The Testcenter facility 'Dosimetric Test Lab' within IMST GmbH is accredited by the German National 'Deutsche Akkreditierungsstelle GmbH (DAkkS)' for testing according to the scope as listed in the accreditation certificate: D-PL-12139-01-01.

Report

Dosimetric Assessment of the Portable Device XYfi from Option tested in one Host Product (FCC ID: NCMOGI0643)

According to the FCC Requirements

September 27, 2011

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This revised version of the report supersedes all previous versions

Executive Summary

The device XYfi is a new USB stick from Option operating in the 850 MHz, 900 MHz, 1800 MHz, 1900 MHz and 2450 MHz frequency range. The device has two integrated antennas and the system concepts used are the GPRS/EDGE 850, GPRS/EDGE 900, GPRS/EDGE 1800, GPRS/EDGE 1900, WCDMA I (FDD), WCDMA II (FDD) and IEEE 802.11 b/g/n standards. The USB stick provides HSDPA and HSUPA in WCDMA. In simultaneous transmission mode a WLAN and WWAN connection could be active at the same time.

The objective of the measurements done by IMST was the dosimetric assessment of one device in body worn configuration in the GPRS 850 (Class 11), GPRS 1900 (Class 12), WCDMA II (FDD) and IEEE 802.11 b standards. The measurements were performed in combination with one host product (Dell Latitude X300). According to Fig. 2 the device was tested in six positions in 180° configurations with a maximum distance of 5 mm between DUT and phantom. Since the device is equipped with a swivel antenna which can be used in 180° and 90° angel, additional measurements in worst case configuration for the 90° mode has been conducted. 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]
- Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies [KDB 447498]
- SAR Measurement Procedure for 802.11 a/b/g Transmitter [KDB 248227]
- SAR Evaluation Considerations for Handsets with Multiple Transmitter and Antennas [KDB 648474]

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

Since the device has a swivel antenna a PBA was send to the authorities. According to the FCC reply, the USB stick was tested in the following configurations:

According to Fig. 2 the device was tested in six positions in 180° configuration for GPRS/EDGE 850 (Class 11), GPRS/EDGE 1900 (Class 12) and WCDMA II (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 (Dell Latitude X300).

According the output power measurements, for GPRS 850 Class 11 and GPRS 1900 Class 12 delivers the highest output power. Therefore the SAR tests are conducted in GPRS Class 11 for GPRS/EDGE 850 and Class 12 for GPRS/EDGE 1900.

Additionally, "bottom tip" (position 6) and the position that delivers the highest SAR value was assessed in 90° configuration.

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1 Subject of Investigation

The device XYfi is a new USB stick from Option operating in the 850 MHz, 900 MHz, 1800 MHz, 1900 MHz and 2450 MHz frequency range. The device has two integrated antennas and the system concepts used are the GPRS/EDGE 850, GPRS/EDGE 900, GPRS/EDGE 1800, GPRS/EDGE 1900, WCDMA I (FDD), WCDMA II (FDD) and IEEE 802.11 b/g/n standards. The USB stick provides HSDPA and HSUPA in WCDMA.

-> Please refer to Test Setup Photos.

Fig. 1: Pictures of the device under test in 90° and 180° configuration.

The objective of the measurements done by IMST was the dosimetric assessment of one device in body worn configuration in the GPRS 850 (Class 11), GPRS 1900 (Class 12), WCDMA II (FDD) and IEEE 802.11 b standards. The measurements were performed in combination with one host product (Dell Latitude X300). According to Fig. 2 the device was tested in six positions in 180° configurations with a maximum distance of 5 mm between DUT and phantom. Since the device is equipped with a swivel antenna which can be used in 180° and 90° angel, additional measurements in worst case configuration for the 90° mode has been conducted. The examinations have been carried out with the dosimetric assessment system „DASY4“ described 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:

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

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 2 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.

Standard	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.

-> Please refer to Test Setup Photos.

Fig. 2: Device with all applicable orientations.

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 14.

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].

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

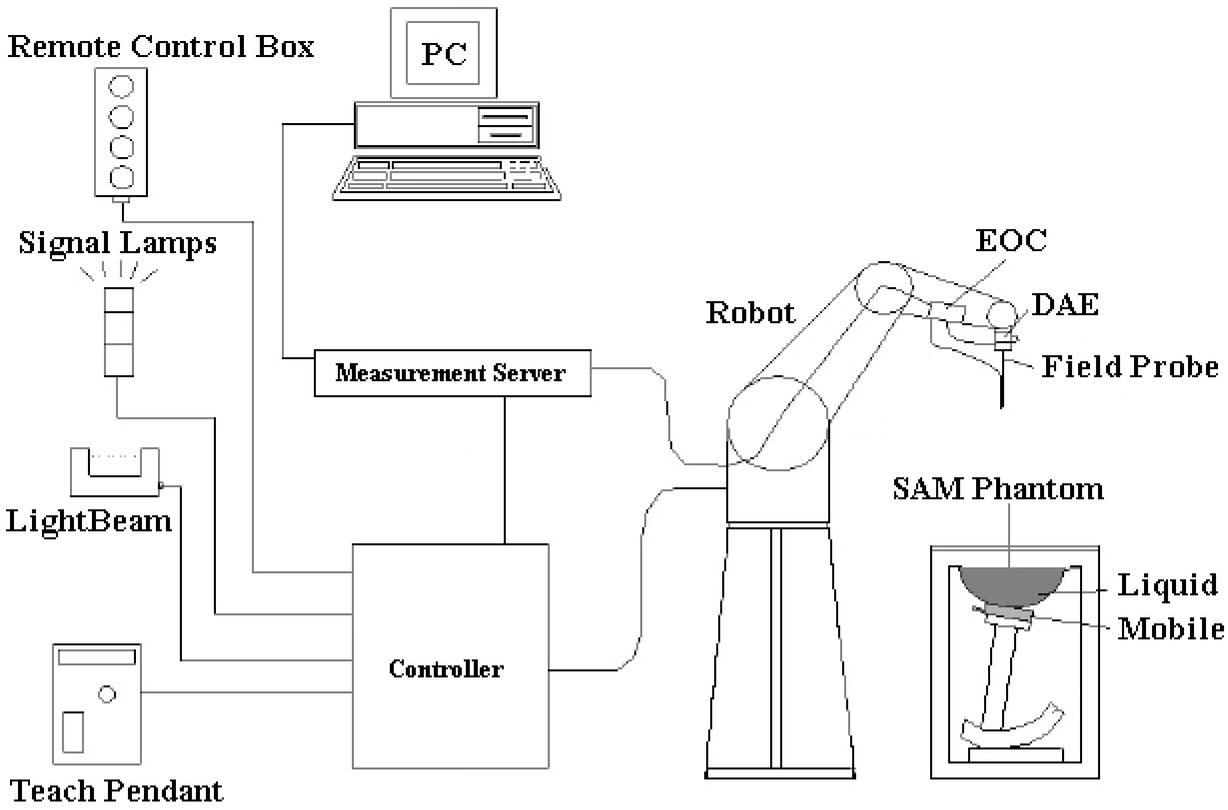

Fig. 3: The DASY4 measurement system.

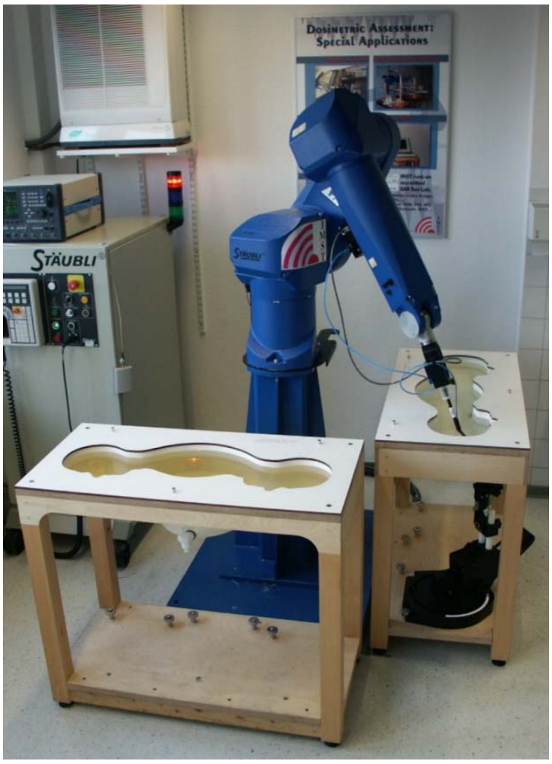

Fig. 4: The measurement set-up with two SAM phantoms containing tissue simulating liquid.

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 mm $\pm$ 0.2 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: 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°

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 ± 0.21dB.

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		UNII	
					b	g		
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 3: 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

4.5 Uncertainty Assessment

Table 4 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 ± 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	± 5.9 %	Normal	1	1	± 5.9 %	∞
Axial isotropy	± 4.7 %	Rectangular	√3	0.7	± 1.9 %	∞
Hemispherical isotropy	± 9.6 %	Rectangular	√3	0.7	± 3.9 %	∞
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	± 1.0 %	Normal	1	1	± 1.0 %	∞
Response time	± 0.8 %	Rectangular	√3	1	± 0.5 %	∞
Integration time	± 2.6%	Rectangular	√3	1	± 1.5 %	∞
RF ambient conditions	± 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 %	∞
Algorithm for max SAR eval.	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Test Sample Related						
Device positioning	± 2.9 %	Normal	1	1	± 2.9 %	145
Device holder	± 3.6 %	Normal	1	1	± 3.6 %	5
Power drift	± 5.0 %	Rectangular	√3	1	± 2.9 %	∞
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					± 10.8 %	

Table 4: 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 16.7 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		Channel 128 824.2 MHz	Channel 190 836.4 MHz	Channel 251 848.8 MHz	Ambient [° C]	Liquid [° C]
GPRS	Pos. 1		0.531 (0.022)		22.7	22.3
	Pos. 2		0.544 (-0.058)		22.7	22.3
	Pos. 3		0.289 (-0.150)		22.7	22.3
	Pos. 4		0.324 (0.132)		22.7	22.3
	Pos. 5		0.207 (-0.065)		22.7	22.3
EDGE	Pos. 2		0.399 (-0.138)		22.7	22.3

Table 5: Measurement results for GPRS and EDGE 850 (Class 11) for the Option XYfi.

Test Position (Liquid depth 18.5 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		Channel 512 1850.2 MHz	Channel 661 1880.0 MHz	Channel 810 1909.6 MHz	Ambient [° C]	Liquid [° C]
GPRS	Pos. 1	1.260 (0.149)	1.090 (0.104)	1.050*(-0.130)	21.2	21.0
	Pos. 2		0.782 (0.021)		21.2	21.0
	Pos. 3	1.030 (0.033)	0.977 (0.049)	0.796 (-0.031)	21.2	21.0
	Pos. 4		0.494 (-0.133)		21.2	21.0
	Pos. 5		0.060 (0.030)		21.2	21.0
EDGE	Pos. 1	1.070 (-0.050)	1.010 (-0.127)	0.864 (-0.076)	21.2	21.0
	Pos. 2		0.772 (-0.057)		21.2	21.0
	Pos. 3	0.983 (-0.071)	0.949 (0.016)	0.786 (0.047)	21.2	21.0
	Pos. 4		0.430 (0.030)		21.2	21.0
	Pos. 5		0.067 (0.182)		21.2	21.0

Table 6: Measurement results for GPRS and EDGE 1900 (Class 12) for the Option XYfi (* Max Cube).

Test Position (Liquid depth 18.5 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		Channel 9262 1852.4 MHz	Channel 9400 1880.0 MHz	Channel 9538 1907.6 MHz	Ambient [° C]	Liquid [° C]
RMC	Pos. 1	1.080 (-0.132)	1.270* (0.005)	0.895 (-0.050)	21.4	21.2
	Pos. 2	0.772 (-0.113)	0.805* (-0.168)	0.628 (0.052)	21.4	21.2
	Pos. 3	0.979 (-0.064)	0.920 (0.055)	0.656 (-0.007)	21.4	21.2
	Pos. 4		0.711 (-0.014)		21.4	21.2
	Pos. 5		0.091 (-0.025)		21.4	21.2
HSDPA (subtest 1)	Pos. 1		1.230 (0.023)		21.4	21.2
HSUPA (subtest 5)	Pos. 1		1.050 (0.083)		21.4	21.2

Table 7: Measurement results for WCDMA II (FDD) in RMC, HSDPA and HSUPA for the Option XYfi.

Test Position (Liquid depth 18.5 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		Channel 9262 1852.4 MHz	Channel 9400 1880.0 MHz	Channel 9538 1907.6 MHz	Ambient [° C]	Liquid [° C]
RMC	Pos. 1		1.380 (0.167)		21.4	21.2

Table 8: Measurement results for WCDMA II (FDD) in 90° configuration for the Option XYfi.

Test Position (Liquid depth 18.5 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		Channel 9262 1852.4 MHz	Channel 9400 1880.0 MHz	Channel 9538 1907.6 MHz	Ambient [° C]	Liquid [° C]
RMC	Pos. 6		0.067(0.127)		21.4	21.2

Table 9: Measurement results for WCDMA II (FDD) in 90° "Bottom Tip" configuration for the Option XYfi.

Test Position (Liquid depth 16.8 cm)		SAR_{1g} [W/kg] (Drift[dB])			Temperature	
		Channel 1 2412 MHz	Channel 6 2437 MHz	Channel 11 2462 MHz	Ambient [° C]	Liquid [° C]
IEEE 802.11 b (1 Mbps)	Pos. 1		0.038 (0.181)		22.0	21.7
	Pos. 2		0.233 (0.003)		22.0	21.7
	Pos. 3		0.071 (-0.097)		22.0	21.7
	Pos. 4		0.045 (-0.083)		22.0	21.7
	Pos. 5		0.007 (-0.122)		22.0	21.7

Table 10: Measurement results for IEEE 802.11 b for the Option XYfi.

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).

Compared to GPRS, output power measurements in EDGE result lower power values. Nevertheless, for the cases where SAR values in GPRS mode are > 0.8 mW/g, SAR assessment was conducted only for the worst case configuration.

Since the output power in 802.11 b mode is higher than in g-mode or n-mode, SAR assessment was conducted in b mode only.

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.

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

Test Position (Liquid depth 18.5 cm)	SAR_{1g} [W/kg] Multimeter	SAR_{1g} [W/kg] (Drift[dB])
Worst Case WCDMA II Position 1 Channel 9400 (Initial Position)	1.400	1.270 (0.005)
Initial Device Position + 5 mm	0.610	N.A.
Initial Device Position + 10 mm	0.180	N.A.

Table 11: Measurement results for worst case configuration, moving the device away from the initial test position. An enhanced energy coupling is not detected.

6 Co-Located SAR Results

Table 13 shows the possible co-transmission modes for body worn configuration for the worst case configuration. For multi mode SAR the worst case SAR values of each mode are accumulated and compared to the corresponding limit.

Test Position	Highest SAR_{1g} [W/kg]			
	Worst Case WWAN	Coresponding WiFi Value	Combined SAR	SAR Limit
Position 1	1.380	0.038	1.418	1.6
Position 2	0.805	0.233	1.038	1.6
Position 3	1.030	0.071	1.101	1.6
Position 4	0.711	0.045	0.756	1.6
Position 5	0.207	0.007	0.214	1.6

Table 12: Measurement results for co-transmission mode for WWAN – WiFi worst case configuration for the Option XYfi.

Test Position	Highest SAR_{1g} [W/kg]			
	Scaled Worst Case WWAN	Coresponding WiFi Value	Combined SAR	SAR Limit
Position 1	1.56	0.038	1.598	1.6

Table 13: Scaled SAR taken into account manufacturer information regarding typical output power plus calibration tolerance for WCDMA II – WiFi worst case configuration for the Option XYfi.

Conclusion:

Since the sum of measured and scaled SAR in co-transmission mode is below 1.6 mW/g, according KDB 648474 volume scan SAR is not necessary.

7 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 14.
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	HSDPA				HSUPA				
			RMC	Sub 1	Sub 2	Sub 3	Sub 4	Sub 1	Sub 2	Sub 3	Sub 4	Sub 5
WCDMA II	1852.4	9262	19.3	19.76	19.06	18.96	19.01	19.09	17.10	17.87	17.72	19.13
	1880.0	9400	20.2	19.84	19.40	19.39	19.43	19.14	17.54	18.52	18.23	19.61
	1907.6	9538	19.7	19.62	19.07	19.12	19.08	18.82	17.24	18.04	17.87	19.18
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
AGV								20	12	15	17	21

Table 14: According TS 34.121 table C10.1.4 measured max output power values for the used Option XYfi.

According manufacturer information the typical output power for WCDMA II is 20 dBm with a calibration tolerance of +/- 0.7 dB

As stated by the manufacturer, the UE is fully compliant with 3GPP standards defining required UMTS spreading factors.

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.

Output Power per Slot [dBm]										
Band	Frequency [MHz]	Channel	GPRS (GMSK / CS1)				EDGE (GMSK / MCS1)			
			1 TX	2 TX	3 TX	4 TX	1 TX	2 TX	3 TX	4 TX
850	824.2	128	31.8	29.1	27.7	26.0	31.6	28.3	26.8	25.3
	836.6	190	31.9	29.2	27.7	26.3	31.4	28.2	26.9	25.3
	848.8	251	31.8	29.1	27.6	26.2	31.5	28.4	26.7	25.4
1900	1850.2	512	28.7	26.5	24.7	24.1	28.7	25.6	23.7	22.8
	1880.0	661	28.9	26.3	24.4	24	28.8	26.2	24.2	23.4
	1909.8	810	28.8	26.3	24.5	23.3	28.8	25.9	24.0	23.2

Table 15: Measured max. output power values for the used Option XYfi.

Output Power averaged over 8 Slot [dBm]										
Band	Frequency [MHz]	Channel	GPRS (GMSK / CS1)				EDGE (GMSK / MCS1)			
			1 TX	2 TX	3 TX	4 TX	1 TX	2 TX	3 TX	4 TX
850	824.2	128	22.8	23.1	23.4	23.0	22.6	22.3	22.5	22.3
	836.6	190	22.9	23.2	23.4	23.3	22.4	22.2	22.6	22.3
	848.8	251	22.8	23.1	23.3	23.2	22.5	22.4	22.4	22.4
1900	1850.2	512	19.7	20.5	20.4	21.1	19.7	19.6	19.4	19.8
	1880.0	661	19.9	20.3	20.1	21.0	19.8	20.2	19.9	20.4
	1909.8	810	19.8	20.3	20.2	20.3	19.8	19.9	19.7	20.2

Table 16: Measured max. output power values for the used Option XYfi. averaged over 8 slots.

Mode	Frequency [MHz]	Channel	Data Rate	Output Power [dBm]
802.11 b	2412	1	1 Mbps	13.26
	2437	6		12.99
	2462	11		12.22
802.11 g	2412	1	6 Mbps	12.05
	2437	6		11.67
	2462	11		12.21
802.11 n	2412	1	SISO 20 MHz	12.08
	2437	6		11.75
	2462	11		12.12

Table 17: Measured max. output power values for IEEE 802.11 b/g/n for the used Option XYfi.

8 Evaluation

In Figure 5 - 10 the flat phantom SAR results for GPRS 850, GPRS 1900, WCDMA II (FDD) and IEEE 802.11 b given in Table 5 - 10 are summarized and compared to the limit.

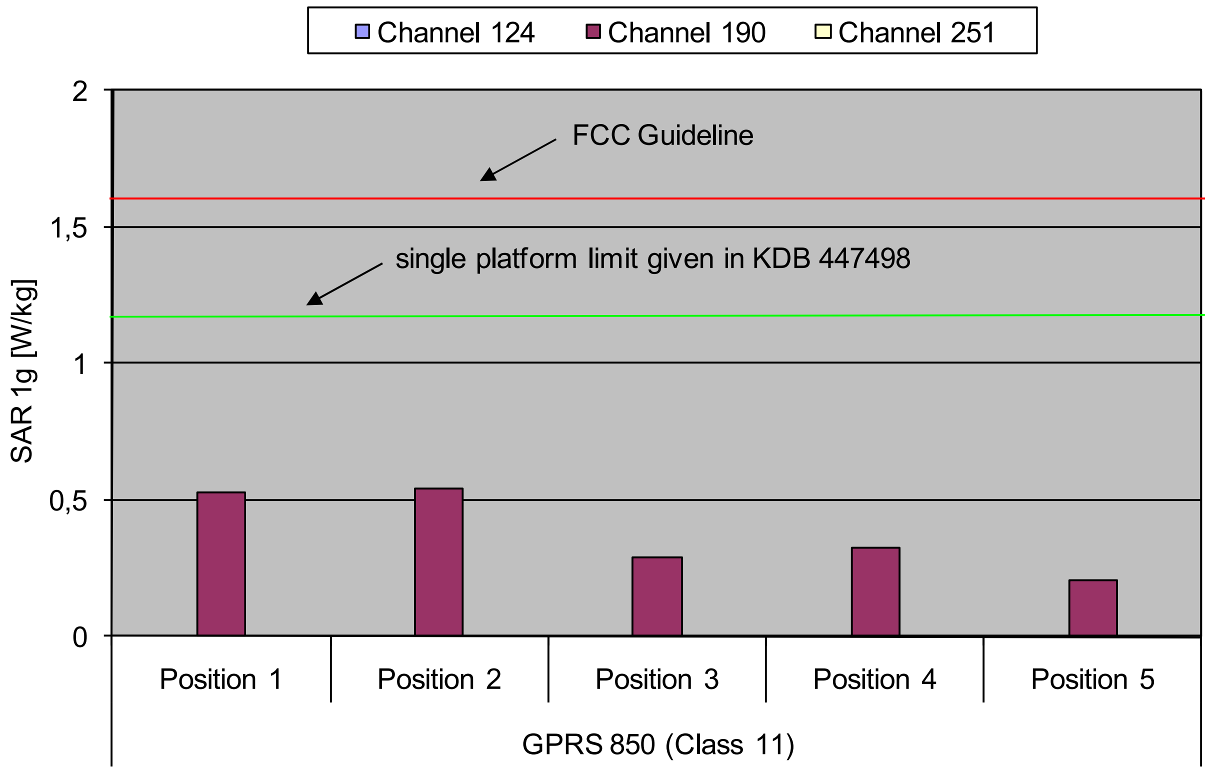

Fig. 5: The measured SAR values for the Option XYfi for GPRS 850 (Class 11) in comparison to the FCC exposure limit.

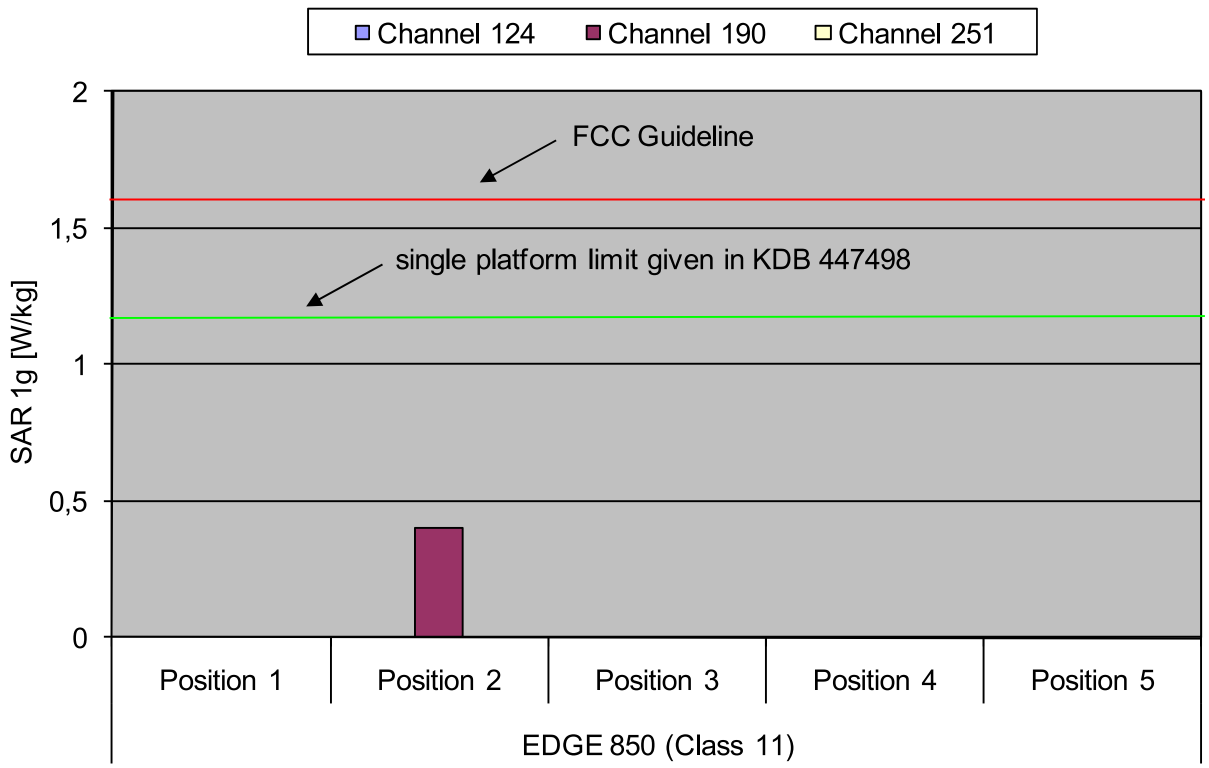

Fig. 6: The measured SAR values for the Option XYfi for EDGE 850 (Class 11) in comparison to the FCC exposure limit.

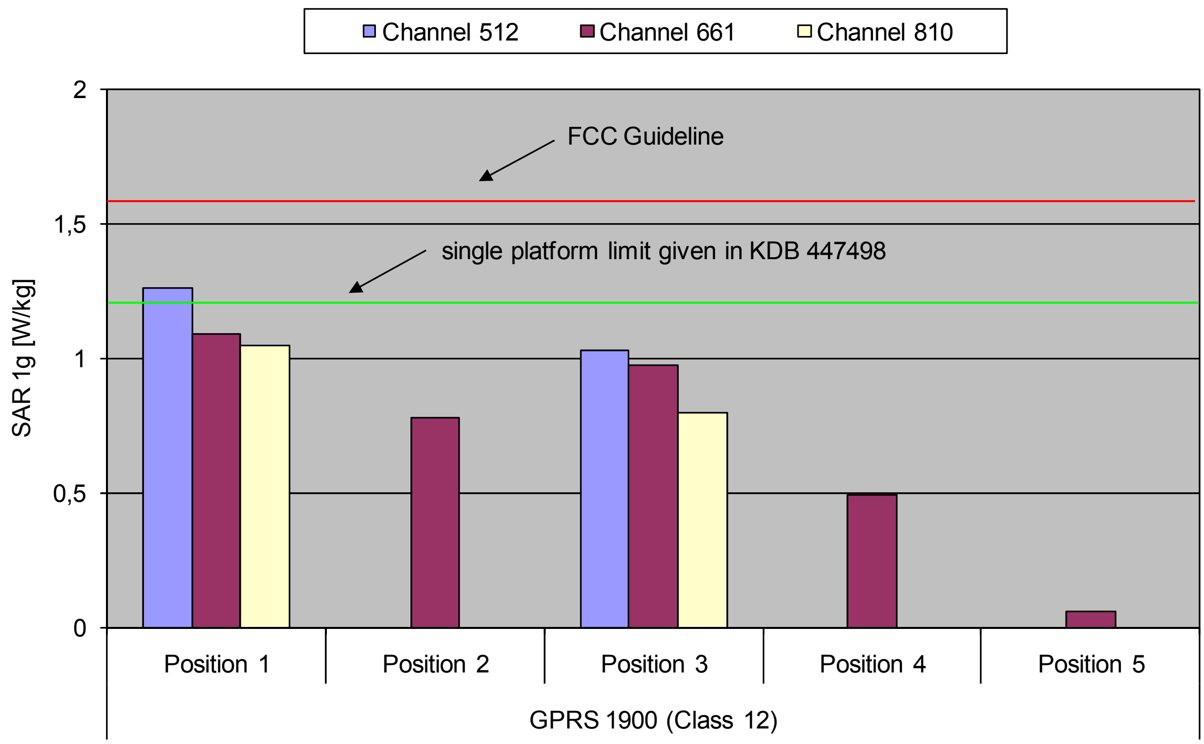

Fig. 7: The measured SAR values for the Option XYfi for GPRS 1900 (Class 12) in comparison to the FCC exposure limit.

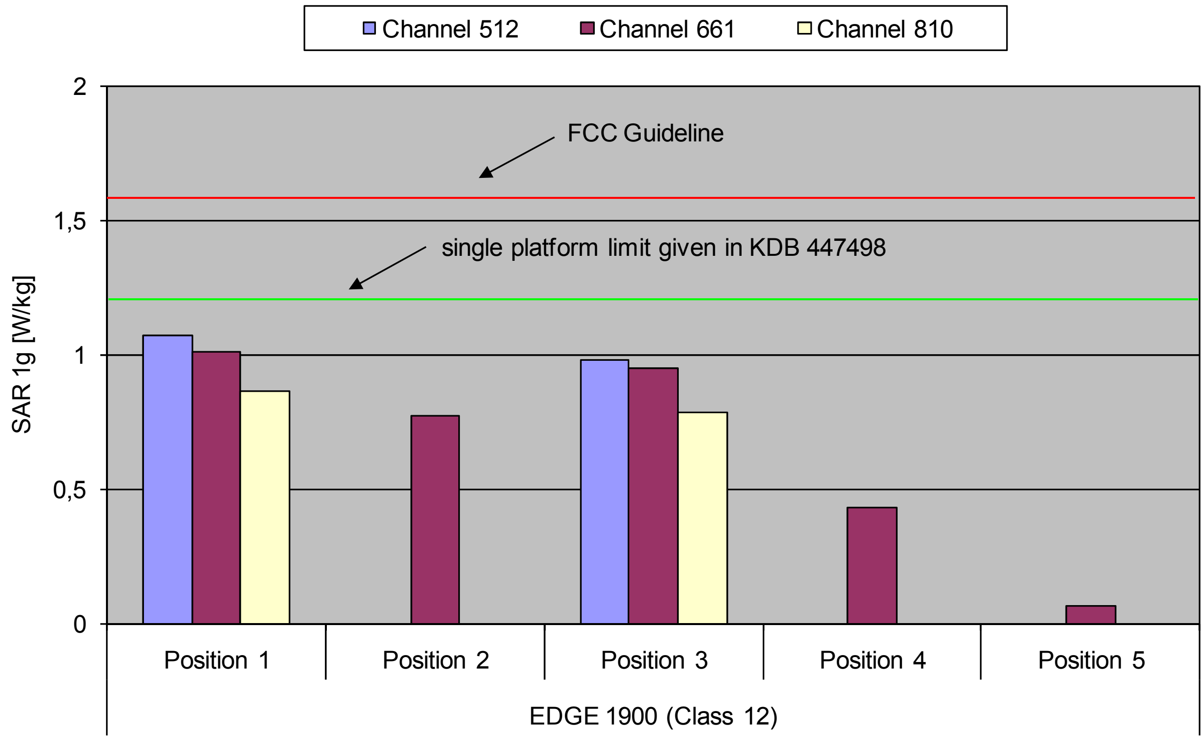

Fig. 8: The measured SAR values for the Option XYfi for EDGE 1900 (Class 12) in comparison to the FCC exposure limit.

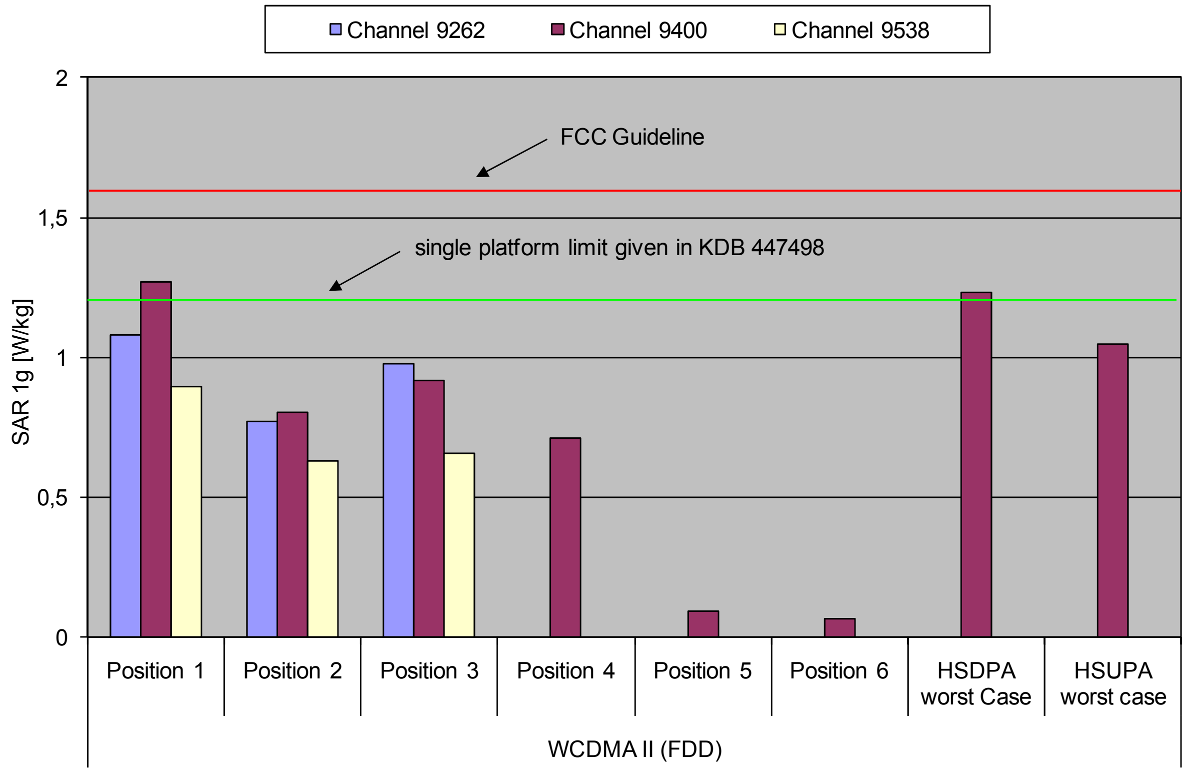

Fig. 9: The measured SAR values for the Option XYfi for WCDMA II (FDD) in comparison to the FCC exposure limit.

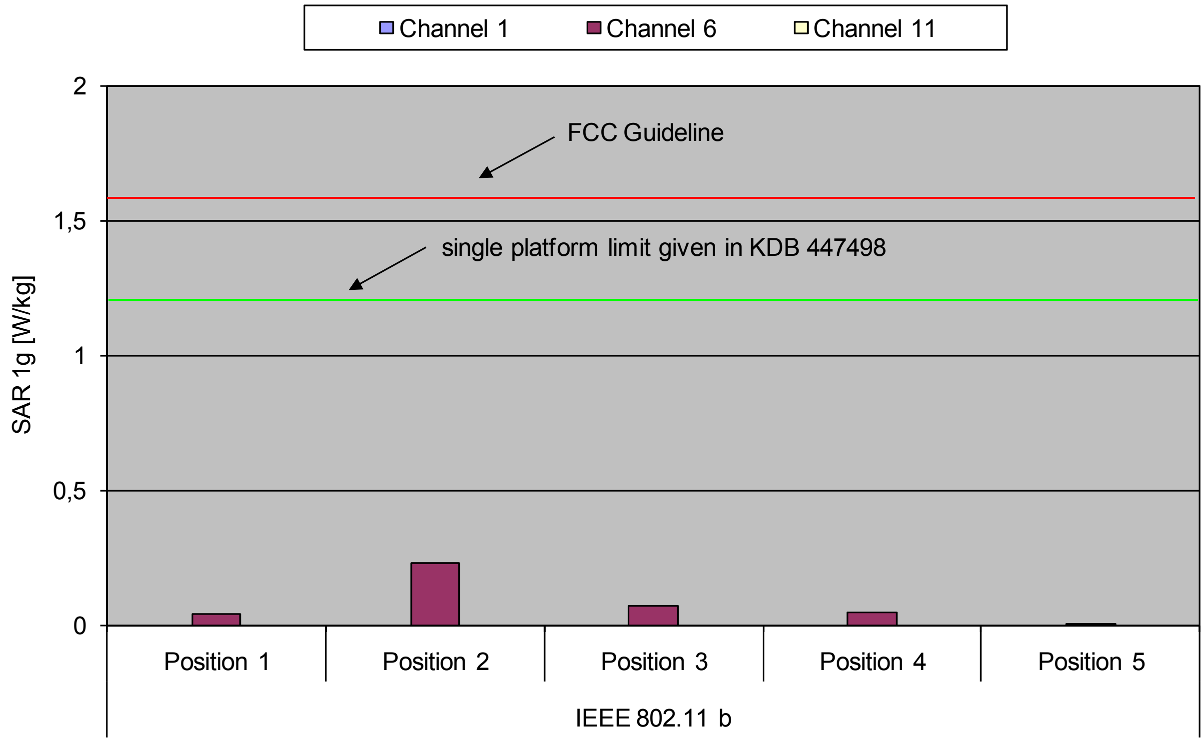

Fig. 10: The measured SAR values for the Option XYfi for IEEE 802.11 b in comparison to the FCC exposure limit.

9 Appendix

9.1 Administrative Data

Date of validation:	835 MHz (GPRS 850):	July 28, 2011
	835 MHz (WCDMA V):	July 28, 2011
	1900 MHz (GPRS 1900):	July 27, 2011
	1900 MHz (WCDMA II):	July 26, 2011
	2450 MHz (WLAN):	September 07, 2011

Date of measurement:	July 26, 2011 – September 07, 2011
Data stored:	7layers_6620_858
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

9.2 Device under Test and Test Conditions

MTE:	Option XYfi (USB stick), identical prototype
Date of receipt:	July 05, 2011
IMEI:	004401441460058
FCC ID:	NCMOGI0643
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: 4 tested with max.allow. UE Power of 24dBm
RF exposure environment:	General Population/ Uncontrolled
Power supply:	Host Device
Antenna:	Antenna Type: integrated swivel
Measured Standards:	GPRS 850 (Class 12) with 4TX uplink; GPRS 1900 (Class 12) with 4 TX uplink, WCDMA II, IEEE802.11b
Method to establish a call:	GPRS 850, GPRS 1900, WCDMA II, V: Basestation simulator, using the air interface
Modulation:	GPRS: GMSK; WCDMA (FDD): QPSK; IEEE802.11: DSSS
Used Phantom:	SAM Twin Phantom V4.0. as defined by the IEEE SCC-34/SC2 group and delivered by Schmid & Partner Engineering AG

Option XYfi	TX Range [MHz]	RX Range [MHz]	Used Channels [low. middle. high]	Used Crest Factor
GPRS/EDGE 850	824.2 – 848.8	869.2 – 893.8	128, 190, 251	2.67
GPRS/EDGE 1900	1850.2 –1909.8	1930.2 – 1989.8	512, 661, 810	2
WCDMA II (FDD)	1852.4 – 1907.6	1932.4 – 1987.6	9262, 9400, 9538	1
IEEE802.11 b	2412.0 – 2462.0	2412.0 – 2462.0	6	1

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

9.3 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
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-IonizedWater

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 Body (GPRS/EDGE 850)	Recommended Value	55.20 ± 2.70	0.97 ± 0.10
	Measured Value (Ch. 128)	54.30	0.98
	Measured Value (Ch. 190)	54.20	0.99
	Measured Value (Ch. 251)	54.10	1.00
1900 MHz Body. (GPRS /EDGE 1900)	Recommended Value	53.30 ± 2.65	1.52 ± 0.15
	Measured Value (Ch. 512)	54.20	1.46
	Measured Value (Ch. 661)	54.00	1.49
	Measured Value (Ch. 810)	53.90	1.55
1900 MHz Body. (WCDMA II)	Recommended Value	53.30 ± 2.65	1.52 ± 0.15
	Measured Value (Ch. 9262)	54.20	1.46
	Measured Value (Ch. 9400)	54.00	1.49
	Measured Value (Ch. 9538)	53.90	1.55
2450 MHz Body. (IEEE 802.11 b)	Recommended Value	52.70 ± 2.63	1.95 ± 0.09
	Measured Value (Ch. 1)	51.30	1.95
	Measured Value (Ch. 6)	51.00	1.98
	Measured Value (Ch. 11)	50.70	2.01

Table 19: Parameters of the tissue simulating liquid.

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 20 - 21 and shown in Fig. 11 - 13. 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 Body	2.49	55.70	1.00
D1900V2. SN #5d051		9.42	52.90	1.54
D2450V2. SN #709		13.20	51.70	2.00

Table 20: Dipole target results.

Used Dipoles		SAR_{1g} [W/kg]	ε_r	σ [S/m]
835 MHz. SN: 437 (GPRS/EDGE 850)	Measured Values Body	2.53	54.20	0.99
1900 MHz. SN:5d051 (GPRS/EDGE 1900 ; WCDMA II)		9.84	54.00	1.53
2450 MHz. SN:709 (IEEE 802.11)		13.60	50.80	1.99

Table 21: Measured dipole validation results.

Test Laboratory: IMST GmbH. DASY Blue (I); File Name: 280711_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 = 0.99 mho/m; ε_r = 54.2; 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) = 2.74 mW/g
d=10mm. Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm. dy=5mm. dz=5mm
Reference Value = 55.3 V/m; Power Drift = 0.009 dB
Peak SAR (extrapolated) = 3.59 W/kg
SAR(1 g) = 2.53 mW/g; SAR(10 g) = 1.66 mW/g
Maximum value of SAR (measured) = 2.75 mW/g

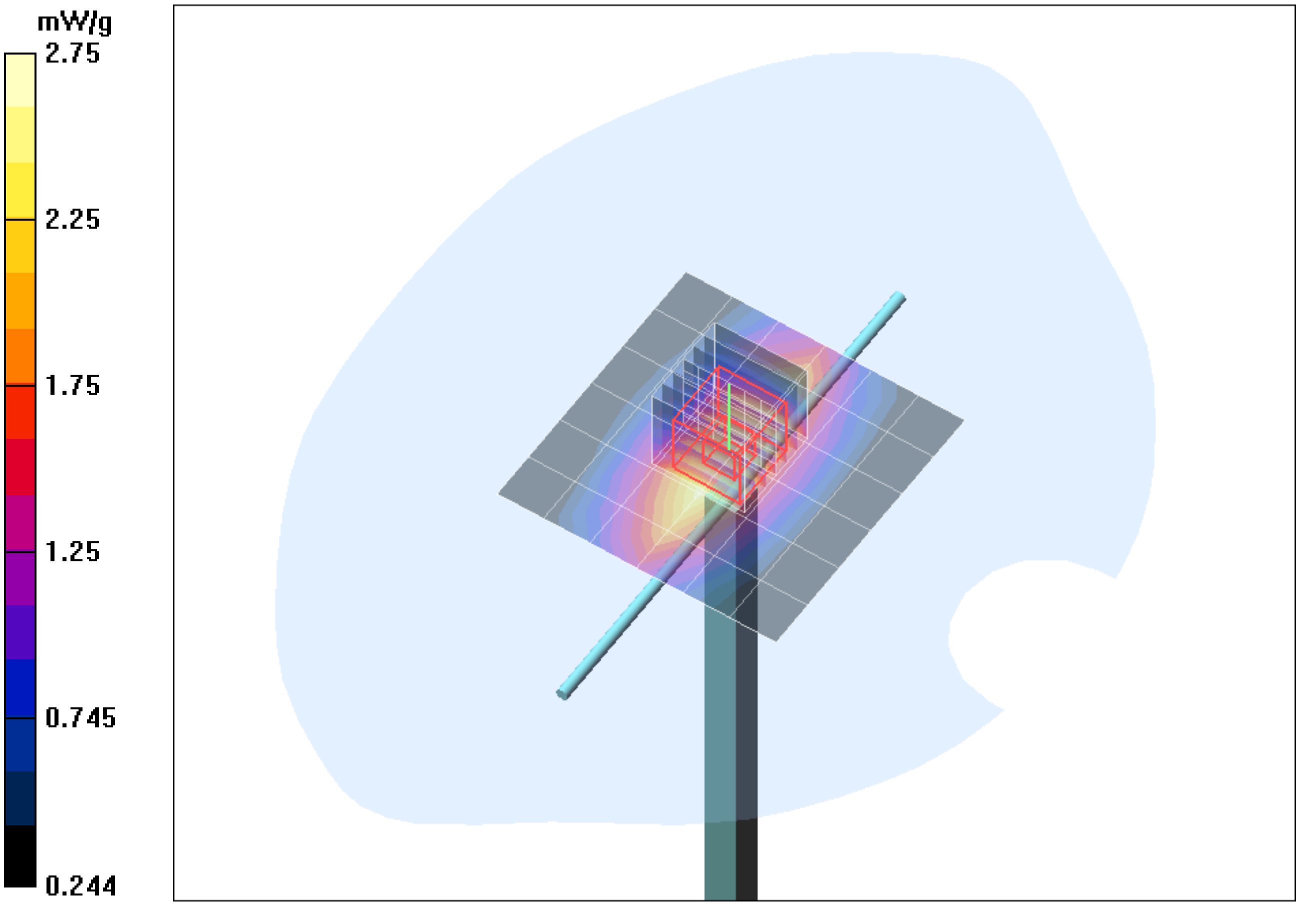

Fig. 11: Validation measurement 835 MHz Body (GPRS/EDGE 850, July 28, 2011), coarse grid. Ambient Temperature: 22.8°C. Liquid Temperature: 22.3°C.

Test Laboratory: Imst GmbH. DASY Yellow (II); File Name: 260711_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 = 1.53 mho/m; ε_r = 54; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(7.89. 7.89. 7.89); Calibrated: 16.09.2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 17.09.2010
- 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) = 11.0 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 = 0.028 dB
Peak SAR (extrapolated) = 18.5 W/kg
SAR(1 g) = 9.84 mW/g; SAR(10 g) = 5.06 mW/g

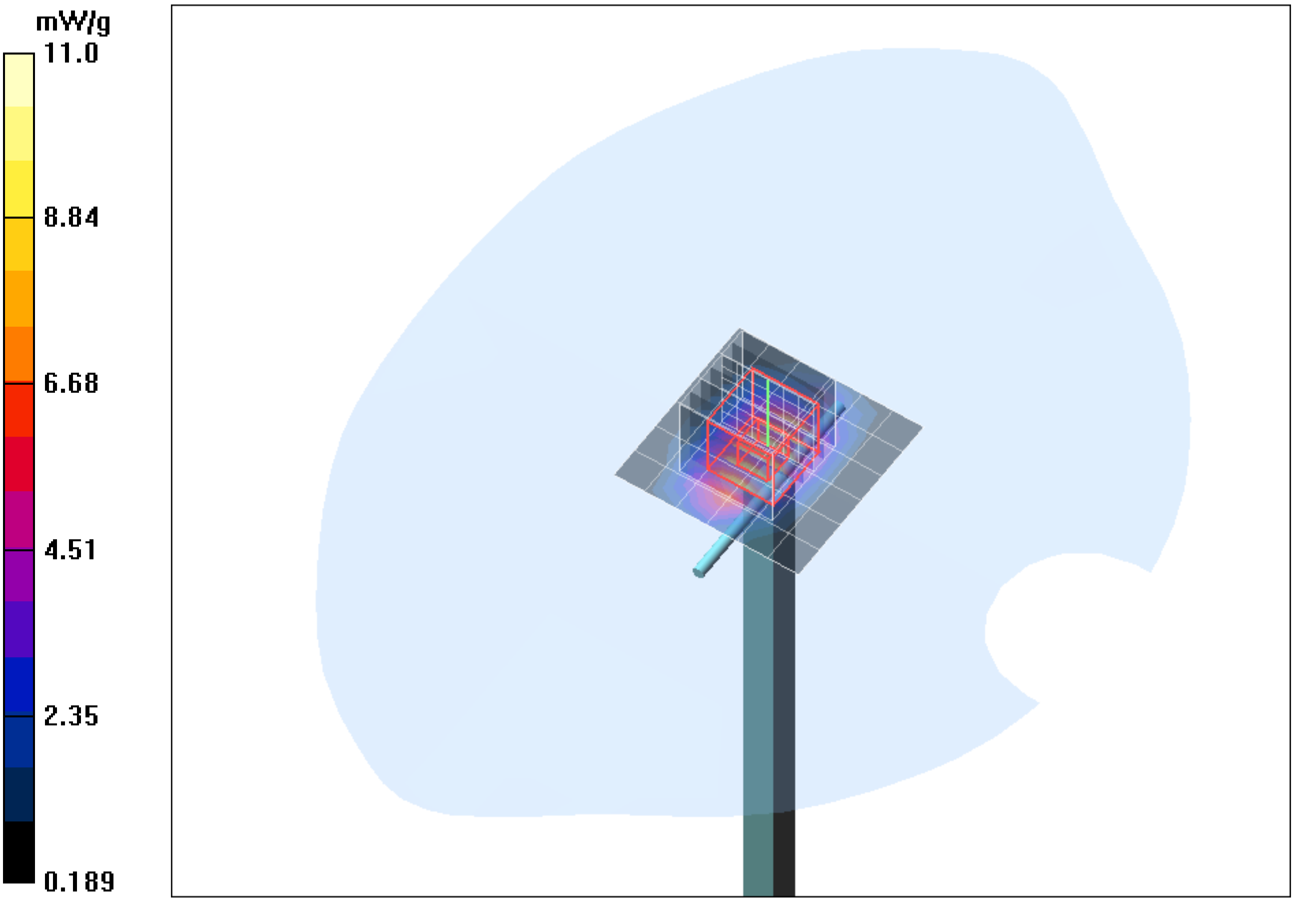

Fig. 12: Validation measurement 1900 MHz Body (GPRS/EDGE 1900 and WCDMA II, July 27, 2011), coarse grid. Ambient Temperature: 21.4°C. Liquid Temperature: 21.2°C.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 070911_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 = 1.99 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(7.48, 7.48, 7.48); Calibrated: 16.09.2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 17.09.2010
- 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) = 15.3 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.1 V/m; Power Drift = 0.026 dB
Peak SAR (extrapolated) = 28.6 W/kg
SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.23 mW/g

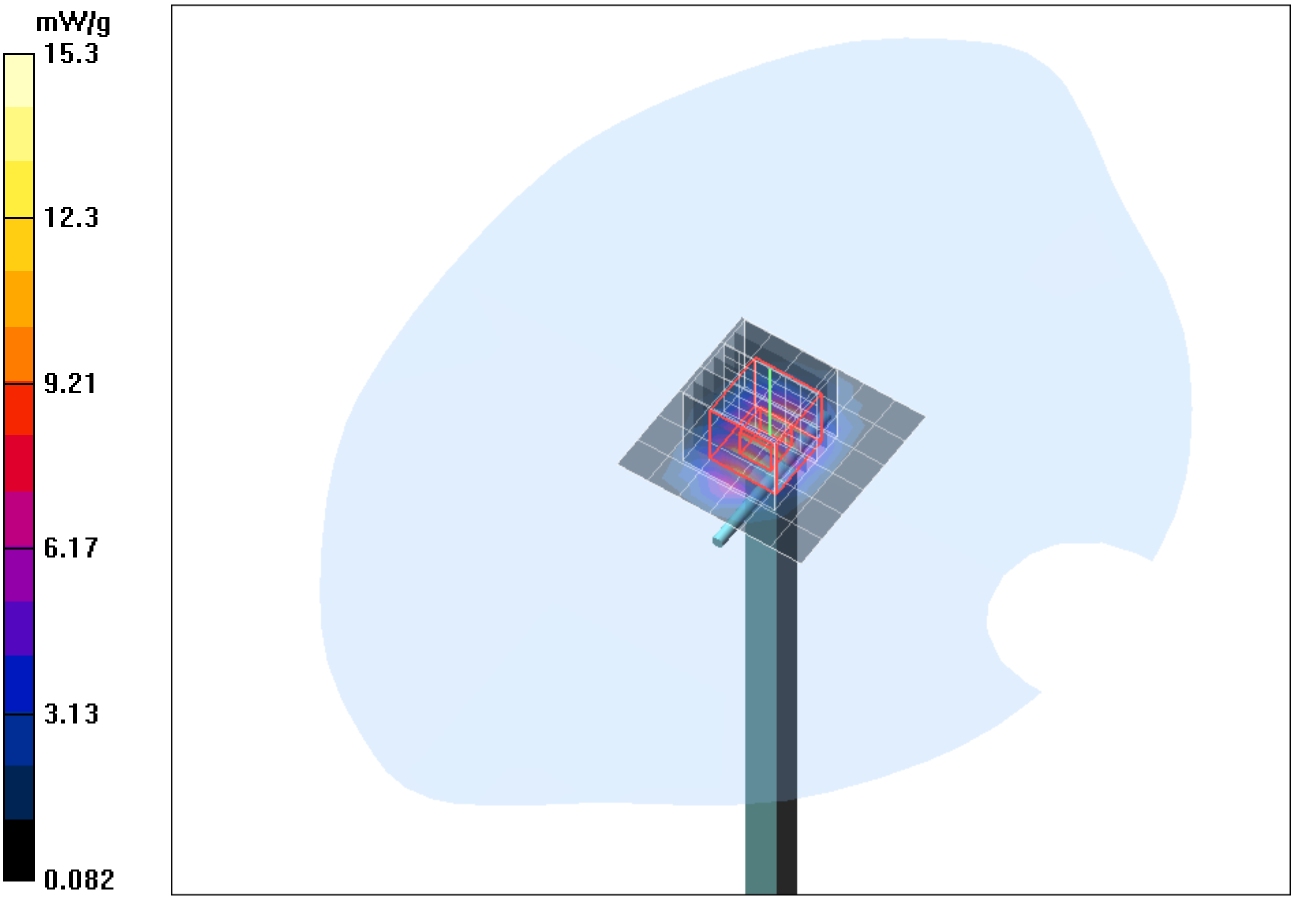

Fig. 13: Validation measurement 2450 MHz Body (IEEE 802.11, September 07, 2011). coarse grid. Ambient Temperature: 22.0°C. Liquid Temperature: 21.7°C.

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i	Standard Uncertainty	v_i^2 or v_{eff}
Measurement System						
Probe calibration	± 4.8 %	Normal	1	1	± 4.8 %	∞
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	± 1.0 %	Normal	1	1	± 1.0 %	∞
Response time	± 0 %	Rectangular	√3	1	± 0 %	∞
Integration time	± 0%	Rectangular	√3	1	± 0 %	∞
RF ambient conditions	± 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 eval.	± 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					± 8.4 %	

Table 22: 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: 37% ± 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	ET3DV6	1669	02/2011	02/2012
Dosimetric E-Field Probe	EX3DV4	3536	09/2010	09/2011
Data Acquisition Electronics	DAE 3	335	02/2011	02/2012
Data Acquisition Electronics	DAE 4	631	09/2010	09/2011
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	09/2009	09/2011
Validation Dipole	D2450V2	709	12/2009	12/2011
Material Measurement				
Network Analyzer	E5071C	MY46103220	08/2009	08/2011
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	12/2010	12/2012
Power Meter. Agilent	E4417A	GB41050441	12/2010	12/2012
Power Meter. Anritsu	ML2487A	6K00002319	12/2009	12/2011
Power Meter. Anritsu	ML2488A	6K00002078	12/2009	12/2011
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	12/2009	12/2011
Power Sensor. Anritsu	MA2490A	031565	12/2009	12/2011
RF Sources				
Network Analyzer	E5071C	MY46103220	08/2009	08/2011
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	01/2010	01/2012
Anritsu	MT8815B	6200586536	N/A	N/A

Table 24: Test equipment. General.

9.8 Certificates of Conformity

Schmid & Partner Engineering AG **speag**

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. 14: 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. 15: Certificate of conformity for the used SAM phantom.

9.9 Pictures of the Device under Test

Fig. 16 - 19 show the device under test.

-> Please refer to Test Setup Photos.

Fig. 16: Front view of the host device Dell Latitude X300.

-> Please refer to Test Setup Photos.

Fig. 17: Device under test.

-> Please refer to Test Setup Photos.

Fig. 18: Device under test. top view.

-> Please refer to Test Setup Photos.

Fig. 19: Device under test. bottom view.

9.10 Test Positions for the Device under Test

Fig. 20 – Fig. 26 show the test positions for the SAR measurements.

-> Please refer to Test Setup Photos.

Fig. 20: Position 1 with the Dell Latitude X300.

-> Please refer to Test Setup Photos.

Fig. 21: Position 2 with the Dell Latitude X300.

-> Please refer to Test Setup Photos.

Fig. 22: Position 3 with the Dell Latitude X300.

-> Please refer to Test Setup Photos.

Fig. 23: Position 4 with the Dell Latitude X300.

-> Please refer to Test Setup Photos.

Fig. 24: Position 5 with the Dell Latitude X300.

-> Please refer to Test Setup Photos.

Fig. 25: Position 6 (Bottom Tip configuration) with the Dell Latitude X300.

-> Please refer to Test Setup Photos.

Fig. 26: Position 1 (90° configuration) with the Dell Latitude X300.

9.11 Pictures to demonstrate the required Liquid Depth

Fig. 27 – Fig. 29 show the liquid depth in the used SAM phantom.

Fig. 27: Liquid depth for GPRS/EDGE 850 and WCDMA V Body measurements.

Fig. 28: Liquid depth for GPRS/ EDGE 1900 and WCDMA II Body measurements.

Fig. 29: Liquid depth for IEEE 802.11 Body measurements

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[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.

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