DAT-P-152/98-01

Report

Dosimetric Assessment of the Mobile Phone Fuji F-022

In Body Worn Configuration against the European Council Recommendation

April 13, 2011

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Executive Summary

The F-022 is a new mobile phone from Fuji operating in the 850 MHz, 900 MHz, 1800 MHz, 1900 MHz and 1950 MHz frequency range. The device has an integrated antenna and the system concepts used are the GSM 850 (GPRS Class 8), GSM 900 (GPRS Class 8), DCS 1800 (GPRS Class 8), PCS 1900 (GPRS Class 8), WCDMA I (FDD) and WCDMA V (FDD) standards.

The objective of the measurements done by IMST was the dosimetric assessment of one device in body worn configuration in the GSM 900 (GPRS Class 8), DCS 1800 (GPRS Class 8) and WCDMA I (FDD) standards. The examinations have been carried out with the dosimetric assessment system „DASY4“.

Since there is currently no practical European standard for the body worn measurements of such devices, the investigations were made according to the IEC draft standard IEC 62209-2: Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Human models, instrumentation, and procedures Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30 MHz to 6 GHz Handheld and Body-Mounted Devices used in close proximity to the Body [IEC 62209-2]. The device shall comply with the basic restriction as specified in the European Council Recommendation [1999 519 EC] on the limitation of exposure of the general public to electromagnetic fields.

The device F-022 from Fuji is in compliance with the basic restrictions as specified in the European Council Recommendation [1999 519 EC] for the measured GSM 900, DCS 1800 and WCDMA I (FDD) standards. The tests were performed according to the standard IEC 62209-2 with a closest distance of 15 mm between test device and phantom.

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1 Subject of Investigation

The F-022is a new mobile phone from Fuji operating in the 850 MHz, 900 MHz, 1800 MHz, 1900 MHz and 1950 MHz frequency range. The device has an integrated antenna and the system concepts used are the GSM 850 (GPRS Class 8), GSM 900 (GPRS Class 8), DCS 1800 (GPRS Class 8), PCS 1900 (GPRS Class 8), WCDMA I (FDD) and WCDMA V (FDD) standards.

Fig. 1: Pictures of the device under test.

The objective of the measurements done by IMST was the dosimetric assessment of one device in body worn configuration in the GSM 900 (GPRS Class 8), DCS 1800 (GPRS Class 8) and WCDMA I (FDD) standards. The examinations have been carried out with the dosimetric assessment system „DASY4“ described below.

2 The ICNIRP 1998 Guidelines and the European Council Recommendation

In 1998 ICNIRP (International Commission on Non-Ionizing Radiation Protection) published its guidelines covering the frequency range up to 300 GHz [ICNIRP 1998]. In 1999 these guidelines were adopted by the European Union in terms of the European Council Recommendation [1999 519 EC].

2.1 Distinction Between Exposed Population, Duration of Exposure and Frequencies

The ICNIRP Guidelines distinguish between occupational and general public exposure. The occupationally exposed population consists of adults who are generally exposed under known conditions and are trained to be aware of potential risk and to take appropriate precautions. By contrast, the general public comprises individuals of all ages and of varying health status, and may include particularly susceptible groups or individuals. In many cases, members of the public are unaware of their exposure to electromagnetic fields. Moreover, individual members of the public cannot reasonably be expected to take precautions to minimise or avoid exposure.

In the ICNIRP Guidelines the general public exposure limits are derived from values one fifth those of occupational exposure.

In addition the duration of exposure is considered. A limit is made at 6 minutes exposure time. For short-term exposure below a duration of 6 minutes, higher field strengths are admissible.

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

2.2 Basic Restrictions and Reference Levels

The biological relevant parameter describing the effects of electromagnetic fields in the frequency range of interest (300 MHz – 3 GHz) is the specific absorption rate SAR (dimension: power/mass). It is a measure of the power absorbed per unit mass. The SAR may be spatially averaged over the total mass of an exposed body or its parts. The SAR is calculated from the r.m.s. electric field strength *E* inside the human body, the conductivity σ and the mass density ρ of the biological tissue:

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

The specific absorption rate describes the initial rate of temperature rise $\partial T / \partial t$ as a function of the specific heat capacity *c* of the tissue. A limitation of the specific absorption rate in terms of basic restrictions 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), a set of more readily measurable reference levels in terms of external electric *E* and magnetic field strength *H* and power density *S*, derived from the SAR limits, is defined. The limits for *E*, *H* and *S* have been fixed so that even under worst-case conditions, the basic restrictions for the specific absorption rate SAR are not exceeded.

The reference levels may be exceeded if the exposure can be shown by appropriate techniques to produce SAR values below the corresponding basic restrictions.

2.3 SAR Limits

In this report the comparison between the measured data and the exposure limits defined in the ICNIRP Guidelines 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 general public exposure and for exposure times longer than 6 minutes [ICNIRP 1998]. According to Table 1 the SAR values have to be averaged over a mass of 10 g (SAR_{10g}) with the shape of a cube.

Standard	Status	SAR limit [W/kg]
ICNIRP 1998	Guidelines	2.0

Table 1: Relevant spatial peak SAR limit averaged over a mass of 10 g.

3 The IEC Measurement Procedure

Since there is currently no practical European standard which contains the body worn configuration in the frequency range from 30 MHz up to 6 GHz, the measurements were made according to the standard IEC 62209-2: Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Human models, instrumentation, and procedures Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30 MHz to 6 GHz Handheld and Body-Mounted Devices used in close proximity to the Body [IEC 62209-2].

In 2005 the IEC has released the standard IEC 62209-1 [IEC 62209-1] which provides a procedure to determine the SAR for hand-held devices used in close proximity of the ear within the frequency range from 300 MHz to 3 GHz. The part 2 extends the scope to other communications devices such as two-way radios, palmtops, laptops, desktop computers and body-mounted wireless devices.

3.1 Position of the device under test

The device shall be tested against a flat phantom with a maximum separation distance up to 25 cm and be positioned in such a way that the peak maximum SAR is captured. For the case that several usage positions are possible, testing is only needed for the position with the shortest distance between the device and the phantom.

3.1.1 Body worn device (e.g. mobile phone positioned at the waist)

Accessories such as headsets that do not contain RF transmitters and are primarily used at the head and those that do not change the output power or the current distribution (hands-free kits) need not to be tested. Depending on the availability of a carry-accessory two different cases a possible:

- If a carry accessory like a belt-clip, holster or pouch is available or recommended, they should be attached to the device in normal use configuration and tested with a specific distance given by the manufacturer or with the closest distance as possible. If several positions are possible, all ways shall be tested.

  For purpose of determining test requirements, accessories may be divided into two categories: those that do not contain metallic components (no impact on SAR) and those that do. For multiple accessories that do not contain metallic components, the device may be tested only with that accessory which provides the closest spacing to the body.

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

- If there no carry accessories available the test shall be conducted with a specific distance given by the manufacturer or with the closest distance as possible (0 cm). Both sides, the back and the font shall be positioned against the phantom and shall be tested (Fig. 2).

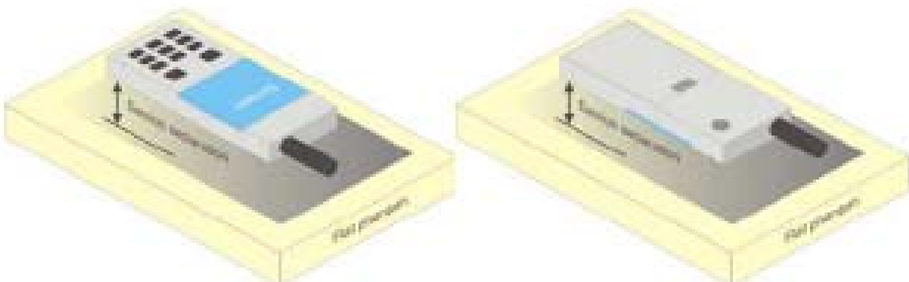


Fig. 2: Test positions for body worn devices.

3.1.2 Body supported device (e.g. laptop with RF module on top of the thighs)

If no information is given by the manufacturer concerning the positioning of the device or the antenna, the device shall be positioned below the phantom with its bottom side directly touching it. The screen shall be in an open position (90 ° or a typical operating angle). Where a screen mounted antenna is present, this position shall be repeated with the screen against the flat phantom (Fig. 3).

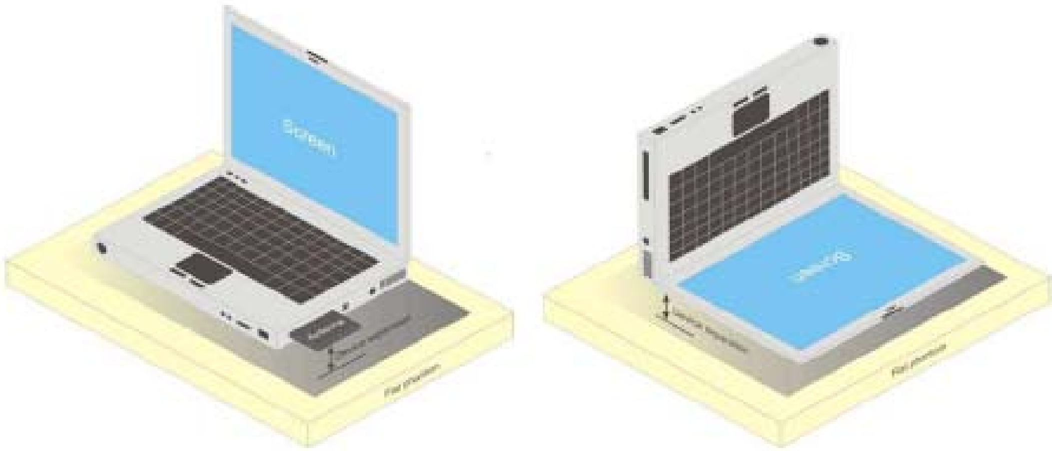


Fig. 3: Different measurement positions for a Portable computer.

For other devices that fall into this category which may be body or limb mounted, the same principles as above are applied (Fig. 4).

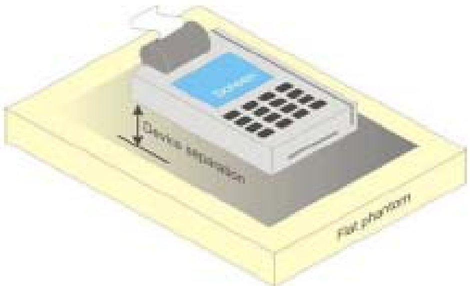


Fig. 4: Measurement positions for body or limb mounted devices.

Tablet PCs should be assessed with its intended base against the flat phantom at the separation distance that corresponds to the intended use position as specified by the manufacturer and additionally with each edge of the device against the flat phantom. For body supported devices with integral screen required for normal operation, the screen will not to be tested if it ordinarily remains 200 mm from the body. If there is no intended use position is specified, the device shall be tested directly against the body of the phantom in useable position (Fig. 5).

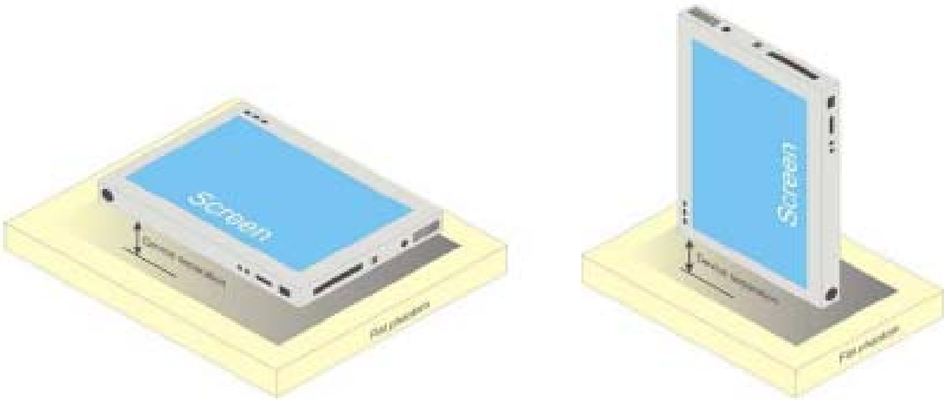


Fig. 5 Different measurement positions for a Tablet PC.

3.1.3 Desktop device (e.g. stationary PC with RF module or DECT base unit)

If the intended use position is not specified, the device shall be tested in direct contact to the body phantom (Fig. 6 and Fig. 7).

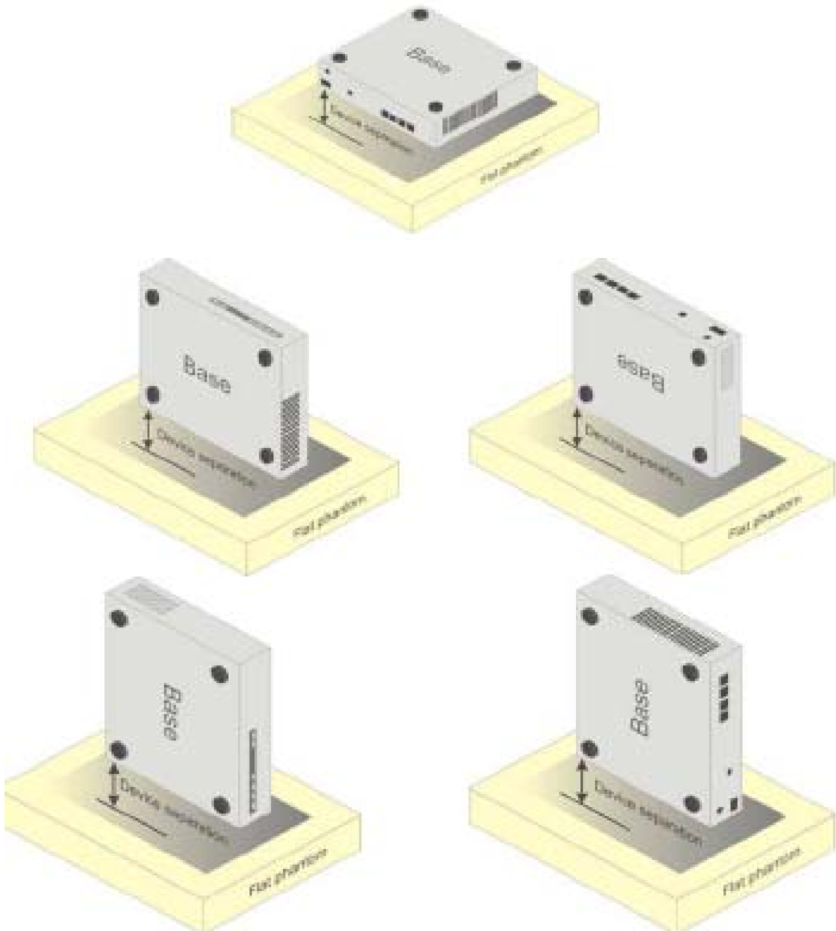


Fig. 6 Different measurement positions for desktop devices with external antenna.

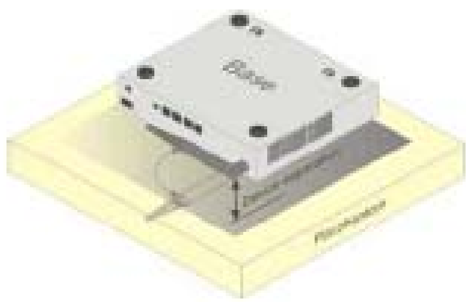


Fig. 7: Measurement positions for desktop devices with only one external antenna.

3.1.4 Front of face device, PTT / PoC (e.g. two-way radio)

If no information is given by the manufacturer concerning the specific distance, the device shall be positioned with the front according Fig. 8 (surface which is intended to face the user) towards the phantom with the following distances:

- 0 cm for devices with optical viewfinders
- 25 mm for two way radios
- 25 mm for devices with LCD viewfinders

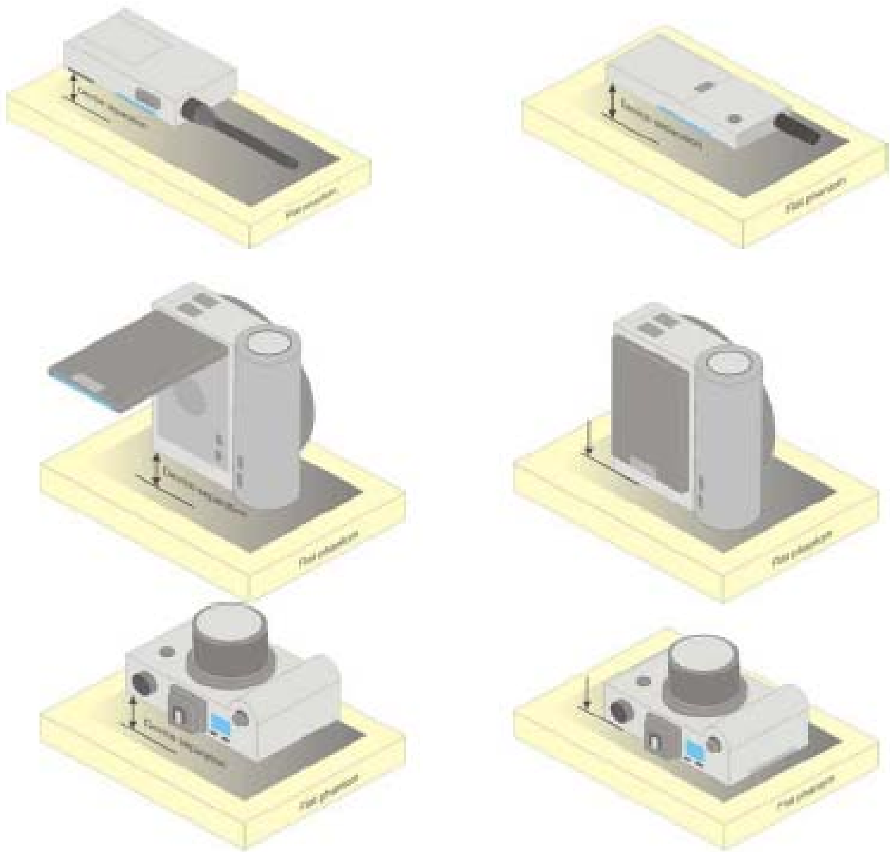


Fig. 8: Different measurement positions for front to face devices.

3.1.5 Hand-held usage (e.g. more than 20 cm away from head and body)

The device shall be positioned directly touching the phantom with those sides that are in contact with the hand in a typical use position (Fig. 9).

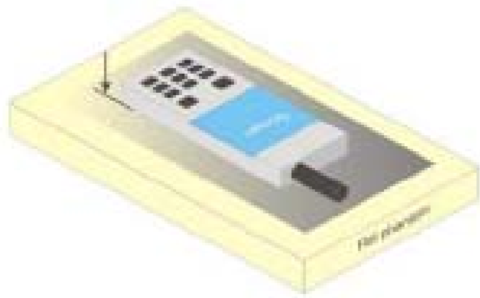


Fig. 9: Measurement position for hand-held usage.

3.1.6 Limb worn device (e.g. wristwatch with RFmodule)

The device shall be parallel positioned, directly touching the phantom with the backside. For this the wristband has to be opened and divided into two parts (Fig. 10).

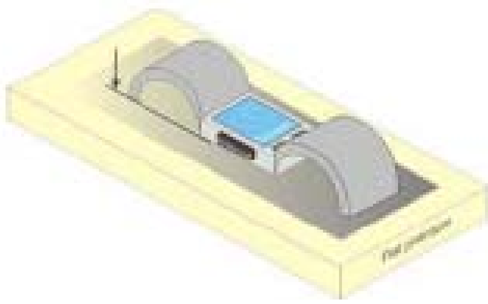


Fig. 10: Measurement position for limb worn devices.

3.1.7 Clothing integrated devices (including hats and helmets)

For reliable and repeatable measurements, these devices shall be removed from the clothing and all wireless or RF transmitting components shall be placed in the orientation and at the separation distance to the phantom surface that correspond to intended use of the device when it is integrated into the clothing (Fig. 11).

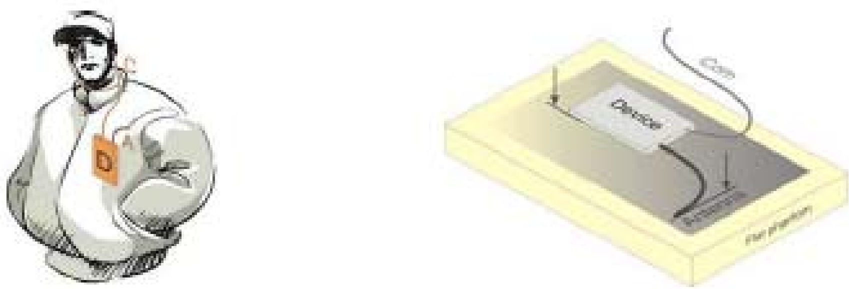


Fig. 11: Measurement position for clothing integrated devices.

3.2 Phantom Requirements

For the validation of the system and the SAR measurements a flat phantom with the shape of a ellipse shall be used which is made of low loss and low permittivity material. The thickness of the bottom shall be 2.0 mm with a tolerance of ±0.2 mm and the minimum dimensions are:

- 20 % larger than each of the width or length of the device including the antenna
- At 300 MHz and below, the longitudinal dimensions shall be 600 mm in the major dimension and the width shall be 400 mm in the minor dimension. The size of the bottom of the flat phantom will be not less than the ellipse built using the above dimensions as major and minor axis. The depth of the liquid shall be 150 mm
- For 300 MHz to 800 MHz, the longitudinal dimensions shall be 0.6 of the wavelength in air or larger in the major dimension and the width at the feed point shall be 0.4 of the wavelength in air or larger in the minor dimension
- Between 800 MHz and 6 GHz the phantom may have any bottom-face shape that encompasses an ellipse with length of 225 mm and width of 150 mm. The depth of the liquid can be reduced providing the reflections from the liquid surface does not influence the measurements by 1 %.

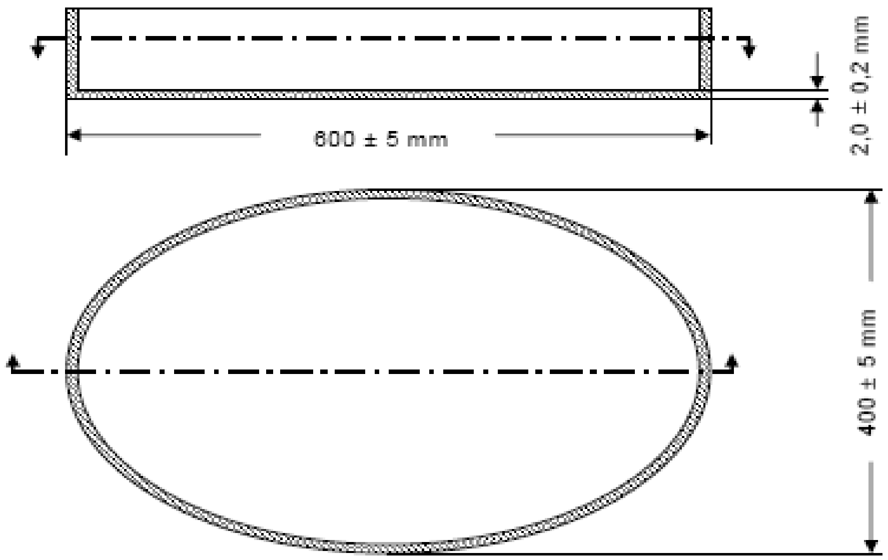


Fig. 12: Shape and dimensions of the phantom

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 middle frequency channels of each operating mode / setup. For the worst case position the lowest and the highest channels have to be measured, additional for all other conditions where the SAR value is within 3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

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. 13.

- Fully compliant with all current measurement standards, as stated in Fig. 38
- 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. 14 shows the equipment, similar to the installations in other laboratories.

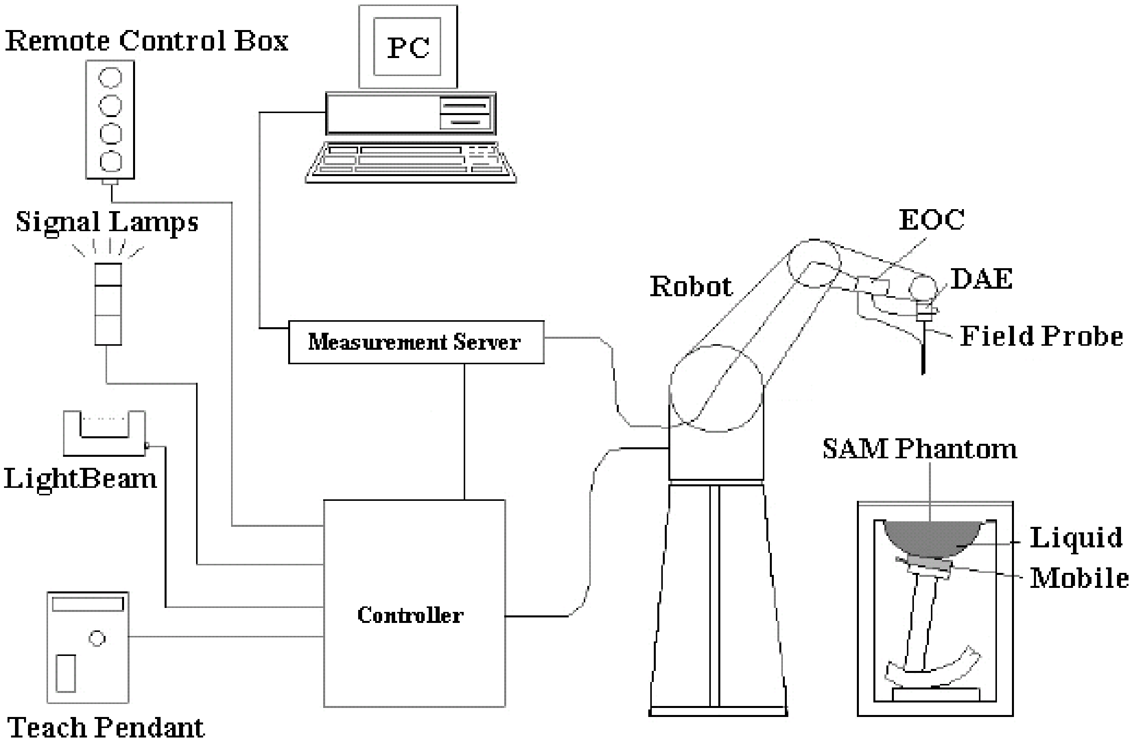


Fig. 13: The DASY4 measurement system.

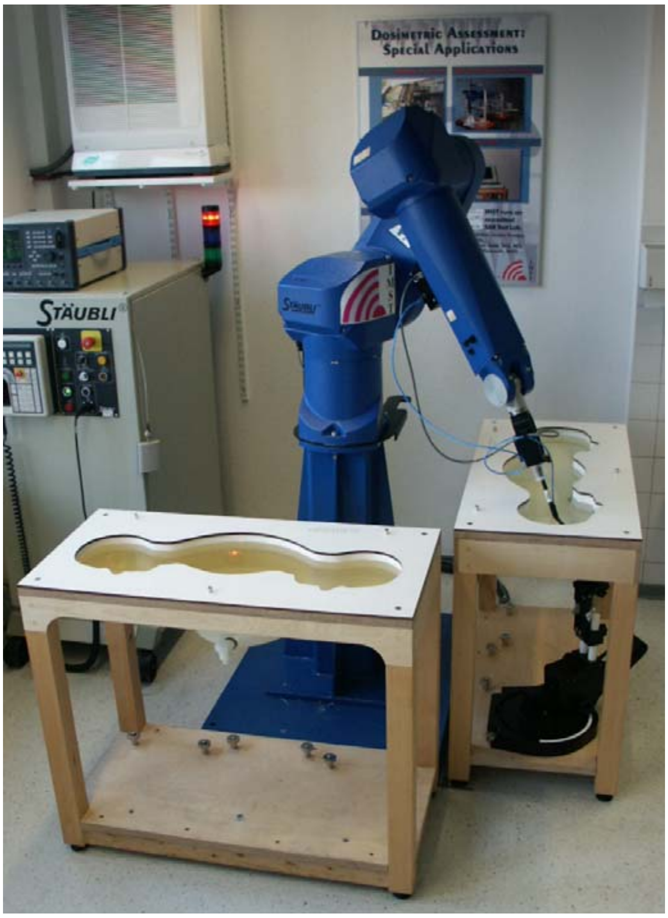


Fig. 14: The measurement set-up with two phantoms containing tissue simulating liquid.

4.1 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM Twin Phantom V4.0) defined by the IEEE SCC-34/SC2 group or the ELI4 phantom defined by the IEC standard and delivered by Schmid & Partner Engineering AG are used. The phantoms are a fibreglass shell integrated in a wooden table. The thickness of the phantoms amounts to 2 mm ± 0.2 mm. They enables the dosimetric evaluation of left and right hand phone usage (SAM V4.0) and a flat area for the system performance check and body worn measurements. The phantom set-up includes a coverage (polyethylene), which prevents the evaporation of the liquid. The details and the Certificates of conformity can be found in Fig. 39 and Fig. 40.

- SAM V4.0: Used for validations and SAR measurements above 800 MHz
- ELI4: Used for validations and SAR measurements below 800 MHz

4.2 Probe

For the measurements the Dosimetric E-Field Probes ET3DV6 or EX3DV4 manufactured and calibrated annually by Schmid & Partner Engineering AG with following specifications are used.

ET3DV6:

- Dynamic range: 5µW/g to > 100mW/g
- Tip diameter: 6.8 mm
- Probe linearity: ± 0.2 dB (30 MHz to 3 GHz)
- Axial isotropy: ± 0.2 dB
- Spherical isotropy: ± 0.4 dB
- Distance from probe tip to dipole centers: 2.7 mm
- Calibration range: 900MHz / 1850MHz for head and body simulating liquid

EX3DV4:

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

4.3 Measurement Procedure

The device operating at the maximum power level is placed by a non metallic device holder in the above described positions at the phantom. The distribution of the electric field strength *E* is measured in the tissue simulating liquid within the shell phantom. To achieve this a miniaturised field probes with high sensitivity and low field disturbance is 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 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.

The following steps are used for each test position:

- Establish a call with the maximum output power with a base station simulator or activating of the transmitter with highest output power.
- Measurement of the local E-field value at a fixed location (P1). This value serves as a reference value for calculating a possible power drift.
- Measurement of the SAR distribution with a grid spacing of 15 mm x 15 mm and a constant distance to the inner surface of the phantom. Since the sensors can not directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With this values the area of the maximum SAR is calculated by a interpolation scheme (combination of a least-square fitted function and a weighted average method). Additionally all peaks within 2 dB of the maximum SAR are assessed.
- Around these points, a cube of 30 mm x 30 mm x 30 mm is assessed by measuring 7 x 7 x 7 points. With these data, the peak spatial-average SAR value can be calculated within the SEMCAD software.
- The used extrapolation and interpolation routines are all based on the modified Quadratic Shepard´s method [DASY4].
- Repetition of the E-field measurement at the fixed location (P1) and repetition of the whole procedure if the two results differ by more than ± 0.21dB.

4.4 Uncertainty Assessment

Table 2 includes the uncertainty budget suggested by the [IEC 62209-2] and determined by Schmid & Partner Engineering AG. The expanded uncertainty (K=2) is assessed to be ± 19.3 %. The requirements for the validity and the Certificate of conformity can be found in Fig. 38.

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i	Standard Uncertainty	v_i^2 or v_{eff}
Measurement Equipment						
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 %	∞
Linearity	± 4.7 %	Rectangular	√3	1	± 2.7 %	∞
Detection limits	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Readout Electronics	± 0.3 %	Normal	1	1	± 0.3 %	∞
Boundary effects	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Response time	± 0.8 %	Normal	1	1	± 0.8 %	∞
RF Ambient Noise	± 3.0 %	Rectangular	√3	1	± 1.7 %	∞
RF Ambient Reflections	± 3.0 %	Rectangular	√3	1	± 1.7 %	∞
Integration time	± 2.6 %	Normal	1	1	± 2.6 %	∞
Probe Positioner	± 0.4 %	Rectangular	√3	1	± 0.2 %	∞
Probe Positioning	± 2.9 %	Rectangular	√3	1	± 1.7 %	∞
Algorithms for Max. SAR Eva.	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Test Sample						
Device Holder	± 3.6 %	Normal	1	1	± 3.6 %	5
Power Drift	± 5.0 %	Rectangular	√3	1	± 2.9 %	145
Positioning of the device	± 2.9%	Normal	1	1	± 2.9 %	145
Physical Parameters						
Phantom Uncertainty	± 4.0 %	Rectangular	√3	1	± 2.3 %	∞
Liquid conductivity (target)	± 5.0 %	Rectangular	√3	0.5	± 1.4 %	∞
Liquid conductivity (meas.)	± 4.3 %	Rectangular	√3	0.5	± 1.2 %	∞
Liquid permittivity (target)	± 5.0 %	Rectangular	√3	0.5	± 1.4 %	∞
Liquid permittivity (meas.)	± 2.5 %	Rectangular	√3	0.5	± 1.2 %	∞
Combined Uncertainty					**± 11.0 %**	

Table 2: Uncertainty budget of DASY4.

5 SAR Results

The Tables below contain the measured SAR values averaged over a mass of 10 g.

Phantom Configuration		SAR_{10g} [W/kg]		
		Channel 975 880.2 MHz	Channel 038 897.6 MHz	Channel 124 914.8 MHz
GSM 900	Position 1, display up, headset attached		0.167	
	Position 2, display down, headset attached		0.253	
GPRS 900 (Class 8)	Position 1, display up, without accessory		0.274	
	Position 2, display down, without accessory	0.333	0.433	0.539

Table 3: Measurement results in body worn configuration for GSM/GPRS 900 for the Fuji F-022 (gap = 15 mm).

Phantom Configuration		SAR_{10g} [W/kg]		
		Channel 512 1710.2 MHz	Channel 699 1747.6 MHz	Channel 885 1784.8 MHz
DCS 1800	Position 1, display up, headset attached		0.045	
	Position 2, display down, headset attached		0.101	
GPRS 1800 (Class 8)	Position 1, display up, without accessory		0.059	
	Position 2, display down, without accessory	0.095	0.116	0.181

Table 4: Measurement results in body worn configuration for DCS/GPRS 1800 for the Fuji F-022 (gap = 15 mm).

Phantom Configuration		SAR$_{10g}$ [W/kg]		
		Channel 9613 1922.6 MHz	Channel 9750 1950.0 MHz	Channel 9887 1977.4 MHz
WCDMA I (FDD)	Position 1, display up, without accessory		0.396	
	Position 2, display down, without accessory	0.594	0.622	0.576
	Position 2, display down, headset attached		0.496	

Table 5: Measurement results in body worn configuration for WCDMA I (FDD) for the Fuji F-022 (gap = 15 mm).

6 Evaluation

In Fig. 15 - Fig. 17 the SAR results for GSM/GPRS 900, DCS 1800 and WCDMA I (FDD) given in Table 3 – Table 5 are summarised and compared to the limit.

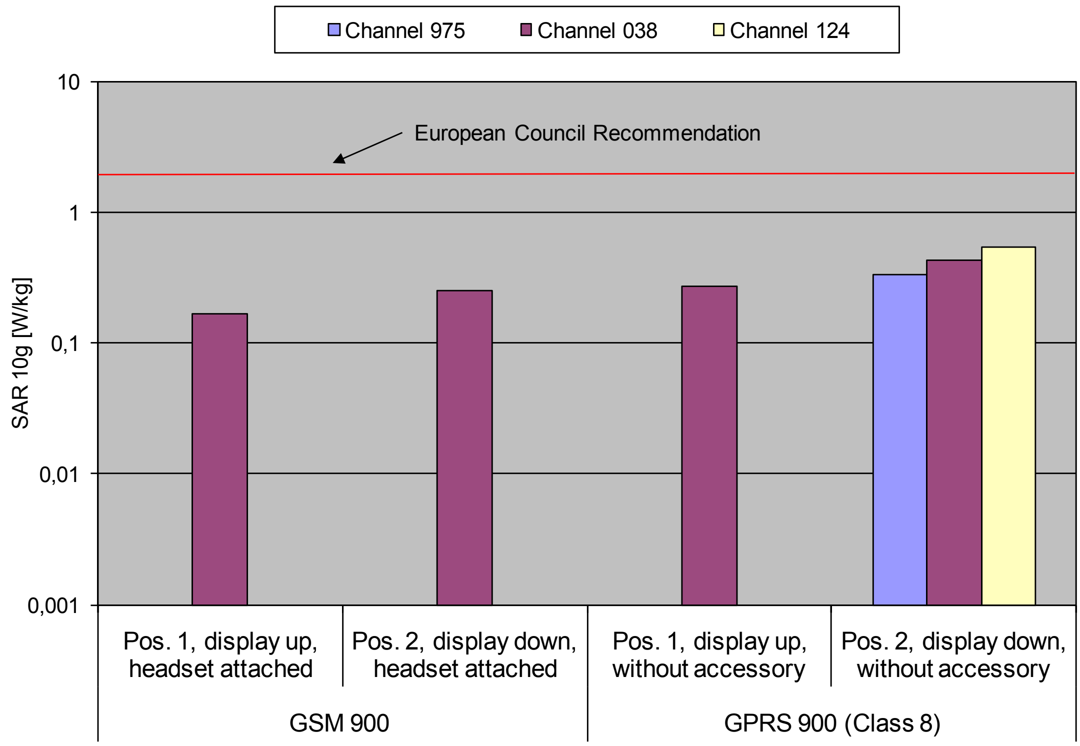


Fig. 15: The measured SAR values using the Fuji F-022 for GSM/GPRS 900 in comparison to the European Council Recommendation (1999/519/EC).

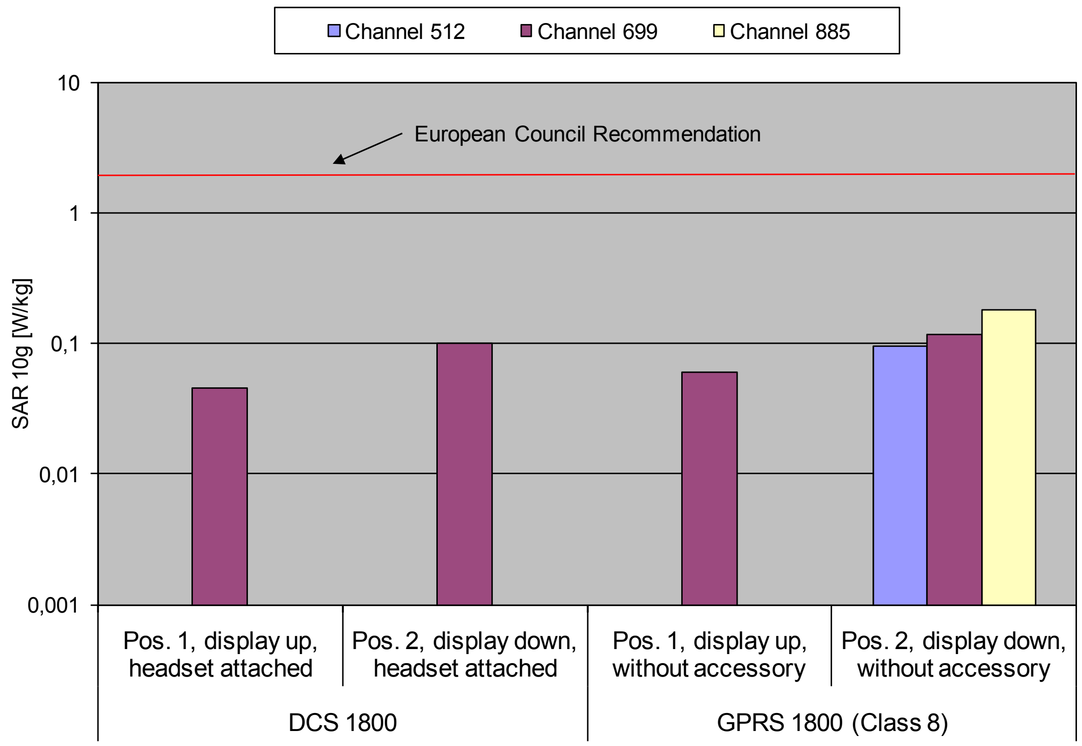


Fig. 16: The measured SAR values using the Fuji F-022 for DCS/GPRS 1800 comparison to the European Council Recommendation (1999/519/EC).

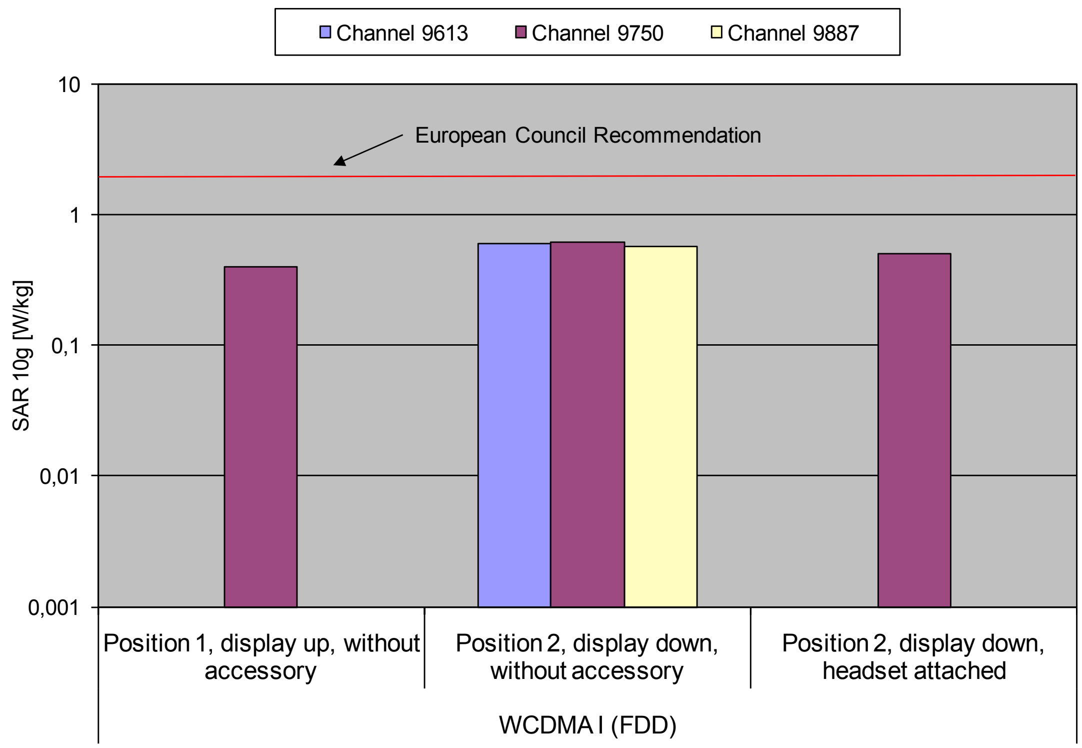


Fig. 17: The measured SAR values using the Fuji F-022 for WCDMA I (FDD) in comparison to the European Council Recommendation (1999/519/EC).

Fig. 18 - Fig. 34 show the SAR distribution plots for GSM/GPRS 900, DCS/GRPS 1800 and WCDMA I (FDD).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yghm_1_up_15mm_HS.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: GSM 900

Communication System: GSM 900; Frequency: 897.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 897.6 MHz; σ = 0.98 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(6.23, 6.23, 6.23); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Sugar 1341; Type: QD 000 P40 CB; Serial: TP-1341
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.245 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.2 V/m; Power Drift = -0.058 dB
Peak SAR (extrapolated) = 0.306 W/kg
SAR(1 g) = 0.236 mW/g; SAR(10 g) = 0.167 mW/g
Maximum value of SAR (measured) = 0.251 mW/g

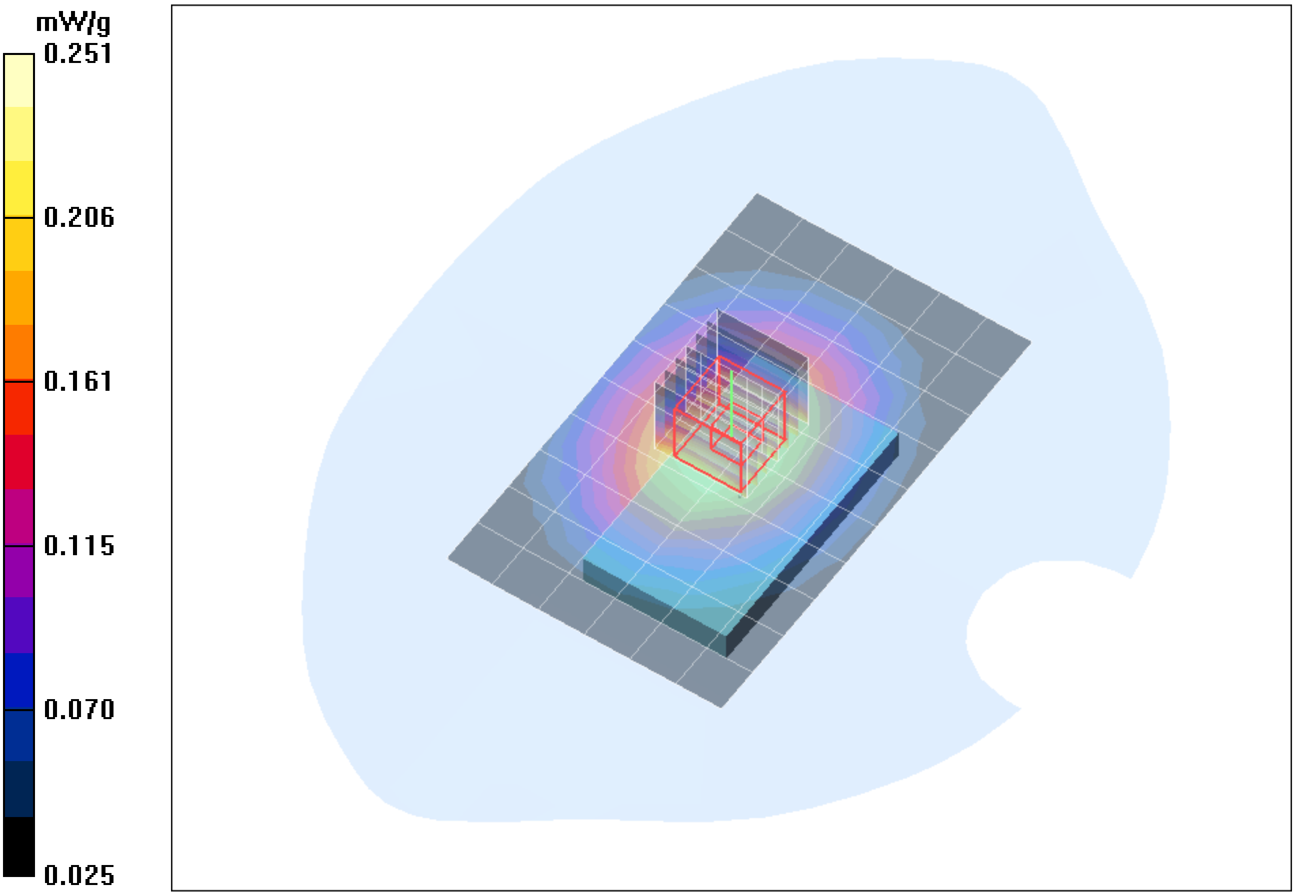


Fig. 18: SAR distribution plot for GSM 900 for the Fuji F-022, position 1, display towards the phantom, headset attached (channel 038, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yghm_2_down_15mm_HS.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: GSM 900

Communication System: GSM 900; Frequency: 897.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 897.6 MHz; σ = 0.98 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(6.23, 6.23, 6.23); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Sugar 1341; Type: QD 000 P40 CB; Serial: TP-1341
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.380 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.5 V/m; Power Drift = -0.084 dB
Peak SAR (extrapolated) = 0.486 W/kg
SAR(1 g) = 0.365 mW/g; SAR(10 g) = 0.253 mW/g
Maximum value of SAR (measured) = 0.389 mW/g

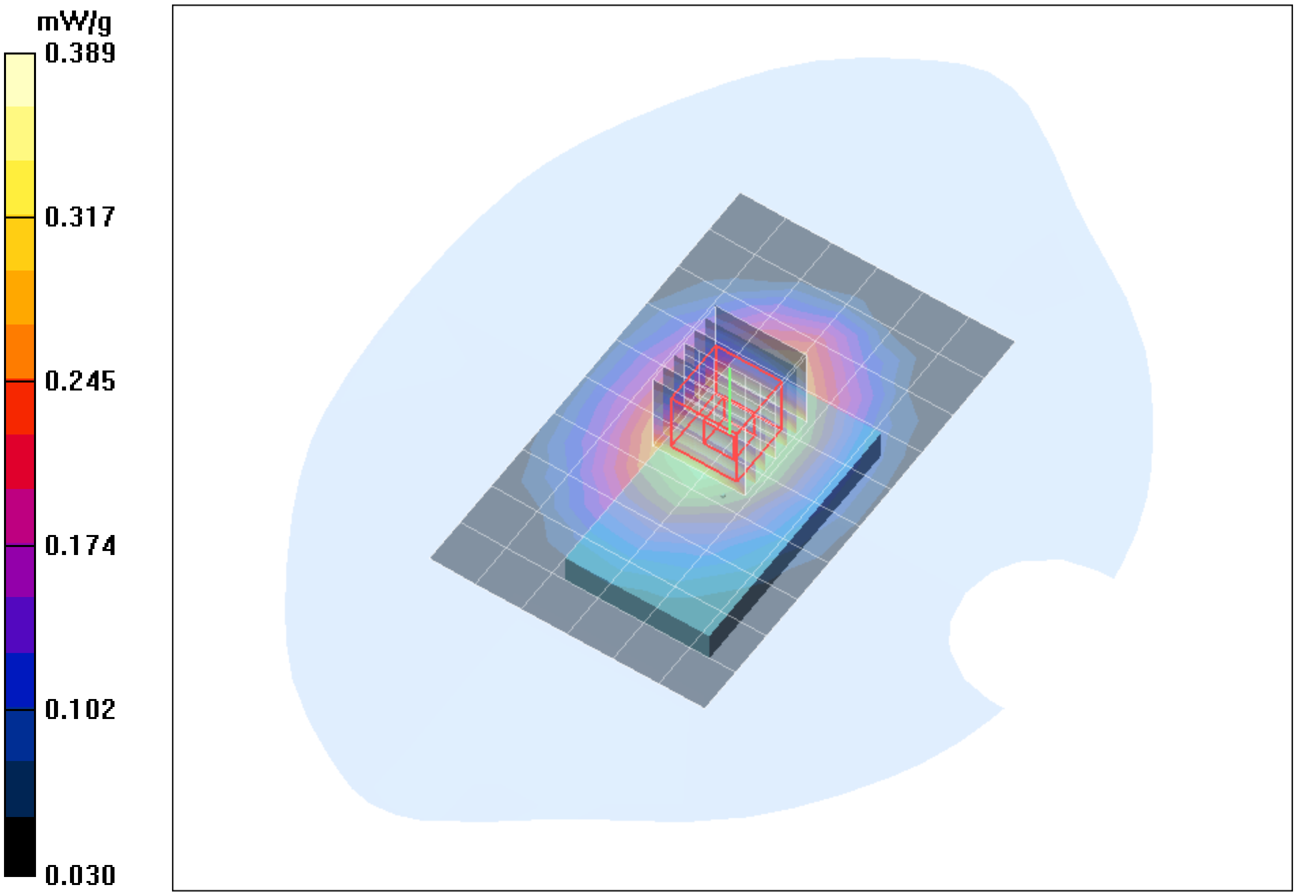


Fig. 19: SAR distribution plot for GSM 900 for the Fuji F-022, position 2, display towards the ground, headset attached (channel 038, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yghm_3_up_15mm_gprs.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: GPRS 900

Communication System: GPRS 900; Frequency: 897.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 897.6 MHz; σ = 0.98 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(6.23, 6.23, 6.23); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Sugar 1341; Type: QD 000 P40 CB; Serial: TP-1341
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.401 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.2 V/m; Power Drift = -0.162 dB
Peak SAR (extrapolated) = 0.503 W/kg
SAR(1 g) = 0.386 mW/g; SAR(10 g) = 0.274 mW/g
Maximum value of SAR (measured) = 0.411 mW/g

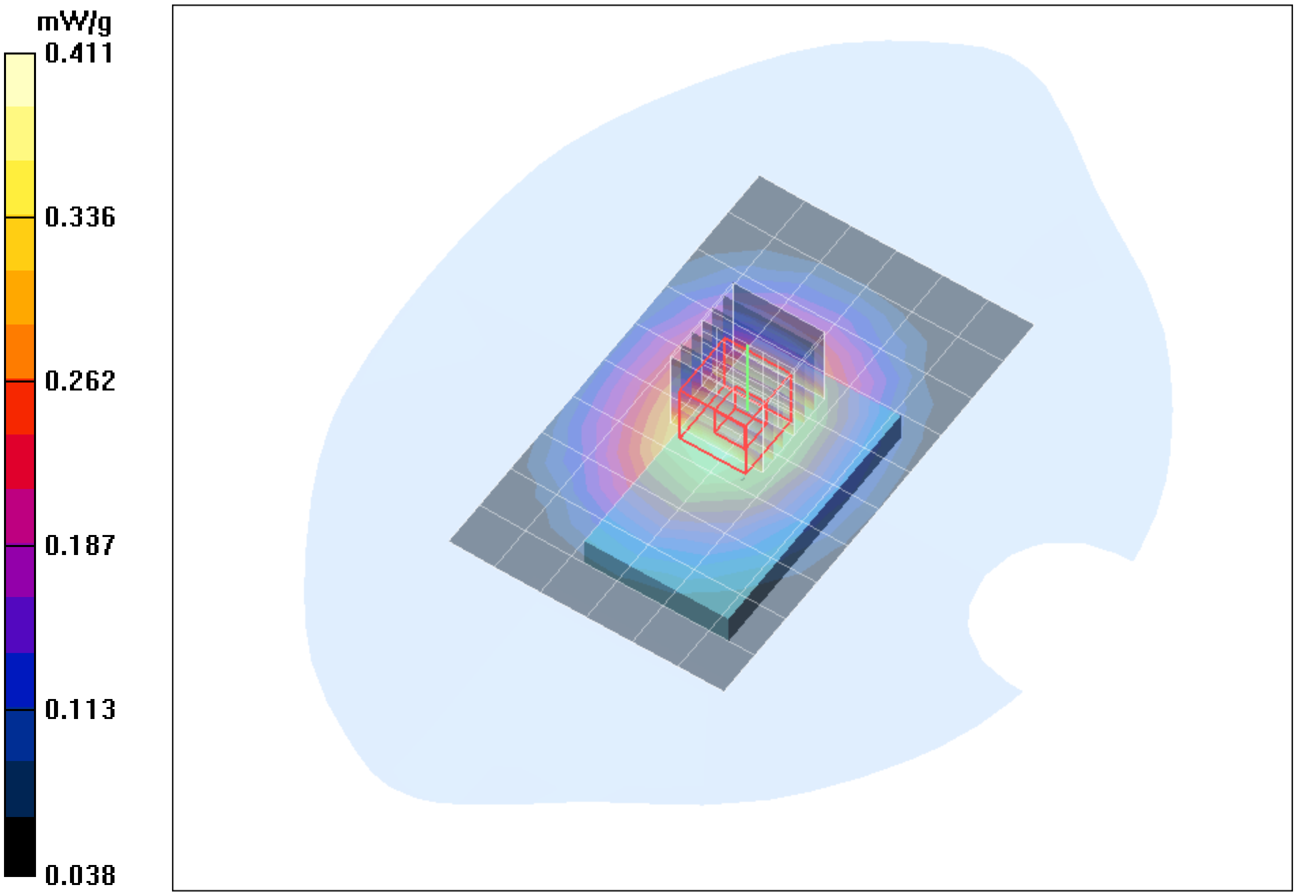


Fig. 20: SAR distribution plot for GPRS 900 (Class 8) for the Fuji F-022, position 1, display towards the phantom, without accessory (channel 038, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yghm_4_down_15mm_gprs.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: GPRS 900

Communication System: GPRS 900; Frequency: 897.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 897.6 MHz; σ = 0.98 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(6.23, 6.23, 6.23); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Sugar 1341; Type: QD 000 P40 CB; Serial: TP-1341
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.649 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.7 V/m; Power Drift = -0.178 dB
Peak SAR (extrapolated) = 0.824 W/kg
SAR(1 g) = 0.622 mW/g; SAR(10 g) = 0.433 mW/g
Maximum value of SAR (measured) = 0.666 mW/g

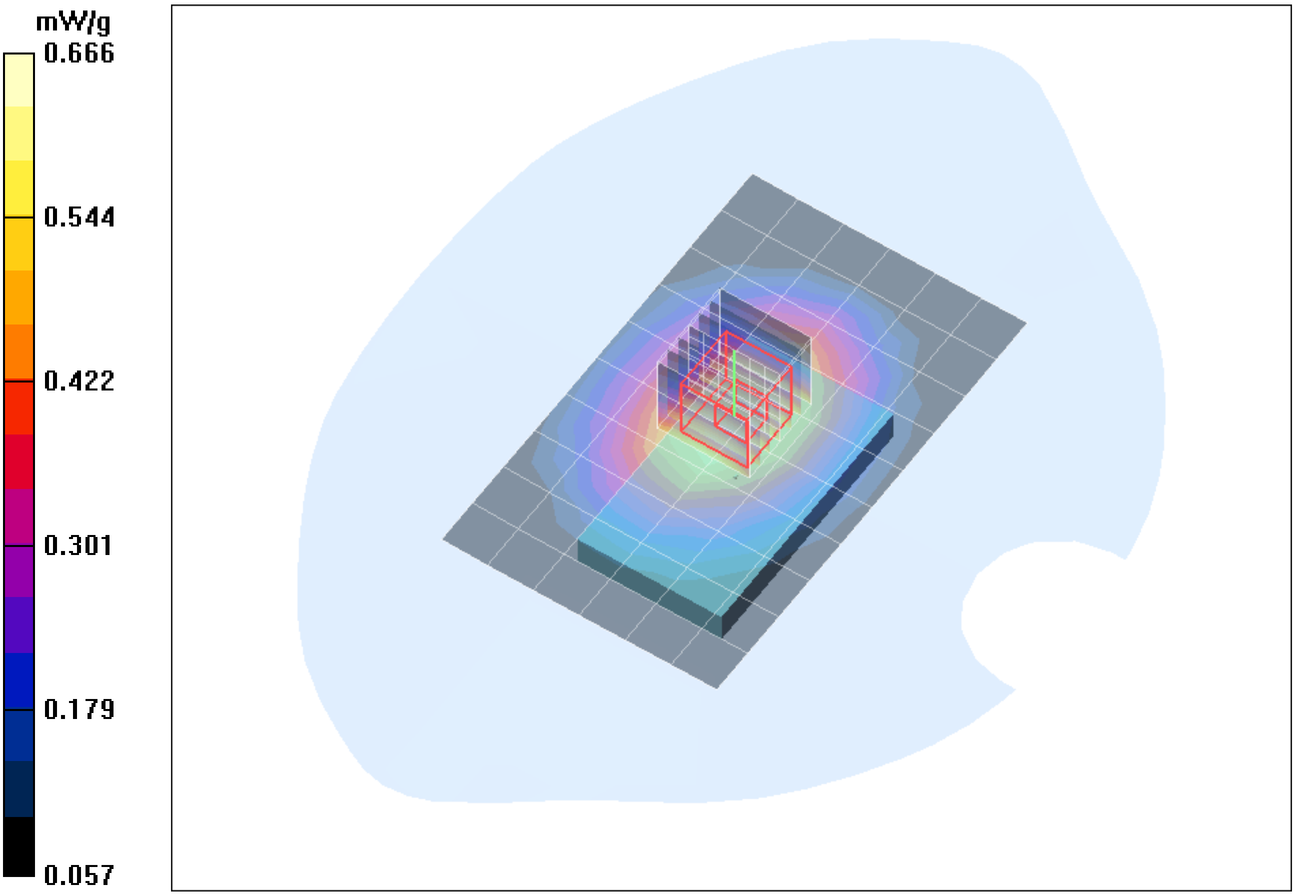


Fig. 21: SAR distribution plot for GPRS 900 (Class 8) for the Fuji F-022, position 2, display towards the ground, without accessory (channel 038, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yghl_4_down_15mm_gprs.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: GPRS 900

Communication System: GPRS 900; Frequency: 880.2 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 880.2 MHz; σ = 0.97 mho/m; ε_r = 42; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(6.23, 6.23, 6.23); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Sugar 1341; Type: QD 000 P40 CB; Serial: TP-1341
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.495 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.5 V/m; Power Drift = -0.145 dB
Peak SAR (extrapolated) = 0.631 W/kg
SAR(1 g) = 0.476 mW/g; SAR(10 g) = 0.333 mW/g
Maximum value of SAR (measured) = 0.513 mW/g

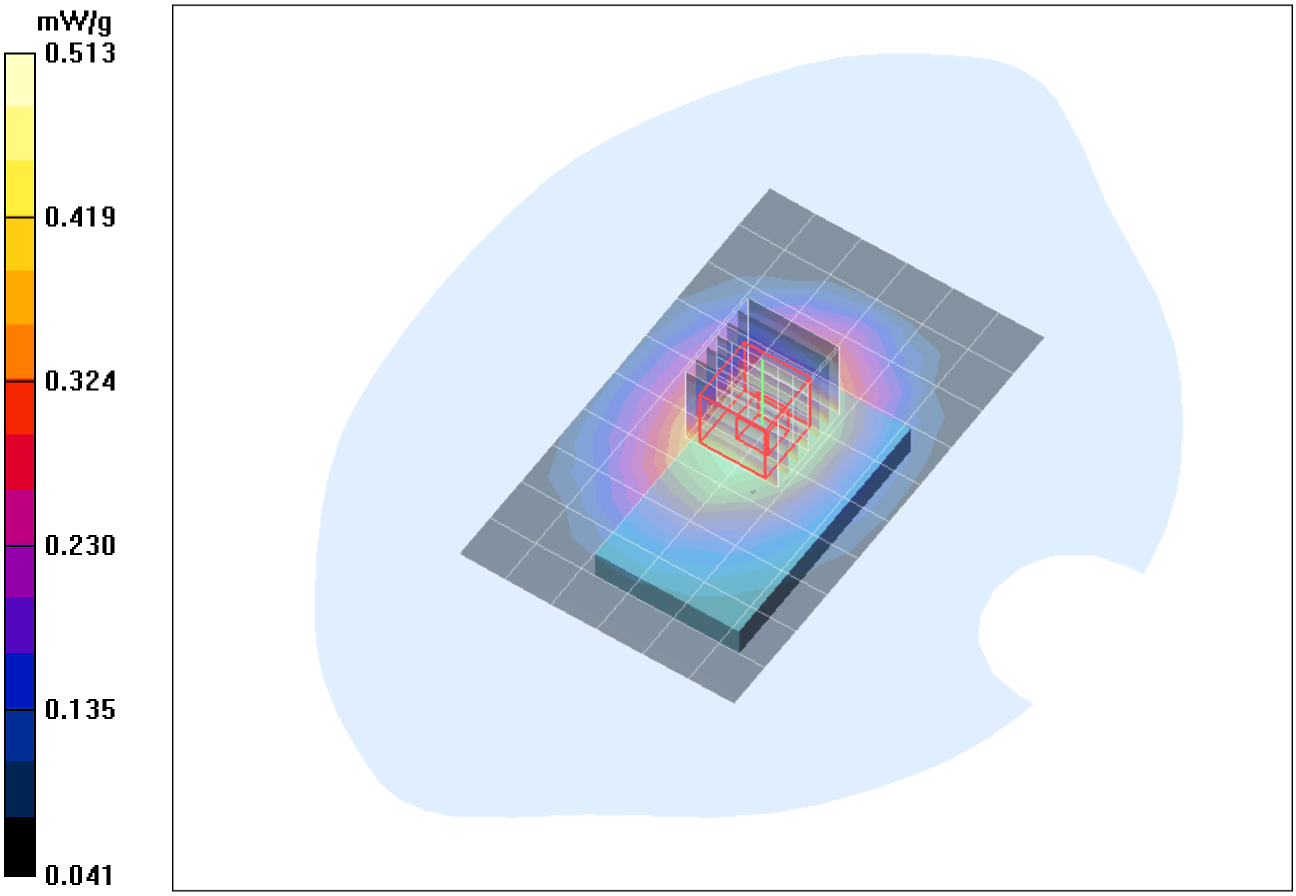


Fig. 22: SAR distribution plot for GPRS 900 (Class 8) for the Fuji F-022, position 2, display towards the ground, without accessory (channel 975, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yghh_4_down_15mm_gprs.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: GPRS 900

Communication System: GPRS 900; Frequency: 914.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 914.8 MHz; σ = 1 mho/m; ε_r = 41.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(6.23, 6.23, 6.23); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Sugar 1341; Type: QD 000 P40 CB; Serial: TP-1341
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.796 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 29.1 V/m; Power Drift = 0.016 dB
Peak SAR (extrapolated) = 1.01 W/kg
SAR(1 g) = 0.773 mW/g; SAR(10 g) = 0.539 mW/g
Maximum value of SAR (measured) = 0.822 mW/g

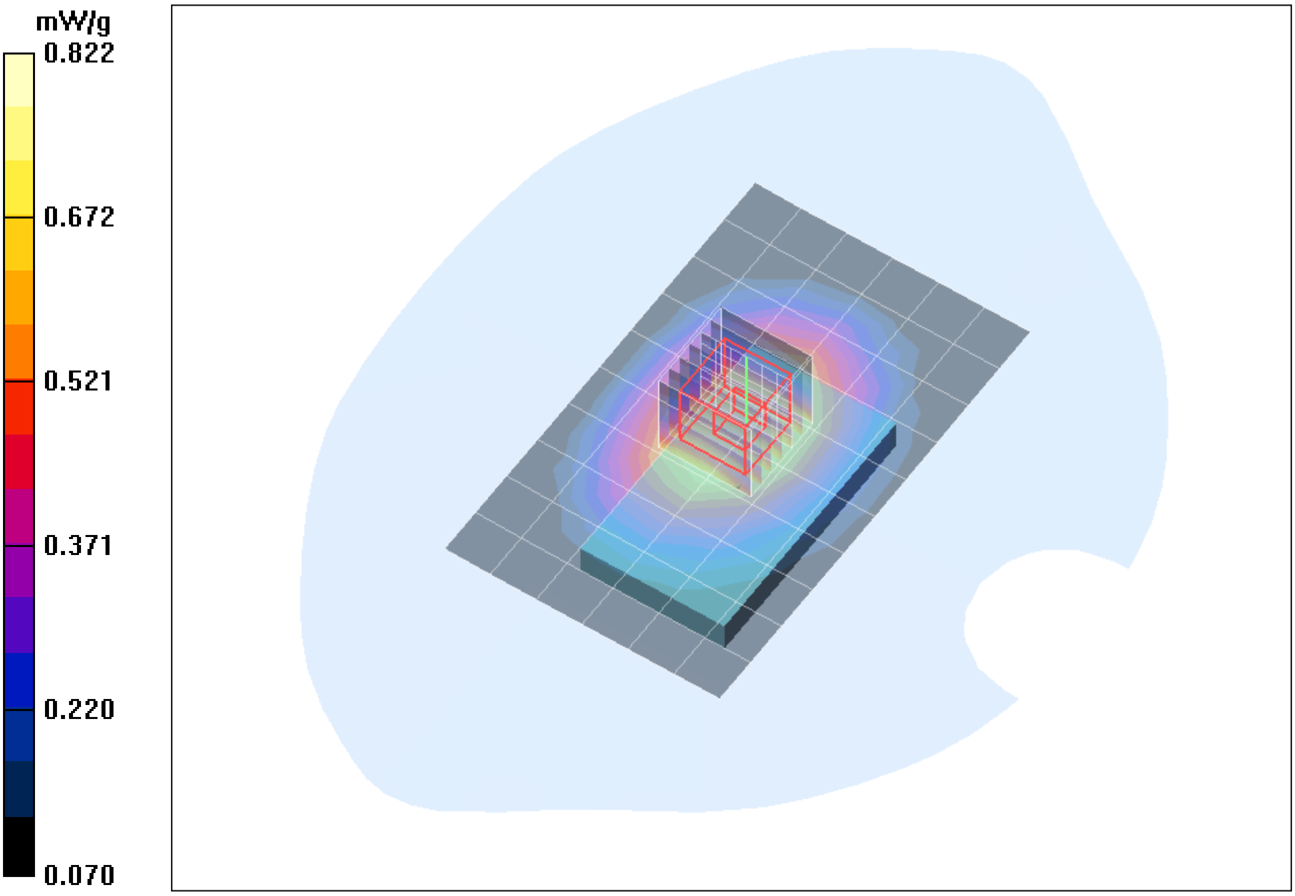


Fig. 23: SAR distribution plot for GPRS 900 (Class 8) for the Fuji F-022, position 2, display towards the ground, without accessory (channel 124, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_ydhm_1_up_15mm_HS.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: DCS 1800

Communication System: GSM 1800; Frequency: 1747.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1747.6 MHz; σ = 1.37 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(5.34, 5.34, 5.34); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.076 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.95 V/m; Power Drift = -0.085 dB
Peak SAR (extrapolated) = 0.115 W/kg
SAR(1 g) = 0.074 mW/g; SAR(10 g) = 0.045 mW/g
Maximum value of SAR (measured) = 0.080 mW/g

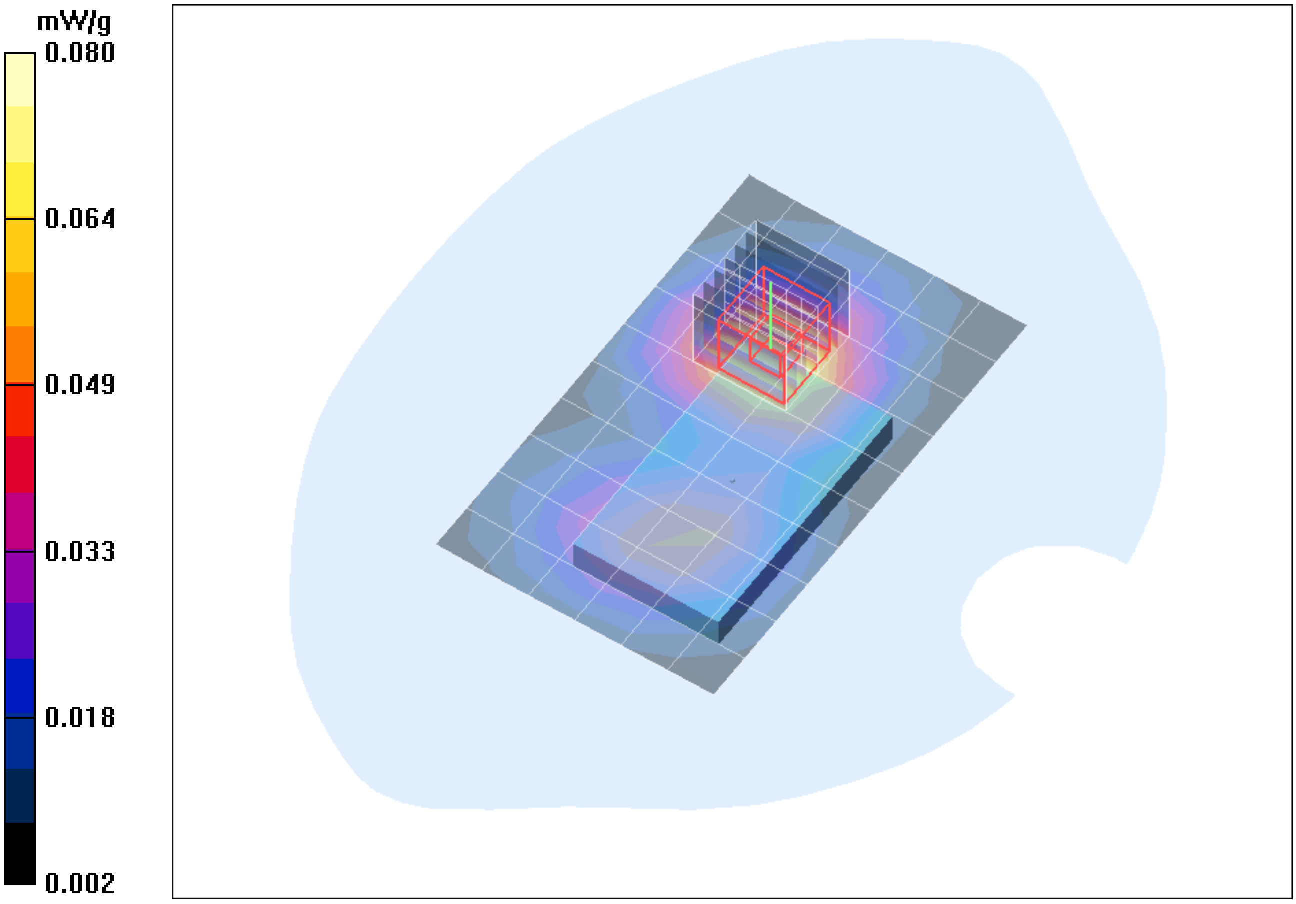


Fig. 24: SAR distribution plot for DCS 1800 for the Fuji F-022, position 1, display towards the phantom, headset attached (channel 699, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_ydhm_2_down_15mm_HS.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: DCS 1800

Communication System: GSM 1800; Frequency: 1747.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1747.6 MHz; σ = 1.37 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(5.34, 5.34, 5.34); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.177 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.41 V/m; Power Drift = -0.119 dB
Peak SAR (extrapolated) = 0.306 W/kg
SAR(1 g) = 0.182 mW/g; SAR(10 g) = 0.101 mW/g
Maximum value of SAR (measured) = 0.202 mW/g

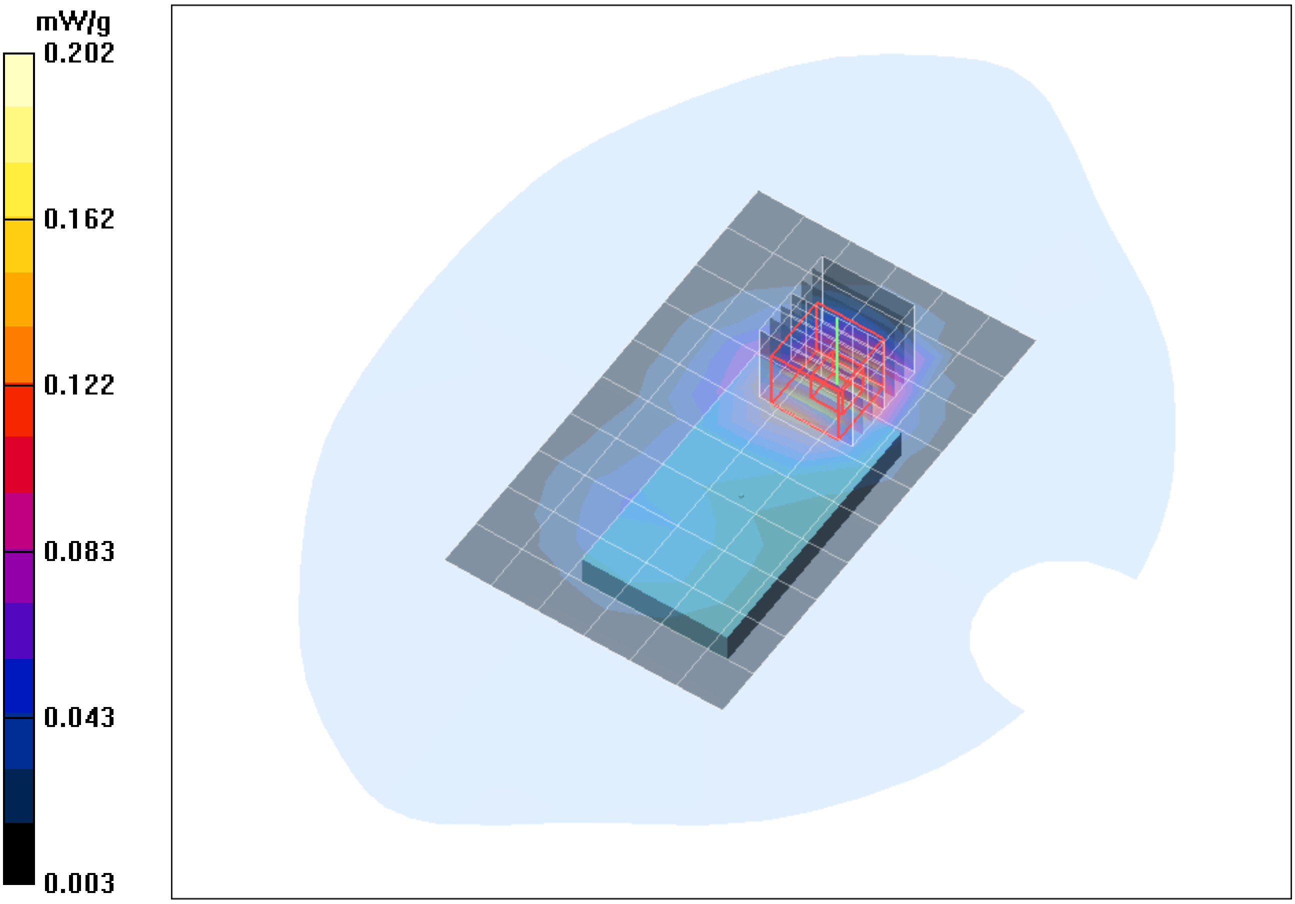


Fig. 25: SAR distribution plot for DCS 1800 for the Fuji F-022, position 2, display towards the ground, headset attached (channel 699, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_ydhm_3_up_15mm_gprs.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: GPRS 1800

Communication System: GPRS 1800; Frequency: 1747.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1747.6 MHz; σ = 1.37 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(5.34, 5.34, 5.34); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.101 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.06 V/m; Power Drift = -0.020 dB
Peak SAR (extrapolated) = 0.146 W/kg
SAR(1 g) = 0.095 mW/g; SAR(10 g) = 0.059 mW/g
Maximum value of SAR (measured) = 0.102 mW/g

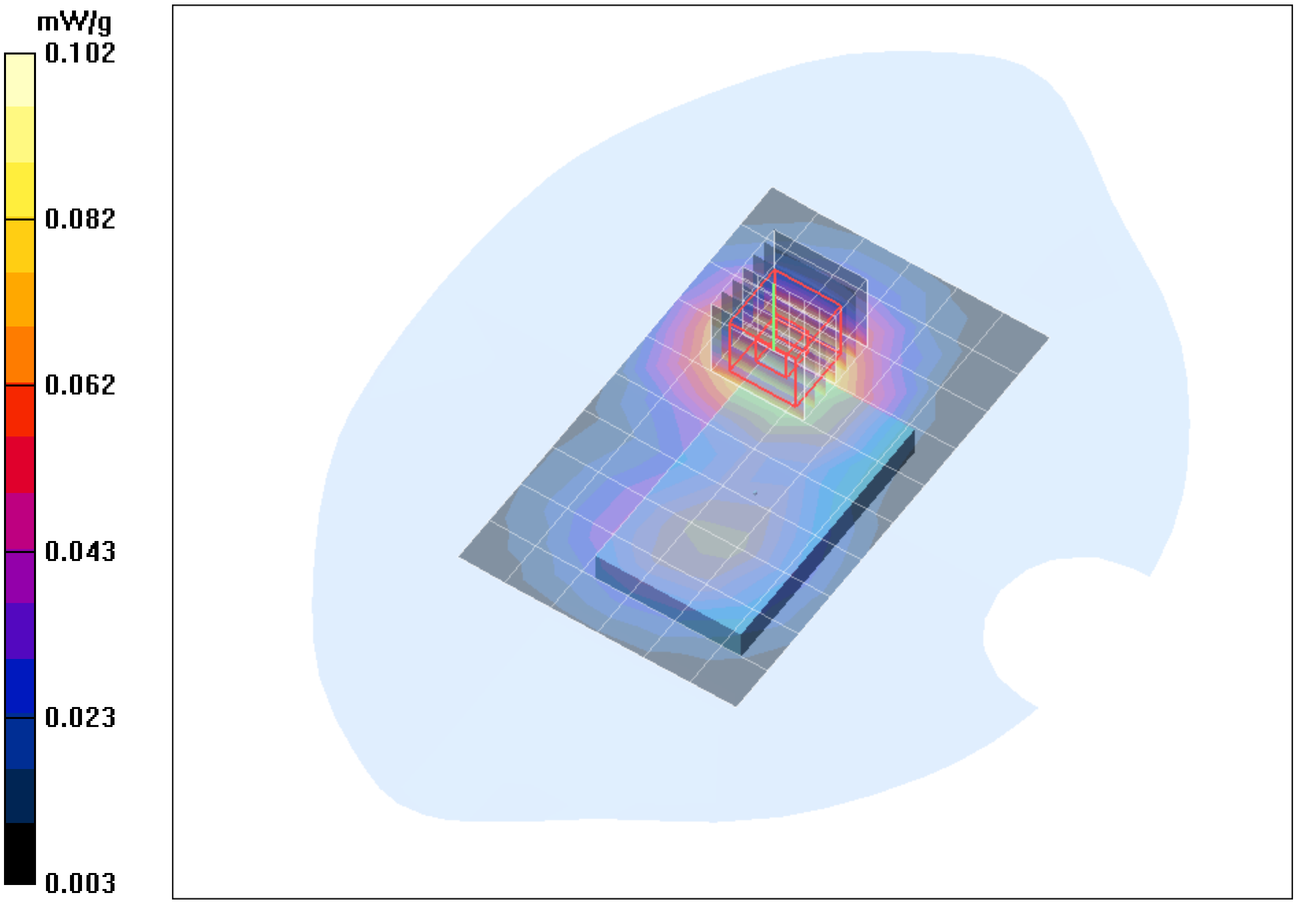


Fig. 26: SAR distribution plot for GPRS 1800 (Class 8) for the Fuji F-022, position 1, display towards the phantom, without accessory (channel 699, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_ydhm_4_down_15mm_gprs.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: GPRS 1800

Communication System: GPRS 1800; Frequency: 1747.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1747.6 MHz; σ = 1.37 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(5.34, 5.34, 5.34); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.217 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.87 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 0.323 W/kg
SAR(1 g) = 0.200 mW/g; SAR(10 g) = 0.116 mW/g
Maximum value of SAR (measured) = 0.221 mW/g

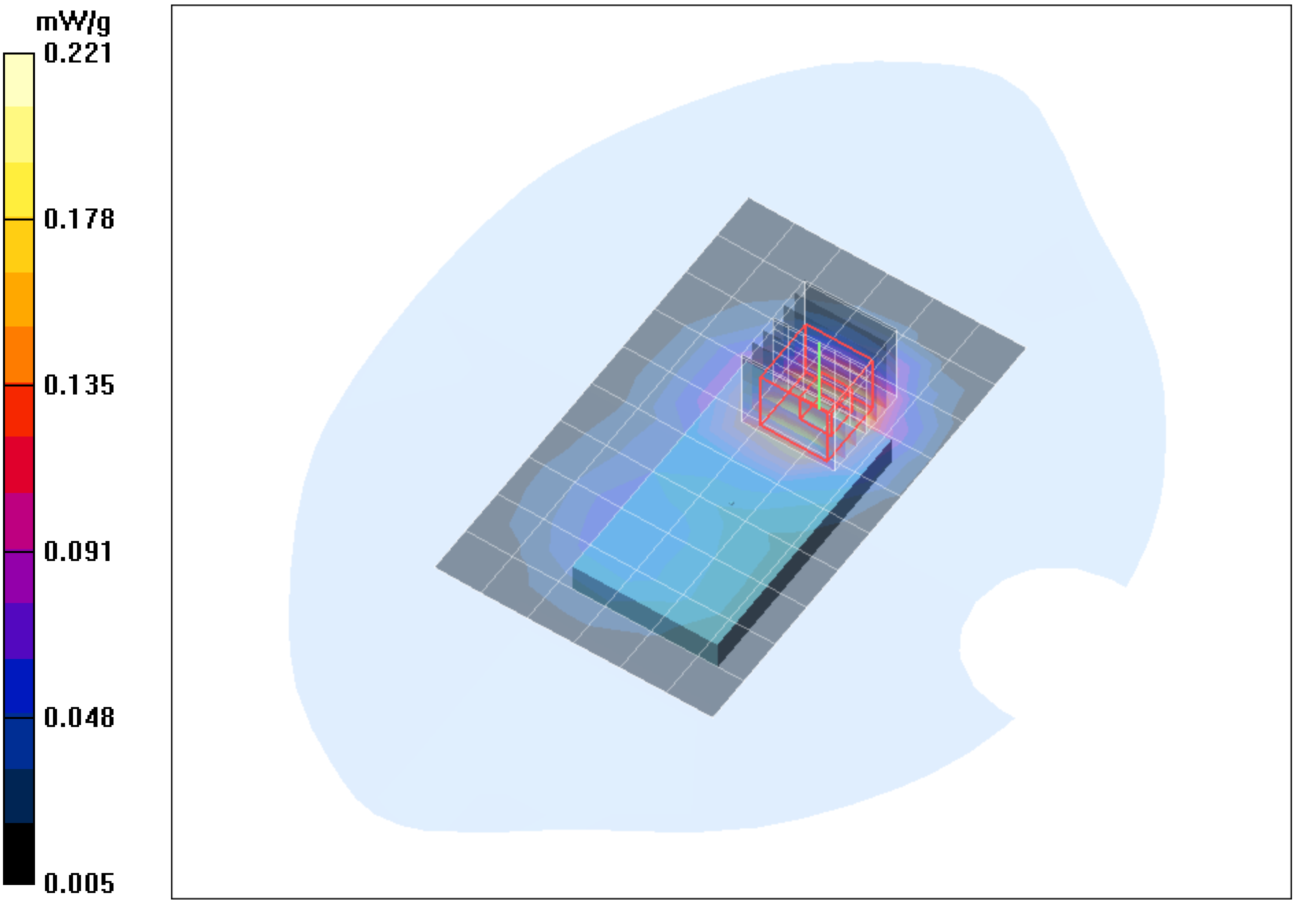


Fig. 27: SAR distribution plot for GPRS 1800 (Class 8) for the Fuji F-022, position 2, display towards the ground, without accessory (channel 699, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_ydhl_4_down_15mm_gprs.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: GPRS 1800

Communication System: GPRS 1800; Frequency: 1710.2 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1710.2 MHz; σ = 1.31 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(5.34, 5.34, 5.34); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.174 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.14 V/m; Power Drift = -0.032 dB
Peak SAR (extrapolated) = 0.265 W/kg
SAR(1 g) = 0.165 mW/g; SAR(10 g) = 0.095 mW/g
Maximum value of SAR (measured) = 0.182 mW/g

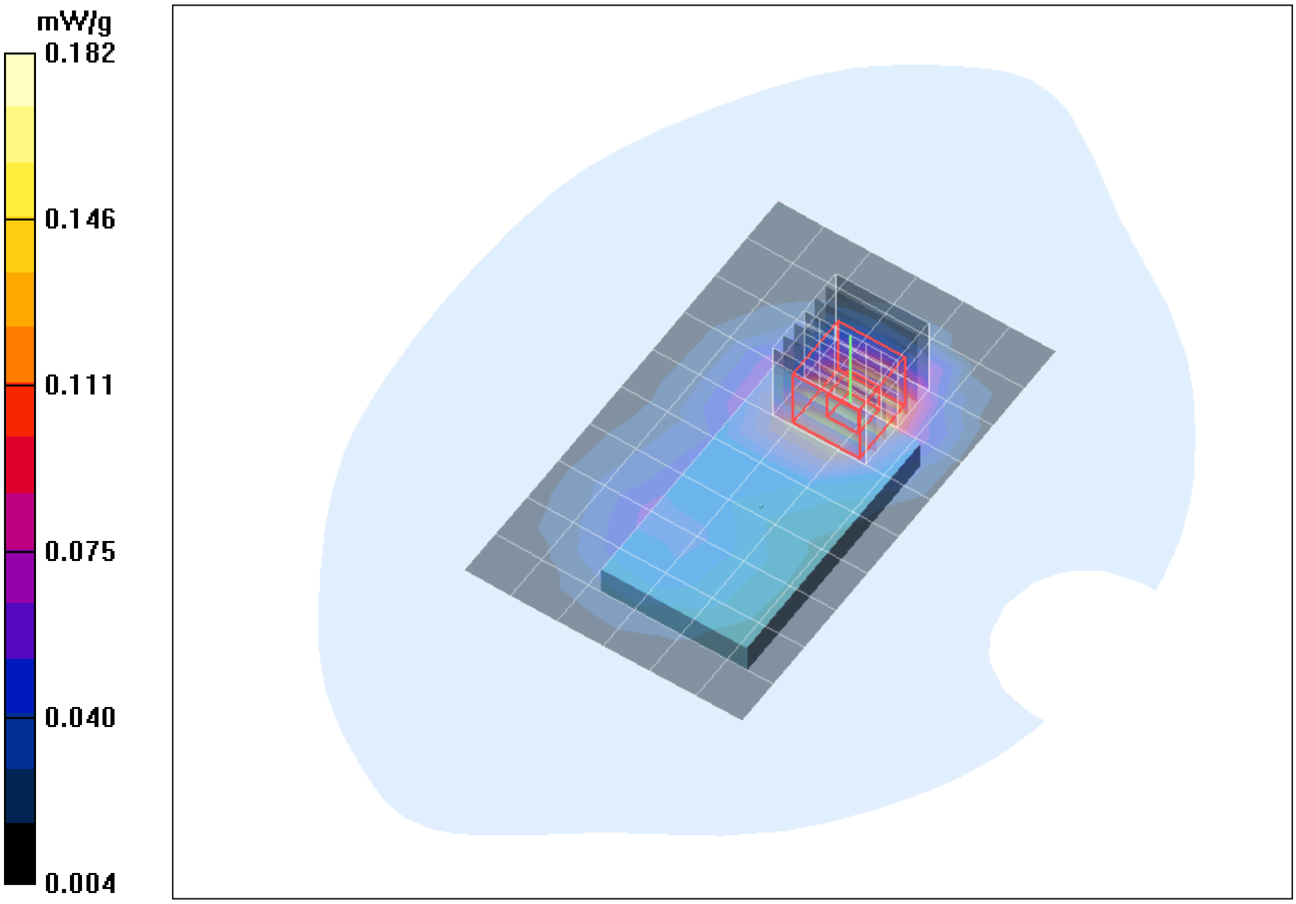


Fig. 28: SAR distribution plot for GPRS 1800 (Class 8) for the Fuji F-022, position 2, display towards the ground, without accessory (channel 512, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_ydhh_4_down_15mm_gprs.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: GPRS 1800

Communication System: GPRS 1800; Frequency: 1784.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1784.8 MHz; σ = 1.42 mho/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(5.34, 5.34, 5.34); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.319 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.37 V/m; Power Drift = -0.049 dB
Peak SAR (extrapolated) = 0.518 W/kg
SAR(1 g) = 0.314 mW/g; SAR(10 g) = 0.181 mW/g
Maximum value of SAR (measured) = 0.344 mW/g

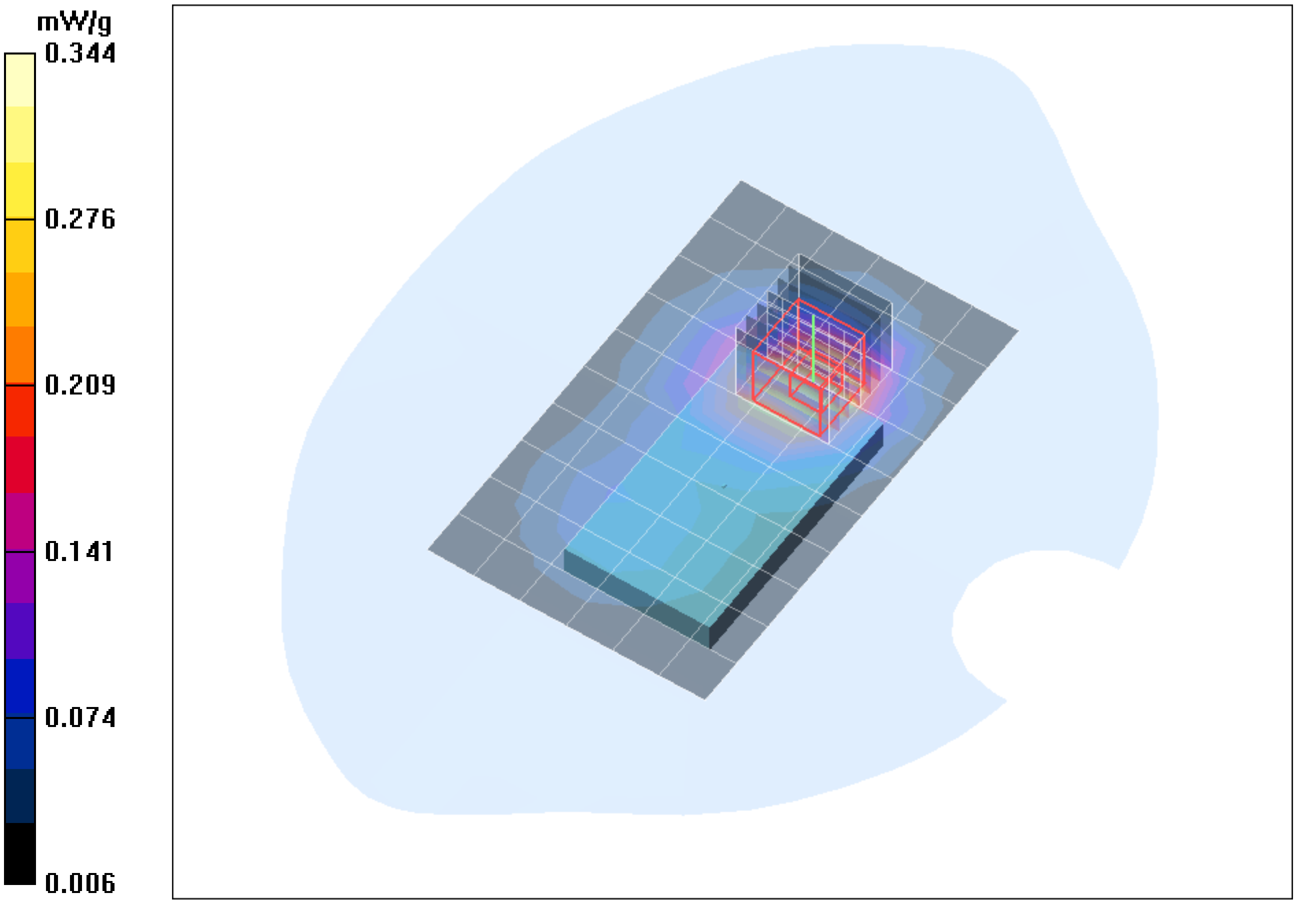


Fig. 29: SAR distribution plot for GPRS 1800 (Class 8) for the Fuji F-022, position 2, display towards the ground, without accessory (channel 885, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yuhm_1_up_15mm.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: WCDMA I

Communication System: WCDMA FDD ; Frequency: 1950 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1950 MHz; σ = 1.46 mho/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(7.95, 7.95, 7.95); Calibrated: 18.09.2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 17.09.2010
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.870 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.6 V/m; Power Drift = -0.057 dB
Peak SAR (extrapolated) = 1.12 W/kg
SAR(1 g) = 0.669 mW/g; SAR(10 g) = 0.396 mW/g
Maximum value of SAR (measured) = 0.893 mW/g

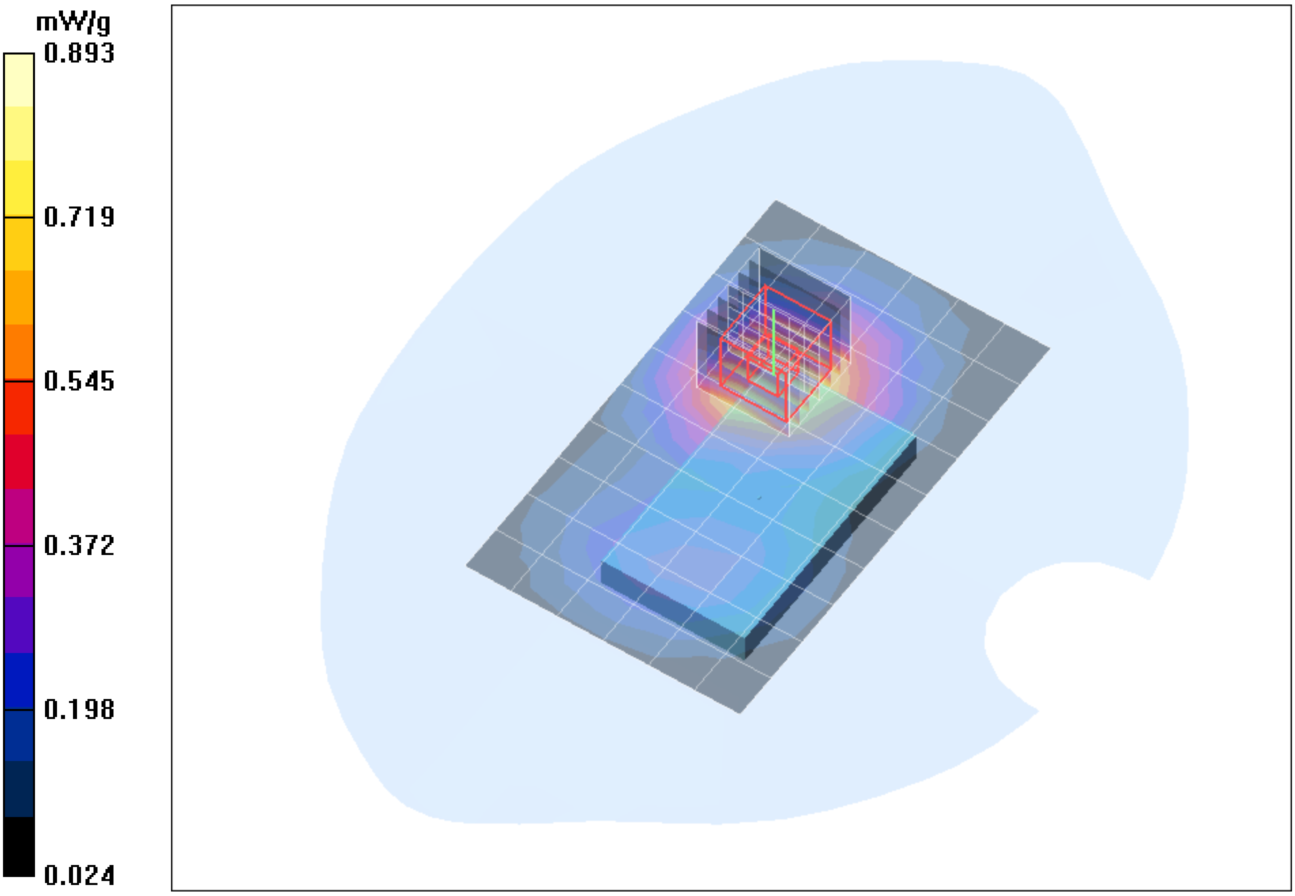


Fig. 30: SAR distribution plot for WCDMA I (FDD) for the Fuji F-022, position 1, display towards the phantom, without accessory (channel 9750, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yuhm_2_down_15mm.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: WCDMA I

Communication System: WCDMA FDD ; Frequency: 1950 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1950 MHz; σ = 1.46 mho/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(7.95, 7.95, 7.95); Calibrated: 18.09.2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 17.09.2010
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.43 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.1 V/m; Power Drift = 0.020 dB
Peak SAR (extrapolated) = 1.89 W/kg
SAR(1 g) = 1.1 mW/g; SAR(10 g) = 0.622 mW/g
Maximum value of SAR (measured) = 1.49 mW/g

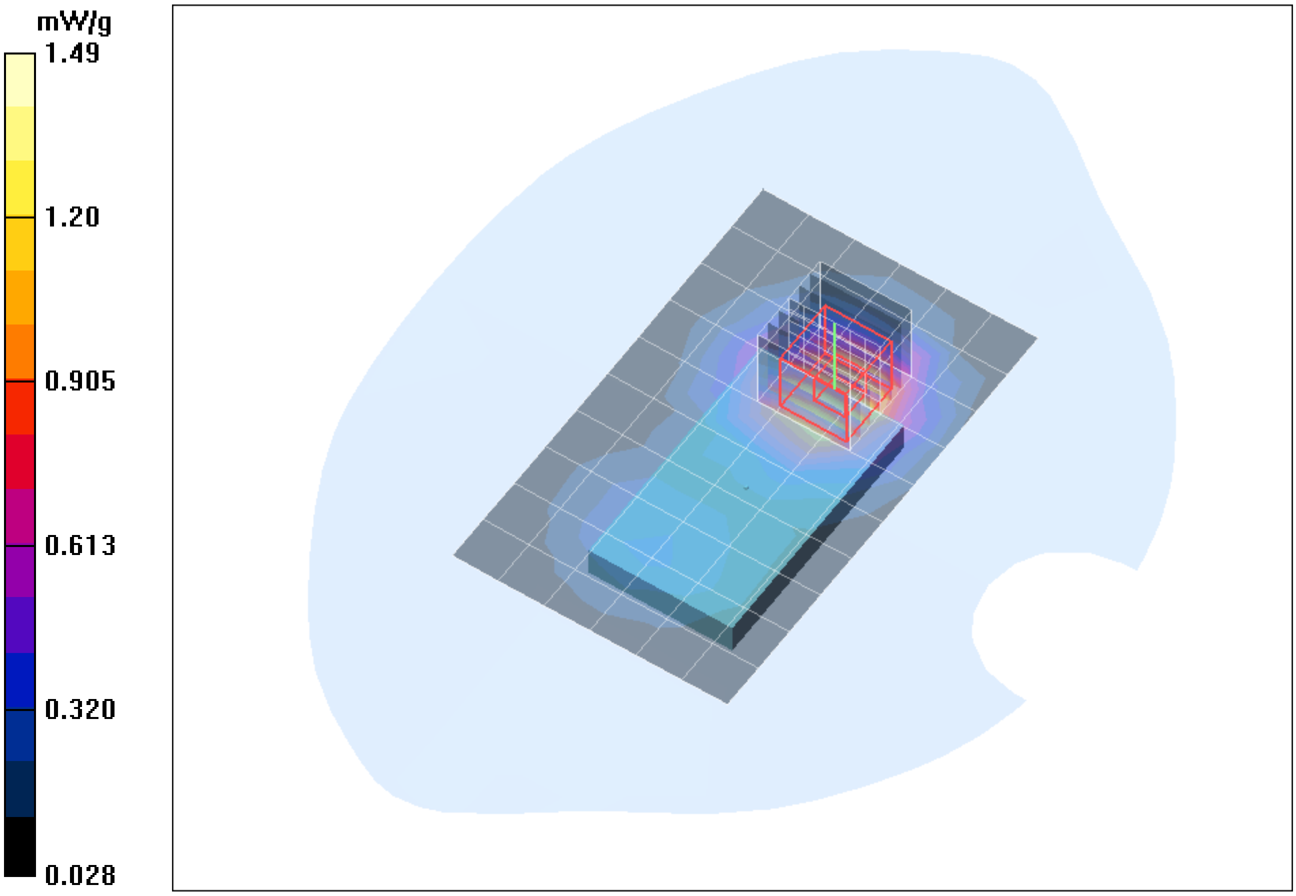


Fig. 31: SAR distribution plot for WCDMA I (FDD) for the Fuji F-022, position 2, display towards the ground, without accessory (channel 9750, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yuhm_2_down_15mm_HS.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: WCDMA I

Communication System: WCDMA FDD ; Frequency: 1950 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1950 MHz; σ = 1.46 mho/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(7.95, 7.95, 7.95); Calibrated: 18.09.2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 17.09.2010
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.14 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.9 V/m; Power Drift = 0.026 dB
Peak SAR (extrapolated) = 1.63 W/kg
SAR(1 g) = 0.914 mW/g; SAR(10 g) = 0.496 mW/g
Maximum value of SAR (measured) = 1.26 mW/g

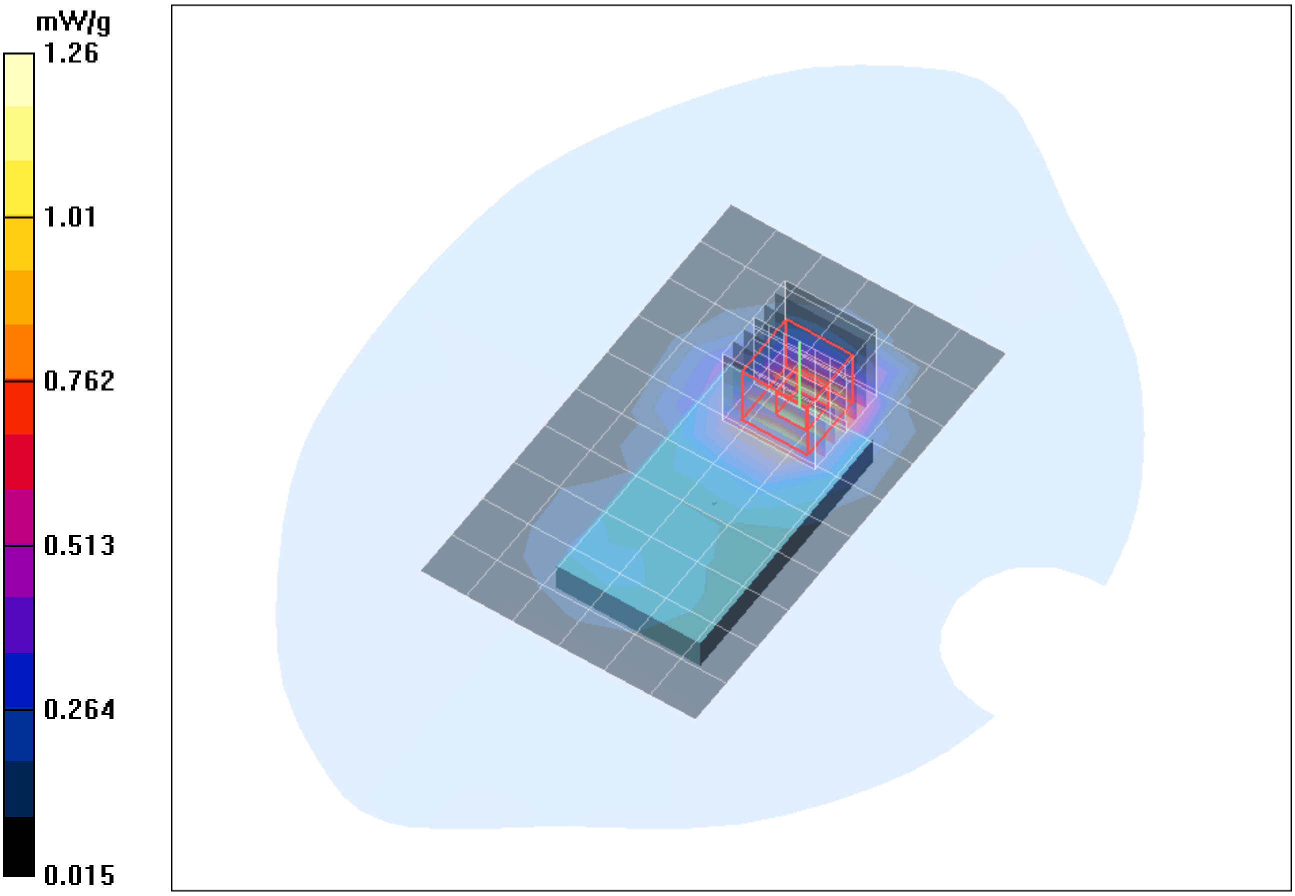


Fig. 32: SAR distribution plot for WCDMA I (FDD) for the Fuji F-022, position 2, display towards the ground, headset attached (channel 9750, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yuhl_2_down_15mm.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: WCDMA I

Communication System: WCDMA FDD ; Frequency: 1922.6 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1922.6 MHz; σ = 1.45 mho/m; ε_r = 39.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(7.95, 7.95, 7.95); Calibrated: 18.09.2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 17.09.2010
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.36 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.0 V/m; Power Drift = 0.025 dB
Peak SAR (extrapolated) = 1.77 W/kg
SAR(1 g) = 1.04 mW/g; SAR(10 g) = 0.594 mW/g
Maximum value of SAR (measured) = 1.41 mW/g

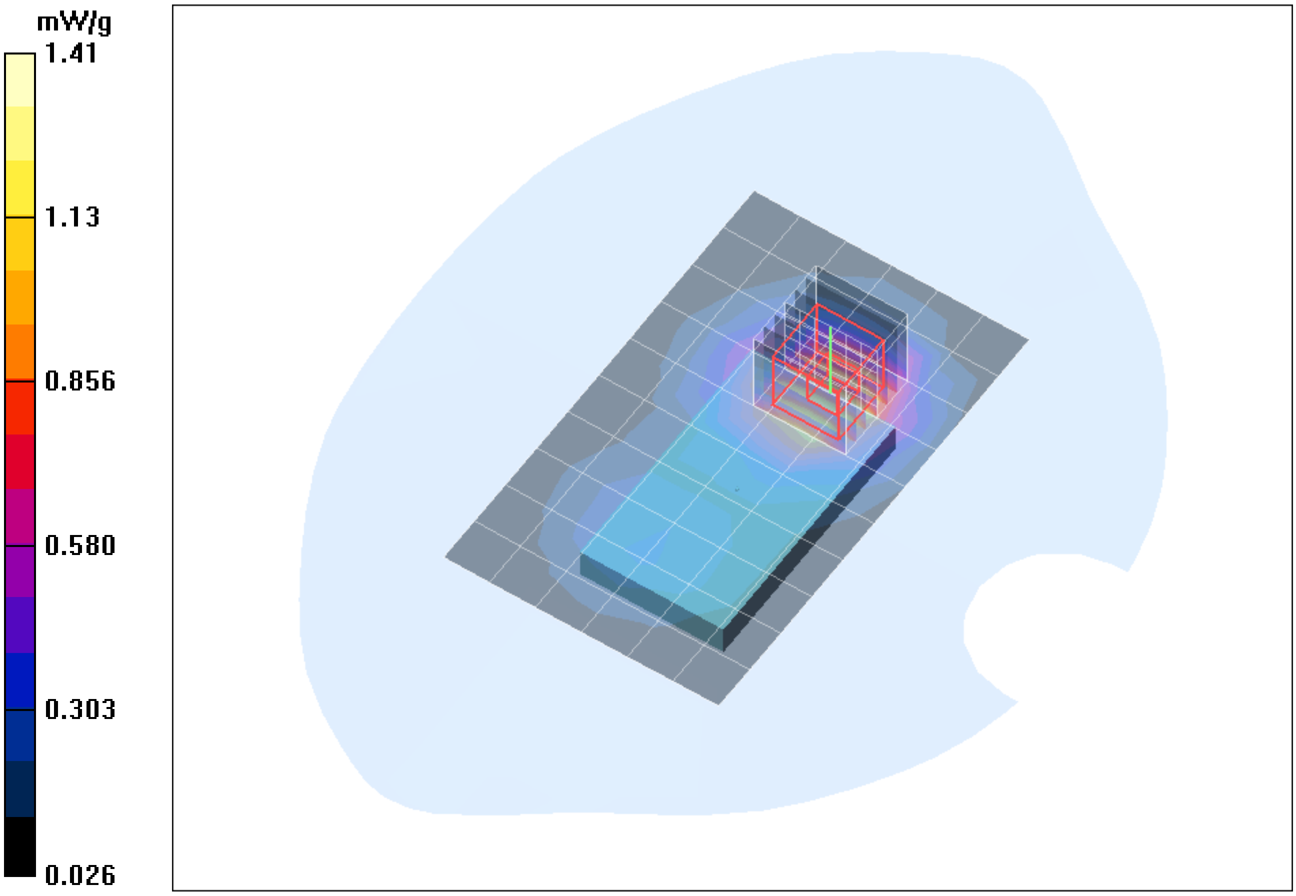


Fig. 33: SAR distribution plot for WCDMA I (FDD) for the Fuji F-022, position 2, display towards the ground, without accessory (channel 9613, gap = 15 mm).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 991_yuhh_2_down_15mm.da4

DUT: Fujitsu; Type: Folli Follie; Serial: 354224040010991
Program Name: WCDMA I

Communication System: WCDMA FDD ; Frequency: 1977.6 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1977.6 MHz; σ = 1.47 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(7.95, 7.95, 7.95); Calibrated: 18.09.2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 17.09.2010
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Worn/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.31 mW/g
Body Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.0 V/m; Power Drift = -0.065 dB
Peak SAR (extrapolated) = 1.76 W/kg
SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.576 mW/g
Maximum value of SAR (measured) = 1.38 mW/g

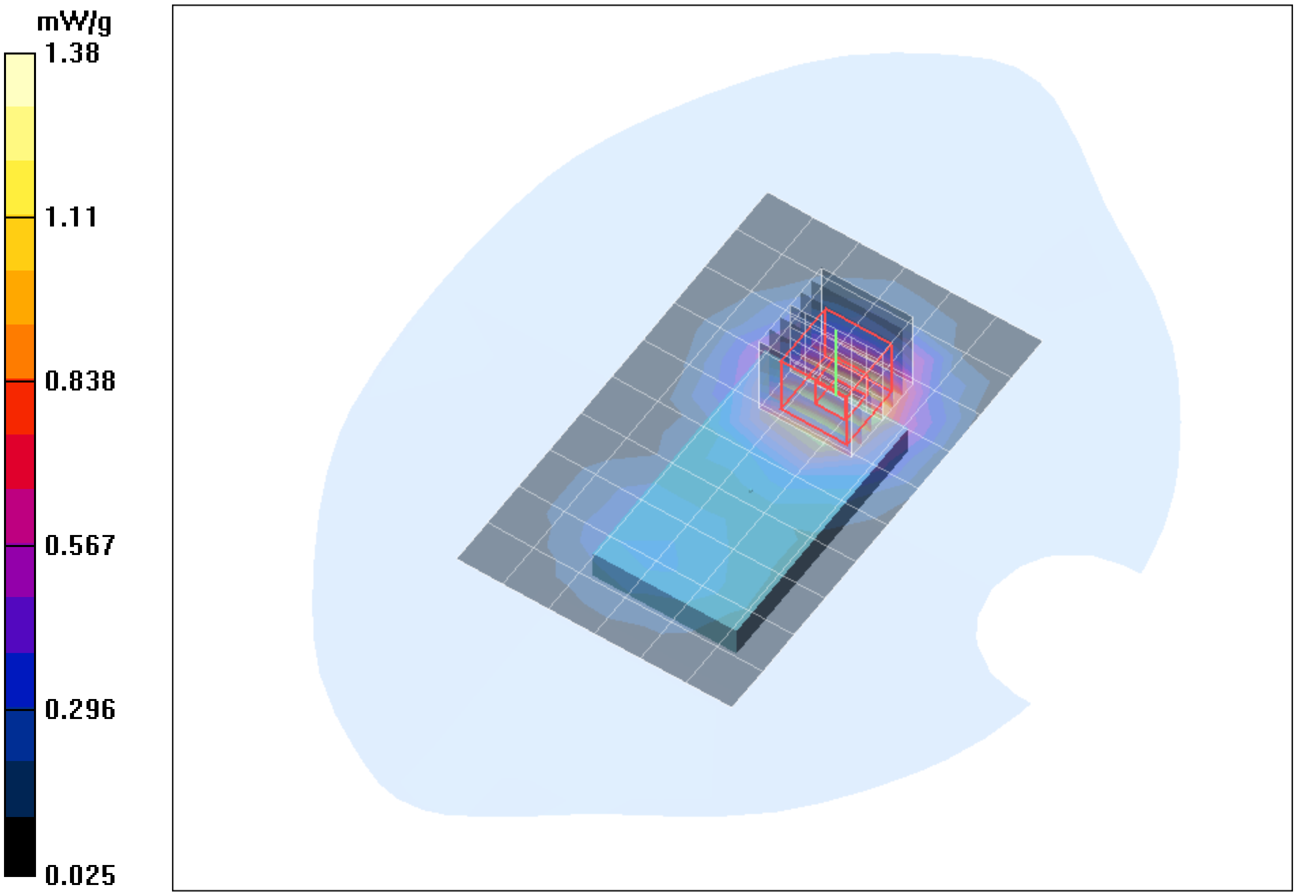


Fig. 34: SAR distribution plot for WCDMA I (FDD) for the Fuji F-022, position 2, display towards the ground, without accessory (channel 9887, gap = 15 mm).

7 Appendix

7.1 Administrative Data

Date of validation:	900 MHz (GSM 900) :	March 21, 2011
	1750 MHz (DCS 1800):	March 24, 2011
	1900 MHz (WCDMA):	March 18, 2011
Date of measurement:	March 18, 2011 – March 24, 2011	
Data stored:	7layers_6620_841	

7.2 Device under Test and Test Conditions

MTE:	Fuji F-022
Date of receipt:	March 15, 2011
IMEI:	354224040010991
Power supply:	internal battery
Supplied Antennas:	integrated
Measured Standards:	GSM 900, DCS 1800, WCDMA I (FDD)
Used GPRS Class:	8
WCDMA Mode:	12.2 kbps RMC in Test Loop Mode 1
Modulation:	GSM: GMSK; WCDMA (FDD): QPSK

	TX Range [MHz]	RX Range [MHz]	Used Channels [low, middle, high]	Used Crest Factor
GSM 900	880.2 – 914.8	925.2 – 959.8	975, 038, 124	8.3
DCS 1800	1710.2 – 1784.8	1805.2 – 1879.8	512, 699, 885	8.3
WCDMA I (FDD)	1922.6 – 1977.4	2112.6 – 2167.4	9613, 9750, 9887	1

Power Class:	GSM 900: 4, tested with power level 5 DCS 1800: 1, tested with power level 0 WCDMA I (FDD): tested with max. allow. UE Power of 33dBm
Used Phantom:	SAM Twin Phantom V4.0, as defined by the IEEE SCC-34/SC2 group and delivered by Schmid & Partner Engineering AG.

7.3 Tissue Recipes

The following recipes are provided in percentage by weight.

900 MHz:	56.63%	Sugar
	40.71%	De-Ionized Water
	1.48%	Salt
	0.99%	Hydroxyetyl-cellulose
	0.19%	Preventol D7
1750 MHz:	45.65%	Diethylenglykol-monobutylether
	54.00%	De-Ionized Water
	0.35%	Salt
1900 MHz:	45.51%	Diethylenglykol-monobutylether
	55.41%	De-Ionized Water
	0.08%	Salt

7.4 Material Parameters

For the measurement of the following parameters the HP 85070B dielectric probe kit is used, representing the open-ended coaxial probe measurement procedure. The measured values should be within ± 5% of the recommended values given by the IEC 62209-2.

Frequency		ε_r	σ [S/m]
900 MHz Head	Recommended Value	39.90 – 43.60	0.94 – 1.02
	Measured Value (Validation)	41.50	0.98
	Measured Value (CH 975)	42.00	0.97
	Measured Value (CH 038)	41.50	0.98
	Measured Value (CH 124)	41.20	1.00
1750 MHz Head	Recommended Value	38.20 – 42.00	1.31 –1.43
	Measured Value (Validation)	41.10	1.37
	Measured Value (CH 512)	41.50	1.31
	Measured Value (CH 699)	41.10	1.37
	Measured Value (CH 885)	41.30	1.42
1900 MHz Head (WCDMA)	Recommended Value	38.00 – 42.00	1.33 - 1.47
	Measured Value (Validation)	39.50	1.43
	Measured Value (CH 9613)	39.70	1.45
	Measured Value (CH 9750)	39.40	1.46
	Measured Value (CH 9887)	38.90	1.47

Table 6: Parameters of the tissue simulating liquid.

7.5 Simplified Performance Checking

The simplified performance check was realized using the dipole validation kits. The input power of the dipole antennas were 250 mW and they were placed under the flat part of the SAM phantoms. The target and measured results are listed in the table 7 - 8 and shown in figure 35 - 37. The target values were adopted from the calibration certificates.

Available Dipoles		SAR_{10g} [W/kg]	ε_r	σ [S/m]
D900V2, SN #006	Target Values Head	1.85	42.70	0.97
D1750V2, SN #1005		4.79	41.20	1.37
D1900V2, SN #5d051		4.76	40.30	1.45

Table 7: Dipole target results.

Used Dipoles		SAR_{10g} [W/kg]	ε_r	σ [S/m]
900 MHz, SN: #006	Measured Values Head	1.74	41.50	0.98
1750 MHz, SN: #1005		4.85	41.10	1.37
1900 MHz, SN: #5d051		5.00	39.50	1.43

Table 8: Measured dipole validation results.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 210310_y_1669.da4

DUT: Dipole 900 MHz SN:006; Type: D900V2; Serial: D900V2 - SN:006
Program Name: System Performance Check at 900 MHz

Communication System: CW; Frequency: 900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 900 MHz; σ = 0.98 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(6.23, 6.23, 6.23); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Sugar 1341; Type: QD 000 P40 CB; Serial: TP-1341
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.95 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.6 V/m; Power Drift = 0.044 dB
Peak SAR (extrapolated) = 3.94 W/kg
SAR(1 g) = 2.71 mW/g; SAR(10 g) = 1.74 mW/g

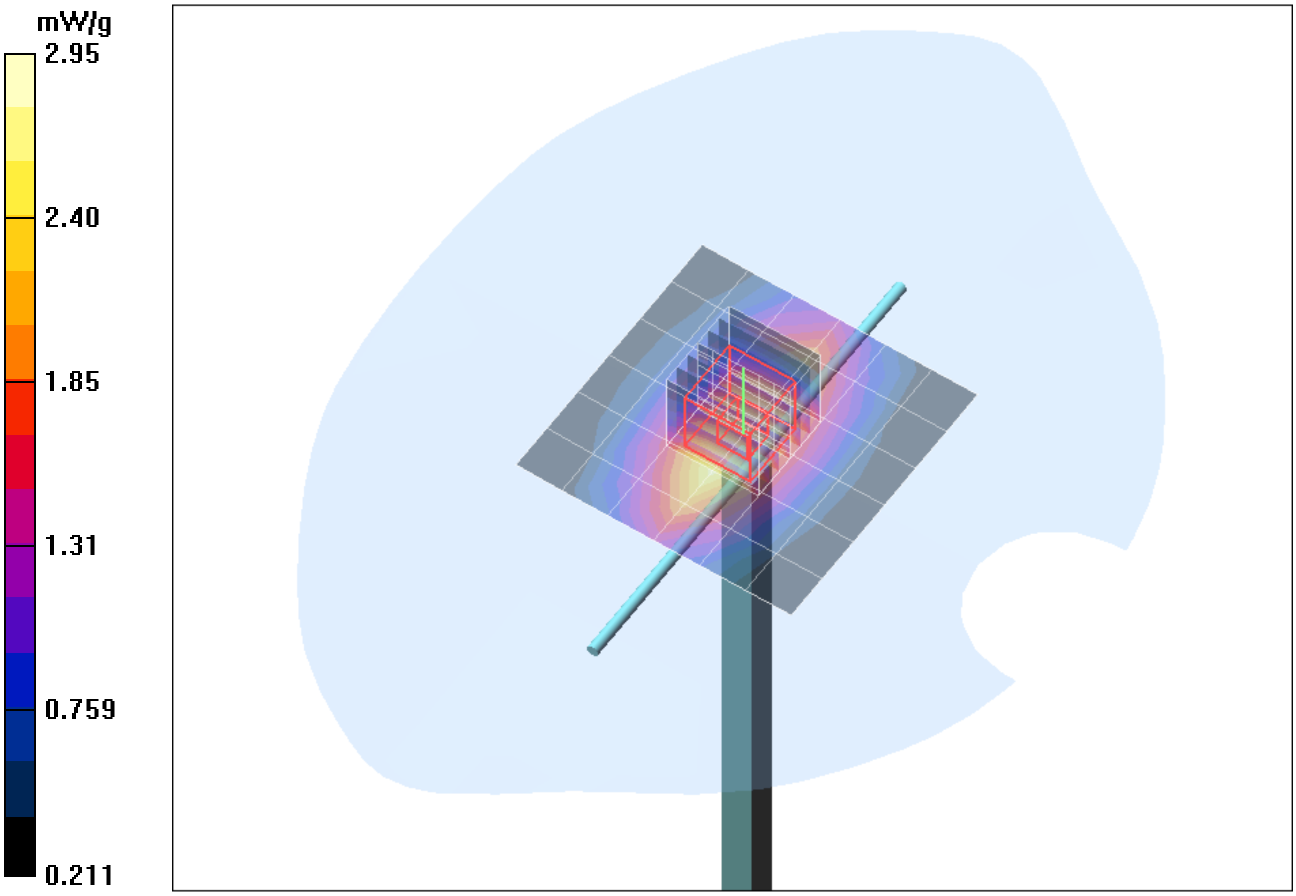


Fig. 35: Validation measurement 900 MHz.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 240311_y_1669.da4

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

Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1750 MHz; σ = 1.37 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1669; ConvF(5.34, 5.34, 5.34); Calibrated: 21.02.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 10.1 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.6 V/m; Power Drift = 0.010 dB
Peak SAR (extrapolated) = 15.7 W/kg
SAR(1 g) = 9.07 mW/g; SAR(10 g) = 4.85 mW/g
Maximum value of SAR (measured) = 10.3 mW/g

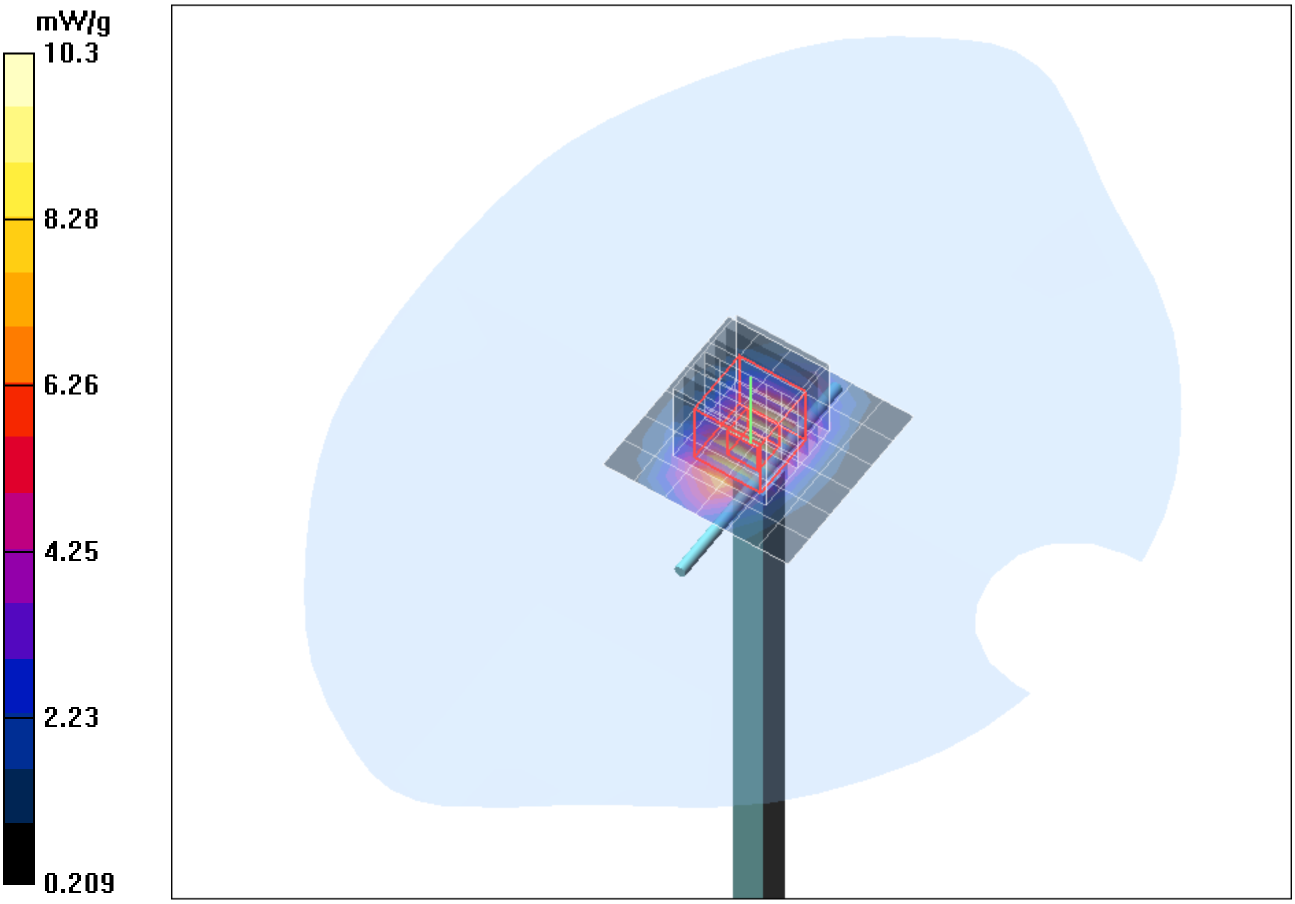


Fig. 36: Validation measurement 1750 MHz (DCS 1800).

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 180311_y_3536.da4

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

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.43 mho/m; ε_r = 39.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3536; ConvF(7.77, 7.77, 7.77); Calibrated: 16.09.2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 17.09.2010
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 10.9 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.8 V/m; Power Drift = -0.009 dB
Peak SAR (extrapolated) = 19.1 W/kg
SAR(1 g) = 9.81 mW/g; SAR(10 g) = 5 mW/g
Maximum value of SAR (measured) = 11.0 mW/g

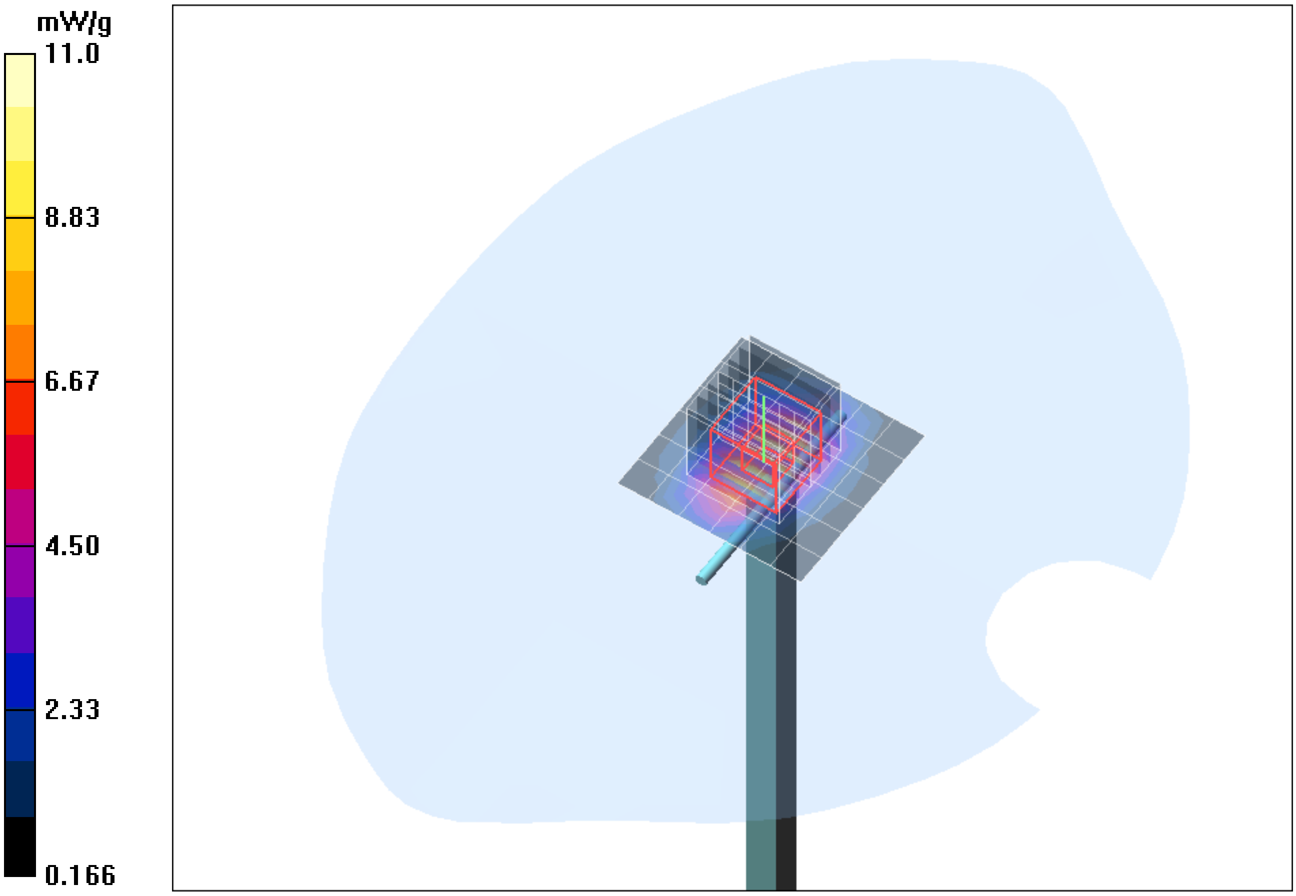


Fig. 37: Validation measurement 1900 MHz (WCDMA).

7.6 Environment

Ambient temperature: 21 °C ± 1 °C, Liquid temperature: 20 °C ± 1 °C
Humidity: 40 % ± 5 %

7.7 Test Equipment

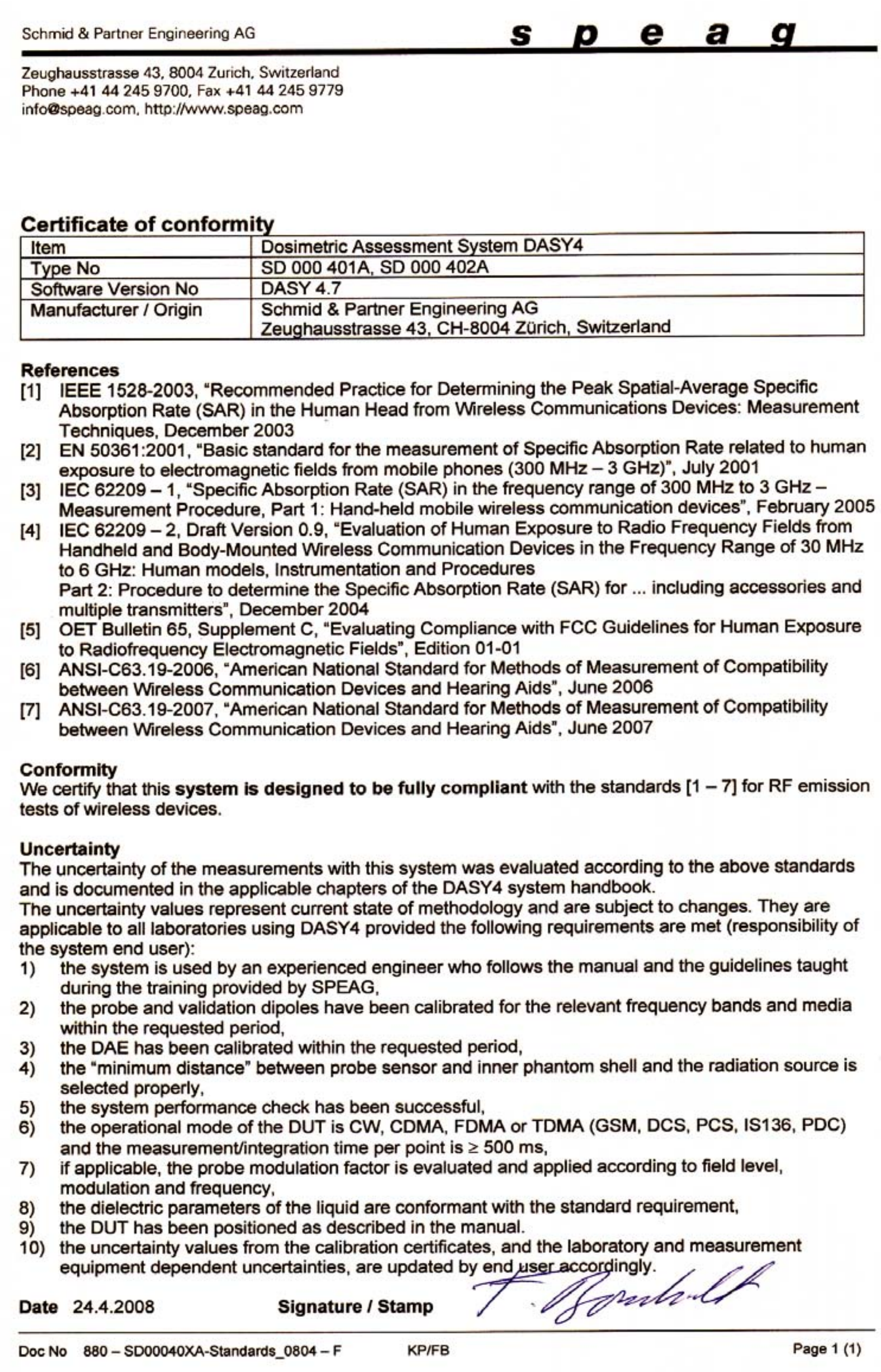
Test Equipment	Model	Serial Number	Last Calibration	Next Calibration
DASY4 Systems				
Software Versions DASY4	V4.7	N/A	N/A	N/A
Software Versions SEMCAD	V1.8	N/A	N/A	N/A
Dosimetric E-Field Probe	ET3DV6	1669	02/2011	02/2012
Dosimetric E-Field Probe	EX3DV4	3536	09/2010	09/2011
Data Acquisition Electronics	DAE 3	335	02/2011	02/2012
Data Acquisition Electronics	DAE 4	631	09/2010	09/2011
Phantom	SAM	1059	N/A	N/A
Phantom	SAM	1176	N/A	N/A
Phantom	SAM	1340	N/A	N/A
Phantom	SAM	1341	N/A	N/A
Dipoles				
Validation Dipole	D900V2	006	09/2009	09/2011
Validation Dipole	D1750V2	1005	02/2010	02/2012
Validation Dipole	D1900V2	5d051	09/2009	09/2011
Material Measurement				
Network Analyzer	E5071C	MY46103220	08/2009	08/2011
Dielectric Probe Kit	HP85070B	US33020263	N/A	N/A

Table 9: SAR equipment.

Test Equipment	Model	Serial Number	Last Calibration	Next Calibration
Power Meters				
Power Meter, Agilent	E4416A	GB41050414	12/2010	12/2012
Power Meter, Agilent	E4417A	GB41050441	12/2010	12/2012
Power Meter, Anritsu	ML2487A	6K00002319	12/2009	12/2011
Power Meter, Anritsu	ML2488A	6K00002078	12/2009	12/2011
Power Sensors				
Power Sensor, Agilent	E9301H	US40010212	12/2010	12/2012
Power Sensor, Agilent	E9301A	MY41495584	12/2010	12/2012
Power Sensor, Anritsu	MA2481B	031600	12/2009	12/2011
Power Sensor, Anritsu	MA2490A	031565	12/2009	12/2011
RF Sources				
Network Analyzer	E5071C	MY46103220	08/2009	08/2011
Rohde & Schwarz	SME300	100142	N/A	N/A
Amplifiers				
Mini Circuits	ZHL-42	D012296	N/A	N/A
Mini Circuits	ZHL-42	D031104#01	N/A	N/A
Ciao Wireless	CA26-451	102	N/A	N/A
Radio Tester				
Rohde & Schwarz	CMU200	835305/050	N/A	N/A

Table 10: Test equipment, General.

7.8 Certificates of Conformity



Schmid & Partner Engineering AG **s p e a g**

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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**

Doc No 880 – SD00040XA-Standards_0804 – F KP/FB Page 1 (1)

Fig. 38: 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
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Doc No 881 – QD 000 P40 BA – B Page 1 (1)

Fig. 39: Certificate of conformity for the used SAM phantom

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s p e a g

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

Certificate of Conformity / First Article Inspection

Item	Oval Flat Phantom ELI 4.0
Type No	QD OVA 001 B
Series No	1003 and higher
Manufacturer	SPEAG Zeughausstrasse 43 CH-8004 Zürich Switzerland

Tests
Complete tests were made on the prototype units QD OVA 001 AA 1001, QD OVA 001 AB 1002, pre-series units QD OVA 001 BA 1003-1005 as well as on the series units QD OVA 001 BB, 1006 ff.

Test	Requirement	Details	Units tested
Dimensions	Compliant with the standard IEC 62209 – 2 [1] requirements	Dimensions of bottom for 300 MHz – 6 GHz: longitudinal = 600 mm (max. dimension) width= 400 mm (min dimension) depth= 190 mm Shape: ellipse	Prototypes, Samples
Material thickness	Compliant with the standard IEC 62209 – 2 [1] requirements	Bottom plate: 2.0mm +/- 0.2mm	Prototypes, All items
Material parameters	Dielectric parameters for required frequencies	300 MHz – 6 GHz Rel. permittivity = 4 +/-1, Loss tangent ≤ 0.05	Material sample
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions. Observe Technical Note for material compatibility.	DEGMBE based simulating liquids	Equivalent phantoms, Material sample
Sagging	Compliant with the requirements according to the standard. Sagging of the flat section when filled with tissue simulating liquid	< 1% typical < 0.8% if filled with 155mm of HSL900 and without DUT below	Prototypes, Sample testing

Standards
[1] 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

Conformity
Based on the sample tests above, we certify that this item is in compliance with the standard [1].

Date 07.07.2005

Signature / Stamp

s p e a g
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info@speag.com, http://www.speag.com

Fig. 40: Certificate of conformity for the available ELI4 phantom

7.9 Pictures of the Device under Test

Figure 41 - 43 show the device under test and the used accessories.

Fig. 41: Front view of the Fuji F-022.

Fig. 42: Back view of the Fuji F-022.

Fig. 43: Pictures of the used headset under test.

7.10 Test positions for the Device under Test

Figure 44 - 45 show the test positions for the SAR measurements for the Fuji F-022.

Fig. 44: Body worn configuration, position 1, display up (towards the phantom), 15 mm distance

Fig. 45: Body worn configuration, position 2, display down (towards the ground), 15 mm distance.

8 References

[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.

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