SAR Test Report

Report No.: AGC00119150104FH01

FCC ID	:	BRCPC1021
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Tablet PC
BRAND NAME	:	Kinwei, Titan
MODEL NAME	:	PC1021, PC1021ME, PC1021Y, PCXXXX(XXXX represents0000~9999), PCXXXXME(XXXX represents0000~9999), PCXXXXY(XXXX represents0000~9999;Y represents A~Z), KW-PC1021I,KW-PC1021,KW-PC1021J, KW-PCXXXXI(XXXX represents0000~9999), KW-PCXXXX(XXXX represents0000~9999), KW-PCXXXXJ(XXXX represents0000~9999)
CLIENT	:	Kintech Co., Ltd.
DATE OF ISSUE	:	Apr. 03,2015
STANDARD(S)	:	IEEE Std. 1528:2003 47CFR § 2.1093 IEEE/ANSI C95.1
REPORT VERSION	:	V1.0

Attestation of Global Compliance(Shenzhen) Co., Ltd.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Apr. 03,2015	Valid	Original Report

The test plans were performed in accordance with IEEE Std. 1528:2003; 47CFR § 2.1093; IEEE/ANSI C95.1 and the following specific FCC Test Procedures:

- KDB 447498 D01 General RF Exposure Guidance v05r02
- KDB 648474 D04 Handset SAR v01r02
- KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
- KDB 941225 D01 3G SAR Procedures v03
- KDB 616217 D04 SAR for laptop and tablets v01
- KDB 248227 D01 SAR meas for 802 11 a b g v01r02

Test Report Certification

Applicant Name :	Kintech Co., Ltd.
Applicant Address :	1F-5F, Bldg 22, Chen Tian Industral Zone, Xi Xiang, Bao An District, Shenzhen Guang Dong, China
Manufacturer Name :	Kintech Co., Ltd.
Manufacturer Address :	1F-5F, Bldg 22, Chen Tian Industral Zone, Xi Xiang, Bao An District, Shenzhen Guang Dong, China
Product Designation :	Tablet PC
Brand Name :	Kinwei, Titan
Model Name :	PC1021, PC1021ME, PC1021Y, PCXXXX(XXXX represents0000~9999), PCXXXXME(XXXX represents0000~9999), PCXXXXY(XXXX represents0000~9999;Y represents A~Z), KW-PC1021I,KW-PC1021,KW-PC1021J, KW-PCXXXXI(XXXX represents0000~9999), KW-PCXXXX(XXXX represents0000~9999), KW-PCXXXXJ(XXXX represents0000~9999)
Different Description	All the models are the same, only different in model names. The test model is PC1021.
EUT Voltage :	DC3.7V by battery
Applicable Standard :	IEEE Std. 1528:2003 47CFR § 2.1093 IEEE/ANSI C95.1
Test Date :	Apr. 01,2015 to Apr. 03,2015
Performed Location	Attestation of Global Compliance(Shenzhen) Co., Ltd.
	2 F, Building 2, No.1-No.4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang Street, Bao'an District, Shenzhen, China
Report Template	AGCRT-US-3G3/SAR (2015-04-03)

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1. SUMMARY OF MAXIMUM SAR VALUE

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

Highest Reported SAR ：

Exposure Position	Frequency Band	Highest Reported Maximum SAR(W/Kg)	Highest Simultaneous Reported SAR(W/Kg)
Body	2G Band	**0.745**	**1.295**
	3G Band	**0.723**	**1.178**

Exposure Position	Frequency Band	Highest Reported Maximum SAR(W/Kg)
Body	WIFI	**0.633**

This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6W/Kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1, and had been tested in accordance with measurement methods and procedures specified in IEEE 1528-2003 and the relevant KDB files like KDB 941225 D01 ,KDB 865664 D02….etc.

2. GENERAL INFORMATION

2.1. EUT Description

General Information	
Product Designation	Tablet PC
Test Model	PC1021
Hardware Version	P102A-MB-V1.0.0
Software Version	P102_VJC031_20150124
Device Category	Portable
RF Exposure Environment	Uncontrolled
Antenna Type	Internal
GSM and GPRS& EGPRS	
Support Band	☒GSM 850 ☒PCS 1900 (U.S. Bands) ☒GSM 900 ☒DCS 1800 (Non-U.S. Bands)
GPRS & EGPRS Type	Class B
GPRS & EGPRS Class	Class 12(1Tx+4Rx, 2Tx+3Rx, 3Tx+2Rx, 4Tx+1Rx)
TX Frequency Range	GSM 850 : 824.2~848.8MHz;; PCS 1900: 1850.2~1909.8MHz;
RX Frequency Range	GSM 850 : 869~894MHz PCS 1900: 1930~1990MHz
Release Version	R99
Type of modulation	GMSK for GSM/GPRS; GMSK & 8-PSK for EGPRS
Antenna Gain	-1.0dBi
Max. Average Power (Max. Peak Power)	GSM850: 31.83dBm(32.45dBm- Peak Power) PCS1900: 28.39dBm(28.77dBm-Peak Power)
WCDMA	
Support Band	U.S. Bands: ☒UMTS FDD Band II ☒UMTS FDD Band V Non-U.S. Bands: ☐UMTS FDD Band I ☐UMTS FDD Band VIII
HS Type	HSPA(HSUPA/HSDPA)
TX Frequency Range	WCDMA FDD Band II: 1852.4 -1907.6MHz WCDMA FDD Band V: 826.4-846.6MHz
RX Frequency Range	WCDMA FDD Band II: 1930-1990MHz WCDMA FDD Band V: 869-894MHz
Release Version	Rel-6
Type of modulation	QPSK
Antenna Gain	-1.0dBi
Max. Average Power (Max. Peak Power)	Band II: 22.29dBm (22.73dBm- Peak Power) Band V: 22.28dBm (22.75dBm- Peak Power)

EUT Description(Continue)

Bluetooth	
Bluetooth Version	☐V2.0 ☐V2.1 ☐V2.1+EDR ☒V3.0 ☐V3.0+HS ☒V4.0
Operation Frequency	2402~2480MHz
Type of modulation	☒GFSK ☒Π/4-DQPSK ☒8-DPSK
Avg. Burst Power	2.33dBm
Antenna Gain	0dBi
WIFI	
WIFI Specification	☐802.11a ☒802.11b ☒802.11g ☒802.11n(20) ☒802.11n(40)
Operation Frequency	2412~2462MHz
Avg. Burst Power	11b:13.28dBm,11g:10.27dBm,11n(20):9.99dBm,11n(40):7.66dBm
Antenna Gain	0dBi
Accessories	
Battery	Voltage and Capacitance: 3.7 V & 5000mAh
Adapter	Input: AC 100-240V, 50/60Hz, 0.3A Output: DC 5V, 2A
Earphone	Brand name: N/A Model No. : N/A

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

Product	Type	
	☒ Production unit	☐ Identical Prototype

2.2. Test Procedure

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of all equipment.
3	EUT Communicate with CMU 200, and test them respectively at U.S. bands

2.3. Test Environment

Ambient conditions in the laboratory:

Items	Required	Actual
Temperature (°C)	18-25	21± 2
Humidity (%RH)	30-70	55±2

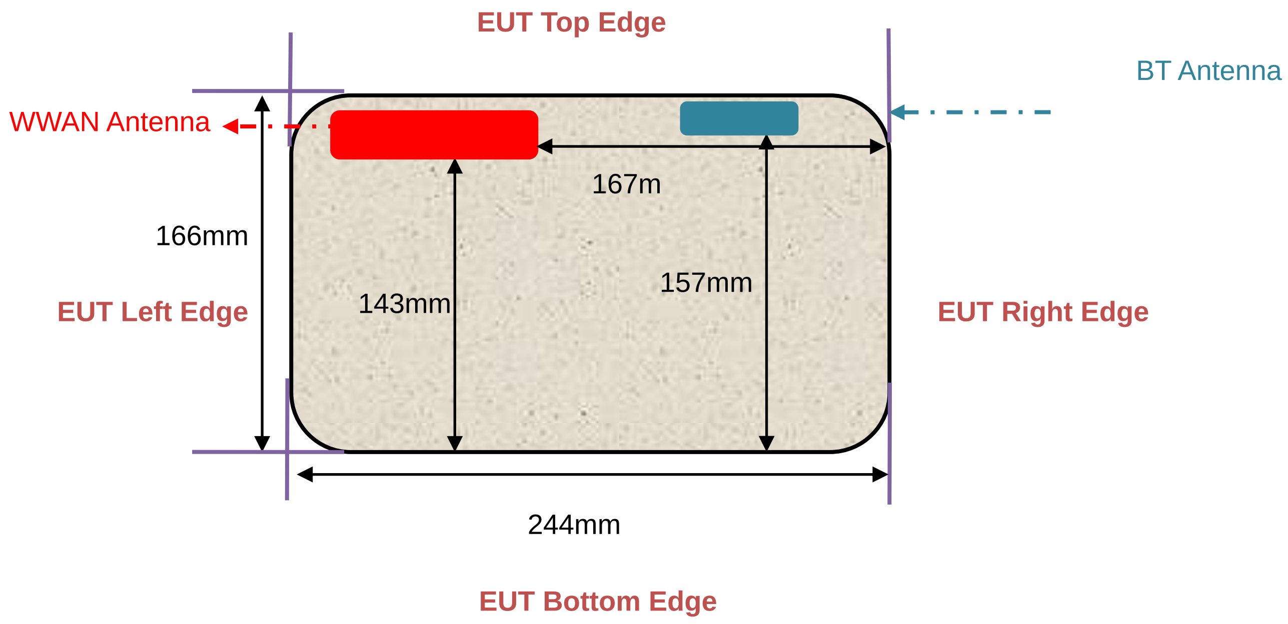
2.4. Test Configuration and setting

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

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

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

Antenna Location: (the front view)



For WWAN mode:

Test Configurations	Antenna to edges/surface	SAR required
Back	<25mm	Yes
Front	<25mm	Yes
Edge 1 (Top)	5	Yes
Edge 2 (Right)	167	No
Edge 3 (Bottom)	143	No
Edge 4 (Left)	14	Yes

For WLAN mode:

Test Configurations	Antenna to edges/surface	SAR required
Back	<25mm	Yes
Front	<25mm	Yes
Edge 1 (Top)	2	Yes
Edge 2 (Right)	64	No
Edge 3 (Bottom)	157	No
Edge 4 (Left)	148	No

3. SAR MEASUREMENT SYSTEM

3.1. Specific Absorption Rate (SAR)

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

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

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

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

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

$$SAR = c_h \left.\frac{dT}{dt}\right|_{t=0}$$

Where

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

3.2. SAR Measurement Procedure

The EUT is set to transmit at the required power in line with product specification, at each frequency relating to the LOW, MID, and HIGH channel settings.

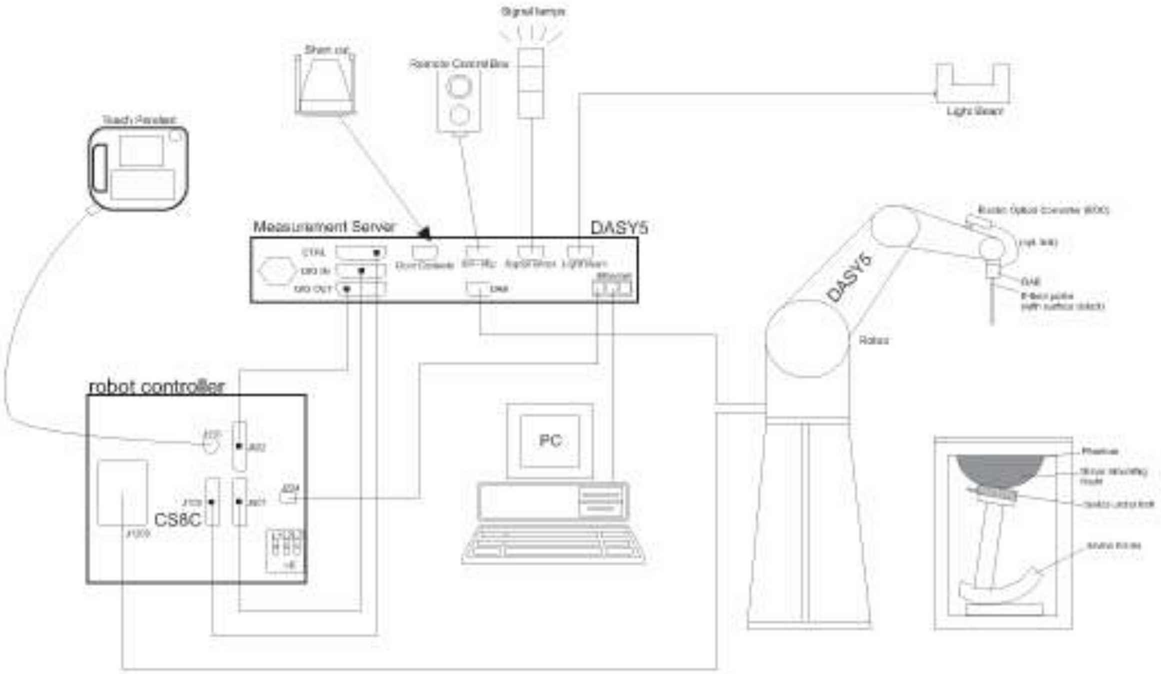
Pre-scans are made on the device to establish the location for the transmitting antenna, using a large area scan in either air or tissue simulation fluid.

The EUT is placed against the SAM twin phantom where the maximum area scan dimensions are larger than the physical size of the resonating antenna. When the scan size is not large enough to cover the peak SAR distribution, it is modified by either extending the area scan size in both the X and Y directions, or the device is shifted within the predefined area.

The area scan is then run to establish the peak SAR location (interpolated resolution set at $1mm^2$) which is then used to orient the center of the zoom scan. The zoom scan is then executed and the 1g and 10g averages are derived from the zoom scan volume (interpolated resolution set at $1mm^3$).

When multiple peak SAR location were found during the same configuration or test mode, Zoom scan shall performed on each peak SAR location, only the peak point with maximum SAR value will be reported for the configuration or test mode.

3.3. DASY5 System Description



DASY5 System Configurations

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

(1)A standard high precision 6-axis robot with controller, teach pendant and software.

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

(3)A dosimetric probe equipped with an optical surface detector system.

(4)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.

(5) A Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.

(6) A computer running WinXP

(7) DASY software.

(8)Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.

(9) Phantoms, device holders and other accessories according to the targeted measurement.

3.3.1. Applications

Predefined procedures and evaluations for automated compliance testing with all worldwide standards, e.g. IEEE 1528, ANSI C95.1,relevant KDB files and TCB files.

3.3.2. Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for applications utilize a $10mm^2$ step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments. When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2013 and relevant KDB files, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan).

3.3.3. Zoom Scan (Cube Scan Averaging)

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. A density of 1000 kg/m^3 is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1 g cube is 10mm, with the side length of the 10 g cube 21,5mm. The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications utilize a physical step of 7x7x7 (5mmx5mmx5mm) providing a volume of 30mm in the X & Y axis, and 30mm in the Z axis.

3.3.4. Uncertainty of Inter-/Extrapolation and Averaging

In order to evaluate the uncertainty of the interpolation, extrapolation and averaged SAR calculation algorithms of the Post processor, DASY 5 allows the generation of measurement grids which are artificially predefined by analytically based test functions. Therefore, the grids of area scans and zoom scans can be filled with uncertainty test data, according to the SAR benchmark functions of IEEE 1528.The three analytical functions shown in equations as below are used to describe the possible range of the expected SAR distributions for the tested handsets. The field gradients are covered by the spatially flat distribution f1, the spatially steep distribution f3 and f2 accounts for H-field cancellation on the phantom/tissue surface.

$$f_1(x,y,z) = Ae^{-\frac{z}{2a}} \cos^2\left(\frac{\pi}{2}\frac{\sqrt{x'^2+y'^2}}{5a}\right)$$

$$f_2(x,y,z) = Ae^{-\frac{z}{a}} \frac{a^2}{a^2+x'^2}\left(3-e^{-\frac{2z}{a}}\right)\cos^2\left(\frac{\pi}{2}\frac{y'}{3a}\right)$$

$$f_3(x,y,z) = A\frac{a^2}{\frac{a^2}{4}+x'^2+y'^2}\left(e^{-\frac{2z}{a}}+\frac{a^2}{2(a+2z)^2}\right)$$

3.4. DASY5 E-Field Probe

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

3.5. Isotropic E-Field Probe Specification

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

3.6. Robot

The DASY system uses the high precision robots (DASY5:TX60) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from is used.
The XL robot series have many features that are important for our application:
- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

3.7. Light Beam Unit

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

3.8. Device Holder

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

3.9. Measurement Server

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

3.10. ELI4 Phantom

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

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

4. TISSUE SIMULATING LIQUID

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

4.1. The composition of the tissue simulating liquid

Ingredient	835MHz	1900MHz	2450MHz
(% Weight)	Body	Body	Body
Water	52.4	40.5	73.2
Salt	1.40	0.50	0.04
Sugar	45.0	58.0	0.00
HEC	1.00	0.50	0.00
Preventol	0.20	0.50	0.00
DGBE	0.00	0.00	26.7
TWEEN	0.00	0.00	0.00

4.2. Tissue Calibration Result

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

Tissue Stimulant Measurement for 835MHz				
Fr. (MHz)	Dielectric Parameters (±5%)		Tissue Temp [°C]	Test time
	body			
	εr 55.20 52.44-57-96	δ[s/m] 0.97 0.9215-1.0185		
824.2	56.82	0.93	21.6	Apr. 01,2015
826.4	56.13	0.95	21.6	Apr. 01,2015
835	55.76	0.96	21.6	Apr. 01,2015
836.6	54.95	0.97	21.6	Apr. 01,2015
846.6	54.62	0.98	21.6	Apr. 01,2015
848.8	54.13	0.99	21.6	Apr. 01,2015

Tissue Stimulant Measurement for 1900MHz				
Fr. (MHz)	Dielectric Parameters (±5%)		Tissue Temp [°C]	Test time
	body			
	εr 53.30 50.635-55.965	δ[s/m] 1.52 1.444-1.596		
1850.2	54.92	1.47	21.4	Apr. 02,2015
1852.4	54.74	1.47	21.4	Apr. 02,2015
1880	54.30	1.49	21.4	Apr. 02,2015
1900	53.59	1.52	21.4	Apr. 02,2015
1907.6	53.13	1.55	21.4	Apr. 02,2015
1909.8	53.08	1.57	21.4	Apr. 02,2015

Tissue Stimulant Measurement for 2450MHz				
Fr. (MHz)	Dielectric Parameters (±5%)		Tissue Temp [°C]	Test time
	body			
	εr 52.7 50.065-55.335	δ[s/m] 1.95 1.8525-2.0475		
2412	53.42	1.87	22.3	Apr. 03,2015
2437	53.01	1.90	22.3	Apr. 03,2015
2450	52.63	1.93	22.3	Apr. 03,2015
2462	52.19	1.94	22.3	Apr. 03,2015

4.3. Tissue Dielectric Parameters for Head and Body Phantoms

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

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

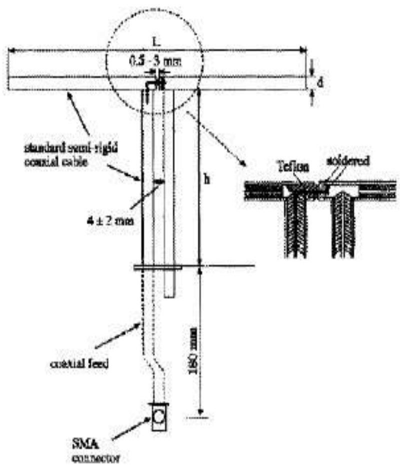
(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)

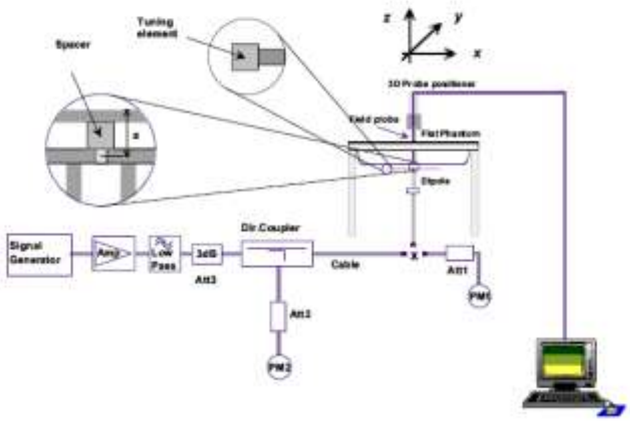
5. SAR MEASUREMENT PROCEDURE

5.1. SAR System Cheek Procedures

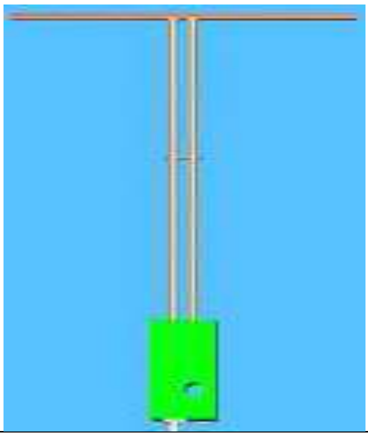
Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system check and system validation. System kit includes a dipole, and dipole device holder.

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





5.2. SAR System Cheek
5.2.1. Validation Dipoles

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

Frequency	L (mm)	h (mm)	d (mm)
835MHz	161.0	89.8	3.6
1900MHz	68	39.5	3.6

5.2.2. System cheek Result

System Performance Check at 835 MHz &1900MHz for Body								
Validation Kit: SN 46/11DIP 0G835-190 & SN 46/11DIP 1G900-187								
Frequency [MHz]	Target Value(W/Kg)		Reference Result (± 10%)		Tested Value(W/Kg)		Tissue Temp. [°C]	Test time
	1g	10g	1g	10g	1g	10g		
835	9.90	6.39	8.91-10.89	5.75-7.03	10.592	6.912	21.6	Apr. 01,2015
1900	40.74	21.43	36.666-44.814	19.287-23.573	40.48	20.96	21.4	Apr. 02,2015
2450	54.19	24.96	48.771-59.609	22.464-27.456	53.28	24.48	22.3	Apr. 03,2015

6. EUT TEST POSITION

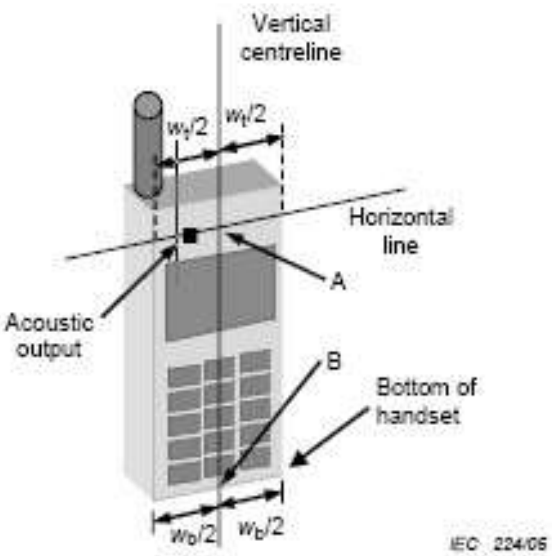
This EUT was tested in **Body Back and Body Front and 4 edges.**

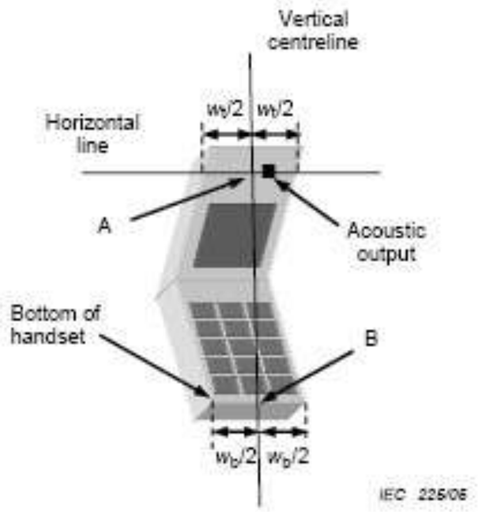
6.1. Define Two Imaginary Lines on the Handset

(1)The vertical centerline passes through two points on the front side of the handset the midpoint of the width wt of the handset at the level of the acoustic output, and the midpoint of the width wb of the handset.

(2)The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.

(3)The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.



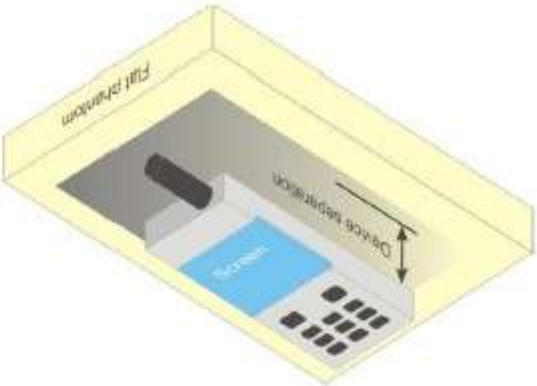


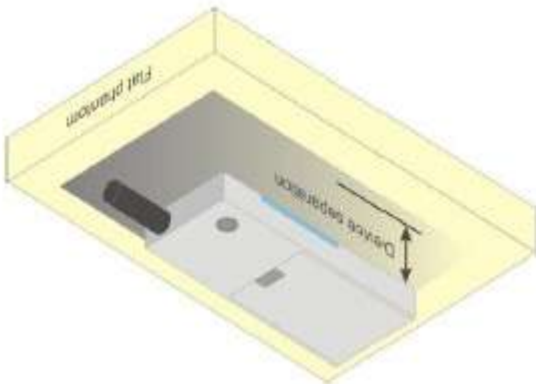
6.2. Body Worn Position

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

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

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





7. SAR EXPOSURE LIMITS

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

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

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

8. TEST EQUIPMENT LIST

Equipment description	Manufacturer/ Model	Identification No.	Current calibration date	Next calibration date
Stäubli Robot	Stäubli-TX60	F13/5Q2UD1/A/01	N/A	N/A
Robot Controller	Stäubli-CS8	139522	N/A	N/A
TISSUE Probe	SATIMO	SN 45/11 OCPG45	12/03/2014	12/02/2015
E-Field Probe	Speag-EX3DV4	3953	11/06/2014	11/05/2015
SAM Twin Phantom	Speag-SAM	1790	N/A	N/A
Device Holder	Speag-SD 000 H01 KA	SD 000 H01 KA	N/A	N/A
DAE4	Speag-SD 000 D04 BM	1398	10/27/2014	10/26/2015
SAR Software	Speag-DASY5	DASY52.8	N/A	N/A
Liquid	SATIMO	-	N/A	N/A
Radio Communication Tester	R&S-CMU200	069Y7-158-13-712	03/06/2015	03/05/2016
Dipole	SATIMO SID900	SN46/11 DIP 0G900-185	11/14/2013	11/13/2016
Dipole	SATIMO SID1900	SN46/11 DIP 1G900-187	11/14/2013	11/13/2016
Dipole	SATIMO SID2450	SN46/11 DIP 2G450-189	11/14/2013	11/13/2016
Signal Generator	Agilent-E4438C	MY44260051	03/06/2015	03/05/2016
Power Sensor	NRP-Z23	US38261498	03/06/2015	03/05/2016
Spectrum Analyzer E4440	Agilent	US41421290	05/27/2014	05/26/2015
Network Analyzer	Rhode & Schwarz ZVL6	SN100132	03/06/2015	03/05/2016
Attenuator	Warison /WATT-6SR1211	N/A	N/A	N/A
Attenuator	Mini-circuits / VAT-10+	N/A	N/A	N/A
Amplifier	EM30180	SN060552	03/06/2015	03/05/2016
Directional Couple	Werlatone/ C5571-10	N/A	N/A	N/A
Directional Couple	Werlatone/ C6026-10	N/A	N/A	N/A
Power Sensor	NRP-Z21	1137.6000.02	10/22/2014	10/21/2015
Power Viewer	R&S/V2.3.1.0	N/A	N/A	N/A

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

9. MEASUREMENT UNCERTAINTY

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

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

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

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

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

(b) κ is the coverage factor

Table 13.1 Standard Uncertainty for Assumed Distribution (above table)

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

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

DAYS5 Measurement Uncertainty Measurement uncertainty for 30 MHz to 3GHz averaged over 1 gram / 10 gram.							
Error Description	Uncertainty value(±10%)	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.0	Normal	1	1	1	±6.0%	±6.0%
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%
Hemispherical Isotropy	9.6	Rectangular	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%
Linearity	4.7	Rectangular	$\sqrt{3}$	1	1	±2.7%	±2.7%
Probe Modulation Response	2.4	Rectangular	$\sqrt{3}$	1	1	±1.4%	±1.4%
System Detection Limits	1.0	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%
Boundary Effects	2.0	Rectangular	$\sqrt{3}$	1	1	±1.2%	±1.2%
Readout Electronics	0.3	Normal	$\sqrt{3}$	1	1	±0.3%	±0.3%
Response Time	0.8	Rectangular	$\sqrt{3}$	1	1	±0.5%	±0.5%
Integration Time	2.6	Rectangular	$\sqrt{3}$	1	1	±1.5%	±1.5%
RF Ambient Noise	3.0	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%
RF Ambient Reflection	3.0	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%
Probe Positioner	0.8	Rectangular	$\sqrt{3}$	1	1	±0.5%	±0.5%
Probe Positioning	6.7	Rectangular	$\sqrt{3}$	1	1	±3.9%	±3.9%
Post-processing	4.0	Rectangular	$\sqrt{3}$	1	1	±2.3%	±2.3%
Test Sample Related							
Device Positioning	3.6	Normal	1	1	1	±3.6%	±2.3%
Device Holder	2.9	Normal	1	1	1	±2.9%	±2.3%
Measurement SAR Drift	5.0	Rectangular	$\sqrt{3}$	1	1	±2.9%	±2.3%
Power Scaling	0.0	Rectangular	$\sqrt{3}$	1	1	±0.0%	±2.3%
Phantom and Setup							
Phantom Uncertainty	4.0	Rectangular	$\sqrt{3}$	1	1	±2.3%	±2.3%
Liquid Conductivity(Meas.)	2.5	Normal	1	0.78	0.71	±2.0%	±2.0%
Liquid Conductivity(Target)	5.0	Rectangular	$\sqrt{3}$	0.64	0.43	±1.8%	±1.8%
Liquid Permittivity(Meas.)	2.5	Normal		0.26	0.26	±0.7%	±0.7%
Liquid Permittivity((Target)	5.0	Rectangular	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%
Liquid Conductivity-temperature uncertainty	1.7	Rectangular	$\sqrt{3}$	0.78	0.71	±0.8%	±0.7%
Liquid Permittivity-temperature uncertainty	0.3	Rectangular	$\sqrt{3}$	0.23	0.26	±0.0%	±0.0%
Combined Standard Uncertainty						±12.2%	±11.9%
Coverage Factor for 95%						K=2	
Expanded Uncertainty						±22.0%	±21.5%

10. CONDUCTED POWER MEASUREMENT

GSM BAND

Mode	Frequency(MHz)	Avg. Burst Power(dBm)	Duty cycle Factor(dBm)	Frame Power(dBm)
Maximum Power <1>				
GSM 850	824.2	**31.83**	-9	22.83
	836.6	31.81	-9	22.81
	848.8	31.76	-9	22.76
GPRS 850 （1 Slot）	824.2	31.16	-9	22.16
	836.6	31.27	-9	22.27
	848.8	31.29	-9	22.29
GPRS 850 （2 Slot）	824.2	30.17	-6	24.17
	836.6	30.12	-6	24.12
	848.8	30.19	-6	24.19
GPRS 850 （3 Slot）	824.2	28.35	-4.26	24.09
	836.6	28.38	-4.26	24.12
	848.8	28.29	-4.26	24.03
GPRS 850 （4 Slot）	824.2	27.31	-3	24.31
	836.6	27.36	-3	**24.36**
	848.8	27.28	-3	24.28
EGPRS 850 （1 Slot）	824.2	27.89	-9	18.89
	836.6	27.88	-9	18.88
	848.8	27.76	-9	18.76
EGPRS 850 （2 Slot）	824.2	27.92	-6	21.92
	836.6	27.83	-6	21.83
	848.8	27.98	-6	21.98
EGPRS 850 （3 Slot）	824.2	26.09	-4.26	21.83
	836.6	26.14	-4.26	21.88
	848.8	26.11	-4.26	21.85
EGPRS 850 （4 Slot）	824.2	25.84	-3	22.84
	836.6	25.81	-3	22.81
	848.8	25.89	-3	22.89

GSM BAND CONTINUE

Mode	Frequency(MHz)	Avg. Burst Power(dBm)	Duty cycle Factor(dBm)	Frame Power(dBm)
PCS1900	1850.2	**28.39**	-9	19.39
	1880	28.31	-9	19.31
	1909.8	28.27	-9	19.27
GPRS1900 （1 Slot）	1850.2	28.15	-9	19.15
	1880	28.17	-9	19.17
	1909.8	28.11	-9	19.11
GPRS1900 （2 Slot）	1850.2	27.29	-6	**21.29**
	1880	27.24	-6	21.24
	1909.8	27.18	-6	21.18
GPRS1900 （3 Slot）	1850.2	25.47	-4.26	21.21
	1880	25.44	-4.26	21.18
	1909.8	25.38	-4.26	21.12
GPRS1900 （4 Slot）	1850.2	24.23	-3	21.23
	1880	24.21	-3	21.21
	1909.8	24.28	-3	21.28
EGPRS1900 （1 Slot）	1850.2	26.31	-9	17.31
	1880	26.26	-9	17.26
	1909.8	26.21	-9	17.21
EGPRS1900 （2 Slot）	1850.2	25.41	-6	19.41
	1880	25.38	-6	19.38
	1909.8	25.48	-6	19.48
EGPRS1900 （3 Slot）	1850.2	24.25	-4.26	19.99
	1880	24.21	-4.26	19.95
	1909.8	24.29	-4.26	20.03
EGPRS1900 （4 Slot）	1850.2	23.33	-3	20.33
	1880	23.37	-3	20.37
	1909.8	23.29	-3	20.29
Maximum Power <2>				
GSM835	824.2	31.46	-9	22.46
PCS1900	1850.2	28.11	-9	19.11

Note 1:
The Frame Power (Source-based time-averaged Power) is scaled the maximum burst average power based on time slots. The calculated methods are show as following:
Frame Power = Max burst power (1 Up Slot) – 9 dB
Frame Power = Max burst power (2 Up Slot) – 6 dB
Frame Power = Max burst power (3 Up Slot) – 4.26 dB
Frame Power = Max burst power (4 Up Slot) – 3 dB

UMTS BAND
HSDPA Setup Configuration:

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

·The RF path losses were compensated into the measurements.

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

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

(2) Set RMC 12.2Kbps+HSDPA mode.

(3) Set Cell Power=-86dBm

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

(5) Select HSDPA Uplink Parameters

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

(7) Set Ack - Nack Repetition Factor to 3

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

(9) Set CQI Repetition Factor to 2

(10) Power Ctrl Mode=All Up bits

·The transmitted maximum output power was recorded.

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

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

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

HSUPA Setup Configuration:

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

· The RF path losses were compensated into the measurements.

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

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

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

(3) Set Cell Power = -86 dBm

(4) Set Channel Type = 12.2k + HSPA

(5) Set UE Target Power

(6) Power Ctrl Mode= Alternating bits

(7) Set and observe the E-TFCI

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

· The transmitted maximum output power was recorded.

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

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

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

UMTS BAND II

Mode	Frequency (MHz)	Avg. Burst Power (dBm)
WCDMA 1900 RMC	1852.4	**22.29**
	1880	22.21
	1907.6	22.13
HSDPA Subtest 1	1852.4	22.08
	1880	22.06
	1907.6	22.02
HSDPA Subtest 2	1852.4	20.68
	1880	20.64
	1907.6	20.61
HSDPA Subtest 3	1852.4	20.38
	1880	20.32
	1907.6	20.29
HSDPA Subtest 4	1852.4	20.19
	1880	20.15
	1907.6	20.12
HSUPA Subtest 1	1852.4	22.09
	1880	22.04
	1907.6	22.16
HSUPA Subtest 2	1852.4	21.17
	1880	21.14
	1907.6	21.27
HSUPA Subtest 3	1852.4	20.31
	1880	20.18
	1907.6	20.22
HSUPA Subtest 4	1852.4	19.83
	1880	19.89
	1907.6	19.78
HSUPA Subtest 5	1852.4	19.29
	1880	19.24
	1907.6	19.21

UMTS BAND V

Mode	Frequency (MHz)	Avg. Burst Power (dBm)
WCDMA 850 RMC	826.4	**22.28**
	836.6	22.24
	846.6	22.21
HSDPA Subtest 1	826.4	21.84
	836.6	21.89
	846.6	21.78
HSDPA Subtest 2	826.4	21.18
	836.6	21.16
	846.6	21.13
HSDPA Subtest 3	826.4	20.35
	836.6	20.32
	846.6	20.27
HSDPA Subtest 4	826.4	19.89
	836.6	19.83
	846.6	19.81
HSUPA Subtest 1	826.4	22.11
	836.6	22.12
	846.6	22.19
HSUPA Subtest 2	826.4	21.15
	836.6	21.13
	846.6	21.08
HSUPA Subtest 3	826.4	20.36
	836.6	20.42
	846.6	20.27
HSUPA Subtest 4	826.4	19.83
	836.6	19.81
	846.6	19.77
HSUPA Subtest 5	826.4	19.13
	836.6	19.23
	846.6	19.25

WIFI

Mode	Data Rate (Mbps)	Channel	Frequency(MHz)	Avg. Burst Power(dBm)
802.11b	1	01	2412	13.00
		06	2437	12.69
		11	2462	**13.28**
802.11g	6	01	2412	9.01
		06	2437	10.27
		11	2462	9.47
802.11n(20)	6.5	01	2412	8.54
		06	2437	9.99
		11	2462	9.15
802.11n(40)	13.5	03	2422	6.48
		06	2437	7.66
		09	2452	7.05

Bluetooth_V3.0

Modulation	Channel	Frequency(MHz)	Average Power (dBm)
GFSK	0	2402	**2.33**
	39	2441	1.89
	78	2480	1.26
π /4-DQPSK	0	2402	1.73
	39	2441	1.34
	78	2480	0.58
8-DPSK	0	2402	1.74
	39	2441	1.33
	78	2480	0.6

Bluetooth_V4.0

Modulation	Channel	Frequency(MHz)	Peak Power (dBm)
GFSK	0	2402	-6.69
	19	2440	**-6.61**
	39	2480	-6.97

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

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

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

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

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

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

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

11. TEST RESULTS

11.1. SAR Test Results Summary

11.1.1. Test position and configuration

According to IEEE 1528-2003, Body SAR was performed with the device 0mm from the phantom.

11.1.2. Operation Mode

• According to KDB 447498 D01 v05r02 ,for each exposure position, if the highest 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional.

• Per KDB 865664 D01 v01r03,for each frequency band, if the measured SAR is ≥0.8W/Kg, testing for repeated SAR measurement is required , that the highest measured SAR is only to be tested. When the SAR results are near the limit, the following procedures are required for each device to verify these types of SAR measurement related variation concerns by repeating the highest measured SAR configuration in each frequency band.

(1) When the original highest measured SAR is ≥0.8W/Kg, repeat that measurement once.
(2) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is ＞1.20 or when the original or repeated measurement is ≥1.45 W/Kg.
(3) Perform a third repeated measurement only if the original, first and second repeated measurement is ≥ 1.5 W/Kg and ratio of largest to smallest SAR for the original, first and second measurement is ≥1.20.

• Body-worn exposure conditions are intended to voice call operations, therefore GSM voice call mode is selected to be test.

• According to KDB 648474 D04 v01r02,when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤1.2W/Kg, SAR testing with a headset connected is not required.

• According to 248227 D01 v01r02, SAR is not required for 802.11g channels when the maximum average output power is less than 1/4dB higher than measured on the corresponding 802.11b channels.

•Maximum Scaling SAR in order to calculate the Maximum SAR values to test under the standard Peak Power, Calculation method is as follows:
Maximum Scaling SAR =tested SAR (Max.) ×[maximum turn-up power (mw)/ maximum measurement output power(mw)]

11.1.3. Test Result

SAR MEASUREMENT									
Ambient Temperature (°C) : 21.7				Relative Humidity (%): 51					
Liquid Temperature (°C) : 21.6				Depth of Liquid (cm):>15					
Product: Tablet PC									
Test Mode: GSM850 with GMSK modulation									
Position	**Mode**	**Ch.**	**Fr. (MHz)**	**Power Drift (<±0.2)**	**SAR (1g) (W/kg)**	**Max. Turn-up Power (dBm)**	**Meas. output Power (dBm)**	**Scaled SAR (W/Kg)**	**Limit W/kg**
SIM 1 Card									
Body back	voice	190	836.6	0.01	0.347	33	31.81	0.456	1.6
Body front	voice	190	836.6	0	0.270	33	31.81	0.355	1.6
Edge 1 (Top)	voice	190	836.6	-0.03	**0.376**	33	31.81	0.495	1.6
Edge 2(Right)	voice	190	836.6	0.08	0.032	33	31.81	0.042	1.6
Edge 3(Bottom)	voice	190	836.6	0.10	0.017	33	31.81	0.022	1.6
Edge 4(Left)	voice	190	836.6	-0.02	0.302	33	31.81	0.397	1.6
Body back	GPRS-4 slot	190	836.6	-0.03	0.294	28	27.36	0.341	1.6
Body front	GPRS-4 slot	190	836.6	-0.08	0.417	28	27.36	0.483	1.6
Edge 1 (Top)	GPRS-4 slot	190	836.6	0.07	**0.571**	28	27.36	**0.662**	1.6
Edge 2(Right)	GPRS-4 slot	190	836.6	0.14	0.051	28	27.36	0.059	1.6
Edge 3(Bottom)	GPRS-4 slot	190	836.6	-0.03	0.027	28	27.36	0.031	1.6
Edge 4(Left)	GPRS-4 slot	190	836.6	0.12	0.468	28	27.36	0.542	1.6
SIM 2 Card									
Edge 1 (Top)	GPRS-4 slot	190	836.6	0.03	0.391	33	31.46	0.557	1.6

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

SAR MEASUREMENT									
Ambient Temperature (°C) : 21.6				Relative Humidity (%): 52					
Liquid Temperature (°C) : 21.4				Depth of Liquid (cm):>15					
Product: Tablet PC									
Test Mode: PCS1900 with GMSK modulation									
Position	**Mode**	**Ch.**	**Fr. (MHz)**	**Power Drift (<±0.2)**	**SAR (1g) (W/kg)**	**Max. Turn-up Power (dBm)**	**Meas. output Power (dBm)**	**Scaled SAR (W/Kg)**	**Limit W/kg**
SIM 1 Card									
Body back	voice	661	1880.0	-0.12	**0.567**	29	28.31	0.665	1.6
Body front	voice	661	1880.0	0.04	0.515	29	28.31	0.604	1.6
Edge 1 (Top)	voice	661	1880.0	0.11	0.273	29	28.31	0.320	1.6
Edge 2(Right)	voice	661	1880.0	0.17	0.078	29	28.31	0.091	1.6
Edge 3(Bottom)	voice	661	1880.0	-0.11	0.034	29	28.31	0.040	1.6
Edge 4(Left)	voice	661	1880.0	0.07	0.191	29	28.31	0.224	1.6
Body back	GPRS-2 slot	661	1880.0	-0.11	**0.625**	28	27.24	**0.745**	1.6
Body front	GPRS-2 slot	661	1880.0	-0.15	0.524	28	27.24	0.624	1.6
Edge 1 (Top)	GPRS-2 slot	661	1880.0	0.01	0.398	28	27.24	0.474	1.6
Edge 2(Right)	GPRS-2 slot	661	1880.0	0.15	0.105	28	27.24	0.125	1.6
Edge 3(Bottom)	GPRS-2 slot	661	1880.0	0.12	0.058	28	27.24	0.069	1.6
Edge 4(Left)	GPRS-2 slot	661	1880.0	0.13	0.318	28	27.24	0.379	1.6
SIM 2 Card									
Body back	GPRS-2 slot	661	1880.0	-0.02	0.420	29	28.11	0.516	1.6

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

SAR MEASUREMENT									
Ambient Temperature (°C) : 21.6				Relative Humidity (%): 52					
Liquid Temperature (°C) : 21.4				Depth of Liquid (cm):>15					
Product: Tablet PC									
Test Mode: WCDMA Band II with QPSK modulation									
Position	**Mode**	**Ch.**	**Fr. (MHz)**	**Power Drift (<±0.2)**	**SAR (1g) (W/kg)**	**Max. Turn-up Power (dBm)**	**Meas. output Power (dBm)**	**Scaled SAR (W/Kg)**	**Limit W/kg**
SIM 1 Card									
Body back	RMC 12.2kbps	9400	1880	0.06	**0.603**	23	22.21	**0.723**	1.6
Body front	RMC 12.2kbps	9400	1880	0.09	0.569	23	22.21	0.683	1.6
Edge 1 (Top)	RMC 12.2kbps	9400	1880	-0.03	0.454	23	22.21	0.545	1.6
Edge 2(Right)	RMC 12.2kbps	9400	1880	0.05	0.092	23	22.21	0.110	1.6
Edge 3(Bottom)	RMC 12.2kbps	9400	1880	-0.01	0.045	23	22.21	0.054	1.6
Edge 4(Left)	RMC 12.2kbps	9400	1880	0.14	0.267	23	22.21	0.320	1.6

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

SAR MEASUREMENT									
Ambient Temperature (°C) : 21.7				Relative Humidity (%): 51					
Liquid Temperature (°C) : 21.6				Depth of Liquid (cm):>15					
Product: Tablet PC									
Test Mode: WCDMA Band V with QPSK modulation									
Position	**Mode**	**Ch.**	**Fr. (MHz)**	**Power Drift (<±0.2)**	**SAR (1g) (W/kg)**	**Max. Turn-up Power (dBm)**	**Meas. output Power (dBm)**	**Scaled SAR (W/Kg)**	**Limit W/kg**
SIM 1 Card									
Body back	RMC 12.2kbps	4183	836.6	-0.14	0.296	23	22.24	0.353	1.6
Body front	RMC 12.2kbps	4183	836.6	-0.08	0.208	23	22.24	0.248	1.6
Edge 1 (Top)	RMC 12.2kbps	4183	836.6	-0.05	**0.298**	23	22.24	**0.355**	1.6
Edge 2(Right)	RMC 12.2kbps	4183	836.6	0	0.036	23	22.24	0.043	1.6
Edge 3(Bottom)	RMC 12.2kbps	4183	836.6	-0.17	0.013	23	22.24	0.015	1.6
Edge 4(Left)	RMC 12.2kbps	4183	836.6	0.06	0.240	23	22.24	0.286	1.6

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

SAR MEASUREMENT									
Ambient Temperature (°C) : 22.8				Relative Humidity (%): 52					
Liquid Temperature (°C) : 22.3				Depth of Liquid (cm):>15					
Product: Tablet PC									
Test Mode:802.11b									
Position	**Mode**	**Ch.**	**Fr. (MHz)**	**Power Drift (<±0.2)**	**SAR (1g) (W/kg)**	**Max. Turn-up Power (dBm)**	**Meas. output Power (dBm)**	**Scaled SAR (W/Kg)**	**Limit W/kg**
SIM 1 Card									
Body back	DTS	6	2437	0	0.315	14	12.69	0.426	1.6
Body front	DTS	6	2437	-0.07	0.356	14	12.69	0.481	1.6
Edge 1 (Top)	DTS	6	2437	-0.02	**0.468**	14	12.69	**0.633**	1.6
Edge 2(Right)	DTS	6	2437	0.07	0.154	14	12.69	0.208	1.6
Edge 3(Bottom)	DTS	6	2437	-0.10	0.039	14	12.69	0.053	1.6
Edge 4(Left)	DTS	6	2437	0.17	0.265	14	12.69	0.358	1.6

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

SAR MEASUREMENT									
Ambient Temperature (°C) : 22.8				Relative Humidity (%): 55					
Liquid Temperature (°C) : 22.3				Depth of Liquid (cm):>15					
Product: Tablet PC									
Test Mode:802.11g									
Position	**Mode**	**Ch.**	**Fr. (MHz)**	**Power Drift (<±0.2)**	**SAR (1g) (W/kg)**	**Max. Turn-up Power (dBm)**	**Meas. output Power (dBm)**	**Scaled SAR (W/Kg)**	**Limit W/kg**
SIM 1 Card									
Body front	DTS	6	2437	-0.16	0.237	11	10.27	0.280	1.6
Edge 1 (Top)	DTS	6	2437	0.08	**0.238**	11	10.27	**0.282**	1.6

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

Simultaneous Multi-band Transmission Evaluation:

Application Simultaneous Transmission information:

NO	Simultaneous state	Portable Handset			Note
		Head	Body-worn	Hotspot	
1	GSM(voice)+WLAN 2.4GHz (data)	-	Yes	-	-
2	WCDMA(voice)+WLAN 2.4GHz (data)	-	Yes	-	-
3	GSM(voice)+Bluetooth(data)	-	Yes	-	-
4	WCDMA(voice)+Bluetooth(data)	-	Yes	-	-
5	GPRS/EGDE(Data) + Bluetooth(data)	-	Yes	-	-
6	GPRS/EGDE(Data) + WLAN 2.4GHz (data)	-	Yes	-	-
7	WCDMA (Data) + Bluetooth(data)	-	Yes	-	-
8	WCDMA (Data) + WLAN 2.4GHz (data)	-	Yes	-	-

NOTE:

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

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

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

Estimated SAR		Max Power including Tune-up Tolerance		Separation Distance (mm)	Estimated SAR (W/kg)
		dBm	mW		
BT	Body	3	1.995	5	0.082 W/kg

Maximum test results (WWAN) with BT SAR:
BT: Body (1.0cm gap): 0.082 W/kg

Sum of the SAR for GSM 850 &Wi-Fi & BT:

RF Exposure Conditions	Test Position	Simultaneous Transmission Scenario			Σ1-g SAR (W/Kg)	SPLSR (Yes/No)
		GSM 850 Band	WI-Fi DTS Band	Bluetooth		
Body-worn	Back	0.456	0.426		0.882	No
	Front	0.355	0.481		0.836	No
	Edge 1	0.495	0.633		1.128	No
	Edge 2	0.042	0.208		0.250	No
	Edge 3	0.022	0.053		0.075	No
	Edge 4	0.397	0.358		0.755	No
	Back	0.456		0.082	0.538	No
	Front	0.355		0.082	0.437	No
	Edge 1	0.495		0.082	0.577	No
	Edge 2	0.042		0.082	0.124	No
	Edge 3	0.022		0.082	0.104	No
	Edge 4	0.397		0.082	0.479	No
Body-worn GPRS-4 slot	Back	0.341	0.426		0.767	No
	Front	0.483	0.481		0.964	No
	Edge 1	0.662	0.633		**1.295**	No
	Edge 2	0.059	0.208		0.267	No
	Edge 3	0.031	0.053		0.084	No
	Edge 4	0.542	0.358		0.900	No
	Back	0.341		0.082	0.423	No
	Front	0.483		0.082	0.565	No
	Edge 1	0.662		0.082	0.744	No
	Edge 2	0.059		0.082	0.141	No
	Edge 3	0.031		0.082	0.113	No
	Edge 4	0.542		0.082	0.624	No

Note:

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

Sum of the SAR for GSM 1900 &Wi-Fi & BT:

RF Exposure Conditions	Test Position	Simultaneous Transmission Scenario			Σ1-g SAR (W/Kg)	SPLSR (Yes/No)
		PCS 1900 Band	WI-Fi DTS Band	Bluetooth		
Body-worn	Back	0.665	0.426		1.091	No
	Front	0.604	0.481		1.085	No
	Edge 1	0.320	0.633		0.953	No
	Edge 2	0.091	0.208		0.299	No
	Edge 3	0.040	0.053		0.093	No
	Edge 4	0.224	0.358		0.582	No
	Back	0.665		0.082	0.747	No
	Front	0.604		0.082	0.686	No
	Edge 1	0.320		0.082	0.402	No
	Edge 2	0.091		0.082	0.173	No
	Edge 3	0.040		0.082	0.122	No
	Edge 4	0.224		0.082	0.306	No
Body-worn GPRS-2 slot	Back	0.745	0.426		1.171	No
	Front	0.624	0.481		1.105	No
	Edge 1	0.474	0.633		1.107	No
	Edge 2	0.125	0.208		0.333	No
	Edge 3	0.069	0.053		0.122	No
	Edge 4	0.379	0.358		0.737	No
	Back	0.745		0.082	0.827	No
	Front	0.624		0.082	0.706	No
	Edge 1	0.474		0.082	0.556	No
	Edge 2	0.125		0.082	0.207	No
	Edge 3	0.069		0.082	0.151	No
	Edge 4	0.379		0.082	0.461	No

Note:

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

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

RF Exposure Conditions	Test Position	Simultaneous Transmission Scenario			Σ1-g SAR (W/Kg)	SPLSR (Yes/No)
		WCDMA Band II	Wi-Fi DTS Band	Bluetooth		
Body-worn	**Back**	0.723	0.426		1.149	**No**
	Front	0.683	0.481		1.164	**No**
	Edge 1	0.545	0.633		**1.178**	**No**
	Edge 2	0.110	0.208		0.318	**No**
	Edge 3	0.054	0.053		0.107	**No**
	Edge 4	0.320	0.358		0.678	**No**
	Back	0.723		0.082	0.805	**No**
	Front	0.683		0.082	0.765	**No**
	Edge 1	0.545		0.082	0.627	**No**
	Edge 2	0.110		0.082	0.192	**No**
	Edge 3	0.054		0.082	0.136	**No**
	Edge 4	0.320		0.082	0.402	**No**

Note:

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

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

RF Exposure Conditions	Test Position	Simultaneous Transmission Scenario			Σ1-g SAR (W/Kg)	SPLSR (Yes/No)
		WCDMA Band V	Wi-Fi DTS Band	Bluetooth		
Body-worn	**Back**	0.353	0.426		0.779	**No**
	Front	0.248	0.481		0.729	**No**
	Edge 1	0.355	0.633		0.988	**No**
	Edge 2	0.043	0.208		0.251	**No**
	Edge 3	0.015	0.053		0.068	**No**
	Edge 4	0.286	0.358		0.644	**No**
	Back	0.353		0.082	0.435	**No**
	Front	0.248		0.082	0.330	**No**
	Edge 1	0.355		0.082	0.437	**No**
	Edge 2	0.043		0.082	0.125	**No**
	Edge 3	0.015		0.082	0.097	**No**
	Edge 4	0.286		0.082	0.368	**No**

Note:

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

APPENDIX A. SAR SYSTEM CHEEK DATA

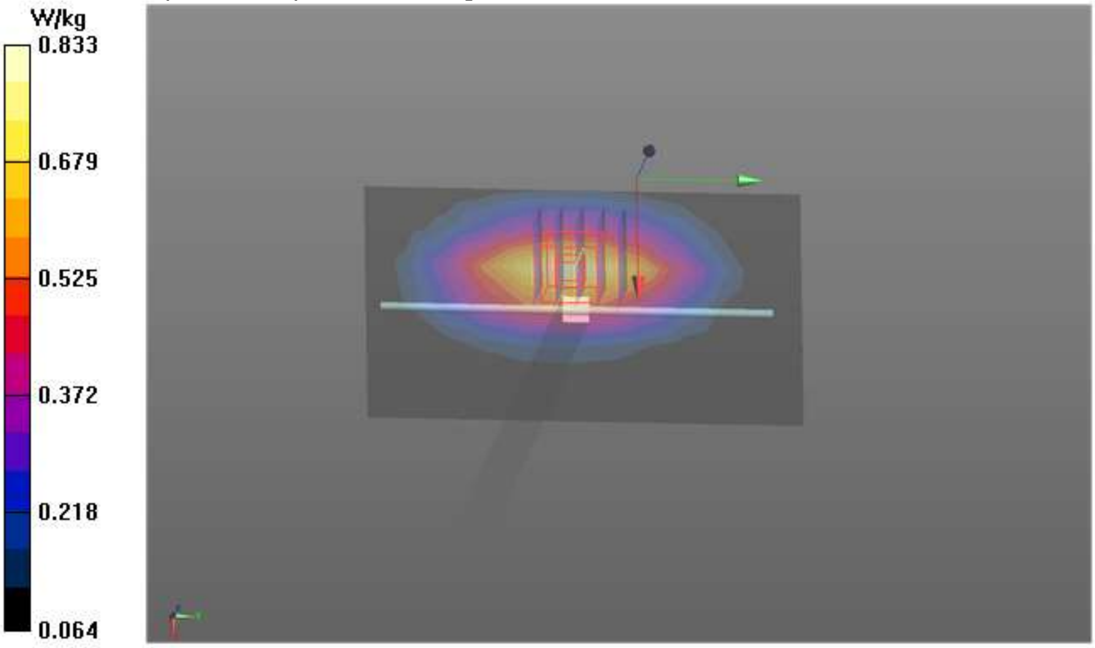
Test Laboratory: AGC Lab **Date: Apr. 01,2015**
System Check Body 835 MHz
DUT: Dipole 835 MHz Type: SID 835
Communication System CW; Communication System Band: D835 (835.0 MHz); Duty Cycle: 1:1;
Frequency: 835 MHz; Medium parameters used: f = 835 MHz; σ=0.96 mho/m; εr =55.76; ρ= 1000 kg/m³ ;
Phantom section: Flat Section; Input Power=18dBm
Ambient temperature (℃): 21.7, Liquid temperature (℃): 21.6

DASY Configuration:

- Probe: EX3DV4 - SN3953; ConvF(10.08,10.08, 10.08); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Configuration/System Check 835MHz Body/Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.826 W/kg

Configuration/System Check 835MHz Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.580 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.986 W/kg
SAR(1 g) = 0.662 W/kg; SAR(10 g) = 0.432 W/kg
Maximum value of SAR (measured) = 0.833 W/kg

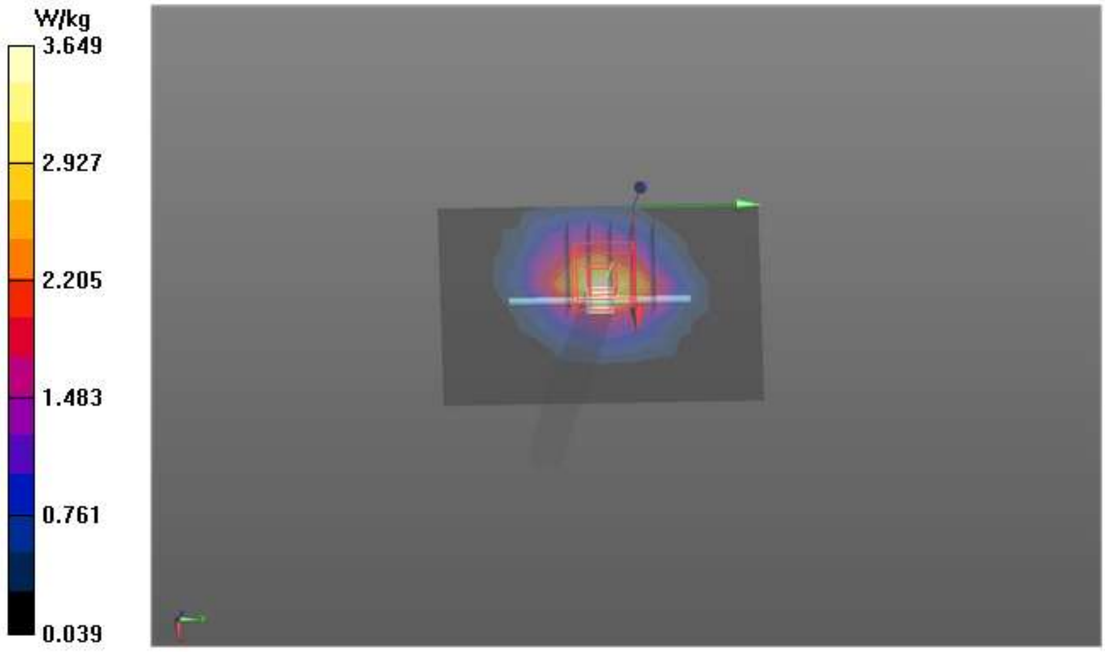


Test Laboratory: AGC Lab **Date: Apr. 02,2015**
System Check Body 1900MHz
DUT: Dipole 1900 MHz; Type: SID 1900
Communication System: CW; Communication System Band: D1900 (1900.0 MHz); Duty Cycle:1:1;
Frequency: 1900 MHz; Medium parameters used: f = 1900 MHz; σ=1.52 mho/m; εr =53.59; ρ= 1000 kg/m³ ;
Phantom section: Flat Section; Input Power=18dBm
Ambient temperature (℃):21.6, Liquid temperature (℃): 21.4

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(7.79,7.79,7.79); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Configuration/System Check 1900MHz Body /Area Scan (6x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.69 W/kg

Configuration/System Check 1900MHz Body /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 46.048 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 4.84 W/kg
SAR(1 g) = 2.53 W/kg; SAR(10 g) = 1.31 W/kg
Maximum value of SAR (measured) = 3.65 W/kg

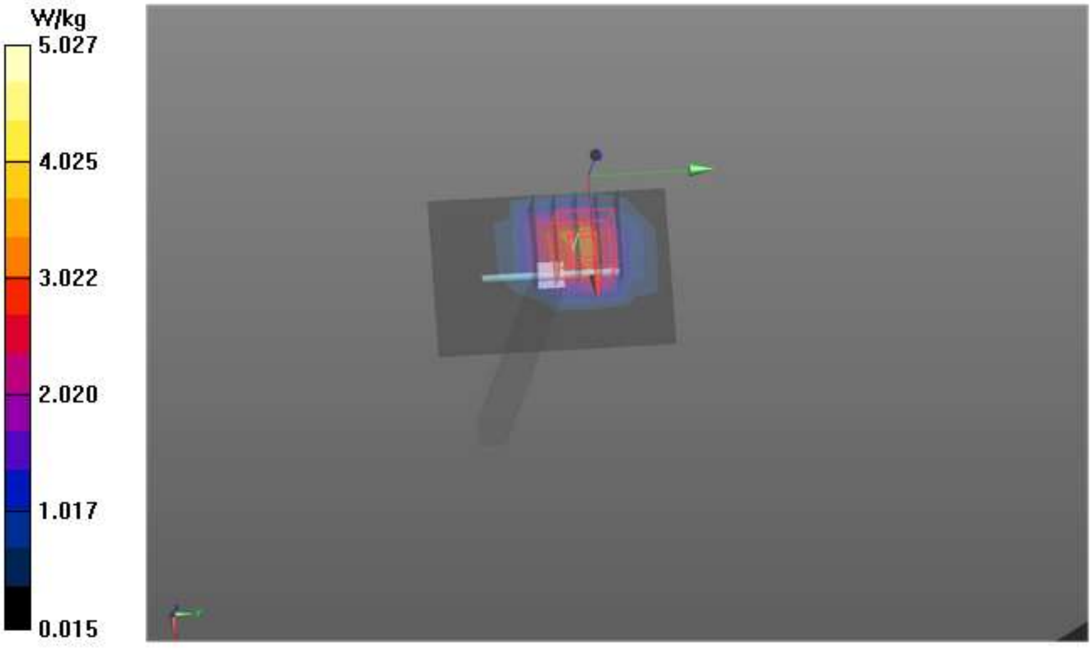


Test Laboratory: AGC Lab **Date: Apr. 02,2015**
System Check Body 2450 MHz
DUT: Dipole 2450 MHz; Type: SID 2450
Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Duty Cycle:1:1;
Frequency: 2450 MHz; Medium parameters used: f = 2450 MHz; σ=1.93 mho/m; εr =52.63; ρ= 1000 kg/m³ ;
Phantom section: Flat Section; Input Power=18dBm
Ambient temperature (℃):22.8, Liquid temperature (℃): 22.3

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(7.79,7.79,7.79); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Configuration/System Check 2450MHz Body /Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.40 W/kg

Configuration/System Check 2450MHz Body /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 38.104 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 7.15 W/kg
SAR(1 g) = 3.33 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 5.03 W/kg



APPENDIX B. SAR MEASUREMENT DATA

Test Laboratory: AGC Lab **Date: Apr. 01,2015**
GSM 850 Mid- Body- Edge 1
DUT: Tablet PC; Type: PC1021

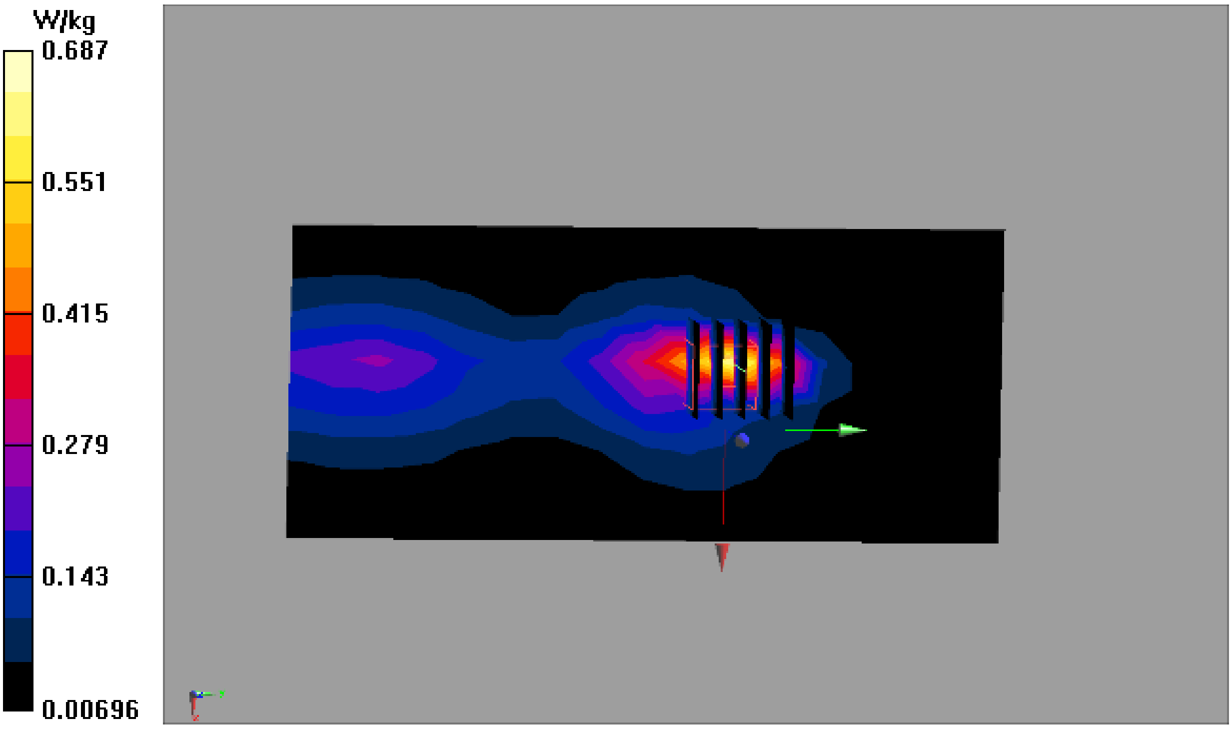
Communication System: UID 0, Generic GSM (0); Communication System Band: GSM 850 (824.2 – 848.8 MHz); Duty Cycle: 1:8.3;Frequency: 836.6 MHz; Medium parameters used: f = 835 MHz; σ= 0.97mho/m; εr = 54.95; ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):21.7, Liquid temperature (℃): 21.6

DASY Configuration:

- Probe: EX3DV4 - SN3953; ConvF(10.08,10.08, 10.08); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QDOVA002AA;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

BODY/ Edge 1/Area Scan (8x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.650 W/kg

BODY/ Edge 1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.597 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.03 W/kg
SAR(1 g) = 0.376 W/kg; SAR(10 g) = 0.172 W/kg
Maximum value of SAR (measured) = 0.687 W/kg



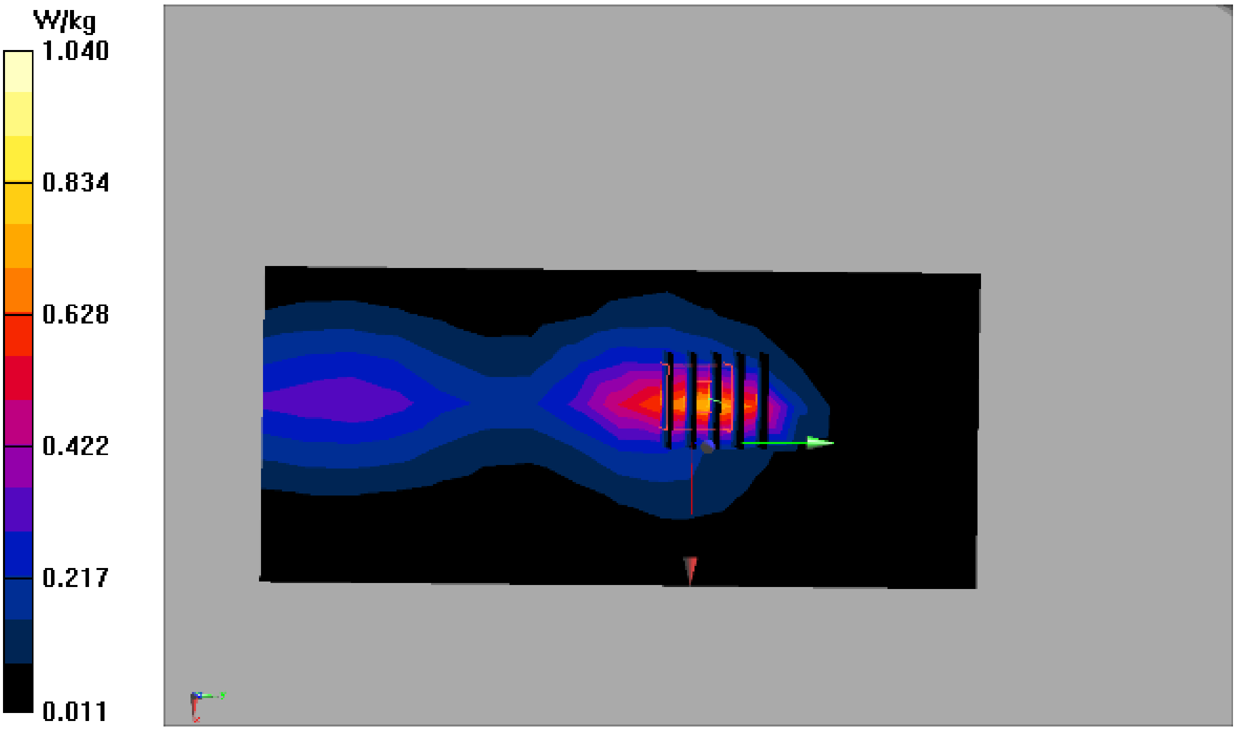
Test Laboratory: AGC Lab **Date: Apr. 01,2015**
GPRS 850 Mid- Edge 1 (4up)
DUT: Tablet PC; Type: PC1021

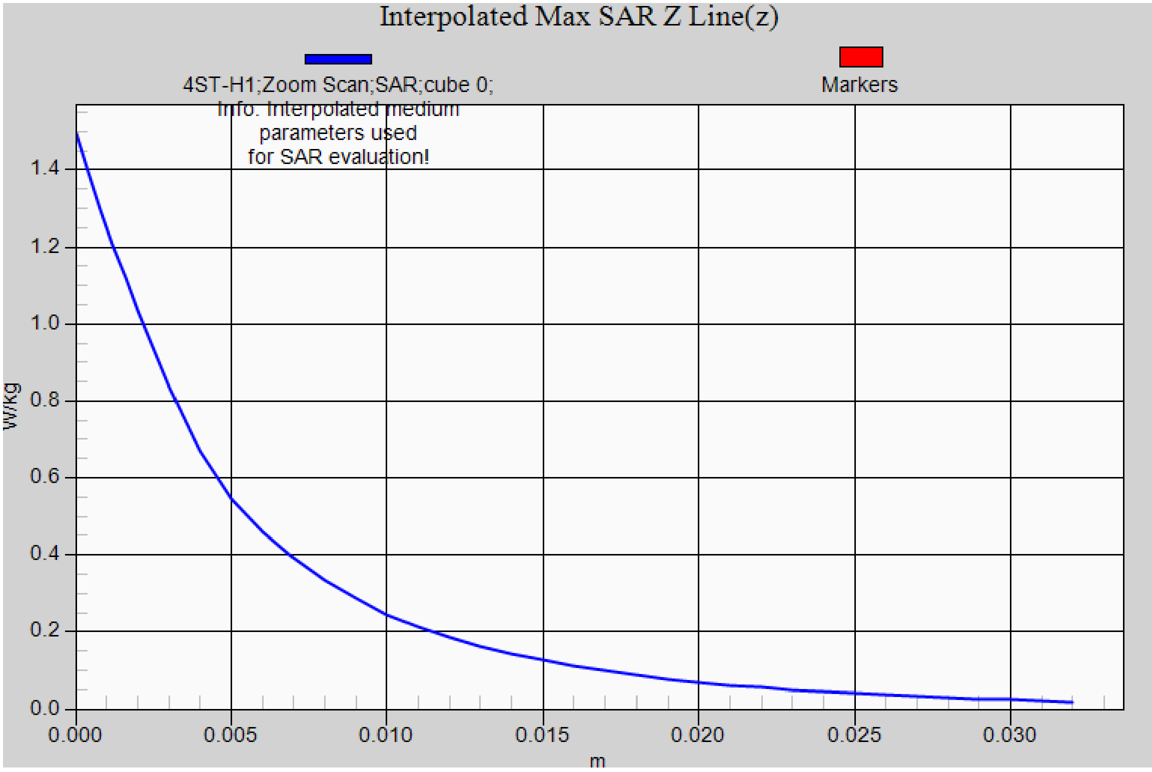
Communication System: GPRS-4 Slot; Communication System Band: GSM 850 (824.2 – 848.8 MHz); Duty Cycle: 1:2.1;Frequency: 836.6 MHz; Medium parameters used: f = 835 MHz; σ= 0.97mho/m; εr = 54.95;
ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):21.7, Liquid temperature (℃): 21.6

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(10.08,10.08, 10.08); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QDOVA002AA;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

BODY/4ST- Edge 1/Area Scan (8x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.782 W/kg

BODY/4ST- Edge 1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.423 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 1.50 W/kg
SAR(1 g) = 0.571 W/kg; SAR(10 g) = 0.261 W/kg
Maximum value of SAR (measured) = 1.04 W/kg




Interpolated Max SAR Z Line(z)
4ST-H1;Zoom Scan;SAR;cube 0;
Info: Interpolated medium parameters used for SAR evaluation!
Markers
W/kg
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

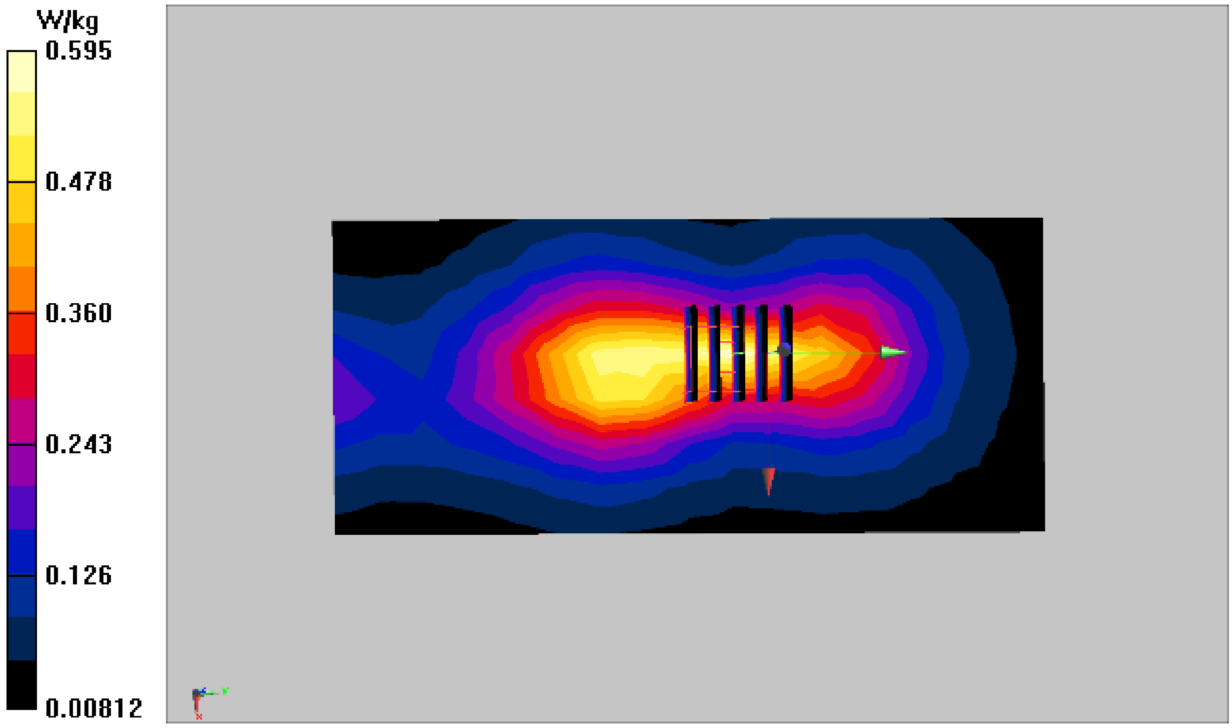
Test Laboratory: AGC Lab **Date: Apr. 01,2015**
GPRS 850 Mid- Edge 1 (4up) <SIM 2>
DUT: Tablet PC; Type: PC1021

Communication System: GPRS-4 Slot; Communication System Band: GSM 850 (824.2 – 848.8 MHz); Duty Cycle: 1:2.1;Frequency: 836.6 MHz; Medium parameters used: f = 835 MHz; σ= 0.97mho/m; εr = 54.95;
ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):21.7, Liquid temperature (℃): 21.6

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(10.08,10.08, 10.08); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QDOVA002AA;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

BODY/4ST- Edge 1-2/Area Scan (8x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.590 W/kg

BODY/4ST- Edge 1-2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.216 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.805 W/kg
SAR(1 g) = 0.391 W/kg; SAR(10 g) = 0.212 W/kg
Maximum value of SAR (measured) = 0.595 W/kg



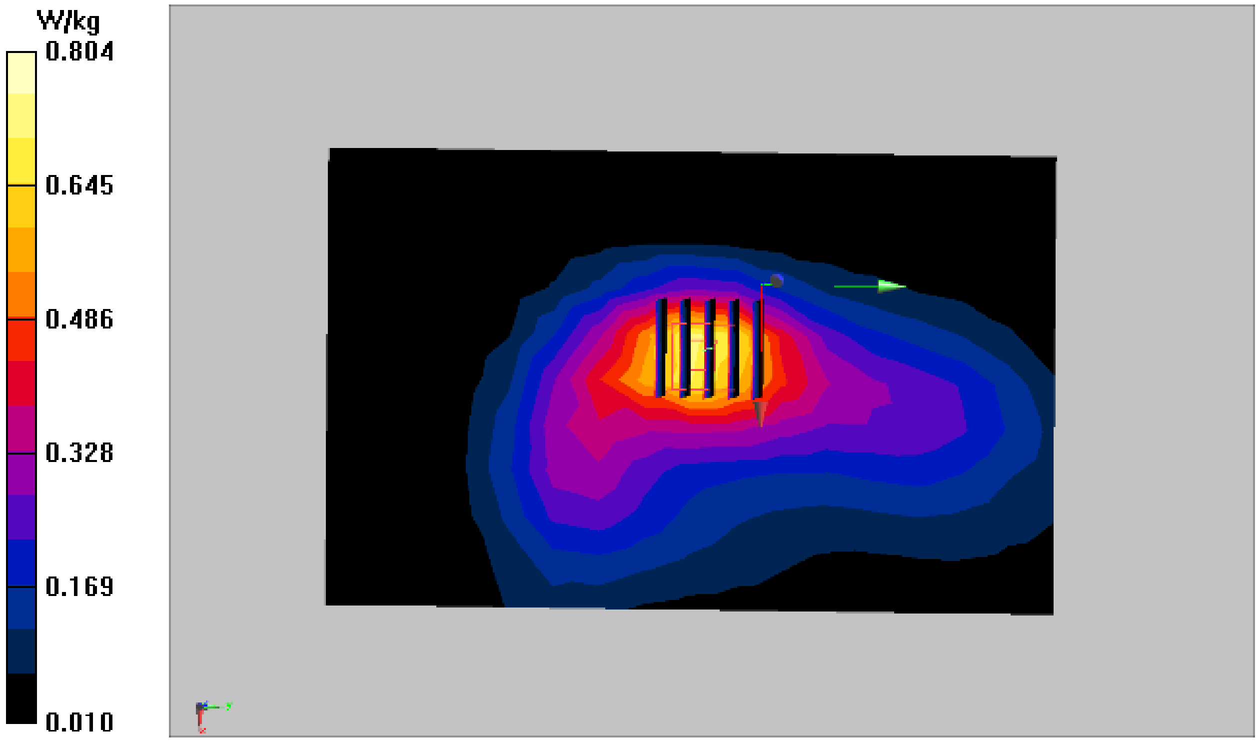
Test Laboratory: AGC Lab **Date: Apr. 02,2015**
PCS 1900 Mid-Body- Back
DUT: Tablet PC; Type: PC1021

Communication System: UID 0, Generic GSM (0); Communication System Band: PCS 1900 (1850.2 – 1909.8 MHz); Duty Cycle: 1:8.3; Frequency: 1880 MHz; Medium parameters used: f = 1900 MHz; σ= 1.49 mho/m; εr =54.30; ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):21.6, Liquid temperature (℃): 21.4

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(7.79,7.79,7.79); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

BODY/BACK/Area Scan (11x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.719 W/kg

BODY/BACK/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.071 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.06 W/kg
SAR(1 g) = 0.567 W/kg; SAR(10 g) = 0.314 W/kg
Maximum value of SAR (measured) = 0.804 W/kg



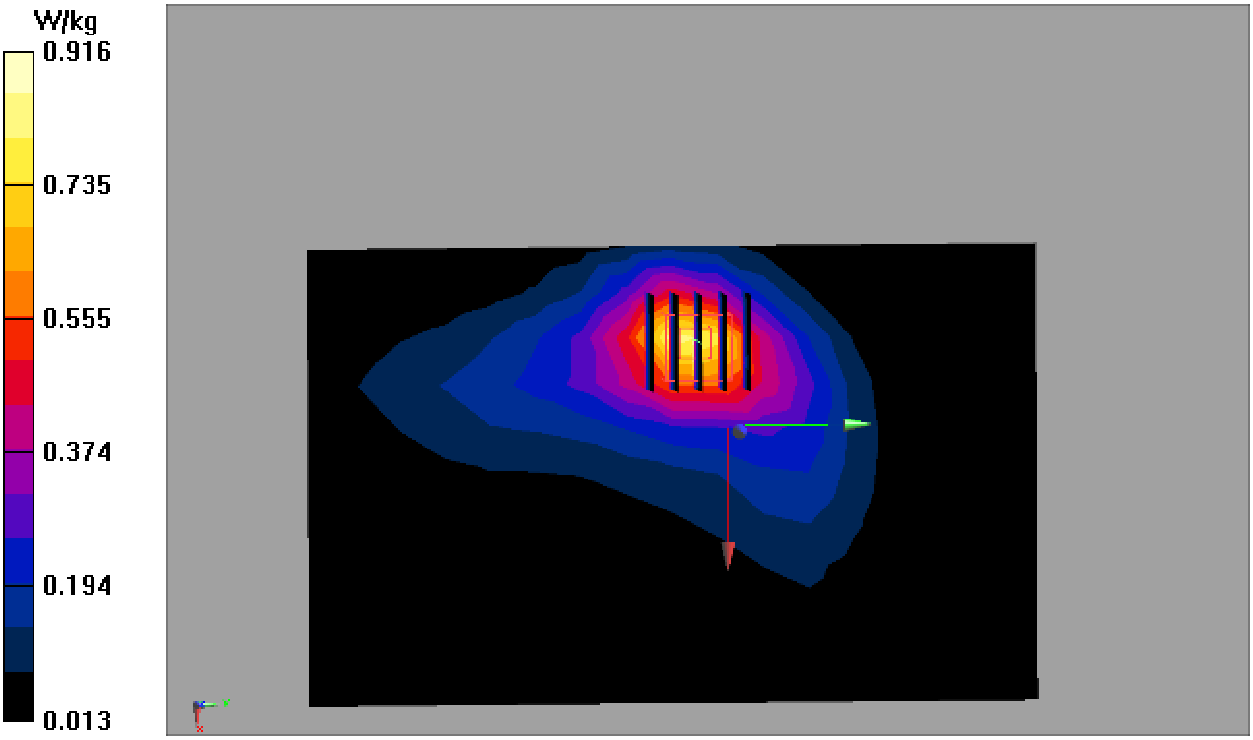
Test Laboratory: AGC Lab **Date: Apr. 02,2015**
GPRS 1900 Mid-Body- Back (2up)
DUT: Tablet PC; Type: PC1021

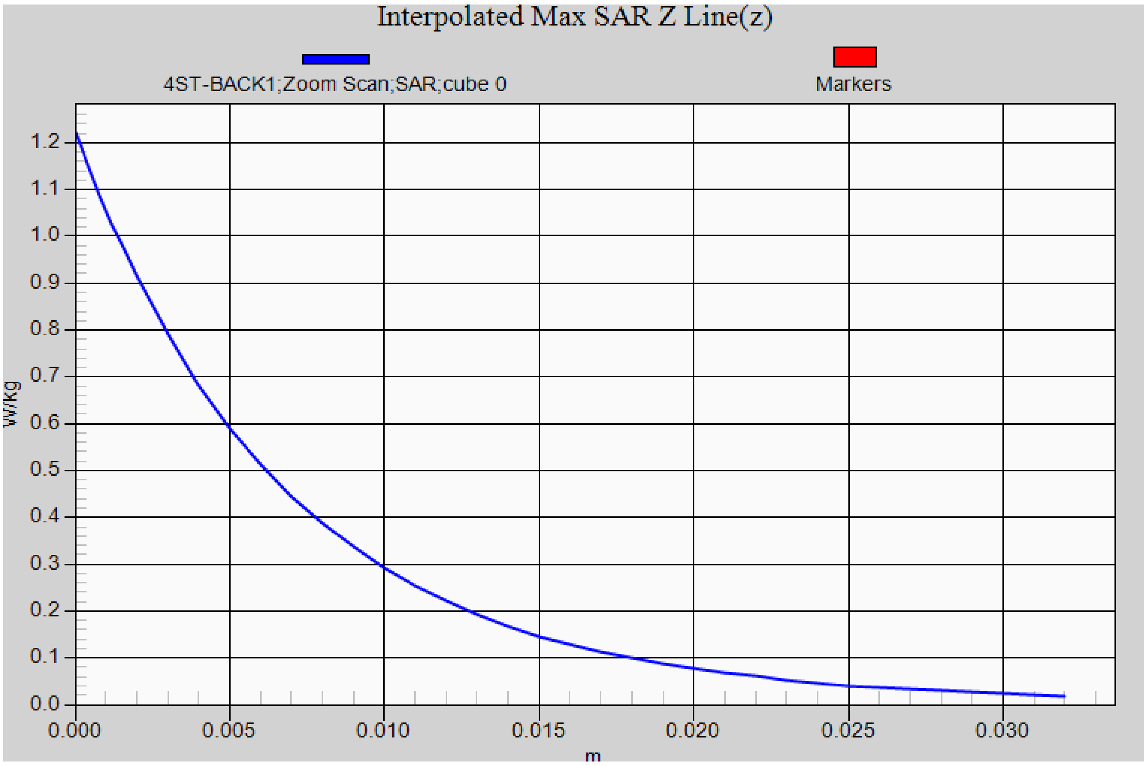
Communication System: GPRS-2Slot; Communication System Band: PCS 1900 (1850.2 – 1909.8 MHz); Duty Cycle: 1:4.2; Frequency: 1880 MHz; Medium parameters used: f = 1900 MHz; σ= 1.49 mho/m; εr =54.30;
ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):21.6, Liquid temperature (℃): 21.4

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(7.79,7.79,7.79); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

BODY/2ST-BACK/Area Scan (11x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.833 W/kg

BODY/2ST-BACK/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.600 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 1.22 W/kg
SAR(1 g) = 0.625 W/kg; SAR(10 g) = 0.332 W/kg
Maximum value of SAR (measured) = 0.916 W/kg




Interpolated Max SAR Z Line(z)
4ST-BACK1;Zoom Scan;SAR;cube 0
Markers
W/kg
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

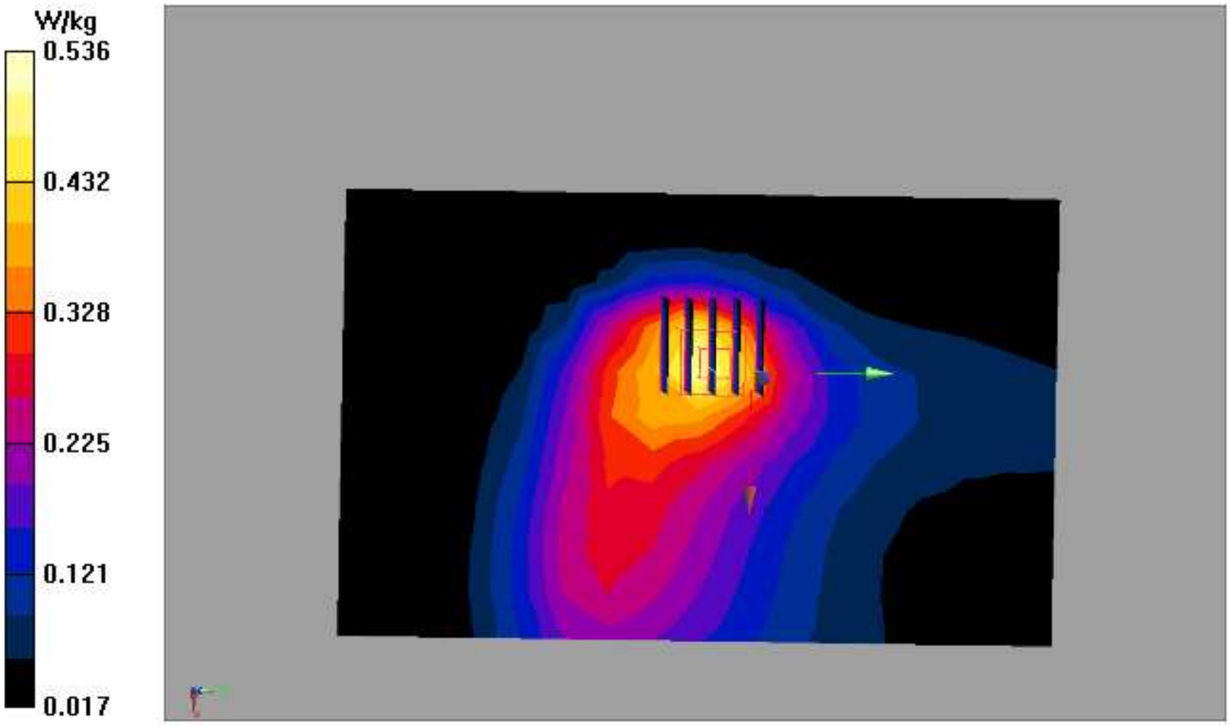
Test Laboratory: AGC Lab **Date: Apr. 02,2015**
GPRS 1900 Mid-Body- Back (2up) <SIM 2>
DUT: Tablet PC; Type: PC1021

Communication System: GPRS-2Slot; Communication System Band: PCS 1900 (1850.2 – 1909.8 MHz); Duty Cycle: 1:4.2; Frequency: 1880 MHz; Medium parameters used: f = 1900 MHz; σ= 1.49 mho/m; εr =54.30; ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):21.6, Liquid temperature (℃): 21.4

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(7.79,7.79,7.79); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

BODY/2ST-BACK-2 /Area Scan (11x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.511 W/kg

BODY/2ST-BACK -2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.769 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.653 W/kg
SAR(1 g) = 0.420 W/kg; SAR(10 g) = 0.265 W/kg
Maximum value of SAR (measured) = 0.536 W/kg



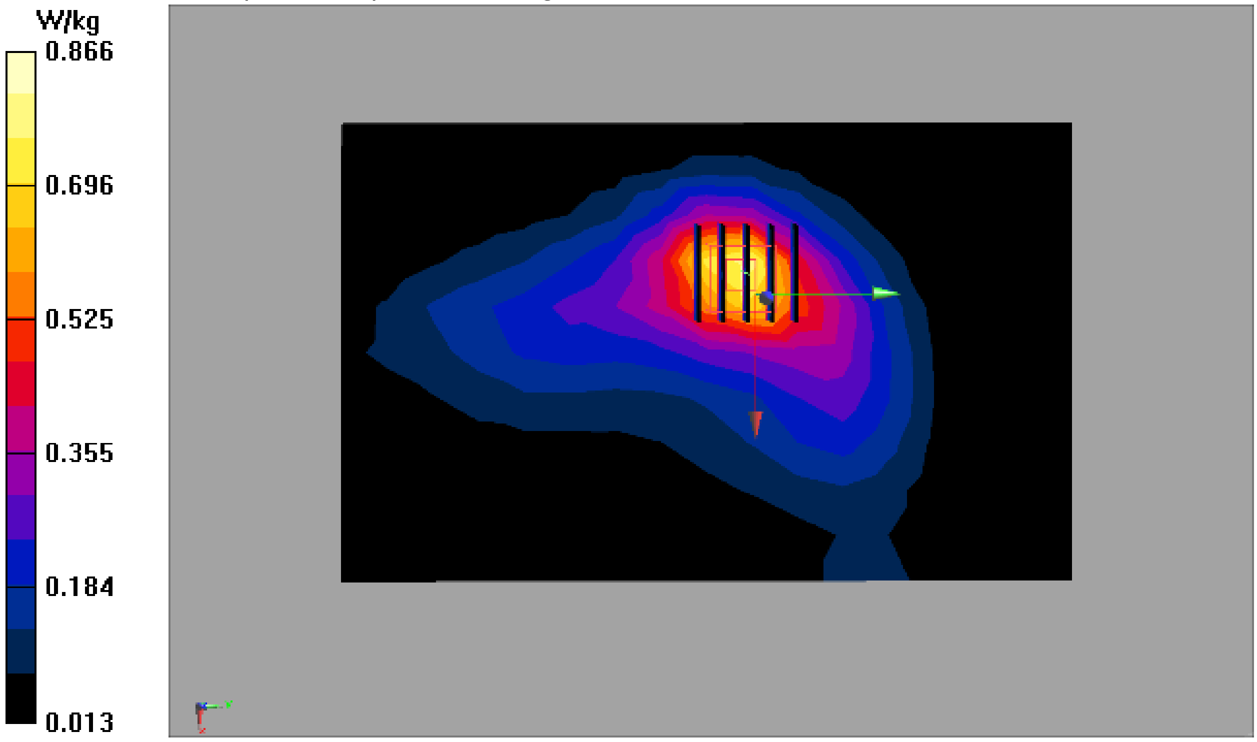
Test Laboratory: AGC Lab **Date: Apr. 02,2015**
WCDMA Band Ⅱ Mid -Body-Towards Grounds
DUT: Tablet PC; Type: PC1021

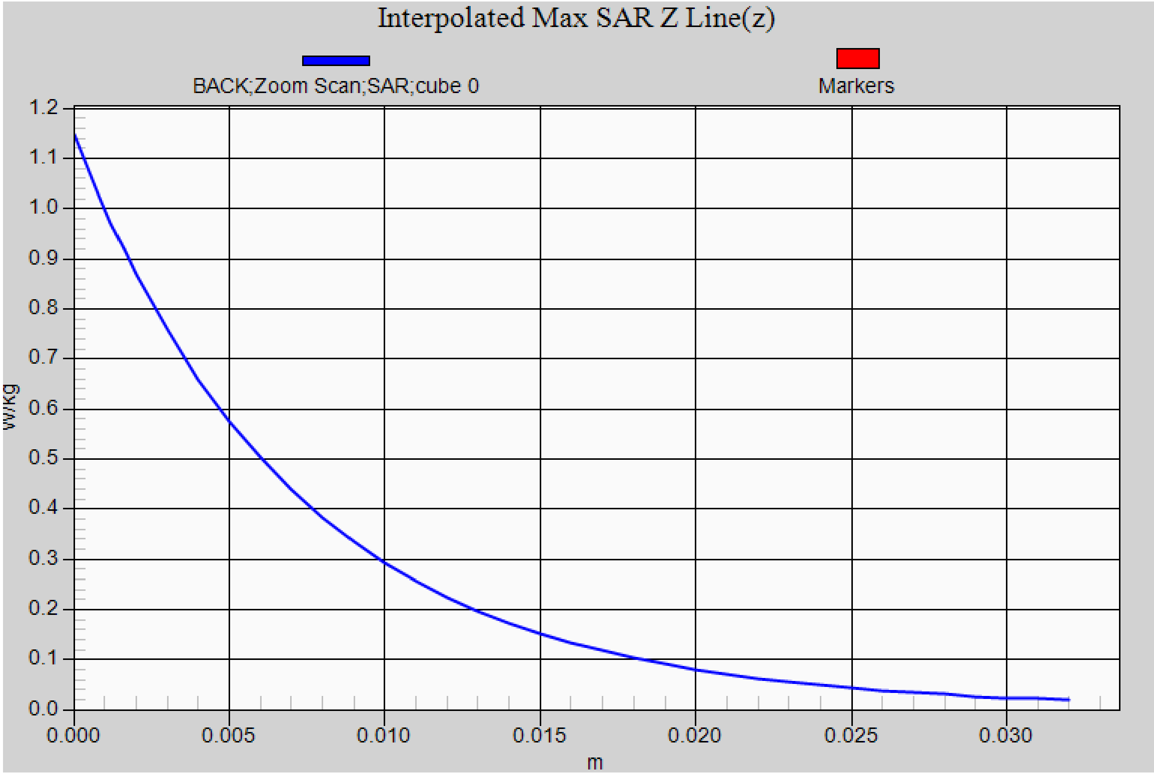
Communication System: UID 0, WCDMA 1900 (0); Communication System Band: Band Ⅱ UTRA/FDD ;
Duty Cycle:1:1; Frequency: 1880 MHz; Medium parameters used: f = 1900 MHz; σ= 1.49 mho/m; εr =54.30;
ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):21.6, Liquid temperature (℃): 21.4

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(7.79,7.79,7.79); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

BODY/BACK/Area Scan (11x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.777 W/kg

BODY/BACK/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.120 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.15 W/kg
SAR(1 g) = 0.603 W/kg; SAR(10 g) = 0.326 W/kg
Maximum value of SAR (measured) = 0.866 W/kg




Interpolated Max SAR Z Line(z)
BACK;Zoom Scan;SAR;cube 0
Markers
W/kg
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

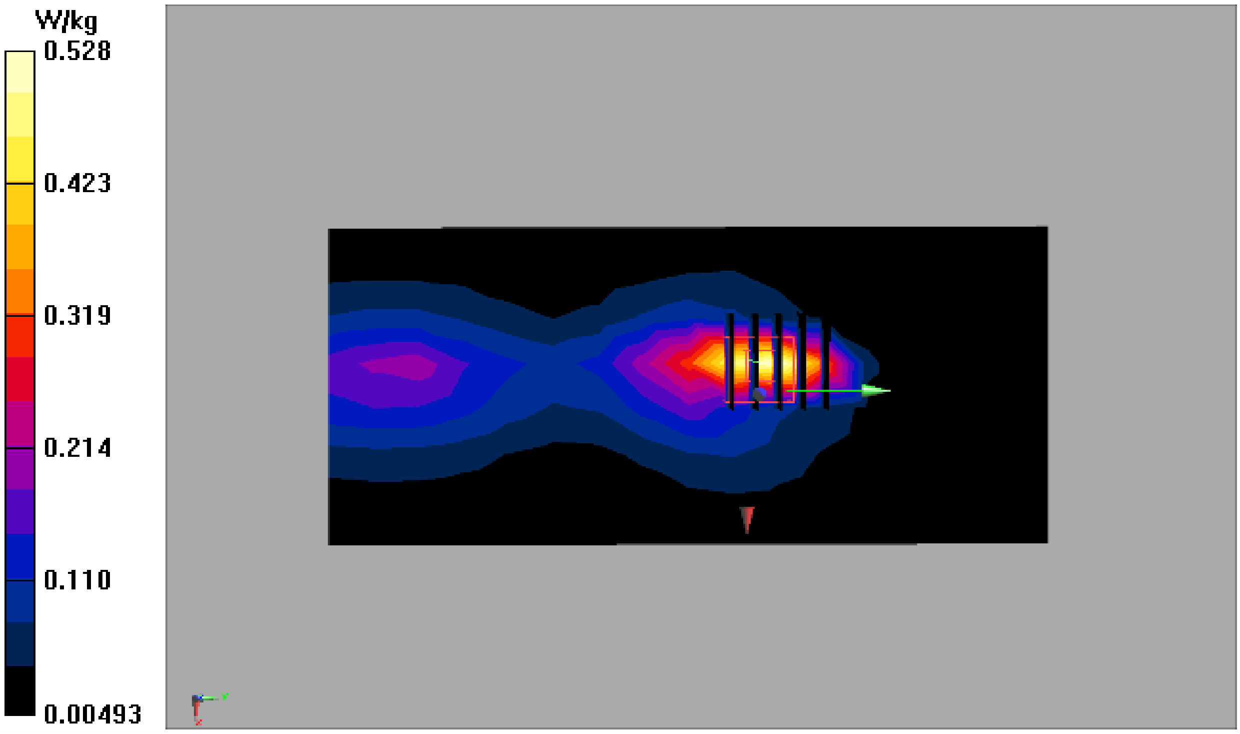
Test Laboratory: AGC Lab **Date: Apr. 01,2015**
WCDMA Band Ⅴ Mid-Body- Edge 1
DUT: Tablet PC; Type: PC1021

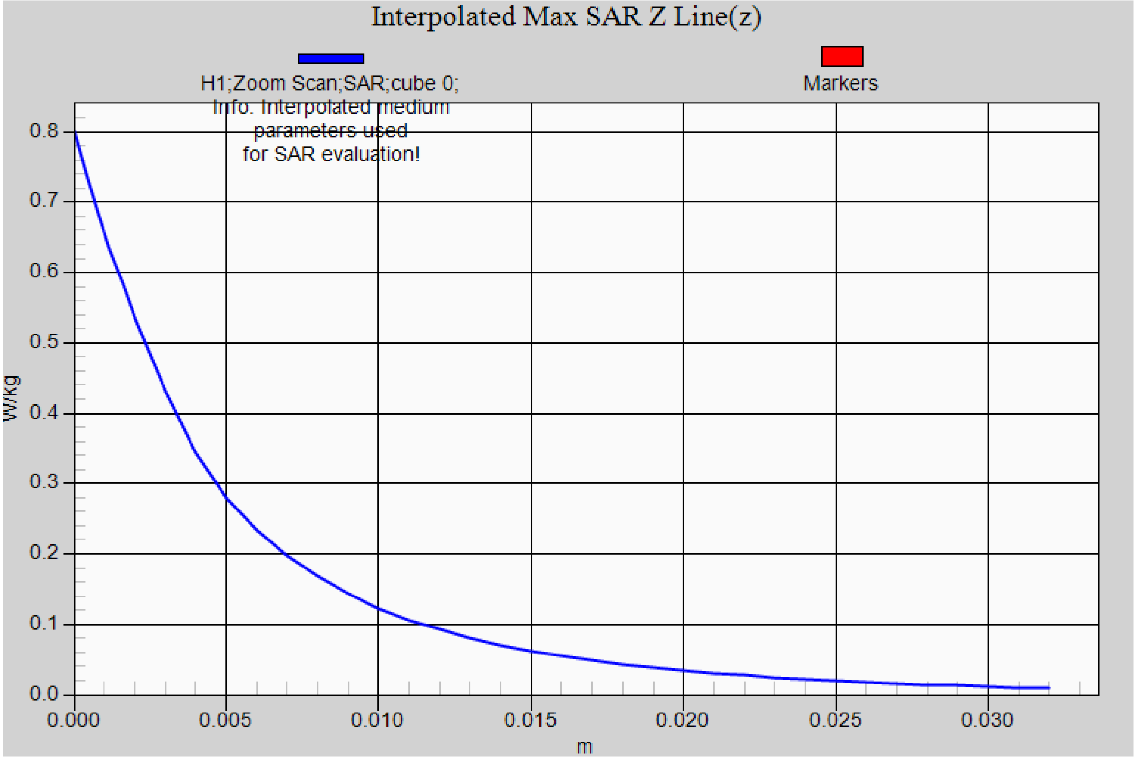
Communication System: UID 0, WCDMA 850 (0); Communication System Band: BAND Ⅴ UTRA/FDD;
Duty Cycle:1:1; Frequency: 835 MHz; Medium parameters used: f = 835 MHz;σ=0.97 mho/m; εr =54.95;
ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):21.7, Liquid temperature (℃): 21.6

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(10.08,10.08, 10.08); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

BODY/ Edge 1/Area Scan (8x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.533 W/kg

BODY/ Edge 1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.891 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.802 W/kg
SAR(1 g) = 0.298 W/kg; SAR(10 g) = 0.135 W/kg
Maximum value of SAR (measured) = 0.528 W/kg




Interpolated Max SAR Z Line(z)
H1;Zoom Scan;SAR;cube 0;
Info: Interpolated medium
parameters used
for SAR evaluation!
Markers
W/kg
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

Test Laboratory: AGC Lab **Date: Apr. 03,2015**
802.11b Mid - Edge 1
DUT: Tablet PC; Type: PC1021

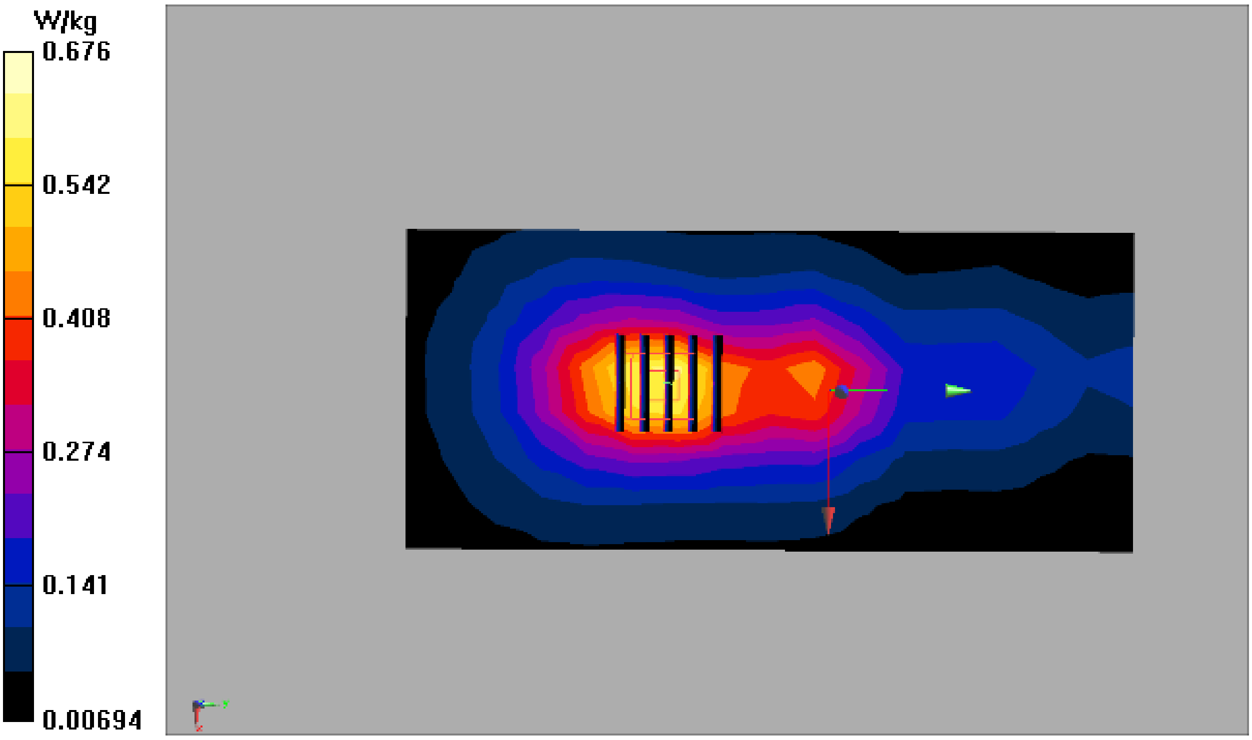
Communication System: Wi-Fi; Communication System Band: 802.11b; Duty Cycle: 1:1;
Frequency: 2437 MHz; Medium parameters used: f = 2450 MHz; σ =1.90 mho/m; εr =53.01; ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):22.8, Liquid temperature (℃): 22.3

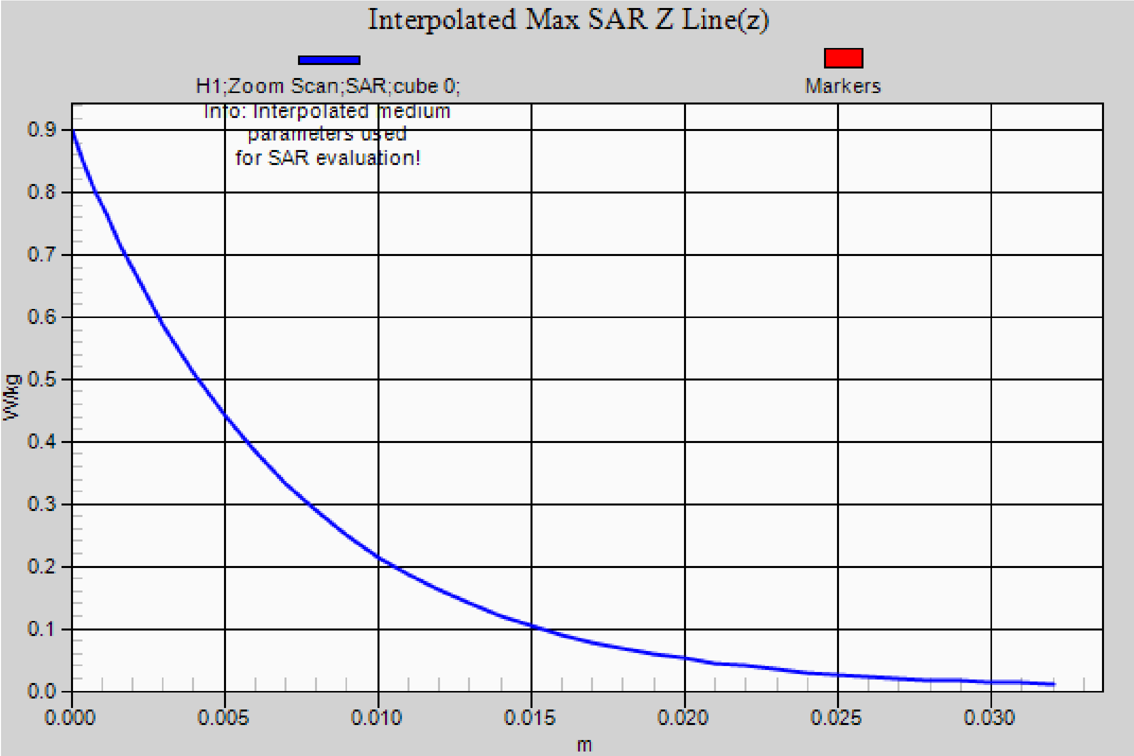
DASY Configuration:

- Probe: EX3DV4 - SN3953; ConvF(7.48, 7.48, 7.48); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

B-WIFI/ Edge 1/Area Scan (8x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.601 W/kg

B-WIFI/ Edge 1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.050 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.899 W/kg
SAR(1 g) = 0.468 W/kg; SAR(10 g) = 0.252 W/kg
Maximum value of SAR (measured) = 0.676 W/kg




Interpolated Max SAR Z Line(z)
H1;Zoom Scan;SAR;cube 0;
Info: Interpolated medium parameters used for SAR evaluation!
Markers
W/kg
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

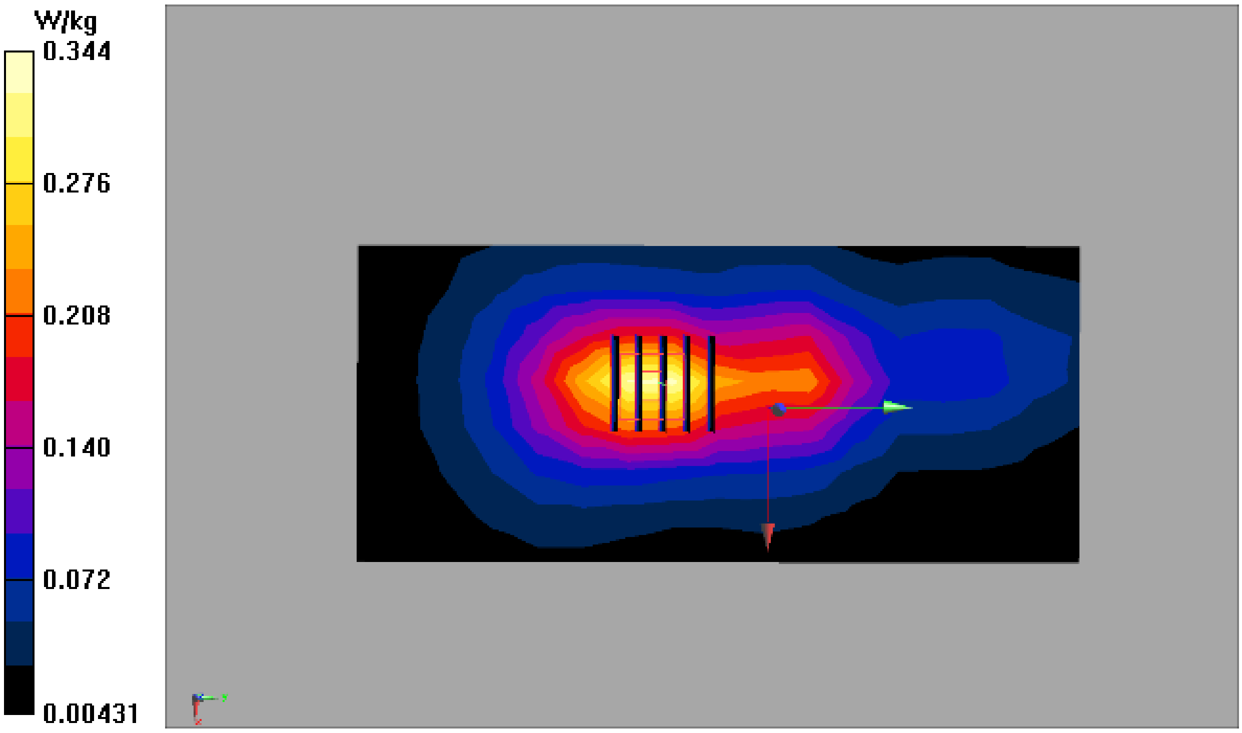
Test Laboratory: AGC Lab **Date: Apr. 03,2015**
802.11g Mid - Edge 1
DUT: Tablet PC; Type: PC1021

Communication System: Wi-Fi; Communication System Band: 802.11g; Duty Cycle: 1:1;
Frequency: 2437 MHz; Medium parameters used: f = 2450 MHz; σ =1.90 mho/m; εr =53.01; ρ= 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (℃):22.8, Liquid temperature (℃): 22.3

DASY Configuration:
- Probe: EX3DV4 - SN3953; ConvF(7.48, 7.48, 7.48); Calibrated: 11/06/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1398; Calibrated: 10/27/2014
- Phantom: SAM (20deg probe tilt) with CRP v5.0; Type: QD000P40CD;
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

G-WIFI/ Edge 1/Area Scan (8x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.330 W/kg

G-WIFI/ Edge 1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.199 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.459 W/kg
SAR(1 g) = 0.238 W/kg; SAR(10 g) = 0.128 W/kg
Maximum value of SAR (measured) = 0.344 W/kg



APPENDIX C. TEST SETUP PHOTOGRAPHS &EUT PHOTOGRAPHS

Test Setup Photographs

Body Back 0mm

Body Front 0mm

Edge 1(Top)

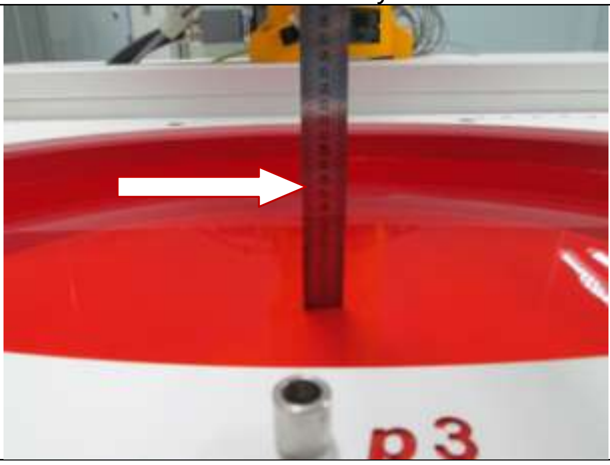
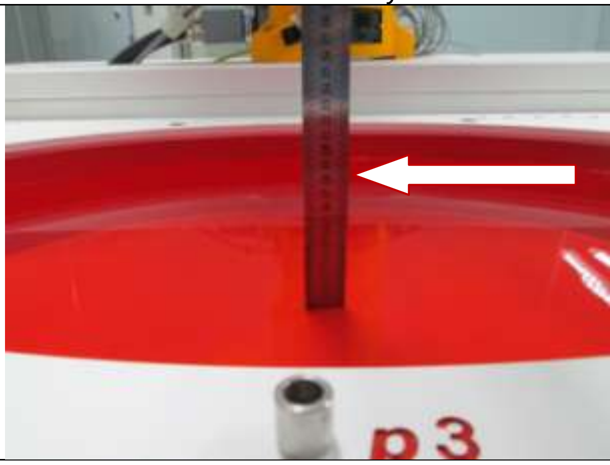
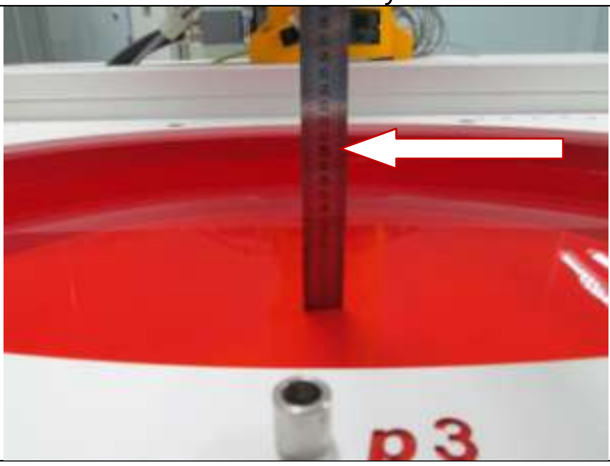
Edge 2(Right)

Edge 3(Bottom)

Edge 4(Left)

DEPTH OF THE LIQUID IN THE PHANTOM—ZOOM IN

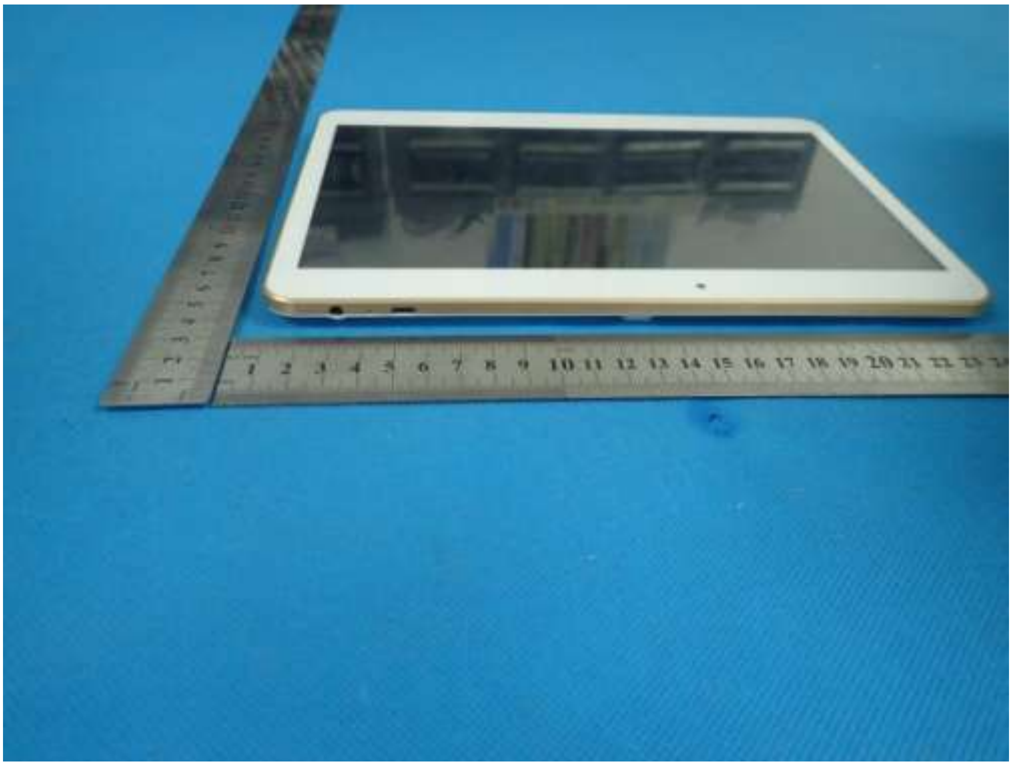
Note：The position used in the measurement were according to IEEE 1528-2003

850MHz body	1900MHz body
	
2450MHz body	
	

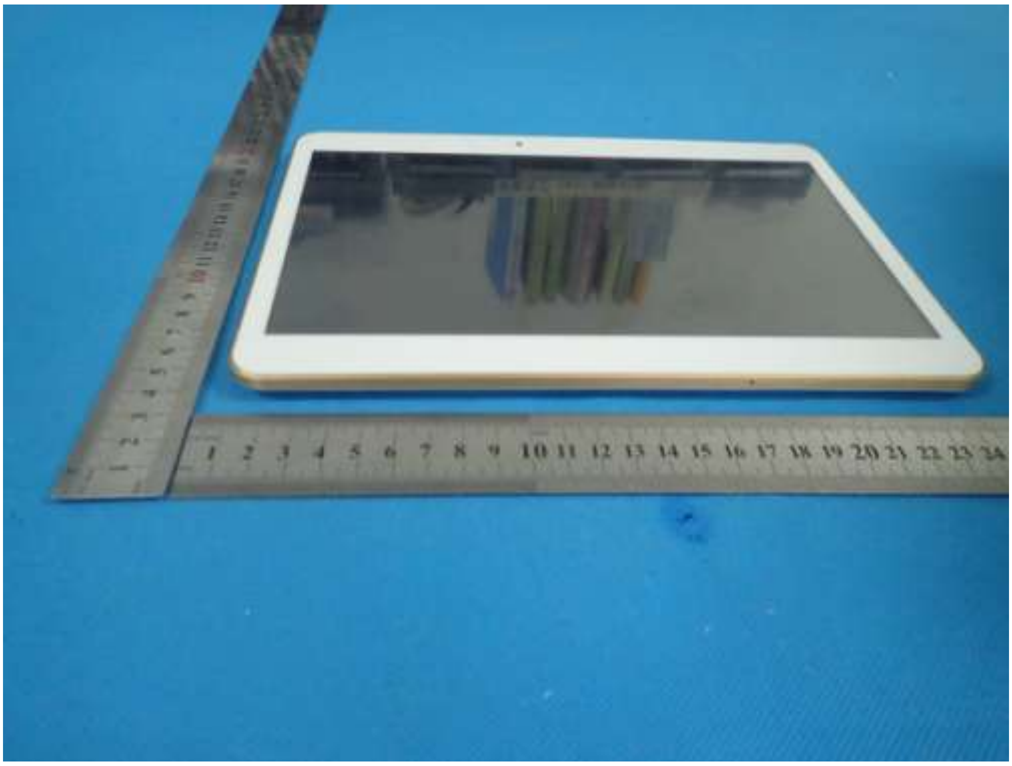
EUT PHOTOGRAPHS

All VIEW OF EUT

TOP VIEW OF EUT



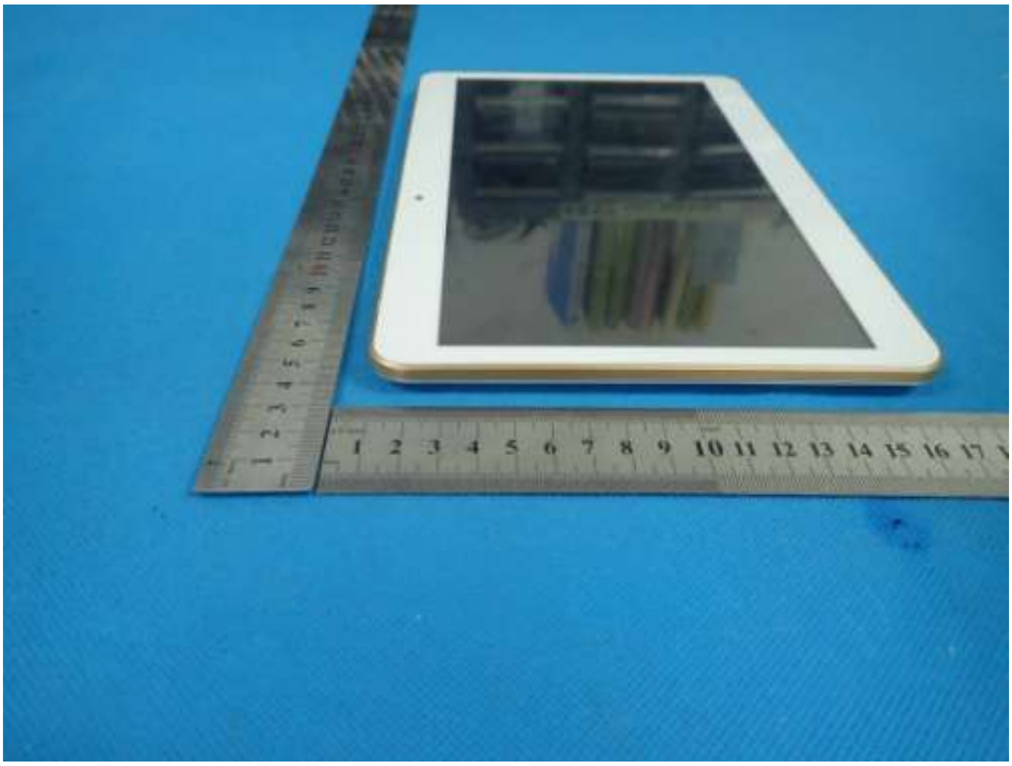
BOTTOM VIEW OF EUT



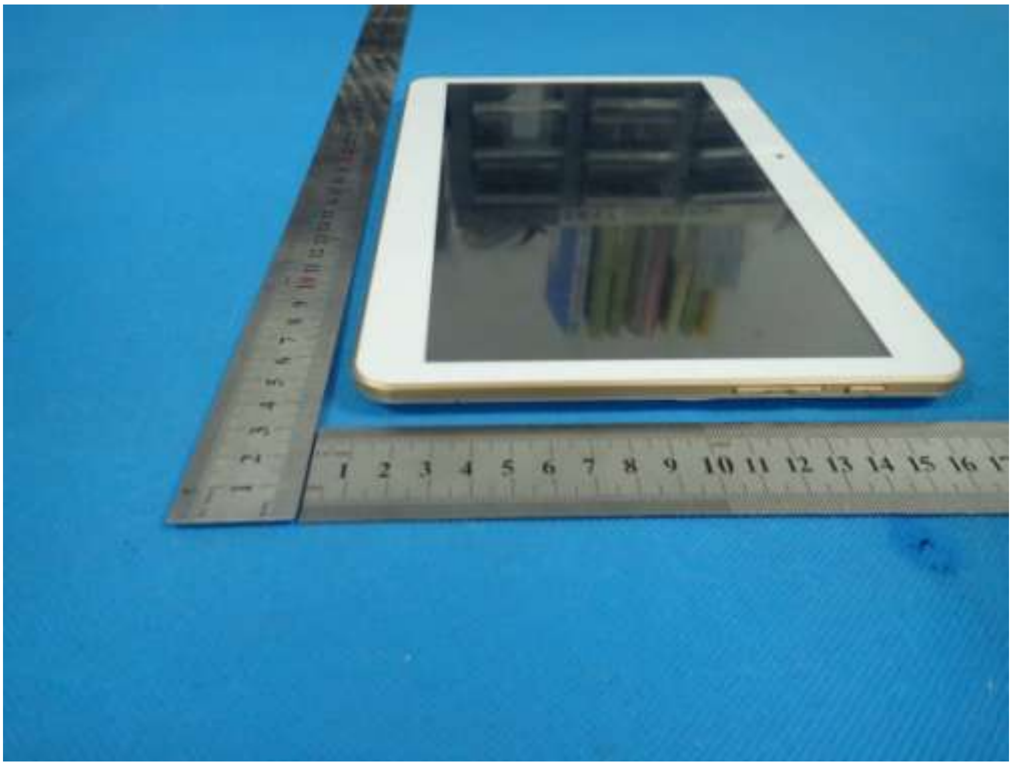
FRONT VIEW OF EUT

BACK VIEW OF EUT

LEFT VIEW OF EUT

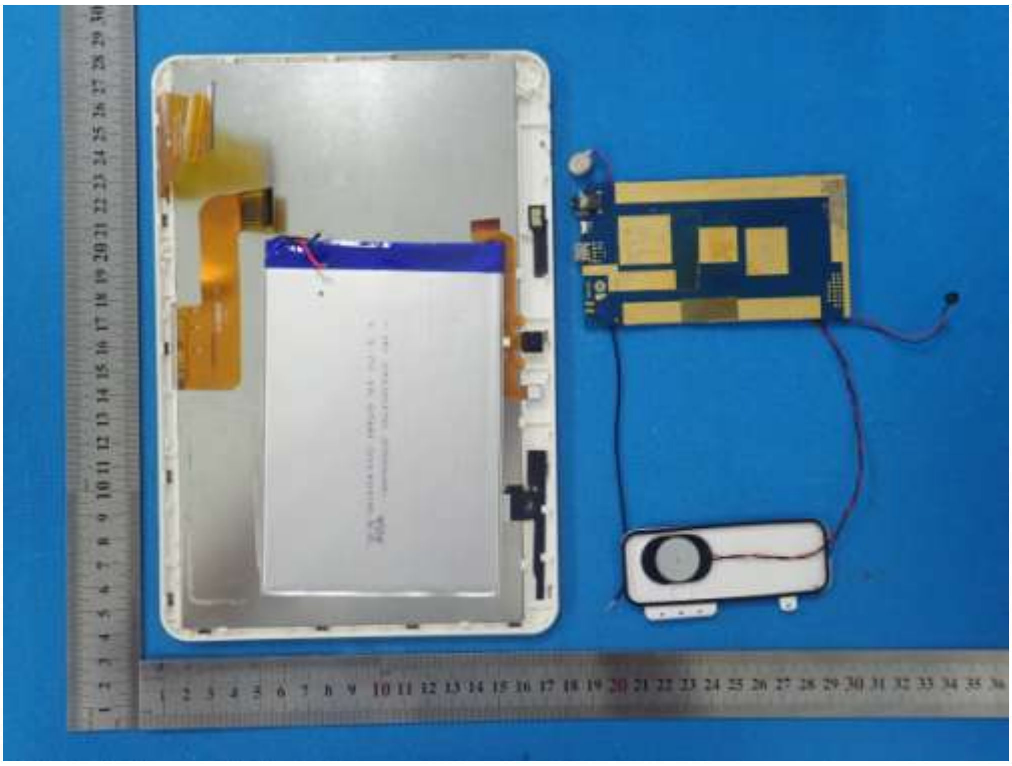


RIGHT VIEW OF EUT

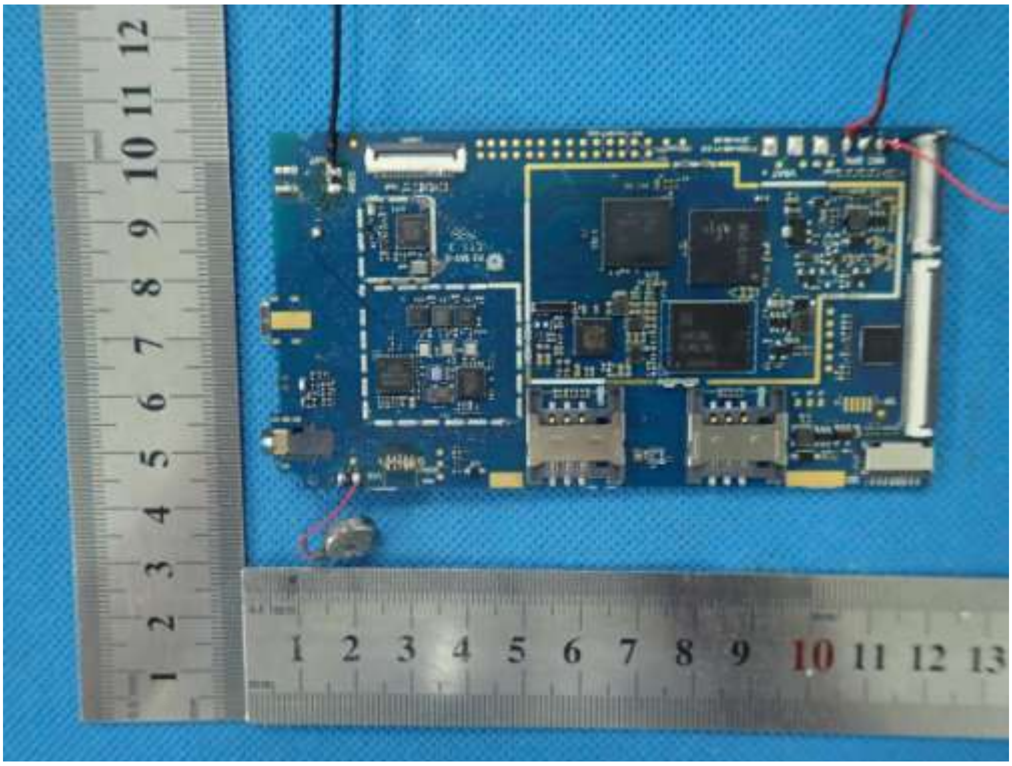


OPEN VIEW OF EUT-1

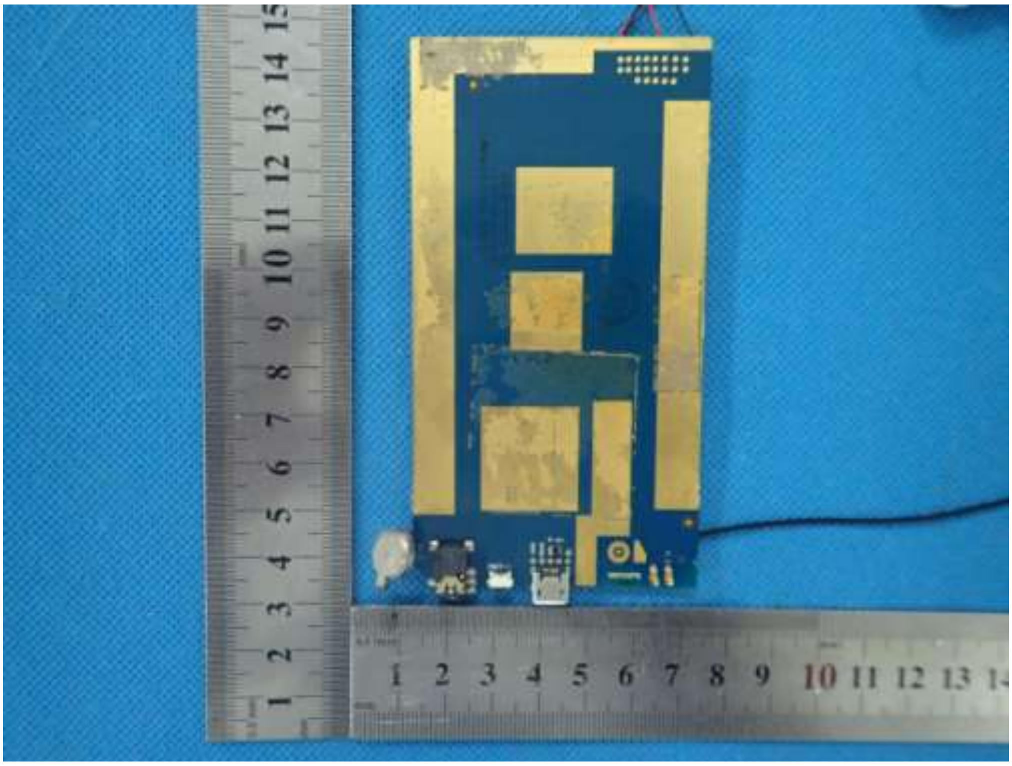
OPEN VIEW OF EUT-2



INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



APPENDIX D. PROBE CALIBRATION DATA

In Collaboration with speag 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 agc-cert(鑫宇环) Certificate No: Z14-97116

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3953
Calibration Procedure(s)	TMC-OS-E-02-195 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	November 06, 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-14 (CTTL, No.J14X02146)	Jun-15
Power sensor NRP-Z91	101547	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Power sensor NRP-Z91	101548	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
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 3617	28-Aug-14(SPEAG,No.EX3-3617_Aug14)	Aug-15
DAE4	SN 1331	23-Jan-14 (SPEAG, DAE4-1331_Jan14)	Jan -15
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	01-Jul-14 (CTTL, No.J14X02145)	Jun-15
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: November 07, 2014

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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: 3953

Calibrated: November 06, 2014

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY – Parameters of Probe: EX3DV4 - SN: 3953

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	0.53	0.54	0.48	±10.8%
DCP(mV)[B]	101.6	101.2	100.0	

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	192.6	±2.5%
		Y	0.0	0.0	1.0		191.5	
		Z	0.0	0.0	1.0		179.1	

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: 3953

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)
835	41.5	0.90	10.12	10.12	10.12	0.14	1.25	±12%
900	41.5	0.97	9.70	9.70	9.70	0.23	1.04	±12%
1810	40.0	1.40	8.00	8.00	8.00	0.17	1.34	±12%
1900	40.0	1.40	7.89	7.89	7.89	0.22	1.17	±12%
2100	39.8	1.49	8.05	8.05	8.05	0.16	1.42	±12%
2450	39.2	1.80	7.32	7.32	7.32	0.63	0.66	±12%
3500	37.9	2.91	7.35	7.35	7.35	0.50	0.88	±13%
3700	37.7	3.12	7.03	7.03	7.03	0.45	1.02	±13%
5200	36.0	4.66	5.64	5.64	5.64	0.29	1.53	±13%
5300	35.9	4.76	5.32	5.32	5.32	0.45	0.77	±13%
5500	35.6	4.96	4.78	4.78	4.78	0.36	0.90	±13%
5600	35.5	5.07	4.60	4.60	4.60	0.34	0.96	±13%
5800	35.3	5.27	4.40	4.40	4.40	0.32	0.84	±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: 3953

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)
835	55.2	0.97	10.08	10.08	10.08	0.19	1.27	±12%
900	55.0	1.05	9.84	9.84	9.84	0.25	1.11	±12%
1810	53.3	1.52	7.93	7.93	7.93	0.16	1.63	±12%
1900	53.3	1.52	7.79	7.79	7.79	0.20	1.24	±12%
2100	53.2	1.62	8.10	8.10	8.10	0.16	1.71	±12%
2450	52.7	1.95	7.48	7.48	7.48	0.48	0.84	±12%
3500	51.3	3.31	6.70	6.70	6.70	0.53	0.90	±13%
3700	51.0	3.55	6.73	6.73	6.73	0.48	0.97	±13%
5200	49.0	5.30	4.92	4.92	4.92	0.43	1.17	±13%
5300	48.9	5.42	4.74	4.74	4.74	0.42	1.20	±13%
5500	48.6	5.65	4.33	4.33	4.33	0.42	1.45	±13%
5600	48.5	5.77	4.23	4.23	4.23	0.43	1.56	±13%
5800	48.2	6.00	4.32	4.32	4.32	0.45	1.69	±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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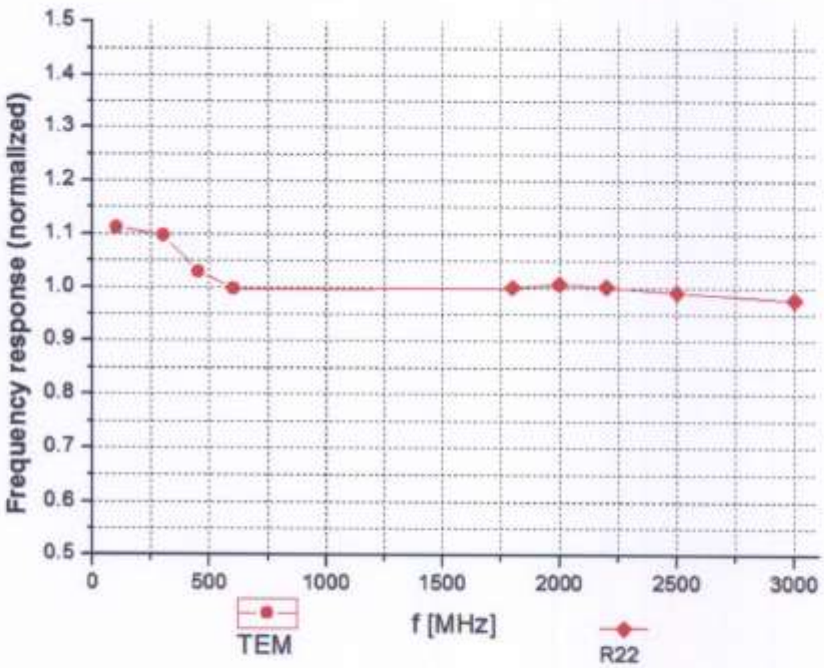
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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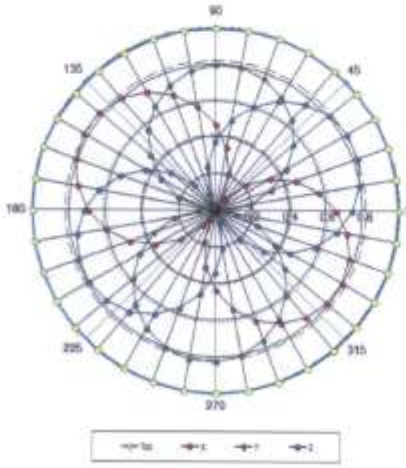
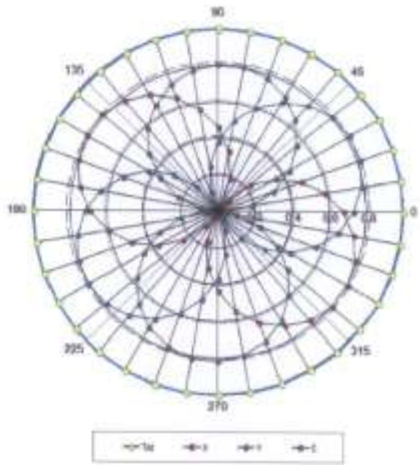
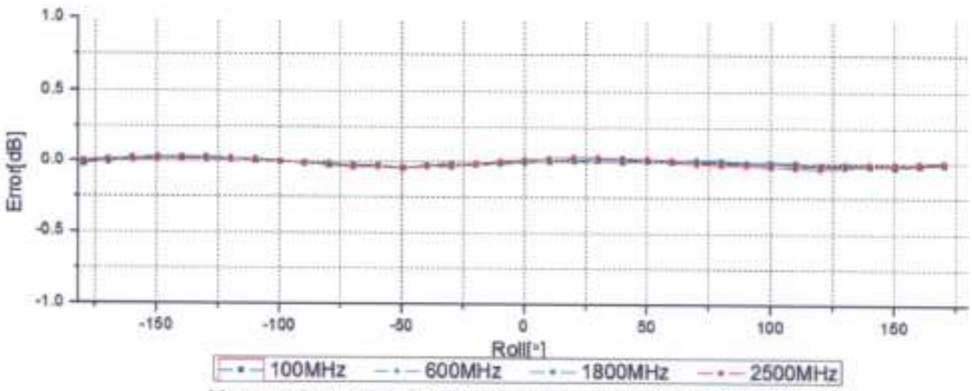
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





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

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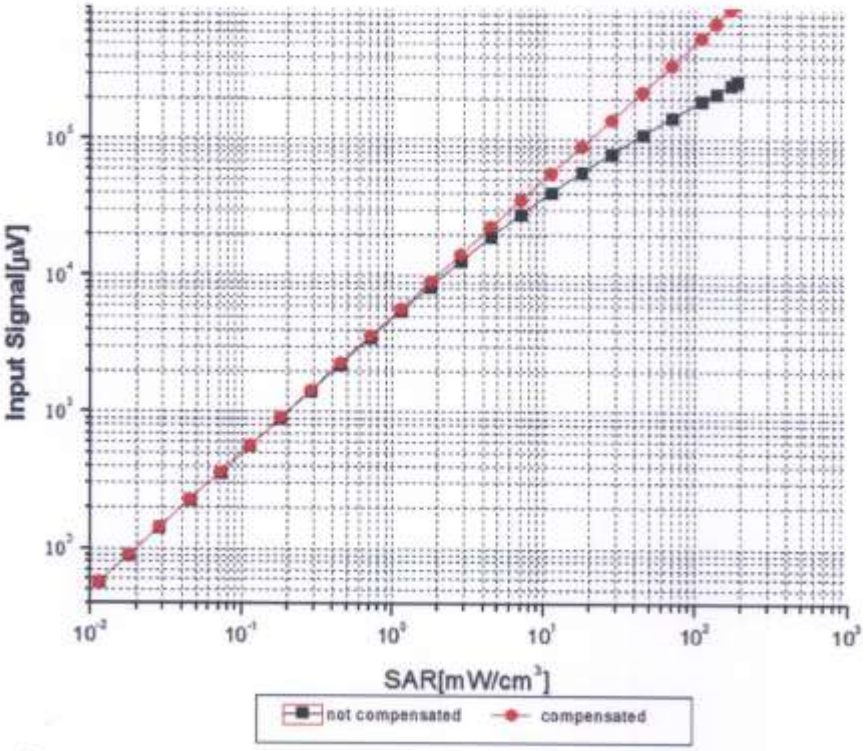
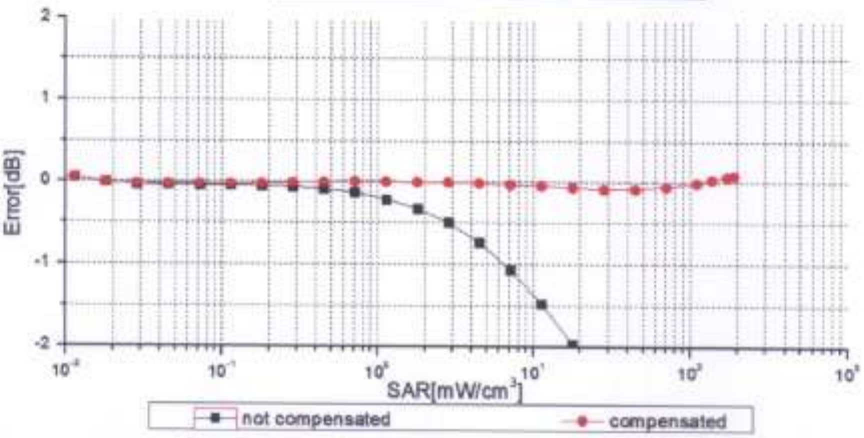
Dynamic Range f(SAR$_{head}$)
(TEM cell, f = 900 MHz)





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

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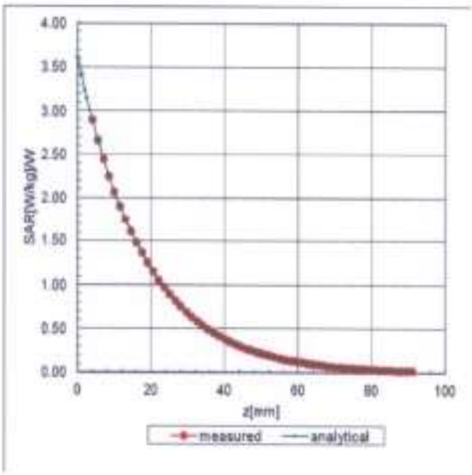
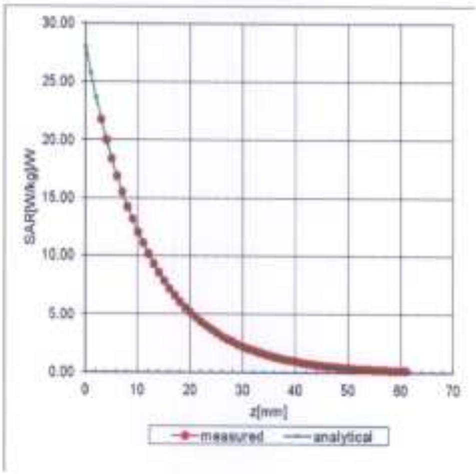
Conversion Factor Assessment

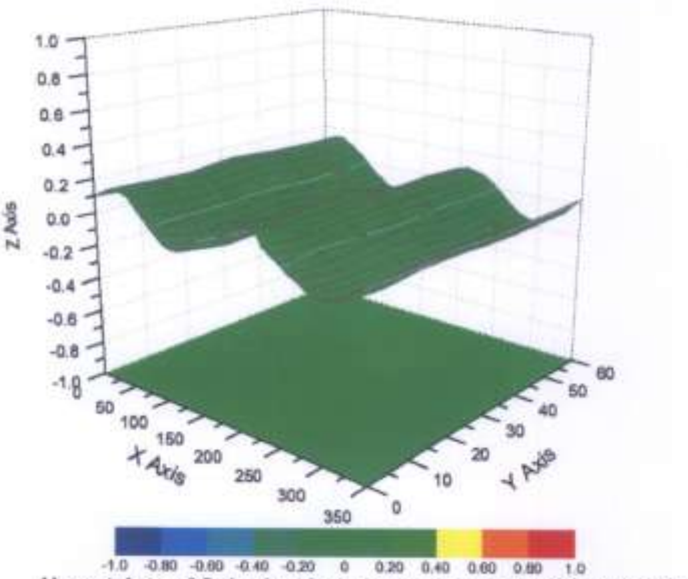
f=900 MHz, WGLS R9(H_convF)



f=1810 MHz, WGLS R22(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: 3953

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	32
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

APPENDIX E. DAE CALIBRATION DATA

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CALIBRATION
No. L0570

Client : agc-cert(鑫宇环) Certificate No: Z14-97132

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1398
Calibration Procedure(s)	TMC-OS-E-01-198 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	October 27, 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
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: October 28, 2014

In Collaboration with
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CALIBRATION LABORATORY

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Glossary:

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

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.

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DC Voltage Measurement

A/D - Converter Resolution nominal
High Range: 1LSB = 6.1μV , full range = -100...+300 mV
Low Range: 1LSB = 61nV , full range = -1.......+3mV
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.206 ± 0.15% (k=2)	404.186 ± 0.15% (k=2)	403.648 ± 0.15% (k=2)
Low Range	3.97611 ± 0.7% (k=2)	3.99334 ± 0.7% (k=2)	3.97121 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	196° ± 1 °

APPENDIX F. DIPOLE CALIBRATION DATA

SATIMO
The microwave vision company

SAR Reference Dipole Calibration Report

Ref : ACR.318.5.13.SATU.A

ATTESTATION OF GLOBAL COMPLIANCE CO. LTD.
1&2F, NO.2 BUILDING, HUAFENG NO.1 INDUSTRIAL PARK, GUSHU COMMUNITY XIXIANG STREET
BAOAN DISTRICT, SHENZHEN, P.R. CHINA
SATIMO COMOSAR REFERENCE DIPOLE
FREQUENCY: 900 MHZ
SERIAL NO.: SN 46/11 DIP 0G900-185

Calibrated at SATIMO US
2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED
Calibration CERT #2246.02

11/14/13

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	11/14/2013	JS
Checked by :	Jérôme LUC	Product Manager	11/14/2013	JS
Approved by :	Kim RUTKOWSKI	Quality Manager	11/14/2013	Kim Rutkowski

	Customer Name
Distribution :	ATTESTATION OF GLOBAL COMPLIANCE CO. LTD.

Issue	Date	Modifications
A	11/14/2013	Initial release

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5 Measurement Uncertainty 5
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5.2 Dimension Measurement 5
5.3 Validation Measurement 5
6 Calibration Measurement Results 6
6.1 Return Loss and Impedance 6
6.2 Mechanical Dimensions 6
7 Validation measurement 7
7.1 Measurement Condition 7
7.2 Head Liquid Measurement 7
7.3 Measurement Result 8
7.4 Body Measurement Result 9
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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 900 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID900
Serial Number	SN 46/11 DIP 0G900-185
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

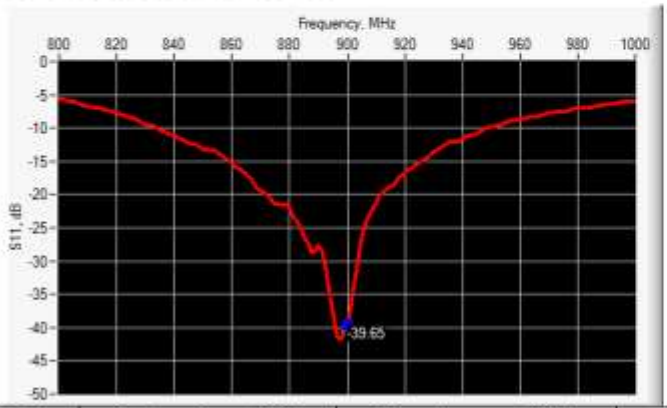
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
900	-39.65	-20	50.5 Ω - -1.1 jΩ

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.	PASS	83.3 ±1 %.	PASS	3.6 ±1 %.	PASS
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 MEASUREMENT CONDITION

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 41.8 sigma : 0.96
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

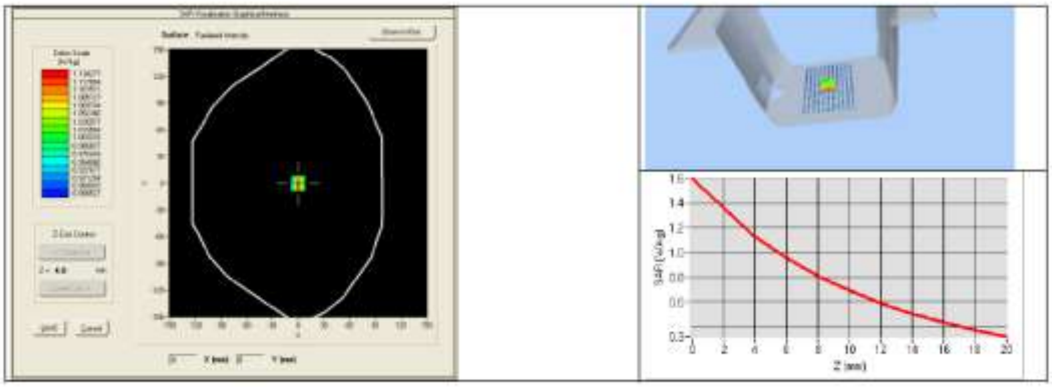
7.2 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %	PASS	0.97 ±5 %	PASS
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.3 MEASUREMENT RESULT

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

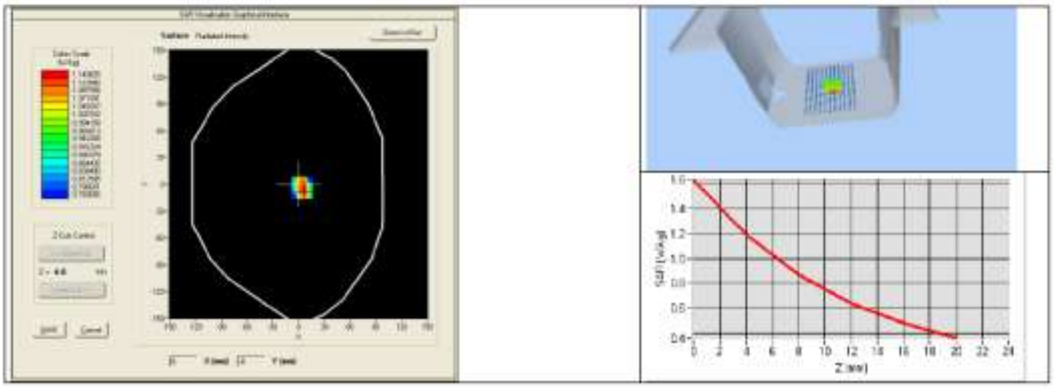
Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9	10.70 (1.07)	6.99	6.72 (0.67)
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.4 BODY MEASUREMENT RESULT

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 56.0 sigma : 1.04
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
900	11.27 (1.13)	7.18 (0.72)



8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
SAM Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Calipers	Carrera	CALIPER-01	12/2010	12/2013
Reference Probe	Satimo	EPG122 SN 18/11	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Multimeter	Keithley 2000	1188656	11/2010	11/2013
Signal Generator	Agilent E4438C	MY49070581	12/2010	12/2013
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2010	11/2013
Power Sensor	HP ECP-E26A	US37181460	11/2010	11/2013
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	3/2012	3/2014

SAR Reference Dipole Calibration Report

Ref : ACR.318.7.13.SATU.A

ATTESTATION OF GLOBAL COMPLIANCE CO. LTD.

1&2F, NO.2 BUILDING, HUAFENG NO.1 INDUSTRIAL PARK, GUSHU COMMUNITY XIXIANG STREET BAOAN DISTRICT, SHENZHEN, P.R. CHINA

SATIMO COMOSAR REFERENCE DIPOLE

FREQUENCY: 1900 MHZ

SERIAL NO.: SN 46/11 DIP 1G900-187

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED
Calibration CERT #2246.02

11/14/13

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	11/14/2013	JS
Checked by :	Jérôme LUC	Product Manager	11/14/2013	JS
Approved by :	Kim RUTKOWSKI	Quality Manager	11/14/2013	Kim Rutkowski

	Customer Name
Distribution :	ATTESTATION OF GLOBAL COMPLIANCE CO. LTD.

Issue	*Date*	*Modifications*
A	11/14/2013	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1900 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID1900
Serial Number	SN 46/11 DIP 1G900-187
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

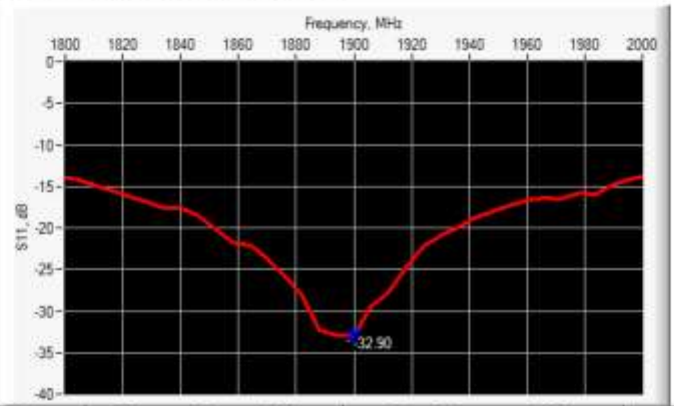
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1900	-32.90	-20	48.9 Ω + 2.3 jΩ

6.2 MECHANICAL DIMENSIONS

Frequency MHz	**L** mm		**h** mm		**d** mm	
	required	**measured**	**required**	**measured**	**required**	**measured**
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.	PASS	39.5 ±1 %.	PASS	3.6 ±1 %.	PASS
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 MEASUREMENT CONDITION

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 39.8 sigma : 1.43
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	1900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

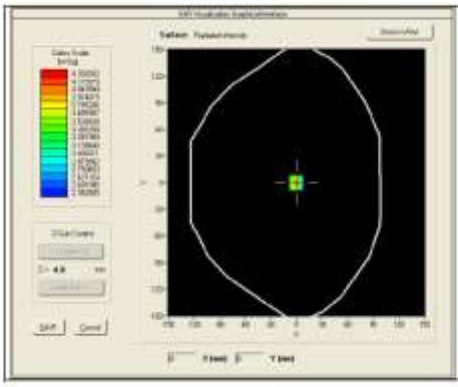
7.2 HEAD LIQUID MEASUREMENT

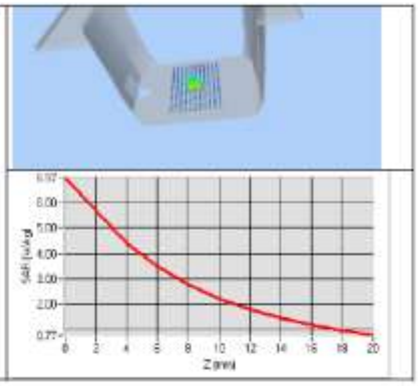
Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %	PASS	1.40 ±5 %	PASS
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.3 MEASUREMENT RESULT

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7	39.65 (3.96)	20.5	20.24 (2.02)
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	

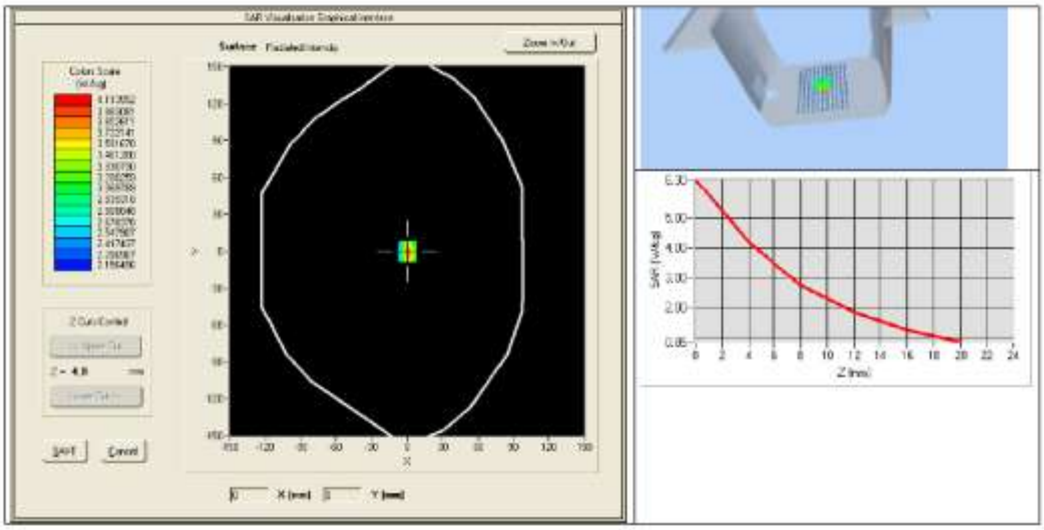




7.4 BODY MEASUREMENT RESULT

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 52.5 sigma : 1.50
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	1900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1900	40.74 (4.07)	21.43 (2.14)



8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
SAM Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Calipers	Carrera	CALIPER-01	12/2010	12/2013
Reference Probe	Satimo	EPG122 SN 18/11	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Multimeter	Keithley 2000	1188656	11/2010	11/2013
Signal Generator	Agilent E4438C	MY49070581	12/2010	12/2013
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2010	11/2013
Power Sensor	HP ECP-E26A	US37181460	11/2010	11/2013
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	3/2012	3/2014

SAR Reference Dipole Calibration Report

Ref: ACR.318.9.13.SATU.A

ATTESTATION OF GLOBAL COMPLIANCE CO. LTD.

1&2F, NO.2 BUILDING, HUAFENG NO.1 INDUSTRIAL PARK, GUSHU COMMUNITY XIXIANG STREET BAOAN DISTRICT, SHENZHEN, P.R. CHINA

SATIMO COMOSAR REFERENCE DIPOLE

FREQUENCY: 2450 MHZ

SERIAL NO.: SN 46/11 DIP 2G450-189

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED
Calibration CERT #2246.02

11/14/13

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	11/14/2013	JS
Checked by :	Jérôme LUC	Product Manager	11/14/2013	JS
Approved by :	Kim RUTKOWSKI	Quality Manager	11/14/2013	Kim Rutkowski

	Customer Name
Distribution :	ATTESTATION OF GLOBAL COMPLIANCE CO. LTD.

Issue	Date	Modifications
A	11/14/2013	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2450 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID2450
Serial Number	SN 46/11 DIP 2G450-189
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

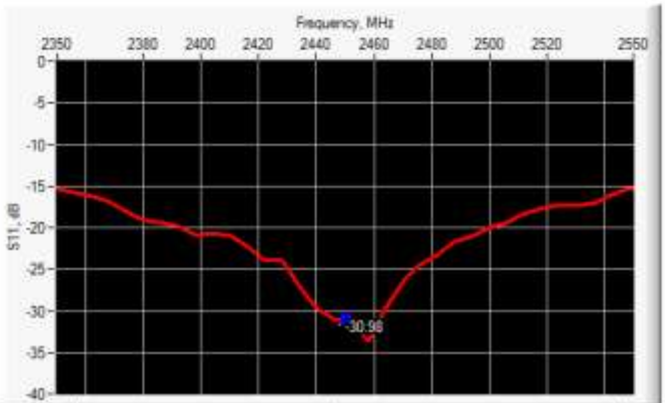
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-30.98	-20	47.3 Ω + 0.1 jΩ

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.	PASS	30.4 ±1 %.	PASS	3.6 ±1 %.	PASS
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 MEASUREMENT CONDITION

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 38.6 sigma : 1.82
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45%

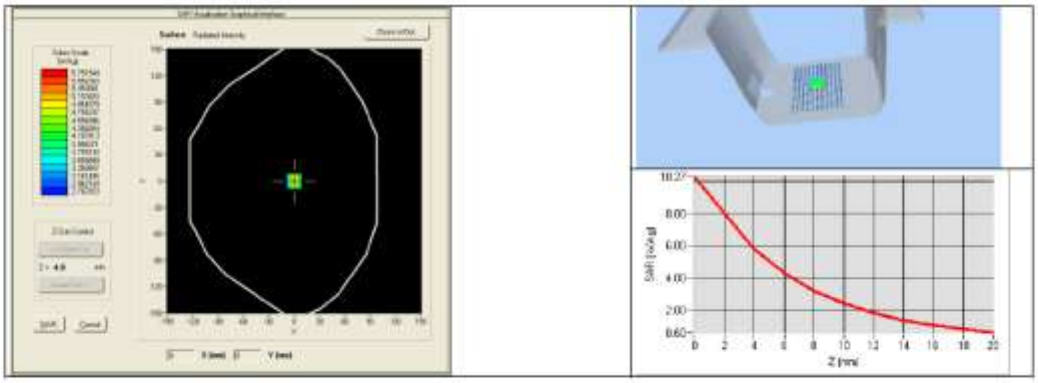
7.2 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %	PASS	1.80 ±5 %	PASS
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.3 MEASUREMENT RESULT

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

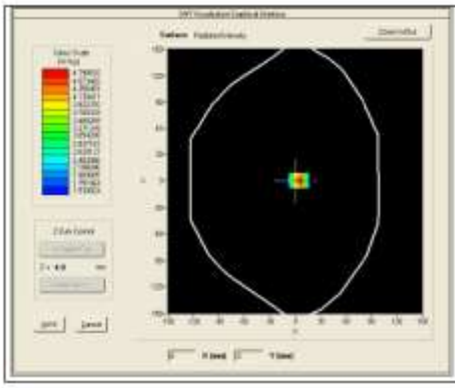
Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4	54.40 (5.44)	24	23.75 (2.38)
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	

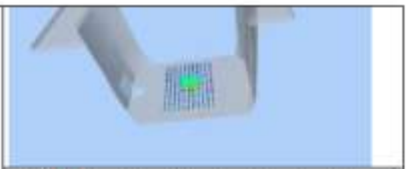


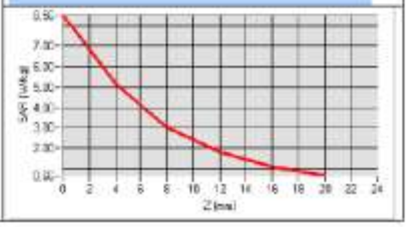
7.4 BODY MEASUREMENT RESULT

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 52.0 sigma : 1.94
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2450	54.19 (5.42)	24.96 (2.50)







8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
SAM Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Calipers	Carrera	CALIPER-01	12/2010	12/2013
Reference Probe	Satimo	EPG122 SN 18/11	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Multimeter	Keithley 2000	1188656	11/2010	11/2013
Signal Generator	Agilent E4438C	MY49070581	12/2010	12/2013
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2010	11/2013
Power Sensor	HP ECP-E26A	US37181460	11/2010	11/2013
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	3/2012	3/2014