TEST REPORT

No. I16D00274-SAR

For

Client: **Verykool USA Inc**

Production: **Mobile Phone**

Model Name: **s4513**

FCC ID: **WA6S4513**

Hardware Version: **R615-MB-V2.0**

Software Version: **S4513_VK_Generic_Dual_SW_1.0**

Issued date: **2017-2-15**

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
I16D00274-SAR	00	2017-2-15	Initial creation of test report

CONTENTS

1. Test Laboratory

1.1. Testing Location

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1.2. Testing Environment

Normal Temperature:	18-25℃
Relative Humidity:	10-70%
Ambient noise & Reflection:	< 0.012 W/kg

1.3. Project Data

Project Leader:	XuYuting
Testing Start Date:	2017-1-14
Testing End Date:	2017-2-7

1.4. Signature

Yan Hang
(Prepared this test report)

Song Kaihua
(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 **s4513** are as follows (with expanded uncertainty 22.4%)

Table 2.1: Max. Reported SAR (1g)

Band	Position/Distance	SAR 10g (W/Kg)
GSM 850	Head	0.459
	Hotspot/10mm	0.694
GSM 1900	Head	0.290
	Hotspot/10mm	0.533
WCDMA Band2	Head	0.600
	Hotspot/10mm	1.110
WCDMA Band5	Head	0.328
	Hotspot/10mm	0.812
Wi-Fi	Head	0.288
	Hotspot/10mm	0.058

Table 2.2: The maximum of SAR values

	Maximum SAR value for Head	**Maximum SAR value for Hotspot**
GSM	0.459	0.694
WCDMA	0.600	1.110
WIFI	0.288	0.058

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

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

The sample has three antennas. One is main antenna for GSM/WCDMA, and the other is for WiFi/BT and GPS. So simultaneous transmission is GSM/WCDMA and WiFi/BT.

Table 2.3: Simultaneous SAR (1g)

Transmission SAR(W/Kg)							
Test Position			2G	3G	WIFI	BT	SUM
Head	Left	Cheek	0.459	0.482	0.288	0.133	0.770
		Tilt 15°	0.401	0.194	0.204	0.133	0.605
	Right	Cheek	0.455	0.600	0.105	0.133	0.733
		Tilt 15°	0.438	0.217	0.091	0.133	0.571
Hotspot 10mm	Phantom Side		0.367	0.660	0.033	0.066	0.726
	Ground Side		0.694	0.866	0.058	0.066	0.932
	Left Side		0.130	0.308	0.010	0.066	0.374
	Right Side		0.489	0.360	0.029	0.066	0.555
	Bottom Side		0.482	1.110	--	0.066	1.176
	Top Side		--	--	0.033	0.066	0.066

According to the above table, the maximum sum of reported SAR values for GSM/WCDMA/LTE and WiFi is **1.176 W/kg** (1g). The detail for simultaneous transmission consideration is described in chapter 12.

3. Client Information

3.1. Applicant Information

Company Name:	Verykool USA Inc
Address:	3636 Nobel Drive, Suite 325, San Diego, CA92122 USA
Email:	Sunny.choi@infosonics.com
Contact:	Sunny Choi

3.2. Manufacturer Information

Company Name:	Fortune Ship
Address:	6/F, Kanghesheng Building, No.1 Chuangsheng Road, Nanshan District, Shenzhen, Guangdong, China
Email:	lwanhui@fortuneship.com
Contact:	Sky

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

4.1. About EUT

Description:	Mobile Phone
Model name:	s4513
Operation Model(s):	GSM850/1900,WCDMA Band II/V WIFI2450
Tx Frequency:	824.2-848.8MHz(GSM850) 1850.2-1909.8MHz（GSM1900） 1852.4-1907.6 MHz (WCDMA Band II) 826.4-846.6MHz (WCDMA Band V) 2412- 2462 MHz (Wi-Fi) 2400-2483.5 MHz (BT)
Test device Production information: GPRS/EGPRS Class Mode: GPRS/ EGPRS Multislot Class:	Production unit B 12
Device type:	Portable device
UE category:	3
Antenna type:	Inner antenna
Accessories/Body-worn configurations:	Headset Battery
Dimensions: Hotspot Mode:	13.2cm×6.8cmx0.8cm Support simultaneous transmission of hotspot and voice (or data)
FCC ID:	WA6S4513

4.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Receive Date
N03	35213906976280	R615-MB-V2.0	S4513_VK_Generic_Dual_SW_1.0	2016-12-26

*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
A04	N/A	N/A	N/A	N/A

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

5. TEST METHODOLOGY

5.1. Applicable Limit Regulations

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

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

5.2. Applicable Measurement Standards

IEEE 1528–2013: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices:
Experimental Techniques.

KDB648474 D04 Handset SAR v01r03:SAR Evaluation Considerations for Wireless Handsets.

KDB248227 D01 802 11 Wi-Fi SAR v02r02: SAR measurement procedures for 802.112abg transmitters.

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

KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04:SAR Measurement Requirements for 100 MHz to 6 GHz

KDB865664 D02 RF Exposure Reporting v01r02:provides general reporting requirements as well as certain specific information required to support MPE and SAR compliance.

KDB941225 D01 3G SAR Procedures v03r01: 3G SAR Measurement Procedures.

KDB941225 D05 SAR for LTE Devices v02r04: SAR Evaluation Considerations for LTE Devices.

KDB941225 D06 hotspot SAR v02r01:SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities.

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

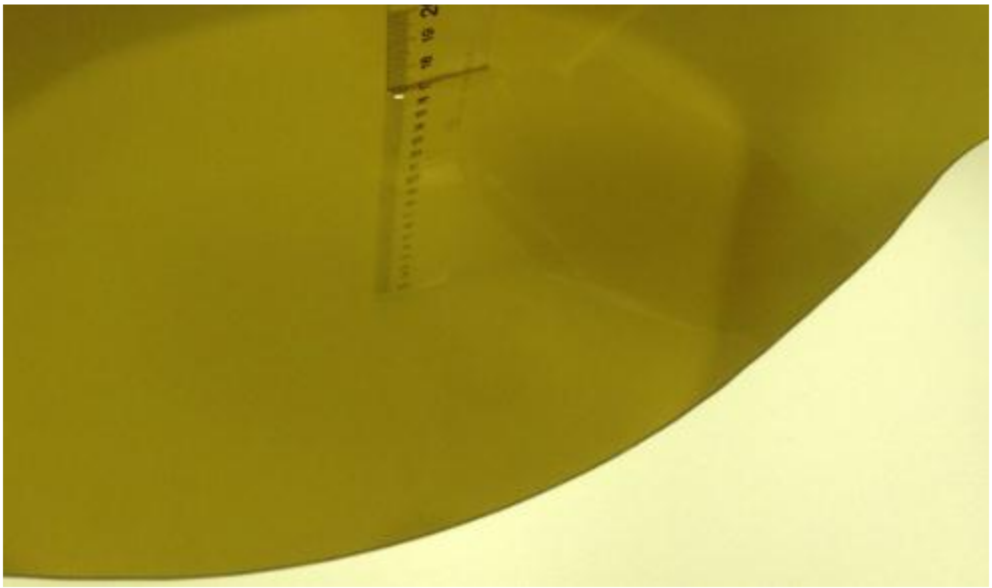
Table 7.1: Targets for tissue simulating liquid

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

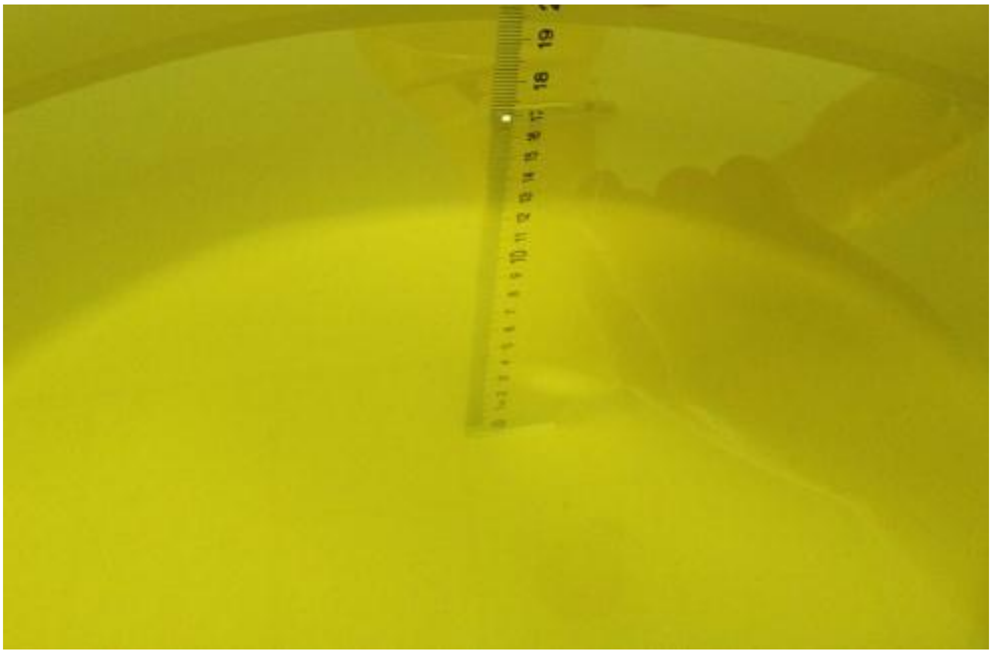
7.2. Dielectric Performance

Table 7.2: Dielectric Performance of Tissue Simulating Liquid

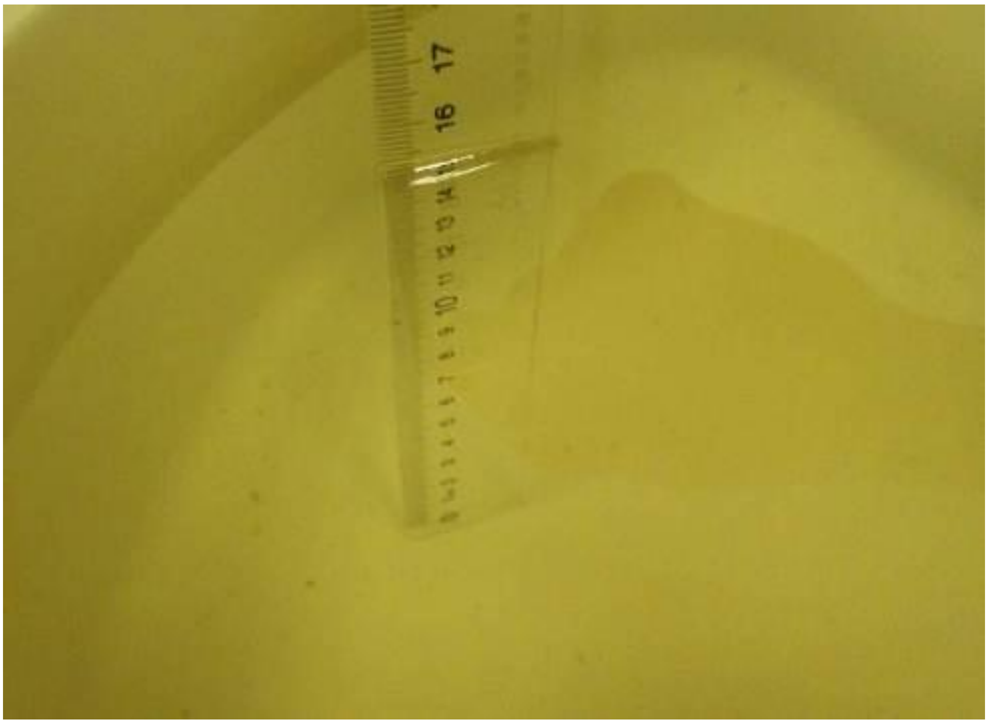
Measurement Value						
Liquid Temperature: 22.5 ℃						
Type	**Frequency**	**Permittivity ε**	**Drift (%)**	**Conductivity σ**	**Drift (%)**	Test Date
Head	835 MHz	41.51	0.02%	0.898	-0.22%	2017-01-14
Head	1900 MHz	39.63	-0.92%	1.386	-1.00%	2017-01-15
Head	2450 MHz	39.11	-0.23%	1.812	0.67%	2017-02-07
Body	835 MHz	56.16	1.74%	1.002	3.30%	2017-01-14
Body	1900 MHz	53.23	-0.13%	1.526	0.39%	2017-01-15
Body	2450 MHz	53.94	2.35%	1.921	-1.49%	2017-02-07



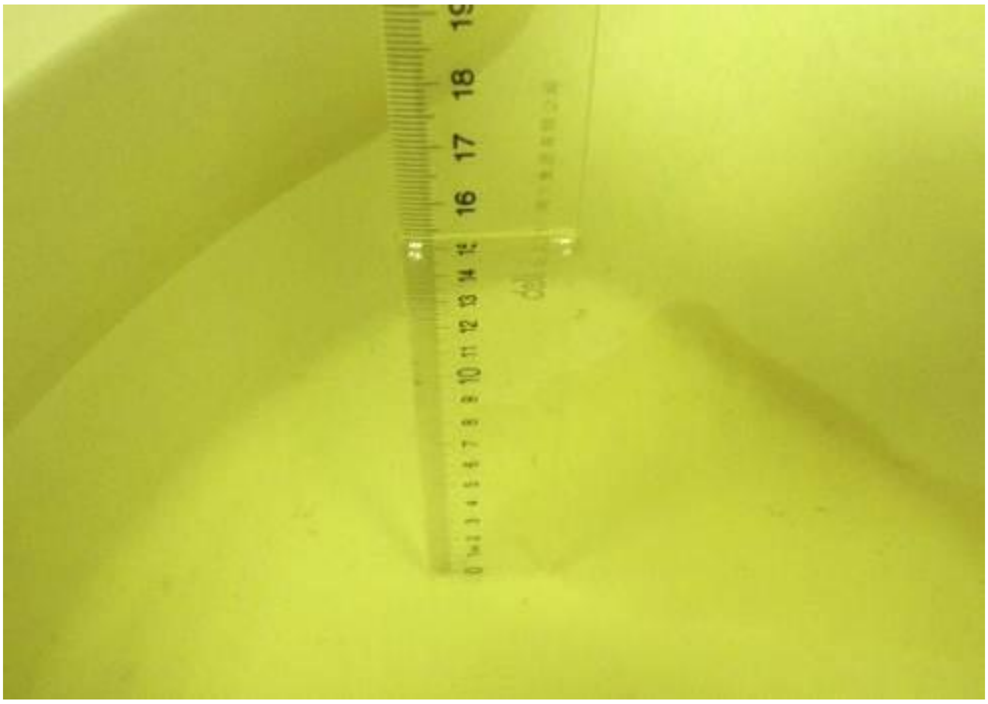
Picture 7-1: Liquid depth in the Flat Phantom (835 MHz Head)



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

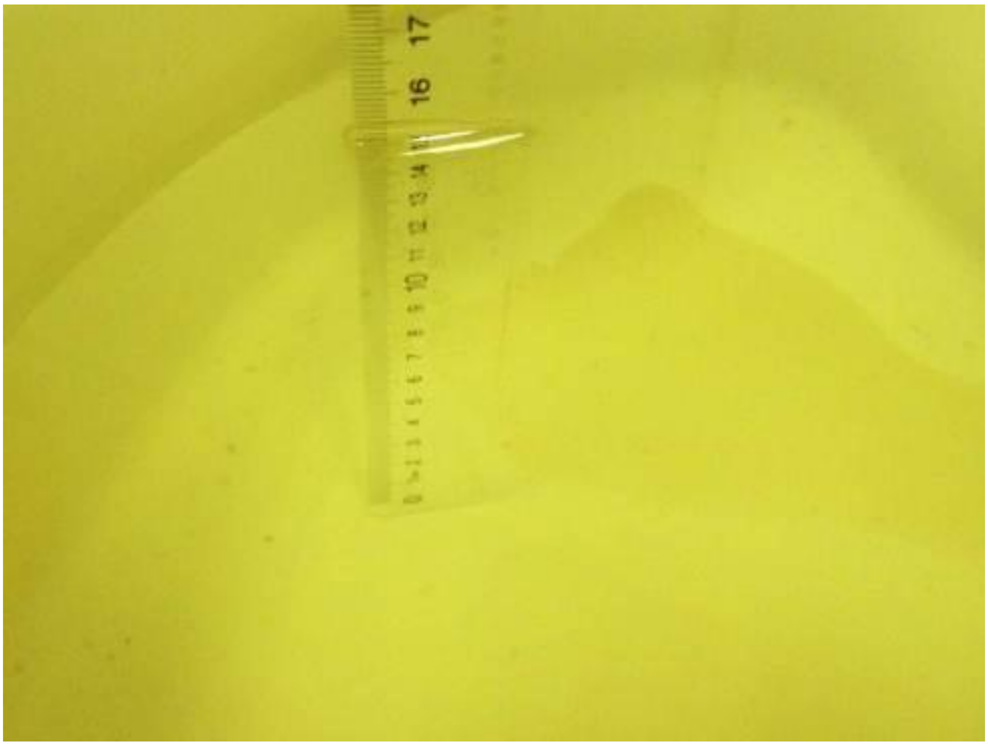


Picture 7-3: Liquid depth in the Flat Phantom (835 MHz Body)



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

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

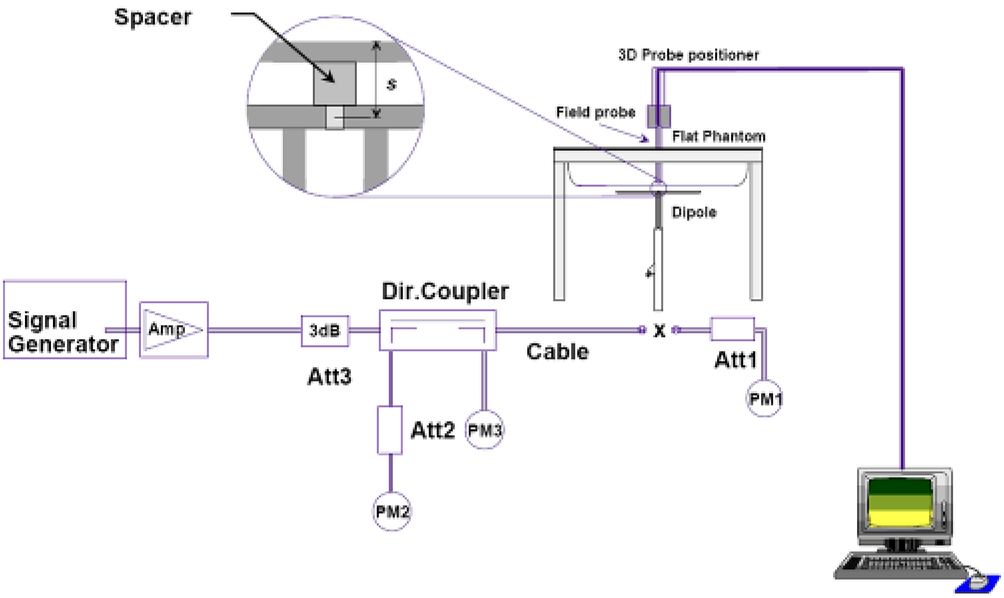


Picture 7-6: Liquid depth in the Flat Phantom (2450 MHz Body)

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 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

Verification Results							
Input power level: 250mW							
Frequency	**Target value (W/kg)**		**Measured value (W/kg)**		**Deviation**		**Test date**
	10 g Average	**1 g Average**	**10 g Average**	**1 g Average**	**10 g Average**	**1 g Average**	
835 MHz	1.51	2.31	1.50	2.30	-0.66%	-0.43%	2017-01-14
1900 MHz	5.22	10.1	5.14	9.89	-1.53%	-2.08%	2017-01-15
2450 MHz	6.06	13.2	6.13	13.4	1.16%	1.52%	2017-02-07

Table 8.2: System Verification of Body

Verification Results							
Input power level: 250mW							
Frequency	**Target value (W/kg)**		**Measured value (W/kg)**		**Deviation**		**Test date**
	10 g Average	**1 g Average**	**10 g Average**	**1 g Average**	**10 g Average**	**1 g Average**	
835 MHz	1.56	2.37	1.54	2.36	-1.28%	-0.42%	2017-01-14
1900 MHz	5.33	10.3	5.26	10.4	-1.31%	0.97%	2017-01-15
2450 MHz	6.16	13.2	6.11	13.1	-0.81%	-0.76%	2017-02-07

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),

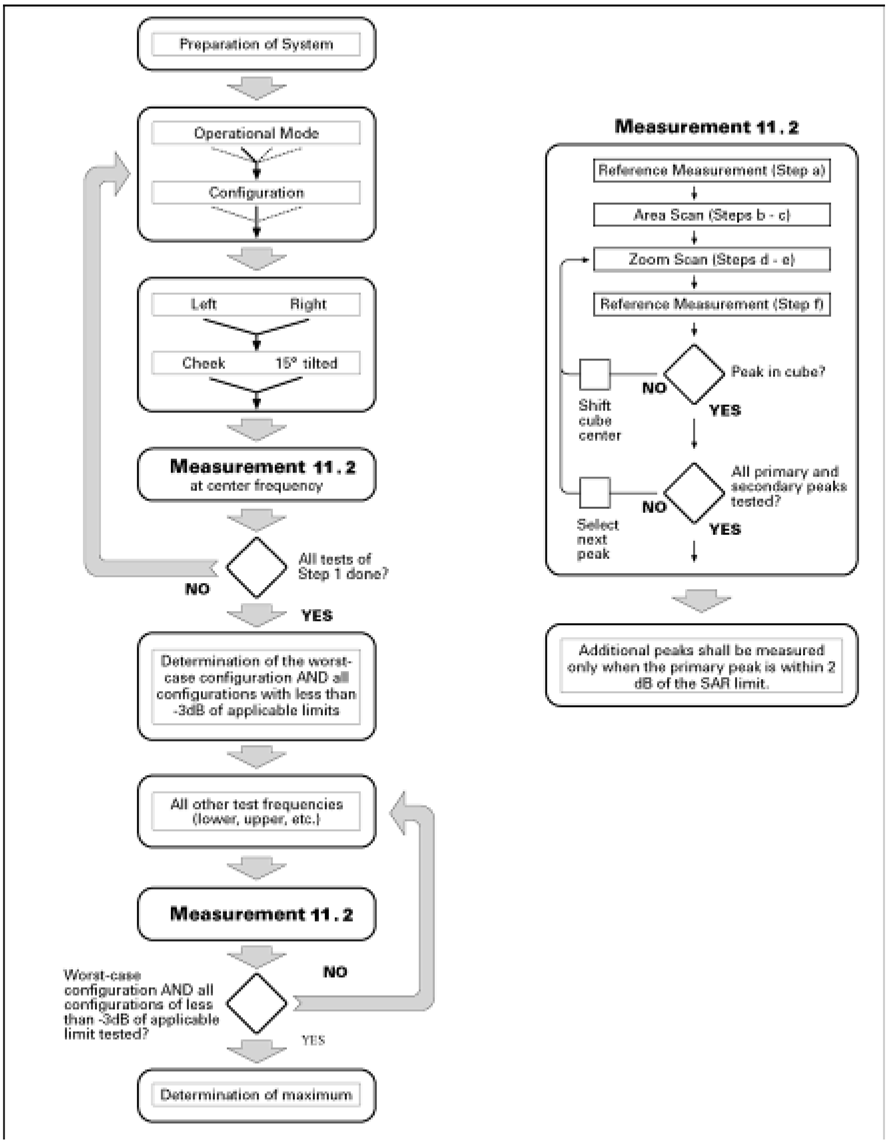
b) all configurations for each device position in a), e.g., antenna extended and retracted, and

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 9.1Block 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 and δ 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. 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 and δ 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. WCDMA Measurement Procedures for SAR

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

For Release 5 HSDPA Data Devices:

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	CM/dB	MPR/dB
1	2/15	15/15	64	2/15	4/15	2.0	1.0
2	12/15	15/15	64	12/15	24/25	2.0	1.0
3	15/15	8/15	64	15/8	30/15	2.0	1.0
4	15/15	4/15	64	15/4	30/15	2.0	1.0

For Release 6 HSUPA Data Devices

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (dB)	MPR (dB)	AG Index	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1039/225	4	1	2.0	1.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	2.0	1.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	2.0	1.0	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	2.0	1.0	21	81

9.4. SAR Measurement for LTE

SAR tests for LTE are performed with a base station simulator, Anritsu 8820. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. All powers were measured with the Anritsu 8820

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

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

1) QPSK with 1 RB allocation

Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

2) QPSK with 50% RB allocation

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

3) QPSK with 100% RB allocation

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

9.5. Bluetooth & Wi-Fi Measurement Procedures for SAR

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

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

9.6. Power Drift

To control the output power stability during the SAR test, DASY4 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Section 14 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

10. Area Scan Based 1-g SAR

10.1 Requirement of KDB

According to the KDB447498 D01 v06, when the implementation is based the specific polynomial fit algorithm as presented at the 29th Bioelectromagnetics Society meeting (2007) and the estimated 1-g SAR is ≤ 1.2 W/kg, a zoom scan measurement is not required provided it is also not needed for any other purpose; for example, if the peak SAR location required fo simultaneous transmission SAR test exclusion can be determined accurately by the SAR system or manually to discriminate between distinctive peaks and scattered noisy SAR distributions from area scans.

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

10.2 Fast SAR Algorithms

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

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

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

Both algorithms are implemented in DASY software.

11. Conducted Output Power

11.1. Manufacturing tolerance

Table 11.1: GSM Speech

GSM 850			
Channel	Channel 128	Channel 190	Channel 251
Maximum Target Value (dBm)	33	33	33
GSM1900			
Channel	Channel 512	Channel 661	Channel 810
Maximum Target Value (dBm)	28.5	28.5	28.5

Table 11.2: GPRS/EGPRS (GMSK Modulation)

GSM 850				
Channel		**128**	**190**	**251**
1 Txslots	Maximum Target Value (dBm)	33	33	33
2 Txslots	Maximum Target Value (dBm)	30.5	30.5	30.5
3 Txslots	Maximum Target Value (dBm)	28.5	28.5	28.5
4 Txslots	Maximum Target Value (dBm)	28.5	28.5	28.5
GSM 1900				
Channel		**512**	**661**	**810**
1 Txslots	Maximum Target Value (dBm)	28.5	28.5	28.5
2 Txslots	Maximum Target Value (dBm)	26.5	26.5	26.5
3 Txslots	Maximum Target Value (dBm)	24.5	24.5	24.5
4 Txslots	Maximum Target Value (dBm)	23.5	23.5	23.5

Table 11.3: WCDMA

WCDMA Band II			
Channel	Channel 9262	Channel 9400	Channel 9538
Maximum Target Value (dBm)	22	22	22

Table 11.4: HSDPA

WCDMA Band II					MPR (dB)
Channel		9262	9400	9538	
1	Maximum Target Value (dBm)	22	22	22	1
2	Maximum Target Value (dBm)	22	22	22	1
3	Maximum Target Value (dBm)	22	22	22	1
4	Maximum Target Value (dBm)	22	22	22	1

Table 11.6: HSUPA

WCDMA Band II					MPR (dB)
Channel		9262	9400	9538	
1	Maximum Target Value (dBm)	21	21	21	1
2	Maximum Target Value (dBm)	21	21	21	1
3	Maximum Target Value (dBm)	21	21	21	1
4	Maximum Target Value (dBm)	21	21	21	1
5	Maximum Target Value (dBm)	21	21	21	1

Table 11.7: WCDMA

WCDMA Band V			
Channel	4233	4182	4132
Maximum Target Value (dBm)	22.5	22.5	22.5

Table 11.8: HSDPA

WCDMA Band V					MPR (dB)
Channel		4233	4182	4132	
1	Maximum Target Value (dBm)	22.5	22.5	22.5	1
2	Maximum Target Value (dBm)	22.5	22.5	22.5	1
3	Maximum Target Value (dBm)	22	22	22	1
4	Maximum Target Value (dBm)	22	22	22	1

Table 11.9: HSUPA

WCDMA Band V					MPR (dB)
Channel		4233	4182	4132	
1	Maximum Target Value (dBm)	22	22	22	1
2	Maximum Target Value (dBm)	22	22	22	1
3	Maximum Target Value (dBm)	22	22	22	1
4	Maximum Target	22	22	22	1

	Value (dBm)				
5	Maximum Target Value (dBm)	22	22	22	1

Table 11.10: WiFi

802.11b			
Channel	Channel 1	Channel 6	Channel 11
Maximum Target Value (dBm)	10	10	10
802.11g			
Channel	Channel 1	Channel 6	Channel 11
Maximum Target Value (dBm)	8	8	8
802.11n			
Channel	Channel 1	Channel 6	Channel 11
Maximum Target Value (dBm)	5	5	5

Table 11.11: Bluetooth

Bluetooth 2.1			
Channel	Channel 0	Channel 39	Channel 78
Maximum Target Value (dBm)	5	5	5

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 11.13: The conducted power measurement results for GSM

GSM 850MHZ	Conducted Power (dBm)		
	Channel 128(824.2MHz)	**Channel 190(836.6MHz)**	**Channel 251(848.6MHz)**
	32.59	32.52	32.43
GSM 1900MHZ	**Conducted Power (dBm)**		
	Channel 512(1850.2MHz)	**Channel 661(1880MHz)**	**Channel 810(1909.8MHz)**
	28.48	28.30	28.45

Table 11.14: The conducted power measurement results for GPRS/EGPRS (GMSK)

GSM 850	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	128	**190**	**251**		**128**	**190**	**251**
1 Txslot	32.57	32.54	32.46	-9.03dB	23.54	23.51	23.43
2 Txslots	30.03	30.06	30.03	-6.02dB	24.01	24.04	24.01
3 Txslots	28.46	28.45	28.35	-4.26dB	24.2	24.19	24.09
4 Txslots	27.24	27.21	27.14	-3.01dB	24.23	24.2	24.13
GSM 1900	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	512	**661**	**810**		**512**	**661**	**810**
1 Txslot	28.46	28.31	28.44	-9.03dB	19.43	19.28	19.41
2 Txslots	26.14	26.04	25.95	-6.02dB	20.12	20.02	19.93
3 Txslots	24.45	24.4	24.33	-4.26dB	20.19	20.14	20.07
4 Txslots	22.37	22.38	22.34	-3.01dB	19.36	19.37	19.33

NOTES:

1) Division Factors

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

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

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

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

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

According to the conducted power as above, the body measurements are performed with 4Txslots for 850MHz ; 3Txslots for1900MHz;

11.3. WCDMA Measurement result

Table 11.16: The conducted Power for WCDMA

Item	band	WCDMA BAND II result(dBm)		
	ARFCN	9612 (1922.4MHz)	9750 (1950.0MHz)	9888 (1977.6MHz)
WCDMA	\	21.48	21.84	21.91
HSDPA	1	20.25	20.5	20.49
	2	20.05	20.46	20.66
	3	19.71	20.01	20.1
	4	19.83	20.11	20.17
HSUPA	1	19.61	20.11	20.26
	2	19.16	19.45	19.6
	3	19.15	19.59	19.53
	4	19.96	20.29	20.44
	5	19.76	20.19	20.33
Item	band	WCDMA BAND V result(dBm)		
	ARFCN	4133 (826.4MHz)	4182 (836.4MHz)	4232 (846.6MHz)
WCDMA	\	22.36	22.41	22.27
HSDPA	1	21.11	21.17	20.95
	2	20.91	21.09	21.01
	3	20.64	20.68	20.56
	4	20.74	20.71	20.56
HSUPA	1	20.54	20.68	20.59
	2	20.01	20.09	19.9
	3	20.01	20.14	19.94
	4	20.94	20.91	20.82
	5	20.65	20.74	20.65

11.4. Wi-Fi and BT Measurement result

Table 11.18: The conducted power for Bluetooth

GFSK			
Channel	Ch0 (2402 MHz)	Ch39 (2441MHz)	CH78 (2480MHz)
Conducted Output Power (dBm)	2.5	3.8	4.7
π /4 DQPSK			
Channel	Ch0 (2402 MHz)	Ch39 (2441MHz)	CH78 (2480MHz)
Conducted Output Power (dBm)	3.6	3.7	4.3
8DPSK			
Channel	Ch0 (2402 MHz)	Ch39 (2441MHz)	CH78 (2480MHz)
Conducted Output Power (dBm)	3.7	3.8	4.7

NOTE: According to KDB447498 D01 BT standalone SAR are not required, because maximum average output power is less than 10mW.

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.

SAR head value of BT is 0.133 W/Kg. SAR body value of BT is 0.066 W/Kg.

The default power measurement procedures are:

a) Power must be measured at each transmit antenna port according to the DSSS and OFDM transmission configurations in each standalone and aggregated frequency band.

b) Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units.

1) When the same highest maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.

2) When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.11 configurations with the same maximum output power.

c) For each transmission mode configuration, power must be measured for the highest and lowest channels; and at the mid-band channel(s) when there are at least 3 channels. For configurations with multiple mid-band channels, due to an even number of channels, both channels should be measured.

During WLAN SAR testing EUT is configured with the WLAN continuous TX tool, and the transmission duty factor was monitored on the spectrum analyzer with zero-span setting，the duty cycle is 100%.

Table 11.19: The average conducted power for WiFi

Mode	Channel	Frequence	Average power(dBm)
802.11 b	1	2412 MHZ	9.62
	6	2437 MHZ	9.15
	11	2462 MHZ	9.13
802.11 g	1	2412 MHZ	7.46
	6	2437 MHZ	7.22
	11	2462 MHZ	7.10
802.11 n 20M	1	2412 MHZ	4.14
	6	2437 MHZ	3.64
	11	2462 MHZ	3.72

2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied. SAR is not required for the following 2.4 GHz OFDM conditions.

a) When KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.

b) When the highest *reported* SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

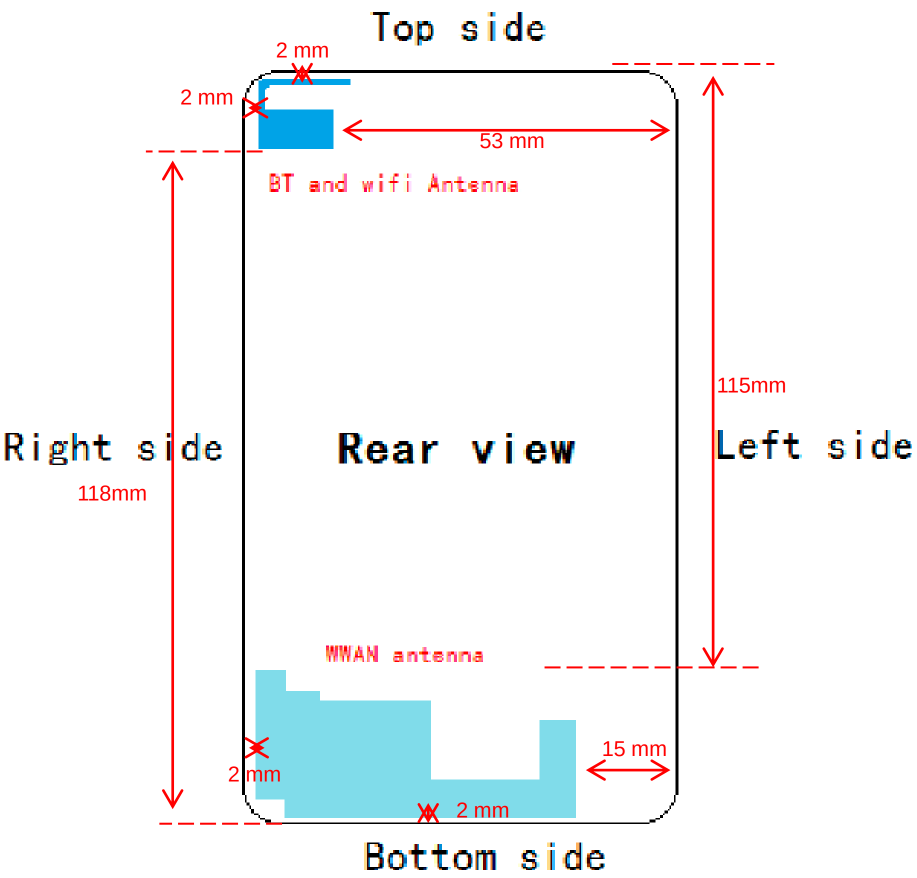
12. Simultaneous TX SAR Considerations

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

Note:

WWAN Antenna meaning is 2G/3G TX Antenna

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.

$$\frac{\text{(max. power of channel, including tune-up tolerance, mW)}}{\text{(min. test separation distance, mm)}} * \sqrt{\text{Frequency (GHz)}} \leqslant 3.0$$

Based on the above equation, Bluetooth SAR was not required:

Evaluation=0.996 ＜3.0

Based on the above equation, WiFi SAR was required:

Evaluation=3.15 > 3.0

12.4. SAR Measurement Positions

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

SAR Measurement Positions						
Antenna Mode	Phantom	Ground	Left	Right	Top	Bottom
WWAN	Yes	Yes	Yes	Yes	No	Yes
WLAN	Yes	Yes	No	Yes	Yes	No

13. Evaluation of Simultaneous

Table 13.1: Summary of Transmitters

Band/Mode	Frequency (GHz)	SAR test exclusion threshold(mW)	RF output power (mW)
Bluetooth	2.41	10	3.16
2.4GHz WLAN 802.11 b/g/n	2.45	10	10

Table13.2 Simultaneous transmission SAR

Standalone SAR for 2G(W/Kg)					
Test Position			GSM 850	GSM 1900	Highest SAR
Head voice	Left	Cheek	0.459	0.275	0.459
		Tilt 15°	0.401	0.099	0.401
	Right	Cheek	0.455	0.290	0.455
		Tilt 15°	0.438	0.128	0.438
Hotspot 10mm	Phantom Side		0.290	0.367	0.367
	Ground Side		0.694	0.533	0.694
	Left Side		0.100	0.130	0.130
	Right Side		0.489	0.148	0.489
	Bottom Side		0.119	0.482	0.482
	Top Side		--	--	--

Standalone SAR for 3G (W/Kg)					
Test Position			WCDMA Band II	WCDMA Band V	Highest SAR
Head data	Left	Cheek	0.482	0.328	0.482
		Tilt 15°	0.184	0.194	0.194
	Right	Cheek	0.600	0.197	0.600
		Tilt 15°	0.217	0.173	0.217
Hotspot 10mm	Phantom Side		0.660	0.389	0.660
	Ground Side		0.866	0.812	0.866
	Left Side		0.308	0.262	0.308
	Right Side		0.360	0.306	0.360
	Bottom Side		1.110	0.080	1.110
	Top Side		--	--	--

Transmission SAR(W/Kg)							
Test Position			2G	3G	WIFI	BT	SUM
Head	Left	Cheek	0.459	0.482	0.288	0.133	0.770
		Tilt 15°	0.401	0.194	0.204	0.133	0.605
	Right	Cheek	0.455	0.600	0.105	0.133	0.733
		Tilt 15°	0.438	0.217	0.091	0.133	0.571
Hotspot 10mm	Phantom Side		0.367	0.660	0.033	0.066	0.726
	Ground Side		0.694	0.866	0.058	0.066	0.932
	Left Side		0.130	0.308	0.010	0.066	0.374
	Right Side		0.489	0.360	0.029	0.066	0.555
	Bottom Side		0.482	1.110	--	0.066	1.176
	Top Side		--	--	0.033	0.066	0.066

According to the conducted power measurement result, we can draw the conclusion that: stand-alone SAR for WiFi should be performed. Then, simultaneous transmission SAR for WiFi/BT is considered with measurement results of GSM/WCDMA and WiFi/BT. According to the above table, the sum of reported SAR values for GSM/WCDMA and WiFi<1.6W/kg. So the simultaneous transmission SAR is not required for WiFi/BT transmitter.

14. SAR Test Result

14.1. SAR results for Fast SAR

Table 14.1: Duty Cycle

Duty Cycle	
Speech for GSM900/1800	1:8.3
GPRS for GSM900/1800	1:2
WCDMA Band I/ Band V/and WiFi	1:1

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

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	190	Left	Touch	Fig.1	32.52	33	1.117	0.411	0.459	0.18
836.6	190	Left	Tilt	/	32.52	33	1.117	0.359	0.401	-0.12
836.6	190	Right	Touch	/	32.52	33	1.117	0.407	0.455	0.02
836.6	190	Right	Tilt	/	32.52	33	1.117	0.392	0.438	0.06
824.2	128	Left	Touch	/	32.59	33	1.099	0.410	0.451	-0.10
848.8	251	Left	Touch	/	32.43	33	1.140	0.371	0.423	0.10

Table 14.3: SAR Values (GSM 1900 MHz Band - Head)

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1880	661	Left	Touch	/	28.30	28.5	1.047	0.263	0.275	0.08
1880	661	Left	Tilt	/	28.30	28.5	1.047	0.0944	0.099	-0.03
1880	661	Right	Touch	/	28.30	28.5	1.047	0.274	0.287	0.02
1880	661	Right	Tilt	/	28.30	28.5	1.047	0.122	0.128	-0.11
1850.2	512	Right	Touch	Fig.2	28.48	28.5	1.005	0.289	0.290	0.04
1909.8	810	Right	Touch	/	28.25	28.5	1.059	0.284	0.287	-0.04

Table 14.4: SAR Values (WCDMA Band II- Head)

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1880	9800	Left	Touch	/	21.84	22	1.038	0.465	0.482	-0.12
1880	9800	Left	Tilt	/	21.84	22	1.038	0.177	0.184	0.16
1880	9800	Right	Touch	Fig.3	21.84	22	1.038	0.578	0.600	0.10
1880	9800	Right	Tilt	/	21.84	22	1.038	0.209	0.217	0.14

1852.4	9662	Right	Touch	/	21.48	22	1.127	0.441	0.497	0.08
1907.6	9938	Right	Touch	/	21.91	22	1.021	0.421	0.430	0.18

Table 14.5: SAR Values (WCDMA Band V- Head)

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	4182	Left	Touch	/	22.41	22.5	1.021	0.264	0.270	-0.08
836.6	4182	Left	Tilt	/	22.41	22.5	1.021	0.190	0.194	0.16
836.6	4182	Right	Touch		22.41	22.5	1.021	0.193	0.197	-0.07
836.6	4182	Right	Tilt	/	22.41	22.5	1.021	0.169	0.173	0.14
826.4	4132	Left	Touch	/	22.36	22.5	1.033	0.197	0.203	0.08
846.6	4232	Left	Touch	Fig.4	22.27	22.5	1.054	0.311	0.328	0.11

Table 14.6:SAR Values (WiFi2450- Head)

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
2412	1	Left	Touch	Fig.5	9.62	10	1.091	0.264	0.288	0.07
2412	1	Left	Touch	/	9.62	10	1.091	0.187	0.204	0.16
2412	1	Left	Touch		9.62	10	1.091	0.096	0.105	0.18
2412	1	Left	Touch	/	9.62	10	1.091	0.083	0.091	0.14

Table 14.7: SAR Values (GSM 850 MHz Band–Hotspot)

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	190	GPRS (4)	Phantom	/	27.21	27.5	1.069	0.271	0.290	0.02
836.6	190	GPRS (4)	Ground	/	27.21	27.5	1.069	0.624	0.667	0.06
836.6	190	GPRS (4)	Left	/	27.21	27.5	1.069	0.094	0.100	-0.10
836.6	190	GPRS (4)	Right	/	27.21	27.5	1.069	0.457	0.489	-0.02
836.6	190	GPRS (4)	Bottom	/	27.21	27.5	1.069	0.111	0.119	0.05
824.2	128	GPRS (4)	Ground	/	27.24	27.5	1.062	0.611	0.649	-0.08
848.8	251	GPRS (4)	Ground	Fig.6	27.14	27.5	1.086	0.639	0.694	0.11

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

Table 14.8: SAR Values (GSM 1900 MHz Band–Hotspot)

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1880	661	GPRS (3)	Phantom	/	24.4	24.5	1.023	0.359	0.367	-0.10
1880	661	GPRS (3)	Ground	/	24.4	24.5	1.023	0.486	0.497	0.10
1880	661	GPRS (3)	Left	/	24.4	24.5	1.023	0.127	0.130	0.13
1880	661	GPRS (3)	Right	/	24.4	24.5	1.023	0.145	0.148	-0.14
1880	661	GPRS (3)	Bottom	/	24.4	24.5	1.023	0.471	0.482	-0.03
1850.2	512	GPRS (3)	Ground	Fig.7	24.45	24.5	1.012	0.527	0.533	0.00
1909.8	810	GPRS (3)	Ground	/	24.33	24.5	1.040	0.505	0.525	0.15

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

Table 14.9:SAR Values (WCDMA Band II –Hotspot)

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1880	9800	12.2K RMC	Phantom	/	21.84	22	1.038	0.636	0.660	0.06
1880	9800	12.2K RMC	Ground	/	21.84	22	1.038	0.835	0.866	0.13
1880	9800	12.2K RMC	Left	/	21.84	22	1.038	0.297	0.308	-0.04
1880	9800	12.2K RMC	Right	/	21.84	22	1.038	0.347	0.360	0.12
1880	9800	12.2K RMC	Bottom	Fig.8	21.84	22	1.038	1.07	1.110	0.10
1852.4	9662	12.2K RMC	Bottom	/	21.48	22	1.127	0.780	0.879	0.12
1907.6	9938	12.2K RMC	Bottom	/	21.91	22	1.021	0.810	0.827	0.09
1852.4	9662	12.2K RMC	Ground	/	21.48	22	1.127	0.721	0.813	0.13
1907.6	9938	12.2K RMC	Ground	/	21.91	22	1.021	0.660	0.674	0.11
SIM2										
1880	9800	12.2K RMC	Bottom	/	21.84	22	1.038	0.942	0.978	0.10
Repeated										
1880	9800	12.2K RMC	Bottom	Fig.9	21.84	22	1.038	1.06	1.1	-0.10

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

Table 14.10: SAR Values (WCDMA Band V –Hotspot)

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	4175	12.2K RMC	Phantom	/	22.41	22.5	1.021	0.381	0.389	0.01
836.6	4175	12.2K RMC	Ground	/	22.41	22.5	1.021	0.675	0.689	0.06
836.6	4175	12.2K RMC	Left	/	22.41	22.5	1.021	0.257	0.262	0.13
836.6	4175	12.2K RMC	Right	/	22.41	22.5	1.021	0.300	0.306	0.16
836.6	4175	12.2K RMC	Bottom	/	22.41	22.5	1.021	0.0784	0.080	0.18
826.4	4132	12.2K RMC	Ground	/	22.36	22.5	1.033	0.635	0.656	0.13
846.6	4232	12.2K RMC	Ground	Fig.10	22.27	22.5	1.054	0.77	0.812	0.07

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

Table 14.11:SAR Values (WiFi2450 –Hotspot)

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
2412	1	802.11 b	Phantom	/	9.62	10	1.091	0.03	0.033	0.01
2412	1	802.11 b	Ground	Fig.11	9.62	10	1.091	0.053	0.058	0.14
2412	1	802.11 b	Left	/	9.62	10	1.091	0.009	0.010	0.13
2412	1	802.11 b	Right	/	9.62	10	1.091	0.027	0.029	0.16
2412	1	802.11 b	Top	/	9.62	10	1.091	0.03	0.033	0.18

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

SAR results for Standard procedure

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

Table 14.12: SAR Values for Head

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	190	Left	Touch	Fig.1	32.52	33	1.117	0.411	0.459	0.18
1850.2	512	Right	Touch	Fig.2	28.48	28.5	1.005	0.289	0.290	0.04
1880	9800	Right	Touch	Fig.3	21.84	22	1.038	0.578	0.600	0.10
846.6	4232	Left	Touch	Fig.4	22.27	22.5	1.054	0.311	0.328	0.11
2412	1	Left	Touch	Fig.5	9.62	10	1.091	0.264	0.288	0.07

Table 14.13: SAR Values for Hotspot/Body worn

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
848.8	251	GPRS (4)	Ground	Fig.6	27.14	27.5	1.086	0.639	0.694	0.11
1850.2	512	GPRS (3)	Ground	Fig.7	24.45	24.5	1.012	0.527	0.533	0.00
1880	9800	12.2K RMC	Bottom	Fig.8	21.84	22	1.038	1.07	1.110	0.10
1880	9800	12.2K RMC	Bottom	Fig.9	21.84	22	1.038	1.06	1.1	-0.10
846.6	4232	12.2K RMC	Ground	Fig.10	22.27	22.5	1.054	0.77	0.812	0.07
2412	1	802.11 b	Ground	Fig.11	9.62	10	1.091	0.053	0.058	0.14

15. SAR Measurement Variability

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

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

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

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

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

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

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

Frequency		Test Position	Original SAR (W/kg)	First Repeated SAR (W/kg)	second repeated (1g)(W/kg)	The Ratio
MHz	Ch.					
1880	9800	Bottom	1.07	1.08	N/A	1.009

Note: According to the KDB 865664 D01repeated measurement is not required when the original highest measured SAR is < 0.8 W/kg.

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 (meas.)	2.5	N	1	0.6	0.49	1.5	1.2	∞
Combined Std Uncertainty						±11.2%	±10.9%	387
Expanded Std Uncertainty						**±22.4 %**	**±21.8 %**	

17. Main Test Instrument

Table 17.1: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	N5242A	MY51221755	Jan 6, 2017	1 year
02	Power meter	NRVD	102257	May 12, 2016	1 year
03	Power sensor	NRV-Z5	100241		
			100644		
04	Signal Generator	E4438C	MY49072044	Jan 6, 2017	1 Year
05	Amplifier	NTWPA-0086010F	12023024	No Calibration Requested	
06	Coupler	778D	MY4825551	May 12, 2016	1 year
07	BTS	E5515C	MY50266468	Jan 18, 2016	1 year
08	E-field Probe	EX3DV4	7375	Dec 8, 2016	1 year
			3754	Jan 13, 2017	
09	DAE	SPEAG DAE3	360	Nov 8, 2016	1 year
		SPEAG DAE4	1244	Dec 12,2016	
10	Dipole Validation Kit	SPEAG D835V2	4d112	Oct 22, 2015	Two year
		SPEAG D1900V2	5d134	Nov 4,2015	Two year
		SPEAG D2450V2	858	Oct 30,2015	Two year

ANNEX A. GRAPH RESULTS

GSM 850MHz Left Cheek Middle

Date/Time: 2017/1/14
Electronics: DAE3 Sn360
Medium: Head 835MHz
Medium parameters used: f = 837 MHz; σ = 0.899 S/m; ε_r = 41.486; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: GSM Professional 835MHz; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Probe: EX3DV4 - SN7375ConvF(9.73, 9.73, 9.73); Calibrated: 12/8/2016
GSM 850MHz Left Cheek Middle/Area Scan (121x71x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.490 W/kg
GSM 850MHz Left Cheek Middle/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.839 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.507 W/kg
SAR(1 g) = 0.411 W/kg; SAR(10 g) = 0.314 W/kg
Maximum of SAR (measured) = 0.432 W/kg

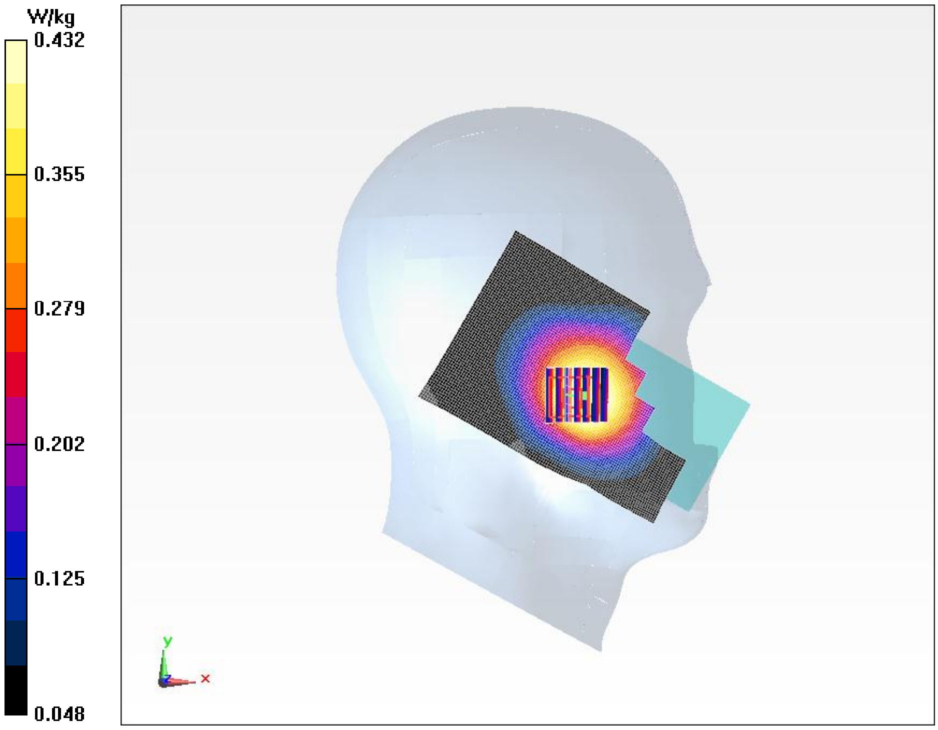


Fig.1 GSM 850MHz Left Cheek Middle

GSM 1900MHz Right Cheek Low

Date/Time: 2017/1/15
Electronics: DAE3 Sn360
Medium: Head 1900MHz
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.402 S/m; ε_r = 40.472; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: GSM Professional 1900MHz; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3
Probe: EX3DV4 - SN7375ConvF(7.92, 7.92, 7.92); Calibrated: 12/8/2016
GSM 1900MHz Right Cheek Low/Area Scan (121x71x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.337 W/kg
GSM 1900MHz Right Cheek Low/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.865 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.439 W/kg
SAR(1 g) = 0.289 W/kg; SAR(10 g) = 0.184 W/kg
Maximum value of SAR (measured) = 0.321 W/kg

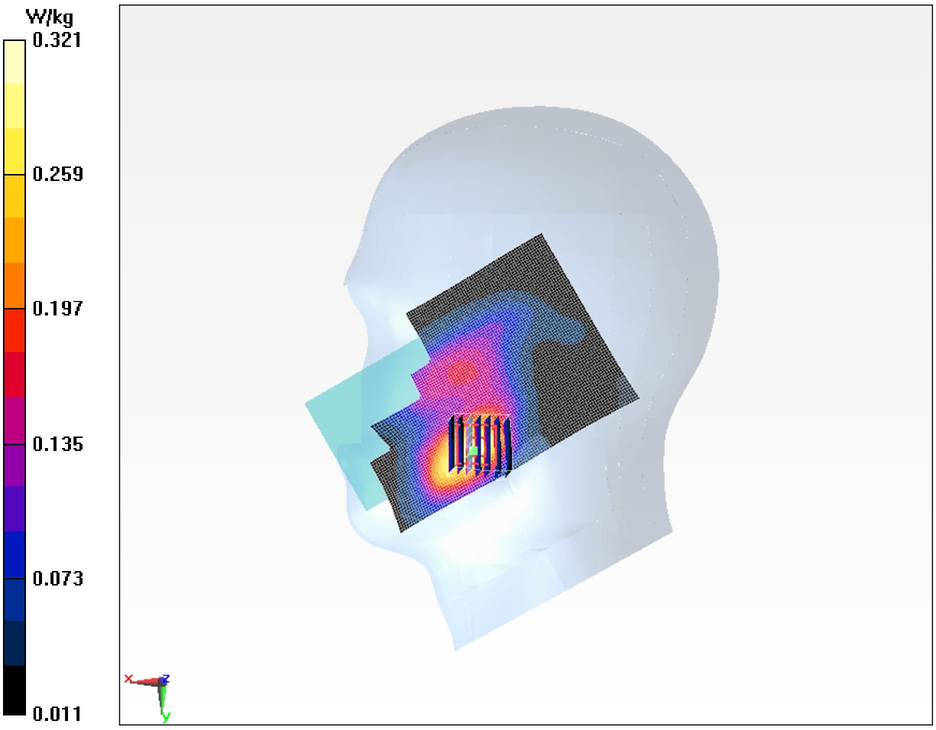


Fig.2 GSM 1900MHz Right Cheek Low

WCDMA Band 2 Right Cheek Middle

Date/Time: 2017/1/15
Electronics: DAE3 Sn360
Medium: Head 1900MHz
Medium parameters used: f = 1880 MHz; σ = 1.409 S/m; ε_r = 40.167; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: WCDMA Professional Band Ⅱ; Frequency: 1880 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN7375ConvF(7.92, 7.92, 7.92); Calibrated: 12/8/2016
WCDMA Band 2 Right Cheek Middle/Area Scan (121x71x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.565 W/kg
WCDMA Band 2 Right Cheek Middle/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.979 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.901 W/kg
SAR(1 g) = 0.578 W/kg; SAR(10 g) = 0.355 W/kg
Maximum value of SAR (measured) = 0.635 W/kg

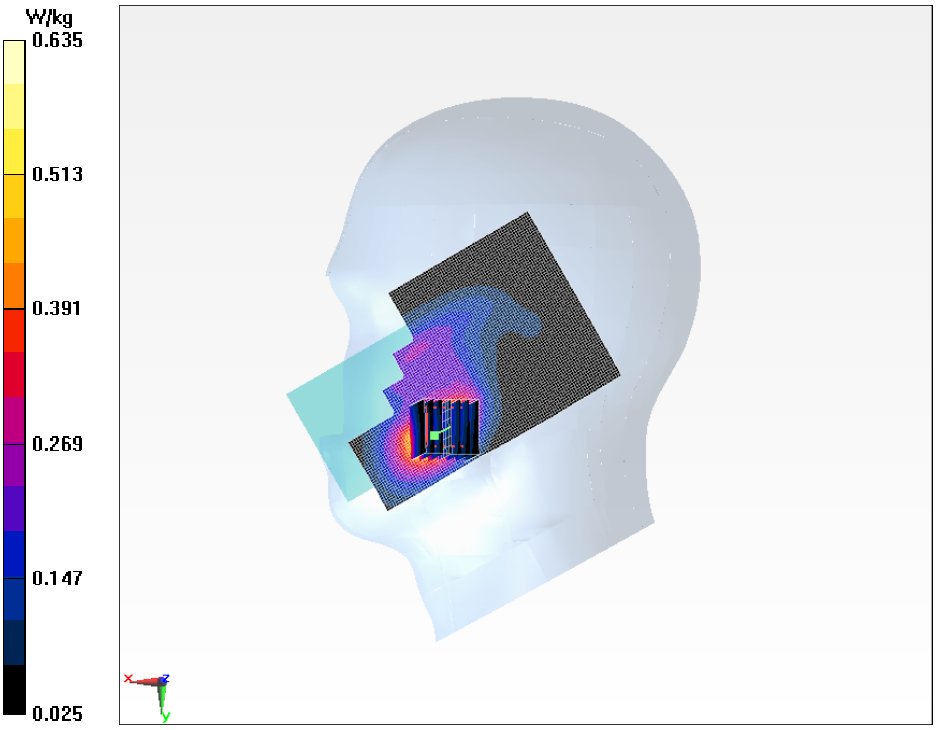


Fig.3 WCDMA Band 2 Right Cheek Middle

WCDMA Band5 Left Cheek High

Date/Time: 2017/1/14
Electronics: DAE3 Sn360
Medium: Head 835MHz
Medium parameters used: f = 847 MHz; σ = 0.925 S/m; ε_r = 41.309; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: WCDMA Professional 835MHz; Frequency: 846.6 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN7375ConvF(9.73, 9.73, 9.73); Calibrated: 12/8/2016
WCDMA Band5 Left Cheek High/Area Scan (121x71x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.330 W/kg
WCDMA Band5 Left Cheek High/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.275 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 0.396 W/kg
SAR(1 g) = 0.311 W/kg; SAR(10 g) = 0.231 W/kg
Maximum value of SAR (measured) = 0.332 W/kg

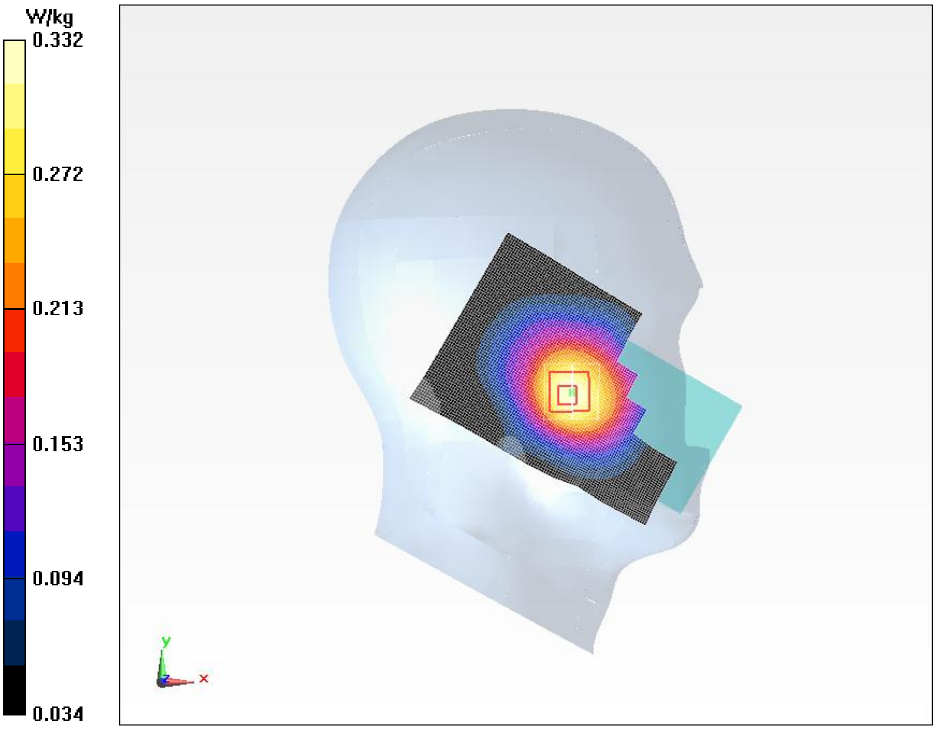


Fig.4 WCDMA Band5 Left Cheek High

WiFi 802.11b Left Cheek Low

Date/Time: 2017/2/7
Electronics: DAE4 Sn1244
Medium: Head 2450MHz
Medium parameters used: f = 2412 MHz; σ = 1.802 S/m; ε_r = 39.551; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: Wifi 2450 2450MHz; Frequency: 2412 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3754ConvF(7.26, 7.26, 7.26); Calibrated: 1/13/2017
WiFi 802.11b Left Cheek Low/Area Scan (121x71x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.306 W/kg
WiFi 802.11b Left Cheek Low/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.855 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.653 W/kg
SAR(1 g) = 0.264 W/kg; SAR(10 g) = 0.120 W/kg
Maximum value of SAR (measured) = 0.294 W/kg

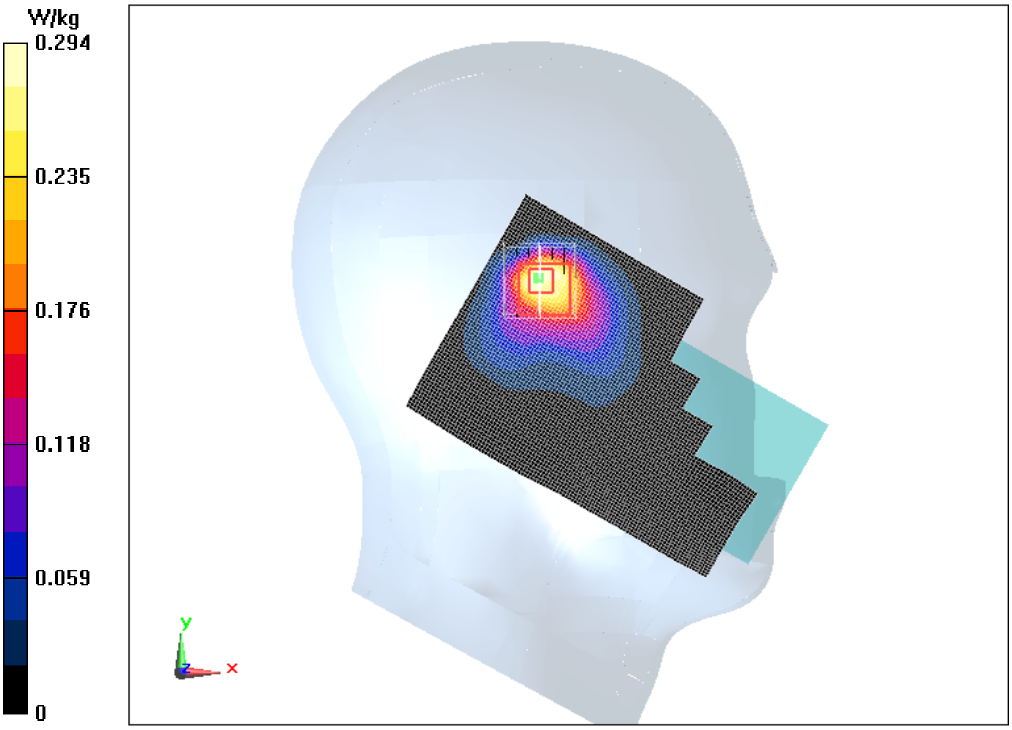


Fig.5 WiFi 802.11b Left Cheek Low

GPRS 850MHz 4TS Ground1 Mode High

Date/Time: 2017/1/14
Electronics: DAE3 Sn360
Medium: Body 850MHz
Medium parameters used: f = 849 MHz; σ = 1.012 S/m; ε_r = 56.205; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: GSM 850MHz GPRS 4TS (0); Frequency: 848.8 MHz; Duty Cycle: 1:2
Probe: EX3DV4 - SN7375ConvF(9.94, 9.94, 9.94); Calibrated: 12/8/2016

GPRS 850MHz 4TS Ground1 Mode High/Area Scan (71x111x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.667 W/kg

GPRS 850MHz 4TS Ground1 Mode High/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 22.69 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 0.848 W/kg
SAR(1 g) = 0.639 W/kg; SAR(10 g) = 0.472 W/kg
Maximum value of SAR (measured) = 0.676 W/kg

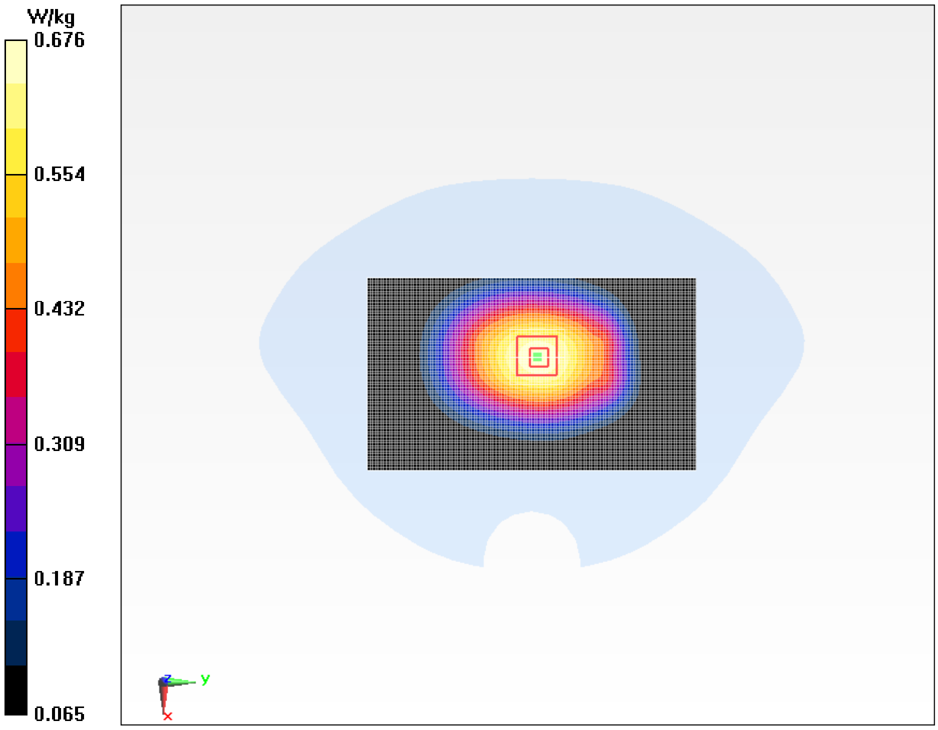


Fig.6 GPRS 850MHz 4TS Ground1 Mode High

GPRS 1900MHz 3TS Ground Mode Low

Date/Time: 2017/1/15
Electronics: DAE3 Sn360
Medium: Body 1900MHz
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.505 S/m; ε_r = 53.74; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: GSM 1900MHz GPRS 3TS (0); Frequency: 1850.2 MHz; Duty Cycle: 1:2.77
Probe: EX3DV4 - SN7375ConvF(7.62, 7.62, 7.62); Calibrated: 12/8/2016
GPRS 1900MHz 3TS Ground Mode Low/Area Scan (71x131x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.580 W/kg
GPRS 1900MHz 3TS Ground Mode Low/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.151 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.816 W/kg
SAR(1 g) = 0.527 W/kg; SAR(10 g) = 0.332 W/kg
Maximum value of SAR (measured) = 0.568 W/kg

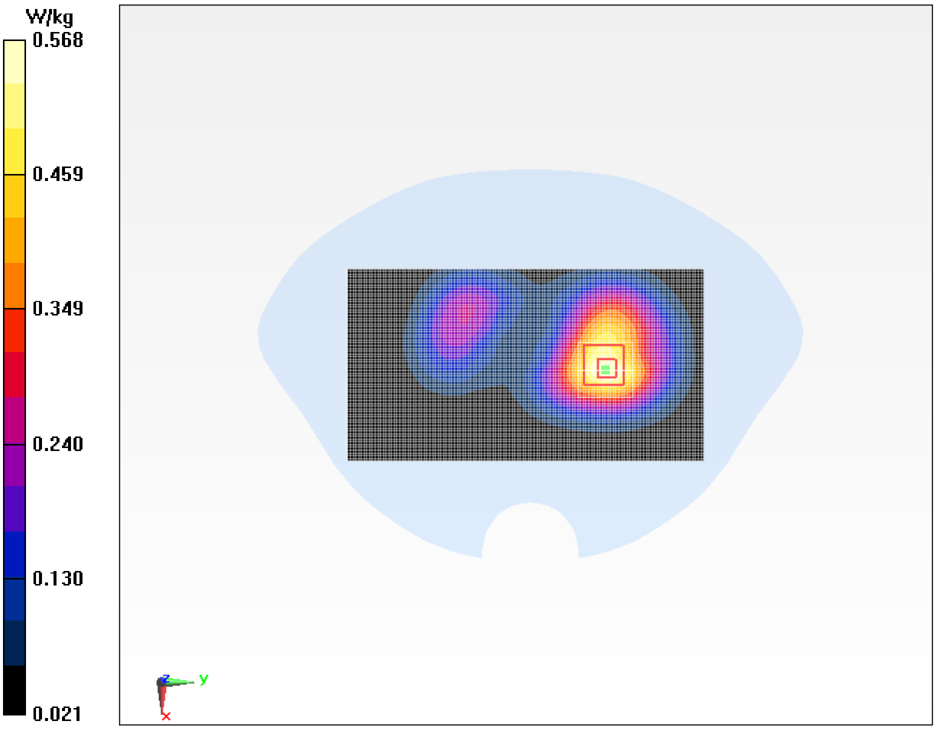


Fig.7 GPRS 1900MHz 3TS Ground Mode Low

WCDMA Band 2 Bottom Mode Middle

Date/Time: 2017/1/15
Electronics: DAE3 Sn360
Medium: Body 1900MHz
Medium parameters used: f = 1880 MHz; σ = 1.534 S/m; ε_r = 53.619; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: WCDMA Professional Band Ⅱ; Frequency: 1880 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN7375ConvF(7.62, 7.62, 7.62); Calibrated: 12/8/2016

WCDMA Band 2 Bottom Mode Middle/Area Scan (31x71x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 1.09 W/kg

WCDMA Band 2 Bottom Mode Middle/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.86 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 1.83 W/kg
SAR(1 g) = 1.07 W/kg; SAR(10 g) = 0.591 W/kg
Maximum value of SAR (measured) = 1.20 W/kg

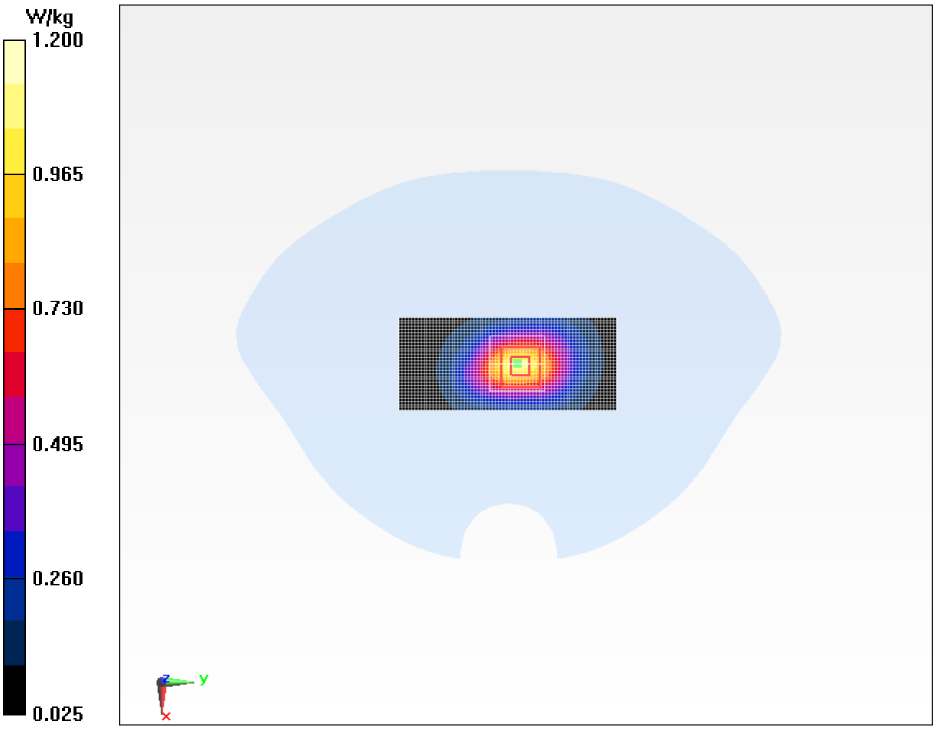


Fig.8 WCDMA Band 2 Bottom Mode Middle

WCDMA Band 2 Bottom Mode Middle repeated

Date/Time: 2017/1/15
Electronics: DAE3 Sn360
Medium: Body 1900MHz
Medium parameters used: f = 1880 MHz; σ = 1.534 S/m; ε_r = 53.619; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: WCDMA Professional Band Ⅱ; Frequency: 1880 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN7375ConvF(7.62, 7.62, 7.62); Calibrated: 12/8/2016

WCDMA Band 2 Bottom Mode Middle repeated/Area Scan (31x71x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 1.09 W/kg

WCDMA Band 2 Bottom Mode Middle repeated/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.49 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 1.79 W/kg
SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.588 W/kg
Maximum value of SAR (measured) = 1.21 W/kg

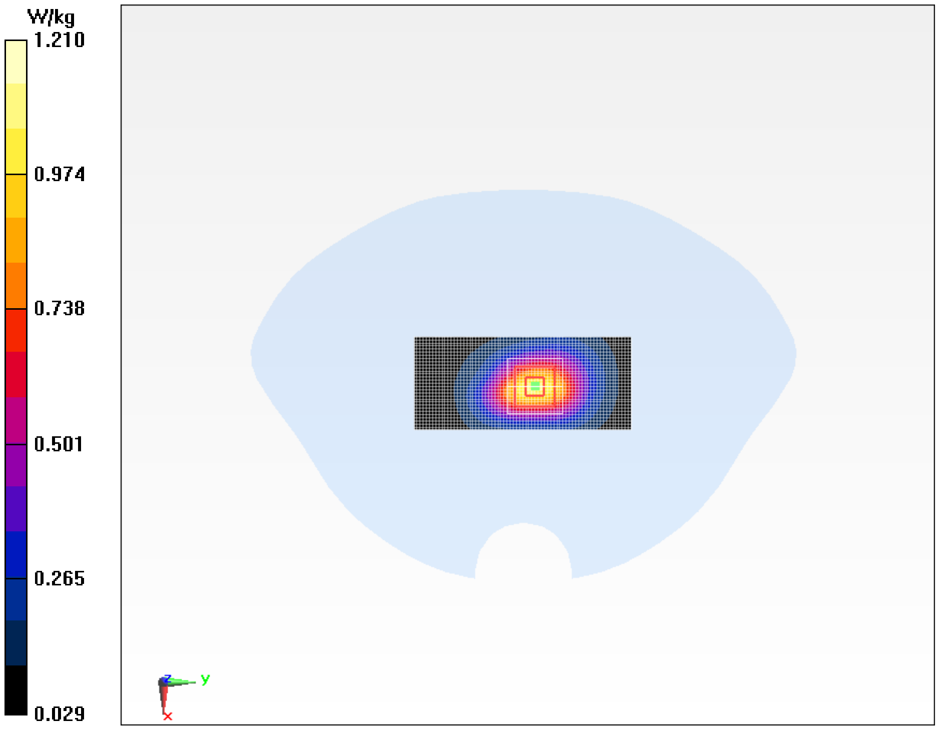


Fig.9 WCDMA Band 2 Bottom Mode Middle repeated

WCDMA Band5 Ground Mode High

Date/Time: 2017/1/14
Electronics: DAE3 Sn360
Medium: Body 850MHz
Medium parameters used: f = 847 MHz; σ = 1.009 S/m; ε_r = 56.214; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: WCDMA Professional Band Ⅴ; Frequency: 846.6 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN7375ConvF(9.94, 9.94, 9.94); Calibrated: 12/8/2016

WCDMA Band5 Ground Mode High/Area Scan (71x121x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.810 W/kg

WCDMA Band5 Ground Mode High/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.61 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.987 W/kg
SAR(1 g) = 0.770 W/kg; SAR(10 g) = 0.575 W/kg
Maximum value of SAR (measured) = 0.819 W/kg

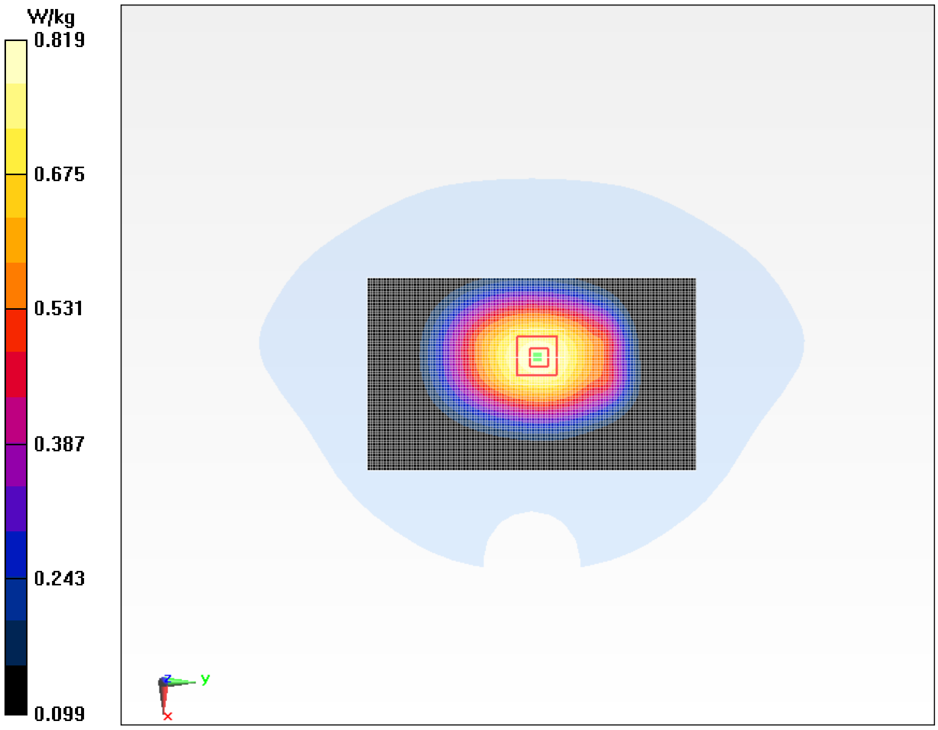


Fig.10 WCDMA Band5 Ground Mode High

WiFi 802.11b Ground Mode Low

Date/Time: 2017/2/7
Electronics: DAE4 Sn1244
Medium: Body 2450MHz
Medium parameters used: f = 2412 MHz; σ = 1.859 S/m; ε_r = 53.625; ρ = 1000 kg/m^3
Ambient Temperature:22 ℃ Liquid Temperature:22 ℃
Communication System: Wifi 2450 2450MHz; Frequency: 2412 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3754ConvF(7.22, 7.22, 7.22); Calibrated: 1/13/2017
WiFi 802.11b Ground Mode Low/Area Scan (71x111x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.0892 W/kg
WiFi 802.11b Ground Mode Low/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.461 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 0.117 W/kg
SAR(1 g) = 0.053 W/kg; SAR(10 g) = 0.027 W/kg
Maximum of SAR (measured) = 0.0552 W/kg

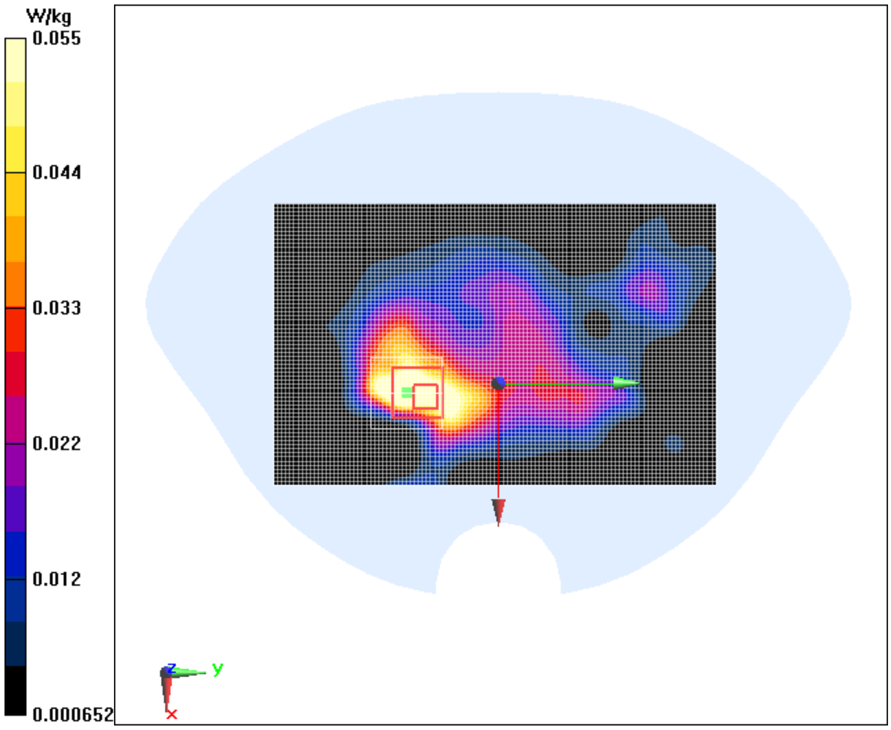


Fig.11 WiFi 802.11b Ground Mode Low

ANNEX B. SYSTEM VALIDATION RESULTS

835 MHz

Date/Time: 2017/1/14

Electronics: DAE3 Sn360

Medium: Head 835MHz

Medium parameters used: f = 835 MHz; σ = 0.898 S/m; ε_r = 41.512; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CW 835MHz; Frequency: 835 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN7375ConvF(9.73, 9.73, 9.73);

System Validation /Area Scan (60x120x1):

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

Maximum value of SAR (Measurement) = 2.81 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0:

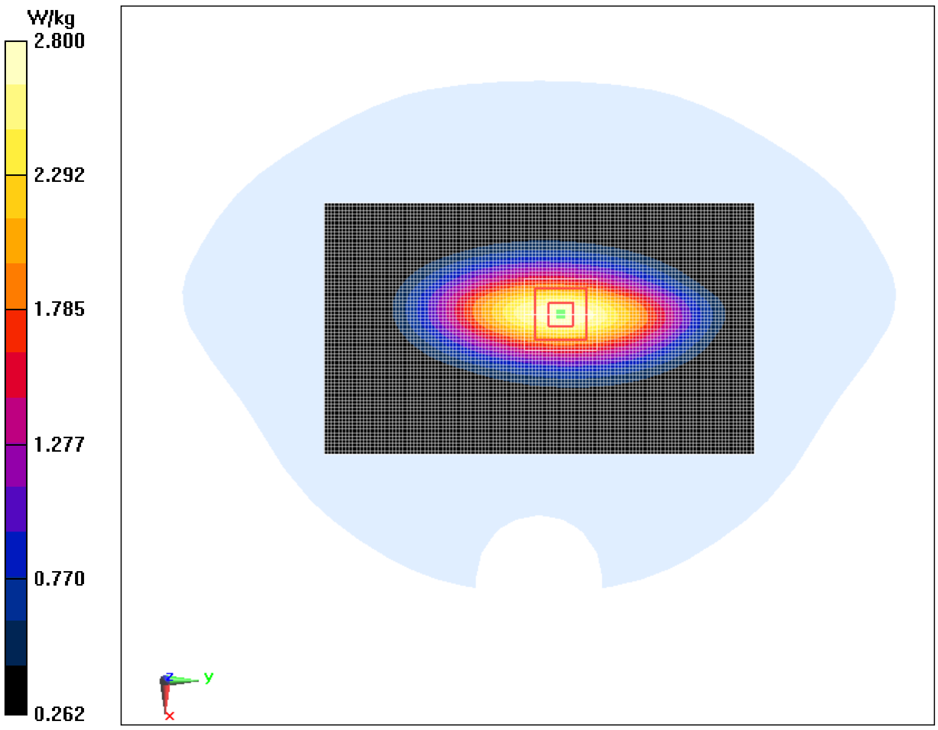
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.89 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 3.16 W/kg

SAR(1 g) = 2.30W/kg; SAR(10 g) = 1.50 W/kg

Maximum value of SAR (measured) = 2.80 W/kg



1900MHz

Date/Time: 2017/1/15

Electronics: DAE3 Sn360

Medium: Head 1900MHz

Medium parameters used: f = 1900 MHz; σ = 1.386 S/m; ε_r = 39.631; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CW 1900MHz; Frequency: 1900 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN7375ConvF (7.92, 7.92, 7.92);

System check Validation /Area Scan (60x60x1):

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

Maximum value of SAR (Measurement) = 15.4 W/kg

System check Validation /Zoom Scan (7x7x7) /Cube 0:

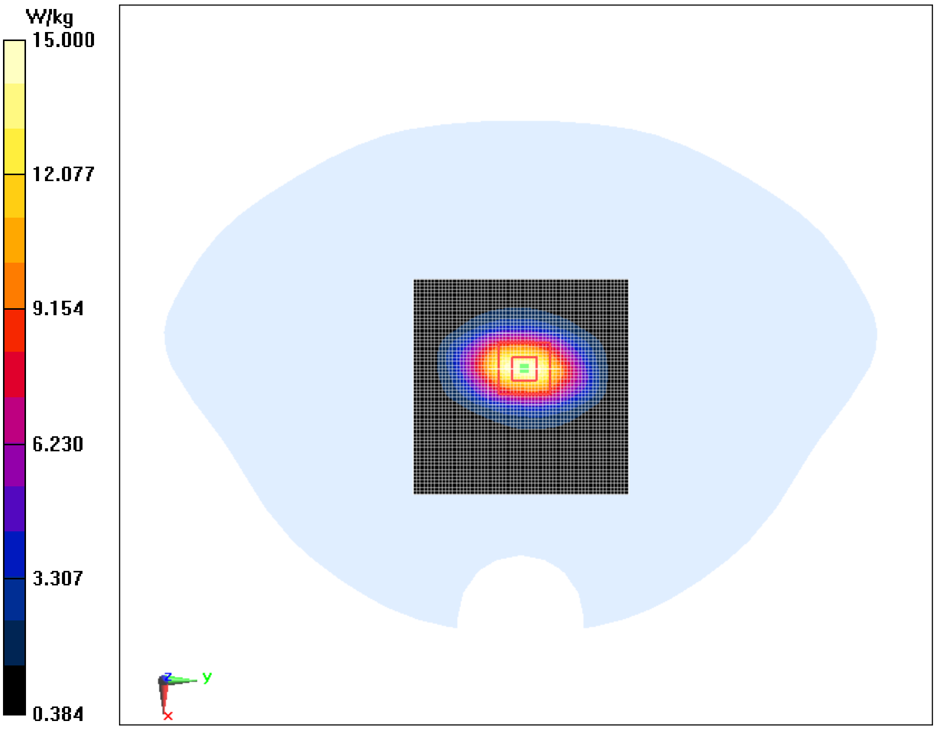
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 105.1 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 19.3 W/kg

SAR(1 g) = 9.89 W/kg; SAR(10 g) = 5.14 W/kg

Maximum value of SAR (measured) = 15.0 W/kg



2450MHz

Date/Time: 2017/2/7

Electronics: DAE4 Sn1244

Medium: Head 2450MHz

Medium parameters used: f = 2450 MHz; σ = 1.812 S/m; ε_r = 39.113; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CW 2450MHz; Frequency: 2450 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN3754ConvF(7.26, 7.26, 7.26);

System Validation /Area Scan (40x80x1):

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

Maximum value of SAR (Measurement) = 21.2 W/kg

System Validation/Zoom Scan (7x7x7) /Cube 0:

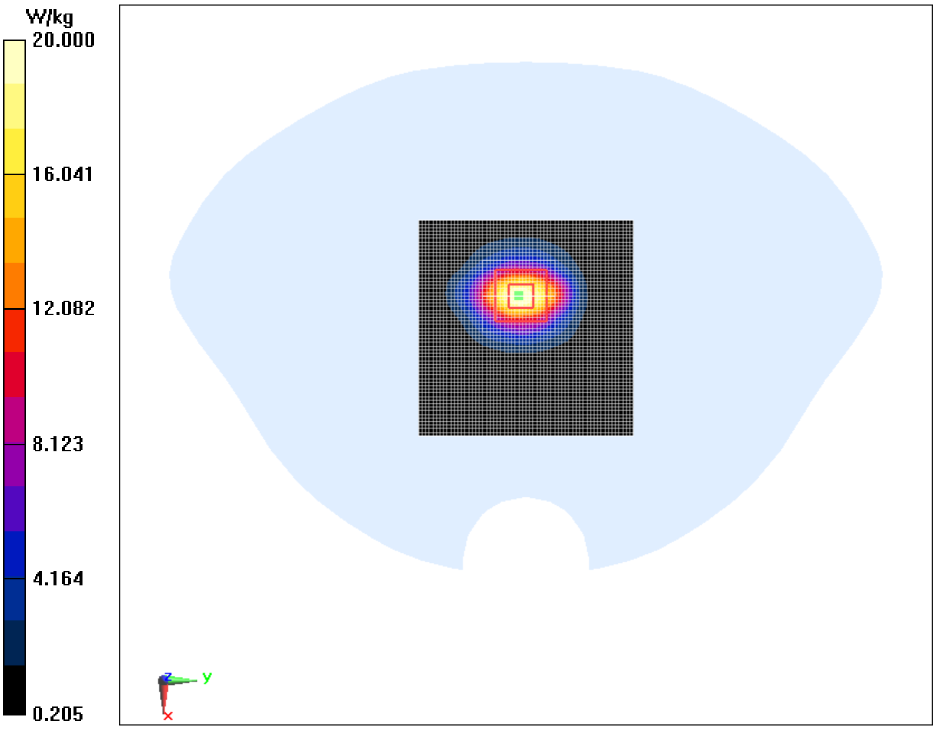
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.3 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 26.6 W/kg

SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.13 W/kg

Maximum value of SAR (measured) = 20.0 W/kg



835 MHz Body

Date/Time: 2017/1/14

Electronics: DAE3 Sn360

Medium: Body 835MHz

Medium parameters used: f = 835 MHz; σ = 1.002 S/m; ε_r = 56.158; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CW 850MHz; Frequency: 835 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN7375ConvF (9.94, 9.94, 9.94);

System Validation/Area Scan (60x120x1):

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

Maximum value of SAR (Measurement) = 2.79 W/kg

System Validation/Zoom Scan(7x7x7)/Cube 0:

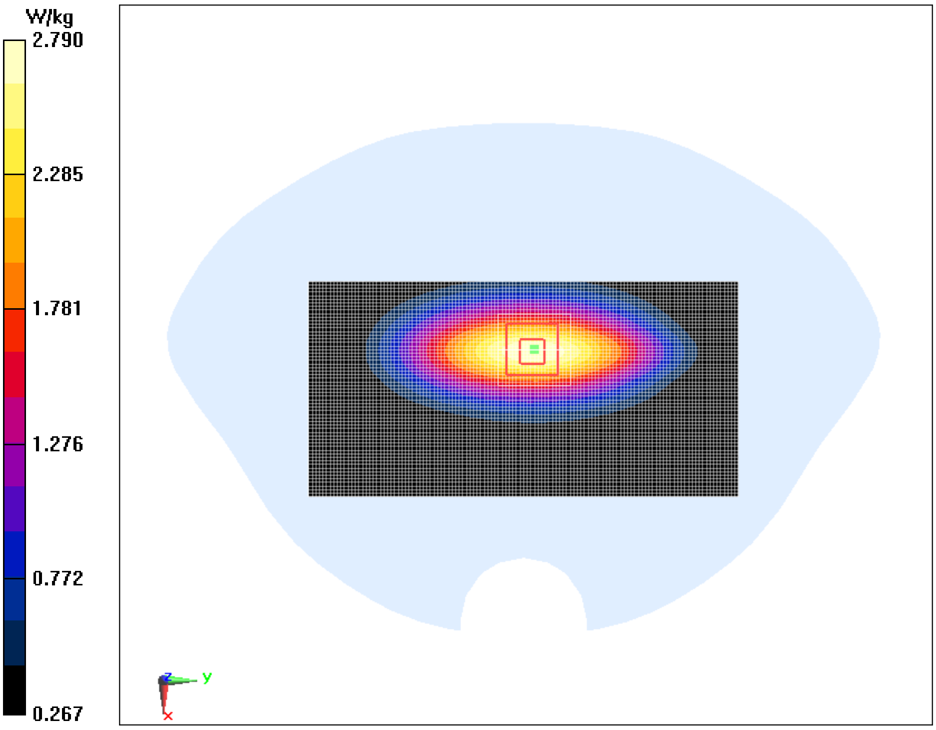
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.31 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 3.55 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.54 W/kg

Maximum value of SAR (measured) = 2.79 W/kg



1900MHz Body

Date/Time: 2017/1/15

Electronics: DAE3 Sn360

Medium: Body 1900MHz

Medium parameters used: f = 1900 MHz; σ = 1.526 S/m; ε_r = 53.234; ρ = 1000 kg/m^3

Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃

Communication System: CW 1900MHz; Frequency: 1900 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN7375ConvF (7.62, 7.62, 7.62);

System Validation/Area Scan (60x90x1):

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

Maximum value of SAR (Measurement) = 13.8 W/kg

System Validation/Zoom Scan(7x7x7)/Cube 0:

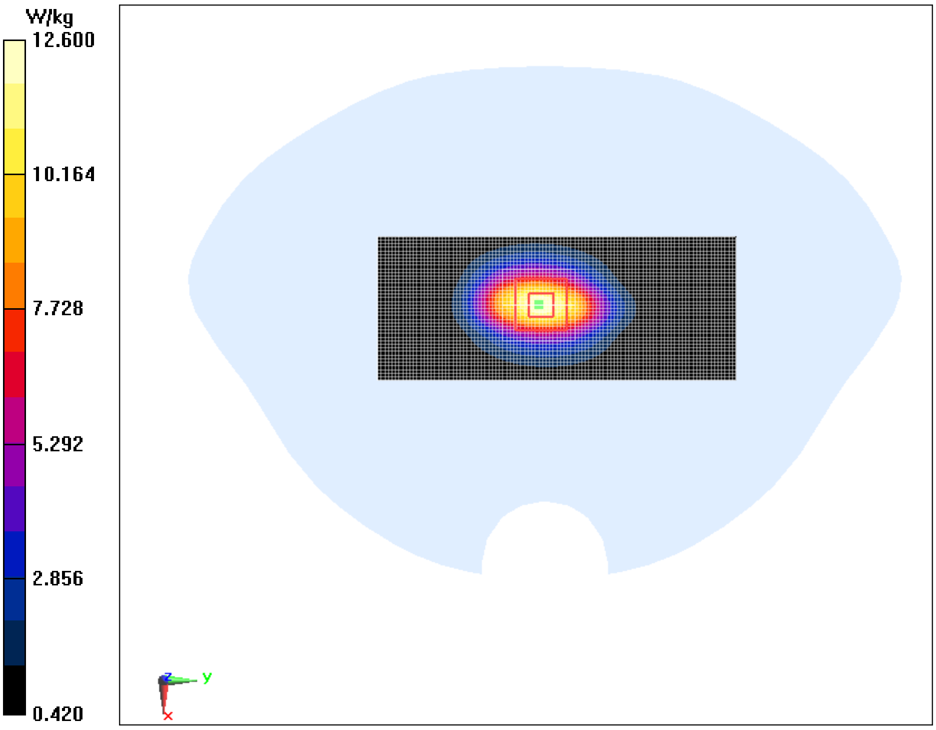
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.21 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 18.8 W/kg

SAR(1 g) = 9.89 W/kg; SAR(10 g) = 5.14 W/kg

Maximum value of SAR (measured) = 12.6 W/kg



2450MHz Body

Date/Time: 2017/2/7

Electronics: DAE4 Sn1244

Medium: Body 2450 MHz

Medium parameters used: f = 2450 MHz; σ = 1.921 S/m; εr = 53.936; 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(7.22, 7.22, 7.22);

System Validation/ Area Scan (100x100x1):

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

Maximum value of SAR (measured) = 22.76 W/kg

System Validation/Zoom Scan (7x7x7)/Cube 0:

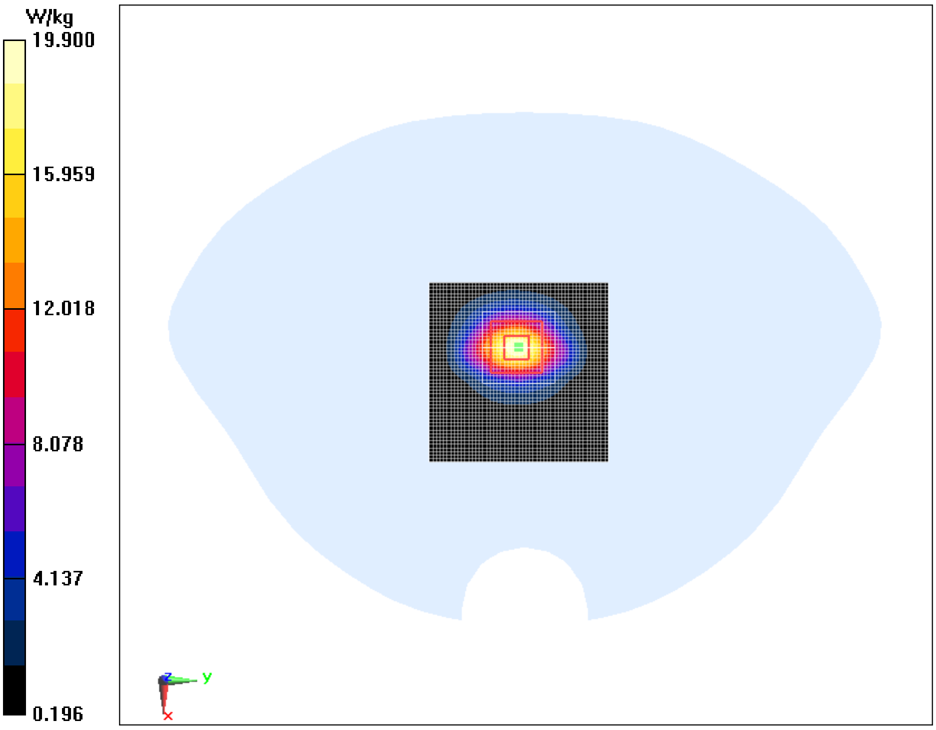
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.3 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 28.18 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.11 W/kg

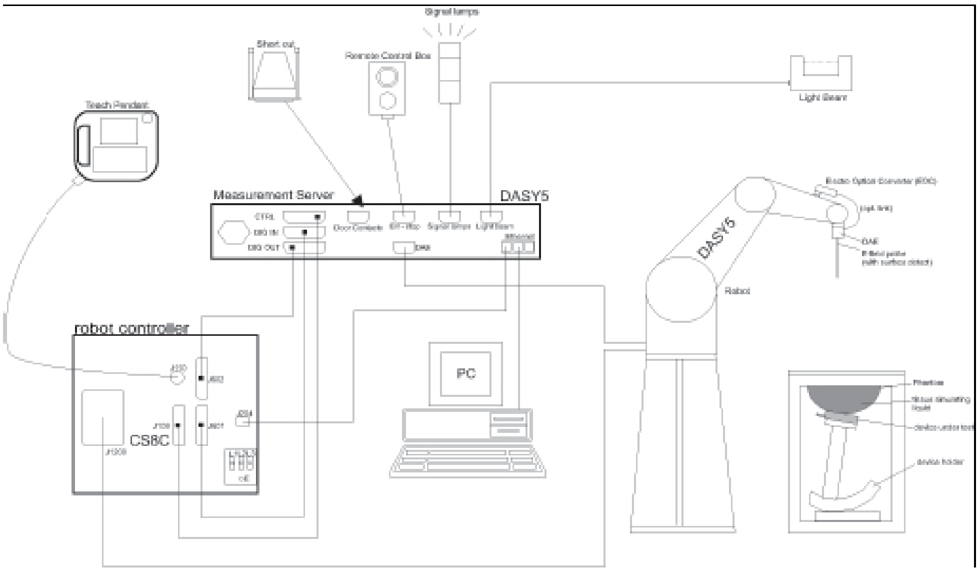
Maximum value of SAR (measured) = 19.9 W/kg



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 2ndord curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:

Model: ES3DV3, EX3DV4

Frequency Range: 700MHz — 2.6GHz(ES3DV3)

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

Linearity: ± 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.

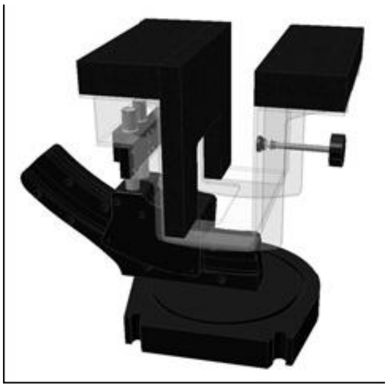
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference 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 90^{th} percentile of the population. The phantom enables the dissymmetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

Shell Thickness: 2 ± 0. 2 mm

Filling Volume: Approx. 25 liters

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

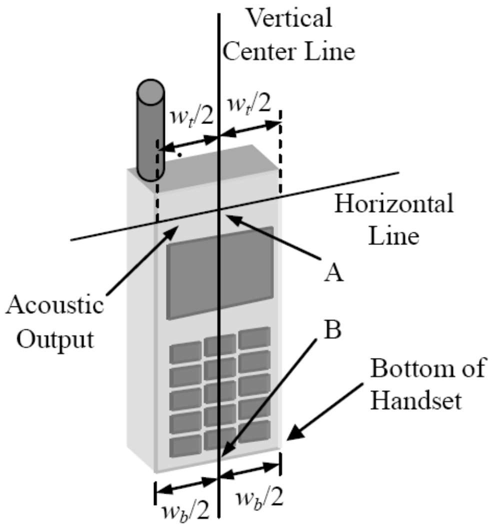
Available: Special

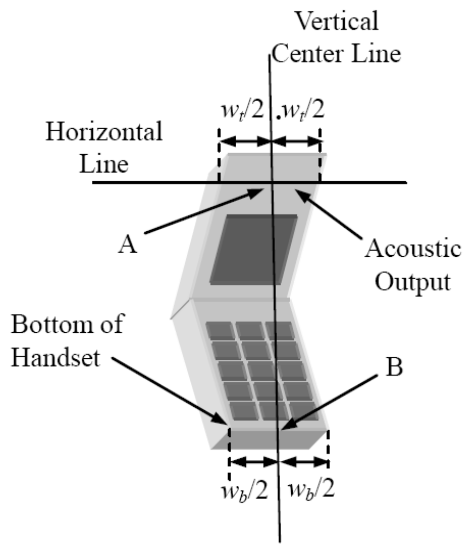
Picture C.9: SAM Twin Phantom

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

D.1. General considerations

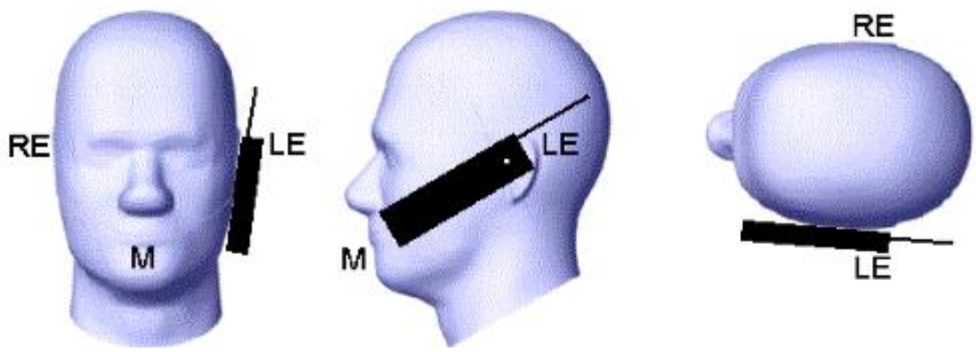
This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.



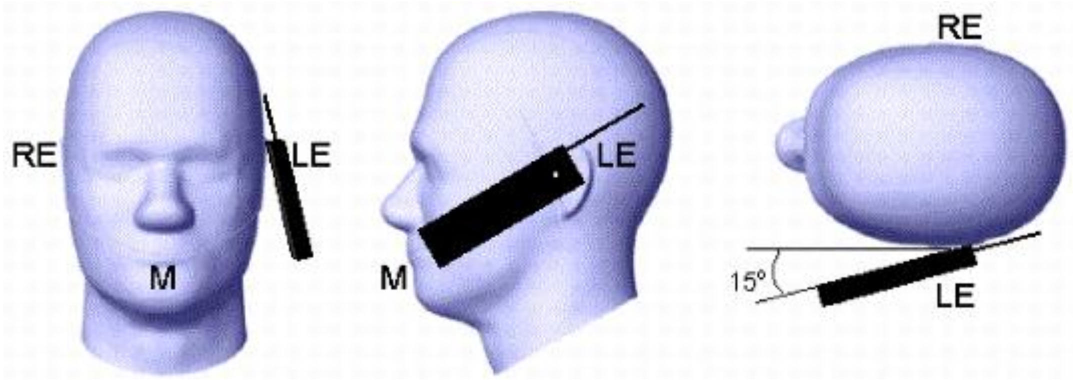


w_t	Width of the handset at the level of the acoustic
w_b	Width of the bottom of the handset
A	Midpoint of the width w_t of the handset at the level of the acoustic output
B	Midpoint of the width w_b of the bottom of the handset

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



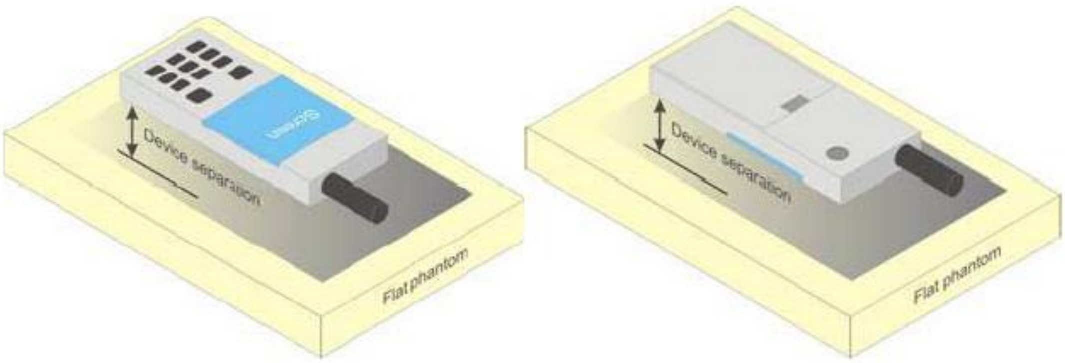
Picture D.2 Cheek position of the wireless device on the left side of SAM



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.

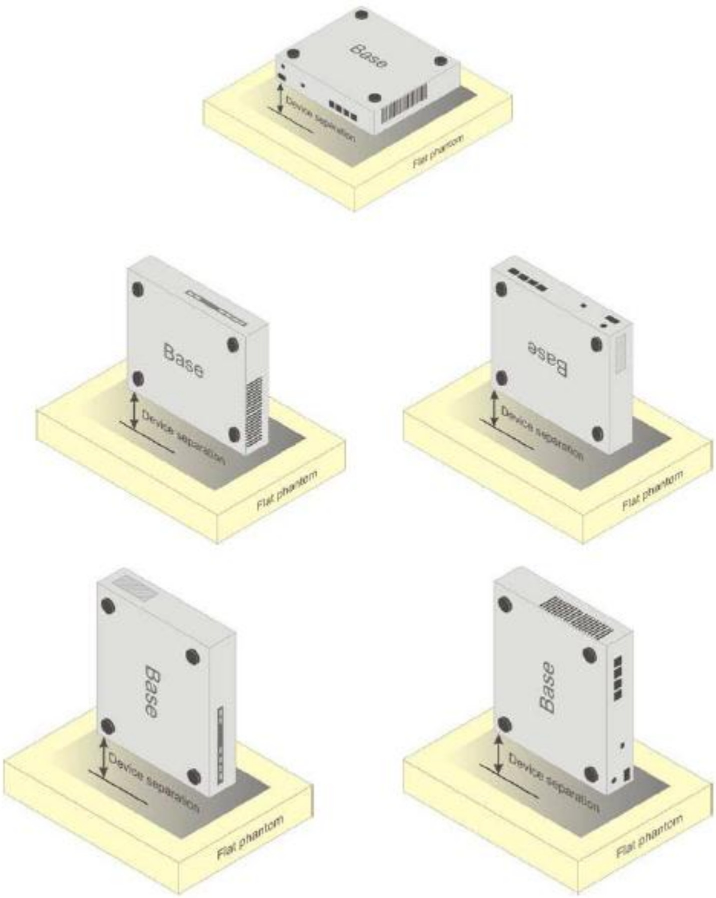


Picture D.4Test positions for body-worn devices

D.3. Desktop device

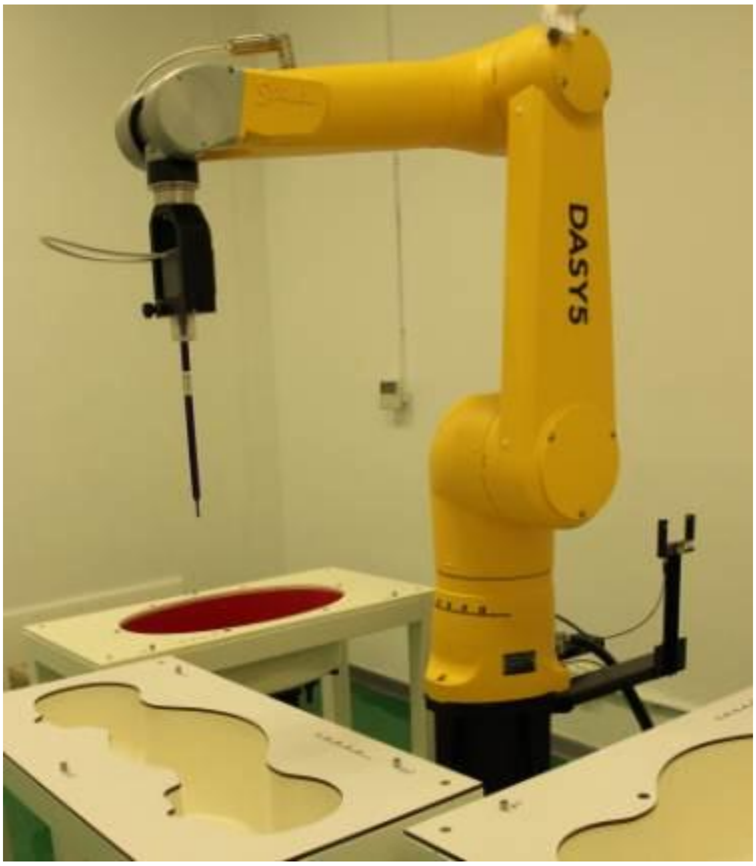
A typical example of a desktop device is a wireless enabled desktop computer placed on a table or desk when used.

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 bevalidated with the SAR system(s) that operates with such components.

Table F.1: System Validation Part 1

System No.	Probe SN.	Liquid name	Validation date	Frequency point	**Permittivity ε**	**Conductivity σ (S/m)**
1	7375	Head 835MHz	Jan 14, 2017	835MHz	41.51	0.898
2	7375	Head 1900MHz	Jan 15, 2017	1900MHz	39.63	1.386
3	3754	Head 2450MHz	Feb 7, 2017	2450MHz	39.11	1.812
4	7375	Body 835MHz	Jan 14, 2017	835MHz	56.16	1.002
5	7375	Body 1900MHz	Jan 15, 2017	1900MHz	53.23	1.526
6	3754	Body 2450MHz	Feb 7, 2017	2450MHz	53.94	1.921

Table F.2: System Validation Part 2

CW Validation	Sensitivity	PASS	PASS
	Probe linearity	PASS	PASS
	Probe Isotropy	PASS	PASS
Mod Validation	MOD.type	GMSK	GMSK
	MOD.type	OFDM	OFDM
	Duty factor	PASS	PASS
	PAR	PASS	PASS

ANNEX G. Probe and DAE Calibration Certificate

In Collaboration with speag CALIBRATION LABORATORY
中国认可 国际互认 校准 CALIBRATION CNAS L0570
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Client : Auden Certificate No: Z16-97204

CALIBRATION CERTIFICATE

Object	DAE3 - SN: 360
Calibration Procedure(s)	FD-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	November 08, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	27-June-16 (CTTL, No:J16X04778)	June-17

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: November 09, 2016

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

Certificate No: Z16-97204 Page 1 of 3

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speag
CALIBRATION LABORATORY
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E-mail: cttl@chinattl.com Http://www.chinattl.cn

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.

Certificate No: Z16-97204 Page 2 of 3