



## SAR EVALUATION REPORT

**Applicant Name:**

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

**Date of Testing:**

01/12/16 - 01/15/16

**Test Site/Location:**

PCTEST Lab, Columbia, MD, USA

**Document Serial No.:**

0Y1601110078.A3L

**FCC ID:**

**A3LSMG935X**

**APPLICANT:**

**SAMSUNG ELECTRONICS, CO. LTD.**

**DUT Type:**

Portable Handset

**Application Type:**

Certification

**FCC Rule Part(s):**

CFR §2.1093

**Model(s):**

SM-G935X

| Equipment Class                                   | Band & Mode  | Tx Frequency    | SAR              |                       |
|---------------------------------------------------|--------------|-----------------|------------------|-----------------------|
|                                                   |              |                 | 1 gm Head (W/kg) | 1 gm Body-Worn (W/kg) |
| DTS                                               | 2.4 GHz WLAN | 2412 - 2472 MHz | 0.38             | 0.15                  |
| NII                                               | U-NII-1      | 5180 - 5240 MHz |                  |                       |
| NII                                               | U-NII-2A     | 5260 - 5320 MHz | 0.21             | 0.32                  |
| NII                                               | U-NII-2C     | 5500 - 5720 MHz | 0.29             | 0.34                  |
| NII                                               | U-NII-3      | 5745 - 5825 MHz | 0.56             | 0.16                  |
| DSS/DTS                                           | Bluetooth    | 2402 - 2480 MHz | N/A              |                       |
| <b>Simultaneous SAR per KDB 690783 D01v01r03:</b> |              |                 | <b>0.90</b>      | <b>0.49</b>           |

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 1.8 of this report; for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

  
Randy Ortanez  
President



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

|                                          |                                                                                     |                                      |                                                                                       |                                        |
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| FCC ID: A3LSMG935X                       |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1601110078.A3L | <b>Test Dates:</b><br>01/12/16 - 01/15/16                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 1 of 35                           |

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|                                          |                                                                                     |                                      |                                                                                       |                                        |
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# 1 DEVICE UNDER TEST

## 1.1 Device Overview

| Band & Mode  | Operating Modes | Tx Frequency    |
|--------------|-----------------|-----------------|
| 2.4 GHz WLAN | Data            | 2412 - 2472 MHz |
| U-NII-1      | Data            | 5180 - 5240 MHz |
| U-NII-2A     | Data            | 5260 - 5320 MHz |
| U-NII-2C     | Data            | 5500 - 5720 MHz |
| U-NII-3      | Data            | 5745 - 5825 MHz |
| Bluetooth    | Data            | 2402 - 2480 MHz |
| NFC          | Data            | 13.56 MHz       |
| ANT+         | Data            | 2402 - 2480 MHz |
| MST          | Data            | 1 - 8.3 kHz     |

## 1.2 Power Reduction for SAR

This device uses an independent fixed level power reduction mechanism for WLAN operations during voice or VoIP held to ear scenarios. Per FCC Guidance, the held-to-ear exposure conditions were evaluated at reduced power according to the head SAR positions described in IEEE 1528-2013. The reduced powers for the power reduction mechanisms were confirmed via conducted power measurements at the RF port (See Section 8). Detailed descriptions of the mechanisms are included in the operational description.

## 1.3 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 D01v06.

### 1.2.1 Maximum WLAN/BT Power

| Mode / Band            |         | Modulated Average - Single Tx Chain (dBm) |       |       |
|------------------------|---------|-------------------------------------------|-------|-------|
|                        |         | ch 1-11                                   | ch 12 | ch 13 |
| IEEE 802.11b (2.4 GHz) | Maximum | 19.5                                      |       |       |
|                        | Nominal | 19.0                                      |       |       |
| IEEE 802.11g (2.4 GHz) | Maximum | 17.5                                      | 15.5  | 9.5   |
|                        | Nominal | 17.0                                      | 15.0  | 9.0   |
| IEEE 802.11n (2.4 GHz) | Maximum | 17.5                                      | 15.5  | 9.5   |
|                        | Nominal | 17.0                                      | 15.0  | 9.0   |

| Mode / Band                      |         | Modulated Average - MIMO (dBm) |       |       |
|----------------------------------|---------|--------------------------------|-------|-------|
|                                  |         | ch 1-11                        | ch 12 | ch 13 |
| IEEE 802.11g (2.4 GHz) (CDD)     | Maximum | 17.5                           | 15.5  | 9.5   |
|                                  | Nominal | 17.0                           | 15.0  | 9.0   |
| IEEE 802.11n (2.4 GHz) (CDD+SDM) | Maximum | 17.5                           | 15.5  | 9.5   |
|                                  | Nominal | 17.0                           | 15.0  | 9.0   |

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
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| Mode / Band  |         | Modulated Average (dBm) |
|--------------|---------|-------------------------|
| Bluetooth    | Maximum | <b>10.5</b>             |
|              | Nominal | <b>10.0</b>             |
| Bluetooth LE | Maximum | <b>6.0</b>              |
|              | Nominal | <b>5.5</b>              |

| Mode / Band           |         | Modulated Average - Single Tx Chain (dBm) |                   |                  |             |                   |                  |               |
|-----------------------|---------|-------------------------------------------|-------------------|------------------|-------------|-------------------|------------------|---------------|
|                       |         | 20 MHz Bandwidth                          |                   | 40 MHz Bandwidth |             |                   | 80 MHz Bandwidth |               |
|                       |         | ch 36, 64, 100                            | ch 40-60, 104-165 | ch 38            | ch62, 102   | ch 46-54, 110-159 | ch42, 106        | ch58, 122-155 |
| IEEE 802.11a (5 GHz)  | Maximum | <b>15.5</b>                               | <b>16.5</b>       |                  |             |                   |                  |               |
|                       | Nominal | <b>15.0</b>                               | <b>16.0</b>       |                  |             |                   |                  |               |
| IEEE 802.11n (5 GHz)  | Maximum | <b>15.5</b>                               | <b>16.5</b>       | <b>13.5</b>      | <b>14.5</b> | <b>15.5</b>       |                  |               |
|                       | Nominal | <b>15.0</b>                               | <b>16.0</b>       | <b>13.0</b>      | <b>14.0</b> | <b>15.0</b>       |                  |               |
| IEEE 802.11ac (5 GHz) | Maximum | <b>15.5</b>                               | <b>16.5</b>       | <b>13.5</b>      | <b>14.5</b> | <b>15.5</b>       | <b>12.5</b>      | <b>13.5</b>   |
|                       | Nominal | <b>15.0</b>                               | <b>16.0</b>       | <b>13.0</b>      | <b>14.0</b> | <b>15.0</b>       | <b>12.0</b>      | <b>13.0</b>   |

| Mode / Band                     |         | Modulated Average - MIMO (dBm) |                   |                  |             |                   |                  |               |
|---------------------------------|---------|--------------------------------|-------------------|------------------|-------------|-------------------|------------------|---------------|
|                                 |         | 20 MHz Bandwidth               |                   | 40 MHz Bandwidth |             |                   | 80 MHz Bandwidth |               |
|                                 |         | ch 36, 64, 100                 | ch 40-60, 104-165 | ch 38            | ch62, 102   | ch 46-54, 110-159 | ch42, 106        | ch58, 122-155 |
| IEEE 802.11a (5 GHz) (CDD)      | Maximum | <b>15.5</b>                    | <b>16.5</b>       |                  |             |                   |                  |               |
|                                 | Nominal | <b>15.0</b>                    | <b>16.0</b>       |                  |             |                   |                  |               |
| IEEE 802.11n (5 GHz) (CDD+SDM)  | Maximum | <b>15.5</b>                    | <b>16.5</b>       | <b>13.5</b>      | <b>14.5</b> | <b>15.5</b>       |                  |               |
|                                 | Nominal | <b>15.0</b>                    | <b>16.0</b>       | <b>13.0</b>      | <b>14.0</b> | <b>15.0</b>       |                  |               |
| IEEE 802.11ac (5 GHz) (CDD+SDM) | Maximum | <b>15.5</b>                    | <b>16.5</b>       | <b>13.5</b>      | <b>14.5</b> | <b>15.5</b>       | <b>12.5</b>      | <b>13.5</b>   |
|                                 | Nominal | <b>15.0</b>                    | <b>16.0</b>       | <b>13.0</b>      | <b>14.0</b> | <b>15.0</b>       | <b>12.0</b>      | <b>13.0</b>   |

|                                          |                                                                                     |                                      |                                                                                       |                                        |
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## 1.2.2 Reduced WLAN Power- Proximity Sensor Active (Held to Ear)

| Mode / Band            |         | Modulated Average (dBm) |       |            |
|------------------------|---------|-------------------------|-------|------------|
|                        |         | ch 1-11                 | ch 12 | ch 13      |
| IEEE 802.11b (2.4 GHz) | Maximum | <b>13.5</b>             |       |            |
|                        | Nominal | <b>13.0</b>             |       |            |
| IEEE 802.11g (2.4 GHz) | Maximum | <b>13.5</b>             |       | <b>9.5</b> |
|                        | Nominal | <b>13.0</b>             |       | <b>9.0</b> |
| IEEE 802.11n (2.4 GHz) | Maximum | <b>13.5</b>             |       | <b>9.5</b> |
|                        | Nominal | <b>13.0</b>             |       | <b>9.0</b> |

| Mode / Band                      |         | Modulated Average - MIMO (dBm) |             |            |
|----------------------------------|---------|--------------------------------|-------------|------------|
|                                  |         | Ch. 1-11                       | Ch. 12      | Ch. 13     |
| IEEE 802.11g (CDD) (2.4 GHz)     | Maximum | <b>16.5</b>                    | <b>15.5</b> | <b>9.5</b> |
|                                  | Nominal | <b>16.0</b>                    | <b>15.0</b> | <b>9.0</b> |
| IEEE 802.11n (CDD+SDM) (2.4 GHz) | Maximum | <b>16.5</b>                    | <b>15.5</b> | <b>9.5</b> |
|                                  | Nominal | <b>16.0</b>                    | <b>15.0</b> | <b>9.0</b> |

| Mode / Band           |         | Modulated Average (dBm) |                  |                  |
|-----------------------|---------|-------------------------|------------------|------------------|
|                       |         | 20 MHz Bandwidth        | 40 MHz Bandwidth | 80 MHz Bandwidth |
| IEEE 802.11a (5 GHz)  | Maximum | <b>10.5</b>             |                  |                  |
|                       | Nominal | <b>10.0</b>             |                  |                  |
| IEEE 802.11n (5 GHz)  | Maximum | <b>10.5</b>             | <b>10.5</b>      |                  |
|                       | Nominal | <b>10.0</b>             | <b>10.0</b>      |                  |
| IEEE 802.11ac (5 GHz) | Maximum | <b>10.5</b>             | <b>10.5</b>      | <b>10.5</b>      |
|                       | Nominal | <b>10.0</b>             | <b>10.0</b>      | <b>10.0</b>      |

| Mode / Band                        |         | Modulated Average - MIMO (dBm) |                  |                  |               |
|------------------------------------|---------|--------------------------------|------------------|------------------|---------------|
|                                    |         | 20 MHz Bandwidth               | 40 MHz Bandwidth | 80 MHz Bandwidth |               |
|                                    |         |                                |                  | ch42, 106        | ch58, 122-155 |
| IEEE 802.11a (5 GHz)<br>(CDD)      | Maximum | 13.5                           |                  |                  |               |
|                                    | Nominal | 13.0                           |                  |                  |               |
| IEEE 802.11n (5 GHz)<br>(CDD+SDM)  | Maximum | 13.5                           |                  |                  |               |
|                                    | Nominal | 13.0                           |                  |                  |               |
| IEEE 802.11ac (5 GHz)<br>(CDD+SDM) | Maximum | 13.5                           | 12.5             | 13.5             |               |
|                                    | Nominal | 13.0                           | 12.0             | 13.0             |               |

## 1.4 DUT Antenna Locations

The overall dimensions of this device are < 9 x 5 cm. A diagram showing the location of the device antennas can be found in Appendix F.

## 1.5 Near Field Communications (NFC) Antenna

This DUT has NFC Operations. The NFC antenna is integrated into the device for this model. Therefore, all SAR tests were performed with the device which already incorporates the NFC antenna. A diagram showing the location of the NFC antenna can be found in Appendix F.

|                                   |                                                                                     |                               |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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## 1.6 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, 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.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06 3) procedures.

**Table 1-1**  
**Simultaneous Transmission Scenarios**

| No. | Capable Transmit Configuration          | Head | Body-Worn Accessory | Notes                                             |
|-----|-----------------------------------------|------|---------------------|---------------------------------------------------|
| 1   | 2.4 GHz WIFI Ant 1 + 2.4 GHz WIFI Ant 2 | Yes* | Yes*                | *-Pre-installed VOIP applications are considered. |
| 2   | 2.4 GHz WIFI Ant 1 + 5 GHz WIFI Ant 2   | Yes* | Yes*                | *-Pre-installed VOIP applications are considered. |
| 3   | 5 GHz WIFI Ant 1 + 5 GHz WIFI Ant 2     | Yes* | Yes*                | *-Pre-installed VOIP applications are considered. |
| 4   | 5 GHz WIFI Ant 1 + 2.4 GHz WIFI Ant 2   | Yes* | Yes*                | *-Pre-installed VOIP applications are considered. |
| 5   | 2.4 GHz WIFI Ant 1 + 5 GHz WIFI Ant 1   | N/A  | N/A                 | Not Supported by HW                               |
| 6   | 2.4 GHz WIFI Ant 2 + 5 GHz WIFI Ant 2   | N/A  | N/A                 | Not Supported by HW                               |

1. 2.4 GHz WLAN, 5 GHz WLAN and 2.4 GHz Bluetooth that share the same antenna path cannot transmit simultaneously.
2. This device supports 2x2 MIMO Tx for WLAN 802.11a/g/n/ac. Each WLAN antenna can transmit independently or together when operating with MIMO.

## 1.7 Miscellaneous SAR Test Considerations

### (A) WIFI/BT

This device does not support network-based voice services but does support VOIP operations. Therefore, this device was evaluated per the procedures outlined in KDB 648474 D04 for handsets.

This device supports IEEE 802.11ac with the following features:

- a) Up to 80 MHz Bandwidth only
- b) No aggregate channel configurations
- c) 2 Tx antenna output
- d) 256 QAM is supported
- e) Band gap and TDWR channels are supported

Since U-NII-1 and U-NII-2A bands have the same maximum output power and the highest reported SAR for U-NII-2A is less than 1.2 W/kg for 1g SAR, SAR is not required for U-NII-1 band according to FCC KDB 248227 D01v02r02.

Per FCC KDB 447498 D01v06, the 1g SAR exclusion threshold for distances <50mm is defined by the following equation:

$$\frac{\text{Max Power of Channel (mW)}}{\text{Test Separation Dist (mm)}} * \sqrt{\text{Frequency (GHz)}} \leq 3.0$$

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, body-worn Bluetooth SAR was not required;  $[(11/15) * \sqrt{2.480}] = 1.2 < 3.0$ . Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.

This device supports channel 1-13 for 2.4 GHz WLAN. However, due to the reduced output power for channels 12 and 13, channels 1, 6, and 11 were considered for SAR testing per KDB 248227 D01v02r02.

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
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## 1.8 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v06 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)

## 1.9 Device Serial Numbers

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

|              | Head Serial Number | Body-Worn Serial Number |
|--------------|--------------------|-------------------------|
| 2.4 GHz WLAN | 00580              | 0C6B5                   |
| 5 GHz WLAN   | 0C6B5              | 00580                   |

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

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

## 2.1 SAR Definition

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

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

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

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

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

where:

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

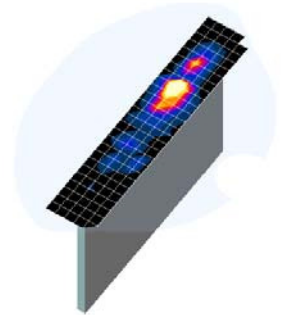
NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces,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

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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### 3.1 Measurement Procedure

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

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



**Figure 3-1**  
Sample SAR Area Scan

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

| Frequency | Maximum Area Scan Resolution (mm)<br>( $\Delta x_{area}, \Delta y_{area}$ ) | 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            |                              |                                          |
|           |                                                                             |                                                                             | $\Delta z_{zoom}(n)$                      | $\Delta z_{zoom}(1)^*$ | $\Delta z_{zoom}(n>1)^*$     |                                          |
| ≤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                                      |

\*Also compliant to IEEE 1528-2013 Table 6

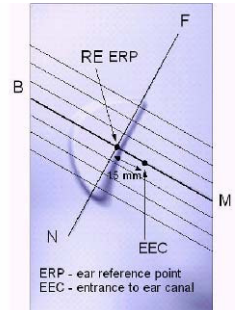
|                                   |                                                                                     |                               |  |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------|--|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG935X                |  | SAR EVALUATION REPORT         |  |  | Reviewed by:<br>Quality Manager |
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## 4

## DEFINITION OF REFERENCE POINTS

### 4.1 EAR REFERENCE POINT

Figure 4-2 shows the front, back and side views of the SAM Twin Phantom. The point “M” is the reference point for the center of the mouth, “LE” is the left ear reference point (ERP), and “RE” is the right ERP. The ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 4-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front), also called the Reference Pivoting Line, is not perpendicular to the reference plane (see Figure 4-1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].



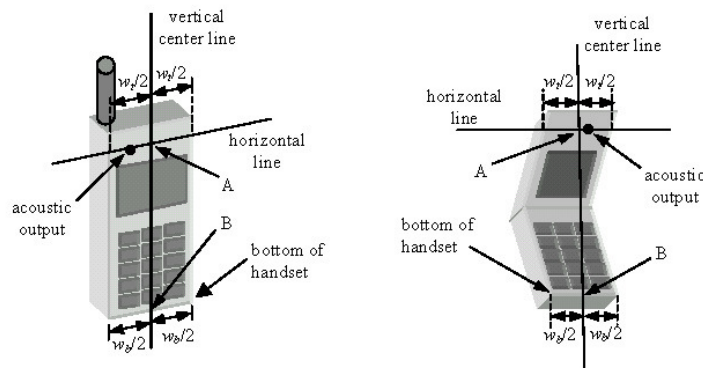
**Figure 4-1**  
Close-Up Side view  
of ERP

### 4.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the acoustic output located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (See Figure 4-3). The acoustic output was then located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at its top and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point.



**Figure 4-2**  
Front, back and side view of SAM Twin Phantom



**Figure 4-3**  
Handset Vertical Center & Horizontal Line Reference Points

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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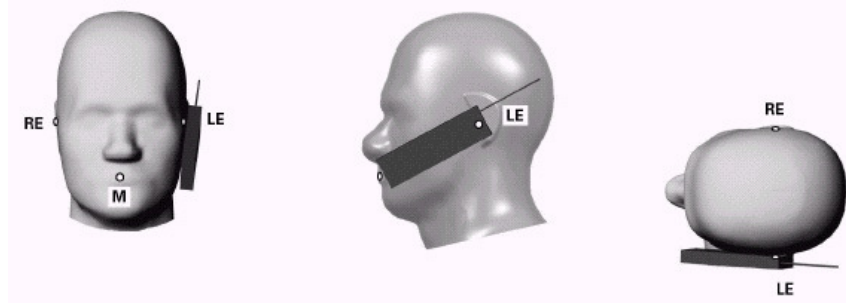
## 5 TEST CONFIGURATION POSITIONS FOR HANDSETS

### 5.1 Device Holder

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

### 5.2 Positioning for Cheek

1. The test device was positioned with the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 5-1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.



**Figure 5-1 Front, Side and Top View of Cheek Position**

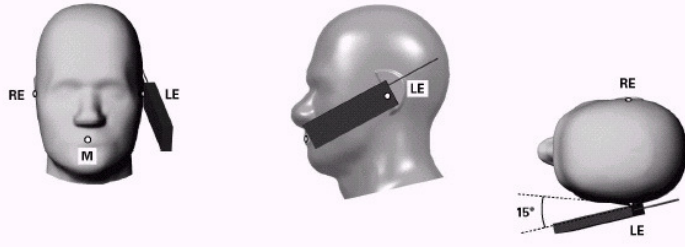
2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the pinna.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the reference plane.
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical with respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the device contact with the ear, the device was rotated about the NF line until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 5-2).

### 5.3 Positioning for Ear / 15° Tilt

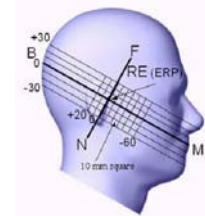
With the test device aligned in the “Cheek Position”:

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. In this situation, the tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 5-2).

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
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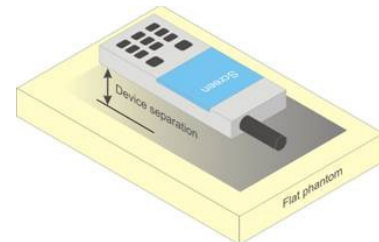
**Figure 5-2 Front, Side and Top View of Ear/15° Tilt Position**



**Figure 5-3 Side view w/ relevant markings**

## 5.4 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 5-4). Per FCC KDB Publication 648474 D04v01r03, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is  $> 1.2 \text{ W/kg}$ , the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.



**Figure 5-4 Sample Body-Worn Diagram**

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

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
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## 5.5 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1-g body and 10-g extremity SAR Exclusion Thresholds found in KDB Publication 447498 D01v06 should be applied to determine SAR test requirements.

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

|                                          |                                                                                     |                                      |                                                                                       |                                        |
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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 for licensed transmitters are performed using a base station simulator under digital average power.

### 7.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, 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 D01v01r03.

### 7.2 SAR Testing with 802.11 Transmitters

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. 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 D01v02r02 for more details.

#### 7.2.1 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.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

#### 7.2.2 U-NII-1 and U-NII-2A

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, SAR measurement using OFDM SAR test procedures is not required for U-NII-1 unless the highest reported SAR for U-NII-2A is  $> 1.2$  W/kg. When different maximum output powers are specified for the bands, SAR measurement for the U-NII band with the lower maximum output power is not required unless the highest reported SAR for the U-NII band with the higher maximum output power, adjusted by the ratio of lower to higher specified maximum output power for the two bands, is  $> 1.2$  W/kg.

#### 7.2.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification. Unless band gap channels are permanently disabled, SAR must be considered for these channels. Each band is tested independently according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
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## 7.2.4 Initial Test Position Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is  $\leq 0.4$  W/kg for 1g SAR, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is  $\leq 0.8$  W/kg for 1g SAR or all test positions are measured.

## 7.2.5 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

- 1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is  $\leq 0.8$  W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 2) When the reported SAR is  $> 0.8$  W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is  $> 1.2$  W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is  $> 1.2$  W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed.

## 7.2.6 OFDM Transmission Mode and SAR Test Channel Selection

For the 2.4 GHz and 5 GHz bands, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a, 802.11n and 802.11ac or 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 802.11n and 802.11ac or 802.11g then 802.11n, is used for SAR measurement. When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

## 7.2.7 Initial Test Configuration Procedure

For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order IEEE 802.11 mode. The channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration.

When the reported SAR is  $\leq 0.8$  W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is  $\leq 1.2$  W/kg or all channels are measured. When there are multiple untested

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
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channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements (See Section 7.2.6).

## 7.2.8 Subsequent Test Configuration Procedures

For OFDM configurations in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure. When the highest reported SAR (for the initial test configuration), adjusted by the ratio of the specified maximum output power of the subsequent test configuration to initial test configuration, is  $\leq 1.2$  W/kg, no additional SAR tests for the subsequent test configurations are required.

## 7.2.9 MIMO SAR considerations

Per KDB 248227 D01v02r02, the simultaneous SAR provisions in KDB Publication 447498 D01v06 should be applied to determine simultaneous transmission SAR test exclusion for WIFI MIMO. If the sum of 1g single transmission chain SAR measurements is  $< 1.6$  W/kg, no additional SAR measurements for MIMO are required. Alternatively, SAR for MIMO can be measured with all antennas transmitting simultaneously at the specified maximum output power of MIMO operation.

|                                   |                                                                                     |                               |                                                                                       |                                 |
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## 8 RF CONDUCTED POWERS

### 8.1 WLAN Conducted Powers

**Table 8-1**  
**2.4 GHz WLAN Maximum Average RF Power – Antenna 1**

| Freq [MHz] | Channel | 2.4GHz Conducted Power [dBm] |         |         |
|------------|---------|------------------------------|---------|---------|
|            |         | IEEE Transmission Mode       |         |         |
|            |         | 802.11b                      | 802.11g | 802.11n |
| 2412       | 1       | 19.41                        | 17.32   | 17.16   |
| 2437       | 6       | 18.75                        | 17.23   | 17.08   |
| 2462       | 11      | 18.79                        | 17.15   | 17.00   |

**Table 8-2**  
**2.4 GHz WLAN Maximum Average RF Power – Antenna 2**

| Freq [MHz] | Channel | 2.4GHz Conducted Power [dBm] |         |         |
|------------|---------|------------------------------|---------|---------|
|            |         | IEEE Transmission Mode       |         |         |
|            |         | 802.11b                      | 802.11g | 802.11n |
| 2412       | 1       | 18.13                        | 17.28   | 17.08   |
| 2437       | 6       | 18.93                        | 16.91   | 16.80   |
| 2462       | 11      | 18.92                        | 16.75   | 16.56   |

**Table 8-3**  
**2.4 GHz WLAN Reduced Average RF Power – Antenna 1**

| Freq [MHz] | Channel | 2.4GHz Conducted Power [dBm] |         |         |
|------------|---------|------------------------------|---------|---------|
|            |         | IEEE Transmission Mode       |         |         |
|            |         | 802.11b                      | 802.11g | 802.11n |
| 2412       | 1       | 12.59                        | 12.42   | 13.43   |
| 2437       | 6       | 13.20                        | 12.67   | 12.91   |
| 2462       | 11      | 13.06                        | 12.60   | 12.56   |

**Table 8-4**  
**2.4 GHz WLAN Reduced Average RF Power – Antenna 2**

| Freq [MHz] | Channel | 2.4GHz Conducted Power [dBm] |         |         |
|------------|---------|------------------------------|---------|---------|
|            |         | IEEE Transmission Mode       |         |         |
|            |         | 802.11b                      | 802.11g | 802.11n |
| 2412       | 1       | 12.80                        | 11.63   | 13.49   |
| 2437       | 6       | 13.40                        | 12.72   | 12.75   |
| 2462       | 11      | 13.34                        | 12.60   | 12.53   |

**Table 8-5**  
**5 GHz WLAN Maximum Average RF Power – Antenna 1**

| Freq [MHz] | Channel | 5GHz (20MHz) Conducted Power [dBm] |         |          |
|------------|---------|------------------------------------|---------|----------|
|            |         | IEEE Transmission Mode             |         |          |
|            |         | 802.11a                            | 802.11n | 802.11ac |
| 5180       | 36      | 14.59                              | 14.40   | 14.73    |
| 5200       | 40      | 16.03                              | 15.85   | 16.10    |
| 5220       | 44      | 16.01                              | 15.94   | 16.06    |
| 5240       | 48      | 15.92                              | 15.87   | 16.02    |
| 5260       | 52      | 16.49                              | 16.29   | 16.47    |
| 5280       | 56      | 16.48                              | 16.22   | 16.43    |
| 5300       | 60      | 16.45                              | 16.32   | 16.37    |
| 5320       | 64      | 14.77                              | 14.71   | 14.87    |
| 5500       | 100     | 14.20                              | 13.97   | 14.33    |
| 5520       | 104     | 15.81                              | 15.57   | 15.70    |
| 5600       | 120     | 15.70                              | 16.37   | 15.52    |
| 5620       | 124     | 15.57                              | 16.40   | 15.53    |
| 5720       | 144     | 16.27                              | 16.10   | 16.20    |
| 5745       | 149     | 15.58                              | 16.40   | 16.45    |
| 5785       | 157     | 15.50                              | 16.25   | 16.38    |
| 5825       | 165     | 16.31                              | 16.22   | 16.13    |

**Table 8-6**  
**5 GHz WLAN Maximum Average RF Power – Antenna 2**

| Freq [MHz] | Channel | 5GHz (20MHz) Conducted Power [dBm] |         |          |
|------------|---------|------------------------------------|---------|----------|
|            |         | IEEE Transmission Mode             |         |          |
|            |         | 802.11a                            | 802.11n | 802.11ac |
| 5180       | 36      | 14.57                              | 14.49   | 15.17    |
| 5200       | 40      | 16.16                              | 16.13   | 16.13    |
| 5220       | 44      | 16.13                              | 16.08   | 16.18    |
| 5240       | 48      | 16.28                              | 16.10   | 16.21    |
| 5260       | 52      | 16.44                              | 16.28   | 16.37    |
| 5280       | 56      | 16.42                              | 16.37   | 16.30    |
| 5300       | 60      | 16.43                              | 16.29   | 16.36    |
| 5320       | 64      | 14.72                              | 14.69   | 15.39    |
| 5500       | 100     | 14.63                              | 14.66   | 15.47    |
| 5520       | 104     | 16.33                              | 16.25   | 16.31    |
| 5600       | 120     | 16.08                              | 15.97   | 16.03    |
| 5620       | 124     | 16.04                              | 16.02   | 16.04    |
| 5720       | 144     | 15.85                              | 15.68   | 15.90    |
| 5745       | 149     | 16.20                              | 16.11   | 16.33    |
| 5785       | 157     | 16.05                              | 16.05   | 16.31    |
| 5825       | 165     | 16.15                              | 16.01   | 16.26    |

|                                   |                                                                                     |                               |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG935X                |  | <b>SAR EVALUATION REPORT</b>  |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1601110078.A3L | Test Dates:<br>01/12/16 - 01/15/16                                                  | DUT Type:<br>Portable Handset | Page 19 of 35                                                                         |                                 |

**Table 8-7**  
**5 GHz WLAN Reduced Average RF Power – Antenna 1**

| 5GHz (80MHz) Conducted Power |         |                              |
|------------------------------|---------|------------------------------|
| Freq [MHz]                   | Channel | IEEE<br>Transmission<br>Mode |
|                              |         | 802.11ac                     |
| 5210                         | 42      | 9.57                         |
| 5290                         | 58      | <b>9.53</b>                  |
| 5530                         | 106     | <b>10.49</b>                 |
| 5610                         | 122     | 10.37                        |
| 5690                         | 138     | 10.20                        |
| 5775                         | 155     | <b>10.00</b>                 |

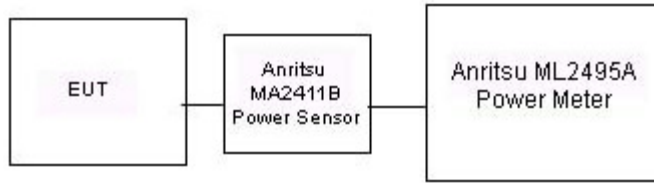
**Table 8-8**  
**5 GHz WLAN Reduced Average RF Power – Antenna 2**

| 5GHz (80MHz) Conducted Power |         |                              |
|------------------------------|---------|------------------------------|
| Freq [MHz]                   | Channel | IEEE<br>Transmission<br>Mode |
|                              |         | 802.11ac                     |
| 5210                         | 42      | 10.01                        |
| 5290                         | 58      | <b>10.49</b>                 |
| 5530                         | 106     | <b>9.70</b>                  |
| 5610                         | 122     | 9.60                         |
| 5690                         | 138     | 9.54                         |
| 5775                         | 155     | <b>10.44</b>                 |

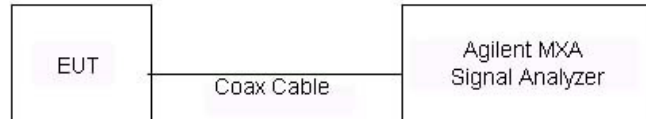
Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.
- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, due to an even number of channels, both channels were measured.
- The bolded data rate and channel above were tested for SAR.

|                                   |                                                                                                                                   |                               |                                                                                       |                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG935X                |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR EVALUATION REPORT</b>  |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1601110078.A3L | Test Dates:<br>01/12/16 - 01/15/16                                                                                                | DUT Type:<br>Portable Handset | Page 20 of 35                                                                         |                                 |



**Figure 8-1**  
**Power Measurement Setup for Bandwidths < 50 MHz**



**Figure 8-2**  
**Power Measurement Setup for Bandwidths > 50 MHz**

|                                   |                                                                                     |                               |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSMG935X                |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1601110078.A3L | Test Dates:<br>01/12/16 - 01/15/16                                                  | DUT Type:<br>Portable Handset | Page 21 of 35                                                                         |                                 |

## 9

## SYSTEM VERIFICATION

## 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 $\epsilon$ |
|------------------------------------|-------------|-------------------------------------|--------------------------|---------------------------------------|------------------------------------------|-------------------------------------|----------------------------------------|----------------|------------------|
| 01/15/2016                         | 2450H       | 22.0                                | 2400                     | 1.763                                 | 38.856                                   | 1.756                               | 39.289                                 | 0.40%          | -1.10%           |
|                                    |             |                                     | 2450                     | 1.822                                 | 38.658                                   | 1.800                               | 39.200                                 | 1.22%          | -1.38%           |
|                                    |             |                                     | 2500                     | 1.877                                 | 38.465                                   | 1.855                               | 39.136                                 | 1.19%          | -1.71%           |
| 01/14/2016                         | 5200H-5800H | 21.7                                | 5240                     | 4.674                                 | 36.275                                   | 4.696                               | 35.940                                 | -0.47%         | 0.93%            |
|                                    |             |                                     | 5260                     | 4.696                                 | 36.211                                   | 4.717                               | 35.917                                 | -0.45%         | 0.82%            |
|                                    |             |                                     | 5280                     | 4.720                                 | 36.215                                   | 4.737                               | 35.894                                 | -0.36%         | 0.89%            |
|                                    |             |                                     | 5300                     | 4.737                                 | 36.167                                   | 4.758                               | 35.871                                 | -0.44%         | 0.83%            |
|                                    |             |                                     | 5500                     | 4.935                                 | 35.880                                   | 4.963                               | 35.643                                 | -0.56%         | 0.66%            |
|                                    |             |                                     | 5520                     | 4.959                                 | 35.886                                   | 4.983                               | 35.620                                 | -0.48%         | 0.75%            |
|                                    |             |                                     | 5540                     | 4.989                                 | 35.814                                   | 5.004                               | 35.597                                 | -0.30%         | 0.61%            |
|                                    |             |                                     | 5600                     | 5.043                                 | 35.740                                   | 5.065                               | 35.529                                 | -0.43%         | 0.59%            |
|                                    |             |                                     | 5745                     | 5.204                                 | 35.504                                   | 5.214                               | 35.363                                 | -0.19%         | 0.40%            |
|                                    |             |                                     | 5765                     | 5.224                                 | 35.488                                   | 5.235                               | 35.335                                 | -0.21%         | 0.43%            |
|                                    |             |                                     | 5785                     | 5.244                                 | 35.453                                   | 5.255                               | 35.315                                 | -0.21%         | 0.39%            |
| 01/12/2016                         | 2450B       | 22.5                                | 2400                     | 1.920                                 | 52.493                                   | 1.902                               | 52.767                                 | 0.95%          | -0.52%           |
|                                    |             |                                     | 2450                     | 1.994                                 | 52.299                                   | 1.950                               | 52.700                                 | 2.26%          | -0.76%           |
|                                    |             |                                     | 2500                     | 2.062                                 | 52.082                                   | 2.021                               | 52.636                                 | 2.03%          | -1.05%           |
| 01/12/2016                         | 5200B-5800B | 23.8                                | 5260                     | 5.406                                 | 48.575                                   | 5.369                               | 48.933                                 | 0.69%          | -0.73%           |
|                                    |             |                                     | 5300                     | 5.455                                 | 48.493                                   | 5.416                               | 48.879                                 | 0.72%          | -0.79%           |
|                                    |             |                                     | 5500                     | 5.711                                 | 48.227                                   | 5.650                               | 48.607                                 | 1.08%          | -0.78%           |
|                                    |             |                                     | 5520                     | 5.727                                 | 48.253                                   | 5.673                               | 48.580                                 | 0.95%          | -0.67%           |
|                                    |             |                                     | 5700                     | 5.981                                 | 47.920                                   | 5.883                               | 48.336                                 | 1.67%          | -0.86%           |
|                                    |             |                                     | 5745                     | 6.039                                 | 47.844                                   | 5.936                               | 48.275                                 | 1.74%          | -0.89%           |
|                                    |             |                                     | 5800                     | 6.135                                 | 47.714                                   | 6.000                               | 48.200                                 | 2.25%          | -1.01%           |
|                                    |             |                                     | 5825                     | 6.169                                 | 47.626                                   | 6.029                               | 48.166                                 | 2.32%          | -1.12%           |

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

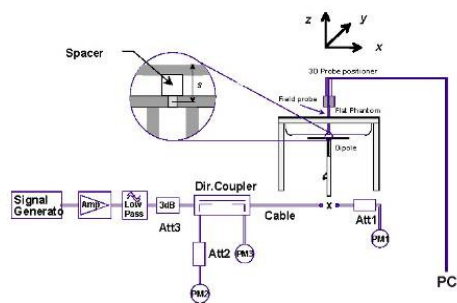
|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG935X                       |  <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>0Y1601110078.A3L | <b>Test Dates:</b><br>01/12/16 - 01/15/16                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 22 of 35                          |

## 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> (%) |
| J                                        | 2450                   | HEAD        | 01/15/2016 | 22.7           | 22.0             | 0.100           | 719       | 3319     | 5.040                             | 54.200                              | 50.400                                  | -7.01%                      |
| E                                        | 5250                   | HEAD        | 01/14/2016 | 24.2           | 22.0             | 0.050           | 1191      | 7308     | 3.940                             | 82.500                              | 78.800                                  | -4.48%                      |
| E                                        | 5600                   | HEAD        | 01/14/2016 | 24.2           | 22.0             | 0.050           | 1191      | 7308     | 4.310                             | 84.500                              | 86.200                                  | 2.01%                       |
| E                                        | 5750                   | HEAD        | 01/14/2016 | 24.2           | 22.0             | 0.050           | 1191      | 7308     | 3.850                             | 80.000                              | 77.000                                  | -3.75%                      |
| J                                        | 2450                   | BODY        | 01/12/2016 | 22.1           | 22.5             | 0.100           | 719       | 3319     | 5.330                             | 51.900                              | 53.300                                  | 2.70%                       |
| D                                        | 5300                   | BODY        | 01/12/2016 | 23.8           | 23.6             | 0.050           | 1120      | 7357     | 3.770                             | 75.200                              | 75.400                                  | 0.27%                       |
| D                                        | 5500                   | BODY        | 01/12/2016 | 23.8           | 23.6             | 0.050           | 1120      | 7357     | 3.820                             | 79.500                              | 76.400                                  | -3.90%                      |
| D                                        | 5800                   | BODY        | 01/12/2016 | 23.8           | 23.6             | 0.050           | 1120      | 7357     | 3.720                             | 76.300                              | 74.400                                  | -2.49%                      |



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



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

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG935X                       |  <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>0Y1601110078.A3L | <b>Test Dates:</b><br>01/12/16 - 01/15/16                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 23 of 35                          |

## 10

## SAR DATA SUMMARY

## 10.1 Standalone Head SAR Data

Table 10-1  
DTS Head SAR

| MEASUREMENT RESULTS                                                                               |     |         |         |                 |                             |                       |                  |                                                 |               |                 |                      |                  |                |                       |          |                        |                             |                   |        |
|---------------------------------------------------------------------------------------------------|-----|---------|---------|-----------------|-----------------------------|-----------------------|------------------|-------------------------------------------------|---------------|-----------------|----------------------|------------------|----------------|-----------------------|----------|------------------------|-----------------------------|-------------------|--------|
| FREQUENCY                                                                                         |     | Mode    | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | Antenna Config. | Device Serial Number | Data Rate (Mbps) | Duty Cycle (%) | Peak SAR of Area Scan | SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Reported SAR (1g) | Plot # |
| MHz                                                                                               | Ch. |         |         |                 |                             |                       |                  |                                                 |               |                 |                      |                  |                | W/kg                  | (W/kg)   |                        |                             | (W/kg)            |        |
| 2437                                                                                              | 6   | 802.11b | DSSS    | 22              | 13.5                        | 13.20                 | -0.01            | Right                                           | Cheek         | 1               | 00580                | 1                | 99.8           | 0.322                 | 0.320    | 1.072                  | 1.002                       | 0.344             |        |
| 2437                                                                                              | 6   | 802.11b | DSSS    | 22              | 13.5                        | 13.20                 | -                | Right                                           | Tilt          | 1               | 00580                | 1                | 99.8           | 0.207                 | -        | 1.072                  | 1.002                       | -                 |        |
| 2437                                                                                              | 6   | 802.11b | DSSS    | 22              | 13.5                        | 13.20                 | -                | Left                                            | Cheek         | 1               | 00580                | 1                | 99.8           | 0.172                 | -        | 1.072                  | 1.002                       | -                 |        |
| 2437                                                                                              | 6   | 802.11b | DSSS    | 22              | 13.5                        | 13.20                 | -                | Left                                            | Tilt          | 1               | 00580                | 1                | 99.8           | 0.136                 | -        | 1.072                  | 1.002                       | -                 |        |
| 2437                                                                                              | 6   | 802.11b | DSSS    | 22              | 13.5                        | 13.40                 | -                | Right                                           | Cheek         | 2               | 00580                | 1                | 99.8           | 0.241                 | -        | 1.023                  | 1.002                       | -                 |        |
| 2437                                                                                              | 6   | 802.11b | DSSS    | 22              | 13.5                        | 13.40                 | -                | Right                                           | Tilt          | 2               | 00580                | 1                | 99.8           | 0.215                 | -        | 1.023                  | 1.002                       | -                 |        |
| 2437                                                                                              | 6   | 802.11b | DSSS    | 22              | 13.5                        | 13.40                 | 0.00             | Left                                            | Cheek         | 2               | 00580                | 1                | 99.8           | 0.479                 | 0.368    | 1.023                  | 1.002                       | 0.377             | A1     |
| 2437                                                                                              | 6   | 802.11b | DSSS    | 22              | 13.5                        | 13.40                 | -                | Left                                            | Tilt          | 2               | 00580                | 1                | 99.8           | 0.426                 | -        | 1.023                  | 1.002                       | -                 |        |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |         |         |                 |                             |                       |                  | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |               |                 |                      |                  |                |                       |          |                        |                             |                   |        |

Table 10-2  
NII Head SAR

| MEASUREMENT RESULTS                                                                               |     |          |         |                 |                             |                       |                  |       |               |                                                 |                      |                  |                |                       |          |                        |                             |                   |        |
|---------------------------------------------------------------------------------------------------|-----|----------|---------|-----------------|-----------------------------|-----------------------|------------------|-------|---------------|-------------------------------------------------|----------------------|------------------|----------------|-----------------------|----------|------------------------|-----------------------------|-------------------|--------|
| FREQUENCY                                                                                         |     | Mode     | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side  | Test Position | Antenna Config.                                 | Device Serial Number | Data Rate (Mbps) | Duty Cycle (%) | Peak SAR of Area Scan | SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Reported SAR (1g) | Plot # |
| MHz                                                                                               | Ch. |          |         |                 |                             |                       |                  |       |               |                                                 |                      |                  |                | W/kg                  | (W/kg)   | (W/kg)                 |                             |                   |        |
| 5290                                                                                              | 58  | 802.11ac | OFDM    | 80              | 10.5                        | 9.53                  | 0.18             | Right | Cheek         | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.325                 | 0.162    | 1.250                  | 1.030                       | 0.209             |        |
| 5290                                                                                              | 58  | 802.11ac | OFDM    | 80              | 10.5                        | 9.53                  | -                | Right | Tilt          | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.210                 | -        | 1.250                  | 1.030                       | -                 |        |
| 5290                                                                                              | 58  | 802.11ac | OFDM    | 80              | 10.5                        | 9.53                  | -                | Left  | Cheek         | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.117                 | -        | 1.250                  | 1.030                       | -                 |        |
| 5290                                                                                              | 58  | 802.11ac | OFDM    | 80              | 10.5                        | 9.53                  | -                | Left  | Tilt          | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.073                 | -        | 1.250                  | 1.030                       | -                 |        |
| 5290                                                                                              | 58  | 802.11ac | OFDM    | 80              | 10.5                        | 10.49                 | 0.16             | Right | Cheek         | 2                                               | 0C6B5                | 29.3             | 93.3           | 0.289                 | 0.150    | 1.002                  | 1.072                       | 0.161             |        |
| 5290                                                                                              | 58  | 802.11ac | OFDM    | 80              | 10.5                        | 10.49                 | -                | Right | Tilt          | 2                                               | 0C6B5                | 29.3             | 93.3           | 0.224                 | -        | 1.002                  | 1.072                       | -                 |        |
| 5290                                                                                              | 58  | 802.11ac | OFDM    | 80              | 10.5                        | 10.49                 | -                | Left  | Cheek         | 2                                               | 0C6B5                | 29.3             | 93.3           | 0.233                 | -        | 1.002                  | 1.072                       | -                 |        |
| 5290                                                                                              | 58  | 802.11ac | OFDM    | 80              | 10.5                        | 10.49                 | -                | Left  | Tilt          | 2                                               | 0C6B5                | 29.3             | 93.3           | 0.233                 | -        | 1.002                  | 1.072                       | -                 |        |
| 5530                                                                                              | 106 | 802.11ac | OFDM    | 80              | 10.5                        | 10.49                 | -0.19            | Right | Cheek         | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.425                 | 0.128    | 1.002                  | 1.030                       | 0.132             |        |
| 5530                                                                                              | 106 | 802.11ac | OFDM    | 80              | 10.5                        | 10.49                 | -                | Right | Tilt          | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.331                 | -        | 1.002                  | 1.030                       | -                 |        |
| 5530                                                                                              | 106 | 802.11ac | OFDM    | 80              | 10.5                        | 10.49                 | -                | Left  | Cheek         | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.173                 | -        | 1.002                  | 1.030                       | -                 |        |
| 5530                                                                                              | 106 | 802.11ac | OFDM    | 80              | 10.5                        | 10.49                 | -                | Left  | Tilt          | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.191                 | -        | 1.002                  | 1.030                       | -                 |        |
| 5530                                                                                              | 106 | 802.11ac | OFDM    | 80              | 10.5                        | 9.70                  | -                | Right | Cheek         | 2                                               | 0C6B5                | 29.3             | 93.3           | 0.534                 | -        | 1.202                  | 1.072                       | -                 |        |
| 5530                                                                                              | 106 | 802.11ac | OFDM    | 80              | 10.5                        | 9.70                  | -                | Right | Tilt          | 2                                               | 0C6B5                | 29.3             | 93.3           | 0.495                 | -        | 1.202                  | 1.072                       | -                 |        |
| 5530                                                                                              | 106 | 802.11ac | OFDM    | 80              | 10.5                        | 9.70                  | -0.11            | Left  | Cheek         | 2                                               | 0C6B5                | 29.3             | 93.3           | 0.793                 | 0.224    | 1.202                  | 1.072                       | 0.288             |        |
| 5530                                                                                              | 106 | 802.11ac | OFDM    | 80              | 10.5                        | 9.70                  | -                | Left  | Tilt          | 2                                               | 0C6B5                | 29.3             | 93.3           | 0.779                 | -        | 1.202                  | 1.072                       | -                 |        |
| 5775                                                                                              | 155 | 802.11ac | OFDM    | 80              | 10.5                        | 10.00                 | -                | Right | Cheek         | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.238                 | -        | 1.122                  | 1.030                       | -                 |        |
| 5775                                                                                              | 155 | 802.11ac | OFDM    | 80              | 10.5                        | 10.00                 | -0.11            | Right | Tilt          | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.241                 | 0.052    | 1.122                  | 1.030                       | 0.060             |        |
| 5775                                                                                              | 155 | 802.11ac | OFDM    | 80              | 10.5                        | 10.00                 | -                | Left  | Cheek         | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.090                 | -        | 1.122                  | 1.030                       | -                 |        |
| 5775                                                                                              | 155 | 802.11ac | OFDM    | 80              | 10.5                        | 10.00                 | -                | Left  | Tilt          | 1                                               | 0C6B5                | 29.3             | 97.1           | 0.118                 | -        | 1.122                  | 1.030                       | -                 |        |
| 5775                                                                                              | 155 | 802.11ac | OFDM    | 80              | 10.5                        | 10.44                 | -0.14            | Right | Cheek         | 2                                               | 0C6B5                | 29.3             | 93.3           | 1.147                 | 0.454    | 1.014                  | 1.072                       | 0.493             |        |
| 5775                                                                                              | 155 | 802.11ac | OFDM    | 80              | 10.5                        | 10.44                 | -                | Right | Tilt          | 2                                               | 0C6B5                | 29.3             | 93.3           | 0.743                 | -        | 1.014                  | 1.072                       | -                 |        |
| 5775                                                                                              | 155 | 802.11ac | OFDM    | 80              | 10.5                        | 10.44                 | 0.08             | Left  | Cheek         | 2                                               | 0C6B5                | 29.3             | 93.3           | 1.471                 | 0.513    | 1.014                  | 1.072                       | 0.557             | A2     |
| 5775                                                                                              | 155 | 802.11ac | OFDM    | 80              | 10.5                        | 10.44                 | -                | Left  | Tilt          | 2                                               | 0C6B5                | 29.3             | 93.3           | 0.411                 | -        | 1.014                  | 1.072                       | -                 |        |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |          |         |                 |                             |                       |                  |       |               | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |                      |                  |                |                       |          |                        |                             |                   |        |

|                                   |                                                                                                                            |                               |                                                                                       |                                 |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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| Document S/N:<br>OY1601110078.A3L | Test Dates:<br>01/12/16 - 01/15/16                                                                                         | DUT Type:<br>Portable Handset |                                                                                       | Page 24 of 35                   |

## 10.2 Standalone Body-Worn SAR Data

**Table 10-3**  
**DTS Body-Worn SAR**

| MEASUREMENT RESULTS                                                                               |     |         |         |                 |                             |                       |                  |                                                 |                 |                      |                  |      |                |                       |          |                        |                             |                   |        |
|---------------------------------------------------------------------------------------------------|-----|---------|---------|-----------------|-----------------------------|-----------------------|------------------|-------------------------------------------------|-----------------|----------------------|------------------|------|----------------|-----------------------|----------|------------------------|-----------------------------|-------------------|--------|
| FREQUENCY                                                                                         |     | Mode    | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing                                         | Antenna Config. | Device Serial Number | Data Rate (Mbps) | Side | Duty Cycle (%) | Peak SAR of Area Scan | SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Reported SAR (1g) | Plot # |
| MHz                                                                                               | Ch. |         |         |                 |                             |                       |                  |                                                 |                 |                      |                  |      |                | W/kg                  | (W/kg)   |                        |                             | (W/kg)            |        |
| 2412                                                                                              | 1   | 802.11b | DSSS    | 22              | 19.5                        | 19.41                 | 0.09             | 15 mm                                           | 1               | 0C6B5                | 1                | back | 99.8           | 0.163                 | 0.145    | 1.021                  | 1.002                       | 0.148             | A3     |
| 2437                                                                                              | 6   | 802.11b | DSSS    | 22              | 19.5                        | 18.93                 | 0.00             | 15 mm                                           | 2               | 0C6B5                | 1                | back | 99.8           | 0.124                 | 0.107    | 1.140                  | 1.002                       | 0.122             |        |
| 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 10-4**  
**NII Body-Worn SAR**

| MEASUREMENT RESULTS                      |     |         |         |                 |                             |                       |                  |                                         |                 |                      |                  |      |                |                       |          |                        |                             |                   |        |
|------------------------------------------|-----|---------|---------|-----------------|-----------------------------|-----------------------|------------------|-----------------------------------------|-----------------|----------------------|------------------|------|----------------|-----------------------|----------|------------------------|-----------------------------|-------------------|--------|
| FREQUENCY                                |     | Mode    | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing                                 | Antenna Config. | Device Serial Number | Data Rate (Mbps) | Side | Duty Cycle (%) | Peak SAR of Area Scan | SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Reported SAR (1g) | Plot # |
| MHz                                      | Ch. |         |         |                 |                             |                       |                  |                                         |                 |                      |                  |      |                | W/kg                  | (W/kg)   |                        |                             | (W/kg)            |        |
| 5260                                     | 52  | 802.11a | OFDM    | 20              | 16.5                        | 16.49                 | 0.09             | 15 mm                                   | 1               | 00580                | 6                | back | 98.7           | 0.261                 | 0.151    | 1.002                  | 1.013                       | 0.153             |        |
| 5260                                     | 52  | 802.11a | OFDM    | 20              | 16.5                        | 16.44                 | 0.15             | 15 mm                                   | 2               | 00580                | 6                | back | 98.2           | 0.573                 | 0.307    | 1.014                  | 1.018                       | 0.317             |        |
| 5720                                     | 144 | 802.11a | OFDM    | 20              | 16.5                        | 16.27                 | 0.17             | 15 mm                                   | 1               | 00580                | 6                | back | 98.7           | 0.133                 | 0.082    | 1.054                  | 1.013                       | 0.087             |        |
| 5520                                     | 104 | 802.11a | OFDM    | 20              | 16.5                        | 16.33                 | 0.18             | 15 mm                                   | 2               | 00580                | 6                | back | 98.2           | 0.638                 | 0.316    | 1.040                  | 1.018                       | 0.335             | A4     |
| 5825                                     | 165 | 802.11a | OFDM    | 20              | 16.5                        | 16.31                 | 0.04             | 15 mm                                   | 1               | 00580                | 6                | back | 98.7           | 0.176                 | 0.100    | 1.045                  | 1.013                       | 0.106             |        |
| 5745                                     | 149 | 802.11a | OFDM    | 20              | 16.5                        | 16.20                 | 0.11             | 15 mm                                   | 2               | 00580                | 6                | back | 98.2           | 0.269                 | 0.142    | 1.072                  | 1.018                       | 0.155             |        |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |     |         |         |                 |                             |                       |                  |                                         |                 |                      |                  |      |                |                       |          |                        |                             |                   |        |
| Spatial Peak                             |     |         |         |                 |                             |                       |                  | Body                                    |                 |                      |                  |      |                |                       |          |                        |                             |                   |        |
| Uncontrolled Exposure/General Population |     |         |         |                 |                             |                       |                  | 1.6 W/kg (mW/g)<br>averaged over 1 gram |                 |                      |                  |      |                |                       |          |                        |                             |                   |        |

## 10.3 SAR Test Notes

### General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the 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 D01v06.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 15 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01r03, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was  $\leq 1.2$  W/kg, no additional body-worn SAR evaluations using a headset cable were required.
8. Per FCC KDB 865664 D01 v01r04, variability SAR tests were not performed because the measured SAR results for a frequency band were less than 0.8 W/kg. Please see Section 12 for more information.

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
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| <b>Document S/N:</b><br>OY1601110078.A3L | <b>Test Dates:</b><br>01/12/16 - 01/15/16                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 25 of 35                          |

WLAN Notes:

1. For held-to-ear operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is  $\leq 0.4$  W/kg, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is  $\leq 0.8$  W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 GHz WIFI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 7.2.5 for more information.
3. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 GHz WIFI single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg. See Section 7.2.6 for more information.
4. Per KDB Publication 248227 D01v02r02, SAR for MIMO was evaluated by following the simultaneous SAR provisions from KDB Publication 447498 D01v06. Please see Section 11 for complete analysis.
5. When the maximum reported averaged SAR is  $\leq 0.8$  W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was  $\leq 1.20$  W/kg or all test channels were measured.
6. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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# 11 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

## 11.6 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to devices with built-in unlicensed transmitter such as 802.11 and Bluetooth devices which may simultaneously transmit with the other unlicensed transmitter.

## 11.7 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v06 4.3.2 and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific physical test configuration is  $\leq 1.6$  W/kg. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1-g SAR.

## 11.8 Head SAR Simultaneous Transmission Analysis

**Table 11-1**  
**Simultaneous Transmission Scenario for MIMO 2.4 GHz WLAN (Held to Ear)**

| Exposure Condition | 2.4 GHz WLAN Ant 1 SAR (W/kg) | 2.4 GHz WLAN Ant 2 SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|--------------------|-------------------------------|-------------------------------|---------------------|
|                    | 1                             | 2                             | 1+2                 |
| Head SAR           | 0.344                         | 0.377                         | 0.721               |

**Table 11-2**  
**Simultaneous Transmission Scenario for MIMO 5 GHz WLAN (Held to Ear)**

| Exposure Condition | 5 GHz WLAN Ant 1 SAR (W/kg) | 5 GHz WLAN Ant 2 SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|--------------------|-----------------------------|-----------------------------|---------------------|
|                    | 1                           | 2                           | 1+2                 |
| Head SAR           | 0.209                       | 0.557                       | 0.766               |

**Table 11-3**  
**Simultaneous Transmission Scenario for 2.4 GHz Ant 1 and 5 GHz Ant 2 WLAN (Held to Ear)**

| Exposure Condition | 2.4 GHz WLAN Ant 1 SAR (W/kg) | 5 GHz WLAN Ant 2 SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|--------------------|-------------------------------|-----------------------------|---------------------|
|                    | 1                             | 2                           | 1+2                 |
| Head SAR           | 0.344                         | 0.557                       | <b>0.901</b>        |

|                                   |                                                                                                                                   |                               |                                                                                       |                                 |
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**Table 11-4**  
**Simultaneous Transmission Scenario for 2.4 GHz Ant 2 and 5 GHz Ant 1 WLAN (Held to Ear)**

| Exposure Condition | 5 GHz WLAN Ant 1 SAR (W/kg) | 2.4 GHz WLAN Ant 2 SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|--------------------|-----------------------------|-------------------------------|---------------------|
|                    | 1                           | 2                             | 1+2                 |
| Head SAR           | 0.209                       | 0.377                         | 0.586               |

## 11.9 Body-Worn Simultaneous Transmission Analysis

**Table 11-5**  
**Simultaneous Transmission Scenario for MIMO 2.4 GHz WLAN (Body-Worn at 1.5 cm)**

| Exposure Condition | 2.4 GHz WLAN Ant 1 SAR (W/kg) | 2.4 GHz WLAN Ant 2 SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|--------------------|-------------------------------|-------------------------------|---------------------|
|                    | 1                             | 2                             | 1+2                 |
| Body-Worn          | 0.148                         | 0.122                         | 0.270               |

**Table 11-6**  
**Simultaneous Transmission Scenario for MIMO 5 GHz WLAN (Body-Worn at 1.5 cm)**

| Exposure Condition | 5 GHz WLAN Ant 1 SAR (W/kg) | 5 GHz WLAN Ant 2 SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|--------------------|-----------------------------|-----------------------------|---------------------|
|                    | 1                           | 2                           | 1+2                 |
| Body-Worn          | 0.153                       | 0.335                       | 0.488               |

**Table 11-7**  
**Simultaneous Transmission Scenario for 2.4 GHz Ant 1 and 5 GHz Ant 2 WLAN (Body-Worn at 1.5 cm)**

| Exposure Condition | 2.4 GHz WLAN Ant 1 SAR (W/kg) | 5 GHz WLAN Ant 2 SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|--------------------|-------------------------------|-----------------------------|---------------------|
|                    | 1                             | 2                           | 1+2                 |
| Body-Worn          | 0.148                         | 0.335                       | 0.483               |

**Table 11-8**  
**Simultaneous Transmission Scenario for 2.4 GHz Ant 2 and 5 GHz Ant 1 WLAN**  
**(Body-Worn at 1.5 cm)**

| Exposure Condition | 2.4 GHz WLAN Ant 2 SAR (W/kg) | 5 GHz WLAN Ant 1 SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|--------------------|-------------------------------|-----------------------------|---------------------|
|                    | 1                             | 2                           | 1+2                 |
| Body-Worn          | 0.122                         | 0.153                       | 0.275               |

### 11.10 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 D01v06 and IEEE 1528-2013 Section 6.3.4.1.2.

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

### 12.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was not assessed for each frequency band since all measured SAR values are  $< 0.80$  W/kg for 1g SAR.

### 12.2 Measurement Uncertainty

The measured 1g SAR was  $< 1.5$  W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 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               | 3/15/2015  | Annual       | 3/15/2016  | MY45470194    |
| Agilent            | 8594A     | (9kHz-2.9GHz) Spectrum Analyzer               | N/A        | N/A          | N/A        | 3051A00187    |
| Agilent            | 8648D     | (9kHz-4GHz) Signal Generator                  | 3/15/2015  | Annual       | 3/15/2016  | 3629U00687    |
| Agilent            | E4438C    | ESG Vector Signal Generator                   | 3/13/2015  | Annual       | 3/13/2016  | MY42082385    |
| Agilent            | N9020A    | MXA Signal Analyzer                           | 11/5/2015  | Annual       | 11/5/2016  | US46470561    |
| Agilent            | N5182A    | MXG Vector Signal Generator                   | 3/16/2015  | Annual       | 3/16/2016  | MY47420651    |
| Agilent            | 8753ES    | Network Analyzer                              | 3/20/2015  | Annual       | 3/20/2016  | MY40001472    |
| Amplifier Research | 15S1G6    | Amplifier                                     | N/A        | CBT          | N/A        | 433971        |
| Amplifier Research | 15S1G6    | Amplifier                                     | N/A        | CBT          | N/A        | 433978        |
| Anritsu            | ML2438A   | Power Meter                                   | 3/13/2015  | Annual       | 3/13/2016  | 1070030       |
| Anritsu            | ML2495A   | Power Meter                                   | 10/16/2015 | Biennial     | 10/15/2017 | 941001        |
| Anritsu            | MA2481A   | Power Sensor                                  | 3/10/2015  | Annual       | 3/10/2016  | 2400          |
| Anritsu            | MA2481A   | Power Sensor                                  | 3/11/2015  | Annual       | 3/11/2016  | 5318          |
| Anritsu            | MA2411B   | Pulse Power Sensor                            | 8/3/2015   | Annual       | 8/3/2016   | 1126066       |
| Anritsu            | MA2411B   | Pulse Power Sensor                            | 3/13/2015  | Annual       | 3/13/2016  | 1207470       |
| Anritsu            | MA24106A  | USB Power Sensor                              | 5/29/2015  | Annual       | 5/29/2016  | 1231535       |
| Anritsu            | MA24106A  | USB Power Sensor                              | 5/29/2015  | Annual       | 5/29/2016  | 1231538       |
| COMTech            | AR85729-5 | Solid State Amplifier                         | N/A        | CBT          | N/A        | M155A00-009   |
| Control Company    | 4040      | Digital Thermometer                           | 3/18/2015  | Biennial     | 3/18/2017  | 150194895     |
| Control Company    | 4353      | Long Stem Thermometer                         | 3/5/2015   | Biennial     | 3/5/2017   | 150149565     |
| Keysight           | 772D      | Dual Directional Coupler                      | N/A        | CBT          | N/A        | MY52180215    |
| MCL                | BW-N6W5+  | 6dB Attenuator                                | N/A        | CBT          | N/A        | 1139          |
| MiniCircuits       | VLF-6000+ | Low Pass Filter                               | N/A        | CBT          | N/A        | N/A           |
| Mini-Circuits      | BW-N20W5+ | DC to 18 GHz Precision Fixed 20 dB Attenuator | N/A        | CBT          | N/A        | N/A           |
| Mini-Circuits      | NLP-2950+ | Low Pass Filter DC to 2700 MHz                | N/A        | CBT          | N/A        | N/A           |
| Mini-Circuits      | BW-N20W5  | Power Attenuator                              | N/A        | CBT          | N/A        | 1226          |
| Mitutoyo           | CD-6"CSX  | Digital Caliper                               | 5/8/2014   | Biennial     | 5/8/2016   | 13264165      |
| Narda              | 4014C-6   | 4 - 8 GHz SMA 6 dB Directional Coupler        | N/A        | CBT          | N/A        | N/A           |
| Narda              | BW-S3W2   | Attenuator (3dB)                              | N/A        | CBT          | N/A        | 120           |
| Pasternack         | PE2208-6  | Bidirectional Coupler                         | N/A        | CBT          | N/A        | N/A           |
| Pasternack         | PE2209-10 | Bidirectional Coupler                         | N/A        | CBT          | N/A        | N/A           |
| Pasternack         | NC-100    | Torque Wrench                                 | 5/21/2015  | Biennial     | 5/21/2017  | N/A           |
| Rohde & Schwarz    | NRVD      | Dual Channel Power Meter                      | N/A        | CBT          | N/A        | 101695        |
| Rohde & Schwarz    | NRV-Z32   | Peak Power Sensor                             | N/A        | CBT          | N/A        | 836019/013    |
| Rohde & Schwarz    | SMIQ03B   | Signal Generator                              | N/A        | CBT          | N/A        | DE27259       |
| Seekonk            | NC-100    | Torque Wrench                                 | 3/18/2014  | Biennial     | 3/18/2016  | N/A           |
| SPEAG              | D2450V2   | 2450 MHz SAR Dipole                           | 8/20/2015  | Annual       | 8/20/2016  | 719           |
| SPEAG              | D5GHzV2   | 5 GHz SAR Dipole                              | 9/16/2015  | Annual       | 9/16/2016  | 1191          |
| SPEAG              | D5GHzV2   | 5 GHz SAR Dipole                              | 2/17/2015  | Annual       | 2/17/2016  | 1120          |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 3/13/2015  | Annual       | 3/13/2016  | 1368          |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 8/24/2015  | Annual       | 8/24/2016  | 1322          |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 4/20/2015  | Annual       | 4/20/2016  | 1407          |
| SPEAG              | DAK-3.5   | Dielectric Assessment Kit                     | 5/12/2015  | Annual       | 5/12/2016  | 1070          |
| SPEAG              | ES3DV3    | SAR Probe                                     | 3/19/2015  | Annual       | 3/19/2016  | 3319          |
| SPEAG              | EX3DV4    | SAR Probe                                     | 7/21/2015  | Annual       | 7/21/2016  | 7308          |
| SPEAG              | EX3DV4    | SAR Probe                                     | 4/23/2015  | Annual       | 4/23/2016  | 7357          |

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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| <b>Document S/N:</b><br>OY1601110078.A3L | <b>Test Dates:</b><br>01/12/16 - 01/15/16                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 31 of 35                          |

# 14 MEASUREMENT UNCERTAINTIES

| a                                                                             | c             | d              | e=<br>f(d,k) | f                     | g                        | h =<br>c x f/e                 | i =<br>c x g/e                   | k              |
|-------------------------------------------------------------------------------|---------------|----------------|--------------|-----------------------|--------------------------|--------------------------------|----------------------------------|----------------|
| Uncertainty Component                                                         | 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                                                             | 6.55          | N              | 1            | 1.0                   | 1.0                      | 6.6                            | 6.6                              | ∞              |
| Axial Isotropy                                                                | 0.25          | N              | 1            | 0.7                   | 0.7                      | 0.2                            | 0.2                              | ∞              |
| Hemishperical Isotropy                                                        | 1.3           | N              | 1            | 0.7                   | 0.7                      | 0.9                            | 0.9                              | ∞              |
| Boundary Effect                                                               | 2.0           | R              | 1.73         | 1.0                   | 1.0                      | 1.2                            | 1.2                              | ∞              |
| Linearity                                                                     | 0.3           | N              | 1            | 1.0                   | 1.0                      | 0.3                            | 0.3                              | ∞              |
| System Detection Limits                                                       | 0.25          | R              | 1.73         | 1.0                   | 1.0                      | 0.1                            | 0.1                              | ∞              |
| Readout Electronics                                                           | 0.3           | N              | 1            | 1.0                   | 1.0                      | 0.3                            | 0.3                              | ∞              |
| Response Time                                                                 | 0.8           | R              | 1.73         | 1.0                   | 1.0                      | 0.5                            | 0.5                              | ∞              |
| Integration Time                                                              | 2.6           | R              | 1.73         | 1.0                   | 1.0                      | 1.5                            | 1.5                              | ∞              |
| RF Ambient Conditions - Noise                                                 | 3.0           | R              | 1.73         | 1.0                   | 1.0                      | 1.7                            | 1.7                              | ∞              |
| RF Ambient Conditions - Reflections                                           | 3.0           | R              | 1.73         | 1.0                   | 1.0                      | 1.7                            | 1.7                              | ∞              |
| Probe Positioner Mechanical Tolerance                                         | 0.4           | R              | 1.73         | 1.0                   | 1.0                      | 0.2                            | 0.2                              | ∞              |
| Probe Positioning w/ respect to Phantom                                       | 6.7           | R              | 1.73         | 1.0                   | 1.0                      | 3.9                            | 3.9                              | ∞              |
| Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation | 4.0           | R              | 1.73         | 1.0                   | 1.0                      | 2.3                            | 2.3                              | ∞              |
| <b>Test Sample Related</b>                                                    |               |                |              |                       |                          |                                |                                  |                |
| Test Sample Positioning                                                       | 2.7           | N              | 1            | 1.0                   | 1.0                      | 2.7                            | 2.7                              | 35             |
| Device Holder Uncertainty                                                     | 1.67          | N              | 1            | 1.0                   | 1.0                      | 1.7                            | 1.7                              | 5              |
| Output Power Variation - SAR drift measurement                                | 5.0           | R              | 1.73         | 1.0                   | 1.0                      | 2.9                            | 2.9                              | ∞              |
| SAR Scaling                                                                   | 0.0           | R              | 1.73         | 1.0                   | 1.0                      | 0.0                            | 0.0                              | ∞              |
| <b>Phantom &amp; Tissue Parameters</b>                                        |               |                |              |                       |                          |                                |                                  |                |
| Phantom Uncertainty (Shape & Thickness tolerances)                            | 7.6           | R              | 1.73         | 1.0                   | 1.0                      | 4.4                            | 4.4                              | ∞              |
| Liquid Conductivity - measurement uncertainty                                 | 4.2           | N              | 1            | 0.78                  | 0.71                     | 3.3                            | 3.0                              | 10             |
| Liquid Permittivity - measurement uncertainty                                 | 4.1           | N              | 1            | 0.23                  | 0.26                     | 1.0                            | 1.1                              | 10             |
| Liquid Conductivity - Temperature Uncertainty                                 | 3.4           | R              | 1.73         | 0.78                  | 0.71                     | 1.5                            | 1.4                              | ∞              |
| Liquid Permittivity - Temperature Uncertainty                                 | 0.6           | R              | 1.73         | 0.23                  | 0.26                     | 0.1                            | 0.1                              | ∞              |
| Liquid Conductivity - deviation from target values                            | 5.0           | R              | 1.73         | 0.64                  | 0.43                     | 1.8                            | 1.2                              | ∞              |
| Liquid Permittivity - deviation from target values                            | 5.0           | R              | 1.73         | 0.60                  | 0.49                     | 1.7                            | 1.4                              | ∞              |
| <b>Combined Standard Uncertainty (k=1)</b>                                    | RSS           |                |              |                       |                          | 11.5                           | 11.3                             | 60             |
| <b>Expanded Uncertainty</b><br>(95% CONFIDENCE LEVEL)                         | k=2           |                |              |                       |                          | 23.0                           | 22.6                             |                |

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG935X                       |  <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>OY1601110078.A3L | <b>Test Dates:</b><br>01/12/16 - 01/15/16                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 32 of 35                          |

## 15 CONCLUSION

### 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]

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSMG935X                       |  <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>0Y1601110078.A3L | <b>Test Dates:</b><br>01/12/16 - 01/15/16                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 33 of 35                          |

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|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSMG935X                |  <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>OY1601110078.A3L | <b>Test Dates:</b><br>01/12/16 - 01/15/16                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 34 of 35                          |

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|                                          |                                                                                     |                                      |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSMG935X                |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1601110078.A3L | <b>Test Dates:</b><br>01/12/16 - 01/15/16                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 35 of 35                          |

## APPENDIX A: SAR TEST DATA

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG935X; Type: Portable Handset; Serial: 00580**

Communication System: UID 0, IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.807 \text{ S/m}$ ;  $\epsilon_r = 38.709$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 01-15-2016; Ambient Temp: 22.7°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3319; ConvF(4.55, 4.55, 4.55); Calibrated: 3/19/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

**Mode: IEEE 802.11b, 22 MHz Bandwidth, Left Head, Cheek,  
Ch 6, 1 Mbps, Antenna 2**

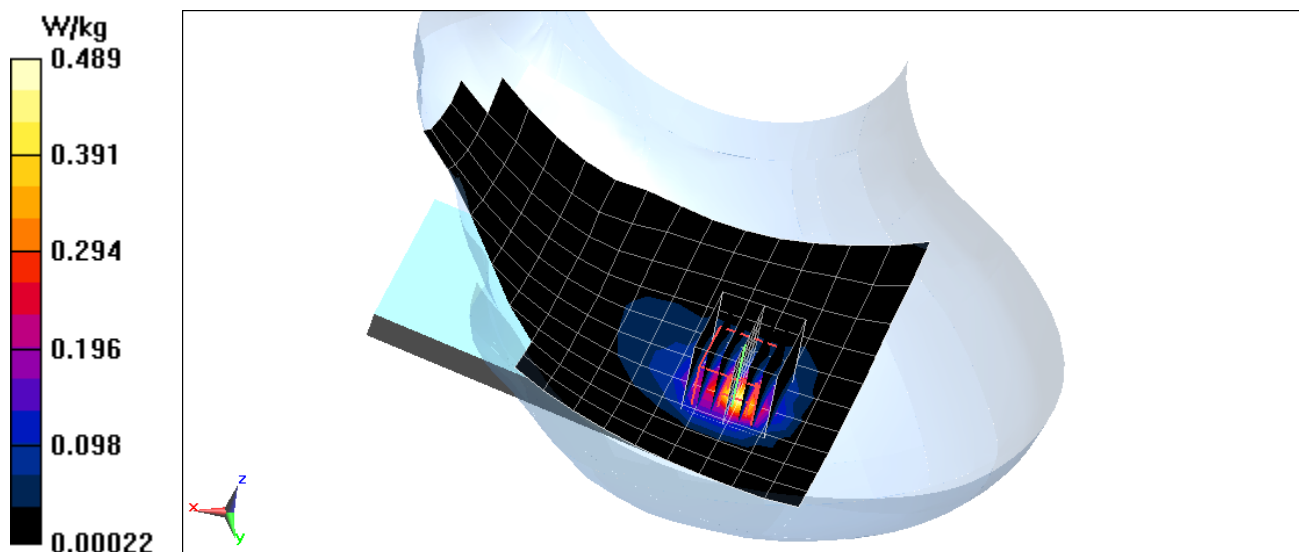
**Area Scan (11x18x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Reference Value = 15.92 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.871 W/kg

**SAR(1 g) = 0.368 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG935X; Type: Portable Handset; Serial: 0C6B5**

Communication System: UID 0, IEEE 802.11ac; Frequency: 5775 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used (interpolated):

$f = 5775 \text{ MHz}$ ;  $\sigma = 5.234 \text{ S/m}$ ;  $\epsilon_r = 35.471$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 01-14-2015; Ambient Temp: 24.2°C; Tissue Temp: 22.0°C

Probe: EX3DV4 - SN7308; ConvF(4.86, 4.86, 4.86); Calibrated: 7/21/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

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

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

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

**Mode: IEEE 802.11ac, U-NII-3, 80 MHz Bandwidth, Left Head, Cheek,  
Ch 155, 29.3 Mbps, Antenna 2**

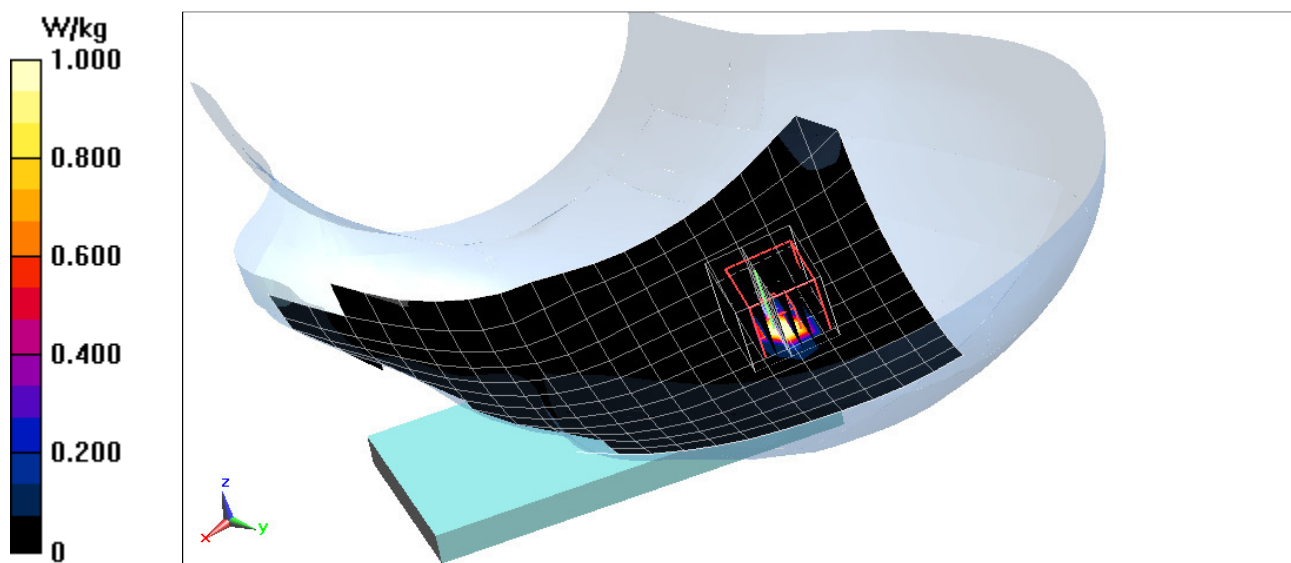
**Area Scan (13x22x1):** Measurement grid: dx=10mm, dy=10mm

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

Reference Value = 9.586 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 3.30 W/kg

**SAR(1 g) = 0.513 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG935X; Type: Portable Handset; Serial: 0C6B5**

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

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$ ;  $\sigma = 1.938 \text{ S/m}$ ;  $\epsilon_r = 52.446$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 01-12-2016; Ambient Temp: 22.1°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3319; ConvF(4.11, 4.11, 4.11); Calibrated: 3/19/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226

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

**Mode: IEEE 802.11b, 22 MHz Bandwidth, Body SAR, Ch 01,  
1 Mbps, Back Side, Antenna 1**

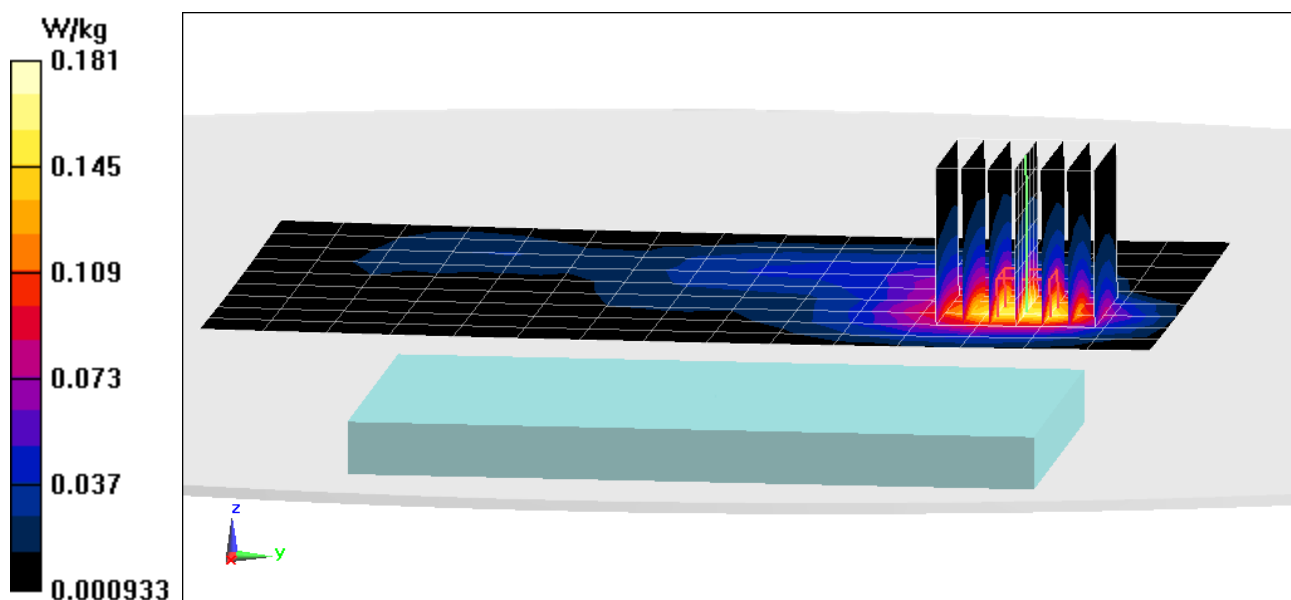
**Area Scan (10x16x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Reference Value = 8.738 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.279 W/kg

**SAR(1 g) = 0.145 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSMG935X; Type: Portable Handset; Serial: 00580**

Communication System: UID 0, 802.11a 5.2-5.8 GHz Band; Frequency: 5520 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$f = 5520 \text{ MHz}$ ;  $\sigma = 5.727 \text{ S/m}$ ;  $\epsilon_r = 48.253$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 01-12-2016; Ambient Temp: 23.8°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN7357; ConvF(3.83, 3.83, 3.83); Calibrated: 4/23/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

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

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

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

**Mode: IEEE 802.11a, U-NII-2C, 20 MHz Bandwidth, Body SAR, Ch 104,  
6 Mbps, Back Side, Ant 2**

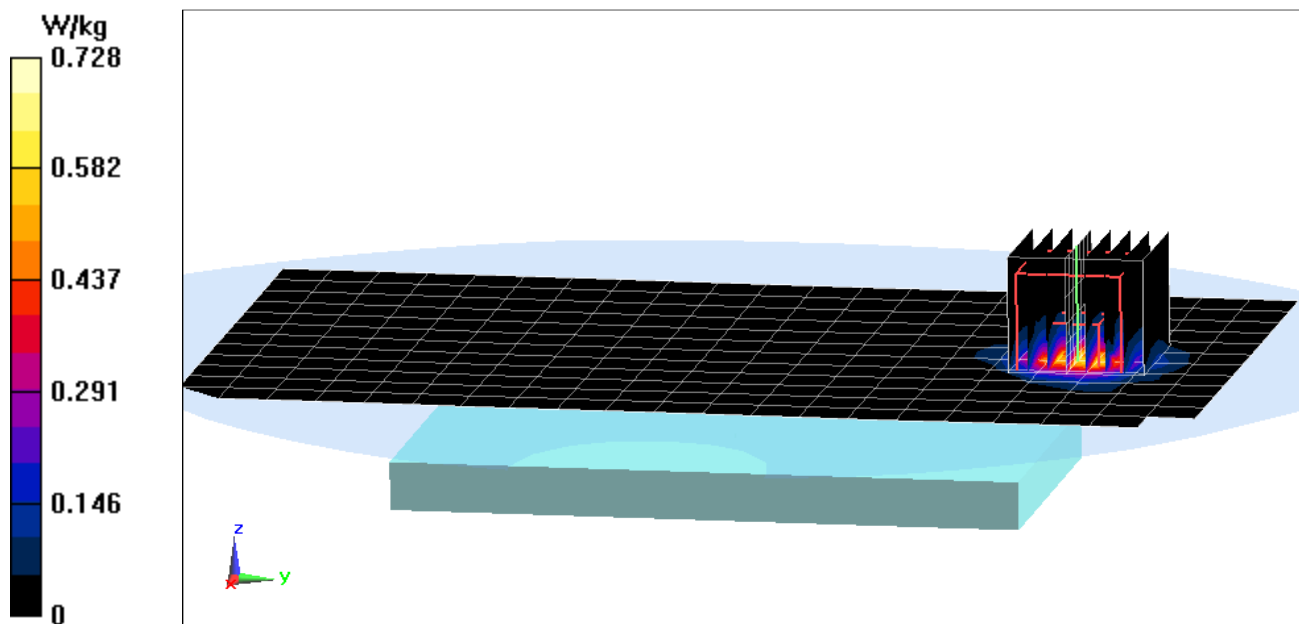
**Area Scan (13x22x1):** Measurement grid: dx=10mm, dy=10mm

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

Reference Value = 7.566 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 1.11 W/kg

**SAR(1 g) = 0.316 W/kg**



## APPENDIX B: SYSTEM VERIFICATION

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 719**

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

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.822 \text{ S/m}$ ;  $\epsilon_r = 38.658$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-15-2016; Ambient Temp: 22.7°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3319; ConvF(4.55, 4.55, 4.55); Calibrated: 3/19/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

## **2450 MHz System Verification at 20.0 dBm (100 mW)**

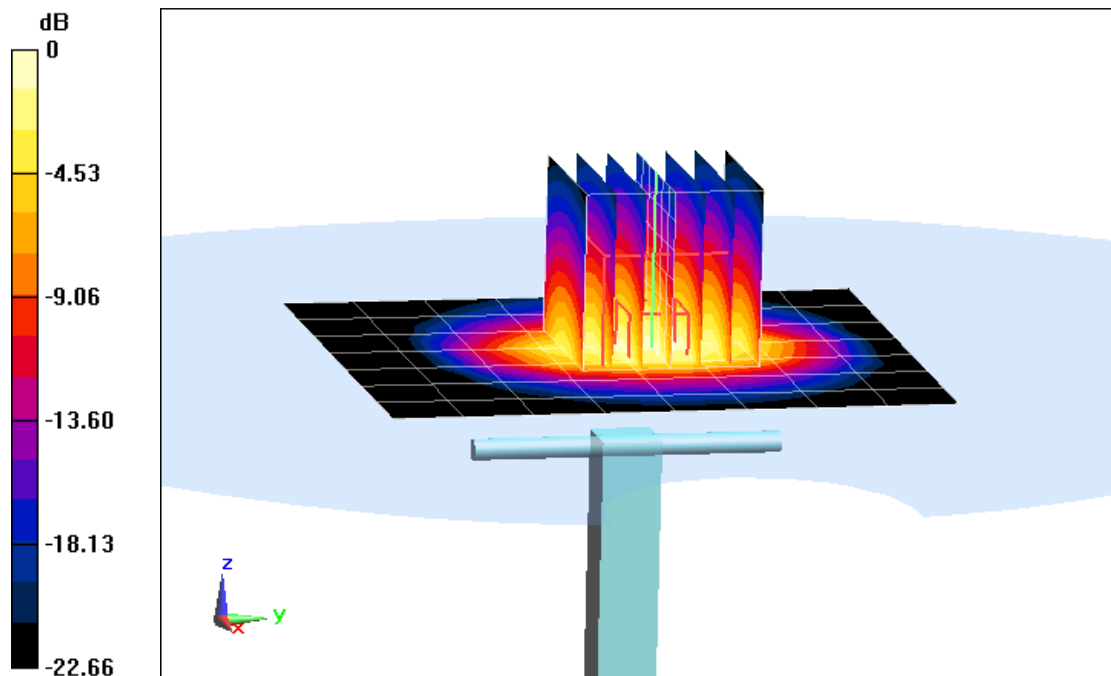
**Area Scan (8x9x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Peak SAR (extrapolated) = 10.6 W/kg

**SAR(1 g) = 5.04 W/kg**

Deviation(1 g) = -7.01%



0 dB = 6.71 W/kg = 8.27 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1191**

Communication System: UID 0, CW; Frequency: 5250 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used (interpolated):

$f = 5250 \text{ MHz}$ ;  $\sigma = 4.685 \text{ S/m}$ ;  $\epsilon_r = 36.243$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-14-2016; Ambient Temp: 24.2°C; Tissue Temp: 22.0°C

Probe: EX3DV4 - SN7308; ConvF(5.2, 5.2, 5.2); Calibrated: 7/21/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

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

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

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

## 5250 MHz System Verification at 17.0 dBm (50 mW)

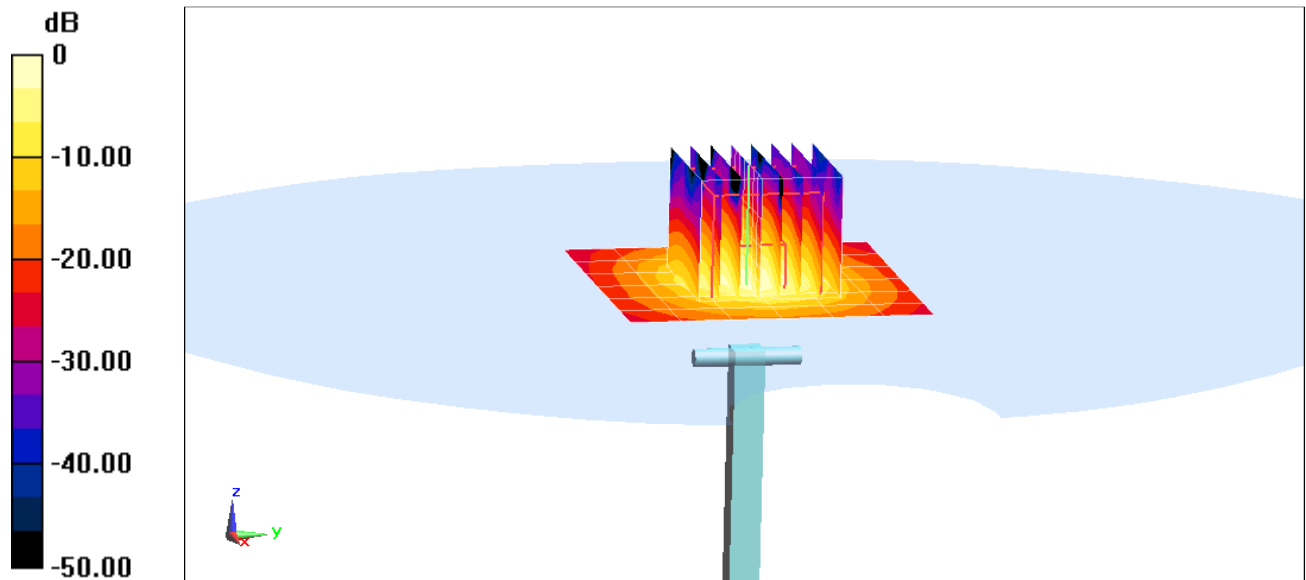
**Area Scan (7x7x1):** Measurement grid: dx=10mm, dy=10mm

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

Peak SAR (extrapolated) = 15.8 W/kg

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

Deviation(1 g) = -4.48%



0 dB = 9.17 W/kg = 9.62 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1191**

Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5600 \text{ MHz}$ ;  $\sigma = 5.043 \text{ S/m}$ ;  $\epsilon_r = 35.74$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-14-2016; Ambient Temp: 24.2°C; Tissue Temp: 22.0°C

Probe: EX3DV4 - SN7308; ConvF(4.65, 4.65, 4.65); Calibrated: 7/21/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

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

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

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

## 5600 MHz System Verification at 17.0 dBm (50 mW)

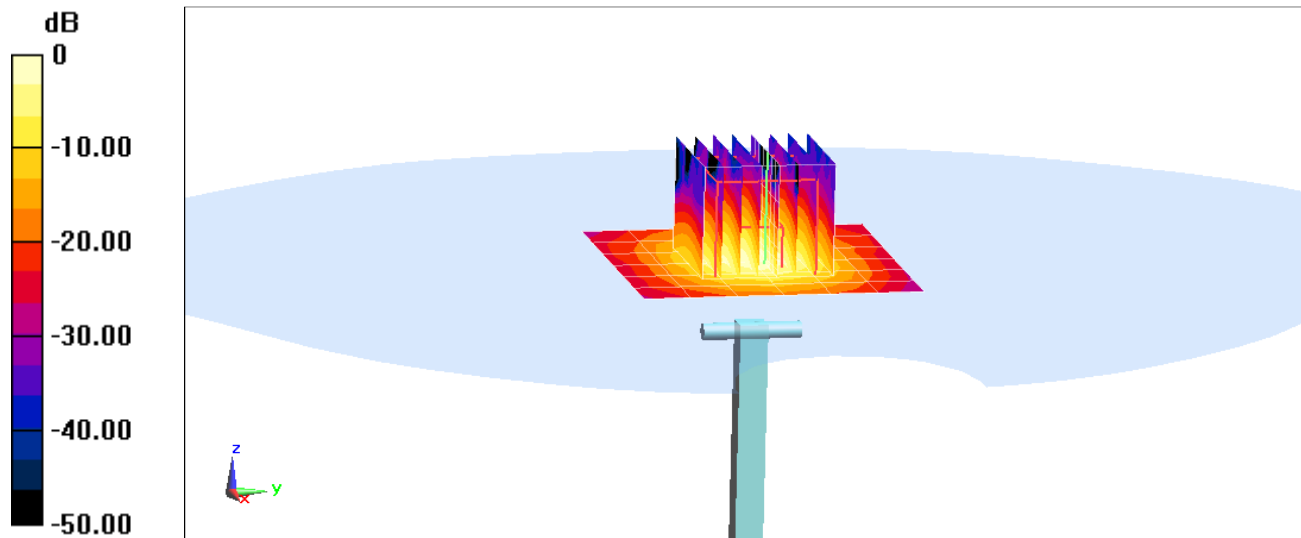
**Area Scan (7x7x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

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

Peak SAR (extrapolated) = 18.1 W/kg

**SAR(1 g) = 4.31 W/kg**

Deviation(1 g) = 2.01%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1191**

Communication System: UID 0, CW; Frequency: 5750 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used (interpolated):

$f = 5750 \text{ MHz}$ ;  $\sigma = 5.209 \text{ S/m}$ ;  $\epsilon_r = 35.5$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-14-2016; Ambient Temp: 24.2°C; Tissue Temp: 22.0°C

Probe: EX3DV4 - SN7308; ConvF(4.86, 4.86, 4.86); Calibrated: 7/21/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

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

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

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

## **5750 MHz System Verification at 17.0 dBm (50 mW)**

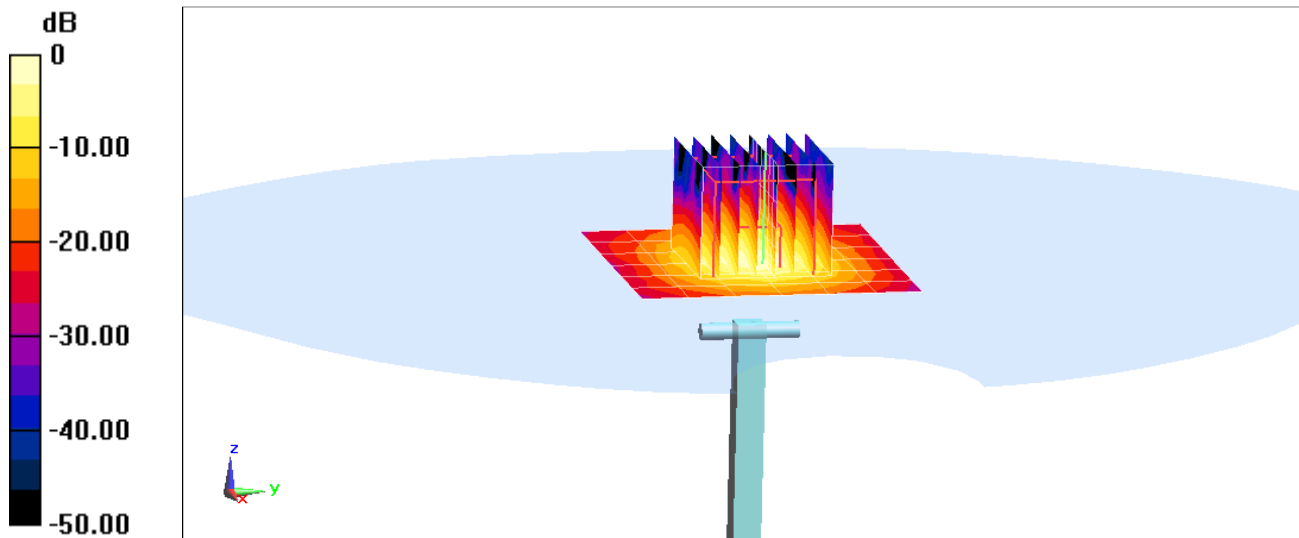
**Area Scan (7x7x1):** Measurement grid: dx=10mm, dy=10mm

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

Peak SAR (extrapolated) = 16.8 W/kg

**SAR(1 g) = 3.85 W/kg**

Deviation(1 g) = -3.75%



0 dB = 9.30 W/kg = 9.68 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 719**

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

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.994 \text{ S/m}$ ;  $\epsilon_r = 52.299$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-12-2016; Ambient Temp: 22.1°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3319; ConvF(4.11, 4.11, 4.11); Calibrated: 3/19/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226

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

## 2450 MHz System Verification at 20.0 dBm (100 mW)

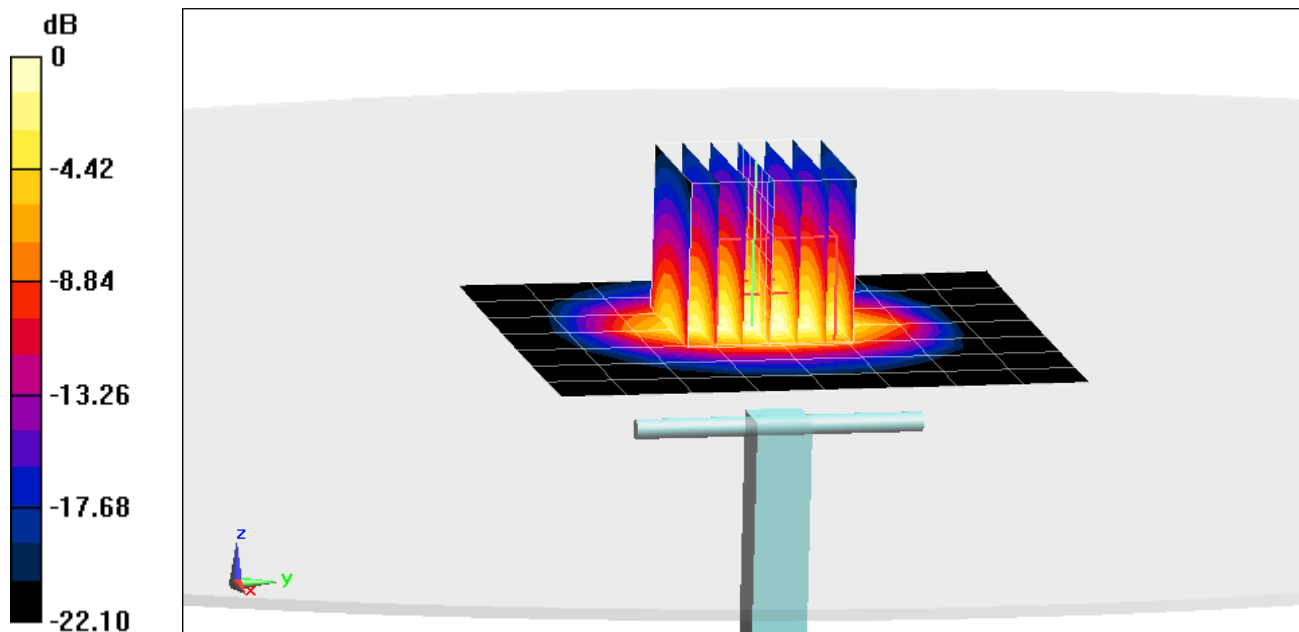
**Area Scan (8x9x1):** Measurement grid: dx=12mm, dy=12mm

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

Peak SAR (extrapolated) = 11.3 W/kg

**SAR(1 g) = 5.33 W/kg**

Deviation(1 g) = 2.70%



0 dB = 7.01 W/kg = 8.46 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1120**

Communication System: UID 0, CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body; Medium parameters used:

$f = 5300 \text{ MHz}$ ;  $\sigma = 5.455 \text{ S/m}$ ;  $\epsilon_r = 48.493$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-12-2016; Ambient Temp: 23.8°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN7357; ConvF(4.11, 4.11, 4.11); Calibrated: 4/23/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

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

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

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

## 5300 MHz System Verification at 17.0 dBm (50 mW)

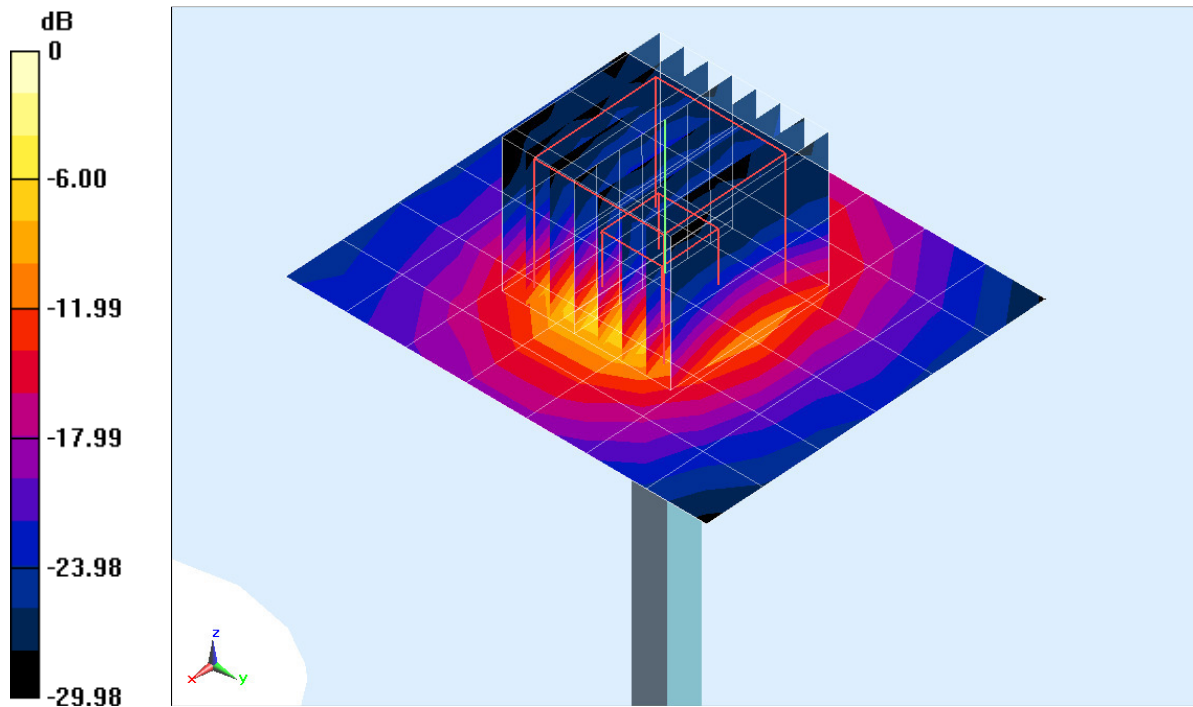
**Area Scan (7x8x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

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

Peak SAR (extrapolated) = 14.9 W/kg

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

Deviation = 0.27%



0 dB = 8.94 W/kg = 9.51 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1120**

Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body; Medium parameters used:

$f = 5500 \text{ MHz}$ ;  $\sigma = 5.711 \text{ S/m}$ ;  $\epsilon_r = 48.227$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-12-2016; Ambient Temp: 23.8°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN7357; ConvF(3.83, 3.83, 3.83); Calibrated: 4/23/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

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

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

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

## **5500 MHz System Verification at 17.0 dBm (50 mW)**

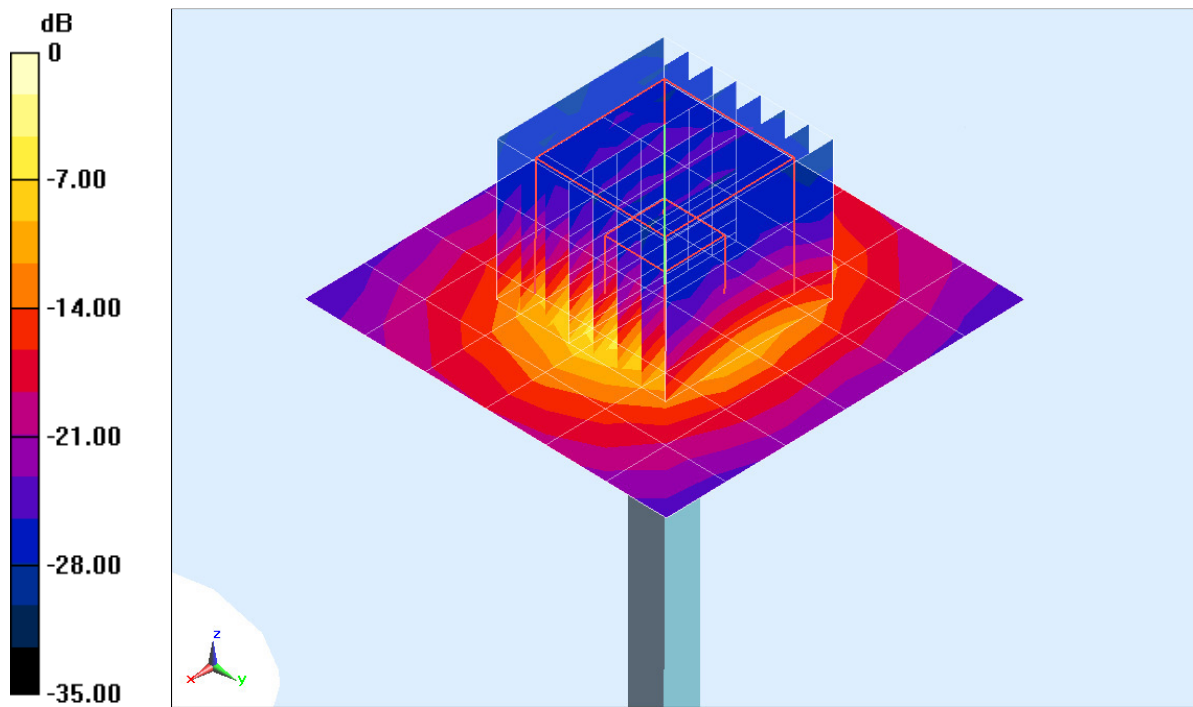
**Area Scan (7x7x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

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

Peak SAR (extrapolated) = 15.9 W/kg

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

Deviation = -3.90%



0 dB = 9.39 W/kg = 9.73 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1120**

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

Medium: 5 GHz Body; Medium parameters used:

$f = 5800 \text{ MHz}$ ;  $\sigma = 6.135 \text{ S/m}$ ;  $\epsilon_r = 47.714$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-12-2016; Ambient Temp: 23.8°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN7357; ConvF(3.82, 3.82, 3.82); Calibrated: 4/23/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

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

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

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

## **5800 MHz System Verification at 17.0 dBm (50 mW)**

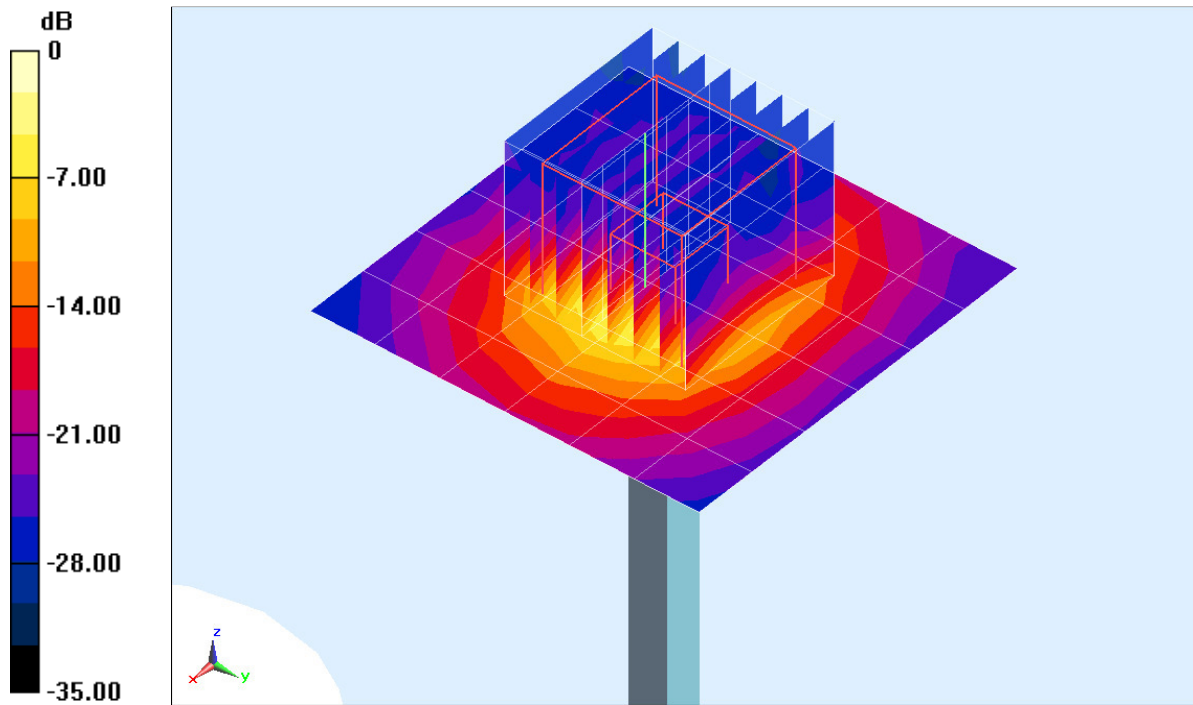
**Area Scan (7x7x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

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

Peak SAR (extrapolated) = 16.0 W/kg

**SAR(1 g) = 3.72 W/kg**

Deviation = -2.49%



0 dB = 9.02 W/kg = 9.55 dBW/kg

## APPENDIX C: PROBE CALIBRATION



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

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D2450V2-719\_Aug15**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 719**

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

Calibration date: **August 20, 2015**

BN ✓  
9/3/15

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

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A        | GB37480704         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | US37292783         | 07-Oct-14 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | MY41092317         | 07-Oct-14 (No. 217-02021)         | Oct-15                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 01-Apr-15 (No. 217-02131)         | Mar-16                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 01-Apr-15 (No. 217-02134)         | Mar-16                 |
| Reference Probe ES3DV3      | SN: 3205           | 30-Dec-14 (No. ES3-3205_Dec14)    | Dec-15                 |
| DAE4                        | SN: 601            | 17-Aug-15 (No. DAE4-601_Aug15)    | Aug-16                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-13) | In house check: Oct-16 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

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

Signature

*M. Weber*

Approved by: **Katja Pokovic** Technical Manager

*Katja Pokovic*

Issued: August 21, 2015

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



Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

### Glossary:

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

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

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.8.8     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 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 | 39.2 $\pm$ 6 % | 1.87 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 | 13.8 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 54.2 W/kg $\pm$ 17.0 % (k=2) |

|                                                         |                    |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
| SAR measured                                            | 250 mW input power | 6.48 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 25.7 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 | 53.2 $\pm$ 6 % | 2.00 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 | 13.1 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 51.9 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 | 6.11 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 24.3 W/kg $\pm$ 16.5 % (k=2) |

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

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.5 $\Omega$ + 5.3 j $\Omega$ |
| Return Loss                          | - 23.5 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.1 $\Omega$ + 6.5 j $\Omega$ |
| Return Loss                          | - 23.7 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.149 ns |
|----------------------------------|----------|

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

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

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

### Additional EUT Data

|                 |                    |
|-----------------|--------------------|
| Manufactured by | SPEAG              |
| Manufactured on | September 10, 2002 |

## DASY5 Validation Report for Head TSL

Date: 20.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719**

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450 \text{ MHz}$ ;  $\sigma = 1.87 \text{ S/m}$ ;  $\epsilon_r = 39.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

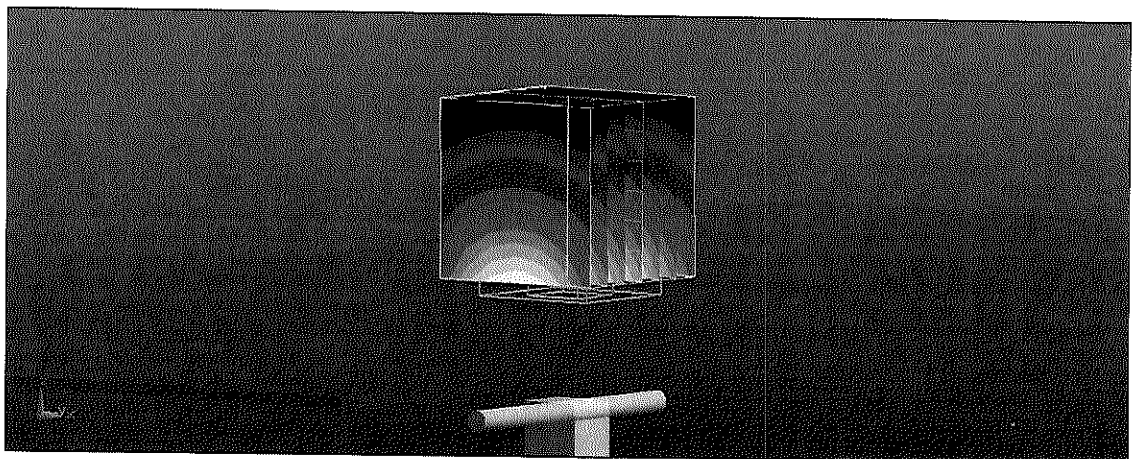
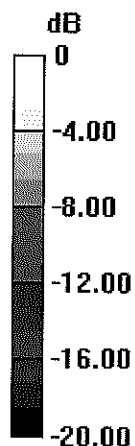
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 102.2 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 28.1 W/kg

**SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.48 W/kg**

Maximum value of SAR (measured) = 18.2 W/kg

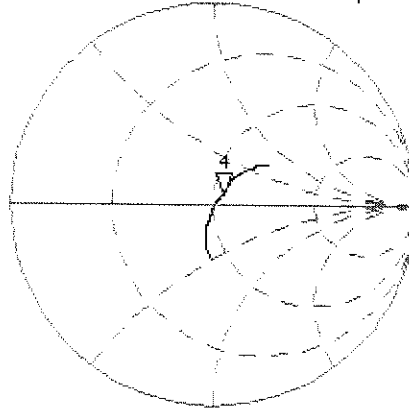


0 dB = 18.2 W/kg = 12.60 dBW/kg

## Impedance Measurement Plot for Head TSL

CH1 S11 1 U FS 19 Aug 2015 12:34:37  
4: 54.510  $\Omega$  5.3223  $\Omega$  345.74 pF 2 450.000 000 MHz

\*  
De1  
CA



Avg  
16

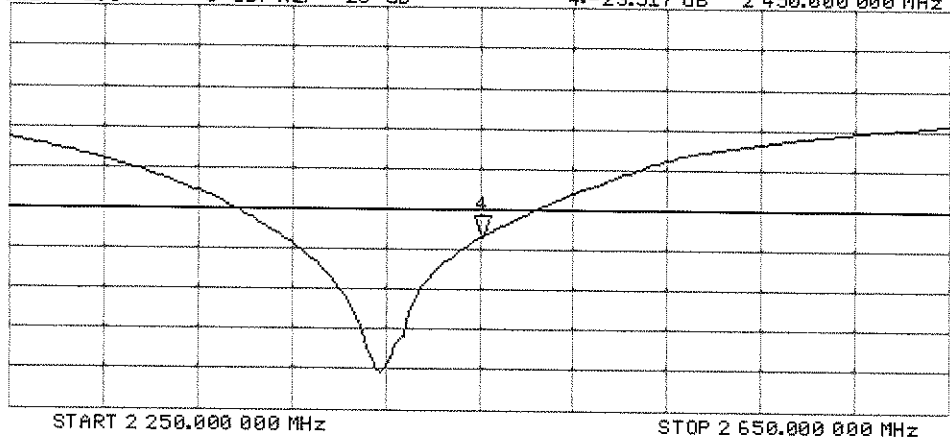
H1d

CH2 S11 LOG 5 dB/REF -20 dB 4:-23.517 dB 2 450.000 000 MHz

CA

Avg  
16

H1d



## DASY5 Validation Report for Body TSL

Date: 19.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719**

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2$  S/m;  $\epsilon_r = 53.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

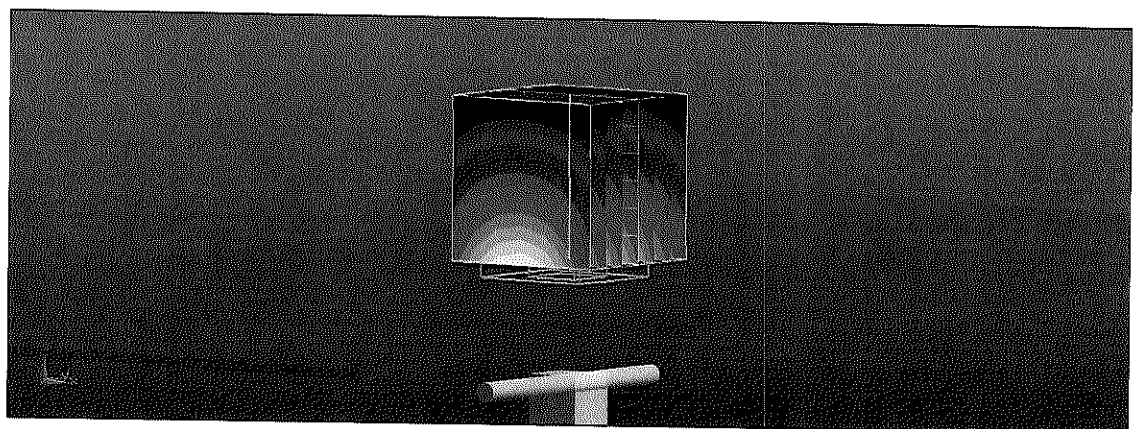
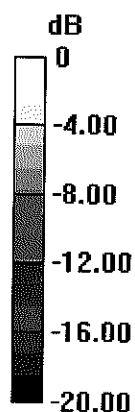
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.73 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.9 W/kg

**SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.11 W/kg**

Maximum value of SAR (measured) = 17.3 W/kg

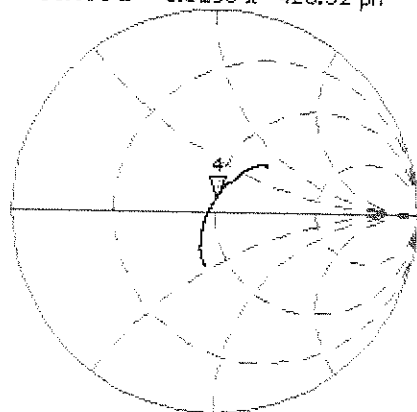


0 dB = 17.3 W/kg = 12.38 dBW/kg

Impedance Measurement Plot for Body TSL

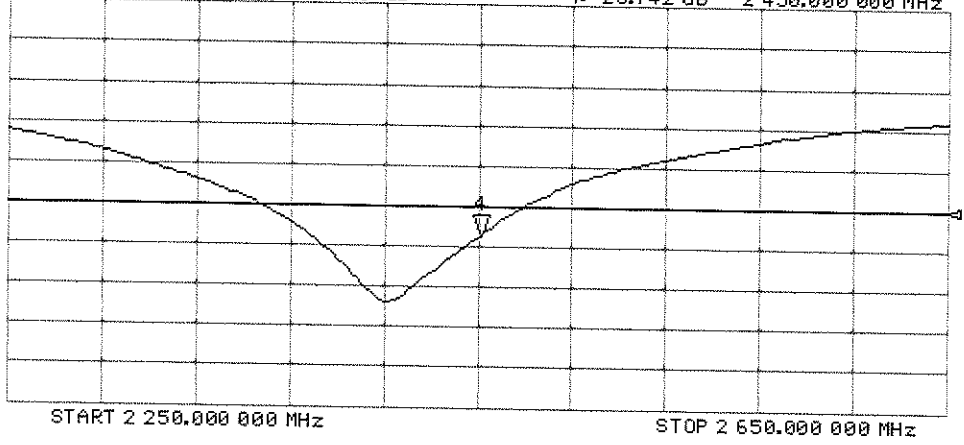
CH1 S11 1 U FS 19 Aug 2015 12:33:47  
4: 50.098  $\Omega$  6.5195  $\Omega$  423.52 pF 2 450.000 000 MHz

\*  
De1  
CΔ  
Avg  
16  
H1d



CH2 S11 LOG 5 dB/REF -20 dB 4:-23.742 dB 2 450.000 000 MHz

CΔ  
Avg  
16  
H1d





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D5GHzV2-1191\_Sep15**

## CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1191**

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

Calibration date: **September 16, 2015**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)     | Scheduled Calibration |
|-----------------------------|--------------------|--------------------------------|-----------------------|
| Power meter EPM-442A        | GB37480704         | 07-Oct-14 (No. 217-02020)      | Oct-15                |
| Power sensor HP 8481A       | US37292783         | 07-Oct-14 (No. 217-02020)      | Oct-15                |
| Power sensor HP 8481A       | MY41092317         | 07-Oct-14 (No. 217-02021)      | Oct-15                |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 01-Apr-15 (No. 217-02131)      | Mar-16                |
| Type-N mismatch combination | SN: 6047.2 / 06327 | 01-Apr-15 (No. 217-02134)      | Mar-16                |
| Reference Probe EX3DV4      | SN: 3503           | 30-Dec-14 (No. EX3-3503_Dec14) | Dec-15                |
| DAE4                        | SN: 601            | 17-Aug-15 (No. DAE4-601_Aug15) | Aug-16                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| RF generator R&S SMT-06   | 100972           | 15-Jun-15 (in house check Jun-15) | In house check: Jun-16 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

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

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

Signature

Issued: September 18, 2015

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



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Accreditation No.: **SCS 0108**

### Glossary:

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

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

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

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

## Measurement Conditions

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

|                              |                                                                                              |                                  |
|------------------------------|----------------------------------------------------------------------------------------------|----------------------------------|
| DASY Version                 | DASY5                                                                                        | V52.8.8                          |
| Extrapolation                | Advanced Extrapolation                                                                       |                                  |
| Phantom                      | Modular Flat Phantom V5.0                                                                    |                                  |
| Distance Dipole Center - TSL | 10 mm                                                                                        | with Spacer                      |
| Zoom Scan Resolution         | $dx, dy = 4.0 \text{ mm}, dz = 1.4 \text{ mm}$                                               | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 5250 MHz $\pm 1 \text{ MHz}$<br>5600 MHz $\pm 1 \text{ MHz}$<br>5750 MHz $\pm 1 \text{ MHz}$ |                                  |

## Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

|                                         | Temperature                 | Permittivity    | Conductivity                  |
|-----------------------------------------|-----------------------------|-----------------|-------------------------------|
| Nominal Head TSL parameters             | 22.0 °C                     | 35.9            | 4.71 mho/m                    |
| Measured Head TSL parameters            | $(22.0 \pm 0.2) \text{ °C}$ | $34.9 \pm 6 \%$ | $4.54 \text{ mho/m} \pm 6 \%$ |
| Head TSL temperature change during test | $< 0.5 \text{ °C}$          | ---             | ---                           |

## SAR result with Head TSL at 5250 MHz

|                                                       |                    |                                                 |
|-------------------------------------------------------|--------------------|-------------------------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                                                 |
| SAR measured                                          | 100 mW input power | 8.31 W/kg                                       |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | <b>82.5 W/kg <math>\pm 19.9 \%</math> (k=2)</b> |

|                                                         |                    |                                                 |
|---------------------------------------------------------|--------------------|-------------------------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                                                 |
| SAR measured                                            | 100 mW input power | 2.38 W/kg                                       |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | <b>23.6 W/kg <math>\pm 19.5 \%</math> (k=2)</b> |

### Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.5         | 5.07 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 34.4 ± 6 %   | 4.88 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Head TSL at 5600 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 8.52 W/kg                       |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>84.5 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.43 W/kg                       |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>24.1 W/kg ± 19.5 % (k=2)</b> |

### Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.4         | 5.22 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 34.2 ± 6 %   | 5.04 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ---          | ---              |

### SAR result with Head TSL at 5750 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 8.07 W/kg                       |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>80.0 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.31 W/kg                       |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>22.9 W/kg ± 19.5 % (k=2)</b> |

### Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.9         | 5.36 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 47.3 ± 6 %   | 5.53 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ---          | ---              |

### SAR result with Body TSL at 5250 MHz

|                                                       |                    |                          |
|-------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                          |
| SAR measured                                          | 100 mW input power | 7.77 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 77.2 W/kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.17 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.5 W/kg ± 19.5 % (k=2) |

### 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 | 46.7 ± 6 %   | 5.99 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ---          | ---              |

### SAR result with Body TSL at 5600 MHz

|                                                       |                    |                          |
|-------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                          |
| SAR measured                                          | 100 mW input power | 8.24 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 81.9 W/kg ± 19.9 % (k=2) |

|                                                         |                    |                          |
|---------------------------------------------------------|--------------------|--------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
| SAR measured                                            | 100 mW input power | 2.30 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 22.8 W/kg ± 19.5 % (k=2) |

## Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.3         | 5.94 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 46.5 ± 6 %   | 6.20 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

## SAR result with Body TSL at 5750 MHz

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 7.76 W/kg                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>77.1 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.16 W/kg                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>21.4 W/kg ± 19.5 % (k=2)</b> |

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

### Antenna Parameters with Head TSL at 5250 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.1 $\Omega$ - 5.2 j $\Omega$ |
| Return Loss                          | - 24.0 dB                      |

### Antenna Parameters with Head TSL at 5600 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 58.0 $\Omega$ - 3.2 j $\Omega$ |
| Return Loss                          | - 22.0 dB                      |

### Antenna Parameters with Head TSL at 5750 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 59.2 $\Omega$ + 3.7 j $\Omega$ |
| Return Loss                          | - 20.8 dB                      |

### Antenna Parameters with Body TSL at 5250 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.5 $\Omega$ - 3.9 j $\Omega$ |
| Return Loss                          | - 24.8 dB                      |

### Antenna Parameters with Body TSL at 5600 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 59.0 $\Omega$ - 2.5 j $\Omega$ |
| Return Loss                          | - 21.3 dB                      |

### Antenna Parameters with Body TSL at 5750 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 59.9 $\Omega$ + 4.8 j $\Omega$ |
| Return Loss                          | - 20.0 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.203 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 | August 28, 2003 |

## DASY5 Validation Report for Head TSL

Date: 15.09.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1191**

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.54$  S/m;  $\epsilon_r = 34.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>,

Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.88$  S/m;  $\epsilon_r = 34.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>,

Medium parameters used:  $f = 5750$  MHz;  $\sigma = 5.04$  S/m;  $\epsilon_r = 34.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.45, 5.45, 5.45); Calibrated: 30.12.2014, ConvF(4.92, 4.92, 4.92); Calibrated: 30.12.2014, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.94 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.7 W/kg

**SAR(1 g) = 8.31 W/kg; SAR(10 g) = 2.38 W/kg**

Maximum value of SAR (measured) = 19.5 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 = 63.94 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 33.8 W/kg

**SAR(1 g) = 8.52 W/kg; SAR(10 g) = 2.43 W/kg**

Maximum value of SAR (measured) = 20.7 W/kg

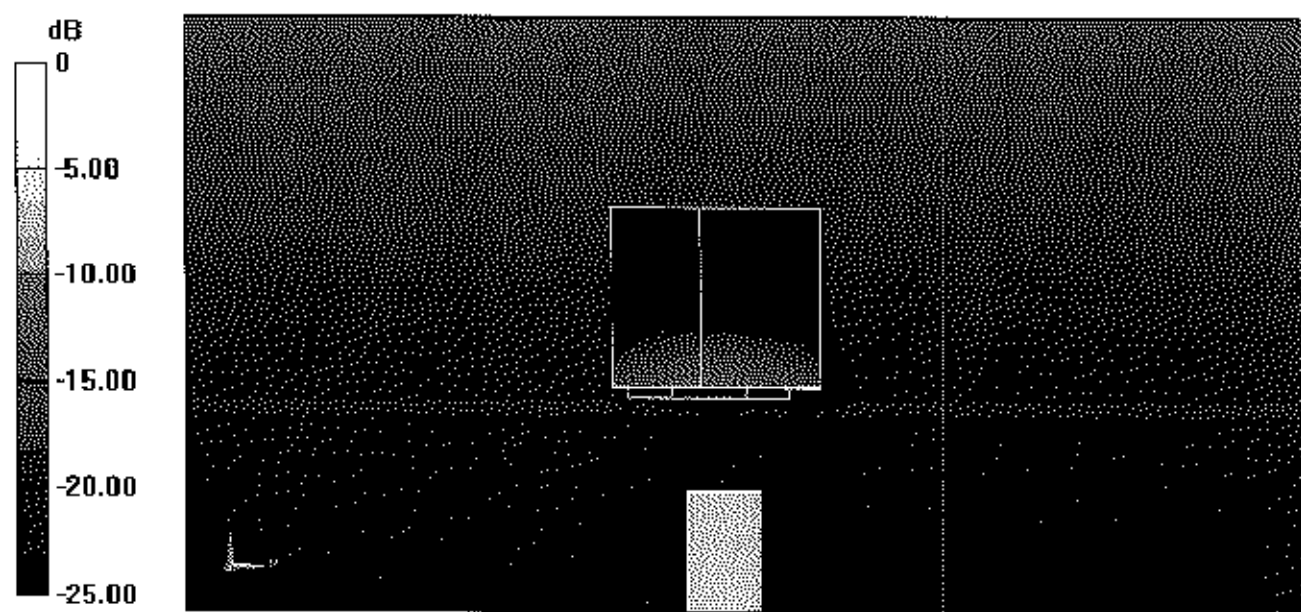
**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 61.52 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 33.4 W/kg

**SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.31 W/kg**

Maximum value of SAR (measured) = 19.9 W/kg

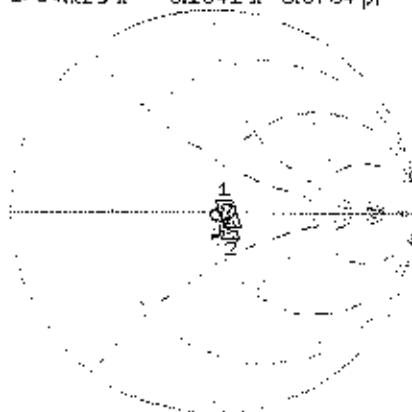


0 dB = 19.9 W/kg = 12.99 dBW/kg

# Impedance Measurement Plot for Head TSL

15 Sep 2015 15:38:52  
 CH1 S11 1 U FS 1: 54.123  $\Omega$  -5.1641  $\Omega$  5.8704 pF 5 250.000 000 MHz

#  
 Del  
 Cor  
 Avg  
 16  
 H1d



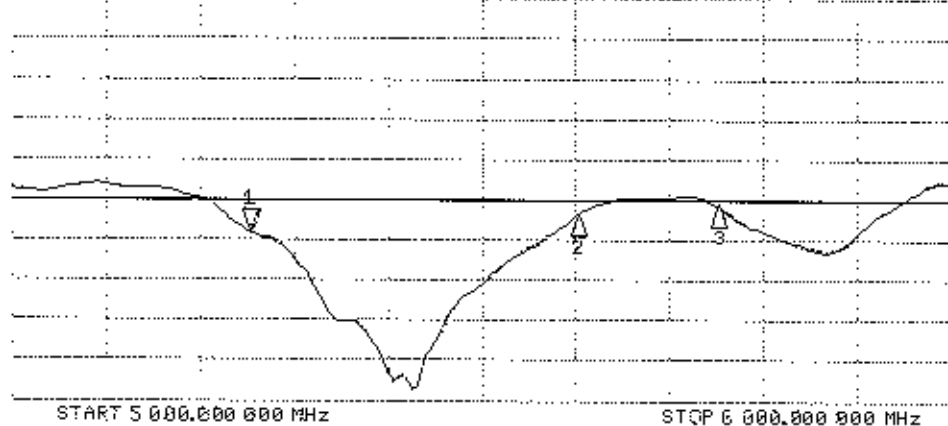
CH1 Markers

2: 57.959  $\Omega$   
 -3.1855  $\Omega$   
 5.60000 GHz

3: 59.244  $\Omega$   
 3.6875  $\Omega$   
 5.75000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -23.955 dB 5 250.000 000 MHz

Cor  
 Avg  
 16  
 H1d



CH2 Markers

2: -22.001 dB  
 5.60000 GHz

3: -20.813 dB  
 5.75000 GHz

START 5 000.000 000 MHz

STOP 6 000.000 000 MHz

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1191**

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz  
Medium parameters used:  $f = 5250$  MHz;  $\sigma = 5.53$  S/m;  $\epsilon_r = 47.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>,  
Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.99$  S/m;  $\epsilon_r = 46.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>,  
Medium parameters used:  $f = 5750$  MHz;  $\sigma = 6.2$  S/m;  $\epsilon_r = 46.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

**DASY52 Configuration:**

- Probe: EX3DV4 - SN3503; ConvF(4.9, 4.9, 4.9); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm**

Reference Value = 58.40 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 30.8 W/kg

**SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.17 W/kg**

Maximum value of SAR (measured) = 19.0 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 = 59.20 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 36.1 W/kg

**SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.3 W/kg**

Maximum value of SAR (measured) = 21.0 W/kg

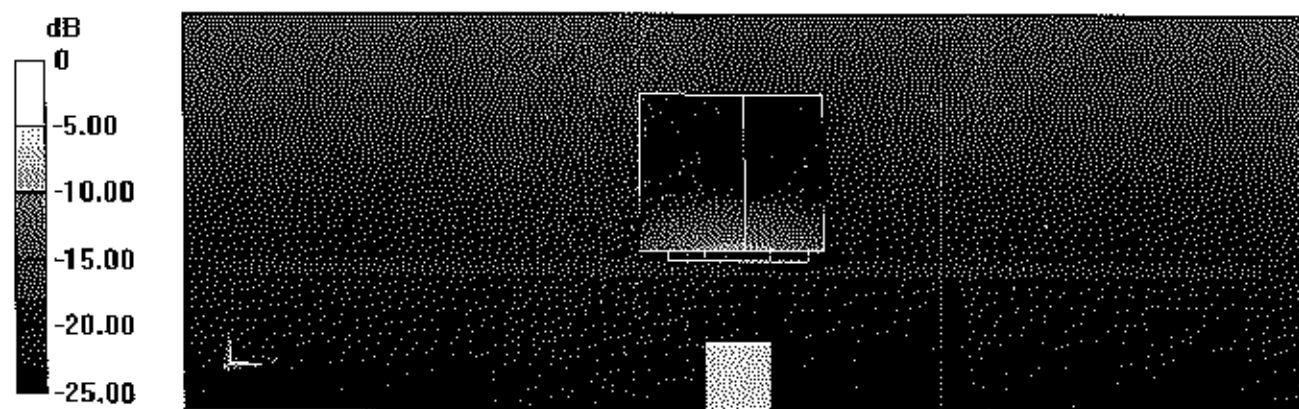
**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm**

Reference Value = 56.52 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 35.5 W/kg

**SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.16 W/kg**

Maximum value of SAR (measured) = 19.9 W/kg



0 dB = 19.9 W/kg = 12.99 dBW/kg

Impedance Measurement Plot for Body TSL

