

## SAR TEST REPORT

For

### Vuzix Corporation

25 Hendrix Road, West Henrietta NY 14586 United States Of America

**FCC ID: 2AA9D-490**

**IC: 11503A-490**

|                                        |                                                                                                                                                                                                                                                                                                         |                                                                                       |  |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--|
| <b>Report Type:</b><br>Original Report |                                                                                                                                                                                                                                                                                                         | <b>Product Type:</b><br>M4000                                                         |  |
| <b>Report Number:</b>                  | RSZ200511004-20B                                                                                                                                                                                                                                                                                        |                                                                                       |  |
| <b>Report Date:</b>                    | 2020-08-05                                                                                                                                                                                                                                                                                              |                                                                                       |  |
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| Attestation of Test Results |                        |                                         |                     |
|-----------------------------|------------------------|-----------------------------------------|---------------------|
| <b>EUT Information</b>      | <b>EUT Description</b> | M4000                                   |                     |
|                             | <b>Tested Model</b>    | 490                                     |                     |
|                             | <b>FCC ID</b>          | 2AA9D-490                               |                     |
|                             | <b>IC</b>              | 11503A-490                              |                     |
|                             | <b>Serial Number</b>   | RSZ200511004-RF-S4                      |                     |
|                             | <b>Test Date</b>       | 2020/07/01                              |                     |
| <b>MODE</b>                 |                        | <b>Max. SAR Level(s) Reported(W/kg)</b> | <b>Limit (W/kg)</b> |
| <b>WLAN 2.4G</b>            | 1g Head SAR            | <b>0.11</b>                             | <b>1.6</b>          |
| <b>WLAN 5.2G</b>            | 1g Head SAR            | <b>0.30</b>                             |                     |
| <b>WLAN 5.8G</b>            | 1g Head SAR            | <b>0.46</b>                             |                     |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Applicable Standards</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>RSS-102 Issue 5 March 2015</b><br>Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands).                                                                                                                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>IEEE1528:2013</b><br>IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>RSS-102 Issue 5 March 2015</b><br>Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands).                                                                                                                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>IEC 62209-1:2016</b><br>Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Part 1: Devices used next to the ear (Frequency range of 300 MHz to 6 GHz) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>KDB procedures</b><br>KDB 447498 D01 General RF Exposure Guidance v06<br>KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04<br>KDB 865664 D02 RF Exposure Reporting v01r02<br>KDB 248227 D01 802.11 Wi-Fi SAR v02r02                                                             |
| <p><b>Note:</b> This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in <b>FCC 47 CFR part 2.1093</b> and has been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and RF exposure KDB procedures.</p> <p><b>The results and statements contained in this report pertain only to the device(s) evaluated.</b></p> |                                                                                                                                                                                                                                                                                         |

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## DOCUMENT REVISION HISTORY

| Revision Number | Report Number    | Description of Revision | Date of Revision |
|-----------------|------------------|-------------------------|------------------|
| 0               | RSZ200511004-20B | Original Report         | 2020-08-05       |

## EUT DESCRIPTION

This report has been prepared on behalf of **Vuzix Corporation** and their product **M4000**, Model: **490**, FCC ID: **2AA9D-490**; IC: **11503A-490** or the EUT (Equipment under Test) as referred to in the rest of this report.

*\*All measurement and test data in this report was gathered from production sample serial number: RSZ200511004-RF-S4(Assigned by BACL, Shenzhen).The EUT supplied by the applicant was received on 2020-05-13.*

## Technical Specification

|                                            |                                                                                                                                                         |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Device Type:</b>                        | Portable                                                                                                                                                |
| <b>Exposure Category:</b>                  | Population / Uncontrolled                                                                                                                               |
| <b>Antenna Type(s):</b>                    | Internal Antenna                                                                                                                                        |
| <b>Proximity sensor for SAR reduction:</b> | None                                                                                                                                                    |
| <b>Face-Head Accessories:</b>              | None                                                                                                                                                    |
| <b>Operation Mode :</b>                    | WLAN, Bluetooth                                                                                                                                         |
| <b>Frequency Band:</b>                     | WLAN (2.4G): 2412-2462 MHz<br>WLAN (5.2G): 5180-5240 MHz<br>WLAN (5.8G): 5745-5825 MHz<br>Bluetooth: 2402 -2480 MHz                                     |
| <b>Conducted RF Power:</b>                 | WLAN (2.4G): 17.83 dBm<br>WLAN (5.2G): 15.02 dBm<br>WLAN (5.8G): 16.40 dBm<br>Bluetooth(BDR/EDR): 5.29 dBm<br>Bluetooth LE: 6.74 dBm(1M), 6.94 dBm (2M) |
| <b>Power Source:</b>                       | Rechargeable Battery                                                                                                                                    |
| <b>Normal Operation:</b>                   | Next to Head                                                                                                                                            |

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## REFERENCE, STANDARDS, AND GUIDELINES

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### FCC:

The Report and Order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in North America is 1.6 mW/g average over 1 gram of tissue mass.

### CE:

The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 2 mW/g as recommended by EN62209-1 for an uncontrolled environment. According to the Standard, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in Europe is 2 mW/g average over 10 gram of tissue mass.

The test configurations were laid out on a specially designed test fixture to ensure the reproducibility of measurements. Each configuration was scanned for SAR. Analysis of each scan was carried out to characterize the above effects in the device.

**SAR Limits****FCC Limit(1g Tissue)**

| EXPOSURE LIMITS                                                  | SAR (W/kg)                                                     |                                                        |
|------------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------|
|                                                                  | (General Population /<br>Uncontrolled Exposure<br>Environment) | (Occupational /<br>Controlled Exposure<br>Environment) |
| Spatial Average<br>(averaged over the whole body)                | 0.08                                                           | 0.4                                                    |
| Spatial Peak<br>(averaged over any 1 g of tissue)                | <b>1.60</b>                                                    | 8.0                                                    |
| Spatial Peak<br>(hands/wrists/feet/ankles<br>averaged over 10 g) | 4.0                                                            | 20.0                                                   |

**CE Limit(1g Tissue)**

| EXPOSURE LIMITS                                                  | SAR (W/kg)                                                     |                                                        |
|------------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------|
|                                                                  | (General Population /<br>Uncontrolled Exposure<br>Environment) | (Occupational /<br>Controlled Exposure<br>Environment) |
| Spatial Average<br>(averaged over the whole body)                | 0.08                                                           | 0.4                                                    |
| Spatial Peak<br>(averaged over any 10 g of<br>tissue)            | 2.0                                                            | 10                                                     |
| Spatial Peak<br>(hands/wrists/feet/ankles<br>averaged over 10 g) | 4.0                                                            | 20.0                                                   |

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

General Population/Uncontrolled environments Spatial Peak limit 1.6W/kg (FCC) & 2 W/kg (CE) applied to the EUT.

## **FACILITIES**

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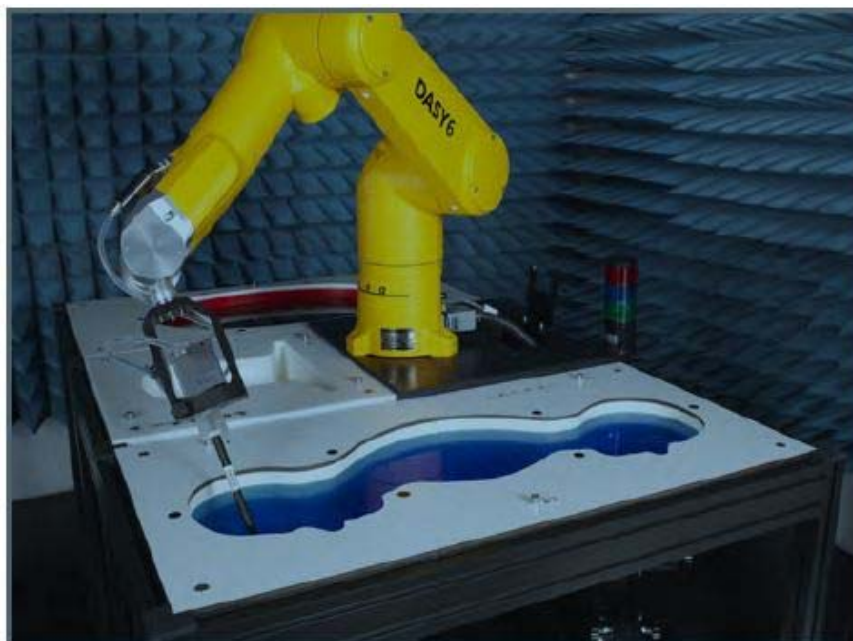
The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect data is located at 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

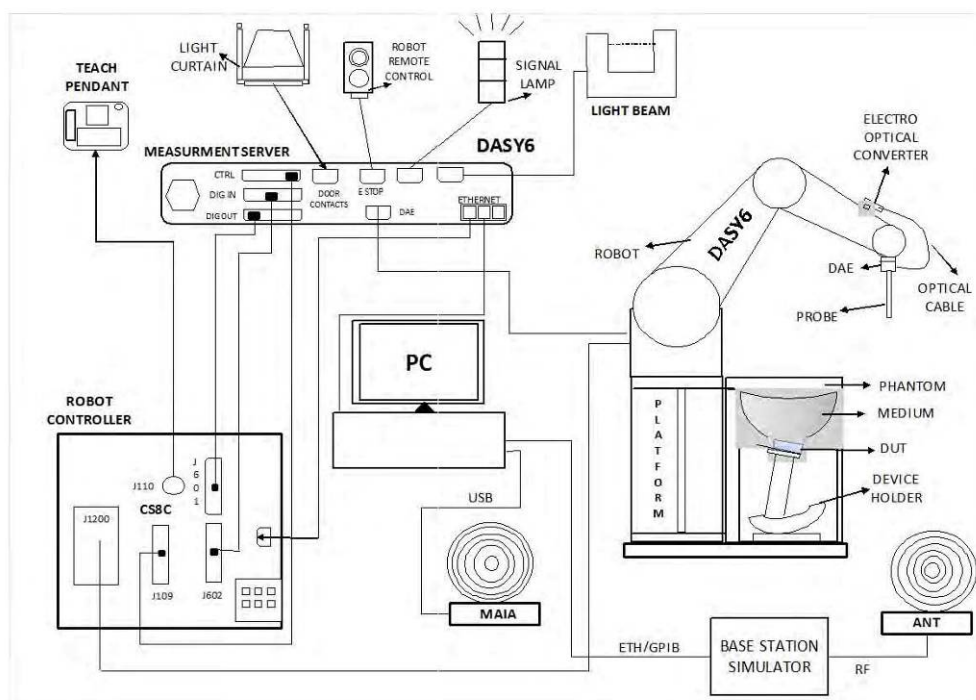
## DESCRIPTION OF TEST SYSTEM

These measurements were performed with the automated near-field scanning system DASY6 from Schmid & Partner Engineering AG (SPEAG) which is the Fifth generation of the system shown in the figure hereinafter:



### DASY6 System Description

The DASY6 system for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot (Staubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal application, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 professional operating system and the DASY52 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

### DASY6 Measurement Server

The DASY6 measurement server is based on a PC/104 CPU board with a 400 MHz Intel ULV Celeron, 128 MB chip-disk and 128 MB RAM. The necessary circuits for communication with the DAE4 (or DAE3) electronics box, as well as the 16-bit AD converter system for optical detection and digital I/O interface are contained on the DASY6 I/O board, which is directly connected to the PC/104 bus of the CPU board.



The measurement server performs all real-time data evaluations of field measurements and surface detection, controls robot movements, and handles safety operations. The PC operating system cannot interfere with these time-critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port, which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Connection of devices from any other supplier could seriously damage the measurement server.

### Data Acquisition Electronics

The data acquisition electronics (DAE4) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of both the DAE4 as well as of the DAE3 box is 200M $\Omega$ ; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

**EX3DV4 E-Field Probes**

|                      |                                                                                                                                                                                                               |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Frequency</b>     | 10 MHz to > 6 GHz<br>Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)                                                                                                                                                |
| <b>Directivity</b>   | $\pm 0.3$ dB in TSL (rotation around probe axis)<br>$\pm 0.5$ dB in TSL (rotation normal to probe axis)                                                                                                       |
| <b>Dynamic Range</b> | 10 $\mu$ W/g to > 100 mW/g<br>Linearity: $\pm 0.2$ dB (noise: typically < 1 $\mu$ W/g)                                                                                                                        |
| <b>Dimensions</b>    | Overall length: 337 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm                                                                          |
| <b>Application</b>   | High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%. |
| <b>Compatibility</b> | DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI                                                                                                                                                                |

**SAM Twin Phantom**

The SAM Twin Phantom (shown in front of DASY6) is a fiberglass shell phantom with shell thickness 2 mm, except in the ear region where the thickness is increased to 6 mm. The phantom has three measurement areas: 1) Left Head, 2) Right Head, and 3) Flat Section. For larger devices, the use of the ELI-Phantom (shown behind DASY6) is required. For devices such as glasses with a wireless link, the Face Down Phantom is the most suitable (between the SAM Twin and ELI phantoms).

When the phantom is mounted inside allocated slot of the DASY6 platform, phantom reference points can be taught directly in the DASY5 V5.2 software. When the DASY6 platform is used to mount the

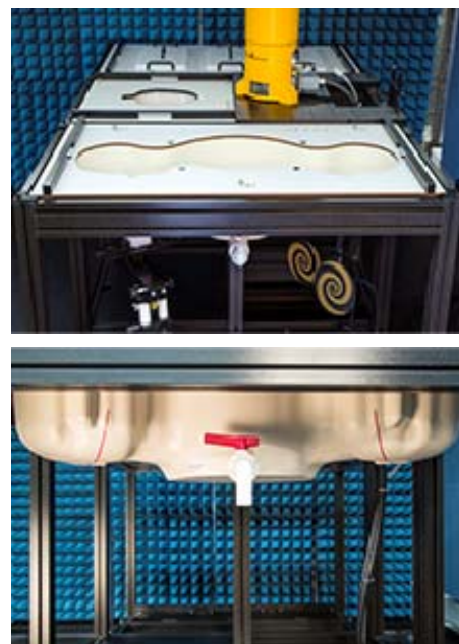
Phantom, some of the phantom teaching points cannot be reached by the robot in DASY5 V5.2. A special tool called P1a-P2aX-Former is provided to transform two of the three points, P1 and P2, to reachable locations. To use these new teaching points, a revised phantom configuration file is required.

In addition to our standard broadband liquids, the phantom can be used with the following tissue simulating liquids:

Sugar-water-based liquids can be left permanently in the phantom. Always cover the liquid when the system is not in use to prevent changes in liquid parameters due to water evaporation.

DGBE-based liquids should be used with care. As DGBE is a softener for most plastics, the liquid should be taken out of the phantom, and the phantom should be dried when the system is not in use (desirable at least once a week).

Do not use other organic solvents without previously testing the solvent resistivity of the phantom. Approximately 25 liters of liquid is required to fill the SAM Twin phantom.



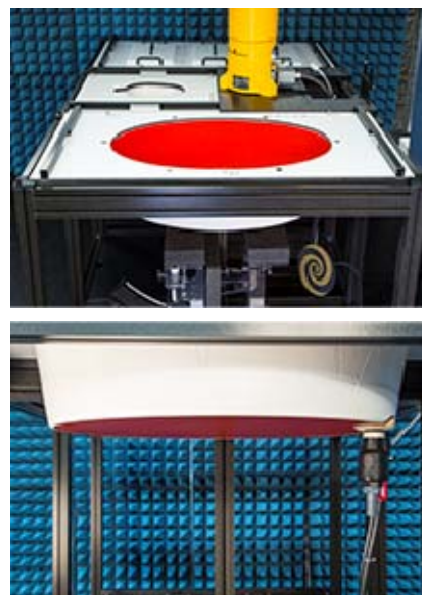
## ELI Phantom

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6 GHz. ELI is fully compatible with the latest draft of the standard IEC 62209-2 and the use of all known tissue simulating liquids. ELI has been optimized for performance and can be integrated into a SPEAG standard phantom table. A cover is provided to prevent evaporation of water and changes in liquid parameters. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points.

The phantom can be used with the following tissue simulating liquids:

- Sugar-water-based liquids can be left permanently in the phantom. Always cover the liquid when the system is not in use to prevent changes in liquid parameters due to water evaporation.
- DGBE-based liquids should be used with care. As DGBE is a softener for most plastics, the liquid should be taken out of the phantom, and the phantom should be dried when the system is not in use (desirable at least once a week).
- Do not use other organic solvents without previously testing the solvent resistivity of the phantom.

Approximately 25 liters of liquid is required to fill the ELI phantom.



## Robots

The DASY6 system uses the high-precision industrial robots TX60L, TX90XL, and RX160L from Staubli SA (France). The TX robot family - the successor of the well-known RX robot family - continues to offer the features important for DASY6 applications:

- High precision (repeatability 0.04mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchrony motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

The robots are controlled by the Staubli CS8c robot controllers. All information regarding the use and maintenance of the robot arm and the robot controller is provided

**Calibration Frequency Points for EX3DV4 E-Field Probes SN: 7522 Calibrated: 2020/04/01**

| Calibration Frequency Point(MHz) | Frequency Range(MHz) |      | Conversion Factor |      |      |
|----------------------------------|----------------------|------|-------------------|------|------|
|                                  | From                 | To   | X                 | Y    | Z    |
| 750 Head                         | 650                  | 850  | 9.92              | 9.92 | 9.92 |
| 900 Head                         | 850                  | 1000 | 9.4               | 9.4  | 9.4  |
| 1750 Head                        | 1650                 | 1850 | 8.21              | 8.21 | 8.21 |
| 1900 Head                        | 1850                 | 2000 | 7.95              | 7.95 | 7.95 |
| 2300 Head                        | 2200                 | 2400 | 7.53              | 7.53 | 7.53 |
| 2450 Head                        | 2400                 | 2550 | 7.15              | 7.15 | 7.15 |
| 2600 Head                        | 2550                 | 2700 | 7.04              | 7.04 | 7.04 |
| 5200 Head                        | 5090                 | 5250 | 5.2               | 5.2  | 5.2  |
| 5300 Head                        | 5250                 | 5410 | 4.96              | 4.96 | 4.96 |
| 5600 Head                        | 5490                 | 5700 | 4.55              | 4.55 | 4.55 |
| 5800 Head                        | 5700                 | 5910 | 4.65              | 4.65 | 4.65 |

**Area Scans**

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 15mm 2 step integral, with 1.5mm interpolation used to locate the peak SAR area used for zoom scan assessments.

Where the system identifies multiple SAR peaks (which are within 25% of peak value) the system will provide the user with the option of assessing each peak location individually for zoom scan averaging.

**Zoom Scan (Cube Scan Averaging)**

The averaging zoom scan volume utilized in the DASY5 software is in the shape of a cube and the side dimension of a 1 g or 10 g mass is dependent on the density of the liquid representing the simulated tissue. A density of 1000 kg/m<sup>3</sup> is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1g cube is 10mm, with the side length of the 10g cube is 21.5mm.

When the cube intersects with the surface of the phantom, it is oriented so that 3 vertices touch the surface of the shell or the center of a face is tangent to the surface. The face of the cube closest to the surface is modified in order to conform to the tangent surface.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications (including FCC) utilize a physical step of 7 x 7 x 7 (5mmx5mmx5mm) providing a volume of 30 mm in the X & Y & Z axis.

## Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEC 62209-1:2016

### Recommended Tissue Dielectric properties for Head liquid

**Table A.3 – Dielectric properties of the head tissue-equivalent liquid**

| Frequency<br>MHz | Relative permittivity<br>$\epsilon_r$ | Conductivity ( $\sigma$ )<br>S/m |
|------------------|---------------------------------------|----------------------------------|
| 300              | 45,3                                  | 0,87                             |
| 450              | 43,5                                  | 0,87                             |
| <i>750</i>       | <i>41,9</i>                           | <i>0,89</i>                      |
| 835              | 41,5                                  | 0,90                             |
| 900              | 41,5                                  | 0,97                             |
| 1 450            | 40,5                                  | 1,20                             |
| <i>1 500</i>     | <i>40,4</i>                           | <i>1,23</i>                      |
| <i>1 640</i>     | <i>40,2</i>                           | <i>1,31</i>                      |
| <i>1 750</i>     | <i>40,1</i>                           | <i>1,37</i>                      |
| 1 800            | 40,0                                  | 1,40                             |
| 1 900            | 40,0                                  | 1,40                             |
| 2 000            | 40,0                                  | 1,40                             |
| <i>2 100</i>     | <i>39,8</i>                           | <i>1,49</i>                      |
| <i>2 300</i>     | <i>39,5</i>                           | <i>1,67</i>                      |
| 2 450            | 39,2                                  | 1,80                             |
| <i>2 600</i>     | <i>39,0</i>                           | <i>1,96</i>                      |
| 3 000            | 38,5                                  | 2,40                             |
| <i>3 500</i>     | <i>37,9</i>                           | <i>2,91</i>                      |
| <i>4 000</i>     | <i>37,4</i>                           | <i>3,43</i>                      |
| <i>4 500</i>     | <i>36,8</i>                           | <i>3,94</i>                      |
| <i>5 000</i>     | <i>36,2</i>                           | <i>4,45</i>                      |
| <i>5 200</i>     | <i>36,0</i>                           | <i>4,66</i>                      |
| <i>5 400</i>     | <i>35,8</i>                           | <i>4,86</i>                      |
| <i>5 600</i>     | <i>35,5</i>                           | <i>5,07</i>                      |
| <i>5 800</i>     | <i>35,3</i>                           | <i>5,27</i>                      |
| <i>6 000</i>     | <i>35,1</i>                           | <i>5,48</i>                      |

NOTE For convenience, permittivity and conductivity values at those frequencies which are not part of the original data provided by Drossos et al. [33] or the extension to 5 800 MHz are provided (i.e. the values shown *in italics*). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6 000 MHz that were linearly extrapolated from the values at 3 000 MHz and 5 800 MHz.

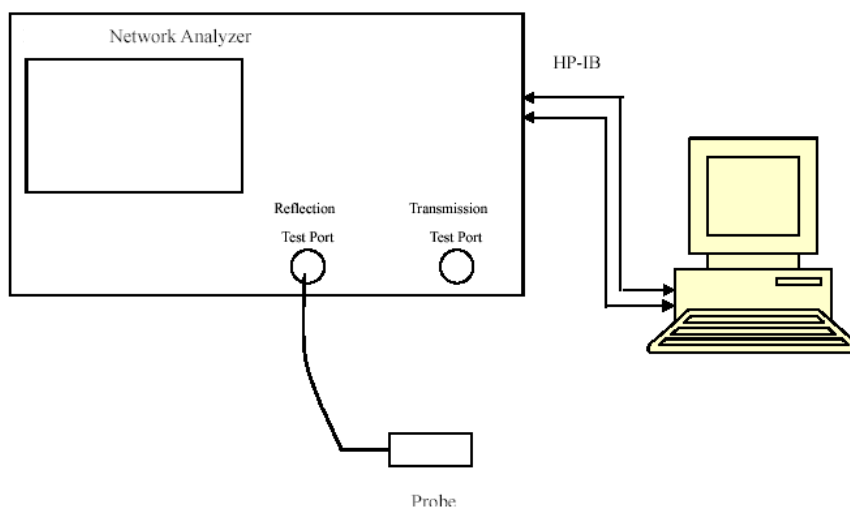
## EQUIPMENT LIST AND CALIBRATION

### Equipments List & Calibration Information

| Equipment                    | Model           | S/N           | Calibration Date | Calibration Due Date |
|------------------------------|-----------------|---------------|------------------|----------------------|
| DASY5 Test Software          | DASY52 52.10.2  | N/A           | NCR              | NCR                  |
| DASY6 Measurement Server     | DASY6 6.0.31    | N/A           | NCR              | NCR                  |
| Data Acquisition Electronics | DAE4            | 1562          | 2020/03/03       | 2021/03/02           |
| E-Field Probe                | EX3DV4          | 7522          | 2020/04/01       | 2021/03/31           |
| Mounting Device              | MD4HHTV5        | SD 000 H01 KA | NCR              | NCR                  |
| SAM Twin Phantom             | SAM-Twin V8.0   | 1962          | NCR              | NCR                  |
| Dipole, 2450MHz              | D2450V2         | 751           | 2017/10/12       | 2020/10/12           |
| Dipole, 5GHz                 | D5GHzV2         | 1225          | 2020/1/10        | 2023/1/9             |
| Simulated Tissue Liquid Head | HBBL600-10000V6 | 180622-2      | Each Time        |                      |
| Network Analyzer             | 8753D           | 3410A08288    | 2019/07/22       | 2020/07/21           |
| Dielectric Assessment Kit    | DAK-3.5         | 1248          | NCR              | NCR                  |
| Anritsu Signal Generator     | 68369B          | 4114          | 2019/07/09       | 2020/07/08           |
| USB wideband power sensor    | U2021XA         | MY54250003    | 2019/07/10       | 2020/07/09           |
| Power Amplifier              | 5S1G4           | 71377         | NCR              | NCR                  |
| Directional Coupler          | 4242-10         | 3307          | NCR              | NCR                  |
| Attenuator                   | 3dB             | 5402          | NCR              | NCR                  |
| Attenuator                   | 10dB            | AU 3842       | NCR              | NCR                  |

## SAR MEASUREMENT SYSTEM VERIFICATION

### Liquid Verification



Liquid Verification Setup Block Diagram

### Liquid Verification Results

| Frequency (MHz) | Liquid Type | Liquid Parameter |                | Target Value |                | Delta (%)          |                | Tolerance (%) |
|-----------------|-------------|------------------|----------------|--------------|----------------|--------------------|----------------|---------------|
|                 |             | $\epsilon_r$     | $\sigma$ (S/m) | $\epsilon_r$ | $\sigma$ (S/m) | $\Delta\epsilon_r$ | $\Delta\sigma$ |               |
| 2412            | Head        | 40.112           | 1.738          | 39.28        | 1.77           | 2.12               | -1.81          | $\pm 5$       |
| 2437            | Head        | 40.152           | 1.768          | 39.23        | 1.79           | 2.35               | -1.23          | $\pm 5$       |
| 2450            | Head        | 40.036           | 1.794          | 39.20        | 1.80           | 2.13               | -0.33          | $\pm 5$       |
| 2462            | Head        | 40.445           | 1.816          | 39.18        | 1.81           | 3.23               | 0.33           | $\pm 5$       |

\*Liquid Verification above was performed on 2020/07/01.

| Frequency (MHz) | Liquid Type | Liquid Parameter |                | Target Value |                | Delta (%)          |                | Tolerance (%) |
|-----------------|-------------|------------------|----------------|--------------|----------------|--------------------|----------------|---------------|
|                 |             | $\epsilon_r$     | $\sigma$ (S/m) | $\epsilon_r$ | $\sigma$ (S/m) | $\Delta\epsilon_r$ | $\Delta\sigma$ |               |
| 5180            | Head        | 36.803           | 4.487          | 36.02        | 4.64           | 2.17               | -3.3           | $\pm 5$       |
| 5200            | Head        | 36.445           | 4.567          | 36.00        | 4.66           | 1.24               | -2             | $\pm 5$       |
| 5240            | Head        | 36.632           | 4.597          | 35.96        | 4.70           | 1.87               | -2.19          | $\pm 5$       |
| 5250            | Head        | 36.675           | 4.608          | 35.95        | 4.71           | 2.02               | -2.17          | $\pm 5$       |

\*Liquid Verification above was performed on 2020/07/01.

| Frequency<br>(MHz) | Liquid Type | Liquid<br>Parameter |                   | Target Value |                   | Delta<br>(%)       |                | Tolerance<br>(%) |
|--------------------|-------------|---------------------|-------------------|--------------|-------------------|--------------------|----------------|------------------|
|                    |             | $\epsilon_r$        | $\sigma$<br>(S/m) | $\epsilon_r$ | $\sigma$<br>(S/m) | $\Delta\epsilon_r$ | $\Delta\sigma$ |                  |
| 5745               | Head        | 35.652              | 5.065             | 35.28        | 5.22              | 1.05               | -2.97          | $\pm 5$          |
| 5785               | Head        | 35.424              | 5.162             | 35.22        | 5.26              | 0.58               | -1.86          | $\pm 5$          |
| 5800               | Head        | 35.398              | 5.187             | 35.30        | 5.27              | 0.28               | -1.57          | $\pm 5$          |
| 5825               | Head        | 35.407              | 5.231             | 35.28        | 5.30              | 0.36               | -1.3           | $\pm 5$          |

\*Liquid Verification above was performed on 2020/07/01.

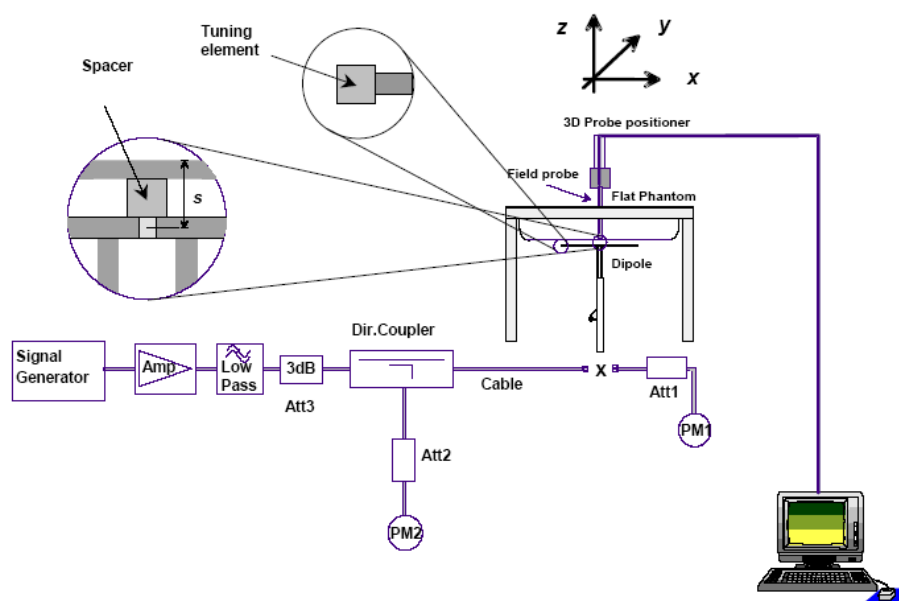
## System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of  $\pm 10\%$ . The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

The spacing distances in the **System Verification Setup Block Diagram** is given by the following:

- $s = 15 \text{ mm} \pm 0,2 \text{ mm}$  for  $300 \text{ MHz} \leq f \leq 1\,000 \text{ MHz}$ ;
- $s = 10 \text{ mm} \pm 0,2 \text{ mm}$  for  $1\,000 \text{ MHz} < f \leq 3\,000 \text{ MHz}$ ;
- $s = 10 \text{ mm} \pm 0,2 \text{ mm}$  for  $3\,000 \text{ MHz} < f \leq 6\,000 \text{ MHz}$ .

## System Verification Setup Block Diagram



## System Accuracy Check Results

| Date       | Frequency Band (MHz) | Liquid Type | Input Power (mW) | Measured SAR (W/kg) | Normalized to 1W (W/kg) | Target Value (W/Kg) | Delta (%) | Tolerance (%) |
|------------|----------------------|-------------|------------------|---------------------|-------------------------|---------------------|-----------|---------------|
| 2020/07/01 | 2450                 | Head        | 100              | 1g 5.31             | 53.1                    | 52.5                | 1.143     | $\pm 10$      |
| 2020/07/01 | 5200                 | Head        | 250              | 1g 19.8             | 79.2                    | 80.7                | -1.859    | $\pm 10$      |
| 2020/07/01 | 5800                 | Head        | 250              | 1g 19.3             | 77.2                    | 80.2                | -3.741    | $\pm 10$      |

\*The SAR values above are normalized to 1 Watt forward power.

## SAR SYSTEM VALIDATION DATA

### System Performance 2450 MHz Head

**DUT: Dipole 2450MHz; Type: D2450V2; Serial: 751**

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.794$  S/m;  $\epsilon_r = 40.036$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.15, 7.15, 7.15) @ 2450 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Head 2450MHz Pin=100mW/Area Scan (81x121x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 6.18 W/kg

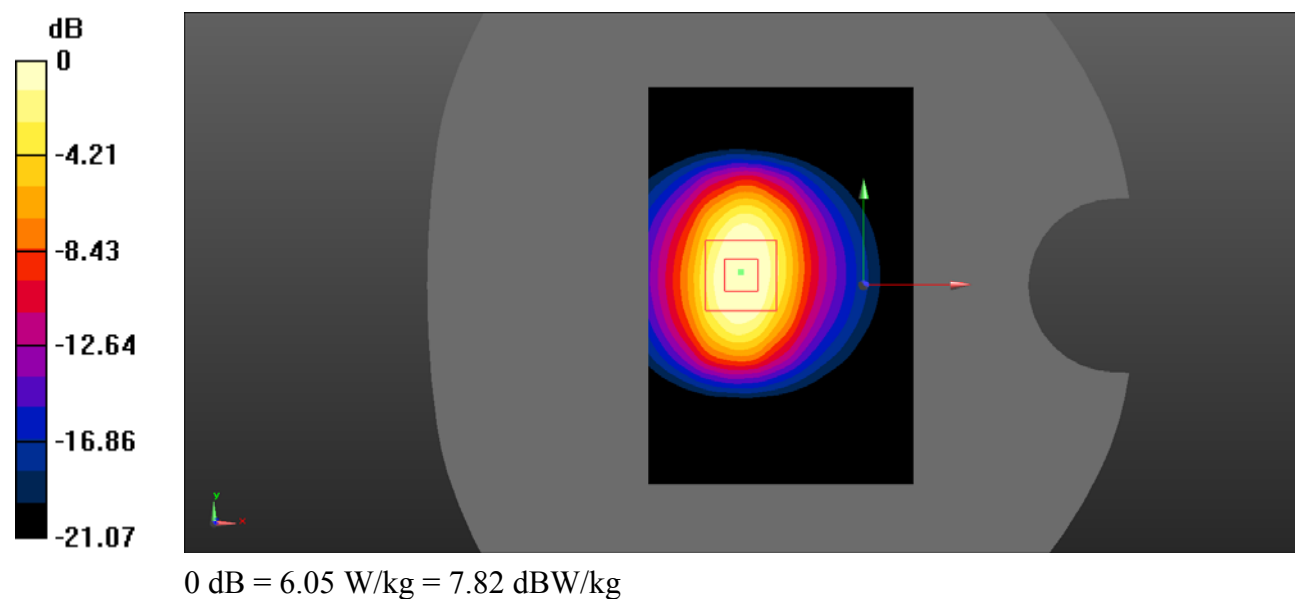
**Head 2450MHz Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.28 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 10.6 W/kg

**SAR(1 g) = 5.31 W/kg; SAR(10 g) = 2.54 W/kg**

Maximum value of SAR (measured) = 6.05 W/kg



**System Performance 5250 MHz Head****DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: 1225**

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

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.608$  S/m;  $\epsilon_r = 36.675$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7522; ConvF(5.2, 5.2, 5.2) @ 5250 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Head 5250MHz Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 51.6 W/kg

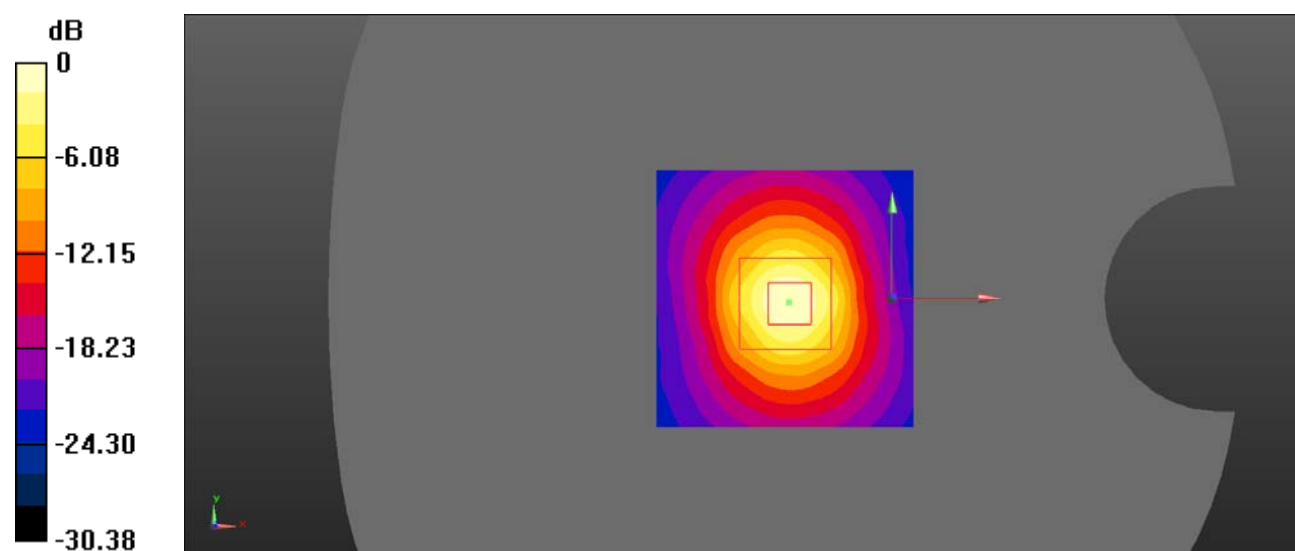
**Head 5250MHz Pin=250mW/Zoom Scan (8x8x15)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 75.24 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 77.5 W/kg

**SAR(1 g) = 19.8 W/kg; SAR(10 g) = 5.64 W/kg**

Maximum value of SAR (measured) = 47.2 W/kg



0 dB = 47.2 W/kg = 16.74 dBW/kg

**System Performance 5800 MHz Head****DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: 1225**

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

Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.187$  S/m;  $\epsilon_r = 35.398$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(4.65, 4.65, 4.65) @ 5800 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn876; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Head 5800MHz Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 50.9 W/kg

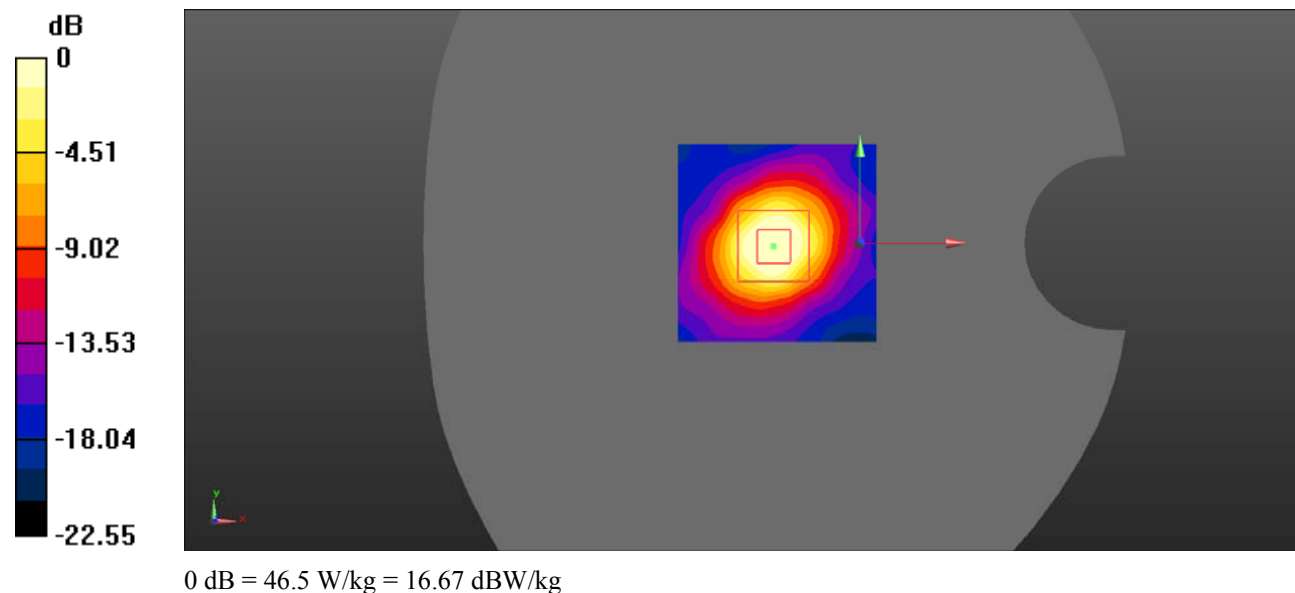
**Head 5800MHz Pin=250mW/Zoom Scan (8x8x15)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 75.08 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 77.1 W/kg

**SAR(1 g) = 19.3 W/kg; SAR(10 g) = 5.62 W/kg**

Maximum value of SAR (measured) = 46.6 W/kg

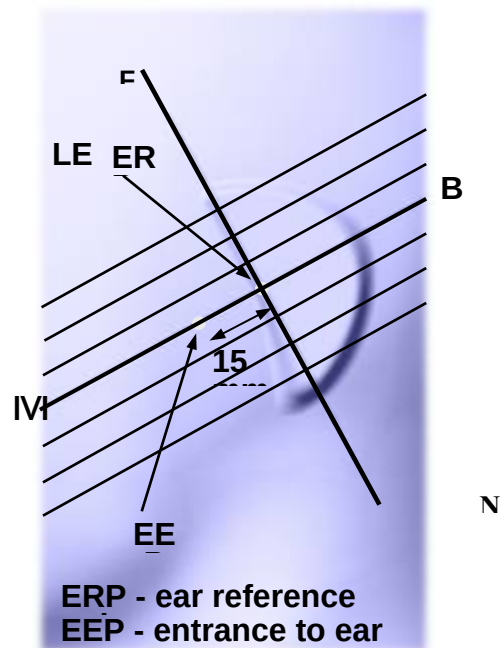
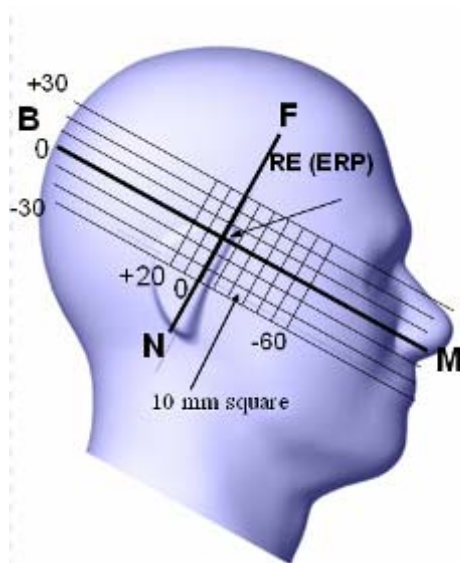


## EUT TEST STRATEGY AND METHODOLOGY

### Test Positions for Device Operating Next to a Person's Ear

This category includes most wireless handsets with fixed, retractable or internal antennas located toward the top half of the device, with or without a foldout, sliding or similar keypad cover. The handset should have its earpiece located within the upper  $\frac{1}{4}$  of the device, either along the centerline or off-centered, as perceived by its users. This type of handset should be positioned in a normal operating position with the "test device reference point" located along the "vertical centerline" on the front of the device aligned to the "ear reference point". The "test device reference point" should be located at the same level as the center of the earpiece region. The "vertical centerline" should bisect the front surface of the handset at its top and bottom edges. A "ear reference point" is located on the outer surface of the head phantom on each ear spacer. It is located 1.5 cm above the center of the ear canal entrance in the "phantom reference plane" defined by the three lines joining the center of each "ear reference point" (left and right) and the tip of the mouth.

A handset should be initially positioned with the earpiece region pressed against the ear spacer of a head phantom. For the SCC-34/SC-2 head phantom, the device should be positioned parallel to the "N-F" line defined along the base of the ear spacer that contains the "ear reference point". For interim head phantoms, the device should be positioned parallel to the cheek for maximum RF energy coupling. The "test device reference point" is aligned to the "ear reference point" on the head phantom and the "vertical centerline" is aligned to the "phantom reference plane". This is called the "initial ear position". While maintaining these three alignments, the body of the handset is gradually adjusted to each of the following positions for evaluating SAR:



## Cheek/Touch Position

The device is brought toward the mouth of the head phantom by pivoting against the “ear reference point” or along the “N-F” line for the SCC-34/SC-2 head phantom.

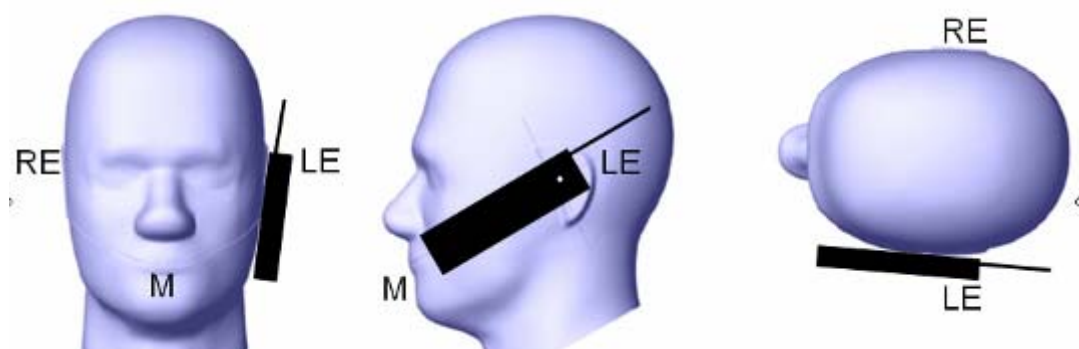
This test position is established:

When any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom.

(or) When any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.

For existing head phantoms – when the handset loses contact with the phantom at the pivoting point, rotation should continue until the device touches the cheek of the phantom or breaks its last contact from the ear spacer.

### Cheek /Touch Position



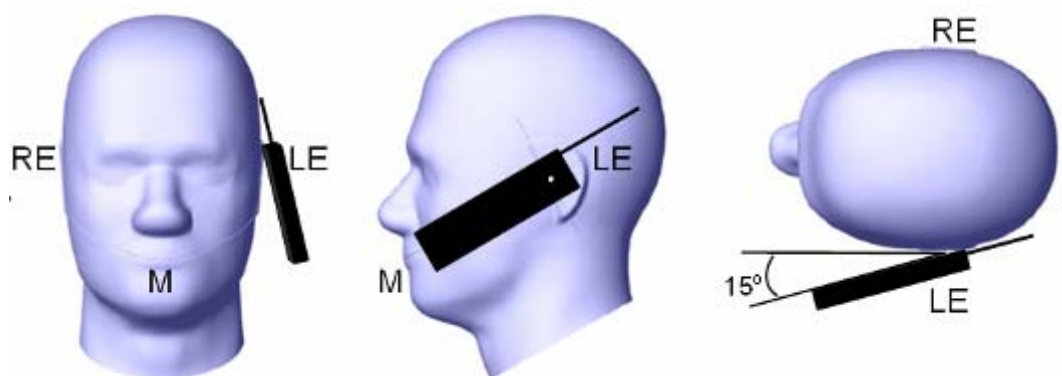
## Ear/Tilt Position

With the handset aligned in the “Cheek/Touch Position”:

1) If the earpiece of the handset is not in full contact with the phantom’s ear spacer (in the “Cheek/Touch position”) and the peak SAR location for the “Cheek/Touch” position is located at the ear spacer region or corresponds to the earpiece region of the handset, the device should be returned to the “initial ear position” by rotating it away from the mouth until the earpiece is in full contact with the ear spacer.

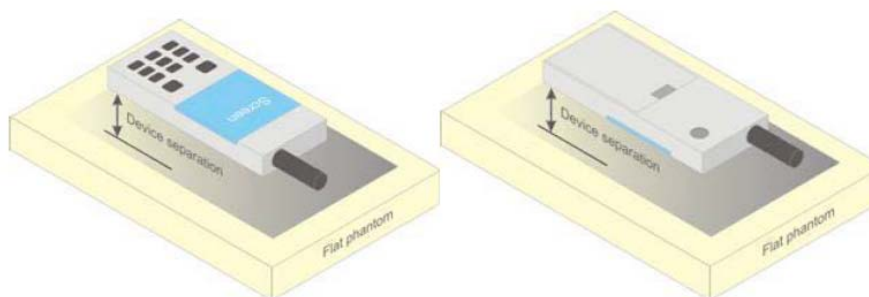
2) (otherwise) The handset should be moved (translated) away from the cheek perpendicular to the line passes through both “ear reference points” (note: one of these ear reference points may not physically exist on a split head model) for approximate 2-3 cm. While it is in this position, the device handset is tilted away from the mouth with respect to the “test device reference point” until the inside angle between the vertical centerline on the front surface of the phone and the horizontal line passing through the ear reference point is by 15 80°. After the tilt, it is then moved (translated) back toward the head perpendicular to the line passes through both “ear reference points” until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process should be repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously. This test position may require a device holder or positioner to achieve the translation and tilting with acceptable positioning repeatability.

If a device is also designed to transmit with its keypad cover closed for operating in the head position, such positions should also be considered in the SAR evaluation. The device should be tested on the left and right side of the head phantom in the “Cheek/Touch” and “Ear/Tilt” positions. When applicable, each configuration should be tested with the antenna in its fully extended and fully retracted positions. These test configurations should be tested at the high, middle and low frequency channels of each operating mode; for example, AMPS, CDMA, and TDMA. If the SAR measured at the middle channel for each test configuration (left, right, Cheek/Touch, Tilt/Ear, extended and retracted) is at least 2.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s). If the transmission band of the test device is less than 10 MHz, testing at the high and low frequency channels is optional.

**Ear /Tilt 15° Position****Test positions for body-worn and other configurations**

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device. When multiple accessories that do not contain metallic components are supplied with the device, the device may be tested with only the accessory that dictates the closest spacing to the body. When multiple accessories that contain metallic components are supplied with the device, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (e.g., 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 must be tested.

Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 1.5 cm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances. Other separation distances may be used, but they should not exceed 2.5 cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components.



**Figure 5 – Test positions for body-worn devices**

**Test Distance for SAR Evaluation**

For this case the EUT(Equipment Under Test) is set 10mm away from the phantom, the test distance is 0mm.

## SAR Evaluation Procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the ear point or central position was used as a reference value for assessing the power drop. The SAR at this point is measured at the start of the test and then again at the end of the testing.

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or radiating structures of the EUT, the horizontal grid spacing was 15 mm x 15 mm, and the SAR distribution was determined by integrated grid of 1.5mm x 1.5mm. Based on these data, the area of the maximum absorption was determined by spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 30 mm x 30 mm x 30 mm was assessed by measuring 7x 7 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

- 1) The data at the surface were extrapolated, since the center of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

- 2) The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 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 integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the averages.

All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

## CONDUCTED OUTPUT POWER MEASUREMENT

### Provision Applicable

The measured peak output power should be greater and within 5% than EMI measurement.

### EUT Exercise Software

Wi-Fi test in the engineer mode.

“AiThinker Serial Tool V1.2.3.exe” Software was used, and the power level is default.

### Maximum Target Output Power

| Max Target Power(dBm) |         |        |      |
|-----------------------|---------|--------|------|
| Mode/Band             | Channel |        |      |
|                       | Low     | Middle | High |
| 2.4G WLAN             | 18.1    | 18.1   | 18.1 |
| 5.2G WLAN             | 15.3    | 15.3   | 15.3 |
| 5.8G WLAN             | 15.0    | 15.0   | 15.0 |
| Bluetooth BDR/EDR     | 5.6     | 5.6    | 5.6  |
| Bluetooth BLE(1M)     | 7.0     | 7.0    | 7.0  |
| Bluetooth BLE(2M)     | 7.2     | 7.2    | 7.2  |

### Test Results:

#### WLAN 2.4G:

| Mode         | Channel frequency (MHz) | Data Rate | RF Output Power(dBm) |
|--------------|-------------------------|-----------|----------------------|
| 802.11b      | 2412                    | 1Mbps     | 17.61                |
|              | 2437                    |           | <b>17.83</b>         |
|              | 2462                    |           | 17.62                |
| 802.11g      | 2412                    | 6Mbps     | 17.31                |
|              | 2437                    |           | 17.51                |
|              | 2462                    |           | 17.80                |
| 802.11n HT20 | 2412                    | MCS0      | 17.38                |
|              | 2437                    |           | 17.66                |
|              | 2462                    |           | 17.45                |
| 802.11n HT40 | 2422                    | MCS0      | 16.48                |
|              | 2437                    |           | 16.26                |
|              | 2452                    |           | 16.13                |

**WLAN 5.2G:**

| Mode       | Channel frequency (MHz) | Data Rate | RF Output Power(dBm) |
|------------|-------------------------|-----------|----------------------|
| 802.11a    | 5180                    | 1Mbps     | 14.27                |
|            | 5200                    |           | 14.66                |
|            | 5240                    |           | 14.20                |
| 802.11n20  | 5180                    | 6Mbps     | 14.86                |
|            | 5200                    |           | 14.93                |
|            | 5240                    |           | 14.07                |
| 802.11n40  | 5190                    | MCS0      | 14.66                |
|            | 5230                    |           | 14.69                |
| 802.11ac20 | 5180                    | MCS0      | 14.88                |
|            | 5200                    |           | <b>15.02</b>         |
|            | 5240                    |           | 14.22                |
| 802.11ac40 | 5190                    | MCS0      | 14.70                |
|            | 5230                    |           | 14.74                |
| 802.11ac80 | 5210                    | MCS0      | 14.98                |

**WLAN 5.8G:**

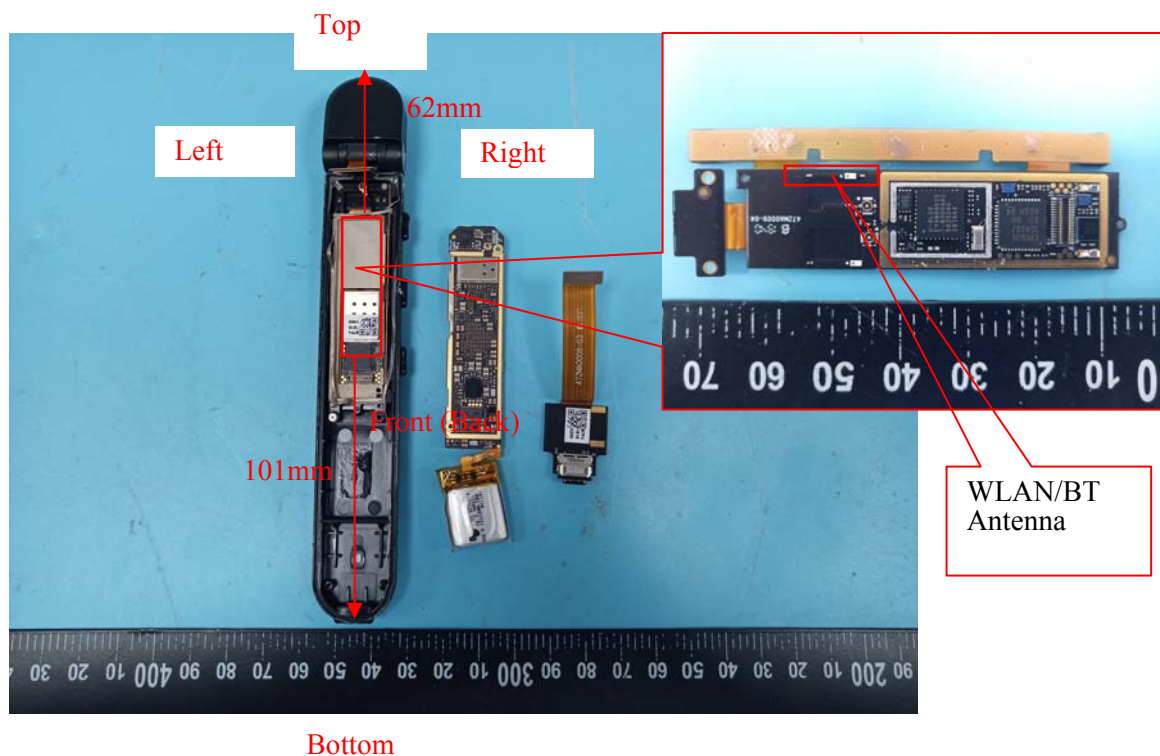
| Mode       | Channel frequency (MHz) | Data Rate | RF Output Power(dBm) |
|------------|-------------------------|-----------|----------------------|
| 802.11a    | 5745                    | 1Mbps     | 14.37                |
|            | 5785                    |           | 14.54                |
|            | 5825                    |           | 14.44                |
| 802.11n20  | 5745                    | 6Mbps     | 14.50                |
|            | 5785                    |           | 14.71                |
|            | 5825                    |           | 14.52                |
| 802.11n40  | 5755                    | MCS0      | 14.30                |
|            | 5795                    |           | 14.37                |
| 802.11ac20 | 5745                    | MCS0      | 14.60                |
|            | 5785                    |           | 14.66                |
|            | 5825                    |           | 14.59                |
| 802.11ac40 | 5755                    | MCS0      | 14.38                |
|            | 5795                    |           | 14.41                |
| 802.11ac80 | 5775                    | MCS0      | <b>14.74</b>         |

**Bluetooth:**

| Mode                 | Channel frequency<br>(MHz) | RF Output Power<br>(dBm) |
|----------------------|----------------------------|--------------------------|
| BDR(GFSK)            | 2402                       | 4.13                     |
|                      | 2441                       | 3.71                     |
|                      | 2480                       | 4.95                     |
| EDR( $\pi/4$ -DQPSK) | 2402                       | 3.18                     |
|                      | 2441                       | 2.68                     |
|                      | 2480                       | 3.93                     |
| EDR(8-DPSK)          | 2402                       | 3.43                     |
|                      | 2441                       | 3.08                     |
|                      | 2480                       | <b>5.29</b>              |
| Bluetooth LE(1M)     | 2402                       | 5.55                     |
|                      | 2440                       | 5.60                     |
|                      | 2480                       | <b>6.74</b>              |
| Bluetooth LE(2M)     | 2402                       | 5.63                     |
|                      | 2440                       | 5.80                     |
|                      | 2480                       | <b>6.94</b>              |

## Standalone SAR test exclusion considerations

### Antennas Location:



### Antenna Distance To Edge

| Antenna Distance To Edge(mm) |       |      |      |       |     |        |
|------------------------------|-------|------|------|-------|-----|--------|
| Antenna                      | Front | Back | Left | Right | Top | Bottom |
| WLAN Antenna (Wi-Fi & BT)    | 20    | 10   | <5   | 15    | 62  | 101    |

**Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power.** For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

**Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance<sup>4,5</sup>**

| Frequency (MHz) | Exemption Limits (mW)           |                                 |                                 |                                 |                                 |
|-----------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                 | At separation distance of ≤5 mm | At separation distance of 10 mm | At separation distance of 15 mm | At separation distance of 20 mm | At separation distance of 25 mm |
| ≤300            | 71 mW                           | 101 mW                          | 132 mW                          | 162 mW                          | 193 mW                          |
| 450             | 52 mW                           | 70 mW                           | 88 mW                           | 106 mW                          | 123 mW                          |
| 835             | 17 mW                           | 30 mW                           | 42 mW                           | 55 mW                           | 67 mW                           |
| 1900            | 7 mW                            | 10 mW                           | 18 mW                           | 34 mW                           | 60 mW                           |
| 2450            | 4 mW                            | 7 mW                            | 15 mW                           | 30 mW                           | 52 mW                           |
| 3500            | 2 mW                            | 6 mW                            | 16 mW                           | 32 mW                           | 55 mW                           |
| 5800            | 1 mW                            | 6 mW                            | 15 mW                           | 27 mW                           | 41 mW                           |

| Frequency (MHz) | Exemption Limits (mW)           |                                 |                                 |                                 |                                  |
|-----------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|----------------------------------|
|                 | At separation distance of 30 mm | At separation distance of 35 mm | At separation distance of 40 mm | At separation distance of 45 mm | At separation distance of ≥50 mm |
| ≤300            | 223 mW                          | 254 mW                          | 284 mW                          | 315 mW                          | 345 mW                           |
| 450             | 141 mW                          | 159 mW                          | 177 mW                          | 195 mW                          | 213 mW                           |
| 835             | 80 mW                           | 92 mW                           | 105 mW                          | 117 mW                          | 130 mW                           |
| 1900            | 99 mW                           | 153 mW                          | 225 mW                          | 316 mW                          | 431 mW                           |
| 2450            | 83 mW                           | 123 mW                          | 173 mW                          | 235 mW                          | 309 mW                           |
| 3500            | 86 mW                           | 124 mW                          | 170 mW                          | 225 mW                          | 290 mW                           |
| 5800            | 56 mW                           | 71 mW                           | 85 mW                           | 97 mW                           | 106 mW                           |

| Mode              | Frequency (MHz) | Max P <sub>avg</sub> (dBm) | Max P <sub>avg</sub> (mW) | Position | Distance (mm) | Test exclusion Threshold (mW) | SAR Test Exclusion |
|-------------------|-----------------|----------------------------|---------------------------|----------|---------------|-------------------------------|--------------------|
| 2.4G WLAN         | 2462            | 18.1                       | 64.565                    | Front    | 20            | 30.02                         | No                 |
| 5.2G WLAN         | 5240            | 13.5                       | 22.387                    | Front    | 20            | 28.22                         | No                 |
| 5.8G WLAN         | 5785            | 15.0                       | 31.623                    | Front    | 20            | 27.03                         | No                 |
| Bluetooth BDR/EDR | 2480            | 5.6                        | 3.631                     | Front    | 20            | 31.94                         | Yes                |
| Bluetooth BLE 4.0 | 2480            | 7.0                        | 5.012                     | Front    | 20            | 31.94                         | Yes                |
| Bluetooth BLE 5.0 | 2480            | 7.2                        | 5.248                     | Front    | 20            | 31.94                         | Yes                |

Note: only front side touch to head for use with normal condition.

## SAR MEASUREMENT RESULTS

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This page summarizes the results of the performed dosimetric evaluation.

### SAR Test Data

#### Environmental Conditions

|                    |              |
|--------------------|--------------|
| Temperature:       | 22.1-23.6 °C |
| Relative Humidity: | 43-52%       |
| ATM Pressure:      | 101.3 kPa    |
| Test Date:         | 2020/07/01   |

*Testing was performed by Seven Liang, Ricardo Lan.*

#### Note:

1. According to **Notice 2016-DRS001**: Based on the IEEE 1528 and IEC 62209 requirements, the high, mid and low channels for the configuration with the highest SAR value must be tested regardless of the SAR value measured
2. According to **Notice 2012-DRS0529**, if the correction  $\Delta$ SAR has a negative sign, **the measured SAR result should be corrected**, and has a positive sign, the measured SAR result shall not be corrected.

**WLAN 2.4G:**

| EUT Position           | Frequency (MHz) | Test Mode | Max. Meas. Power (dBm) | Max. Rated Power (dBm) | 1g SAR (W/kg) |           |             |      |
|------------------------|-----------------|-----------|------------------------|------------------------|---------------|-----------|-------------|------|
|                        |                 |           |                        |                        | Scaled Factor | Meas. SAR | Scaled SAR  | Plot |
| Front to Phantom (0mm) | 2412            | 802.11b   | 17.61                  | 18.1                   | 1.119         | 0.052     | 0.06        | 1#   |
|                        | 2437            | 802.11b   | 17.83                  | 18.1                   | 1.064         | 0.064     | 0.07        | 2#   |
|                        | 2462            | 802.11b   | 17.62                  | 18.1                   | 1.117         | 0.095     | <b>0.11</b> | 3#   |

**WLAN 5.2G:**

| EUT Position           | Frequency (MHz) | Test Mode | Max. Meas. Power (dBm) | Max. Rated Power (dBm) | 1g SAR (W/kg) |           |             |      |
|------------------------|-----------------|-----------|------------------------|------------------------|---------------|-----------|-------------|------|
|                        |                 |           |                        |                        | Scaled Factor | Meas. SAR | Scaled SAR  | Plot |
| Front to Phantom (0mm) | 5180            | 802.11a   | 14.27                  | 15.3                   | 1.268         | 0.172     | 0.22        | 4#   |
|                        | 5200            | 802.11a   | 14.66                  | 15.3                   | 1.159         | 0.189     | 0.22        | 5#   |
|                        | 5240            | 802.11a   | 14.20                  | 15.3                   | 1.288         | 0.229     | <b>0.30</b> | 6#   |

**WLAN 5.8G:**

| EUT Position           | Frequency (MHz) | Test Mode | Max. Meas. Power (dBm) | Max. Rated Power (dBm) | 1g SAR (W/kg) |           |             |      |
|------------------------|-----------------|-----------|------------------------|------------------------|---------------|-----------|-------------|------|
|                        |                 |           |                        |                        | Scaled Factor | Meas. SAR | Scaled SAR  | Plot |
| Front to Phantom (0mm) | 5745            | 802.11a   | 14.37                  | 15                     | 1.156         | 0.396     | <b>0.46</b> | 7#   |
|                        | 5785            | 802.11a   | 14.54                  | 15                     | 1.112         | 0.358     | 0.40        | 8#   |
|                        | 5825            | 802.11a   | 14.44                  | 15                     | 1.138         | 0.347     | 0.39        | 9#   |

**Note:**

1. When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channels are optional.
2. When the highest *reported* SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2\text{ W/kg}$ , OFDM SAR is not required.
3. When SAR or MPE 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.

## SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results

- 1) Repeated measurement is not required when the original highest measured SAR is  $< 0.80$  W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is  $\geq 0.80$  W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 1.45$  W/kg ( $\sim 10\%$  from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

*Note: The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.*

### The Highest Measured SAR Configuration in Each Frequency Band

#### Head

| SAR probe calibration point | Frequency Band | Freq.(MHz) | EUT Position | Meas. SAR (W/kg) |          | Largest to Smallest SAR Ratio |
|-----------------------------|----------------|------------|--------------|------------------|----------|-------------------------------|
|                             |                |            |              | Original         | Repeated |                               |
| /                           | /              | /          | /            | /                | /        | /                             |

#### Body

| SAR probe calibration point | Frequency Band | Freq.(MHz) | EUT Position | Meas. SAR (W/kg) |          | Largest to Smallest SAR Ratio |
|-----------------------------|----------------|------------|--------------|------------------|----------|-------------------------------|
|                             |                |            |              | Original         | Repeated |                               |
| /                           | /              | /          | /            | /                | /        | /                             |

#### Note:

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not  $> 1.20$ .
2. The measured SAR results **do not** have to be scaled to the maximum tune-up tolerance to determine if repeated measurements are required.
3. SAR measurement variability must be assessed for each frequency band, which is determined by the **SAR probe calibration point and tissue-equivalent medium** used for the device measurements..

## SAR SIMULTANEOUS TRANSMISSION DESCRIPTION

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**Simultaneous Transmission:**

| Description of Simultaneous Transmit Capabilities |               |
|---------------------------------------------------|---------------|
| Transmitter Combination                           | Simultaneous? |
| Wi-Fi+ Bluetooth                                  | ×             |

**Note:** WLAN and Bluetooth transmit with a same antenna

## SAR Plots

### Plot 1#

**DUT: M4000 ; Type: 490; Serial: RSZ200511004-RF-S4**

Communication System: UID 0, 2.4G DTS (0); Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2412$  MHz;  $\sigma = 1.738$  S/m;  $\epsilon_r = 40.112$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.15, 7.15, 7.15) @ 2412 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Front to Phantom/WLAN 2.4G 802.11b Low/Area Scan (71x161x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

Maximum value of SAR (interpolated) = 0.0627 W/kg

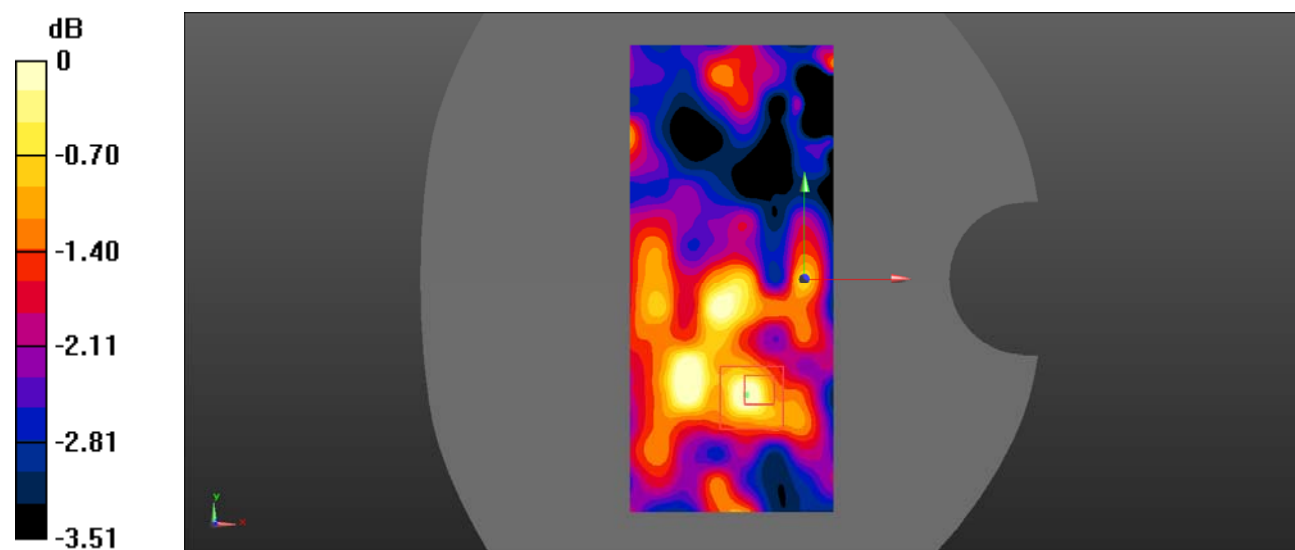
**Front to Phantom/WLAN 2.4G 802.11b Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 4.686 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.0800 W/kg

**SAR(1 g) = 0.052 W/kg; SAR(10 g) = 0.041 W/kg**

Maximum value of SAR (measured) = 0.0575 W/kg



0 dB = 0.0575 W/kg = -12.40 dBW/kg

**Plot 2#****DUT: M4000 ; Type: 490; Serial: RSZ200511004-RF-S4**

Communication System: UID 0, 2.4G DTS (0); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.768$  S/m;  $\epsilon_r = 40.152$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.15, 7.15, 7.15) @ 2437 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

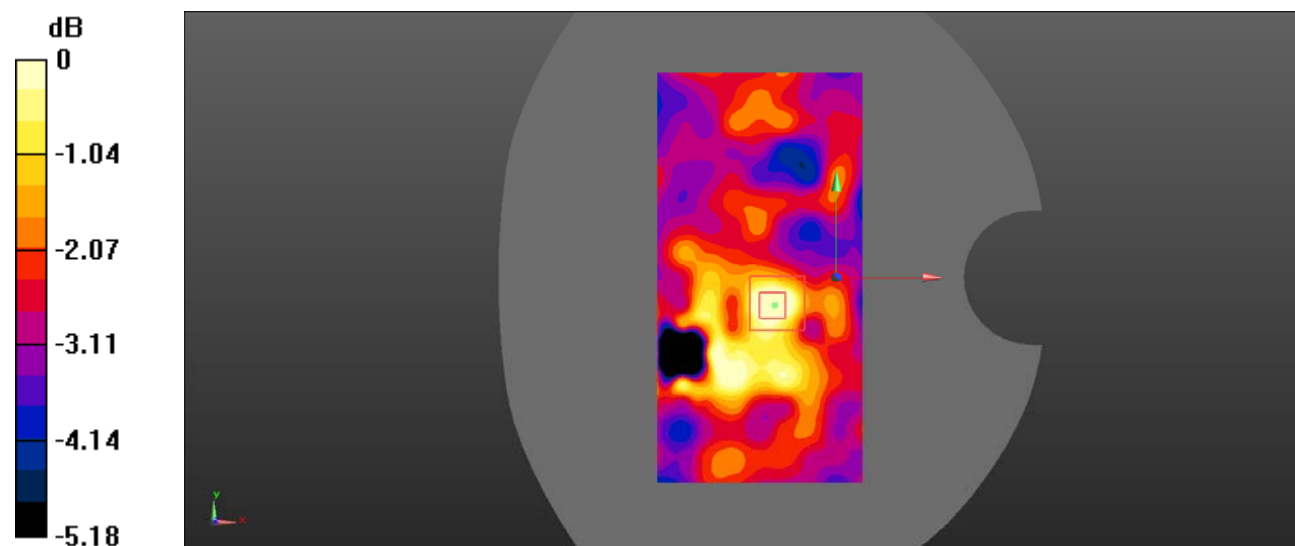
**Front to Phantom/WLAN 2.4G 802.11b Mid/Area Scan (81x161x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm  
Maximum value of SAR (interpolated) = 0.0845 W/kg**Front to Phantom/WLAN 2.4G 802.11b Mid/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.440 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.0920 W/kg

**SAR(1 g) = 0.064 W/kg; SAR(10 g) = 0.048 W/kg**

Maximum value of SAR (measured) = 0.0696 W/kg



0 dB = 0.0696 W/kg = -11.57 dBW/kg

**Plot 3#****DUT: M4000 ; Type: 490; Serial: RSZ200511004-RF-S4**

Communication System: UID 0, 2.4G DTS (0); Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.816$  S/m;  $\epsilon_r = 40.445$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.15, 7.15, 7.15) @ 2462 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Front to Phantom/WLAN 2.4G 802.11b High/Area Scan (81x161x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.104 W/kg

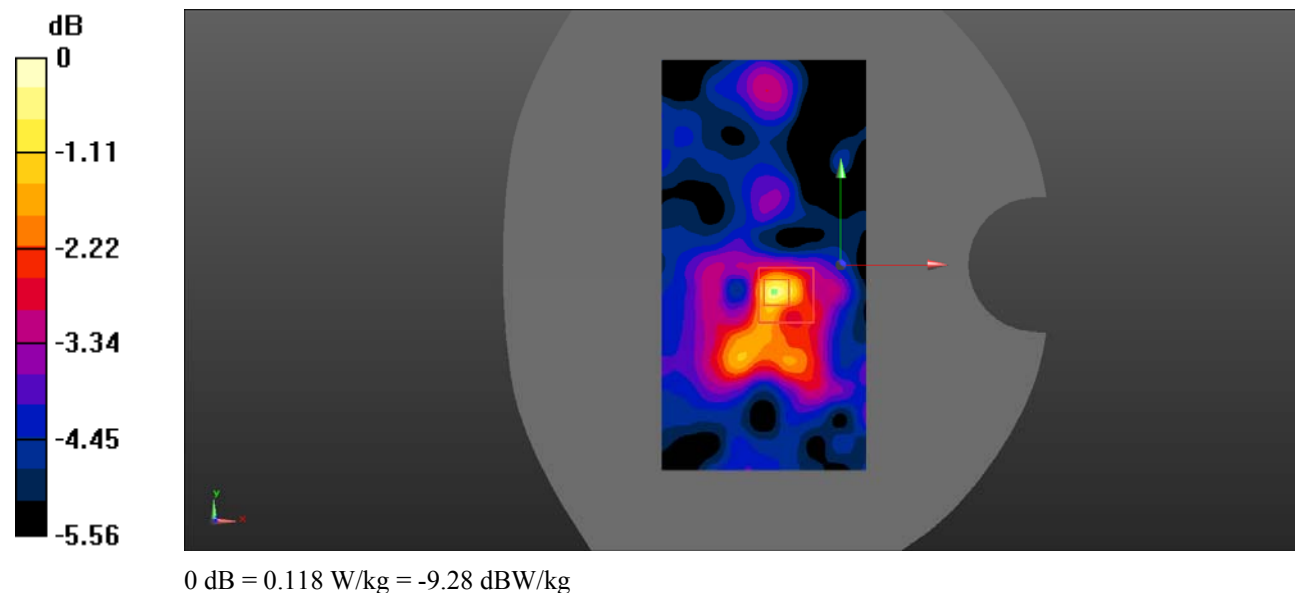
**Front to Phantom/WLAN 2.4G 802.11b High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.780 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.159 W/kg

**SAR(1 g) = 0.095 W/kg; SAR(10 g) = 0.057 W/kg**

Maximum value of SAR (measured) = 0.118 W/kg



**Plot 4#****DUT: M4000 ; Type: 490; Serial: RSZ200511004-RF-S4**

Communication System: UID 0, 5.2G WiFi (0); Frequency: 5180 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 5180$  MHz;  $\sigma = 4.487$  S/m;  $\epsilon_r = 36.803$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(5.2, 5.2, 5.2) @ 5180 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Front to Phantom/WLAN 5.2G 802.11a Low 2/Area Scan (71x161x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.205 W/kg

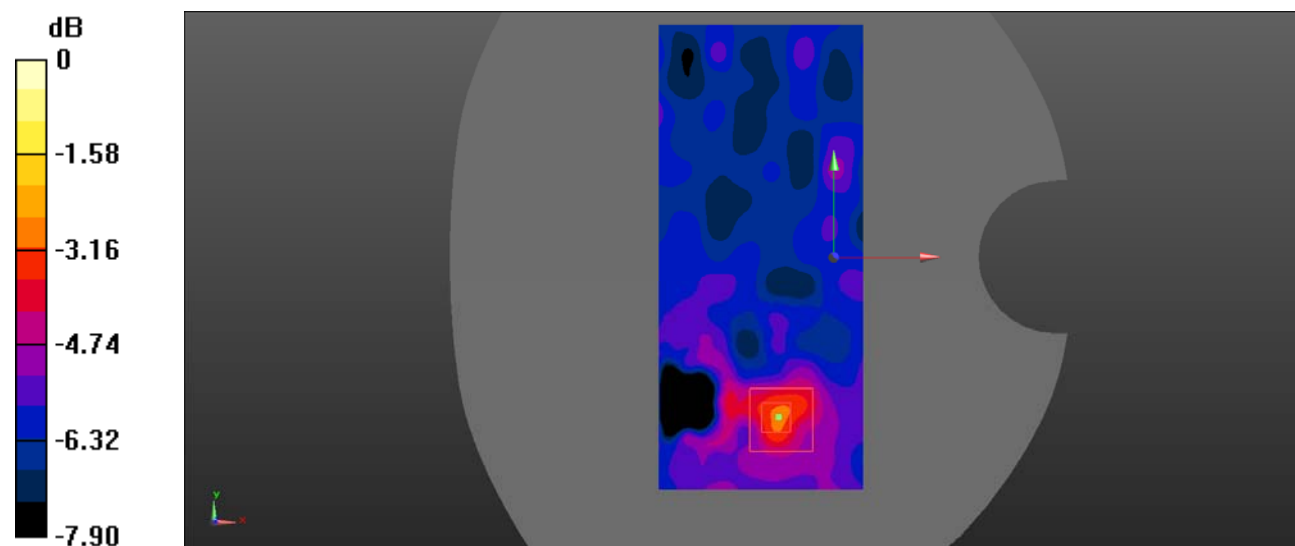
**Front to Phantom/WLAN 5.2G 802.11a Low 2/Zoom Scan (9x9x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 4.765 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 0.409 W/kg

**SAR(1 g) = 0.172 W/kg; SAR(10 g) = 0.138 W/kg**

Maximum value of SAR (measured) = 0.409 W/kg



0 dB = 0.409 W/kg = -3.88 dBW/kg

**Plot 5#****DUT: M4000 ; Type: 490; Serial: RSZ200511004-RF-S4**

Communication System: UID 0, 5.2G WiFi (0); Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 4.567$  S/m;  $\epsilon_r = 36.445$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(5.2, 5.2, 5.2) @ 5200 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Front to Phantom/WLAN 5.2G 802.11a Mid/Area Scan (81x161x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.244 W/kg

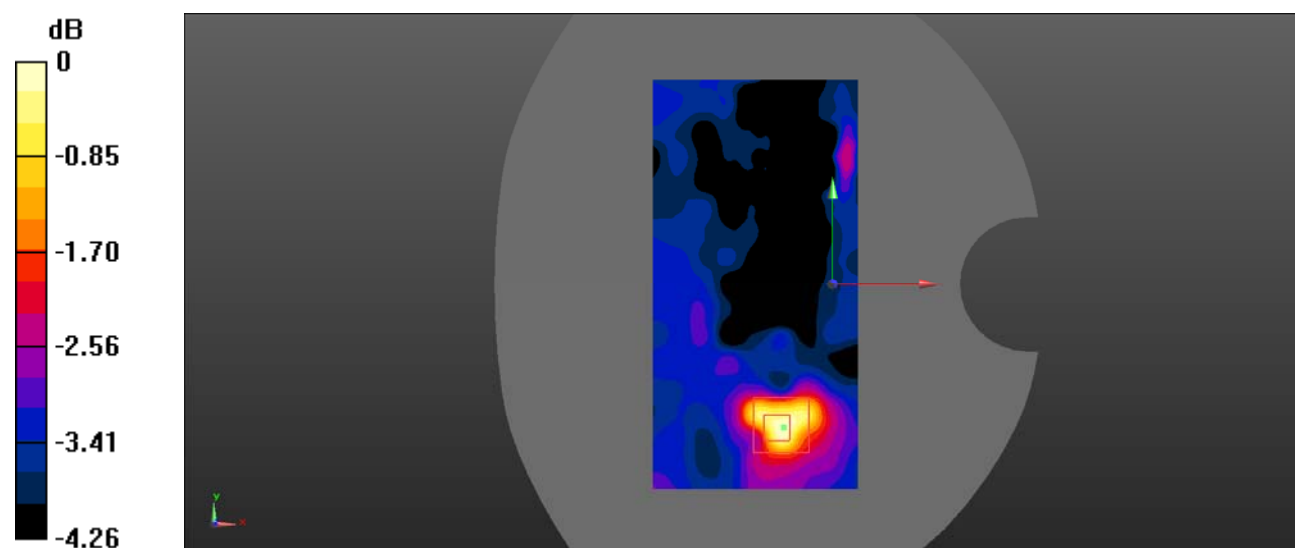
**Front to Phantom/WLAN 5.2G 802.11a Mid/Zoom Scan (8x8x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 4.929 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.336 W/kg

**SAR(1 g) = 0.189 W/kg; SAR(10 g) = 0.145 W/kg**

Maximum value of SAR (measured) = 0.248 W/kg



0 dB = 0.248 W/kg = -6.06 dBW/kg

**Plot 6#****DUT: M4000 ; Type: 490; Serial: RSZ200511004-RF-S4**

Communication System: UID 0, 5.2G WiFi (0); Frequency: 5240 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 5240$  MHz;  $\sigma = 4.597$  S/m;  $\epsilon_r = 36.632$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(5.2, 5.2, 5.2) @ 5240 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Front to Phantom/WLAN 5.2G 802.11a High/Area Scan (81x161x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.295 W/kg

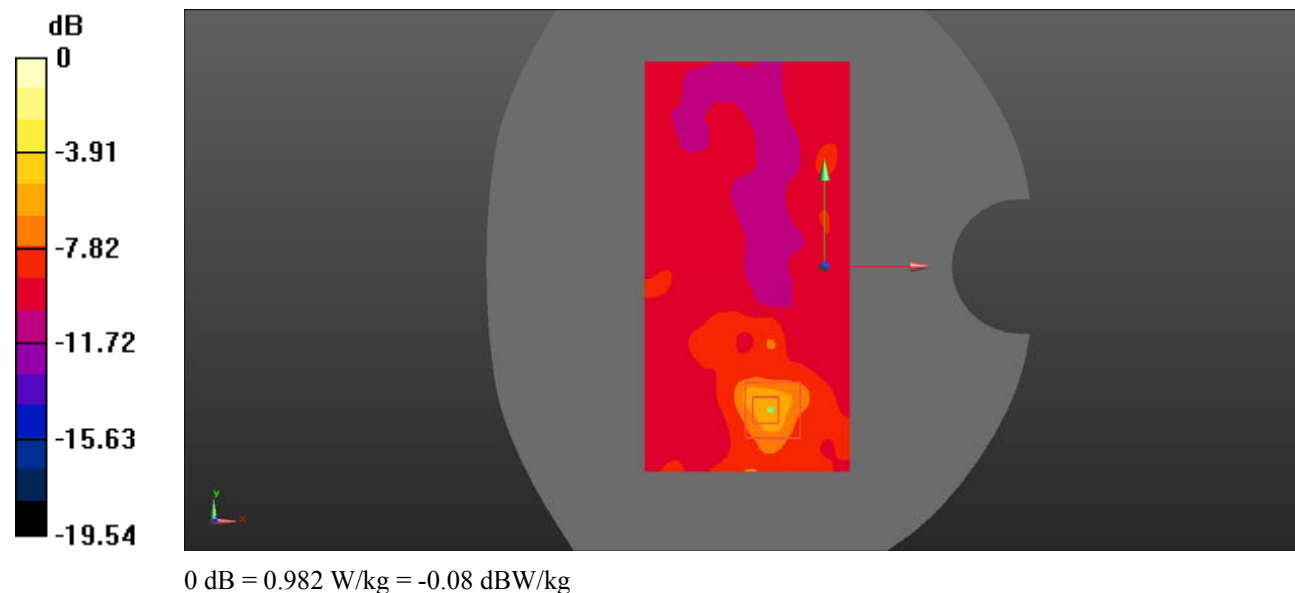
**Front to Phantom/WLAN 5.2G 802.11a High/Zoom Scan (8x8x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 4.793 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.982 W/kg

**SAR(1 g) = 0.229 W/kg; SAR(10 g) = 0.157 W/kg**

Maximum value of SAR (measured) = 0.982 W/kg



**Plot 7#****DUT: M4000 ; Type: 490; Serial: RSZ200511004-RF-S4**

Communication System: UID 0, 5.8G Wi-Fi (0); Frequency: 5745 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 5745$  MHz;  $\sigma = 5.065$  S/m;  $\epsilon_r = 35.652$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(4.65, 4.65, 4.65) @ 5745 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Front to Phantom/WLAN 5.8G 802.11a Low 3/Area Scan (71x141x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.802 W/kg

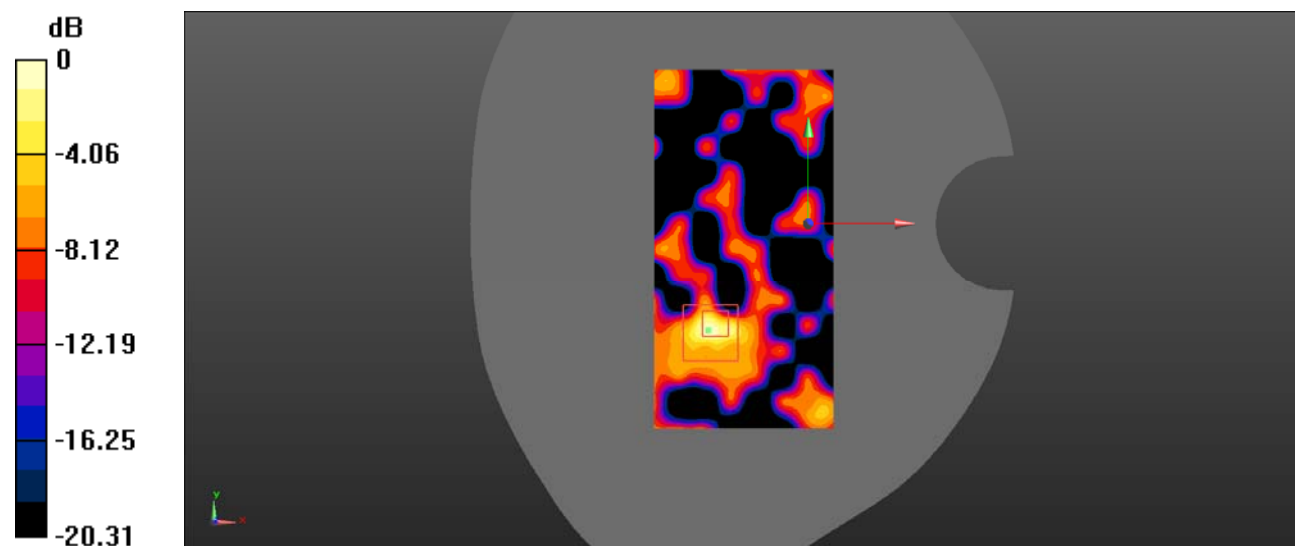
**Front to Phantom/WLAN 5.8G 802.11a Low 3/Zoom Scan (8x8x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 2.975 V/m; Power Drift = 4.15 dB

Peak SAR (extrapolated) = 2.36 W/kg

**SAR(1 g) = 0.396 W/kg; SAR(10 g) = 0.168 W/kg**

Maximum value of SAR (measured) = 0.898 W/kg



0 dB = 0.898 W/kg = -0.47 dBW/kg

**Plot 8#****DUT: M4000 ; Type: 490; Serial: RSZ200511004-RF-S4**

Communication System: UID 0, 5.8G Wi-Fi (0); Frequency: 5785 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 5785$  MHz;  $\sigma = 5.162$  S/m;  $\epsilon_r = 35.424$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(4.65, 4.65, 4.65) @ 5785 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Front to Phantom/WLAN 5.8G 802.11a Mid 2/Area Scan (81x141x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.683 W/kg

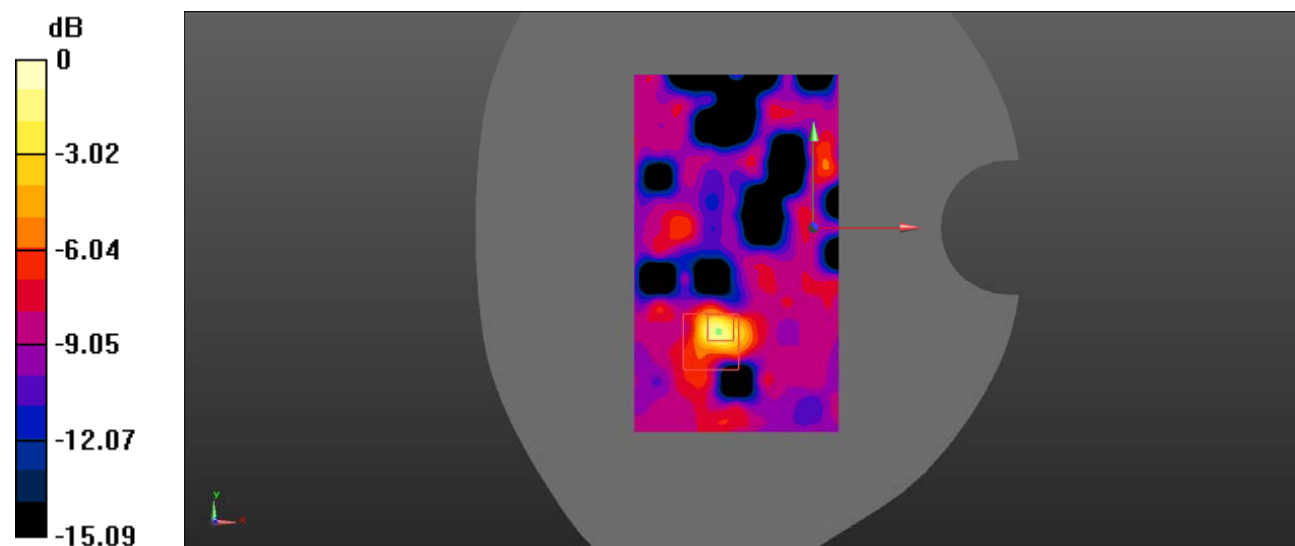
**Front to Phantom/WLAN 5.8G 802.11a Mid 2/Zoom Scan (9x9x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 3.619 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 1.48 W/kg

**SAR(1 g) = 0.358 W/kg; SAR(10 g) = 0.143 W/kg**

Maximum value of SAR (measured) = 0.834 W/kg



0 dB = 0.834 W/kg = -0.79 dBW/kg

**Plot 9#****DUT: M4000 ; Type: 490; Serial: RSZ200511004-RF-S4**

Communication System: UID 0, 5.8G Wi-Fi (0); Frequency: 5825 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 5825$  MHz;  $\sigma = 5.231$  S/m;  $\epsilon_r = 35.407$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(4.65, 4.65, 4.65) @ 5825 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

**Front to Phantom/WLAN 5.8G 802.11a High/Area Scan (81x161x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.680 W/kg

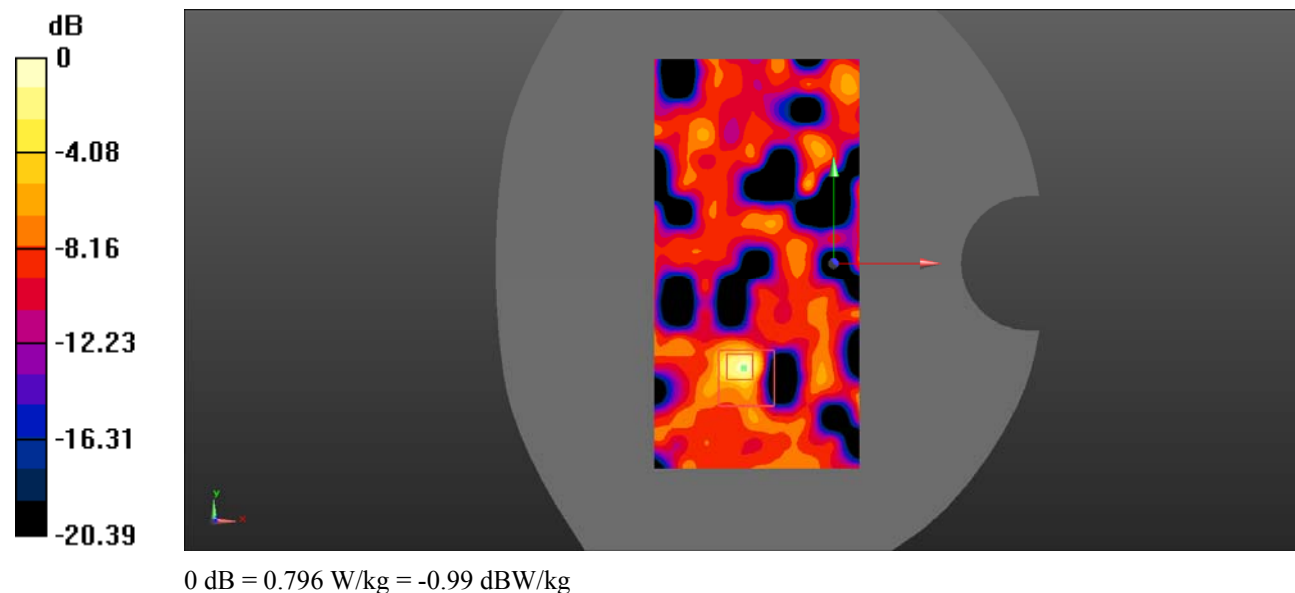
**Front to Phantom/WLAN 5.8G 802.11a High/Zoom Scan (9x9x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 4.087 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.24 W/kg

**SAR(1 g) = 0.347 W/kg; SAR(10 g) = 0.141 W/kg**

Maximum value of SAR (measured) = 0.796 W/kg



## APPENDIX A MEASUREMENT UNCERTAINTY

The uncertainty budget has been determined for the measurement system and is given in the following Table.

**Measurement uncertainty evaluation for IEEE1528-2013 SAR test**

| Source of uncertainty                                   | Tolerance/<br>uncertainty<br>± % | Probability<br>distribution | Divisor    | ci<br>(1 g) | ci<br>(10 g) | Standard<br>uncertainty<br>± %, (1 g) | Standard<br>uncertainty<br>± %, (10 g) |
|---------------------------------------------------------|----------------------------------|-----------------------------|------------|-------------|--------------|---------------------------------------|----------------------------------------|
| <b>Measurement system</b>                               |                                  |                             |            |             |              |                                       |                                        |
| Probe calibration                                       | 6.55                             | N                           | 1          | 1           | 1            | 6.6                                   | 6.6                                    |
| Axial Isotropy                                          | 4.7                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.7                                   | 2.7                                    |
| Hemispherical Isotropy                                  | 9.6                              | R                           | $\sqrt{3}$ | 0           | 0            | 0.0                                   | 0.0                                    |
| Boundary effect                                         | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| Linearity                                               | 4.7                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.7                                   | 2.7                                    |
| Detection limits                                        | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| Readout electronics                                     | 0.3                              | N                           | 1          | 1           | 1            | 0.3                                   | 0.3                                    |
| Response time                                           | 0.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.0                                   | 0.0                                    |
| Integration time                                        | 0.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.0                                   | 0.0                                    |
| RF ambient conditions – noise                           | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| RF ambient<br>conditions–reflections                    | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| Probe positioner mech.<br>Restrictions                  | 0.8                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.5                                   | 0.5                                    |
| Probe positioning with respect to<br>phantom shell      | 6.7                              | R                           | $\sqrt{3}$ | 1           | 1            | 3.9                                   | 3.9                                    |
| Post-processing                                         | 2.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 1.2                                   | 1.2                                    |
| <b>Test sample related</b>                              |                                  |                             |            |             |              |                                       |                                        |
| Test sample positioning                                 | 2.8                              | N                           | 1          | 1           | 1            | 2.8                                   | 2.8                                    |
| Device holder uncertainty                               | 6.3                              | N                           | 1          | 1           | 1            | 6.3                                   | 6.3                                    |
| Drift of output power                                   | 5.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.9                                   | 2.9                                    |
| <b>Phantom and set-up</b>                               |                                  |                             |            |             |              |                                       |                                        |
| Phantom uncertainty (shape and<br>thickness tolerances) | 4.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.3                                   | 2.3                                    |
| Liquid conductivity target)                             | 5.0                              | R                           | $\sqrt{3}$ | 0.64        | 0.43         | 1.8                                   | 1.2                                    |
| Liquid conductivity meas.)                              | 2.5                              | N                           | 1          | 0.64        | 0.43         | 1.6                                   | 1.1                                    |
| Liquid permittivity target)                             | 5.0                              | R                           | $\sqrt{3}$ | 0.6         | 0.49         | 1.7                                   | 1.4                                    |
| Liquid permittivity meas.)                              | 2.5                              | N                           | 1          | 0.6         | 0.49         | 1.5                                   | 1.2                                    |
| Combined standard uncertainty                           |                                  | RSS                         |            |             |              | 12.2                                  | 12.0                                   |
| Expanded uncertainty 95 %<br>confidence interval)       |                                  |                             |            |             |              | 24.3                                  | 23.9                                   |

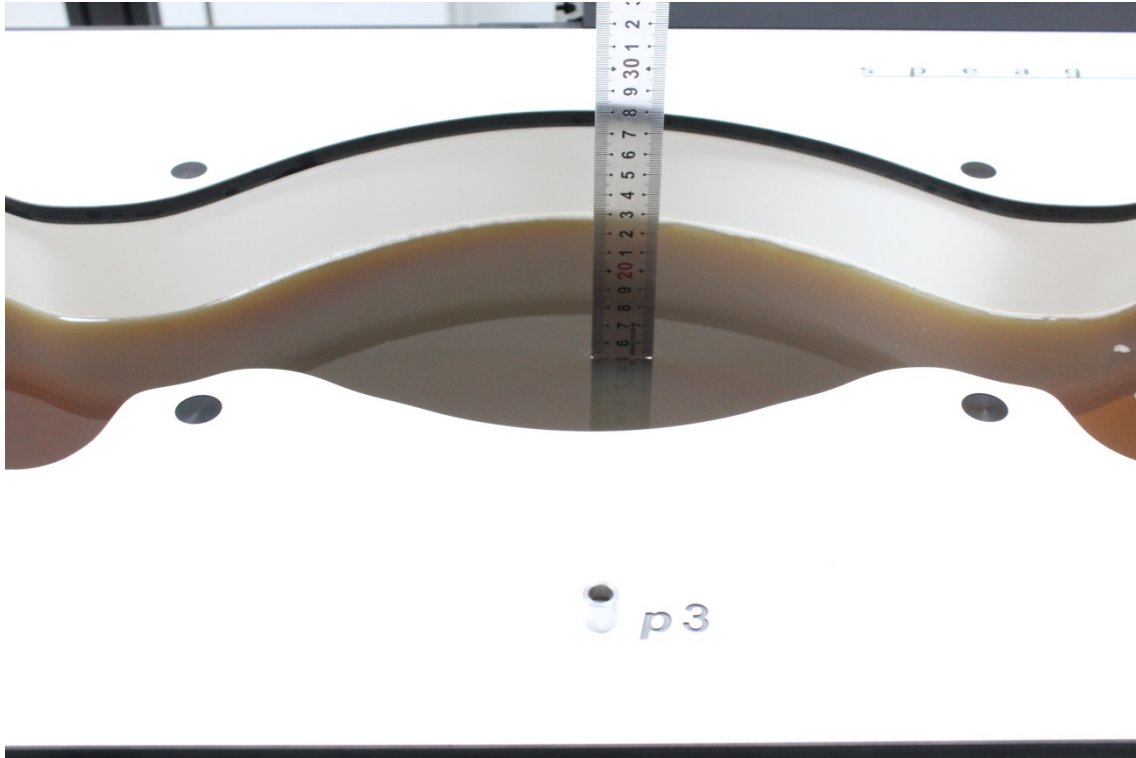
## Measurement uncertainty evaluation for IEC62209-2 SAR test

| Source of uncertainty                                                              | Tolerance/<br>uncertainty<br>± % | Probability<br>distribution | Divisor    | ci<br>(1 g) | ci<br>(10 g) | Standard<br>uncertainty<br>± %, (1 g) | Standard<br>uncertainty<br>± %, (10 g) |
|------------------------------------------------------------------------------------|----------------------------------|-----------------------------|------------|-------------|--------------|---------------------------------------|----------------------------------------|
| <b>Measurement system</b>                                                          |                                  |                             |            |             |              |                                       |                                        |
| Probe calibration                                                                  | 6.55                             | N                           | 1          | 1           | 1            | 6.6                                   | 6.6                                    |
| Axial Isotropy                                                                     | 4.7                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.7                                   | 2.7                                    |
| Hemispherical Isotropy                                                             | 9.6                              | R                           | $\sqrt{3}$ | 0           | 0            | 0.0                                   | 0.0                                    |
| Linearity                                                                          | 4.7                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.7                                   | 2.7                                    |
| Modulation Response                                                                | 0.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.0                                   | 0.0                                    |
| Detection limits                                                                   | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| Boundary effect                                                                    | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| Readout electronics                                                                | 0.3                              | N                           | 1          | 1           | 1            | 0.3                                   | 0.3                                    |
| Response time                                                                      | 0.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.0                                   | 0.0                                    |
| Integration time                                                                   | 0.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.0                                   | 0.0                                    |
| RF ambient conditions – noise                                                      | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| RF ambient conditions–reflections                                                  | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| Probe positioner mech.<br>Restrictions                                             | 0.8                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.5                                   | 0.5                                    |
| Probe positioning with respect to<br>phantom shell                                 | 6.7                              | R                           | $\sqrt{3}$ | 1           | 1            | 3.9                                   | 3.9                                    |
| Post-processing                                                                    | 2.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 1.2                                   | 1.2                                    |
| <b>Test sample related</b>                                                         |                                  |                             |            |             |              |                                       |                                        |
| Device holder Uncertainty                                                          | 6.3                              | N                           | 1          | 1           | 1            | 6.3                                   | 6.3                                    |
| Test sample positioning                                                            | 2.8                              | N                           | 1          | 1           | 1            | 2.8                                   | 2.8                                    |
| Power scaling                                                                      | 4.5                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.6                                   | 2.6                                    |
| Drift of output power                                                              | 5.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.9                                   | 2.9                                    |
| <b>Phantom and set-up</b>                                                          |                                  |                             |            |             |              |                                       |                                        |
| Phantom uncertainty (shape and<br>thickness tolerances)                            | 4.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.3                                   | 2.3                                    |
| Algorithm for correcting SAR for<br>deviations in permittivity and<br>conductivity | 1.9                              | N                           | 1          | 1           | 0.84         | 1.1                                   | 0.9                                    |
| Liquid conductivity (meas.)                                                        | 2.5                              | N                           | 1          | 0.64        | 0.43         | 1.6                                   | 1.1                                    |
| Liquid permittivity (meas.)                                                        | 2.5                              | N                           | 1          | 0.6         | 0.49         | 1.5                                   | 1.2                                    |
| Temp. unc. - Conductivity                                                          | 1.7                              | R                           | $\sqrt{3}$ | 0.78        | 0.71         | 0.8                                   | 0.7                                    |
| Temp. unc. - Permittivity                                                          | 0.3                              | R                           | $\sqrt{3}$ | 0.23        | 0.26         | 0.0                                   | 0.0                                    |
| Combined standard uncertainty                                                      |                                  | RSS                         |            |             |              | 12.2                                  | 12.1                                   |
| Expanded uncertainty 95 %<br>confidence interval)                                  |                                  |                             |            |             |              | 24.5                                  | 24.2                                   |

## APPENDIX B EUT TEST POSITION PHOTOS

**Liquid depth  $\geq 15\text{cm}$**

Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962



**Front to Phantom (0mm) Setup Photo**



## APPENDIX C PROBE CALIBRATION CERTIFICATES



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

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Client

BACL

Certificate No: Z20-60085

## CALIBRATION CERTIFICATE

Object

EX3DV4 - SN : 7522

Calibration Procedure(s)

FF-Z11-004-01

Calibration Procedures for Dosimetric E-field Probes

Calibration date:

April 01, 2020

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

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

Calibration Equipment used (M&amp;TE critical for calibration)

| Primary Standards        | ID #        | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|--------------------------|-------------|------------------------------------------|-----------------------|
| Power Meter NRP2         | 101919      | 18-Jun-19(CTTL, No.J19X05125)            | Jun-20                |
| Power sensor NRP-Z91     | 101547      | 18-Jun-19(CTTL, No.J19X05125)            | Jun-20                |
| Power sensor NRP-Z91     | 101548      | 18-Jun-19(CTTL, No.J19X05125)            | Jun-20                |
| Reference 10dBAttenuator | 18N50W-10dB | 10-Feb-20(CTTL, No.J20X00525)            | Feb-22                |
| Reference 20dBAttenuator | 18N50W-20dB | 10-Feb-20(CTTL, No.J20X00526)            | Feb-22                |
| Reference Probe EX3DV4   | SN 7307     | 24-May-19(SPEAG, No.EX3-7307_May19/2)    | May-20                |
| DAE4                     | SN 1525     | 26-Aug-19(SPEAG, No.DAE4-1525_Aug19)     | Aug-20                |
| Secondary Standards      | ID #        | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| SignalGenerator MG3700A  | 6201052605  | 18-Jun-19(CTTL, No.J19X05127)            | Jun-20                |
| Network Analyzer E5071C  | MY46110673  | 10-Feb-20(CTTL, No.J20X00515)            | Feb-21                |

|                | Name        | Function           | Signature |
|----------------|-------------|--------------------|-----------|
| Calibrated by: | Yu Zongying | SAR Test Engineer  |           |
| Reviewed by:   | Lin Hao     | SAR Test Engineer  |           |
| Approved by:   | Qi Dianyuan | SAR Project Leader |           |

Issued: April 03, 2020

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

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### Glossary:

|                       |                                                                                                                                             |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| TSL                   | tissue simulating liquid                                                                                                                    |
| NORM <sub>x,y,z</sub> | sensitivity in free space                                                                                                                   |
| ConvF                 | sensitivity in TSL / NORM <sub>x,y,z</sub>                                                                                                  |
| DCP                   | diode compression point                                                                                                                     |
| CF                    | crest factor (1/duty_cycle) of the RF signal                                                                                                |
| A,B,C,D               | modulation dependent linearization parameters                                                                                               |
| Polarization $\Phi$   | $\Phi$ rotation around probe axis                                                                                                           |
| Polarization $\theta$ | $\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i<br>$\theta=0$ is normal to probe axis |

Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system

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

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>: Assessed for E-field polarization  $\theta=0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the  $E^2$ -field uncertainty inside TSL (see below ConvF).
- NORM( $f$ )<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>: A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).

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## DASY/EASY – Parameters of Probe: EX3DV4 – SN:7522

### Basic Calibration Parameters

|                                                          | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|----------------------------------------------------------|----------|----------|----------|-----------|
| Norm( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 0.43     | 0.44     | 0.51     | ±10.0%    |
| DCP(mV) <sup>B</sup>                                     | 99.1     | 99.3     | 102.4    |           |

### Modulation Calibration Parameters

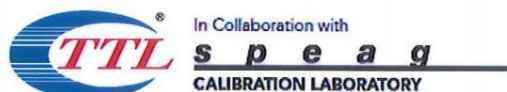
| UID | Communication System Name |   | A dB | B dB $\sqrt{\mu\text{V}}$ | C   | D dB | VR mV | Unc <sup>E</sup> (k=2) |
|-----|---------------------------|---|------|---------------------------|-----|------|-------|------------------------|
| 0   | CW                        | X | 0.0  | 0.0                       | 1.0 | 0.00 | 149.8 | ±2.7%                  |
|     |                           | Y | 0.0  | 0.0                       | 1.0 |      | 153.0 |                        |
|     |                           | Z | 0.0  | 0.0                       | 1.0 |      | 174.8 |                        |

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

<sup>A</sup> The uncertainties of Norm X, Y, Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 4).

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

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



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## DASY/EASY – Parameters of Probe: EX3DV4 – SN:7522

### Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz] <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup> (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750                  | 41.9                               | 0.89                            | 9.92    | 9.92    | 9.92    | 0.40               | 0.75                    | ±12.1%      |
| 900                  | 41.5                               | 0.97                            | 9.40    | 9.40    | 9.40    | 0.13               | 1.95                    | ±12.1%      |
| 1750                 | 40.1                               | 1.37                            | 8.21    | 8.21    | 8.21    | 0.22               | 1.08                    | ±12.1%      |
| 1900                 | 40.0                               | 1.40                            | 7.95    | 7.95    | 7.95    | 0.21               | 1.22                    | ±12.1%      |
| 2300                 | 39.5                               | 1.67                            | 7.53    | 7.53    | 7.53    | 0.44               | 0.81                    | ±12.1%      |
| 2450                 | 39.2                               | 1.80                            | 7.15    | 7.15    | 7.15    | 0.48               | 0.79                    | ±12.1%      |
| 2600                 | 39.0                               | 1.96                            | 7.04    | 7.04    | 7.04    | 0.59               | 0.72                    | ±12.1%      |
| 5200                 | 36.0                               | 4.66                            | 5.20    | 5.20    | 5.20    | 0.45               | 1.75                    | ±13.3%      |
| 5300                 | 35.9                               | 4.76                            | 4.96    | 4.96    | 4.96    | 0.45               | 1.75                    | ±13.3%      |
| 5600                 | 35.5                               | 5.07                            | 4.55    | 4.55    | 4.55    | 0.45               | 1.60                    | ±13.3%      |
| 5800                 | 35.3                               | 5.27                            | 4.65    | 4.65    | 4.65    | 0.45               | 1.65                    | ±13.3%      |

<sup>C</sup> Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

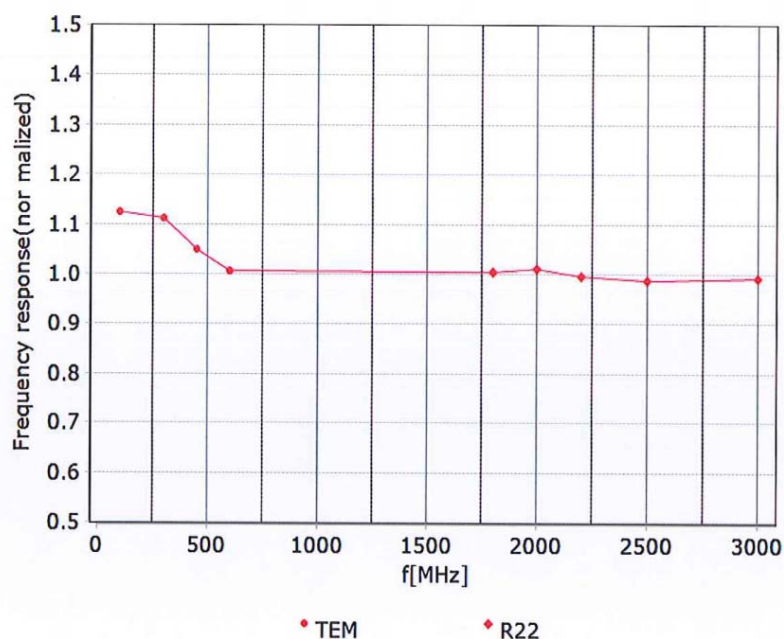
<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

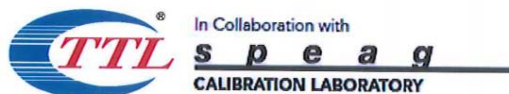


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## Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field:  $\pm 7.4\%$  ( $k=2$ )

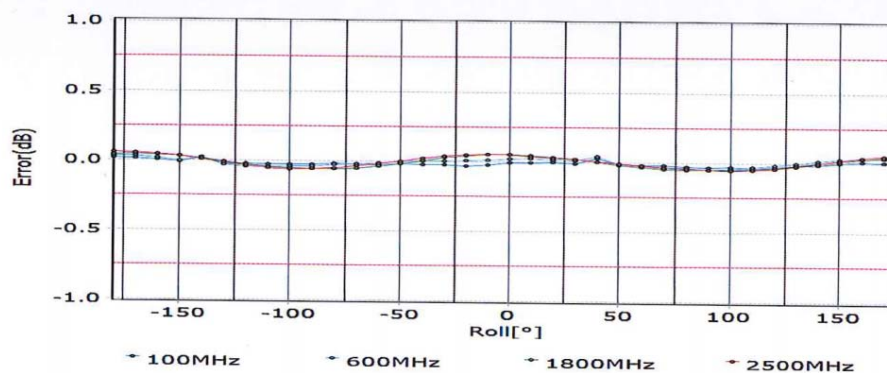
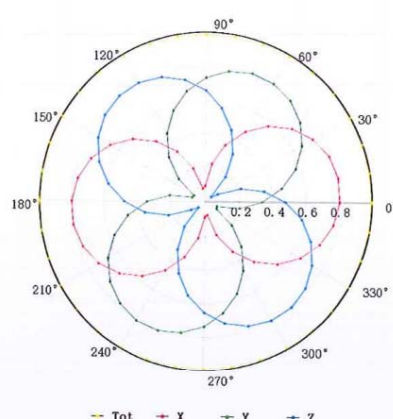
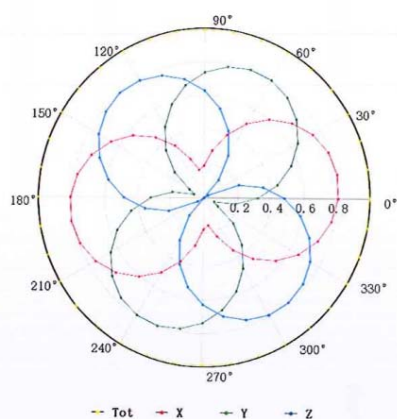


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## Receiving Pattern ( $\Phi$ ), $\theta=0^\circ$

**f=600 MHz, TEM**

**f=1800 MHz, R22**

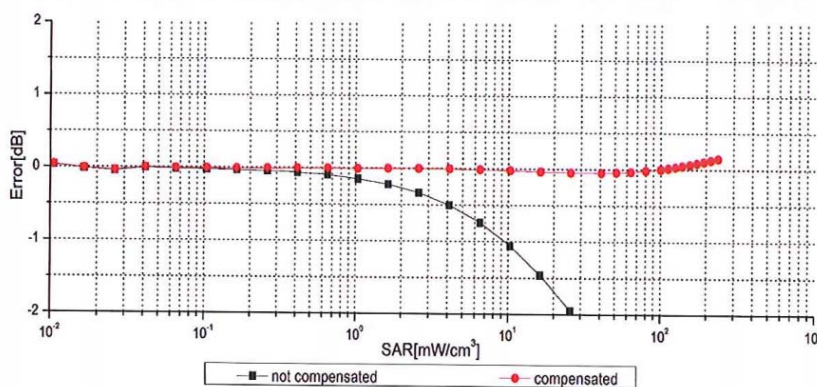
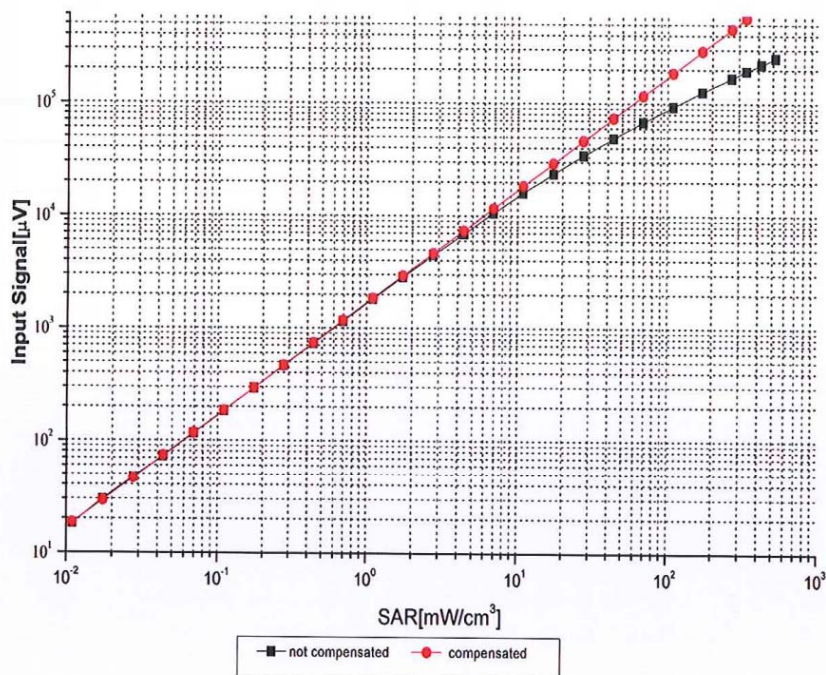


Uncertainty of Axial Isotropy Assessment:  $\pm 1.2\%$  ( $k=2$ )



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



Uncertainty of Linearity Assessment:  $\pm 0.9\%$  ( $k=2$ )

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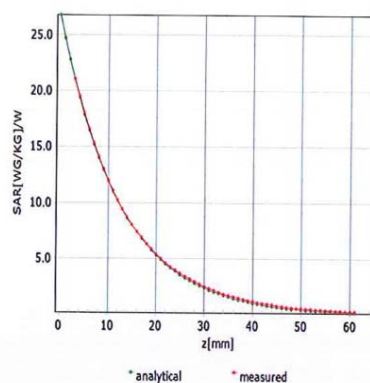
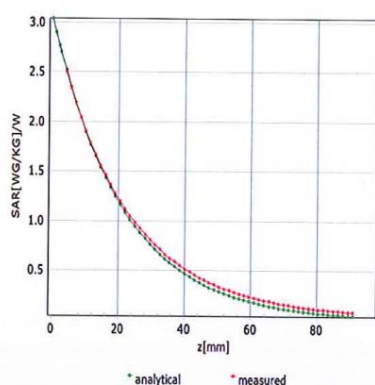


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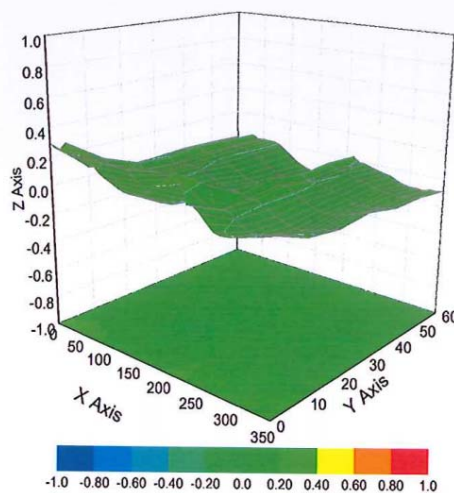
## Conversion Factor Assessment

f=750 MHz,WGLS R9(H\_convF)

f=1750 MHz,WGLS R22(H\_convF)



## Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment:  $\pm 3.2\%$  (K=2)

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## DASY/EASY – Parameters of Probe: EX3DV4 – SN:7522

### Other Probe Parameters

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | 31.2       |
| Mechanical Surface Detection Mode             | enabled    |
| Optical Surface Detection Mode                | disable    |
| Probe Overall Length                          | 337mm      |
| Probe Body Diameter                           | 10mm       |
| Tip Length                                    | 10mm       |
| Tip Diameter                                  | 2.5mm      |
| Probe Tip to Sensor X Calibration Point       | 1mm        |
| Probe Tip to Sensor Y Calibration Point       | 1mm        |
| Probe Tip to Sensor Z Calibration Point       | 1mm        |
| Recommended Measurement Distance from Surface | 1.4mm      |

## APPENDIX D DIPOLE CALIBRATION CERTIFICATES



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Client

BACL

Certificate No: Z17-97192

### CALIBRATION CERTIFICATE

Object D2450V2 - SN: 751

Calibration Procedure(s) FF-Z11-003-01  
Calibration Procedures for dipole validation kits

Calibration date: October 12, 2017

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards       | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|------------------------------------------|-----------------------|
| Power Meter NRVD        | 102196     | 02-Mar-17 (CTTL, No.J17X01254)           | Mar-18                |
| Power sensor NRV-Z5     | 100596     | 02-Mar-17 (CTTL, No.J17X01254)           | Mar-18                |
| Reference Probe EX3DV4  | SN 3846    | 13-Jan-17(CTTL-SPEAG,No.Z16-97251)       | Jan-18                |
| DAE4                    | SN 1331    | 19-Jan-17(CTTL-SPEAG,No.Z17-97015)       | Jan-18                |
| Secondary Standards     | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 13-Jan-17 (CTTL, No.J17X00286)           | Jan-18                |
| Network Analyzer E5071C | MY46110673 | 13-Jan-17 (CTTL, No.J17X00285)           | Jan-18                |

|                | Name        | Function           | Signature |
|----------------|-------------|--------------------|-----------|
| Calibrated by: | Zhao Jing   | SAR Test Engineer  |           |
| Reviewed by:   | Lin Hao     | SAR Test Engineer  |           |
| Approved by:   | Qi Dianyuan | SAR Project Leader |           |

Issued: October 15, 2017

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

Certificate No: Z17-97192

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**Glossary:**

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

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

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**

- e) 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%.



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### Measurement Conditions

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

|                              |                          |              |
|------------------------------|--------------------------|--------------|
| DASY Version                 | DASY52                   | 52.10.0.1446 |
| Extrapolation                | Advanced Extrapolation   |              |
| Phantom                      | Triple Flat Phantom 5.1C |              |
| 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 | 39.1 $\pm$ 6 % | 1.82 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | ----           | ----                 |

### SAR result with Head TSL

|                                                |                    |                                |
|------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 $cm^3$ (1 g) of Head TSL   | Condition          |                                |
| SAR measured                                   | 250 mW input power | 13.2 mW / g                    |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 52.5 mW / g $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 $cm^3$ (10 g) of Head TSL | Condition          |                                |
| SAR measured                                   | 250 mW input power | 6.16 mW / g                    |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 24.6 mW / g $\pm$ 18.7 % (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 | 53.3 $\pm$ 6 % | 1.96 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | <1.0 °C             | ----           | ----                 |

### SAR result with Body TSL

|                                                |                    |                                |
|------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 $cm^3$ (1 g) of Body TSL   | Condition          |                                |
| SAR measured                                   | 250 mW input power | 12.9 mW / g                    |
| SAR for nominal Body TSL parameters            | normalized to 1W   | 51.7 mW / g $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 $cm^3$ (10 g) of Body TSL | Condition          |                                |
| SAR measured                                   | 250 mW input power | 6.05 mW / g                    |
| SAR for nominal Body TSL parameters            | normalized to 1W   | 24.2 mW / g $\pm$ 18.7 % (k=2) |



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#### Appendix (Additional assessments outside the scope of CNAS L0570)

##### Antenna Parameters with Head TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 54.5Ω+ 4.65jΩ |
| Return Loss                          | - 24.1dB      |

##### Antenna Parameters with Body TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 51.5Ω+ 6.76jΩ |
| Return Loss                          | - 23.3dB      |

##### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.265 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 |
|-----------------|-------|



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**DASY5 Validation Report for Head TSL**

Date: 10.12.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 751**

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.819$  S/m;  $\epsilon_r = 39.06$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(7.22,7.22,7.22); Calibrated: 1/13/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

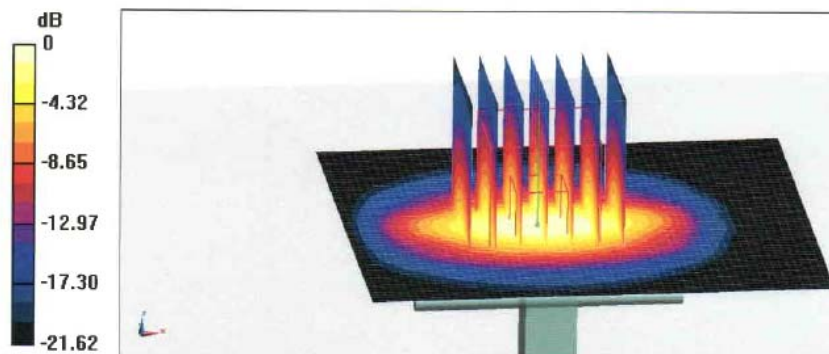
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 103.5 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 26.9 W/kg

**SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.16 W/kg**

Maximum value of SAR (measured) = 21.6 W/kg

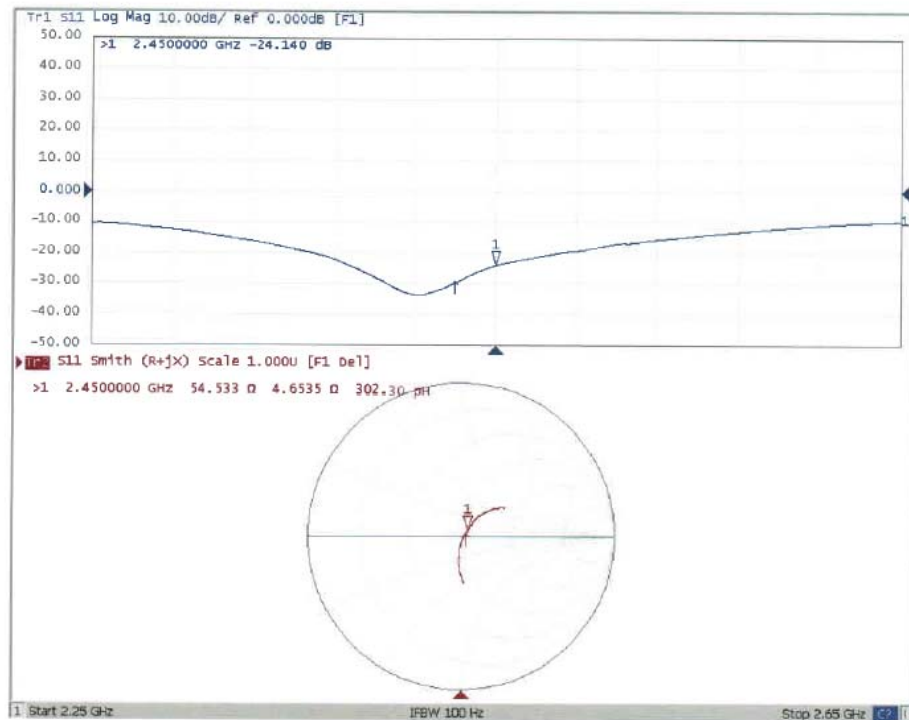
**0 dB = 21.6 W/kg = 13.34 dBW/kg**



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### Impedance Measurement Plot for Head TSL





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**DASY5 Validation Report for Body TSL**

Date: 10.12.2017

Test Laboratory: CCTL, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 751**

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.957$  S/m;  $\epsilon_r = 53.32$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(7.31,7.31,7.31); Calibrated: 1/13/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

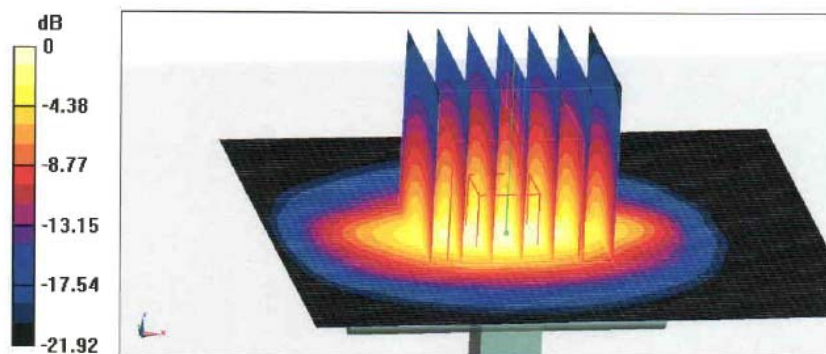
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.93 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 25.9 W/kg

**SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6.05 W/kg**

Maximum value of SAR (measured) = 20.9 W/kg

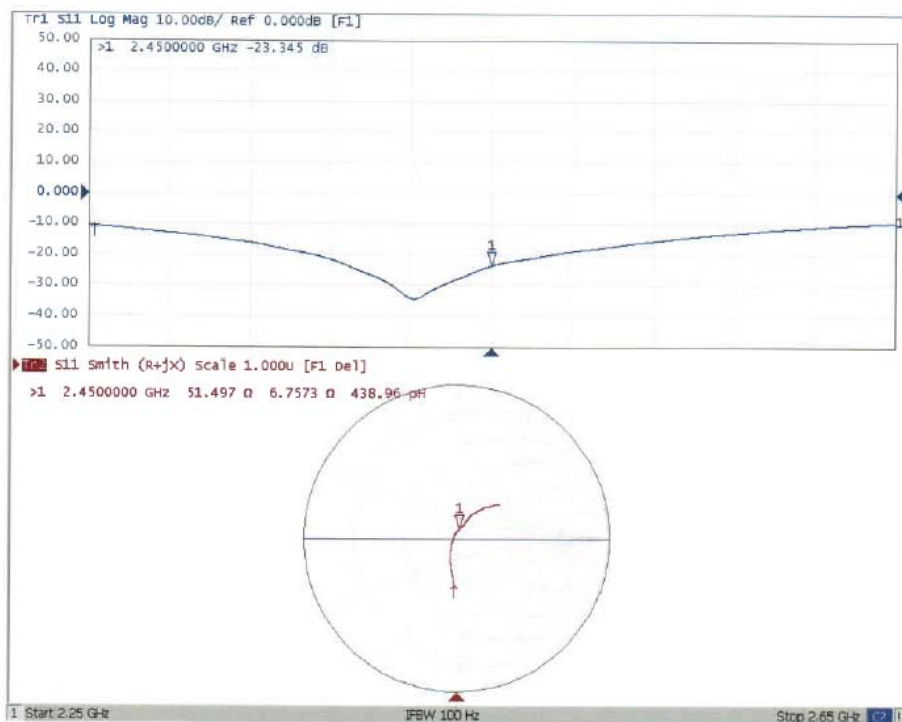
**0 dB = 20.9 W/kg = 13.20 dBW/kg**



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### Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 0108**

Client **BACL USA**

Certificate No: **D5GHzV2-1301\_Jan20**

## CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1301**

Calibration procedure(s) **QA CAL-22.v4  
Calibration Procedure for SAR Validation Sources between 3-6 GHz**

Calibration date: **January 10, 2020**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards               | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|---------------------------------|--------------------|-----------------------------------|------------------------|
| Power meter NRP                 | SN: 104778         | 03-Apr-19 (No. 217-02892/02893)   | Apr-20                 |
| Power sensor NRP-Z91            | SN: 103244         | 03-Apr-19 (No. 217-02892)         | Apr-20                 |
| Power sensor NRP-Z91            | SN: 103245         | 03-Apr-19 (No. 217-02893)         | Apr-20                 |
| Reference 20 dB Attenuator      | SN: 5058 (20k)     | 04-Apr-19 (No. 217-02894)         | Apr-20                 |
| Type-N mismatch combination     | SN: 5047.2 / 06327 | 04-Apr-19 (No. 217-02895)         | Apr-20                 |
| Reference Probe EX3DV4          | SN: 3503           | 31-Dec-19 (No. EX3-3503_Dec19)    | Dec-20                 |
| DAE4                            | SN: 601            | 27-Dec-19 (No. DAE4-601_Dec19)    | Dec-20                 |
| Secondary Standards             | ID #               | Check Date (in house)             | Scheduled Check        |
| Power meter E4419B              | SN: GB39512475     | 30-Oct-14 (in house check Feb-19) | In house check: Oct-20 |
| Power sensor HP 8481A           | SN: US37292783     | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| Power sensor HP 8481A           | SN: MY41092317     | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| RF generator R&S SMT-06         | SN: 100972         | 15-Jun-15 (in house check Oct-18) | In house check: Oct-20 |
| Network Analyzer Agilent E8358A | SN: US41080477     | 31-Mar-14 (in house check Oct-19) | In house check: Oct-20 |

|                |               |                       |           |
|----------------|---------------|-----------------------|-----------|
|                | Name          | Function              | Signature |
| Calibrated by: | Michael Weber | Laboratory Technician |           |
| Approved by:   | Katja Pokovic | Technical Manager     |           |

Issued: January 14, 2020

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Accreditation No.: **SCS 0108**

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#### Glossary:

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

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

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

- DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

**Measurement Conditions**

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

|                                     |                                                                      |                                  |
|-------------------------------------|----------------------------------------------------------------------|----------------------------------|
| <b>DASY Version</b>                 | DASY5                                                                | V52.10.3                         |
| <b>Extrapolation</b>                | Advanced Extrapolation                                               |                                  |
| <b>Phantom</b>                      | Modular Flat Phantom V5.0                                            |                                  |
| <b>Distance Dipole Center - TSL</b> | 10 mm                                                                | with Spacer                      |
| <b>Zoom Scan Resolution</b>         | dx, dy = 4.0 mm, dz = 1.4 mm                                         | Graded Ratio = 1.4 (Z direction) |
| <b>Frequency</b>                    | 5250 MHz $\pm$ 1 MHz<br>5600 MHz $\pm$ 1 MHz<br>5800 MHz $\pm$ 1 MHz |                                  |

**Head TSL parameters at 5250 MHz**

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Head TSL parameters</b>             | 22.0 °C             | 35.9           | 4.71 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 34.8 $\pm$ 6 % | 4.48 mho/m $\pm$ 6 % |
| <b>Head TSL temperature change during test</b> | < 0.5 °C            | ----           | ----                 |

**SAR result with Head TSL at 5250 MHz**

|                                                             |                    |                                                |
|-------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                                |
| SAR measured                                                | 100 mW input power | 8.13 W/kg                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>80.7 W/kg <math>\pm</math> 19.9 % (k=2)</b> |

|                                                               |                    |                                                |
|---------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                                |
| SAR measured                                                  | 100 mW input power | 2.33 W/kg                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>23.0 W/kg <math>\pm</math> 19.5 % (k=2)</b> |

**Head TSL parameters at 5600 MHz**

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Head TSL parameters</b>             | 22.0 °C             | 35.5           | 5.07 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 34.3 $\pm$ 6 % | 4.83 mho/m $\pm$ 6 % |
| <b>Head TSL temperature change during test</b> | < 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 | 8.59 W/kg                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>85.1 W/kg <math>\pm</math> 19.9 % (k=2)</b> |

|                                                               |                    |                                                |
|---------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                                |
| SAR measured                                                  | 100 mW input power | 2.44 W/kg                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>24.1 W/kg <math>\pm</math> 19.5 % (k=2)</b> |

**Head TSL parameters at 5800 MHz**

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.3         | 5.27 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 34.0 ± 6 %   | 5.03 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

**SAR result with Head TSL at 5800 MHz**

|                                                             |                    |                                 |
|-------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                 |
| SAR measured                                                | 100 mW input power | 8.10 W/kg                       |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>80.2 W/kg ± 19.9 % (k=2)</b> |

|                                                               |                    |                                 |
|---------------------------------------------------------------|--------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                 |
| SAR measured                                                  | 100 mW input power | 2.29 W/kg                       |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>22.6 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 | 47.8 $\Omega$ - 3.1 j $\Omega$ |
| Return Loss                          | - 28.2 dB                      |

**Antenna Parameters with Head TSL at 5600 MHz**

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.9 $\Omega$ + 1.9 j $\Omega$ |
| Return Loss                          | - 31.4 dB                      |

**Antenna Parameters with Head TSL at 5800 MHz**

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.2 $\Omega$ + 3.1 j $\Omega$ |
| Return Loss                          | - 29.6 dB                      |

**General Antenna Parameters and Design**

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.192 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 |
|-----------------|-------|

**DASY5 Validation Report for Head TSL**

Date: 10.01.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1301**

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.48$  S/m;  $\epsilon_r = 34.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>,Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.83$  S/m;  $\epsilon_r = 34.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>,Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.03$  S/m;  $\epsilon_r = 34$ ;  $\rho = 1000$  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) @ 5250 MHz, ConvF(5, 5, 5) @ 5600 MHz, ConvF(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

**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 = 77.91 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 28.2 W/kg

**SAR(1 g) = 8.13 W/kg; SAR(10 g) = 2.33 W/kg**

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 70.1%

Maximum value of SAR (measured) = 18.1 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan,****dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 78.16 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 32.2 W/kg

**SAR(1 g) = 8.59 W/kg; SAR(10 g) = 2.44 W/kg**

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 67.4%

Maximum value of SAR (measured) = 19.8 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan,****dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 75.29 V/m; Power Drift = 0.04 dB

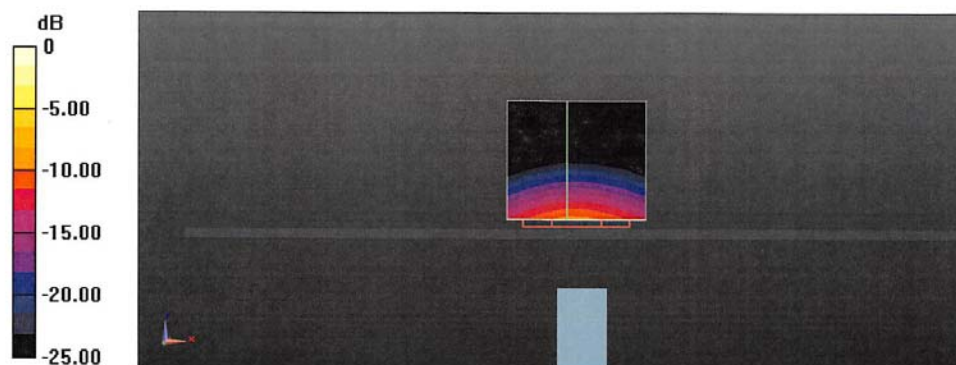
Peak SAR (extrapolated) = 32.5 W/kg

**SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.29 W/kg**

Smallest distance from peaks to all points 3 dB below = 7.4 mm

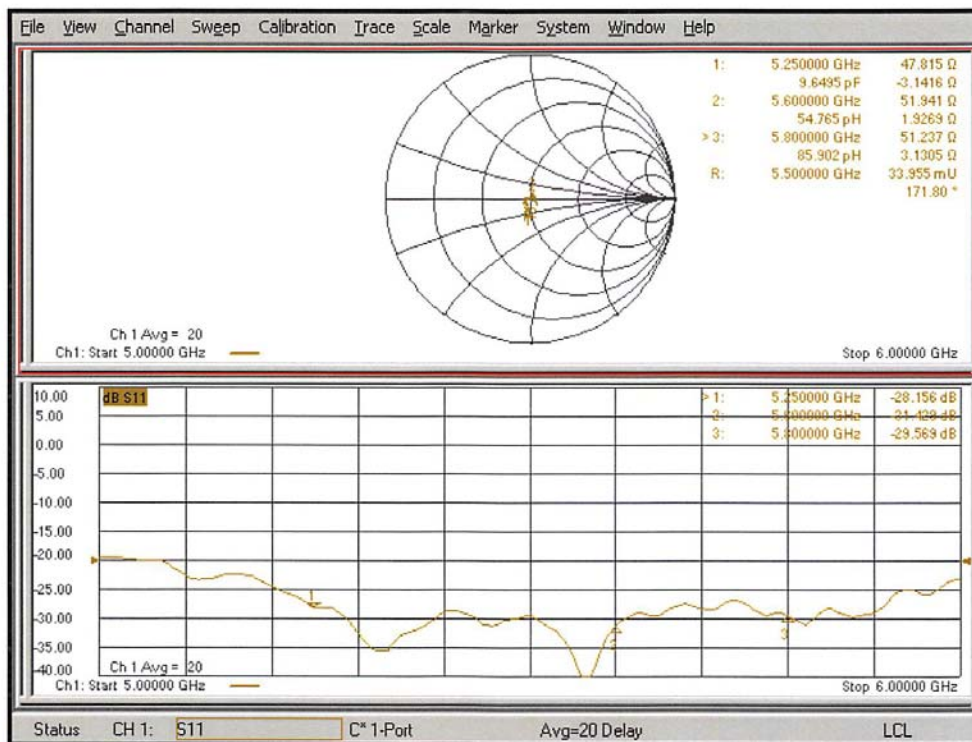
Ratio of SAR at M2 to SAR at M1 = 65.1%

Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

# Impedance Measurement Plot for Head TSL



\*\*\*\*\* END OF REPORT \*\*\*\*\*