SAR TEST REPORT

No. I14Z49142-SEM03

For

TCT Mobile Limited

HSDPA/HSUPA/HSPA+/UMTS tri band /GSM quad band/LTE 6 band mobile phone

Model Name: VF-895N

With

Hardware Version: PIO

Software Version: 020FBN2

FCC ID: RAD543

Issued Date: 2015-03-04

TESTING
CNAS L0570

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.

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REPORT HISTORY

Report Number	Revision	Issue Date	Description
I14Z49142-SEM03	Rev.0	2015/02/04	Initial creation of test report
I14Z49142-SEM03	Rev.1	2015/02/16	1. Update the table 2.2 on page 7 and the table 13.1 on page 37 2. Add the plots of peak SAR distance in section 13 on page 37
I14Z49142-SEM03	Rev.2	2015/03/04	Add the conducted power of channel 12&13 for WLAN in section 11.5 on page 34

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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

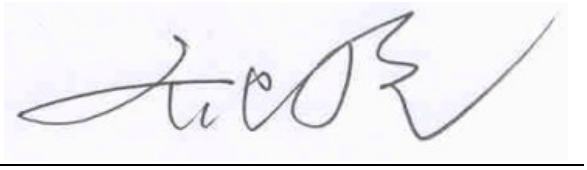
1.3 Project Data

Project Leader:	Qi Dianyuan
Test Engineer:	Lin Xiaojun
Testing Start Date:	January 9, 2015
Testing End Date:	January 14, 2015

1.4 Signature

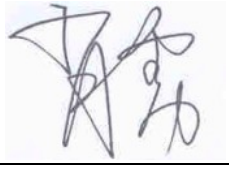
Lin Xiaojun

(Prepared this test report)



Qi Dianyuan

(Reviewed this test report)



Xiao Li

Deputy Director of the laboratory

(Approved this test report)

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2 Statement of Compliance

The maximum results of SAR found during testing for TCT Mobile Limited HSDPA/HSUPA/HSPA+/UMTS tri band /GSM quad band/LTE 6 band mobile phone VF-895N are as follows:

Table 2.1: Highest Reported SAR (1g)

Exposure Configuration	Technology Band	Highest Reported SAR 1g (W/Kg)	Equipment Class
Head (Separation Distance 0mm)	GSM 850	0.44	PCE
	PCS 1900	0.18	
	UMTS FDD 5	0.67	
	LTE Band 5	0.43	
	LTE Band 7	0.34	
	WLAN 2.4 GHz	0.80	DTS
Body-worn (Separation Distance 10mm)	GSM 850	1.16	PCE
	PCS 1900	1.03	
	UMTS FDD 5	0.71	
	LTE Band 5	0.59	
	LTE Band 7	1.52	
	WLAN 2.4 GHz	0.28	DTS

The SAR values found for the Mobile Phone are below the maximum recommended levels of 1.6 W/Kg as averaged over any 1g tissue according to the ANSI C95.1-1999.

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 10 mm 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**: 1.52 W/kg (1g).**

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

	Band	Position	Main antenna	WiFi	Sum	Distance (mm)	Ratio
Maximum reported SAR value for Head	GSM 850	Right hand, Touch cheek	0.44	0.54	**0.98**	/	**/**
	PCS 1900	Right hand, Touch cheek	0.18	0.54	**0.72**	/	**/**
	UMTS FDD 5	Right hand, Touch cheek	0.67	0.54	**1.21**	/	**/**
	LTE Band 5	Right hand, Touch cheek	0.43	0.54	**0.97**	/	**/**
	LTE Band 7	Left hand, Touch cheek	0.34	0.80	**1.14**	/	**/**
	WLAN 2.4 GHz	Left hand, Touch cheek	0.64	0.80	**1.44**	/	**/**
Maximum reported SAR value for Body	GSM 850	Rear	1.16	0.28	**1.44**	/	**/**
	PCS 1900	Front	1.03	0.26	**1.29**	/	**/**
	UMTS FDD 5	Rear	0.71	0.28	**0.99**	/	**/**
	LTE Band 5	Rear	0.59	0.28	**0.87**	/	**/**
	LTE Band 7	Rear	1.52	0.28	**1.80**[1]	103	**0.02**
	WLAN 2.4 GHz	Rear	1.52	0.28	**1.80**[1]	103	**0.02**

[1] – According to the KDB 447498 D01, when the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The ratio is determined by $(SAR1 + SAR2)^{1.5}/Ri$, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

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	Right hand, Touch cheek	0.67	0.13[2]	**0.80**
Maximum reported SAR value for Body	Rear	1.52	0.07[2]	**1.59**

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

According to the above tables, the highest sum of reported SAR values is **1.80 W/kg (1g)**. The detail for simultaneous transmission consideration is described in chapter 13.

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3 Client Information

3.1 Applicant Information

Company Name:	TCT Mobile Limited
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3.2 Manufacturer Information

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Fax:	0086-21-61460602

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

4.1 About EUT

Description:	HSDPA/HSUPA/HSPA+/UMTS tri band /GSM quad band/LTE 6 band mobile phone
Model name:	VF-895N
Operating mode(s):	GSM 850/900/1800/1900, WCDMA 850/900/2100, BT, Wi-Fi, LTE Band 1/3/5/7/8/20
Tested Tx Frequency:	825 – 848.8 MHz (GSM 850)
	1850.2 – 1910 MHz (GSM 1900)
	826.4–846.6 MHz (WCDMA850 Band V)
	829 – 844 MHz (LTE Band 5)
	2502.5 – 2567.5 MHz (LTE Band 7)
	2412 – 2462 MHz (Wi-Fi 2.4G)
GPRS/EGPRS Multislot Class:	33
GPRS capability Class:	B
Test device Production information:	Production unit
Device type:	Portable device
Antenna type:	Integrated antenna
Hotspot mode:	Support simultaneous transmission of hotspot and voice(or data)
Form factor:	141.65 mm × 71.9 mm

4.2 Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version
EUT1	356907060005630	PIO	020FBN2
EUT2	356907060005200	PIO	020FBN2
EUT3	356907060008535	PIO	020FBN2

*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 EUT 3.

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	TLp025A2	/	SCUD
AE2	Headset	CCB0009A16C1	/	JUWEI
AE3	Headset	CCB0009A16C4	/	Meihao

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

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5 TEST METHODOLOGY

5.1 Applicable Limit Regulations

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

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

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: Experimental Techniques.

KDB447498 D01: General RF Exposure Guidance v05r02: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

KDB648474 D04 Handset SAR v01r02: SAR Evaluation Considerations for Wireless Handsets.

KDB941225 D01 SAR test for 3G devices v03: SAR Measurement Procedures for 3G Devices

KDB941225 D05 SAR for LTE Devices v02r03: SAR Evaluation Considerations for LTE Devices

KDB941225 D06 Hotspot Mode SAR v02: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

KDB248227: SAR measurement procedures for 802.112abg transmitters

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

KDB 865664 D02 RF Exposure Reporting v01r01: RF Exposure Compliance Reporting and Documentation Considerations

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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.

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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
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	37.06～40.96
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 (%)
2015-01-14	Head	835 MHz	42.57	2.58	0.922	2.44
	Body	835 MHz	53.99	-2.19	0.985	1.55
2015-01-09	Head	1900 MHz	40.05	0.13	1.382	-1.29
	Body	1900 MHz	54.06	1.43	1.508	-0.79
2015-01-11	Head	2450 MHz	38.38	-2.09	1.833	1.83
	Body	2450 MHz	51.82	-1.67	2.009	3.03
2015-01-10	Head	2600 MHz	37.72	-3.31	1.99	1.53
	Body	2600 MHz	50.64	-3.54	2.218	2.69

Note: The liquid temperature is 22.0 °C

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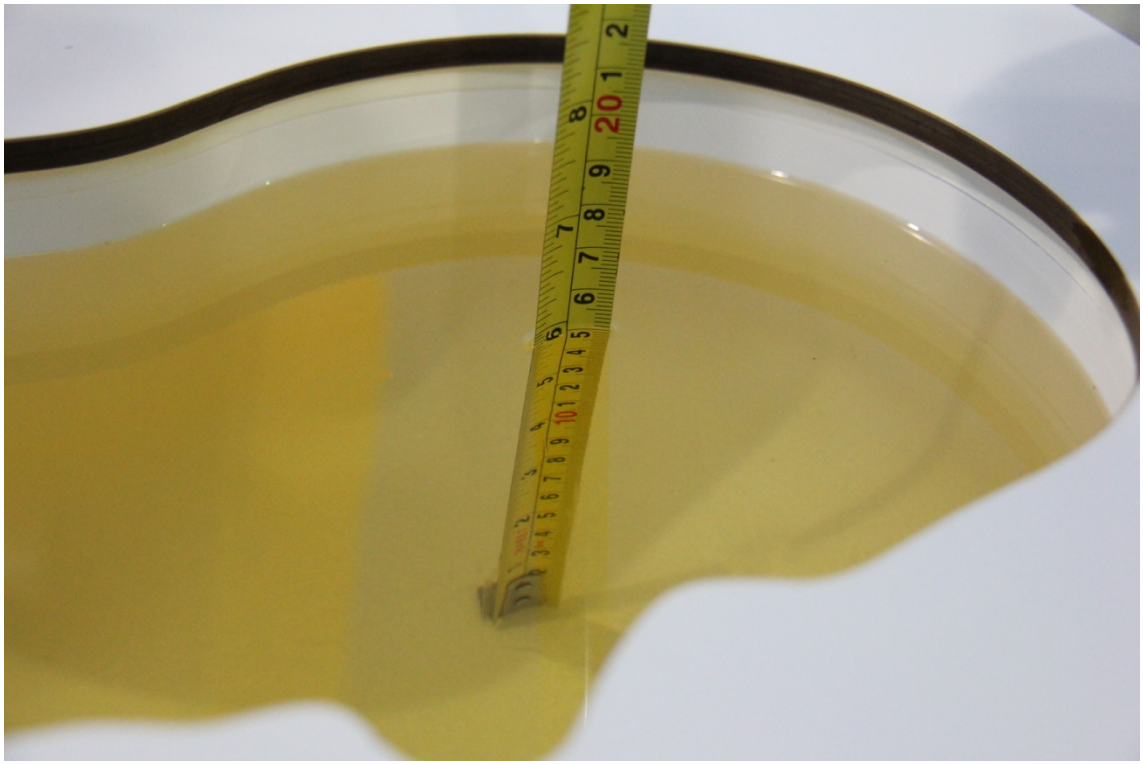
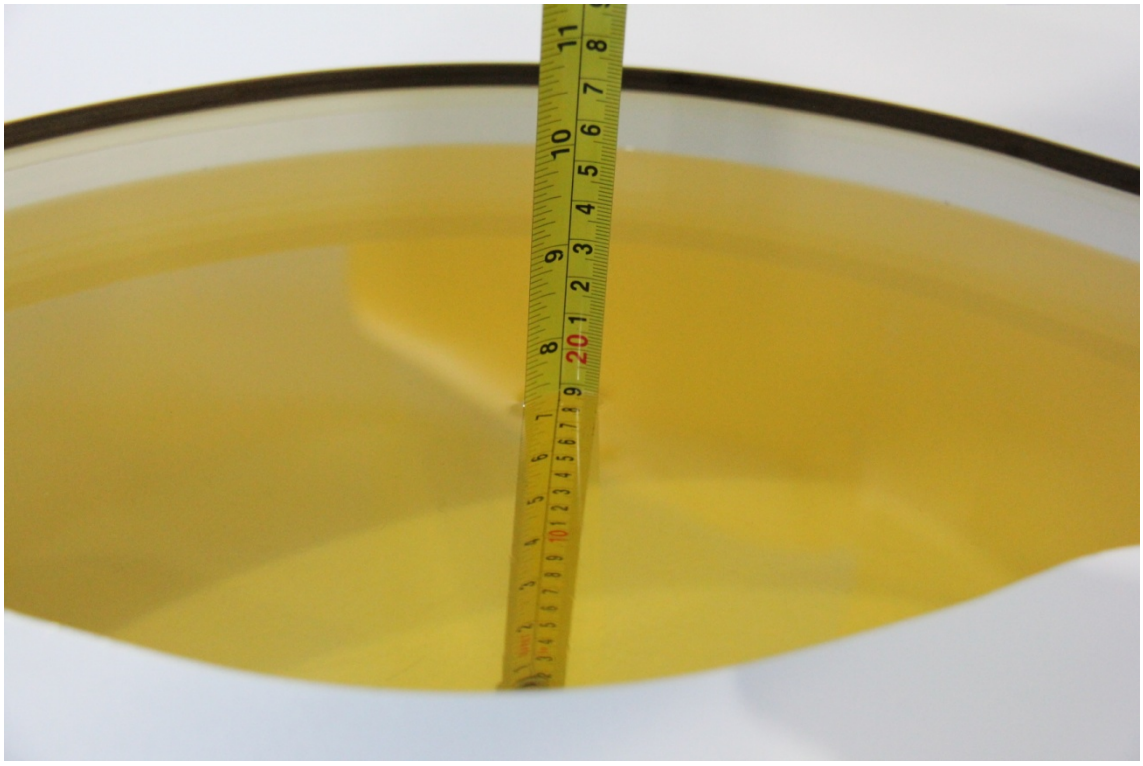


Picture 7-1 Liquid depth in the Head Phantom (835 MHz)



Picture 7-2 Liquid depth in the Flat Phantom (835 MHz)

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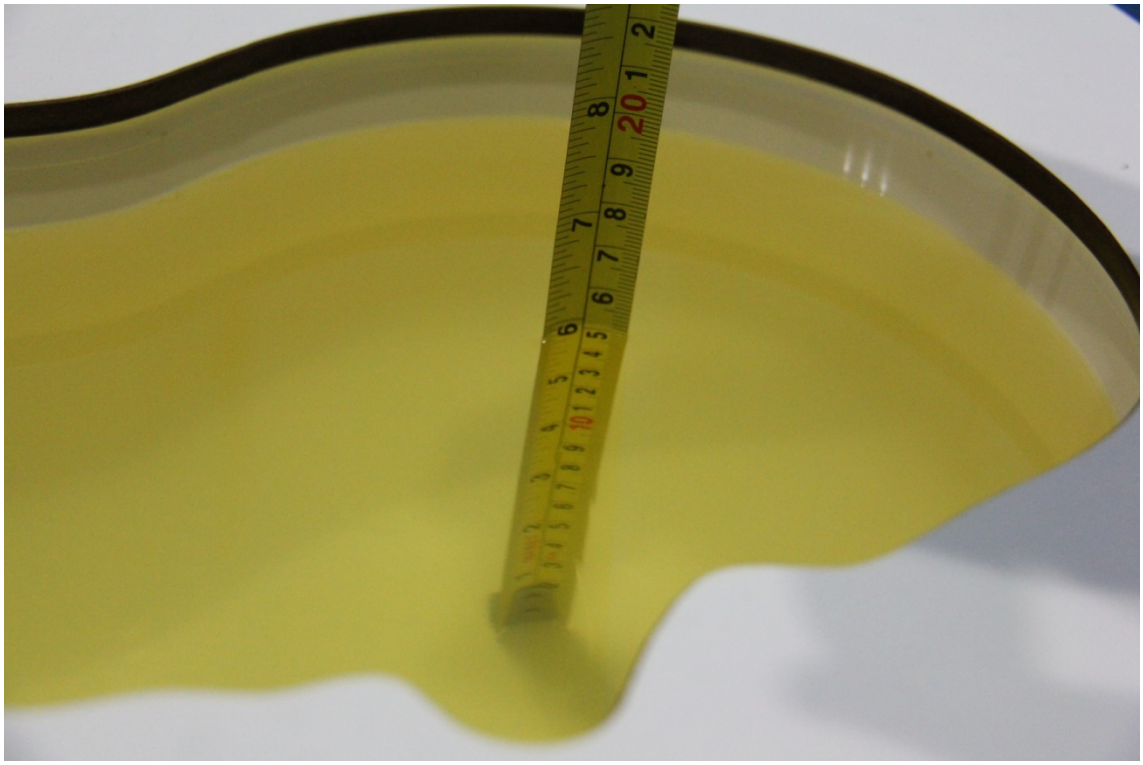
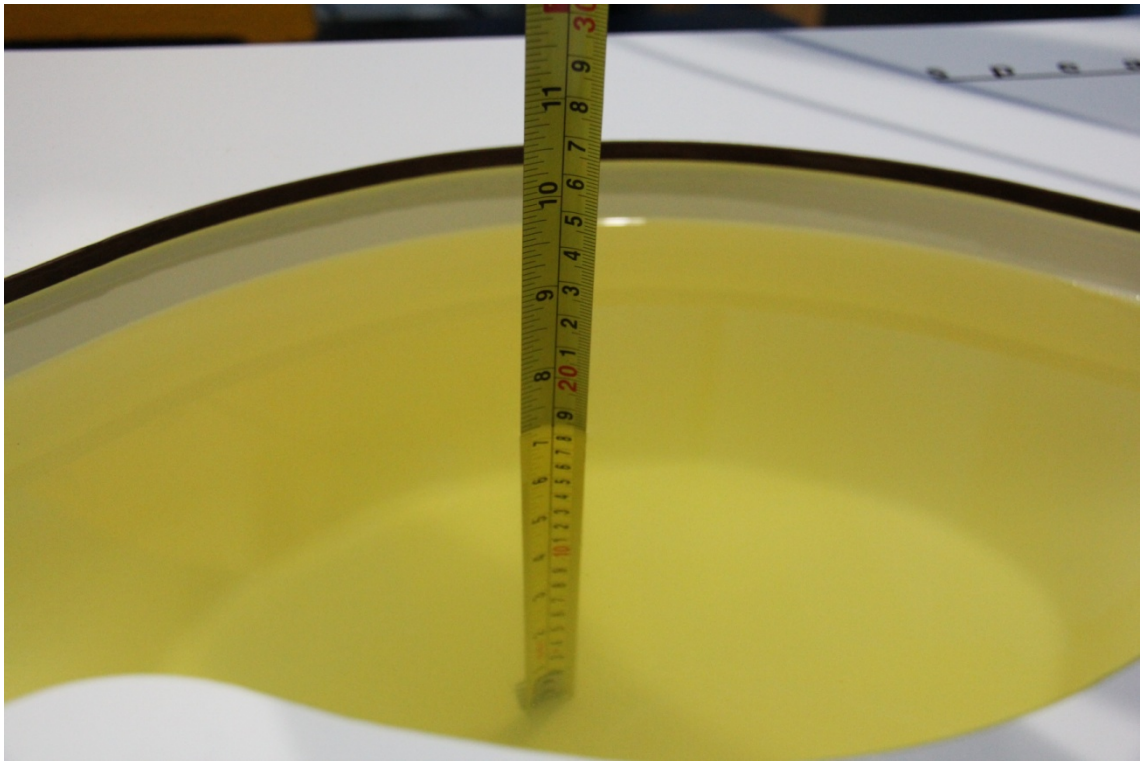


Picture 7-3 Liquid depth in the Head Phantom (1900 MHz)



Picture 7-4 Liquid depth in the Flat Phantom (1900MHz)

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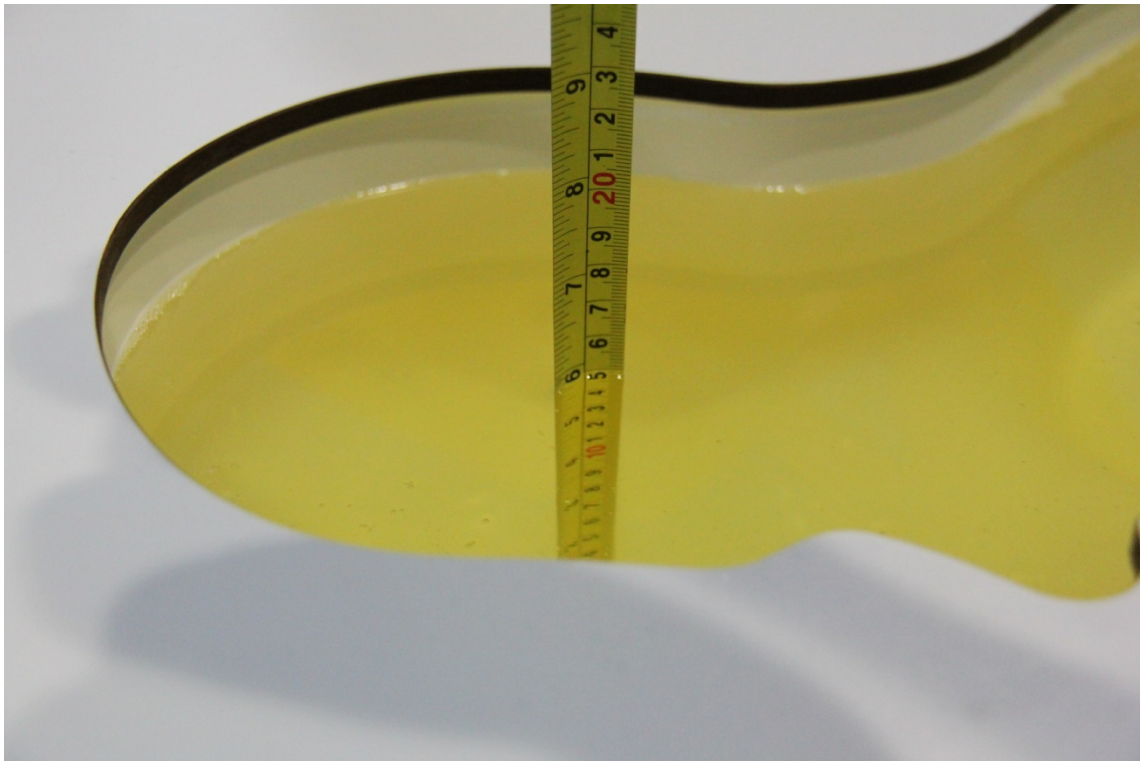
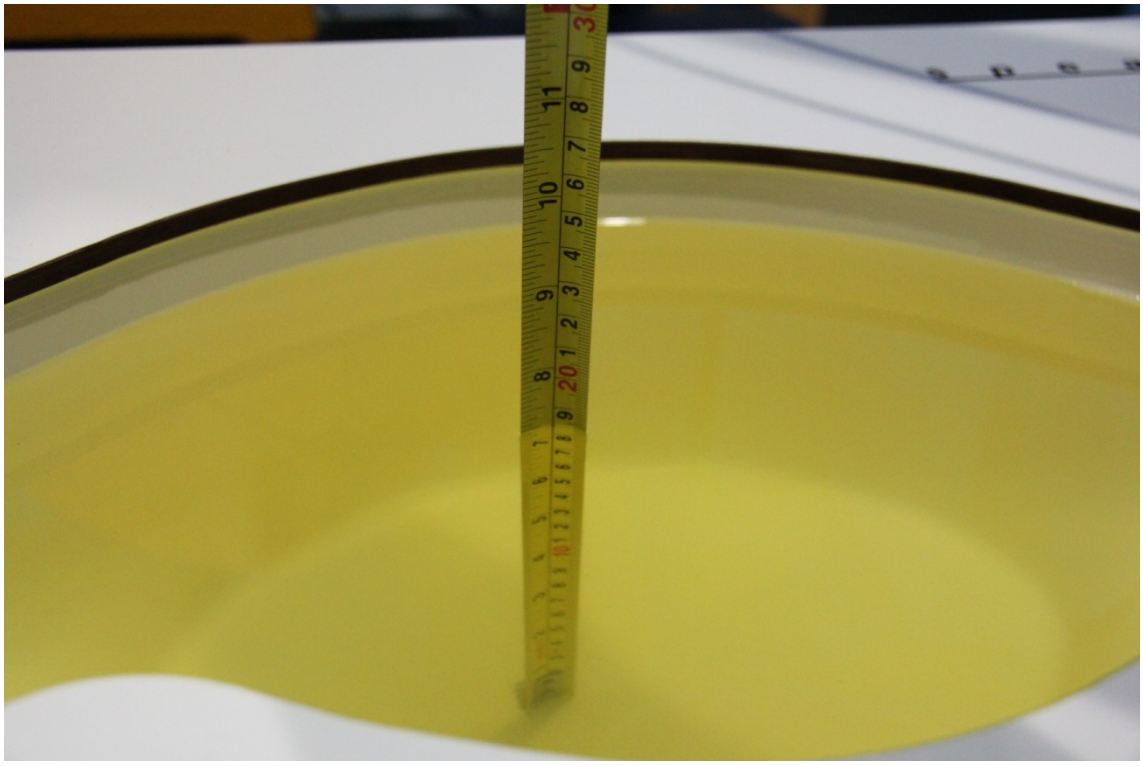


Picture 7-5 Liquid depth in the Head Phantom (2450MHz)



Picture 7-6 Liquid depth in the Flat Phantom (2450MHz)

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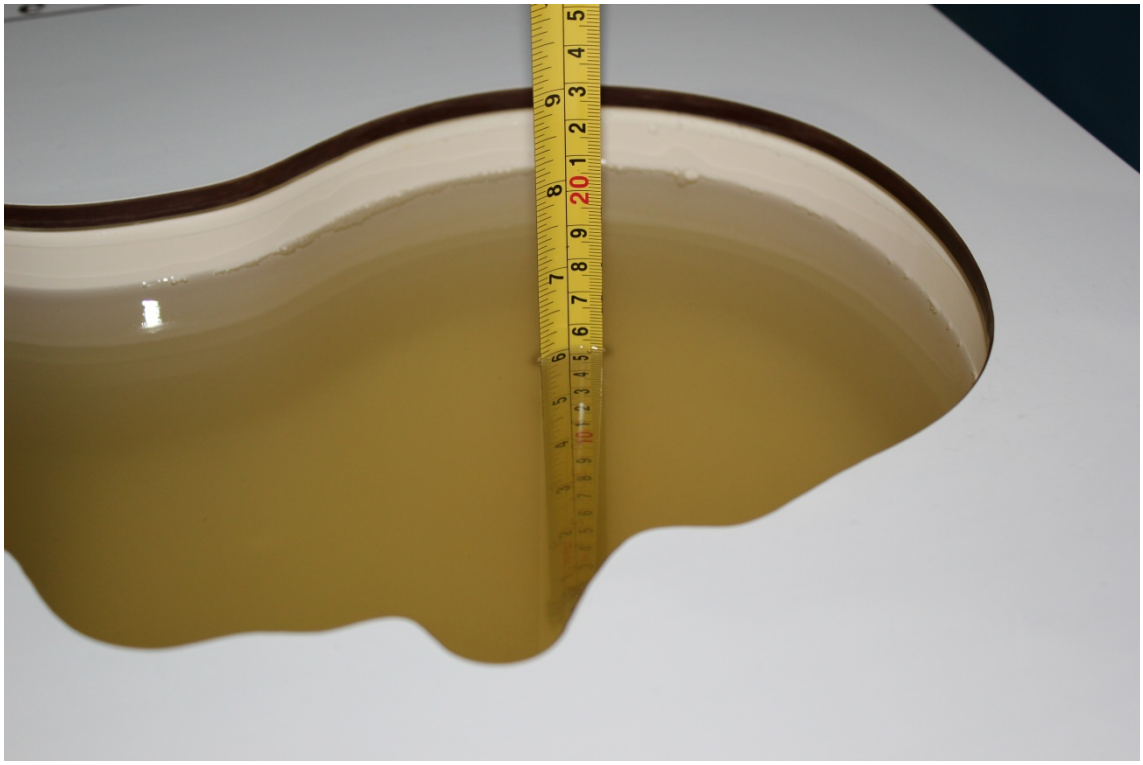
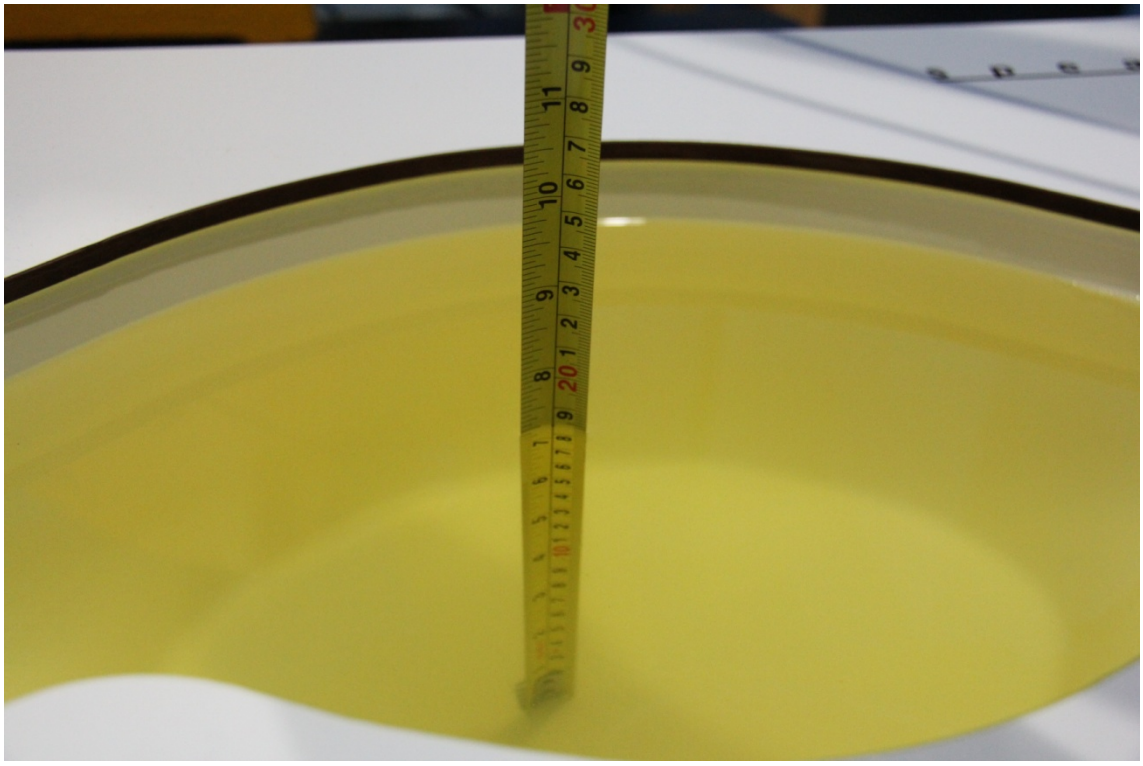


Picture 7-7 Liquid depth in the Head Phantom (2600 MHz Head)



Picture 7-8 Liquid depth in the Flat Phantom (2600MHz)

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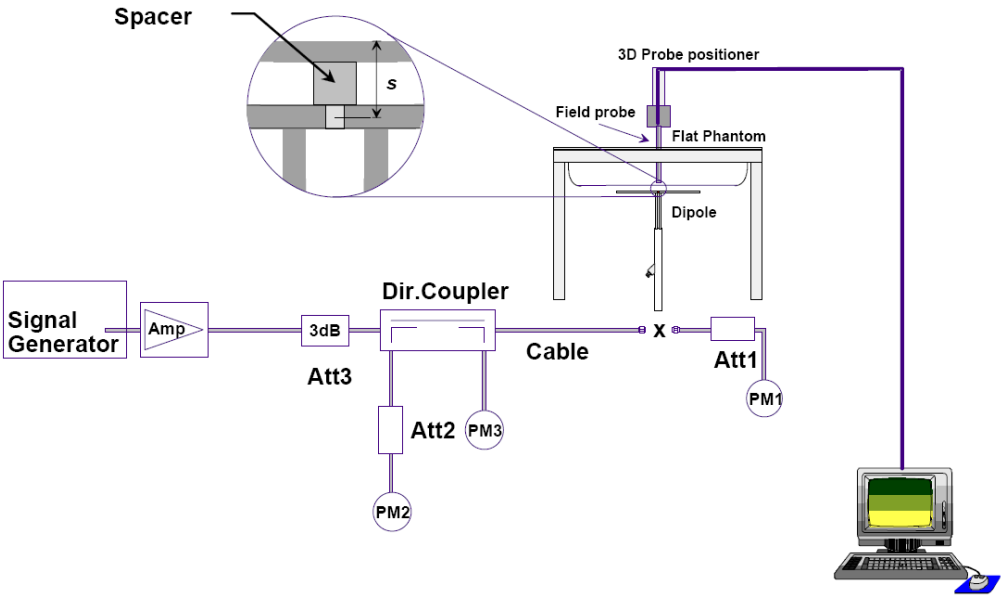
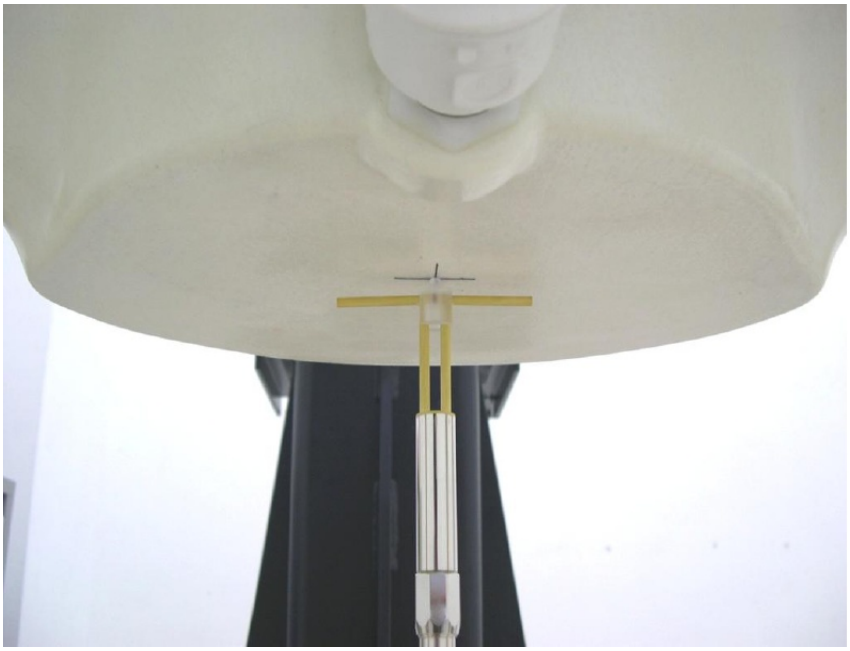
8 System verification

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

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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
2015-01-14	835 MHz	6.17	9.43	6.40	9.80	3.73%	3.92%
2015-01-09	1900 MHz	21.1	40.6	20.4	38.8	-3.32%	-4.43%
2015-01-11	2450 MHz	24.7	53.2	24.44	52.40	-1.05%	-1.50%
2015-01-10	2600 MHz	25.9	57.8	25.28	56.00	-2.39%	-3.11%

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
2015-01-14	835 MHz	6.33	9.55	6.24	9.52	-1.42%	-0.31%
2015-01-09	1900 MHz	21.4	40.4	21.2	40.4	-0.93%	0%
2015-01-11	2450 MHz	23.9	51.3	23.60	50.00	-1.26%	-2.53%
2015-01-10	2600 MHz	25.4	57.2	25.84	58.00	1.73%	1.40%

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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 within 3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

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

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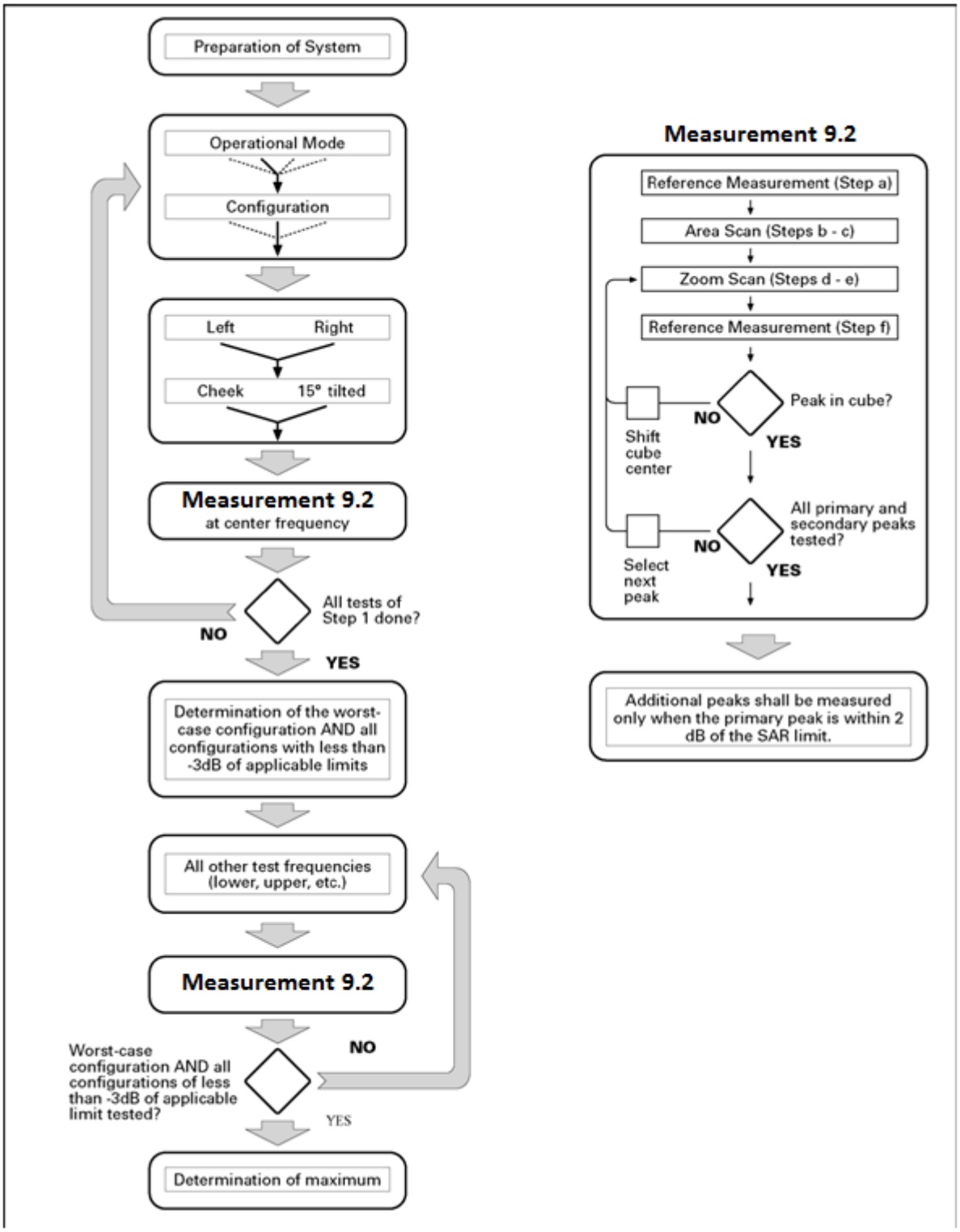

Picture 9.1 Block diagram of the tests to be performed

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

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

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

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

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

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

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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	3.0	3.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	3.0	3.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	3.0	3.0	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	3.0	3.0	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	2.0	2.0	21	81

9.4 SAR Measurement for LTE

SAR tests for LTE are performed with a base station simulator, Rohde & Rchwarz CMW500. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. All powers were measured with the CMW 500.

It is performed for conducted power and SAR based on the KDB941225 D05.

SAR is evaluated separately according to the following procedures for the different test positions in each exposure condition – head, body, body-worn accessories and other use conditions. The procedures in the following subsections are applied separately to test each LTE frequency band.

1) QPSK with 1 RB allocation

   Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output

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power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

2) QPSK with 50% RB allocation
The procedures required for 1 RB allocation in 1) are applied to measure the SAR for QPSK with 50% RB allocation.

3) QPSK with 100% RB allocation
For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 1) and 2) are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

9.5 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 Table 14.2 to Table 14.25 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

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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-g SAR is ≤ 1.2 W/kg, a zoom scan measurement is not required provided it is also not needed for any other purpose; for example, if the peak SAR location required for simultaneous transmission SAR test exclusion can be determined accurately by the SAR system or manually to discriminate between distinctive peaks and scattered noisy SAR distributions from area scans.

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

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 55 wireless handsets. For the sample size studied, the root-mean-squared errors of the algorithm are 1.2% and 5.8% for 1- and 10-g averaged SAR, respectively. 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.

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11 Conducted Output Power

11.1 Manufacturing tolerance

Table 11.1: GSM Speech

GSM 850			
Channel	Channel 251	Channel 190	Channel 128
Target (dBm)	32.5	32.5	32.5
Tune-up (dBm)	33.5	33.5	33.5
GSM 1900			
Channel	Channel 810	Channel 661	Channel 512
Target (dBm)	29.5	29.5	29.5
Tune-up (dBm)	30.5	30.5	30.5

Table 11.2: GPRS and EGPRS

GSM 850 GPRS (GMSK)				
Channel		**251**	**190**	**128**
1 Txslot	Target (dBm)	32.5	32.5	32.5
	Tune-up (dBm)	33.5	33.5	33.5
2 Txslots	Target (dBm)	31.2	31.2	31.2
	Tune-up (dBm)	32.2	32.2	32.2
3 Txslots	Target (dBm)	29.4	29.4	29.4
	Tune-up (dBm)	30.4	30.4	30.4
4 Txslots	Target (dBm)	28.2	28.2	28.2
	Tune-up (dBm)	29.2	29.2	29.2
GSM 850 EGPRS (GMSK)				
Channel		**251**	**190**	**128**
1 Txslot	Target (dBm)	32.5	32.5	32.5
	Tune-up (dBm)	33.5	33.5	33.5
2 Txslots	Target (dBm)	31.2	31.2	31.2
	Tune-up (dBm)	32.2	32.2	32.2
3 Txslots	Target (dBm)	29.4	29.4	29.4
	Tune-up (dBm)	30.4	30.4	30.4
4 Txslots	Target (dBm)	28.2	28.2	28.2
	Tune-up (dBm)	29.2	29.2	29.2
GSM 1900 GPRS (GMSK)				
Channel		**810**	**661**	**512**
1 Txslot	Target (dBm)	28.5	28.5	28.5
	Tune-up (dBm)	29.5	29.5	29.5
2 Txslots	Target (dBm)	28	28	28
	Tune-up (dBm)	29	29	29
3 Txslots	Target (dBm)	26.5	26.5	26.5
	Tune-up (dBm)	27.5	27.5	27.5

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4 Txslots	Target (dBm)	25.5	25.5	25.5
	Tune-up (dBm)	26.5	26.5	26.5
GSM 1900 EGPRS (GMSK)				
Channel		**810**	**661**	**512**
1 Txslot	Target (dBm)	28.5	28.5	28.5
	Tune-up (dBm)	29.5	29.5	29.5
2 Txslots	Target (dBm)	28	28	28
	Tune-up (dBm)	29	29	29
3 Txslots	Target (dBm)	26.5	26.5	26.5
	Tune-up (dBm)	27.5	27.5	27.5
4 Txslots	Target (dBm)	25.5	25.5	25.5
	Tune-up (dBm)	26.5	26.5	26.5

Table 11.3: WCDMA

WCDMA 850 CS			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	23	23	23
Tune-up (dBm)	24	24	24
HSUPA (sub-test 1)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21.6	21.6	21.4
Tune-up (dBm)	22.62	22.25	22.79
HSUPA (sub-test 2)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21	21	21
Tune-up (dBm)	21.73	21.67	21.93
HSUPA (sub-test 3)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	20.7	20.8	20.6
Tune-up (dBm)	22.04	22.12	22.43
HSUPA (sub-test 4)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21.1	21	21
Tune-up (dBm)	22.07	21.83	22.24
HSUPA (sub-test 5)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21.8	21.9	21.9
Tune-up (dBm)	23.36	23.29	23.62
DC-HSDPA (sub-test 1)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21.12	21.25	21.14
Tune-up (dBm)	23.12	23.25	23.14

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DC-HSDPA (sub-test 2)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21.09	21.22	21.13
Tune-up (dBm)	23.09	23.22	23.13
DC-HSDPA (sub-test 3)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21.13	21.21	21.13
Tune-up (dBm)	23.13	23.21	23.13
DC-HSDPA (sub-test 4)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21.11	21.22	21.12
Tune-up (dBm)	23.11	23.22	23.12

Table 11.4: LTE

Mode	Target (dBm)	Tune-up (dBm)
LTE Band 5	23	24
LTE Band 7	21.5	22.5

LTE MPR will follow up 3GPP setting as below:

Modulation	Channel bandwidth / Transmission bandwidth (NRB)						MPR (dB)
	1.4MHz	3.0MHz	5MHz	10MHz	15MHz	20MHz	
QPSK	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	0
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	2

Table 11.5: Bluetooth

Bluetooth			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	1.5	3.5	2.5
Tune-up (dBm)	3	5	4

Table 11.6: WiFi

Mode	Target (dBm)	Tune-up (dBm)
802.11b channel 1/6/11	16	18
802.11b channel 12/13	9	11
802.11g 6Mbps~24Mbps channel 1/6/11	10	12
802.11g 6Mbps~24Mbps channel 12/13	4	6
802.11g 36Mbps~54Mbps channel 1/6/11	9	11
802.11g 36Mbps~54Mbps channel 12/13	3	5
802.11n MCS0~MCS3 channel 1/6/11	8	10
802.11n MCS0~MCS3 channel 12/13	2	5
802.11n MCS4~MCS7 channel 1/6/11	7	9
802.11n MCS4~MCS7 channel 12/13	0	2

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11.2 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.

Table 11.7: The conducted power measurement results for GSM850/1900

GSM 850MHz	Conducted Power (dBm)		
	Channel 251(848.8MHz)	Channel 190(836.6MHz)	Channel 128(824.2MHz)
	32.90	32.77	33.15
GSM 1900MHz	Conducted Power (dBm)		
	Channel 810(1909.8MHz)	Channel 661(1880MHz)	Channel 512(1850.2MHz)
	29.41	29.54	29.30

Table 11.8: The conducted power measurement results for GPRS and EGPRS

GSM 850 GPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	251	**190**	**128**		**251**	**190**	**128**
1 Txslot	32.97	32.70	33.14	-9.03dB	23.94	23.67	24.11
2 Txslots	31.13	31.24	31.35	-6.02dB	25.11	25.22	25.33
3Txslots	29.57	29.39	29.50	-4.26dB	25.31	25.13	25.24
4 Txslots	28.45	28.30	28.41	-3.01dB	**25.44**	**25.29**	**25.40**
GSM 850 EGPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	251	**190**	**128**		**251**	**190**	**128**
1 Txslot	32.71	33.05	33.10	-9.03dB	23.68	24.02	24.07
2 Txslots	30.84	31.12	31.26	-6.02dB	24.82	25.10	25.24
3Txslots	29.50	29.35	29.46	-4.26dB	25.24	25.09	25.20
4 Txslots	28.38	28.22	28.39	-3.01dB	**25.37**	**25.21**	**25.38**
PCS1900 GPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	810	**661**	**512**		**810**	**661**	**512**
1 Txslot	28.83	28.81	28.58	-9.03dB	19.80	19.78	19.55
2 Txslots	27.77	27.38	27.52	-6.02dB	21.75	21.36	21.50
3Txslots	25.97	25.93	25.82	-4.26dB	21.71	21.67	21.56
4 Txslots	24.98	24.91	24.74	-3.01dB	**21.97**	**21.90**	**21.73**
PCS1900 EGPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	810	**661**	**512**		**810**	**661**	**512**
1 Txslot	28.50	28.78	28.52	-9.03dB	19.47	19.75	19.49
2 Txslots	27.45	27.42	27.48	-6.02dB	21.43	21.40	21.46
3Txslots	25.73	25.99	25.77	-4.26dB	21.47	21.73	21.51
4 Txslots	24.81	24.90	24.87	-3.01dB	**21.80**	**21.89**	**21.86**

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

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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 GSM1900.
Note: According to the KDB941225 D03, "when SAR tests for EDGE or EGPRS mode is necessary, GMSK modulation should be used".

11.3 WCDMA Measurement result

Table 11.9: The conducted Power for WCDMA

Item	band	FDDV result		
	ARFCN	4233 (846.6MHz)	4182 (836.4MHz)	4132 (826.4MHz)
WCDMA	\	22.76	22.83	22.75
HSUPA	1	20.62	20.25	20.79
	2	19.73	19.67	19.93
	3	20.04	20.12	20.43
	4	20.07	19.83	20.24
	5	21.36	21.29	21.62
DC-HSDPA	1	21.12	21.25	21.14
	2	21.09	21.22	21.13
	3	21.13	21.21	21.13
	4	21.11	21.22	21.12

11.4 LTE Measurement result

Table 11.10: The conducted Power for LTE

Band 5							
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Max. Target Power (dBm)	QPSK		16QAM	
	RB offset (Start RB)			Actual output power (dBm)	MPR	Actual output power (dBm)	MPR
1.4 MHz	1RB High (5)	848.3	24	22.52	0	21.51	1
		836.5	24	22.77	0	21.82	1
		824.7	24	22.66	0	21.58	1
	1RB Middle (3)	848.3	24	22.46	0	21.34	1
		836.5	24	23.02	0	22.17	1
		824.7	24	22.81	0	22.22	1
	1RB Low (0)	848.3	24	22.75	0	21.50	1
		836.5	24	23.05	0	22.02	1
		824.7	24	22.89	0	22.02	1
	3RB High (3)	848.3	24	22.59	0	21.55	1
		836.5	24	22.76	0	21.91	1
		824.7	24	22.67	0	21.70	1

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	3RB Middle (1)	848.3	24	22.42	0	21.44	1
		836.5	24	22.99	0	22.19	1
		824.7	24	22.80	0	22.18	1
	3RB Low (0)	848.3	24	22.67	0	21.49	1
		836.5	24	23.13	0	21.98	1
		824.7	24	22.88	0	21.87	1
	6RB (0)	848.3	24	21.62	1	20.65	2
		836.5	24	21.76	1	20.73	2
		824.7	24	21.99	1	20.93	2
3 MHz	1RB High (14)	847.5	24	22.54	0	21.51	1
		836.5	24	22.86	0	21.79	1
		825.5	24	22.64	0	21.65	1
	1RB Middle (7)	847.5	24	22.47	0	21.46	1
		836.5	24	23.08	0	22.14	1
		825.5	24	22.88	0	22.22	1
	1RB Low (0)	847.5	24	22.75	0	21.46	1
		836.5	24	23.04	0	21.98	1
		825.5	24	22.94	0	21.98	1
	8RB High (7)	847.5	24	21.67	1	20.99	2
		836.5	24	21.87	1	20.80	2
		825.5	24	21.85	1	20.75	2
	8RB Middle (4)	847.5	24	21.72	1	21.04	2
		836.5	24	21.81	1	20.81	2
		825.5	24	22.02	1	20.74	2
	8RB Low (0)	847.5	24	21.90	1	21.05	2
		836.5	24	21.92	1	20.81	2
		825.5	24	22.02	1	20.86	2
	15RB (0)	847.5	24	21.73	1	20.65	2
		836.5	24	21.84	1	20.70	2
		825.5	24	21.95	1	20.97	2
5 MHz	1RB High (24)	846.5	24	22.58	0	21.59	1
		836.5	24	22.86	0	21.80	1
		826.5	24	22.66	0	21.69	1
	1RB Middle (12)	846.5	24	22.56	0	21.40	1
		836.5	24	23.00	0	22.08	1
		826.5	24	22.87	0	22.19	1
	1RB Low (0)	846.5	24	22.80	0	21.43	1
		836.5	24	23.13	0	21.98	1
		826.5	24	22.94	0	21.90	1
	12RB High (13)	846.5	24	21.59	1	21.05	2
		836.5	24	21.87	1	20.77	2
		826.5	24	21.84	1	20.77	2

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	12RB Middle (6)	846.5	24	21.69	1	20.98	2
		836.5	24	21.93	1	20.73	2
		826.5	24	22.02	1	20.76	2
	12RB Low (0)	846.5	24	21.87	1	21.06	2
		836.5	24	21.85	1	20.84	2
		826.5	24	22.05	1	20.88	2
	25RB (0)	846.5	24	21.71	1	20.63	2
		836.5	24	21.79	1	20.70	2
		826.5	24	21.95	1	20.97	2
10 MHz	1RB High (49)	844.0	24	22.60	0	21.56	1
		836.5	24	22.86	0	21.86	1
		829.0	24	22.71	0	21.68	1
	1RB Middle (24)	844.0	24	22.53	0	21.43	1
		836.5	24	23.07	0	22.14	1
		829.0	24	22.85	0	22.20	1
	1RB Low (0)	844.0	24	22.75	0	21.45	1
		836.5	24	23.10	0	21.96	1
		829.0	24	22.95	0	21.97	1
	25RB High (25)	844.0	24	21.66	1	21.01	2
		836.5	24	21.84	1	20.78	2
		829.0	24	21.87	1	20.78	2
	25RB Middle (12)	844.0	24	21.69	1	21.05	2
		836.5	24	21.88	1	20.80	2
		829.0	24	22.08	1	20.79	2
	25RB Low (0)	844.0	24	21.89	1	21.07	2
		836.5	24	21.91	1	20.82	2
		829.0	24	22.01	1	20.87	2
	50RB (0)	844.0	24	21.72	1	20.69	2
		836.5	24	21.80	1	20.75	2
		829.0	24	21.97	1	20.96	2

Band 7

Bandwidth (MHz)	RB allocation / RB offset (Start RB)	Frequency (MHz)	Max. Target Power (dBm)	QPSK		16QAM	
				Actual output power (dBm)	MPR	Actual output power (dBm)	MPR
5 MHz	1RB High (24)	2567.5	22.5	21.73	0	20.62	1
		2535	22.5	21.84	0	20.79	1
		2502.5	22.5	21.75	0	21.04	1
	1RB Middle (12)	2567.5	22.5	21.96	0	20.82	1
		2535	22.5	21.84	0	20.76	1
		2502.5	22.5	21.79	0	21.22	1
	1RB Low (0)	2567.5	22.5	21.82	0	20.79	1
		2535	22.5	22.06	0	20.61	1
		2502.5	22.5	21.80	0	21.12	1

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	12RB High (13)	2567.5	22.5	20.35	1	19.56	2
		2535	22.5	20.72	1	19.60	2
		2502.5	22.5	20.81	1	19.68	2
	12RB Middle (6)	2567.5	22.5	20.58	1	19.81	2
		2535	22.5	20.96	1	19.86	2
		2502.5	22.5	20.80	1	19.86	2
	12RB Low (0)	2567.5	22.5	20.77	1	19.89	2
		2535	22.5	20.92	1	20.00	2
		2502.5	22.5	20.83	1	19.83	2
	25RB (0)	2567.5	22.5	20.72	1	19.77	2
		2535	22.5	20.81	1	19.86	2
		2502.5	22.5	20.77	1	19.75	2
10 MHz	1RB High (49)	2565	22.5	21.74	0	20.64	1
		2535	22.5	21.80	0	20.78	1
		2505	22.5	21.71	0	21.07	1
	1RB Middle (24)	2565	22.5	21.84	0	20.86	1
		2535	22.5	21.85	0	20.70	1
		2505	22.5	21.90	0	21.12	1
	1RB Low (0)	2565	22.5	21.83	0	20.76	1
		2535	22.5	22.03	0	20.67	1
		2505	22.5	21.88	0	21.13	1
	25RB High (25)	2565	22.5	20.47	1	19.60	2
		2535	22.5	20.69	1	19.67	2
		2505	22.5	20.75	1	19.67	2
	25RB Middle (12)	2565	22.5	20.49	1	19.87	2
		2535	22.5	20.91	1	19.84	2
		2505	22.5	20.76	1	19.86	2
	25RB Low (0)	2565	22.5	20.79	1	19.88	2
		2535	22.5	20.88	1	19.99	2
		2505	22.5	20.80	1	19.84	2
	50RB (0)	2565	22.5	20.67	1	19.77	2
		2535	22.5	20.89	1	19.86	2
		2505	22.5	20.73	1	19.76	2
15 MHz	1RB High (74)	2562.5	22.5	21.72	0	20.59	1
		2535	22.5	21.87	0	20.79	1
		2507.5	22.5	21.75	0	21.05	1
	1RB Middle (37)	2562.5	22.5	21.97	0	20.86	1
		2535	22.5	21.82	0	20.76	1
		2507.5	22.5	21.90	0	21.13	1
	1RB Low (0)	2562.5	22.5	21.83	0	20.80	1
		2535	22.5	22.04	0	20.66	1
		2507.5	22.5	21.85	0	21.16	1

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	36RB High (38)	2562.5	22.5	20.39	1	19.61	2
		2535	22.5	20.64	1	19.63	2
		2507.5	22.5	20.76	1	19.65	2
	36RB Middle (19)	2562.5	22.5	20.53	1	19.84	2
		2535	22.5	20.95	1	19.81	2
		2507.5	22.5	20.75	1	19.82	2
	36RB Low (0)	2562.5	22.5	20.80	1	19.93	2
		2535	22.5	20.89	1	20.01	2
		2507.5	22.5	20.75	1	19.79	2
	75RB (0)	2562.5	22.5	20.63	1	19.73	2
		2535	22.5	20.92	1	19.85	2
		2507.5	22.5	20.73	1	19.75	2
20 MHz	1RB High (99)	2560	22.5	21.79	0	20.64	1
		2535	22.5	21.85	0	20.78	1
		2510	22.5	21.78	0	21.06	1
	1RB Middle (50)	2560	22.5	21.92	0	20.82	1
		2535	22.5	21.87	0	20.74	1
		2510	22.5	21.86	0	21.19	1
	1RB Low (0)	2560	22.5	21.85	0	20.81	1
		2535	22.5	22.14	0	20.65	1
		2510	22.5	21.85	0	21.14	1
	50RB High (50)	2560	22.5	20.43	1	19.60	2
		2535	22.5	20.72	1	19.66	2
		2510	22.5	20.79	1	19.70	2
	50RB Middle (25)	2560	22.5	20.57	1	19.84	2
		2535	22.5	20.91	1	19.84	2
		2510	22.5	20.81	1	19.83	2
	50RB Low (0)	2560	22.5	20.79	1	19.95	2
		2535	22.5	20.95	1	20.01	2
		2510	22.5	20.80	1	19.81	2
	100RB (0)	2560	22.5	20.69	1	19.76	2
		2535	22.5	20.88	1	19.84	2
		2510	22.5	20.78	1	19.81	2

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11.5 Wi-Fi and BT Measurement result

The output power of BT antenna is as following:

Mode	Conducted Power (dBm)		
	Channel 0 (2402MHz)	Channel 39 (2441MHz)	Channel 78 (2480MHz)
GFSK	1.86	4.21	3.30

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

802.11b (dBm)

Channel\data rate	1Mbps	2Mbps	5.5Mbps	11Mbps
1	16.07	/	/	/
6	17.05	16.89	16.87	16.51
11	16.11	/	/	/
12	9.76	/	/	/
13	9.96	/	/	/

802.11g (dBm)

Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
1	10.82	/	/	/	/	/	/	/
6	11.72	11.52	11.34	10.91	10.52	9.92	9.42	9.22
11	11.11	/	/	/	/	/	/	/
12	5.64	/	/	/	/	/	/	/
13	5.94	/	/	/	/	/	/	/

802.11n (dBm) - HT20 (2.4G)

Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1	8.71	/	/	/	/	/	/	/
6	9.68	9.12	8.81	8.43	7.85	7.38	7.21	7.02
11	9.05	/	/	/	/	/	/	/
12	3.51	/	/	/	/	/	/	/
13	3.71	/	/	/	/	/	/	/

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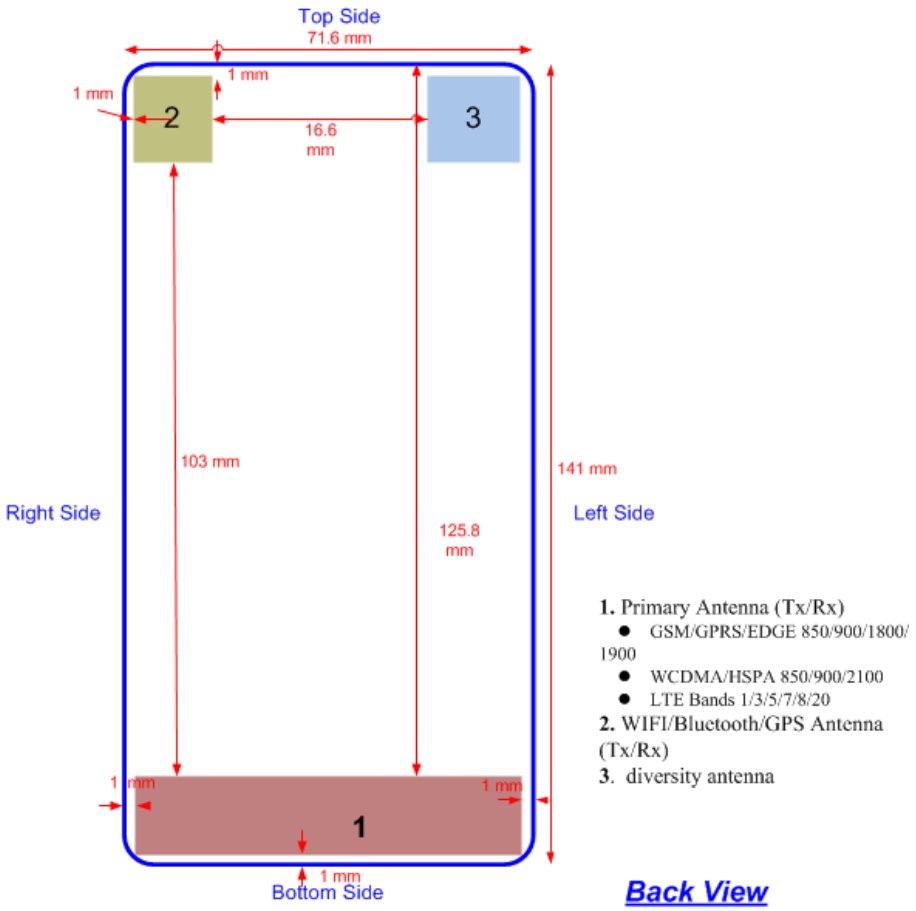
12 Simultaneous TX SAR Considerations

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



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	Yes	Yes	Yes	Yes	No	Yes
WLAN	Yes	Yes	No	Yes	Yes	No

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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	Head	9.60	4.21	2.64	Yes
		Body	19.20	4.21	2.64	Yes
2.4GHz WLAN 802.11 b	2.45	Head	9.58	17.05	50.70	No
		Body	19.17	17.05	50.70	No

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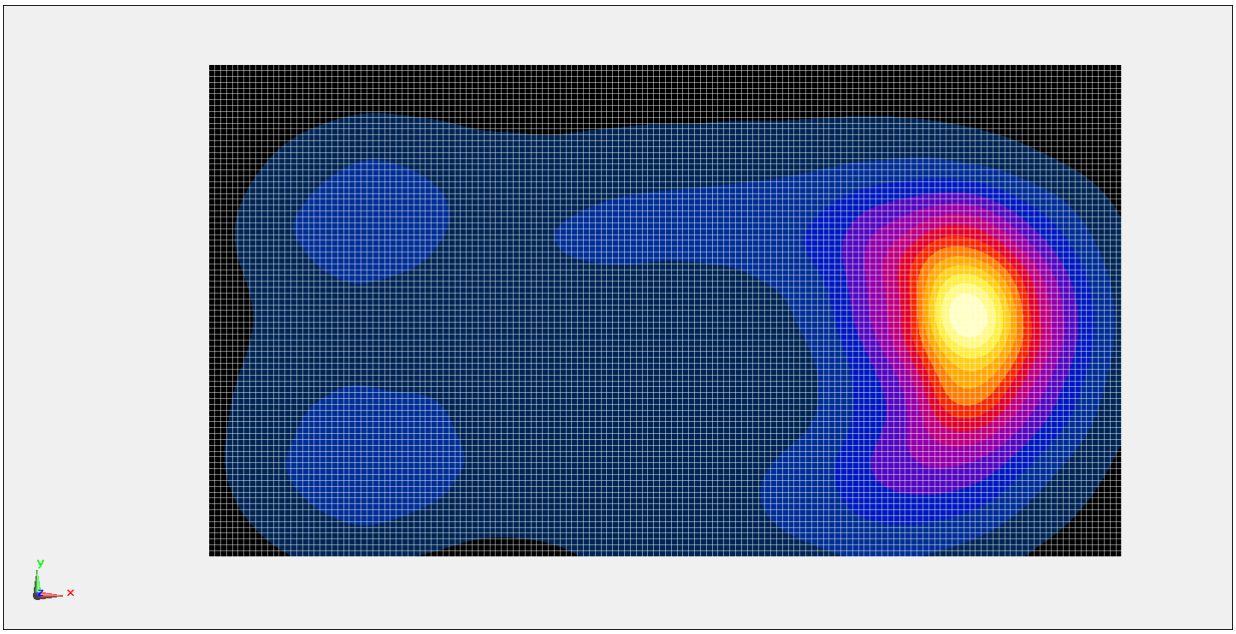
13 Evaluation of Simultaneous

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

	Band	Position	Main antenna	WiFi	Sum	Distance (mm)	Ratio
Maximum reported SAR value for Head	GSM 850	Right hand, Touch cheek	0.44	0.54	**0.98**	/	**/**
	PCS 1900	Right hand, Touch cheek	0.18	0.54	**0.72**	/	**/**
	UMTS FDD 5	Right hand, Touch cheek	0.67	0.54	**1.21**	/	**/**
	LTE Band 5	Right hand, Touch cheek	0.43	0.54	**0.97**	/	**/**
	LTE Band 7	Left hand, Touch cheek	0.34	0.80	**1.14**	/	**/**
	WLAN 2.4 GHz	Left hand, Touch cheek	0.64	0.80	**1.44**	/	**/**
Maximum reported SAR value for Body	GSM 850	Rear	1.16	0.28	**1.44**	/	**/**
	PCS 1900	Front	1.03	0.26	**1.29**	/	**/**
	UMTS FDD 5	Rear	0.71	0.28	**0.99**	/	**/**
	LTE Band 5	Rear	0.59	0.28	**0.87**	/	**/**
	LTE Band 7	Rear	1.52	0.28	**1.80**[1]	103	**0.02**
	WLAN 2.4 GHz	Rear	1.52	0.28	**1.80**[1]	103	**0.02**

[1] – According to the KDB 447498 D01, when the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The ratio is determined by $(SAR1 + SAR2)^{1.5}/Ri$, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.



Picture 13.1 Plot of distance for Body

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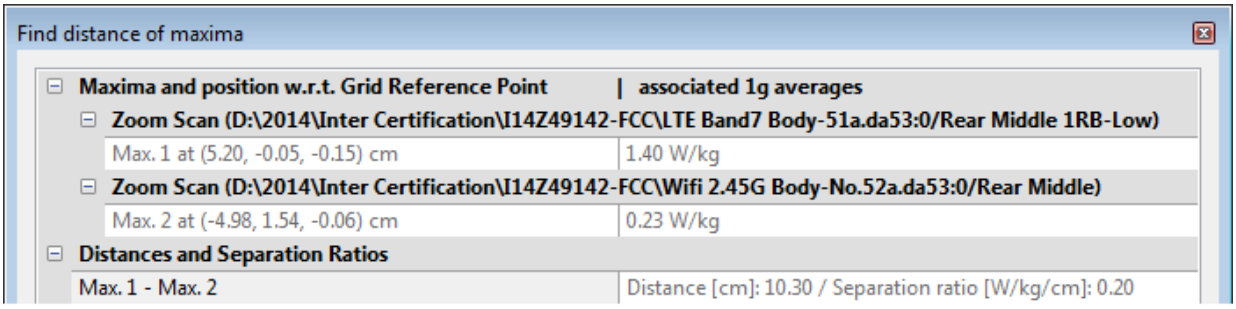

Picture 13.2 Distance evaluation for Body

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	Right hand, Touch cheek	0.67	0.13[2]	**0.80**
Maximum reported SAR value for Body	Rear	1.52	0.07[2]	**1.59**

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

Table 13.3: Estimated SAR for Bluetooth

Position	F (GHz)	Distance (mm)	Upper limit of power *		Estimated$_{1g}$ (W/kg)
			dBm	mW	
Head	2.441	5	5	3.16	0.13
Body	2.441	10	5	3.16	0.07

* - 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 but the ratio < 0.04.
So the simultaneous transmission SAR with volume scans is not required.

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14 SAR Test Result

It is determined by user manual for the distance between the EUT and the phantom bottom.
The distance is 10mm and just applied to the condition of body worn accessory.
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-g SAR is the highest measured SAR in each exposure configuration, wireless mode and frequency band combination or > 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	1:2
WCDMA & LTE & WiFi	1:1

14.1 SAR results for Fast SAR

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

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°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)
MHz	Ch.										
848.8	251	Left	Touch	/	32.90	33.5	0.260	**0.30**	0.370	**0.42**	-0.05
836.6	190	Left	Touch	/	32.77	33.5	0.263	**0.31**	0.375	**0.44**	-0.07
824.2	128	Left	Touch	/	33.15	33.5	0.272	**0.29**	0.386	**0.42**	0.01
848.8	251	Left	Tilt	/	32.90	33.5	0.148	**0.17**	0.209	**0.24**	-0.03
836.6	190	Left	Tilt	/	32.77	33.5	0.150	**0.18**	0.211	**0.25**	-0.05
824.2	128	Left	Tilt	/	33.15	33.5	0.156	**0.17**	0.220	**0.24**	0.04
848.8	251	Right	Touch	/	32.90	33.5	0.266	**0.31**	0.378	**0.43**	-0.08
836.6	190	Right	Touch	/	32.77	33.5	0.265	**0.31**	0.376	**0.44**	-0.01
824.2	128	Right	Touch	Fig.1	33.15	33.5	0.315	**0.34**	0.408	**0.44**	0.01
848.8	251	Right	Tilt	/	32.90	33.5	0.167	**0.19**	0.236	**0.27**	-0.06
836.6	190	Right	Tilt	/	32.77	33.5	0.166	**0.20**	0.233	**0.28**	-0.02
824.2	128	Right	Tilt	/	33.15	33.5	0.168	**0.18**	0.236	**0.26**	-0.09

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Table 14.3: SAR Values (GSM 850 MHz Band - Body)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C											
Frequency		Mode (number of timeslots)	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)
MHz	Ch.										
848.8	251	GPRS (4)	Front	/	28.45	29.2	0.486	**0.58**	0.686	**0.82**	0.03
836.6	190	GPRS (4)	Front	/	28.30	29.2	0.625	**0.77**	0.878	**1.08**	0.05
824.2	128	GPRS (4)	Front	/	28.41	29.2	0.635	**0.76**	0.893	**1.07**	0.10
848.8	251	GPRS (4)	Rear	/	28.45	29.2	0.510	**0.61**	0.716	**0.85**	-0.07
836.6	190	GPRS (4)	Rear	/	28.30	29.2	0.625	**0.77**	0.878	**1.08**	0.05
824.2	128	GPRS (4)	Rear	Fig.2	28.41	29.2	0.751	**0.90**	0.966	**1.16**	-0.12
836.6	190	GPRS (4)	Left	/	28.30	29.2	0.225	**0.28**	0.371	**0.46**	0.00
836.6	190	GPRS (4)	Right	/	28.30	29.2	0.237	**0.29**	0.350	**0.43**	0.08
836.6	190	GPRS (4)	Bottom	/	28.30	29.2	0.110	**0.14**	0.176	**0.22**	0.00
824.2	128	EGPRS (4)	Rear	/	28.39	29.2	0.656	**0.79**	0.948	**1.14**	0.12
824.2	128	Speech	Rear Headset1	/	33.15	33.5	0.463	**0.50**	0.608	**0.66**	0.11
824.2	128	Speech	Rear Headset2	/	33.15	33.5	0.392	**0.42**	0.554	**0.60**	-0.16

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: Headset1 is CCB0009A16C1, Headset2 is CCB0009A16C4.

Table 14.4: 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)
MHz	Ch.										
1909.8	810	Left	Touch	/	29.41	30.5	0.059	**0.08**	0.103	**0.13**	0.02
1880	661	Left	Touch	/	29.54	30.5	0.065	**0.08**	0.110	**0.14**	0.04
1850.2	512	Left	Touch	/	29.30	30.5	0.062	**0.08**	0.104	**0.14**	0.06
1909.8	810	Left	Tilt	/	29.41	30.5	0.025	**0.03**	0.043	**0.05**	0.15
1880	661	Left	Tilt	/	29.54	30.5	0.026	**0.03**	0.043	**0.05**	0.02
1850.2	512	Left	Tilt	/	29.30	30.5	0.021	**0.03**	0.035	**0.05**	0.04
1909.8	810	Right	Touch	/	29.41	30.5	0.060	**0.08**	0.103	**0.13**	0.02
1880	661	Right	Touch	/	29.54	30.5	0.068	**0.09**	0.115	**0.14**	0.05
1850.2	512	Right	Touch	Fig.3	29.30	30.5	0.082	**0.11**	0.136	**0.18**	0.06
1909.8	810	Right	Tilt	/	29.41	30.5	0.024	**0.03**	0.045	**0.06**	0.06
1880	661	Right	Tilt	/	29.54	30.5	0.023	**0.03**	0.042	**0.05**	0.09
1850.2	512	Right	Tilt	/	29.30	30.5	0.019	**0.03**	0.037	**0.05**	0.08

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Table 14.5: SAR Values (GSM 1900 MHz Band - Body)

Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C											
Frequency		Mode (number of timeslots)	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)
MHz	Ch.										
1909.8	810	GPRS (4)	Front	/	24.98	26.5	0.293	**0.42**	0.536	**0.76**	0.00
1880	661	GPRS (4)	Front	Fig.4	24.91	26.5	0.393	**0.57**	0.715	**1.03**	0.07
1850.2	512	GPRS (4)	Front	/	24.74	26.5	0.310	**0.46**	0.584	**0.88**	-0.01
1880	661	GPRS (4)	Rear	/	24.91	26.5	0.235	**0.34**	0.412	**0.59**	-0.03
1880	661	GPRS (4)	Left	/	24.91	26.5	0.099	**0.14**	0.179	**0.26**	0.08
1880	661	GPRS (4)	Right	/	24.91	26.5	0.084	**0.12**	0.151	**0.22**	0.00
1909.8	810	GPRS (4)	Bottom	/	24.98	26.5	0.242	**0.34**	0.462	**0.66**	-0.07
1880	661	GPRS (4)	Bottom	/	24.91	26.5	0.322	**0.46**	0.614	**0.89**	-0.02
1850.2	512	GPRS (4)	Bottom	/	24.74	26.5	0.266	**0.40**	0.505	**0.76**	0.05
1880	661	EGPRS (4)	Front	/	24.90	26.5	0.353	**0.51**	0.689	**1.00**	0.04
1880	661	Speech	Front Headset1	/	29.54	30.5	0.241	**0.30**	0.423	**0.53**	-0.11
1880	661	Speech	Front Headset2	/	29.54	30.5	0.226	**0.28**	0.395	**0.49**	-0.11

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: Headset1 is CCB0009A16C1, Headset2 is CCB0009A16C4.

Table 14.6: SAR Values (WCDMA 850 MHz Band - Head)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°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)
MHz	Ch.										
846.6	4233	Left	Touch	/	22.76	24.0	0.373	**0.50**	0.484	**0.64**	-0.04
836.4	4182	Left	Touch	/	22.83	24.0	0.337	**0.44**	0.477	**0.62**	0.05
826.4	4132	Left	Touch	/	22.75	24.0	0.288	**0.38**	0.405	**0.54**	0.05
846.6	4233	Left	Tilt	/	22.76	24.0	0.187	**0.25**	0.264	**0.35**	0.13
836.4	4182	Left	Tilt	/	22.83	24.0	0.186	**0.24**	0.263	**0.34**	0.15
826.4	4132	Left	Tilt	/	22.75	24.0	0.166	**0.22**	0.234	**0.31**	0.03
846.6	4233	Right	Touch	Fig.5	22.76	24.0	0.387	**0.51**	0.507	**0.67**	0.03
836.4	4182	Right	Touch	/	22.83	24.0	0.339	**0.44**	0.481	**0.63**	-0.04
826.4	4132	Right	Touch	/	22.75	24.0	0.252	**0.34**	0.357	**0.48**	-0.03
846.6	4233	Right	Tilt	/	22.76	24.0	0.154	**0.20**	0.218	**0.29**	-0.05
836.4	4182	Right	Tilt	/	22.83	24.0	0.150	**0.20**	0.212	**0.28**	-0.03
826.4	4132	Right	Tilt	/	22.75	24.0	0.142	**0.19**	0.200	**0.27**	0.08

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Table 14.7: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C										
Frequency		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)
MHz	Ch.									
836.4	4182	Front	/	22.83	24.0	0.335	**0.44**	0.473	**0.62**	0.01
846.6	4233	Rear	/	22.76	24.0	0.371	**0.49**	0.526	**0.70**	0.02
836.4	4182	Rear	Fig.6	22.83	24.0	0.419	**0.55**	0.540	**0.71**	0.04
826.4	4132	Rear	/	22.75	24.0	0.361	**0.48**	0.510	**0.68**	0.00
836.4	4182	Left	/	22.83	24.0	0.226	**0.30**	0.335	**0.44**	-0.01
836.4	4182	Right	/	22.83	24.0	0.244	**0.32**	0.362	**0.47**	-0.10
836.4	4182	Bottom	/	22.83	24.0	0.115	**0.15**	0.179	**0.23**	-0.05
836.4	4182	Rear Headset1	/	22.83	24.0	0.378	**0.49**	0.534	**0.70**	-0.02
836.4	4182	Rear Headset2	/	22.83	24.0	0.369	**0.48**	0.522	**0.68**	-0.14

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: Headset1 is CCB0009A16C1, Headset2 is CCB0009A16C4.

Table 14.8: SAR Values (LTE Band5 - Head)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C												
Frequency		Mode	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)
MHz	Ch.											
836.5	20525	1RB_Low	Left	Touch	/	23.10	24.0	0.255	**0.31**	0.334	**0.41**	-0.12
836.5	20525	1RB_Low	Left	Tilt	/	23.10	24.0	0.103	**0.13**	0.145	**0.18**	0.11
836.5	20525	1RB_Low	Right	Touch	Fig.7	23.10	24.0	0.270	**0.33**	0.350	**0.43**	0.07
836.5	20525	1RB_Low	Right	Tilt	/	23.10	24.0	0.094	**0.12**	0.131	**0.16**	0.08
829	20450	25RB_Mid	Left	Touch	/	22.08	23.0	0.183	**0.23**	0.257	**0.32**	-0.07
829	20450	25RB_Mid	Left	Tilt	/	22.08	23.0	0.077	**0.10**	0.108	**0.13**	0.16
829	20450	25RB_Mid	Right	Touch	/	22.08	23.0	0.187	**0.23**	0.267	**0.33**	-0.19
829	20450	25RB_Mid	Right	Tilt	/	22.08	23.0	0.073	**0.09**	0.102	**0.13**	0.13

Note1: The LTE mode is QPSK_10MHz.

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Table 14.9: SAR Values (LTE Band5 - Body)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C											
Frequency		Mode	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)
MHz	Ch.										
836.5	20525	1RB_Low	Front	/	23.10	24.0	0.278	**0.34**	0.398	**0.49**	0.11
836.5	20525	1RB_Low	Rear	Fig.8	23.10	24.0	0.357	**0.44**	0.482	**0.59**	0.08
836.5	20525	1RB_Low	Left	/	23.10	24.0	0.132	**0.16**	0.195	**0.24**	-0.08
836.5	20525	1RB_Low	Right	/	23.10	24.0	0.141	**0.17**	0.208	**0.26**	0.14
836.5	20525	1RB_Low	Bottom	/	23.10	24.0	0.099	**0.12**	0.164	**0.20**	0.02
829	20450	25RB_Mid	Front	/	22.08	23.0	0.228	**0.28**	0.325	**0.40**	0.05
829	20450	25RB_Mid	Rear	/	22.08	23.0	0.269	**0.33**	0.384	**0.47**	-0.06
829	20450	25RB_Mid	Left	/	22.08	23.0	0.111	**0.14**	0.164	**0.20**	-0.04
829	20450	25RB_Mid	Right	/	22.08	23.0	0.121	**0.15**	0.178	**0.22**	0.04
829	20450	25RB_Mid	Bottom	/	22.08	23.0	0.087	**0.11**	0.134	**0.17**	-0.02

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: The LTE mode is QPSK_10MHz.

Table 14.10: SAR Values (LTE Band7 - Head)

Ambient Temperature: 22.2°C Liquid Temperature: 21.7°C												
Frequency		Mode	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)
MHz	Ch.											
2535	21100	1RB_Low	Left	Touch	Fig.9	22.14	22.5	0.161	**0.17**	0.309	**0.34**	0.05
2535	21100	1RB_Low	Left	Tilt	/	22.14	22.5	0.041	**0.04**	0.080	**0.09**	0.02
2535	21100	1RB_Low	Right	Touch	/	22.14	22.5	0.139	**0.15**	0.284	**0.31**	0.05
2535	21100	1RB_Low	Right	Tilt	/	22.14	22.5	0.028	**0.03**	0.062	**0.07**	0.08
2535	21100	50RB_Low	Left	Touch	/	20.95	21.5	0.122	**0.14**	0.235	**0.27**	0.03
2535	21100	50RB_Low	Left	Tilt	/	20.95	21.5	0.031	**0.03**	0.060	**0.07**	0.03
2535	21100	50RB_Low	Right	Touch	/	20.95	21.5	0.104	**0.12**	0.212	**0.24**	-0.08
2535	21100	50RB_Low	Right	Tilt	/	20.95	21.5	0.022	**0.02**	0.043	**0.05**	0.04

Note1: The LTE mode is QPSK_20MHz.

Table 14.11: SAR Values (LTE Band7 - Body)

Ambient Temperature: 22.2°C Liquid Temperature: 21.7°C											
Frequency		Mode	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)
MHz	Ch.										
QPSK_20M											
2560	21350	1RB_Low	Front	/	21.85	22.5	0.454	**0.53**	0.966	**1.12**	-0.16
2535	21100	1RB_Low	Front	/	22.14	22.5	0.533	**0.58**	1.03	**1.12**	0.09

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2510	20850	1RB_Low	Front	/	21.85	22.5	0.478	**0.56**	1.01	**1.17**	0.03
2560	21350	1RB_Low	Rear	/	21.85	22.5	0.651	**0.76**	1.30	**1.51**	0.19
2535	21100	1RB_Low	Rear	Fig.10	22.14	22.5	0.670	**0.73**	1.40	**1.52**	-0.11
2510	20850	1RB_Low	Rear	/	21.85	22.5	0.540	**0.63**	1.11	**1.29**	0.08
2535	21100	1RB_Mid	Rear	/	21.87	22.5	0.604	**0.70**	1.28	**1.48**	-0.10
2535	21100	1RB_High	Rear	/	21.85	22.5	0.585	**0.68**	1.25	**1.45**	0.06
2535	21100	1RB_Low	Left	/	22.14	22.5	0.086	**0.09**	0.146	**0.16**	-0.03
2535	21100	1RB_Low	Right	/	22.14	22.5	0.096	**0.10**	0.169	**0.18**	0.03
2560	21350	1RB_Low	Bottom	/	21.85	22.5	0.592	**0.69**	1.18	**1.37**	-0.19
2535	21100	1RB_Low	Bottom	/	22.14	22.5	0.653	**0.71**	1.33	**1.44**	-0.07
2510	20850	1RB_Low	Bottom	/	21.85	22.5	0.566	**0.66**	1.13	**1.31**	0.07
2535	21100	50RB_Low	Front	/	20.95	21.5	0.347	**0.39**	0.700	**0.79**	-0.01
2560	21350	50RB_Low	Rear	/	20.79	21.5	0.502	**0.59**	1.05	**1.24**	0.01
2535	21100	50RB_Low	Rear	/	20.95	21.5	0.516	**0.59**	1.12	**1.27**	-0.07
2510	20850	50RB_Low	Rear	/	20.80	21.5	0.430	**0.51**	0.883	**1.04**	0.04
2535	21100	50RB_Low	Left	/	20.95	21.5	0.061	**0.07**	0.105	**0.12**	0.04
2535	21100	50RB_Low	Right	/	20.95	21.5	0.056	**0.06**	0.097	**0.11**	0.16
2560	21350	50RB_Low	Bottom	/	20.79	21.5	0.494	**0.58**	0.987	**1.16**	-0.05
2535	21100	50RB_Low	Bottom	/	20.95	21.5	0.518	**0.59**	1.06	**1.20**	0.02
2510	20850	50RB_Low	Bottom	/	20.80	21.5	0.463	**0.54**	0.922	**1.08**	0.00
2535	21100	100RB	Front	/	20.88	21.5	0.364	**0.42**	0.748	**0.86**	0.16
2560	21350	100RB	Rear	/	20.69	21.5	0.435	**0.52**	0.901	**1.09**	0.03
2535	21100	100RB	Rear	/	20.88	21.5	0.514	**0.59**	1.07	**1.23**	0.07
2510	20850	100RB	Rear	/	20.78	21.5	0.428	**0.51**	0.883	**1.04**	0.14
2535	21100	100RB	Bottom	/	20.88	21.5	0.502	**0.58**	1.00	**1.15**	-0.10
16QAM_20M											
2560	21350	1RB_Mid	Rear	/	20.82	21.5	0.464	**0.54**	0.938	**1.10**	0.15
2535	21100	1RB_Mid	Rear	/	20.74	21.5	0.417	**0.50**	0.862	**1.03**	0.03
2510	20850	1RB_Mid	Rear	/	21.19	21.5	0.463	**0.50**	0.975	**1.05**	-0.10
2560	21350	50RB_Low	Rear	/	19.95	20.5	0.375	**0.43**	0.779	**0.88**	0.02
2535	21100	50RB_Low	Rear	/	20.01	20.5	0.391	**0.44**	0.816	**0.91**	-0.06
2510	20850	50RB_Low	Rear	/	19.81	20.5	0.370	**0.43**	0.769	**0.90**	0.13
2535	21100	100RB	Rear	/	19.84	20.5	0.376	**0.44**	0.781	**0.91**	0.06
QPSK_15M											
2560	21350	1RB_Low	Rear	/	21.83	22.5	0.582	**0.68**	1.21	**1.41**	0.17
2535	21100	1RB_Low	Rear	/	22.04	22.5	0.635	**0.71**	1.29	**1.43**	0.03
2510	20850	1RB_Low	Rear	/	21.85	22.5	0.552	**0.64**	1.14	**1.32**	0.10
2560	21350	36RB_Mid	Rear	/	20.53	21.5	0.484	**0.61**	1.01	**1.26**	0.15
2535	21100	36RB_Mid	Rear	/	20.95	21.5	0.480	**0.54**	1.00	**1.13**	0.14
2510	20850	36RB_Mid	Rear	/	20.75	21.5	0.441	**0.52**	0.907	**1.08**	0.17
2535	21100	75RB	Rear	/	20.92	21.5	0.452	**0.52**	0.937	**1.07**	0.18
QPSK_10M											
2560	21350	1RB_Low	Rear	/	21.83	22.5	0.575	**0.67**	1.19	**1.39**	0.11

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2535	21100	1RB_Low	Rear	/	22.03	22.5	0.599	**0.67**	1.24	**1.38**	0.13
2510	20850	1RB_Low	Rear	/	21.88	22.5	0.582	**0.67**	1.20	**1.38**	0.09
2560	21350	25RB_Mid	Rear	/	20.49	21.5	0.476	**0.60**	0.990	**1.25**	0.17
2535	21100	25RB_Mid	Rear	/	20.91	21.5	0.481	**0.55**	1.00	**1.15**	0.11
2510	20850	25RB_Mid	Rear	/	20.76	21.5	0.445	**0.53**	0.918	**1.09**	0.02
2535	21100	50RB	Rear	/	20.89	21.5	0.456	**0.52**	0.942	**1.08**	0.10
QPSK_5M											
2560	21350	1RB_Low	Rear	/	21.82	22.5	0.603	**0.71**	1.23	**1.44**	-0.15
2535	21100	1RB_Low	Rear	/	22.06	22.5	0.473	**0.52**	1.23	**1.36**	0.07
2510	20850	1RB_Low	Rear	/	21.80	22.5	0.532	**0.63**	1.10	**1.29**	0.03
2560	21350	12RB_Mid	Rear	/	20.58	21.5	0.459	**0.57**	0.956	**1.18**	0.19
2535	21100	12RB_Mid	Rear	/	20.96	21.5	0.473	**0.54**	0.984	**1.11**	-0.08
2510	20850	12RB_Mid	Rear	/	20.80	21.5	0.433	**0.51**	0.887	**1.04**	0.11
2535	21100	25RB	Rear	/	20.81	21.5	0.444	**0.52**	0.919	**1.08**	0.17

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.12: SAR Values (Wi-Fi 802.11b - 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)
MHz	Ch.										
2437	6	Left	Touch	Fig.11	17.05	18.0	0.323	**0.40**	0.645	**0.80**	-0.04
2437	6	Left	Tilt	/	17.05	18.0	0.279	**0.35**	0.590	**0.73**	0.05
2437	6	Right	Touch	/	17.05	18.0	0.233	**0.29**	0.436	**0.54**	0.02
2437	6	Right	Tilt	/	17.05	18.0	0.205	**0.26**	0.383	**0.48**	0.00

Table 14.13: SAR Values (Wi-Fi 802.11b - Body)

Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C										
Frequency		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)
MHz	Ch.									
2437	6	Front	/	17.05	18.0	0.115	**0.14**	0.207	**0.26**	-0.14
2437	6	Rear	Fig.12	17.05	18.0	0.125	**0.16**	0.229	**0.28**	0.06
2437	6	Right	/	17.05	18.0	0.036	**0.05**	0.068	**0.09**	0.13
2437	6	Top	/	17.05	18.0	0.113	**0.14**	0.208	**0.26**	-0.03

Note1: The distance between the EUT and the phantom bottom is 10mm.

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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 14.14: SAR Values (GSM 850 MHz Band - Head)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°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)
MHz	Ch.										
824.2	128	Right	Touch	Fig.1	33.15	33.5	0.315	**0.34**	0.408	**0.44**	0.01

Table 14.15: SAR Values (GSM 850 MHz Band - Body)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C											
Frequency		Mode (number of timeslots)	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)
MHz	Ch.										
824.2	128	GPRS (4)	Rear	Fig.2	28.41	29.2	0.751	**0.90**	0.966	**1.16**	-0.12

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.16: 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)
MHz	Ch.										
1850.2	512	Right	Touch	Fig.3	29.30	30.5	0.082	**0.11**	0.136	**0.18**	0.06

Table 14.17: SAR Values (GSM 1900 MHz Band - Body)

Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C											
Frequency		Mode (number of timeslots)	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)
MHz	Ch.										
1880	661	GPRS (4)	Front	Fig.4	24.91	26.5	0.393	**0.57**	0.715	**1.03**	0.07

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.18: SAR Values (WCDMA 850 MHz Band - Head)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°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)
MHz	Ch.										
846.6	4233	Right	Touch	Fig.5	22.76	24.0	0.387	**0.51**	0.507	**0.67**	0.03

Table 14.19: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C										
Frequency		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)
MHz	Ch.									
836.4	4182	Rear	Fig.6	22.83	24.0	0.419	**0.55**	0.540	**0.71**	0.04

Note1: The distance between the EUT and the phantom bottom is 10mm.

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Table 14.20: SAR Values (LTE Band5 - Head)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C												
Frequency		Mode	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)
MHz	Ch.											
836.5	20525	1RB_Low	Right	Touch	Fig.7	23.10	24.0	0.270	**0.33**	0.350	**0.43**	0.07

Note1: The LTE mode is QPSK_10MHz.

Table 14.21: SAR Values (LTE Band5 - Body)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C											
Frequency		Mode	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)
MHz	Ch.										
836.5	20525	1RB_Low	Rear	Fig.8	23.10	24.0	0.357	**0.44**	0.482	**0.59**	0.08

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: The LTE mode is QPSK_10MHz.

Table 14.22: SAR Values (LTE Band7 - Head)

Ambient Temperature: 22.2°C Liquid Temperature: 21.7°C												
Frequency		Mode	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)
MHz	Ch.											
2535	21100	1RB_Low	Left	Touch	Fig.9	22.14	22.5	0.161	**0.17**	0.309	**0.34**	0.05

Note1: The LTE mode is QPSK_20MHz.

Table 14.23: SAR Values (LTE Band7 - Body)

Ambient Temperature: 22.2°C Liquid Temperature: 21.7°C												
Frequency		Mode	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)
MHz	Ch.										
QPSK_20M											
2560	21350	1RB_Low	Rear	/	21.85	22.5	0.651	**0.76**	1.30	**1.51**	0.19
2535	21100	1RB_Low	Rear	Fig.10	22.14	22.5	0.670	**0.73**	1.40	**1.52**	-0.11
2510	20850	1RB_Low	Rear	/	21.85	22.5	0.540	**0.63**	1.11	**1.29**	0.08
2535	21100	1RB_Mid	Rear	/	21.87	22.5	0.604	**0.70**	1.28	**1.48**	-0.10
2535	21100	1RB_High	Rear	/	21.85	22.5	0.585	**0.68**	1.25	**1.45**	0.06
2560	21350	1RB_Low	Bottom	/	21.85	22.5	0.592	**0.69**	1.18	**1.37**	-0.19
2535	21100	1RB_Low	Bottom	/	22.14	22.5	0.653	**0.71**	1.33	**1.44**	-0.07
2510	20850	1RB_Low	Bottom	/	21.85	22.5	0.566	**0.66**	1.13	**1.31**	0.07
2560	21350	50RB_Low	Rear	/	20.79	21.5	0.502	**0.59**	1.05	**1.24**	0.01
2535	21100	50RB_Low	Rear	/	20.95	21.5	0.516	**0.59**	1.12	**1.27**	-0.07
2535	21100	100RB	Rear	/	20.88	21.5	0.514	**0.59**	1.07	**1.23**	0.07

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QPSK_15M											
2560	21350	1RB_Low	Rear	/	21.83	22.5	0.582	**0.68**	1.21	**1.41**	0.17
2535	21100	1RB_Low	Rear	/	22.04	22.5	0.635	**0.71**	1.29	**1.43**	0.03
2510	20850	1RB_Low	Rear	/	21.85	22.5	0.552	**0.64**	1.14	**1.32**	0.10
2560	21350	36RB_Mid	Rear	/	20.53	21.5	0.484	**0.61**	1.01	**1.26**	0.15
QPSK_10M											
2560	21350	1RB_Low	Rear	/	21.83	22.5	0.575	**0.67**	1.19	**1.39**	0.11
2535	21100	1RB_Low	Rear	/	22.03	22.5	0.599	**0.67**	1.24	**1.38**	0.13
2510	20850	1RB_Low	Rear	/	21.88	22.5	0.582	**0.67**	1.20	**1.38**	0.09
2560	21350	25RB_Mid	Rear	/	20.49	21.5	0.476	**0.60**	0.990	**1.25**	0.17
QPSK_5M											
2560	21350	1RB_Low	Rear	/	21.82	22.5	0.603	**0.71**	1.23	**1.44**	-0.15
2535	21100	1RB_Low	Rear	/	22.06	22.5	0.473	**0.52**	1.23	**1.36**	0.07
2510	20850	1RB_Low	Rear	/	21.80	22.5	0.532	**0.63**	1.10	**1.29**	0.03

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.24: SAR Values (Wi-Fi 802.11b - 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)
MHz	Ch.										
2437	6	Left	Touch	Fig.11	17.05	18.0	0.323	**0.40**	0.645	**0.80**	-0.04

Table 14.25: SAR Values (Wi-Fi 802.11b - Body)

Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C										
Frequency		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)
MHz	Ch.									
2437	6	Rear	Fig.12	17.05	18.0	0.125	**0.16**	0.229	**0.28**	0.06

Note1: The distance between the EUT and the phantom bottom is 10mm.

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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; steps 2) through 4) do not apply.

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

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

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

Table 15.1: SAR Measurement Variability for Body GSM 850 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
824.2	128	Rear	10	0.966	0.954	1.01	/

Table 15.2: SAR Measurement Variability for Body LTE Band 7 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
2535	21100	Rear	10	1.40	1.38	1.01	/

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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	5.5	N	1	1	1	5.5	5.5	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	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	RF ambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
15	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
16	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
17	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
20	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
21	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521

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Combined standard uncertainty	$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					9.25	9.12	257
Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$					18.5	18.2	

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	6.5	N	1	1	1	6.5	6.5	∞
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	RF ambient 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

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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		$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						10.8	10.7	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						21.6	21.4	

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	5.5	N	1	1	1	5.5	5.5	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	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	RF ambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. Restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
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	∞

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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		$u_c^{'} = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						10.1	9.95	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						20.2	19.9	

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	6.5	N	1	1	1	6.5	6.5	∞
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	RF ambient 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										

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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		$u_c^{'} = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						13.3	13.2	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						26.6	26.4	

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	February 15, 2014	One year
02	Power meter	NRVD	102196	March 15,2014	One year
03	Power sensor	NRV-Z5	100596		
04	Signal Generator	E4438C	MY49071430	February 08, 2014	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	E5515C	MY50263375	January 30, 2014	One year
07	BTS	CMW500	129942	March 11, 2014	One year
08	E-field Probe	SPEAG EX3DV4	3846	September 24, 2014	One year
09	DAE	SPEAG DAE4	777	September 17, 2014	One year
10	Dipole Validation Kit	SPEAG D835V2	4d069	August 28, 2014	One year
11	Dipole Validation Kit	SPEAG D1900V2	5d101	July 23, 2014	One year
12	Dipole Validation Kit	SPEAG D2450V2	853	July 24, 2014	One year
13	Dipole Validation Kit	SPEAG D2600V2	1012	July 16, 2014	One year

END OF REPORT BODY

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ANNEX A Graph Results

850 Right Cheek Low

Date: 2015-1-14
Electronics: DAE4 Sn777
Medium: Head 850 MHz
Medium parameters used: f = 825 MHz; σ = 0.914 mho/m; εr = 42.682; ρ = 1000 kg/m^3
Ambient Temperature: 22.3^{o}C Liquid Temperature: 21.8^{o}C
Communication System: GSM 850 Frequency: 824.2 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3846 ConvF(9.18, 9.18, 9.18)

Cheek Low/Area Scan (71x111x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.436 W/kg

Cheek Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.946 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.502 W/kg
SAR(1 g) = 0.408 W/kg; SAR(10 g) = 0.315 W/kg
Maximum value of SAR (measured) = 0.440 W/kg

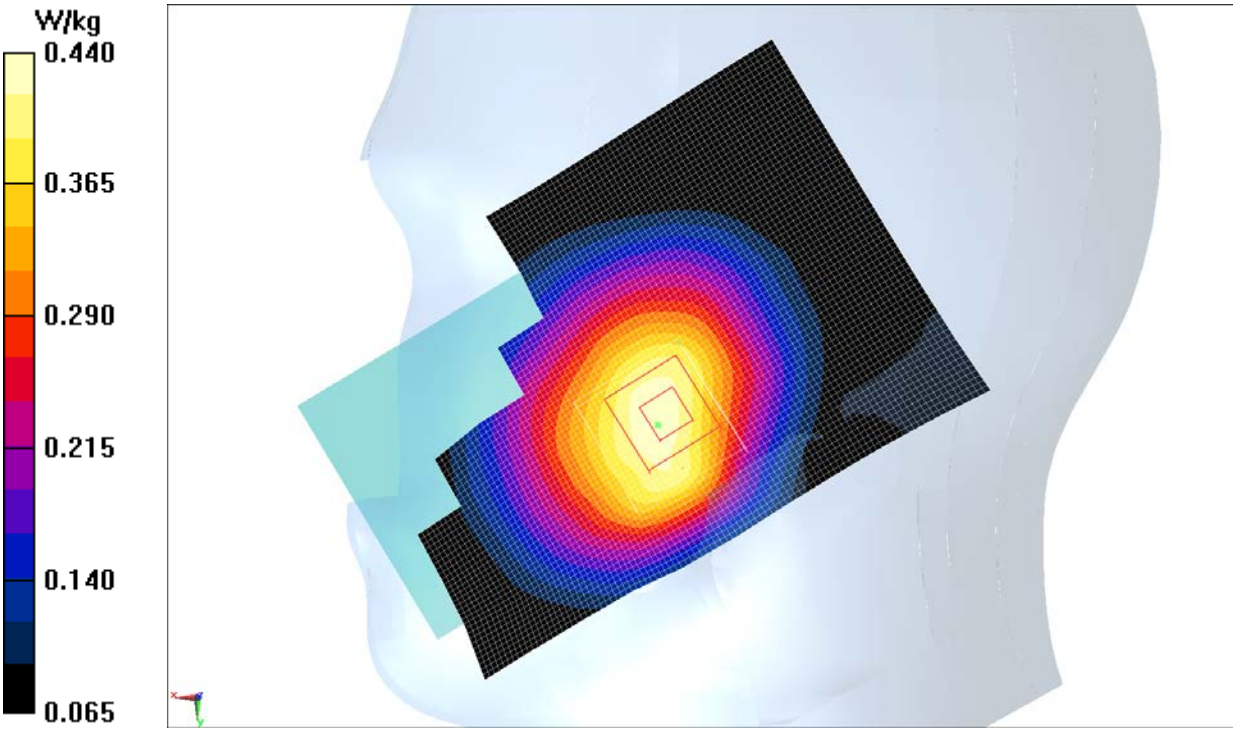

Fig.1 850MHz

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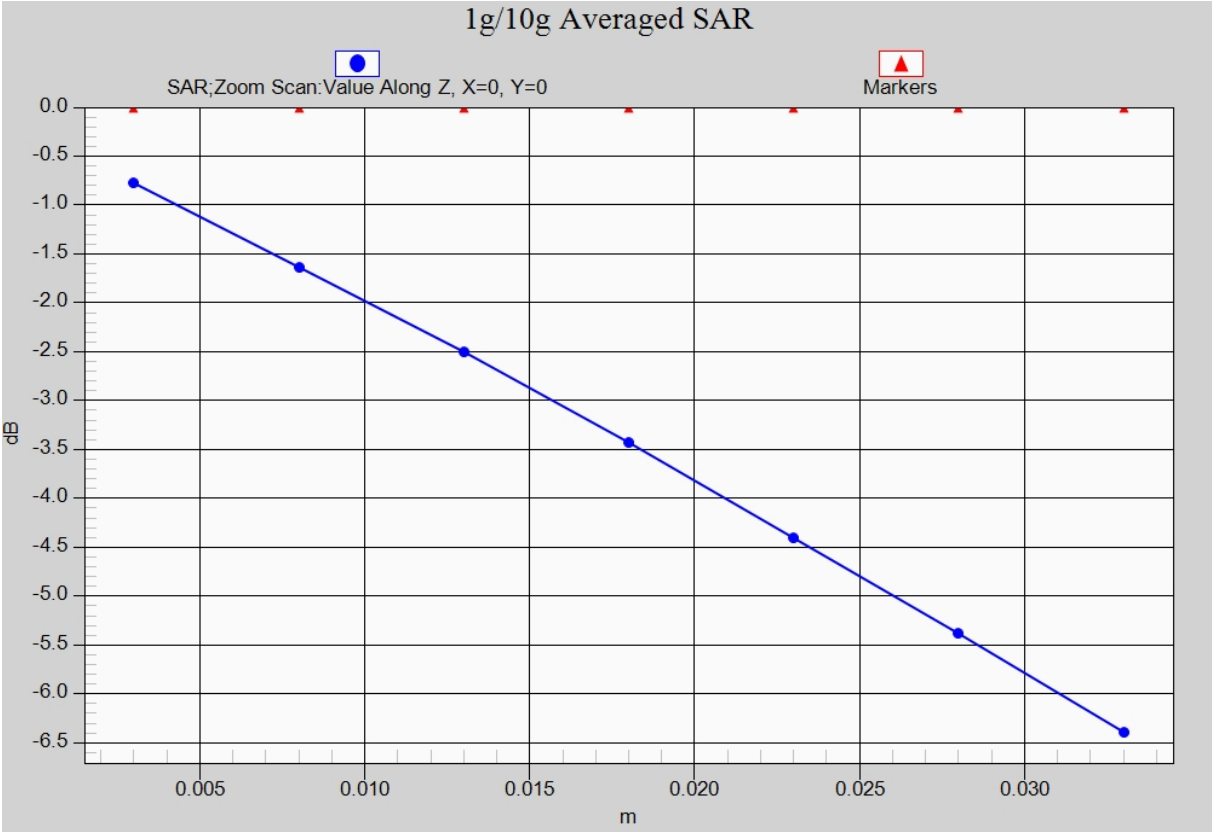

Fig. 1-1 Z-Scan at power reference point (850 MHz)

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850 Body Rear Low

Date: 2015-1-14
Electronics: DAE4 Sn777
Medium: Body 850 MHz
Medium parameters used: f = 848.8 MHz; σ = 0.974 mho/m; εr = 54.073; ρ = 1000 kg/m^3
Ambient Temperature: 22.3^{o}C Liquid Temperature: 21.8^{o}C
Communication System: GSM 850 GPRS Frequency: 824.2 MHz Duty Cycle: 1:2
Probe: EX3DV4 - SN3846 ConvF(9.09, 9.09, 9.09)

Rear Low/Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.14 W/kg

Rear Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 34.12 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.20 W/kg
SAR(1 g) = 0.966 W/kg; SAR(10 g) = 0.751 W/kg
Maximum value of SAR (measured) = 1.05 W/kg

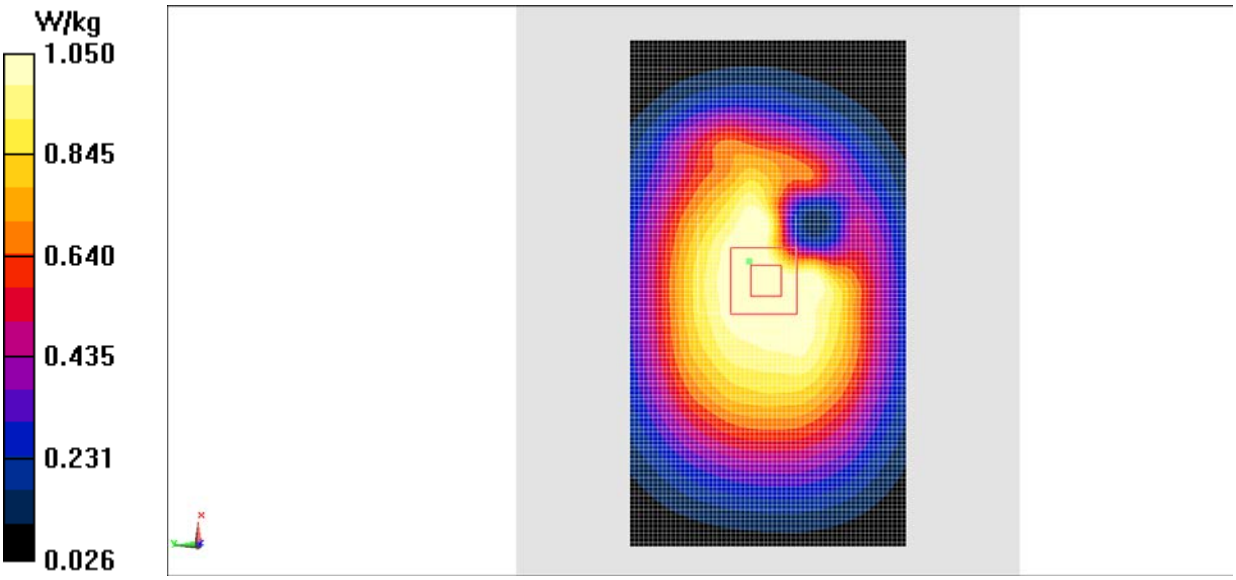

Fig.2 850 MHz

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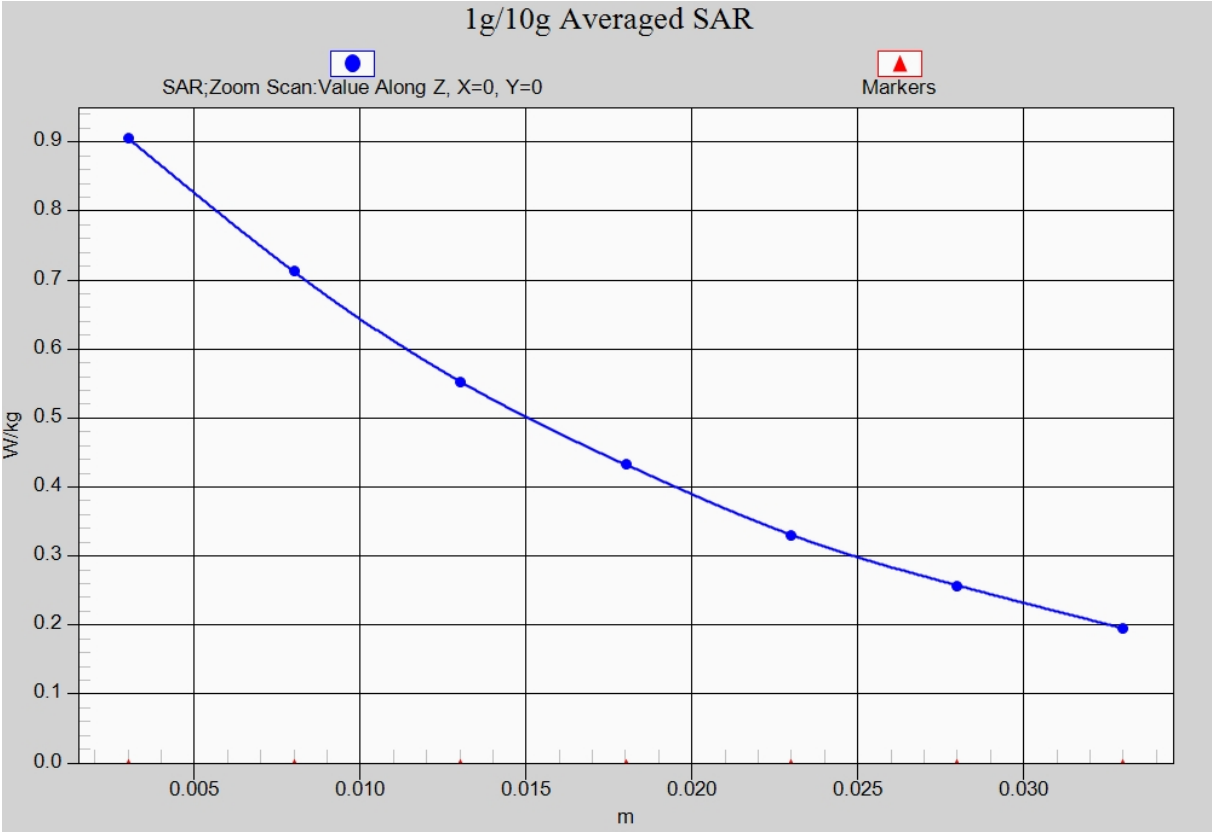

Fig. 2-1 Z-Scan at power reference point (850 MHz)

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1900 Right Cheek Low

Date: 2015-1-9
Electronics: DAE4 Sn777
Medium: Head 1900 MHz
Medium parameters used: f = 1850.2 MHz; σ = 1.338 S/m; ε_r = 40.274; ρ = 1000 kg/m^3
Ambient Temperature: 22.5^{o}C Liquid Temperature: 22.0^{o}C
Communication System: GSM 1900MHz Frequency: 1850.2MHz Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3846 ConvF(7.26, 7.26, 7.26)

Cheek Low/Area Scan (71x111x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.175 W/kg

Cheek Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.317 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.213 W/kg
SAR(1 g) = 0.136 W/kg; SAR(10 g) = 0.082 W/kg
Maximum value of SAR (measured) = 0.168 W/kg

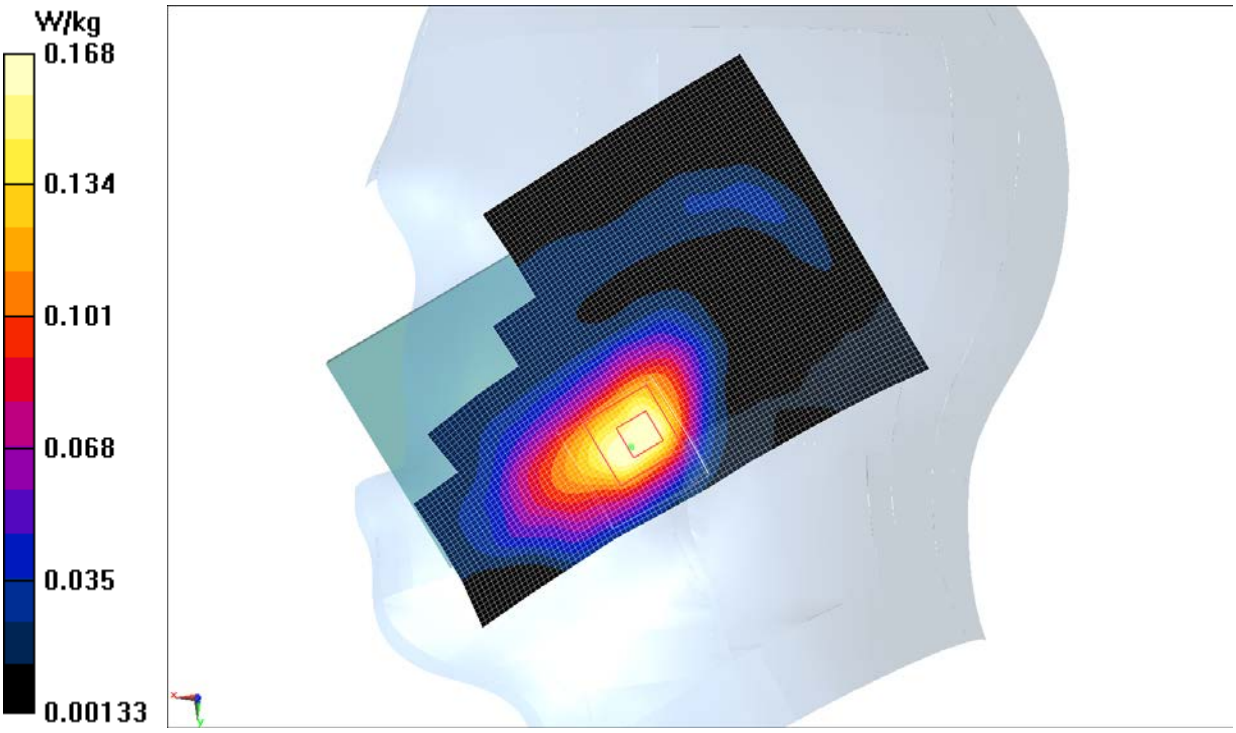

Fig.3 1900 MHz

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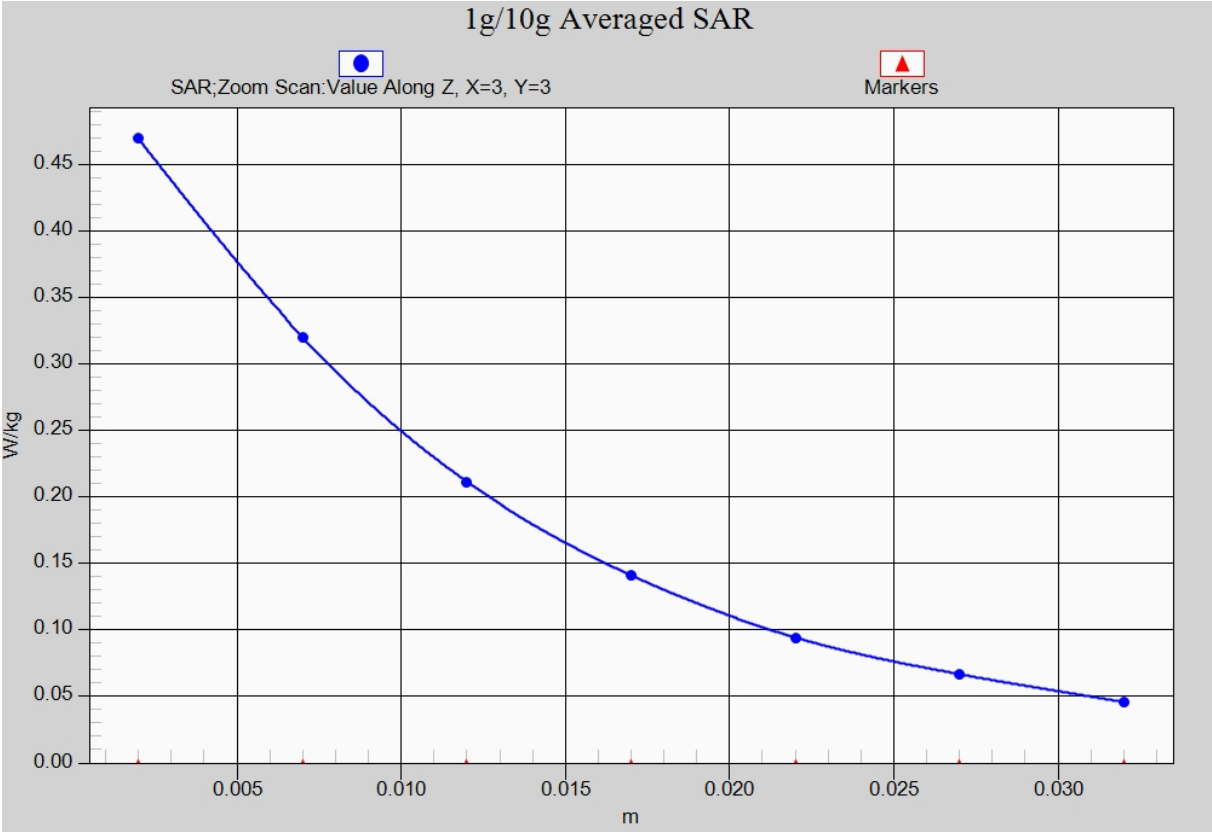

Fig. 3-1 Z-Scan at power reference point (1900 MHz)

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1900 Body Front Middle

Date: 2015-1-9
Electronics: DAE4 Sn777
Medium: Body 1900 MHz
Medium parameters used: f = 1880 MHz; σ = 1.489 S/m; ε_r = 54.116; ρ = 1000 kg/m^3
Ambient Temperature: 22.5^{o}C Liquid Temperature: 22.0^{o}C
Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:2
Probe: EX3DV4 - SN3846 ConvF(7.15, 7.15, 7.15)

Front Middle/Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.750 W/kg

Front Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.834 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.715 W/kg; SAR(10 g) = 0.393 W/kg
Maximum value of SAR (measured) = 0.818 W/kg

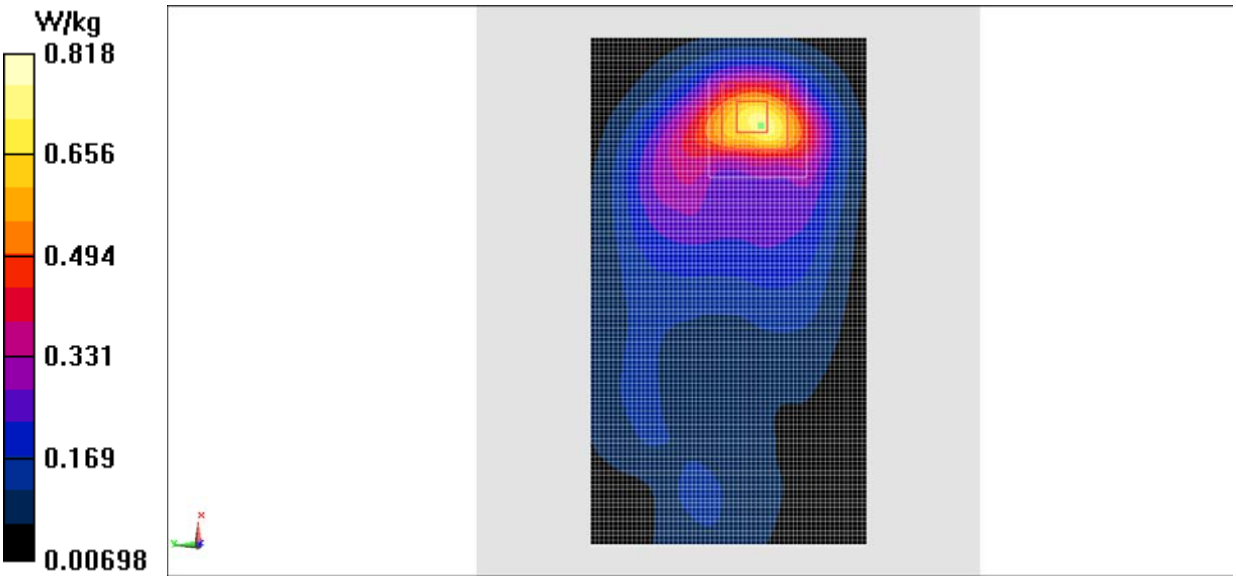

Fig.4 1900 MHz

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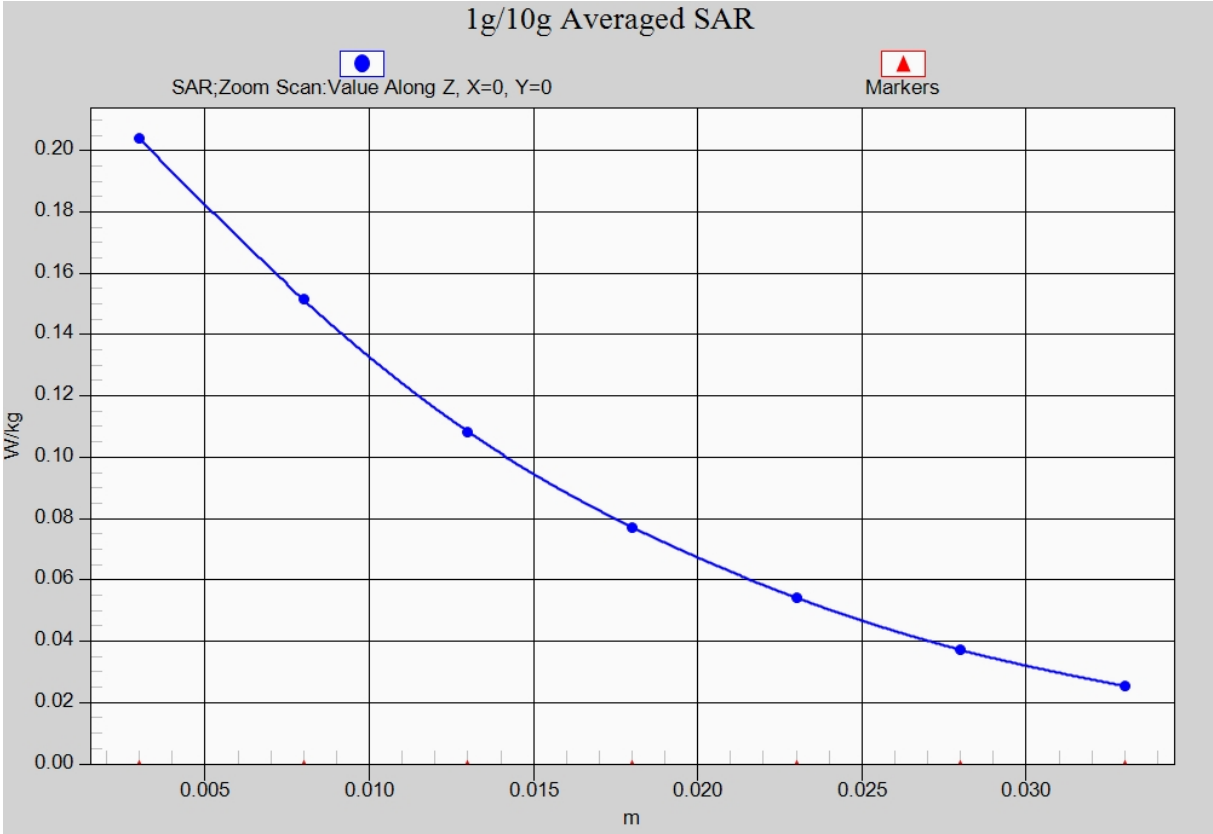

Fig.4-1 Z-Scan at power reference point (1900 MHz)

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WCDMA 850 Right Cheek High

Date: 2015-1-14
Electronics: DAE4 Sn777
Medium: Head 850 MHz
Medium parameters used (interpolated): f = 846.6 MHz; σ = 0.934 mho/m; εr = 42.41; ρ = 1000 kg/m^3
Ambient Temperature: 22.3^{o}C Liquid Temperature: 21.8^{o}C
Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(9.18, 9.18, 9.18)

Cheek High/Area Scan (71x111x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.585 W/kg

Cheek High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.501 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.632 W/kg
SAR(1 g) = 0.507 W/kg; SAR(10 g) = 0.387 W/kg
Maximum value of SAR (measured) = 0.573 W/kg

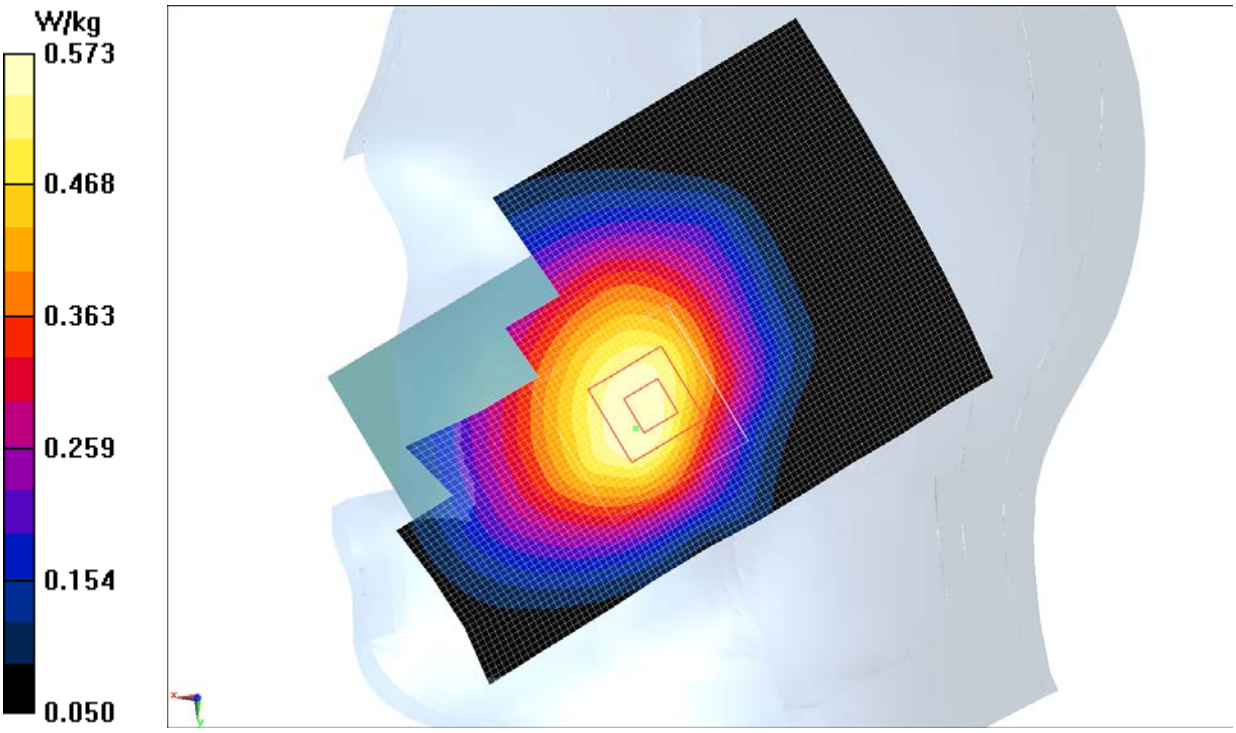

Fig.5 WCDMA 850

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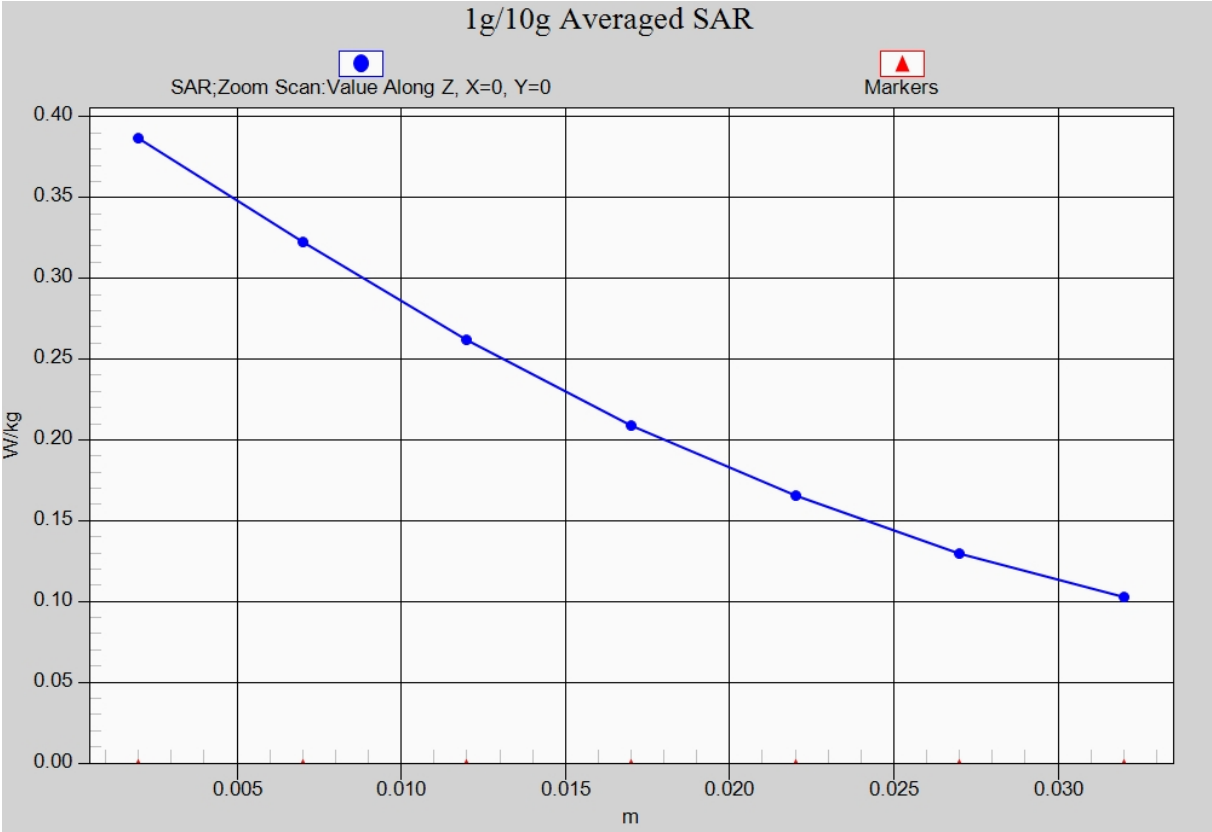

Fig. 5-1 Z-Scan at power reference point (WCDMA 850)

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WCDMA 850 Body Rear Middle

Date: 2015-1-14
Electronics: DAE4 Sn777
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 836.4 MHz; σ = 0.986 mho/m; εr = 53.975; ρ = 1000 kg/m^3
Ambient Temperature: 22.3^{o}C Liquid Temperature: 21.8^{o}C
Communication System: WCDMA; Frequency: 836.4 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(9.09, 9.09, 9.09)

Rear Middle/Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.602 W/kg

Rear Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.31 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.687 W/kg
SAR(1 g) = 0.540 W/kg; SAR(10 g) = 0.419 W/kg
Maximum value of SAR (measured) = 0.594 W/kg

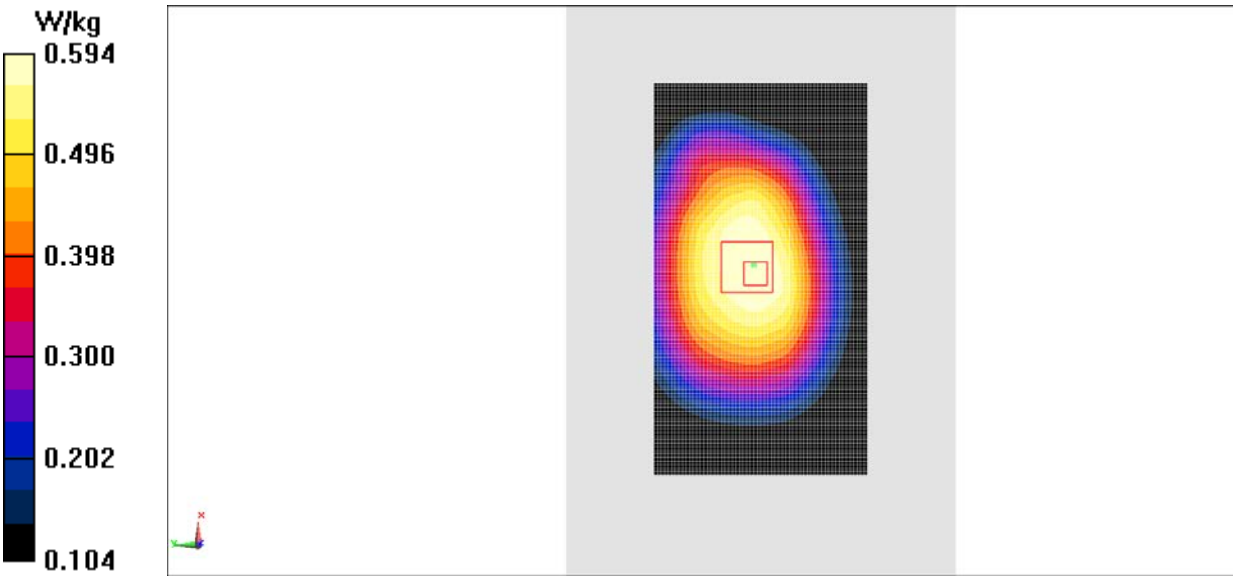

Fig.6 WCDMA 850

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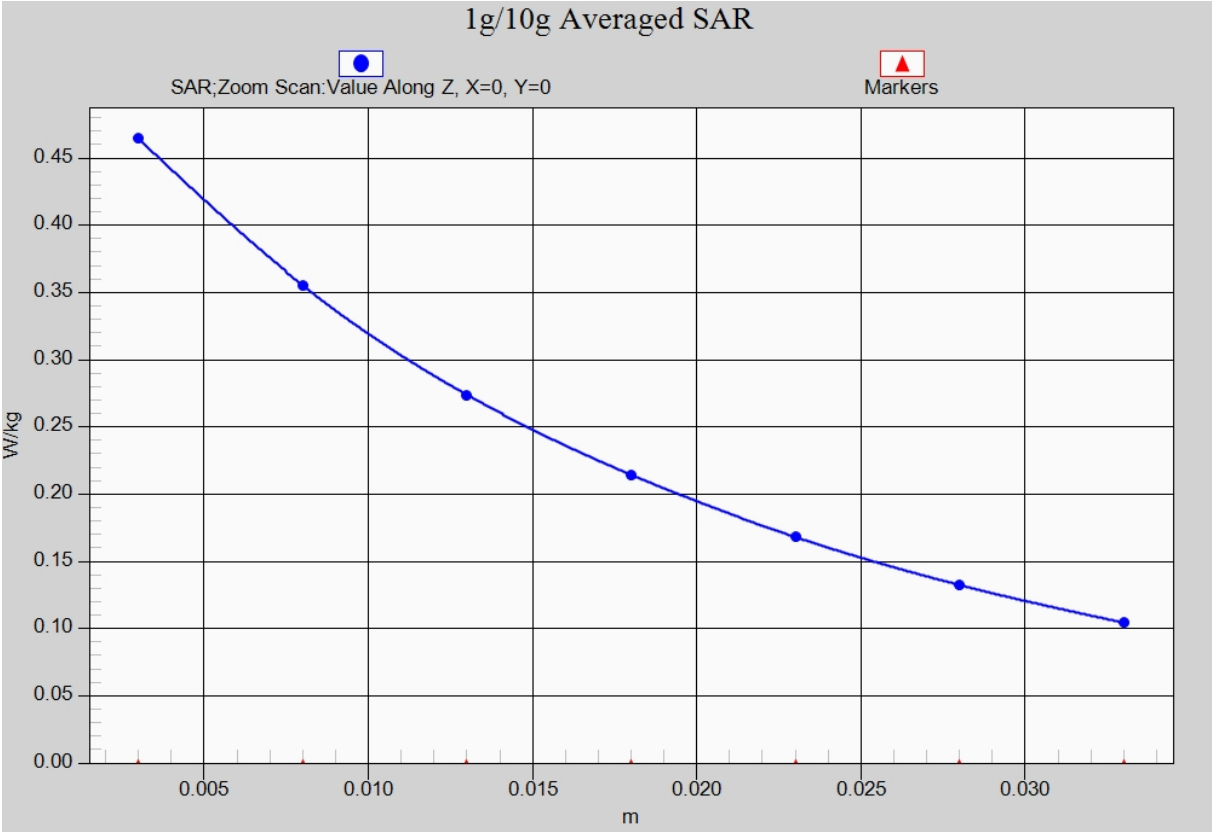

Fig. 6-1 Z-Scan at power reference point (WCDMA850)

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LTE Band5 Right Cheek Middle with QPSK_10M_1RB_Low

Date: 2015-1-14
Electronics: DAE4 Sn777
Medium: Head 850 MHz
Medium parameters used (interpolated): f = 836.5 MHz; σ = 0.918 mho/m; εr = 42.635; ρ = 1000 kg/m^3
Ambient Temperature: 22.3^{o}C Liquid Temperature: 21.8^{o}C
Communication System: LTE Band5 Frequency: 836.5 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(9.18, 9.18, 9.18)

Cheek Middle/Area Scan (71x111x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.417 W/kg

Cheek Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.334 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.445 W/kg
SAR(1 g) = 0.350 W/kg; SAR(10 g) = 0.270 W/kg
Maximum value of SAR (measured) = 0.393 W/kg

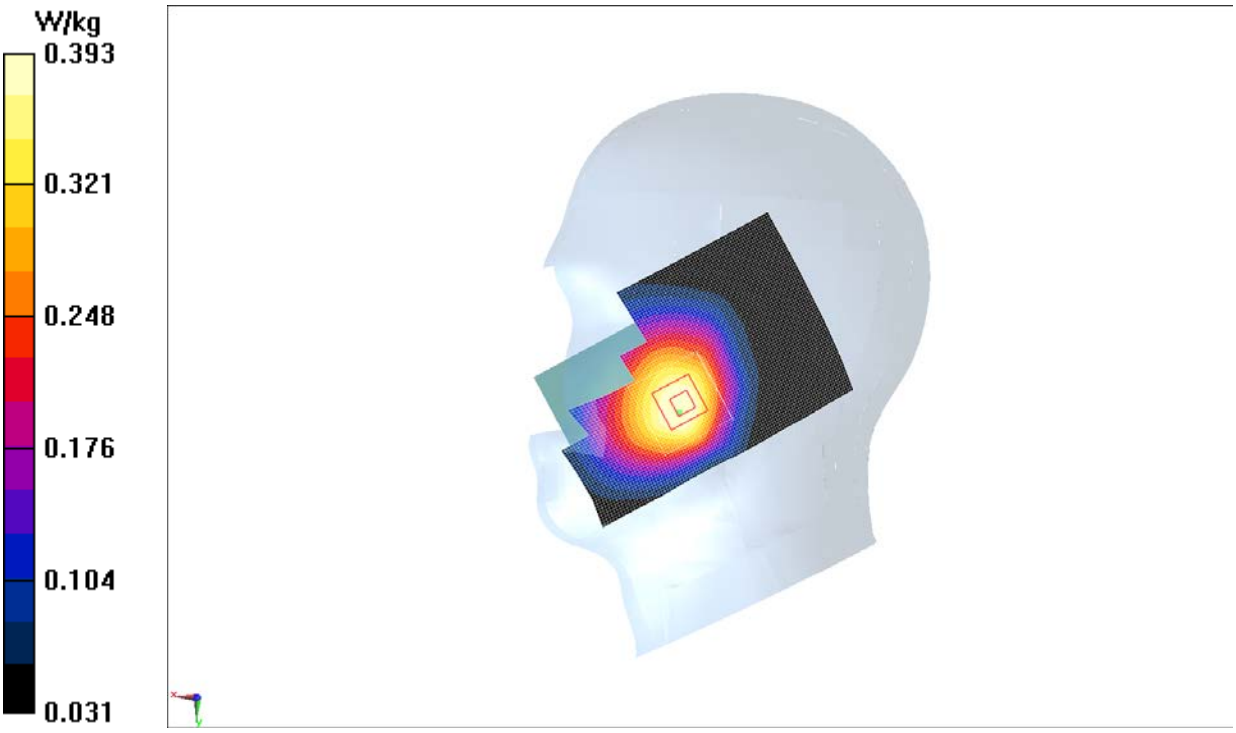

Fig.7 LTE Band5

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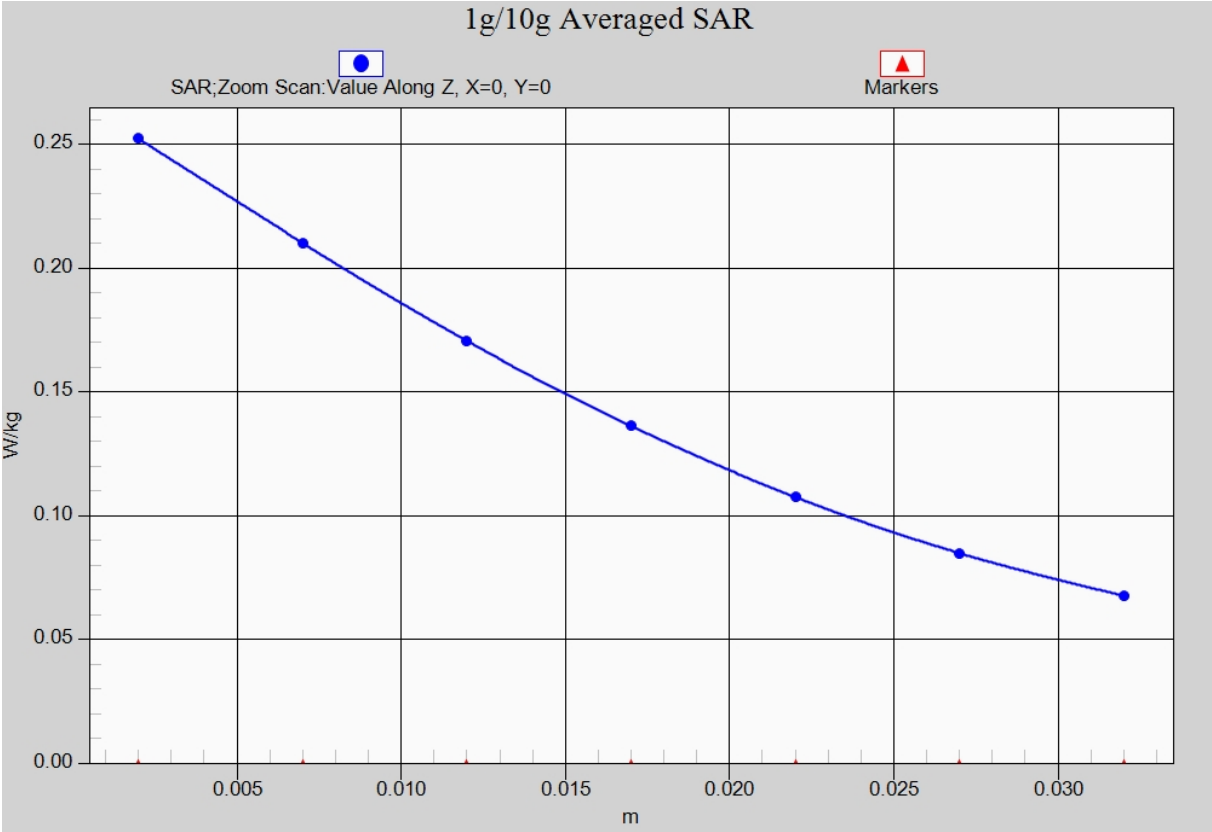

Fig. 7-1 Z-Scan at power reference point (LTE Band5)

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LTE Band5 Body Rear Middle with QPSK_10M_1RB_Low

Date: 2015-1-14
Electronics: DAE4 Sn777
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 836.5 MHz; σ = 0.978 mho/m; εr = 54.03; ρ = 1000 kg/m^3
Ambient Temperature: 22.3^{o}C Liquid Temperature: 21.8^{o}C
Communication System: LTE Band5 Frequency: 836.5 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(9.09, 9.09, 9.09)

Rear Middle/Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.526 W/kg

Rear Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.60 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.636 W/kg
SAR(1 g) = 0.482 W/kg; SAR(10 g) = 0.357 W/kg
Maximum value of SAR (measured) = 0.532 W/kg

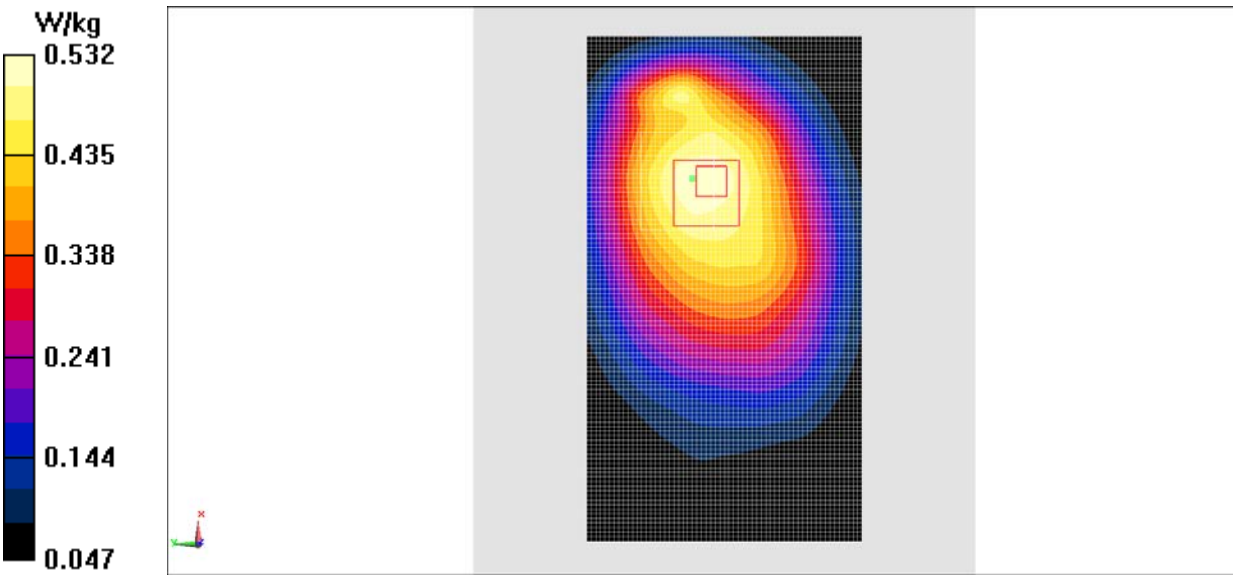

Fig.8 LTE Band5

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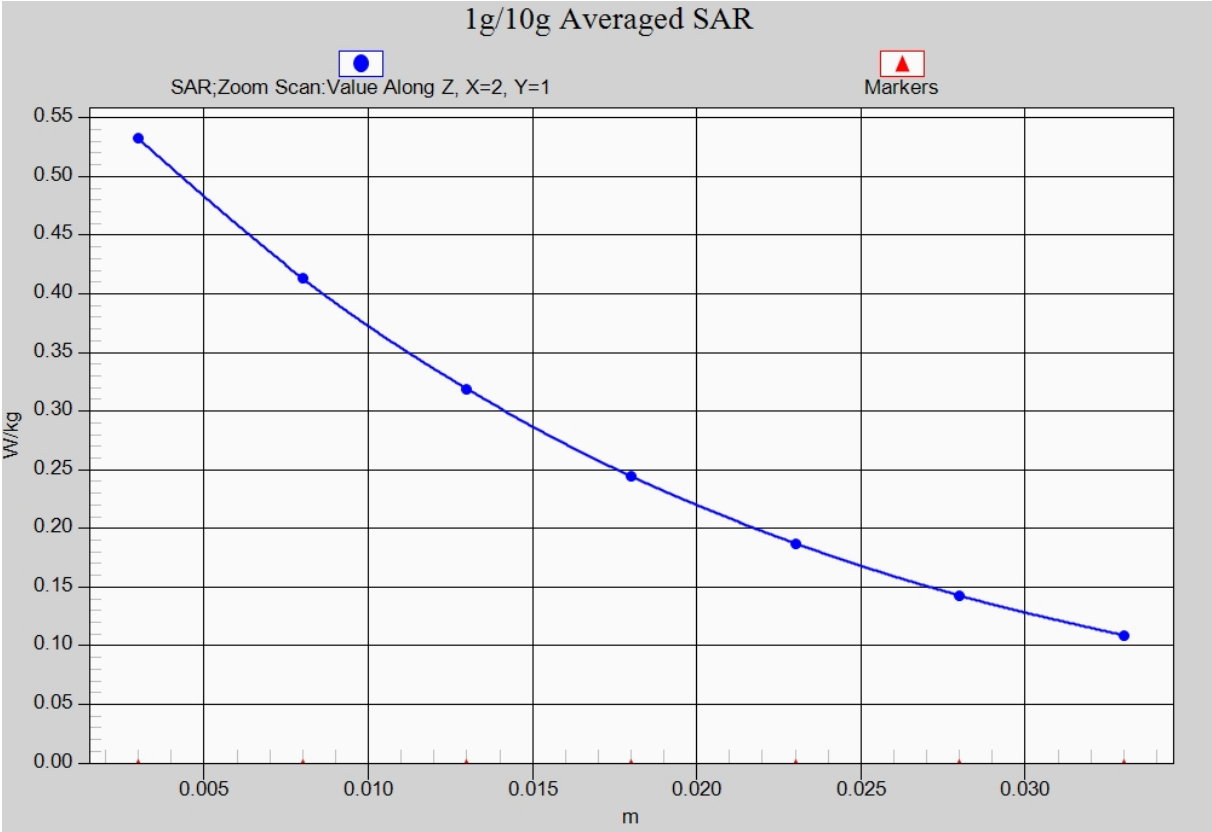

Fig. 8-1 Z-Scan at power reference point (LTE Band5)

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LTE Band7 Left Cheek Middle with QPSK_20M_1RB_Low

Date: 2015-1-10
Electronics: DAE4 Sn777
Medium: Head 2600 MHz
Medium parameters used: f = 2535 MHz; σ = 1.92 mho/m; εr = 38.003; ρ = 1000 kg/m^3
Ambient Temperature: 22.2^{o}C Liquid Temperature: 21.7^{o}C
Communication System: LTE Band7 Frequency: 2535 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(6.50, 6.50, 6.50)

Cheek Middle/Area Scan (81x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.351 W/kg

Cheek Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.503 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.582 W/kg
SAR(1 g) = 0.309 W/kg; SAR(10 g) = 0.161 W/kg
Maximum value of SAR (measured) = 0.345 W/kg

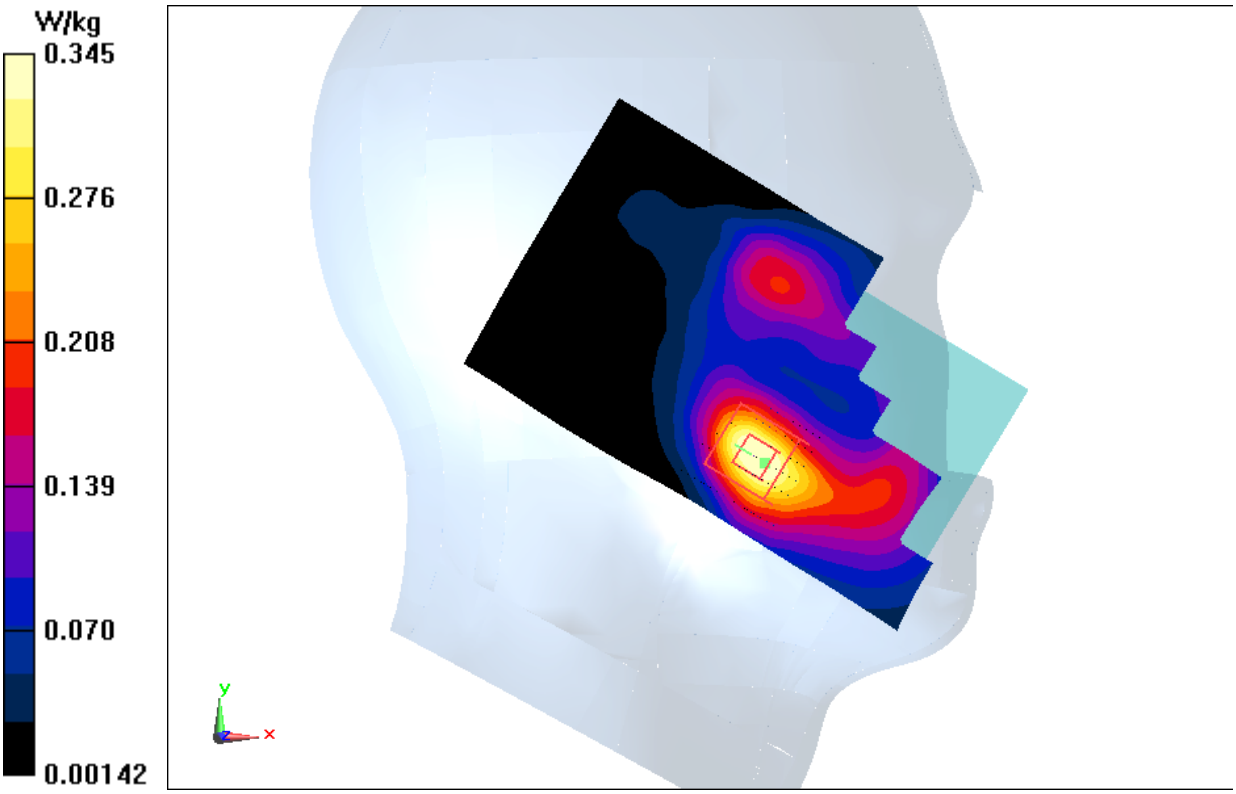

Fig.9 LTE Band7

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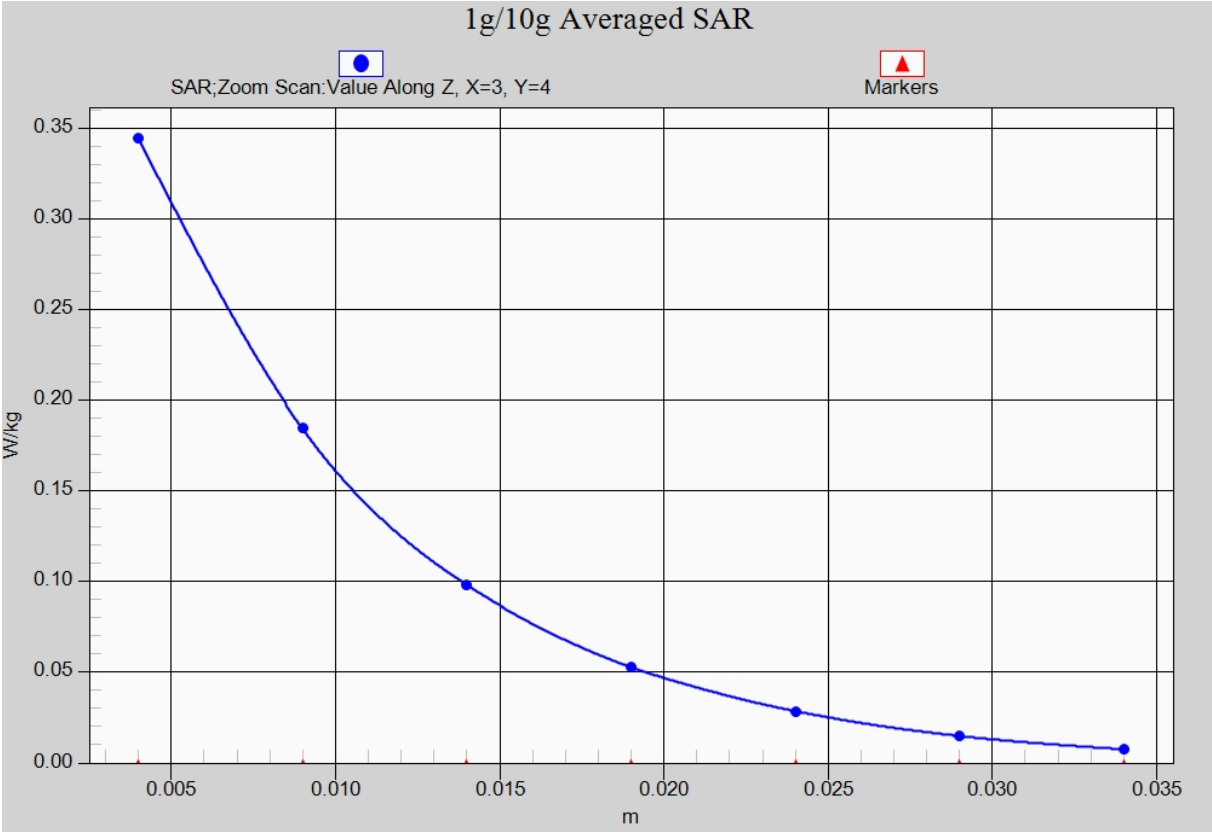

Fig. 9-1 Z-Scan at power reference point (LTE Band7)

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LTE Band7 Body Rear Middle with QPSK_20M_1RB_Low

Date: 2015-1-10
Electronics: DAE4 Sn777
Medium: Body 2600 MHz
Medium parameters used: f = 2535 MHz; σ = 2.156 mho/m; εr = 50.812; ρ = 1000 kg/m^3
Ambient Temperature: 22.2^{o}C Liquid Temperature: 21.7^{o}C
Communication System: LTE Band7 Frequency: 2535 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(6.68, 6.68, 6.68)

Rear Middle/Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.89 W/kg

Rear Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.676 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 2.86 W/kg
SAR(1 g) = 1.4 W/kg; SAR(10 g) = 0.670 W/kg
Maximum value of SAR (measured) = 1.58 W/kg

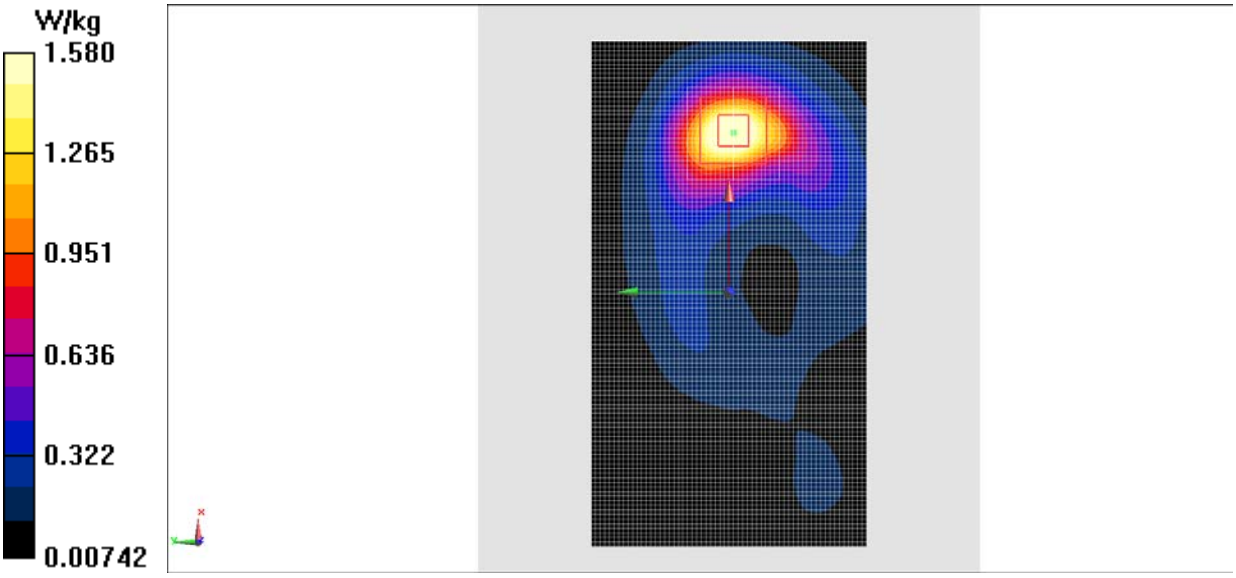

Fig.10 LTE Band7

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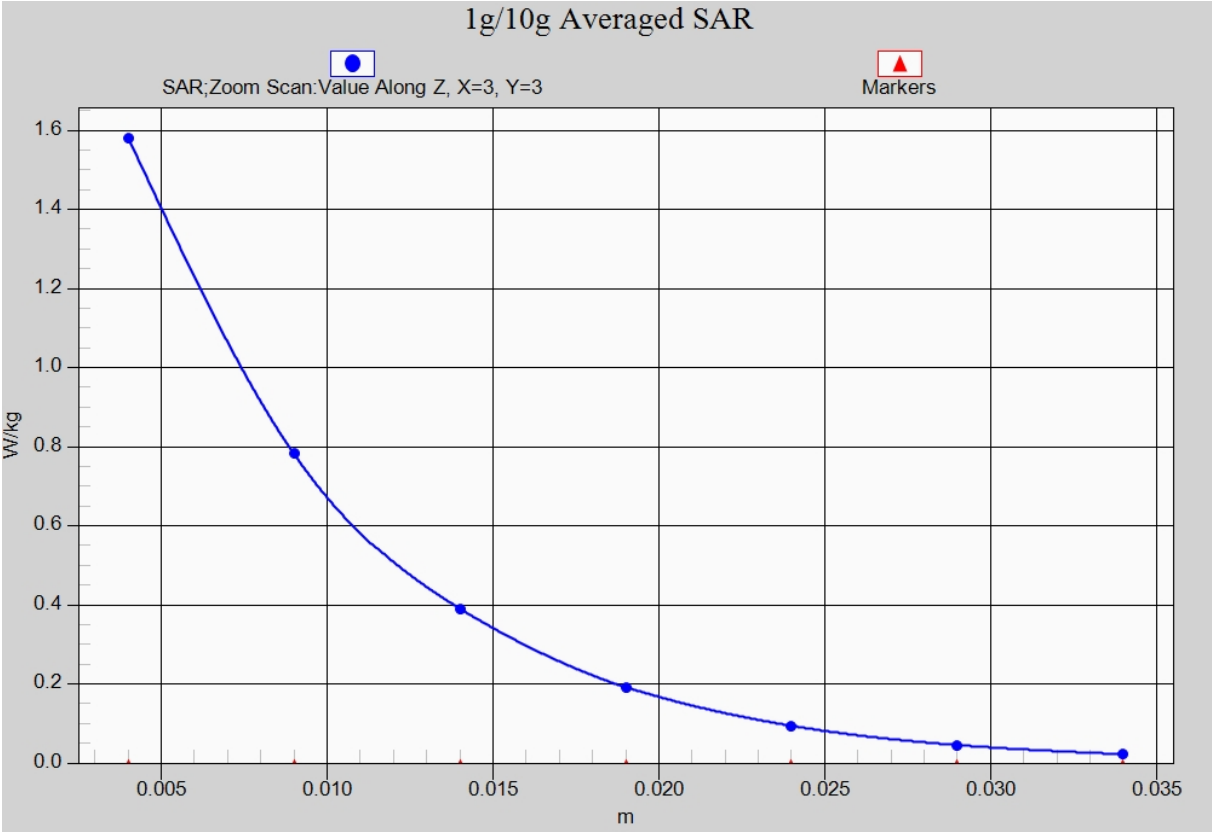

Fig. 10-1 Z-Scan at power reference point (LTE Band7)

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Wifi 802.11b Left Cheek Channel 6

Date: 2015-1-11
Electronics: DAE4 Sn777
Medium: Head 2450 MHz
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.822 mho/m; ε_r = 38.452; ρ = 1000 kg/m^3
Ambient Temperature: 22.5^{o}C Liquid Temperature: 22.0^{o}C
Communication System: WLan 2450 Frequency: 2437 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(6.56, 6.56, 6.56)

Cheek Middle/Area Scan (71x111x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.800 W/kg

Cheek Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.69 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.44 W/kg
SAR(1 g) = 0.645 W/kg; SAR(10 g) = 0.323 W/kg
Maximum value of SAR (measured) = 0.659 W/kg

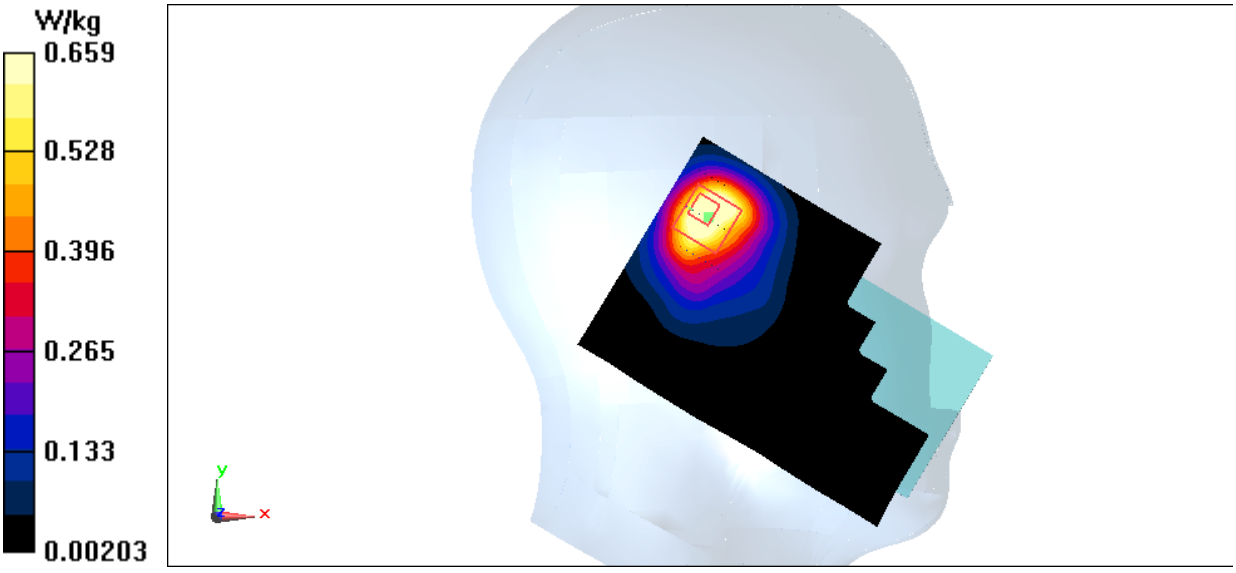

Fig.11 2450 MHz

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