



Accredited testing laboratory

DAR registration number: DAT-P-176/94-D1

Test report no. : 1-0623-01-08/08
Type identification : i.roc
Test specification : IEEE 1528-2003
FCC-ID : XAM0035000000
IC-ID : 8311A-0035000000

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1 General Information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

1.1.1 Statement of Compliance

The SAR values found for the i.roc PDA are below the maximum recommended levels of 1.6 W/Kg as averaged over any 1 g tissue according to the FCC rule §2.1093, the ANSI/IEEE C 95.1:1999, the NCRP Report Number 86 for uncontrolled environment, according to the Health Canada's Safety Code 6 and the Industry Canada Radio Standards Specification RSS-102 for General Population/Uncontrolled exposure. For body worn operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal and that positions the handset a minimum of 0 mm from the body, or with the accessories tested for this test report. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

The measurement together with the test system set-up is described in chapter 2.3 of this test report. A detailed description of the equipment under test can be found in chapter 1.5.

Test engineer:

2009-05-19

Oleksandr Hnatovskiy



Date

Name

Signature

Technical responsibility for area of testing:

2009-05-19

Thomas Vogler



Date

Name

Signature

1.2 Testing laboratory

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Germany
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e-mail: info@ict.cetecom.de
Internet: <http://www.cetecom-ict.de>

State of accreditation: The Test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025. DAR registration number: DAT-P-176/94-D1

Test location, if different from CETECOM ICT Services GmbH

Name: ---
Street: ---
Town: ---
Country: ---
Phone: ---
Fax: ---

1.3 Details of applicant

Name: Ecom engineering GmbH
Street: Industriestr. 2
Town: 97959 Assamstadt
Country: Germany
Contact: Martin Haaf
Telephone: +49(0)6294 / 4224-650

1.4 Application details

Date of receipt of application: 2008-09-15
Date of receipt of test item: 2009-04-03
Start/Date of test: 2009-04-06
End of test: 2009-05-19

Person(s) present during the test: ---

1.5 Test item

Description of the test item: PDA

Type identification: i.roc

FCC-ID: XAM0035000000
 IC-ID: 8311A-0035000000
 Serial number: 3566-PMMC-0008 / 3566-PMMC-0007 / 3566-PMMC-0004

Manufacturer:

Name: Ecom engineering GmbH
 Street: Industriestr. 2
 Town: 97959 Assamstadt
 Country:

additional information on the DUT:

device type : PDA
 device category : portable device
 test device production information : identical prototype
 exposure category: uncontrolled environment / general population

device operating configurations :

operating mode(s) WLAN - Direct Sequence Spread Spectrum 802.11b
 Bluetooth
 operating frequency range 2412 MHz (channel 1) - 2462 MHz (channel 11)
 measured peak output power (conducted): 16.8 dBm (WLAN)
 antenna type : Integrated antenna
 accessories / body-worn configurations : 1st holster
 2nd holster
 strap

The DUT may be equipped with different RFID modules.
 The configurations tested for this test report are as follows :

device	FCC-ID	IC-ID
i.roc	XAM0035000000	8311A-0035000000
RFx11 134kHz	XAM0027390000	8311A-0027590000
RFx11 125kHz	XAM0027590000	8311A-0027590000
RFx10 13 56MHz	XAM0027670000	8311A-0027670000

The RFID Modules were no subject to test for SAR because of their low frequency, but the DUT has been tested in all configurations to take into account the hardware differences and their influence on the WLAN signal.

Further details about test configuration see chapter 2.5 (test results)

1.6 Test specification(s)

Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01)

IEEE 1528-2003 (April 21, 2003)

RSS-102: Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 2 of November 2005))

Canada’s Safety Code 6: Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz (99-EHD-237)

IEEE Std C95.3 – 1991, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.

IEEE Std C95.1 – 1999, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.

1.6.1 RF exposure limits

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain)	1.60 mW/g	8.00 mW/g
Spatial Average SAR** (Whole Body)	0.08 mW/g	0.40 mW/g
Spatial Peak SAR*** (Hands/Feet/Ankle/Wrist)	4.00 mW/g	20.00 mW/g

Table 1: RF exposure limits

The limit applied in this test report is shown in **bold** letters

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

2 Technical test

2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed.	<input checked="" type="checkbox"/>
The deviations as specified in 2.5 were ascertained in the course of the tests performed.	<input type="checkbox"/>

2.2 Test environment

General Environment conditions in the test area are as follows:

Ambient temperature: 20°C – 24°C
 Tissue simulating liquid: 20°C – 24°C
 Humidity: 40% – 50%

Exact temperature values for each test are shown in the table(s) under 2.5. and/or on the measurement plots.

2.3 Measurement and test set-up

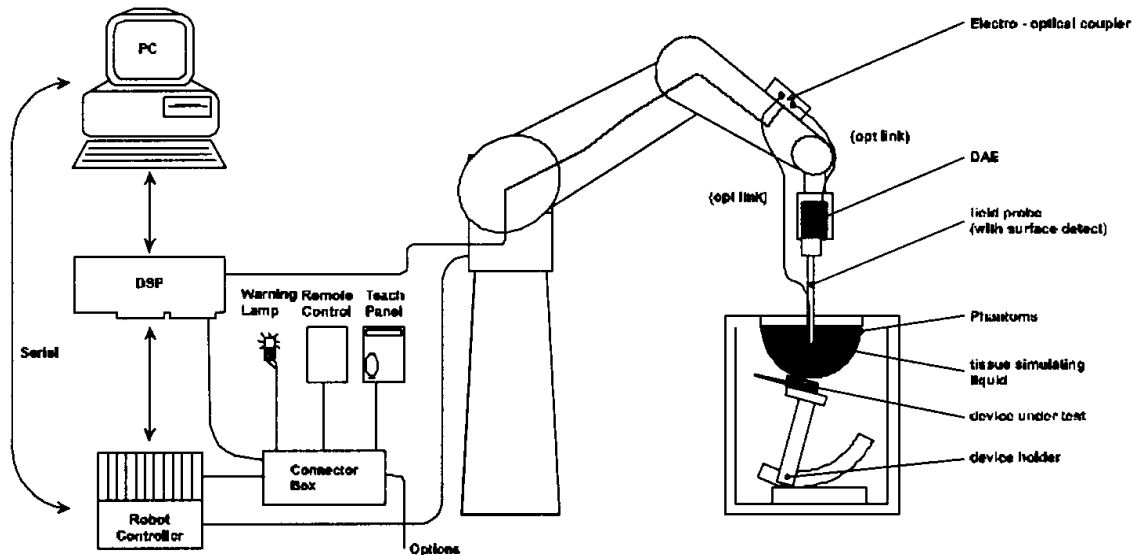
The measurement system is described in chapter 2.4.

The test setup for the system validation can be found in chapter 2.4.14.

A description of positioning and test signal control can be found in chapter 2.5 together with the test results.

2.4 Measurement system

2.4.1 System Description



The DAS4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- A unit to operate the optical surface detector which is connected to the EOC.
- The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DAS4 measurement server.
- The DAS4 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2000
- DAS4 software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System validation dipoles allowing to validate the proper functioning of the system.

2.4.2 Test environment

The DASY4 measurement system is placed at the head end of a room with dimensions: 5 x 2.5 x 3 m³, the SAM phantom is placed in a distance of 75 cm from the side walls and 1.1m from the rear wall. Above the test system a 1.5 x 1.5 m² array of pyramid absorbers is installed to reduce reflections from the ceiling.

Picture 1 of the photo documentation shows a complete view of the test environment.

The system allows the measurement of SAR values larger than 0.005 mW/g.

2.4.3 Probe description

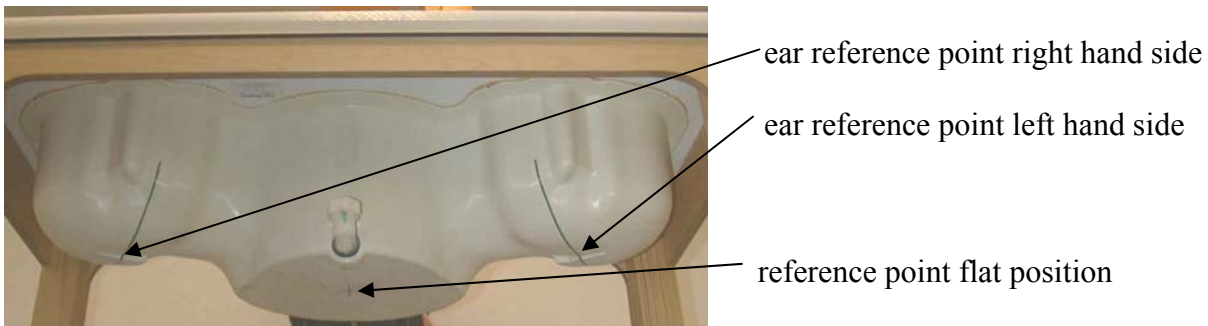
Isotropic E-Field Probe ET3DV6 for Dosimetric Measurements

Technical data according to manufacturer information	
Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycoether)
Calibration	In air from 10 MHz to 2.5 GHz In head tissue simulating liquid (HSL) at 900 (800-1000) MHz and 1.8 GHz (1700-1910 MHz) (accuracy ± 9.5%; k=2) Calibration for other liquids and frequencies upon request
Frequency	10 MHz to 3 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Optical Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces (ET3DV6 only)
Dimensions	Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application	General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms (ET3DV6)

2.4.4 Phantom description

The used SAM Phantom meets the requirements specified in Edition 01-01 of Supplement C to OET Bulletin 65 for Specific Absorption Rate (SAR) measurements.

The phantom consists of a fibreglass shell integrated in a wooden table. It allows left-hand and right-hand head as well as body-worn measurements with a maximum liquid depth of 18 cm in head position and 22 cm in planar position (body measurements). The thickness of the Phantom shell is 2 mm +/- 0.1 mm.



2.4.5 Device holder description

The DASY4 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. This device holder is used for standard mobile phones or PDA's only. If necessary an additional support of polystyrene material is used.



Larger DUT's (e.g. notebooks) cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values.

Therefore those devices are normally only tested at the flat part of the SAM.

2.4.6 Scanning procedure

The DASY4 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

- The „reference“ and „drift“ measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT's output power and should vary max. +/- 5 %.
- The „surface check“ measurement tests the optical surface detection system of the DASY4 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above $\pm 0.1\text{mm}$). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^\circ$.)
- The „area scan“ measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The standard scan uses large grid spacing for faster measurement. Standard grid spacing for head measurements is 15 mm in x- and y- dimension. If a finer resolution is needed, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation. Results of this coarse scan are shown in annex 2.
- A „7x7x7 zoom scan“ measures the field in a volume around the 2D peak SAR value acquired in the previous „coarse“ scan. This is a fine 7x7 grid where the robot additionally moves the probe in 7 steps along the z-axis away from the bottom of the Phantom. Grid spacing for the cube measurement is 5 mm in x and y-direction and 5 mm in z-direction. DASY4 is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in annex 2. Test results relevant for the specified standard (see chapter 1.6.) are shown in table form in chapter 2.5.
- A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 2mm steps. This measurement shows the continuity of the liquid and can - depending in the field strength – also show the liquid depth. A z-axis scan of the measurement with maximum SAR value is shown in annex 2.

2.4.7 Spatial Peak SAR Evaluation

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of 7 x 7 x 7 points. The algorithm that finds the maximal averaged volume is separated into three different stages.

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting 'Graph Evaluated'.
- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.
- All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

Extrapolation

The extrapolation is based on a least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

Interpolation

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff].

Volume Averaging

At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.

Advanced Extrapolation

DASY4 uses the advanced extrapolation option which is able to compensate boundary effects on E-field probes.

2.4.8 Data Storage and Evaluation

Data Storage

The DASY4 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Norm _i , a _{i0} , a _{i1} , a _{i2}
	- Conversion factor	ConvF _i
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY4 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf/dcp_i$$

with V_i = compensated signal of channel i (i = x, y, z)
 U_i = input signal of channel i (i = x, y, z)
 cf = crest factor of exciting field (DASY parameter)
 dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes: $E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$

H-field probes: $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2)/f$

with V_i = compensated signal of channel i (i = x, y, z)
 $Norm_i$ = sensor sensitivity of channel i (i = x, y, z)
 [mV/(V/m)²] for E-field Probes
 $ConvF$ = sensitivity enhancement in solution
 a_{ij} = sensor sensitivity factors for H-field probes
 f = carrier frequency [GHz]
 E_i = electric field strength of channel i in V/m
 H_i = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

The primary field data are used to calculate the derived field units.

$$SAR = (E_{tot}^2 \cdot \sigma) / (\rho \cdot 1000)$$

with SAR = local specific absorption rate in mW/g
 E_{tot} = total field strength in V/m
 σ = conductivity in [mho/m] or [Siemens/m]
 ρ = equivalent tissue density in g/cm³

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with P_{pwe} = equivalent power density of a plane wave in mW/cm²
 E_{tot} = total electric field strength in V/m
 H_{tot} = total magnetic field strength in A/m

2.4.9 Test equipment utilized

This table gives a complete overview of the SAR measurement equipment

Devices used during the test described in chapter 2.5. are marked ☒

	Manufacturer	Device	Type	Serial number	Date of last calibration)*
<input type="checkbox"/>	Schmid & Partner Engineering AG	Dosimetric E-Field Probe	ET3DV6	1558	August 15, 2008
<input checked="" type="checkbox"/>	Schmid & Partner Engineering AG	Dosimetric E-Field Probe	ET3DV6	1559	January 14, 2009
<input type="checkbox"/>	Schmid & Partner Engineering AG	900 MHz System Validation Dipole	D900V2	102	August 18, 2008
<input type="checkbox"/>	Schmid & Partner Engineering AG	1800 MHz System Validation Dipole	D1800V2	287	August 19, 2008
<input type="checkbox"/>	Schmid & Partner Engineering AG	1900 MHz System Validation Dipole	D1900V2	531	May 14, 2008
<input checked="" type="checkbox"/>	Schmid & Partner Engineering AG	2450 MHz System Validation Dipole	D2450V2	710	August 20, 2008
<input type="checkbox"/>	Schmid & Partner Engineering AG	Data acquisition electronics	DAE3V1	413	January 8, 2009
<input checked="" type="checkbox"/>	Schmid & Partner Engineering AG	Data acquisition electronics	DAE3V1	477	May 14, 2008
<input checked="" type="checkbox"/>	Schmid & Partner Engineering AG	Software	DASY 4 V4.7	---	N/A
<input checked="" type="checkbox"/>	Schmid & Partner Engineering AG	Phantom	SAM	---	N/A
<input checked="" type="checkbox"/>	Rohde & Schwarz	Universal Radio Communication Tester	CMU 200	106826	January 15, 2009
<input checked="" type="checkbox"/>	Hewlett Packard)*	Network Analyser 300 kHz to 6 GHz	8753C	2937U00269	January 9, 2009
<input checked="" type="checkbox"/>	Hewlett Packard)*	Network Analyser 300 kHz to 6 GHz	85047A	2936A00872	January 9, 2009
<input checked="" type="checkbox"/>	Hewlett Packard	Dielectric Probe Kit	85070C	US99360146	N/A
<input checked="" type="checkbox"/>	Hewlett Packard	Signal Generator	8665A	2833A00112	January 8, 2009
<input checked="" type="checkbox"/>	Amplifier Reasearch	Amplifier	25S1G4 (25 Watt)	20452	N/A
<input checked="" type="checkbox"/>	Rohde & Schwarz	Power Meter	NRP	101367	January 9, 2009
<input checked="" type="checkbox"/>	Rohde & Schwarz	Power Meter Sensor	NRP Z22	100227	January 9, 2009
<input checked="" type="checkbox"/>	Rohde & Schwarz	Power Meter Sensor	NRP Z22	100234	January 9, 2009

)* : Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

2.4.12 Measurement uncertainty evaluation for SAR test

The overall combined measurement uncertainty of the measurement system is $\pm 10,3\%$ ($K=1$).

The expanded uncertainty ($k=2$) is assessed to be $\pm 20.6\%$

This measurement uncertainty budget is suggested by IEEE P1528 and determined by Schmid & Partner Engineering AG. The breakdown of the individual uncertainties is as follows:

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i 1g	c_i 10g	Standard Uncertainty 1g	Standard Uncertainty 10g	v_i^2 or v_{eff}
Measurement System								
Probe calibration	$\pm 4.8\%$	Normal	1	1	1	$\pm 4.8\%$	$\pm 4.8\%$	∞
Axial isotropy	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 1.9\%$	$\pm 1.9\%$	∞
Hemispherical isotropy	$\pm 9.6\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 3.9\%$	$\pm 3.9\%$	∞
Spatial resolution	$\pm 0.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Boundary effects	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Probe linearity	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
System detection limits	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Readout electronics	$\pm 1.0\%$	Normal	1	1	1	$\pm 1.0\%$	$\pm 1.0\%$	∞
Response time	$\pm 0.8\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.5\%$	$\pm 0.5\%$	∞
Integration time	$\pm 2.6\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5\%$	$\pm 1.5\%$	∞
RF ambient conditions	$\pm 3.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Probe positioner	$\pm 0.4\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.2\%$	$\pm 0.2\%$	∞
Probe positioning	$\pm 2.9\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Max. SAR evaluation	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Test Sample Related								
Device positioning	$\pm 2.9\%$	Normal	1	1	1	$\pm 2.9\%$	$\pm 2.9\%$	145
Device holder uncertainty	$\pm 3.6\%$	Normal	1	1	1	$\pm 3.6\%$	$\pm 3.6\%$	5
Power drift	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9\%$	$\pm 2.9\%$	∞
Phantom and Set-up								
Phantom uncertainty	$\pm 4.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3\%$	$\pm 2.3\%$	∞
Liquid conductivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8\%$	$\pm 1.2\%$	∞
Liquid conductivity (meas.)	$\pm 2.5\%$	Normal	1	0.64	0.43	$\pm 1.6\%$	$\pm 1.1\%$	∞
Liquid permittivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.6	0.49	$\pm 1.7\%$	$\pm 1.4\%$	∞
Liquid permittivity (meas.)	$\pm 2.5\%$	Normal	1	0.6	0.49	$\pm 1.5\%$	$\pm 1.2\%$	∞
Combined Uncertainty						$\pm 10.3\%$	$\pm 10.0\%$	330
Expanded Std. Uncertainty						$\pm 20.6\%$	$\pm 20.1\%$	

Table 5: Measurement uncertainties

2.4.13 Measurement uncertainty evaluation for system validation

The overall combined measurement uncertainty of the measurement system is $\pm 8.4\%$ ($K=1$).

The expanded uncertainty ($k=2$) is assessed to be $\pm 16.8\%$

This measurement uncertainty budget is suggested by IEEE P1528 and determined by Schmid & Partner Engineering AG. The breakdown of the individual uncertainties is as follows:

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i 1g	c_i 10g	Standard Uncertainty 1g	Standard Uncertainty 10g	v_i^2 or v_{eff}
Measurement System								
Probe calibration	$\pm 4.8\%$	Normal	1	1	1	$\pm 4.8\%$	$\pm 4.8\%$	∞
Axial isotropy	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 1.9\%$	$\pm 1.9\%$	∞
Hemispherical isotropy	$\pm 0.0\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 0.0\%$	$\pm 3.9\%$	∞
Boundary effects	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Probe linearity	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
System detection limits	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Readout electronics	$\pm 1.0\%$	Normal	1	1	1	$\pm 1.0\%$	$\pm 1.0\%$	∞
Response time	$\pm 0.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Integration time	$\pm 0.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
RF ambient conditions	$\pm 3.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Probe positioner	$\pm 0.4\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.2\%$	$\pm 0.2\%$	∞
Probe positioning	$\pm 2.9\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Max. SAR evaluation	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Test Sample Related								
Dipole axis to liquid distance	$\pm 2.0\%$	Normal	1	1	1	$\pm 1.2\%$	$\pm 1.2\%$	∞
Power drift	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
Phantom and Set-up								
Phantom uncertainty	$\pm 4.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3\%$	$\pm 2.3\%$	∞
Liquid conductivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8\%$	$\pm 1.2\%$	∞
Liquid conductivity (meas.)	$\pm 2.5\%$	Normal	1	0.64	0.43	$\pm 1.6\%$	$\pm 1.1\%$	∞
Liquid permittivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.6	0.49	$\pm 1.7\%$	$\pm 1.4\%$	∞
Liquid permittivity (meas.)	$\pm 2.5\%$	Normal	1	0.6	0.49	$\pm 1.5\%$	$\pm 1.2\%$	∞
Combined Uncertainty						$\pm 8.4\%$	$\pm 8.1\%$	
Expanded Std. Uncertainty						$\pm 16.8\%$	$\pm 16.2\%$	

Table 6: Measurement uncertainties

2.4.14 System validation

The system validation is performed for verifying the accuracy of the complete measurement system and performance of the software. The system validation is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows validation results for all frequency bands and tissue liquids used during the tests of the test item described in chapter 1.5. (graphic plot(s) see annex 1).

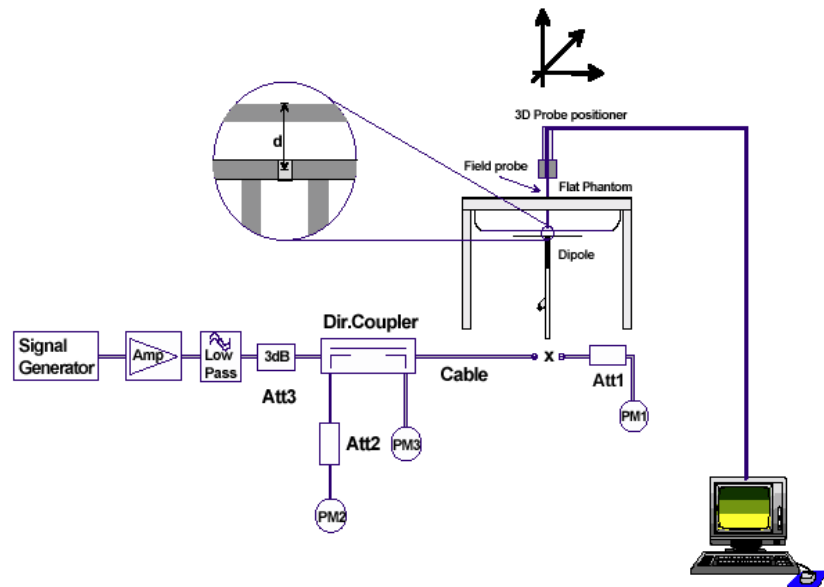
Validation Kit	Frequency	Target Peak SAR (1000 mW) (+/- 10%)	Target SAR_{1g} (1000 mW) (+/- 10%)	Measured Peak SAR (1000 mW)	Measured SAR_{1g} (1000 mW)	Measured date
D2450V2 S/N: 710	2450 MHz body	99.6 mW/g	49.4 mW/g	107.9 mW/g	51.6 mW/g	2009-04-06
D2450V2 S/N: 710	2450 MHz body	99.6 mW/g	49.4 mW/g	108.4 mW/g	52.1 mW/g	2009-04-07
D2450V2 S/N: 710	2450 MHz body	99.6 mW/g	49.4 mW/g	104.2 mW/g	50.1 mW/g	2009-05-19

Table 7: Results system validation

2.4.15 Validation procedure

The validation is performed by using a validation dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a plexiglass spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 1000 mW. To adjust this power a power meter is used. The power sensor is connected to the cable before the validation to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the validation to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).

Validation results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system.



2.5 Test results (Body SAR)

2.5.1 Information and considerations on SAR test configurations

The DUT is an explosion proof PDA, which can be equipped with different RFID modules. It can also be offered without such a module. SAR tests cover several versions of the DUT.

3 different samples of the DUT were tested, each of them equipped with one of the 3 different versions of RFID modules (125 kHz, 134 kHz and 13.56 MHz). Additionally the sample with highest SAR was selected to be tested with RFID module removed and plastic cover in place.

Furthermore additional body worn accessories can be used together with the DUT. As those accessories contain metal SAR measurements were regarded as necessary in general use conditions with those accessories. They were also performed with the DUT showing highest SAR results.

Due to the special construction of the DUT with additional shielding and a thick housing the antennas of the different radio modules are placed further inside the DUT compared to slim standard PDAs. The distance of the WLAN antenna to the outside cover is about 1 to 1.3 cm (see photo 14) which is reflected by the SAR results.

2.5.2 SAR results

The table contains the measured SAR values averaged over a mass of 1 g					
Channel / frequency	Position	accessories	SAR value	Limit	Liquid temperature
DUT #1 (RFID module 125 kHz)					
6 / 2437 MHz	front	---	0.0220 W/kg	1.6 W/kg	21.6 °C
6 / 2437 MHz	rear	---	0.0019 W/kg	1.6 W/kg	21.6 °C
DUT #2 (RFID module 134 kHz)					
6 / 2437 MHz	front	---	0.0160 W/kg	1.6 W/kg	21.6 °C
6 / 2437 MHz	rear	---	0.0027 W/kg	1.6 W/kg	21.6 °C
DUT #3 (RFID module 13.56 MHz)					
6 / 2437 MHz	front	---	0.0550 W/kg	1.6 W/kg	21.6 °C
6 / 2437 MHz	rear	---	0.0046 W/kg	1.6 W/kg	21.6 °C
6 / 2437 MHz	rear	1 st holster	0.0001 W/kg	1.6 W/kg	21.8 °C
6 / 2437 MHz	rear	1 st holster with cover	0.00005 W/kg	1.6 W/kg	21.7 °C
6 / 2437 MHz	front	2 nd holster	0.0037 W/kg	1.6 W/kg	21.7 °C
6 / 2437 MHz	rear	2 nd holster	0.0008 W/kg	1.6 W/kg	21.7 °C
6 / 2437 MHz	rear	strap	0.0010 W/kg	1.6 W/kg	21.7 °C
DUT #3 without RFID module					
6 / 2437 MHz	front	---	0.0430 W/kg	1.6 W/kg	21.0 °C
6 / 2437 MHz	rear	---	0.0057 W/kg	1.6 W/kg	21.0 °C

Table 8: Test results (Body SAR)

Note: The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB lower than the SAR limit (< 0.8 W/kg), testing at the high and low channels is optional.

2.6 Conducted power

The DUT was tested using a test software installed on the PDA to set the test channel and output power at 100% duty cycle with the following values

WLAN 2.4 GHz		
Channel / frequency	average power	peak power
6 / 2437 MHz	16.7 dBm	16.8 dBm

Table 9: Conducted power

The DUT includes an additional Bluetooth module with only 1.8 dBm output power. Therefore no addition SAR measurements with BT were performed.

Annex 1 System performance verification

Date/Time: 06.04.2009 09:44:07 Date/Time: 06.04.2009 09:47:41

System Performance Check-D2450 body 2009-04-06

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:710

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection) Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

d=10mm, Pin=1000mW/Area Scan (51x51x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 75.5 mW/g

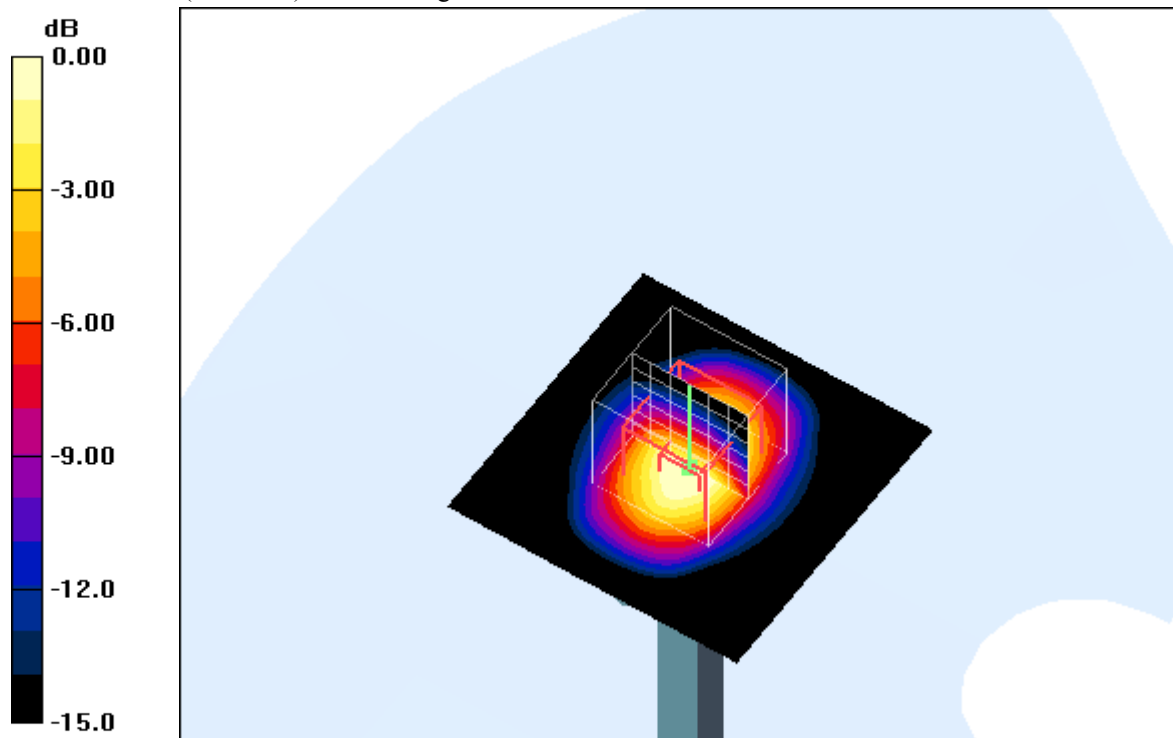
d=10mm, Pin=1000mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 180.0 V/m; Power Drift = -0.037 dB

Peak SAR (extrapolated) = 107.9 W/kg

SAR(1 g) = 51.6 mW/g; SAR(10 g) = 23.7 mW/g

Maximum value of SAR (measured) = 57.9 mW/g



0 dB = 57.9mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) :

ambient temperature: 21.8°C; liquid temperature: 21.5°C

Date/Time: 07.04.2009 10:22:08 Date/Time: 07.04.2009 10:25:46

System Performance Check-D2450 body 2009-04-07

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:710

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection) Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

d=10mm, Pin=1000mW/Area Scan (51x51x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 71.8 mW/g

d=10mm, Pin=1000mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,

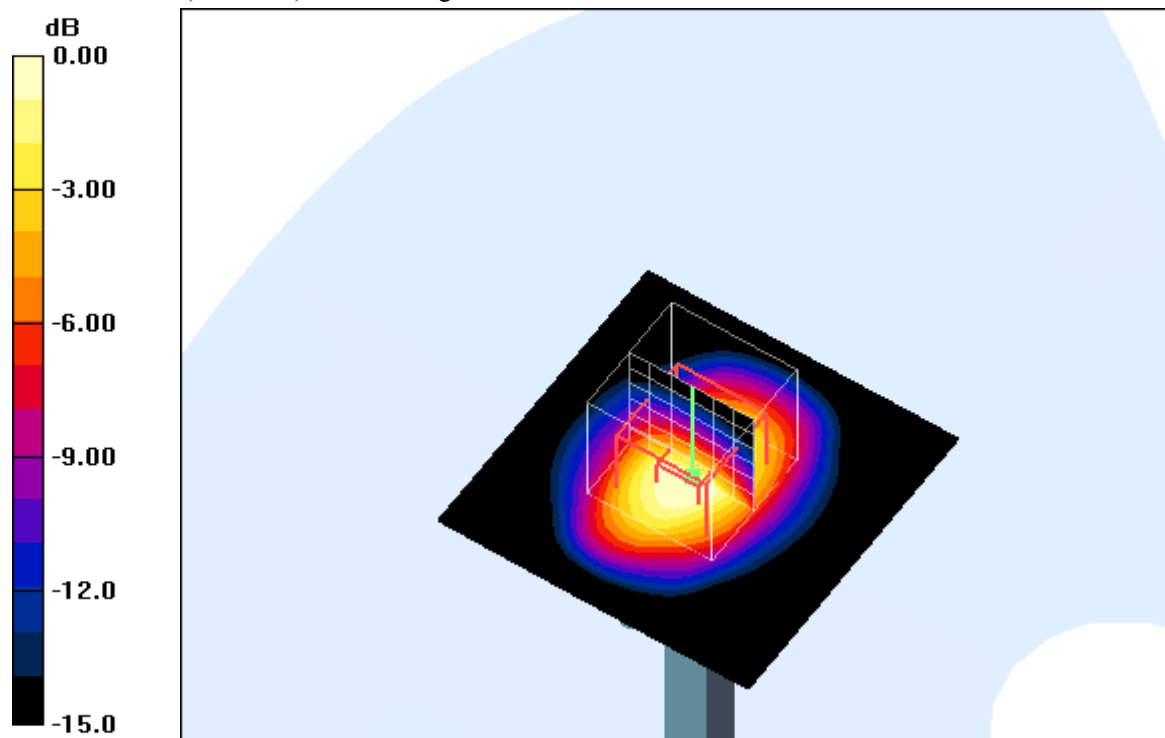
dz=5mm

Reference Value = 174.4 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 108.4 W/kg

SAR(1 g) = 52.1 mW/g; SAR(10 g) = 24.2 mW/g

Maximum value of SAR (measured) = 58.2 mW/g



0 dB = 58.2mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) :

ambient temperature: 21.9°C; liquid temperature: 21.6°C

Date/Time: 19.05.2009 11:41:43 Date/Time: 19.05.2009 11:45:28

System Performance Check-D2450 body 2009-04-07

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:710

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 1.99 \text{ mho/m}$; $\epsilon_r = 52.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection) Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

d=10mm, Pin=1000mW/Area Scan (51x51x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 64.2 mW/g

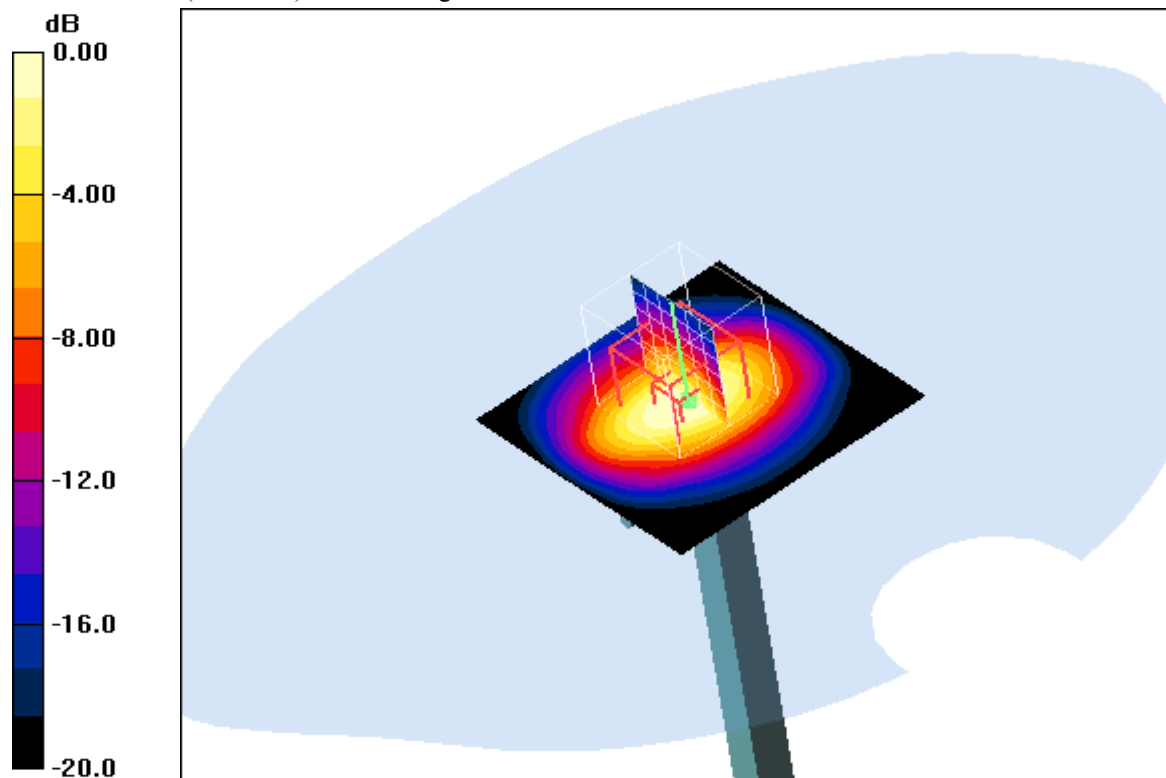
d=10mm, Pin=1000mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 159.2 V/m; Power Drift = -0.022 dB

Peak SAR (extrapolated) = 104.2 W/kg

SAR(1 g) = 50.1 mW/g; SAR(10 g) = 23.4 mW/g

Maximum value of SAR (measured) = 55.2 mW/g



0 dB = 55.2mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) :

ambient temperature: 20.8°C; liquid temperature: 20.3°C

Deviation of target: +1.4% (1 g)

Annex 2 Measurement results (printout from DASY TM)

Annex 2.1 WLAN 2450 MHz body

Date/Time: 06.04.2009 14:34:42 Date/Time: 06.04.2009 14:50:52

P1528_OET65_EN50385-Body-WLAN2450 #1

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0008

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Front position - Middle/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.030 mW/g

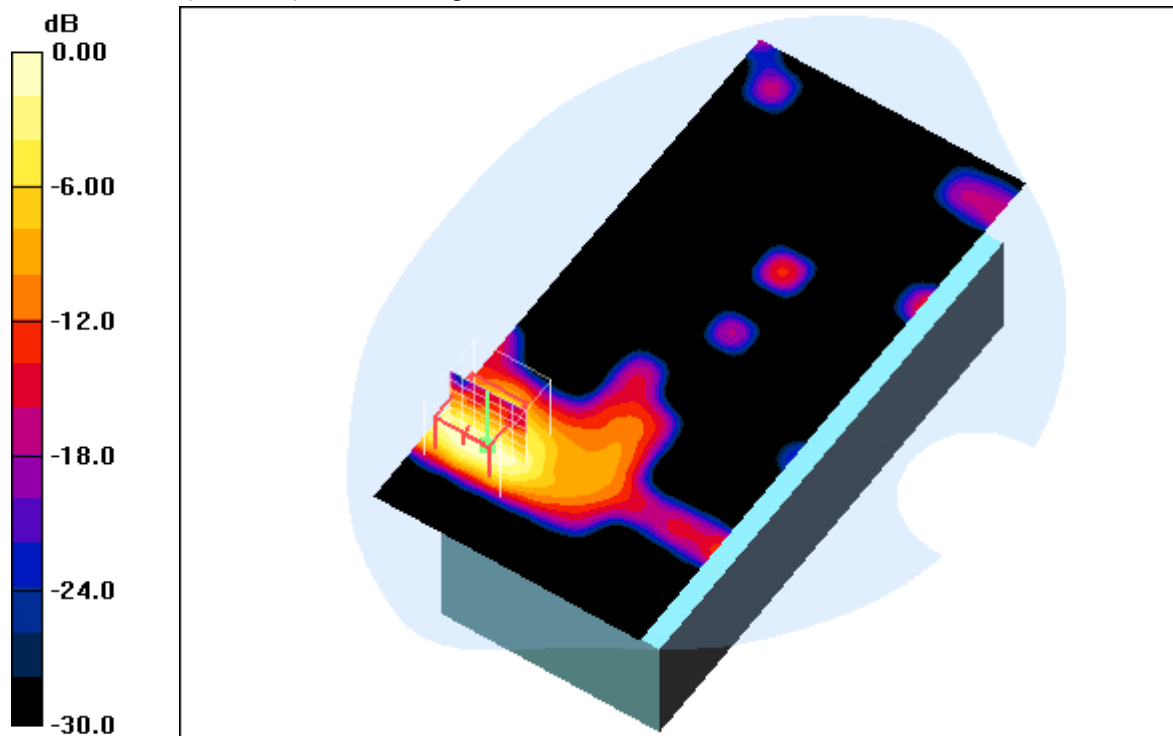
Front position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 2.97 V/m; Power Drift = 0.116 dB

Peak SAR (extrapolated) = 0.060 W/kg

SAR(1 g) = 0.022 mW/g; SAR(10 g) = 0.00943 mW/g

Maximum value of SAR (measured) = 0.025 mW/g



0 dB = 0.025mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM

ambient temperature: 21.8°C; liquid temperature: 21.6°C

Date/Time: 06.04.2009 13:53:51 Date/Time: 06.04.2009 14:10:32

P1528_OET65_EN50385-Body-WLAN2450 #1

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0008

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Rear position - Middle/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.00 mW/g

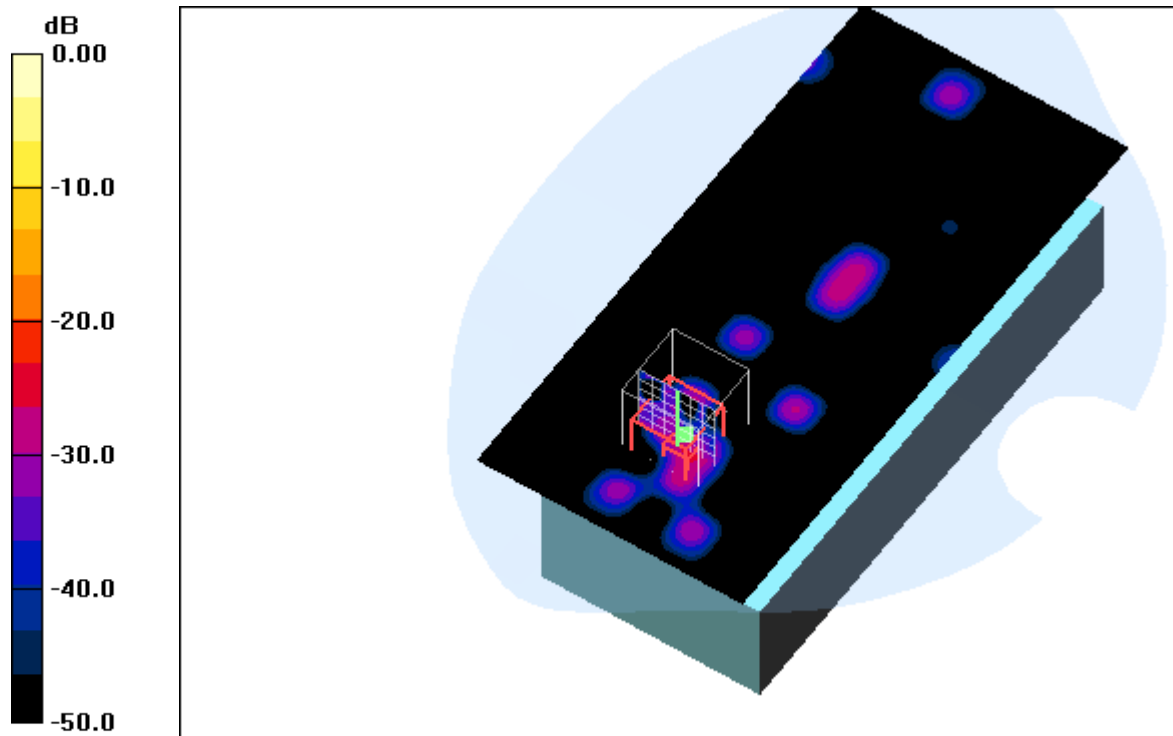
Rear position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 1.15 V/m; Power Drift = 0.194 dB

Peak SAR (extrapolated) = 0.01 W/kg

SAR(1 g) = 0.00187 mW/g; SAR(10 g) = 0.000634 mW/g

Maximum value of SAR (measured) = 0.00 mW/g



0 dB = 0.00mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM

ambient temperature: 21.8°C; liquid temperature: 21.6°C

Date/Time: 06.04.2009 11:31:13 Date/Time: 06.04.2009 11:50:25

P1528_OET65_EN50385-Body-WLAN2450 #2

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0007

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Front position - Middle/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.018 mW/g

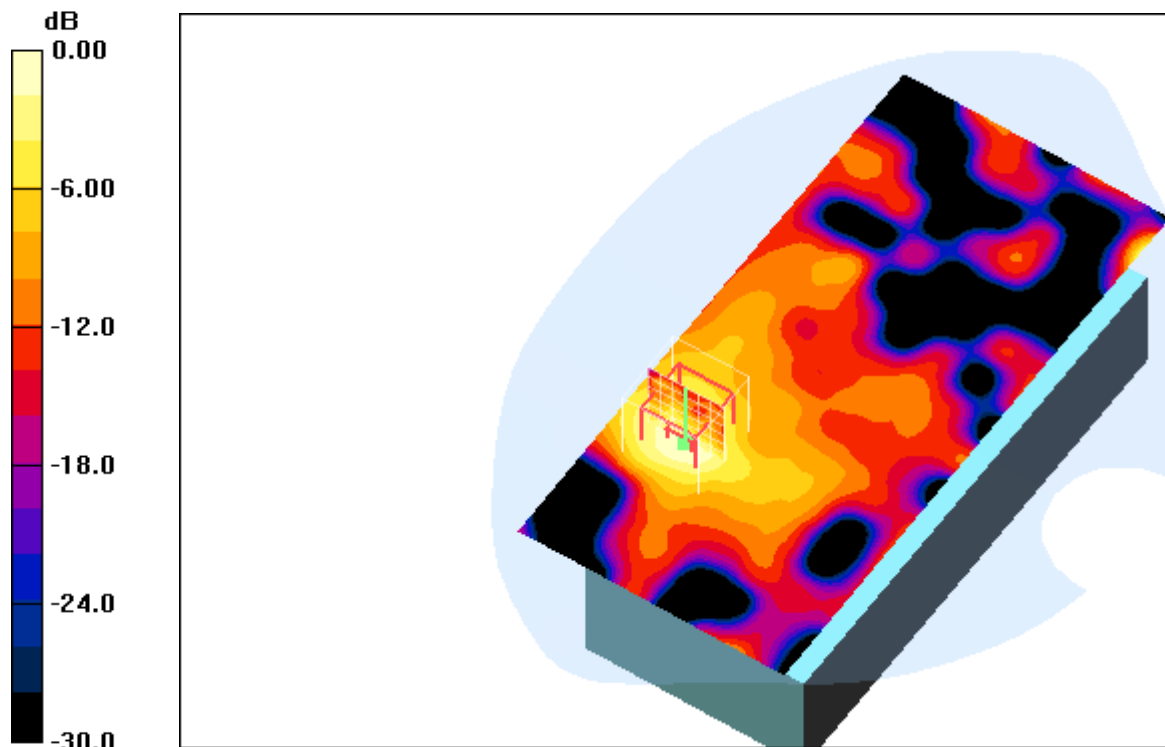
Front position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 3.11 V/m; Power Drift = -0.112 dB

Peak SAR (extrapolated) = 0.035 W/kg

SAR(1 g) = 0.016 mW/g; SAR(10 g) = 0.00705 mW/g

Maximum value of SAR (measured) = 0.018 mW/g



0 dB = 0.018mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM

ambient temperature: 21.8°C; liquid temperature: 21.6°C

Date/Time: 06.04.2009 12:11:09 Date/Time: 06.04.2009 12:28:05

P1528_OET65_EN50385-Body-WLAN2450 #2

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0007

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Rear position - Middle/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.01 mW/g

Rear position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

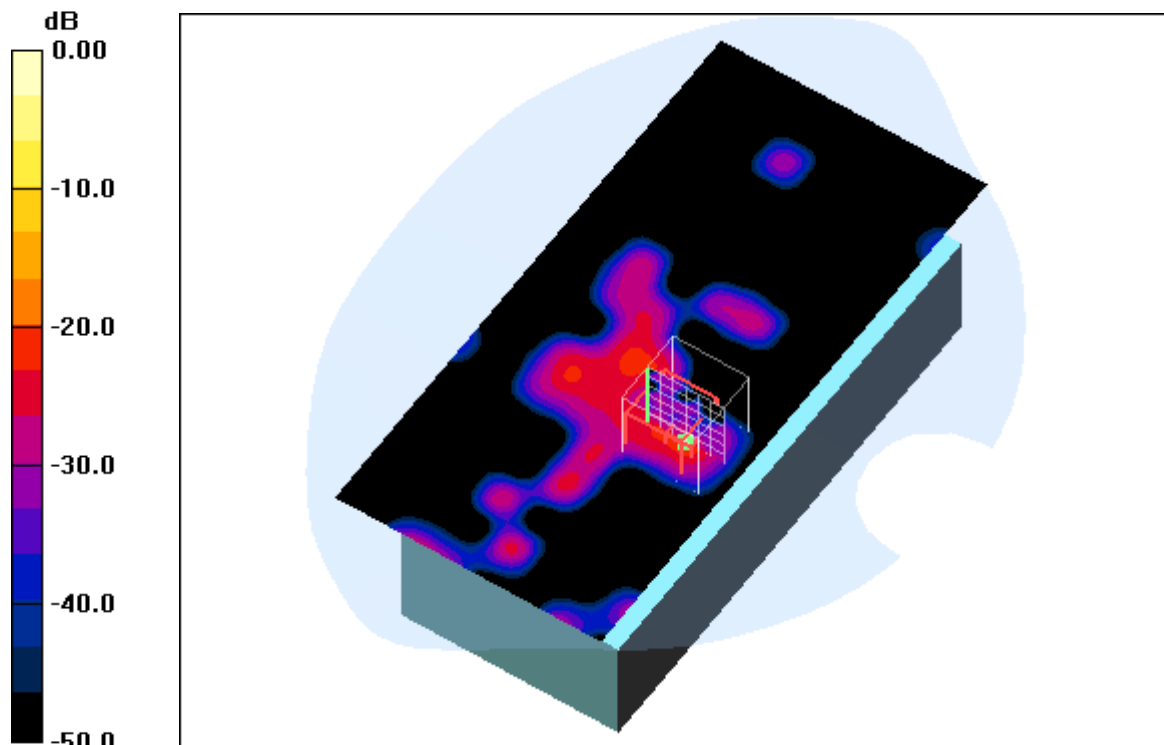
Reference Value = 1.35 V/m; Power Drift = 0.137 dB

Peak SAR (extrapolated) = 0.013 W/kg

SAR(1 g) = 0.00269 mW/g; SAR(10 g) = 0.00115 mW/g

SAR(1 g) = 0.00269 mW/g; SAR(10 g) = 0.00115 mW/g

Maximum value of SAR (measured) = 0.00 mW/g



0 dB = 0.00mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM

ambient temperature: 21.8°C; liquid temperature: 21.6°C

Date/Time: 06.04.2009 16:02:42 Date/Time: 06.04.2009 16:19:51

P1528_OET65_EN50385-Body-WLAN2450 #3

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0004

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Front position - Middle/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.055 mW/g

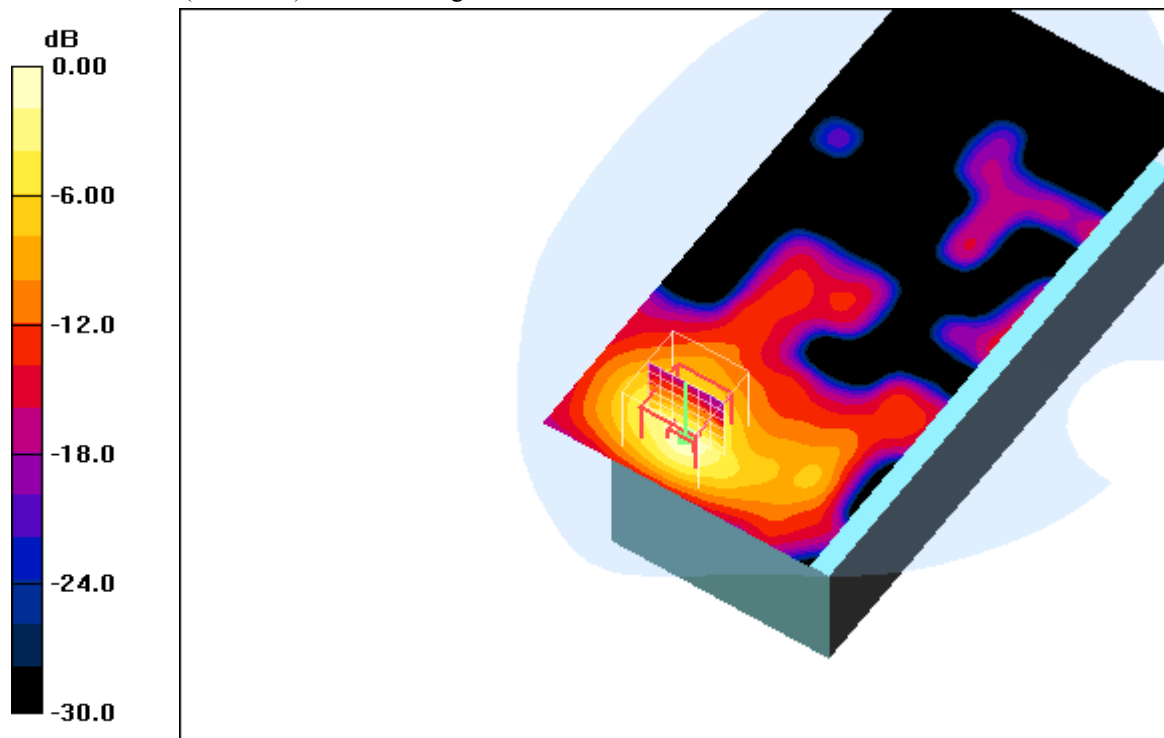
Front position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 4.86 V/m; Power Drift = -0.110 dB

Peak SAR (extrapolated) = 0.136 W/kg

SAR(1 g) = 0.055 mW/g; SAR(10 g) = 0.024 mW/g

Maximum value of SAR (measured) = 0.061 mW/g



Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM

ambient temperature: 21.8°C; liquid temperature: 21.6°C

Date/Time: 06.04.2009 16:53:16 Date/Time: 06.04.2009 17:11:57

P1528_OET65_EN50385-Body-WLAN2450 #3

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0004

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Rear position - Middle/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.01 mW/g

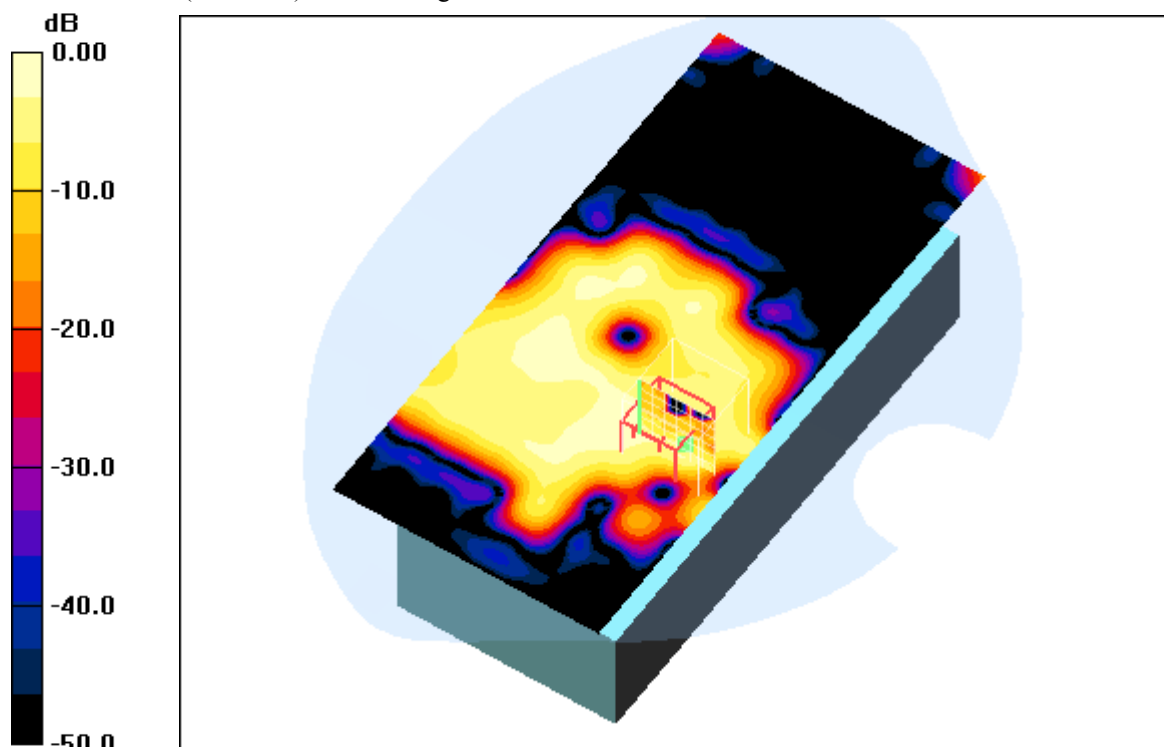
Rear position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 2.09 V/m; Power Drift = -0.147 dB

Peak SAR (extrapolated) = 0.014 W/kg

SAR(1 g) = 0.00459 mW/g; SAR(10 g) = 0.00225 mW/g

Maximum value of SAR (measured) = 0.01 mW/g



0 dB = 0.010mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM

ambient temperature: 21.8°C; liquid temperature: 21.6°C

Date/Time: 07.04.2009 15:01:42 Date/Time: 07.04.2009 15:18:52

P1528_OET65_EN50385-Body-WLAN2450 #3

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0004

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Rear position - Middle Holster 1/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.01 mW/g

Rear position - Middle Holster 1/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

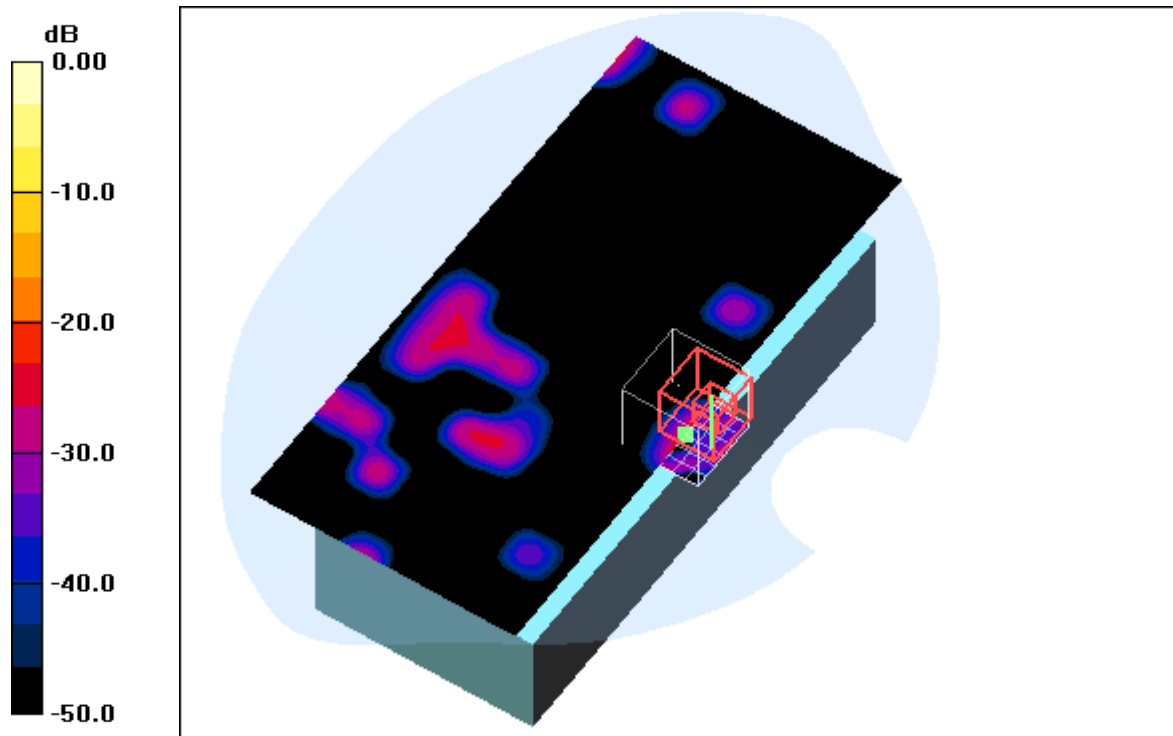
$dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 0.522 V/m; Power Drift = -5.70 dB

Peak SAR (extrapolated) = 0.01 W/kg

SAR(1 g) = 0.000143 mW/g; SAR(10 g) = 2.79e-005 mW/g

Maximum value of SAR (measured) = 0.00 mW/g



0 dB = 0.00mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM

ambient temperature: 21.6°C; liquid temperature: 21.8°C

Date/Time: 07.04.2009 15:41:57 Date/Time: 07.04.2009 16:00:30

P1528_OET65_EN50385-Body-WLAN2450 #3

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0004

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Rear position - Middle Holster 1 with cover/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.00 mW/g

Rear position - Middle Holster 1 with cover/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

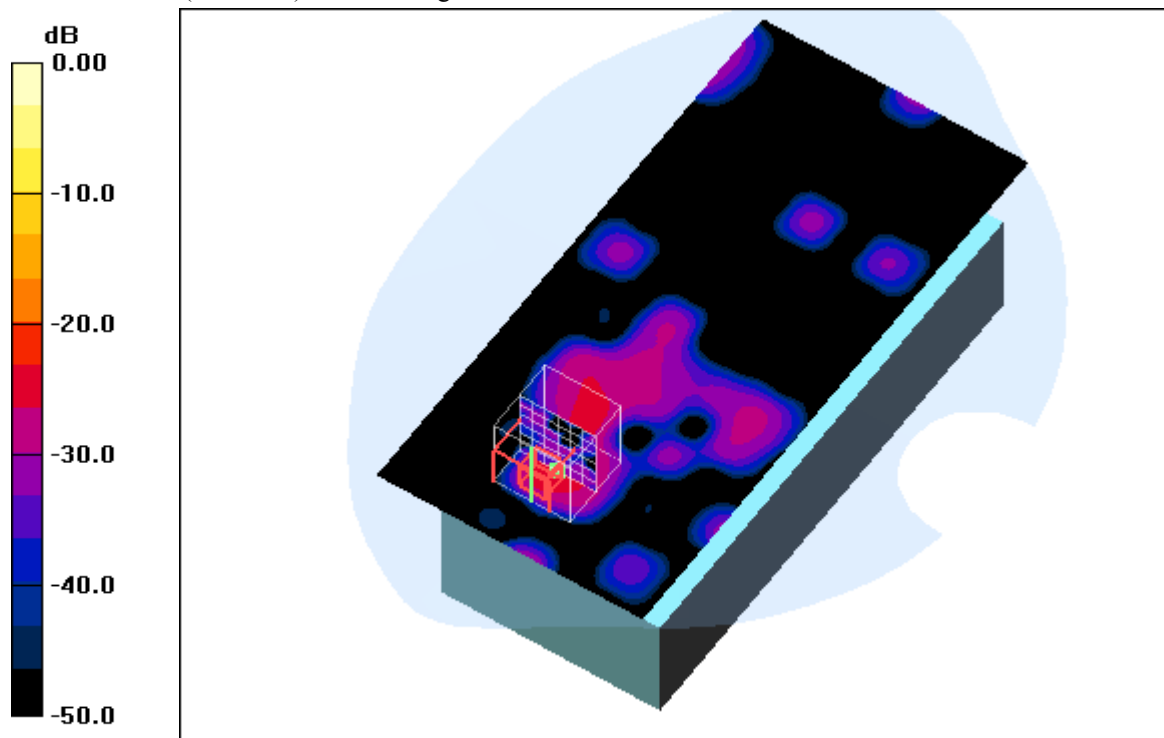
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 0.508 V/m; Power Drift = -0.113 dB

Peak SAR (extrapolated) = 0.00 W/kg

SAR(1 g) = 4.66e-005 mW/g; SAR(10 g) = 8.99e-006 mW/g

Maximum value of SAR (measured) = 0.00 mW/g



0 dB = 0.00mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM

ambient temperature: 21.8°C; liquid temperature: 21.7°C

Date/Time: 07.04.2009 17:04:08 Date/Time: 07.04.2009 17:23:55

P1528_OET65_EN50385-Body-WLAN2450 #3

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0004

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

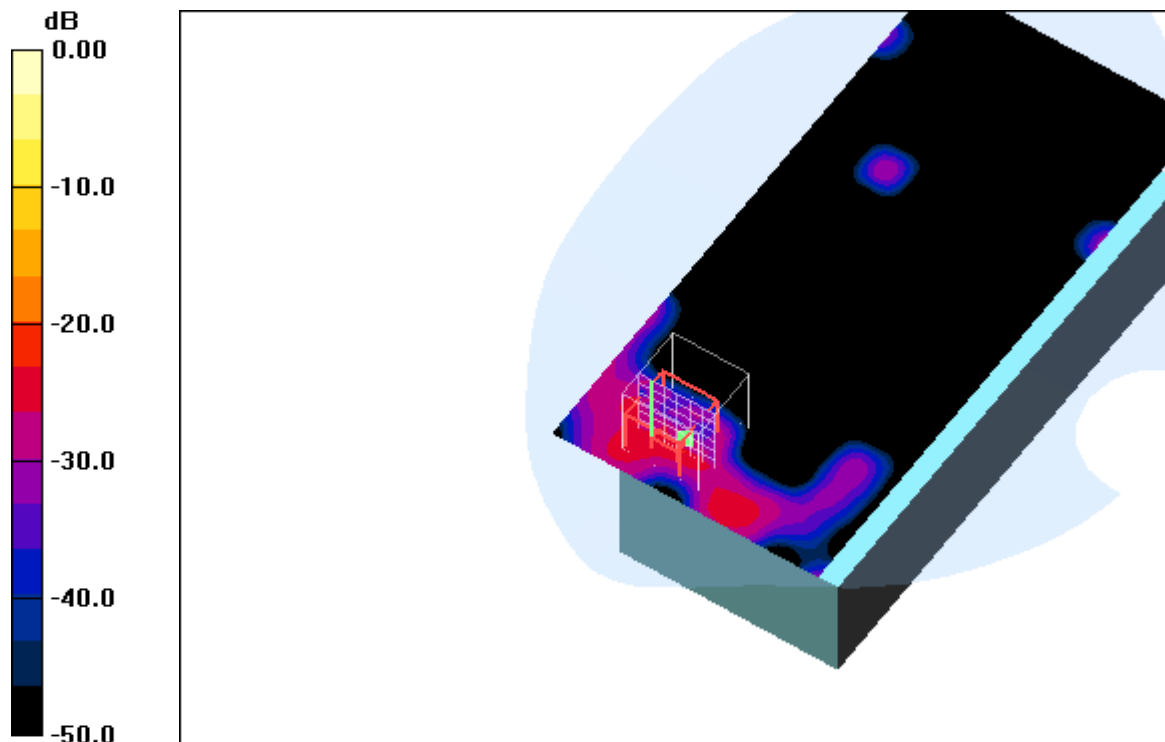
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Front position - Middle Holster 2/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 0.01 mW/g

Front position - Middle Holster 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
 $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$
 Reference Value = 1.13 V/m; Power Drift = 0.171 dB
 Peak SAR (extrapolated) = 0.016 W/kg
SAR(1 g) = 0.0037 mW/g; SAR(10 g) = 0.00147 mW/g
 Maximum value of SAR (measured) = 0.00 mW/g



0 dB = 0.00mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM
 ambient temperature: 21.8°C; liquid temperature: 21.7°C

Date/Time: 07.04.2009 16:21:49 Date/Time: 07.04.2009 16:41:29

P1528_OET65_EN50385-Body-WLAN2450

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0004

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Rear position - Middle Holster 2/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.00 mW/g

Rear position - Middle Holster 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

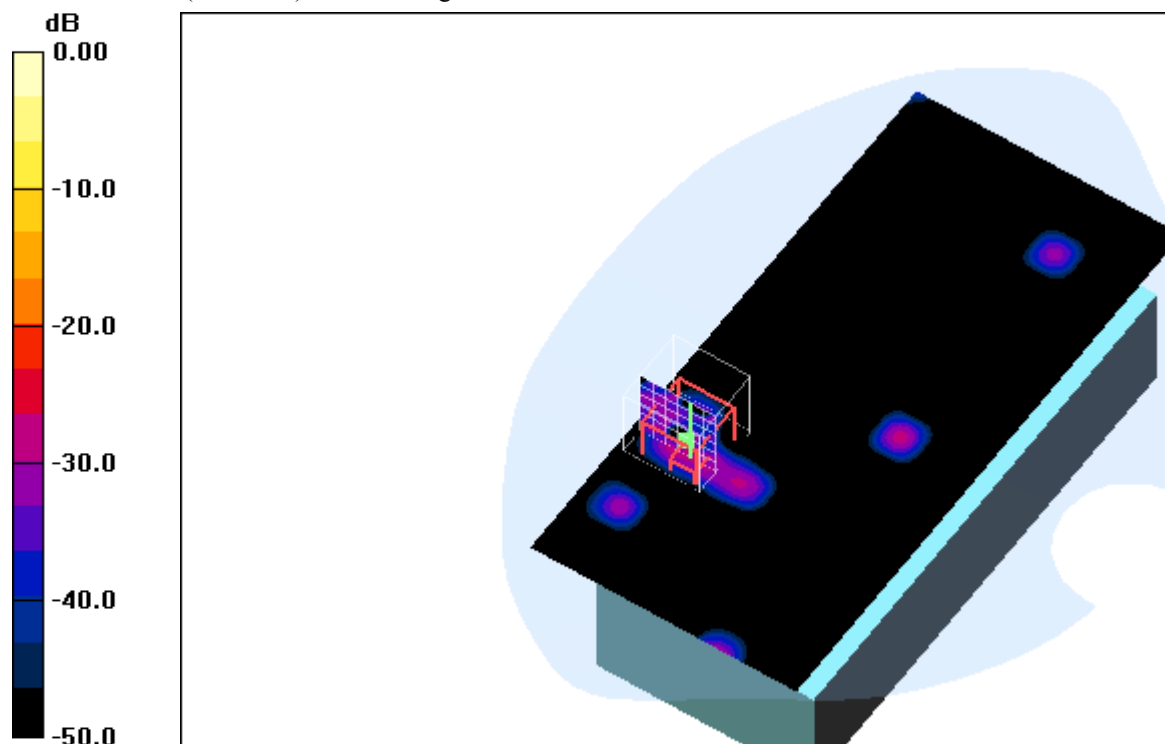
$dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 0.475 V/m; Power Drift = -0.144 dB

Peak SAR (extrapolated) = 0.00 W/kg

SAR(1 g) = 0.00082 mW/g; SAR(10 g) = 0.000137 mW/g

Maximum value of SAR (measured) = 0.00 mW/g



0 dB = 0.00mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM

ambient temperature: 21.8°C; liquid temperature: 21.7°C

Date/Time: 07.04.2009 12:21:16 Date/Time: 07.04.2009 12:39:37

P1528_OET65_EN50385-Body-WLAN2450 #3

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0004

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 52.8$; $\rho = 1000 \text{ kg/m}^3$

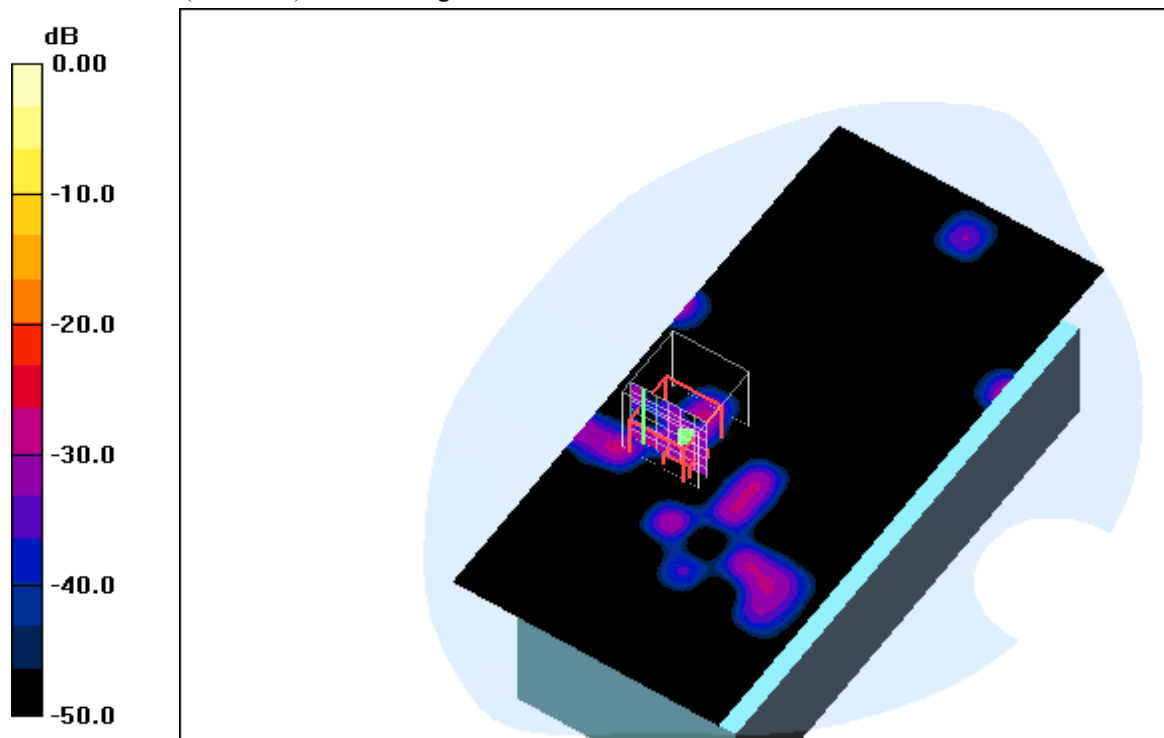
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn477; Calibrated: 14.05.2008
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Rear position - Middle Strap/Area Scan (71x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 0.00 mW/g

Rear position - Middle Strap/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$
 Reference Value = 0.773 V/m; Power Drift = 0.123 dB
 Peak SAR (extrapolated) = 0.01 W/kg
SAR(1 g) = 0.000976 mW/g; SAR(10 g) = 0.000271 mW/g
 Maximum value of SAR (measured) = 0.00 mW/g



0 dB = 0.00mW/g

Additional information:

position or distance of DUT to SAM (if not standard head positions) : DUT touching SAM
 ambient temperature: 21.8°C; liquid temperature: 21.7°C

Date/Time: 19.05.2009 13:59:37 Date/Time: 19.05.2009 14:11:15

P1528_OET65-Body-WLAN2450 #3 without RFID-Module

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0004

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.99 \text{ mho/m}$; $\epsilon_r = 52.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn413; Calibrated: 08.01.2009
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Front position - Middle/Area Scan (71x141x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.046 mW/g

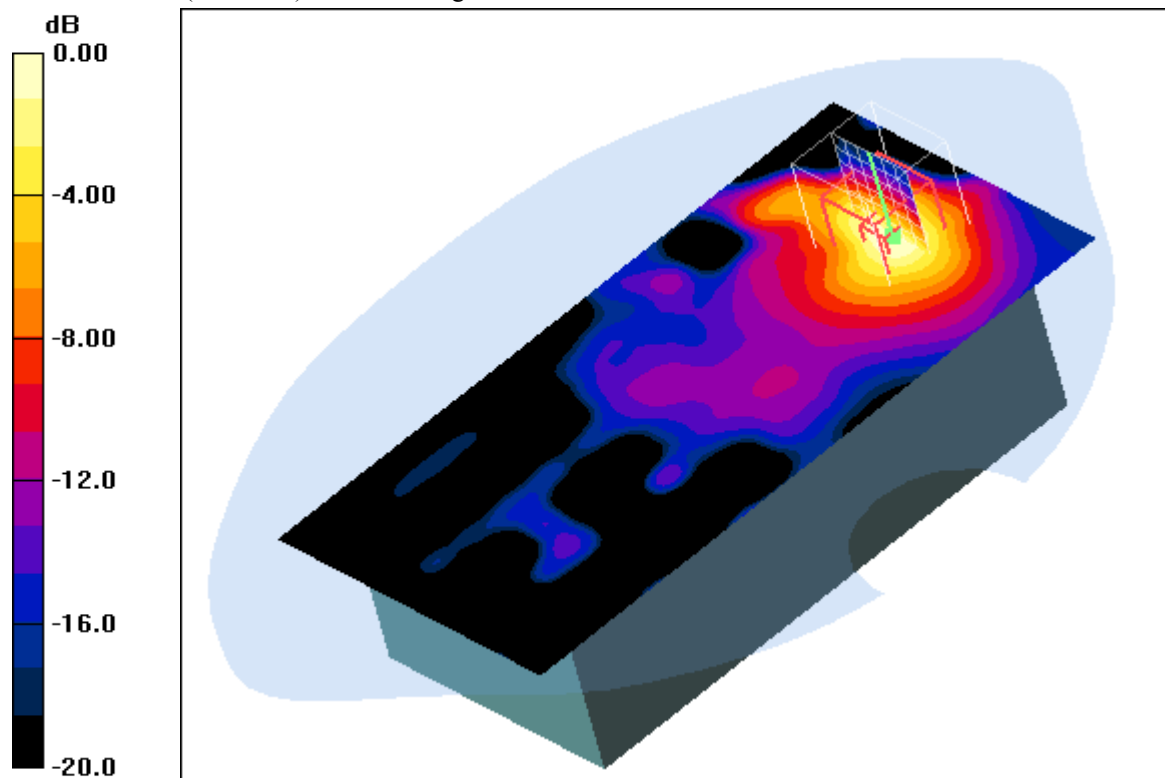
Front position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 4.88 V/m; Power Drift = 0.063 dB

Peak SAR (extrapolated) = 0.106 W/kg

SAR(1 g) = 0.043 mW/g; SAR(10 g) = 0.019 mW/g

Maximum value of SAR (measured) = 0.048 mW/g



0 dB = 0.048mW/g

Additional information:

position or distance of DUT to SAM: without any distance

ambient temperature: 21.0°C; liquid temperature: 20.3°C

Date/Time: 19.05.2009 14:29:33 Date/Time: 19.05.2009 14:41:00

P1528_OET65-Body-WLAN2450 #3 without RFID-Module

DUT: Ecom i.roc; Type: 620 -Ex; Serial: 3566-PMMC-0004

Communication System: WLAN 2450 US; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.99 \text{ mho/m}$; $\epsilon_r = 52.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1559; ConvF(3.91, 3.91, 3.91); Calibrated: 14.01.2009
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn413; Calibrated: 08.01.2009
- Phantom: SAM left; Type: SAM; Serial: 1041
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 146

Rear position - Middle/Area Scan (71x141x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.01 mW/g

Rear position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

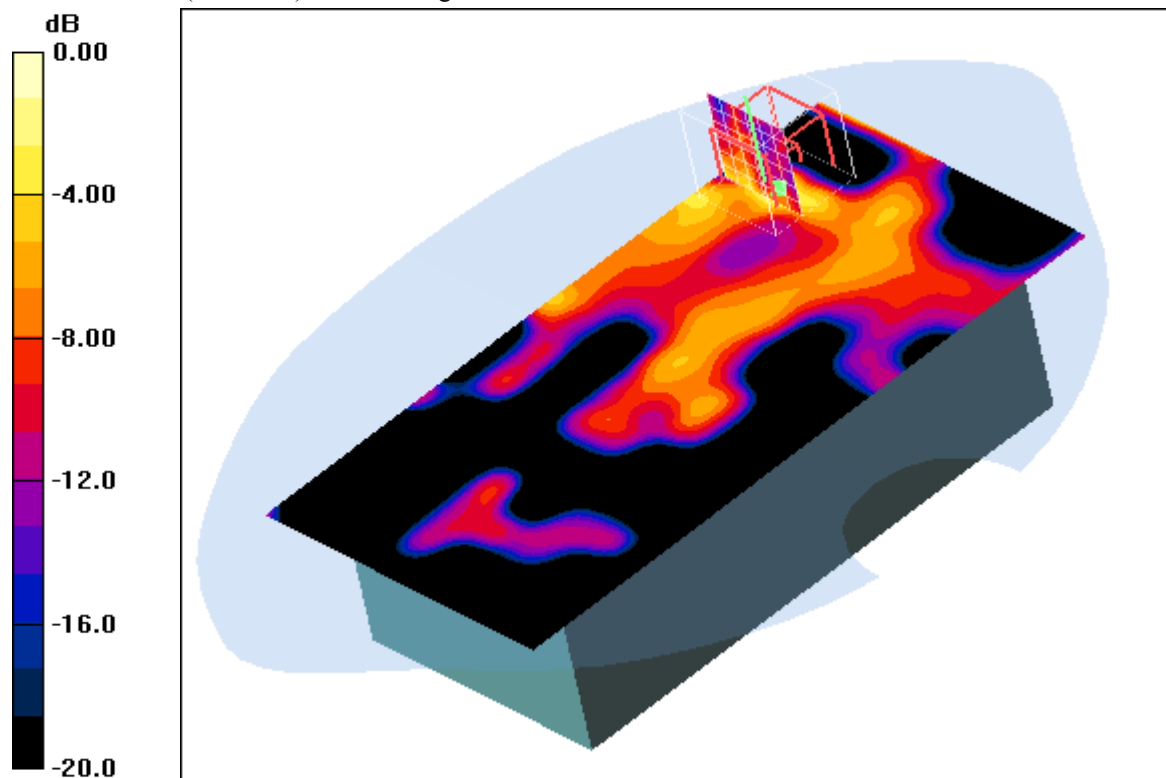
Reference Value = 1.84 V/m; Power Drift = -0.159 dB

Peak SAR (extrapolated) = 0.014 W/kg

SAR(1 g) = 0.00572 mW/g; SAR(10 g) = 0.00287 mW/g

SAR(1 g) = 0.00572 mW/g; SAR(10 g) = 0.00287 mW/g

Maximum value of SAR (measured) = 0.01 mW/g



0 dB = 0.010mW/g

Additional information:

position or distance of DUT to SAM: without any distance

ambient temperature: 21.0°C; liquid temperature: 20.3°C

Annex 3 Photo documentation

Photo 1: Measurement System DASY 4

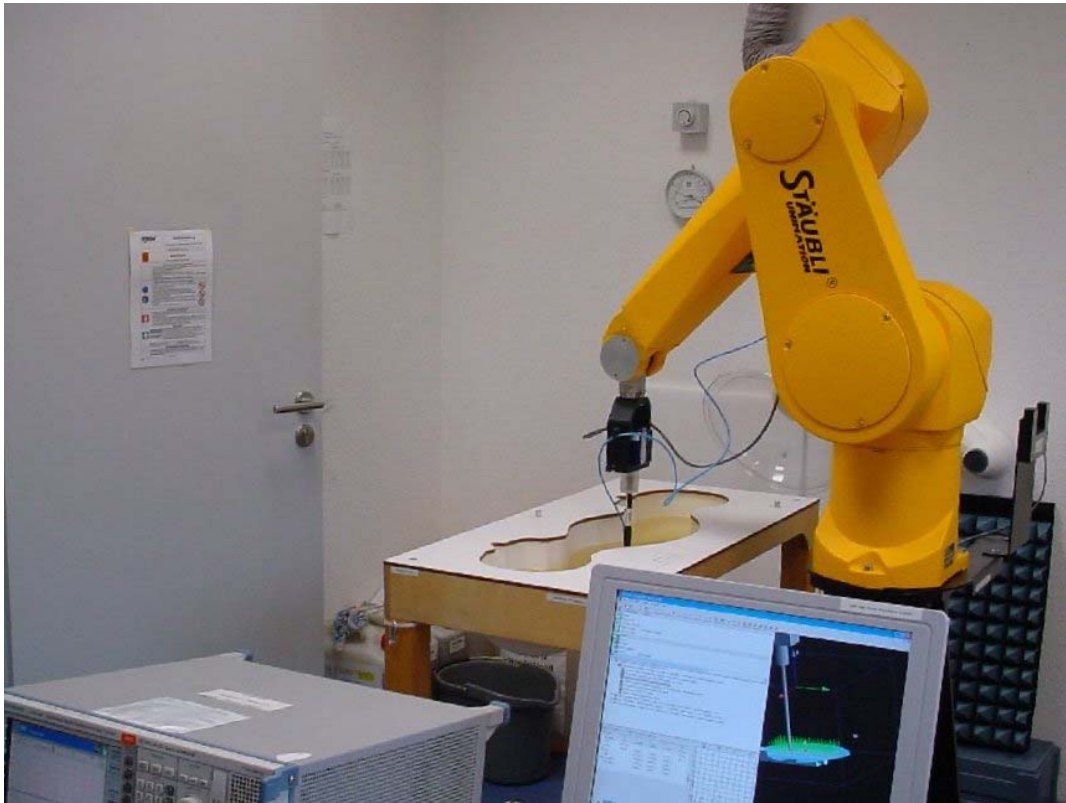


Photo 2: DUT - front view



Photo 3: DUT - side view



Photo 4: DUT #1 - rear view



Photo 7: DUT #1 - rear view (label)



Photo 8: DUT #2 - rear view (label)



Photo 9: DUT #3 - rear view (label)



Photo 10: DUT #3 - front view (without RFID-Module)



Photo 11: DUT #3 - side view (without RFID-Module)



Photo 12: DUT #3 - rear view (without RFID-Module)



Photo 13: DUT #3 - top view (without RFID-Module)

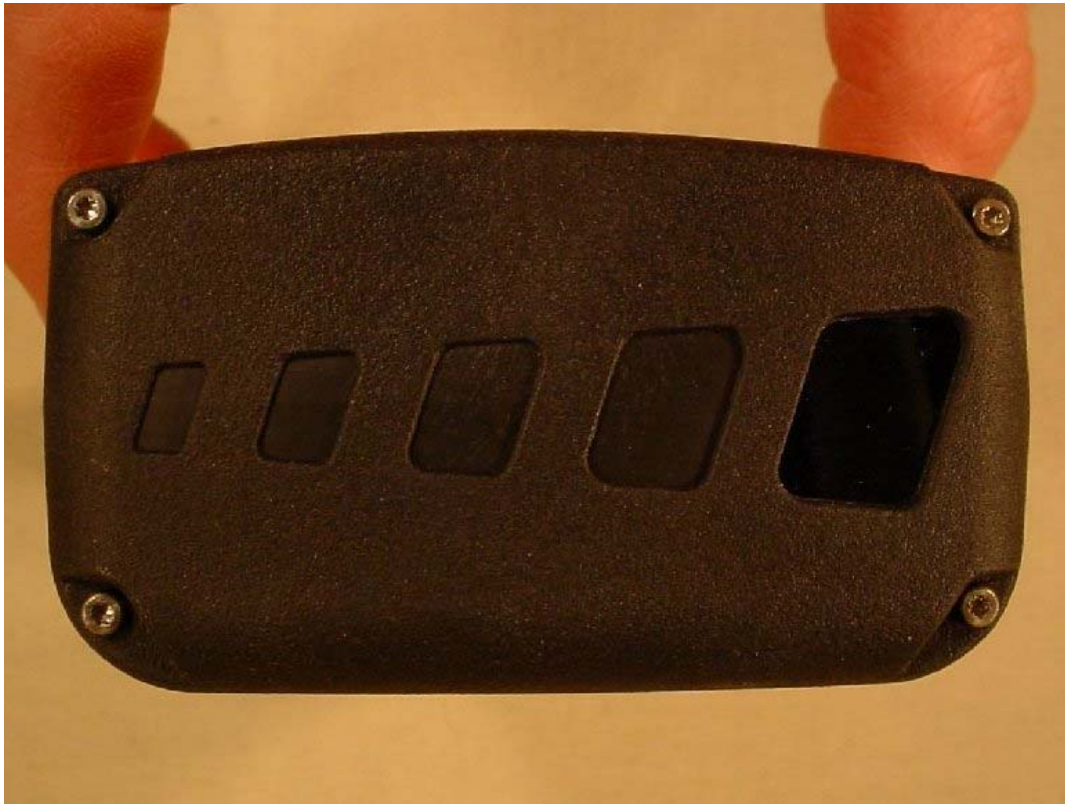


Photo 14: DUT #3 - top view opened



Photo 15: DUT with 1st holster - front view



Photo 16: DUT with 1st holster - side view



Photo 17: DUT with 1st holster - side view

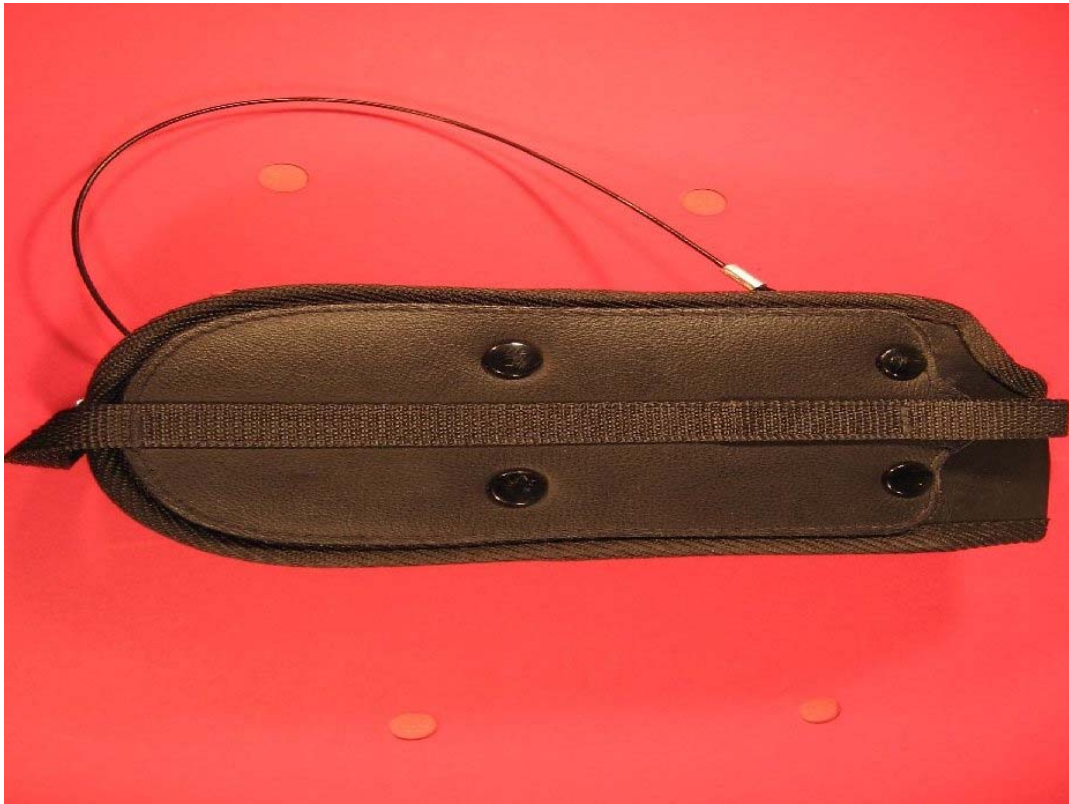


Photo 18: DUT with 1st holster - rear view



Photo 19: DUT with 2nd holster - front view



Photo 20: DUT with 2nd holster - rear view

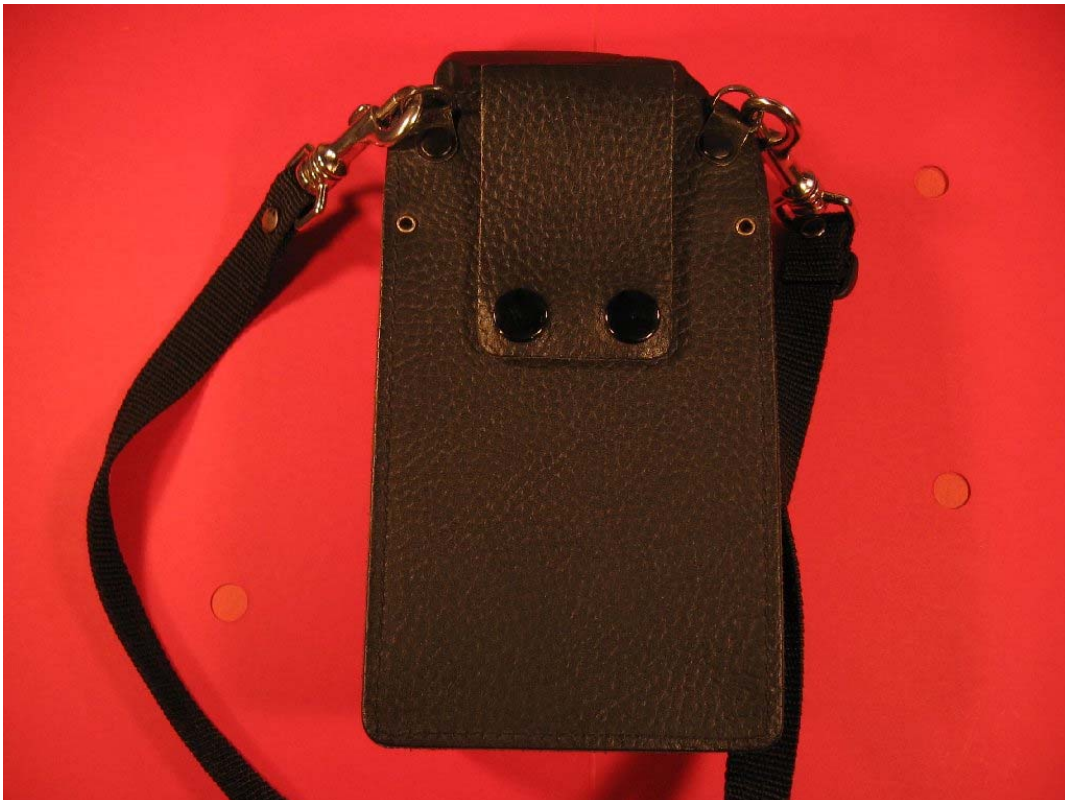


Photo 21: DUT with 2nd holster - side view



Photo 22: DUT with 2nd holster - side view



Photo 23: Test position body worn front side without any distance



Photo 24: Test position body worn front side without any distance



Photo 25: Test position body worn rear side without any distance



Photo 26: Test position body worn rear side without any distance



Photo 27: Test position body worn rear side (with the strap) without any distance



Photo 28: Test position body worn front side (with the 1st holster) without any distance



Photo 29: Test position body worn rear side (with the 1st holster) without any distance



Photo 30: Test position body worn rear side (with the 2nd holster) without any distance



Photo 31: Test position body worn rear side (with the 2nd holster) without any distance



Photo 32: Test position body worn front side (with the 2nd holster) without any distance



Photo 33: Test position body worn front side (without RFID-Module) without any distance



Photo 34: Test position body worn rear side (without RFID-Module) without any distance

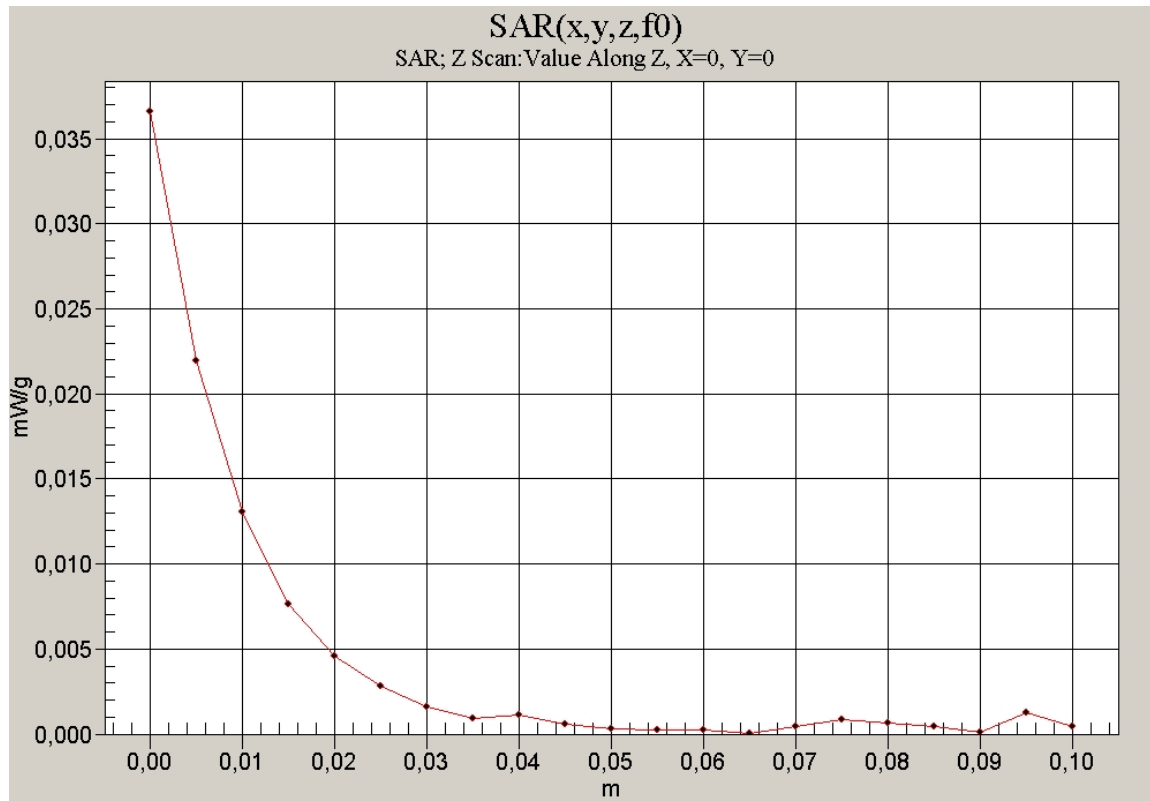


Annex 3.1 Liquid depth

Photo 35: Liquid depth 2450 MHz body simulating liquid



Annex 3.2 Z-axis scans



2450 MHz body

Annex 4 RF Technical Brief Cover Sheet acc. to RSS-102

1. COMPANY NUMBER: 8311A

2. MODEL NUMBER: i.roc

including the following RFID modules:

RFx11_134kHz, RFx11_125kHz, RFx10_13_56MHz

3. MANUFACTURER: Ecom engineering GmbH

4. TYPE OF EVALUATION:

(b) SAR Evaluation: Body-worn Device

- **Multiple transmitters: Yes No**
- **Evaluated against exposure limits: General Public Use Controlled Use**
- **Duty cycle used in evaluation: 100 %**
- **Standard used for evaluation: RSS-102 Issue 2 (2005-11)**
- **SAR value: 0.055 W/kg. Measured Computed Calculated**

Annex 4.1 Declaration of RF Exposure Compliance

ATTESTATION: I attest that the information provided in Annex 4 is correct; that a Technical Brief was prepared and the information it contains is correct; that the device evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed and that the device meets the SAR and/or RF exposure limits of RSS-102.

Signature:



Date: 2009-05-19

NAME : Thomas Vogler

TITLE : Dipl.-Ing. (FH)

COMPANY : CETECOM ICT Services GmbH

Annex 5 Calibration parameters

Calibration parameters are described in the additional document :

**Appendix to test report no. 1-0623-01-08/08‘
Calibration data, Phantom certificate
and detail information of the DASY4 System**