# TEST REPORT

| | |
|---|---|
| **Report Reference No.....:** | **A1407096052-SAR** |
| **FCC ID..... :** | **2ACWO-TM7** |
| Compiled by ( position+printed name+signature)..: | File administrators Tony Li |
| Supervised by ( position+printed name+signature)..: | Technique principal Robin Fang |
| Approved by ( position+printed name+signature)..: | Manager James Wu |
| Date of issue.....: | July,26 2014 |
| Representative Laboratory Name ....: | Shenzhen CTL Electron Technology Co., Ltd. |
| Address.....: | A0402, Block 1, Kefa Industrial District, Huanguan Nan Rd, Xintian community, Guanlan, Baoan, Shenzhen, China |
| Testing Laboratory Name.....: | The Testing and Technology Center for Industrial Products of Shenzhen Entry-Exit Inspection and Quarantine Bureau |
| Address.....: | No.289, 8th Industry Road, NanshanDistrict,Shenzhen,Guangdong |
| **Applicant's name.....:** | **AURA TECHNOLOGY LIMTED** |
| Address.....: | FLAT/RM810, Star House, 3 Salisbury Road, Tsimshatsui, Hong Kong |
| **Test specification ..... :** | |
| Standard .....: | **ANSI C95.1–1999**<br>**47CFR §2.1093** |
| TRF Originator.....: | Shenzhen CTL Electron Technology Co., Ltd. |
| Master TRF.....: | Dated 2012-06 |

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| | |
|---|---|
| **Test item description .....:** | Telpad |
| Trade Mark .....: | / |
| Manufacturer .....: | SHENZHEN KWANG SUNG ELECTRONICS CO.,LTD |
| Model/Type reference.....: | TM7 |
| Listed Models .....: | / |
| Rating .....: | DC 3.70V/DC 5.0V adapter from AC120V/60Hz |
| Android Version .....: | Android 4.1.1 |
| Result.....: | **PASS** |

# T E S T R E P O R T

| Test Report No. : | A1407096052-SAR | July,26 2014<br>Date of issue |
|---|---|---|

| | | |
|---|---|---|
| Equipment under Test | : | Telpad |
| Model /Type | : | TM7 |
| Listed Models | : | / |
| **Applicant** | : | **AURA TECHNOLOGY LIMTED** |
| Address | : | FLAT/RM810, Star House, 3 Salisbury Road, Tsimshatsui, Hong Kong |
| **Manufacturer** | : | **SHENZHEN KWANG SUNG ELECTRONICS CO.,LTD** |
| Address | : | Shitoushan Industrial Zone, Shi Yan Town, Baoan District, Shenzhen, PRC |

| Test Result | PASS |
|---|---|

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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# 1. TEST STANDARDS

The tests were performed according to following standards:

IEEE Std C95.1, 1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz. It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.
IEEE Std 1528™-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.
KDB 447498 D01 Mobile Portable RF Exposure v05r01: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r02: SAR Measurement Requirements for 100 MHz to 6 GHz
KDB865664 D02 SAR Reporting v01: RF Exposure Compliance Reporting and Documentation Considerations
KDB248227: SAR measurement procedures for 802.112abg transmitters
FCC Part 2.1093 Radiofrequency Radiation Exposure Evaluation:Portable Devices
KDB 616217 D04 SAR for laptop and Internet Tablets v01: SAR Evaluation Considerations for Laptop, Notebook, Netbook and Internet Tablet Computers

# 2. SUMMARY

## 2.1. General Remarks

| | | |
|---|---|---|
| Date of receipt of test sample | : | July 25,2014 |
| | | |
| | | |
| Testing commenced on | : | July 25,2014 |
| | | |
| | | |
| Testing concluded on | : | July 25,2014 |

## 2.2. Product Description

The **AURA TECHNOLOGY LIMTED**'s Model: TM7 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

| | |
|---|---|
| Name of EUT | Telpad |
| Model Number | TM7 |
| FCC ID | 2ACWO-TM7 |
| WLAN | Supported 802.11b/802.11g/802.11n |
| Bluetooth | Supported BT v2.1+EDR |
| Antenna Type | Internal |
| WLAN FCC Operation frequency | IEEE 802.11b: 2412MHz—2462MHz<br>IEEE 802.11g: 2412MHz—2462MHz<br>IEEE 802.11n HT20: 2412MHz—2462MHz<br>IEEE 802.11n HT40: 2422MHz—2452MHz |
| Bluetooth FCC Operation frequency | 2402MHz-2480MHz |
| WLAN Modulation | IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)<br>IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK) |
| Bluetooth Modulation | GFSK,8DPSK,π/4DQPSK |
| Android Version | Android 4.1.1 |

## 2.3. Statement of Compliance

The maximum of results of SAR found during testing for TM7 are follows:

| Exposure Configuration | Technolohy Band | Highest Reported SAR 1g(W/Kg) | Equipment Class |
|---|---|---|---|
| Body-worn (Separation Distance 0mm) | WLAN2450 | **0.776** | DTS |

The SAR values found for the Telpad are below the maximum recommended levels of 1.6W/Kg as averaged over any 1g tissue accordintg to the ANSI C95.1-1999.
For body worn operation,this devices has been tested and meets FCC RF exposure guidelines when used with any accessory that conrtains no metal and which provides a minimum separation distance of 0mm between this devices and the body of the user.User of other accessories may not ensure compliance with FCC RF exposure guidelines.
The EUT battery must be fully charged and checked periodically during the test to ascertain iniform power output.

The highest reported SAR values is obtained at the case of,and the values are: **0.776W/Kg(1g).**

| Test Position | WLAN Reported SAR1g (W/Kg) | Bluetooth Estimated SAR (W/Kg) | Summation Reported SAR(1g) (W/kg) | SAR –to-peak-location Separation Ratio | Simultaneous Measurement Required? |
|---|---|---|---|---|---|
| Body-Rear Side | 0.776 | 0.0832 | **0.859** | 0.859<1.60 | No |
| Body-Bottom Side | 0.763 | 0.0832 | 0.846 | 0.846<1.60 | No |
| Body-Left Side | 0.587 | 0.0832 | 0.670 | 0.670<1.60 | No |

Note:1. The value with green color is the maximum values of standalone
2. The value with blue color is the maximum values of $\sum SAR_{1g}$

Accordint to the above tables,the highest sum of reported SAR values is **0.859W/Kg** for Body.

## 2.4. Equipment under Test

**Power supply system utilised**

| | | | | | |
|---|---|---|---|---|---|
| Power supply voltage | : | ○ | 120V / 60 Hz | ○ | 115V / 60Hz |
| | | ○ | 12 V DC | ○ | 24 V DC |
| | | ● | Other (specified in blank below) | | |

DC 3.70 V/DC 5.0V Adapter from AC 120V/60Hz

## 2.5. Short description of the Equipment under Test (EUT)

2.4GHz (Telpad (M/N: TM7)).

The EUT battery must be fully charged and checked periodically during the test to ascertain maximum power output.

## 2.6. EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

● - supplied by the manufacturer

○ - supplied by the lab

| | | | |
|---|---|---|---|
| ○ | Power Cable | Length (m) : | / |
| | | Shield : | / |
| | | Detachable : | / |
| ○ | Multimeter | Manufacturer : | / |
| | | Model No. : | / |

**Battery information :**
Capacitance:3500mAh
Nominal Voltage:3.70V

**Adapter:**
MODEL:JHD-AP012U-050210AB
INPUT:100-240V～0.3A 50/60Hz 0.35A
OUTPUT: 5V DC 2100mA
Power Cable: 60cm
◇ Shielded ◆ Unshielded

## 2.7. Note

1. The EUT is a Telpad with WLAN and Bluetooth function,The functions of the EUT listed as below:

| | Test Standards | Reference Report |
|---|---|---|
| WLAN | FCC Part 15 Subpart C | A1407096052-RW |
| Bluetooth | FCC Part 15 Subpart C | A1407096052-RB |
| JBP | FCC Part 15 Subpart B | A1407096052-JBP |
| SAR | FCC Per 47 CFR 2.1093(d) | A1407096052-SAR |

# 3. TEST ENVIRONMENT

## 3.1. Address of the test laboratory

**The Testing and Technology Center for Industrial Products of Shenzhen Entry-Exit Inspection and Quarantine Bureau**
No.289, 8th Industry Road, Nanshan District, Shenzhen, Guangdong, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2009) and CISPR Publication 22.

## 3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

### CNAS-Lab Code: L2872

The Testing and Technology Center for Industrial Products of Shenzhen Entry-Exit Inspection and Quarantine Bureau has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: May 16, 2014. Valid time is until May 15, 2017.
Environmental conditions

## 3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

| | |
|---|---|
| Temperature: | 18-25 ° C |
| | |
| Humidity: | 40-65 % |
| | |
| Atmospheric pressure: | 950-1050mbar |

## 3.4. SAR Limits

FCC Limit (1g Tissue)

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

## 3.5. Equipments Used during the Test

| Test Equipment | Manufacturer | Type/Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Calibration Interval |
| Data Acquisition Electronics DAEx | SPEAG | DAE4 | 1315 | 2013/11/25 | 1 |
| E-field Probe | SPEAG | ES3DV3 | 3109 | 2013/11/29 | 1 |
| System Validation Dipole 2450V2 | SPEAG | D2450V2 | 884 | 2013/12/11 | 3 |
| Network analyzer | Agilent | 8753E | US37390562 | 2014/03/24 | 1 |
| Dielectric Probe Kit | Agilent | 85070E | US44020288 | / | / |
| Power meter | Agilent | E4417A | GB41292254 | 2014/03/24 | 1 |
| Power sensor | Agilent | 8481H | MY41095360 | 2014/03/24 | 1 |
| Signal generator | IFR | 2032 | 203002/100 | 2013/10/26 | 1 |
| Amplifier | AR | 75A250 | 302205 | 2013/10/26 | 1 |

# 4. SAR Measurements System configuration

## 4.1. SAR Measurement Set-up

The DASY5 system for performing compliance tests consists of the following items:

A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).

A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

A data acquisition electronic (DAE) which performs the signal amplification, 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.

A unit to operate the optical surface detector which is connected to the EOC.

The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.

The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003.

DASY5 software and SEMCAD data evaluation software.

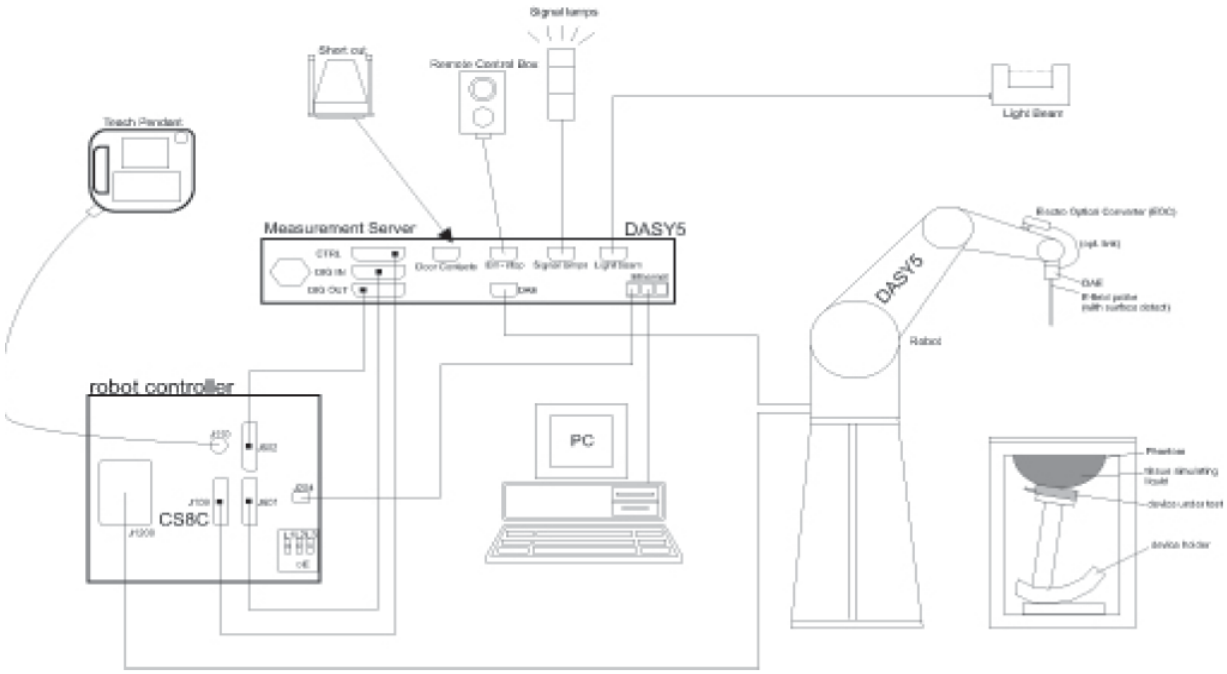
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

The generic twin phantom enabling the testing of left-hand and right-hand usage.

The device holder for handheld mobile phones.

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles allowing to validate the proper functioning of the system.



## 4.2. DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe ES3DV3 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

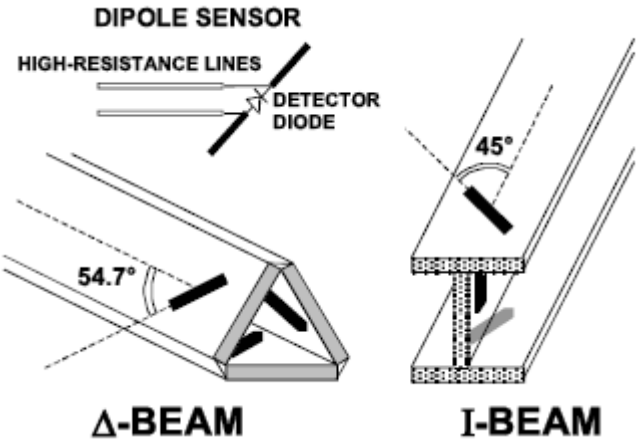
Probe Specification

| | |
|---|---|
| Construction | Symmetrical design with triangular core<br>Interleaved sensors<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| Calibration | ISO/IEC 17025 calibration service available. |
| Frequency | 10 MHz to 4 GHz;<br>Linearity: ± 0.2 dB (30 MHz to 4 GHz) |
| Directivity | ± 0.2 dB in HSL (rotation around probe axis)<br>± 0.3 dB in tissue material (rotation normal to probe axis) |
| Dynamic Range | 5 µW/g to > 100 mW/g;<br>Linearity: ± 0.2 dB |
| Dimensions | Overall length: 337 mm (Tip: 20 mm)<br>Tip diameter: 3.9 mm (Body: 12 mm)<br>Distance from probe tip to dipole centers: 2.0 mm |
| Application | General dosimetry up to 4 GHz<br>Dosimetry in strong gradient fields<br>Compliance tests of mobile phones |
| Compatibility | DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI |

Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



## 4.3. Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM Twin Phantom

## 4.4. Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

Device holder supplied by SPEAG

## 4.5. Scanning Procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ± 5 %.

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

Area Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot.Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

Zoom Scan
Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

Spatial Peak Detection
The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses.The DASY5 system allows evaluations that combine measured data and robot positions, such as: • maximum search • extrapolation • boundary correction • peak search for averaged SAR During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard’s method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard’s method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

## 4.6. Data Storage and Evaluation

Data Storage
The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “.DA4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation
The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

| | | |
|---|---|---|
| Probe parameters: | - Sensitivity | Normi, ai0, ai1, ai2 |
| | - Conversion factor | ConvFi |
| | - Diode compression point | Dcpi |
| Device parameters: | - Frequency | f |
| | - Crest factor | cf |
| Media parameters: | - Conductivity | σ |
| | - Density | ρ |

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

With Vi = compensated signal of channel i ( i = x, y, z )
Ui = input signal of channel i ( i = x, y, z )
cf = crest factor of exciting field (DASY parameter)
dcpi = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E} - \text{fieldprobes}: \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\text{H} - \text{fieldprobes}: \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

With Vi = compensated signal of channel i (i = x, y, z)
Normi = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)2] for E-field Probes
ConvF = sensitivity enhancement in solution
aij = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strength of channel i in V/m
Hi = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

with SAR = local specific absorption rate in mW/g
Etot = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

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

The liquid is consisted of water,salt,Glycol,Sugar,Preventol and Cellulose.The liquid has previously been proven to be suited for worst-case.It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB865664.

| Target Frequency (MHz) | Head | | Body | |
|---|---|---|---|---|
| | $\varepsilon_r$ | σ(S/m) | $\varepsilon_r$ | σ(S/m) |
| 150 | 52.3 | 0.76 | 61.9 | 0.80 |
| 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 | 0.98 | 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 |

## 4.8. Tissue equivalent liquid properties

Dielectric performance of Body tissue simulating liquid

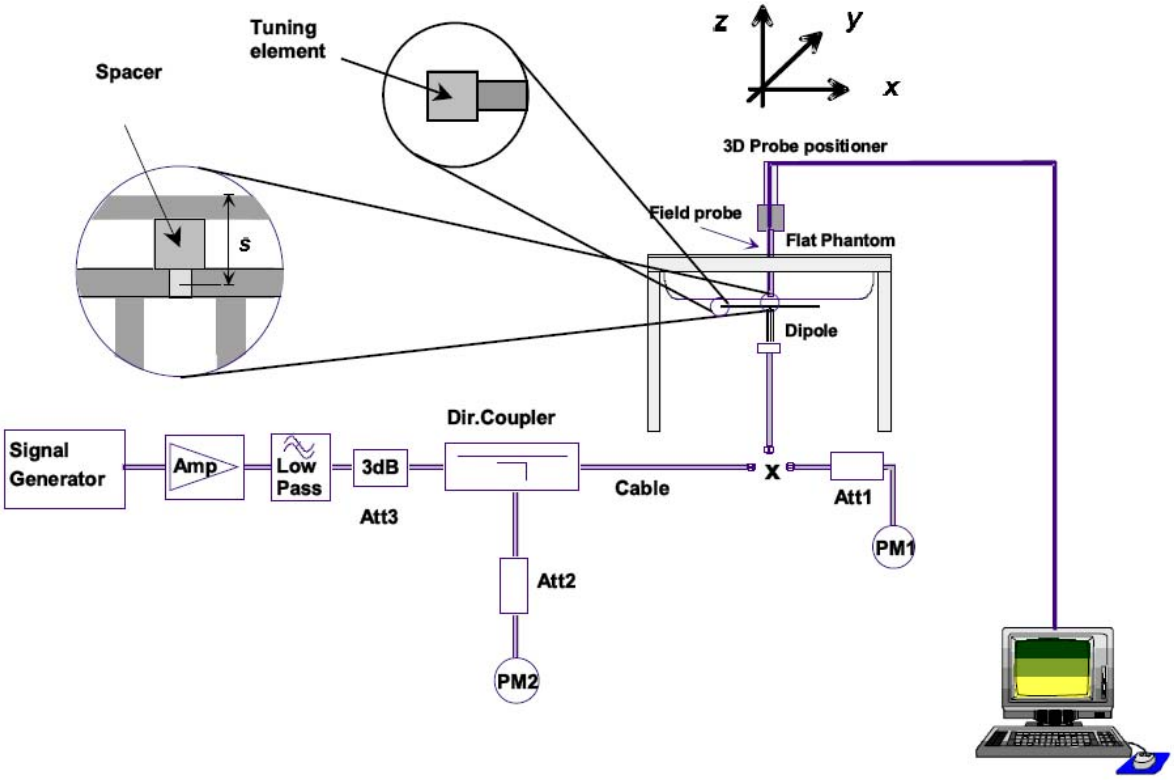
| Tissue Type | Measured Frequency (MHz) | Target Tissue | | Measured Tissue | | Liquid Temp. | Test Data |
|---|---|---|---|---|---|---|---|
| | | $\varepsilon_r$ | σ | $\varepsilon_r$ | σ | | |
| 2450B | 2412 | 52.75 (50.11～55.39) | 1.91 (1.81～2.01) | 52.70 | 1.96 | 22 degree | 2014-07-25 |
| | 2437 | 52.72 (50.08～55.36) | 1.94 (1.84～2.04) | 52.60 | 2.00 | | |
| | 2450 | 52.7 (50.07～55.34) | 1.95 (1.85～2.05) | 52.60 | 2.02 | | |
| | 2462 | 52.68 (50.05～55.31) | 1.97 (1.87～2.07) | 52.60 | 2.03 | | |

## 4.9. System Check

The purpose of the system check is to verify that the system operates within its specifications at the decice test frequency.The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.




The output power on dipole port must be calibrated to 24 dBm (250mW) before dipole is connected.

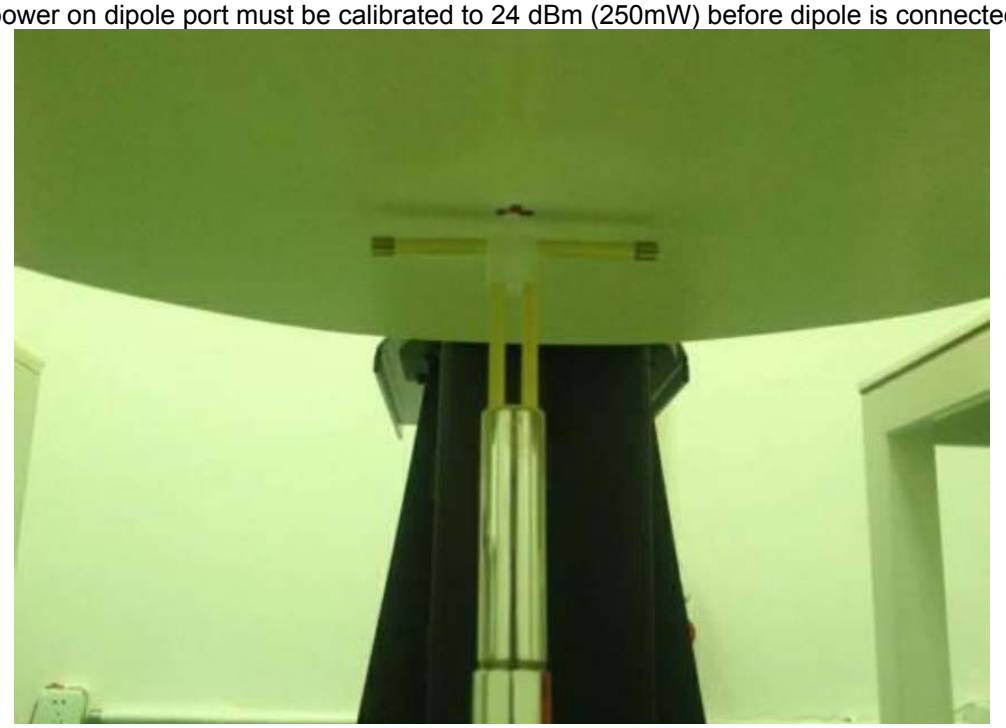


Photo of Dipole Setup

System Validation of Body

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Measurement is made at temperature 22.0 ℃ and relative humidity 55%. | | | | | | | |
| Liquid temperature 22.0 ℃ | | | | | | | |
| Measurement Date: 2450MHz July 25th, 2014 | | | | | | | |
| Verification results | Frequency (MHz) | Target value (W/kg) | | Measured value (W/kg) | | Deviation | |
| | | 1 g Average | 10 g Average | 1 g Average | 10 g Average | 1 g Average | 10 g Average |
| | 2450 | 12.90 | 5.98 | 12.81 | 5.94 | -0.70% | -0.67% |

## 4.10. SAR measurement procedure

### 4.10.1 Tests to be performed

In order to determine the highest value of the peak spatial-average SAR of a handset, all device positions, configurations and operational modes shall be tested for each frequency band according to steps 1 to 3 below. A flowchart of the test process is shown in Picture 11.1.

Step 1: The tests described in 11.2 shall be performed at the channel that is closest to the centre of the transmit frequency band ($f_c$) for:

a). all device positions (cheek and tilt, for both left and right sides of the SAM phantom;

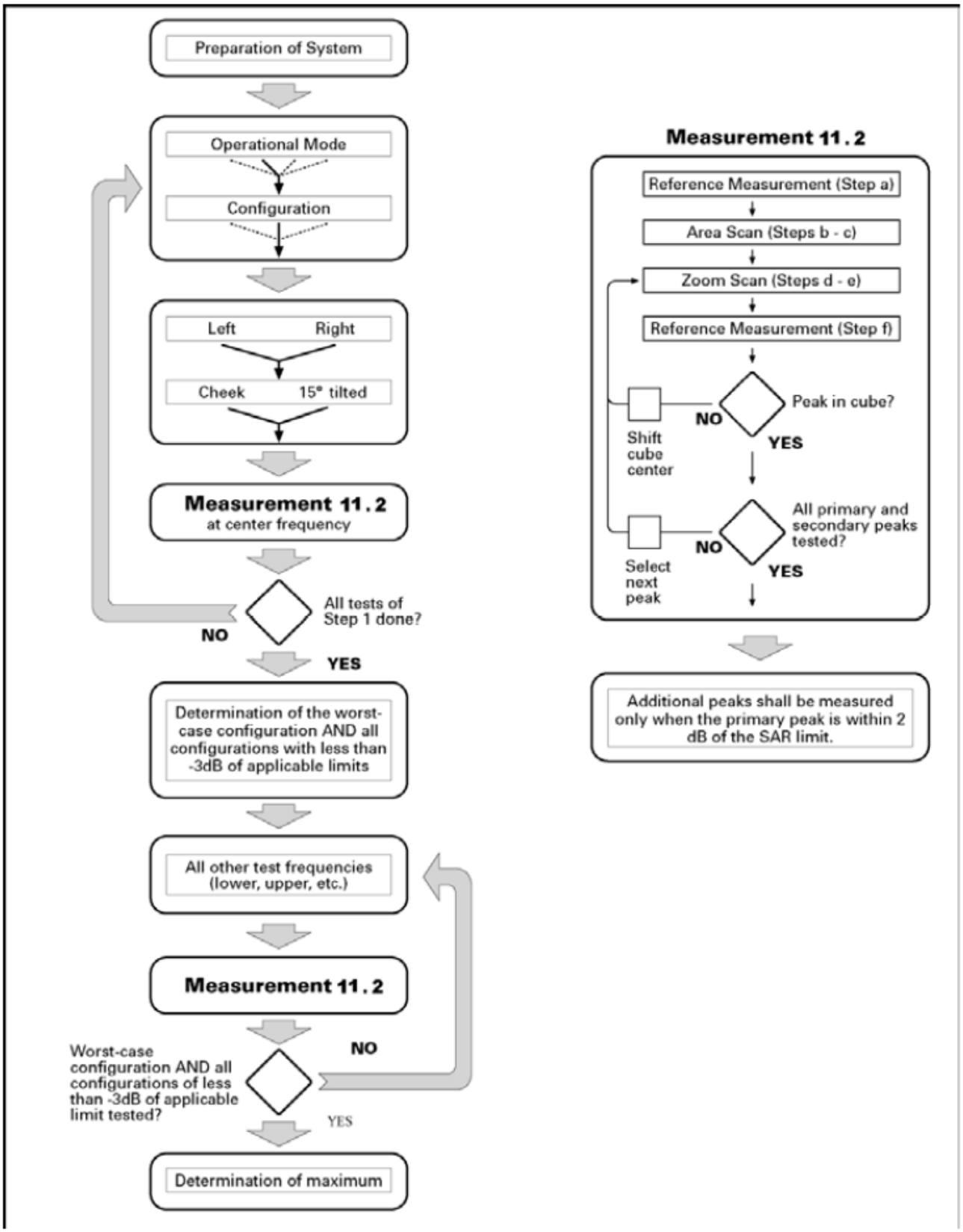
b). all configurations for each device position in a), e.g., antenna extended and retracted, and

c). all operational modes, e.g., analogue and digital, for each device position in a) and configuration in b) in each frequency band.

If more than three frequencies need to be tested according to 11.1 (i.e., $N_c > 3$), then all frequencies, configurations and modes shall be tested for all of the above test conditions.

Step 2: For the condition providing highest peak spatial-average SAR determined in Step 1, perform all tests described in 11.2 at all other test frequencies, i.e., lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the peak spatial-average SAR value determined in Step 1 is within 3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

Step 3: Examine all data to determine the highest value of the peak spatial-average SAR found in Steps 1 to 2.




Picture 10.1 Block diagram of the tests to be performed

**4.10.2 General Measurement Procedure**

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements,

according to the reference distribution functions specified in IEEE Std 1528-2003. The results should be documented as part of the system validation records and may be requested to support test results when all the measurement parameters in the following table are not satisfied.

| | | | ≤ 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. | |
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$ | | | ≤ 2 GHz: ≤ 8 mm<br>2 – 3 GHz: ≤ 5 mm* | 3 – 4 GHz: ≤ 5 mm*<br>4 – 6 GHz: ≤ 4 mm* |
| Maximum zoom scan spatial resolution, normal to phantom surface | uniform grid: $\Delta z_{Zoom}(n)$ | | ≤ 5 mm | 3 – 4 GHz: ≤ 4 mm<br>4 – 5 GHz: ≤ 3 mm<br>5 – 6 GHz: ≤ 2 mm |
| | graded grid | $\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface | ≤ 4 mm | 3 – 4 GHz: ≤ 3 mm<br>4 – 5 GHz: ≤ 2.5 mm<br>5 – 6 GHz: ≤ 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 | | ≥ 30 mm | 3 – 4 GHz: ≥ 28 mm<br>4 – 5 GHz: ≥ 25 mm<br>5 – 6 GHz: ≥ 22 mm |

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 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.

### 4.10.3 WLAN Measurement Procedures for SAR

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal. The Tx power is set to 58 for 802.11 b mode, set to 48 for 802.11 g mode, set to 40 for 802.11 n mode by software, This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1.

For the 802.11b/g/n SAR tests, a communication link is set up with the test mode software for WIFI mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the highest power rate.

802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g/n modes are tested on the maximum average output channel;

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

### 4.10.4 Power Drift

To control the output power stability during the SAR test, DASY5 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Table 14.1 to Table 14.11 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

### 4.10.4 Area Scan Based 1-g SAR

#### 4.10.4.1 Requirement of KDB

According to the KDB447498 D01 v05, when the implementation is based the specific polynomial fit algorithm as presented at the 29th Bioelectromagnetics Society meeting (2007) and the estimated 1-g SAR is ≤ 1.2 W/kg, a zoom scan measurement is not required provided it is also not needed for any other purpose; for example, if the peak SAR location required for simultaneous transmission SAR test exclusion can be determined accurately by the SAR system or manually to discriminate between distinctive peaks and scattered noisy SAR distributions from area scans.

There must not be any warning or alert messages due to various measurement concerns identified by the SAR system; for example, noise in measurements, peaks too close to scan boundary, peaks are too sharp, spatial resolution and uncertainty issues etc. The SAR system verification must also demonstrate that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR (See Annex B). When all the SAR results for each exposure condition in a frequency band and wireless mode are based on estimated 1-g SAR, the 1-g SAR for the highest SAR configuration must be determined by a zoom scan.

#### 4.10.4.2 Fast SAR Algorithms

The approach is based on the area scan measurement applying a frequency dependent attenuation parameter. This attenuation parameter was empirically determined by analyzing a large number of phones. The MOTOROLA FAST SAR was developed and validated by the MOTOROLA Research Group in Ft. Lauderdale.

In the initial study, an approximation algorithm based on Linear fit was developed. The accuracy of the algorithm has been demonstrated across a broad frequency range (136-2450 MHz) and for both 1- and 10-g averaged SAR using a sample of 264 SAR measurements from 55 wireless handsets. For the sample size studied, the root-mean-squared errors of the algorithm are 1.2% and 5.8% for 1- and 10-g averaged SAR, respectively

In the second step, the same research group optimized the fitting algorithm to an Polynomial fit whereby the frequency validity was extended to cover the range 30-6000MHz. Details of this study can be found in the BEMS 2007 Proceedings.

Both algorithms are implemented in DASY software.

# 5. TEST CONDITIONS AND RESULTS

## 5.1. Conducted Power Results

Max Conducted power measurement results and power drift from tune-up tolerance provide by manufacturer:

***WLAN***

| Mode | Channel | Frequency (MHz) | Worst case Data rate of worst case | Conducted Output Power (dBm) | |
|---|---|---|---|---|---|
| | | | | Peak | Average |
| 802.11b | 1 | 2412 | 1Mbps | 15.22 | 13.25 |
| | 6 | 2437 | 1Mbps | 15.97 | 13.76 |
| | 11 | 2462 | 1Mbps | 15.64 | 13.49 |
| 802.11g | 1 | 2412 | 6Mbps | 19.65 | 12.22 |
| | 6 | 2437 | 6Mbps | 19.94 | 12.22 |
| | 11 | 2462 | 6Mbps | 19.03 | 12.13 |
| 802.11n(20MHz) | 1 | 2412 | 6.5 Mbps | 20.22 | 10.28 |
| | 6 | 2437 | 6.5 Mbps | 20.36 | 10.19 |
| | 11 | 2462 | 6.5 Mbps | 20.85 | 10.34 |
| 802.11n(40MHz) | 3 | 2422 | 13.5 Mbps | 17.02 | 8.23 |
| | 6 | 2437 | 13.5 Mbps | 17.64 | 8.41 |
| | 9 | 2452 | 13.5 Mbps | 17.33 | 8.37 |

**Note:** SAR is not required for 802.11g/n channels if the output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels, and for each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB higher than those measured at the lowest data rate. According to the above conducted power, the EUT should be tested for “802.11b, 1Mbps”.

***Bluetooth***

| Mode | Channel | Frequency (MHz) | Conducted Peak Output Power (dBm) |
|---|---|---|---|
| GFSK | 00 | 2402 | 1.84 |
| | 39 | 2441 | 2.35 |
| | 78 | 2480 | 2.35 |
| 8DPSK | 00 | 2402 | 1.33 |
| | 39 | 2441 | 1.61 |
| | 78 | 2480 | 1.61 |
| π/4DQPSK | 00 | 2402 | 1.34 |
| | 39 | 2441 | 1.57 |
| | 78 | 2480 | 1.60 |

**Manufacturing tolerance**

**WLAN**

| **802.11b (Average)** | | | |
|---|---|---|---|
| Channel | Channel 1 | Channel 6 | Channel 11 |
| Target (dBm) | 13.0 | 13.0 | 13.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| **802.11g (Average)** | | | |
| Channel | Channel 810 | Channel 661 | Channel 512 |
| Target (dBm) | 12.0 | 12.0 | 12.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| **802.11n(20MHz) (Average)** | | | |
| Channel | Channel 1 | Channel 6 | Channel 11 |
| Target (dBm) | 10.0 | 10.0 | 10.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| **802.11n(40MHz) (Average)** | | | |
| Channel | Channel 3 | Channel 6 | Channel 9 |
| Target (dBm) | 8.0 | 8.0 | 8.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |

**Bluetooth**

| GFSK (Peak) | | | |
|---|---|---|---|
| Channel | Channel 00 | Channel 39 | Channel 78 |
| Target (dBm) | 2.0 | 2.0 | 2.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| **8PSK (Peak)** | | | |
| Channel | Channel 00 | Channel 39 | Channel 78 |
| Target (dBm) | 1.0 | 1.0 | 1.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| **π/4DQPSK (Peak)** | | | |
| Channel | Channel 00 | Channel 39 | Channel 78 |
| Target (dBm) | 1.0 | 1.0 | 1.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |

## 5.2. Simultaneous TX SAR Considerations

### 5.2.1 Introduction

The following procedures adopted from “FCC SAR Considerations for Cell Phones with Multiple Transmitters” are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter.
For the DUT,the WLAN and BT modules sharing difference antenna,and so these two modules can transmit signal simultaneously.

### 5.2.2 Transmit Antenna Separation Distances

The product can support WLAN and Bluetooth function,and WLAN and Bluetooth share difference antenna,according to following picture 1 showed that the diagonal dimension(21.7cm>20cm) and fihure 2 for antenna position of the DUT.So accroding to KDB 616217 and KDB447498 for SAR testing.

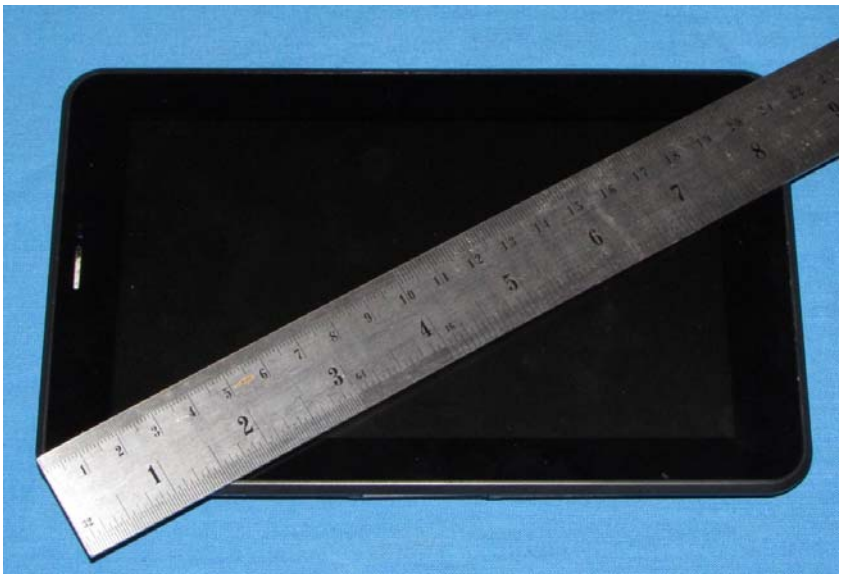


Figure 1:The diagonal dimension of the DUT

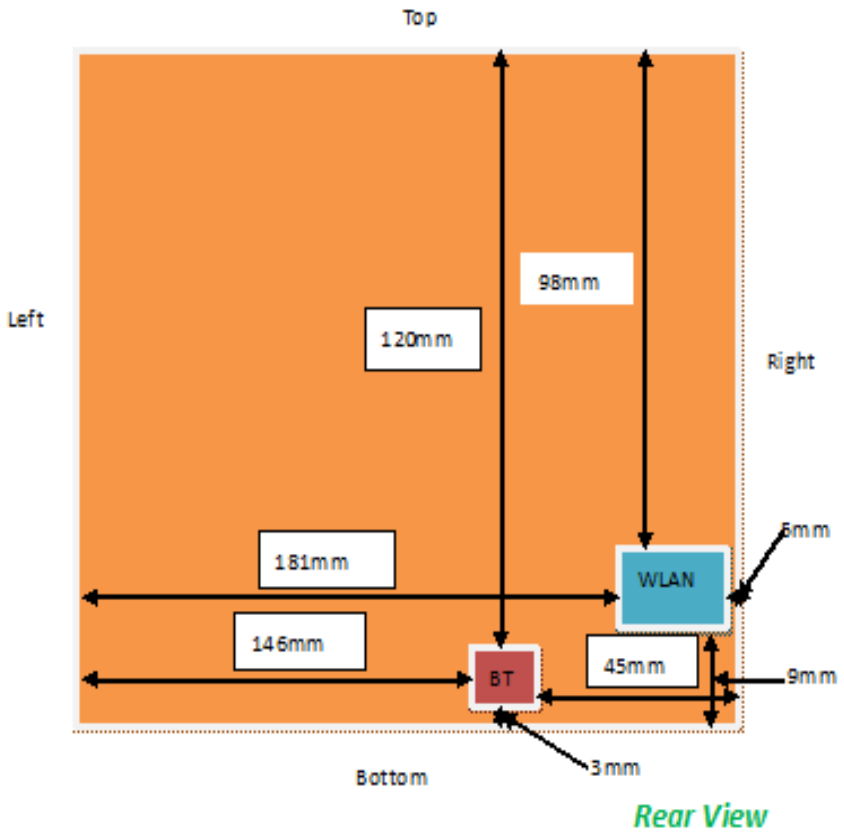



Figure 2:The antenna positions of the DUT

### 5.2.2 SAR Measurement Positions

According to KDB447498 and Figure 2 for antenna positions of the DUT;

1. Rear side: the Rear side of the EUT towards and contacted to the phantom.
2. Bottom side: SAR test was required. Beacuse the distance between WLAN antenna and Bottom side was 9mm,maximum average output power (including tune-up tolerance)14.0dBm>9.80dBm(9.56mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
3. Left side: SAR test was not required. Beacuse the distance between WLAN antenna and Left side was 181mm,maximum output power (including tune-up tolerance) 14.0dBm<31.47dBm(1408.59mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
4. Top side:SAR test was not required. Beacuse the distance between WLAN antenna and Top side was 98mm,maximum output power (including tune-up tolerance) 14.0dBm<27.60dBm(575.59mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
5. Right Side: SAR test was required. Beacuse the distance between WLAN antenna and Right side was 5mm,maximum output power (including tune-up tolerance)14.0dBm>9.80dBm(9.56mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
6. Front Side: SAR test was not required.
7. The 3/4 positions are not the most conservative antenna- to-user distance at edge mode. According to KDB 447498 4) ii) (2) –SAR is required only the edge with the most conservative exposure conditions, No SAR)

### 5.2.3 Standalone SAR Test Exclusion Considerations

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.

The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] ·[ √ f(GHz)] ≤ 3.0 for 1-g SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

**Appendix A**

**SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm**

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table.

| MHz | 5 | 10 | 15 | 20 | 25 | mm |
|---|---|---|---|---|---|---|
| 150 | 39 | 77 | 116 | 155 | 194 | SAR Test Exclusion Threshold (mW) |
| 300 | 27 | 55 | 82 | 110 | 137 | |
| 450 | 22 | 45 | 67 | 89 | 112 | |
| 835 | 16 | 33 | 49 | 66 | 82 | |
| 900 | 16 | 32 | 47 | 63 | 79 | |
| 1500 | 12 | 24 | 37 | 49 | 61 | |
| 1900 | 11 | 22 | 33 | 44 | 54 | |
| 2450 | 10 | 19 | 29 | 38 | 48 | |
| 3600 | 8 | 16 | 24 | 32 | 40 | |
| 5200 | 7 | 13 | 20 | 26 | 33 | |
| 5400 | 6 | 13 | 19 | 26 | 32 | |
| 5800 | 6 | 12 | 19 | 25 | 31 | |

Picture 12.2 Power Thresholds

Table 5.2.3.1 Standalone SAR test exclusion considerations

| Band/Mode | F(GHz) | SAR test exclusion threshold (mW) | RF output power | | SAR test exclusion |
|---|---|---|---|---|---|
| | | | dBm | mW | |
| Bluetooth | 2.441 | 9.67 | 3.00 | 2.00 | Yes |
| 2.4GHz WLAN | 2.45 | 9.56 | 14.00 | 25.12 | No |

### 5.2.4 Estimated SAR

When standalone SAR is not required to be measured per FCC KDB 447498 D01,the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

$$\text{Estimated SAR}=\frac{(\text{max.power of channel,including tune-up tolerance,mW})}{(\text{min.test separation distance,mm})}*\frac{\sqrt{f(GHz)}}{7.5}$$

Per FCC KD B447498 D01,simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the transmitting antenna in a specific a physical test configuration is ≤1.6 W/Kg.When the sum is greater than the SAR limit,SAR test exclusion is determined by the SAR to peak location separation ratio.

$$\text{Ratio}=\frac{(\text{SAR}_1+\text{SAR}_2)^{1.5}}{(\text{peak location separation,mm})}<0.04$$

For Bluetooth,the Estimated SAR for Body at 5mm.

**Estimated $SAR_{Body}$=((1.995mW)/5mm)*(1.5627/7.5)=0.832W/Kg**

### 5.2.5 Evaluation of Simultaneous SAR

***WLAN & BT Mode***

| Test Position | WLAN Reported SAR1g (W/Kg) | Bluetooth Estimated SAR (W/Kg) | Summation Reported SAR(1g) (W/kg) | SAR –to-peak-location Separation Ratio | Simultaneous Measurement Required? |
|---|---|---|---|---|---|
| Body-Rear Side | 0.776 | 0.0832 | **0.859** | 0.859<1.60 | No |
| Body-Bottom Side | 0.763 | 0.0832 | 0.846 | 0.846<1.60 | No |
| Body-Left Side | 0.587 | 0.0832 | 0.670 | 0.670<1.60 | No |

## 5.3. SAR Measurement Results

It is determined by user manual for the distance between the EUT and the phantom bottom.The distance is 5mm and just applied to the condition of body worn accessory.
The calculated SAR is obtained by the following formula:

Reported SAR=Measured SAR*$10^{(Ptarget-Pmeasured))/10}$
Scaling factor=$10^{(Ptarget-Pmeasured))/10}$
Reported SAR= Measured SAR* Scaling factor

Where $P_{target}$ is the power of manufacturing upper limit;
$P_{measured}$ is the measured power;
Measured SAR is measured SAR at measured power which including power drift)
Reported SAR which including Power Drift and Scaling factor

**Duty Cycle**

| Test Mode | Duty Cycle |
|---|---|
| WLAN2450 | 1:1 |

***SAR Values (WLAN 2450-Body)***

| Test Frequency | | Test Position | Maximum Allowed Power (dBm) | Conducted Power (dBm) | Measurement SAR over 1g(W/kg) | Power drift | Scaling Factor | Reported SAR over1g (W/kg) | SAR limit 1g (W/kg) | Ref. Plot # |
|---|---|---|---|---|---|---|---|---|---|---|
| Ch | MHz | | | | | | | | | |
| 6 | 2437 | Front | 14.00 | 13.76 | N/A | N/A | N/A | N/A | N/A | N/A |
| 6 | 2437 | Rear | 14.00 | 13.76 | **0.732** | **-0.04** | **1.06** | **0.776** | 1.60 | 1 |
| 6 | 2437 | Left | 14.00 | 13.76 | 0.720 | -0.02 | 1.06 | 0.763 | 1.60 | N/A |
| 6 | 2437 | Top | 14.00 | 13.76 | N/A | N/A | N/A | N/A | N/A | N/A |
| 6 | 2437 | Right | 14.00 | 13.76 | N/A | N/A | N/A | N/A | N/A | N/A |
| 6 | 2437 | Bottom | 14.00 | 13.76 | 0.554 | 0.11 | 1.16 | 0.587 | 1.60 | N/A |

*Note: 1.According to KDB447498,When the 1-g SAR for the mid-band channel,or the channel with highest output power satidfy the following conditions,testing of the other channels in the band is not required.*
*≤0.8W/Kg and transmission band ≤100MHz;*
*≤0.6W/Kg and 100MHz ≤transmission band ≤200MHz;*
*≤ 0.4W/Kg and transmission band >200MHz*
*2.Accoding to KDB 248227,Each channel should be tested at the lowest data rate in each mode.*

## 5.4. SAR Measurement Variability

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. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. The following procedures are applied to determine if repeated measurements are required.

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 ≥ 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 ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

## 5.5. Measurement Uncertainty (300MHz-3GHz)

| Accoroding to IEEE 1528:2013 and IEC62209-1/2011(300MHz-3GHz range) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Error Description | Type | Uncertainty Value | Probably Distribution | Div. | (Ci) 1g | (Ci) 10g | Std. Unc. (1g) | Std. Unc. (10g) | Degree of freedom |
| Measurement System | | | | | | | | | | |
| 1 | Probe calibration | B | 5.50% | N | 1 | 1 | 1 | 5.50% | 5.50% | ∞ |
| 2 | Axial isotropy | B | 4.70% | R | $\sqrt{3}$ | 0.7 | 0.7 | 1.90% | 1.90% | ∞ |
| 3 | Hemispherical isotropy | B | 9.60% | R | $\sqrt{3}$ | 0.7 | 0.7 | 3.90% | 3.90% | ∞ |
| 4 | Boundary Effects | B | 1.00% | R | $\sqrt{3}$ | 1 | 1 | 0.60% | 0.60% | ∞ |
| 5 | Probe Linearity | B | 4.70% | R | $\sqrt{3}$ | 1 | 1 | 2.70% | 2.70% | ∞ |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Detection limit | B | 1.00% | R | $\sqrt{3}$ | 1 | 1 | 0.60% | 0.60% | ∞ |
| 7 | RF ambient conditions-noise | B | 0.00% | R | $\sqrt{3}$ | 1 | 1 | 0.00% | 0.00% | ∞ |
| 8 | RF ambient conditions-reflection | B | 0.00% | R | $\sqrt{3}$ | 1 | 1 | 0.00% | 0.00% | ∞ |
| 9 | Response time | B | 0.80% | R | $\sqrt{3}$ | 1 | 1 | 0.50% | 0.50% | ∞ |
| 10 | Integration time | B | 5.00% | R | $\sqrt{3}$ | 1 | 1 | 2.90% | 2.90% | ∞ |
| 11 | RF ambient | B | 3.00% | R | $\sqrt{3}$ | 1 | 1 | 1.70% | 1.70% | ∞ |
| 12 | Probe positioned mech. restrictions | B | 0.40% | R | $\sqrt{3}$ | 1 | 1 | 0.20% | 0.20% | ∞ |
| 13 | Probe positioning with respect to phantom shell | B | 2.90% | R | $\sqrt{3}$ | 1 | 1 | 1.70% | 1.70% | ∞ |
| 14 | Max.SAR evalation | B | 3.90% | R | $\sqrt{3}$ | 1 | 1 | 2.30% | 2.30% | ∞ |
| Test Sample Related | | | | | | | | | | |
| 15 | Test sample positioning | A | 1.86% | N | 1 | 1 | 1 | 1.86% | 1.86% | ∞ |
| 16 | Device holder uncertainty | A | 1.70% | N | 1 | 1 | 1 | 1.70% | 1.70% | ∞ |
| 17 | Drift of output power | B | 5.00% | R | $\sqrt{3}$ | 1 | 1 | 2.90% | 2.90% | ∞ |
| Phantom and Set-up | | | | | | | | | | |
| 18 | Phantom uncertainty | B | 4.00% | R | $\sqrt{3}$ | 1 | 1 | 2.30% | 2.30% | ∞ |
| 19 | Liquid conductivity (target) | B | 5.00% | R | $\sqrt{3}$ | 0.64 | 0.43 | 1.80% | 1.20% | ∞ |
| 20 | Liquid conductivity (meas.) | A | 0.50% | N | 1 | 0.64 | 0.43 | 0.32% | 0.26% | ∞ |
| 21 | Liquid permittivity (target) | B | 5.00% | R | $\sqrt{3}$ | 0.64 | 0.43 | 1.80% | 1.20% | ∞ |
| 22 | Liquid cpermittivity (meas.) | A | 0.16% | N | 1 | 0.64 | 0.43 | 0.10% | 0.07% | ∞ |
| Combined standard uncertainty | $u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$ | | / | / | / | / | / | 10.20% | 10.00% | ∞ |
| Expanded uncertainty (confidence interval of 95 %) | $u_e = 2u_c$ | | / | R | K=2 | / | / | 20.40% | 20.00% | ∞ |

## 5.6. System Check Results

**System Performance Check at 2450 MHz Body**

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 884

Date/Time: 7/25/2014 AM

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

Medium parameters used (interpolated): f = 2450 MHz; $\sigma$ = 2.02 S/m; $\varepsilon_r$ = 52.60; $\rho$ = 1000 kg/m$^3$

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3109 ConvF(4.35, 4.35, 4.35); Calibrated: 29/11/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 11/25/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x91x1):** Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) = 14.93 mW/g

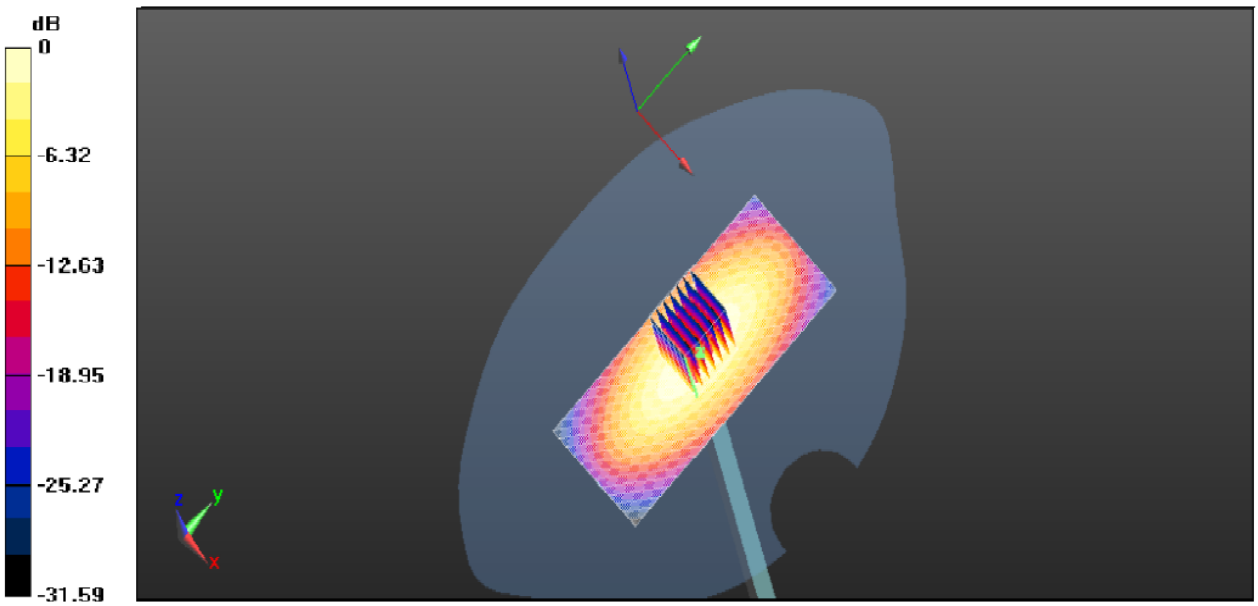
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.112 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 16.94 mW/g

**SAR(1 g) = 12.81 mW/g; SAR(10 g) = 5.94 mW/g**

Maximum value of SAR (measured) = 15.07 mW/g




0 dB = 15.07 mW/g = 23.56 dB mW/g

System Performance Check 2450MHz Body 250mW

## 5.7. SAR Test Graph Results

*SAR plots for the **highest measured SAR** in each exposure configuration, wireless mode and frequency band combination according to FCC KDB 865664 D02*

**WLAN2450 Rear Side Middle Channel -Channel 6-2437MHz (1Mbps)**

Communication System: Customer System; Frequency: 2437 MHz;Duty Cycle:1:1

Medium parameters used (interpolated): f = 2437 MHz; σ =2.00 S/m; $\varepsilon_r$ = 52.60; ρ = 1000 kg/m$^3$

Phantom section: Body- worn

Probe: ES3DV3 - SN3109 ConvF(4.35, 4.35, 4.35); Calibrated: 29/11/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 11/25/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (31x91x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.784 W/kg

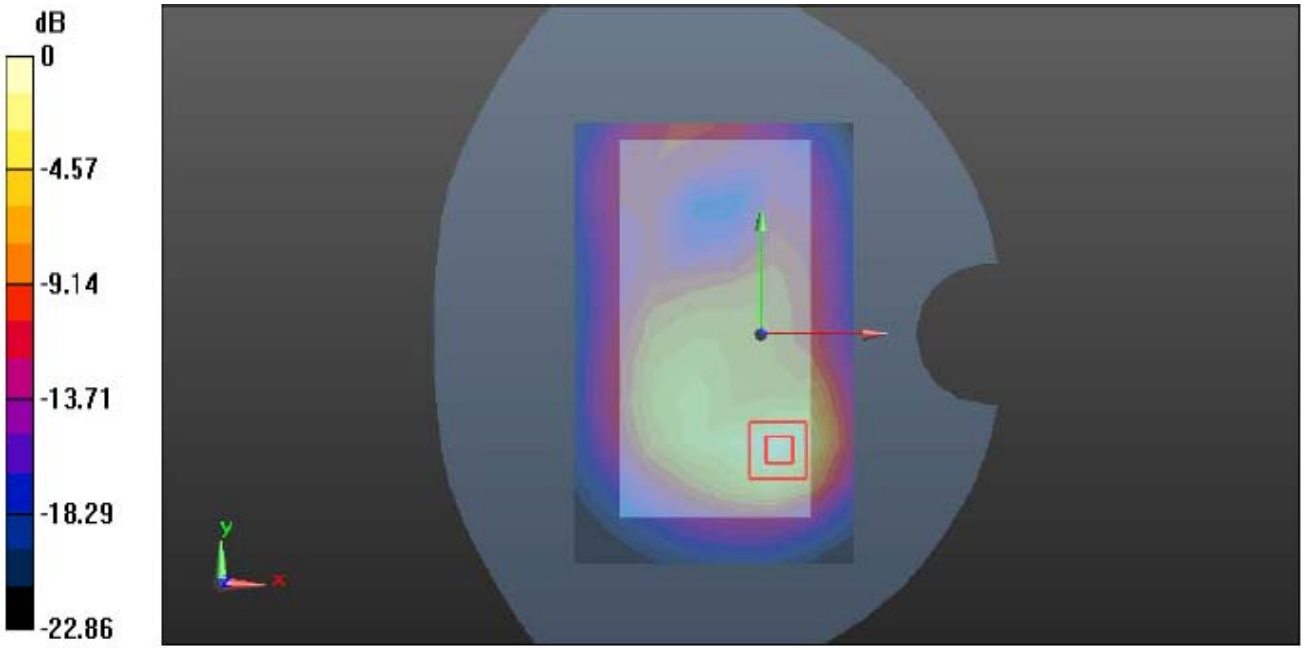
**Zoom Scan (7x7x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.220 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.45 W/Kg

**SAR(1 g) = 0.732 W/Kg; SAR(10 g) = 0.357 W/Kg**

Maximum value of SAR (measured) = 0.825 W/kg




0dB = 0.784 W/kg = -1.06 dBW/kg

Plot 1: Rear Side (WLAN2450-Middle Channel-Channel 6-2437MHz(1Mbps))

# 6. Calibration Certificate

## 6.1. Probe Calibration Ceriticate

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Client **SZJTT** **Certificate No: J13-2-3046**

**CALIBRATION CERTIFICATE**

| | |
|---|---|
| Object | ES3DV3 - SN:3109 |
| Calibration Procedure(s) | TMC-OS-E-02-195<br>Calibration Procedures for Dosimetric E-field Probes |
| Calibration date: | November 29, 2013 |

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power Meter NRP2 | 101919 | 01-Jul-13 (TMC, No.JW13-044) | Jun-14 |
| Power sensor NRP-Z91 | 101547 | 01-Jul-13 (TMC, No.JW13-044) | Jun-14 |
| Power sensor NRP-Z91 | 101548 | 01-Jul-13 (TMC, No.JW13-044) | Jun-14 |
| Reference10dBAttenuator | BT0520 | 12-Dec-12(TMC,No.JZ12-867) | Dec-14 |
| Reference20dBAttenuator | BT0267 | 12-Dec-12(TMC,No.JZ12-866) | Dec-14 |
| Reference Probe EX3DV4 | SN 3846 | 03-Sep-13(SPEAG,No.EX3-3846_Sep13) | Sep-14 |
| DAE4 | SN 777 | 22-Feb-13 (SPEAG, DAE4-777_Feb13) | Feb -14 |
| **Secondary Standards** | **ID #** | **Cal Date(Calibrated by, Certificate No.)** | **Scheduled Calibration** |
| SignalGeneratorMG3700A | 6201052605 | 01-Jul-13 (TMC, No.JW13-045) | Jun-14 |
| Network Analyzer E5071C | MY46110673 | 15-Feb-13 (TMC, No.JZ13-781) | Feb-14 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Yu Zongying | SAR Test Engineer | |
| Reviewed by: | Qi Dianyuan | SAR Project Leader | |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory | |

Issued: December 2, 2013

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 |
| NORMx,y,z | sensitivity in free space |
| ConvF | sensitivity in TSL / NORMx,y,z |
| DCP | diode compression point |
| CF | crest factor (1/duty_cycle) of the RF signal |
| A,B,C,D | modulation dependent linearization parameters |
| Polarization Φ | Φ rotation around probe axis |
| Polarization θ | θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i θ=0 is normal to probe axis |

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

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

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005

**Methods Applied and Interpretation of Parameters:**

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the $E^2$-field uncertainty inside TSL (see below ConvF).
- *NORM(f)x,y,z = NORMx,y,z* 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.
- *DCPx,y,z:* 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.
- *Ax,y,z; Bx,y,z; Cx,y,z;VRx,y,z:*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≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. 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 NORMx,y,z* 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±50MHz to±100MHz.
- *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 *NORMx* (no uncertainty required).

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# Probe ES3DV3

# SN: 3109

Calibrated: November 29, 2013

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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# DASY – Parameters of Probe: ES3DV3 - SN: 3109

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|---|---|---|---|
| Norm(μV/(V/m)$^2$)[A] | 1.15 | 1.20 | 1.19 | ±10.8% |
| DCP(mV)[B] | 102.8 | 104.8 | 103.2 | |

## Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB√μV | C | D dB | VR mV | Unc[E] (k=2) |
|---|---|---|---|---|---|---|---|---|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 187.0 | ±2.3% |
| | | Y | 0.0 | 0.0 | 1.0 | | 195.4 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 193.3 | |

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

[A] The uncertainties of Norm X, Y, Z do not affect the $E^2$-field uncertainty inside TSL (see Page 5 and Page 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly 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 – Parameters of Probe: ES3DV3 - SN: 3109

## Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz][C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 850 | 41.5 | 0.92 | 6.00 | 6.00 | 6.00 | 0.46 | 1.47 | ±12% |
| 900 | 41.5 | 0.97 | 6.15 | 6.15 | 6.15 | 0.32 | 1.80 | ±12% |
| 1810 | 40.0 | 1.40 | 5.05 | 5.05 | 5.05 | 0.36 | 1.95 | ±12% |
| 1900 | 40.0 | 1.40 | 5.07 | 5.07 | 5.07 | 0.34 | 2.23 | ±12% |
| 2450 | 39.2 | 1.80 | 4.73 | 4.73 | 4.73 | 1.07 | 1.00 | ±12% |

[C] Frequency validity 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.
[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) 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 (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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# DASY – Parameters of Probe: ES3DV3 - SN: 3109

## Calibration Parameter Determined in Body Tissue Simulating Media

| f [MHz][C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 850 | 55.2 | 0.99 | 5.99 | 5.99 | 5.99 | 0.36 | 1.72 | ±12% |
| 900 | 55.0 | 1.05 | 6.07 | 6.07 | 6.07 | 0.39 | 1.62 | ±12% |
| 1810 | 53.3 | 1.52 | 4.71 | 4.71 | 4.71 | 0.32 | 2.57 | ±12% |
| 1900 | 53.3 | 1.52 | 4.62 | 4.62 | 4.62 | 0.40 | 2.09 | ±12% |
| 2450 | 52.7 | 1.95 | 4.35 | 4.35 | 4.35 | 0.72 | 1.36 | ±12% |

[C] Frequency validity 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.
[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) 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 (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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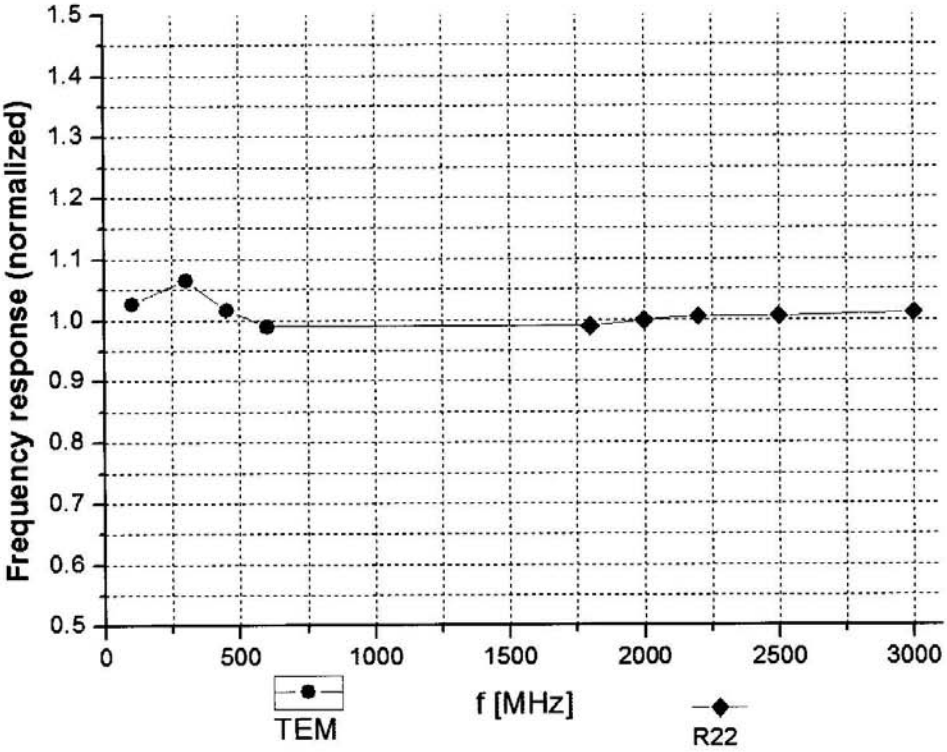
# Frequency Response of E-Field
## (TEM-Cell: ifi110 EXX, Waveguide: R22)




**Uncertainty of Frequency Response of E-field: ±7.5% (k=2)**

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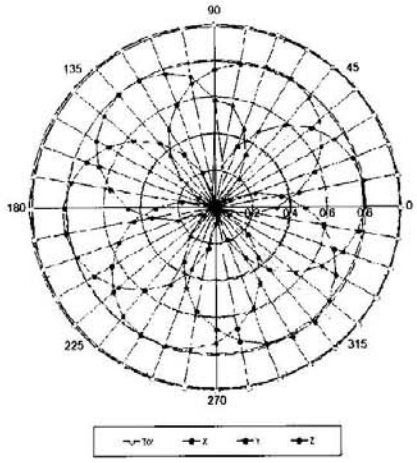
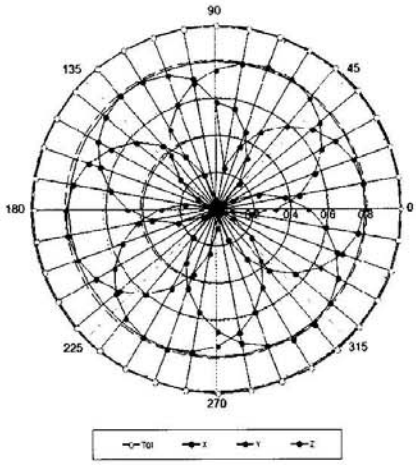
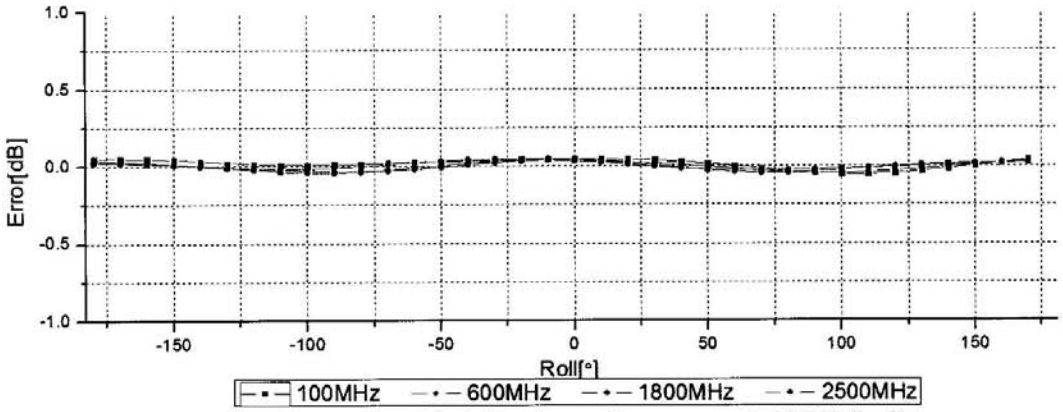
# Receiving Pattern (Φ), θ=0°

## f=600 MHz, TEM




## f=1800 MHz, R22




**Uncertainty of Axial Isotropy Assessment: ±0.9% (k=2)**

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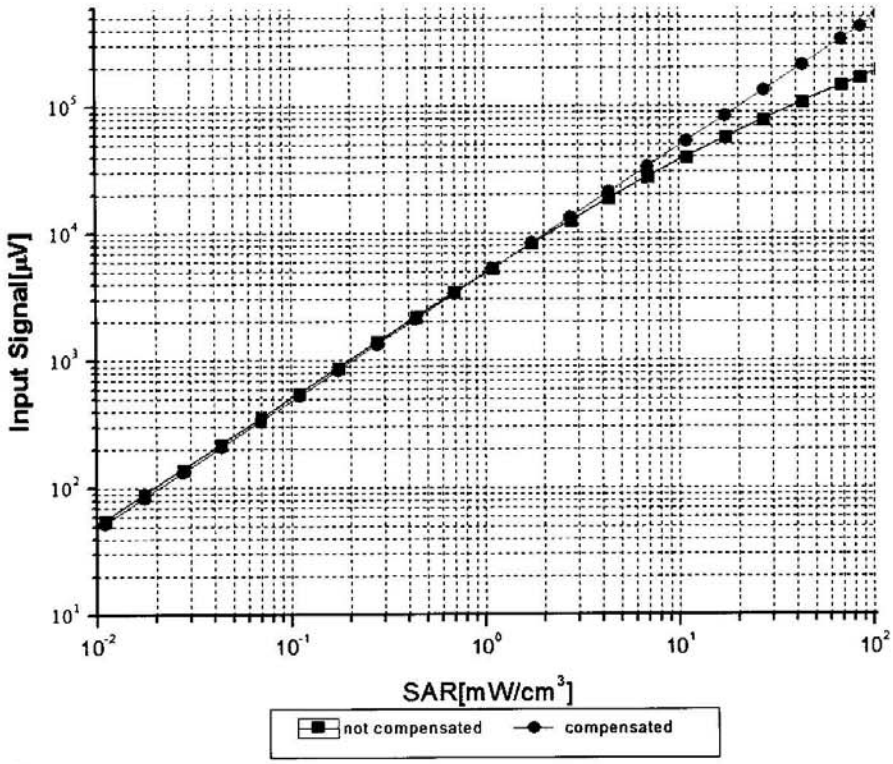
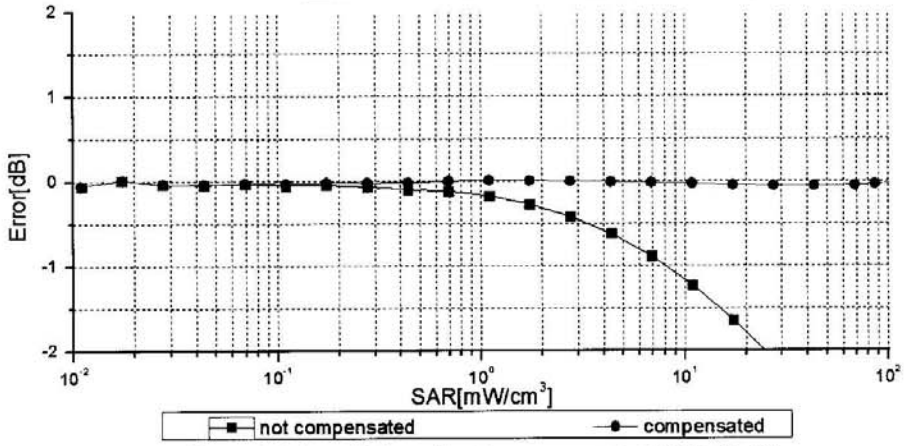
# Dynamic Range f($SAR_{head}$)
## (TEM cell, f = 900 MHz)




**Uncertainty of Linearity Assessment: ±0.9% (k=2)**

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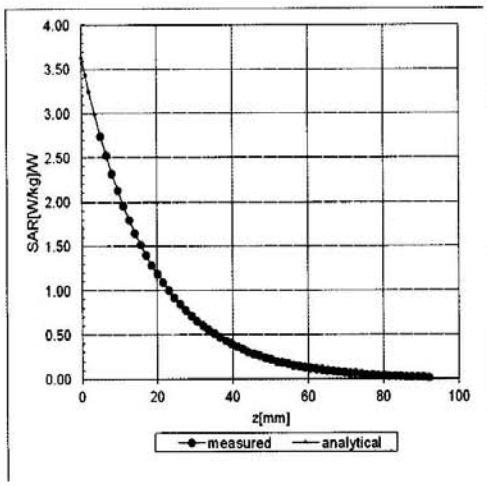
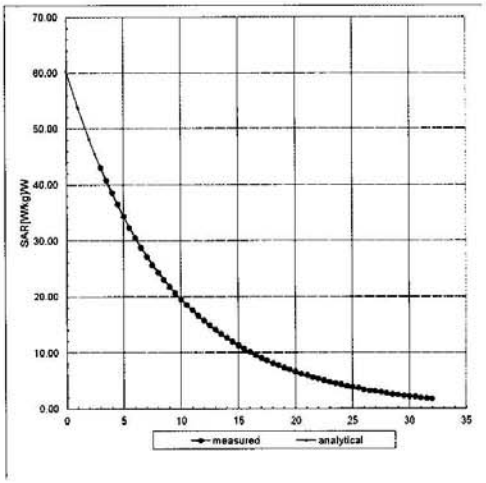
# Conversion Factor Assessment

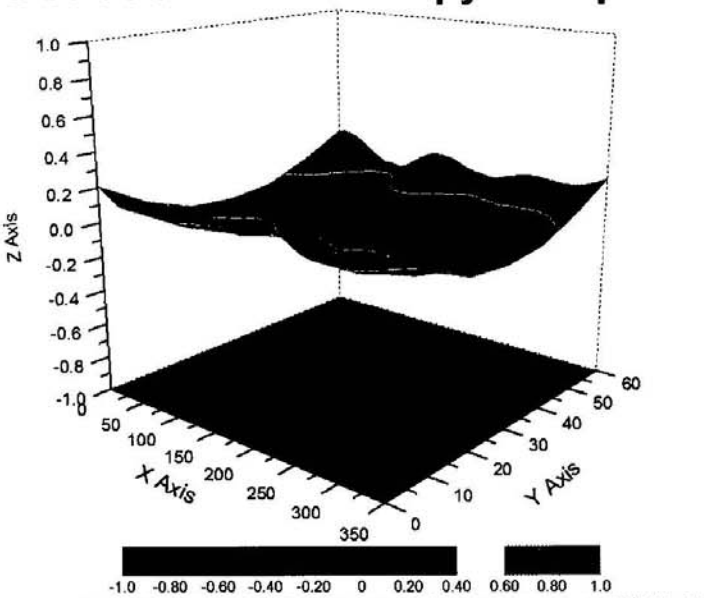
**f=900 MHz, WGLS R9(H_convF)**




**f=2450 MHz, WGLS R26(H_convF)**




# Deviation from Isotropy in Liquid




**Uncertainty of Spherical Isotropy Assessment: ±2.8% (K=2)**

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# DASY - Parameters of Probe: ES3DV3 - SN: 3109

## Other Probe Parameters

| | |
|---|---|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 161.6 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disable |
| Probe Overall Length | 337mm |
| Probe Body Diameter | 10mm |
| Tip Length | 10mm |
| Tip Diameter | 4mm |
| Probe Tip to Sensor X Calibration Point | 2mm |
| Probe Tip to Sensor Y Calibration Point | 2mm |
| Probe Tip to Sensor Z Calibration Point | 2mm |
| Recommended Measurement Distance from Surface | 3mm |

## 6.2. D2450V2 Dipole Calibration Ceriticate

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Client CIQ SZ (Auden) **Certificate No: J13-2-3053**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D2450V2 - SN: 884 |
| Calibration Procedure(s) | TMC-OS-E-02-194<br>Calibration procedure for dipole validation kits |
| Calibration date: | December 11, 2013 |

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)℃ 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 | 102083 | 11-Sep-13 (TMC, No.JZ13-443) | Sep-14 |
| Power sensor NRV-Z5 | 100595 | 11-Sep-13 (TMC, No. JZ13-443) | Sep -14 |
| Reference Probe ES3DV3 | SN 3149 | 5- Sep-13 (SPEAG, No.ES3-3149_Sep13) | Sep-14 |
| DAE4 | SN 777 | 22-Feb-13 (SPEAG, DAE4-777_Feb13) | Feb -14 |
| Signal Generator E4438C | MY49070393 | 13-Nov-13 (TMC, No.JZ13-394) | Nov-14 |
| Network Analyzer E8362B | MY43021135 | 19-Oct-13 (TMC, No.JZ13-278) | Oct-14 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Zhao Jing | SAR Test Engineer | |
| Reviewed by: | Qi Dianyuan | SAR Project Leader | |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory | |

Issued: December 17, 2013

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**Glossary:**

| | |
|---|---|
| TSL | tissue simulating liquid |
| ConvF | sensitivity in TSL / NORMx,y,z |
| 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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005

c) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**

d) 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 | 52.8.7.1137 |
| **Extrapolation** | Advanced Extrapolation | |
| **Phantom** | Twin Phantom | |
| **Distance Dipole Center - TSL** | 10 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 2450 MHz ± 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 ± 0.2) °C | 39.0 ± 6 % | 1.82 mho/m ± 6 % |
| **Head TSL temperature change during test** | <0.5 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 13.0 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **51.7 mW /g ± 20.8 % (k=2)** |
| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | Condition | |
| SAR measured | 250 mW input power | 6.05 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **24.1 mW /g ± 20.4 % (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 ± 0.2) °C | 52.8 ± 6 % | 1.94 mho/m ± 6 % |
| **Body TSL temperature change during test** | <0.5 °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 | **51.8 mW /g ± 20.8 % (k=2)** |
| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | Condition | |
| SAR measured | 250 mW input power | 5.98 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **24.0 mW /g ± 20.4 % (k=2)** |

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## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 46.8Ω+ 3.76jΩ |
| Return Loss | - 25.9dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 55.2Ω+ 2.38jΩ |
| Return Loss | - 25.4dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.199 ns |

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

| | |
|---|---|
| Manufactured by | SPEAG |

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**DASY5 Validation Report for Head TSL** Date: 12.10.2013

Test Laboratory: TMC, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 884**

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: f = 2450 MHz; $\sigma$ = 1.817 mho/m; $\varepsilon r$ = 38.96; $\rho$ = 1000 kg/m$^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3149; ConvF(4.48,4.48,4.48); Calibrated: 2013/9/5
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 22/2/2013
- Phantom: SAM 1593; Type: QD000P40CC;
- DASY52 52.8.7(1137); SEMCAD X Version 14.6.10 (7164)

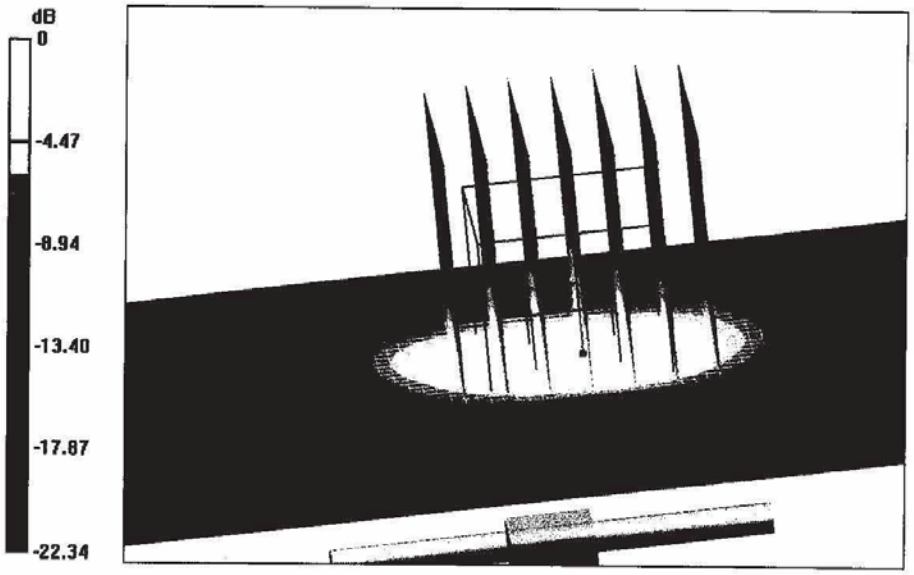
**Dipole Calibration for Head Tissue/Pin=250mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 86.529 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 27.0 W/kg

**SAR(1 g) = 13 W/kg; SAR(10 g) = 6.05 W/kg**

Maximum value of SAR (measured) = 16.2 W/kg




0 dB = 16.2 W/kg = 12.10 dBW/kg

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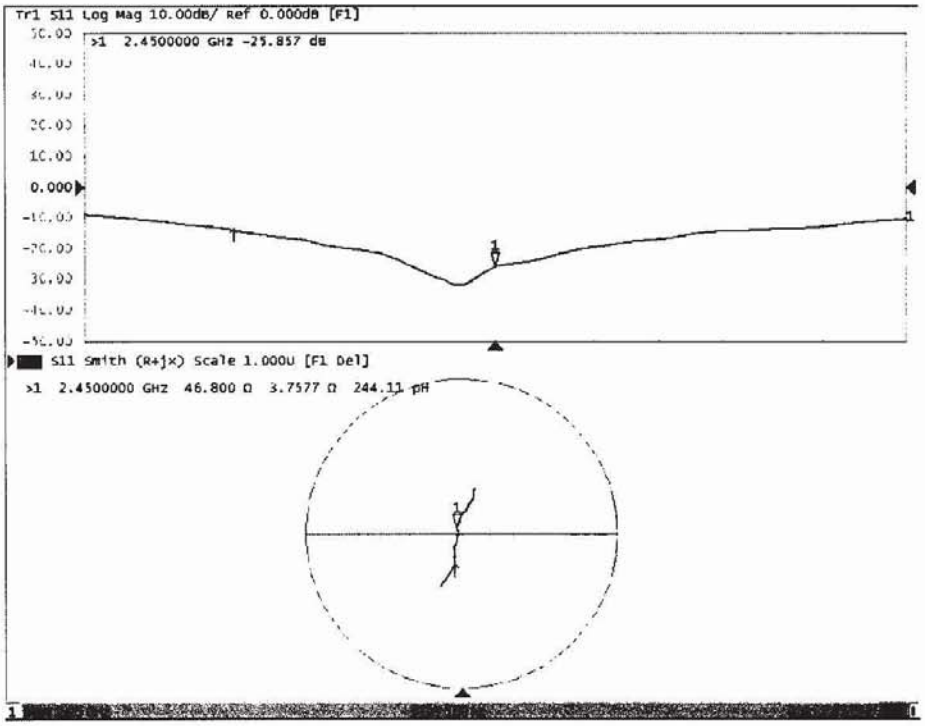
## Impedance Measurement Plot for Head TSL



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**DASY5 Validation Report for Body TSL** Date: 12.11.2013

Test Laboratory: TMC, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 884**

Communication System: CW; Frequency: 2450 MHz;

Medium parameters used: f = 2450 MHz; σ = 1.939 mho/m; εr = 52.97; ρ = 1000 kg/m$^3$

Phantom section: Flat Phantom

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

DASY5 Configuration:

- Probe: ES3DVS - SN3149; ConvF(4.21,4.21,4.21) ; Calibrated: 2013/9/5
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 22/2/2013
- Phantom: SAM1186; Type: QD000P40CC;
- DASY52 52.8.7(1137); SEMCAD X Version 14.6.10 (7164)

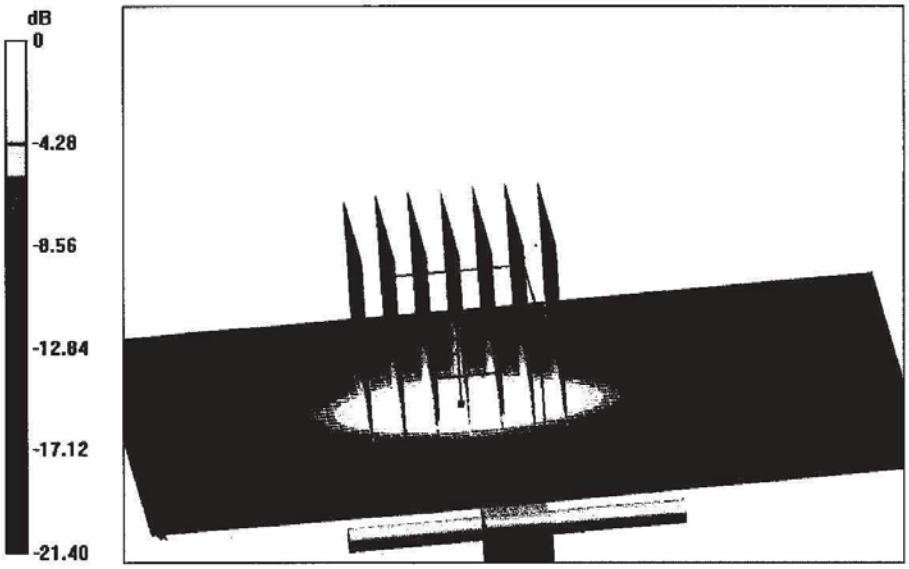
**Dipole Calibration for Body Tissue/Pin=250mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 84.687 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 27.1 W/kg

**SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.98 W/kg**

Maximum value of SAR (measured) = 16.0 W/kg




0 dB = 16.0 W/kg = 12.04 dBW/kg

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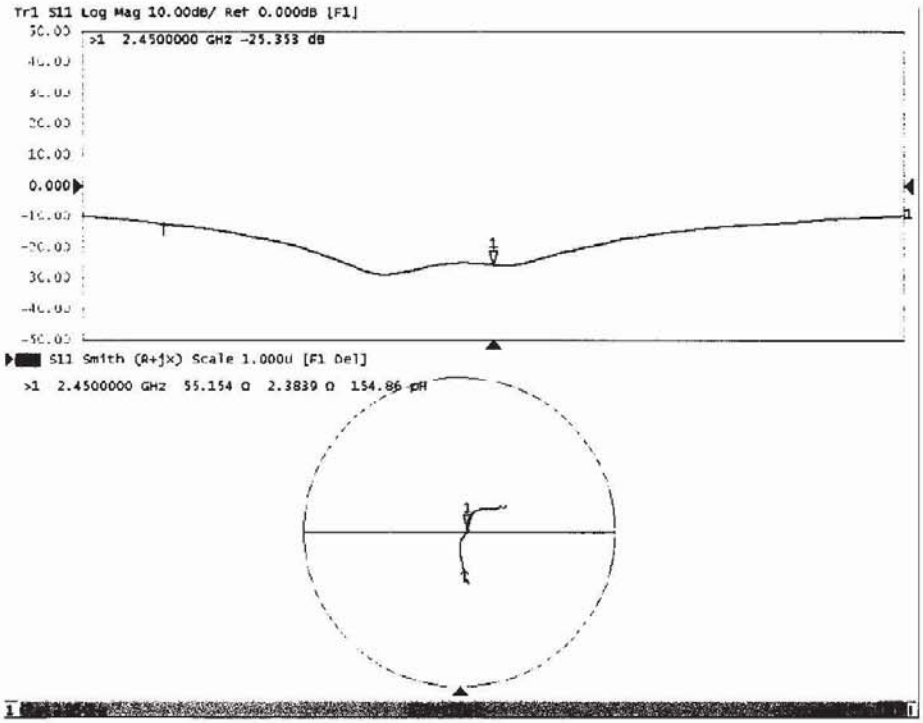
## Impedance Measurement Plot for Body TSL



## 6.3. DAE4 Calibration Ceriticate

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校 准
CNAS L0442

Client : CIQ SZ (Auden) Certificate No: J13-2-3048

### CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | DAE4 - SN: 1315 |
| Calibration Procedure(s) | TMC-OS-E-01-198<br>Calibration Procedure for the Data Acquisition Electronics (DAEx) |
| Calibration date: | November 25, 2013 |

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Documenting Process Calibrator 753 | 1971018 | 01-July-13 (TMC, No:JW13-049) | July-14 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Yu zongying | SAR Test Engineer | |
| Reviewed by: | Qi Dianyuan | SAR Project Leader | |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory | |

Issued: November 25, 2013

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

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**Glossary:**

| | |
|---|---|
| DAE | data acquisition electronics |
| Connector angle | information used in DASY system to align probe sensor X to the robot coordinate system. |

**Methods Applied and Interpretation of Parameters:**

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.

- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.

- The report provide only calibration results for DAE, it does not contain other performance test results.

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## DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.....+3mV

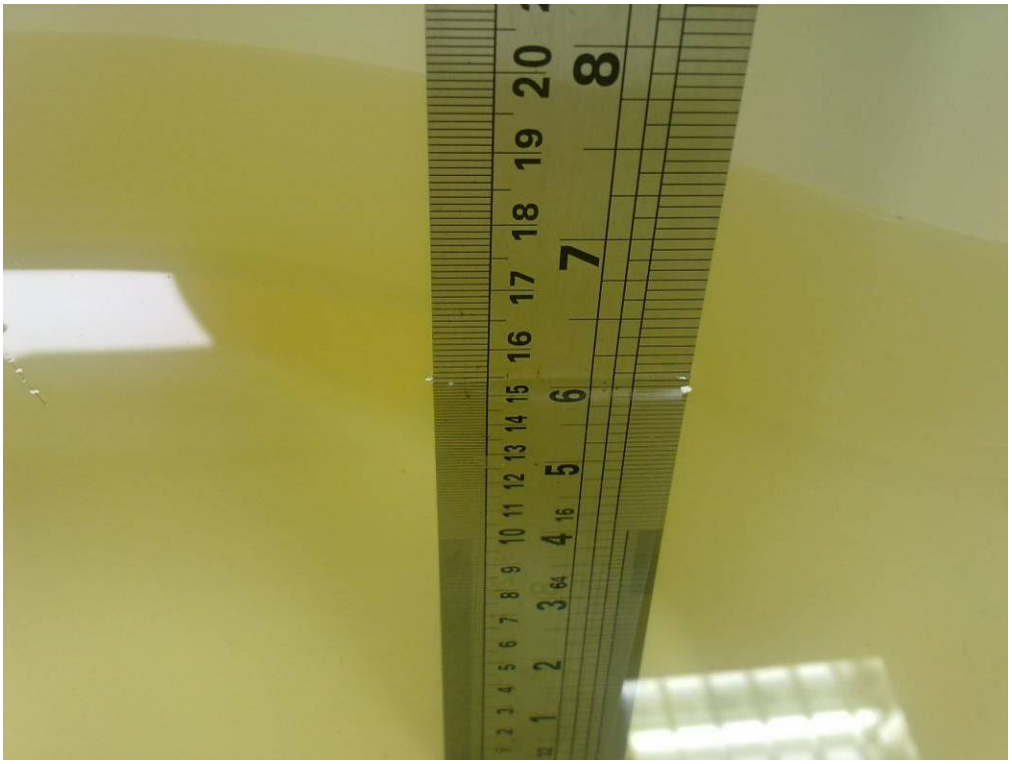
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---|---|---|---|
| High Range | 403.915 ± 0.15% (k=2) | 405.171 ± 0.15% (k=2) | 404.667 ± 0.15% (k=2) |
| Low Range | 3.98903 ± 0.7% (k=2) | 3.94180 ± 0.7% (k=2) | 3.93862 ± 0.7% (k=2) |

## Connector Angle

| | |
|---|---|
| **Connector Angle** to be used in DASY system | 162.5° ± 1 ° |

# 7. Test Setup Photos



**Photograph of the depth in the Body Phantom (2450MHz)**

**0mm Body-worn Rear Side Setup Photo**

**0mm Body-worn Bottom Side Setup Photo**

**0mm Body-worn Right Side Setup Photo**

# 8. External Photos of the EUT

**External Photos**

TELPAD

RESET
DC-5V
HDMI
SD

TELPAD

TELPAD

TELPAD

AC/DC ADAPTER

**.....End of Report.....**