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Report

Dosimetric Assessment of the Portable Device PSION 7545MBW (FCC ID: GM37545MBW) (IC: 2739D-7545MBW) According to the FCC and IC Requirements

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Executive Summary

The 7545MBW (FCC ID: GM37545MBW), containing the 7545MBWP (FCC ID: GM37545MBWP) radio module, is a new portable device from PSION operating in the 850 MHz, 900 MHz, 1800 MHz, 1900 MHz, 2450 MHz and 5 GHz frequency range. The device has different integrated antennas and the system concepts used are IEEE 802.11 a/b/g/n, GSM 850, GSM 900, DCS 1800, PCS 1900, WCDMA I, II, V standards, including GPRS Class 10 and Bluetooth capability.

The objective of the measurements done by IMST was the dosimetric assessment of one device in head and body worn configuration in the GSM 850 (GPRS Class 10), PCS 1900 (GPRS Class 10), WCDMA II, V and IEEE 802.11 a/b/g/n standards. For WiFi, a special test software was used, so the tests are conducted with an specific output power and channel. Since WWAN and WiFi could be active at the same time, co-location considerations are applicable. SAR assessment in Bluetooth mode was not conducted because the Bluetooth output power is below the power threshold mentioned in the applicable KDB. The examinations have been carried out with the dosimetric assessment system „DASY4“.

Based on the KDB 648474 [KDB 648474] measurements with Bluetooth are not required since the output power is below the threshold for Bluetooth.

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 and IC RSS 102 Issue 4 and the following specific FCC Procedures:

- KDB 941225 D01 SAR test for 3G devices v02
- KDB 941225 D03 SAR Test Reduction GSM/GPRS/EDGE v01
- KDB 648474 D01 SAR Handset Multi Xmiter and Ant, v01r05
- KDB 248227 D01 SAR meas. for 802.11 abg v01r02

All measurements have been performed in accordance to the recommendations given by SPEAG.

Compliance Statement

The portable device 7545MBW from PSION (FCC ID: GM37545MBW) with integrated 7545MBWP (FCC ID: GM37545MBWP) radio module is in compliance with the IC RSS 102 Issue 4 [RSS 102] and Federal Communications Commission (FCC) Guidelines [OET 65] for uncontrolled exposure. SAR assessment in body worn was conducted with a holster in direct contact to phantom.

Max. $SAR_{1g\ (measured)}$ = 1.020 W/kg (IEEE 802.11 a, CH 104, Body Worn, Pos. 2 with holster)

Max. $SAR_{1g\ (co\text{-}transmission)}$ = 1.177 W/kg (WiFi - WWAN, Worst case configuration)

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1 Subject of Investigation

The 7545MBW (FCC ID: GM37545MBW) containing the 7545MBWP (FCC ID: GM37545MBWP) radio module and is a new portable device from PSION operating in the 850 MHz, 900 MHz, 1800 MHz, 1900 MHz, 2450 MHz and 5 GHz frequency range. The device has different integrated antennas and the system concepts used are IEEE 802.11 a/b/g/n, GSM 850, GSM 900, DCS 1800, PCS 1900, WCDMA I, II, V standards, including GPRS Class 10 and Bluetooth capability.

Fig. 1: Pictures of the device under test.

The objective of the measurements done by IMST was the dosimetric assessment of one device in head and body worn configuration in the GSM 850 (GPRS Class 10), PCS 1900 (GPRS Class 10), WCDMA II, V and IEEE 802.11 a/b/g/n standards. For WiFi, a special test software was used, so the tests are conducted with an specific output power and channel. Since WWAN and WiFi could be active at the same time, co-location considerations are applicable. SAR assessment in Bluetooth mode was not conducted because the Bluetooth output power is below the power threshold mentioned in the applicable KDB. The examinations have been carried out with the dosimetric assessment system „DASY4".

2 The IEEE Standard C95.1-1999 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 Std 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 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:

$$SAR = \sigma \frac{E^2}{\rho} = c \left. \frac{\partial T}{\partial t} \right|_{t \to 0+} . \qquad (1)$$

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 SAR Limit

In this report the comparison between the FCC 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.

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 Device Operating Next to a Person’s Ear

3.2.1 Phantom Requirements

The phantom is a simplified representation of the human anatomy and comprised of material with electrical properties similar to the corresponding tissues. The physical characteristics of the phantom model shall resemble the head and the neck of a user since the shape is a dominant parameter for exposure.

3.2.2 Test Positions

As it cannot be expected that the user will hold the mobile phone exactly in one well defined position, different operational conditions shall be tested. The Supplement C to OET Bulletin 65 requires two test positions. For an exact description helpful geometrical definitions are introduced and shown in Fig. 2 - 3.

There are two imaginary lines on the mobile, the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width w_t of the handset at the level of the acoustic output (point A on Fig. 2), and the midpoint of the width w_b of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Fig. 2). The two lines intersect at point A.

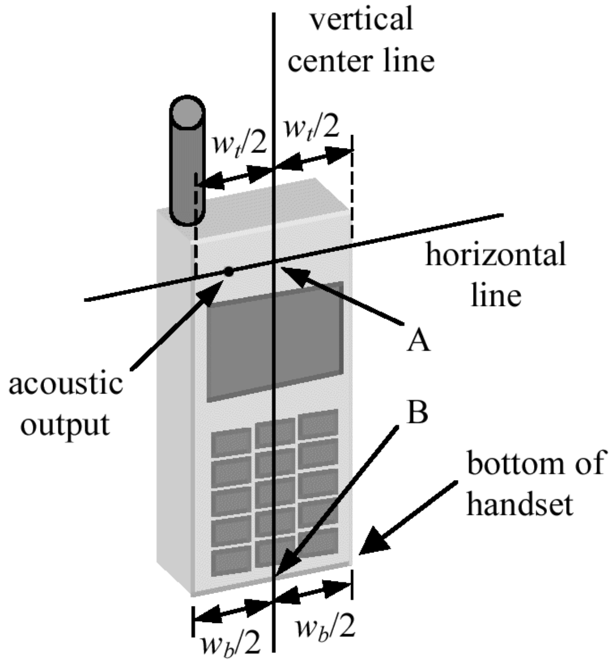

Fig. 2: Handset vertical and horizontal reference lines.

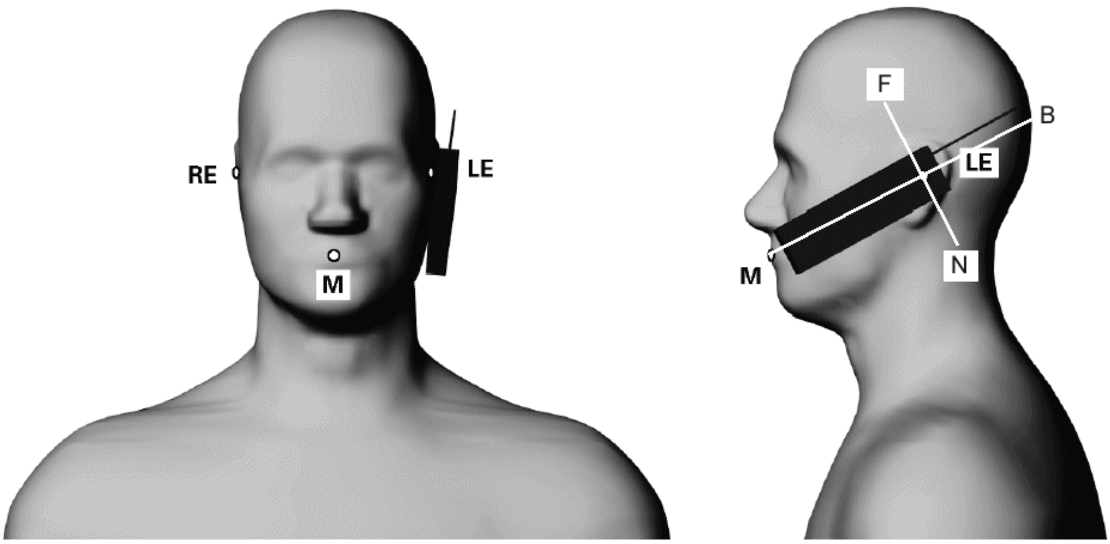

Fig. 3: Phantom reference points.

According to Fig. 3 the human head position is given by means of the following three reference points: auditory canal opening of both ears (RE and LE) and the center of the closed mouth (M). The ear reference points are 15-17 mm above the entrance to the ear canal along the BM line (back-mouth), as shown in Fig. 3. The plane passing through the two ear canals and M is defined as the reference plane. The line NF (Neck-Front) perpendicular to the reference plane and passing through the RE (or LE) is called the reference pivoting line. Line BM is perpendicular to the NF line. With this definitions the test positions are given by

- **Cheek Position (see Fig. 4):**

Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Fig. 3), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom. Translate the handset towards the phantom along the line passing through RE and LE until the handset touches the ear. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane). Rotate the phone around the vertical centerline until the phone (horizontal line) is symmetrical with respect to the line NF. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, rotate the handset about the line NF until any point on the handset is in contact with a phantom point below the ear.

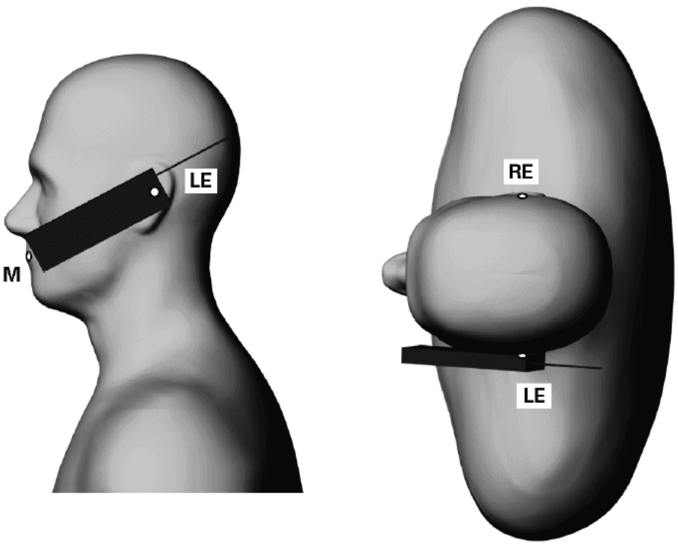

Fig. 4: The cheek position.

- **Tilted Position (see Fig. 5):**

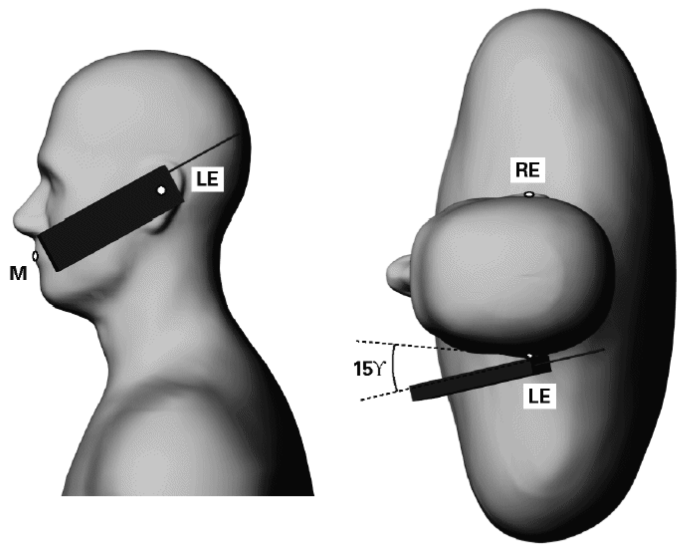

Fig. 5: The tilted position.

While maintaining the orientation of the phone retract the phone parallel to the reference plane far enough to enable a rotation of the phone by 15°. Rotate the phone around the horizontal line by 15°. While maintaining the orientation of the phone, move the phone parallel to the reference plane until any part of the phone touches the head. In this position, point A will be located on the line RE-LE.

3.2.3 Test to be Performed

The SAR test shall be performed with both phone positions described above, on the left and right side of the phantom. The device shall be measured for all modes operating when the device is next to the ear, even if the different modes operate in the same frequency band.

For devices with retractable antenna the SAR test shall be performed with the antenna fully extended and fully retracted. Other factors that may affect the exposure shall also be tested. For example, optional antennas or optional battery packs which may significantly change the volume, lengths, flip open/closed, etc. of the device, or any other accessories which might have the potential to considerably increase the peak spatial-average SAR value.

The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional.

4 Body-Worn Configurations

The body-worn configurations shall be tested with the supplied accessories (belt-clips, holsters, etc.) attached to the device in normal use configuration. Devices with a headset output shall be tested with a connected headset.

For purpose of determining test requirements, accessories may be divided into two categories: those that do not contain metallic components and those that do. For multiple accessories that do not contain metallic components, the device may be tested only with that accessory which provides the closest spacing to the body.

For multiple accessories that contain metallic components, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component, only the accessory that provides the closest spacing to the body must be tested.

If the manufacturer provides none body-worn accessories a separation distance of 1.5 cm between the back of the device and the flat phantom is recommended. Other separation distances may be used, but they shall not exceed 2.5 cm.

4.1 PoC (PTT) Position

The PoC (PTT) configurations shall be tested with the front of the device positioned at 25 mm from a flat phantom (display towards the phantom).

4.2 Phantom Requirements

For body-worn and other configurations a flat phantom shall be used which is comprised of material with electrical properties similar to the corresponding tissues.

4.3 Test to be Performed

For devices with retractable antenna the SAR test shall be performed with the antenna fully extended and fully retracted. Other factors that may affect the exposure shall also be tested. For example, optional antennas or optional battery packs which may significantly change the volume, lengths, flip open/closed, etc. of the device, or any other accessories which might have the potential to considerably increase the peak spatial-average SAR value.

The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional

4.4 Additional Information for 802.11 a/b/g Transmitters

In May 2007 the FCC published the revised issue of the SAR Measurement Procedures for 802 a/b/g transmitters to support the SAR measurements for demonstrating compliance with the FCC RF exposure guidelines. Additional information were required to establish specific device operating configurations to use during the measurements since the specific signal modulations, data rates, network conditions and other parameters were not considered within the current SAR measurement procedures (FCC, IEEE-1528).

Following the most important differences compared to the common SAR measurements of e.g. mobile phones working in the GSM or PCS standards were listed:

- Using of chipset based test mode software to ensure consistent and reliable results
- If the device supports switched diversity, the SAR should be measured with only one antenna transmitting (with fixed modulation and data rate) at a time
- The SAR is measured for the “default test channels” listed below as given by the FCC
- SAR measurements for 802.11 g channels when the maximum avg output power is less than ≥ 0.25 dB higher than the values for the corresponding 802.11b channels
- The avg. output power for 802.11a should be measured on all channels in each frequency band

- If the channel with the maximum avg. output power is not included in the default test channels, this channel should be tested instead of an adjacent default test channel
- For multiple channel bandwidth configurations, the configuration with the highest output power limit should be tested.
- Each channel should be tested at the lowest data rate in each a/b/g mode
- When the extrapolated maximum peak SAR for the maximum output channel is ≤ 1.6 W/kg and the 1g avg SAR is ≤ 0.8 W/kg, testing of other channels in the default test channel configuration is optional.
- If the device supports MIMO capability and the antennas are in close proximity to each other (within 3 cm – 5 cm), it is necessary to summarize the SAR_{1g} values of the antennas.
- If the peak SAR locations from different antennas are more than 5 cm apart, spatial summing is optional.
- Each channel should be tested at the lowest data rate in each a-b/g mode.

Mode 802.11		Frequency [MHz]	Channel	Turbo Channel	Default Test Channels § 15.247 b	Default Test Channels § 15.247 g	Default Test Channels UNII	
b / g		2412	1°		x	^		
		2437	6	6	x	^		
		2462	11°		x	^		
a	UNII	5180	36				x	
		5200	40	42 (5.21 GHz)				*
		5220	44					*
		5240	48	50 (5.29 GHz)			x	
		5260	52				x	
		5280	56	58 (5.29 GHz)				*
		5300	60					*
		5320	64				x	
		5500	100	Unknown				*
		5520	104				x	
		5540	108					*
		5560	112					*
		5580	116				x	
		5600	120					*
		5620	124				x	
		5640	128					*
		5660	132					*
		5680	136				x	
		5700	140					*
	UNII or §15.247	5745	149		x		x	
		5765	153	152 (5.76 GHz)		*		*
		5785	157		x			*
		5805	161	160 (5.80 GHz)		*	x	
	§15.247	5825	165		x			

Table 2: Default Test channels given by the FCC.

X: default test channels

*: possible 802.11a channels with maximum avg output > the default test channels

^: possible 802.11g channels with maximum avg output ¼ dB ≥ the default test channels

°: when output power is reduced for channel 1 and / or 11 to meet restricted band requirements the highest output channels closet to each of these channels should be tested

5 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: 6. Additional Fig: 7 shows the equipment, similar to the installations in other laboratories.

- Fully compliant with all current measurement standards as stated in Fig. 34
- 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

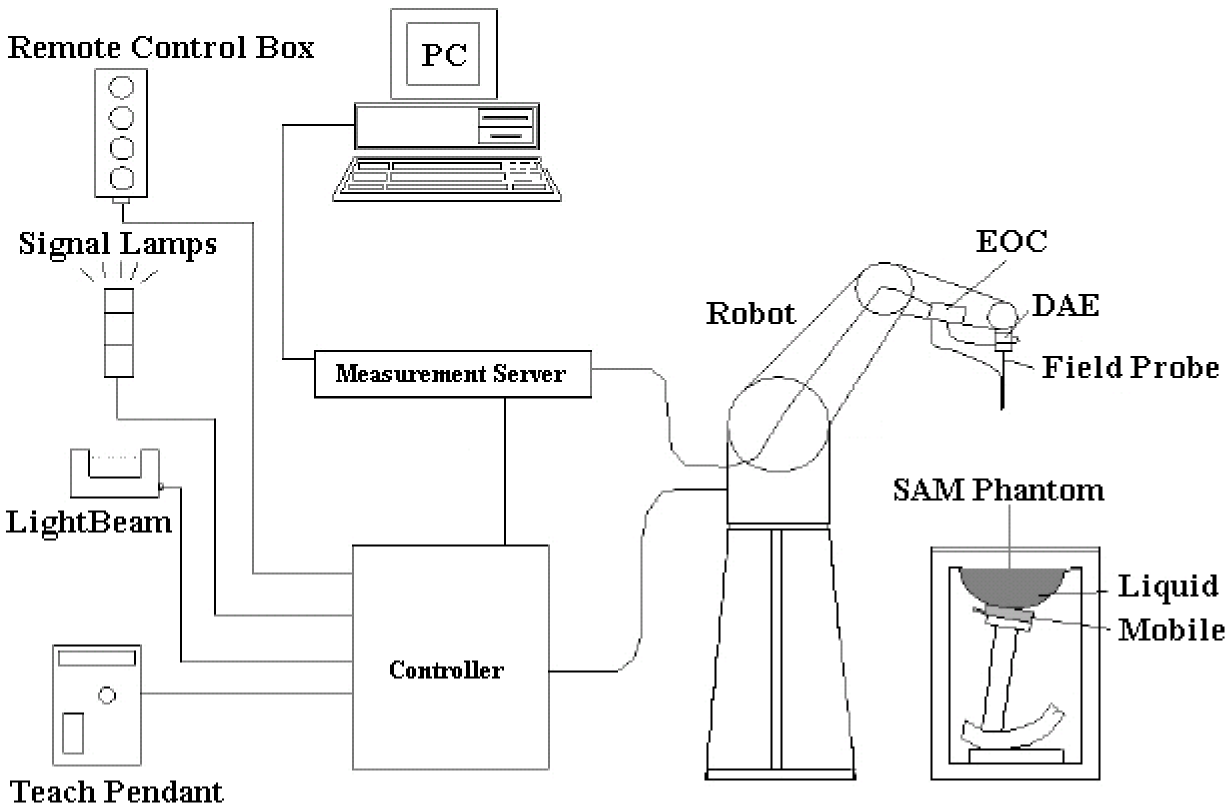

Fig. 6: The DASY4 measurement system.

Fig. 7: The measurement set-up with two SAM phantoms containing tissue simulating liquid.

The mobile phone 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.

5.1 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 mm ± 0.2 mm. It enables the dosimetric evaluation of left and right hand phone usage and includes an additional flat phantom part for the system performance check and body worn measurements. 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. 35.

5.2 Probe

For the measurements the Dosimetric E-Field Probes ET3DV6 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: 5µW/g to > 100mW/g
- Tip diameter: 6.8 mm
- Probe linearity: ± 0.2 dB (30 MHz to 3 GHz)
- Axial isotropy: ± 0.2 dB
- Spherical isotropy: ± 0.4 dB
- Distance from probe tip to dipole centers: 2.7 mm
- Calibration range: 900MHz / 1850MHz for head and body simulating liquid
- Angle between probe axis (evaluation axis) and surface normal line: less than 30°

EX3DV4:

- Dynamic range: 10µW/g to > 100mW/g (noise typically < 1µW/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°

5.3 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 ± 0.21dB.

5.4 Uncertainty Assessment

Table 3 includes the worst case uncertainty budget determined by Schmid & Partner Engineering AG for the frequency range up to 6 GHz. The expanded uncertainty (K=2) is assessed to be ± 25.9 %.

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i	Standard Uncertainty	v_i^2 or v_{eff}
Measurement Equipment						
Calibration	± 6.8 %	Normal	1	1	± 6.8 %	∞
Axial Isotropy	± 4.7 %	Rectangular	√3	0.7	± 1.9 %	∞
Hemispherical Isotropy	± 9.6 %	Rectangular	√3	0.7	± 3.9 %	∞
Linearity	± 4.7 %	Rectangular	√3	1	± 2.7 %	∞
Detection limits	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Boundary effects	± 2.0 %	Rectangular	√3	1	± 1.2 %	∞
Readout Electronics	± 0.3 %	Normal	1	1	± 0.3 %	∞
Response time	± 0.8 %	Rectangular	√3	1	± 0.5 %	∞
RF Ambient Noise	± 3.0 %	Rectangular	√3	1	± 1.7 %	∞
RF Ambient Reflections	± 3.0 %	Rectangular	√3	1	± 1.7 %	∞
Integration time	± 2.6 %	Rectangular	√3	1	± 1.5 %	∞
Probe Positioner	± 0.8 %	Rectangular	√3	1	± 0.5 %	∞
Probe Positioning	± 9.9 %	Rectangular	√3	1	± 5.7 %	∞
Max SAR Eavaluation	± 4.0%	Rectangular	√3	1	± 2.3 %	∞
Mechanical Constraints						
Positioning of the phone	± 2.9 %	Normal	1	1	± 2.9 %	∞
Device Holder	± 3.6 %	Normal	1	1	± 3.6 %	∞
Power Drift	± 5.0 %	Rectangular	√3	1	± 2.9 %	∞
Physical Parameters						
Phantom Uncertainty	± 4.0 %	Rectangular	√3	1	± 2.3 %	∞
Liquid conductivity (target)	± 5.0 %	Rectangular	√3	0.64	± 1.8 %	∞
Liquid conductivity (meas.)	± 2.5 %	Normal	1	0.64	± 1.6 %	∞
Liquid permittivity (target)	± 5.0 %	Rectangular	√3	0.60	± 1.7 %	∞
Liquid permittivity (meas.)	± 2.5 %	Normal	1	0.60	± 1.5 %	∞
Combined Uncertainty					**± 12.9 %**	

Table 3: Uncertainty budget of DASY4.

6 Output Power Values

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 4.

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].

Output Power [dBm]												
Band	Frequency [MHz]	Channel	WCDMA RMC	HSDPA				HSUPA				
				Subt. 1	Subt. 2	Subt. 3	Subt. 4	Subt. 1	Subt. 2	Subt. 3	Subt. 4	Subt. 5
850 (FDD V)	826.4	4132	23.9	24.6	24.4	24.2	24.0	23.9	22.2	23.0	22.3	23.9
	836.6	4183	24.1	24.8	24.6	24.3	24.1	23.6	22.6	23.0	22.7	23.5
	846.6	4233	23.9	24.6	24.6	24.3	24.2	23.4	22.4	22.8	22.8	23.5
1900 (FDD II)	1852.4	9262	24.1	25.0	24.8	24.7	24.6	24.1	22.8	23.0	22.8	24.1
	1880.0	9400	23.9	24.6	24.5	24.3	24.1	23.3	22.4	22.7	22.6	23.9
	1907.6	9538	24.1	24.9	24.8	24.6	24.5	24.1	22.5	23.0	22.5	24.1
βc				2/15	12/15	15/15	15/15	11/15	6/15	15/15	2/15	15/15
βd				15/15	15/15	8/15	4/15	15/15	15/15	9/15	15/15	15/15
ΔACK, ΔNACK, ΔCQI				8	8	8	8	8	8	8	8	8

Table 4: According TS 34.121 table C10.1.4 measured max. output power values for WCMDA for the used PSION 7545MBW.

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 rage. For a single channel the spreading factor can range from 4 to 256. For more then 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 that the required HSPA test parameters, including stable TFCI and output power conditions, have been used for the HSPA SAR measurements.

Following KDB 941225 D03 additional SAR tests in EDGE are conducted with GMSK modulation with MCS 1.

			Output Power per Slot [dBm]					Averaged Output Power over 8 Slots [dBm]			
Band	Frequency [MHz]	Channel	GSM	GPRS (GMSK / CS1)		EDGE (GMSK / MCS1)		GPRS (GMSK / CS1)		EDGE (GMSK / MCS1)	
				1 TX	2 TX	1 TX	2 TX	1 TX	2 TX	1 TX	2 TX
850	824.2	128	33.1	32.4	29.0	33.2	30.1	23.4	23.0	24.2	24.1
	836.6	190	33.4	32.6	29.3	33.4	30.2	23.6	23.3	24.4	24.2
	848.8	251	33.2	32.5	29.2	33.2	30.0	23.5	23.2	24.2	24.0
1900	1850.2	512	29.1	29.1	25.8	29.3	26.1	20.1	19.8	20.3	20.1
	1880.0	661	29.1	28.5	25.2	29.3	26.0	19.5	19.2	20.3	20.0
	1909.8	810	29.4	28.1	24.6	29.6	26.0	19.1	18.6	20.6	20.0

Table 5: Measured max. output power values for the used PSION 7545MBW.

	Channel	Frequency [MHz]	Duty Cycle	Conducted Power [dBm]
Bluetooth	1	2402	100%	3.0
	39	2441		2.8
	78	2480		2.5

Table 6: Measured max. output power values for Bluetooth for the used PSION 7545MBW.

	Channel	Frequency [MHz]	Output Power [dBm]		
			b-mode (1 Mbps)	g-mode (6 Mbps)	n-mode (6.5 Mbps)
IEEE 802.11 (2.45 GHz range)	1	2412	15.4	13.0	10.6
	6	2437	15.9	13.7	11.0
	11	2462	16.8	14.4	11.8

Table 7: Measured max. output power values for IEEE 802.11 b/g/n for the used PSION 7545MBW

	Channel	Frequency [MHz]	Output Power [dBm]	
			b-mode (1 Mbps)	n-mode (6.5 Mbps)
IEEE 802.11 (5 GHz range)	36	5180	12.8	11.7
	40	5200	12.5	12.2
	44	5220	12.6	12.1
	48	5240	12.1	12.5
	52	5260	13.3	12.8
	56	5280	13.6	12.9
	60	5300	13.5	13.1
	64	5320	13.6	13.2
	100	5500	12.6	12.1
	104	5520	12.4	12.0
	108	5540	12.3	11.8
	112	5560	12.2	11.9
	116	5580	11.9	11.8
	120	5600	11.6	11.4
	124	5620	11.4	11.0
	128	5640	11.2	11.1
	132	5660	10.8	10.8
	136	5680	10.6	10.6
	140	5700	10.4	9.9
	149	5745	9.7	9.6
	153	5765	9.5	9.3
	157	5785	9.4	9.3
	161	5805	9.2	8.8

Table 8: Measured max. output power values for IEEE 802.11 a/n for the used PSION 7545MBW

7 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	
		CH 128 824.2 MHz	CH 190 836.4 MHz	CH 251 848.8 MHz	Ambient [° C]	Liquid [° C]
Left Side	Cheek		0.698 (0.098)		21.6	21.4
	Tilted		0.781 (0.168)		21.6	21.4
Right Side	Cheek		0.658 (-0.087)		21.6	21.4
	Tilted		0.783 (0.065)		21.6	21.4

Table 9: Measurement results for GSM 850 in head configuration for the PSION 7545MBW.

Test Position (Liquid depth: 16.4 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		CH 512 1850.2 MHz	CH 661 1880.0 MHz	CH 810 1909.6 MHz	Ambient [° C]	Liquid [° C]
Left Side	Cheek		0.210 (-0.128)		21.4	21.1
	Tilted		0.193 (-0.133)		21.4	21.1
Right Side	Cheek		0.262 (0.112)		21.4	21.1
	Tilted		0.154 (-0.047)		21.4	21.1

Table 10: Measurement results for PCS 1900 in head configuration for the PSION 7545MBW.

Test Position (Liquid depth: 15.5 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		CH 4132 826.4 MHz	CH 4183 836.6 MHz	CH 4233 846.6 MHz	Ambient [° C]	Liquid [° C]
Left Side	Cheek		0.670 (-0.114)		21.6	21.3
	Tilted		0.673 (-0.152)		21.6	21.3
Right Side	Cheek		0.640 (-0.024)		21.6	21.3
	Tilted		0.754 (-0.023)		21.6	21.3

Table 11: Measurement results for WCDMA V (FDD) in head configuration for the PSION 7545MBW.

Test Position (Liquid depth: 16.4 cm)		SAR$_{1g}$ [W/kg] (Drift[dB])			Temperature	
		CH 9262 1852.4 MHz	CH 9400 1880.0 MHz	CH 9538 1907.6 MHz	Ambient [° C]	Liquid [° C]
Left Side	Cheek		0.368 (-0.169)		21.6	21.2
	Tilted		0.314 (-0.017)		21.6	21.2
Right Side	Cheek		0.431 (0.149)		21.6	21.2
	Tilted		0.282 (0.140)		21.6	21.2

Table 12: Measurement results for WCDMA II (FDD) in head configuration for the PSION 7545MBW.

For IEEE 802.11 a/g/n only the channels which delivers the highest output power are assessed in head configuration.

Test Position (Liquid depth: 15.9 cm)			SAR$_{1g}$ [W/kg] (Drift[dB])			Temperature	
			CH 1 2412 MHz	CH 6 2437 MHz	CH 11 2462 MHz	Ambient [° C]	Liquid [° C]
b-mode	Left Side	Cheek	0.087 (0.121)	0.136 (-0.130)	0.138 (0.089)	22.0	21.7
		Tilted		0.042 (-0.030)		22.0	21.7
	Right Side	Cheek		0.087 (0.056)		22.0	21.7
		Tilted		0.032 (0.148)		22.0	21.7
g-mode	Left Side	Cheek			0.136 (-0.114)	22.0	21.7
n-mode	Left Side	Cheek			0.110 (0.093)	22.0	21.7

Table 13: Measurement results for IEEE 802.11 b/g/n in head configuration for the PSION 7545MBW.

Test Position (Liquid depth: 15.1 cm)			SAR$_{1g}$ [W/kg] (Drift[dB])			Temperature	
			CH 64 5320 MHz	CH 104 5520 MHz	CH 149 5745 MHz	Ambient [° C]	Liquid [° C]
a-mode	Left Side	Cheek	0.317 (-0.031)	0.310 (-0.145)	0.447 (-0.148)	22.0	21.3
		Tilted	0.211 (0.085)	0.276 (0.132)	0.304 (0.139)	22.0	21.3
	Right Side	Cheek	0.226 (-0.059)	0.269 (0.162)	0.383 (0.115)	22.0	21.3
		Tilted	0.229 (-0.098)	0.299 (-0.036)	0.180 (-0.084)	22.0	21.3
n-mode	Left Side	Cheek	0.277 (0.047)	0.305 (0.152)	0.402 (-0.138)	22.0	21.3

Table 14: Measurement results for IEEE 802.11 a/n (5 GHz range) in head configuration for the PSION 7545MBW.

Test Position (Liquid depth 16.6 cm)		SAR$_{1g}$ [W/kg] (Drift[dB])			Temperature	
		CH 128 824.2 MHz	CH 190 836.4 MHz	CH 251 848.8 MHz	Ambient [° C]	Liquid [° C]
GPRS 850	Pos. 1, with holster		0.200 (-0.131)		20.9	20.5
	Pos. 2, with holster		0.154 (-0.150)		20.9	20.5
EGPRS 850	Pos. 1, with holster		0.169 (-0.106)		20.9	20.5
	Pos. 2, with holster		0.161 (-0.103)		20.9	20.5

Table 15: Measurement results for GPRS/EGPRS 850 (Class 10) in body worn configuration for the PSION 7545MBW (gap = 0 mm).

Test Position (Liquid depth 18.5 cm)		SAR$_{1g}$ [W/kg] (Drift[dB])			Temperature	
		CH 512 1850.2 MHz	CH 661 1880.0 MHz	CH 810 1909.6 MHz	Ambient [° C]	Liquid [° C]
GPRS 1900	Pos. 1, with holster		0.191 (0.047)		21.6	21.2
	Pos. 2, with holster		0.035 (0.132)		21.6	21.2
EGPRS 1900	Pos. 1, with holster		0.221 (-0.047)		21.6	21.2
	Pos. 2, with holster		0.047 (0.073)		21.6	21.2

Table 16: Measurement results for GPRS/EGPRS 1900 (Class 10) in body worn configuration for the PSION 7545MBW (gap = 0 mm).

Test Position (Liquid depth 16.6 cm)		SAR$_{1g}$ [W/kg] (Drift[dB])			Temperature	
		CH 4132 826.4 MHz	CH 4183 836.6 MHz	CH 4233 846.6 MHz	Ambient [° C]	Liquid [° C]
WCDMA (RMC)	Pos. 1, with holster		0.242 (-0.079)		20.9	20.5
	Pos. 2, with holster		0.157 (-0.102)		20.9	20.5
HSDPA (subt. 1)	Pos. 1, with holster		0.241 (-0.100)		20.9	20.5
HSUPA (subt. 5)	Pos. 1, with holster		0.211 (-0.164)		20.9	20.5

Table 17: Measurement results for WCDMA V (FDD) in body worn configuration for the PSION 7545MBW (gap = 0 mm).

Test Position (Liquid depth 16.6 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		CH 9262 1852.4 MHz	CH 9400 1880.0 MHz	CH 9538 1907.6 MHz	Ambient [° C]	Liquid [° C]
WCDMA (RMC)	Pos. 1, with holster		0.395 (0.010)		21.4	21.1
	Pos. 2, with holster		0.072 (0.044)		21.4	21.1
HSDPA (subt. 1)	Pos. 1, with holster		0.338 (-0.169)		21.4	21.1
HSUPA (subt. 5)	Pos. 1, with holster		0.329 (-0.199)		21.4	21.1

Table 18: Measurement results for WCDMA II (FDD) in body worn configuration for the PSION 7545MBW (gap = 0 mm).

For IEEE 802.11 a/g/n only the channels which delivers the highest output power are assessed in body worn configuration

Test Position (Liquid depth 16.8 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		CH 1 2412 MHz	CH 6 2437 MHz	CH 11 2462 MHz	Ambient [° C]	Liquid [° C]
b-mode	Pos. 1, with holster	0.297 (-0.069)	0.460 (-0.193)	0.569 (-0.035)	21.4	20.7
	Pos. 2, with holster		0.007 (-0.186)		21.4	20.7
g-mode	Pos. 1, with holster			0.541 (0.081)	21.4	20.7
n-mode	Pos. 1, with holster			0.497 (0.152)	21.4	20.7

Table 19: Measurement results for IEEE 802.11 b/g/n in body worn configuration for the PSION 7545MBW (gap = 0 mm).

Test Position (Liquid depth 15.5 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		CH 64 5320 MHz	CH 104 5520 MHz	CH 149 5745 MHz	Ambient [° C]	Liquid [° C]
a-mode	Pos. 1, with holster	0.075 (0.060)	0.049 (-0.034)	0.035 (0.084)	22.1	21.4
	Pos. 2, with holster	0.792 (-0.109)	1.020 (-0.100)	0.714 (-0.154)	22.1	21.4
n-mode	Pos. 2, with holster	0.769 (-0.036)	0.903 (-0.068)	0.575 (-0.024)	22.1	21.4

Table 20: Measurement results for IEEE 802.11 a/n (5 GHz range) in body worn configuration for the PSION 7545MBW (gap = 0 mm).

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%.

7.1 Co-Located SAR Results

Table 21 – 22 shows the possible co-located transmission for the worst case configuration. For multi mode the worst case SAR values of each mode are accumulated and compared to the corresponding limits.

Test Position	Highest SAR_{1g} [W/kg]					
	Worst Case WWAN Value	Coresponding WiFi Value	BT	Combined SAR	SAR Limit	
Tilted Right Side of Head	0.783 (GSM 850, CH 190)	0.299 (a-mode, CH 104)	/	1.082	1.6	PASS

Table 21: Measurement results for co-location mode for WWAN – WiFi worst case configuration the PSION 7545MBW.

Test Position	Highest SAR_{1g} [W/kg]					
	Worst Case WiFi Value	Coresponding WWAN Value	BT	Combined SAR	SAR Limit	
Pos. 2, with holster	1.020 (a-mode, CH 104)	0.157 (WCDMA V, CH 4183)	/	1.177	1.6	PASS

Table 22: Measurement results for co-location mode for WiFi - WWAN worst case configuration for the PSION 7545MBW.

Based on the KDB 648474 [KDB 648474] measurements with Bluetooth are not required since the output power is below the threshold for Bluetooth.

Conclusion:

Simultaneous transmission	Simultaneous SAR
WWAN & BT	No (Stand-alone SAR not required for BT)
WiFi & BT	No (Stand-alone SAR not required for BT)
WWAN & WiFi	No (sum of 1g SAR < 1.6 W/kg)

8 Evaluation

In Figure 8 - 19 the SAR results for GSM 850, PCS 1900, WCDMA II, WCDMA V and IEEE 802.11 a/b/g/n standards given in table 9 - 20 are summarized and compared to the.

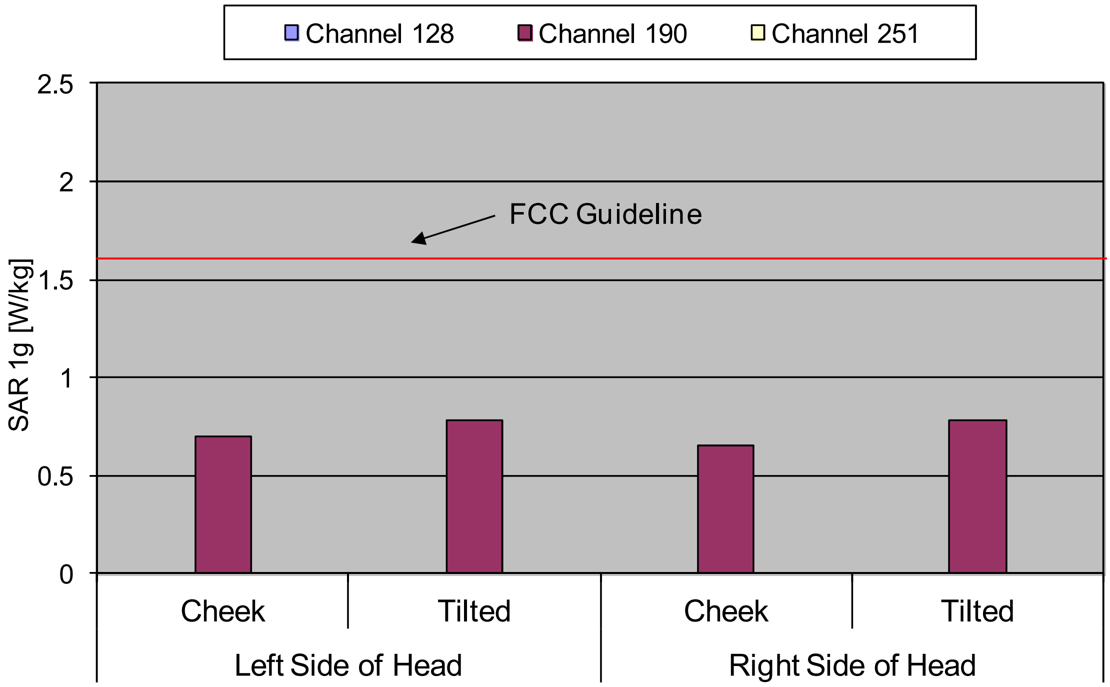

Fig. 8: The measured head SAR values for the PSION 7545MBW for GSM 850 in head configuration, in comparison to the FCC exposure limit.

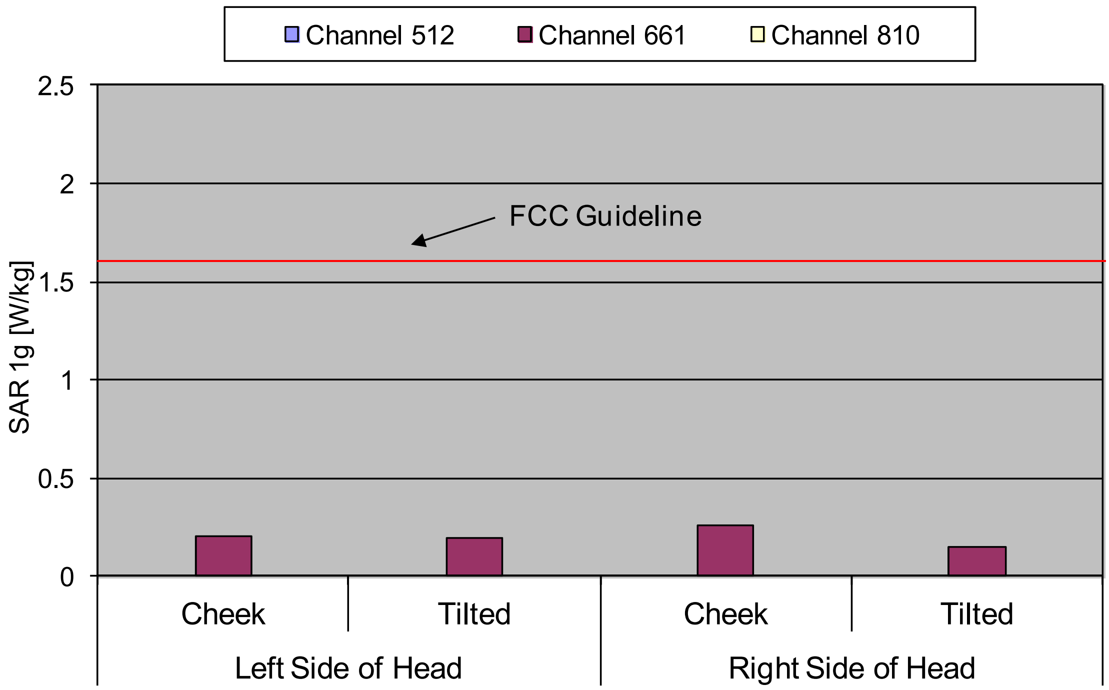

Fig. 9: The measured head SAR values for the PSION 7545MBW for PCS 1900 in head configuration, in comparison to the FCC exposure limit.

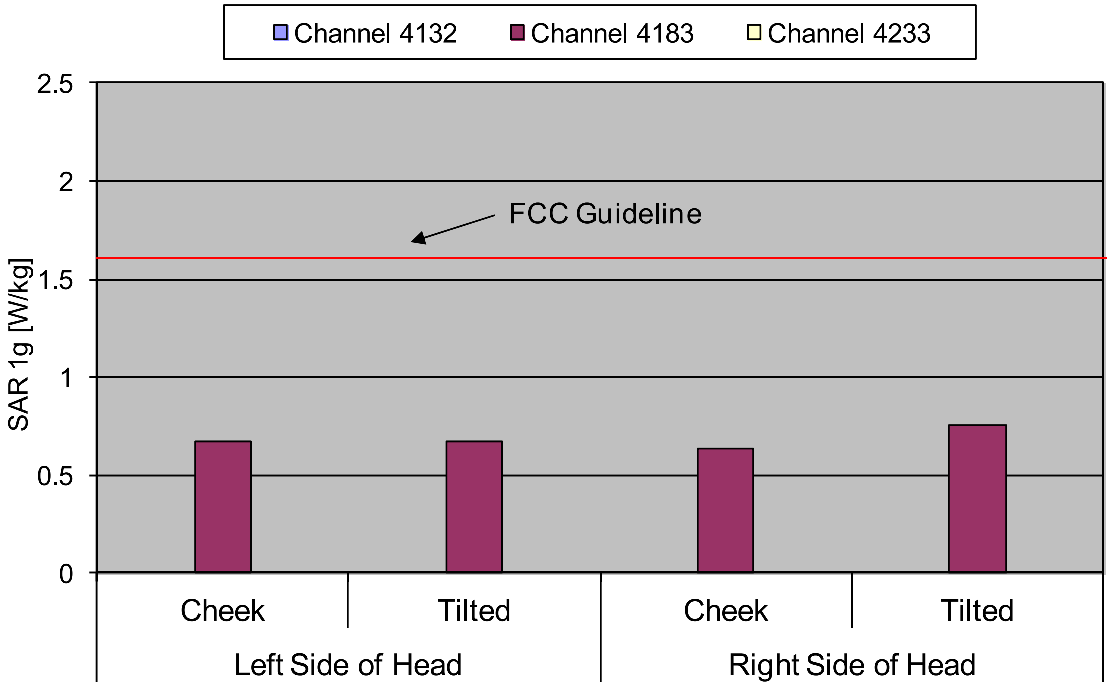

Fig. 10: The measured head SAR values for the PSION 7545MBW for WCDMA V (FDD) in head configuration, in comparison to the FCC exposure limit.

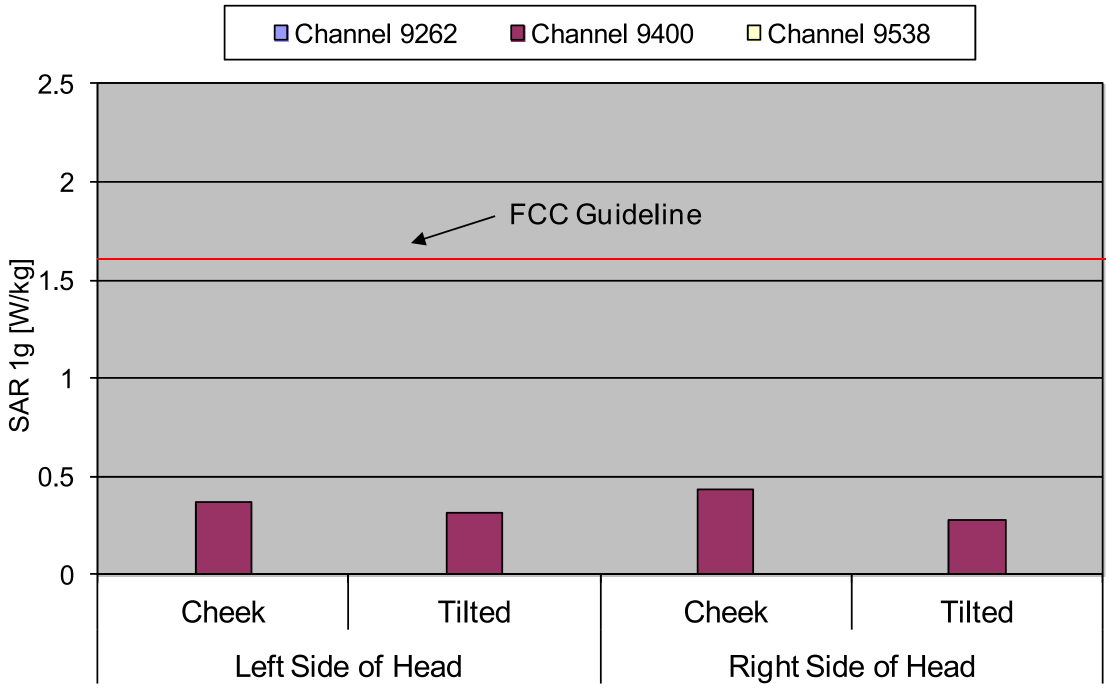

Fig. 11: The measured head SAR values for the PSION 7545MBW for WCDMA II (FDD) in head configuration, in comparison to the FCC exposure limit.

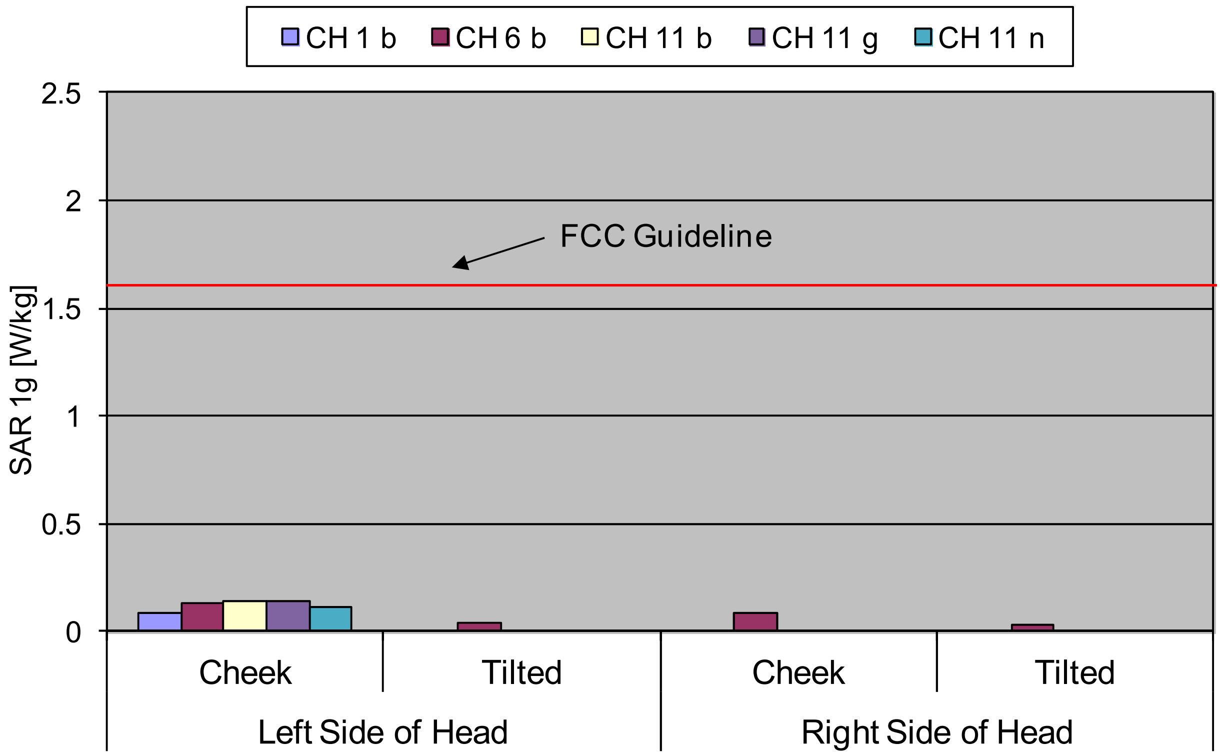

Fig. 12: The measured head SAR values for the PSION 7545MBW for IEEE 802.11 b/g/n in head configuration, in comparison to the FCC exposure limit.

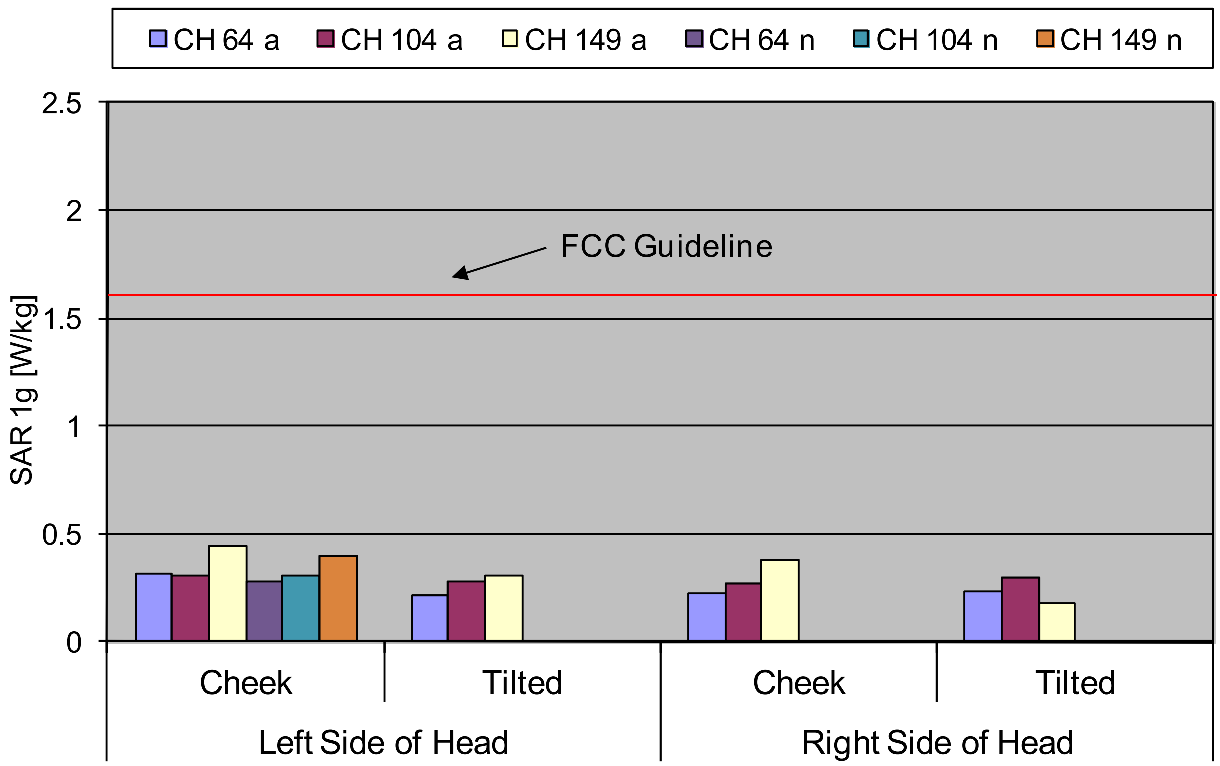

Fig. 13: The measured head SAR values for the PSION 7545MBW for IEEE 802.11 a/n in head configuration, in comparison to the FCC exposure limit.

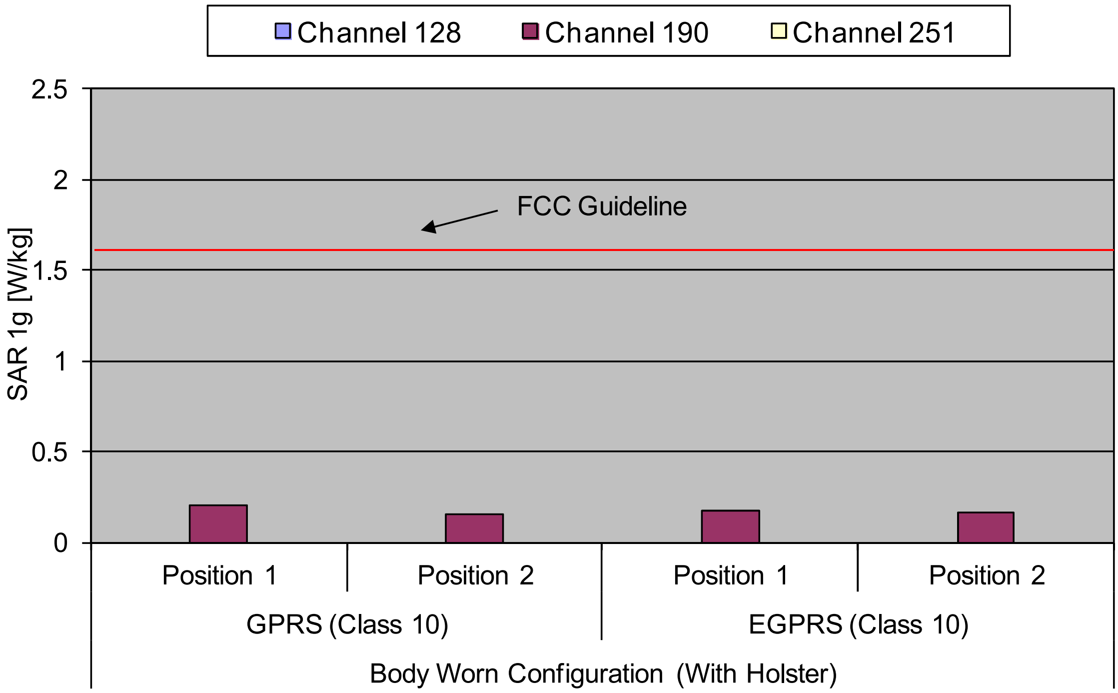

Fig. 14: The measured body SAR values for the PSION 7545MBW for GPRS/EGPRS 850 (Class 10) in body worn configuration, in comparison to the FCC exposure limit.

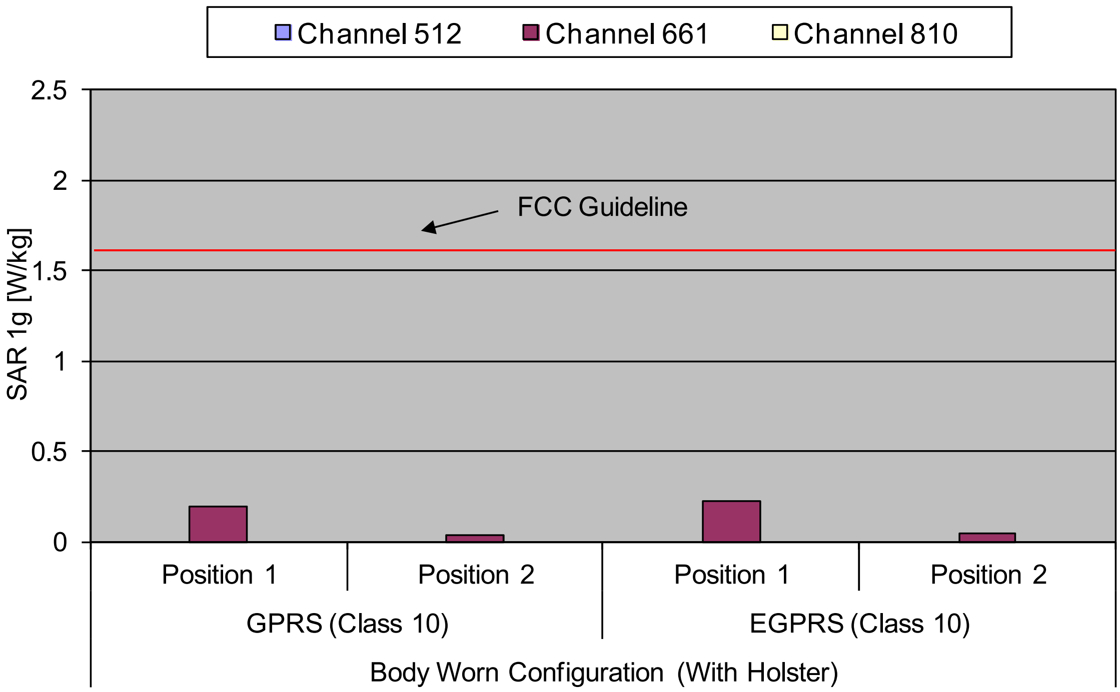

Fig. 15: The measured body SAR values for the PSION 7545MBW for GPRS/EGPRS 1900 (Class 10) in body worn configuration, in comparison to the FCC exposure limit.

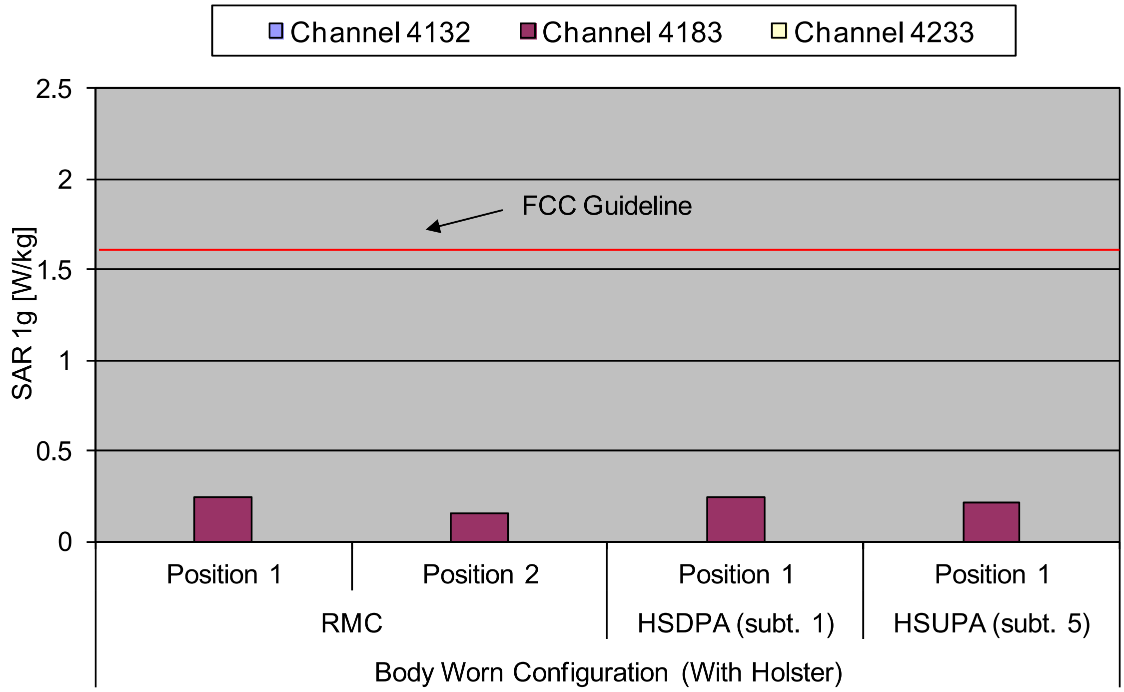

Fig. 16: The measured body SAR values for the PSION 7545MBW for WCDMA V (FDD) in body worn configuration, in comparison to the FCC exposure limit.

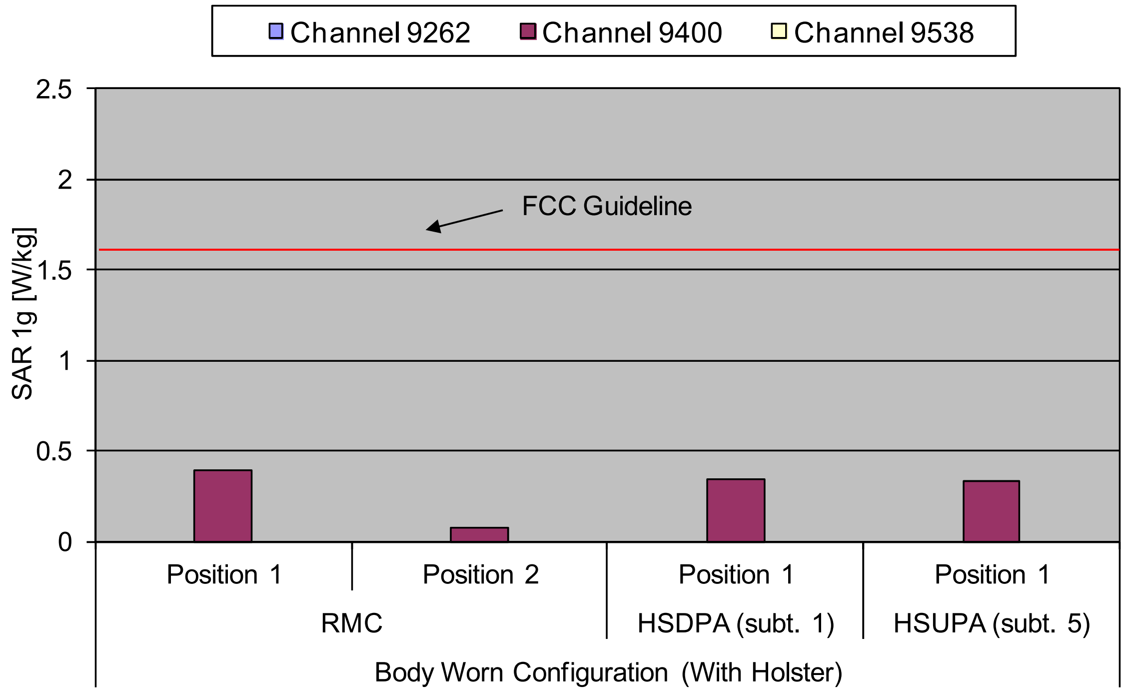

Fig. 17: The measured body SAR values for the PSION 7545MBW, for WCDMA II (FDD) in body worn configuration, in comparison to the FCC exposure limit.

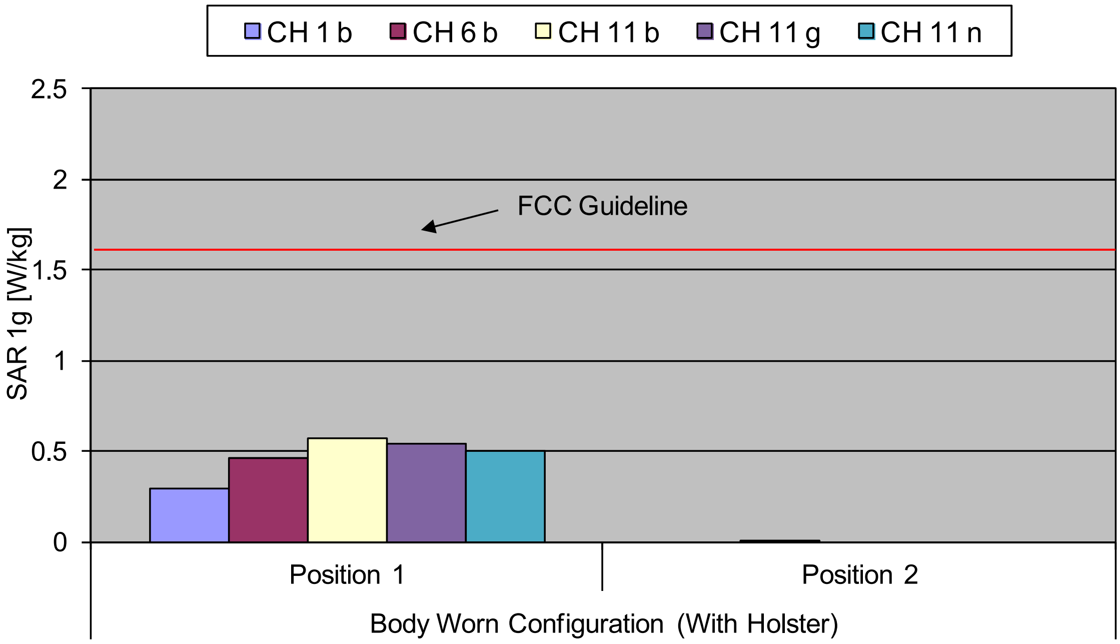

Fig. 18: The measured body SAR values for the PSION 7545MBW for IEEE 802.11 b/g/n in body worn configuration, in comparison to the FCC exposure limit.

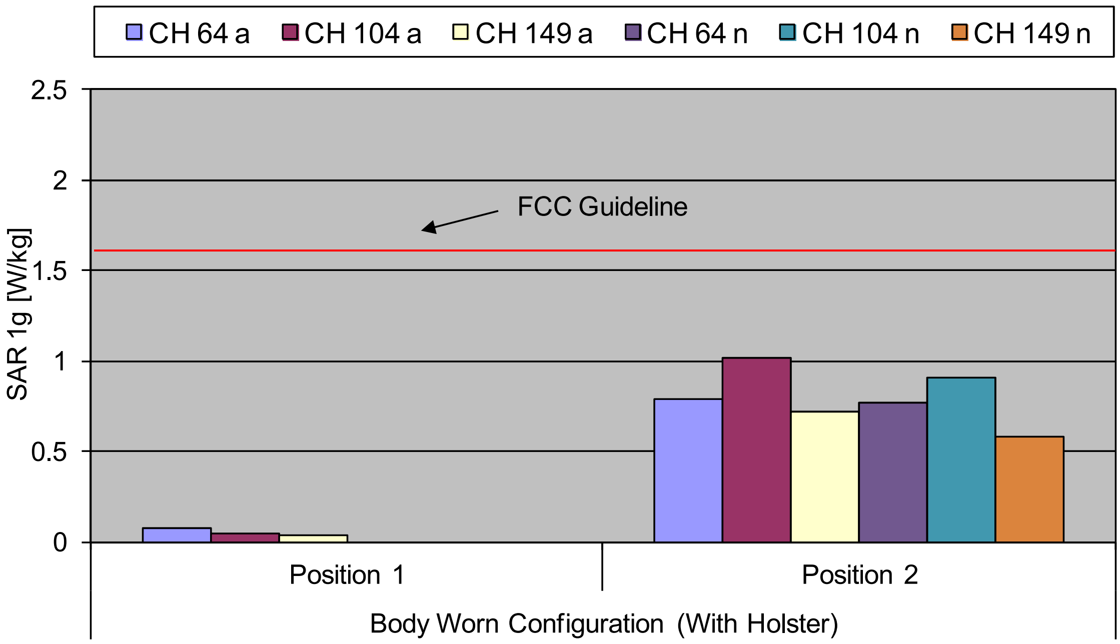

Fig. 19: The measured body SAR values for the PSION 7545MBW for IEEE 802.11 a/n in body worn configuration, in comparison to the FCC exposure limit.

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9 Appendix

9.1 Administrative Data

Date of Validation:	850 MHz (Head GSM 850):	December 22, 2011
	850 MHz (Head WCDMA V):	January 19, 2012
	1900 MHz (Head PCS 1900):	December 20, 2011
	1900 MHz (Head WCDMA II):	January 20, 2012
	2450 MHz (Head IEEE 802.11):	December 29, 2011
	5200 MHz (Head IEEE 802.11):	January 11, 2012
	5500 MHz (Head IEEE 802.11):	January 11, 2012
	5800 MHz (Head IEEE 802.11):	January 25, 2012
	850 MHz (Body 850/FDD V):	January 18, 2012
	1900 MHz (Body 1900/FDD II):	January 17, 2012
	2450 MHz (Body IEEE 802.11):	February 14, 2012
	5200 MHz (Body IEEE 802.11):	February 14, 2012
	5500 MHz (Body IEEE 802.11):	February 15, 2012
	5800 MHz (Body IEEE 802.11):	February 16, 2012

Date of Measurement: December 20, 2011– February 16, 2012
Data Stored: 7layers_6620_878
Contact:
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9.2 Device under Test and Test Conditions

MTE:	PSION 7545MBW (identical prototype)
Date of Receipt:	December 16, 2012
IMEI:	004401080643519
FCC ID (DUT):	GM37545MBW
FCC ID (radio module):	GM37545MBWP
IC:	2739D-7545MBW
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 IEEE 802.11 a/b/g/n with max output power
RF Exposure Environment:	General Population/ Uncontrolled
Power Supply:	internal battery
Antenna:	integrated

Measured Standards:	GSM 850 and GPRS/EDGE 850 (Class 10) PCS 1900 and GPRS/EDGE 1900 (Class 10) WCDMA V and WCDMA II IEEE 802.11 b: data rate: 1 Mbps IEEE 802.11 g: data rate: 6 Mbps IEEE 802.11 n: data rate: 6.5 Mbps IEEE 802.11 a: data rate: 6 Mbps
Method to Establish a Call:	GSM, GPRS, EGPRS and WCDMA: Basestation simulator, using the air interface IEEE 802.11 a/b/g/n: Test Mode
Modulation:	GPRS/EGPRS: GMSK; WCDMA (FDD): QPSK IEEE 802.11 a/b/g/n: OFDM, DSSS;
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	Modulation
GSM/GPRS 850	190	33	3	CS1	GSM/ GPRS	GMSK
EGPRS 850	190	33	3	MCS1	EGPRS	GMSK
GSM/GPRS 1900	661	30	3	CS1	GSM/ GPRS	GMSK
EGPRS 1900	661	30	3	MCS1	EGPRS	GMSK

Table 23: Configuration of Base Station Controller for measurements in 2 G mode.

Band	DL-Power [dBm]	Attenuation [dB]	TPC – Algorithm	Dedicated Channel
WCDMA V	-52	33	2	RMC
WCDMA II	-52	33	2	RMC

Table 24: Configuration of Base Station Controller for measurements in 3 G mode.

PSION 7545MBW	TX Range [MHz]	RX Range [MHz]	Used Channels [low, middle, high]	Used Crest Factor
GSM 850	824.2 – 848.8	869.2 – 893.8	128, 190, 251	8.3
PCS 1900	1850.2 –1909.8	1930.2 – 1989.8	512, 661, 810	8.3
EDGE/GPRS 850	824.2 – 848.8	869.2 – 893.8	128, 190, 251	4
EDGE/GPRS 1900	1850.2 –1909.8	1930.2 – 1989.8	512, 661, 810	4
WCDMA II (FDD)	1852.4 – 1907.6	1932.4 – 1987.6	9262, 9400, 9538	1
WCDMA V (FDD)	826.4 – 846.6	871.4 – 891.6	4132, 4183, 4233	1
IEEE 802.11 b/g	2412.0 – 2462.0	2412.0 – 2462.0	1, 6, 11	1
IEEE 802.11 a	5180.0 – 5320.0	5180.0 – 5320.0	64	1
IEEE 802.11 a	5520.0 – 5680.0	5520.0 – 5680.0	104	1
IEEE 802.11 a	5745.0 - 5805.0	5745.0 - 5805.0	149	1

Table 25: Used channels and crest factors during the test.

9.3 Tissue Recipes

The following recipes are provided in percentage by weight.

835 MHz, Head:	41.45 %	De-Ionized Water
	1.45 %	Salt
	56.00 %	Sugar
	00.10 %	Preventol D7
	01.00 %	Hydroxyetyl-Cellulose
835 MHz, Body:	52.40 %	De-Ionized Water
	01.50 %	Salt
	45.00 %	Sugar
	00.10 %	Preventol D7
	01.00 %	Hydroxyetyl-Cellulose
1900 MHz, Head:	45.65%	Diethylenglykol-monobutylether
	54.00%	De-Ionized Water
	0.35%	Salt
1900 MHz, Body:	29.68%	Diethylenglykol-monobutylether
	70.00%	De-Ionized Water
	0.32%	Salt
2450 MHz. Body:	31.40%	Diethylenglykol-monobutylether
	68.60%	De-Ionized Water

The tissue simulating liquids for the frequency range from 3.5 GHz up to 5.8 GHz were delivered by SPEAG, therefore the detailed compositions are not available and only the included ingredients were listed and shown in Figure 34.

3500 MHz – 5800 MHz, Head / Body:	11.0 % - 36 %	Mineral Oil
	0.5 % - 15 %	Emulsifiers
	60.0 % - 78 %	Water
	0.4 % - 3 %	Additives and salt

9.4 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 ± 5% of the recommended values given by the FCC.

Frequency		ε_r	σ [S/m]
835 MHz Head (GSM 850)	Recommended Value	41.50 ± 2.00	0.90 ± 0.04
	Measured Value (Ch. 128)	42.30	0.92
	Measured Value (Ch. 190)	42.20	0.93
	Measured Value (Ch. 251)	42.00	0.94
835 MHz Head (WCDMA V)	Recommended Value	41.50 ± 2.00	0.90 ± 0.04
	Measured Value (Ch. 4132)	40.90	0.90
	Measured Value (Ch. 4183)	40.90	0.91
	Measured Value (Ch. 4233)	40.80	0.92
835 MHz Body (GPRS/EGPRS 850)	Recommended Value	55.20 ± 2.70	0.97 ± 0.10
	Measured Value (Ch. 128)	53.90	0.97
	Measured Value (Ch. 190)	53.80	0.98
	Measured Value (Ch. 251)	53.70	0.99
835 MHz Body (WCDMA V)	Recommended Value	55.20 ± 2.70	0.97 ± 0.10
	Measured Value (Ch. 4132)	53.90	0.97
	Measured Value (Ch. 4183)	53.80	0.98
	Measured Value (Ch. 4233)	53.70	0.99

Table 26: Parameters of the tissue simulating liquid (850 MHz).

Frequency		ε_r	σ [S/m]
1900 MHz Head, (PCS 1900)	Recommended Value	40.00 ± 2.00	1.40 ± 0.06
	Measured Value (Ch. 512)	41.60	1.34
	Measured Value (Ch. 661)	41.40	1.37
	Measured Value (Ch. 810)	41.40	1.40
1900 MHz Head, (WCDMA II)	Recommended Value	40.00 ± 2.00	1.40 ± 0.06
	Measured Value (Ch. 9262)	41.50	1.34
	Measured Value (Ch. 9400)	41.30	1.39
	Measured Value (Ch. 9538)	41.30	1.46
1900 MHz Body, (GPRS/EGPRS 1900)	Recommended Value	53.30 ± 2.65	1.52 ± 0.15
	Measured Value (Ch. 512)	53.40	1.50
	Measured Value (Ch. 661)	53.20	1.53
	Measured Value (Ch. 810)	53.10	1.57
1900 MHz Body, (WCDMA II)	Recommended Value	53.30 ± 2.65	1.52 ± 0.15
	Measured Value (Ch. 9262)	53.40	1.50
	Measured Value (Ch. 9400)	53.20	1.53
	Measured Value (Ch. 9538)	53.10	1.57

Table 27: Parameters of the tissue simulating liquid (1900 MHz).

Frequency		ε_r	σ [S/m]
2450 MHz Head. (IEEE 802.11 b/g/n)	Recommended Value	39.20 ± 1.9	1.80 ± 0.09
	Measured Value (Ch. 1)	40.00	1.77
	Measured Value (Ch. 6)	39.90	1.82
	Measured Value (Ch. 11)	39.90	1.85
5200 MHz Head (IEEE 802.11 a/n)	Recommended Value (5200 MHz)	36.00 ± 1.80	4.66 ± 0.23
	Measured Value, 5320 MHz (Ch. 64)	34.90	4.79
5500 MHz Head (IEEE 802.11 a)	Recommended Value (5500 MHz)	35.60 ± 1.80	4.96 ± 0.25
	Measured Value, 5520 MHz (Ch. 104)	34.70	5.08
5800MHz Head (IEEE 802.11 a)	Recommended Value (5800 MHz)	35.30 ± 1.80	5.27 ± 0.27
	Measured Value, 5745 MHz (Ch. 149)	33.90	5.33
2450 MHz Body. (IEEE 802.11 b/g/n)	Recommended Value	52.70 ± 2.63	1.95 ± 0.09
	Measured Value (Ch. 1)	51.30	1.89
	Measured Value (Ch. 6)	51.30	1.97
	Measured Value (Ch. 11)	51.50	2.03
5200 MHz Body (IEEE 802.11 a/n)	Recommended Value (5200 MHz)	49.00 ± 2.40	5.30 ± 0.26
	Measured Value, 5320 MHz (Ch. 64)	47.70	5.37
5500 MHz Body (IEEE 802.11 a)	Recommended Value (5500 MHz)	48.60 ± 2.40	5.65 ± 0.28
	Measured Value, 5520 MHz (Ch. 104)	48.00	5.71
5800MHz Body (IEEE 802.11 a)	Recommended Value (5800 MHz)	48.20 ± 2.40	6.00 ± 0.30
	Measured Value, 5745 MHz (Ch. 149)	48.00	6.13

Table 28: Parameters of the tissue simulating liquid (IEEE 802.11 a/b/g/n).

9.5 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 29 - 30 and shown in figure 20 - 33. The target values were adopted from the calibration certificates.

Available Dipoles		SAR_{1g} [W/kg]	ε_r	σ [S/m]
D835V2, SN #437	Target Values Head	2.56	41.10	0.91
D1900V2, SN #5d051		9.53	39.40	1.43
D2450MHz, SN #709		13.90	39.90	1.84
D5200 MHz, SN #1028		20.90	37.50	4.89
D5500 MHz, SN #1028		21.50	36.80	5.21
D5800 MHz, SN #1028		20.80	36.10	5.53
D835V2, SN #437	Target Values Body	2.49	55.70	1.00
D1900V2, SN #5d051		9.66	52.10	1.54
D2450MHz, SN #709		13.70	51.20	2.00
D5200 MHz, SN #1028		20.10	47.30	5.38
D5500 MHz, SN #1028		21.20	46.80	5.84
D5800 MHz, SN #1028		19.10	46.10	6.29

Table 29: Dipole target results.

Used Dipoles		SAR_{1g} [W/kg]	ε_r	σ [S/m]
835 MHz, SN: 437 (Validation GSM 850)	Measured Values Head	2.62	42.20	0.93
835 MHz, SN: 437 (Validation WCDMA V)		2.52	40.90	0.91
1900 MHz, SN:5d051 (Validation PCS 1900)		9.27	41.40	1.38
1900 MHz, SN:5d051 (Validation WCDMA II)		9.69	41.30	1.44
2450 MHz, SN: 709 (Validation 802.11 b/g/n)		13.90	39.90	1.84
5200 MHz, SN: 1028 (Validation 802.11 a/n)		22.30	35.30	4.72
5500 MHz, SN: 1028 (Validation 802.11 a/n)		22.40	34.70	5.07
5800 MHz, SN: 1028 (Validation 802.11 a/n)		21.60	33.90	5.49
835 MHz, SN: 437 (Validation GPRS/EGPRS 850)	Measured Values Body	2.48	53.80	0.98
835 MHz, SN: 437 (Validation WCDMA V)		2.48	53.80	0.98
1900 MHz, SN:5d051 (Validation GPRS/EGPRS 1900)		9.52	53.20	1.55
1900 MHz, SN:5d051 (Validation WCDMA II)		9.52	53.20	1.55
2450 MHz, SN: 709 (Validation 802.11 b/g/n)		13.50	51.40	2.01
5200 MHz, SN: 1028 (Validation 802.11 a/n)		20.00	48.00	5.19
5500 MHz, SN: 1028 (Validation 802.11 a/n)		20.70	48.20	5.57
5800 MHz, SN: 1028 (Validation 802.11 a/n)		20.40	48.00	6.13

Table 30: Measured dipole validation results.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 221211_y_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 MHz; σ = 0.93 mho/m; ε_r = 42.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(6.67, 6.67, 6.67); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Sugar 1341; Type: QD 000 P40 CB; Serial: TP-1341
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.91 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.5 V/m; Power Drift = -0.021 dB
Peak SAR (extrapolated) = 3.70 W/kg
SAR(1 g) = 2.62 mW/g; SAR(10 g) = 1.73 mW/g
Maximum value of SAR (measured) = 2.84 mW/g

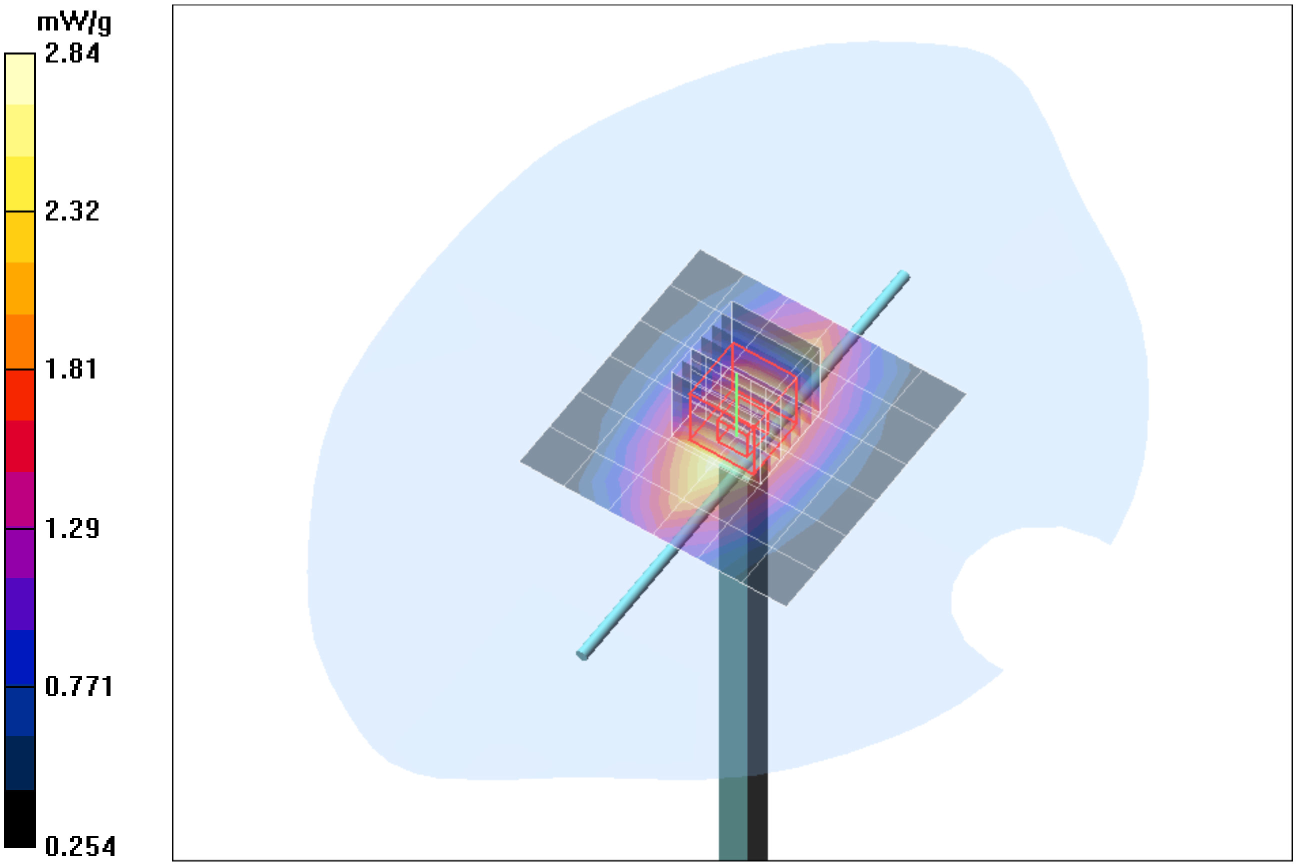

Fig. 20: Validation measurement 835 MHz (GSM 850) Head (December 22, 2011), coarse grid. Ambient Temperature: 21.6° C, Liquid Temperature: 21.3° C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 190112_y_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 MHz; σ = 0.91 mho/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(6.67, 6.67, 6.67); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Sugar 1059; Type: Speag; Serial: 1059
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.72 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.5 V/m; Power Drift = -0.049 dB
Peak SAR (extrapolated) = 3.61 W/kg
SAR(1 g) = 2.52 mW/g; SAR(10 g) = 1.65 mW/g

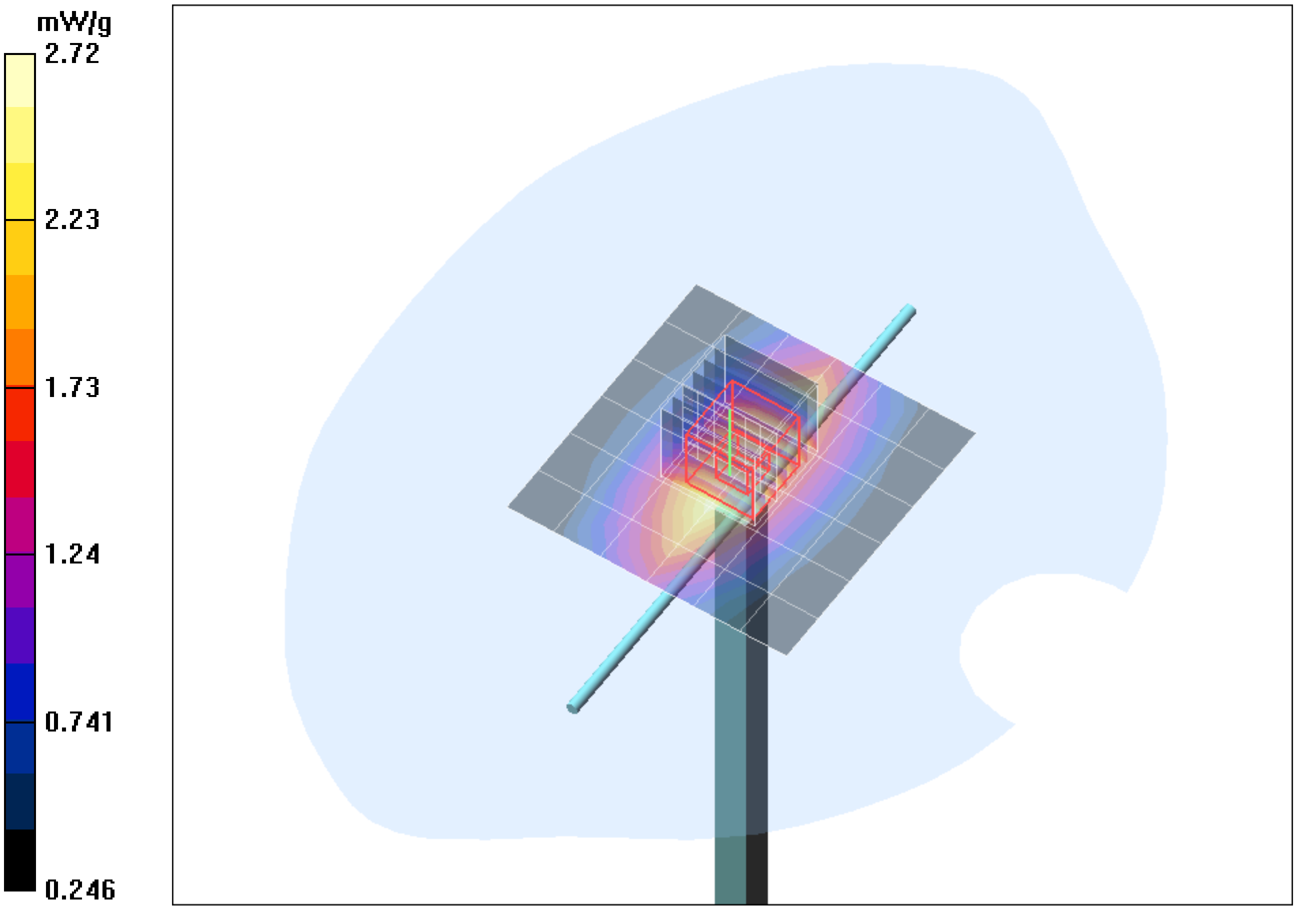

Fig. 21: Validation measurement 835 MHz (WCDMA V) Head (January 19, 2012), coarse grid. Ambient Temperature: 21.9° C, Liquid Temperature: 21.6° C.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 201211_y_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; σ = 1.38 mho/m; ε_r = 41.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(8.07, 8.07, 8.07); Calibrated: 26.09.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- 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) = 10.4 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.3 V/m; Power Drift = -0.004 dB
Peak SAR (extrapolated) = 17.9 W/kg
SAR(1 g) = 9.27 mW/g; SAR(10 g) = 4.73 mW/g
Maximum value of SAR (measured) = 10.3 mW/g

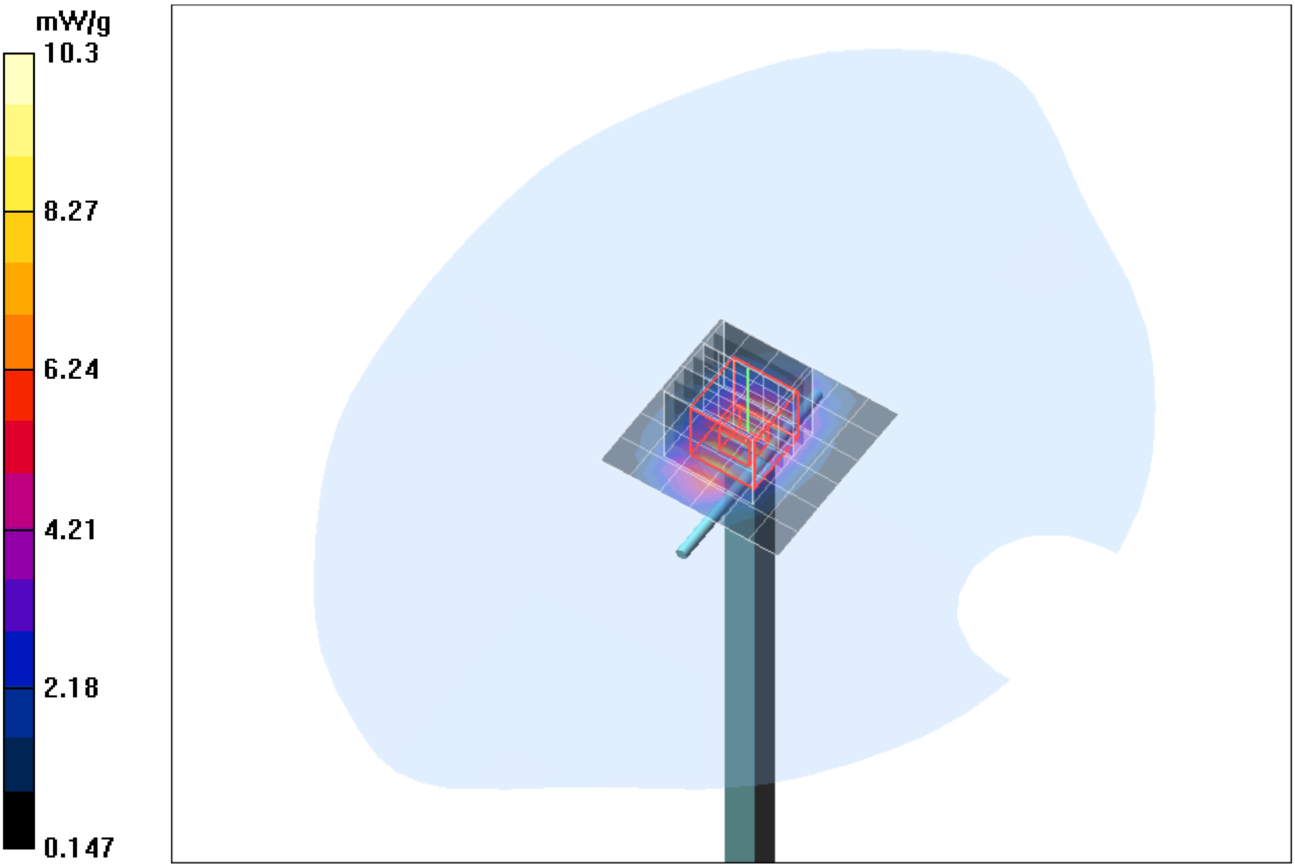

Fig. 22: Validation measurement 1900 MHz (PCS 1900) Head (December 20, 2011), coarse grid. Ambient Temperature: 21.2° C, Liquid Temperature: 21.0° C.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 200112_y_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; σ = 1.44 mho/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(8.07, 8.07, 8.07); Calibrated: 26.09.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- 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) = 10.8 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.2 V/m; Power Drift = -0.001 dB
Peak SAR (extrapolated) = 18.8 W/kg
SAR(1 g) = 9.69 mW/g; SAR(10 g) = 4.93 mW/g

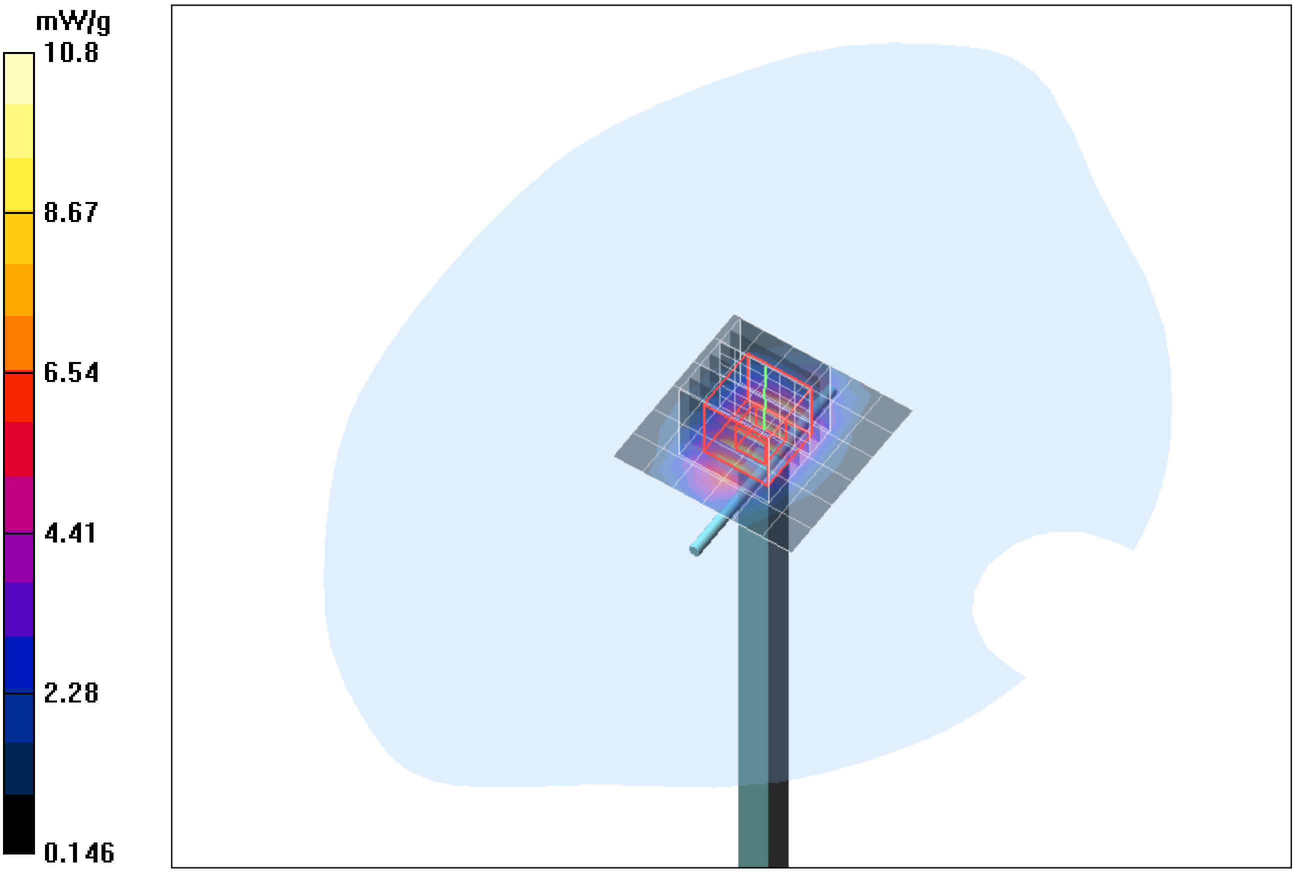

Fig. 23: Validation measurement 1900 MHz (WCDMA II) Head (January 20, 2012), coarse grid. Ambient Temperature: 21.6° C, Liquid Temperature: 21.2° C.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 29122011_y_3536.da4

DUT: Dipole 2450 MHz SN: 709; Type: D2450V2; Serial: D2450V2 - SN:709
Program Name: System Performance Check at 2450 MHz

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.84 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(7.45, 7.45, 7.45); Calibrated: 26.09.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- 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) = 15.5 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.7 V/m; Power Drift = 0.030 dB
Peak SAR (extrapolated) = 31.5 W/kg
SAR(1 g) = 13.9 mW/g; SAR(10 g) = 6.26 mW/g

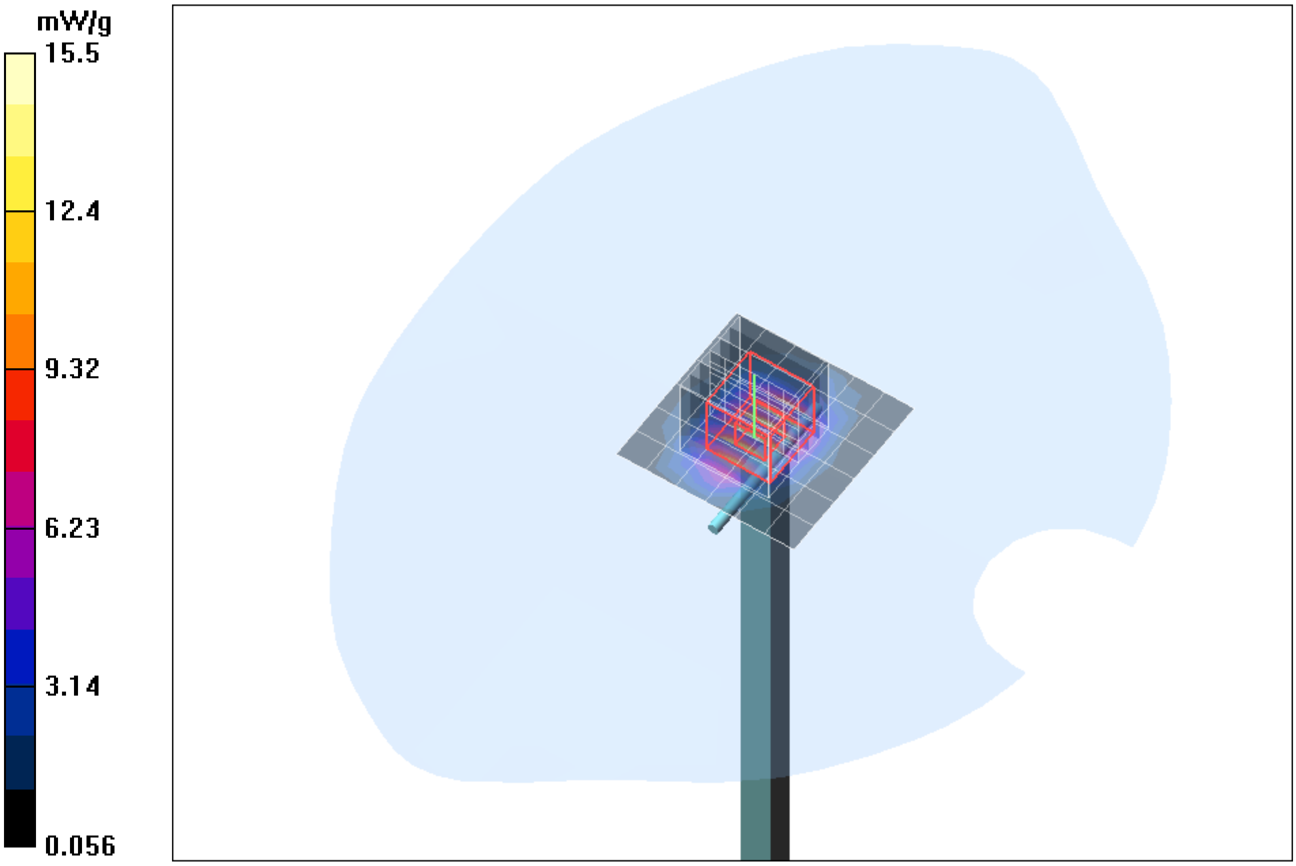

Fig. 24: Validation measurement 2450 MHz Head (December 29,2011), coarse grid. Ambient Temperature: 22.0° C, Liquid Temperature: 21.6° C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 110112_b_3536_5200.da4

DUT: Dipole 5GHz SN: 1028; Type: D5GHzV2; Serial: D5GHzV2 - SN:1028
Program Name: System Performance Check at 5200 MHz

Communication System: CW; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 4.72 mho/m; ε_r = 35.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(5.27, 5.27, 5.27); Calibrated: 26.09.2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- 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 (14x14x1): Measurement grid: dx=7.5mm, dy=7.5mm
Maximum value of SAR (measured) = 38.4 mW/g
d=10mm, Pin=250mW/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 94.9 V/m; Power Drift = -0.070 dB
Peak SAR (extrapolated) = 84.6 W/kg
SAR(1 g) = 22.3 mW/g; SAR(10 g) = 6.52 mW/g
Maximum value of SAR (measured) = 41.7 mW/g

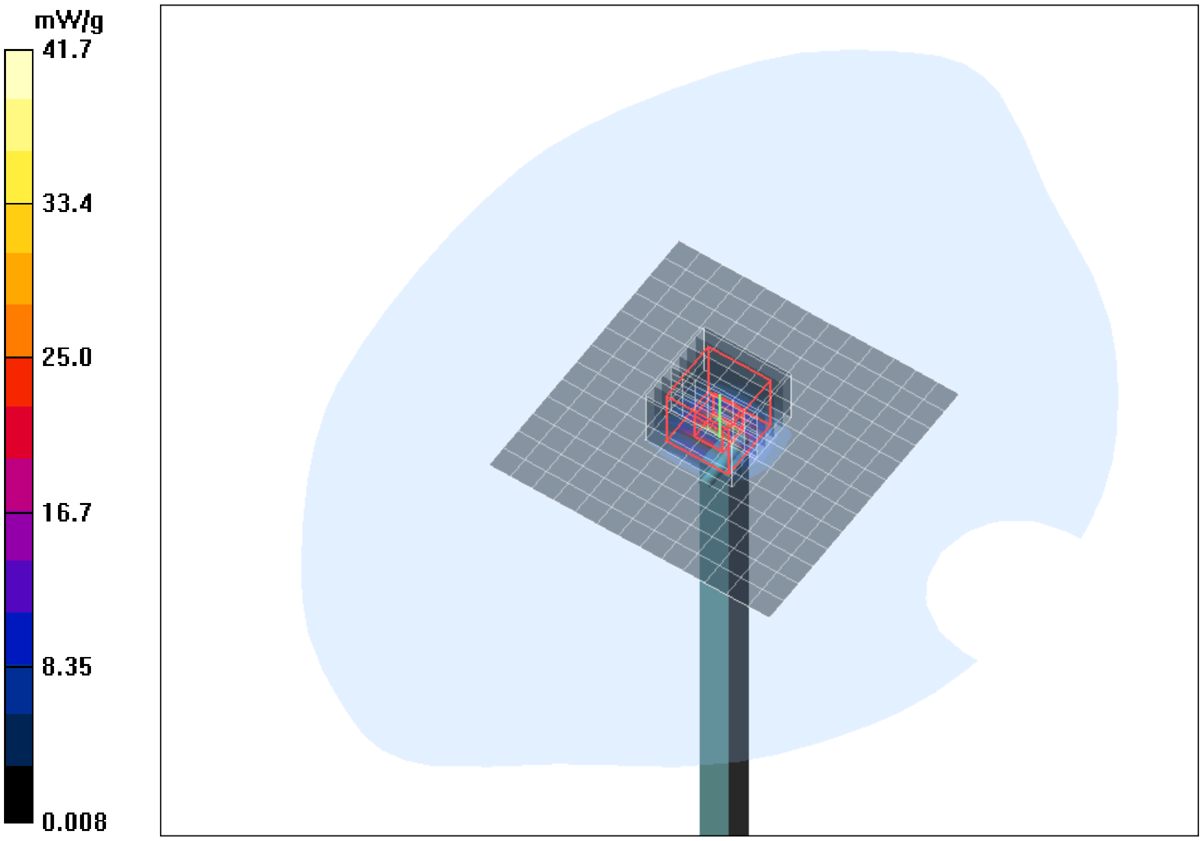

Fig. 25: Validation measurement 5200 MHz Head (January 11, 2012), coarse grid. Ambient Temperature: 21.9° C, Liquid Temperature: 21.3° C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 110112_b_3536_5500.da4

DUT: Dipole 5GHz SN: 1028; Type: D5GHzV2; Serial: D5GHzV2 - SN:1028
Program Name: System Performance Check at 5500 MHz

Communication System: CW; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5500 MHz; σ = 5.07 mho/m; ε_r = 34.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(4.61, 4.61, 4.61); Calibrated: 26.09.2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- 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 (14x14x1): Measurement grid: dx=7.5mm, dy=7.5mm
Maximum value of SAR (measured) = 40.8 mW/g
d=10mm, Pin=250mW/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 94.9 V/m; Power Drift = 0.058 dB
Peak SAR (extrapolated) = 83.9 W/kg
SAR(1 g) = 22.4 mW/g; SAR(10 g) = 6.45 mW/g
Maximum value of SAR (measured) = 43.1 mW/g

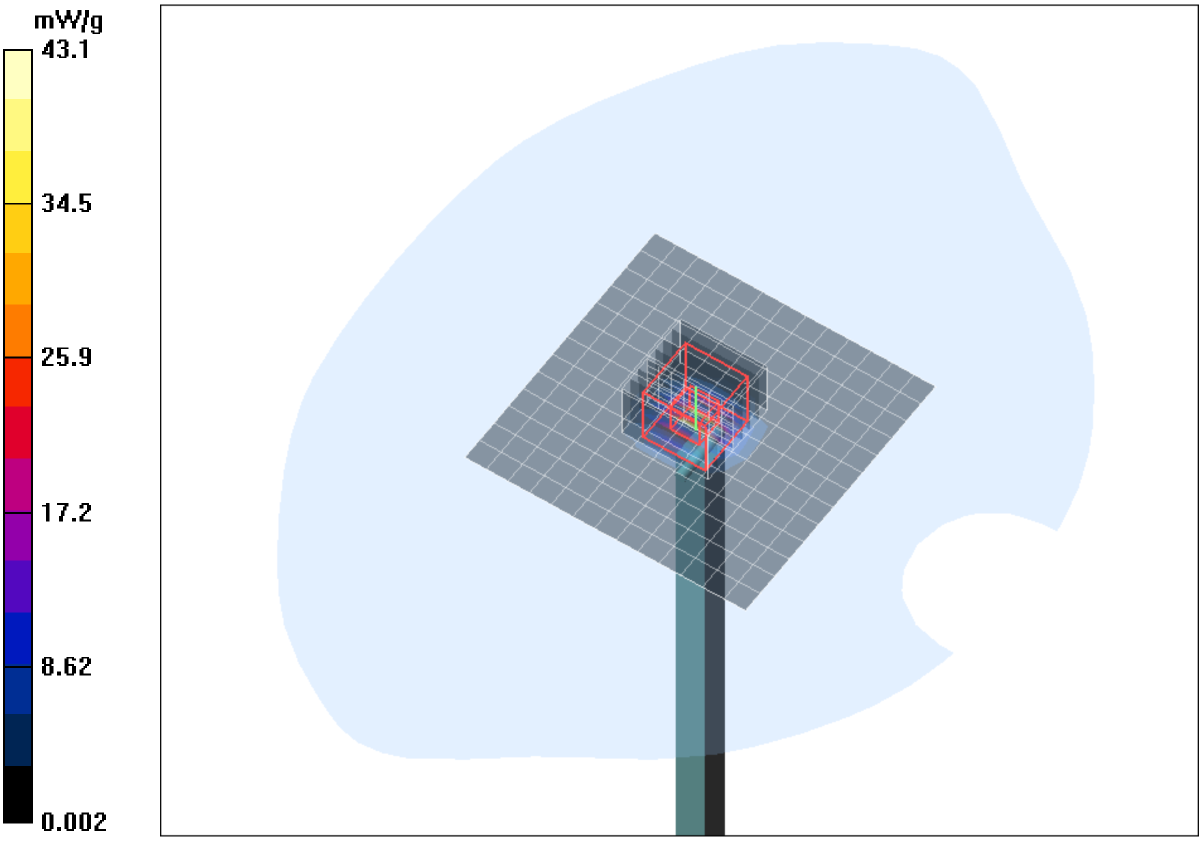

Fig. 26: Validation measurement 5500 MHz Head (January 11, 2012), coarse grid. Ambient Temperature: 21.9° C, Liquid Temperature: 21.5° C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 250112_b_3536_5800.da4

DUT: Dipole 5GHz SN: 1028; Type: D5GHzV2; Serial: D5GHzV2 - SN:1028
Program Name: System Performance Check at 5800 MHz

Communication System: CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 5.49 mho/m; ε_r = 33.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(4.53, 4.53, 4.53); Calibrated: 26.09.2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- 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 (14x14x1): Measurement grid: dx=7.5mm, dy=7.5mm
Maximum value of SAR (measured) = 37.6 mW/g
d=10mm, Pin=250mW/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 89.2 V/m; Power Drift = 0.047 dB
Peak SAR (extrapolated) = 89.4 W/kg
SAR(1 g) = 21.6 mW/g; SAR(10 g) = 6.19 mW/g
Maximum value of SAR (measured) = 43.0 mW/g

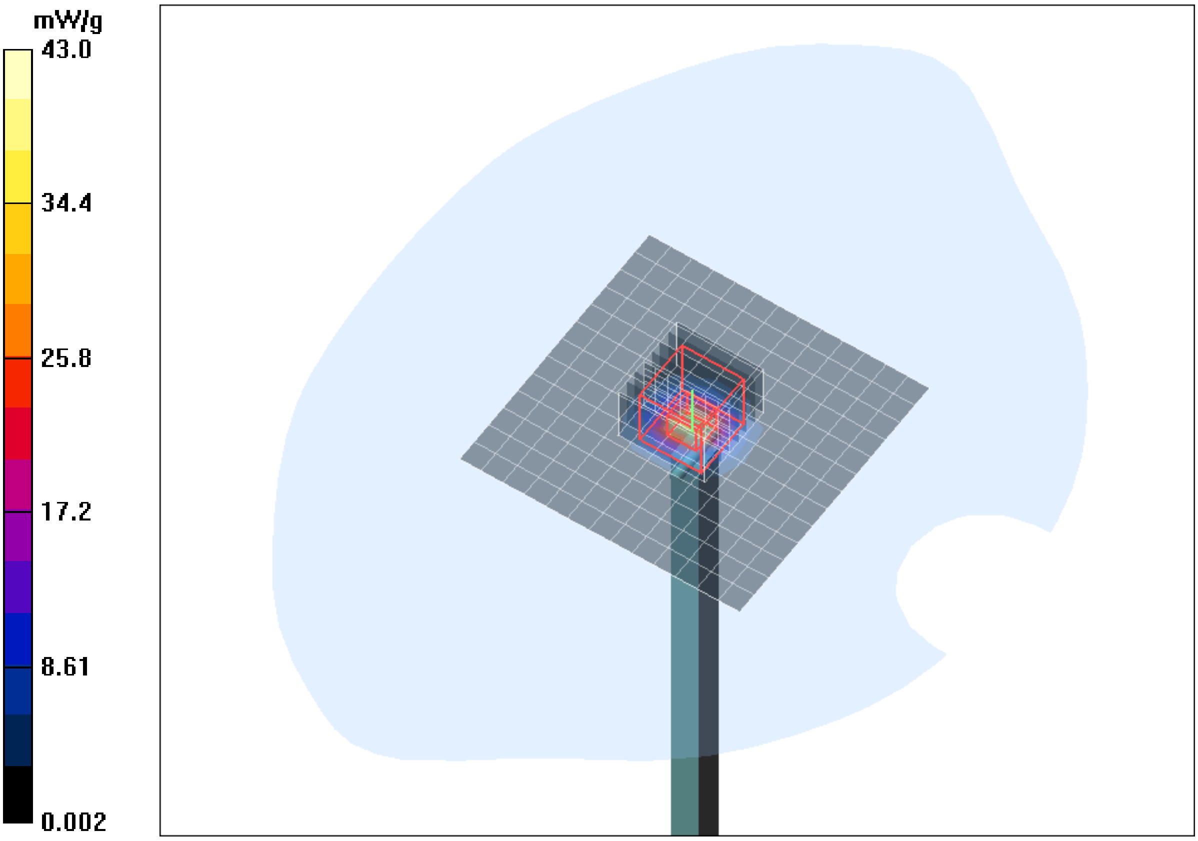

Fig. 27: Validation measurement 5800 MHz Head (January 25, 2012), coarse grid.
Ambient Temperature: 21.2° C, Liquid Temperature: 20.7° C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 180112_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 MHz; σ = 0.98 mho/m; ε_r = 53.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(6.32, 6.32, 6.32); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Sugar 1059; Type: Speag; Serial: 1059
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.73 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.2 V/m; Power Drift = -0.021 dB
Peak SAR (extrapolated) = 3.50 W/kg
SAR(1 g) = 2.48 mW/g; SAR(10 g) = 1.63 mW/g
Maximum value of SAR (measured) = 2.70 mW/g

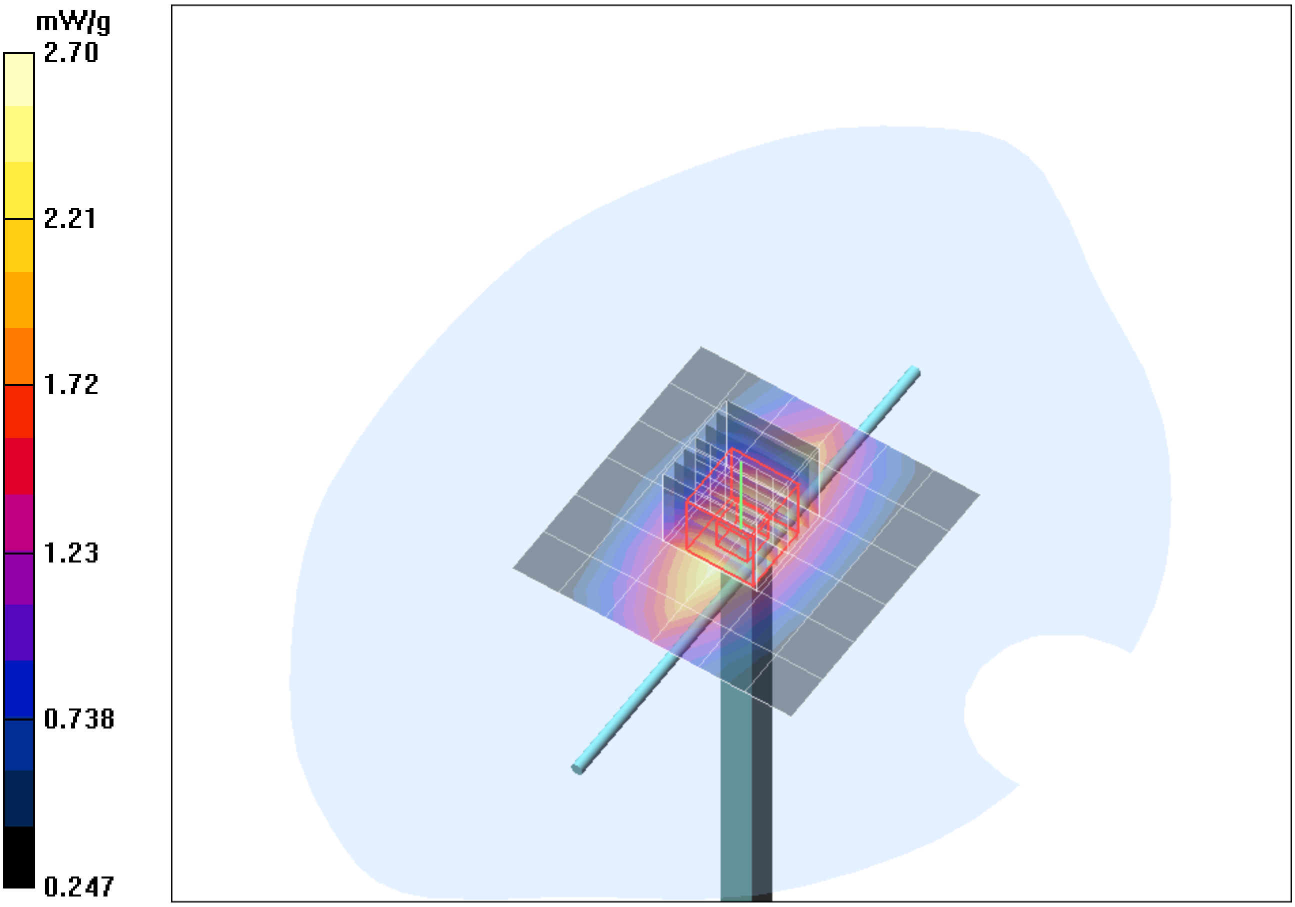

Fig. 28: Validation measurement 835 MHz Body (January 18, 2012), coarse grid.
Ambient Temperature: 20.6° C, Liquid Temperature: 20.4° C.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 170112_y_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; σ = 1.55 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3536; ConvF(8.03, 8.03, 8.03); Calibrated: 26.09.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- 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 = -0.012 dB

Peak SAR (extrapolated) = 18.3 W/kg

SAR(1 g) = 9.52 mW/g; SAR(10 g) = 4.84 mW/g

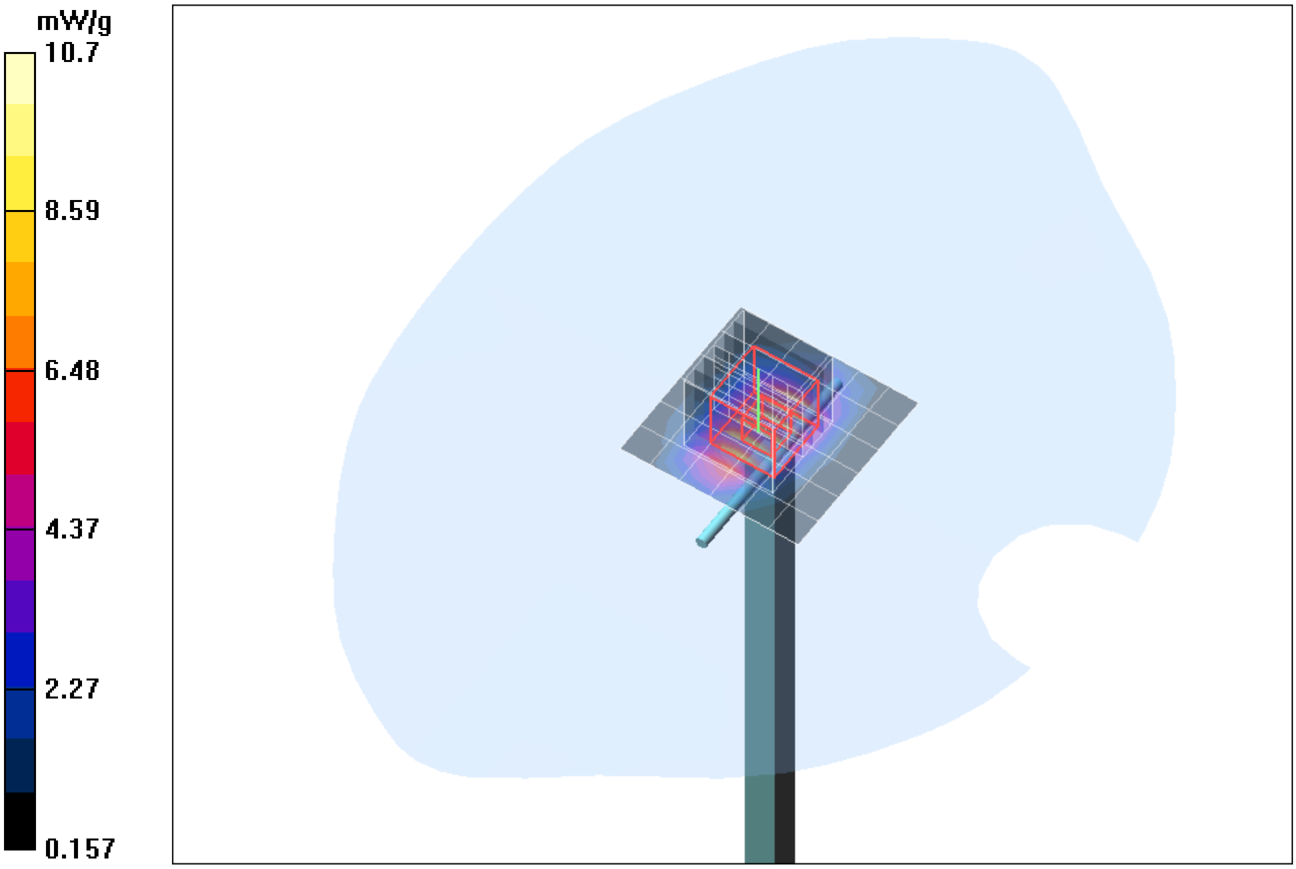

Fig. 29: Validation measurement 1900 MHz Body (January 17, 2012), coarse grid. Ambient Temperature: 21.3° C, Liquid Temperature: 21.1° C.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 140212_y_3536_2450.da4

DUT: Dipole 2450 MHz SN: 709; Type: D2450V2; Serial: D2450V2 - SN:709
Program Name: System Performance Check at 2450 MHz

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 2.01 mho/m; ε_r = 51.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(7.42, 7.42, 7.42); Calibrated: 26.09.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- 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) = 15.2 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 86.9 V/m; Power Drift = 0.004 dB
Peak SAR (extrapolated) = 29.1 W/kg
SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.06 mW/g

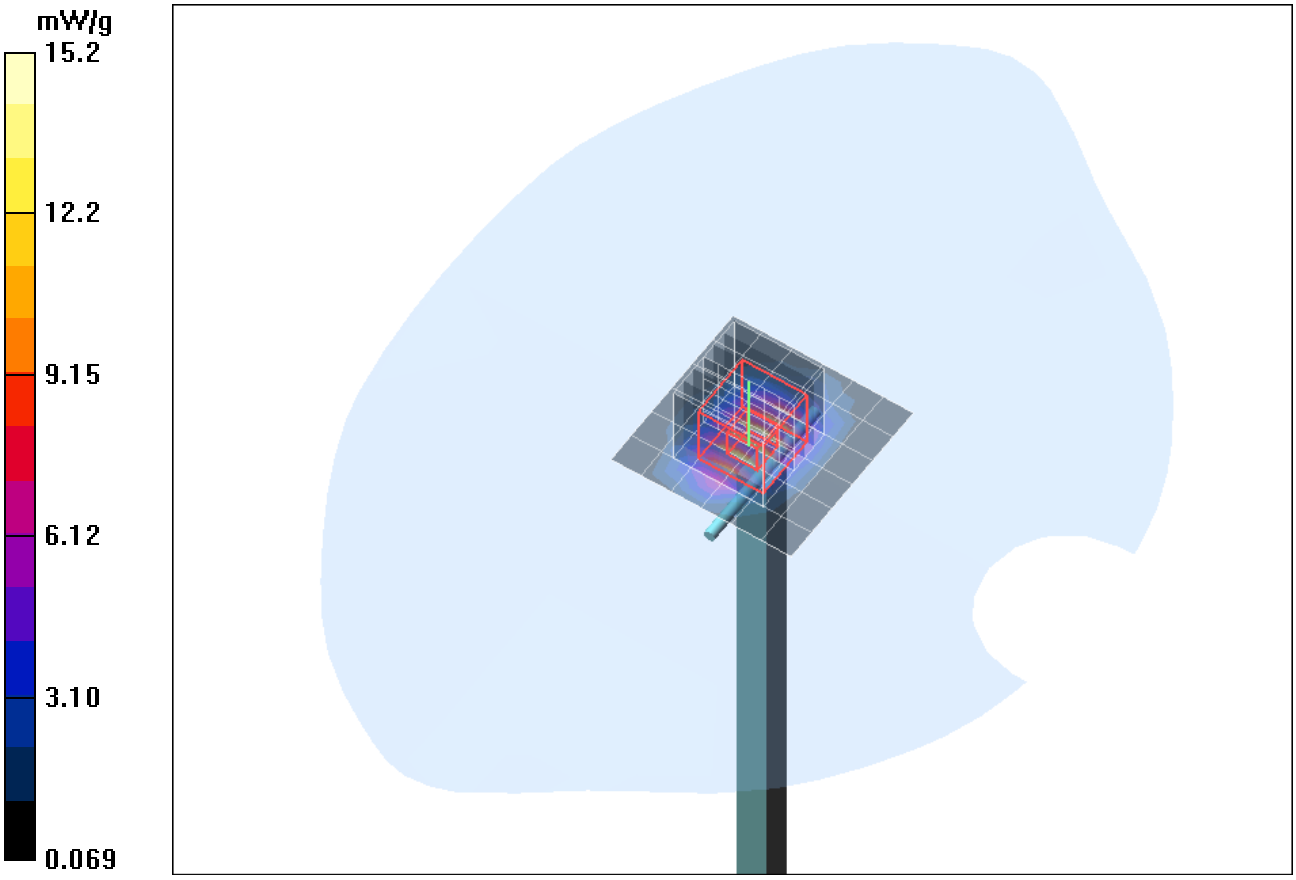

Fig. 30: Validation measurement 2450 MHz Body (February 14, 2012) coarse grid. Ambient Temperature: 21.3°C. Liquid Temperature: 20.7°C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 140212_b_3536_5200.da4

DUT: Dipole 5GHz SN: 1028; Type: D5GHzV2; Serial: D5GHzV2 - SN:1028
Program Name: System Performance Check at 5200 MHz

Communication System: CW; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.19 mho/m; ε_r = 48; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(4.43, 4.43, 4.43); Calibrated: 26.09.2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- 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 (14x14x1): Measurement grid: dx=7.5mm, dy=7.5mm
Maximum value of SAR (measured) = 32.6 mW/g
d=10mm, Pin=250mW/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 93.7 V/m; Power Drift = -0.146 dB
Peak SAR (extrapolated) = 69.4 W/kg
SAR(1 g) = 20 mW/g; SAR(10 g) = 5.72 mW/g
Maximum value of SAR (measured) = 38.3 mW/g

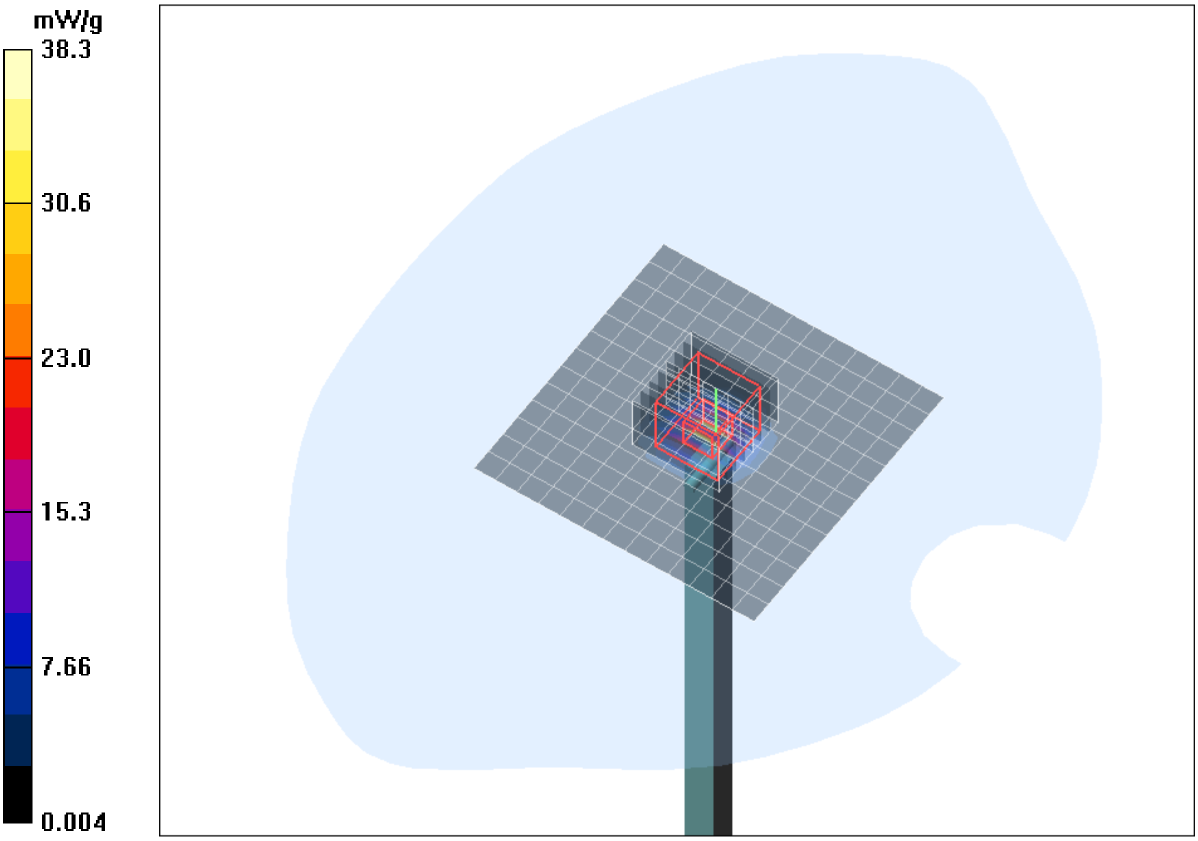

Fig. 31: Validation measurement 5200 MHz Body (February 14, 2012) coarse grid. Ambient Temperature: 22.1°C. Liquid Temperature: 21.4°C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 150212_b_3536_5500.da4

DUT: Dipole 5GHz SN: 1028; Type: D5GHzV2; Serial: D5GHzV2 - SN:1028
Program Name: System Performance Check at 5500 MHz

Communication System: CW; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5500 MHz; σ = 5.57 mho/m; ε_r = 48.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(3.92, 3.92, 3.92); Calibrated: 26.09.2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- 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 (14x14x1): Measurement grid: dx=7.5mm, dy=7.5mm
Maximum value of SAR (measured) = 33.4 mW/g
d=10mm, Pin=250mW/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 90.5 V/m; Power Drift = -0.015 dB
Peak SAR (extrapolated) = 75.7 W/kg
SAR(1 g) = 20.7 mW/g; SAR(10 g) = 5.74 mW/g
Maximum value of SAR (measured) = 40.1 mW/g

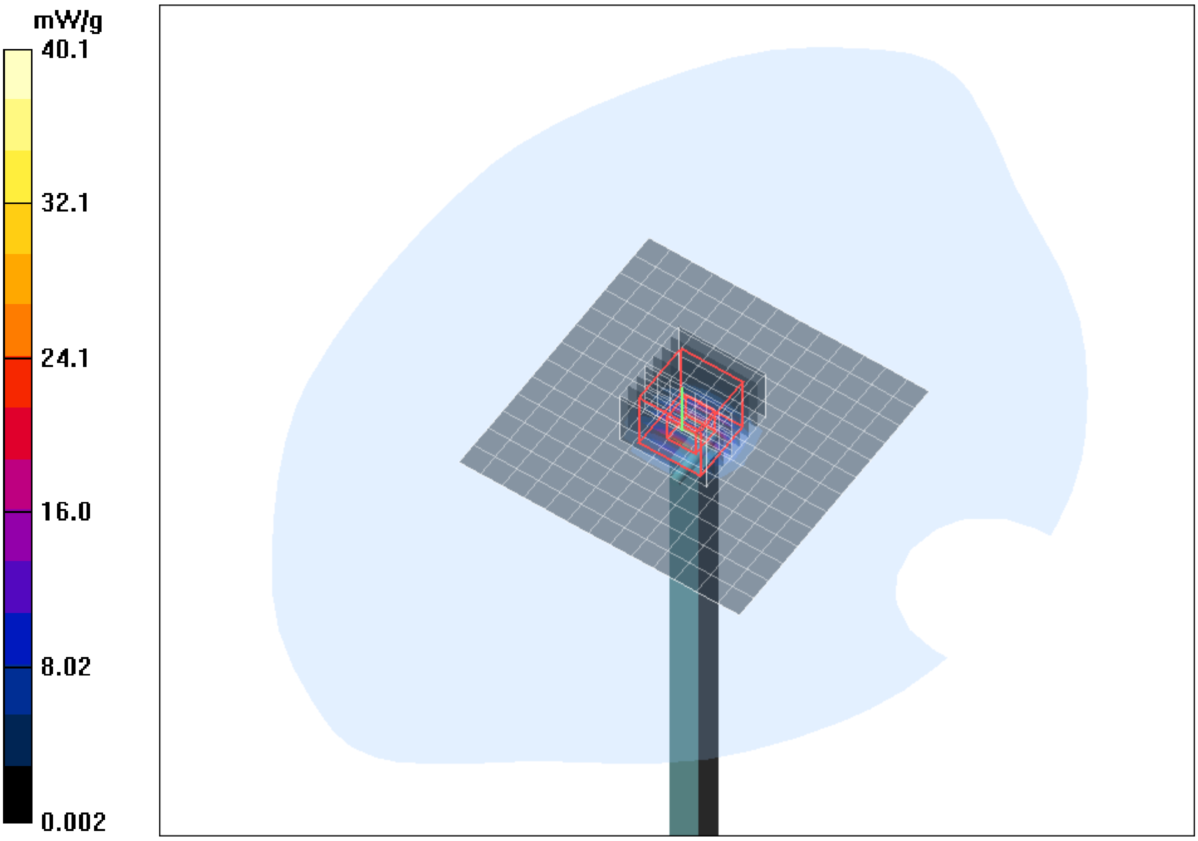

Fig. 32: Validation measurement 5500 MHz Body (February 15, 2012) coarse grid. Ambient Temperature: 22.5°C. Liquid Temperature: 21.6°C.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 160212_b_3536_5800.da4

DUT: Dipole 5GHz SN: 1028; Type: D5GHzV2; Serial: D5GHzV2 - SN:1028
Program Name: System Performance Check at 5800 MHz

Communication System: CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 6.19 mho/m; ε_r = 47.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(4.03, 4.03, 4.03); Calibrated: 26.09.2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 21.09.2011
- 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 (14x14x1): Measurement grid: dx=7.5mm, dy=7.5mm
Maximum value of SAR (measured) = 37.8 mW/g
d=10mm, Pin=250mW/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 86.1 V/m; Power Drift = -0.091 dB
Peak SAR (extrapolated) = 75.3 W/kg
SAR(1 g) = 20.4 mW/g; SAR(10 g) = 5.77 mW/g
Maximum value of SAR (measured) = 39.4 mW/g

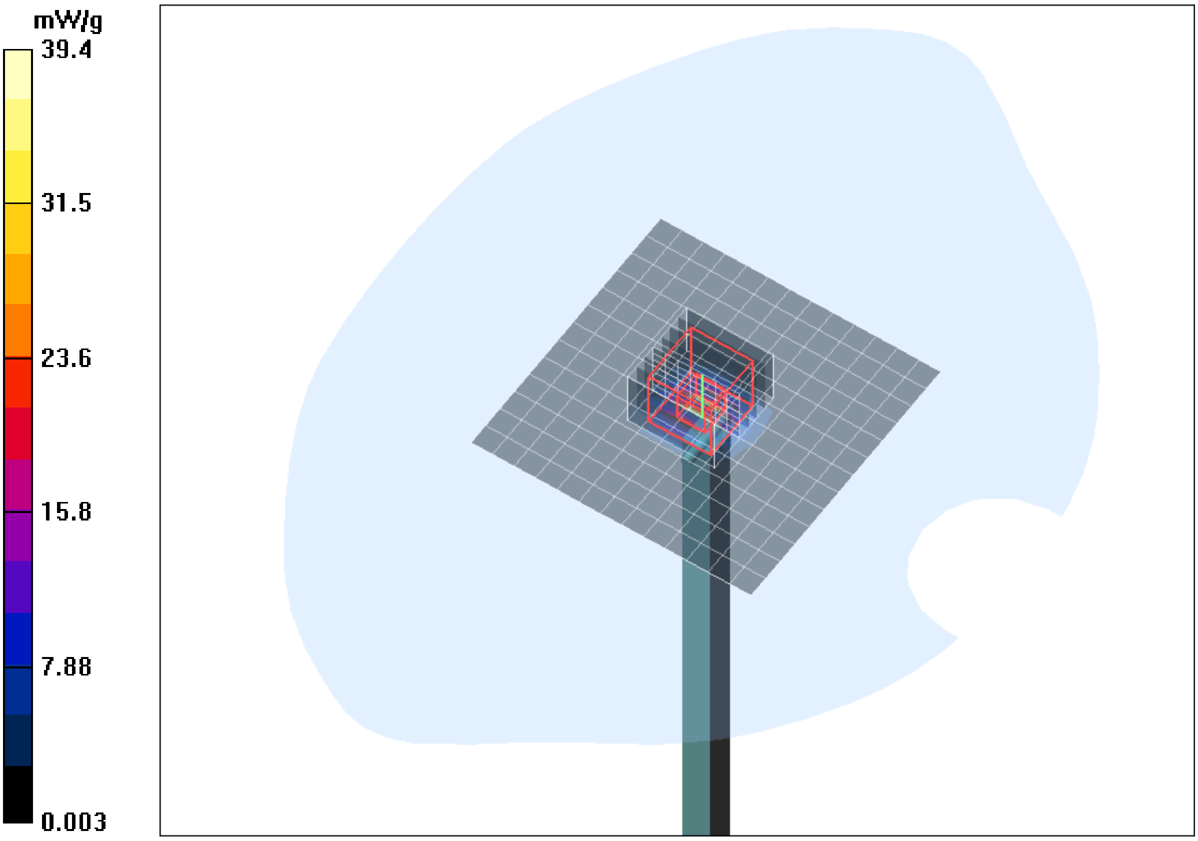

Fig. 33: Validation measurement 5800 MHz Body (February 16, 2012) coarse grid. Ambient Temperature: 22.5°C. Liquid Temperature: 21.8°C.

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i	Standard Uncertainty	v_i^2 or v_{eff}
Measurement System						
Probe calibration	± 6.8 %	Normal	1	1	± 6.8 %	∞
Axial isotropy	± 4.7 %	Rectangular	√3	1	± 2.7 %	∞
Hemispherical isotropy	± 0 %	Rectangular	√3	1	± 0 %	∞
Boundary effects	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Linearity	± 4.7 %	Rectangular	√3	1	± 2.7 %	∞
System detection limit	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Readout electronics	± 0.3 %	Normal	1	1	± 0.3 %	∞
Response time	± 0 %	Rectangular	√3	1	± 0 %	∞
Integration time	± 0%	Rectangular	√3	1	± 0 %	∞
RF ambient conditions	± 3.0 %	Rectangular	√3	1	± 1.7 %	∞
RF ambient reflections	± 3.0 %	Rectangular	√3	1	± 1.7 %	∞
Probe positioner	± 0.4 %	Rectangular	√3	1	± 0.2 %	∞
Probe positioning	± 2.9 %	Rectangular	√3	1	± 1.7 %	∞
Algorithms for max SAR evaluation.	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Dipole						
Dipole Axis to Liquid Distance	± 2.0 %	Rectangular	1	1	± 1.2 %	∞
Input power and SAR drift mea.	± 4.7 %	Rectangular	√3	1	± 2.7 %	∞
Phantom and Set-up						
Phantom uncertainty	± 4.0 %	Rectangular	√3	1	± 2.3 %	∞
Liquid conductivity (target)	± 5.0 %	Rectangular	√3	0.64	± 1.8 %	∞
Liquid conductivity (meas.)	± 2.5 %	Normal	1	0.64	± 1.6 %	∞
Liquid permittivity (target)	± 5.0 %	Rectangular	√3	0.6	± 1.7 %	∞
Liquid permittivity (meas.)	± 2.5 %	Normal	1	0.6	± 1.5 %	∞
Combined Uncertainty					± 9.8 %	

Table 31: Uncertainty budget for the system performance check.

9.6 Environment

To comply with the required noise level (less than 12 mW/kg) periodically measurements without a DUT were conducted.
Humidity: 40% ± 5 %

9.7 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	ET3DV6R	1669	02/2011	02/2012
Dosimetric E-Field Probe	EX3DV4	3536	09/2011	09/2012
Data Acquisition Electronics	DAE 3	335	02/2011	02/2012
Data Acquisition Electronics	DAE 4	631	09/2011	09/2012
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	04/2010	04/2012
Validation Dipole	D1900V2	5d051	09/2011	09/2013
Validation Dipole	D2450V2	709	12/2011	12/2013
Validation Dipole	D5GHzV2	1028	04/2010	04/2012
Material Measurement				
Network Analyzer	E5071C	MY46103220	08/2011	08/2013
Dielectric Probe Kit	HP85070B	US33020263	N/A	N/A

Table 32: SAR equipment.

Test Equipment	Model	Serial Number	Last Calibration	Next Calibration
Power Meters				
Power Meter, Agilent	E4416A	GB41050414	12/2010	12/2012
Power Meter, Agilent	E4417A	GB41050441	12/2010	12/2012
Power Meter, Anritsu	ML2487A	6K00002319	02/2010	02/2012
Power Meter, Anritsu	ML2488A	6K00002078	02/2010	02/2012
Power Sensors				
Power Sensor, Agilent	E9301H	US40010212	12/2010	12/2012
Power Sensor, Agilent	E9301A	MY41495584	12/2010	12/2012
Power Sensor, Anritsu	MA2481B	031600	02/2010	02/2012
Power Sensor, Anritsu	MA2490A	031565	02/2010	02/2012
RF Sources				
Network Analyzer	E5071C	MY46103220	08/2011	08/2013
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	N/A	N/A

Table 33: Test equipment, General.

9.8 Certificates of Conformity

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Certificate of conformity

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

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

Uncertainty
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**

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Fig. 34: Certificate of conformity for the used DASY4 system

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

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. 35: Certificate of conformity for the used SAM phantom.

9.9 Pictures of the Device under Test

Fig. 36 - 40 show the devices under test and the used accessories.

Fig. 36: Front and back view of the PSION 7545MBW.

Fig. 37: Side view of the PSION 7545MBW.

Fig. 38: Pictures of the used holster.

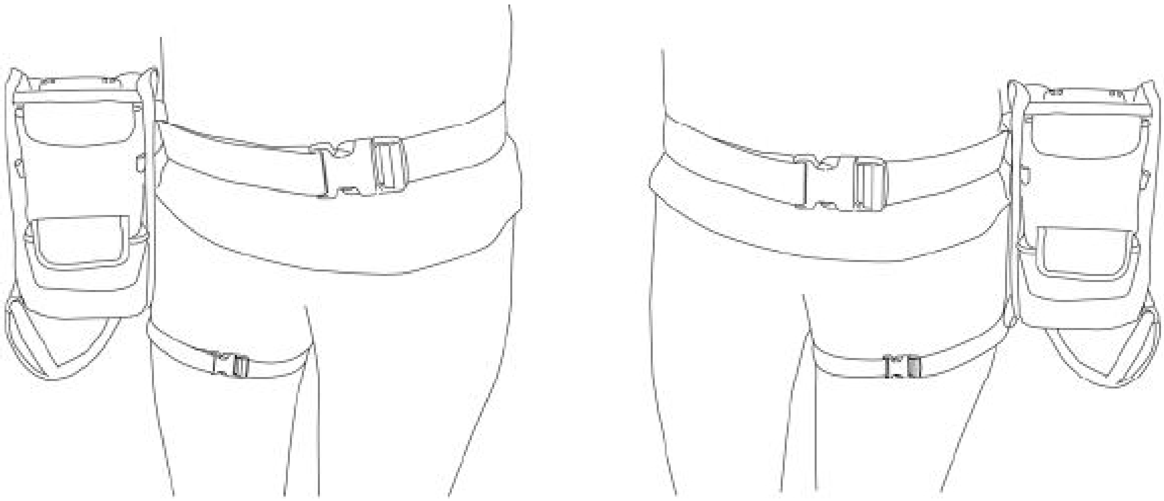

Fig. 39: Pictures of the holster use case scenario.

Fig. 40: Pictures of the PSION 7545MBW with holster.

9.10 Test positions for the Device under Test

Fig. 41 - 46 show the test positions for the SAR measurements for the PSION 7545MBW.

Fig. 41: Cheek position, left side.

Fig. 42: Tilted position, left side.

Fig. 43: Cheek position, right side.

Fig. 44: Tilted position, right side.

Fig. 45: Body worn configuration, position 1 with holster, left side of display in direct contact against the flat phantom.

Fig. 46: Body worn configuration, position 2 with holster, right side of display in direct contact against the flat phantom.

9.11 Pictures to Demonstrate the Required Liquid Depth

Figure 47 - Figure 54 show the liquid depth in the used SAM phantom.

Fig. 47: Liquid depth for GSM 850 and WCDMA V Head measurements

Fig. 48: Liquid depth for PCS 1900 and WCDMA II Head measurements

Fig. 49: Liquid depth for IEEE 802.11 b/g/n Head measure-ments

Fig. 50: Liquid depth for IEEE 802.11 a/n Head measurements

Fig. 51: Liquid depth for GSM 850 and WCDMA V Body measurements

Fig. 52: Liquid depth for PCS 1900 and WCDMA II Body measurements

Fig. 53: Liquid depth for IEEE 802.11 b/g/n Body measurements

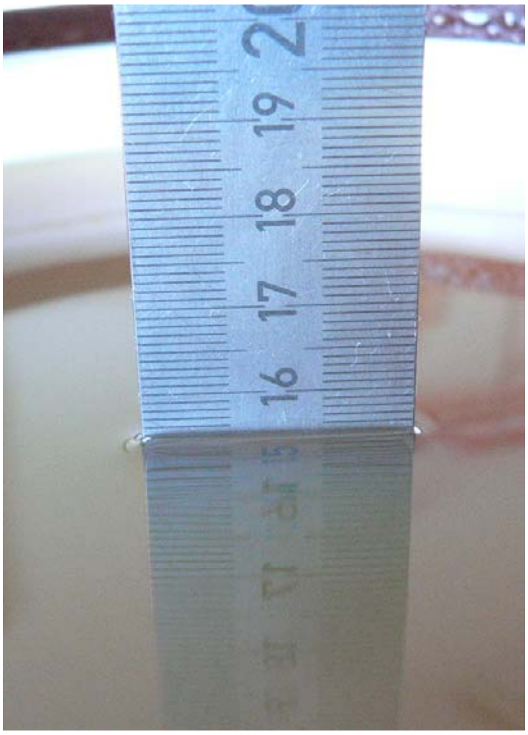

Fig. 54: Liquid depth for IEEE 802.11 a/n Body measurements

10 References

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[IC RSS 102] Industry Canada, Radio Standards Specification, Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands); RSS-102 Issue 4 March 2010

[IEEE C95.1-1999] IEEE Std C95.1-1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, Inst. of Electrical and Electronics Engineers, Inc., 1999.

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[ICNIRP 1998] ICNIRP: Guidelines for Limiting Exposure to Time-varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz), In: Health Physics, Vol. 74, No. 4, 494-522, 1998.

[IEEE 1528-2003] IEEE Std 1528-2003: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques. 1528-2003, December 19, 2003, The Institute of Electrical and Electronics Engineers.

[NIST 1994] NIST: Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results, Technical Note 1297 (TN1297), United States Department of Commerce Technology Administration, National Institute of Standards and Technology, 1994.

[DASY4] Schmid & Partner Engineering AG: DASY4 Manual. April 2008

[FCC 96-326] FCC 96-326, ET Docket No. 93-62, Report and Order, August 1, 1996