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 KX-TGAE20 (FCC ID: ACJ96NKX-TGAE20) (IC: 216A-KXTGAE20)

According to the FCC Requirements

November 22, 2013

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The test results only relate to the items tested. This report shall not be reproduced except in full without the written approval of the testing laboratory. This version supersedes all previous versions of this report.

Executive Summary

The KX-TGAE20 is a new cordless phone (Portable Device) from Panasonic operating in the 1920 MHz frequency range. The device has an integrated antenna and work in US DECT standard.

The objective of the measurements done by IMST was the dosimetric assessment of one device in a worst case setup in head and body worn configuration. The handset was set to use one specific frequency and maximum output power during the measurement. The examinations have been carried out with the dosimetric assessment system „DASY4“.

The measurements were made according to the 47 CFR § 2.1093 [47CFR] for evaluating compliance of mobile and portable devices with FCC limits for human exposure (general population) to radiofrequency emissions, IEEE 1528-2003 [IEEE1528-2003] and IC RSS 102 Issue 4.

Additional information and guidelines given by the following FCC documents were used:

- SAR Measurement Requirements for 100 MHz to 6 GHz [KDB 865664 D01 v01r01]
- Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies [KDB 447498 D01 v05r01]

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

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Compliance Statement

The Panasonic KX-TGAE20 cordless phone (FCC ID: ACJ96NKX-TGAE20; IC: 216A-KXTGAE20) is in compliance with the following standards for uncontrolled exposure:

- **47 CFR § 2.1093 [47CFR]**
- **IC RSS 102 Issue 4 [RSS 102],**
- **IEEE Std. C95.1 - 1999 [C95.1-1999],**
- **IEEE Std. C95.3 - 2002 [C95.3-2002],**
- **IEEE 1528-2003 [IEEE 1528-2003],**
- **The latest version of all relevant FCC OET KDB Procedures**

The phone was tested in addition to the head positions in the following body worn configurations:

- **Display towards the phantom, headset + belt clip attached, distance 0 mm**
- **Display towards the ground, headset + belt clip attached, distance 0 mm**

The maximum results of SAR for the KX-TGAE20 are as follows:

Band	Frequency [MHz]	CH	Phantom Configuration		Figure No.	Highest Measured SAR_{1g} [W/kg]	Highest Reported SAR_{1g} [W/kg]	Plot No.
US DECT	1924.992	2	Left Head	Cheek	15	0.034	0.034	1
			Body Worn	Pos. 1	19	0.019	0.019	5

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1 Subject of Investigation

The KX-TGAE20 is a new cordless phone (Portable Device) from Panasonic operating in the 1920 MHz frequency range. The device has an integrated antenna and work in US DECT standard.

Fig. 1: Pictures of the device under test.

The objective of the measurements done by IMST was the dosimetric assessment of one device in a worst case setup in head and body worn configuration. The handset was set to use one specific frequency and maximum output power during the measurement. 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 [KDB 865664] 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.

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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:

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

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 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.

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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]. In 2013 the FCC has published a Notice of Proposed Rule Making [FCC 03-137] that discontinued the Supplement C to OET Bulletin 65 and reference will be made to KDB publications in 2.1093 (d)(3) of 47 CFR [47 CFR].

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.

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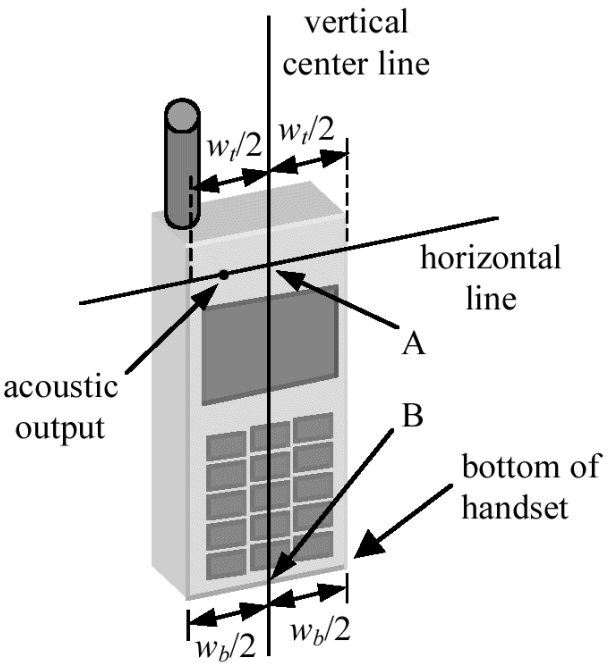

Fig. 2: Handset vertical and horizontal reference lines.

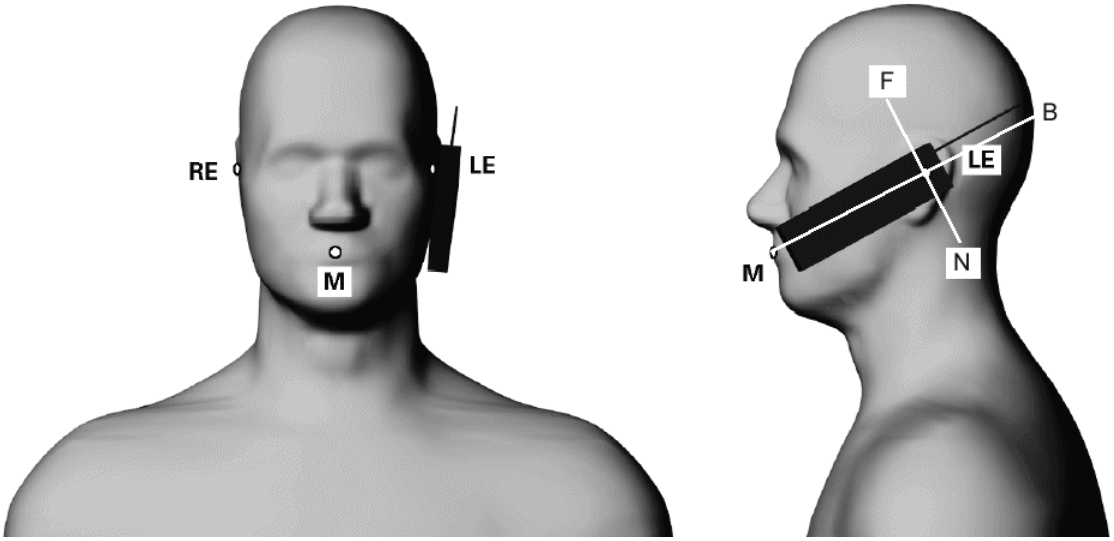

Fig. 3: Phantom reference points.

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

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- **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.

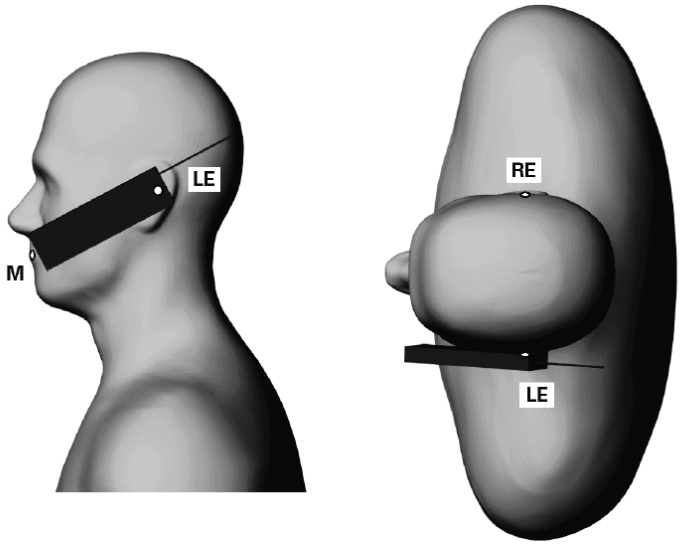

Fig. 4: The cheek position.

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

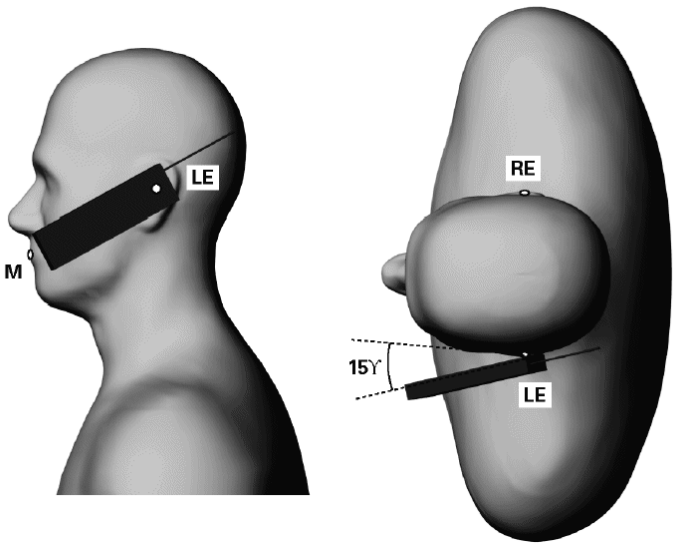

Fig. 5: The tilted position.

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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.

3.2.4 Measurement Variability

According KDB 865664 SAR measurement variability was assessed for each frequency band which was determined by the SAR probe calibration point and tissue equivalent medium, used for the device measurement. When both head and body tissue equivalent media were required for SAR measurements in a frequency band, the variability measurement procedure were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue equivalent medium in a frequency band. The test device was returned to ambient conditions with the battery fully charged before it was remounted on the device holder for the repeated measurements to minimize any unexpected variations in the repeated results. Repeated measurement is not required when the original measured highest SAR is < 0.8 W/kg.

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4 Body-worn Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. Per FCC KDB 648474 [KDB 648474], Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB 447498 [KDB 447498] should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body worn accessory, measured without headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body worn accessory with a headset attached to the handset.

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.

Devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body worn accessories, must be tested for SAR compliance using a conservative minimum test separation distance ≤ 5 mm to support compliance. Nevertheless, all accessories that contain metallic components must be tested for compliance additionally.

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

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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 resp. that channel with the highest output power for each test configuration is < 0.4 W/kg, testing at the high and low channels is optional.

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. 11
- 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

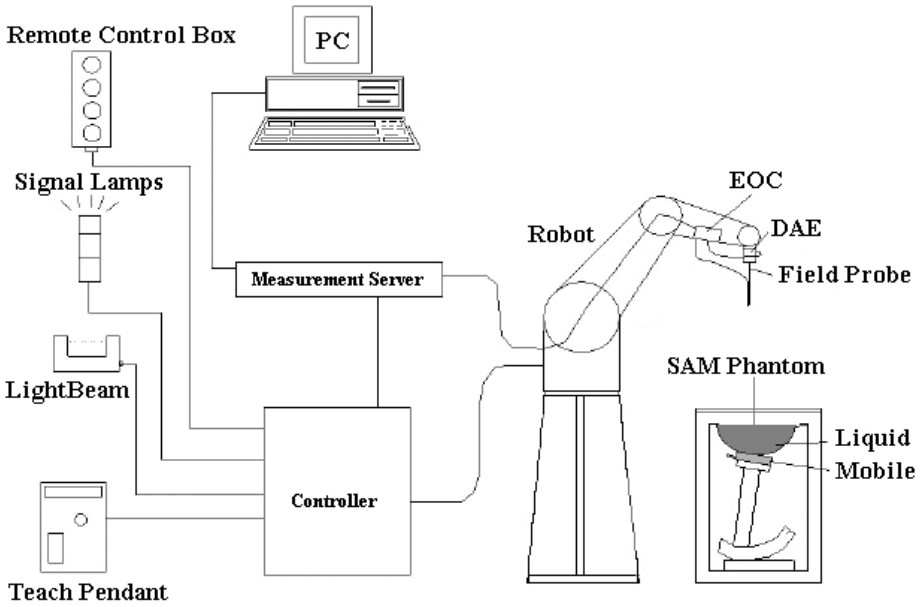

Fig. 6: The DASY4 measurement system.

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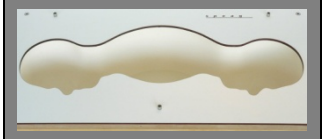
Fig. 7: The measurement set-up with two SAM phantoms containing tissue simulating liquid.

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 Phantoms

Twin SAM Phantom V4.0	
	Specific Anthropomorphic Mannequin defined in IEEE 1528 and IEC 62209-1 and delivered by Schmid & Partner Engineering AG. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. The details and the Certificate of conformity can be found in Fig. 12.
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)
Dimensions	Length: 1000 mm; Width: 500 mm Height: adjustable feet
Filling Volume	approx. 25 liters

5.2 E-Field-Probes

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.

ET3DV6R	
Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system (ET3DV6 only) Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Dimensions	Overall length: 337 mm (Tip: 16 mm) Tip diameter: 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm
Frequency	10 MHz to 2.3 GHz Linearity: ± 0.2 dB (30 MHz to 2.3 GHz)
Directivity	Axial isotropy: ± 0.2 dB in TSL (rotation around probe axis) Spherical isotropy: ± 0.4 dB in TSL (rotation normal to probe axis)
Dynamic Range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Calibration Range	450 MHz / 750 MHz / 900 MHz / 1750 MHz / 1900 MHz / 1950 MHz for head and body simulating liquid

EX3DV4	
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Frequency	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	Axial isotropy: ± 0.3 dB in TSL (rotation around probe axis) Spherical isotropy: ± 0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Calibration Range	1950 MHz / 2450 MHz / 2600 MHz / 3500 MHz / 5200 MHz / 5300 MHz / 5600 MHz / 5800 MHz for head and body simulating liquid

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 resolution settings for area scan and zoom scan according KDB 865664 D01 as shown in Table 2.
- 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.

			≤ 3 GHz	≥ 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 - 3 GHz: ≤ 12 mm	3 - 4 GHz: ≤ 12 mm 4 - 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: ΔX_{Zoom}, ΔY_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 - 3 GHz: ≤ 5 mm*	3 - 4 GHz: ≤ 5 mm* 4 - 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	Uniform grid: $\Delta Z_{Zoom}(n)$		≤ 5 mm	3 - 4 GHz: ≤ 4 mm 4 - 5 GHz: ≤ 3 mm 5 - 6 GHz: ≤ 2 mm
	graded grid	$\Delta Z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 - 4 GHz: ≤ 3 mm 4 - 5 GHz: ≤ 2.5 mm 5 - 6 GHz: ≤ 2 mm
		$\Delta Z_{Zoom}(n>1)$: between subsequent points	≤ 1.5· $\Delta Z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 - 4 GHz: ≥ 28 mm 4 - 5 GHz: ≥ 25 mm 5 - 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium: see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz				

Table 2: Parameters for SAR scan procedures.

5.4 Uncertainty Assessment

Table 3 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 3: Uncertainty budget of DASY4.

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6 Output Power Values and Tune-Up Information

Band	Frequency [MHz]	Channel	Output Power [dBm]	Tune-Up Tolerance [dBm]	Tune-Up Limit [dBm]
US DECT	1921.536	00	19.0	0	19.0
	1924.992	02	19.1	0	19.1
	1928.448	04	19.1	0	19.1

Table 4: Measured output power values for Panasonic KX-TGAE20.

7 SAR Results

The tables below contain the measured SAR values averaged over a mass of 1 g. SAR assessment was conducted in the worst case configuration with output power values according Table 4.

According KDB 447498 D01 V05, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.

Scaling Factor = tune-up limit power (mW) / RF power (mW)
Reported SAR = measured SAR * scaling factor

Furthermore, testing of other required channels within the operating mode of frequency band is not required when the reported SAR for the mid-band or highest output power channel is ≤ 0.4 W/kg for transmission band ≥ 200 MHz.

Band	Freq. [MHz]	CH	Phantom Configuration		Figure No.	Measured SAR_{1g} [W/kg]	Power Drift [dB]	Scaling Factor	Reported SAR_{1g} [W/kg]	Plot No.
US DECT	1924.992	2	Left Head	Cheek	15	0.034	-0.152	1	0.034	1
				Tilted	16	0.016	-0.176	1	0.016	2
			Right Head	Cheek	17	0.025	-0.028	1	0.025	3
				Tilted	18	0.015	-0.179	1	0.015	4
	1924.992	2	Body Worn	Pos. 1	19	0.019	0.154	1	0.019	5
				Pos. 2	20	0.009	-0.062	1	0.009	6

Table 5: Measurement results in head and body worn configuration for the Panasonic KX-TGAE20.

Since the measured max SAR is < 0.8 W/kg measurement variability assessment according KDB 865664 is not applicable.

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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 Evaluation

In figure 8 the SAR results for US DECT Standard given in table 5 are summarized and compared to the limit.

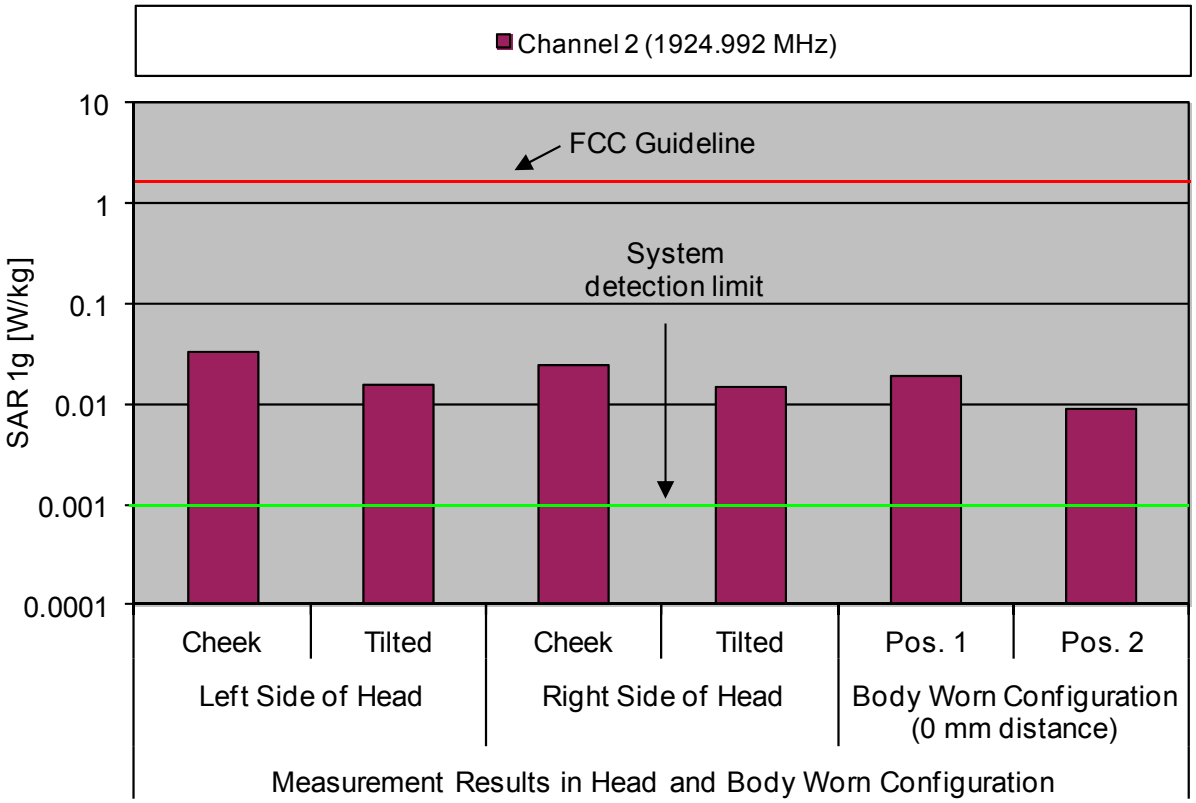

Fig. 8: The reported SAR values for head and body worn configuration for the Panasonic KX-TGAE20, for the US DECT standard in comparison to the FCC exposure limit.

Dasy_Report_FCC_DECT_1900_Head_Body_1.0/10.07.2013/AvB

8 Appendix

8.1 Administrative Data

Date of Validation:	1900 MHz, Head: November 18, 2013
	1900 MHz, Body: November 20, 2013
Date of Measurement:	November 19, 2013 - November 20, 2013
Data Stored:	Nemko_60320_6130400
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

8.2 Device under Test and Test Conditions

MTE:	Panasonic KX-TGAE20 (production line unit)
Date of Receipt:	November 15, 2013
SN:	N.A.
FCC ID:	ACJ96NKX-TGAE20
IC ID:	216A-KXTGAE20
Equipment Class:	Portable device
RF Exposure Environment:	General Population/ Uncontrolled
Power Supply:	Internal Battery
Antenna:	integrated
Used Accessory:	Headset (KX-TCA430), belt clip
Measured Standards:	US DECT (1924.992 MHz)
Method to Establish a Call:	Internal software
Crest Factor:	24
TX Range:	DECT: 1921.536 MHz – 1928.448 MHz
RX Range:	DECT: 1921.536 MHz – 1928.448 MHz
Used TX Channels:	DECT: low: ch 0 center: ch 2, high: ch 4
Used Phantom:	SAM Twin Phantom V4.0, as defined by the IEEE SCC-34/SC2 group and delivered by Schmid & Partner Engineering AG

8.3 Tissue Recipes

The following recipes are provided in percentage by weight.

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

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8.4 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]	Temperature	
				Ambient [C]	Liquid [° C]
1900 MHz Head	Recommended Value	40.00 ± 2.00	1.40 ± 0.07	20.0 - 26.0	-
	Measured Value (Validation)	40.70	1.38	21.2	20.9
	Measured Value (CH 02)	40.60	1.40	21.2	20.9
1900 MHz Body	Recommended Value	53.30 ± 2.60	1.52 ± 0.07	20.0 - 26.0	-
	Measured Value (Validation)	52.00	1.53	21.1	20.4
	Measured Value (CH 02)	51.90	1.56	21.3	20.5

Table 6: Parameters of the tissue simulating liquids.

8.5 Simplified Performance Checking

The simplified performance check was realized using the dipole validation kits. The input power of the dipole antennas were 250 mW (cw signal) and they were placed under the flat part of the SAM phantom. The target and measured results are listed in the table 7 - 8 and shown in figure 9 - 10. The target values were adopted from the calibration certificates which are attached in the appendix. Table 9 includes the uncertainty assessment for the system performance checking which was suggested by the [IEEE 1528-2003] and determined by Schmid & Partner Engineering AG. The expanded uncertainty (K=2) is assessed to be ± 16.8%.

Available Dipoles		SAR_{1g} [W/kg]	ε_r	σ [S/m]
D1900V2, SN #5d051	Target Values Head	9.80	41.40	1.43
D1900V2, SN #5d051	Target Values Body	9.53	55.00	1.51

Table 7: Dipole target results as given by the calibration certificates.

Used Dipoles		SAR_{1g} [W/kg]	ε_r	σ [S/m]	Temperature	
					Ambient [C]	Liquid [° C]
1900 MHz, SN #5d051	Measured Values Head	9.74	40.70	1.38	21.2	20.9
1900 MHz, SN #5d051	Measured Values Body	9.24	52.00	1.53	21.1	20.4

Table 8: Measured dipole validation results.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 181113_y_1669.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 = 40.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(5.05, 5.05, 5.05); Calibrated: 19.02.2013
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 23.09.2013
- 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) = 11.1 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.7 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 17.3 W/kg
SAR(1 g) = 9.74 mW/g; SAR(10 g) = 5.01 mW/g
Maximum value of SAR (measured) = 11.0 mW/g

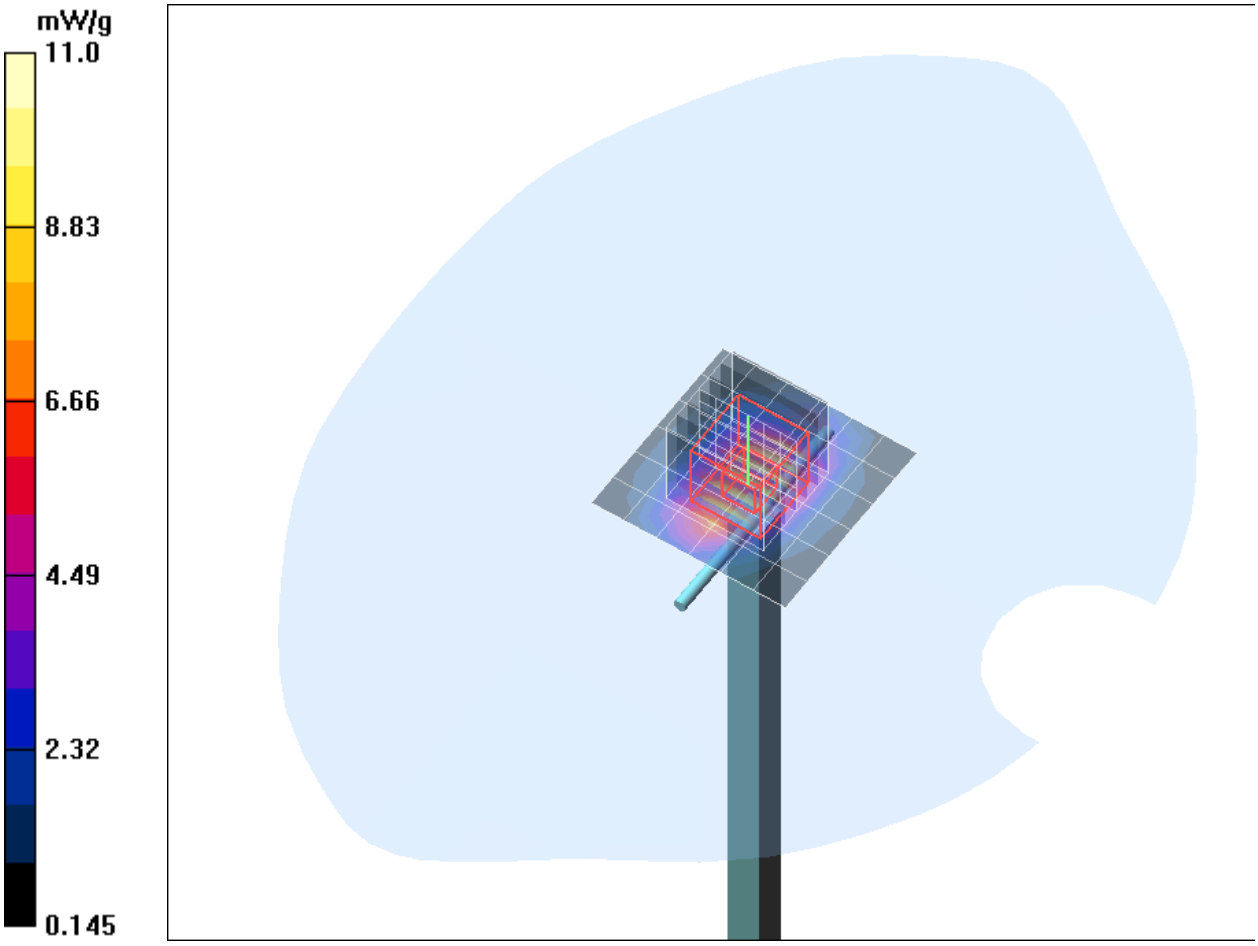

Fig. 9: Validation measurement 1900 MHz Head (November 18, 2013), coarse grid.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 201113_y_1669.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 = 52; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(4.68, 4.68, 4.68); Calibrated: 19.02.2013
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 23.09.2013
- 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) = 10.5 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.4 V/m; Power Drift = 0.027 dB
Peak SAR (extrapolated) = 15.3 W/kg
SAR(1 g) = 9.24 mW/g; SAR(10 g) = 4.87 mW/g

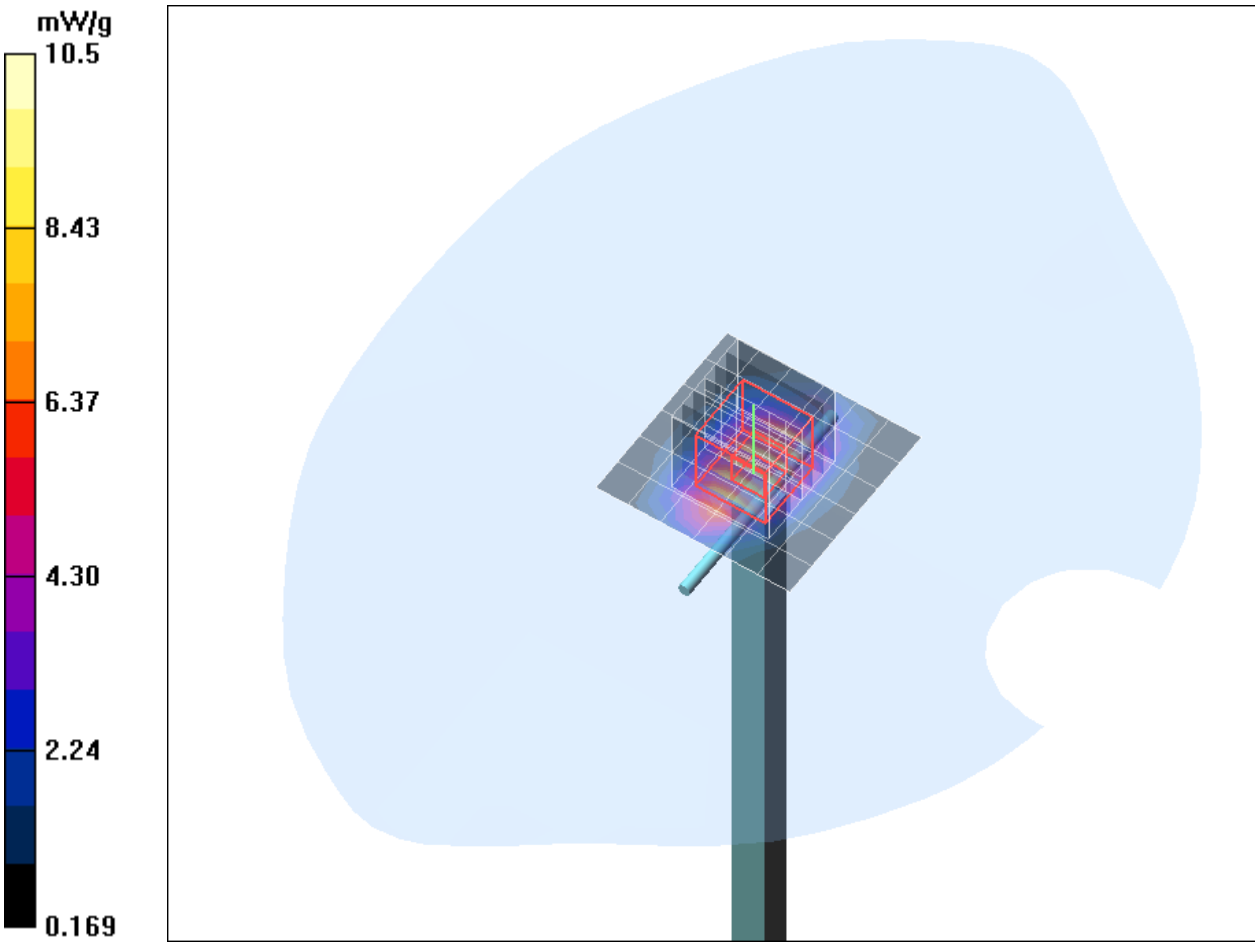

Fig. 10: Validation measurement 1900 MHz Body (November 20, 2013), coarse grid.

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	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 %	∞
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					± 9.2 %	

Table 9: Uncertainty budget for the system performance check.

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8.6 Environment

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

8.7 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	03/2013	03/2014
Data Acquisition Electronics	DAE 4	631	09/2013	09/2014
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	D1900V2	5d051	09/2013	09/2015
Material Measurement				
Network Analyzer	E5071C	MY46103220	07/2013	07/2015
Dielectric Probe Kit	HP85070B	US33020263	N/A	N/A

Table 10: SAR equipment.

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Test Equipment	Model	Serial Number	Last Calibration	Next Calibration
Power Meters				
Power Meter, Agilent	E4416A	GB41050414	12/2012	12/2014
Power Meter, Agilent	E4417A	GB41050441	12/2012	12/2014
Power Meter, Anritsu	ML2487A	6K00002319	02/2012	02/2014
Power Meter, Anritsu	ML2488A	6K00002078	02/2012	02/2014
Power Sensors				
Power Sensor, Agilent	E9301H	US40010212	12/2012	12/2014
Power Sensor, Agilent	E9301A	MY41495584	12/2012	12/2014
Power Sensor, Anritsu	MA2481B	031600	02/2012	02/2014
Power Sensor, Anritsu	MA2490A	031565	02/2012	02/2014
RF Sources				
Network Analyzer	E5071C	MY46103220	07/2013	07/2015
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 11: Test equipment, General.

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8.8 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. 11: 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

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Fig. 12: Certificate of conformity for the used SAM phantom.

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8.9 Pictures of the Device under Test

Figure 13 - 14 show the device under test and the used accessory.

CONFIDENTIAL

Fig. 13: Pictures of the device under test.

CONFIDENTIAL

Fig. 14: Pictures of the used accessory, headset and belt clip .

Dasy_Report_FCC_DECT_1900_Head_Body_1.0/10.07.2013/AvB

8.10 Test Positions for the Device under Test

Figure 15 - 20 show the test positions for the SAR measurements.

Fig. 15: Cheek position, left side.

Fig. 16: Tilted position, left side.

Fig. 17: Cheek position, right side.

Fig. 18: Tilted position, right side.

Fig. 19: Body worn configuration for KX-TGAE20, position 1, display towards the phantom, 0 mm distance.

Fig. 20: Body worn configuration for KX-TGAE20, position 2, display towards the ground, 0 mm distance.

Dasy_Report_FCC_DECT_1900_Head_Body_1.0/10.07.2013/AvB

8.11 Pictures to Demonstrate the Required Liquid Depth

Figure 21 - 22 show the liquid depth in the used SAM phantom.

Fig. 21: Liquid depth for 1900 MHz
Head measurements

Fig. 22: Liquid depth for 1900
Body worn measurements

Dasy_Report_FCC_DECT_1900_Head_Body_1.0/10.07.2013/AvB

9 References

[OET 65] Federal Communications Commission: Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01), FCC, 2001.

[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.

[IEEE C95.1-2005] IEEE Std C95.1-2005: 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., 2005.

[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

[KDB 648474] 648474 D01 SAR Handsets Multi Xmiter and Ant, v01r05 , SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas

[KDB 447498] 447498 D01 v05r01 General RF Exposure Guidance v05, May 28, 2013

[KDB 865664] 865664 D01 v01r01 SAR measurement 100 MHz to 6 GHz, May 28, 2013

[47 CFR] Code of Federal Regulations; Title 47, Telecommunications

Dasy_Report_FCC_DECT_1900_Head_Body_1.0/10.07.2013/AvB