SAR TEST REPORT

No. I17Z61083-SEM01

For

Lenovo PC HK Limited

Portable Tablet Computer

Model Name: Lenovo TB-7304I

With

Hardware Version: Lenovo Tablet TB-7304I

Software Version: TB-7304I_RF01_170728

FCC ID: O57TB7304I

Issued Date: 2017-8-18

TESTING
NVLAP LAB CODE 600118-0

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

Test Laboratory:

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REPORT HISTORY

Report Number	Revision	Issue Date	Description
I17Z61083-SEM01	Rev.0	2017-8-14	Initial creation of test report
I17Z61083-SEM01	Rev.1	2017-8-16	Update ANNEX I
I17Z61083-SEM01	Rev.2	2017-8-18	1. Update the power table of WCDMA 2. Update the description of test distance and the most conservative triggering distance

TABLE OF CONTENT

1 Test Laboratory

1.1 Testing Location

Company Name:	CTTL(Shouxiang)
Address:	No. 51 Shouxiang Science Building, Xueyuan Road, Haidian District, Beijing, P. R. China100191

1.2 Testing Environment

Temperature:	18°C~25°C,
Relative humidity:	30%~ 70%
Ground system resistance:	< 0.5 Ω
Ambient noise & Reflection:	< 0.012 W/kg

1.3 Project Data

Project Leader:	Qi Dianyuan
Test Engineer:	Lin Xiaojun
Testing Start Date:	July 14, 2017
Testing End Date:	July 16, 2017

1.4 Signature

Lin Xiaojun

(Prepared this test report)

Qi Dianyuan

(Reviewed this test report)

Lu Bingsong

Deputy Director of the laboratory

(Approved this test report)

2 Statement of Compliance

The maximum results of SAR found during testing for Lenovo PC HK Limited Portable Tablet Computer Lenovo TB-7304I are as follows:

Table 2.1: Highest Reported SAR (1g)

Exposure Configuration	Technology Band	Highest Reported SAR 1g(W/kg)	Equipment Class
Head	GSM 850	0.10	PCE
	PCS 1900	0.10	
	WCDMA 850	0.04	
	WCDMA 1900	0.17	
	WLAN 2.4 GHz	0.30	DTS
Body SAR	GSM 850	1.35	PCE
	PCS 1900	0.95	
	WCDMA 850	0.59	
	WCDMA 1900	0.66	
	WLAN 2.4 GHz	0.70	DTS

The SAR values found for the tablet computer are below the maximum recommended levels of 1.6 W/Kg as averaged over any 1g tissue according to the ANSI C95.1-1992.

For body worn operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal and which provides a minimum separation distance of 0 mm and 13mm between this device and the body of the user. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

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

The measurement together with the test system set-up is described in annex C of this test report. A detailed description of the equipment under test can be found in chapter 4 of this test report. The highest reported SAR value is obtained at the case of **(Table 2.1),** and the values are**: 1.35 W/kg(1g).**

Table 2.2: The sum of reported SAR values for main antenna and WiFi

	Position	Main antenna	WiFi	Sum
Highest SAR value for Head	Left hand, Touch cheek	0.17	0.12	**0.29**
	Right hand, Touch cheek	0.12	0.30	**0.42**
Highest reported SAR value for Body	Rear 0mm	0.66	0.68	**1.34**
	Rear 8m	1.35	/	**1.35**

Table 2.3: The sum of reported SAR values for main antenna and BT

	Position	Main antenna	BT	Sum
Maximum reported SAR value for Head	Left hand, Touch cheek	0.17	0.19[1]	**0.36**
	Right hand, Touch cheek	0.12	0.19[1]	**0.31**
Maximum reported SAR value for Body	Rear 0mm	0.66	0.19[1]	**0.85**
	Rear 8	1.35	0.05[1]	**1.40**

[1] - Estimated SAR for Bluetooth (see the table 13.3)

According to the above tables, the highest sum of reported SAR values is **1.40 W/kg (1g)**. The detail for simultaneous transmission consideration is described in chapter 13.

3 Client Information

3.1 Applicant Information

Company Name:	Lenovo(Shanghai) Electronics Technology Co., Ltd.
Address /Post:	NO.68 BUILDING, 199 FENJU RD, Pilot Free Trade Zone, 200131, China
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3.2 Manufacturer Information

Company Name:	Lenovo PC HK Limited
Address /Post:	23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong
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Fax:	+86-10-58863425

4 Equipment Under Test (EUT) and Ancillary Equipment (AE)

4.1 About EUT

Description:	Portable Tablet Computer
Model name:	Lenovo TB-7304I
Operating mode(s):	GSM 850/900/1800/1900, UMTS FDD 1/2/5/8, BT, Wi-Fi2.4G
Tested Tx Frequency:	825 – 848.8 MHz (GSM 850)
	1850.2 – 1910 MHz (GSM 1900)
	826.4–846.6 MHz (WCDMA 850 Band V)
	1852.4–1907.6 MHz (WCDMA1900 Band II)
	2412 – 2462 MHz (Wi-Fi 2.4G)
GPRS/EGPRS Multislot Class:	12
GPRS capability Class:	B
Test device Production information:	Production unit
Device type:	Portable device
Antenna type:	Integrated antenna

4.2 Internal Identification of EUT used during the test

EUT ID*	SN	HW Version	SW Version
EUT1	865485030010141	Lenovo Tablet TB-7304I	TB-7304I_RF01_170728
EUT2	865485030010026	Lenovo Tablet TB-7304I	TB-7304I_RF01_170728
EUT3	865485030010406	Lenovo Tablet TB-7304I	TB-7304I_RF01_170728
EUT4	865485030010265	Lenovo Tablet TB-7304I	TB-7304I_RF01_170728

*EUT ID: is used to identify the test sample in the lab internally.

Note: It is performed to test SAR with the EUT1&2 and conducted power with the EUT3&4.

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	L13D1P31	/	Sunwoda
AE2	Battery	L13D1P31	/	SCUD

*AE ID: is used to identify the test sample in the lab internally.

There are Two kinds of combination modes to be tested and the detail information is as follows:

	SKU1		SKU2		SKU3		SKU4	
Material description	Model	Supplier	Model	Supplier	Model	Supplier	Model	Supplier
RAM+ROM	1+16 1st supplier		1+16 2nd supplier		2+16 1st supplier		2+16 2nd supplier	
moter	Motor_Semi-circular column_11.1*5.0*5.0_line_150mm	HZF	Motor_Semi-circular column_11.1*5.0*5.0_line_150mm	KW	Motor_Semi-circular column_11.1*5.0*5.0_line_150mm	HZF	Motor_Semi-circular column_11.1*5.0*5.0_line_150mm	KW
memory	KMFE60012M-B214	Samsung	KMFE10012M-B214013	Samsung	KMFE60012M-B214	Samsung	KMFE10012M-B214013	Samsung
PMIC	PMIC;MT6328V/AN;UMC Fab only;VFBGA206	MTK	PMIC;MT6328V/AN;UMC Fab only;VFBGA206	MTK	PMIC;MT6328V/AN;UMC Fab only;VFBGA206	MTK	PMIC;MT6328V/AN;UMC Fab only;VFBGA206	MTK
AP	BB;MT8735V/WD;VFBGA641;0.4mm	MTK	BB;MT8735V/WD;VFBGA641;0.4mm	MTK	BB;MT8735V/WD;VFBGA641;0.4mm	MTK	BB;MT8735V/WD;VFBGA641;0.4mm	MTK
PA	AP6690-R95MOG/AP7169-R95MOG	AIROHA	AP6690-R95MOG/AP7169-R95MOG	AIROHA	AP6690-R95MOG/AP7169-R95MOG	AIROHA	AP6690-R95MOG/AP7169-R95MOG	AIROHA
BT+WLAN+GPS+FM	WIFI/BT/GPS/FM&*MT6625LNAJC;HLMCfab only	MTK	WIFI/BT/GPS/FM&*MT6625LNAJC;HLMCfab only	MTK	WIFI/BT/GPS/FM&*MT6625LNAJC;HLMCfab only	MTK	WIFI/BT/GPS/FM&*MT6625LNAJC;HLMCfab only	MTK
Antenna	A1961	Saintenna Electronic Technology Co.,Ltd	A1961	Saintenna Electronic Technology Co.,Ltd	A1961	Saintenna Electronic Technology Co.,Ltd	A1961	Saintenna Electronic Technology Co.,Ltd
speaker	Speaker_1511*3.3mm_tanpian_0 mm	Xichun	Speaker_15*11*3.3mm_tanpian_none_Dongsheng	Dongsheng	Speaker_1511*3.3mm_tanpian_0 mm	Xichun	Speaker_15*11*3.3mm_tanpian_none_Dongsheng	Dongsheng
BB	MT8735V/WD	MTK	MT8735V/WD	MTK	MT8735V/WD	MTK	MT8735V/WD	MTK
LCM	LCM_6.95_1024*600_oncell_3.6MAX_300_DX_HX8394D_ZIF	BOE	LCM_6.95_1024*600_oncell_3.6max_300_HSD_NT51021BH_ZIF	DJ	LCM_6.95_1024*600_oncell_3.6MAX_300_DX_HX8394D_ZIF	BOE	LCM_6.95_1024*600_oncell_3.6max_300_HSD_NT51021BH_ZIF	DJ
RF transceiver	Transceiver;MT6169V/AM;TSMC Fab14 only	MTK	Transceiver;MT6169V/AM;TSMC Fab14 only	MTK	Transceiver;MT6169V/AM;TSMC Fab14 only	MTK	Transceiver;MT6169V/AM;TSMC Fab14 only	MTK
PCBA	A1961_PCB_V2_ZhiHao	ZhiHao	A1961_PCB_V2_YLAD	YLAD	A1961_PCB_V2_ZhiHao	ZhiHao	A1961_PCB_V2_YLAD	YLAD
Camera_Back	Camera_6.5*6.5*3.6_200W_SP2509_FF_ZIF_connector	CXT	Camera_6.5*6.5*3.6_200W_GC2375_FF_ZIF_connector	BLX	Camera_6.5*6.5*3.6_200W_SP2509_FF_ZIF_connector	CXT	Camera_6.5*6.5*3.6_200W_GC2375_FF_ZIF_connector	BLX
Camera_Front	Camera_6.5*6.5*3.6_200W_SP2509_FF_ZIF_connector	CXT	Camera_6.5*6.5*3.6_200W_GC2375_FF_ZIF_connector	BLX	Camera_6.5*6.5*3.6_200W_SP2509_FF_ZIF_connector	CXT	Camera_6.5*6.5*3.6_200W_GC2375_FF_ZIF_connector	BLX
Battery	A1990A_3450mAh_ATL3087A0_Lenovo_L13D1P31	Sunwoda	A1900 batter_3450mAh_CA3087A0HV_Lenovo_no label	SCUD	A1990A_3450mAh_ATL3087A0_Lenovo_L13D1P31	Sunwoda	A1900 batter_3450mAh_CA3087A0HV_Lenovo_no label	SCUD

We'll perform the SAR measurement with SKU3 and retest on highest value point with SKU4.

5 TEST METHODOLOGY

5.1 Applicable Limit Regulations

ANSI C95.1–1992:IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

It specifies the maximum exposure limit of **1.6 W/kg** as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

5.2 Applicable Measurement Standards

IEEE 1528–2013: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

KDB447498 D01: General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

KDB941225 D01 SAR test for 3G devices v03r01: SAR Measurement Procedures for 3G Devices

KDB941225 D06 Hotspot Mode SAR v02r01: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

KDB248227 D01 802.11 Wi-Fi SAR v02r02: SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS

KDB616217 D04 SAR for laptop and tablets v01r02 SAR Evaluation Considerations for Laptop, Notebook, Notebook and Tablet Computers.

KDB865664 D01SAR measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz.

KDB865664 D02RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations

6 Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

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

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

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

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

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

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

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

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

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

7 Tissue Simulating Liquids

7.1 Targets for tissue simulating liquid

Table 7.1: Targets for tissue simulating liquid

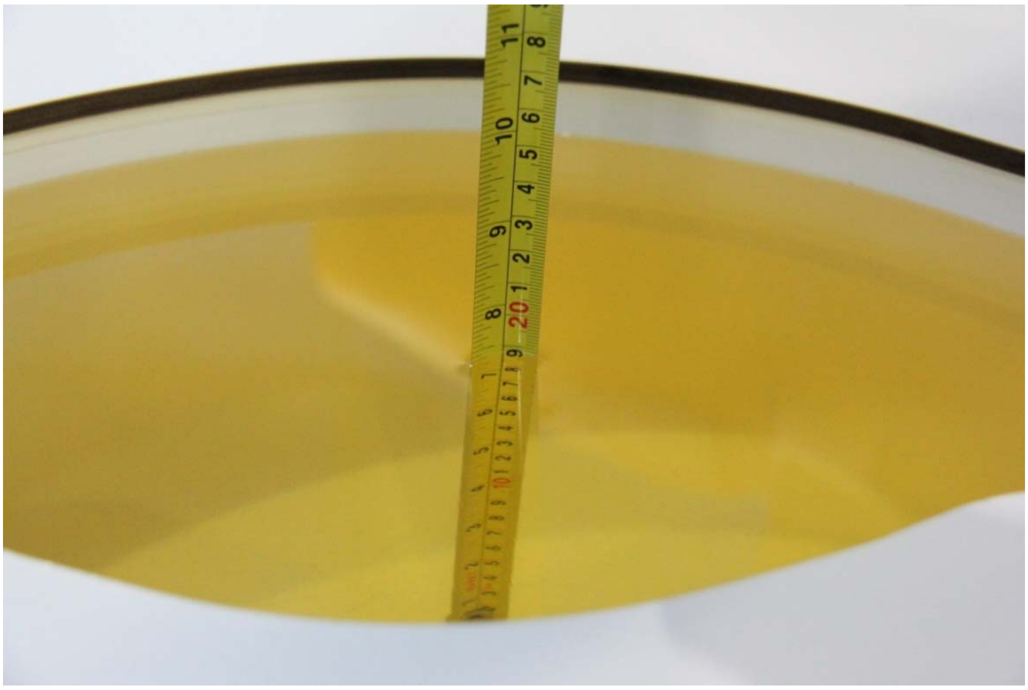
Frequency(MHz)	Liquid Type	Conductivity(σ)	± 5% Range	Permittivity(ε)	± 5% Range
835	Head	0.90	0.86～0.95	41.5	39.4～43.6
835	Body	0.97	0.92～1.02	55.2	52.4～58.0
1750	Head	1.37	1.30～1.44	40.08	38.1～42.1
1750	Body	1.49	1.42～1.56	53.4	50.7～56.1
1900	Head	1.40	1.33～1.47	40.0	38.0～42.0
1900	Body	1.52	1.44～1.60	53.3	50.6～56.0
2450	Head	1.80	1.71～1.89	39.2	37.2～41.2
2450	Body	1.95	1.85～2.05	52.7	50.1～55.3
2600	Head	1.96	1.86～2.06	39.01	37.1～41.0
2600	Body	2.16	2.05～2.27	52.5	49.9～55.1

7.2 Dielectric Performance

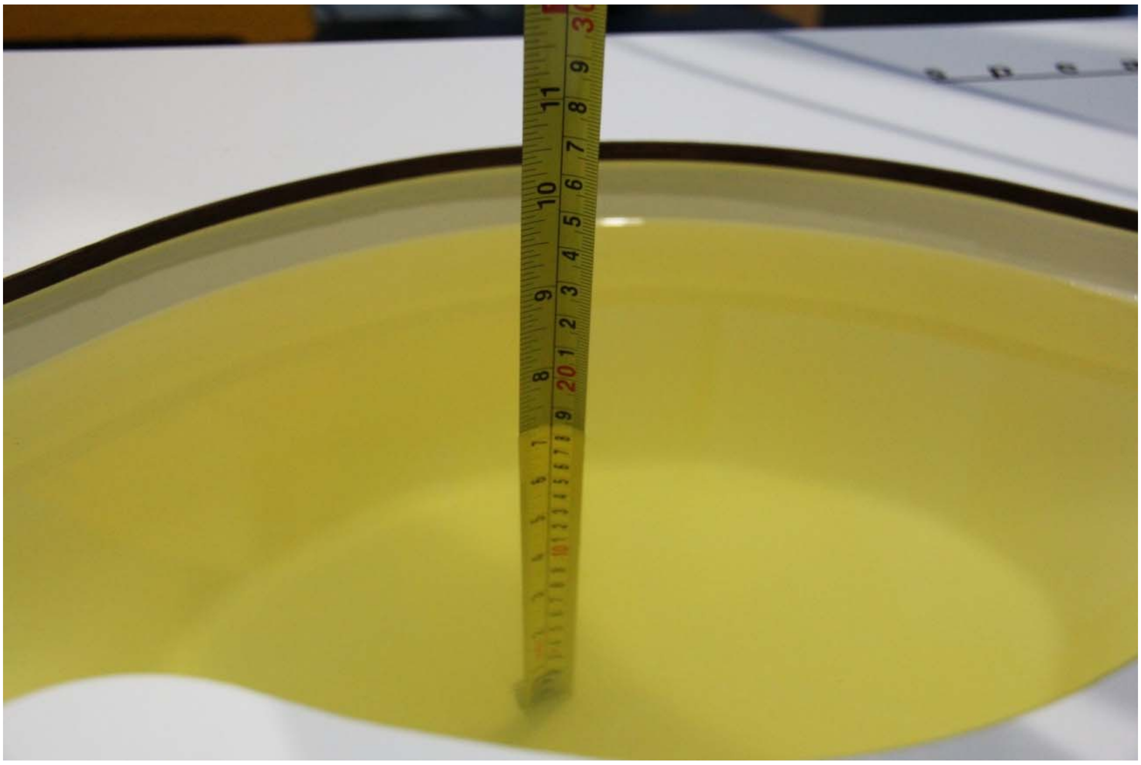
Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2017-7-14	Head	835 MHz	42.21	1.71	0.916	1.78
	Body	835 MHz	54.05	-2.08	0.988	1.86
2017-7-15	Head	1900 MHz	40.53	1.33	1.417	1.21
	Body	1900 MHz	52.28	-1.91	1.528	0.53
2017-7-16	Head	2450 MHz	39.37	0.43	1.849	2.72
	Body	2450 MHz	52.27	-0.82	1.928	-1.13

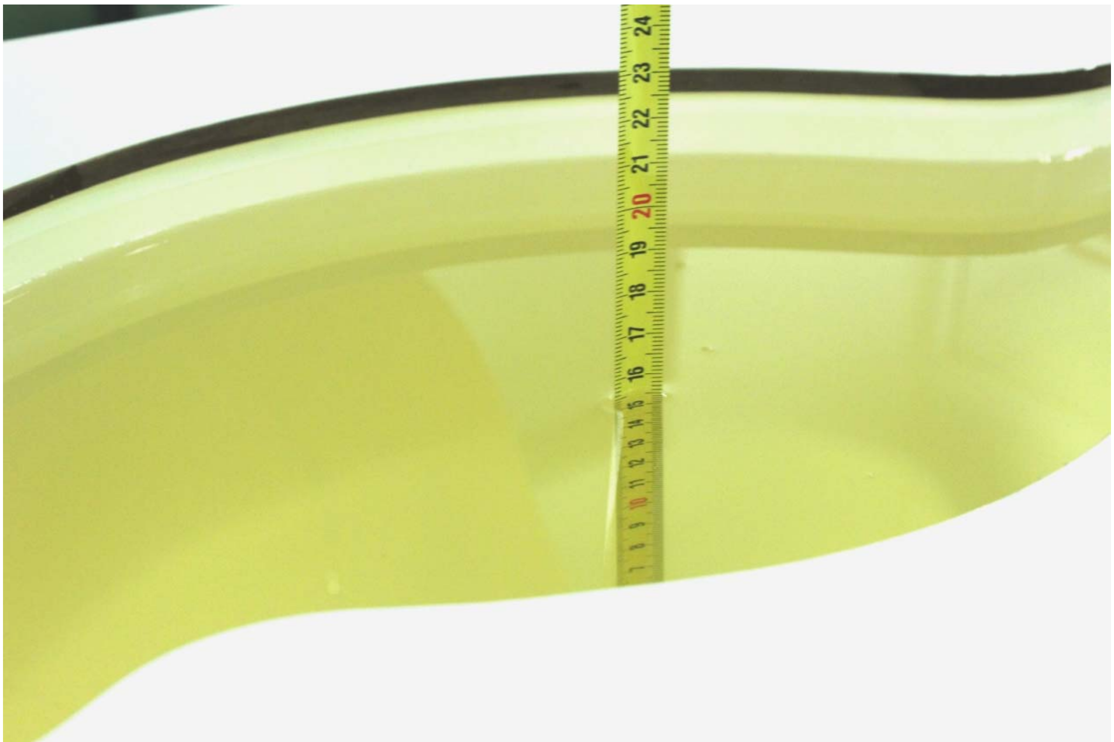
Note: The liquid temperature is 22.0℃



Picture 7-1 Liquid depth in the Flat Phantom (835 MHz)



Picture 7-2 Liquid depth in the Flat Phantom (1900MHz)

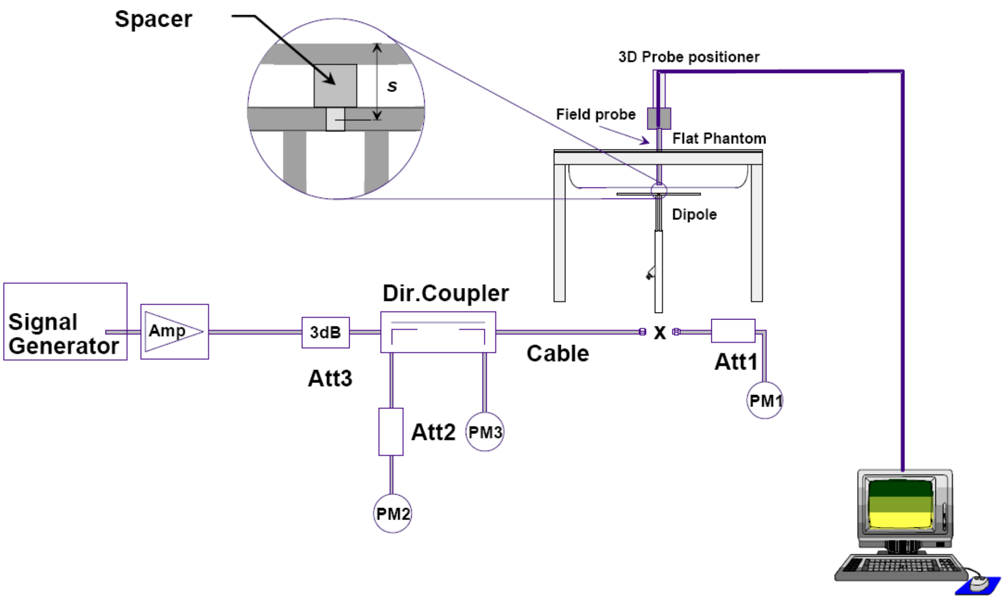


Picture 7-3 Liquid depth in the Flat Phantom (2450MHz)

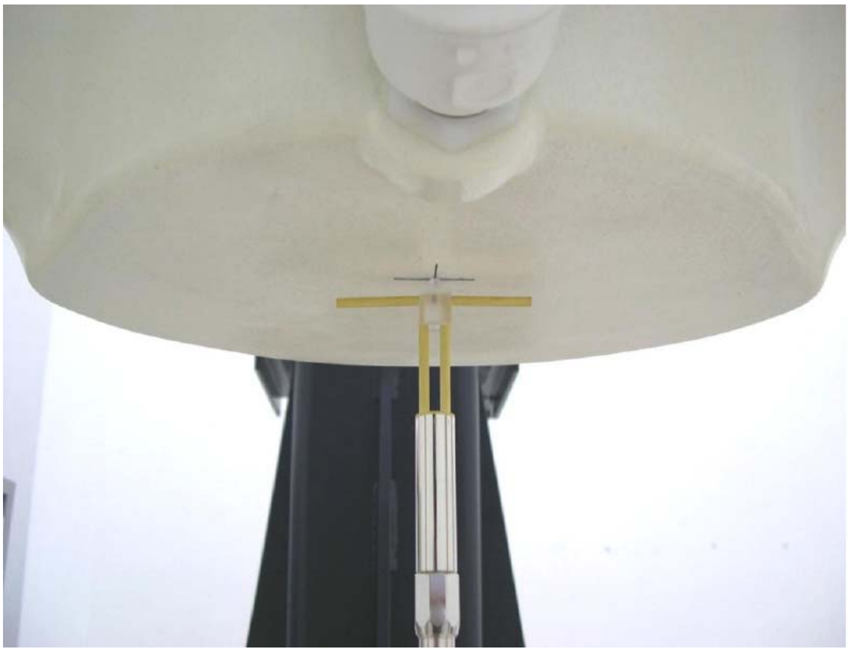
8 System verification

8.1 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:



Picture 8.1 System Setup for System Evaluation



Picture 8.2 Photo of Dipole Setup

8.2 System Verification

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device.

The system verification results are required that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR. The details are presented in annex B.

Table 8.1: System Verification of Head

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value(W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2017-7-14	835 MHz	6.18	9.44	6.16	9.28	-0.32%	-1.69%
2017-7-15	1900 MHz	21.20	40.70	20.94	40.44	-1.23%	-0.64%
2017-7-16	2450 MHz	24.60	52.80	24.56	52.44	-0.16%	-0.68%

Table 8.2: System Verification of Body

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2017-7-14	835 MHz	6.36	9.69	6.32	9.60	-0.63%	-0.93%
2017-7-15	1900 MHz	21.30	40.10	20.96	41.24	-1.60%	2.84%
2017-7-16	2450 MHz	24.10	51.20	24.36	52.84	1.08%	3.20%

9 Measurement Procedures

9.1 Tests to be performed

In order to determine the highest value of the peak spatial-average SAR of a handset, all device positions, configurations and operational modes shall be tested for each frequency band according to steps 1 to 3 below. A flowchart of the test process is shown in picture 9.1.

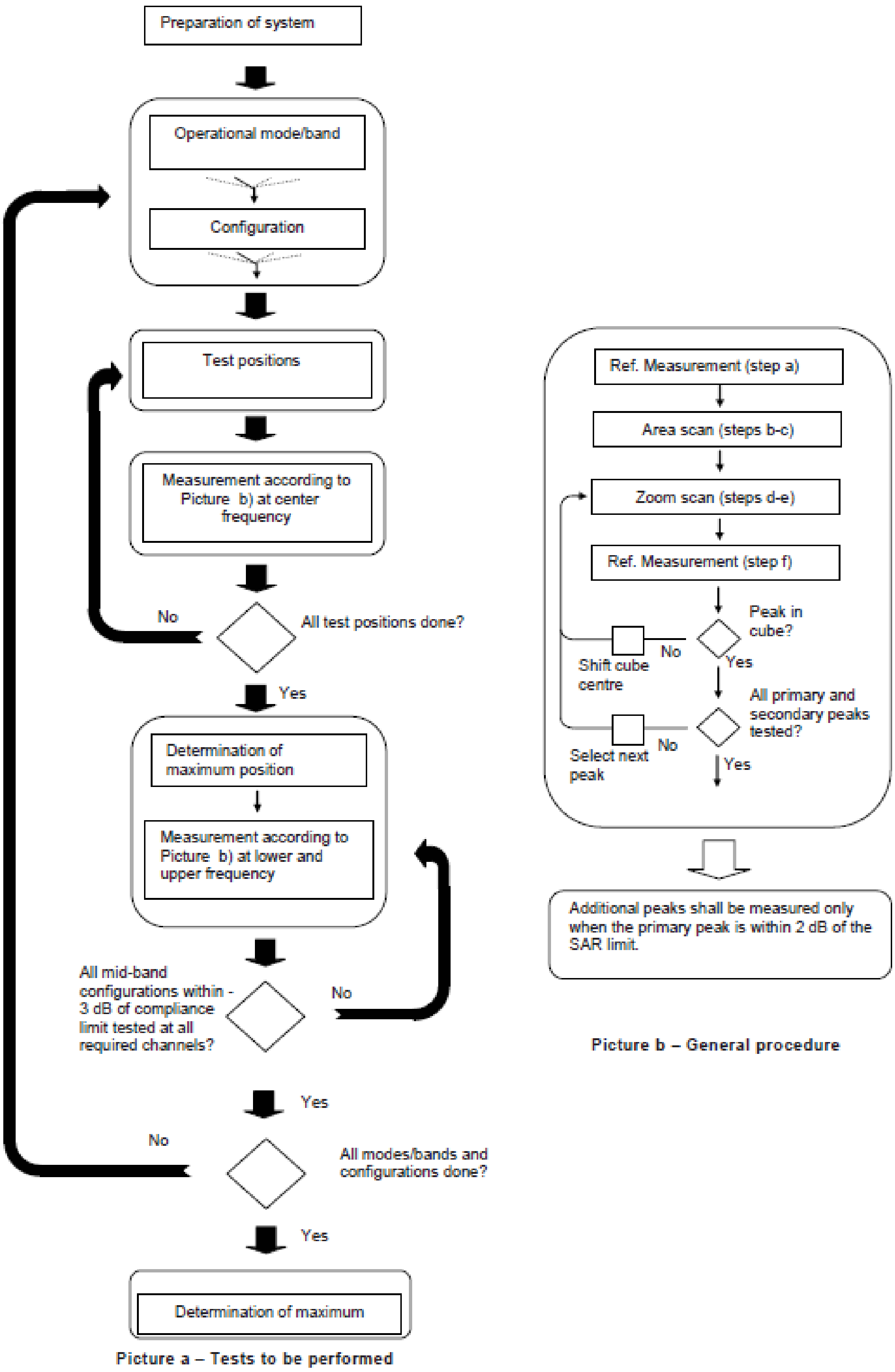
Step 1: The tests described in 9.2 shall be performed at the channel that is closest to the centre of the transmit frequency band (f_c) for:

a) all device positions (cheek and tilt, for both left and right sides of the SAM phantom, as described in annex D),
b) all configurations for each device position in a), e.g., antenna extended and retracted, and
c) all operational modes, e.g., analogue and digital, for each device position in a) and configuration in b) in each frequency band.

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

Step 2: For the condition providing highest peak spatial-average SAR determined in Step 1,perform all tests described in 9.2 at all other test frequencies, i.e., lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the peak spatial-average SAR value determined in Step 1 is within3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

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



Picture 9.1Block diagram of the tests to be performed

9.2 General Measurement Procedure

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2003. The results should be documented as part of the system validation records and may be requested to support test results when all the measurement parameters in the following table are not satisfied.

			$\leq$ 3 GHz	$>$ 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			$\leq$ 2 GHz: $\leq$ 15 mm 2 – 3 GHz: $\leq$ 12 mm	3 – 4 GHz: $\leq$ 12 mm 4 – 6 GHz: $\leq$ 10 mm
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			$\leq$ 2 GHz: $\leq$ 8 mm 2 – 3 GHz: $\leq$ 5 mm*	3 – 4 GHz: $\leq$ 5 mm* 4 – 6 GHz: $\leq$ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\leq$ 5 mm	3 – 4 GHz: $\leq$ 4 mm 4 – 5 GHz: $\leq$ 3 mm 5 – 6 GHz: $\leq$ 2 mm
Maximum zoom scan spatial resolution, normal to phantom surface	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	$\leq$ 4 mm	3 – 4 GHz: $\leq$ 3 mm 4 – 5 GHz: $\leq$ 2.5 mm 5 – 6 GHz: $\leq$ 2 mm
Maximum zoom scan spatial resolution, normal to phantom surface	graded grid	$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		$\geq$ 30 mm	3 – 4 GHz: $\geq$ 28 mm 4 – 5 GHz: $\geq$ 25 mm 5 – 6 GHz: $\geq$ 22 mm

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

* When zoom scan is required and the <u>*reported*</u> SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

9.3 WCDMA Measurement Procedures for SAR

The following procedures are applicable to WCDMA handsets operating under 3GPP Release99, Release 5 and Release 6. The default test configuration is to measure SAR with an established radio link between the DUT and a communication test set using a 12.2kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations (DPCCH & $DPDCH_n$), HSDPA and HSPA (HSUPA/HSDPA) modes according to output power, exposure conditions and device operating capabilities. Both uplink and downlink should be configured with the same RMC or AMR, when required. SAR for Release 5 HSDPA and Release 6 HSPA are measured using the applicable FRC (fixed reference channel) and E-DCH reference channel configurations. Maximum output power is verified according to applicable versions of 3GPP TS 34.121 and SAR must be measured according to these maximum output conditions. When Maximum Power Reduction (MPR) is not implemented according to Cubic Metric (CM) requirements for Release 6 HSPA, the following procedures do not apply.

For Release 5 HSDPA Data Devices:

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	CM/dB
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15	15/15	64	12/15	24/25	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

For Release 6 HSPA Data Devices

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (dB)	MPR (dB)	AG Index	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1039/225	4	1	1.5	1.5	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	1.5	1.5	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	1.5	1.5	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	1.5	1.5	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	1.5	1.5	21	81

Rel.8 DC-HSDPA (Cat 24)

SAR test exclusion for Rel.8 DC-HSDPA must satisfy the SAR test exclusion requirements of Rel.5 HSDPA. SAR test exclusion for DC-HSDPA devices is determined by power measurements according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to qualify for SAR test exclusion.

9.4 Bluetooth & Wi-Fi Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of 802.11 transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable.

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

9.6 Power Drift

To control the output power stability during the SAR test, DASY4 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in section14 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

10 Area Scan Based 1-g SAR

10.1 Requirement of KDB

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

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

10.2 Fast SAR Algorithms

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

In the initial study, an approximation algorithm based on Linear fit was developed. The accuracy of the algorithm has been demonstrated across a broad frequency range (136-2450 MHz)and for both 1- and 10-g averaged SAR using a sample of 264 SAR measurements from 55wireless handsets. For the sample size studied, the root-mean-squared errors of the algorithm mare 1.2% and 5.8% for 1- and 10-g averaged SAR, respectively. The paper describing the algorithm in detail is expected to be published in August 2004 within the Special Issue of Transactions on MTT.

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

Both algorithms are implemented in DASY software.

11 Conducted Output Power

This device uses a proximity sensor for SAR compliance. The proximity sensor is activated when the device is used in close proximity to the user's body. The proximity sensors trigger power reduction for all bands except Bluetooth. There is no power reduction mechanism for BT modes for SAR purposes.

11.1 GSM Measurement result

During the process of testing, the EUT was controlled via Agilent Digital Radio Communication tester (E5515C) to ensure the maximum power transmission and proper modulation. This result contains conducted output power for the EUT. In all cases, the measured peak output power should be greater and within 5% than EMI measurement.

Normal Power – Proximity sensor not active

Table 11.1-1: GSM Speech

GSM 850			
Channel	Channel 251	Channel 190	Channel 128
Target (dBm)	32.55	32.57	32.39
Tune-up (dBm)	33	33	33
GSM 1900			
Channel	Channel 810	Channel 661	Channel 512
Target (dBm)	29.32	29.29	29.24
Tune-up (dBm)	29.5	29.5	29.5

Table 11.1-2: The conducted power measurement results for GPRS and EGPRS

GSM 850 GPRS (GMSK)	Measured Power (dBm)			Tune up	calculation	Averaged Power (dBm)		
	251	190	128			251	190	128
1 Txslot	32.55	32.55	32.36	**33.00**	-9.03	23.52	23.52	23.33
2 Txslots	31.92	31.94	31.76	**32.00**	-6.02	25.90	25.92	25.74
3Txslots	30.32	30.34	30.14	**30.50**	-4.26	26.06	26.08	25.88
4 Txslots	**29.27**	**29.30**	**29.15**	**30.00**	**-3.01**	**26.26**	**26.29**	**26.14**
GSM 850 EGPRS (GMSK)	Measured Power (dBm)			Tune up	calculation	Averaged Power (dBm)		
	251	190	128			251	190	128
1 Txslot	32.51	32.53	32.34	**33.00**	-9.03	23.48	23.50	23.31
2 Txslots	31.89	31.91	31.73	**32.00**	-6.02	25.87	25.89	25.71
3Txslots	30.28	30.30	30.11	**31.00**	-4.26	26.02	26.04	25.85
4 Txslots	**29.36**	**29.36**	**29.18**	**30.00**	**-3.01**	**26.35**	**26.35**	**26.17**
GSM 850 EGPRS (8PSK)	Measured Power (dBm)			Tune up	calculation	Averaged Power (dBm)		
	251	190	128			251	190	128
1 Txslot	26.87	26.59	26.51	**27.00**	-9.03	17.84	17.56	17.48
2 Txslots	25.94	25.58	25.58	**26.00**	-6.02	19.92	19.56	19.56

3Txslots	24.02	23.61	23.59	**24.50**	-4.26	19.76	19.35	19.33
4 Txslots	23.06	22.68	22.68	**23.50**	-3.01	20.05	19.67	19.67
PCS1900 GPRS (GMSK)	Measured Power (dBm)			**Tune up**	calculation	Averaged Power (dBm)		
	810	661	512			810	661	512
1 Txslot	29.31	29.28	29.23	**29.50**	-9.03	20.28	20.25	20.20
2 Txslots	28.72	28.68	28.61	**29.00**	-6.02	22.70	22.66	22.59
3Txslots	27.24	27.13	27.03	**28.00**	-4.26	22.98	22.87	22.77
4 Txslots	**26.17**	**26.05**	**25.90**	**26.50**	**-3.01**	**23.16**	**23.04**	**22.89**

PCS1900 EGPRS (GMSK)	Measured Power (dBm)			**Tune up**	calculation	Averaged Power (dBm)		
	810	661	512			810	661	512
1 Txslot	29.28	29.26	29.23	**29.50**	-9.03	20.25	20.23	20.20
2 Txslots	28.68	28.65	28.59	**29.00**	-6.02	22.66	22.63	22.57
3Txslots	27.22	27.11	27.00	**28.00**	-4.26	22.96	22.85	22.74
4 Txslots	**26.13**	**26.02**	**25.88**	**26.50**	**-3.01**	**23.12**	**23.01**	**22.87**
PCS1900 EGPRS (8PSK)	Measured Power (dBm)			**Tune up**	calculation	Averaged Power (dBm)		
	810	661	512			810	661	512
1 Txslot	26.71	26.39	26.39	**27.00**	-9.03	17.68	17.36	17.36
2 Txslots	25.75	25.56	25.55	**26.00**	-6.02	19.73	19.54	19.53
3Txslots	23.86	23.67	23.61	**24.00**	-4.26	19.60	19.41	19.35
4 Txslots	22.74	22.53	22.52	**23.00**	-3.01	19.73	19.52	19.51

NOTES:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

According to the conducted power as above, the body measurements are performed with 4Txslots for GSM850 and 4Txslots for GSM1900.

Low Power – Proximity sensor active

Table 11.1-3: The conducted power measurement results for GSM, GPRS and EGPRS

GSM 850	Measured Power (dBm)			Tune up	calculation	Averaged Power (dBm)		
GPRS (GMSK)	251	190	128			251	190	128
1 Txslot	27.63	27.75	27.61	**28.00**	-9.03	18.60	18.72	18.58
2 Txslots	24.62	24.71	24.53	**25.00**	-6.02	18.60	18.69	18.51
3Txslots	22.79	22.90	22.72	**23.00**	-4.26	18.53	18.64	18.46
4 Txslots	**21.69**	**21.84**	**21.65**	**22.00**	**-3.01**	**18.68**	**18.83**	**18.64**
GSM 850	Measured Power (dBm)			Tune up	calculation	Averaged Power (dBm)		
EGPRS (GMSK)	251	190	128			251	190	128
1 Txslot	27.62	27.72	27.56	**28.00**	-9.03	18.59	18.69	18.53
2 Txslots	24.62	24.72	24.51	**25.00**	-6.02	18.60	18.70	18.49
3Txslots	22.80	22.91	22.73	**23.00**	-4.26	18.54	18.65	18.47
4 Txslots	**21.73**	**21.86**	**21.65**	**22.00**	**-3.01**	**18.72**	**18.85**	**18.64**
GSM 850	Measured Power (dBm)			Tune up	calculation	Averaged Power (dBm)		
EGPRS (8PSK)	251	190	128			251	190	128
1 Txslot	21.37	21.04	21.02	**21.50**	-9.03	12.34	12.01	11.99
2 Txslots	18.24	17.90	17.87	**18.50**	-6.02	12.22	11.88	11.85
3Txslots	16.43	16.07	16.10	**17.00**	-4.26	12.17	11.81	11.84
4 Txslots	15.41	15.02	15.01	**16.00**	-3.01	12.40	12.01	12.00
PCS1900	Measured Power (dBm)			Tune up	calculation	Averaged Power (dBm)		
GPRS (GMSK)	810	661	512			810	661	512
1 Txslot	24.75	24.50	24.36	**25.00**	-9.03	15.72	15.47	15.33
2 Txslots	**21.81**	**21.51**	**21.40**	**22.00**	**-6.02**	**15.79**	**15.49**	**15.38**
3Txslots	19.98	19.70	19.57	**20.50**	-4.26	15.72	15.44	15.31
4 Txslots	18.70	18.45	18.28	**20.00**	-3.01	15.69	15.44	15.27
PCS1900	Measured Power (dBm)			Tune up	calculation	Averaged Power (dBm)		
EGPRS (GMSK)	810	661	512			810	661	512
1 Txslot	24.77	24.50	24.36	**25.00**	-9.03	15.74	15.47	15.33
2 Txslots	**21.81**	**21.50**	**21.40**	**22.00**	**-6.02**	**15.79**	**15.48**	**15.38**
3Txslots	19.98	19.72	19.57	**20.50**	-4.26	15.72	15.46	15.31
4 Txslots	18.70	18.45	18.30	**20.00**	-3.01	15.69	15.44	15.29
PCS1900	Measured Power (dBm)			Tune up	calculation	Averaged Power (dBm)		
EGPRS (8PSK)	810	661	512			810	661	512
1 Txslot	20.99	20.83	20.98	**21.50**	-9.03	11.96	11.80	11.95
2 Txslots	17.99	17.81	17.97	**18.50**	-6.02	11.97	11.79	11.95
3Txslots	16.10	15.99	16.20	**16.50**	-4.26	11.84	11.73	11.94
4 Txslots	14.58	14.46	14.67	**15.00**	-3.01	11.57	11.45	11.66

NOTES:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

According to the conducted power as above, the body measurements are performed with 2Txslots for GSM850 and 2Txslots for 1900.

11.2 WCDMA Measurement result

Normal Power – Proximity sensor not active

Table 11.2-1: The conducted Power for WCDMA

Item	band	FDDV result			
	ARFCN	4132 (826.4MHz)	4182 (836.4MHz)	4233 (846.6MHz)	Tune up
WCDMA	\	22.73	22.55	22.61	23
HSUPA	1	19.78	20.09	20.23	20
	2	19.7	20.01	19.72	20
	3	20.69	20.99	20.72	21.5
	4	19.25	19.58	19.19	20
	5	21.73	21.96	21.70	22.5
HSPA+	1	20.42	20.39	20.55	21
DC-HSDPA	1	20.82	20.88	21.15	21.5
	2	20.79	20.85	21.11	21.5
	3	20.98	20.95	21.12	21.5
	4	20.95	20.94	21.11	21.5
Item	band	FDDII result			
	ARFCN	9262 (1852.4MHz)	9400 (1880MHz)	9538 (1907.6MHz)	Tune up
WCDMA	\	22.57	22.72	22.56	23
HSUPA	1	20.08	20.13	20.51	21
	2	20.08	20.14	20.01	20.5
	3	21.07	21.10	20.99	21.5
	4	19.56	19.60	19.48	20
	5	22.02	22.06	21.94	22.5
HSPA+	1	20.59	20.64	20.66	21
DC-HSDPA	1	20.98	21.35	21.24	21.5
	2	20.99	21.34	21.25	21.5
	3	20.99	21.36	21.23	21.5
	4	20.95	21.33	21.26	21.5

Low Power – Proximity sensor active

Table 11.2-2: The conducted Power for WCDMA

Item	band	FDDV result			
	ARFCN	4132 (826.4MHz)	4182 (836.4MHz)	4233 (846.6MHz)	Tune up
WCDMA	\	17.11	17.18	17.05	17.5
HSUPA	1	15.27	15.15	15.64	16
	2	15.2	15.11	15.07	15.5
	3	16.18	16.08	16.06	16.5
	4	14.66	14.54	14.61	15
	5	17.15	17.04	17.03	18
HSPA+	1	15.93	15.88	15.94	16.5
DC-HSDPA	1	16.32	16.32	16.57	17
	2	16.31	16.33	16.53	17
	3	16.42	16.42	16.54	17
	4	16.45	16.46	16.52	17
Item	band	FDDII result			
	ARFCN	9262 (1852.4MHz)	9400 (1880MHz)	9538 (1907.6MHz)	Tune up
WCDMA	\	17.07	17.00	17.04	17.5
HSUPA	1	15.45	15.57	15.91	16.5
	2	15.45	15.56	15.41	16
	3	16.46	16.52	16.39	17
	4	14.89	15.01	14.87	15.5
	5	17.37	17.49	17.34	18
HSPA+	1	16.12	16.12	16.11	16.5
DC-HSDPA	1	16.57	16.85	16.72	17
	2	16.54	16.87	16.73	17
	3	16.53	16.91	16.74	17
	4	16.49	16.88	16.73	17

11.4 Wi-Fi and BT Measurement result

The output power of BT antenna is as following:

Condition	GFSK			EDR2M-4_DQPSK			EDR3M-8DPSK		
	Channel 0	Channel 39	Channel 78	Channel 0	Channel 39	Channel 78	Channel 0	Channel 39	Channel 78
Peak Output Power(dBm)									
Hopping OFF	6.11	5.67	5.91	5.00	4.53	4.70	5.06	4.60	4.82
Tune up	6.50	6.50	6.50	5.50	5.50	5.50	5.50	5.50	5.50

The average conducted power for Wi-Fi is as following:

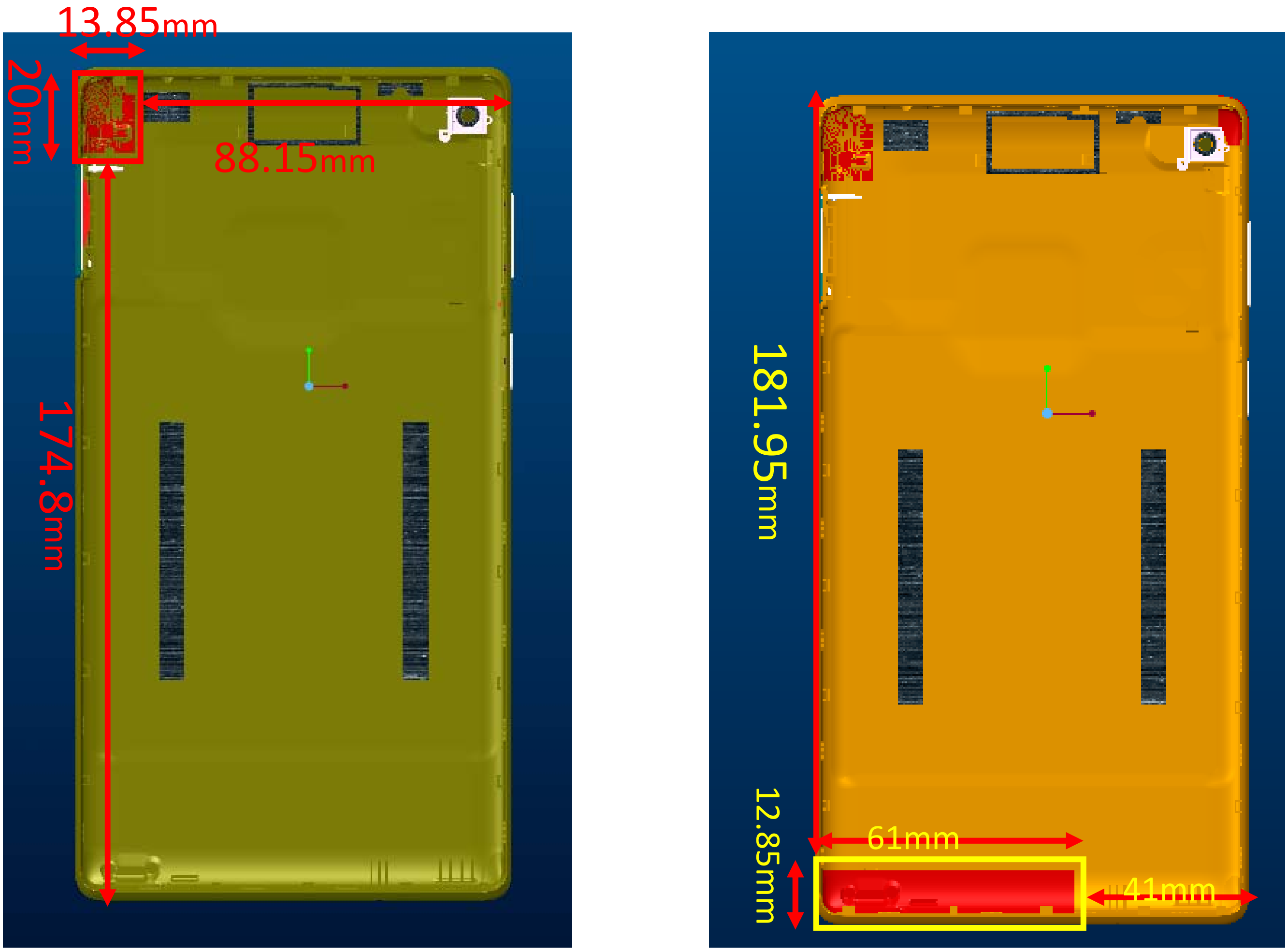
802.11b(dBm)									
Channel\data rate	1Mbps	2Mbps	5.5Mbps	11Mbps					tune up
1(2412MHz)	13.31	/	13.38	/					14.00
6(2437MHz)	13.39	13.35	13.52	13.44					14.00
11(2462MHz)	13.23	/	13.32	/					14.00
802.11g(dBm)									
Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps	tune up
1(2412MHz)	11.82	/	11.89	/	/	/	/	/	13.00
6(2437MHz)	11.87	11.84	12.04	11.98	11.64	11.49	11.54	11.50	13.00
11(2462MHz)	11.81	/	11.78	/	/	/	/	/	13.00
802.11n(dBm)-20MHz									
Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	tune up
1(2412MHz)	11.29	/	/	/	/	/	/	/	12.00
6(2437MHz)	11.39	11.27	11.21	11.12	10.96	11.02	10.98	10.93	12.00
11(2462MHz)	11.28	/	/	/	/	/	/	/	12.00
802.11n(dBm)-40MHz									
Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	
3(2422MHz)	11.36	/	/	/	/	/	/	/	
tune up	12.00	/	/	/	/	/	/	/	
6(2437MHz)	11.37	11.25	11.11	10.28	10.08	10.07	9.52	9.42	
tune up	12.00	12.00	12.00	12.00	12.00	12.00	11.00	11.00	
9(2452MHz)	11.21	/	/	/	/	/	/	/	
tune up	12.00	/	/	/	/	/	/	/	

12 Simultaneous TX SAR Considerations

12.1 Introduction

The following procedures adopted from “FCC SAR Considerations for Cell Phones with Multiple Transmitters” are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter.
For this device, the BT and Wi-Fi can transmit simultaneous with other transmitters.

12.2 Transmit Antenna Separation Distances



BT/WLAN antenna　　***Front View***　　Main antenna

Picture 12.1 Antenna Locations

12.3 SAR Measurement Positions

According to the KDB941225 D06 Hot Spot SAR v01, the edges with less than 2.5 cm distance to the antennas need to be tested for SAR.

SAR measurement positions						
Mode	Front	Rear	Left edge	Right edge	Top edge	Bottom edge
Main antenna	No	Yes	Yes	No	No	Yes
WLAN	No	Yes	Yes	No	No	Yes

12.4 Standalone SAR Test Exclusion Considerations

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied. The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances≤ 50 mm are determined by:

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

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

Table 12.1: Standalone SAR test exclusion considerations

Band/Mode	F(GHz)	Position	SAR test exclusion threshold(mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.441	Body	19.20	6.5	4.47	Yes
2.4GHz WLAN	2.45	Body	19.17	14	25.12	No

13 Evaluation of Simultaneous

Table 13.1: The sum of reported SAR values for main antenna and WiFi

	Position	Main antenna	WiFi	Sum
Highest SAR value for Head	Left hand, Touch cheek	0.17	0.12	**0.29**
	Right hand, Touch cheek	0.12	0.30	**0.42**
Highest reported SAR value for Body	Rear 0mm	0.66	0.68	**1.34**
	Rear 8m	1.35	/	**1.35**

Table 13.2: The sum of reported SAR values for main antenna and BT

	Position	Main antenna	BT	Sum
Maximum reported SAR value for Head	Left hand, Touch cheek	0.17	0.19[1]	**0.36**
	Right hand, Touch cheek	0.12	0.19[1]	**0.31**
Maximum reported SAR value for Body	Rear 0mm	0.66	0.19[1]	**0.85**
	Rear 8	1.35	0.05[1]	**1.40**

[1] - Estimated SAR for Bluetooth (see the table 13.3)

Table 13.3: Estimated SAR for Bluetooth

Mode/Band	F (GHz)	Position	Distance (mm)	Upper limit of power *		Estimated$_{1g}$ (W/kg)
				dBm	mW	
Bluetooth	2.441	Head	5	6.5	4.47	0.19
		Body	5	6.5	4.47	0.19
			8	6.5	4.47	0.05

* - Maximum possible output power declared by manufacturer

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to 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.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Conclusion:
According to the above tables, the sum of reported SAR values is<1.6W/kg. So the simultaneous transmission SAR with volume scans is not required.

14 SAR Test Result

It is determined by KDB 616217 D04 for the distance between the EUT and the phantom bottom (0mm and 13mm).

It is performed for all SAR measurements with area scan based 1-g SAR estimation (Fast SAR). A zoom scan measurement is added when the estimated 1-gSAR is the highest measured SAR in each exposure configuration, wireless mode and frequency band combination or more than 1.2W/kg.

The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} \times 10^{(P_{Target} - P_{Measured})/10}$$

Where P_{Target} is the power of manufacturing upper limit;

$P_{Measured}$ is the measured power in chapter 11.

Table 14.1: Duty Cycle

Mode	**Duty Cycle**
Speech for GSM850/1900	1:8.3
GPRS&EGPRS for GSM850/1900 with Normal power	1:2
GPRS&EGPRS for GSM850 with Low power	1:2
GPRS&EGPRS for GSM1900 with Low power	1:4
WCDMA	1:1

14.1 SAR results for Fast SAR

Table 14.1-1: SAR Values (GSM 850 MHz Band - Head)

Ambient Temperature: 22.5 ℃ Liquid Temperature: 22.0 ℃											
Frequency		Side	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch	MHz										
190	836.6	L	Cheek	/	32.57	33	0.064	**0.07**	0.080	**0.09**	0.05
190	836.6	L	Tilt	/	32.57	33	0.045	**0.05**	0.055	**0.06**	-0.01
251	848.8	R	Cheek	Fig.1	32.55	33	0.069	**0.08**	0.091	**0.10**	-0.02
190	836.6	R	Cheek	/	32.57	33	0.053	**0.06**	0.077	**0.09**	0.08
128	824.2	R	Cheek	/	32.39	33	0.044	**0.05**	0.058	**0.07**	0.04
190	836.6	R	Tilt	/	32.57	33	0.037	**0.04**	0.046	**0.05**	-0.05
251	848.8	R	Cheek	SKU4	32.55	33	0.064	**0.07**	0.088	**0.10**	0.02

Table 14.1-2: SAR Values (GSM 850 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode (number of timeslots)	Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
251	848.8	GPRS (4)	Rear 8mm	Fig.2	29.27	30	0.746	**0.88**	1.14	**1.35**	0.01
190	836.6	GPRS (4)	Rear 8mm	/	29.3	30	0.693	**0.81**	1.09	**1.28**	0.06
128	824.2	GPRS (4)	Rear 8mm	/	29.15	30	0.616	**0.75**	1.00	**1.22**	-0.01
190	836.6	GPRS (4)	Left 8mm	/	29.3	30	0.117	**0.14**	0.208	**0.24**	-0.04
190	836.6	GPRS (4)	Bottom 8mm	/	29.3	30	0.273	**0.32**	0.465	**0.55**	0.02
190	836.6	GPRS (4)	Rear 0mm	/	21.84	22	0.224	**0.23**	0.444	**0.46**	0.09
190	836.6	GPRS (4)	Left 0mm	/	21.84	22	0.061	**0.06**	0.115	**0.12**	-0.05
190	836.6	GPRS (4)	Bottom 0mm	/	21.84	22	0.125	**0.13**	0.272	**0.28**	0.02
251	848.8	EGPRS (4)	Rear 8mm	/	29.36	30	0.731	**0.85**	1.11	**1.29**	0.04
251	848.8	GPRS (4)	Rear 8mm	SKU4	29.27	30	0.720	**0.85**	1.11	**1.32**	0.01

Table 14.1-3: SAR Values (GSM 1900 MHz Band - Head)

Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C											
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch	MHz										
810	1909.8	L	Cheek	Fig.3	29.32	29.5	0.061	**0.06**	0.096	**0.10**	0.04
661	1880	L	Cheek	/	29.29	29.5	0.062	**0.07**	0.097	**0.10**	-0.03
512	1850.2	L	Cheek	/	29.24	29.5	0.053	**0.06**	0.084	**0.09**	-0.09
661	1880	L	Tilt	/	29.29	29.5	0.030	**0.03**	0.050	**0.05**	-0.1
661	1880	R	Cheek	/	29.29	29.5	0.048	**0.05**	0.073	**0.08**	0.14
661	1880	R	Tilt	/	29.29	29.5	0.039	**0.04**	0.061	**0.06**	0.07
661	1880	L	Cheek	SKU4	29.29	29.5	0.057	**0.06**	0.091	**0.10**	-0.02

Table 14.1-4: SAR Values (GSM 1900 MHz Band - Body)

Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃											
Frequency		Mode (number of timeslots)	Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
810	1909.8	GPRS (4)	Rear 8mm	Fig.4	26.17	26.5	0.501	**0.54**	0.881	**0.95**	0.06
661	1880	GPRS (4)	Rear 8mm	/	26.05	26.5	0.430	**0.48**	0.732	**0.81**	0.02
512	1850.2	GPRS (4)	Rear 8mm	/	25.9	26.5	0.351	**0.40**	0.700	**0.80**	-0.08
661	1880	GPRS (4)	Left 8mm	/	26.05	26.5	0.254	**0.28**	0.418	**0.46**	0.17
661	1880	GPRS (4)	Bottom 8mm	/	26.05	26.5	0.179	**0.20**	0.267	**0.30**	0.05
661	1880	GPRS (2)	Rear 0mm	/	21.51	22	0.265	**0.30**	0.542	**0.61**	0.01
661	1880	GPRS (2)	Left 0mm	/	21.51	22	0.059	**0.07**	0.105	**0.12**	-0.07
661	1880	GPRS (2)	Bottom 0mm	/	21.51	22	0.097	**0.11**	0.213	**0.24**	0.15
810	1909.8	EGPRS (4)	Rear 8mm	/	26.13	26.5	0.499	**0.54**	0.876	**0.95**	0.04
810	1909.8	GPRS (4)	Rear 8mm	SKU4	26.17	26.5	0.418	**0.45**	0.716	**0.77**	-0.09

Table 14.1-5: SAR Values (WCDMA 850 MHz Band - Head)

Ambient Temperature: 22.5 ℃ Liquid Temperature: 22.0 ℃											
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch	MHz										
4182	836.4	L	Cheek	/	22.55	23	0.019	**0.02**	0.028	**0.03**	0.09
4182	836.4	L	Tilt	/	22.55	23	0.011	**0.01**	0.016	**0.02**	0.05
4233	846.6	R	Cheek	Fig.5	22.61	23	0.031	**0.03**	0.041	**0.04**	0.02
4182	836.4	R	Cheek	/	22.55	23	0.022	**0.02**	0.031	**0.03**	0.04
4132	826.4	R	Cheek	/	22.73	23	0.029	**0.03**	0.037	**0.04**	0.05
4182	836.4	R	Tilt	/	22.55	23	0.009	**0.01**	0.013	**0.01**	0.07
4233	846.6	R	Cheek	SKU4	22.61	23	0.025	**0.03**	0.036	**0.04**	-0.08

Table 14.1-6: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃										
Frequency		Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
4182	836.4	Rear 8mm	/	22.55	23	0.240	**0.27**	0.340	**0.38**	0.06
4182	836.4	Left 8mm	/	22.55	23	0.030	**0.03**	0.044	**0.05**	-0.02
4182	836.4	Bottom 8mm	/	22.55	23	0.089	**0.10**	0.145	**0.16**	-0.09
4233	846.6	Rear 0mm	Fig.6	17.11	17.5	0.294	**0.32**	0.537	**0.59**	-0.1
4182	836.4	Rear 0mm	/	17.18	17.5	0.276	**0.30**	0.502	**0.54**	0.04
4132	826.4	Rear 0mm	/	17.05	17.5	0.281	**0.31**	0.513	**0.57**	0.02
4182	836.4	Left 0mm	/	17.18	17.5	0.046	**0.05**	0.079	**0.09**	0.06
4182	836.4	Bottom 0mm	/	17.18	17.5	0.146	**0.16**	0.292	**0.31**	-0.01
4233	846.6	Rear 0mm	SKU4	17.11	17.5	0.277	**0.30**	0.525	**0.57**	0.03

Table 14.1-7: SAR Values (WCDMA 1900 MHz Band - Head)

Ambient Temperature: 22.5 ℃ Liquid Temperature: 22.0 ℃											
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch	MHz										
9938	1907.6	L	Cheek	/	22.56	23	0.090	**0.10**	0.139	**0.15**	0.02
9800	1880	L	Cheek	/	22.72	23	0.103	**0.11**	0.160	**0.17**	-0.03
9662	1852.4	L	Cheek	Fig.7	22.57	23	0.086	**0.09**	0.146	**0.16**	0.1
9800	1880	L	Tilt	/	22.72	23	0.045	**0.05**	0.076	**0.08**	0.02
9800	1880	R	Cheek	/	22.72	23	0.074	**0.08**	0.116	**0.12**	0.08
9800	1880	R	Tilt	/	22.72	23	0.049	**0.05**	0.081	**0.09**	0.05
9800	1880	L	Cheek	SKU4	22.72	23	0.084	**0.09**	0.143	**0.15**	0.11

Table 14.1-8: SAR Values (WCDMA 1900 MHz Band - Body)

Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃										
Frequency		Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
9938	1880	Rear 8mm	/	22.72	23	0.183	**0.20**	0.328	**0.35**	0.09
9938	1880	Left 8mm	/	22.72	23	0.133	**0.14**	0.221	**0.24**	-0.02
9938	1880	Bottom 8mm	/	22.72	23	0.300	**0.32**	0.542	**0.58**	0.1
9938	1907.6	Rear 0mm	Fig.8	17.07	17.5	0.308	**0.34**	0.602	**0.66**	0.05
9800	1880	Rear 0mm	/	17	17.5	0.292	**0.33**	0.563	**0.63**	0.02
9662	1852.4	Rear 0mm	/	17.04	17.5	0.234	**0.26**	0.446	**0.50**	-0.1
9938	1880	Left 0mm	/	17	17.5	0.074	**0.08**	0.137	**0.15**	0.14
9938	1880	Bottom 0mm	/	17	17.5	0.112	**0.13**	0.279	**0.31**	0.08
9938	1907.6	Rear 0mm	SKU4	17.07	17.5	0.186	**0.21**	0.597	**0.66**	0.06

Table 14.1-9: SAR Values (WLAN - Head)

Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C											
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch	MHz										
6	2437	L	Cheek	/	13.52	14	0.060	**0.07**	0.108	**0.12**	0.08
6	2437	L	Tilt	/	13.52	14	0.070	**0.08**	0.140	**0.16**	0.08
11	2462	R	Cheek	/	13.32	14	0.040	**0.05**	0.102	**0.12**	-0.19
6	2437	R	Cheek	Fig.9	13.52	14	0.112	**0.13**	0.260	**0.29**	0.16
1	2412	R	Cheek	/	13.38	14	0.090	**0.10**	0.202	**0.23**	0.08
6	2437	R	Tilt	/	13.52	14	0.078	**0.09**	0.186	**0.21**	0.09
6	2437	R	Cheek	SKU4	13.52	14	0.064	**0.07**	0.145	**0.16**	0.08

Table 14.1-10: SAR Values (WLAN - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
11	2462	Rear 0mm	/	13.32	14	0.133	**0.16**	0.358	**0.42**	0.06
6	2437	Rear 0mm	/	13.52	14	0.151	**0.17**	0.383	**0.43**	-0.01
1	2412	Rear 0mm	Fig.10	13.38	14	0.203	**0.23**	0.588	**0.68**	0.04
6	2437	Left 0mm	/	13.52	14	0.058	**0.06**	0.159	**0.18**	-0.05
6	2437	Top 0mm	/	13.52	14	0.053	**0.06**	0.150	**0.17**	0.02
1	2412	Rear 0mm	SKU4	13.38	14	0.191	**0.22**	0.570	**0.66**	0.08

According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. The scaled reported SAR is presented as below.

Table 14.1-11: SAR Values (WLAN - Head) – Scaled Reported SAR

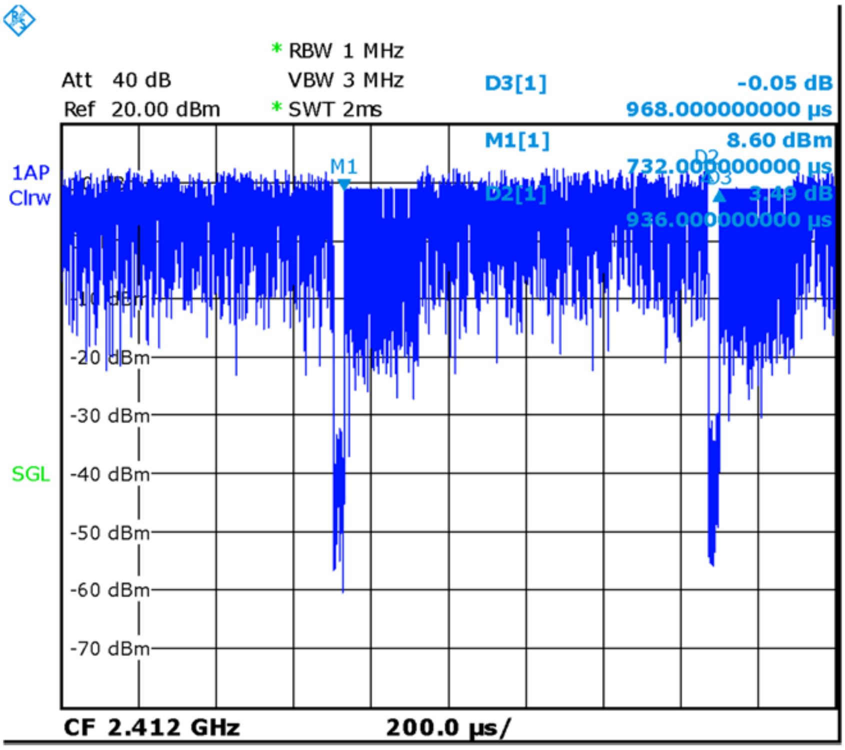
Ambient Temperature: 22.9℃ Liquid Temperature: 22.5℃						
Frequency		Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.					
2437	6	Right Touch	96.71%	100%	**0.29**	**0.30**

SAR is not required for OFDM because the 802.11b adjusted SAR ≤ 1.2 W/kg.

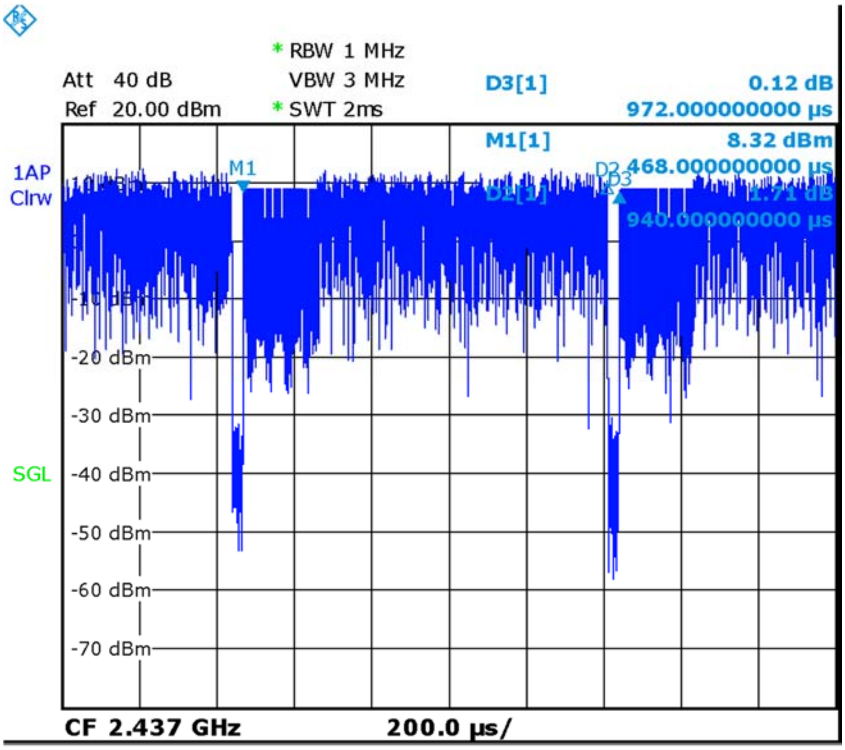
Table 14.1-12: SAR Values (WLAN - Body) – Scaled Reported SAR

Ambient Temperature: 22.9℃ Liquid Temperature: 22.5℃						
Frequency		Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.					
2412	1	Rear 0mm	96.69%	100%	**0.68**	**0.70**

SAR is not required for OFDM because the 802.11b adjusted SAR ≤ 1.2 W/kg.



Picture 14.1 Duty factor plot CH1



Picture 14.2 Duty factor plot CH6

14.2 SAR results for Standard procedure

There is zoom scan measurement to be added for the highest measured SAR in each exposure configuration/band.

Table 14.2-1: SAR Values (GSM 850 MHz Band - Head)

Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C											
Frequency		Side	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch	MHz										
251	848.8	R	Cheek	Fig.1	32.55	33	0.069	**0.08**	0.091	**0.10**	-0.02

Table 14.2-2: SAR Values (GSM 850 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode (number of timeslots)	Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
251	848.8	GPRS (4)	Rear 8mm	Fig.2	29.27	30	0.746	**0.88**	1.14	**1.35**	0.01

Table 14.2-3: SAR Values (GSM 1900 MHz Band - Head)

Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C											
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch	MHz										
661	1880	L	Cheek	/	29.29	29.5	0.062	**0.07**	0.097	**0.10**	-0.03

Table 14.2-4: SAR Values (GSM 1900 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode (number of timeslots)	Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
810	1909.8	GPRS (4)	Rear 8mm	Fig.4	26.17	26.5	0.501	**0.54**	0.881	**0.95**	0.06

Table 14.2-5: SAR Values (WCDMA 850 MHz Band - Head)

Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C											
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch	MHz										
4233	846.6	R	Cheek	Fig.5	22.61	23	0.031	**0.03**	0.041	**0.04**	0.02

Table 14.2-6: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
4233	846.6	Rear 0mm	Fig.6	17.11	17.5	0.294	**0.32**	0.537	**0.59**	-0.1

Table 14.2-7: SAR Values (WCDMA 1900 MHz Band - Head)

Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C											
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch	MHz										
9800	1880	L	Cheek	/	22.72	23	0.103	**0.11**	0.160	**0.17**	-0.03

Table 14.2-8: SAR Values (WCDMA 1900 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
9938	1907.6	Rear 0mm	Fig.8	17.07	17.5	0.308	**0.34**	0.602	**0.66**	0.05

Table 14.2-9: SAR Values (WLAN - Head)

Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C											
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch	MHz										
6	2437	R	Cheek	Fig.9	13.52	14	0.112	**0.13**	0.260	**0.29**	0.16

Table 14.1-10: SAR Values (WLAN - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
1	2412	Rear 0mm	Fig.10	13.38	14	0.203	**0.23**	0.588	**0.68**	0.04

15 SAR Measurement Variability

SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

The following procedures are applied to determine if repeated measurements are required.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.

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

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Table 15.1: SAR Measurement Variability for Body GSM850 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
Ch.	MHz						
251	848.8	Rear	8	1.14	1.12	1.02	/

Table 15.1: SAR Measurement Variability for Body PCS1900 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
Ch.	MHz						
810	1909.8	Rear	8	0.881	0.879	1.00	/

16 Measurement Uncertainty

16.1 Measurement Uncertainty for Normal SAR Tests (300MHz~3GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	6.0	N	1	1	1	6.0	6.0	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	N	1	1	1	0.6	0.6	∞
6	Readout electronics	B	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RFambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
15	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
16	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
17	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
20	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
21	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521

Combined standard uncertainty		$u_c^{'}=\sqrt{\sum_{i=1}^{21}c_i^2u_i^2}$						9.55	9.43	257
Expanded uncertainty (confidence interval of 95 %)		$u_e=2u_c$						19.1	18.9	

16.2 Measurement Uncertainty for Normal SAR Tests (3~6GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	6.55	N	1	1	1	6.55	6.55	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	2.0	R	$\sqrt{3}$	1	1	1.2	1.2	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Readout electronics	B	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RFambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. restrictions	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
12	Probe positioning with respect to phantom shell	B	6.7	R	$\sqrt{3}$	1	1	3.9	3.9	∞
13	Post-processing	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
15	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
16	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
17	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
20	Liquid permittivity	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞

	(target)									
21	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						10.7	10.6	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						21.4	21.1	

16.3 Measurement Uncertainty for Fast SAR Tests (300MHz~3GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	6.0	N	1	1	1	6.0	6.0	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Readout electronics	B	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RFambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. Restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
14	Fast SAR z-Approximation	B	7.0	R	$\sqrt{3}$	1	1	4.0	4.0	∞
Test sample related										
15	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
16	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
17	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
18	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞

19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
21	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
22	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						10.4	10.3	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						20.8	20.6	

16.4 Measurement Uncertainty for Fast SAR Tests (3~6GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	6.55	N	1	1	1	6.55	6.55	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	2.0	R	$\sqrt{3}$	1	1	1.2	1.2	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Readout electronics	B	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RFambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. Restrictions	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
12	Probe positioning with respect to phantom shell	B	6.7	R	$\sqrt{3}$	1	1	3.9	3.9	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
14	Fast SAR z-Approximation	B	14.0	R	$\sqrt{3}$	1	1	8.1	8.1	∞
Test sample related										
15	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
16	Device holder	A	3.4	N	1	1	1	3.4	3.4	5

	uncertainty									
17	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
18	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
21	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
22	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						13.5	13.4	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						27.0	26.8	

17 MAIN TEST INSTRUMENTS

Table 17.1: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	January 13, 2017	One year
02	Dielectric Probe Kit	85070E	Agilent	No Calibration Requested	
03	Power meter	NRVD	102083	September 22, 2016	One year
04	Power sensor	NRV-Z5	100595		
05	Signal Generator	E4438C	MY49071430	January 13,2017	One Year
06	Amplifier	60S1G4	0331848	No Calibration Requested	
07	Directional Coupler	778D	MY48220584	No Calibration Requested	
08	BTS	E5515C	MY50263375	January 16, 2017	One year
09	BTS	CMW500	159890	November25, 2016	One year
10	E-field Probe	SPEAG EX3DV4	3846	January 13,2017	One year
11	DAE	SPEAG DAE4	1331	January 19, 2017	One year
12	Dipole Validation Kit	SPEAG D835V2	4d069	July 20,2016	One year
13	Dipole Validation Kit	SPEAG D1900V2	5d101	July 28,2016	One year
14	Dipole Validation Kit	SPEAG D2450V2	853	July 25,2016	One year

END OF REPORT BODY

ANNEX A Graph Results

850 Right Cheek High

Date: 2017-7-14
Electronics: DAE4 Sn1331
Medium: Head 850 MHz
Medium parameters used (interpolated): f = 848.8 MHz; σ = 0.931 mho/m; εr = 41.51; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: GSM 850 Frequency: 848.8 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 – SN3846 ConvF(9.33, 9.33, 9.33)

Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.0989 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.846 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.116 W/kg
SAR(1 g) = 0.091 W/kg; SAR(10 g) = 0.069 W/kg
Maximum value of SAR (measured) = 0.101 W/kg

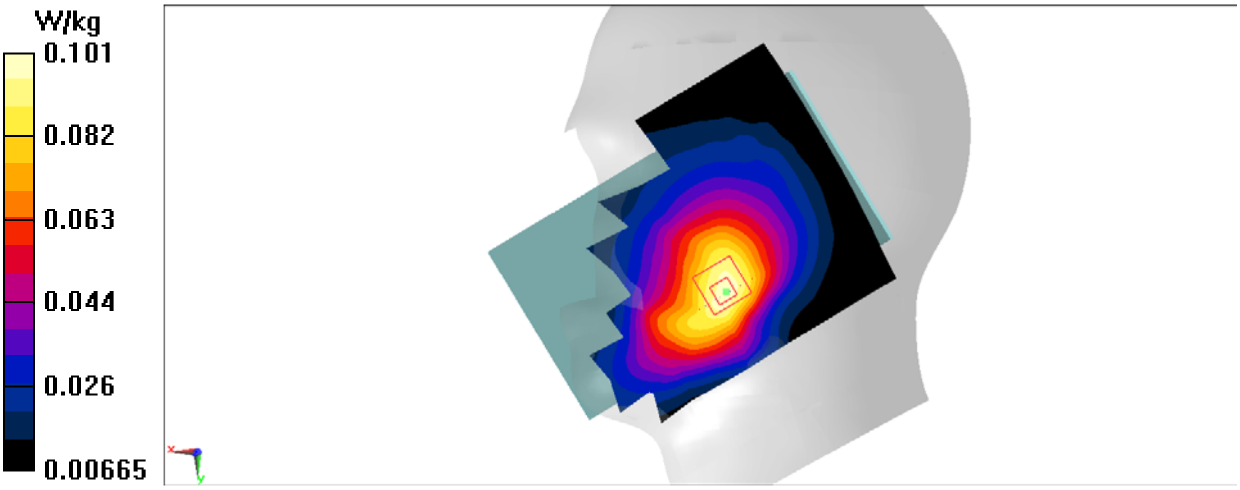


Fig.1 850MHz

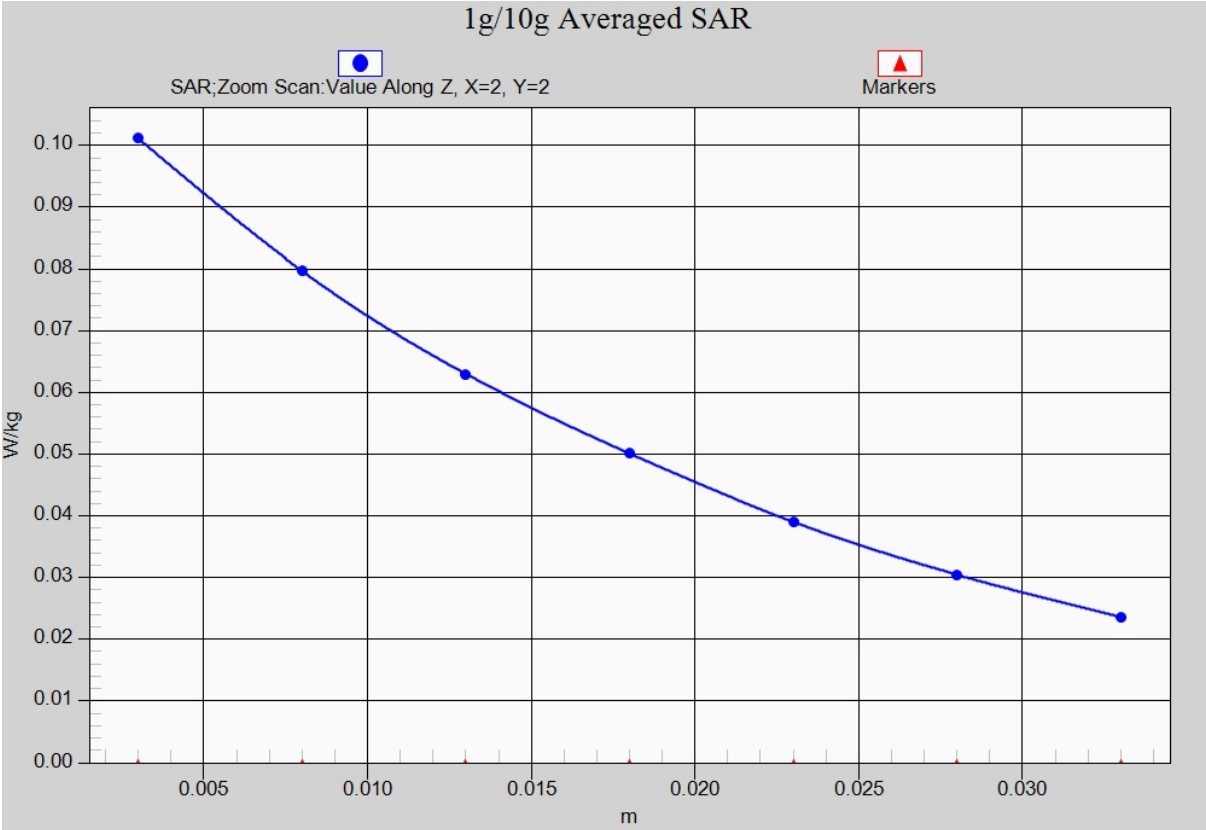


Fig. 1-1 Z-Scan at power reference point (850 MHz)

850 Body Rear High

Date: 2017-7-14
Electronics: DAE4 Sn1331
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 848.8 MHz; σ = 1.004 mho/m; εr = 53.16; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: GSM 850 GPRS Frequency: 848.8 MHz Duty Cycle: 1:2
Probe: EX3DV4 – SN3846 ConvF(9.52, 9.52, 9.52)

Area Scan (151x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.57 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.58 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.78 W/kg
SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.746 W/kg
Maximum value of SAR (measured) = 1.44 W/kg

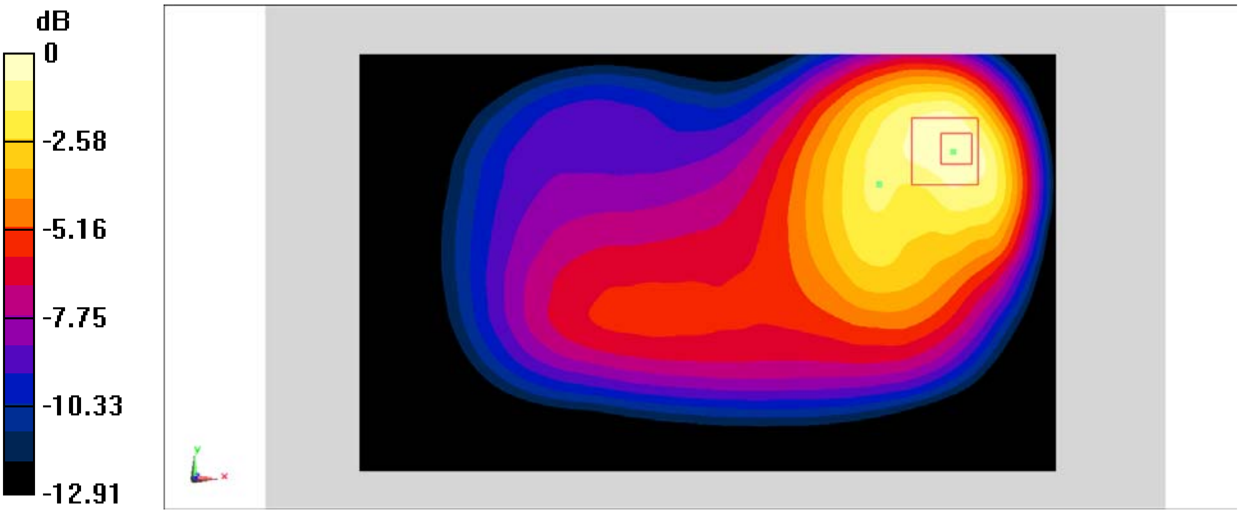


Fig.2 850 MHz

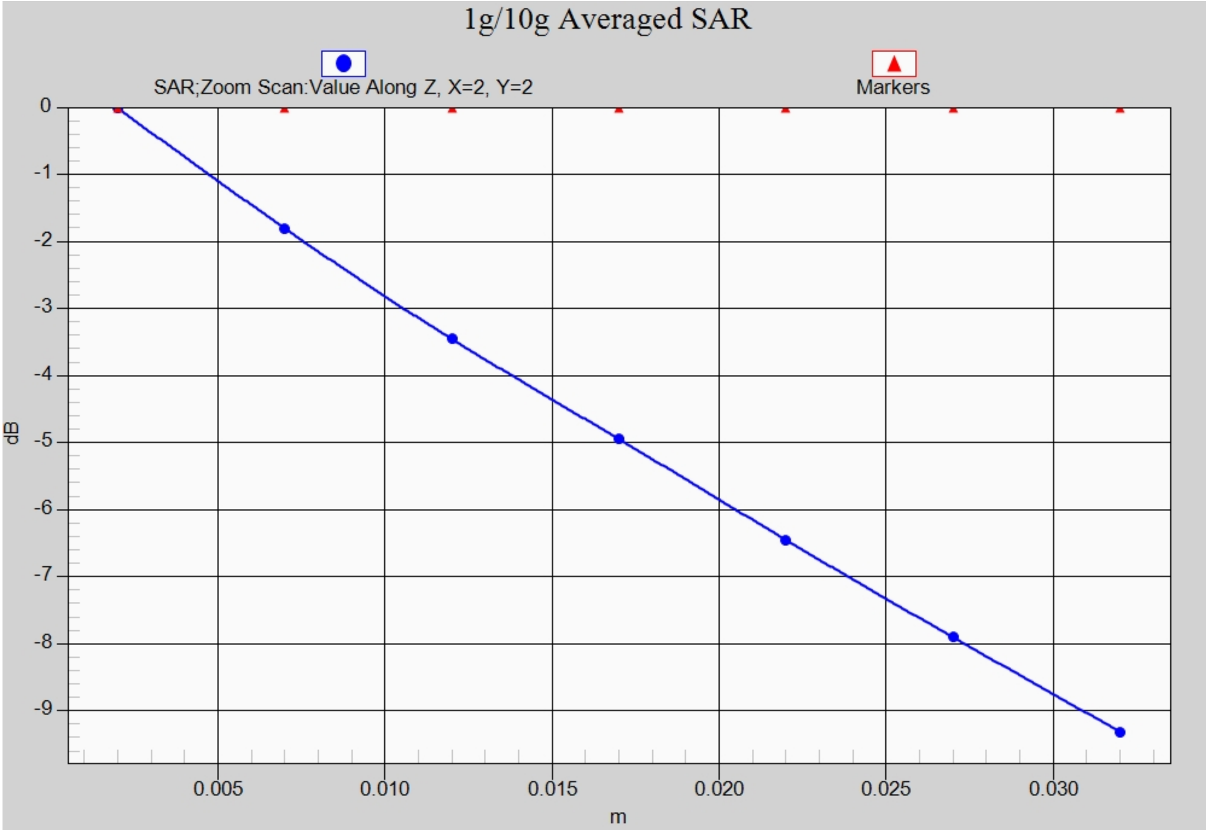


Fig. 2-1 Z-Scan at power reference point (850 MHz)

1900 Left Cheek Middle

Date: 2017-7-15

Electronics: DAE4 Sn1331

Medium: Head 1900 MHz

Medium parameters used: f = 1880 MHz; σ = 1.402 mho/m; εr = 40.96; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C

Communication System: GSM 1900MHz Frequency: 1880 MHz Duty Cycle: 1:8.3

Probe: EX3DV4– SN3846 ConvF(7.89, 7.89, 7.89)

Area Scan (81x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.114 W/kg

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

Reference Value = 4.694 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.135 W/kg

SAR(1 g) = 0.097 W/kg; SAR(10 g) = 0.062 W/kg

Maximum value of SAR (measured) = 0.101 W/kg

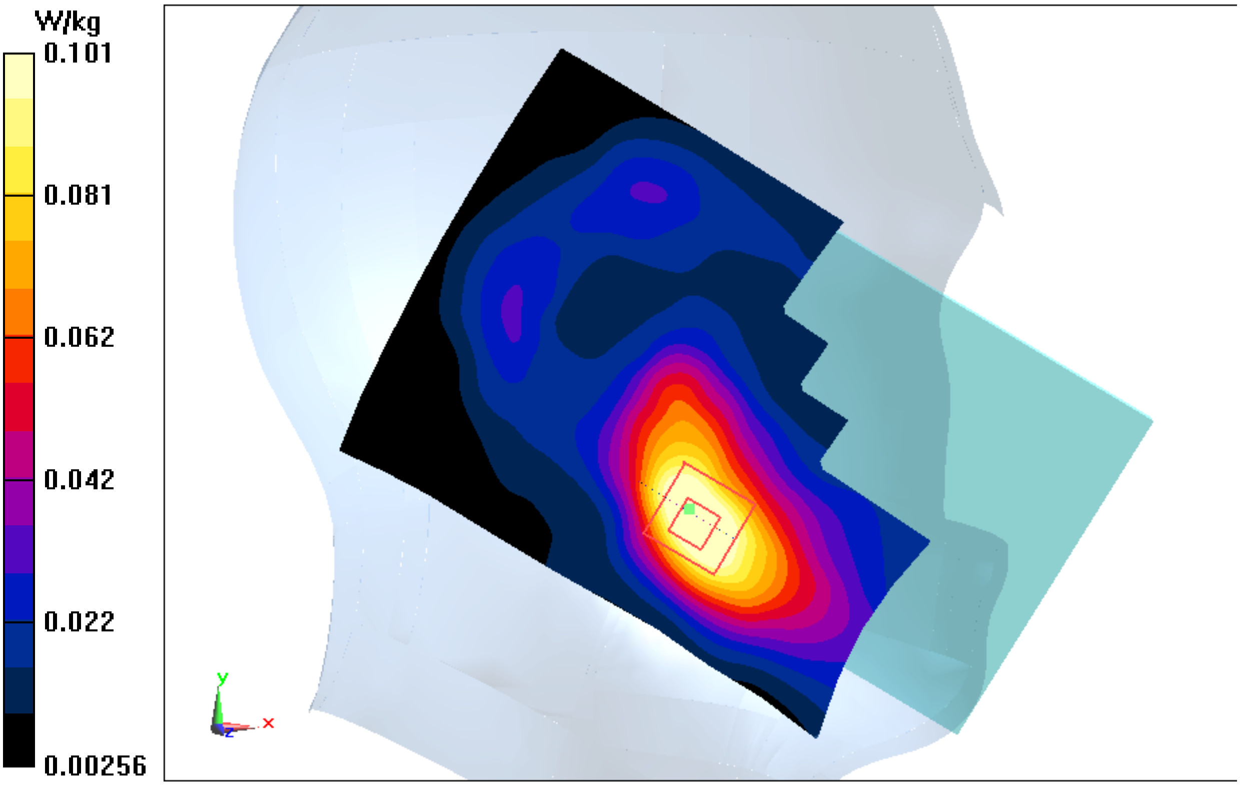


Fig.3 1900 MHz

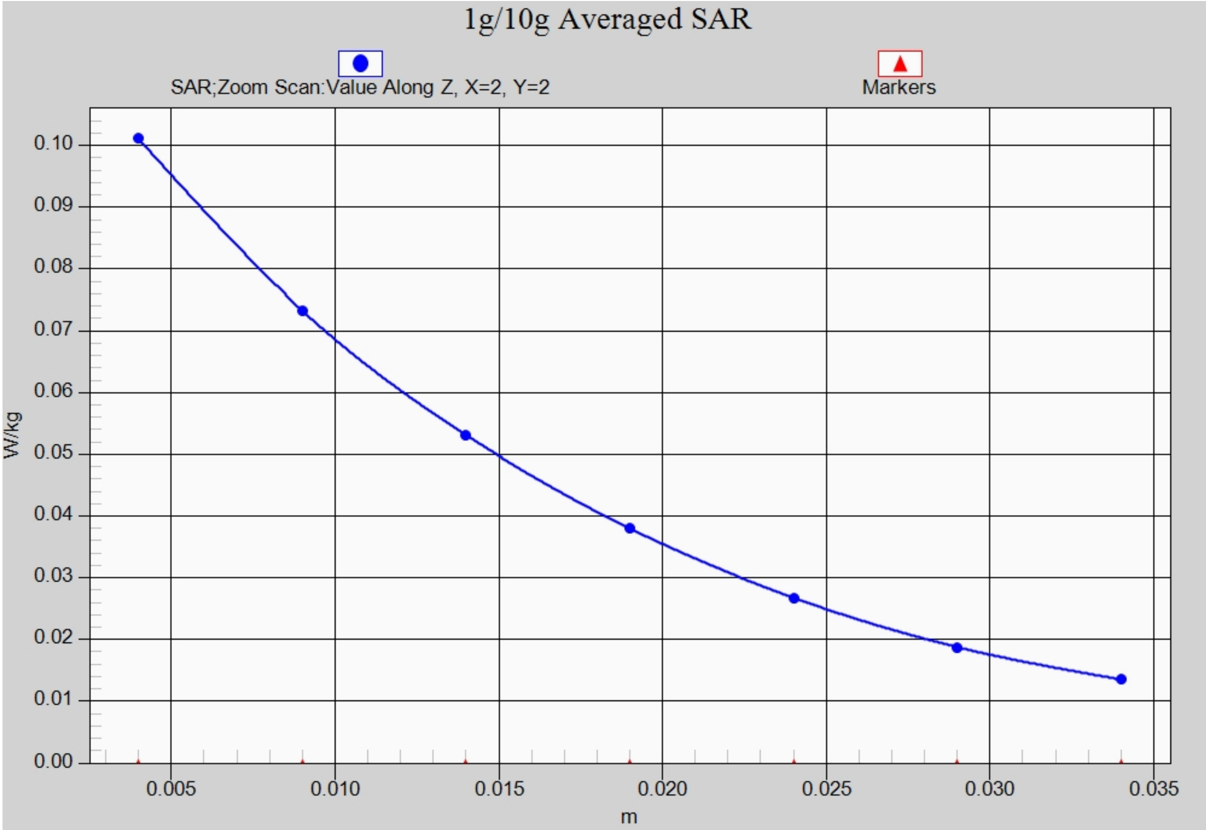


Fig. 3-1 Z-Scan at power reference point (1900 MHz)

1900 Body Rear High
Date: 2017-7-15
Electronics: DAE4 Sn1331
Medium: Body 1900 MHz
Medium parameters used: f = 1909.8 MHz; σ =1.536 mho/m; εr = 40.96; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: GSM 1900MHz GPRS Frequency: 1909.8 MHz Duty Cycle: 1:2
Probe: EX3DV4– SN3846 ConvF(7.57, 7.57, 7.57)

Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.14 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.715 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.53 W/kg
SAR(1 g) = 0.881 W/kg; SAR(10 g) = 0.501 W/kg
Maximum value of SAR (measured) = 0.970 W/kg

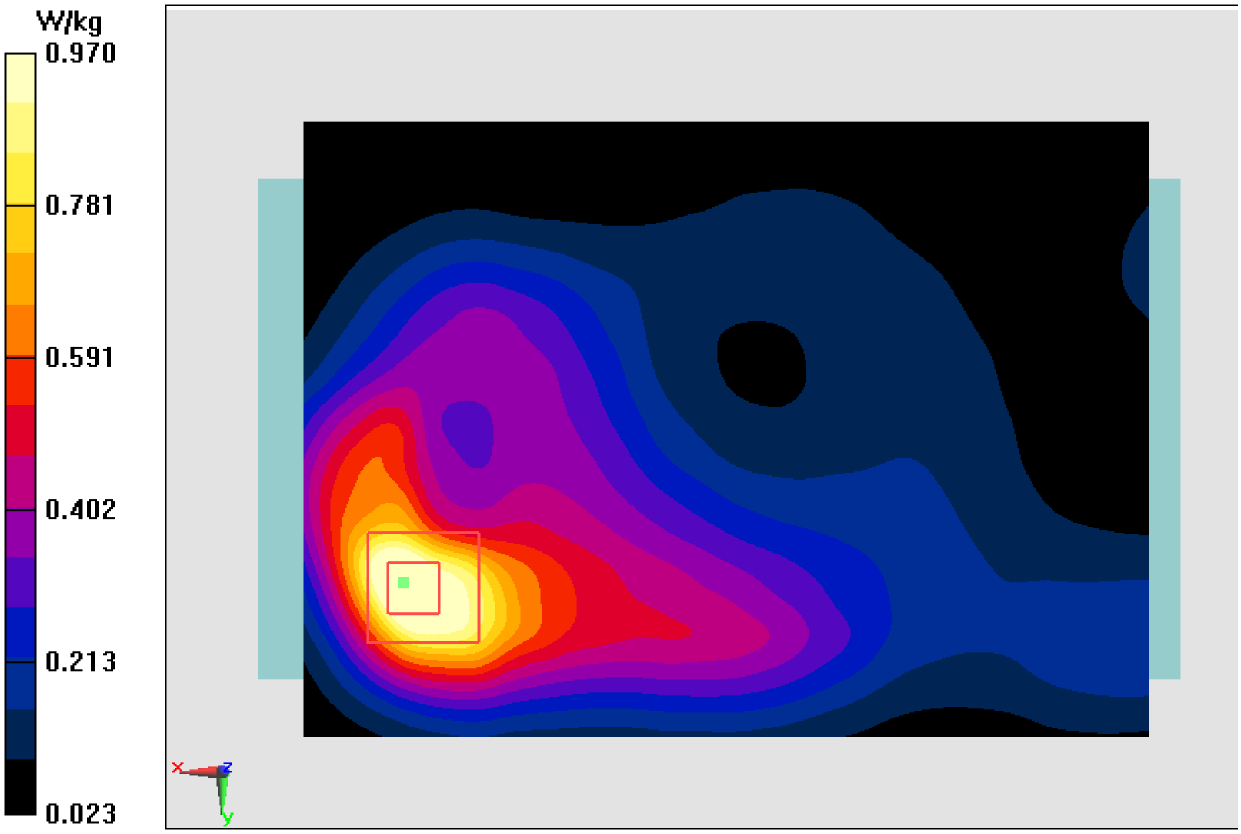


Fig.4 1900 MHz

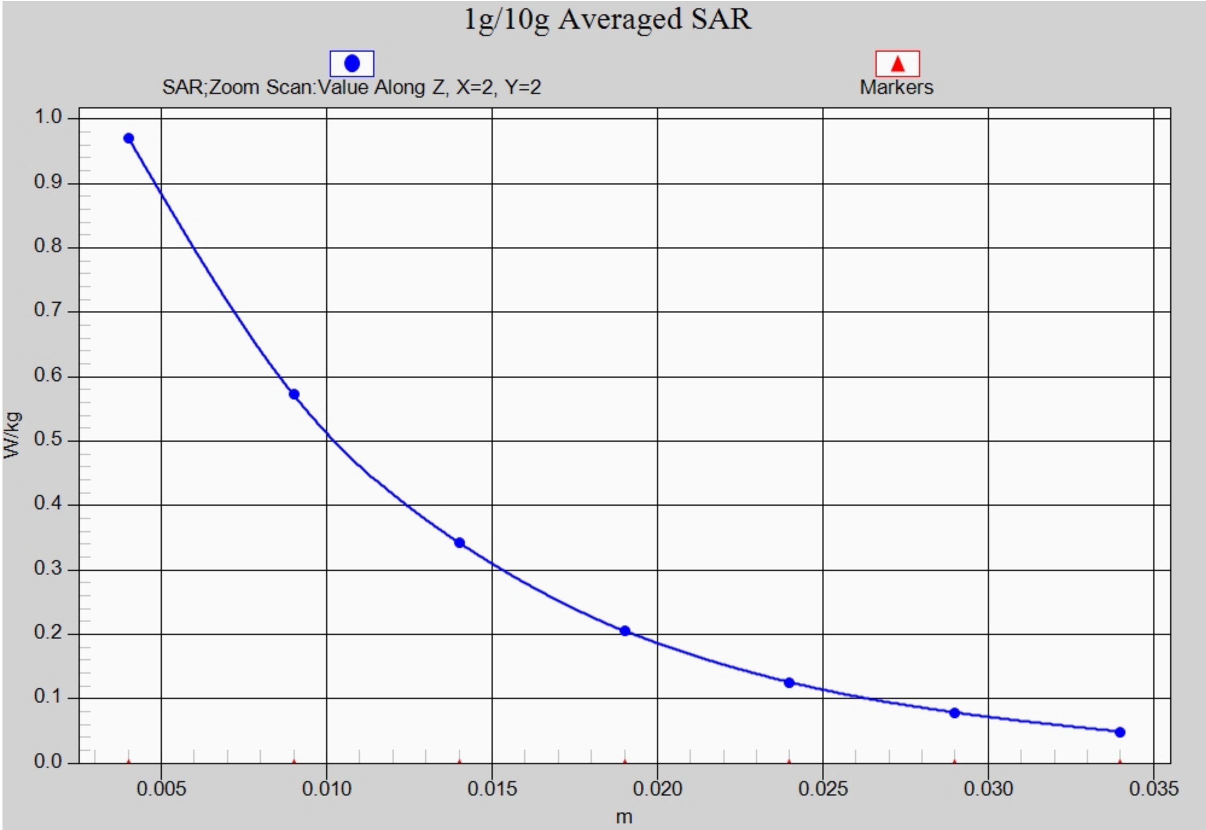


Fig. 4-1 Z-Scan at power reference point (1900 MHz)

WCDMA 850 Right Cheek High

Date: 2017-7-14
Electronics: DAE4 Sn1331
Medium: Head 850 MHz
Medium parameters used (interpolated): f = 846.6 MHz; σ = 0.929 mho/m; εr = 41.62; ρ = 1000 kg/m^3
Ambient Temperature: 22.5ºC Liquid Temperature: 22.0ºC
Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(9.33, 9.33, 9.33)

Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.0476 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.620 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.0530 W/kg
SAR(1 g) = 0.041 W/kg; SAR(10 g) = 0.031 W/kg
Maximum value of SAR (measured) = 0.0452 W/kg

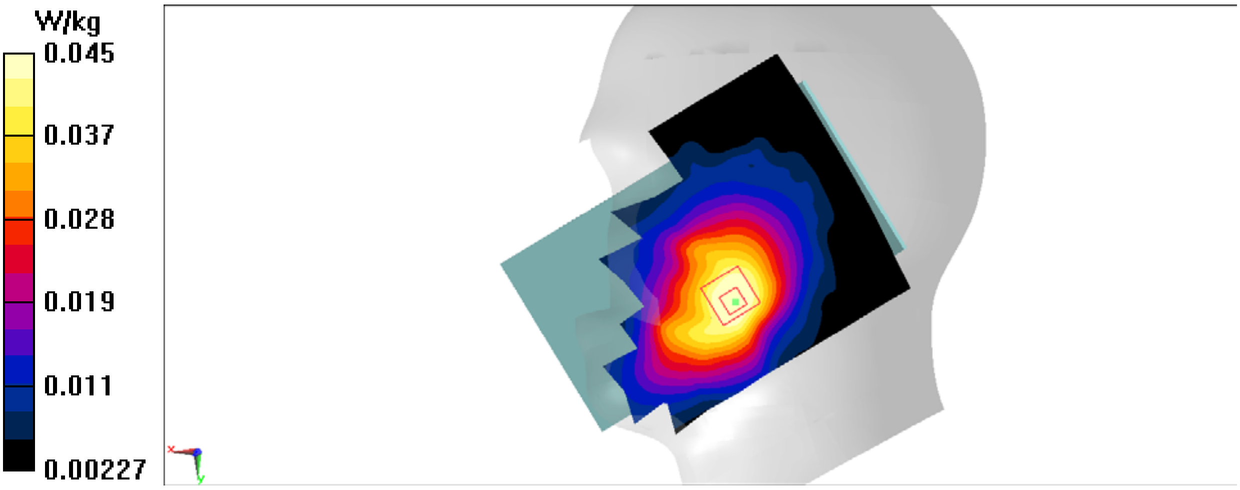


Fig.5 WCDMA 850

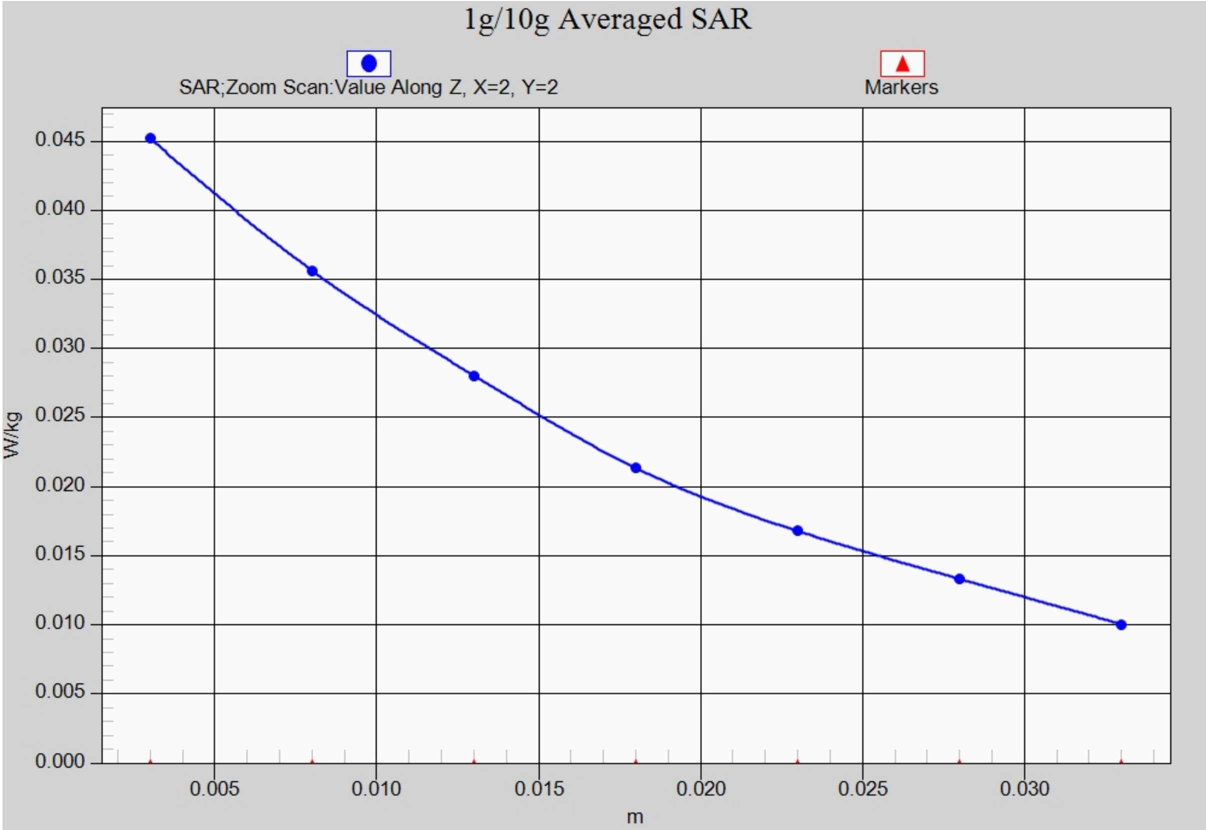


Fig. 5-1 Z-Scan at power reference point (850 MHz)

WCDMA 850 Body Rear High

Date: 2017-7-14
Electronics: DAE4 Sn1331
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 846.6 MHz; σ = 1.002 mho/m; εr = 53.30; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(9.52, 9.52, 9.52)

Area Scan (151x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.848 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.251 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 1.02 W/kg
SAR(1 g) = 0.537 W/kg; SAR(10 g) = 0.294 W/kg
Maximum value of SAR (measured) = 0.760 W/kg

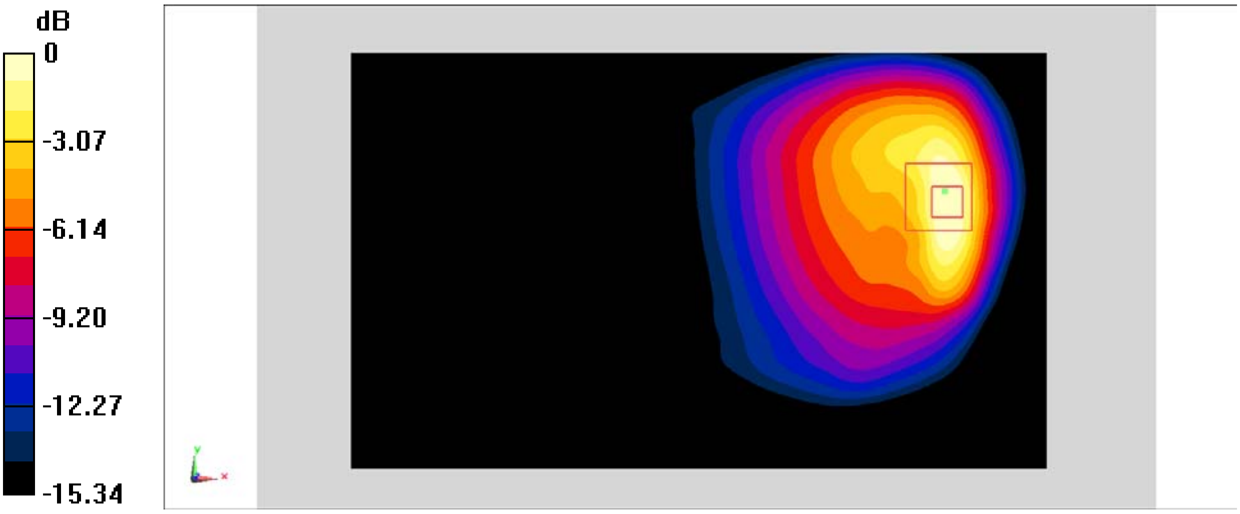


Fig.6 WCDMA 850

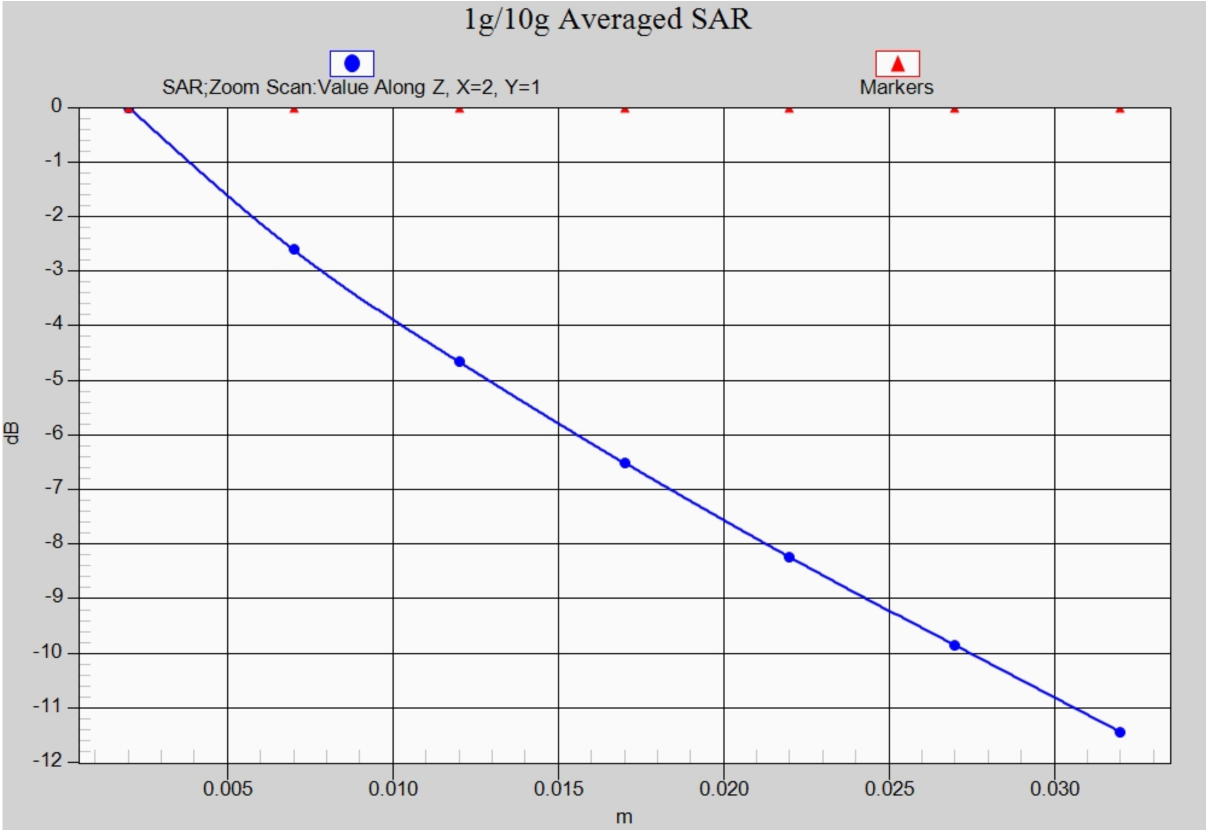


Fig. 6-1 Z-Scan at power reference point (WCDMA850)

WCDMA 1900 Left Cheek Middle

Date: 2017-7-15

Electronics: DAE4 Sn1331

Medium: Head 1900 MHz

Medium parameters used (interpolated): f = 1880 MHz; σ = 1.402 mho/m; εr = 40.96; ρ = 1000 kg/m^3

Ambient Temperature: 22.5ºC Liquid Temperature: 22.0ºC

Communication System: WCDMA 1900 Frequency: 1880 MHz Duty Cycle: 1:1

Probe: EX3DV4– SN3846 ConvF(7.89, 7.89, 7.89)

Area Scan (81x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.187 W/kg

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

Reference Value = 5.971 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.226 W/kg

SAR(1 g) = 0.160 W/kg; SAR(10 g) = 0.103 W/kg

Maximum value of SAR (measured) = 0.170 W/kg

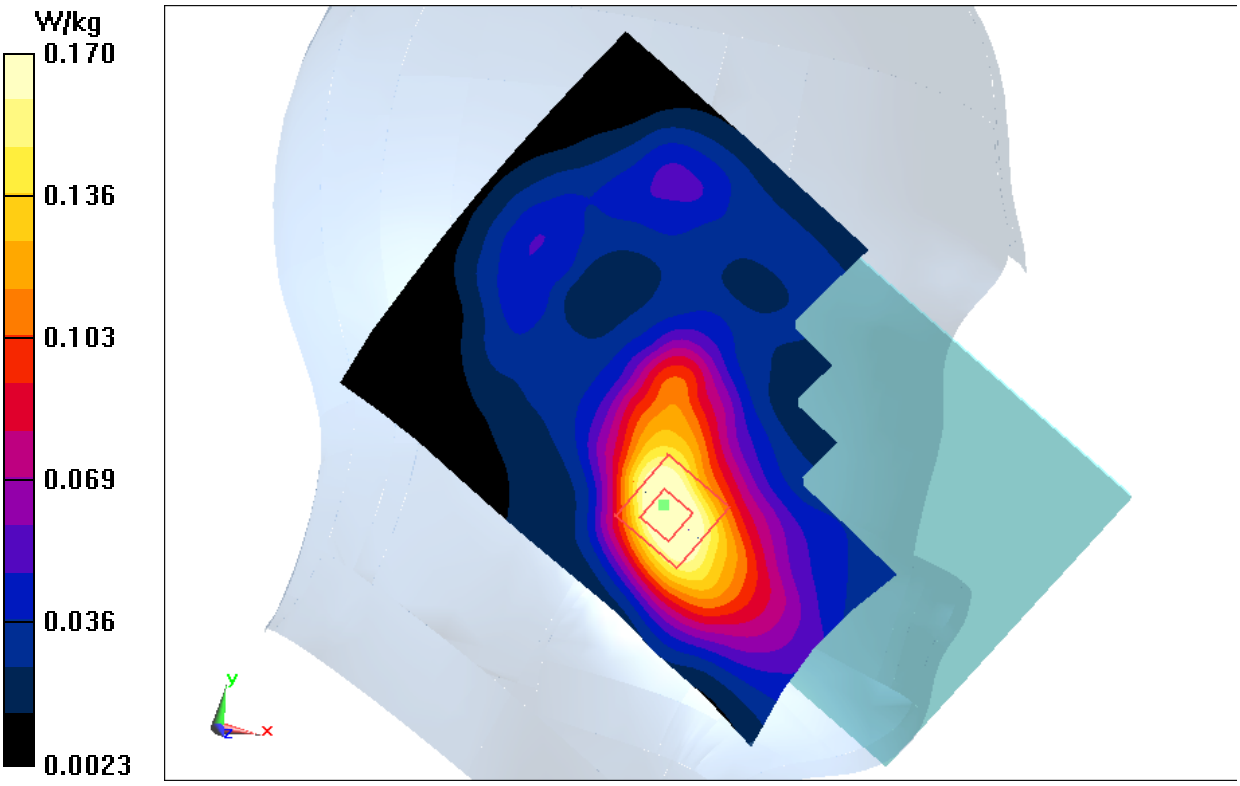


Fig.7 WCDMA1900

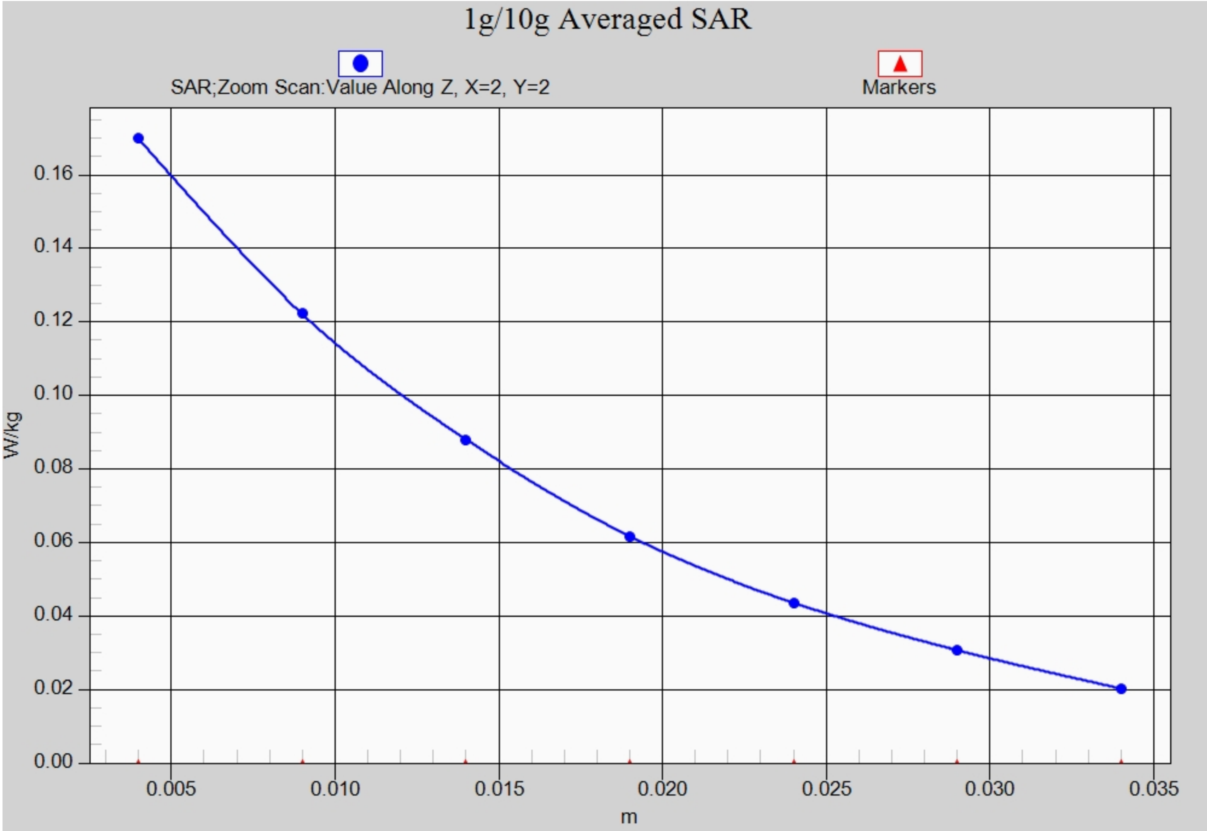


Fig. 7-1 Z-Scan at power reference point (WCDMA1900)

WCDMA 1900 Body Rear High
Date: 2017-7-15
Electronics: DAE4 Sn1331
Medium: Body 1900 MHz
Medium parameters used (interpolated): f = 1907.6 MHz; σ = 1.534 mho/m; εr = 52.07; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: WCDMA 1900 Frequency: 1907.6 MHz Duty Cycle: 1:1
Probe: EX3DV4– SN3846 ConvF(7.57, 7.57, 7.57)

Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.754 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.849 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.19 W/kg
SAR(1 g) = 0.602 W/kg; SAR(10 g) = 0.308 W/kg
Maximum value of SAR (measured) = 0.679 W/kg

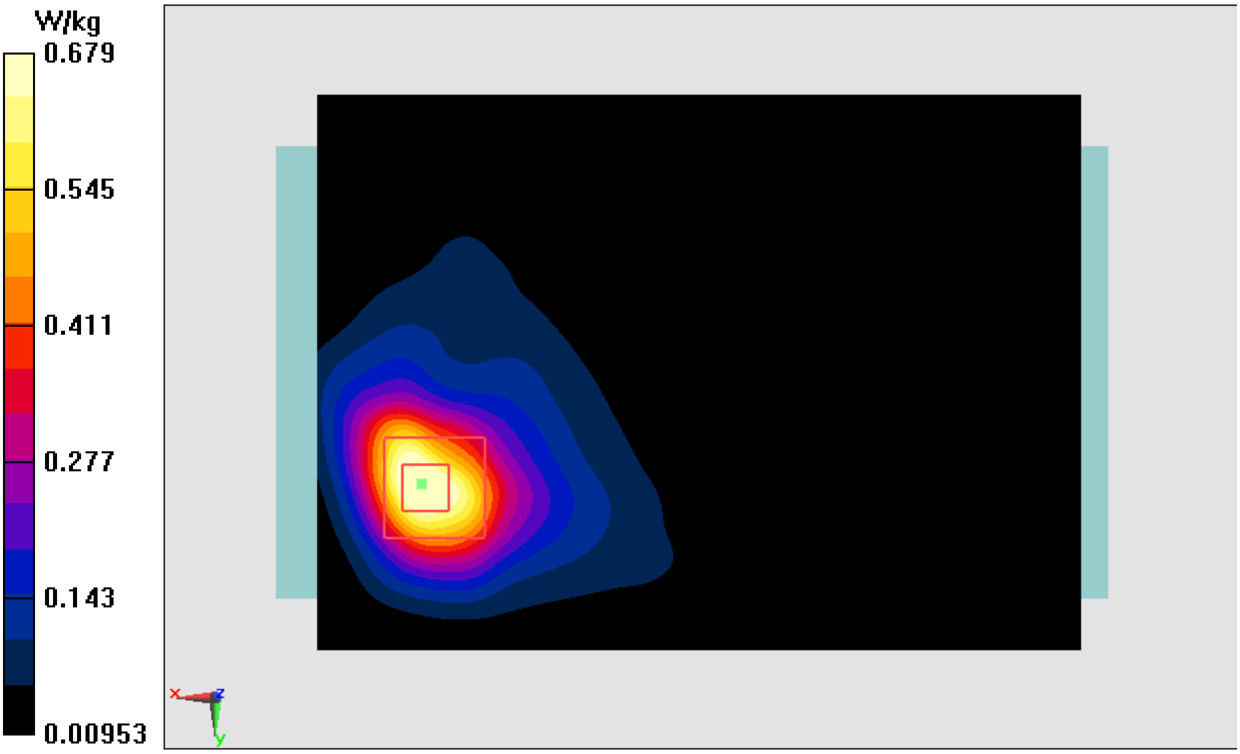


Fig.8 WCDMA1900

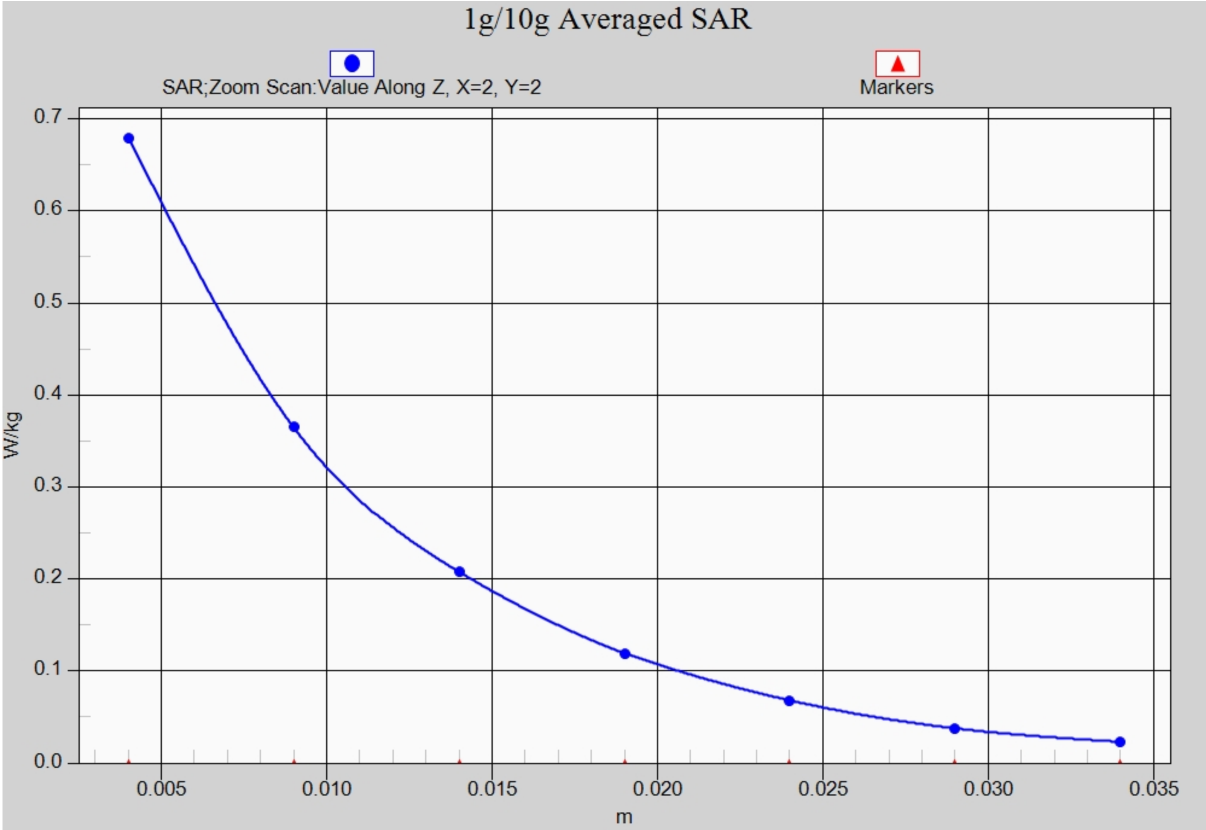


Fig. 8-1 Z-Scan at power reference point (WCDMA1900)

Wifi 802.11b Right Cheek Channel 6

Date: 2017-7-16
Electronics: DAE4 Sn1331
Medium: Head 2450 MHz
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.839 mho/m; ε_r = 39.58; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: WLan 2450 Frequency: 2437 MHz Duty Cycle: 1:1
Probe: EX3DV4– SN3846 ConvF(7.22, 7.22, 7.22)

Area Scan (91x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.296 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.495 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.651 W/kg
SAR(1 g) = 0.260 W/kg; SAR(10 g) = 0.112 W/kg
Maximum value of SAR (measured) = 0.344 W/kg

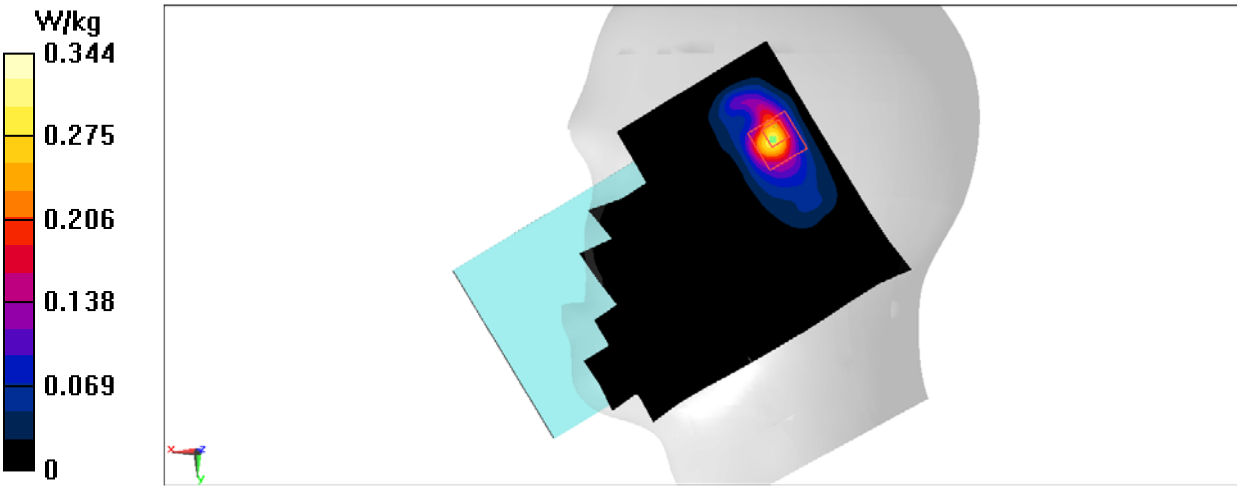


Fig.9 2450 MHz

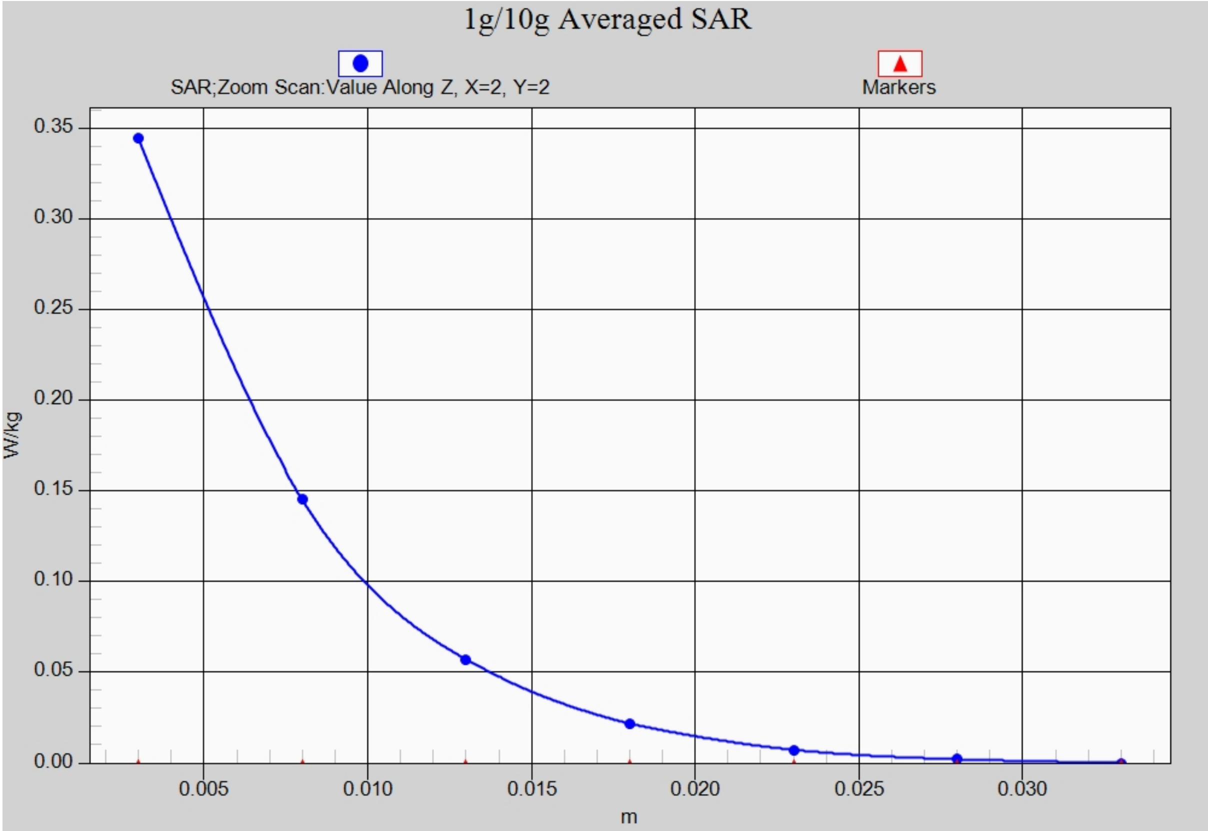


Fig. 9-1 Z-Scan at power reference point (2450 MHz)

Wifi 802.11b Body Rear Channel 1

Date: 2017-7-16
Electronics: DAE4 Sn1331
Medium: Body 2450 MHz
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.898 mho/m; ε_r = 53.08; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C   Liquid Temperature: 22.0°C
Communication System: WLan 2450 Frequency: 2412 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.31, 7.31, 7.31)

Area Scan (151x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.64 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.6750 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 1.76 W/kg
SAR(1 g) = 0.588 W/kg; SAR(10 g) = 0.203 W/kg
Maximum value of SAR (measured) = 1.22 W/kg

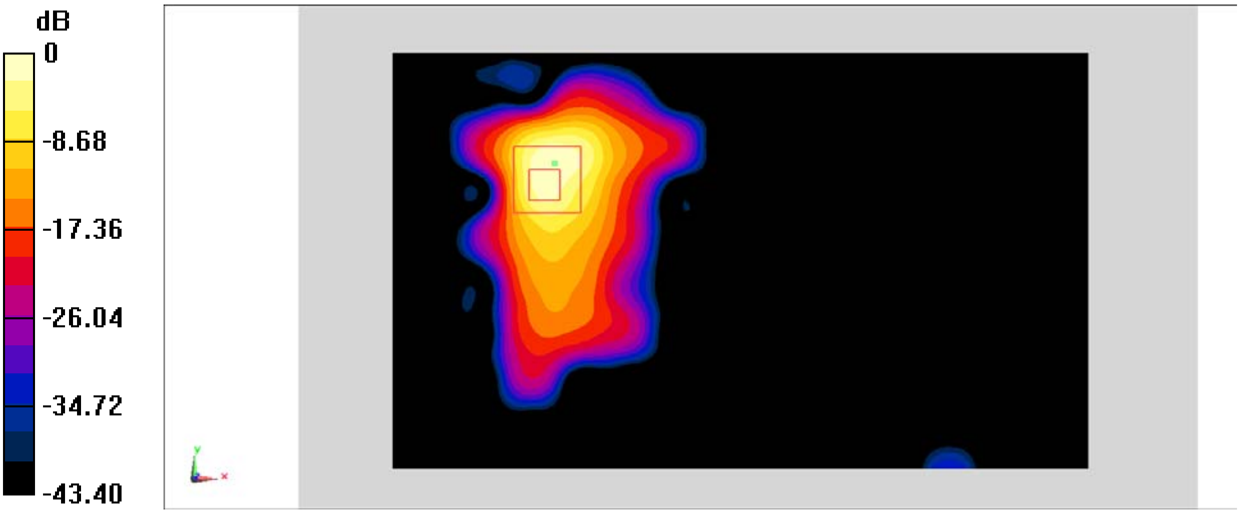


Fig.10 2450 MHz

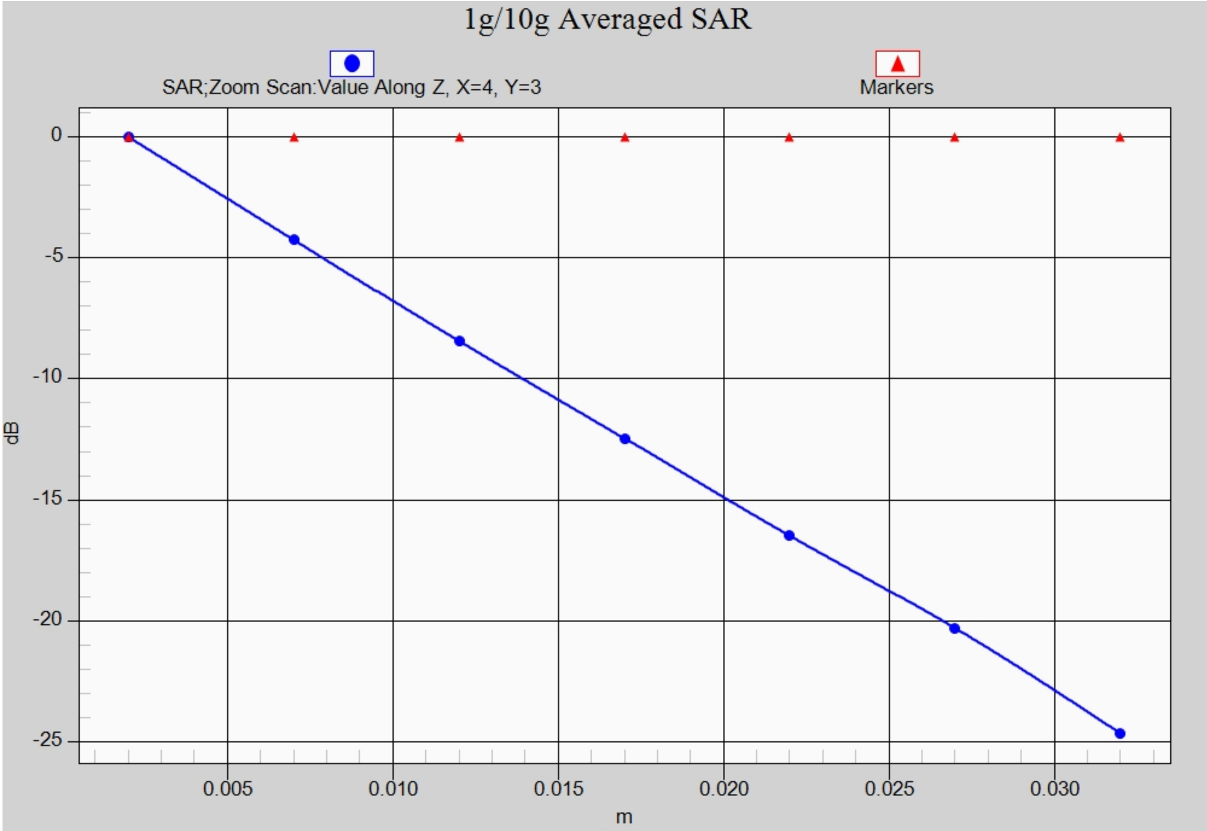


Fig. 10-1 Z-Scan at power reference point (2450 MHz)

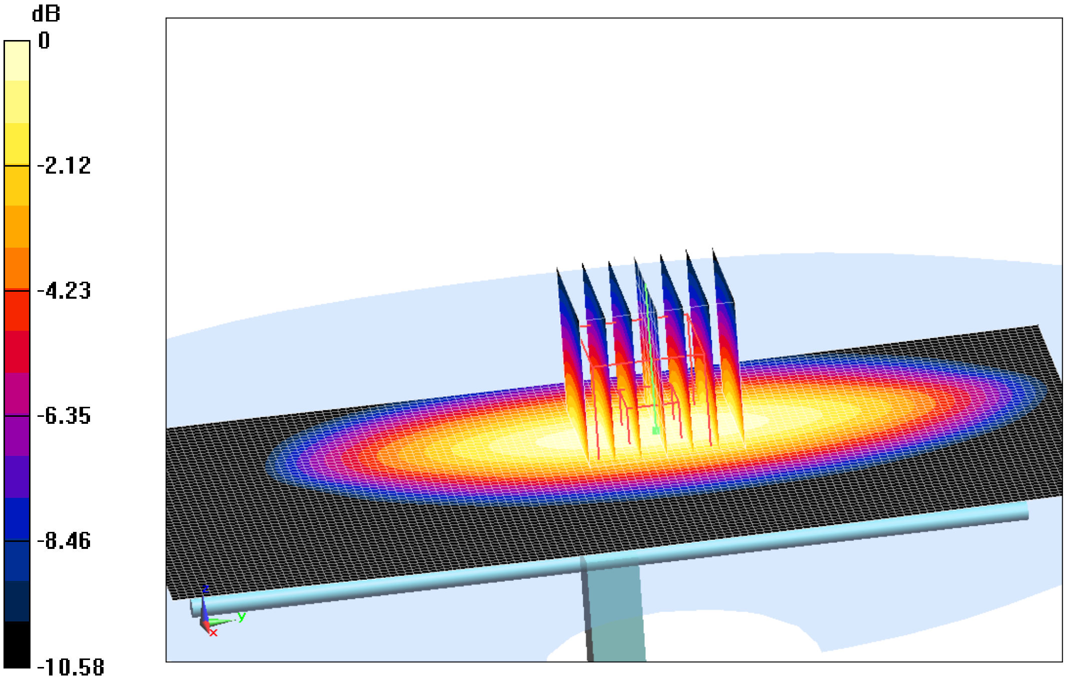
ANNEX B System Verification Results

835 MHz

Date: 2017-7-14
Electronics: DAE4 Sn1331
Medium: Head 835 MHz
Medium parameters used: f = 835 MHz; σ =0.916 mho/m; ε_r = 42.21; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(9.33, 9.33, 9.33)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value =59.39 V/m; Power Drift = -0.06 dB
Fast SAR: SAR(1 g) = 2.27 W/kg; SAR(10 g) = 1.50 W/kg
Maximum value of SAR (interpolated) = 3.25 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =59.39 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 3.61 W/kg
SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 3.32 W/kg



0 dB = 3.32 W/kg = 5.21 dB W/kg

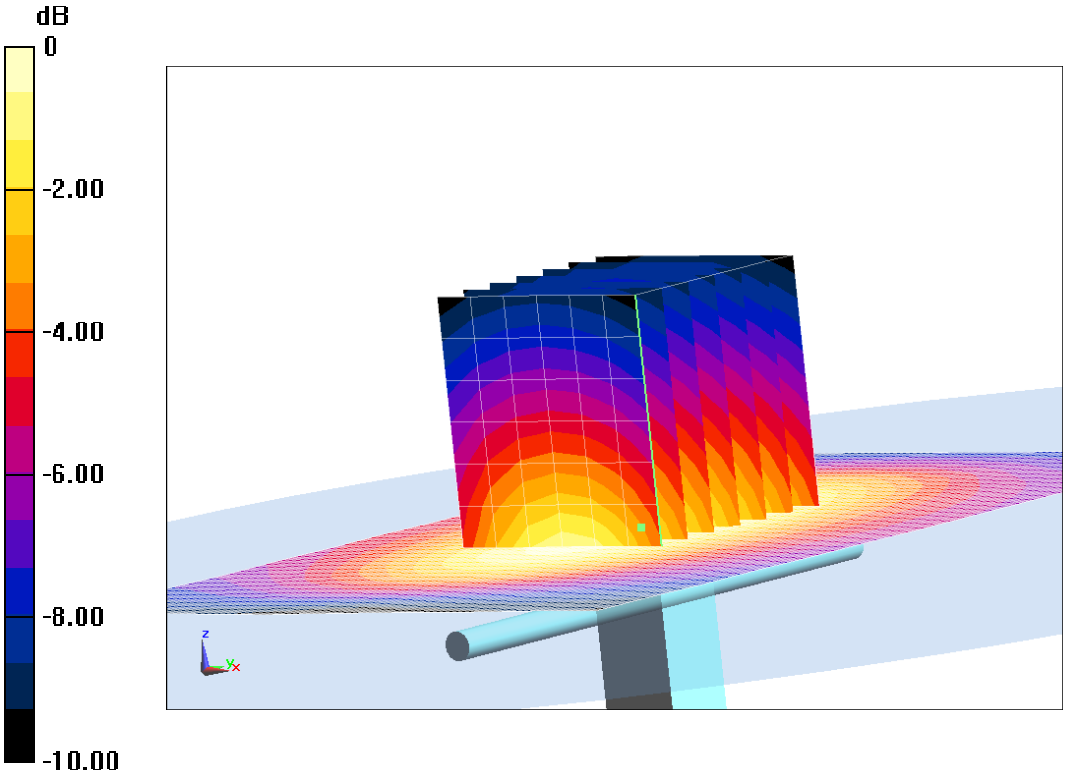
Fig.B.1 validation 835 MHz 250mW

835 MHz

Date: 2017-7-14
Electronics: DAE4 Sn1331
Medium: Body835 MHz
Medium parameters used: f = 835 MHz; σ =0.988 mho/m; ε_r = 54.05; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(9.52,9.52,9.52)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value =60.43 V/m; Power Drift = -0.04 dB
Fast SAR: SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (interpolated) = 3.35 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =60.43 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.71 W/kg
SAR(1 g) = 2.40 W/kg; SAR(10 g) = 1.57 W/kg
Maximum value of SAR (measured) = 3.31 W/kg



0 dB = 3.31 W/kg = 5.20 dB W/kg

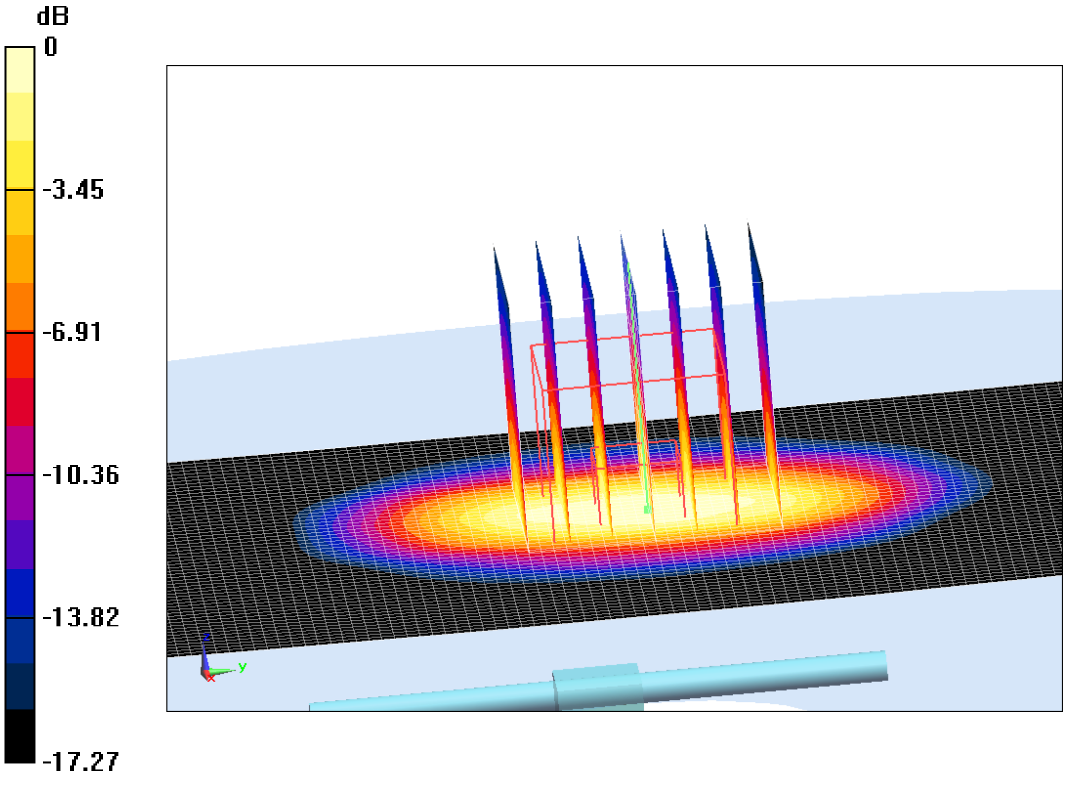
Fig.B.2 validation 835 MHz 250mW

1900 MHz

Date: 2017-7-15
Electronics: DAE4 Sn1331
Medium: Head1900 MHz
Medium parameters used: f = 1900 MHz; σ =1.417 mho/m; ε_r = 40.53; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.89, 7.89, 7.89)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value =107.9 V/m; Power Drift = -0.05 dB
Fast SAR: SAR(1 g) = 9.93 W/kg; SAR(10 g) = 5.07 W/kg
Maximum value of SAR (interpolated) = 15.7 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =107.9 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 18.88 W/kg
SAR(1 g) = 10.11 W/kg; SAR(10 g) = 5.23 W/kg
Maximum value of SAR (measured) = 15.9 W/kg



0 dB = 15.9 W/kg = 12.01 dB W/kg

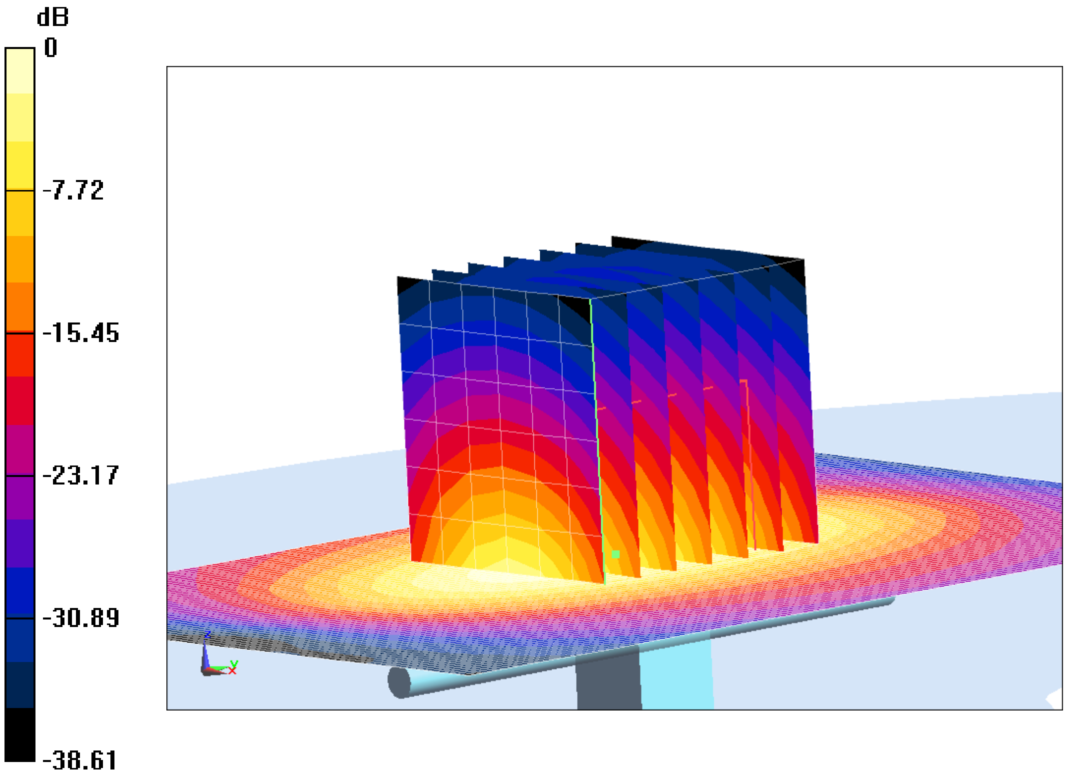
Fig.B.3 validation 1900 MHz 250mW

1900 MHz

Date: 2017-7-15
Electronics: DAE4 Sn1331
Medium: Body1900 MHz
Medium parameters used: f = 1900 MHz; σ =1.528 mho/m; ε_r = 52.28; ρ = 1000 kg/m^3
Ambient Temperature: 22.5ºC   Liquid Temperature: 22.0ºC
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.57, 7.57, 7.57)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value =103.9 V/m; Power Drift = 0.02 dB
Fast SAR: SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.04 W/kg
Maximum value of SAR (interpolated) = 14.8 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =103.9 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 17.3 W/kg
SAR(1 g) = 10.31 W/kg; SAR(10 g) = 5.23 W/kg
Maximum value of SAR (measured) = 15.1 W/kg



0 dB = 15.1 W/kg = 11.79 dB W/kg

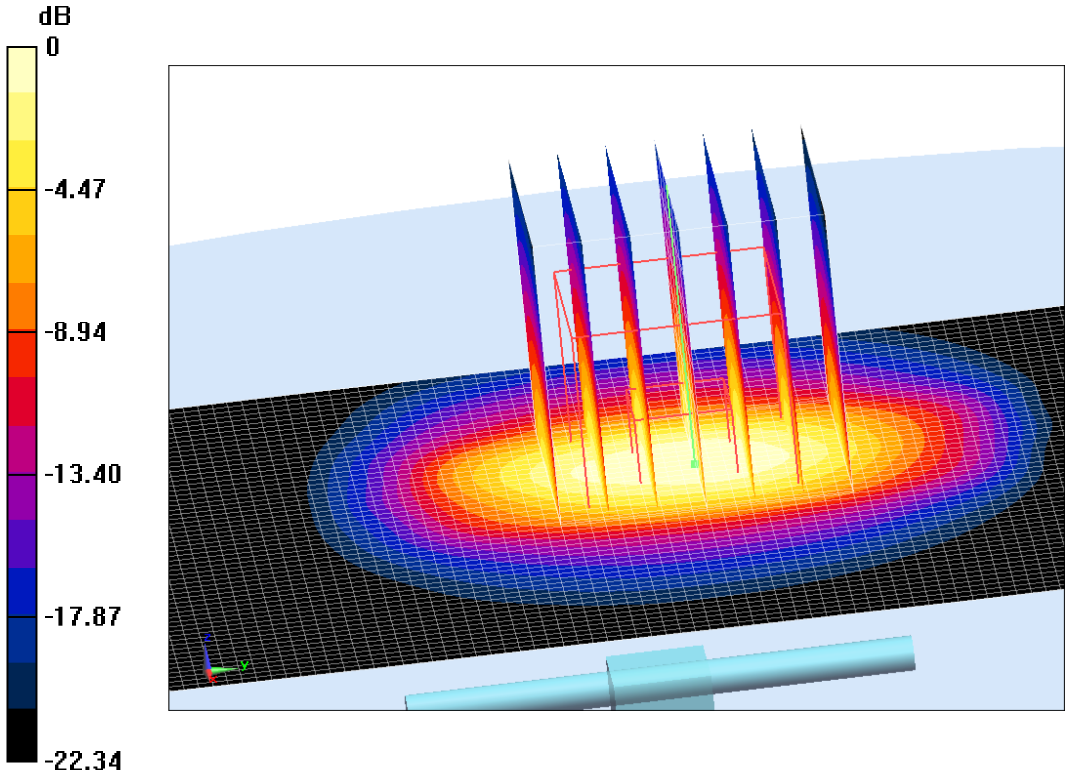
Fig.B.4 validation 1900 MHz 250mW

2450 MHz

Date: 2017-7-16
Electronics: DAE4 Sn1331
Medium: Head 2450 MHz
Medium parameters used: f = 2450 MHz; σ =1.849mho/m; ε_r = 39.37; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.22,7.22,7.22)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value =116.7 V/m; Power Drift = 0.05 dB
Fast SAR: SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.31 W/kg
Maximum value of SAR (interpolated) = 22.2 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =116.7 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 27.74 W/kg
SAR(1 g) = 13.11 W/kg; SAR(10 g) = 6.13 W/kg
Maximum value of SAR (measured) = 21.9 W/kg



0 dB = 21.9 W/kg = 13.40 dB W/kg

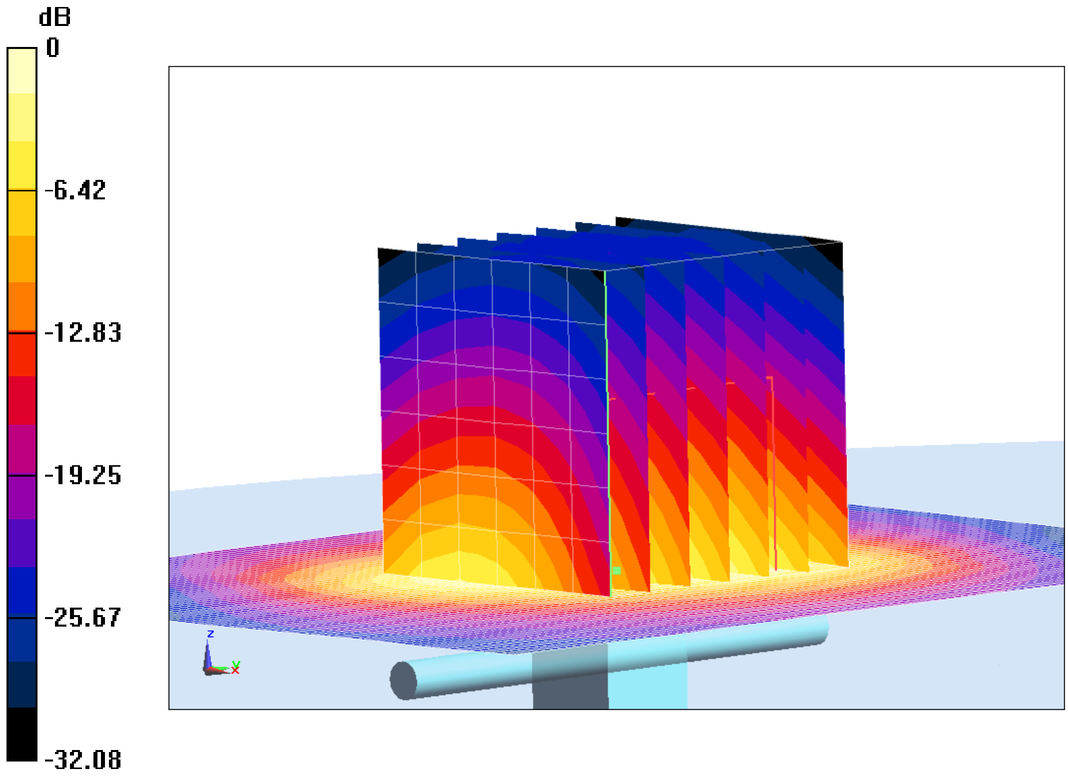
Fig.B.5 validation 2450 MHz 250mW

2450 MHz

Date: 2017-6-14
Electronics: DAE4 Sn1331
Medium: Body2450 MHz
Medium parameters used: f = 2450 MHz; σ =1.928 mho/m; ε_r = 52.27; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C   Liquid Temperature: 22.0°C
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.31,7.31,7.31)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value =104.9 V/m; Power Drift = -0.03 dB
Fast SAR: SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.28 W/kg
Maximum value of SAR (interpolated) = 21.6 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =104.9 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 26.2 W/kg
SAR(1 g) = 13.21 W/kg; SAR(10 g) = 6.08 W/kg
Maximum value of SAR (measured) = 21.3 W/kg



0 dB = 21.3 W/kg = 13.28 dB W/kg

Fig.B.6 validation 2450 MHz 250mW

The SAR system verification must be required that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR.

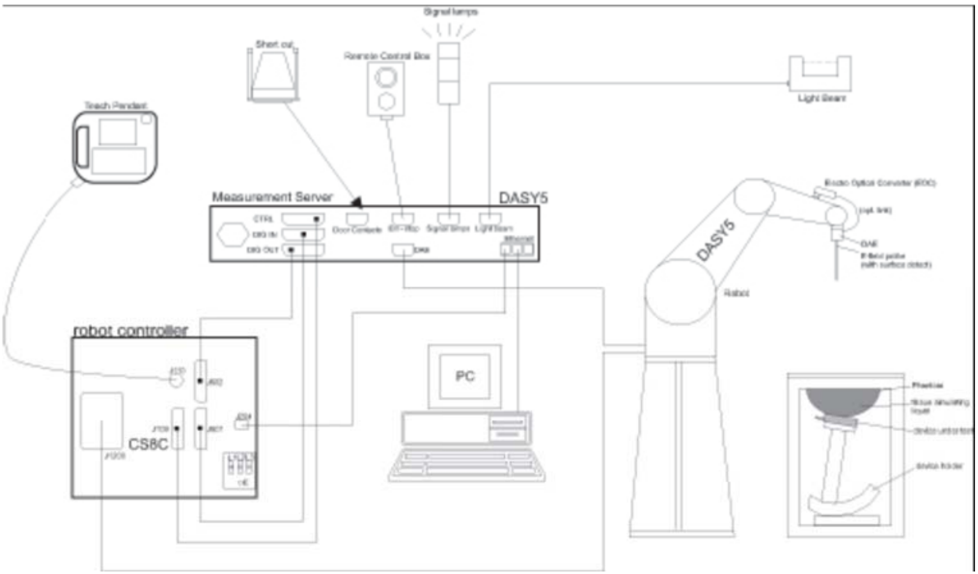
Table B.1 Comparison between area scan and zoom scan for system verification

Date	Band	Position	Area scan (1g)	Zoom scan (1g)	Drift (%)
2017-7-14	835	Head	2.27	2.32	-2.16
	835	Body	2.4	2.45	-2.04
2017-7-15	1900	Head	9.93	10.11	-1.78
	1900	Body	10.1	10.31	-2.04
2017-7-16	2450	Head	13.3	13.11	1.45
	2450	Body	13.4	13.21	1.44

ANNEX C SAR Measurement Setup

C.1 Measurement Set-up

The Dasy4 or DASY5 system for performing compliance tests is illustrated above graphically. This system consists of the following items:



Picture C.1SAR Lab Test Measurement Set-up

- A standard high precision 6-axis robot (StäubliTX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY4 or DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as
- warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

C.2 Dasy4 or DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 or DASY5 software reads the reflection durning a software approach and looks for the maximum using 2nd ord curve fitting. The approach is stopped at reaching the maximum.

Picture C.2Near-field Probe

Probe Specifications:

Model: ES3DV3, EX3DV4

Frequency Range: 10MHz — 6.0GHz(EX3DV4)
10MHz — 4GHz(ES3DV3)

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

Linearity: ± 0.2 dB(30 MHz to 6 GHz) for EX3DV4
± 0.2 dB(30 MHz to 4 GHz) for ES3DV3

DynamicRange: 10 mW/kg — 100W/kg

Probe Length: 330 mm

Probe Tip Length: 20 mm

Body Diameter: 12 mm

Tip Diameter: 2.5 mm (3.9 mm for ES3DV3)

Tip-Center: 1 mm (2.0mm for ES3DV3)

Application:SAR Dosimetry Testing
Compliance tests of tablet computers
Dosimetry in strong gradient fields

Picture C.3E-field Probe

C.3 E-field Probe Calibration

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an RF Signal generator, TEM cell, and RF Power Meter.

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and inn a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

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

Where:

Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

ΔT = Temperature increase due to RF exposure.

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

Where:

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

C.4 Other Test Equipment

C.4.1 Data Acquisition Electronics(DAE)

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

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

PictureC.4: DAE

C.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY4: RX90XL; DASY5: RX160L) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

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

Picture C.5DASY 4

Picture C.6DASY 5

C.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU broad with CPU (dasy4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128MB), RAM (DASY4: 64 MB, DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O broad, which is directly connected to the PC/104 bus of the CPU broad.

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

Picture C.7 Server for DASY 4 **Picture C.8 Server for DASY 5**

C.4.4 Device Holder for Phantom

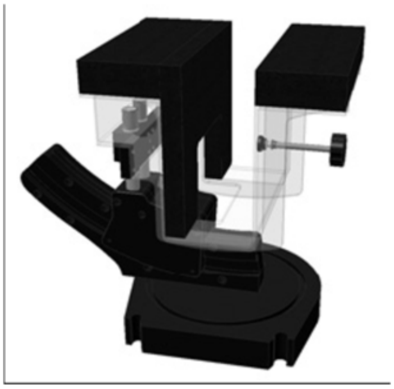
The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. Accurate device positioning is therefore crucial for accurate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

The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

<Laptop Extension Kit>

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



Picture C.9-1: Device Holder **Picture C.9-2: Laptop Extension Kit**

C.4.5 Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to

Represent the 90th percentile of the population. The phantom enables the dissymmetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

Shell Thickness: 2±0. 2 mm

Filling Volume: Approx. 25 liters

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

Available: Special

Picture C.10: SAM Twin Phantom

ANNEX D Position of the wireless device in relation to the phantom

D.1 SAR Testing for Tablet per KDB Publication 616217 D04 v01r02

This device can be used in full sized tablet exposure conditions, due to its size. Per FCC KDB 616217 D04 v01r02, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR Exclusion Threshold in KDB 447498 D01v06 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the perpendicular to the phantom.

D.2 Additional Test Positions due to Proximity Sensor Considerations

This device uses a proximity sensor to reduce power in tablet device use conditions.
While the device is touching the user on the antenna, the proximity sensor activates and thus reduces the maximum output power allowed. However, when the device is moved beyond the sensor triggering distance, the sensors de-activate and thus maximum output power is no longer limited. Therefore, an additional exposure condition is needed in the vicinity of the triggering distance to ensure SAR is compliant when the device is allowed to operate at a non-reduced output power level. FCC KDB 616217 D04 v01r02 Section 6 was used as a guideline for selecting SAR test distances for this device at these additional exposure conditions. Since the proximity sensor activation distance for the rear and top edge of the device is 14mm, a conservative distance of 13mm was tested for SAR on the rear and top edge at maximum power. Sensor triggering distance summary data is included in Annex I. The proximity sensor does not trigger power reduction from the front, left edge, right edge and bottom edge.

D.3 DUT Setup Photos

Picture D.1

ANNEX E Equivalent Media Recipes

The liquid used for the frequency range of 800-3000 MHz consisted of water, sugar, salt, preventol, glycol monobutyl and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table E.1 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.

TableE.1: Composition of the Tissue Equivalent Matter

Frequency (MHz)	835Head	835Body	1900 Head	1900 Body	2450 Head	2450 Body	5800 Head	5800 Body
Ingredients (% by weight)								
Water	41.45	52.5	55.242	69.91	58.79	72.60	65.53	65.53
Sugar	56.0	45.0	\	\	\	\	\	\
Salt	1.45	1.4	0.306	0.13	0.06	0.18	\	\
Preventol	0.1	0.1	\	\	\	\	\	\
Cellulose	1.0	1.0	\	\	\	\	\	\
Glycol Monobutyl	\	\	44.452	29.96	41.15	27.22	\	\
Diethylenglycol monohexylether	\	\	\	\	\	\	17.24	17.24
Triton X-100	\	\	\	\	\	\	17.24	17.24
Dielectric Parameters Target Value	ε=41.5 σ=0.90	ε=55.2 σ=0.97	ε=40.0 σ=1.40	ε=53.3 σ=1.52	ε=39.2 σ=1.80	ε=52.7 σ=1.95	ε=35.3 σ=5.27	ε=48.2 σ=6.00

Note: There are a little adjustment respectively for 750, 1750, 2600, 5200, 5300 and 5600 based on the recipe of closest frequency in table E.1.

ANNEX F System Validation

The SAR system must be validated against its performance specifications before it is deployed. When SAR probes, system components or software are changed, upgraded or recalibrated, these must be validated with the SAR system(s) that operates with such components.

Table F.1: System ValidationFor 3846

Probe SN.	Liquid name	Validation date	Frequency point	Status (OK or Not)
3846	Head 750MHz	Jan.19,2017	750 MHz	OK
3846	Head 850MHz	Jan.19,2017	850 MHz	OK
3846	Head 900MHz	Jan.18,2017	900 MHz	OK
3846	Head 1750MHz	Jan.17,2017	1750 MHz	OK
3846	Head 1810MHz	Jan.17,2017	1810 MHz	OK
3846	Head 1900MHz	Jan.16,2017	1900 MHz	OK
3846	Head 1950MHz	Jan.16,2017	1950 MHz	OK
3846	Head 2000MHz	Jan.16,2017	2000 MHz	OK
3846	Head 2100MHz	Jan.16,2017	2100 MHz	OK
3846	Head 2300MHz	Jan.15,2017	2300 MHz	OK
3846	Head 2450MHz	Jan.15,2017	2450 MHz	OK
3846	Head 2550MHz	Jan.15,2017	2550 MHz	OK
3846	Head 2600MHz	Jan.15,2017	2600 MHz	OK
3846	Head 3500MHz	Jan.14,2017	3500 MHz	OK
3846	Head 3700MHz	Jan.14,2017	3700 MHz	OK
3846	Head 5200MHz	Jan.13,2017	5200 MHz	OK
3846	Head 5500MHz	Jan.13,2017	5500 MHz	OK
3846	Head 5800MHz	Jan.13,2017	5800 MHz	OK
3846	Body 750MHz	Jan.19,2017	750 MHz	OK
3846	Body 850MHz	Jan.19,2017	850 MHz	OK
3846	Body 900MHz	Jan.18,2017	900 MHz	OK
3846	Body 1750MHz	Jan.17,2017	1750 MHz	OK
3846	Body 1810MHz	Jan.17,2017	1810 MHz	OK
3846	Body 1900MHz	Jan.16,2017	1900 MHz	OK
3846	Body 1950MHz	Jan.16,2017	1950 MHz	OK
3846	Body 2000MHz	Jan.16,2017	2000 MHz	OK
3846	Body 2100MHz	Jan.16,2017	2100 MHz	OK
3846	Body 2300MHz	Jan.15,2017	2300 MHz	OK
3846	Body 2450MHz	Jan.15,2017	2450 MHz	OK
3846	Body 2550MHz	Jan.15,2017	2550 MHz	OK
3846	Body 2600MHz	Jan.15,2017	2600 MHz	OK
3846	Body 3500MHz	Jan.14,2017	3500 MHz	OK
3846	Body 3700MHz	Jan.14,2017	3700 MHz	OK
3846	Body 5200MHz	Jan.13,2017	5200 MHz	OK
3846	Body 5500MHz	Jan.13,2017	5500 MHz	OK
3846	Body 5800MHz	Jan.13,2017	5800 MHz	OK

ANNEX G Probe Calibration Certificate

Probe 3846 Calibration Certificate

In Collaboration with s p e a g CALIBRATION LABORATORY

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Client CTTL Certificate No: Z16-97251

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3846

Calibration Procedure(s): FD-Z11-004-01
Calibration Procedures for Dosimetric E-field Probes

Calibration date: January 13, 2017

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	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101548	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference10dBAttenuator	18N50W-10dB	13-Mar-16(CTTL,No.J16X01547)	Mar-18
Reference20dBAttenuator	18N50W-20dB	13-Mar-16(CTTL, No.J16X01548)	Mar-18
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG,No.EX3-7433_Sep16)	Sep-17
DAE4	SN 1331	21-Jan-16(SPEAG, No.DAE4-1331_Jan16)	Jan -17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	27-Jun-16 (CTTL, No.J16X04776)	Jun-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan -17

	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: January 14, 2017

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

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Glossary:

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

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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: 3846

Calibrated: January 13, 2017

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3846

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)²)[A]	0.39	0.47	0.47	±10.8%
DCP(mV)[B]	99.4	98.9	99.6	

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	175.0	±2.1%
		Y	0.0	0.0	1.0		188.3	
		Z	0.0	0.0	1.0		190.7	

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/EASY – Parameters of Probe: EX3DV4 – SN: 3846

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	9.65	9.65	9.65	0.30	0.70	±12%
900	41.5	0.97	9.33	9.33	9.33	0.16	1.27	±12%
1450	40.5	1.20	8.42	8.42	8.42	0.26	0.92	±12%
1750	40.1	1.37	8.16	8.16	8.16	0.22	1.09	±12%
1900	40.0	1.40	7.89	7.89	7.89	0.23	1.14	±12%
2100	39.8	1.49	7.90	7.90	7.90	0.20	1.18	±12%
2300	39.5	1.67	7.43	7.43	7.43	0.53	0.72	±12%
2450	39.2	1.80	7.22	7.22	7.22	0.43	0.87	±12%
2600	39.0	1.96	7.12	7.12	7.12	0.52	0.80	±12%
5250	35.9	4.71	5.37	5.37	5.37	0.45	1.15	±13%
5600	35.5	5.07	4.72	4.72	4.72	0.45	1.30	±13%
5750	35.4	5.22	4.95	4.95	4.95	0.45	1.40	±13%

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[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.