Full

SAR TEST REPORT

No. ECIT-2013-0139-FCC-SAR

For

Client : ZTE Corporation

Production : CDMA Digital Mobile Phone

Model Name : ZTE N880G

Hardware Version: cy1B

Software Version: MOVILNET_VE_N880GV1.0.0B03

Issued date: 2013-8-29

FCC ID: SRQZTEN880G

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 ECIT Shanghai.

Test Laboratory:

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Revision Version

Report Number	Revision	Date	Memo
ECIT-2013-0139-FCC-SAR	00	2013/8/29	Initial creation of test report

CONTENTS

1 Test Laboratory

1.1 Testing Location

Company Name:	ECIT Shanghai, East China Institute of Telecommunications
Address:	7F, G Area,No. 668, Beijing East Road, Huangpu District, Shanghai, P. R. China
Postal Code:	200001
Telephone:	00862163843300
Fax:	00862163843301

1.2 Testing Environment

Normal Temperature:	15-35℃
Relative Humidity:	20-75%
Ambient noise & Reflection:	< 0.012 W/kg

1.3 Project Data

Project Leader:	Liu Jianquan
Testing Start Date:	Aug 22, 2013
Testing End Date:	Aug 27, 2013

1.4 Signature

Hu Jiajing
(Testing engineer)

Yu Naiping
(Reviewed this test report)

Zheng Zhongbin
Director of the laboratory
(Approved this test report)

2 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for ZTE N880G are as follows (with expanded uncertainty 22.4%)

Table 2.1: Max. Reported SAR (1g)

Band	Position	Reported SAR 1g (W/Kg)
CDMA 800	Head	0.577
	Body	1.119
Wifi 2450	Head	0.061
	Body	0.012

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 C95.1-1992.

For body worn operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

The measurement together with the test system set-up is described in chapter 7 of this test report. A detailed description of the equipment under test can be found in chapter 3 of this test report. The maximum reported SAR value is obtained at the case of **(Table 2.1),** and the values are**: 1.119W/kg (1g).**

Simultaneous Transmission SAR(W/Kg)						
Test Position			**CDMA Band 0**	**WIFI**	**BT** note	**SUM**
Head	Left	Cheek	0.525	0.061	0.066	0.591
		Tilt 15°	0.392	0.053	0.066	0.458
	Right	Cheek	0.577	0.041	0.066	0.643
		Tilt 15°	0.414	0.040	0.066	0.480
Body	Phantom Side		0.677	0.00522	0.066	0.743
	Ground Side		1.119	0.012	0.066	1.185
	Left Side		0.637	0.00328	0.066	0.703
	Right Side		0.617	0.00274	0.066	0.683
	Top Side		N/A	0.00274	0.066	N/A
	Bottom Side		0.093	0.00244	0.066	0.159

According to the above table, the maximum sum of reported SAR values for CDMA and BT/Wifi is **1.185 W/kg (1g)**. The above numerical SAR results for all worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured simultaneous SAR summation is required per FCC KDB Publication 447498 D01 v05. The detail for simultaneous transmission consideration is described in chapter 13.

3 Client Information

3.1 Applicant Information

Company Name:	ZTE Corporation
Address /Post:	ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District,Shenzhen, Guangdong, 518057, P.R.China
City:	Shenzhen
Country:	China

3.2 Manufacturer Information

Company Name:	ZTE Corporation
Address /Post:	ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District,Shenzhen, Guangdong, 518057, P.R.China
City:	Shenzhen
Country:	China

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

4.1 About EUT

Description:	CDMA Digital Mobile Phone
Model name:	ZTE N880G
Operation Model(s):	CDMA 800;Wifi 2450
Tx Frequency:	824.7 - 848.3 MHz （CDMA）
	2402 ~ 2480 MHz (BT)
	2412-2462 MHz (Wi-Fi)
Test device Production information:	Production unit
Device type:	Portable device
Antenna type:	Inner antenna
Accessories/Body-worn configurations:	Headset
Form factor:	13.0cm×6.5cm
Hotspot Mode:	Support simultaneous transmission of hotspot and voice (or data)
FCC ID:	SRQZTEN880G

4.2 Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version:
N09	SN:324232030237	cy1B	MOVILNET_VE_N880GV1.0.0B03

*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
B01	Battery	Li3720T42P3h585651	N/A	ZTE Corporation
A02	Headset	HMZ8-C4-OMTP 3.5	N/A	ZTE Corporation

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

5 TEST METHODOLOGY

5.1 Applicable Limit Regulations

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

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

5.2 Applicable Measurement Standards

IC RSS-102 ISSUE4: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

IEEE 1528–2003: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques.

OET Bulletin 65 (Edition 97-01) and Supplement C(Edition 01-01): Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits.

KDB648474 D04 SAR Handsets Multi Xmiter and Ant v01: SAR Evaluation Considerations for Wireless Handsets.

KDB447498 D01 General RF Exposure Guidance v05: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

KDB865664 D01: SAR Measurement Requirements for 100 MHz to 6 GHz

KDB941225 D01 SAR test for 3G devices v02: provides the SAR test procedures for 3G devices that operate under rule Parts 22H, 24E, 27L are described in the attached document.

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

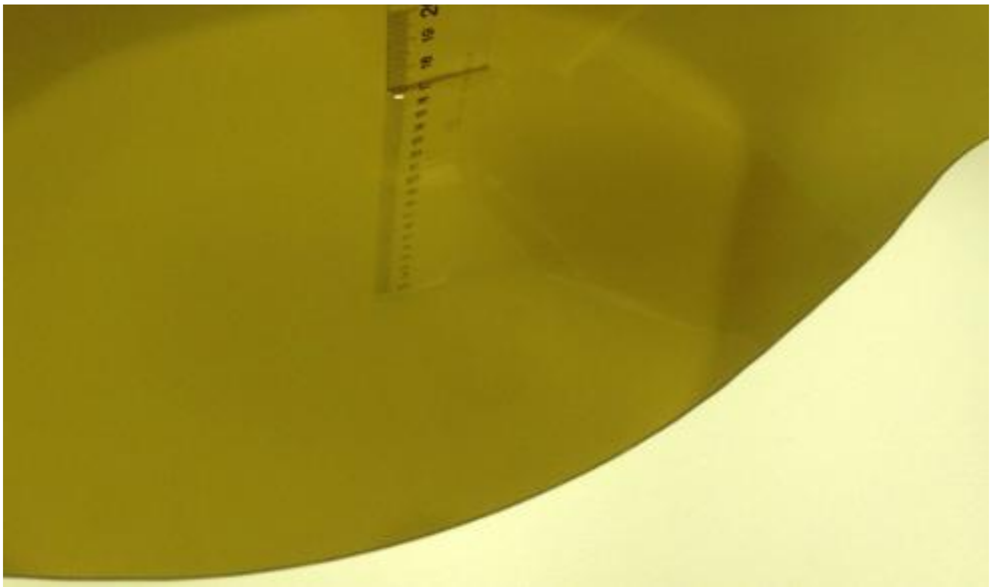
Table 7.1: Targets for tissue simulating liquid

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

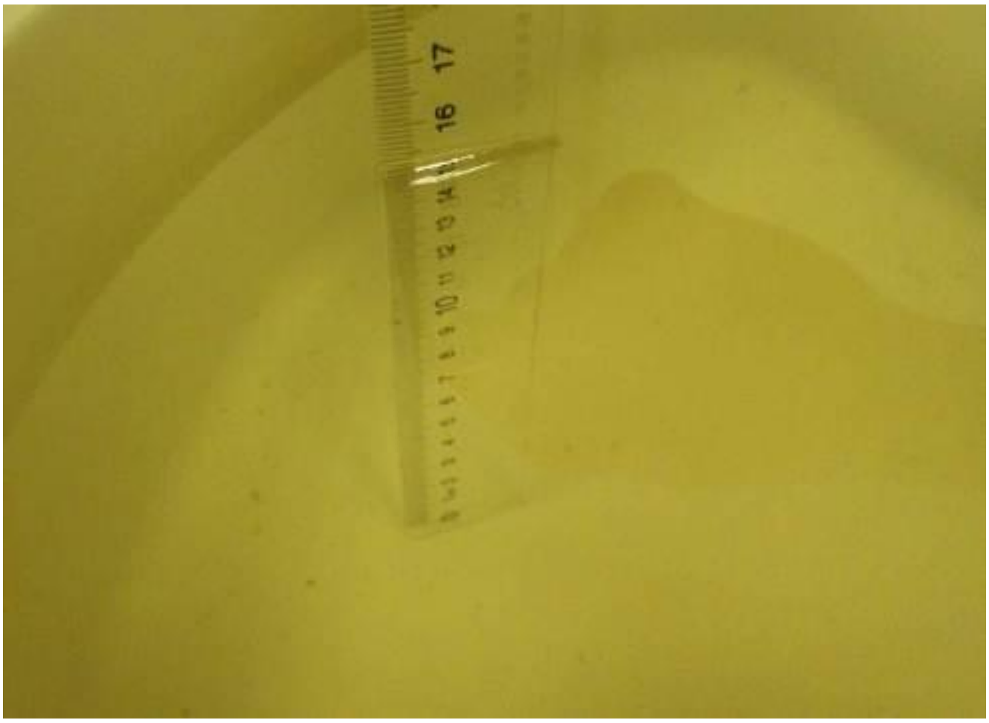
7.2 Dielectric Performance

Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date : 835 MHz Head **Aug 23, 2013** 2450 MHz Head **Aug 26, 2013** 835 MHz Body **Aug 22, 2013** 2450 MHz Body **Aug 27, 2013**						
/	**Type**	**Frequency**	**Permittivity ε**	**Drift (%)**	**Conductivity σ (S/m)**	**Drift (%)**
Measurement value	Head	835 MHz	41.04	-1.10%	0.917	1.88%
	Body	835 MHz	55.15	0.09%	0.999	2.97%
	Head	2450 MHz	38.87	0.84%	1.824	1.33%
	Body	2450 MHz	53.95	2.37%	1.918	1.64%

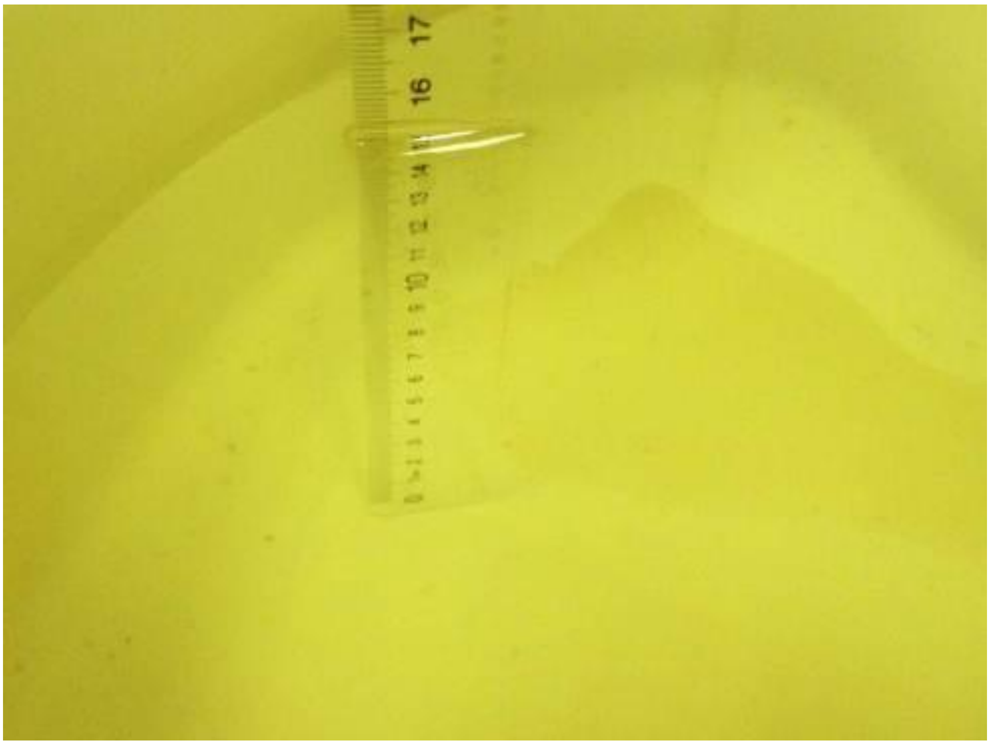


Picture 7-1: Liquid depth in the Flat Phantom (835 MHz Head)



Picture 7-3: Liquid depth in the Flat Phantom (835 MHz Body)

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

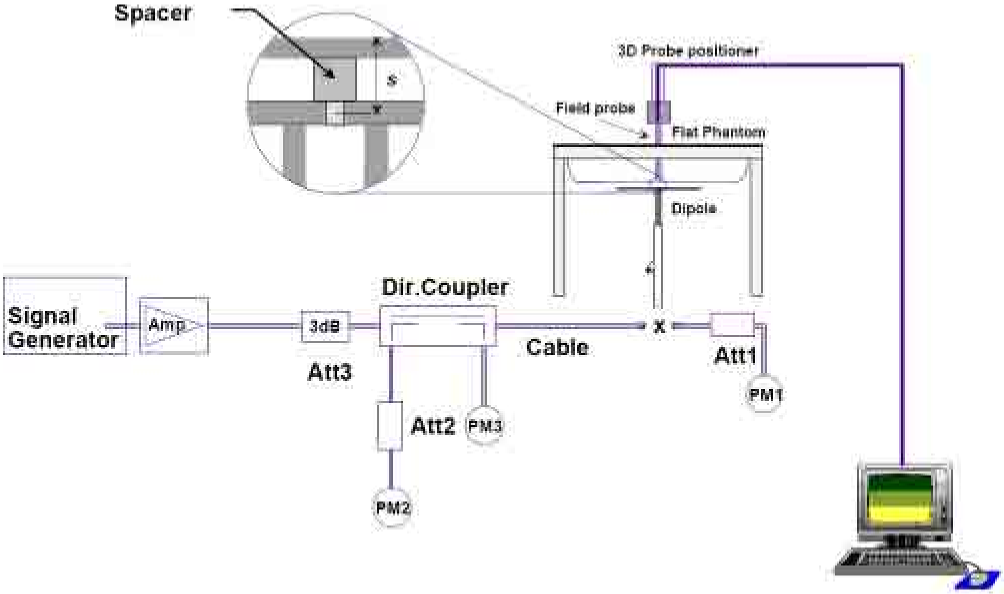


Picture 7-6: Liquid depth in the Flat Phantom (2450 MHz Body)

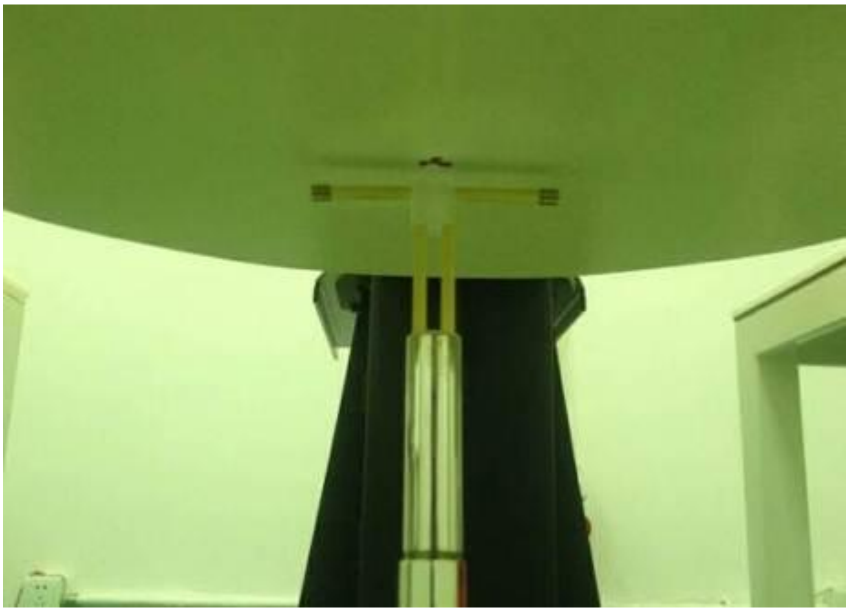
8 System verification

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.

Table 8.1: System Verification of Head

Measurement Date : 835 MHz Head **Aug 23, 2013** 2450 MHz Head **Aug 26, 2013**							
Input power level: 250mW							
Verification results	**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**
	835 MHz	6.10	9.35	6.20	9.40	1.63%	0.53%
	2450 MHz	25.0	53.6	23.72	51.04	-5.12%	-4.77%

Table 8.2: System Verification of Body

Measurement Date : 835 MHz Body **Aug 22, 2013** 2450 MHz Body **Aug 27, 2013**							
Input power level: 250mW							
Verification results	**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**
	835 MHz	6.29	9.50	6.60	10.12	4.93%	6.53%
	2450 MHz	24.1	51.4	24.64	53.2	2.24%	3.50%

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 11.1.

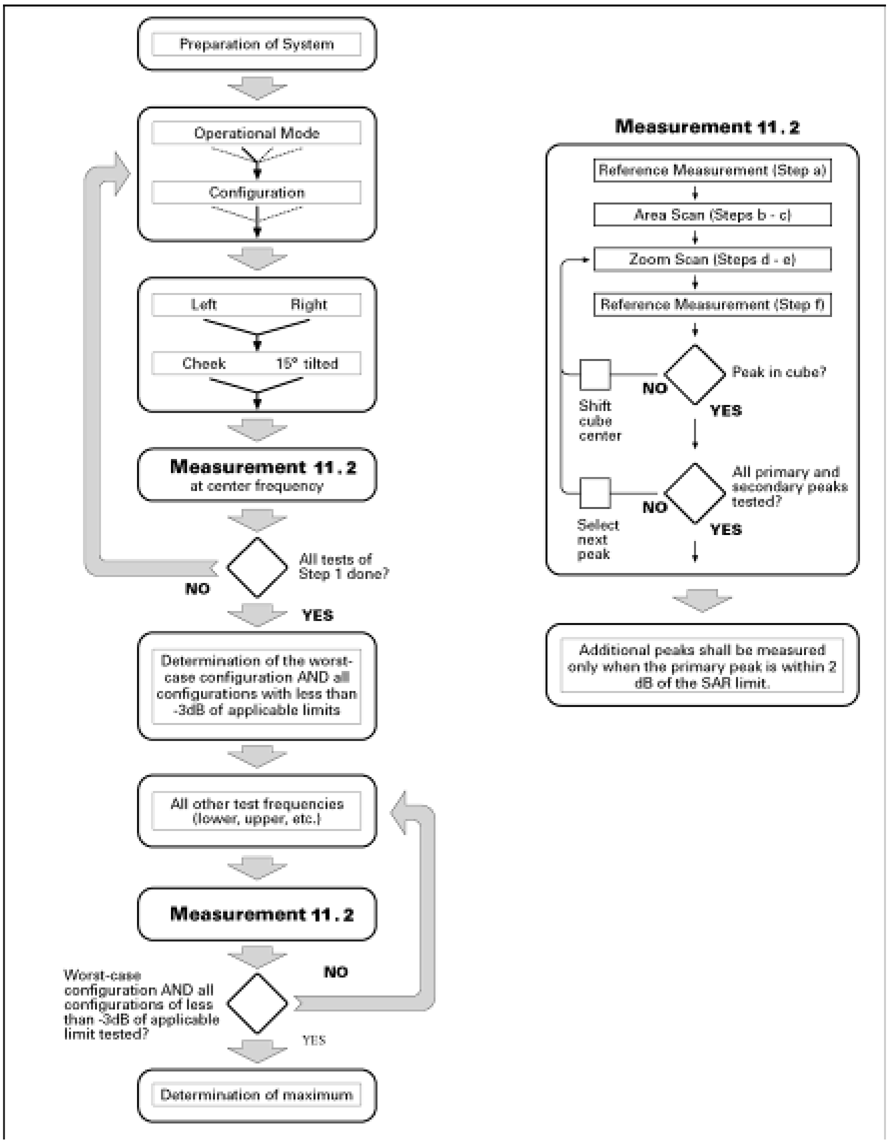
Step 1: The tests described in 11.2 shall be performed at the channel that is closest to the centre of the transmit frequency band (f_c) for:

a) all device positions (cheek and tilt, for both left and right sides of the SAM phantom, as described in Chapter 8),
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 11.2 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 following procedure shall be performed for each of the test conditions (see Picture 11.1) described in 11.1:

a) Measure the local SAR at a test point within 8 mm or less in the normal direction from the inner surface of the phantom.

b) Measure the two-dimensional SAR distribution within the phantom (area scan procedure). The boundary of the measurement area shall not be closer than 20 mm from the phantom side walls. The distance between the measurement points should enable the detection of the location of local maximum with an accuracy of better than half the linear dimension of the tissue cube after interpolation. A maximum grip spacing of 20 mm for frequencies below 3 GHz and (60/f [GHz]) mm for frequencies of 3GHz and greater is recommended. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz andδ In(2)/2 mm for frequencies of 3 GHz and greater, whereδ is the plane wave skin depth and In(x) is the natural logarithm. The maximum variation of the sensor-phantom surface shall be ±1 mm for frequencies below 3 GHz and ±0.5 mm for frequencies of 3 GHz and greater. At all measurement points the angle of the probe with respect to the line normal to the surface should be less than 5°. If this cannot be achieved for a measurement distance to the phantom inner surface shorter than the probe diameter, additional uncertainty evaluation is needed.

c) From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that are not within the zoom-scan volume; additional peaks shall be measured only when the primary peak is within 2 dB of the SAR limit. This is consistent with the 2 dB threshold already stated;

d) Measure the three-dimensional SAR distribution at the local maxima locations identified in step c). The horizontal grid step shall be (24/f[GHz]) mm or less but not more than 8 mm. The minimum zoom size of 30 mm by 30 mm and 30 mm for frequencies below 3 GHz. For higher frequencies, the minimum zoom size of 22 mm by 22 mm and 22 mm. The grip step in the vertical direction shall be (8-f[GHz]) mm or less but not more than 5 mm, if uniform spacing is used. If variable spacing is used in the vertical direction, the maximum spacing between the two closest measured points to the phantom shell shall be (12 / f[GHz]) mm or less but not more than 4 mm, and the spacing between father points shall increase by an incremental factor not exceeding 1.5. When variable spacing is used, extrapolation routines shall be tested with the same spacing as used in measurements. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz andδ In(2)/2 mm for frequencies of 3 GHz and greater, where δ is the plane wave skin depth and In(x) is the natural logarithm. Separate grids shall be centered on each of the local SAR maxima found in step c). Uncertainties due to field distortion between the media boundary and the dielectric enclosure of the probe should also be minimized, which is achieved is the distance between the phantom surface and physical tip of the probe is larger than probe tip diameter. Other methods may utilize correction procedures for these boundary effects that enable high precision measurements closer than half the probe diameter. For all measurement points, the angle of the probe with respect to the flat phantom surface shall be less than 5°. If this cannot be achieved an additional uncertainty evaluation is needed.

e) Use post processing(e.g. interpolation and extrapolation) procedures to determine the local SAR values at the spatial resolution needed for mass averaging.

9.3 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.

9.4 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 14.5 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

11 Conducted Output Power

11.1 Manufacturing tolerance

Table 11.1: CDMA

CDMA Band 0			
Channel	Channel 1013	Channel 384	Channel 777
Maximum Target Value (dBm)	24.5	24.5	24.5

Table 11.7: WiFi

WiFi 802.11b			
Channel	Channel 1	Channel 6	Channel 11
Maximum Target Value (dBm)	13.5	13.5	13.5
WiFi 802.11g			
Channel	Channel 1	Channel 6	Channel 11
Maximum Target Value (dBm)	12.2	12.2	12.2
WiFi 802.11n			
Channel	Channel 1	Channel 6	Channel 11
Maximum Target Value (dBm)	10.0	10.0	10.0

For BT, power of tune up tolerance is 4±1 dBm.

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 11.5: The conducted power measurement results for CDMA800

Mode	Test case			BC0 (850MHz) Channel		
	No.	FWD RC/TAP	REV RC/TAP	Conducted Power (dBm)		
				1013	384	777
1x	1	RC1	RC1 (SO2)	23.21	23.46	23.17
	2	RC1	RC1 (SO55)	23.59	24.14	23.3
	3	RC2	RC2 (SO9)	23.60	24.18	23.34
	4	RC2	RC2 (SO55)	23.61	24.07	23.29
	5	RC3	RC3 (SO55)	23.63	24.14	23.36
	6	RC3	RC3 (SO32)	23.59	24.14	23.32
EV-DO(REV.0)				23.69	24.11	23.20
EV-DO(REV.A)				23.16	23.70	23.06

NOTE: SAR for body exposure configurations is measured in RC3 with the DUT configured using TDSO / SO32, to transmit at full rate on FCH with all other code channels disabled. SAR for multiple code channels (FCH + SCHn) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only.

11.3 BT Measurement result

The output power of BT antenna is as following:

For GFSK

Channel	Ch0 (2402 MHz)	Ch39 (2441MHz)	CH78 (2480MHz)
Conducted Output Power (dBm)	4.11	4.34	4.47

For π/4 DQPSK

Channel	Ch0 (2402 MHz)	Ch39 (2441MHz)	CH78 (2480MHz)
Conducted Output Power (dBm)	3.13	3.28	3.56

For 8DPSK

Channel	Ch0 (2402 MHz)	Ch39 (2441MHz)	CH78 (2480MHz)
Conducted Output Power (dBm)	3.08	3.29	3.54

NOTE:BT standalone SAR are not required, because maximum average output power is less than 10mW.

The average conducted power for WiFi is as following:

802.11b（dBm）

Channel\data rate	1Mbps	2Mbps	5.5Mbps	11Mbps
1	12.86	12.01	12.15	12.56
6	13.19	12.78	12.65	12.72
11	12.89	12.12	12.15	12.34

802.11g（dBm）

Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
1	11.96	10.22	10.24	10.56	10.98	10.52	10.46	10.44
6	12.18	11.32	11.85	11.92	11.95	11.26	11.15	11.08
11	11.90	11.12	11.05	10.84	10.59	10.59	10.35	10.48

20M 802.11n（dBm）

Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1	9.02	9.15	9.11	9.05	8.98	8.49	8.51	8.72
6	9.12	9.38	9.24	9.31	9.15	9.05	8.89	8.95
11	8.96	9.12	8.75	8.65	8.72	8.66	8.59	8.45

The peak conducted power for WiFi is as following:

802.11b（dBm）

Channel\data rate	1Mbps	2Mbps	5.5Mbps	11Mbps
1	16.95	16.93	16.72	16.64
6	17.12	16.98	16.85	17.01
11	16.84	16.81	16.79	16.68

802.11g（dBm）

Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
1	18.98	18.79	18.63	17.86	18.83	18.93	18.10	17.73
6	19.35	19.26	19.15	18.51	18.62	18.52	18.15	18.32
11	19.14	19.08	19.07	19.10	18.98	18.92	18.58	18.64

20M 802.11n（dBm）

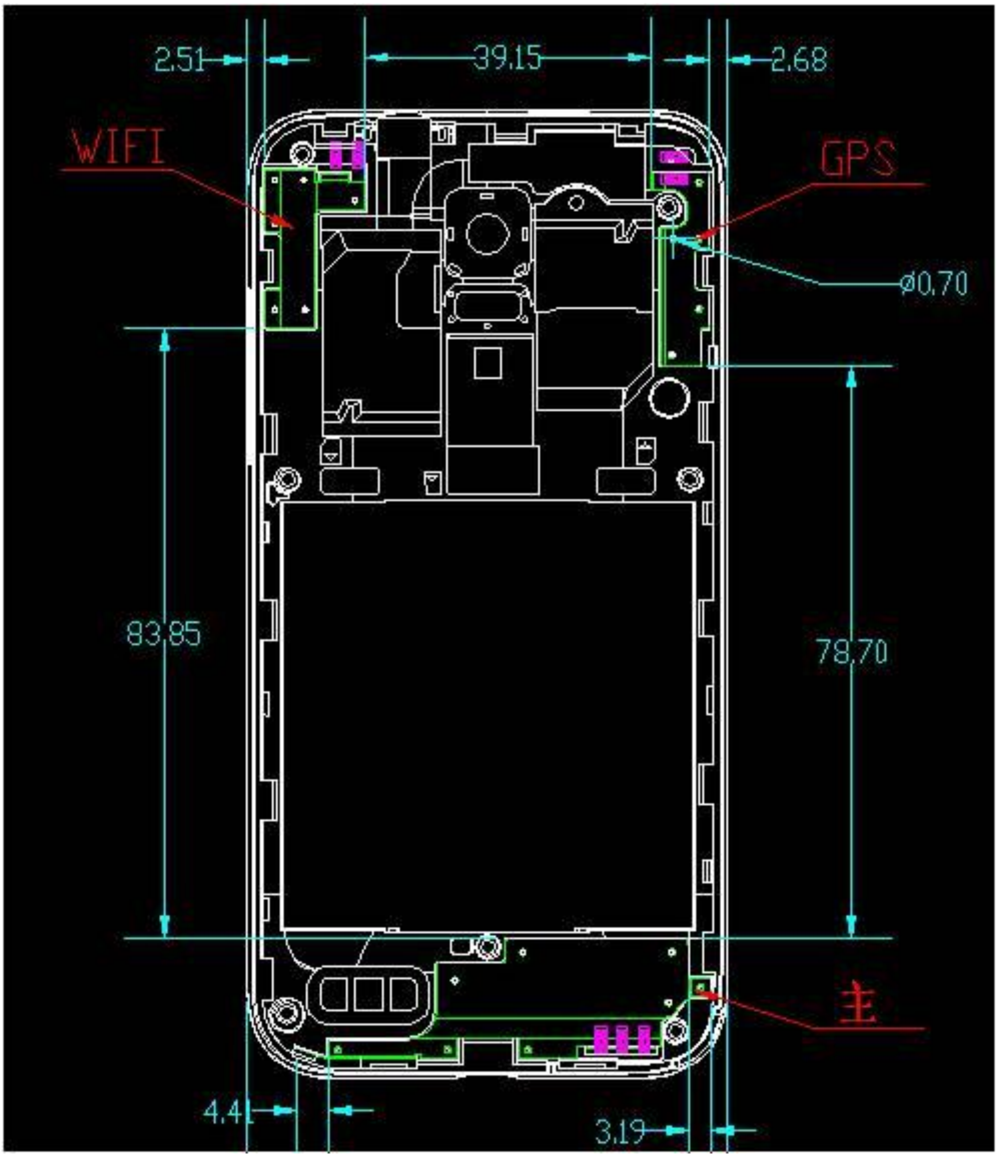
Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1	16.60	16.72	16.36	14.87	14.77	15.83	15.30	15.03
6	15.24	15.36	15.13	15.08	14.75	14.81	14.92	14.98
11	15.10	15.17	15.08	15.12	15.09	14.95	14.83	14.54

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 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

According to the KDB447498 appendix A, the SAR test exclusion threshold for 2450MHz at 5mm test separation distances is 10mW.

Appendix A

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

Picture 12.2 Power Thresholds

13 Evaluation of Simultaneous

Table 13.1: Summary of Transmitters

Band/Mode	F(GHz)	SAR test exclusion threshold (mW)	RF output power (mW)
Bluetooth	2.480	10	2.80

Simultaneous Transmission SAR(W/Kg)						
Test Position			**CDMA Band 0**	**WIFI**	**BT** note	**SUM**
Head	Left	Cheek	0.525	0.061	0.066	0.591
		Tilt 15°	0.392	0.053	0.066	0.458
	Right	Cheek	0.577	0.041	0.066	0.643
		Tilt 15°	0.414	0.040	0.066	0.480
Body	Phantom Side		0.677	0.00522	0.066	0.743
	Ground Side		1.119	0.012	0.066	1.185
	Left Side		0.637	0.00328	0.066	0.703
	Right Side		0.617	0.00274	0.066	0.683
	Top Side		N/A	0.00274	0.066	N/A
	Bottom Side		0.093	0.00244	0.066	0.159

NOTE: According to the conducted power measurement result, we can draw the conclusion that: The BT Standalone SAR evaluation by measurement or numerical simulation is not required. When the standalone SAR test exclusion is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion

(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;
where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
So,

For BT, SAR value for 1-g SAR is 0.066 W/Kg.

The above numerical SAR results for all worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured simultaneous SAR summation is required per FCC KDB Publication 447498 D01 v05.
According to the above table, the sum of reported SAR values for GSM and WiFi/BT ＜1.6W/kg. So the simultaneous transmission SAR is not required for WiFi/BT transmitter.

14 SAR Test Result

Table 14.1: Duty Cycle

	Duty Cycle
CDMA Band 0 and WiFi	1:1

Table 14.2: SAR Values (CDMA Band 0 - Head)

Frequency		Side	Test Position	Maximum allowed Power (dBm)	Measured average power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.								
836.5	384	Left	Touch	24.5	24.14	1.086	0.484	0.525	0.11
836.5	384	Left	Tilt	24.5	24.14	1.086	0.361	0.392	0.17
836.5	384	Right	Touch	24.5	24.14	1.086	0.486	0.528	-0.13
836.5	384	Right	Tilt	24.5	24.14	1.086	0.381	0.414	-0.12
824.7	1013	Right	Touch	24.5	23.63	1.222	0.335	0.409	-0.16
848.3	777	Right	Touch	24.5	23.36	1.300	0.444	0.577	0.03

Table 14.3: SAR Values (CDMA Band 0 - Body)

Frequency		Mode	Test Position	Maximum allowed Power (dBm)	Measured average power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.								
836.5	384	US Cellular	Phantom	24.5	24.14	1.086	0.623	0.677	0.04
836.5	384	US Cellular	Ground	24.5	24.14	1.086	1.03	1.119	0.05
836.5	384	US Cellular	Top	N/A	N/A	N/A	N/A	N/A	N/A
836.5	384	US Cellular	Bottom	24.5	24.14	1.086	0.086	0.093	-0.03
836.5	384	US Cellular	Left	24.5	24.14	1.086	0.587	0.637	0.07
836.5	384	US Cellular	Right	24.5	24.14	1.086	0.568	0.617	-0.07
824.7	1013	US Cellular	Ground	24.5	23.63	1.222	0.890	1.087	0.13
848.3	777	US Cellular	Ground	24.5	23.36	1.300	0.880	1.144	-0.05
836.5	384	US Cellular	Ground (Headset)	24.5	24.14	1.086	0.708	0.769	-0.03

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

Table 14.4: SAR Values (Wi-Fi 802.11b - Head)

Frequency		Side	Test Position	Maximum allowed Power (dBm)	Measured average power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.								
2437	6	Left	Touch	13.5	13.19	1.074	0.057	0.061	0.17
2437	6	Left	Tilt	13.5	13.19	1.074	0.049	0.053	0.18
2437	6	Right	Touch	13.5	13.19	1.074	0.038	0.041	0.19
2437	6	Right	Tilt	13.5	13.19	1.074	0.037	0.040	0.15

Table 14.5: SAR Values (Wi-Fi 802.11b - Body)

Frequency		Test Position	Maximum allowed Power (dBm)	Measured average power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.							
2437	6	Phantom	13.5	13.19	1.074	0.00486	0.00522	0.17
2437	6	Ground	13.5	13.19	1.074	0.011	0.012	0.18
2437	6	Top	13.5	13.19	1.074	0.00255	0.00274	0.09
2437	6	Bottom	13.5	13.19	1.074	0.00227	0.00244	-0.12
2437	6	Left	13.5	13.19	1.074	0.00305	0.00328	0.15
2437	6	Right	13.5	13.19	1.074	0.00255	0.00274	0.17

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 Head Value (1g)

Frequency		Side	Test Position	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio
MHz	Ch.					
N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

Frequency		Mode(number of timeslots)	Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio
MHz	Ch.						
836.5	384	US Cellular	Ground	10	1.03	1.04	1.01
824.7	1013	US Cellular	Ground	10	0.890	0.866	1.03
848.3	777	US Cellular	Ground	10	0.880	0.881	1.00

16 Measurement Uncertainty

Error Description	Unc. value , ±%	Prob. Dist.	Div .	c_i 1g	c_i 10g	Std.Unc. ±%,1g	Std.Unc. ±%,10g	V_i v_{eff}
Measurement System								
Probe Calibration	6.0	N	1	1	1	6.0	6.0	∞
Axial Isotropy	0.5	R	$\sqrt{3}$	0.7	0.7	0.2	0.2	∞
Hemispherical Isotropy	2.6	R	$\sqrt{3}$	0.7	0.7	1.1	1.1	∞
Boundary Effects	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
Linearity	0.6	R	$\sqrt{3}$	1	1	0.3	0.3	∞
System Detection Limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Readout Electronics	0.7	N	1	1	1	0.7	0.7	∞
Response Time	0	R	$\sqrt{3}$	1	1	0	0	∞
Integration Time	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
RF Ambient Noise	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
RF Ambient Reflections	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
Probe Positioner	1.5	R	$\sqrt{3}$	1	1	0.9	0.9	∞
Probe Positioning	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
Max. SAR Eval.	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test Sample Related								
Device Positioning	2.9	N	1	1	1	2.9	2.9	145
Device Holder	3.6	N	1	1	1	3.6	3.6	5
Diople								
Power Drift	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Dipole Positioning	2.0	N	1	1	1	2.0	2.0	∞
Dipole Input Power	5.0	N	1	1	1	5.0	5.0	∞
Phantom and Setup								
Phantom Uncertainty	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
Liquid Conductivity (target)	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (meas.)	2.5	N	1	0.64	0.43	1.6	1.1	∞
Liquid Permittivity (target)	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
Liquid Permittivity	2.5	N	1	0.6	0.49	1.5	1.2	∞

(meas.)								
Combined Std Uncertainty						±11.2%	±10.9%	387
Expanded Std Uncertainty						**±22.4%**	**±21.8%**	

17 Main Test Instrument

Table 16.1: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	N5242A	MY51221755	May 21, 2013	One year
02	Power meter	NRVD	102257	Aug 31, 2013	One year
03	Power sensor	NRV-Z5	100644,100241		
04	Signal Generator	E4438C	MY49072044	May 21, 2013	One Year
05	Amplifier	NTWPA-0086010F	12023024	No Calibration Requested	
06	Coupler	778D	MY48220551	Aug 23, 2013	One year
07	BTS	E5515C	MY50266468	May 21, 2013	One year
08	E-field Probe	ES3DV3	3252	Aug 5, 2013	One year
09	E-field Probe	EX3DV4	3754	Aug 8, 2013	One year
10	DAE	SPEAG DAE4	1244	Jul 9, 2013	One year
11	Dipole Validation Kit	SPEAG D835V2	4d092	Jun 17, 2013	One year
12	Dipole Validation Kit	SPEAG D2450V2	858	Jul 13, 2013	One year

ANNEX A GRAPH RESULTS

CDMA800MHz Left Cheek Middle

Date/Time: 8/23/2013

Electronics: DAE4 Sn1244

Medium: Head 850MHz

Medium parameters used: f = 837 MHz; σ = 0.919 S/m; ε_r = 40.986; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(6.1, 6.1, 6.1); Calibrated: 8/5/2013

Middle Cheek Left CDMA800MHz/Area Scan (12x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.504 W/kg

Middle Cheek Left CDMA800MHz/Zoom Scan (5x5x7)/Cube 0:

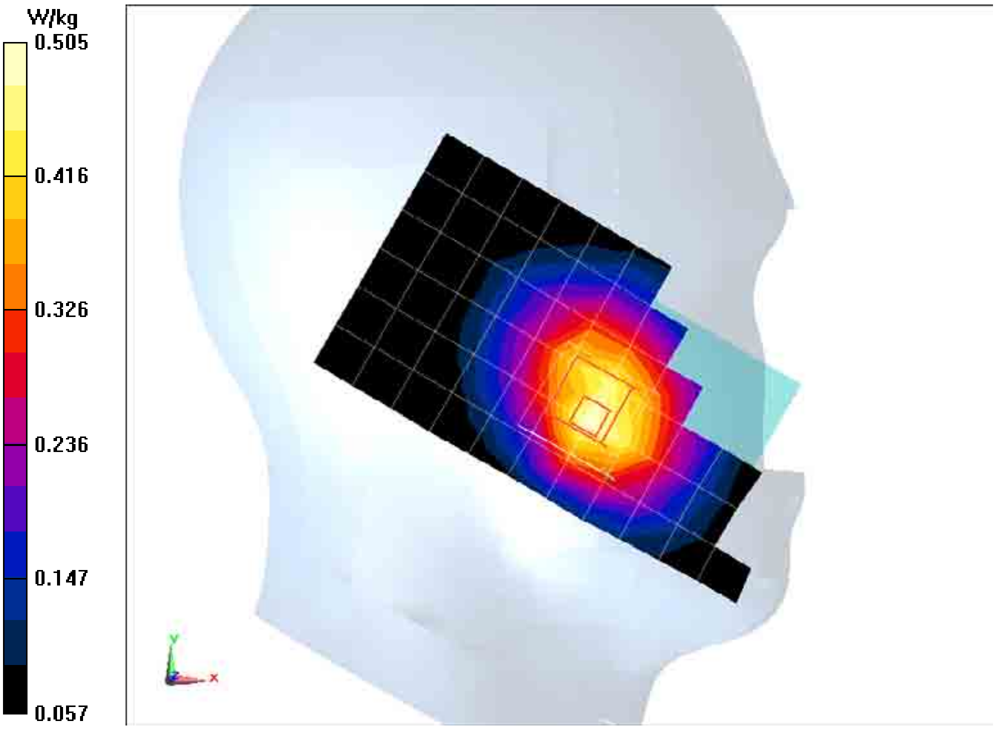
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 7.206 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.655 W/kg

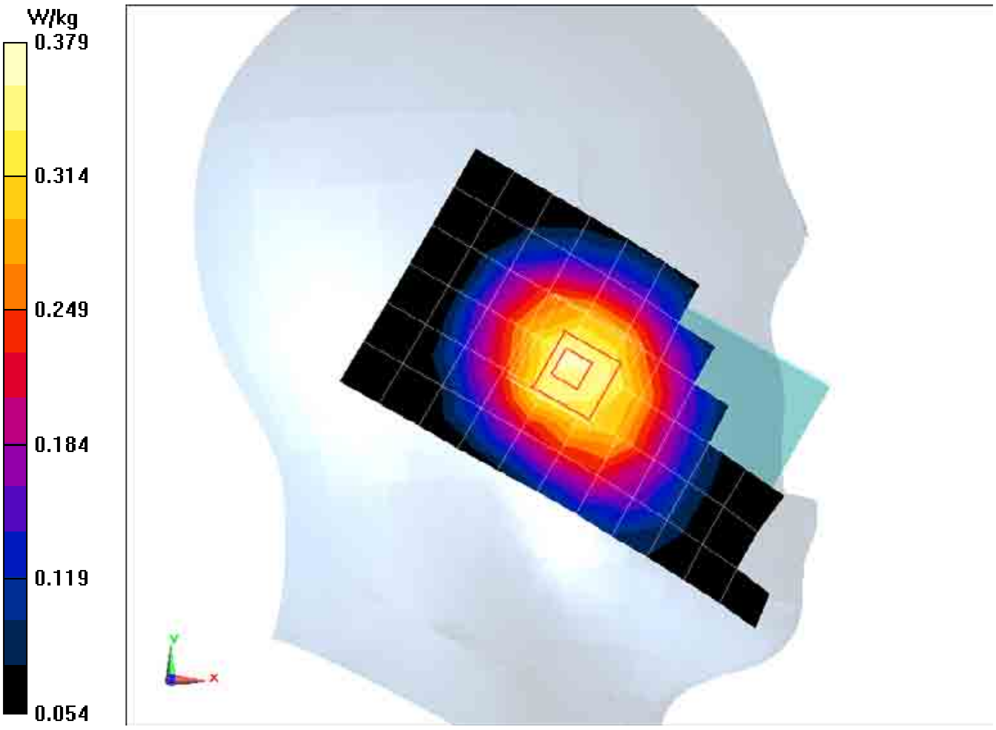
SAR(1 g) = 0.484 W/kg; SAR(10 g) = 0.356 W/kg

Maximum value of SAR (measured) = 0.505 W/kg



CDMA800MHz Left Tilt Middle

Date/Time: 8/23/2013
Electronics: DAE4 Sn1244
Medium: Head 850MHz
Medium parameters used: f = 837 MHz; σ = 0.919 S/m; ε_r = 40.986; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.1, 6.1, 6.1); Calibrated: 8/5/2013
Middle Tilt Left CDMA800MHz/Area Scan (12x7x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.366 W/kg
Middle Tilt Left CDMA800MHz/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.440 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.431 W/kg
SAR(1 g) = 0.361 W/kg; SAR(10 g) = 0.279 W/kg
Maximum value of SAR (measured) = 0.379 W/kg



CDMA800MHz Right Cheek Middle

Date/Time: 8/23/2013

Electronics: DAE4 Sn1244

Medium: Head 850MHz

Medium parameters used: f = 837 MHz; σ = 0.919 S/m; ε_r = 40.986; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(6.1, 6.1, 6.1); Calibrated: 8/5/2013

Middle Cheek Right CDMA800MHz/Area Scan (12x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.483 W/kg

Middle Cheek Right CDMA800MHz/Zoom Scan (5x5x7)/Cube 0:

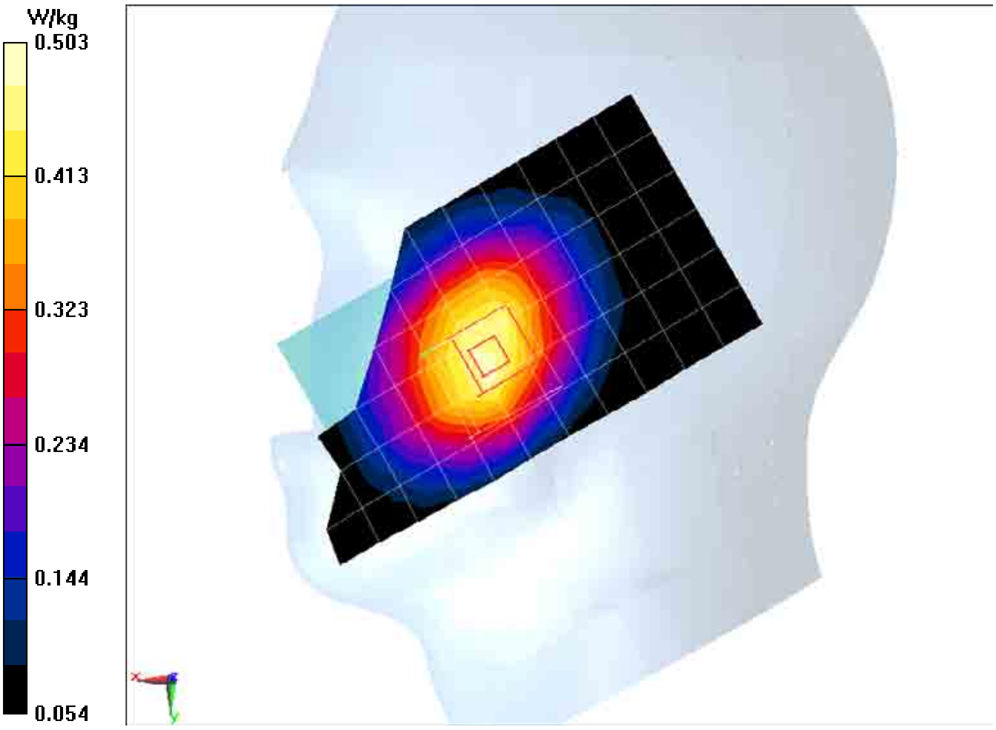
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.403 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.604 W/kg

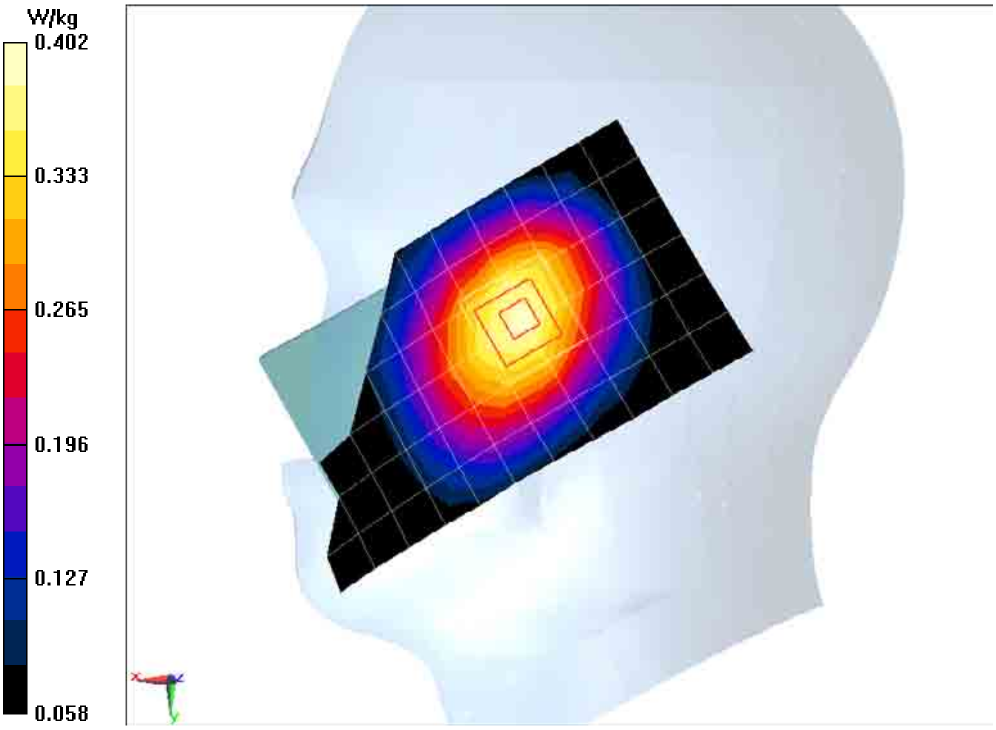
SAR(1 g) = 0.486 W/kg; SAR(10 g) = 0.365 W/kg

Maximum value of SAR (measured) = 0.503 W/kg



CDMA800MHz Right Tilt Middle

Date/Time: 8/23/2013
Electronics: DAE4 Sn1244
Medium: Head 850MHz
Medium parameters used: f = 837 MHz; σ = 0.919 S/m; ε_r = 40.986; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.1, 6.1, 6.1); Calibrated: 8/5/2013
Middle Tilt Right CDMA800MHz/Area Scan (12x7x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.399 W/kg
Middle Tilt Right CDMA800MHz/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.763 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.452 W/kg
SAR(1 g) = 0.381 W/kg; SAR(10 g) = 0.292 W/kg
Maximum value of SAR (measured) = 0.402 W/kg



CDMA800MHz Right Cheek Low

Date/Time: 8/23/2013

Electronics: DAE4 Sn1244

Medium: Head 850MHz

Medium parameters used: f = 825 MHz; σ = 0.911 S/m; ε_r = 41.306; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CDMA 800MHz; Frequency: 824.7 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(6.1, 6.1, 6.1); Calibrated: 8/5/2013

Low Cheek Right CDMA800MHz/Area Scan (12x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.364 W/kg

Low Cheek Right CDMA800MHz/Zoom Scan (5x5x7)/Cube 0:

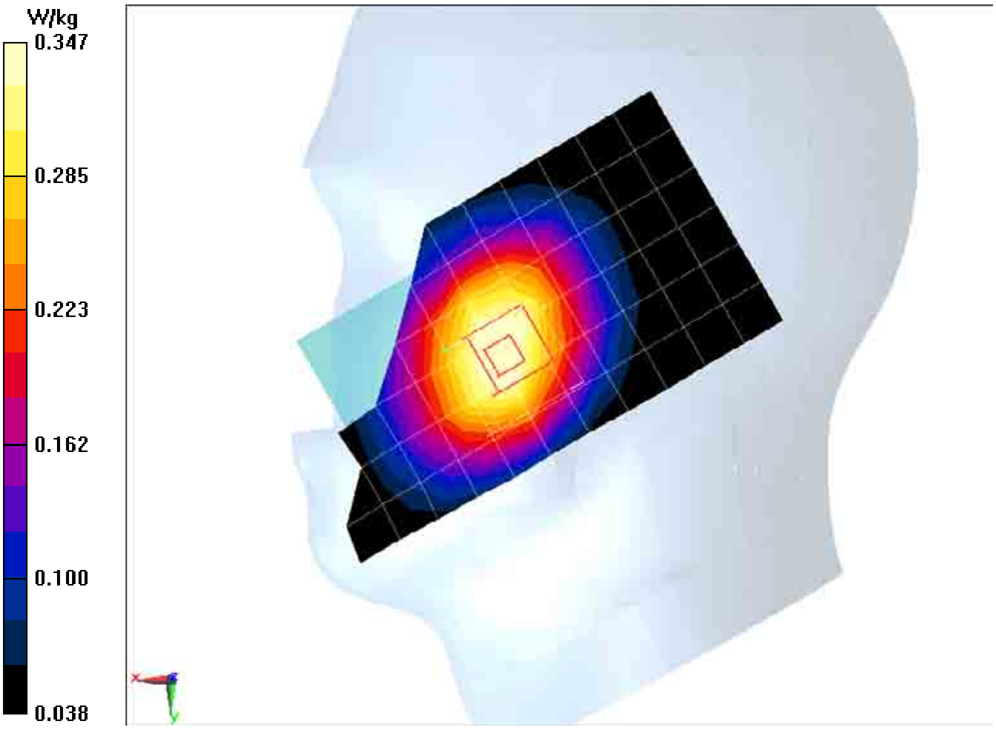
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.327 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 0.408 W/kg

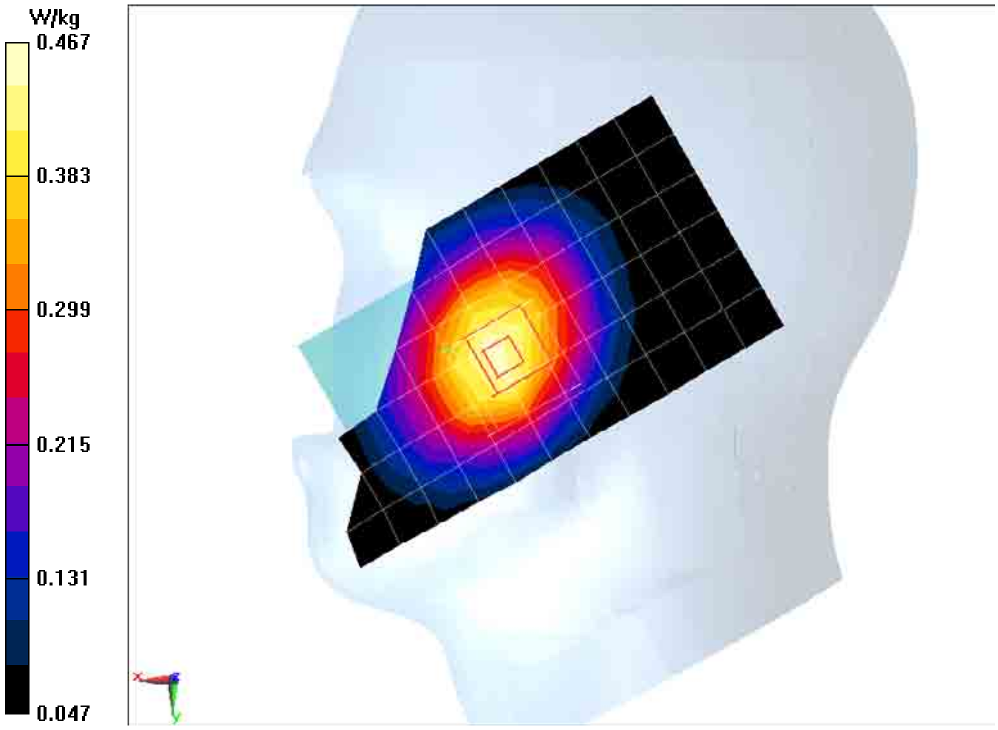
SAR(1 g) = 0.335 W/kg; SAR(10 g) = 0.258 W/kg

Maximum value of SAR (measured) = 0.347 W/kg



CDMA800MHz Right Cheek High

Date/Time: 8/23/2013
Electronics: DAE4 Sn1244
Medium: Head 850MHz
Medium parameters used (interpolated): f = 848.31 MHz; σ = 0.929 S/m; ε_r = 40.795; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: CDMA 800MHz; Frequency: 848.31 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.1, 6.1, 6.1); Calibrated: 8/5/2013
High Cheek Right CDMA800MHz/Area Scan (12x7x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.458 W/kg
High Cheek Right CDMA800MHz/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.365 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.543 W/kg
SAR(1 g) = 0.444 W/kg; SAR(10 g) = 0.338 W/kg
Maximum value of SAR (measured) = 0.467 W/kg



CDMA800MHz Body Toward Ground Middle

Date/Time: 8/22/2013

Electronics: DAE4 Sn1244

Medium: Body 850MHz

Medium parameters used: f = 837 MHz; σ = 1.001 S/m; ε_r = 55.152; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013

Middle Toward Ground CDMA800MHz/Area Scan (10x17x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 1.06 W/kg

Middle Toward Ground CDMA800MHz/Zoom Scan (5x5x7)/Cube 0:

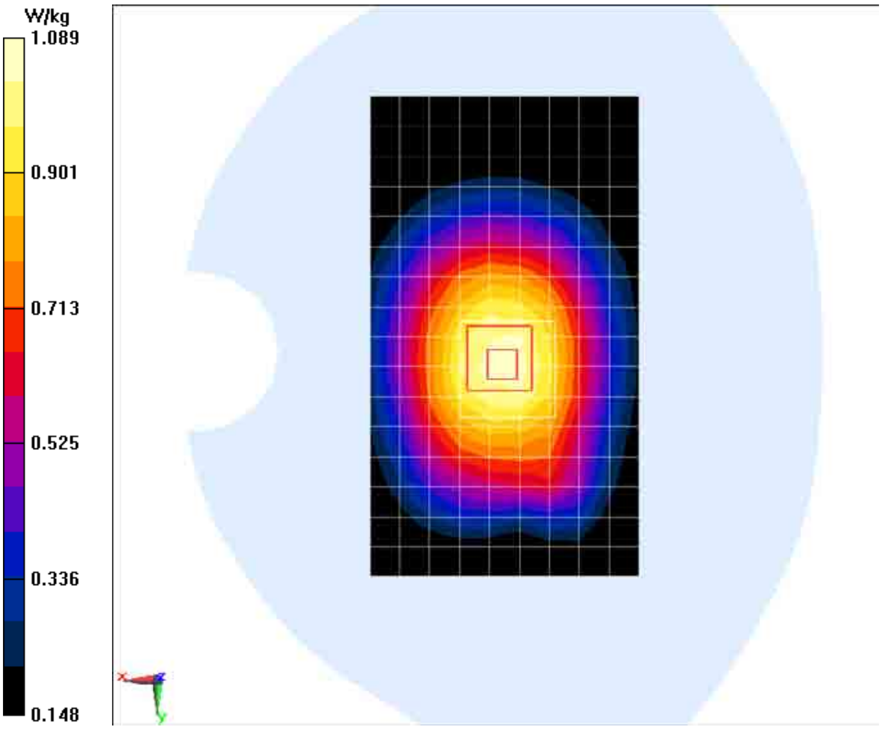
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 33.179 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.29 W/kg

SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.785 W/kg

Maximum value of SAR (measured) = 1.09 W/kg

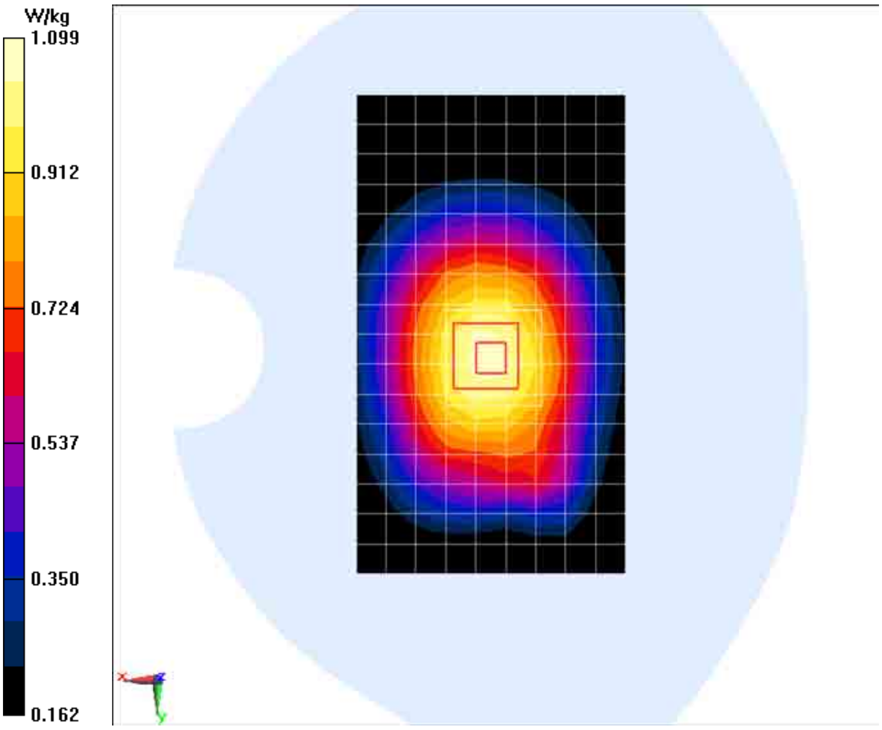


CDMA800MHz Body Toward Ground Middle 2

Date/Time: 8/22/2013
Electronics: DAE4 Sn1244
Medium: Body 850MHz
Medium parameters used: f = 837 MHz; σ = 1.001 S/m; ε_r = 55.152; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013

Middle Toward Ground CDMA800MHz 2/Area Scan (10x17x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.06 W/kg

Middle Toward Ground CDMA800MHz 2/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.490 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.28 W/kg
SAR(1 g) = 1.04 W/kg; SAR(10 g) = 0.801 W/kg
Maximum value of SAR (measured) = 1.10 W/kg



CDMA800MHz Body Toward Phantom Middle

Date/Time: 8/22/2013

Electronics: DAE4 Sn1244

Medium: Body 850MHz

Medium parameters used: f = 837 MHz; σ = 1.001 S/m; ε_r = 55.152; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013

Middle Toward Phantom CDMA800MHz/Area Scan (10x17x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.649 W/kg

Middle Toward Phantom CDMA800MHz/Zoom Scan (5x5x7)/Cube 0:

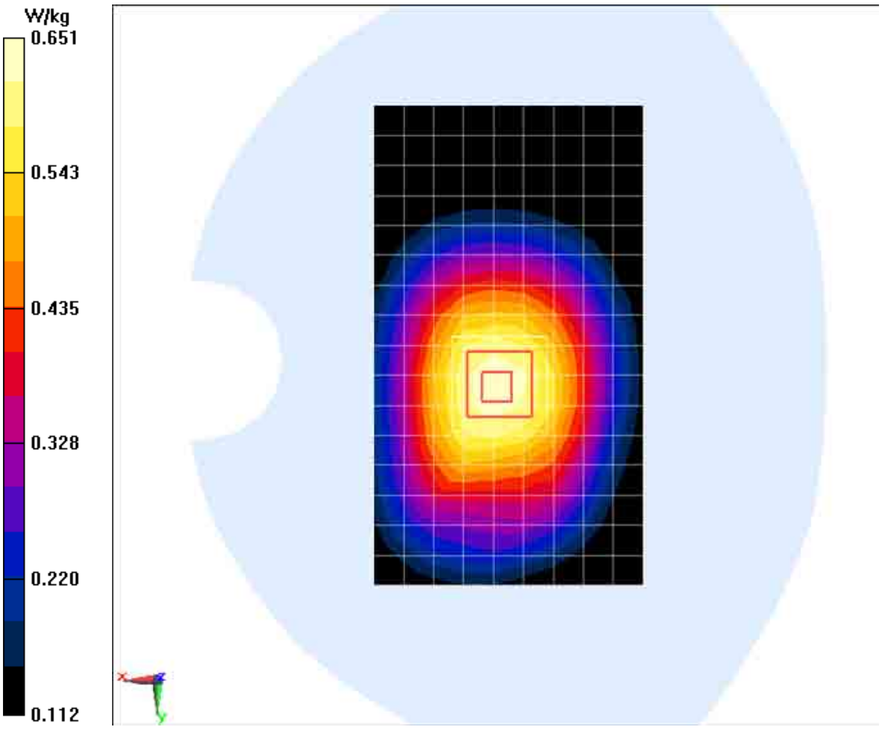
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 25.611 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.758 W/kg

SAR(1 g) = 0.623 W/kg; SAR(10 g) = 0.481 W/kg

Maximum value of SAR (measured) = 0.651 W/kg



CDMA 800MHz Body Left Middle

Date/Time: 8/22/2013

Electronics: DAE4 Sn1244

Medium: Body 850MHz

Medium parameters used: f = 837 MHz; σ = 1.001 S/m; ε_r = 55.152; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013

Middle Left CDMA 800MHz/Area Scan (6x18x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.624 W/kg

Middle Left CDMA 800MHz/Zoom Scan (5x5x7)/Cube 0:

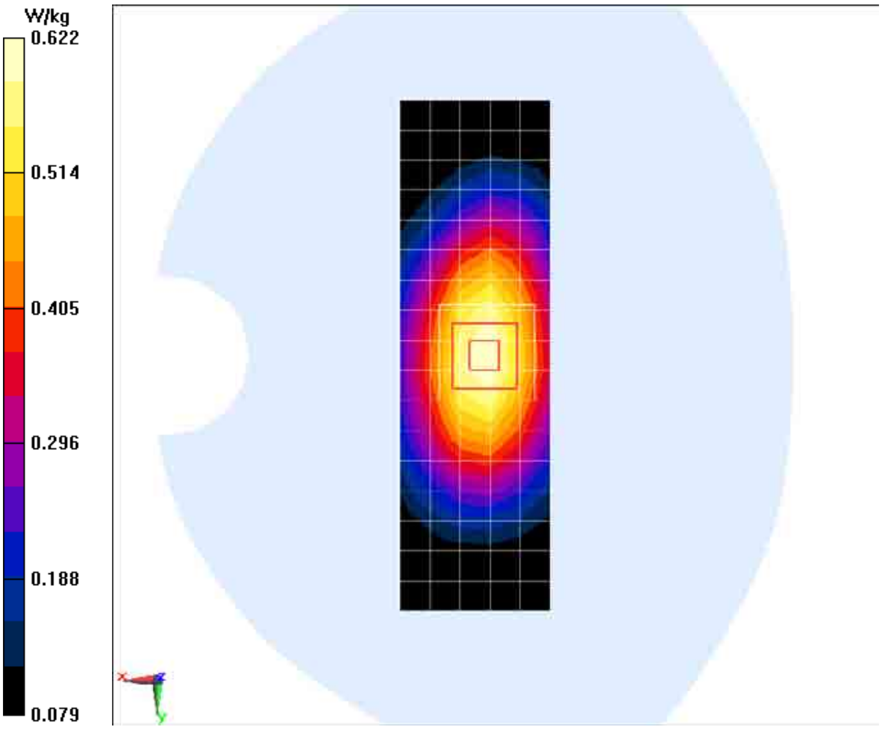
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 25.389 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.789 W/kg

SAR(1 g) = 0.587 W/kg; SAR(10 g) = 0.416 W/kg

Maximum value of SAR (measured) = 0.622 W/kg



CDMA 800MHz Body Right Middle

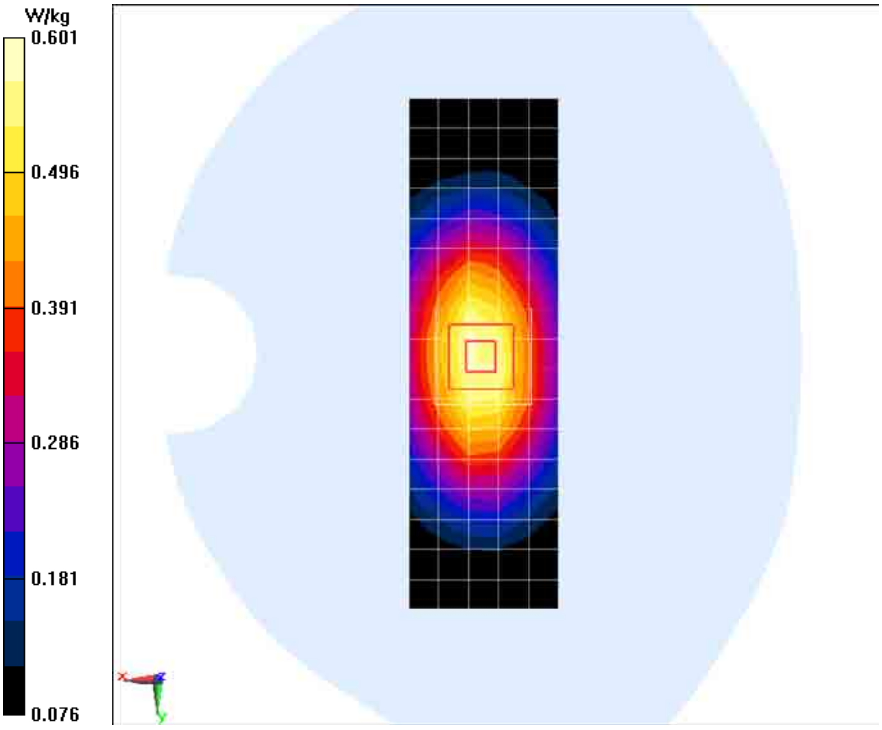
Date/Time: 8/22/2013
Electronics: DAE4 Sn1244
Medium: Body 850MHz
Medium parameters used: f = 837 MHz; σ = 1.001 S/m; ε_r = 55.152; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013

Middle Right CDMA 800MHz/Area Scan (6x18x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.579 W/kg

Middle Right CDMA 800MHz/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.119 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.766 W/kg
SAR(1 g) = 0.568 W/kg; SAR(10 g) = 0.401 W/kg
Maximum value of SAR (measured) = 0.601 W/kg



CDMA 800MHz Body Bottom Middle

Date/Time: 8/22/2013

Electronics: DAE4 Sn1244

Medium: Body 850MHz

Medium parameters used: f = 837 MHz; σ = 1.001 S/m; ε_r = 55.152; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013

Middle Bottom CDMA 800MHz/Area Scan (7x11x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.0940 W/kg

Middle Bottom CDMA 800MHz/Zoom Scan (5x5x7)/Cube 0:

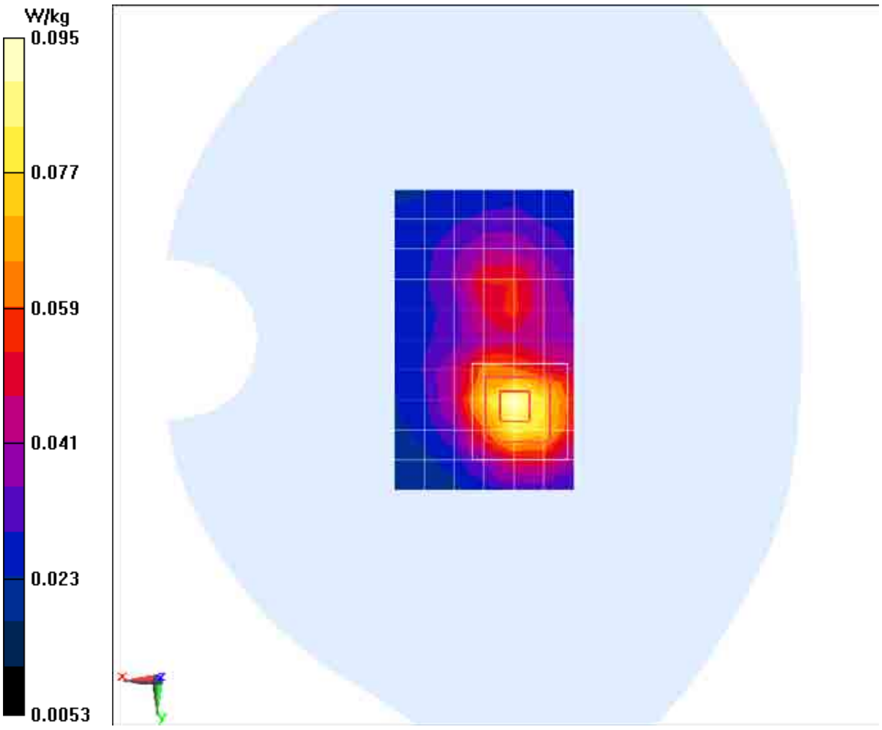
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.631 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.135 W/kg

SAR(1 g) = 0.086 W/kg; SAR(10 g) = 0.053 W/kg

Maximum value of SAR (measured) = 0.0947 W/kg



CDMA800MHz Body Toward Ground Low

Date/Time: 8/22/2013

Electronics: DAE4 Sn1244

Medium: Body 850MHz

Medium parameters used: f = 825 MHz; σ = 0.993 S/m; ε_r = 55.142; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CDMA 800MHz; Frequency: 824.7 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013

Low Toward Ground CDMA800MHz 2/Area Scan (10x17x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.932 W/kg

Low Toward Ground CDMA800MHz 2/Zoom Scan (5x5x7)/Cube 0:

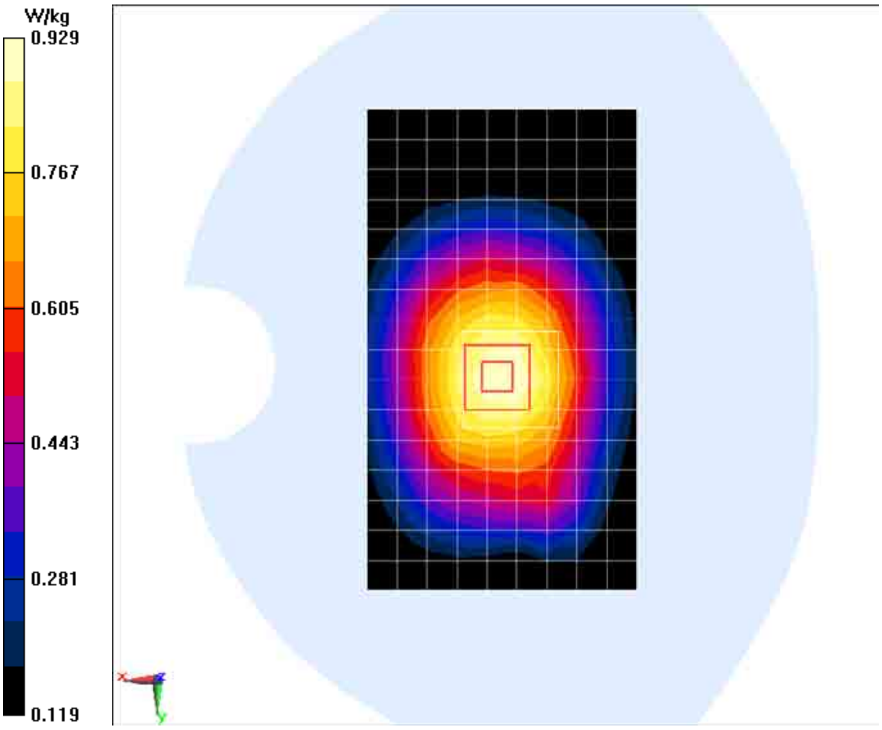
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 30.549 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.12 W/kg

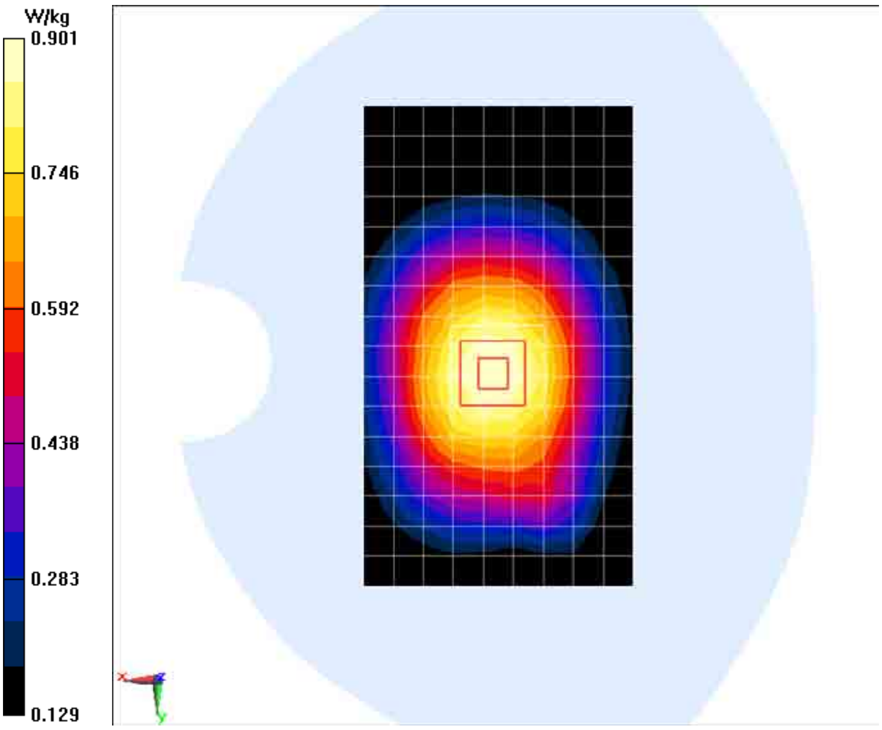
SAR(1 g) = 0.890 W/kg; SAR(10 g) = 0.680 W/kg

Maximum value of SAR (measured) = 0.929 W/kg



CDMA800MHz Body Toward Ground Low 2

Date/Time: 8/22/2013
Electronics: DAE4 Sn1244
Medium: Body 850MHz
Medium parameters used: f = 825 MHz; σ = 0.993 S/m; ε_r = 55.142; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: CDMA 800MHz; Frequency: 824.7 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013
Low Toward Ground CDMA800MHz/Area Scan (10x17x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.893 W/kg
Low Toward Ground CDMA800MHz/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.477 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 1.06 W/kg
SAR(1 g) = 0.866 W/kg; SAR(10 g) = 0.663 W/kg
Maximum value of SAR (measured) = 0.901 W/kg



CDMA800MHz Body Toward Ground High

Date/Time: 8/22/2013

Electronics: DAE4 Sn1244

Medium: Body 850MHz

Medium parameters used (interpolated): f = 848.31 MHz; σ = 1.014 S/m; ε_r = 55.207; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CDMA 800MHz; Frequency: 848.31 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013

High Toward Ground CDMA800MHz/Area Scan (10x17x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.898 W/kg

High Toward Ground CDMA800MHz/Zoom Scan (5x5x7)/Cube 0:

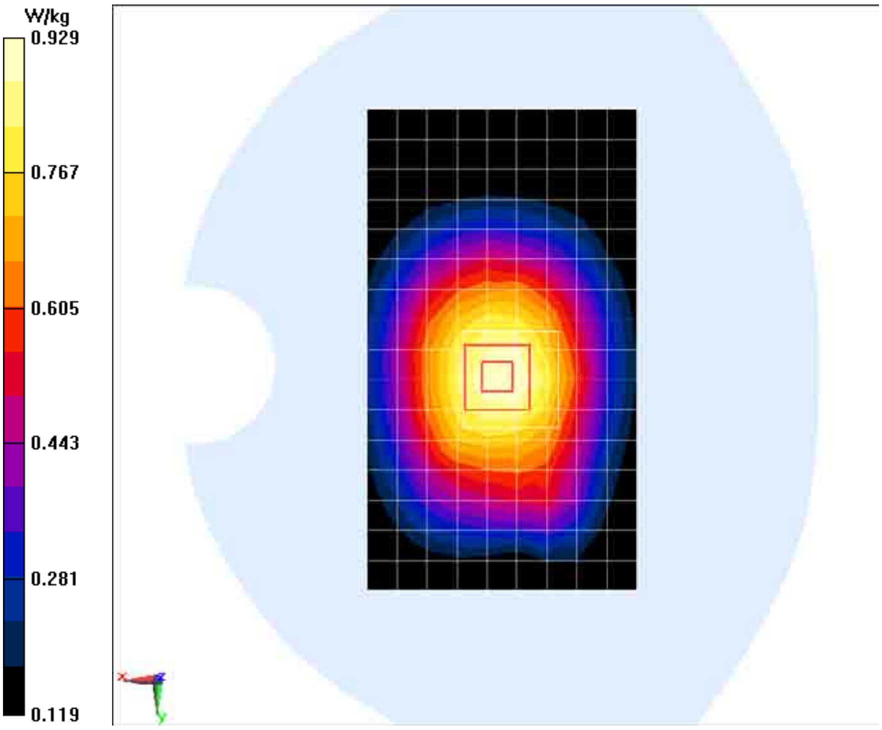
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 30.478 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 1.06 W/kg

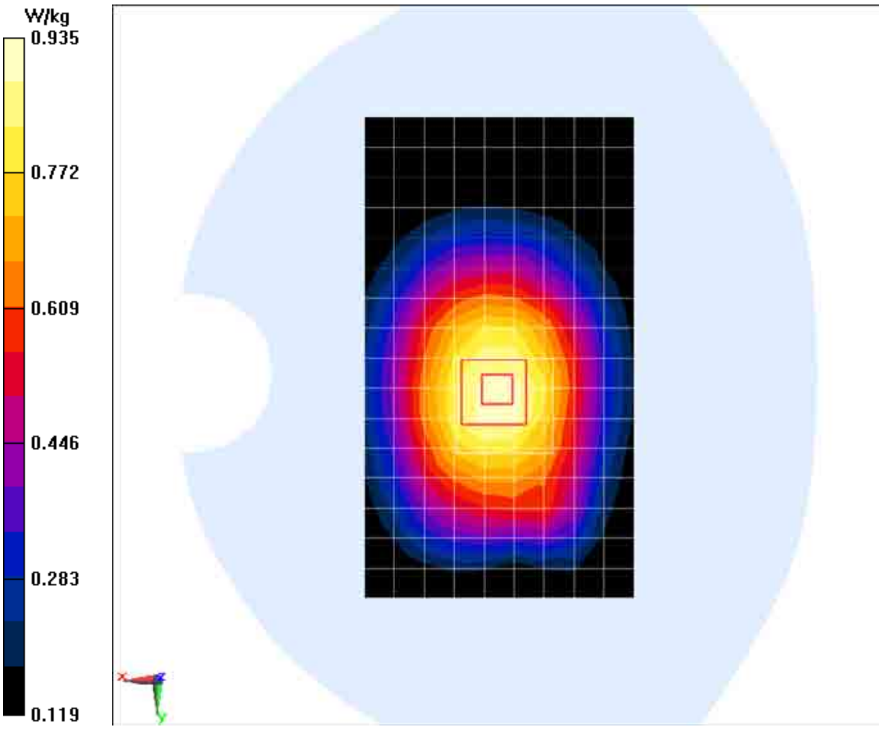
SAR(1 g) = 0.880 W/kg; SAR(10 g) = 0.673 W/kg

Maximum value of SAR (measured) = 0.918 W/kg



CDMA800MHz Body Toward Ground High 2

Date/Time: 8/22/2013
Electronics: DAE4 Sn1244
Medium: Body 850MHz
Medium parameters used (interpolated): f = 848.31 MHz; σ = 1.014 S/m; ε_r = 55.207; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: CDMA 800MHz; Frequency: 848.31 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013
High Toward Ground CDMA800MHz 2/Area Scan (10x17x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.911 W/kg
High Toward Ground CDMA800MHz 2/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.301 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 1.09 W/kg
SAR(1 g) = 0.881 W/kg; SAR(10 g) = 0.673 W/kg
Maximum value of SAR (measured) = 0.935 W/kg



CDMA800MHz Body Toward Ground Middle With Headset

Date/Time: 8/22/2013

Electronics: DAE4 Sn1244

Medium: Body 850MHz

Medium parameters used: f = 837 MHz; σ = 1.001 S/m; ε_r = 55.152; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CDMA 800MHz; Frequency: 836.52 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14); Calibrated: 8/5/2013

Middle Toward Ground CDMA800MHz With Headset/Area Scan (10x17x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.734 W/kg

Middle Toward Ground CDMA800MHz With Headset/Zoom Scan (5x5x7)/Cube 0:

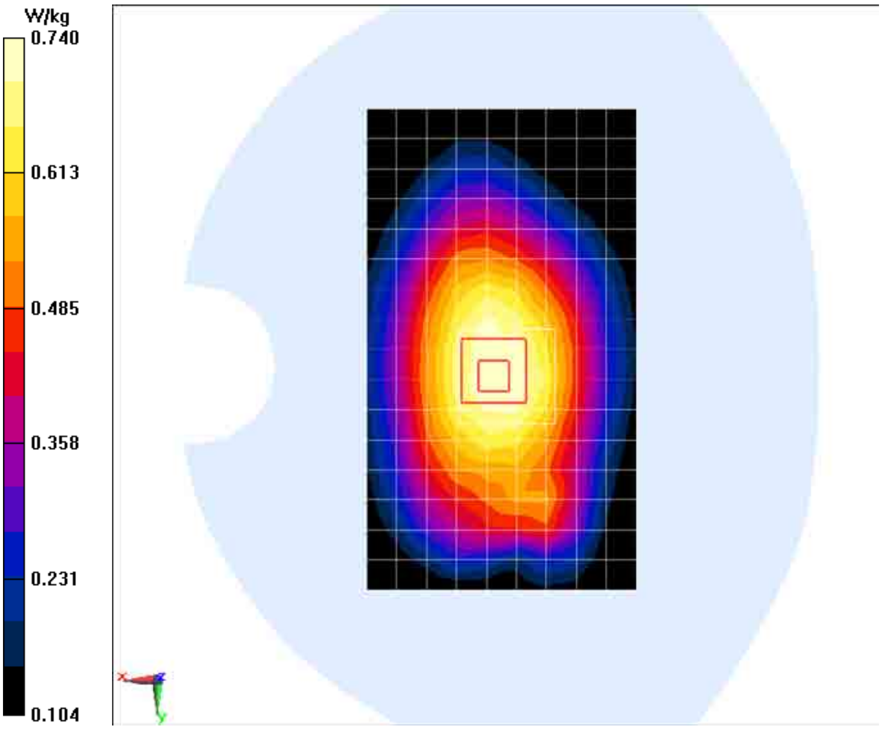
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 27.800 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.838 W/kg

SAR(1 g) = 0.708 W/kg; SAR(10 g) = 0.545 W/kg

Maximum value of SAR (measured) = 0.740 W/kg



WiFi2450MHz Left Cheek Middle

Date/Time: 8/26/2013

Electronics: DAE4 Sn1244

Medium: Head 2450MHz

Medium parameters used: f = 2437 MHz; σ = 1.811 S/m; ε_r = 38.95; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃   Liquid Temperature:22.5 ℃

Communication System:WiFi 2450MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN3754ConvF(7.07, 7.07, 7.07); Calibrated: 7/20/2013

Middle Cheek Left WiFi2450MHz/Area Scan (12x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.0475 W/kg

Middle Cheek Left WiFi2450MHz/Zoom Scan (5x5x7)/Cube 0:

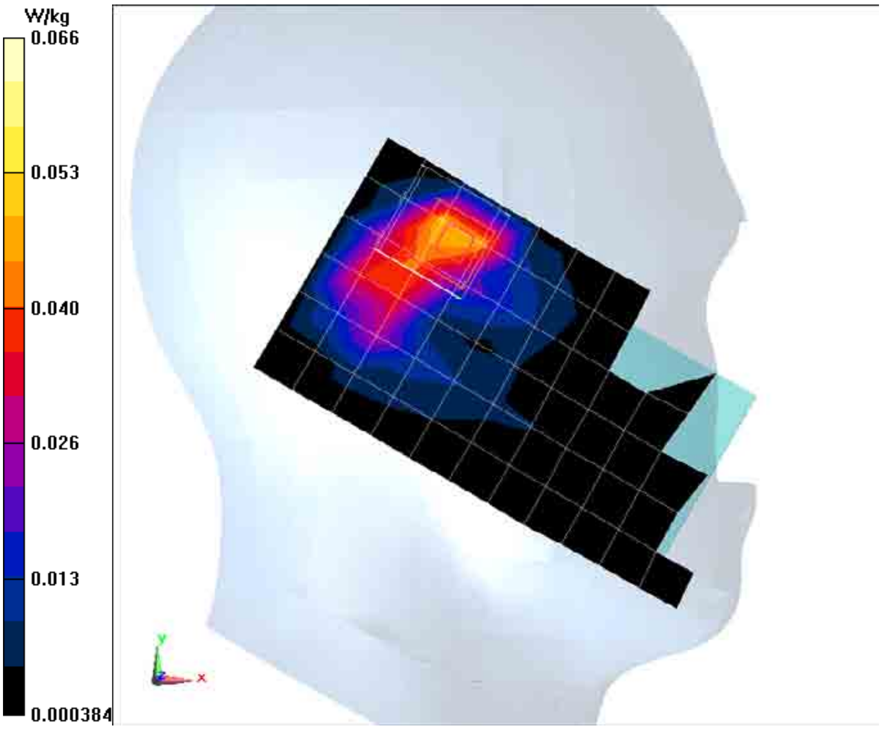
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.531 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 0.125 W/kg

SAR(1 g) = 0.057 W/kg; SAR(10 g) = 0.026 W/kg

Maximum value of SAR (measured) = 0.0656 W/kg



WiFi2450MHz Left Tilt Middle

Date/Time: 8/26/2013

Electronics: DAE4 Sn1244

Medium: Head 2450MHz

Medium parameters used: f = 2437 MHz; σ = 1.811 S/m; ε_r = 38.95; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System:WiFi 2450MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN3754ConvF(7.07, 7.07, 7.07); Calibrated: 7/20/2013

Middle Tilt Left WiFi2450MHz/Area Scan (12x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.0446 W/kg

Middle Tilt Left WiFi2450MHz/Zoom Scan (5x5x7)/Cube 0:

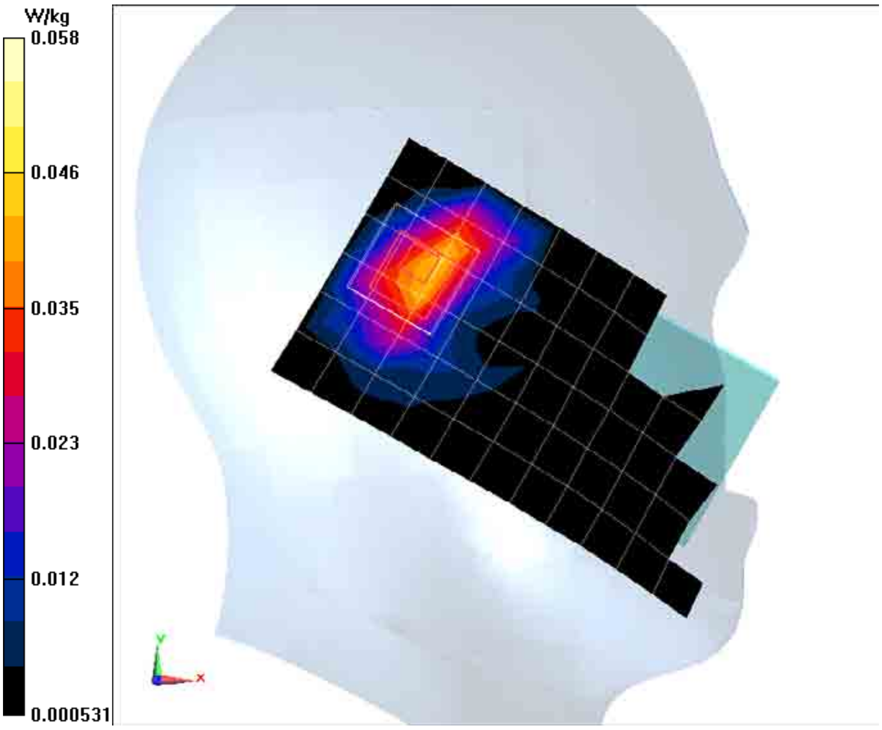
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.988 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 0.0980 W/kg

SAR(1 g) = 0.049 W/kg; SAR(10 g) = 0.023 W/kg

Maximum value of SAR (measured) = 0.0578 W/kg



WiFi2450MHz Right Cheek Middle

Date/Time: 8/26/2013

Electronics: DAE4 Sn1244

Medium: Head 2450MHz

Medium parameters used: f = 2437 MHz; σ = 1.811 S/m; ε_r = 38.95; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System:WiFi 2450MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN3754ConvF(7.07, 7.07, 7.07); Calibrated: 7/20/2013

Middle Cheek Right WiFi2450MHz/Area Scan (12x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.0401 W/kg

Middle Cheek Right WiFi2450MHz/Zoom Scan (5x5x7)/Cube 0:

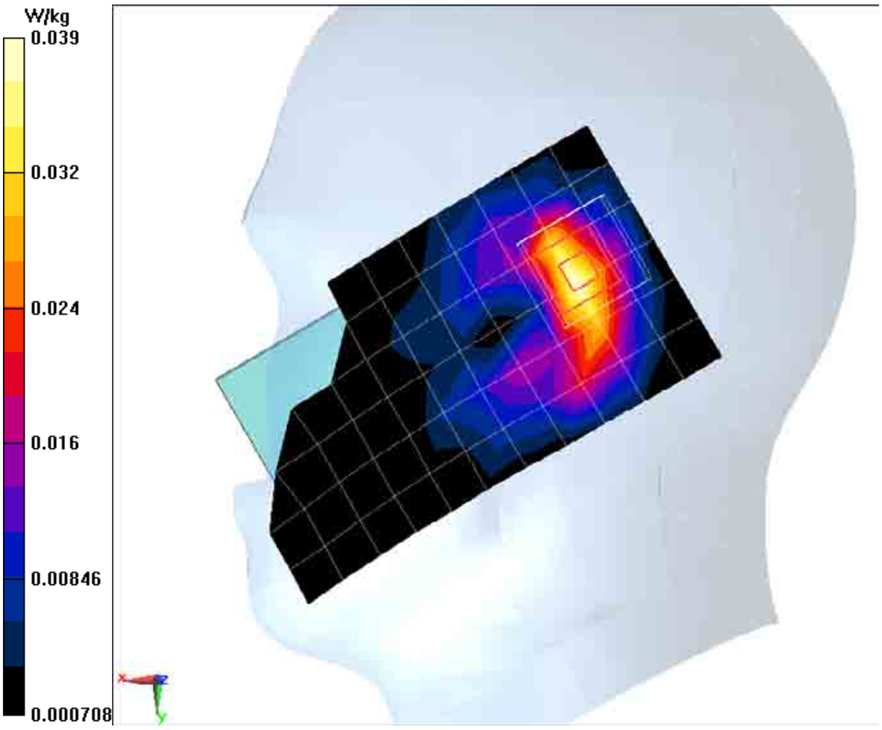
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.009 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.0710 W/kg

SAR(1 g) = 0.038 W/kg; SAR(10 g) = 0.017 W/kg

Maximum value of SAR (measured) = 0.0395 W/kg



WiFi2450MHz Right Tilt Middle

Date/Time: 8/26/2013

Electronics: DAE4 Sn1244

Medium: Head 2450MHz

Medium parameters used: f = 2437 MHz; σ = 1.811 S/m; ε_r = 38.95; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System:WiFi 2450MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN3754ConvF(7.07, 7.07, 7.07); Calibrated: 7/20/2013

Middle Tilt Right WiFi2450MHz/Area Scan (12x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.0385 W/kg

Middle Tilt Right WiFi2450MHz/Zoom Scan (5x5x7)/Cube 0:

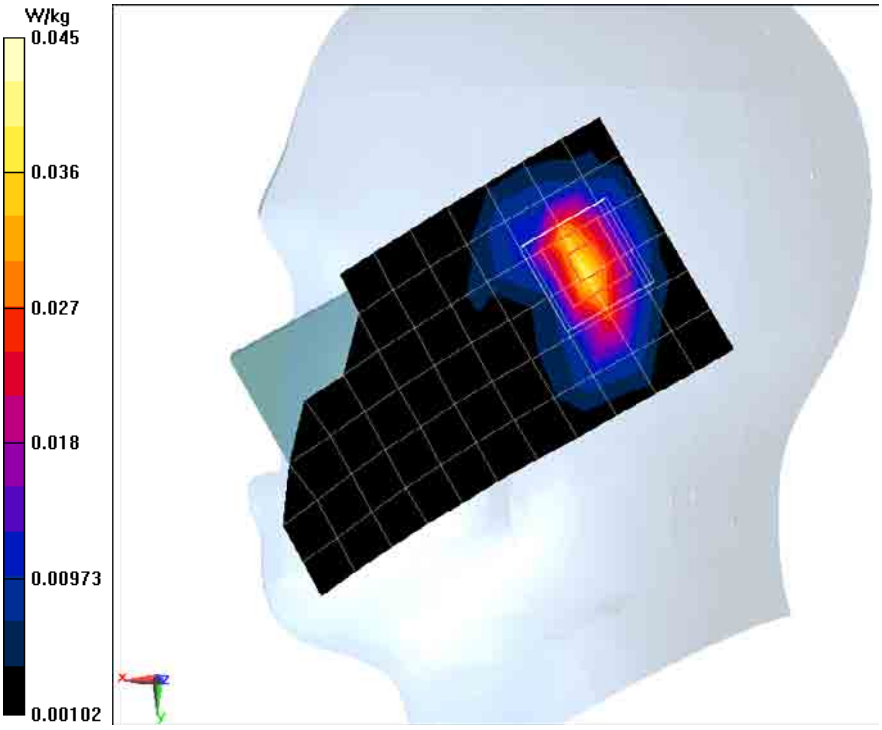
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.751 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.0680 W/kg

SAR(1 g) = 0.037 W/kg; SAR(10 g) = 0.018 W/kg

Maximum value of SAR (measured) = 0.0445 W/kg



Wifi2450MHz Body Phantom Middle

Date/Time: 8/27/2013

Electronics: DAE4 Sn1244

Medium: Body 2450MHz

Medium parameters used: f = 2437 MHz; σ = 1.902 S/m; ε_r = 53.946; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃   Liquid Temperature:22.5 ℃

Communication System:WiFi 2450MHz;   Frequency: 2437 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN3754ConvF(6.66, 6.66, 6.66); Calibrated: 7/22/2013

Middle Phantom   Wifi2450MHz/Area Scan (9x16x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR   (measured) = 0.00739 W/kg

Middle Phantom   Wifi2450MHz/Zoom Scan (5x5x7)/Cube 0:

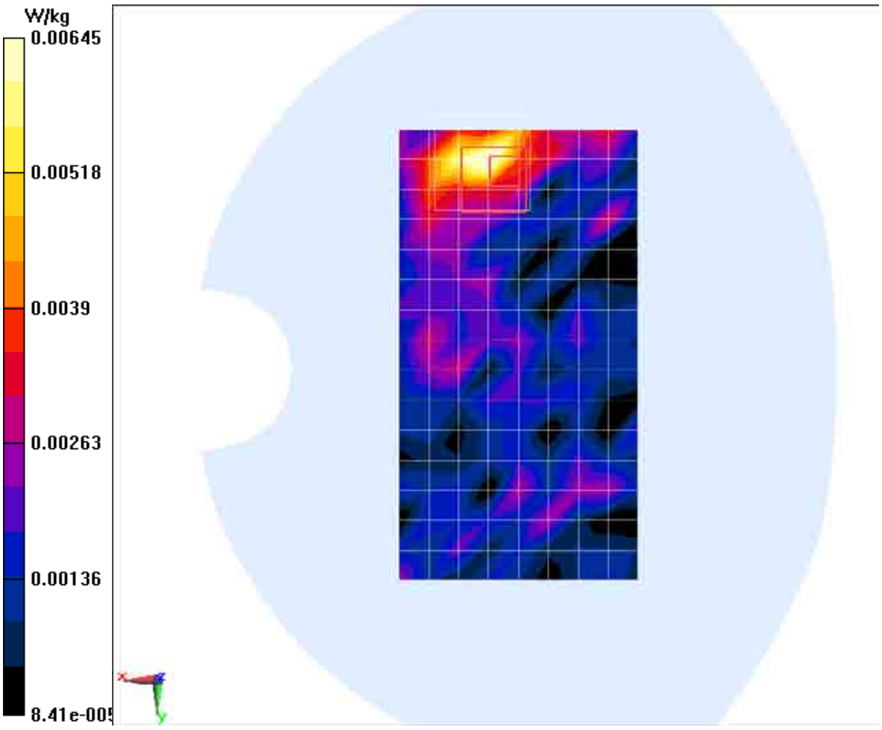
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.204 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 0.00645 W/kg

SAR(1 g) = 0.00486 W/kg; SAR(10 g) = 0.00326 W/kg

Maximum value of SAR   (measured) = 0.00645 W/kg



Wifi2450MHz Body Toward Ground Middle

Date/Time: 8/27/2013

Electronics: DAE4 Sn1244

Medium: Body 2450MHz

Medium parameters used: f = 2437 MHz; σ = 1.902 S/m; ε_r = 53.946; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System:WiFi 2450MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN3754ConvF(6.66, 6.66, 6.66); Calibrated: 7/22/2013

Middle Toward Ground Wifi2450MHz/Area Scan (9x16x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.0104 W/kg

Middle Toward Ground Wifi2450MHz/Zoom Scan (5x5x7)/Cube 0:

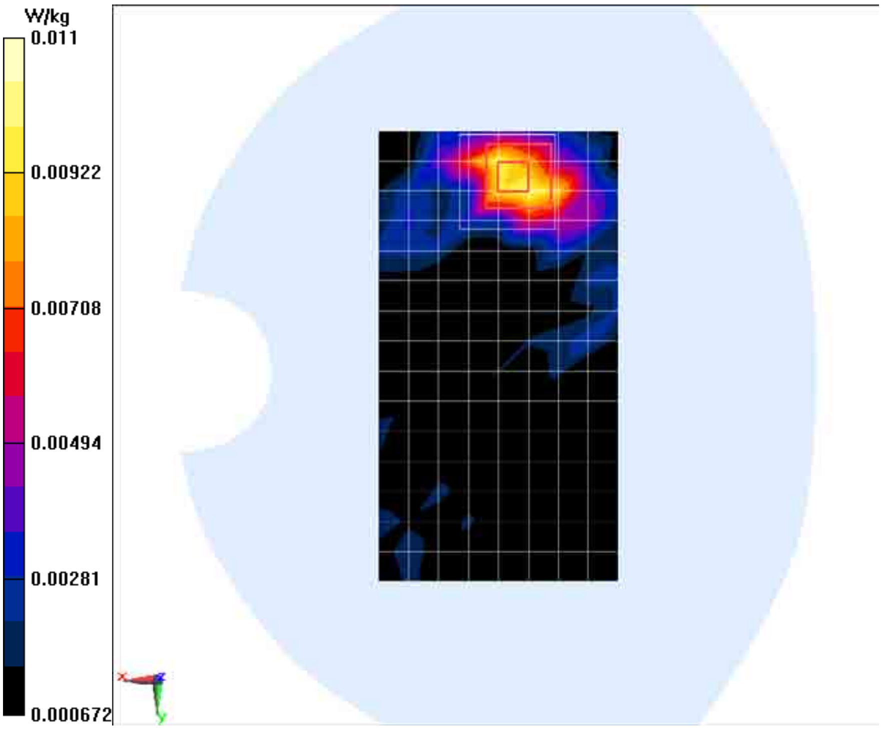
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.280 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 0.0190 W/kg

SAR(1 g) = 0.011 W/kg; SAR(10 g) = 0.00635 W/kg

Maximum value of SAR (measured) = 0.0114 W/kg



Wifi2450MHz Body Top Middle

Date/Time: 8/27/2013

Electronics: DAE4 Sn1244

Medium: Body 2450MHz

Medium parameters used: f = 2437 MHz; σ = 1.902 S/m; ε_r = 53.946; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System:WiFi 2450MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN3754ConvF(6.66, 6.66, 6.66); Calibrated: 7/22/2013

Middle Top Wifi2450MHz/Area Scan (6x11x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.00195 W/kg

Middle Top Wifi2450MHz/Zoom Scan (5x5x7)/Cube 0:

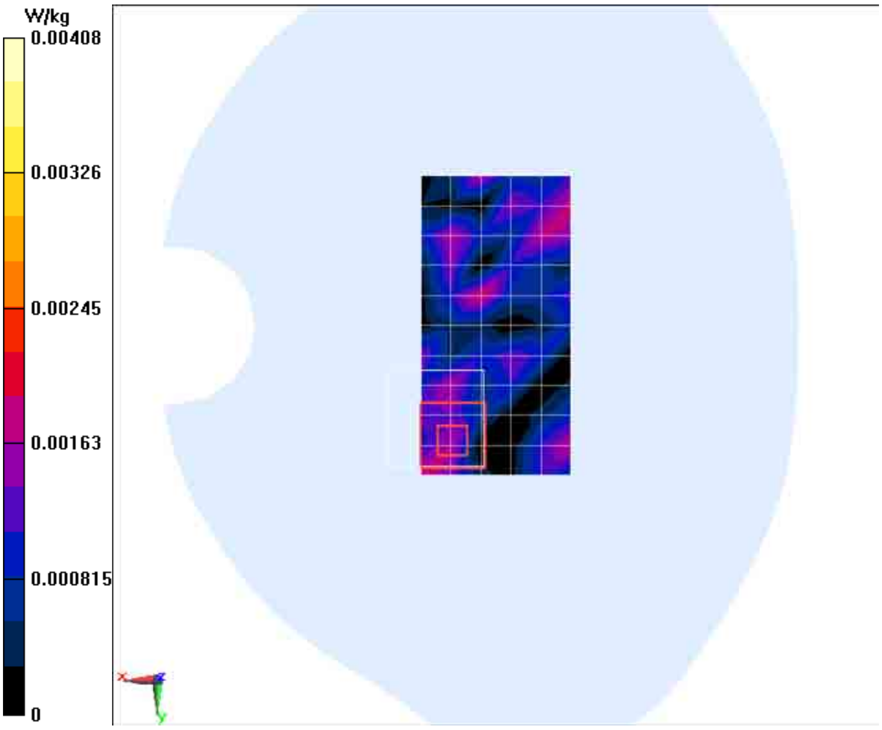
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.007 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.00566 W/kg

SAR(1 g) = 0.00255 W/kg; SAR(10 g) = 0.00139 W/kg

Maximum value of SAR (measured) = 0.00408 W/kg



Wifi2450MHz Body Bottom Middle

Date/Time: 8/27/2013

Electronics: DAE4 Sn1244

Medium: Body 2450MHz

Medium parameters used: f = 2437 MHz; σ = 1.902 S/m; ε_r = 53.946; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System:WiFi 2450MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN3754ConvF(6.66, 6.66, 6.66); Calibrated: 7/22/2013

Middle Bottom Wifi2450MHz/Area Scan (6x11x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.00295 W/kg

Middle Bottom Wifi2450MHz/Zoom Scan (5x5x7)/Cube 0:

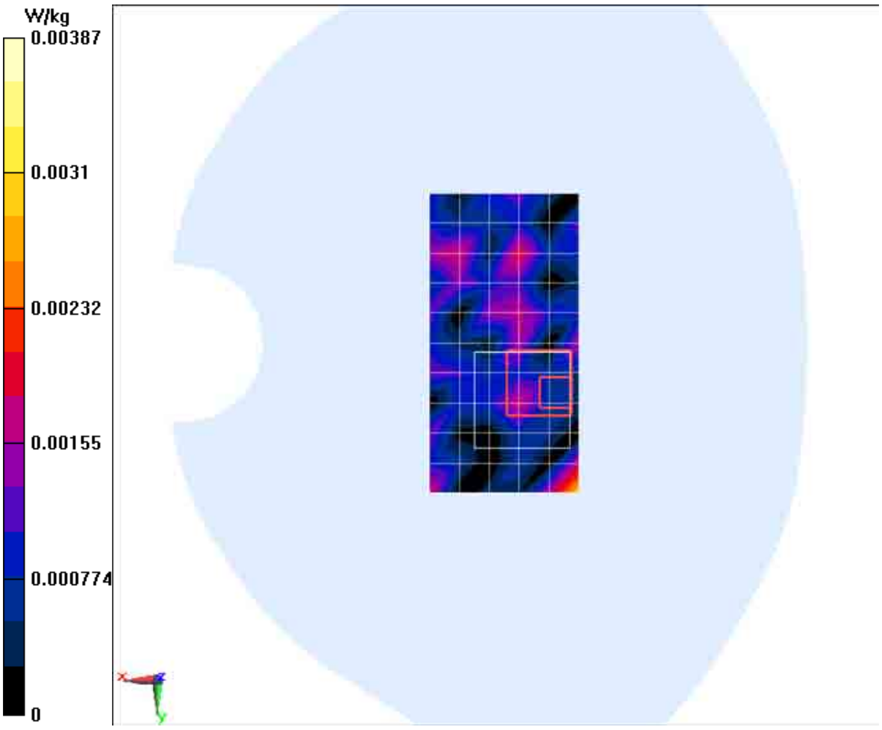
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.124 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.00391 W/kg

SAR(1 g) = 0.00227 W/kg; SAR(10 g) = 0.00143 W/kg

Maximum value of SAR (measured) = 0.00387 W/kg



Wifi2450MHz Body Left Middle

Date/Time: 8/27/2013

Electronics: DAE4 Sn1244

Medium: Body 2450MHz

Medium parameters used: f = 2437 MHz; σ = 1.902 S/m; ε_r = 53.946; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System:WiFi 2450MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN3754ConvF(6.66, 6.66, 6.66); Calibrated: 7/22/2013

Middle Left Wifi2450MHz/Area Scan (5x16x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.00260 W/kg

Middle Left Wifi2450MHz/Zoom Scan (5x5x7)/Cube 0:

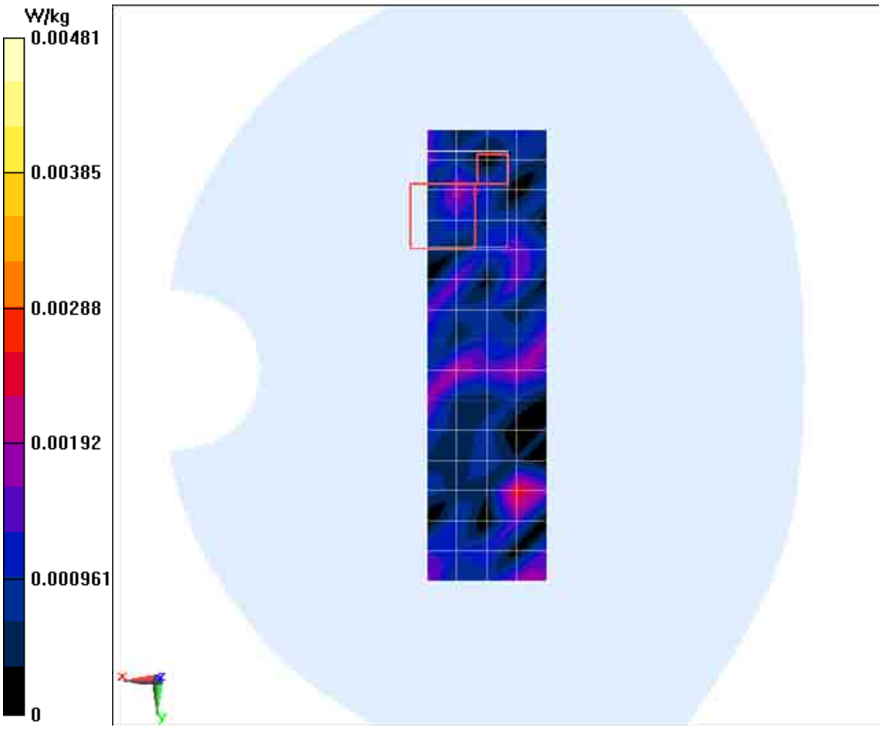
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.167 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.00714 W/kg

SAR(1 g) = 0.00305 W/kg; SAR(10 g) = 0.00166 W/kg

Maximum value of SAR (measured) = 0.00481 W/kg

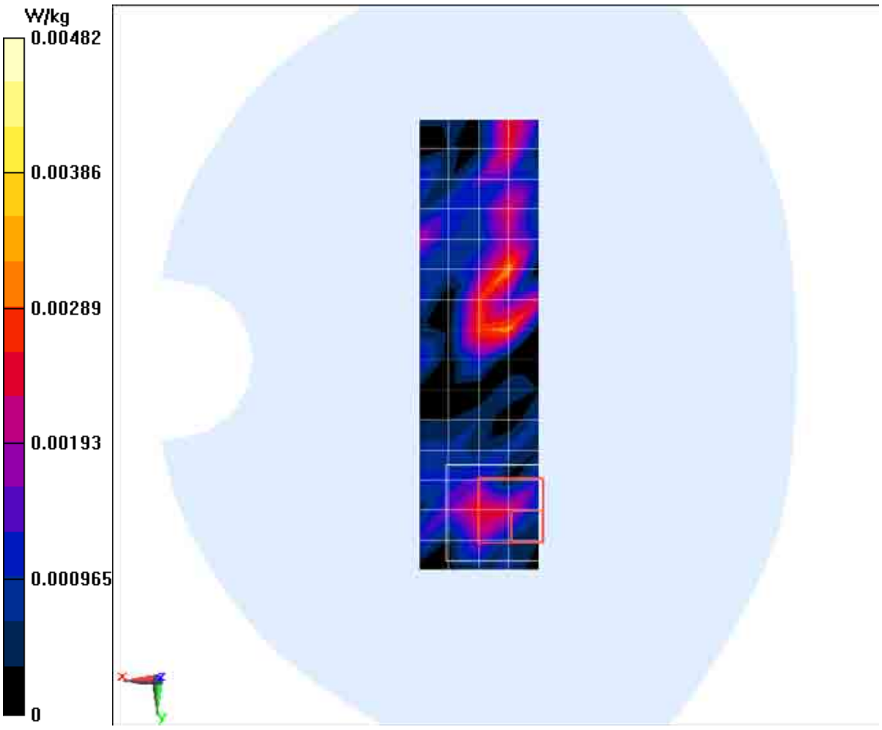


Wifi2450MHz Body Right Middle

Date/Time: 8/27/2013
Electronics: DAE4 Sn1244
Medium: Body 2450MHz
Medium parameters used: f = 2437 MHz; σ = 1.902 S/m; ε_r = 53.946; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System:WiFi 2450MHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3754ConvF(6.66, 6.66, 6.66); Calibrated: 7/22/2013

Middle Right Wifi2450MHz/Area Scan (5x16x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.00318 W/kg

Middle Right Wifi2450MHz/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.027 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.00482 W/kg
SAR(1 g) = 0.00255 W/kg; SAR(10 g) = 0.00148 W/kg
Maximum value of SAR (measured) = 0.00482 W/kg



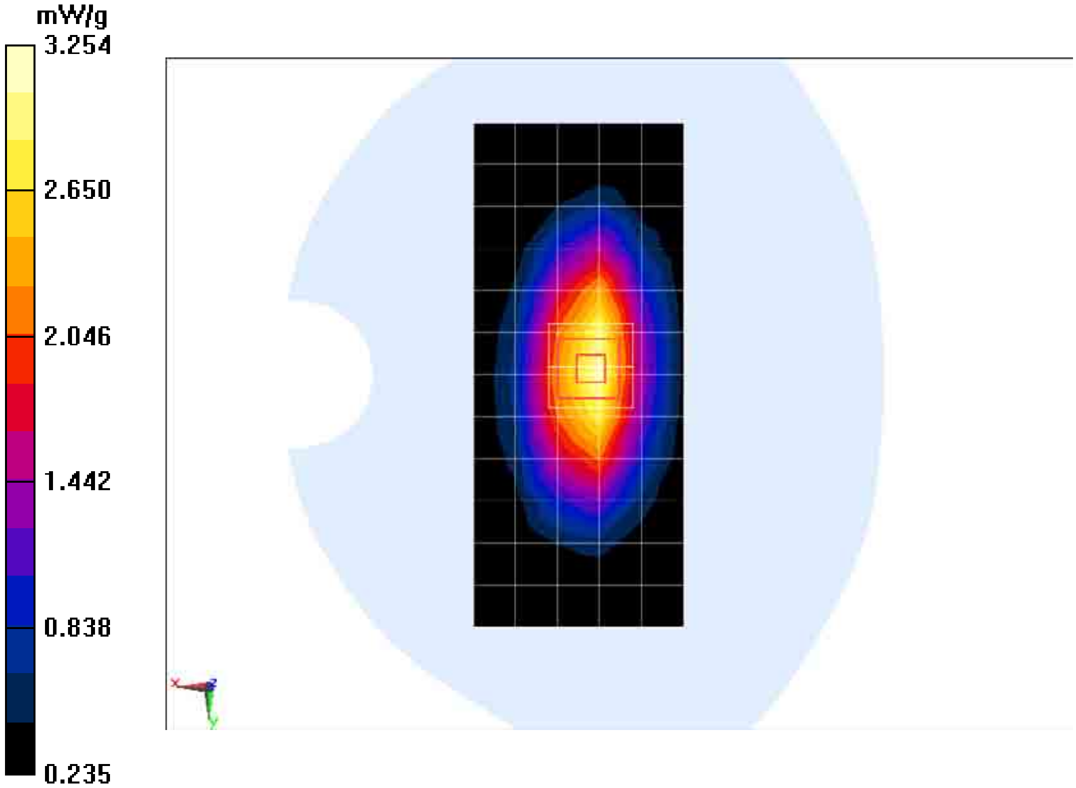
ANNEX B SYSTEM VALIDATION RESULTS

835MHz-Head

Date/Time: 8/23/2013
Electronics: DAE4 Sn1244
Medium: Head 835MHz
Medium parameters used: f = 835 MHz; σ = 0.917 mho/m; εr = 41.04; ρ = 1000 kg/m3
Ambient Temperature:22.5° C Liquid Temperature:22.5° C
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.10, 6.10, 6.10)

System Validation/Area Scan(101x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.153 mW/g

System Validation/Zoom Scan(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 50.235 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.857 mW/g
SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.55 mW/g
Maximum value of SAR (measured) = 3.254 mW/g

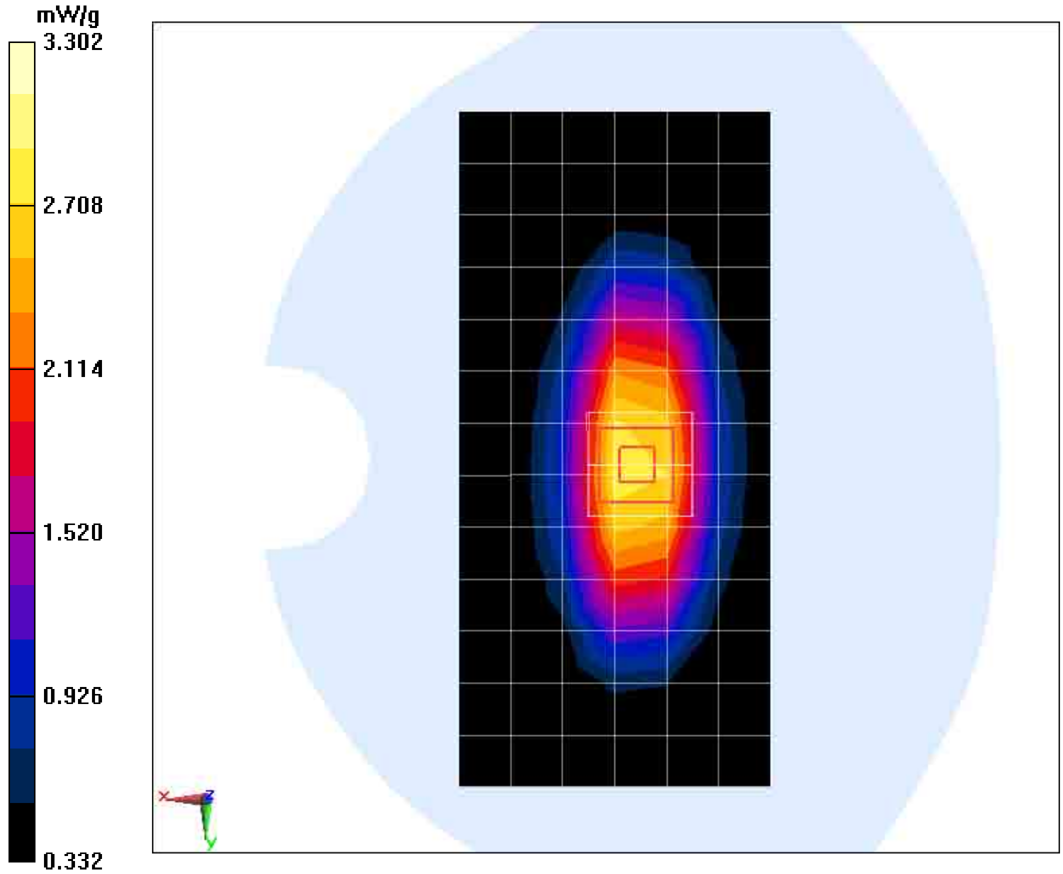


835MHz-Body

Date/Time: 8/22/2013
Electronics: DAE4 Sn1244
Medium: Body 850 MHz
Medium parameters used: f = 835 MHz; σ = 0.999 mho/m; εr = 55.15; ρ = 1000 kg/m3
Ambient Temperature:22.5° C   Liquid Temperature:22.5° C
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.14, 6.14, 6.14)

System Validation/Area Scan(101x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.849 mW/g

System Validation/Zoom Scan(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.728 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 3.871 mW/g
SAR(1 g) = 2.53 mW/g; SAR(10 g) = 1.65 mW/g
Maximum value of SAR (measured) = 3.302 mW/g

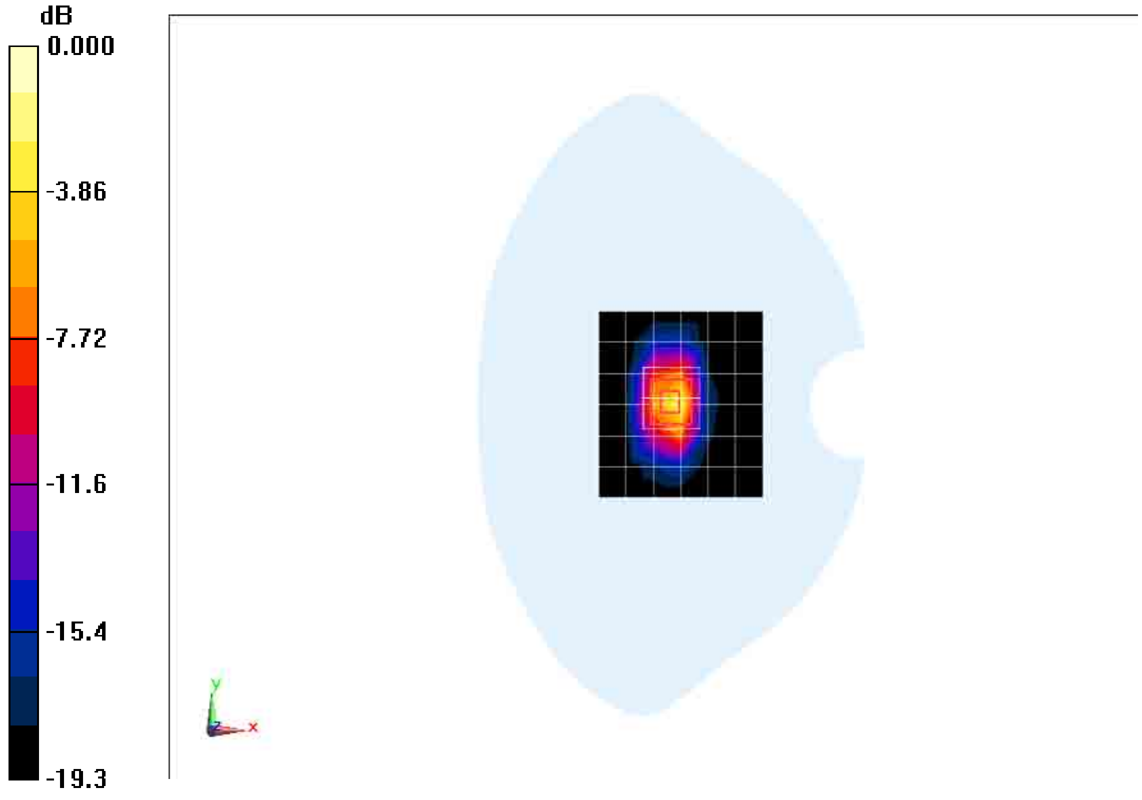


2450MHz-Head

Date/Time: 8/26/2013
Electronics: DAE4 Sn1244
Medium: Head 2450MHz
Medium parameters used: f = 2450 MHz; σ = 1.824 mho/m; εr = 38.87; ρ = 1000 kg/m3
Ambien Temperature:22.5° C Liquid Temperature:22.5° C
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3754ConvF(7.09, 7.09, 7.09)

System Validation/ Area Scan (101x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 12.79 mW/g

System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.872 V/m; Power Drift = 0.028 dB
Peak SAR (extrapolated) = 17.651 mW/g
SAR(1 g) = 12.76 mW/g; SAR(10 g) = 5.93 mW/g
Maximum value of SAR (measured) = 13.563 mW/g

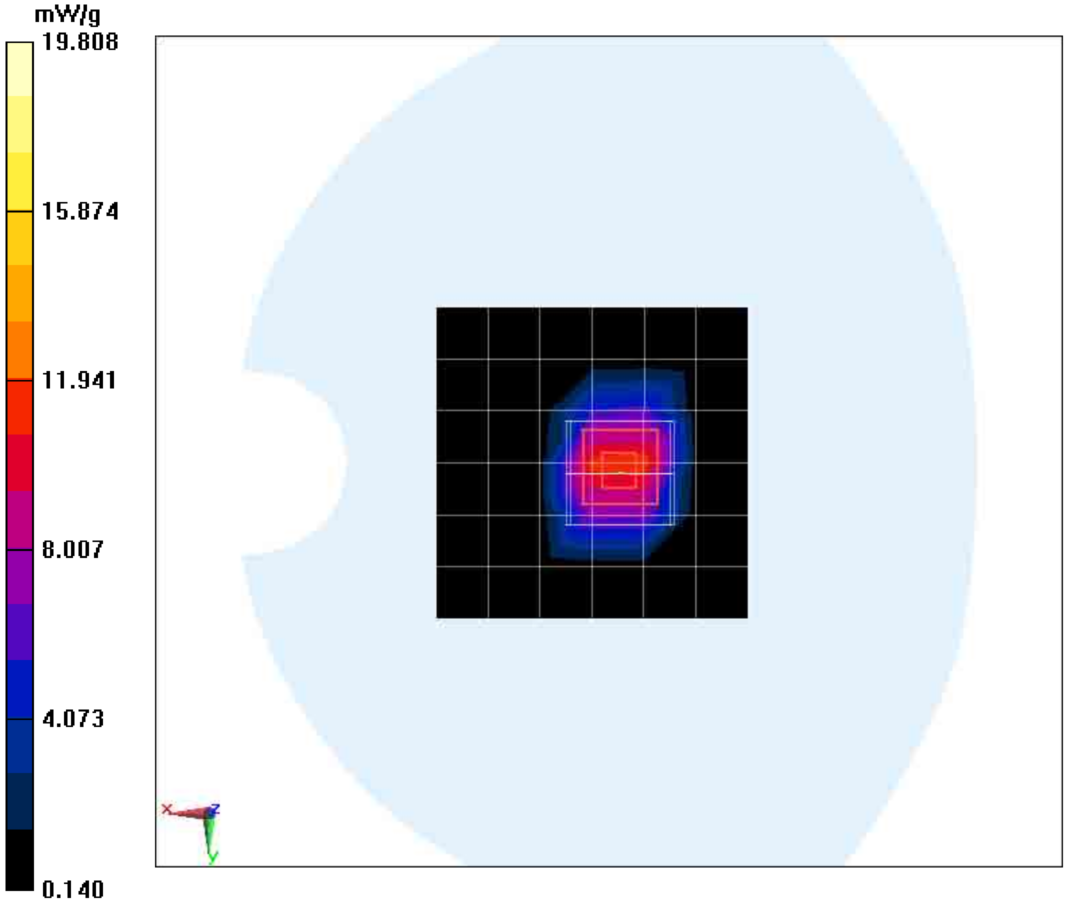


2450MHz-Body

Date/Time: 8/27/2013
Electronics: DAE4 Sn1244
Medium: Body 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.918 mho/m; εr = 53.946; ρ = 1000 kg/m3
Ambien Temperature:22.5° C Liquid Temperature:22.5° C
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3754ConvF(6.66, 6.66, 6.66)

System Validation/ Area Scan (101x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 11.758 mW/g

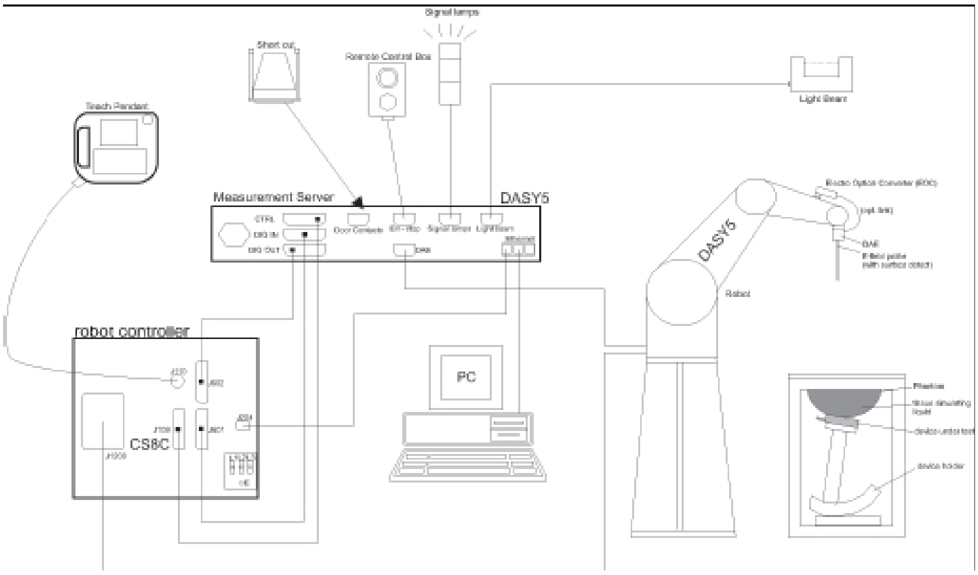
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.005 V/m; Power Drift = 0.26 dB
Peak SAR (extrapolated) = 26.396 mW/g
SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.16 mW/g
Maximum value of SAR (measured) = 19.808 mW/g



ANNEX C SAR Measurement Setup

C.1 Measurement Set-up

The 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 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 DASY5 E-field Probe System

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

Probe Specifications:

Model: **ES3DV3**

Frequency Range: **2.0GHz — 3.0GHz(EX3DV4)**
700MHz — 2.0GHz(ES3DV3)

Calibration: **In head and body simulating tissue at Frequencies from 835 up to 2450MHz**

Linearity: **± 0.2 dB(2.0GHz — 3.0GHz) for EX3DV4**
± 0.2 dB(700MHz — 2.0GHz) 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 free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and inn a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/ cm^2.

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

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

Where:

Δt = Exposure time (30 seconds),

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

ΔT = Temperature increase due to RF exposure.

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

Where:

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

C.4 Other Test Equipment

C.4.1 Data Acquisition Electronics(DAE)

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

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

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

PictureC.4: DAE

C.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY5: RX90L) 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 5

C.4.3 Measurement Server

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

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.6 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.

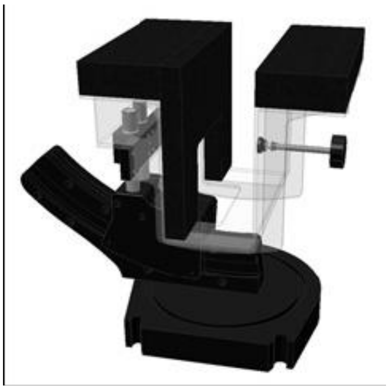
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference 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.7: Device Holder



Picture C.8: Laptop Extension Kit

C.4.5 Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to
Represent the 90th percentile of the population. The phantom enables the dissymmetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

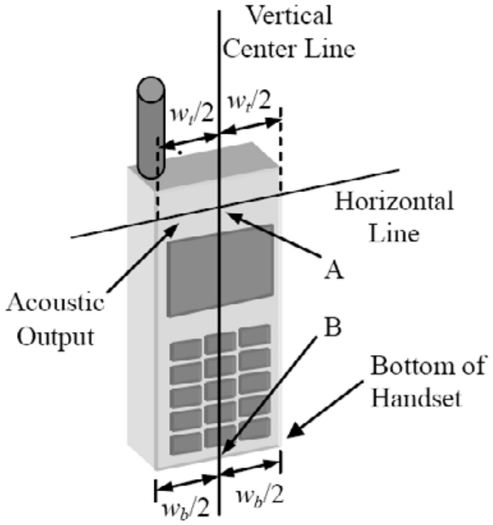
Shell Thickness: 2 ± 0. 2 mm
Filling Volume: Approx. 25 liters
Dimensions: 810 x l000 x 500 mm (H x L x W)
Available: Special

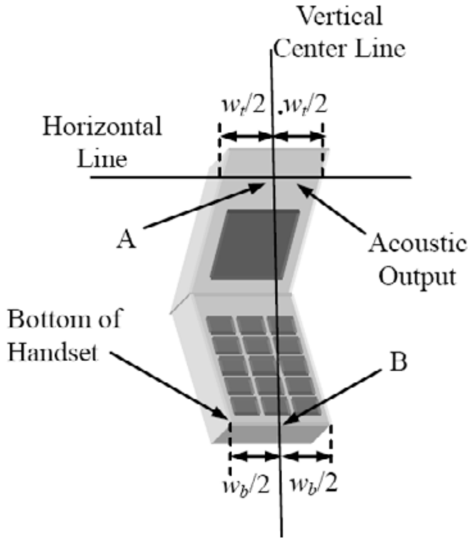
Picture C.9: SAM Twin Phantom

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.





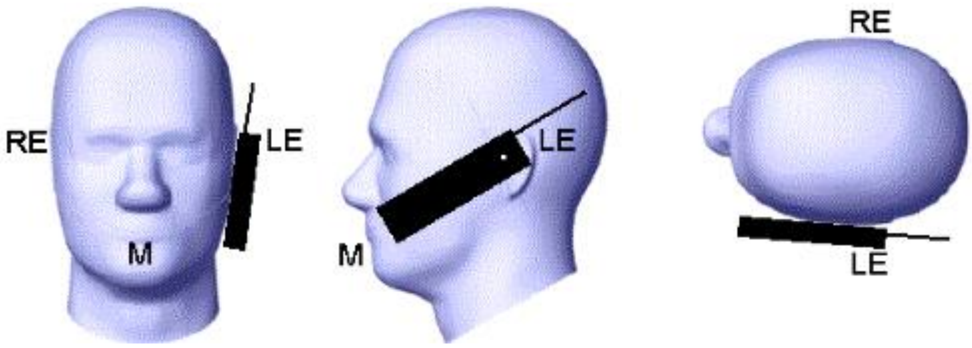
w_t Width of the handset at the level of the acoustic

w_b Width of the bottom of the handset

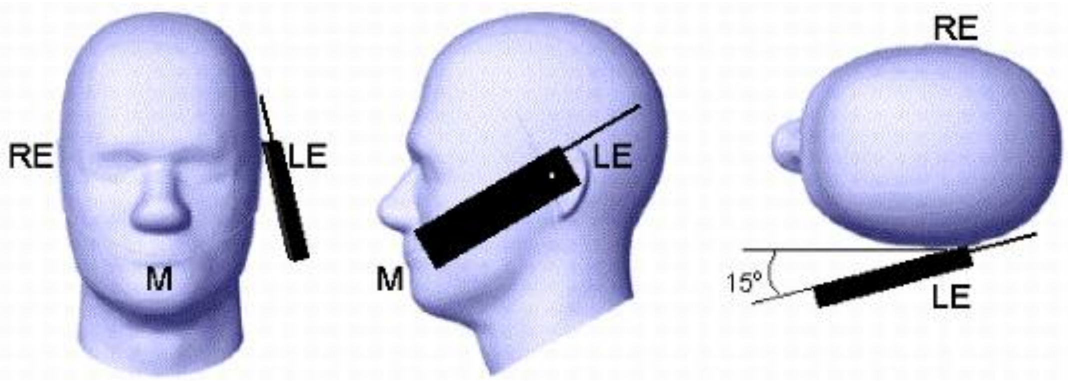
A Midpoint of the width w_t of the handset at the level of the acoustic output

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



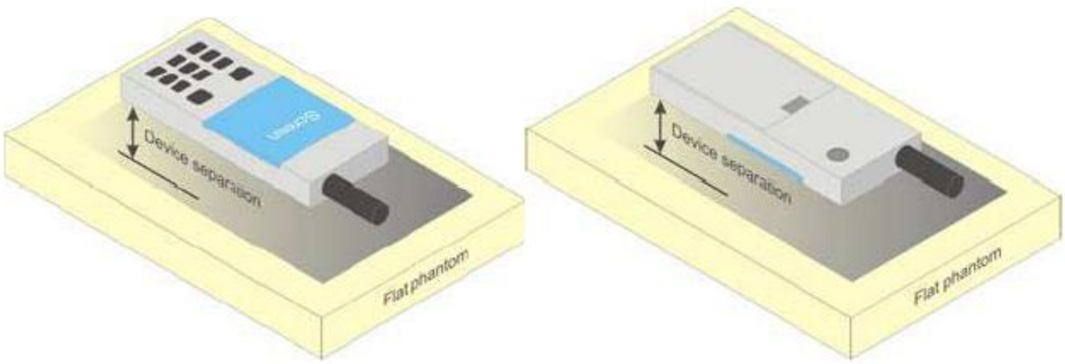
Picture D.2 Cheek position of the wireless device on the left side of SAM



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

D.2 Body-worn device

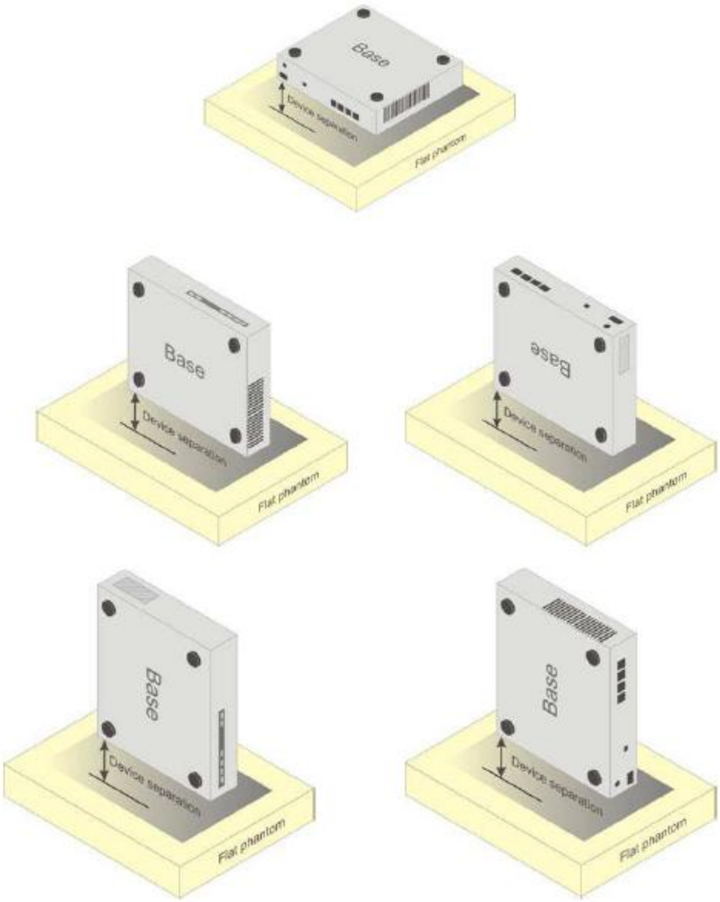
A typical example of a body-worn device is a mobile phone, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.



Picture D.4 Test positions for body-worn devices

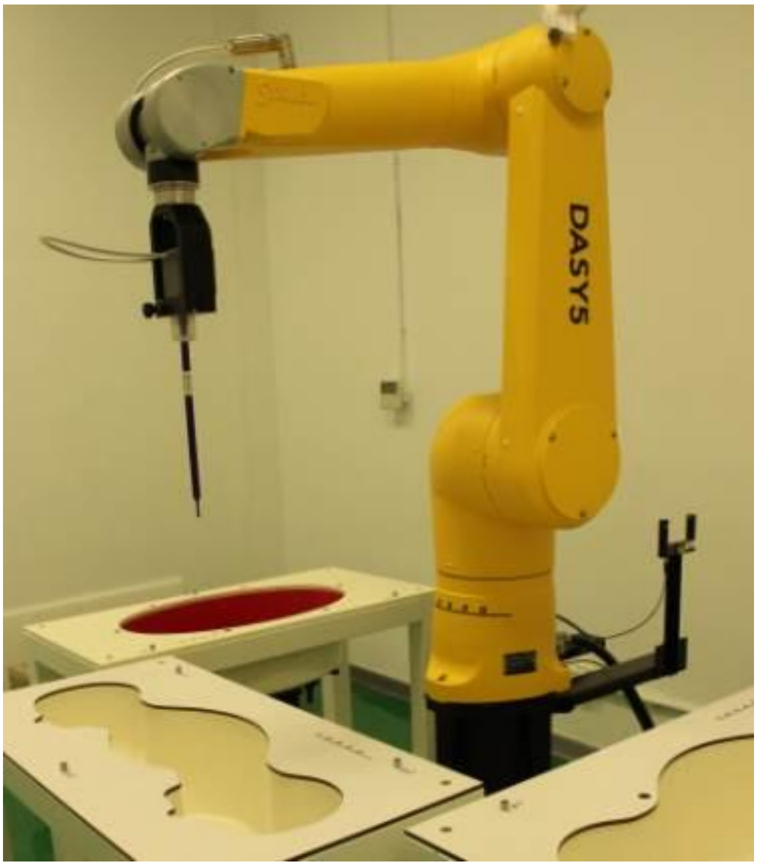
D.3 Desktop device

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 DSY5 system Set-up

Note:
The photos of test sample and test positions show in additional document.

ANNEX E Equivalent Media Recipes

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

Table E.1: Composition of the Tissue Equivalent Matter

Frequency (MHz)	835 Head	835 Body	1900 Head	1900 Body	2450 Head	2450 Body
Ingredients (% by weight)						
Water	41.45	52.5	55.242	69.91	58.79	72.60
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
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

ANNEX F System Validation

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

Table F.1: System Validation

System No.	Probe SN.	Liquid name	Validation date	Frequency point	Status (OK or Not)
N/A	3252	Head 835MHz	Aug 5,2013	835MHz	OK
N/A	3754	Head 2450MHz	Aug 8,2013	1900MHz	OK
N/A	3252	Body 835MHz	Aug 5,2013	835MHz	OK
N/A	3754	Body 2450MHz	Aug 8,2013	1900MHz	OK

NOTE: The parameters of tissue simulating liquids can be found in chapter 7 of this test report.

ANNEX G Probe and DAE Calibration Certificate

In Collaboration with s p e a g CALIBRATION LABORATORY

Client : CATR-SH

Certificate No:JZ13-2-2040

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1244
Calibration Procedure(s)	TMC-OS-E-01-198 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date	July 9, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Documenting Process Calibrator 753	1971018	01-July-13 (TMC, No:JW13-049)	July-14

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Xiao Li	Deputy Director of the laboratory	

Issued: July 24, 2013

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

Certificate No: JZ13-2-2040 Page 1 of 3

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Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: [illegible] Http://www.emcite.com

Glossary:

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

Methods Applied and Interpretation of Parameters:

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

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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1μV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1 .... +3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.907 ± 0.15% (k=2)	403.655 ± 0.15% (k=2)	404.564 ± 0.15% (k=2)
Low Range	3.98600 ± 0.7% (k=2)	3.96871 ± 0.7% (k=2)	4.01324 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	46° ± 1 °

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ilac-MRA CNAS 校准 CNAS L0442

Client CATR-SH Certificate No: J13-2-2041

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3754

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

Calibration date: August 8, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101547	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101548	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Reference10dBAttenuator	BT0520	12-Dec-12(TMC,No.JZ12-867)	Dec-14
Reference20dBAttenuator	BT0267	12-Dec-12(TMC,No.JZ12-866)	Dec-14
Reference Probe EX3DV4	SN 3846	25-Dec-12(SPEAG,No.EX3-3846_Dec12)	Dec-13
DAE4	SN 777	22-Feb-13 (SPEAG, DAE4-777_Feb13)	Feb -14
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	01-Jul-13 (TMC, No.JW13-045)	Jun-14
Network Analyzer E5071C	MY46110673	15-Feb-13 (TMC, No.JZ13-781)	Feb-14

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Xiao Li	Deputy Director of the laboratory	

Issued: August 9, 2013

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Certificate No: J13-2-2041 Page 1 of 11

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Glossary:

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

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 300MHz to 3GHz)", February 2005

Methods Applied and Interpretation of Parameters:

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

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E-mail: Info@emcite.com Http://www.emcite.com

Probe EX3DV4

SN: 3754

Calibrated: August 8, 2013

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: J13-2-2041 Page 3 of 11

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E-mail: [illegible] Http://www.[illegible]

DASY – Parameters of Probe: EX3DV4 - SN: 3754

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$)[A]	0.40	0.45	0.45	±10.8%
DCP(mV)[B]	104.0	104.0	103.1	

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	108.0	±3.2%
		Y	0.0	0.0	1.0		115.1	
		Z	0.0	0.0	1.0		115.7	

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

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

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E-mail: [illegible] Http://[illegible]

DASY – Parameters of Probe: EX3DV4 - SN: 3754

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)
2000	40.0	1.40	7.57	7.57	7.57	0.13	3.89	±12%
2300	39.5	1.67	7.33	7.33	7.33	0.17	2.17	±12%
2450	39.2	1.80	7.09	7.09	7.09	0.14	2.92	±12%
2600	39.0	1.96	6.72	6.72	6.72	0.14	2.89	±12%

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

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E-mail: [illegible] Http://[illegible]

DASY – Parameters of Probe: EX3DV4 - SN: 3754

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)
2000	53.3	1.52	7.61	7.61	7.61	0.17	2.67	±12%
2300	52.9	1.81	7.20	7.20	7.20	0.19	2.05	±12%
2450	52.7	1.95	6.66	6.66	6.66	0.17	3.22	±12%
2600	52.5	2.16	6.29	6.29	6.29	0.14	3.23	±12%

[C] Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Certificate No: [illegible] Page [illegible] of 11

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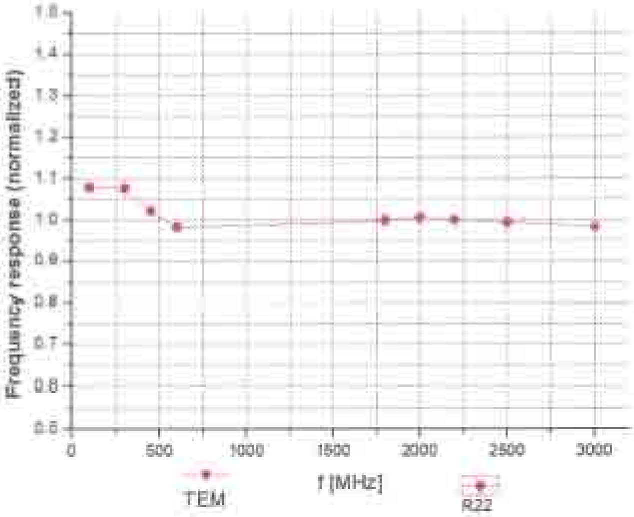
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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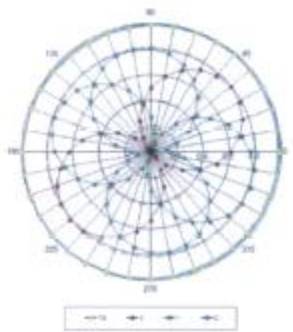
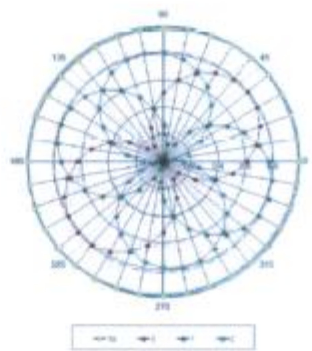
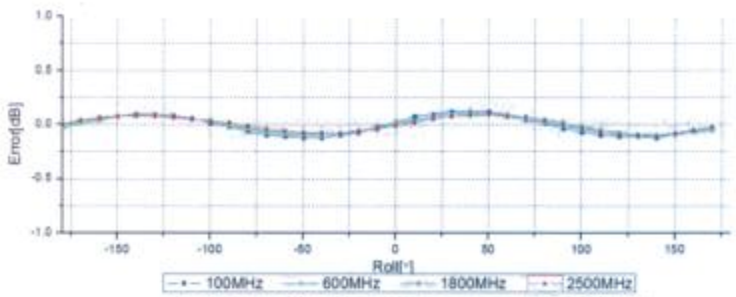
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM

f=1800 MHz, R22







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

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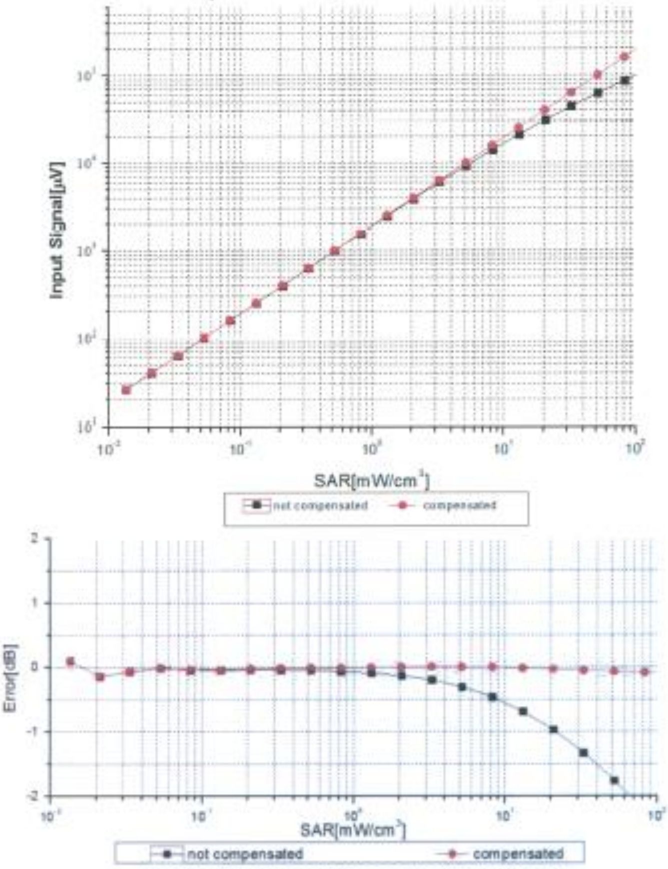
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)



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

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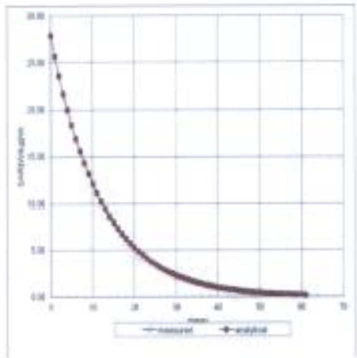
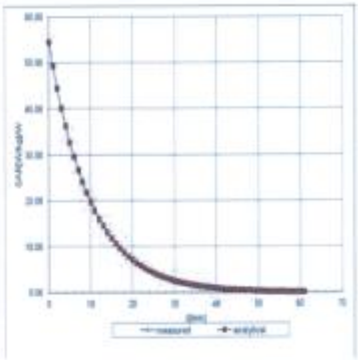
Conversion Factor Assessment

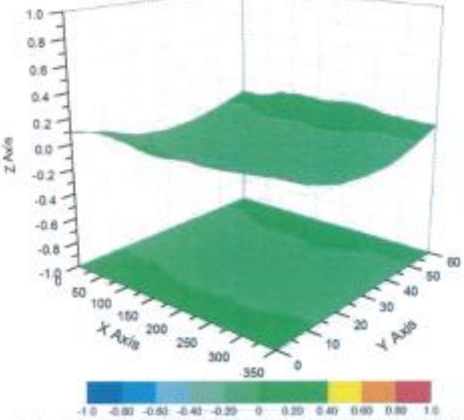
f=2000 MHz, WGLS R22(H_convF



f=2450 MHz, WGLS R26(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±2.8% (K=2)

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DASY - Parameters of Probe: EX3DV4 - SN: 3754

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	15.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	2mm

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校 准 CNAS L0442

Client CATR-SH Certificate No: J13-2-2042

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3252
Calibration Procedure(s)	TMC-OS-E-02-195 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	August 5, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101547	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101548	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Reference10dBAttenuator	BT0520	12-Dec-12(TMC,No.JZ12-867)	Dec-14
Reference20dBAttenuator	BT0267	12-Dec-12(TMC,No.JZ12-866)	Dec-14
Reference Probe EX3DV4	SN 3846	20-Dec-12(SPEAG,No.EX3-3846_Dec12)	Dec-13
DAE4	SN 777	22-Feb-13 (SPEAG, DAE4-777_Feb13)	Feb -14
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	01-Jul-13 (TMC, No.JW13-045)	Jun-14
Network Analyzer E5071C	MY46110673	15-Feb-13 (TMC, No.JZ13-781)	Feb-14

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Xiao Li	Deputy Director of the laboratory	

Issued: August 7, 2013

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Glossary:

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

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 300MHz to 3GHz)", February 2005

Methods Applied and Interpretation of Parameters:

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

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Probe ES3DV3

SN: 3252

Calibrated: August 5, 2013

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY – Parameters of Probe: ES3DV3 - SN: 3252

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$)[A]	1.29	1.34	1.32	±10.8%
DCP(mV)[B]	103.4	104.6	102.4	

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	207.8	±3.3%
		Y	0.0	0.0	1.0		209.7	
		Z	0.0	0.0	1.0		209.5	

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

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

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DASY – Parameters of Probe: ES3DV3 - SN: 3252

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)
850	41.5	0.92	6.10	6.10	6.10	0.27	1.98	±12%
900	41.5	0.97	6.19	6.19	6.19	0.31	1.79	±12%
1750	40.1	1.37	5.58	5.58	5.58	0.37	1.87	±12%
1900	40.0	1.40	5.24	5.24	5.24	0.43	1.82	±12%

[C] Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Certificate No: Z13-2-2047 Page 5 of 11

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[illegible]

DASY – Parameters of Probe: ES3DV3 - SN: 3252

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)
850	55.2	0.99	6.14	6.14	6.14	0.40	1.69	±12%
900	55.0	1.05	6.11	6.11	6.11	0.39	1.80	±12%
1750	53.4	1.49	5.20	5.20	5.20	0.43	1.94	±12%
1900	53.3	1.52	5.03	5.03	5.03	0.46	1.85	±12%

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

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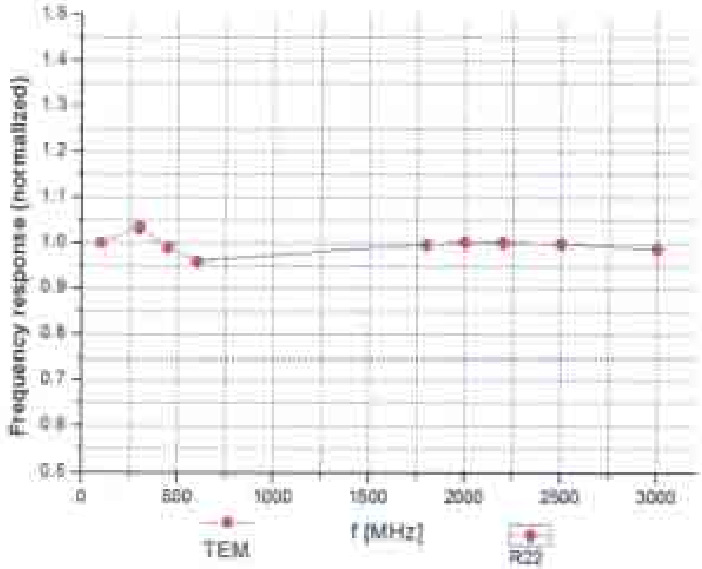
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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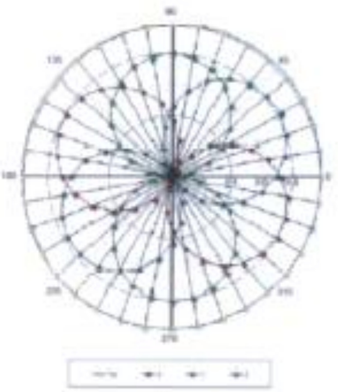
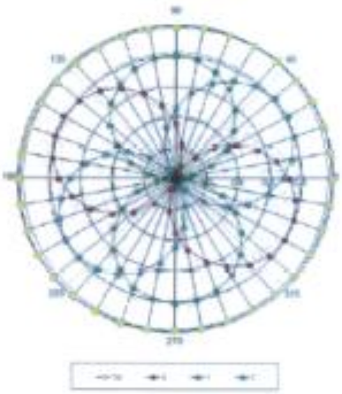
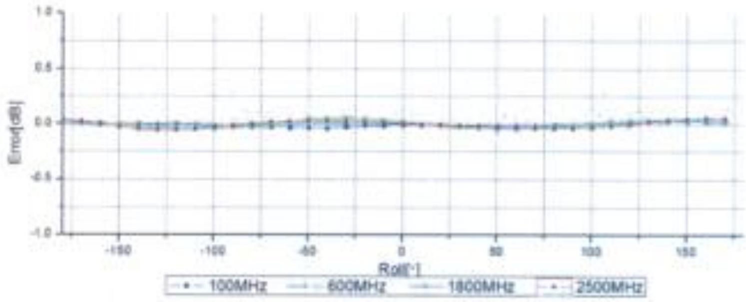
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





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

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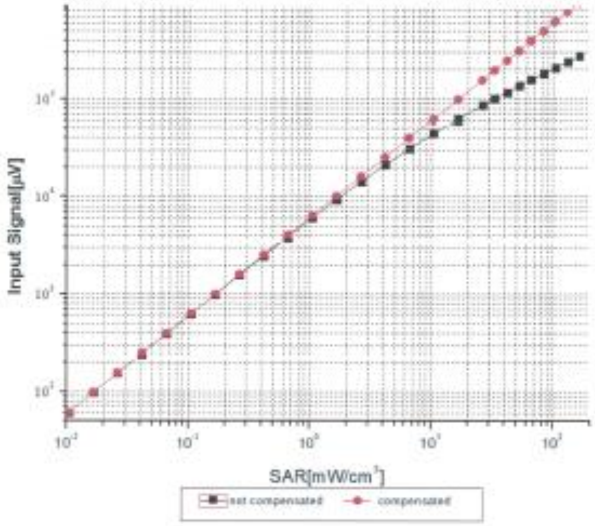
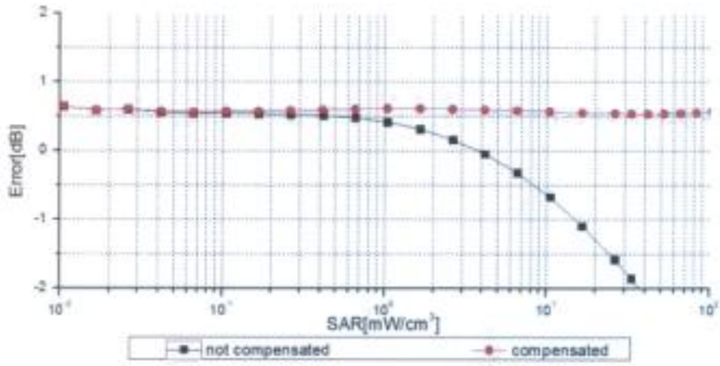
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)





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

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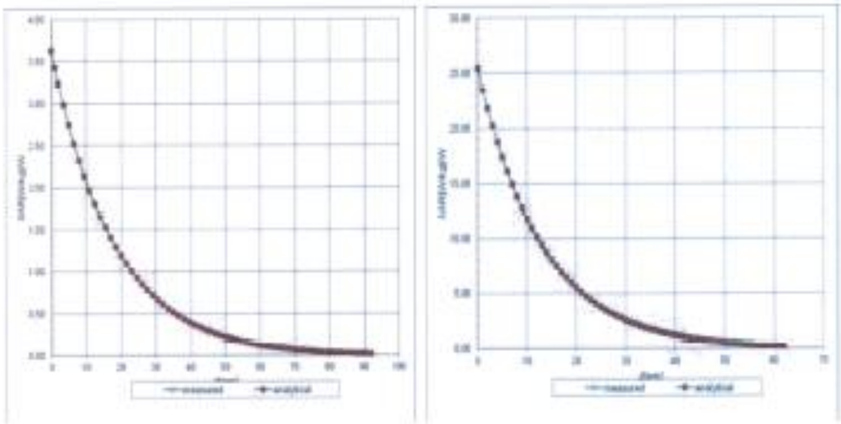
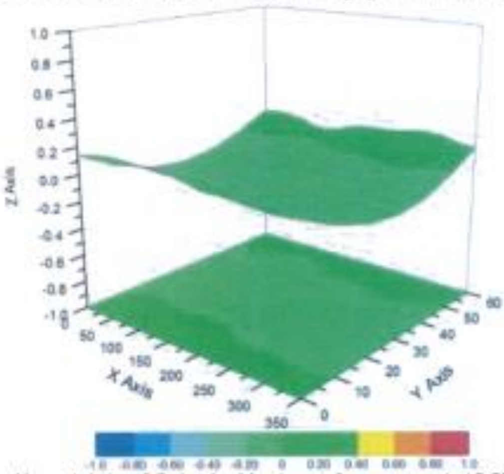
Conversion Factor Assessment

f=900 MHz, WGLS R9(H_convF) f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±2.8% (K=2)

Certificate No: J13-2-2042 Page 10 of 11

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DASY - Parameters of Probe: ES3DV3 - SN: 3252

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	129.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
Tip Diameter	4mm
Probe Tip to Sensor X Calibration Point	2mm
Probe Tip to Sensor Y Calibration Point	2mm
Probe Tip to Sensor Z Calibration Point	2mm
Recommended Measurement Distance from Surface	3mm

ANNEX H Dipole 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: Auden

Certificate No: D835V2-4d092_Jun13

CALIBRATION CERTIFICATE

Object: D835V2 - SN: 4d092

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

Calibration date: June 17, 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: June 17, 2013

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

Certificate No: D835V2-4d092_Jun13 Page 1 of 8

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "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%.

Certificate No: D835V2-4d092_Jun13 Page 2 of 8

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	40.5 ± 6 %	0.94 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	2.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.81 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.18 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	53.6 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.27 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.14 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω - 1.1 jΩ
Return Loss	- 31.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8 Ω - 3.1 jΩ
Return Loss	- 28.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.388 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	September 15, 2009

DASY5 Validation Report for Head TSL

Date: 13.06.2013

Test Laboratory: Industry Canada - Certification & Engineering Bureau

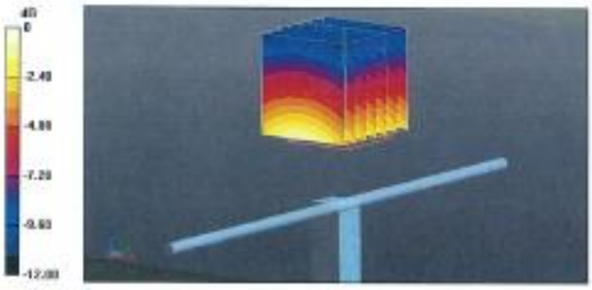
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d092

Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.94 S/m; ε_r = 40.5; 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)

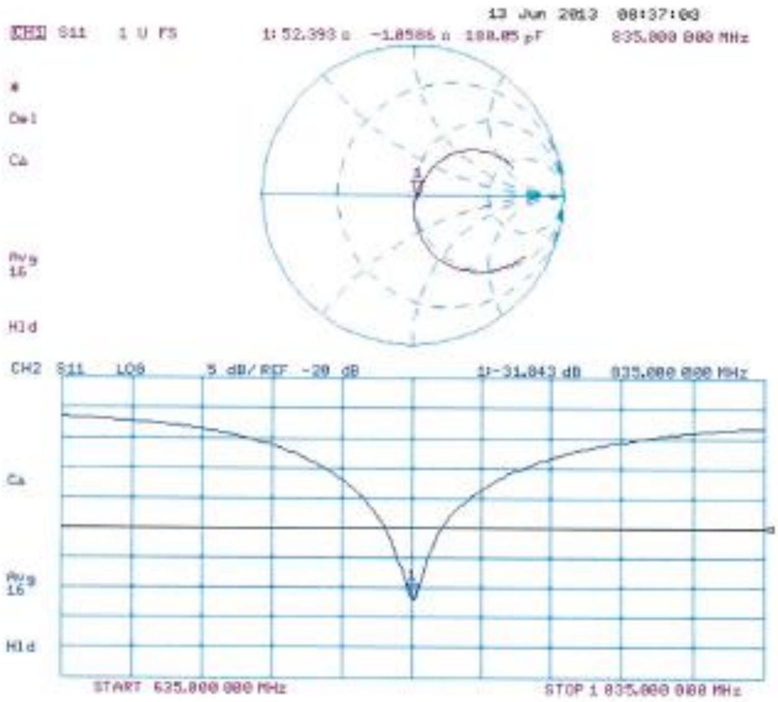
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.874 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.75 W/kg
SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 2.89 W/kg



0 dB = 2.89 W/kg = 4.61 dBW/kg

Certificate No: D835V2-4d092_Jun13 Page 5 of 8

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.06.2013

Test Laboratory: SPEAG, Zurich, Switzerland

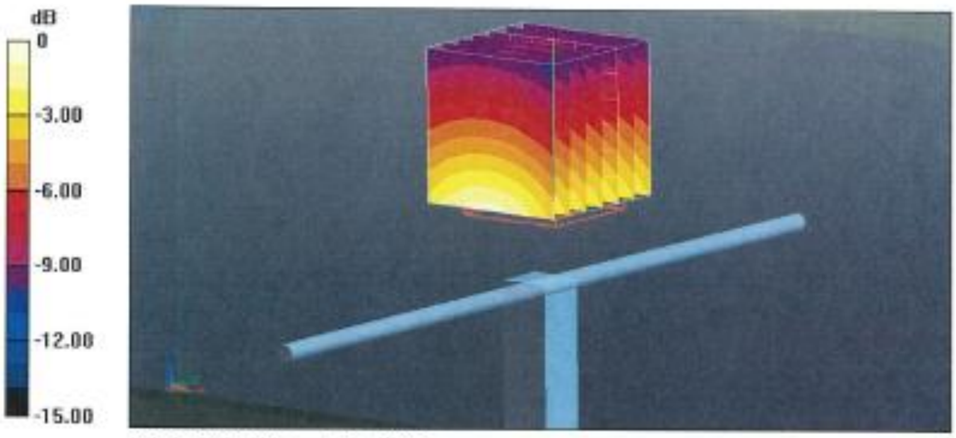
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d092

Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.99 S/m; ε_r = 53.6; 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)

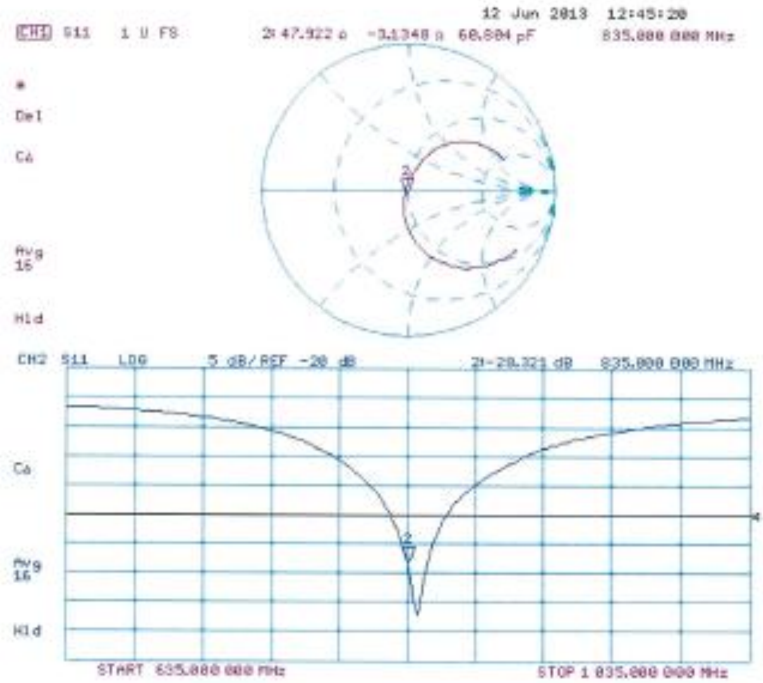
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.483 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 3.47 W/kg
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (measured) = 2.76 W/kg



0 dB = 2.76 W/kg = 4.41 dBW/kg

Certificate No: D835V2-4d092_Jun13 Page 7 of 8

Impedance Measurement Plot for Body TSL



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CNAS L0442

Client CATR-SH Certificate No: J13-2-2038

CALIBRATION CERTIFICATE

Object D2450V2 - SN: 858

Calibration Procedure(s) TMC-OS-E-02-194
Calibration procedure for dipole validation kits

Calibration date: July 13, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	11-Sep-12 (TMC, No.JZ12-443)	Sep-13
Power sensor NRV-Z5	100595	11-Sep-12 (TMC, No. JZ12-443)	Sep -13
Reference Probe EX3DV4	SN 3846	20- Dec-12 (SPEAG, No.EX3-3846_Dec12)	Dec-13
DAE4	SN 777	22-Feb-13 (SPEAG, DAE4-777_Feb13)	Feb -14
Signal Generator E4438C	MY49070393	13-Nov-12 (TMC, No.JZ12-394)	Nov-13
Network Analyzer E8362B	MY43021135	19-Oct-12 (TMC, No.JZ13-278)	Oct-13

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Xiao Li	Deputy Director of the laboratory	

Issued: July 26, 2013

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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 300MHz to 3GHz)", February 2005

c) KDB865664, 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%.

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Measurement Conditions

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

DASY Version	DASY52	52.8.7.1137
Extrapolation	Advanced Extrapolation	
Phantom	Twin 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	37.6 ± 6 %	1.78 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	12.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**49.8 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.78 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**23.0 mW /g ± 20.4 % (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	51.9 ± 6 %	1.93 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	11.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**47.7 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.56 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**22.2 mW /g ± 20.4 % (k=2)**

Certificate No: J13-2-2036 Page 3 of 8

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.9Ω+4.60jΩ
Return Loss	- 24.0dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.9Ω+ 5.86jΩ
Return Loss	- 24.6dB

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	April 23, 2010

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DASY5 Validation Report for Head TSL Date: 13.07.2013

Test Laboratory: TMC, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 858

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: f = 2450 MHz; σ = 1.777 mho/m; εr = 37.61; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(7.13,7.13,7.13); Calibrated:20,12,2012
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 22/2/2013
- Phantom: Flat Phantom; Type: QD000P40CC;
- Measurement SW: DASY52 52.8.7(1137); SEMCAD X Version 14.6.10 (7164)

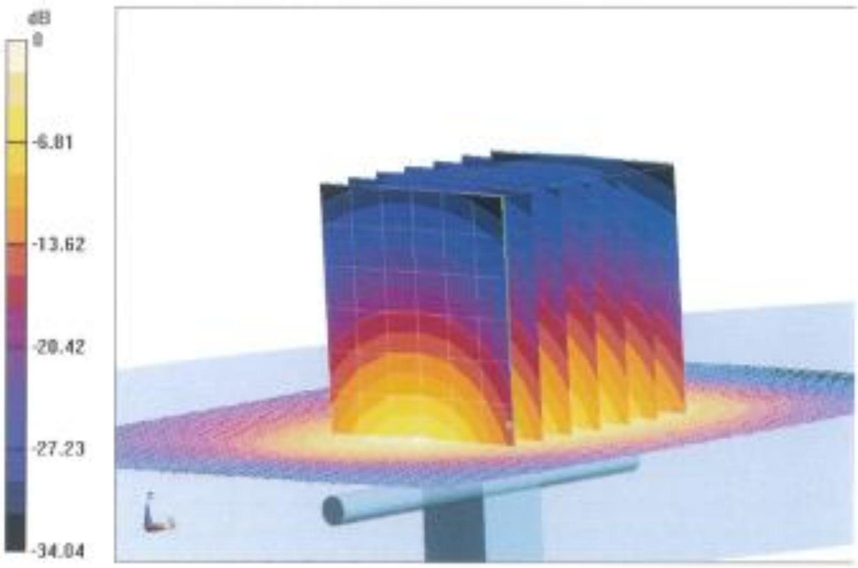
Dipole Calibration for Head Tissue/Pin=250mW, d=10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 82.927 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 26.0 W/kg

SAR(1 g) = 12.4 W/kg; SAR(10 g) = 5.76 W/kg

Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.4 W/kg = 11.57 dBW/kg

Certificate No: J13-2-2038 Page 5 of 8

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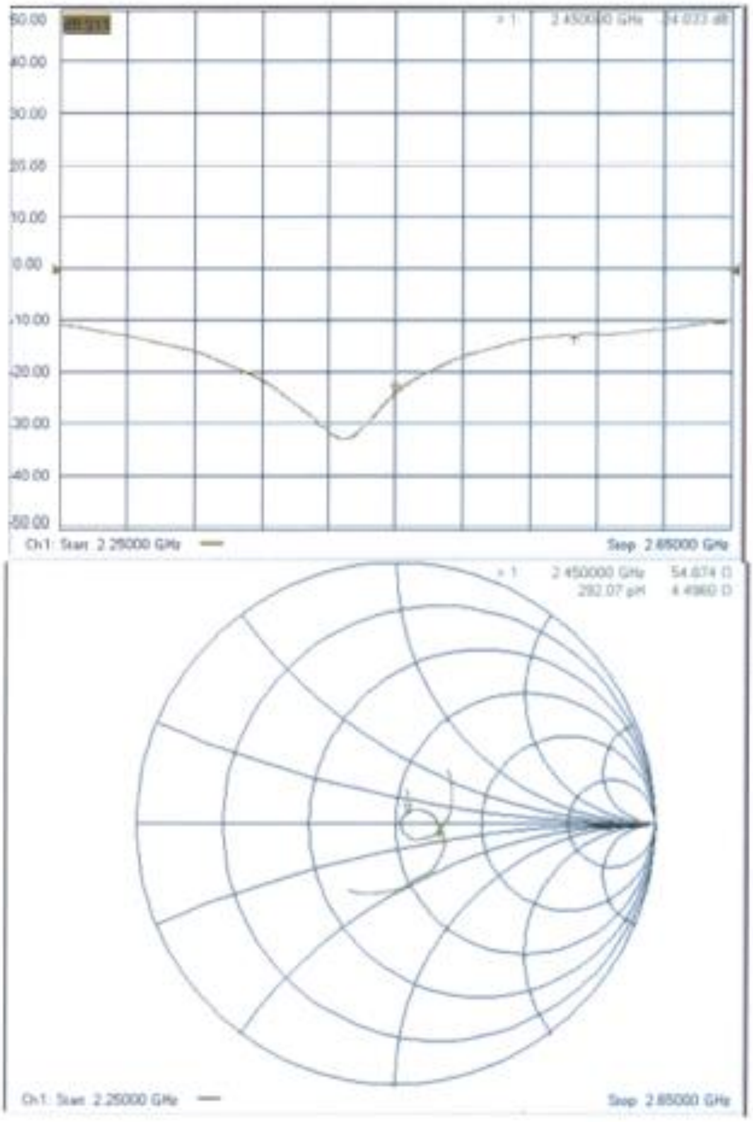
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 11.07.2013

Test Laboratory: TMC, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 858

Communication System: CW; Frequency: 2450 MHz;

Medium parameters used: f = 2450 MHz; σ = 1.927 mho/m; εr = 51.858; ρ = 1000 kg/m^3

Phantom section: Flat Phantom

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(7,7,7) ; Calibrated:20.12.2012
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 22/2/2013
- Phantom: Flat Phantom; Type: QD000P40CC
- Measurement SW: DASY52 52.8.7(1137); SEMCAD X Version 14.6.10 (7164)

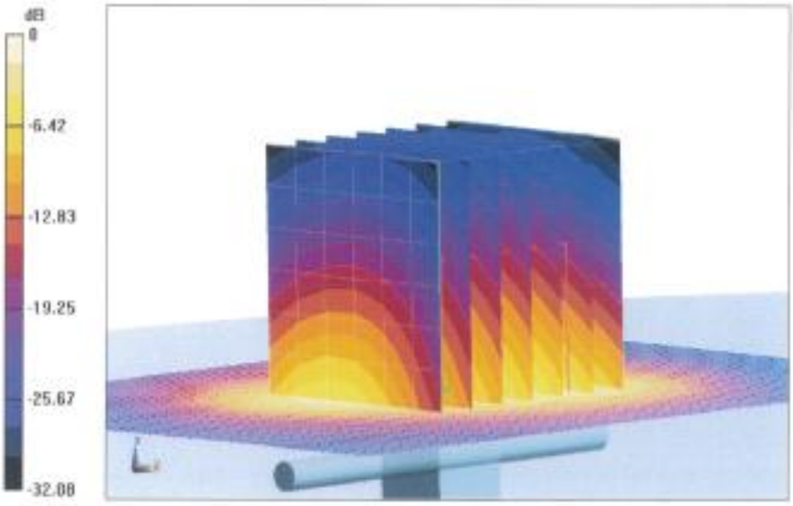
Dipole Calibration for Body Tissue/Pin=250mW, d=10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 83.465 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 24.1 W/kg

SAR(1 g) = 11.9 W/kg; SAR(10 g) = 5.55 W/kg

Maximum value of SAR (measured) = 13.7 W/kg



0 dB = 13.6 W/kg = 11.32 dBW/kg

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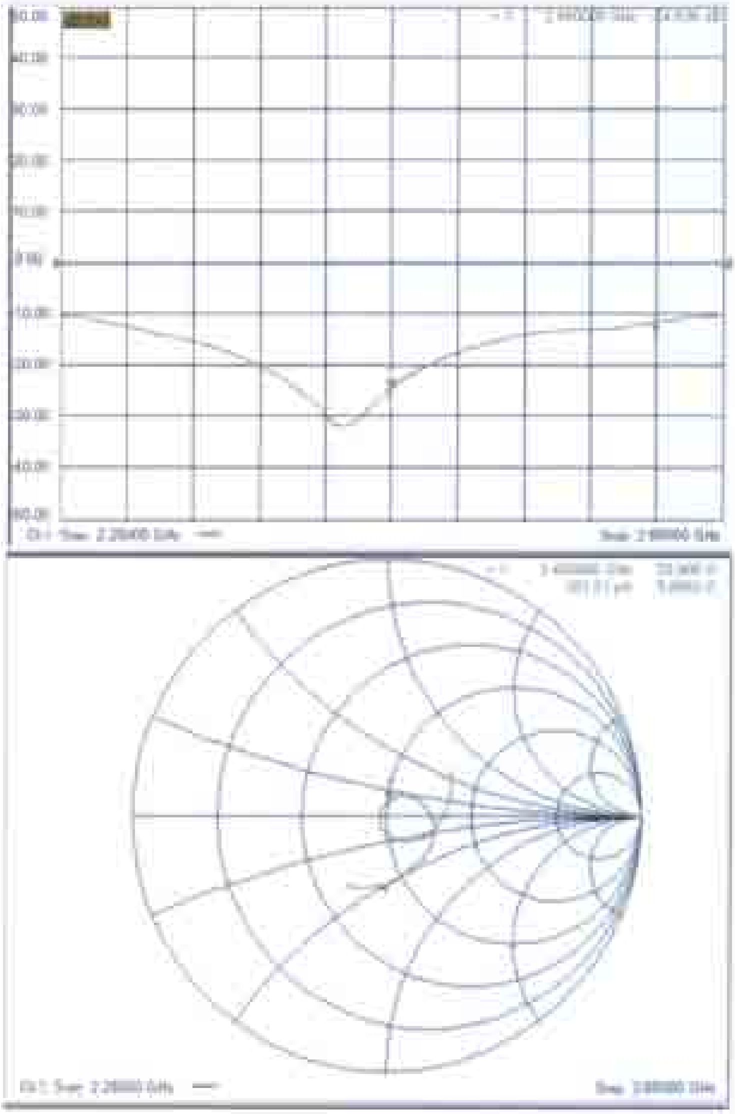
Impedance Measurement Plot for Body TSL



The end of report