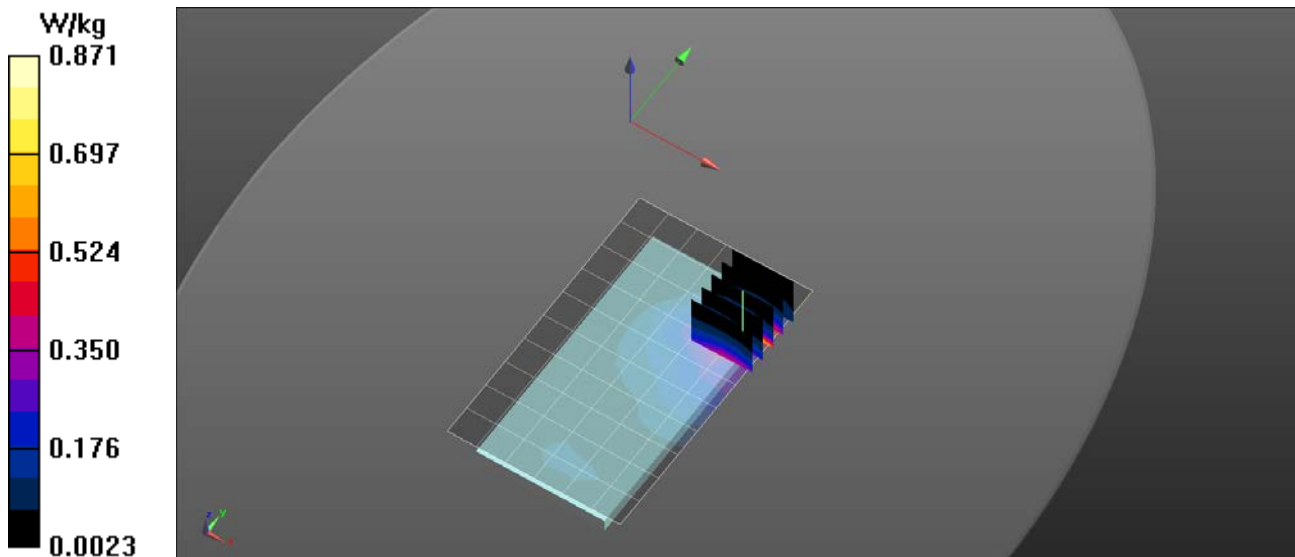
Reference Value = 17.38 V/m; Power Drift = -0.02 dB

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



# RF Exposure Lab

## 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;  $\sigma = 1.44$  S/m;  $\epsilon_r = 39.56$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section

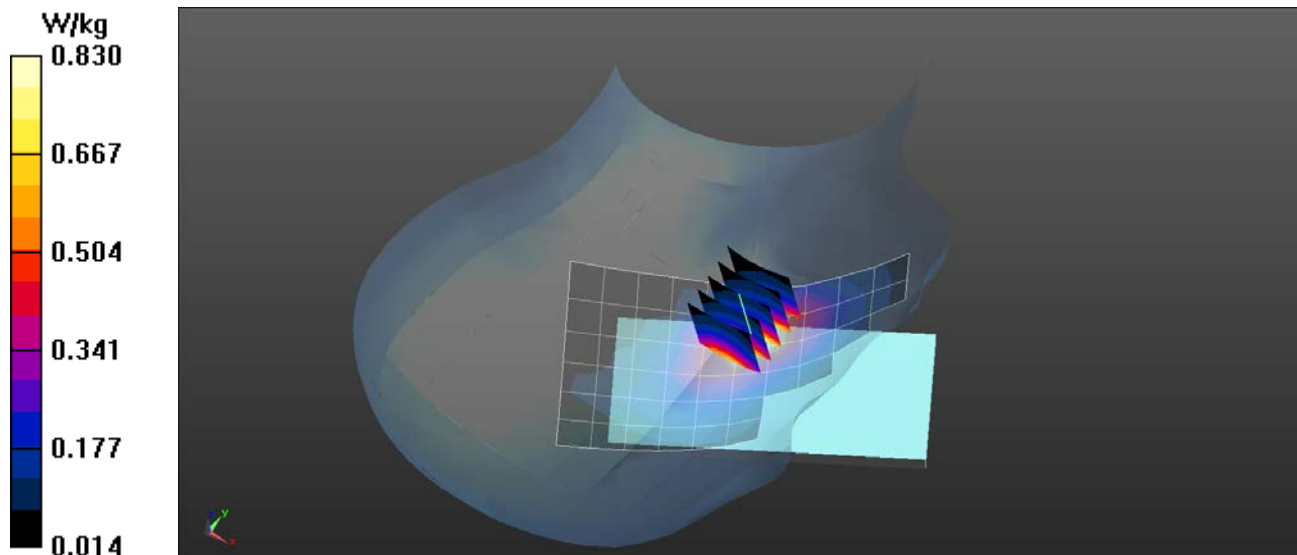
Test Date: Date: 6/19/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

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



# RF Exposure Lab

## 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:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.45 \text{ S/m}$ ;  $\epsilon_r = 52.1$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section

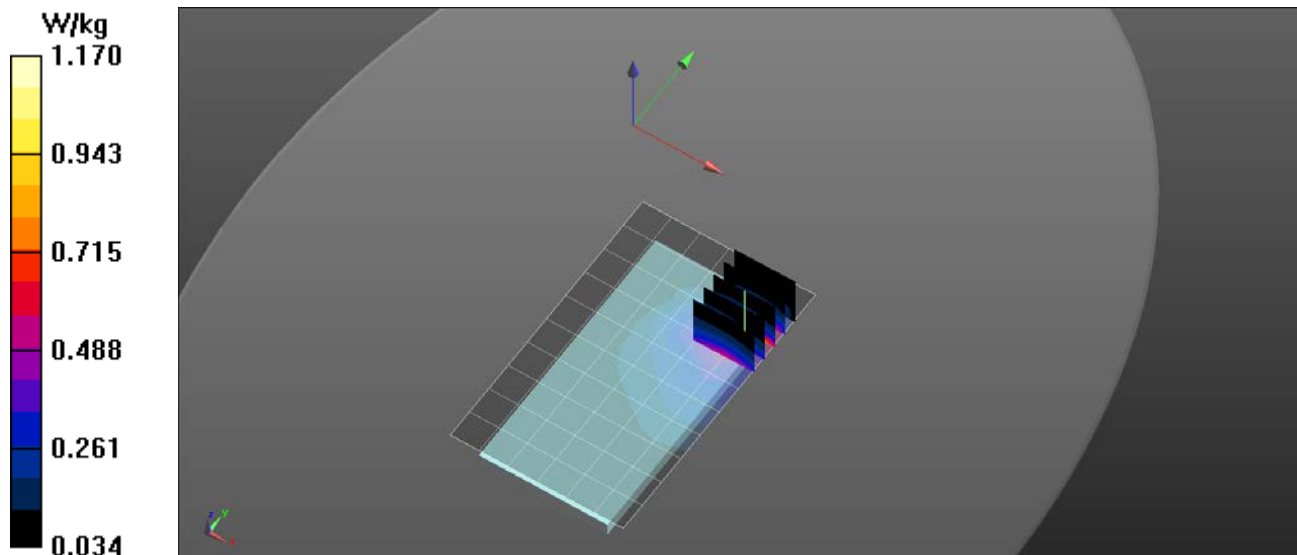
Test Date: Date: 6/20/2018; Ambient Temp: 23 °C; Tissue Temp: 21 °C

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:  
 $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
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:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$   
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



# RF Exposure Lab

## 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:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.42 \text{ S/m}$ ;  $\epsilon_r = 39.59$ ;  $\rho = 1000 \text{ kg/m}^3$   
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:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
Maximum value of SAR (measured) = 0.517 W/kg

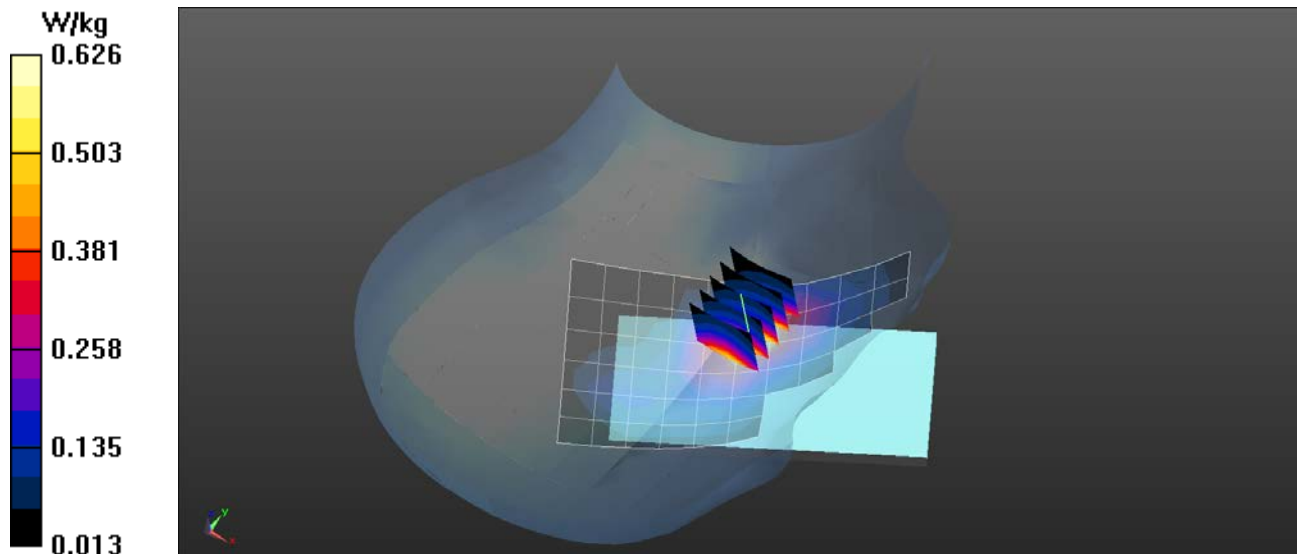
**GSM 1900 Head/iPhone 8 Right 1900 Baseline/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

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





# RF Exposure Lab

## 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;  $\sigma = 1.499$  S/m;  $\epsilon_r = 52.119$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

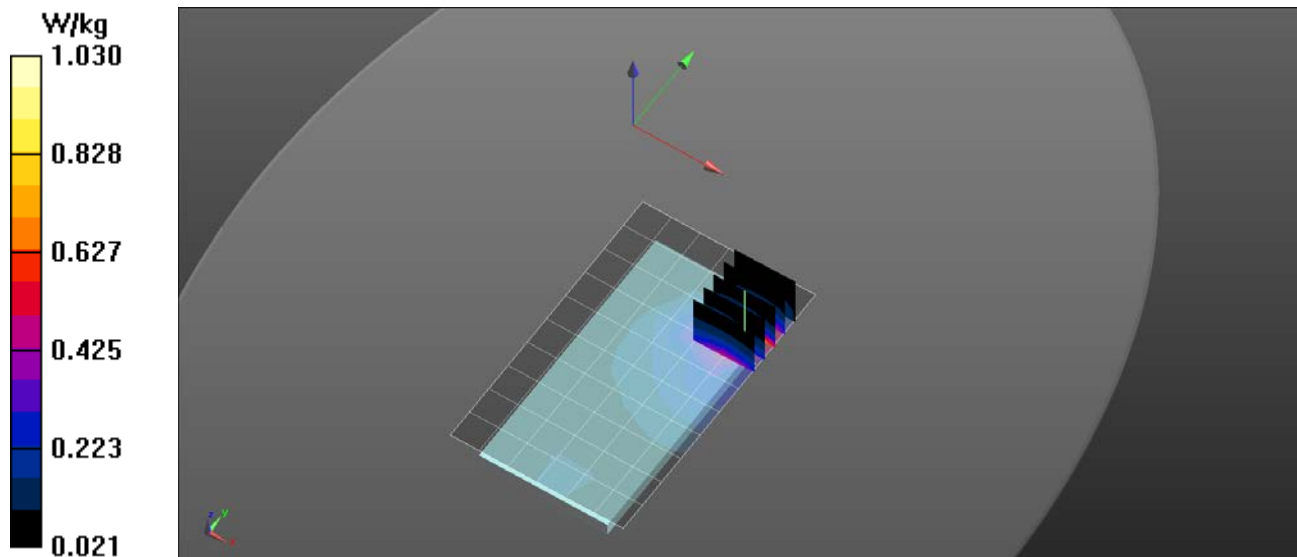
Reference Value = 14.69 V/m; Power Drift = -0.01 dB

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





# RF Exposure Lab

## 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;  $\sigma = 1.44$  S/m;  $\epsilon_r = 39.542$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

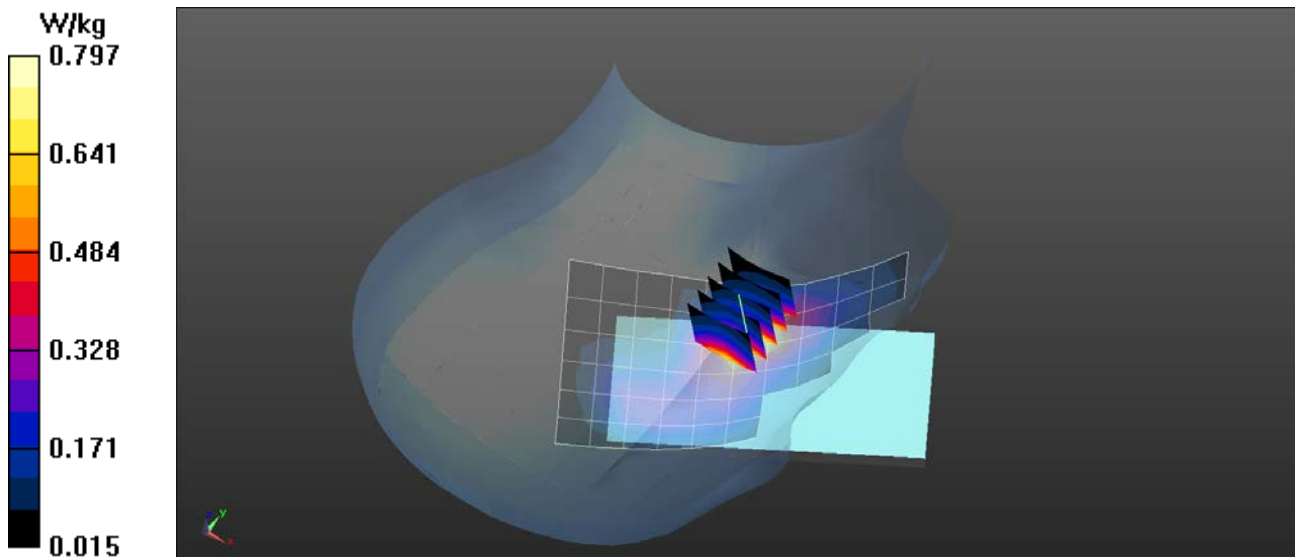
Reference Value = 9.529 V/m; Power Drift = 0.01 dB

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



# RF Exposure Lab

## 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;  $\sigma = 1.496$  S/m;  $\epsilon_r = 52.114$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

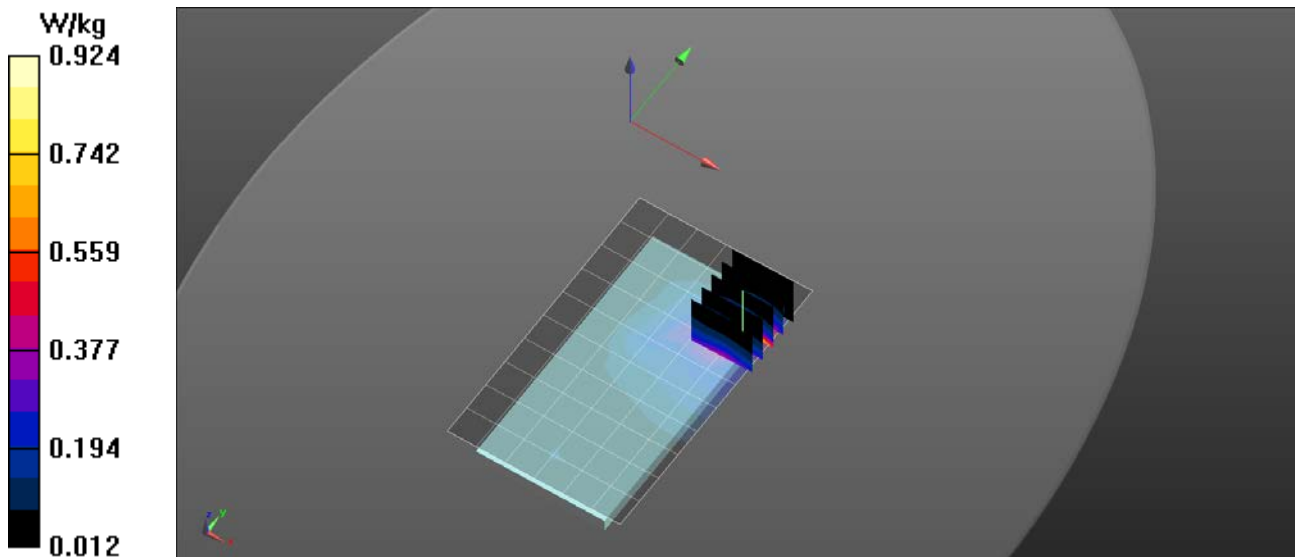
Reference Value = 19.78 V/m; Power Drift = -0.03 dB

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



# RF Exposure Lab

## 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;  $\sigma = 1.827$  S/m;  $\epsilon_r = 39.012$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

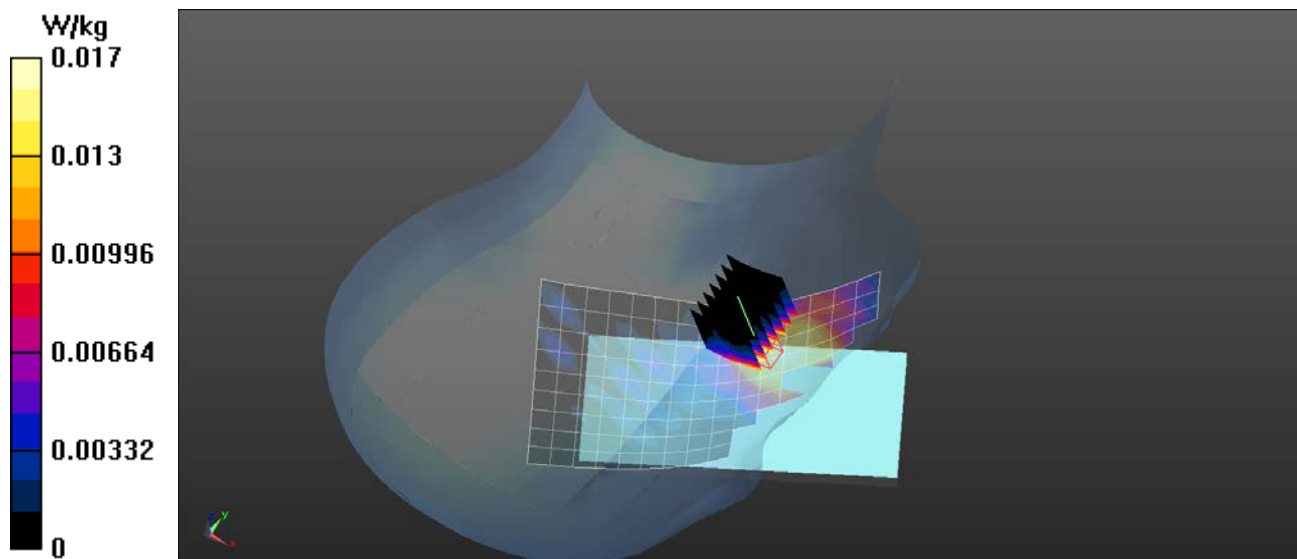
Reference Value = 0.4360 V/m; Power Drift = -0.00 dB

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



# 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;  $\sigma = 1.947$  S/m;  $\epsilon_r = 52.666$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

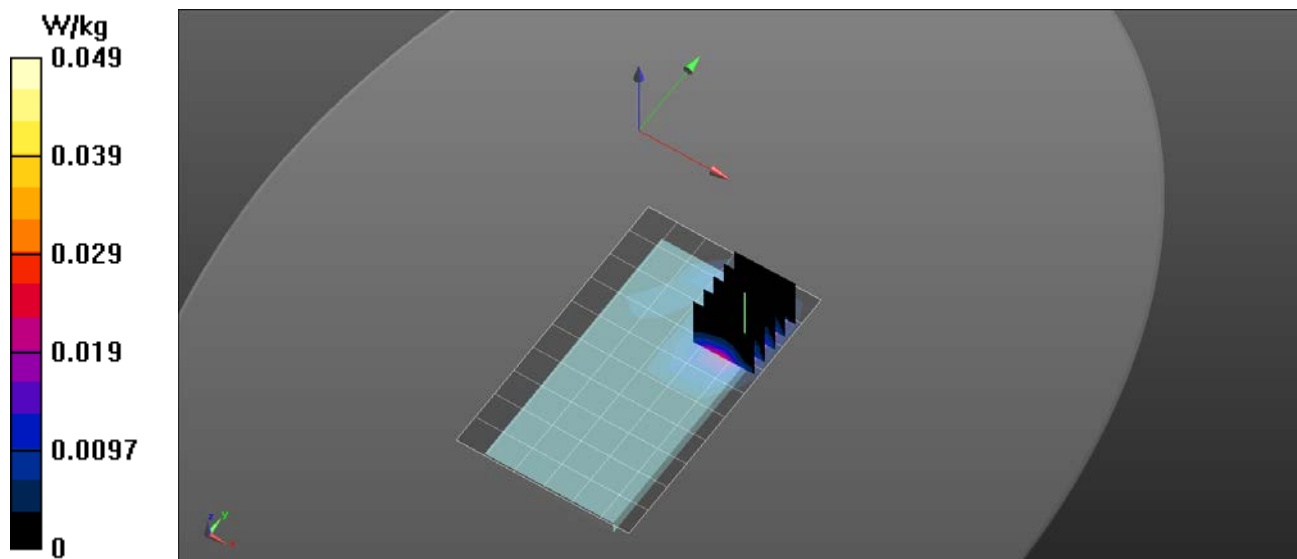
Reference Value = 1.127 V/m; Power Drift = -0.01 dB

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



## Appendix C – Test Setup Photos



**Right Touch No Case**



**Right Touch With Case**



**Left Touch No Case**



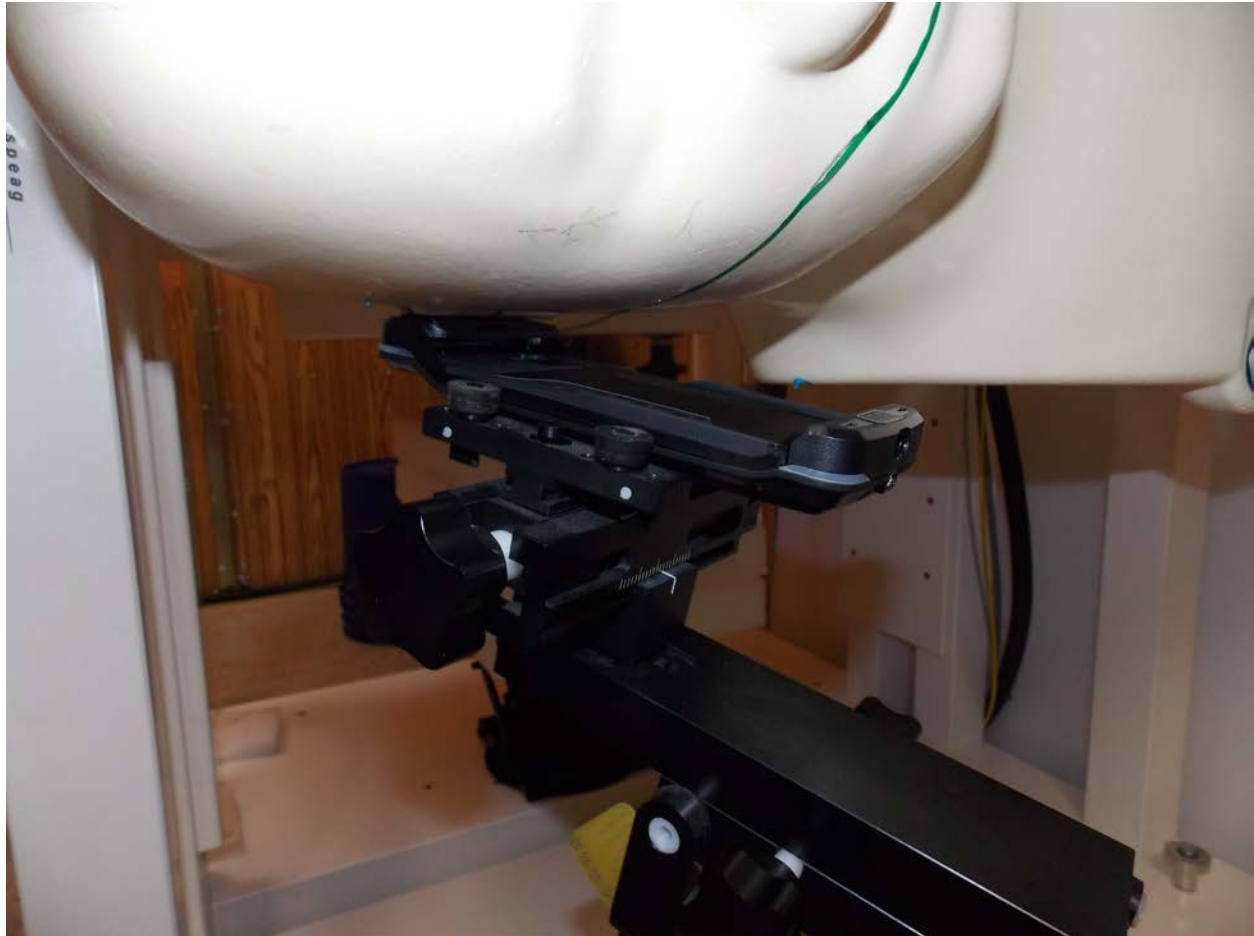


**Left Touch With Case**





**Right Touch Case Only**



**Right Tilt Case Only**



**Left Touch Case Only**



**Left Touch Case Only**



**Body Front Configuration No Case 5 mm Gap**



**Body Front Configuration With Case 5 mm Gap**





**Body Back Configuration No Case 5 mm Gap**



**Body Back Configuration With Case 5 mm Gap**





**Body Front Configuration Case Only 0 mm Gap**



**Body Back Configuration Case Only 0 mm Gap**



**Front of Device (Case)**



**Back of Device (Case)**

## **Appendix D – Probe Calibration Data Sheets**

gm

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



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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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

Client **RF Exposure Lab**

Certificate No: **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 ( $22 \pm 3$ )°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 |

|                                                                                                                 |                              |                                          |                        |
|-----------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------|------------------------|
| Calibrated by:                                                                                                  | Name<br><b>Leif Klysner</b>  | Function<br><b>Laboratory Technician</b> | Signature<br>          |
| Approved by:                                                                                                    | Name<br><b>Katja Pokovic</b> | Function<br><b>Technical Manager</b>     | Signature<br>          |
|                                                                                                                 |                              |                                          | Issued: April 20, 2018 |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |                              |                                          |                        |



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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

### Glossary:

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

### Calibration is Performed According to the Following Standards:

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

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* *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*.
- DCP<sub>x,y,z</sub>**: 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
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: 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  $f \leq 800$  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 NORM<sub>x,y,z</sub> \* *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  $\pm 50$  MHz to  $\pm 100$  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 NORM<sub>x</sub> (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 ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 0.44     | 0.45     | 0.48     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 102.6    | 97.6     | 96.4     |               |

### Modulation Calibration Parameters

| UID | Communication System Name |   | A<br>dB | B<br>dB/ $\mu\text{V}$ | C   | D<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-----|---------------------------|---|---------|------------------------|-----|---------|----------|---------------------------|
| 0   | CW                        | X | 0.0     | 0.0                    | 1.0 | 0.00    | 136.8    | $\pm 3.3 \%$              |
|     |                           | 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%.

<sup>A</sup> The uncertainties of Norm X,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> 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) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup> (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 %  |

<sup>C</sup> 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.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) 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 ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> 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

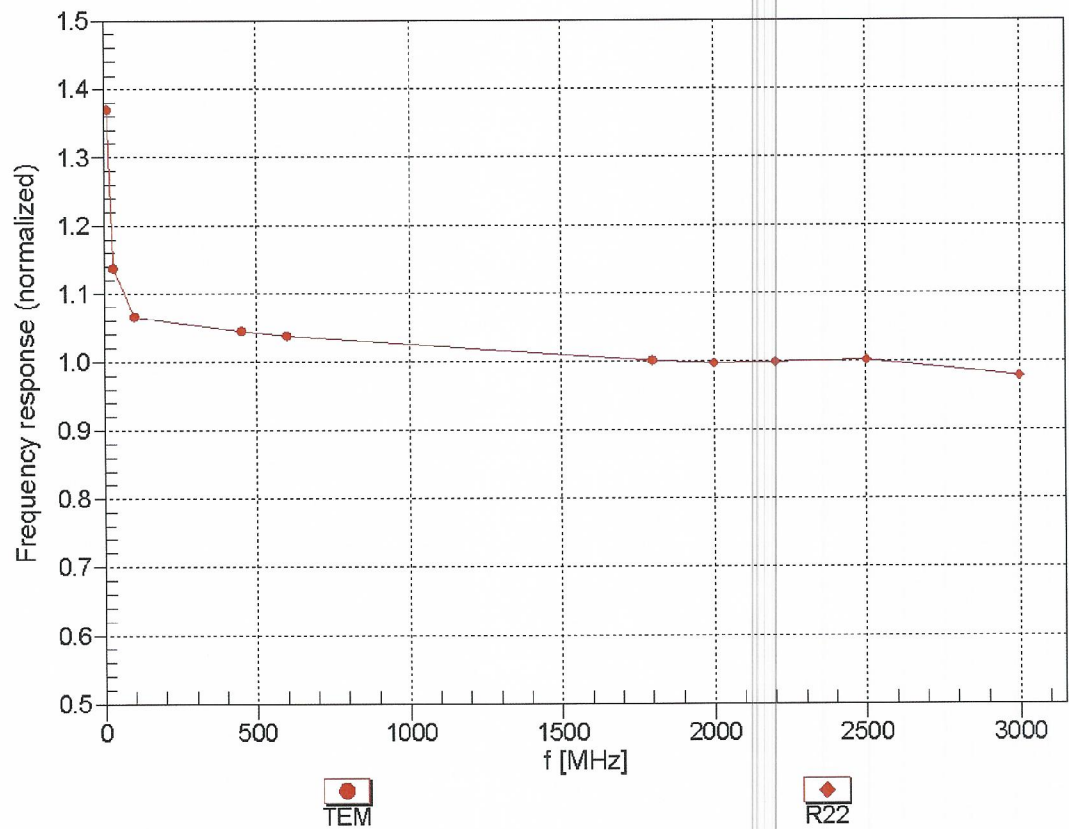
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup> (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 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 %  |

<sup>C</sup> 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.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) 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 ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> 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.

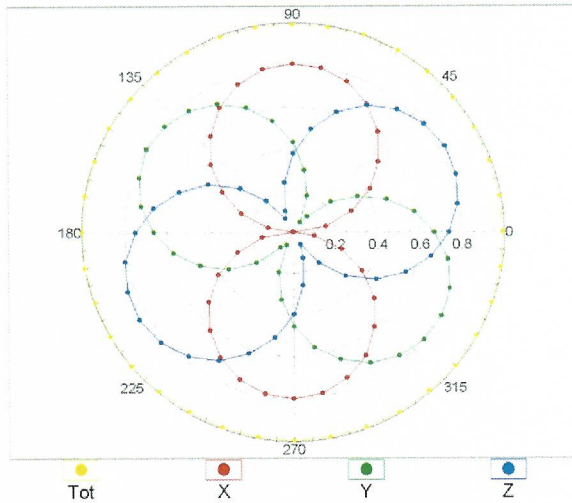
**Frequency Response of E-Field**  
(TEM-Cell:ifi1110 EXX, Waveguide: R22)



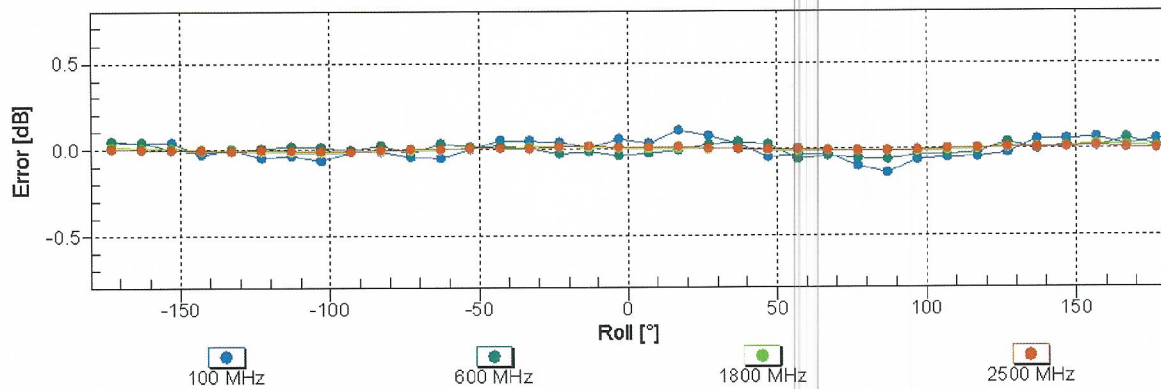
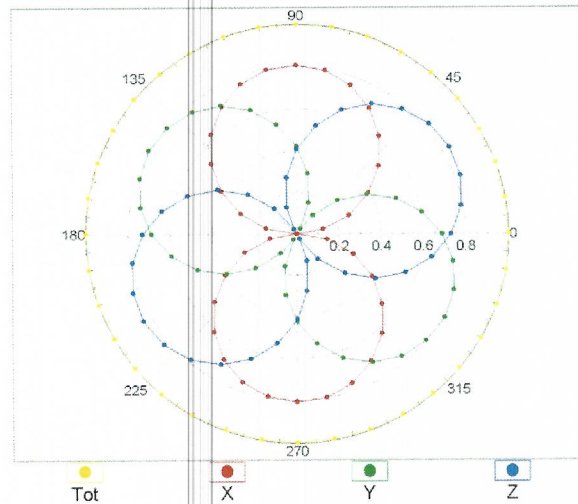
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

## Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$

f=600 MHz, TEM

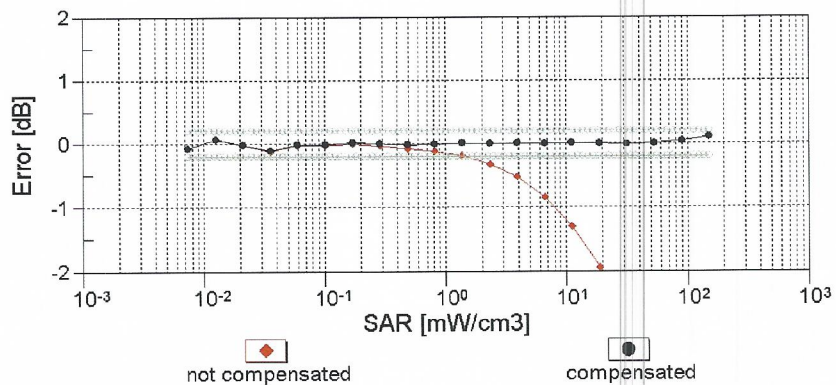
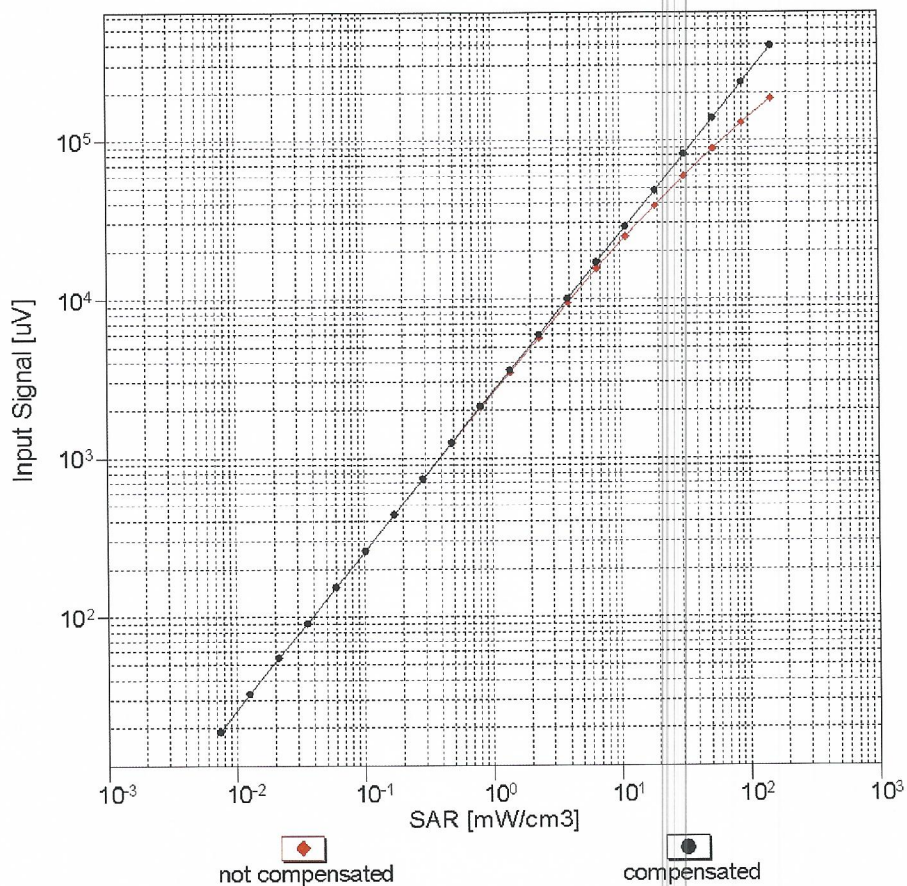


f=1800 MHz, R22



Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

# Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f_{\text{eval}} = 1900 \text{ MHz}$ )



Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )