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# Report

# Dosimetric Assessment of the Portable Device KX-PRXA10 (FCC ID: ACJ96NKX-PRXA10) (IC: 216A-KXPRXA10)

# According to the FCC Requirements

December 03, 2013


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This revised version supersedes all previous versions.


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## Executive Summary

The KX-PRXA10 is a new cordless phone (Portable Device) from Panasonic operating in the 1920 MHz and 2400 MHz frequency range. The device has two integrated antennas and work in US DECT, IEEE 802.11 b/g/n and Bluetooth standards. Since Bluetooth and IEEE 802.11 b/g/n share one antenna, simultaneous transmission in these modes is not avaidable.

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. Since there was a special test software available, SAR tests in DECT and IEEE 802.11 b/g/n are conducted with a specific channel, bandwidth and maximum output power during the measurement. Based on the KDB 648474 [KDB 648474] measurements with Bluetooth are not required since the output power is below the threshold for Bluetooth. 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 and IEEE 1528-2003 [IEEE1528-2003].

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]
- SAR Measurement Procedures for 802.11 a/b/g Transmitters [KDB 248227]

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

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## Compliance Statement

**The Panasonic KX-PRXA10 cordless phone (FCC ID: ACJ96NKX-PRXA10; IC: 216A-KXPRXA10) is in compliance with the following standards for uncontrolled exposure:**

- **47 CFR § 2.1093 [47CFR]**
- **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, distance 0 mm**
- **Display towards the ground, distance 0 mm**

**The maximum results of SAR for the KX-PRXA10 are as follows:**

| WORST CASE SAR RESULTS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Phantom Configuration** | | **Highest $SAR_{1g}$ for DECT [W/kg]** | **Highest $SAR_{1g}$ for WiFi [W/kg]** | **Estimated SAR for BT [W/kg]** | **Combined Reported $SAR_{1g}$ [W/kg]** | **SAR Limit [W/kg]** | |
| HEAD | Right Cheek | 0.027 | 0.162 | | 0.189 | 1.6 | PASS |
| BODY | Pos. 2 | 0.043 | 0.662 | | 0.705 | 1.6 | PASS |

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## Subject of Investigation

The KX-PRXA10 is a new cordless phone (Portable Device) from Panasonic operating in the 1920 MHz and 2400 MHz frequency range. The device has two integrated antennas and work in US DECT, IEEE 802.11 b/g/n and Bluetooth standards. Since Bluetooth and IEEE 802.11 b/g/n share one antenna, simultaneous transmission in these modes is not avaidable.

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. Since there was a special test software available, SAR tests in DECT and IEEE 802.11 b/g/n are conducted with a specific channel, bandwidth and maximum output power during the measurement. Based on the KDB 648474 [KDB 648474] measurements with Bluetooth are not required since the output power is below the threshold for Bluetooth. The examinations have been carried out with the dosimetric assessment system „DASY4.

## 1 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].

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.

| RULE | SAR LIMIT [W/kg] |
|---|---|
| 47 CFR § 2.1093 (d)(2) | 1.6 |

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

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## 1.1 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.

## 1.2 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 $\sigma$ and the mass density $\rho$ of the biological tissue:

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

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.

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# 2 The FCC Measurement Procedure

## 2.1 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. All tests have been conducted according the latest version of all relevant KDBs.

## 2.2 Device Operating Next to a Person's Ear

### 2.2.1 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.

### 2.2.2 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 IEEE 1528-2003 [IEEE 1528] requires two test positions. For an exact description helpful geometrical definitions are introduced and shown in Fig. 2 - 3.

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

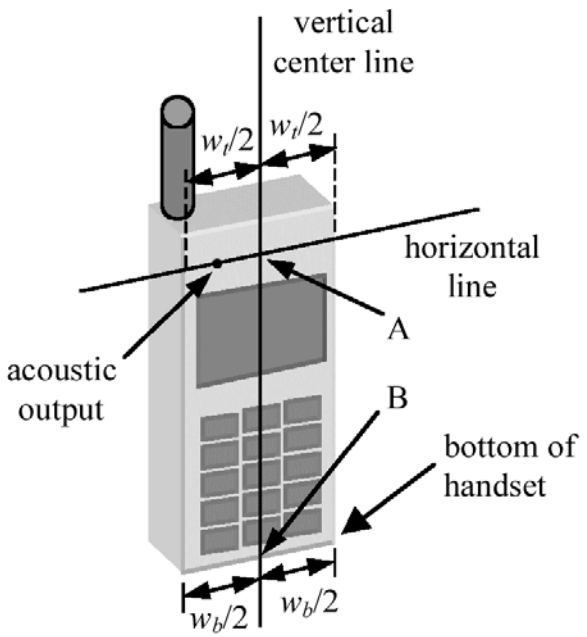


Fig. 2: Handset vertical and horizontal reference lines.

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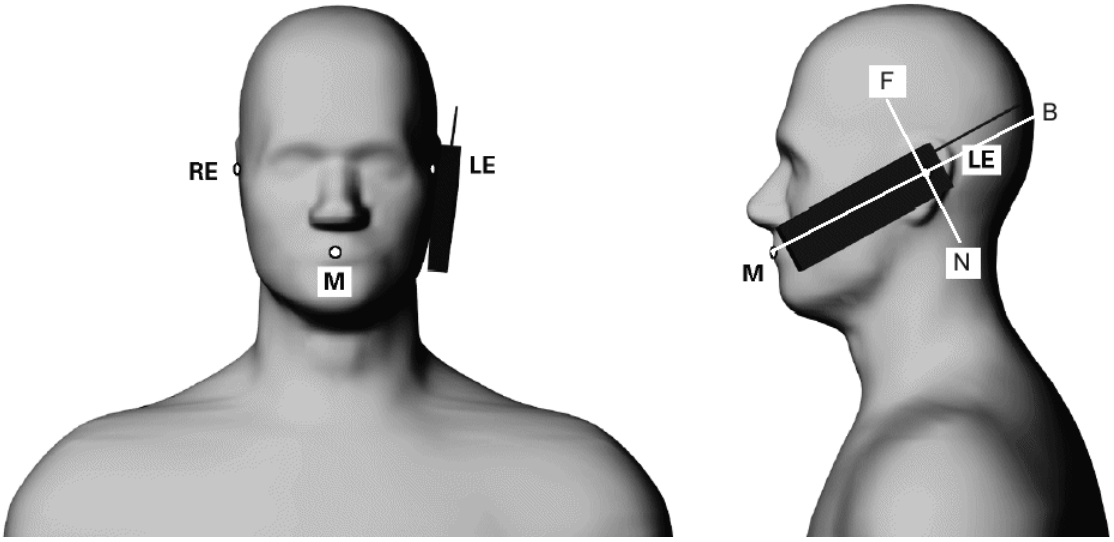


Fig. 3: Phantom reference points.

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

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

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

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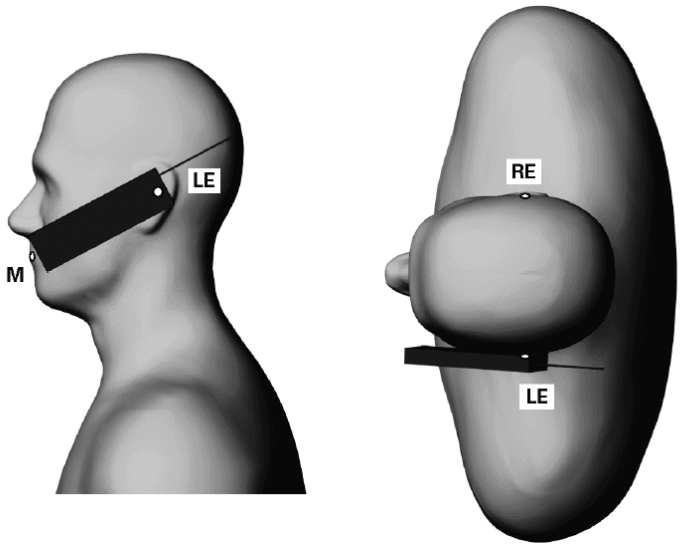


Fig. 4: The cheek position.

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

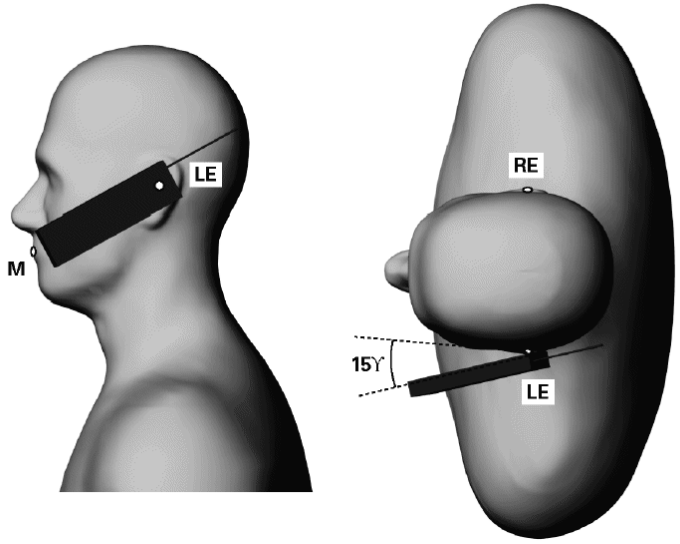


Fig. 5: The tilted position.

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

### 2.2.3 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

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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 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.

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### 3.1 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).

### 3.2 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.

### 3.3 Test to be Performed

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

The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at the middle channel 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.

### 3.4 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

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- 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 | ^ | | |

Table 2: Default Test channels given by the FCC.

**X**: default test channels

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

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

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

### 3.4.1 Measurement Variability

According KDB 865664 repeated measurements are required only when the measured SAR is ≥ 0.80 W/kg. If the measured SAR value of the initial repeated measurement is < 1.45 W/kg with ≤ 20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. A second repeated measurement is required only if the measured result for the initial repeated measurement is within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties. The following procedures are applied to determine if repeated measurements are required.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

## 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: 6. Additional Fig: 7 show the equipment, similar to the installations in other laboratories.

- Fully compliant with all current measurement standards as stated in Fig. 14
- 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

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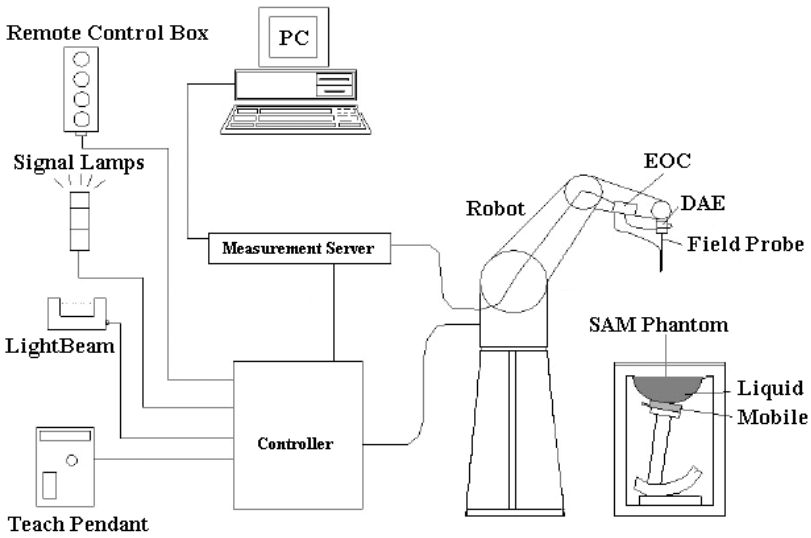


Fig. 6: The DASY4 measurement system.

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

The mobile phone operating at the maximum power level is placed by a non metallic device holder (delivered from Schmid & Partner) in the above described positions at a shell phantom of a human being. The distribution of the electric field strength *E* is measured in the tissue simulating liquid within the shell phantom. For this miniaturised field probes with high sensitivity and low field disturbance are used. Afterwards the corresponding SAR values are calculated with the known electrical conductivity $\sigma$ and the mass density $\rho$ 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 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.<br>The details and the Certificate of conformity can be found in Fig. 15. |
| **Shell Thickness** | 2 ± 0.2 mm (6 ± 0.2 mm at ear point) |
| **Dimensions** | Length: 1000 mm; Width: 500 mm<br>Height: adjustable feet |
| **Filling Volume** | approx. 25 liters |

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## 4.2 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<br>Built-in optical fiber for surface detection system (ET3DV6 only)<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| **Dimensions** | Overall length: 337 mm (Tip: 16 mm)<br>Tip diameter: 6.8 mm (Body: 12 mm)<br>Distance from probe tip to dipole centers: 2.7 mm |
| **Frequency** | 10 MHz to 2.3 GHz<br>Linearity: ± 0.2 dB (30 MHz to 2.3 GHz) |
| **Directivity** | Axial isotropy: ± 0.2 dB in TSL (rotation around probe axis)<br>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<br>for head and body simulating liquid |

| EX3DV4 | |
|---|---|
| **Construction** | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| **Dimensions** | Overall length: 337 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm |
| **Frequency** | 10 MHz to > 6 GHz<br>Linearity: ± 0.2 dB (30 MHz to 6 GHz) |
| **Directivity** | Axial isotropy: ± 0.3 dB in TSL (rotation around probe axis)<br>Spherical isotropy: ± 0.5 dB in TSL (rotation normal to probe axis) |
| **Dynamic Range** | 10 µW/g to > 100 mW/g<br>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 |

## 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 resolution settings for area scan and zoom scan according KDB 865664 D01 as shown in Table 3.
- 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: $\Delta x_{Area}$, $\Delta y_{Area}$ | | | ≤ 2 GHz: ≤ 15 mm<br>2 - 3 GHz: ≤ 12 mm | 3 - 4 GHz: ≤ 12 mm<br>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: $\Delta X_{Zoom}$, $\Delta Y_{Zoom}$ | | | ≤ 2 GHz: ≤ 8 mm<br>2 - 3 GHz: ≤ 5 mm* | 3 - 4 GHz: ≤ 5 mm*<br>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<br>4 - 5 GHz: ≤ 3 mm<br>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<br>4 - 5 GHz: ≤ 2.5 mm<br>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<br>4 - 5 GHz: ≥ 25 mm<br>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.<br>* 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 3: Parameters for SAR scan procedures.

## 4.4 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 Output Power Values and Tune-Up Information

| AVARAGE MEASURED AND MAXIMUM TRANSMIT OUTPUT POWER VALUES [dBm] | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mode** | **Freq. [MHz]** | **CH** | **Measured Output Power** | | | | | | | | | **Tune-Up Limit** |
| **DECT** | 1921.536 | 00 | 19.0 | | | | | | | | | 19.0 |
| | 1924.992 | 02 | 19.1 | | | | | | | | | 19.1 |
| | 1928.448 | 04 | 19.2 | | | | | | | | | 19.2 |
| **Mode** | **Freq. [MHz]** | **CH** | **Measured Output Power for Data Rate [Mbit/s]** | | | | | | | | | **Tune-Up Limit** |
| | | | **1** | | **2** | | **5.5** | | **11** | | | |
| IEEE 802.11b | 2412 | 1 | 11.5 | | 11.5 | | 11.5 | | 11.5 | | | 12.0 |
| | 2437 | 6 | 11.5 | | 11.5 | | 11.5 | | 11.5 | | | 12.0 |
| | 2462 | 11 | 8.1 | | 8.1 | | 8.1 | | 8.1 | | | 9.0 |
| **Mode** | **Freq. [MHz]** | **CH** | **Measured Output Power for Data Rate [Mbit/s]** | | | | | | | | | **Tune-Up Limit** |
| | | | **6** | **9** | **12** | **18** | **24** | **36** | **48** | **54** | | |
| IEEE 802.11g | 2412 | 1 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.6 | 12.7 | 12.7 | | 13.0 |
| | 2437 | 6 | 12.9 | 12.8 | 12.8 | 12.9 | 12.8 | 12.7 | 12.6 | 12.8 | | 13.0 |
| | 2462 | 11 | 8.7 | 8.7 | 8.7 | 8.8 | 8.6 | 8.8 | 8.8 | 8.8 | | 10.0 |
| **Mode** | **Freq. [MHz]** | **CH** | **Measured Output Power for Data Rate [Mbit/s]** | | | | | | | | | **Tune-Up Limit** |
| | | | **MCS0** | **MCS1** | **MCS2** | **MCS3** | **MCS4** | **MCS5** | **MCS6** | **MCS7** | | |
| IEEE 802.11n 20 MHz | 2412 | 1 | 12.7 | 12.7 | 12.8 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | | 13.0 |
| | 2437 | 6 | 12.7 | 12.6 | 12.7 | 12.7 | 12.8 | 12.8 | 12.8 | 12.8 | | 13.0 |
| | 2462 | 11 | 8.6 | 8.6 | 8.6 | 8.6 | 8.6 | 8.6 | 8.6 | 8.6 | | 10.0 |
| IEEE 802.11n 40 MHz | 2422 | 3 | 12.1 | 12.1 | 12.1 | 12 | 12.1 | 12.0 | 12.1 | 12.0 | | 13.0 |
| | 2437 | 6 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.9 | 12.6 | | 13.0 |
| | 2452 | 9 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | | 10.0 |

Table 5: Conducted output power and maximum transmit power values for Panasonic KX-PRXA10 for US DECT and IEEE 802.11 b/g/n.

# 6 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 5.

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

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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.

| SAR MEASUREMENT RESULTS IN HEAD CONFIGURATION | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. [MHz] | | | CH | Head Phantom Config. | | Fig No. | Measured $SAR_{1g}$ [W/kg] | Power Drift [dB] | Output Power [dBm] | Tune Up Limit [dBm] | Scaling Factor | Reported $SAR_{1g}$ [W/kg] | Plot No. |
| DECT | | 1924.99 | 02 | Left | Cheek | 18 | 0.013 | 0.081 | 19.1 | 19.1 | 1 | 0.013 | 1 |
| | | | | | Tilted | 19 | 0.016 | -0.060 | | | | 0.016 | 2 |
| | | | | Right | Cheek | 20 | 0.027 | 0.096 | | | | 0.027 | 3 |
| | | | | | Tilted | 21 | 0.024 | -0.072 | | | | 0.024 | 4 |
| IEEE 802.11b | | 2437 | 6 | Left | Cheek | 18 | 0.097 | 0.056 | 11.5 | 12.0 | 1.122 | 0.109 | 5 |
| | | | | | Tilted | 19 | 0.039 | 0.116 | | | | 0.044 | 6 |
| | | | | Right | Cheek | 20 | 0.081 | -0.187 | | | | 0.091 | 7 |
| | | | | | Tilted | 21 | 0.030 | -0.200 | | | | 0.034 | 8 |
| IEEE 802.11g | | 2437 | 6 | Left | Cheek | 18 | 0.117 | 0.099 | 12.9 | 13.0 | 1.023 | 0.120 | 9 |
| | | | | | Tilted | 19 | 0.050 | 0.100 | | | | 0.051 | 10 |
| | | | | Right | Cheek | 20 | 0.098 | -0.022 | | | | 0.100 | 11 |
| | | | | | Tilted | 21 | 0.033 | 0.123 | | | | 0.034 | 12 |
| IEEE 802.11n | HT 20 | 2437 | 6 | Left | Cheek | 18 | 0.151 | 0.120 | 12.7 | 13.0 | 1.072 | 0.162 | 13 |
| | | | | | Tilted | 19 | 0.056 | 0.181 | | | | 0.060 | 14 |
| | | | | Right | Cheek | 20 | 0.147 | -0.190 | | | | 0.158 | 15 |
| | | | | | Tilted | 21 | 0.059 | 0.179 | | | | 0.063 | 16 |
| | | 2412 | 1 | Left | Cheek | 18 | 0.110 | 0.068 | 12.7 | 13.0 | 1.072 | 0.118 | 17 |
| | | 2462 | 11 | | | | 0.037 | -0.157 | 8.4 | 10.0 | 1.445 | 0.053 | 18 |
| | HT40 | 2437 | 6 | Left | Cheek | 18 | 0.148 | 0.082 | 12.7 | 13.0 | 1.072 | 0.159 | 19 |

Table 6: Measurement results in head configuration for Panasonic KX-PRXA10.

| SAR MEASUREMENT RESULTS IN BODY WORN CONFIGURATION | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. [MHz] | | | CH | Flat Phantom Config. | Fig No. | Measured $SAR_{1g}$ [W/kg] | Power Drift [dB] | Output Power [dBm] | Tune Up Limit [dBm] | Scaling Factor | Reported $SAR_{1g}$ [W/kg] | Plot No. |
| DECT | | 1924.99 | 02 | Pos. 1 | 22 | 0.034 | 0.181 | 19.1 | 19.1 | 1 | 0.034 | 20 |
| | | | | Pos. 2 | 23 | 0.043 | -0.170 | | | | 0.043 | 21 |
| 802.11b | | 2437 | 6 | Pos. 1 | 22 | 0.276 | 0.149 | 11.5 | 12.0 | 1.122 | 0.310 | 22 |
| | | | | Pos. 2 | 23 | 0.493 | 0.090 | | | | 0.553 | 23 |
| 802.11g | | 2437 | 6 | Pos. 1 | 22 | 0.312 | 0.016 | 12.9 | 13.0 | 1.023 | 0.319 | 24 |
| | | | | Pos. 2 | 23 | 0.596 | 0.108 | | | | 0.610 | 25 |
| 802.11n | HT20 | 2437 | 6 | Pos. 1 | 22 | 0.402 | -0.026 | 12.7 | 13.0 | 1.072 | 0.431 | 26 |
| | | | | Pos. 2 | 23 | 0.618 | 0.149 | | | | 0.662 | 27 |
| | | 2412 | 1 | Pos. 2 | 23 | 0.429 | 0.190 | 12.7 | 13.0 | 1.072 | 0.460 | 28 |
| | | 2462 | 11 | | | 0.107 | -0.068 | 8.4 | 10.0 | 1.445 | 0.155 | 29 |
| | HT40 | 2437 | 6 | Pos. 2 | 23 | 0.613 | 0.057 | 12.7 | 13 | 1.072 | 0.657 | 30 |

Table 7: Measurement results in body worn configuration for Panasonic KX-PRXA10.

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

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%.

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# 7 Standalone SAR Test Exclusion

| STANDALONE SAR TESTEXCLUSION CONSIDERATION | | | | | | |
|---|---|---|---|---|---|---|
| **Communication System** | **Freq. [MHz]** | **Distance [mm]** | **Pavg [dBm]** | **Pavg [mW]** | **Threshold 1g Comparison Values** | **SAR Test Exclusion (Yes/No)** |
| DECT | 1.925 | 5 | 19.1 | 81.3 | 22.6 | No |
| WiFi | 2.437 | 5 | 12.9 | 19.5 | 6.08 | No |
| Bluetooth | 2.450 | 5 | 0.0 | 1.0 | 0.31 | Yes |

Table 8: Standalone SAR consideration for body worn.

Standalone SAR test exclusion according KDB 447498 D01v05r01with 1g SAR exclusion thresholds for 100 MHz to 6GHz at test separation distances ≤ 50 mm determined by:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] [√f(GHz)] ≤ 3.0 for 1-g SAR where

- f (GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation25
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

## 7.1 Estimated SAR for Standalone SAR Excluded Modes

| ESTIMATED SAR | | | | | |
|---|---|---|---|---|---|
| **Communication System** | **Freq. [GHz]** | **Distance [mm]** | **Pavg [dBm]** | **Pavg [mW]** | **Estimated $SAR_{1g}$ [W/kg]** |
| Bluetooth | 2.45 | 5 | 0 | 1 | 0.042 |

Table 9: Estimated stand alone SAR .

When the standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion:

- (*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] [√f(GHz)/*x*] W/kg for *test separation distances* ≤ 50 mm;

where *x* = 7.5 for 1-g SAR.

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

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## 7.2 Co-Located SAR Results

Table 10 shows the possible co-located transmission for the worst case configuration for head and body worn configuration. For multi mode SAR the worst case SAR values of each mode are accumulated and compared to the corresponding limit.

| CO-LOCATED SAR RESULTS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Phantom Configuration** | | **Highest $SAR_{1g}$ for DECT [W/kg]** | **Highest $SAR_{1g}$ for WiFi [W/kg]** | **Estimated SAR for BT [W/kg]** | **Combined Reported $SAR_{1g}$ [W/kg]** | **SAR Limit [W/kg]** | |
| HEAD | Right Cheek | 0.027 | 0.162 | | 0.189 | 1.6 | PASS |
| BODY | Position 2 | 0.043 | 0.662 | | 0.705 | 1.6 | PASS |
| HEAD | Right Cheek | 0.027 | | 0.042 | 0.069 | 1.6 | PASS |
| BODY | Position 2 | 0.043 | | 0.042 | 0.085 | 1.6 | PASS |

Table 10: Reported SAR results for co-transmission mode for DECT – WiFi and DECT - Bluetooth worst case configuration for the Panasonic KX-PRXA10.

Since WiFi and Bluetooth share one antenne, these modes can´t be active at the same time. There is no Hotspotmode avaidable.

## 7.3 Evaluation

In Fig. 8 – Fig. 9 the SAR results for head and body worn configuration given in Table 6 - Table 7 are summarized and compared to the limit.

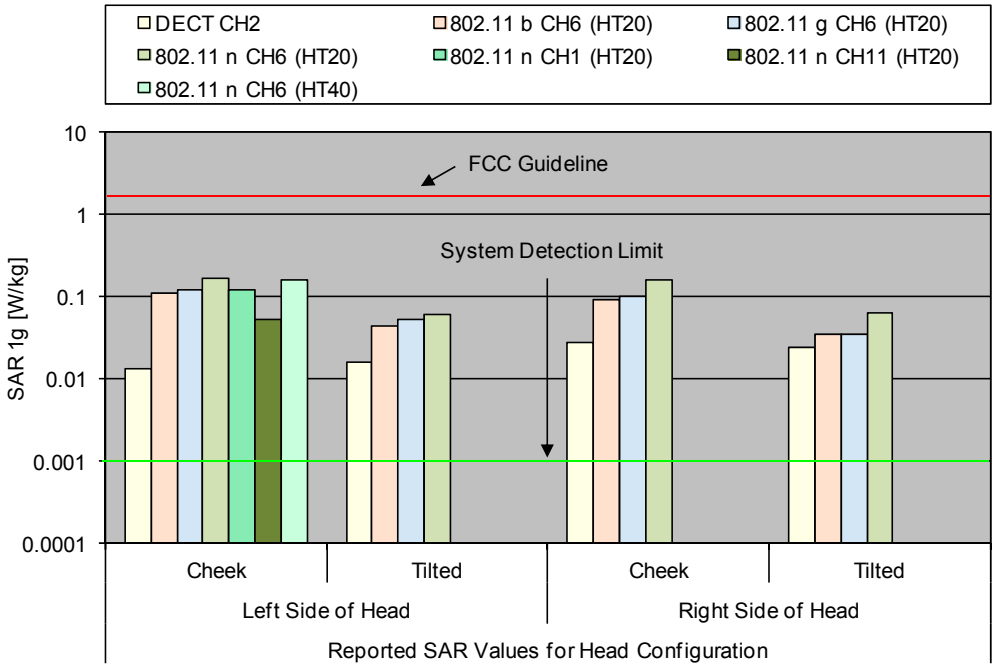


Fig. 8: The reported SAR values for head configuration for the Panasonic KX-PRXA10, for the US DECT and IEEE 802.11 b/g/n standard in comparison to the FCC exposure limit.

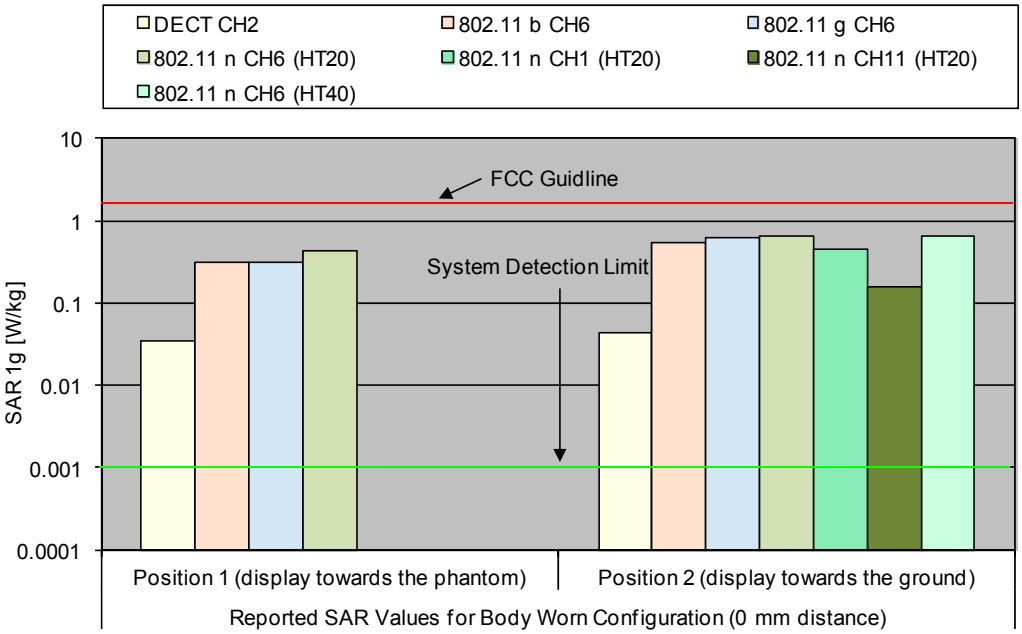


Fig. 9: The reported SAR values for body worn configuration for the Panasonic KX-PRXA10, for the US DECT and IEEE 082.11 b/g/n standard in comparison to the FCC exposure limit.

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# 8 Appendix

## 8.1 Administrative Data

| | | |
|---|---|---|
| Date of Validation: | 1900 MHz, Head: | December 02, 2013 |
| | 2450 MHz, Head: | November 25, 2013 |
| | 1900 MHz, Body: | December 02, 2013 |
| | 2450 MHz, Body: | November 28, 2013 |
| Date of Measurement: | November 25, 2013 - December 02, 2013 | |
| Data Stored: | Nemko_60320_6130411 | |
| Contact: | IMST GmbH<br>Carl-Friedrich-Gauß-Str. 2<br>D-47475 Kamp-Lintfort, Germany<br>Tel.: +49- 2842-981 378<br>Fax: +49- 2842-981 399<br>email: vandenBosch@imst.de | |

## 8.2 Device under Test and Test Conditions

| | |
|---|---|
| MTE: | Panasonic KX-PRXA10 (production line unit) |
| Date of Receipt: | November 25, 2013 |
| SN: | 3GBQA001016 |
| FCC ID: | ACJ96NKX-PRXA10 |
| IC ID: | 216A-KXPRXA10 |
| Equipment Class: | Portable device |
| RF Exposure Environment: | General Population/ Uncontrolled |
| Power Supply: | Internal Battery |
| Antenna: | integrated |
| Used Accessory: | N.A. |
| Measured Standards: | US DECT (1924.992 MHz)<br>IEEE 802.11 b: data rate: 1 Mbps<br>IEEE 802.11 g: data rate: 6 Mbps<br>IEEE 802.11 n: data rate: 6.5 Mbps (MCS 0) |
| Method to Establish a Call: | Test software |
| 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 |

| Panasonic KX-PRXA10 | TX Range [MHz] | RX Range [MHz] | Used Channels | Used Crest Factor |
|---|---|---|---|---|
| US DECT | 1921.536 - 1928.448 | | 02 | 24 |
| IEEE 802.11 b/g | 2412.0 – 2462.0 | | 6 | 1 |
| IEEE 802.11 n (HT20) | 2412.0 – 2462.0 | | 1, 6, 11 | 1 |
| IEEE 802.11 n (HT40) | 2422.0 – 2452.0 | | 6 | 1 |

Table 11: Used channels and crest factors during the test.

## 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 |
| 2450 MHz, Head: | 45.65% | Diethylenglykol-monobutylether |
| | 54.00% | De-Ionized Water |
| 2450 MHz, Body: | 31.40% | Diethylenglykol-monobutylether |
| | 68.60% | De-Ionized Water |

## 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 | | $\varepsilon_r$ | 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) | 41.00 | 1.39 | 21.6 | 21.4 |
| | Measured Value (CH 2) | 40.90 | 1.41 | 21.4 | 21.3 |
| 1900 MHz Body | Recommended Value | 53.30 ± 2.60 | 1.52 ± 0.07 | 20.0 - 26.0 | - |
| | Measured Value (Validation) | 52.90 | 1.55 | 21.8 | 21.5 |
| | Measured Value (CH 2) | 52.80 | 1.58 | 21.8 | 21.5 |
| 2450 MHz Head | Recommended Value | 39.20 ± 2.00 | 1.80 ± 0.09 | 20.0 - 26.0 | - |
| | Measured Value (Validation) | 40.20 | 1.82 | 21.0 | 20.8 |
| | Measured Value (CH 1) | 40.50 | 1.73 | 21.4 | 21.0 |
| | Measured Value (CH 6) | 40.20 | 1.78 | 21.4 | 21.0 |
| | Measured Value (CH 11) | 40.20 | 1.85 | 21.4 | 21.0 |
| 2450 MHz Body | Recommended Value | 52.70 ± 2.63 | 1.95 ± 0.09 | 20.0 - 26.0 | - |
| | Measured Value (Validation) | 51.60 | 1.88 | 21.6 | 21.4 |
| | Measured Value (CH 1) | 51.60 | 1.96 | 21.8 | 21.3 |
| | Measured Value (CH 6) | 51.60 | 2.00 | 21.8 | 21.3 |
| | Measured Value (CH 11) | 51.60 | 2.04 | 21.8 | 21.3 |

Table 12: Parameters of the tissue simulating liquids.

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## 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 13 - 14 and shown in figure 11 - 13. The target values were adopted from the calibration certificates which are attached in the appendix. Table 15 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] | $\varepsilon_r$ | σ [S/m] |
|---|---|---|---|---|
| D1900V2, SN #5d051 | Target Values Head | 9.80 | 41.40 | 1.43 |
| | Target Values Body | 9.53 | 55.00 | 1.51 |
| D2450V2, SN: 709 | Target Values Head | 13.80 | 39.70 | 1.81 |
| | Target Values Body | 13.90 | 50.90 | 1.96 |

Table 13: Dipole target results as given by the calibration certificates.

| Used Dipoles | | $SAR_{1g}$ [W/kg] | $\varepsilon_r$ | σ [S/m] |
|---|---|---|---|---|
| 1900 MHz, SN #5d051 | Measured Values Head | 9.83 | 41.00 | 1.39 |
| | Measured Values Body | 9.54 | 52.90 | 1.55 |
| D2450V2, SN: 709 | Target Values Head | 13.70 | 40.20 | 1.82 |
| | Target Values Body | 13.80 | 51.60 | 2.00 |

Table 14: Dipole measured validation results.

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**Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 021213_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; $\sigma$ = 1.39 mho/m; $\varepsilon_r$ = 41; $\rho$ = 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 = 94.9 V/m; Power Drift = 0.005 dB
Peak SAR (extrapolated) = 17.2 W/kg
**SAR(1 g) = 9.83 mW/g; SAR(10 g) = 5.11 mW/g**
Maximum value of SAR (measured) = 11.2 mW/g

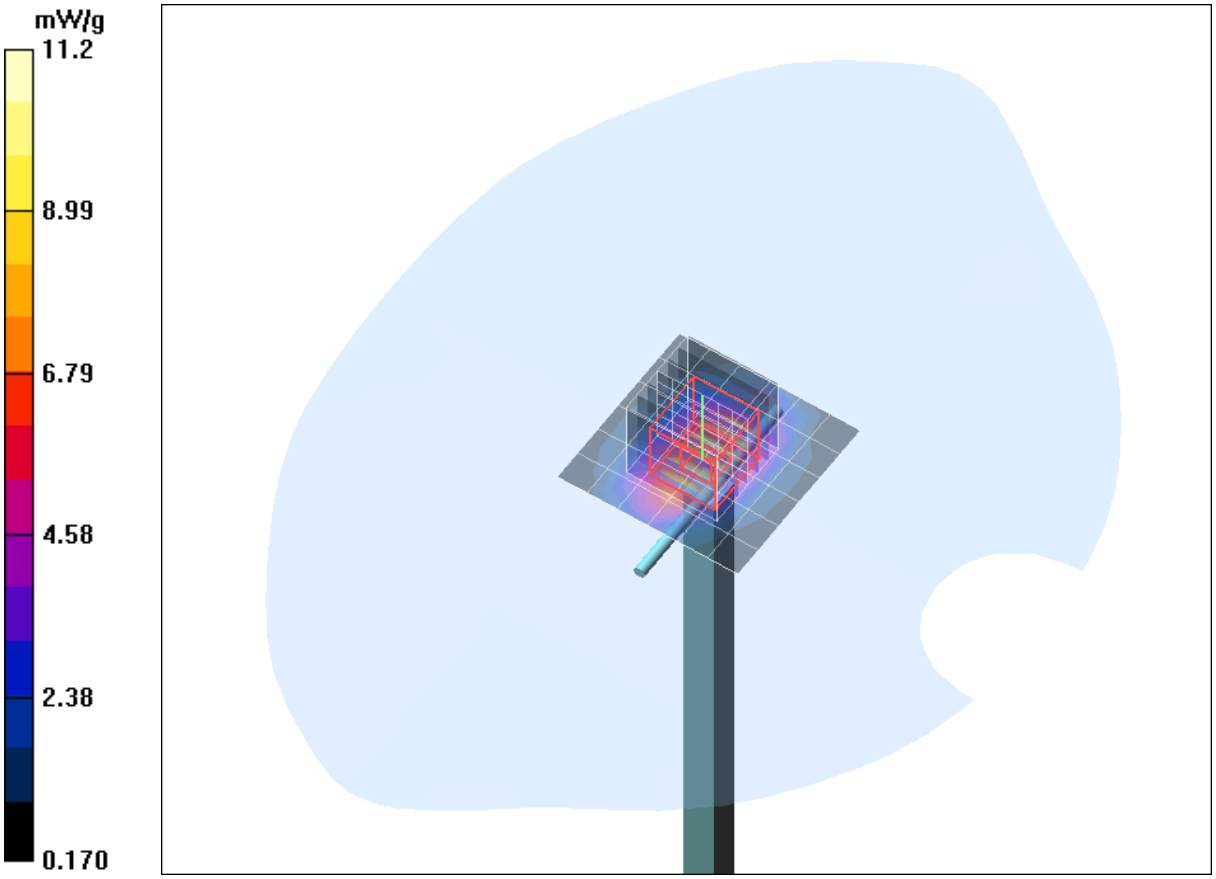


Fig. 10: Validation measurement 1900 MHz Head (December 02, 2013), coarse grid.

**Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 021213_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; $\sigma$ = 1.55 mho/m; $\varepsilon_r$ = 52.9; $\rho$ = 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) = 10.9 mW/g
**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.3 V/m; Power Drift = -0.012 dB
Peak SAR (extrapolated) = 15.7 W/kg
**SAR(1 g) = 9.54 mW/g; SAR(10 g) = 5.05 mW/g**

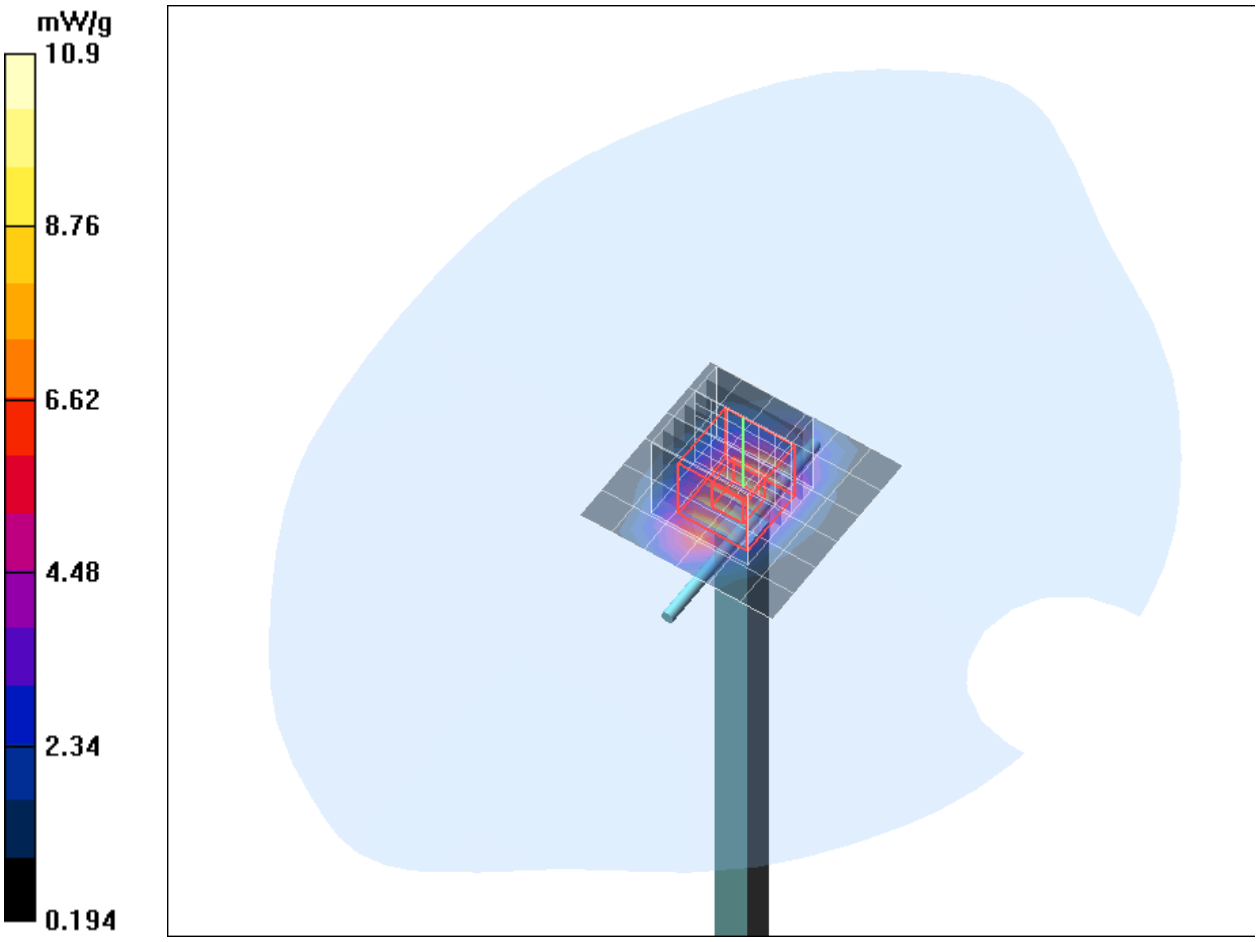


Fig. 11: Validation measurement 1900 MHz Body (December 02, 2013), coarse grid.

**Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 251113_y_3860.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; $\sigma$ = 1.82 mho/m; $\varepsilon_r$ = 40.2; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3860; ConvF(7.38, 7.38, 7.38); Calibrated: 29.07.2013
- 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) = 15.4 mW/g
**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.4 V/m; Power Drift = -0.048 dB
Peak SAR (extrapolated) = 31.0 W/kg
**SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.14 mW/g**
Maximum value of SAR (measured) = 15.3 mW/g

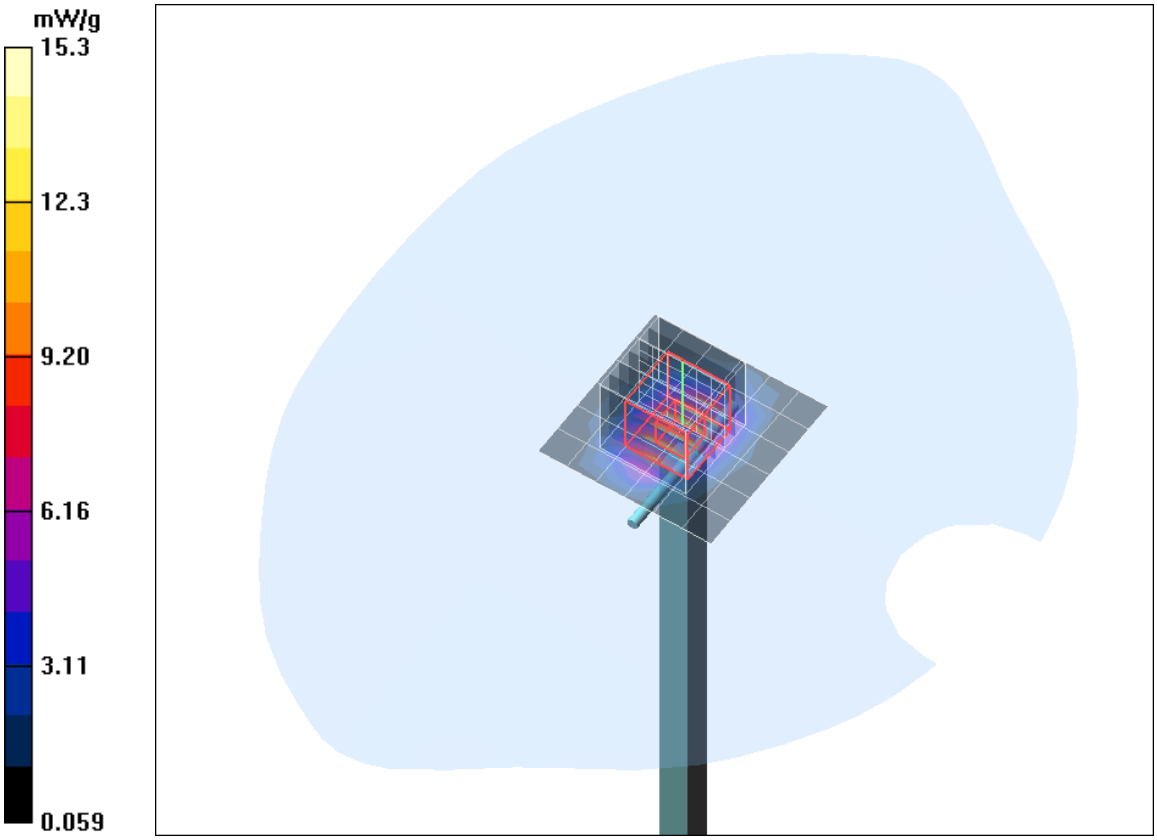


Fig. 12: Validation measurement 2450 MHz Head (November 25, 2013), coarse grid.

**Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 281113_y_3860_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; $\sigma$ = 2 mho/m; $\varepsilon_r$ = 51.6; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3860; ConvF(7.47, 7.47, 7.47); Calibrated: 29.07.2013
- 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) = 15.7 mW/g
**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.9 V/m; Power Drift = 0.062 dB
Peak SAR (extrapolated) = 30.4 W/kg
**SAR(1 g) = 13.8 mW/g; SAR(10 g) = 6.24 mW/g**
Maximum value of SAR (measured) = 15.8 mW/g

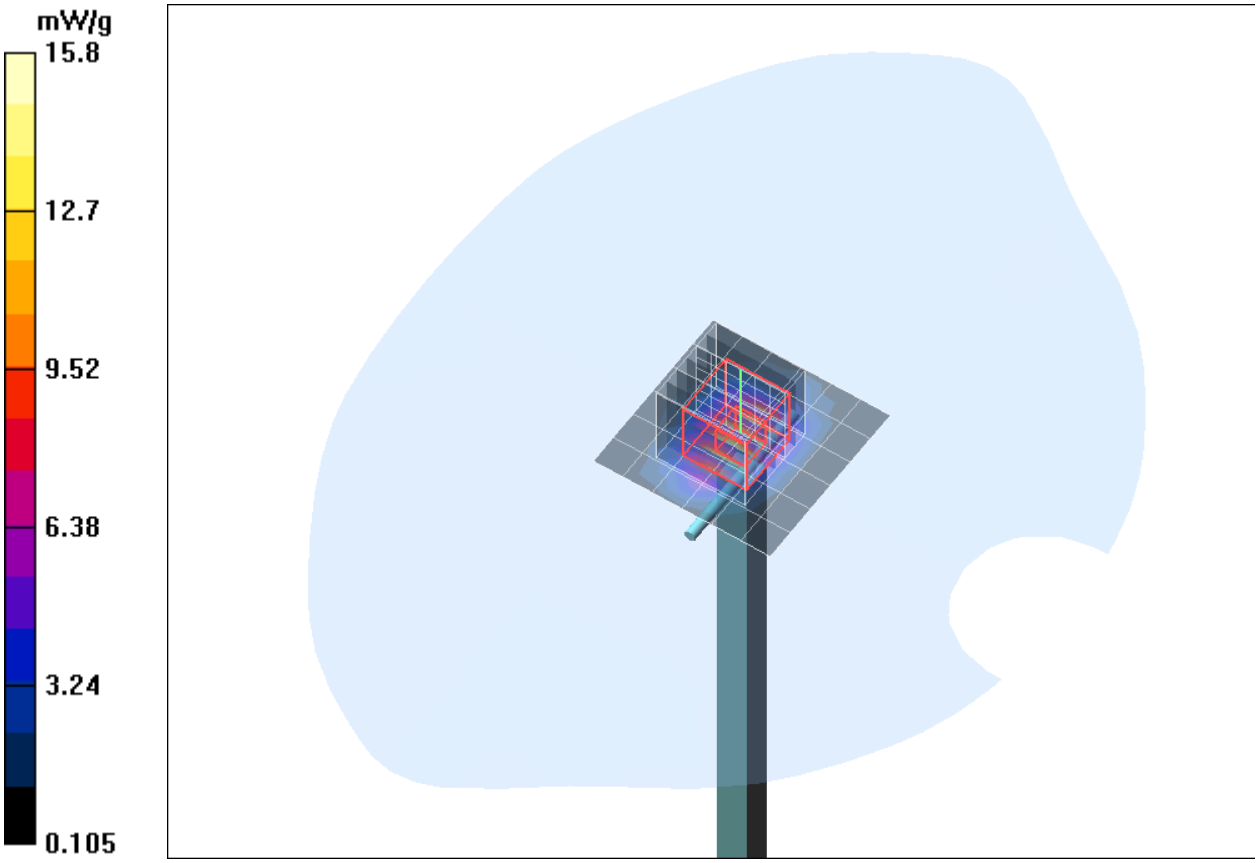


Fig. 13: Validation measurement 2450 MHz Head (November 28, 2013), coarse grid.

| 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 15: 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 |
| Dosimetric E-Field Probe | EX3DV4 | 3860 | 07/2013 | 07/2014 |
| 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 |
| Validation Dipole | D2450V2 | 709 | 09/2013 | 09/2015 |
| **Material Measurement** | | | | |
| Network Analyzer | E5071C | MY46103220 | 07/2013 | 07/2015 |
| Dielectric Probe Kit | HP85070B | US33020263 | N/A | N/A |

Table 16: 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 17: 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<br>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<br>Hauptstr. 69<br>CH-8559 Fruthwilen<br>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<br>Relative permittivity < 5<br>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. 15: Certificate of conformity for the used SAM phantom.

## 8.9 Pictures of the Device under Test

Figure 16 - 17 show the device under test with antenna layout and antenna separation distances.

CONFIDENTIAL

Fig. 16: Pictures of the device under test.

CONFIDENTIAL

Fig. 17: Antenna Layout of the device under test with antenna separation distances.

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## 8.10 Test Positions for the Device under Test

Figure 18 - 23 show the test positions for the SAR measurements.

Fig. 18: Cheek position, left side.

Fig. 19: Tilted position, left side.

Fig. 20: Cheek position, right side.

Fig. 21: Tilted position, right side.

Fig. 22: Body worn configuration for KX-PRXA10, position 1, display towards the phantom, 0 mm distance.

Fig. 23: Body worn configuration for KX-PRXA10, position 2, display towards the ground, 0 mm distance.

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## 8.11 Pictures to Demonstrate the Required Liquid Depth

Figure 24 - 27 show the liquid depth in the used SAM phantom.

Fig. 24: Liquid depth for 1900 MHz Head measurements

Fig. 25: Liquid depth for 1900 MHz Body worn measurements

Fig. 26: Liquid depth for 2450 MHz head measurements.

Fig. 27: Liquid depth for 2450 MHz body worn measurements.

# 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


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