# SAR Test Report

Report No.: AGC01826150601FH01

| | | |
|---|---|---|
| **FCC ID** | : | 2ACHAT80 |
| **APPLICATION PURPOSE** | : | Original Equipment |
| **PRODUCT DESIGNATION** | : | rugged tablet |
| **BRAND NAME** | : | HUGEROCK |
| **MODEL NAME** | : | T80 |
| **CLIENT** | : | Shenzhen SOTEN Technology Co., LTD. |
| **DATE OF ISSUE** | : | July 10,2015 |
| **STANDARD(S)** | : | IEEE Std. 1528:2003<br>IEEE Std. 1528a:2005<br>FCC 47CFR § 2.1093<br>IEEE/ANSI C95.1:1992 |
| **REPORT VERSION** | : | V1.0 |

***A**ttestation of Global Compliance(Shenzhen) Co., Ltd.*

## Report Revise Record

| Report Version | Revise Time | Issued Date | Valid Version | Notes |
|---|---|---|---|---|
| V1.0 | / | July 10,2015 | Valid | Original Report |

# Test Report Certification

| | |
|---|---|
| Applicant Name : | Shenzhen SOTEN Technology Co., LTD. |
| Applicant Address : | 7c, Baisha Technology Industrial Park, No.3011, Shahe West Road, Nanshan District, Shenzhen, Guangdong, China |
| Manufacturer Name : | EARNING SPRING GROUP |
| Manufacturer Address : | Chitat Industrial Park, Longping West Road, Central City, Longgang District Shenzhen, Guangdong, China |
| Product Designation : | rugged tablet |
| Brand Name : | HUGEROCK |
| Model Name : | T80 |
| Series Model | T81, T82 |
| Different Description | All the models are the same, only different in model names. |
| IMEI | 352185050951150 |
| EUT Voltage : | DC3.7V by battery |
| Applicable Standard : | IEEE Std. 1528:2003<br>IEEE Std. 1528a:2005<br>FCC 47CFR § 2.1093<br>IEEE/ANSI C95.1:1992 |
| Test Date : | July 03,2015 to July 06,2015 |
| Performed Location | Attestation of Global Compliance(Shenzhen) Co., Ltd.<br>2 F, Building 2, No.1-No.4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang Street, Bao'an District, Shenzhen, China |
| Report Template | AGCRT-US-3G3/SAR (2015-05-01) |

Tested By Bobby Wang

Bobby Wang July 10,2015

Checked By Angela Li

Angela Li July 10,2015

Authorized By Solger Zhang

Solger Zhang July 10,2015

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# 1. SUMMARY OF MAXIMUM SAR VALUE

**The maximum results of Specific Absorption Rate (SAR) found during testing for EUT are as follows:**

| Frequency Band | Highest Reported 1g-SAR(W/Kg) |
|---|---|
| | Body-worn(with 0 mm separation) |
| UMTS Band V | 0.226 |
| WIFI 2.4G | 0.424 |
| Simultaneous Reported SAR | 0.650 |

This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6W/Kg) specified in IEEE Std. 1528:2003; IEEE1528a-2005;FCC 47CFR § 2.1093; IEEE/ANSI C95.1:1992 and the following specific FCC Test Procedures:

- KDB 447498 D01 General RF Exposure Guidance v05r02
- KDB 648474 D04 Handset SAR v01r02
- KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
- KDB 941225 D01 3G SAR Procedures v03
- KDB 941225 D06 Hot Spot SAR v02
- KDB 248227 D01 802.11 Wi-Fi SAR v02
- KDB 616217 D04 SAR for laptop and tablets v01r01

# 2. GENERAL INFORMATION

## 2.1. EUT Description

| **General Information** | |
|---|---|
| Product Designation | rugged tablet |
| Test Model | T80 |
| Hardware Version | T80-V2.0 |
| Software Version | T80-20150601 |
| Device Category | Portable |
| RF Exposure Environment | Uncontrolled |
| Antenna Type | Internal |
| **WCDMA** | |
| Support Band | ☐UMTS FDD Band II ☒UMTS FDD Band V<br>☒UMTS FDD Band I ☐UMTS FDD Band VIII |
| HS Type | HSPA(HSUPA/HSDPA) |
| TX Frequency Range | WCDMA FDD Band V: 820-850MHz |
| RX Frequency Range | WCDMA FDD Band V: 869-894MHz |
| Release Version | Rel-6 |
| Type of modulation | WCDMA:QPSK |
| Antenna Gain | 1.0dBi |
| Max. Average Power<br>(Max. Peak Power) | Band V: 21.28dBm (21.51dBm) |
| **Bluetooth** | |
| Bluetooth Version | ☐V2.0 ☐V2.1 ☐V2.1+EDR ☒V3.0 ☐V3.0+HS ☒V4.0 |
| Operation Frequency | 2402~2480MHz |
| Type of modulation | ☒GFSK ☒Π/4-DQPSK ☒8-DPSK |
| Peak. Burst Power | 7.44dBm |
| Antenna Gain | 0.9dBi |

## EUT Description( Continue)

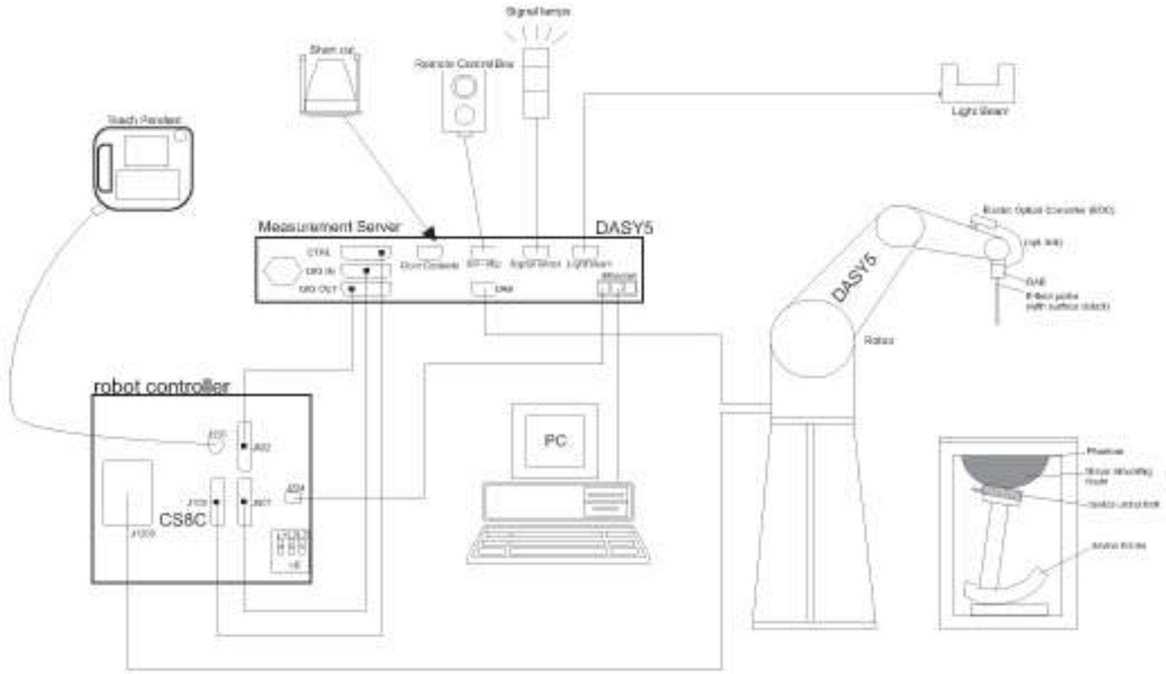
| **WIFI** | |
|---|---|
| WIFI Specification | ☐802.11a ☒802.11b ☒802.11g ☒802.11n(20) ☒802.11n(40) |
| Operation Frequency | 2412~2462MHz |
| Avg. Burst Power | 11b:13.54dBm,11g: 10.86dBm,11n(20): 10.44dBm,11n(40): 8.75dBm |
| Antenna Gain | 0.9dBi |
| **Accessories** | |
| Battery | Brand name: N/A<br>Model No. : 7090152<br>Voltage and Capacitance: 3.7 V & 10000mAh |
| Adapter | Brand name: Chicony<br>Model No. : W12-010N3B<br>Input: AC 100-240V, 50/60Hz, 0.3A Output: DC 5.35V, 2.0A |
| Earphone | Brand name: N/A<br>Model No. : N/A |

Note:CMU200 can measure the average power and Peak power at the same time

| | |
|---|---|
| Product | Type |
| | ☒ Production unit ☐ Identical Prototype |

# 3. SAR MEASUREMENT SYSTEM

## 3.1. The DASY5 system used for performing compliance tests consists of following items




- A standard high precision 6-axis robot with controller, teach pendant and software.
- Data acquisition electronics (DAE) which attached to the robot arm extension. The DAE 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
- A dosimetric probe equipped with an optical surface detector system.
- 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.
- A Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- Phantoms, device holders and other accessories according to the targeted measurement.

## 3.2. DASY5 E-Field Probe

The SAR measurement is conducted with the dosimetric probe manufactured by SPEAG. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528 and relevant KDB files.) The calibration data are in Appendix D.

### Isotropic E-Field Probe Specification

| | | |
|---|---|---|
| **Model** | EX3DV4 | |
| **Manufacture** | SPEAG | |
| **frequency** | 0.3GHz-6 GHz<br>Linearity:±0.2dB(300 MHz-6 GHz) |  |
| **Dynamic Range** | 0.01W/Kg-100W/Kg<br>Linearity:±0.2dB | |
| **Dimensions** | Overall length:337mm<br>Tip diameter:2.5mm<br>Typical distance from probe tip to dipole centers:1mm | |
| **Application** | High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%. | |

## 3.3. Data Acquisition Electronics description

The data acquisition electronics (DAE) consist if a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converte and a command decoder with a control logic unit. Transmission to the measurement sever is accomplished through an optical downlink fir 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.

DAE4

| | | |
|---|---|---|
| **Input Impedance** | 200MOhm |  |
| **The Inputs** | Symmetrical and floating | |
| **Common mode rejection** | above 80 dB | |

### 3.4. Robot

The DASY system uses the high precision robots (DASY5:TX60) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from is used.
The XL robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

### 3.5. Light Beam Unit

The light beam switch allows automatic “tooling” of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.
The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned prob.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position. E, the same position will be reached with another aligned probe within 0

### 3.6. Device Holder

| | |
|---|---|
| The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR).<br>Thus the device needs no repositioning when changing the angles.<br>The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered. |  |

### 3.7. Measurement Server

| | |
|---|---|
| The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chip-disk (DASY5: 128MB), RAM (DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DAYS I/O board, which is directly connected to the PC/104 bus of the CPU board.<br>The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations. |  |

## 3.8. PHANTOM

### SAM Twin Phantom

| | |
|---|---|
| The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:<br> Left head<br> Right head<br> Flat phantom |  |

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

### ELI4 Phantom

| | |
|---|---|
|  Flat phantom a fiberglass shell flat phantom with 2mm+/- 0.2 mm shell thickness. It has only one measurement area for Flat phantom |  |

# 4. SAR MEASUREMENT PROCEDURE

## 4.1. Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and occupational/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of given mass density (ρ). The equation description is as below:

$$\mathrm{SAR} = \frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\mathrm{d}W}{\mathrm{d}m}\right) = \frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\mathrm{d}W}{\rho \mathrm{d}V}\right)$$

SAR is expressed in units of Watts per kilogram (W/Kg)
SAR can be obtained using either of the following equations:

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

$$\mathrm{SAR} = c_h \left.\frac{\mathrm{d}T}{\mathrm{d}t}\right|_{t=0}$$

Where

| | |
|---|---|
| SAR | is the specific absorption rate in watts per kilogram; |
| $E$ | is the r.m.s. value of the electric field strength in the tissue in volts per meter; |
| $\sigma$ | is the conductivity of the tissue in 13ignale per metre; |
| $\rho$ | is the density of the tissue in kilograms per cubic metre; |
| $c_h$ | is the heat capacity of the tissue in joules per kilogram and Kelvin; |
| $\frac{\mathrm{dT}}{\mathrm{dt}} \mid t = 0$ | is the initial time derivative of temperature in the tissue in kelvins per second |

## 4.2. SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface is 2.7mm This distance cannot be smaller than the distance os sensor calibration points to probe tip as `defined in the probe properties,

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in db) is specified in the standards for compliance testing. For example, a 2db range is required in IEEE Standard 1528 and IEC62209 standards, whereby 3db is a requirement when compliance is assessed in accordance with the ARIB standard (Japan) If one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximum are detected, the number of Zoom Scan has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100MHz to 6GHz

| | ≤ 3 GHz | > 3 GHz |
|---|---|---|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | 5 ± 1 mm | ½·δ·ln(2) ± 0.5 mm |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location | 30° ± 1° | 20° ± 1° |
| Maximum area scan spatial resolution: $\Delta x_{Area}$, $\Delta y_{Area}$ | ≤ 2 GHz: ≤ 15 mm<br>2 – 3 GHz: ≤ 12 mm | 3 – 4 GHz: ≤ 12 mm<br>4 – 6 GHz: ≤ 10 mm |
| | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device. | |

Step 3: Zoom Scan

Zoom Scan are used to assess the peak spatial SAR value within a cubic average volume containing 1g abd 10g of simulated tissue. The Zoom Scan measures points(refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1g and 10g and displays these values next to the job’s label.

Zoom Scan Parameters extracted from KDB865664 d01 SAR Measurement 100MHz to 6GHz

| | | | | |
|---|---|---|---|---|
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$ | | | $\leq$ 2 GHz: $\leq$ 8 mm<br>2 – 3 GHz: $\leq$ 5 mm* | 3 – 4 GHz: $\leq$ 5 mm*<br>4 – 6 GHz: $\leq$ 4 mm* |
| Maximum zoom scan spatial resolution, normal to phantom surface | uniform grid: $\Delta z_{Zoom}(n)$ | | $\leq$ 5 mm | 3 – 4 GHz: $\leq$ 4 mm<br>4 – 5 GHz: $\leq$ 3 mm<br>5 – 6 GHz: $\leq$ 2 mm |
| | graded grid | $\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface | $\leq$ 4 mm | 3 – 4 GHz: $\leq$ 3 mm<br>4 – 5 GHz: $\leq$ 2.5 mm<br>5 – 6 GHz: $\leq$ 2 mm |
| | | $\Delta z_{Zoom}(n>1)$: between subsequent points | $\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ | |
| Minimum zoom scan volume | x, y, z | | $\geq$ 30 mm | 3 – 4 GHz: $\geq$ 28 mm<br>4 – 5 GHz: $\geq$ 25 mm<br>5 – 6 GHz: $\geq$ 22 mm |
| Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.<br>* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz. | | | | |

Step 4: Power Drift Measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the same settings. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

## 4.3. RF Exposure Conditions

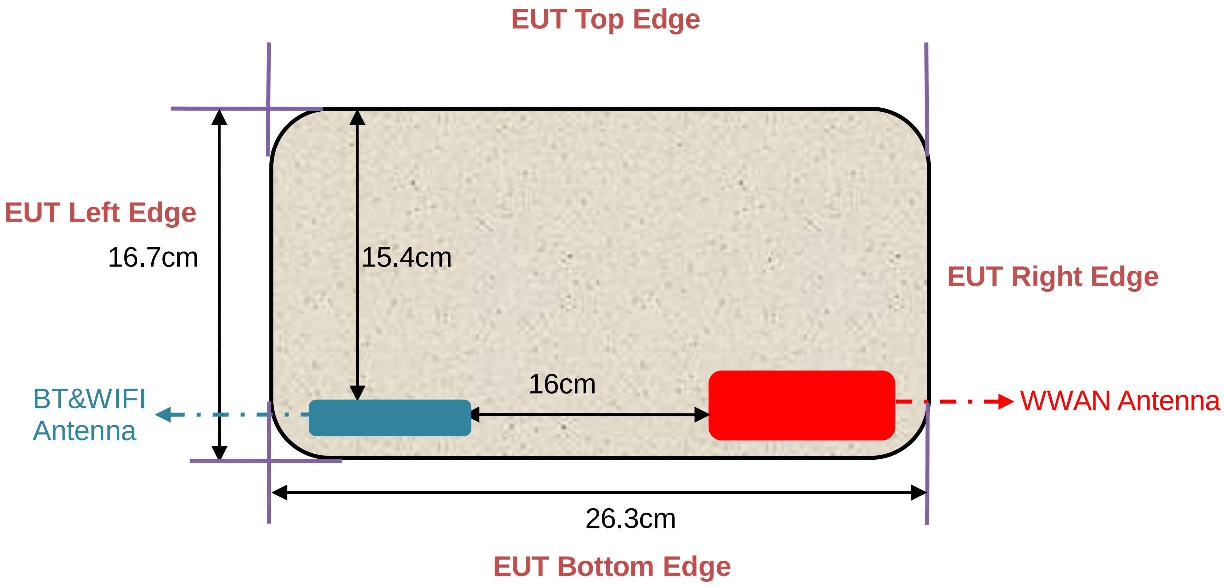
Test Configuration and setting:

The EUT is a model of GSM Portable Mobile Station (MS). It supports WCDMA/HSPA, BT, WIFI, and support hotspot mode.

For WWAN SAR testing, the device was controlled by using a base station emulator. Communication between the device and the emulator were established by air link. The distance between the EUT and the antenna is larger than 50cm, and the output power radiated from the emulator antenna is at least 30db smaller than the output power of EUT.

For WLAN testing, the EUT is configured with the WLAN continuous TX tool through engineering command.

**Antenna Location: (the front view)**



For WWAN mode:

| Test Configurations | Antenna to edges/surface | SAR required | Note |
|---|---|---|---|
| Body | | | |
| Back | <25mm | Yes | - |
| Front | <25mm | Yes | - |
| Edge 1 (Top) | 141 | No | SAR is not required for the distance between the antenna and the edge is >25mm as per KDB 941225D06 Hotspot SAR |
| Edge 2 (Right) | 14 | Yes | - |
| Edge 3 (Bottom) | 11 | Yes | - |
| Edge 4 (Left) | 212 | No | SAR is not required for the distance between the antenna and the edge is >25mm as per KDB 941225D06 Hotspot SAR |

For WLAN mode:

| Test Configurations | Antenna to edges/surface | SAR required | Note |
|---|---|---|---|
| Body | | | |
| Back | <25mm | Yes | - |
| Front | <25mm | Yes | - |
| Edge 1 (Top) | 154 | No | SAR is not required for the distance between the antenna and the edge is >25mm as per KDB 941225D06 Hotspot SAR |
| Edge 2 (Right) | 210 | No | SAR is not required for the distance between the antenna and the edge is >25mm as per KDB 941225D06 Hotspot SAR |
| Edge 3 (Bottom) | 11 | Yes | - |
| Edge 4 (Left) | 20 | Yes | - |

# 5. TISSUE SIMULATING LIQUID

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15cm. For head SAR testing the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15cm For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm.The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in 4.2

## 5.1. The composition of the tissue simulating liquid

| Ingredient | Water | Salt | Sugar | HEC | Preventol | DGBE | TWEEN | Triton X-100 |
|---|---|---|---|---|---|---|---|---|
| 835MHz Body | √ | √ | √ | √ | √ | -- | -- | -- |
| 2450MHz Body | √ | √ | -- | -- | -- | √ | -- | -- |

## 5.2. Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in IEEE 1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in IEEE 1528.

| Target Frequency (MHz) | head | | body | |
|---|---|---|---|---|
| | εr | σ (S/m) | εr | σ (S/m) |
| 300 | 45.3 | 0.87 | 58.2 | 0.92 |
| 450 | 43.5 | 0.87 | 56.7 | 0.94 |
| **835** | 41.5 | 0.90 | **55.2** | **0.97** |
| 900 | 41.5 | 0.97 | 55.0 | 1.05 |
| 915 | 41.5 | 1.01 | 55.0 | 1.06 |
| 1450 | 40.5 | 1.20 | 54.0 | 1.30 |
| 1610 | 40.3 | 1.29 | 53.8 | 1.40 |
| 1800 – 2000 | 40.0 | 1.40 | 53.3 | 1.52 |
| **2450** | 39.2 | 1.80 | **52.7** | **1.95** |
| 3000 | 38.5 | 2.40 | 52.0 | 2.73 |
| 5800 | 35.3 | 5.27 | 48.2 | 6.00 |

(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)

### 5.3. Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using DASY5 Dielectric Probe Kit and R&S Network Analyzer ZVL6.

| Tissue Stimulant Measurement for 835MHz | | | | | |
|---|---|---|---|---|---|
| | Fr. (MHz) | Dielectric Parameters (±5%) | | Tissue Temp [oC] | Test time |
| | | εr 55.20(52.44-57-96) | δ[s/m]0.97(0.9215-1.0185) | | |
| Body | 826.4 | 55.83 | 0.94 | 22.0 | July 03,2015 |
| | 835 | 55.07 | 0.96 | | |
| | 836.6 | 54.36 | 0.97 | | |
| | 846.6 | 53.99 | 0.99 | | |

| Tissue Stimulant Measurement for 2450MHz | | | | | |
|---|---|---|---|---|---|
| | Fr. (MHz) | Dielectric Parameters (±5%) | | Tissue Temp [oC] | Test time |
| | | εr52.7(50.065-55.335) | δ[s/m]1.95(1.8525-2.0475) | | |
| Body | 2412 | 53.93 | 1.89 | 22.0 | July 06,2015 |
| | 2437 | 53.34 | 1.92 | | |
| | 2450 | 52.77 | 1.95 | | |
| | 2462 | 52.09 | 1.96 | | |

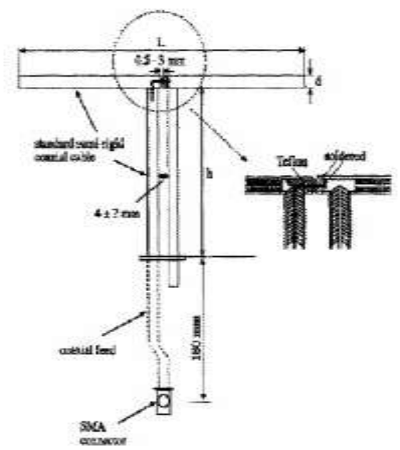
# 6. SAR SYSTEM CHECK PROCEDURE

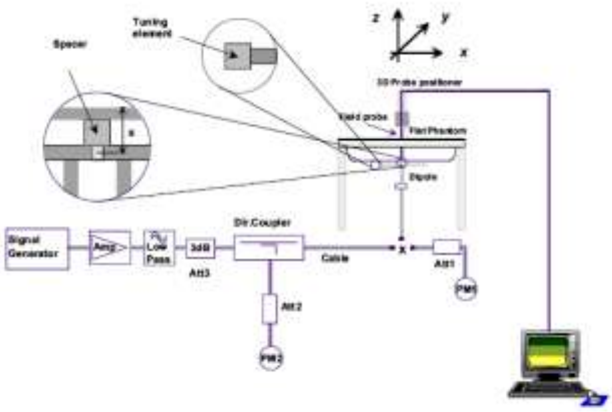
## 6.1. SAR System Check Procedures

SAR system check is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are remeasured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

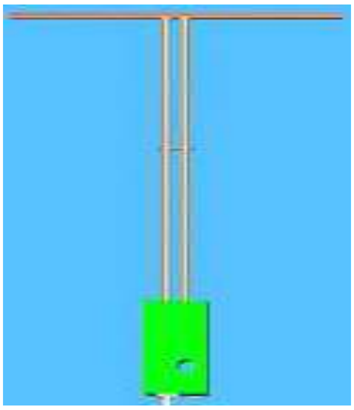
Each DASY system is equipped with one or more system check kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system check and system validation. System kit includes a dipole, and dipole device holder.

The system check verifies that the system operates within its specifications. It’s performed daily or before every SAR measurement. The system check uses normal SAR measurement in the flat section of the phantom with a matched dipole at a specified distance. The system check setup is shown as below.



## 6.2. SAR System Check
### 6.2.1. Dipoles

| | |
|---|---|
|  | The dipoles used is based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of both IEEE and FCC Supplement C. the table below provides details for the mechanical and electrical Specifications for the dipoles. |

| | |
|---|---|
|  | The dipoles used is based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of both IEEE and FCC Supplement C. the table below provides details for the mechanical and electrical Specifications for the dipoles. |

| Frequency | L (mm) | h (mm) | d (mm) |
|---|---|---|---|
| 835MHz | 161.0 | 89.8 | 3.6 |
| 2450MHz | 51.5 | 30.4 | 3.6 |

### 6.2.2. System Check Result

| **System Performance Check at 835 MHz & 2450MHz for Body** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Validation Kit: SN 46/11DIP 0G835-190 & D24500V2-SN:968** | | | | | | | | |
| Frequency [MHz] | Target Value(W/Kg) | | Reference Result (± 10%) | | Tested Value(W/Kg) | | Tissue Temp. [°C] | Test time |
| | 1g | 10g | 1g | 10g | 1g | 10g | | |
| 835 | 9.90 | 6.39 | 8.91-10.89 | 5.75-7.03 | 10.816 | 6.352 | 22.0 | July 03,2015 |
| 2450 | 51.7 | 24.3 | 46.53-56.87 | 21.87-26.73 | 53.12 | 24.96 | 22.0 | July 06,2015 |

# 7. EUT TEST POSITION

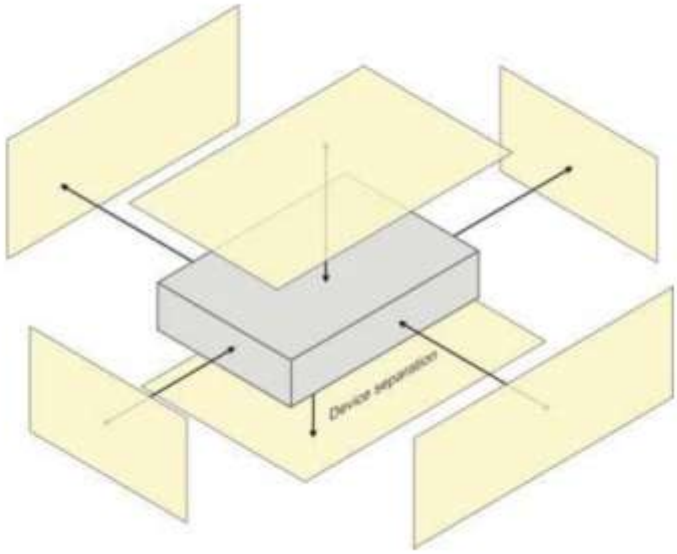
This EUT was tested in **Body back, Body front and 4 edges.**

## 7.1.Body Worn Position

(1) To position the EUT parallel to the phantom surface.

(2) To adjust the EUT parallel to the flat phantom.

(3) To adjust the distance between the EUT surface and the flat phantom to **0mm.**



# 8. SAR EXPOSURE LIMITS

SAR assessments have been made in line with the requirements of IEEE-1528, FCC Supplement C, and comply with ANSI/IEEE C95.1-1992 “Uncontrolled Environments” limits. These limits apply to a location which is deemed as “Uncontrolled Environment” which can be described as a situation where the general public may be exposed to an RF source with no prior knowledge or control over their exposure.

**Limits for General Population/Uncontrolled Exposure (W/kg)**

| Type Exposure | Uncontrolled Environment Limit (W/kg) |
|---|---|
| Spatial Peak SAR (1g cube tissue for brain or body) | 1.60 |
| Spatial Average SAR (Whole body) | 0.08 |
| Spatial Peak SAR (Limbs) | 4.0 |

# 9. TEST EQUIPMENT LIST

| Equipment description | Manufacturer/ Model | Identification No. | Current calibration date | Next calibration date |
|---|---|---|---|---|
| Stäubli Robot | Stäubli-TX60 | F13/5Q2UD1/A/01 | N/A | N/A |
| Robot Controller | Stäubli-CS8 | 139522 | N/A | N/A |
| TISSUE Probe | SATIMO | SN 45/11 OCPG45 | 12/03/2014 | 12/02/2015 |
| E-Field Probe | Speag-EX3DV4 | 3953 | 11/06/2014 | 11/05/2015 |
| SAM Twin Phantom | Speag-SAM | 1790 | N/A | N/A |
| Device Holder | Speag-SD 000 H01 KA | SD 000 H01 KA | N/A | N/A |
| DAE4 | Speag-SD 000 D04 BM | 1398 | 03/11/2015 | 03/10/2016 |
| SAR Software | Speag-DASY5 | DASY52.8 | N/A | N/A |
| Liquid | SATIMO | - | N/A | N/A |
| Radio Communication Tester | R&S-CMU200 | 069Y7-158-13-712 | 03/06/2015 | 03/05/2016 |
| Dipole | SATIMO SID835 | SN46/11 DIP 0G835-190 | 10/02/2014 | 10/01/2017 |
| Dipole | D2450V2 | SN968 | 06/12/2015 | 06/11/2018 |
| Signal Generator | Agilent-E4438C | MY44260051 | 03/06/2015 | 03/05/2016 |
| Power Sensor | NRP-Z23 | US38261498 | 03/06/2015 | 03/05/2016 |
| Spectrum Analyzer E4440 | Agilent | US41421290 | 07/25/2014 | 07/24/2015 |
| Network Analyzer | Rhode & Schwarz ZVL6 | SN100132 | 03/06/2015 | 03/05/2016 |
| Attenuator | Warison /WATT-6SR1211 | N/A | N/A | N/A |
| Attenuator | Mini-circuits / VAT-10+ | N/A | N/A | N/A |
| Amplifier | EM30180 | SN060552 | 03/06/2015 | 03/05/2016 |
| Directional Couple | Werlatone/ C5571-10 | SN99463 | 07/30/2014 | 07/29/2015 |
| Directional Couple | Werlatone/ C6026-10 | SN99482 | 07/30/2014 | 07/29/2015 |
| Power Sensor | NRP-Z21 | 1137.6000.02 | 10/22/2014 | 10/21/2015 |
| Power Viewer | R&S | V2.3.1.0 | N/A | N/A |

Note: Per KDB 865664Dipole SAR Validation, AGC Lab has adopted 3 years calibration intervals. On annual basis, every measurement dipole has been evaluated and is in compliance with the following criteria:
1. There is no physical damage on the dipole;
2. System validation with specific dipole is within 10% of calibrated value;
3. Return-loss is within 20% of calibrated measurement;
4. Impedance is within 5Ω of calibrated measurement.

# 10. MEASUREMENT UNCERTAINTY

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table as follow.

| **Uncertainty Distributions** | **Normal** | **Rectangular** | **Triangular** | **U-Shape** |
|---|---|---|---|---|
| Multi-plying Factor(a) | 1/k(b) | $1/\sqrt{3}$ | $1/\sqrt{6}$ | $1/\sqrt{2}$ |

(a) Standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) $\kappa$ is the coverage factor

**Table 13.1 Standard Uncertainty for Assumed Distribution (above table)**

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

| DAYS5 Measurement Uncertainty<br>Measurement uncertainty for 30 MHz to 3GHz averaged over 1 gram / 10 gram. | | | | | | | |
|---|---|---|---|---|---|---|---|
| Error Description | Uncertainty value(±10%) | Probability Distribution | Divisor | (Ci) 1g | (Ci) 10g | Standard Uncertainty (1g) | Standard Uncertainty (10g) |
| Measurement System | | | | | | | |
| Probe Calibration | 6.53 | Normal | 1 | 1 | 1 | 6.53 | 6.53 |
| Axial Isotropy | 4.6 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.66 | 2.66 |
| Hemispherical Isotropy | 9.3 | Rectangular | $\sqrt{3}$ | 1 | 1 | 5.37 | 5.37 |
| Linearity | 4.5 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.60 | 2.60 |
| Probe Modulation Response | 0.2 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.12 | 0.12 |
| System Detection Limits | 0.9 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.52 | 0.52 |
| Boundary Effects | 0.9 | Rectangular | $\sqrt{3}$ | 0 | 0 | 0 | 0 |
| Readout Electronics | 0.2 | Normal | $\sqrt{3}$ | 1 | 1 | 0.12 | 0.12 |
| Response Time | 0 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0 | 0 |
| Integration Time | 0 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0 | 0 |
| RF Ambient Noise | 0.9 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.52 | 0.52 |
| RF Ambient Reflection | 0.9 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.52 | 0.52 |
| Probe Positioner | 0.7 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.40 | 0.40 |
| Probe Positioning | 6.5 | Rectangular | $\sqrt{3}$ | 1 | 1 | 3.75 | 3.75 |
| Post-processing | 3.8 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.19 | 2.19 |
| Test Sample Related | | | | | | | |
| Device Positioning | 3.6 | Normal | 1 | 1 | 1 | 3.6 | 3.6 |
| Device Holder | 2.9 | Normal | 1 | 1 | 1 | 2.9 | 2.9 |
| Measurement SAR Drift | 5.0 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.89 | 2.89 |
| Power Scaling | 0.0 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0 | 0 |
| Phantom and Setup | | | | | | | |
| Phantom Uncertainty | 3.9 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.25 | 2.25 |
| Liquid Conductivity(Meas.) | 2.4 | Normal | 1 | 0.78 | 0.71 | 1.87 | 1.70 |
| Liquid Conductivity(Target) | 4.9 | Rectangular | $\sqrt{3}$ | 0.64 | 0.43 | 1.81 | 1.22 |
| Liquid Permittivity(Meas.) | 2.4 | Normal | 1 | 0.26 | 0.26 | 0.62 | 0.62 |
| Liquid Permittivity((Target) | 4.9 | Rectangular | $\sqrt{3}$ | 0.6 | 0.49 | 1.70 | 1.39 |
| Liquid Conductivity-temperature uncertainty | 1.6 | Rectangular | $\sqrt{3}$ | 0.78 | 0.71 | 0.72 | 0.66 |
| Liquid Permittivity-temperature uncertainty | 0.2 | Rectangular | $\sqrt{3}$ | 0.23 | 0.26 | 0.026 | 0.03 |
| Combined Standard Uncertainty | | | | | | 12.03 | 12.00 |
| Coverage Factor for 95% | | | | | | K=2 | |
| Expanded Uncertainty | | | | | | ±24.06% | ±24.00% |

| DAYS5 System Check Uncertainty for 30 MHz to 6GHz averaged range | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Error Description | Uncer. Value (±10%) | Prob. Dist. | Div. | (Ci) 1g | (Ci) 10g | Std. Unc. (1g) | Std. Unc. (10g) | $(v_i)$ $V_{eff}$ |
| **Measurement System** | | | | | | | | |
| Probe Calibration | 6.53 | Normal | 1 | 1 | 1 | 6.53 | 6.53 | ∞ |
| Axial Isotropy | 4.6 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.66 | 2.66 | ∞ |
| Hemispherical Isotropy | 9.3 | Rectangular | $\sqrt{3}$ | 1 | 1 | 5.37 | 5.37 | ∞ |
| Boundary Effects | 0.9 | Rectangular | $\sqrt{3}$ | 0 | 0 | 0 | 0 | ∞ |
| Linearity | 4.5 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.60 | 2.60 | ∞ |
| System Detection Limits | 0.9 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.52 | 0.52 | ∞ |
| Modulation Response | 0 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0 | 0 | ∞ |
| Readout Electronics | 0.2 | Normal | 1 | 1 | 1 | 0.2 | 0.2 | ∞ |
| Response Time | 0 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0 | 0 | ∞ |
| Integration Time | 0 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0 | 0 | ∞ |
| RF Ambient Noise | 0.9 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.52 | 0.52 | ∞ |
| RF Ambient Reflection | 0.9 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.52 | 0.52 | ∞ |
| Probe Positioner | 0.7 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.402 | 0.402 | ∞ |
| Probe Positioning | 6.5 | Rectangular | $\sqrt{3}$ | 1 | 1 | 3.752 | 3.752 | ∞ |
| Max. SAR Eval. | 1.9 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.10 | 1.10 | ∞ |
| **Dipole Related** | | | | | | | | |
| Deviation of exp. Dipole | 5.3 | Rectangular | $\sqrt{3}$ | 1 | 1 | 3.06 | 3.06 | ∞ |
| Dipole Axis to Liquid Dist. | 2.0 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.15 | 1.15 | ∞ |
| Input power & SAR drift | 3.3 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.91 | 1.91 | ∞ |
| **Phantom and Setup** | | | | | | | | |
| Phantom Uncertainty | 3.9 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.25 | 2.25 | ∞ |
| SAR correction | 1.8 | Rectangular | $\sqrt{3}$ | 1 | 0.84 | 1.04 | 0.87 | ∞ |
| Liquid Conductivity(Meas.) | 2.4 | Normal | 1 | 0.78 | 0.71 | 1.87 | 1.70 | ∞ |
| Liquid Permittivity(Meas.) | 2.4 | Normal | 1 | 0.26 | 0.26 | 0.62 | 0.62 | ∞ |
| Temp. unc. – Conductivity | 1.6 | Rectangular | $\sqrt{3}$ | 0.78 | 0.71 | 0.72 | 0.66 | ∞ |
| Temp. unc. – Permittivity | 0.2 | Rectangular | $\sqrt{3}$ | 0.23 | 0.26 | 0.02 | 0.03 | ∞ |
| Combined Std. Uncertainty | | | | | | 11.16 | 11.10 | |
| Expanded STD Uncertainty | | | | | | ±22.32% | ±22.20% | |

# 11. CONDUCTED POWER MEASUREMENT

**UMTS BAND**

**HSDPA Setup Configuration:**

·The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.

·The RF path losses were compensated into the measurements.

·A call was established between EUT and Based Station with following setting:

(1) Set Gain Factors(βc and βd) parameters set according to each

(2) Set RMC 12.2Kbps+HSDPA mode.

(3) Set Cell Power=-86dBm

(4) Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)

(5) Select HSDPA Uplink Parameters

(6) Set Delta ACK, Delta NACK and Delta CQI=8

(7) Set Ack – Nack Repetition Factor to 3

(8) Set CQI Feedback Cycle (k) to 4ms

(9) Set CQI Repetition Factor to 2

(10) Power Ctrl Mode=All Up bits

·The transmitted maximum output power was recorded.

Table C.10.2.4: β values for transmitter characteristics tests with HS-DPCCH

| Sub-test | βc (Note5) | βd | βd (SF) | βc/βd | βHS (Note1, Note 2) | CM (dB) (Note 3) | MPR (dB) (Note 3) |
|---|---|---|---|---|---|---|---|
| 1 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 0.0 | 0.0 |
| 2 | 12/15(Note 4) | 15/15(Note 4) | 64 | 12/15(Note 4) | 24/15 | 1.0 | 0.0 |
| 3 | 15/15 | 8/15 | 64 | 15/8 | 30/15 | 1.5 | 0.5 |
| 4 | 15/15 | 4/15 | 64 | 15/4 | 30/15 | 1.5 | 0.5 |

Note 1: ΔACK, ΔNACK and ΔCQI = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$.
Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, ΔACK and ΔNACK = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$, and ΔCQI = 24/15 with $\beta_{hs}$ = 24/15 * $\beta_c$.
Note 3: CM = 1 for βc/βd =12/15, hs/ c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only Ues that support HSDPA in release 6 and later releases.
Note 4: For subtest 2 the c/ d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the 28ignaled gain factors for the reference TFC (TF1, TF1) to c = 11/15 and d = 15/15.

**HSUPA Setup Configuration:**

· The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.

· The RF path losses were compensated into the measurements.

· A call was established between EUT and Base Station with following setting * :

(1) Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK

(2) Set the Gain Factors (βc and βd) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121

(3) Set Cell Power = -86 dBm

(4) Set Channel Type = 12.2k + HSPA

(5) Set UE Target Power

(6) Power Ctrl Mode= Alternating bits

(7) Set and observe the E-TFCI

(8) Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI

· The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

| Sub-test | βc | βd | βd (SF) | βc/βd | βHS (Note1) | βec | βed (Note 4) (Note 5) | βed (SF) | βed (Codes) | CM (dB) (Note 2) | MPR (dB) (Note 2) (Note 6) | AG Index (Note 5) | E-TFCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11/15 (Note 3) | 15/15 (Note 3) | 64 | 11/15 (Note 3) | 22/15 | 209/225 | 1309/225 | 4 | 1 | 1.0 | 0.0 | 20 | 75 |
| 2 | 6/15 | 15/15 | 64 | 6/15 | 12/15 | 12/15 | 94/75 | 4 | 1 | 3.0 | 2.0 | 12 | 67 |
| 3 | 15/15 | 9/15 | 64 | 15/9 | 30/15 | 30/15 | βed1: 47/15<br>βed2: 47/15 | 4<br>4 | 2 | 2.0 | 1.0 | 15 | 92 |
| 4 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 2/15 | 56/75 | 4 | 1 | 3.0 | 2.0 | 17 | 71 |
| 5 | 15/15 | 0 | - | - | 5/15 | 5/15 | 47/15 | 4 | 1 | 1.0 | 0.0 | 12 | 67 |

Note 1: For sub-test 1 to 4, ΔACK, ΔNACK and ΔCQI = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$. For sub-test 5, ΔACK, ΔNACK and ΔCQI = 5/15 with $\beta_{hs}$ = 5/15 * $\beta_c$.
Note 2: CM = 1 for βc/βd =12/15, hs/ c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the c/ d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the 29ignaled gain factors for the reference TFC (TF1, TF1) to c = 10/15 and d = 15/15.
Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.
Note 5: βed cannot be set directly; it is set by Absolute Grant Value.
Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

**UMTS BAND V**

| Mode | Frequency (MHz) | Avg. Burst Power (dBm) |
|---|---|---|
| WCDMA 850 RMC | 826.4 | **21.28** |
| | 836.6 | 21.24 |
| | 846.6 | 21.21 |
| WCDMA 850 AMR | 826.4 | 21.16 |
| | 836.6 | 21.14 |
| | 846.6 | 21.13 |
| HSDPA Subtest 1 | 826.4 | 20.51 |
| | 836.6 | 20.49 |
| | 846.6 | 20.42 |
| HSDPA Subtest 2 | 826.4 | 20.33 |
| | 836.6 | 20.29 |
| | 846.6 | 20.27 |
| HSDPA Subtest 3 | 826.4 | 20.36 |
| | 836.6 | 20.34 |
| | 846.6 | 20.31 |
| HSDPA Subtest 4 | 826.4 | 20.35 |
| | 836.6 | 20.36 |
| | 846.6 | 20.38 |
| HSUPA Subtest 1 | 826.4 | 20.29 |
| | 836.6 | 20.26 |
| | 846.6 | 20.27 |
| HSUPA Subtest 2 | 826.4 | 20.34 |
| | 836.6 | 20.31 |
| | 846.6 | 20.39 |
| HSUPA Subtest 3 | 826.4 | 20.25 |
| | 836.6 | 20.28 |
| | 846.6 | 20.24 |
| HSUPA Subtest 4 | 826.4 | 20.28 |
| | 836.6 | 20.25 |
| | 846.6 | 20.16 |
| HSUPA Subtest 5 | 826.4 | 20.37 |
| | 836.6 | 20.35 |
| | 846.6 | 20.29 |

According to 3GPP 25.101 sub-clause 6.2.2 , the maximum output power is allowed to be reduced by following the table.

Table 6.1aA: UE maximum output power with HS-DPCCH and E-DCH

| UE Transmit Channel Configuration | CM(db) | MPR(db) |
|---|---|---|
| For all combinations of ,DPDCH,DPCCH HS-DPDCH,E-DPDCH and E-DPCCH | 0≤ CM≤3.5 | MAX(CM-1,0) |
| Note: CM=1 for $\beta_c/\beta_d$=12/15, $\beta_{hs}/\beta_c$=24/15.For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference. | | |

The device supports MPR to solve linearity issues (ACLR or SEM) due to the higher peak-to average ratios (PAR) of the HSUPA signal. This prevents saturating the full range of the TX DAC inside of device and provides a reduced power output to the RF transceiver chip according to the Cubic Metric (a function of the combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH).

When E-DPDCH channels are present the beta gains on those channels are reduced firsts to try to get the power under the allowed limit. If the beta gains are lowered as far as possible, then a hard limiting is applied at the maximum allowed level.

The SW currently recalculates the cubic metric every time the beta gains on the E-DPDCH are reduced. The cubic metric will likely get lower each time this is done .However, there is no reported reduction of maximum output power in the HSUPA mode since the device also provides a compensation for the power back-off by increasing the gain of TX_AGC in the transceiver (PA) device.

The end effect is that the DUT output power is identical to the case where there is no MPR in the device.

**WIFI**

| Mode | Data Rate (Mbps) | Channel | Frequency(MHz) | Avg. Burst Power(dBm) |
|---|---|---|---|---|
| 802.11b | 1 | 01 | 2412 | **13.54** |
| | | 06 | 2437 | 13.47 |
| | | 11 | 2462 | 13.41 |
| 802.11g | 6 | 01 | 2412 | 10.86 |
| | | 06 | 2437 | 10.68 |
| | | 11 | 2462 | 10.62 |
| 802.11n(20) | 6.5 | 01 | 2412 | 10.44 |
| | | 06 | 2437 | 10.38 |
| | | 11 | 2462 | 10.35 |
| 802.11n(40) | 13.5 | 03 | 2422 | 8.75 |
| | | 06 | 2437 | 8.71 |
| | | 09 | 2452 | 8.62 |

**Bluetooth_V3.0**

| Modulation | Channel | Frequency(MHz) | Peak Power (dBm) |
|---|---|---|---|
| GFSK | 0 | 2402 | **7.44** |
| | 39 | 2441 | 6.77 |
| | 78 | 2480 | 6.59 |
| π /4-DQPSK | 0 | 2402 | 6.25 |
| | 39 | 2441 | 5.50 |
| | 78 | 2480 | 5.54 |
| 8-DPSK | 0 | 2402 | 6.21 |
| | 39 | 2441 | 5.69 |
| | 78 | 2480 | 5.53 |

**Bluetooth_V4.0**

| Modulation | Channel | Frequency(MHz) | Peak Power (dBm) |
|---|---|---|---|
| GFSK | 0 | 2402 | **-1.76** |
| | 19 | 2440 | -2.17 |
| | 39 | 2480 | -2.02 |

# 12. TEST RESULTS

## 12.1. SAR Test Results Summary

### 12.1.1. Test position and configuration

Body SAR was performed with the device 0mm from the phantom.

### 12.1.2. Operation Mode

1. Per KDB 447498 D01 v05r02 ,for each exposure position, if the highest 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional.
2. Per KDB 865664 D01 v01r03,for each frequency band, if the measured SAR is ≥0.8W/Kg, testing for repeated SAR measurement is required , that the highest measured SAR is only to be tested. When the SAR results are near the limit, the following procedures are required for each device to verify these types of SAR measurement related variation concerns by repeating the highest measured SAR configuration in each frequency band.
   (1) When the original highest measured SAR is ≥0.8W/Kg, repeat that measurement once.
   (2) 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 ≥1.45 W/Kg.
   (3) Perform a third repeated measurement only if the original, first and second repeated measurement is ≥1.5 W/Kg and ratio of largest to smallest SAR for the original, first and second measurement is ≥ 1.20.
3. Per KDB 648474 D04 v01r02,when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤1.2W/Kg, SAR testing with a headset connected is not required.
4. Per 248227 D01 v01r02, SAR is not required for 802.11g channels when the maximum average output power is less than 1/4dB higher than measured on the corresponding 802.11b channels.
5. Maximum Scaling SAR in order to calculate the Maximum SAR values to test under the standard Peak Power, Calculation method is as follows:
   Maximum Scaling SAR =tested SAR (Max.) ×[maximum turn-up power (mw)/ maximum measurement output power(mw) ]

### 12.1.3. Test Result

| SAR MEASUREMENT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth of Liquid (cm):>15 | | | | Relative Humidity (%): 53 | | | | | |
| Product: rugged tablet | | | | | | | | | |
| Test Mode: WCDMA Band V with QPSK modulation | | | | | | | | | |
| **Position** | **Mode** | **Ch.** | **Fr. (MHz)** | **Power Drift (<±0.2)** | **SAR (1g) (W/kg)** | **Max. Turn-up Power (dBm)** | **Meas. Output Power (dBm)** | **Scaled SAR (W/Kg)** | **Limit W/kg** |
| Body back | RMC 12.2kbps | 4183 | 836.6 | -0.18 | **0.151** | 23 | 21.24 | **0.226** | 1.6 |
| Body front | RMC 12.2kbps | 4183 | 836.6 | -0.08 | 0.098 | 23 | 21.24 | 0.147 | 1.6 |
| Edge 1 (Top) | RMC 12.2kbps | 4183 | 836.6 | 0.06 | 0.00578 | 23 | 21.24 | 0.009 | 1.6 |
| Edge 2(Right) | RMC 12.2kbps | 4183 | 836.6 | -0.14 | 0.090 | 23 | 21.24 | 0.135 | 1.6 |
| Edge 3(Bottom) | RMC 12.2kbps | 4183 | 836.6 | -0.12 | 0.073 | 23 | 21.24 | 0.109 | 1.6 |
| Edge 4(Left) | RMC 12.2kbps | 4183 | 836.6 | 0.11 | 0.00626 | 23 | 21.24 | 0.009 | 1.6 |

Note:
· When the 1-g Reported SAR is ≤ 0.8 W/kg, testing for low and high channel is optional. Refer to KDB 447498.
·The test separation for body is 0mm of all above table.

| SAR MEASUREMENT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth of Liquid (cm):>15 | | | | Relative Humidity (%): 53 | | | | | |
| Product: rugged tablet | | | | | | | | | |
| Test Mode:802.11b | | | | | | | | | |
| **Position** | **Mode** | **Ch.** | **Fr. (MHz)** | **Power Drift (<±0.2)** | **SAR (1g) (W/kg)** | **Max. Turn-up Power (dBm)** | **Meas. Output Power (dBm)** | **Scaled SAR (W/Kg)** | **Limit W/kg** |
| Body back | DTS | 6 | 2437 | -0.13 | **0.298** | 15 | 13.47 | **0.424** | 1.6 |
| Body front | DTS | 6 | 2437 | -0.00 | 0.088 | 15 | 13.47 | 0.125 | 1.6 |
| Edge 1 (Top) | DTS | 6 | 2437 | -0.15 | 0.012 | 15 | 13.47 | 0.017 | 1.6 |
| Edge 2(Right) | DTS | 6 | 2437 | -0.14 | 0.039 | 15 | 13.47 | 0.055 | 1.6 |
| Edge 3(Bottom) | DTS | 6 | 2437 | 0.16 | 0.199 | 15 | 13.47 | 0.283 | 1.6 |
| Edge 4(Left) | DTS | 6 | 2437 | -0.02 | 0.012 | 15 | 13.47 | 0.017 | 1.6 |

Note:
· According to KDB248227, SAR is not required for 802.11n HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels.
· All of above "DTS" means data transmitters.
· The test separation of all above table for body part is 0mm.

## Simultaneous Multi-band Transmission Evaluation:

**Application Simultaneous Transmission information:**

| NO | Simultaneous state | Portable Handset | | |
|---|---|---|---|---|
| | | Head | Body-worn | Hotspot |
| 2 | WCDMA(voice)+WLAN 2.4GHz (data) | - | Yes | - |
| 4 | WCDMA(voice)+Bluetooth(data) | - | Yes | - |
| 7 | WCDMA (Data) + Bluetooth(data) | - | Yes | |
| 8 | WCDMA (Data) + WLAN 2.4GHz (data) | - | Yes | Yes |

NOTE:

1. WLAN and BT share the same antenna, and cannot transmit simultaneously.
2. Simultaneous with every transmitter must be the same test position.
3. KDB 447498 D01, BT SAR is excluded as below table.
4. KDB 447498 D01, for handsets the test separation distance is determined by the smallest distance between the outer surface of the device and the user; which is 0mm for head SAR and 10mm for body-worn SAR.
5. If the test separation distance is <5mm, 5mm is used for excluded SAR calculation.
6. According to KDB447497 D01 4.3.2, simultaneous transmission SAR test exclusion is as follow:
   (1) Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna.
   (2) Any transmitters and antennas should be considered when calculating simultaneous mode.
   (3) For mobile phone and PC, it's the sum of all transmitters and antennas at the same mode with same position in each applicable exposure condition
   (4) When the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion:

   (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;

   where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
7. When the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The simultaneous transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SAR to peak location separation ratio to qualify for test exclusion. The ratio is determined by (SAR1 + SAR2)1.5/Ri, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

| Estimated SAR | | Max Power including Tune-up Tolerance | | Separation Distance (mm) | Estimated SAR (W/kg) |
|---|---|---|---|---|---|
| | | dBm | mW | | |
| **BT** | Body | 8 | 6.310 | 0 | 0.261 |

**Maximum test results (WWAN) with BT SAR:**

**BT:** Body (0cm gap): 0.261W/kg

**Sum of the SAR for WCDMA Band V &Wi-Fi & BT:**

| RF Exposure Conditions | Test Position | Simultaneous Transmission Scenario | | | Σ1-g SAR (W/Kg) | SPLSR (Yes/No) |
|---|---|---|---|---|---|---|
| | | WCDMA Band V | Wi-Fi DTS Band | Bluetooth | | |
| Body-worn | Rear | 0.226 | 0.424 | | **0.650** | No |
| | Front | 0.147 | 0.125 | | 0.272 | No |
| | Edge 1 | 0.009 | 0.017 | | 0.026 | No |
| | Edge 2 | 0.135 | 0.055 | | 0.190 | No |
| | Edge 3 | 0.109 | 0.283 | | 0.392 | No |
| | Edge 4 | 0.009 | 0.017 | | 0.026 | No |
| | Rear | 0.226 | | 0.261 | 0.487 | No |
| | Front | 0.147 | | 0.261 | 0.408 | No |
| | Edge 1 | 0.009 | | 0.261 | 0.270 | No |
| | Edge 2 | 0.135 | | 0.261 | 0.396 | No |
| | Edge 3 | 0.109 | | 0.261 | 0.370 | No |
| | Edge 4 | 0.009 | | 0.261 | 0.270 | No |

**Note:**

- According to KDB 447498 D01 General RF Exposure Guidance, when the simultaneous transmission SAR is less than1.6 W/Kg, SPLSR assessment is not required.
- SPLSR mean is “The SAR to Peak Location Separation Ratio “

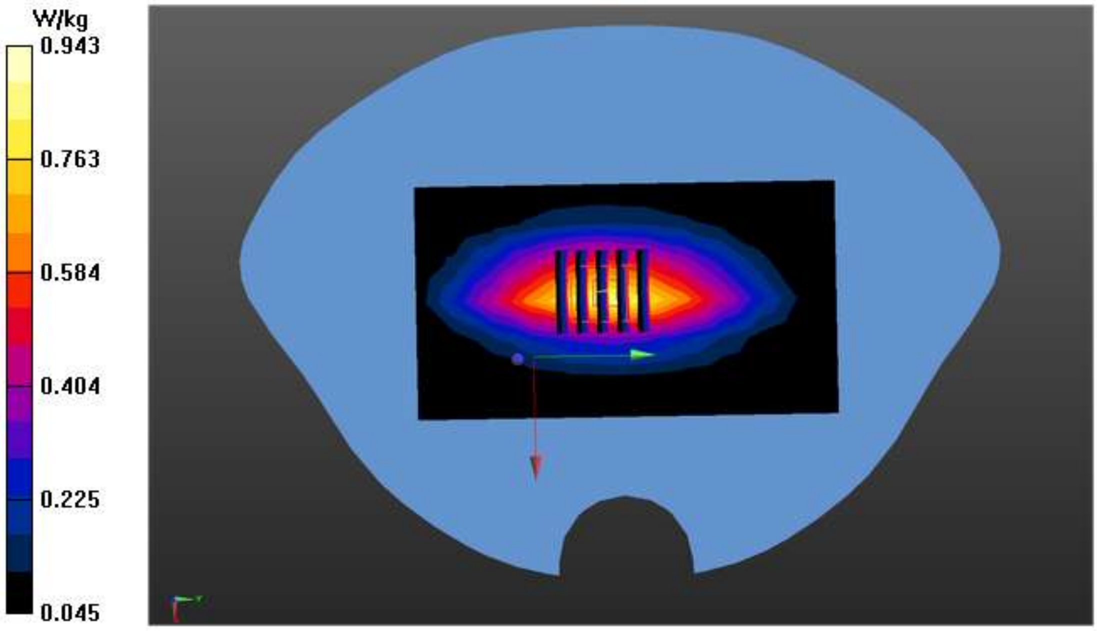
# APPENDIX A. SAR SYSTEM CHECK DATA

**Test Laboratory: AGC Lab** **Date: July 03,2015**
**System Check Body 835 MHz**
**DUT: Dipole 835 MHz Type: SID 835**
Communication System CW; Communication System Band: D835 (835.0 MHz); Duty Cycle: 1:1;
Frequency: 835 MHz; Medium parameters used: f = 835 MHz; σ=0.97 mho/m; εr =54.36; ρ= 1000 kg/m³ ;
Phantom section: Flat Section; Input Power=18dBm
Ambient temperature (℃): 22.3, Liquid temperature (℃): 22.0

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(10.08,10.08, 10.08); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 03/11/2015
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Configuration/System Check 835MHz Body/Area Scan (7x12x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.894 W/kg

**Configuration/System Check 835MHz Body/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.944 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.19 W/kg
**SAR(1 g) = 0.676 W/kg; SAR(10 g) = 0.397 W/kg**
Maximum value of SAR (measured) = 0.943 W/kg

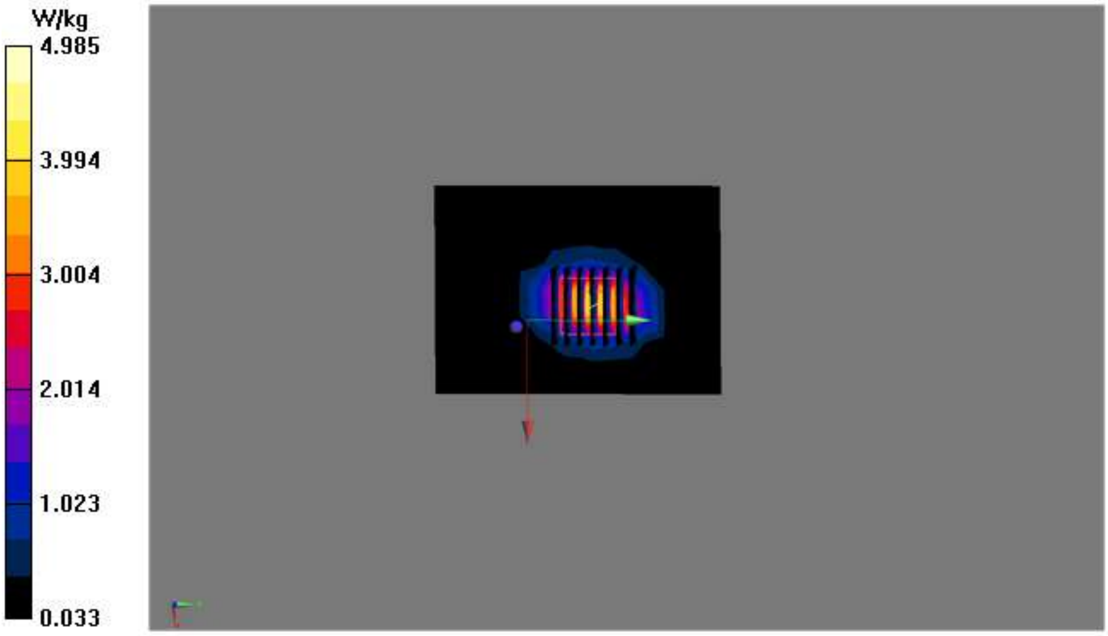


**Test Laboratory: AGC Lab** **Date: July 06,2015**
**System Check Body 2450 MHz**
**DUT: Dipole 2450 MHz Type: SID 2450**
Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Duty Cycle: 1:1;
Frequency: 2450 MHz; Medium parameters used: f = 2450 MHz; $\sigma$ = 1.92 mho/m; $\varepsilon r$ = 53.34; $\rho$= 1000 kg/m$^3$ ;
Phantom section: Flat Section; Input Power=18dBm
Ambient temperature (℃): 22.2, Liquid temperature (℃): 22.0

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(7.48, 7.48, 7.48); Calibrated: 11/06/2014
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 03/11/2015
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Configuration/System Check 2450MHz / Area Scan (9x12x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 3.98 W/kg

**Configuration/System Check 2450MHz / Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 44.766 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 6.62 W/kg
**SAR(1 g) = 3.32 W/kg; SAR(10 g) = 1.56 W/kg**
Maximum value of SAR (measured) = 4.98 W/kg



# APPENDIX B. SAR MEASUREMENT DATA

**Test Laboratory: AGC Lab** **Date: July 03,2015**

**WCDMA Band Ⅴ Mid-Body-Towards Grounds**

**DUT: rugged tablet; Type: T80**

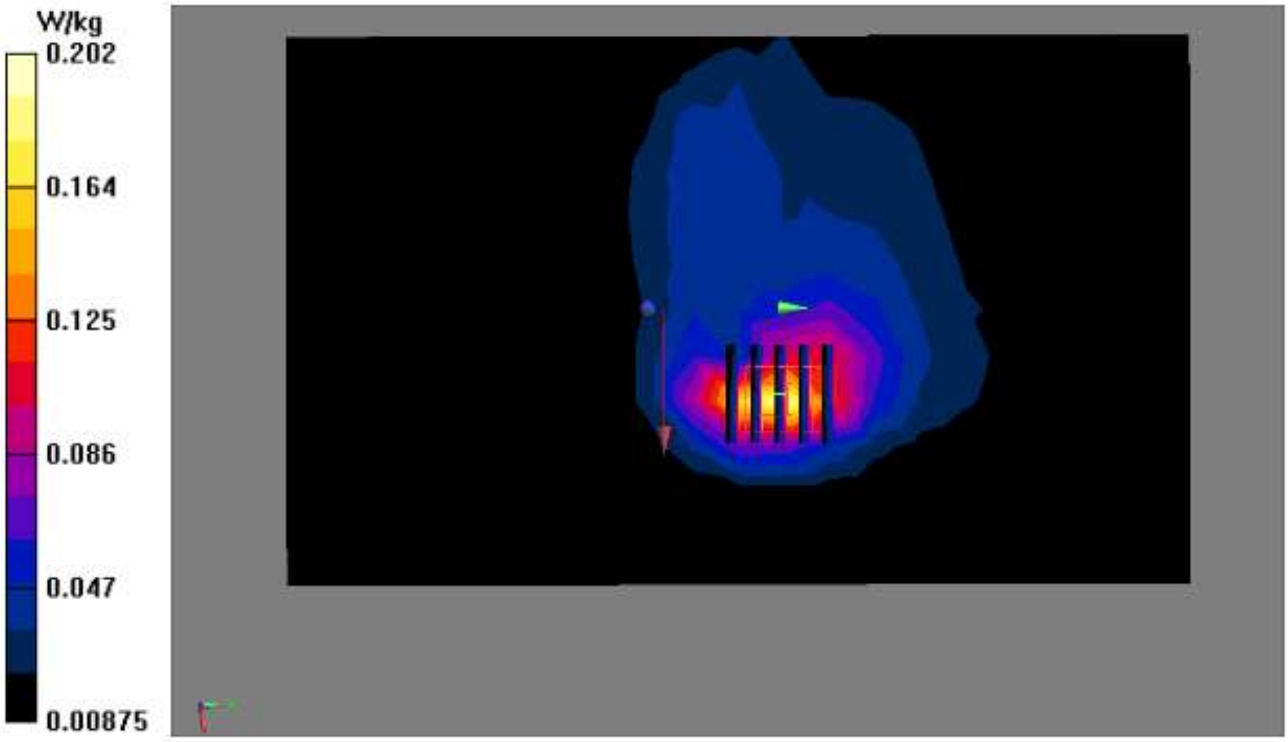
Communication System: UID 0, WCDMA 850 (0); Communication System Band: BAND Ⅴ UTRA/FDD; Duty Cycle:1:1; Frequency: 836.6 MHz; Medium parameters used: f = 835 MHz;σ=0.97 mho/m; εr =54.36; ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):22.3, Liquid temperature (℃): 22.0

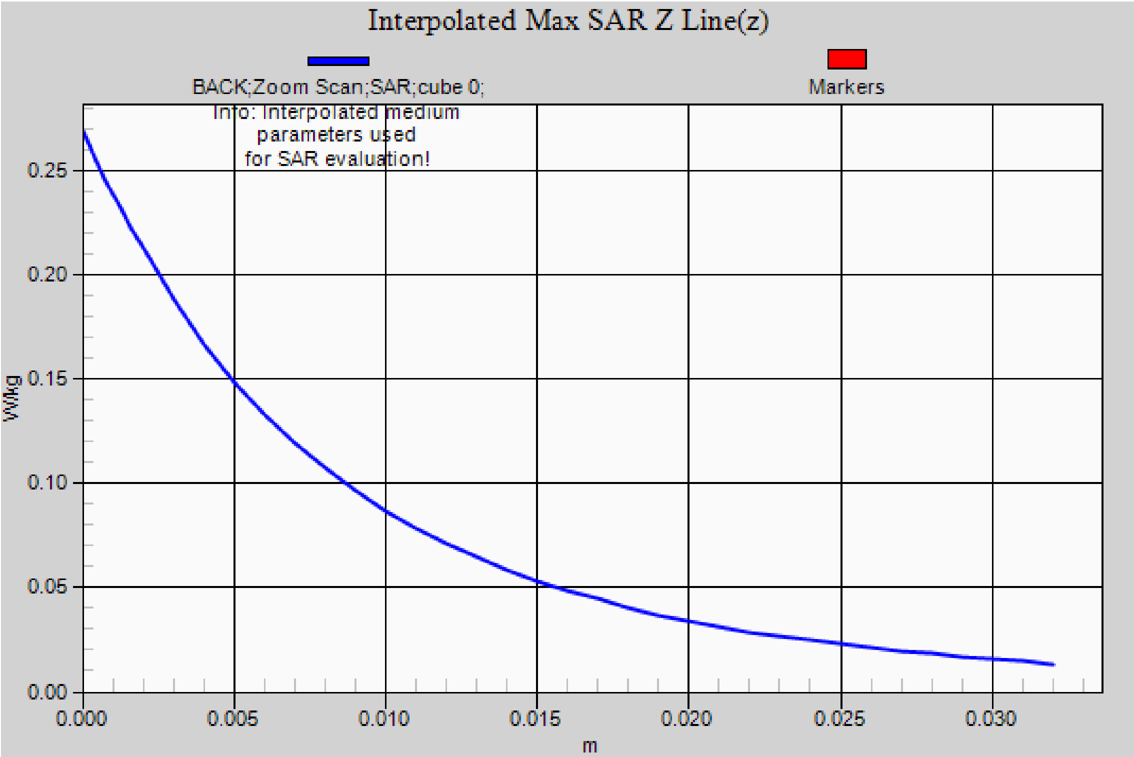
DASY Configuration:

- Probe: EX3DV4 - SN3953; ConvF(10.08,10.08, 10.08); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 03/11/2015
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**BODY/BACK/Area Scan (13x21x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.196 W/kg

**BODY/BACK/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.361 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 0.269 W/kg
**SAR(1 g) = 0.151 W/kg; SAR(10 g) = 0.086 W/kg**
Maximum value of SAR (measured) = 0.202 W/kg




Interpolated Max SAR Z Line(z)
BACK;Zoom Scan;SAR;cube 0;
Markers
Info: Interpolated medium parameters used for SAR evaluation!
W/kg
0.25
0.20
0.15
0.10
0.05
0.00
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

## WIFI MODE

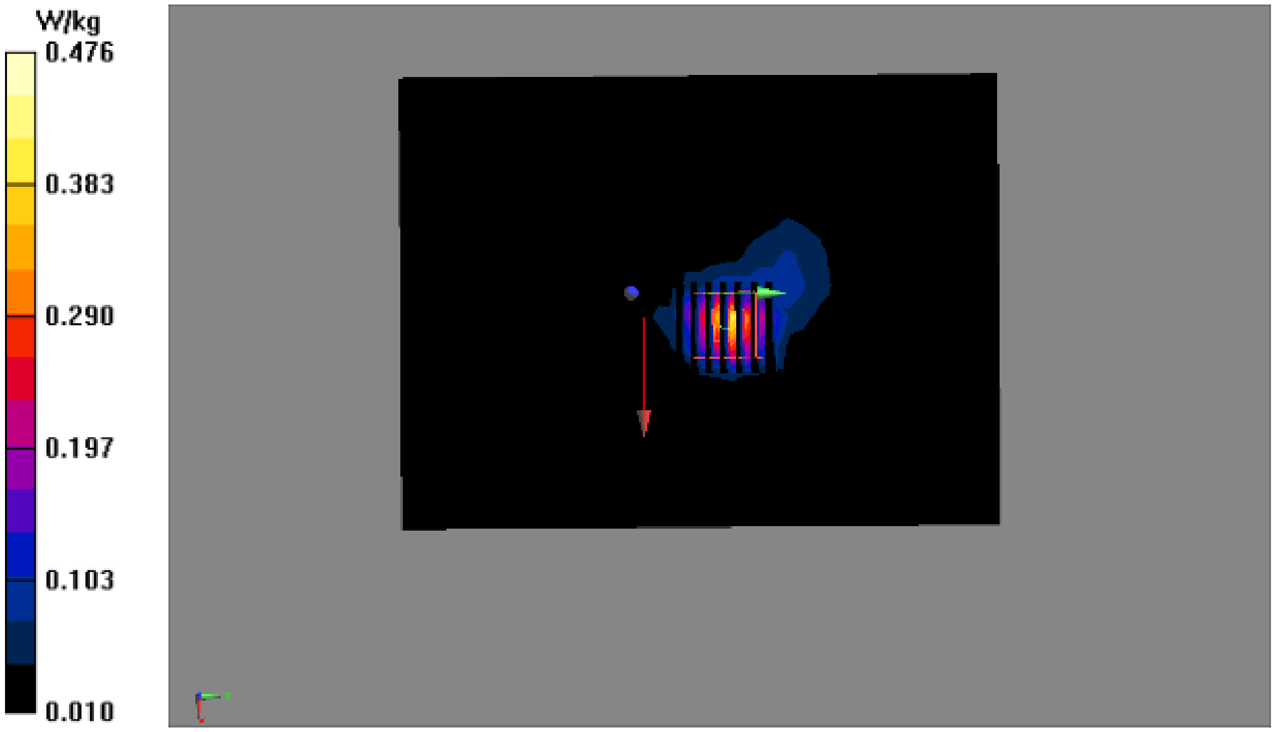
**Test Laboratory: AGC Lab** **Date: July 06,2015**
**802.11b Mid- Body- Back (DTS)**
**DUT: rugged tablet; Type: T80**

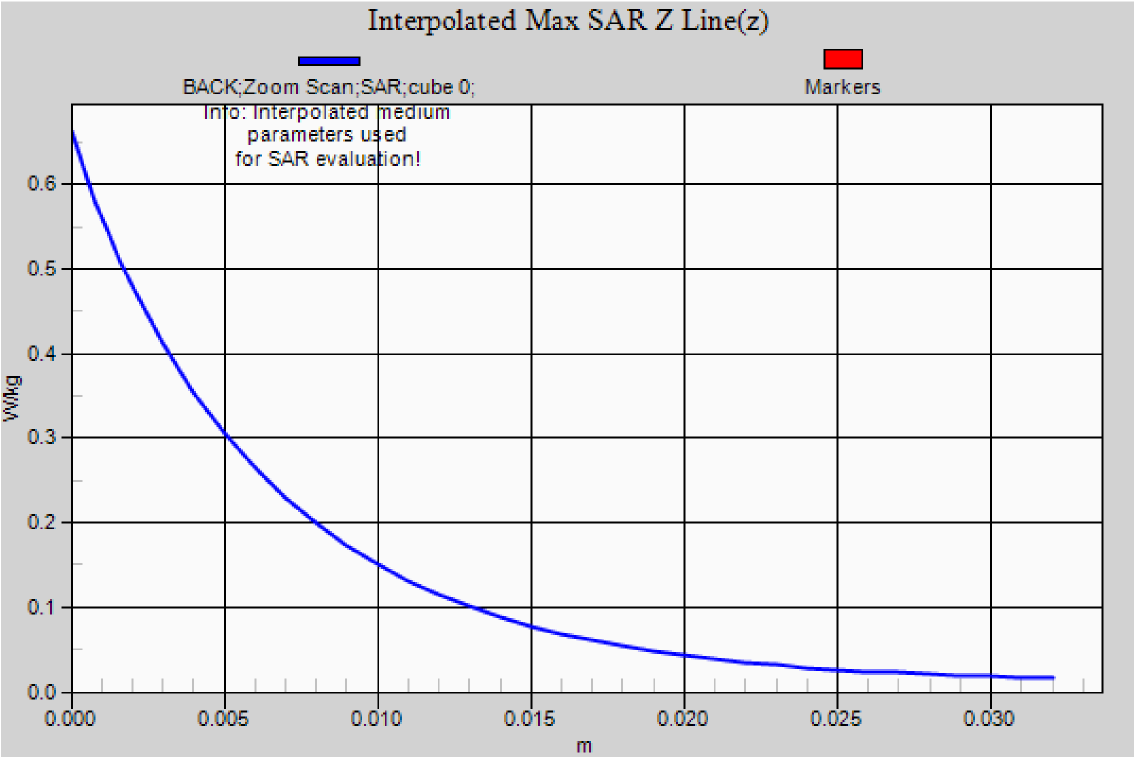
Communication System: UID 0, WiFi 802.11b (0); Communication System Band: 802.11b; Duty Cycle: 1:1;
Frequency: 2437 MHz; Medium parameters used: f = 2450 MHz; σ=1.92 mho/m; εr =53.34;; ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃): 22.2, Liquid temperature (℃): 22.0

DASY Configuration:
Probe: EX3DV4 - SN3953; ConvF(7.48, 7.48, 7.48); Calibrated: 11/06/2014
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 03/11/2015
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**B-WIFI/BACK/Area Scan (16x21x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.425 W/kg

**B-WIFI/BACK/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.137 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.663 W/kg
**SAR(1 g) = 0.298 W/kg; SAR(10 g) = 0.124 W/kg**
Maximum value of SAR (measured) = 0.476 W/kg




Interpolated Max SAR Z Line(z)
BACK;Zoom Scan;SAR;cube 0;
Markers
Info: Interpolated medium
parameters used
for SAR evaluation!
W/kg
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

## APPENDIX C. TEST SETUP PHOTOGRAPHS & EUT PHOTOGRAPHS

Refer to Attached files.

## APPENDIX D. CALIBRATION DATA

Refer to Attached files.