



## SAR EVALUATION REPORT

**Applicant Name:**

Samsung Electronics, Co. Ltd.  
129, Samsung-ro, Maetan dong,  
Yeongtong-gu, Suwon-si  
Gyeonggi-do 16677, Korea

**Date of Testing:**

08/18/15 - 09/08/15

**Test Site/Location:**

PCTEST Lab, Columbia, MD, USA

**Document Serial No.:**

OY1508201591-R1.A3L

**FCC ID:**

**A3LSMG928R4**

**APPLICANT:**

**SAMSUNG ELECTRONICS, CO. LTD.**

**DUT Type:**

Portable Handset

**Application Type:**

Class II Permissive change

**FCC Rule Part(s):**

CFR §2.1093

**Model(s):**

SM-G928R4

**Original Grant Date:**

07/16/2015

**Permissive Change(s):**

Adding Wireless Charging Battery Cover

| Equipment Class | Band & Mode        | Tx Frequency          | SAR              |                       |                     |                      |
|-----------------|--------------------|-----------------------|------------------|-----------------------|---------------------|----------------------|
|                 |                    |                       | 1 gm Head (W/kg) | 1 gm Body-Worn (W/kg) | 1 gm Hotspot (W/kg) | 10 gm Phablet (W/kg) |
| PCE             | GSM/GPRS/EDGE 850  | 824.20 - 848.80 MHz   | 0.24             | 0.16                  | 0.71                | 2.53                 |
| PCE             | UMTS 850           | 826.40 - 846.60 MHz   |                  |                       |                     |                      |
| PCE             | GSM/GPRS/EDGE 1900 | 1850.20 - 1909.80 MHz |                  |                       |                     |                      |
| PCE             | UMTS 1900          | 1852.4 - 1907.6 MHz   |                  |                       |                     |                      |
| PCE             | Cell. CDMA/EVDO    | 824.70 - 848.31 MHz   |                  |                       |                     |                      |
| PCE             | PCS CDMA/EVDO      | 1851.25 - 1908.75 MHz |                  |                       |                     |                      |
| PCE             | LTE Band 12        | 701.5 - 713.5 MHz     |                  |                       |                     |                      |
| PCE             | LTE Band 13        | 779.5 - 784.5 MHz     |                  |                       |                     |                      |
| PCE             | LTE Band 5 (Cell)  | 824.7 - 848.3 MHz     |                  |                       |                     |                      |
| PCE             | LTE Band 4 (AWS)   | 1710.7 - 1754.3 MHz   |                  |                       |                     |                      |
| PCE             | LTE Band 25 (PCS)  | 1850.7 - 1914.3 MHz   | 0.33             | <0.1                  | <0.1                |                      |
| DTS             | 2.4 GHz WLAN       | 2412 - 2462 MHz       |                  |                       |                     |                      |
| Nil             | U-NII-1            | 5180 - 5240 MHz       |                  |                       |                     |                      |
| Nil             | U-NII-2A           | 5260 - 5320 MHz       |                  |                       |                     |                      |
| Nil             | U-NII-2C           | 5500 - 5720 MHz       |                  |                       |                     |                      |
| Nil             | U-NII-3            | 5745 - 5825 MHz       | 0.20             | <0.1                  | 0.11                | 0.38                 |
| DSS/DTS         | Bluetooth          | 2402 - 2480 MHz       |                  |                       |                     |                      |
| N/A             |                    |                       |                  |                       |                     |                      |

Note: This revised Test Report (S/N: OY1508201591-R1.A3L) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

Note: The table above shows the maximum SAR data for the device evaluated with the additional accessory only and may not represent the maximum SAR values for other use conditions without the accessory. Please refer to RF Exposure Technical Report S/N OY1506151218.A3L for original compliance evaluation.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.3 of this report; for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me 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. Test results reported herein relate only to the item(s) tested.

  
Randy Ortanez  
President



The SAR Tick is an initiative of the Mobile Manufacturers Forum (MMF). While a product may be considered eligible, use of the SAR Tick logo requires an agreement with the MMF. Further details can be obtained by emailing: [sartick@mmfai.info](mailto:sartick@mmfai.info).

|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSMG928R4                  |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 1 of 26                           |

# T A B L E O F C O N T E N T S

|                                                       |                                                  |    |
|-------------------------------------------------------|--------------------------------------------------|----|
| 1                                                     | DEVICE UNDER TEST .....                          | 3  |
| 2                                                     | INTRODUCTION .....                               | 5  |
| 3                                                     | DOSIMETRIC ASSESSMENT .....                      | 6  |
| 4                                                     | DEFINITION OF REFERENCE POINTS .....             | 7  |
| 5                                                     | TEST CONFIGURATION POSITIONS FOR HANDSETS .....  | 8  |
| 6                                                     | RF EXPOSURE LIMITS .....                         | 12 |
| 7                                                     | SYSTEM VERIFICATION.....                         | 13 |
| 8                                                     | SAR DATA SUMMARY .....                           | 15 |
| 9                                                     | FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS..... | 18 |
| 10                                                    | SAR MEASUREMENT VARIABILITY .....                | 20 |
| 11                                                    | EQUIPMENT LIST .....                             | 20 |
| 12                                                    | MEASUREMENT UNCERTAINTIES .....                  | 22 |
| 13                                                    | CONCLUSION.....                                  | 24 |
| 14                                                    | REFERENCES .....                                 | 25 |
| APPENDIX A: SAR TEST PLOTS                            |                                                  |    |
| APPENDIX B: SAR DIPOLE VERIFICATION PLOTS             |                                                  |    |
| APPENDIX C: PROBE AND DIPOLE CALIBRATION CERTIFICATES |                                                  |    |
| APPENDIX D: SAR TISSUE SPECIFICATIONS                 |                                                  |    |
| APPENDIX E: SAR SYSTEM VALIDATION                     |                                                  |    |
| APPENDIX F: SAR TEST DIAGRAMS AND PHOTOGRAPHS         |                                                  |    |

|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSMG928R4                  |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset | Page 2 of 26                                                                          |                                        |

# 1 DEVICE UNDER TEST

## 1.1 Device Overview

| Band & Mode        | Operating Modes | Tx Frequency          |
|--------------------|-----------------|-----------------------|
| GSM/GPRS/EDGE 850  | Voice/Data      | 824.20 - 848.80 MHz   |
| UMTS 850           | Voice/Data      | 826.40 - 846.60 MHz   |
| GSM/GPRS/EDGE 1900 | Voice/Data      | 1850.20 - 1909.80 MHz |
| UMTS 1900          | Voice/Data      | 1852.4 - 1907.6 MHz   |
| Cell. CDMA/EVDO    | Voice/Data      | 824.70 - 848.31 MHz   |
| PCS CDMA/EVDO      | Voice/Data      | 1851.25 - 1908.75 MHz |
| LTE Band 12        | Data            | 701.5 - 713.5 MHz     |
| LTE Band 13        | Data            | 779.5 - 784.5 MHz     |
| LTE Band 5 (Cell)  | Data            | 824.7 - 848.3 MHz     |
| LTE Band 4 (AWS)   | Data            | 1710.7 - 1754.3 MHz   |
| LTE Band 25 (PCS)  | Data            | 1850.7 - 1914.3 MHz   |
| 2.4 GHz WLAN       | Data            | 2412 - 2462 MHz       |
| U-NII-1            | Data            | 5180 - 5240 MHz       |
| U-NII-2A           | Data            | 5260 - 5320 MHz       |
| U-NII-2C           | Data            | 5500 - 5720 MHz       |
| U-NII-3            | Data            | 5745 - 5825 MHz       |
| Bluetooth          | Data            | 2402 - 2480 MHz       |
| NFC                | Data            | 13.56 MHz             |
| ANT+               | Data            | 2402 - 2480 MHz       |
| MST                | Data            | 1-8.3 kHz             |

Note: This permissive change is to reflect the addition of the wireless charging battery cover only. There are no changes made to the host device – all transmission modes/bands, output power levels, antenna locations, and simultaneous transmission scenarios remain identical to the original certification.

## 1.2 Wireless Charging Battery Cover

This DUT may be used with an optional wireless charging battery cover that is used on the back of the device. Per FCC KDB Publication 648474 D04v01r02 and April 2014 TCB Workshop slides, SAR with the additional wireless charging cover was measured for the configuration with the highest reported SAR (amongst all modes) for each frequency band and each exposure condition. SAR tests were additionally performed for any test configurations in the original equipment authorization with 1g SAR >1.2 W/kg or 10g SAR > 3.0 W/kg. In addition, SAR measurements without the accessory were repeated to confirm the host test samples produced same range of SAR as in the original filing.

## 1.3 SAR Evaluation Exclusion

Per FCC Guidance and FCC KDB Publication 680106 D01, RF exposure for the portable wireless charging operations due to the cover was evaluated using MPE to confirm numerical SAR evaluation exclusion. Since the field strength levels were < 25% of the MPE limit ~ 5 cm, no numerical SAR analysis was required.

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 3 of 26                    |

## 1.4 Guidance Applied

- IEEE 1528-2003
- FCC KDB Publication 941225 D01v03, D05v02r03, D05Av01, D06v02 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01V02r01 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05r02 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r03, D02v01r01 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 648474 D03-D04 (Phablet Procedures, Wireless Charging Cover)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)
- April 2014 TCB Workshop Notes (Wireless Charging Cover)

## 1.5 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.

|                    | Serial Number          |
|--------------------|------------------------|
| GSM/GPRS/EDGE 850  | 9660B                  |
| GSM/GPRS/EDGE 1900 | 9635F                  |
| UMTS 1900          | 930ED                  |
| Cell. CDMA/EVDO    | 96361                  |
| PCS CDMA/EVDO      | 9660B                  |
| LTE Band 12        | 93705                  |
| LTE Band 13        | 96361                  |
| LTE Band 4 (AWS)   | 96361,<br>930ED, 96547 |
| 2.4 GHz WLAN       | 9587C                  |
| 5 GHz WLAN         | 9587C                  |

|                                             |                                                                                                                                   |                                      |                                                                                       |                                        |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG928R4                         |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 4 of 26                           |

## 2 INTRODUCTION

The FCC and Industry Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [22]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

### 2.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density ( $\rho$ ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 2-1).

**Equation 2-1**  
**SAR Mathematical Equation**

$$SAR = \frac{d}{dt} \left( \frac{dU}{dm} \right) = \frac{d}{dt} \left( \frac{dU}{\rho dv} \right)$$

**SAR is expressed in units of Watts per Kilogram (W/kg).**

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

where:

- $\sigma$  = conductivity of the tissue-simulating material (S/m)
- $\rho$  = mass density of the tissue-simulating material (kg/m<sup>3</sup>)
- E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

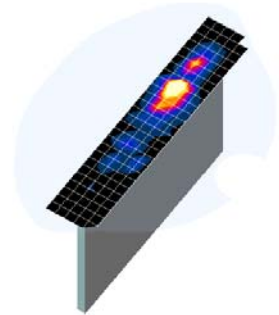
|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG928R4                         |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 5 of 26                           |

### 3 DOSIMETRIC ASSESSMENT

#### 3.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01 and IEEE 1528-2013:

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01 (See Table 3-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01 (See Table 3-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
  - a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 3-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
  - b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
  - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.



**Figure 1**  
**Sample SAR Area**  
**Scan**

**Table 3-1**  
**Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01\***

| Frequency | Maximum Area Scan Resolution (mm)<br>( $\Delta x_{\text{area}}, \Delta y_{\text{area}}$ ) | Maximum Zoom Scan Resolution (mm)<br>( $\Delta x_{\text{zoom}}, \Delta y_{\text{zoom}}$ ) | Maximum Zoom Scan Spatial Resolution (mm) |                             |                                      | Minimum Zoom Scan Volume (mm)<br>(x,y,z) |
|-----------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------|-----------------------------|--------------------------------------|------------------------------------------|
|           |                                                                                           |                                                                                           | Uniform Grid                              | Graded Grid                 |                                      |                                          |
|           |                                                                                           |                                                                                           |                                           | $\Delta z_{\text{zoom}}(n)$ | $\Delta z_{\text{zoom}}(1)^*$        |                                          |
| ≤ 2 GHz   | ≤ 15                                                                                      | ≤ 8                                                                                       | ≤ 5                                       | ≤ 4                         | ≤ 1.5* $\Delta z_{\text{zoom}}(n-1)$ | ≥ 30                                     |
| 2-3 GHz   | ≤ 12                                                                                      | ≤ 5                                                                                       | ≤ 5                                       | ≤ 4                         | ≤ 1.5* $\Delta z_{\text{zoom}}(n-1)$ | ≥ 30                                     |
| 3-4 GHz   | ≤ 12                                                                                      | ≤ 5                                                                                       | ≤ 4                                       | ≤ 3                         | ≤ 1.5* $\Delta z_{\text{zoom}}(n-1)$ | ≥ 28                                     |
| 4-5 GHz   | ≤ 10                                                                                      | ≤ 4                                                                                       | ≤ 3                                       | ≤ 2.5                       | ≤ 1.5* $\Delta z_{\text{zoom}}(n-1)$ | ≥ 25                                     |
| 5-6 GHz   | ≤ 10                                                                                      | ≤ 4                                                                                       | ≤ 2                                       | ≤ 2                         | ≤ 1.5* $\Delta z_{\text{zoom}}(n-1)$ | ≥ 22                                     |

\*Also compliant to IEEE 1528-2013 Table 6

|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG928R4                         |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 6 of 26                           |

© 2015 PCTEST Engineering Laboratory, Inc.

REV 14.0 M  
07/21/2014

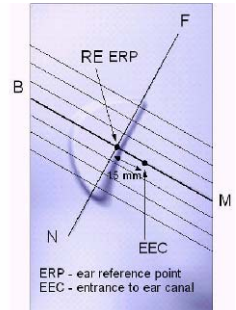
© 2015 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact [INFO@PCTESTLAB.COM](mailto:INFO@PCTESTLAB.COM).

## 4

## DEFINITION OF REFERENCE POINTS

### 4.1 EAR REFERENCE POINT

Figure 3 shows the front, back and side views of the SAM Twin 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 ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 2. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front), also called the Reference Pivoting Line, is not perpendicular to the reference plane (see Figure 2). 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].



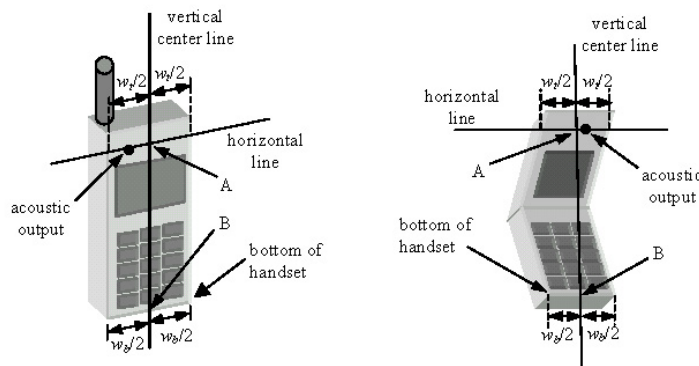
**Figure 2**  
Close-Up Side view  
of ERP

### 4.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the acoustic output located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (See Figure 4). The acoustic output was then located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at its top and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point.



**Figure 3**  
Front, back and side view of SAM Twin Phantom



**Figure 4**  
Handset Vertical Center & Horizontal Line Reference Points

|                                             |                                                                                                                                   |                                      |                                                                                       |                                        |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG928R4                         |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 7 of 26                           |

## 5 TEST CONFIGURATION POSITIONS FOR HANDSETS

### 5.1 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity  $\epsilon = 3$  and loss tangent  $\delta = 0.02$ .

### 5.2 Positioning for Cheek

1. The test device was positioned with 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 5), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

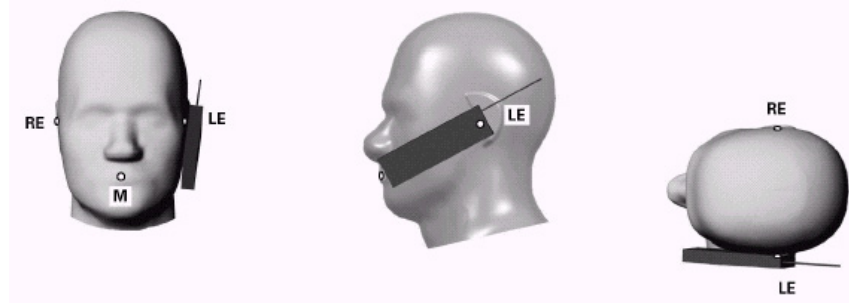


Figure 5 Front, Side and Top View of Cheek Position

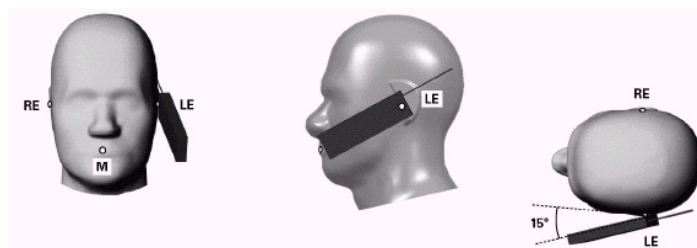
2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the pinna.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the reference plane.
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was 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, the device was rotated about the NF line until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 6).

### 5.3 Positioning for Ear / 15° Tilt

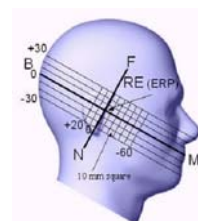
With the test device aligned in the “Cheek Position”:

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. In this situation, the tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 6).

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 8 of 26                    |



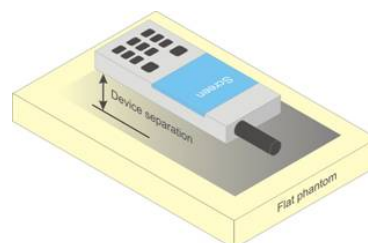
**Figure 6 Front, Side and Top View of Ear/15° Tilt Position**



**Figure 7 Side view w/ relevant markings**

## 5.4 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 8). Per FCC KDB Publication 648474 D04v01, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01v05 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is  $> 1.2 \text{ W/kg}$ , the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.



**Figure 8 Sample Body-Worn Diagram**

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 multiple accessories that contain metallic components are tested with the device with each accessory. 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 with a separation distance between the back of the device and the flat phantom is used. Test position spacing was 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 in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 9 of 26                    |

## 5.5 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1-g body and 10-g phablet SAR Exclusion Thresholds found in KDB Publication 44798 D01v05 should be applied to determine SAR test requirements.

Per KDB Publication 447498 D01v06, Cell phones (handsets) are not normally designed to be used on extremities or operated in extremity only exposure conditions. The maximum output power levels of handsets generally do not require phablet SAR testing to show compliance. Therefore, extremity SAR was not evaluated for this device.

## 5.6 Wireless Router Configurations

Some battery-operated handsets have the capability to transmit and receive user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06v02 where SAR test considerations for handsets ( $L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$ ) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v05 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

## 5.7 Additional Test Positions due to Proximity Conditions

This device uses a sensor to reduce output powers in phablet (hand-held) use conditions. When the sensor detects a user is touching the device on or near to the antenna the device reduces the maximum allowed output power. However, the proximity sensor is not active when the device is moved beyond the sensor triggering distance and the maximum output power is no longer limited. Therefore, an additional exposure condition is needed in the vicinity of the triggering distance to ensure SAR is compliant when the device is allowed to operate at a non-reduced output power level.

FCC KDB 616217 D04 Section 6 was used as a guideline for selecting SAR test distances for this device at these additional exposure conditions. The smallest separation distance determined by the sensor triggering and sensor coverage for each applicable edge, minus 1 mm, was used as the test separation distance for SAR testing.

The proximity sensor is designed to support sufficient detection range and sensitivity to cover regions of the sensors in all applicable directions.

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 10 of 26                   |

© 2015 PCTEST Engineering Laboratory, Inc.

REV 14.0 M  
07/21/2014

© 2015 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact [INFO@PCTESTLAB.COM](mailto:INFO@PCTESTLAB.COM).

## 5.8 Phablet Configurations

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC minitables that support voice calls next to the ear, the phablets procedures outlined in KDB Publication 648474 D04 v01r01DR04 should be applied to evaluate SAR compliance. A device marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance. In addition to the normally required head and body-worn accessory SAR test procedures required for handsets, the UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna  $\leq 25$  mm from that surface or edge, in direct contact with the phantom, for 10-g SAR. The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g SAR is required only for the surfaces and edges with hotspot mode scaled to the maximum output power (including tolerance) is 1-g SAR > 1.2 W/kg.

|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSMG928R4                  |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 11 of 26                          |

© 2015 PCTEST Engineering Laboratory, Inc.

REV 14.0 M  
07/21/2014

© 2015 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact [INFO@PCTESTLAB.COM](mailto:INFO@PCTESTLAB.COM).

## 6 RF EXPOSURE LIMITS

### 6.1 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.

### 6.2 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 6-1**  
**SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6**

| HUMAN EXPOSURE LIMITS                                               |                                                                           |                                                                   |
|---------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------|
|                                                                     | UNCONTROLLED ENVIRONMENT<br><i>General Population</i><br>(W/kg) or (mW/g) | CONTROLLED ENVIRONMENT<br><i>Occupational</i><br>(W/kg) or (mW/g) |
| <b>Peak Spatial Average SAR</b><br>Head                             | 1.6                                                                       | 8.0                                                               |
| <b>Whole Body SAR</b>                                               | 0.08                                                                      | 0.4                                                               |
| <b>Peak Spatial Average SAR</b><br>Hands, Feet, Ankle, Wrists, etc. | 4.0                                                                       | 20                                                                |

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 12 of 26                   |

## 7 SYSTEM VERIFICATION

### 7.1 Tissue Verification

**Table 7-1  
Measured Tissue Properties**

| Calibrated for Tests Performed on: | Tissue Type | Tissue Temp During Calibration (C°) | Measured Frequency (MHz) | Measured Conductivity, $\sigma$ (S/m) | Measured Dielectric Constant, $\epsilon$ | TARGET Conductivity, $\sigma$ (S/m) | TARGET Dielectric Constant, $\epsilon$ | % dev $\sigma$ | % dev $\epsilon$ |
|------------------------------------|-------------|-------------------------------------|--------------------------|---------------------------------------|------------------------------------------|-------------------------------------|----------------------------------------|----------------|------------------|
| 8/21/2015                          | 750H        | 22.1                                | 725                      | 0.871                                 | 42.324                                   | 0.891                               | 42.071                                 | -2.24%         | 0.60%            |
|                                    |             |                                     | 740                      | 0.885                                 | 42.131                                   | 0.893                               | 41.994                                 | -0.90%         | 0.33%            |
|                                    |             |                                     | 755                      | 0.900                                 | 42.016                                   | 0.894                               | 41.916                                 | 0.67%          | 0.24%            |
|                                    |             |                                     | 770                      | 0.913                                 | 41.792                                   | 0.895                               | 41.838                                 | 2.01%          | -0.11%           |
|                                    |             |                                     | 785                      | 0.925                                 | 41.594                                   | 0.896                               | 41.760                                 | 3.24%          | -0.40%           |
| 8/20/2015                          | 835H        | 22.5                                | 820                      | 0.905                                 | 42.292                                   | 0.899                               | 41.578                                 | 0.67%          | 1.72%            |
|                                    |             |                                     | 835                      | 0.920                                 | 42.100                                   | 0.900                               | 41.500                                 | 2.22%          | 1.45%            |
|                                    |             |                                     | 850                      | 0.935                                 | 41.916                                   | 0.916                               | 41.500                                 | 2.07%          | 1.00%            |
| 8/20/2015                          | 1750H       | 22.1                                | 1710                     | 1.328                                 | 38.486                                   | 1.348                               | 40.142                                 | -1.48%         | -4.13%           |
|                                    |             |                                     | 1750                     | 1.370                                 | 38.232                                   | 1.371                               | 40.079                                 | -0.07%         | -4.61%           |
|                                    |             |                                     | 1790                     | 1.409                                 | 38.094                                   | 1.394                               | 40.016                                 | 1.08%          | -4.80%           |
| 8/20/2015                          | 1900H       | 23.2                                | 1850                     | 1.379                                 | 40.031                                   | 1.400                               | 40.000                                 | -1.50%         | 0.08%            |
|                                    |             |                                     | 1880                     | 1.408                                 | 39.897                                   | 1.400                               | 40.000                                 | 0.57%          | -0.26%           |
|                                    |             |                                     | 1910                     | 1.439                                 | 39.816                                   | 1.400                               | 40.000                                 | 2.79%          | -0.46%           |
| 8/19/2015                          | 2450H       | 23.5                                | 2400                     | 1.788                                 | 38.900                                   | 1.756                               | 39.289                                 | 1.82%          | -0.99%           |
|                                    |             |                                     | 2450                     | 1.846                                 | 38.712                                   | 1.800                               | 39.200                                 | 2.56%          | -1.24%           |
|                                    |             |                                     | 2500                     | 1.907                                 | 38.520                                   | 1.855                               | 39.136                                 | 2.80%          | -1.57%           |
| 8/18/2015                          | 5800H       | 22.8                                | 5745                     | 5.019                                 | 36.918                                   | 5.214                               | 35.363                                 | -3.74%         | 4.40%            |
|                                    |             |                                     | 5800                     | 5.084                                 | 36.644                                   | 5.270                               | 35.300                                 | -3.53%         | 3.81%            |
|                                    |             |                                     | 700                      | 0.918                                 | 55.858                                   | 0.959                               | 55.726                                 | -4.28%         | 0.24%            |
| 8/20/2015                          | 750B        | 22.3                                | 710                      | 0.928                                 | 55.731                                   | 0.960                               | 55.687                                 | -3.33%         | 0.08%            |
|                                    |             |                                     | 725                      | 0.940                                 | 55.607                                   | 0.961                               | 55.629                                 | -2.19%         | -0.04%           |
|                                    |             |                                     | 740                      | 0.955                                 | 55.367                                   | 0.963                               | 55.570                                 | -0.83%         | -0.37%           |
|                                    |             |                                     | 755                      | 0.971                                 | 55.315                                   | 0.964                               | 55.512                                 | 0.73%          | -0.35%           |
|                                    |             |                                     | 770                      | 0.987                                 | 55.071                                   | 0.965                               | 55.453                                 | 2.28%          | -0.69%           |
|                                    |             |                                     | 785                      | 0.998                                 | 54.941                                   | 0.966                               | 55.395                                 | 3.31%          | -0.82%           |
| 8/21/2015                          | 835B        | 22.1                                | 820                      | 0.985                                 | 53.783                                   | 0.969                               | 55.258                                 | 1.65%          | -2.67%           |
|                                    |             |                                     | 835                      | 1.000                                 | 53.648                                   | 0.970                               | 55.200                                 | 3.09%          | -2.81%           |
|                                    |             |                                     | 850                      | 1.015                                 | 53.502                                   | 0.988                               | 55.154                                 | 2.73%          | -3.00%           |
| 8/19/2015                          | 1750B       | 22.5                                | 1710                     | 1.438                                 | 51.641                                   | 1.463                               | 53.537                                 | -1.71%         | -3.54%           |
|                                    |             |                                     | 1750                     | 1.483                                 | 51.462                                   | 1.488                               | 53.432                                 | -0.34%         | -3.69%           |
|                                    |             |                                     | 1790                     | 1.526                                 | 51.350                                   | 1.514                               | 53.326                                 | 0.79%          | -3.71%           |
| 9/8/2015                           | 1750B       | 21.3                                | 1710                     | 1.446                                 | 51.951                                   | 1.463                               | 53.537                                 | -1.16%         | -2.96%           |
|                                    |             |                                     | 1750                     | 1.489                                 | 51.846                                   | 1.488                               | 53.432                                 | 0.07%          | -2.97%           |
|                                    |             |                                     | 1790                     | 1.530                                 | 51.669                                   | 1.514                               | 53.326                                 | 1.06%          | -3.11%           |
| 8/19/2015                          | 1900B       | 22.4                                | 1850                     | 1.520                                 | 51.903                                   | 1.520                               | 53.300                                 | 0.00%          | -2.62%           |
|                                    |             |                                     | 1880                     | 1.554                                 | 51.804                                   | 1.520                               | 53.300                                 | 2.24%          | -2.81%           |
|                                    |             |                                     | 1910                     | 1.589                                 | 51.695                                   | 1.520                               | 53.300                                 | 4.54%          | -3.01%           |
| 8/24/2015                          | 1900B       | 22.3                                | 1850                     | 1.527                                 | 52.098                                   | 1.520                               | 53.300                                 | 0.46%          | -2.26%           |
|                                    |             |                                     | 1880                     | 1.560                                 | 51.986                                   | 1.520                               | 53.300                                 | 2.63%          | -2.47%           |
|                                    |             |                                     | 1910                     | 1.594                                 | 51.857                                   | 1.520                               | 53.300                                 | 4.87%          | -2.71%           |
| 8/19/2015                          | 2400B       | 21.4                                | 2400                     | 1.937                                 | 51.162                                   | 1.902                               | 52.767                                 | 1.84%          | -3.04%           |
|                                    |             |                                     | 2450                     | 2.004                                 | 50.974                                   | 1.950                               | 52.700                                 | 2.77%          | -3.28%           |
|                                    |             |                                     | 2500                     | 2.075                                 | 50.777                                   | 2.021                               | 52.636                                 | 2.67%          | -3.53%           |
| 8/18/2015                          | 5800B       | 23.0                                | 5700                     | 5.987                                 | 46.693                                   | 5.883                               | 48.336                                 | 1.77%          | -3.40%           |
|                                    |             |                                     | 5745                     | 6.012                                 | 46.560                                   | 5.936                               | 48.275                                 | 1.28%          | -3.55%           |
|                                    |             |                                     | 5800                     | 6.141                                 | 46.449                                   | 6.000                               | 48.200                                 | 2.35%          | -3.63%           |

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG928R4                         |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 13 of 26                          |

© 2015 PCTEST Engineering Laboratory, Inc.

REV 14.0 M  
07/21/2014

© 2015 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact [INFO@PCTESTLAB.COM](mailto:INFO@PCTESTLAB.COM).

## 7.2 Test System Verification

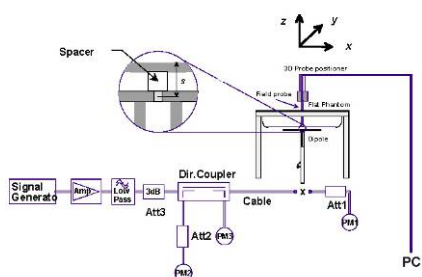
Prior to SAR assessment, the system is verified to  $\pm 10\%$  of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in Appendix E.

**Table 7-2**  
**System Verification Results – 1g**

| System Verification<br>TARGET & MEASURED |                        |             |            |                |                  |                 |           |          |                                   |                                     |                                         |                             |
|------------------------------------------|------------------------|-------------|------------|----------------|------------------|-----------------|-----------|----------|-----------------------------------|-------------------------------------|-----------------------------------------|-----------------------------|
| SAR System #                             | Tissue Frequency (MHz) | Tissue Type | Date:      | Amb. Temp (°C) | Liquid Temp (°C) | Input Power (W) | Dipole SN | Probe SN | Measured SAR <sub>1g</sub> (W/kg) | 1 W Target SAR <sub>1g</sub> (W/kg) | 1 W Normalized SAR <sub>1g</sub> (W/kg) | Deviation <sub>1g</sub> (%) |
| E                                        | 750                    | HEAD        | 08/21/2015 | 23.6           | 22.2             | 0.200           | 1003      | 3332     | 1.550                             | 8.090                               | 7.750                                   | -4.20%                      |
| J                                        | 835                    | HEAD        | 08/20/2015 | 22.0           | 22.5             | 0.200           | 4d119     | 3319     | 1.800                             | 9.380                               | 9.000                                   | -4.05%                      |
| G                                        | 1750                   | HEAD        | 08/20/2015 | 23.3           | 22.5             | 0.100           | 1051      | 3318     | 3.770                             | 36.200                              | 37.700                                  | 4.14%                       |
| J                                        | 1900                   | HEAD        | 08/20/2015 | 21.8           | 22.3             | 0.100           | 5d141     | 3319     | 3.940                             | 39.900                              | 39.400                                  | -1.25%                      |
| H                                        | 2450                   | HEAD        | 08/19/2015 | 23.2           | 23.2             | 0.100           | 882       | 3263     | 5.490                             | 52.300                              | 54.900                                  | 4.97%                       |
| A                                        | 5800                   | HEAD        | 08/18/2015 | 21.5           | 22.8             | 0.050           | 1191      | 3914     | 4.080                             | 82.300                              | 81.600                                  | -0.85%                      |
| E                                        | 750                    | BODY        | 08/20/2015 | 23.0           | 22.3             | 0.200           | 1003      | 3332     | 1.720                             | 8.460                               | 8.600                                   | 1.65%                       |
| G                                        | 835                    | BODY        | 08/21/2015 | 21.3           | 21.8             | 0.200           | 4d119     | 3318     | 1.880                             | 9.200                               | 9.400                                   | 2.17%                       |
| I                                        | 1750                   | BODY        | 08/19/2015 | 23.3           | 22.6             | 0.100           | 1051      | 3213     | 3.820                             | 37.100                              | 38.200                                  | 2.96%                       |
| H                                        | 1900                   | BODY        | 08/19/2015 | 21.7           | 22.3             | 0.100           | 5d141     | 3263     | 4.210                             | 40.000                              | 42.100                                  | 5.25%                       |
| G                                        | 2450                   | BODY        | 08/19/2015 | 21.9           | 21.4             | 0.100           | 882       | 3318     | 5.360                             | 50.700                              | 53.600                                  | 5.72%                       |
| E                                        | 5800                   | BODY        | 08/18/2015 | 23.2           | 22.1             | 0.050           | 1057      | 3589     | 3.570                             | 75.100                              | 71.400                                  | -4.93%                      |

**Table 7-3**  
**System Verification Results – 10g**

| System Verification<br>TARGET & MEASURED |                        |             |            |                |                  |                 |           |          |                                    |                                      |                                          |                              |
|------------------------------------------|------------------------|-------------|------------|----------------|------------------|-----------------|-----------|----------|------------------------------------|--------------------------------------|------------------------------------------|------------------------------|
| SAR System #                             | Tissue Frequency (MHz) | Tissue Type | Date:      | Amb. Temp (°C) | Liquid Temp (°C) | Input Power (W) | Dipole SN | Probe SN | Measured SAR <sub>10g</sub> (W/kg) | 1 W Target SAR <sub>10g</sub> (W/kg) | 1 W Normalized SAR <sub>10g</sub> (W/kg) | Deviation <sub>10g</sub> (%) |
| E                                        | 750                    | BODY        | 08/20/2015 | 23.0           | 22.3             | 0.200           | 1003      | 3332     | 1.150                              | 5.580                                | 5.750                                    | 3.05%                        |
| E                                        | 1750                   | BODY        | 09/08/2015 | 22.7           | 21.2             | 0.100           | 1051      | 3351     | 1.960                              | 20.000                               | 19.600                                   | -2.00%                       |
| H                                        | 1900                   | BODY        | 08/24/2015 | 23.3           | 22.1             | 0.100           | 5d141     | 3263     | 2.200                              | 21.200                               | 22.000                                   | 3.77%                        |
| E                                        | 5800                   | BODY        | 08/18/2015 | 23.2           | 22.1             | 0.050           | 1057      | 3589     | 1.000                              | 20.600                               | 20.000                                   | -2.91%                       |



**Figure 9**  
**System Verification Setup Diagram**



**Figure 10**  
**System Verification Setup Photo**

|                                      |                                    |                               |  |                                 |
|--------------------------------------|------------------------------------|-------------------------------|--|---------------------------------|
| FCC ID: A3LSMG928R4                  |                                    | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15 | DUT Type:<br>Portable Handset |  | Page 14 of 26                   |

## 8

## SAR DATA SUMMARY

## 8.1 Standalone Head SAR Data

Table 8-1  
CDMA Head SAR

| MEASUREMENT RESULTS                                                                               |     |            |          |                             |                       |                  |       |                                                 |                      |            |                    |                |                           |                          |                             |        |
|---------------------------------------------------------------------------------------------------|-----|------------|----------|-----------------------------|-----------------------|------------------|-------|-------------------------------------------------|----------------------|------------|--------------------|----------------|---------------------------|--------------------------|-----------------------------|--------|
| FREQUENCY                                                                                         |     | Mode/Band  | Service  | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side  | Test Position                                   | Device Serial Number | Duty Cycle | Accessory SAR (1g) | Scaling Factor | Accessory Scaled SAR (1g) | Original Scaled SAR (1g) | Re-verified Scaled SAR (1g) | Plot # |
| MHz                                                                                               | Ch  |            |          |                             |                       |                  |       |                                                 |                      |            | (W/kg)             |                | (W/kg)                    | (W/kg)                   | (W/kg)                      |        |
| 836.52                                                                                            | 384 | Cell. CDMA | RC3/SO55 | 25.0                        | 24.80                 | 0.09             | Right | Cheek                                           | 96361                | 1:1        | 0.230              | 1.047          | 0.241                     | 0.407                    | 0.365                       | A1     |
| 1880.00                                                                                           | 600 | PCS CDMA   | RC3/SO55 | 25.0                        | 24.25                 | 0.05             | Right | Cheek                                           | 9660B                | 1:1        | 0.090              | 1.189          | 0.107                     | 0.196                    | 0.185                       | A2     |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |            |          |                             |                       |                  |       | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |                      |            |                    |                |                           |                          |                             |        |

Table 8-2  
LTE Head SAR Data

| MEASUREMENT RESULTS                      |       |      |                 |                             |                       |                  |          |      |               |            |         |           |                      |            |                      |                |                           |                          |                             |        |    |
|------------------------------------------|-------|------|-----------------|-----------------------------|-----------------------|------------------|----------|------|---------------|------------|---------|-----------|----------------------|------------|----------------------|----------------|---------------------------|--------------------------|-----------------------------|--------|----|
| FREQUENCY                                |       | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Side | Test Position | Modulation | RB Size | RB Offset | Device Serial Number | Duty Cycle | Accessory SAR (1g)   | Scaling Factor | Accessory Scaled SAR (1g) | Original Scaled SAR (1g) | Re-verified Scaled SAR (1g) | Plot # |    |
| MHz                                      | Ch.   |      |                 |                             |                       |                  |          |      |               |            |         |           |                      |            | (W/kg)               |                | (W/kg)                    | (W/kg)                   |                             |        |    |
| 782.00                                   | 23230 | Mid  | LTE Band 13     | 10                          | 25.0                  | 24.34            | 0.20     | 0    | Right         | Cheek      | QPSK    | 1         | 0                    | 96361      | 1:1                  | 0.185          | 1.164                     | 0.215                    | 0.260                       | 0.256  | A3 |
| 1732.50                                  | 20175 | Mid  | LTE Band 4      | 20                          | 24.5                  | 24.50            | -0.18    | 0    | Right         | Cheek      | QPSK    | 1         | 0                    | 96361      | 1:1                  | 0.200          | 1.000                     | 0.200                    | 0.238                       | 0.207  | A4 |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |       |      |                 |                             |                       |                  |          |      |               |            |         |           |                      |            | Head                 |                |                           |                          |                             |        |    |
| Spatial Peak                             |       |      |                 |                             |                       |                  |          |      |               |            |         |           |                      |            | 1.6 W/kg (mW/g)      |                |                           |                          |                             |        |    |
| Uncontrolled Exposure/General Population |       |      |                 |                             |                       |                  |          |      |               |            |         |           |                      |            | averaged over 1 gram |                |                           |                          |                             |        |    |

Table 8-3  
WLAN Head SAR Data

| MEASUREMENT RESULTS                                                                               |     |         |         |                 |                             |                       |                  |       |                                                 |                 |                      |                  |                |                       |                    |                        |                             |                           |                          |                             |        |
|---------------------------------------------------------------------------------------------------|-----|---------|---------|-----------------|-----------------------------|-----------------------|------------------|-------|-------------------------------------------------|-----------------|----------------------|------------------|----------------|-----------------------|--------------------|------------------------|-----------------------------|---------------------------|--------------------------|-----------------------------|--------|
| FREQUENCY                                                                                         |     | Mode    | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side  | Test Position                                   | Antenna Config. | Device Serial Number | Data Rate (Mbps) | Duty Cycle (%) | Peak SAR of Area Scan | Accessory SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Accessory Scaled SAR (1g) | Original Scaled SAR (1g) | Re-verified Scaled SAR (1g) | Plot # |
| MHz                                                                                               | Ch. |         |         |                 |                             |                       |                  |       |                                                 |                 |                      |                  |                | W/kg                  | (W/kg)             |                        |                             | (W/kg)                    | (W/kg)                   |                             |        |
| 2462                                                                                              | 11  | 802.11b | DSSS    | 22              | 15.5                        | 15.45                 | -0.01            | Right | Cheek                                           | 1               | 9587C                | 1                | 100.0          | 0.458                 | 0.329              | 1.012                  | 1.000                       | 0.333                     | 0.543                    | 0.606                       | A5     |
| 5745                                                                                              | 149 | 802.11a | OFDM    | 20              | 10.5                        | 10.45                 | 0.14             | Right | Cheek                                           | 1               | 9587C                | 6                | 99.3           | 0.450                 | 0.195              | 1.012                  | 1.008                       | 0.199                     | 0.399                    | 0.364                       | A6     |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |         |         |                 |                             |                       |                  |       | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |                 |                      |                  |                |                       |                    |                        |                             |                           |                          |                             |        |

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 15 of 26                   |

## 8.2 Standalone Body-Worn SAR Data

**Table 8-4**  
**2G/3G Body-Worn SAR Data**

| MEASUREMENT RESULTS                      |     |          |             |                             |                       |                  |                      |                      |                 |            |      |                    |                |                           |                          |                             |        |
|------------------------------------------|-----|----------|-------------|-----------------------------|-----------------------|------------------|----------------------|----------------------|-----------------|------------|------|--------------------|----------------|---------------------------|--------------------------|-----------------------------|--------|
| FREQUENCY                                |     | Mode     | Service     | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing              | Device Serial Number | # of Time Slots | Duty Cycle | Side | Accessory SAR (1g) | Scaling Factor | Accessory Scaled SAR (1g) | Original Scaled SAR (1g) | Re-verified Scaled SAR (1g) | Plot # |
| MHz                                      | Ch. |          |             |                             |                       |                  |                      |                      |                 |            |      | (W/kg)             |                | (W/kg)                    | (W/kg)                   | (W/kg)                      |        |
| 836.60                                   | 190 | GSM 850  | GSM         | 33.5                        | 33.12                 | -0.20            | 15 mm                | 9660B                | 1               | 1:8.3      | back | 0.121              | 1.091          | 0.132                     | 0.410                    | 0.428                       | A7     |
| 1880.00                                  | 600 | PCS CDMA | TDSO / SO32 | 25.0                        | 24.24                 | 0.01             | 15 mm                | 9660B                | N/A             | 1:1        | back | 0.092              | 1.191          | 0.110                     | 0.409                    | 0.414                       | A8     |
| Spatial Peak                             |     |          |             |                             |                       |                  | 1.6 W/kg (mW/g)      |                      |                 |            |      |                    |                |                           |                          |                             |        |
| Uncontrolled Exposure/General Population |     |          |             |                             |                       |                  | averaged over 1 gram |                      |                 |            |      |                    |                |                           |                          |                             |        |

**Table 8-5**  
**LTE Body-Worn SAR Data**

| MEASUREMENT RESULTS                      |       |      |                  |                             |                       |                  |                      |                      |            |         |           |         |       |            |                    |                |                           |                          |                             |        |     |
|------------------------------------------|-------|------|------------------|-----------------------------|-----------------------|------------------|----------------------|----------------------|------------|---------|-----------|---------|-------|------------|--------------------|----------------|---------------------------|--------------------------|-----------------------------|--------|-----|
| FREQUENCY                                |       | Mode | Bandwidth [MHz]  | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB]             | Device Serial Number | Modulation | RB Size | RB Offset | Spacing | Side  | Duty Cycle | Accessory SAR (1g) | Scaling Factor | Accessory Scaled SAR (1g) | Original Scaled SAR (1g) | Re-verified Scaled SAR (1g) | Plot # |     |
| MHz                                      | Ch.   |      |                  |                             |                       |                  |                      |                      |            |         |           |         |       |            | (W/kg)             |                | (W/kg)                    | (W/kg)                   | (W/kg)                      |        |     |
| 782.00                                   | 23230 | Mid  | LTE Band 13      | 10                          | 25.0                  | 24.34            | 0.04                 | 0                    | 96361      | QPSK    | 1         | 0       | 15 mm | back       | 1:1                | 0.140          | 1.164                     | 0.163                    | 0.434                       | 0.438  | A9  |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 24.5                  | 24.50            | -0.01                | 0                    | 96361      | QPSK    | 1         | 0       | 15 mm | back       | 1:1                | 0.124          | 1.000                     | 0.124                    | 0.751                       | 0.655  | A10 |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |       |      |                  |                             |                       |                  | Body                 |                      |            |         |           |         |       |            |                    |                |                           |                          |                             |        |     |
| Spatial Peak                             |       |      |                  |                             |                       |                  | 1.6 W/kg (mW/g)      |                      |            |         |           |         |       |            |                    |                |                           |                          |                             |        |     |
| Uncontrolled Exposure/General Population |       |      |                  |                             |                       |                  | averaged over 1 gram |                      |            |         |           |         |       |            |                    |                |                           |                          |                             |        |     |

**Table 8-6**  
**WLAN Body-Worn SAR Data**

| MEASUREMENT RESULTS                      |     |         |         |                 |                             |                       |                  |         |                 |                      |                  |      |                |                       |                    |                        |                             |                          |                          |                             |        |
|------------------------------------------|-----|---------|---------|-----------------|-----------------------------|-----------------------|------------------|---------|-----------------|----------------------|------------------|------|----------------|-----------------------|--------------------|------------------------|-----------------------------|--------------------------|--------------------------|-----------------------------|--------|
| FREQUENCY                                |     | Mode    | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing | Antenna Config. | Device Serial Number | Data Rate (Mbps) | Side | Duty Cycle (%) | Peak SAR of Area Scan | Accessory SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Accessed Scaled SAR (1g) | Original Scaled SAR (1g) | Re-verified Scaled SAR (1g) | Plot # |
| MHz                                      | Ch. |         |         |                 |                             |                       |                  |         |                 |                      |                  |      |                | W/kg                  | (W/kg)             |                        |                             | (W/kg)                   | (W/kg)                   | (W/kg)                      |        |
| 2412                                     | 1   | 802.11b | DSSS    | 22              | 17.5                        | 16.85                 | 0.13             | 10 mm   | 2               | 9587C                | 1                | back | 99.7           | 0.044                 | 0.037              | 1.161                  | 1.004                       | 0.043                    | 0.191                    | 0.191                       | A11    |
| 5745                                     | 149 | 802.11a | OFDM    | 20              | 13.5                        | 12.84                 | 0.06             | 10 mm   | 2               | 9587C                | 6                | back | 98.6           | 0.051                 | 0.024              | 1.164                  | 1.014                       | 0.029                    | 0.042                    | 0.045                       | A12    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |     |         |         |                 |                             |                       |                  |         |                 |                      |                  |      |                | Body                  |                    |                        |                             |                          |                          |                             |        |
| Spatial Peak                             |     |         |         |                 |                             |                       |                  |         |                 |                      |                  |      |                | 1.6 W/kg (mW/g)       |                    |                        |                             |                          |                          |                             |        |
| Uncontrolled Exposure/General Population |     |         |         |                 |                             |                       |                  |         |                 |                      |                  |      |                | averaged over 1 gram  |                    |                        |                             |                          |                          |                             |        |

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 16 of 26                   |

© 2015 PCTEST Engineering Laboratory, Inc.

REV 14.0 M  
07/21/2014

© 2015 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact [INFO@PCTESTLAB.COM](mailto:INFO@PCTESTLAB.COM).

## 8.3 Standalone Wireless Router SAR Data

**Table 8-7**  
**2G/3G Hotspot SAR Data**

| MEASUREMENT RESULTS                      |      |           |         |                             |                       |                  |                      |                      |                 |            |        |                    |                |                           |                          |                             |        |
|------------------------------------------|------|-----------|---------|-----------------------------|-----------------------|------------------|----------------------|----------------------|-----------------|------------|--------|--------------------|----------------|---------------------------|--------------------------|-----------------------------|--------|
| FREQUENCY                                |      | Mode      | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing              | Device Serial Number | # of GPRS Slots | Duty Cycle | Side   | Accessory SAR (1g) | Scaling Factor | Accessory Scaled SAR (1g) | Original Scaled SAR (1g) | Re-verified Scaled SAR (1g) | Plot # |
| MHz                                      | Ch.  |           |         |                             |                       |                  |                      |                      |                 |            |        | (W/kg)             |                | (W/kg)                    | (W/kg)                   | (W/kg)                      |        |
| 836.60                                   | 190  | GSM 850   | GPRS    | 30.0                        | 29.97                 | 0.04             | 10 mm                | 9660B                | 3               | 1:2.76     | front  | 0.704              | 1.007          | 0.709                     | 0.981                    | 0.862                       | A13    |
| 1852.40                                  | 9262 | UMTS 1900 | RMC     | 20.5                        | 19.82                 | -0.02            | 10 mm                | 930ED                | N/A             | 1:1        | bottom | 0.601              | 1.169          | 0.703                     | 1.042                    | 1.078                       | A14    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |      |           |         |                             |                       |                  | Body                 |                      |                 |            |        |                    |                |                           |                          |                             |        |
| Spatial Peak                             |      |           |         |                             |                       |                  | 1.6 W/kg (mW/g)      |                      |                 |            |        |                    |                |                           |                          |                             |        |
| Uncontrolled Exposure/General Population |      |           |         |                             |                       |                  | averaged over 1 gram |                      |                 |            |        |                    |                |                           |                          |                             |        |

**Table 8-8**  
**LTE Hotspot SAR Data**

| MEASUREMENT RESULTS                      |       |      |                 |                             |                       |                  |          |                                         |            |         |           |         |       |            |                    |                |                           |                          |                             |        |     |
|------------------------------------------|-------|------|-----------------|-----------------------------|-----------------------|------------------|----------|-----------------------------------------|------------|---------|-----------|---------|-------|------------|--------------------|----------------|---------------------------|--------------------------|-----------------------------|--------|-----|
| FREQUENCY                                |       | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Device Serial Number                    | Modulation | RB Size | RB Offset | Spacing | Side  | Duty Cycle | Accessory SAR (1g) | Scaling Factor | Accessory Scaled SAR (1g) | Original Scaled SAR (1g) | Re-verified Scaled SAR (1g) | Plot # |     |
| MHz                                      | Ch.   |      |                 |                             |                       |                  |          |                                         |            |         |           |         |       |            | (W/kg)             |                | (W/kg)                    | (W/kg)                   |                             |        |     |
| 782.00                                   | 23230 | Mid  | LTE Band 13     | 10                          | 25.0                  | 24.34            | 0.04     | 0                                       | 96361      | QPSK    | 1         | 0       | 10 mm | back       | 1:1                | 0.190          | 1.164                     | 0.221                    | 0.696                       | 0.658  | A15 |
| 1732.50                                  | 20175 | Mid  | LTE Band 4      | 20                          | 20.5                  | 19.71            | -0.02    | 0                                       | 930ED      | QPSK    | 100       | 0       | 10 mm | bottom     | 1:1                | 0.595          | 1.199                     | 0.713                    | 0.900                       | 0.807  | A16 |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |       |      |                 |                             |                       |                  |          |                                         |            |         |           |         |       |            |                    |                |                           |                          |                             |        |     |
| Spatial Peak                             |       |      |                 |                             |                       |                  |          | Body                                    |            |         |           |         |       |            |                    |                |                           |                          |                             |        |     |
| Uncontrolled Exposure/General Population |       |      |                 |                             |                       |                  |          | 1.6 W/kg (mW/g)<br>averaged over 1 gram |            |         |           |         |       |            |                    |                |                           |                          |                             |        |     |

**Table 8-9**  
**WLAN Hotspot SAR Data**

| MEASUREMENT RESULTS                      |     |         |         |                 |                             |                       |                  |                      |                 |                      |                  |       |                |                       |                    |                        |                             |                           |                          |                             |        |
|------------------------------------------|-----|---------|---------|-----------------|-----------------------------|-----------------------|------------------|----------------------|-----------------|----------------------|------------------|-------|----------------|-----------------------|--------------------|------------------------|-----------------------------|---------------------------|--------------------------|-----------------------------|--------|
| FREQUENCY                                |     | Mode    | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing              | Antenna Config. | Device Serial Number | Data Rate (Mbps) | Side  | Duty Cycle (%) | Peak SAR of Area Scan | Accessory SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Accessory Scaled SAR (1g) | Original Scaled SAR (1g) | Re-verified Scaled SAR (1g) | Plot # |
| MHz                                      | Ch. |         |         |                 |                             |                       |                  |                      |                 |                      |                  |       |                | W/kg                  | (W/kg)             |                        |                             | (W/kg)                    | (W/kg)                   | (W/kg)                      |        |
| 2412                                     | 1   | 802.11b | DSSS    | 22              | 17.5                        | 16.85                 | 0.13             | 10 mm                | 2               | 9587C                | 1                | back  | 99.7           | 0.044                 | 0.037              | 1.161                  | 1.004                       | 0.043                     | 0.191                    | 0.191                       | A11    |
| 5745                                     | 149 | 802.11a | OFDM    | 20              | 13.5                        | 12.84                 | 0.08             | 10 mm                | 2               | 9587C                | 6                | front | 98.6           | 0.266                 | 0.091              | 1.164                  | 1.014                       | 0.107                     | 0.214                    | 0.229                       | A17    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |     |         |         |                 |                             |                       |                  | Body                 |                 |                      |                  |       |                |                       |                    |                        |                             |                           |                          |                             |        |
| Spatial Peak                             |     |         |         |                 |                             |                       |                  | 1.6 W/kg (mW/g)      |                 |                      |                  |       |                |                       |                    |                        |                             |                           |                          |                             |        |
| Uncontrolled Exposure/General Population |     |         |         |                 |                             |                       |                  | averaged over 1 gram |                 |                      |                  |       |                |                       |                    |                        |                             |                           |                          |                             |        |

## 8.4 Standalone Phablet SAR Data

**Table 8-10**  
**GPRS Phablet SAR**

| MEASUREMENT RESULTS                                                                               |     |          |         |                             |                       |                  |                                                      |                      |                 |            |       |                     |                |                            |                           |                              |        |
|---------------------------------------------------------------------------------------------------|-----|----------|---------|-----------------------------|-----------------------|------------------|------------------------------------------------------|----------------------|-----------------|------------|-------|---------------------|----------------|----------------------------|---------------------------|------------------------------|--------|
| FREQUENCY                                                                                         |     | Mode     | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing                                              | Device Serial Number | # of GPRS Slots | Duty Cycle | Side  | Accessory SAR (10g) | Scaling Factor | Accessory Scaled SAR (10g) | Original Scaled SAR (10g) | Re-verified Scaled SAR (10g) | Plot # |
| MHz                                                                                               | Ch. |          |         |                             |                       |                  |                                                      |                      |                 |            |       | (W/kg)              |                | (W/kg)                     | (W/kg)                    |                              |        |
| 1850.20                                                                                           | 512 | GSM 1900 | GPRS    | 26.5                        | 25.67                 | 0.08             | 1 mm                                                 | 9635F                | 4               | 1:2.076    | front | 1.420               | 1.211          | 1.720                      | 2.979                     | 2.749                        | A18    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |          |         |                             |                       |                  | Phablet<br>4.0 W/kg (mW/g)<br>averaged over 10 grams |                      |                 |            |       |                     |                |                            |                           |                              |        |

**Table 8-11**  
**LTE Phablet SAR**

| MEASUREMENT RESULTS                                                                               |       |      |                  |                             |                       |                  |          |                                                      |            |         |           |         |      |            |                     |                |                            |                           |                              |        |     |
|---------------------------------------------------------------------------------------------------|-------|------|------------------|-----------------------------|-----------------------|------------------|----------|------------------------------------------------------|------------|---------|-----------|---------|------|------------|---------------------|----------------|----------------------------|---------------------------|------------------------------|--------|-----|
| FREQUENCY                                                                                         |       | Mode | Bandwidth [MHz]  | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Device Serial Number                                 | Modulation | RB Size | RB Offset | Spacing | Side | Duty Cycle | Accessory SAR (10g) | Scaling Factor | Accessory Scaled SAR (10g) | Original Scaled SAR (10g) | Re-verified Scaled SAR (10g) | Plot # |     |
| MHz                                                                                               | Ch.   |      |                  |                             |                       |                  |          |                                                      |            |         |           |         |      |            | (W/kg)              | (W/kg)         | (W/kg)                     | (W/kg)                    |                              |        |     |
| 707.50                                                                                            | 23095 | Mid  | LTE Band 12      | 10                          | 23.5                  | 22.72            | 0.02     | 0                                                    | 93705      | QPSK    | 1         | 0       | 0 mm | back       | 1:1                 | 0.186          | 1.197                      | 0.223                     | 1.317                        | 1.162  | A19 |
| 1732.50                                                                                           | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 21.5                  | 21.39            | 0.05     | 0                                                    | 96547      | QPSK    | 50        | 0       | 0 mm | bottom     | 1:1                 | 2.460          | 1.026                      | 2.524                     | 3.109                        | 2.739  |     |
| 1732.50                                                                                           | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 21.5                  | 21.39            | -0.04    | 0                                                    | 96547      | QPSK    | 50        | 0       | 0 mm | bottom     | 1:1                 | 2.479          | 1.026                      | 2.534                     | 3.109                        | 2.739  | A20 |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |       |      |                  |                             |                       |                  |          | Phablet<br>4.0 W/kg (mW/g)<br>averaged over 10 grams |            |         |           |         |      |            |                     |                |                            |                           |                              |        |     |

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 17 of 26                   |

**Table 8-12**  
**WLAN Phablet SAR**

| MEASUREMENT RESULTS                      |     |      |         |                 |                             |                       |                  |         |                                                      |                      |                  |      |                |                       |                     |                        |                             |                            |                           |                              |        |     |
|------------------------------------------|-----|------|---------|-----------------|-----------------------------|-----------------------|------------------|---------|------------------------------------------------------|----------------------|------------------|------|----------------|-----------------------|---------------------|------------------------|-----------------------------|----------------------------|---------------------------|------------------------------|--------|-----|
| FREQUENCY                                |     | Mode | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing | Antenna Config.                                      | Device Serial Number | Data Rate (Mbps) | Side | Duty Cycle (%) | Peak SAR of Area Scan | Accessory SAR (10g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Accessory Scaled SAR (10g) | Original Scaled SAR (10g) | Re-verified Scaled SAR (10g) | Plot # |     |
| MHz                                      | Ch. |      |         |                 |                             |                       |                  |         |                                                      |                      |                  |      |                | W/kg                  | (W/kg)              |                        |                             | (W/kg)                     | (W/kg)                    | (W/kg)                       |        |     |
| 5720                                     | 144 |      | 802.11a | OFDM            | 20                          | 13.5                  | 13.29            | -0.02   | 0 mm                                                 | 1                    | 9587C            | 6    | front          | 99.3                  | 4.259               | 0.354                  | 1.050                       | 1.008                      | 0.375                     | 0.528                        | 0.552  | A21 |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |     |      |         |                 |                             |                       |                  |         |                                                      |                      |                  |      |                |                       |                     |                        |                             |                            |                           |                              |        |     |
| Spatial Peak                             |     |      |         |                 |                             |                       |                  |         |                                                      |                      |                  |      |                |                       |                     |                        |                             |                            |                           |                              |        |     |
| Uncontrolled Exposure/General Population |     |      |         |                 |                             |                       |                  |         | Phablet<br>4.0 W/kg (mW/g)<br>averaged over 10 grams |                      |                  |      |                |                       |                     |                        |                             |                            |                           |                              |        |     |

## 8.5 SAR Test Notes

- The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, and FCC KDB Publication 447498 D01v05.
- Liquid tissue depth was at least 15.0 cm for all frequencies.
- The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
- SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05.
- Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 15 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance. A separation distance of 10 mm was used for WLAN body-worn measurements because it is more conservative.
- Per FCC KDB Publication 648474 D04v01, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was  $\leq 1.2$  W/kg, no additional body-worn SAR evaluations using a headset cable were required.
- Per FCC KDB 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg for 1 g SAR results and greater than 2.0 W/kg for 10 g SAR results. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 10 for variability analysis.
- Per FCC KDB Publication 648474 D04v01r02 and April 2014 TCB Workshop slides, SAR with the additional wireless charging cover was measured for the configuration with the highest reported SAR (amongst all modes) for each frequency band and each exposure condition. SAR tests were additionally performed for any test configurations in the original equipment authorization with 1g SAR  $> 1.2$  W/kg or 10g SAR  $> 3.0$  W/kg.
- Prior to measurement with the accessory, the SAR values and conducted powers of the host device were verified against the results in the original filing.
- To confirm any SAR variation was solely due to additional wireless charging cover, the SAR results of the host device were re-verified against the results in the original filing. There were no noticeable changes in the SAR distributions between the host measured with wireless charging accessory attached and without the charging accessory.

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | <b>SAR EVALUATION REPORT</b>  |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 18 of 26                   |

### 9.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05 are applicable to handsets with built-in unlicensed transmitters such as 802.11a/b/g/n/ac and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

### 9.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05 IV.C.1.iii and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is  $\leq 1.6$  W/kg.

### 9.3 Simultaneous Transmission Analysis

All SAR results with the wireless charging cover attached were less than the results without the additional accessory. Therefore, no further analysis was required to determine that the SAR limit would not be exceeded for all possible simultaneous transmission scenarios with the accessory. Please see the original compliance report for complete simultaneous transmission analysis for the device without the accessory.

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 19 of 26                   |

## 10 SAR MEASUREMENT VARIABILITY

### 10.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

Per FCC KDB Publication 865664 D01v01, Phablet SAR measurement variability was assessed since measured 10g SAR for some frequency band was above 2.0 W/kg.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

- 1) When the original highest measured SAR is  $\geq 0.80$  W/kg, the measurement was repeated once.
- 2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was  $> 1.20$  or when the original or repeated measurement was  $\geq 1.45$  W/kg ( $\sim 10\%$  from the 1-g SAR limit).
- 3) A third repeated measurement was performed only if the original, first or second repeated measurement was  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .
- 4) Repeated measurements are not required when the original highest measured SAR is  $< 0.80$  W/kg
- 5) 10g Phablet SAR measurement variability analysis applies a factor of 2.5 to the procedures outlined above.

**Table 10-1**  
**Phablet SAR Measurement Variability**  
**Results**

| PHABLET VARIABILITY RESULTS                                                                       |           |       |                  |                          |        |         |                                                      |                        |       |                        |       |                        |       |
|---------------------------------------------------------------------------------------------------|-----------|-------|------------------|--------------------------|--------|---------|------------------------------------------------------|------------------------|-------|------------------------|-------|------------------------|-------|
| Band                                                                                              | FREQUENCY |       | Mode             | Service                  | Side   | Spacing | Measured SAR (10g)                                   | 1st Repeated SAR (10g) | Ratio | 2nd Repeated SAR (10g) | Ratio | 3rd Repeated SAR (10g) | Ratio |
|                                                                                                   | MHz       | Ch.   |                  |                          |        |         | (W/kg)                                               | (W/kg)                 |       | (W/kg)                 |       | (W/kg)                 |       |
| 1750                                                                                              | 1732.50   | 20175 | LTE Band 4 (AWS) | QPSK, 50 RB, 0 RB Offset | bottom | 0 mm    | 2.460                                                | 2.470                  | 1.00  | N/A                    | N/A   | N/A                    | N/A   |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |           |       |                  |                          |        |         | Phablet<br>4.0 W/kg (mW/g)<br>averaged over 10 grams |                        |       |                        |       |                        |       |

### 10.2 Measurement Uncertainty

The measured 1g SAR was  $< 1.5$  W/kg and the measured 10g SAR was  $< 3.75$  W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01, the extended measurement uncertainty analysis per IEEE 1528-2003 was not required.

|                                             |                                                                                                                                   |                                      |                                                                                       |                                        |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG928R4                         |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 20 of 26                          |

# 11 EQUIPMENT LIST

| Manufacturer       | Model     | Description                                   | Cal Date   | Cal Interval | Cal Due    | Serial Number |
|--------------------|-----------|-----------------------------------------------|------------|--------------|------------|---------------|
| Agilent            | 8594A     | (9kHz-2.9GHz) Spectrum Analyzer               | N/A        | N/A          | N/A        | 3051A00187    |
| Agilent            | 8648D     | (9kHz-4GHz) Signal Generator                  | 3/15/2015  | Annual       | 3/15/2016  | 3629J00687    |
| Agilent            | 8753E     | (30kHz-6GHz) Network Analyzer                 | 12/30/2014 | Annual       | 12/30/2015 | JP38020182    |
| Agilent            | 8753ES    | S-Parameter Network Analyzer                  | 1/20/2015  | Annual       | 1/20/2016  | US39170122    |
| Agilent            | E4438C    | ESG Vector Signal Generator                   | 3/12/2015  | Annual       | 3/12/2016  | MY45090700    |
| Agilent            | E5515C    | Wireless Communications Test Set              | 11/5/2013  | Biennial     | 11/5/2015  | GB46310798    |
| Agilent            | E8257D    | (250kHz-20GHz) Signal Generator               | 3/15/2015  | Annual       | 3/15/2016  | MY45470194    |
| Agilent            | N5182A    | MXG Vector Signal Generator                   | 10/27/2014 | Annual       | 10/27/2015 | MY47420603    |
| Agilent            | N9020A    | MXA Signal Analyzer                           | 10/27/2014 | Annual       | 10/27/2015 | US46470561    |
| Amplifier Research | 1551G6    | Amplifier                                     | CBT        | N/A          | CBT        | 433971        |
| Anritsu            | MA24106A  | USB Power Sensor                              | 3/2/2015   | Annual       | 3/2/2016   | 1344555       |
| Anritsu            | MA24106A  | USB Power Sensor                              | 3/2/2015   | Annual       | 3/2/2016   | 1344556       |
| Anritsu            | MA2411B   | Pulse Power Sensor                            | 11/13/2014 | Annual       | 11/13/2015 | 1339018       |
| Anritsu            | MA2411B   | Pulse Power Sensor                            | 11/17/2014 | Annual       | 11/17/2015 | 1207364       |
| Anritsu            | ML2496A   | Power Meter                                   | 3/13/2015  | Annual       | 3/13/2016  | 1306009       |
| Anritsu            | MT8820C   | Radio Communication Analyzer                  | 11/18/2014 | Annual       | 11/18/2015 | 6201300731    |
| COMTech            | AR85729-5 | Solid State Amplifier                         | CBT        | N/A          | CBT        | M155A00-009   |
| Control Company    | 4040      | Digital Thermometer                           | 3/15/2015  | Biennial     | 3/15/2017  | 150194929     |
| Fisher Scientific  | S407993   | Long Stem Thermometer                         | 11/4/2013  | Biennial     | 11/4/2015  | 130671826     |
| Gigatronics        | 80701A    | (0.05-18GHz) Power Sensor                     | 10/30/2014 | Annual       | 10/30/2015 | 1833460       |
| Gigatronics        | 8651A     | Universal Power Meter                         | 10/30/2014 | Annual       | 10/30/2015 | 8650319       |
| Keysight           | 772D      | Dual Directional Coupler                      | CBT        | N/A          | CBT        | MY52180215    |
| MCL                | BW-N6W5+  | 6dB Attenuator                                | CBT        | N/A          | CBT        | 1139          |
| Mini-Circuits      | BW-N20W5  | Power Attenuator                              | CBT        | N/A          | CBT        | 1226          |
| Mini-Circuits      | BW-N20W5+ | DC to 18 GHz Precision Fixed 20 dB Attenuator | CBT        | N/A          | CBT        | N/A           |
| Mini-Circuits      | NLP-1200+ | Low Pass Filter DC to 1000 MHz                | CBT        | N/A          | CBT        | N/A           |
| Mini-Circuits      | NLP-2950+ | Low Pass Filter DC to 2700 MHz                | CBT        | N/A          | CBT        | N/A           |
| Mitutoyo           | CD-6"CSX  | Digital Caliper                               | 5/8/2014   | Biennial     | 5/8/2016   | 13264162      |
| Narda              | 4014C-6   | 4 - 8 GHz SMA 6 dB Directional Coupler        | CBT        | N/A          | CBT        | N/A           |
| Narda              | 4772-3    | Attenuator (3dB)                              | CBT        | N/A          | CBT        | 9406          |
| Pasternack         | PE2208-6  | Bidirectional Coupler                         | CBT        | N/A          | CBT        | N/A           |
| Pasternack         | PE2209-10 | Bidirectional Coupler                         | CBT        | N/A          | CBT        | N/A           |
| Rohde & Schwarz    | CMU200    | Base Station Simulator                        | 12/4/2014  | Annual       | 12/4/2015  | 833855/0010   |
| Rohde & Schwarz    | CMW500    | Radio Communication Tester                    | 3/18/2015  | Annual       | 3/18/2016  | 128633        |
| Seekonk            | NC-100    | Torque Wrench                                 | 3/18/2014  | Biennial     | 3/18/2016  | N/A           |
| Seekonk            | NC-100    | Torque Wrench 5/16", 8" lbs                   | 3/18/2014  | Biennial     | 3/18/2016  | N/A           |
| SPEAG              | D1750V2   | 1750 MHz SAR Dipole                           | 4/15/2015  | Annual       | 4/15/2016  | 1051          |
| SPEAG              | D1900V2   | 1900 MHz SAR Dipole                           | 4/14/2015  | Annual       | 4/14/2016  | 5d141         |
| SPEAG              | D2450V2   | 2450 MHz SAR Dipole                           | 2/18/2015  | Annual       | 2/18/2016  | 882           |
| SPEAG              | D5GHzV2   | 5 GHz SAR Dipole                              | 1/21/2015  | Annual       | 1/21/2016  | 1057          |
| SPEAG              | D5GHzV2   | 5 GHz SAR Dipole                              | 9/25/2014  | Annual       | 9/25/2015  | 1191          |
| SPEAG              | D750V3    | 750 MHz Dipole                                | 1/16/2015  | Annual       | 1/16/2016  | 1003          |
| SPEAG              | D835V2    | 835 MHz SAR Dipole                            | 4/13/2015  | Annual       | 4/13/2016  | 4d119         |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 9/17/2014  | Annual       | 9/17/2015  | 1323          |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 10/31/2014 | Annual       | 10/31/2015 | 1333          |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 1/14/2015  | Annual       | 1/14/2016  | 1272          |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 3/13/2015  | Annual       | 3/13/2016  | 1368          |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 4/20/2015  | Annual       | 4/20/2016  | 1407          |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 6/17/2015  | Annual       | 6/17/2016  | 859           |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 8/12/2014  | Annual       | 8/12/2015  | 1322          |
| SPEAG              | DAK-3.5   | Dielectric Assessment Kit                     | 5/12/2015  | Annual       | 5/12/2016  | 1070          |
| SPEAG              | DAKS-3.5  | Portable Dielectric Assessment Kit            | 7/14/2015  | Annual       | 7/14/2016  | 1039          |
| SPEAG              | ES3DV3    | SAR Probe                                     | 9/18/2014  | Annual       | 9/18/2015  | 3332          |
| SPEAG              | ES3DV3    | SAR Probe                                     | 1/20/2015  | Annual       | 1/20/2016  | 3213          |
| SPEAG              | ES3DV3    | SAR Probe                                     | 1/23/2015  | Annual       | 1/23/2016  | 3318          |
| SPEAG              | ES3DV3    | SAR Probe                                     | 3/19/2015  | Annual       | 3/19/2016  | 3319          |
| SPEAG              | ES3DV3    | SAR Probe                                     | 5/20/2015  | Annual       | 5/20/2016  | 3263          |
| SPEAG              | ES3DV3    | SAR Probe                                     | 6/22/2015  | Annual       | 6/22/2016  | 3351          |
| SPEAG              | EX3DV4    | SAR Probe                                     | 1/22/2015  | Annual       | 1/22/2016  | 3589          |
| SPEAG              | EX3DV4    | SAR Probe                                     | 2/10/2015  | Annual       | 2/10/2016  | 3914          |

Note:

1. CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.
2. Each equipment item was used solely within its respective calibration period.

|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG928R4                         |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 21 of 26                          |

© 2015 PCTEST Engineering Laboratory, Inc.

REV 14.0 M  
07/21/2014

© 2015 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact [INFO@PCTESTLAB.COM](mailto:INFO@PCTESTLAB.COM).

## 12 MEASUREMENT UNCERTAINTIES

Applicable for frequencies less than 3000 MHz:

| a                                                                             | b                    | c             | d              | e=<br>f(d,k) | f                     | g                        | h =<br>c x f/e                 | i =<br>c x g/e                   | k              |
|-------------------------------------------------------------------------------|----------------------|---------------|----------------|--------------|-----------------------|--------------------------|--------------------------------|----------------------------------|----------------|
| Uncertainty<br>Component                                                      | IEEE<br>1528<br>Sec. | Tol.<br>(± %) | Prob.<br>Dist. | Div.         | c <sub>i</sub><br>1gm | c <sub>i</sub><br>10 gms | 1gm<br>u <sub>i</sub><br>(± %) | 10gms<br>u <sub>i</sub><br>(± %) | v <sub>i</sub> |
| <b>Measurement System</b>                                                     |                      |               |                |              |                       |                          |                                |                                  |                |
| Probe Calibration                                                             | E.2.1                | 6.0           | N              | 1            | 1.0                   | 1.0                      | 6.0                            | 6.0                              | ∞              |
| Axial Isotropy                                                                | E.2.2                | 0.25          | N              | 1            | 0.7                   | 0.7                      | 0.2                            | 0.2                              | ∞              |
| Hemishperical Isotropy                                                        | E.2.2                | 1.3           | N              | 1            | 1.0                   | 1.0                      | 1.3                            | 1.3                              | ∞              |
| Boundary E ffect                                                              | E.2.3                | 0.4           | N              | 1            | 1.0                   | 1.0                      | 0.4                            | 0.4                              | ∞              |
| Linearity                                                                     | E.2.4                | 0.3           | N              | 1            | 1.0                   | 1.0                      | 0.3                            | 0.3                              | ∞              |
| System Detection Limits                                                       | E.2.5                | 5.1           | N              | 1            | 1.0                   | 1.0                      | 5.1                            | 5.1                              | ∞              |
| Readout E lectronics                                                          | E.2.6                | 1.0           | N              | 1            | 1.0                   | 1.0                      | 1.0                            | 1.0                              | ∞              |
| Response Time                                                                 | E.2.7                | 0.8           | R              | 1.73         | 1.0                   | 1.0                      | 0.5                            | 0.5                              | ∞              |
| Integration Time                                                              | E.2.8                | 2.6           | R              | 1.73         | 1.0                   | 1.0                      | 1.5                            | 1.5                              | ∞              |
| RF Ambient Conditions                                                         | E.6.1                | 3.0           | R              | 1.73         | 1.0                   | 1.0                      | 1.7                            | 1.7                              | ∞              |
| Probe Positioner Mechanical Tolerance                                         | E.6.2                | 0.4           | R              | 1.73         | 1.0                   | 1.0                      | 0.2                            | 0.2                              | ∞              |
| Probe Positioning w/ respect to Phantom                                       | E.6.3                | 2.9           | R              | 1.73         | 1.0                   | 1.0                      | 1.7                            | 1.7                              | ∞              |
| Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation | E.5                  | 1.0           | R              | 1.73         | 1.0                   | 1.0                      | 0.6                            | 0.6                              | ∞              |
| <b>Test Sample Related</b>                                                    |                      |               |                |              |                       |                          |                                |                                  |                |
| Test Sample Positioning                                                       | E.4.2                | 6.0           | N              | 1            | 1.0                   | 1.0                      | 6.0                            | 6.0                              | 287            |
| Device Holder Uncertainty                                                     | E.4.1                | 3.32          | R              | 1.73         | 1.0                   | 1.0                      | 1.9                            | 1.9                              | ∞              |
| Output Power Variation - S AR drift measurement                               | 6.6.2                | 5.0           | R              | 1.73         | 1.0                   | 1.0                      | 2.9                            | 2.9                              | ∞              |
| <b>Phantom &amp; Tissue Parameters</b>                                        |                      |               |                |              |                       |                          |                                |                                  |                |
| Phantom Uncertainty (Shape & Thickness tolerances)                            | E.3.1                | 4.0           | R              | 1.73         | 1.0                   | 1.0                      | 2.3                            | 2.3                              | ∞              |
| Liquid Conductivity - deviation from target values                            | E.3.2                | 5.0           | R              | 1.73         | 0.64                  | 0.43                     | 1.8                            | 1.2                              | ∞              |
| Liquid Conductivity - measurement uncertainty                                 | E.3.3                | 3.8           | N              | 1            | 0.64                  | 0.43                     | 2.4                            | 1.6                              | 6              |
| Liquid Permittivity - deviation from target values                            | E.3.2                | 5.0           | R              | 1.73         | 0.60                  | 0.49                     | 1.7                            | 1.4                              | ∞              |
| Liquid Permittivity - measurement uncertainty                                 | E.3.3                | 4.5           | N              | 1            | 0.60                  | 0.49                     | 2.7                            | 2.2                              | 6              |
| <b>Combined Standard Uncertainty (k=1)</b>                                    |                      |               |                |              |                       |                          | RSS                            | 12.1                             | 11.7           |
| <b>Expanded Uncertainty</b>                                                   |                      |               |                |              |                       |                          | k=2                            | 24.2                             | 23.5           |
| (95% CONFIDENCE LEVEL)                                                        |                      |               |                |              |                       |                          |                                |                                  |                |

The above measurement uncertainties are according to IEEE Std. 1528-2003

|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG928R4                         |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 22 of 26                          |

© 2015 PCTEST Engineering Laboratory, Inc.

REV 14.0 M  
07/21/2014

© 2015 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact [INFO@PCTESTLAB.COM](mailto:INFO@PCTESTLAB.COM).

Applicable for frequencies up to 6 GHz:

| a                                                                             | b                    | c             | d              | e=<br>f(d,k) | f                     | g                        | h =<br>c x f/e                 | i =<br>c x g/e                   | k              |
|-------------------------------------------------------------------------------|----------------------|---------------|----------------|--------------|-----------------------|--------------------------|--------------------------------|----------------------------------|----------------|
| Uncertainty<br>Component                                                      | IEEE<br>1528<br>Sec. | Tol.<br>(± %) | Prob.<br>Dist. | Div.         | c <sub>i</sub><br>1gm | c <sub>i</sub><br>10 gms | 1gm<br>u <sub>i</sub><br>(± %) | 10gms<br>u <sub>i</sub><br>(± %) | v <sub>i</sub> |
| <b>Measurement System</b>                                                     |                      |               |                |              |                       |                          |                                |                                  |                |
| Probe Calibration                                                             | E.2.1                | 6.55          | N              | 1            | 1.0                   | 1.0                      | 6.6                            | 6.6                              | ∞              |
| Axial Isotropy                                                                | E.2.2                | 0.25          | N              | 1            | 0.7                   | 0.7                      | 0.2                            | 0.2                              | ∞              |
| Hemishperical Isotropy                                                        | E.2.2                | 1.3           | N              | 1            | 1.0                   | 1.0                      | 1.3                            | 1.3                              | ∞              |
| Boundary Effect                                                               | E.2.3                | 0.4           | N              | 1            | 1.0                   | 1.0                      | 0.4                            | 0.4                              | ∞              |
| Linearity                                                                     | E.2.4                | 0.3           | N              | 1            | 1.0                   | 1.0                      | 0.3                            | 0.3                              | ∞              |
| System Detection Limits                                                       | E.2.5                | 5.1           | N              | 1            | 1.0                   | 1.0                      | 5.1                            | 5.1                              | ∞              |
| Readout Electronics                                                           | E.2.6                | 1.0           | N              | 1            | 1.0                   | 1.0                      | 1.0                            | 1.0                              | ∞              |
| Response Time                                                                 | E.2.7                | 0.8           | R              | 1.73         | 1.0                   | 1.0                      | 0.5                            | 0.5                              | ∞              |
| Integration Time                                                              | E.2.8                | 2.6           | R              | 1.73         | 1.0                   | 1.0                      | 1.5                            | 1.5                              | ∞              |
| RF Ambient Conditions                                                         | E.6.1                | 3.0           | R              | 1.73         | 1.0                   | 1.0                      | 1.7                            | 1.7                              | ∞              |
| Probe Positioner Mechanical Tolerance                                         | E.6.2                | 0.4           | R              | 1.73         | 1.0                   | 1.0                      | 0.2                            | 0.2                              | ∞              |
| Probe Positioning w/ respect to Phantom                                       | E.6.3                | 2.9           | R              | 1.73         | 1.0                   | 1.0                      | 1.7                            | 1.7                              | ∞              |
| Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation | E.5                  | 1.0           | R              | 1.73         | 1.0                   | 1.0                      | 0.6                            | 0.6                              | ∞              |
| <b>Test Sample Related</b>                                                    |                      |               |                |              |                       |                          |                                |                                  |                |
| Test Sample Positioning                                                       | E.4.2                | 6.0           | N              | 1            | 1.0                   | 1.0                      | 6.0                            | 6.0                              | 287            |
| Device Holder Uncertainty                                                     | E.4.1                | 3.32          | R              | 1.73         | 1.0                   | 1.0                      | 1.9                            | 1.9                              | ∞              |
| Output Power Variation - SAR drift measurement                                | E.6.2                | 5.0           | R              | 1.73         | 1.0                   | 1.0                      | 2.9                            | 2.9                              | ∞              |
| <b>Phantom &amp; Tissue Parameters</b>                                        |                      |               |                |              |                       |                          |                                |                                  |                |
| Phantom Uncertainty (Shape & Thickness tolerances)                            | E.3.1                | 4.0           | R              | 1.73         | 1.0                   | 1.0                      | 2.3                            | 2.3                              | ∞              |
| Liquid Conductivity - deviation from target values                            | E.3.2                | 5.0           | R              | 1.73         | 0.64                  | 0.43                     | 1.8                            | 1.2                              | ∞              |
| Liquid Conductivity - measurement uncertainty                                 | E.3.3                | 3.8           | N              | 1            | 0.64                  | 0.43                     | 2.4                            | 1.6                              | 6              |
| Liquid Permittivity - deviation from target values                            | E.3.2                | 5.0           | R              | 1.73         | 0.60                  | 0.49                     | 1.7                            | 1.4                              | ∞              |
| Liquid Permittivity - measurement uncertainty                                 | E.3.3                | 4.5           | N              | 1            | 0.60                  | 0.49                     | 2.7                            | 2.2                              | 6              |
| <b>Combined Standard Uncertainty (k=1)</b>                                    |                      |               |                |              |                       |                          | RSS                            | 12.4                             | 12.0           |
| <b>Expanded Uncertainty</b><br>(95% CONFIDENCE LEVEL)                         |                      |               |                |              |                       |                          | k=2                            | 24.7                             | 24.0           |

The above measurement uncertainties are according to IEEE Std. 1528-2003

|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG928R4                         |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset | Page 23 of 26                                                                         |                                        |

© 2015 PCTEST Engineering Laboratory, Inc.

REV 14.0 M  
07/21/2014

© 2015 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact [INFO@PCTESTLAB.COM](mailto:INFO@PCTESTLAB.COM).

## 13 CONCLUSION

### 13.1 Measurement Conclusion

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

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend 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 various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSMG928R4                  |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 24 of 26                          |

© 2015 PCTEST Engineering Laboratory, Inc.

REV 14.0 M  
07/21/2014

© 2015 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact [INFO@PCTESTLAB.COM](mailto:INFO@PCTESTLAB.COM).

## 14 REFERENCES

- [1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.
- [2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, 2006.
- [3] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, Sept. 1992.
- [4] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.
- [5] IEEE Standards Coordinating Committee 39 –Standards Coordinating Committee 34 – IEEE Std. 1528-2003, Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Measurement Techniques.
- [6] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.
- [7] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.
- [8] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. 1-124.
- [9] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.
- [10] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.
- [11] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.
- [12] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [13] G. Hartsgrrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.
- [14] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.
- [15] W. Gander, Computermathematick, Birkhaeuser, Basel, 1992.
- [16] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.
- [17] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

|                                      |                                                                                     |                               |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG928R4                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1508201591-R1.A3L | Test Dates:<br>08/18/15 - 09/08/15                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 25 of 26                   |

- [18] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.
- [19] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hochschule Zürich, Dosimetric Evaluation of the Cellular Phone.
- [20] IEC 62209-1, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz), Feb. 2005.
- [21] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 4, March 2010.
- [22] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2009
- [23] FCC SAR Test Procedures for 2G-3G Devices, Mobile Hotspot and UMPC Devices KDB Publications 941225, D01-D07
- [24] SAR Measurement Guidance for IEEE 802.11 Transmitters, KDB Publication 248227 D01V02r01
- [25] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publications 648474 D03-D04
- [26] FCC SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers, FCC KDB Publication 616217 D04
- [27] FCC SAR Measurement and Reporting Requirements for 100MHz – 6 GHz, KDB Publications 865664 D01-D02
- [28] FCC General RF Exposure Guidance and SAR Procedures for Dongles, KDB Publication 447498, D01-D02
- [29] Anexo à Resolução No. 533, de 10 de Setembro de 2009.
- [30] IEC 62209-2, 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), Mar. 2010.

|                                             |                                                                                     |                                      |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSMG928R4                  |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1508201591-R1.A3L | <b>Test Dates:</b><br>08/18/15 - 09/08/15                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 26 of 26                          |

© 2015 PCTEST Engineering Laboratory, Inc.

REV 14.0 M  
07/21/2014

© 2015 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact [INFO@PCTESTLAB.COM](mailto:INFO@PCTESTLAB.COM).

## APPENDIX A: SAR TEST DATA

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 96361**

Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: 835 Head, Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.922 \text{ S/m}$ ;  $\epsilon_r = 42.081$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 08-20-2015; Ambient Temp: 22.0°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3319; ConvF(6.41, 6.41, 6.41); Calibrated: 3/19/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/13/2015

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1800

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: Cell. CDMA, Rule Part 22H, Right Head, Cheek, Mid.ch, Wireless Charging Cover**

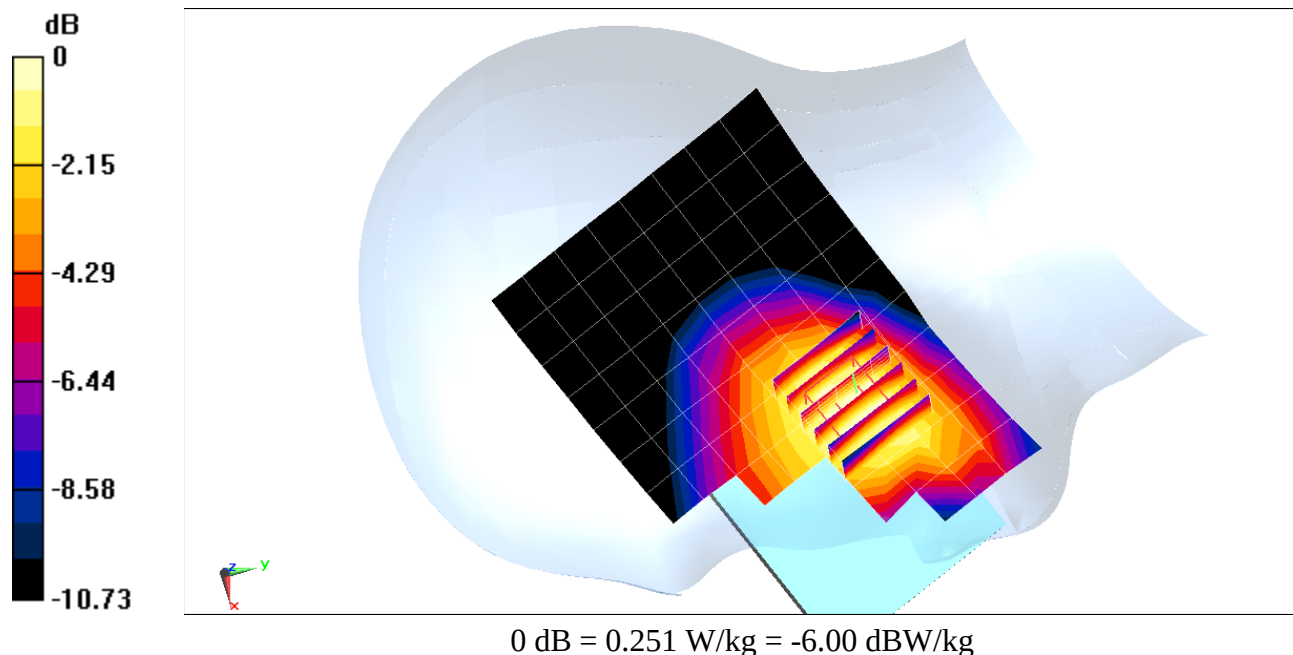
**Area Scan (9x15x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (6x6x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 16.19 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.292 W/kg

**SAR(1 g) = 0.230 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9660B**

Communication System: UID 0, CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Head, Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.408 \text{ S/m}$ ;  $\epsilon_r = 39.897$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 08-20-2015; Ambient Temp: 21.8°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3319; ConvF(5.1, 5.1, 5.1); Calibrated: 3/19/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/13/2015

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1800

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: PCS CDMA, Right Head, Cheek, Mid.ch, Wireless Charging Cover**

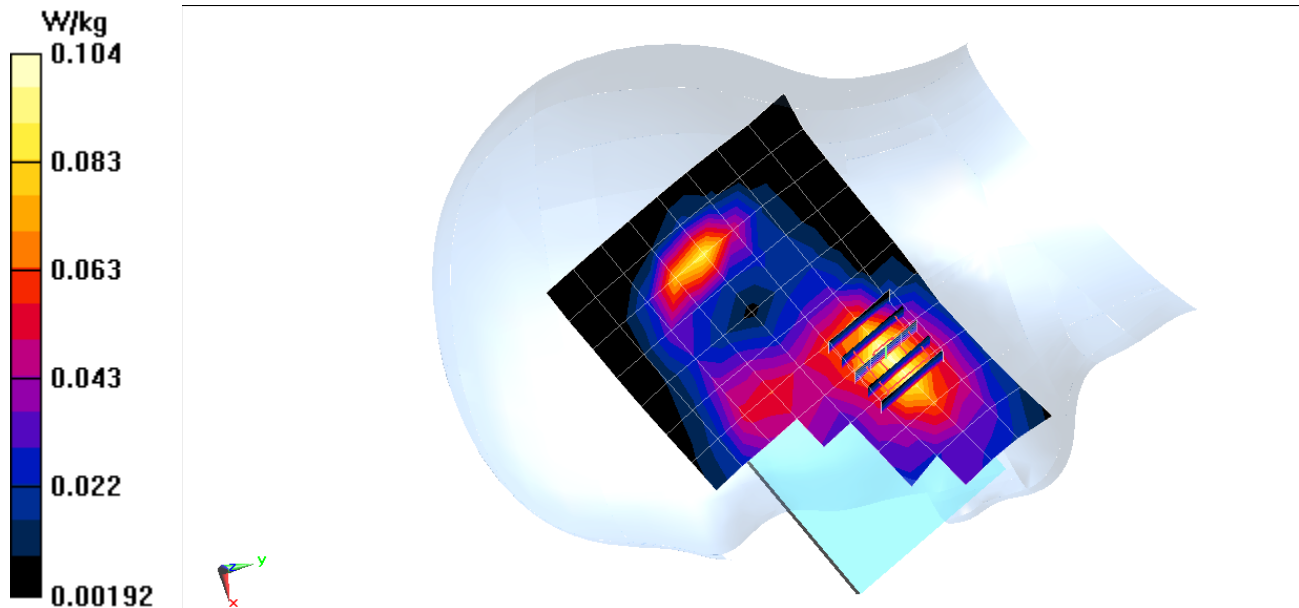
**Area Scan (9x15x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 8.362 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.135 W/kg

**SAR(1 g) = 0.090 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 96361**

Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 750 Head, Medium parameters used (interpolated):

$f = 782 \text{ MHz}$ ;  $\sigma = 0.923 \text{ S/m}$ ;  $\epsilon_r = 41.634$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 08-21-2015; Ambient Temp: 23.6°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3332; ConvF(6.56, 6.56, 6.56); Calibrated: 9/18/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 13, Right Head, Cheek, Mid.ch,  
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Wireless Charging Cover**

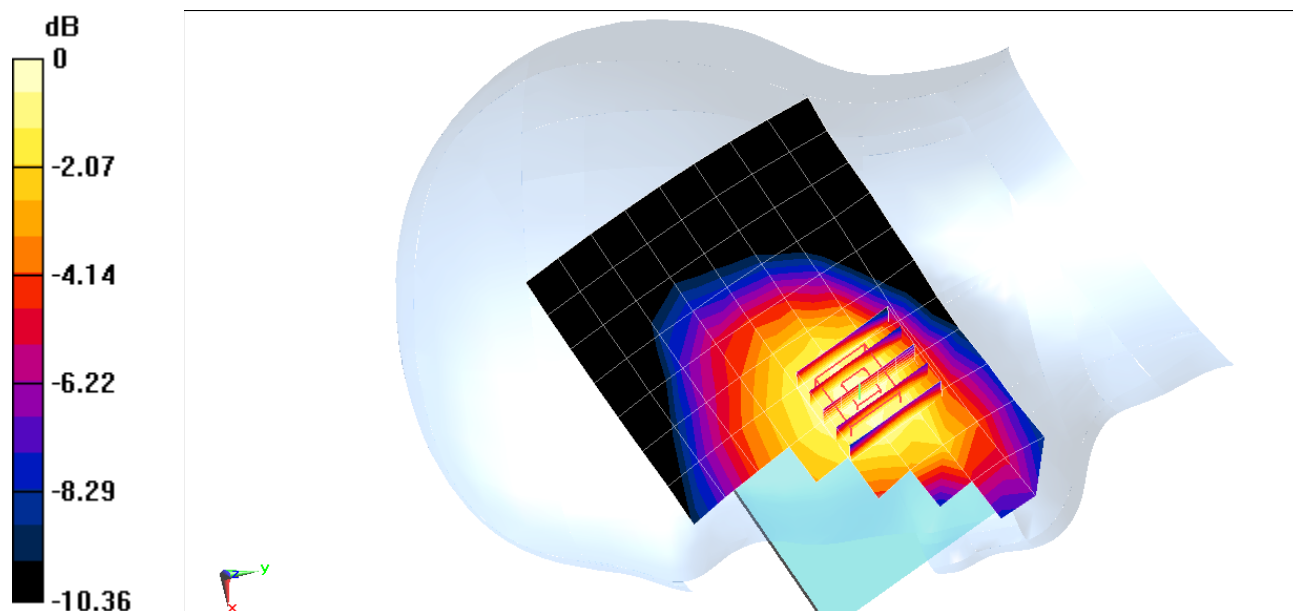
**Area Scan (9x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (6x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 14.87 V/m; Power Drift = 0.20 dB

Peak SAR (extrapolated) = 0.231 W/kg

**SAR(1 g) = 0.185 W/kg**



0 dB = 0.199 W/kg = -7.01 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 96361**

Communication System: UID 0, LTE RF Band 4; Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium: 1750 Head, Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$ ;  $\sigma = 1.352 \text{ S/m}$ ;  $\epsilon_r = 38.343$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 08-20-2015; Ambient Temp: 23.3°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3318; ConvF(5.27, 5.27, 5.27); Calibrated: 1/23/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/14/2015

Phantom: SAM Front; Type: SAM; Serial: 1686

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 4 (AWS), Right Head, Cheek, Mid.ch,  
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Wireless Charging Cover**

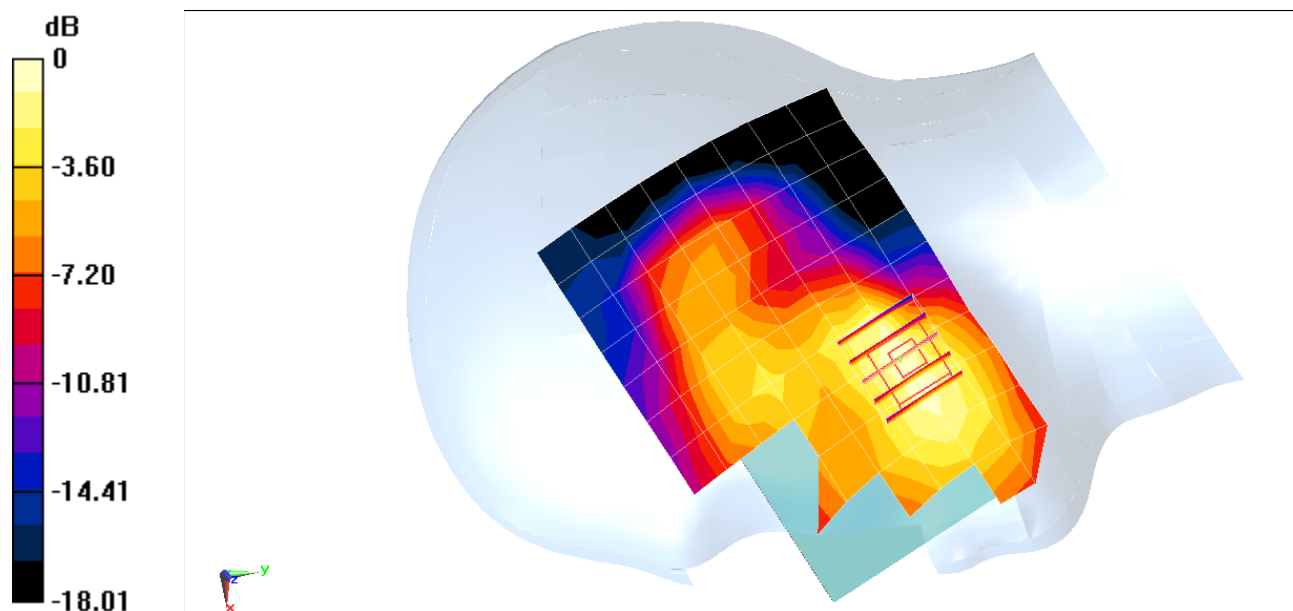
**Area Scan (9x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 13.35 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.301 W/kg

**SAR(1 g) = 0.200 W/kg**



0 dB = 0.225 W/kg = -6.48 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9587C**

Communication System: UID 0, IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: 2450 Head, Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.861 \text{ S/m}$ ;  $\epsilon_r = 38.666$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 08-19-2015; Ambient Temp: 23.2°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3263; ConvF(4.4, 4.4, 4.4); Calibrated: 5/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 6/17/2015

Phantom: SAM with CRP (Left); Type: SAM; Serial: 1715

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: IEEE 802.11b, 22 MHz Bandwidth, Right Head, Cheek,  
Ch 11, 1 Mbps, Antenna 1, Wireless Charging Cover**

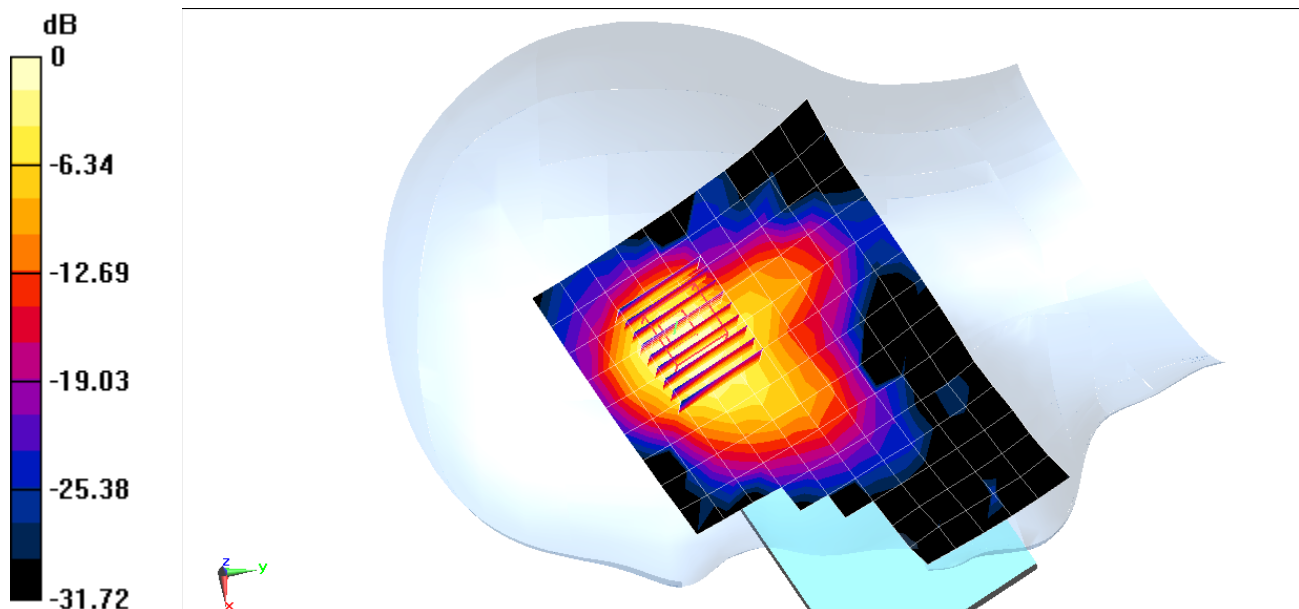
**Area Scan (11x18x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

**Zoom Scan (8x9x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 12.44 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.766 W/kg

**SAR(1 g) = 0.329 W/kg**



0 dB = 0.422 W/kg = -3.75 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9587C**

Communication System: UID 0, 802.11a 5.2-5.8 GHz Band; Frequency: 5745 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head, Medium parameters used:

$f = 5745 \text{ MHz}$ ;  $\sigma = 5.019 \text{ S/m}$ ;  $\epsilon_r = 36.918$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 08-18-2015; Ambient Temp: 21.5°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3914; ConvF(4.67, 4.67, 4.67); Calibrated: 2/10/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/31/2014

Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: IEEE 802.11a, U-NII-3, 20 MHz Bandwidth, Right Head, Cheek,  
Ch 149, 6 Mbps, Antenna 1, Wireless Charging Cover**

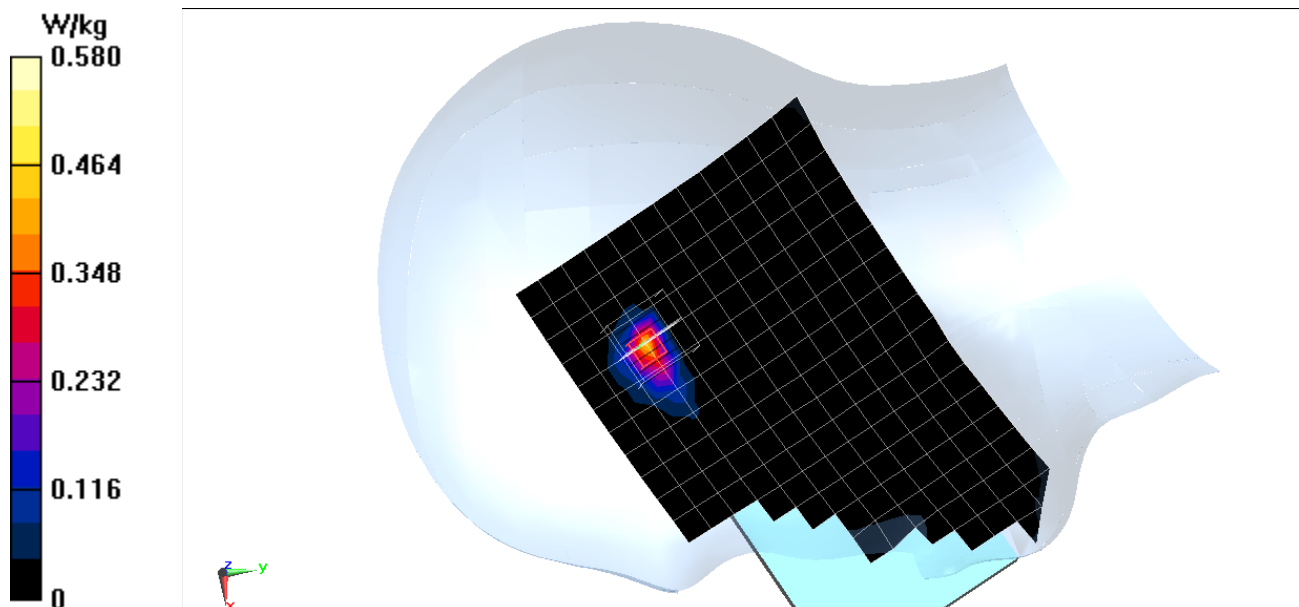
**Area Scan (13x22x1):** Measurement grid: dx=10mm, dy=10mm

**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 6.530 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.992 W/kg

**SAR(1 g) = 0.195 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9660B**

Communication System: UID 0, GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Body, Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$ ;  $\sigma = 1.002 \text{ S/m}$ ;  $\epsilon_r = 53.632$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-21-2015; Ambient Temp: 21.3°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3318; ConvF(6.23, 6.23, 6.23); Calibrated: 1/23/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/14/2015

Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2027

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: GSM 850, Body SAR, Back side, Mid.ch, Wireless Charging Cover**

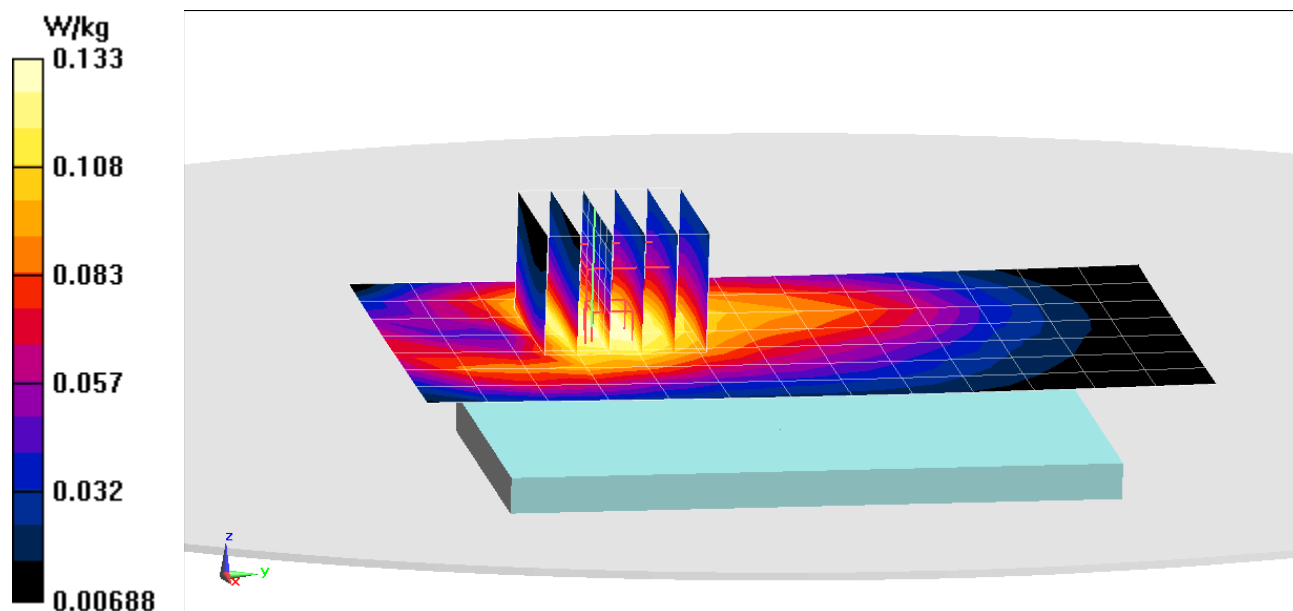
**Area Scan (8x14x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (6x6x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 11.43 V/m; Power Drift = -0.20 dB

Peak SAR (extrapolated) = 0.158 W/kg

**SAR(1 g) = 0.121 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9660B**

Communication System: UID 0, CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Body; Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.554 \text{ S/m}$ ;  $\epsilon_r = 51.804$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-19-2015; Ambient Temp: 21.7°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF(4.66, 4.66, 4.66); Calibrated: 5/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 6/17/2015

Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Mode: PCS. CDMA, Body SAR, Back side,  
Wireless Charging Cover, Mid.ch**

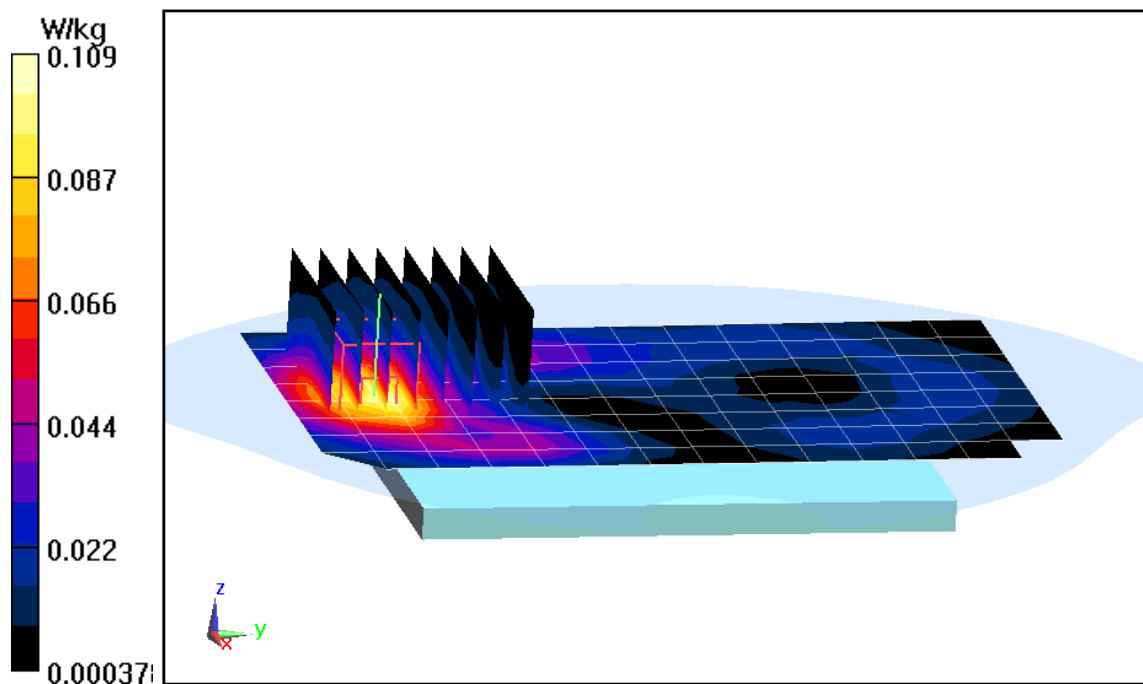
**Area Scan (9x15x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.096 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.142 W/kg

**SAR (1 g) = 0.092 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 96361**

Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 750 Body, Medium parameters used (interpolated):

$f = 782 \text{ MHz}$ ;  $\sigma = 0.996 \text{ S/m}$ ;  $\epsilon_r = 54.967$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-20-2015; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3332; ConvF(6.24, 6.24, 6.24); Calibrated: 9/18/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 13, Body SAR, Back side, Mid.ch,  
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Wireless Charging Cover**

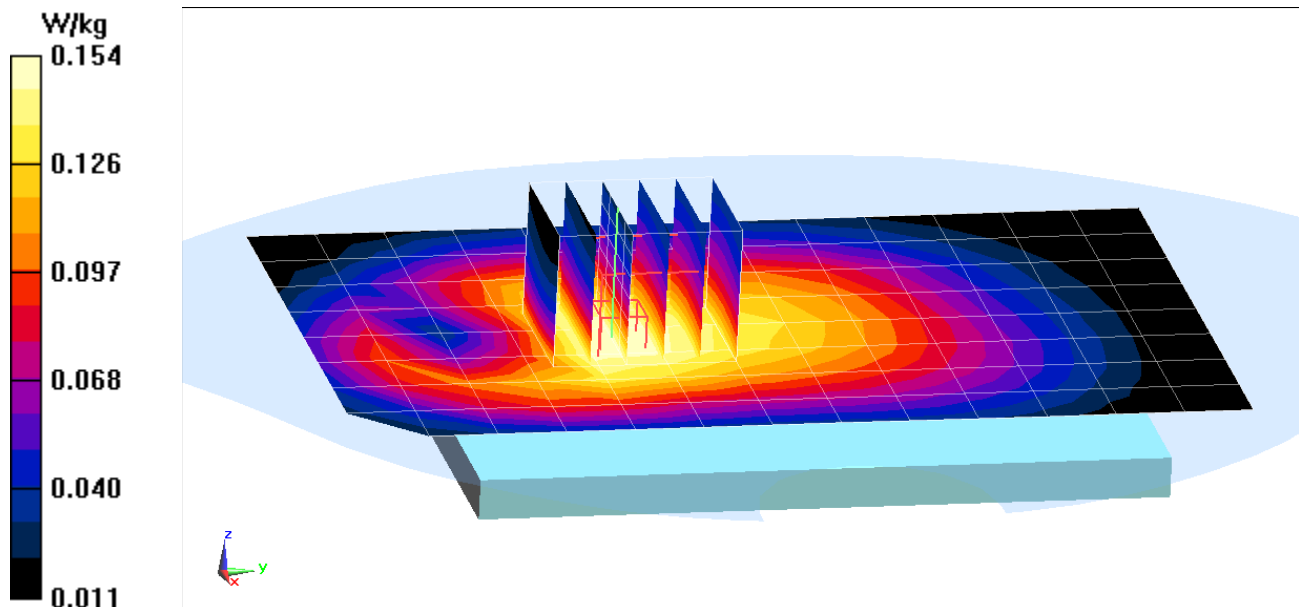
**Area Scan (9x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (5x6x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 12.04 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.179 W/kg

**SAR(1 g) = 0.140 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 96361**

Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium: 1750 Body, Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$ ;  $\sigma = 1.463 \text{ S/m}$ ;  $\epsilon_r = 51.54$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-19-2015; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3213; ConvF(4.93, 4.93, 4.93); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/20/2015

Phantom: ELI Left v6.0; Type: QDOVA001BB; Serial: TP:1202

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch,  
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Wireless Charging Cover**

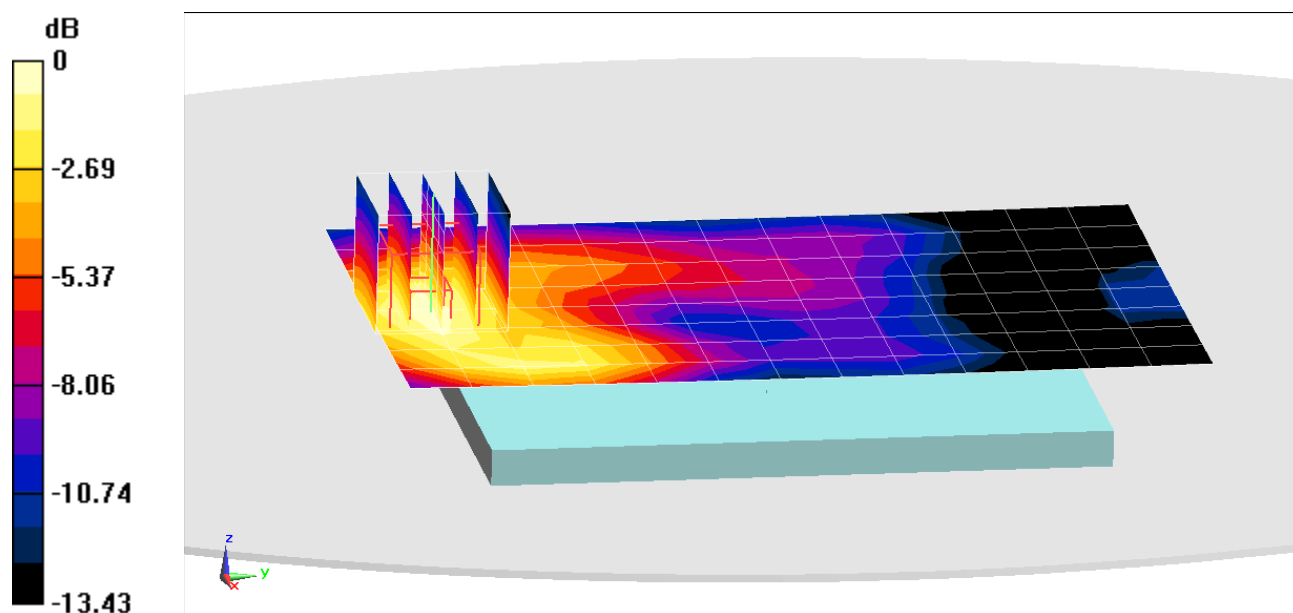
**Area Scan (9x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 9.779 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.189 W/kg

**SAR(1 g) = 0.124 W/kg**



0 dB = 0.146 W/kg = -8.36 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9587C**

Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: 2450 Body, Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$ ;  $\sigma = 1.953 \text{ S/m}$ ;  $\epsilon_r = 51.117$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-19-2015; Ambient Temp: 21.9°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3318; ConvF(4.37, 4.37, 4.37); Calibrated: 1/23/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/14/2015

Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2027

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: IEEE 802.11b, 22 MHz Bandwidth, Body SAR, Ch 1, 1 Mbps,  
Back Side, Antenna 2, Wireless Charging Cover**

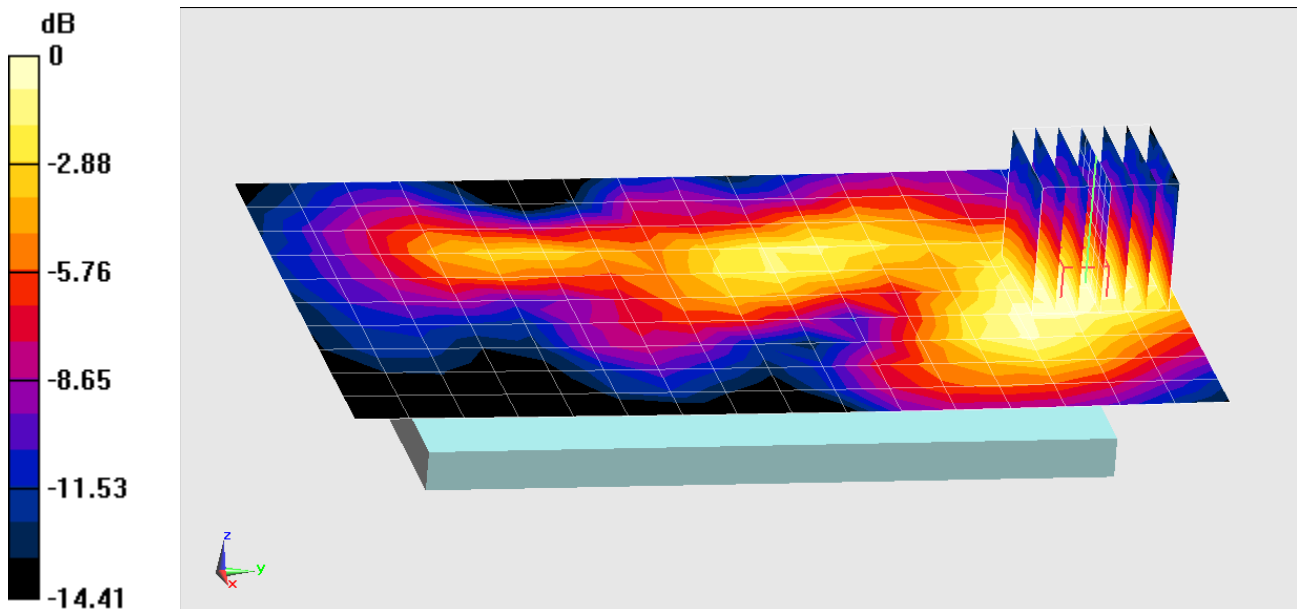
**Area Scan (11x17x1):** Measurement grid: dx=12mm, dy=12mm

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

Reference Value = 4.531 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.0660 W/kg

**SAR(1 g) = 0.037 W/kg**



0 dB = 0.0447 W/kg = -13.50 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9587C**

Communication System: UID 0, 802.11a 5.2-5.8 GHz Band; Frequency: 5745 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body, Medium parameters used:

$f = 5745 \text{ MHz}$ ;  $\sigma = 6.012 \text{ S/m}$ ;  $\epsilon_r = 46.56$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-18-2015; Ambient Temp: 23.2°C; Tissue Temp: 22.1°C

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: IEEE 802.11a, U-NII-3, 20 MHz Bandwidth, Body SAR, Ch 149, 6 Mbps,  
Back Side, Antenna 2, Wireless Charging Cover**

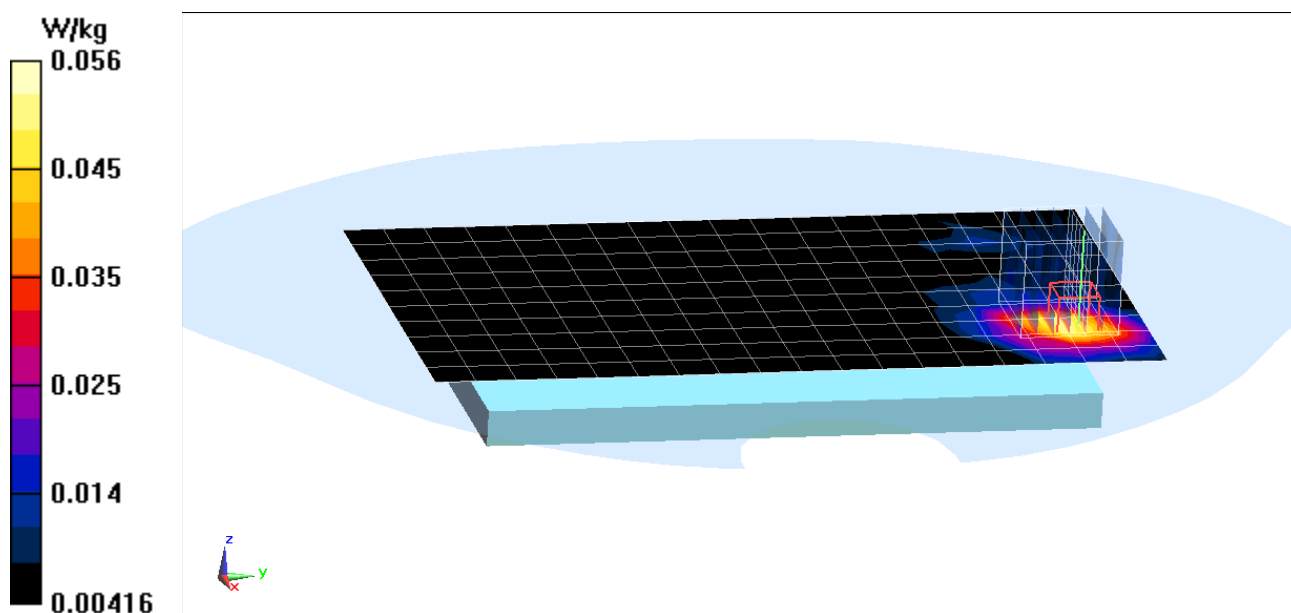
**Area Scan (11x19x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$ ; Graded Ratio: 1.4

Reference Value = 1.989 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.0990 W/kg

**SAR(1 g) = 0.024 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9660B**

Communication System: UID 0, GSM GPRS; 3 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:2.76

Medium: 850 Body, Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$ ;  $\sigma = 1.002 \text{ S/m}$ ;  $\epsilon_r = 53.632$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-21-2015; Ambient Temp: 21.3°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3318; ConvF(6.23, 6.23, 6.23); Calibrated: 1/23/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/14/2015

Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2027

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: GPRS 850, Body SAR, Front side, Mid.ch, 3 Tx Slots. Wireless Charging Cover**

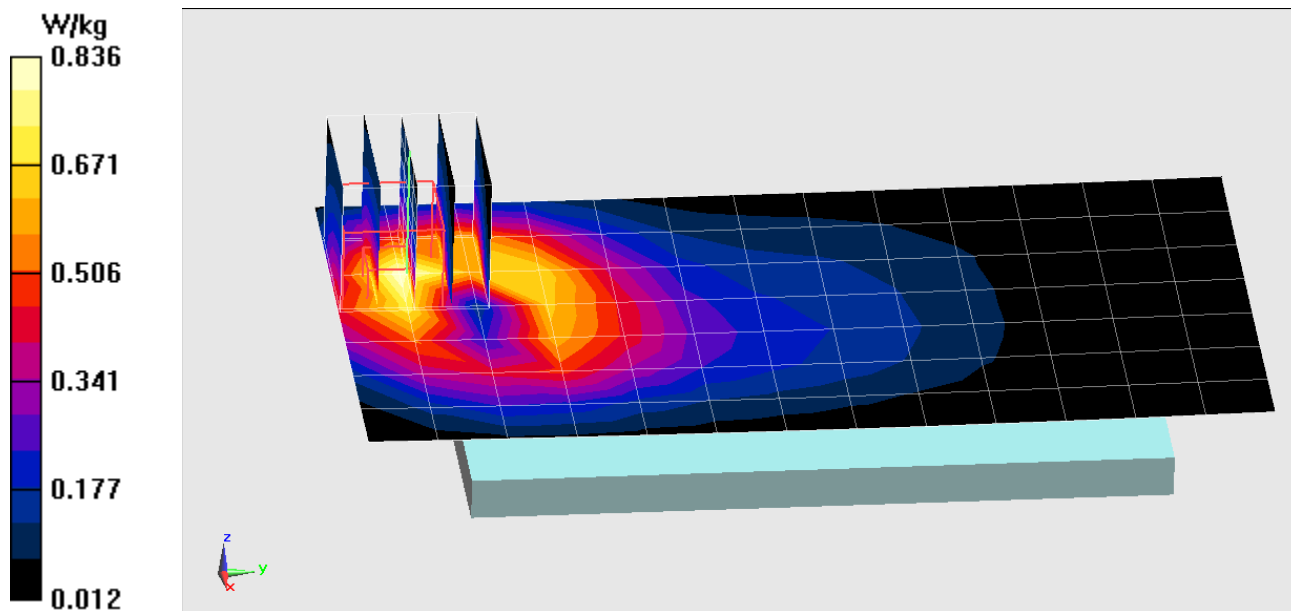
**Area Scan (8x14x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 27.79 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 1.19 W/kg

**SAR(1 g) = 0.704 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 930ED**

Communication System: UID 0, UMTS; Frequency: 1852.4 MHz; Duty Cycle: 1:1

Medium: 1900 Body, Medium parameters used (interpolated):

$f = 1852.4 \text{ MHz}$ ;  $\sigma = 1.523 \text{ S/m}$ ;  $\epsilon_r = 51.895$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-19-2015; Ambient Temp: 21.7°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF(4.66, 4.66, 4.66); Calibrated: 5/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 6/17/2015

Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: UMTS 1900, Body SAR, Bottom Edge, Low.ch, Wireless Charging Cover**

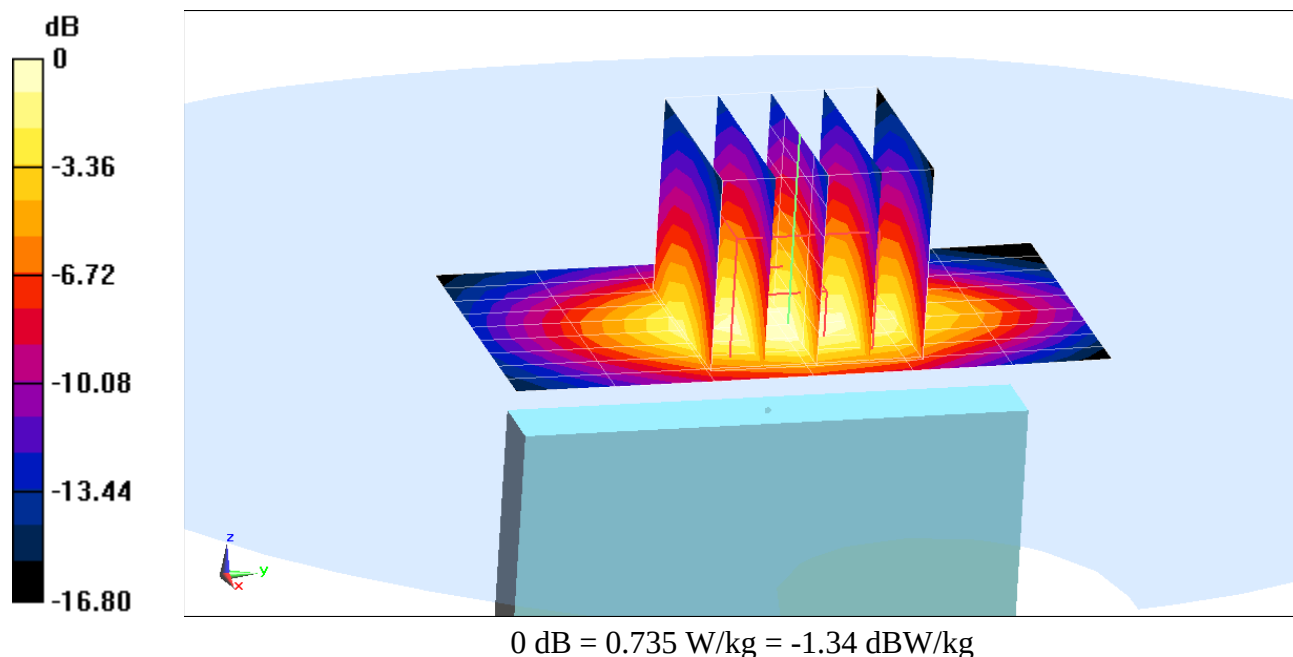
**Area Scan (10x7x1):** Measurement grid: dx=5mm, dy=15mm

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

Reference Value = 21.46 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.976 W/kg

**SAR(1 g) = 0.601 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 96361**

Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 750 Body, Medium parameters used (interpolated):

$f = 782 \text{ MHz}$ ;  $\sigma = 0.996 \text{ S/m}$ ;  $\epsilon_r = 54.967$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-20-2015; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3332; ConvF(6.24, 6.24, 6.24); Calibrated: 9/18/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 13, Body SAR, Back side, Mid.ch,  
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Wireless Charging Cover**

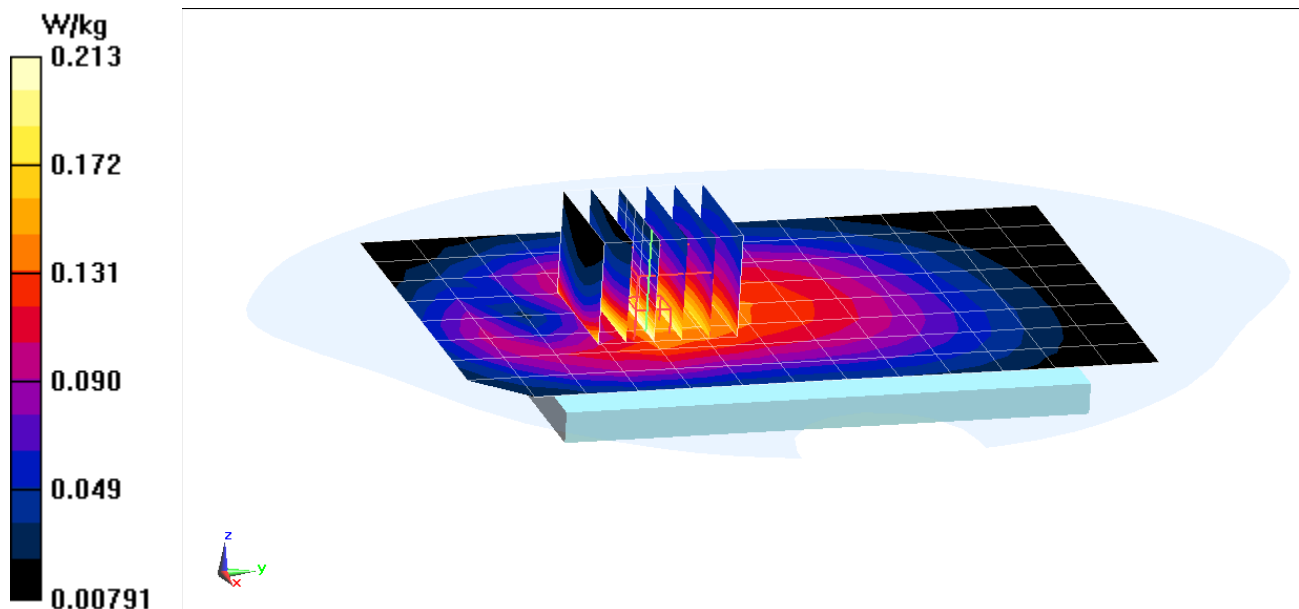
**Area Scan (9x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (6x6x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 14.18 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.258 W/kg

**SAR(1 g) = 0.190 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 930ED**

Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium: 1750 Body, Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$ ;  $\sigma = 1.463 \text{ S/m}$ ;  $\epsilon_r = 51.54$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-19-2015; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3213; ConvF(4.93, 4.93, 4.93); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/20/2015

Phantom: ELI Left v6.0; Type: QDOVA001BB; Serial: TP:1202

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 4 (AWS), Body SAR, Bottom Edge, Mid.ch,  
20 MHz Bandwidth, QPSK, 100 RB, 0 RB Offset, Wireless Charging Cover**

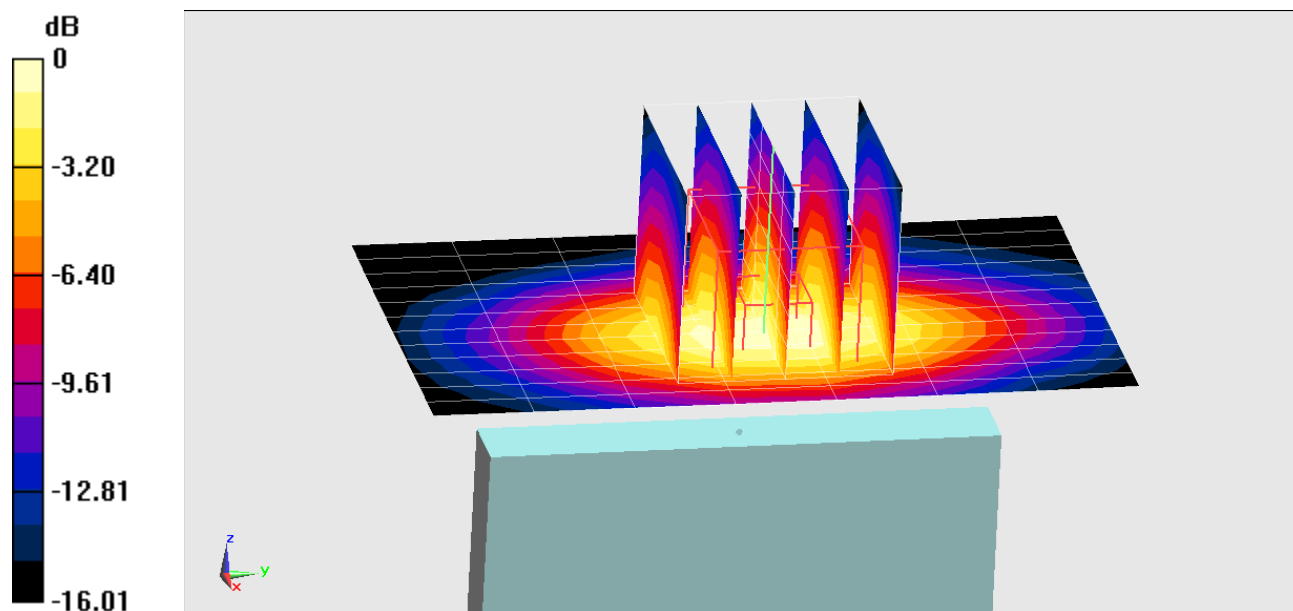
**Area Scan (13x8x1):** Measurement grid:  $dx=5\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 21.12 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.960 W/kg

**SAR(1 g) = 0.595 W/kg**



0 dB = 0.724 W/kg = -1.40 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9587C**

Communication System: UID 0, 802.11a 5.2-5.8 GHz Band; Frequency: 5745 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body, Medium parameters used:

$f = 5745 \text{ MHz}$ ;  $\sigma = 6.012 \text{ S/m}$ ;  $\epsilon_r = 46.56$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-18-2015; Ambient Temp: 23.2°C; Tissue Temp: 22.1°C

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: IEEE 802.11a, U-NII-3, 20 MHz Bandwidth, Body SAR, Ch 149,  
6 Mbps, Front Side, Antenna 2, Wireless Charging Cover**

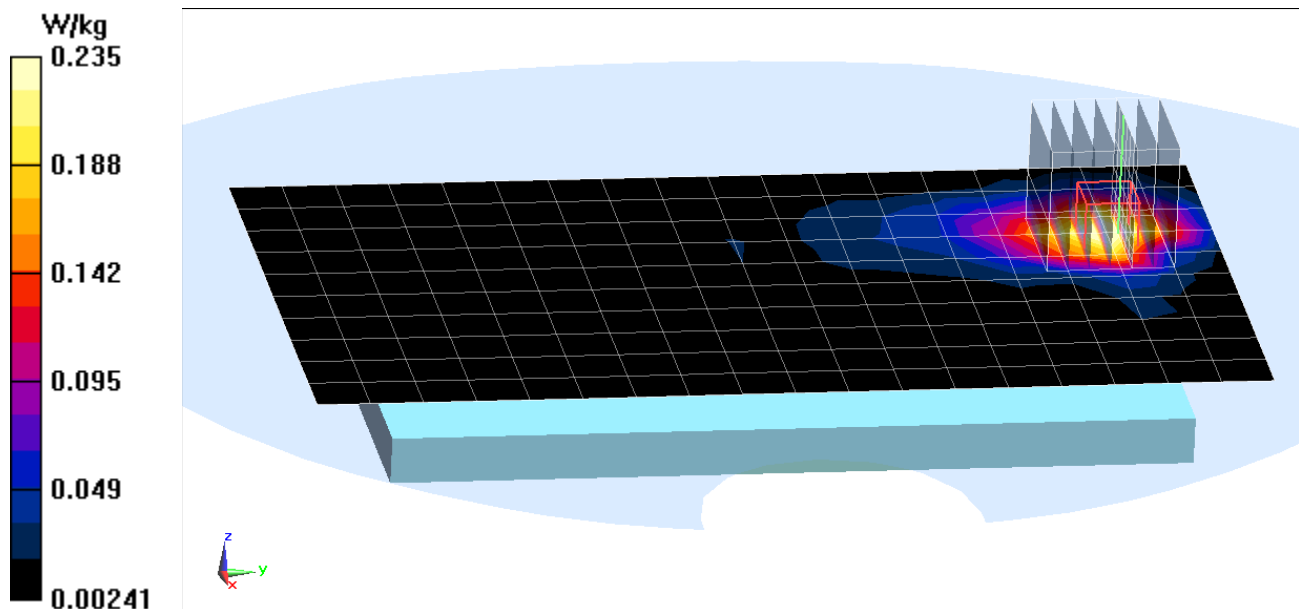
**Area Scan (11x19x1):** Measurement grid: dx=10mm, dy=10mm

**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 4.054 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.380 W/kg

**SAR(1 g) = 0.091 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9635F**

Communication System: UID 0, GSM; 4 Tx slots; Frequency: 1850.2 MHz; Duty Cycle: 1:2.076

Medium: 1900 Body; Medium parameters used (interpolated):

$f = 1850.2 \text{ MHz}$ ;  $\sigma = 1.527 \text{ S/m}$ ;  $\epsilon_r = 52.097$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.1 cm

Test Date: 08-24-2015; Ambient Temp: 23.3°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3263; ConvF(4.66, 4.66, 4.66); Calibrated: 5/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 6/17/2015

Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Mode: GPRS 1900, Phablet SAR, Front side,  
Wireless Charging Cover, Low.ch, 4 Tx Slots**

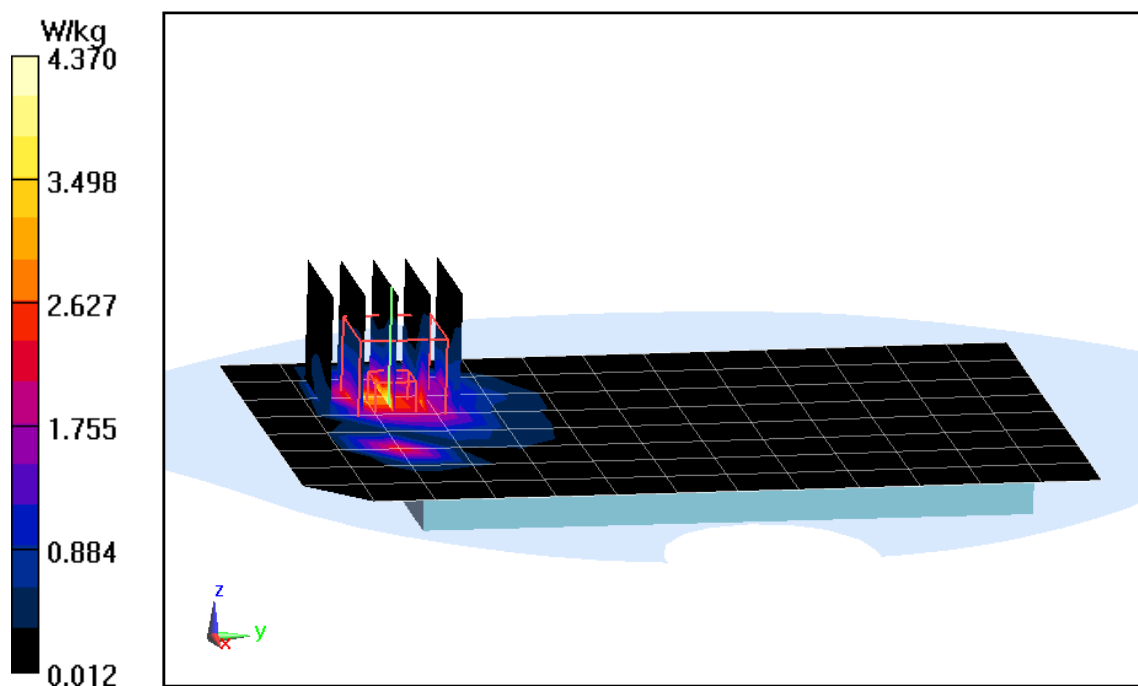
**Area Scan (9x14x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 43.40 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 6.18 W/kg

**SAR(10 g) = 1.42 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 93705**

Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1

Medium: 750 Body; Medium parameters used (interpolated):

$f = 707.5$  MHz;  $\sigma = 0.926$  S/m;  $\epsilon_r = 55.763$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 08-20-2015; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3332; ConvF(6.24, 6.24, 6.24); Calibrated: 9/18/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 12, Phablet SAR, Back side, Wireless Charging Cover,  
Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

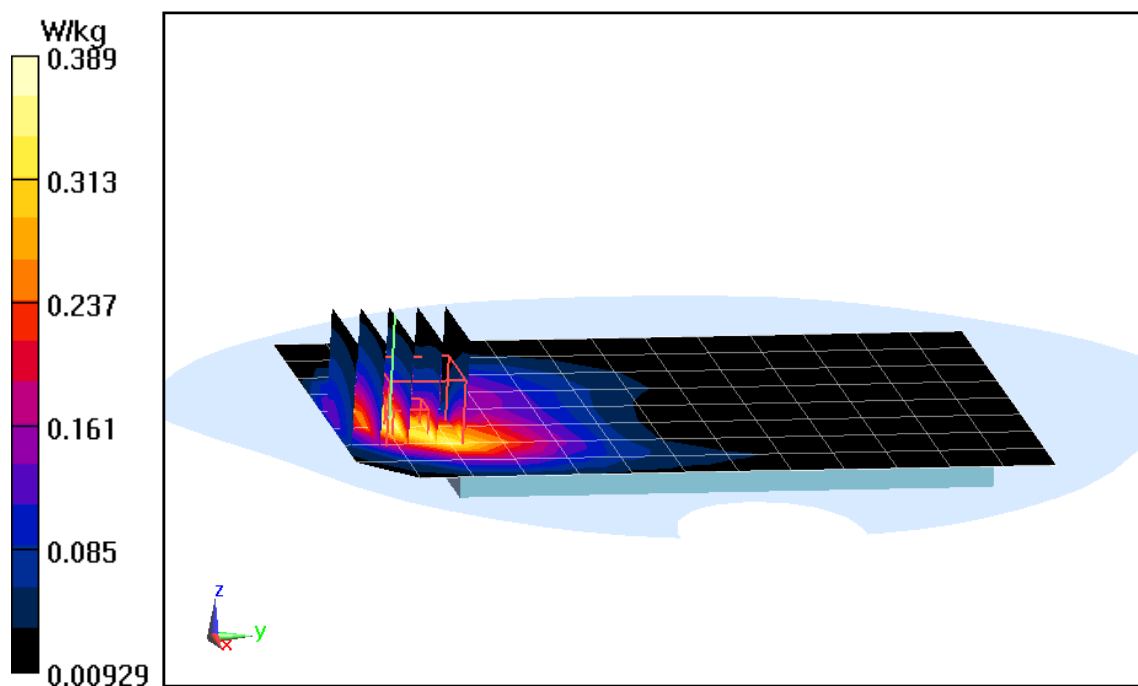
**Area Scan (9x14x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 18.60 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.573 W/kg

**SAR(10 g) = 0.186 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 96547**

Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium: 1750 Body; Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$ ;  $\sigma = 1.47 \text{ S/m}$ ;  $\epsilon_r = 51.892$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 09-08-2015; Ambient Temp: 22.7°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3351; ConvF(4.88, 4.88, 4.88); Calibrated: 6/22/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2015

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 4 (AWS), Phablet SAR, Bottom Edge, Mid.ch,  
20 MHz Bandwidth, QPSK, 50 RB, 0 RB Offset, Wireless Charging Cover**

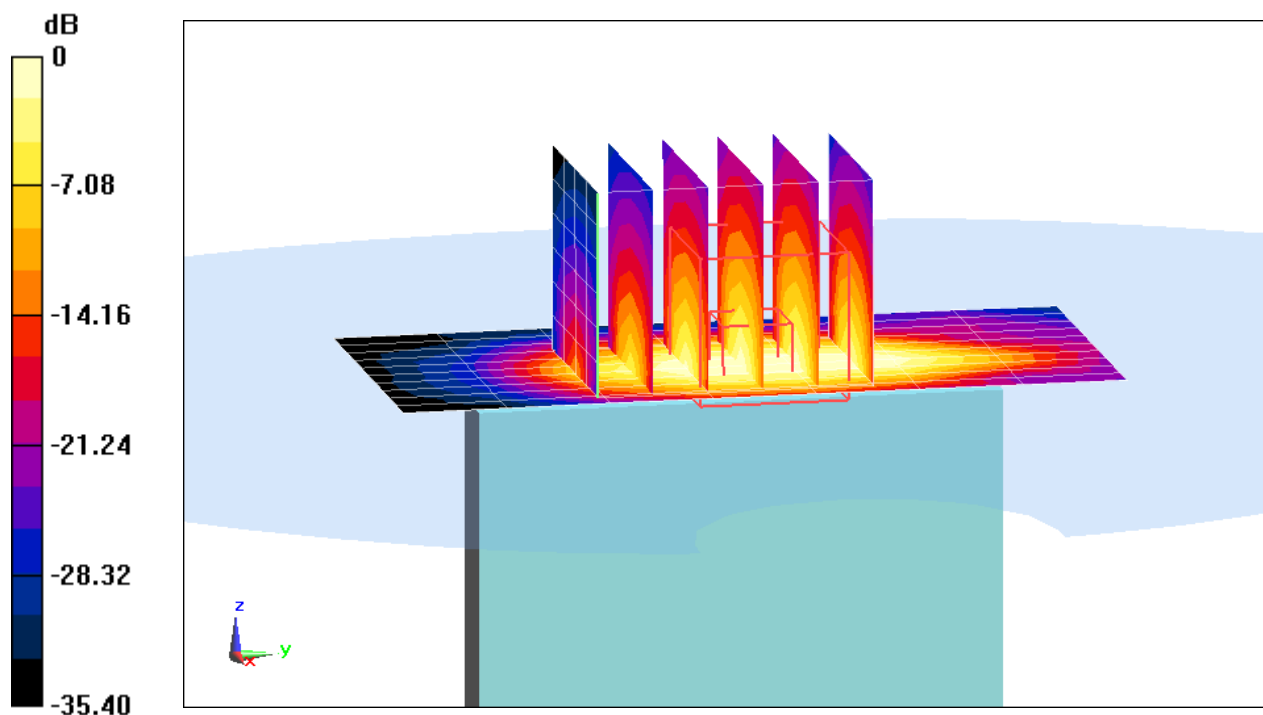
**Area Scan (11x8x1):** Measurement grid:  $dx=5\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (5x6x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 59.55 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 9.88 W/kg

**SAR(10 g) = 2.47 W/kg**



0 dB = 6.92 W/kg = 8.40 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG928R4; Type: Portable Handset; Serial: 9587C**

Communication System: UID 0, 802.11a 5.2-5.8 GHz Band; Frequency: 5720 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body, Medium parameters used (interpolated):

$f = 5720$  MHz;  $\sigma = 5.998$  S/m;  $\epsilon_r = 46.634$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 08-18-2015; Ambient Temp: 23.2°C; Tissue Temp: 22.1°C

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: IEEE 802.11a, U-NII-2C, 20 MHz Bandwidth, Phablet SAR, Ch 144,  
6 Mbps, Front Side, Antenna 1, Wireless Charging Cover**

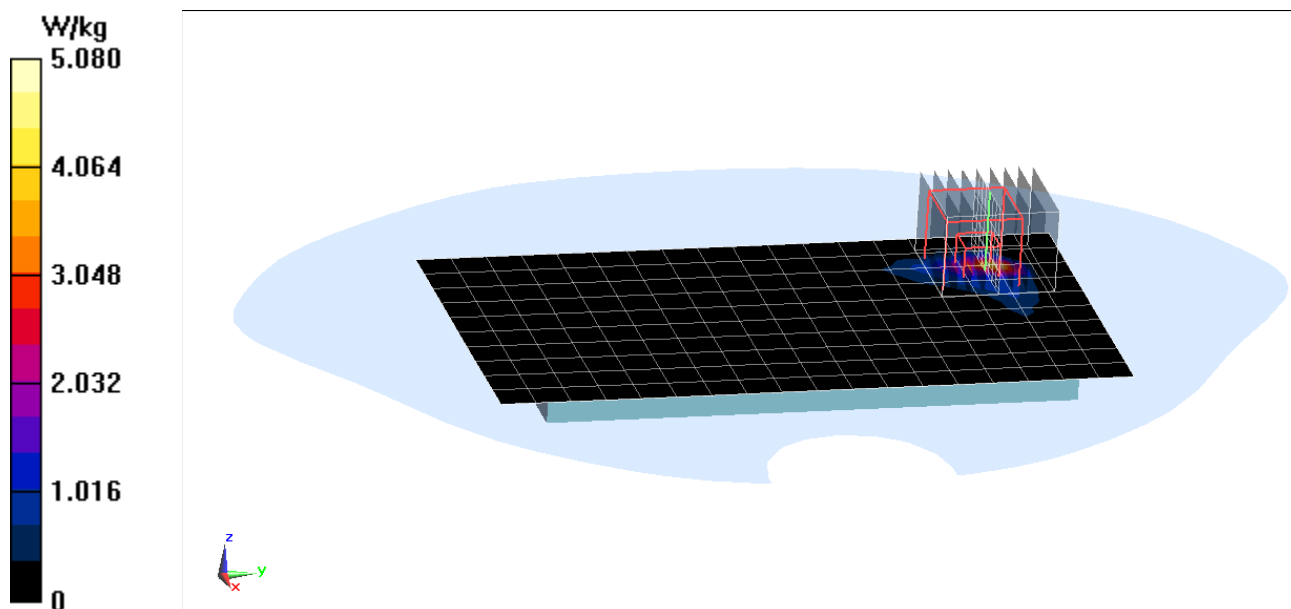
**Area Scan (11x19x1):** Measurement grid: dx=10mm, dy=10mm

**Zoom Scan (9x9x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 13.47 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 10.4 W/kg

**SAR(10 g) = 0.354 W/kg**



## APPENDIX B: SYSTEM VERIFICATION

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 750 MHz; Type: D750V3; Serial: 1003**

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 750 Head, Medium parameters used (interpolated):

$f = 750 \text{ MHz}$ ;  $\sigma = 0.895 \text{ S/m}$ ;  $\epsilon_r = 42.054$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-21-2015; Ambient Temp: 23.6°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3332; ConvF(6.56, 6.56, 6.56); Calibrated: 9/18/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 750 MHz System Verification

**Area Scan (7x15x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

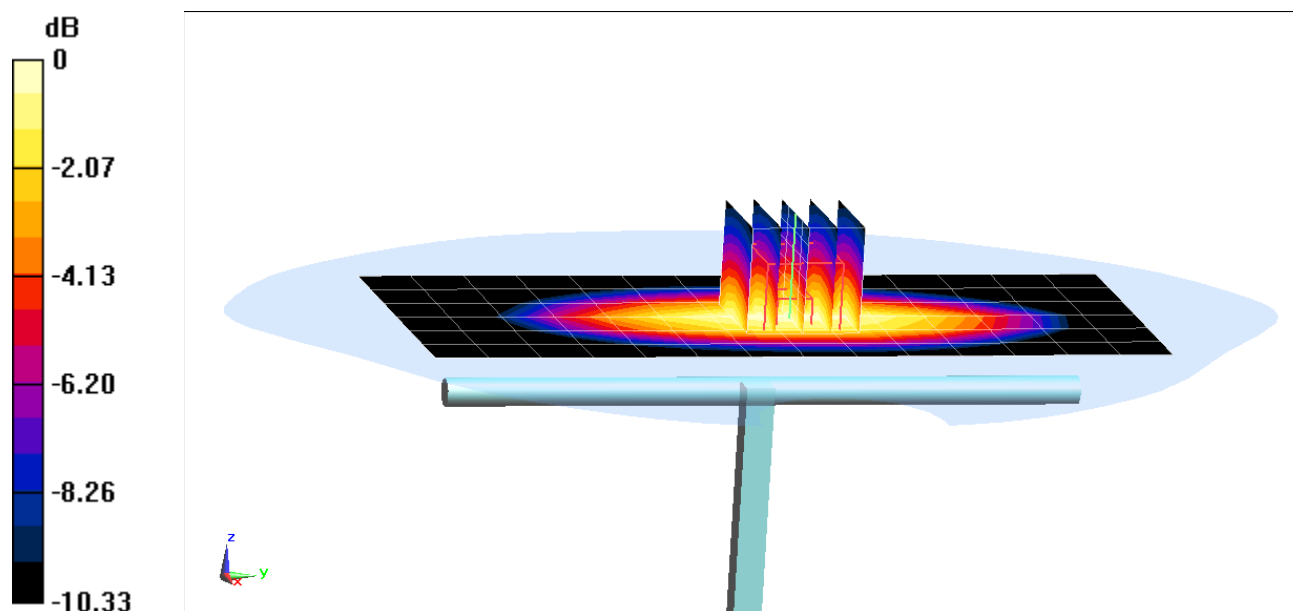
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Input Power = 23 dBm (200 mW)

Peak SAR (extrapolated) = 2.30 W/kg

**SAR(1 g) = 1.55 W/kg**

Deviation(1 g) = -4.20%



0 dB = 1.81 W/kg = 2.58 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119**

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 850 Head Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.92 \text{ S/m}$ ;  $\epsilon_r = 42.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-20-2015; Ambient Temp: 22.0°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3319; ConvF(6.41, 6.41, 6.41); Calibrated: 3/19/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/13/2015

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1800

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

## 835 MHz System Verification

**Area Scan (7x14x1):** Measurement grid: dx=15mm, dy=15mm

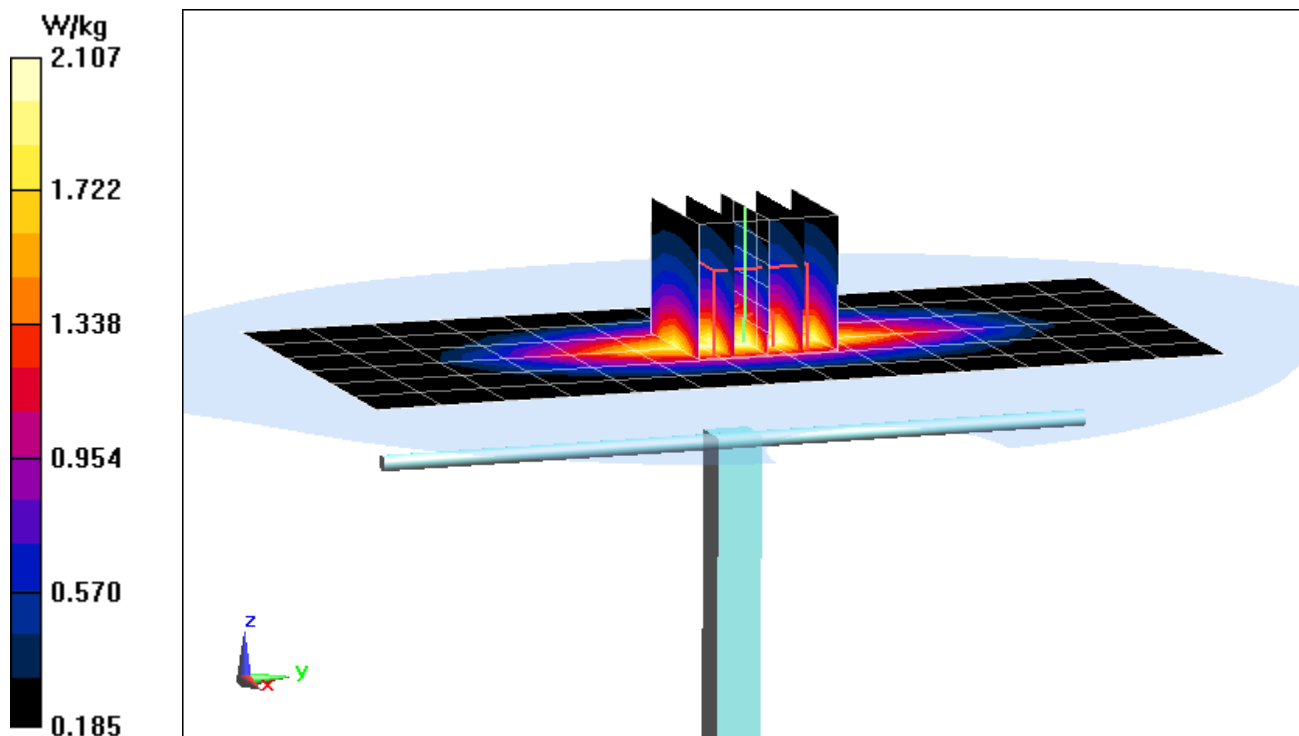
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power= 23 dBm (200 mW)

Peak SAR (extrapolated) = 2.64 W/kg

**SAR(1 g) = 1.8 W/kg**

Deviation(1 g) = -4.05%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1051**

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 1750 Head, Medium parameters used:

$f = 1750 \text{ MHz}$ ;  $\sigma = 1.37 \text{ S/m}$ ;  $\epsilon_r = 38.232$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-20-2015; Ambient Temp: 23.3°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3318; ConvF(5.27, 5.27, 5.27); Calibrated: 1/23/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/14/2015

Phantom: SAM Front; Type: SAM; Serial: 1686

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 1750 MHz System Verification

**Area Scan (7x9x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

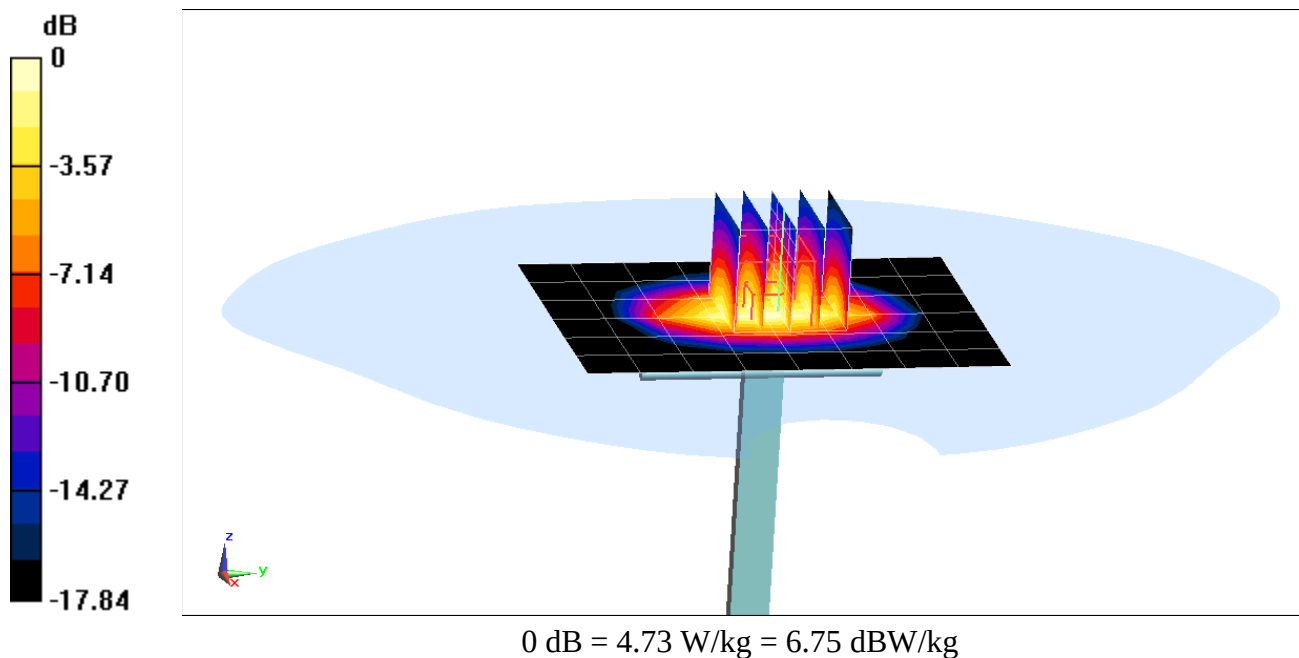
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 6.93 W/kg

**SAR(1 g) = 3.77 W/kg**

Deviation(1 g) = 4.14%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d141**

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.429 \text{ S/m}$ ;  $\epsilon_r = 39.843$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-20-2015; Ambient Temp: 21.8°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3319; ConvF(5.1, 5.1, 5.1); Calibrated: 3/19/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/13/2015

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1800

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 1900 MHz System Verification

**Area Scan (7x10x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

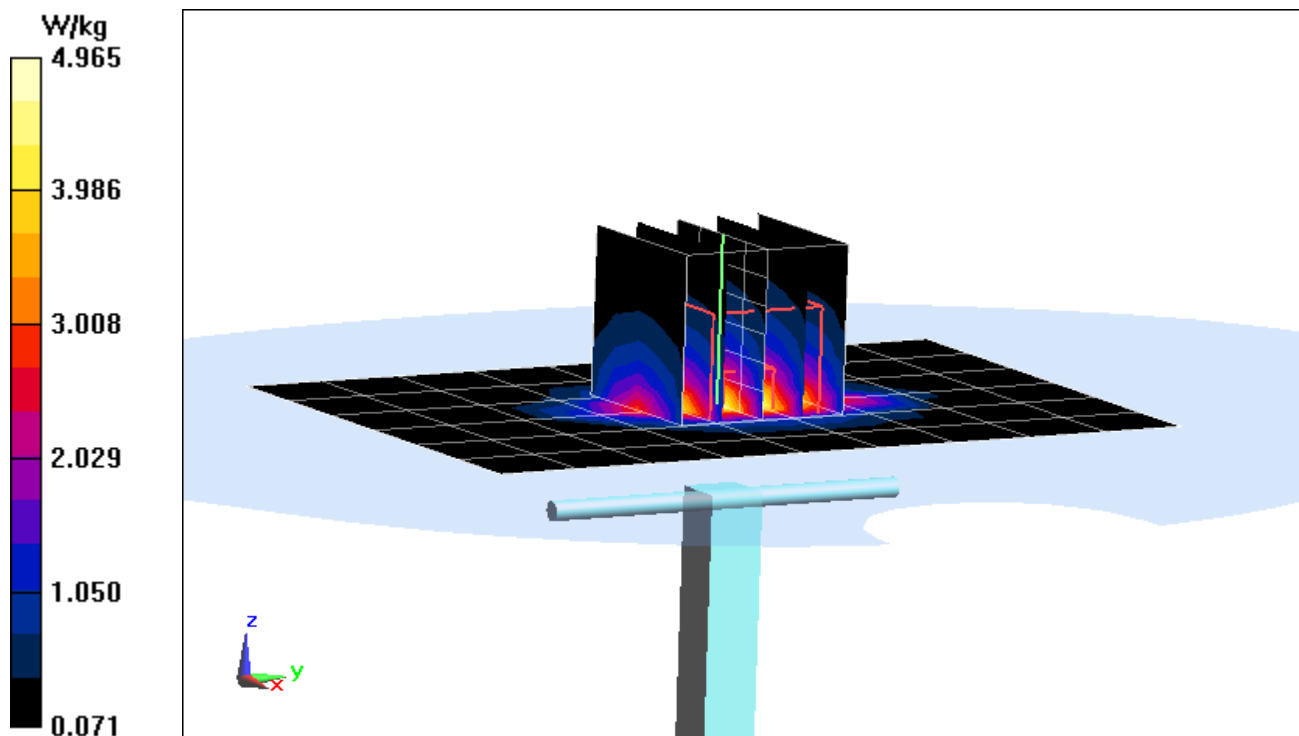
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 7.17 W/kg

**SAR(1 g) = 3.94 W/kg**

Deviation(1 g) = -1.25%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 882**

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Head, Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.846 \text{ S/m}$ ;  $\epsilon_r = 38.712$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-19-2015; Ambient Temp: 23.2°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3263; ConvF(4.4, 4.4, 4.4); Calibrated: 5/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 6/17/2015

Phantom: SAM with CRP (Left); Type: SAM; Serial: 1715

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 2450 MHz System Verification

**Area Scan (8x9x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

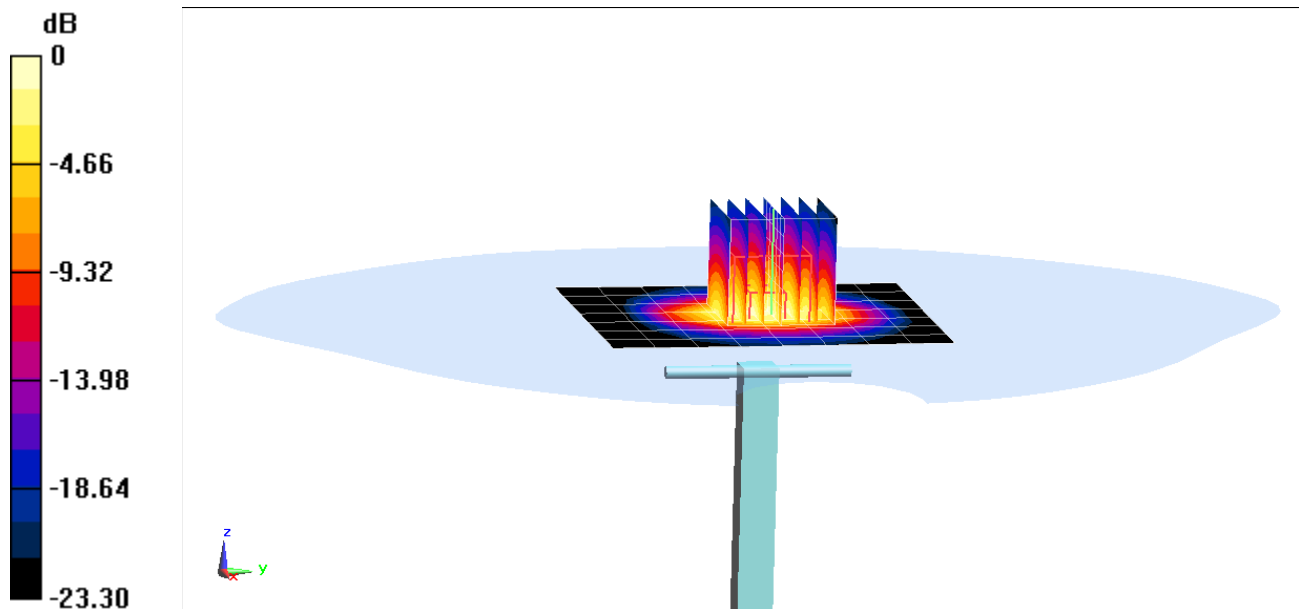
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 11.5 W/kg

**SAR(1 g) = 5.49 W/kg**

Deviation(1 g) = 4.97%



0 dB = 7.27 W/kg = 8.62 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1191**

Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head, Medium parameters used:

$f = 5800 \text{ MHz}$ ;  $\sigma = 5.084 \text{ S/m}$ ;  $\epsilon_r = 36.644$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-18-2015; Ambient Temp: 21.5°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3914; ConvF(4.67, 4.67, 4.67); Calibrated: 2/10/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/31/2014

Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 5800 MHz System Verification

**Area Scan (7x7x1):** Measurement grid: dx=10mm, dy=10mm

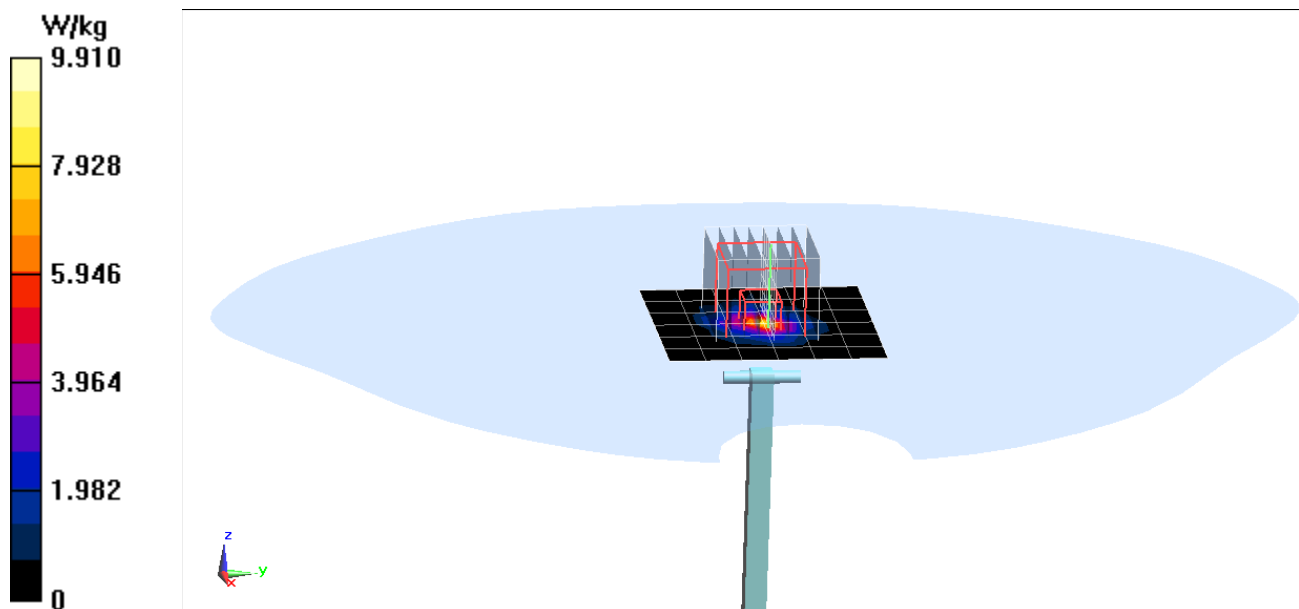
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 18.7 W/kg

**SAR(1 g) = 4.08 W/kg**

Deviation(1 g) = -0.85%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 750 MHz; Type: D750V3; Serial: 1003**

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 750 Body, Medium parameters used (interpolated):

$f = 750 \text{ MHz}$ ;  $\sigma = 0.966 \text{ S/m}$ ;  $\epsilon_r = 55.332$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-20-2015; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3332; ConvF(6.24, 6.24, 6.24); Calibrated: 9/18/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 750 MHz System Verification

**Area Scan (7x15x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

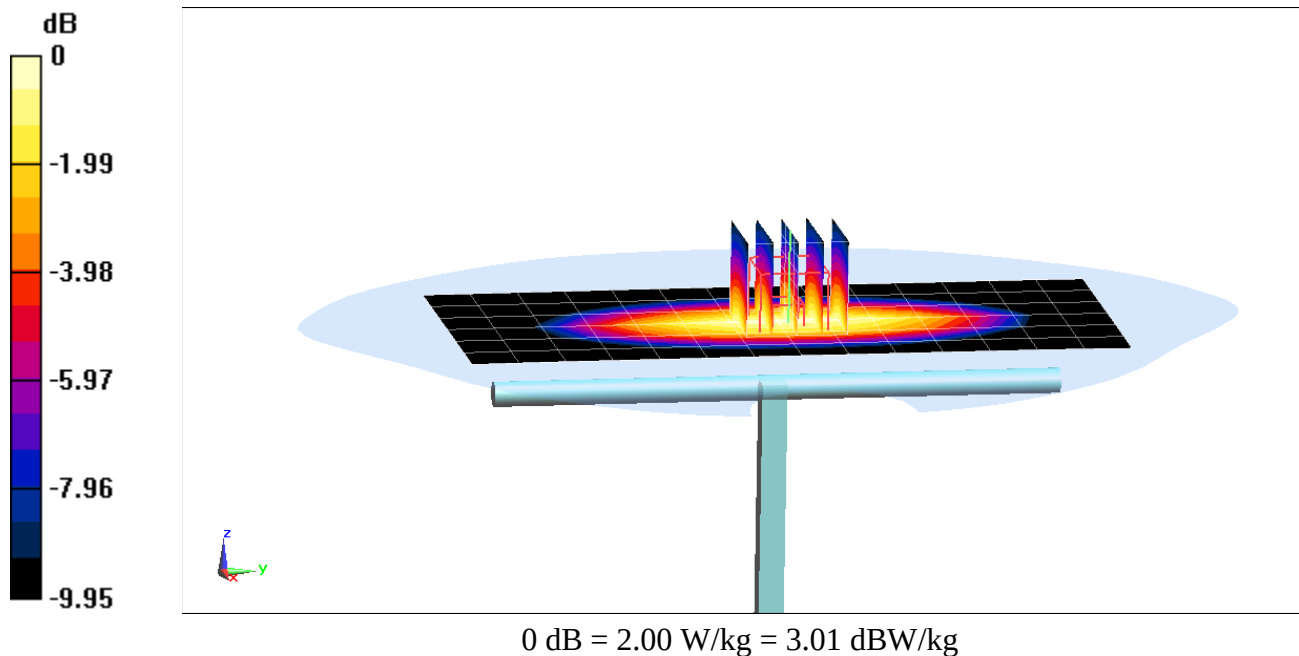
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Input Power = 23 dBm (200 mW)

Peak SAR (extrapolated) = 2.48 W/kg

**SAR(1 g) = 1.72 W/kg; SAR (10g) = 1.15 W/kg**

Deviation(1 g) = 1.65%; Deviation (10g) 3.05%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119**

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 850 Body Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 1 \text{ S/m}$ ;  $\epsilon_r = 53.648$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-21-2015; Ambient Temp: 21.3°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3318; ConvF(6.23, 6.23, 6.23); Calibrated: 1/23/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/14/2015

Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2027

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

## 835 MHz System Verification

**Area Scan (7x14x1):** Measurement grid: dx=15mm, dy=15mm

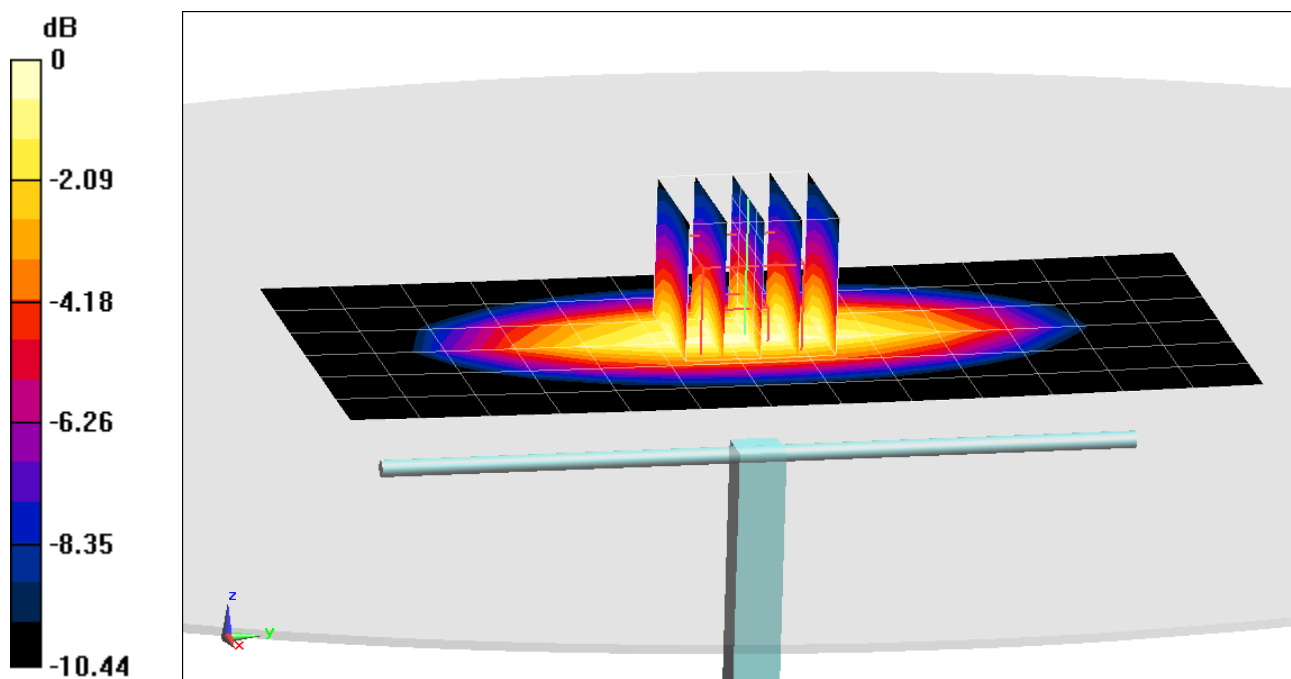
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 23 dBm (200 mW)

Peak SAR (extrapolated) = 2.77 W/kg

**SAR(1 g) = 1.88 W/kg**

Deviation = 2.17%



0 dB = 2.20 W/kg = 3.42 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1051**

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 1750 Body, Medium parameters used:

$f = 1750 \text{ MHz}$ ;  $\sigma = 1.483 \text{ S/m}$ ;  $\epsilon_r = 51.462$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-19-2015; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3213; ConvF(4.93, 4.93, 4.93); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/20/2015

Phantom: ELI Left v6.0; Type: QDOVA001BB; Serial: TP:1202

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 1750 MHz System Verification

**Area Scan (7x9x1):** Measurement grid: dx=15mm, dy=15mm

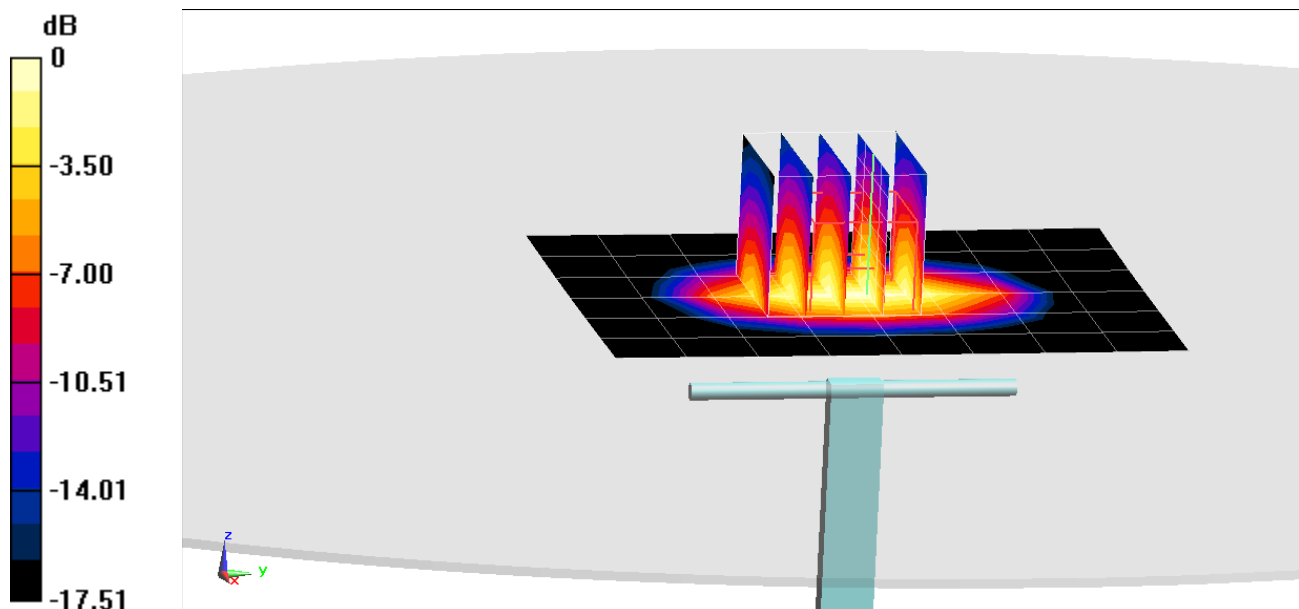
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 6.74 W/kg

**SAR(1 g) = 3.82 W/kg**

Deviation(1 g) = 2.96%



0 dB = 4.76 W/kg = 6.78 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1051**

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 1750 Body Medium parameters used:

$f = 1750 \text{ MHz}$ ;  $\sigma = 1.489 \text{ S/m}$ ;  $\epsilon_r = 51.846$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-08-2015; Ambient Temp: 22.7°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3351; ConvF(4.88, 4.88, 4.88); Calibrated: 6/22/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2015

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 1750 MHz System Verification

**Area Scan (7x9x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

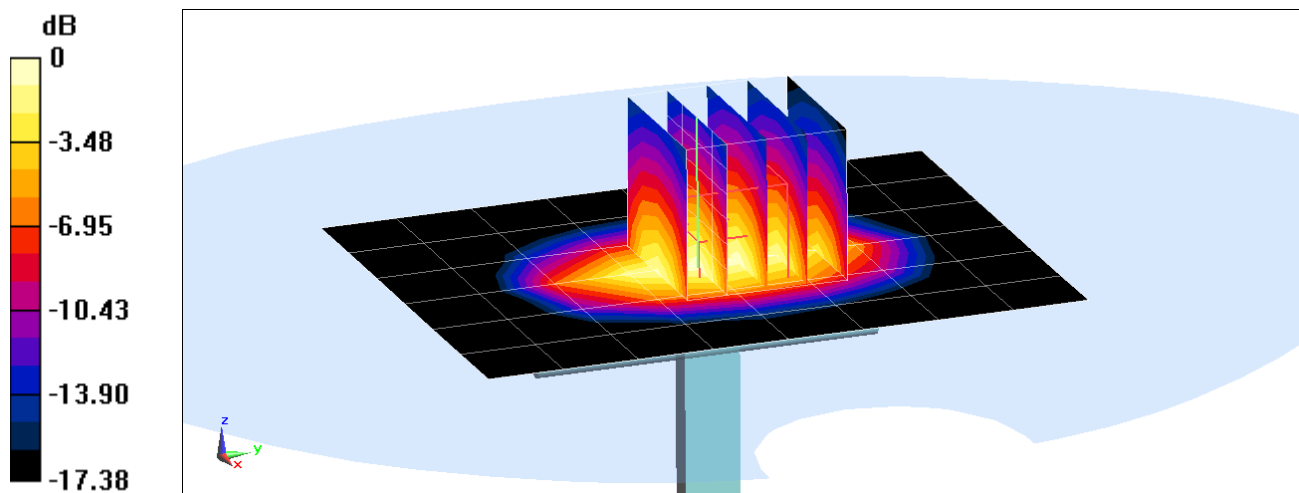
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 6.39 W/kg

**SAR(10 g) = 1.96 W/kg**

Deviation(10 g): -2.00%



0 dB = 4.53 W/kg = 6.56 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d141**

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body, Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.577 \text{ S/m}$ ;  $\epsilon_r = 51.731$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-19-2015; Ambient Temp: 21.7°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF(4.66, 4.66, 4.66); Calibrated: 5/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 6/17/2015

Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 1900 MHz System Verification

**Area Scan (7x10x1):** Measurement grid: dx=15mm, dy=15mm

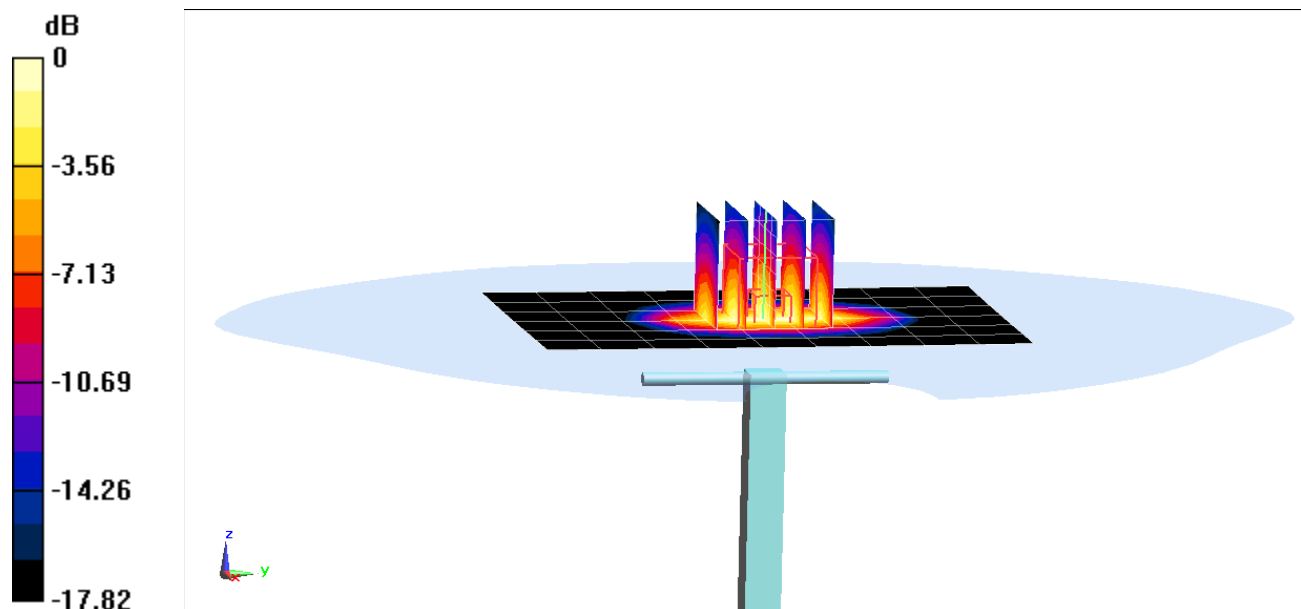
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 7.42 W/kg

**SAR(1 g) = 4.21 W/kg**

Deviation(1 g) = 5.25%



0 dB = 5.28 W/kg = 7.23 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d141**

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body; Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.583 \text{ S/m}$ ;  $\epsilon_r = 51.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-24-2015; Ambient Temp: 23.3°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3263; ConvF(4.66, 4.66, 4.66); Calibrated: 5/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 6/17/2015

Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 1900 MHz System Verification

**Area Scan (7x10x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

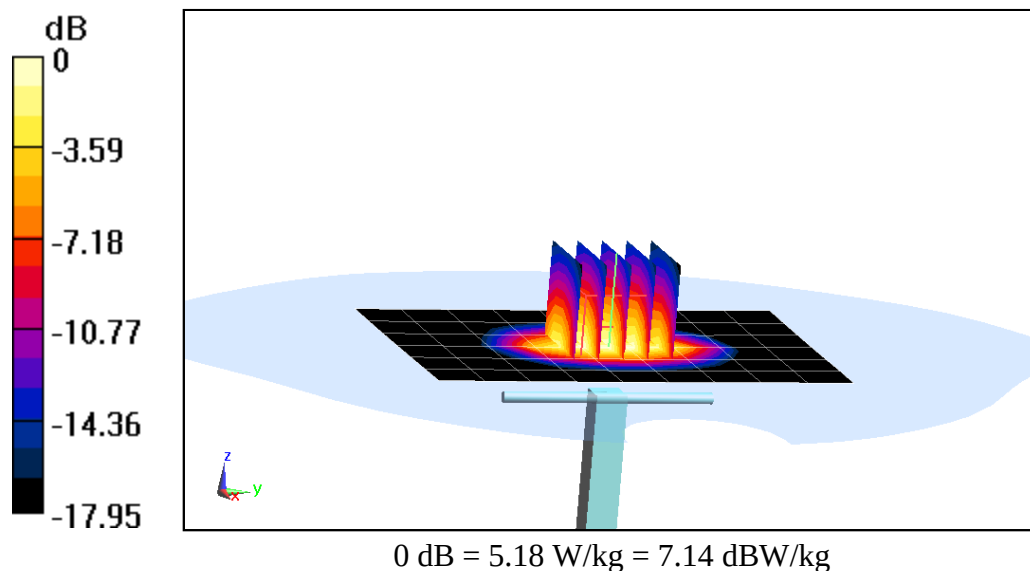
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 7.47 W/kg

**SAR(10 g) = 2.2 W/kg**

Deviation = 3.77%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 882**

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body, Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 2.004 \text{ S/m}$ ;  $\epsilon_r = 50.974$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-19-2015; Ambient Temp: 21.9°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3318; ConvF(4.37, 4.37, 4.37); Calibrated: 1/23/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/14/2015

Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2027

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 2450 MHz System Verification

**Area Scan (8x9x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

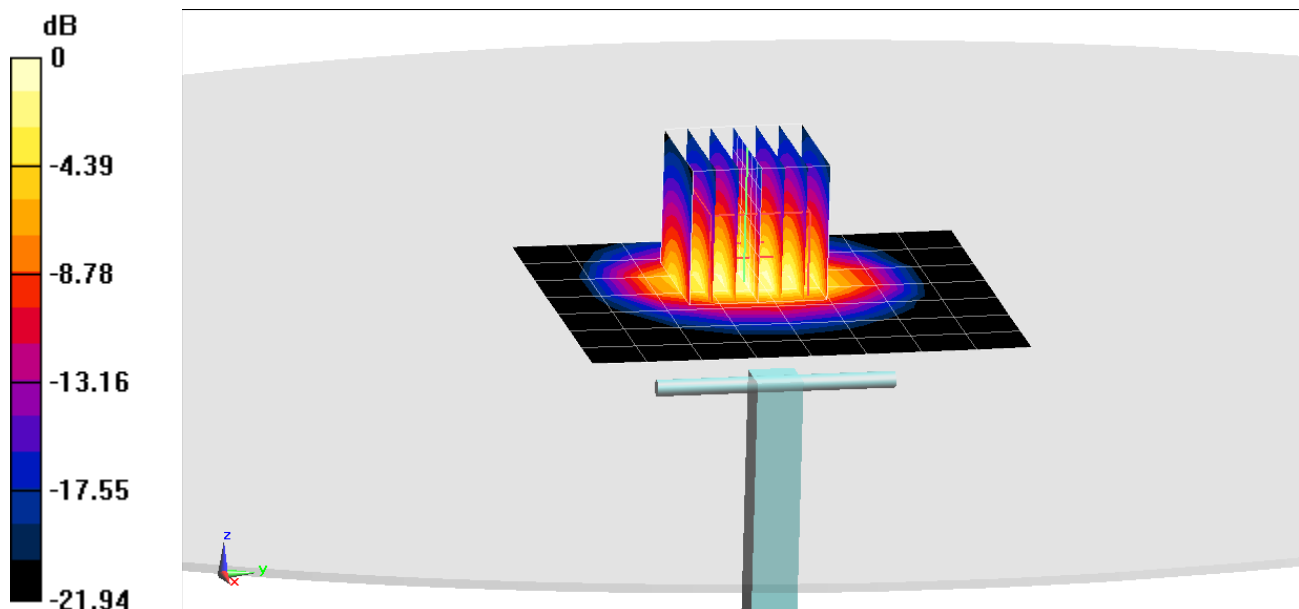
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 11.3 W/kg

**SAR(1 g) = 5.36 W/kg**

Deviation(1 g) = 5.72%



0 dB = 7.08 W/kg = 8.50 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body, Medium parameters used:

$f = 5800 \text{ MHz}$ ;  $\sigma = 6.141 \text{ S/m}$ ;  $\epsilon_r = 46.449$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-18-2015; Ambient Temp: 23.2°C; Tissue Temp: 22.1°C

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## 5800 MHz System Verification

**Area Scan (7x7x1):** Measurement grid: dx=10mm, dy=10mm

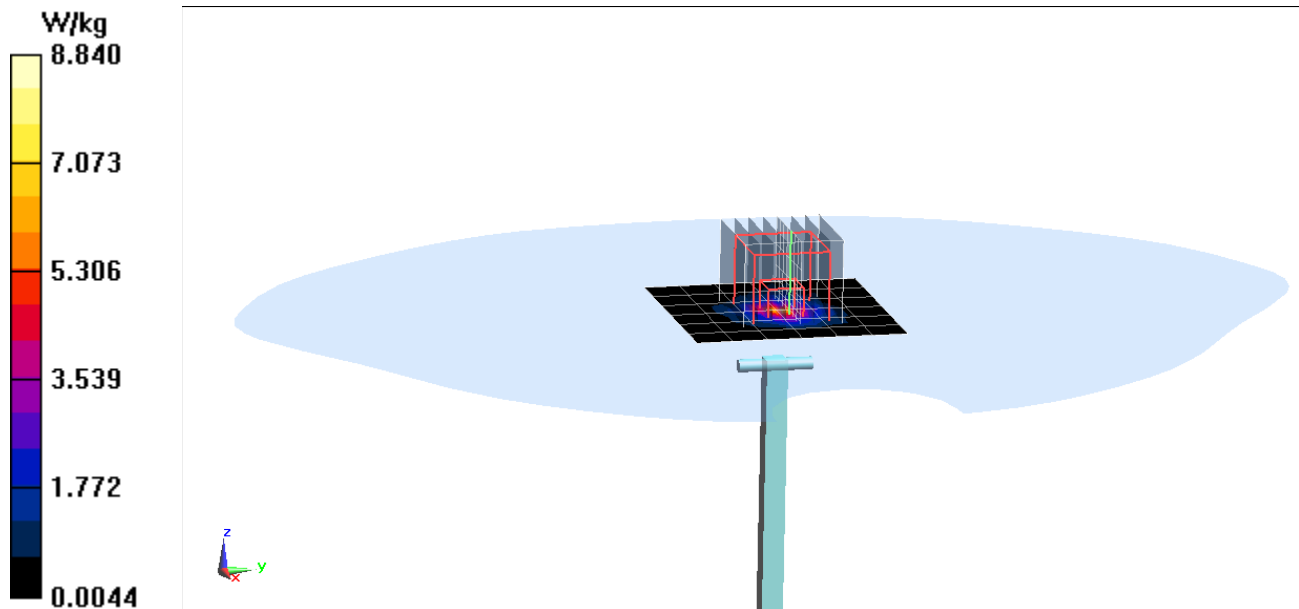
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 16.0 W/kg

**SAR(1 g) = 3.57 W/kg; SAR(10 g) = 1 W/kg**

Deviation(1 g) = -4.93%; Deviation(10 g) = -2.91%



## APPENDIX C: PROBE CALIBRATION



Accreditation No.: **SCS 0108**

Accredited by the Swiss Accreditation Service (SAS)

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

Certificate No: **D750V3-1003\_Jan15**

Client **PC Test**

## CALIBRATION CERTIFICATE

Object **D750V3 - SN: 1003**

Calibration procedure(s) **QA CAL-05.v9**  
**Calibration procedure for dipole validation kits above 700 MHz**

CC  
2/3/15

Calibration date: **January 16, 2015**

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 EPM-442A        | GB37480704         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | US37292783         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | MY41092317         | 07-Oct-14 (No. 217-02021)         | Oct-15                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 03-Apr-14 (No. 217-01918)         | Apr-15                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 03-Apr-14 (No. 217-01921)         | Apr-15                 |
| Reference Probe ES3DV3      | SN: 3205           | 30-Dec-14 (No. ES3-3205_Dec14)    | Dec-15                 |
| DAE4                        | SN: 601            | 18-Aug-14 (No. DAE4-601_Aug14)    | Aug-15                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-13) | In house check: Oct-16 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

Calibrated by: **Name**  
**Michael Weber** **Function**  
**Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: January 19, 2015

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



Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

**Glossary:**

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

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

- 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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.8.8     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 750 MHz $\pm$ 1 MHz    |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 41.9           | 0.89 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 41.7 $\pm$ 6 % | 0.91 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

|                                                       |                    |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                              |
| SAR measured                                          | 250 mW input power | 2.06 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 8.09 W/kg $\pm$ 17.0 % (k=2) |

|                                                         |                    |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
| SAR measured                                            | 250 mW input power | 1.35 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 5.32 W/kg $\pm$ 16.5 % (k=2) |

## Body TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 55.5           | 0.96 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 56.0 $\pm$ 6 % | 0.99 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

|                                                       |                    |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                              |
| SAR measured                                          | 250 mW input power | 2.16 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 8.46 W/kg $\pm$ 17.0 % (k=2) |

|                                                         |                    |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                              |
| SAR measured                                            | 250 mW input power | 1.42 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 5.58 W/kg $\pm$ 16.5 % (k=2) |

## Appendix (Additional assessments outside the scope of SCS0108)

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 53.7 $\Omega$ - 1.4 j $\Omega$ |
| Return Loss                          | - 28.5 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.3 $\Omega$ - 3.8 j $\Omega$ |
| Return Loss                          | - 27.5 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.043 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |                  |
|-----------------|------------------|
| Manufactured by | SPEAG            |
| Manufactured on | January 21, 2009 |

## DASY5 Validation Report for Head TSL

Date: 16.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1003**

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.91 \text{ S/m}$ ;  $\epsilon_r = 41.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.44, 6.44, 6.44); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

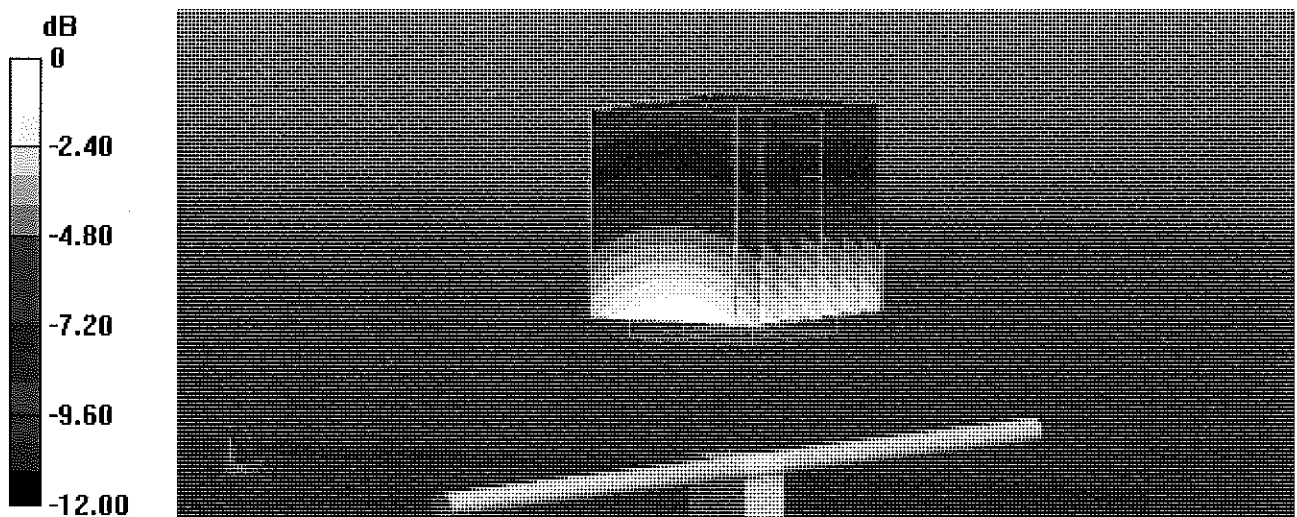
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 53.08 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.05 W/kg

**SAR(1 g) = 2.06 W/kg; SAR(10 g) = 1.35 W/kg**

Maximum value of SAR (measured) = 2.41 W/kg

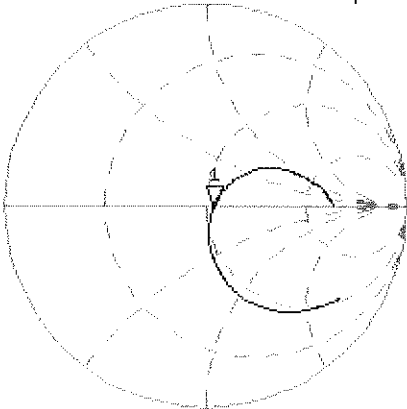


0 dB = 2.41 W/kg = 3.82 dBW/kg

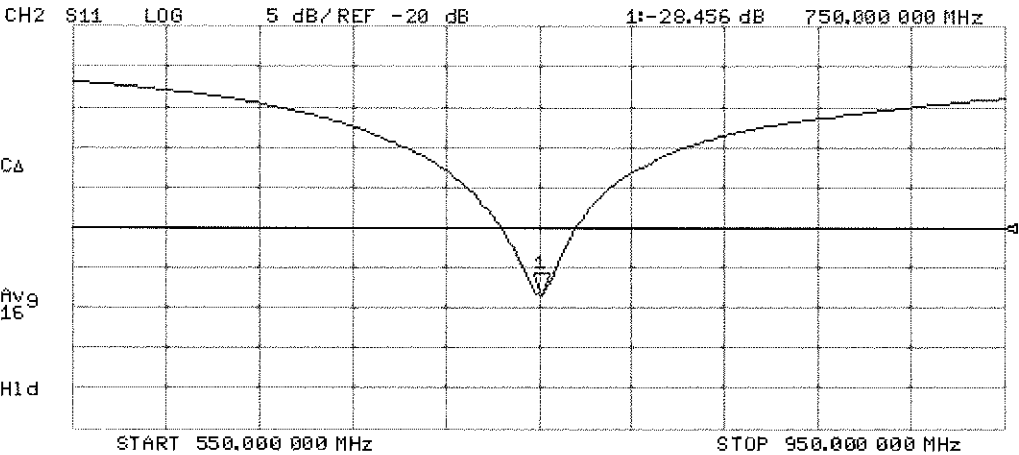
Impedance Measurement Plot for Head TSL

16 Jan 2015 16:07:22  
[CH1] S11 1 U FS 1: 53.666  $\Omega$  -1.3730  $\Delta$  154.55 pF 750.000 000 MHz

\*  
Del  
CA



Avg  
16  
H1d



CA  
Avg  
16  
H1d

## DASY5 Validation Report for Body TSL

Date: 16.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1003**

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.99$  S/m;  $\epsilon_r = 56$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.21, 6.21, 6.21); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

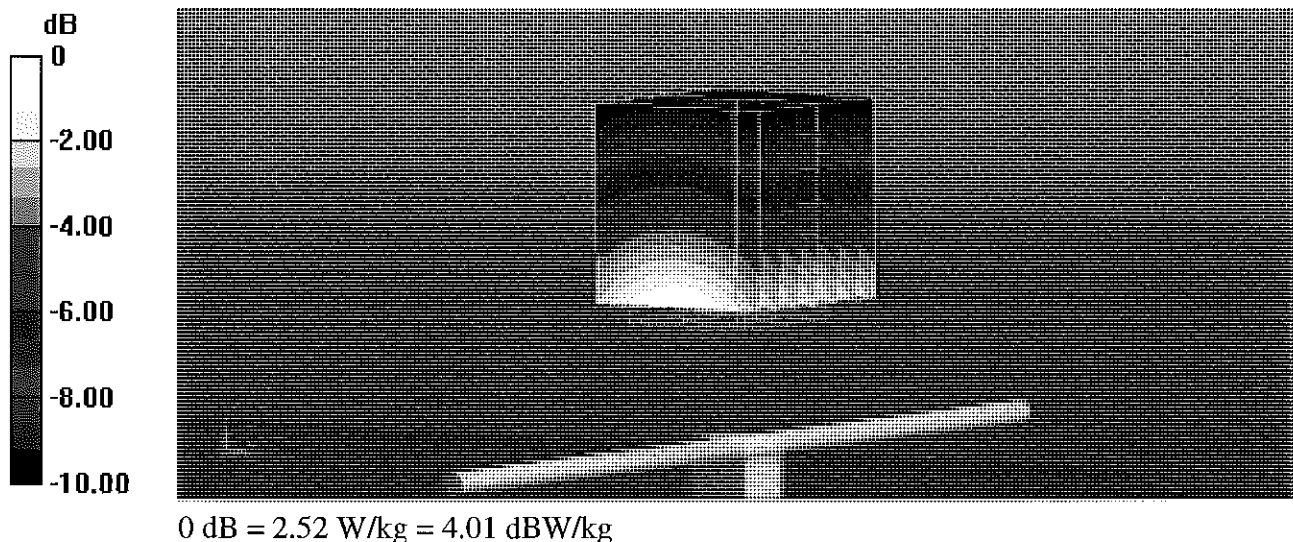
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 52.21 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.16 W/kg

**SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.42 W/kg**

Maximum value of SAR (measured) = 2.52 W/kg

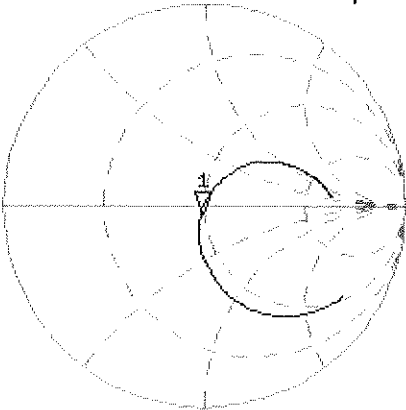


Impedance Measurement Plot for Body TSL

16 Jan 2015 13:37:35

CH1 S11 1 U FS 1: 48.268  $\Omega$  -3.7676  $\Omega$  56.324 pF 750.000 000 MHz

\*  
De1  
CA

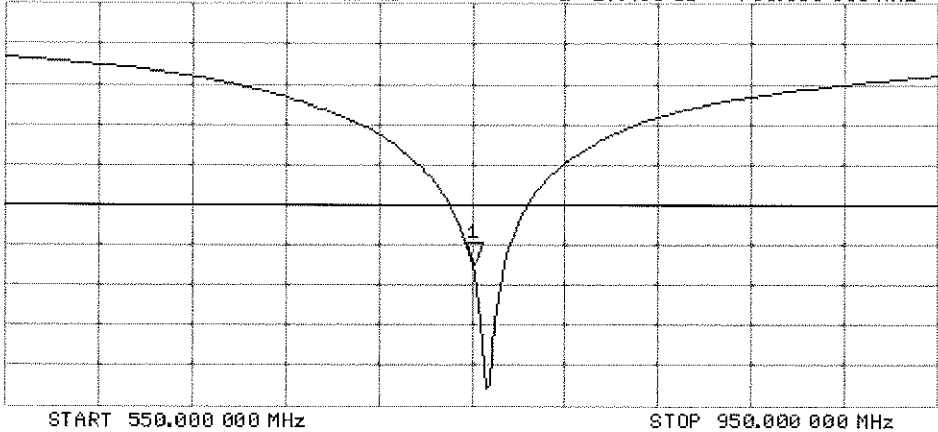


Avg  
16  
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-27.498 dB 750.000 000 MHz

CA

Avg  
16  
H1d





Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D835V2-4d119\_Apr15**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN:4d119**

Calibration procedure(s) **QA CAL-05.v9**  
 Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **April 13, 2015**

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 EPM-442A        | GB37480704         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | US37292783         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | MY41092317         | 07-Oct-14 (No. 217-02021)         | Oct-15                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 01-Apr-15 (No. 217-02131)         | Mar-16                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 01-Apr-15 (No. 217-02134)         | Mar-16                 |
| Reference Probe ES3DV3      | SN: 3205           | 30-Dec-14 (No. ES3-3205_Dec14)    | Dec-15                 |
| DAE4                        | SN: 601            | 18-Aug-14 (No. DAE4-601_Aug14)    | Aug-15                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-13) | In house check: Oct-16 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

Calibrated by: **Israe Elnaouq** **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: April 13, 2015

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



Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

**Glossary:**

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

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

- 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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.8.8     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 835 MHz $\pm$ 1 MHz    |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 41.5           | 0.90 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 40.9 $\pm$ 6 % | 0.94 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 2.43 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 9.38 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 1.57 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 6.11 W/kg $\pm$ 16.5 % (k=2) |

## Body TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 55.2           | 0.97 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 55.4 $\pm$ 6 % | 1.01 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 2.37 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 9.20 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 1.55 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 6.06 W/kg $\pm$ 16.5 % (k=2) |

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.2 $\Omega$ - 2.2 j $\Omega$ |
| Return Loss                          | - 33.3 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 47.7 $\Omega$ - 4.9 j $\Omega$ |
| Return Loss                          | - 25.1 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.386 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |               |
|-----------------|---------------|
| Manufactured by | SPEAG         |
| Manufactured on | June 29, 2010 |

## DASY5 Validation Report for Head TSL

Date: 13.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d119**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.94 \text{ S/m}$ ;  $\epsilon_r = 40.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.2, 6.2, 6.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole Calibration for Head Tissue/Pin=250 mW,  $d=15\text{mm}$ /Zoom Scan (7x7x7)/Cube 0:**

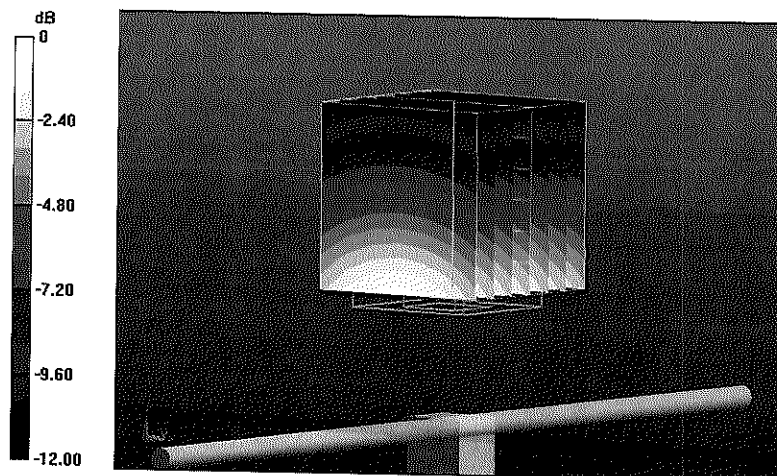
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $56.77 \text{ V/m}$ ; Power Drift =  $0.01 \text{ dB}$

Peak SAR (extrapolated) =  $3.64 \text{ W/kg}$

**SAR(1 g) =  $2.43 \text{ W/kg}$ ; SAR(10 g) =  $1.57 \text{ W/kg}$**

Maximum value of SAR (measured) =  $2.85 \text{ W/kg}$



0 dB =  $2.85 \text{ W/kg}$  =  $4.55 \text{ dBW/kg}$

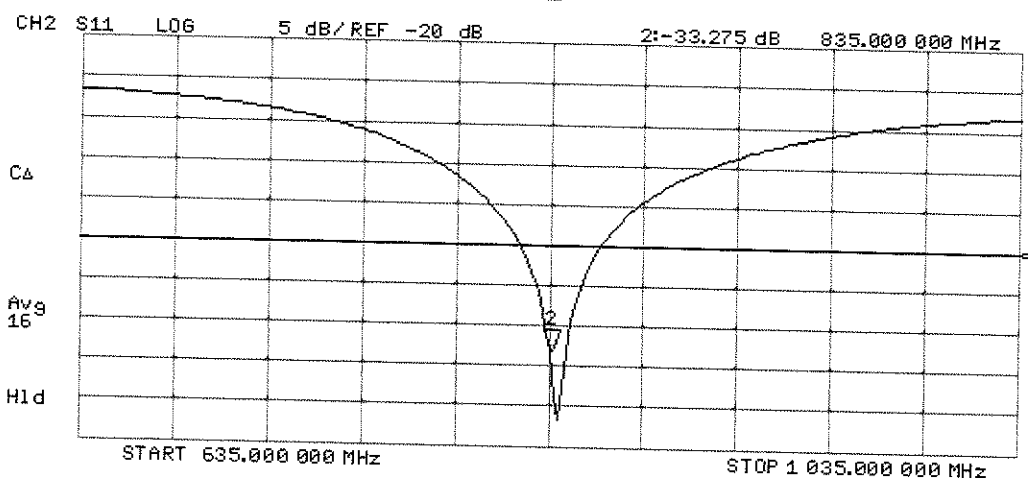
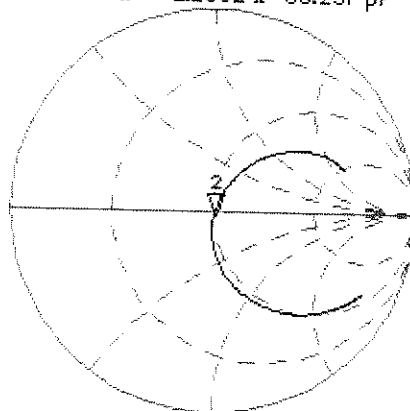
# Impedance Measurement Plot for Head TSL

CH1 S11 1 U FS 13 Apr 2015 13:42:59  
 2: 50.213  $\Omega$  -2.1602  $\Omega$  88.237 pF 835.000 000 MHz

\*  
 Del  
 CA

Avg  
 16

H1d



# DASY5 Validation Report for Body TSL

Date: 13.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d119**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 1.01 \text{ S/m}$ ;  $\epsilon_r = 55.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.17, 6.17, 6.17); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole Calibration for Body Tissue/Pin=250 mW,  $d=15\text{mm}$ /Zoom Scan (7x7x7)/Cube 0:**

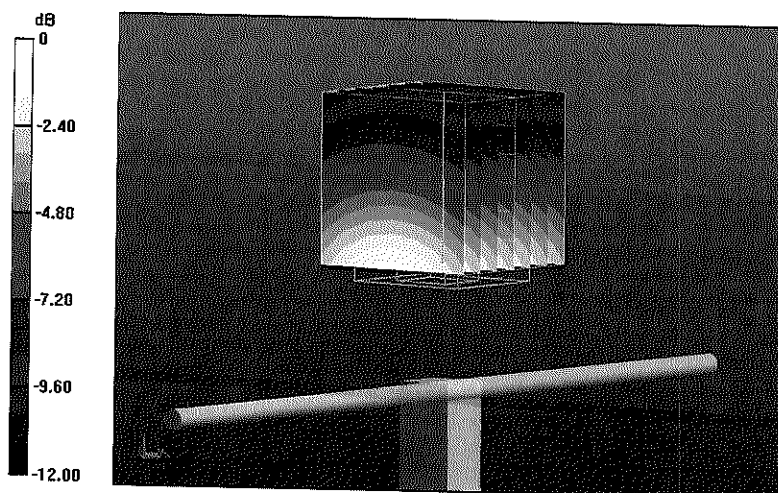
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 54.44 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 3.52 W/kg

**SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.55 W/kg**

Maximum value of SAR (measured) = 2.77 W/kg



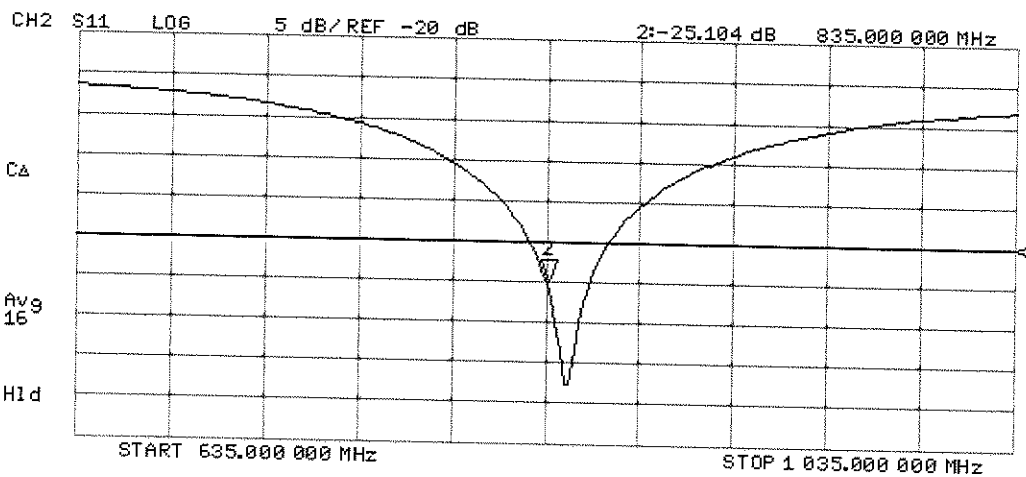
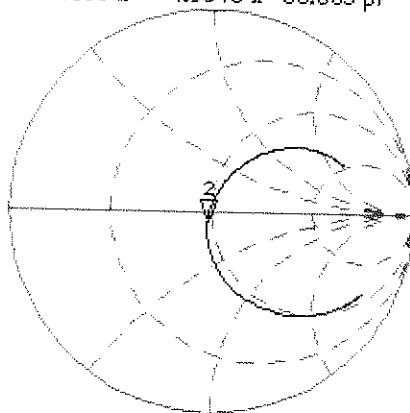
# Impedance Measurement Plot for Body TSL

CH1 S11 1 U FS 13 Apr 2015 10:53:33  
 2: 47.658  $\Omega$  -4.9043  $\Omega$  38.865 pF 835.000 000 MHz

\*  
 Del  
 CA

Avg  
 16

H1d





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 **PC Test**

Certificate No: **D1750V2-1051\_Apr15**

## CALIBRATION CERTIFICATE

Object **D1750V2 - SN:1051**

Calibration procedure(s) **QA CAL-05.v9**  
**Calibration procedure for dipole validation kits above 700 MHz**

PM ✓  
 4/29/15

Calibration date: **April 15, 2015**

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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A        | GB37480704         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | US37292783         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | MY41092317         | 07-Oct-14 (No. 217-02021)         | Oct-15                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 01-Apr-15 (No. 217-02131)         | Mar-16                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 01-Apr-15 (No. 217-02134)         | Mar-16                 |
| Reference Probe ES3DV3      | SN: 3205           | 30-Dec-14 (No. ES3-3205_Dec14)    | Dec-15                 |
| DAE4                        | SN: 601            | 18-Aug-14 (No. DAE4-601_Aug14)    | Aug-15                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-13) | In house check: Oct-16 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

Calibrated by: **Jeton Kastrati** **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: April 15, 2015

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



Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

**Glossary:**

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

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

- 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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.8.8     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 1750 MHz $\pm$ 1 MHz   |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 40.1           | 1.37 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 38.9 $\pm$ 6 % | 1.35 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 9.04 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 36.2 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 4.80 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 19.2 W/kg $\pm$ 16.5 % (k=2) |

## Body TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 53.4           | 1.49 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 51.5 $\pm$ 6 % | 1.48 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 9.32 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 37.1 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 5.01 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 20.0 W/kg $\pm$ 16.5 % (k=2) |

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.3 $\Omega$ - 0.2 j $\Omega$ |
| Return Loss                          | - 37.5 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 46.9 $\Omega$ + 0.3 j $\Omega$ |
| Return Loss                          | - 29.9 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.221 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |                   |
|-----------------|-------------------|
| Manufactured by | SPEAG             |
| Manufactured on | February 19, 2010 |

## DASY5 Validation Report for Head TSL

Date: 15.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1051**

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used:  $f = 1750 \text{ MHz}$ ;  $\sigma = 1.35 \text{ S/m}$ ;  $\epsilon_r = 38.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

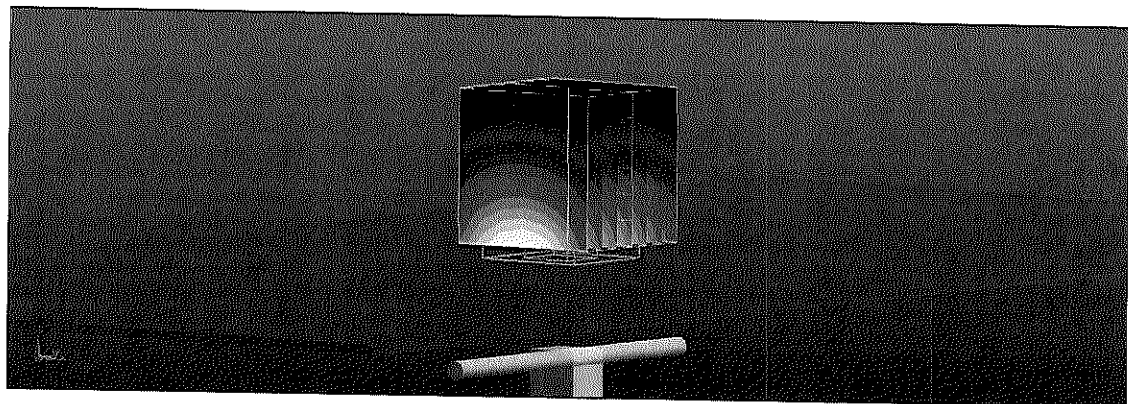
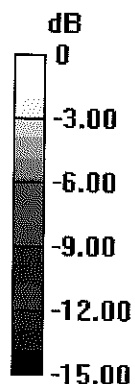
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 94.99 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 16.3 W/kg

**SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.8 W/kg**

Maximum value of SAR (measured) = 11.5 W/kg

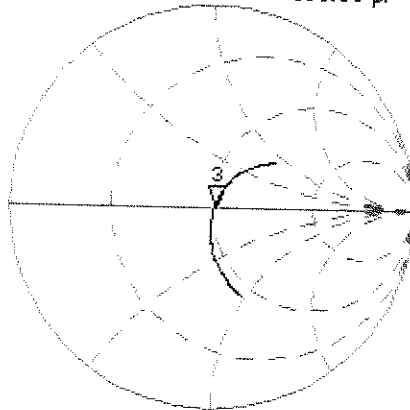


0 dB = 11.5 W/kg = 10.61 dBW/kg

# Impedance Measurement Plot for Head TSL

CH1 S11 1 U FS 15 Apr 2015 12:25:31  
 3: 51.330  $\Omega$  -248.05 m $\Omega$  365.65 pF 1 750.000 000 MHz

\*  
 Del  
 C $\Delta$



Avg  
 15

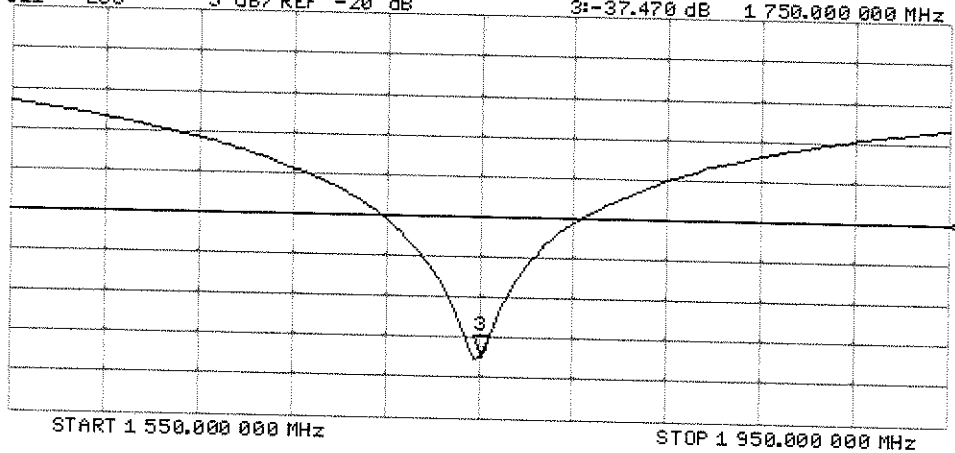
H1d

CH2 S11 LOG 5 dB/REF -20 dB 3:-37.470 dB 1 750.000 000 MHz

C $\Delta$

Avg  
 15

H1d



## DASY5 Validation Report for Body TSL

Date: 15.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1051**

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.48$  S/m;  $\epsilon_r = 51.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.88, 4.88, 4.88); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

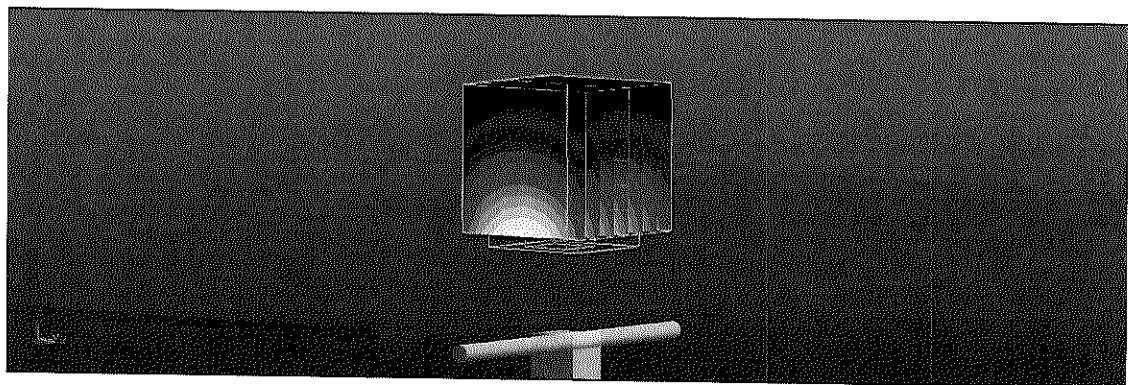
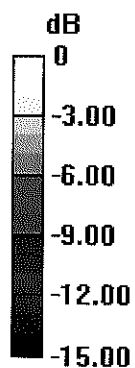
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.87 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 16.0 W/kg

**SAR(1 g) = 9.32 W/kg; SAR(10 g) = 5.01 W/kg**

Maximum value of SAR (measured) = 11.7 W/kg

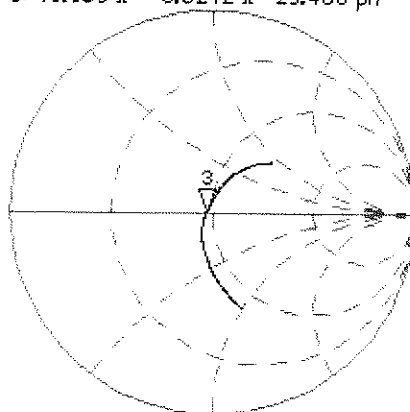


0 dB = 11.7 W/kg = 10.68 dBW/kg

# Impedance Measurement Plot for Body TSL

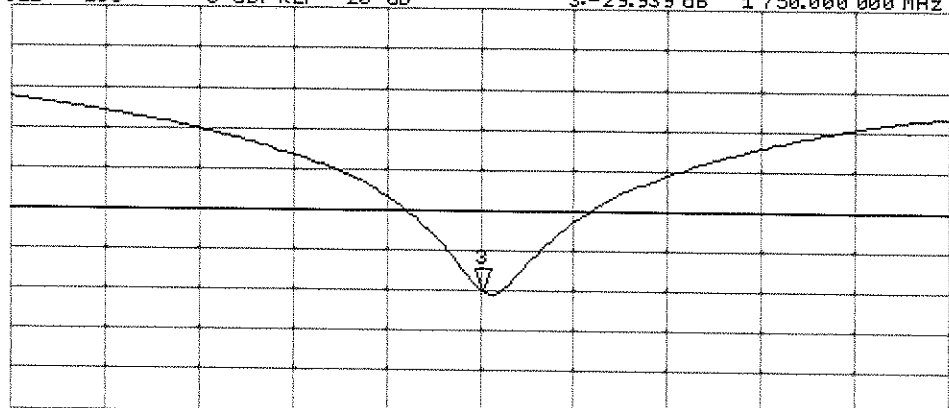
15 Apr 2015 12:23:57  
 [CH1] S11 1 U FS 3: 46.930  $\Omega$  0.3242  $\Omega$  29.486 pH 1 750.000 000 MHz

\*  
 Del  
 Ca  
 Avg  
 16  
 H1 d



CH2 S11 LOG 5 dB/REF -20 dB 3:-29.939 dB 1 750.000 000 MHz

Ca  
 Avg  
 16  
 H1 d



START 1 550.000 000 MHz

STOP 1 950.000 000 MHz



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 **PC Test**

Certificate No: **D1900V2-5d141\_Apr15**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN:5d141**

Calibration procedure(s) **QA CAL-05.v9**  
**Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **April 14, 2015**

PN ✓  
 4/29/15

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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A        | GB37480704         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | US37292783         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | MY41092317         | 07-Oct-14 (No. 217-02021)         | Oct-15                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 01-Apr-15 (No. 217-02131)         | Mar-16                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 01-Apr-15 (No. 217-02134)         | Mar-16                 |
| Reference Probe ES3DV3      | SN: 3205           | 30-Dec-14 (No. ES3-3205_Dec14)    | Dec-15                 |
| DAE4                        | SN: 601            | 18-Aug-14 (No. DAE4-601_Aug14)    | Aug-15                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-13) | In house check: Oct-16 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

Calibrated by: Name **Claudio Leubler** Function **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** Technical Manager

Issued: April 14, 2015

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



Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

### Glossary:

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

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

- 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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.8.8     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 1900 MHz $\pm$ 1 MHz   |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         |                     |                |                      |
|-----------------------------------------|---------------------|----------------|----------------------|
|                                         | Temperature         | Permittivity   | Conductivity         |
| Nominal Head TSL parameters             | 22.0 °C             | 40.0           | 1.40 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 38.6 $\pm$ 6 % | 1.37 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

|                                                       |                    |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                              |
| SAR measured                                          | 250 mW input power | 9.93 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 39.9 W/kg $\pm$ 17.0 % (k=2) |

|                                                         |                    |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
| SAR measured                                            | 250 mW input power | 5.20 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 20.9 W/kg $\pm$ 16.5 % (k=2) |

## Body TSL parameters

The following parameters and calculations were applied.

|                                         |                     |                |                      |
|-----------------------------------------|---------------------|----------------|----------------------|
|                                         | Temperature         | Permittivity   | Conductivity         |
| Nominal Body TSL parameters             | 22.0 °C             | 53.3           | 1.52 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 52.8 $\pm$ 6 % | 1.50 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

|                                                       |                    |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                              |
| SAR measured                                          | 250 mW input power | 9.94 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 40.0 W/kg $\pm$ 17.0 % (k=2) |

|                                                         |                    |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                              |
| SAR measured                                            | 250 mW input power | 5.29 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.2 W/kg $\pm$ 16.5 % (k=2) |

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $53.0 \Omega + 4.6 j\Omega$ |
| Return Loss                          | - 25.5 dB                   |

### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $48.2 \Omega + 5.6 j\Omega$ |
| Return Loss                          | - 24.5 dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.198 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |                |
|-----------------|----------------|
| Manufactured by | SPEAG          |
| Manufactured on | March 11, 2011 |

## DASY5 Validation Report for Head TSL

Date: 14.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d141**

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.37$  S/m;  $\epsilon_r = 38.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5, 5, 5); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

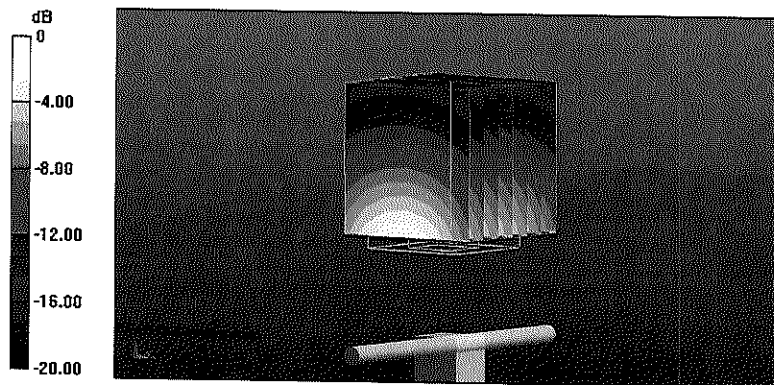
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.18 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 18.2 W/kg

**SAR(1 g) = 9.93 W/kg; SAR(10 g) = 5.2 W/kg**

Maximum value of SAR (measured) = 12.5 W/kg

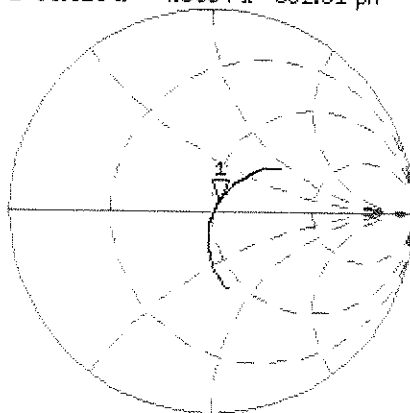


0 dB = 12.5 W/kg = 10.97 dBW/kg

# Impedance Measurement Plot for Head TSL

14 Apr 2015 13:39:53  
 [CH1] S11 1 U FS 1: 53.010  $\Omega$  4.5664  $\Omega$  382.51 pF 1 900.000 000 MHz

\*  
 De1  
 CA



Avg  
 16

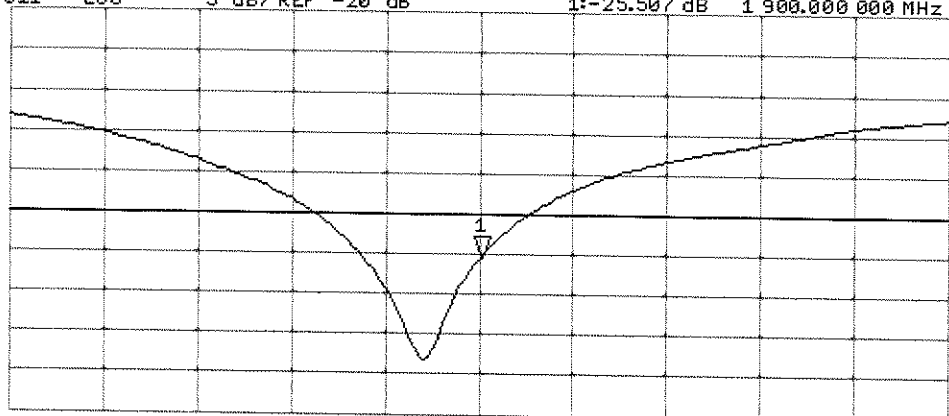
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-25.507 dB 1 900.000 000 MHz

CA

Avg  
 16

H1d



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz

## DASY5 Validation Report for Body TSL

Date: 14.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d141**

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.5$  S/m;  $\epsilon_r = 52.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

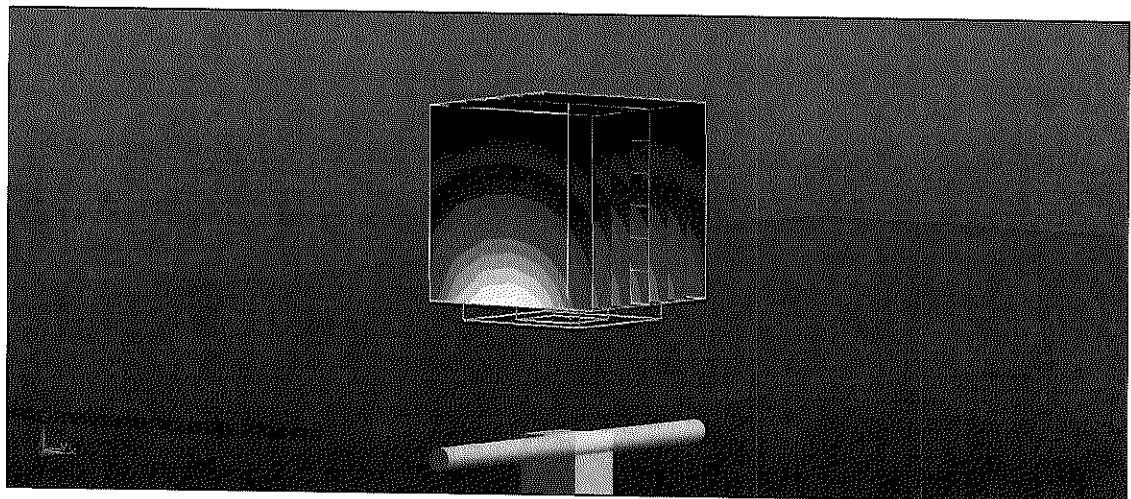
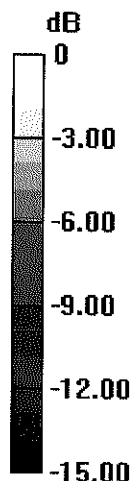
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.73 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 16.9 W/kg

**SAR(1 g) = 9.94 W/kg; SAR(10 g) = 5.29 W/kg**

Maximum value of SAR (measured) = 12.5 W/kg

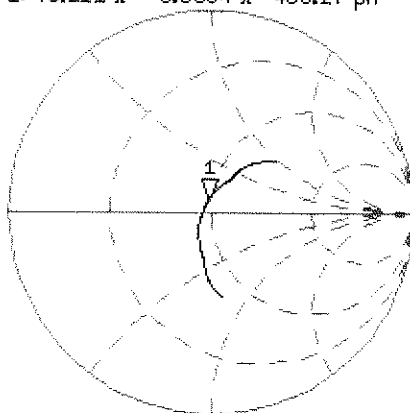


0 dB = 12.5 W/kg = 10.97 dBW/kg

# Impedance Measurement Plot for Body TSL

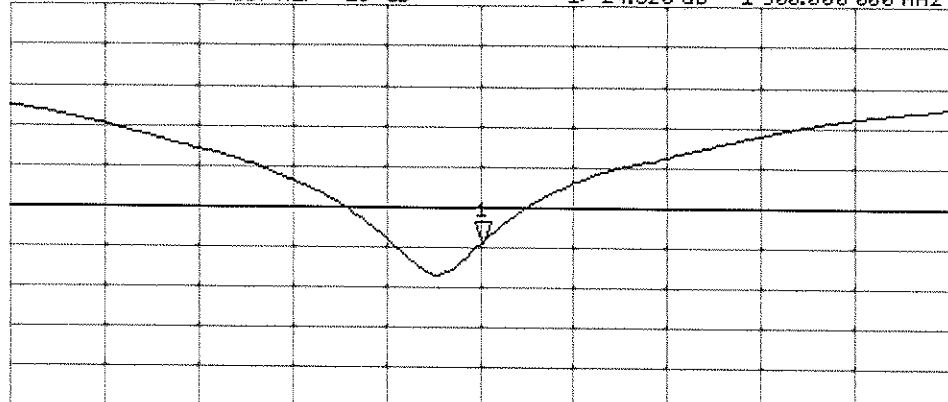
14 Apr 2015 13:39:04  
 CH1 S11 1 U FS 1: 48.211  $\Omega$  5.5664  $\Omega$  466.27 pF 1 900.000 000 MHz

\*  
 Del  
 CA  
 Avg  
 16  
 H1d



CH2 S11 LOG 5 dB/REF -20 dB 1:-24,520 dB 1 900.000 000 MHz

CA  
 Avg  
 16  
 H1d



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz



Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D2450V2-882\_Feb15**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN:882**

Calibration procedure(s) **QA CAL-05.v9**  
**Calibration procedure for dipole validation kits above 700 MHz**

PNV  
 3/6/15

Calibration date: **February 18, 2015**

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 EPM-442A        | GB37480704         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | US37292783         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | MY41092317         | 07-Oct-14 (No. 217-02021)         | Oct-15                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 03-Apr-14 (No. 217-01918)         | Apr-15                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 03-Apr-14 (No. 217-01921)         | Apr-15                 |
| Reference Probe ES3DV3      | SN: 3205           | 30-Dec-14 (No. ES3-3205_Dec14)    | Dec-15                 |
| DAE4                        | SN: 601            | 18-Aug-14 (No. DAE4-601_Aug14)    | Aug-15                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-13) | In house check: Oct-16 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

Calibrated by: **Name** Michael Weber **Function** Laboratory Technician

Signature

Approved by: **Name** Katja Pokovic **Function** Technical Manager

Issued: February 18, 2015

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

### 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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

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

## Measurement Conditions

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

|                                     |                        |             |
|-------------------------------------|------------------------|-------------|
| <b>DASY Version</b>                 | DASY5                  | V52.8.8     |
| <b>Extrapolation</b>                | Advanced Extrapolation |             |
| <b>Phantom</b>                      | Modular Flat Phantom   |             |
| <b>Distance Dipole Center - TSL</b> | 10 mm                  | with Spacer |
| <b>Zoom Scan Resolution</b>         | dx, dy, dz = 5 mm      |             |
| <b>Frequency</b>                    | 2450 MHz $\pm$ 1 MHz   |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Head TSL parameters</b>             | 22.0 °C             | 39.2           | 1.80 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 38.2 $\pm$ 6 % | 1.87 mho/m $\pm$ 6 % |
| <b>Head TSL temperature change during test</b> | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

|                                                             |                    |                                                |
|-------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                                |
| SAR measured                                                | 250 mW input power | 13.4 W/kg                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>52.3 W/kg <math>\pm</math> 17.0 % (k=2)</b> |

|                                                               |                    |                                                |
|---------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                                |
| SAR measured                                                  | 250 mW input power | 6.16 W/kg                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>24.3 W/kg <math>\pm</math> 16.5 % (k=2)</b> |

## Body TSL parameters

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Body TSL parameters</b>             | 22.0 °C             | 52.7           | 1.95 mho/m           |
| <b>Measured Body TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 51.7 $\pm$ 6 % | 2.04 mho/m $\pm$ 6 % |
| <b>Body TSL temperature change during test</b> | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

|                                                             |                    |                                                |
|-------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                                |
| SAR measured                                                | 250 mW input power | 13.0 W/kg                                      |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>50.7 W/kg <math>\pm</math> 17.0 % (k=2)</b> |

|                                                               |                    |                                                |
|---------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                                |
| SAR measured                                                  | 250 mW input power | 5.97 W/kg                                      |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>23.5 W/kg <math>\pm</math> 16.5 % (k=2)</b> |

## Appendix (Additional assessments outside the scope of SCS0108)

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 52.8 $\Omega$ - 0.2 j $\Omega$ |
| Return Loss                          | - 31.2 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.4 $\Omega$ + 1.9 j $\Omega$ |
| Return Loss                          | - 34.4 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.156 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |                  |
|-----------------|------------------|
| Manufactured by | SPEAG            |
| Manufactured on | October 06, 2011 |

## DASY5 Validation Report for Head TSL

Date: 18.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:882**

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.87$  S/m;  $\epsilon_r = 38.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Head Tissue - ES Probe/Pin=250 mW, d=10mm/Zoom Scan

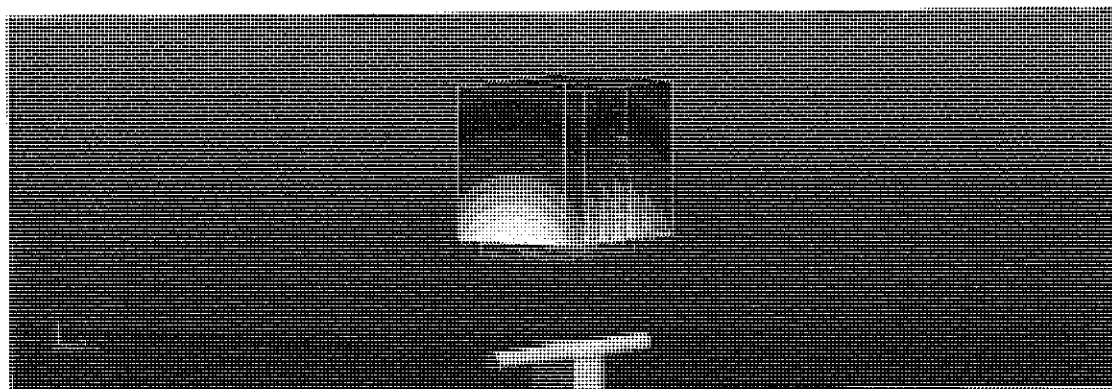
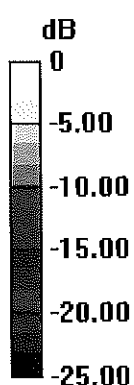
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.95 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 27.9 W/kg

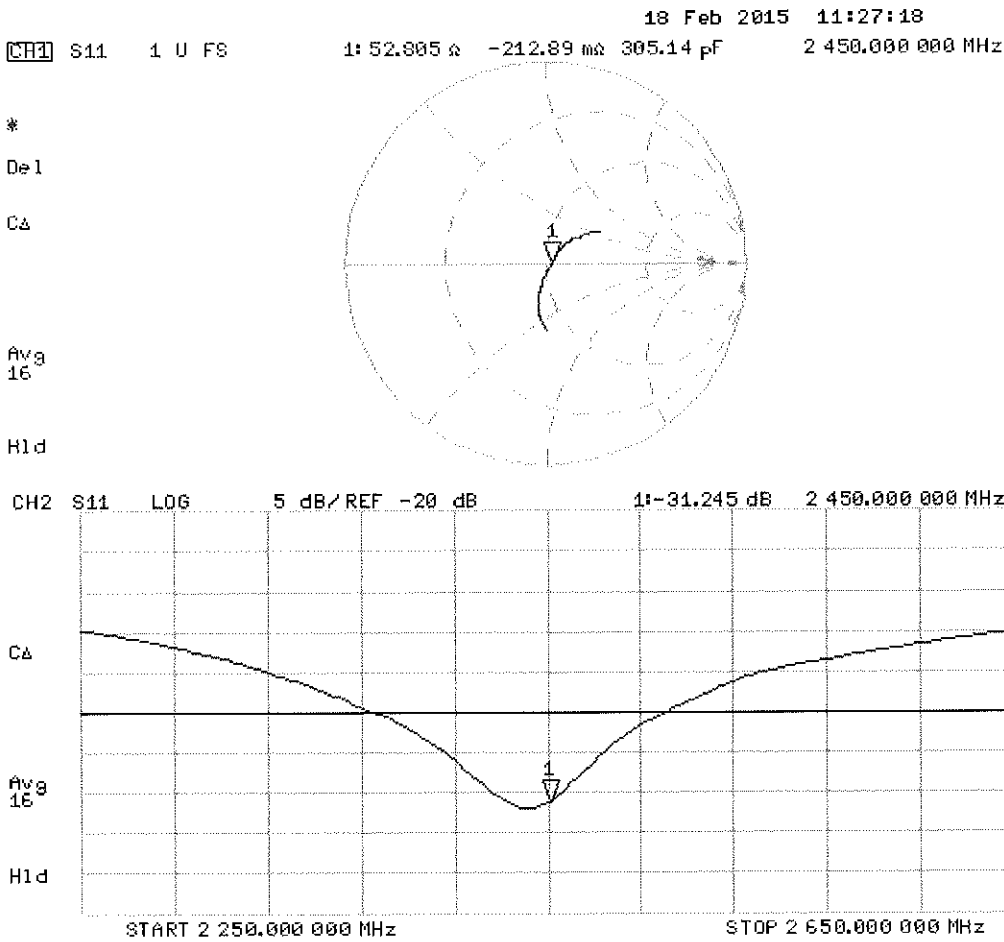
**SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.16 W/kg**

Maximum value of SAR (measured) = 17.3 W/kg



0 dB = 17.3 W/kg = 12.38 dBW/kg

Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 18.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:882**

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.04$  S/m;  $\epsilon_r = 51.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Body Tissue - ES Probe/Pin=250 mW, d=10mm/Zoom Scan

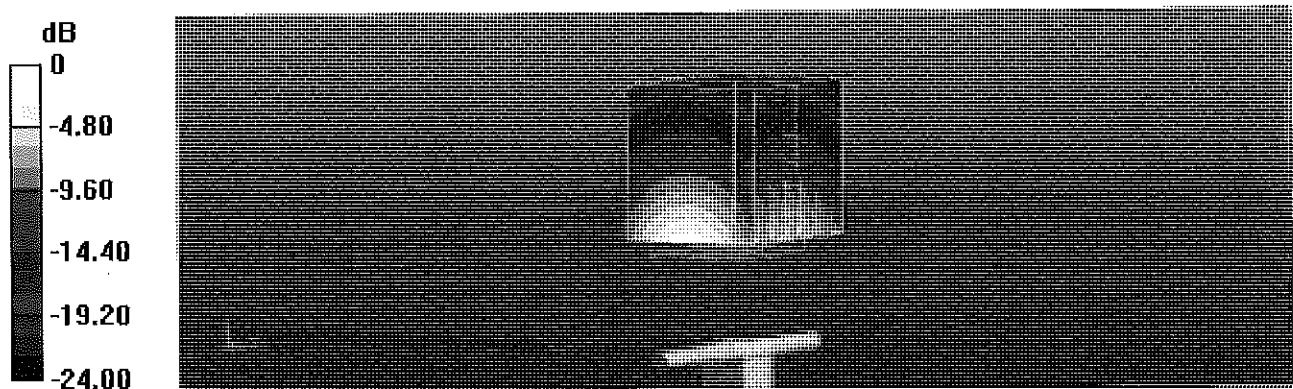
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.16 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 27.2 W/kg

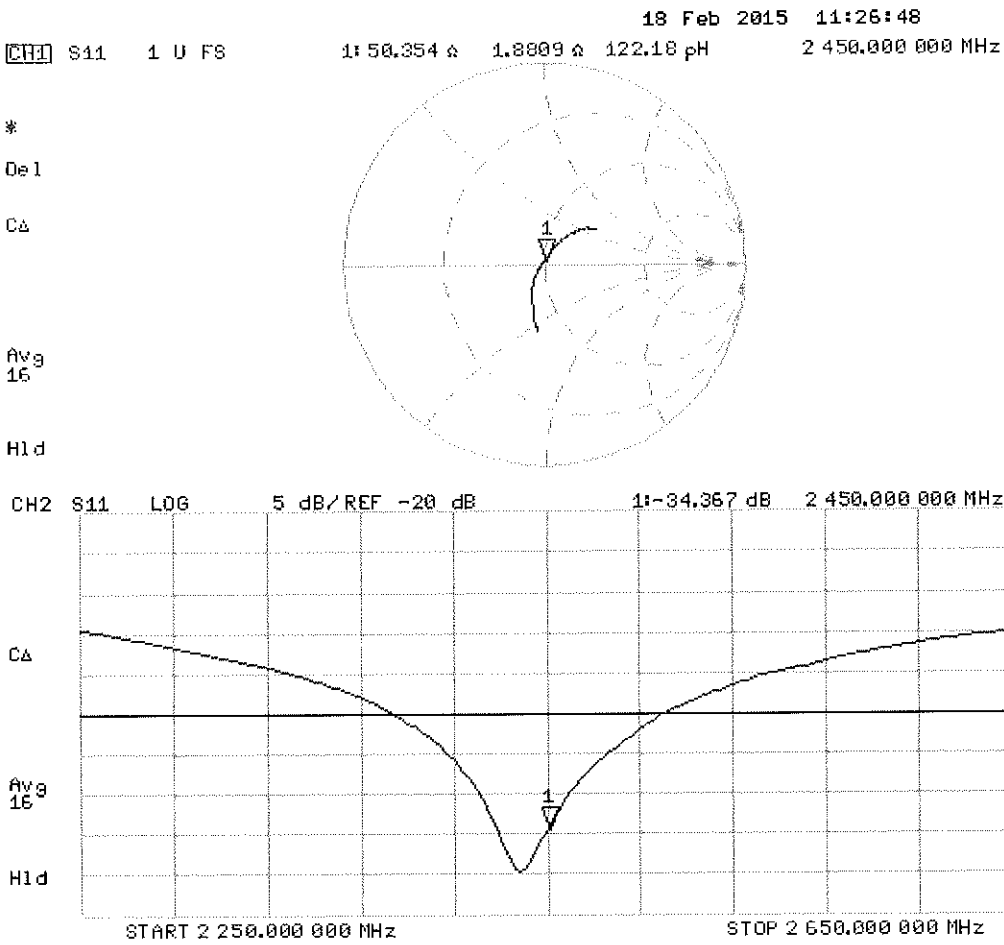
**SAR(1 g) = 13 W/kg; SAR(10 g) = 5.97 W/kg**

Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D5GHzV2-1191\_Sep14**

## CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1191**

Calibration procedure(s) **QA CAL-22.v2**  
**Calibration procedure for dipole validation kits between 3-6 GHz**

CC  
11/14

Calibration date: **September 25, 2014**

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 EPM-442A        | GB37480704         | 09-Oct-13 (No. 217-01827)         | Oct-14                 |
| Power sensor HP 8481A       | US37292783         | 09-Oct-13 (No. 217-01827)         | Oct-14                 |
| Power sensor HP 8481A       | MY41092317         | 09-Oct-13 (No. 217-01828)         | Oct-14                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 03-Apr-14 (No. 217-01918)         | Apr-15                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 03-Apr-14 (No. 217-01921)         | Apr-15                 |
| Reference Probe EX3DV4      | SN: 3503           | 30-Dec-13 (No. EX3-3503_Dec13)    | Dec-14                 |
| DAE4                        | SN: 601            | 18-Aug-14 (No. DAE4-601_Aug14)    | Aug-15                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-13) | In house check: Oct-16 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-13) | In house check: Oct-14 |

Calibrated by: **Claudio Leubler** **Laboratory Technician**

Approved by: **Katja Pokovic** **Technical Manager**

Signature

Issued: September 25, 2014

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



**Glossary:**

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

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

- IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
- 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

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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

## Measurement Conditions

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

|                              |                                                                                                                      |                                  |
|------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------|
| DASY Version                 | DASY5                                                                                                                | V52.8.8                          |
| Extrapolation                | Advanced Extrapolation                                                                                               |                                  |
| Phantom                      | Modular Flat Phantom V5.0                                                                                            |                                  |
| Distance Dipole Center - TSL | 10 mm                                                                                                                | with Spacer                      |
| Zoom Scan Resolution         | dx, dy = 4.0 mm, dz = 1.4 mm                                                                                         | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 5200 MHz $\pm$ 1 MHz<br>5300 MHz $\pm$ 1 MHz<br>5500 MHz $\pm$ 1 MHz<br>5600 MHz $\pm$ 1 MHz<br>5800 MHz $\pm$ 1 MHz |                                  |

## Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

|                                         |                     |                |                      |
|-----------------------------------------|---------------------|----------------|----------------------|
|                                         | Temperature         | Permittivity   | Conductivity         |
| Nominal Head TSL parameters             | 22.0 °C             | 36.0           | 4.66 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 34.9 $\pm$ 6 % | 4.54 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL at 5200 MHz

|                                                       |                    |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                              |
| SAR measured                                          | 100 mW input power | 8.17 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 81.1 W/kg $\pm$ 19.9 % (k=2) |

|                                                         |                    |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
| SAR measured                                            | 100 mW input power | 2.33 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 23.1 W/kg $\pm$ 19.5 % (k=2) |

### Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.9         | 4.76 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 34.8 ± 6 %   | 4.64 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Head TSL at 5300 MHz

|                                                       |                    |                            |
|-------------------------------------------------------|--------------------|----------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                            |
| SAR measured                                          | 100 mW input power | 8.64 W/kg                  |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 85.8 W / kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.47 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.5 W/kg ± 19.5 % (k=2) |

### Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.6         | 4.96 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 34.5 ± 6 %   | 4.83 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Head TSL at 5500 MHz

|                                                       |                    |                          |
|-------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
| SAR measured                                          | 100 mW input power | 8.93 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 88.6 W/kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.54 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 25.2 W/kg ± 19.5 % (k=2) |

### Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.5         | 5.07 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 34.4 ± 6 %   | 4.93 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Head TSL at 5600 MHz

|                                                       |                    |                          |
|-------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
| SAR measured                                          | 100 mW input power | 8.76 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 86.9 W/kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.49 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.7 W/kg ± 19.5 % (k=2) |

### Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.3         | 5.27 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 34.1 ± 6 %   | 5.14 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Head TSL at 5800 MHz

|                                                       |                    |                          |
|-------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
| SAR measured                                          | 100 mW input power | 8.30 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 82.3 W/kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.35 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 23.3 W/kg ± 19.5 % (k=2) |

### Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 49.0         | 5.30 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 47.1 ± 6 %   | 5.40 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Body TSL at 5200 MHz

|                                                       |                    |                          |
|-------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                          |
| SAR measured                                          | 100 mW input power | 7.84 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 77.8 W/kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.18 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.6 W/kg ± 19.5 % (k=2) |

### Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.9         | 5.42 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 46.9 ± 6 %   | 5.53 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Body TSL at 5300 MHz

|                                                       |                    |                          |
|-------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                          |
| SAR measured                                          | 100 mW input power | 8.05 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 79.9 W/kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.25 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 22.3 W/kg ± 19.5 % (k=2) |

**Body TSL parameters at 5500 MHz**

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.6         | 5.65 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 46.6 ± 6 %   | 5.79 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

**SAR result with Body TSL at 5500 MHz**

|                                                       |                    |                          |
|-------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                          |
| SAR measured                                          | 100 mW input power | 8.37 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 83.1 W/kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.32 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 23.0 W/kg ± 19.5 % (k=2) |

**Body TSL parameters at 5600 MHz**

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.5         | 5.77 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 46.4 ± 6 %   | 5.93 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

**SAR result with Body TSL at 5600 MHz**

|                                                       |                    |                          |
|-------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                          |
| SAR measured                                          | 100 mW input power | 8.48 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 84.1 W/kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.35 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 23.3 W/kg ± 19.5 % (k=2) |

**Body TSL parameters at 5800 MHz**

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.2         | 6.00 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 46.1 ± 6 %   | 6.21 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

**SAR result with Body TSL at 5800 MHz**

|                                                       |                    |                          |
|-------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                          |
| SAR measured                                          | 100 mW input power | 7.86 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 78.0 W/kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.17 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.5 W/kg ± 19.5 % (k=2) |

## Appendix (Additional assessments outside the scope of SCS108)

### Antenna Parameters with Head TSL at 5200 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.8 $\Omega$ - 9.9 j $\Omega$ |
| Return Loss                          | - 20.1 dB                      |

### Antenna Parameters with Head TSL at 5300 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.5 $\Omega$ - 1.5 j $\Omega$ |
| Return Loss                          | - 26.8 dB                      |

### Antenna Parameters with Head TSL at 5500 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.6 $\Omega$ - 2.0 j $\Omega$ |
| Return Loss                          | - 33.9 dB                      |

### Antenna Parameters with Head TSL at 5600 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 56.5 $\Omega$ - 4.4 j $\Omega$ |
| Return Loss                          | - 22.7 dB                      |

### Antenna Parameters with Head TSL at 5800 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 56.6 $\Omega$ + 4.4 j $\Omega$ |
| Return Loss                          | - 22.6 dB                      |

### Antenna Parameters with Body TSL at 5200 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.9 $\Omega$ - 8.1 j $\Omega$ |
| Return Loss                          | - 21.8 dB                      |

### Antenna Parameters with Body TSL at 5300 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.5 $\Omega$ + 0.1 j $\Omega$ |
| Return Loss                          | - 27.3 dB                      |

### Antenna Parameters with Body TSL at 5500 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.2 $\Omega$ - 0.6 j $\Omega$ |
| Return Loss                          | - 43.8 dB                      |

### Antenna Parameters with Body TSL at 5600 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 57.5 $\Omega$ - 3.2 j $\Omega$ |
| Return Loss                          | - 22.4 dB                      |

### Antenna Parameters with Body TSL at 5800 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 57.2 $\Omega$ + 5.2 j $\Omega$ |
| Return Loss                          | - 21.7 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.202 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |                |
|-----------------|----------------|
| Manufactured by | SPEAG          |
| Manufactured on | April 01, 2014 |

## DASY5 Validation Report for Head TSL

Date: 25.09.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1191**

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 4.54$  S/m;  $\epsilon_r = 34.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5300$  MHz;  $\sigma = 4.64$  S/m;  $\epsilon_r = 34.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5500$  MHz;  $\sigma = 4.83$  S/m;  $\epsilon_r = 34.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.93$  S/m;  $\epsilon_r = 34.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.14$  S/m;  $\epsilon_r = 34.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.52, 5.52, 5.52); Calibrated: 30.12.2013, ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2013, ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.86, 4.86, 4.86); Calibrated: 30.12.2013, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.20 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 30.0 W/kg

**SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.33 W/kg**

Maximum value of SAR (measured) = 18.5 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.90 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 32.7 W/kg

**SAR(1 g) = 8.64 W/kg; SAR(10 g) = 2.47 W/kg**

Maximum value of SAR (measured) = 19.8 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.91 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 35.3 W/kg

**SAR(1 g) = 8.93 W/kg; SAR(10 g) = 2.54 W/kg**

Maximum value of SAR (measured) = 20.9 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.29 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 34.8 W/kg

**SAR(1 g) = 8.76 W/kg; SAR(10 g) = 2.49 W/kg**

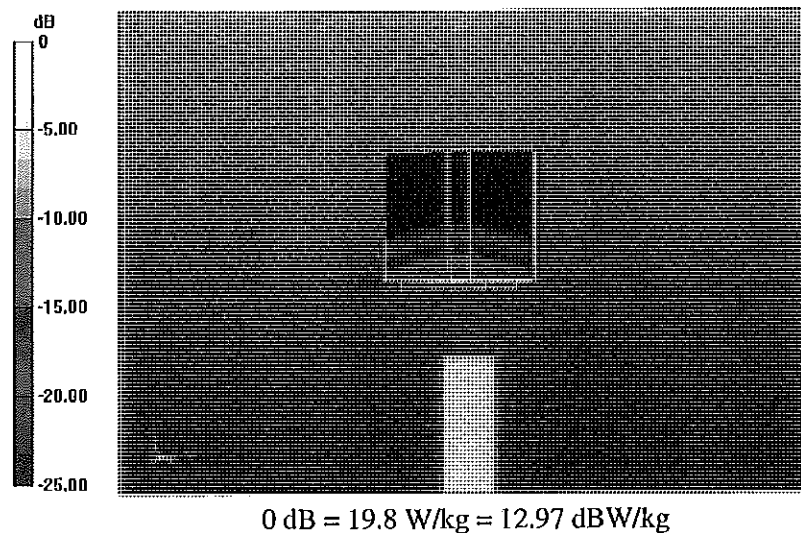
Maximum value of SAR (measured) = 20.7 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 62.74 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 34.4 W/kg

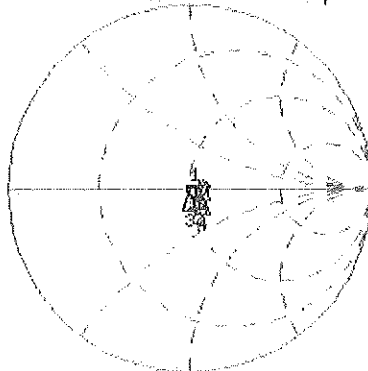
**SAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.35 W/kg**



# Impedance Measurement Plot for Head TSL

25 Sep 2014 11:07:52  
 [CH1] S11 1 U FS 1: 51.911  $\Omega$  -9.9180  $\Omega$  3.0060 pF 5 200.000 000 MHz

#  
 Del  
 Cor  
 Avg  
 0  
 H1d

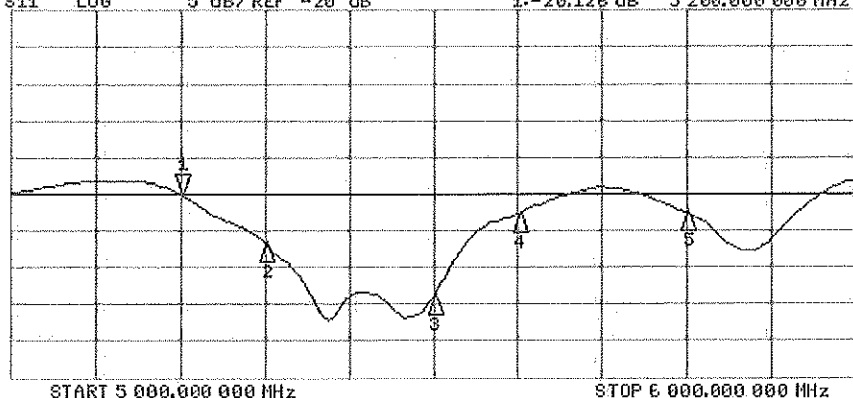


CH1 Markers

2: 54.518  $\Omega$   
 -1.5078  $\Omega$   
 5.30000 GHz  
 3: 49.566  $\Omega$   
 -1.9707  $\Omega$   
 5.50000 GHz  
 4: 56.516  $\Omega$   
 -4.3633  $\Omega$   
 5.60000 GHz  
 5: 56.555  $\Omega$   
 4.3904  $\Omega$   
 5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1:-20.126 dB 5 200.000 000 MHz

Cor  
 Avg  
 0  
 H1d



CH2 Markers

2: -26.825 dB  
 5.30000 GHz  
 3: -33.870 dB  
 5.50000 GHz  
 4: -22.660 dB  
 5.60000 GHz  
 5: -22.611 dB  
 5.80000 GHz

## DASY5 Validation Report for Body TSL

Date: 24.09.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1191**

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 5.4$  S/m;  $\epsilon_r = 47.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5300$  MHz;  $\sigma = 5.53$  S/m;  $\epsilon_r = 46.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5500$  MHz;  $\sigma = 5.79$  S/m;  $\epsilon_r = 46.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.93$  S/m;  $\epsilon_r = 46.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.21$  S/m;  $\epsilon_r = 46.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013, ConvF(4.52, 4.52, 4.52); Calibrated: 30.12.2013, ConvF(4.3, 4.3, 4.3); Calibrated: 30.12.2013, ConvF(4.47, 4.47, 4.47); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.46 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.7 W/kg

**SAR(1 g) = 7.84 W/kg; SAR(10 g) = 2.18 W/kg**

Maximum value of SAR (measured) = 18.5 W/kg

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.42 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 32.1 W/kg

**SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.25 W/kg**

Maximum value of SAR (measured) = 19.1 W/kg

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.44 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 35.8 W/kg

**SAR(1 g) = 8.37 W/kg; SAR(10 g) = 2.32 W/kg**

Maximum value of SAR (measured) = 20.4 W/kg

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.44 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 37.0 W/kg

**SAR(1 g) = 8.48 W/kg; SAR(10 g) = 2.35 W/kg**

Maximum value of SAR (measured) = 20.9 W/kg

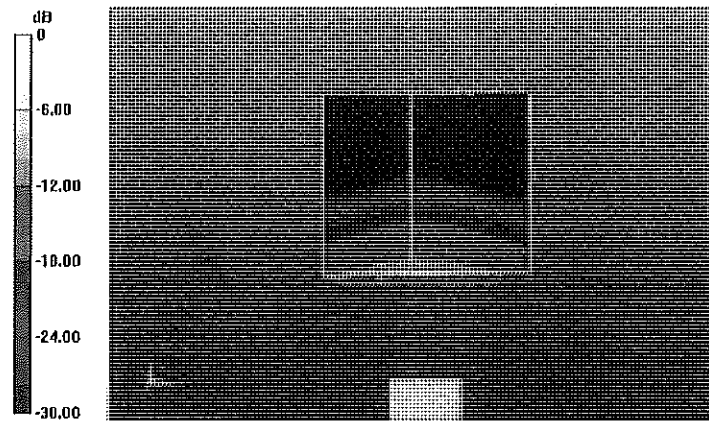
**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 56.69 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 36.4 W/kg

**SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.17 W/kg**

Maximum value of SAR (measured) = 19.7 W/kg

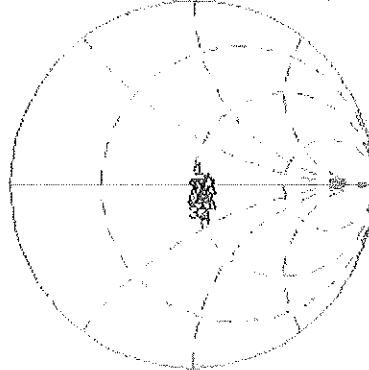


0 dB = 19.7 W/kg = 12.94 dBW/kg

# Impedance Measurement Plot for Body TSL

24 Sep 2014 11:05:50  
 [CH1] S11 1 U FS 1: 51.867  $\Omega$  -8.0566  $\Omega$  3.7989 pF 5 200.000 000 MHz

#  
 Del  
 Cor  
 Avg  
 16  
 H1d

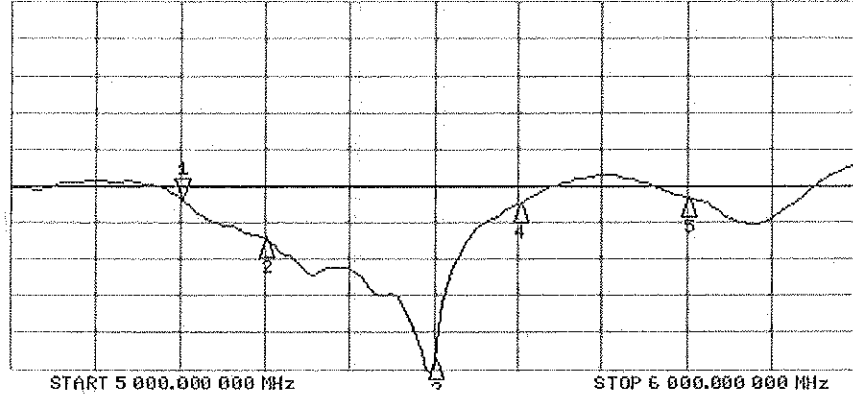


CH1 Markers

2: 54.531  $\Omega$   
 0.1015  $\Omega$   
 5.30000 GHz  
 3: 50.207  $\Omega$   
 -613.28  $\Omega$   
 5.50000 GHz  
 4: 57.480  $\Omega$   
 -3.1563  $\Omega$   
 5.60000 GHz  
 5: 57.150  $\Omega$   
 5.1934  $\Omega$   
 5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -21.835 dB 5 200.000 000 MHz

Cor  
 Avg  
 16  
 H1d



CH2 Markers

2: -27.251 dB  
 5.30000 GHz  
 3: -43.776 dB  
 5.50000 GHz  
 4: -22.442 dB  
 5.60000 GHz  
 5: -21.682 dB  
 5.80000 GHz



Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D5GHzV2-1057\_Jan15**

## CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1057**

Calibration procedure(s) **QA CAL-22.v2**  
**Calibration procedure for dipole validation kits between 3-6 GHz**

CC  
 2/3/15

Calibration date: **January 21, 2015**

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  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A        | GB37480704         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | US37292783         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | MY41092317         | 07-Oct-14 (No. 217-02021)         | Oct-15                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 03-Apr-14 (No. 217-01918)         | Apr-15                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 03-Apr-14 (No. 217-01921)         | Apr-15                 |
| Reference Probe EX3DV4      | SN: 3503           | 30-Dec-14 (No. EX3-3503_Dec14)    | Dec-15                 |
| DAE4                        | SN: 601            | 18-Aug-14 (No. DAE4-601_Aug14)    | Aug-15                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-13) | In house check: Oct-16 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

Calibrated by: **Name** Michael Weber **Function** Laboratory Technician

Signature

Approved by: **Name** Katja Pokovic **Function** Technical Manager

Issued: January 22, 2015

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



Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

**Glossary:**

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

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

- IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
- 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

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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

## Measurement Conditions

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

|                                     |                                                                                                                      |                                  |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>DASY Version</b>                 | DASY5                                                                                                                | V52.8.8                          |
| <b>Extrapolation</b>                | Advanced Extrapolation                                                                                               |                                  |
| <b>Phantom</b>                      | Modular Flat Phantom V5.0                                                                                            |                                  |
| <b>Distance Dipole Center - TSL</b> | 10 mm                                                                                                                | with Spacer                      |
| <b>Zoom Scan Resolution</b>         | dx, dy = 4.0 mm, dz = 1.4 mm                                                                                         | Graded Ratio = 1.4 (Z direction) |
| <b>Frequency</b>                    | 5200 MHz $\pm$ 1 MHz<br>5300 MHz $\pm$ 1 MHz<br>5500 MHz $\pm$ 1 MHz<br>5600 MHz $\pm$ 1 MHz<br>5800 MHz $\pm$ 1 MHz |                                  |

## Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Head TSL parameters</b>             | 22.0 °C             | 36.0           | 4.66 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 36.3 $\pm$ 6 % | 4.56 mho/m $\pm$ 6 % |
| <b>Head TSL temperature change during test</b> | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL at 5200 MHz

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                                                |
|-------------------------------------------------------|--------------------|------------------------------------------------|
| SAR measured                                          | 100 mW input power | 8.14 W/kg                                      |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | <b>81.5 W/kg <math>\pm</math> 19.9 % (k=2)</b> |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                                                |
|---------------------------------------------------------|--------------------|------------------------------------------------|
| SAR measured                                            | 100 mW input power | 2.31 W/kg                                      |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | <b>23.1 W/kg <math>\pm</math> 19.5 % (k=2)</b> |

### Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.9         | 4.76 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 36.1 ± 6 %   | 4.66 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Head TSL at 5300 MHz

|                                                             |                    |                                   |
|-------------------------------------------------------------|--------------------|-----------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                   |
| SAR measured                                                | 100 mW input power | 8.47 W/kg                         |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>84.7 W / kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.41 W/kg                       |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>24.1 W/kg ± 19.5 % (k=2)</b> |

### Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.6         | 4.96 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 35.9 ± 6 %   | 4.86 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Head TSL at 5500 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 8.43 W/kg                       |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>84.3 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.38 W/kg                       |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>23.8 W/kg ± 19.5 % (k=2)</b> |

### Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.5         | 5.07 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 35.6 ± 6 %   | 4.97 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Head TSL at 5600 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 8.38 W/kg                       |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>83.8 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.37 W/kg                       |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>23.7 W/kg ± 19.5 % (k=2)</b> |

### Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.3         | 5.27 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 35.4 ± 6 %   | 5.18 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Head TSL at 5800 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 8.11 W/kg                       |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>81.1 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.29 W/kg                       |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>22.9 W/kg ± 19.5 % (k=2)</b> |

### Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 49.0         | 5.30 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 49.4 ± 6 %   | 5.42 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Body TSL at 5200 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 7.37 W/kg                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>73.9 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.05 W/kg                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>20.6 W/kg ± 19.5 % (k=2)</b> |

### Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.9         | 5.42 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 49.2 ± 6 %   | 5.55 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Body TSL at 5300 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 7.41 W/kg                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>74.2 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.08 W/kg                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>20.9 W/kg ± 19.5 % (k=2)</b> |

### Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.6         | 5.65 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 48.9 ± 6 %   | 5.82 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Body TSL at 5500 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 7.90 W/kg                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>79.2 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.19 W/kg                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>22.0 W/kg ± 19.5 % (k=2)</b> |

### Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.5         | 5.77 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 48.7 ± 6 %   | 5.96 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Body TSL at 5600 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 7.75 W/kg                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>77.7 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.14 W/kg                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>21.5 W/kg ± 19.5 % (k=2)</b> |

### Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.2         | 6.00 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 48.4 ± 6 %   | 6.25 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Body TSL at 5800 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 7.49 W/kg                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>75.1 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.06 W/kg                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>20.6 W/kg ± 19.5 % (k=2)</b> |

## Appendix (Additional assessments outside the scope of SCS0108)

### Antenna Parameters with Head TSL at 5200 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.0 $\Omega$ - 9.4 j $\Omega$ |
| Return Loss                          | - 20.4 dB                      |

### Antenna Parameters with Head TSL at 5300 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.3 $\Omega$ - 4.2 j $\Omega$ |
| Return Loss                          | - 26.8 dB                      |

### Antenna Parameters with Head TSL at 5500 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.2 $\Omega$ - 5.0 j $\Omega$ |
| Return Loss                          | - 25.9 dB                      |

### Antenna Parameters with Head TSL at 5600 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.4 $\Omega$ - 4.8 j $\Omega$ |
| Return Loss                          | - 24.1 dB                      |

### Antenna Parameters with Head TSL at 5800 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.8 $\Omega$ - 2.6 j $\Omega$ |
| Return Loss                          | - 30.1 dB                      |

### Antenna Parameters with Body TSL at 5200 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.2 $\Omega$ - 8.4 j $\Omega$ |
| Return Loss                          | - 21.2 dB                      |

### Antenna Parameters with Body TSL at 5300 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.6 $\Omega$ - 3.6 j $\Omega$ |
| Return Loss                          | - 28.2 dB                      |

### Antenna Parameters with Body TSL at 5500 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.4 $\Omega$ - 4.1 j $\Omega$ |
| Return Loss                          | - 27.6 dB                      |

### Antenna Parameters with Body TSL at 5600 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 55.1 $\Omega$ - 4.0 j $\Omega$ |
| Return Loss                          | - 24.2 dB                      |

### Antenna Parameters with Body TSL at 5800 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.6 $\Omega$ - 1.6 j $\Omega$ |
| Return Loss                          | - 33.0 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.202 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |                   |
|-----------------|-------------------|
| Manufactured by | SPEAG             |
| Manufactured on | November 27, 2006 |

## DASY5 Validation Report for Head TSL

Date: 21.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1057**

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 4.56$  S/m;  $\epsilon_r = 36.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5300$  MHz;  $\sigma = 4.66$  S/m;  $\epsilon_r = 36.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5500$  MHz;  $\sigma = 4.86$  S/m;  $\epsilon_r = 35.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.97$  S/m;  $\epsilon_r = 35.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.18$  S/m;  $\epsilon_r = 35.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.51, 5.51, 5.51); Calibrated: 30.12.2014, ConvF(5.21, 5.21, 5.21); Calibrated: 30.12.2014, ConvF(5.12, 5.12, 5.12); Calibrated: 30.12.2014, ConvF(4.92, 4.92, 4.92); Calibrated: 30.12.2014, ConvF(4.9, 4.9, 4.9); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.51 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 29.8 W/kg

**SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.31 W/kg**

Maximum value of SAR (measured) = 19.3 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.30 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 32.1 W/kg

**SAR(1 g) = 8.47 W/kg; SAR(10 g) = 2.41 W/kg**

Maximum value of SAR (measured) = 20.4 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.33 V/m; Power Drift = 0.07 dB

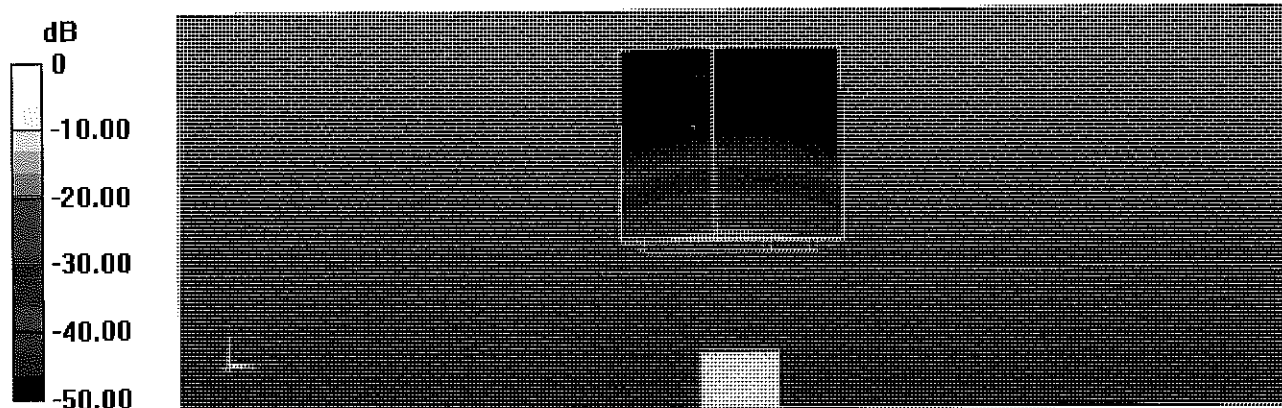
Peak SAR (extrapolated) = 33.5 W/kg

**SAR(1 g) = 8.43 W/kg; SAR(10 g) = 2.38 W/kg**

Maximum value of SAR (measured) = 20.6 W/kg

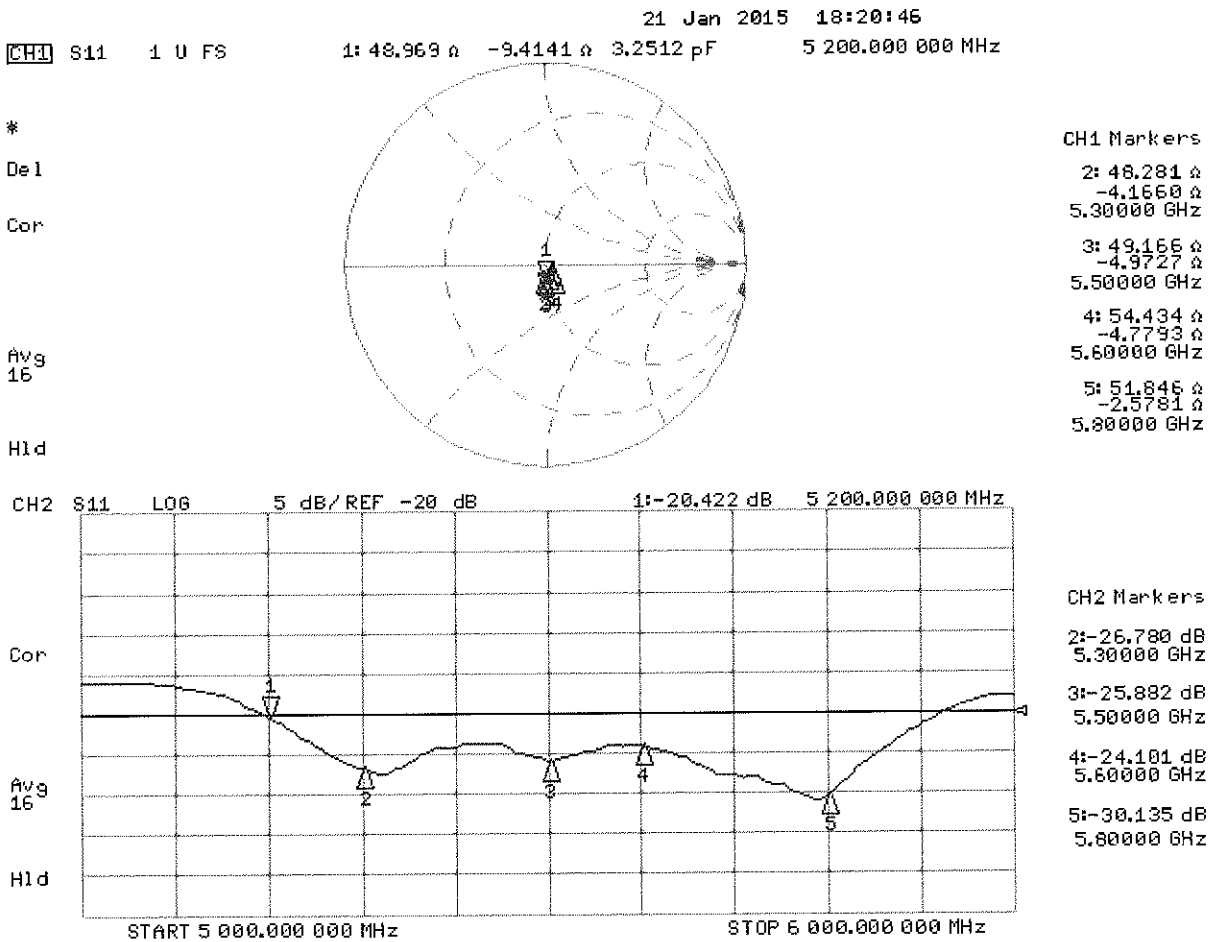
**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 64.47 V/m; Power Drift = 0.09 dB  
Peak SAR (extrapolated) = 33.5 W/kg  
**SAR(1 g) = 8.38 W/kg; SAR(10 g) = 2.37 W/kg**  
Maximum value of SAR (measured) = 20.2 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 62.34 V/m; Power Drift = 0.06 dB  
Peak SAR (extrapolated) = 33.8 W/kg  
**SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.29 W/kg**  
Maximum value of SAR (measured) = 19.8 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 20.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1057**

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 5.42$  S/m;  $\epsilon_r = 49.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5300$  MHz;  $\sigma = 5.55$  S/m;  $\epsilon_r = 49.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5500$  MHz;  $\sigma = 5.82$  S/m;  $\epsilon_r = 48.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.96$  S/m;  $\epsilon_r = 48.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.25$  S/m;  $\epsilon_r = 48.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.95, 4.95, 4.95); Calibrated: 30.12.2014, ConvF(4.78, 4.78, 4.78); Calibrated: 30.12.2014, ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014, ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.76 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 28.9 W/kg

**SAR(1 g) = 7.37 W/kg; SAR(10 g) = 2.05 W/kg**

Maximum value of SAR (measured) = 17.4 W/kg

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.35 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 29.8 W/kg

**SAR(1 g) = 7.41 W/kg; SAR(10 g) = 2.08 W/kg**

Maximum value of SAR (measured) = 17.6 W/kg

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 59.04 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 33.7 W/kg

**SAR(1 g) = 7.9 W/kg; SAR(10 g) = 2.19 W/kg**

Maximum value of SAR (measured) = 19.2 W/kg

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.74 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 34.1 W/kg

**SAR(1 g) = 7.75 W/kg; SAR(10 g) = 2.14 W/kg**

Maximum value of SAR (measured) = 19.1 W/kg

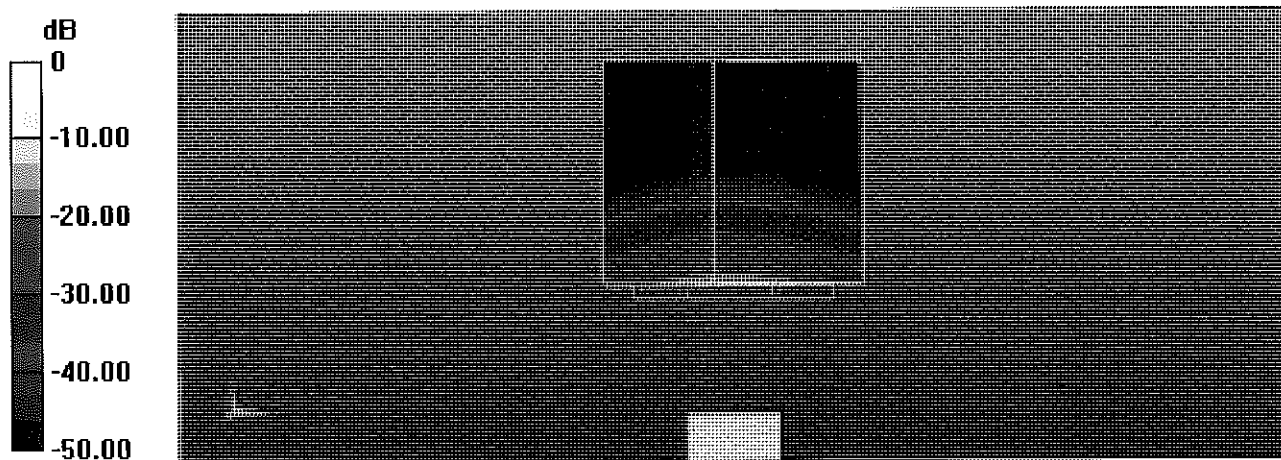
**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 55.86 V/m; Power Drift = -0.01 dB

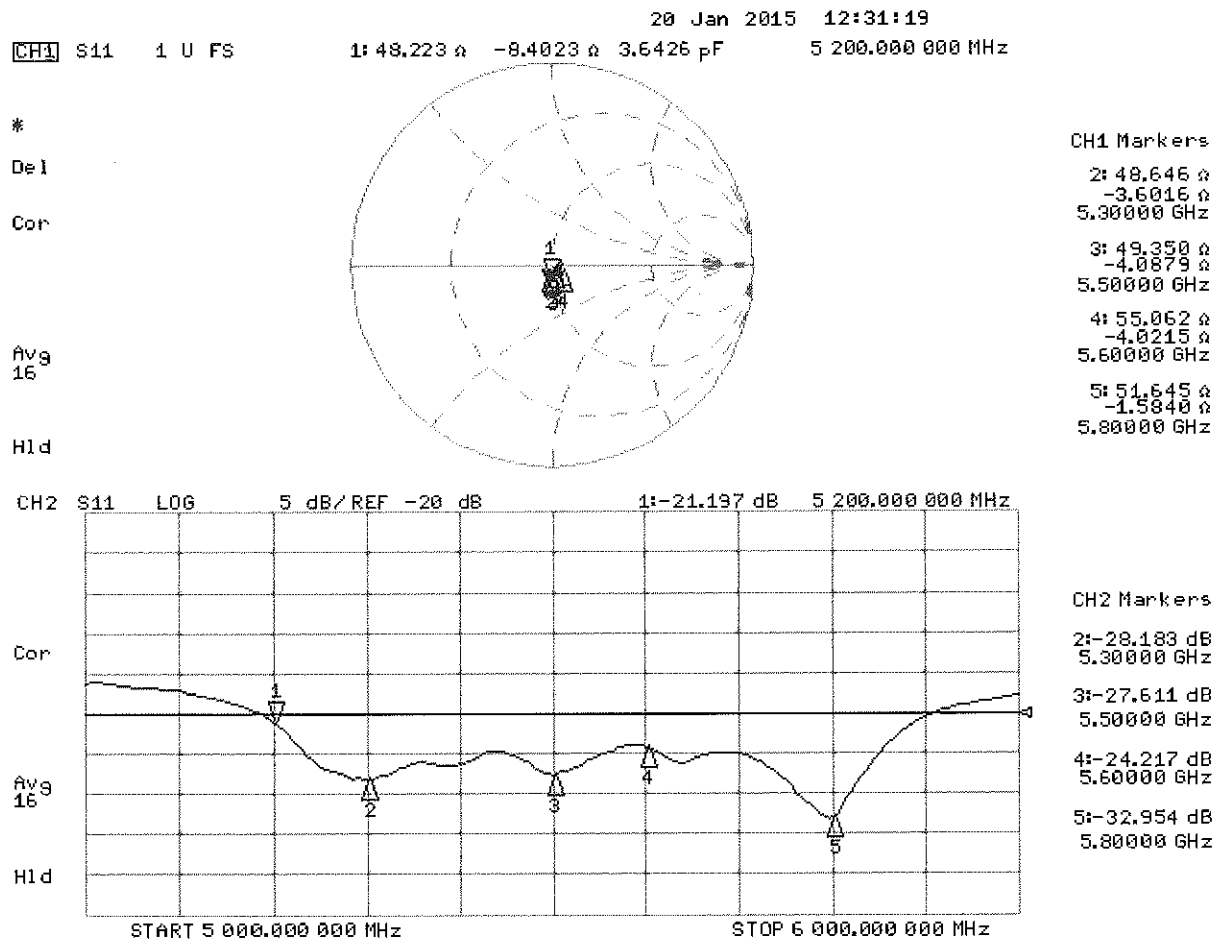
Peak SAR (extrapolated) = 34.7 W/kg

**SAR(1 g) = 7.49 W/kg; SAR(10 g) = 2.06 W/kg**

Maximum value of SAR (measured) = 18.6 W/kg



Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **EX3-3589\_Jan15**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3589**

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**

CC  
 1/30/15

Calibration date: **January 22, 2015**

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  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 03-Apr-14 (No. 217-01911)         | Apr-15                 |
| Power sensor E4412A        | MY41498087      | 03-Apr-14 (No. 217-01911)         | Apr-15                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 03-Apr-14 (No. 217-01915)         | Apr-15                 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 03-Apr-14 (No. 217-01919)         | Apr-15                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 03-Apr-14 (No. 217-01920)         | Apr-15                 |
| Reference Probe ES3DV2     | SN: 3013        | 30-Dec-14 (No. ES3-3013_Dec14)    | Dec-15                 |
| DAE4                       | SN: 660         | 14-Jan-15 (No. DAE4-660_Jan15)    | Jan-16                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-13)  | In house check: Apr-16 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

|                                                                                                                 |                         |                                   |                          |
|-----------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------|--------------------------|
| Calibrated by:                                                                                                  | Name<br>Claudio Leubler | Function<br>Laboratory Technician | Signature<br>            |
| Approved by:                                                                                                    | Katja Pokovic           | Technical Manager                 |                          |
|                                                                                                                 |                         |                                   | Issued: January 26, 2015 |
| 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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

### 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  $E^2$ -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:3589

Manufactured: March 30, 2006  
Calibrated: January 22, 2015

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|-----------------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 0.46     | 0.41     | 0.39     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 103.1    | 102.4    | 104.4    |               |

### Modulation Calibration Parameters

| UID           | Communication System Name                               |   | A<br>dB | B<br>dB $\sqrt{\mu\text{V}}$ | 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    | 146.6    | $\pm 3.3 \%$              |
|               |                                                         | Y | 0.0     | 0.0                          | 1.0  |         | 143.1    |                           |
|               |                                                         | Z | 0.0     | 0.0                          | 1.0  |         | 170.4    |                           |
| 10010-<br>CAA | SAR Validation (Square, 100ms, 10ms)                    | X | 16.82   | 80.0                         | 16.9 | 10.00   | 39.1     | $\pm 0.7 \%$              |
|               |                                                         | Y | 7.79    | 73.4                         | 15.1 |         | 39.0     |                           |
|               |                                                         | Z | 2.50    | 64.1                         | 12.2 |         | 43.2     |                           |
| 10012-<br>CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)                | X | 3.02    | 68.9                         | 18.6 | 1.87    | 115.1    | $\pm 0.7 \%$              |
|               |                                                         | Y | 3.08    | 69.3                         | 18.8 |         | 114.1    |                           |
|               |                                                         | Z | 3.07    | 70.1                         | 19.4 |         | 134.9    |                           |
| 10013-<br>CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)           | X | 10.36   | 68.2                         | 21.5 | 9.46    | 104.8    | $\pm 2.5 \%$              |
|               |                                                         | Y | 10.20   | 68.2                         | 21.6 |         | 104.2    |                           |
|               |                                                         | Z | 10.36   | 68.6                         | 21.7 |         | 122.2    |                           |
| 10032-<br>CAA | IEEE 802.15.1 Bluetooth (GFSK, DH5)                     | X | 79.80   | 100.0                        | 18.7 | 1.16    | 134.5    | $\pm 0.9 \%$              |
|               |                                                         | Y | 98.53   | 99.4                         | 18.2 |         | 133.2    |                           |
|               |                                                         | Z | 0.27    | 57.7                         | 4.8  |         | 113.6    |                           |
| 10062-<br>CAB | IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)                | X | 9.91    | 67.7                         | 20.7 | 8.68    | 104.8    | $\pm 2.2 \%$              |
|               |                                                         | Y | 9.83    | 67.7                         | 20.9 |         | 105.4    |                           |
|               |                                                         | Z | 10.08   | 68.3                         | 21.1 |         | 126.6    |                           |
| 10103-<br>CAB | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)                | X | 7.73    | 67.7                         | 21.4 | 9.29    | 106.3    | $\pm 1.9 \%$              |
|               |                                                         | Y | 8.16    | 69.5                         | 22.6 |         | 106.5    |                           |
|               |                                                         | Z | 7.50    | 67.6                         | 21.5 |         | 121.6    |                           |
| 10117-<br>CAB | IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)                | X | 9.91    | 67.7                         | 20.3 | 8.07    | 112.1    | $\pm 1.9 \%$              |
|               |                                                         | Y | 9.90    | 67.8                         | 20.5 |         | 111.8    |                           |
|               |                                                         | Z | 10.04   | 68.2                         | 20.6 |         | 134.2    |                           |
| 10151-<br>CAB | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)                 | X | 7.99    | 69.5                         | 22.6 | 9.28    | 146.2    | $\pm 2.2 \%$              |
|               |                                                         | Y | 8.43    | 71.4                         | 23.8 |         | 148.8    |                           |
|               |                                                         | Z | 7.09    | 66.7                         | 21.0 |         | 116.8    |                           |
| 10172-<br>CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)                   | X | 6.34    | 69.7                         | 22.8 | 9.21    | 118.1    | $\pm 1.7 \%$              |
|               |                                                         | Y | 6.41    | 70.8                         | 23.7 |         | 115.8    |                           |
|               |                                                         | Z | 6.10    | 69.1                         | 22.6 |         | 132.9    |                           |
| 10196-<br>CAB | IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)                 | X | 9.49    | 67.3                         | 20.2 | 8.10    | 101.7    | $\pm 1.9 \%$              |
|               |                                                         | Y | 9.44    | 67.3                         | 20.3 |         | 106.1    |                           |
|               |                                                         | Z | 9.71    | 68.1                         | 20.6 |         | 127.1    |                           |
| 10317-<br>AAB | IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle) | X | 9.70    | 67.5                         | 20.5 | 8.36    | 102.8    | $\pm 2.2 \%$              |
|               |                                                         | Y | 9.68    | 67.7                         | 20.7 |         | 108.0    |                           |
|               |                                                         | Z | 9.97    | 68.5                         | 21.0 |         | 127.5    |                           |

|           |                                                               |   |       |      |      |      |       |        |
|-----------|---------------------------------------------------------------|---|-------|------|------|------|-------|--------|
| 10400-AAB | IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)           | X | 9.73  | 67.5 | 20.4 | 8.37 | 102.2 | ±1.9 % |
|           |                                                               | Y | 9.78  | 67.8 | 20.7 |      | 109.0 |        |
|           |                                                               | Z | 10.00 | 68.4 | 20.9 |      | 129.9 |        |
| 10401-AAB | IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)           | X | 10.39 | 67.9 | 20.7 | 8.60 | 108.7 | ±2.2 % |
|           |                                                               | Y | 10.63 | 68.6 | 21.2 |      | 117.4 |        |
|           |                                                               | Z | 10.71 | 68.9 | 21.2 |      | 138.2 |        |
| 10402-AAB | IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)           | X | 10.38 | 67.8 | 20.5 | 8.53 | 107.9 | ±2.2 % |
|           |                                                               | Y | 10.82 | 69.0 | 21.2 |      | 119.6 |        |
|           |                                                               | Z | 10.65 | 68.6 | 20.9 |      | 137.1 |        |
| 10415-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)     | X | 3.06  | 70.1 | 19.2 | 1.54 | 108.9 | ±0.7 % |
|           |                                                               | Y | 3.37  | 71.8 | 19.9 |      | 116.8 |        |
|           |                                                               | Z | 2.93  | 69.8 | 19.1 |      | 135.5 |        |
| 10416-AAA | IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle) | X | 10.23 | 69.0 | 21.2 | 8.23 | 149.0 | ±2.2 % |
|           |                                                               | Y | 9.64  | 67.7 | 20.7 |      | 109.5 |        |
|           |                                                               | Z | 9.67  | 67.8 | 20.5 |      | 125.2 |        |
| 10417-AAA | IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)     | X | 9.56  | 67.3 | 20.3 | 8.23 | 101.7 | ±1.9 % |
|           |                                                               | Y | 9.64  | 67.8 | 20.7 |      | 109.6 |        |
|           |                                                               | Z | 9.79  | 68.1 | 20.7 |      | 128.3 |        |

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 NormX,Y,Z do not affect the  $E^2$ -field uncertainty inside TSL (see Pages 6 and 7).

<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:3589

### 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) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 2450                 | 39.2                               | 1.80                            | 6.48    | 6.48    | 6.48    | 0.39               | 0.82                    | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 6.30    | 6.30    | 6.30    | 0.38               | 0.89                    | ± 12.0 %    |
| 5200                 | 36.0                               | 4.66                            | 4.66    | 4.66    | 4.66    | 0.35               | 1.80                    | ± 13.1 %    |
| 5300                 | 35.9                               | 4.76                            | 4.43    | 4.43    | 4.43    | 0.35               | 1.80                    | ± 13.1 %    |
| 5500                 | 35.6                               | 4.96                            | 4.23    | 4.23    | 4.23    | 0.40               | 1.80                    | ± 13.1 %    |
| 5600                 | 35.5                               | 5.07                            | 4.03    | 4.03    | 4.03    | 0.40               | 1.80                    | ± 13.1 %    |
| 5800                 | 35.3                               | 5.27                            | 4.19    | 4.19    | 4.19    | 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:3589

### 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) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 2450                 | 52.7                               | 1.95                            | 6.60    | 6.60    | 6.60    | 0.80               | 0.57                    | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 6.36    | 6.36    | 6.36    | 0.80               | 0.50                    | ± 12.0 %    |
| 5200                 | 49.0                               | 5.30                            | 4.01    | 4.01    | 4.01    | 0.45               | 1.90                    | ± 13.1 %    |
| 5300                 | 48.9                               | 5.42                            | 3.79    | 3.79    | 3.79    | 0.45               | 1.90                    | ± 13.1 %    |
| 5500                 | 48.6                               | 5.65                            | 3.65    | 3.65    | 3.65    | 0.45               | 1.90                    | ± 13.1 %    |
| 5600                 | 48.5                               | 5.77                            | 3.42    | 3.42    | 3.42    | 0.50               | 1.90                    | ± 13.1 %    |
| 5800                 | 48.2                               | 6.00                            | 3.79    | 3.79    | 3.79    | 0.50               | 1.90                    | ± 13.1 %    |

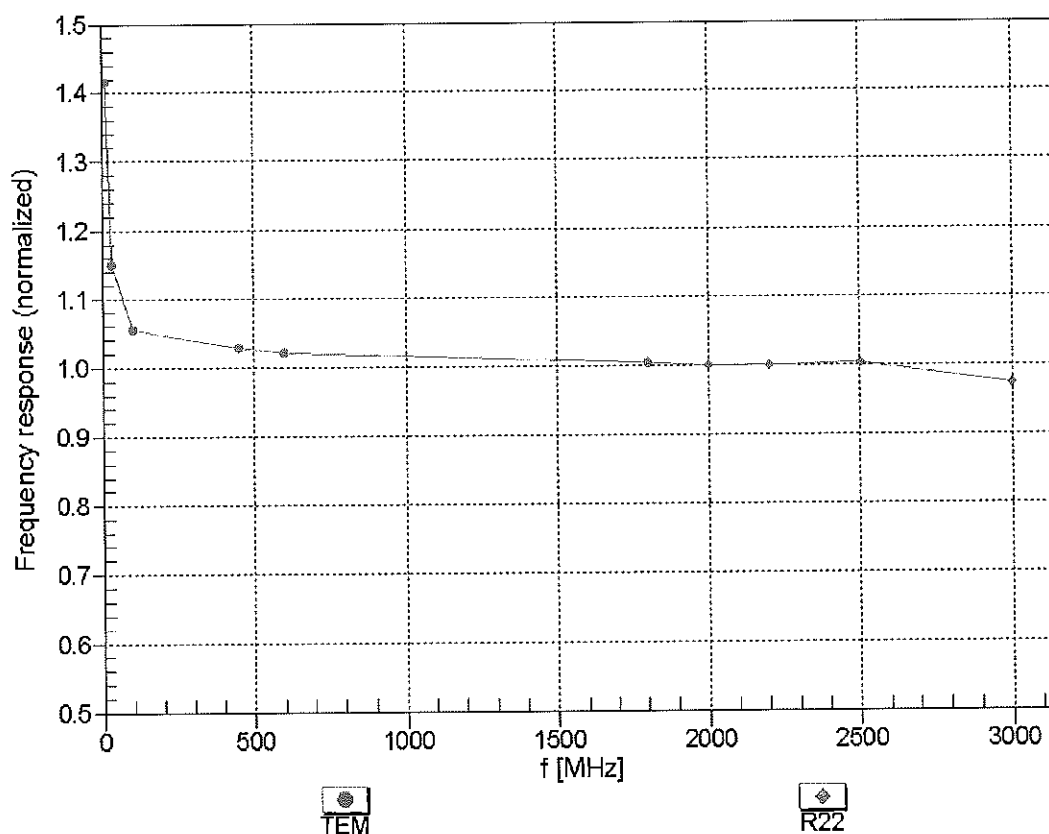
<sup>c</sup> Frequency validity above 300 MHz of  $\pm 100$  MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to  $\pm 50$  MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is  $\pm 10$ , 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  $\pm 110$  MHz.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to  $\pm 10\%$  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  $\pm 5\%$ . 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  $\pm 1\%$  for frequencies below 3 GHz and below  $\pm 2\%$  for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

## Frequency Response of E-Field

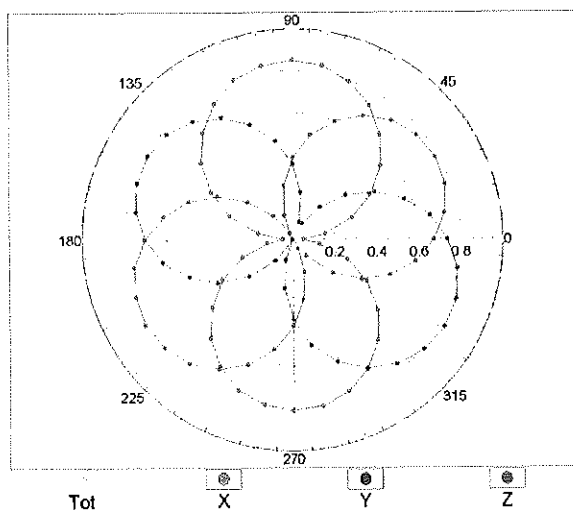
(TEM-Cell:ifi110 EXX, Waveguide: R22)



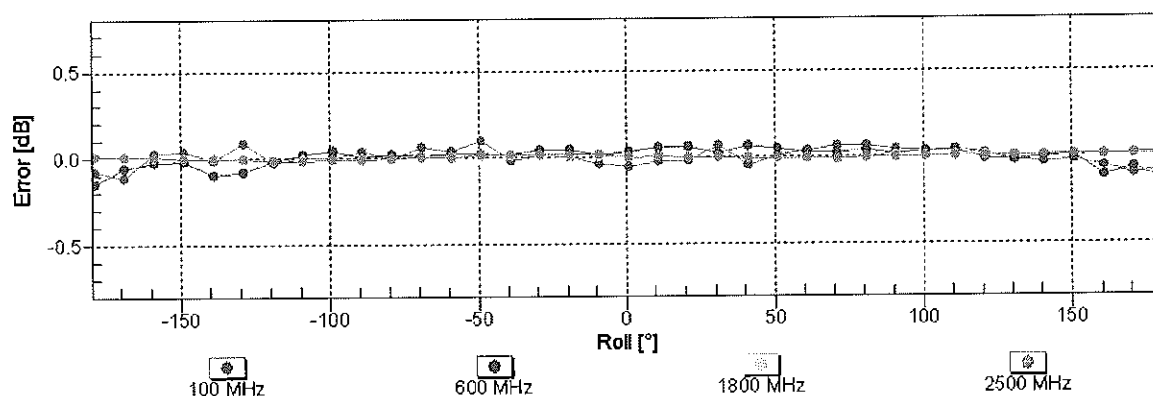
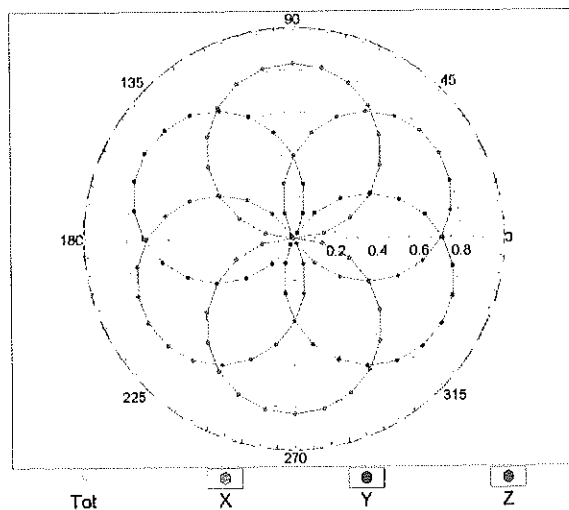
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

f=600 MHz,TEM

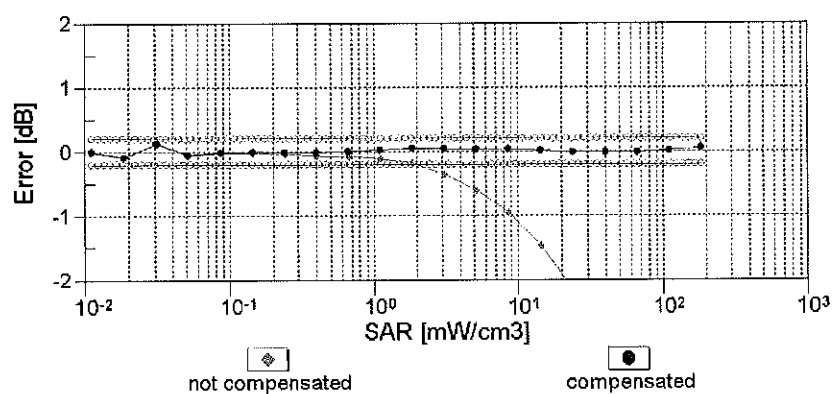
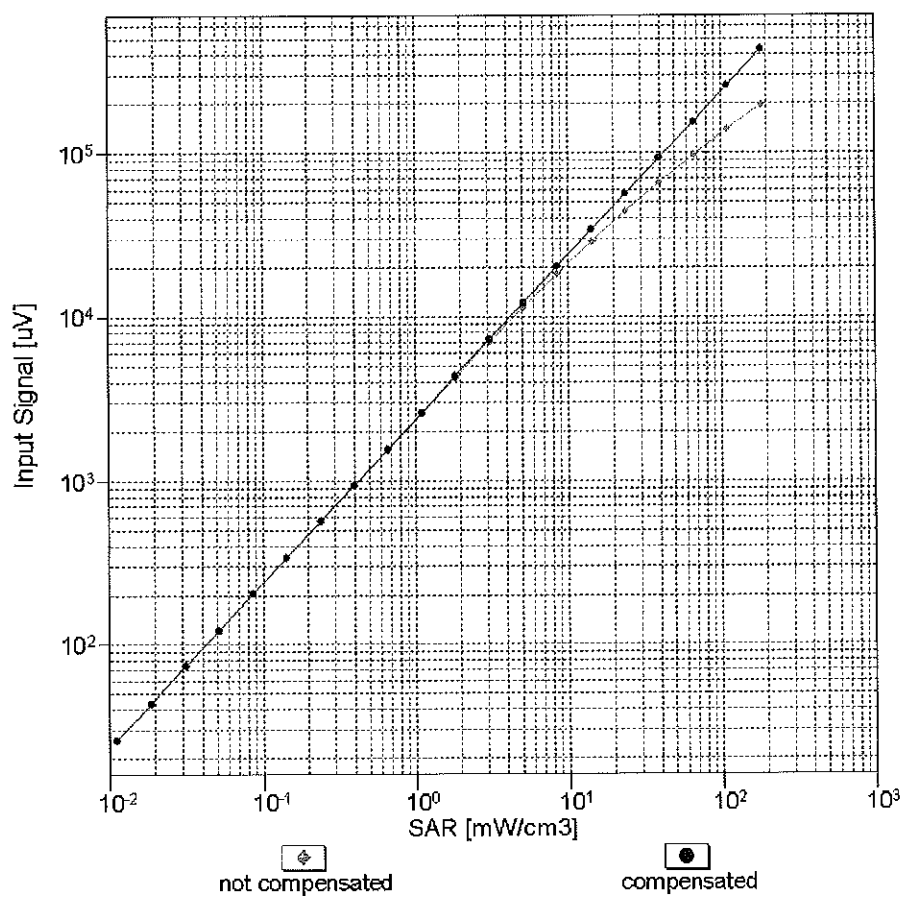


f=1800 MHz,R22



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

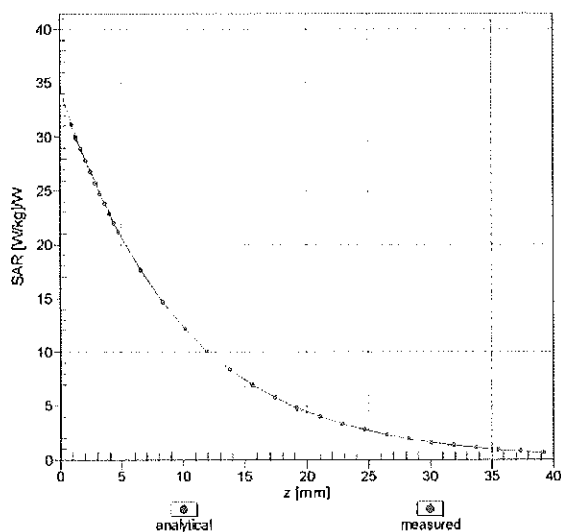
# Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f_{\text{eval}} = 1900 \text{ MHz}$ )



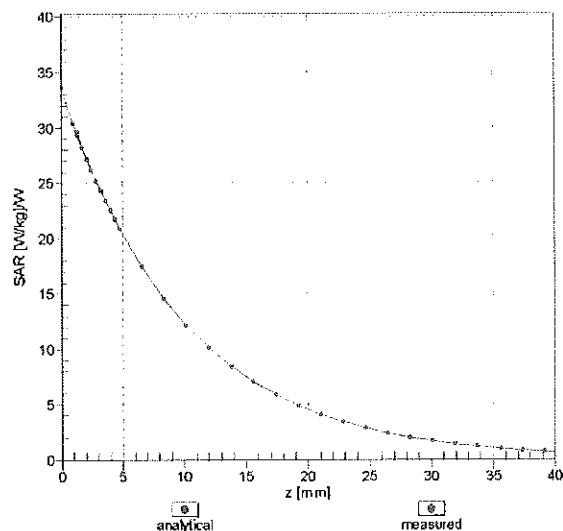
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment

$f = 2450 \text{ MHz}$ , WGLS R22 (H\_convF)

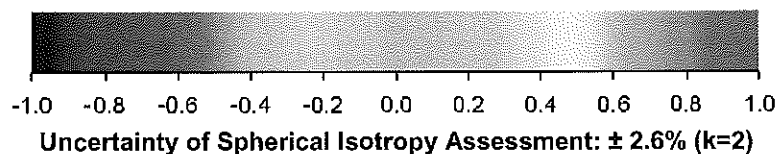
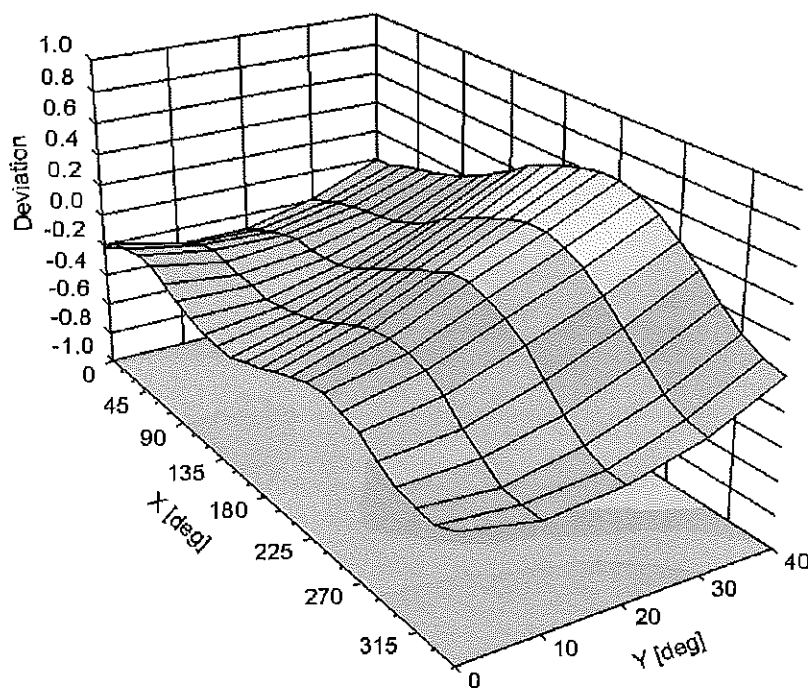


$f = 2450 \text{ MHz}$ , WGLS R22 (M\_convF)



## Deviation from Isotropy in Liquid

Error ( $\phi$ ,  $\theta$ ),  $f = 900 \text{ MHz}$



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

### Other Probe Parameters

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | -39.1      |
| Mechanical Surface Detection Mode             | enabled    |
| Optical Surface Detection Mode                | disabled   |
| Probe Overall Length                          | 337 mm     |
| Probe Body Diameter                           | 10 mm      |
| Tip Length                                    | 9 mm       |
| Tip Diameter                                  | 2.5 mm     |
| Probe Tip to Sensor X Calibration Point       | 1 mm       |
| Probe Tip to Sensor Y Calibration Point       | 1 mm       |
| Probe Tip to Sensor Z Calibration Point       | 1 mm       |
| Recommended Measurement Distance from Surface | 1.4 mm     |



Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **ES3-3319\_Mar15**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3319**

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

Calibration date: **March 19, 2015**

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 E4419B         | GB41293874      | 03-Apr-14 (No. 217-01911)         | Apr-15                 |
| Power sensor E4412A        | MY41498087      | 03-Apr-14 (No. 217-01911)         | Apr-15                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 03-Apr-14 (No. 217-01915)         | Apr-15                 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 03-Apr-14 (No. 217-01919)         | Apr-15                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 03-Apr-14 (No. 217-01920)         | Apr-15                 |
| Reference Probe ES3DV2     | SN: 3013        | 30-Dec-14 (No. ES3-3013_Dec14)    | Dec-15                 |
| DAE4                       | SN: 660         | 14-Jan-15 (No. DAE4-660_Jan15)    | Jan-16                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-13)  | In house check: Apr-16 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

|                                                                                                                 |                              |                                          |                        |
|-----------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------|------------------------|
| Calibrated by:                                                                                                  | Name<br><b>Israe Elnaouq</b> | Function<br><b>Laboratory Technician</b> | Signature<br>          |
| Approved by:                                                                                                    | <b>Katja Pokovic</b>         | <b>Technical Manager</b>                 |                        |
|                                                                                                                 |                              |                                          | Issued: March 19, 2015 |
| 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 $\varphi$   | $\varphi$ 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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

### 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 ES3DV3

## SN:3319

Manufactured: January 10, 2012  
Calibrated: March 19, 2015

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

# DASY/EASY - Parameters of Probe: ES3DV3 - SN:3319

## Basic Calibration Parameters

|                                       | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|---------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu V/(V/m)^2$ ) <sup>A</sup> | 1.12     | 1.08     | 1.15     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                 | 104.4    | 106.0    | 104.4    |               |

## Modulation Calibration Parameters

| UID       | Communication System Name                     |   | A<br>dB | B<br>dB $\sqrt{\mu V}$ | 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    | 176.1    | $\pm 3.3 \%$              |
|           |                                               | Y | 0.0     | 0.0                    | 1.0  |         | 192.7    |                           |
|           |                                               | Z | 0.0     | 0.0                    | 1.0  |         | 174.6    |                           |
| 10010-CAA | SAR Validation (Square, 100ms, 10ms)          | X | 3.26    | 64.8                   | 13.4 | 10.00   | 41.7     | $\pm 1.9 \%$              |
|           |                                               | Y | 2.66    | 62.2                   | 11.7 |         | 39.5     |                           |
|           |                                               | Z | 3.51    | 64.8                   | 13.2 |         | 42.1     |                           |
| 10011-CAB | UMTS-FDD (WCDMA)                              | X | 3.47    | 68.1                   | 19.1 | 2.91    | 142.9    | $\pm 0.5 \%$              |
|           |                                               | Y | 3.37    | 67.9                   | 19.1 |         | 133.0    |                           |
|           |                                               | Z | 3.57    | 68.7                   | 19.4 |         | 138.6    |                           |
| 10012-CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)      | X | 3.48    | 71.8                   | 20.2 | 1.87    | 143.9    | $\pm 0.7 \%$              |
|           |                                               | Y | 3.23    | 70.9                   | 19.9 |         | 134.6    |                           |
|           |                                               | Z | 3.68    | 72.8                   | 20.6 |         | 140.5    |                           |
| 10013-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps) | X | 11.18   | 70.5                   | 23.1 | 9.46    | 143.4    | $\pm 3.3 \%$              |
|           |                                               | Y | 10.98   | 70.5                   | 23.2 |         | 129.9    |                           |
|           |                                               | Z | 11.19   | 70.6                   | 23.1 |         | 138.8    |                           |
| 10021-DAB | GSM-FDD (TDMA, GMSK)                          | X | 15.55   | 92.7                   | 26.1 | 9.39    | 126.5    | $\pm 1.7 \%$              |
|           |                                               | Y | 21.21   | 98.0                   | 27.2 |         | 142.0    |                           |
|           |                                               | Z | 19.50   | 96.1                   | 27.0 |         | 125.4    |                           |
| 10023-DAB | GPRS-FDD (TDMA, GMSK, TN 0)                   | X | 23.54   | 100.0                  | 28.4 | 9.57    | 142.6    | $\pm 2.2 \%$              |
|           |                                               | Y | 23.24   | 99.9                   | 28.0 |         | 137.4    |                           |
|           |                                               | Z | 23.57   | 99.6                   | 28.2 |         | 139.7    |                           |
| 10024-DAB | GPRS-FDD (TDMA, GMSK, TN 0-1)                 | X | 17.00   | 90.2                   | 22.7 | 6.56    | 128.9    | $\pm 2.2 \%$              |
|           |                                               | Y | 35.20   | 99.7                   | 24.9 |         | 148.2    |                           |
|           |                                               | Z | 33.12   | 99.6                   | 25.4 |         | 123.8    |                           |
| 10027-DAB | GPRS-FDD (TDMA, GMSK, TN 0-1-2)               | X | 44.20   | 99.6                   | 23.6 | 4.80    | 146.0    | $\pm 1.9 \%$              |
|           |                                               | Y | 49.99   | 99.9                   | 23.0 |         | 136.6    |                           |
|           |                                               | Z | 41.43   | 99.6                   | 23.9 |         | 141.4    |                           |
| 10028-DAB | GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)             | X | 46.56   | 99.7                   | 22.7 | 3.55    | 127.7    | $\pm 2.2 \%$              |
|           |                                               | Y | 58.11   | 99.8                   | 21.9 |         | 145.3    |                           |
|           |                                               | Z | 55.65   | 99.6                   | 22.2 |         | 124.3    |                           |
| 10032-CAA | IEEE 802.15.1 Bluetooth (GFSK, DH5)           | X | 34.25   | 99.4                   | 21.1 | 1.16    | 140.3    | $\pm 1.7 \%$              |
|           |                                               | Y | 40.72   | 100.0                  | 20.6 |         | 135.7    |                           |
|           |                                               | Z | 45.39   | 100.0                  | 20.8 |         | 136.4    |                           |
| 10100-CAB | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)      | X | 6.30    | 67.1                   | 19.5 | 5.67    | 127.4    | $\pm 1.4 \%$              |
|           |                                               | Y | 6.58    | 68.4                   | 20.3 |         | 149.0    |                           |
|           |                                               | Z | 6.55    | 68.0                   | 19.9 |         | 146.3    |                           |

|           |                                          |   |       |      |      |      |       |        |
|-----------|------------------------------------------|---|-------|------|------|------|-------|--------|
| 10103-CAB | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK) | X | 10.47 | 75.6 | 25.8 | 9.29 | 146.6 | ±3.0 % |
|           |                                          | Y | 10.18 | 75.8 | 26.3 |      | 136.2 |        |
|           |                                          | Z | 10.38 | 75.3 | 25.6 |      | 140.8 |        |
| 10108-CAC | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK) | X | 6.18  | 66.6 | 19.4 | 5.80 | 126.9 | ±1.4 % |
|           |                                          | Y | 6.40  | 67.8 | 20.1 |      | 147.0 |        |
|           |                                          | Z | 6.44  | 67.6 | 19.9 |      | 145.7 |        |
| 10117-CAB | IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK) | X | 10.24 | 69.0 | 21.3 | 8.07 | 142.7 | ±2.5 % |
|           |                                          | Y | 10.25 | 69.2 | 21.5 |      | 136.7 |        |
|           |                                          | Z | 10.16 | 68.8 | 21.2 |      | 136.6 |        |
| 10151-CAB | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)  | X | 9.85  | 74.8 | 25.6 | 9.28 | 140.8 | ±3.0 % |
|           |                                          | Y | 9.49  | 74.7 | 25.9 |      | 130.5 |        |
|           |                                          | Z | 9.90  | 74.8 | 25.6 |      | 136.8 |        |
| 10154-CAC | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)  | X | 6.13  | 67.1 | 19.7 | 5.75 | 146.6 | ±1.4 % |
|           |                                          | Y | 6.11  | 67.4 | 19.9 |      | 147.7 |        |
|           |                                          | Z | 6.12  | 67.1 | 19.7 |      | 142.3 |        |
| 10160-CAB | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)  | X | 6.33  | 66.7 | 19.4 | 5.82 | 128.9 | ±1.4 % |
|           |                                          | Y | 6.33  | 67.1 | 19.7 |      | 128.7 |        |
|           |                                          | Z | 6.57  | 67.6 | 19.9 |      | 147.4 |        |
| 10169-CAB | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)    | X | 4.89  | 66.4 | 19.5 | 5.73 | 127.5 | ±1.2 % |
|           |                                          | Y | 4.99  | 67.5 | 20.2 |      | 149.3 |        |
|           |                                          | Z | 5.09  | 67.3 | 20.0 |      | 145.1 |        |
| 10172-CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)    | X | 7.99  | 75.8 | 26.3 | 9.21 | 127.6 | ±2.7 % |
|           |                                          | Y | 9.29  | 81.7 | 29.6 |      | 149.8 |        |
|           |                                          | Z | 8.04  | 75.8 | 26.3 |      | 123.6 |        |
| 10175-CAC | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)    | X | 5.08  | 67.3 | 20.0 | 5.72 | 149.3 | ±1.4 % |
|           |                                          | Y | 5.00  | 67.6 | 20.3 |      | 145.0 |        |
|           |                                          | Z | 5.09  | 67.3 | 20.0 |      | 145.0 |        |
| 10181-CAB | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)    | X | 5.08  | 67.3 | 20.0 | 5.72 | 148.5 | ±1.4 % |
|           |                                          | Y | 5.06  | 67.9 | 20.4 |      | 147.1 |        |
|           |                                          | Z | 5.11  | 67.4 | 20.0 |      | 144.8 |        |
| 10196-CAB | IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)  | X | 9.89  | 68.7 | 21.2 | 8.10 | 134.6 | ±2.2 % |
|           |                                          | Y | 9.84  | 68.9 | 21.4 |      | 130.4 |        |
|           |                                          | Z | 9.82  | 68.5 | 21.1 |      | 130.4 |        |
| 10225-CAB | UMTS-FDD (HSPA+)                         | X | 7.02  | 67.1 | 19.5 | 5.97 | 138.0 | ±1.4 % |
|           |                                          | Y | 6.88  | 67.0 | 19.5 |      | 133.2 |        |
|           |                                          | Z | 7.01  | 67.1 | 19.5 |      | 134.6 |        |
| 10237-CAB | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)    | X | 8.01  | 75.9 | 26.4 | 9.21 | 128.0 | ±2.7 % |
|           |                                          | Y | 9.39  | 82.1 | 29.9 |      | 149.7 |        |
|           |                                          | Z | 8.34  | 76.9 | 26.9 |      | 129.1 |        |
| 10252-CAB | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)  | X | 9.05  | 73.6 | 25.1 | 9.24 | 130.6 | ±3.0 % |
|           |                                          | Y | 8.76  | 73.7 | 25.5 |      | 123.6 |        |
|           |                                          | Z | 9.10  | 73.6 | 25.1 |      | 127.8 |        |
| 10267-CAB | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK) | X | 9.81  | 74.7 | 25.6 | 9.30 | 139.3 | ±3.0 % |
|           |                                          | Y | 9.50  | 74.8 | 25.9 |      | 130.7 |        |
|           |                                          | Z | 9.81  | 74.6 | 25.5 |      | 135.0 |        |

|           |                                                               |   |       |      |      |      |       |        |
|-----------|---------------------------------------------------------------|---|-------|------|------|------|-------|--------|
| 10275-CAB | UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)                      | X | 4.49  | 67.1 | 18.9 | 3.96 | 140.1 | ±0.7 % |
|           |                                                               | Y | 4.46  | 67.2 | 19.0 |      | 137.6 |        |
|           |                                                               | Z | 4.52  | 67.1 | 18.9 |      | 137.1 |        |
| 10291-AAB | CDMA2000, RC3, SO55, Full Rate                                | X | 3.68  | 67.0 | 18.8 | 3.46 | 129.3 | ±0.7 % |
|           |                                                               | Y | 3.64  | 67.3 | 19.0 |      | 130.3 |        |
|           |                                                               | Z | 3.84  | 67.9 | 19.2 |      | 148.6 |        |
| 10292-AAB | CDMA2000, RC3, SO32, Full Rate                                | X | 3.64  | 67.2 | 18.8 | 3.39 | 131.8 | ±0.5 % |
|           |                                                               | Y | 3.60  | 67.4 | 19.1 |      | 128.2 |        |
|           |                                                               | Z | 3.71  | 67.5 | 19.0 |      | 128.0 |        |
| 10297-AAA | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)                       | X | 6.43  | 67.5 | 19.9 | 5.81 | 147.2 | ±1.7 % |
|           |                                                               | Y | 6.39  | 67.7 | 20.0 |      | 145.4 |        |
|           |                                                               | Z | 6.42  | 67.5 | 19.8 |      | 143.2 |        |
| 10311-AAA | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)                      | X | 6.73  | 67.1 | 19.7 | 6.06 | 129.7 | ±1.4 % |
|           |                                                               | Y | 6.75  | 67.5 | 19.9 |      | 130.8 |        |
|           |                                                               | Z | 6.75  | 67.3 | 19.7 |      | 126.2 |        |
| 10400-AAB | IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)           | X | 10.14 | 68.9 | 21.5 | 8.37 | 136.7 | ±2.5 % |
|           |                                                               | Y | 10.23 | 69.5 | 22.0 |      | 136.5 |        |
|           |                                                               | Z | 10.13 | 68.9 | 21.5 |      | 132.8 |        |
| 10403-AAB | CDMA2000 (1xEV-DO, Rev. 0)                                    | X | 4.97  | 69.2 | 19.3 | 3.76 | 143.5 | ±0.5 % |
|           |                                                               | Y | 4.87  | 69.3 | 19.4 |      | 141.0 |        |
|           |                                                               | Z | 5.02  | 69.2 | 19.3 |      | 139.6 |        |
| 10404-AAB | CDMA2000 (1xEV-DO, Rev. A)                                    | X | 4.91  | 69.3 | 19.4 | 3.77 | 139.8 | ±0.7 % |
|           |                                                               | Y | 4.67  | 68.9 | 19.1 |      | 138.9 |        |
|           |                                                               | Z | 4.89  | 69.1 | 19.3 |      | 137.1 |        |
| 10415-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)     | X | 2.93  | 70.1 | 19.6 | 1.54 | 137.8 | ±0.7 % |
|           |                                                               | Y | 2.84  | 69.8 | 19.6 |      | 138.2 |        |
|           |                                                               | Z | 3.04  | 70.8 | 19.9 |      | 134.2 |        |
| 10416-AAA | IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle) | X | 9.94  | 68.7 | 21.3 | 8.23 | 134.6 | ±2.2 % |
|           |                                                               | Y | 10.00 | 69.1 | 21.7 |      | 134.1 |        |
|           |                                                               | Z | 9.89  | 68.5 | 21.2 |      | 130.1 |        |

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 NormX,Y,Z do not affect the  $E^2$ -field uncertainty inside TSL (see Pages 7 and 8).

<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: ES3DV3 - SN:3319

### 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) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.69    | 6.69    | 6.69    | 0.40               | 1.70                    | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.41    | 6.41    | 6.41    | 0.43               | 1.62                    | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.29    | 5.29    | 5.29    | 0.80               | 1.16                    | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 5.10    | 5.10    | 5.10    | 0.80               | 1.24                    | ± 12.0 %    |
| 2300                 | 39.5                               | 1.67                            | 4.77    | 4.77    | 4.77    | 0.64               | 1.38                    | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.55    | 4.55    | 4.55    | 0.80               | 1.29                    | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.39    | 4.39    | 4.39    | 0.80               | 1.31                    | ± 12.0 %    |

<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: ES3DV3 - SN:3319

### 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 (mm) <sup>G</sup> | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750                  | 55.5                               | 0.96                            | 6.10    | 6.10    | 6.10    | 0.34               | 1.80                    | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 6.07    | 6.07    | 6.07    | 0.47               | 1.56                    | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 4.83    | 4.83    | 4.83    | 0.70               | 1.36                    | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 4.53    | 4.53    | 4.53    | 0.71               | 1.39                    | ± 12.0 %    |
| 2300                 | 52.9                               | 1.81                            | 4.24    | 4.24    | 4.24    | 0.80               | 1.26                    | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.11    | 4.11    | 4.11    | 0.80               | 1.10                    | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 3.90    | 3.90    | 3.90    | 0.80               | 1.11                    | ± 12.0 %    |

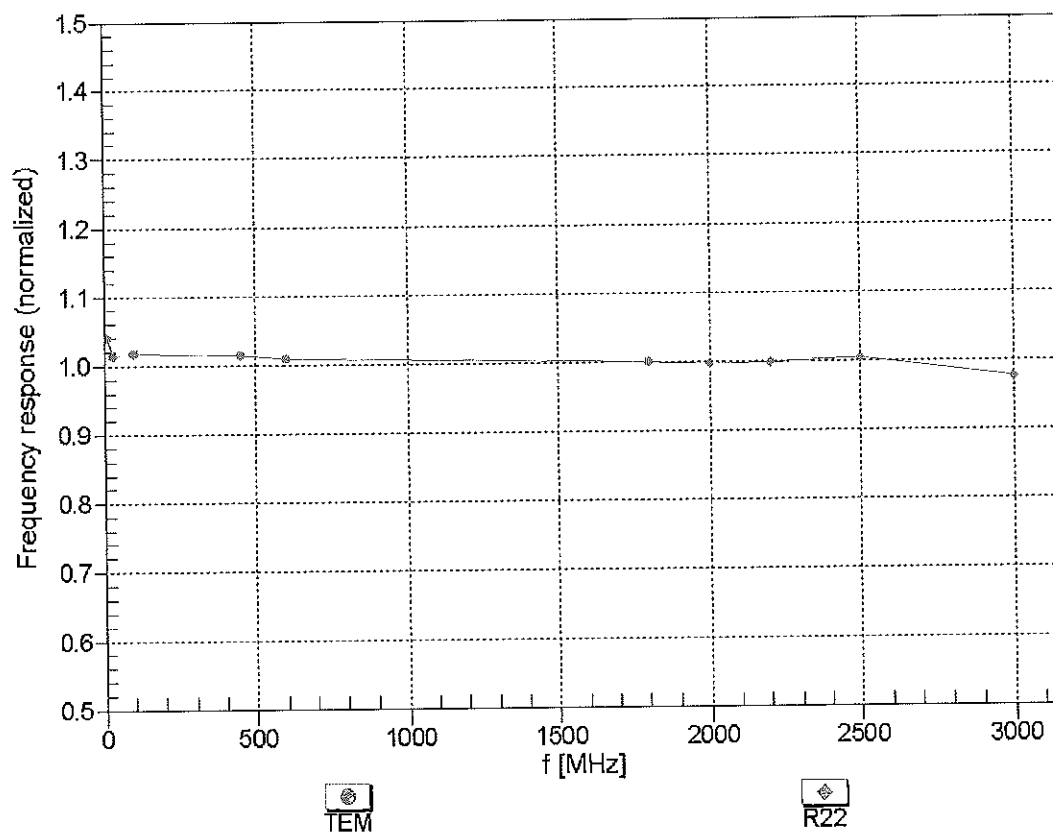
<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 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:ifi110 EXX, Waveguide: R22)

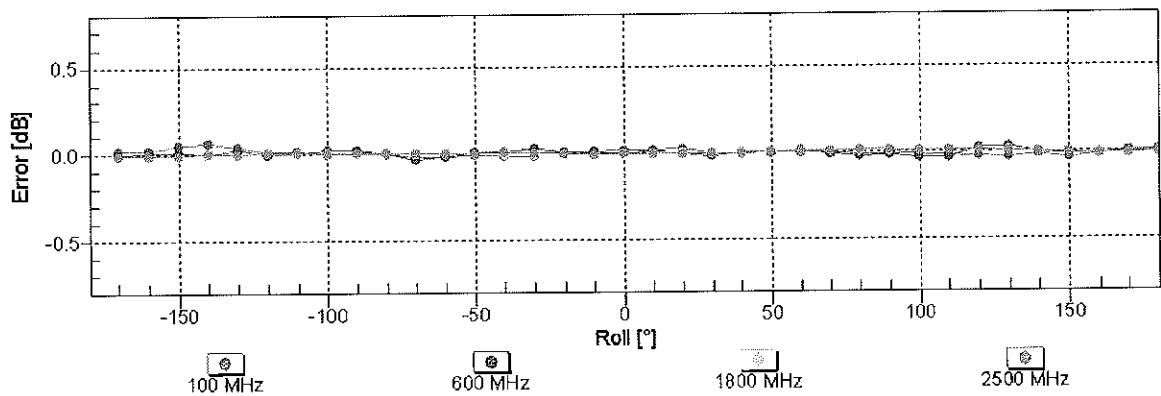
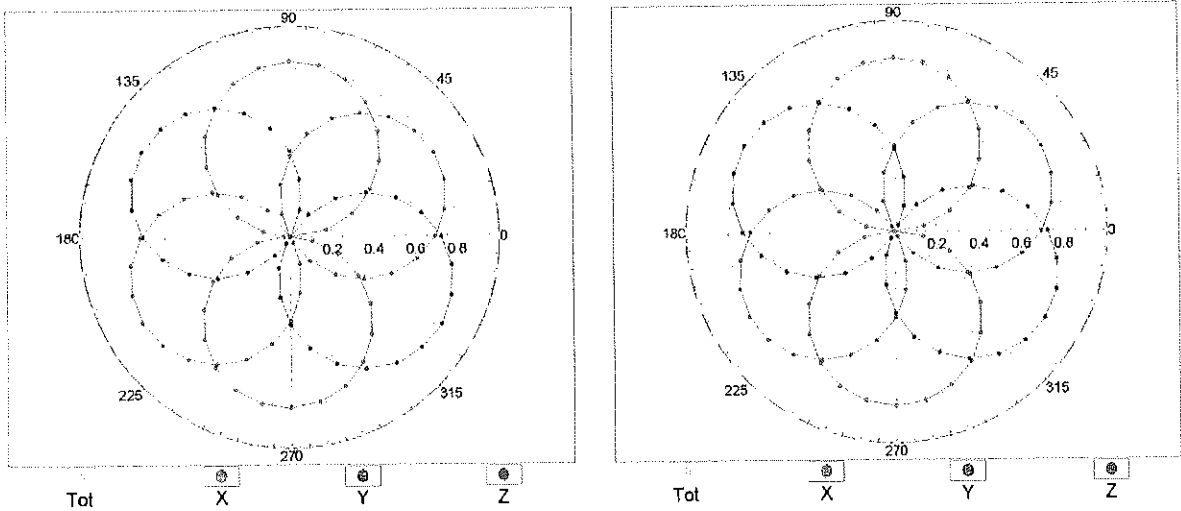


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

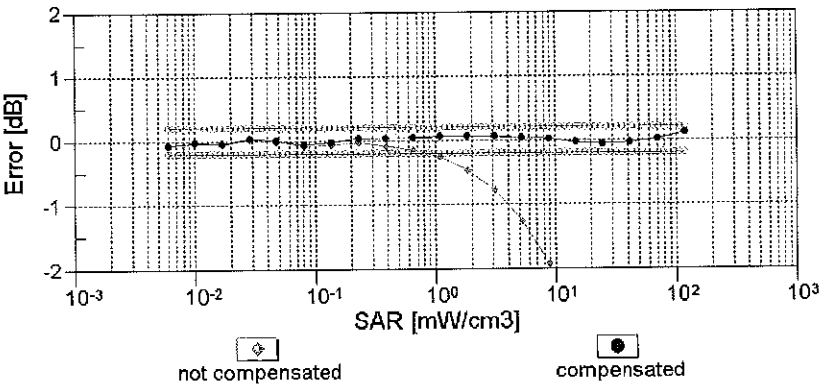
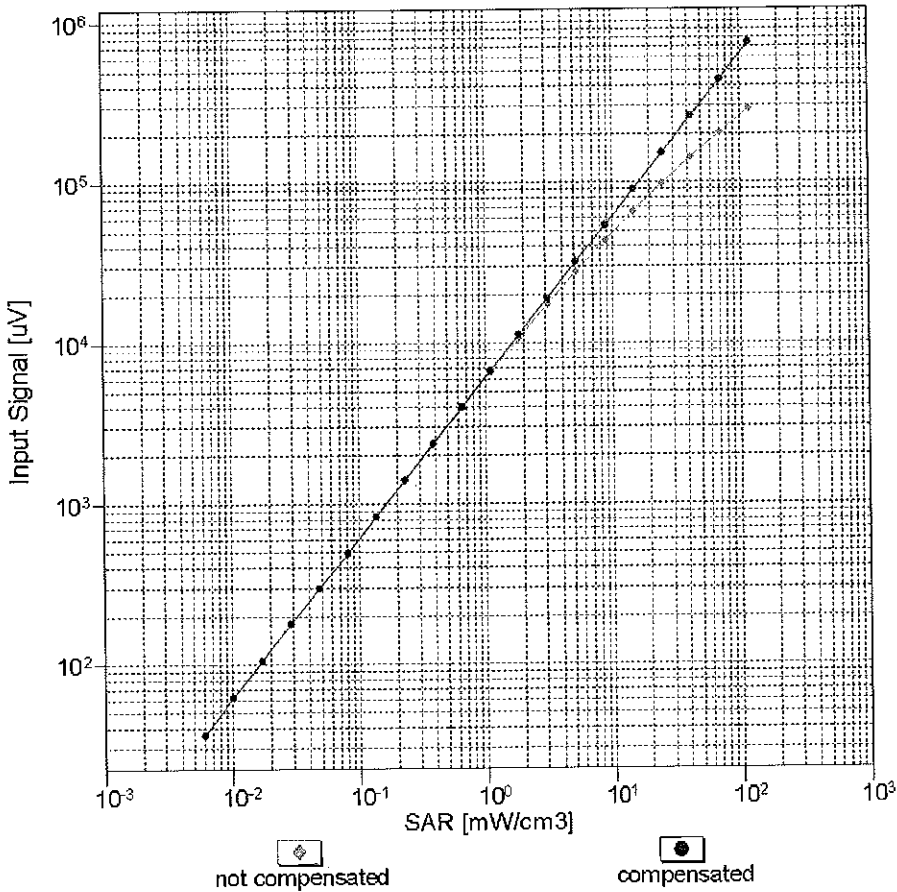
f=600 MHz,TEM

f=1800 MHz,R22



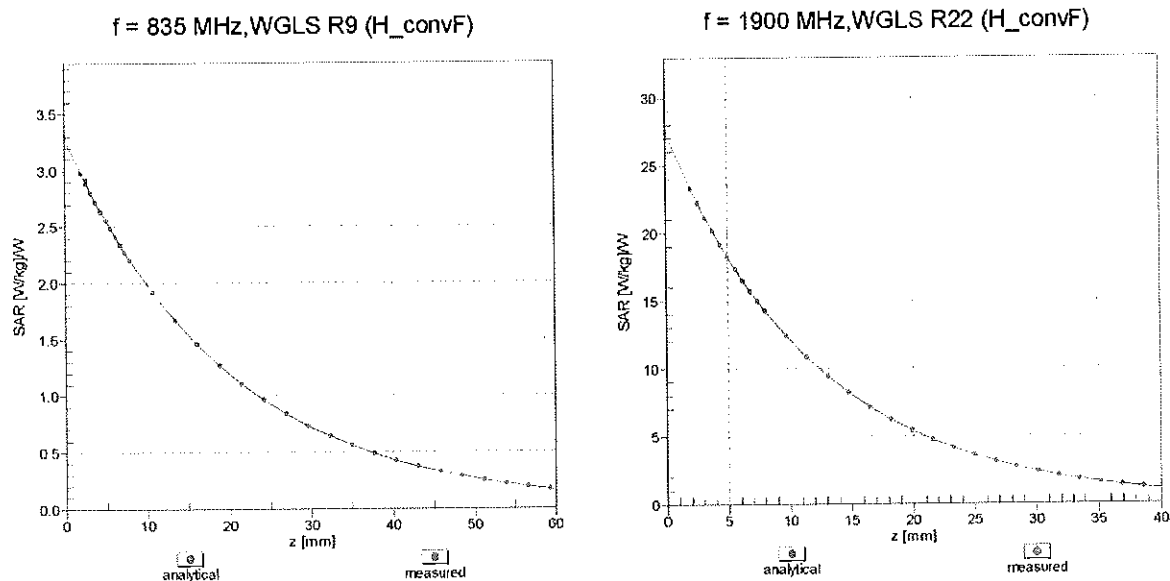
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

**Dynamic Range f(SAR<sub>head</sub>)**  
(TEM cell , f<sub>eval</sub>= 1900 MHz)



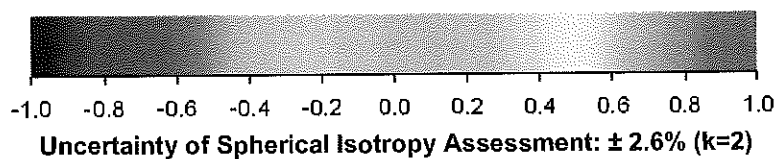
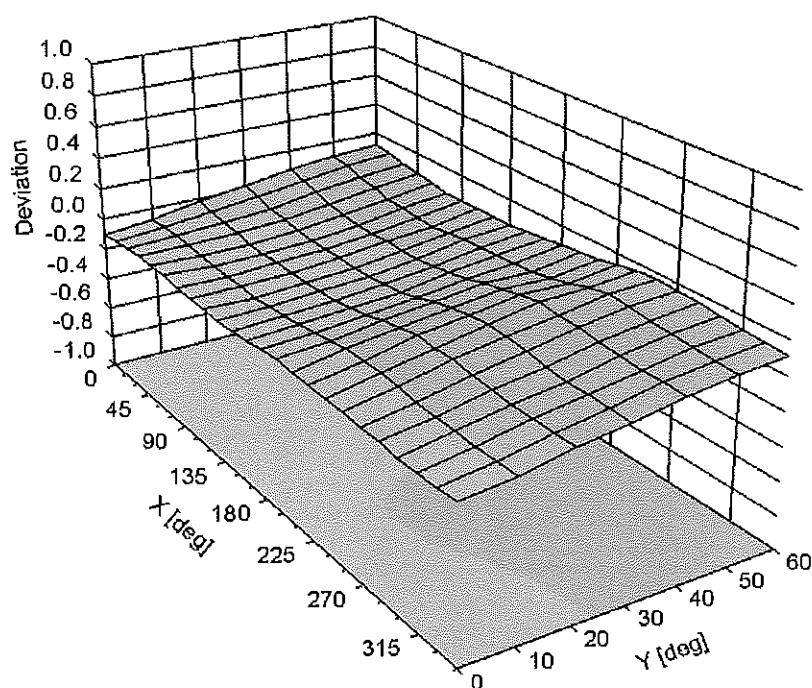
**Uncertainty of Linearity Assessment: ± 0.6% (k=2)**

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi, \theta$ ),  $f = 900 \text{ MHz}$



**DASY/EASY - Parameters of Probe: ES3DV3 - SN:3319****Other Probe Parameters**

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | -120.2     |
| Mechanical Surface Detection Mode             | enabled    |
| Optical Surface Detection Mode                | disabled   |
| Probe Overall Length                          | 337 mm     |
| Probe Body Diameter                           | 10 mm      |
| Tip Length                                    | 10 mm      |
| Tip Diameter                                  | 4 mm       |
| Probe Tip to Sensor X Calibration Point       | 2 mm       |
| Probe Tip to Sensor Y Calibration Point       | 2 mm       |
| Probe Tip to Sensor Z Calibration Point       | 2 mm       |
| Recommended Measurement Distance from Surface | 3 mm       |



Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **ES3-3318\_Jan15**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3318**

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

CC  
 1/30/15

Calibration date: **January 23, 2015**

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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 03-Apr-14 (No. 217-01911)         | Apr-15                 |
| Power sensor E4412A        | MY41498087      | 03-Apr-14 (No. 217-01911)         | Apr-15                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 03-Apr-14 (No. 217-01915)         | Apr-15                 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 03-Apr-14 (No. 217-01919)         | Apr-15                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 03-Apr-14 (No. 217-01920)         | Apr-15                 |
| Reference Probe ES3DV2     | SN: 3013        | 30-Dec-14 (No. ES3-3013_Dec14)    | Dec-15                 |
| DAE4                       | SN: 660         | 14-Jan-15 (No. DAE4-660_Jan15)    | Jan-16                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-13)  | In house check: Apr-16 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

|                |                              |                                          |                          |
|----------------|------------------------------|------------------------------------------|--------------------------|
| Calibrated by: | Name<br><b>Israe Elnaouq</b> | Function<br><b>Laboratory Technician</b> | Signature<br>            |
| Approved by:   | <b>Katja Pokovic</b>         | <b>Technical Manager</b>                 |                          |
|                |                              |                                          | Issued: January 26, 2015 |

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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

### 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 ES3DV3

## SN:3318

Manufactured: January 10, 2012  
Calibrated: January 23, 2015

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

# DASY/EASY - Parameters of Probe: ES3DV3 - SN:3318

## Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|-----------------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.15     | 0.92     | 1.28     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 106.4    | 109.2    | 103.4    |               |

## Modulation Calibration Parameters

| UID       | Communication System Name                     |   | A<br>dB | B<br>dB $\sqrt{\mu\text{V}}$ | 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    | 200.6    | $\pm 3.5 \%$              |
|           |                                               | Y | 0.0     | 0.0                          | 1.0  |         | 185.3    |                           |
|           |                                               | Z | 0.0     | 0.0                          | 1.0  |         | 207.7    |                           |
| 10010-CAA | SAR Validation (Square, 100ms, 10ms)          | X | 3.26    | 66.4                         | 14.0 | 10.00   | 41.4     | $\pm 1.2 \%$              |
|           |                                               | Y | 1.76    | 59.6                         | 9.8  |         | 36.1     |                           |
|           |                                               | Z | 1.82    | 57.7                         | 9.6  |         | 43.6     |                           |
| 10011-CAB | UMTS-FDD (WCDMA)                              | X | 3.48    | 68.9                         | 19.9 | 2.91    | 120.2    | $\pm 0.5 \%$              |
|           |                                               | Y | 3.76    | 70.1                         | 19.9 |         | 146.0    |                           |
|           |                                               | Z | 3.11    | 66.0                         | 17.9 |         | 124.4    |                           |
| 10012-CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)      | X | 3.71    | 74.2                         | 21.7 | 1.87    | 121.7    | $\pm 0.7 \%$              |
|           |                                               | Y | 3.65    | 73.3                         | 20.7 |         | 147.5    |                           |
|           |                                               | Z | 2.77    | 67.4                         | 17.8 |         | 126.6    |                           |
| 10013-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps) | X | 10.68   | 69.5                         | 22.7 | 9.46    | 114.7    | $\pm 2.5 \%$              |
|           |                                               | Y | 10.82   | 70.4                         | 23.0 |         | 139.8    |                           |
|           |                                               | Z | 11.22   | 71.1                         | 23.7 |         | 122.2    |                           |
| 10021-DAB | GSM-FDD (TDMA, GMSK)                          | X | 16.13   | 95.0                         | 26.6 | 9.39    | 122.7    | $\pm 2.2 \%$              |
|           |                                               | Y | 4.61    | 73.1                         | 17.2 |         | 130.8    |                           |
|           |                                               | Z | 15.10   | 92.0                         | 25.4 |         | 135.9    |                           |
| 10023-DAB | GPRS-FDD (TDMA, GMSK, TN 0)                   | X | 17.03   | 96.8                         | 27.5 | 9.57    | 113.0    | $\pm 1.9 \%$              |
|           |                                               | Y | 4.15    | 71.7                         | 16.8 |         | 119.9    |                           |
|           |                                               | Z | 21.50   | 98.0                         | 27.5 |         | 130.9    |                           |
| 10024-DAB | GPRS-FDD (TDMA, GMSK, TN 0-1)                 | X | 35.51   | 99.5                         | 24.5 | 6.56    | 147.6    | $\pm 2.7 \%$              |
|           |                                               | Y | 6.12    | 77.2                         | 17.1 |         | 118.1    |                           |
|           |                                               | Z | 38.50   | 99.7                         | 24.7 |         | 114.0    |                           |
| 10027-DAB | GPRS-FDD (TDMA, GMSK, TN 0-1-2)               | X | 45.57   | 99.9                         | 23.2 | 4.80    | 113.3    | $\pm 1.7 \%$              |
|           |                                               | Y | 2.73    | 68.4                         | 12.6 |         | 133.3    |                           |
|           |                                               | Z | 54.59   | 99.9                         | 22.9 |         | 131.0    |                           |
| 10028-DAB | GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)             | X | 53.68   | 99.5                         | 21.9 | 3.55    | 123.0    | $\pm 3.0 \%$              |
|           |                                               | Y | 60.05   | 99.8                         | 21.1 |         | 144.9    |                           |
|           |                                               | Z | 66.60   | 99.6                         | 21.6 |         | 140.7    |                           |
| 10032-CAA | IEEE 802.15.1 Bluetooth (GFSK, DH5)           | X | 20.92   | 99.4                         | 21.8 | 1.16    | 136.6    | $\pm 2.2 \%$              |
|           |                                               | Y | 95.40   | 88.3                         | 13.8 |         | 117.6    |                           |
|           |                                               | Z | 100.00  | 99.5                         | 18.7 |         | 110.1    |                           |
| 10100-CAB | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)      | X | 6.50    | 68.1                         | 20.2 | 5.67    | 130.5    | $\pm 1.2 \%$              |
|           |                                               | Y | 6.11    | 66.7                         | 19.2 |         | 107.2    |                           |
|           |                                               | Z | 6.55    | 68.2                         | 20.1 |         | 142.7    |                           |

|           |                                          |   |       |      |      |      |       |        |
|-----------|------------------------------------------|---|-------|------|------|------|-------|--------|
| 10103-CAB | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK) | X | 9.76  | 74.8 | 25.9 | 9.29 | 116.0 | ±2.5 % |
|           |                                          | Y | 8.85  | 72.2 | 24.1 |      | 134.9 |        |
|           |                                          | Z | 10.83 | 77.4 | 27.2 |      | 131.5 |        |
| 10108-CAC | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK) | X | 6.36  | 67.7 | 20.1 | 5.80 | 128.7 | ±1.2 % |
|           |                                          | Y | 5.92  | 66.1 | 19.0 |      | 106.6 |        |
|           |                                          | Z | 6.42  | 67.7 | 20.0 |      | 140.4 |        |
| 10117-CAB | IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK) | X | 10.20 | 69.1 | 21.6 | 8.07 | 118.1 | ±2.5 % |
|           |                                          | Y | 10.27 | 69.3 | 21.4 |      | 143.9 |        |
|           |                                          | Z | 10.43 | 69.7 | 21.8 |      | 131.0 |        |
| 10151-CAB | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)  | X | 9.09  | 73.7 | 25.5 | 9.28 | 112.0 | ±2.7 % |
|           |                                          | Y | 8.35  | 71.5 | 23.9 |      | 131.1 |        |
|           |                                          | Z | 9.58  | 74.4 | 25.6 |      | 126.8 |        |
| 10154-CAC | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)  | X | 6.01  | 67.0 | 19.8 | 5.75 | 126.4 | ±1.2 % |
|           |                                          | Y | 6.17  | 67.7 | 19.9 |      | 148.9 |        |
|           |                                          | Z | 6.07  | 67.1 | 19.7 |      | 137.2 |        |
| 10160-CAB | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)  | X | 6.41  | 67.4 | 19.9 | 5.82 | 130.9 | ±0.9 % |
|           |                                          | Y | 6.06  | 66.2 | 19.0 |      | 109.1 |        |
|           |                                          | Z | 6.54  | 67.7 | 20.0 |      | 142.6 |        |
| 10169-CAB | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)    | X | 4.79  | 66.5 | 19.8 | 5.73 | 109.4 | ±0.9 % |
|           |                                          | Y | 4.82  | 67.1 | 19.8 |      | 128.8 |        |
|           |                                          | Z | 4.85  | 66.4 | 19.5 |      | 119.0 |        |
| 10172-CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)    | X | 8.44  | 79.3 | 28.7 | 9.21 | 125.1 | ±2.5 % |
|           |                                          | Y | 7.15  | 75.0 | 26.0 |      | 144.0 |        |
|           |                                          | Z | 10.13 | 83.8 | 30.8 |      | 141.9 |        |
| 10175-CAC | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)    | X | 5.13  | 68.2 | 20.8 | 5.72 | 146.5 | ±0.9 % |
|           |                                          | Y | 4.77  | 66.8 | 19.6 |      | 125.2 |        |
|           |                                          | Z | 4.81  | 66.2 | 19.4 |      | 118.5 |        |
| 10181-CAB | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)    | X | 5.11  | 68.1 | 20.7 | 5.72 | 146.4 | ±0.9 % |
|           |                                          | Y | 4.79  | 67.0 | 19.7 |      | 126.0 |        |
|           |                                          | Z | 4.88  | 66.6 | 19.7 |      | 118.9 |        |
| 10196-CAB | IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)  | X | 9.63  | 68.3 | 21.2 | 8.10 | 108.2 | ±2.5 % |
|           |                                          | Y | 9.84  | 68.9 | 21.3 |      | 135.5 |        |
|           |                                          | Z | 9.99  | 69.2 | 21.7 |      | 124.0 |        |
| 10225-CAB | UMTS-FDD (HSPA+)                         | X | 6.99  | 67.3 | 19.7 | 5.97 | 134.8 | ±0.9 % |
|           |                                          | Y | 6.73  | 66.8 | 19.2 |      | 115.9 |        |
|           |                                          | Z | 6.71  | 66.2 | 19.0 |      | 106.3 |        |
| 10237-CAB | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)    | X | 7.79  | 76.4 | 27.0 | 9.21 | 126.4 | ±2.5 % |
|           |                                          | Y | 7.19  | 75.1 | 26.1 |      | 144.7 |        |
|           |                                          | Z | 10.12 | 83.9 | 30.9 |      | 142.0 |        |
| 10252-CAB | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)  | X | 8.19  | 71.9 | 24.7 | 9.24 | 103.3 | ±2.2 % |
|           |                                          | Y | 7.76  | 70.8 | 23.6 |      | 122.0 |        |
|           |                                          | Z | 9.31  | 75.2 | 26.4 |      | 119.1 |        |
| 10267-CAB | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK) | X | 8.90  | 73.0 | 25.1 | 9.30 | 108.7 | ±2.2 % |
|           |                                          | Y | 8.38  | 71.6 | 24.0 |      | 129.7 |        |
|           |                                          | Z | 10.15 | 76.5 | 26.9 |      | 126.1 |        |

|           |                                                               |   |       |      |      |      |       |        |
|-----------|---------------------------------------------------------------|---|-------|------|------|------|-------|--------|
| 10275-CAB | UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)                      | X | 4.42  | 67.2 | 19.2 | 3.96 | 119.1 | ±0.7 % |
|           |                                                               | Y | 4.71  | 68.5 | 19.5 |      | 143.8 |        |
|           |                                                               | Z | 4.39  | 66.7 | 18.6 |      | 131.7 |        |
| 10291-AAB | CDMA2000, RC3, SO55, Full Rate                                | X | 3.65  | 67.5 | 19.3 | 3.46 | 111.3 | ±0.5 % |
|           |                                                               | Y | 3.89  | 69.0 | 19.6 |      | 130.9 |        |
|           |                                                               | Z | 3.49  | 66.1 | 18.2 |      | 122.4 |        |
| 10292-AAB | CDMA2000, RC3, SO32, Full Rate                                | X | 3.60  | 67.6 | 19.3 | 3.39 | 114.4 | ±0.5 % |
|           |                                                               | Y | 3.85  | 69.1 | 19.7 |      | 133.4 |        |
|           |                                                               | Z | 3.45  | 66.2 | 18.2 |      | 123.7 |        |
| 10297-AAA | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)                       | X | 6.36  | 67.6 | 20.1 | 5.81 | 128.7 | ±1.2 % |
|           |                                                               | Y | 5.95  | 66.1 | 19.0 |      | 106.5 |        |
|           |                                                               | Z | 6.39  | 67.6 | 19.9 |      | 140.7 |        |
| 10311-AAA | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)                      | X | 6.98  | 68.4 | 20.6 | 6.06 | 134.9 | ±1.2 % |
|           |                                                               | Y | 6.52  | 66.7 | 19.3 |      | 111.3 |        |
|           |                                                               | Z | 7.06  | 68.6 | 20.5 |      | 146.2 |        |
| 10403-AAB | CDMA2000 (1xEV-DO, Rev. 0)                                    | X | 4.97  | 69.7 | 19.7 | 3.76 | 122.2 | ±0.5 % |
|           |                                                               | Y | 5.31  | 71.6 | 20.2 |      | 143.6 |        |
|           |                                                               | Z | 4.54  | 67.3 | 18.2 |      | 133.0 |        |
| 10404-AAB | CDMA2000 (1xEV-DO, Rev. A)                                    | X | 4.77  | 69.4 | 19.6 | 3.77 | 120.8 | ±0.5 % |
|           |                                                               | Y | 5.40  | 72.4 | 20.6 |      | 141.3 |        |
|           |                                                               | Z | 4.71  | 68.5 | 18.9 |      | 131.5 |        |
| 10415-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)     | X | 3.07  | 71.7 | 20.7 | 1.54 | 120.5 | ±0.7 % |
|           |                                                               | Y | 3.52  | 73.8 | 21.0 |      | 142.0 |        |
|           |                                                               | Z | 2.38  | 66.1 | 17.4 |      | 129.6 |        |
| 10416-AAA | IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle) | X | 9.73  | 68.3 | 21.2 | 8.23 | 114.7 | ±2.5 % |
|           |                                                               | Y | 9.99  | 69.2 | 21.5 |      | 138.0 |        |
|           |                                                               | Z | 10.10 | 69.4 | 21.9 |      | 125.3 |        |

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 NormX,Y,Z do not affect the  $E^2$ -field uncertainty inside TSL (see Pages 7 and 8).

<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: ES3DV3 - SN:3318

### 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) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.58    | 6.58    | 6.58    | 0.36               | 1.73                    | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.39    | 6.39    | 6.39    | 0.80               | 1.14                    | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.27    | 5.27    | 5.27    | 0.76               | 1.19                    | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 5.05    | 5.05    | 5.05    | 0.44               | 1.55                    | ± 12.0 %    |
| 2300                 | 39.5                               | 1.67                            | 4.78    | 4.78    | 4.78    | 0.80               | 1.23                    | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.50    | 4.50    | 4.50    | 0.55               | 1.49                    | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.34    | 4.34    | 4.34    | 0.76               | 1.32                    | ± 12.0 %    |

<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: ES3DV3 - SN:3318

### 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) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750                  | 55.5                               | 0.96                            | 6.22    | 6.22    | 6.22    | 0.67               | 1.28                    | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 6.23    | 6.23    | 6.23    | 0.80               | 1.19                    | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 4.95    | 4.95    | 4.95    | 0.40               | 1.77                    | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 4.76    | 4.76    | 4.76    | 0.60               | 1.48                    | ± 12.0 %    |
| 2300                 | 52.9                               | 1.81                            | 4.52    | 4.52    | 4.52    | 0.80               | 1.19                    | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.37    | 4.37    | 4.37    | 0.72               | 1.23                    | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 4.17    | 4.17    | 4.17    | 0.80               | 1.00                    | ± 12.0 %    |

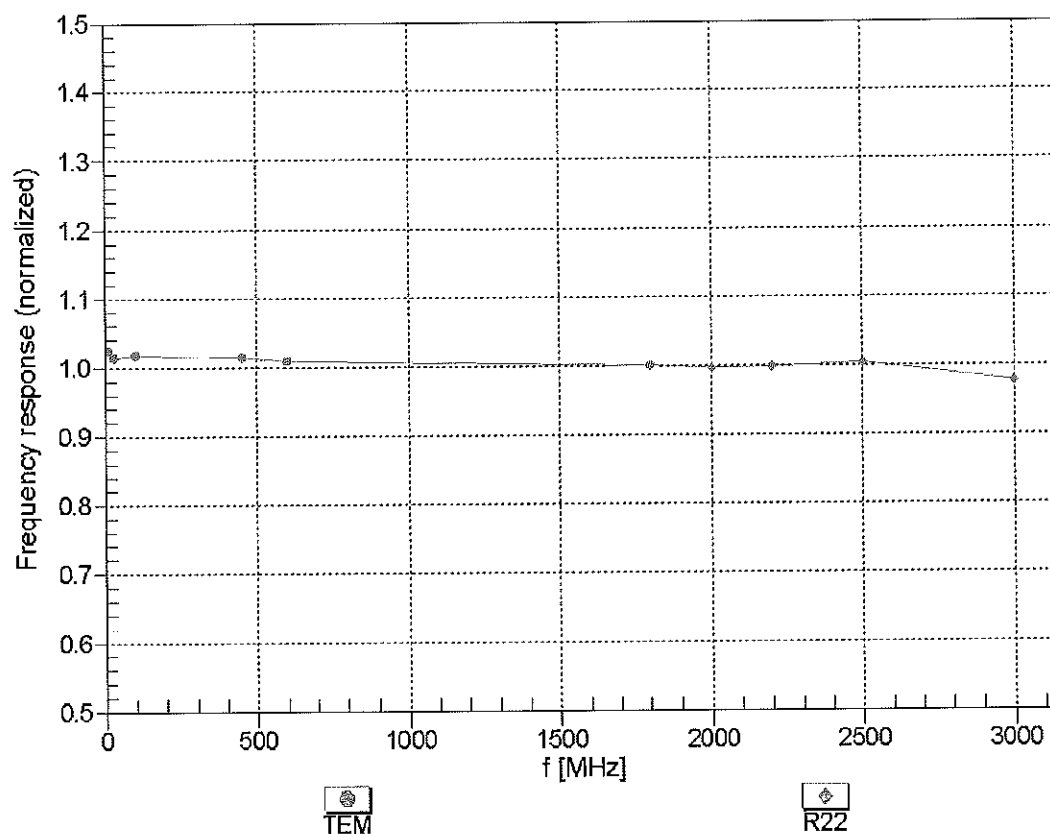
<sup>C</sup> Frequency validity above 300 MHz of  $\pm 100$  MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to  $\pm 50$  MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is  $\pm 10$ , 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  $\pm 110$  MHz.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to  $\pm 10\%$  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  $\pm 5\%$ . 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  $\pm 1\%$  for frequencies below 3 GHz and below  $\pm 2\%$  for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

## Frequency Response of E-Field

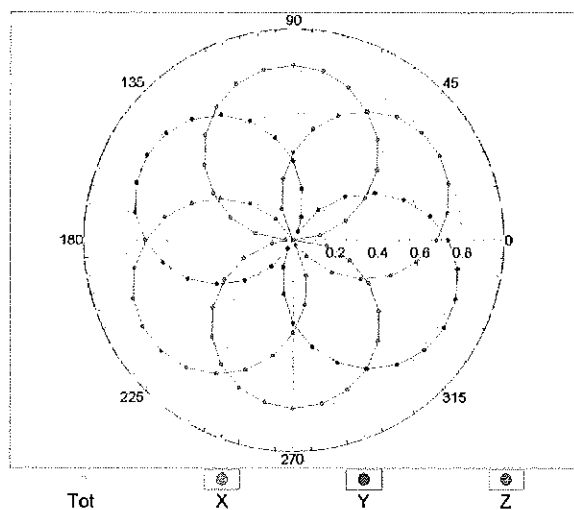
(TEM-Cell:ifi110 EXX, Waveguide: R22)



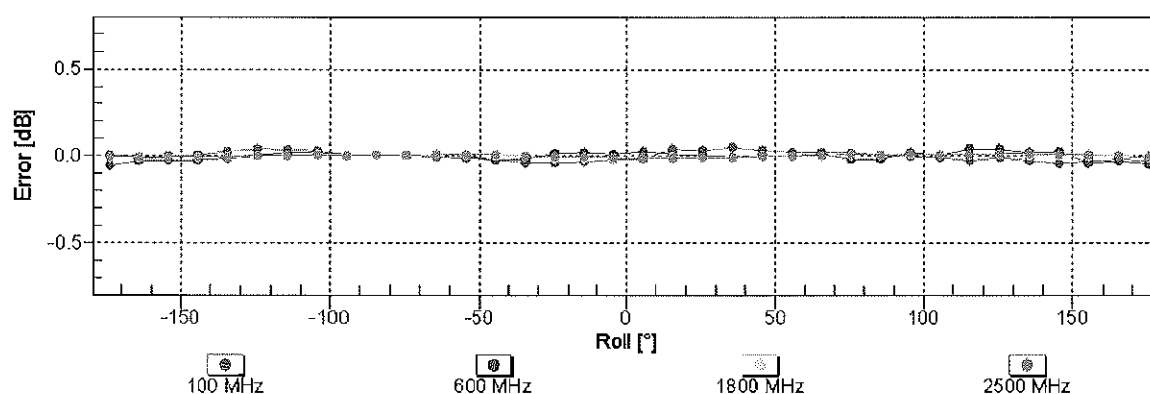
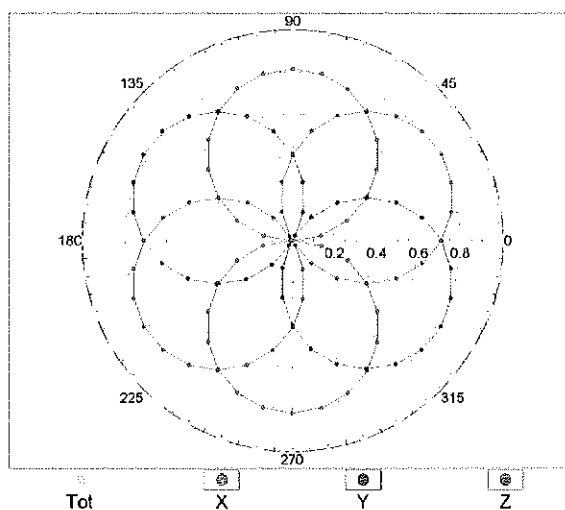
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

f=600 MHz,TEM



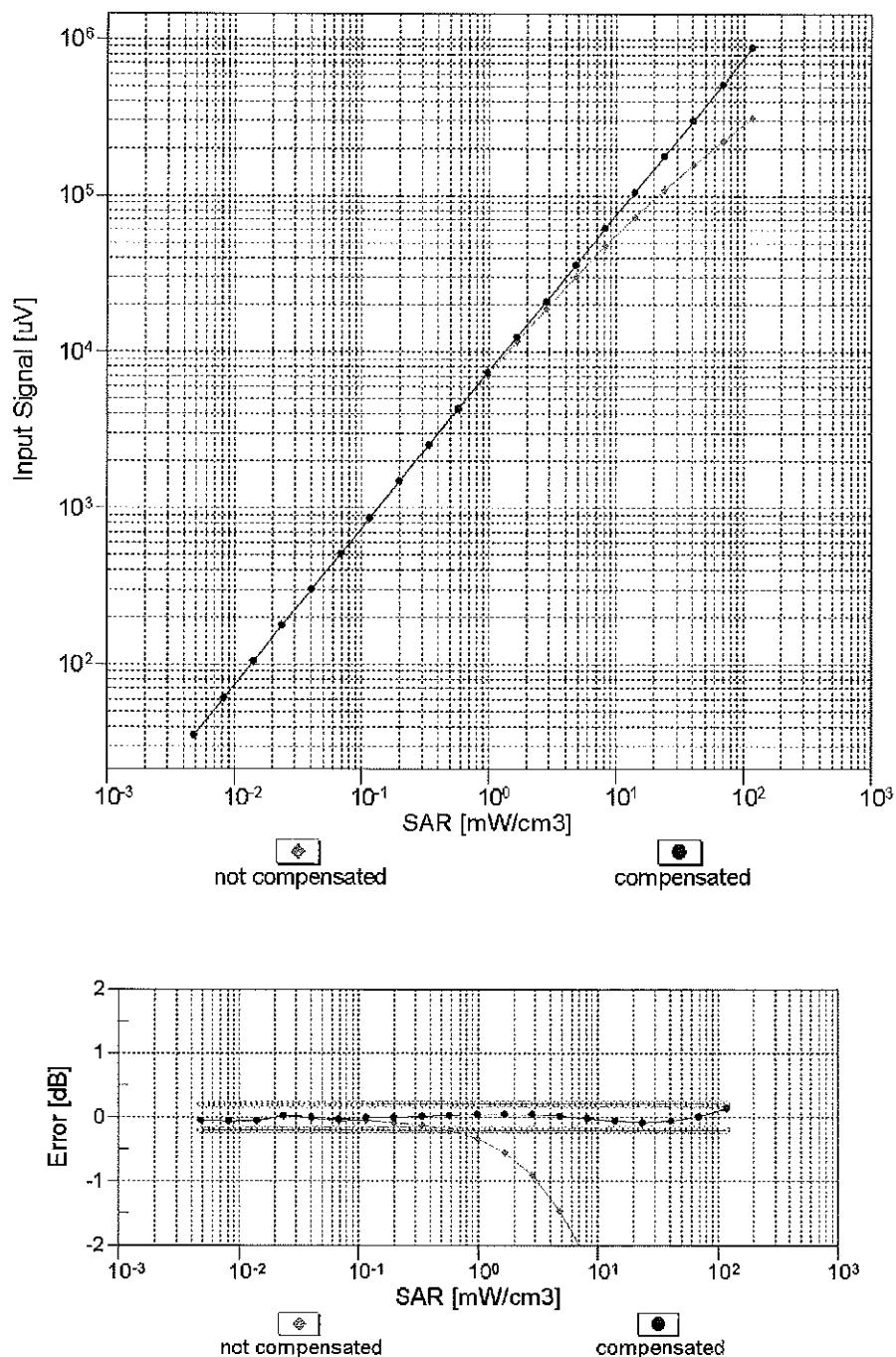
f=1800 MHz,R22



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

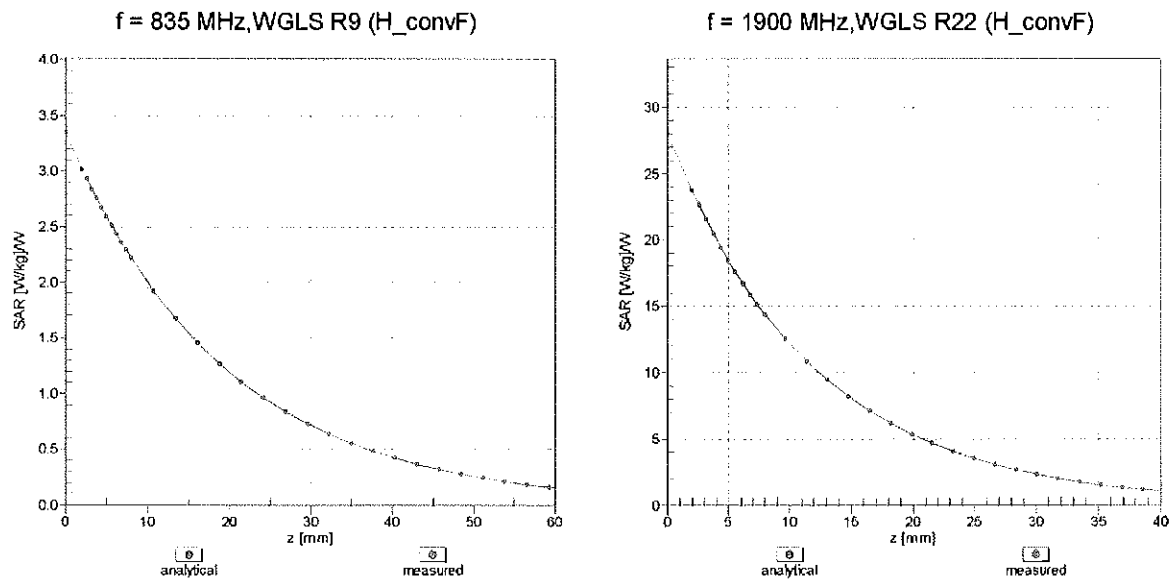
# Dynamic Range f(SAR<sub>head</sub>)

(TEM cell , f<sub>eval</sub>= 1900 MHz)



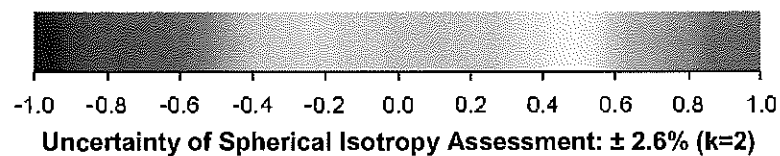
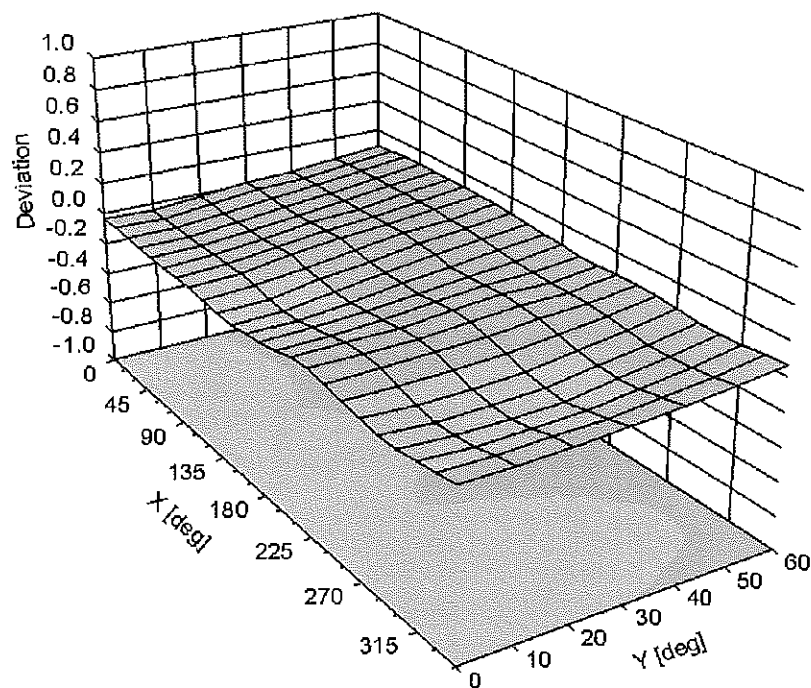
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi, \theta$ ),  $f = 900 \text{ MHz}$



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3318

### Other Probe Parameters

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | -104.4     |
| Mechanical Surface Detection Mode             | enabled    |
| Optical Surface Detection Mode                | disabled   |
| Probe Overall Length                          | 337 mm     |
| Probe Body Diameter                           | 10 mm      |
| Tip Length                                    | 10 mm      |
| Tip Diameter                                  | 4 mm       |
| Probe Tip to Sensor X Calibration Point       | 2 mm       |
| Probe Tip to Sensor Y Calibration Point       | 2 mm       |
| Probe Tip to Sensor Z Calibration Point       | 2 mm       |
| Recommended Measurement Distance from Surface | 3 mm       |