



SAR TEST REPORT

No. I17N00558-SAR

For

Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd

Smart Watch

Model Name: coolpad 301A

With

Hardware Version: V2

Software Version: GROVCN00X1000DPX1706083

FCC:R38YL301A

Issued Date: 2017-07-06

Note:

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

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REPORT HISTORY

Report Number	Revision	Issue Date	Description
I17N00558-SAR	Rev.0	2017-07-06	Initial creation of test report

TABLE OF CONTENT

1 TEST LABORATORY	5
1.1 TESTING LOCATION	5
1.2 TESTING ENVIRONMENT	5
1.3 PROJECT DATA.....	5
1.4 SIGNATURE.....	5
2 STATEMENT OF COMPLIANCE.....	6
3 CLIENT INFORMATION.....	7
3.1 APPLICANT INFORMATION.....	7
3.2 MANUFACTURER INFORMATION.....	7
4 EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE)	8
4.1 ABOUT EUT	8
4.2 INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST	8
4.3 INTERNAL IDENTIFICATION OF AE USED DURING THE TEST	8
5 TEST METHODOLOGY.....	9
5.1 APPLICABLE LIMIT REGULATIONS.....	9
5.2 APPLICABLE MEASUREMENT STANDARDS	9
6 SPECIFIC ABSORPTION RATE (SAR)	10
6.1 INTRODUCTION	10
6.2 SAR DEFINITION.....	10
7 TISSUE SIMULATING LIQUIDS	11
7.1 TARGETS FOR TISSUE SIMULATING LIQUID.....	11
7.2 DIELECTRIC PERFORMANCE	11
8 SYSTEM VERIFICATION	14
8.1 SYSTEM SETUP	14
8.2 SYSTEM VERIFICATION.....	15
9 MEASUREMENT PROCEDURES.....	16
9.1 TESTS TO BE PERFORMED	16
9.2 GENERAL MEASUREMENT PROCEDURE.....	17
9.3 WCDMA MEASUREMENT PROCEDURES FOR SAR	18
9.4 BLUETOOTH & WI-FI MEASUREMENT PROCEDURES FOR SAR	19
9.5 SAR MEASUREMENT FOR LTE.....	19
9.6 POWER DRIFT	20
10 CONDUCTED OUTPUT POWER.....	21
10.1 MANUFACTURING TOLERANCE.....	21
10.2 GSM MEASUREMENT RESULT.....	23
10.3 WCDMA MEASUREMENT RESULT	24

10.4 LTE-FDD MEASUREMENT RESULT	26
10.5 WI-FI AND BT MEASUREMENT RESULT	31
11 SIMULTANEOUS TX SAR CONSIDERATIONS	32
11.1 INTRODUCTION.....	32
11.2 ANTENNA LOCATIONS	32
11.3 STANDALONE SAR TEST EXCLUSION CONSIDERATIONS	33
12 EVALUATION OF SIMULTANEOUS.....	34
13 SAR TEST RESULT	35
14 SAR MEASUREMENT VARIABILITY.....	39
15 MEASUREMENT UNCERTAINTY	40
15.1 MEASUREMENT UNCERTAINTY FOR NORMAL SAR TESTS (300MHz~3GHz).....	40
16 MAIN TEST INSTRUMENTS.....	41
ANNEX A GRAPH RESULTS.....	42
ANNEX B SYSTEM VERIFICATION RESULTS	70
ANNEX C SAR MEASUREMENT SETUP	76
C.1 MEASUREMENT SET-UP.....	76
C.2 DASY5 E-FIELD PROBE SYSTEM.....	77
C.3 E-FIELD PROBE CALIBRATION.....	77
C.4 OTHER TEST EQUIPMENT	78
ANNEX D POSITION OF THE WIRELESS DEVICE IN RELATION TO THE PHANTOM	82
D.1 GENERAL CONSIDERATIONS.....	82
D.2 BODY-WORN DEVICE	83
D.3 DESKTOP DEVICE.....	83
D.4 DUT SETUP PHOTOS.....	84
ANNEX E EQUIVALENT MEDIA RECIPES.....	85
ANNEX F SYSTEM VALIDATION	86
ANNEX G DAE CALIBRATION CERTIFICATE.....	87
ANNEX H PROBE CALIBRATION CERTIFICATE.....	92
ANNEX I DIPOLE CALIBRATION CERTIFICATE.....	103

1 Test Laboratory

1.1 Testing Location

Company Name:	CTTL(Shenzhen)
Address:	TCL International E City No.1001 Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province P.R.China

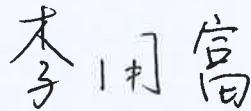
1.2 Testing Environment

Temperature:	18°C~25 °C
Relative humidity:	30%~ 70%
Ground system resistance:	< 4Ω
Ambient noise & Reflection:	< 0.012 W/kg

1.3 Project Data

Project Leader:	Zhang Yunzhuan
Test Engineer:	Li Yongfu
Testing Start Date:	June 25, 2017
Testing End Date:	June 25, 2017

1.4 Signature



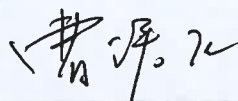
Li Yongfu

(Prepared this test report)



Zhang Yunzhuan

(Reviewed this test report)



Cao JunfeiDeputy Director of the laboratory
(Approved this test report)

2 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd Smart Watchcoolpad 301A are as follows:

Table 2.1: Highest Reported SAR (1g)

Exposure Configuration	Technology Band	Highest Reported SAR	Equipment Class	Limited (W/kg)
Next to the mouth (Separation Distance 10mm) 1g(W/kg)	GSM850	0.47	PCE	1.6
	PCS1900	1.05		
	UMTSFDD 5	0.32		
	UMTSFDD 2	1.32		
	UMTSFDD 4	0.86		
	LTEBand2	1.05		
	LTEBand4	0.93		
wrist-worn (Separation Distance 0mm) 10g(W/kg)	GSM850	0.56	PCE	4.0
	PCS1900	0.74		
	UMTSFDD 5	0.43		
	UMTSFDD 2	0.25		
	UMTSFDD 4	0.97		
	LTEBand2	0.96		
	LTEBand 4	0.78		

The SAR values found for the EUT are below the maximum recommended levels of 1.6 W/Kg as averaged over any 1g tissue and 4.0 W/Kg as averaged over any 10g tissue according to the ANSI C95.1-1999.

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

The measurement together with the test system set-up is described in annex C of this test report. A detailed description of the equipment under test can be found in chapter 4 of this test report.

The highest reported SAR value is obtained at the case of **(Table 2.1)**, and the values are: **1.32W/kg(1g)**.

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

	Position	Main antenna	BT*	Sum	Limited (W/kg)
Highest reported SAR 1g(W/Kg)	Next to the mouth	1.32	0.15	1.47	1.6
Highest reported SAR 10g(W/Kg)	wrist-worn	0.97	0.26	1.23	4.0

BT*-Estimated SAR for Bluetooth (see the table 12.2)

According to the above tables, the highest sum of reported SAR values is **1.47W/kg (1g)**. The detail for simultaneous transmission consideration is described in chapter 12.

3 Client Information

3.1 Applicant Information

Company Name:	Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd
Address /Post:	Coolpad Information Harbor, High-tech Industrial Park (North), Nanshan District, Shenzhen, P.R.C.
Contact:	amei lii
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Telephone:	+86 13410415799
Fax:	/

3.2 Manufacturer Information

Company Name:	Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd
Address /Post:	Coolpad Information Harbor, High-tech Industrial Park (North), Nanshan District, Shenzhen, P.R.C.
Contact:	haocai
Email:	liamei@yulong.com
Telephone:	+86 13410415799
Fax:	/

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

4.1 About EUT

Description:	Smart Watch
Model Name:	coolpad 301A
Operating mode(s):	GSM 850/1900, WCDMA 850/1700/1900, LTE_FDD Band 2/4/, BT
Tested Tx Frequency:	825–848.8 MHz (GSM 850)
	1850.2–1910 MHz (GSM 1900)
	826.4–846.6 MHz (WCDMA850 Band V)
	1712.4–1752.6 MHz (WCDMA1700 Band IV)
	1852.4–1907.6 MHz (WCDMA1900 Band II)
	1850.7–1909.3 MHz (LTE_FDD Band 2)
	1710.7–1754.3 MHz (LTE_FDD Band 4)
GPRS&EGPRS Multislot Class:	12
GPRS capability Class:	/
WCDMA Category:	HSDPA: 10
	HSUPA: 6
	HSPA+(Uplink): 6
	HSPA+(downlink): 14
	DC-HSDPA: 24
Release Version:	GSM: R99
	GPRS: R99
	UMTS: 9
Test device Production information:	Production unit
Device type:	Portable device
Antenna type:	Integrated antenna

4.2 Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version
EUT1	IMEI: 865188030010653	V2	GROVCN00X1000DPX1706083
EUT2	IMEI: 865188030000563	V2	GROVCN00X1000DPX1706083

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

Note: It is performed to test SAR with the EUT1, and conducted power with the EUT 2.

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	ZS05WA	/	SCUD (FUJIAN) Electronics Co., Ltd.

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

5 TEST METHODOLOGY

5.1 Applicable Limit Regulations

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

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

5.2 Applicable Measurement Standards

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

KDB 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

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

KDB941225 D05 SAR for LTE Devices v02r05: SAR Evaluation Considerations for LTE Devices

KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz.

KDB 865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations

6 Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

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

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

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

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

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

Where: C is the specific heat 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

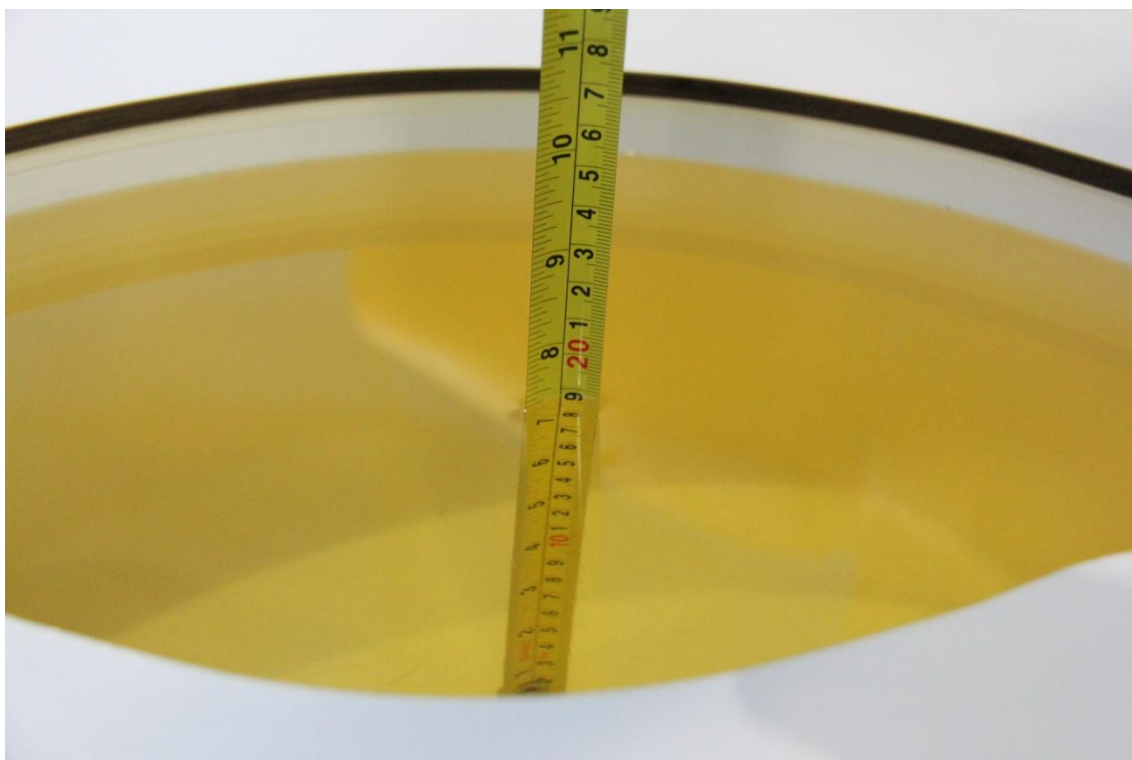
Frequency (MHz)	Liquid Type	Conductivity (σ)	$\pm 5\%$ Range	Permittivity (ϵ)	$\pm 5\%$ Range
835	Head	0.90	0.86~0.95	41.5	39.4~43.6
835	Body	0.97	0.92~1.02	55.2	52.4~58.0
1800	Head	1.40	1.33~1.47	40.0	38.0~42.0
1800	Body	1.52	1.44~1.60	53.5	50.8~56.1
1900	Head	1.40	1.33~1.47	40.0	38.0~42.0
1900	Body	1.52	1.44~1.60	53.3	50.6~56.0

7.2 Dielectric Performance

Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Conductivity σ (S/m)	Drift (%)	Permittivity ϵ	Drift (%)
2017-6-25	Head	835	0.886	-1.56	41.86	0.87
2017-6-25	Body	835	0.955	-1.55	55.83	1.14
2017-6-25	Head	1800	1.428	2.00	39.29	-1.78
2017-6-25	Body	1800	1.545	1.64	52.37	-2.11
2017-6-25	Head	1900	1.406	0.43	38.74	-3.15
2017-6-25	Body	1900	1.512	-0.53	54.33	1.93

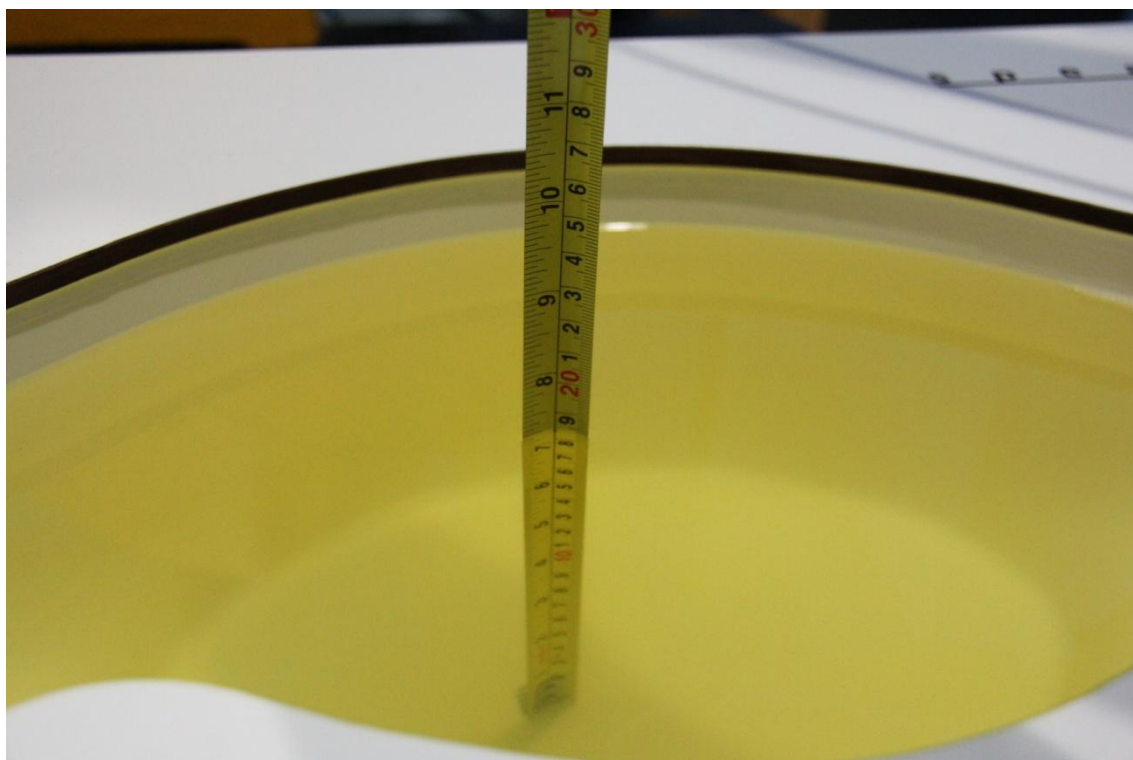
Note: The liquid temperature is 22.0°C



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



Picture 7-2: Liquid depth in the Flat Phantom (1800MHz)

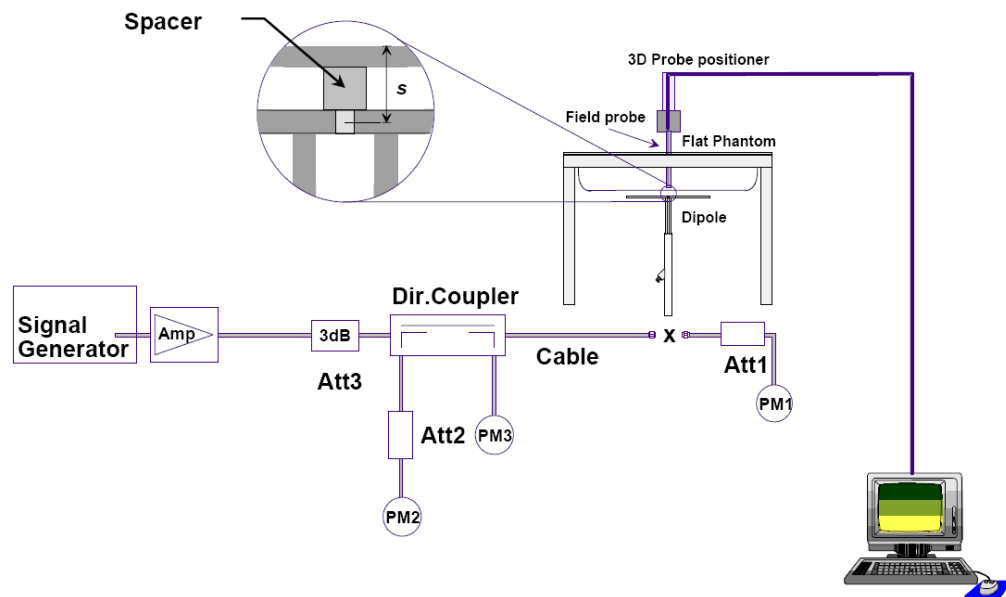


Picture 7-3: Liquid depth in the Flat Phantom (1900MHz)

8System verification

8.1 System Setup

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



Picture 8.1 System Setup for System Evaluation



Picture 8.2 Photo of Dipole Setup

8.2 System Verification

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

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

Table 8.1: System Verification of Head

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation(%)	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2017-6-25	835 MHz	6.03	9.22	5.80	8.88	-3.81	-3.69
2017-6-25	1800 MHz	20.6	38.8	20.76	39.48	0.78	1.75
2017-6-25	1900 MHz	21.0	40.8	20.64	39.40	-1.71	-3.43

Table 8.2: System Verification of Body

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation(%)	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2017-6-25	835 MHz	6.20	9.44	6.00	9.04	-3.23	-4.24
2017-6-25	1800 MHz	21.1	39.6	20.48	38.28	-2.94	-3.33
2017-6-25	1900 MHz	21.3	41.1	21.80	42.40	2.35	3.16

9 Measurement Procedures

9.1 Tests to be performed

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

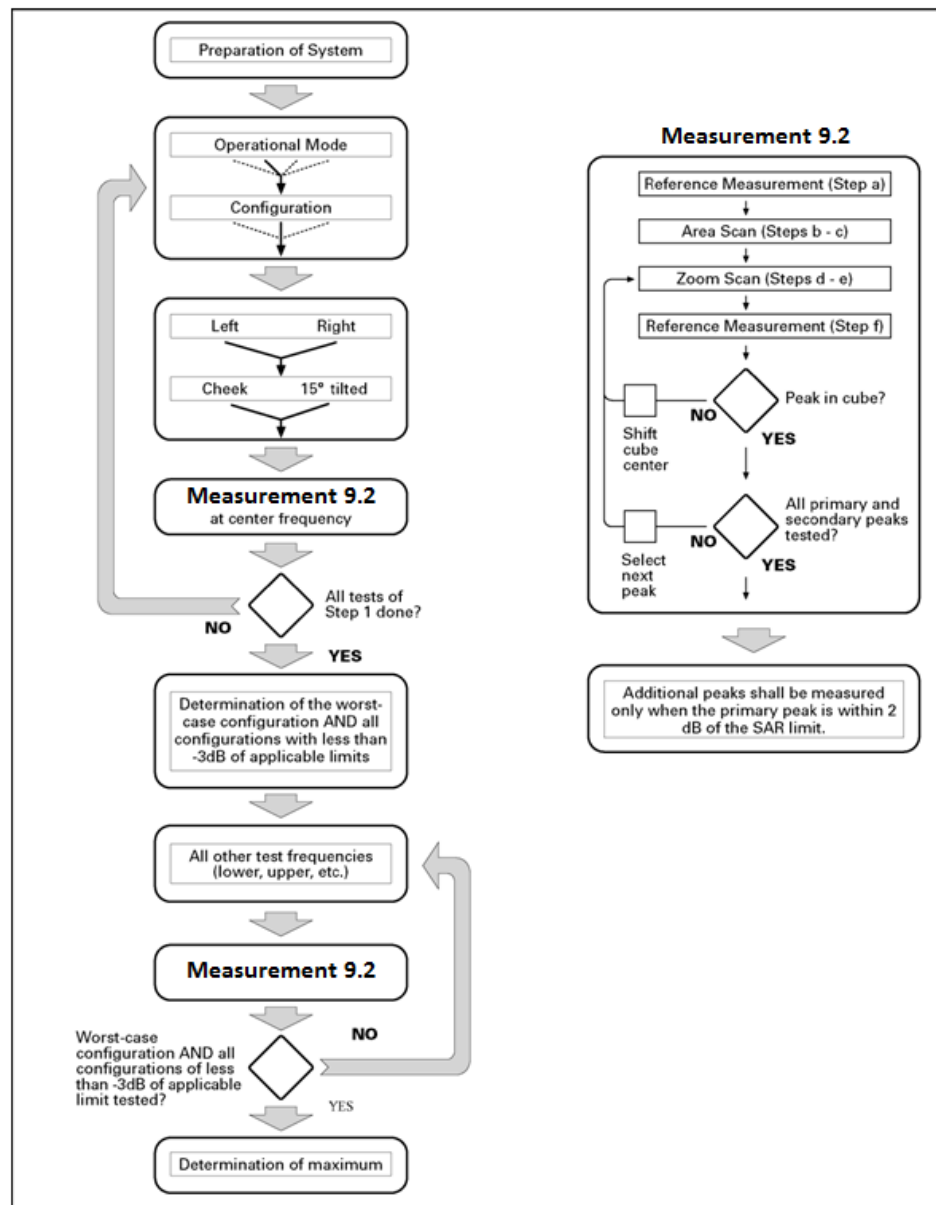
Step 1: The tests described in 9.2 shall be performed at the channel that is closest to the center of the transmit frequency band (f_c) for:

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

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

Step 2: For the condition providing highest peak spatial-average SAR determined in Step 1, perform all tests described in 9.2 at all other test frequencies, i.e., lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the peak spatial-average SAR value determined in Step 1 is within 3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

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



Picture 9.1 Block diagram of the tests to be performed

9.2 General Measurement Procedure

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2013. The results should be documented as part of the system validation records and may be requested to support test results

when all the measurement parameters in the following table are not satisfied.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	$\frac{1}{4} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be \leq the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom} , Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <u>reported</u> SAR from the area scan based <i>I-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

9.3 WCDMA Measurement Procedures for SAR

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

For Release 5 HSDPA Data Devices:

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

For Release 6 HSPA Data Devices

Sub-test	β_c	β_d	β_d (SF)	β_c / β_d	β_{hs}	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (dB)	MPR (dB)	AG Index	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}:47/15$ $\beta_{ed2}:47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	3.0	2.0	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	1.0	0.0	21	81

9.4 Bluetooth & Wi-Fi Measurement Procedures for SAR

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

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

9.5 SAR Measurement for LTE

SAR tests for LTE are performed with a base station simulator, Anristu MT8820C. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. All powers were measured with the Anristu MT8820C. 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 ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

9.6 Power Drift

To control the output power stability during the SAR test, DASY5 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Section14 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

10 Conducted Output Power

10.1 Manufacturing tolerance

Table 10.1: GSM Speech

GSM 850			
Channel	Channel 251	Channel 190	Channel 128
Target (dBm)	32	32	32
Tolerance \pm (dB)	1	1	1
GSM 1900			
Channel	Channel 810	Channel 661	Channel 512
Target (dBm)	30	30	30
Tolerance \pm (dB)	1	1	1

Table 10.2: GPRS & EGPRS

GSM 850 GPRS/ EGPRS(GMSK)				
Channel		251	190	128
1Txslot	Target (dBm)	32	32	32
	Tolerance \pm (dB)	1	1	1
2Txslots	Target (dBm)	30.5	30.5	30.5
	Tolerance \pm (dB)	1	1	1
3Txslots	Target (dBm)	30	30	30
	Tolerance \pm (dB)	1	1	1
4Txslots	Target (dBm)	29.5	29.5	29.5
	Tolerance \pm (dB)	1	1	1
GSM 1900 GPRS/ EGPRS (GMSK)				
Channel		810	661	512
1Txslot	Target (dBm)	30	30	30
	Tolerance \pm (dB)	1	1	1
2Txslots	Target (dBm)	29.5	29.5	29.5
	Tolerance \pm (dB)	1	1	1
3Txslots	Target (dBm)	29	29	29
	Tolerance \pm (dB)	1	1	1
4Txslots	Target (dBm)	29	29	29
	Tolerance \pm (dB)	1	1	1

Table 10.3: WCDMA

UMTS Band V		Conducted Power (dBm)		
		Channel 4233	Channel 4182	Channel 4132
CS	Target (dBm)	22	22	22
	Tolerance \pm (dB)	1	1	1
HSUPA sub-test 1-5	Target (dBm)	20	20	20
	Tolerance \pm (dB)	1	1	1
HSDPA sub-test1-4	Target (dBm)	22	22	22
	Tolerance \pm (dB)	1	1	1
UMTS Band IV		Conducted Power(dBm)		
		Channel 1513	Channel 1413	Channel 1312
CS	Target (dBm)	22	22	22
	Tolerance \pm (dB)	1	1	1
HSUPA sub-test 1-5	Target (dBm)	20	20	20
	Tolerance \pm (dB)	1	1	1
HSDPA sub-test 1-4	Target (dBm)	22	22	22
	Tolerance \pm (dB)	1	1	1
UMTS Band II		Conducted Power(dBm)		
		Channel 9538	Channel 9400	Channel 9262
CS	Target (dBm)	21	21	21
	Tolerance \pm (dB)	1	1	1
HSUPA sub-test 1-5	Target (dBm)	20	20	20
	Tolerance \pm (dB)	1	1	1
HSDPA sub-test 1-4	Target (dBm)	21	21	21
	Tolerance \pm (dB)	1	1	1

Table 10.4: LTE

LTE Band 2			
Channel	Channel 19100	Channel 18900	Channel 18700
Target (dBm)	22.5	22.5	22.5
Tolerance \pm (dB)	1	1	1
LTE Band 4			
Channel	Channel 20300	Channel 20175	Channel 20050
Target (dBm)	23	23	23
Tolerance \pm (dB)	1	1	1

LTE MPR will follow up 3GPP setting as below:

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

Table 10.5: Bluetooth

Mode		2402MHz (Ch0)	2441MHz (Ch39)	2480MHz (Ch78)
GFSK	Target (dBm)	5	7	5
	Tolerance \pm (dB)	1	1	1
EDR2M-4_DQPSK	Target (dBm)	5	7	5
	Tolerance \pm (dB)	1	1	1
EDR3M-8DPSK	Target (dBm)	5	7	5
	Tolerance \pm (dB)	1	1	1
GFSK(BLE)	Target (dBm)	-3	-1	-3
	Tolerance \pm (dB)	1	1	1

10.2 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 10.6: The conducted power measurement results for GSM850/1900

GSM 850MHz	Conducted Power (dBm)		
	Channel 251(848.8MHz)	Channel 190(836.6MHz)	Channel 128(824.2MHz)
	32.21	32.18	32.02
GSM 1900MHz	Conducted Power(dBm)		
	Channel 810(1909.8MHz)	Channel 661(1880MHz)	Channel 512(1850.2MHz)
	30.32	30.37	30.31

Table 10.7: The conducted power measurement results for GPRS and EGPRS

GSM 850		Measured Power (dBm)			calculation	Average Power (dBm)		
		251	190	128		251	190	128
GPRS/ EGPRS	1Txslots	32.17	32.15	31.98	-9.03dB	23.14	23.12	22.95
	2Txslots	31.39	31.41	31.45	-6.02dB	25.37	25.39	25.43
	3Txslots	30.87	30.71	30.57	-4.26dB	26.61	26.45	26.31
	4Txslots	30.02	30.11	30.14	-3.01dB	27.01	27.1	27.13
EGPRS (8PSK)	1Txslots	26.42	26.47	26.38	-9.03dB	17.39	17.44	17.35
	2Txslots	25.72	25.78	25.81	-6.02dB	19.70	19.76	19.79
	3Txslots	25.25	25.42	25.36	-4.26dB	20.99	21.16	21.10
	4Txslots	25.14	25.12	25.11	-3.01dB	22.13	22.11	22.10

GSM 1900		Measured Power (dBm)			calculation	Average Power (dBm)		
		810	661	512		810	661	512
GPRS/ EGPRS	1Txslots	30.34	30.38	30.33	-9.03dB	21.31	21.35	21.3
	2Txslots	30.07	30.15	30.17	-6.02dB	24.05	24.13	24.15
	3Txslots	29.93	29.94	29.95	-4.26dB	25.67	25.68	25.69
	4Txslots	29.67	29.75	29.74	-3.01dB	26.66	26.74	26.73
EGPRS (8PSK)	1Txslots	25.87	26.02	26.35	-9.03dB	16.84	16.99	17.32
	2Txslots	25.38	25.56	25.84	-6.02dB	19.36	19.54	19.82
	3Txslots	25.04	25.25	25.59	-4.26dB	20.78	20.99	21.33
	4Txslots	24.72	24.91	25.22	-3.01dB	21.71	21.9	22.21

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 GSM 850andGSM 1900.

10.3 WCDMA Measurement result

Table 10.8: The conducted Power for WCDMA850/1700/1900

Item	band	FDDBand 5 result		
	ARFCN	4233 (846.6MHz)	4182(836.4MHz)	4132 (826.4MHz)
WCDMA	\	21.8	21.8	21.9
HSDPA	1	21.8	21.5	21.8
	2	21.8	21.5	21.8
	3	21.3	21.1	21.2
	4	21.4	21.2	21.2
HSUPA	1	20.1	20.9	20.9
	2	19.3	19.9	19.9
	3	19.4	19.8	19.4
	4	20.3	20.4	20.4
	5	20.8	20.7	20.8

Item	band	FDD Band4 result		
	ARFCN	1513 (1752.6MHz)	1413(1732.6MHz)	1312 (1712.4MHz)
WCDMA	\	21.3	21.3	21.7
HSDPA	1	21.3	21.2	21.3
	2	21.3	21.2	21.3
	3	20.8	20.7	20.8
	4	20.9	20.7	20.7
HSUPA	1	20.4	20.4	20.8
	2	19.4	19.3	19.7
	3	19.0	18.9	19.8
	4	19.9	20.0	20.2
	5	20.4	20.4	20.8
Item	band	FDD Band2 result		
	ARFCN	9538 (1907.6MHz)	9400 (1880MHz)	9262 (1852.4MHz)
WCDMA	\	21.8	21.6	21.6
HSDPA	1	21.2	21.3	21.4
	2	21.1	21.3	21.3
	3	20.6	20.8	20.7
	4	20.6	20.8	20.7
HSUPA	1	19.9	20.5	19.8
	2	19.7	19.6	19.6
	3	19.2	19.6	19.0
	4	20.2	20.1	20.0
	5	20.6	20.6	20.5

10.4LTE-FDD Measurement result

Table 10.9: The conducted Power for LTE-FDD

LTE-FDD Band 2				Actual output Power (dBm)		
Band-width	RBallocation	RBoffset	Modulation	High	Middle	Low
1.4 MHz				1909.3MHz	1880MHz	1850.7MHz
	1RB	High	QPSK	21.98	22.86	22.66
			16QAM	20.67	20.14	21.13
		Middle	QPSK	22.30	22.91	22.56
			16QAM	20.89	20.15	21.17
		Low	QPSK	22.22	22.85	22.41
			16QAM	20.92	21.43	21.12
	3RB	High	QPSK	22.47	22.91	22.80
			16QAM	21.01	21.74	21.45
		Middle	QPSK	22.59	22.94	22.77
			16QAM	21.52	21.82	21.50
		Low	QPSK	22.48	22.87	22.59
			16QAM	21.51	21.84	21.50
	6RB	/	QPSK	21.31	21.93	20.54
			16QAM	19.72	22.15	19.65
3 MHz				1908.5MHz	1880MHz	1851.5MHz
	1RB	High	QPSK	22.22	22.99	22.69
			16QAM	21.22	21.65	21.19
		Middle	QPSK	22.69	22.98	22.55
			16QAM	21.33	21.60	21.11
		Low	QPSK	22.77	22.74	22.63
			16QAM	21.32	21.55	21.34
	8RB	High	QPSK	21.34	22.07	21.86
			16QAM	19.12	19.69	20.94
		Middle	QPSK	21.53	21.21	21.71
			16QAM	19.22	20.11	20.31
		Low	QPSK	22.25	22.39	21.66
			16QAM	21.01	21.12	20.82
	15RB	/	QPSK	21.99	21.97	21.85
			16QAM	21.12	21.00	20.77

5 MHz				1907.5MHz	1880MHz	1852.5MHz
	1RB	High	QPSK	22.25	22.76	22.66
			16QAM	20.77	21.40	21.81
		Middle	QPSK	23.17	22.64	22.81
			16QAM	21.94	21.63	21.64
		Low	QPSK	22.98	22.46	22.63
			16QAM	21.52	21.30	21.30
	12RB	High	QPSK	21.60	21.85	21.79
			16QAM	20.40	20.89	20.63
		Middle	QPSK	21.97	21.92	21.75
			16QAM	20.73	20.99	20.70
		Low	QPSK	21.97	21.75	21.63
16QAM			20.76	20.71	20.60	
25RB	/	QPSK	21.85	21.88	21.65	
		16QAM	20.81	21.13	20.62	
10 MHz				1905MHz	1880MHz	1855MHz
	1RB	High	QPSK	22.57	22.72	22.55
			16QAM	20.72	21.67	21.24
		Middle	QPSK	23.17	22.86	22.83
			16QAM	21.88	21.53	21.22
		Low	QPSK	22.97	22.63	22.67
			16QAM	21.72	21.56	20.77
	25RB	High	QPSK	22.00	21.98	21.83
			16QAM	20.99	21.13	20.95
		Middle	QPSK	21.96	21.93	21.83
			16QAM	21.11	20.96	20.94
		Low	QPSK	21.97	21.84	21.75
			16QAM	21.11	20.75	20.84
	50RB	/	QPSK	22.08	21.96	21.81
			16QAM	21.11	21.05	20.80

15 MHz				1902.5MHz	1880MHz	1857.5MHz
	1RB	High	QPSK	22.76	22.95	22.08
			16QAM	21.09	22.43	21.40
		Middle	QPSK	22.66	21.88	21.06
			16QAM	20.10	21.23	20.36
		Low	QPSK	21.42	22.04	20.83
			16QAM	20.11	21.08	19.73
	36RB	High	QPSK	21.45	21.11	21.01
			16QAM	20.56	20.01	21.78
		Middle	QPSK	21.22	21.16	22.02
			16QAM	20.63	20.07	21.85
		Low	QPSK	21.41	22.14	22.89
16QAM			20.47	21.83	21.78	
75RB	/	QPSK	21.96	22.38	22.18	
		16QAM	21.01	20.98	20.87	
20 MHz				1900MHz	1880MHz	1860MHz
	1RB	High	QPSK	22.32	22.84	21.81
			16QAM	21.21	21.94	20.94
		Middle	QPSK	23.01	22.84	22.62
			16QAM	22.72	22.04	21.93
		Low	QPSK	22.89	22.85	22.61
			16QAM	21.48	21.45	21.88
	50RB	High	QPSK	21.91	22.03	21.86
			16QAM	20.71	20.90	20.37
		Middle	QPSK	22.11	22.02	21.70
			16QAM	20.74	20.94	20.22
		Low	QPSK	22.10	21.79	21.63
			16QAM	21.23	20.79	20.22
	100RB	/	QPSK	21.96	22.07	21.59
			16QAM	20.55	20.91	20.66

LTE-FDD Band 4				Actual output Power (dBm)		
Band-width	RB allocation	RB offset	Modulation	High	Middle	Low
1.4 MHz				1754.3MHz	1732.5MHz	1710.7MHz
	1RB	High	QPSK	22.80	23.06	23.57
			16QAM	20.75	21.38	22.20
		Middle	QPSK	22.80	23.07	23.60
			16QAM	21.00	21.39	22.42
		Low	QPSK	22.72	23.01	23.59
			16QAM	20.91	22.22	22.23
	3RB	High	QPSK	22.59	23.15	23.82
			16QAM	21.26	22.17	22.48
		Middle	QPSK	22.61	23.09	23.86
			16QAM	21.40	22.07	22.60
		Low	QPSK	22.55	23.08	23.68
			16QAM	21.20	22.03	22.51
	6RB	/	QPSK	21.73	22.07	22.64
			16QAM	20.33	21.17	21.34
3 MHz				1753.5MHz	1732.5MHz	1711.5MHz
	1RB	High	QPSK	22.77	22.95	23.53
			16QAM	21.47	21.51	22.10
		Middle	QPSK	22.61	22.95	23.61
			16QAM	21.36	21.60	22.52
		Low	QPSK	22.49	23.14	23.40
			16QAM	21.12	21.62	22.29
	8RB	High	QPSK	21.61	21.99	22.91
			16QAM	20.63	21.15	21.86
		Middle	QPSK	21.55	21.94	22.76
			16QAM	20.67	21.15	21.73
		Low	QPSK	21.71	22.14	22.71
			16QAM	20.54	21.18	21.70
	15RB	/	QPSK	21.53	21.15	22.68
			16QAM	20.58	20.89	21.66

5 MHz				1752.5MHz	1732.5MHz	1712.5MHz
	1RB	High	QPSK	22.82	22.83	23.29
			16QAM	21.46	22.05	22.45
		Middle	QPSK	22.97	23.09	23.46
			16QAM	21.24	22.13	22.42
		Low	QPSK	22.86	23.16	23.37
			16QAM	21.78	21.87	22.27
	12RB	High	QPSK	21.75	22.11	22.64
			16QAM	20.87	21.22	21.61
		Middle	QPSK	21.87	21.96	22.68
			16QAM	20.95	21.14	21.56
		Low	QPSK	21.93	22.20	22.64
			16QAM	20.90	21.43	21.45
	25RB	/	QPSK	21.78	22.33	22.63
16QAM			20.98	21.54	21.67	
10 MHz				1750MHz	1732.5MHz	1715MHz
	1RB	High	QPSK	23.23	23.27	24.02
			16QAM	21.79	21.64	22.18
		Middle	QPSK	23.24	23.31	23.94
			16QAM	21.85	21.88	22.27
		Low	QPSK	23.19	23.39	23.74
			16QAM	21.82	22.10	21.80
	25RB	High	QPSK	22.09	22.44	22.86
			16QAM	20.72	21.20	22.09
		Middle	QPSK	22.26	22.28	22.88
			16QAM	21.06	21.23	21.98
		Low	QPSK	22.32	22.57	22.85
			16QAM	21.08	21.36	22.03
	50RB	/	QPSK	22.19	22.40	22.85
16QAM			20.93	21.29	21.80	

15 MHz				1747.5MHz	1732.5MHz	1717.5MHz
	1RB	High	QPSK	23.23	23.51	24.01
			16QAM	22.14	21.55	22.98
		Middle	QPSK	23.25	23.70	23.97
			16QAM	21.74	21.95	22.58
		Low	QPSK	23.30	24.01	23.72
			16QAM	21.68	22.12	22.29
	36RB	High	QPSK	23.33	23.65	24.01
			16QAM	22.20	22.72	22.81
		Middle	QPSK	23.28	23.62	23.82
			16QAM	21.82	22.36	22.76
		Low	QPSK	23.35	23.87	23.81
			16QAM	21.81	22.57	22.76
	75RB	/	QPSK	22.41	22.80	22.90
16QAM			21.02	21.68	21.86	
20 MHz				1745MHz	1732.5MHz	1720MHz
	1RB	High	QPSK	23.00	23.00	23.65
			16QAM	21.65	21.84	22.10
		Middle	QPSK	23.37	23.13	23.89
			16QAM	22.25	22.54	22.55
		Low	QPSK	23.64	23.89	23.72
			16QAM	21.96	22.15	21.81
	50RB	High	QPSK	22.15	22.02	22.54
			16QAM	20.80	21.32	21.96
		Middle	QPSK	22.30	22.17	22.81
			16QAM	20.98	21.38	22.14
		Low	QPSK	22.37	22.57	22.86
			16QAM	21.44	21.57	21.95
	100RB	/	QPSK	22.09	22.27	22.78
			16QAM	21.16	21.61	21.96

10.5 BT Measurement result

The output power of BT antenna is as following:

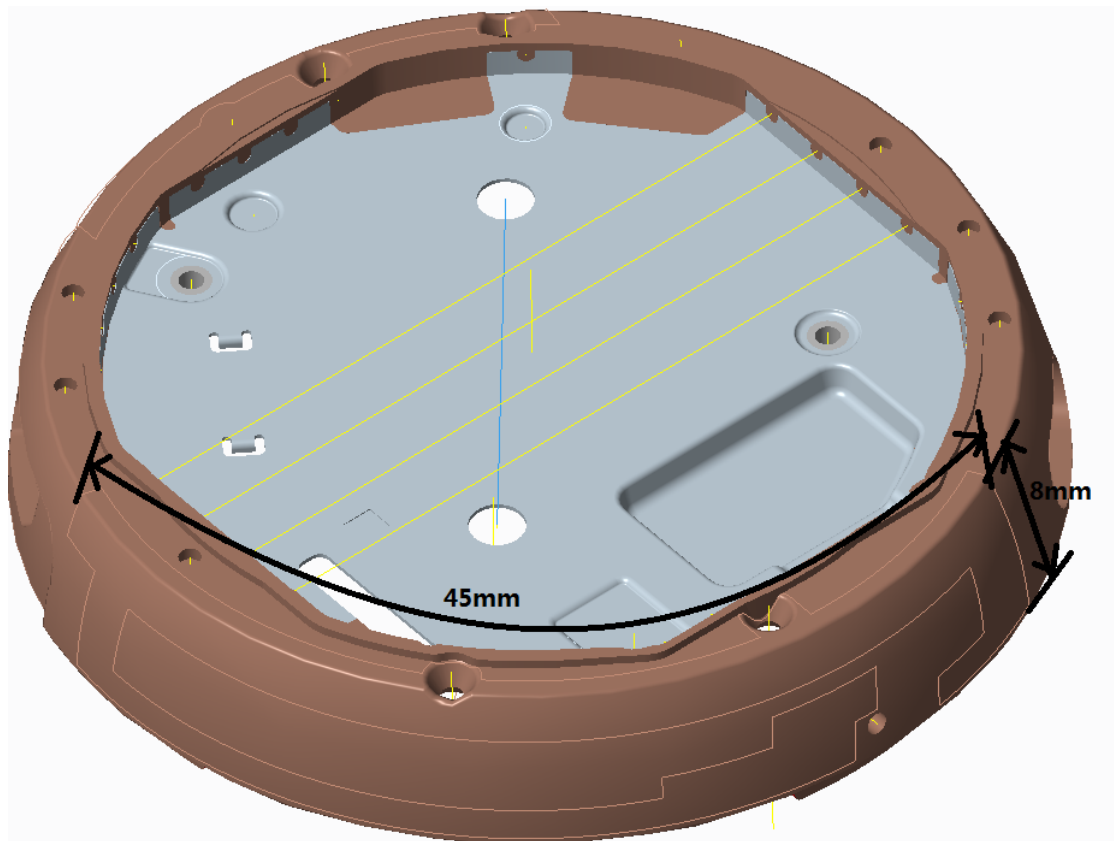
Mode	Conducted Power (dBm)		
	Channel 0 (2402MHz)	Channel 39 (2441MHz)	Channel 78 (2480MHz)
GFSK	5.28	7.25	5.37
$\pi/4$ DQPSK	5.40	7.37	5.47
8DPSK	5.77	7.73	5.87
BLE	-3.62	-1.80	-2.57

11 Simultaneous TX SAR Considerations

11.1 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.

11.2 Antenna Locations



Picture 11.1 Antenna Locations

11.3 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:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR, where

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

Table 12.1: Standalone SAR test exclusion considerations

Band/Mode	f(GHz)	Position	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.441	Head	9.60	8	6.31	Yes
		Body	19.20	8	6.31	Yes

12 Evaluation of Simultaneous

Table 12.1: The sum of reported SAR values for main antenna and Bluetooth

	Position	Main antenna	BT*	Sum	Limited (W/kg)
Highest reported SAR 1g(W/Kg)	Next to the mouth	1.32	0.15	1.47	1.6
Highest reported SAR 10g(W/Kg)	wrist-worn	0.97	0.26	1.23	4.0

BT* - Estimated SAR for Bluetooth (see the table 12.2)

Table 12.2: Estimated SAR for Bluetooth

Position	f (GHz)	Distance (mm)	Upper limit of power *		Estimated _{1g} (W/kg)
			dBm	mW	
Next to the mouth	2.441	10	8	6.31	0.15
wrist-worn	2.441	5	8	6.31	0.26

* - Maximum possible output power declared by manufacturer

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;

Where x = 7.5 for 1-g SAR.

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Conclusion:

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

13 SARTest Result

The calculated SAR is obtained by the following formula:

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

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

P_{Measured} is the measured power in chapter 10.

Table 13.1: Duty Cycle

Mode	Duty Cycle
Speech for GSM850/1900	1:8.3
GPRS&EGPRS for GSM1900	1:2
WCDMA850/1700/1900	1:1
FDD_LTE Band 2/4	1:1

Table 13.2: SAR Values (GSM 850 MHz - Next to the mouth)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	190	Front	Fig.1	32.18	33	0.242	0.29	0.388	0.47	-0.08

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

Table 13.3: SAR Values (GSM 850 MHz - wrist-worn)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	190	Rear	Fig.2	30.11	30.5	0.516	0.56	0.843	0.92	0.09
836.6	190	RearEGPRS	/	30.11	30.5	0.488	0.53	0.825	0.90	-0.06

Note: The distance between the EUT and the phantom bottom is 0mm.

Table 13.4: SAR Values (GSM 1900 MHz - Next to the mouth)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1909.8	810	Front		30.32	31	0.412	0.48	0.856	1.00	-0.10
1880	661	Front	Fig.3	30.37	31	0.449	0.52	0.910	1.05	0.04
1850.2	512	Front	/	30.31	31	0.432	0.51	0.884	1.04	0.05

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

Table 13.5: SAR Values (GSM 1900 MHz - wrist-worn)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1880	661	Rear	Fig.4	29.75	30	0.695	0.74	1.380	1.46	0.05
1880	661	RearEGPRS	/	29.75	30	0.687	0.73	1.270	1.35	0.07

Note: The distance between the EUT and the phantom bottom is 0mm.

Table 13.6: SAR Values (WCDMA850 MHz - Next to the mouth)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.4	4182	Front	Fig.5	21.8	23	0.150	0.20	0.243	0.32	-0.02

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

Table 13.7: SAR Values (WCDMA850 MHz - wrist-worn)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.4	4182	Rear	Fig.6	21.8	23	0.328	0.43	0.520	0.69	-0.04

Note: The distance between the EUT and the phantom bottom is 0mm.

Table 13.8: SAR Values (WCDMA1900 MHz - Next to the mouth)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1907.6	9538	Front	Fig.7	21.8	22	0.777	0.81	1.260	1.32	0.12
1880	9400	Front	/	21.6	22	0.537	0.59	1.080	1.18	-0.08
1852.4	9262	Front	/	21.6	22	0.469	0.51	0.867	0.95	0.10

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

Table 13.9: SAR Values (WCDMA1900 MHz-wrist-worn)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1880	9400	Rear	Fig.8	21.6	22	0.238	0.25	0.421	0.44	0.13

Note: The distance between the EUT and the phantom bottom is 0mm.

Table 13.10: SAR Values (WCDMA1700 MHz - Next to the mouth)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1732.6	1413	Front	Fig.9	21.3	23	0.319	0.47	0.582	0.86	0.02
1752.6	1513	Front	/	21.3	23	0.302	0.45	0.554	0.82	0.07
1712.4	1312	Front	/	21.7	23	0.326	0.44	0.608	0.82	-0.05

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

Table 13.11: SAR Values (WCDMA1700 MHz - wrist-worn)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1732.6	1413	Rear	Fig.10	21.3	23	0.653	0.97	1.100	1.63	0.10

Note: The distance between the EUT and the phantom bottom is 0mm.

Table 13.12: SAR Values (LTE Band 2-Next to the mouth)

Frequency		Configuration	Test Position	Conduct-ed Power (dBm)	Max. tune-up Power (dBm)	Figure No.	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
1900	19100	1RB_Mid	Front	23.01	23.5	Fig.11	0.476	0.53	0.939	1.05	0.12
1900	19100	50RB_Mid	Front	22.11	22.5	/	0.367	0.40	0.683	0.75	0.03
1880	18900	1RB_Mid	Front	22.84	23.5	/	0.384	0.45	0.726	0.85	-0.06
1860	18700	1RB_Mid	Front	22.62	23.5	/	0.412	0.50	0.784	0.96	-0.02
1880	18900	100RB	Front	22.07	22.5	/	0.384	0.42	0.695	0.77	0.09

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

Table 13.13: SAR Values (LTE Band 2-wrist-worn)

Frequency		Configuration	Test Position	Conduct-ed Power (dBm)	Max. tune-up Power (dBm)	Figure No.	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
1900	19100	1RB_Mid	Rear	23.01	23.5	Fig.12	0.858	0.96	1.780	1.99	-0.09
1900	19100	50RB_Mid	Rear	22.11	22.5	/	0.756	0.83	1.540	1.68	-0.04

Note: The distance between the EUT and the phantom bottom is 0mm.

Table 13.14: SAR Values (LTE Band 4-Next to the mouth)

Frequency		Configuration	Test Position	Conduct-ed Power (dBm)	Max. tune-up Power (dBm)	Figure No.	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
1720	20050	1RB_Mid	Front	23.89	24	Fig.13	0.529	0.54	0.908	0.93	-0.06
1720	20050	50RB_Low	Front	22.86	23	/	0.397	0.41	0.707	0.73	-0.15
1745	20300	1RB_Mid	Front	23.37	24	/	0.442	0.51	0.786	0.91	0.08
1732.5	20175	1RB_Mid	Front	23.13	24	/	0.405	0.49	0.678	0.83	0.10
1720	20050	100RB	Front	22.78	23	/	0.386	0.41	0.663	0.70	0.05

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

Table 13.15: SAR Values (LTE Band 4-wrist-worn)

Frequency		Configuration	Test Position	Conduct-ed Power (dBm)	Max. tune-up Power (dBm)	Figure No.	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
1720	20050	1RB_Mid	Rear	23.89	24	Fig.14	0.765	0.78	1.290	1.32	-0.07
1720	20050	50RB_Low	Rear	22.86	23	/	0.696	0.72	1.030	1.06	-0.11

Note: The distance between the EUT and the phantom bottom is 0mm.

14 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 ($\sim 10\%$ 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 14.1: SAR Measurement Variability for GSM 1900 MHz - Next to the mouth (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
1880	661	Front	10	0.910	0.902	1.01	/

Table 14.2: SAR Measurement Variability for WCDMA 1900 MHz - Next to the mouth (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
1907.6	9538	Front	10	1.260	1.22	1.03	/

Table 14.2: SAR Measurement Variability for LTE Band 2- Next to the mouth (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
1900	19100	Front	10	0.939	0.928	1.01	/

Table 14.2: SAR Measurement Variability for LTE Band 4- Next to the mouth (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
1720	20050	Front	10	0.908	0.887	1.02	/

15 Measurement Uncertainty

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

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	6.0	N	1	1	1	6.0	6.0	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	1	1	1.6	1.6	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	6.4	6.4	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	0.5	0.5	∞
5	Detection limit	B	1.0	N	1	1	1	1	1	∞
6	Readout electronics	B	0.3	R	$\sqrt{3}$	1	1	0.6	0.6	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.0	0.0	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.0	1.0	∞
9	RFambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
10	RFambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
11	Probe positioned mech. restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	1.2	1.2	∞
14	Probe modulation response	B	2.3	R	$\sqrt{3}$	1	1	1.21	1.21	∞
Test sample related										
15	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	5
16	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
17	Power scaling	B	2.4	R	$\sqrt{3}$	1	1	2.4	2.4	∞
18	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
19	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
20	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
21	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1	0.28	9
22	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
23	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	0.31	0.25	9
24	Algorithm for correcting SAR for deviations in permittivity and conductivity	B	1.9	N	1	1	1	1.9	1.9	∞
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						11.9	11.8	323
Expanded uncertainty (Confidence interval of 95 %)		$u_e = 2u_c$						23.8	23.7	

16MAIN TEST INSTRUMENTS

Table 16.1: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	Agilent E5071C	MY46103759	2016-11-19	One year
02	Dielectricprobe	85070E	MY44300317	/	
03	Power meter	NRP	102603	2017-01-06	One year
04	Power sensor	NRP-Z51	102211		
05	Signal Generator	E8257D	MY47461211	2017-06-06	One year
06	Amplifier	VTL5400	0404	/	
07	DAE	SPEAG DAE4	786	2016-12-08	One year
08	E-field Probe	SPEAG EX3DV4	3633	2017-01-23	One year
09	Dipole Validation Kit	SPEAG D835V2	4d057	2015-10-22	Three year
10	Dipole Validation Kit	SPEAG D1800V2	2d147	2015-11-03	Three year
11	Dipole Validation Kit	SPEAG D1900V2	5d088	2015-11-04	Three year
12	BTS	E5515C	GB47460389	2017-01-06	One year
13	Radio Communication Analyzer	Anristu MT8820C	6201563767	2017-01-06	One year

END OF REPORT BODY

ANNEX A Graph Results

GSM850 Next to the mouth

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Head 835 MHz

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.888$ S/m; $\epsilon_r = 41.832$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, GSM (0) Frequency: 836.6 MHz Duty Cycle: 1:8.3

Probe: EX3DV4 - SN3633 ConvF(9.04, 9.04, 9.04);

Front side Mid /Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.456 W/kg

Front side Mid /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.85 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.647 W/kg

SAR(1 g) = 0.388 W/kg; SAR(10 g) = 0.242 W/kg

Maximum value of SAR (measured) = 0.412 W/kg

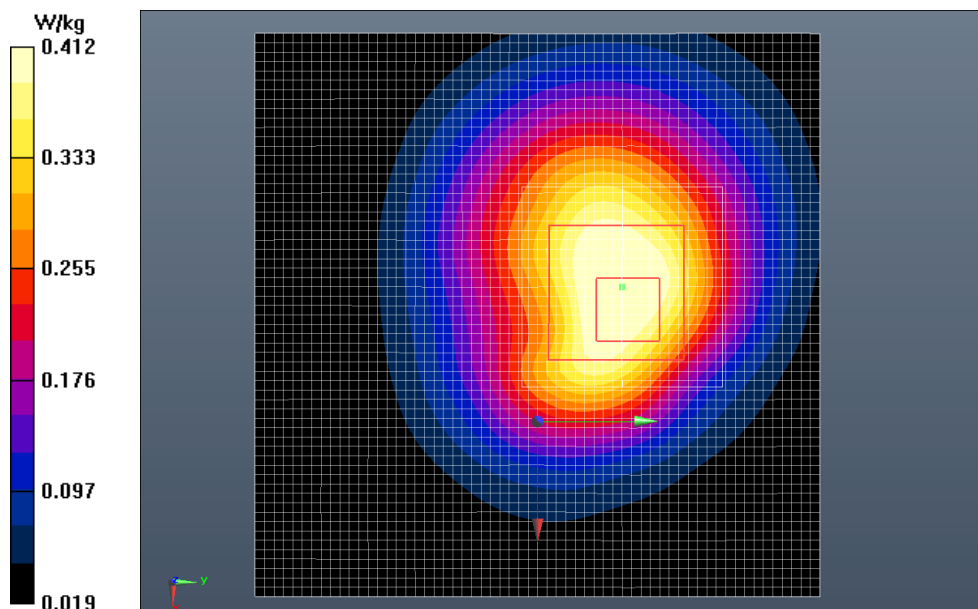


Fig.1 GSM 850MHz

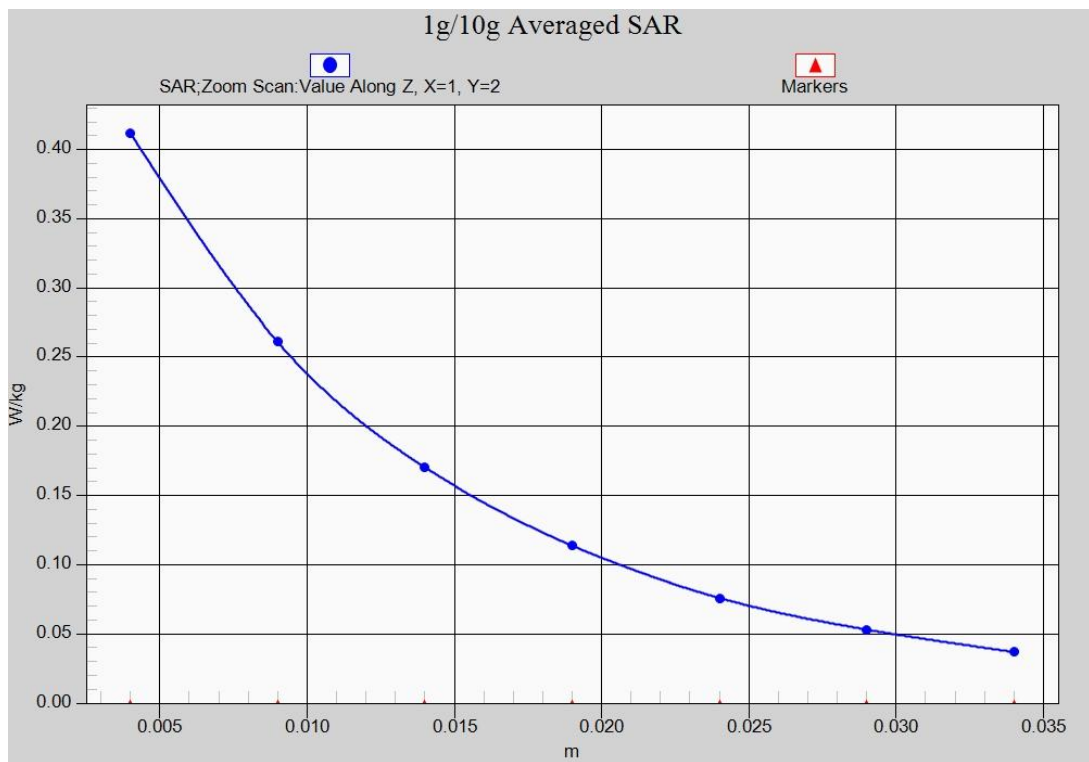


Fig.1-1 Z-Scan at power reference point (GSM 850 MHz)

GSM850 wrist-worn

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Body 835 MHz

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.957$ S/m; $\epsilon_r = 55.807$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, 4 slot GPRS (0) Frequency: 836.6 MHz Duty Cycle: 1:2

Probe: EX3DV4 - SN3633 ConvF(9.41, 9.41, 9.41);

Rear side Mid/Area Scan (51x51x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 1.01 W/kg

Rear side Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 16.07 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 1.37 W/kg

SAR(1 g) = 0.843 W/kg; SAR(10 g) = 0.516 W/kg

Maximum value of SAR (measured) = 0.891 W/kg

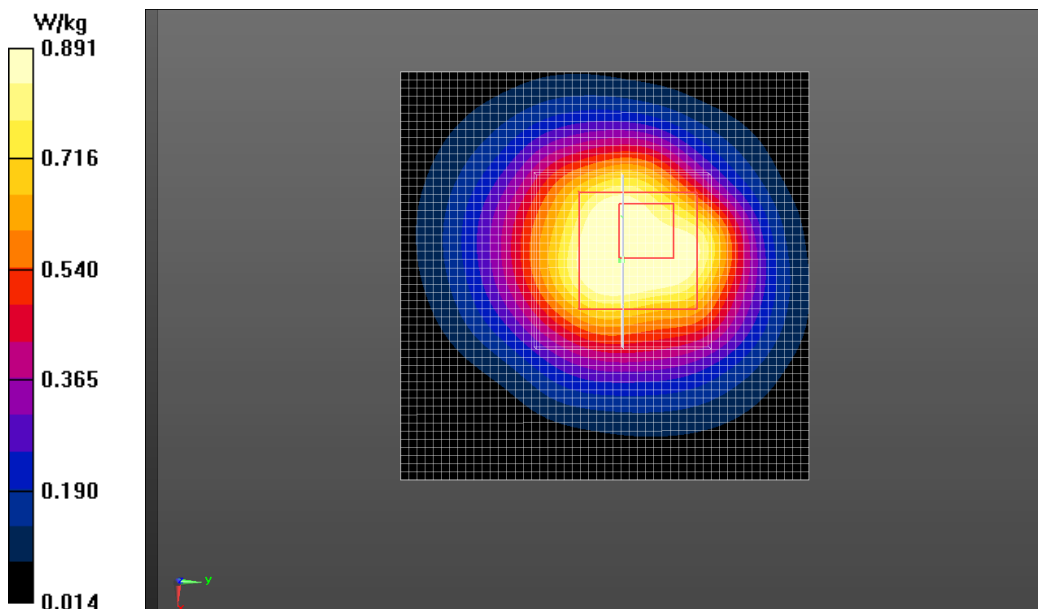


Fig.2 GSM 850 MHz

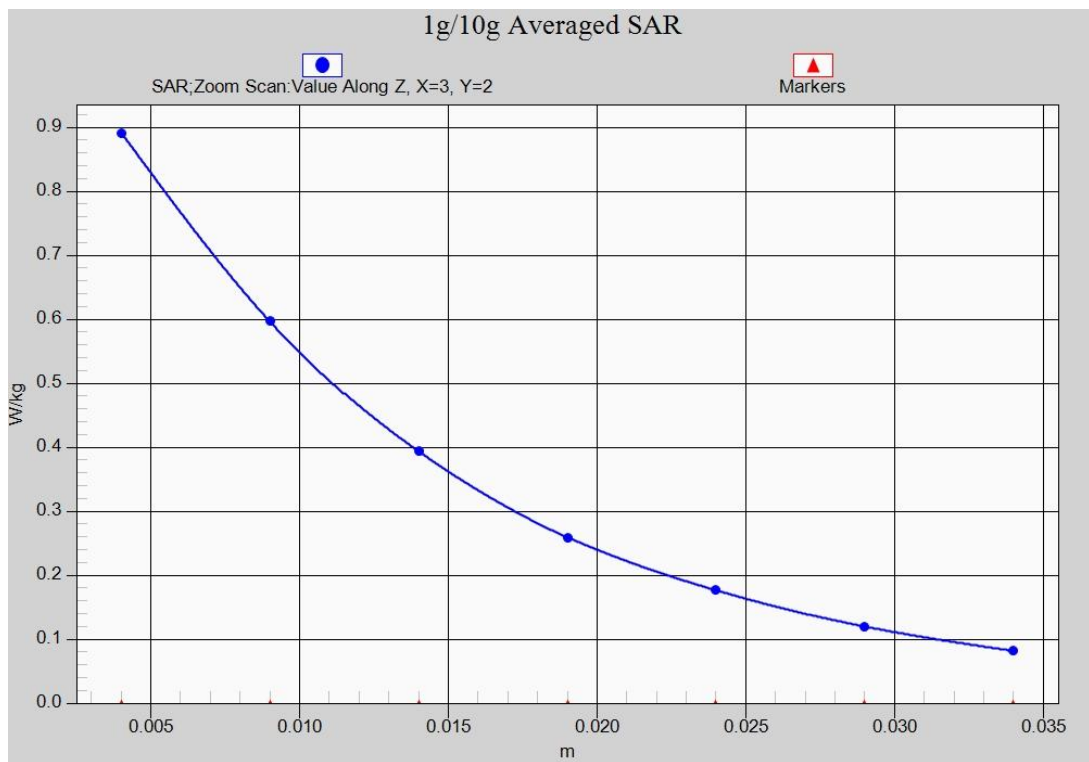


Fig.2-1 Z-Scan at power reference point (GSM 850 MHz)

GSM1900 Next to the mouth

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Head 1900 MHz

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.387$ S/m; $\epsilon_r = 38.833$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, GSM (0) Frequency: 1880 MHz Duty Cycle: 1:8.3

Probe: EX3DV4 - SN3633 ConvF(8, 8, 8);

Front side Mid/Area Scan (61x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 1.08 W/kg

Front side Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 12.91 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 1.72 W/kg

SAR(1 g) = 0.910 W/kg; SAR(10 g) = 0.449 W/kg

Maximum value of SAR (measured) = 1.00 W/kg

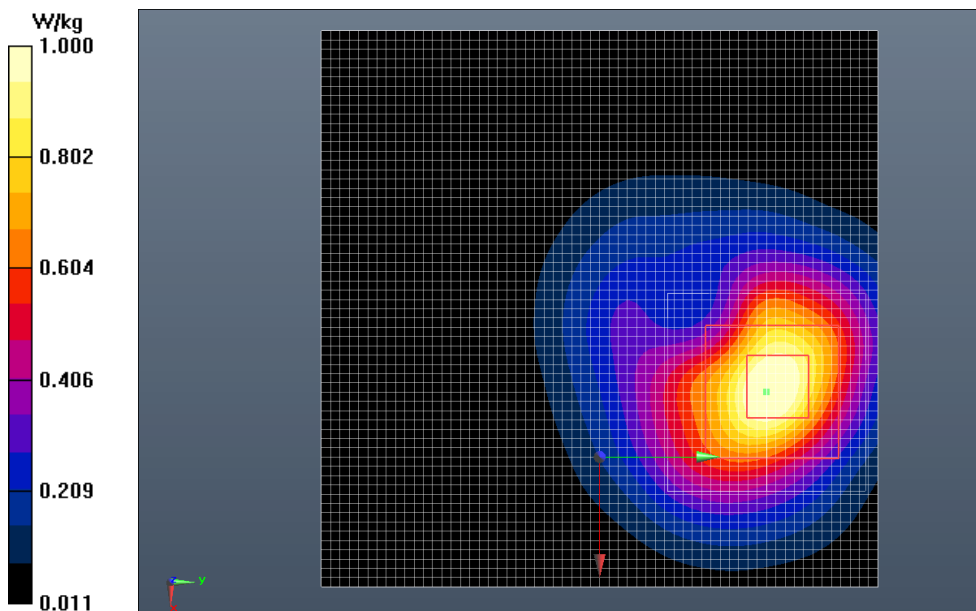


Fig.3 GSM 1900 MHz

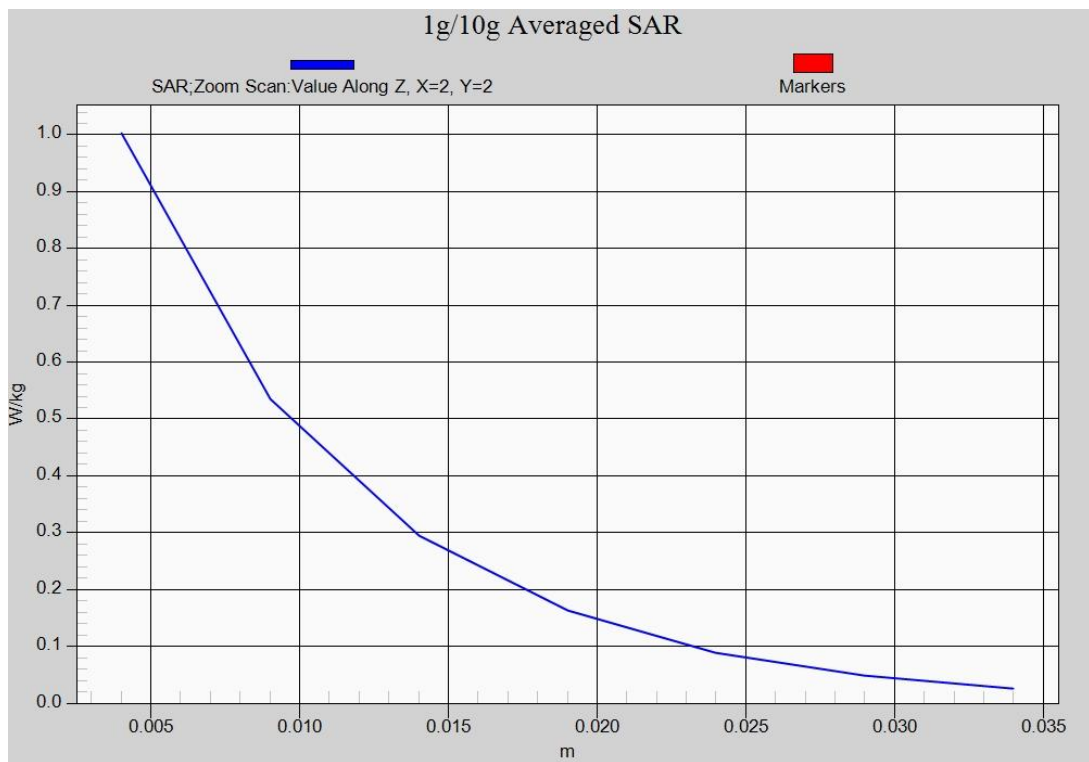


Fig.3-1 Z-Scan at power reference point (GSM 1900 MHz)

GSM1900 wrist-worn

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Body 1900 MHz

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.493$ S/m; $\epsilon_r = 54.361$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, 4 slot GPRS (0) Frequency: 1880 MHz Duty Cycle: 1:2

Probe: EX3DV4 - SN3633 ConvF(7.55, 7.55, 7.55);

Rear side Mid/Area Scan (61x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 1.61 W/kg

Reaside Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 14.11 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 2.41 W/kg

SAR(1 g) = 1.38 W/kg; SAR(10 g) = 0.695 W/kg

Maximum value of SAR (measured) = 1.56 W/kg

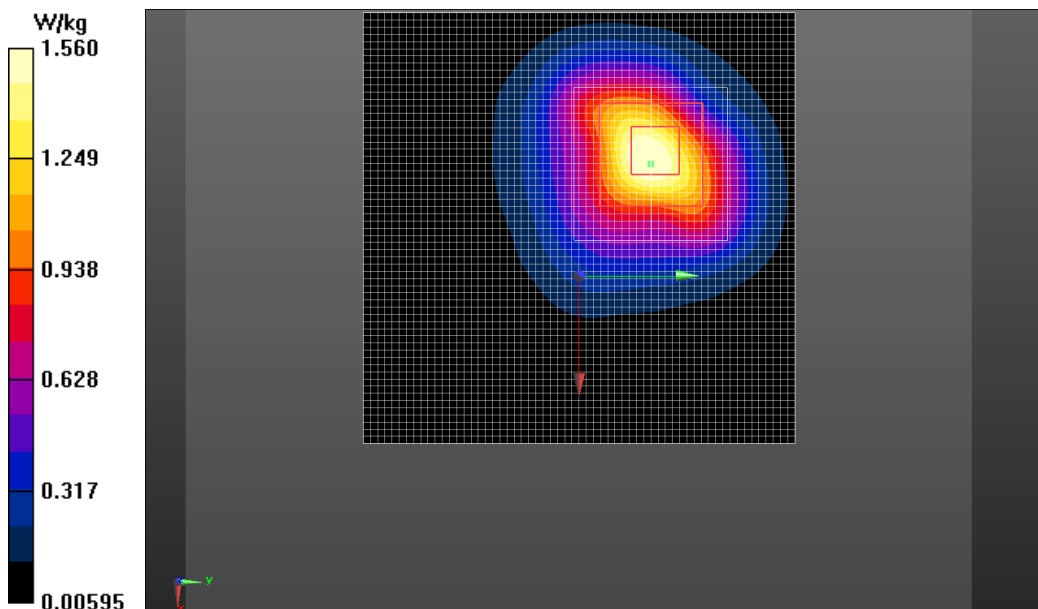


Fig.4 GSM 1900 MHz

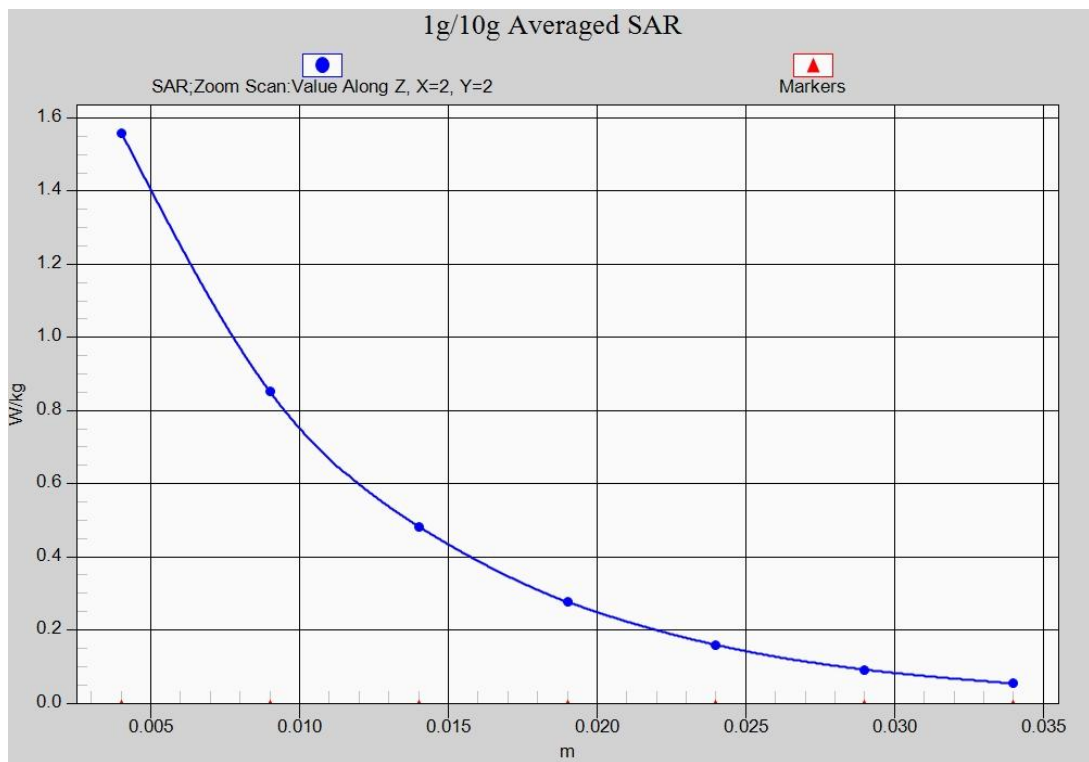


Fig.4-1 Z-Scan at power reference point (GSM 1900 MHz CH661)

WCDMA 850 Next to the mouth

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Head 835 MHz

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.888$ S/m; $\epsilon_r = 41.835$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, WCDMA (0) Frequency: 836.4 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633 ConvF(9.04, 9.04, 9.04);

Front side Mid /Area Scan (61x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.283 W/kg

Front side Mid /Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 10.66 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.406 W/kg

SAR(1 g) = 0.243 W/kg; SAR(10 g) = 0.150 W/kg

Maximum value of SAR (measured) = 0.259 W/kg

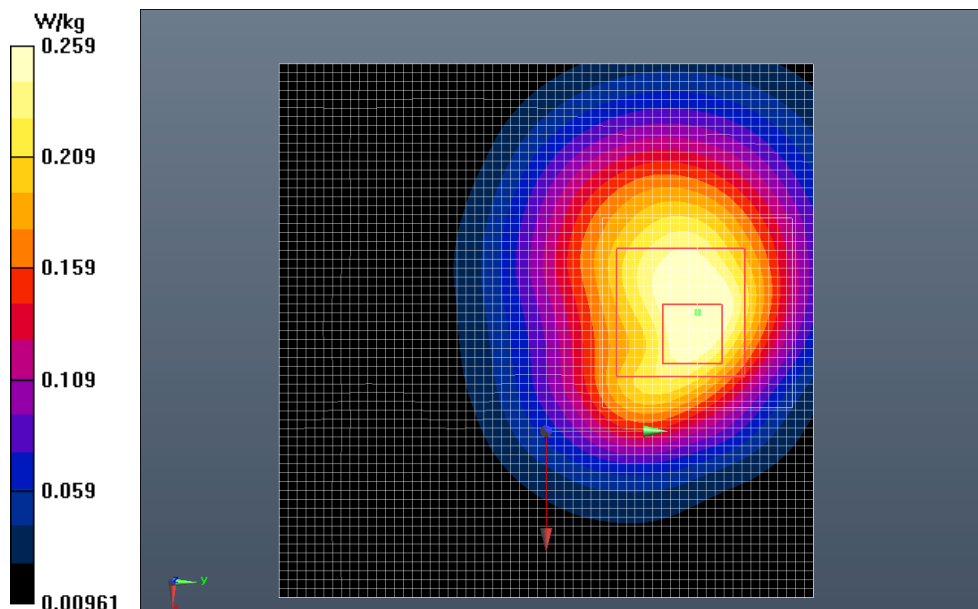


Fig.5 WCDMA850

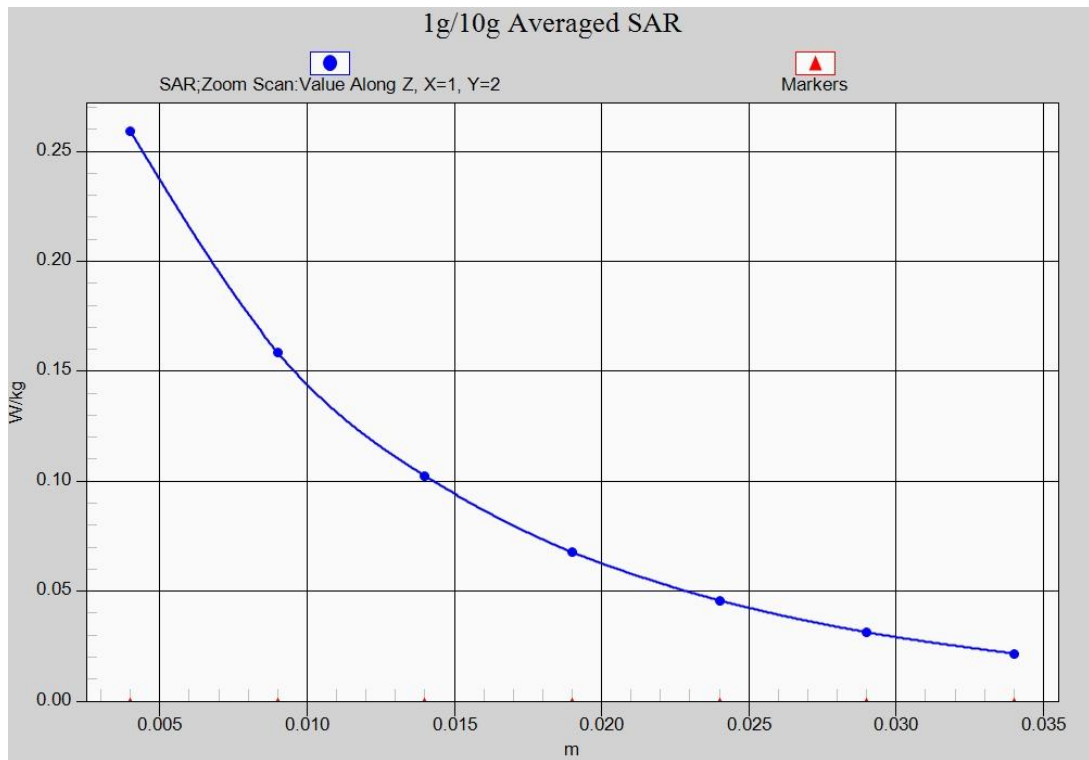


Fig.5-1 Z-Scan at power reference point (WCDMA850)

WCDMA 850 wrist-worn

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Body 835 MHz

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.957$ S/m; $\epsilon_r = 55.81$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, WCDMA (0) Frequency: 836.4 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633 ConvF(9.41, 9.41, 9.41);

Rear side Mid /Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.605 W/kg

Rear side Mid /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.46 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.881 W/kg

SAR(1 g) = 0.520 W/kg; SAR(10 g) = 0.328 W/kg

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

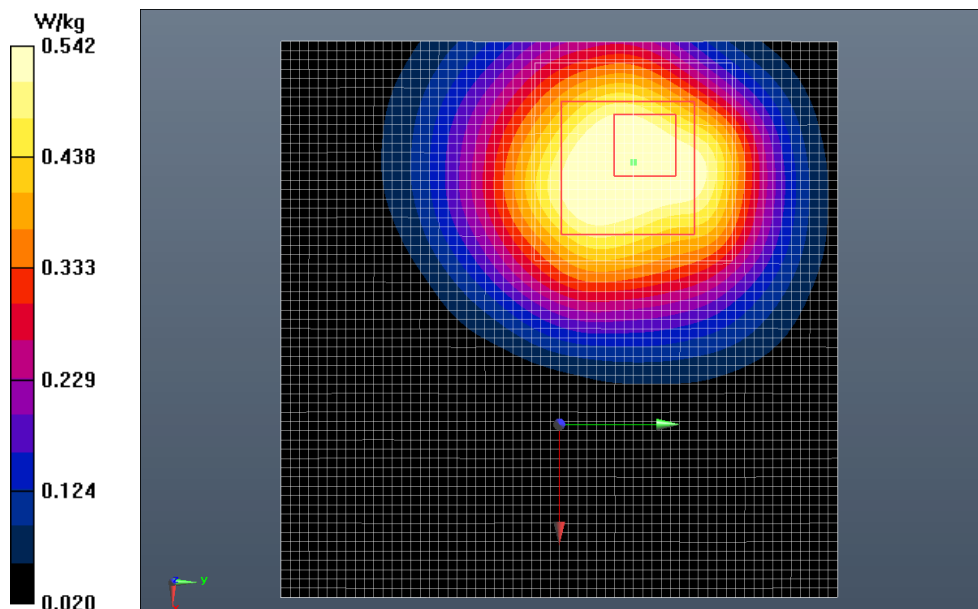


Fig.6 WCDMA850

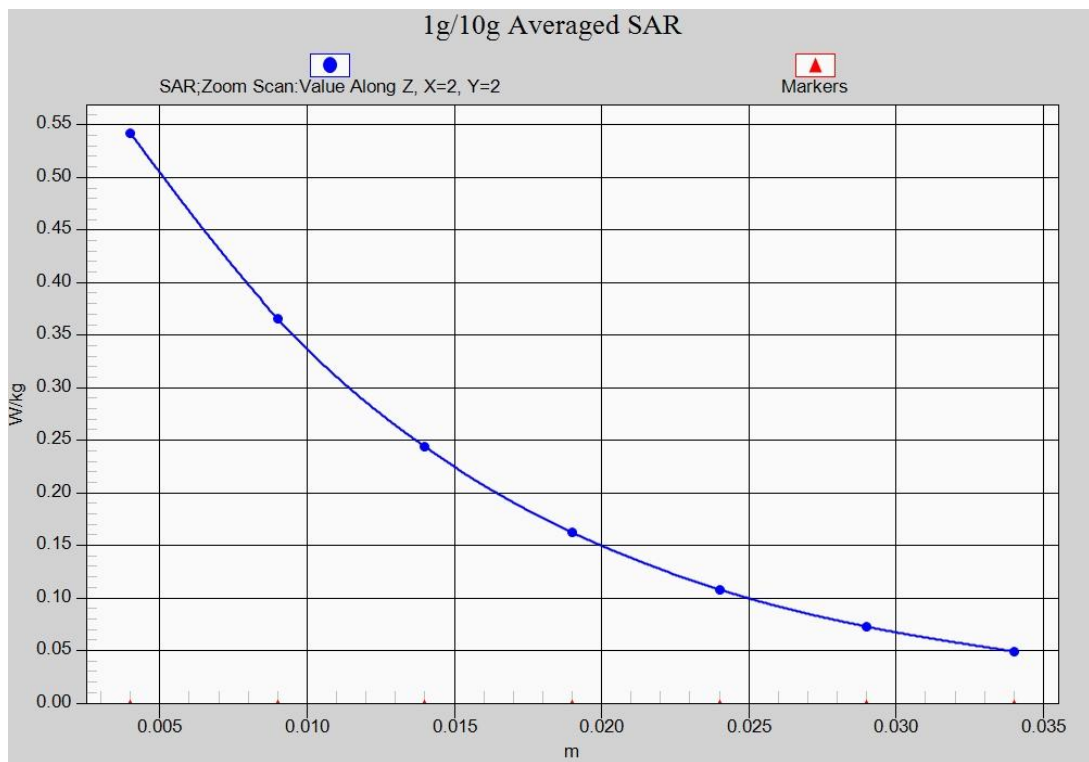


Fig.6-1 Z-Scan at power reference point (WCDMA850)

WCDMA 1900 Next to the mouth

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Head 1900 MHz

Medium parameters used: $f = 1908$ MHz; $\sigma = 1.413$ S/m; $\epsilon_r = 38.701$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, WCDMA (0) Frequency: 1908 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633 ConvF(8, 8, 8);

Front side High /Area Scan (51x51x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 1.51 W/kg

Front side High /Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 14.94 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 2.53 W/kg

SAR(1 g) = 1.26 W/kg; SAR(10 g) = 0.777 W/kg

Maximum value of SAR (measured) = 1.71 W/kg

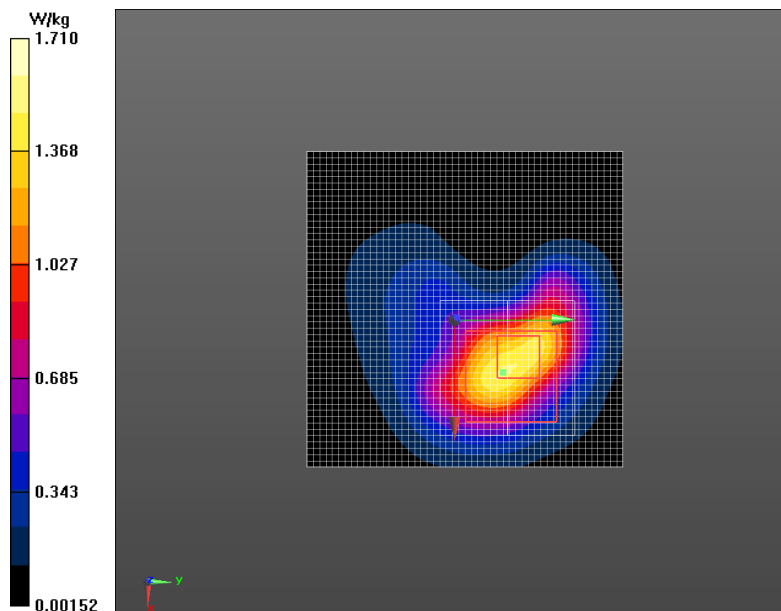


Fig.7 WCDMA1900

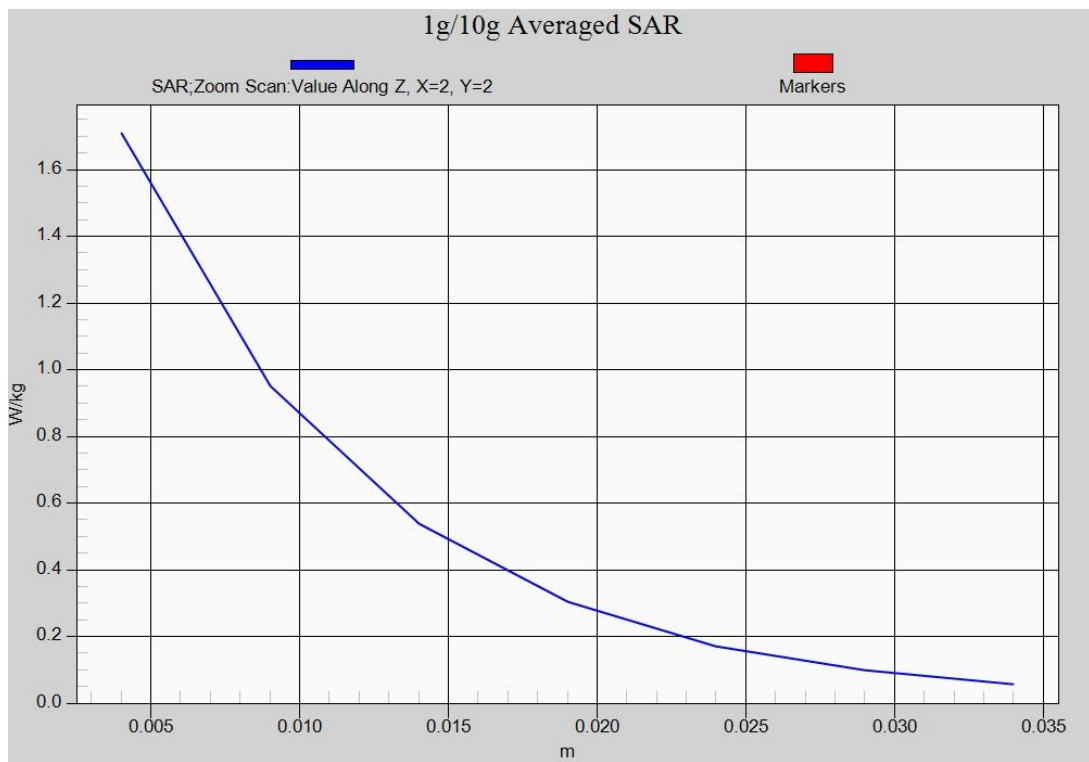


Fig.7-1 Z-Scan at power reference point (WCDMA1900)

WCDMA 1900 wrist-worn

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Body 1900 MHz

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.493$ S/m; $\epsilon_r = 54.361$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, WCDMA (0) Frequency: 1880 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633 ConvF(7.55, 7.55, 7.55);

Rear side Mid/Area Scan (51x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.742 W/kg

Rear side Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 14.12 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.76 W/kg

SAR(1 g) = 0.421 W/kg; SAR(10 g) = 0.238 W/kg

Maximum value of SAR (measured) = 0.676 W/kg

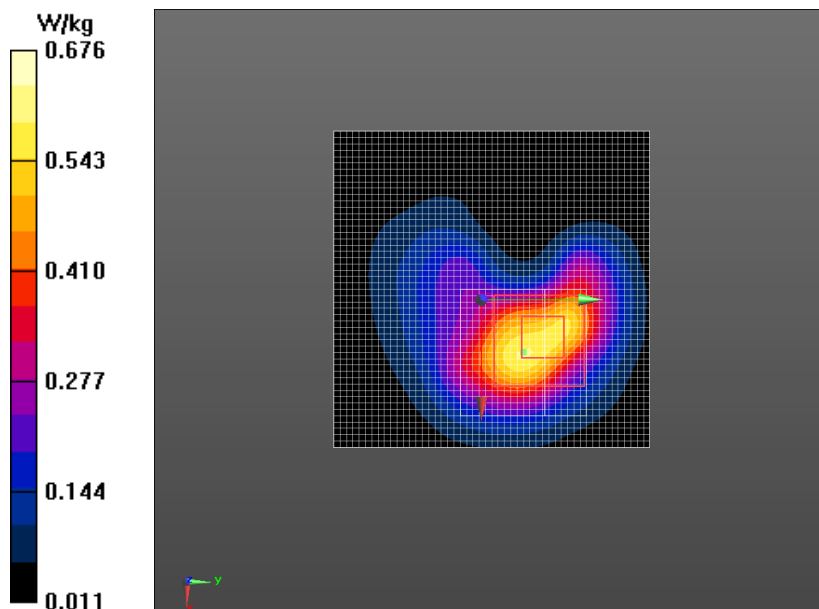


Fig.8 WCDMA1900

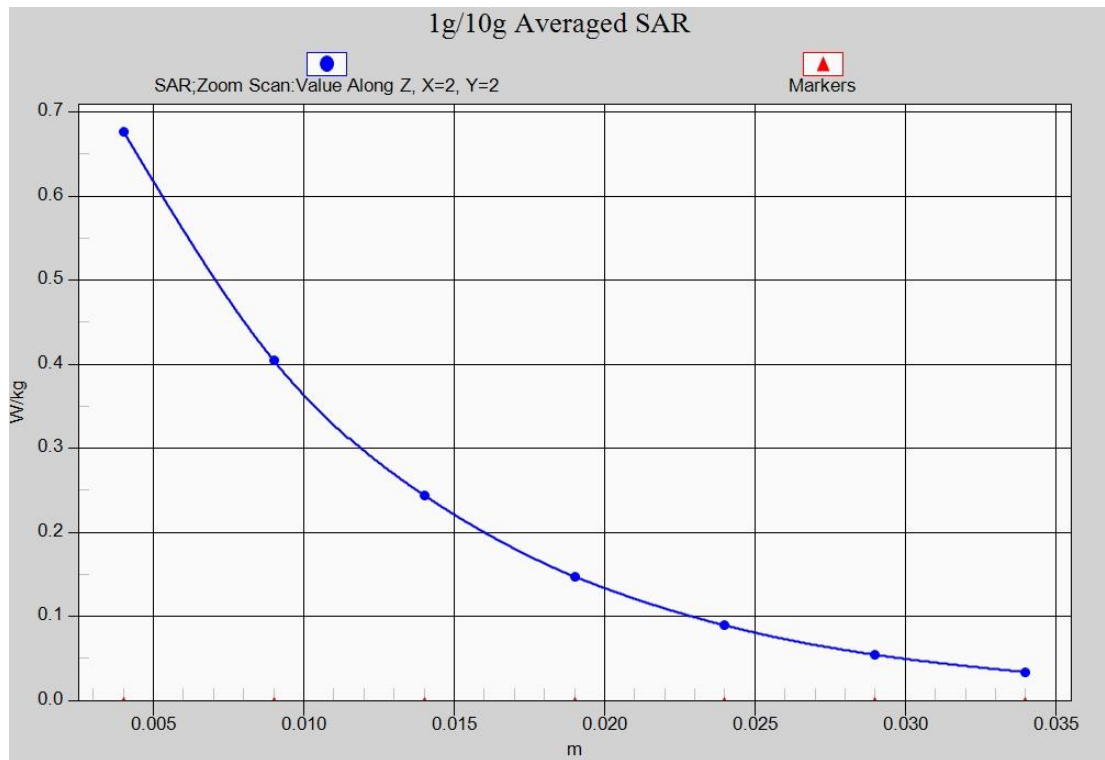


Fig.8-1 Z-Scan at power reference point (WCDMA1900)

WCDMA 1700 Next to the mouth

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Head 1800 MHz

Medium parameters used (interpolated): $f = 1732.6$ MHz; $\sigma = 1.355$ S/m; $\epsilon_r = 39.481$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, WCDMA (0) Frequency: 1732.6 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633 ConvF(8.08, 8.08, 8.08);

Front Side Mid/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.702 W/kg

Front Side Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.00 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.582 W/kg; SAR(10 g) = 0.319 W/kg

Maximum value of SAR (measured) = 0.717 W/kg

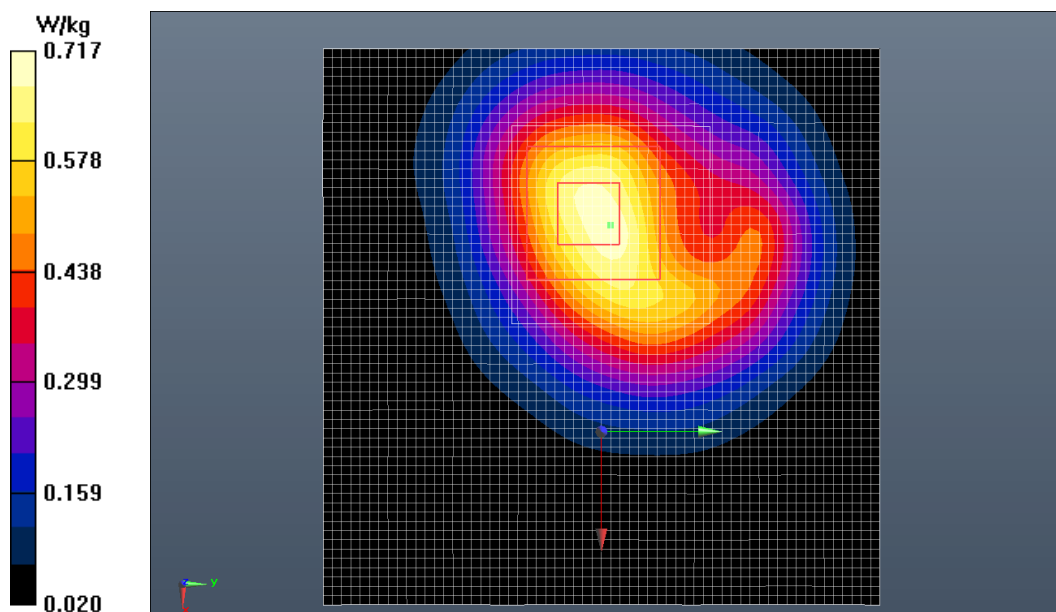


Fig.9 WCDMA1700

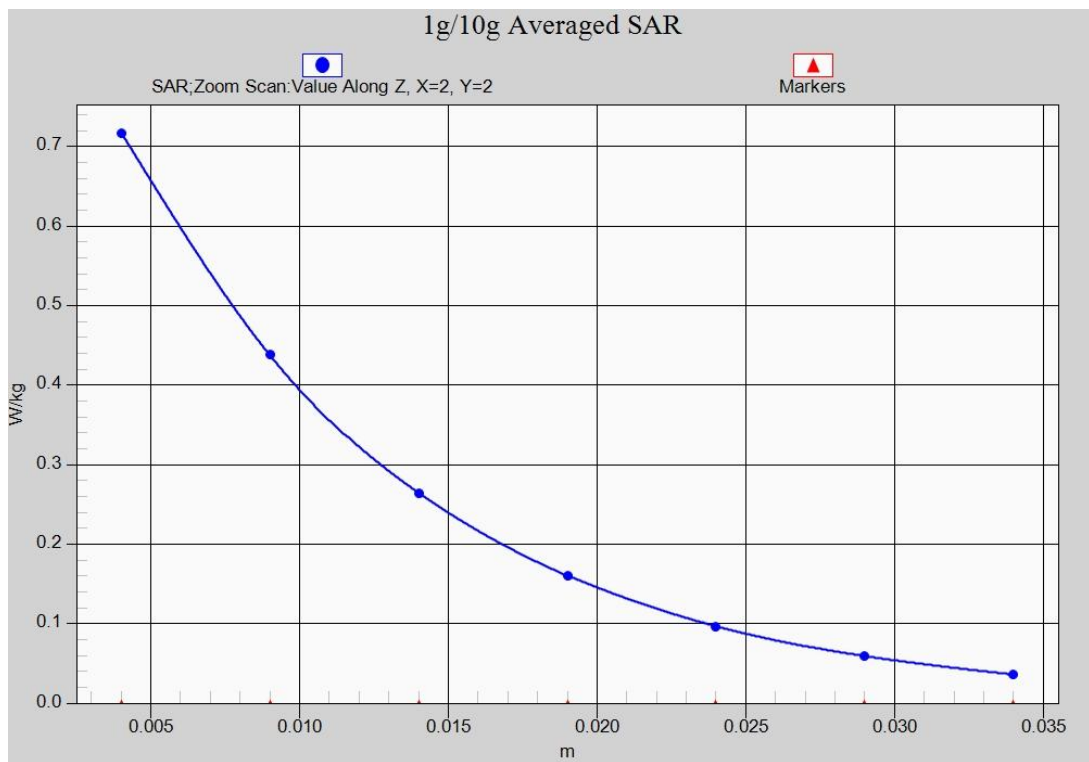


Fig.9-1 Z-Scan at power reference point (WCDMA1700)

WCDMA 1700 wrist-worn

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Body 1800 MHz

Medium parameters used (interpolated): $f = 1732.6$ MHz; $\sigma = 1.483$ S/m; $\epsilon_r = 52.572$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, WCDMA (0) Frequency: 1732.6 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633 ConvF(7.9, 7.9, 7.9);

Rear Side Mid/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.30 W/kg

Rear Side Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.69 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 1.72 W/kg

SAR(1 g) = 1.1 W/kg; SAR(10 g) = 0.653 W/kg

Maximum value of SAR (measured) = 1.21 W/kg

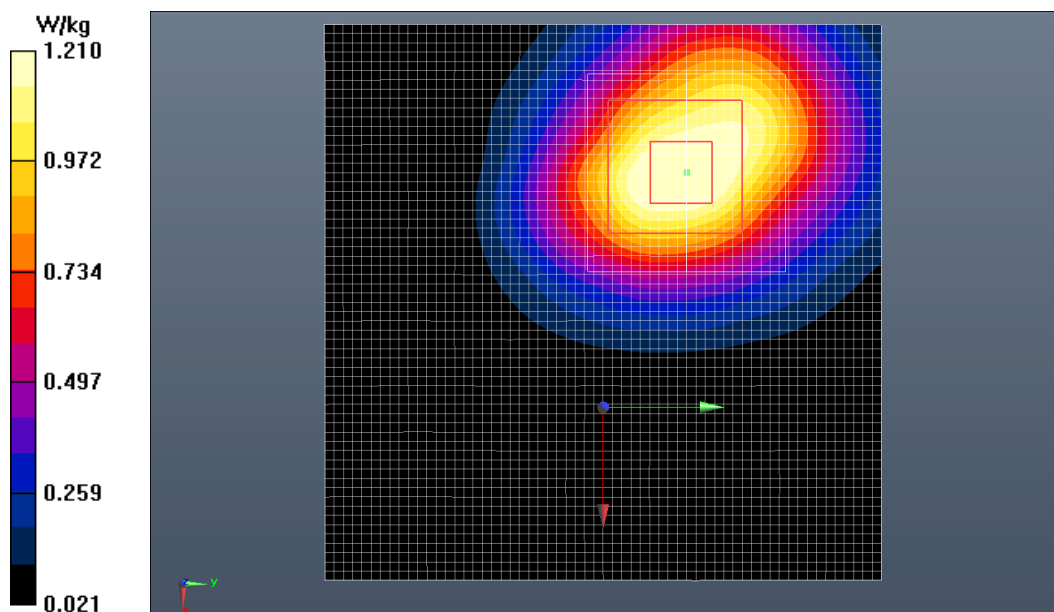


Fig.10 WCDMA1700

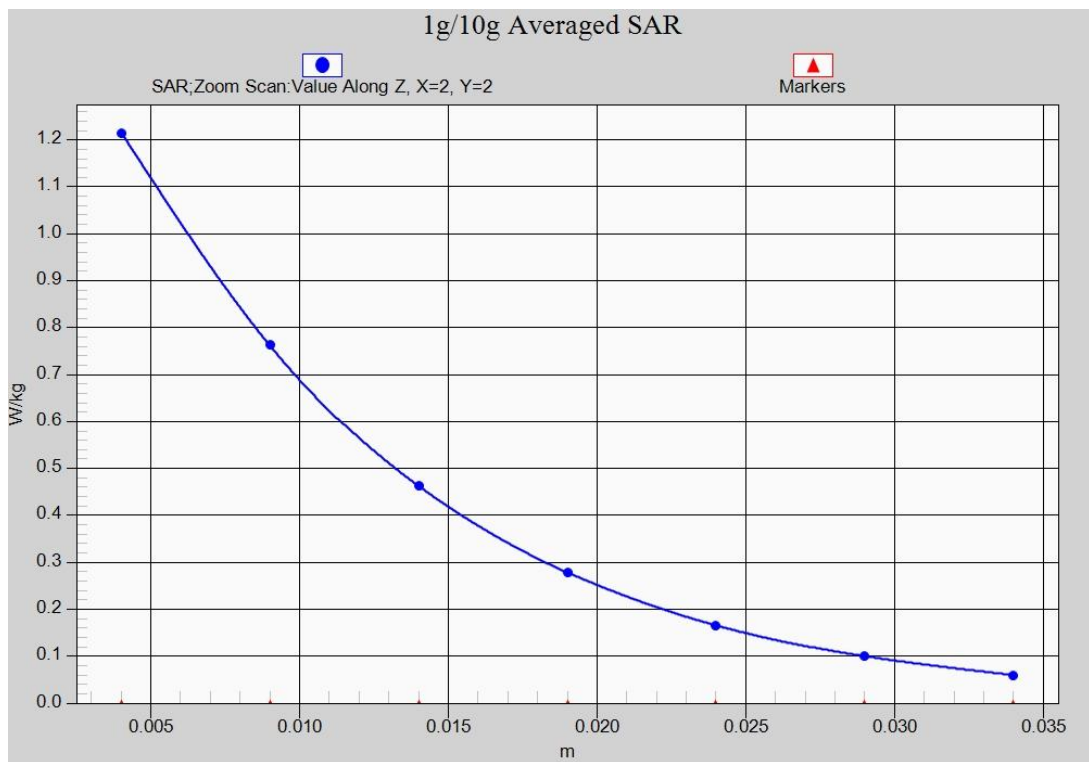


Fig.10-1 Z-Scan at power reference point (WCDMA1700)

LTE Band 2Next to the mouth

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Head 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.406$ S/m; $\epsilon_r = 38.742$; $\rho = 1000$ kg/m³

Ambient Temperature:22.0°C Liquid Temperature:21.5°C

Communication System: UID 0, LTE_FDD (0) Frequency: 1900 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633 ConvF(8, 8, 8);

Front side High1RB_Mid/Area Scan (51x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

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

Front side High1RB_Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 13.27 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 1.75 W/kg

SAR(1 g) = 0.939 W/kg; SAR(10 g) = 0.476 W/kg

Maximum value of SAR (measured) = 1.04 W/kg

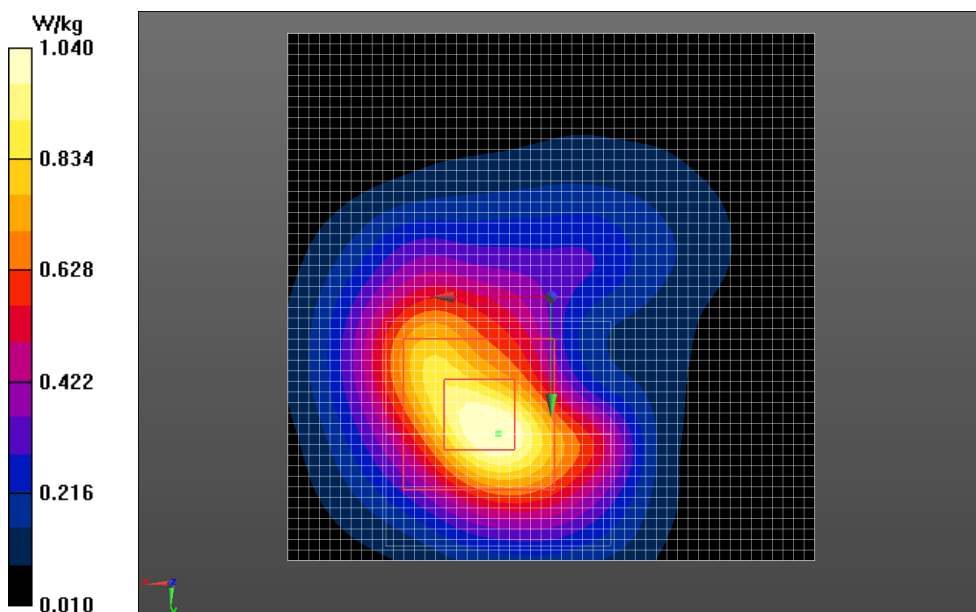


Fig.11 LTE Band 2

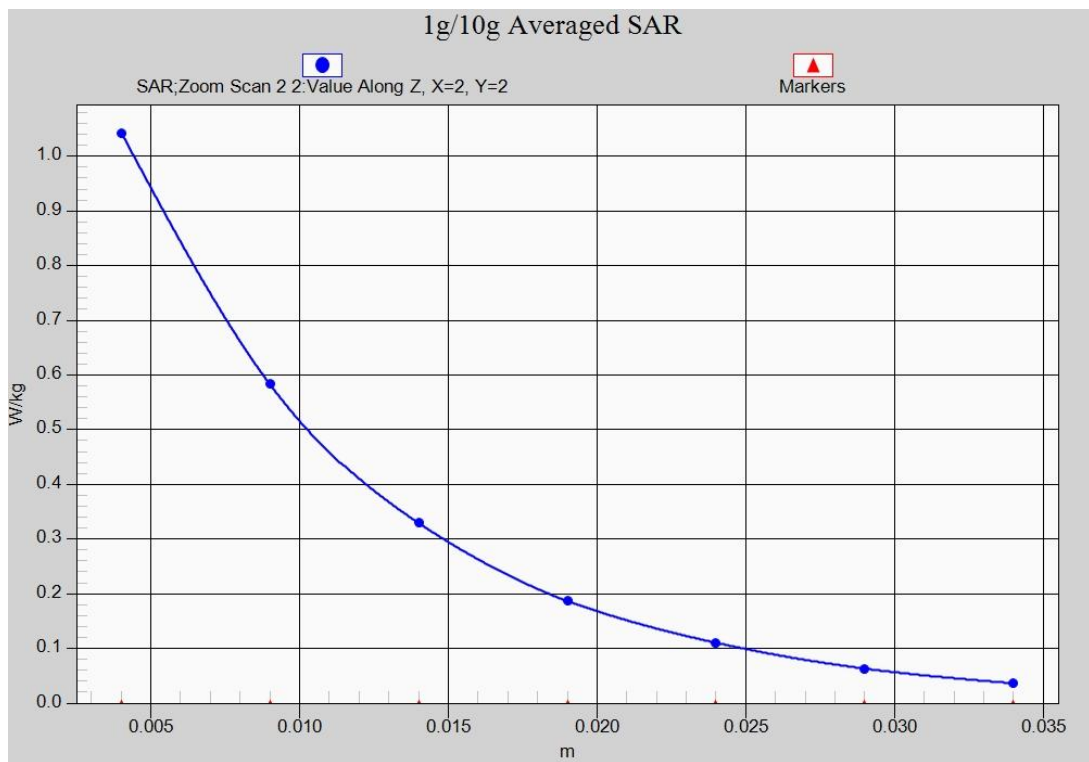


Fig.11-1 Z-Scan at power reference point (LTE Band 2)

LTE Band 2 wrist-worn

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Body 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.512$ S/m; $\epsilon_r = 54.328$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, LTE_FDD (0) Frequency: 1900 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633 ConvF(7.55, 7.55, 7.55);

Rear Side High 1RB_Mid/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.86 W/kg

Rear Side High 1RB_Middle/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 13.81 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 3.63 W/kg

SAR(1 g) = 1.78 W/kg; SAR(10 g) = 0.858 W/kg

Maximum value of SAR (measured) = 2.01 W/kg

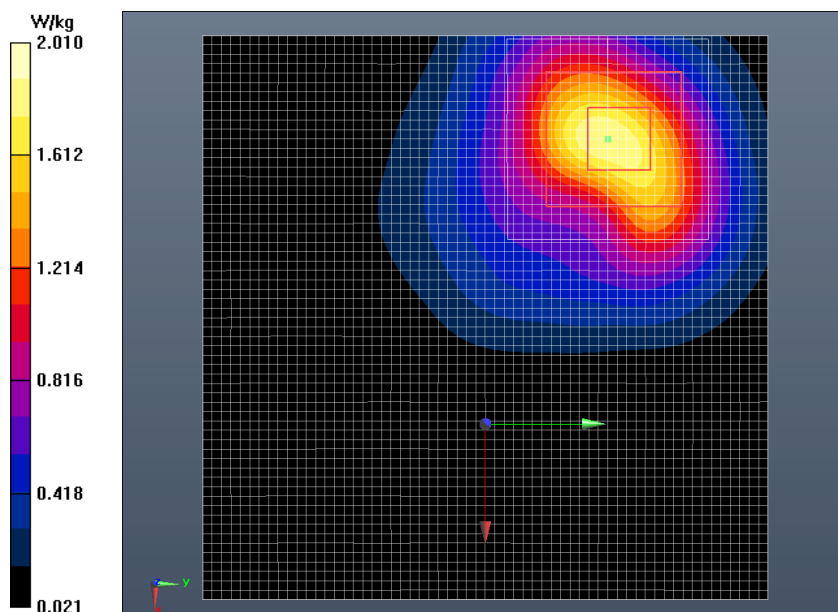


Fig.12 LTE Band 2

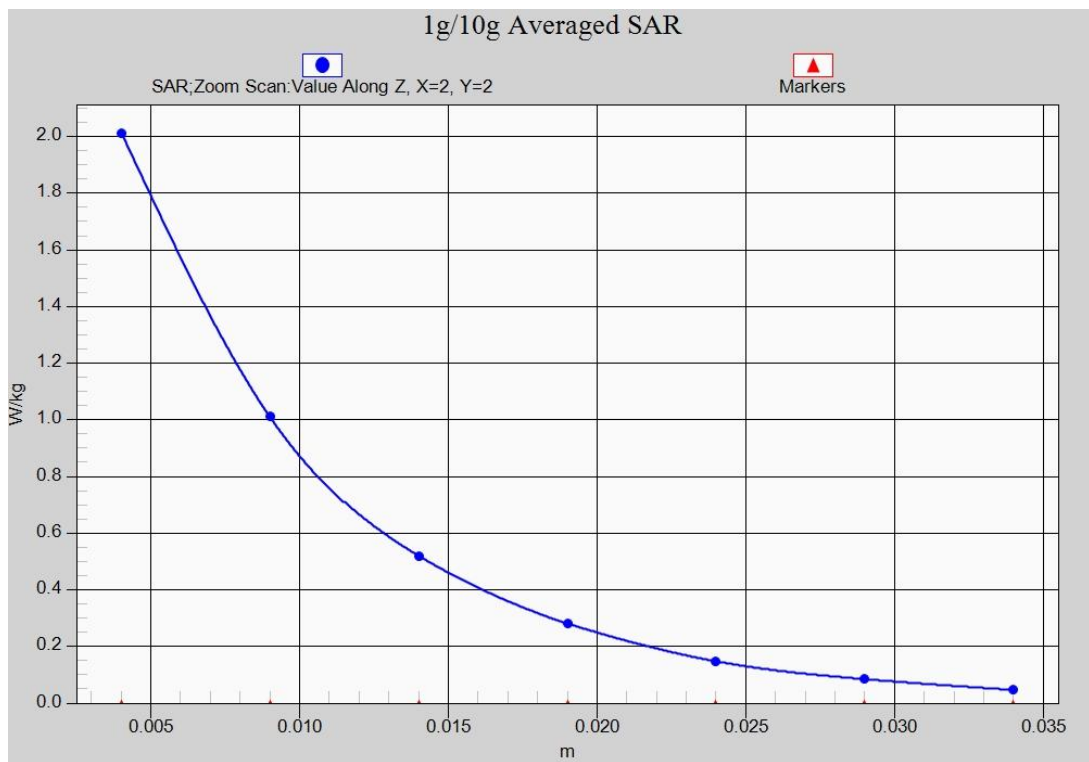


Fig.12-1 Z-Scan at power reference point (LTE Band 2)

LTE Band 4Next to the mouth

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Head 1800 MHz

Medium parameters used (interpolated): $f = 1720$ MHz; $\sigma = 1.343$ S/m; $\epsilon_r = 39.544$; $\rho = 1000$ kg/m³

Ambient Temperature:22.0°C Liquid Temperature:21.5°C

Communication System: UID 0, LTE_FDD (0) Frequency: 1720 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633 ConvF(8.08, 8.08, 8.08);

Front side Low1RB_Mid/Area Scan (51x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

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

Front side Low1RB_Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.96 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 1.42 W/kg

SAR(1 g) = 0.908 W/kg; SAR(10 g) = 0.529 W/kg

Maximum value of SAR (measured) = 0.997 W/kg

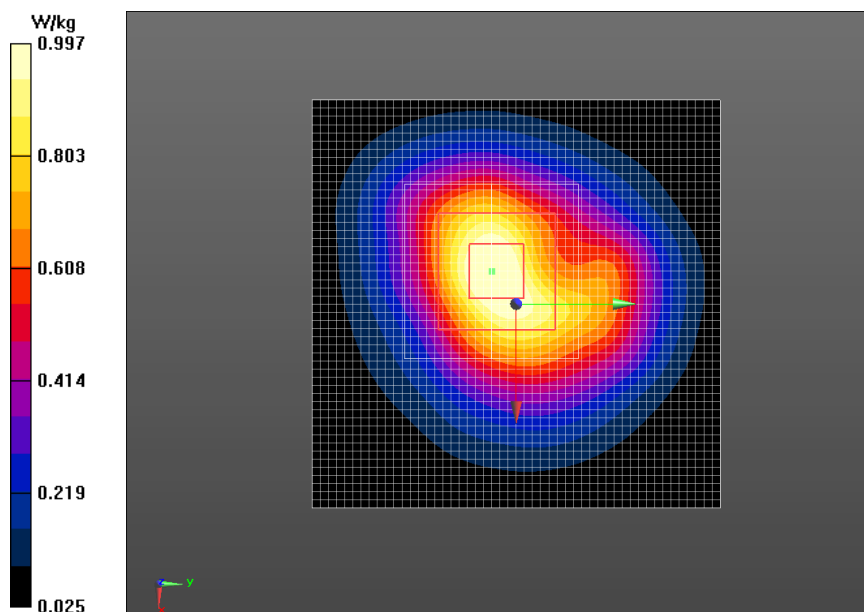


Fig.13 LTE Band4

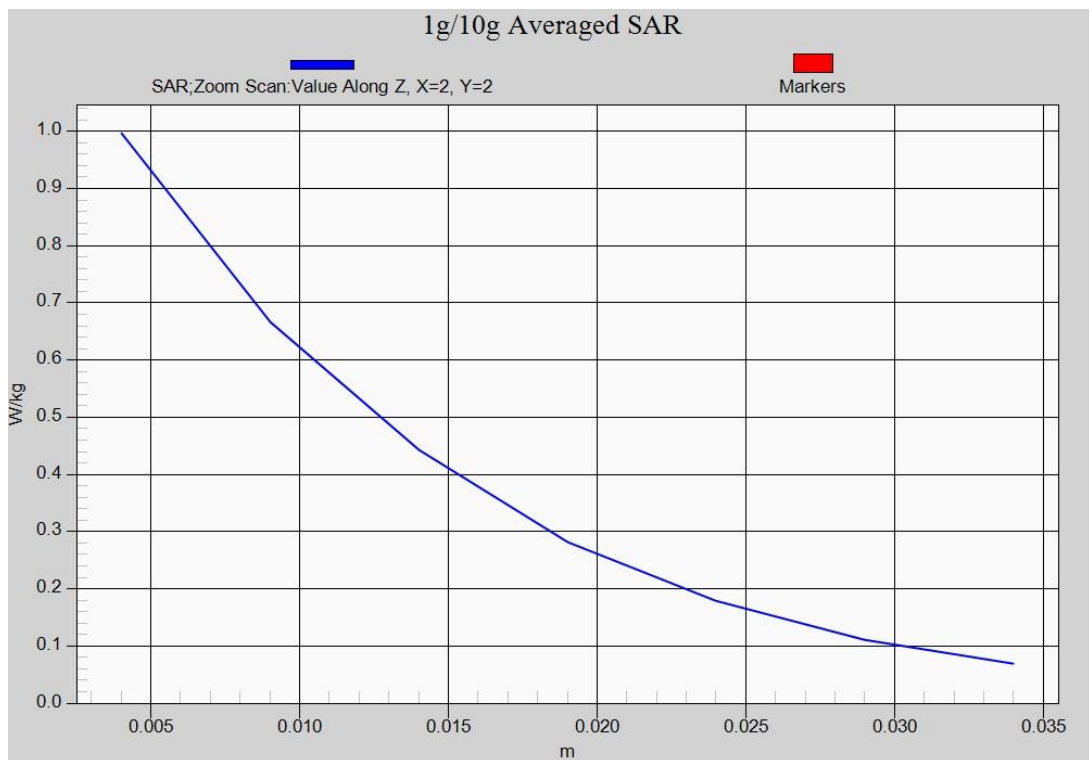


Fig.13-1 Z-Scan at power reference point (LTE Band 4)

LTE Band 4 wrist-worn

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Body 1800 MHz

Medium parameters used (interpolated): $f = 1720$ MHz; $\sigma = 1.471$ S/m; $\epsilon_r = 52.648$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: UID 0, LTE_FDD (0) Frequency: 1720 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633 ConvF(7.9, 7.9, 7.9);

Rear Side Low 1RB_Mid/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.51 W/kg

Rear Side Low 1RB_Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.05 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 2.03 W/kg

SAR(1 g) = 1.29 W/kg; SAR(10 g) = 0.765 W/kg

Maximum value of SAR (measured) = 1.39 W/kg

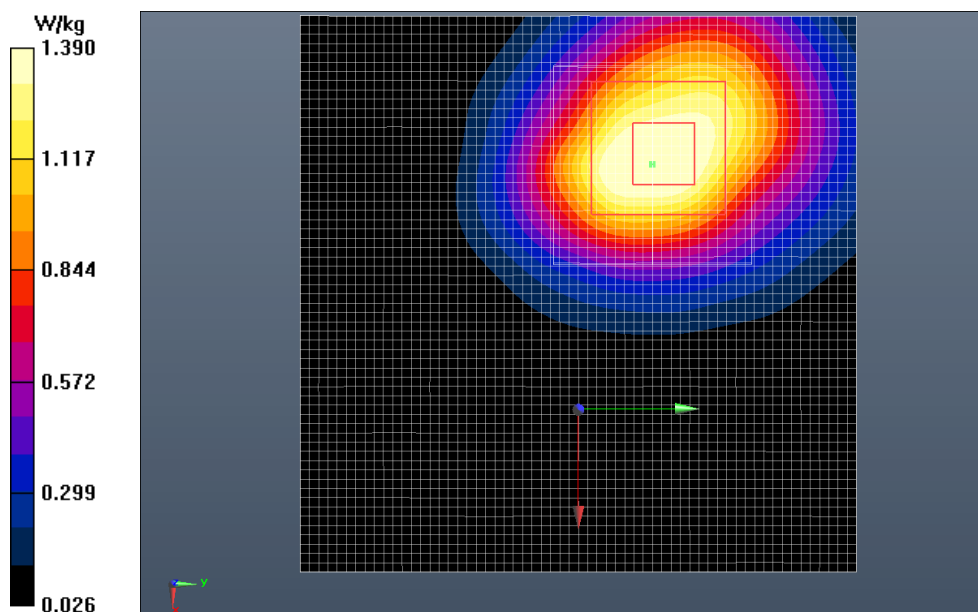


Fig.14 LTE Band 4

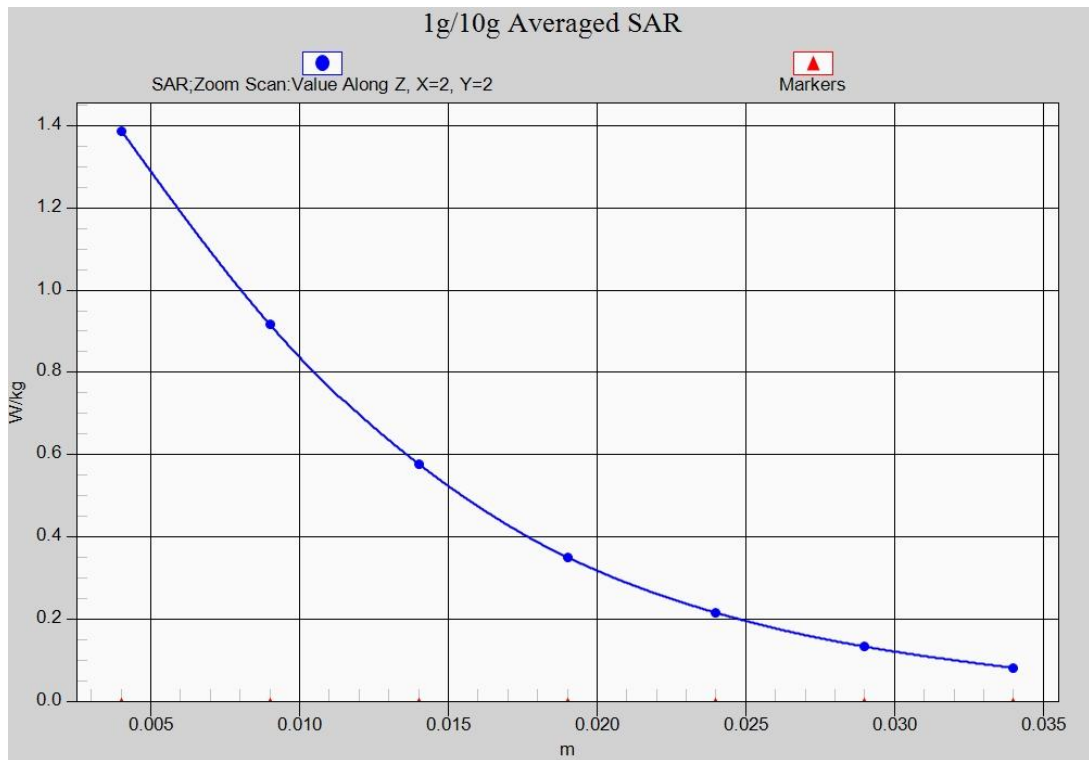


Fig.14-1 Z-Scan at power reference point (LTE Band 4)

ANNEX B System Verification Results

835MHz

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Head 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.886 \text{ S/m}$; $\epsilon_r = 41.864$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C

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

Probe: EX3DV4 - SN3633ConvF (9.04, 9.04, 9.04)

System Validation /Area Scan (81x161x1): Interpolated grid: $dx=1.000 \text{ mm}$, $dy=1.000 \text{ mm}$

Reference Value = 52.758 V/m ; Power Drift = 0.05 dB

Fast SAR: SAR(1 g) = 2.24 W/kg ; SAR(10 g) = 1.50 W/kg

Maximum value of SAR (interpolated) = 2.47 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 52.758 V/m ; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 3.25 W/kg

SAR(1 g) = 2.22W/kg ; SAR(10 g) = 1.45W/kg

Maximum value of SAR (measured) = 2.44 W/kg

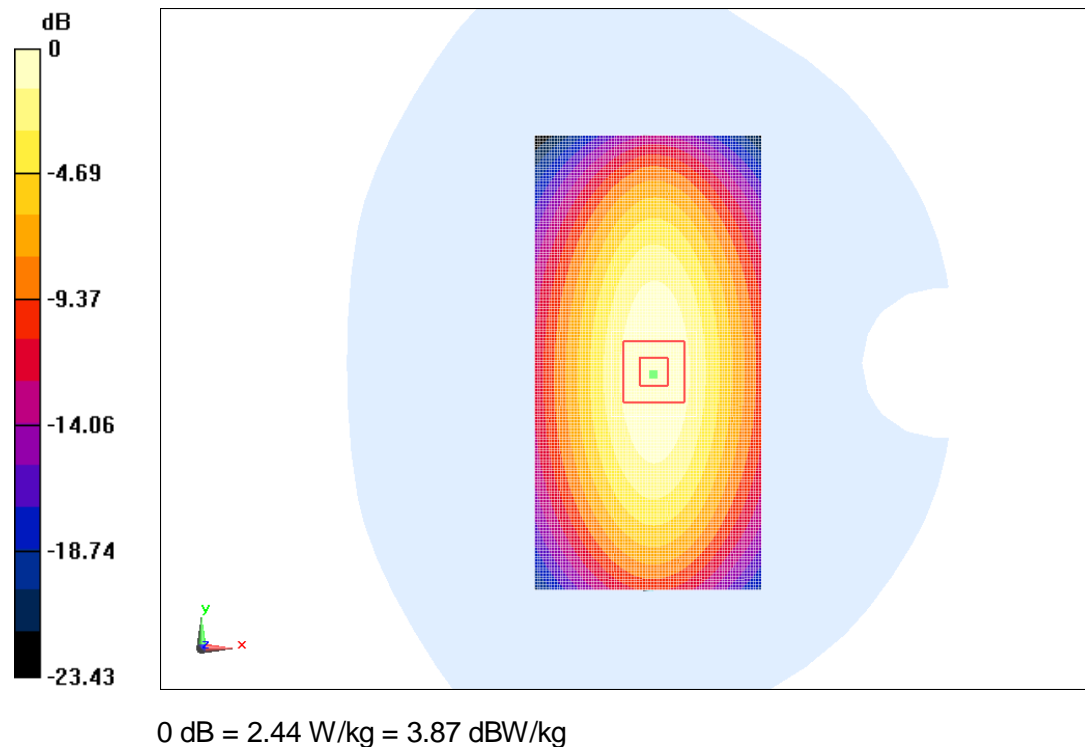


Fig.B.1 validation 835MHz 250mW

835MHz

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Body 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.955 \text{ S/m}$; $\epsilon_r = 55.832$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C

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

Probe: EX3DV4 - SN3633ConvF (9.41, 9.41, 9.41)

System Validation /Area Scan (81x171x1): Interpolated grid: $dx=1.000 \text{ mm}$, $dy=1.000 \text{ mm}$

Reference Value = 55.685 V/m ; Power Drift = -0.07 dB

Fast SAR: SAR(1 g) = 2.31 W/kg ; SAR(10 g) = 1.54 W/kg

Maximum value of SAR (interpolated) = 2.62 W/kg

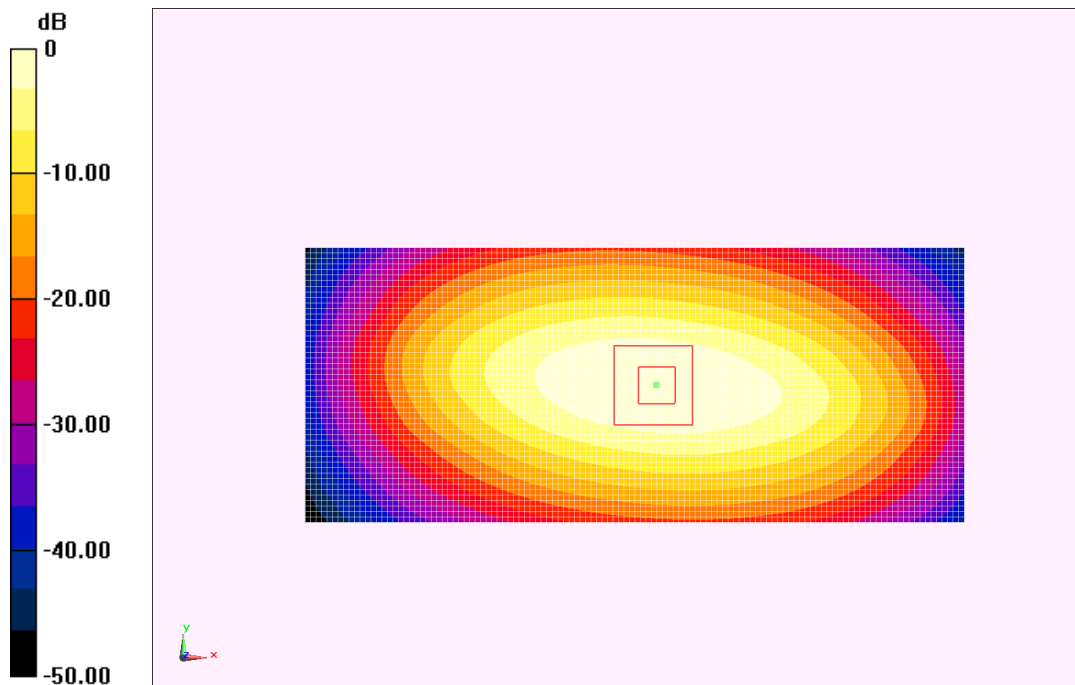
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 55.685 V/m ; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 3.59 W/kg

SAR(1 g) = 2.26 W/kg ; SAR(10 g) = 1.50 W/kg

Maximum value of SAR (measured) = 2.54 W/kg



0 dB = 2.54 W/kg = 4.05 dBW/kg

Fig.B.2validation 835MHz 250mW

1800MHz

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Head 1800 MHz

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.428$ S/m; $\epsilon_r = 39.287$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: CW_TMC Frequency: 1800 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633ConvF (8.08, 8.08, 8.08);

System Validation/Area Scan (61x121x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Reference Value = 80.362 V/m; Power Drift = -0.02 dB

Fast SAR: SAR(1 g) = 9.66 W/kg; SAR(10 g) = 5.15 W/kg

Maximum value of SAR (interpolated) = 12.2 W/kg

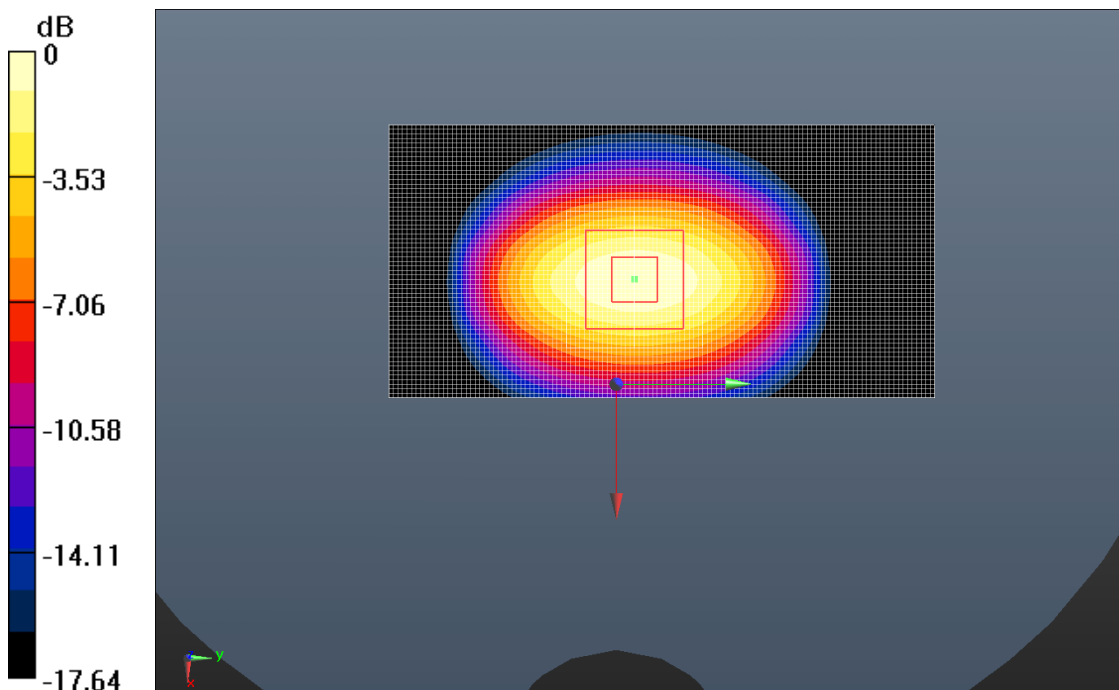
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 80.362 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 19.3 W/kg

SAR(1 g) = 9.87 W/kg; SAR(10 g) = 5.19 W/kg

Maximum value of SAR (measured) = 12.7 W/kg



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

Fig.B.3 validation 1800MHz 250mW

1800MHz

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Body 1800 MHz

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.545$ S/m; $\epsilon_r = 52.365$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: CW_TMC Frequency: 1800 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3633ConvF (7.9, 7.9, 7.9);

System Validation/Area Scan (61x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Reference Value = 77.824 V/m; Power Drift = -0.10 dB

Fast SAR: SAR(1 g) = 9.68 W/kg; SAR(10 g) = 5.22 W/kg

Maximum value of SAR (interpolated) = 12.5 W/kg

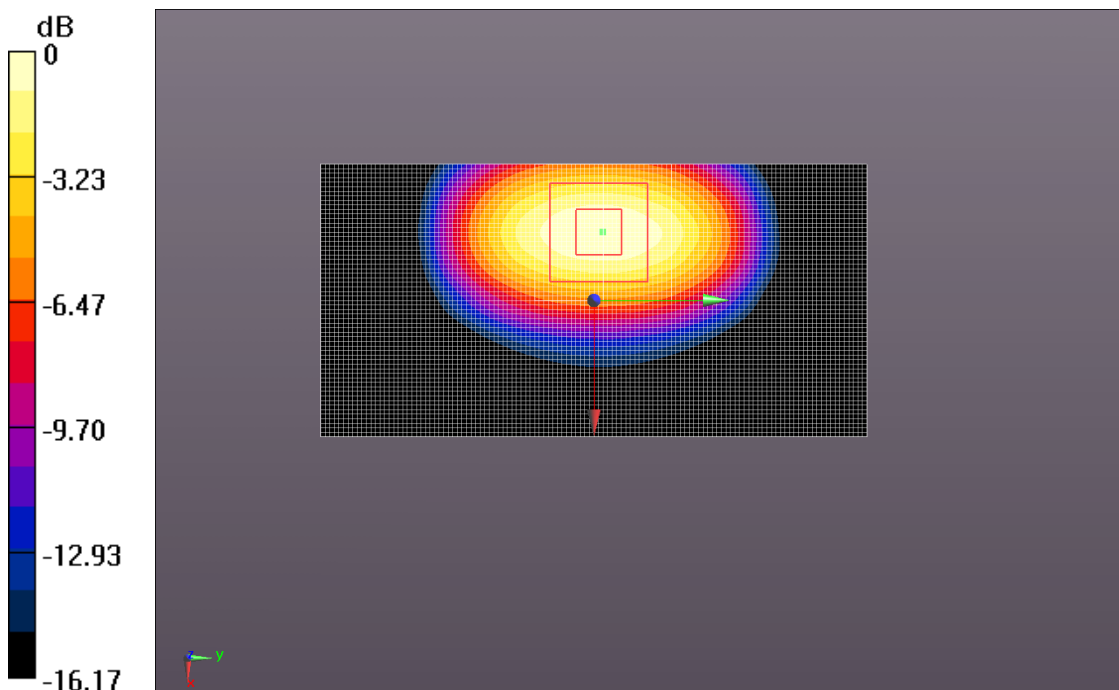
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 77.824 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 16.9 W/kg

SAR(1 g) = 9.57 W/kg; SAR(10 g) = 5.12 W/kg

Maximum value of SAR (measured) = 11.6 W/kg



0 dB = 11.6 W/kg = 10.64 dBW/kg

Fig.B.4 validation 1800MHz 250mW

1900MHz

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Head 1900 MHz

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.406 \text{ S/m}$; $\epsilon_r = 38.742$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C

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

Probe: EX3DV4 - SN3633ConvF (8, 8, 8);

System Validation /Area Scan (81x121x1): Interpolated grid: $dx=1.000 \text{ mm}$, $dy=1.000 \text{ mm}$

Reference Value = 86.382 V/m ; Power Drift = -0.04dB

Fast SAR: SAR(1 g) = 10.1 W/kg ; SAR(10 g) = 5.22 W/kg

Maximum value of SAR (interpolated) = 12.5 W/kg

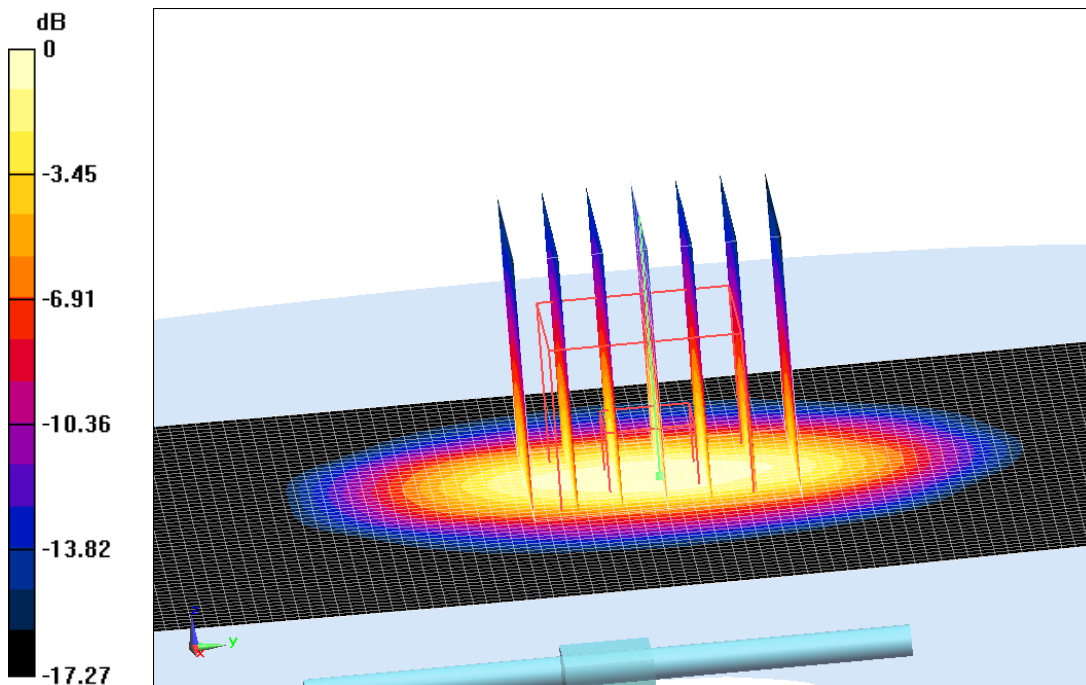
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 86.382 V/m ; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 17.7 W/kg

SAR(1 g) = 9.85 W/kg ; SAR(10 g) = 5.16 W/kg

Maximum value of SAR (measured) = 11.8 W/kg



0 dB = 11.8 W/kg = 10.72 dBW/kg

Fig.B.5validation 1900MHz 250mW

1900MHz

Date: 2017-6-25

Electronics: DAE4 Sn786

Medium: Body 1900 MHz

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.512 \text{ S/m}$; $\epsilon_r = 54.328$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C

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

Probe: EX3DV4 - SN3633ConvF (7.55, 7.55, 7.55)

System validation /Area Scan (81x121x1): Interpolated grid: $dx=1.000 \text{ mm}$, $dy=1.000 \text{ mm}$

Reference Value = 68.183 V/m ; Power Drift = -0.06 dB

Fast SAR: SAR(1 g) = 10.9 W/kg ; SAR(10 g) = 5.51 W/kg

Maximum value of SAR (interpolated) = 13.1 W/kg

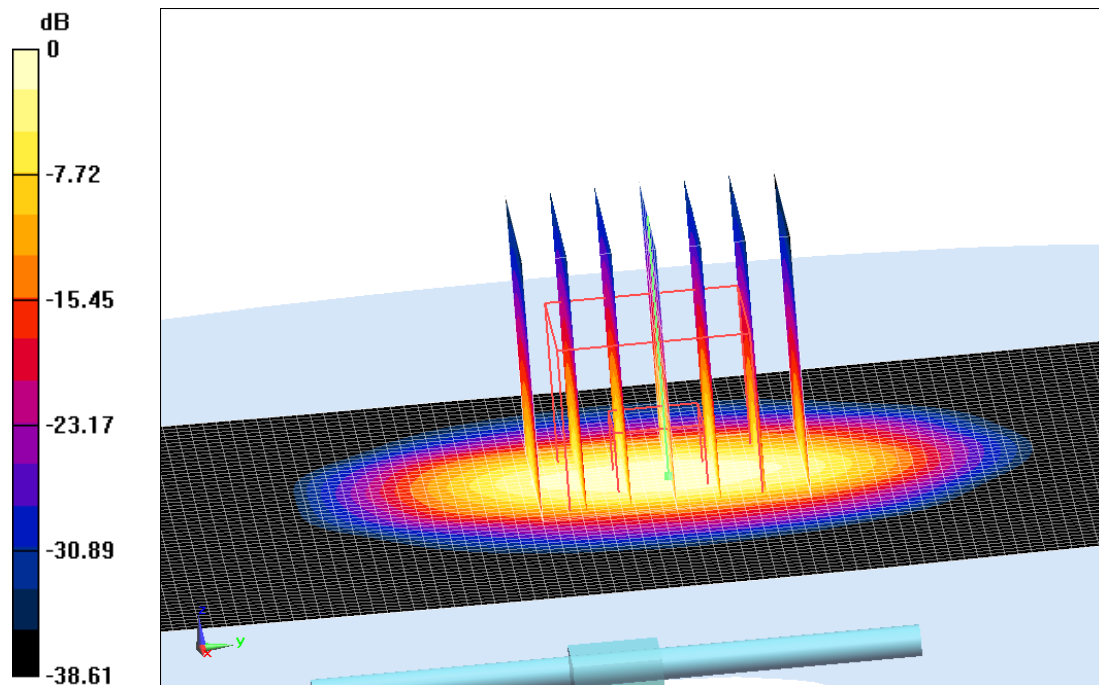
System validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 68.183 V/m ; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 10.6 W/kg ; SAR(10 g) = 5.45 W/kg

Maximum value of SAR (measured) = 12.5 W/kg



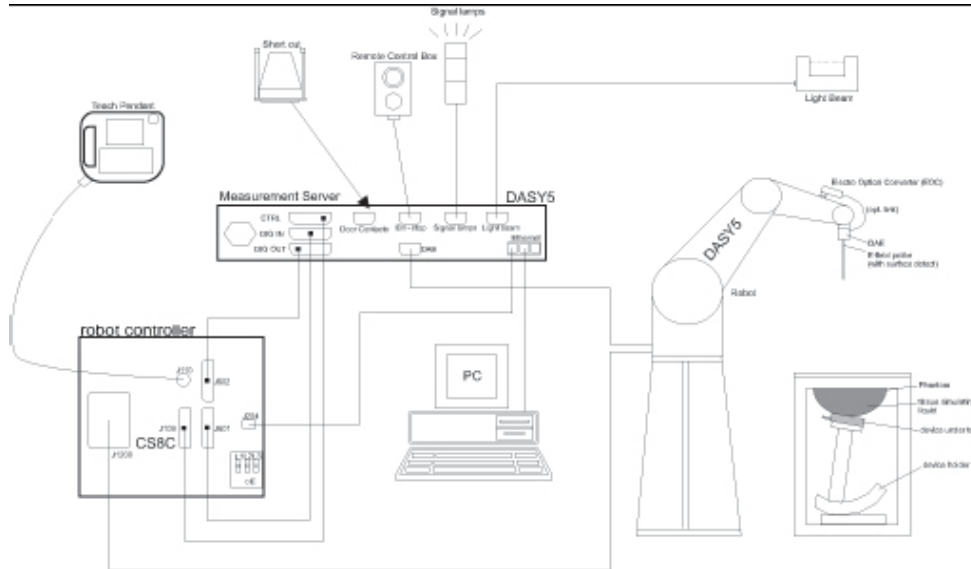
0 dB = 12.5 W/kg = 10.97 dBW/kg

Fig.B.6validation 1900MHz 250Mw

ANNEX C SAR Measurement Setup

C.1 Measurement Set-up

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 (StäubliTX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the 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 during a software approach and looks for the maximum using 2nd order curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:

Model:	ES3DV3, EX3DV4
Frequency	10MHz — 6.0GHz(EX3DV4)
Range:	10MHz — 4GHz(ES3DV3)
Calibration:	In head and body simulating tissue at Frequencies from 835 up to 5800MHz
Linearity:	± 0.2 dB(30 MHz to 6 GHz) for EX3DV4 ± 0.2 dB(30 MHz to 4 GHz) for ES3DV3
DynamicRange:	10 mW/kg — 100W/kg
Probe Length:	330 mm
Probe Tip	
Length:	20 mm
Body Diameter:	12 mm
Tip Diameter:	2.5 mm (3.9 mm for ES3DV3)
Tip-Center:	1 mm (2.0mm for ES3DV3)
Application:SAR	Dosimetry Testing Compliance tests of 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 in 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/ cm².

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/m³).

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: RX160L) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

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



Picture C.5 DASY 5

C.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU board 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 board, which is directly connected to the PC/104 bus of the CPU board.

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 $\pm 0.5\text{mm}$ would produce a SAR uncertainty of $\pm 20\%$. 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 $\varepsilon = 3$ and loss tangent $\delta = 0.02$. 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.7-1: Device Holder Picture C.7-2: Laptop Extension Kit

C.4.5 Phantom

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

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

Shell Thickness: 2 ± 0.2 mm
Filling Volume: Approx. 25 liters
Dimensions: 810 x 1000 x 500 mm (H x L x W)
Available: Special

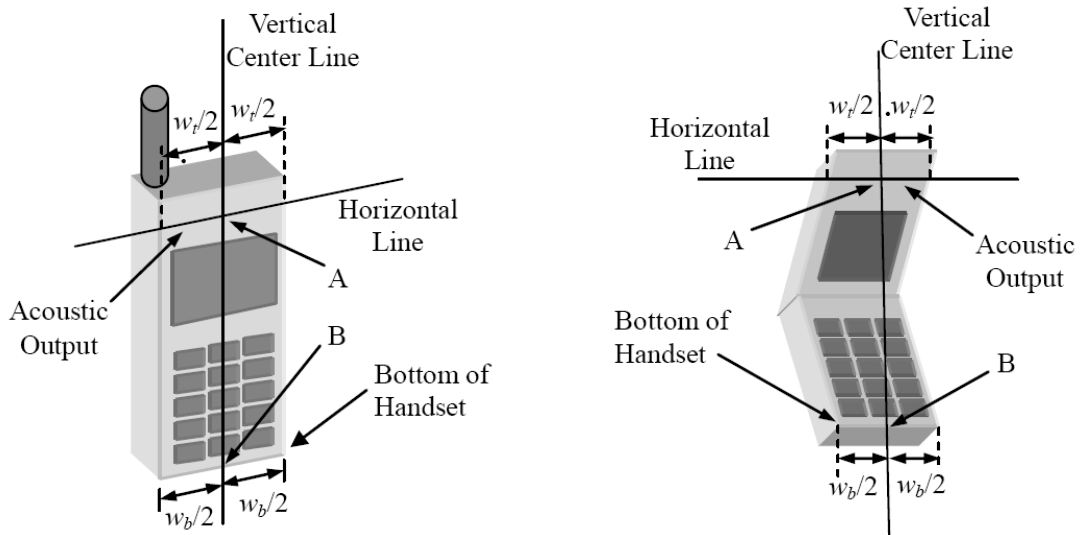


Picture C.8: SAM Twin Phantom

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.



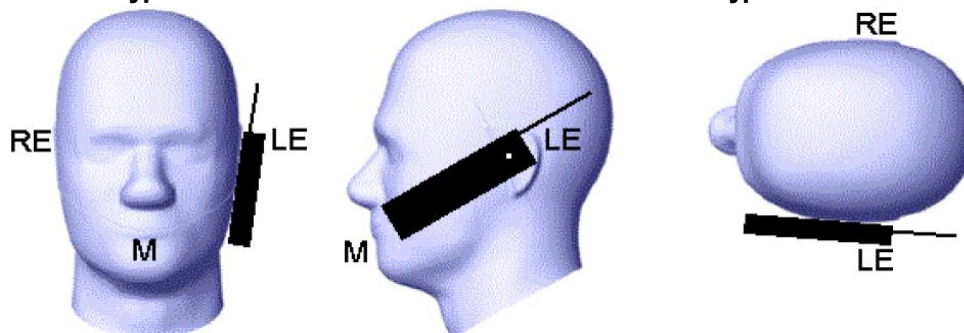
w_t Width of the handset at the level of the acoustic

w_b Width of the bottom of the handset

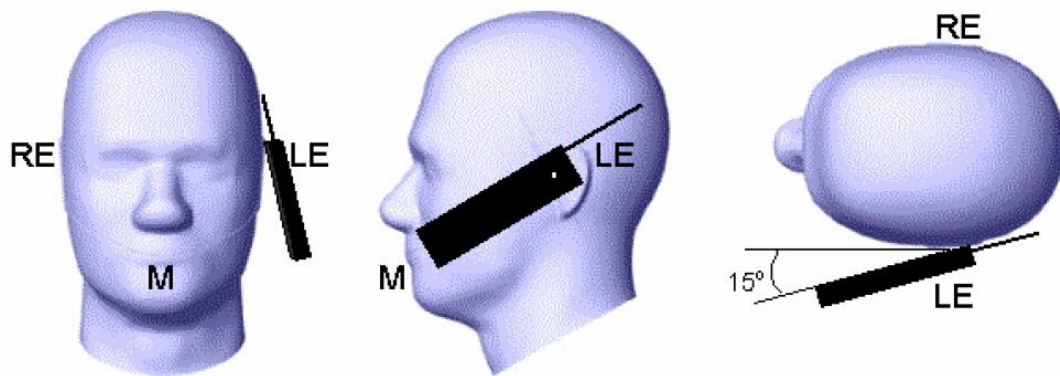
A Midpoint of the width w_t of the handset at the level of the acoustic output

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



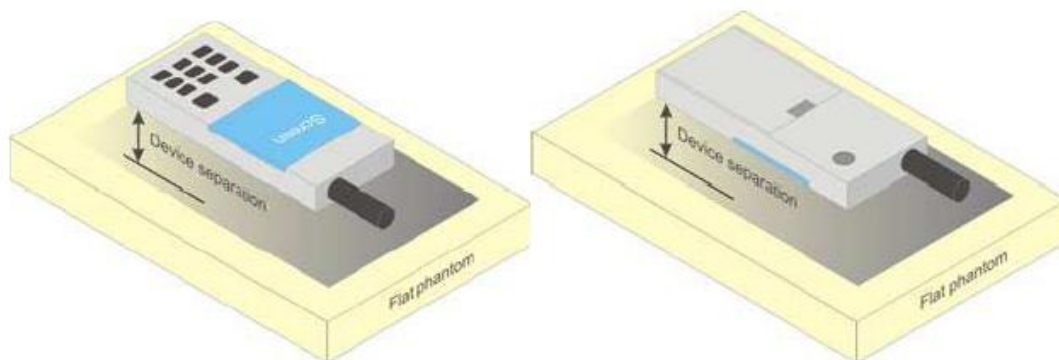
Picture D.2 Cheek position of the wireless device on the left side of SAM



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.