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SAR TEST REPORT

For

nextbook

Model No.: NXA101LTE116

FCC ID: S7JNXA101LTE116

Trademark: N/A

REPORT NO.: ES150110115E

ISSUE DATE: March 13, 2015

Prepared for

SHENZHEN YIFANG DIGITAL TECHNOLOGY CO., LTD.

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Prepared by

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GENERAL SUMMARY

Applicant:	SHENZHEN YIFANG DIGITAL TECHNOLOGY CO., LTD.
Manufacturer:	SHENZHEN YIFANG DIGITAL TECHNOLOGY CO., LTD.
Product Description:	nextbook
Model Number:	NXA101LTE116
Trade Mark:	N/A

We hereby certify that:

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 following Reference 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 v01r02: SAR Measurement Requirements for 100 MHz to 6 GHz

KDB 865664 D02 SAR Reporting v10r01

KDB 447498 D01 General RF Exposure Guidance v05r02: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

KDB 616217 D04 SAR for laptop and tablets v01r01: SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers

KDB 248227 D01 SAR meas for 802 11 a b g v01r02: SAR Measurement Procedures for 802.11a/b/g Transmitters.

KDB 941225 D05 SAR meas for LTE Devices V02r03.

KDB 941225 D05A Rel.10 LTE SAR Test Guidance V01r01.

This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 4 of this test report are below limits specified in the relevant standards for the tested bands only. The test results of this report relate only to the tested sample identified in this report.

Date of Test : March 13, 2015

Prepared by : Jack Li/Editor

Reviewer : Joe Xia/Supervisor

Approve & Authorized Signer : Lisa Wang/Manager

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1 General Information

1.1 Product Description

Applicant	SHENZHEN YIFANG DIGITAL TECHNOLOGY CO., LTD.
Manufacturer	SHENZHEN YIFANG DIGITAL TECHNOLOGY CO., LTD.
Device Type	Portable Device
Exposure Category	Uncontrolled Environment/General Population
Product Name	nextbook
MEID	/
Antenna Type	PIFA antenna
Antenna Gain	2dBi for Bluetooth/Wifi; 2dBi for LTE Band 4; 0.5dBi for LTE Band 13;
Operating Frequency Range	2412MHz -2462MHz for 802.11b/g; 2412MHz -2462MHz for 802.11n(HT20); 2422MHz -2452MHz for 802.11n(HT40); 2402MHz -2480MHz for Bluetooth;
LTE TX Frequency	LTE Band 4 : 1710.7 MHz ~ 1754.3 MHz LTE Band 13 : 779.5 MHz ~ 784.5 MHz
LTE RX Frequency	LTE Band 4 : 2110.7 MHz ~ 2154.3 MHz LTE Band 13 : 748.5 MHz ~ 753.5 MHz
Number of Channels	11 channels for 802.11b/g; 11 channels for 802.11n(HT20); 7 channels for 802.11n(HT40); 79 channels for Bluetooth;
LTE Bandwidth	LTE Band 4: 3MHz / 5MHz / 10MHz / 15MHz / 20MHz LTE Band 13: 5MHz / 10MHz
Test Modulation	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; QPSK, 16QAM for LTE Band;
LTE Voice/ Data requirements	Data only
LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.

Note: The LTE main antenna support TX and RX, the LTE aux antenna support RX only.
The sample under test was selected by the Client.
Components list please refer to documents of the manufacturer.

LTE MPR permanently built-in by design

Table 6.2.-1: Maximum Power Reduction(MPR) for Power Class 3							
Modulation	Channel Bandwidth/ Transmission Bandwidth(RB)						MPR
	1.4MHz	3.0MHz	5MHz	10MHz	15MHz	20MHz	
QPSK	>5	>4	>8	>12	>16	>18	≤1
16-QAM	≤5	≤4	≤8	≤12	≤16	≤18	≤1
16-QAM	>5	>4	>8	>12	>16	>18	≤2

Test Channel Number and Frequency

LTE Band 4										
	Bandwidth: 3MHz		Bandwidth: 5MHz		Bandwidth: 10MHz		Bandwidth: 15MHz		Bandwidth: 20MHz	
	Channel	Freq (MHz)	Channel	Freq (MHz)	Channel	Freq (MHz)	Channel	Freq (MHz)	Channel	Freq (MHz)
L	19965	1711.5	19975	1712.5	20000	1715.0	20025	1717.5	20050	1720.0
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20385	1753.5	20375	1752.5	20350	1750.0	20325	1747.5	20300	1745.0

LTE Band 13				
	Bandwidth: 5MHz		Bandwidth: 10MHz	
	Channel	Freq (MHz)	Channel	Freq (MHz)
L	23205	779.5	--	--
M	23230	782.0	23230	782.0
H	23255	784.5	--	--

Modified Information

Version.	Summary	Date of Rev.	Report No.
Ver.1.0	Original Report	2015-03-13	ES150210115E

1.2 The Maximum SAR1g Value

Mode	channel	Position	Separation distance	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)
LTE Band 4	20050	Edge1	0.8mm	1.01	1.248

1.3 Special Accessories

N/A

1.4 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

2 RF Exposure Evaluation

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.

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.

Maximum Tune-Up Limit

For LTE Band:

Mode	Modulation	Bandwidth	RB Size	MPR	Target Average power mode	Target Reduced power mode	Tolerance
LTE Band4	QPSK	3	≤4	0	23	16	±1
		3	>4	0	23	16	±1
		5	≤8	0	23	16	±1
		5	>8	0	23	16	±1
		10	≤12	0	23	16	±1
		10	>12	0	23	16	±1
		15	≤16	0	23	16	±1
		15	>16	0	23	16	±1
		20	≤18	0	23	16	±1
		20	>18	0	23	16	±1
	16QAM	3	≤4	0	23	16	±1
		3	>4	0	23	16	±1
		5	≤8	0	23	16	±1
		5	>8	0	23	16	±1
		10	≤12	0	23	16	±1
		10	>12	0	23	16	±1
		15	≤16	0	23	16	±1
		15	>16	0	23	16	±1
		20	≤18	0	23	16	±1
		20	>18	0	23	16	±1

Mode	Modulation	Bandwidth	RB Size	MPR	Target Average power mode	Target Reduced power mode	Tolerance
LTE Band13	QPSK	5	≤8	0	23	18	±1
		5	>8	0	23	18	±1
		10	≤12	0	23	18	±1
		10	>12	0	23	18	±1
	16QAM	5	≤8	0	23	18	±1
		5	>8	0	23	18	±1
		10	≤12	0	23	18	±1
		10	>12	0	23	18	±1

For Classic Bluetooth:

Mode	Channel	Target power	Tolerance
Bluetooth 2.0/2.1/3.0 (GFSK)	Low	-5	±1
	Mid	-5	±1
	High	-5	±1
Bluetooth 2.0/2.1/3.0 (Pi/4-DQPSK)	Low	-6	±1
	Mid	-6	±1
	High	-6	±1
Bluetooth 2.0/2.1/3.0(8DPSK)	Low	-5	±1
	Mid	-5	±1
	High	-5	±1

For BLE:

Mode	Channel	Target power	Tolerance
Bluetooth 4.0 (BLE)	Low	1.0	±1
	Mid	1.0	±1
	High	1.0	±1

For Wifi:

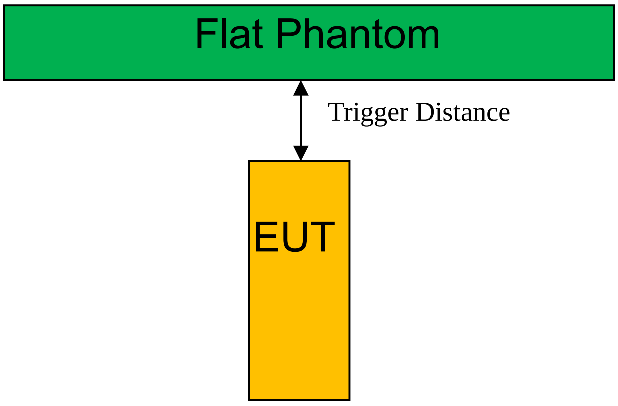
Channel	Frequency (GHz)	Mode	Target power	Tolerance
Low	2.412	11b	6	±1
Mid	2.437	11b	6	±1
High	2.462	11b	6	±1
Low	2.412	11g	3	±1
Mid	2.437	11g	3	±1
High	2.462	11g	3	±1
Low	2.412	11n HT20	3	±1
Mid	2.437	11n HT20	3	±1
High	2.462	11n HT20	3	±1
Low	2.422	11n HT40	3	±1
Mid	2.437	11n HT40	3	±1
High	2.452	11n HT40	3	±1

3 Proximity Sensor Triggering Test

3.1 Proximity Sensor Triggering Distance (KDB 616217 D04 section 6.2)

Proximity sensor triggering distance testing was performed according to the procedures outlined in KDB 616217 D04 section 6.2, and EUT moving further away from the flat phantom and EUT moving toward the flat phantom were both assessed. The details are illustrated in the exhibit “P-Sensor operational description”, and the shortest triggering distances were reported and used for SAR assessment.

In the preliminary triggering distance testing, the tissue-equivalent medium for different frequency bands were used for verification; the 1750MHz and 750MHz tissue-equivalent medium for band 4 and band 13 was used for formal proximity sensor triggering testing.



Proximity Sensor Trigger Distance (mm)		
Position	Bottom Face	Edge 1
Minimum	12	9

Bottom Face	Measured Power(dBm)						
Distance(mm)	20	17	16	15	14	13	12
LTE Band 4(BW20,RB Size 1,RB Offset0)	23.42	23.42	23.40	23.41	23.42	23.41	16.42
LTE Band 13(BW10,RB Size 1,RB Offset0)	23.60	23.61	23.59	23.61	23.60	23.61	18.61

Bottom Face	Measured Power(dBm)							
Distance(mm)	11	10	9	8	6	4	2	0
LTE Band 4(BW20,RB Size 1,RB Offset0)	16.40	16.42	16.40	16.41	16.42	16.41	16.40	16.42
LTE Band 13(BW10,RB Size 1,RB Offset0)	18.61	18.60	18.62	18.62	18.61	18.62	18.61	18.60

Edge 1	Measured Power(dBm)						
Distance(mm)	18	16	14	13	12	11	10
LTE Band 4(BW20,RB Size 1,RB Offset0)	23.42	23.42	23.42	23.42	23.42	23.42	23.42
LTE Band 13(BW10,RB Size 1,RB Offset0)	23.61	23.60	23.60	23.61	23.61	23.60	23.59

Edge 1	Measured Power(dBm)							
Distance(mm)	9	8	7	6	5	3	1	0
LTE Band 4(BW20,RB Size 1,RB Offset0)	16.42	16.40	16.40	16.41	16.41	16.40	16.42	16.41
LTE Band 13(BW10,RB Size 1,RB Offset0)	18.60	18.60	18.61	18.61	18.62	18.61	18.62	18.62

3.2 Proximity Sensor Triggering Coverage (KDB 616217 D04 section 6.3)

If a sensor is spatially offset from the antenna(s), it is necessary to verify sensor triggering for conditions where the antenna is next to the user but the sensor is laterally further away to ensure sensor coverage is sufficient for reducing the power to maintain compliance. For p-sensor coverage testing, the device is moved and “along the direction of maximum antenna and sensor offset”.

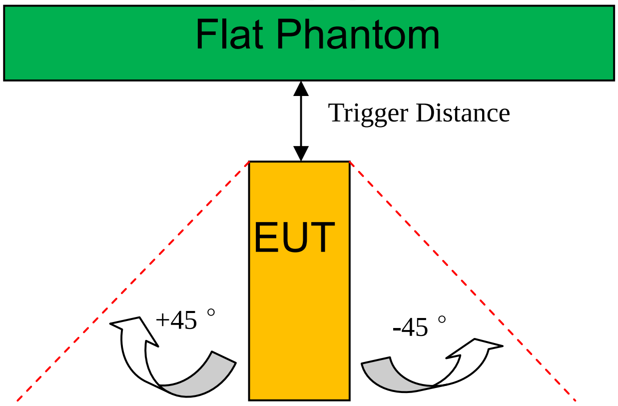
Illustrated in the internal photo exhibit, although the senor is spatially offset, there is no trigger condition where the antenna is next to the user but the sensor is laterally further away, therefore proximity sensor coverage testing is not required.

This procedure is not required because antenna and sensor are collocated and the peak SAR location is overlapping with the sensor.

3.3 Tablet Tilt angle influences to proximity sensor triggering (KDB 616217 D04 section 6.4)

The influence of table tilt angles to proximity sensor triggering was determined by positioning each tablet edge that contains a transmitting antenna, perpendicular to the flat phantom, at 8 mm separation.

Rotating the tablet around the edge next to the phantom in ≤ 10° increments until the tablet is ± 45° from the vertical position at 0°, and the maximum output power remains in the reduced mode.



The Sensor Trigger Distance (mm)	
Position	Edge 1
Minimum	9

3.4 Proximity sensor power reduction

Exposure Position / wireless mode	Bottom Face	Edge 1	Edge 2	Edge 3	Edge 4
LTE Band 4(BW20, RB Size 1, RB Offset 0)	7dBm	7dBm	0dBm	0dBm	0dBm
LTE Band 13(BW10, RB Size 1, RB Offset 0)	5dBm	5dBm	0dBm	0dBm	0dBm

Remark:

1. Reduced maximum limit applied by activation of proximity sensor.
2. Power reduction is not applicable for WLAN and Bluetooth.
3. Tests were performed in accordance with KDB 616217 D04 section 6.1, 6.2, 6.3, 6.4 and 6.5 and compliant results are shown and described in exhibit “P-Sensor operational description”.
4. For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at a conservative trigger distance was performed:
   Bottom Face: 11 mm
   Edge3: 8 mm

4 Specific Absorption Rate (SAR)

4.1 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.

4.2 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:

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

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

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

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

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.

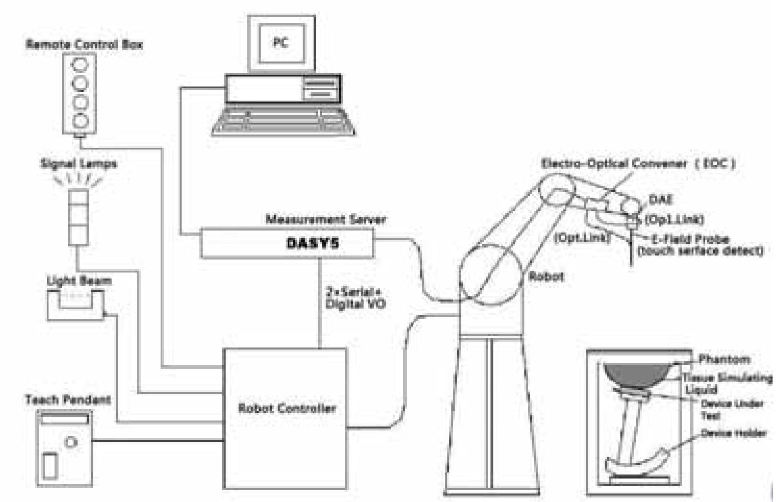
However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

5 SAR Measurements System Configuration

5.1 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

5.2 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 2^{nd} 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

5.3 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).

5.4 Other Test Equipment

5.4.1 Data Acquisition Electronics (DAE)

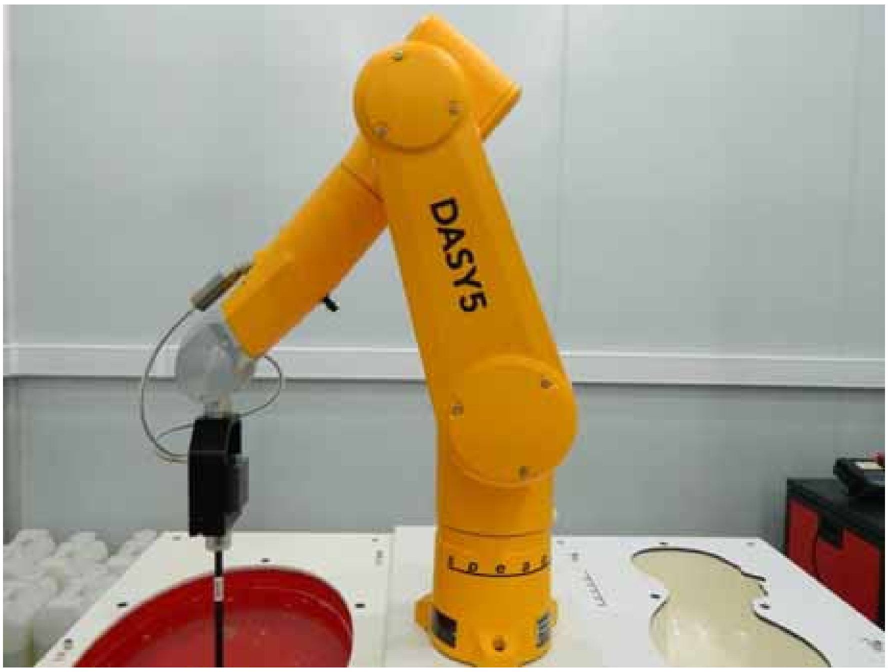
The data acquisition electronics consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical 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

5.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX90XL) 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

5.4.3 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.

5.4.4 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>

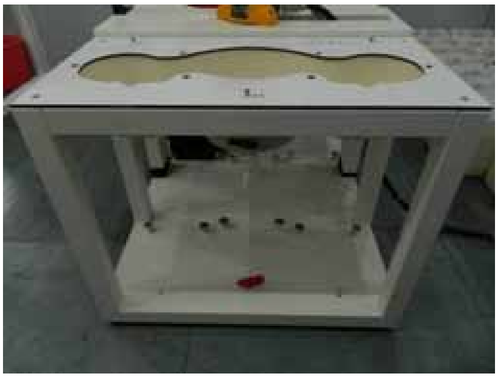
The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM and ELI phantoms.

Picture 6: Device Holder

5.4.5 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



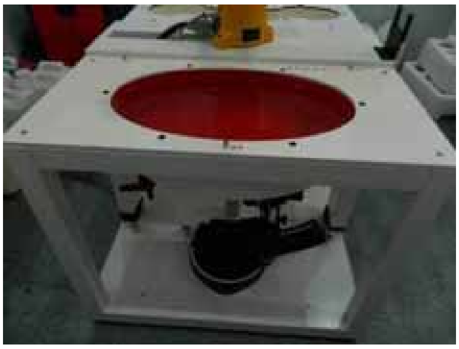
Picture 7: SAM Twin Phantom

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

5.5 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

5.6 Data Storage and Evaluation

5.6.1 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.

5.6.2 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 Normi, ai0, ai1, ai2

- Conversion factor ConvFi

- Diode compression point Dcpi

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)

dcpi = 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)

$\mathbf{Norm_i}$ = sensor sensitivity of channel i (i = x, y, z)

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

ConvF = sensitivity enhancement in solution

$\mathbf{a_{ij}}$ **=** sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

$\mathbf{E_i}$ = electric field strength of channel i in V/m

$\mathbf{H_i}$ = magnetic field strength of channel i in A/m

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

$\mathbf{E_{tot}}$ **= (Ex2+ EY2+ Ez2)1/2**

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

SAR = ($\mathbf{E_{tot}}$**) 2 · σ / (ρ· 1000)**

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

$\mathbf{E_{tot}}$ = 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.

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

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

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

5.7 Tissue-equivalent Liquid

5.7.1 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 Body Tissue Equivalent Matter

MIXTURE%	FREQUENCY (Body) 750MHz
Water	50.5
Glycol	48.7
Salt	0.8
Dielectric Parameters Target Value	f=750MHz ε=55.5 σ=0.96

MIXTURE%	FREQUENCY (Body) 1750MHz
Water	69.6
Glycol	29.9
Salt	0.5
Dielectric Parameters Target Value	f=1750MHz ε=53.4 σ=1.49

5.7.2 Tissue-equivalent Liquid Properties

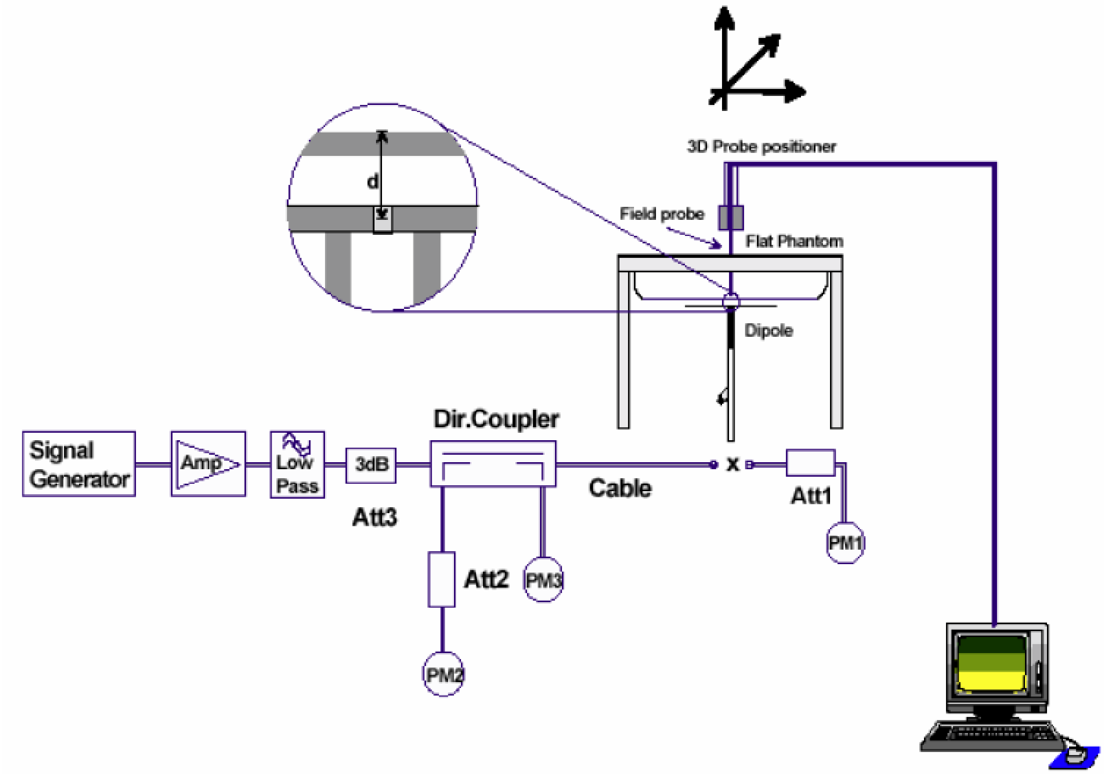
Table 3: Dielectric Performance of Tissue Simulating Liquid

Date	Frequency	Temp ℃	Measured Dielectric Parameters		Target Dielectric Parameters		Limit (Within ±5%)	
			ε_r	σ(s/m)	ε_r	σ(s/m)	Dev εr(%)	Dev σ(%)
2015-03-04	750MHz (Body)	22.7	55.974	0.974	55.5	0.96	0.85	1.46
2015-03-06	1750MHz (Body)	22.9	54.565	1.524	53.4	1.49	2.18	2.28

5.8 System Check

5.8.1 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

Table 4: Antenna Parameters with Body Tissue Simulating Liquid

Dipole D750V3 SN: 1078				
Body Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2014-06-23	-36.586	/	49.557	/

Dipole D1750V2 SN: 1023				
Body Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2014-06-17	-28.439	/	46.377	/

5.8.2 System Check Results

Table 5: System Check for Body Tissue Simulating Liquid

Frequency	Test date	Temp ℃	250W SAR1g	1W Normalized SAR1g	1W Target SAR1g	Limit (±10% Deviation)
			(W/kg)			
750MHz	2015-3-4	22.7	2.21	8.84	8.63	2.43
1750MHz	2015-3-6	22.9	9.88	39.52	37.9	4.27

6 Measurement Procedures

6.1 General Description of Test Procedures

For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal. The Tx power is set to 15 for 802.11 b 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 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. 802.11b/g/n modes are tested on the maximum average output channel. SAR is not required for 802.11a/g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

For LTE SAR Tests:

1. R&S CMW500 base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r03, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r03, for QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
6. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r03, smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.
8. Tests were performed when EUT operating without power back-off and operating with power back-off in accordance with general note 3, 4, 5, 6, 7 above.

This device can be used also in full sized tablet exposure conditions, due to its size. Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR exclusion threshold in KDB 447498 D01v05r02 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 required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.
This EUT was tested in five different positions. They are bottom-face of tablet PC, Edge1, Edge2, Edge3 and Edge4. EUT has proximity sensor function, it would be on bottom-face and Edge4 active, the sensor trigger distance is 1.2cm, EUT transmitting full power in normal mode was performed. Additional the surface of EUT is touching with phantom 0 cm for bottom-face and Edge4 with reduce power, Edge1, Edge2 and Edge 3 with full power were performed.

6.2 Measurement Variability

Per FCC KDB Publication 865664 D01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.
SAR Measurement Variability was assessed using the following procedures for each frequency band:
1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2) A second repeated measurement was preformed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

6.3 Test Position

6.3.1 Test Positions Requirements

The overall diagonal dimension of the display section of a tablet is 23 cm > 20 cm, Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. SAR evaluation for the front surface of tablet display screens are generally not necessary. The SAR Exclusion Threshold in KDB 447498 D01 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 required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

6.3.2 SAR test reduction and exclusion guidance

(1) The SAR exclusion threshold for distances <50mm is defined by the following equation:

(max. power of channel, including tune-up tolerance, mW)/ (min. test separation distance, mm). $\sqrt{\text{Frequency (GHz)}}$ **≤3.0**

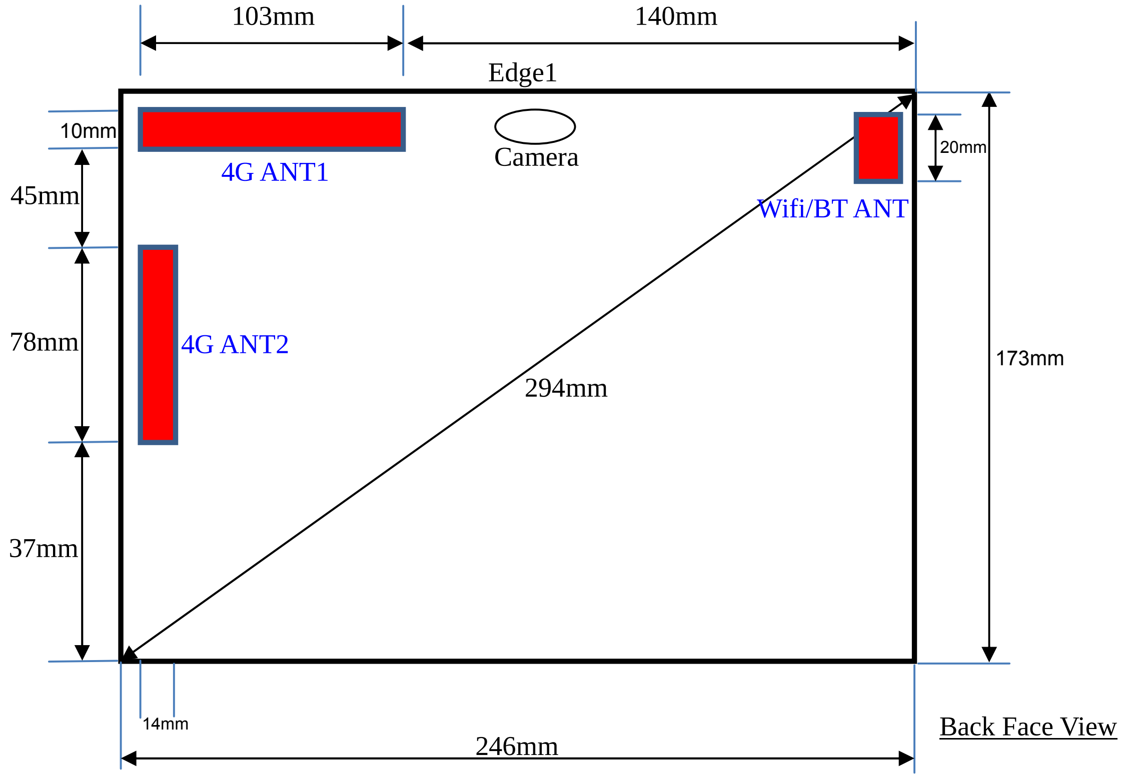
(2) The SAR exclusion threshold for distances >50mm is defined by the following equation, as illustrated in KDB 447498 D01 Appendix B:

a) at 100 MHz to 1500 MHz

[(Power allowed at numeric Threshold at 50 mm in step 1) + (test separation distance - 50 mm) · (f (MHz)/150)] mW

b) at > 1500 MHz and ≤ 6 GHz

[Power allowed at numeric Threshold at 50 mm in step 1) + (test separation distance-50 mm) ·10] mW



Note: The location of the antennas inside EUT and test positions is shown in ANNEX C:

6.4 Test Results

6.4.1 Worse Conducted Power Results

The output average power of WiFi 2.4G is as following:

Mode	Channel	Data rate (Mbps)	Power Setting	AV Power (dBm)
11b	1	1	30	6.7
	6	1	31	6.3
	11	1	33	6.3
11g	1	6	35	3.3
	6	6	36	3.1
	11	6	38	3.0
11n HT20	1	MCS0	35	2.8
	6	MCS0	36	2.5
	11	MCS0	38	2.6
11n HT40	3	MCS0	40	2.5
	6	MCS0	40	2.4
	9	MCS0	40	2.1

The output average power of BT (DSS) is as following:

Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm)
GFSK	0	2402	-4.630
	39	2441	-4.618
	78	2480	-5.768
π/4DQPSK	0	2402	-5.968
	39	2441	-5.850
	78	2480	-6.977
8DPSK	0	2402	-4.769
	39	2441	-4.636
	78	2480	-5.746

The output average power of BT (DTS) is as following:

Mode	Channel 0 (dBm)	Channel 39 (dBm)	Channel 78 (dBm)
GFSK	1.573	1.683	0.583

The output average power of LTE Band is as following:

Mode	Band Width (MHz)	Modulation	Uplink Channel Number	Frequency (MHz)	RB Size	RB Offset	Maximum Average Power (dBm)	Reduced Average Power (dBm)
LTE Band 4	20MHz	QPSK	20050	1720	1	0	23.25	16.56
					1	50	23.19	16.47
					1	99	23.20	16.39
					50	0	22.88	16.07
					50	50	22.97	16.08
					100	0	22.98	16.08
			20175	1732.5	1	0	23.42	16.42
					1	50	22.95	16.36
					1	99	23.33	16.33
					50	0	22.77	16.08
					50	50	23.01	16.00
					100	0	22.91	15.88
			20300	1745	1	0	23.23	16.29
					1	50	23.12	16.31
					1	99	22.88	16.28
					50	0	22.86	16.17
					50	50	22.71	16.11
					100	0	22.81	16.02
		16-QAM	20050	1720	1	0	23.17	16.05
					1	50	23.19	16.16
					1	99	23.19	16.16
					24	0	22.97	15.95
					24	76	23.08	16.07
					100	0	23.03	16.03
			20175	1732.5	1	0	23.39	16.10
					1	50	23.39	16.19
					1	99	23.34	16.13
					75	0	22.90	15.91
					75	25	22.99	15.96
					100	0	22.97	15.98
			20300	1745	1	0	23.22	16.11
					1	49	23.15	16.12
					1	99	23.16	16.17
					75	0	22.89	15.88
					75	25	22.82	15.79
					100	0	22.79	15.80

Mode	Band Width (MHz)	Modulation	Uplink Channel Number	Frequency (MHz)	RB Size	RB Offset	Maximum Average Power (dBm)	Reduced Average Power (dBm)
LTE Band 4	5MHz	QPSK	19975	1712.5	1	0	23.49	16.06
					1	13	23.40	16.03
					1	24	23.44	15.97
					10	0	23.08	15.67
					10	15	23.06	15.65
					25	0	23.07	15.73
			20175	1732.5	1	0	23.19	16.20
					1	12	23.08	16.07
					1	24	23.29	16.30
					10	0	22.86	15.85
					10	6	22.89	15.90
					25	0	22.95	15.95
			20375	1752.5	1	0	23.06	16.49
					1	13	23.02	16.38
					1	24	22.98	16.41
					10	0	22.70	16.06
					10	6	22.65	16.06
					25	0	22.72	16.07
		16-QAM	19975	1712.5	1	0	23.17	16.00
					1	13	23.11	16.00
					1	24	23.10	16.04
					8	0	23.13	15.92
					8	17	23.19	15.75
					25	0	23.03	15.78
			20175	1732.5	1	0	23.39	16.18
					1	13	23.33	16.12
					1	24	23.30	16.07
					8	0	23.43	16.03
					8	17	23.39	16.10
					25	0	23.15	16.02
			20375	1752.5	1	0	23.01	16.18
					1	13	23.00	16.11
					1	24	23.03	16.07
					8	0	22.91	16.12
					8	17	22.75	16.06
					25	0	22.79	16.15

Mode	Band Width (MHz)	Modulation	Uplink Channel Number	Frequency (MHz)	RB Size	RB Offset	Maximum Average Power (dBm)	Reduced Average Power (dBm)
LTE Band 4	3MHz	QPSK	19965	1711.5	1	0	23.37	16.36
					1	8	23.34	16.35
					1	14	23.25	16.24
					10	0	23.10	16.10
					10	5	23.12	16.11
					15	0	23.10	16.11
			20175	1732.5	1	0	23.20	16.19
					1	8	23.06	16.07
					1	14	23.15	16.14
					10	0	22.87	15.88
					10	5	22.88	15.87
					15	0	22.92	15.93
			20385	1753.5	1	0	22.97	15.98
					1	7	22.82	15.81
					1	14	22.87	15.87
					10	0	22.58	15.55
					10	5	22.59	15.58
					15	0	22.61	15.58
		16-QAM	19965	1711.5	1	0	23.30	16.07
					1	8	23.29	16.00
					1	14	23.30	16.09
					6	0	23.29	16.07
					6	9	23.21	16.00
					15	0	23.23	16.03
			20175	1732.5	1	0	23.15	16.16
					1	8	23.19	16.06
					1	14	23.12	16.01
					6	0	23.16	16.01
					6	4	23.08	15.97
					15	0	22.99	15.97
			20385	1753.5	1	0	22.96	16.14
					1	7	22.84	16.13
					1	14	22.82	16.12
					6	0	22.93	16.02
					6	9	22.97	15.94
					15	0	22.72	15.69

Mode	Band Width (MHz)	Modulation	Uplink Channel Number	Frequency (MHz)	RB Size	RB Offset	Maximum Average Power (dBm)	Reduced Average Power (dBm)
LTE Band 13	5MHz	QPSK	23205	779.5	1	0	23.42	18.43
					1	13	23.48	18.47
					1	24	23.50	18.48
					15	0	23.06	18.03
					15	10	23.04	18.05
					25	0	23.09	18.10
			23230	782	1	0	23.60	18.59
					1	13	23.51	18.79
					1	24	23.54	18.53
					10	0	23.20	18.40
					10	15	23.12	18.34
					25	0	23.16	18.36
			23255	784.5	1	0	23.64	18.83
					1	13	23.36	18.77
					1	24	23.12	18.70
					10	0	23.06	18.64
					10	15	23.04	18.61
					25	0	23.00	18.50
		16-QAM	23205	779.5	1	0	23.39	18.26
					1	13	23.34	18.23
					1	24	23.38	18.27
					8	0	23.32	18.10
					8	17	23.46	18.15
					25	0	23.04	18.12
			23230	782	1	0	23.48	18.55
					1	12	23.44	18.52
					1	24	23.41	18.51
					8	0	23.52	18.41
					8	17	23.46	18.33
					25	0	23.43	18.31
			23255	784.5	1	0	23.47	18.76
					1	12	23.45	18.75
					1	24	23.40	18.69
					8	0	23.35	18.36
					8	17	23.23	18.22
					25	0	23.24	18.23

Mode	Band Width (MHz)	Modulation	Uplink Channel Number	Frequency (MHz)	RB Size	RB Offset	Maximum Average Power (dBm)	Reduced Average Power (dBm)
LTE Band 13	10MHz	QPSK	23230	782	1	0	23.31	18.62
					1	25	23.17	18.86
					1	49	23.25	18.52
					25	0	23.18	18.56
					25	25	23.14	18.53
					50	0	23.21	18.52
		16-QAM	23230	782	1	0	22.81	18.59
					1	24	22.84	18.63
					1	49	22.59	18.46
					30	0	22.75	18.44
					30	20	22.76	18.46
					50	0	22.78	18.39

6.4.2 SAR Test Results

SAR Values LTE Band 4:

Mode	Test Position	Gap (cm)	Power Reduction	Ch.	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
20M,1Rb 0offset,QPSK	Bottom face	0	Sensor on	20050	16.56	17.00	1.107	0.658	0.728
20M,1Rb 0offset,QPSK	Edge1	0	Sensor on	20050	16.56	17.00	1.107	0.393	0.435
20M,1Rb 0offset,QPSK	Edge2	0	Sensor off	20050	23.55	24.00	1.109	0.294	0.326
20M,1Rb 0offset,QPSK	Bottom face	1.1	Sensor off	20050	23.55	24.00	1.109	0.899	0.997
20M,1Rb 0offset,QPSK	Edge1	0.8	Sensor off	20050	23.55	24.00	1.109	1.09	1.209
20M,1Rb 0offset,QPSK	Bottom face	1.1	Sensor off	20175	23.42	24.00	1.143	0.873	0.998
20M,1Rb 49offset,QPSK	Bottom face	1.1	Sensor off	20300	23.32	24.00	1.169	0.926	1.083
20M,1Rb 0offset,QPSK	Edge1	0.8	Sensor off	20175	23.42	24.00	1.143	1.02	1.166
20M,1Rb 49offset,QPSK	Edge1	0.8	Sensor off	20300	23.32	24.00	1.169	1.04	1.216
20M,50Rb 0offset,QPSK	Bottom face	0	Sensor on	20300	16.17	17.00	1.211	0.607	0.735
20M,50Rb 0offset,QPSK	Edge1	0	Sensor on	20300	16.17	17.00	1.211	0.512	0.620
20M,50Rb 0offset,QPSK	Edge2	0	Sensor off	20300	23.16	24.00	1.213	0.259	0.314
20M,50Rb 0offset,QPSK	Bottom face	1.1	Sensor off	20300	23.16	24.00	1.213	0.892	1.082
20M,50Rb 0offset,QPSK	Edge1	0.8	Sensor off	20300	23.16	24.00	1.213	1.02	1.238
20M,50Rb 0offset,QPSK	Bottom face	1.1	Sensor off	20050	23.08	24.00	1.236	0.893	1.104
20M,50Rb 0offset,QPSK	Bottom face	1.1	Sensor off	20175	23.07	24.00	1.239	0.861	1.067
20M,50Rb 0offset,QPSK	Edge1	0.8	Sensor off	20050	23.08	24.00	1.236	0.983	1.215
20M,50Rb 0offset,QPSK	Edge1	0.8	Sensor off	20175	23.07	24.00	1.239	0.964	1.194
20M,100Rb 0offset,QPSK	Bottom face	0	Sensor on	20050	16.08	17.00	1.236	0.603	0.745
20M,100Rb 0offset,QPSK	Edge1	0	Sensor on	20050	16.08	17.00	1.236	0.416	0.514
20M,100Rb 0offset,QPSK	Edge2	0	Sensor off	20050	23.08	24.00	1.236	0.273	0.337
20M,100Rb 0offset,QPSK	Bottom face	1.1	Sensor off	20050	23.08	24.00	1.236	0.862	1.065
20M,100Rb 0offset,QPSK	Edge1	0.8	Sensor off	20050	23.08	24.00	1.236	1.01	**1.248**
20M,100Rb 0offset,QPSK	Bottom face	1.1	Sensor off	20175	22.91	24.00	1.285	0.876	1.126
20M,100Rb 0offset,QPSK	Bottom face	1.1	Sensor off	20300	23.01	24.00	1.256	0.838	1.053
20M,100Rb 0offset,QPSK	Edge1	0.8	Sensor off	20175	22.91	24.00	1.285	0.931	1.197
20M,100Rb 0offset,QPSK	Edge1	0.8	Sensor off	20300	23.01	24.00	1.256	0.897	1.127

SAR Values LTE Band 13:

Mode	Test Position	Gap (cm)	Power Reduction	Ch.	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
10M,1Rb 24offset,QPSK	Bottom face	0	Sensor on	23230	18.86	19.00	1.033	0.607	0.627
10M,1Rb 24offset,QPSK	Edge1	0	Sensor on	23230	18.86	19.00	1.033	0.569	0.588
10M,1Rb 24offset,QPSK	Edge2	0	Sensor off	23230	23.87	24.00	1.030	0.174	0.179
10M,1Rb 24offset,QPSK	Bottom face	1.1	Sensor off	23230	23.87	24.00	1.030	0.555	0.572
10M,1Rb 24offset,QPSK	Edge1	0.8	Sensor off	23230	23.87	24.00	1.030	0.388	0.400
10M,25Rb 0offset,QPSK	Bottom face	0	Sensor on	23230	18.56	19.00	1.107	0.625	**0.692**
10M,25Rb 0offset,QPSK	Edge1	0	Sensor on	23230	18.56	19.00	1.107	0.58	0.642
10M,25Rb 0offset,QPSK	Edge2	0	Sensor off	23230	23.58	24.00	1.102	0.173	0.191
10M,25Rb 0offset,QPSK	Bottom face	1.1	Sensor off	23230	23.58	24.00	1.102	0.556	0.612
10M,25Rb 0offset,QPSK	Edge1	0.8	Sensor off	23230	23.58	24.00	1.102	0.388	0.427
10M,50Rb 0offset,QPSK	Bottom face	0	Sensor on	23230	18.52	19.00	1.117	0.546	0.610
10M,50Rb 0offset,QPSK	Edge1	0	Sensor on	23230	18.52	19.00	1.117	0.585	0.653
10M,50Rb 0offset,QPSK	Edge2	0	Sensor off	23230	23.51	24.00	1.119	0.173	0.194
10M,50Rb 0offset,QPSK	Bottom face	1.1	Sensor off	23230	23.51	24.00	1.119	0.556	0.622
10M,50Rb 0offset,QPSK	Edge1	0.8	Sensor off	23230	23.51	24.00	1.119	0.453	0.507

For Repeat SAR:

Mode	Test Position	Gap (cm)	Power Reduction	Ch.	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
20M,1Rb 0offset,QPSK	Edge1	0.8	Sensor off	20050	23.55	24.00	1.109	1.07	1.187
20M,1Rb 0offset,QPSK	Edge1	0.8	Sensor off	20050	23.55	24.00	1.109	1.06	1.176

Note: 1.Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

2. Per KDB 941225 D05v02r03, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, Using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r03, for QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
6. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r03, smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤1.45 W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.
8. When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
9. A second repeated measurement was preformed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
10. A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
11. Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

6.4.3 Simultaneous Transmission Conditions

When standalone SAR is not required to be measured per FCC KDB 447498 D01v05 4.3.2 2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

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

Per FCC KDB 447498 D01v05 IV.C.1.iii, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific 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.

Ration=(SAR1 + SAR2)$^{1.5}$/Ri ≤ 0.04

Estimated $SAR_{BT\ bottom\ face}$= [(10^(2/10))/5] * (2.441$^{1/2}$/7.5)=0.066 W/kg
Estimated $SAR_{BT\ edge2}$= [(10^(2/10))/5] * (2.441$^{1/2}$/7.5)=0.066 W/kg
Estimated $SAR_{BT\ edge3}$= [(10^(2/10))/5] * (2.441$^{1/2}$/7.5)=0.066 W/kg
Estimated $SAR_{BT\ edge4}$= [(10^(2/10))/5] * (2.441$^{1/2}$/7.5)=0.066 W/kg

Estimated $SAR_{wifi\ bottom\ face}$= [(10^(7/10))/5] * (2.412$^{1/2}$/7.5)=0.208W/kg
Estimated $SAR_{wifi\ edge2}$= [(10^(7/10))/5] * (2.412$^{1/2}$/7.5)=0.208W/kg
Estimated $SAR_{wifi\ edge3}$= [(10^(7/10))/5] * (2.412$^{1/2}$/7.5)=0.208W/kg
Estimated $SAR_{wifi\ edge4}$= [(10^(7/10))/5] * (2.412$^{1/2}$/7.5)=0.208W/kg

About Bluetooth DSS and LTE antenna(Body):

WWAN Band	Test Position	WWAN	WLAN DSS	Max, Σ SAR	SPLSR Results
		SAR (W/kg)	SAR (W/kg)		
LTE Band 4	Bottom face	1.126	0.066	1.192	
	Edge1	1.248	0.066	1.314	
	Edge2	0.337	0.066	0.403	
LTE Band 13	Bottom face	1.126	0.066	1.192	
	Edge1	1.248	0.066	1.314	
	Edge2	0.337	0.066	0.403	

About WIFI and LTE antenna(Body):

WWAN Band	Test Position	WWAN	WLAN DTS	Max, Σ SAR	SPLSR Results
		SAR (W/kg)	SAR (W/kg)		
LTE Band 4	Bottom face	1.126	0.208	1.334	
	Edge1	1.248	0.208	1.456	
	Edge2	0.337	0.208	0.545	
LTE Band 13	Bottom face	1.126	0.208	1.334	
	Edge1	1.248	0.208	1.456	
	Edge2	0.337	0.208	0.545	

MAX. ΣSAR1g =1.456 W/kg <1.6 W/kg, So the Simultaneous SAR are not required for BT and wifi antenna.

7 700MHz to 3GHz Measurement Uncertainty

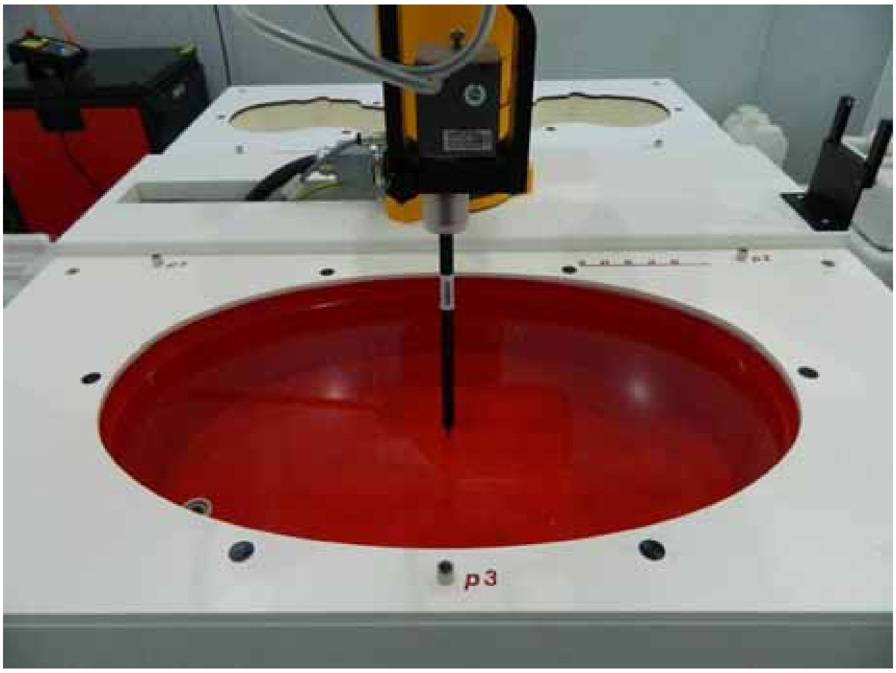
No.	Description	Type	Uncertainty Value(%)	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	5.5	N	1	1	1	5.5	5.5	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	N	1	1	1	0.6	0.6	∞
6	Readout electronics	B	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RF ambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
15	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
16	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
17	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
20	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
21	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
continue										
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						9.25	9.12	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						18.5	18.2	\

8 MAIN TEST INSTRUMENTS

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1	Signal Generator	Agilent	N5181A	MY50145187	Nov 04, 2014	1year
2	RF Power Meter. Dual Channel	BOONTON	4232A	10539	2014-5-17	1year
3	Power Sensor	BOONTON	51011EMC	34236/34238	2014-5-17	1year
4	Wideband Radio Communication Tester	R&S	CMW500	1201.0002K50-140822zk	2014-5-17	1year
5	E-Field Probe	SPEAG	EX3DV4	3753	2014-3-26	1year
6	DAE	SPEAG	DAE4	905	2014-7-14	1year
7	Validation Kit 750MHz	SPEAG	D750V3	1078	2014-6-23	1year
8	Validation Kit 1750MHz	SPEAG	D1750V2	1023	2014-6-17	1year

END OF REPORT BODY

ANNEX A TEST LAYOUT



ANNEX B SYSTEM CHECK RESULT

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date/Time: 04.03.2015

System Performance Check-D750MHz-MSL-150304

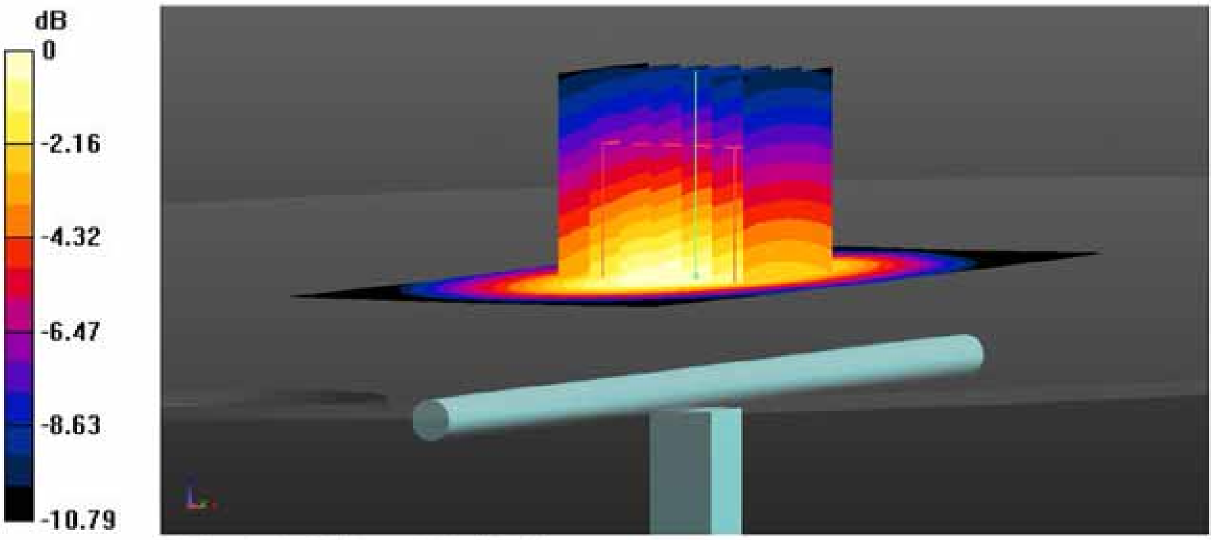
DUT: Dipole 750 MHz D750V3 SN:1078
Communication System: UID 0, CW (0); Frequency: 750 MHz;Duty Cycle: 1:1
Medium: MSL_750_150304
Medium parameters used: f = 750 MHz; σ = 0.974 S/m; ε_r = 55.974; ρ = 1000 kg/m^3
Ambient Temperature: 23.6 ℃; Liquid Temperature: 22.7 ℃

DASY Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.54, 9.54, 9.54); Calibrated: 26.03.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 14.07.2014
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequency at 750MHz/d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (41x101x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.03 W/kg

System Performance Check at Frequency at 750MHz/d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.631 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.80 W/kg
SAR(1 g) = 2.21 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (measured) = 3.01 W/kg



0 dB = 3.01 W/kg = 4.79 dBW/kg

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date/Time: 06.03.2015

SystemPerformanceCheck-D1750MHz-MSL-150306

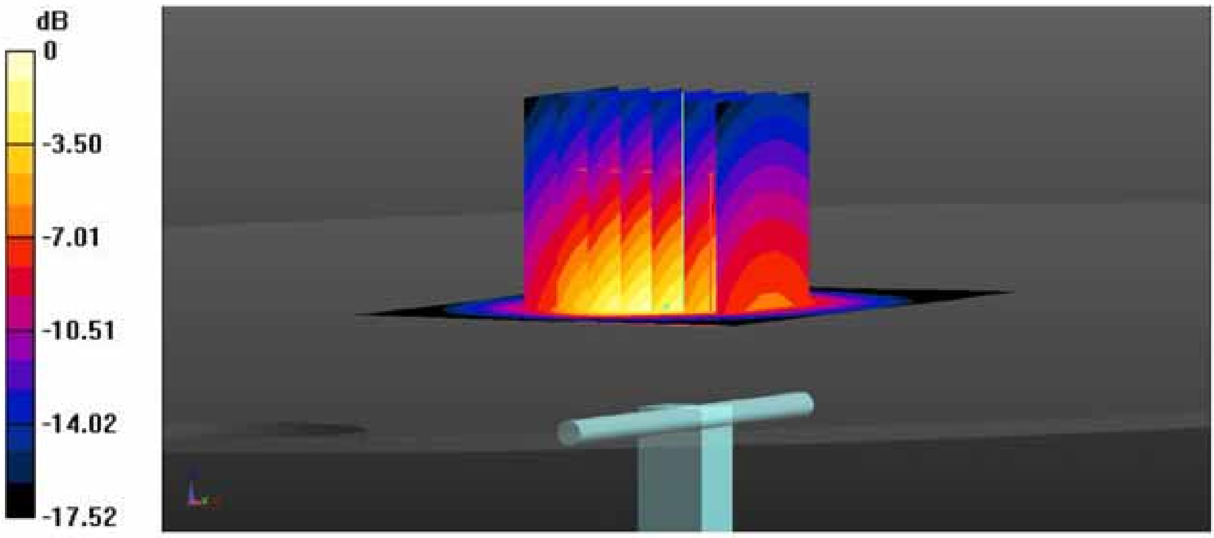
DUT: Dipole 1750 MHz D1750V2 SN:1023
Communication System: UID 0, CW (0); Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: MSL_1750_0306
Medium parameters used: f = 1750 MHz; σ = 1.524 S/m; ε_r = 54.565; ρ = 1000 kg/m^3
Ambient Temperature: 23.8 ℃; Liquid Temperature: 22.9 ℃

DASY Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.80, 7.80, 7.80); Calibrated: 26.03.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 14.07.2014
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequency at 1750MHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (41x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.6 W/kg

System Performance Check at Frequency at 1750MHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.789 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 17.7 W/kg
SAR(1 g) = 9.88 W/kg; SAR(10 g) = 5.18 W/kg
Maximum value of SAR (measured) = 14.0 W/kg



0 dB = 14.0 W/kg = 11.46 dBW/kg

ANNEX C GRAPH Result

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date/Time: 04.03.2015

03-LTE Band 13-10M-QPSK-25RB 0Offset-Bottom Face-0cm-Ch23230-Sensor on

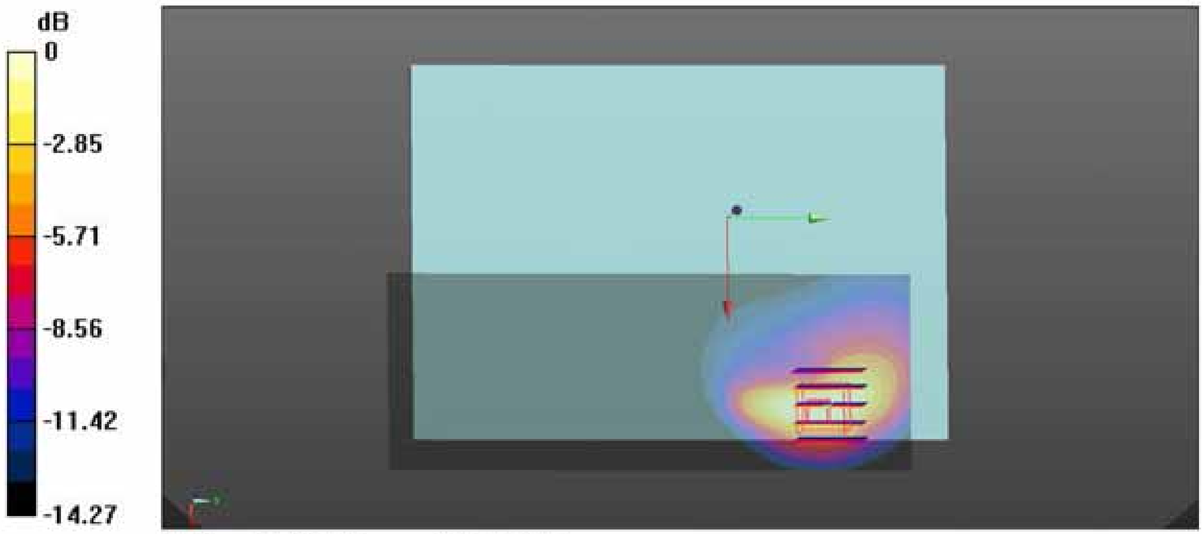
DUT: NXA101LTE116
Communication System: UID 0, Generic LTE (0); Frequency: 782 MHz;Duty Cycle: 1:1
Medium: MSL_750_150302
Medium parameters used: f = 782 MHz; σ = 0.992 S/m; ε_r = 54.931; ρ = 1000 kg/m^3
Ambient Temperature: 23.6 ℃; Liquid Temperature: 22.7 ℃

DASY Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.54, 9.54, 9.54); Calibrated: 26.03.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 14.07.2014
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Configuration/Ch23230/Area Scan (61x161x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.962 W/kg

Configuration/Ch23230/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.440 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.625 W/kg; SAR(10 g) = 0.342 W/kg
Maximum value of SAR (measured) = 0.936 W/kg



0 dB = 0.936 W/kg = -0.29 dBW/kg

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date/Time: 06.03.2015

20-LTE Band 4-20M-QPSK-100RB 0Offset-Edge1-0.8cm-Ch20050-Sensor off

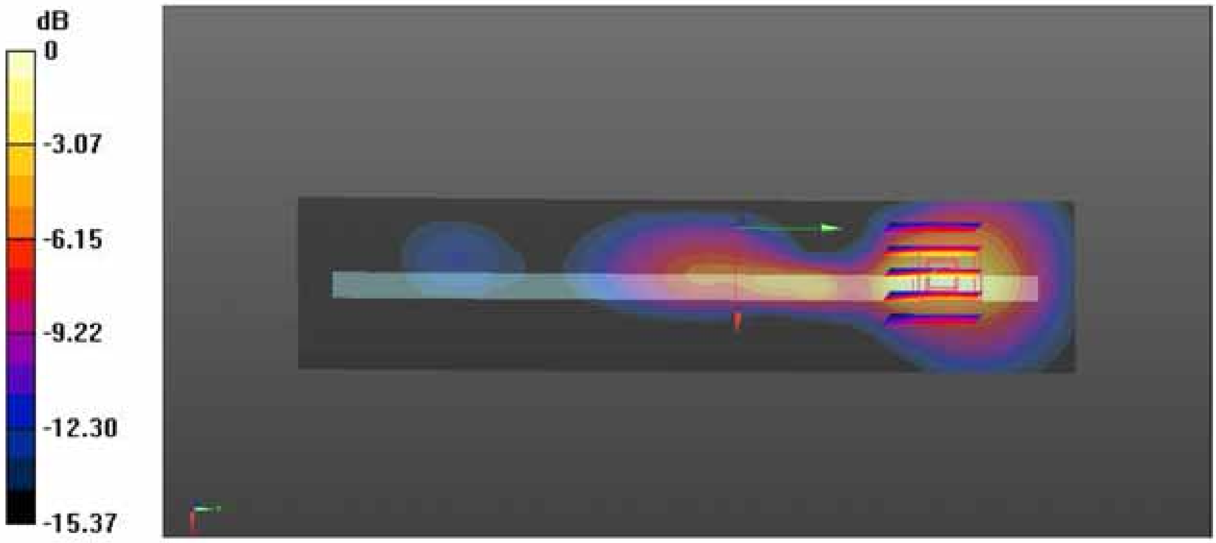
DUT: NXA101LTE116
Communication System: UID 0, Generic LTE (0); Frequency: 1720 MHz;Duty Cycle: 1:1
Medium: MSL_1750_0306
Medium parameters used: f = 1720 MHz; σ = 1.492 S/m; ε_r = 54.672; ρ = 1000 kg/m^3
Ambient Temperature: 23.8 ℃; Liquid Temperature: 22.9 ℃

DASY Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.80, 7.80, 7.80); Calibrated: 26.03.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 14.07.2014
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Configuration/Ch20050/Area Scan (41x181x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.41 W/kg

Configuration/Ch20050/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.569 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.62 W/kg
SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.583 W/kg
Maximum value of SAR (measured) = 1.32 W/kg



0 dB = 1.32 W/kg = 1.21 dBW/kg

ANNEX D Probe Calibration Certificate

TMC In Collaboration with **speag** CALIBRATION LABORATORY

Add: No.52 Huayuanbei Road, Haidian District, Beijing, 100191, China
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E-mail: Info@emcite.com Http://www.emcite.com

ilac-MRA CNAS 校准 CNAS L0442

Client Auden Certificate No: Z14-97009

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3753

Calibration Procedure(s): TMC-OS-E-02-195
Calibration Procedures for Dosimetric E-field Probes

Calibration date: March 26, 2014

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
DAE4	SN 915	11-Jun-13 (SPEAG, DAE4-915_Jun13)	Jun -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-14 (TMC, No.JZ14-781)	Feb-15

	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: March 28, 2014

TMC In Collaboration with s p e a g CALIBRATION 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
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

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 EX3DV4

SN: 3753

Calibrated: March 26, 2014

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY – Parameters of Probe: EX3DV4 - SN: 3753

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	0.45	0.29	0.45	±10.8%
DCP(mV)[B]	103.6	105.4	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	185.5	±2.2%
		Y	0.0	0.0	1.0		140.5	
		Z	0.0	0.0	1.0		182.2	

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: EX3DV4 - SN: 3753

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[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	9.48	9.48	9.48	1.17	0.55	±12%
850	41.5	0.92	9.13	9.13	9.13	0.20	1.08	±12%
900	41.5	0.97	9.35	9.35	9.35	0.08	1.64	±12%
1750	40.1	1.37	8.06	8.06	8.06	0.18	1.40	±12%
1900	40.0	1.40	7.91	7.91	7.91	0.20	1.28	±12%
2000	40.0	1.40	7.86	7.86	7.86	0.14	2.71	±12%
2450	39.2	1.80	7.29	7.29	7.29	0.65	0.70	±12%
5200	36.0	4.66	4.83	4.83	4.83	0.38	1.09	±13%
5300	35.9	4.76	4.92	4.92	4.92	0.40	1.25	±13%
5500	35.6	4.96	4.80	4.80	4.80	0.38	1.39	±13%
5600	35.5	5.07	4.65	4.65	4.65	0.41	1.33	±13%
5800	35.3	5.27	4.58	4.58	4.58	0.43	1.42	±13%

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

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DASY – Parameters of Probe: EX3DV4 - SN: 3753

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[G]	Depth[G] (mm)	Unct. (k=2)
750	55.5	0.96	9.54	9.54	9.54	1.97	0.55	±12%
850	55.2	0.99	9.14	9.14	9.14	0.20	1.23	±12%
900	55.0	1.05	9.12	9.12	9.12	0.27	1.02	±12%
1750	53.4	1.49	7.80	7.80	7.80	0.15	2.08	±12%
1900	53.3	1.52	7.49	7.49	7.49	0.15	2.30	±12%
2000	53.3	1.52	7.83	7.83	7.83	0.15	3.24	±12%
2450	52.7	1.95	7.31	7.31	7.31	0.55	0.80	±12%
2600	52.5	2.16	6.93	6.93	6.93	0.55	0.79	±12%
3500	51.3	3.31	6.60	6.60	6.60	0.36	1.26	±13%
5200	49.0	5.30	4.67	4.67	4.67	0.39	1.24	±13%
5300	48.9	5.42	4.42	4.42	4.42	0.43	1.43	±13%
5500	48.6	5.65	4.21	4.21	4.21	0.39	1.70	±13%
5600	48.5	5.77	4.15	4.15	4.15	0.43	1.66	±13%
5800	48.2	6.00	4.24	4.24	4.24	0.44	1.62	±13%

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

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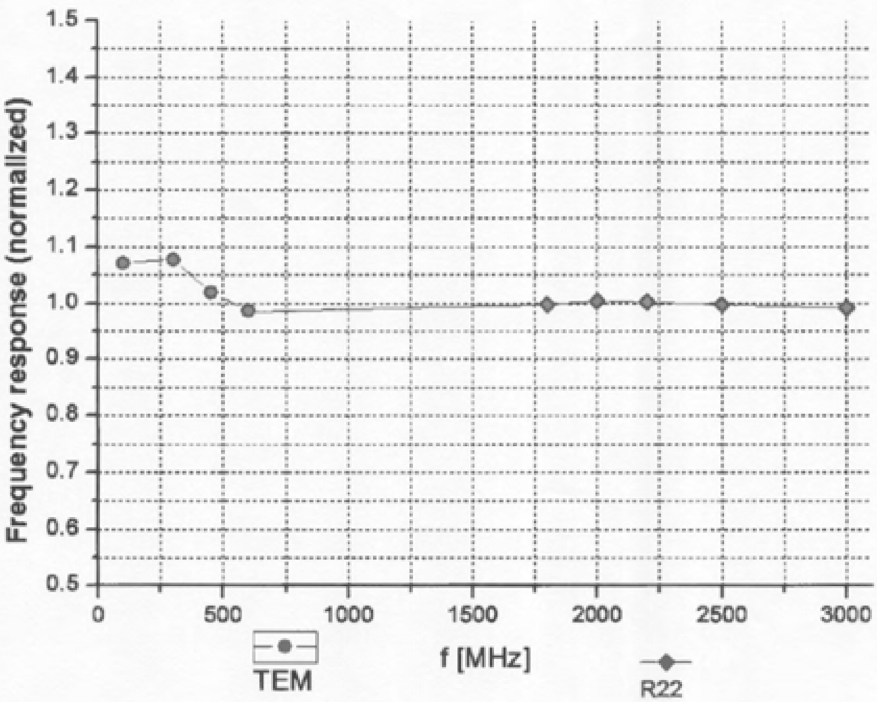
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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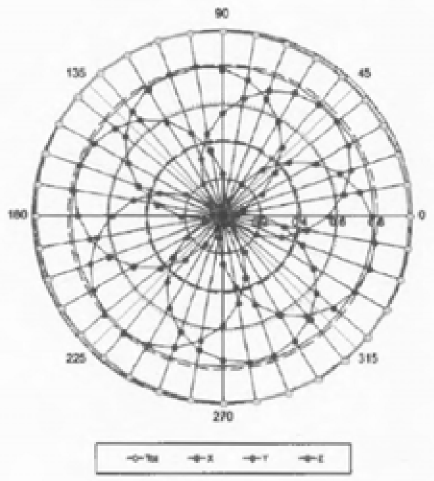
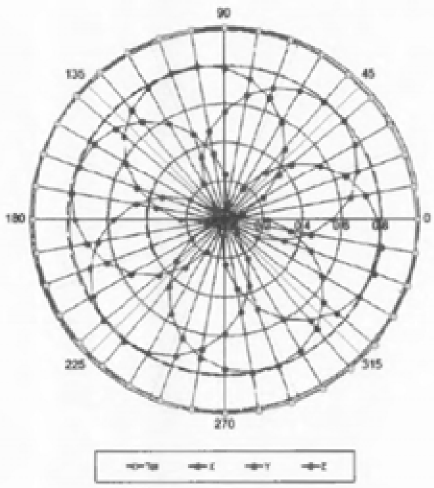
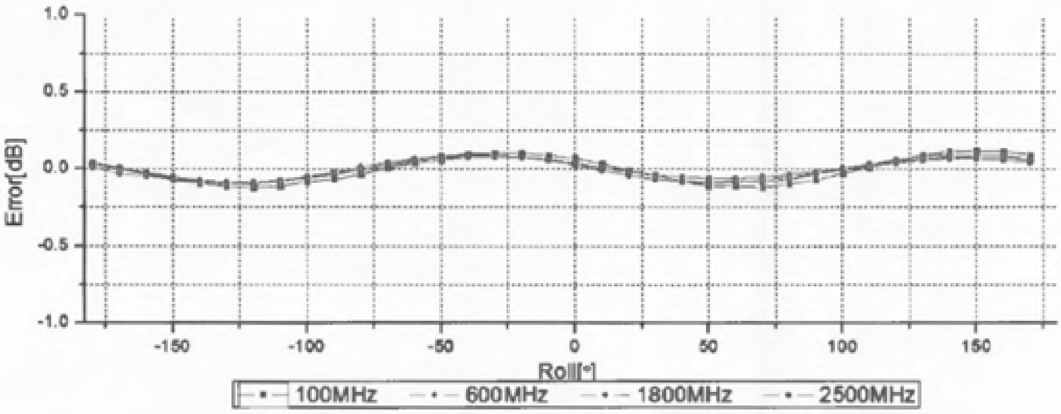
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





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

Certificate No: Z14-97009 Page 8 of 11

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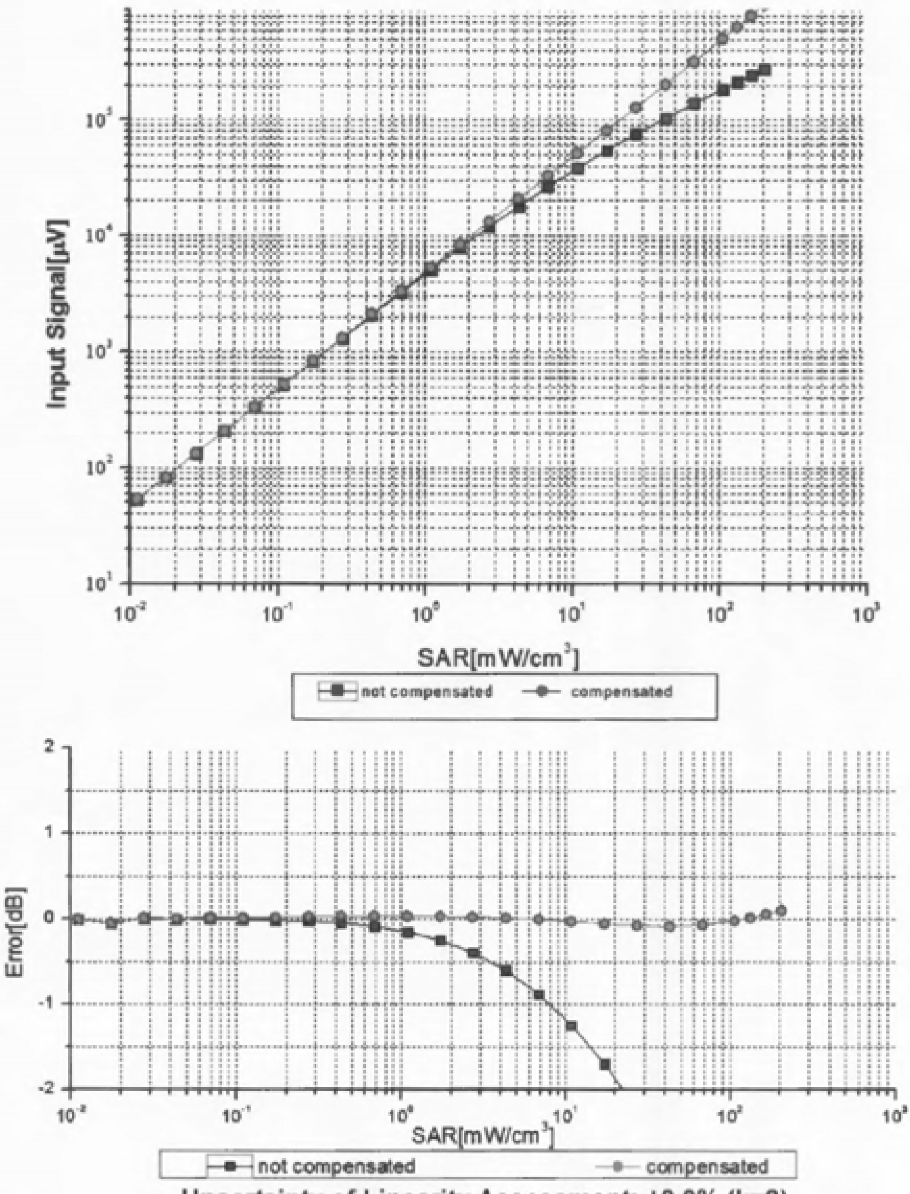
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)



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

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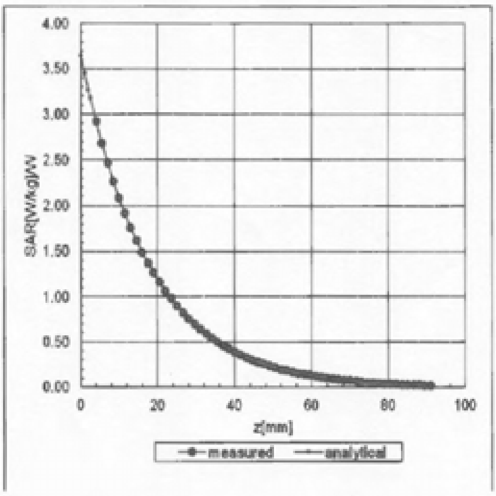
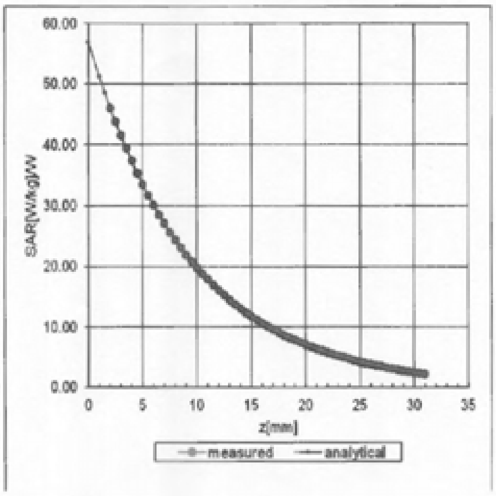
Conversion Factor Assessment

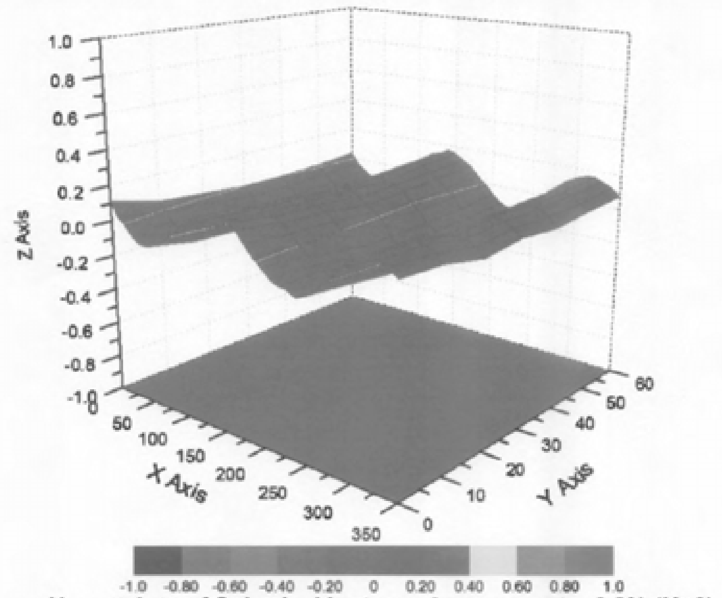
f=900 MHz, WGLS R9(H_convF)



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: EX3DV4 - SN: 3753

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	47.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	2mm

ANNEX E Dipole Calibration Certificate

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **D750V3-1078_Jun14**

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1078
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	June 23, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: June 23, 2014

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

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.7 ± 6 %	0.92 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	2.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.34 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.44 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.4 ± 6 %	0.99 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	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.63 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.65 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.7 Ω + 0.6 jΩ
Return Loss	- 26.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6 Ω - 1.4 jΩ
Return Loss	- 36.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.034 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 15, 2012

DASY5 Validation Report for Head TSL

Date: 16.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

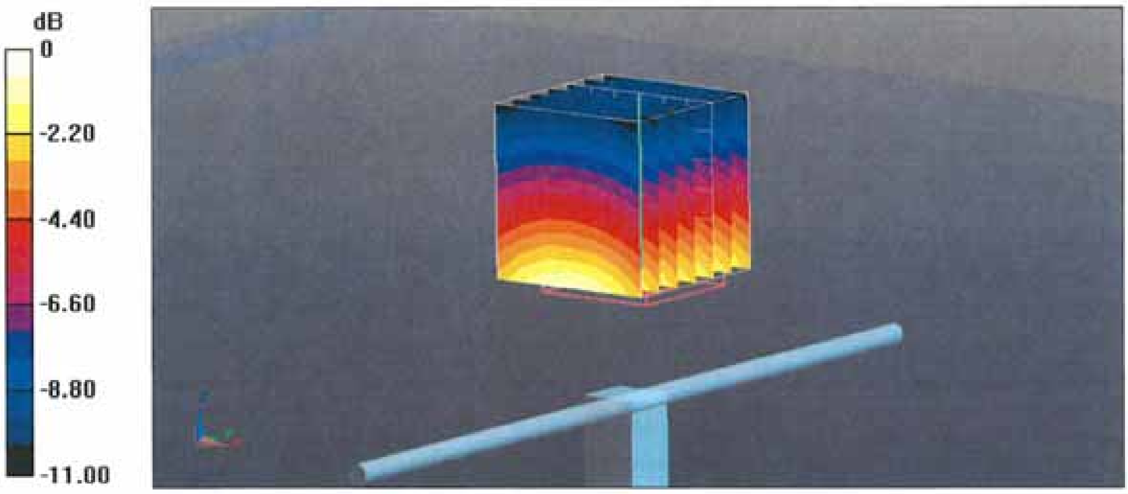
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1078

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.92 S/m; ε_r = 41.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

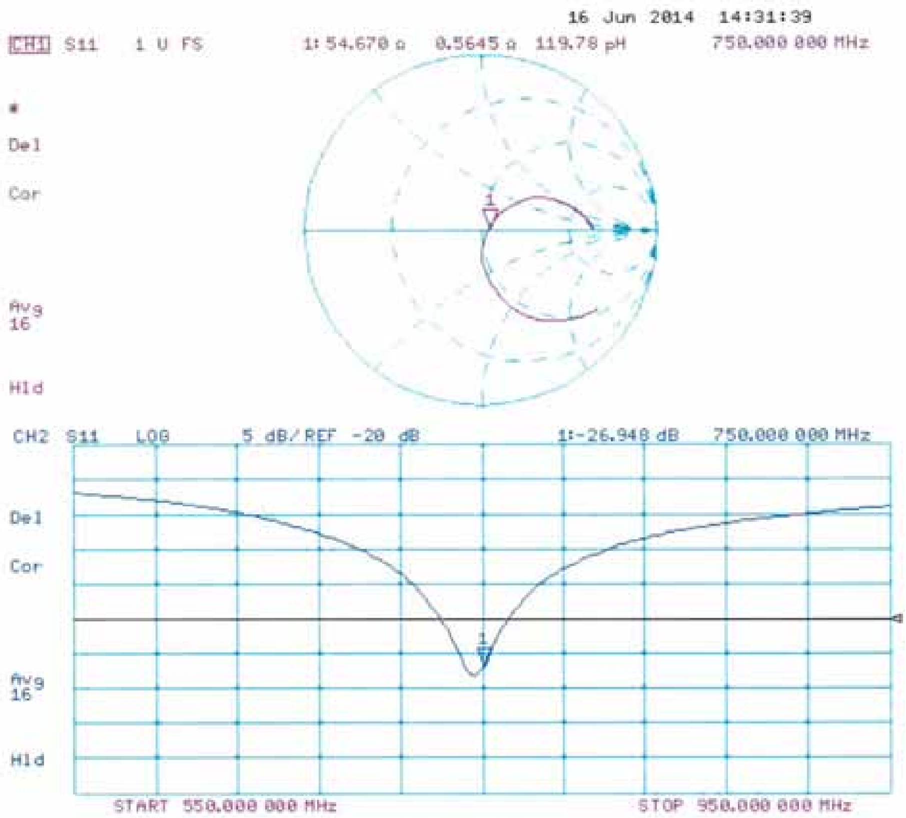
- Probe: ES3DV3 - SN3205; ConvF(6.37, 6.37, 6.37); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.86 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.21 W/kg
SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.39 W/kg
Maximum value of SAR (measured) = 2.51 W/kg



0 dB = 2.51 W/kg = 4.00 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

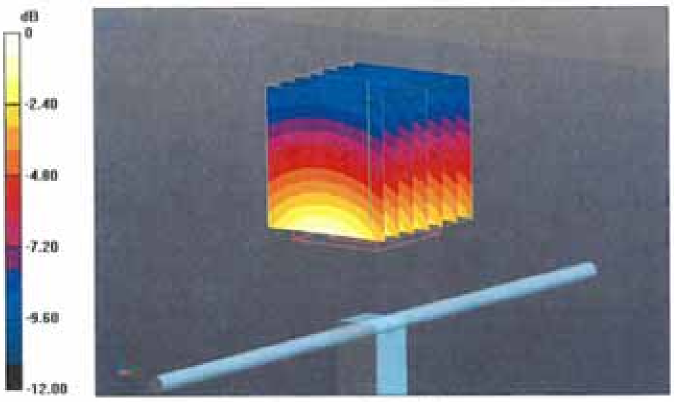
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1078

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; $\sigma = 0.99$ S/m; $\varepsilon_r = 55.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

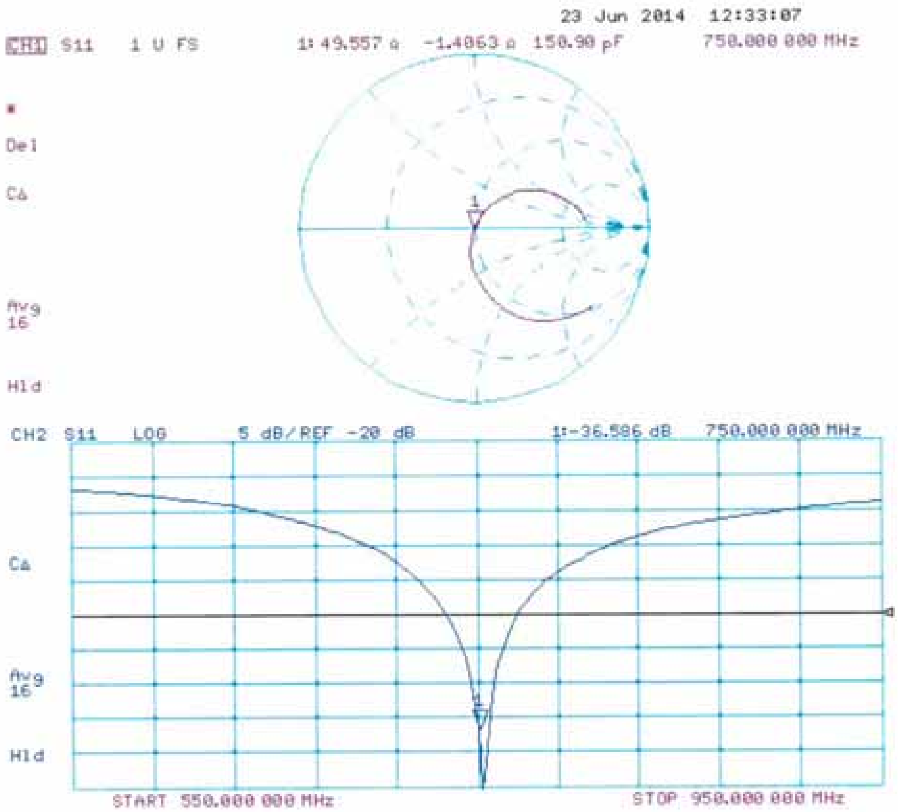
- Probe: ES3DV3 - SN3205; ConvF(6.13, 6.13, 6.13); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.60 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.28 W/kg
SAR(1 g) = 2.21 W/kg; SAR(10 g) = 1.44 W/kg
Maximum value of SAR (measured) = 2.57 W/kg



0 dB = 2.57 W/kg = 4.10 dBW/kg

Impedance Measurement Plot for Body TSL



Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client Auden

Certificate No: D1750V2-1023_Jun14

CALIBRATION CERTIFICATE

Object D1750V2 - SN: 1023

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

Calibration date: June 17, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	Leif Klysner
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 18, 2014

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.3 ± 6 %	1.37 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	9.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.88 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.5 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.0 ± 6 %	1.49 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	9.54 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.4 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.2 Ω - 0.4 jΩ
Return Loss	- 38.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.4 Ω + 0.4 jΩ
Return Loss	- 28.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.217 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 20, 2009

DASY5 Validation Report for Head TSL

Date: 17.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

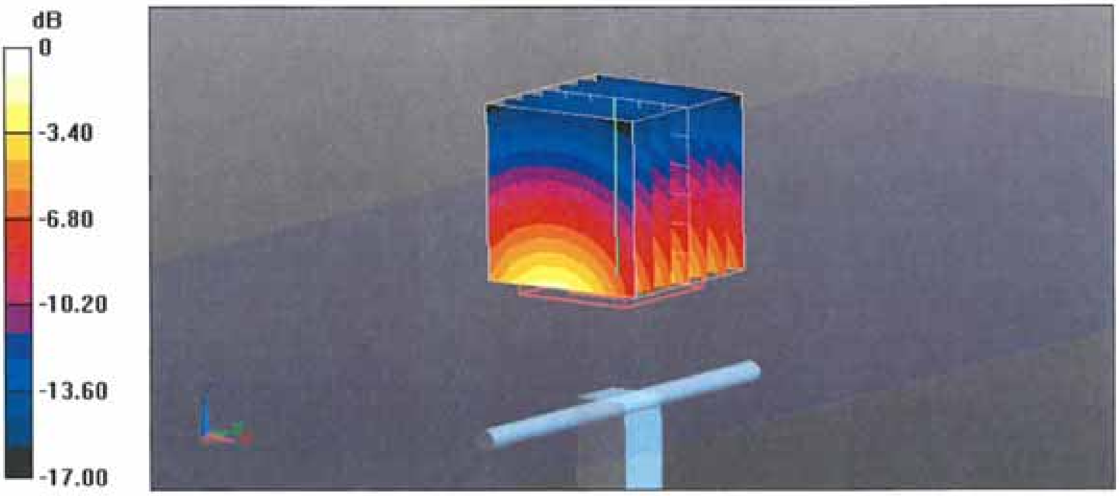
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1023

Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.37 S/m; ε_r = 39.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

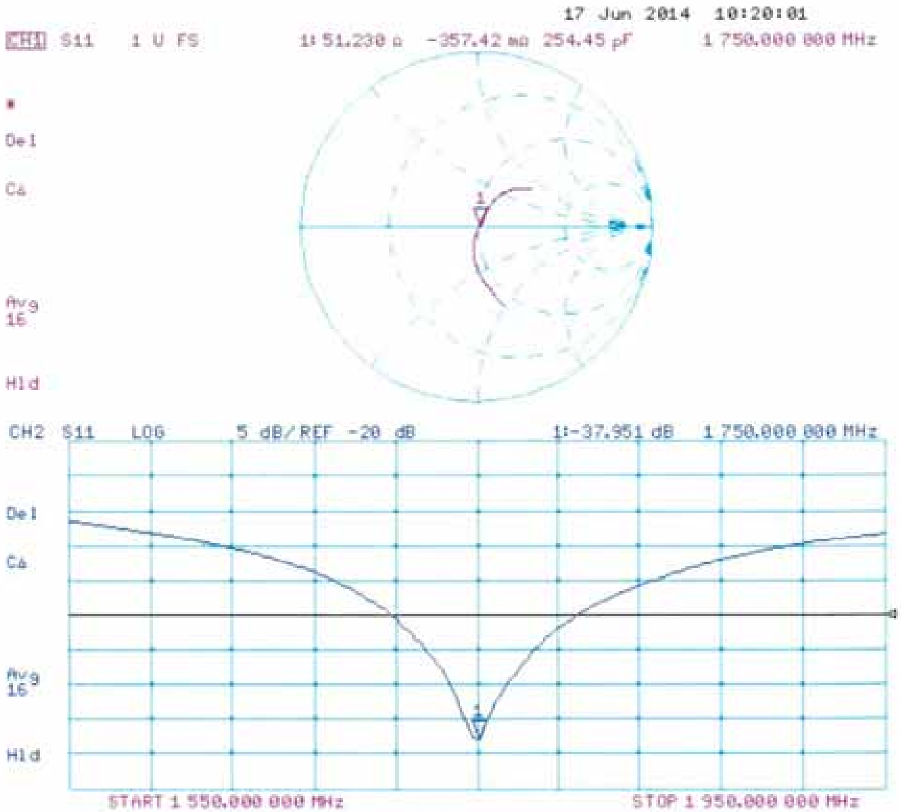
- Probe: ES3DV3 - SN3205; ConvF(5.23, 5.23, 5.23); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.67 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 16.6 W/kg
SAR(1 g) = 9.21 W/kg; SAR(10 g) = 4.88 W/kg
Maximum value of SAR (measured) = 11.5 W/kg



0 dB = 11.5 W/kg = 10.61 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

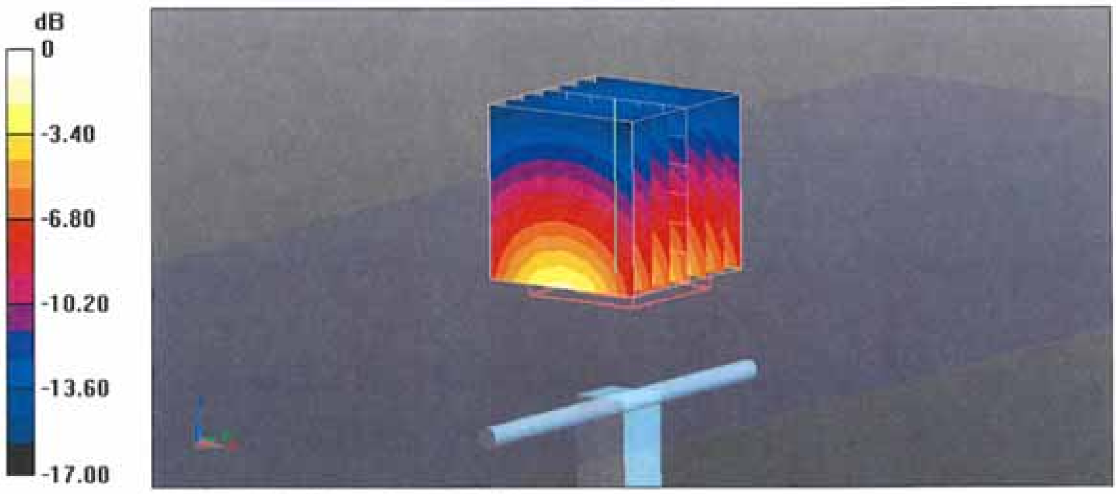
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1023

Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.49 S/m; ε_r = 52; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

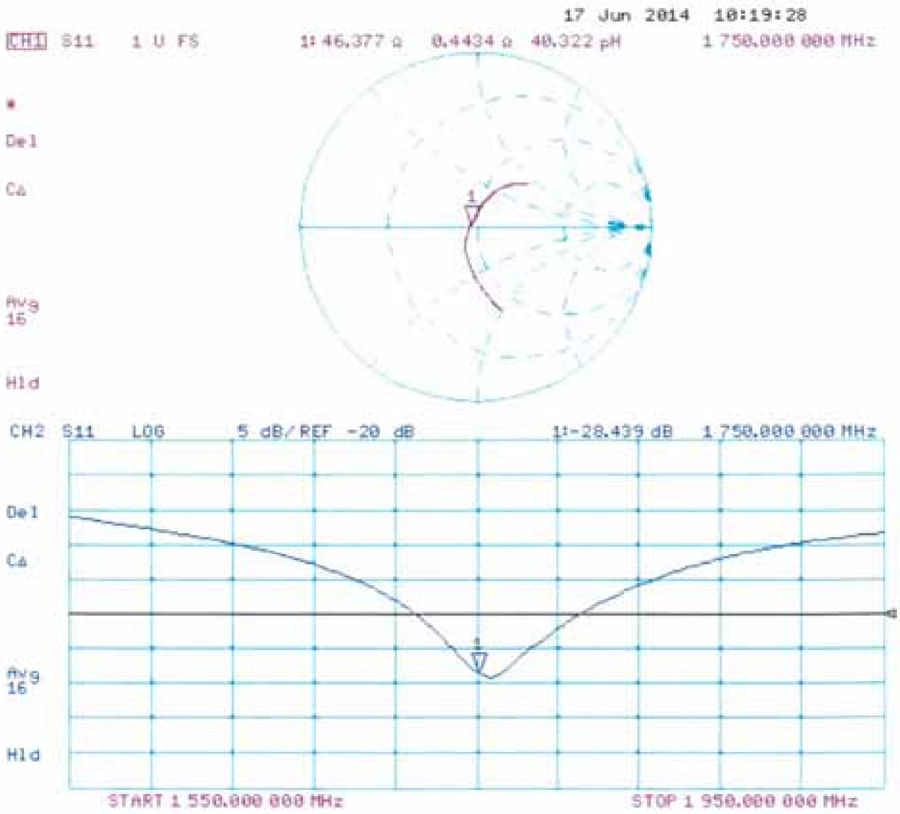
- Probe: ES3DV3 - SN3205; ConvF(4.89, 4.89, 4.89); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.68 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 9.54 W/kg; SAR(10 g) = 5.12 W/kg
Maximum value of SAR (measured) = 12.0 W/kg



0 dB = 12.0 W/kg = 10.79 dBW/kg

Impedance Measurement Plot for Body TSL



ANNEX F DAE4 Calibration Certificate

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

CALIBRATION
No. L0570

Client : Auden

Certificate No: Z14-97064

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 905
Calibration Procedure(s)	TMC-OS-E-01-198 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	July 14, 2014

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-14 (CTTL, No:J14X02147)	July-15

	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: July 16, 2014

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

Certificate No: Z14-97064 Page 1 of 3

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

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.

In Collaboration with speag
CALIBRATION LABORATORY

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E-mail: cttl@chinattl.com Http://www.chinattl.cn

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	404.736 ± 0.15% (k=2)	405.279 ± 0.15% (k=2)	404.866 ± 0.15% (k=2)
Low Range	3.98084 ± 0.7% (k=2)	4.0026 ± 0.7% (k=2)	3.99725 ± 0.7% (k=2)

Connector Angle

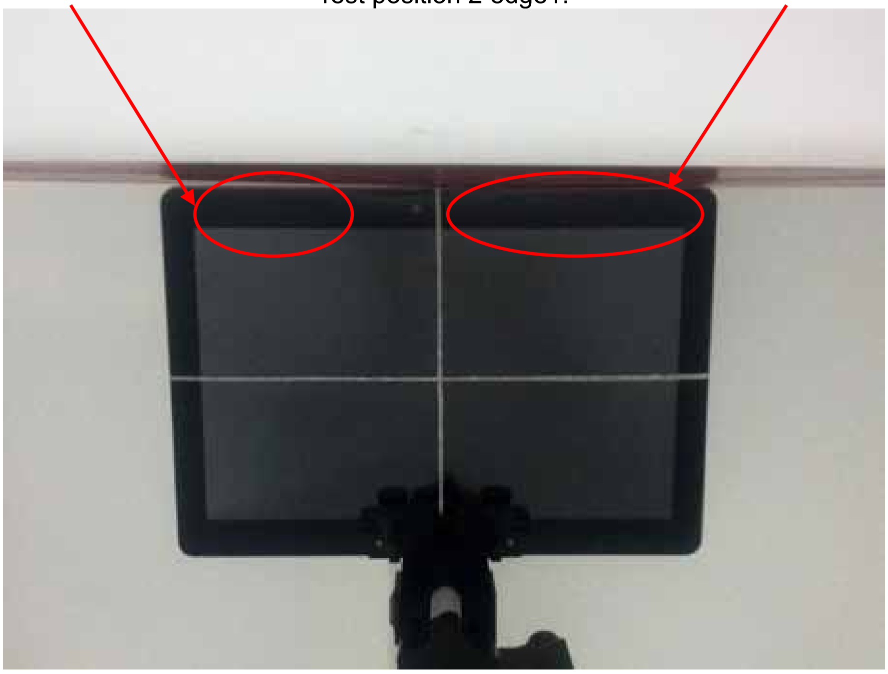
Connector Angle to be used in DASY system	270° ± 1 °

ANNEX G The EUT Appearance and Test Configuration

Test position 1 Bottom face:

Picture 1

Test position 2 edge1:



Picture 2

Test position 3 edge2:

Picture 3

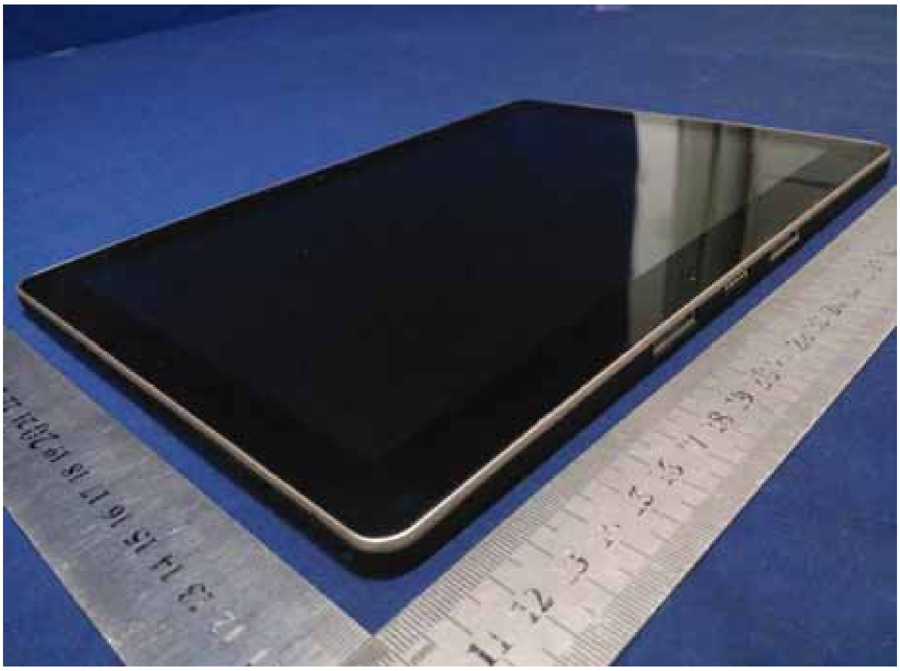
Test position 1 Bottom face_1.1cm:

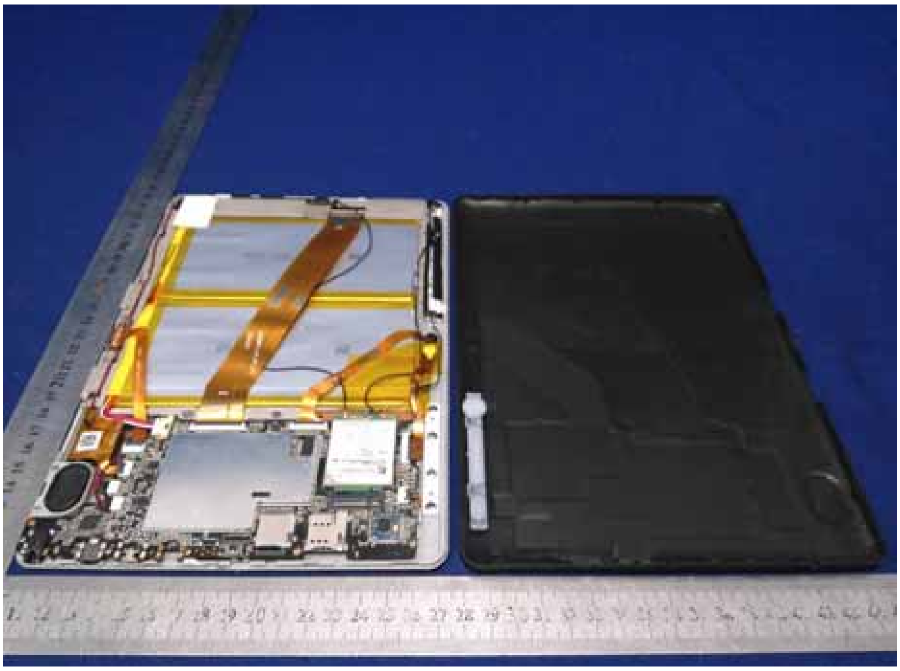
Picture 4

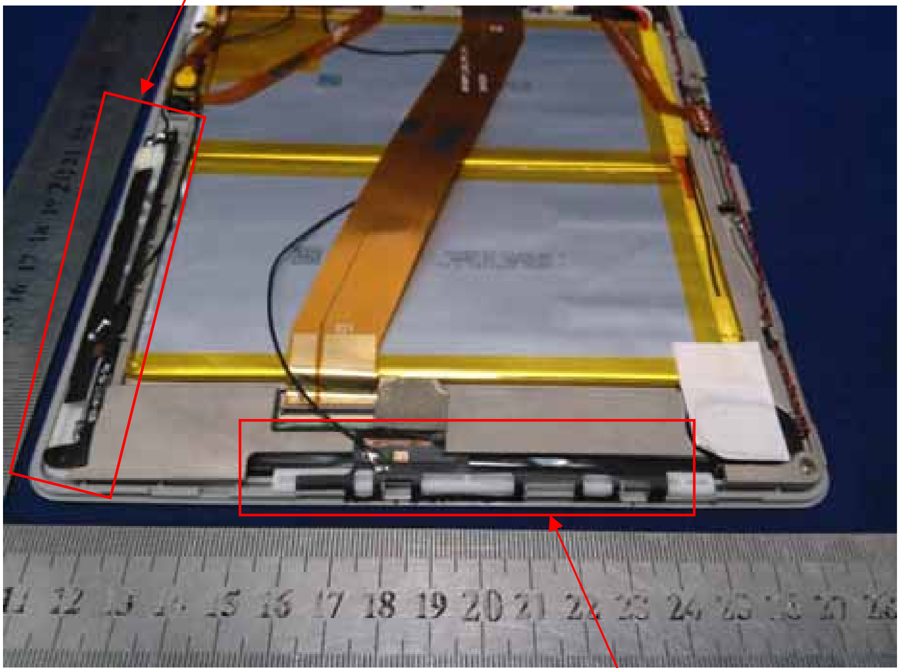
Test position 2 edge1_0.8cm:

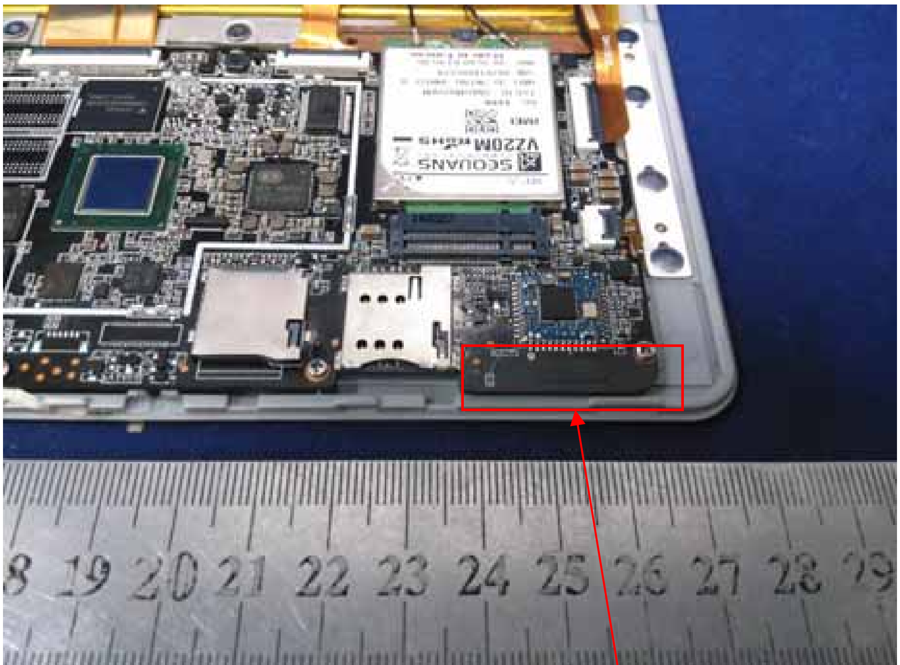
Picture 5

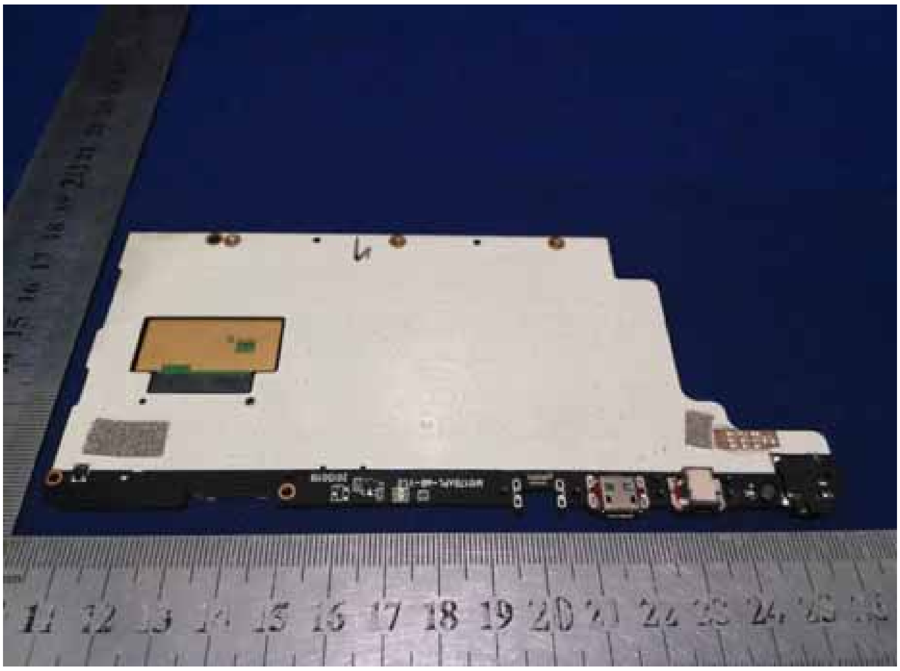
EUT Photos






4G Antenna/Main Antenna
4G Antenna/Auxiliary Antenna/RX Only


Bluetooth/Wifi Antenna

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DC : 1440
Made in Taiwan

END OF REPORT