TEST REPORT

No. I18D00214-SAR01

For

Client: Mobiwire SAS

Production: Connected Mobile with Printer

Brand name: MobiIOT

Model Name: MP4

FCC ID: QPN-3G128-MP4

Hardware Version: V01

Software Version: V01

Issued date: 2019-01-22

Note:

Test Laboratory:

ECIT Shanghai, East China Institute of Telecommunications

Add: 7-8F, G Area, No.668, Beijing East Road, Huangpu District, Shanghai, P. R. China

Tel: (+86)-021-63843300, E-Mail: welcome@ecit.org.cn

NOTE

1. The test results in this test report relate only to the devices specified in this report.
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3. For the test results, the uncertainty of measurement is not taken into account when judging the compliance with specification, and the results of measurement or the average value of measurement results are taken as the criterion of the compliance with specification directly.

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Revision Version

Report Number	Revision	Date	Memo
I18D00214-SAR01	00	2019-01-22	Initial creation of test report

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1. Test Laboratory

1.1. Testing Location

Company Name:	ECIT Shanghai, East China Institute of Telecommunications
Address:	7-8F, G Area,No. 668, Beijing East Road, Huangpu District, Shanghai, P. R. China
Postal Code:	200001
Telephone:	(+86)-021-63843300
Fax:	(+86)-021-63843301
FCC registration No:	958356

1.2. Testing Environment

Normal Temperature:	18-25℃
Relative Humidity:	25-75%
Ambient noise & Reflection:	< 0.012 W/kg

1.3. Project Data

Project Leader:	Liu Zeguang
Testing Start Date:	2018-11-28
Testing End Date:	2018-12-14

1.4. Signature

Yan Hang
(Prepared this test report)

Fu Erliang
(Reviewed this test report)

Zheng Zhongbin
(Approved this test report)

2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **MP4** are as follows .

Table 2.1: Max. Reported SAR (1g)

Band	SAR 1g(W/Kg)	
	Body worn(5mm)	Hotspot(5mm)
GSM 850	1.116	1.269
GSM 1900	1.024	1.024
WCDMA Band2	0.908	0.908
WCDMA Band5	0.500	0.656
2.4G WiFi	0.317	0.317

Table 2.2: Max. Reported SAR (10g)

Band	Position/Distance	SAR 10g (W/Kg)
GSM 850	Limb	1.298
GSM 1900	Limb	0.883
WCDMA Band2	Limb	0.989
WCDMA Band5	Limb	0.532
2.4G WiFi	Limb	0.616

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, 4.0 W/Kg as averaged over any 10g 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.

Table 2.3: Simultaneous SAR

Simultaneous multi-band transmission						
Test Position		2G	3G	BT	WiFi	SUM
Hotspot &Body- worn 5 mm(1g)	Phantom Side	0.744	0.363	0.167	0.013	0.911
	Ground Side	0.936	0.715	0.167	0.317	1.253
	Ground Tilt Side	1.116	0.908	0.167	--	1.283
Hotspot 5 mm(1g)	Left Side	0.510	0.359	0.167	0.038	0.677
	Right Side	0.698	0.242	0.167	0.023	0.865
	Top Side	--	--	0.167	0.011	0.167
	Bottom Side	1.269	0.879	0.167	--	1.436

Simultaneous multi-band transmission						
Test Position		2G	3G	BT	WiFi	SUM
Hotspot &Body- worn 0 mm(10g)	Phantom Side	0.603	0.416	0.167	0.010	0.77
	Ground Side	0.993	0.776	0.167	0.616	1.609
	Ground Tilt Side	0.883	0.989	0.167	--	1.156
Hotspot 0 mm(10g)	Left Side	0.453	0.427	0.167	0.028	0.62
	Right Side	0.610	0.290	0.167	0.020	0.777
	Top Side	--	--	0.167	0.010	0.167
	Bottom Side	1.298	0.806	0.167	--	1.465

According to the above table, the maximum sum of reported SAR values for GSM/WCDMA and BT/WiFi is **1.436 W/kg** (1g). GSM/WCDMA and BT/WiFi is **1.609 W/kg** (10g)

3. Client Information

3.1. Applicant Information

Company Name:	Mobiwire SAS
Address:	79 AVENUE FRANCOIS ARAGO 92017 NANTERRE CEDEX France.
Telephone:	0574-59555707
Postcode:	France 92017

3.2. Manufacturer Information

Company Name:	Mobiwire SAS
Address:	79 AVENUE FRANCOIS ARAGO 92017 NANTERRE CEDEX France.
Telephone:	0574-59555707
Postcode:	France 92017

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

4.1. About EUT

Description:	Connected Mobile with Printer
Model name:	MP4
Operation Model(s):	GSM850/GSM900/GSM1800/GSM1900 WCDMA Band I/Band II /Band V/BandVIII BT4.0,BLE;WiFi 802.11b,g,n
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 (WiFi) 2402 – 2480 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:	N/A
Hotspot Mode:	Support

4.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Receive Date
N06	SIM:353722100000662 SIM:353722100000670	V01	V01	2018-11-07

*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
N/A	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 and **4.0 W/kg** as averaged over any 10 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 WiFi 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.

KDB 648474 D03 Wireless Chargers Battery Cover v01r04: Evaluation and approval considerations for handsets with specific wireless charging battery covers

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

NOTE: KDB is not in A2LA Scope List.

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
1800	Head	1.40	1.33～1.47	40.0	38.0～42.0
1800	Body	1.52	1.44～1.60	53.3	50.6～56.0
1900	Head	1.40	1.33～1.47	40.0	38.0～42.0
1900	Body	1.52	1.44～1.60	53.3	50.6～56.0
2450	Head	1.80	1.71～1.89	39.2	37.2～41.2
2450	Body	1.95	1.85～2.05	52.7	50.1～55.3
2600	Head	1.96	1.86~2.06	39.0	37.1~40.9
2600	Body	2.16	2.05~2.27	52.5	59.9~55.1
5200	Head	4.66	4.43~4.89	36.0	34.2~37.8
5200	Body	5.30	5.04~5.57	49.0	46.6~51.5
5800	Head	5.27	5.01~5.53	35.3	33.5~37.1
5800	Body	6.00	5.70~6.30	48.2	45.8~50.6

7.2. Dielectric Performance

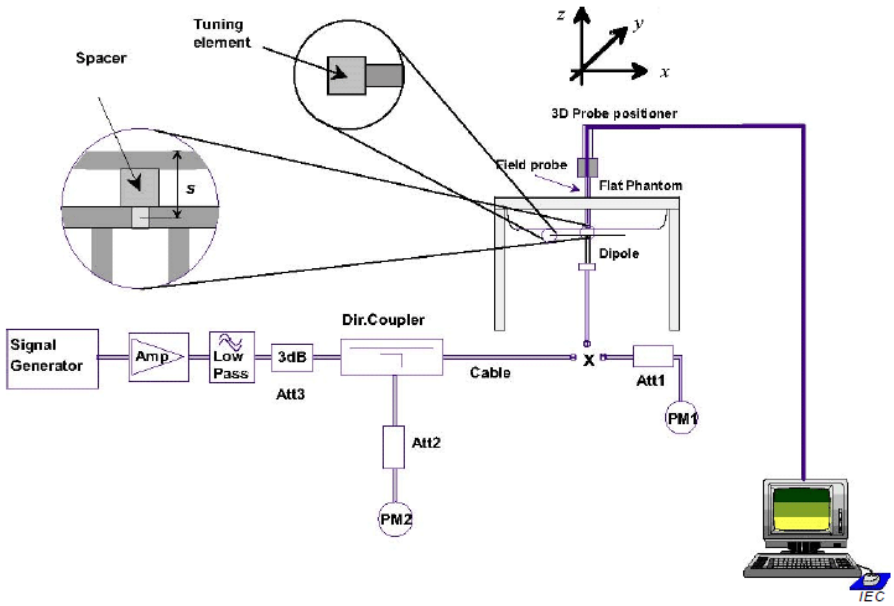
Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Value						
Liquid Temperature: 22.5 ℃						
Type	**Frequency**	**Permittivity ε**	**Drift (%)**	**Conductivity σ**	**Drift (%)**	Test Date
Body	835 MHz	57.108	3.46%	1.001	3.20%	2018/11/28
Body	1900 MHz	54.278	1.83%	1.484	-2.37%	2018/11/29
Body	2450 MHz	54.12	2.69%	1.932	-0.92%	2018/12/14

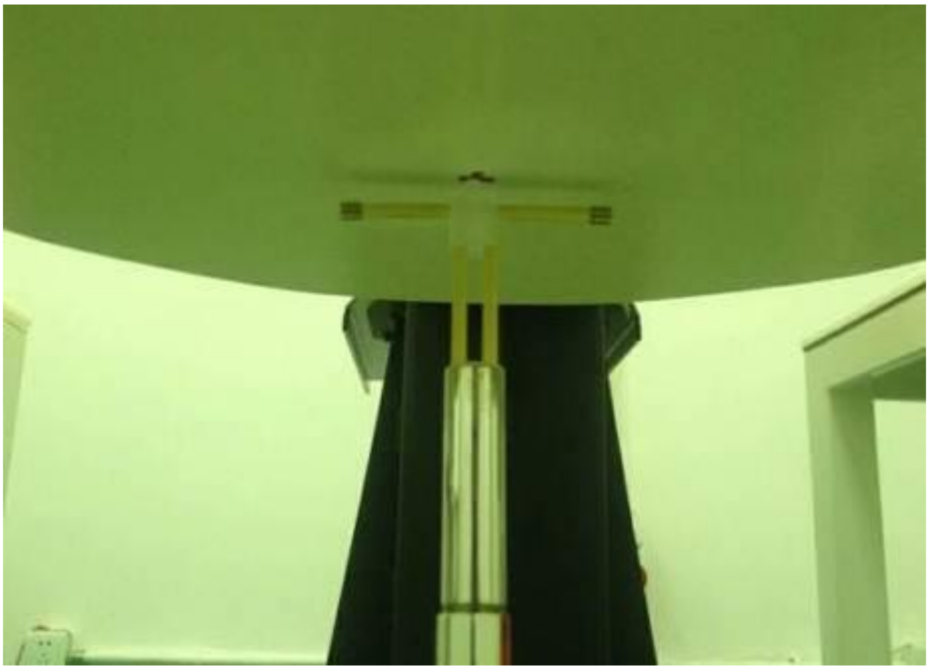
8. System verification

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 Body

Verification Results							
Input power level: 1W							
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	6.40	9.75	6.68	10	4.37%	2.56%	2018/11/28
1900 MHz	21.2	40.4	21.52	40.4	1.51%	0.00%	2018/11/29
2450 MHz	23.5	50.5	24.28	52	3.32%	2.97%	2018/12/14

9. Measurement Procedures

9.1. Tests to be performed

According to the SAR test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement

(b) Area scan

(c) Zoom scan

(d) Power drift measurement

The SAR measurement procedures for each of test conditions are as follows:

(a) Make EUT to transm it maximum output power

(b) Measure conducted output power through RF cable

(c) Place the EUT in the specific position of phantom as Appendix D demonstrates.

(d) Measure SAR results for Middle channel or the highest power channel on each testing position.

(e) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

(f) Record the SAR value

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.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 mm ± 1 mm</td><td>½·δ·ln(2) mm ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$ mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

9.3. WCDMA Measurement Procedures for SAR

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

For Release 5 HSDPA Data Devices:

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	CM/dB	MPR (dB)
1	2/15	15/15	64	2/15	4/15	1.5	0.5
2	12/15	15/15	64	12/15	24/25	2.0	1
3	15/15	8/15	64	15/8	30/15	2.0	1
4	15/15	4/15	64	15/4	30/15	2.0	1

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	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	3.0	2.0	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. Bluetooth & WiFi Measurement Procedures for SAR

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

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

9.5. Power Drift

To control the output power stability during the SAR test, DASY4 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Section 13 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

Manufacturing tolerance

Table 11.1: GPRS (GMSK Modulation)

GSM 850				
Channel		**128**	**190**	**251**
1 Txslots	Maximum Target Value (dBm)	33.0	33.0	33.0
2 Txslots	Maximum Target Value (dBm)	32.0	32.0	32.0
3 Txslots	Maximum Target Value (dBm)	30.0	30.0	30.0
4 Txslots	Maximum Target Value (dBm)	29.0	29.0	29.0
GSM 1900				
Channel		**512**	**661**	**810**
1 Txslots	Maximum Target Value (dBm)	30.0	30.0	30.0
2 Txslots	Maximum Target Value (dBm)	29.0	29.0	29.0
3 Txslots	Maximum Target Value (dBm)	27.0	27.0	27.0
4 Txslots	Maximum Target Value (dBm)	26.0	26.0	26.0

Table 11.2: EGPRS (8-PSK Modulation)

GSM 850				
Channel		**128**	**190**	**251**
1 Txslots	Maximum Target Value (dBm)	27.5	27.5	27.5
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)	23.0	23.0	23.0
GSM 1900				
Channel		**512**	**661**	**810**
1 Txslots	Maximum Target Value (dBm)	27.5	27.5	27.5
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)	23.0	23.0	23.0

Table 11.3: WCDMA

WCDMA Band II			
Channel	Channel 9262	Channel 9400	Channel 9538
Maximum Target Value (dBm)	23.0	23.0	23.0

WCDMA Band II **HSDPA**					MPR (dB)
Channel		9262	9400	9538	
1	Maximum Target Value (dBm)	22.5	22.5	22.5	1
2	Maximum Target Value (dBm)	22.0	22.0	22.0	1
3	Maximum Target Value (dBm)	22.0	22.0	22.0	1
4	Maximum Target Value (dBm)	22.0	22.0	22.0	1
WCDMA Band II **HSUPA**					MPR (dB)
Channel		9262	9400	9538	
1	Maximum Target Value (dBm)	22.0	22.0	22.0	1
2	Maximum Target Value (dBm)	22.0	22.0	22.0	1
3	Maximum Target Value (dBm)	22.0	22.0	22.0	1
4	Maximum Target Value (dBm)	22.0	22.0	22.0	1
5	Maximum Target Value (dBm)	22.0	22.0	22.0	1

Table 11.4: WCDMA

WCDMA Band V			
Channel	4132	4183	4233
Maximum Target Value (dBm)	23.0	23.0	23.0

WCDMA Band V **HSDPA**					MPR (dB)
Channel		4132	4183	4233	
1	Maximum Target Value (dBm)	22.5	22.5	22.5	1
2	Maximum Target Value (dBm)	22.0	22.0	22.0	1
3	Maximum Target Value (dBm)	22.0	22.0	22.0	1
4	Maximum Target Value (dBm)	22.0	22.0	22.0	1
WCDMA Band V **HSUPA**					MPR (dB)
Channel		4132	4183	4233	
1	Maximum Target Value (dBm)	22.0	22.0	22.0	1
2	Maximum Target Value (dBm)	22.0	22.0	22.0	1
3	Maximum Target Value (dBm)	22.0	22.0	22.0	1
4	Maximum Target Value (dBm)	22.0	22.0	22.0	1
5	Maximum Target Value (dBm)	21.5	21.5	21.5	1

Table 11.5: WiFi

WiFi 802.11b 2.4G			
Channel	Channel 1	Channel 6	Channel 11
Maximum Target Value (dBm)	16.0	16.0	16.0
WiFi 802.11g 2.4G			
Channel	Channel 1	Channel 6	Channel 11
Maximum Target Value (dBm)	16.0	16.0	16.0
WiFi 802.11n 20M 2.4G			
Channel	Channel 1	Channel 6	Channel 11
Maximum Target Value (dBm)	16.0	16.0	16.0
WiFi 802.11n 40M 2.4G			
Channel	Channel 3	Channel 6	Channel 9
Maximum Target Value (dBm)	15.0	15.0	15.0

Table 11.6: Bluetooth

Bluetooth			
Channel	Channel 0	Channel 39	Channel 78
Maximum Target Value (dBm)	6	6	6

Table 11.7: BLE

BLE			
Channel	Channel 0	Channel 19	Channel 39
Maximum Target Value (dBm)	4.5	4.5	4.5

11.1. 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 11.8: The conducted power measurement results for GPRS/EGPRS

GSM 850 GMSK	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	128	**190**	**251**		**128**	**190**	**251**
1 Txslot	32.53	32.69	32.75	-9.03dB	23.5	23.66	23.72
2 Txslots	31.62	31.64	31.64	-6.02dB	25.6	25.62	25.62
3 Txslots	29.63	29.72	29.67	-4.26dB	25.37	25.46	25.41
4 Txslots	28.61	28.66	28.65	-3.01dB	25.6	25.65	25.64
GSM 1900 GMSK	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	512	**661**	**810**		**512**	**661**	**810**
1 Txslot	29.72	29.7	29.67	-9.03dB	20.69	20.67	20.64
2 Txslots	28.74	28.73	28.71	-6.02dB	22.72	22.71	22.69
3 Txslots	26.72	26.75	26.71	-4.26dB	22.46	22.49	22.45
4 Txslots	25.73	25.71	25.69	-3.01dB	22.72	22.7	22.68

Table 11.9: The conducted power measurement results for E-GPRS

GSM 850 8-PSK	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	128	**190**	**251**		**128**	**190**	**251**
1 Txslot	26.81	26.82	27.13	-9.03dB	17.78	17.79	18.1
2 Txslots	25.62	25.65	25.62	-6.02dB	19.6	19.63	19.6
3 Txslots	23.41	23.45	23.42	-4.26dB	19.15	19.19	19.16
4 Txslots	22.02	22	22.02	-3.01dB	19.01	18.99	19.01
GSM 1900 8-PSK	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	512	**661**	**810**		**512**	**661**	**810**
1 Txslot	26.44	26.45	26.41	-9.03dB	17.41	17.42	17.38
2 Txslots	25.43	25.41	25.48	-6.02dB	19.41	19.39	19.46
3 Txslots	23.31	23.3	23.33	-4.26dB	19.05	19.04	19.07
4 Txslots	21.92	21.9	21.93	-3.01dB	18.91	18.89	18.92

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 ; 4Txslots for1900MHz;

11.2. WCDMA Measurement result

Table 11.10: The conducted Power for WCDMA

Item	band	WCDMA BAND II result(dBm)		
	ARFCN	9262 (1852.4MHz)	9400 (1880.0MHz)	9538 (1907.6MHz)
WCDMA	\	22.82	22.73	22.79
HSDPA	1	22.1	22	22.05
	2	21.88	21.8	21.87
	3	21.55	21.5	21.58
	4	21.47	21.4	21.45
HSUPA	1	21.45	21.4	21.44
	2	21.5	21.34	21.48
	3	21.49	21.48	21.41
	4	21.3	21.18	21.32
	5	21.1	21.08	21.21
Item	band	WCDMA BAND V result(dBm)		
	ARFCN	Channel 4132 (826.4MHz)	Channel 4183 (836.6MHz)	Channel 4233 (846.6MHz)
WCDMA	\	22.58	22.75	22.55
HSDPA	1	21.86	22.02	21.81
	2	21.64	21.82	21.63
	3	21.31	21.52	21.34
	4	21.23	21.42	21.21
HSUPA	1	21.21	21.42	21.2
	2	21.26	21.36	21.24
	3	21.25	21.5	21.17
	4	21.06	21.2	21.08
	5	20.86	21.1	20.97

11.3. WiFi and BT Measurement result

Table 11.11: The conducted average power for Bluetooth

GFSK			
Channel	Ch0 (2402 MHz)	Ch39 (2441MHz)	CH78 (2480MHz)
Conducted Output Power (dBm)	5.03	4.65	4.28
π /4 DQPSK			
Channel	Ch0 (2402 MHz)	Ch39 (2441MHz)	CH78 (2480MHz)
Conducted Output Power (dBm)	4.53	4.21	3.83
8DPSK			
Channel	Ch0 (2402 MHz)	Ch39 (2441MHz)	CH78 (2480MHz)
Conducted Output Power (dBm)	4.35	4.13	3.7

Table 11.12: The conducted average power for BLE

GFSK			
Channel	Ch0 (2402 MHz)	Ch19 (2440MHz)	CH39 (2480MHz)
Conducted Output Power (dBm)	3.73	3.49	2.82

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 body value of BT is 0.167 W/Kg for 1g.SAR body value of BT is 0.167 W/Kg for 10g

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%.

Duty Cycle 802.11b mode

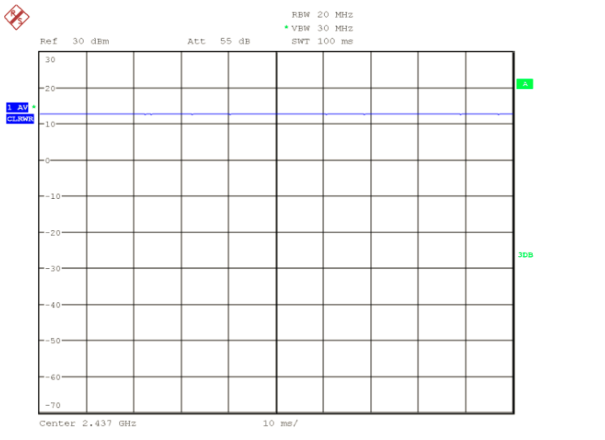


Table 11.13: The average conducted power for WiFi

Mode	Channel	Frequence	Average power(dBm)
802.11 b	1	2412 MHZ	15.01
	6	2437 MHZ	15.18
	11	2462 MHZ	15.24
802.11 g	1	2412 MHZ	14.74
	6	2437 MHZ	15.03
	11	2462 MHZ	15.31
802.11 n 20M	1	2412 MHZ	14.91
	6	2437 MHZ	15.16
	11	2462 MHZ	15.42
802.11 n	3	2422 MHZ	14.33

40M	6	2437 MHZ	14.41
	9	2452 MHZ	14.49

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.

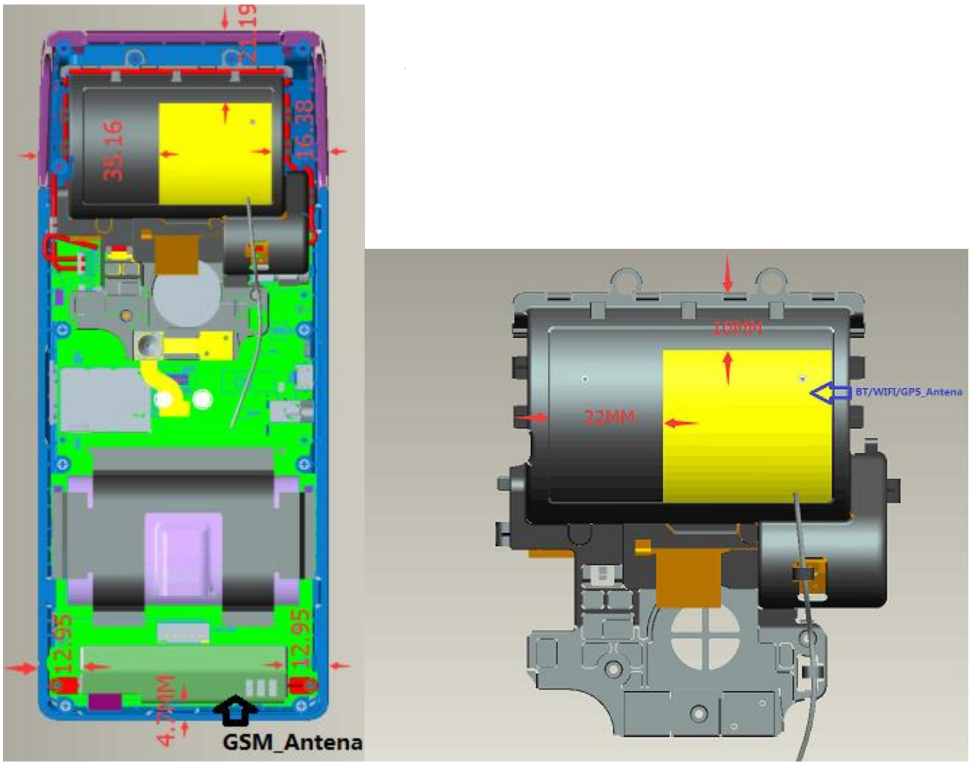
12. Simultaneous TX SAR Considerations

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 WiFi can transmit simultaneous with other transmitters.

12.2. Transmit Antenna Separation Distances



Picture 12.1 Antenna Locations

12.3. Standalone SAR Test Exclusion Considerations

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.

The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·

[√f(GHz)] ≤ 3.0 for 1-g SAR, where

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

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

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

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

Evaluation=1.254＜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. SAR Test Result

Table 13.1: SAR Values (GSM 850 MHz Band-Body)

Frequency		Mode /Band	Service /Headset	Test Position	Spacing (mm)	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Power Drift (dB)
MHz	Ch.											
Hotspot & Body worn												
836.6	190	GPRS 4TS	Class12	Toward Phantom	0	/	28.66	29.0	1.081	0.558	0.603	-0.19
836.6	190	GPRS 4TS	Class12	Toward Ground	0	/	28.66	29.0	1.081	0.918	0.993	0.08
836.6	190	GPRS 4TS	Class12	Toward Ground Tit	0	/	28.66	29.0	1.081	0.773	0.836	-0.07
Hotspot												
836.6	190	GPRS 4TS	Class12	Toward Left	0	/	28.66	29.0	1.081	0.419	0.453	-0.14
836.6	190	GPRS 4TS	Class12	Toward Right	0	/	28.66	29.0	1.081	0.564	0.610	0.12
836.6	190	GPRS 4TS	Class12	Toward Bottom	0	1	28.66	29.0	1.081	1.2	1.298	-0.12

Table 13.2: SAR Values (GSM 850 MHz Band-Body)

Frequency		Mode /Band	Service /Headset	Test Position	Spacing (mm)	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.											
Hotspot & Body worn												
836.6	190	GPRS 4TS	Class12	Toward Phantom	5	/	28.66	29.0	1.081	0.688	0.744	-0.07
836.6	190	GPRS 4TS	Class12	Toward Ground	5	/	28.66	29.0	1.081	0.801	0.866	-0.10
824.2	128	GPRS 4TS	Class12	Toward Ground	5	/	28.61	29.0	1.094	0.856	0.936	0.11
848.8	251	GPRS 4TS	Class12	Toward Ground	5	/	28.65	29.0	1.084	0.77	0.835	-0.05
836.6	190	GPRS 4TS	Class12	Toward Ground Tit	5	/	28.66	29.0	1.081	0.978	1.058	0.10
824.2	128	GPRS 4TS	Class12	Toward Ground Tit	5	/	28.61	29.0	1.094	1.02	1.116	0.19
848.8	251	GPRS 4TS	Class12	Toward Ground Tit	5	/	28.65	29.0	1.084	0.934	1.012	0.00
Hotspot												
836.6	190	GPRS 4TS	Class12	Toward Left	5	/	28.66	29.0	1.081	0.472	0.510	-0.14
836.6	190	GPRS 4TS	Class12	Toward Right	5	/	28.66	29.0	1.081	0.645	0.698	0.05
836.6	190	GPRS 4TS	Class12	Toward Bottom	5	/	28.66	29.0	1.081	1.13	1.222	-0.12
824.2	128	GPRS 4TS	Class12	Toward Bottom	5	2	28.61	29.0	1.094	1.16	1.269	-0.18
848.8	251	GPRS 4TS	Class12	Toward Bottom	5	/	28.65	29.0	1.084	1.08	1.171	-0.11
Repeated												
824.2	128	GPRS 4TS	Class12	Toward Bottom	5	/	28.61	29.0	1.081	1.14	1.233	-0.13
SIM2												
824.2	128	GPRS 4TS	Class12	Toward Bottom	5	/	28.61	29.0	1.081	1.15	1.243	-0.14

Table 13.3: SAR Values (GSM 1900 MHz Band-Body)

Frequency MHz	Frequency Ch.	Mode /Band	Service /Headset	Test Position	Spacing (mm)	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Power Drift (dB)
Hotspot & Body worn												
1880	661	GPRS 4TS	Class12	Toward Phantom	0	/	25.71	26.0	1.069	0.118	0.126	0.12
1880	661	GPRS 4TS	Class12	Toward Ground	0	/	25.71	26.0	1.069	0.624	0.667	0.15
1880	661	GPRS 4TS	Class12	Toward Ground Tit	0	3	25.71	26.0	1.069	0.826	0.883	-0.13
Hotspot												
1880	661	GPRS 4TS	Class12	Toward Left	0	/	25.71	26.0	1.069	0.286	0.306	-0.04
1880	661	GPRS 4TS	Class12	Toward Right	0	/	25.71	26.0	1.069	0.0673	0.072	-0.07
1909.8	810	GPRS 4TS	Class12	Toward Bottom	0	/	25.71	26.0	1.069	0.467	0.499	-0.13

Table 13.4: SAR Values (GSM 1900 MHz Band-Body)

Frequency MHz	Frequency Ch.	Mode /Band	Service /Headset	Test Position	Spacing (mm)	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)
Hotspot & Body worn												
1880	661	GPRS 4TS	Class12	Toward Phantom	5	/	25.71	26.0	1.069	0.123	0.131	-0.04
1880	661	GPRS 4TS	Class12	Toward Ground	5	/	25.71	26.0	1.069	0.476	0.509	-0.11
1880	661	GPRS 4TS	Class12	Toward Ground Tit	5	/	25.71	26.0	1.069	0.77	0.823	0.06
1850.2	512	GPRS 4TS	Class12	Toward Ground Tit	5	4	25.73	26.0	1.064	0.962	1.024	0.16
1909.8	810	GPRS 4TS	Class12	Toward Ground Tit	5	/	25.69	26.0	1.074	0.897	0.963	0.01
Hotspot												
1880	661	GPRS 4TS	Class12	Toward Left	5	/	25.71	26.0	1.069	0.256	0.274	0.10
1880	661	GPRS 4TS	Class12	Toward Right	5	/	25.71	26.0	1.069	0.113	0.121	0.05
1880	661	GPRS 4TS	Class12	Toward Bottom	5	/	25.71	26.0	1.069	0.508	0.543	-0.05
Repeated												
1850.2	512	GPRS 4TS	Class12	Toward Ground Tit	5	/	25.73	26.0	1.064	0.955	1.016	0.15

Table 13.5: SAR Values (WCDMA Band II-Body)

Frequency		Mode /Band	Service /Headset	Test Position	Spacing (mm)	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Power Drift (dB)
MHz	Ch.											
Hotspot & Body worn												
1880	9400	Band II	12.2kbps RMC	Toward Phantom	0	/	22.73	23.0	1.064	0.137	0.146	0.10
1880	9400	Band II	12.2kbps RMC	Toward Ground	0	/	22.73	23.0	1.064	0.729	0.776	0.12
1880	9400	Band II	12.2kbps RMC	Toward Ground Tit	0	5	22.73	23.0	1.064	0.929	0.989	-0.19
Hotspot												
1880	9400	Band II	12.2kbps RMC	Toward Left	0	/	22.73	23.0	1.064	0.401	0.427	0.16
1880	9400	Band II	12.2kbps RMC	Toward Right	0	/	22.73	23.0	1.064	0.0867	0.092	-0.14
1880	9400	Band II	12.2kbps RMC	Toward Bottom	0	/	22.73	23.0	1.064	0.757	0.806	0.03

Table 13.6: SAR Values (WCDMA Band II-Body)

Frequency		Mode /Band	Service /Headset	Test Position	Spacing (mm)	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.											
Hotspot & Body worn												
1880	9400	Band II	12.2kbps RMC	Toward Phantom	5	/	22.73	23.0	1.064	0.19	0.202	0.01
1880	9400	Band II	12.2kbps RMC	Toward Ground	5	/	22.73	23.0	1.064	0.672	0.715	0.02
1880	9400	Band II	12.2kbps RMC	Toward Ground Tit	5	/	22.73	23.0	1.064	0.735	0.782	-0.01
1852.4	9262	Band II	12.2kbps RMC	Toward Ground Tit	5	/	22.82	23.0	1.042	0.868	0.905	0.12
1907.6	9538	Band II	12.2kbps RMC	Toward Ground Tit	5	/	22.79	23.0	1.050	0.752	0.789	0.11
Hotspot												
1880	9400	Band II	12.2kbps RMC	Toward Left	5	/	22.73	23.0	1.064	0.269	0.286	0.05
1880	9400	Band II	12.2kbps RMC	Toward Right	5	/	22.73	23.0	1.064	0.131	0.139	0.00
1880	9400	Band II	12.2kbps RMC	Toward Bottom	5	/	22.73	23.0	1.064	0.708	0.753	0.13
1852.4	9262	Band II	12.2kbps RMC	Toward Bottom	5	/	22.82	23.0	1.042	0.843	0.879	0.09
1907.6	9538	Band II	12.2kbps RMC	Toward Bottom	5	/	22.79	23.0	1.050	0.804	0.844	0.02
Repeated												
1852.4	9262	Band II	12.2kbps RMC	Toward Ground Tit	5	6	22.82	23.0	1.042	0.871	0.908	-0.05

Table 13.7: SAR Values (WCDMA Band V-Body)

Frequency		Mode /Band	Service /Headset	Test Position	Spacing (mm)	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Power Drift (dB)
MHz	Ch.											
Hotspot & Body worn												
836.6	4183	Band V	12.2kbps RMC	Toward Phantom	0	/	22.75	23.0	1.059	0.393	0.416	0.11
836.6	4183	Band V	12.2kbps RMC	Toward Ground	0	7	22.75	23.0	1.059	0.502	0.532	0.14
836.6	4183	Band V	12.2kbps RMC	Toward Ground Tilt	0	/	22.75	23.0	1.059	0.456	0.483	0.12
Hotspot												
836.6	4183	Band V	12.2kbps RMC	Toward Left	0	/	22.75	23.0	1.059	0.348	0.369	0.17
836.6	4183	Band V	12.2kbps RMC	Toward Right	0	/	22.75	23.0	1.059	0.274	0.290	-0.12
836.6	4183	Band V	12.2kbps RMC	Toward Bottom	0	/	22.75	23.0	1.059	0.358	0.379	0.13

Table 13.8: SAR Values (WCDMA Band V-Body)

Frequency		Mode /Band	Service /Headset	Test Position	Spacing (mm)	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.											
Hotspot & Body worn												
836.6	4183	Band V	12.2kbps RMC	Toward Phantom	5	/	22.75	23.0	1.059	0.343	0.363	0.14
836.6	4183	Band V	12.2kbps RMC	Toward Ground	5	/	22.75	23.0	1.059	0.472	0.500	0.10
836.6	4183	Band V	12.2kbps RMC	Toward Ground Tilt	5	/	22.75	23.0	1.059	0.436	0.462	0.15
Hotspot												
836.6	4183	Band V	12.2kbps RMC	Toward Left	5	/	22.75	23.0	1.059	0.339	0.359	0.12
836.6	4183	Band V	12.2kbps RMC	Toward Right	5	/	22.75	23.0	1.059	0.228	0.242	0.01
836.6	4183	Band V	12.2kbps RMC	Toward Bottom	5	8	22.75	23.0	1.059	0.619	0.656	-0.15

Table 13.9: SAR Values (WiFi 802.11b - Body)

Frequency MHz	Frequency Ch.	Mode /Band	Service /Headset	Test Position	Spacing (mm)	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Power Drift (dB)
Hotspot & Body worn												
2462	11	WiFi 2450	802.11b	Toward Phantom	0	/	15.24	16.0	1.191	0.008	0.010	0.04
2462	11	WiFi 2450	802.11b	Toward Ground	0	9	15.24	16.0	1.191	0.517	0.616	0.13
Hotspot												
2462	11	WiFi 2450	802.11b	Toward Left	0	/	15.24	16.0	1.191	0.0239	0.028	0.08
2462	11	WiFi 2450	802.11b	Toward Right	0	/	15.24	16.0	1.191	0.0165	0.020	0.03
2462	11	WiFi 2450	802.11b	Toward Top	0	/	15.24	16.0	1.191	0.008	0.010	0.13

Table 13.10: SAR Values (WiFi 802.11b - Body)

Frequency MHz	Frequency Ch.	Mode /Band	Service /Headset	Test Position	Spacing (mm)	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)
Hotspot & Body worn												
2462	11	WiFi 2450	802.11b	Toward Phantom	5	/	15.24	16.0	1.191	0.011	0.013	0.08
2462	11	WiFi 2450	802.11b	Toward Ground	5	10	15.24	16.0	1.191	0.266	0.317	-0.12
2462	11	WiFi 2450	802.11b	Toward Left	5	/	15.24	16.0	1.191	0.0318	0.038	0.06
2462	11	WiFi 2450	802.11b	Toward Right	5	/	15.24	16.0	1.191	0.0197	0.023	0.12
2462	11	WiFi 2450	802.11b	Toward Top	5	/	15.24	16.0	1.191	0.009	0.011	0.42

14. Evaluation of Simultaneous

Table14.1 Simultaneous transmission SAR

Standalone SAR for 2G(W/Kg)				
Test Position		GSM 850	GSM 1900	Highest SAR
Hotspot &Body-worn 0 mm	Phantom Side	0.603	0.126	0.603
	Ground Side	0.993	0.667	0.993
	Ground Tilt Side	0.836	0.883	0.883
Hotspot 0 mm	Left Side	0.453	0.306	0.453
	Right Side	0.610	0.072	0.610
	Top Side	--	--	--
	Bottom Side	1.298	0.499	1.298

Standalone SAR for 3G(W/Kg)				
Test Position		WCDMA Band II	WCDMA Band V	Highest SAR
Hotspot &Body-worn 0 mm	Phantom Side	0.146	0.416	0.416
	Ground Side	0.776	0.532	0.776
	Ground Tilt Side	0.989	0.483	0.989
Hotspot 0 mm	Left Side	0.427	0.369	0.427
	Right Side	0.092	0.290	0.290
	Top Side	--	--	--
	Bottom Side	0.806	0.379	0.806

Simultaneous multi-band transmission						
Test Position		2G	3G	BT	WiFi	SUM
Hotspot &Body- worn 0 mm(10g)	Phantom Side	0.603	0.416	0.167	0.010	0.77
	Ground Side	0.993	0.776	0.167	0.616	1.609
	Ground Tilt Side	0.883	0.989	0.167	--	1.156
Hotspot 0 mm(10g)	Left Side	0.453	0.427	0.167	0.028	0.62
	Right Side	0.610	0.290	0.167	0.020	0.777
	Top Side	--	--	0.167	0.010	0.167
	Bottom Side	1.298	0.806	0.167	--	1.465

Table14.2 Simultaneous transmission SAR

Standalone SAR for 2G(W/Kg)				
Test Position		GSM 850	GSM 1900	Highest SAR
Hotspot &Body-worn 5 mm	Phantom Side	0.744	0.131	0.744
	Ground Side	0.936	0.509	0.936
	Ground Tilt Side	1.116	1.024	1.116
Hotspot 5 mm	Left Side	0.510	0.274	0.510
	Right Side	0.698	0.121	0.698
	Top Side	--	--	--
	Bottom Side	1.269	0.543	1.269

Standalone SAR for 3G(W/Kg)				
Test Position		WCDMA Band II	WCDMA Band V	Highest SAR
Hotspot &Body-worn 5 mm	Phantom Side	0.202	0.363	0.363
	Ground Side	0.715	0.500	0.715
	Ground Tilt Side	0.908	0.462	0.908
Hotspot 5 mm	Left Side	0.286	0.359	0.359
	Right Side	0.139	0.242	0.242
	Top Side	--	--	--
	Bottom Side	0.879	0.656	0.879

Simultaneous multi-band transmission						
Test Position		2G	3G	BT	WiFi	SUM
Hotspot &Body- worn 5 mm(1g)	Phantom Side	0.744	0.363	0.167	0.013	0.911
	Ground Side	0.936	0.715	0.167	0.317	1.253
	Ground Tilt Side	1.116	0.908	0.167	--	1.283
Hotspot 5 mm(1g)	Left Side	0.510	0.359	0.167	0.038	0.677
	Right Side	0.698	0.242	0.167	0.023	0.865
	Top Side	--	--	0.167	0.011	0.167
	Bottom Side	1.269	0.879	0.167	--	1.436

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/LTE/CDMA and WiFi/BT. According to the above table, the sum of reported SAR values for GSM/WCDMA/LTECDMA and WiFi<1.6W/kg. So the simultaneous transmission SAR is not required for WiFi/BT transmitter.

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		Configuration	Test Position	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio
MHz	Ch.					
824.2	128	GPRS 4TS	Bottom	1.16	1.14	1.018
1850.2	512	GPRS 4TS	Ground Tit	0.962	0.955	1.007
1852.4	9262	12.2kbps RMC	Ground Tit	0.868	0.871	1.003

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

Measurement uncertainty for 750 MHz to 3 GHz averaged over 1 gram						
Uncertainty Component	Uncertainty	Prob.	Div.	$c_{i\,(1g)}$	Std. Unc. (1-g)	v_i or Veff
Measurement System						
Probe Calibration (*k*=1)	5.4	Normal	2	1	5.40	∞
Probe Isotropy	4.70	Rectangular	√3	0.7	1.90	∞
Modulation Response	2.40	Rectangular	√3	1	1.39	∞
Hemispherical Isotropy	2.60	Rectangular	√3	0.7	1.05	∞
Boundary Effect	1.00	Rectangular	√3	1	0.58	∞
Linearity	4.70	Rectangular	√3	1	2.71	∞
System Detection Limit	1.00	Rectangular	√3	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	√3	1	0.46	∞
Integration Time	2.60	Rectangular	√3	1	1.50	∞
RF Ambient Noise	0.00	Rectangular	√3	1	0.00	∞
RF Ambient Reflections	0.00	Rectangular	√3	1	0.00	∞
Probe Positioner	0.40	Rectangular	√3	1	0.23	∞
Probe Positioning	2.90	Rectangular	√3	1	1.67	∞
Post-processing	1.00	Rectangular	√3	1	0.58	∞
Test sample Related						
Test sample Positioning	1.2	Normal	1	1	1.2	5
Device Holder Uncertainty	3.2	Normal	1	1	3.2	71
Power drift	5	Rectangular	√3	1	2.89	∞
Power Scaling	0	Rectangular	√3	1	0.00	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	4	Rectangular	√3	1	2.31	∞
SAR correction	1.9	Rectangular	√3	1	1.10	∞
Liquid Conductivity (meas)	4.19	Rectangular	1	0.78	3.27	∞
Liquid Permittivity (meas)	4.4	Rectangular	1	0.26	1.14	∞
Temp. unc. - Conductivity	0.18	Rectangular	√3	0.78	0.08	∞
Temp. unc. - Permittivity	0.54	Rectangular	√3	0.23	0.07	∞
Combined Std. Uncertainty		RSS			9.39	
Expanded STD Uncertainty		*k*=2			18.77%	

System check uncertainty for 750 MHz to 3 GHz averaged over 1 gram						
Uncertainty Component	Uncertainty	Prob.	Div.	$c_{i\ (1g)}$	Std. Unc. (1-g)	v_i or Veff
Measurement System						
Probe Calibration (*k*=1)	5.40	Normal	1	1	5.40	∞
Probe Isotropy	4.70	Rectangular	√3	0.7	1.90	∞
Modulation Response	2.40	Rectangular	√3	1	1.39	∞
Hemispherical Isotropy	2.60	Rectangular	√3	0.7	1.05	∞
Boundary Effect	1.00	Rectangular	√3	1	0.58	∞
Linearity	4.70	Rectangular	√3	1	2.71	∞
System Detection Limit	1.00	Rectangular	√3	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	√3	1	0.46	∞
Integration Time	2.60	Rectangular	√3	1	1.50	∞
RF Ambient Noise	0.00	Rectangular	√3	1	0.00	∞
RF Ambient Reflections	0.00	Rectangular	√3	1	0.00	∞
Probe Positioner	0.40	Rectangular	√3	1	0.23	∞
Probe Positioning	2.90	Rectangular	√3	1	1.67	∞
Post-processing	1.00	Rectangular	√3	1	0.58	∞
Field source						
Deviation of the experimental source from numerical source	5.5	Normal	1	1	5.5	∞
Source to liquid distance	2	Rectangular	√3	1	1.15	∞
Power drift	5	Rectangular	√3	1	2.89	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	4	Rectangular	√3	1	2.31	∞
SAR correction	1.9	Rectangular	√3	1	1.10	∞
Liquid Conductivity (meas)	4.19	Normal	1	0.78	3.27	∞
Liquid Permittivity (meas)	4.4	Normal	1	0.26	1.14	∞
Temp. unc. - Conductivity	0.18	Rectangular	√3	0.78	0.08	∞
Temp. unc. - Permittivity	0.54	Rectangular	√3	0.23	0.07	∞
Combined Std. Uncertainty		RSS			10.39	
Expanded STD Uncertainty		*k*=2			20.79%	

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	Dec 25, 2017	1 year
02	Power meter	NRVD	102257	May 11, 2018	1 year
03	Power sensor	NRV-Z5	100241		
			100644		
04	Signal Generator	E4438C	MY49072044	May 11, 2018	1 Year
05	Amplifier	NTWPA-0086010F	12023024	No Calibration Requested	
06	Coupler	778D	MY4825551	May 11, 2018	1 year
07	BTS	E5515C	MY50266468	Dec 25, 2017	1 year
08	BTS	MT8820C	6201240338	May 11, 2018	1 year
09	E-field Probe	ES3DV3	3252	Aug 31, 2017	1 year
				Sep 4,2018	1 year
10	DAE	SPEAG DAE4	1244	Dec 4,2017	1 year
				Dec 3,2018	1 year
11	Dipole Validation Kit	SPEAG D835V2	4d112	Oct 25, 2018	3 year
		SPEAG D1900V2	5d151	Dec 6,2017	3 year
		SPEAG D2450V2	858	Oct 26,2018	3 year

ANNEX A. Highest SAR GRAPH RESULTS

Fig.1 GPRS850 4TS Bottom Mode Middle

Date/Time: 2018/11/28
Electronics: DAE4 Sn1244
Medium parameters used: f = 837 MHz; σ = 1.003 S/m; ε_r = 57.087; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: GSM 850MHz GPRS 3TS (0); Frequency: 836.6 MHz;
Duty Cycle: 1:2
Probe: ES3DV3 - SN3252ConvF(6.34, 6.34, 6.34); Calibrated: 9/4/2018
GPRS850 4TS Bottom Mode Middle/Area Scan (41x71x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 2.66 W/kg
GPRS850 4TS Bottom Mode Middle/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 46.21 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 4.27 W/kg
SAR(1 g) = 2.19 W/kg; SAR(10 g) = 1.2 W/kg
Maximum value of SAR (measured) = 2.49 W/kg

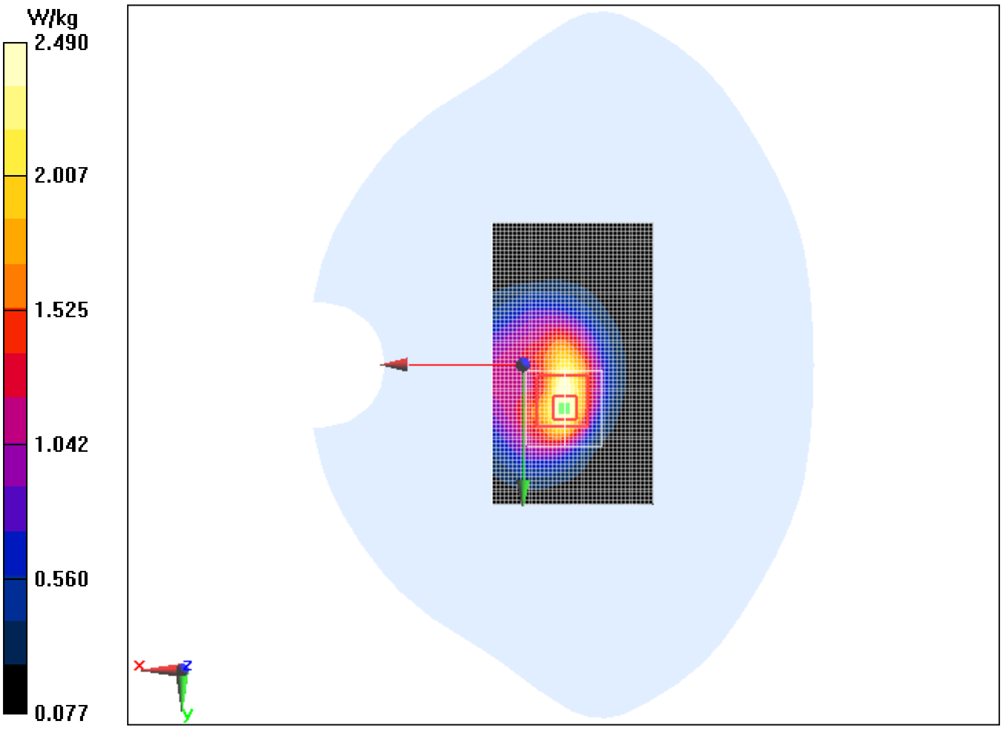


Fig.2 GPRS850 4TS Bottom Mode Low

Date/Time: 2018/11/28
Electronics: DAE4 Sn1244
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.991 S/m; ε_r = 57.221; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: GSM 850MHz GPRS 4TS (0); Frequency: 824.2 MHz; Duty Cycle: 1:2
Probe: ES3DV3 - SN3252ConvF(6.34, 6.34, 6.34); Calibrated: 9/4/2018
GPRS850 4TS Bottom Mode Low/Area Scan (41x71x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 1.35 W/kg
GPRS850 4TS Bottom Mode Low/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.07 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 1.98 W/kg
SAR(1 g) = 1.16 W/kg; SAR(10 g) = 0.671 W/kg
Maximum value of SAR (measured) = 1.28 W/kg

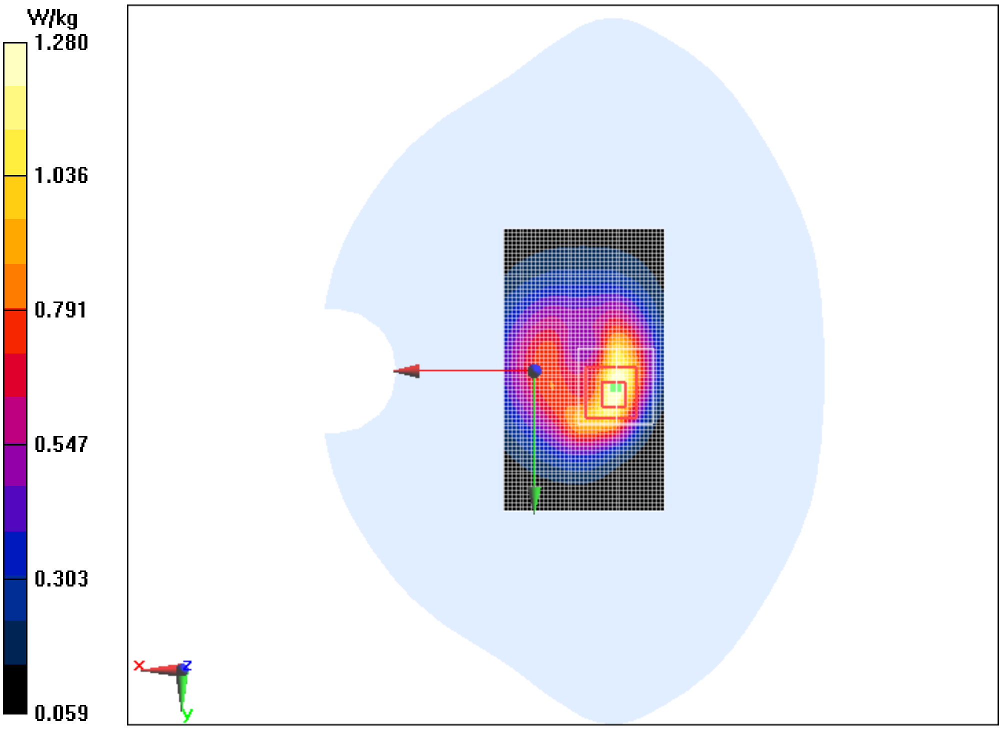


Fig.3 GSM1900 4TS Ground Mode Middle

Date/Time: 2018/11/29
Electronics: DAE4 Sn1244
Medium parameters used (extrapolated): f = 1880 MHz; σ = 1.464 S/m; ε_r = 52.354; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: GSM 1900MHz GPRS 4TS (0); Frequency: 1880 MHz; Duty Cycle: 1:2
Probe: ES3DV3 - SN3252ConvF(4.77, 4.77, 4.77); Calibrated: 9/4/2018
GSM1900 4TS Ground Mode Middle/Area Scan (61x121x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 1.74 W/kg
GSM1900 4TS Ground Mode Middle/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.152 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 2.65 W/kg
SAR(1 g) = 1.54 W/kg; SAR(10 g) = 0.826 W/kg
Maximum value of SAR (measured) = 1.73 W/kg

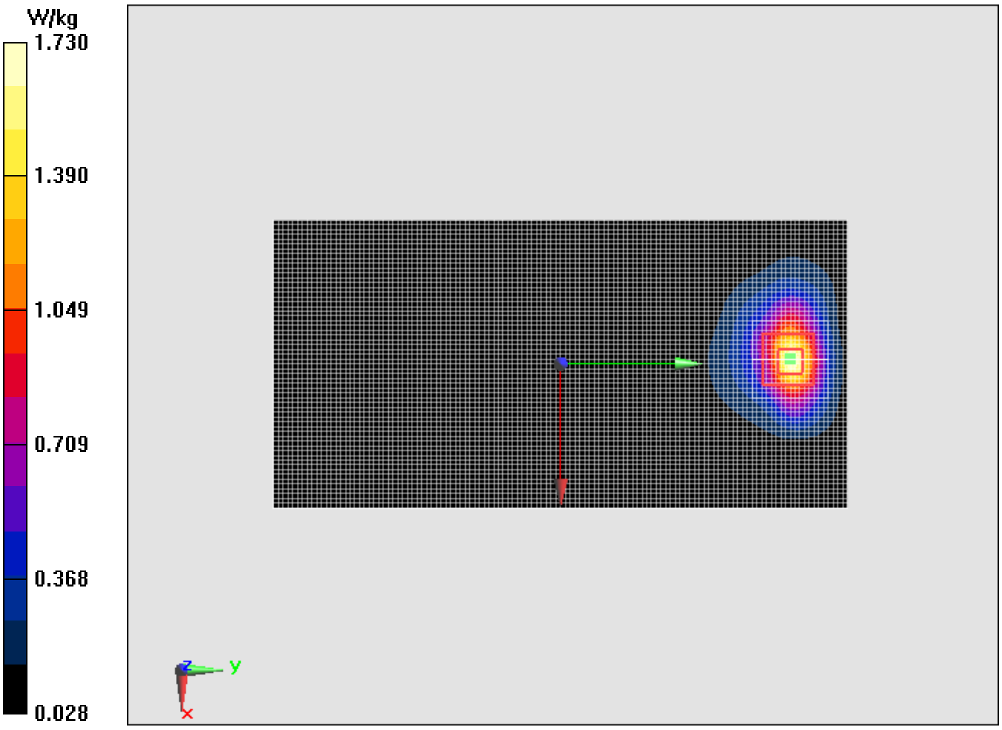


Fig.4 GSM1900 4TS Ground Mode Low

Date/Time: 2018/11/29
Electronics: DAE4 Sn1244
Medium parameters used (extrapolated): f = 1850.2 MHz; σ = 1.434 S/m; ε_r = 52.468; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃   Liquid Temperature:22.5 ℃
Communication System: GSM 1900MHz GPRS 4TS (0); Frequency: 1850.2 MHz; Duty Cycle: 1:2
Probe: ES3DV3 - SN3252ConvF(4.77, 4.77, 4.77); Calibrated: 9/4/2018

GSM1900 4TS Ground Mode Low/Area Scan (61x121x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.980 W/kg

GSM1900 4TS Ground Mode Low/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.637 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 1.59 W/kg
SAR(1 g) = 0.962 W/kg; SAR(10 g) = 0.541 W/kg
Maximum value of SAR (measured) = 1.06 W/kg

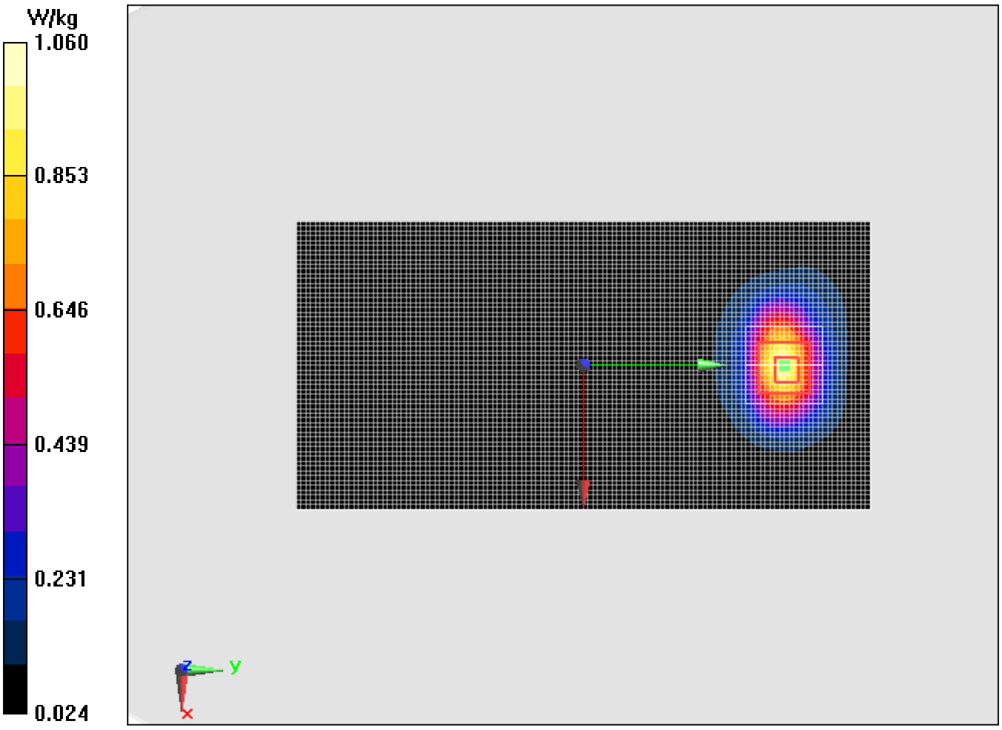


Fig.5 WCDMA Band2 Ground Mode Middle

Date/Time: 2018/11/29
Electronics: DAE4 Sn1244
Medium parameters used (extrapolated): f = 1880 MHz; σ = 1.464 S/m; ε_r = 52.354; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃　　Liquid Temperature:22.5 ℃
Communication System: WCDMA Professional Band Ⅱ; Frequency: 1880 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(4.77, 4.77, 4.77); Calibrated: 9/4/2018

WCDMA Band2 Ground Mode Middle/Area Scan (61x121x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 1.72 W/kg

WCDMA Band2 Ground Mode Middle/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.029 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 2.99 W/kg
SAR(1 g) = 1.73 W/kg; SAR(10 g) = 0.929 W/kg
Maximum value of SAR (measured) = 1.88 W/kg

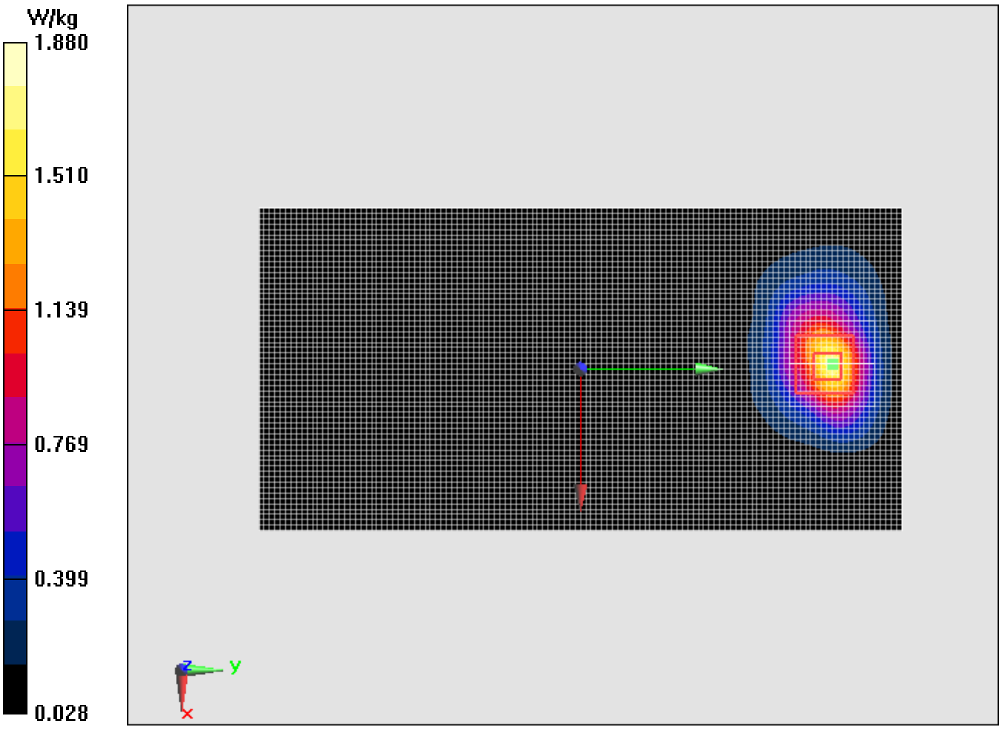


Fig.6 WCDMA Band2 Ground Mode Low Repeated

Date/Time: 2018/11/29
Electronics: DAE4 Sn1244
Medium parameters used (extrapolated): f = 1852.4 MHz; σ = 1.436 S/m; ε_r = 52.46; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: WCDMA Professional Band Ⅱ; Frequency: 1852.4 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(4.77, 4.77, 4.77); Calibrated: 9/4/2018

WCDMA Band2 Ground Mode Low Repeated/Area Scan (61x121x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.899 W/kg

WCDMA Band2 Ground Mode Low Repeated/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.820 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 1.43 W/kg
SAR(1 g) = 0.871 W/kg; SAR(10 g) = 0.496 W/kg
Maximum value of SAR (measured) = 0.931 W/kg

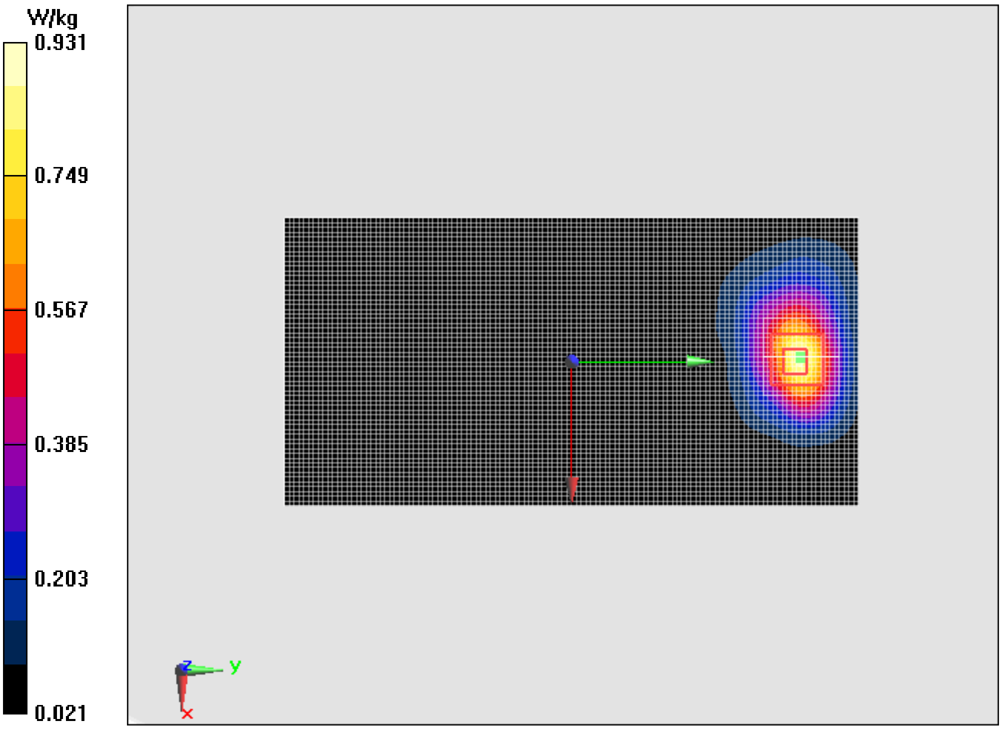


Fig.7 WCDMA Band5 Ground Mode Middle

Date/Time: 2018/11/28
Electronics: DAE4 Sn1244
Medium parameters used: f = 837 MHz; σ = 1.003 S/m; ε_r = 57.087; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: WCDMA Professional Band Ⅴ; Frequency: 836.6 MHz;
Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.34, 6.34, 6.34); Calibrated: 9/4/2018
WCDMA Band5 Ground Mode Middle/Area Scan (61x121x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 1.03 W/kg
WCDMA Band5 Ground Mode Middle/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.720 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 1.27 W/kg
SAR(1 g) = 0.814 W/kg; SAR(10 g) = 0.502 W/kg
Maximum value of SAR (measured) = 0.868 W/kg

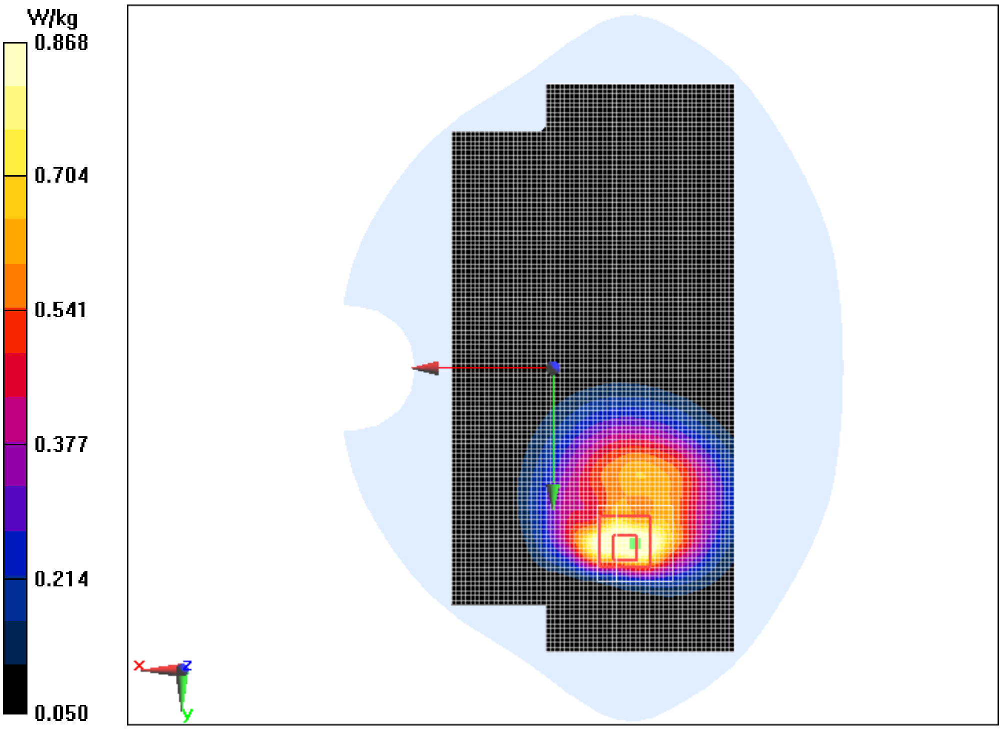


Fig.8 WCDMA Band5 Bottom Mode Middle

Date/Time: 2018/11/28
Electronics: DAE4 Sn1244
Medium parameters used: f = 837 MHz; σ = 1.003 S/m; ε_r = 57.087; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: WCDMA Professional Band Ⅴ; Frequency: 836.6 MHz;
Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(6.34, 6.34, 6.34); Calibrated: 9/4/2018

WCDMA Band5 Bottom Mode Middle/Area Scan (41x71x1):

Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.720 W/kg

WCDMA Band5 Bottom Mode Middle/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.49 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 1.06 W/kg
SAR(1 g) = 0.619 W/kg; SAR(10 g) = 0.358 W/kg
Maximum value of SAR (measured) = 0.684 W/kg

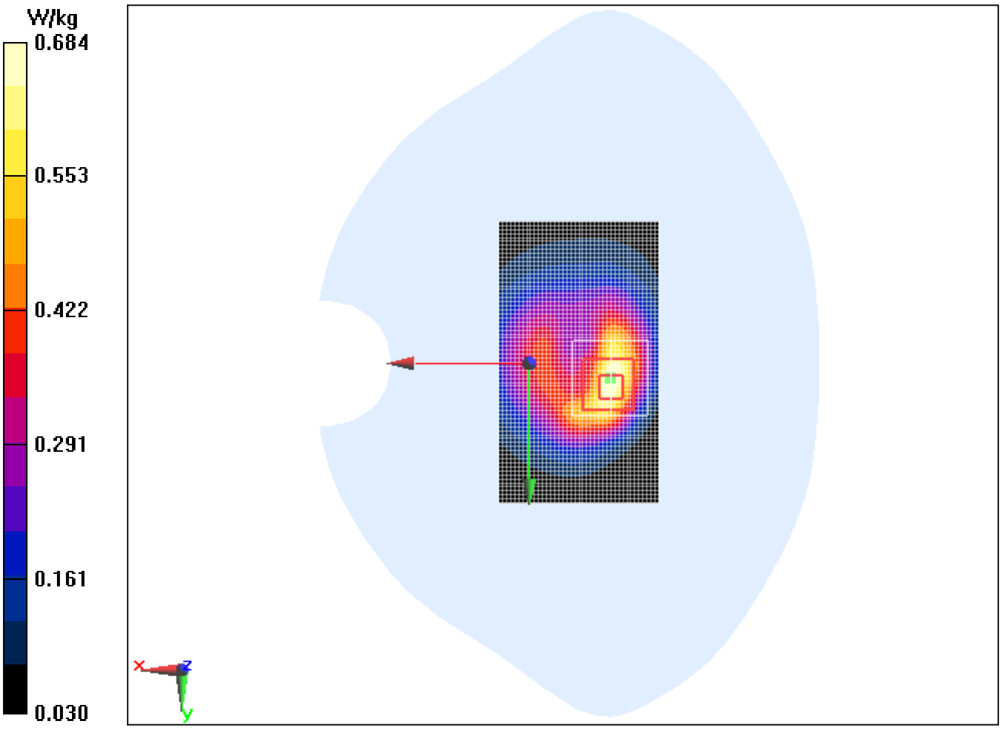


Fig.9 WiFi2450 Ground Mode High

Date/Time: 2018/12/14
Electronics: DAE4 Sn1244
Medium parameters used: f = 2462 MHz; σ = 1.946 S/m; ε_r = 54.081; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: Wifi 2450 2450MHz; Frequency: 2462 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(4.41, 4.41, 4.41); Calibrated: 9/4/2018
WiFi2450 Ground Mode High 15/Area Scan (61x121x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 1.70 W/kg
WiFi2450 Ground Mode High 15/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 3.28 W/kg
SAR(1 g) = 1.19 W/kg; SAR(10 g) = 0.517 W/kg
Maximum value of SAR (measured) = 1.31 W/kg

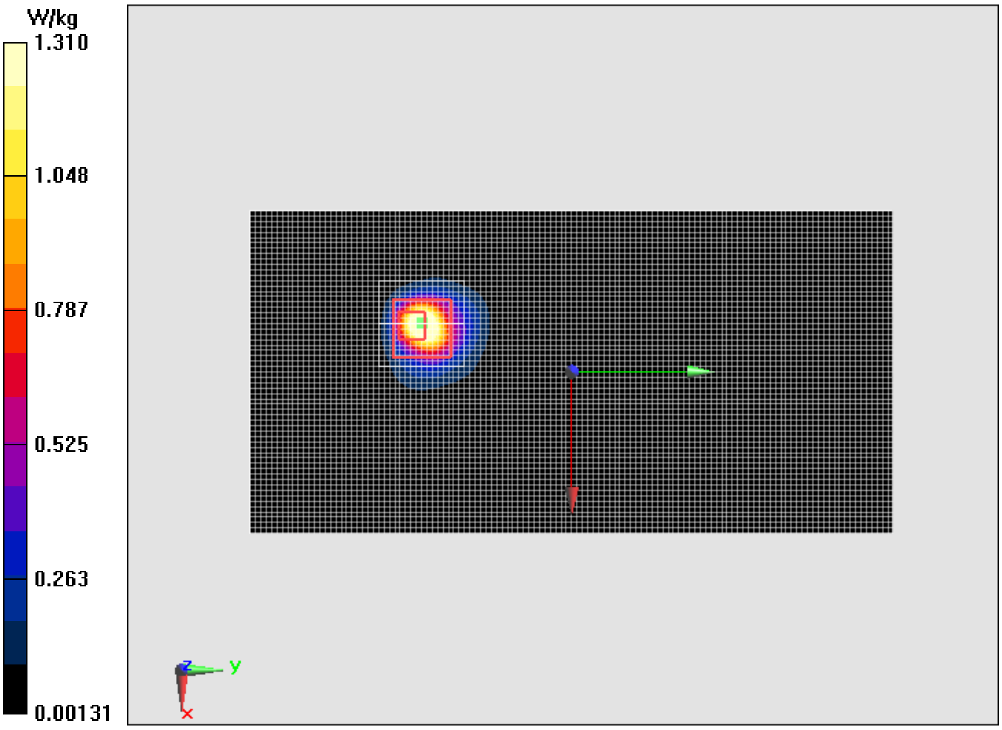
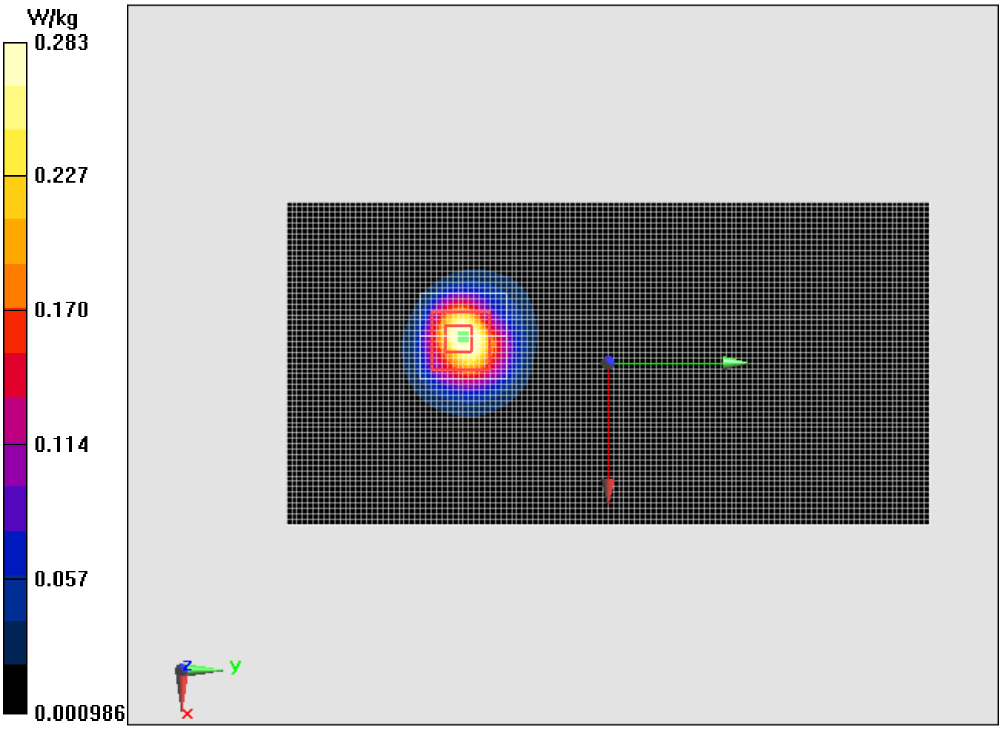


Fig.10 WiFi2450 Ground Mode High

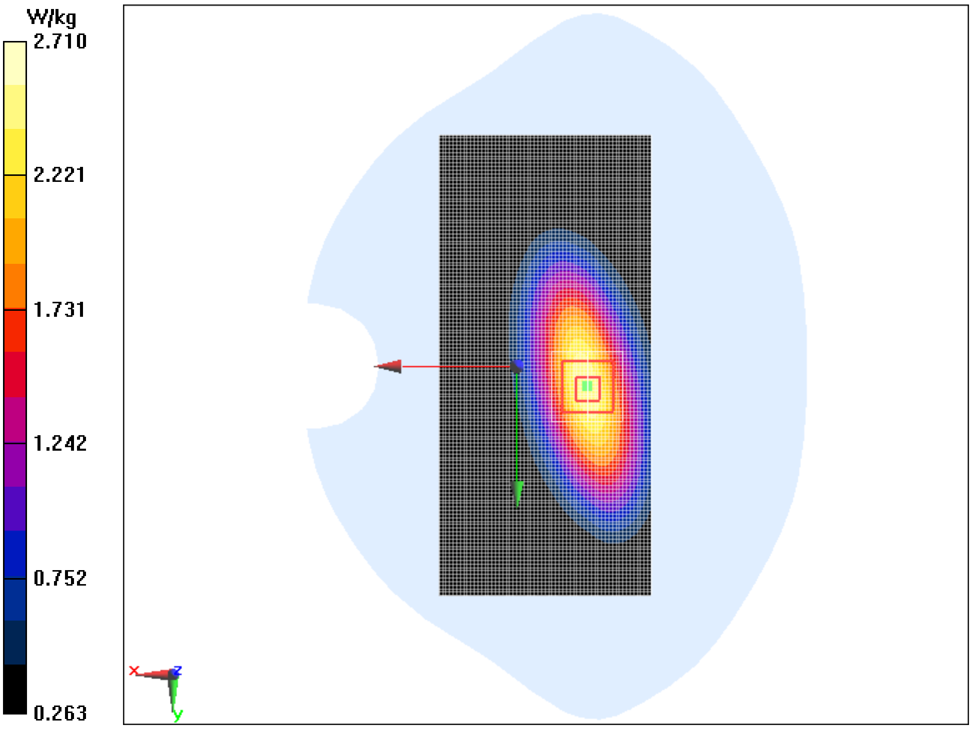
Date/Time: 2018/12/14
Electronics: DAE4 Sn1244
Medium parameters used: f = 2462 MHz; σ = 1.946 S/m; ε_r = 54.081; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃   Liquid Temperature:22.5 ℃
Communication System: Wifi 2450 2450MHz; Frequency: 2462 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(4.41, 4.41, 4.41); Calibrated: 9/4/2018
WiFi2450 Ground Mode High/Area Scan (61x61x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 0.358 W/kg
WiFi2450 Ground Mode High/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.567 W/kg
SAR(1 g) = 0.266 W/kg; SAR(10 g) = 0.134 W/kg
Maximum value of SAR (measured) = 0.283 W/kg



ANNEX B. SYSTEM VALIDATION RESULTS

835MHz

Date/Time: 2018/11/28
Electronics: DAE4 Sn1244
Medium parameters used: f = 835 MHz; σ = 1.001 S/m; ε_r = 57.108; 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: ES3DV3 - SN3252ConvF(6.34, 6.34, 6.34); Calibrated: 9/4/2018
System Validation/Area Scan (61x131x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 2.55 W/kg
System Validation/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 44.09 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 3.61 W/kg
SAR(1 g) = 2.5 W/kg; SAR(10 g) = 1.67 W/kg
Maximum value of SAR (measured) = 2.71 W/kg



1900MHz

Date/Time: 2018/11/29

Electronics: DAE4 Sn1244

Medium parameters used: f = 1900 MHz; σ = 1.484 S/m; ε_r = 52.278; 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: ES3DV3 - SN3252ConvF(4.77, 4.77, 4.77); Calibrated: 9/4/2018

System Validation /Area Scan (61x61x1):

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

Maximum value of SAR (Measurement) = 12.0 W/kg

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

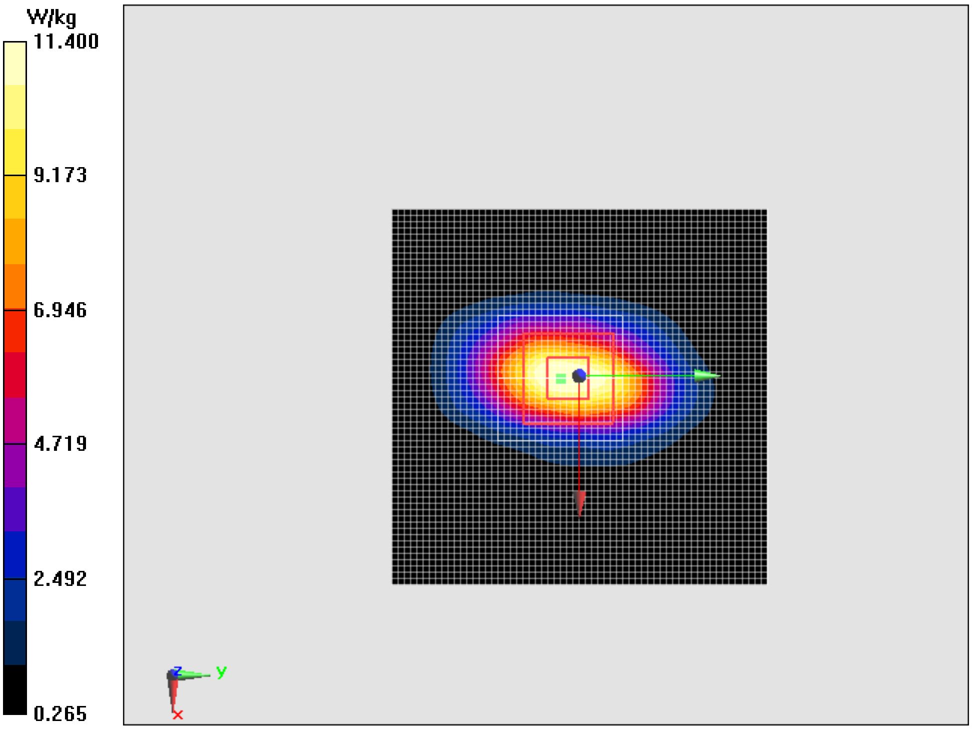
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.99 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 18.1 W/kg

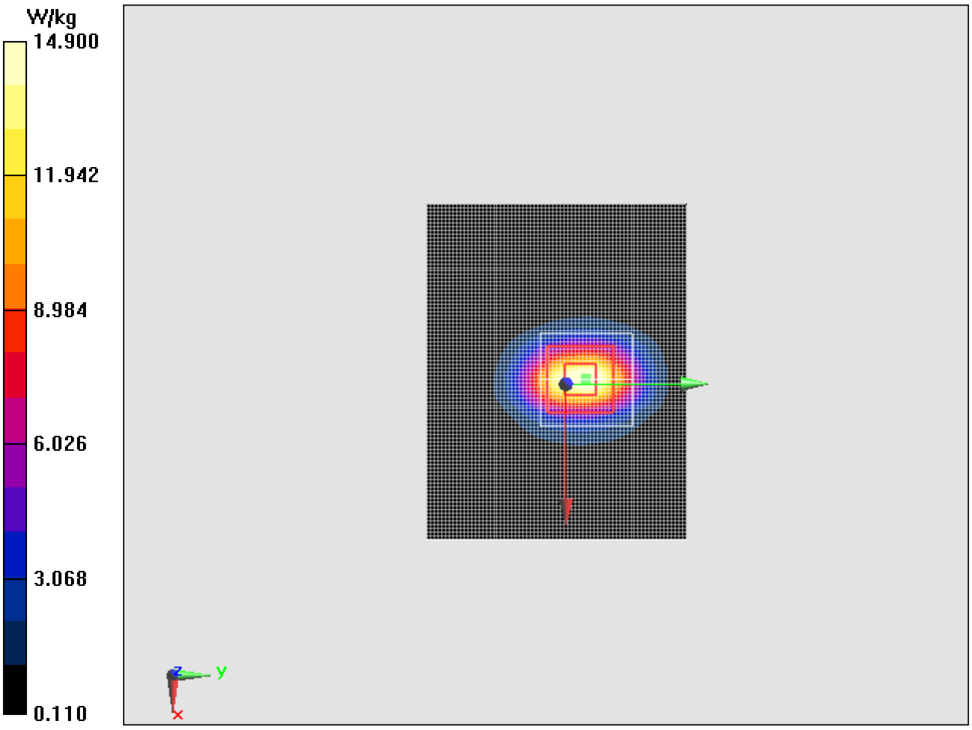
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.38 W/kg

Maximum value of SAR (measured) = 11.4 W/kg



2450MHz

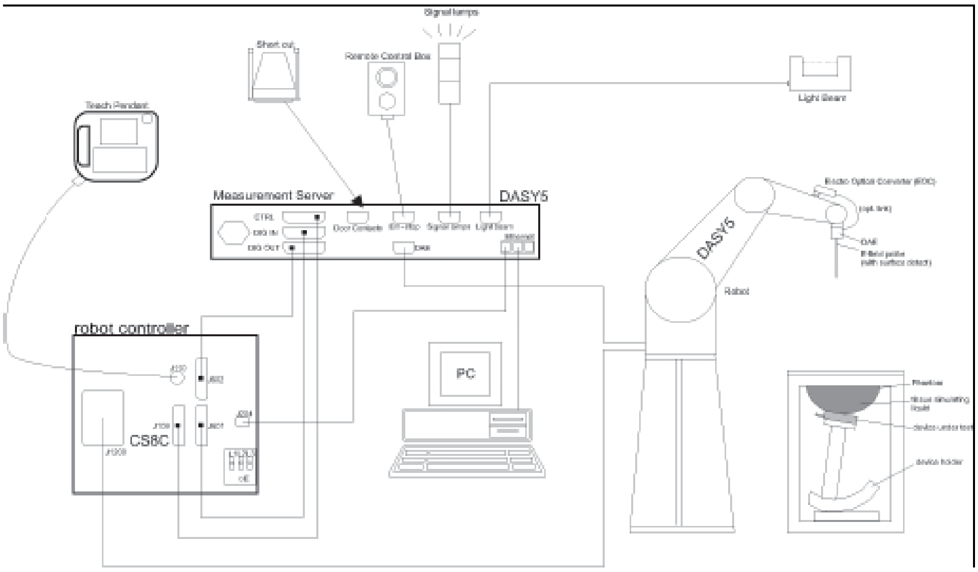
Date/Time: 2018/12/14
Electronics: DAE4 Sn1244
Medium parameters used: f = 2450 MHz; σ = 1.932 S/m; ε_r = 54.12; ρ = 1000 kg/m^3
Ambient Temperature:22.5 ℃ Liquid Temperature:22.5 ℃
Communication System: CW 2450MHz; Frequency: 2450 MHz; Duty Cycle: 1:1
Probe: ES3DV3 - SN3252ConvF(4.41, 4.41, 4.41); Calibrated: 9/4/2018
System Validation/Area Scan (91x71x1):
Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (Measurement) = 15.7 W/kg
System Validation/Zoom Scan (7x7x7) (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 84.87 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 25.9 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.07 W/kg
Maximum value of SAR (measured) = 14.9 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 2nd ord curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:
Model: ES3DV3,EX3DV4
Frequency Range: 10MHz — 6GHz(EX3DV4)
10MHz — 4GHz(ES3DV3)
Calibration: In head and body simulating tissue at Frequencies from 835 up to 5800MHz
Linearity: ± 0.2 dB(30 MHz to 4 GHz) for ES3DV3
± 0.2 dB(30 MHz to 6 GHz) for EX3DV4
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

Picture7-2 Near-field Probe

Picture 7-3 E-field Probe

C.3. E-field Probe Calibration

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

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

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

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

Where:

Δt = Exposure time (30 seconds),

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

ΔT = Temperature increase due to RF exposure.

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

Where:

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

C.4. Other Test Equipment

C.4.1. Data Acquisition Electronics(DAE)

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

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

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating.

Common mode rejection is above 80 dB.

PictureC.4: DAE

C.4.2. Robot

The SPEAG DASY system uses the high precision robots (DASY5: RX90L) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

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

Picture C.5 DASY 5

C.4.3. Measurement Server

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

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

Picture C.6 Server for DASY 5

C.4.4. Device Holder for Phantom

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

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

Thus the device needs no repositioning when

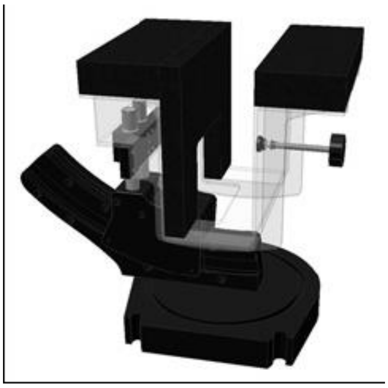
changing the angles.

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

<Laptop Extension Kit>

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

Picture C.7: Device Holder



Picture C.8: Laptop Extension Kit

C.4.5. Phantom

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

Shell Thickness: 2 ± 0. 2 mm

Filling Volume: Approx. 25 liters

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

Available: Special

Picture C.9: SAM Twin Phantom