



## SAR EVALUATION REPORT

**Applicant Name:**

Samsung Electronics, Co. Ltd.  
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Yeongtong-gu, Suwon-si  
Gyeonggi-do 443-742, Korea

**Date of Testing:**

08/19/13 - 08/27/13

**Test Site/Location:**

PCTEST Lab, Columbia, MD, USA

**Document Serial No.:**

0Y1308271687.A3L

**FCC ID:**

**A3LSMV100T**

**APPLICANT:**

**SAMSUNG ELECTRONICS, CO. LTD.**

**DUT Type:**

Portable Wireless Router

**Application Type:**

Class II Permissive Change

**FCC Rule Part(s):**

CFR §2.1093

**Model(s):**

SM-V100T

**Permissive Change(s):**

See FCC Change Document

**Date of Original Certification:**

July 29, 2013

| Equipment Class                                   | Band & Mode      | Tx Frequency          | Measured Conducted Power [dBm] | SAR                 |
|---------------------------------------------------|------------------|-----------------------|--------------------------------|---------------------|
|                                                   |                  |                       |                                | 1 gm Hotspot (W/kg) |
| PCB                                               | GPRS/EDGE 850    | 824.20 - 848.80 MHz   | 29.20                          | 0.55                |
| PCB                                               | UMTS 850         | 826.40 - 846.60 MHz   | 21.90                          | 0.75                |
| PCB                                               | UMTS 1750        | 1712.4 - 1752.5 MHz   | 22.71                          | 1.09                |
| PCB                                               | GPRS/EDGE 1900   | 1850.20 - 1909.80 MHz | 25.43                          | 1.00                |
| PCB                                               | UMTS 1900        | 1852.4 - 1907.6 MHz   | 22.75                          | 0.73                |
| PCB                                               | LTE Band 17      | 706.5 - 713.5 MHz     | 24.99                          | 0.41                |
| PCB                                               | LTE Band 4 (AWS) | 1712.5 - 1752.5 MHz   | 22.35                          | 1.02                |
| DTS                                               | 2.4 GHz WLAN     | 2412 - 2462 MHz       | 18.15                          | 0.34                |
| DTS                                               | 5.8 GHz WLAN     | 5745 - 5825 MHz       | 14.24                          | 0.59                |
| <b>Simultaneous SAR per KDB 690783 D01v01r02:</b> |                  |                       |                                | <b>1.49</b>         |

Note: Powers in the above table represent output powers for the SAR test configurations and may not represent the highest output powers for all configurations for each mode.

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 1.7 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



|                                          |                                                                                     |                                              |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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# 1 DEVICE UNDER TEST

## 1.1 Device Overview

| Band & Mode      | Operating Modes | Tx Frequency          |
|------------------|-----------------|-----------------------|
| GPRS/EDGE 850    | Data            | 824.20 - 848.80 MHz   |
| UMTS 850         | Data            | 826.40 - 846.60 MHz   |
| UMTS 1750        | Data            | 1712.4 - 1752.5 MHz   |
| GPRS/EDGE 1900   | Data            | 1850.20 - 1909.80 MHz |
| UMTS 1900        | Data            | 1852.4 - 1907.6 MHz   |
| LTE Band 17      | Data            | 706.5 - 713.5 MHz     |
| LTE Band 4 (AWS) | Data            | 1712.5 - 1752.5 MHz   |
| 2.4 GHz WLAN     | Data            | 2412 - 2462 MHz       |
| 5.8 GHz WLAN     | Data            | 5745 - 5825 MHz       |

## 1.2 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v05r01.

| Mode / Band    |         | Burst Average GMSK (dBm) |               |               |               | Burst Average 8-PSK (dBm) |               |               |               |
|----------------|---------|--------------------------|---------------|---------------|---------------|---------------------------|---------------|---------------|---------------|
|                |         | 1 TX<br>Slots            | 2 TX<br>Slots | 3 TX<br>Slots | 4 TX<br>Slots | 1 TX<br>Slots             | 2 TX<br>Slots | 3 TX<br>Slots | 4 TX<br>Slots |
| GPRS/EDGE 850  | Maximum | 33.0                     | 30.5          | 28.7          | 27.5          | 27.5                      | 26.0          | 24.5          | 23.0          |
|                | Nominal | 32.5                     | 30.0          | 28.2          | 27.0          | 27.0                      | 25.5          | 24.0          | 22.5          |
| GPRS/EDGE 1900 | Maximum | 30.0                     | 29.5          | 27.8          | 26.8          | 27.5                      | 26.0          | 24.5          | 23.3          |
|                | Nominal | 29.5                     | 29.0          | 27.3          | 26.3          | 27.0                      | 25.5          | 24.0          | 22.8          |

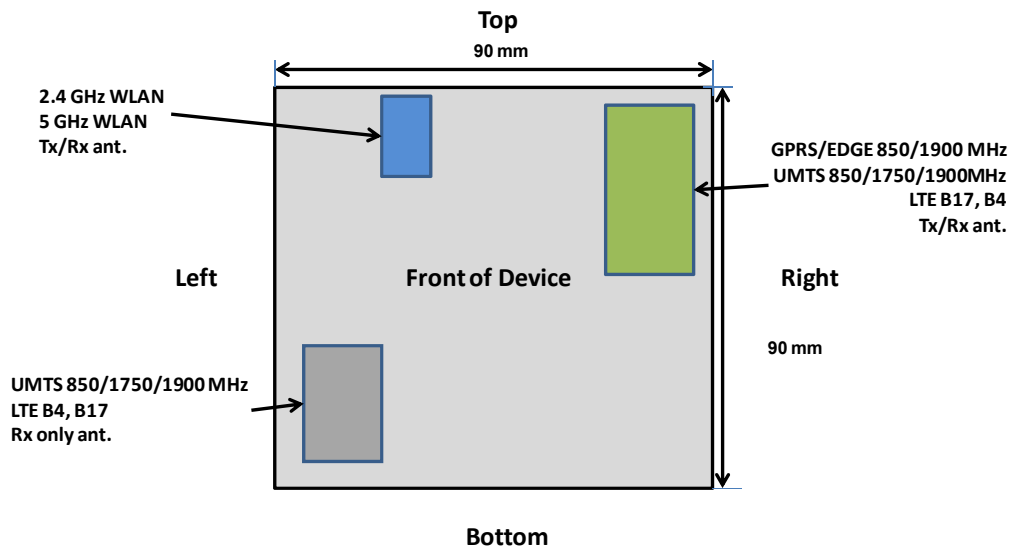
| Mode / Band            |         | Modulated Average (dBm) |            |            |
|------------------------|---------|-------------------------|------------|------------|
|                        |         | 3GPP RMC                | 3GPP HSDPA | 3GPP HSUPA |
| UMTS Band 5 (850 MHz)  | Maximum | 23.3                    | 23.3       | 23.0       |
|                        | Nominal | 22.8                    | 22.8       | 22.5       |
| UMTS Band 4 (1750 MHz) | Maximum | 23.3                    | 23.3       | 23.0       |
|                        | Nominal | 22.8                    | 22.8       | 22.5       |
| UMTS Band 2 (1900 MHz) | Maximum | 23.3                    | 23.3       | 22.8       |
|                        | Nominal | 22.8                    | 22.8       | 22.3       |

| Mode / Band      |         | Modulated Average (dBm) |
|------------------|---------|-------------------------|
| LTE Band 17      | Maximum | 25.0                    |
|                  | Nominal | 24.5                    |
| LTE Band 4 (AWS) | Maximum | 23.0                    |
|                  | Nominal | 22.5                    |

|                                   |                                                                                                                                                                                                        |                                       |                                 |
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| Mode / Band            |         | Modulated Average (dBm) |
|------------------------|---------|-------------------------|
| IEEE 802.11b (2.4 GHz) | Maximum | 18.5                    |
|                        | Nominal | 18.0                    |
| IEEE 802.11g (2.4 GHz) | Maximum | 14.5                    |
|                        | Nominal | 14.0                    |
| IEEE 802.11n (2.4 GHz) | Maximum | 13.5                    |
|                        | Nominal | 13.0                    |
| IEEE 802.11a (5 GHz)   | Maximum | 14.5                    |
|                        | Nominal | 14.0                    |
| IEEE 802.11n (5 GHz)   | Maximum | 13.5                    |
|                        | Nominal | 13.0                    |
| IEEE 802.11ac (5 GHz)  | Maximum | 12.5                    |
|                        | Nominal | 12.0                    |

### 1.3 DUT Antenna Locations



Note: Exact antenna dimensions and separation distances are shown in the Technical Descriptions in the FCC Filing.

**Figure 1-1**  
**DUT Antenna Locations**

|                                          |                                                                                     |                                              |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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**Table 1-1**  
**Mobile Hotspot Sides for SAR Testing**

| Mobile Hotspot Sides for SAR Testing |      |       |     |        |       |      |
|--------------------------------------|------|-------|-----|--------|-------|------|
| Mode                                 | Back | Front | Top | Bottom | Right | Left |
| GPRS 850                             | Yes  | Yes   | Yes | No     | Yes   | No   |
| UMTS 850                             | Yes  | Yes   | Yes | No     | Yes   | No   |
| UMTS 1750                            | Yes  | Yes   | Yes | No     | Yes   | No   |
| GPRS 1900                            | Yes  | Yes   | Yes | No     | Yes   | No   |
| LTE Band 17                          | Yes  | Yes   | Yes | No     | Yes   | No   |
| LTE Band 4 (AWS)                     | Yes  | Yes   | Yes | No     | Yes   | No   |
| 2.4 GHz WLAN                         | Yes  | Yes   | Yes | No     | No    | Yes  |
| 5 GHz WLAN                           | Yes  | Yes   | Yes | No     | No    | Yes  |

Note: Back and Front sides of the device, as well as any edge within 2.5 cm of a transmitting antenna, were evaluated for SAR. Particular DUT edges are not required to be evaluated for Wireless Router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v01r01 guidance, page 2. Table 1-1 summarizes the configurations required for testing. The FCC Filing shows the distances between the transmit antennas and the edges of the device.

## 1.4 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D05v01r01, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the DUT are shown in Figure 1-2 and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.



**Figure 1-2**  
**Simultaneous Transmission Paths**

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v05r01 3) procedures.

|                                          |                                                                                     |                                              |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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**Table 1-2**  
**Simultaneous Transmission Scenarios**

| No.                                                                                                                  | Capable Transmit Configurations            | Body                  | Note       |
|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-----------------------|------------|
|                                                                                                                      |                                            | FCC KDB<br>941225 D06 |            |
| 1                                                                                                                    | 850/1900 MHz GPRS/EDGE Data + WIFI 2.4 GHz | Yes                   | 2G Hotspot |
| 2                                                                                                                    | 850/1750/1900 MHz UMTS Data + WIFI 2.4 GHz | Yes                   | 3G Hotspot |
| 3                                                                                                                    | Band 4/17 LTE Data + WIFI 2.4 GHz          | Yes                   | 4G Hotspot |
| 4                                                                                                                    | 850/1900 MHz GPRS/EDGE Data + WIFI 5.8 GHz | Yes                   | 2G Hotspot |
| 5                                                                                                                    | 850/1750/1900 MHz UMTS Data + WIFI 5.8 GHz | Yes                   | 3G Hotspot |
| 6                                                                                                                    | Band 4/17 LTE Data + WIFI 5.8 GHz          | Yes                   | 4G Hotspot |
| Notes:<br>1. GPRS/EDGE/UMTS/LTE use one modem and transceiver IC. The signals can not be transmitted simultaneously. |                                            |                       |            |

## 1.5 SAR Test Exclusions Applied

### (A) WIFI

2.4 GHz WLAN and 5 GHz WLAN share the same antenna path and cannot transmit simultaneously.

This device supports 20 MHz and 40 MHz Bandwidths for IEEE 802.11n for 5 GHz WIFI only. IEEE 802.11n was not evaluated for SAR since the average output power of 20 MHz and 40 MHz bandwidths was not more than 0.25 dB higher than the average output power of IEEE 802.11a.

This device supports IEEE 802.11ac with the following features:

- a) Up to 80 MHz Bandwidth only
- b) No aggregate channel configurations
- c) 1 Tx antenna output
- d) 256 QAM is supported
- e) No new 5 GHz channels

Full SAR evaluations for all IEEE 802.11ac configurations were not required since the average output power was not more than 0.25 dB higher than IEEE 802.11a mode. IEEE 802.11ac was evaluated for the highest IEEE 802.11a position in each 5 GHz band and exposure condition.

### (B) Licensed Transmitter(s)

This device is only capable of QPSK HSUPA in the uplink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01v02r02.

LTE SAR for the higher modulations and lower bandwidths were not tested since the maximum average output power of all required channels and configurations was not more than 0.5 dB higher than the highest bandwidth; and the reported LTE SAR for the highest bandwidth was less than 1.45 W/kg for all configurations according to FCC KDB 941225 D05v02r02.

## 1.6 Power Reduction for SAR

There is no power reduction used for any band/mode implemented in this device for SAR purposes.

|                                   |                                                                                     |                                       |                                                                                       |                                 |
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## 1.7 Guidance Applied

- FCC KDB Publication 941225 D01-D06 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v01r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05r01 (General SAR Guidance)
- FCC KDB Publication 865664 D01-D02 (SAR Measurements up to 6 GHz)
- April 2013 TCB Workshop Notes (IEEE 802.11ac)

## 1.8 Device Serial Numbers

The manufacturer has confirmed that the device tested (Serial Number: FK-174-E) has the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.

|                                          |                                                                                     |                                              |                                                                                       |                                        |
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## 2 LTE INFORMATION

| LTE Information                                                                                                   |                                                 |                |                |
|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|----------------|----------------|
| FCC ID                                                                                                            | A3LSMV100T                                      |                |                |
| Form Factor                                                                                                       | Portable Handset                                |                |                |
| Frequency Range of each LTE transmission band                                                                     | LTE Band 17 (706.5 - 713.5 MHz)                 |                |                |
|                                                                                                                   | LTE Band 4 (AWS) (1712.5 - 1752.5 MHz)          |                |                |
| Channel Bandwidths                                                                                                | LTE Band 17: 5 MHz, 10 MHz                      |                |                |
|                                                                                                                   | LTE Band 4 (AWS): 5 MHz, 10 MHz, 15 MHz, 20 MHz |                |                |
| Channel Numbers and Frequencies (MHz)                                                                             | Low                                             | Mid            | High           |
| LTE Band 17: 5 MHz                                                                                                | 706.5 (23755)                                   | 710 (23790)    | 713.5 (23825)  |
| LTE Band 17: 10 MHz                                                                                               | 709 (23780)                                     | 710 (23790)    | 711 (23800)    |
| LTE Band 4 (AWS): 5 MHz                                                                                           | 1712.5 (19975)                                  | 1732.5 (20175) | 1752.5 (20375) |
| LTE Band 4 (AWS): 10 MHz                                                                                          | 1715 (20000)                                    | 1732.5 (20175) | 1750 (20350)   |
| LTE Band 4 (AWS): 15 MHz                                                                                          | 1717.5 (20025)                                  | 1732.5 (20175) | 1747.5 (20325) |
| LTE Band 4 (AWS): 20 MHz                                                                                          | 1720 (20050)                                    | 1732.5 (20175) | 1745 (20300)   |
| UE Category                                                                                                       | 3                                               |                |                |
| Modulations Supported in UL                                                                                       | QPSK, 16QAM                                     |                |                |
| LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided) | YES                                             |                |                |
| A-MPR (Additional MPR) disabled for SAR Testing?                                                                  | YES                                             |                |                |

|                                   |                                                                                                                                                                                                        |                                       |                                 |
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### 3 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 [24]. 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.

#### 3.1 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 3-1).

**Equation 3-1**  
**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]

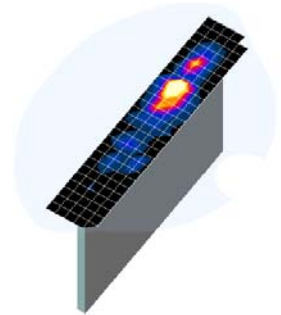
|                                   |                                                                                     |                                       |                                                                                       |                                 |
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## 4 DOSIMETRIC ASSESSMENT

### 4.1 Measurement Procedure

The evaluation was performed using the following procedure:

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 D01v01r01 (See Table 4-1).
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 D01v01r01 (See Table 4-1). 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. The data was extrapolated to the surface of the outer-shell of the phantom. The combined distance extrapolated was the combined distance from the center of the dipoles 2.7mm away from the tip of the probe housing plus the 1.2 mm distance between the surface and the lowest measuring point. 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 4-1**  
**Sample SAR Area Scan**

**Table 4-1**  
**Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r01**

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

|                                   |                                                                                                                                                                                                        |                                       |                                 |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------|
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| Document S/N:<br>OY1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                                                                                                                                     | DUT Type:<br>Portable Wireless Router | Page 10 of 40                   |

## 5 SAR TESTING PROCEDURES

### 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 Wireless Router Configurations

Some battery-operated devices 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 D06v01r02 where SAR test considerations for devices ( $L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$ ) 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 device meets the given size constraints, the aforementioned procedure was followed for SAR testing.

This device operates using 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 D01v05r01 publication procedures.

|                                   |                                                                                     |                                       |                                                                                       |                                 |
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## 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.

|                                   |                                                                                     |                                       |                                                                                       |                                 |
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## 7 FCC MEASUREMENT PROCEDURES

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

### 7.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v05r01, When SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r02.

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

The following procedures are according to FCC KDB Publication 941225 D01 "SAR Measurement Procedures for 3G Devices" v02r02, October 2007.

The device was placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test were evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device was tested throughout the SAR test at maximum output power, the SAR measurement system measures a "point SAR" at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviated by more than 5%, the SAR test and drift measurements were repeated.

### 7.3 SAR Measurement Conditions for UMTS

#### 7.3.1 Output Power Verification

Maximum output power is measured on the High, Middle and Low channels for each applicable transmission band according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all "1s".

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121 (release 5), using the appropriate RMC with TPC (transmit power control) set to all "1s" or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HS-DPCCH etc) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.

#### 7.3.2 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all "1s".

|                                   |                                                                                     |                                       |                                                                                       |                                 |
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### 7.3.3 Procedures Used to Establish RF Signal for SAR HSDPA Data Devices

The following procedures are applicable to HSDPA data devices operating under 3GPP Release 5. Body exposure conditions are typically applicable to these devices, including handsets and data modems operating in various electronic devices. HSDPA operates in conjunction with UMTS and requires an active DPCH. The default test configuration is to measure SAR in UMTS without HSDPA, with an established radio link between the DUT and a communication test set with 12.2 kbps RMC mode configured in Test Loop Mode 1; and tested with HSDPA with FRC and a 12.2 kbps RMC using the highest SAR configuration in UMTS. SAR is selectively confirmed for other physical channel configurations according to output power, exposure conditions and device operating capabilities. Maximum output power is verified according to 3GPP TS 23.121 (Release 5) and SAR must be measured according to these maximum output conditions.

| Sub-Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\beta_c$         | $\beta_d$         | $\beta_d$<br>(SF) | $\beta_c/\beta_d$ | $\beta_{HS}$<br>(Note 1,<br>Note 2) | CM (dB)<br>(Note 3) | MPR (dB)<br>(Note 3) |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------------------------|---------------------|----------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2/15              | 15/15             | 64                | 2/15              | 4/15                                | 0.0                 | 0.0                  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 12/15<br>(Note 4) | 15/15<br>(Note 4) | 64                | 12/15<br>(Note 4) | 24/15                               | 1.0                 | 0.0                  |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 15/15             | 8/15              | 64                | 15/8              | 30/15                               | 1.5                 | 0.5                  |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 15/15             | 4/15              | 64                | 15/4              | 30/15                               | 1.5                 | 0.5                  |
| <p>Note 1: <math>\Delta_{ACK}</math>, <math>\Delta_{NACK}</math> and <math>\Delta_{CQI} = 8 \Leftrightarrow A_{HS} = \beta_{HS}/\beta_c = 30/15 \Leftrightarrow \beta_{HS} = 30/15 * \beta_c</math>.</p> <p>Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, <math>\Delta_{ACK}</math> and <math>\Delta_{NACK} = 8</math> (<math>A_{HS} = 30/15</math>) with <math>\beta_{HS} = 30/15 * \beta_c</math>, and <math>\Delta_{CQI} = 7</math> (<math>A_{HS} = 24/15</math>) with <math>\beta_{HS} = 24/15 * \beta_c</math>.</p> <p>Note 3: CM = 1 for <math>\beta_c/\beta_d = 12/15</math>, <math>\beta_{HS}/\beta_c = 24/15</math>. For all other combinations of DPCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.</p> |                   |                   |                   |                   |                                     |                     |                      |

Figure 7-1  
Table C.10.1.4 of TS 234.121-1

### 7.3.4 SAR Measurement Conditions for HSUPA Data Devices

SAR for body exposure configurations are measured according to the 'Body SAR Measurements' procedures in the 'WCDMA Handsets' section of the KDB 941225 D01v02r02 FCC 3G document. In addition, Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least ¼ dB higher of that measured without HSPA in 12.2 kbps RMC mode or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA. When VOIP is applicable for head exposure, SAR is not required when the maximum output of each RF channel with HSPA is less than ¼ dB higher than that measured using 12.2 kbps RMC; otherwise, the same HSPA configuration used for body measurements should be used to test for head exposure.

Due to inner loop power control requirements in HSPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and EDCH configurations for HSPA should be configured according to the  $\beta$  values indicated below as well as other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Devices' sections of the FCC 3G document.

|                                   |                                                                                     |                                       |                                                                                       |                                 |
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| Sub-test | $\beta_c$            | $\beta_d$            | $\beta_d$ (SF) | $\beta_c/\beta_d$    | $\beta_{hs}^{(1)}$ | $\beta_{ec}$ | $\beta_{ed}$                                 | $\beta_{ed}$ (SF) | $\beta_{ed}$ (codes) | CM <sup>(2)</sup> (dB) | MPR (dB) | AG <sup>(4)</sup> Index | E-TFCI |
|----------|----------------------|----------------------|----------------|----------------------|--------------------|--------------|----------------------------------------------|-------------------|----------------------|------------------------|----------|-------------------------|--------|
| 1        | 11/15 <sup>(3)</sup> | 15/15 <sup>(3)</sup> | 64             | 11/15 <sup>(3)</sup> | 22/15              | 209/225      | 1039/225                                     | 4                 | 1                    | 1.0                    | 0.0      | 20                      | 75     |
| 2        | 6/15                 | 15/15                | 64             | 6/15                 | 12/15              | 12/15        | 94/75                                        | 4                 | 1                    | 3.0                    | 2.0      | 12                      | 67     |
| 3        | 15/15                | 9/15                 | 64             | 15/9                 | 30/15              | 30/15        | $\beta_{ed1}: 47/15$<br>$\beta_{ed2}: 47/15$ | 4                 | 2                    | 2.0                    | 1.0      | 15                      | 92     |
| 4        | 2/15                 | 15/15                | 64             | 2/15                 | 4/15               | 2/15         | 56/75                                        | 4                 | 1                    | 3.0                    | 2.0      | 17                      | 71     |
| 5        | 15/15 <sup>(4)</sup> | 15/15 <sup>(4)</sup> | 64             | 15/15 <sup>(4)</sup> | 30/15              | 24/15        | 134/15                                       | 4                 | 1                    | 1.0                    | 0.0      | 21                      | 81     |

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{15} = \beta_{15}/\beta_c = 30/15 \Leftrightarrow \beta_{15} = 30/15 * \beta_c$ .

Note 2: CM = 1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{15}/\beta_c = 24/15$ . For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the  $\beta_c/\beta_d$  ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 10/15$  and  $\beta_d = 15/15$ .

Note 4: For subtest 5 the  $\beta_c/\beta_d$  ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 14/15$  and  $\beta_d = 15/15$ .

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.

Note 6:  $\beta_{ed}$  can not be set directly; it is set by Absolute Grant Value.

## 7.4 SAR Measurement Conditions for LTE

LTE modes were tested according to FCC KDB 941225 D05v02r02 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 was used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing.

### 7.4.1 Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

### 7.4.2 MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

### 7.4.3 A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

### 7.4.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r02:

- a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
  - i. The required channel and offset combination with the highest maximum output power is required for SAR.
  - ii. When the reported SAR is  $\leq 0.8$  W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
  - iii. When the reported SAR for a required test channel is  $> 1.45$  W/kg, SAR is required for all RB offset configurations for that channel.

|                                   |                                                                                     |                                       |                                                                                       |                                 |
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- b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
- c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
- d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.

## 7.5 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n/ac transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v01r02 for more details.

### 7.5.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

### 7.5.2 Frequency Channel Configurations [27]

For 2.4 GHz, the highest average RF output power channel between the low, mid and high channel at the lowest data rate was selected for SAR evaluation in 802.11b mode. 802.11g/n modes and higher data rates for 802.11b were additionally evaluated for SAR if the output power of the respective mode was 0.25 dB or higher than the powers of the SAR configurations tested in the 802.11b mode.

For 5 GHz, the highest average RF output power channel across the default test channels at the lowest data rate was selected for SAR evaluation in 802.11a. When the adjacent channels are higher in power than the default channels, these “required channels” were considered instead of the default channels for SAR testing. 802.11n modes and higher data rates for 802.11a/n were evaluated only if the respective mode was 0.25 dB or higher than the 802.11a mode. 802.11ac SAR was evaluated for highest 802.11a configuration in each 5 GHz band and each exposure condition. 802.11ac modes were additionally evaluated for SAR if the output power for the respective mode was more than 0.25 dB higher than powers of 802.11a modes.

If the maximum extrapolated peak SAR of the zoom scan for the highest output channel was less than 1.6 W/kg and if the 1g averaged SAR was less than 0.8 W/kg, SAR testing was not required for the other test channels in the band.

|                                   |                                                                                                                                                                                                        |                                       |                                 |
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## 8 RF CONDUCTED POWERS

### 8.1 GSM Conducted Powers

|          |         | Maximum Burst-Averaged Output Power            |                         |                         |                         |                         |                         |                         |                         |
|----------|---------|------------------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|          |         | GPRS/EDGE Data (GMSK)                          |                         |                         |                         | EDGE Data (8-PSK)       |                         |                         |                         |
| Band     | Channel | GPRS [dBm]<br>1 Tx Slot                        | GPRS [dBm]<br>2 Tx Slot | GPRS [dBm]<br>3 Tx Slot | GPRS [dBm]<br>4 Tx Slot | EDGE [dBm]<br>1 Tx Slot | EDGE [dBm]<br>2 Tx Slot | EDGE [dBm]<br>3 Tx Slot | EDGE [dBm]<br>4 Tx Slot |
| GSM 850  | 128     | 31.78                                          | <b>29.11</b>            | 27.25                   | 26.09                   | 26.63                   | 25.04                   | 23.51                   | 22.12                   |
|          | 190     | 31.71                                          | <b>29.20</b>            | 27.30                   | 26.04                   | 26.70                   | 25.07                   | 23.44                   | 22.13                   |
|          | 251     | 31.64                                          | <b>29.14</b>            | 27.58                   | 26.01                   | 26.73                   | 25.11                   | 23.53                   | 22.24                   |
| GSM 1900 | 512     | 28.81                                          | 28.28                   | 26.58                   | <b>25.41</b>            | 26.60                   | 24.97                   | 23.34                   | 21.97                   |
|          | 661     | 28.79                                          | 28.17                   | 26.40                   | <b>25.43</b>            | 26.38                   | 24.81                   | 23.16                   | 21.80                   |
|          | 810     | 28.59                                          | 28.03                   | 26.34                   | <b>25.18</b>            | 26.26                   | 24.63                   | 23.04                   | 21.65                   |
|          |         | Calculated Maximum Frame-Averaged Output Power |                         |                         |                         |                         |                         |                         |                         |
|          |         | GPRS/EDGE Data (GMSK)                          |                         |                         |                         | EDGE Data (8-PSK)       |                         |                         |                         |
| Band     | Channel | GPRS [dBm]<br>1 Tx Slot                        | GPRS [dBm]<br>2 Tx Slot | GPRS [dBm]<br>3 Tx Slot | GPRS [dBm]<br>4 Tx Slot | EDGE [dBm]<br>1 Tx Slot | EDGE [dBm]<br>2 Tx Slot | EDGE [dBm]<br>3 Tx Slot | EDGE [dBm]<br>4 Tx Slot |
| GSM 850  | 128     | 22.75                                          | <b>23.09</b>            | 22.99                   | 23.08                   | 17.60                   | 19.02                   | 19.25                   | 19.11                   |
|          | 190     | 22.68                                          | <b>23.18</b>            | 23.04                   | 23.03                   | 17.67                   | 19.05                   | 19.18                   | 19.12                   |
|          | 251     | 22.61                                          | <b>23.12</b>            | 23.32                   | 23.00                   | 17.70                   | 19.09                   | 19.27                   | 19.23                   |
| GSM 1900 | 512     | 19.78                                          | 22.26                   | 22.32                   | <b>22.40</b>            | 17.57                   | 18.95                   | 19.08                   | 18.96                   |
|          | 661     | 19.76                                          | 22.15                   | 22.14                   | <b>22.42</b>            | 17.35                   | 18.79                   | 18.90                   | 18.79                   |
|          | 810     | 19.56                                          | 22.01                   | 22.08                   | <b>22.17</b>            | 17.23                   | 18.61                   | 18.78                   | 18.64                   |

**Note:**

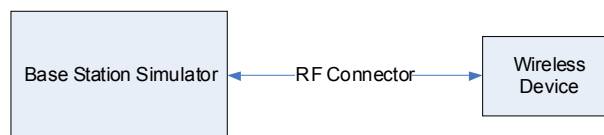
- Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
- The bolded GPRS modes were selected for SAR testing according to the highest frame-averaged output power table according to KDB 941225 D03v01.
- GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.
- EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.

**GSM Class: C**

**GPRS Multislot class: 12 (Max 4 Tx uplink slots)**

**EDGE Multislot class: 12 (Max 4 Tx uplink slots)**

**DTM Multislot Class: N/A**



**Figure 8-1**  
**Power Measurement Setup**

|                                   |                                    |                                       |               |                                 |
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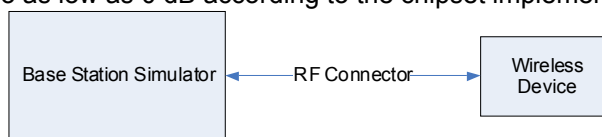
## 8.2 UMTS Conducted Powers

| Mode  | 3GPP 34.121 Subtest | Cellular Band [dBm] |       |       | AWS Band [dBm] |       |       | PCS Band [dBm] |       |       | 3GPP MPR [dB] |
|-------|---------------------|---------------------|-------|-------|----------------|-------|-------|----------------|-------|-------|---------------|
|       |                     | 4132                | 4183  | 4233  | 1312           | 1412  | 1862  | 9262           | 9400  | 9538  |               |
| WCDMA | 12.2 kbps RMC       | 21.71               | 21.90 | 21.95 | 22.55          | 22.71 | 22.33 | 22.78          | 22.75 | 22.25 | -             |
| HSDPA | Subtest 1           | 21.94               | 22.07 | 22.12 | 22.70          | 22.90 | 22.50 | 22.60          | 22.35 | 22.13 | 0             |
|       | Subtest 2           | 22.14               | 22.13 | 22.10 | 22.77          | 22.91 | 22.55 | 22.64          | 22.37 | 22.29 | 0             |
|       | Subtest 3           | 21.55               | 21.68 | 21.85 | 22.40          | 22.53 | 22.21 | 22.25          | 22.01 | 21.78 | 0.5           |
|       | Subtest 4           | 21.40               | 21.70 | 21.90 | 22.41          | 22.57 | 22.20 | 22.34          | 22.04 | 21.91 | 0.5           |
| HSUPA | Subtest 1           | 21.64               | 21.63 | 21.79 | 22.26          | 22.47 | 22.20 | 22.27          | 22.00 | 21.80 | 0             |
|       | Subtest 2           | 20.69               | 20.70 | 20.90 | 21.33          | 21.58 | 21.16 | 20.77          | 21.00 | 20.83 | 2             |
|       | Subtest 3           | 21.04               | 21.03 | 21.24 | 21.43          | 21.31 | 21.33 | 21.75          | 21.42 | 21.16 | 1             |
|       | Subtest 4           | 20.69               | 20.88 | 21.09 | 21.16          | 21.57 | 20.92 | 21.13          | 20.90 | 20.70 | 2             |
|       | Subtest 5           | 21.64               | 21.56 | 21.71 | 22.53          | 22.80 | 22.57 | 22.29          | 22.11 | 22.09 | 0             |

UMTS SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02r02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.

This device does not support DC-HSDPA.

It is expected by the manufacturer that MPR for some HSUPA subtests may be up to 1 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model.



**Figure 8-2**  
**Power Measurement Setup**

|                                   |                                                                                                                                                                                                        |                                       |                                 |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  <b>SAR EVALUATION REPORT</b>  |                                       | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                                                                                                                                     | DUT Type:<br>Portable Wireless Router | Page 18 of 40                   |

## 8.3 LTE Conducted Powers

### 8.3.1

### LTE Band 17

**Table 8-1**  
**LTE Band 17 Conducted Powers - 10 MHz Bandwidth**

|     | Frequency [MHz] | Channel | Bandwidth [MHz] | Modulation | RB Size | RB Offset | Conducted Power [dBm] | Target MPR [dB] | MPR Allowed per 3GPP [dB] |
|-----|-----------------|---------|-----------------|------------|---------|-----------|-----------------------|-----------------|---------------------------|
| Mid | 710.0           | 23790   | 10              | QPSK       | 1       | 0         | 24.94                 | 0               | 0                         |
|     | 710.0           | 23790   | 10              | QPSK       | 1       | 25        | 24.79                 | 0               | 0                         |
|     | 710.0           | 23790   | 10              | QPSK       | 1       | 49        | 24.99                 | 0               | 0                         |
|     | 710.0           | 23790   | 10              | QPSK       | 25      | 0         | 23.78                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 10              | QPSK       | 25      | 12        | 23.73                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 10              | QPSK       | 25      | 25        | 23.80                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 10              | QPSK       | 50      | 0         | 23.67                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 10              | 16QAM      | 1       | 0         | 23.87                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 10              | 16QAM      | 1       | 25        | 23.77                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 10              | 16QAM      | 1       | 49        | 23.99                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 10              | 16QAM      | 25      | 0         | 22.67                 | 2               | 0-2                       |
|     | 710.0           | 23790   | 10              | 16QAM      | 25      | 12        | 22.69                 | 2               | 0-2                       |
|     | 710.0           | 23790   | 10              | 16QAM      | 25      | 25        | 22.76                 | 2               | 0-2                       |
|     | 710.0           | 23790   | 10              | 16QAM      | 50      | 0         | 22.52                 | 2               | 0-2                       |

Note: LTE Band 17 at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02r02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

**Table 8-2**  
**LTE Band 17 Conducted Powers - 5 MHz Bandwidth**

|     | Frequency [MHz] | Channel | Bandwidth [MHz] | Modulation | RB Size | RB Offset | Conducted Power [dBm] | Target MPR [dB] | MPR Allowed per 3GPP [dB] |
|-----|-----------------|---------|-----------------|------------|---------|-----------|-----------------------|-----------------|---------------------------|
| Mid | 710.0           | 23790   | 5               | QPSK       | 1       | 0         | 24.99                 | 0               | 0                         |
|     | 710.0           | 23790   | 5               | QPSK       | 1       | 12        | 24.75                 | 0               | 0                         |
|     | 710.0           | 23790   | 5               | QPSK       | 1       | 24        | 24.98                 | 0               | 0                         |
|     | 710.0           | 23790   | 5               | QPSK       | 12      | 0         | 23.77                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 5               | QPSK       | 12      | 6         | 23.75                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 5               | QPSK       | 12      | 13        | 23.76                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 5               | QPSK       | 25      | 0         | 23.60                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 5               | 16-QAM     | 1       | 0         | 23.76                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 5               | 16-QAM     | 1       | 12        | 23.94                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 5               | 16-QAM     | 1       | 24        | 23.97                 | 1               | 0-1                       |
|     | 710.0           | 23790   | 5               | 16-QAM     | 12      | 0         | 22.70                 | 2               | 0-2                       |
|     | 710.0           | 23790   | 5               | 16-QAM     | 12      | 6         | 22.69                 | 2               | 0-2                       |
|     | 710.0           | 23790   | 5               | 16-QAM     | 12      | 13        | 22.79                 | 2               | 0-2                       |
|     | 710.0           | 23790   | 5               | 16-QAM     | 25      | 0         | 22.67                 | 2               | 0-2                       |

Note: LTE Band 17 at 5 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02r02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

|                                   |                                                                                     |                                       |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  | SAR EVALUATION REPORT                 |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                  | DUT Type:<br>Portable Wireless Router |                                                                                       | Page 19 of 40                   |

### 8.3.2

### LTE Band 4 (AWS)

**Table 8-3**  
**LTE Band 4 (AWS) Conducted Powers - 20 MHz Bandwidth**

|     | Frequency [MHz] | Channel | Bandwidth [MHz] | Modulation | RB Size | RB Offset | Conducted Power [dBm] | Target MPR [dB] | MPR Allowed per 3GPP [dB] |
|-----|-----------------|---------|-----------------|------------|---------|-----------|-----------------------|-----------------|---------------------------|
| Mid | 1732.5          | 20175   | 20              | QPSK       | 1       | 0         | 22.35                 | 0               | 0                         |
|     | 1732.5          | 20175   | 20              | QPSK       | 1       | 50        | 22.26                 | 0               | 0                         |
|     | 1732.5          | 20175   | 20              | QPSK       | 1       | 99        | 22.34                 | 0               | 0                         |
|     | 1732.5          | 20175   | 20              | QPSK       | 50      | 0         | 21.01                 | 1               | 0-1                       |
|     | 1732.5          | 20175   | 20              | QPSK       | 50      | 25        | 21.07                 | 1               | 0-1                       |
|     | 1732.5          | 20175   | 20              | QPSK       | 50      | 50        | 21.23                 | 1               | 0-1                       |
|     | 1732.5          | 20175   | 20              | QPSK       | 100     | 0         | 21.07                 | 1               | 0-1                       |
|     | 1732.5          | 20175   | 20              | 16QAM      | 1       | 0         | 21.24                 | 1               | 0-1                       |
|     | 1732.5          | 20175   | 20              | 16QAM      | 1       | 50        | 21.39                 | 1               | 0-1                       |
|     | 1732.5          | 20175   | 20              | 16QAM      | 1       | 99        | 21.75                 | 1               | 0-1                       |
|     | 1732.5          | 20175   | 20              | 16QAM      | 50      | 0         | 20.01                 | 2               | 0-2                       |
|     | 1732.5          | 20175   | 20              | 16QAM      | 50      | 25        | 20.13                 | 2               | 0-2                       |
|     | 1732.5          | 20175   | 20              | 16QAM      | 50      | 50        | 20.19                 | 2               | 0-2                       |
|     | 1732.5          | 20175   | 20              | 16QAM      | 100     | 0         | 20.05                 | 2               | 0-2                       |

Note: LTE Band 4 (AWS) at 20 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02r02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

**Table 8-4**  
**LTE Band 4 (AWS) Conducted Powers - 15 MHz Bandwidth**

|     | Frequency [MHz] | Channel | Bandwidth [MHz] | Modulation | RB Size | RB Offset | Conducted Power [dBm] | Target MPR [dB] | MPR Allowed per 3GPP [dB] |
|-----|-----------------|---------|-----------------|------------|---------|-----------|-----------------------|-----------------|---------------------------|
| Low | 1717.5          | 20025   | 15              | QPSK       | 1       | 0         | 22.47                 | 0               | 0                         |
|     | 1717.5          | 20025   | 15              | QPSK       | 1       | 36        | 22.38                 | 0               | 0                         |
|     | 1717.5          | 20025   | 15              | QPSK       | 1       | 74        | 22.23                 | 0               | 0                         |
|     | 1717.5          | 20025   | 15              | QPSK       | 36      | 0         | 21.01                 | 1               | 0-1                       |
|     | 1717.5          | 20025   | 15              | QPSK       | 36      | 18        | 21.02                 | 1               | 0-1                       |
|     | 1717.5          | 20025   | 15              | QPSK       | 36      | 37        | 21.05                 | 1               | 0-1                       |
|     | 1717.5          | 20025   | 15              | QPSK       | 75      | 0         | 21.00                 | 1               | 0-1                       |
|     | 1717.5          | 20025   | 15              | 16QAM      | 1       | 0         | 21.42                 | 1               | 0-1                       |
|     | 1717.5          | 20025   | 15              | 16QAM      | 1       | 36        | 21.23                 | 1               | 0-1                       |
|     | 1717.5          | 20025   | 15              | 16QAM      | 1       | 74        | 21.60                 | 1               | 0-1                       |
|     | 1717.5          | 20025   | 15              | 16QAM      | 36      | 0         | 20.03                 | 2               | 0-2                       |
|     | 1717.5          | 20025   | 15              | 16QAM      | 36      | 18        | 20.01                 | 2               | 0-2                       |
|     | 1717.5          | 20025   | 15              | 16QAM      | 36      | 37        | 20.02                 | 2               | 0-2                       |
|     | 1717.5          | 20025   | 15              | 16QAM      | 75      | 0         | 20.01                 | 2               | 0-2                       |

|     |        |       |    |       |    |    |       |   |     |
|-----|--------|-------|----|-------|----|----|-------|---|-----|
| Mid | 1732.5 | 20175 | 15 | QPSK  | 1  | 0  | 22.43 | 0 | 0   |
|     | 1732.5 | 20175 | 15 | QPSK  | 1  | 36 | 22.55 | 0 | 0   |
|     | 1732.5 | 20175 | 15 | QPSK  | 1  | 74 | 22.49 | 0 | 0   |
|     | 1732.5 | 20175 | 15 | QPSK  | 36 | 0  | 21.12 | 1 | 0-1 |
|     | 1732.5 | 20175 | 15 | QPSK  | 36 | 18 | 21.06 | 1 | 0-1 |
|     | 1732.5 | 20175 | 15 | QPSK  | 36 | 37 | 21.11 | 1 | 0-1 |
|     | 1732.5 | 20175 | 15 | QPSK  | 75 | 0  | 21.00 | 1 | 0-1 |
|     | 1732.5 | 20175 | 15 | 16QAM | 1  | 0  | 21.76 | 1 | 0-1 |
|     | 1732.5 | 20175 | 15 | 16QAM | 1  | 36 | 21.77 | 1 | 0-1 |
|     | 1732.5 | 20175 | 15 | 16QAM | 1  | 74 | 21.43 | 1 | 0-1 |
|     | 1732.5 | 20175 | 15 | 16QAM | 36 | 0  | 20.12 | 2 | 0-2 |
|     | 1732.5 | 20175 | 15 | 16QAM | 36 | 18 | 20.20 | 2 | 0-2 |
|     | 1732.5 | 20175 | 15 | 16QAM | 36 | 37 | 20.21 | 2 | 0-2 |
|     | 1732.5 | 20175 | 15 | 16QAM | 75 | 0  | 20.13 | 2 | 0-2 |

|      |        |       |    |       |    |    |       |   |     |
|------|--------|-------|----|-------|----|----|-------|---|-----|
| High | 1747.5 | 20325 | 15 | QPSK  | 1  | 0  | 22.32 | 0 | 0   |
|      | 1747.5 | 20325 | 15 | QPSK  | 1  | 36 | 22.33 | 0 | 0   |
|      | 1747.5 | 20325 | 15 | QPSK  | 1  | 74 | 22.23 | 0 | 0   |
|      | 1747.5 | 20325 | 15 | QPSK  | 36 | 0  | 21.06 | 1 | 0-1 |
|      | 1747.5 | 20325 | 15 | QPSK  | 36 | 18 | 21.01 | 1 | 0-1 |
|      | 1747.5 | 20325 | 15 | QPSK  | 36 | 37 | 21.00 | 1 | 0-1 |
|      | 1747.5 | 20325 | 15 | QPSK  | 75 | 0  | 21.03 | 1 | 0-1 |
|      | 1747.5 | 20325 | 15 | 16QAM | 1  | 0  | 21.11 | 1 | 0-1 |
|      | 1747.5 | 20325 | 15 | 16QAM | 1  | 36 | 21.05 | 1 | 0-1 |
|      | 1747.5 | 20325 | 15 | 16QAM | 1  | 74 | 21.01 | 1 | 0-1 |
|      | 1747.5 | 20325 | 15 | 16QAM | 36 | 0  | 20.03 | 2 | 0-2 |
|      | 1747.5 | 20325 | 15 | 16QAM | 36 | 18 | 20.02 | 2 | 0-2 |
|      | 1747.5 | 20325 | 15 | 16QAM | 36 | 37 | 20.01 | 2 | 0-2 |
|      | 1747.5 | 20325 | 15 | 16QAM | 75 | 0  | 20.02 | 2 | 0-2 |

|                                   |                                                                                     |                                       |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  | SAR EVALUATION REPORT                 |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                  | DUT Type:<br>Portable Wireless Router |                                                                                       | Page 20 of 40                   |

**Table 8-5**  
**LTE Band 4 (AWS) Conducted Powers - 10 MHz Bandwidth**

|      | Frequency [MHz] | Channel | Bandwidth [MHz] | Modulation | RB Size | RB Offset | Conducted Power [dBm] | Target MPR [dB] | MPR Allowed per 3GPP [dB] |
|------|-----------------|---------|-----------------|------------|---------|-----------|-----------------------|-----------------|---------------------------|
| Low  | 1715            | 20000   | 10              | QPSK       | 1       | 0         | 22.53                 | 0               | 0                         |
|      | 1715            | 20000   | 10              | QPSK       | 1       | 25        | 22.37                 | 0               | 0                         |
|      | 1715            | 20000   | 10              | QPSK       | 1       | 49        | 22.47                 | 0               | 0                         |
|      | 1715            | 20000   | 10              | QPSK       | 25      | 0         | 21.22                 | 1               | 0-1                       |
|      | 1715            | 20000   | 10              | QPSK       | 25      | 12        | 21.15                 | 1               | 0-1                       |
|      | 1715            | 20000   | 10              | QPSK       | 25      | 25        | 21.13                 | 1               | 0-1                       |
|      | 1715            | 20000   | 10              | QPSK       | 50      | 0         | 21.08                 | 1               | 0-1                       |
|      | 1715            | 20000   | 10              | 16QAM      | 1       | 0         | 21.33                 | 1               | 0-1                       |
|      | 1715            | 20000   | 10              | 16QAM      | 1       | 25        | 21.20                 | 1               | 0-1                       |
|      | 1715            | 20000   | 10              | 16QAM      | 1       | 49        | 21.33                 | 1               | 0-1                       |
|      | 1715            | 20000   | 10              | 16QAM      | 25      | 0         | 20.25                 | 2               | 0-2                       |
|      | 1715            | 20000   | 10              | 16QAM      | 25      | 12        | 20.29                 | 2               | 0-2                       |
|      | 1715            | 20000   | 10              | 16QAM      | 25      | 25        | 20.15                 | 2               | 0-2                       |
|      | 1715            | 20000   | 10              | 16QAM      | 50      | 0         | 20.17                 | 2               | 0-2                       |
| Mid  | 1732.5          | 20175   | 10              | QPSK       | 1       | 0         | 22.63                 | 0               | 0                         |
|      | 1732.5          | 20175   | 10              | QPSK       | 1       | 25        | 22.75                 | 0               | 0                         |
|      | 1732.5          | 20175   | 10              | QPSK       | 1       | 49        | 22.77                 | 0               | 0                         |
|      | 1732.5          | 20175   | 10              | QPSK       | 25      | 0         | 21.39                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 10              | QPSK       | 25      | 12        | 21.60                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 10              | QPSK       | 25      | 25        | 21.54                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 10              | QPSK       | 50      | 0         | 21.32                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 10              | 16QAM      | 1       | 0         | 21.89                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 10              | 16QAM      | 1       | 25        | 21.93                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 10              | 16QAM      | 1       | 49        | 21.64                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 10              | 16QAM      | 25      | 0         | 20.47                 | 2               | 0-2                       |
|      | 1732.5          | 20175   | 10              | 16QAM      | 25      | 12        | 20.54                 | 2               | 0-2                       |
|      | 1732.5          | 20175   | 10              | 16QAM      | 25      | 25        | 20.51                 | 2               | 0-2                       |
|      | 1732.5          | 20175   | 10              | 16QAM      | 50      | 0         | 20.40                 | 2               | 0-2                       |
| High | 1750            | 20350   | 10              | QPSK       | 1       | 0         | 22.26                 | 0               | 0                         |
|      | 1750            | 20350   | 10              | QPSK       | 1       | 25        | 22.23                 | 0               | 0                         |
|      | 1750            | 20350   | 10              | QPSK       | 1       | 49        | 22.32                 | 0               | 0                         |
|      | 1750            | 20350   | 10              | QPSK       | 25      | 0         | 21.06                 | 1               | 0-1                       |
|      | 1750            | 20350   | 10              | QPSK       | 25      | 12        | 21.06                 | 1               | 0-1                       |
|      | 1750            | 20350   | 10              | QPSK       | 25      | 25        | 21.05                 | 1               | 0-1                       |
|      | 1750            | 20350   | 10              | QPSK       | 50      | 0         | 21.02                 | 1               | 0-1                       |
|      | 1750            | 20350   | 10              | 16QAM      | 1       | 0         | 21.67                 | 1               | 0-1                       |
|      | 1750            | 20350   | 10              | 16QAM      | 1       | 25        | 21.70                 | 1               | 0-1                       |
|      | 1750            | 20350   | 10              | 16QAM      | 1       | 49        | 21.75                 | 1               | 0-1                       |
|      | 1750            | 20350   | 10              | 16QAM      | 25      | 0         | 20.14                 | 2               | 0-2                       |
|      | 1750            | 20350   | 10              | 16QAM      | 25      | 12        | 20.09                 | 2               | 0-2                       |
|      | 1750            | 20350   | 10              | 16QAM      | 25      | 25        | 20.09                 | 2               | 0-2                       |
|      | 1750            | 20350   | 10              | 16QAM      | 50      | 0         | 20.01                 | 2               | 0-2                       |

|                                   |                                                                                     |                                       |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  | SAR EVALUATION REPORT                 |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                  | DUT Type:<br>Portable Wireless Router |                                                                                       | Page 21 of 40                   |

**Table 8-6**  
**LTE Band 4 (AWS) Conducted Powers - 5 MHz Bandwidth**

|      | Frequency [MHz] | Channel | Bandwidth [MHz] | Modulation | RB Size | RB Offset | Conducted Power [dBm] | Target MPR [dB] | MPR Allowed per 3GPP [dB] |
|------|-----------------|---------|-----------------|------------|---------|-----------|-----------------------|-----------------|---------------------------|
| Low  | 1712.5          | 19975   | 5               | QPSK       | 1       | 0         | 22.76                 | 0               | 0                         |
|      | 1712.5          | 19975   | 5               | QPSK       | 1       | 12        | 22.58                 | 0               | 0                         |
|      | 1712.5          | 19975   | 5               | QPSK       | 1       | 24        | 22.35                 | 0               | 0                         |
|      | 1712.5          | 19975   | 5               | QPSK       | 12      | 0         | 21.33                 | 1               | 0-1                       |
|      | 1712.5          | 19975   | 5               | QPSK       | 12      | 6         | 21.32                 | 1               | 0-1                       |
|      | 1712.5          | 19975   | 5               | QPSK       | 12      | 13        | 21.37                 | 1               | 0-1                       |
|      | 1712.5          | 19975   | 5               | QPSK       | 25      | 0         | 21.16                 | 1               | 0-1                       |
|      | 1712.5          | 19975   | 5               | 16-QAM     | 1       | 0         | 21.75                 | 1               | 0-1                       |
|      | 1712.5          | 19975   | 5               | 16-QAM     | 1       | 12        | 21.70                 | 1               | 0-1                       |
|      | 1712.5          | 19975   | 5               | 16-QAM     | 1       | 24        | 21.67                 | 1               | 0-1                       |
|      | 1712.5          | 19975   | 5               | 16-QAM     | 12      | 0         | 20.38                 | 2               | 0-2                       |
|      | 1712.5          | 19975   | 5               | 16-QAM     | 12      | 6         | 20.38                 | 2               | 0-2                       |
|      | 1712.5          | 19975   | 5               | 16-QAM     | 12      | 13        | 20.43                 | 2               | 0-2                       |
|      | 1712.5          | 19975   | 5               | 16-QAM     | 25      | 0         | 20.29                 | 2               | 0-2                       |
|      | 1732.5          | 20175   | 5               | QPSK       | 1       | 0         | 22.75                 | 0               | 0                         |
| Mid  | 1732.5          | 20175   | 5               | QPSK       | 1       | 12        | 22.71                 | 0               | 0                         |
|      | 1732.5          | 20175   | 5               | QPSK       | 1       | 24        | 22.70                 | 0               | 0                         |
|      | 1732.5          | 20175   | 5               | QPSK       | 12      | 0         | 21.53                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 5               | QPSK       | 12      | 6         | 21.60                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 5               | QPSK       | 12      | 13        | 21.58                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 5               | QPSK       | 25      | 0         | 21.55                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 5               | 16-QAM     | 1       | 0         | 21.91                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 5               | 16-QAM     | 1       | 12        | 21.95                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 5               | 16-QAM     | 1       | 24        | 21.77                 | 1               | 0-1                       |
|      | 1732.5          | 20175   | 5               | 16-QAM     | 12      | 0         | 20.63                 | 2               | 0-2                       |
|      | 1732.5          | 20175   | 5               | 16-QAM     | 12      | 6         | 20.75                 | 2               | 0-2                       |
|      | 1732.5          | 20175   | 5               | 16-QAM     | 12      | 13        | 20.67                 | 2               | 0-2                       |
|      | 1732.5          | 20175   | 5               | 16-QAM     | 25      | 0         | 20.66                 | 2               | 0-2                       |
|      | 1752.5          | 20375   | 5               | QPSK       | 1       | 0         | 22.27                 | 0               | 0                         |
|      | 1752.5          | 20375   | 5               | QPSK       | 1       | 12        | 22.29                 | 0               | 0                         |
|      | 1752.5          | 20375   | 5               | QPSK       | 1       | 24        | 22.45                 | 0               | 0                         |
| High | 1752.5          | 20375   | 5               | QPSK       | 12      | 0         | 21.23                 | 1               | 0-1                       |
|      | 1752.5          | 20375   | 5               | QPSK       | 12      | 6         | 21.20                 | 1               | 0-1                       |
|      | 1752.5          | 20375   | 5               | QPSK       | 12      | 13        | 21.21                 | 1               | 0-1                       |
|      | 1752.5          | 20375   | 5               | QPSK       | 25      | 0         | 21.05                 | 1               | 0-1                       |
|      | 1752.5          | 20375   | 5               | 16-QAM     | 1       | 0         | 21.58                 | 1               | 0-1                       |
|      | 1752.5          | 20375   | 5               | 16-QAM     | 1       | 12        | 21.47                 | 1               | 0-1                       |
|      | 1752.5          | 20375   | 5               | 16-QAM     | 1       | 24        | 21.57                 | 1               | 0-1                       |
|      | 1752.5          | 20375   | 5               | 16-QAM     | 12      | 0         | 20.29                 | 2               | 0-2                       |
|      | 1752.5          | 20375   | 5               | 16-QAM     | 12      | 6         | 20.23                 | 2               | 0-2                       |
|      | 1752.5          | 20375   | 5               | 16-QAM     | 12      | 13        | 20.29                 | 2               | 0-2                       |
|      | 1752.5          | 20375   | 5               | 16-QAM     | 25      | 0         | 20.03                 | 2               | 0-2                       |

## 8.4 WLAN Conducted Powers

**Table 8-7**  
**IEEE 802.11b Average RF Power**

| Mode    | Freq [MHz] | Channel | 802.11b (2.4 GHz) Conducted Power [dBm] |       |       |       |
|---------|------------|---------|-----------------------------------------|-------|-------|-------|
|         |            |         | Data Rate [Mbps]                        |       |       |       |
|         |            |         | 1                                       | 2     | 5.5   | 11    |
| 802.11b | 2412       | 1*      | 18.15                                   | 18.21 | 18.15 | 18.31 |
| 802.11b | 2437       | 6*      | 18.05                                   | 18.01 | 17.98 | 18.11 |
| 802.11b | 2462       | 11*     | 17.71                                   | 17.79 | 17.75 | 17.82 |

**Table 8-8**  
**IEEE 802.11g Average RF Power**

| Mode    | Freq [MHz] | Channel | 802.11g (2.4 GHz) Conducted Power [dBm] |       |       |       |       |       |       |       |
|---------|------------|---------|-----------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|         |            |         | Data Rate [Mbps]                        |       |       |       |       |       |       |       |
|         |            |         | 6                                       | 9     | 12    | 18    | 24    | 36    | 48    | 54    |
| 802.11g | 2412       | 1       | 13.83                                   | 13.92 | 14.04 | 13.98 | 14.01 | 14.08 | 14.05 | 14.05 |
| 802.11g | 2437       | 6       | 13.67                                   | 13.72 | 13.79 | 13.76 | 13.79 | 13.88 | 13.91 | 13.91 |
| 802.11g | 2462       | 11      | 13.46                                   | 13.43 | 13.54 | 13.52 | 13.51 | 13.61 | 13.57 | 13.65 |

|                                   |                                                                                     |                                       |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  | <b>SAR EVALUATION REPORT</b>          |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                  | DUT Type:<br>Portable Wireless Router |                                                                                       | Page 22 of 40                   |

**Table 8-9**  
**IEEE 802.11n Average RF Power**

| Mode    | Freq<br>[MHz] | Channel | 802.11n (2.4 GHz) Conducted Power [dBm] |       |       |       |       |       |       |       |
|---------|---------------|---------|-----------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|         |               |         | Data Rate [Mbps]                        |       |       |       |       |       |       |       |
|         |               |         | 6.5                                     | 13    | 20    | 26    | 39    | 52    | 58    | 65    |
| 802.11n | 2412          | 1       | 12.94                                   | 13.04 | 13.03 | 13.12 | 13.14 | 13.19 | 13.29 | 13.21 |
| 802.11n | 2437          | 6       | 12.79                                   | 12.85 | 12.88 | 12.82 | 12.98 | 13.06 | 13.10 | 13.08 |
| 802.11n | 2462          | 11      | 12.54                                   | 12.61 | 12.65 | 12.65 | 12.73 | 12.75 | 12.82 | 12.82 |

**Table 8-10**  
**IEEE 802.11a Average RF Power**

| Mode    | Freq<br>[MHz] | Channel | 802.11a (5GHz) Conducted Power [dBm] |       |       |       |       |       |       |       |
|---------|---------------|---------|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|         |               |         | Data Rate [Mbps]                     |       |       |       |       |       |       |       |
|         |               |         | 6                                    | 9     | 12    | 18    | 24    | 36    | 48    | 54    |
| 802.11a | 5745          | 149*    | 13.95                                | 14.16 | 14.20 | 14.23 | 14.28 | 14.34 | 14.47 | 14.46 |
| 802.11a | 5765          | 153     | 14.24                                | 14.11 | 14.21 | 14.25 | 14.26 | 14.32 | 14.41 | 14.47 |
| 802.11a | 5785          | 157*    | 14.11                                | 14.06 | 14.07 | 14.25 | 14.16 | 14.31 | 14.42 | 14.44 |
| 802.11a | 5805          | 161*    | 14.02                                | 14.11 | 14.11 | 14.19 | 14.19 | 14.29 | 14.43 | 14.42 |
| 802.11a | 5825          | 165     | 13.99                                | 14.12 | 14.14 | 14.21 | 14.15 | 14.35 | 14.41 | 14.48 |

(\*) – indicates default channels per KDB Publication 248227 D01v01r02. When the adjacent channels are higher in power then the default channels, these “required channels” are considered for SAR testing instead of the default channels.

**Table 8-11**  
**IEEE 802.11n Average RF Power – 20 MHz Bandwidth**

| Mode    | Freq<br>[MHz] | Channel | 20MHz BW 802.11n (5GHz) Conducted Power [dBm] |       |       |       |       |       |       |       |
|---------|---------------|---------|-----------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|         |               |         | Data Rate [Mbps]                              |       |       |       |       |       |       |       |
|         |               |         | 6.5                                           | 13    | 19.5  | 26    | 39    | 52    | 58.5  | 65    |
| 802.11n | 5745          | 149     | 12.94                                         | 13.12 | 13.17 | 13.16 | 13.26 | 13.36 | 13.37 | 13.39 |
| 802.11n | 5765          | 153     | 13.06                                         | 13.05 | 13.21 | 13.20 | 13.24 | 13.31 | 13.34 | 13.36 |
| 802.11n | 5785          | 157     | 12.92                                         | 13.04 | 13.12 | 13.11 | 13.26 | 13.25 | 13.27 | 13.37 |
| 802.11n | 5805          | 161     | 12.95                                         | 13.04 | 13.14 | 13.18 | 13.24 | 13.34 | 13.35 | 13.35 |
| 802.11n | 5825          | 165     | 12.94                                         | 13.02 | 13.08 | 13.14 | 13.29 | 13.36 | 13.39 | 13.41 |

**Table 8-12**  
**IEEE 802.11n Average RF Power – 40 MHz Bandwidth**

| Mode    | Freq<br>[MHz] | Channel | 40MHz BW 802.11n (5GHz) Conducted Power [dBm] |       |       |       |       |       |       |       |
|---------|---------------|---------|-----------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|         |               |         | Data Rate [Mbps]                              |       |       |       |       |       |       |       |
|         |               |         | 13.5                                          | 27    | 40.5  | 54    | 81    | 108   | 121.5 | 135   |
| 802.11n | 5755          | 151     | 12.97                                         | 12.98 | 12.98 | 12.92 | 12.99 | 13.01 | 13.05 | 13.12 |
| 802.11n | 5795          | 159     | 12.82                                         | 12.74 | 12.95 | 12.88 | 13.02 | 12.98 | 13.08 | 13.01 |

**Table 8-13**  
**IEEE 802.11ac Average RF Power – 80 MHz Bandwidth**

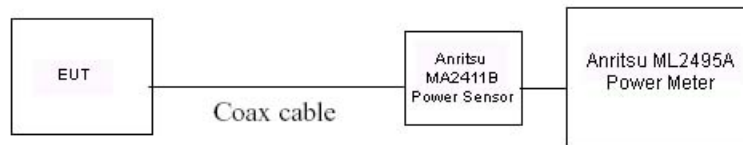
| Freq<br>[MHz] | Channel | 80MHz BW 802.11ac (5GHz) Conducted Power [dBm] |       |       |       |       |       |       |       |       |       |
|---------------|---------|------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|               |         | Data Rate [Mbps]                               |       |       |       |       |       |       |       |       |       |
|               |         | 29.3                                           | 58.5  | 87.8  | 117   | 175.5 | 234   | 263.3 | 292.5 | 351   | 390   |
| 5775          | 155     | 12.35                                          | 12.39 | 12.16 | 12.27 | 12.19 | 12.42 | 12.44 | 12.45 | 12.44 | 12.42 |

|                                   |                                                                                     |                                       |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  | <b>SAR EVALUATION REPORT</b>          |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                  | DUT Type:<br>Portable Wireless Router |                                                                                       | Page 23 of 40                   |

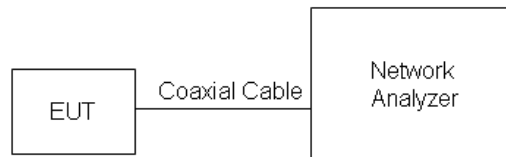
Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012/April 2013 FCC/TCB Meeting Notes:

- For 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11b were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
- For 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
- Full SAR tests for all IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than IEEE 802.11a mode. IEEE 802.11ac was evaluated for the highest IEEE 802.11a position in each 5 GHz band and exposure condition.
- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The bolded data rate and channel above were tested for SAR.

Power measurement for signal bandwidth < 50 MHz



Power measurement for signal bandwidth > 50 MHz



**Figure 8-3**  
**Power Measurement Setup**

|                                          |                                                                                                                                   |                                              |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMV100T                       |  <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>0Y1308271687.A3L | <b>Test Dates:</b><br>08/19/13 - 08/27/13                                                                                         | <b>DUT Type:</b><br>Portable Wireless Router | Page 24 of 40                                                                         |                                        |

## 9.1 Tissue Verification

**Table 9-1**  
**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 $\epsilon$ |
|------------------------------------|-------------|-------------------------------------|--------------------------|---------------------------------------|------------------------------------------|-------------------------------------|----------------------------------------|----------------|------------------|
| 08/19/2013                         | 740B        | 23.0                                | 710                      | 0.931                                 | 55.326                                   | 0.959                               | 55.745                                 | -2.92%         | -0.75%           |
|                                    |             |                                     | 725                      | 0.948                                 | 55.140                                   | 0.961                               | 55.629                                 | -1.35%         | -0.88%           |
|                                    |             |                                     | 740                      | 0.962                                 | 54.981                                   | 0.963                               | 55.570                                 | -0.10%         | -1.06%           |
|                                    |             |                                     | 755                      | 0.975                                 | 54.859                                   | 0.964                               | 55.512                                 | 1.14%          | -1.18%           |
| 08/22/2013                         | 835B        | 23.2                                | 820                      | 0.997                                 | 54.410                                   | 0.969                               | 55.258                                 | 2.89%          | -1.53%           |
|                                    |             |                                     | 835                      | 1.011                                 | 54.339                                   | 0.970                               | 55.200                                 | 4.23%          | -1.56%           |
|                                    |             |                                     | 850                      | 1.025                                 | 54.130                                   | 0.988                               | 55.154                                 | 3.74%          | -1.86%           |
| 08/27/2013                         | 1750B       | 23.1                                | 1710                     | 1.418                                 | 52.536                                   | 1.460                               | 53.540                                 | -2.88%         | -1.88%           |
|                                    |             |                                     | 1750                     | 1.461                                 | 52.342                                   | 1.490                               | 53.430                                 | -1.95%         | -2.04%           |
|                                    |             |                                     | 1790                     | 1.513                                 | 52.211                                   | 1.510                               | 53.330                                 | 0.20%          | -2.10%           |
| 08/21/2013                         | 1900B       | 23.9                                | 1850                     | 1.501                                 | 52.177                                   | 1.520                               | 53.300                                 | -1.25%         | -2.11%           |
|                                    |             |                                     | 1880                     | 1.531                                 | 52.073                                   | 1.520                               | 53.300                                 | 0.72%          | -2.30%           |
|                                    |             |                                     | 1910                     | 1.561                                 | 51.969                                   | 1.520                               | 53.300                                 | 2.70%          | -2.50%           |
| 08/19/2013                         | 2450B       | 22.9                                | 2401                     | 1.964                                 | 50.961                                   | 1.903                               | 52.765                                 | 3.21%          | -3.42%           |
|                                    |             |                                     | 2450                     | 2.030                                 | 50.700                                   | 1.950                               | 52.700                                 | 4.10%          | -3.80%           |
|                                    |             |                                     | 2499                     | 2.110                                 | 50.561                                   | 2.019                               | 52.099                                 | 4.51%          | -2.95%           |
| 08/21/2013                         | 5800B       | 23.5                                | 5765                     | 6.114                                 | 47.746                                   | 5.959                               | 48.220                                 | 2.60%          | -0.98%           |
|                                    |             |                                     | 5785                     | 6.128                                 | 47.749                                   | 5.982                               | 48.242                                 | 2.44%          | -1.02%           |
|                                    |             |                                     | 5800                     | 6.147                                 | 47.802                                   | 6.000                               | 48.200                                 | 2.45%          | -0.83%           |
|                                    |             |                                     | 5805                     | 6.164                                 | 47.764                                   | 6.005                               | 48.166                                 | 2.65%          | -0.83%           |

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 IEEE 1528 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.

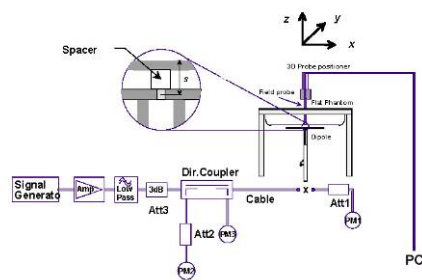
|                                   |                                                                                                                                                                                                        |                                       |                                 |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  <b>SAR EVALUATION REPORT</b>  |                                       | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                                                                                                                                     | DUT Type:<br>Portable Wireless Router | Page 25 of 40                   |

## 9.2 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 9-2**  
**System Verification Results**

| 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> (%) |
| B                                        | 750                    | BODY        | 08/19/2013 | 23.3           | 23.0             | 0.100           | 1054      | 3287     | 0.869                             | 8.720                               | 8.690                                   | -0.34%                      |
| G                                        | 835                    | BODY        | 08/22/2013 | 24.8           | 23.6             | 0.100           | 4d119     | 3209     | 0.991                             | 9.540                               | 9.910                                   | 3.88%                       |
| G                                        | 1750                   | BODY        | 08/27/2013 | 24.1           | 23.1             | 0.100           | 1051      | 3209     | 3.750                             | 37.800                              | 37.500                                  | -0.79%                      |
| E                                        | 1900                   | BODY        | 08/21/2013 | 24.1           | 23.0             | 0.100           | 5d148     | 3920     | 4.360                             | 40.800                              | 43.600                                  | 6.86%                       |
| H                                        | 2450                   | BODY        | 08/19/2013 | 22.8           | 22.1             | 0.040           | 797       | 3318     | 2.150                             | 49.600                              | 53.750                                  | 8.37%                       |
| A                                        | 5800                   | BODY        | 08/21/2013 | 24.3           | 23.8             | 0.100           | 1057      | 3589     | 7.940                             | 75.100                              | 79.400                                  | 5.73%                       |



**Figure 9-1**  
**System Verification Setup Diagram**



**Figure 9-2**  
**System Verification Setup Photo**

|                                   |                                                                                                                                                                                                        |                                       |                                 |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  <b>SAR EVALUATION REPORT</b>  |                                       | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                                                                                                                                     | DUT Type:<br>Portable Wireless Router | Page 26 of 40                   |

# 10 SAR DATA SUMMARY

## 10.1 Standalone Wireless Router SAR Data

Table 10-1  
GPRS/UMTS 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  | SAR (1g) | Scaling Factor | Scaled SAR (1g) | Plot # |
| MHz                                                                                               | Ch.  |           |         |                             |                       |                  |                                                 |                      |                 |            |       | (W/kg)   |                | (W/kg)          |        |
| 836.60                                                                                            | 190  | GSM 850   | GPRS    | 30.5                        | 29.20                 | -0.06            | 10 mm                                           | FK-174-E             | 2               | 1:4.15     | back  | 0.405    | 1.349          | 0.546           | A1     |
| 836.60                                                                                            | 190  | GSM 850   | GPRS    | 30.5                        | 29.20                 | -0.02            | 10 mm                                           | FK-174-E             | 2               | 1:4.15     | front | 0.241    | 1.349          | 0.325           |        |
| 836.60                                                                                            | 190  | GSM 850   | GPRS    | 30.5                        | 29.20                 | -0.06            | 10 mm                                           | FK-174-E             | 2               | 1:4.15     | top   | 0.234    | 1.349          | 0.316           |        |
| 836.60                                                                                            | 190  | GSM 850   | GPRS    | 30.5                        | 29.20                 | -0.13            | 10 mm                                           | FK-174-E             | 2               | 1:4.15     | right | 0.193    | 1.349          | 0.260           |        |
| 836.60                                                                                            | 4183 | UMTS 850  | RMC     | 23.3                        | 21.90                 | -0.04            | 10 mm                                           | FK-174-E             | N/A             | 1:1        | back  | 0.546    | 1.380          | 0.753           | A2     |
| 836.60                                                                                            | 4183 | UMTS 850  | RMC     | 23.3                        | 21.90                 | -0.05            | 10 mm                                           | FK-174-E             | N/A             | 1:1        | front | 0.299    | 1.380          | 0.413           |        |
| 836.60                                                                                            | 4183 | UMTS 850  | RMC     | 23.3                        | 21.90                 | -0.08            | 10 mm                                           | FK-174-E             | N/A             | 1:1        | top   | 0.269    | 1.380          | 0.371           |        |
| 836.60                                                                                            | 4183 | UMTS 850  | RMC     | 23.3                        | 21.90                 | -0.08            | 10 mm                                           | FK-174-E             | N/A             | 1:1        | right | 0.219    | 1.380          | 0.302           |        |
| 1712.40                                                                                           | 1312 | UMTS 1750 | RMC     | 23.3                        | 22.55                 | -0.03            | 10 mm                                           | FK-174-E             | N/A             | 1:1        | back  | 0.787    | 1.189          | 0.936           |        |
| 1732.40                                                                                           | 1412 | UMTS 1750 | RMC     | 23.3                        | 22.71                 | -0.01            | 10 mm                                           | FK-174-E             | N/A             | 1:1        | back  | 0.949    | 1.146          | 1.088           | A3     |
| 1752.50                                                                                           | 1862 | UMTS 1750 | RMC     | 23.3                        | 22.33                 | 0.02             | 10 mm                                           | FK-174-E             | N/A             | 1:1        | back  | 0.780    | 1.250          | 0.975           |        |
| 1732.40                                                                                           | 1412 | UMTS 1750 | RMC     | 23.3                        | 22.71                 | -0.05            | 10 mm                                           | FK-174-E             | N/A             | 1:1        | front | 0.650    | 1.146          | 0.745           |        |
| 1732.40                                                                                           | 1412 | UMTS 1750 | RMC     | 23.3                        | 22.71                 | -0.14            | 10 mm                                           | FK-174-E             | N/A             | 1:1        | top   | 0.206    | 1.146          | 0.236           |        |
| 1712.40                                                                                           | 1312 | UMTS 1750 | RMC     | 23.3                        | 22.55                 | -0.11            | 10 mm                                           | FK-174-E             | N/A             | 1:1        | right | 0.770    | 1.189          | 0.916           |        |
| 1732.40                                                                                           | 1412 | UMTS 1750 | RMC     | 23.3                        | 22.71                 | 0.03             | 10 mm                                           | FK-174-E             | N/A             | 1:1        | right | 0.932    | 1.146          | 1.068           |        |
| 1752.50                                                                                           | 1862 | UMTS 1750 | RMC     | 23.3                        | 22.33                 | -0.09            | 10 mm                                           | FK-174-E             | N/A             | 1:1        | right | 0.707    | 1.250          | 0.884           |        |
| 1732.40                                                                                           | 1412 | UMTS 1750 | RMC     | 23.3                        | 22.71                 | 0.00             | 10 mm                                           | FK-174-E             | N/A             | 1:1        | back  | 0.856    | 1.146          | 0.981           |        |
| 1850.20                                                                                           | 512  | GSM 1900  | GPRS    | 26.8                        | 25.41                 | 0.06             | 10 mm                                           | FK-174-E             | 4               | 1:2.076    | back  | 0.677    | 1.377          | 0.932           |        |
| 1880.00                                                                                           | 661  | GSM 1900  | GPRS    | 26.8                        | 25.43                 | -0.06            | 10 mm                                           | FK-174-E             | 4               | 1:2.076    | back  | 0.592    | 1.371          | 0.812           |        |
| 1909.80                                                                                           | 810  | GSM 1900  | GPRS    | 26.8                        | 25.18                 | 0.01             | 10 mm                                           | FK-174-E             | 4               | 1:2.076    | back  | 0.539    | 1.452          | 0.783           |        |
| 1850.20                                                                                           | 512  | GSM 1900  | GPRS    | 26.8                        | 25.41                 | 0.06             | 10 mm                                           | FK-174-E             | 4               | 1:2.076    | front | 0.667    | 1.377          | 0.918           |        |
| 1880.00                                                                                           | 661  | GSM 1900  | GPRS    | 26.8                        | 25.43                 | -0.01            | 10 mm                                           | FK-174-E             | 4               | 1:2.076    | front | 0.589    | 1.371          | 0.808           |        |
| 1909.80                                                                                           | 810  | GSM 1900  | GPRS    | 26.8                        | 25.18                 | 0.03             | 10 mm                                           | FK-174-E             | 4               | 1:2.076    | front | 0.529    | 1.452          | 0.768           |        |
| 1880.00                                                                                           | 661  | GSM 1900  | GPRS    | 26.8                        | 25.43                 | 0.02             | 10 mm                                           | FK-174-E             | 4               | 1:2.076    | top   | 0.121    | 1.371          | 0.166           |        |
| 1850.20                                                                                           | 512  | GSM 1900  | GPRS    | 26.8                        | 25.41                 | 0.07             | 10 mm                                           | FK-174-E             | 4               | 1:2.076    | right | 0.729    | 1.377          | 1.004           | A4     |
| 1880.00                                                                                           | 661  | GSM 1900  | GPRS    | 26.8                        | 25.43                 | -0.13            | 10 mm                                           | FK-174-E             | 4               | 1:2.076    | right | 0.630    | 1.371          | 0.864           |        |
| 1909.80                                                                                           | 810  | GSM 1900  | GPRS    | 26.8                        | 25.18                 | 0.05             | 10 mm                                           | FK-174-E             | 4               | 1:2.076    | right | 0.511    | 1.452          | 0.742           |        |
| 1880.00                                                                                           | 9400 | UMTS 1900 | RMC     | 23.3                        | 22.75                 | 0.09             | 10 mm                                           | FK-174-E             | N/A             | 1:1        | back  | 0.620    | 1.135          | 0.704           |        |
| 1880.00                                                                                           | 9400 | UMTS 1900 | RMC     | 23.3                        | 22.75                 | 0.04             | 10 mm                                           | FK-174-E             | N/A             | 1:1        | front | 0.585    | 1.135          | 0.664           |        |
| 1880.00                                                                                           | 9400 | UMTS 1900 | RMC     | 23.3                        | 22.75                 | 0.13             | 10 mm                                           | FK-174-E             | N/A             | 1:1        | top   | 0.115    | 1.135          | 0.131           |        |
| 1880.00                                                                                           | 9400 | UMTS 1900 | RMC     | 23.3                        | 22.75                 | 0.00             | 10 mm                                           | FK-174-E             | N/A             | 1:1        | right | 0.642    | 1.135          | 0.729           | A5     |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |      |           |         |                             |                       |                  | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |                      |                 |            |       |          |                |                 |        |

Note: Blue entries indicate variability measurements.

|                                   |                                                                                     |                                       |                       |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|-----------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  |                                       | SAR EVALUATION REPORT |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                  | DUT Type:<br>Portable Wireless Router |                       | Page 27 of 40                                                                         |                                 |

**Table 10-2**  
**LTE Band 17 Hotspot 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 | SAR (1g) | Scaling Factor | Scaled SAR (1g) | Plot # |    |
| MHz                                                                                               | Ch.   |      |                 |                             |                       |                  |          |                      |                                                 |         |           |         |       |            | (W/kg)   |                | (W/kg)          |        |    |
| 710.00                                                                                            | 23790 | Mid  | LTE Band 17     | 10                          | 25.0                  | 24.99            | 0.00     | 0                    | FK-174-E                                        | QPSK    | 1         | 49      | 10 mm | back       | 1:1      | 0.405          | 1.002           | 0.406  | A6 |
| 710.00                                                                                            | 23790 | Mid  | LTE Band 17     | 10                          | 24.0                  | 23.80            | 0.01     | 1                    | FK-174-E                                        | QPSK    | 25        | 25      | 10 mm | back       | 1:1      | 0.323          | 1.047           | 0.338  |    |
| 710.00                                                                                            | 23790 | Mid  | LTE Band 17     | 10                          | 25.0                  | 24.99            | -0.06    | 0                    | FK-174-E                                        | QPSK    | 1         | 49      | 10 mm | front      | 1:1      | 0.177          | 1.002           | 0.177  |    |
| 710.00                                                                                            | 23790 | Mid  | LTE Band 17     | 10                          | 24.0                  | 23.80            | 0.00     | 1                    | FK-174-E                                        | QPSK    | 25        | 25      | 10 mm | front      | 1:1      | 0.140          | 1.047           | 0.147  |    |
| 710.00                                                                                            | 23790 | Mid  | LTE Band 17     | 10                          | 25.0                  | 24.99            | -0.03    | 0                    | FK-174-E                                        | QPSK    | 1         | 49      | 10 mm | top        | 1:1      | 0.092          | 1.002           | 0.092  |    |
| 710.00                                                                                            | 23790 | Mid  | LTE Band 17     | 10                          | 24.0                  | 23.80            | -0.13    | 1                    | FK-174-E                                        | QPSK    | 25        | 25      | 10 mm | top        | 1:1      | 0.073          | 1.047           | 0.076  |    |
| 710.00                                                                                            | 23790 | Mid  | LTE Band 17     | 10                          | 25.0                  | 24.99            | 0.21     | 0                    | FK-173-E                                        | QPSK    | 1         | 49      | 10 mm | right      | 1:1      | 0.121          | 1.002           | 0.121  |    |
| 710.00                                                                                            | 23790 | Mid  | LTE Band 17     | 10                          | 24.0                  | 23.80            | 0.04     | 1                    | FK-174-E                                        | QPSK    | 25        | 25      | 10 mm | right      | 1:1      | 0.092          | 1.047           | 0.096  |    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |       |      |                 |                             |                       |                  |          |                      | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |         |           |         |       |            |          |                |                 |        |    |

**Table 10-3**  
**LTE Band 4 (AWS) Hotspot 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 | SAR (1g) | Scaling Factor | Scaled SAR (1g) | Plot # |    |
|                                          |       |      |                  |                             |                       |                  |          |                      |            |         |           |         |       |            | (W/kg)   |                | (W/kg)          |        |    |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 23.0                  | 22.35            | -0.05    | 0                    | FK-174-E   | QPSK    | 1         | 0       | 10 mm | back       | 1:1      | 0.875          | 1.161           | 1.016  | A7 |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 22.0                  | 21.23            | -0.05    | 1                    | FK-174-E   | QPSK    | 50        | 50      | 10 mm | back       | 1:1      | 0.656          | 1.194           | 0.783  |    |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 22.0                  | 21.07            | 0.01     | 1                    | FK-174-E   | QPSK    | 100       | 0       | 10 mm | back       | 1:1      | 0.670          | 1.239           | 0.830  |    |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 23.0                  | 22.35            | -0.01    | 0                    | FK-174-E   | QPSK    | 1         | 0       | 10 mm | front      | 1:1      | 0.670          | 1.161           | 0.778  |    |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 22.0                  | 21.23            | -0.04    | 1                    | FK-174-E   | QPSK    | 50        | 50      | 10 mm | front      | 1:1      | 0.540          | 1.194           | 0.645  |    |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 23.0                  | 22.35            | 0.00     | 0                    | FK-174-E   | QPSK    | 1         | 0       | 10 mm | top        | 1:1      | 0.188          | 1.161           | 0.218  |    |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 22.0                  | 21.23            | 0.04     | 1                    | FK-174-E   | QPSK    | 50        | 50      | 10 mm | top        | 1:1      | 0.136          | 1.194           | 0.162  |    |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 23.0                  | 22.35            | 0.00     | 0                    | FK-174-E   | QPSK    | 1         | 0       | 10 mm | right      | 1:1      | 0.829          | 1.161           | 0.962  |    |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 22.0                  | 21.23            | 0.04     | 1                    | FK-174-E   | QPSK    | 50        | 50      | 10 mm | right      | 1:1      | 0.699          | 1.194           | 0.835  |    |
| 1732.50                                  | 20175 | Mid  | LTE Band 4 (AWS) | 20                          | 22.0                  | 21.07            | -0.03    | 1                    | FK-174-E   | QPSK    | 100       | 0       | 10 mm | right      | 1:1      | 0.696          | 1.239           | 0.862  |    |
| 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 10-4**  
**WLAN Hotspot SAR**

| MEASUREMENT RESULTS                                   |     |               |         |                             |                       |                  |                                                 |                      |                  |       |            |          |                |                 |        |  |
|-------------------------------------------------------|-----|---------------|---------|-----------------------------|-----------------------|------------------|-------------------------------------------------|----------------------|------------------|-------|------------|----------|----------------|-----------------|--------|--|
| FREQUENCY                                             |     | Mode          | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing                                         | Device Serial Number | Data Rate (Mbps) | Side  | Duty Cycle | SAR (1g) | Scaling Factor | Scaled SAR (1g) | Plot # |  |
| MHz                                                   | Ch. |               |         |                             |                       |                  |                                                 |                      |                  |       |            | (W/kg)   |                | (W/kg)          |        |  |
| 2412                                                  | 1   | IEEE 802.11b  | DSSS    | 18.5                        | 18.15                 | -0.05            | 10 mm                                           | FK-174-E             | 1                | back  | 1:1        | 0.297    | 1.084          | 0.322           |        |  |
| 2412                                                  | 1   | IEEE 802.11b  | DSSS    | 18.5                        | 18.15                 | -0.04            | 10 mm                                           | FK-174-E             | 1                | front | 1:1        | 0.192    | 1.084          | 0.208           |        |  |
| 2412                                                  | 1   | IEEE 802.11b  | DSSS    | 18.5                        | 18.15                 | -0.02            | 10 mm                                           | FK-174-E             | 1                | top   | 1:1        | 0.310    | 1.084          | 0.336           | A8     |  |
| 2412                                                  | 1   | IEEE 802.11b  | DSSS    | 18.5                        | 18.15                 | -0.01            | 10 mm                                           | FK-174-E             | 1                | left  | 1:1        | 0.197    | 1.084          | 0.214           |        |  |
| 5765                                                  | 153 | IEEE 802.11a  | OFDM    | 14.5                        | 14.24                 | 0.11             | 10 mm                                           | FK-174-E             | 6                | back  | 1:1        | 0.210    | 1.062          | 0.223           |        |  |
| 5765                                                  | 153 | IEEE 802.11a  | OFDM    | 14.5                        | 14.24                 | -0.08            | 10 mm                                           | FK-174-E             | 6                | front | 1:1        | 0.442    | 1.062          | 0.469           |        |  |
| 5785                                                  | 157 | IEEE 802.11a  | OFDM    | 14.5                        | 14.11                 | 0.01             | 10 mm                                           | FK-174-E             | 6                | front | 1:1        | 0.456    | 1.094          | 0.499           |        |  |
| 5805                                                  | 161 | IEEE 802.11a  | OFDM    | 14.5                        | 14.02                 | -0.04            | 10 mm                                           | FK-174-E             | 6                | front | 1:1        | 0.508    | 1.117          | 0.567           |        |  |
| 5765                                                  | 153 | IEEE 802.11a  | OFDM    | 14.5                        | 14.24                 | 0.14             | 10 mm                                           | FK-174-E             | 6                | top   | 1:1        | 0.477    | 1.062          | 0.507           |        |  |
| 5785                                                  | 157 | IEEE 802.11a  | OFDM    | 14.5                        | 14.11                 | -0.03            | 10 mm                                           | FK-174-E             | 6                | top   | 1:1        | 0.538    | 1.094          | 0.589           | A9     |  |
| 5805                                                  | 161 | IEEE 802.11a  | OFDM    | 14.5                        | 14.02                 | -0.04            | 10 mm                                           | FK-174-E             | 6                | top   | 1:1        | 0.506    | 1.117          | 0.565           |        |  |
| 5775                                                  | 155 | IEEE 802.11ac | OFDM    | 12.5                        | 12.35                 | 0.12             | 10 mm                                           | FK-174-E             | 29.5             | top   | 1:1        | 0.303    | 1.035          | 0.314           |        |  |
| 5765                                                  | 153 | IEEE 802.11a  | OFDM    | 14.5                        | 14.24                 | 0.03             | 10 mm                                           | FK-174-E             | 6                | left  | 1:1        | 0.395    | 1.062          | 0.419           |        |  |
| 5785                                                  | 157 | IEEE 802.11a  | OFDM    | 14.5                        | 14.11                 | 0.12             | 10 mm                                           | FK-174-E             | 6                | left  | 1:1        | 0.383    | 1.094          | 0.419           |        |  |
| 5805                                                  | 161 | IEEE 802.11a  | OFDM    | 14.5                        | 14.02                 | 0.01             | 10 mm                                           | FK-174-E             | 6                | left  | 1:1        | 0.389    | 1.117          | 0.435           |        |  |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak |     |               |         |                             |                       |                  | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |                      |                  |       |            |          |                |                 |        |  |
| Uncontrolled Exposure/General Population              |     |               |         |                             |                       |                  |                                                 |                      |                  |       |            |          |                |                 |        |  |

|                                   |                                                                                     |                                       |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  | SAR EVALUATION REPORT                 |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                  | DUT Type:<br>Portable Wireless Router |                                                                                       | Page 28 of 40                   |

## 10.2 SAR Test Notes

### General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in KDB Publication 941225 D06v01r01 and FCC KDB Publication 447498 D01v05r01.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. 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.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05r01.
6. Per FCC KDB 865664 D01 v01r01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 12 for variability analysis.
7. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01r01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 5.2 for more details).

### GSM Test Notes:

1. Justification for reduced test configurations per KDB Publication 941225 D03v01: The source-based time-averaged output power was evaluated for all multi-slot operations. The multi-slot configuration with the highest frame averaged output power was evaluated for SAR for hotspot SAR.
2. Per FCC KDB Publication 447498 D01v05r01, since the reported (scaled) SAR measured at the middle channel for some test configurations is > 0.8 W/kg, testing at the other channels is required for such test configuration(s). Since the maximum output power variation across the required test channels is < ½ dB, middle channel was the default used.

### UMTS Notes:

1. UMTS mode in Body SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02r02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
2. Per FCC KDB Publication 447498 D01v05r01, since the reported (scaled) SAR measured at the middle channel for some test configurations is > 0.8 W/kg, testing at the other channels is required for such test configuration(s). Since the maximum output power variation across the required test channels is < ½ dB, middle channel is the default used.

### LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r02. The general test procedures used for testing can be found in Section 7.4.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator.

|                                          |                                                                                     |                                              |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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| <b>Document S/N:</b><br>OY1308271687.A3L | <b>Test Dates:</b><br>08/19/13 - 08/27/13                                           | <b>DUT Type:</b><br>Portable Wireless Router | Page 29 of 40                                                                         |                                        |

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 5 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11a. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz bandwidths) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
3. Per April 2013 TCB Workshop notes, full SAR tests for all IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than IEEE 802.11a mode. IEEE 802.11ac was evaluated for the highest IEEE 802.11a position in each 5 GHz band and exposure condition.
4. WIFI transmission was verified using an uncalibrated spectrum analyzer.
5. Since the the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is >1.6 W/kg for some configurations, SAR testing on other default channels was required.

|                                          |                                                                                                                                                                                                        |                                              |                                        |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------|
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| <b>Document S/N:</b><br>0Y1308271687.A3L | <b>Test Dates:</b><br>08/19/13 - 08/27/13                                                                                                                                                              | <b>DUT Type:</b><br>Portable Wireless Router | Page 30 of 40                          |

# 11 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

## 11.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05r01 are applicable to devices with built-in unlicensed transmitters such as 802.11a/b/g/n/ac devices which may simultaneously transmit with the licensed transmitter.

## 11.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05r01 IV.C.1.iii, 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 physical test configuration is  $\leq 1.6$  W/kg. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v05r01 4.3.2 2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

## 11.3 Hotspot SAR Simultaneous Transmission Analysis

Per FCC KDB Publication 941225 D06v01r01, the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR (“-”).

**Table 11-1**  
**Simultaneous Transmission Scenario (2.4 GHz Hotspot at 1.0 cm)**

| Simult Tx | Configuration | GPRS 850 SAR (W/kg)  | 2.4 GHz WLAN SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|-----------|---------------|----------------------|-------------------------|---------------------|
| Body SAR  | Back          | 0.546                | 0.322                   | 0.868               |
|           | Front         | 0.325                | 0.208                   | 0.533               |
|           | Top           | 0.316                | 0.336                   | 0.652               |
|           | Bottom        | -                    | -                       | 0.000               |
|           | Right         | 0.260                | -                       | 0.260               |
|           | Left          | -                    | 0.214                   | 0.214               |
| Simult Tx | Configuration | UMTS 850 SAR (W/kg)  | 2.4 GHz WLAN SAR (W/kg) | $\Sigma$ SAR (W/kg) |
| Body SAR  | Back          | 0.753                | 0.322                   | 1.075               |
|           | Front         | 0.413                | 0.208                   | 0.621               |
|           | Top           | 0.371                | 0.336                   | 0.707               |
|           | Bottom        | -                    | -                       | 0.000               |
|           | Right         | 0.302                | -                       | 0.302               |
|           | Left          | -                    | 0.214                   | 0.214               |
| Simult Tx | Configuration | UMTS 1750 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | $\Sigma$ SAR (W/kg) |
| Body SAR  | Back          | 1.088                | 0.322                   | 1.410               |
|           | Front         | 0.745                | 0.208                   | 0.953               |
|           | Top           | 0.236                | 0.336                   | 0.572               |
|           | Bottom        | -                    | -                       | 0.000               |
|           | Right         | 1.068                | -                       | 1.068               |
|           | Left          | -                    | 0.214                   | 0.214               |
| Simult Tx | Configuration | GPRS 1900 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | $\Sigma$ SAR (W/kg) |
| Body SAR  | Back          | 0.932                | 0.322                   | 1.254               |
|           | Front         | 0.918                | 0.208                   | 1.126               |
|           | Top           | 0.166                | 0.336                   | 0.502               |
|           | Bottom        | -                    | -                       | 0.000               |
|           | Right         | 1.004                | -                       | 1.004               |
|           | Left          | -                    | 0.214                   | 0.214               |

|                                   |                                                                                                                                                                                                        |                                       |                                 |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------|
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| Simult Tx | Configuration | UMTS 1900 SAR (W/kg)        | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|-----------|---------------|-----------------------------|-------------------------|--------------|
| Body SAR  | Back          | 0.704                       | 0.322                   | 1.026        |
|           | Front         | 0.664                       | 0.208                   | 0.872        |
|           | Top           | 0.131                       | 0.336                   | 0.467        |
|           | Bottom        | -                           | -                       | 0.000        |
|           | Right         | 0.729                       | -                       | 0.729        |
|           | Left          | -                           | 0.214                   | 0.214        |
| Simult Tx | Configuration | LTE Band 17 SAR (W/kg)      | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
| Body SAR  | Back          | 0.406                       | 0.322                   | 0.728        |
|           | Front         | 0.177                       | 0.208                   | 0.385        |
|           | Top           | 0.092                       | 0.336                   | 0.428        |
|           | Bottom        | -                           | -                       | 0.000        |
|           | Right         | 0.121                       | -                       | 0.121        |
|           | Left          | -                           | 0.214                   | 0.214        |
| Simult Tx | Configuration | LTE Band 4 (AWS) SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
| Body SAR  | Back          | 1.016                       | 0.322                   | 1.338        |
|           | Front         | 0.778                       | 0.208                   | 0.986        |
|           | Top           | 0.218                       | 0.336                   | 0.554        |
|           | Bottom        | -                           | -                       | 0.000        |
|           | Right         | 0.962                       | -                       | 0.962        |
|           | Left          | -                           | 0.214                   | 0.214        |

**Table 11-2**  
**Simultaneous Transmission Scenario (5 GHz Hotspot at 1.0 cm)**

| Simult Tx | Configuration | GPRS 850 SAR (W/kg)  | 5.8 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|-----------|---------------|----------------------|-------------------------|--------------|
| Body SAR  | Back          | 0.546                | 0.223                   | 0.769        |
|           | Front         | 0.325                | 0.567                   | 0.892        |
|           | Top           | 0.316                | 0.589                   | 0.905        |
|           | Bottom        | -                    | -                       | 0.000        |
|           | Right         | 0.260                | -                       | 0.260        |
|           | Left          | -                    | 0.435                   | 0.435        |
| Simult Tx | Configuration | UMTS 850 SAR (W/kg)  | 5.8 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
| Body SAR  | Back          | 0.753                | 0.223                   | 0.976        |
|           | Front         | 0.413                | 0.567                   | 0.980        |
|           | Top           | 0.371                | 0.589                   | 0.960        |
|           | Bottom        | -                    | -                       | 0.000        |
|           | Right         | 0.302                | -                       | 0.302        |
|           | Left          | -                    | 0.435                   | 0.435        |
| Simult Tx | Configuration | UMTS 1750 SAR (W/kg) | 5.8 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
| Body SAR  | Back          | 1.088                | 0.223                   | 1.311        |
|           | Front         | 0.745                | 0.567                   | 1.312        |
|           | Top           | 0.236                | 0.589                   | 0.825        |
|           | Bottom        | -                    | -                       | 0.000        |
|           | Right         | 1.068                | -                       | 1.068        |
|           | Left          | -                    | 0.435                   | 0.435        |
| Simult Tx | Configuration | GPRS 1900 SAR (W/kg) | 5.8 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
| Body SAR  | Back          | 0.932                | 0.223                   | 1.155        |
|           | Front         | 0.918                | 0.567                   | <b>1.485</b> |
|           | Top           | 0.166                | 0.589                   | 0.755        |
|           | Bottom        | -                    | -                       | 0.000        |
|           | Right         | 1.004                | -                       | 1.004        |
|           | Left          | -                    | 0.435                   | 0.435        |

|                                          |                                                                                                                                                                                                        |                                              |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
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| Simult Tx | Configuration | UMTS 1900<br>SAR (W/kg)           | 5.8 GHz WLAN<br>SAR (W/kg) | Σ SAR<br>(W/kg) |
|-----------|---------------|-----------------------------------|----------------------------|-----------------|
| Body SAR  | Back          | 0.704                             | 0.223                      | 0.927           |
|           | Front         | 0.664                             | 0.567                      | 1.231           |
|           | Top           | 0.131                             | 0.589                      | 0.720           |
|           | Bottom        | -                                 | -                          | 0.000           |
|           | Right         | 0.729                             | -                          | 0.729           |
|           | Left          | -                                 | 0.435                      | 0.435           |
| Simult Tx | Configuration | LTE Band 17<br>SAR (W/kg)         | 5.8 GHz WLAN<br>SAR (W/kg) | Σ SAR<br>(W/kg) |
| Body SAR  | Back          | 0.406                             | 0.223                      | 0.629           |
|           | Front         | 0.177                             | 0.567                      | 0.744           |
|           | Top           | 0.092                             | 0.589                      | 0.681           |
|           | Bottom        | -                                 | -                          | 0.000           |
|           | Right         | 0.121                             | -                          | 0.121           |
|           | Left          | -                                 | 0.435                      | 0.435           |
| Simult Tx | Configuration | LTE Band 4<br>(AWS) SAR<br>(W/kg) | 5.8 GHz WLAN<br>SAR (W/kg) | Σ SAR<br>(W/kg) |
| Body SAR  | Back          | 1.016                             | 0.223                      | 1.239           |
|           | Front         | 0.778                             | 0.567                      | 1.345           |
|           | Top           | 0.218                             | 0.589                      | 0.807           |
|           | Bottom        | -                                 | -                          | 0.000           |
|           | Right         | 0.962                             | -                          | 0.962           |
|           | Left          | -                                 | 0.435                      | 0.435           |

## 11.4 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v05r01.

|                                          |                                                                                     |                                              |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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## 12 SAR MEASUREMENT VARIABILITY

### 12.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r01, 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.

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

**Table 12-1**  
**Body SAR Measurement Variability Results**

| BODY VARIABILITY RESULTS                 |           |      |           |         |      |                      |                   |                       |       |                       |       |                       |       |
|------------------------------------------|-----------|------|-----------|---------|------|----------------------|-------------------|-----------------------|-------|-----------------------|-------|-----------------------|-------|
| Band                                     | FREQUENCY |      | Mode      | Service | Side | Spacing              | Measured SAR (1g) | 1st Repeated SAR (1g) | Ratio | 2nd Repeated SAR (1g) | Ratio | 3rd Repeated SAR (1g) | Ratio |
|                                          | MHz       | Ch.  |           |         |      |                      | (W/kg)            | (W/kg)                |       | (W/kg)                |       | (W/kg)                |       |
| 1750                                     | 1730.40   | 1412 | UMTS 1750 | RMC     | back | 10 mm                | 0.949             | 0.856                 | 1.11  | N/A                   | N/A   | N/A                   | N/A   |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |           |      |           |         |      | Body                 |                   |                       |       |                       |       |                       |       |
| Spatial Peak                             |           |      |           |         |      | 1.6 W/kg (mW/g)      |                   |                       |       |                       |       |                       |       |
| Uncontrolled Exposure/General Population |           |      |           |         |      | averaged over 1 gram |                   |                       |       |                       |       |                       |       |

### 12.2 Measurement Uncertainty

The measured SAR was  $< 1.5$  W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01r01, the extended measurement uncertainty analysis per IEEE 1528-2003 was not required.

|                                   |                                                                                     |                                       |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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# 13 EQUIPMENT LIST

| Manufacturer       | Model           | Description                                   | Cal Date   | Cal Interval | Cal Due    | Serial Number |
|--------------------|-----------------|-----------------------------------------------|------------|--------------|------------|---------------|
| Agilent            | E8257D          | (250kHz-20GHz) Signal Generator               | 4/16/2013  | Annual       | 4/16/2014  | MY45470194    |
| Agilent            | 8753E           | (30kHz-6GHz) Network Analyzer                 | 4/16/2013  | Annual       | 4/16/2014  | JP38020182    |
| Agilent            | 8594A           | (9kHz-2.9GHz) Spectrum Analyzer               | N/A        | N/A          | N/A        | 3051A00187    |
| Agilent            | 8648D           | (9kHz-4GHz) Signal Generator                  | 4/17/2013  | Annual       | 4/17/2014  | 3629U00687    |
| Agilent            | 85070C          | Dielectric Probe Kit                          | 2/14/2013  | Annual       | 2/14/2014  | MY44300633    |
| Agilent            | 85047A          | S-Parameter Test Set                          | N/A        | N/A          | N/A        | 2904A00579    |
| Agilent            | N9020A          | MXA Signal Analyzer                           | 10/9/2012  | Annual       | 10/9/2013  | US46470561    |
| Amplifier Research | 5S1G4           | 5W, 800MHz-4.2GHz                             | CBT        | N/A          | CBT        | 21910         |
| Anritsu            | ML2495A         | Power Meter                                   | 10/11/2012 | Annual       | 10/11/2013 | 1039008       |
| Anritsu            | ML2496A         | Power Meter                                   | 11/28/2012 | Annual       | 11/28/2013 | 1138001       |
| Anritsu            | ML2438A         | Power Meter                                   | 12/4/2012  | Annual       | 12/4/2013  | 1070030       |
| Anritsu            | ML2438A         | Power Meter                                   | 2/14/2013  | Annual       | 2/14/2014  | 1190013       |
| Anritsu            | MA2411B         | Pulse Power Sensor                            | 12/4/2012  | Annual       | 12/4/2013  | 1207364       |
| Anritsu            | MA2411B         | Pulse Power Sensor                            | 12/5/2012  | Annual       | 12/5/2013  | 1126066       |
| Anritsu            | MA2411B         | Pulse Sensor                                  | 9/19/2012  | Annual       | 9/19/2013  | 1027293       |
| Anritsu            | MT8820C         | Radio Communication Analyzer                  | 6/28/2013  | Annual       | 6/28/2014  | 6201240328    |
| Anritsu            | MA24106A        | USB Power Sensor                              | 12/6/2012  | Annual       | 12/6/2013  | 1248508       |
| Anritsu            | MA24106A        | USB Power Sensor                              | 12/7/2012  | Annual       | 12/7/2013  | 1244524       |
| COMTECH            | AR85729-5/5759B | Solid State Amplifier                         | CBT        | N/A          | CBT        | M3W1A00-1002  |
| Control Company    | 4353            | Long Stem Thermometer                         | 9/25/2012  | Biennial     | 9/25/2014  | 122539615     |
| Control Company    | 36934-158       | Wall-Mounted Thermometer                      | 1/4/2012   | Biennial     | 1/4/2014   | 122014488     |
| Fisher Scientific  | 15-078J         | Long Stem Thermometer                         | 10/30/2012 | Biennial     | 10/30/2014 | 122626059     |
| Gigatronics        | 8651A           | Universal Power Meter                         | 10/10/2012 | Annual       | 10/10/2013 | 8650319       |
| MCL                | BW-N6W5+        | 6dB Attenuator                                | CBT        | N/A          | CBT        | 1139          |
| MiniCircuits       | VLF-6000+       | Low Pass Filter                               | CBT        | N/A          | CBT        | N/A           |
| MiniCircuits       | SLP-2400+       | Low Pass Filter                               | CBT        | N/A          | CBT        | R897950903    |
| 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           |
| 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                        | 5/3/2013   | Annual       | 5/3/2014   | 836371/0079   |
| Rohde & Schwarz    | CMU200          | Base Station Simulator                        | 8/9/2013   | Annual       | 8/9/2014   | 105892        |
| Rohde & Schwarz    | CMW500          | LTE Radio Communication Tester                | 9/26/2012  | Annual       | 9/26/2013  | 108798        |
| Rohde & Schwarz    | CMW500          | LTE Radio Communication Tester                | 10/7/2011  | Biennial     | 10/7/2013  | 103962        |
| Rohde & Schwarz    | SMIQ03B         | Signal Generator                              | 4/17/2013  | Annual       | 4/17/2014  | DE27259       |
| Seekonk            | NC-100          | Torque Wrench (8" lb)                         | 11/29/2011 | Triennial    | 11/29/2014 | 21053         |
| SPEAG              | D1750V2         | 1750 MHz SAR Dipole                           | 4/30/2013  | Annual       | 4/30/2014  | 1051          |
| SPEAG              | D1900V2         | 1900 MHz SAR Dipole                           | 2/6/2013   | Annual       | 2/6/2014   | 5d148         |
| SPEAG              | D2450V2         | 2450 MHz SAR Dipole                           | 1/8/2013   | Annual       | 1/8/2014   | 797           |
| SPEAG              | D5GHzV2         | 5 GHz SAR Dipole                              | 1/11/2013  | Annual       | 1/11/2014  | 1057          |
| SPEAG              | D750V3          | 750 MHz Dipole                                | 3/18/2013  | Annual       | 3/18/2014  | 1054          |
| SPEAG              | D835V2          | 835 MHz SAR Dipole                            | 4/25/2013  | Annual       | 4/25/2014  | 4d119         |
| SPEAG              | DAE4            | Dasy Data Acquisition Electronics             | 4/22/2013  | Annual       | 4/22/2014  | 1364          |
| SPEAG              | DAE4            | Dasy Data Acquisition Electronics             | 11/13/2012 | Annual       | 11/13/2013 | 1333          |
| SPEAG              | DAE4            | Dasy Data Acquisition Electronics             | 1/17/2013  | Annual       | 1/17/2014  | 1272          |
| SPEAG              | DAE4            | Dasy Data Acquisition Electronics             | 2/6/2013   | Annual       | 2/6/2014   | 649           |
| SPEAG              | DAE4            | Dasy Data Acquisition Electronics             | 3/8/2013   | Annual       | 3/8/2014   | 1334          |
| SPEAG              | DAK-3.5         | Dielectric Assessment Kit                     | 12/11/2012 | Annual       | 12/11/2013 | 1091          |
| SPEAG              | DAK-3.5         | Dielectric Assessment Kit                     | 5/14/2013  | Annual       | 5/14/2014  | 1070          |
| SPEAG              | ES3DV3          | SAR Probe                                     | 11/15/2012 | Annual       | 11/15/2013 | 3287          |
| SPEAG              | EX3DV4          | SAR Probe                                     | 1/17/2013  | Annual       | 1/17/2014  | 3589          |
| SPEAG              | EX3DV4          | SAR Probe                                     | 2/27/2013  | Annual       | 2/27/2014  | 3920          |
| SPEAG              | ES3DV3          | SAR Probe                                     | 3/15/2013  | Annual       | 3/15/2014  | 3209          |
| SPEAG              | ES3DV3          | SAR Probe                                     | 4/29/2013  | Annual       | 4/29/2014  | 3318          |
| VWR                | 23226-658       | Long Stem Thermometer                         | 7/11/2012  | Biennial     | 7/11/2014  | 122389330     |
| VWR                | 62344-925       | Mini-Thermometer                              | 10/24/2011 | Biennial     | 10/24/2013 | 111886441     |
| VWR                | 36934-158       | Wall-Mounted Thermometer                      | 9/30/2011  | Biennial     | 9/30/2013  | 111859332     |

Note: 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.

|                                          |                                                                                     |                                              |                                                                                       |                                        |
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## 14 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 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                                | 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><br>(95% CONFIDENCE LEVEL)                         |                      |               |                |              |                       |                          | k=2                            | 24.2                             | 23.5           |

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

|                                   |                                                                                     |                                       |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                |  | SAR EVALUATION REPORT                 |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                  | DUT Type:<br>Portable Wireless Router |                                                                                       | Page 36 of 40                   |

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<br>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                                   | 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                            | 12.4                             | 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: A3LSMV100T                |  <b>SAR EVALUATION REPORT</b>  |                                       | Reviewed by:<br>Quality Manager |
| Document S/N:<br>OY1308271687.A3L | Test Dates:<br>08/19/13 - 08/27/13                                                                                                                                                                     | DUT Type:<br>Portable Wireless Router | Page 37 of 40                   |

## 15 CONCLUSION

### 15.1 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> A3LSMV100T                |  | <b>SAR EVALUATION REPORT</b>                 |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1308271687.A3L | <b>Test Dates:</b><br>08/19/13 - 08/27/13                                           | <b>DUT Type:</b><br>Portable Wireless Router |                                                                                       | Page 38 of 40                          |

## 16 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] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, June 2001.
- [6] IEEE Standards Coordinating Committee 34 – IEEE Std. 1528-2003, Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices.
- [7] 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.
- [8] 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.
- [9] 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. -124.
- [10] 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.
- [11] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.
- [12] 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.
- [13] 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.
- [14] G. Hartsgrrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.
- [15] 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.
- [16] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.
- [17] 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.

|                                          |                                                                                                                                                                                                        |                                              |                                        |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSMV100T                |  <b>SAR EVALUATION REPORT</b>  |                                              | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>OY1308271687.A3L | <b>Test Dates:</b><br>08/19/13 - 08/27/13                                                                                                                                                              | <b>DUT Type:</b><br>Portable Wireless Router | Page 39 of 40                          |

- [18] Federal Communications Commission, OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. Supplement C, Dec. 1997.
- [19] 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.
- [20] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.
- [21] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hochschule Zürich, Dosimetric Evaluation of the Cellular Phone.
- [22] 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.
- [23] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 4, March 2010.
- [24] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2009
- [25] FCC Public Notice DA-02-1438. Office of Engineering and Technology Announces a Transition Period for the Phantom Requirements of Supplement C to OET Bulletin 65, June 19, 2002
- [26] FCC SAR Test Procedures for 2G-3G Devices, Mobile Hotspot and UMPC Devices KDB Publications 941225, D01-D07
- [27] SAR Measurement procedures for IEEE 802.11a/b/g KDB Publication 248227 D01v01r02
- [28] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publications 648474 D03-D04
- [29] FCC SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers, FCC KDB Publication 616217 D04
- [30] FCC SAR Measurement and Reporting Requirements for 100MHz – 6 GHz, KDB Publications 865664 D01-D02
- [31] FCC General RF Exposure Guidance and SAR Procedures for Dongles, KDB Publication 447498, D01-D02
- [32] Anexo à Resolução No. 533, de 10 de Setembro de 2009.
- [33] 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> A3LSMV100T                |  <b>SAR EVALUATION REPORT</b>  |                                              | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1308271687.A3L | <b>Test Dates:</b><br>08/19/13 - 08/27/13                                                                                                                                                              | <b>DUT Type:</b><br>Portable Wireless Router | Page 40 of 40                          |

## APPENDIX A: SAR TEST DATA

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMV100T; Type: Portable Wireless Router; Serial: FK-174-E**

Communication System: GSM GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$ ;  $\sigma = 1.012 \text{ S/m}$ ;  $\epsilon_r = 54.317$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-22-2013; Ambient Temp: 24.8°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3209; ConvF(6.28, 6.28, 6.28); Calibrated: 3/15/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/8/2013

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Mode: GPRS 850, Body SAR, Back side, Mid.ch, 2 Tx Slots**

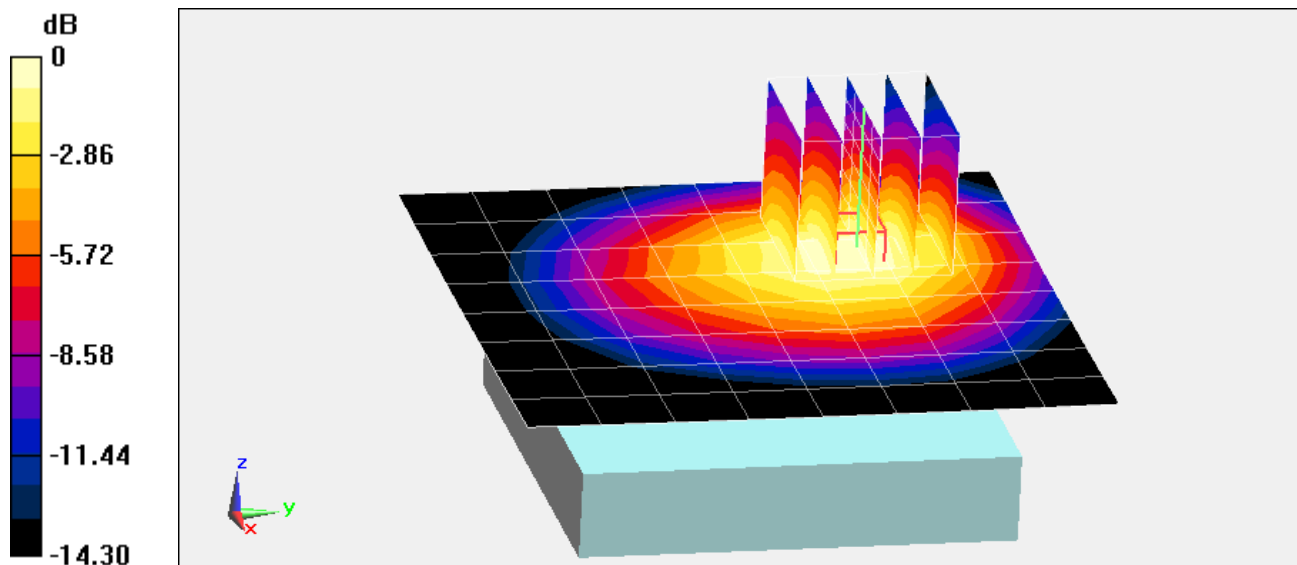
**Area Scan (9x9x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 20.243 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.599 W/kg

**SAR(1 g) = 0.405 W/kg**



0 dB = 0.439 W/kg = -3.58 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMV100T; Type: Portable Wireless Router; Serial: FK-174-E**

Communication System: UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$ ;  $\sigma = 1.012 \text{ S/m}$ ;  $\epsilon_r = 54.317$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-22-2013; Ambient Temp: 24.8°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3209; ConvF(6.28, 6.28, 6.28); Calibrated: 3/15/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/8/2013

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Mode: UMTS 850, Body SAR, Back side, Mid.ch**

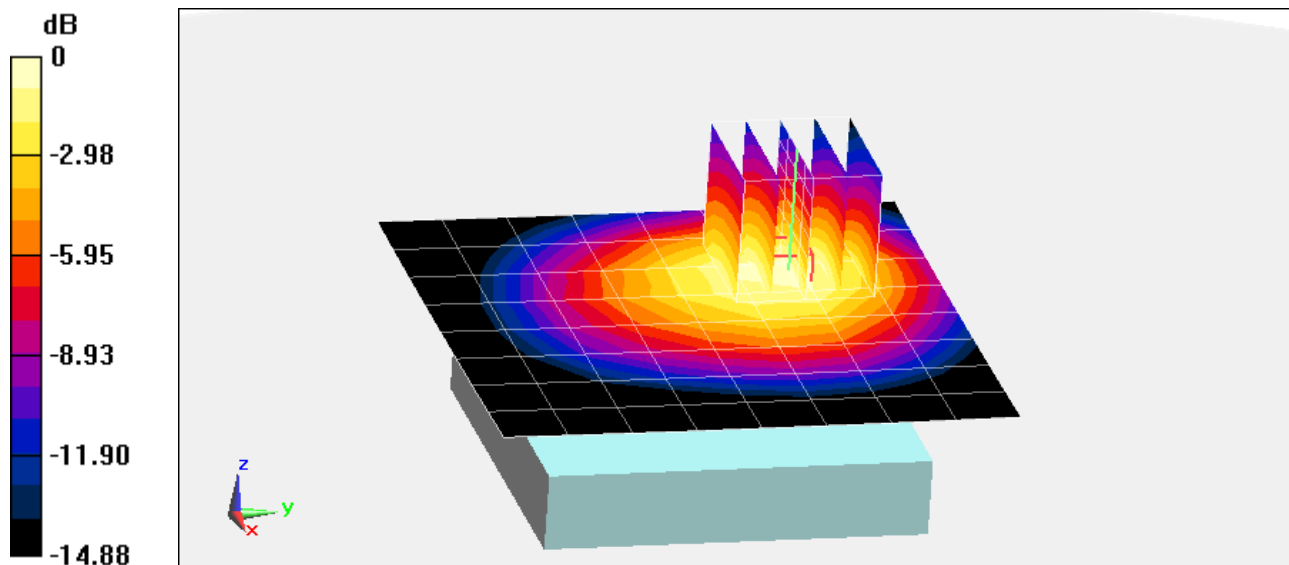
**Area Scan (9x9x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 23.826 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.840 W/kg

**SAR(1 g) = 0.546 W/kg**



0 dB = 0.596 W/kg = -2.25 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMV100T; Type: Portable Wireless Router; Serial: FK-174-E**

Communication System: UMTS; Frequency: 1732.4 MHz; Duty Cycle: 1:1

Medium: 1750 Body Medium parameters used (interpolated):

$f = 1732.4 \text{ MHz}$ ;  $\sigma = 1.442 \text{ S/m}$ ;  $\epsilon_r = 52.427$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-27-2013; Ambient Temp: 24.1°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3209; ConvF(5.03, 5.03, 5.03); Calibrated: 3/15/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/8/2013

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Mode: AWS UMTS, Body SAR, Back side, Mid.ch**

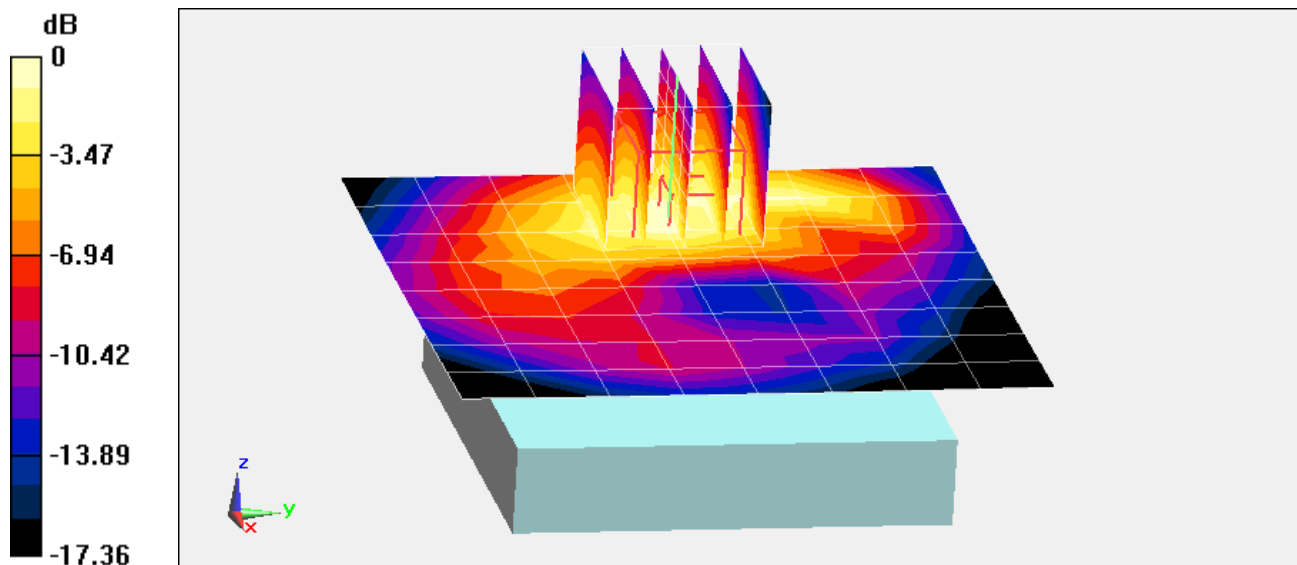
**Area Scan (9x9x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 25.310 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 1.49 W/kg

**SAR(1 g) = 0.949 W/kg**



0 dB = 1.01 W/kg = 0.04 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMV100T; Type: Portable Wireless Router; Serial: FK-174-E**

Communication System: GSM GPRS; 4 Tx slots; Frequency: 1850.2 MHz; Duty Cycle: 1:2.076

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1850.2 \text{ MHz}$ ;  $\sigma = 1.501 \text{ S/m}$ ;  $\epsilon_r = 52.176$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-21-2013; Ambient Temp: 24.1°C; Tissue Temp: 23.0°C

Probe: EX3DV4 - SN3920; ConvF(7.38, 7.38, 7.38); Calibrated: 2/27/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/6/2013

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

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Mode: GPRS 1900, Body SAR, Right Edge, Low.ch, 4 Tx Slots**

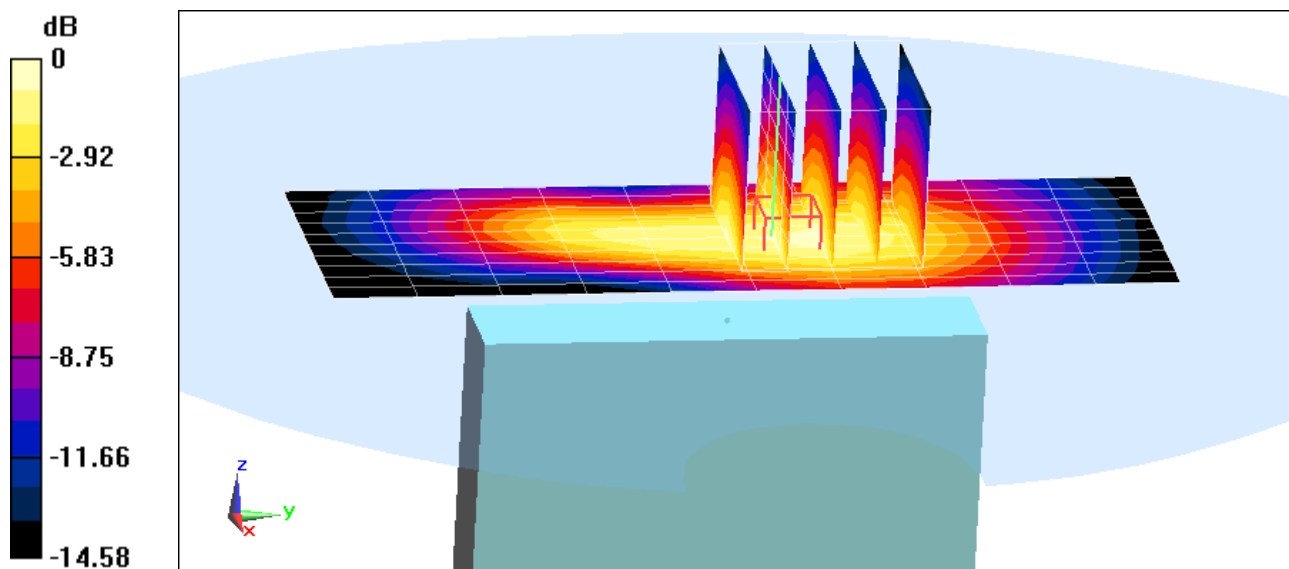
**Area Scan (11x11x1):** Measurement grid: dx=5mm, dy=15mm

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

Reference Value = 22.360 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.14 W/kg

**SAR(1 g) = 0.729 W/kg**



0 dB = 0.790 W/kg = -1.02 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMV100T; Type: Portable Wireless Router; Serial: FK-174-E**

Communication System: UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.531 \text{ S/m}$ ;  $\epsilon_r = 52.073$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-21-2013; Ambient Temp: 24.1°C; Tissue Temp: 23.0°C

Probe: EX3DV4 - SN3920; ConvF(7.38, 7.38, 7.38); Calibrated: 2/27/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/6/2013

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

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Mode: UMTS 1900, Body SAR, Right Edge, Mid.ch**

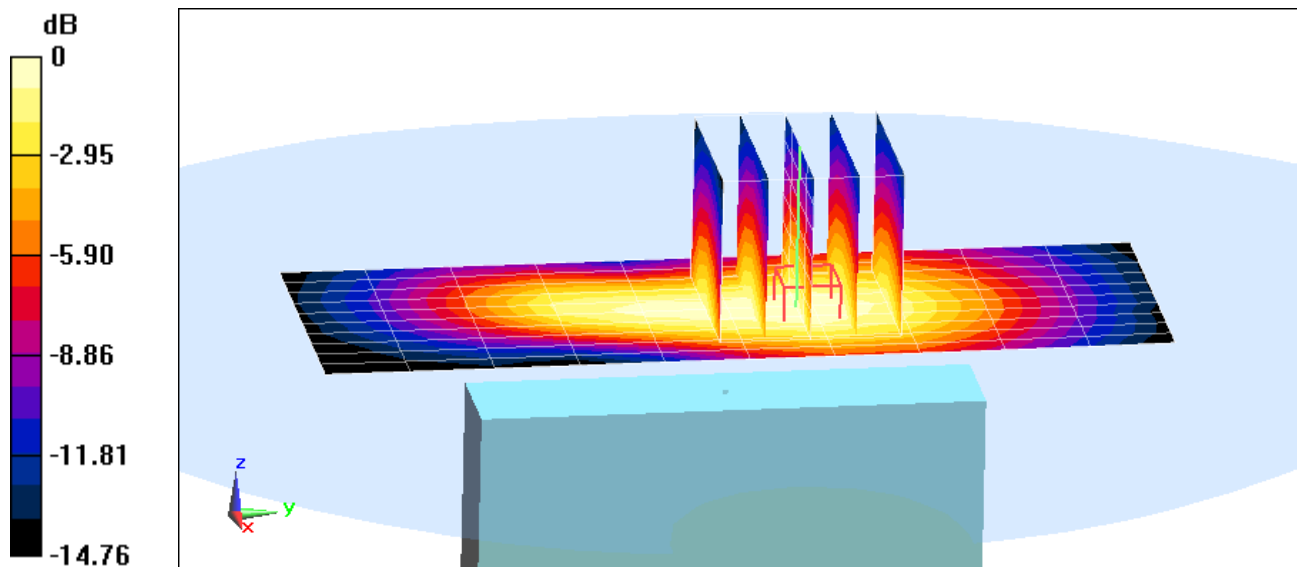
**Area Scan (11x11x1):** Measurement grid: dx=5mm, dy=15mm

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

Reference Value = 21.447 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 1.00 W/kg

**SAR(1 g) = 0.642 W/kg**



0 dB = 0.702 W/kg = -1.54 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMV100T; Type: Portable Wireless Router; Serial: FK-174-E**

Communication System: LTE BAND 17; Frequency: 710 MHz; Duty Cycle: 1:1

Medium: 740 Body Medium parameters used:

$f = 710 \text{ MHz}$ ;  $\sigma = 0.931 \text{ S/m}$ ;  $\epsilon_r = 55.326$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-19-2013; Ambient Temp: 23.3°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3287; ConvF(6.14, 6.14, 6.14); Calibrated: 11/15/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 11/13/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7164)

**Mode: LTE Band 17, Body SAR, Back side, Mid.ch**

**10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset**

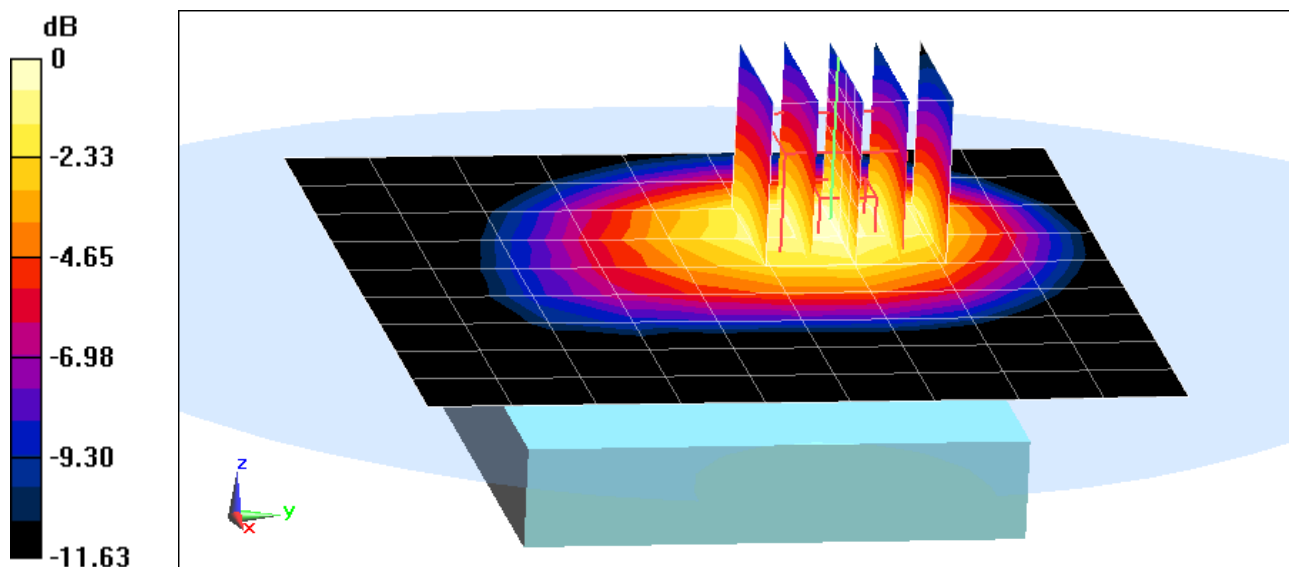
**Area Scan (10x10x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 21.228 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.594 W/kg

**SAR = 0.405 W/kg**



0 dB = 0.437 W/kg = -3.60 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMV100T; Type: Portable Wireless Router; Serial: FK-174-E**

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

Medium: 1750 Body Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$ ;  $\sigma = 1.442 \text{ S/m}$ ;  $\epsilon_r = 52.427$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-27-2013; Ambient Temp: 24.1°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3209; ConvF(5.03, 5.03, 5.03); Calibrated: 3/15/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/8/2013

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

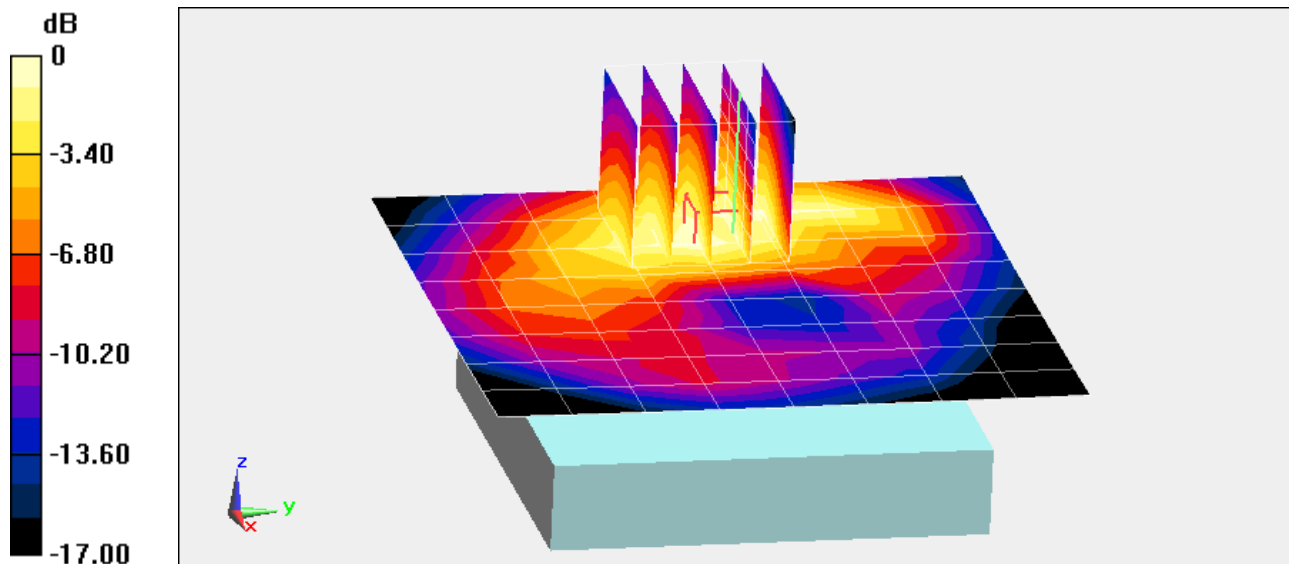
**Area Scan (9x9x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 25.644 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 1.36 W/kg

**SAR(1 g) = 0.875 W/kg**



0 dB = 0.930 W/kg = -0.32 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMV100T; Type: Portable Wireless Router; Serial: FK-174-E**

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

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$ ;  $\sigma = 1.979 \text{ S/m}$ ;  $\epsilon_r = 50.902$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-19-2013; Ambient Temp: 22.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3318; ConvF(4.31, 4.31, 4.31); Calibrated: 4/29/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 4/22/2013

Phantom: ELI left; Type: QDOVA002AA; Serial: TP:1202

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Mode: IEEE 802.11b, Body SAR, Ch 01, 1 Mbps, Top Edge**

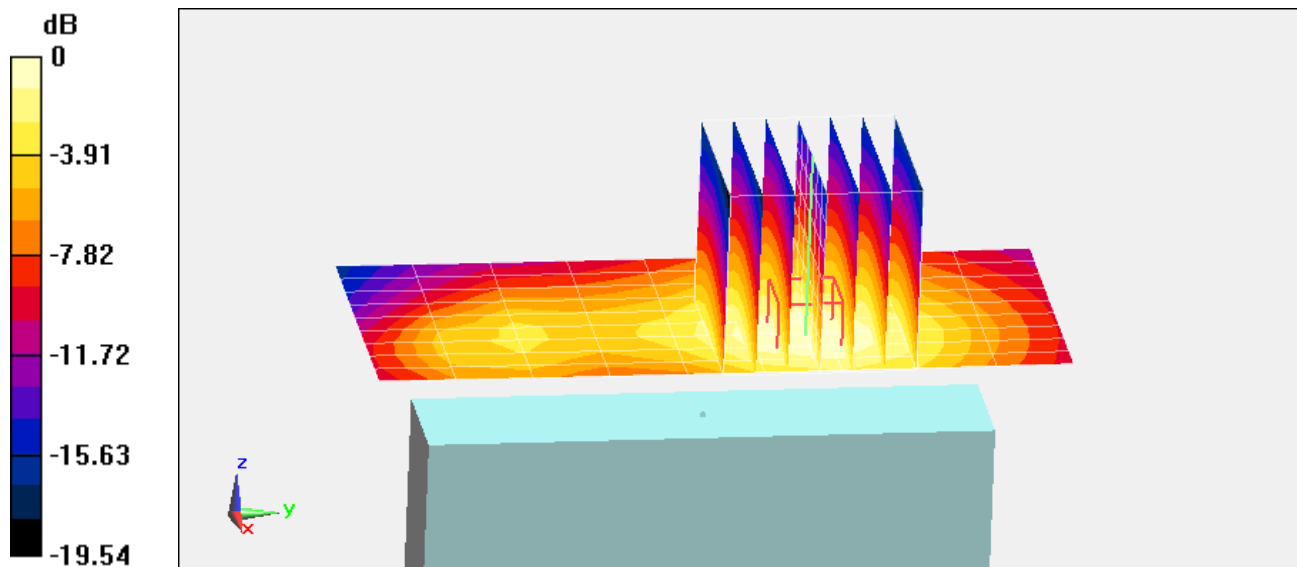
**Area Scan (10x10x1):** Measurement grid: dx=5mm, dy=12mm

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

Reference Value = 13.112 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.573 W/kg

**SAR(1 g) = 0.310 W/kg**



0 dB = 0.384 W/kg = -4.16 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMV100T; Type: Portable Wireless Router; Serial: FK-174-E**

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5785 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$f = 5785 \text{ MHz}$ ;  $\sigma = 6.128 \text{ S/m}$ ;  $\epsilon_r = 47.749$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-21-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.8°C

Probe: EX3DV4 - SN3589; ConvF(3.66, 3.66, 3.66); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7164)

**Mode: IEEE 802.11a, 5.8 GHz, Body SAR, Ch 157, 6 Mbps, Top Edge**

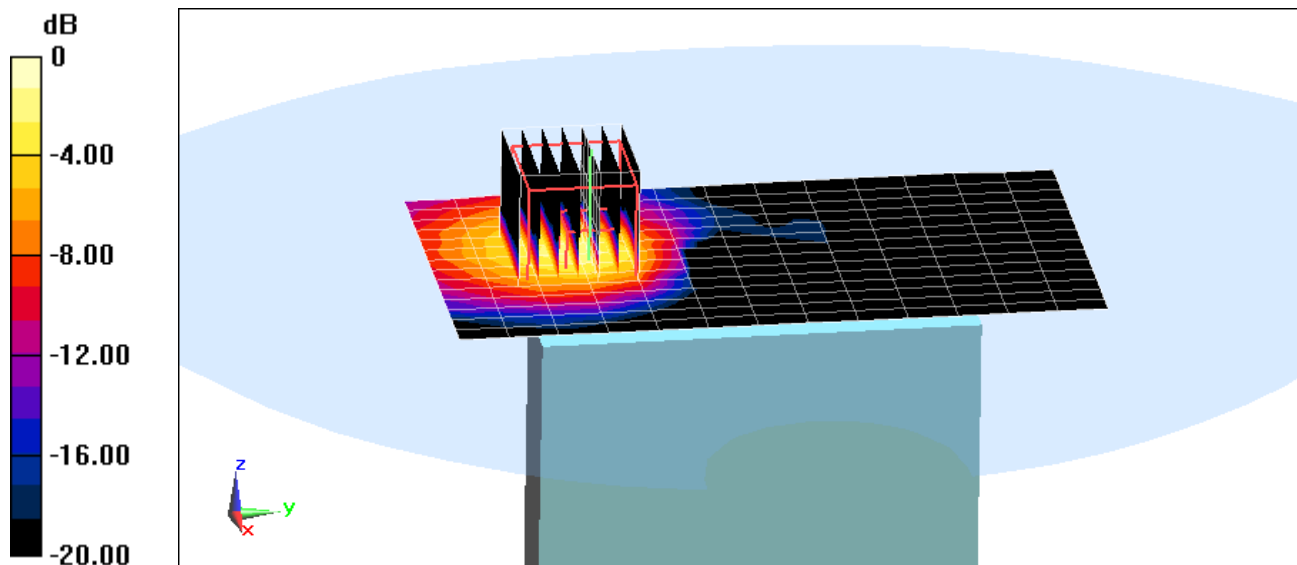
**Area Scan (15x14x1):** Measurement grid: dx=5mm, dy=10mm

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

Reference Value = 9.537 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 2.40 W/kg

**SAR(1 g) = 0.538 W/kg**



0 dB = 1.32 W/kg = 1.21 dBW/kg

## APPENDIX B: SYSTEM VERIFICATION

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 750 MHz; Type: D750V3; Serial: 1054**

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 740 Body Medium parameters used (interpolated):

$f = 750 \text{ MHz}$ ;  $\sigma = 0.971 \text{ S/m}$ ;  $\epsilon_r = 54.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-19-2013; Ambient Temp: 23.3°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3287; ConvF(6.14, 6.14, 6.14); Calibrated: 11/15/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 11/13/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7164)

## 750MHz System Verification

**Area Scan (7x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

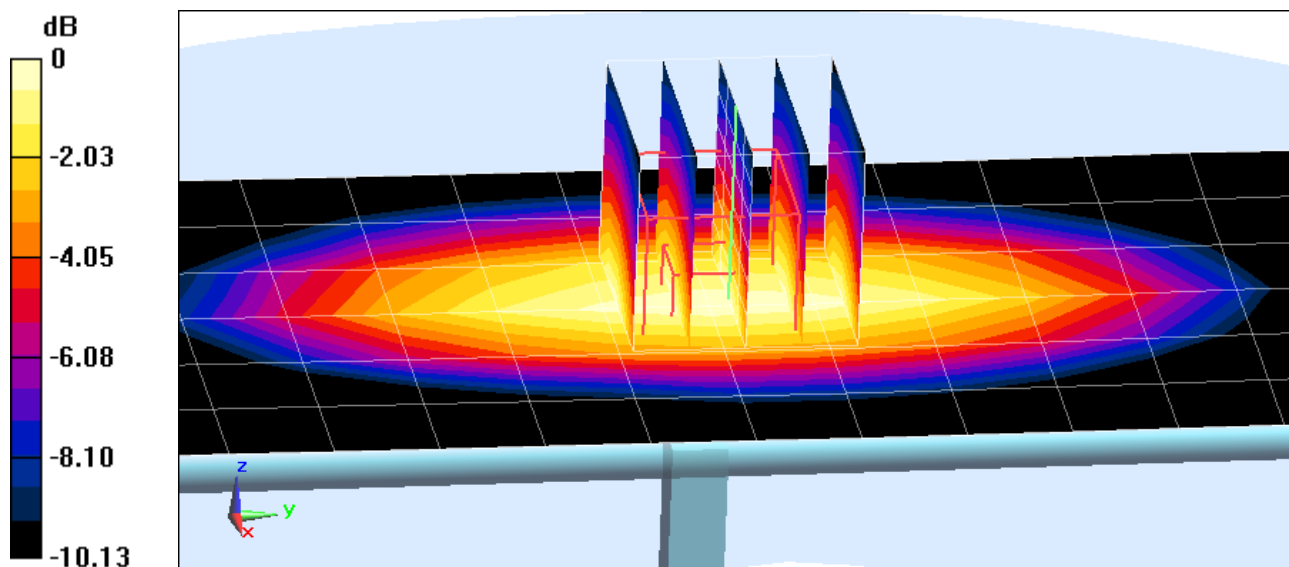
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Input Power: 20.0 dBm ( 100 mW )

Peak SAR (extrapolated) = 1.24 W/kg

**SAR(1 g) = 0.869 W/kg**

Deviation = -0.34%



0 dB = 0.932 W/kg = -0.31 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 1.011 \text{ S/m}$ ;  $\epsilon_r = 54.339$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-22-2013; Ambient Temp: 24.8°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3209; ConvF(6.28, 6.28, 6.28); Calibrated: 3/15/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/8/2013

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

## 835 MHz System Verification

**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

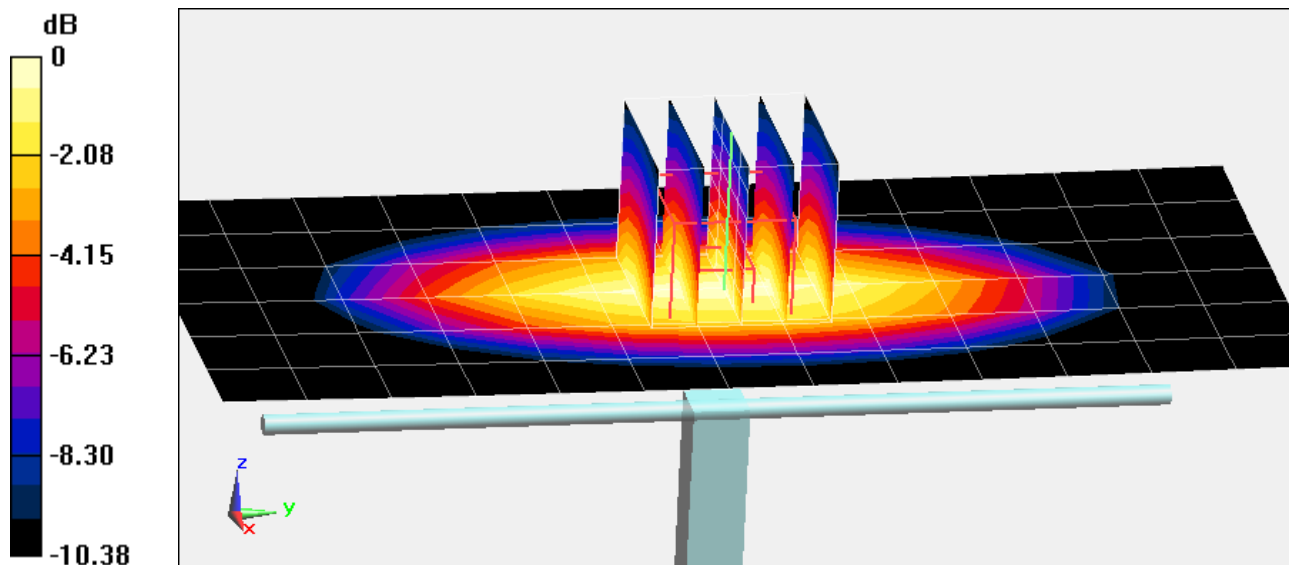
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Input Power: 20.0 dBm ( 100 mW )

Peak SAR (extrapolated) = 1.44 W/kg

**SAR(1 g) = 0.991 W/kg**

Deviation = 3.88%



0 dB = 1.07 W/kg = 0.29 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 1750 Body Medium parameters used:

$f = 1750 \text{ MHz}$ ;  $\sigma = 1.461 \text{ S/m}$ ;  $\epsilon_r = 52.342$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-27-2013; Ambient Temp: 24.1°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3209; ConvF(5.03, 5.03, 5.03); Calibrated: 3/15/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/8/2013

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

## 1750 MHz System Verification

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

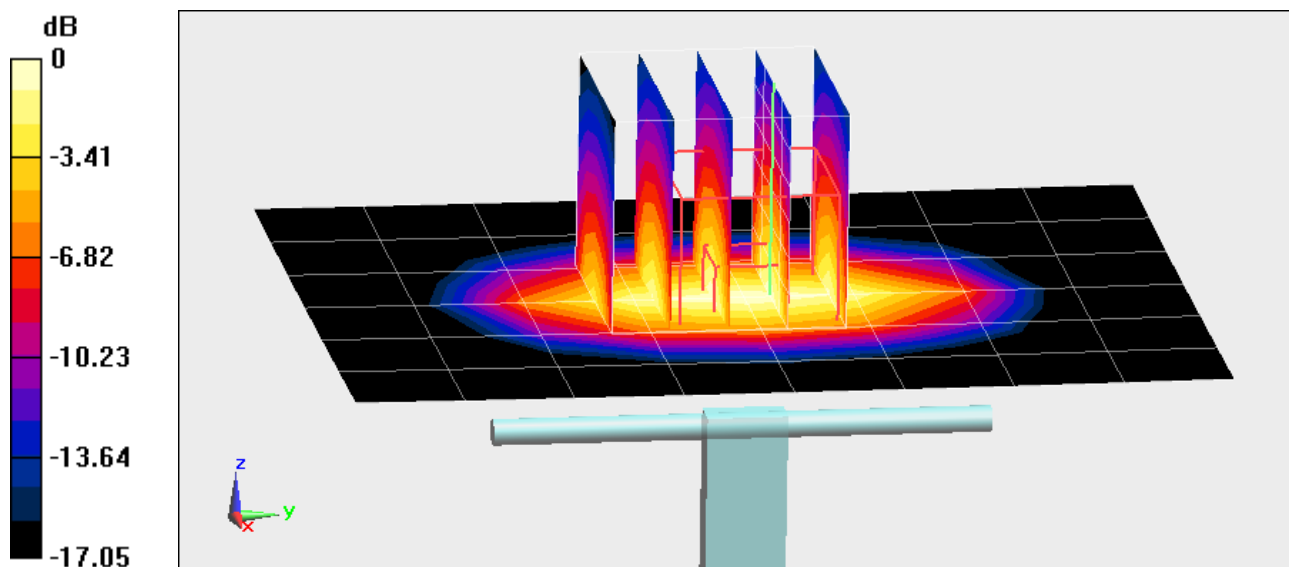
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power: 20.0 dBm ( 100 mW )

Peak SAR (extrapolated) = 6.65 W/kg

**SAR(1 g) = 3.75 W/kg**

Deviation = -0.79%



0 dB = 4.12 W/kg = 6.15 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d148**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.551 \text{ S/m}$ ;  $\epsilon_r = 52.004$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-21-2013; Ambient Temp: 24.1°C; Tissue Temp: 23.0°C

Probe: EX3DV4 - SN3920; ConvF(7.38, 7.38, 7.38); Calibrated: 2/27/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/6/2013

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

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

## 1900 MHz System Verification

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

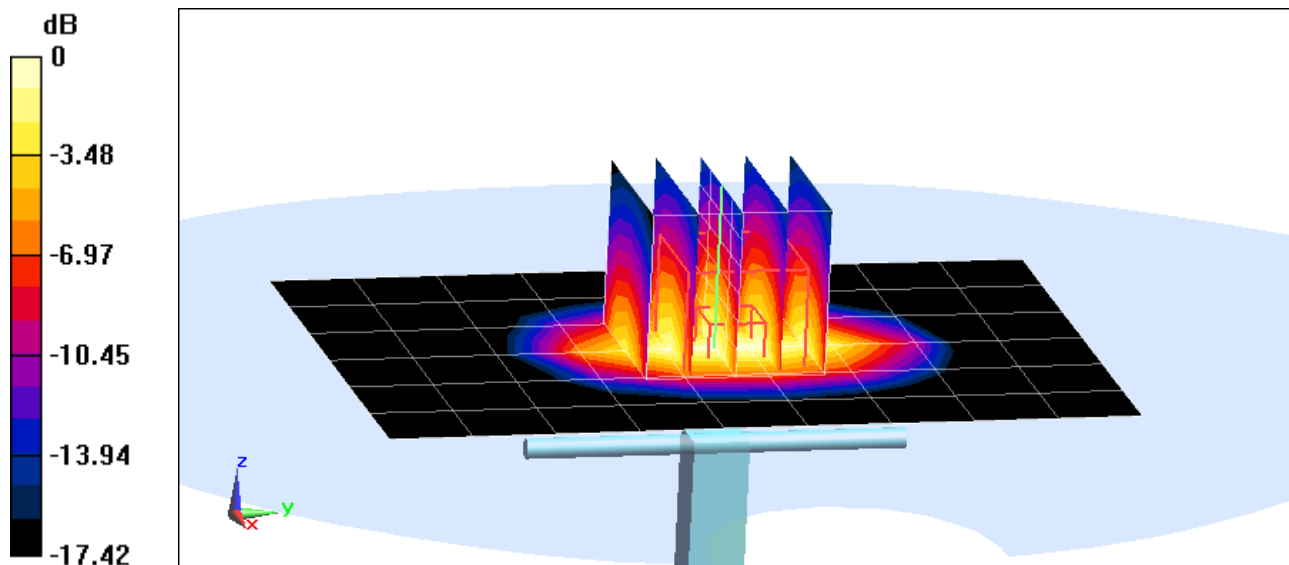
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power: 20.0 dBm ( 100 mW )

Peak SAR (extrapolated) = 7.88 W/kg

**SAR(1 g) = 4.36 W/kg**

Deviation = 6.86%



0 dB = 4.86 W/kg = 6.87 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 797**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 2.03 \text{ S/m}$ ;  $\epsilon_r = 50.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-19-2013; Ambient Temp: 22.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3318; ConvF(4.31, 4.31, 4.31); Calibrated: 4/29/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 4/22/2013

Phantom: ELI left; Type: QDOVA002AA; Serial: TP:1202

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

## 2450 MHz System Verification

**Area Scan (8x9x1):** Measurement grid: dx=12mm, dy=12mm

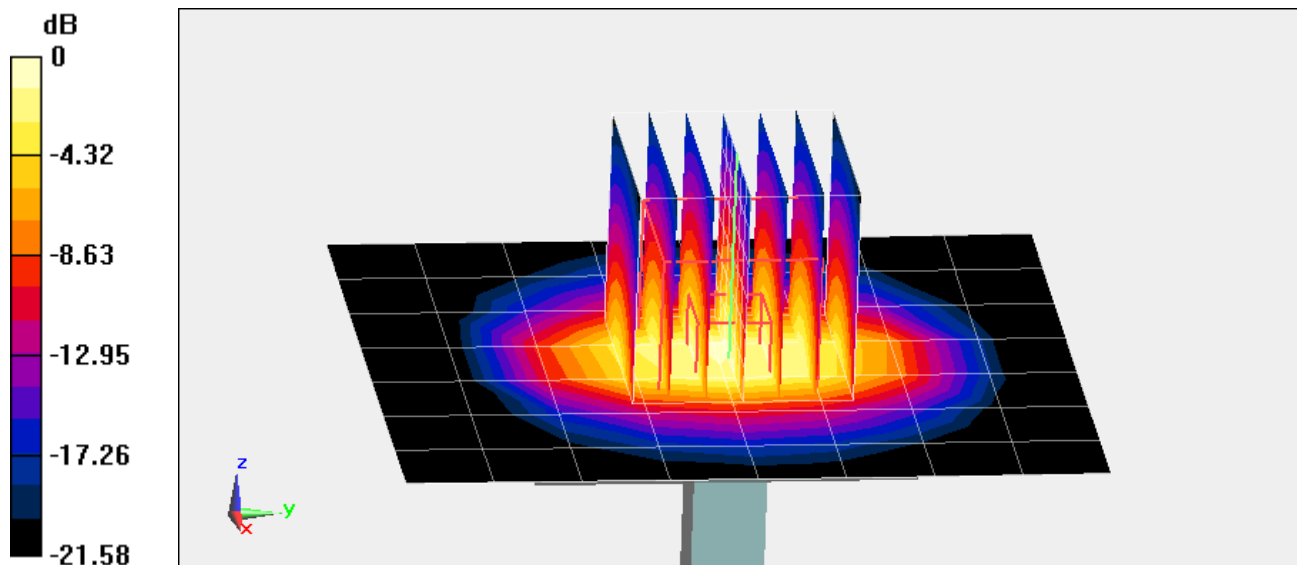
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Input Power: 16.0 dBm ( 40 mW )

Peak SAR (extrapolated) = 4.51 W/kg

**SAR(1 g) = 2.15 W/kg**

Deviation = 8.37%



0 dB = 2.83 W/kg = 4.52 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$f = 5800 \text{ MHz}$ ;  $\sigma = 6.147 \text{ S/m}$ ;  $\epsilon_r = 47.802$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-21-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.8°C

Probe: EX3DV4 - SN3589; ConvF(3.66, 3.66, 3.66); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7164)

## 5800MHz System Verification

**Area Scan (7x9x1):** Measurement grid: dx=10mm, dy=10mm

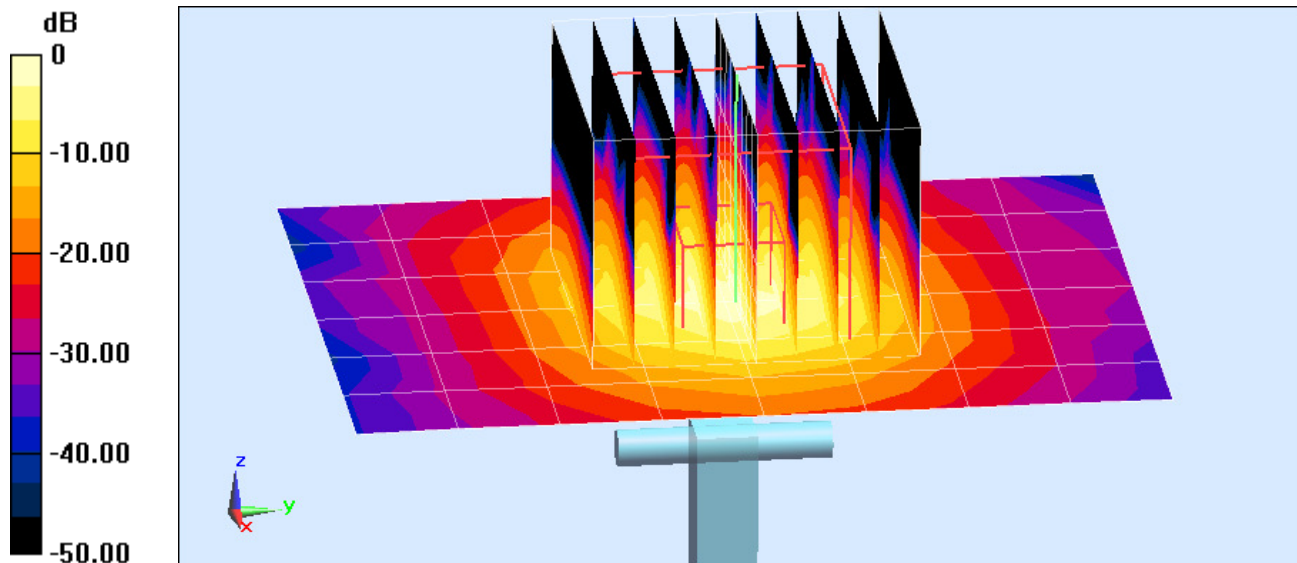
**Zoom Scan (9x9x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power: 20.0 dBm ( 100 mW )

Peak SAR (extrapolated) = 33.5 W/kg

**SAR(1 g) = 7.94 W/kg**

Deviation = 5.73%



0 dB = 19.5 W/kg = 12.90 dBW/kg

## APPENDIX C: PROBE CALIBRATION



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: **D750V3-1054\_Mar13**

## CALIBRATION CERTIFICATE

Object **D750V3 - SN: 1054**

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

Calibration date: **March 18, 2013**

✓ KOK  
3/22/13

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         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Power sensor HP 8481A       | US37292783         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 27-Mar-12 (No. 217-01530)         | Apr-13                 |
| Type-N mismatch combination | SN: 5047.3 / 06327 | 27-Mar-12 (No. 217-01533)         | Apr-13                 |
| Reference Probe ES3DV3      | SN: 3205           | 28-Dec-12 (No. ES3-3205_Dec12)    | Dec-13                 |
| DAE4                        | SN: 601            | 27-Jun-12 (No. DAE4-601_Jun12)    | Jun-13                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

Calibrated by: **Israe El-Naouq** **Israe El-Naouq** **Israe El-Naouq**  
 Name Function Laboratory Technician

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

Signature

Issued: March 18, 2013

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 108**

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 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**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                  | V52.8.5     |
| <b>Extrapolation</b>                | Advanced Extrapolation |             |
| <b>Phantom</b>                      | Modular Flat Phantom   |             |
| <b>Distance Dipole Center - TSL</b> | 15 mm                  | with Spacer |
| <b>Zoom Scan Resolution</b>         | dx, dy, dz = 5 mm      |             |
| <b>Frequency</b>                    | 750 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             | 41.9           | 0.89 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 41.1 $\pm$ 6 % | 0.92 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 | 2.19 W/kg                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>8.50 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 | 1.42 W/kg                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>5.55 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             | 55.5           | 0.96 mho/m           |
| <b>Measured Body TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 54.2 $\pm$ 6 % | 1.00 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 | 2.26 W/kg                                      |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>8.72 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 | 1.48 W/kg                                      |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>5.75 W/kg <math>\pm</math> 16.5 % (k=2)</b> |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.4 $\Omega$ - 0.9 j $\Omega$ |
| Return Loss                          | - 27.2 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.7 $\Omega$ - 2.7 j $\Omega$ |
| Return Loss                          | - 31.4 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.034 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 08, 2011 |

## DASY5 Validation Report for Head TSL

Date: 18.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1054**

Communication System: CW; Frequency: 750 MHz

Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.92 \text{ S/m}$ ;  $\epsilon_r = 41.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.28, 6.28, 6.28); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

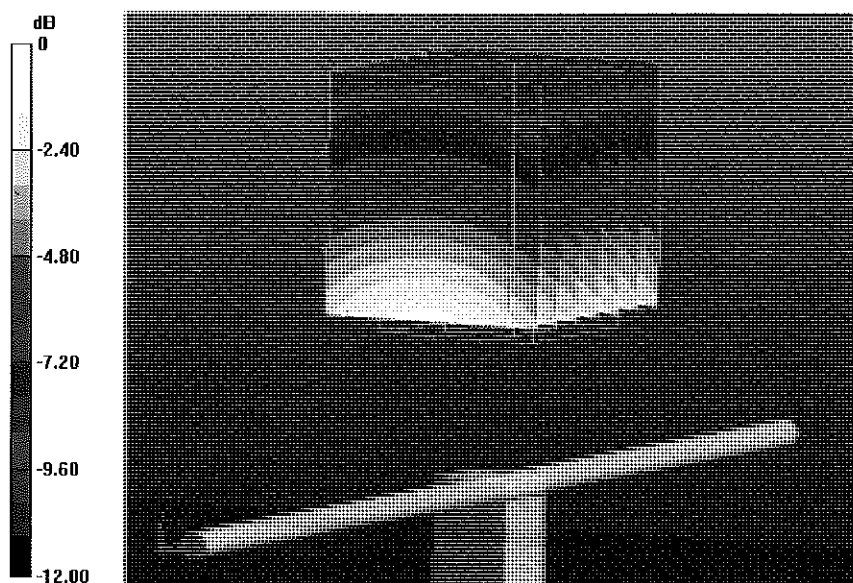
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $52.772 \text{ V/m}$ ; Power Drift =  $0.03 \text{ dB}$

Peak SAR (extrapolated) =  $3.33 \text{ W/kg}$

**SAR(1 g) =  $2.19 \text{ W/kg}$ ; SAR(10 g) =  $1.42 \text{ W/kg}$**

Maximum value of SAR (measured) =  $2.55 \text{ W/kg}$

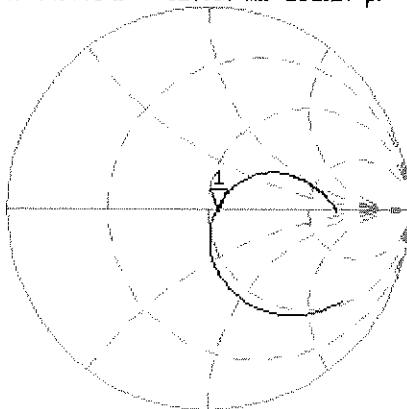


0 dB =  $2.55 \text{ W/kg}$  =  $4.07 \text{ dBW/kg}$

# Impedance Measurement Plot for Head TSL

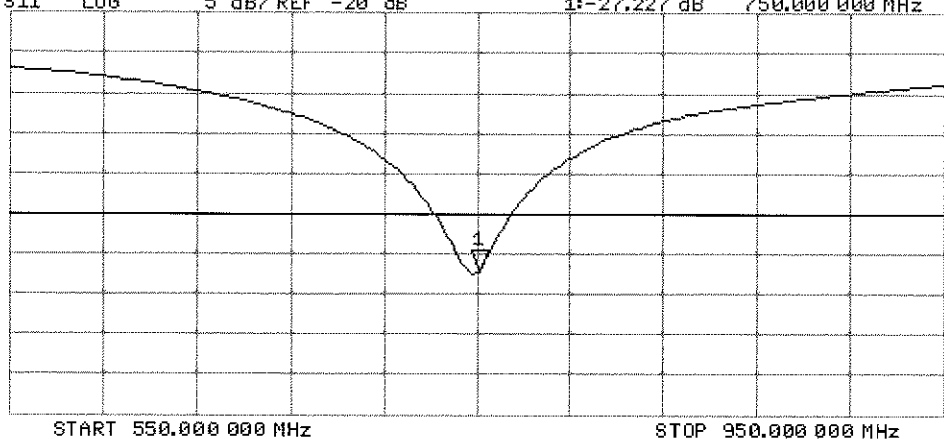
18 Mar 2013 13:14:09  
**CH1** S11 1 U FS 1: 54.449  $\Omega$  -917.97 m $\Omega$  231.17 pF 750.000 000 MHz

\*  
 Del  
 CA  
 Avg  
 16  
 H1 d



CH2 S11 LOG 5 dB/REF -20 dB 1:-27.227 dB 750.000 000 MHz

CA  
 Avg  
 16  
 H1 d



## DASY5 Validation Report for Body TSL

Date: 18.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1054**

Communication System: CW; Frequency: 750 MHz

Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 1 \text{ S/m}$ ;  $\epsilon_r = 54.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.11, 6.11, 6.11); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

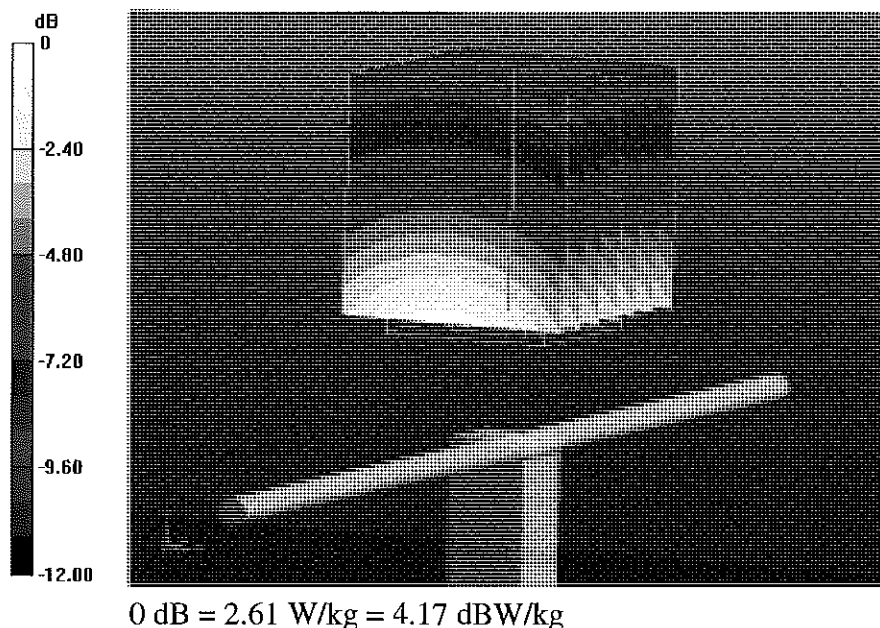
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 52.772 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.32 W/kg

**SAR(1 g) = 2.26 W/kg; SAR(10 g) = 1.48 W/kg**

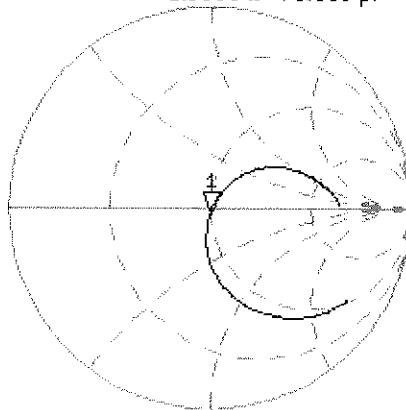
Maximum value of SAR (measured) = 2.61 W/kg



# Impedance Measurement Plot for Body TSL

18 Mar 2013 12:24:11  
 CH1 S11 1 U FS 1: 49.717  $\Delta$  -2.6553  $\Delta$  79.890 pF 750.000 000 MHz

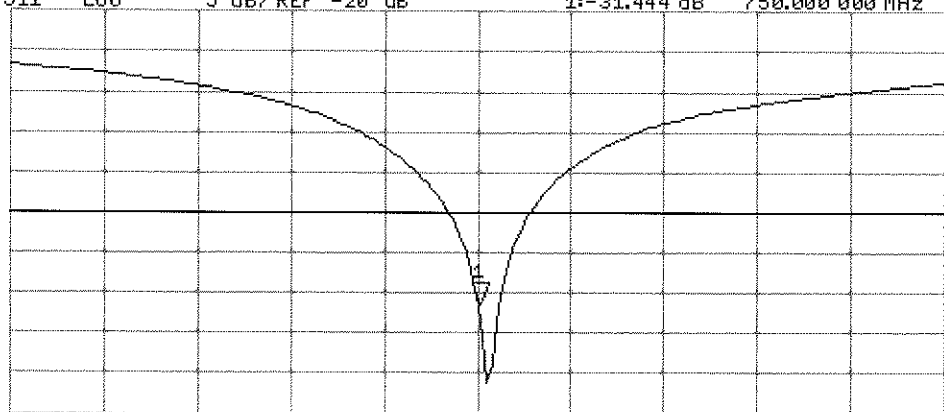
\*  
 De1  
 CA



Av9  
 16  
 H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -31.444 dB 750.000 000 MHz

CA



Av9  
 16  
 H1d

START 550.000 000 MHz

STOP 950.000 000 MHz



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d119\_Apr13**

## 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 25, 2013**

✓  
KOK  
5/8/13

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         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Power sensor HP 8481A       | US37292783         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 04-Apr-13 (No. 217-01736)         | Apr-14                 |
| Type-N mismatch combination | SN: 5047.3 / 06327 | 04-Apr-13 (No. 217-01739)         | Apr-14                 |
| Reference Probe ES3DV3      | SN: 3205           | 28-Dec-12 (No. ES3-3205_Dec12)    | Dec-13                 |
| DAE4                        | SN: 909            | 11-Sep-12 (No. DAE4-909_Sep12)    | Sep-13                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

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

Approved by: **Katja Pokovic**      Technical Manager

Signature

Issued: April 26, 2013

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

### 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 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### 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                  | V52.8.6     |
| <b>Extrapolation</b>                | Advanced Extrapolation |             |
| <b>Phantom</b>                      | Modular Flat Phantom   |             |
| <b>Distance Dipole Center - TSL</b> | 15 mm                  | with Spacer |
| <b>Zoom Scan Resolution</b>         | dx, dy, dz = 5 mm      |             |
| <b>Frequency</b>                    | 835 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             | 41.5           | 0.90 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 40.8 $\pm$ 6 % | 0.94 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 | 2.51 W/kg                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>9.68 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 | 1.62 W/kg                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>6.30 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             | 55.2           | 0.97 mho/m           |
| <b>Measured Body TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 54.0 $\pm$ 6 % | 1.01 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 | 2.47 W/kg                                      |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>9.54 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 | 1.62 W/kg                                      |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>6.31 W/kg <math>\pm</math> 16.5 % (k=2)</b> |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.1 $\Omega$ - 4.7 j $\Omega$ |
| Return Loss                          | - 26.6 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 45.8 $\Omega$ - 6.3 j $\Omega$ |
| Return Loss                          | - 22.1 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.385 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: 25.04.2013

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:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.94 \text{ S/m}$ ;  $\epsilon_r = 40.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.05, 6.05, 6.05); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 11.09.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

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

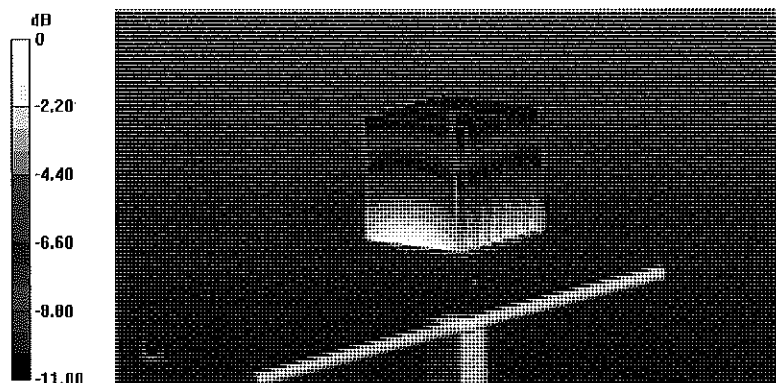
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 57.387 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.86 W/kg

**SAR(1 g) = 2.51 W/kg; SAR(10 g) = 1.62 W/kg**

Maximum value of SAR (measured) = 2.93 W/kg



0 dB = 2.93 W/kg = 4.67 dBW/kg

# Impedance Measurement Plot for Head TSL

25 Apr 2013 09:11:06  
 CH1 S11 1 U FS 1: 50.061  $\Omega$  -4.6621  $\Omega$  40.884 pF 835.000 000 MHz

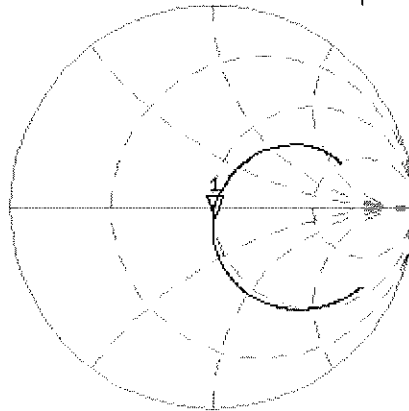
\*

Del

CA

Avg  
16

H1 d

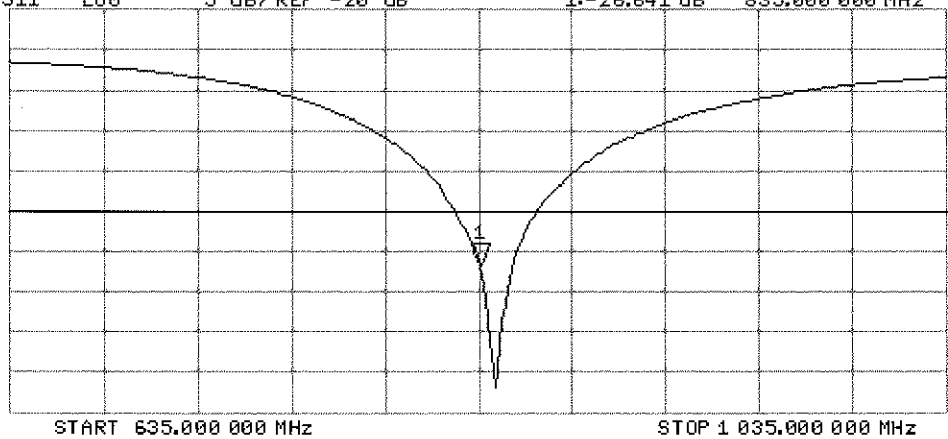


CH2 S11 LOG 5 dB/REF -20 dB 1:-26.641 dB 835.000 000 MHz

CA

Avg  
16

H1 d



## DASY5 Validation Report for Body TSL

Date: 24.04.2013

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:  $f = 835 \text{ MHz}$ ;  $\sigma = 1.01 \text{ S/m}$ ;  $\epsilon_r = 54$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 11.09.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

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

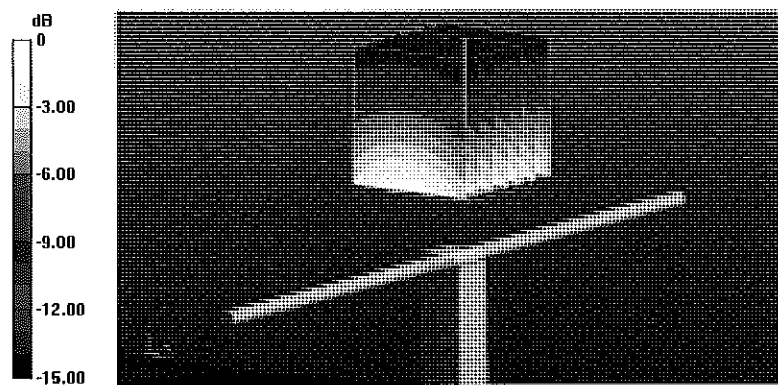
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 55.178 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.68 W/kg

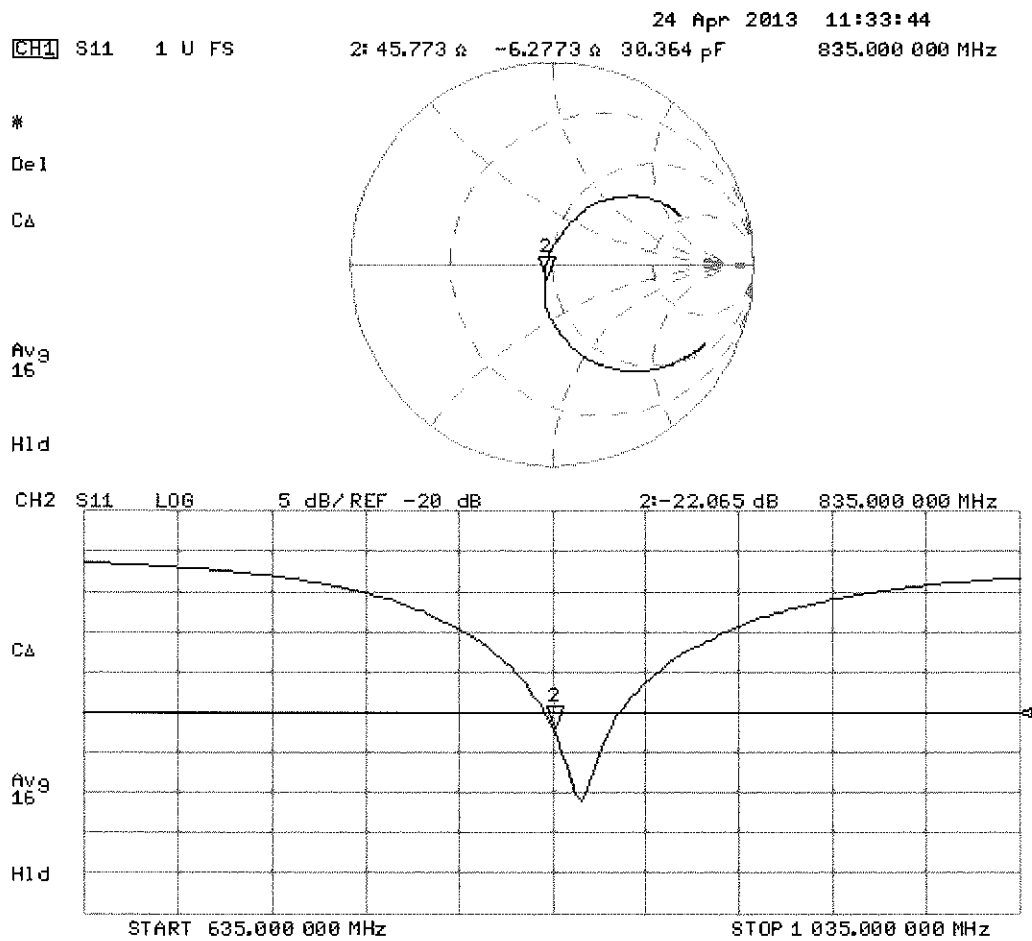
**SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.62 W/kg**

Maximum value of SAR (measured) = 2.89 W/kg



0 dB = 2.89 W/kg = 4.61 dBW/kg

Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1750V2-1051\_Apr13**

## CALIBRATION CERTIFICATE

Object **D1750V2 - SN: 1051**

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

Calibration date: **April 30, 2013**

✓  
KOK  
5/8/13

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         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Power sensor HP 8481A       | US37292783         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 04-Apr-13 (No. 217-01736)         | Apr-14                 |
| Type-N mismatch combination | SN: 5047.3 / 06327 | 04-Apr-13 (No. 217-01739)         | Apr-14                 |
| Reference Probe ES3DV3      | SN: 3205           | 28-Dec-12 (No. ES3-3205_Dec12)    | Dec-13                 |
| DAE4                        | SN: 601            | 25-Apr-13 (No. DAE4-601_Apr13)    | Apr-14                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

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

Signature

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

Issued: April 30, 2013

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Accreditation No.: **SCS 108**

### 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 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### 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                  | V52.8.6     |
| <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>                    | 1750 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             | 40.1           | 1.37 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 39.1 $\pm$ 6 % | 1.33 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 | 9.01 W/kg                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>36.5 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 | 4.83 W/kg                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>19.5 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             | 53.4           | 1.49 mho/m           |
| <b>Measured Body TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 51.8 $\pm$ 6 % | 1.50 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 | 9.55 W/kg                                      |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>37.8 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 | 5.13 W/kg                                      |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>20.4 W/kg <math>\pm</math> 16.5 % (k=2)</b> |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $50.9 \Omega + 0.3 j\Omega$ |
| Return Loss                          | - 40.7 dB                   |

### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $47.0 \Omega + 0.4 j\Omega$ |
| Return Loss                          | - 30.1 dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.222 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: 30.04.2013

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;  $\sigma = 1.33$  S/m;  $\epsilon_r = 39.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.18, 5.18, 5.18); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

### **Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (8x7x7)/Cube 0:**

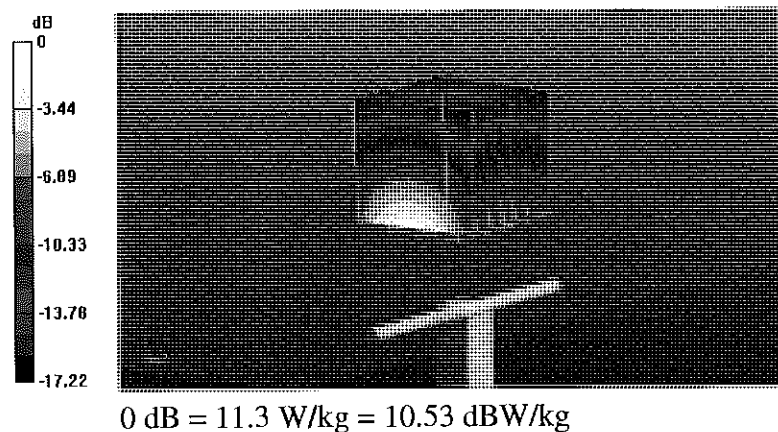
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 90.104 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 16.0 W/kg

**SAR(1 g) = 9.01 W/kg; SAR(10 g) = 4.83 W/kg**

Maximum value of SAR (measured) = 11.3 W/kg



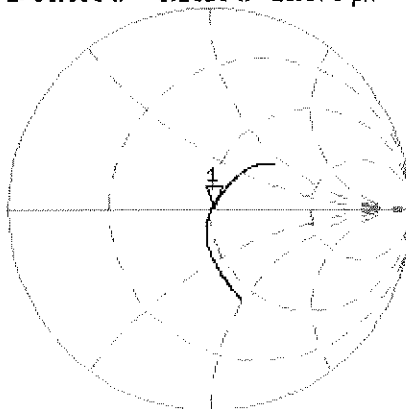
# Impedance Measurement Plot for Head TSL

30 Apr 2013 12:59:57  
 [CH1] S11 1 U FS 1: 50.889  $\Omega$  0.2813  $\Omega$  25.578  $\mu\text{H}$  1 750.000 000 MHz

\*  
 Del  
 C $\Delta$

Avs  
 4

H1d

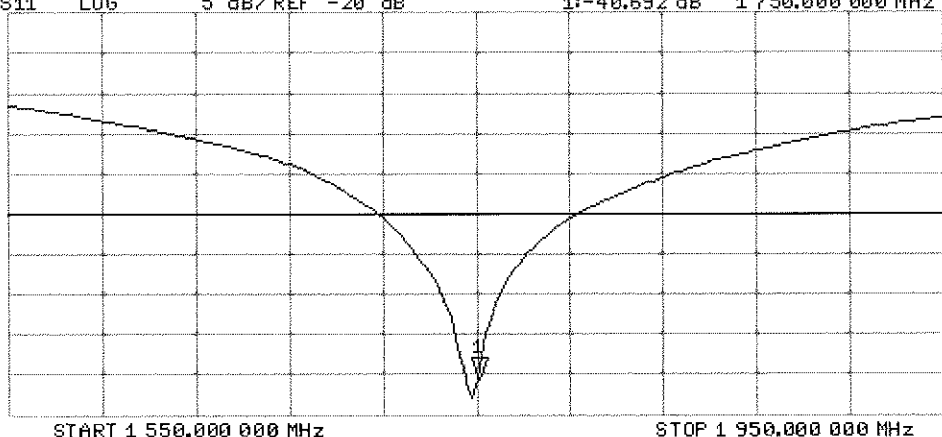


CH2 S11 LOG 5 dB/REF -20 dB 1:-40.692 dB 1 750.000 000 MHz

C $\Delta$

Avs  
 4

H1d



## DASY5 Validation Report for Body TSL

Date: 30.04.2013

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;  $\sigma = 1.5$  S/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.83, 4.83, 4.83); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

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

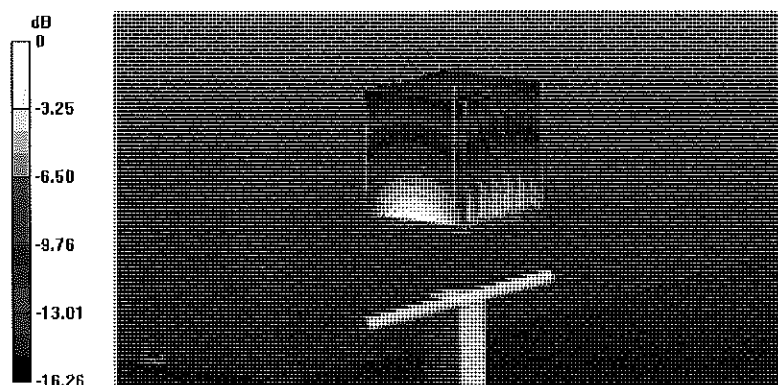
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.473 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 16.4 W/kg

**SAR(1 g) = 9.55 W/kg; SAR(10 g) = 5.13 W/kg**

Maximum value of SAR (measured) = 12.0 W/kg



0 dB = 12.0 W/kg = 10.79 dBW/kg

# Impedance Measurement Plot for Body TSL

30 Apr 2013 12:59:14  
 [CH1] S11 1 U FS 1: 46.998  $\Omega$  0.4160  $\Omega$  37.835  $\mu$ H 1 750.000 000 MHz

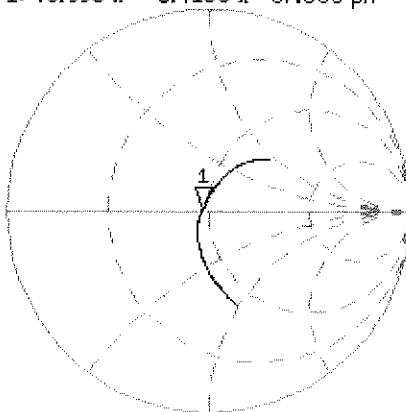
\*

De1

CA

Avg  
16

H1d

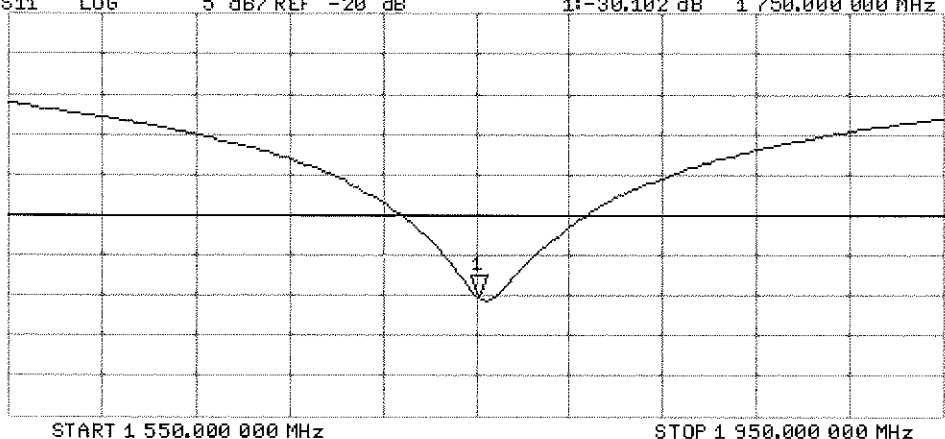


CH2 S11 LOG 5 dB/REF -20 dB 1:-30.102 dB 1 750.000 000 MHz

CA

Avg  
16

H1d





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 Multilateral Agreement for the recognition of calibration certificates

Client **PC Test**

Certificate No: **D1900V2-5d148\_Feb13**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d148**

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

Calibration date: **February 06, 2013**

✓  
KOK  
2/21/13

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         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Power sensor HP 8481A       | US37292783         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 27-Mar-12 (No. 217-01530)         | Apr-13                 |
| Type-N mismatch combination | SN: 5047.3 / 06327 | 27-Mar-12 (No. 217-01533)         | Apr-13                 |
| Reference Probe ES3DV3      | SN: 3205           | 28-Dec-12 (No. ES3-3205_Dec12)    | Dec-13                 |
| DAE4                        | SN: 601            | 27-Jun-12 (No. DAE4-601_Jun12)    | Jun-13                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

Calibrated by: **Leif Klysner**      Name: **Leif Klysner**      Function: **Laboratory Technician**

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

Signature

Issued: February 6, 2013

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**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 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**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                  | V52.8.5     |
| 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 | 39.4 $\pm$ 6 % | 1.38 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 | 9.87 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 39.7 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 | 5.18 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 20.8 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 | 51.9 $\pm$ 6 % | 1.53 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 | 10.3 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 40.8 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 | 5.45 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.7 W/kg $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 52.1 $\Omega$ + 5.9 j $\Omega$ |
| Return Loss                          | - 24.3 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.3 $\Omega$ + 6.3 j $\Omega$ |
| Return Loss                          | - 23.6 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.199 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: 06.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d148**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.38$  S/m;  $\epsilon_r = 39.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

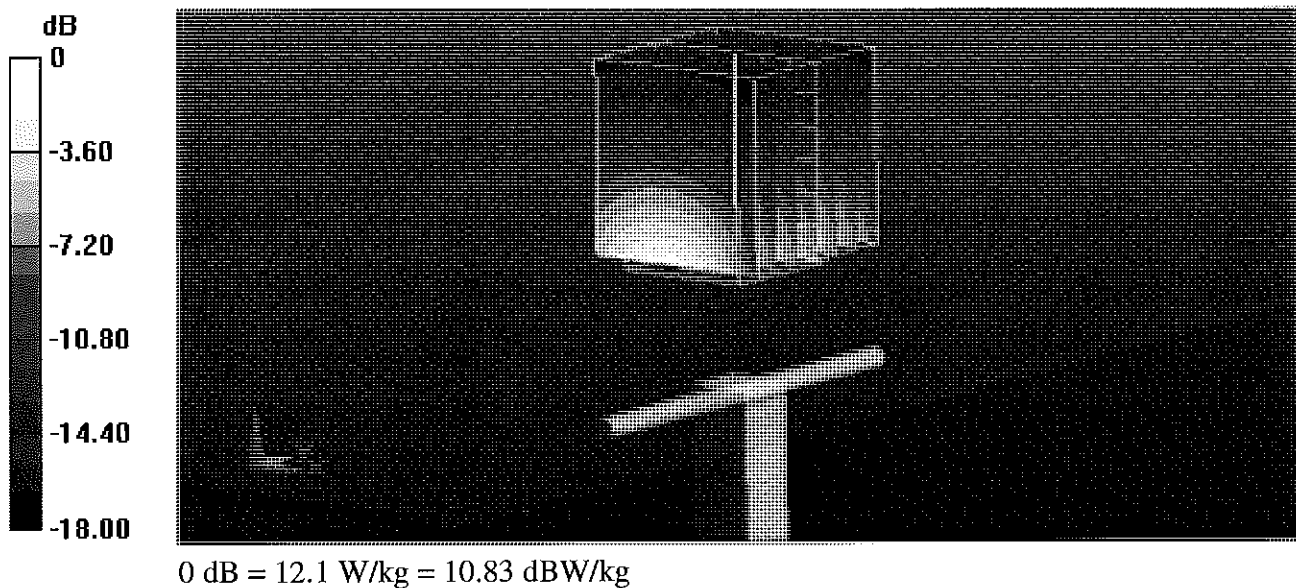
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.534 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 17.8 W/kg

**SAR(1 g) = 9.87 W/kg; SAR(10 g) = 5.18 W/kg**

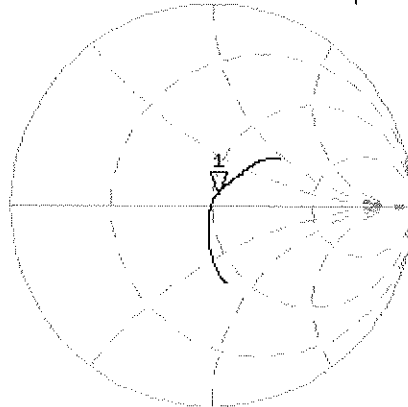
Maximum value of SAR (measured) = 12.1 W/kg



# Impedance Measurement Plot for Head TSL

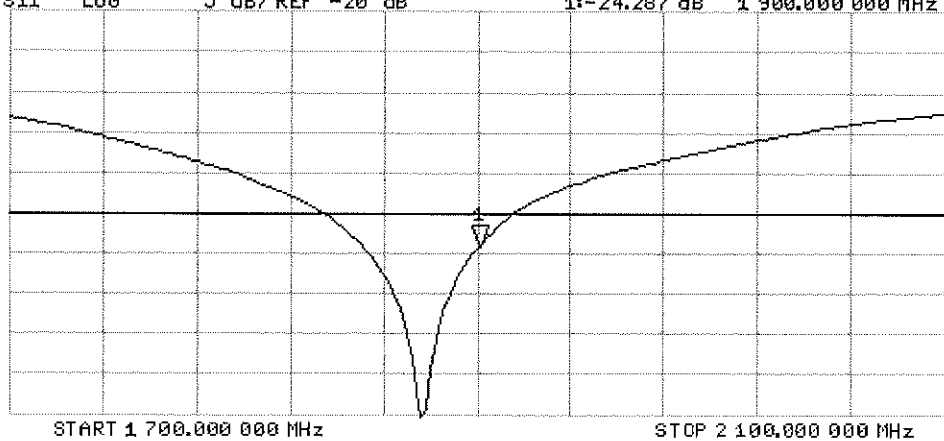
6 Feb 2013 09:25:10  
 CH1 S11 1 U FS 1: 52.125  $\angle$  5.8711  $\angle$  491.80  $\mu$ H 1 900.000 000 MHz

\*  
 Del  
 CA  
 Avg  
 16  
 H1d



CH2 S11 LOG 5 dB/REF -20 dB 1: -24.287 dB 1 900.000 000 MHz

CA  
 Avg  
 16  
 H1d



## DASY5 Validation Report for Body TSL

Date: 06.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d148**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.53$  S/m;  $\epsilon_r = 51.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

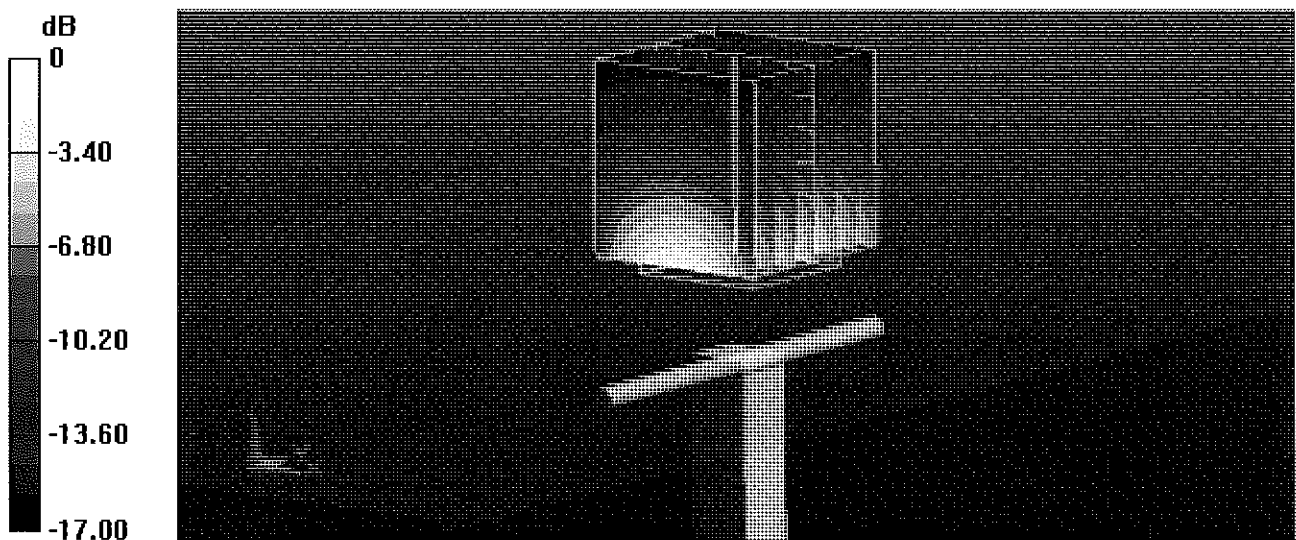
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.534 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 17.9 W/kg

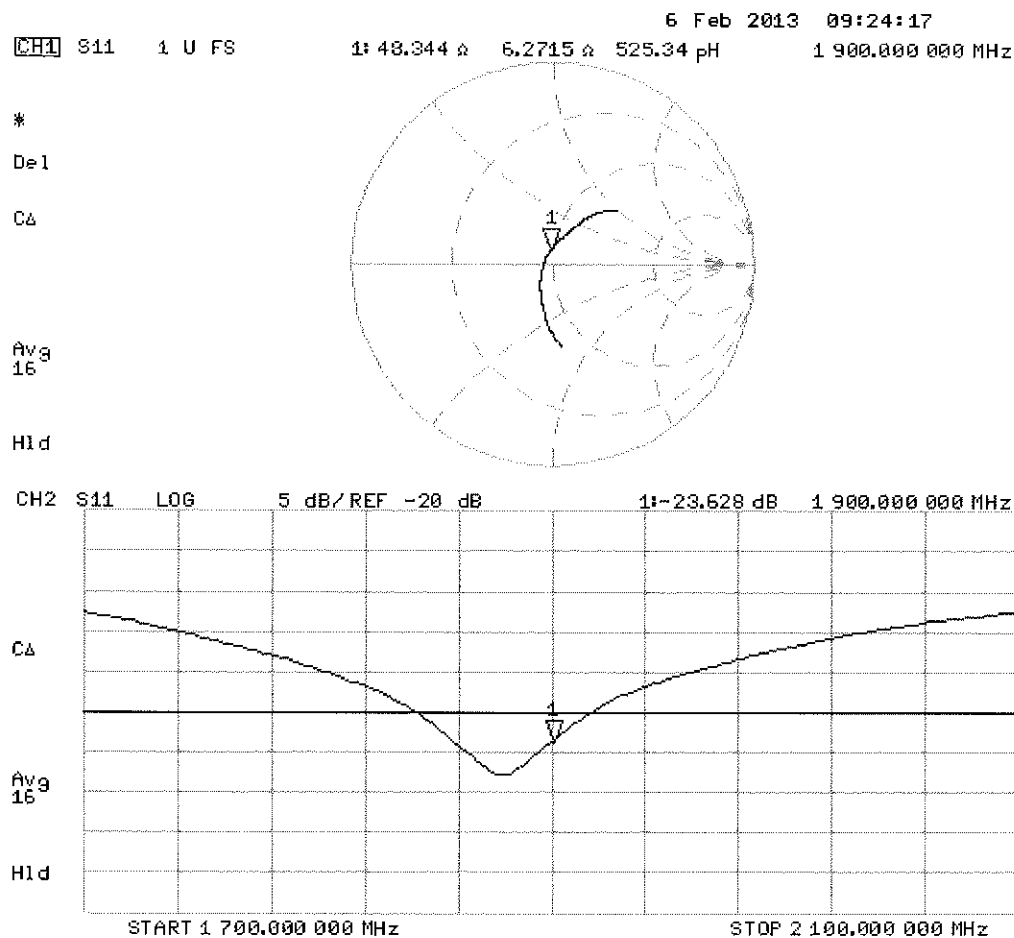
**SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.45 W/kg**

Maximum value of SAR (measured) = 13.1 W/kg



0 dB = 13.1 W/kg = 11.17 dBW/kg

Impedance Measurement Plot for Body TSL





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Client **PC Test**

Certificate No: **D2450V2-797\_Jan13**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 797**

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

Calibration date: **January 08, 2013**

✓  
KOK  
1/28/13

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         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Power sensor HP 8481A       | US37292783         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 27-Mar-12 (No. 217-01530)         | Apr-13                 |
| Type-N mismatch combination | SN: 5047.3 / 06327 | 27-Mar-12 (No. 217-01533)         | Apr-13                 |
| Reference Probe ES3DV3      | SN: 3205           | 28-Dec-12 (No. ES3-3205_Dec12)    | Dec-13                 |
| DAE4                        | SN: 601            | 27-Jun-12 (No. DAE4-601_Jun12)    | Jun-13                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

Calibrated by: **Israe El-Naouq**      Name: **Israe El-Naouq**      Function: **Laboratory Technician**

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

Signature  
*Israe El-Naouq*  
*Katja Pokovic*

Issued: January 8, 2013

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### 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 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### 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                  | V52.8.4     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 2450 MHz $\pm$ 1 MHz   |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 39.2           | 1.80 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 37.9 $\pm$ 6 % | 1.85 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 | 13.4 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 52.5 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 | 6.20 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.5 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             | 52.7           | 1.95 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 50.5 $\pm$ 6 % | 2.01 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 | 12.7 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 49.6 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 | 5.88 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 23.2 W/kg $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $53.3 \Omega + 3.1 j\Omega$ |
| Return Loss                          | - 27.1 dB                   |

### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $49.1 \Omega + 4.9 j\Omega$ |
| Return Loss                          | - 26.0 dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.152 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 24, 2006 |

## DASY5 Validation Report for Head TSL

Date: 08.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 797**

Communication System: CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.85$  S/m;  $\epsilon_r = 37.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

### Dipole Calibration for Head Tissue/ $P_{in}=250$ mW, $d=10$ mm/Zoom Scan (7x7x7)/Cube 0:

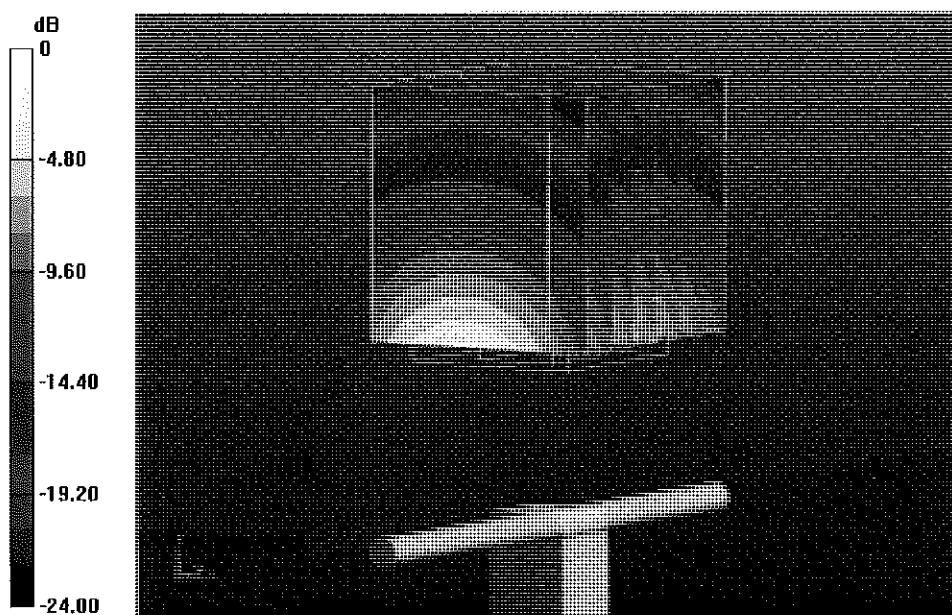
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 99.154 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 27.8 W/kg

**SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.2 W/kg**

Maximum value of SAR (measured) = 17.0 W/kg

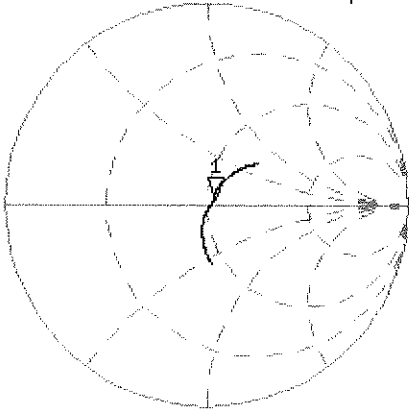


0 dB = 17.0 W/kg = 12.30 dBW/kg

Impedance Measurement Plot for Head TSL

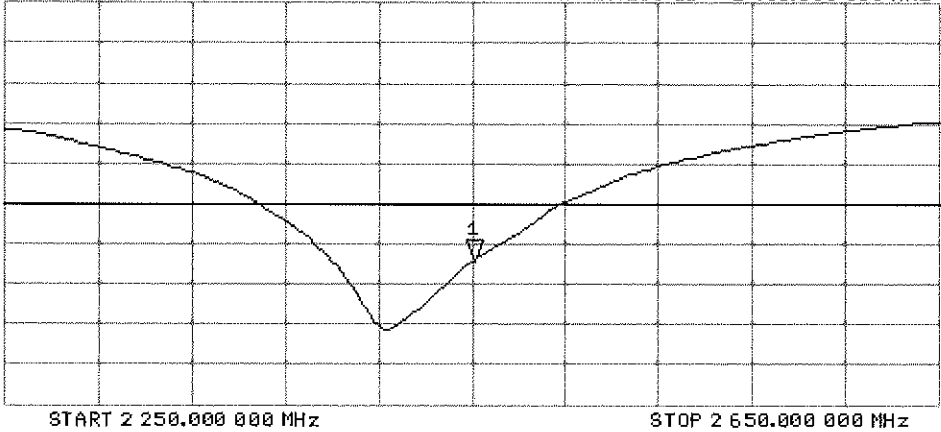
8 Jan 2013 12:37:14  
CH1 S11 1 U FS 1: 53.346  $\angle$  3.0762  $\angle$  199.83 pH 2 450.000 000 MHz

\*  
De1  
Cor  
Avg  
16  
H1d



CH2 S11 LOG 5 dB/REF -20 dB 1: -27.136 dB 2 450.000 000 MHz

Cor  
Avg  
16  
H1d



## DASY5 Validation Report for Body TSL

Date: 08.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 797**

Communication System: CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.01$  S/m;  $\epsilon_r = 50.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

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

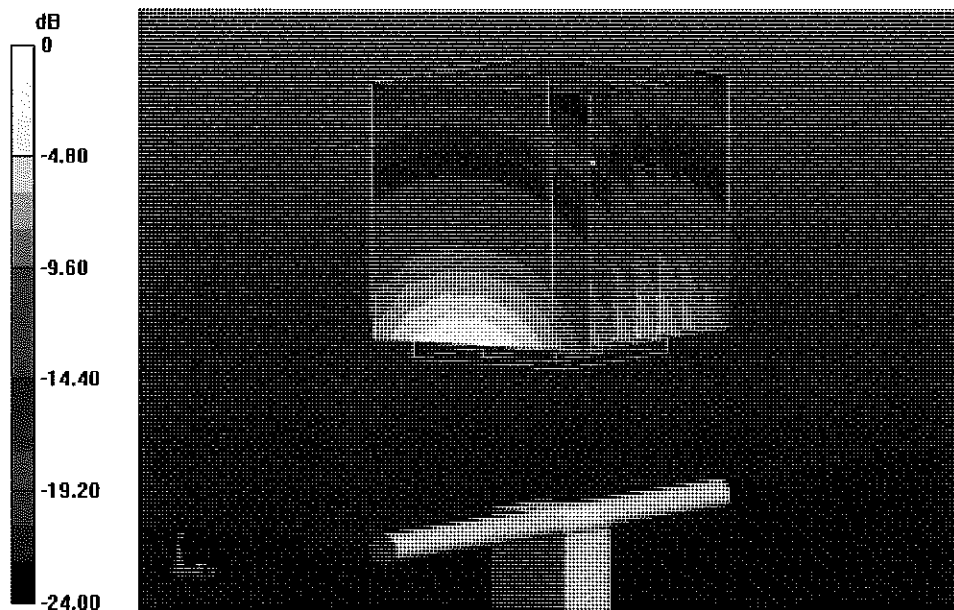
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.935 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.7 W/kg

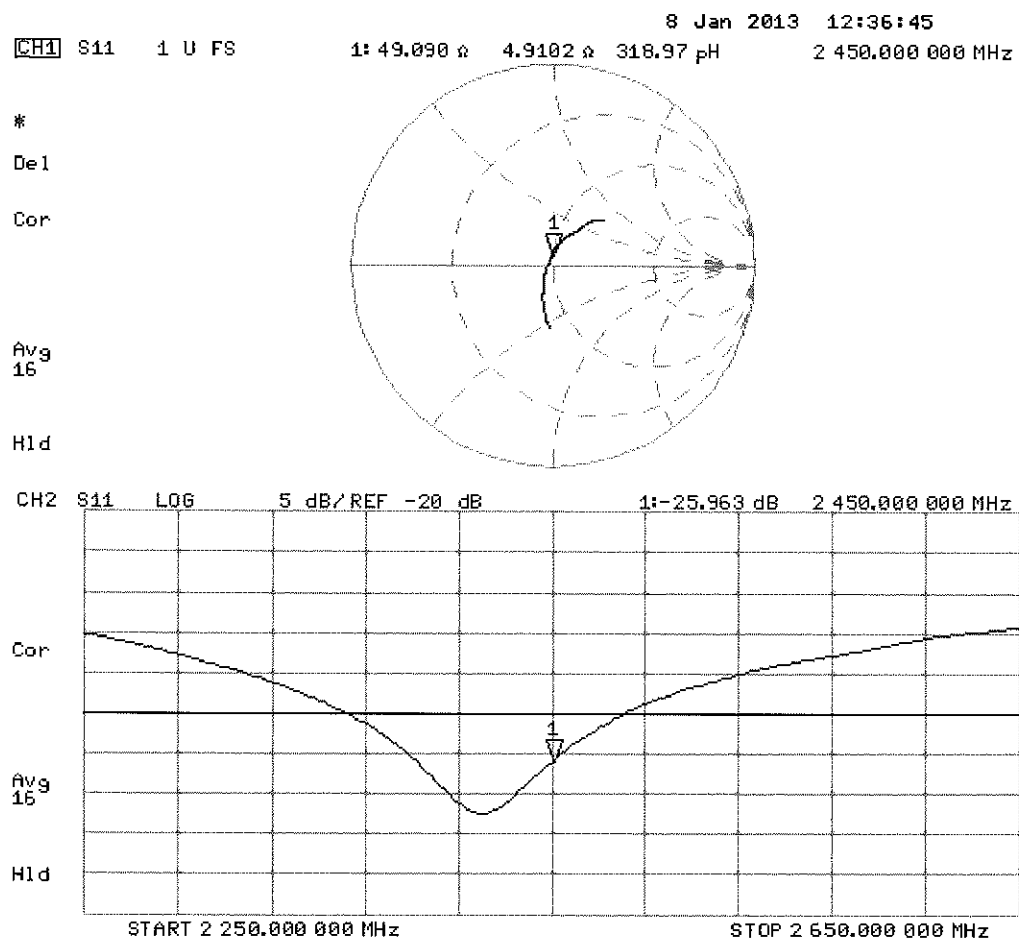
**SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.88 W/kg**

Maximum value of SAR (measured) = 16.7 W/kg



0 dB = 16.7 W/kg = 12.23 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: **D5GHzV2-1057\_Jan13**

## CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1057**

Calibration procedure(s) **QA CAL-22.v2**  
**Calibration procedure for dipole validation kits between 3-6 GHz**

Calibration date: **January 11, 2013**

✓  
KOK  
1/29/13

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         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Power sensor HP 8481A       | US37292783         | 01-Nov-12 (No. 217-01640)         | Oct-13                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 27-Mar-12 (No. 217-01530)         | Apr-13                 |
| Type-N mismatch combination | SN: 5047.3 / 06327 | 27-Mar-12 (No. 217-01533)         | Apr-13                 |
| Reference Probe EX3DV4      | SN: 3503           | 28-Dec-12 (No. EX3-3503_Dec12)    | Dec-13                 |
| DAE4                        | SN: 601            | 27-Jun-12 (No. DAE4-601_Jun12)    | Jun-13                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

Calibrated by: **Israe El-Naouq** Function: **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** Technical Manager

*Israe El-Naouq*  
*Katja Pokovic*

Issued: January 11, 2013

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



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Accreditation No.: **SCS 108**

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:

- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### 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                                                                                                                | V52.8.5                          |
| <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 | 34.6 $\pm$ 6 % | 4.50 mho/m $\pm$ 6 % |
| <b>Head TSL temperature change during test</b> | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL at 5200 MHz

|                                                             |                    |                                                |
|-------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                                |
| SAR measured                                                | 100 mW input power | 7.66 W/kg                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>75.9 W/kg <math>\pm</math> 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 | 2.17 W/kg                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>21.4 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 | 34.5 ± 6 %   | 4.60 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 | 7.76 W/kg                  |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 76.9 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 | 2.22 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 21.9 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 | 34.2 ± 6 %   | 4.79 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 | 8.09 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 80.1 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 | 2.28 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 22.5 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 | 34.1 ± 6 %   | 4.88 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 | 8.12 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 80.4 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 | 2.30 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 22.7 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 | 33.8 ± 6 %   | 5.09 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 | 7.69 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 76.1 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 | 2.17 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 21.4 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 | 47.0 ± 6 %   | 5.42 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 | 7.61 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 75.5 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 | 2.13 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.1 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 | 46.8 ± 6 %   | 5.55 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 | 7.59 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 75.3 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 | 2.13 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.1 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 | 46.5 ± 6 %   | 5.81 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 | 8.14 W/kg                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>80.8 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 | 2.26 W/kg                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>22.4 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 | 46.3 ± 6 %   | 5.94 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 | 8.10 W/kg                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>80.3 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 | 2.25 W/kg                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>22.3 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 | 46.0 ± 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 | 7.57 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 75.1 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 | 2.09 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 20.7 W/kg ± 19.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL at 5200 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.5 $\Omega$ - 9.8 j $\Omega$ |
| Return Loss                          | - 20.3 dB                      |

### Antenna Parameters with Head TSL at 5300 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.5 $\Omega$ - 4.5 j $\Omega$ |
| Return Loss                          | - 26.4 dB                      |

### Antenna Parameters with Head TSL at 5500 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.6 $\Omega$ - 5.8 j $\Omega$ |
| Return Loss                          | - 24.8 dB                      |

### Antenna Parameters with Head TSL at 5600 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 53.9 $\Omega$ - 3.8 j $\Omega$ |
| Return Loss                          | - 25.6 dB                      |

### Antenna Parameters with Head TSL at 5800 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 52.5 $\Omega$ - 4.4 j $\Omega$ |
| Return Loss                          | - 26.1 dB                      |

### Antenna Parameters with Body TSL at 5200 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.3 $\Omega$ - 7.9 j $\Omega$ |
| Return Loss                          | - 22.0 dB                      |

### Antenna Parameters with Body TSL at 5300 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.7 $\Omega$ - 3.2 j $\Omega$ |
| Return Loss                          | - 29.2 dB                      |

### Antenna Parameters with Body TSL at 5500 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.2 $\Omega$ - 4.8 j $\Omega$ |
| Return Loss                          | - 26.2 dB                      |

### Antenna Parameters with Body TSL at 5600 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 53.6 $\Omega$ - 2.1 j $\Omega$ |
| Return Loss                          | - 27.9 dB                      |

## Antenna Parameters with Body TSL at 5800 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 53.3 $\Omega$ - 2.9 j $\Omega$ |
| Return Loss                          | - 27.4 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: 11.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1057**

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 4.5$  S/m;  $\epsilon_r = 34.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5300$  MHz;  $\sigma = 4.6$  S/m;  $\epsilon_r = 34.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5500$  MHz;  $\sigma = 4.79$  S/m;  $\epsilon_r = 34.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.88$  S/m;  $\epsilon_r = 34.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.09$  S/m;  $\epsilon_r = 33.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 28.12.2012, ConvF(5.1, 5.1, 5.1); Calibrated: 28.12.2012, ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.76, 4.76, 4.76); Calibrated: 28.12.2012, ConvF(4.81, 4.81, 4.81); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

**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 = 63.671 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 29.4 W/kg

**SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.17 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 = 63.473 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 30.3 W/kg

**SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.22 W/kg**

Maximum value of SAR (measured) = 18.8 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 = 63.735 V/m; Power Drift = 0.08 dB

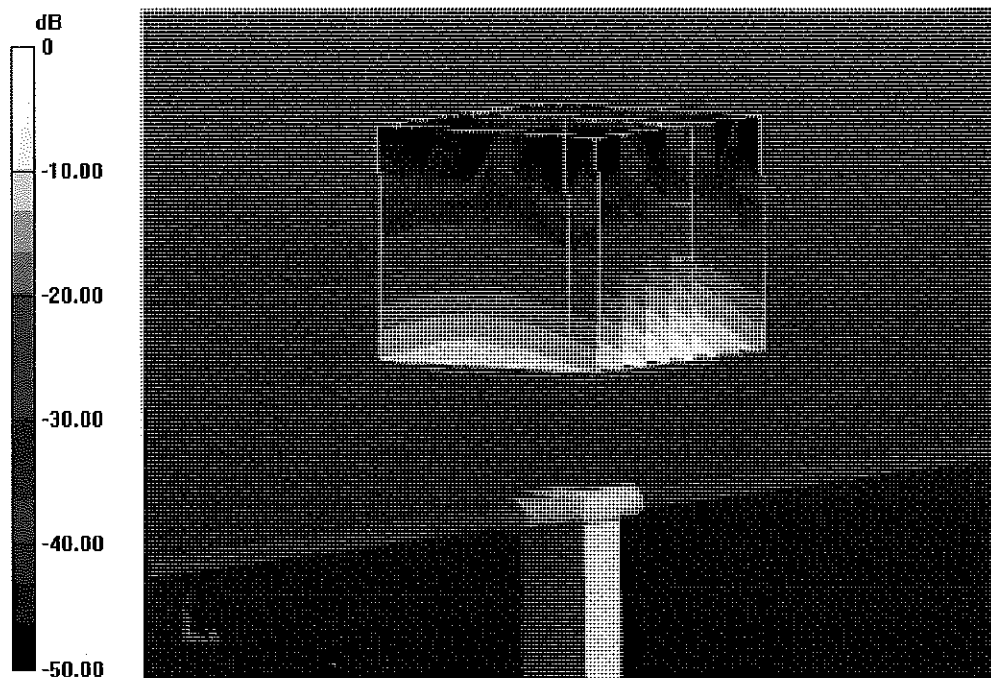
Peak SAR (extrapolated) = 33.2 W/kg

**SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.28 W/kg**

Maximum value of SAR (measured) = 20.1 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 = 63.848 V/m; Power Drift = 0.09 dB  
Peak SAR (extrapolated) = 33.5 W/kg  
**SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.3 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 = 60.467 V/m; Power Drift = 0.08 dB  
Peak SAR (extrapolated) = 33.3 W/kg  
**SAR(1 g) = 7.69 W/kg; SAR(10 g) = 2.17 W/kg**  
Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 19.4 W/kg = 12.88 dBW/kg

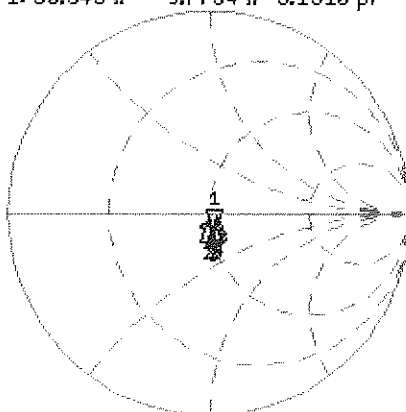
# Impedance Measurement Plot for Head TSL

11 Jan 2013 09:26:56  
 [CH1] S11 1 U FS 1: 50.543  $\Omega$  -9.7754  $\Omega$  3.1310 pF 5 200.000 000 MHz

\*  
 Del  
 CA

Avg  
 16

H1 d



CH1 Markers

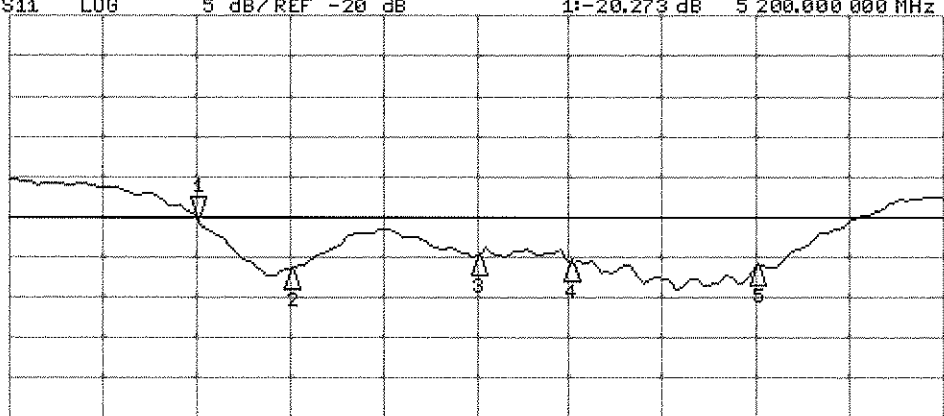
2: 48.508  $\Omega$   
 -4.4805  $\Omega$   
 5.30000 GHz  
 3: 50.617  $\Omega$   
 -5.7559  $\Omega$   
 5.50000 GHz  
 4: 53.891  $\Omega$   
 -3.8418  $\Omega$   
 5.60000 GHz  
 5: 52.500  $\Omega$   
 -4.4160  $\Omega$   
 5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -20.273 dB 5 200.000 000 MHz

CA

Avg  
 16

H1 d



CH2 Markers

2: -26.396 dB  
 5.30000 GHz  
 3: -24.818 dB  
 5.50000 GHz  
 4: -25.573 dB  
 5.60000 GHz  
 5: -26.115 dB  
 5.80000 GHz

START 5 000.000 000 MHz

STOP 6 000.000 000 MHz

## DASY5 Validation Report for Body TSL

Date: 10.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1057**

Communication System: 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;  $\epsilon_r = 47$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5300$  MHz;  $\sigma = 5.55$  S/m;  $\epsilon_r = 46.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5500$  MHz;  $\sigma = 5.81$  S/m;  $\epsilon_r = 46.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.94$  S/m;  $\epsilon_r = 46.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.21$  S/m;  $\epsilon_r = 46$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.67, 4.67, 4.67); Calibrated: 28.12.2012, ConvF(4.43, 4.43, 4.43); Calibrated: 28.12.2012, ConvF(4.22, 4.22, 4.22); Calibrated: 28.12.2012, ConvF(4.38, 4.38, 4.38); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

**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 = 59.074 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 30.4 W/kg

**SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.13 W/kg**

Maximum value of SAR (measured) = 18.0 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 = 58.924 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 30.9 W/kg

**SAR(1 g) = 7.59 W/kg; SAR(10 g) = 2.13 W/kg**

Maximum value of SAR (measured) = 17.9 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 = 59.561 V/m; Power Drift = -0.01 dB

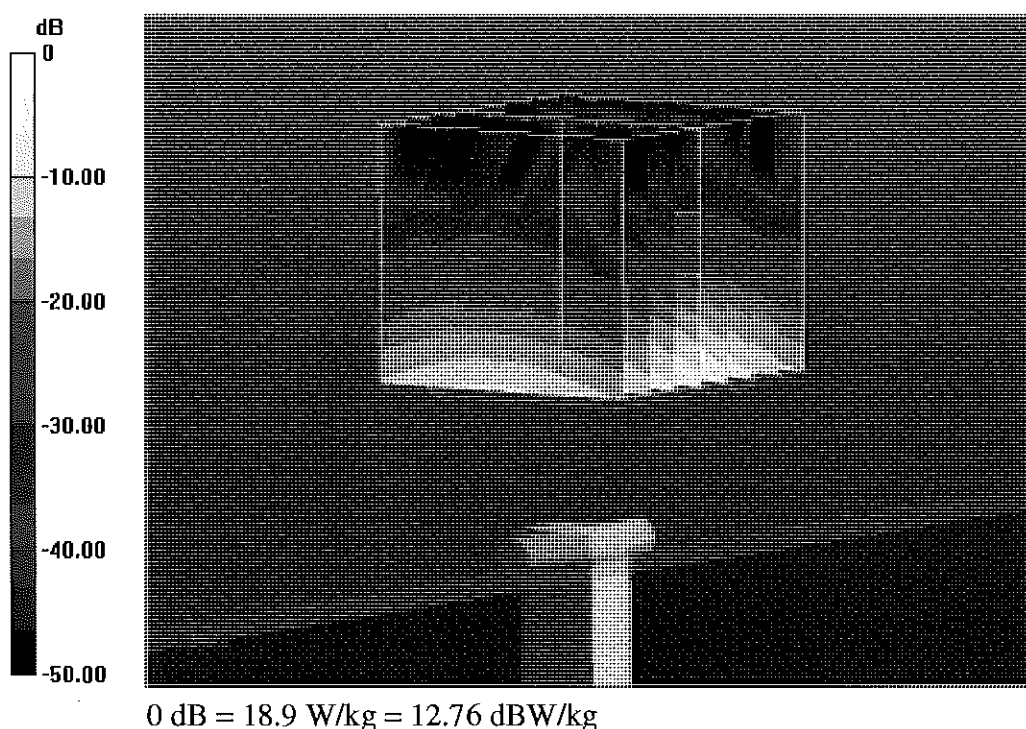
Peak SAR (extrapolated) = 35.3 W/kg

**SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.26 W/kg**

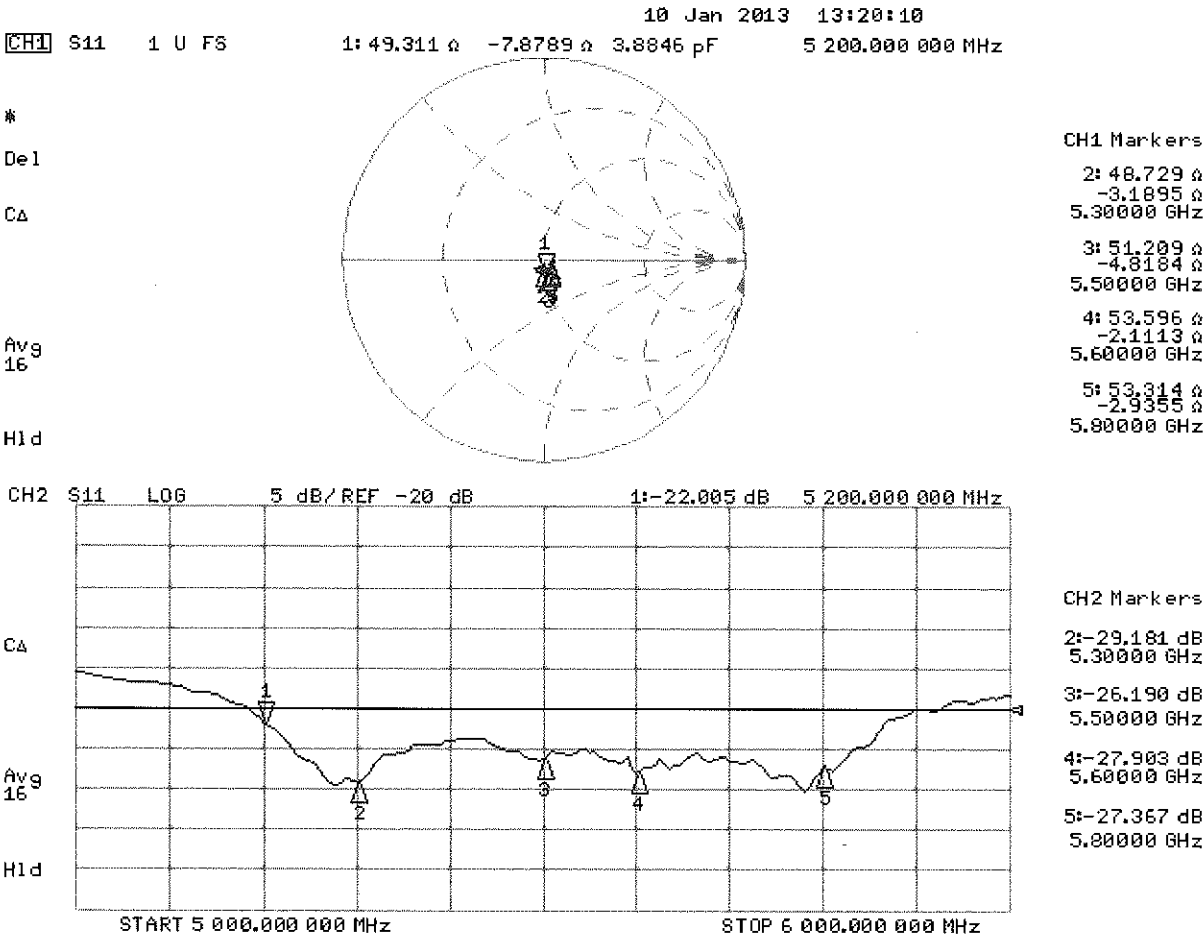
Maximum value of SAR (measured) = 19.7 W/kg

**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 = 58.884 V/m; Power Drift = -0.02 dB  
Peak SAR (extrapolated) = 36.3 W/kg  
**SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.25 W/kg**  
Maximum value of SAR (measured) = 20.0 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 = 55.753 V/m; Power Drift = -0.00 dB  
Peak SAR (extrapolated) = 35.6 W/kg  
**SAR(1 g) = 7.57 W/kg; SAR(10 g) = 2.09 W/kg**  
Maximum value of SAR (measured) = 18.9 W/kg



Impedance Measurement Plot for Body TSL





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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3287\_Nov12**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3287**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4**  
**Calibration procedure for dosimetric E-field probes**

Calibration date: **November 15, 2012**

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      | 29-Mar-12 (No. 217-01508)         | Apr-13                 |
| Power sensor E4412A        | MY41498087      | 29-Mar-12 (No. 217-01508)         | Apr-13                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 27-Mar-12 (No. 217-01531)         | Apr-13                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529)         | Apr-13                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532)         | Apr-13                 |
| Reference Probe ES3DV2     | SN: 3013        | 29-Dec-11 (No. ES3-3013_Dec11)    | Dec-12                 |
| DAE4                       | SN: 660         | 20-Jun-12 (No. DAE4-660_Jun12)    | Jun-13                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-11)  | In house check: Apr-13 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

|                |                         |                                   |                           |
|----------------|-------------------------|-----------------------------------|---------------------------|
| Calibrated by: | Name<br>Claudio Leubler | Function<br>Laboratory Technician | Signature<br>             |
| Approved by:   | Name<br>Katja Pokovic   | Function<br>Technical Manager     | Signature<br>             |
|                |                         |                                   | Issued: November 16, 2012 |

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



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## 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                  | 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 |

## Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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>; VR<sub>x,y,z</sub>**: A, B, C 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.

# Probe ES3DV3

## SN:3287

Manufactured: June 7, 2010  
Calibrated: November 15, 2012

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|-----------------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.31     | 1.25     | 1.25     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 102.9    | 103.6    | 101.6    |               |

### Modulation Calibration Parameters

| UID | Communication System Name | PAR  |   | A<br>dB | B<br>dB | C<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-----|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 0   | CW                        | 0.00 | X | 0.0     | 0.0     | 1.0     | 116.8    | $\pm 3.5 \%$              |
|     |                           |      | Y | 0.0     | 0.0     | 1.0     | 118.5    |                           |
|     |                           |      | Z | 0.0     | 0.0     | 1.0     | 154.1    |                           |

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 5 and 6).

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

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

### 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 | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.40    | 6.40    | 6.40    | 0.20  | 2.54       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.17    | 6.17    | 6.17    | 0.34  | 1.68       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.16    | 5.16    | 5.16    | 0.63  | 1.30       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 4.96    | 4.96    | 4.96    | 0.48  | 1.55       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.30    | 4.30    | 4.30    | 0.79  | 1.31       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.19    | 4.19    | 4.19    | 0.80  | 1.31       | ± 12.0 %    |

<sup>C</sup> Frequency validity 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.

<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.

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

### Calibration Parameter Determined in Body Tissue Simulating Media

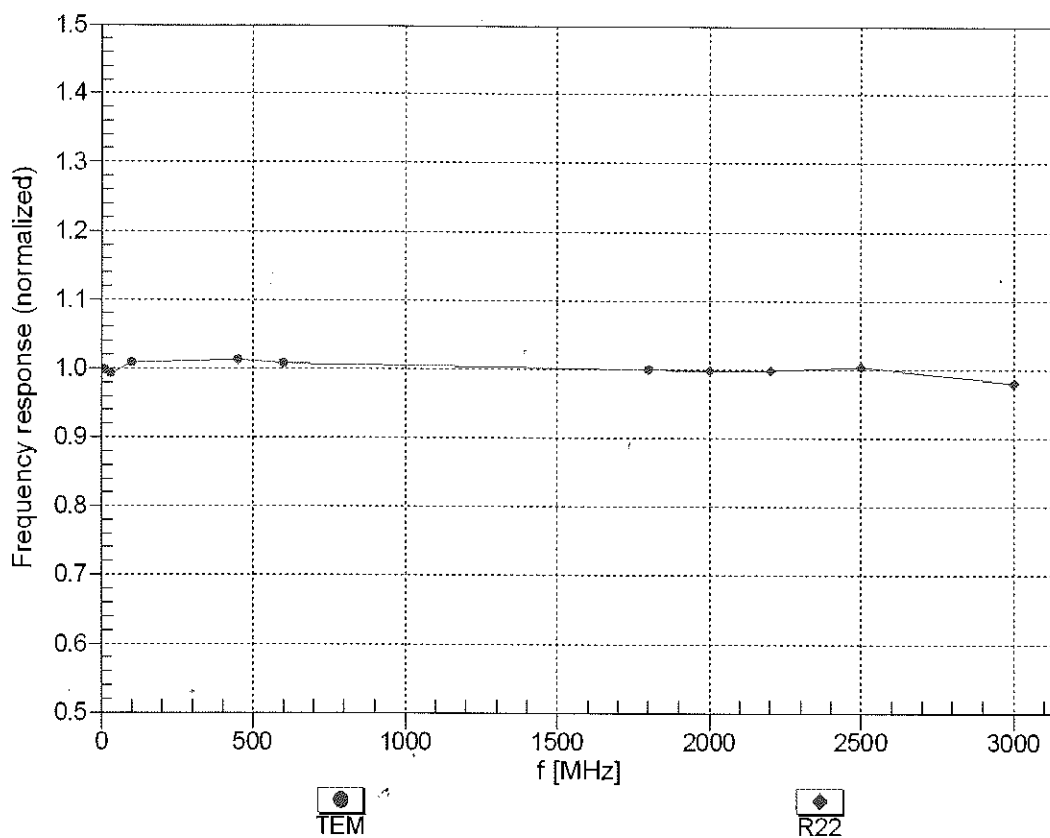
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 6.14    | 6.14    | 6.14    | 0.28  | 2.06       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 6.06    | 6.06    | 6.06    | 0.42  | 1.63       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 4.86    | 4.86    | 4.86    | 0.43  | 1.64       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 4.69    | 4.69    | 4.69    | 0.56  | 1.54       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.29    | 4.29    | 4.29    | 0.80  | 1.02       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 4.12    | 4.12    | 4.12    | 0.64  | 0.92       | ± 12.0 %    |

<sup>C</sup> Frequency validity 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.

<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.

## Frequency Response of E-Field

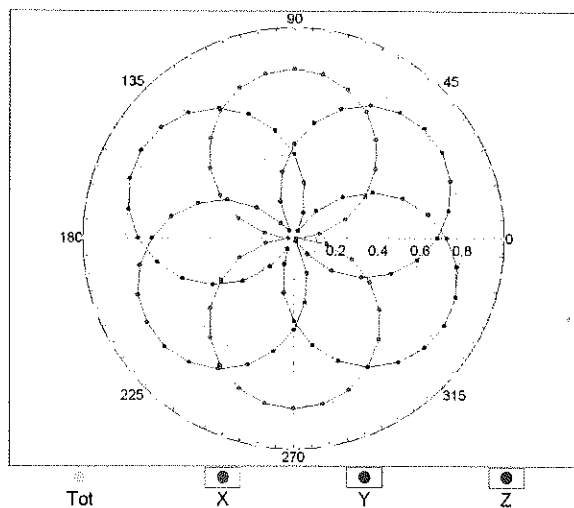
(TEM-Cell: ifi110 EXX, Waveguide: R22)



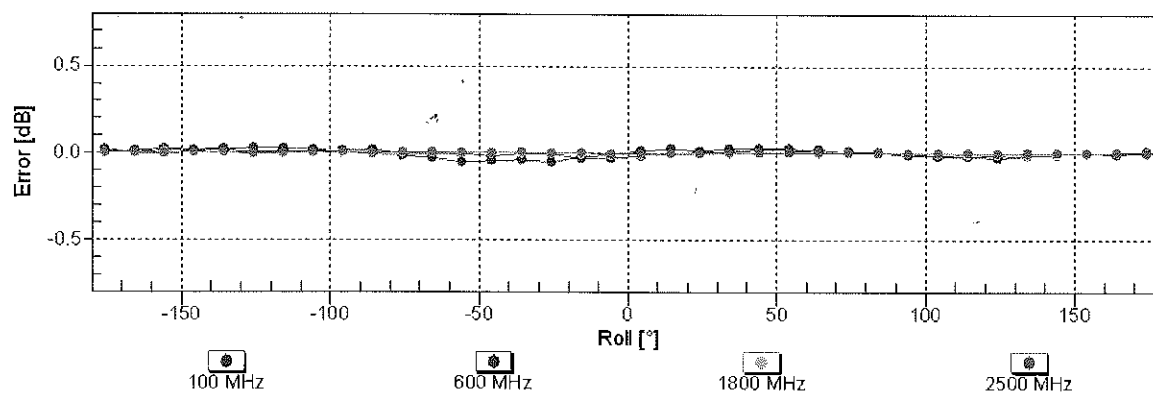
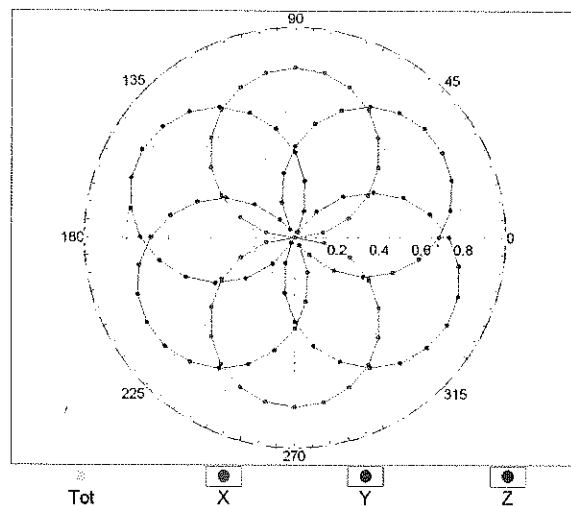
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

f=600 MHz, TEM

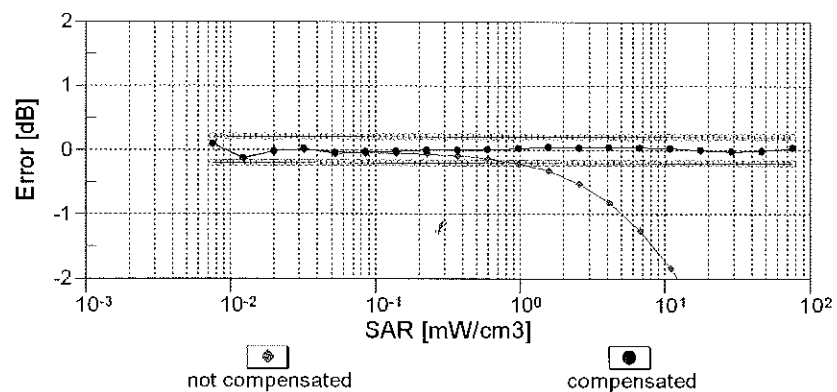
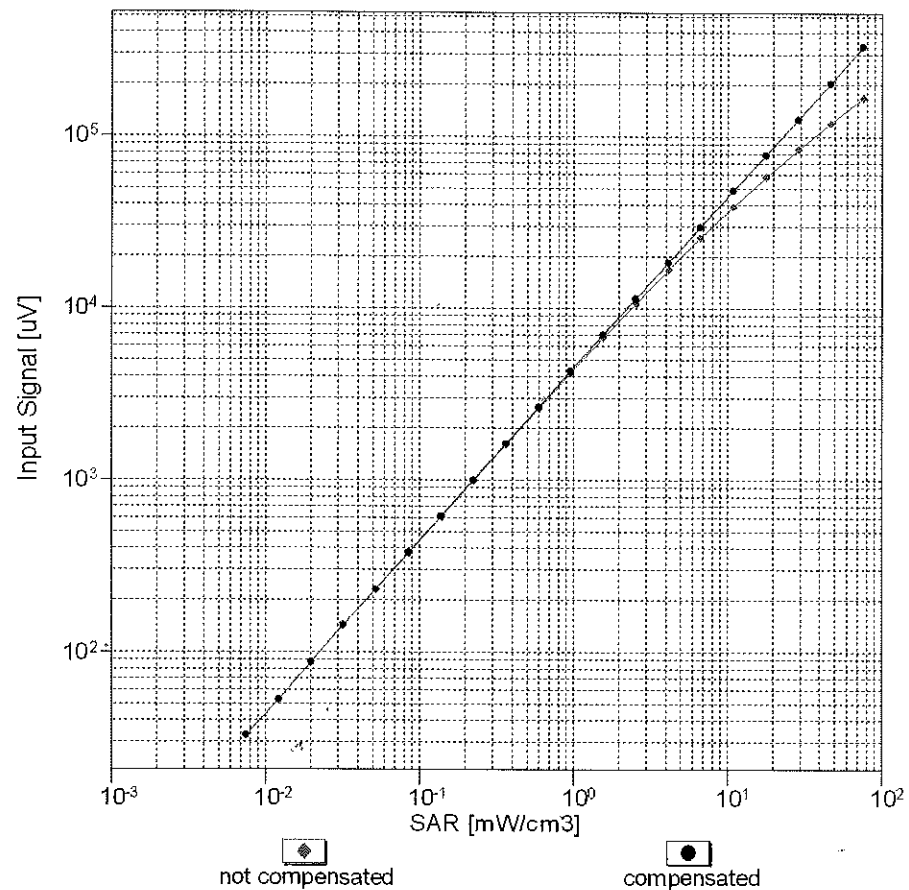


f=1800 MHz, R22



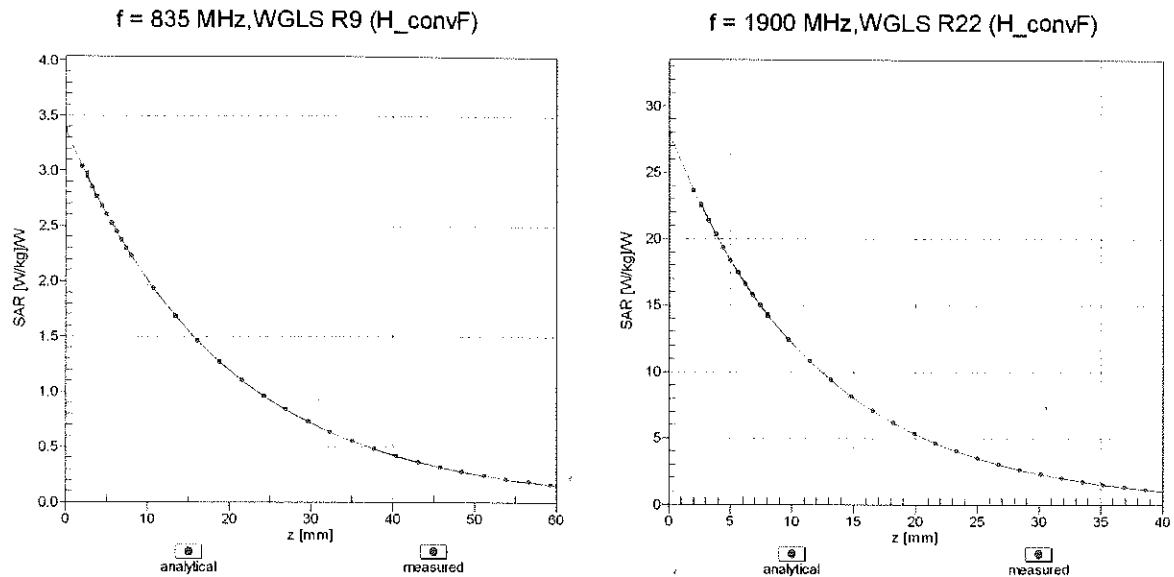
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

## Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f = 900 \text{ MHz}$ )



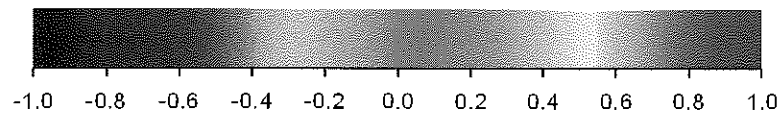
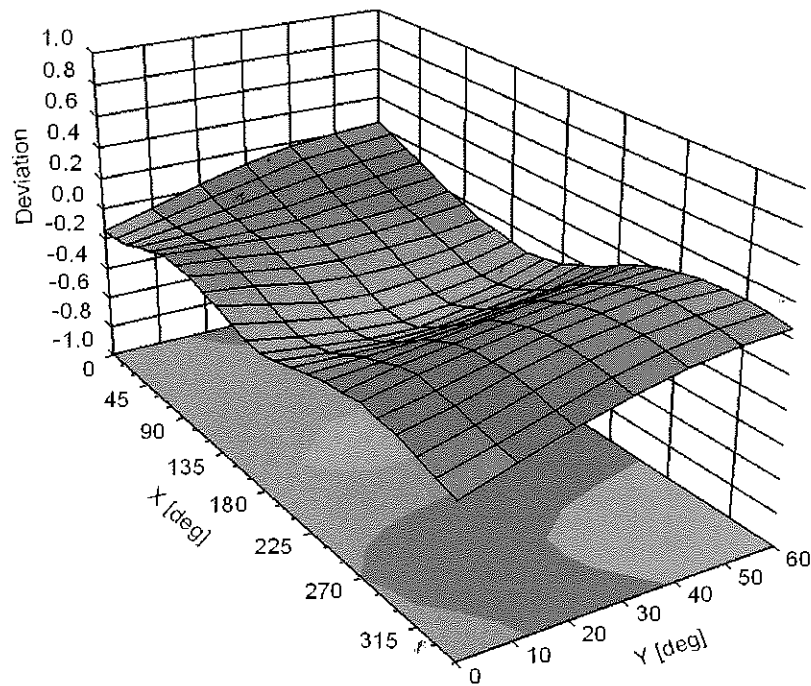
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## 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:3287

### Other Probe Parameters

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | -15.9      |
| 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       |



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3209\_Mar13**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3209**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4**  
**Calibration procedure for dosimetric E-field probes**

Calibration date: **March 15, 2013**

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)

✓ KOK  
3/24/13

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 29-Mar-12 (No. 217-01508)         | Apr-13                 |
| Power sensor E4412A        | MY41498087      | 29-Mar-12 (No. 217-01508)         | Apr-13                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 27-Mar-12 (No. 217-01531)         | Apr-13                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529)         | Apr-13                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532)         | Apr-13                 |
| Reference Probe ES3DV2     | SN: 3013        | 28-Dec-12 (No. ES3-3013_Dec12)    | Dec-13                 |
| DAE4                       | SN: 660         | 31-Jan-13 (No. DAE4-660_Jan13)    | Jan-14                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-11)  | In house check: Apr-13 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

|                                                                                                                 |                               |                                          |                        |
|-----------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------|------------------------|
| Calibrated by:                                                                                                  | Name<br><b>Israe El-Naouq</b> | Function<br><b>Laboratory Technician</b> | Signature<br>          |
| Approved by:                                                                                                    | Name<br><b>Katja Pokovic</b>  | Function<br><b>Technical Manager</b>     | Signature<br>          |
|                                                                                                                 |                               |                                          | Issued: March 15, 2013 |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |                               |                                          |                        |



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Accreditation No.: **SCS 108**

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### 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 |

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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.

# Probe ES3DV3

## SN:3209

Manufactured: October 14, 2008  
Calibrated: March 15, 2013

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|-----------------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.35     | 1.33     | 1.14     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 99.2     | 97.8     | 98.3     |               |

### 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    | 163.6    | $\pm 3.5 \%$              |
|     |                           | Y | 0.0     | 0.0                          | 1.0 |         | 170.3    |                           |
|     |                           | Z | 0.0     | 0.0                          | 1.0 |         | 158.7    |                           |

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 5 and 6).

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

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

### 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 | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.74    | 6.74    | 6.74    | 0.76  | 1.18       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.46    | 6.46    | 6.46    | 0.31  | 1.81       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.39    | 5.39    | 5.39    | 0.80  | 1.21       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 5.21    | 5.21    | 5.21    | 0.78  | 1.26       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.57    | 4.57    | 4.57    | 0.65  | 1.43       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.43    | 4.43    | 4.43    | 0.75  | 1.36       | ± 12.0 %    |

<sup>C</sup> Frequency validity 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.

<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.

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

### Calibration Parameter Determined in Body Tissue Simulating Media

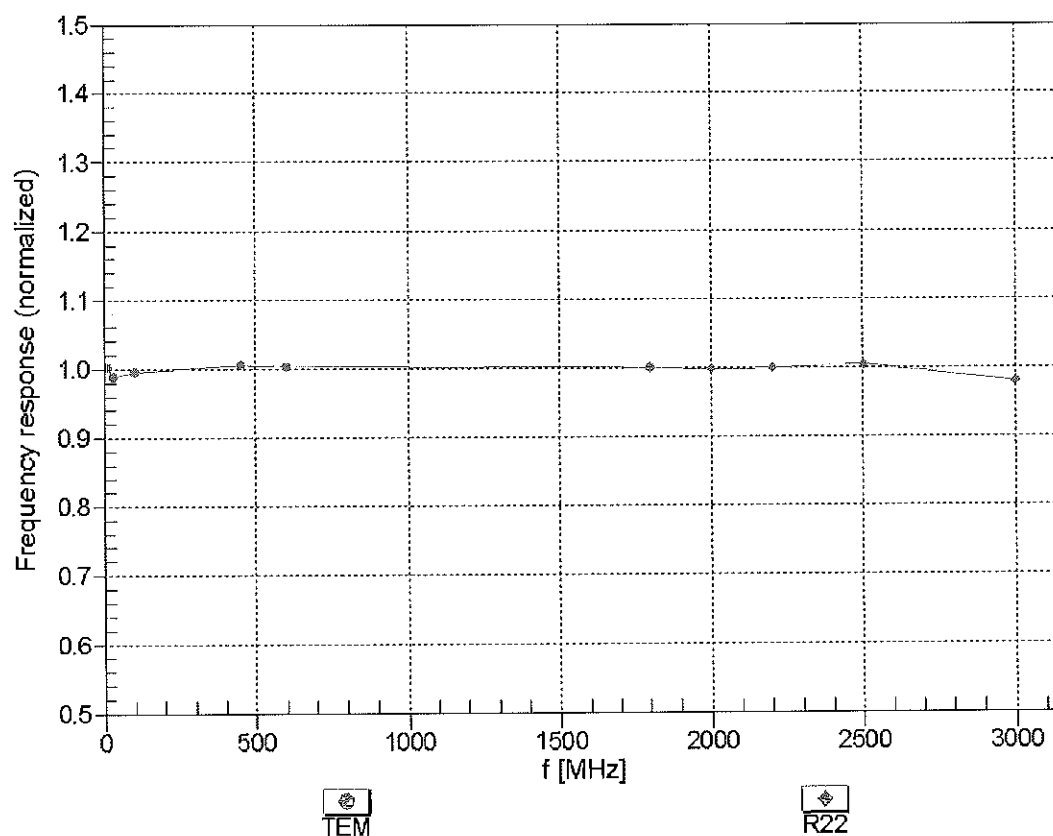
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 6.38    | 6.38    | 6.38    | 0.80  | 1.16       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 6.28    | 6.28    | 6.28    | 0.52  | 1.45       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 5.03    | 5.03    | 5.03    | 0.58  | 1.45       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 4.77    | 4.77    | 4.77    | 0.70  | 1.36       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.34    | 4.34    | 4.34    | 0.80  | 1.15       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 4.11    | 4.11    | 4.11    | 0.80  | 1.00       | ± 12.0 %    |

<sup>C</sup> Frequency validity 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.

<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.

## Frequency Response of E-Field

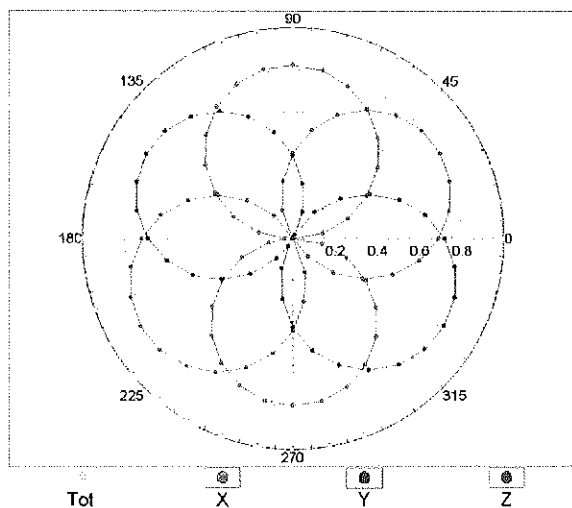
(TEM-Cell:ifi110 EXX, Waveguide: R22)



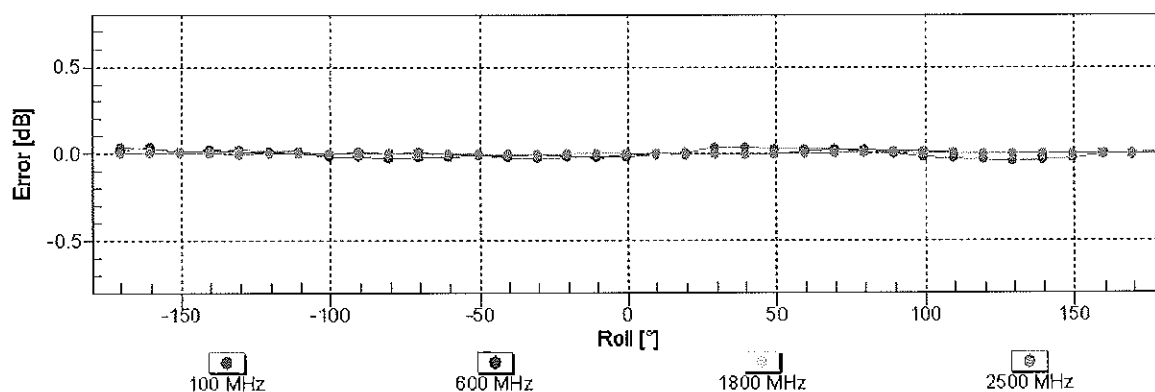
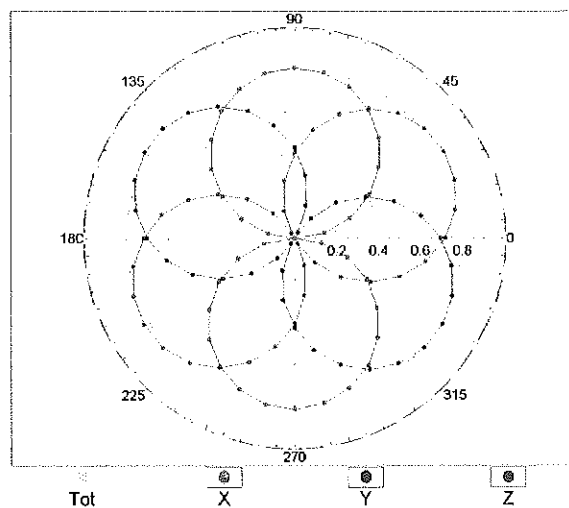
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

f=600 MHz,TEM

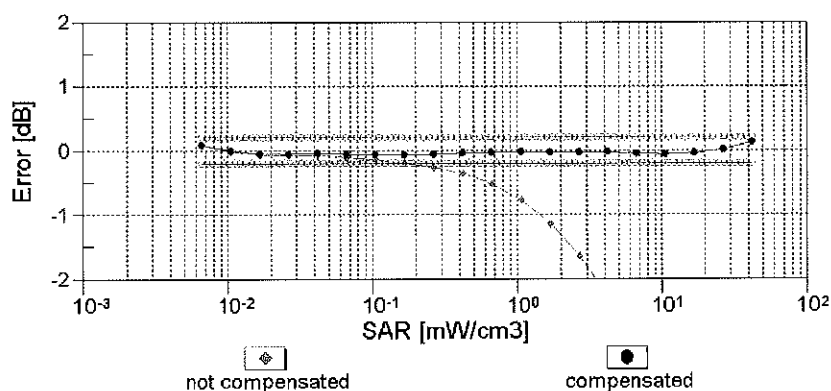
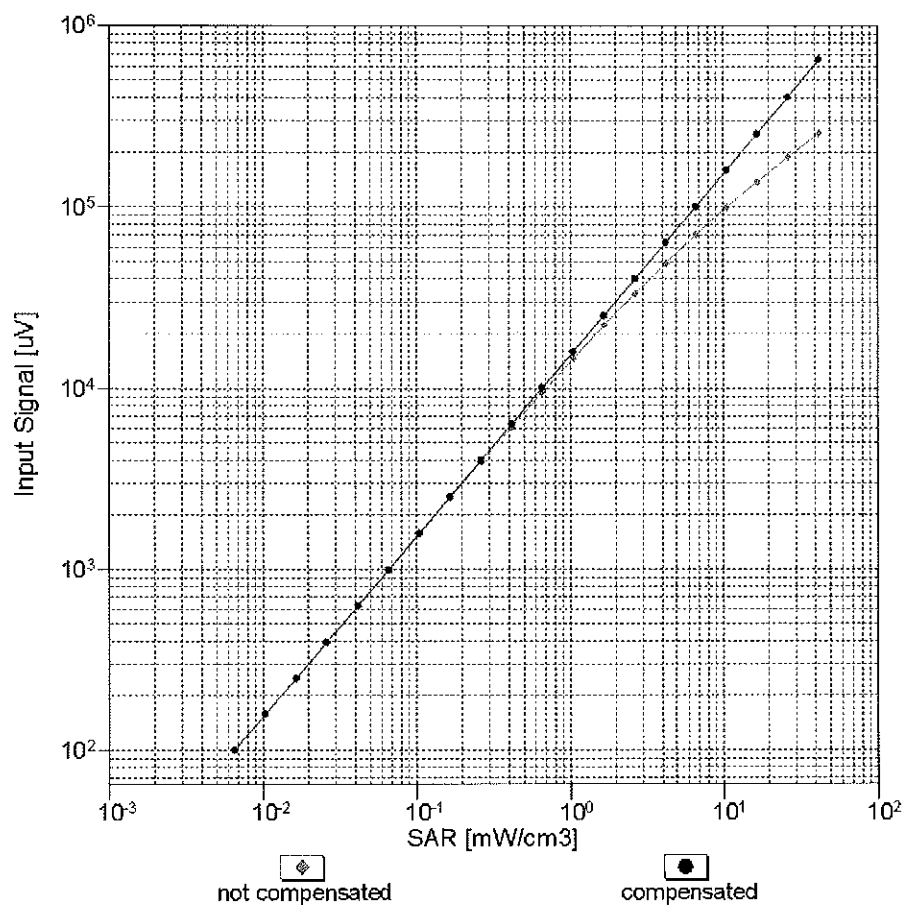


f=1800 MHz,R22



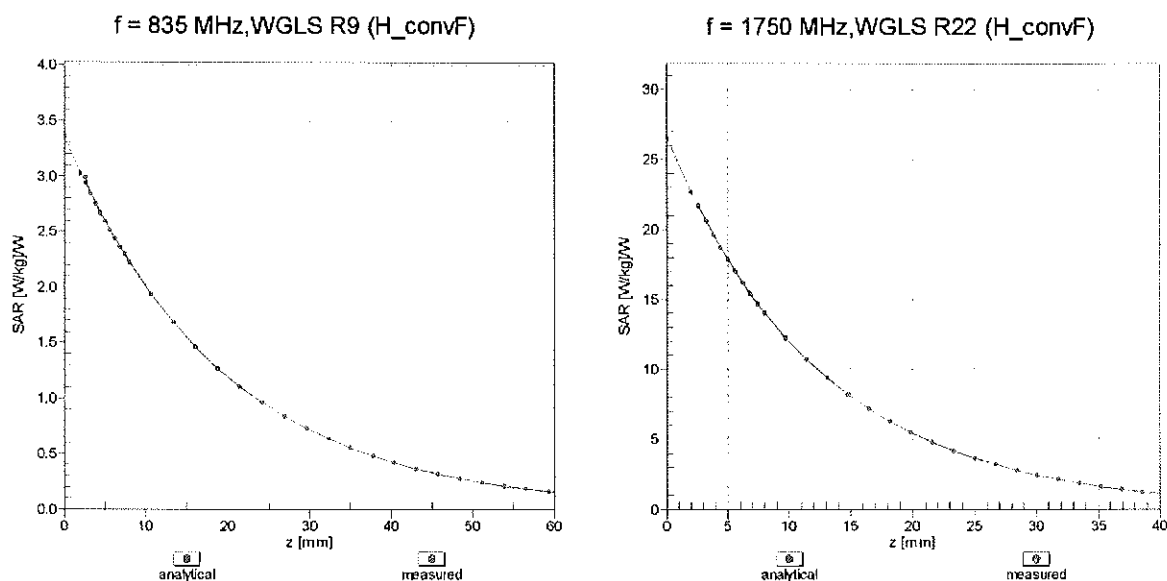
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

## Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$ )



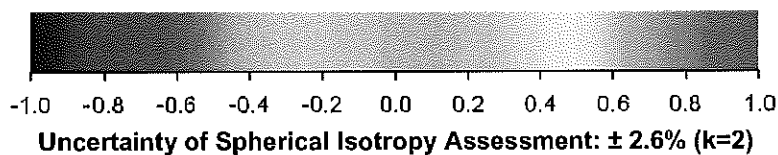
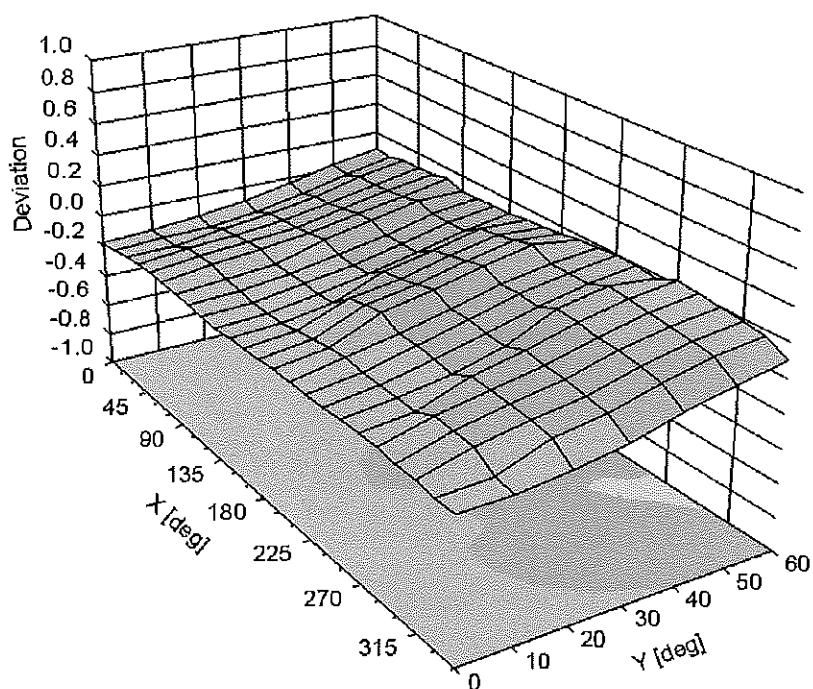
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi, \theta$ ),  $f = 900 \text{ MHz}$



## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

### Other Probe Parameters

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | -40.6      |
| 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       |



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Accreditation No.: **SCS 108**

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Client **PC Test**

Certificate No: **EX3-3920\_Feb13/2**

## CALIBRATION CERTIFICATE (Replacement of No: EX3-3920\_Feb13)

Object **EX3DV4 - SN:3920**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4**  
**Calibration procedure for dosimetric E-field probes**

Calibration date: **February 27, 2013**

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)

✓  
KOK  
3/24/13

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 29-Mar-12 (No. 217-01508)         | Apr-13                 |
| Power sensor E4412A        | MY41498087      | 29-Mar-12 (No. 217-01508)         | Apr-13                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 27-Mar-12 (No. 217-01531)         | Apr-13                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529)         | Apr-13                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532)         | Apr-13                 |
| Reference Probe ES3DV2     | SN: 3013        | 28-Dec-12 (No. ES3-3013_Dec12)    | Dec-13                 |
| DAE4                       | SN: 660         | 31-Jan-13 (No. DAE4-660_Jan13)    | Jan-14                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-11)  | In house check: Apr-13 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

|                |                                |                                          |                       |
|----------------|--------------------------------|------------------------------------------|-----------------------|
| Calibrated by: | Name<br><b>Claudio Leubler</b> | Function<br><b>Laboratory Technician</b> | Signature<br>         |
| Approved by:   | Name<br><b>Katja Pokovic</b>   | Function<br><b>Technical Manager</b>     | Signature<br>         |
|                |                                |                                          | Issued: March 5, 2013 |

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### 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 |

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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.

# Probe EX3DV4

## SN:3920

Manufactured: December 18, 2012  
Calibrated: February 27, 2013

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|-----------------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 0.34     | 0.50     | 0.50     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 101.2    | 101.0    | 99.1     |               |

### 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    | 134.3    | $\pm 3.3 \%$              |
|     |                           | Y | 0.0     | 0.0                          | 1.0 |         | 164.7    |                           |
|     |                           | Z | 0.0     | 0.0                          | 1.0 |         | 161.4    |                           |

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 5 and 6).

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

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

### 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 | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 9.86    | 9.86    | 9.86    | 0.19  | 1.39       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 9.58    | 9.58    | 9.58    | 0.77  | 0.54       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 7.97    | 7.97    | 7.97    | 0.57  | 0.69       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 7.73    | 7.73    | 7.73    | 0.54  | 0.73       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 7.04    | 7.04    | 7.04    | 0.40  | 0.82       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 6.80    | 6.80    | 6.80    | 0.49  | 0.76       | ± 12.0 %    |
| 5200                 | 36.0                               | 4.66                            | 4.87    | 4.87    | 4.87    | 0.35  | 1.80       | ± 13.1 %    |
| 5300                 | 35.9                               | 4.76                            | 4.73    | 4.73    | 4.73    | 0.37  | 1.80       | ± 13.1 %    |
| 5500                 | 35.6                               | 4.96                            | 4.52    | 4.52    | 4.52    | 0.39  | 1.80       | ± 13.1 %    |
| 5600                 | 35.5                               | 5.07                            | 4.17    | 4.17    | 4.17    | 0.50  | 1.80       | ± 13.1 %    |
| 5800                 | 35.3                               | 5.27                            | 4.02    | 4.02    | 4.02    | 0.45  | 1.80       | ± 13.1 %    |

<sup>C</sup> Frequency validity 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.

<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.

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

### Calibration Parameter Determined in Body Tissue Simulating Media

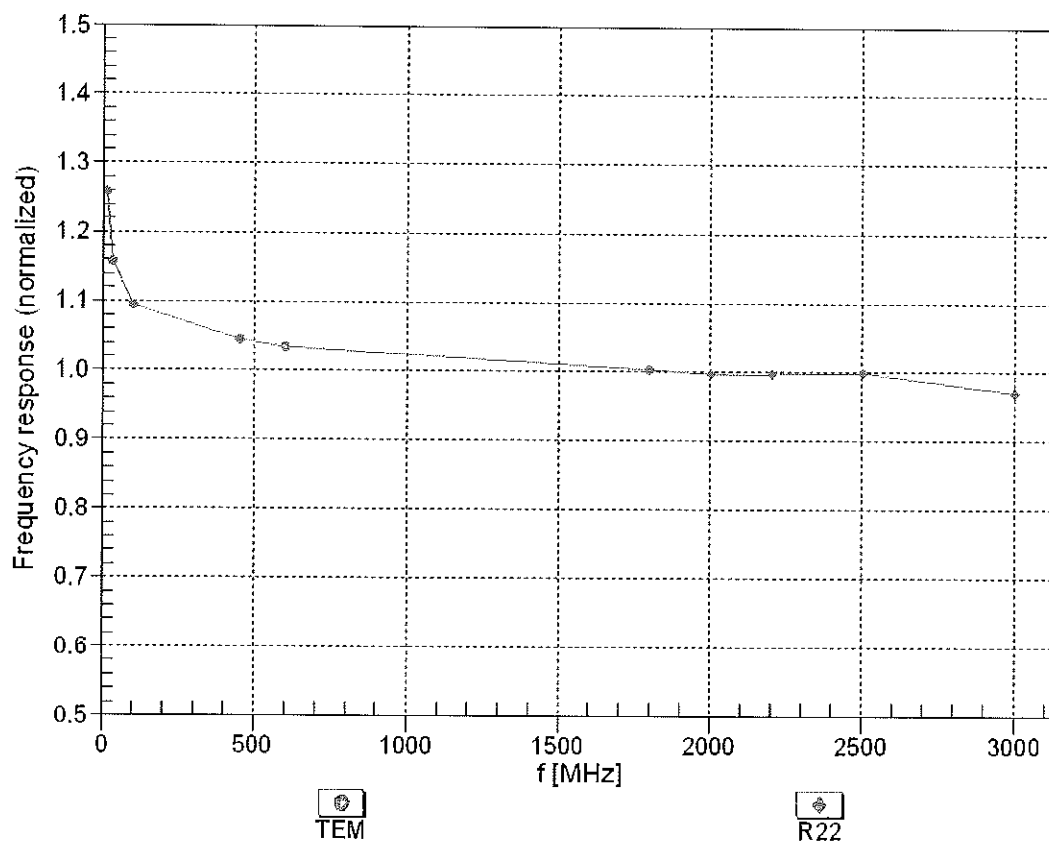
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 9.57    | 9.57    | 9.57    | 0.43  | 0.83       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 9.42    | 9.42    | 9.42    | 0.36  | 0.98       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 7.59    | 7.59    | 7.59    | 0.43  | 0.78       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 7.38    | 7.38    | 7.38    | 0.33  | 0.91       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 7.07    | 7.07    | 7.07    | 0.80  | 0.55       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 6.73    | 6.73    | 6.73    | 0.80  | 0.56       | ± 12.0 %    |
| 5200                 | 49.0                               | 5.30                            | 4.23    | 4.23    | 4.23    | 0.51  | 1.90       | ± 13.1 %    |
| 5300                 | 48.9                               | 5.42                            | 4.13    | 4.13    | 4.13    | 0.49  | 1.90       | ± 13.1 %    |
| 5500                 | 48.6                               | 5.65                            | 3.63    | 3.63    | 3.63    | 0.52  | 1.90       | ± 13.1 %    |
| 5600                 | 48.5                               | 5.77                            | 3.62    | 3.62    | 3.62    | 0.49  | 1.90       | ± 13.1 %    |
| 5800                 | 48.2                               | 6.00                            | 3.91    | 3.91    | 3.91    | 0.54  | 1.90       | ± 13.1 %    |

<sup>C</sup> Frequency validity 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.

<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.

## Frequency Response of E-Field

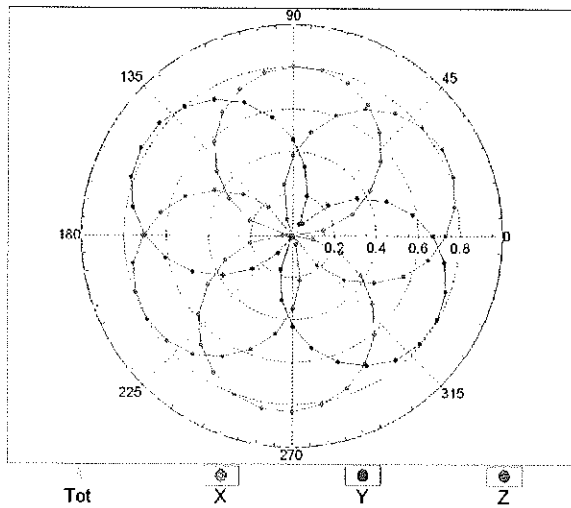
(TEM-Cell:ifi110 EXX, Waveguide: R22)



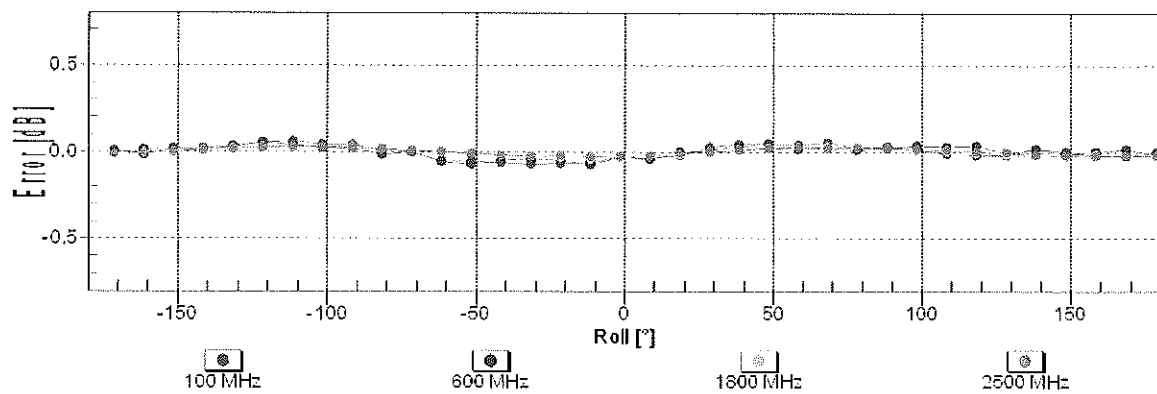
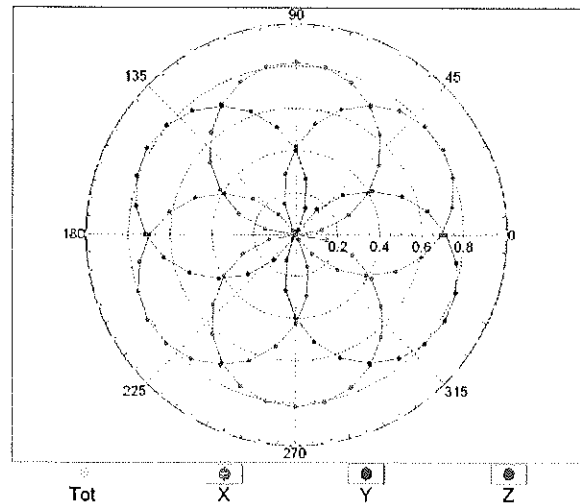
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

f=600 MHz,TEM

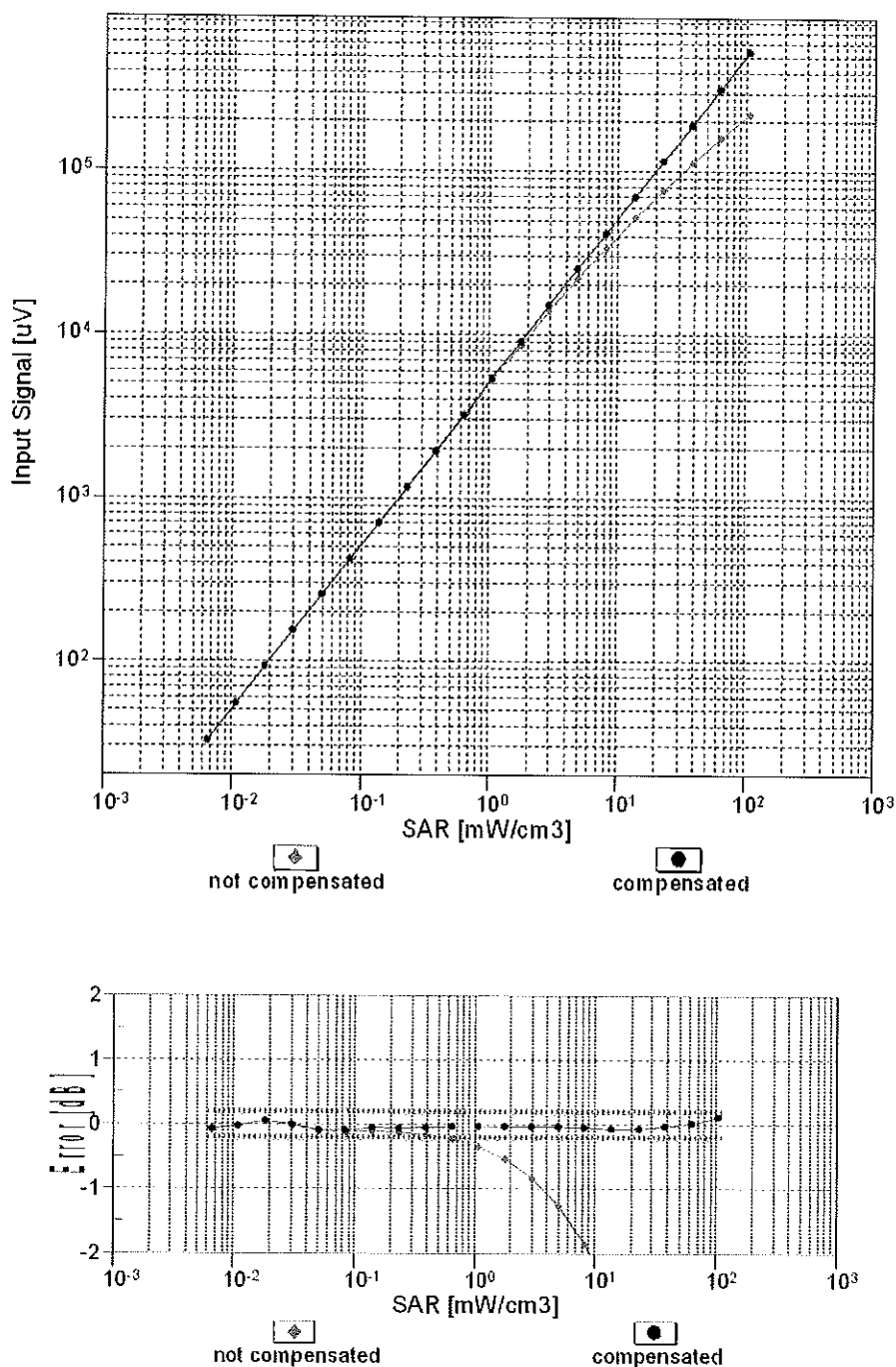


f=1800 MHz,R22



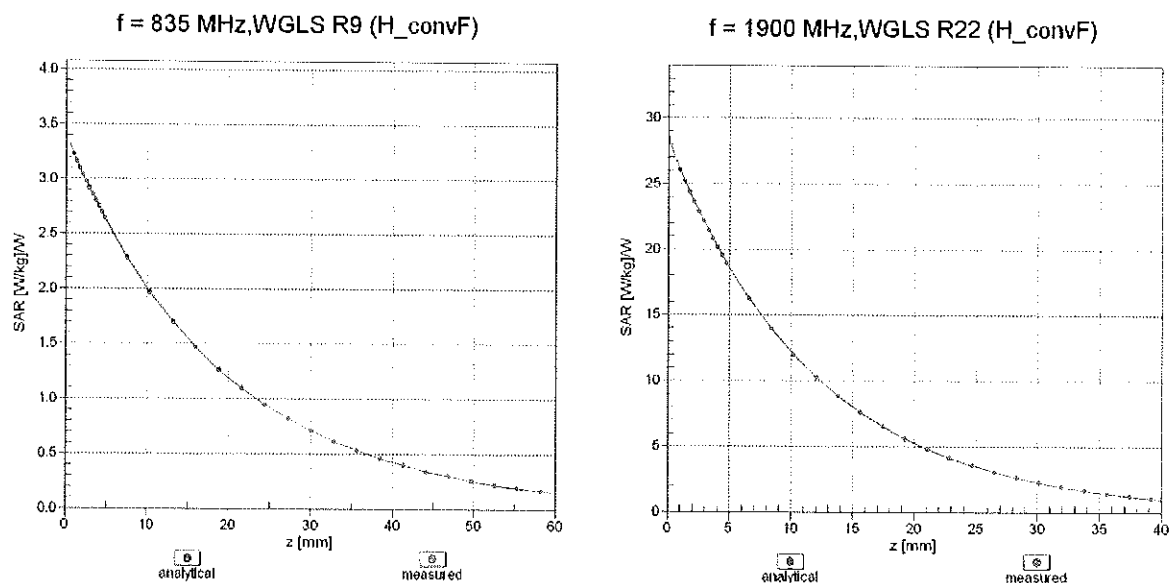
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

# Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$ )



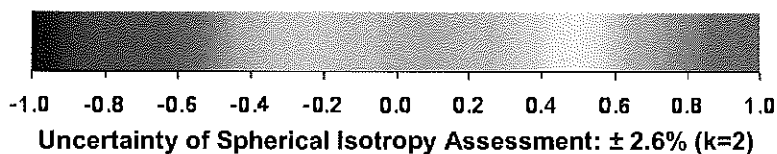
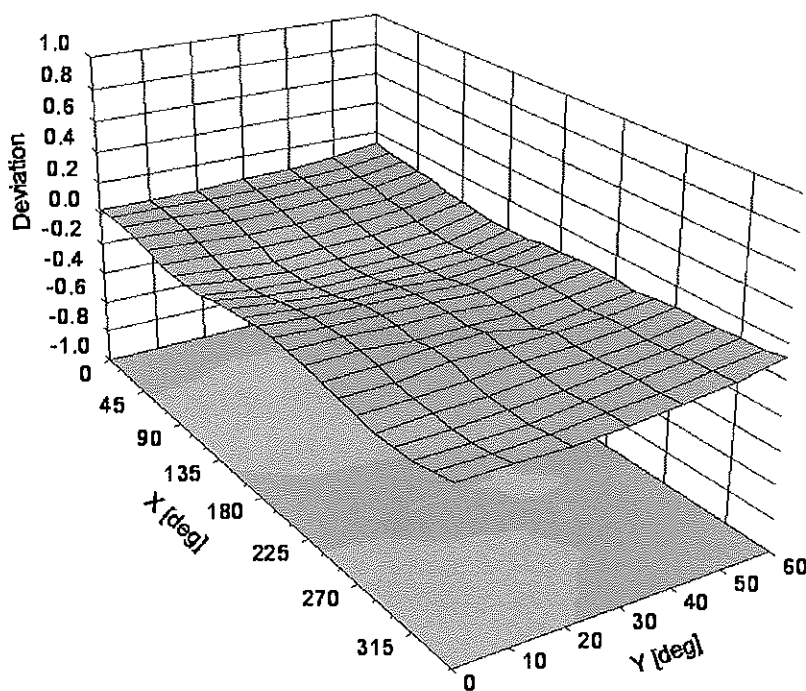
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi, \theta$ ),  $f = 900 \text{ MHz}$



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

### Other Probe Parameters

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | -21.6      |
| Mechanical Surface Detection Mode             | enabled    |
| Optical Surface Detection Mode                | disabled   |
| Probe Overall Length                          | 337 mm     |
| Probe Body Diameter                           | 10 mm      |
| Tip Length                                    | 9 mm       |
| Tip Diameter                                  | 2.5 mm     |
| Probe Tip to Sensor X Calibration Point       | 1 mm       |
| Probe Tip to Sensor Y Calibration Point       | 1 mm       |
| Probe Tip to Sensor Z Calibration Point       | 1 mm       |
| Recommended Measurement Distance from Surface | 2 mm       |



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Accreditation No.: **SCS 108**

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: **ES3-3318\_Apr13**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3318**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4**  
**Calibration procedure for dosimetric E-field probes**

Calibration date: **April 29, 2013**

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      | 04-Apr-13 (No. 217-01733)         | Apr-14                 |
| Power sensor E4412A        | MY41498087      | 04-Apr-13 (No. 217-01733)         | Apr-14                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 04-Apr-13 (No. 217-01737)         | Apr-14                 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 04-Apr-13 (No. 217-01735)         | Apr-14                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 04-Apr-13 (No. 217-01738)         | Apr-14                 |
| Reference Probe ES3DV2     | SN: 3013        | 28-Dec-12 (No. ES3-3013_Dec12)    | Dec-13                 |
| DAE4                       | SN: 660         | 31-Jan-13 (No. DAE4-660_Jan13)    | Jan-14                 |
| 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-15 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

|                                                                                                                 | Name          | Function              | Signature |
|-----------------------------------------------------------------------------------------------------------------|---------------|-----------------------|-----------|
| Calibrated by:                                                                                                  | Dimce Iliev   | Laboratory Technician |           |
| Approved by:                                                                                                    | Katja Pokovic | Technical Manager     |           |
| Issued: April 29, 2013                                                                                          |               |                       |           |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |               |                       |           |



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Accreditation No.: **SCS 108**

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### 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 |

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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.

# Probe ES3DV3

## SN:3318

Manufactured: January 10, 2012  
Calibrated: April 29, 2013

**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     | 1.29     | ± 10.1 %  |
| DCP (mV) <sup>B</sup>                                     | 102.6    | 105.4    | 100.8    |           |

### Modulation Calibration Parameters

| UID | Communication System Name |   | A<br>dB | B<br>dB/ $\mu\text{V}$ | C   | D<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-----|---------------------------|---|---------|------------------------|-----|---------|----------|---------------------------|
| 0   | CW                        | X | 0.0     | 0.0                    | 1.0 | 0.00    | 153.6    | ±3.5 %                    |
|     |                           | Y | 0.0     | 0.0                    | 1.0 |         | 133.8    |                           |
|     |                           | Z | 0.0     | 0.0                    | 1.0 |         | 154.8    |                           |

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

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

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

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

## DASY/EASY - Parameters of Probe: 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 | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.59    | 6.59    | 6.59    | 0.25  | 2.12       | ± 12.0 %    |
| 850                  | 41.5                               | 0.92                            | 6.33    | 6.33    | 6.33    | 0.57  | 1.25       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 5.22    | 5.22    | 5.22    | 0.79  | 1.25       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.59    | 4.59    | 4.59    | 0.80  | 1.30       | ± 12.0 %    |

<sup>C</sup> Frequency validity 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.

<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.

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3318

### Calibration Parameter Determined in Body Tissue Simulating Media

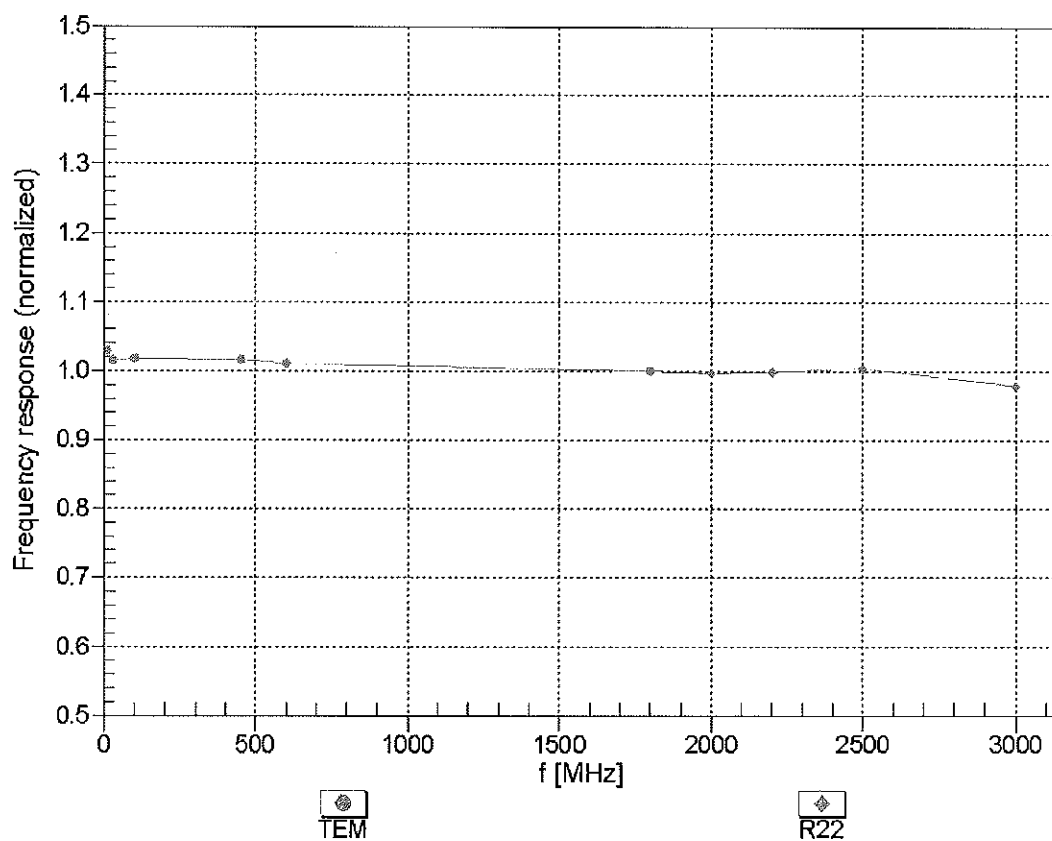
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 6.35    | 6.35    | 6.35    | 0.53  | 1.42       | ± 12.0 %    |
| 850                  | 55.2                               | 0.99                            | 6.21    | 6.21    | 6.21    | 0.57  | 1.38       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 4.79    | 4.79    | 4.79    | 0.46  | 1.77       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.31    | 4.31    | 4.31    | 0.80  | 1.09       | ± 12.0 %    |

<sup>C</sup> Frequency validity 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.

<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.

## Frequency Response of E-Field

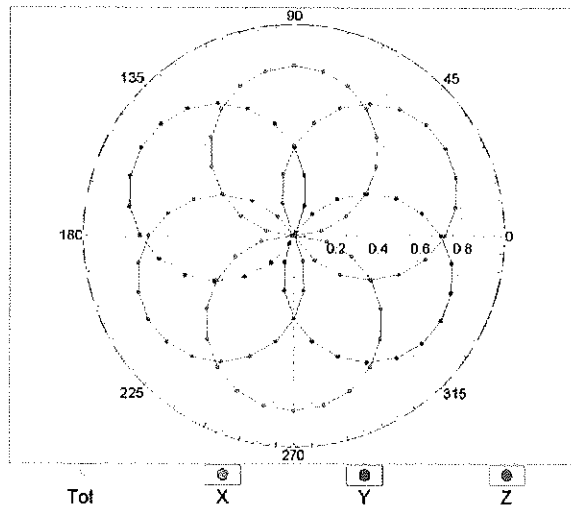
(TEM-Cell:ifi110 EXX, Waveguide: R22)



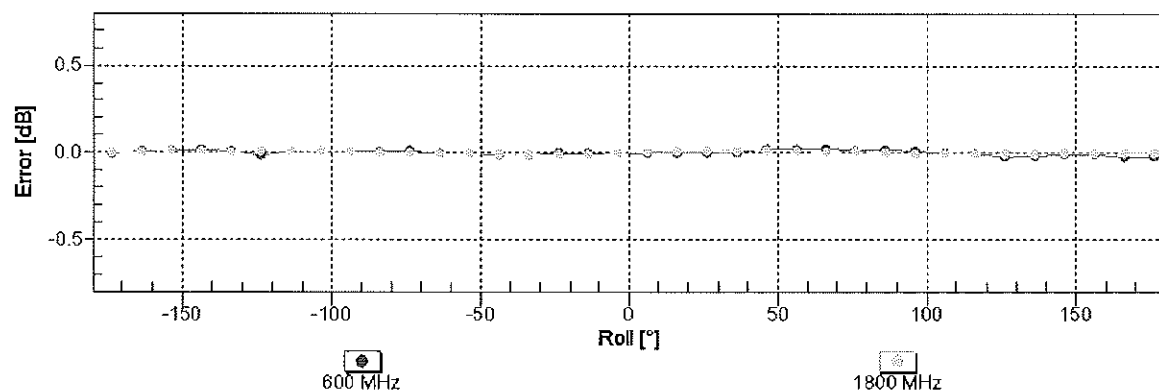
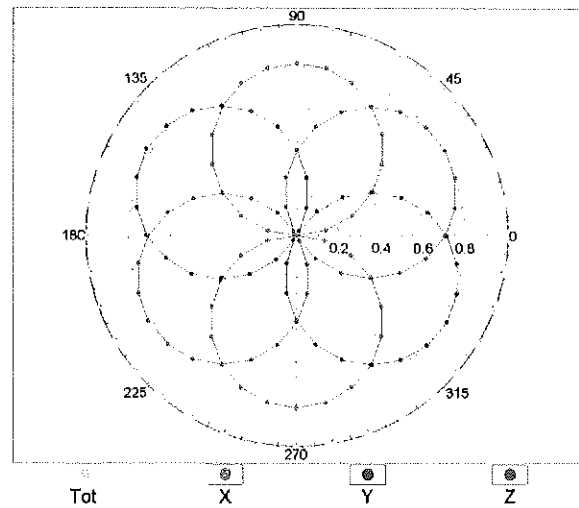
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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

f=600 MHz,TEM

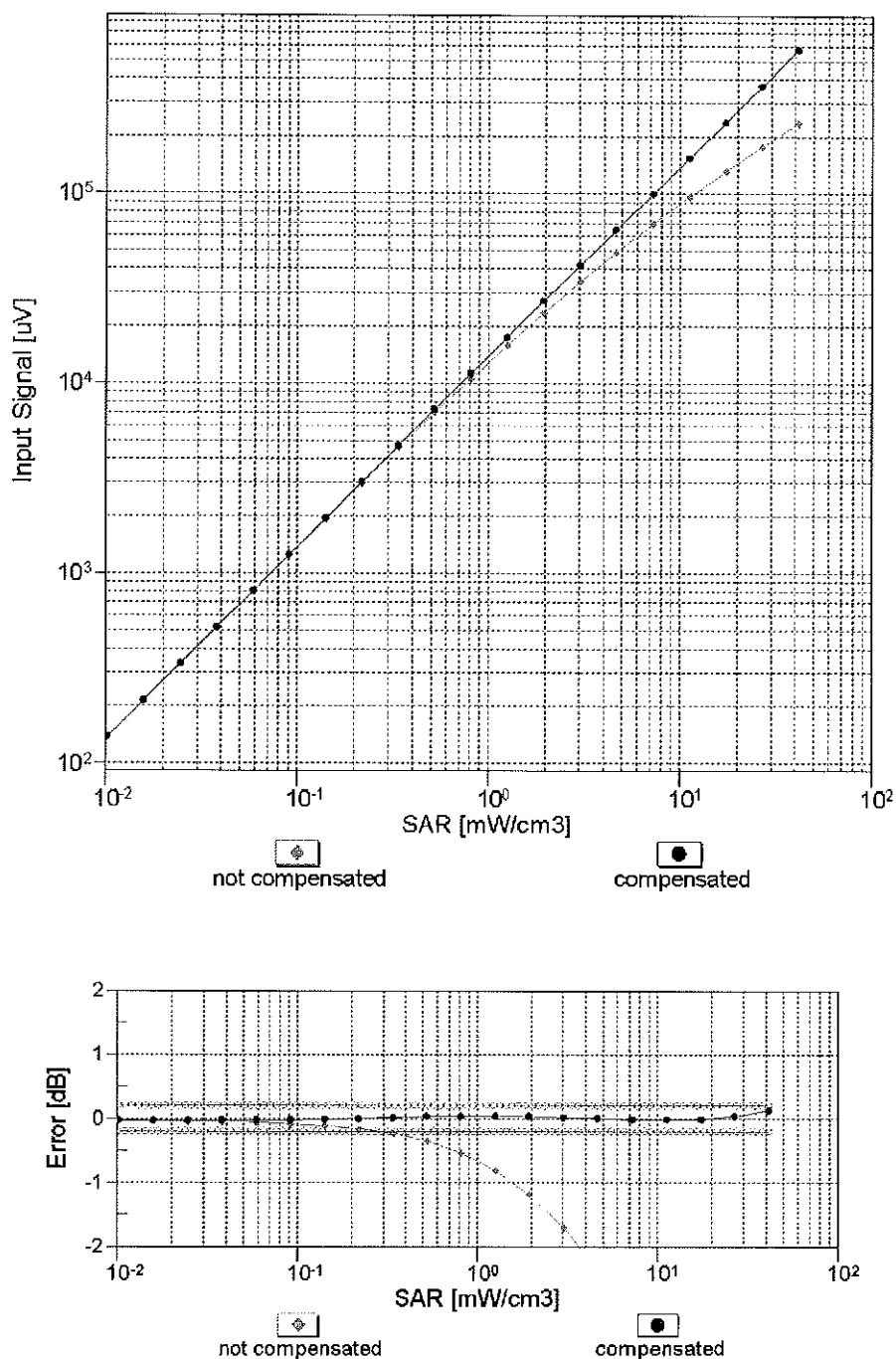


f=1800 MHz,R22



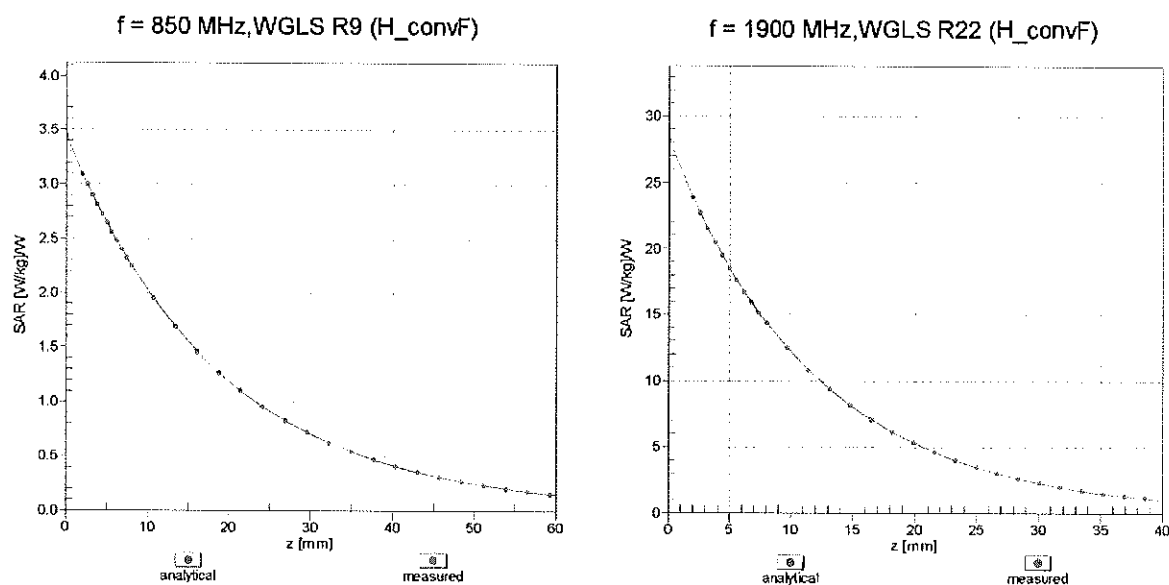
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

# Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$ )



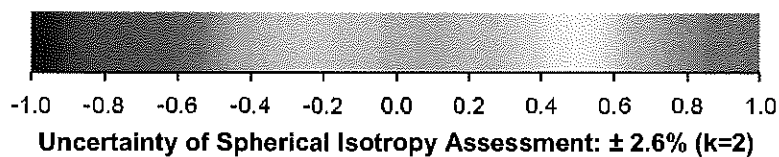
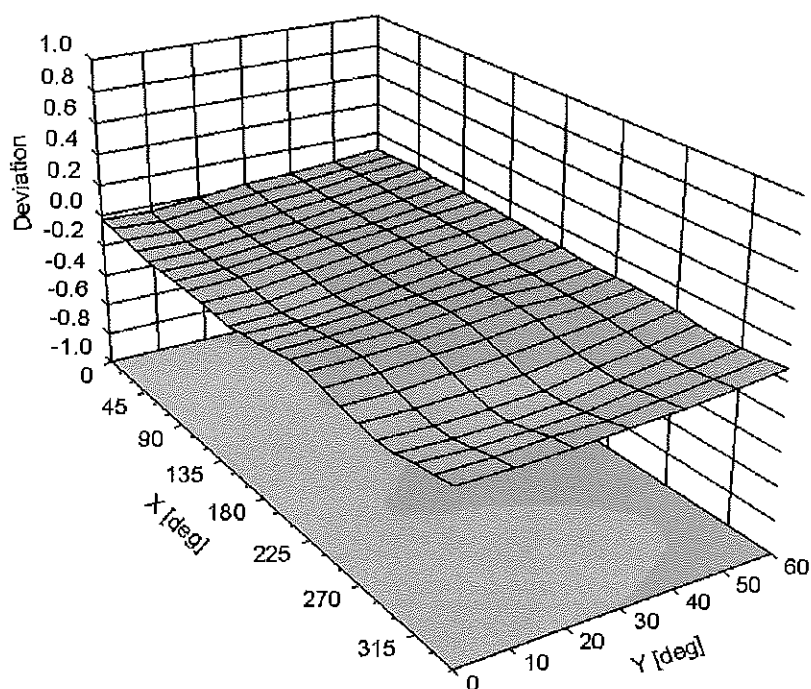
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi$ ,  $\theta$ ),  $f = 900 \text{ MHz}$



## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3318

### Other Probe Parameters

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | -103.8     |
| 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       |

## **Additional Conversion Factors**

**for Dosimetric E-Field Probe**

Type:

**ES3DV3**

Serial Number:

**3318**

Place of Assessment:

**Zurich**

Date of Assessment:

**June 19, 2013**

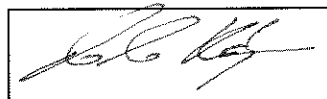
Probe Calibration Date:

**April 29, 2013**

✓  
Kox  
6/25/13

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. The evaluation is coupled with measured conversion factors (probe calibration date indicated above). The uncertainty of the numerical assessment is based on the extrapolation from measured value at 835 MHz or at 1900 MHz.

Assessed by:



## Dosimetric E-Field Probe ES3DV3 SN:3318

Conversion factor ( $\pm$  standard deviation)

1750  $\pm$  50 MHz      *ConvF*      5.59  $\pm$  7%

$\epsilon_r = 40.1 \pm 5\%$   
 $\sigma = 1.37 \pm 5\%$  mho/m  
(head tissue)

1750  $\pm$  50 MHz      *ConvF*      5.22  $\pm$  7%

$\epsilon_r = 53.4 \pm 5\%$   
 $\sigma = 1.49 \pm 5\%$  mho/m  
(body tissue)

### Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also DASY Manual.



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **EX3-3589 Jan13**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3589**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4**  
**Calibration procedure for dosimetric E-field probes**

Calibration date: **January 17, 2013**

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      | 29-Mar-12 (No. 217-01508)         | Apr-13                 |
| Power sensor E4412A        | MY41498087      | 29-Mar-12 (No. 217-01508)         | Apr-13                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 27-Mar-12 (No. 217-01531)         | Apr-13                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529)         | Apr-13                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532)         | Apr-13                 |
| Reference Probe ES3DV2     | SN: 3013        | 28-Dec-12 (No. ES3-3013_Dec12)    | Dec-13                 |
| DAE4                       | SN: 660         | 20-Jun-12 (No. DAE4-660_Jun12)    | Jun-13                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-11)  | In house check: Apr-13 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

|                                                                                                                 | Name           | Function              | Signature |
|-----------------------------------------------------------------------------------------------------------------|----------------|-----------------------|-----------|
| Calibrated by:                                                                                                  | Jeton Kastrati | Laboratory Technician |           |
| Approved by:                                                                                                    | Katja Pokovic  | Technical Manager     |           |
| Issued: January 17, 2013                                                                                        |                |                       |           |
| 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 108**

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 |

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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.

# Probe EX3DV4

## SN:3589

Manufactured: March 30, 2006  
Calibrated: January 17, 2013

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     | 0.40     | 0.40     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 100.5    | 103.8    | 99.6     |               |

### 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    | 165.8    | $\pm 3.3 \%$              |
|     |                           | Y | 0.0     | 0.0                          | 1.0 |         | 134.3    |                           |
|     |                           | Z | 0.0     | 0.0                          | 1.0 |         | 140.5    |                           |

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 5 and 6).

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

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

## DASY/EASY - Parameters of Probe: EX3DV4 - SN: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 | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 8.70    | 8.70    | 8.70    | 0.39  | 0.96       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 8.40    | 8.40    | 8.40    | 0.52  | 0.74       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 7.34    | 7.34    | 7.34    | 0.45  | 0.93       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 7.09    | 7.09    | 7.09    | 0.80  | 0.65       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 6.37    | 6.37    | 6.37    | 0.39  | 0.97       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 6.19    | 6.19    | 6.19    | 0.30  | 1.12       | ± 12.0 %    |
| 5200                 | 36.0                               | 4.66                            | 4.48    | 4.48    | 4.48    | 0.45  | 1.80       | ± 13.1 %    |
| 5300                 | 35.9                               | 4.76                            | 4.27    | 4.27    | 4.27    | 0.45  | 1.80       | ± 13.1 %    |
| 5500                 | 35.6                               | 4.96                            | 4.14    | 4.14    | 4.14    | 0.50  | 1.80       | ± 13.1 %    |
| 5600                 | 35.5                               | 5.07                            | 3.81    | 3.81    | 3.81    | 0.55  | 1.80       | ± 13.1 %    |
| 5800                 | 35.3                               | 5.27                            | 3.85    | 3.85    | 3.85    | 0.55  | 1.80       | ± 13.1 %    |

<sup>C</sup> Frequency validity 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.

<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.

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

### Calibration Parameter Determined in Body Tissue Simulating Media

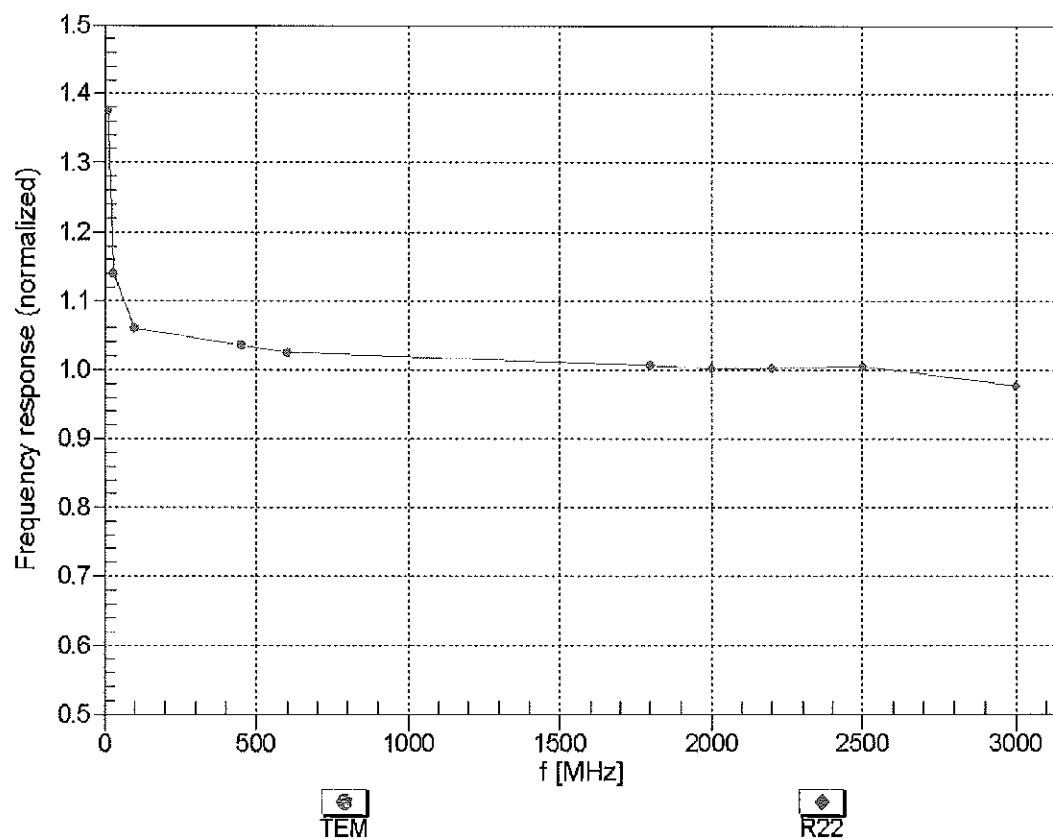
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 8.59    | 8.59    | 8.59    | 0.49  | 0.86       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 8.43    | 8.43    | 8.43    | 0.38  | 1.05       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 7.87    | 7.87    | 7.87    | 0.44  | 0.89       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 7.46    | 7.46    | 7.46    | 0.58  | 0.75       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 7.07    | 7.07    | 7.07    | 0.80  | 0.50       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 6.68    | 6.68    | 6.68    | 0.80  | 0.50       | ± 12.0 %    |
| 5200                 | 49.0                               | 5.30                            | 3.99    | 3.99    | 3.99    | 0.50  | 1.90       | ± 13.1 %    |
| 5300                 | 48.9                               | 5.42                            | 3.81    | 3.81    | 3.81    | 0.50  | 1.90       | ± 13.1 %    |
| 5500                 | 48.6                               | 5.65                            | 3.52    | 3.52    | 3.52    | 0.55  | 1.90       | ± 13.1 %    |
| 5600                 | 48.5                               | 5.77                            | 3.32    | 3.32    | 3.32    | 0.60  | 1.90       | ± 13.1 %    |
| 5800                 | 48.2                               | 6.00                            | 3.66    | 3.66    | 3.66    | 0.60  | 1.90       | ± 13.1 %    |

<sup>C</sup> Frequency validity 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.

<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.

## Frequency Response of E-Field

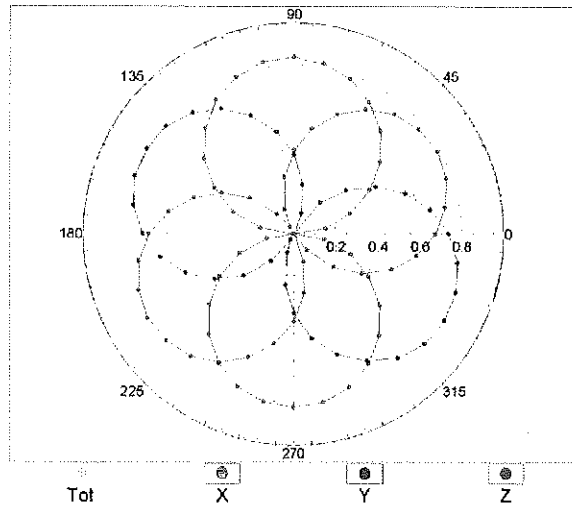
(TEM-Cell:ifi110 EXX, Waveguide: R22)



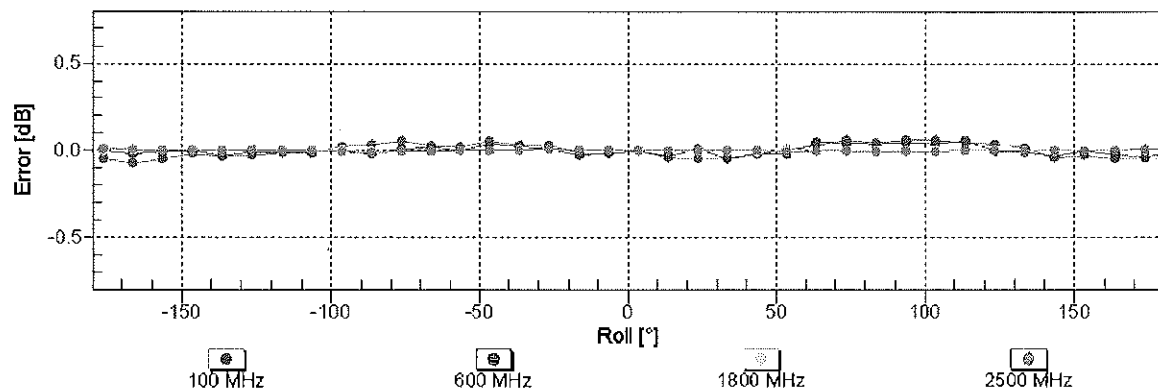
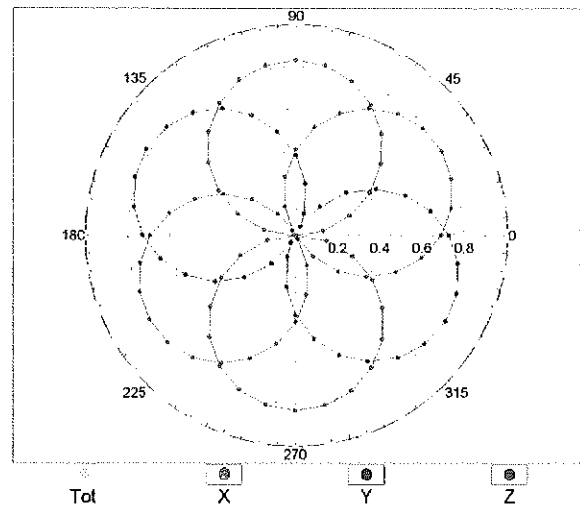
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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

f=600 MHz,TEM

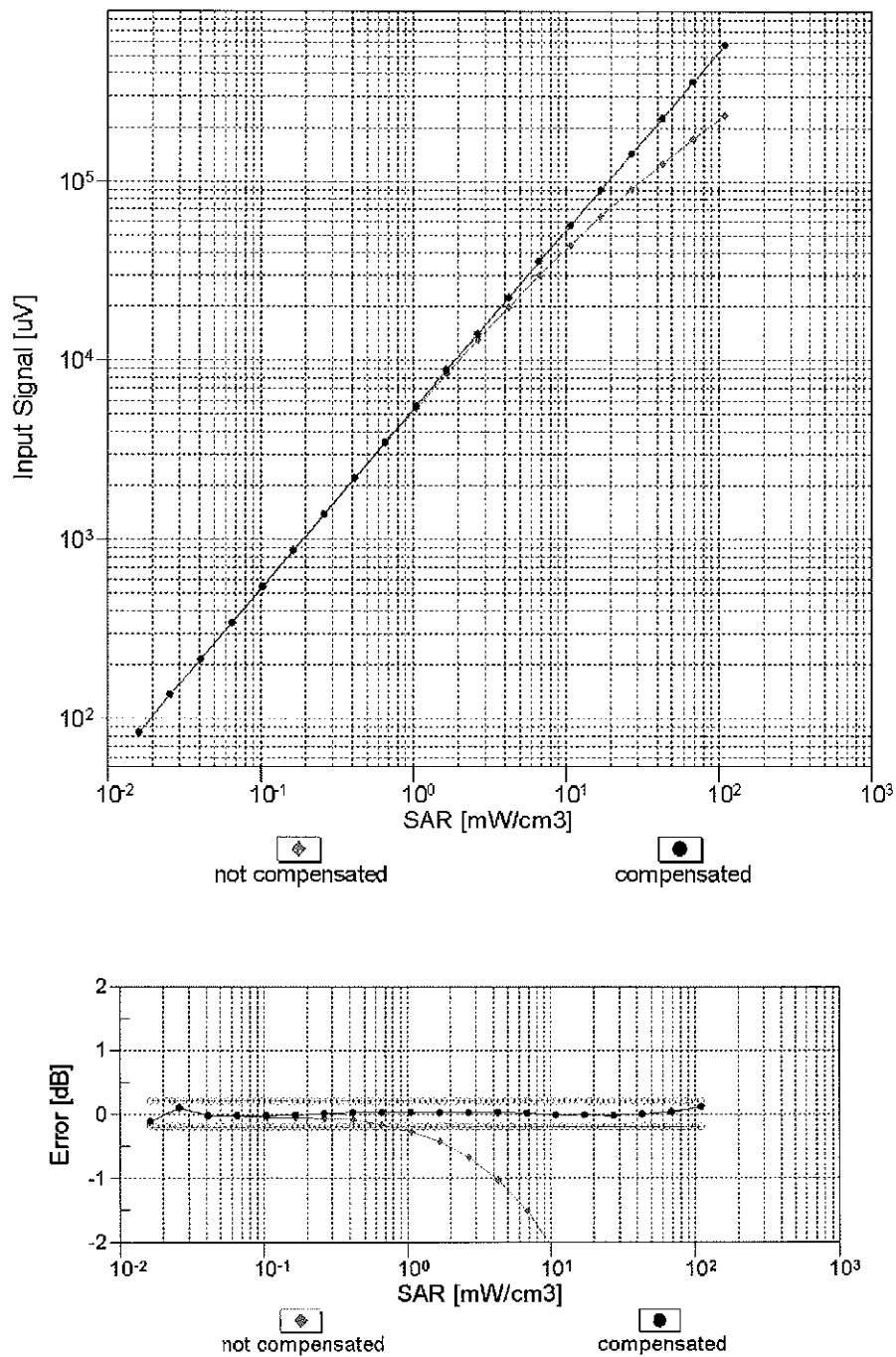


f=1800 MHz,R22



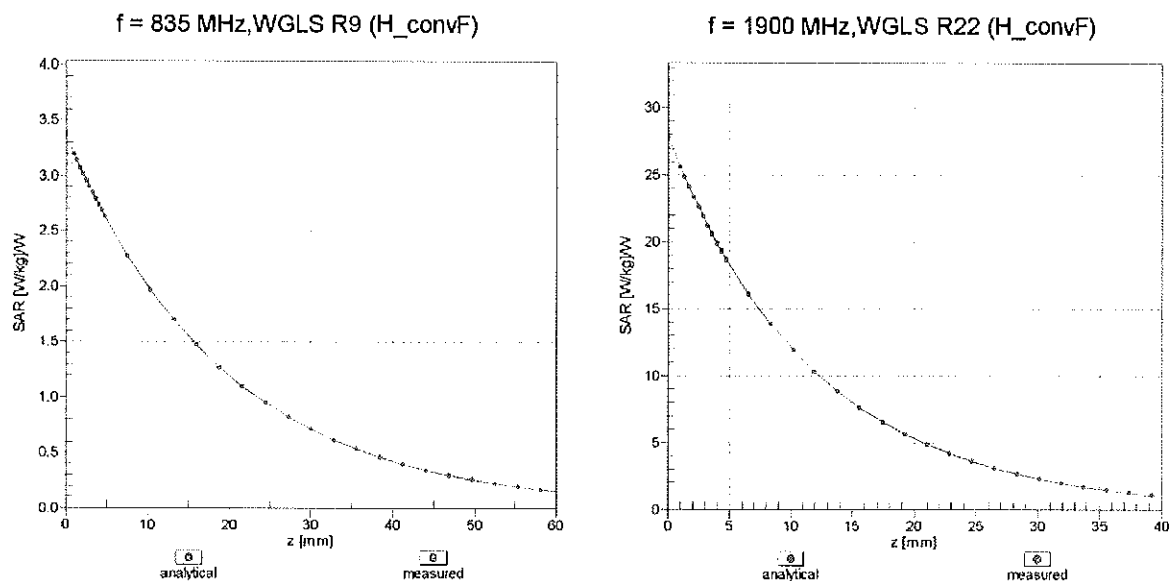
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

# Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f = 900 MHz)



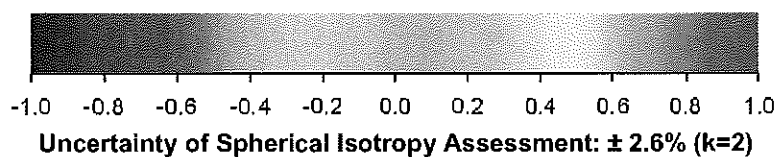
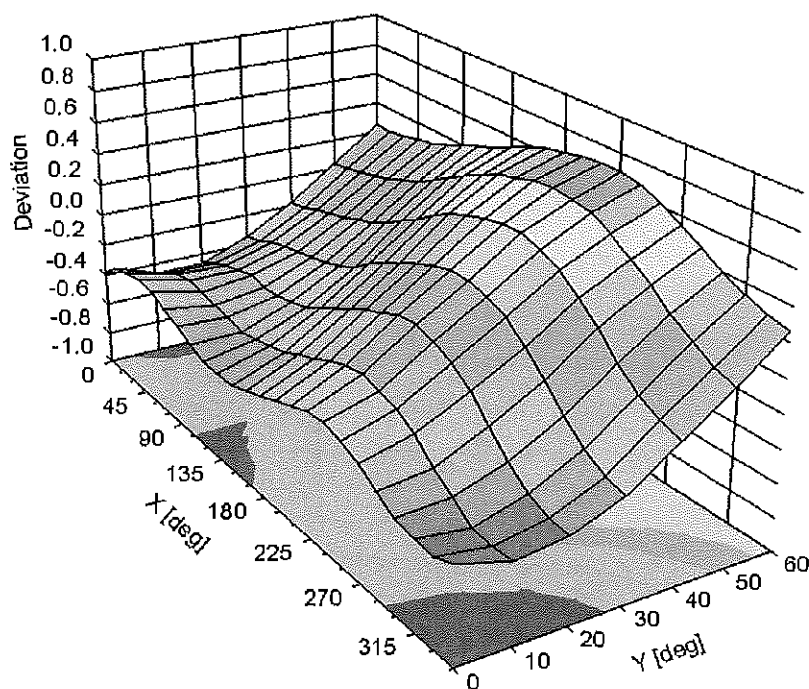
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi, \theta$ ),  $f = 900 \text{ MHz}$



**DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589****Other Probe Parameters**

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | -26.4      |
| 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 | 2 mm       |

## APPENDIX D: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue verification:

- 1) The network analyzer and probe system was configured and calibrated.
- 2) The probe was immersed in the tissue. The tissue was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
- 3) The complex admittance with respect to the probe aperture was measured
- 4) The complex relative permittivity  $\epsilon$  can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\epsilon_r\epsilon_0}{[\ln(b/a)]^2} \int_a^b \int_a^b \int_0^\pi \cos\phi' \frac{\exp[-j\omega r(\mu_0\epsilon_r'\epsilon_0)^{1/2}]}{r} d\phi' d\rho' d\rho$$

where  $Y$  is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively,  $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$ ,  $\omega$  is the angular frequency, and  $j = \sqrt{-1}$ .

**Table D-I**  
**Composition of the Tissue Equivalent Matter**

| Frequency (MHz)           | 750         | 835   | 1750 | 1900  | 2450 | 5200-5800 |
|---------------------------|-------------|-------|------|-------|------|-----------|
| Tissue                    | Body        | Body  | Body | Body  | Body | Body      |
| Ingredients (% by weight) |             |       |      |       |      |           |
| Bactericide               | See Page D2 | 0.1   |      |       |      |           |
| DGBE                      |             |       | 31   | 29.44 | 26.7 |           |
| HEC                       |             | 1     |      |       |      |           |
| NaCl                      |             | 0.94  | 0.2  | 0.39  | 0.1  |           |
| Sucrose                   |             | 44.9  |      |       |      |           |
| Polysorbate (Tween) 80    |             |       |      |       |      | 20        |
| Water                     |             | 53.06 | 68.8 | 70.17 | 73.2 | 80        |

|                                    |                                                                                                                                                                                                        |                                 |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                 |  <b>SAR EVALUATION REPORT</b>  | Reviewed by:<br>Quality Manager |
| Test Dates:<br>08/19/13 - 08/27/13 | DUT Type:<br>Portable Wireless Router                                                                                                                                                                  | APPENDIX D:<br>Page 1 of 2      |

## 2 Composition / Information on ingredients

The Item is composed of the following ingredients:

|                                                                  |                                                                                                                                                     |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| H <sub>2</sub> O                                                 | Water, 35 – 58%                                                                                                                                     |
| Sucrose                                                          | Sugar, white, refined, 40 – 60%                                                                                                                     |
| NaCl                                                             | Sodium Chloride, 0 – 6%                                                                                                                             |
| Hydroxyethyl-cellulose                                           | Medium Viscosity (CAS# 9004-62-0), <0.3%                                                                                                            |
| Preventol-D7                                                     | Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyl-3(2H)-isothiazolone, 0.1 – 0.7% |
| Relevant for safety; Refer to the respective Safety Data Sheet*. |                                                                                                                                                     |

**Figure D-1**

### Composition of 750 MHz Body Tissue Equivalent Matter

**Note:** 750MHz liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

#### Measurement Certificate / Material Test

|              |                                        |
|--------------|----------------------------------------|
| Item Name    | Body Tissue Simulating Liquid (MSL750) |
| Product No.  | SL AAM 075 AA (Charge: 111130-3)       |
| Manufacturer | SPEAG                                  |

#### Measurement Method

TSL dielectric parameters measured using calibrated OCP probe (type DAK).

#### Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

#### Test Condition

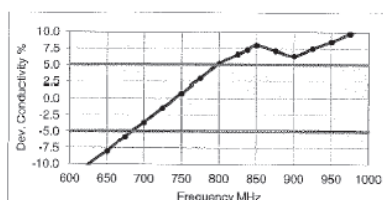
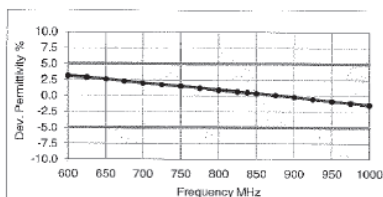
Ambient Condition 22°C ; 30% humidity  
TSL Temperature 22°C  
Test Date 7-Dec-11

#### Additional Information

TSL Density 1.212 g/cm<sup>3</sup>  
TSL Heat-capacity 3.006 kJ/(kg\*K)

#### Results

| f [MHz] | Measured |        |       | Target |       |      | Diff.to Target (%) |         |
|---------|----------|--------|-------|--------|-------|------|--------------------|---------|
|         | HP-e'    | HP-e'' | sigma | eps    | sigma |      | Δ-eps              | Δ-sigma |
| 600     | 57.9     | 26.01  | 0.83  | 56.1   | 0.95  | 3.1  | -12.3              |         |
| 625     | 57.6     | 24.66  | 0.86  | 56.0   | 0.95  | 2.9  | -10.1              |         |
| 650     | 57.4     | 24.31  | 0.88  | 55.9   | 0.96  | 2.6  | -8.0               |         |
| 675     | 57.1     | 24.02  | 0.90  | 55.8   | 0.96  | 2.3  | -5.8               |         |
| 700     | 56.8     | 23.74  | 0.92  | 55.7   | 0.96  | 2.0  | -3.7               |         |
| 725     | 56.6     | 23.50  | 0.95  | 55.6   | 0.96  | 1.7  | -1.5               |         |
| 750     | 56.4     | 23.26  | 0.97  | 55.5   | 0.96  | 1.5  | 0.8                |         |
| 775     | 56.1     | 23.00  | 0.99  | 55.4   | 0.97  | 1.2  | 3.0                |         |
| 800     | 55.8     | 22.86  | 1.02  | 55.3   | 0.97  | 0.9  | 5.2                |         |
| 825     | 55.6     | 22.72  | 1.04  | 55.2   | 0.98  | 0.6  | 6.6                |         |
| 850     | 55.5     | 22.64  | 1.05  | 55.2   | 0.98  | 0.5  | 7.3                |         |
| 875     | 55.4     | 22.57  | 1.07  | 55.2   | 0.99  | 0.4  | 8.0                |         |
| 900     | 54.9     | 22.31  | 1.12  | 55.0   | 1.05  | -0.2 | 6.4                |         |
| 925     | 54.7     | 22.20  | 1.14  | 55.0   | 1.06  | -0.5 | 7.5                |         |
| 950     | 54.5     | 22.09  | 1.17  | 54.9   | 1.08  | -0.9 | 8.5                |         |
| 975     | 54.3     | 21.99  | 1.19  | 54.9   | 1.09  | -1.2 | 9.7                |         |
| 1000    | 54.1     | 21.89  | 1.22  | 54.8   | 1.10  | -1.4 | 10.9               |         |



**Figure D-2**

### 750MHz Body Tissue Equivalent Matter

|                                    |                                                                                                                                   |                            |                                                                                       |                                 |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                 |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR EVALUATION REPORT      |  | Reviewed by:<br>Quality Manager |
| Test Dates:<br>08/19/13 - 08/27/13 | DUT Type:<br>Portable Wireless Router                                                                                             | APPENDIX D:<br>Page 2 of 2 |                                                                                       |                                 |

## APPENDIX E: SAR SYSTEM VALIDATION

Per FCC KDB 865664 D02v01r01, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in IEEE 1528-2003 and FCC KDB 865664 D01v01r01. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

**Table E-I**  
**SAR System Validation Summary**

| SAR SYSTEM # | FREQ. [MHz] | DATE      | PROBE SN | PROBE TYPE | PROBE CAL. POINT |      | COND.        | PERM.            | CW VALIDATION |                 |                | MOD. VALIDATION |             |      |
|--------------|-------------|-----------|----------|------------|------------------|------|--------------|------------------|---------------|-----------------|----------------|-----------------|-------------|------|
|              |             |           |          |            |                  |      | ( $\sigma$ ) | ( $\epsilon_r$ ) | SENSI-TIVITY  | PROBE LINEARITY | PROBE ISOTROPY | MOD. TYPE       | DUTY FACTOR | PAR  |
| B            | 750         | 1/30/2013 | 3287     | ES3DV3     | 750              | Body | 0.981        | 54.40            | PASS          | PASS            | PASS           | N/A             | N/A         | N/A  |
| G            | 835         | 3/26/2013 | 3209     | ES3DV3     | 835              | Body | 1.006        | 54.42            | PASS          | PASS            | PASS           | GMSK            | PASS        | N/A  |
| G            | 1750        | 3/26/2013 | 3209     | ES3DV3     | 1750             | Body | 1.528        | 52.18            | PASS          | PASS            | PASS           | N/A             | N/A         | N/A  |
| E            | 1900        | 3/5/2013  | 3920     | EX3DV4     | 1900             | Body | 1.574        | 52.42            | PASS          | PASS            | PASS           | GMSK            | PASS        | N/A  |
| H            | 2450        | 6/21/2013 | 3318     | ES3DV3     | 2450             | Body | 2.006        | 51.66            | PASS          | PASS            | PASS           | OFDM            | N/A         | PASS |
| A            | 5800        | 1/23/2013 | 3589     | EX3DV4     | 5800             | Body | 6.233        | 46.20            | PASS          | PASS            | PASS           | OFDM            | N/A         | PASS |

NOTE: All measurements were performed using probes calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01r01. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to KDB 865664 D01v01r01.

|                                    |                                                                                     |                       |                                                                                       |                                 |
|------------------------------------|-------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMV100T                 |  | SAR EVALUATION REPORT |  | Reviewed by:<br>Quality Manager |
| Test Dates:<br>08/19/13 - 08/27/13 | DUT Type:<br>Portable Wireless Router                                               |                       |                                                                                       | APPENDIX E:<br>Page 1 of 1      |