SAR TEST REPORT

No. I14Z45242-SEM01

For

VSN Technologies Inc.

Quad GSM/Dual WCDMA Smart Phone

Mode Name: V2000

Marketing Name: R.40

With

Hardware Version: P3

Software Version: TBW972148_8911_V007284

FCC ID: 2AA9WV2000

IC No.: 11665A-V2000

Issued Date: 2014-04-02

DAkkS Deutsche Akkreditierungsstelle D-PL-12123-01-01

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 TMC Beijing.

Test Laboratory:

TMC Beijing, Telecommunication Metrology Center of MIIT

No. 52, Huayuan Bei Road, Haidian District, Beijing, P. R. China 100191.

Tel:+86(0)10-62304633-2079, Fax:+86(0)10-62304633 Email:welcome@emcite.com. www.emcite.com

Revision Version

Report Number	Revision	Date	Memo
I14Z45242-SEM01	00	2014-03-31	Initial creation of test report
I14Z45242-SEM01	01	2014-04-02	Update the Operating mode in section 4.1 on page 9

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1 Test Laboratory

1.1 Testing Location

Company Name:	TMC Beijing, Telecommunication Metrology Center of MIIT
Address:	No 52, Huayuan beilu, Haidian District, Beijing,P.R.China
Postal Code:	100191
Telephone:	+86-10-62304633
Fax:	+86-10-62304793

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:	February 17, 2014
Testing End Date:	February 19, 2014

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)

2 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for VSN Technologies Inc. Dual GSM/Dual WCDMA Smart Phone V2000 / R.40 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	0.66	PCE
	PCS 1900	0.32	
	UMTS FDD 2	0.49	
	UMTS FDD 5	0.48	
	WLAN 2.4 GHz	0.51	DTS
Body-worn (Separation Distance 10mm)	GSM 850	1.22	PCE
	PCS 1900	1.17	
	UMTS FDD 2	0.84	
	UMTS FDD 5	0.73	
	WLAN 2.4 GHz	0.24	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**: 1.22 W/kg (1g).**

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

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Head	Right hand, Touch cheek	0.66	0.51	**1.17**
Highest reported SAR value for Body	Rear	1.22	0.20	**1.42**
	Left Side	0.67	0.24	**0.91**

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

	Position	Main antenna	BT*	Sum
Highest reported SAR value for Head	Right hand, Touch cheek	0.66	0.33	**0.99**
Highest reported SAR value for Body	Rear	1.22	0.17	**1.39**

BT* - Estimated SAR for Bluetooth (see the table 13.3)

According to the above tables, the highest sum of reported SAR values is **1.42 W/kg (1g)**. The detail for simultaneous transmission consideration is described in chapter 13.

3 Client Information

3.1 Applicant Information

Company Name:	VSN Technologies Inc.
Address /Post:	1975 E. Sunrise Blvd., #400 Fort Lauderdale, FL
City:	fort lauderdale
Postal Code:	33323
Country:	United States
Contact:	Donghailun
Email:	amit.verma@vsnmobil.com
Telephone:	9546094912
Fax:	9543068450

3.2 Manufacturer Information

Company Name:	Beijing Benywave Technology Co. Ltd.
Address /Post:	NO.55 Jiachang 2 Road, OPTO-Mechatronics Industrial Park, Tongzhou District
City:	Beijing
Postal Code:	100111
Country:	China
Contact:	/
Email:	/
Telephone:	+86-10-58928917
Fax:	/

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

4.1 About EUT

Description:	Dual GSM/Dual WCDMA Smart Phone
Mode Name:	V2000
Marketing Name:	R.40
Operating mode(s):	GSM 850/1900, WCDMA 850/1900, BT, Wi-Fi
Tested Tx Frequency:	825 – 848.8 MHz (GSM 850)
	1850.2 – 1910 MHz (GSM 1900)
	826.4–846.6 MHz (WCDMA850 Band V)
	1852.4–1907.6 MHz (WCDMA1900 Band II)
	2412 – 2462 MHz (Wi-Fi 2.4G)
GPRS/EGPRS Multislot Class:	12
GPRS capability Class:	B
Test device Production information:	Production unit
Device type:	Portable device
Antenna type:	Integrated antenna
Accessories/Body-worn configurations:	Headset
Hotspot mode:	Support simultaneous transmission of hotspot and voice(or data)

4.2 Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version
EUT1	864513010011606	P3	TBW972148_8911_V007284

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

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	TBT9605	/	/
AE2	Headset	/	/	/

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

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.

RSS-102: Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)

EN 62209-2: 2010 Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)

KDB447498 D01: General RF Exposure Guidance v05r01: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

KDB648474 D04 Handset SAR v01r01: SAR Evaluation Considerations for Wireless Handsets.

KDB941225 D06 Hotspot Mode SAR v01r01: 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 v01r01: SAR Measurement Requirements for 100 MHz to 6 GHz

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

6 Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

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

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

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

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

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

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

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

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

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

7 Tissue Simulating Liquids

7.1 Targets for tissue simulating liquid

Table 7.1: Targets for tissue simulating liquid

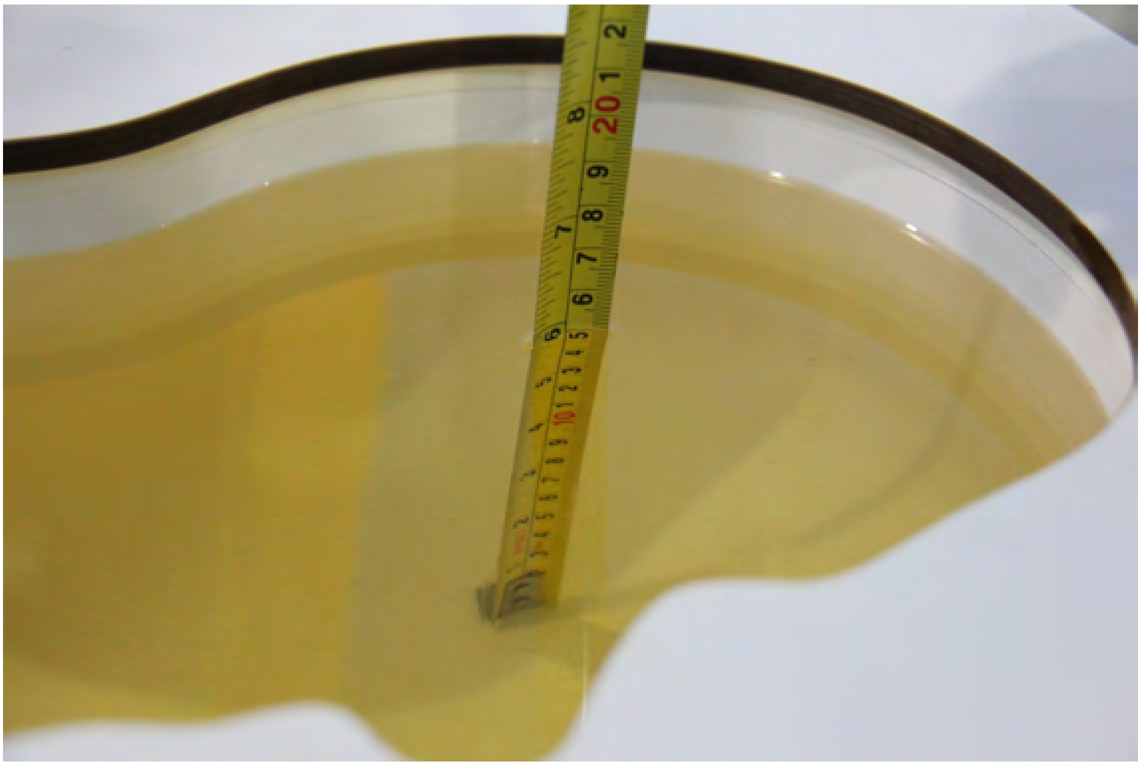
Frequency (MHz)	Liquid Type	Conductivity (σ)	± 5% Range	Permittivity (ε)	± 5% Range
835	Head	0.90	0.86～0.95	41.5	39.4～43.6
835	Body	0.97	0.92～1.02	55.2	52.4～58.0
1900	Head	1.40	1.33～1.47	40.0	38.0～42.0
1900	Body	1.52	1.44～1.60	53.3	50.6～56.0
2450	Head	1.80	1.71～1.89	39.2	37.2～41.2
2450	Body	1.95	1.85～2.05	52.7	50.1～55.3

7.2 Dielectric Performance

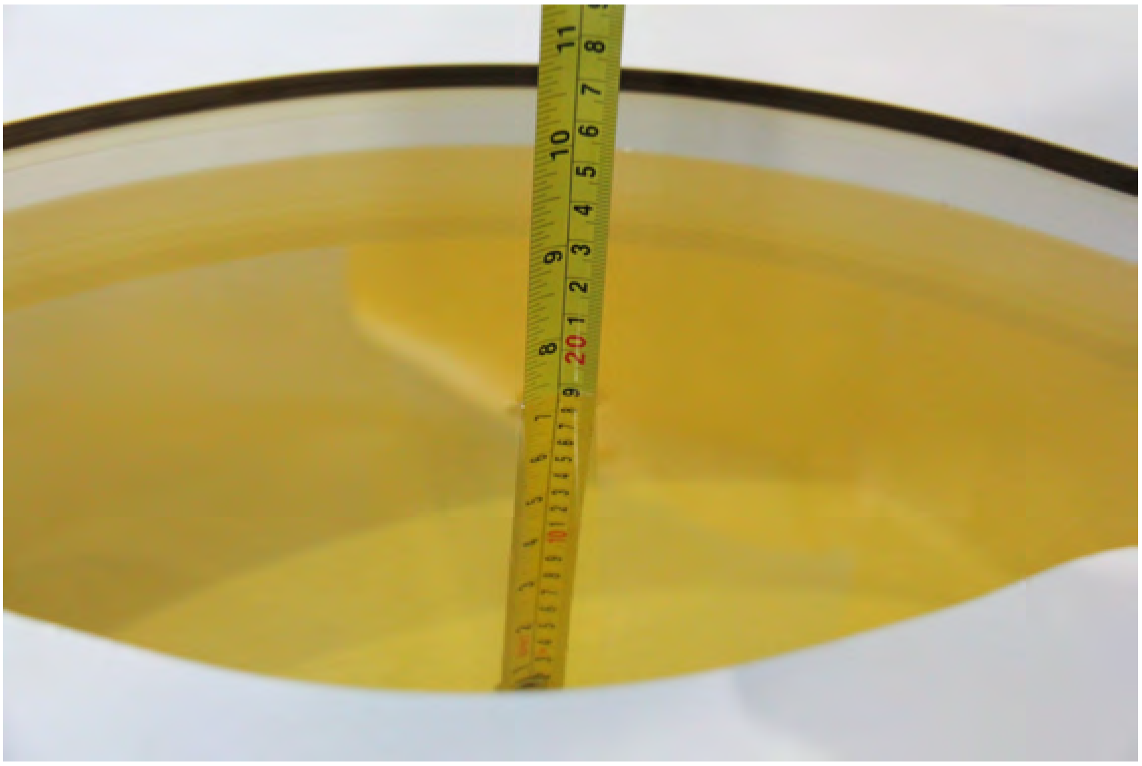
Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	**Type**	**Frequency**	**Permittivity ε**	**Drift (%)**	**Conductivity σ (S/m)**	**Drift (%)**
2014-02-17	Head	835 MHz	41.73	0.55	0.92	2.22
	Body	835 MHz	54.06	-2.07	0.965	-0.52
2014-02-18	Head	1900 MHz	39.18	-2.05	1.414	1.00
	Body	1900 MHz	52.38	-1.73	1.493	-1.78
2014-02-19	Head	2450 MHz	39.5	0.77	1.788	-0.67
	Body	2450 MHz	52.02	-1.29	1.941	-0.46

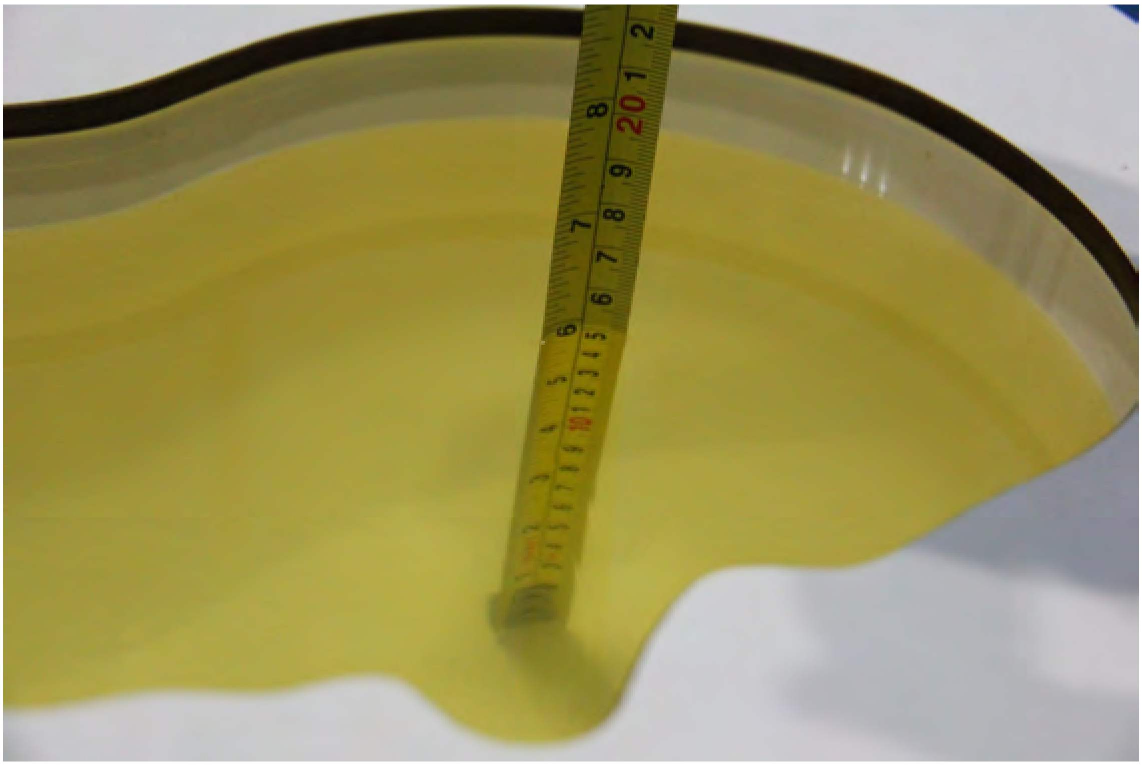
Note: The liquid temperature is 22.0℃



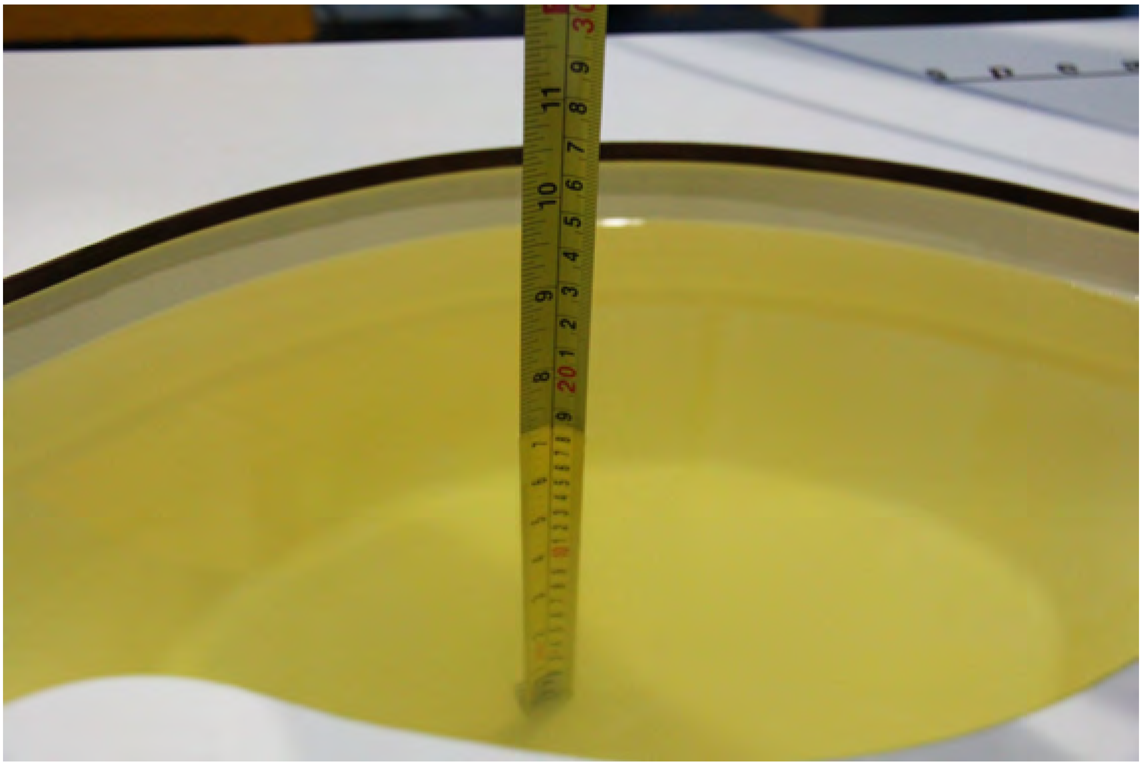
Picture 7-1: Liquid depth in the Head Phantom (835 MHz)



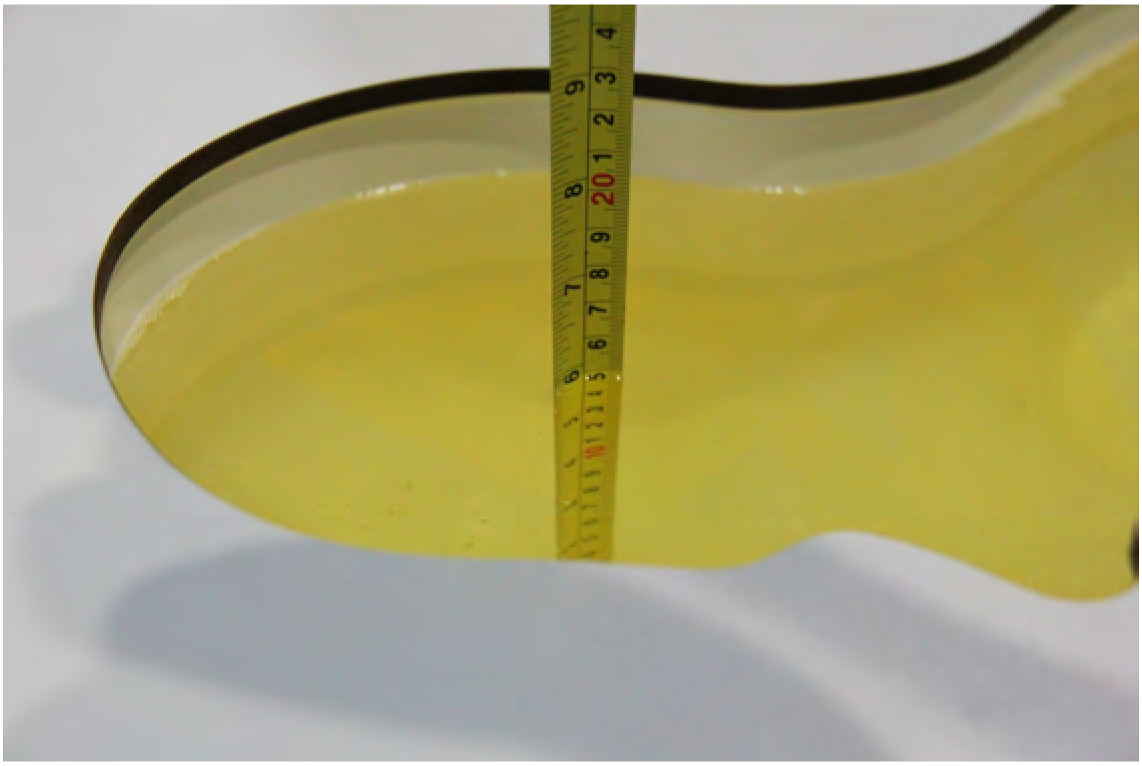
Picture 7-2: Liquid depth in the Flat Phantom (835 MHz)



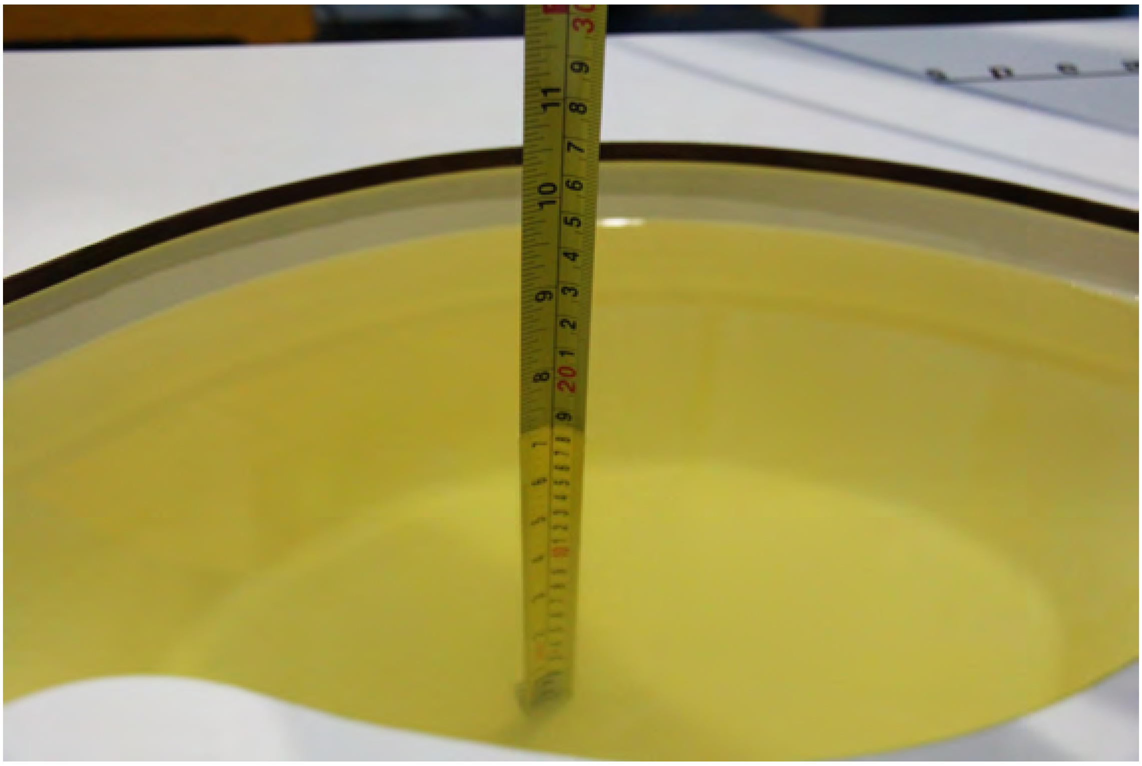
Picture 7-3: Liquid depth in the Head Phantom (1900 MHz)



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



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

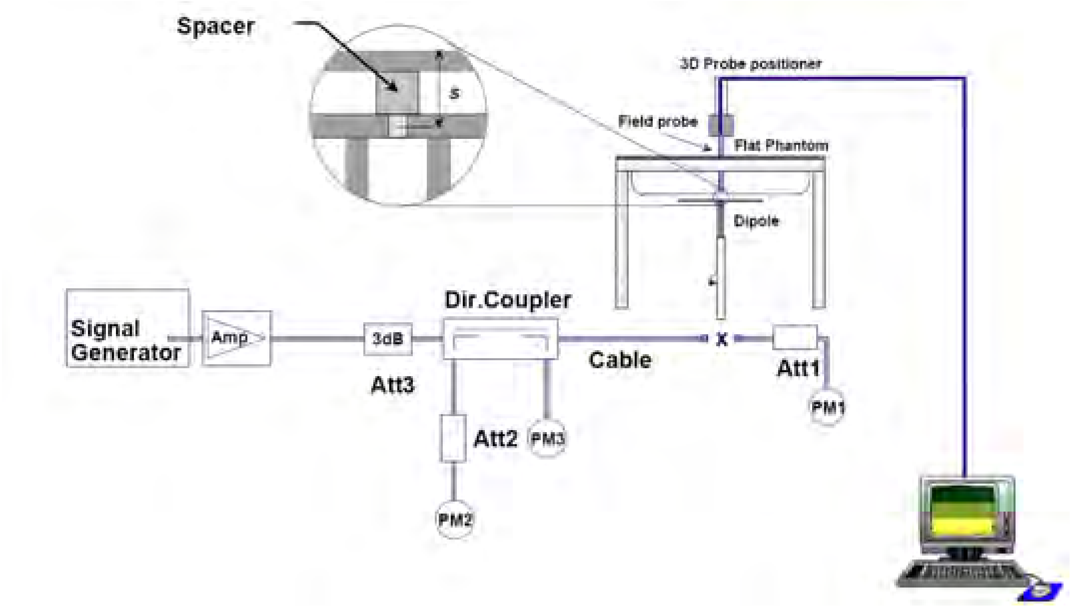


Picture 7-6 Liquid depth in the Flat Phantom (2450MHz)

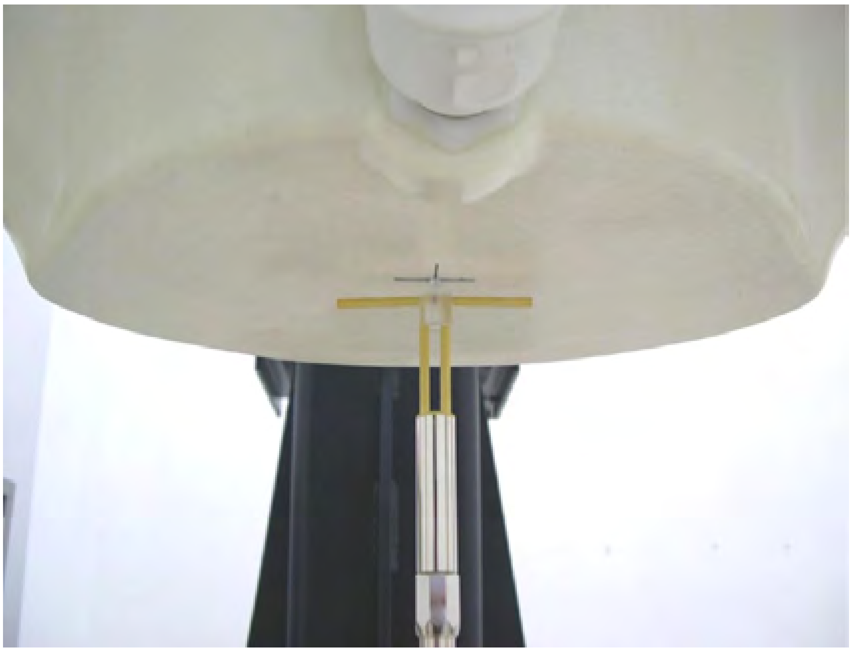
8 System verification

8.1 System Setup

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



Picture 8.1 System Setup for System Evaluation



Picture 8.2 Photo of Dipole Setup

8.2 System Verification

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

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

Table 8.1: System Verification of Head

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2014-02-17	835 MHz	6.16	9.44	6.04	9.16	-1.95%	-2.97%
2014-02-18	1900 MHz	21.3	40.4	21.36	40.40	0.28%	0.00%
2014-02-19	2450 MHz	24.9	53.4	24.20	52.40	-2.81%	-1.87%

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
2014-02-17	835 MHz	6.20	9.40	6.32	9.60	1.94%	2.13%
2014-02-18	1900 MHz	21.9	41.3	21.48	40.80	-1.92%	-1.21%
2014-02-19	2450 MHz	23.4	50.4	23.60	51.20	0.85%	1.59%

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.

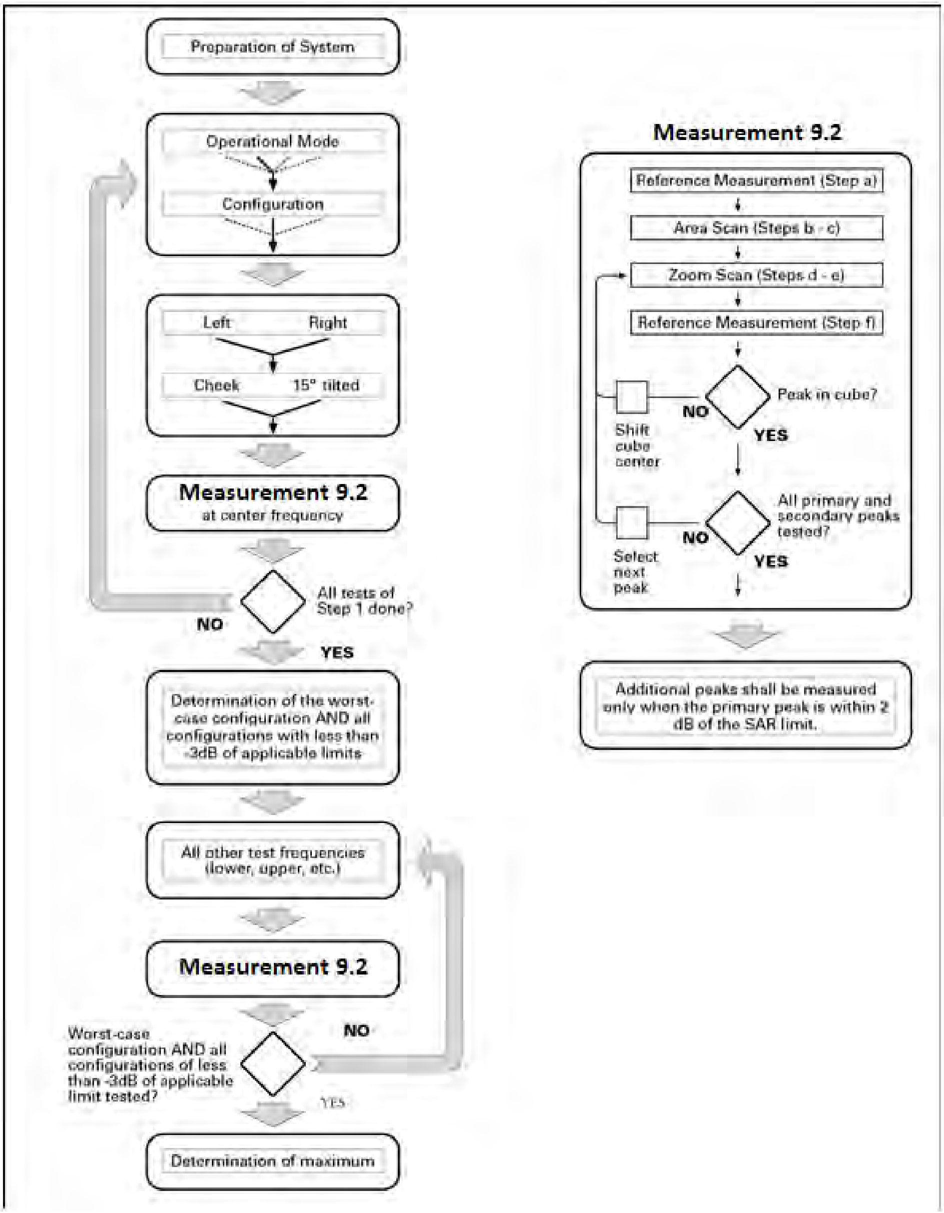
Step 1: The tests described in 9.2 shall be performed at the channel that is closest to the centre of the transmit frequency band (f_c) for:

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.



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 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.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 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.</td></tr>
</table>

9.3 WCDMA Measurement Procedures for SAR

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

For Release 5 HSDPA Data Devices:

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

For Release 6 HSPA Data Devices

Sub-test	β_c	β_d	β_d (SF)	β_c / β_d	β_{hs}	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (dB)	MPR (dB)	AG Index	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1039/225	4	1	1.0	2.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	2.0	1.0	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	1.0	0.0	21	81

9.4 Bluetooth & Wi-Fi Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of 802. 11 transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable.

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

9.5 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 14.21 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

10 Area Scan Based 1-g SAR

10.1 Requirement of KDB

According to the KDB447498 D01 v05, when the implementation is based the specific polynomial fit algorithm as presented at the 29th Bioelectromagnetics Society meeting (2007) and the estimated 1-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.

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)	31.5	31.5	31.5
	Tune-up (dBm)	32.5	32.5	32.5
3Txslots	Target (dBm)	30	30	30
	Tune-up (dBm)	31	31	31
4 Txslots	Target (dBm)	29	29	29
	Tune-up (dBm)	30	30	30
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)	31.5	31.5	31.5
	Tune-up (dBm)	32.5	32.5	32.5
3Txslots	Target (dBm)	30	30	30
	Tune-up (dBm)	31	31	31
4 Txslots	Target (dBm)	29	29	29
	Tune-up (dBm)	30	30	30
GSM 1900 GPRS (GMSK)				
Channel		**810**	**661**	**512**
1 Txslot	Target (dBm)	29.5	29.5	29.5
	Tune-up (dBm)	30.5	30.5	30.5
2 Txslots	Target (dBm)	28.5	28.5	28.5
	Tune-up (dBm)	29.5	29.5	29.5
3Txslots	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

GSM 1900 EGPRS (GMSK)				
Channel		**810**	**661**	**512**
1 Txslot	Target (dBm)	29.5	29.5	29.5
	Tune-up (dBm)	30.5	30.5	30.5
2 Txslots	Target (dBm)	28.5	28.5	28.5
	Tune-up (dBm)	29.5	29.5	29.5
3Txslots	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)	22.5	22.5	22.5
Tune-up (dBm)	23.5	23.5	23.5
HSUPA (sub-test 1)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	20	20	20
Tune-up (dBm)	21	21	21
HSUPA (sub-test 2)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	20	20	20
Tune-up (dBm)	21	21	21
HSUPA (sub-test 3)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21	21	21
Tune-up (dBm)	22	22	22
HSUPA (sub-test 4)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	19	19	19
Tune-up (dBm)	20	20	20
HSUPA (sub-test 5)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	22	22	22
Tune-up (dBm)	23	23	23
WCDMA 1900 CS			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	22	22	22
Tune-up (dBm)	23	23	23
HSUPA (sub-test 1)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	20	20	20
Tune-up (dBm)	21	21	21

HSUPA (sub-test 2)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	20	20	18
Tune-up (dBm)	21	21	19
HSUPA (sub-test 3)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	21	21	21
Tune-up (dBm)	22	22	22
HSUPA (sub-test 4)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	19	19	19
Tune-up (dBm)	20	20	20
HSUPA (sub-test 5)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	22	22	22
Tune-up (dBm)	23	23	23

Table 11.4: Bluetooth

Mode	Target (dBm)	Tune-up (dBm)
GFSK	7	9
EDR2M-4_DQPSK	7	9
EDR3M-8DPSK	7	9

Table 11.5: WiFi

Mode	Target (dBm)	Tune-up (dBm)
802.11 b (2.4GHz)	14	16
802.11 g (2.4GHz) 6Mbps	13	16
802.11 g (2.4GHz) 9Mbps~12Mbps	13.5	15.5
802.11 g (2.4GHz) 18Mbps~24Mbps	13	15
802.11 g (2.4GHz) 36Mbps	12	14
802.11 g (2.4GHz) 48Mbps~54Mbps	11.5	13.5
802.11 n (2.4GHz HT20) MCS0	13	15
802.11 n (2.4GHz HT20) MCS1~MCS3	12.5	14.5
802.11 n (2.4GHz HT20) MCS4~MCS7	11	13

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 11.6: 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)
	31.74	31.83	31.86
GSM 1900MHz	Conducted Power (dBm)		
	Channel 810(1909.8MHz)	Channel 661(1880MHz)	Channel 512(1850.2MHz)
	29.93	29.34	30.01

Table 11.7: 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	31.71	31.79	31.83	-9.03dB	22.68	22.76	22.8
2 Txslots	30.98	31.06	31.12	-6.02dB	24.96	25.04	25.1
3Txslots	29.28	29.35	29.44	-4.26dB	25.02	25.09	25.18
4 Txslots	28.28	28.36	28.42	-3.01dB	**25.27**	**25.35**	**25.41**
GSM 850 EGPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	251	**190**	**128**		**251**	**190**	**128**
1 Txslot	31.66	31.77	31.81	-9.03dB	22.63	22.74	22.78
2 Txslots	30.93	31.04	31.10	-6.02dB	24.91	25.02	25.08
3Txslots	29.24	29.33	29.42	-4.26dB	24.98	25.07	25.16
4 Txslots	28.24	28.33	28.40	-3.01dB	**25.23**	**25.32**	**25.39**
PCS1900 GPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	810	**661**	**512**		**810**	**661**	**512**
1 Txslot	29.90	29.32	30.00	-9.03dB	20.87	20.29	20.97
2 Txslots	28.96	28.37	29.06	-6.02dB	22.94	22.35	23.04
3Txslots	27.03	26.43	27.09	-4.26dB	22.77	22.17	22.83
4 Txslots	26.04	25.40	26.07	-3.01dB	**23.03**	**22.39**	**23.06**
PCS1900 EGPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	810	**661**	**512**		**810**	**661**	**512**
1 Txslot	29.88	29.32	29.99	-9.03dB	20.85	20.29	20.96
2 Txslots	28.94	28.37	29.04	-6.02dB	22.92	22.35	23.02
3Txslots	27.01	26.43	27.08	-4.26dB	22.75	22.17	22.82
4 Txslots	26.03	25.40	26.06	-3.01dB	**23.02**	**22.39**	**23.05**

NOTES:

1) Division Factors

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

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

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

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

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

According to the conducted power as above, the body measurements are performed with 4Txslots for GSM850 and PCS1900.

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 11.8: The conducted Power for WCDMA850/1900

Item	band	FDDV result		
	ARFCN	4233 (846.6MHz)	4182 (836.4MHz)	4132 (826.4MHz)
WCDMA	\	22.60	22.63	22.68
HSUPA	1	19.05	19.81	19.93
	2	19.03	19.79	19.93
	3	20.01	20.77	20.92
	4	18.50	19.25	19.40
	5	21.10	21.77	21.91
Item	band	FDDII result		
	ARFCN	9538 (1907.6MHz)	9400 (1880MHz)	9262 (1852.4MHz)
WCDMA	\	22.99	22.83	22.86
HSUPA	1	20.05	19.84	19.81
	2	20.03	19.82	19.80
	3	21.03	20.80	20.80
	4	19.49	19.26	19.30
	5	21.99	21.79	21.76

Note: HSUPA body SAR for WCDMA850/1900 are not required, because maximum average output power of each RF channel with HSUPA active is not 1/4 dB higher than that measured without HSUPA and the maximum SAR for WCDMA850/1900 are not above 75% of the SAR limit.

11.4 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	8.15	8.58	8.55
EDR2M-4_DQPSK	7.99	8.43	8.43
EDR3M-8DPSK	8.32	8.71	8.66

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

802.11b（dBm）

Channel\data rate	1Mbps	2Mbps	5.5Mbps	11Mbps
1	15.33	15.32	15.18	14.89
6	15.52	15.44	15.3	15.01
11	15.67	15.51	15.38	14.92

802.11g（dBm）

Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
1	14.49	13.92	13.76	13.39	13.1	12.58	11.85	11.7
6	15.58	15.16	14.98	14.64	14.32	13.53	13.07	12.9
11	14.74	14.28	14.1	13.76	13.45	12.7	12.24	12.07

802.11n（dBm）- HT20 (2.4G)

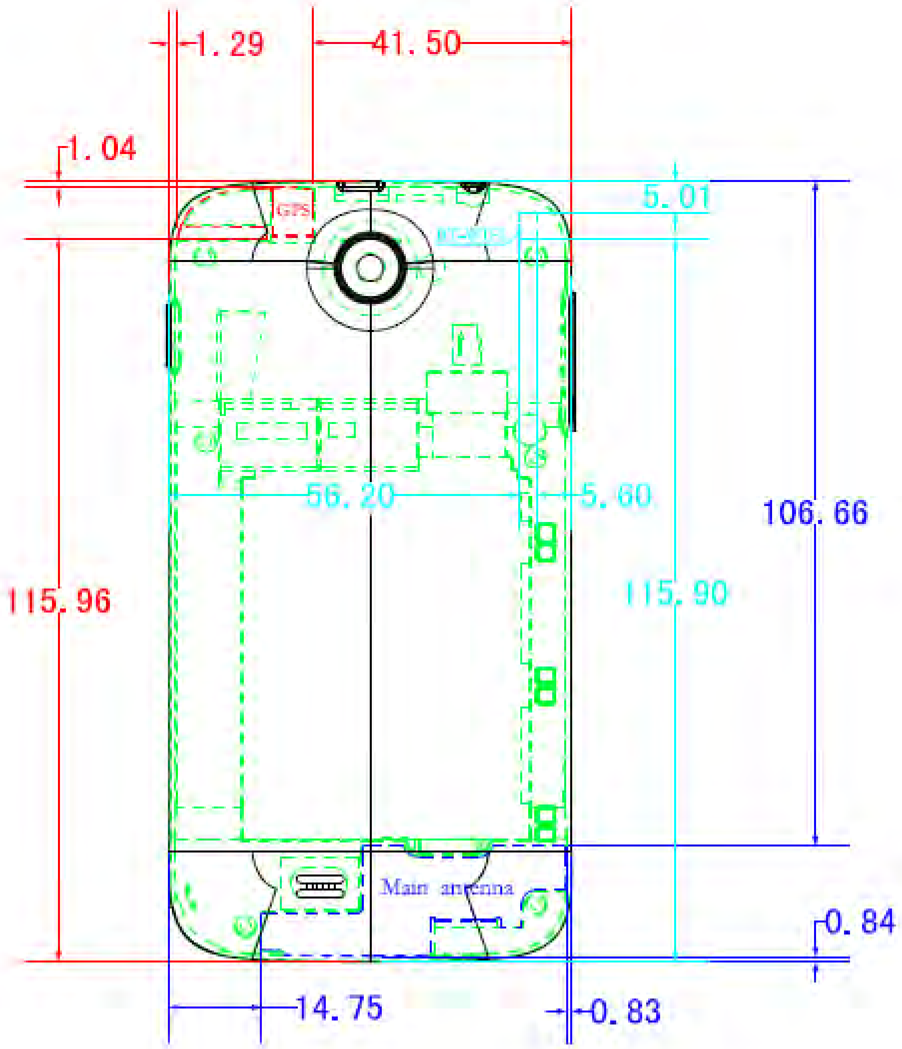
Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1	14.14	13.72	13.39	13.06	12.57	12.18	11.99	11.82
6	14.35	13.95	13.62	13.29	12.56	12.15	11.98	11.85
11	14.74	14.34	13.71	13.41	12.91	12.49	12.09	11.93

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	Yes	No	Yes	No

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	8.71	7.43	Yes
		Body	19.20	8.71	7.43	Yes
2.4GHz WLAN 802.11 b	2.45	Head	9.58	15.67	36.90	No
		Body	19.17	15.67	36.90	No

13 Evaluation of Simultaneous

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

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Head	Right hand, Touch cheek	0.66	0.51	**1.17**
Highest reported SAR value for Body	Left Side	0.67	0.24	**0.91**
	Rear	1.22	0.20	**1.42**

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

	Position	Main antenna	BT*	Sum
Highest reported SAR value for Head	Right hand, Touch cheek	0.66	0.33	**0.99**
Highest reported SAR value for Body	Rear	1.22	0.17	**1.39**

BT* - 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	9	7.94	0.33
Body	2.441	10	9	7.94	0.17

* - Maximum possible output power declared by manufacturer

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;
where x = 7.5 for 1-g SAR.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

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

14 SAR Test Result

It is determined by 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:

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

Where P_{Target} is the power of manufacturing upper limit;
$P_{Measured}$ is the measured power in chapter 11.

Table 14.1: Duty Cycle

Mode	**Duty Cycle**
Speech for GSM850/1900	1:8.3
GPRS&EGPRS for GSM850/1900	1:2
WCDMA850/1900 &WiFi	1:1

14.1 SAR results for Fast SAR

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

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃											
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	/	31.74	33.5	0.325	**0.49**	0.428	**0.64**	-0.09
836.6	190	Left	Touch	/	31.83	33.5	0.261	**0.38**	0.377	**0.55**	0.08
824.2	128	Left	Touch	/	31.86	33.5	0.202	**0.29**	0.291	**0.42**	0.05
848.8	251	Left	Tilt	/	31.74	33.5	0.191	**0.29**	0.277	**0.42**	0.14
836.6	190	Left	Tilt	/	31.83	33.5	0.174	**0.26**	0.252	**0.37**	0.03
824.2	128	Left	Tilt	/	31.86	33.5	0.133	**0.19**	0.192	**0.28**	0.03
848.8	251	Right	Touch	Fig.1	31.74	33.5	0.333	**0.50**	0.439	**0.66**	0.10
836.6	190	Right	Touch	/	31.83	33.5	0.277	**0.41**	0.403	**0.59**	0.06
824.2	128	Right	Touch	/	31.86	33.5	0.219	**0.32**	0.317	**0.46**	-0.12
848.8	251	Right	Tilt	/	31.74	33.5	0.194	**0.29**	0.278	**0.42**	0.00
836.6	190	Right	Tilt	/	31.83	33.5	0.182	**0.27**	0.260	**0.38**	0.02
824.2	128	Right	Tilt	/	31.86	33.5	0.142	**0.21**	0.202	**0.29**	0.07

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

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃											
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.										
836.6	190	GPRS (4)	Front	/	28.36	30	0.367	**0.54**	0.511	**0.75**	0.04
836.6	190	GPRS (4)	Rear	/	28.36	30	0.481	**0.70**	0.676	**0.99**	-0.01
836.6	190	GPRS (4)	Left	/	28.36	30	0.315	**0.46**	0.456	**0.67**	0.11
836.6	190	GPRS (4)	Right	/	28.36	30	0.322	**0.47**	0.465	**0.68**	0.06
836.6	190	GPRS (4)	Bottom	/	28.36	30	0.037	**0.05**	0.0563	**0.08**	-0.18
848.8	251	GPRS (4)	Rear	Fig.2	28.28	30	0.617	**0.92**	0.818	**1.22**	0.03
824.2	128	GPRS (4)	Rear	/	28.42	30	0.392	**0.56**	0.552	**0.79**	0.03
848.8	251	EGPRS (4)	Rear	/	28.24	30	0.570	**0.85**	0.802	**1.20**	-0.03
848.8	251	Speech	Rear Headset	/	31.74	33.5	0.206	**0.31**	0.293	**0.44**	0.02

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

Table 14.4: SAR Values (GSM 1900 MHz Band - Head)

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃											
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	Fig.3	29.93	30.5	0.171	**0.19**	0.285	**0.32**	-0.18
1880	661	Left	Touch	/	29.34	30.5	0.135	**0.18**	0.235	**0.31**	0.11
1850.2	512	Left	Touch	/	30.01	30.5	0.158	**0.18**	0.273	**0.31**	0.15
1909.8	810	Left	Tilt	/	29.93	30.5	0.062	**0.07**	0.105	**0.12**	0.08
1880	661	Left	Tilt	/	29.34	30.5	0.053	**0.07**	0.090	**0.12**	0.15
1850.2	512	Left	Tilt	/	30.01	30.5	0.054	**0.06**	0.093	**0.10**	0.13
1909.8	810	Right	Touch	/	29.93	30.5	0.104	**0.12**	0.186	**0.21**	0.18
1880	661	Right	Touch	/	29.34	30.5	0.091	**0.12**	0.160	**0.21**	0.10
1850.2	512	Right	Touch	/	30.01	30.5	0.126	**0.14**	0.204	**0.23**	0.10
1909.8	810	Right	Tilt	/	29.93	30.5	0.074	**0.08**	0.132	**0.15**	-0.03
1880	661	Right	Tilt	/	29.34	30.5	0.055	**0.07**	0.100	**0.13**	0.13
1850.2	512	Right	Tilt	/	30.01	30.5	0.062	**0.07**	0.111	**0.12**	0.16

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

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃											
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	/	25.40	26.5	0.388	**0.50**	0.638	**0.82**	0.14
1880	661	GPRS (4)	Rear	/	25.40	26.5	0.534	**0.69**	0.904	**1.16**	-0.01
1880	661	GPRS (4)	Left	/	25.40	26.5	0.079	**0.10**	0.137	**0.18**	-0.06

1880	661	GPRS (4)	Right	/	25.40	26.5	0.062	**0.08**	0.110	**0.14**	0.04
1880	661	GPRS (4)	Bottom	/	25.40	26.5	0.303	**0.39**	0.561	**0.72**	0.10
1909.8	810	GPRS (4)	Rear	Fig.4	26.04	26.5	0.627	**0.70**	1.05	**1.17**	0.09
1850.2	512	GPRS (4)	Rear	/	26.07	26.5	0.594	**0.66**	1.01	**1.12**	0.02
1909.8	810	EGPRS (4)	Rear	/	25.40	26.5	0.616	**0.79**	1.03	**1.33**	0.12
1909.8	810	Speech	Rear Headset	/	29.93	30.5	0.307	**0.35**	0.519	**0.59**	-0.10

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

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

Ambient Temperature: 22.3℃ Liquid Temperature: 21.8℃											
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	/	22.60	23.5	0.259	**0.32**	0.348	**0.43**	0.16
836.4	4182	Left	Touch	/	22.63	23.5	0.260	**0.32**	0.375	**0.46**	0.16
826.4	4132	Left	Touch	/	22.68	23.5	0.229	**0.28**	0.330	**0.40**	0.16
846.6	4233	Left	Tilt	/	22.60	23.5	0.198	**0.24**	0.287	**0.35**	-0.19
836.4	4182	Left	Tilt	/	22.63	23.5	0.174	**0.21**	0.252	**0.31**	0.13
826.4	4132	Left	Tilt	/	22.68	23.5	0.156	**0.19**	0.226	**0.27**	0.12
846.6	4233	Right	Touch	Fig.5	22.60	23.5	0.296	**0.36**	0.390	**0.48**	-0.16
836.4	4182	Right	Touch	/	22.63	23.5	0.256	**0.31**	0.371	**0.45**	0.08
826.4	4132	Right	Touch	/	22.68	23.5	0.226	**0.27**	0.328	**0.40**	0.09
846.6	4233	Right	Tilt	/	22.60	23.5	0.174	**0.21**	0.249	**0.31**	0.08
836.4	4182	Right	Tilt	/	22.63	23.5	0.168	**0.21**	0.240	**0.29**	0.08
826.4	4132	Right	Tilt	/	22.68	23.5	0.152	**0.18**	0.217	**0.26**	0.06

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

Ambient Temperature: 22.3℃ Liquid Temperature: 21.8℃										
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	/	22.63	23.5	0.293	**0.36**	0.408	**0.50**	0.00
836.4	4182	Rear	/	22.63	23.5	0.385	**0.47**	0.542	**0.66**	0.01
836.4	4182	Left	/	22.63	23.5	0.264	**0.32**	0.384	**0.47**	0.09
836.4	4182	Right	/	22.63	23.5	0.255	**0.31**	0.368	**0.45**	0.01
836.4	4182	Bottom	/	22.63	23.5	0.247	**0.30**	0.040	**0.05**	0.10
846.6	4233	Rear	Fig.6	22.60	23.5	0.448	**0.55**	0.592	**0.73**	-0.02
826.4	4132	Rear	/	22.68	23.5	0.359	**0.43**	0.506	**0.61**	0.04
846.6	4233	Rear Headset	/	22.60	23.5	0.322	**0.40**	0.456	**0.56**	0.04

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

Table 14.8: SAR Values (WCDMA 1900 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.										
1907.6	9538	Left	Touch	/	22.99	23	0.258	**0.26**	0.448	**0.45**	-0.10
1880	9400	Left	Touch	/	22.83	23	0.2	**0.21**	0.348	**0.36**	0.10
1852.4	9262	Left	Touch	Fig.7	22.86	23	0.29	**0.30**	0.476	**0.49**	0.17
1907.6	9538	Left	Tilt	/	22.99	23	0.0976	**0.10**	0.172	**0.17**	0.16
1880	9400	Left	Tilt	/	22.83	23	0.0674	**0.07**	0.12	**0.12**	0.12
1852.4	9262	Left	Tilt	/	22.86	23	0.0859	**0.09**	0.147	**0.15**	-0.01
1907.6	9538	Right	Touch	/	22.99	23	0.135	**0.14**	0.235	**0.24**	0.11
1880	9400	Right	Touch	/	22.83	23	0.0984	**0.10**	0.17	**0.18**	0.13
1852.4	9262	Right	Touch	/	22.86	23	0.169	**0.17**	0.268	**0.28**	0.13
1907.6	9538	Right	Tilt	/	22.99	23	0.101	**0.10**	0.181	**0.18**	-0.09
1880	9400	Right	Tilt	/	22.83	23	0.0612	**0.06**	0.107	**0.11**	0.15
1852.4	9262	Right	Tilt	/	22.86	23	0.0863	**0.09**	0.148	**0.15**	-0.18

Table 14.9: SAR Values (WCDMA 1900 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.									
1880	9400	Front	/	22.83	23	0.257	**0.27**	0.433	**0.45**	0.09
1880	9400	Rear	/	22.83	23	0.357	**0.37**	0.605	**0.63**	0.17
1880	9400	Left	/	22.83	23	0.058	**0.06**	0.101	**0.11**	0.15
1880	9400	Right	/	22.83	23	0.063	**0.07**	0.111	**0.12**	-0.08
1880	9400	Bottom	/	22.83	23	0.302	**0.31**	0.566	**0.59**	-0.15
1907.6	9538	Rear	/	22.99	23	0.441	**0.44**	0.754	**0.76**	0.17
1852.4	9262	Rear	Fig.8	22.86	23	0.497	**0.51**	0.809	**0.84**	0.08
1852.4	9262	Rear Headset	/	22.86	23	0.486	**0.50**	0.790	**0.82**	0.16

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

Table 14.10: SAR Values (Wi-Fi 802.11b - Head)

Ambient Temperature: 22.2 °C Liquid Temperature: 21.7 °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	/	15.52	16	0.070	**0.08**	0.133	**0.15**	0.19
2437	6	Left	Tilt	/	15.52	16	0.059	**0.07**	0.110	**0.12**	0.15
2437	6	Right	Touch	Fig.9	15.52	16	0.207	**0.23**	0.459	**0.51**	0.12
2437	6	Right	Tilt	/	15.52	16	0.172	**0.19**	0.347	**0.39**	0.13

Table 14.11: SAR Values (Wi-Fi 802.11b - Body)

Ambient Temperature: 22.2 ℃ Liquid Temperature: 21.7 ℃										
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	/	15.52	16	0.044	**0.05**	0.094	**0.10**	0.09
2437	6	Rear	/	15.52	16	0.089	**0.10**	0.183	**0.20**	-0.13
2437	6	Left	Fig.10	15.52	16	0.116	**0.13**	0.217	**0.24**	0.00
2437	6	Top		15.52	16	0.071	**0.08**	0.150	**0.17**	0.01

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

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

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃											
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	Right	Touch	Fig.1	31.74	33.5	0.333	**0.50**	0.439	**0.66**	0.10

Table 14.13: SAR Values (GSM 850 MHz Band - Body)

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃											
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)	Rear	Fig.2	28.28	30	0.617	**0.92**	0.818	**1.22**	0.03

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

Table 14.14: SAR Values (GSM 1900 MHz Band - Head)

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃											
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	Fig.3	29.93	30.5	0.171	**0.19**	0.285	**0.32**	-0.18

Table 14.15: SAR Values (GSM 1900 MHz Band - Body)

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃											
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)	Rear	Fig.4	26.04	26.5	0.627	**0.70**	1.05	**1.17**	0.09

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

Table 14.16: SAR Values (WCDMA 850 MHz Band - Head)

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃											
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	22.60	23.5	0.296	**0.36**	0.39	**0.48**	-0.16

Table 14.17: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃										
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.									
846.6	4233	Rear	Fig.6	22.6	23.5	0.448	**0.55**	0.592	**0.73**	-0.02

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

Table 14.18: SAR Values (WCDMA 1900 MHz Band - Head)

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃											
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.										
1852.4	9262	Left	Touch	Fig.7	22.86	23	0.29	**0.30**	0.476	**0.49**	0.17

Table 14.19: SAR Values (WCDMA 1900 MHz Band - Body)

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.8 ℃										
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.									
1852.4	9262	Rear	Fig.8	22.86	23	0.497	**0.51**	0.809	**0.84**	0.08

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

Table 14.20: SAR Values (Wi-Fi 802.11b - Head)

Ambient Temperature: 22.2 ℃ Liquid Temperature: 21.7 ℃											
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	Right	Touch	Fig.9	15.52	16	0.207	**0.23**	0.459	**0.51**	0.12

Table 14.21: SAR Values (Wi-Fi 802.11b - Body)

Ambient Temperature: 22.2 ℃ Liquid Temperature: 21.7 ℃										
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	Left	Fig.10	15.52	16	0.116	**0.13**	0.217	**0.24**	0.00

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

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.						
848.8	251	Rear	10	0.818	0.801	1.02	/

Table 15.2: SAR Measurement Variability for Body GSM 1900 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
1909.8	810	Rear	10	1.05	1.02	1.03	/

Table 15.3: SAR Measurement Variability for Body WCDMA 1900 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
1852.4	9262	Rear	10	0.809	0.793	1.02	/

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 o f 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	Power scaling	B	2.2	R	$\sqrt{3}$	1	1	2.2	2.2	∞
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	Algorithm for correcting SAR for deviations in permittivity and conductivity	B	1.9	N	1	1	0.84	1.9	1.6	∞
20	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
21	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
22	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
23	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{23} c_i^2 u_i^2}$						9.69	9.47	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						19.4	18.9	

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

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std.Unc. (1g)	Std.Unc. (10g)	Degree o f 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 p ositioned mech. restrictions	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
12	Probe p ositioning w ith 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	Power scaling	B	2.2	R	$\sqrt{3}$	1	1	2.2	2.2	∞
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	Algorithm for co rrecting SAR for d eviations i n permittivity and conductivity	B	1.9	N	1	1	0.84	1.9	1.6	∞
20	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
21	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
22	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
23	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{23} c_i^2 u_i^2}$						11.2	11.0	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						22.3	21.9	

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 o f 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	Power scaling	B	2.2	R	$\sqrt{3}$	1	1	2.2	2.2	∞
18	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
19	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
20	Algorithm for correcting SAR for deviations in permittivity and conductivity	B	1.9	N	1	1	0.84	1.9	1.6	∞
21	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
22	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
23	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
24	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{24} c_i^2 u_i^2}$						10.5	10.3	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						21.0	20.6	

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

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std.Unc. (1g)	Std.Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	6.5	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										
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	Power scaling	B	2.2	R	$\sqrt{3}$	1	1	2.2	2.2	∞
18	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
19	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
20	Algorithm for correcting SAR for deviations in permittivity and conductivity	B	1.9	N	1	1	0.84	1.9	1.6	∞
21	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
22	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
23	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
24	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						13.6	13.5	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						27.2	26.9	

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, 2013	One year
03	Power sensor	NRV-Z5	100596		
04	Signal Generator	E4438C	MY49070393	November 08, 2013	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	E5515C	MY50263375	January 30, 2014	One year
07	E-field Probe	SPEAG EX3DV4	3846	September 03, 2013	One year
08	DAE	SPEAG DAE4	771	November 12, 2013	One year
09	Dipole Validation Kit	SPEAG D835V2	443	August 29, 2013	One year
10	Dipole Validation Kit	SPEAG D1900V2	5d101	July 09, 2013	One year
11	Dipole Validation Kit	SPEAG D2450V2	853	July 08, 2013	One year

END OF REPORT BODY

ANNEX A Graph Results

850 Right Cheek High

Date: 2014-2-17
Electronics: DAE4 Sn771
Medium: Head 850 MHz
Medium parameters used (interpolated): f = 848.8 MHz; σ = 0.930 S/m; εr = 41.7; ρ = 1000 kg/m^3
Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C
Communication System: GSM 850 Frequency: 848.8 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3846 ConvF(8.92, 8.92, 8.92)

Cheek High/Area Scan (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.463 W/kg

Cheek High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.624 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.543 W/kg
SAR(1 g) = 0.439 W/kg; SAR(10 g) = 0.333 W/kg
Maximum value of SAR (measured) = 0.458 W/kg

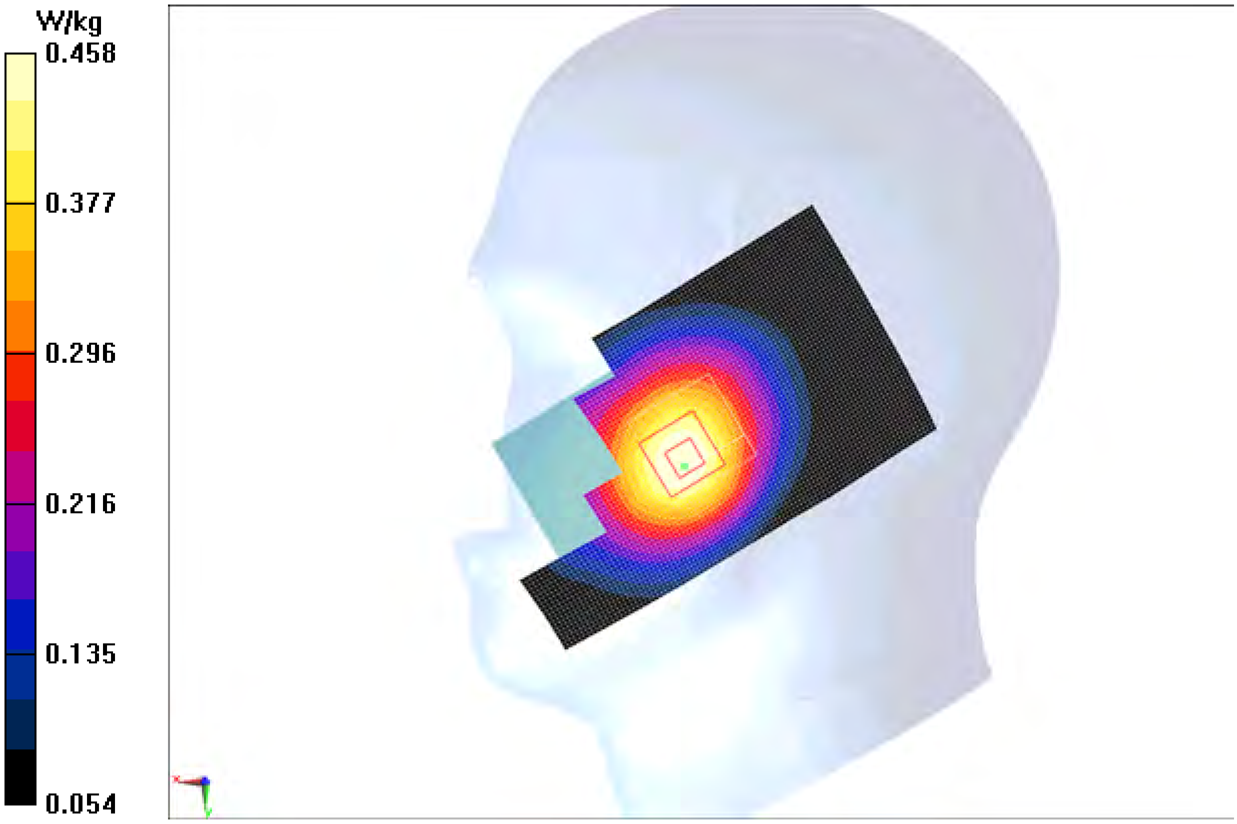


Fig.1 850MHz CH251

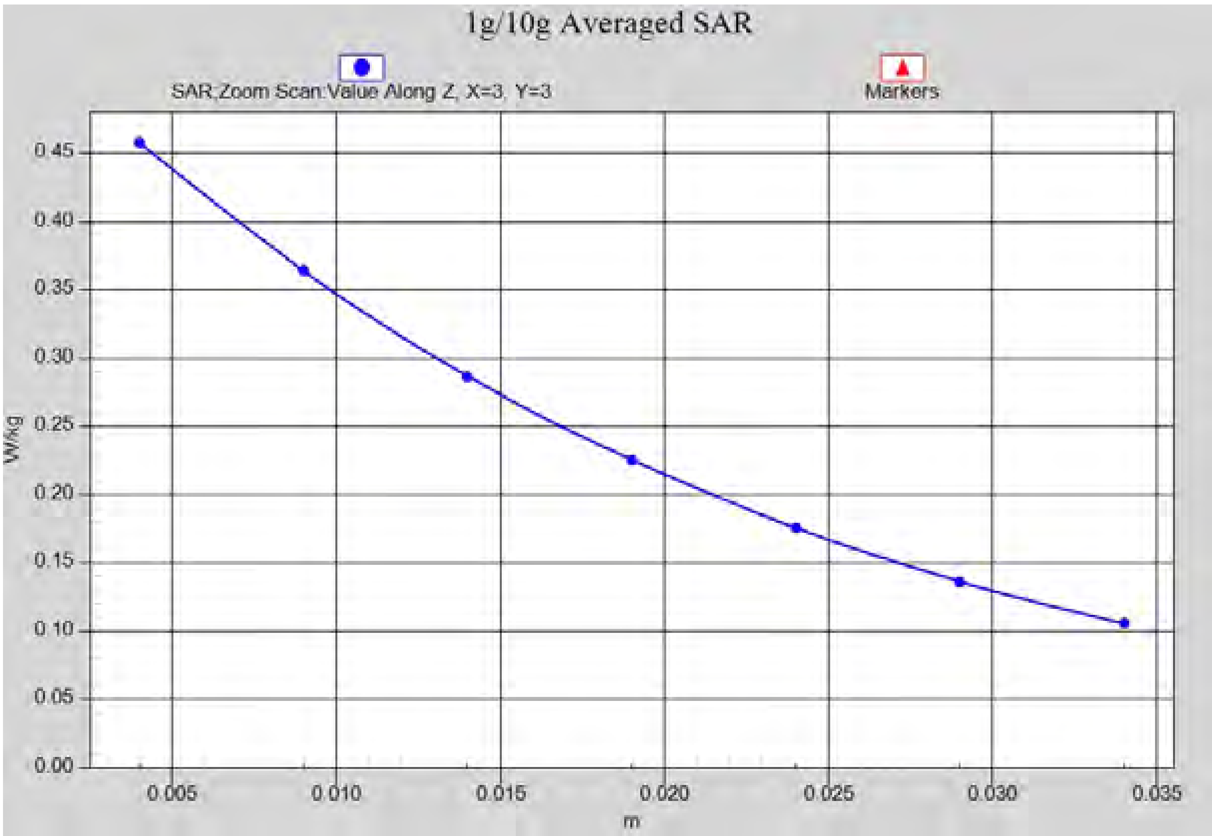


Fig. 1-1 Z-Scan at power reference point (850 MHz CH251)

850 Body Rear High

Date: 2014-2-17

Electronics: DAE4 Sn771

Medium: Body 850 MHz

Medium parameters used (interpolated): f = 848.8 MHz; σ = 0.979 S/m; εr = 53.94; ρ = 1000 kg/m³

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C

Communication System: GSM 850 EGPRS Frequency: 848.8 MHz Duty Cycle: 1:2

Probe: EX3DV4 - SN3846 ConvF(8.73, 8.73, 8.73)

Toward Ground High/Area Scan (61x101x1): Interpolated gr id: dx =1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.848 W/kg

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

Reference Value = 27.742 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 1.05 W/kg

SAR(1 g) = 0.818 W/kg; SAR(10 g) = 0.617 W/kg

Maximum value of SAR (measured) = 0.941 W/kg

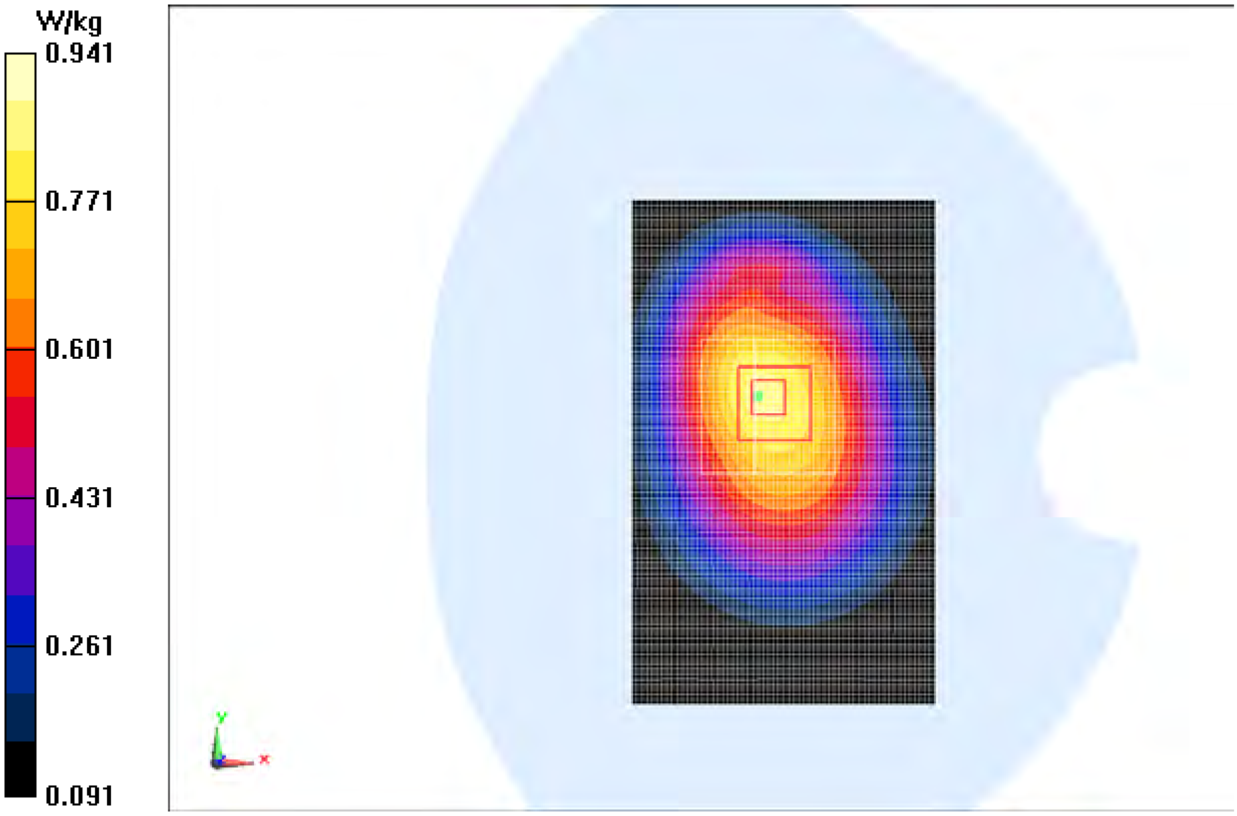


Fig.2 850 MHz CH251

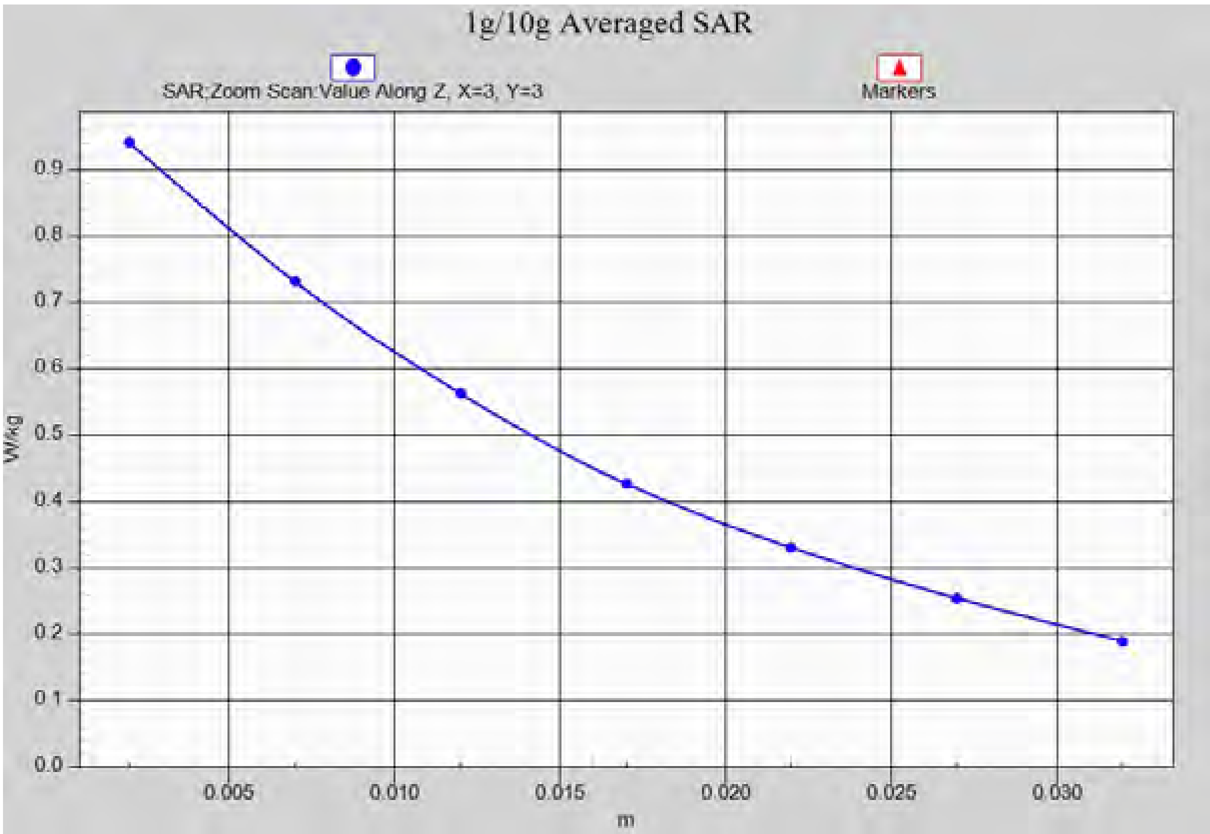


Fig. 2-1 Z-Scan at power reference point (850 MHz CH251)

GSM1900 Left Cheek High
Date: 2014-2-18
Electronics: DAE4 Sn771
Medium: Head 1900 MHz
Medium parameters used: f = 1910 MHz; σ = 1.423 S/m; εr = 39.149; ρ = 1000 kg/m^3
Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C
Communication System: GSM 1900MHz Frequency: 1909.8 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3846 ConvF(7.57, 7.57, 7.57)

Cheek High/Area Scan (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.373 W/kg

Cheek High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.121 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 0.423 W/kg
SAR(1 g) = 0.285 W/kg; SAR(10 g) = 0.171 W/kg
Maximum value of SAR (measured) = 0.314 W/kg

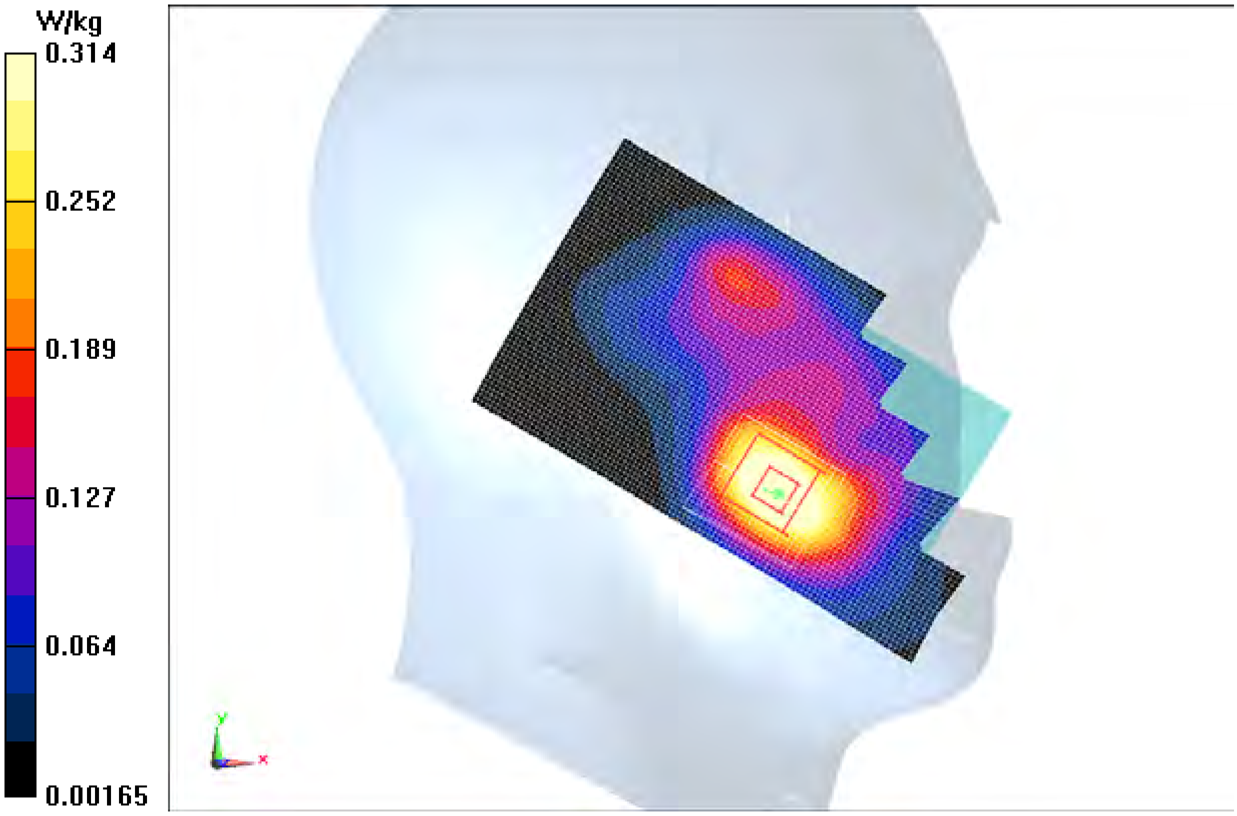


Fig.3 1900 MHz CH810

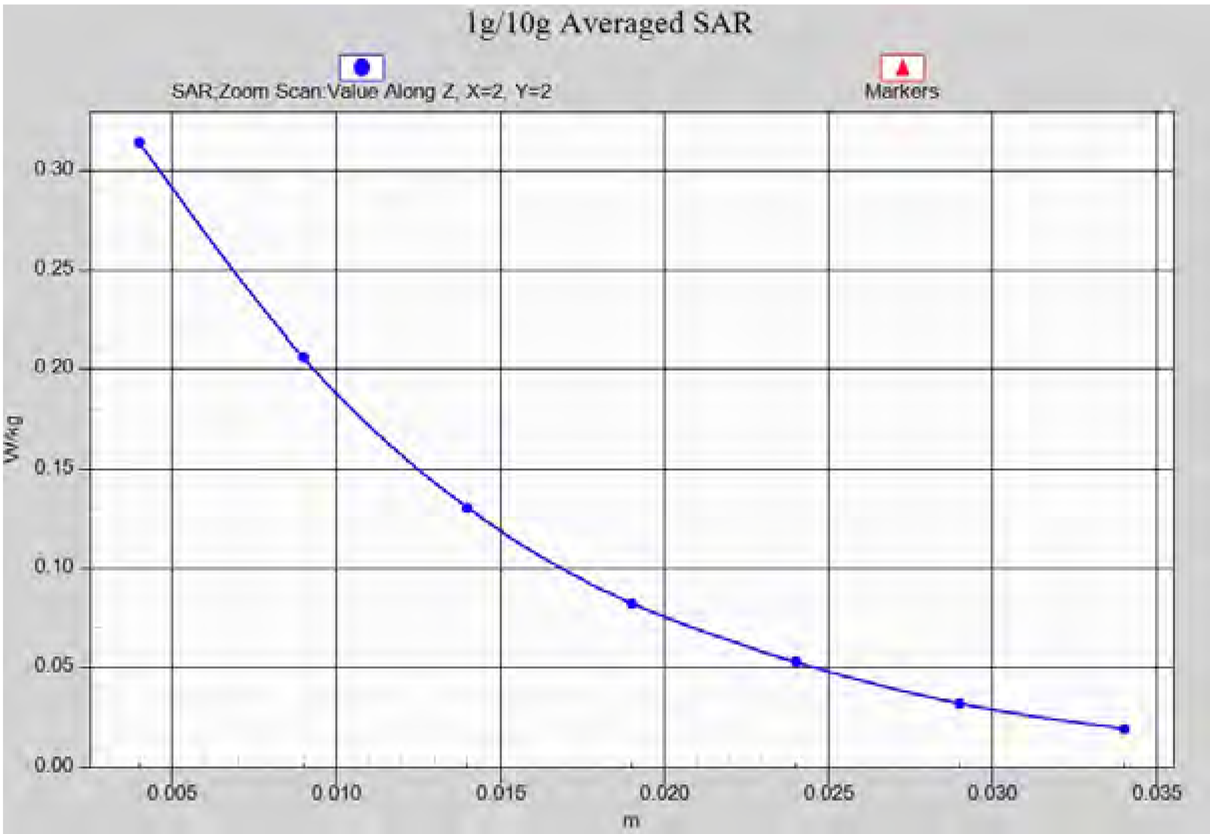


Fig. 3-1 Z-Scan at power reference point (1900 MHz CH810)

GSM1900 Body Rear High

Date: 2014-2-18
Electronics: DAE4 Sn771
Medium: Body 1900 MHz
Medium parameters used: f = 1910 MHz; σ = 1.496 S/m; εr = 52.349; ρ = 1000 kg/m^3
Ambient Temperature: 22.3^{o}C   Liquid Temperature: 21.8^{o}C
Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:2
Probe: EX3DV4 - SN3846 ConvF(7.03, 7.03, 7.03)

Toward Ground High/Area Scan (61x101x1): Interpolated gr id: dx= 1.000 m m, dy= 1.000 mm
Maximum value of SAR (interpolated) = 1.15 W/kg

Toward Ground High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.524 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 1.60 W/kg
SAR(1 g) = 1.05 W/kg; SAR(10 g) = 0.627 W/kg
Maximum value of SAR (measured) = 1.33 W/kg

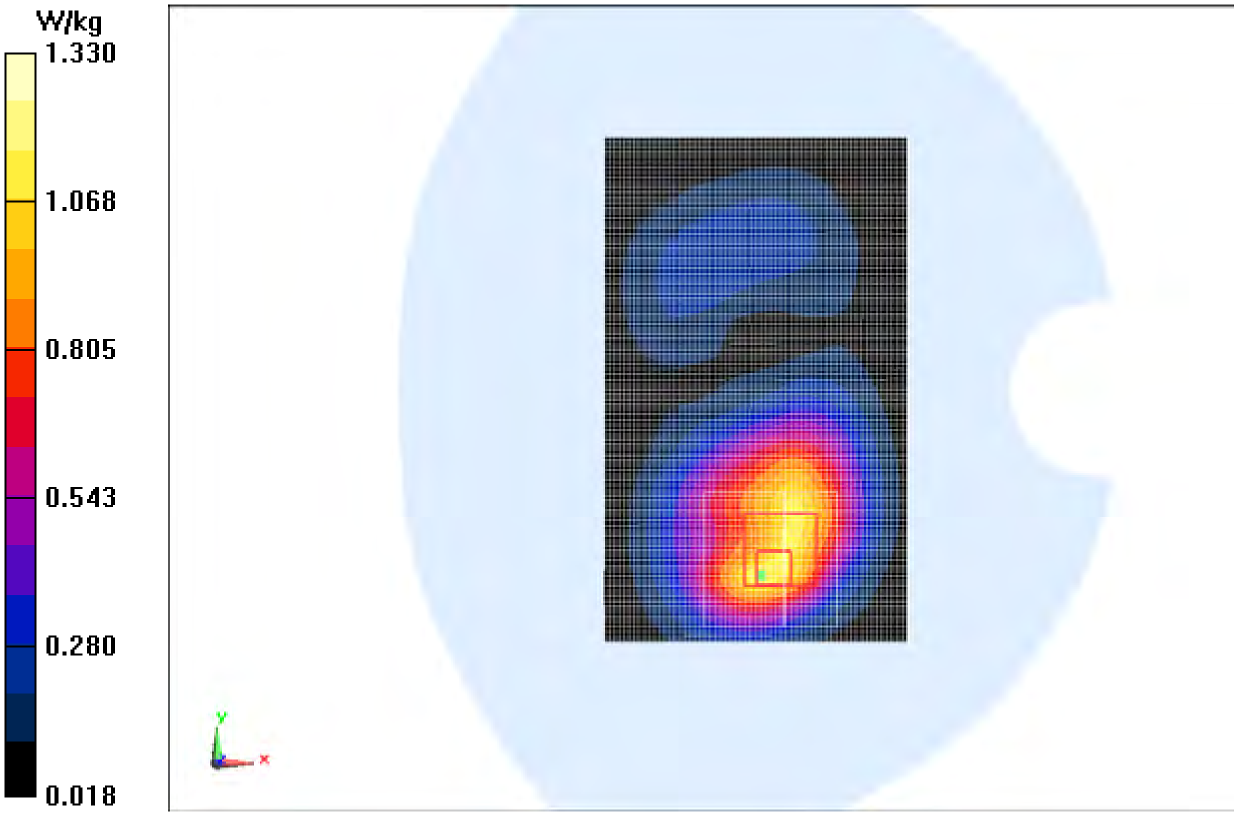


Fig.4 1900 MHz CH810

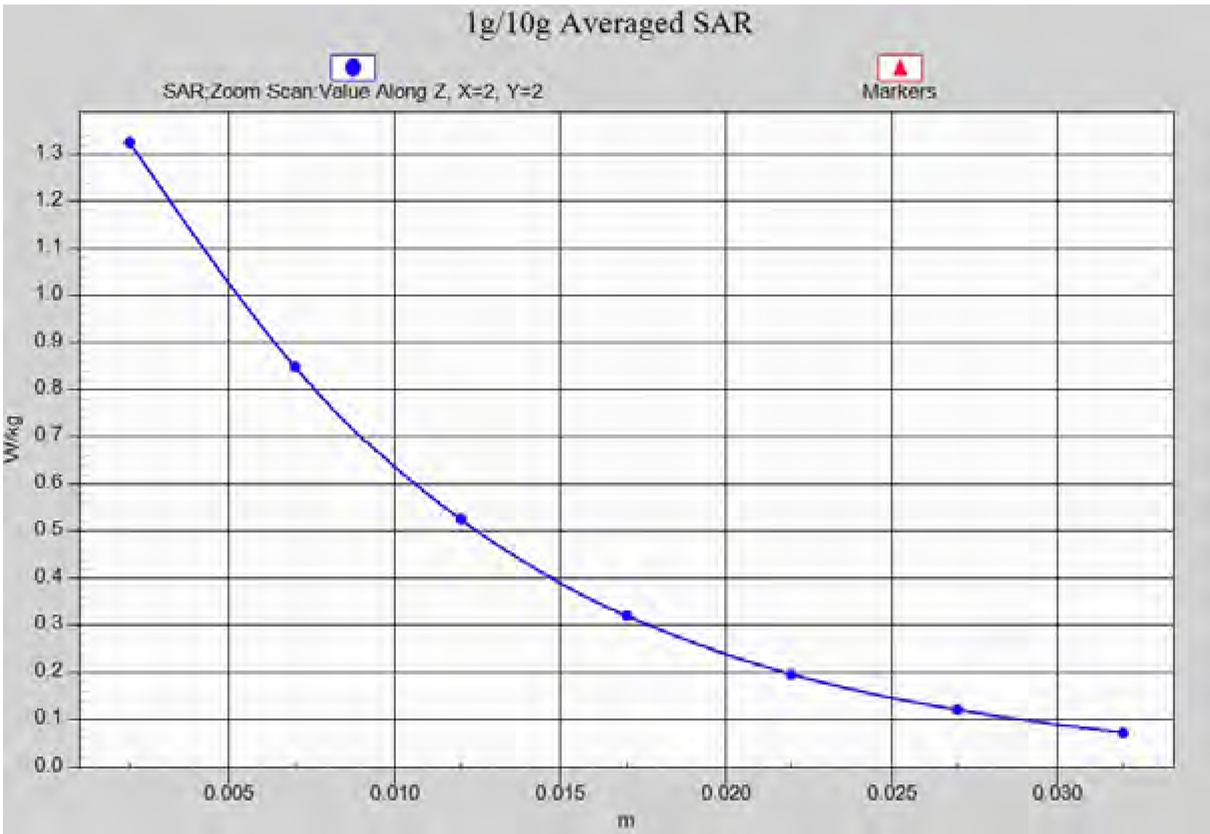


Fig.4-1 Z-Scan at power reference point (1900 MHz CH810)

WCDMA 850 Right Cheek High

Date: 2014-2-17
Electronics: DAE4 Sn771
Medium: Head 850 MHz
Medium parameters used (interpolated): f = 846.6 MHz; σ = 0.929 S/m; εr = 41.69; ρ = 1000 kg/m^3
Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C
Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(8.92, 8.92, 8.92)

Cheek High/Area Scan (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.411 W/kg

Cheek High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.797 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.476 W/kg
SAR(1 g) = 0.390 W/kg; SAR(10 g) = 0.296 W/kg
Maximum value of SAR (measured) = 0.408 W/kg

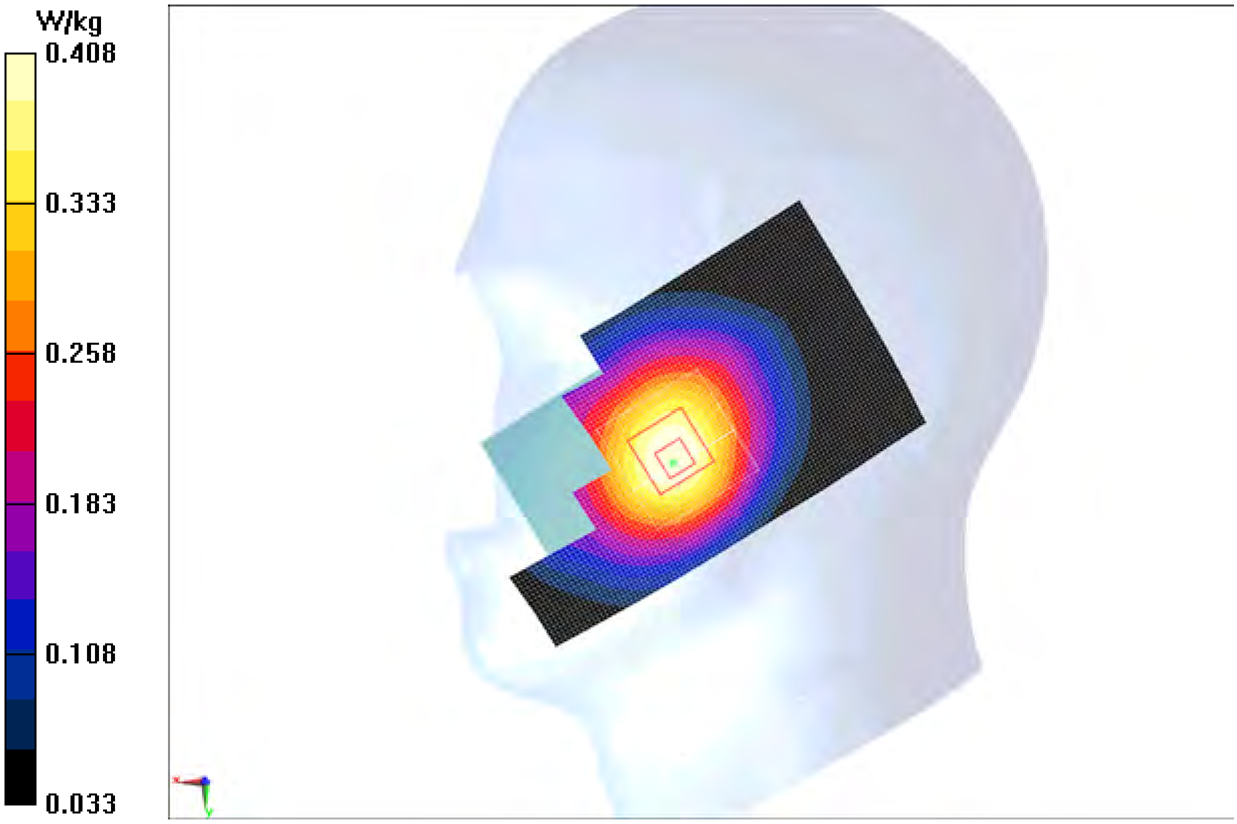


Fig.5 WCDMA 850 CH4233

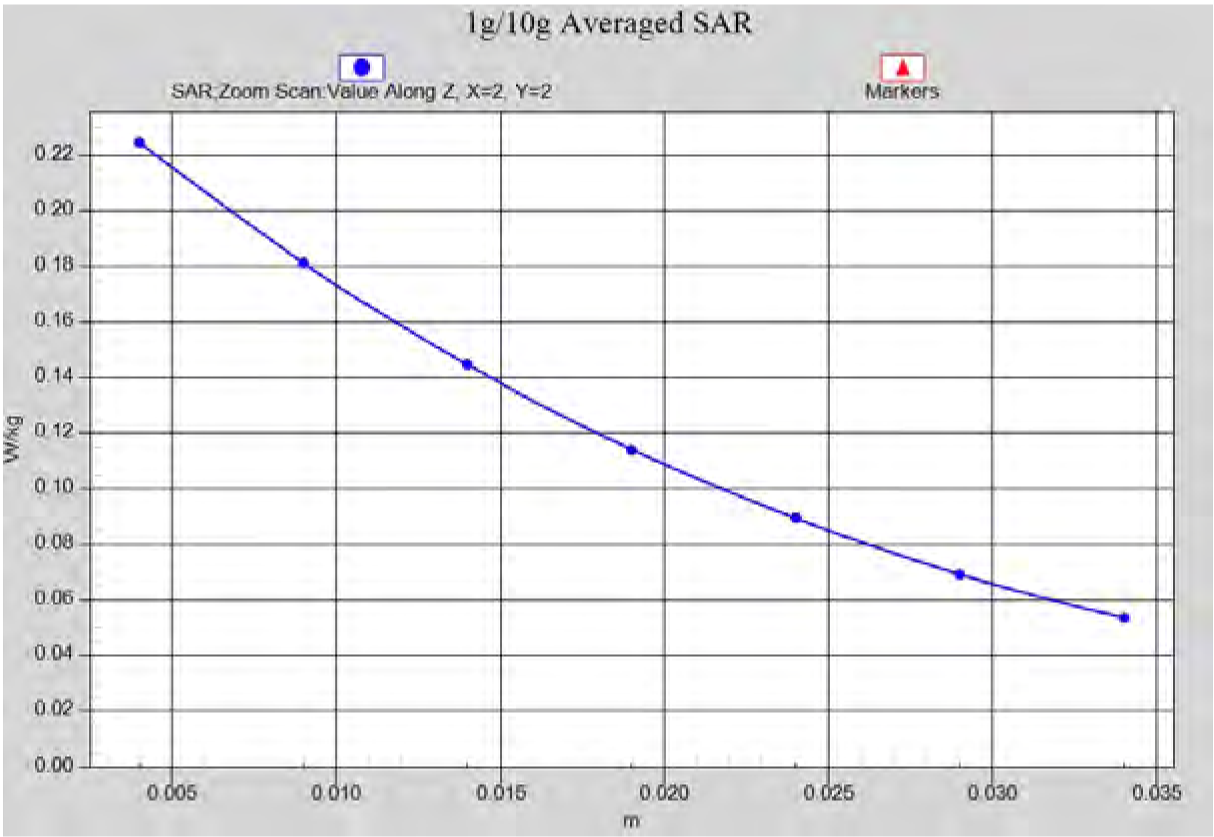


Fig. 5-1 Z-Scan at power reference point (WCDMA 850 CH4233)

WCDMA 850 Body Rear High
Date: 2014-2-17
Electronics: DAE4 Sn771
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 846.6 MHz; σ = 0.971 S/m; εr = 53.96; ρ = 1000 kg/m^3
Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C
Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(8.73, 8.73, 8.73)

Toward Ground High/Area Scan (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.618 W/kg

Toward Ground High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.602 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.761 W/kg
SAR(1 g) = 0.592 W/kg; SAR(10 g) = 0.448 W/kg
Maximum value of SAR (measured) = 0.680 W/kg

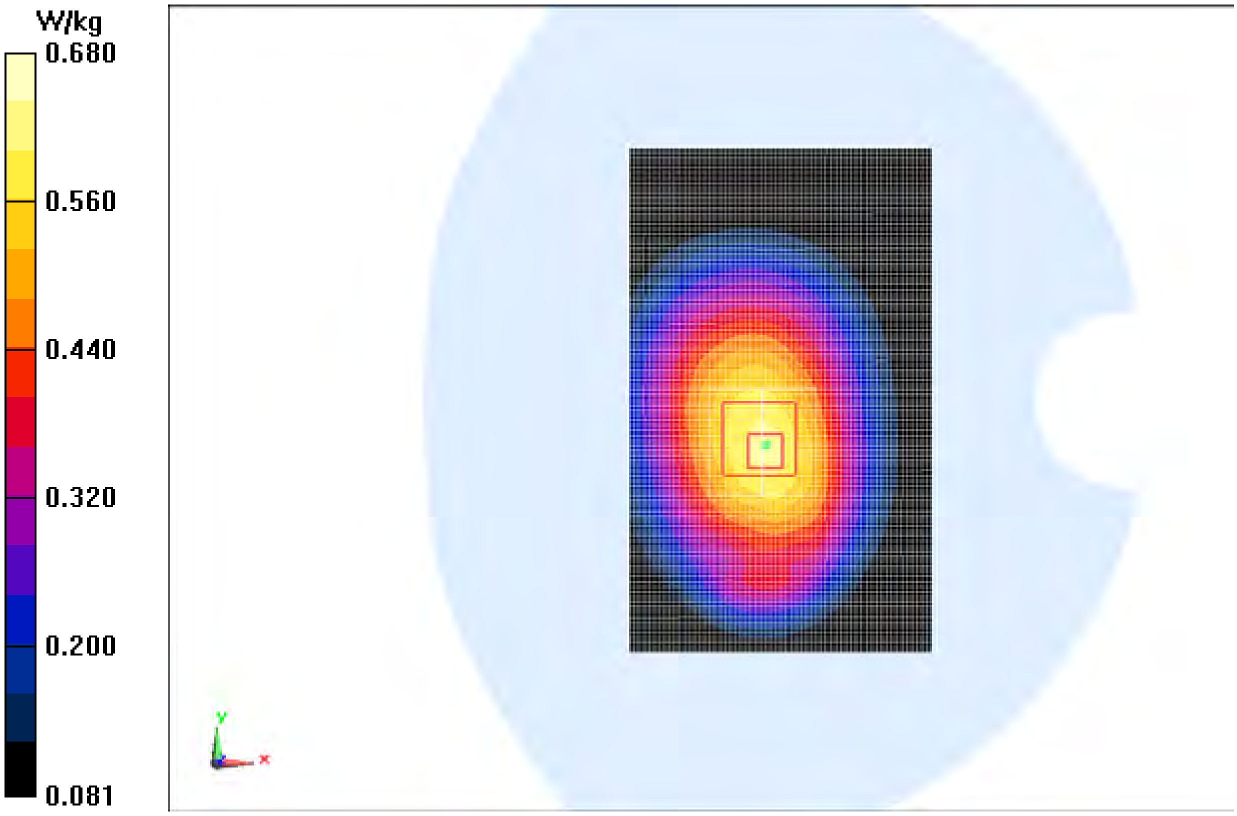


Fig.6 WCDMA 850 CH4233

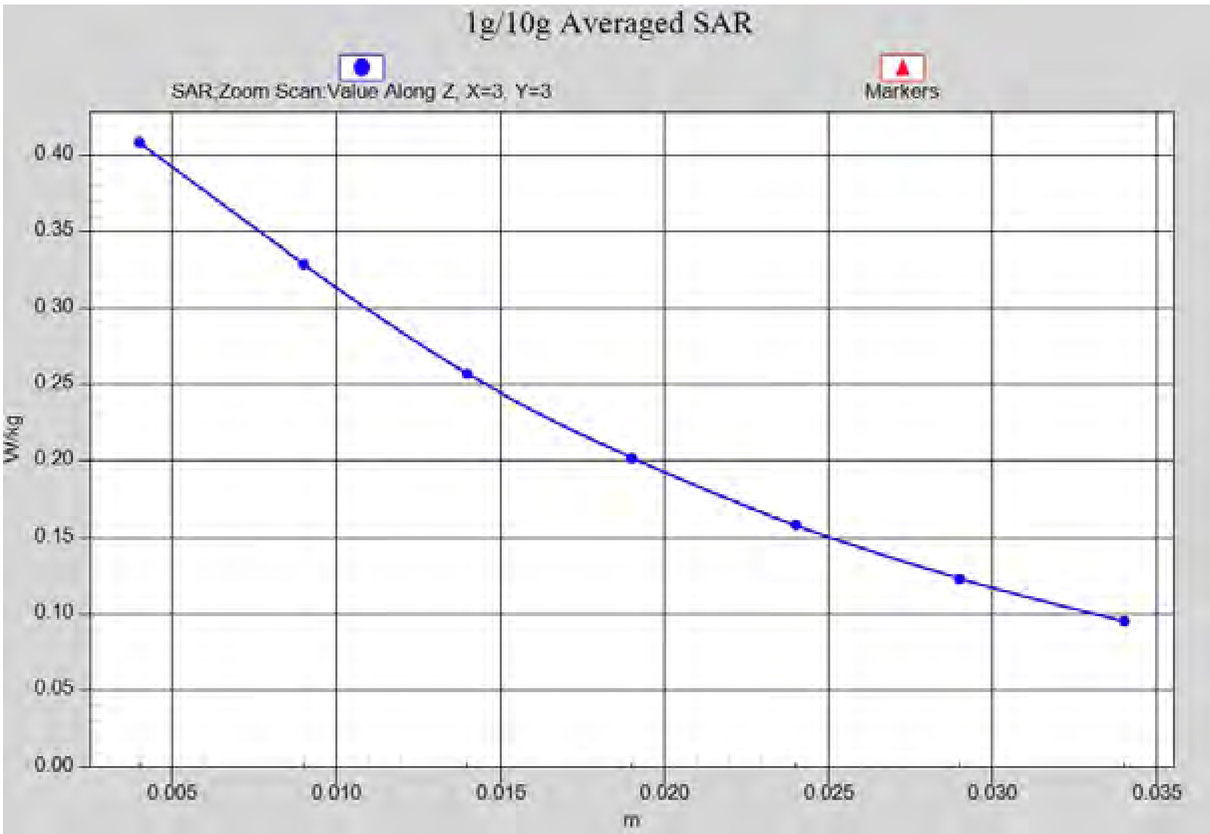


Fig. 6-1 Z-Scan at power reference point (WCDMA850 CH4233)

WCDMA 1900 Left Cheek Low

Date: 2014-2-18
Electronics: DAE4 Sn771
Medium: Head 1900 MHz
Medium parameters used (interpolated): f = 1852.4 MHz; σ = 1.363 S/m; ε_r = 39.358; ρ = 1000 kg/m^3
Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C
Communication System: WCDMA 1900 Frequency: 1852.4 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(7.57, 7.57, 7.57)

Cheek Low/Area Scan (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.618 W/kg

Cheek Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.346 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.691 W/kg
SAR(1 g) = 0.476 W/kg; SAR(10 g) = 0.290 W/kg
Maximum value of SAR (measured) = 0.510 W/kg

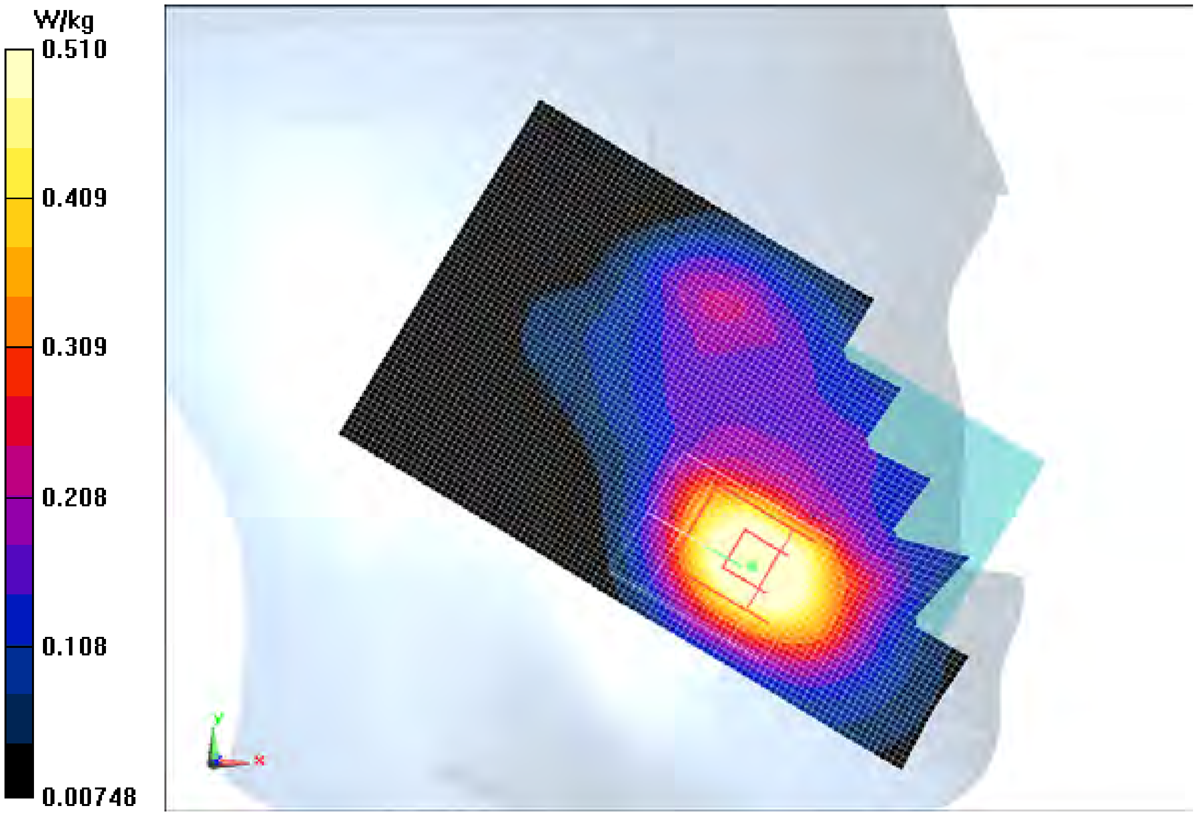


Fig.7 WCDMA1900 CH9262

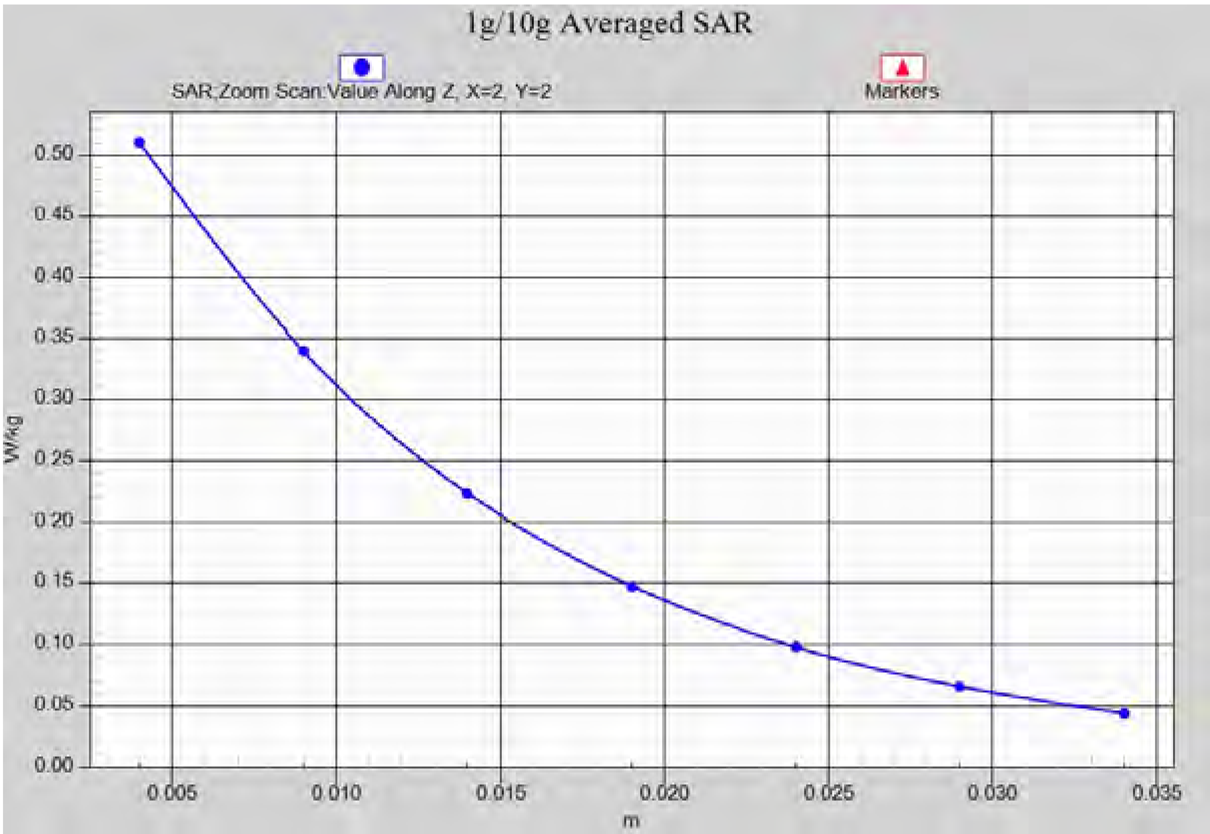


Fig. 7-1 Z-Scan at power reference point (WCDMA1900 CH9262)

WCDMA 1900 Body Rear Low
Date: 2014-2-18
Electronics: DAE4 Sn771
Medium: Body 1900 MHz
Medium parameters used (interpolated): f = 1852.4 MHz; σ = 1.453 S/m; εr = 52.548; ρ = 1000 kg/m^3
Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C
Communication System: WCDMA 1900 Frequency: 1852.4 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(7.03, 7.03, 7.03)

Rear Low/Area Scan (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.925 W/kg

Rear Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.893 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 1.23 W/kg
SAR(1 g) = 0.809 W/kg; SAR(10 g) = 0.497 W/kg
Maximum value of SAR (measured) = 1.06 W/kg

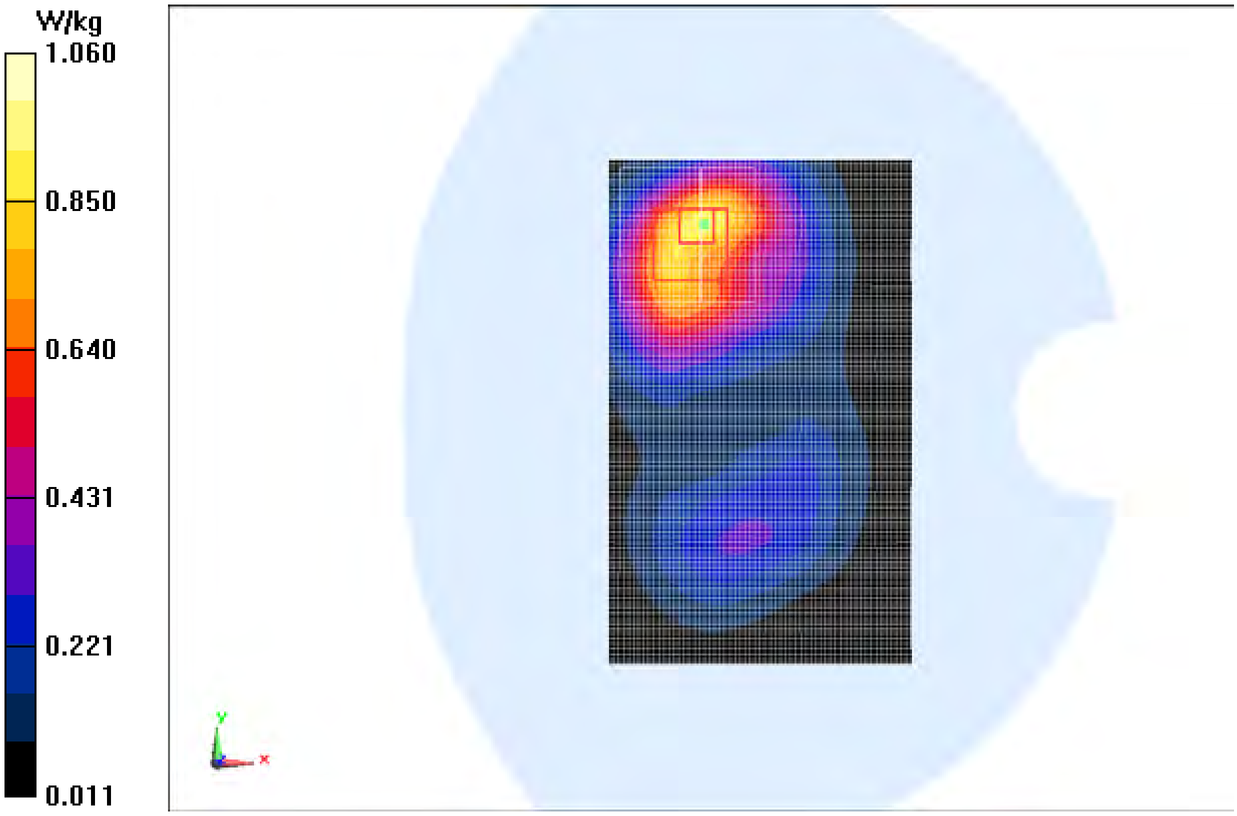


Fig.8 WCDMA1900 CH9262

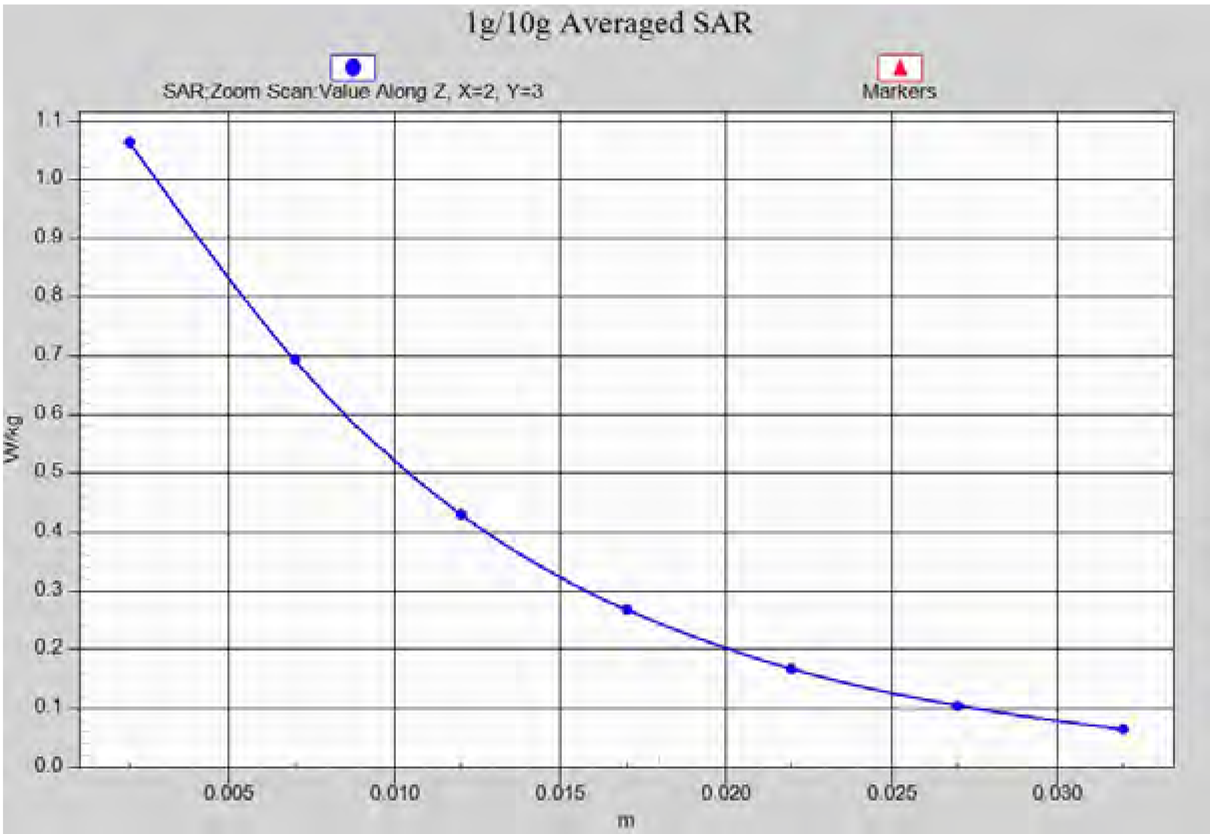


Fig. 8-1 Z-Scan at power reference point (WCDMA1900 CH9262)

Wifi 802.11b Right Cheek Channel 6

Date: 2014-2-19

Electronics: DAE4 Sn771

Medium: Head 2450 MHz

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.775 S/m; ε_r = 39.562; ρ = 1000 kg/m^3

Ambient Temperature: 22.2°C Liquid Temperature: 21.7°C

Communication System: WLan 2450 Frequency: 2437 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(6.78, 6.78, 6.78)

Cheek Middle/Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.552 W/kg

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

Reference Value = 8.824 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.917 W/kg

SAR(1 g) = 0.459 W/kg; SAR(10 g) = 0.207 W/kg

Maximum value of SAR (measured) = 0.542 W/kg

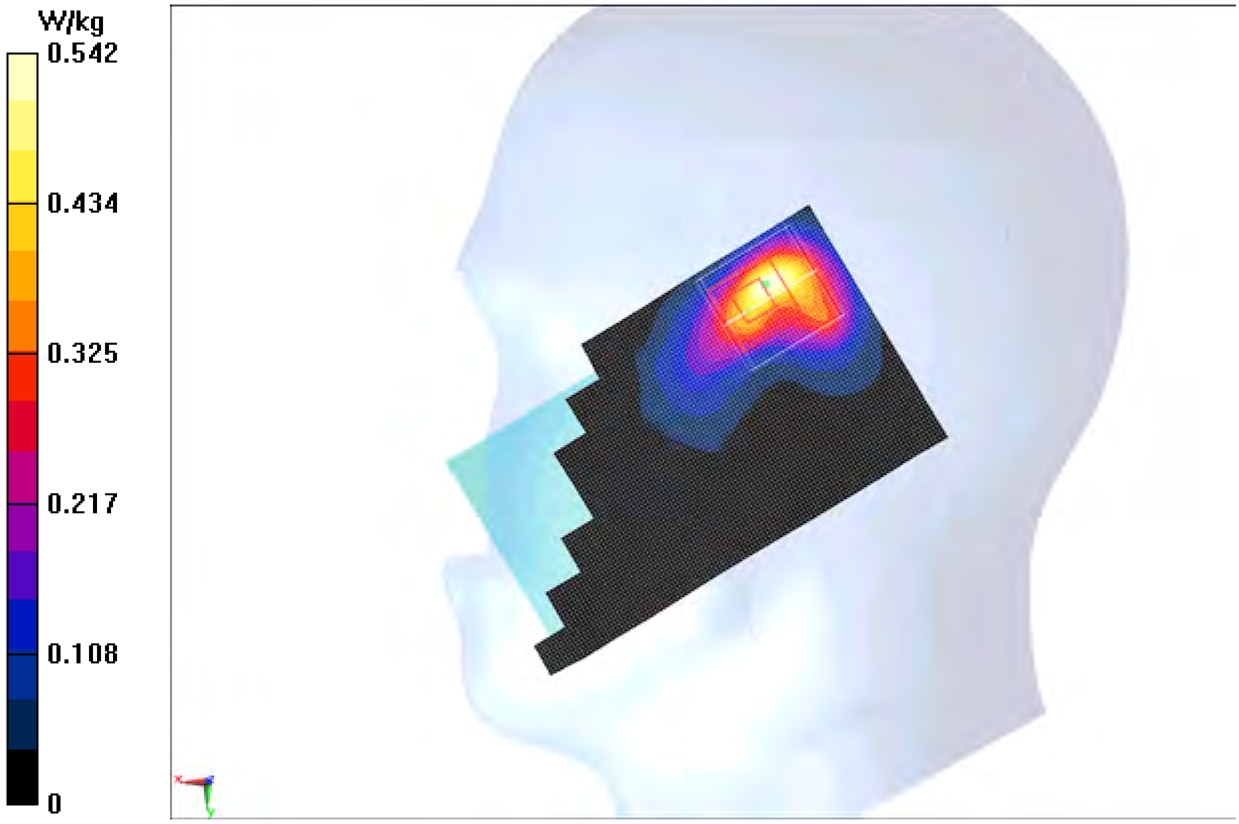


Fig.9 2450 MHz CH6

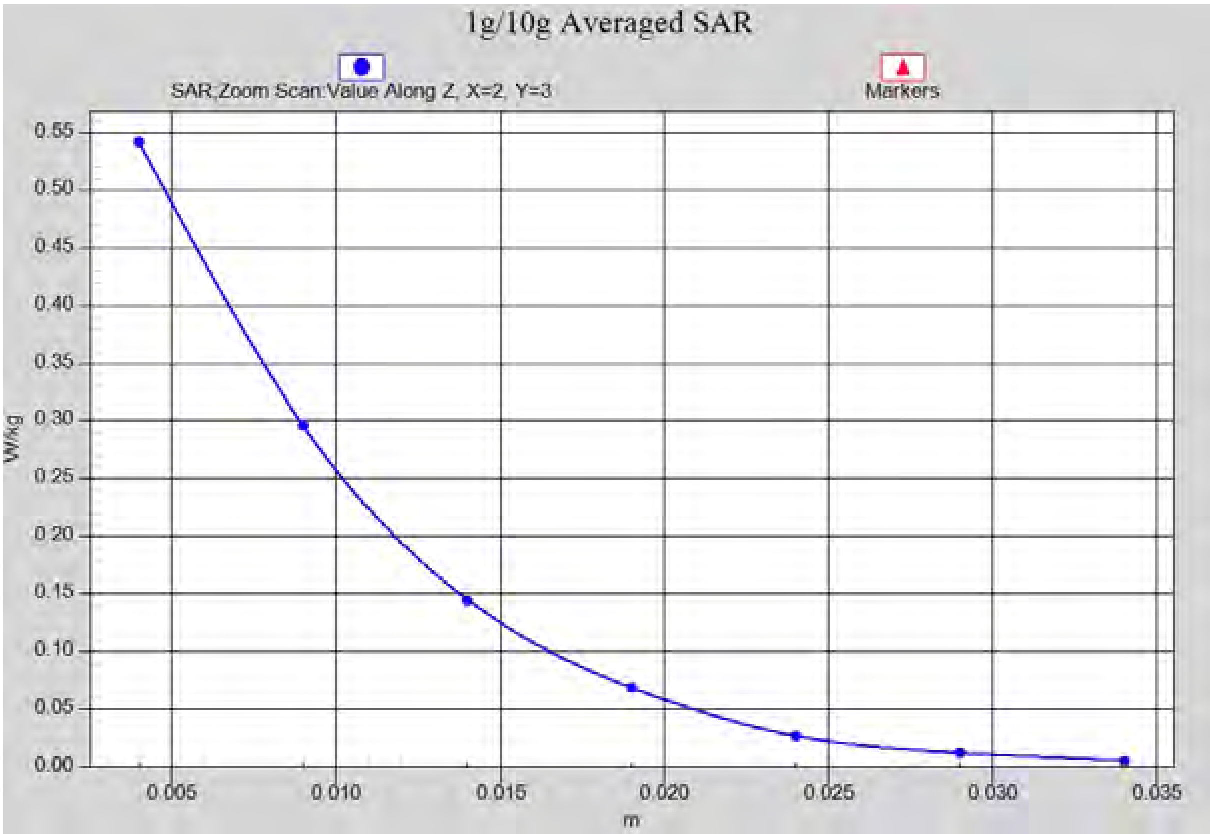


Fig. 9-1 Z-Scan at power reference point (2450 MHz CH6)

Wifi 802.11b Body Left Side Channel 6
Date: 2014-2-19
Electronics: DAE4 Sn771
Medium: Body 2450 MHz
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.927 S/m; ε_r = 52.063; ρ = 1000 kg/m^3
Ambient Temperature: 22.2°C Liquid Temperature: 21.7°C
Communication System: WLan 2450 Frequency: 2437 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(6.73, 6.73, 6.73)

Left Side Middle/Area Scan (71x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.233 W/kg

Left Side Middle/Zoom Scan (7x8x7)/Cube 0: Measurement gr id: dx= 5mm, dy= 5mm, dz=5mm
Reference Value = 8.593 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 0.428 W/kg
SAR(1 g) = 0.217 W/kg; SAR(10 g) = 0.116 W/kg
Maximum value of SAR (measured) = 0.312 W/kg

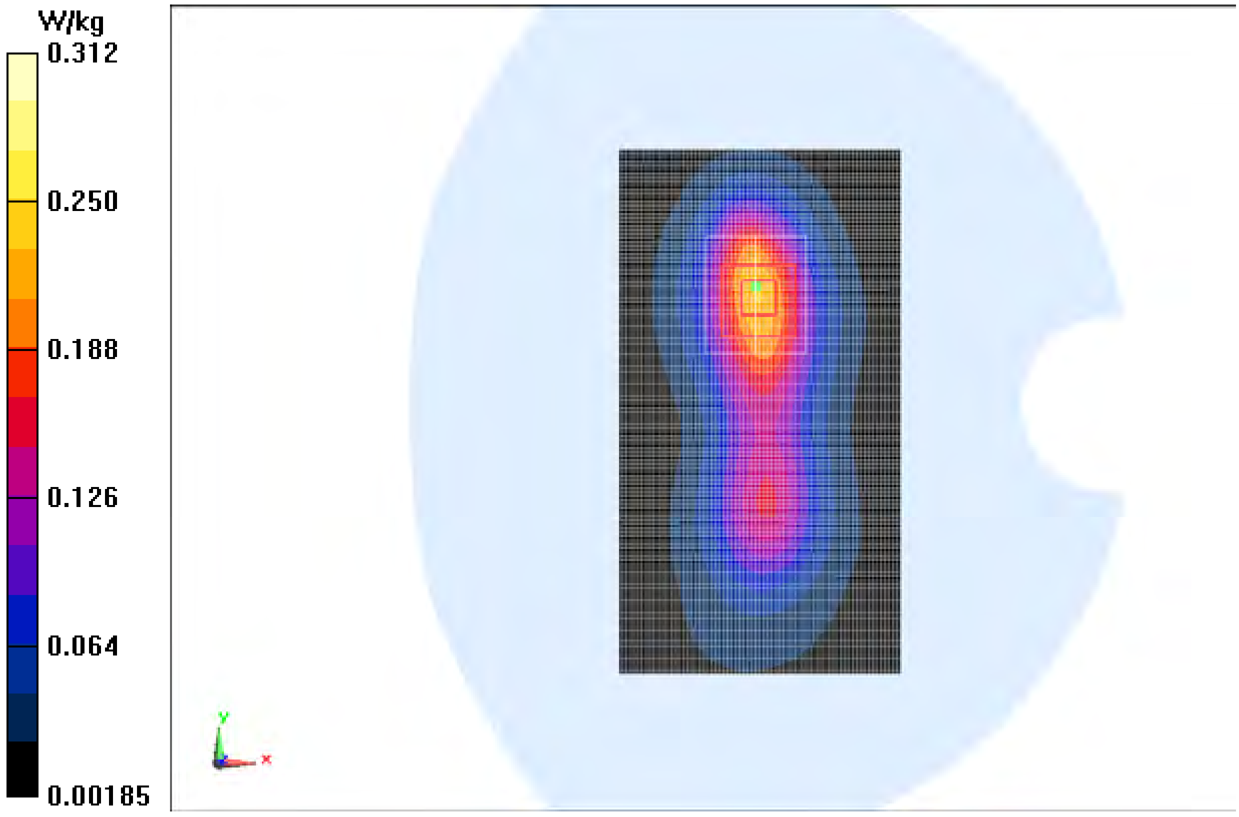


Fig.10 2450 MHz CH6

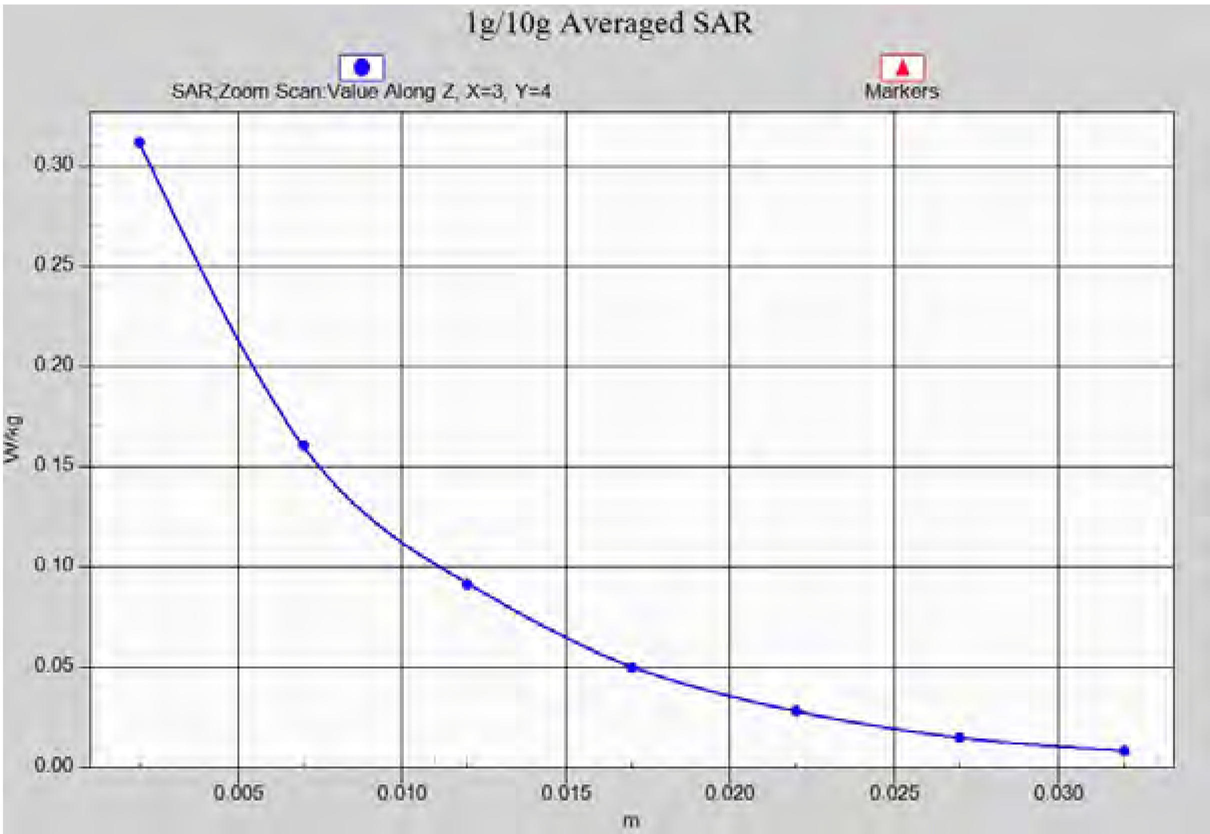


Fig. 10-1 Z-Scan at power reference point (2450 MHz CH6)

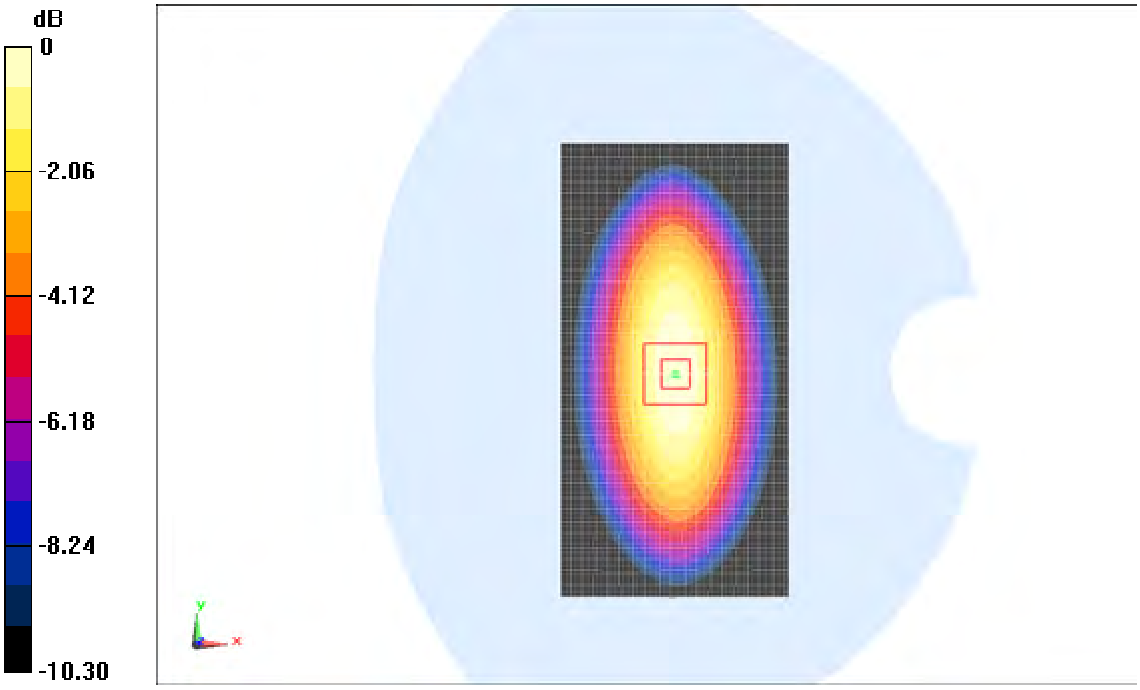
ANNEX B System Verification Results

835MHz

Date: 2014-2-17
Electronics: DAE4 Sn771
Medium: Head 850 MHz
Medium parameters used: f = 835 MHz; σ = 0.92 S/m; ε_r = 41.73; ρ = 1000 kg/m^3
Ambient Temperature: 22.3°C   Liquid Temperature: 21.8°C
Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(8.92, 8.92, 8.92)

System Validation/Area Scan (81x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 53.269 V/m; Power Drift = -0.09 dB
Fast SAR: SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.54 W/kg
Maximum value of SAR (interpolated) = 2.56 W/kg

System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.269 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 3.51 W/kg
SAR(1 g) = 2.29 W/kg; SAR(10 g) = 1.51 W/kg
Maximum value of SAR (measured) = 2.53 W/kg



0 dB = 2.56 W/kg = 8.16 dBW/kg

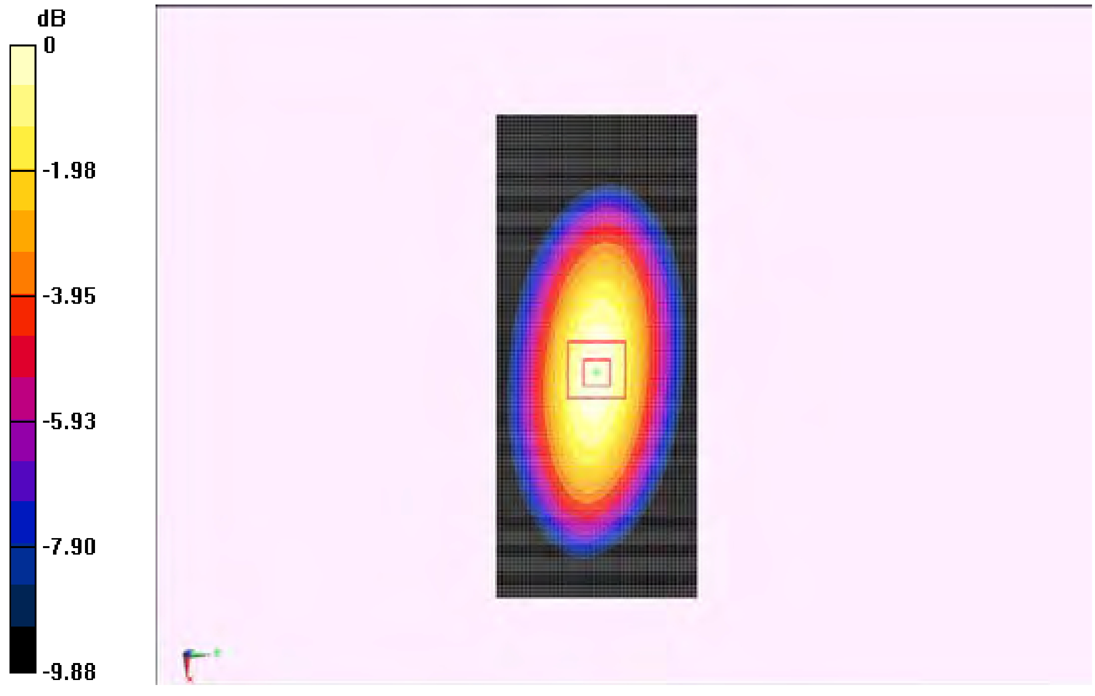
Fig.B.1 validation 835MHz 250mW

835MHz

Date: 2014-2-17
Electronics: DAE4 Sn771
Medium: Body 850 MHz
Medium parameters used: f = 835 MHz; σ = 0.965 S/m; ε_r = 54.06; ρ = 1000 kg/m^3
Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C
Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(8.73, 8.73, 8.73)

System Validation /Area Scan (81x171x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 51.904 V/m; Power Drift = 0.12 dB
Fast SAR: SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (interpolated) = 2.62 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement gr id: dx= 5mm, dy=5mm, dz=5mm
Reference Value = 51.904 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 3.44 W/kg
SAR(1 g) = 2.40 W/kg; SAR(10 g) = 1.58 W/kg
Maximum value of SAR (measured) = 2.64 W/kg



0 dB = 2.62 W/kg = 8.37 dBW/kg

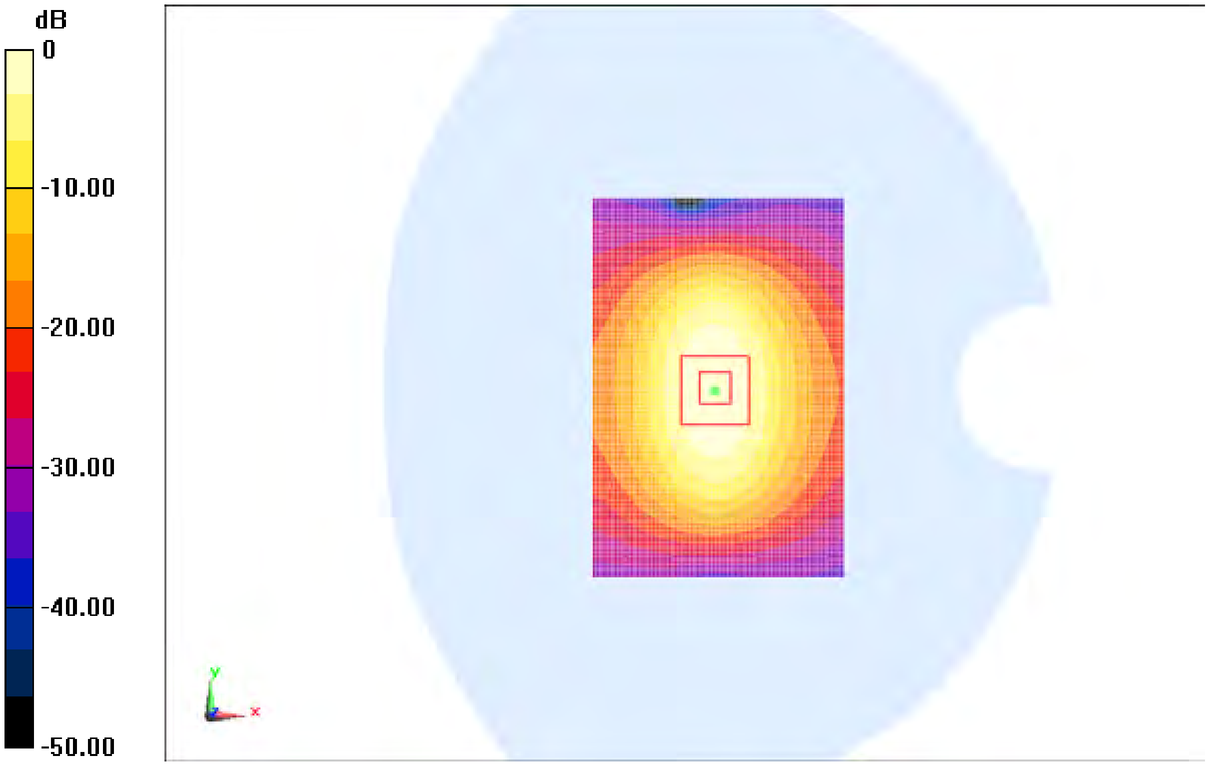
Fig.B.2 validation 835MHz 250mW

1900MHz

Date: 2014-2-18
Electronics: DAE4 Sn771
Medium: Head 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.414 S/m; ε_r = 39.18; ρ = 1000 kg/m^3
Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(7.57, 7.57, 7.57)

System Validation/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm
Reference Value = 97.862 V/m; Power Drift = 0.14 dB
Fast SAR: SAR(1 g) = 9.95 W/kg; SAR(10 g) = 5.18 W/kg
Maximum value of SAR (interpolated) = 11.7 W/kg

System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.862 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 18.12 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.34 W/kg
Maximum value of SAR (measured) = 11.9 W/kg



0 dB = 11.7 W/kg = 21.36 dB W/kg

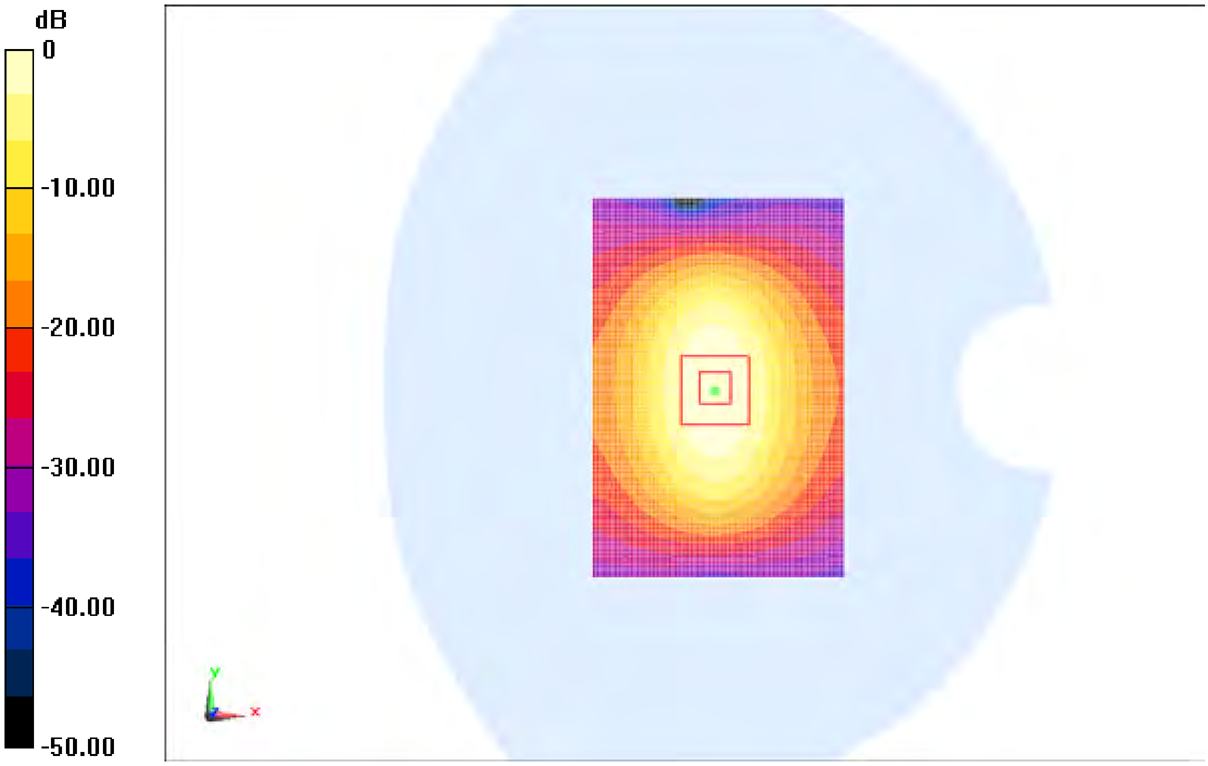
Fig.B.3 validation 1900MHz 250mW

1900MHz

Date: 2014-2-18
Electronics: DAE4 Sn771
Medium: Body 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.493 S/m; ε_r = 52.38; ρ = 1000 kg/m^3
Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(7.03, 7.03, 7.03)

System Validation/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm
Reference Value = 79.303 V/m; Power Drift = -0.07 dB
Fast SAR: SAR(1 g) = 10.0 W/kg; SAR(10 g) = 5.22 W/kg
Maximum value of SAR (interpolated) = 11.6 W/kg

System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 79.303 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 16.61 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.37 W/kg
Maximum value of SAR (measured) = 11.8 W/kg



0 dB = 11.6 W/kg = 21.29 dB W/kg

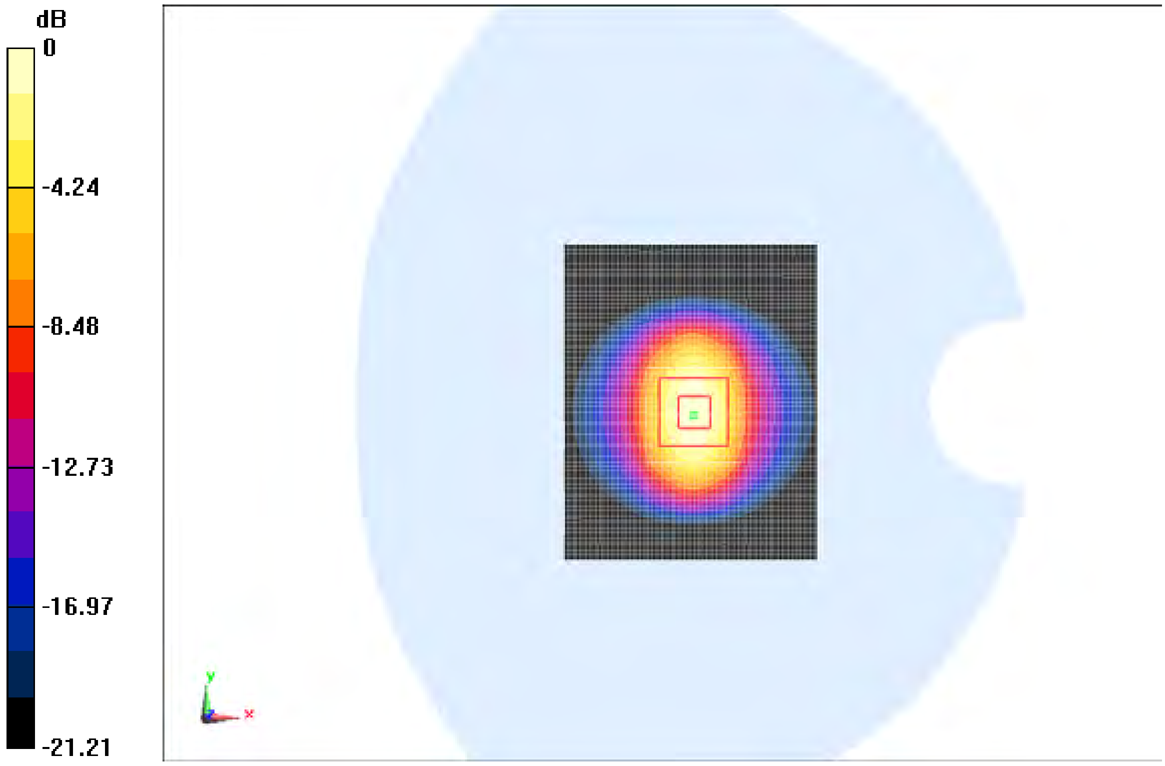
Fig.B.4 validation 1900MHz 250mW

2450MHz

Date: 2014-2-19
Electronics: DAE4 Sn771
Medium: Head 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.788 S/m; ε_r = 39.5; ρ = 1000 kg/m^3
Ambient Temperature: 22.2°C   Liquid Temperature: 21.7°C
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(6.78, 6.78, 6.78)

System Validation /Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm
Reference Value = 91.577 V/m; Power Drift = -0.08 dB
Fast SAR: SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.08 W/kg
Maximum value of SAR (interpolated) = 16.6 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement gr id: dx= 5mm, dy=5mm, dz=5mm
Reference Value = 91.577 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 27.78 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.05 W/kg
Maximum value of SAR (measured) = 16.6 W/kg



0 dB = 16.6 W/kg = 24.40 dB W/kg

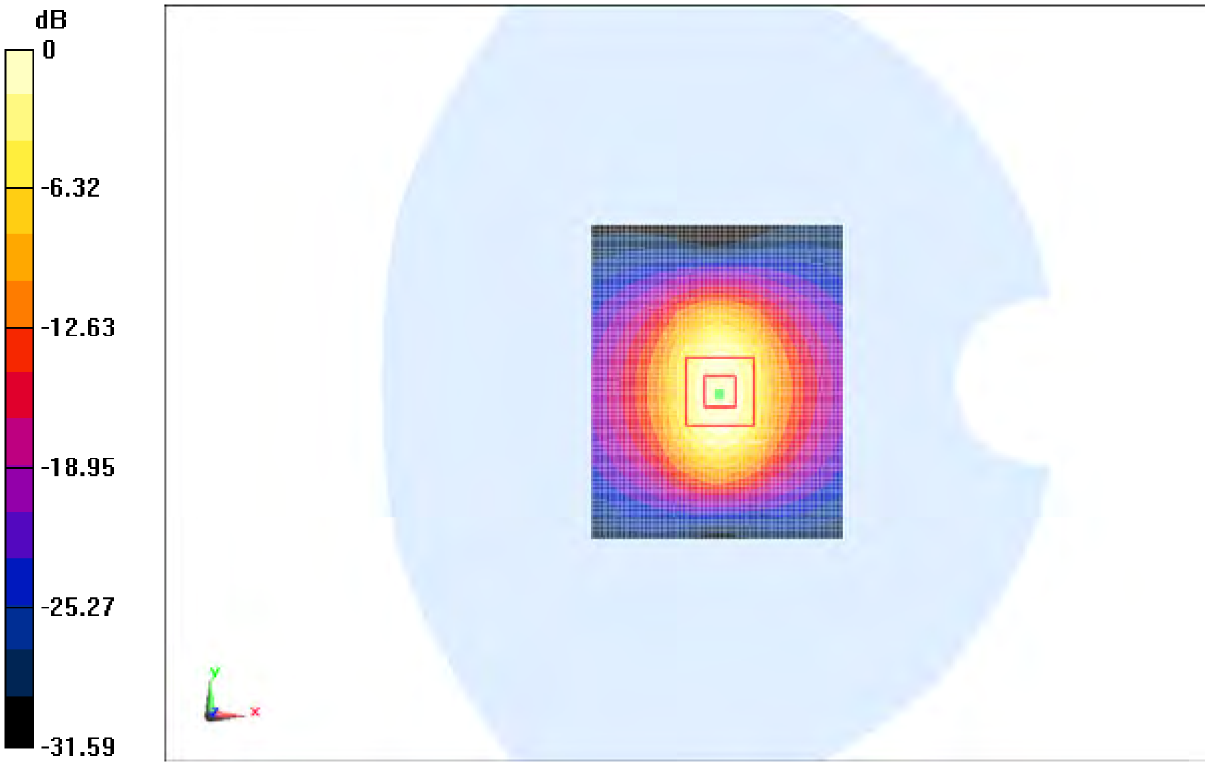
Fig.B.5 validation 2450MHz 250mW

2450MHz

Date: 2014-2-19
Electronics: DAE4 Sn771
Medium: Body 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.941 S/m; ε_r = 52.02; ρ = 1000 kg/m^3
Ambient Temperature: 22.2^{o}C Liquid Temperature: 21.7^{o}C
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(6.73, 6.73, 6.73)

System Validation/Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm
Reference Value = 90.389 V/m; Power Drift = 0.06 dB
Fast SAR: SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.74 W/kg
Maximum value of SAR (interpolated) = 14.4 W/kg

System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.389 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 25.67 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.90 W/kg
Maximum value of SAR (measured) = 14.6 W/kg



0 dB = 14.4 W/kg = 23.17 dB W/kg

Fig.B.6 validation 2450MHz 250mW

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

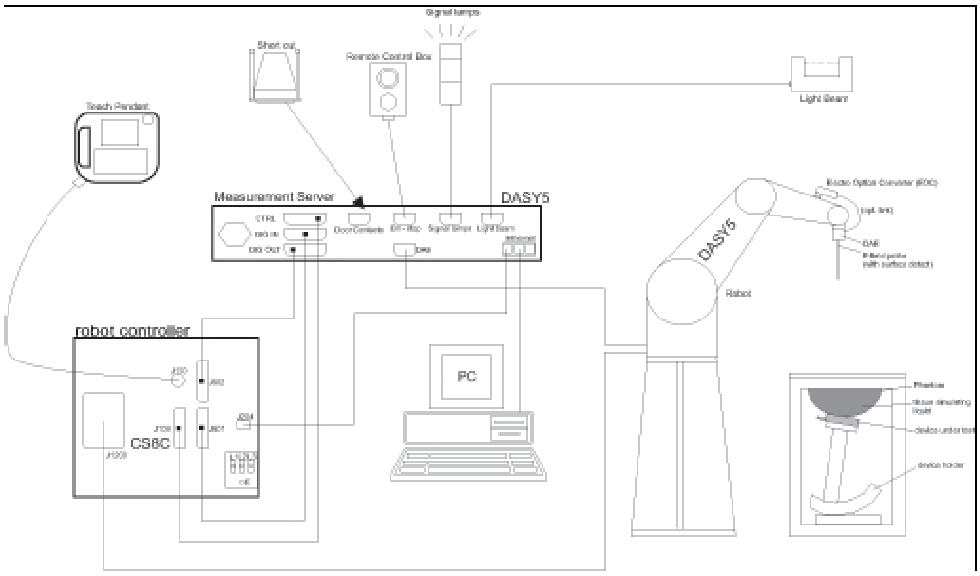
Table B.1 Comparison between area scan and zoom scan for system verification

Band	Position	Area scan (1g)	Zoom scan (1g)	Drift (%)
835	Head	2.36	2.29	3.06
835	Body	2.35	2.40	-2.08
1900	Head	9.95	10.1	-1.49
1900	Body	10.0	10.2	-1.96
2450	Head	13.1	13.1	0.00
2450	Body	12.6	12.8	-1.56

ANNEX C SAR Measurement Setup

C.1 Measurement Set-up

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



Picture C.1 SAR Lab Test Measurement Set-up

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

C.2 Dasy4 or DASY5 E-field Probe System

The S AR m easurements were c onducted wi th t he dos imetric probe des igned i n t he c lassical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pul sed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. I f the probe i s flatly touching t he s urface, the c oupling i s zero. T he di stance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of t he s urface t o prob e angl e. T he DA SY4 or DASY5 s oftware reads t he ref lection dur ning a software approach and looks for the maximum using 2nd ord curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:

Model: E S3DV3, EX3DV4

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

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

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

Dynamic Range: 10 mW/kg — 100W/kg

Probe Length: 330 mm

Probe Tip Length: 20 mm

Body Diameter: 12 mm

Tip Diameter: 2.5 mm (3.9 mm for ES3DV3)

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

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

Picture C.2 Near-field Probe

Picture C.3 E-field Probe

C.3 E-field Probe Calibration

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

The f ree s pace E -field from am plified p robe o utputs i s det ermined i n a test chamber. T his calibration can be performed in a TEM cell if the frequency is below 1 GHz and inn a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/ cm^2.

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

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

Where:

Δt = Exposure time (30 seconds),

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

ΔT = Temperature increase due to RF exposure.

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

Where:

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

C.4 Other Test Equipment

C.4.1 Data Acquisition Electronics(DAE)

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

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

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

PictureC.4: DAE

C.4.2 Robot

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

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

Picture C.5 DASY 4

Picture C.6 DASY 5

C.4.3 Measurement Server

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

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

Picture C.7 Server for DASY 4

Picture C.8 Server for DASY 5

C.4.4 Device Holder for Phantom

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

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

The DASY device holder is constructed of low-loss

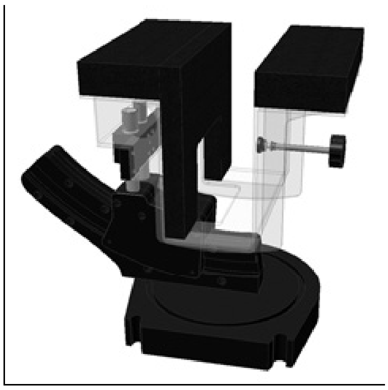
POM material having the following dielectric

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

<Laptop Extension Kit>

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

Picture C.9-1: Device Holder



Picture C.9-2: Laptop Extension Kit

C.4.5 Phantom

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

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

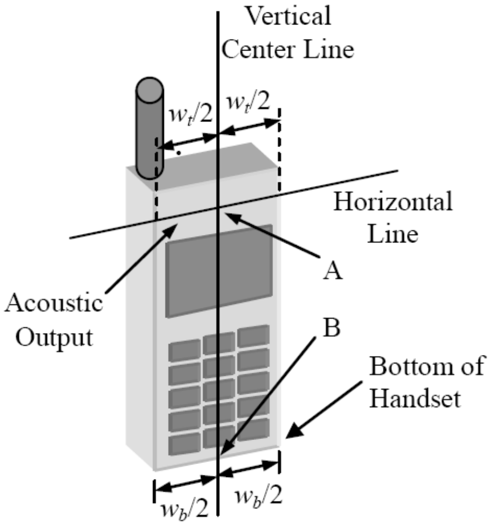
Shell Thickness: 2 ± 0. 2 mm
Filling Volume: Approx. 25 liters
Dimensions: 810 x l000 x 500 mm (H x L x W)
Available: Special

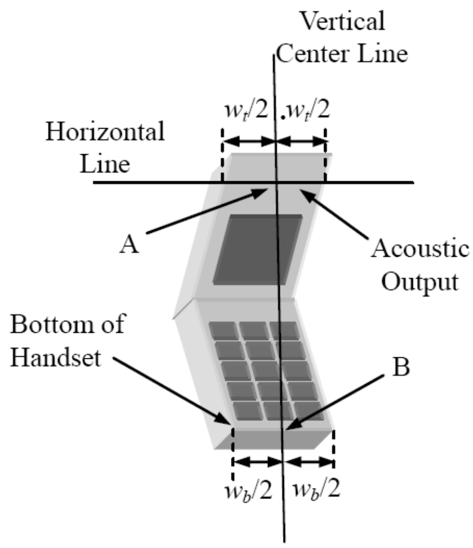
Picture C.10: SAM Twin Phantom

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

D.1 General considerations

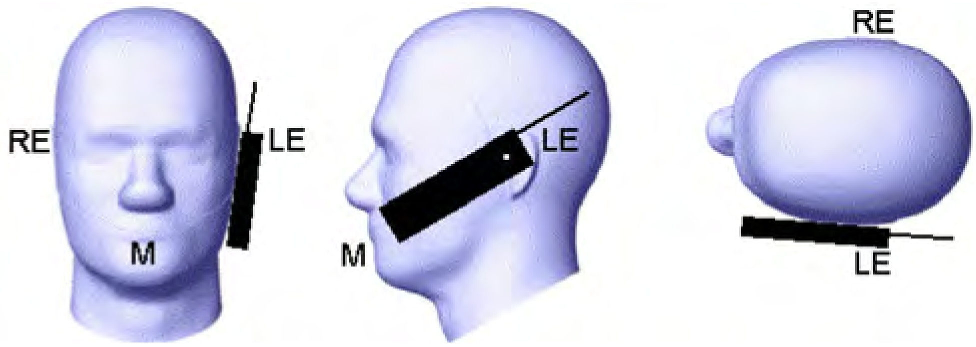
This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.



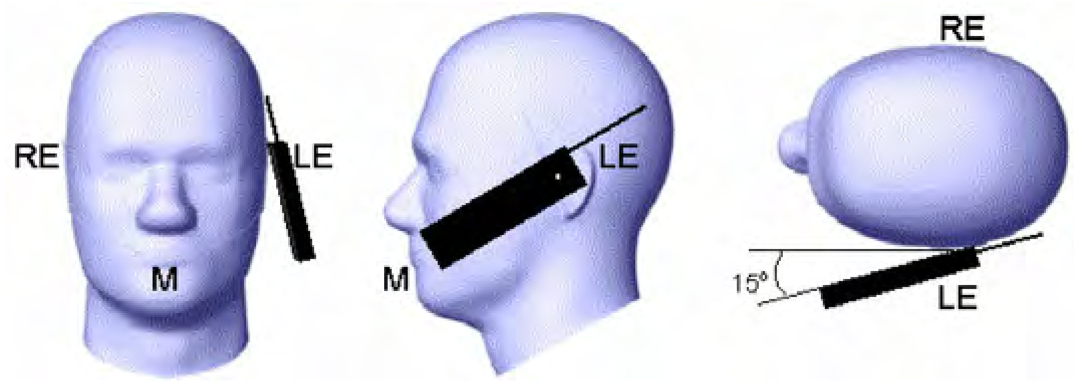


w_t	Width of the handset at the level of the acoustic
w_b	Width of the bottom of the handset
A	Midpoint of the width w_t of the handset at the level of the acoustic output
B	Midpoint of the width w_b of the bottom of the handset

Picture D.1-a Typical “fixed” case handset **Picture D.1-b Typical “clam-shell” case handset**



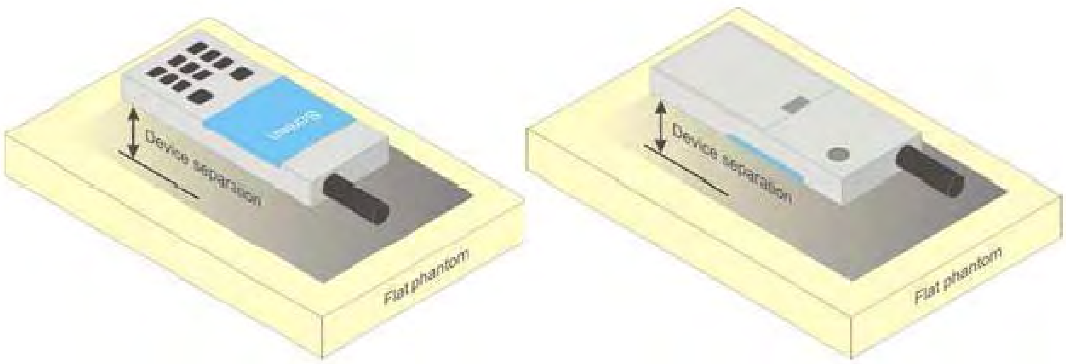
Picture D.2 Cheek position of the wireless device on the left side of SAM



Picture D.3 Tilt position of the wireless device on the left side of SAM

D.2 Body-worn device

A typical example of a body-worn device is a mobile phone, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.

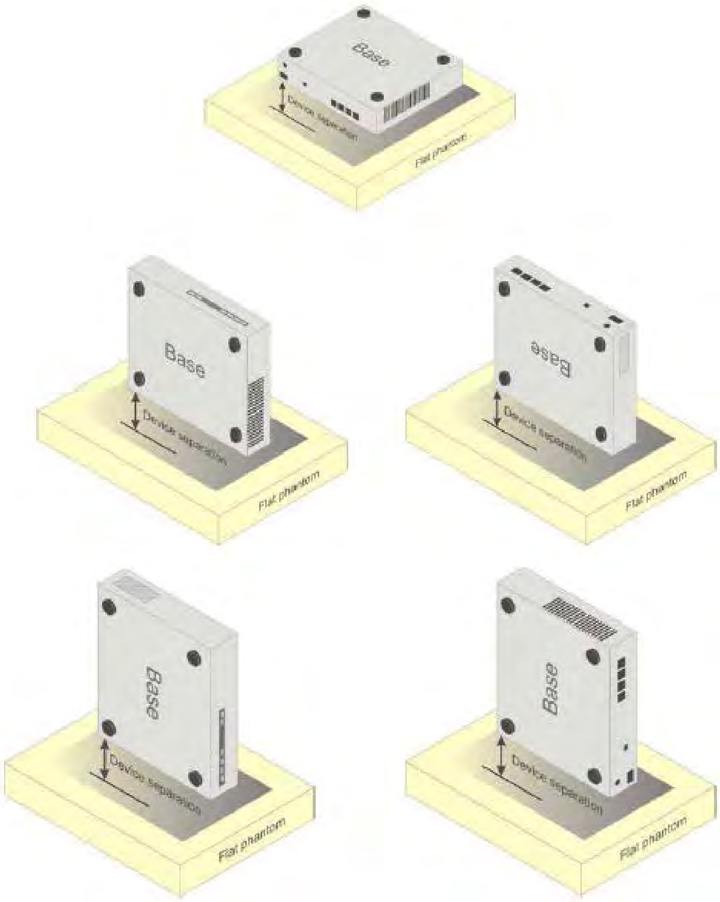


Picture D.4 Test positions for body-worn devices

D.3 Desktop device

A typical example of a desktop device is a wireless enabled desktop computer placed on a table or desk when used.

The DUT shall be positioned at the distance and in the orientation to the phantom that corresponds to the intended use as specified by the manufacturer in the user instructions. For devices that employ an external antenna with variable positions, tests shall be performed for all antenna positions specified. Picture 8.5 show positions for desktop device SAR tests. If the intended use is not specified, the device shall be tested directly against the flat phantom.



Picture D.5 Test positions for desktop devices

D.4 DUT Setup Photos

Picture D.6

ANNEX E Equivalent Media Recipes

The liquid used for the frequency range of 800-3000 MHz consisted of water, sugar, salt, preventol, glycol monobutyl and Cellulose. The liquid has been previously proven to be suited for worst-case. The T able E.1 shows the det ail s olution. I t's s atisfying t he latest t issue di electric parameters requirements proposed by the IEEE 1528 and IEC 62209.

Table E.1: Composition of the Tissue Equivalent Matter

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

ANNEX F S ystem Validation

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

Table F.1: System Validation

Probe SN.	Liquid name	Validation date	Frequency point	Status (OK or Not)
3846	Head 750MHz	Mar. 06, 2013	750 MHz	OK
3846	Head 850MHz	Mar. 06, 2013	850 MHz	OK
3846	Head 900MHz	Mar. 01, 2013	900 MHz	OK
3846	Head 1750MHz	Mar. 03, 2013	1750 MHz	OK
3846	Head 1810MHz	Mar. 03, 2013	1810 MHz	OK
3846	Head 1900MHz	Mar. 07, 2013	1900 MHz	OK
3846	Head 1950MHz	Mar. 04, 2013	1950 MHz	OK
3846	Head 2000MHz	Mar. 04, 2013	2000 MHz	OK
3846	Head 2100MHz	Mar. 05, 2013	2100 MHz	OK
3846	Head 2300MHz	Mar. 05, 2013	2300 MHz	OK
3846	Head 2450MHz	Mar. 02, 2013	2450 MHz	OK
3846	Head 2550MHz	Mar. 08, 2013	2550 MHz	OK
3846	Head 2600MHz	Mar. 08, 2013	2600 MHz	OK
3846	Head 3500MHz	Mar. 09, 2013	3500 MHz	OK
3846	Head 3700MHz	Mar. 09, 2013	3700 MHz	OK
3846	Head 5200MHz	Mar. 10, 2013	5200 MHz	OK
3846	Head 5500MHz	Mar. 10, 2013	5500 MHz	OK
3846	Head 5800MHz	Mar. 10, 2013	5800 MHz	OK
3846	Body 750MHz	Mar. 06, 2013	750 MHz	OK
3846	Body 850MHz	Mar. 06, 2013	850 MHz	OK
3846	Body 900MHz	Mar. 01, 2013	900 MHz	OK
3846	Body 1750MHz	Mar. 03, 2013	1750 MHz	OK
3846	Body 1810MHz	Mar. 03, 2013	1810 MHz	OK
3846	Body 1900MHz	Mar. 07, 2013	1900 MHz	OK
3846	Body 1950MHz	Mar. 04, 2013	1950 MHz	OK
3846	Body 2000MHz	Mar. 04, 2013	2000 MHz	OK
3846	Body 2100MHz	Mar. 05, 2013	2100 MHz	OK
3846	Body 2300MHz	Mar. 05, 2013	2300 MHz	OK
3846	Body 2450MHz	Mar. 02, 2013	2450 MHz	OK
3846	Body 2550MHz	Mar. 08, 2013	2550 MHz	OK
3846	Body 2600MHz	Mar. 08, 2013	2600 MHz	OK
3846	Body 3500MHz	Mar. 09, 2013	3500 MHz	OK
3846	Body 3700MHz	Mar. 09, 2013	3700 MHz	OK
3846	Body 5200MHz	Mar. 10, 2013	5200 MHz	OK
3846	Body 5500MHz	Mar. 10, 2013	5500 MHz	OK
3846	Body 5800MHz	Mar. 10, 2013	5800 MHz	OK

ANNEX G Probe Calibration Certificate

Probe 3846 Calibration Certificate

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

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

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

Accreditation No.: SCS 108

Client: TMC-BJ (Auden)

Certificate No: EX3-3846_Sep13

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3846

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: September 3, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 5, 2013

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

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

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required)

Probe EX3DV4

SN:3846

Manufactured:	October 25, 2011
Repaired:	August 28, 2013
Calibrated:	September 3, 2013

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.39	0.43	0.49	± 10.1 %
DCP (mV)[B]	107.1	101.1	100.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	145.7	±3.3 %
		Y	0.0	0.0	1.0		152.2	
		Z	0.0	0.0	1.0		165.8	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	9.32	9.32	9.32	0.47	0.82	± 12.0 %
850	41.5	0.92	8.92	8.92	8.92	0.20	1.19	± 12.0 %
900	41.5	0.97	8.96	8.96	8.96	0.41	0.85	± 12.0 %
1450	40.5	1.20	8.23	8.23	8.23	0.68	0.63	± 12.0 %
1750	40.1	1.37	7.85	7.85	7.85	0.39	0.81	± 12.0 %
1810	40.0	1.40	7.63	7.63	7.63	0.49	0.72	± 12.0 %
1900	40.0	1.40	7.57	7.57	7.57	0.35	0.87	± 12.0 %
2000	40.0	1.40	7.58	7.58	7.58	0.65	0.64	± 12.0 %
2100	39.8	1.49	7.68	7.68	7.68	0.28	0.93	± 12.0 %
2300	39.5	1.67	7.21	7.21	7.21	0.40	0.79	± 12.0 %
2450	39.2	1.80	6.78	6.78	6.78	0.52	0.68	± 12.0 %
2600	39.0	1.96	6.68	6.68	6.68	0.37	0.83	± 12.0 %
3500	37.9	2.91	6.67	6.67	6.67	0.59	0.77	± 13.1 %
3700	37.7	3.12	6.37	6.37	6.37	0.43	0.92	± 13.1 %
5200	36.0	4.66	5.25	5.25	5.25	0.25	1.80	± 13.1 %
5300	35.9	4.76	5.04	5.04	5.04	0.25	1.80	± 13.1 %
5500	35.6	4.96	4.80	4.80	4.80	0.30	1.80	± 13.1 %
5600	35.5	5.07	4.52	4.52	4.52	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.51	4.51	4.51	0.35	1.80	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

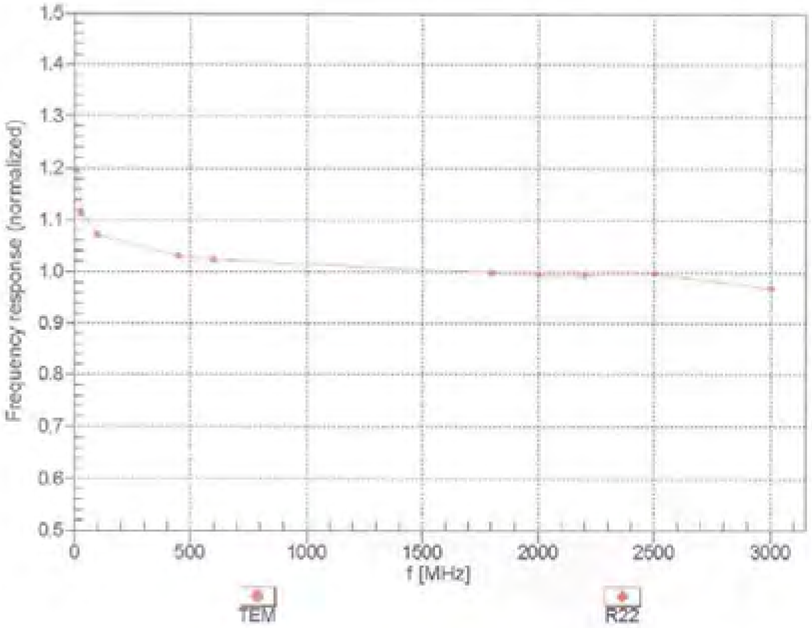
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	8.96	8.96	8.96	0.38	0.91	± 12.0 %
850	55.2	0.99	8.73	8.73	8.73	0.80	0.61	± 12.0 %
900	55.0	1.05	8.71	8.71	8.71	0.80	0.59	± 12.0 %
1450	54.0	1.30	7.82	7.82	7.82	0.80	0.59	± 12.0 %
1750	53.4	1.49	7.56	7.56	7.56	0.71	0.65	± 12.0 %
1810	53.3	1.52	7.27	7.27	7.27	0.47	0.83	± 12.0 %
1900	53.3	1.52	7.03	7.03	7.03	0.30	1.04	± 12.0 %
2000	53.3	1.52	7.52	7.52	7.52	0.38	0.90	± 12.0 %
2100	53.2	1.62	7.54	7.54	7.54	0.43	0.82	± 12.0 %
2300	52.9	1.81	7.00	7.00	7.00	0.76	0.61	± 12.0 %
2450	52.7	1.95	6.73	6.73	6.73	0.80	0.56	± 12.0 %
2600	52.5	2.16	6.59	6.59	6.59	0.80	0.50	± 12.0 %
3500	51.3	3.31	6.18	6.18	6.18	0.38	1.06	± 13.1 %
3700	51.0	3.55	5.99	5.99	5.99	0.43	1.02	± 13.1 %
5200	49.0	5.30	4.36	4.36	4.36	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.17	4.17	4.17	0.40	1.90	± 13.1 %
5500	48.6	5.65	3.81	3.81	3.81	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.77	3.77	3.77	0.35	1.90	± 13.1 %
5800	48.2	6.00	3.94	3.94	3.94	0.45	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)

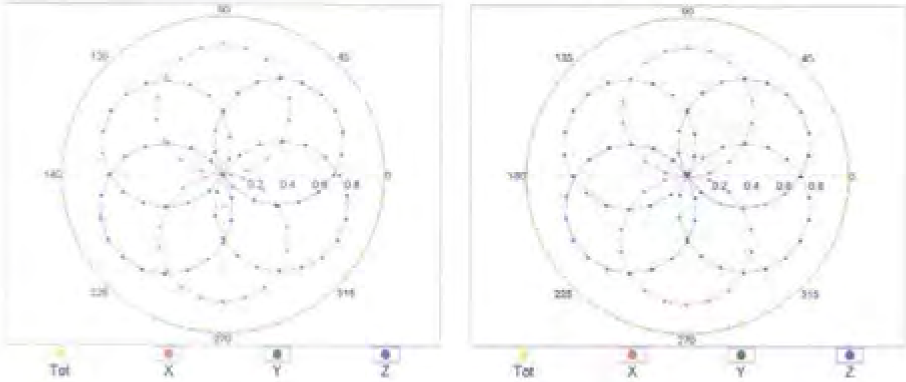


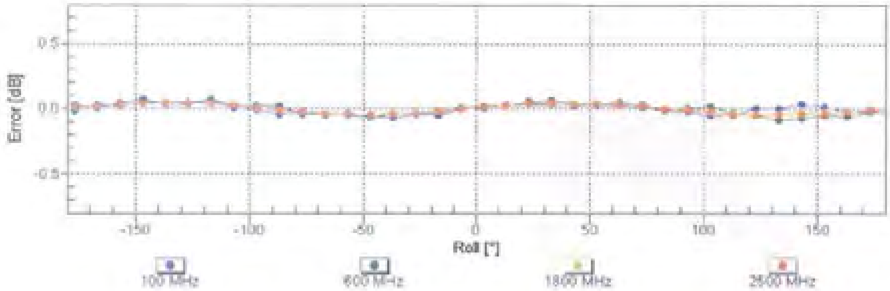
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM

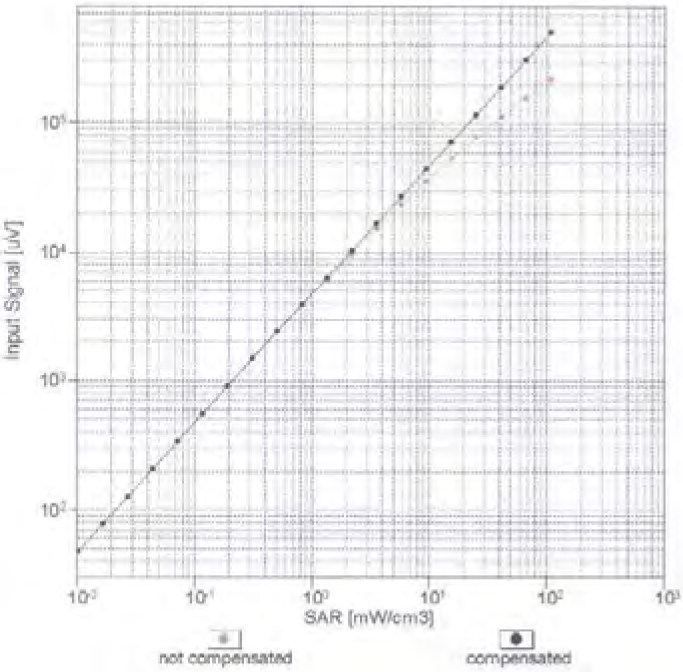
f=1800 MHz,R22

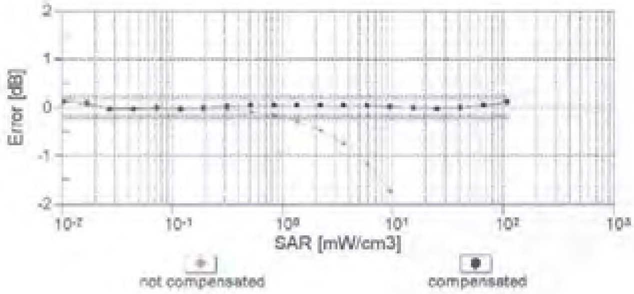




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

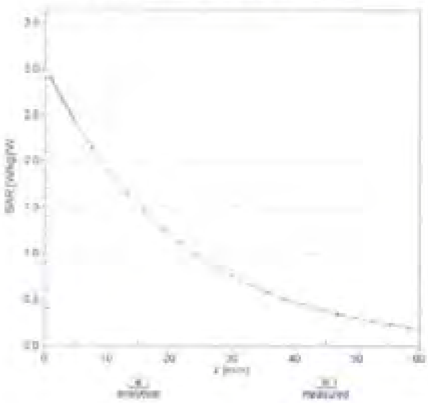
Dynamic Range f(SAR$_{head}$)
(TEM cell , f = 900 MHz)

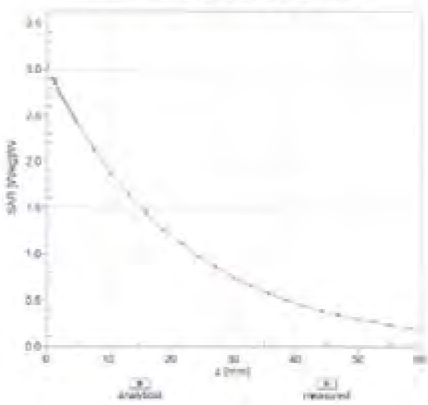




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

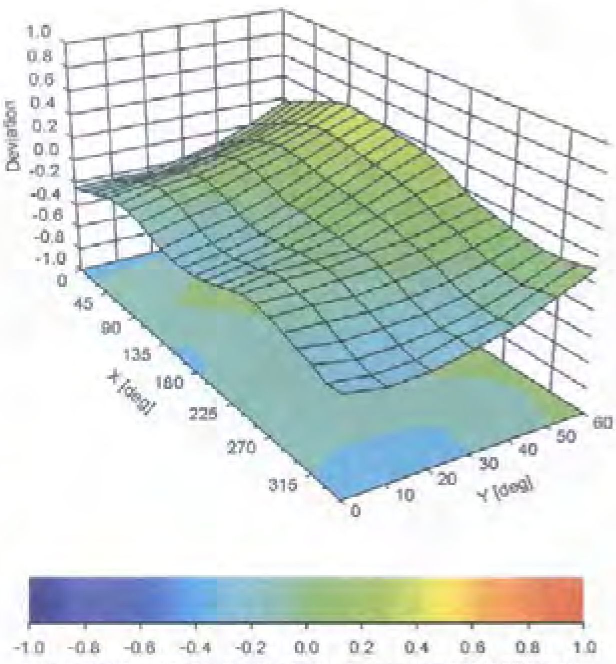
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	3.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

ANNEX H Dipole Calibration Certificate

835 MHz Dipole Calibration Certificate

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Accreditation No.: SCS 108

Client TMC-BJ (Auden)

Certificate No: D835V2-443_Aug13

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 443
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 29, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: August 30, 2013

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.5 ± 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.44 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.16 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.4 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.40 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.20 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4 Ω - 7.6 jΩ
Return Loss	- 22.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.0 Ω - 9.5 jΩ
Return Loss	- 20.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.386 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 26, 2001

DASY5 Validation Report for Head TSL

Date: 29.08.2013

Test Laboratory: SPEAG, Zurich, Switzerland

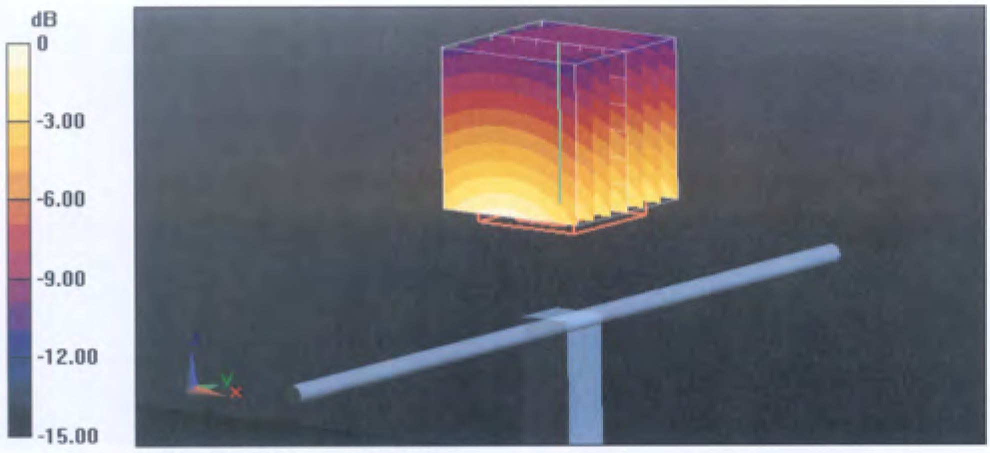
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 443

Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.92 S/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

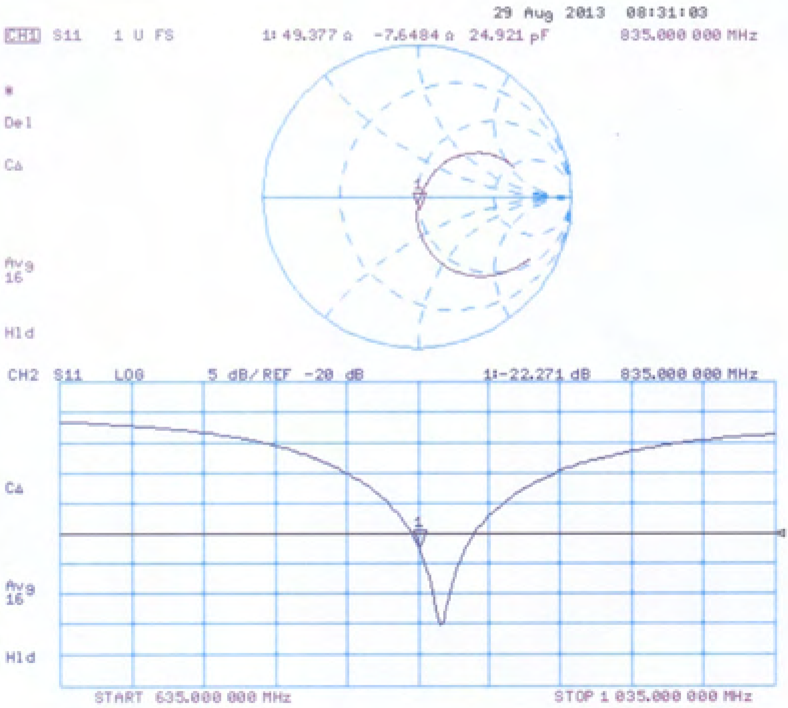
- Probe: ES3DV3 - SN3205; ConvF(6.05, 6.05, 6.05); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.828 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.63 W/kg
SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (measured) = 2.81 W/kg



0 dB = 2.81 W/kg = 4.49 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 29.08.2013

Test Laboratory: SPEAG, Zurich, Switzerland

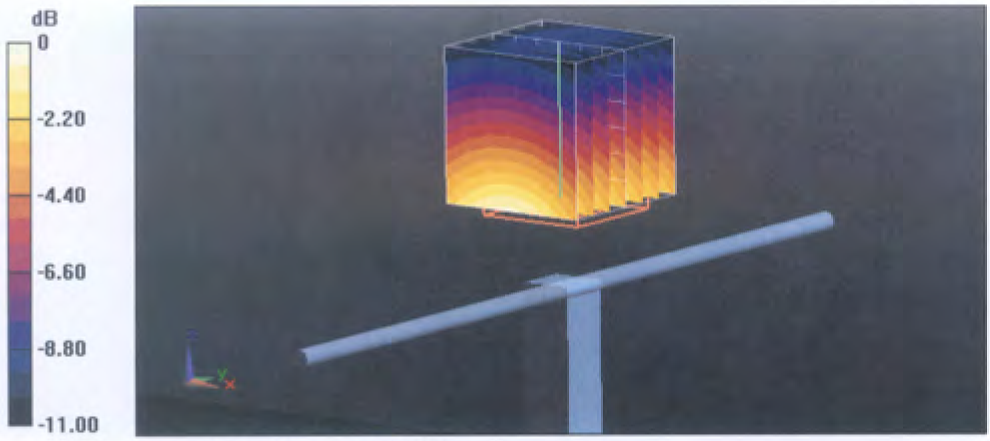
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 443

Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ε_r = 54.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

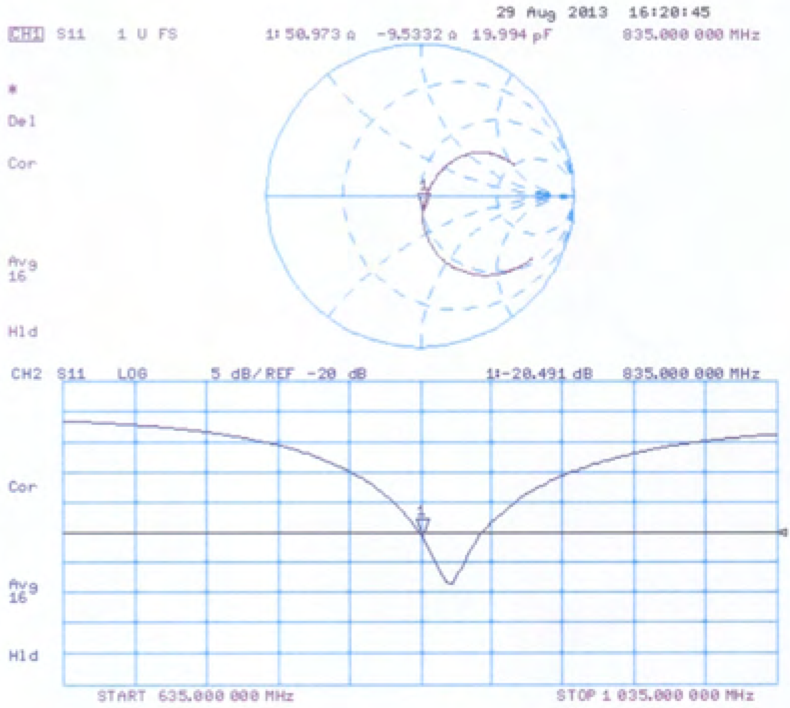
- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.828 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.57 W/kg
SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 2.82 W/kg



0 dB = 2.82 W/kg = 4.50 dBW/kg

Impedance Measurement Plot for Body TSL



1900 MHz Dipole Calibration Certificate

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

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Accreditation No.: **SCS 108**

Client: TMC-BJ (Auden)

Certificate No: D1900V2-5d101_Jul13

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d101
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 09, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: July 9, 2013

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.36 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	1.49 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**41.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.9 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0 Ω + 6.0 jΩ
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7 Ω + 6.5 jΩ
Return Loss	- 22.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 28, 2008

DASY5 Validation Report for Head TSL

Date: 09.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d101

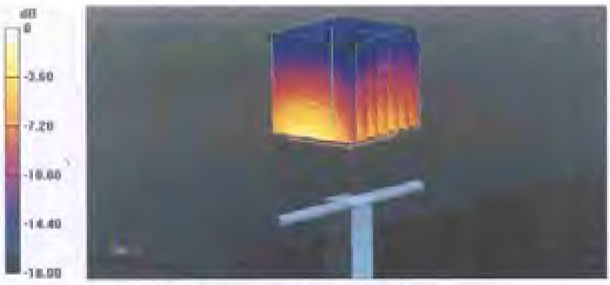
Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.36 S/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

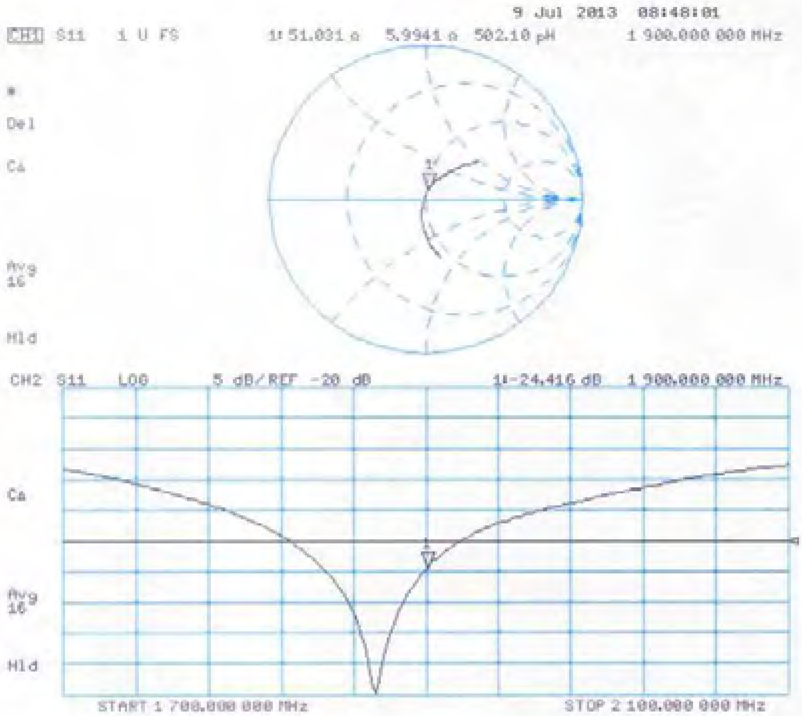
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.435 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 18.2 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.28 W/kg
Maximum value of SAR (measured) = 12.2 W/kg



0 dB = 12.2 W/kg = 10.86 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 09.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d101

Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.49 S/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

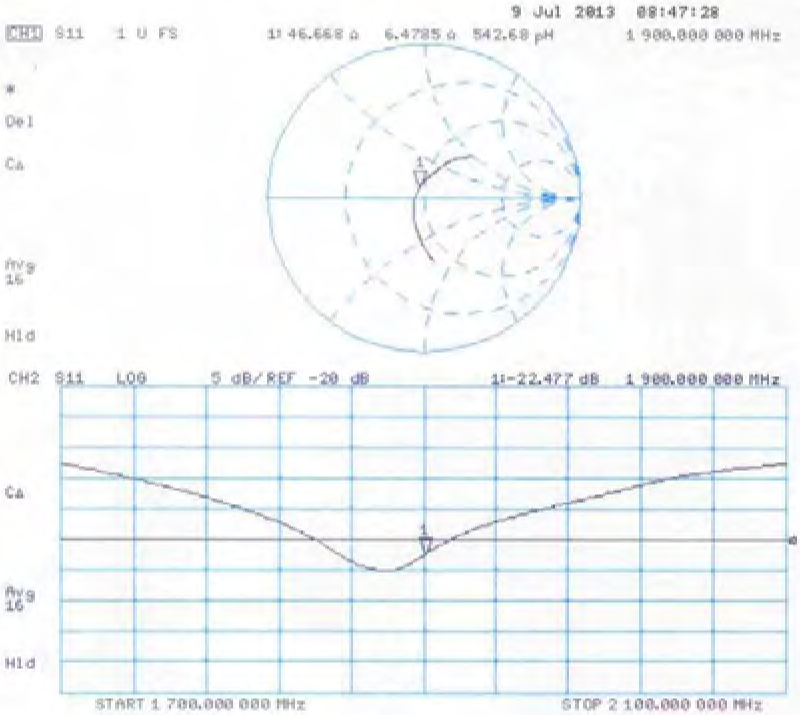
DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.435 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.43 W/kg
Maximum value of SAR (measured) = 12.7 W/kg

0 dB = 12.7 W/kg = 11.04 dBW/kg

Impedance Measurement Plot for Body TSL



2450 MHz Dipole Calibration Certificate

Calibration Laboratory of
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Accreditation No.: **SCS 108**

Client **TMC-BJ (Auden)**

Certificate No: **D2450V2-853_Jul13**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 853

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

Calibration date: July 08, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 9, 2013

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Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.8 ± 6 %	1.81 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.9 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.5 ± 6 %	2.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.9 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.93 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.4 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.8 Ω + 3.4 jΩ
Return Loss	- 25.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.6 Ω + 4.7 jΩ
Return Loss	- 26.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.162 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 10, 2009

DASY5 Validation Report for Head TSL

Date: 08.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

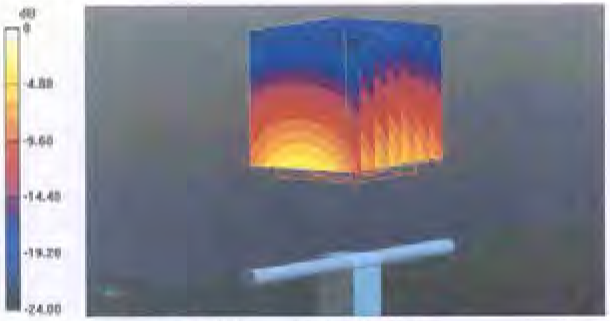
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 853

Communication System: UID 0 - CW ; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.81 S/m; ε_r = 37.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

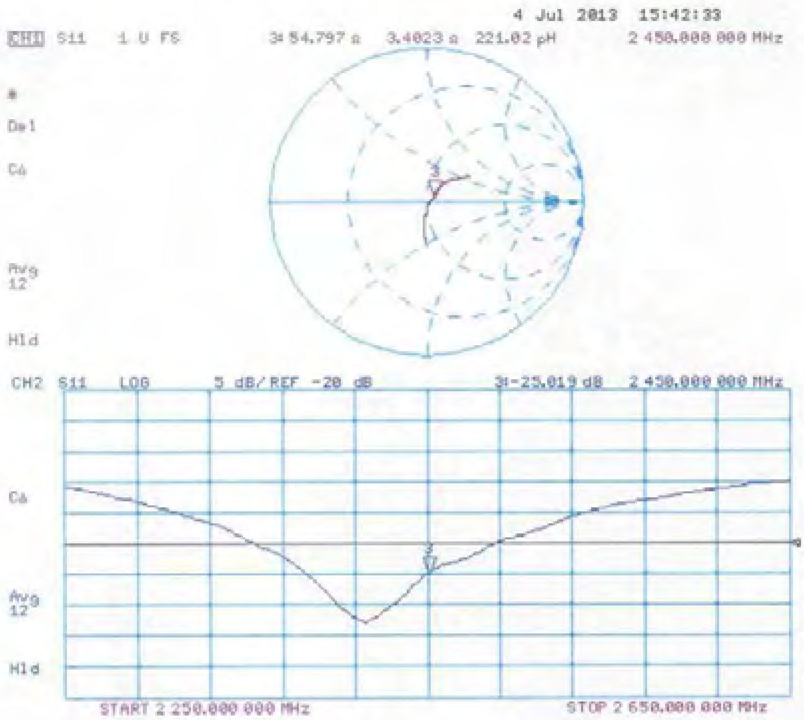
- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.672 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 28.1 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.28 W/kg
Maximum value of SAR (measured) = 17.7 W/kg



0 dB = 17.7 W/kg = 12.48 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 05.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

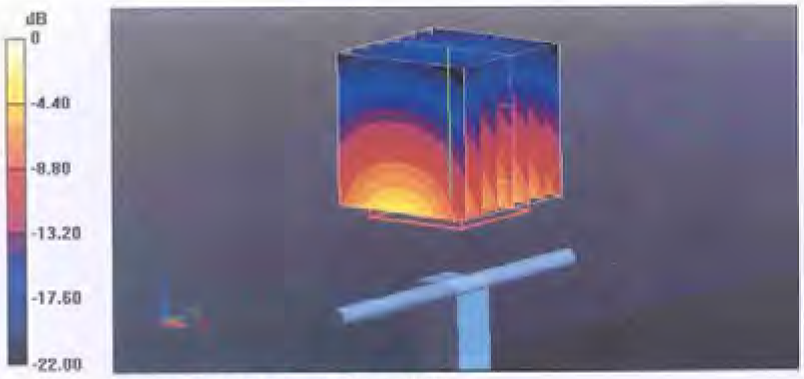
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 853

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.01 S/m; ε_r = 50.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.672 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.93 W/kg
Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 16.9 W/kg = 12.28 dBW/kg

Impedance Measurement Plot for Body TSL