
Report

Dosimetric Assessment of the Portable Device GI0452 from Option (FCC ID: NCMOGI0452) tested in one host product

According to the FCC Requirements

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Executive Summary

The device GI0452 is a new USB stick from Option operating in the 850 MHz, 900 MHz, 1800 MHz and 1900 MHz frequency range. The device has an integrated antenna and the system concepts used are the GPRS/EDGE 850 (Class 12), GPRS/EDGE 900 (Class 12), GPRS/EDGE 1800 (Class 12), GPRS/EDGE 1900 (Class 12), WCDMA I (FDD), WCDMA II (FDD), WCDMA IV (FDD) and WCDMA V (FDD) standards. The USB stick provides HSDPA and HSUPA in WCDMA.

Even though the GI0452 provides GPRS Class 12 (4TX) the output power measurements conducted by IMST shows the highest output power in GPRS Class 10. Therefore the SAR measurements are conducted with GPRS Class 10 (2TX)

The objective of the measurements done by IMST was the dosimetric assessment of one device in body worn configuration in the GPRS 850 (Class 10), GPRS 1900 (Class 10), WCDMA II (FDD), WCDMA IV (FDD) and WCDMA V (FDD) standards. The measurements were performed in combination with one host product (Fujitsu Siemens Amilo Pro). According to Fig. 2 the device was tested in four positions with a maximum distance of 5 mm between DUT and phantom. The examinations have been carried out with the dosimetric assessment system „DASY4“.

The measurements were made according to the Supplement C to OET Bulletin 65 of the Federal Communications Commission (FCC) Guidelines [OET 65] for evaluating compliance of mobile and portable devices with FCC limits for human exposure (general population) to radiofrequency emissions. Additional information and guidelines given by the following FCC documents were used: SAR Measurement Procedures for 3G Devices, KDB 941225 D01, D02, D03 [KDB 941225] and Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies, KDB 447498 D01 and D02 [KDB 447498]. All measurements have been performed in accordance to the recommendations given by SPEAG.

The USB stick was tested for the following configurations:

According to Fig. 2 the device was tested in four positions for GPRS 850 (Class 10), GPRS 1900 (Class 10), WCDMA II (FDD), WCDMA IV (FDD) and WCDMA V (FDD) with a maximum distance of 5 mm between DUT and phantom. In addition, body SAR was also measured in HSDPA using Subtest 1 and HSUPA using Subtest 5 at the highest body SAR configuration without HSDPA and HSUPA. The device was tested with one host product (Fujitsu Siemens Amilo Pro).

According the output power measurements GPRS 850 (Class 10) and GPRS 1900 (Class 10) delivers the highest output power. Therefore the SAR tests are conducted in GPRS Class 10.

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1 Subject of Investigation

The device GI0452 is a new USB stick from Option operating in the 850 MHz, 900 MHz, 1800 MHz and 1900 MHz frequency range. The device has an integrated antenna and the system concepts used are the GPRS/EDGE 850 (Class 12), GPRS/EDGE 900 (Class 12), GPRS/EDGE 1800 (Class 12), GPRS/EDGE 1900 (Class 12), WCDMA I (FDD), WCDMA II (FDD), WCDMA IV (FDD) and WCDMA V (FDD) standards. The USB stick provides HSDPA and HSUPA in WCDMA.

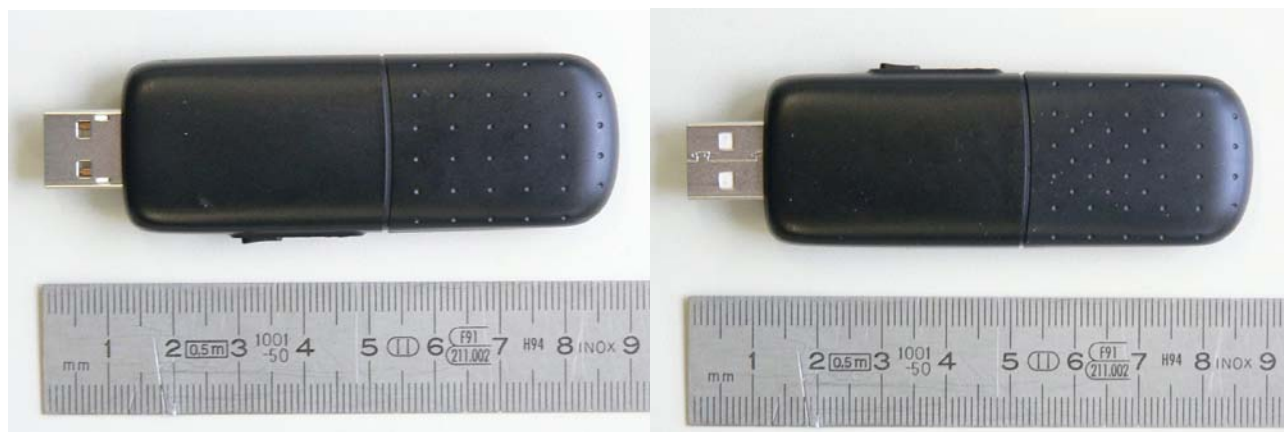


Fig. 1: Pictures of the device under test.

The objective of the measurements done by IMST was the dosimetric assessment of one device in body worn configuration in the GPRS 850 (Class 10), GPRS 1900 (Class 10), WCDMA II (FDD), WCDMA IV (FDD) and WCDMA V (FDD) standards. The measurements were performed in combination with one host product (Fujitsu Siemens Amilo Pro). According to Fig. 2 the device was tested in four positions with a maximum distance of 5 mm between DUT and phantom. The examinations have been carried out with the dosimetric assessment system „DASY4“describes below.

2 The IEEE Standard C95.1 and the FCC Exposure Criteria

In the USA the FCC exposure criteria [OET 65] are based on the withdrawn IEEE Standard C95.1-1999 [IEEE C95.1-1999]. This version was replaced by the IEEE Standard C95.1-2005 [IEEE C95.1-2005] in October, 2005.

Both IEEE standards sets limits for human exposure to radio frequency electromagnetic fields in the frequency range 3 kHz to 300 GHz. One of the major differences in the newly revised C95.1-2005 is the change in the basic restrictions for localized exposure, from 1.6 W/kg averaged over 1 g tissue to 2.0 W/kg averaged over 10 g tissue, which is now identical to the ICNIRP guidelines [ICNIRP 1998].

2.1 Distinction Between Exposed Population, Duration of Exposure and Frequencies

The American Standard [IEEE C95.1-1999] distinguishes between controlled and uncontrolled environment. Controlled environments are locations where there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment or by other cognizant persons. Uncontrolled environments are locations where there is the exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces. For exposure in controlled environments higher field strengths are admissible. In addition the duration of exposure is considered.

Due to the influence of frequency on important parameters, as the penetration depth of the electromagnetic fields into the human body and the absorption capability of different tissues, the limits in general vary with frequency.

2.2 Distinction between Maximum Permissible Exposure and SAR Limits

The biological relevant parameter describing the effects of electromagnetic fields in the frequency range of interest is the specific absorption rate SAR (dimension: power/mass). It is a measure of the power absorbed per unit mass. The SAR may be spatially averaged over the total mass of an exposed body or its parts. The SAR is calculated from the r.m.s. electric field strength E inside the human body, the conductivity σ and the mass density ρ of the biological tissue:

$$SAR = \sigma \frac{E^2}{\rho} = c \frac{\partial T}{\partial t} \Big|_{t \rightarrow 0+} \quad (1)$$

The specific absorption rate describes the initial rate of temperature rise $\partial T / \partial t$ as a function of the specific heat capacity c of the tissue. A limitation of the specific absorption rate prevents an excessive heating of the human body by electromagnetic energy.

As it is sometimes difficult to determine the SAR directly by measurement (e.g. whole body averaged SAR), the standard specifies more readily measurable maximum permissible exposures in terms of external electric E and magnetic field strength H and power density S , derived from the SAR limits. The limits for E , H and S have been fixed so that even under worst case conditions, the limits for the specific absorption rate SAR are not exceeded.

For the relevant frequency range the maximum permissible exposure may be exceeded if the exposure can be shown by appropriate techniques to produce SAR values below the corresponding limits.

2.3 General SAR Limit

In this report the comparison between the American exposure limits and the measured data is made using the spatial peak SAR; the power level of the device under test guarantees that the whole body averaged SAR is not exceeded.

Having in mind a worst case consideration, the SAR limit is valid for uncontrolled environment and mobile respectively portable transmitters. According to table 1 the SAR values have to be averaged over a mass of 1 g (SAR_{1g}) with the shape of a cube.

Standard	Status	SAR limit [W/kg]
IEEE C95.1-1999	Replaced	1.6

Table 1: Relevant spatial peak SAR limit averaged over a mass of 1 g.

2.4 KDB 447498 SAR Limit

Additionally IMST compares the measured SAR values to the limits mentioned in the KDB 447498. For single platform approval the limit of 1.2 mW/g is applicable.

Publication	SAR limit [W/kg]
KDB 447498	1.2

Table 2: Relevant spatial peak SAR limit averaged over a mass of 1 g.

3 The FCC Measurement Procedure

The Federal Communications Commission (FCC) has published a report and order on the 1st of August 1996 [FCC 96-326], which requires routine dosimetric assessment of mobile telecommunications devices, either by laboratory measurement techniques or by computational modeling, prior to equipment authorization or use. In 2001 the Commission's Office of Engineering and Technology has released Edition 01-01 of Supplement C to OET Bulletin 65. This revised edition, which replaces Edition 97-01, provides additional guidance and information for evaluating compliance of mobile and portable devices with FCC limits for human exposure to radiofrequency emissions [OET 65].

3.1 General Requirements

The test shall be performed in a laboratory with an environment which avoids influence on SAR measurements by ambient EM sources and any reflection from the environment itself. The ambient temperature shall be in the range of 20°C to 26°C and 30-70% humidity.

3.2 Test to be performed for Modules in Portable devices (PCMCIA Cards, USB Sticks)

A device may be approved for use in a single platform when all hosts within the same platform have the same operating configurations and exposure conditions, with only minor configuration and construction differences. Following KDB 447498, the applicable SAR limit for portable transmitters, approved in a single platform, is 1.2 W/kg, which is averaged over any one gram of tissue defined as a tissue volume in the shape of a cube. Furthermore for USB-dongle transmitters a separation distance ≤ 0.5 cm is required for USB-dongle transmitters. According to Fig. 2 devices that can be connected to a host through a cable must be tested with the device positioned in four orientations against the flat phantom.

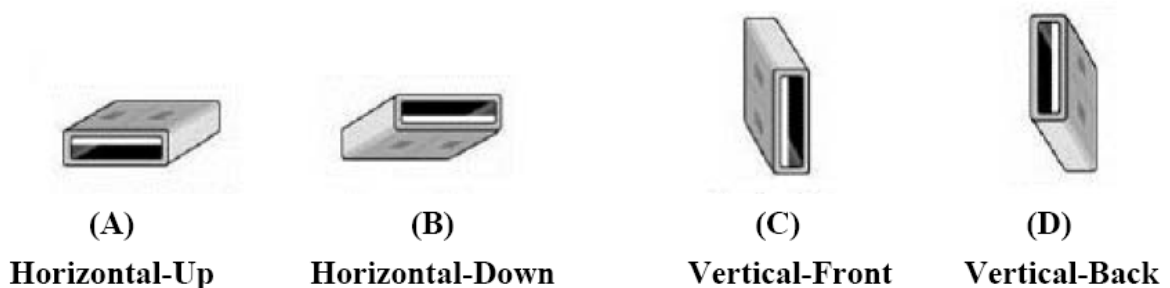


Fig. 2: USB Connector orientations implemented on Laptop Computers.

For measurements in WCDMA without HSDPA or HSUPA, the default test configuration is to establish a radio link between the DUT and a communication test set using a 12.2 kbps RMC configured Test Loop Mode 1 and TPC bits configured to all "1". The SAR will be tested for all bands using a Rel99 call configured to transmit at maximum output power per 3GPP 34.121 [3GPP 34.121]. The Rel99 parameters are summarized in Table 3.

In addition, body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA. Maximum output power is verified according to 3GPP 34.121 and SAR must be measured according to these maximum output conditions.

Furthermore, body SAR for HSUPA is measured with E-DCH with H-Set 1 in Sub-test 5 and QPSK for FRC and a 12.2 kbps RMC configuration in Test Loop Mode 1 using the highest body SAR configuration in 12.2 kbps RMC without HSUPA. Maximum output power is verified according to 3GPP 34.121 and SAR must be measured according to these maximum output conditions as described in KDB 941225 [KDB 941225].

Modes		HSDPA				HSUPA					WCDMA
Sets		1	2	3	4	1	2	3	4	5	RMC
Band	Channel	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]
V	4132	22.8	22.7	22.2	22.2	22.4	20.6	20.8	20.9	22.6	22.7
	4183	22.0	21.8	21.4	21.4	21.3	19.4	20.2	20.6	21.6	22.0
	4233	23.0	22.8	22.4	22.4	22.2	20.4	21.1	21.5	22.4	22.9
IV	1312	21.0	21.0	20.6	20.6	19.9	18.7	19.4	19.6	20.7	21.6
	1413	21.1	21.1	20.6	20.6	20.3	18.5	19.6	19.6	20.3	21.6
	1513	20.5	20.6	20.0	20.0	19.7	18.1	19.1	19.3	20.4	21.5
II	9262	21.4	21.0	21.1	21.0	20.6	18.8	19.8	19.8	20.6	21.5
	9400	21.2	20.6	20.5	20.5	20.5	18.7	18.8	19.2	20.6	21.7
	9538	21.4	20.8	20.9	20.7	20.7	18.8	19.6	19.8	20.7	22.0
β_c		2/15	12/15	15/15	15/15	11/15	6/15	15/15	2/15	15/15	
β_d		15/15	15/15	8/15	4/15	15/15	15/15	9/15	15/15	15/15	
$\Delta ACK, \Delta NACK, \Delta CQI$		8	8	8	8	8	8	8	8	8	
AGV						20	12	15	17	21	

Table 3: According TS 34.121 table C10.1.4 measured max. output power values for the used Option GI0452. The UE implements a modified Maximum Power Reduction in HSUPA of 0,2,1,1 and 0 dB.

The UE is fully compliant with 3GPP standards defining required UMTS spreading factors.

- The DPCCH spreading factor is 256 per 3GPP TS 25.213 section 4.3.1.2.1.
- The DPDCH spreading factor is dependent on number of DPDCH channels and data rate. For a single channel the spreading factor can range from 4 to 256. For more than one DPDCH channel the spreading factor is 4. Further details are defined by 3GPP in TS 25.213 section 4.3.1.2.1.
- HS-DPCCH spreading factor is 256. Further details can be found in 3GPP TS 25.213 section 4.3.1.2.2.
- IMST confirms that the device operating parameters such as the different β and Δ values were configured properly and the power measurement procedures used have included the power setback considerations specified in 3GPP TS 34.121, and that the HSPA channels have remained active with the required E-TFCI and AG index values maintained during the durations of the measurements.
- IMST confirms that the required HSPA test parameters, including stable TFCI and output power conditions, have been used for the HSPA SAR measurements.

		GPRS output power				GPRS output power in relation to 1 TX			
Number of TX		1	2	3	4	1	2	3	4
Band	Channel	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]
850	128	32.3	29.3	27.5	26.3	32.3	32.3	32.2	32.3
	190	32.4	29.4	27.5	26.4	32.4	32.4	32.2	32.4
	251	32.6	29.7	27.8	26.6	32.6	32.7	32.6	32.6
1900	512	29.3	26.3	24.5	23.3	29.3	29.3	29.2	29.3
	661	29.6	26.7	24.8	23.7	29.6	29.7	29.5	29.7
	810	29.5	26.6	24.7	23.6	29.5	29.6	29.4	29.6

Table 4: Measured max. output power values for the used Option GI0452 for GPRS.

4 The Measurement System

DASY is an abbreviation of „Dosimetric Assessment System“ and describes a system that is able to determine the SAR distribution inside a phantom of a human being according to different standards. The DASY4 system consists of the following items as shown in Fig: 3. Additional Fig: 4 shows the equipment, similar to the installations in other laboratories.

- High precision robot with controller
- Measurement server (for surveillance of the robot operation and signal filtering)
- Data acquisition electronics DAE (for signal amplification and filtering)
- Field probes calibrated for use in liquids
- Electro-optical converter EOC (conversion from the optical into a digital signal)
- Light beam (improving of the absolute probe positioning accuracy)
- Two SAM phantoms filled with tissue simulating liquid
- DASY4 software
- SEMCAD

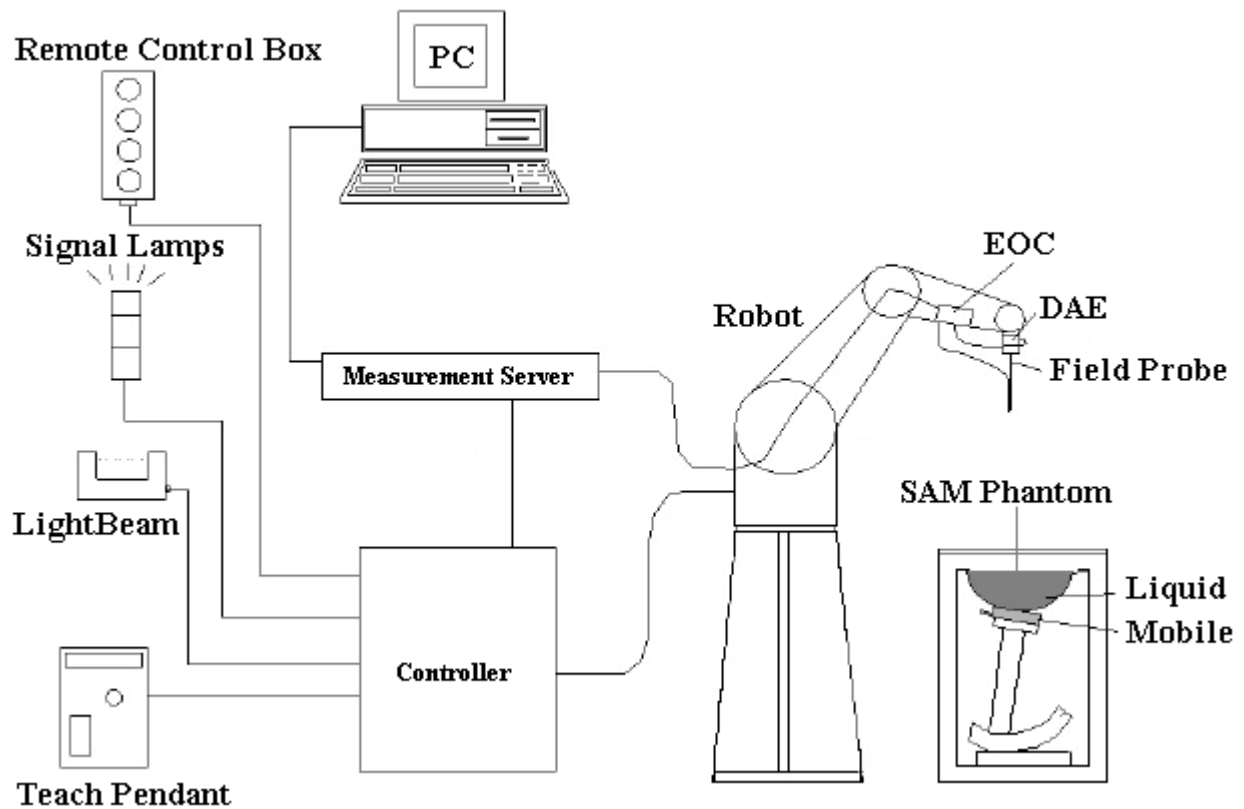


Fig. 3: The DASY4 measurement system.

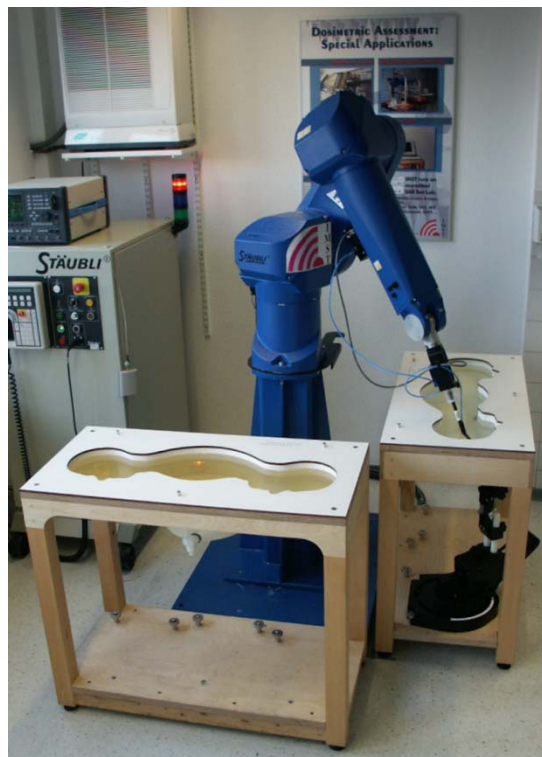


Fig. 4: The measurement set-up with two SAM phantoms containing tissue simulating liquid.

The device operating at the maximum power level is placed by a non metallic device holder (delivered from Schmid & Partner) in the above described positions at a shell phantom of a human being. The distribution of the electric field strength E is measured in the tissue simulating liquid within the shell phantom. For this miniaturised field probes with high sensitivity and low field disturbance are used. Afterwards the corresponding SAR values are calculated with the known electrical conductivity σ and the mass density ρ of the tissue in the SEMCAD FDTD software. The software is able to determine the averaged SAR values (averaging region 1 g or 10 g) for compliance testing.

The measurements are done by two scans: first a coarse scan determines the region of the maximum SAR, afterwards the averaged SAR is measured in a second scan within the shape of a cube. The measurement time takes about 20 minutes.

4.1 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM Twin Phantom V4.0) defined by the IEEE SCC-34/SC2 group and delivered by Schmid & Partner Engineering AG is used. The phantom is a fibreglass shell integrated in a wooden table. The thickness of the phantom amounts to $2 \text{ mm} \pm 0.2 \text{ mm}$. It enables the dosimetric evaluation of left and right hand phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a coverage (polyethylene), which prevents the evaporation of the liquid. The details and the Certificate of conformity can be found in Fig. 15.

4.2 Probe

For the measurements the Dosimetric E-Field Probes ET3DV6R or EX3DV4 with following specifications are used. They are manufactured and calibrated in accordance with FCC [OET 65] and IEEE [IEEE 1528-2003] recommendations annually by Schmid & Partner Engineering AG.

ET3DV6:

- Dynamic range: $5 \mu\text{W/g}$ to $> 100 \text{ mW/g}$
- Tip diameter: 6.8 mm
- Probe linearity: $\pm 0.2 \text{ dB}$ (30 MHz to 3 GHz)
- Axial isotropy: $\pm 0.2 \text{ dB}$
- Spherical isotropy: $\pm 0.4 \text{ dB}$
- Distance from probe tip to dipole centers: 2.7 mm
- Calibration range: 450 MHz / 900 MHz / 1810 MHz / 1950 MHz for head and body simulating liquid
- Angle between probe axis (evaluation axis) and surface normal line: less than 30°

EX3DV4:

- Dynamic range: 10 μ W/g to > 100mW/g (noise typically < 1 μ W/g)
- Tip diameter: 2.5 mm
- Probe linearity: ± 0.2 dB (30 MHz to 6 GHz)
- Axial isotropy: ± 0.2 dB
- Spherical isotropy: ± 0.4 dB
- Distance from probe tip to dipole centers: 1.0 mm
- Calibration range: 1950 MHz / 2450MHz / 3500 MHz / 5200 MHz / 5500 MHz / 5800 MHz for head and body simulating liquid
- Angle between probe axis (evaluation axis) and surface normal line: less than 30°

4.3 Measurement Procedure

The following steps are used for each test position:

- Establish a call with the maximum output power with a base station simulator. The connection between the mobile phone and the base station simulator is established via air interface.
- Measurement of the local E-field value at a fixed location (P1). This value serves as a reference value for calculating a possible power drift.
- Measurement of the SAR distribution with a grid spacing of 15 mm x 15 mm and a constant distance to the inner surface of the phantom. Since the sensors can not directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With this values the area of the maximum SAR is calculated by a interpolation scheme (combination of a least-square fitted function and a weighted average method). Additional all peaks within 2 dB of the maximum SAR are searched.
- Around this points, a cube of 30 mm x 30 mm x 30 mm is assessed by measuring 7 x 7 x 7 points whereby the first two measurement points are within the required 10 mm of the surface. With these data, the peak spatial-average SAR value can be calculated within the SEMCAD software.
- The used extrapolation and interpolation routines are all based on the modified Quadratic Shepard's method [DASY4].
- Repetition of the E-field measurement at the fixed location (P1) and repetition of the whole procedure if the two results differ by more than ± 0.2 dB.

4.4 Uncertainty Assessment

Table 5 includes the worst case uncertainty budget suggested by the [IEEE 1528-2003] and determined by Schmid & Partner Engineering AG. The expanded uncertainty (K=2) is assessed to be $\pm 21.7\%$ and is valid up to 3.0 GHz.

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i	Standard Uncertainty	v_i^2 or v_{eff}
Measurement System						
Probe calibration	$\pm 5.9 \%$	Normal	1	1	$\pm 5.9 \%$	∞
Axial isotropy	$\pm 4.7 \%$	Rectangular	$\sqrt{3}$	0.7	$\pm 1.9 \%$	∞
Hemispherical isotropy	$\pm 9.6 \%$	Rectangular	$\sqrt{3}$	0.7	$\pm 3.9 \%$	∞
Boundary effects	$\pm 1.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0.6 \%$	∞
Linearity	$\pm 4.7 \%$	Rectangular	$\sqrt{3}$	1	$\pm 2.7 \%$	∞
System detection limit	$\pm 1.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0.6 \%$	∞
Readout electronics	$\pm 1.0 \%$	Normal	1	1	$\pm 1.0 \%$	∞
Response time	$\pm 0.8 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0.5 \%$	∞
Integration time	$\pm 2.6 \%$	Rectangular	$\sqrt{3}$	1	$\pm 1.5 \%$	∞
RF ambient conditions	$\pm 3.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 1.7 \%$	∞
Probe positioner	$\pm 0.4 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0.2 \%$	∞
Probe positioning	$\pm 2.9 \%$	Rectangular	$\sqrt{3}$	1	$\pm 1.7 \%$	∞
Algorithm for max SAR eval.	$\pm 1.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0.6 \%$	∞
Test Sample Related						
Device positioning	$\pm 2.9 \%$	Normal	1	1	$\pm 2.9 \%$	145
Device holder	$\pm 3.6 \%$	Normal	1	1	$\pm 3.6 \%$	5
Power drift	$\pm 5.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 2.9 \%$	∞
Phantom and Set-up						
Phantom uncertainty	$\pm 4.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 2.3 \%$	∞
Liquid conductivity (target)	$\pm 5.0 \%$	Rectangular	$\sqrt{3}$	0.64	$\pm 1.8 \%$	∞
Liquid conductivity (meas.)	$\pm 2.5 \%$	Normal	1	0.64	$\pm 1.6 \%$	∞
Liquid permittivity (target)	$\pm 5.0 \%$	Rectangular	$\sqrt{3}$	0.6	$\pm 1.7 \%$	∞
Liquid permittivity (meas.)	$\pm 2.5 \%$	Normal	1	0.6	$\pm 1.5 \%$	∞
Combined Uncertainty					$\pm 10.8 \%$	

Table 5: Uncertainty budget of DASY4.

5 SAR Results

The Tables below contain the measured SAR values averaged over a mass of 1 g.

Test Position (Liquid depth 15.5 cm)	SAR _{1g} [W/kg] (Drift[dB])			Temperature	
	Channel 128 824.2 MHz 29.3 dBm	Channel 190 836.4 MHz 29.4 dBm	Channel 251 848.8 MHz 29.7 dBm	Ambient [° C]	Liquid [° C]
Position A	0.896 (0.006)	1.080 (-0.077)	1.120 (-0.024)	21.9	21.3
Position B	0.900 (-0.083)	0.838 (-0.060)	0.750 (0.069)	21.9	21.3
Position C		0.650 (0.030)		21.9	21.3
Position D		0.450 (-0.183)		21.9	21.3

Table 6: Measurement results for GPRS 850 (Class 10) for the Option GI0452.

Test Position (Liquid depth 16.3 cm)	SAR _{1g} [W/kg] (Drift[dB])			Temperature	
	Channel 512 1850.2 MHz 26.3 dBm	Channel 661 1880.0 MHz 26.7 dBm	Channel 810 1909.6 MHz 26.6 dBm	Ambient [° C]	Liquid [° C]
Position A	1.010* (0.077)	1.120* (0.024)	1.200* (-0.163)	22.2	21.4
Position B	1.070 (0.007)	1.040 (-0.048)	1.200* (-0.028)	22.2	21.4
Position C	0.770 (0.070)	0.847 (0.141)	0.780 (0.006)	22.2	21.4
Position D		0.502 (-0.162)		22.2	21.4

Table 7: Measurement results for GPRS 1900 (Class 10) for the Option GI0452 (* Max Cube).

Test Position (Liquid depth 15.5 cm)	SAR _{1g} [W/kg] (Drift[dB])			Temperature	
	Channel 4132 826.4 MHz 22.7 dBm	Channel 4183 836.6 MHz 22.0 dBm	Channel 4233 846.6 MHz 22.9 dBm	Ambient [° C]	Liquid [° C]
Position A	0.921 (0.116)	0.820 (0.029)	0.837 (-0.114)	22.1	21.3
Position B		0.557* (0.134)		22.1	21.3
Position C		0.405 (-0.070)		22.1	21.3
Position D		0.375 (-0.016)		22.1	21.3

Table 8: Measurement results for WCDMA V (FDD) for the Option GI0452 (* Max Cube).

Test Position (Liquid depth 18.1 cm)	SAR _{1g} [W/kg] (Drift[dB])			Temperature	
	Channel 1312 1712.4 MHz 21.6 dBm	Channel 1413 1732.6 MHz 21.6 dBm	Channel 1513 1752.6 MHz 21.5 dBm	Ambient [° C]	Liquid [° C]
Position A	1.430 (0.120)	1.510 (-0.019)	1.350 (-0.117)	22.0	21.2
Position B	0.727*(-0.016)	0.933*(-0.045)	0.852*(-0.092)	22.0	21.2
Position C		0.563*(-0.132)		22.0	21.2
Position D		0.422 (-0.086)		22.0	21.2

Table 9: Measurement results for WCDMA IV (FDD) for the Option GI0452 (* Max Cube).

Test Position (Liquid depth 18.1 cm)	SAR _{1g} [W/kg] (Drift[dB])			Temperature	
	Channel 1312 1712.4 MHz 21.0 dBm	Channel 1413 1732.6 MHz 21.1 dBm	Channel 1513 1752.6 MHz 20.5 dBm	Ambient [° C]	Liquid [° C]
Position A		1.160* (0.103)		22.0	21.2

Table 10: Measurement results for WCDMA IV (FDD) in HSDPA (subtest 1) for the Option GI0452 (* Max Cube).

Test Position (Liquid depth 18.1 cm)	SAR _{1g} [W/kg] (Drift[dB])			Temperature	
	Channel 1312 1712.4 MHz 20.7 dBm	Channel 1413 1732.6 MHz 20.3 dBm	Channel 1513 1752.6 MHz 20.4 dBm	Ambient [° C]	Liquid [° C]
Position A	1.040*(-0.157)			22.0	21.2

Table 11: Measurement results for WCDMA IV (FDD) in HSUPA (subtest 5) for the Option GI0452 (* Max Cube).

Test Position (Liquid depth 16.3 cm)	SAR _{1g} [W/kg] (Drift[dB])			Temperature	
	Channel 9262 1852.4 MHz 21.5 dBm	Channel 9400 1880.0 MHz 21.7 dBm	Channel 9538 1907.6 MHz 22.0 dBm	Ambient [° C]	Liquid [° C]
Position A	1.500* (0.023)	1.510* (-0.073)	1.510* (-0.018)	22.1	21.4
Position B	1.350 (0.011)	1.220* (-0.134)	1.290* (0.034)	22.1	21.4
Position C		0.761 (0.138)		22.1	21.4
Position D		0.564* (-0.014)		22.1	21.4

Table 12: Measurement results for WCDMA II (FDD) for the Option GI0452 (* Max Cube).

Test Position (Liquid depth 16.3 cm)	SAR _{1g} [W/kg] (Drift[dB])			Temperature	
	Channel 9262 1852.4 MHz 21.5 dBm	Channel 9400 1880.0 MHz 21.7 dBm	Channel 9538 1907.6 MHz 22.0 dBm	Ambient [° C]	Liquid [° C]
Position A			1.570* (-0.179)	22.1	21.4

Table 13: Measurement results for WCDMA II (FDD) in HSDPA (subtest 1) for the Option GI0452 (* Max Cube).

Test Position (Liquid depth 16.3 cm)	SAR _{1g} [W/kg] (Drift[dB])			Temperature	
	Channel 9262 1852.4 MHz 21.5 dBm	Channel 9400 1880.0 MHz 21.7 dBm	Channel 9538 1907.6 MHz 22.0 dBm	Ambient [° C]	Liquid [° C]
Position A			1.440* (0.081)	22.1	21.4

Table 14: Measurement results for WCDMA II (FDD) in HSUPA (subtest 5) for the Option GI0452.

The “* Max Cube” labeling indicates that during the grid scanning an additional peak was found which was within 2.0 dB of the highest peak. The value of the highest cube is given in the tables above, the value from the second assessed cube is given in the SAR distribution plots (see appendix).

The above mentioned power values are “conducted” power values. The SAR measurements conducted by the IMST are following the requirements for 3G devices [KDB 941225] and USB Dongle transmitters [KDB 447498].

Measurements with or without the used USB cable show no difference in output power.

Compared to GPRS output power measurements, EDGE result lower power values. Therefore SAR tests are conducted in GPRS mode only. Output power measurements with two active timeslots (GPRS Class 10) result the highest output power.

To control the output power stability during the SAR test the used 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 the above tables labeled as: (Drift[dB]). This ensures that the power drift during one measurement is within 5%. Please note that we add the measured “power drift” values from the DASY4 system since the used CMU 200 delivers only 1 usable position after decimal point and therefore only one power level is listed in the above tables.

Moving device away from the phantom in 5 mm increments shows continual decrease of the local SAR level:

Test Position (Liquid depth 16.3 cm)	SAR _{1g} [W/kg] Mutimeter	SAR _{1g} [W/kg] (Drift[dB])
Worst case WCDMA II, Channel 9538, HSDPA, Position A (initial Position)	1.740	1.570 (-0.179)
Initial device position + 5 mm	0.770	N.A.
Initial device position + 10 mm	0.400	N.A.

Table 15: Measurement results for worst case configuration, moving the device away from the initial test position. An enhanced energy coupling is not detected.

6 Evaluation

In Fig. 5 - 9 the flat phantom SAR results for GPRS 850, GPRS 1900, WCDMA V, IV an II (FDD) given in Table 6 - 14 are summarized and compared to the limit.

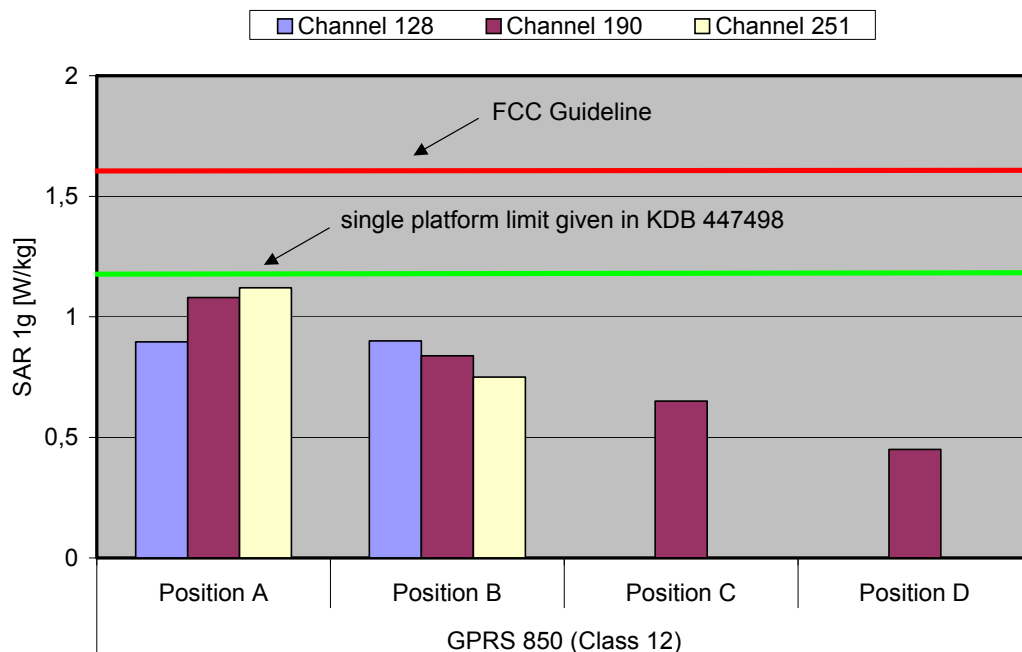


Fig. 5: The measured SAR values for the Option GI0452 for GPRS 850 (Class 10) in comparison to the FCC exposure limit.

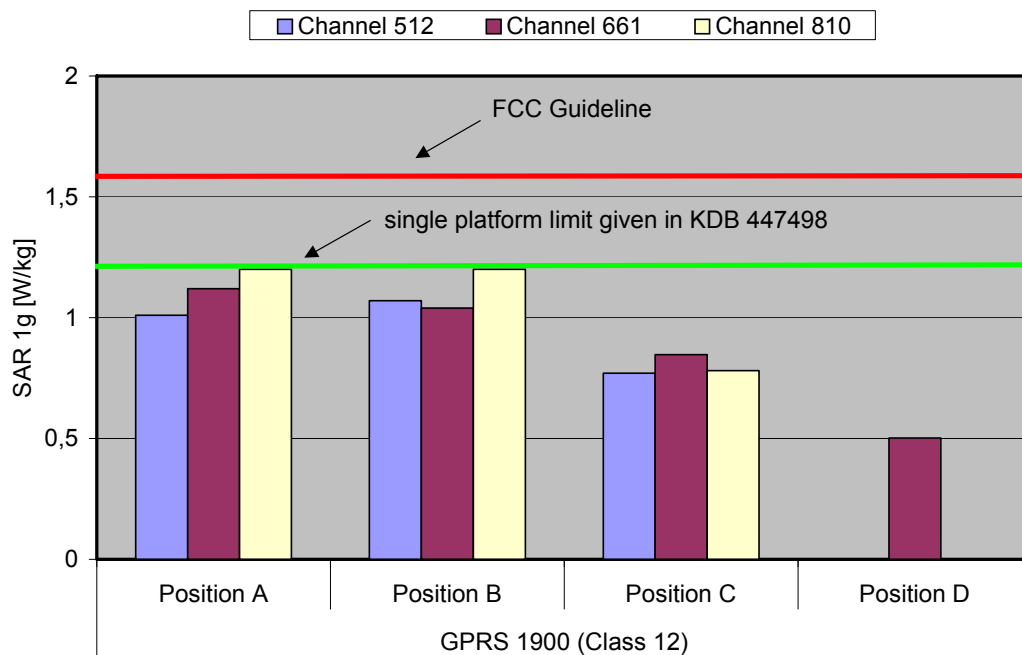


Fig. 6: The measured SAR values for the Option GI0452 for GPRS 1900 (Class 10) in comparison to the FCC exposure limit.

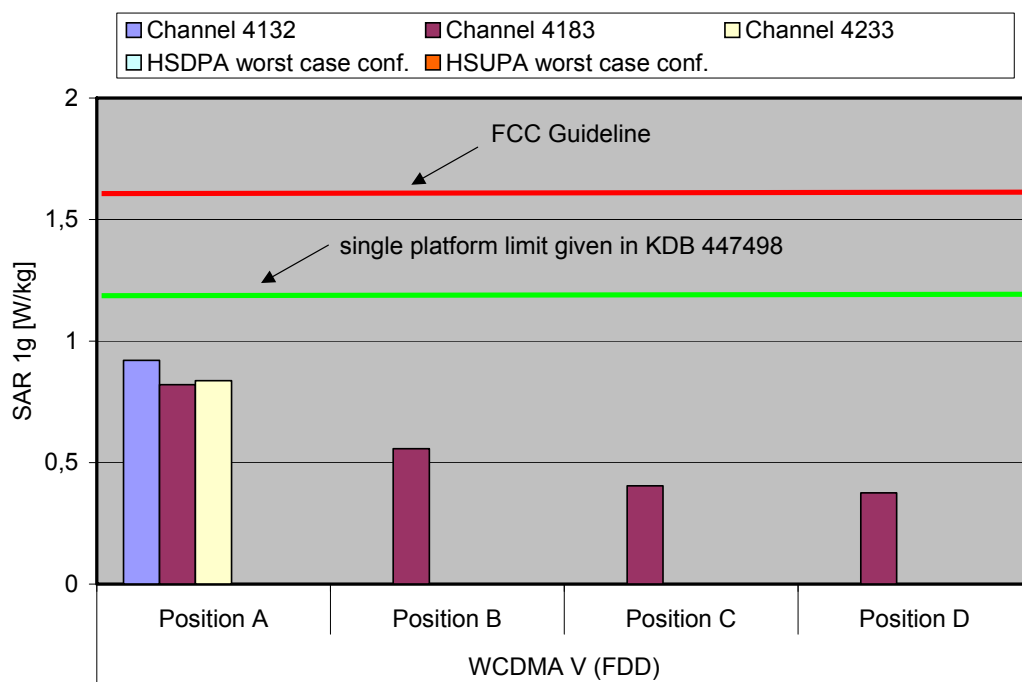


Fig. 7: The measured SAR values for the Option GI0452 for WCDMA V (FDD) in comparison to the FCC exposure limit.

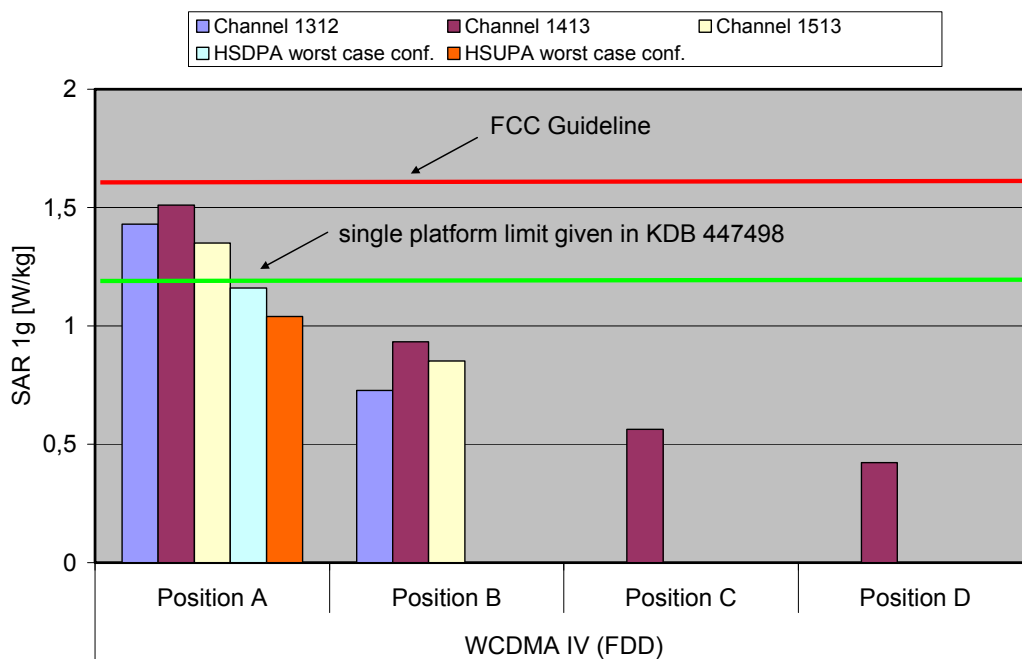


Fig. 8: The measured SAR values for the Option GI0452 for WCDMA IV (FDD) in comparison to the FCC exposure limit.

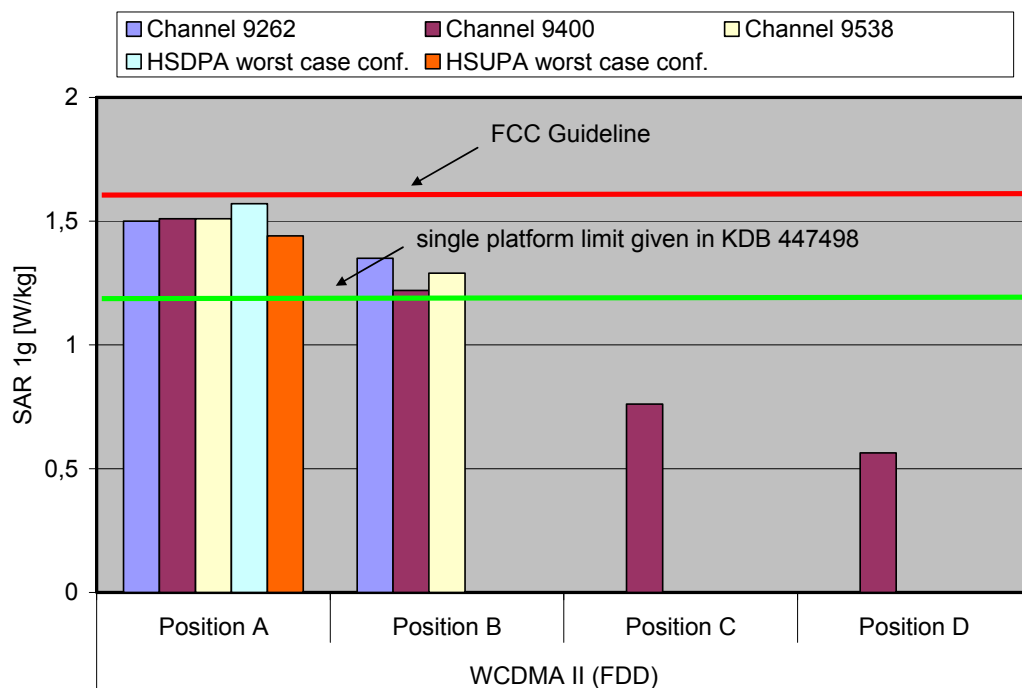


Fig. 9: The measured SAR values for the Option GI0452 for WCDMA II (FDD) in comparison to the FCC exposure limit.

7 Appendix

7.1 Administrative Data

Date of validation: 835 MHz (GPRS 850/FDD V): March 10, 2009
 1750 MHz (WCDMA IV): March 19, 2009
 1900 MHz (GPRS 1900): March 09, 2009
 1900 MHz (WCDMA II): May 19, 2009
 Date of measurement: March 09, 2009 – May 19, 2009
 Data stored: Option_6620_742
 Contact: IMST GmbH
 Carl-Friedrich-Gauß-Str. 2
 D-47475 Kamp-Lintfort, Germany
 Tel.: +49- 2842-981 378, Fax: +49- 2842-981 399
 email: vandenbosch@imst.de

7.2 Device under Test and Test Conditions

MTE: Option GI0452 (USB stick), identical prototype
 Date of receipt: March 09, 2009
 IMEI: 04401441131147
 FCC ID: NCMOGI0452
 Equipment class: Portable device
 Power Class: GPRS 850: 5, tested with power level 5
 GPRS 1900: 2, tested with power level 0
 WCDMA II (FDD) 1900: 3,
 tested with max.allow. UE Power of 33 dBm
 WCDMA V (FDD) 850: 3,
 tested with max.allow. UE Power of 33 dBm
 WCDMA IV (FDD) 1750: 3,
 tested with max.allow. UE Power of 33 dBm
 RF exposure environment: General Population/ Uncontrolled
 Power supply: Host Device
 Antenna: integrated
 Measured Standards: GPRS 850 Class 10 (tested with 2 TX uplink)
 GPRS 1900 Class 10 (tested with 2 TX uplink)
 WCDMA V, WCDMA IV and WCDMA II
 Method to establish a call: GPRS 850, GPRS 1900, WCDMA II, IV, V: Basestation
 simulator, using the air interface
 Modulation: GPRS: GMSK; WCDMA (FDD): QPSK
 Used Phantom: SAM Twin Phantom V4.0, as defined by the IEEE SCC-
 34/SC2 group and delivered by Schmid & Partner
 Engineering AG

Band	BCCH	Attenuation [dB]	Main Slot	Coding Scheme	Mode
GPRS 850	190	30	3	CS1	GPRS
GPRS 1900	661	30	3	CS1	GPRS

Table 16: Configuration of Base Station Controller for measurements in 2 G mode.

Band	DL-Power [dBm]	Attenuation [dB]	TPC – Algorithm	Dedicated Channel
WCDMA IV	-52	24	2	RMC
WCDMA V	-52	24	2	RMC
WCDMA II	-52	24	2	RMC

Table 17: Configuration of Base Station Controller for measurements in 3 G mode.

Option GI0452	TX Range [MHz]	RX Range [MHz]	Used Channels [low, middle, high]	Used Crest Factor
GPRS 850	824.2 – 848.8	869.2 – 893.8	128, 190 , 251	4
GPRS 1900	1850.2 – 1909.8	1930.2 – 1989.8	512, 661, 810	4
WCDMA IV (FDD)	1712.4 – 1752.6	2112.4 – 2152.6	1312, 1413, 1513	1
WCDMA V (FDD)	826.4 – 846.6	871.4 – 891.6	4132, 4183, 4233	1
WCDMA II (FDD)	1852.4 – 1907.6	1932.4 – 1987.6	9262, 9400, 9538	1

Table 18: Used channels and crest factors during the test.

7.3 Tissue Recipes

The following recipes are provided in percentage by weight.

835 MHz, Body:	52.40 %	De-Ionized Water
	01.50 %	Salt
	45.00 %	Sugar
	00.10 %	Preventol D7
	01.00 %	Hydroxyetyl-Cellulose
1750 MHz, Body:	29.44%	Diethylenglykol-monobutylether
	70.17%	De-Ionized Water
	0.39%	Salt
1900 MHz, Body:	29.68%	Diethylenglykol-monobutylether
	70.00%	De-Ionized Water
	0.20%	Salt

7.4 Material Parameters

For the measurement of the following parameters the HP 85070B dielectric probe kit is used, representing the open-ended coaxial probe measurement procedure. The measured values should be within $\pm 5\%$ of the recommended values given by the FCC.

Frequency		ϵ_r	σ [S/m]
835 MHz Body (GPRS 850)	Recommended Value	55.20 ± 2.70	0.97 ± 0.10
	Measured Value (Ch. 128)	57.10	0.99
	Measured Value (Ch. 190)	57.00	1.00
	Measured Value (Ch. 251)	56.90	1.00
835 MHz Body (WCDMA V)	Recommended Value	55.20 ± 2.70	0.97 ± 0.10
	Measured Value (Ch. 4132)	57.10	0.99
	Measured Value (Ch. 4183)	57.00	1.00
	Measured Value (Ch. 4233)	56.90	1.00
1750 MHz Body, (WCDMA IV)	Recommended Value	53.40 ± 2.70	1.49 ± 0.15
	Measured Value (Ch. 1312)	51.80	1.50
	Measured Value (Ch. 1413)	51.60	1.51
	Measured Value (Ch. 1513)	51.60	1.53
1900 MHz Body, (GPRS 1900)	Recommended Value	53.30 ± 2.65	1.52 ± 0.15
	Measured Value (Ch. 512)	53.00	1.47
	Measured Value (Ch. 661)	52.90	1.51
	Measured Value (Ch. 810)	52.80	1.55
1900 MHz Body, (WCDMA II)	Recommended Value	53.30 ± 2.65	1.52 ± 0.15
	Measured Value (Ch. 9262)	52.80	1.47
	Measured Value (Ch. 9400)	52.70	1.53
	Measured Value (Ch. 9538)	52.80	1.58

Table 19: Parameters of the tissue simulating liquid.

7.5 Simplified Performance Checking

The simplified performance check was realized using the dipole validation kits. The input power of the dipole antennas were 250 mW and they were placed under the flat part of the SAM phantoms. The target and measured results are listed in the Table 20 - 21 and shown in Fig. 10 - 13. The target values were adopted from the manufactures calibration certificates.

Available Dipoles		SAR_{1g} [W/kg]	ϵ_r	σ [S/m]
D835V2, SN #437	Target Values Body	2.47	54.80	1.00
D1750V2, SN #1005		9.14	53.30	1.43
D1900V2, SN #5d051		9.26	54.30	1.52

Table 20: Dipole target results.

Used Dipoles		SAR_{1g} [W/kg]	ϵ_r	σ [S/m]
835 MHz, SN: 437 (Validation GPRS 850 and WCDMA V)	Measured Values Body	2.42	57.00	1.00
1750 MHz, SN:1005 (Validation WCDMA IV)		8.95	51.60	1.53
1900 MHz, SN:5d051 (Validation GPRS 1900)		9.89	52.90	1.54
1900 MHz, SN:5d051 (Validation WCDMA II)		9.92	52.80	1.56

Table 21: Measured dipole validation results.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: [100309_b_1669.da4](#)

DUT: Dipole 835 MHz SN437; Type: D835V2; Serial: D835V2 - SN:437
Program Name: System Performance Check at 835 MHz

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 1 \text{ mho/m}$; $\epsilon_r = 57$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6R - SN1669; ConvF(5.89, 5.89, 5.89); Calibrated: 10.02.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 09.02.2009
- Phantom: SAM Sugar 1059; Type: Speag; Serial: 1059
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (measured) = 2.65 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.6 V/m; Power Drift = -0.016 dB

Peak SAR (extrapolated) = 3.48 W/kg

SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.58 mW/g

Maximum value of SAR (measured) = 2.64 mW/g

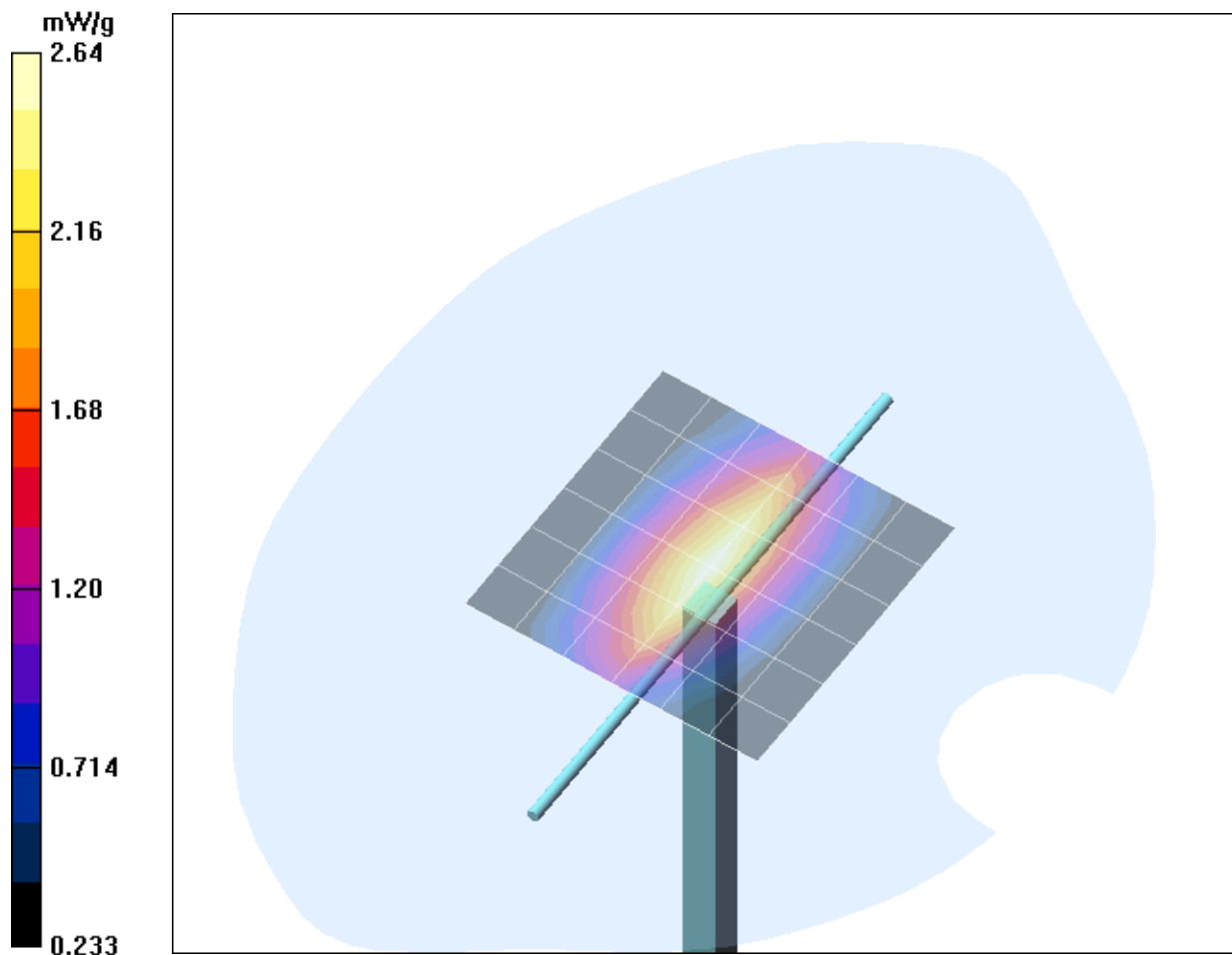


Fig. 10: Validation measurement 835 MHz Body (GPRS 850 and WCDMA V, March 10, 2009), coarse grid. Ambient Temperature: 22.0°C, Liquid Temperature: 21.3°C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: [090309_b_3536.da4](#)

DUT: Dipole 1900 MHz SN: 5d051; Type: D1900V2; Serial: D1900V2 - SN5d051
Program Name: System Performance Check at 1900 MHz

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1900$ MHz; $\sigma = 1.54$ mho/m; $\epsilon_r = 52.9$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3536; ConvF(8.15, 8.15, 8.15); Calibrated: 19.09.2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 17.09.2008
- Phantom: SAM Glycol 1176; Type: Speag; Serial: 1176
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 10.5 mW/g

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

Reference Value = 82.6 V/m; Power Drift = 0.056 dB

Peak SAR (extrapolated) = 18.5 W/kg

SAR(1 g) = 9.89 mW/g; SAR(10 g) = 5.09 mW/g

Maximum value of SAR (measured) = 11.2 mW/g

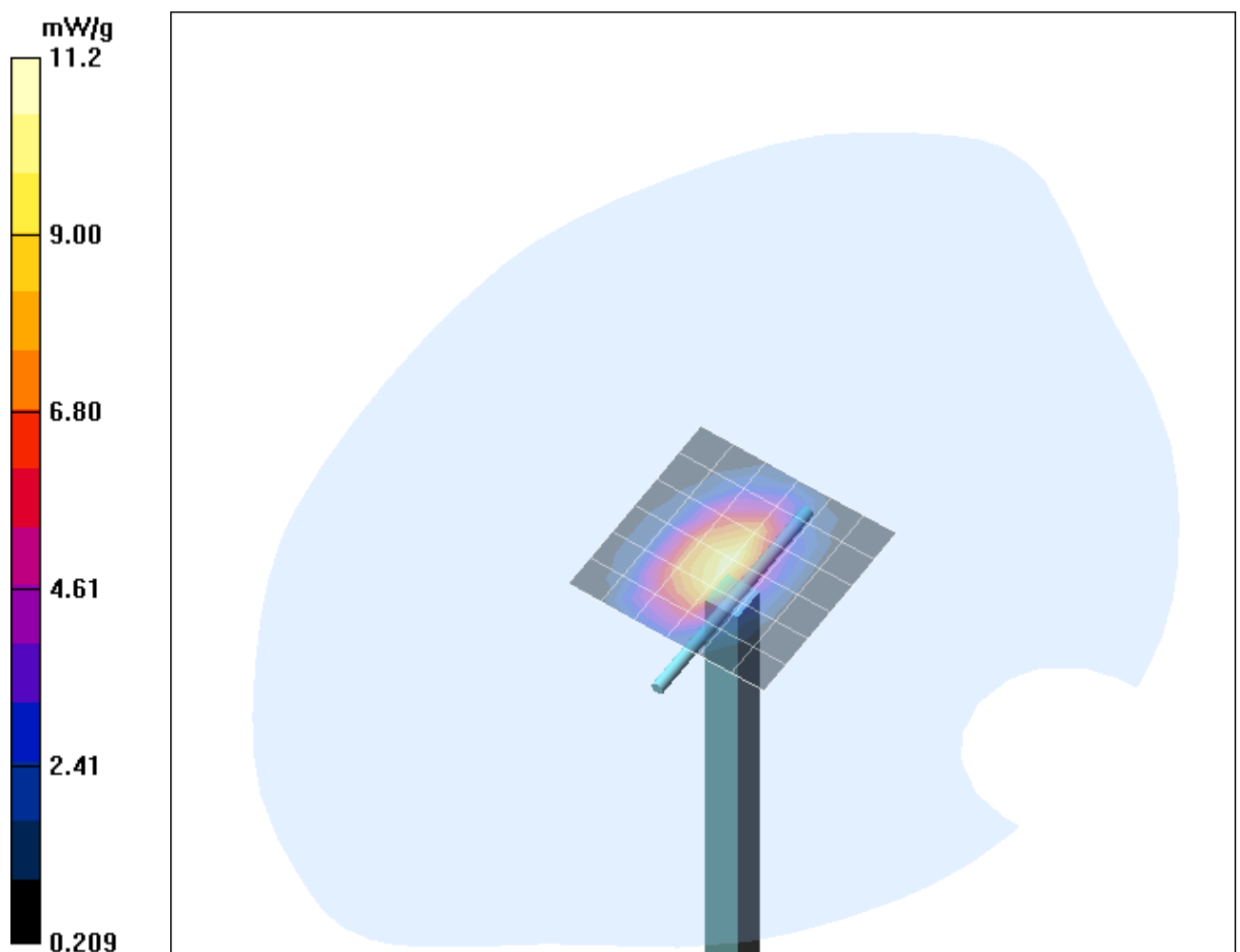


Fig. 11: Validation measurement 1900 MHz Body (GPRS 1900, March 09, 2009), coarse grid. Ambient Temperature: 22.2°C, Liquid Temperature: 21.4°C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: [190309_b_1669.da4](#)

DUT: Dipole 1750 MHz SN: 1005; Type: D1750V2; Serial: D1750V2 - SN:1005
Program Name: System Performance Check at 1750 MHz

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1750$ MHz; $\sigma = 1.53$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6R - SN1669; ConvF(4.75, 4.75, 4.75); Calibrated: 10.02.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 09.02.2009
- Phantom: SAM Glycol 1176; Type: Speag; Serial: 1176
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 9.79 mW/g

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

Reference Value = 85.2 V/m; Power Drift = 0.014 dB

Peak SAR (extrapolated) = 14.4 W/kg

SAR(1 g) = 8.95 mW/g; SAR(10 g) = 4.95 mW/g

Maximum value of SAR (measured) = 10.1 mW/g

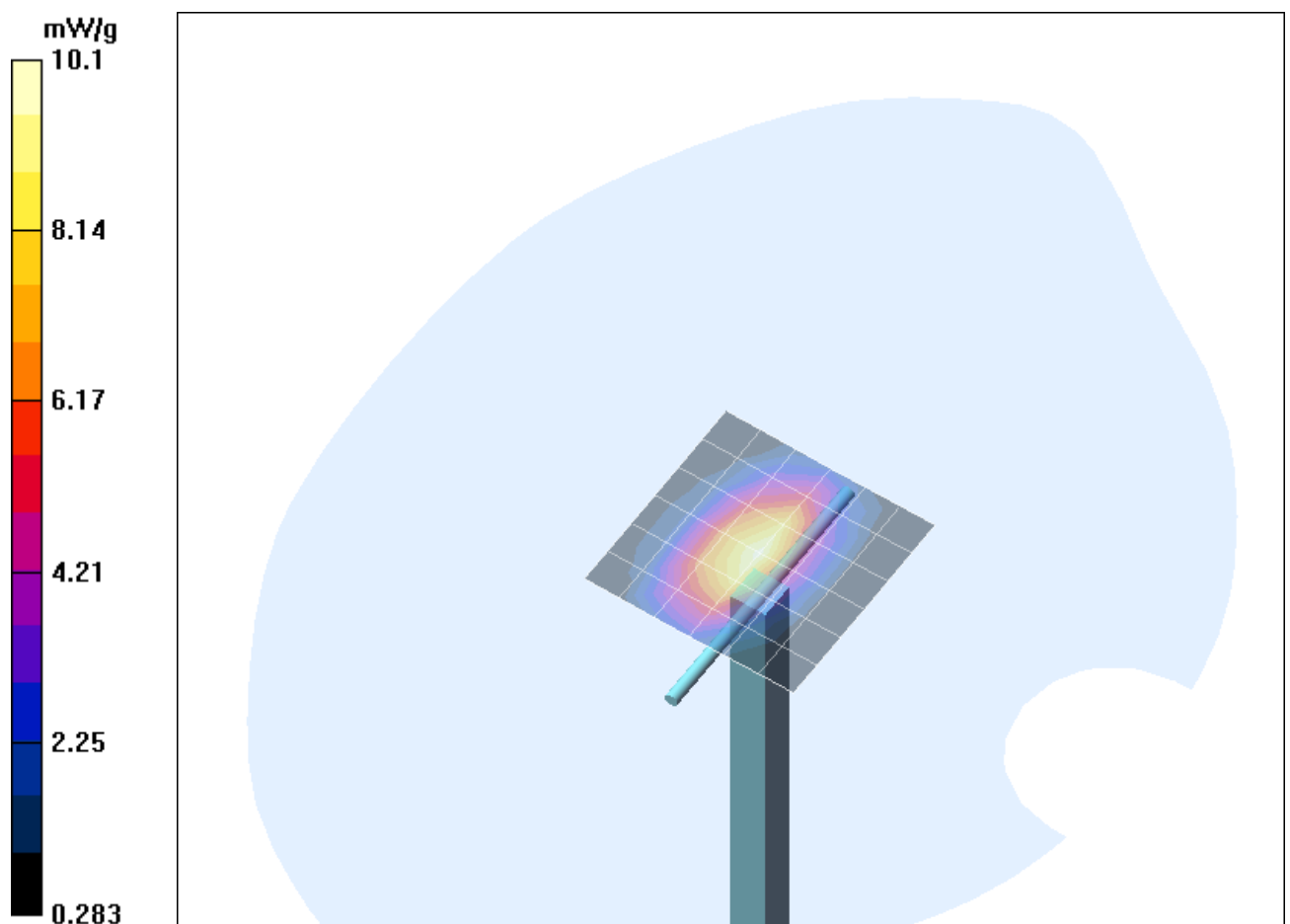


Fig. 12: Validation measurement 1750 MHz Body (WCDMA IV, March 19, 2009), coarse grid. Ambient Temperature: 22.0°C, Liquid Temperature: 21.2°C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: [190509_b_3536.da4](#)

DUT: Dipole 1900 MHz SN: 5d051; Type: D1900V2; Serial: D1900V2 - SN5d051
Program Name: System Performance Check at 1900 MHz

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 52.8$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3536; ConvF(8.15, 8.15, 8.15); Calibrated: 19.09.2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 09.02.2009
- Phantom: SAM Glycol 1176; Type: Speag; Serial: 1176
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 10.7 mW/g

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

Reference Value = 83.0 V/m; Power Drift = 0.037 dB

Peak SAR (extrapolated) = 18.8 W/kg

SAR(1 g) = 9.92 mW/g; SAR(10 g) = 5.08 mW/g

Maximum value of SAR (measured) = 11.1 mW/g

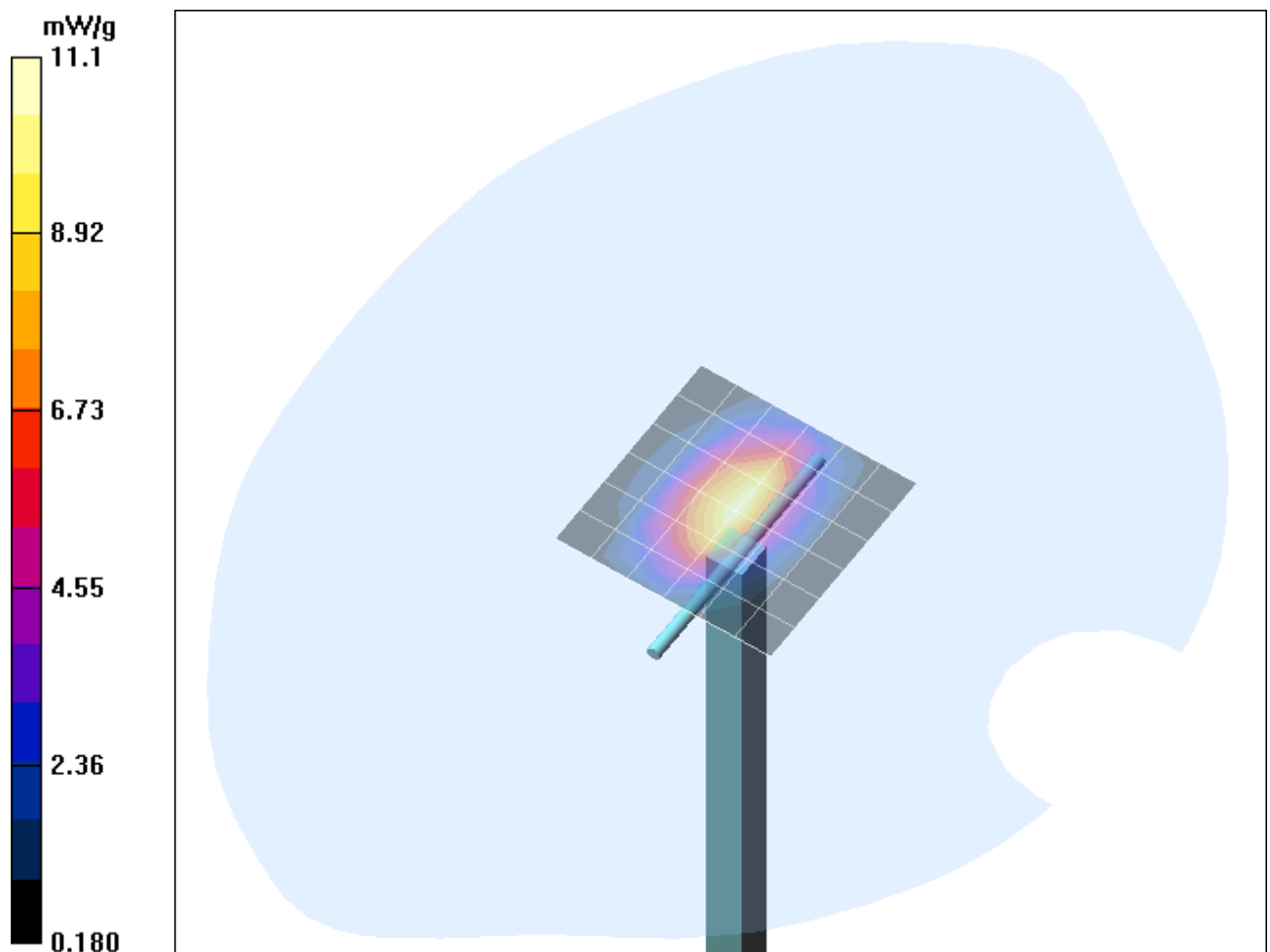


Fig. 13: Validation measurement 1900 MHz Body (WCDMA II, May 19, 2009), coarse grid. Ambient Temperature: 21.9°C, Liquid Temperature: 21.3°C.

Error Sources	Uncertainty Value	Probability Distribution	Divis or	c_i	Standard Uncertainty	v_i^2 or v_{eff}
Measurement System						
Probe calibration	$\pm 4.8 \%$	Normal	1	1	$\pm 4.8 \%$	∞
Axial isotropy	$\pm 4.7 \%$	Rectangular	$\sqrt{3}$	1	$\pm 2.7 \%$	∞
Hemispherical isotropy	$\pm 0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0 \%$	∞
Boundary effects	$\pm 1.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0.6 \%$	∞
Linearity	$\pm 4.7 \%$	Rectangular	$\sqrt{3}$	1	$\pm 2.7 \%$	∞
System detection limit	$\pm 1.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0.6 \%$	∞
Readout electronics	$\pm 1.0 \%$	Normal	1	1	$\pm 1.0 \%$	∞
Response time	$\pm 0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0 \%$	∞
Integration time	$\pm 0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0 \%$	∞
RF ambient conditions	$\pm 3.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 1.7 \%$	∞
Probe positioner	$\pm 0.4 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0.2 \%$	∞
Probe positioning	$\pm 2.9 \%$	Rectangular	$\sqrt{3}$	1	$\pm 1.7 \%$	∞
Algorithms for max SAR eval.	$\pm 1.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 0.6 \%$	∞
Dipole						
Dipole Axis to Liquid Distance	$\pm 2.0 \%$	Rectangular	1	1	$\pm 1.2 \%$	∞
Input power and SAR drift mea.	$\pm 4.7 \%$	Rectangular	$\sqrt{3}$	1	$\pm 2.7 \%$	∞
Phantom and Set-up						
Phantom uncertainty	$\pm 4.0 \%$	Rectangular	$\sqrt{3}$	1	$\pm 2.3 \%$	∞
Liquid conductivity (target)	$\pm 5.0 \%$	Rectangular	$\sqrt{3}$	0.64	$\pm 1.8 \%$	∞
Liquid conductivity (meas.)	$\pm 2.5 \%$	Normal	1	0.64	$\pm 1.6 \%$	∞
Liquid permittivity (target)	$\pm 5.0 \%$	Rectangular	$\sqrt{3}$	0.6	$\pm 1.7 \%$	∞
Liquid permittivity (meas.)	$\pm 2.5 \%$	Normal	1	0.6	$\pm 1.5 \%$	∞
Combined Uncertainty					$\pm 8.4 \%$	

Table 22: Uncertainty budget for the system performance check.

7.6 Environment

To comply with the required noise level (less than 12 mW/kg) periodically measurements without a DUT were conducted. Humidity: $37\% \pm 5\%$

7.7 Test Equipment

Test Equipment	Model	Serial Number	Last Calibration	Next Calibration
DASY4 Systems				
Software Versions DASY4	V4.7	N/A	N/A	N/A
Software Versions SEMCAD	V1.8	N/A	N/A	N/A
Dosimetric E-Field Probe	ET3DV6	1669	03/2009	03/2010
Dosimetric E-Field Probe	EX3DV4	3536	09/2008	09/2009
Data Acquisition Electronics	DAE 4	631	09/2008	09/2009
Data Acquisition Electronics	DAE 4	335	02/2009	02/2010
Phantom	SAM	1059	N/A	N/A
Phantom	SAM	1176	N/A	N/A
Phantom	SAM	1340	N/A	N/A
Phantom	SAM	1341	N/A	N/A
Dipoles				
Validation Dipole	D835V2	437	12/2007	12/2009
Validation Dipole	D1750V2	1005	03/2009	03/2011
Validation Dipole	D1900V2	535	12/2007	12/2009
Validation Dipole	D1900V2	5d051	09/2007	09/2009
Material Measurement				
Network Analyzer	E5071C	MY46103220	01/2008	01/2010
Dielectric Probe Kit	HP85070B	US33020263	N/A	N/A

Table 23: SAR equipment.

Test Equipment	Model	Serial Number	Last Calibration	Next Calibration
Power Meters				
Power Meter, Agilent	E4416A	GB41050414	12/2008	12/2010
Power Meter, Agilent	E4417A	GB41050441	12/2008	12/2010
Power Meter, Anritsu	ML2487A	6K00002319	12/2007	12/2009
Power Meter, Anritsu	ML2488A	6K00002078	12/2007	12/2009
Power Sensors				
Power Sensor, Agilent	E9301H	US40010212	12/2008	12/2010
Power Sensor, Agilent	E9301A	MY41495584	12/2008	12/2010
Power Sensor, Anritsu	MA2481B	031600	12/2007	12/2009
Power Sensor, Anritsu	MA2490A	031565	12/2007	12/2009
RF Sources				
Network Analyzer	E5071C	MY46103220	01/2008	01/2010
Rohde & Schwarz	SME300	100142	N/A	N/A
Amplifiers				
Mini Circuits	ZHL-42	D012296	N/A	N/A
Mini Circuits	ZHL-42	D031104#01	N/A	N/A
Mini Circuits	ZVE-8G	D031004	N/A	N/A
Radio Tester				
Rohde & Schwarz	CMU200	835305/050	12/2008	12/2010
Anritsu	MT8815B	6200586536	N/A	N/A

Table 24: Test equipment, General.

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info@speag.com, <http://www.speag.com>

s p e a g

Item	Dosimetric Assessment System DASY4
Type No	SD 000 401A, SD 000 402A
Software Version No	DASY 4.7
Manufacturer / Origin	Schmid & Partner Engineering AG Zeughausstrasse 43, CH-8004 Zürich, Switzerland

References

- [1] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, December 2003
- [2] EN 50361:2001, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz – 3 GHz)", July 2001
- [3] IEC 62209 – 1, "Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz – Measurement Procedure, Part 1: Hand-held mobile wireless communication devices", February 2005
- [4] IEC 62209 – 2, Draft Version 0.9, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation and Procedures Part 2: Procedure to determine the Specific Absorption Rate (SAR) for ... including accessories and multiple transmitters", December 2004
- [5] OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 01-01
- [6] ANSI-C63.19-2006, "American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids", June 2006
- [7] ANSI-C63.19-2007, "American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids", June 2007

We certify that this **system** is designed to be fully compliant with the standards [1 – 7] for RF emission tests of wireless devices.

The uncertainty of the measurements with this system was evaluated according to the above standards and is documented in the applicable chapters of the DASY4 system handbook.

The uncertainty values represent current state of methodology and are subject to changes. They are applicable to all laboratories using DASY4 provided the following requirements are met (responsibility of the system end user):

- 1) the system is used by an experienced engineer who follows the manual and the guidelines taught during the training provided by SPEAG,
- 2) the probe and validation dipoles have been calibrated for the relevant frequency bands and media within the requested period,
- 3) the DAE has been calibrated within the requested period,
- 4) the "minimum distance" between probe sensor and inner phantom shell and the radiation source is selected properly,
- 5) the system performance check has been successful,
- 6) the operational mode of the DUT is CW, CDMA, FDMA or TDMA (GSM, DCS, PCS, IS136, PDC) and the measurement/integration time per point is ≥ 500 ms,
- 7) if applicable, the probe modulation factor is evaluated and applied according to field level, modulation and frequency,
- 8) the dielectric parameters of the liquid are conformant with the standard requirement,
- 9) the DUT has been positioned as described in the manual.
- 10) the uncertainty values from the calibration certificates, and the laboratory and measurement equipment dependent uncertainties, are updated by end user accordingly.

Date 24.4.2008

Signature / Stamp

F. Bork

Doc No 880 – SD00040XA-Standards 0804 – F

KP/FB

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Fig. 14: Certificate of conformity for the used DASY4 system

Schmid & Partner Engineering AG

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Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 BA
Series No	TP-1002 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards	Liquid type HSL 1800 and others according to the standard.	Pre-series, First article

Standards

- [1] CENELEC EN 50361
- [2] IEEE P1528-200x draft 6.5
- [3] IEC PT 62209 draft 0.9
- (*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 18.11.2001

Signature / Stamp



**Schmid & Partner
Engineering AG**

Zeughausstrasse 43, CH-8004 Zurich
Tel. +41 1 245 97 00, Fax +41 1 245 97 79



Fig. 15: Certificate of conformity for the used SAM phantom.

7.9 Pictures of the device under test

Fig. 16 - 17 show the device under test.



Fig. 16: Front view of the host device Fujitsu Siemens Amilo Pro.



Fig. 17: Device under test.

7.10 Test Positions for the Device under Test

Fig. 18 – Fig. 21 show the test positions for the SAR measurements.

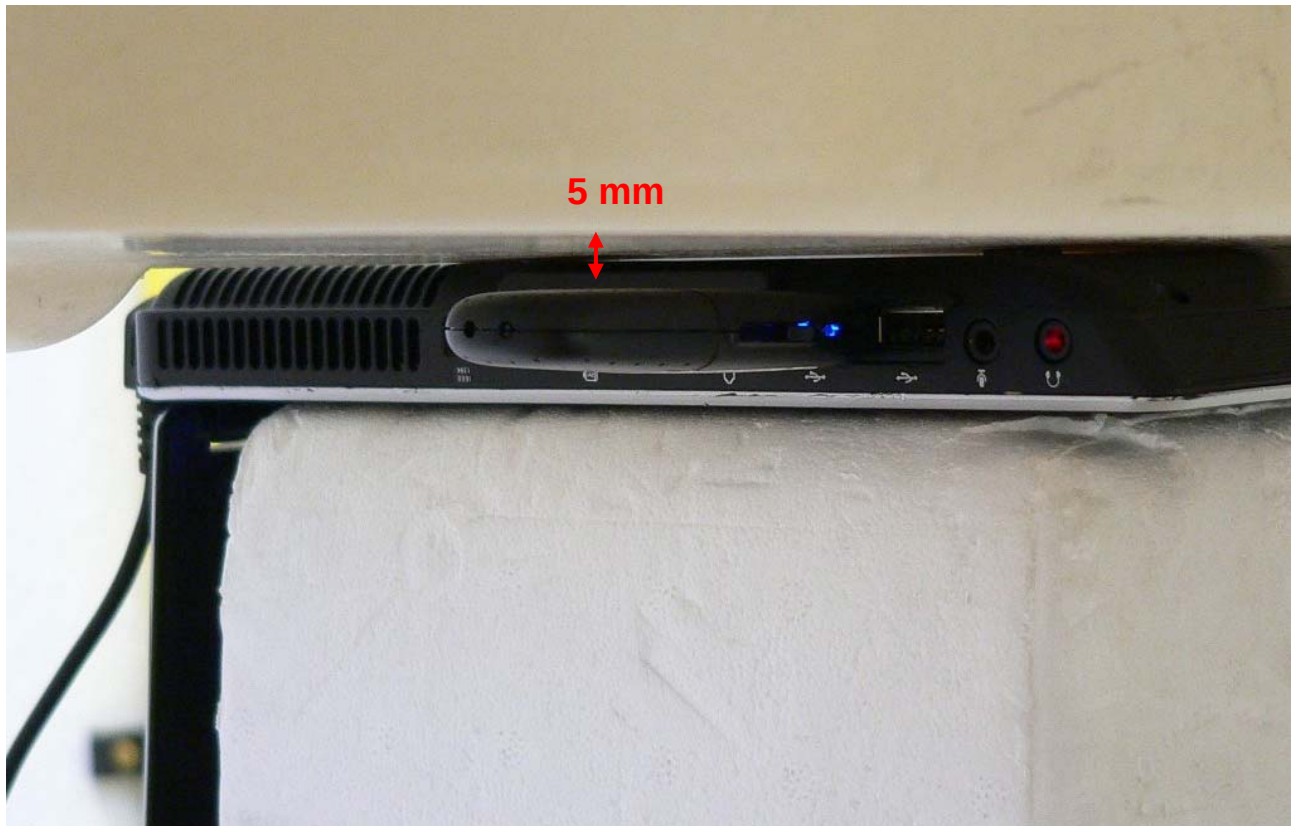


Fig. 18: Position A with the Fujitsu Siemens Amilo Pro.

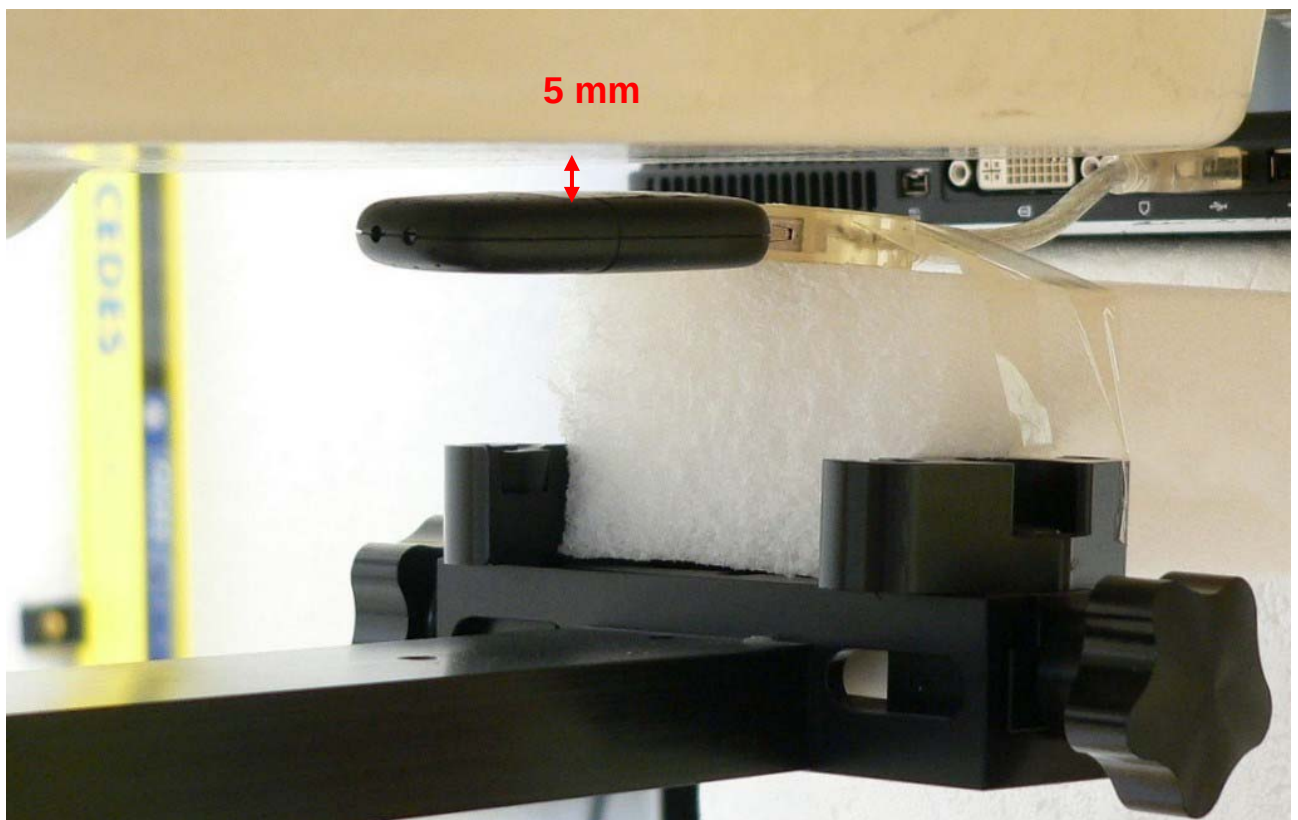


Fig. 19: Position B with the Fujitsu Siemens Amilo Pro.

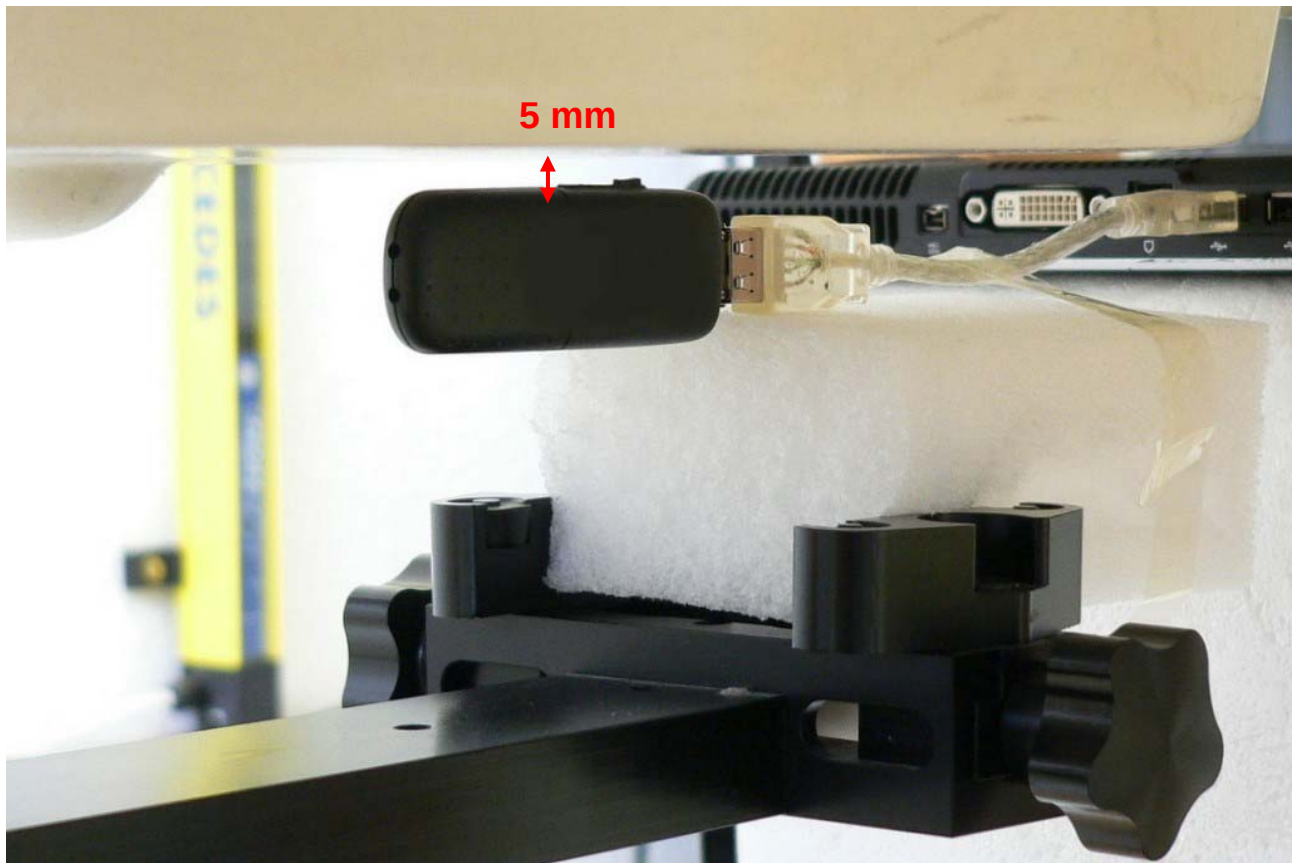


Fig. 20: Position C with the Fujitsu Siemens Amilo Pro.

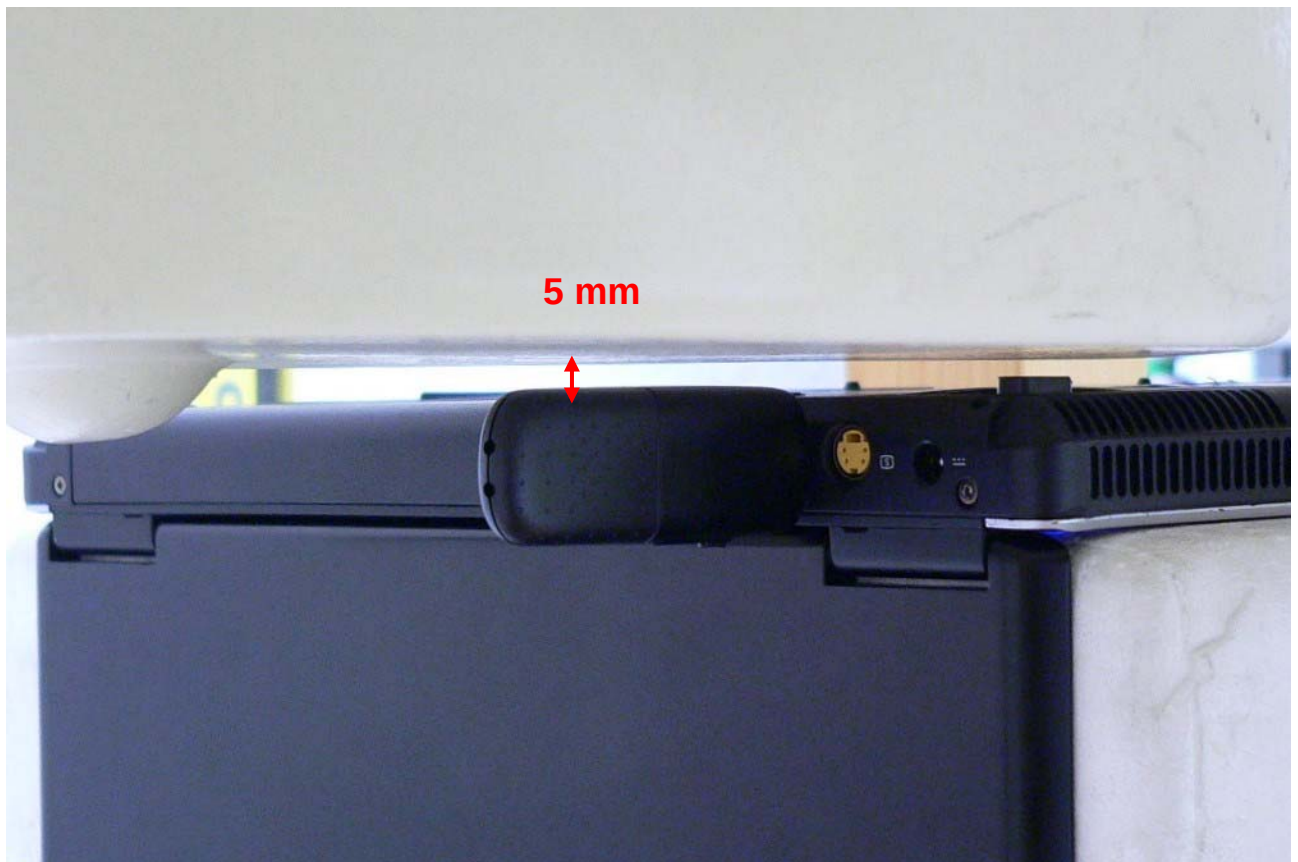


Fig. 21: Position D with the Fujitsu Siemens Amilo Pro.

7.11 Pictures to demonstrate the required liquid depth

Fig. 22 - 24 show the liquid depth in the used SAM phantom.



Fig. 22: Liquid depth for GPRS 850 and WCDMA V Body measurements



Fig. 23: Liquid depth for GPRS 1900 and WCDMA II Body measurements.



Fig. 24: Liquid depth for WCDMA IV Body measurements

8 References

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- 941225 D03 Recommended SAR Test Reduction Procedures GSM/GPRS/EDGE, v01, December 2008