EMTEK
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SAR TEST REPORT

For

Smartphone

Model No.: W5302,W4301,W4302,W4303,W5303,W5305,W5306,W6301

W5402,W4401,W4402,W4403,W5403,W5404,W5405,W5406,W6401

FCC ID: 2ACPR-W5302

Trademark: BMORN

REPORT NO.: ES150530365E

ISSUE DATE: August 10, 2015

Prepared for

Shenzhen Bmorn Technology Co.,Ltd

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Prepared by

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1 TEST RESULT CERTIFICATION

Applicant:	Shenzhen Bmorn Technology Co.,Ltd 5/F, Hengfang Verteran Industrial Park,Xingye Road, Xixiang, Bao'an,Shenzhen, Guangdong,China
Manufacturer:	Shenzhen Bmorn Technology Co.,Ltd 5/F, Hengfang Verteran Industrial Park,Xingye Road, Xixiang, Bao'an,Shenzhen, Guangdong,China
Product Description:	Smartphone
Model Number:	W5302,W4301,W4302,W4303,W5303,W5305,W5306,W6301 W5402,W4401,W4402,W4403,W5403,W5404,W5405,W5406,W6401
File Number:	ES150530365E
Date of Test:	July 17, 2015 to August 10, 2015

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 2 (2.1093) ANSI/IEEE C95.1-1992 IEEE 1528-2013	PASS

The above equipment was tested by SHENZHEN EMTEK CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in IEEE 1528-2013.This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992.

The test results of this report relate only to the tested sample identified in this report

Date of Test : July 17, 2015 to August 10, 2015

Prepared by : Andy Wei
Andy Wei/Editor

Reviewer : Joe Xia
Joe Xia/Supervisor

Approve & Authorized Signer :
Lisa Wang/Manager

2 EUT TECHNICAL DESCRIPTION

Characteristics	Description
Device Type:	Portable Device
Exposure Category:	Uncontrolled Environment/General Population
Test Modulation:	GMSK for GPRS/GSM; 8-PSK for EDGE; QPSK/BPSK for WCDMA; OFDM with BPSK/QPSK/16QAM/64QAM for 802.11g/n; DSSS with DBPSK/DQPSK/CCK for 802.11b; GFSK, pi/4-DQPSK, 8DPSK for Bluetooth 4.0 DSS; GFSK for Bluetooth 4.0 DTS;
Operating Frequency Range:	GSM850: TX824.2MHz~848.8MHz/RX869.2MHz~893.8MHz; PCS1900: TX1850.2MHz~1909.8MHz/RX1930.2MHz~1989.8MHz; WCDMA Band V: TX826.4MHz~846.6MHz /RX 871.4MHz~891.6MHz; WCDMA Band II: TX 1852.4 MHz ~ 1907.6 MHz /RX 1932.4 MHz ~1987.6 MHz; 2412-2462MHz for 802.11b/g; 2412-2462MHz for 802.11n(HT20); 2402-2480MHz for Bluetooth;
Number of Channels:	124 Channels for GSM850; 299 Channels for PCS1900; 102 Channels for WCDMA V; 276 Channels for WCDMA II; 11 channels for 802.11b/g; 11 channels for 802.11n(HT20); 79 channels for Bluetooth 3.0 DSS; 40 channels for Bluetooth 4.0 DTS;
Antenna Type:	Fixed External
IMEI:	1: 355569050367346 2: 355569050367353
Antenna Gain:	GSM&WCDMA:-1dBi ,Bluetooth&Wifi:1dBi
Power supply:	☒DC supply: DC 3.7V internal rechargeable lithium battery or DC 5V from AC Adapter
	☒Adapter supply: Model: SA/6PA/05FEU050100U Input: AC 100-240VAC 50/60Hz 0.4A Output: DC 5V 1000mA
Temperature Range:	0°C ~ +40°C
Product Software Version:	Android 4.4.4
Product Hardware Version:	MNT_SOFIA_3G_KK_FSY_02.1518.00

Note:

1. *For more details, please refer to the User's manual of the EUT.*
2. *The sample under test was selected by the Client.*

Modified Information

Rev.	Summary	Date of Rev.	Report No.
Ver.1.0	Original Report	August 10, 2015	ES150530365E

3 STATEMENT OF COMPLIANCE

<table>
<tr><th rowspan="2">Equipment Class</th><th rowspan="2">Frequency Band</th><th rowspan="2">Operating Mode</th><th colspan="3">Highest SAR Summary</th></tr>
<tr><th>Head
1g SAR (W/kg)
(Gap 0cm)</th><th>Body
1g SAR (W/kg)
(Gap 1cm)</th><th>Simultaneous Transmission SAR (W/kg)</th></tr>
<tr><td rowspan="4">☒PCE</td><td>GSM850</td><td>Data</td><td>0.191</td><td>0.538</td><td rowspan="6">0.707</td></tr>
<tr><td>GSM1900</td><td>Data</td><td>0.023</td><td>0.076</td></tr>
<tr><td>WCDMA V</td><td>Data</td><td>0.206</td><td>0.555</td></tr>
<tr><td>WCDMA II</td><td>Data</td><td>0.053</td><td>0.249</td></tr>
<tr><td>☐DSS</td><td>Bluetooth</td><td>Data</td><td>N/A</td><td>N/A</td></tr>
<tr><td>☒DTS</td><td>WLAN 2.4GHz Band</td><td>Data</td><td>0.501</td><td>0.065</td></tr>
<tr><td colspan="6">NOTE: N/A (Not Applicable)</td></tr>
</table>

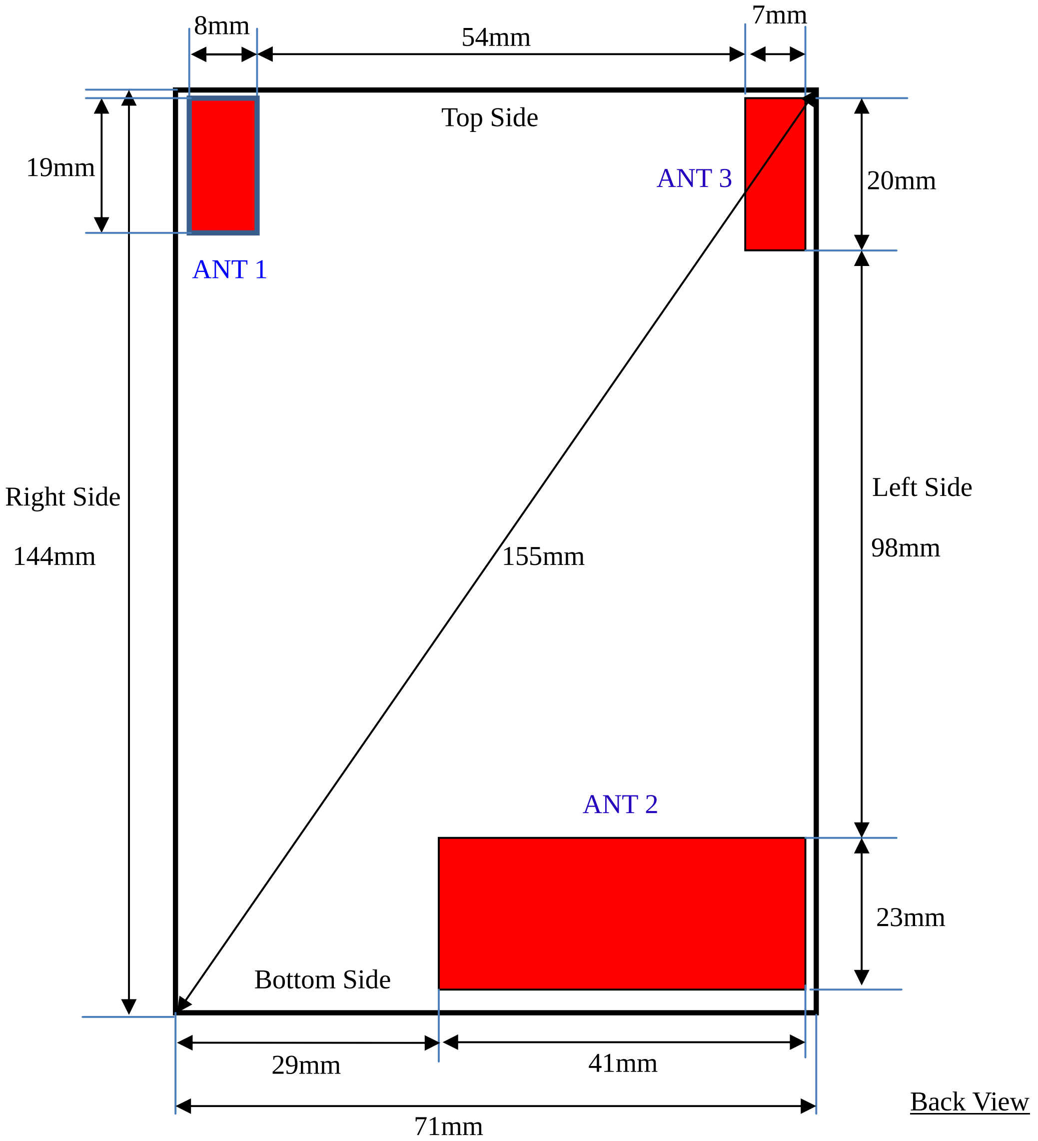
4 AUXILIARY EQUIPMENT DETAILS

AE: Battery	Description
Manufacturer:	N/A
Model:	N/A
S/N:	N/A
capacity:	3500mA
Voltage:	3.7V

5 TEST FACILITY

Site Description		
EMC Lab.	:	Accredited by CNAS, 2013.10.29 The certificate is valid until 2016.10.28 The Laboratory has been assessed and proved to be in compliance with CNAS/CL01: 2006(identical to ISO/IEC17025: 2005) The Certificate Registration Number is L2291 Accredited by TUV Rheinland Shenzhen 2010.5.25 The Laboratory has been assessed according to the requirements ISO/IEC 17025
		Accredited by FCC, April 17, 2014 The Certificate Registration Number is 406365. Accredited by Industry Canada, March 05, 2010 The Certificate Registration Number is 4480A-2.
Name of Firm	:	SHENZHEN EMTEK CO., LTD.
Site Location	:	Bldg 69, Majialong Industry Zone,Nanshan District, Shenzhen, Guangdong, China

6 EUT ANTENNA LOCATIONS



Note:

ANT 1:BT/WIFI Antenna
ANT 2: GSM&WCDMA Antenna
ANT 3:GPS Antenna

Sides for SAR Testing:

Mode	Front	Back	Left Side	Right Side	Top Side	Bottom Side
GSM&WCDMA	YES	YES	YES	N/A	N/A	YES
WIFI&BT	YES	YES	N/A	YES	YES	N/A
Note: N/A means not applicable						

7 GUIDANCE STANDARD

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

FCC 47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices

ANSI C95.1, 1992: Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.(IEEE Std C95.1-1991)

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 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03: SAR Measurement Requirements for 100 MHz to 6 GHz

☒**KDB 447498 D01** Mobile Portable RF Exposure v05r02: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

☒**KDB 648474 D04** Handset SAR v01r02: SAR Evaluation Considerations for Wireless Handsets.

☒ **KDB 248227 D01** 802.11 Wi-Fi SAR v02r01: SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS.
☒**KDB 616217 D04** SAR for laptop and tablets v01r01: SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers

☒**941225 D06** Hotspot Mode v02: SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES

☒**941225 D01** 3G SAR Procedures v03: 3G SAR MEAUREMENT PROCEDURES

Remark:
This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 11 of this test report are below limits specified in the relevant standards for the tested bands only.

8 RF EXPOSURE

8.1 LIMITS

Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and ankles
0.4	8.0	20.0

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

Whole-Body	Partial-Body	Hands, Wrists, Feet and ankles
0.08	1.6	4.0

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

8.2 EVALUATION

☒According to §15.247 (i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

1) The 1-g and 10-g SAR test exclusion thresholds 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*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,[16] where

   - $f_{(GHz)}$ is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation[17]
   - The result is rounded to one decimal place for comparison

   The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evaluation is not required, portable transmitters with output power greater than the applicable low threshold require SAR evaluation to qualify for TCB approval.

8.3 SAR TESTING FOR TABLET

This device can be used also in full sized tablet exposure conditions, due to its size>20cm. Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliace with the tablet touching the phantom. The SAR exclusion threshold in KDB 447498 D01v05r0 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is rquired for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

8.4 MAXIMUM TUNE-UP LIMIT

For Classic Bluetooth:

Mode	Channel	Target power (dBm)	Tolerance
Bluetooth 2.0/2.1/3.0 (GFSK)	Low	3	±1
	Mid	4	±1
	High	4	±1
Bluetooth 2.0/2.1/3.0 (Pi/4-DQPSK)	Low	3	±1
	Mid	4	±1
	High	4	±1
Bluetooth 2.0/2.1/3.0(8DPSK)	Low	3	±1
	Mid	4	±1
	High	4	±1

For BLE:

Mode	Channel	Target power (dBm)	Tolerance
Bluetooth 4.0 (BLE)	Low	3	±1
	Mid	4	±1
	High	4	±1

For Wifi:

Mode	Frequency (GHz)	Channel	Target power (dBm)	Tolerance
11b	2.412	Low	14	±1
	2.437	Mid	14	±1
	2.462	High	14	±1
11g	2.412	Low	12	±1
	2.437	Mid	12	±1
	2.462	High	12	±1
11n (ht 20)	2.412	Low	11	±1
	2.437	Mid	11	±1
	2.462	High	11	±1

For GSM:

Mode	Target power(dBm)		Tolerance
	GSM 850	GSM 1900	
GSM (GMSK, 1 Tx slot)	32	29	±1
GPRS (GMSK, 1 Tx slot)	32	29	±1
GPRS (GMSK, 2 Tx slot)	28.5	25.5	±1
GPRS (GMSK, 3 Tx slot)	26.5	24	±1
GPRS (GMSK, 4 Tx slot)	25	22.5	±1

For WCDMA:

Mode	Target power (dBm)		Tolerance
	WCDMA Band V	WCDMA Band II	
AMR 12.2Kbps	23	22.5	±1
RMC 12.2Kbps	23	22.5	±1
HSDPA Subtest-1	23	22.5	±1
HSDPA Subtest-2	23	22.5	±1
HSDPA Subtest-3	23	22.5	±1
HSDPA Subtest-4	23	22.5	±1
HSUPA Subtest-1	23	22.5	±1
HSUPA Subtest-2	22	21.5	±1
HSUPA Subtest-3	22	21.5	±1
HSUPA Subtest-4	22	21.5	±1
HSUPA Subtest-5	23	22.5	±1

9 SPECIFIC ABSORPTION RATE (SAR)

9.1 INTRODUCTION

SAR is related to the rate at which energy is absorbed per unit mass in an 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 general population/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.

9.2 SAR DEFINITION

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 a given density (ρ). The equation description is as below:

$$SAR = \frac{d}{dt}(\frac{dW}{dm}) = \frac{d}{dt}(\frac{dW}{\rho dv})$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = c(\frac{\delta T}{\delta t})$$

Where: C is the specific head capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue ρ is the mass density of tissue and E is the RMS electrical field strength.

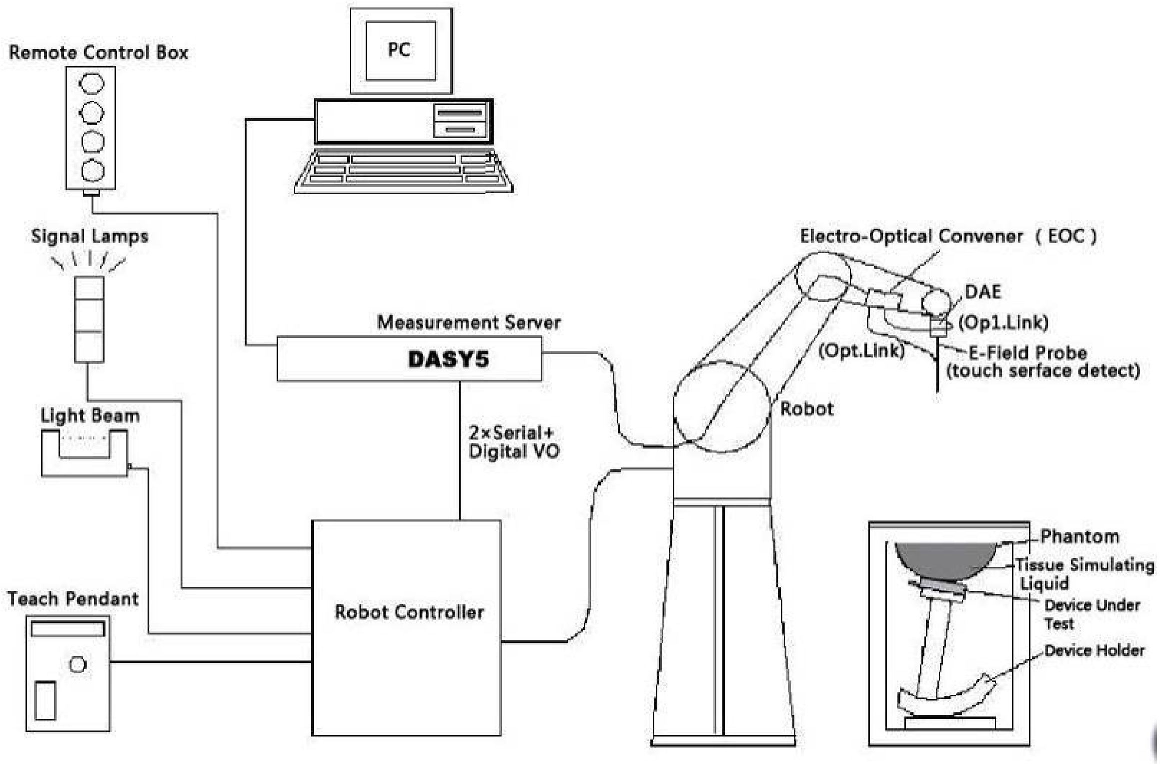
However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

10 SAR MEASUREMENTS SYSTEM CONFIGURATION

10.1 SAR MEASUREMENT SET-UP

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

- A standard high precision 6-axis robot (Stäubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal 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.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.
- Remote control and teach pendant as well as 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.



Picture 1. SAR Lab Test Measurement Set-up

10.2 DASY5 E-FIELD PROBE SYSTEM

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY5 software reads the reflection turning a software approach and looks for the maximum using 2nd ord curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:

Model: EX3DV4

Frequency Range: 10MHz — 6.0GHz (EX3DV4)

Calibration: In head and body simulating tissue at
Frequencies from 835 up to 5800MHz

Linearity: ± 0.2 dB (30 MHz to 6 GHz) for EX3DV4

Dynamic Range: 10 mW/kg — 100W/kg

Probe Length: 330 mm

Probe Tip Length: 20 mm

Body Diameter: 12 mm

Tip Diameter: 2.5 mm

Tip-Center: 1 mm

Application: SAR Dosimetry Testing
Compliance tests of mobile phones
Dosimetry in strong gradient fields

Picture 2 E-field Probe

10.3 E-FIELD PROBE CALIBRATION

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an RF Signal generator, TEM cell, and RF Power Meter.
The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and inn a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mw/ cm^2.
E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C\frac{\Delta T}{\Delta t}$$

Where:
Δt = Exposure time (30 seconds),
C = Heat capacity of tissue (brain or muscle),
ΔT = Temperature increase due to RF exposure.

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

Where:
σ = Simulated tissue conductivity,
ρ = Tissue density (kg/m^3).

10.4 OTHER TEST EQUIPMENT

10.4.1 Data Acquisition Electronics (DAE)

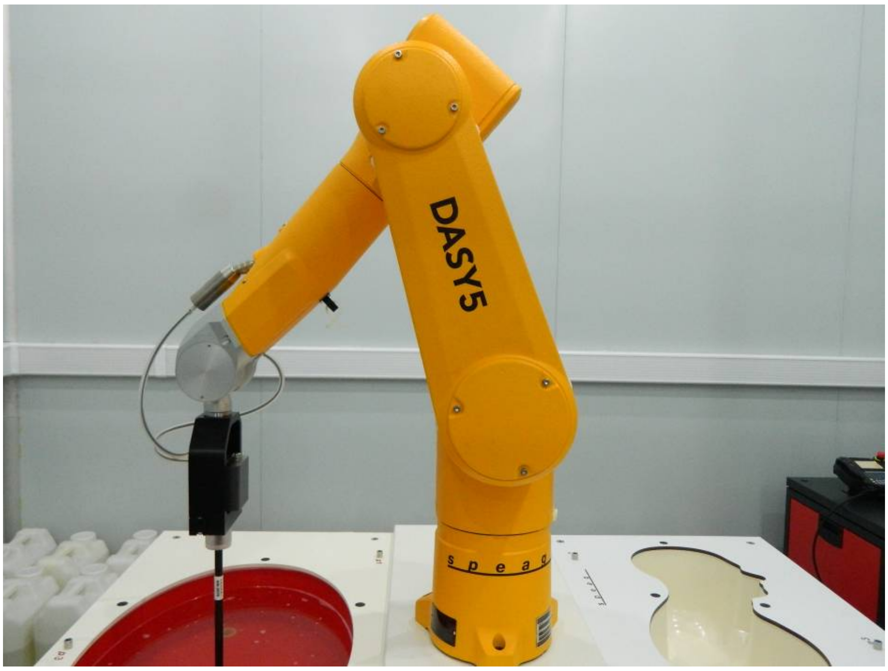
The data acquisition electronics consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.
The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.
The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Picture 3: DAE

10.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX60XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchron motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)



Picture 4 DASY 5

10.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU broad 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 DASY I/O broad, which is directly connected to the PC/104 bus of the CPU broad.

Picture 5 Server for DASY 5

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

10.4.4 Device Holder for Phantom

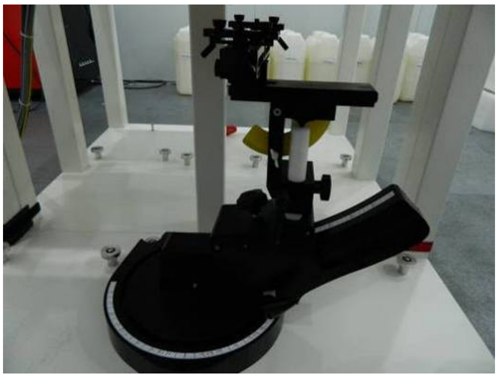
The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

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 are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed 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.

<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM and ELI phantoms.



Picture 6: Device Holder

10.4.5 Phantom

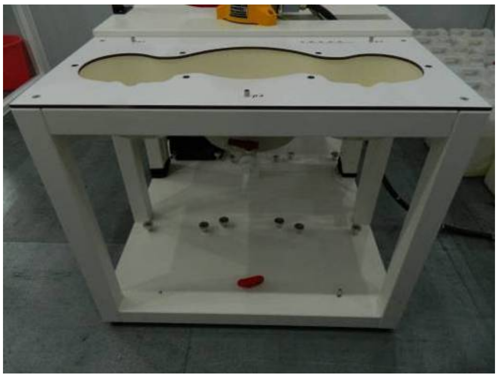
The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to Represent the 90th percentile of the population. The phantom enables the dissymmetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

Shell Thickness: 2 ± 0. 2 mm

Filling Volume: Approx. 25 liters

Dimensions: 810 x l000 x 500 mm (H x L x W)

Available: Special



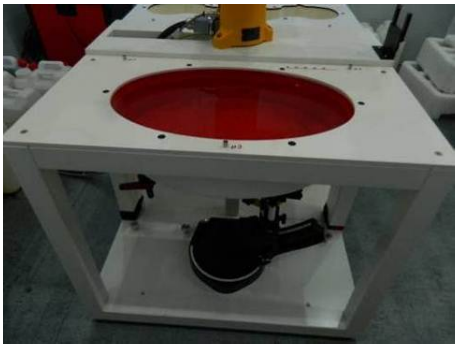
Picture 7: SAM Twin Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

Shell Thickness 2±0.2 mm

Filling Volume Approx. 30 liters

Dimensions 190×600×0 mm (H x L x W)



Picture 8.ELI4 Phantom

10.5 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 is set according to FCC KDB Publication 865664. During 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

After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

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.

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

Table 1: Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01

Frequency	Maximum Area Scan Resolution (mm) (Δxarea, Δyarea)	Maximum Zoom Scan Resolution (mm) (Δxzoom, Δyzoom)	Maximum Zoom Scan Spatial Resolution (mm) Δzzoom(n)	Minimum Zoom Scan Volume (mm) (x,y,z)
≤2 GHz	≤15	≤8	≤5	≥ 30
2-3 GHz	≤12	≤5	≤5	≥30
3-4 GHz	≤12	≤5	≤4	≥28
4-5 GHz	≤10	≤4	≤3	≥25
5-6 GHz	≤10	≤4	≤2	≥22

10.6 DATA STORAGE AND EVALUATION

10.6.1 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 ".DAE4". 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 set up, 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 loss less media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

10.6.2 Data Evaluation by SEMCAD

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 $Norm_i$, a_{i0}, a_{i1}, a_{i2}

- Conversion factor $ConvF_i$

- Diode compression point Dcp_i

Device parameters: - Frequency f

- Crest factor cf

Media parameters: - Conductivity
- Density

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:

$$\mathbf{V_i = U_i + U_i^2 \cdot c f / dcp_i}$$

With $\mathbf{V_i}$ = compensated signal of channel i (i = x, y, z)

$\mathbf{U_i}$ = input signal of channel i (i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

$\mathbf{dcp_i}$ = diode compression point (DASY parameter)

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

evaluated:

E-field probes: $\mathbf{E_i = (V_i / Norm_i \cdot ConvF)^{1/2}}$

H-field probes: $\mathbf{H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f}$

With $\mathbf{V_i}$ = compensated signal of channel i (i = x, y, z)

Norm$_i$ = sensor sensitivity of channel i (i = x, y, z)

[mV/(V/m)2] for E-field Probes

ConvF = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

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

$$E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}$$

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

SAR = (E_{tot}) 2 · σ / (ρ· 1000)

with **SAR** = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m

= conductivity in [mho/m] or [Siemens/m]

= equivalent tissue density in g/cm^3

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. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \text{ or } P_{pwe} = H_{tot}^2 \cdot 37.7$$

with **P_{pwe}** = equivalent power density of a plane wave in mW/cm^2

E_{tot} = total electric field strength in V/m ; **H_{tot}** = total magnetic field strength in A/m

10.7 TISSUE-EQUIVALENT LIQUID

10.7.1 Tissue-equivalent Liquid Ingredients

The liquid is consisted of water, salt and Glycol. The liquid has previously been proven to be suited for worst-case. The Table 3 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB 865664 D01.

Table 2: Composition of the Head Tissue Equivalent Matter

MIXTURE%	FREQUENCY (Head) 835MHz
Water	41.52
Glycol	55.94
Salt	1.44
Preventol	0.1
Cellulose	1.0
Dielectric Parameters Target Value	f=835MHz ε=41.5 σ=0.9

MIXTURE%	FREQUENCY (Head) 1900MHz
Water	55.25
Glycol monobutyl	44.43
Salt	0.32
Dielectric Parameters Target Value	f=1900MHz ε=40.0 σ=1.40

MIXTURE%	FREQUENCY (Head) 2450MHz
Water	62.68
Glycol	36.81
Salt	0.51
Dielectric Parameters Target Value	f=2450MHz ε=39.2 σ=1.80

Table 3: Composition of the Body Tissue Equivalent Matter

MIXTURE%	FREQUENCY (Body) 835MHz
Water	52.3
Glycol	45.1
Salt	1.5
Preventol	0.1
Cellulose	1.0
Dielectric Parameters Target Value	f=835MHz ε=55.2 σ=0.97

MIXTURE%	FREQUENCY (Body) 1900MHz
Water	69.93
Glycol	29.97
Salt	0.1
Dielectric Parameters Target Value	f=1900MHz ε=53.30 σ=1.52

MIXTURE%	FREQUENCY (Body) 2450MHz
Water	73.2
Glycol	26.7
Salt	0.1
Dielectric Parameters Target Value	f=2450MHz ε=52.7 σ=1.95

10.7.2 Tissue-equivalent Liquid Properties

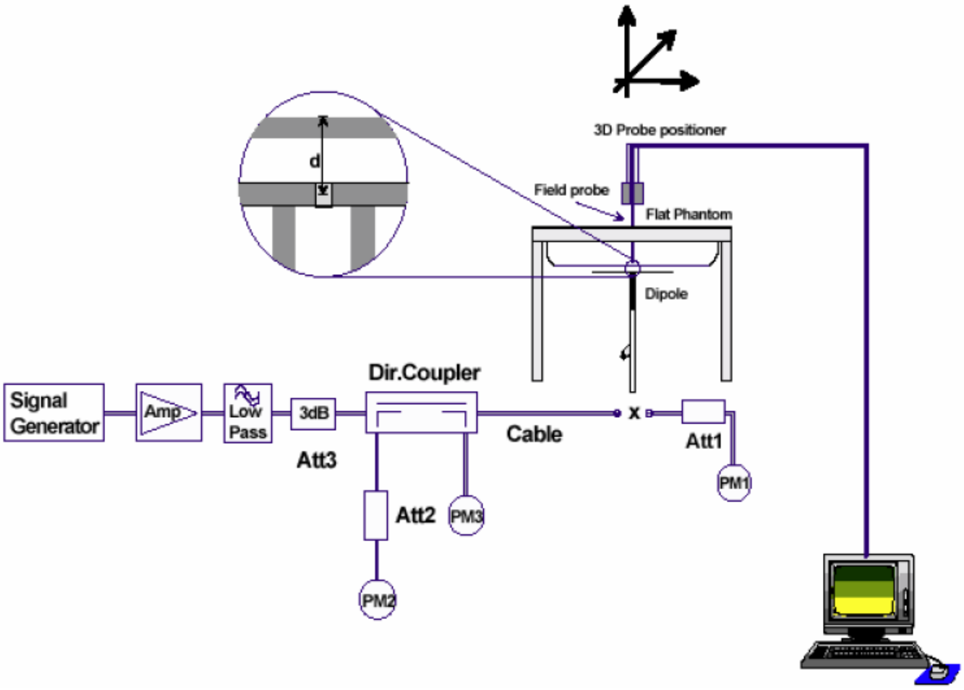
Table 4: Dielectric Performance of Tissue Simulating Liquid

Test Date	Frequ ency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (εr)	Conductivity Target (σ)	Permittivity Target (εr)	Delta (σ) (%)	Delta (εr) (%)	Limit (%)
2015.8.7	900	Head	22.6	0.982	41.873	0.97	41.50	1.24	0.90	±5
2015.8.8	1950	Head	22.5	1.466	39.561	1.40	40.00	4.71	-1.10	±5
2015.8.9	2450	Head	22.7	1.783	40.180	1.80	39.20	-0.94	2.50	±5
2015.8.8	900	Body	22.6	1.059	54.968	1.05	55.00	0.86	-0.06	±5
2015.8.7	1950	Body	22.8	1.576	53.527	1.52	53.30	3.68	0.43	±5
2015.8.9	2450	Body	22.7	2.026	53.063	1.95	52.70	3.90	0.69	±5

10.8 SYSTEM CHECK

10.8.1 Description of System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 5. 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.



Picture 10. System Check Set-up

Justification for Extended SAR Dipole Calibrations
Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< - 20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB 865664 D01:
Table 5: Antenna Parameters with Body Tissue Simulating Liquid

Dipole D900V2 SN: 1d162				
Body Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2014-01-14	-28.581	/	47.850	/
2015-01-11	-28.332	0.87	47.396	-0.454
Head Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2014-01-14	-30.675	/	52.545	/
2015-01-11	-30.317	1.17	52.028	-0.517

Dipole D1950V3 SN: 1151				
Body Liquid				
Date of	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ

Measurement				
2015-01-10	-26.451	/	45.793	/
2015-01-06	-26.036	1.57	45.311	-0.482
Head Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2015-01-10	-33.477	/	49.910	/
2015-01-06	-33.011	1.39	49.527	0.383

Dipole D2450V2 SN: 927				
Head Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2014-1-13	-24.935	/	55.234	/
2015-1-11	-24.769	0.67	54.383	-0.851
Body Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2014-1-13	-26.331	/	51.422	/
2015-1-11	-26.153	0.68	51.016	-0.406

10.8.2 System Check Results

Table 6: System Check for Head /BodyTissue Simulating Liquid

Date	Frequency (MHz)2	Tissue Type2	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2015.8.7	900	Head	250	1d162	3970	1418	2.61	10.40	10.44	0.38
2015.8.8	1950	Head	250	1151	3970	1418	10.60	41.10	42.4	3.16
2015.8.9	2450	Head	250	927	3970	1418	13.70	53.20	54.8	3.01
2015.8.8	900	Body	250	1d162	3970	1418	2.66	10.70	10.64	-0.56
2015.8.7	1950	Body	250	1151	3970	1418	9.59	38.80	38.36	-1.13
2015.8.9	2450	Body	250	927	3970	1418	13.10	50.40	52.4	3.97

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date/Time: 07.08.2015

SystemPerformanceCheck-D900V2-HSL-150807

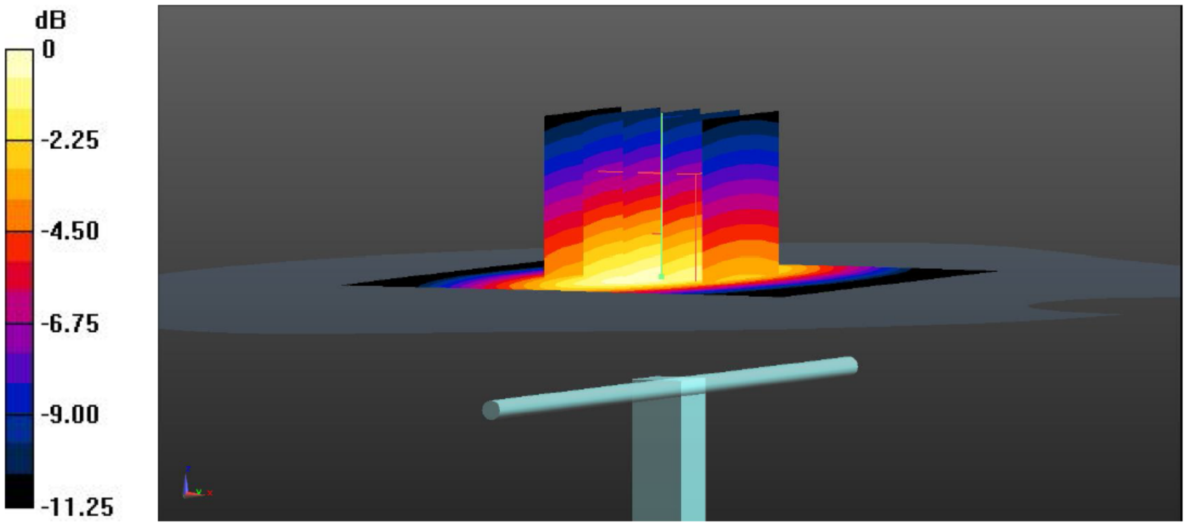
DUT: Dipole 900 MHz D900V2 SN:1d162
Communication System: UID 0, CW; Frequency: 900 MHz;Duty Cycle: 1:1
Medium: HSL_835_150807
Medium parameters used: f = 900 MHz; σ = 0.982 S/m; ε_r = 41.873; ρ = 1000 kg/m^3
Ambient Temperature: 23.3 ℃; Liquid Temperature: 22.6 ℃

DASY Configuration:

- Probe: EX3DV4 - SN3970; ConvF(9.88, 9.88, 9.88); Calibrated: 10.07.2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 23.06.2015
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1794
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequency at 900MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.37 W/kg

System Performance Check at Frequency at 900MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 56.357 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.99 W/kg
SAR(1 g) = 2.61 W/kg; SAR(10 g) = 1.68 W/kg
Maximum value of SAR (measured) = 3.35 W/kg



0 dB = 3.35 W/kg = 5.25 dBW/kg

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date/Time: 08.08.2015

SystemPerformanceCheck-D1950V3-HSL-150808

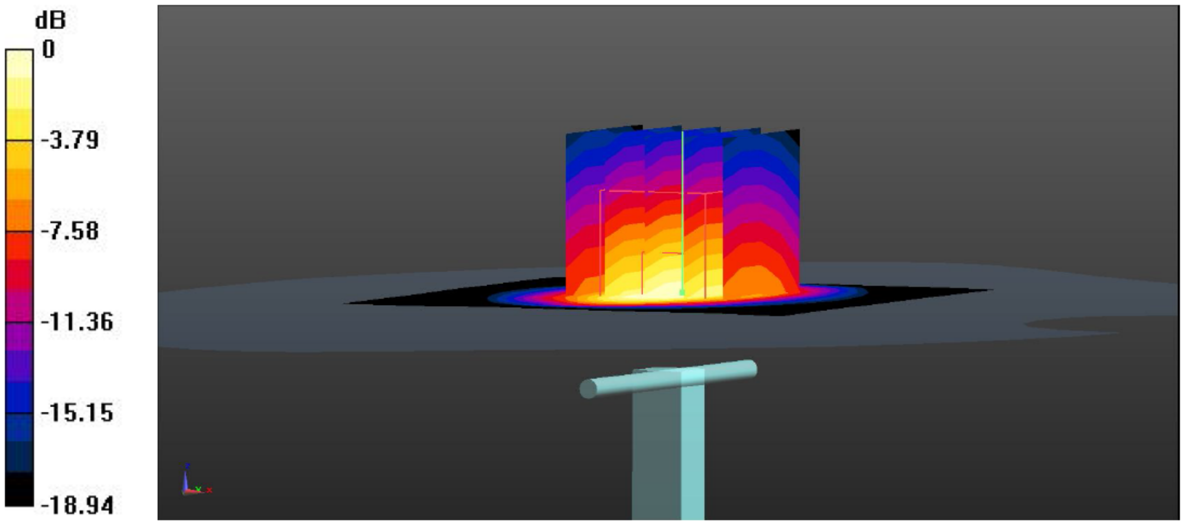
DUT: Dipole 1950 MHz D1950V3 SN:1151
Communication System: UID 0, CW (0); Frequency: 1950 MHz;Duty Cycle: 1:1
Medium: HSL_1900_150808
Medium parameters used: f = 1950 MHz; σ = 1.466 S/m; ε_r = 39.561; ρ = 1000 kg/m^3
Ambient Temperature: 23.4 ℃; Liquid Temperature: 22.5 ℃

DASY Configuration:

- Probe: EX3DV4 - SN3970; ConvF(8.14, 8.14, 8.14); Calibrated: 10.07.2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 23.06.2015
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1794
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequency at 1950MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.8 W/kg

System Performance Check at Frequency at 1950MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 101.0 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 19.1 W/kg
SAR(1 g) = 10.6 W/kg; SAR(10 g) = 5.52 W/kg
Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date/Time: 09.08.2015

SystemPerformanceCheck-D2450V2-HSL-150809

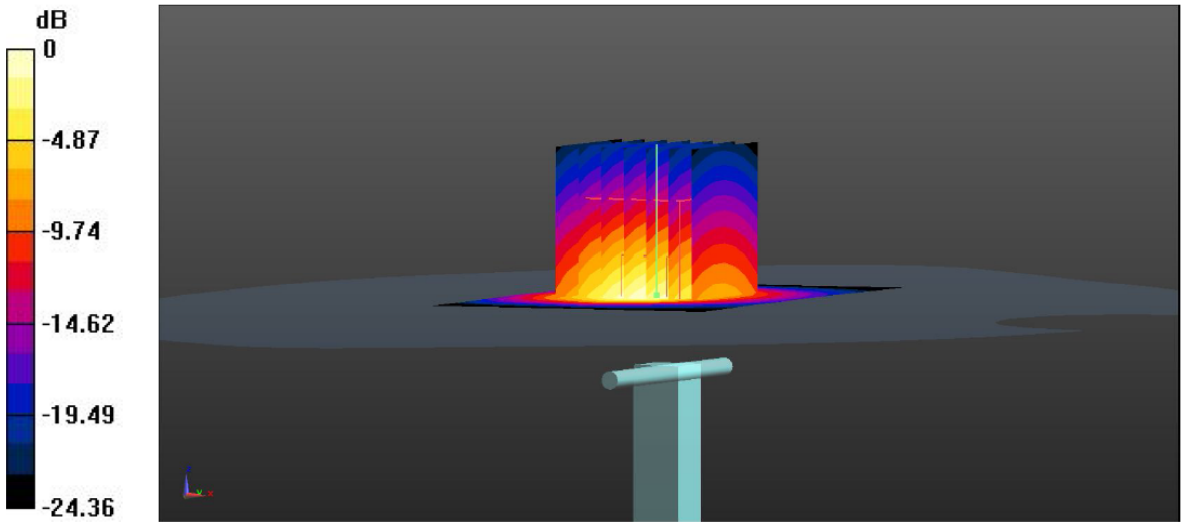
DUT: Dipole 2450 MHz D2450V2 SN:927
Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL_2450_150809
Medium parameters used: f = 2450 MHz; σ = 1.783 S/m; ε_r = 40.18; ρ = 1000 kg/m^3
Ambient Temperature: 23.6 ℃; Liquid Temperature: 22.7 ℃

DASY Configuration:

- Probe: EX3DV4 - SN3970; ConvF(7.36, 7.36, 7.36); Calibrated: 10.07.2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 23.06.2015
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1794
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequency at 2450MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 17.1 W/kg

System Performance Check at Frequency at 2450MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 101.2 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.26 W/kg
Maximum value of SAR (measured) = 17.3 W/kg



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

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date/Time: 08.08.2015

SystemPerformanceCheck-D900V2-MSL-150808

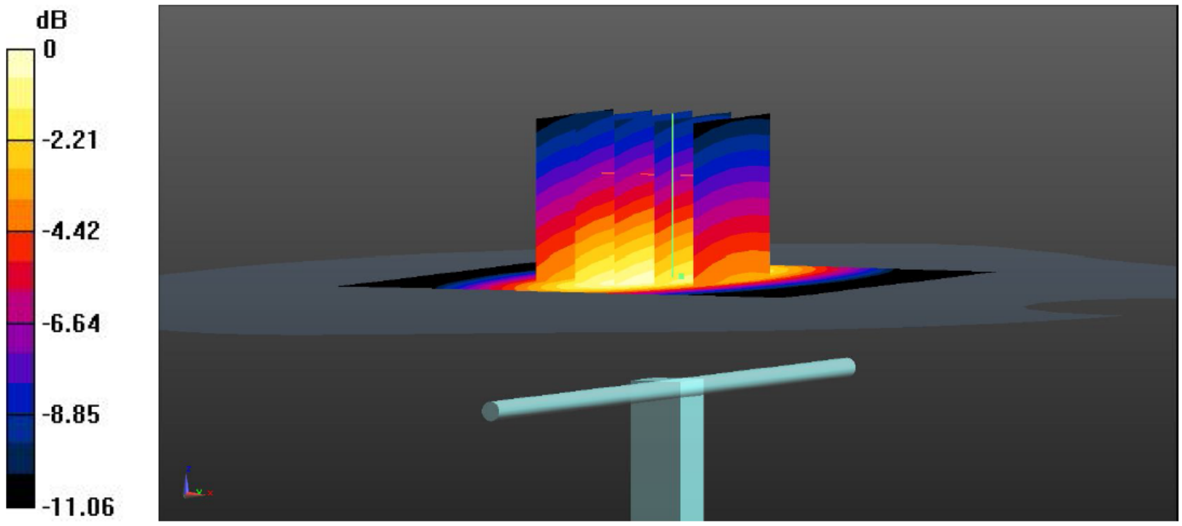
DUT: Dipole 900 MHz D900V2 SN:1d162
Communication System: UID 0, CW; Frequency: 900 MHz;Duty Cycle: 1:1
Medium: MSL_835_150808
Medium parameters used: f = 900 MHz; σ = 1.059 S/m; ε_r = 54.968; ρ = 1000 kg/m^3
Ambient Temperature: 23.5 ℃; Liquid Temperature: 22.6 ℃

DASY Configuration:

- Probe: EX3DV4 - SN3970; ConvF(9.9, 9.9, 9.9); Calibrated: 10.07.2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 23.06.2015
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1794
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequency at 900MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.08 W/kg

System Performance Check at Frequency at 900MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 57.059 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.99 W/kg
SAR(1 g) = 2.66 W/kg; SAR(10 g) = 1.79 W/kg
Maximum value of SAR (measured) = 3.16 W/kg



0 dB = 3.16 W/kg = 5.00 dBW/kg

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date/Time: 07.08.2015

SystemPerformanceCheck-D1950V3-MSL-150807

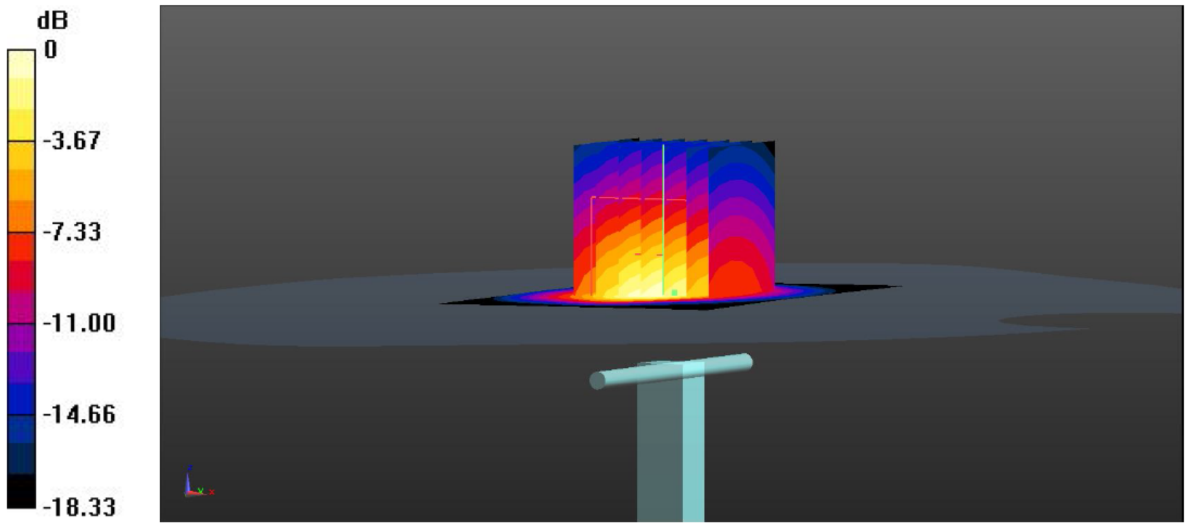
DUT: Dipole 1950 MHz D1950V3 SN:1151
Communication System: UID 0, CW (0); Frequency: 1950 MHz;Duty Cycle: 1:1
Medium: MSL_1900_150807
Medium parameters used: f = 1950 MHz; σ = 1.576 S/m; ε_r = 53.527; ρ = 1000 kg/m^3
Ambient Temperature: 23.6 ℃; Liquid Temperature: 22.8 ℃

DASY Configuration:

- Probe: EX3DV4 - SN3970; ConvF(7.92, 7.92, 7.92); Calibrated: 10.07.2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 23.06.2015
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1794
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequency at 1950MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Area Scan (41x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 13.7 W/kg

System Performance Check at Frequency at 1950MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.935 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 16.6 W/kg
SAR(1 g) = 9.59 W/kg; SAR(10 g) = 4.95 W/kg
Maximum value of SAR (measured) = 13.5 W/kg



0 dB = 13.5 W/kg = 11.30 dBW/kg

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date/Time: 09.08.2015

SystemPerformanceCheck-D2450V2-MSL-150809

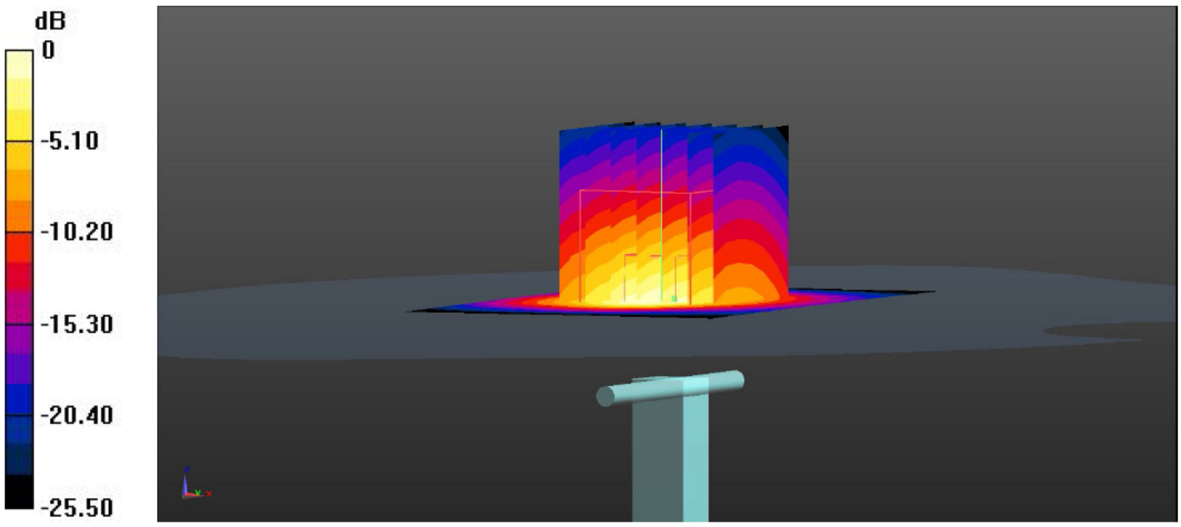
DUT: Dipole 2450 MHz D2450V2 SN:927
Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_150809
Medium parameters used: f = 2450 MHz; σ = 2.026 S/m; ε_r = 53.063; ρ = 1000 kg/m^3
Ambient Temperature: 23.3 ℃; Liquid Temperature: 22.7 ℃

DASY Configuration:

- Probe: EX3DV4 - SN3970; ConvF(7.66, 7.66, 7.66); Calibrated: 10.07.2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 23.06.2015
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1794
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequency at 2450MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Area Scan (41x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 21.1 W/kg

System Performance Check at Frequency at 2450MHz/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.3 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 28.1 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 5.84 W/kg
Maximum value of SAR (measured) = 20.6 W/kg



0 dB = 20.6 W/kg = 13.14 dBW/kg

11 MEASUREMENT PROCEDURES

11.1 GENERAL DESCRIPTION OF TEST PROCEDURES

For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal. 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 lowest data rate. Testing at higher data rates is not required when the maximum average output power is less than 0.25dB higher than those measured at the lowest data rate.802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band.

For the body SAR tests for GSM850 and GSM1900, a communication link is set up with a System Simulator (SS) by air link. Using CMW 500 the power level is set to “5” for GSM850, set to “0” for GSM1900. The GPRS class is 12 for this EUT; it has at most 4Timesolts in uplink and at most 4Timesolts in downlink, the maximum total Timesolts is 5. The EGPRS class is 12 for this EUT; it has at most 4 Timesolts in uplink and at most 4 Timesolts in downlink, the maximum total Timesolts is 5.
When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.
According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot. The allowed power reduction in the multi-slot configuration is as following:
Table 7: The allowed power reduction in the multi-slot configuration:

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power (dB)
1	0
2	0 to 3,0
3	1,8 to 4,8
4	3,0 to 6,0

For the UMTS Test configuration:
Maximum output power is verified on the High, Middle and Low channel according to the procedures described in section 5.2 of 3GPP TS 34. 121, using the appropriate RMC or AMR with TPC(transmit power control) set to all up bits for WCDMA/HSDPA or applying the required inner loop power control procedures to the maximum output power while HSUPA is active. Results for all applicable physical channel configuration (DPCCH, DPDCHn and spreading codes, HSDPA, HSPA) should be tabulated in the SAR report. All configuration that are not supported by the DUT or can not be measured due to technical or equipment limitations should be clearly identified.
SAR for head exposure configurations in voice mode is measured using a 12.2kbps RMC with TPC bits configured to all up bits. SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2kbps AMR is less than 1/4 dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2kbps AMR with a 3.4 kbps SRB(Signaling radio bearer) using the exposure configuration that results in the highest SAR in 12.2kbps RMC for that RF channel.
SAR for body exposure configurations in voice and data modes is measured using 12.2kbps RMC with TPC bits configured to all up bits. SAR for other spreading codes and multiple DPDCHn, when supported by the DUT,are not required when the maximum average output of each RF channel, for each spreading code and DPDCHn configuration, are less than 1/4 dB higher than those measured in 12.2kbps RMC. Otherwise, SAR is measured on the maximum output channel with an applicable RMC configuration for the corresponding spreading code or DPDCHn using the exposure configuration that results in the highest SAR with 12.2 kbps RMC. When more than 2 DPDCHn are supported by the DUT, it may be necessary to configure additional DPDCHn for a DUT using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC.
For the HSDPA Test configuration:
SAR for body exposure configurations is measured according to the ‘Body SAR Measurements’ procedures of that section. In addition,body SAR is also measured for HSDPA when the maximum average output of each RF channel with HSDPA active is at least ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1,