

CETECOM ICT Services
consulting - testing - certification >>>

TEST REPORT

Test Report No.: 1-9110/14-01-02-C



Deutsche
Akkreditierungsstelle
D-PL-12076-01-00

Testing Laboratory

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Test Standard/s

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
RSS-102 Issue 5 Radio Frequency Exposure Compliance of Radio communication Apparatus (All Frequency Bands)
For further applied test standards please refer to section 3 of this test report.

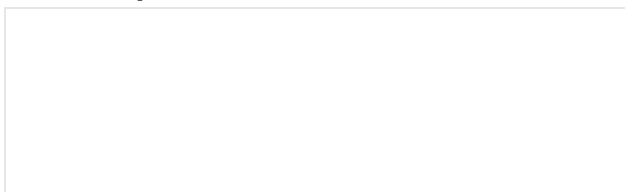
Test Item

Kind of test item: Smart phone
Device type: portable device
Model name: SH1-ACAA
S/N serial number: T26105E5NZ / T26105EBL0
FCC-ID: BXZSH1C
IC: 3724B-SH1C
IMEI-Number: 35999804 282753 7 09
Hardware status: PF
Software status: myco-eng 4.4.2 daily_2014-12-11_eng
Daily_379_2014-12-11 dev-keys
Tested bands: GSM 850/1900, UMTS FDD V, WLAN2.4/5GHz
Antenna: integrated antenna
Battery option: Li-ion Battery 1520mAh / 3.7V
Accessories: ---
Test sample status: identical prototype
Exposure category: general population / uncontrolled environment



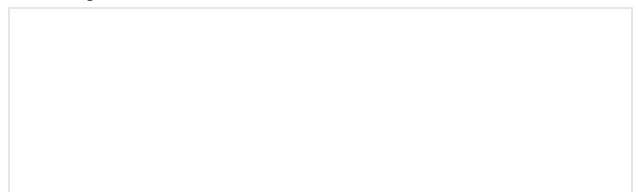
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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. 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 CETECOM ICT Services GmbH.

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2.2 Application details

Date of receipt of order:	2014-12-08
Date of receipt of test item:	2014-12-15
Start of test:	2015-01-17
End of test:	2015-03-18
Person(s) present during the test:	

2.3 Statement of compliance

The SAR values found for the SH1-ACAA Smart phone 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 95.1:1992, 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 a minimum of 0 mm from the body.

2.4 Technical details

Band tested for this test report	Technology	Lowest transmit frequency/MHz	Highest transmit frequency/MHz	Lowest receive Frequency/MHz	Highest receive Frequency/MHz	Kind of modulation	Power Class	Tested power control level	GPRS/EGPRS mobile station class	GPRS/EGPRS multislots class	(E)GPRS voice mode or DTM	Test channel low	Test channel middle	Test channel high	Maximum output power(dBm)*
<input type="checkbox"/>	GSM	880.2	914.8	925.2	959.8	GMSK 8-PSK	4 E2	5	B	12	no	975	37	124	32.9
<input type="checkbox"/>	GSM DCS	1710.2	1784.8	1805.2	1879.8	GMSK 8-PSK	1 E2	0	B	12	no	512	698	885	29.7
<input checked="" type="checkbox"/>	GSM cellular	824.2	848.8	869.2	893.8	GMSK 8-PSK	4 E2	5	B	12	no	128	190	251	30.1
<input checked="" type="checkbox"/>	GSM PCS	1850.2	1909.8	1930.2	1989.8	GMSK 8-PSK	1 E2	0	B	12	no	512	661	810	29.8
<input type="checkbox"/>	UMTS FDD I	1922.4	1977.6	2112.4	2167.6	QPSK	3	max	--	--	--	9612	9750	9888	22.8
<input checked="" type="checkbox"/>	UMTS FDD V	826.4	846.6	871.4	891.6	QPSK	3	max	--	--	--	4132	4182	4233	23.7
<input type="checkbox"/>	UMTS FDD VIII	882.4	912.6	927.4	957.6	QPSK	3	max	--	--	--	2712	2788	2863	23.8
<input type="checkbox"/>	WLAN	2412	2472	2412	2472	CCK OFDM	--	max	--	--	--	1	7	13	16.4
<input checked="" type="checkbox"/>	WLAN US	2412	2462	2412	2462	CCK OFDM	--	max	--	--	--	1	6	11	16.4
<input checked="" type="checkbox"/>	WLAN	5180	5240	5180	5240	OFDM	--	max	--	--	--	--	--	48	11.0
<input checked="" type="checkbox"/>	WLAN	5260	5320	5260	5320	OFDM	--	max	--	--	--	--	--	64	10.0
<input checked="" type="checkbox"/>	WLAN	5500	5700	5500	5700	OFDM	--	max	--	--	--	--	132	--	10.7
<input checked="" type="checkbox"/>	WLAN	5745	5825	5745	5825	OFDM	--	max	--	--	--	--	153	--	9.4

)*: measured slotted peak power for GSM, averaged max. RMS power for UMTS and WLAN.

supported UMTS features	category	remarks
Release 7 HSDPA	10	16QAM in Uplink not supported, 14.4 Mbps for downlink*
Release 6 HSUPA	6	64QAM and MIMO not supported, 5.7 Mbps for uplink*

*HSDPA Cat. 10 / HSUPA Cat.6 data rates DL: max. 14.4 Mbps, UL: max. 5.76 Mbps > EDGE class 12 data rates: DL: max. 237 kbps, UL: max. 237 kbps > GPRS class 12 data rates DL: max. 85.6 kbps, UL: max. 85.6 kbps

2.5 Transmitter and Antenna Operating Configurations

Simultaneous transmission conditions	
GSM / GPRS / EDGE	+ WLAN 2.4GHz
GSM / GPRS / EDGE	+ WLAN 5GHz
UMTS / HSPA	+ WLAN 2.4GHz
UMTS / HSPA	+ WLAN 5GHz

Table 1: Simultaneous transmission conditions

3 Test standards/ procedures references

Test Standard	Version	Test Standard Description
IEEE 1528-2003	2003-04	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
IEEE 1528-2013	2014-06	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
RSS-102 Issue 5	2015-04	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
Canada's Safety Code No. 6	2015-03	Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
IEEE Std. C95-3	2002	IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave
IEEE Std. C95-1	2005	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
IEC 62209-2	2010	Human exposure to radio frequency fields from hand-held and bodymounted wireless communication devices. Human models, instrumentation, and procedures. Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)
FCC KDBs:		
KDB 865664D01v01	February 7, 2014	FCC OET SAR measurement requirements 100 MHz to 6 GHz
KDB 865664D02v01	May 28, 2013	RF Exposure Compliance Reporting and Documentation Considerations
KDB 447498D01v05	February 7, 2014	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
KDB 648474D04v01	December 4, 2013	SAR Evaluation Considerations for Wireless Handsets
KDB 941225D01v03	October 16, 2014	SAR Measurements Procedures for 3G Devices
KDB 248227D01v02	March 16, 2015	SAR Measurement Procedures for 802.11 a/b/g Transmitters

3.1 RF exposure limits

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain and Trunk)	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 2: 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).

4 Summary of Measurement Results

<input checked="" type="checkbox"/>	No deviations from the technical specifications ascertained		
<input type="checkbox"/>	Deviations from the technical specifications ascertained		
Maximum SAR value reported for 1g (W/kg)			
	PCE	DTS	UNII
head	0.580	0.454	0.301
body worn 0 mm distance	1.229	0.583	0.353
collocated situations	ΣSAR evaluation	1.436	
	SPLSR_i ≤ 0.04	0.02	

4.1 SAR measurement variability and measurement uncertainty analysis

This analysis is required for worst case results larger than 0.8 W/kg.

frequency band	highest original measurement result at worst case position (W/kg)	repeated measurement result at worst case position (W/kg)	ratio <1.2
GSM 835	0.698	0.689	1.01
GSM 1900	0.911	0.901	1.01
UMTS FDD V	0.830	0.808	1.03

5 Test Environment

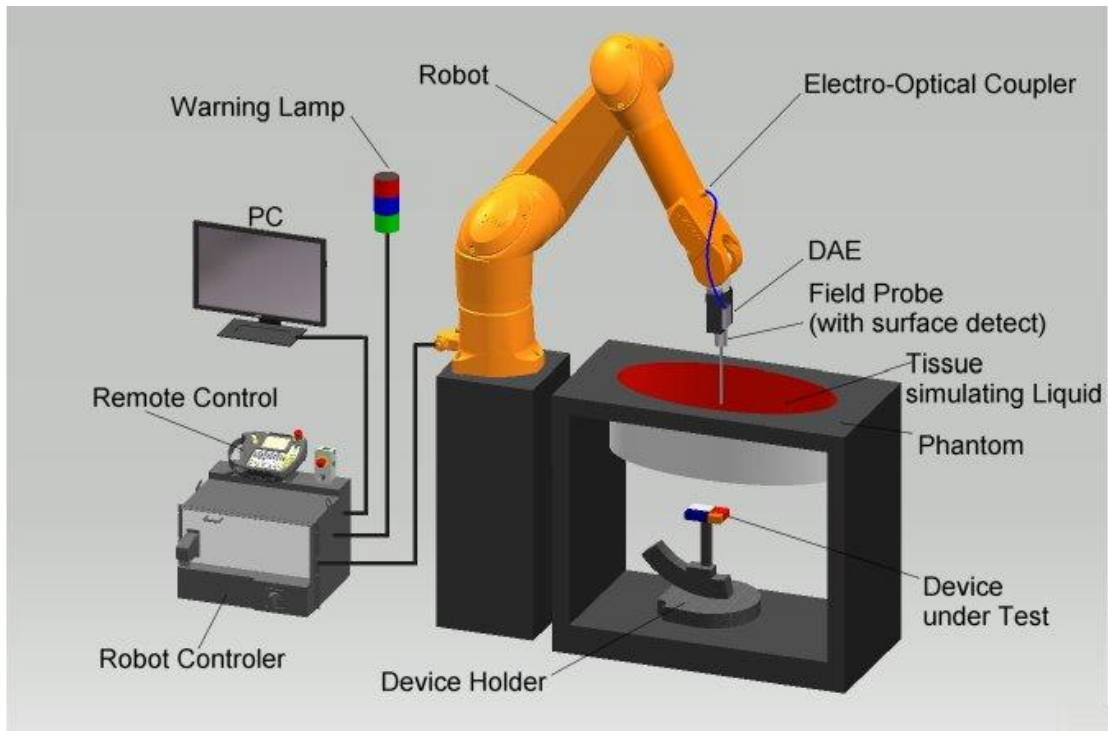
Ambient temperature:	20 – 24 °C
Tissue Simulating liquid:	20 – 24 °C
Relative humidity content:	40 – 50 %
Air pressure:	not relevant for this kind of testing
Power supply:	230 V / 50 Hz

Exact temperature values for each test are shown in the table(s) under 7.1 and/or on the measurement plots.

6 Test Set-up

6.1 Measurement system

6.1.1 System Description



- The DASYS system for performing compliance tests consists of the following items:
- A standard high precision 6-axis robot (Stäubli RX/TX 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.
- 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.
- 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 DASYS measurement server.
- The DASYS 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 7.
- DASYS 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 triple flat and eli phantom for the testing of handheld and body-mounted wireless devices.
- The device holder for handheld mobile phones and mounting device adaptor for laptops
- Tissue simulating liquid mixed according to the given recipes.
- System check dipoles allowing to validate the proper functioning of the system.

6.1.2 Test environment

The DASY measurement system is placed in a laboratory room within an environment which avoids influence on SAR measurements by ambient electromagnetic fields and any reflection from the environment. The pictures at the beginning of the photo documentation show a complete view of the test environment. The system allows the measurement of SAR values larger than 0.005 mW/g.

6.1.3 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 $\pm 9.5\%$; $k=2$) 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 μ W/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)

Isotropic E-Field Probe ES3DV3 for Dosimetric Measurements

Technical data according to manufacturer information

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., butyl diglycol)
Calibration	Calibration certificate in Appendix D
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) ± 0.3 dB in HSL (rotation normal to probe axis)
Dynamic range	5 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 20 mm Body diameter: 12 mm Tip diameter: 3.9 mm Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms (ES3DV3)

Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

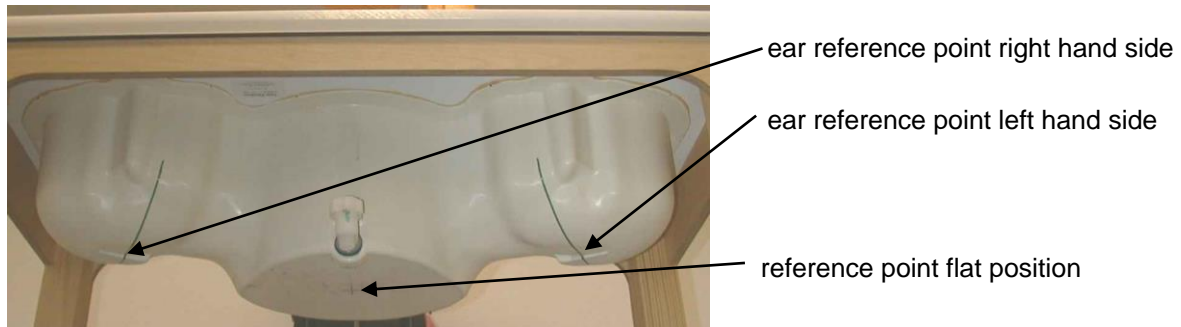
Technical data according to manufacturer information

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to >6 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic range	10 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically <1 μ W/g)
Dimensions	Overall length: 337 mm (Tip: 20mm) Tip length: 2.5 mm (Body: 12mm) Typical distance from probe tip to dipole centers: 1mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

6.1.4 Phantom description

The used SAM Phantom meets the requirements specified in FCC KDB865664 D01 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.



Triple Modular Phantom consists of three identical modules which can be installed and removed separately without emptying the liquid. It includes three reference points for phantom installation. Covers prevent evaporation of the liquid. Phantom material is resistant to DGBE based tissue simulating liquids.

6.1.5 Device holder description

The DASY 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.

6.1.6 Scanning procedure

- The DASY installation includes predefined files with recommended procedures for measurements and system check. 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 highest integrated SAR value is the main concern in compliance test applications. These values can mostly be found at the inner surface of the phantom and cannot be measured directly due to the sensor offset in the probe. To extrapolate the surface values, the measurement distances to the surface must be known accurately. A distance error of 0.5mm could produce SAR errors of 6% at 1800 MHz. Using predefined locations for measurements is not accurate enough. Any shift of the phantom (e.g., slight deformations after filling it with liquid) would produce high uncertainties. For an automatic and accurate detection of the phantom surface, the DASY5 system uses the mechanical surface detection. The detection is always at touch, but the probe will move backward from the surface the indicated distance before starting the measurement.
- 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 scan uses different grid spacings for different frequency measurements. Standard grid spacing for head measurements in frequency ranges ≤ 2 GHz is 15 mm in x- and y-dimension. For higher frequencies a finer resolution is needed, thus for the grid spacing is reduced according the following table:

Area scan grid spacing for different frequency ranges	
Frequency range	Grid spacing
≤ 2 GHz	≤ 15 mm
2 – 4 GHz	≤ 12 mm
4 – 6 GHz	≤ 10 mm

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 B.

- A „zoom scan“ measures the field in a volume around the 2D peak SAR value acquired in the previous „coarse“ scan. It uses a fine meshed grid where the robot moves the probe in steps along all the 3 axis (x,y and z-axis) starting at the bottom of the Phantom. The grid spacing for the cube measurement is varied according to the measured frequency range, the dimensions are given in the following table:

Zoom scan grid spacing and volume for different frequency ranges			
Frequency range	Grid spacing for x, y axis	Grid spacing for z axis	Minimum zoom scan volume
≤ 2 GHz	≤ 8 mm	≤ 5 mm	≥ 30 mm
2 – 3 GHz	≤ 5 mm	≤ 5 mm	≥ 28 mm
3 – 4 GHz	≤ 5 mm	≤ 4 mm	≥ 28 mm
4 – 5 GHz	≤ 4 mm	≤ 3 mm	≥ 25 mm
5 – 6 GHz	≤ 4 mm	≤ 2 mm	≥ 22 mm

DASY 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 B. Test results relevant for the specified standard (see section 3) are shown in table form in section 7.

6.1.7 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 all points in the three directions x, y and z. 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 1 to 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 neighbouring volumes are evaluated until no neighbouring 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

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

6.1.8 Data Storage and Evaluation

Data Storage

The DASY 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", ".DA5x". 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 DASY 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

6.1.9 Measurement uncertainty evaluation for SAR test

DASY5 Uncertainty Budget									
According to IEEE 1528/2003 and IEC 62209-1 for the 30 MHz - 3 GHz range									
Source of uncertainty	Uncertainty Value		Probability Distribution	Divisor	c _i (1g)	c _i (10g)	Standard Uncertainty		v _i ² or v _{eff}
	± %						± %, (1g)	± %, (10g)	
Measurement System									
Probe calibration	± 6.0 %		Normal	1	1	1	± 6.0 %	± 6.0 %	∞
Axial isotropy	± 4.7 %		Rectangular	√ 3	0.7	0.7	± 1.9 %	± 1.9 %	∞
Hemispherical isotropy	± 9.6 %		Rectangular	√ 3	0.7	0.7	± 3.9 %	± 3.9 %	∞
Boundary effects	± 1.0 %		Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞
Probe linearity	± 4.7 %		Rectangular	√ 3	1	1	± 2.7 %	± 2.7 %	∞
System detection limits	± 1.0 %		Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞
Readout electronics	± 0.3 %		Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8 %		Rectangular	√ 3	1	1	± 0.5 %	± 0.5 %	∞
Integration time	± 2.6 %		Rectangular	√ 3	1	1	± 1.5 %	± 1.5 %	∞
RF ambient noise	± 3.0 %		Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞
RF ambient reflections	± 3.0 %		Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞
Probe positioner	± 0.4 %		Rectangular	√ 3	1	1	± 0.2 %	± 0.2 %	∞
Probe positioning	± 2.9 %		Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞
Max.SAR evaluation	± 1.0 %		Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞
Test Sample Related									
Device positioning	± 2.9 %		Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device holder uncertainty	± 3.6 %		Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power drift	± 5.0 %		Rectangular	√ 3	1	1	± 2.9 %	± 2.9 %	∞
Phantom and Set-up									
Phantom uncertainty	± 4.0 %		Rectangular	√ 3	1	1	± 2.3 %	± 2.3 %	∞
Liquid conductivity (target)	± 5.0 %		Rectangular	√ 3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (meas.)	± 5.0 %		Rectangular	√ 3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid permittivity (target)	± 5.0 %		Rectangular	√ 3	0.6	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (meas.)	± 5.0 %		Rectangular	√ 3	0.6	0.49	± 1.7 %	± 1.4 %	∞
Combined Std.							± 11.1 %	± 10.8 %	387
Expanded Std.							± 22.1 %	± 21.6 %	

Table 3: Measurement uncertainties

Worst-Case uncertainty budget for DASY5 assessed according to IEEE 1528/2003.

The budget is valid for 2G and 3G communication signals and frequency range 300MHz - 3 GHz.

For these conditions it represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerable smaller.

Relative DASY5 Uncertainty Budget for SAR Tests										
According to IEEE 1528/2013 and IEC62209/2011 for the 0.3 - 3GHz range										
Error Description	Uncertainty Value		Probability Distribution	Divisor	c _i (1g)	c _i (10g)	Standard Uncertainty		v _i ² or v _{eff}	
	± %						± %, (1g)	± %, (10g)		
Measurement System										
Probe calibration	± 6.0 %		Normal	1	1	1	± 6.0 %	± 6.0 %	∞	
Axial isotropy	± 4.7 %		Rectangular	√ 3	0.7	0.7	± 1.9 %	± 1.9 %	∞	
Hemispherical isotropy	± 9.6 %		Rectangular	√ 3	0.7	0.7	± 3.9 %	± 3.9 %	∞	
Boundary effects	± 1.0 %		Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞	
Probe linearity	± 4.7 %		Rectangular	√ 3	1	1	± 2.7 %	± 2.7 %	∞	
System detection limits	± 1.0 %		Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞	
Modulation Response	± 2.4 %		Rectangular	√ 3	1	1	± 1.4 %	± 1.4 %	∞	
Readout electronics	± 0.3 %		Normal	1	1	1	± 0.3 %	± 0.3 %	∞	
Response time	± 0.8 %		Rectangular	√ 3	1	1	± 0.5 %	± 0.5 %	∞	
Integration time	± 2.6 %		Rectangular	√ 3	1	1	± 1.5 %	± 1.5 %	∞	
RF ambient noise	± 3.0 %		Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞	
RF ambient reflections	± 3.0 %		Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞	
Probe positioner	± 0.4 %		Rectangular	√ 3	1	1	± 0.2 %	± 0.2 %	∞	
Probe positioning	± 2.9 %		Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞	
Max. SAR evaluation	± 2.0 %		Rectangular	√ 3	1	1	± 1.2 %	± 1.2 %	∞	
Test Sample Related										
Device positioning	± 2.9 %		Normal	1	1	1	± 2.9 %	± 2.9 %	145	
Device holder uncertainty	± 3.6 %		Normal	1	1	1	± 3.6 %	± 3.6 %	5	
Power drift	± 5.0 %		Rectangular	√ 3	1	1	± 2.9 %	± 2.9 %	∞	
Phantom and Set-up										
Phantom uncertainty	± 6.1 %		Rectangular	√ 3	1	1	± 3.5 %	± 3.5 %	∞	
SAR correction	± 1.9 %		Rectangular	√ 3	1	0.84	± 1.1 %	± 0.9 %	∞	
Liquid conductivity (meas.)	± 5.0 %		Rectangular	√ 3	0.78	0.71	± 2.3 %	± 2.0 %	∞	
Liquid permittivity (meas.)	± 5.0 %		Rectangular	√ 3	0.26	0.26	± 0.8 %	± 0.8 %	∞	
Temp. Unc. - Conductivity	± 3.4 %		Rectangular	√ 3	0.78	0.71	± 1.5 %	± 1.4 %	∞	
Temp. Unc. - Permittivity	± 0.4 %		Rectangular	√ 3	0.23	0.26	± 0.1 %	± 0.1 %	∞	
Combined Uncertainty							± 11.3 %	± 11.3 %	330	
Expanded Std. Uncertainty							± 22.7 %	± 22.5 %		

Table 4: Measurement uncertainties

Worst-Case uncertainty budget for DASY5 assessed according to IEEE 1528/2013 and IEC 62209-1/2011 standards. The budget is valid for the frequency range 300MHz -3 GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerable smaller.

DASY5 Uncertainty Budget										
According to IEC 62209-2/2010 for the 30 MHz - 6 GHz range										
Source of uncertainty	Uncertainty Value		Probability Distribution	Divisor	c _i (1g)	c _i (10g)	Standard Uncertainty		v _i ² or v _{eff}	
	± %						± %, (1g)	± %, (10g)		
Measurement System										
Probe calibration	± 6.6 %		Normal	1	1	1	± 6.6 %	± 6.6 %	∞	
Axial isotropy	± 4.7 %		Rectangular	√ 3	0.7	0.7	± 1.9 %	± 1.9 %	∞	
Hemispherical isotropy	± 9.6 %		Rectangular	√ 3	0.7	0.7	± 3.9 %	± 3.9 %	∞	
Boundary effects	± 2.0 %		Rectangular	√ 3	1	1	± 1.2 %	± 1.2 %	∞	
Probe linearity	± 4.7 %		Rectangular	√ 3	1	1	± 2.7 %	± 2.7 %	∞	
System detection limits	± 1.0 %		Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞	
Modulation Response	± 2.4 %		Rectangular	√ 3	1	1	± 1.4 %	± 1.4 %	∞	
Readout electronics	± 0.3 %		Normal	1	1	1	± 0.3 %	± 0.3 %	∞	
Response time	± 0.8 %		Rectangular	√ 3	1	1	± 0.5 %	± 0.5 %	∞	
Integration time	± 2.6 %		Rectangular	√ 3	1	1	± 1.5 %	± 1.5 %	∞	
RF ambient noise	± 3.0 %		Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞	
RF ambient reflections	± 3.0 %		Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞	
Probe positioner	± 0.8 %		Rectangular	√ 3	1	1	± 0.5 %	± 0.5 %	∞	
Probe positioning	± 6.7 %		Rectangular	√ 3	1	1	± 3.9 %	± 3.9 %	∞	
Post-processing	± 4.0 %		Rectangular	√ 3	1	1	± 2.3 %	± 2.3 %	∞	
Test Sample Related										
Device positioning	± 2.9 %		Normal	1	1	1	± 2.9 %	± 2.9 %	145	
Device holder uncertainty	± 3.6 %		Normal	1	1	1	± 3.6 %	± 3.6 %	5	
Power drift	± 5.0 %		Rectangular	√ 3	1	1	± 2.9 %	± 2.9 %	∞	
Phantom and Set-up										
Phantom uncertainty	± 7.9 %		Rectangular	√ 3	1	1	± 4.6 %	± 4.6 %	∞	
SAR correction	± 1.9 %		Rectangular	√ 3	1	0.84	± 1.1 %	± 0.9 %	∞	
Liquid conductivity (meas.)	± 5.0 %		Rectangular	√ 3	0.78	0.71	± 2.3 %	± 2.0 %	∞	
Liquid permittivity (meas.)	± 5.0 %		Rectangular	√ 3	0.26	0.26	± 0.8 %	± 0.8 %	∞	
Temp. Unc. - Conductivity	± 3.4 %		Rectangular	√ 3	0.78	0.71	± 1.5 %	± 1.4 %	∞	
Temp. Unc. - Permittivity	± 0.4 %		Rectangular	√ 3	0.23	0.26	± 0.1 %	± 0.1 %	∞	
Combined Uncertainty							± 12.7 %	± 12.6 %	330	
Expanded Std. Uncertainty							± 25.4 %	± 25.3 %		

Table 5: Measurement uncertainties.

Worst-Case uncertainty budget for DASY5 assessed according to IEC 62209-2/2010 standard. The budget is valid for the frequency range 30MHz - 6 GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerable smaller.

Relative DASY5 Uncertainty Budget for SAR Tests									
According to IEEE 1528/2003 and IEC 62209-1 for the 3 - 6 GHz range									
Error Description	Uncertainty Value	Probability Distribution	Divisor	c _i	c _i	Standard Uncertainty		v _i ² or v _{eff}	
				(1g)	(10g)	± %, (1g)	± %, (10g)		
Measurement System									
Probe calibration	± 6.6 %	Normal	1	1	1	± 6.6 %	± 6.6 %	∞	
Axial isotropy	± 4.7 %	Rectangular	√ 3	0.7	0.7	± 1.9 %	± 1.9 %	∞	
Hemispherical isotropy	± 9.6 %	Rectangular	√ 3	0.7	0.7	± 3.9 %	± 3.9 %	∞	
Boundary effects	± 2.0 %	Rectangular	√ 3	1	1	± 1.2 %	± 1.2 %	∞	
Probe linearity	± 4.7 %	Rectangular	√ 3	1	1	± 2.7 %	± 2.7 %	∞	
System detection limits	± 1.0 %	Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞	
Readout electronics	± 0.3 %	Normal	1	1	1	± 0.3 %	± 0.3 %	∞	
Response time	± 0.8 %	Rectangular	√ 3	1	1	± 0.5 %	± 0.5 %	∞	
Integration time	± 2.6 %	Rectangular	√ 3	1	1	± 1.5 %	± 1.5 %	∞	
RF ambient noise	± 3.0 %	Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞	
RF ambient reflections	± 3.0 %	Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞	
Probe positioner	± 0.8 %	Rectangular	√ 3	1	1	± 0.5 %	± 0.5 %	∞	
Probe positioning	± 6.7 %	Rectangular	√ 3	1	1	± 3.9 %	± 3.9 %	∞	
Max. SAR evaluation	± 4.0 %	Rectangular	√ 3	1	1	± 2.3 %	± 2.3 %	∞	
Test Sample Related									
Device positioning	± 2.9 %	Normal	1	1	1	± 2.9 %	± 2.9 %	145	
Device holder uncertainty	± 3.6 %	Normal	1	1	1	± 3.6 %	± 3.6 %	5	
Power drift	± 5.0 %	Rectangular	√ 3	1	1	± 2.9 %	± 2.9 %	∞	
Phantom and Set-up									
Phantom uncertainty	± 4.0 %	Rectangular	√ 3	1	1	± 2.3 %	± 2.3 %	∞	
Liquid conductivity (target)	± 5.0 %	Rectangular	√ 3	0.64	0.43	± 1.8 %	± 1.2 %	∞	
Liquid conductivity (meas.)	± 5.0 %	Rectangular	√ 3	0.64	0.43	± 1.8 %	± 1.2 %	∞	
Liquid permittivity (target)	± 5.0 %	Rectangular	√ 3	0.6	0.49	± 1.7 %	± 1.4 %	∞	
Liquid permittivity (meas.)	± 5.0 %	Rectangular	√ 3	0.6	0.49	± 1.7 %	± 1.4 %	∞	
Combined Uncertainty						± 12.1 %	± 11.9 %	330	
Expanded Std. Uncertainty						± 24.3 %	± 23.8 %		

Table 6: Measurement uncertainties

Worst-Case uncertainty budget for DASY5 valid for 3G communication signals and frequency range 3 - 6 GHz. Probe calibration error reflects uncertainty of the EX3D probe. For specific tests and configurations, the uncertainty could be considerable smaller.

Relative DASY5 Uncertainty Budget for SAR Tests										
According to IEEE 1528/2013 and IEC62209-1/2011 (3-6GHz range)										
Error Description	Uncertainty Value	Probability Distribution	Divisor	c _i	c _i	Standard Uncertainty		v _i ² or v _{eff}		
				(1g)	(10g)	± %, (1g)	± %, (10g)			
Measurement System										
Probe calibration	± 6.6 %	Normal	1	1	1	± 6.6 %	± 6.6 %	∞		
Axial isotropy	± 4.7 %	Rectangular	√ 3	0.7	0.7	± 1.9 %	± 1.9 %	∞		
Hemispherical isotropy	± 9.6 %	Rectangular	√ 3	0.7	0.7	± 3.9 %	± 3.9 %	∞		
Boundary effects	± 2.0 %	Rectangular	√ 3	1	1	± 1.2 %	± 1.2 %	∞		
Probe linearity	± 4.7 %	Rectangular	√ 3	1	1	± 2.7 %	± 2.7 %	∞		
System detection limits	± 1.0 %	Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞		
Modulation Response	± 2.4 %	Rectangular	√ 3	1	1	± 1.4 %	± 1.4 %	∞		
Readout electronics	± 0.3 %	Normal	1	1	1	± 0.3 %	± 0.3 %	∞		
Response time	± 0.8 %	Rectangular	√ 3	1	1	± 0.5 %	± 0.5 %	∞		
Integration time	± 2.6 %	Rectangular	√ 3	1	1	± 1.5 %	± 1.5 %	∞		
RF ambient noise	± 3.0 %	Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞		
RF ambient reflections	± 3.0 %	Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞		
Probe positioner	± 0.8 %	Rectangular	√ 3	1	1	± 0.5 %	± 0.5 %	∞		
Probe positioning	± 6.7 %	Rectangular	√ 3	1	1	± 3.9 %	± 3.9 %	∞		
Max. SAR evaluation	± 4.0 %	Rectangular	√ 3	1	1	± 2.3 %	± 2.3 %	∞		
Test Sample Related										
Device positioning	± 2.9 %	Normal	1	1	1	± 2.9 %	± 2.9 %	145		
Device holder uncertainty	± 3.6 %	Normal	1	1	1	± 3.6 %	± 3.6 %	5		
Power drift	± 5.0 %	Rectangular	√ 3	1	1	± 2.9 %	± 2.9 %	∞		
Phantom and Set-up										
Phantom uncertainty	± 6.6 %	Rectangular	√ 3	1	1	± 3.8 %	± 3.8 %	∞		
SAR correction	± 1.9 %	Rectangular	√ 3	1	0.84	± 1.1 %	± 0.9 %	∞		
Liquid conductivity (meas.)	± 5.0 %	Rectangular	√ 3	0.78	0.71	± 2.3 %	± 2.0 %	∞		
Liquid permittivity (meas.)	± 5.0 %	Rectangular	√ 3	0.26	0.26	± 0.8 %	± 0.8 %	∞		
Temp. Unc. - Conductivity	± 3.4 %	Rectangular	√ 3	0.78	0.71	± 1.5 %	± 1.4 %	∞		
Temp. Unc. - Permittivity	± 0.4 %	Rectangular	√ 3	0.23	0.26	± 0.1 %	± 0.1 %	∞		
Combined Uncertainty						± 12.4 %	± 12.4 %	330		
Expanded Std. Uncertainty						± 24.9 %	± 24.8 %			

Table 7: Measurement uncertainties

Worst-Case uncertainty budget for DASY5 assessed according to IEEE 1528/2013 and IEC 62209-1/2011 standards. The budget is valid for the frequency range 3GHz -6GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerable smaller.

6.1.10 Measurement uncertainty evaluation for System Check

Uncertainty of a System Performance Check with DASY5 System for the 0.3 - 3 GHz range									
Source of uncertainty	Uncertainty Value	Probability Distribution	Divisor	c_i	c_i	Standard Uncertainty		v_i^2 or v_{eff}	
				(1g)	(10g)	± %, (1g)	± %, (10g)		
Measurement System									
Probe calibration	± 6.0 %	Normal	1	1	1	± 6.0 %	± 6.0 %	∞	
Axial isotropy	± 4.7 %	Rectangular	√ 3	0.7	0.7	± 1.9 %	± 1.9 %	∞	
Hemispherical isotropy	± 0.0 %	Rectangular	√ 3	0.7	0.7	± 0.0 %	± 0.0 %	∞	
Boundary effects	± 1.0 %	Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞	
Probe linearity	± 4.7 %	Rectangular	√ 3	1	1	± 2.7 %	± 2.7 %	∞	
System detection limits	± 1.0 %	Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞	
Readout electronics	± 0.3 %	Normal	1	1	1	± 0.3 %	± 0.3 %	∞	
Response time	± 0.0 %	Rectangular	√ 3	1	1	± 0.0 %	± 0.0 %	∞	
Integration time	± 0.0 %	Rectangular	√ 3	1	1	± 0.0 %	± 0.0 %	∞	
RF ambient conditions	± 3.0 %	Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞	
Probe positioner	± 0.4 %	Rectangular	√ 3	1	1	± 0.2 %	± 0.2 %	∞	
Probe positioning	± 2.9 %	Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞	
Max. SAR evaluation	± 1.0 %	Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞	
Test Sample Related									
Dev. of experimental dipole	± 0.0 %	Rectangular	√ 3	1	1	± 0.0 %	± 0.0 %	∞	
Source to liquid distance	± 2.0 %	Rectangular	√ 3	1	1	± 1.2 %	± 1.2 %	∞	
Power drift	± 3.4 %	Rectangular	√ 3	1	1	± 2.0 %	± 2.0 %	∞	
Phantom and Set-up									
Phantom uncertainty	± 4.0 %	Rectangular	√ 3	1	1	± 2.3 %	± 2.3 %	∞	
SAR correction	± 1.9 %	Rectangular	√ 3	1	0.84	± 1.1 %	± 0.9 %	∞	
Liquid conductivity (meas.)	± 5.0 %	Normal	1	0.78	0.71	± 3.9 %	± 3.6 %	∞	
Liquid permittivity (meas.)	± 5.0 %	Normal	1	0.26	0.26	± 1.3 %	± 1.3 %	∞	
Temp. unc. - Conductivity	± 1.7 %	Rectangular	√ 3	0.78	0.71	± 0.8 %	± 0.7 %	∞	
Temp. unc. - Permittivity	± 0.3 %	Rectangular	√ 3	0.23	0.26	± 0.0 %	± 0.0 %	∞	
Combined Uncertainty						± 9.1 %	± 8.9 %	330	
Expanded Std. Uncertainty						± 18.2 %	± 17.9 %		

Table 8: Measurement uncertainties of the System Check with DASY5 (0.3-3GHz)

Uncertainty of a System Performance Check with DASY5 System for the 3 - 6 GHz range										
Source of uncertainty	Uncertainty Value		Probability Distribution	Divisor	c_i	c_i	Standard Uncertainty		v_i^2 or v_{eff}	
					(1g)	(10g)	± %, (1g)	± %, (10g)		
Measurement System										
Probe calibration	±	6.6 %	Normal	1	1	1	± 6.6 %	± 6.6 %	∞	
Axial isotropy	±	4.7 %	Rectangular	√ 3	0.7	0.7	± 1.9 %	± 1.9 %	∞	
Hemispherical isotropy	±	0.0 %	Rectangular	√ 3	0.7	0.7	± 0.0 %	± 0.0 %	∞	
Boundary effects	±	1.0 %	Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞	
Probe linearity	±	4.7 %	Rectangular	√ 3	1	1	± 2.7 %	± 2.7 %	∞	
System detection limits	±	1.0 %	Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞	
Readout electronics	±	0.3 %	Normal	1	1	1	± 0.3 %	± 0.3 %	∞	
Response time	±	0.0 %	Rectangular	√ 3	1	1	± 0.0 %	± 0.0 %	∞	
Integration time	±	0.0 %	Rectangular	√ 3	1	1	± 0.0 %	± 0.0 %	∞	
RF ambient conditions	±	3.0 %	Rectangular	√ 3	1	1	± 1.7 %	± 1.7 %	∞	
Probe positioner	±	0.8 %	Rectangular	√ 3	1	1	± 0.5 %	± 0.5 %	∞	
Probe positioning	±	6.7 %	Rectangular	√ 3	1	1	± 3.9 %	± 3.9 %	∞	
Max. SAR evaluation	±	1.0 %	Rectangular	√ 3	1	1	± 0.6 %	± 0.6 %	∞	
Test Sample Related										
Dev. of experimental dipole	±	0.0 %	Rectangular	√ 3	1	1	± 0.0 %	± 0.0 %	∞	
Source to liquid distance	±	2.0 %	Rectangular	√ 3	1	1	± 1.2 %	± 1.2 %	∞	
Power drift	±	3.4 %	Rectangular	√ 3	1	1	± 2.0 %	± 2.0 %	∞	
Phantom and Set-up										
Phantom uncertainty	±	4.0 %	Rectangular	√ 3	1	1	± 2.3 %	± 2.3 %	∞	
SAR correction	±	1.9 %	Rectangular	√ 3	1	0.84	± 1.1 %	± 0.9 %	∞	
Liquid conductivity (meas.)	±	5.0 %	Normal	1	0.78	0.71	± 3.9 %	± 3.6 %	∞	
Liquid permittivity (meas.)	±	5.0 %	Normal	1	0.26	0.26	± 1.3 %	± 1.3 %	∞	
Temp. unc. - Conductivity	±	1.7 %	Rectangular	√ 3	0.78	0.71	± 0.8 %	± 0.7 %	∞	
Temp. unc. - Permittivity	±	0.3 %	Rectangular	√ 3	0.23	0.26	± 0.0 %	± 0.0 %	∞	
Combined Uncertainty							± 10.1 %	± 10.0 %	330	
Expanded Std. Uncertainty							± 20.2 %	± 19.9 %		

Table 9: Measurement uncertainties of the System Check with DASY5 (3-6GHz)

Note: Worst case probe calibration uncertainty has been applied for all probes used during the measurements.

6.1.11 System check

The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE 1528. The following table shows system check results for all frequency bands and tissue liquids used during the tests (plot(s) see annex A).

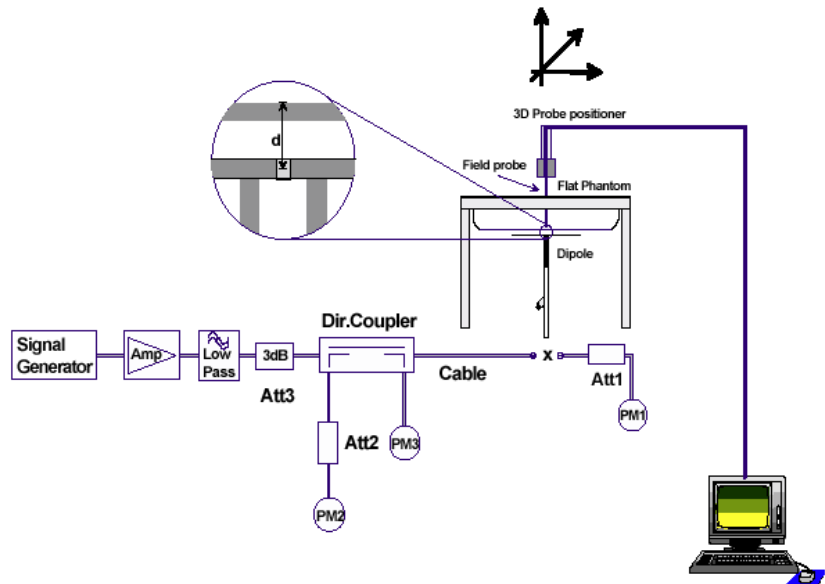
System performance check (1000 mW)								
System validation Kit	Frequency	Target SAR _{1g} /mW/g (+/- 10%)	Target SAR _{10g} /mW/g (+/- 10%)	Measured SAR _{1g} / mW/g	SAR _{1g} dev.	Measured SAR _{10g} / mW/g	SAR _{10g} dev.	Measured date
D835V2 S/N: 4d153	835 MHz head	9.58	6.21	9.55	-0.3%	6.33	1.9%	2015-01-21
D835V2 S/N: 4d153	835 MHz body	9.40	6.12	9.99	6.3%	6.64	8.5%	2015-01-21
D1900V2 S/N: 5d009	1900 MHz head	40.10	21.00	41.40	3.2%	21.40	1.9%	2015-01-19
D1900V2 S/N: 5d009	1900 MHz body	40.90	21.70	37.80	-7.6%	20.00	-7.8%	2015-01-19
D2450V2 S/N: 710	2450 MHz head	52.10	24.00	53.50	2.7%	25.00	4.2%	2015-01-22
D2450V2 S/N: 710	2450 MHz body	51.00	23.80	51.10	0.2%	23.60	-0.8%	2015-01-22
D5GHzV2 S/N: 1055	5200 MHz head	80.40	23.00	82.80	3.0%	23.70	3.0%	2015-03-16
D5GHzV2 S/N: 1055	5500 MHz head	84.90	24.30	88.90	4.7%	24.80	2.1%	2015-03-16
D5GHzV2 S/N: 1055	5800 MHz head	80.10	22.70	79.50	-0.7%	22.20	-2.2%	2015-03-16
D5GHzV2 S/N: 1055	5200 MHz body	74.20	20.80	73.70	-0.7%	20.80	0.0%	2015-03-18
D5GHzV2 S/N: 1055	5500 MHz body	77.90	21.70	71.20	-8.6%	19.90	-8.3%	2015-03-18
D5GHzV2 S/N: 1055	5800 MHz body	73.30	20.20	71.90	-1.9%	20.40	1.0%	2015-03-18

Table 10: Results system check

6.1.12 System check procedure

The system check 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 for frequencies below 2 GHz or 100 mW for frequencies above 2 GHz. To adjust this power a power meter is used. The power sensor is connected to the cable before the system check 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).

System check 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.



6.1.13 System validation

The system validation is performed in a similar way as a system check. It needs to be performed once a SAR measurement system has been established and allows an evaluation of the system accuracy with all components used together with the specified system. It has to be repeated at least once a year or when new system components are used (DAE, probe, phantom, dipole, liquid type).

In addition to the procedure used during system check a system validation also includes checks of probe isotropy, probe modulation factor and RF signal.

The following table lists the system validations relevant for this test report:

Frequency (MHz)	Test System	DASY SW	Dipole Type /SN	Probe Type / SN	Calibrated signal type(s)	DAE unit Type / SN	head validation	body validation
835	Saarbrücken / SAR-2	V52.8.7	D835V2 / 4d153	ES3DV3 / 3320	CW	DAE3/ 477	2014-07-02	2014-07-02
1900	Saarbrücken / SAR-2	V52.8.7	D1900V2 / 5d009	ES3DV3 / 3320	CW	DAE3/ 477	2014-07-14	2014-07-10
1750	Saarbrücken / SAR-3	V52.8.7	D1750V2 / 1093	ES3DV3 / 3326	CW	DAE4/ 1387	2014-07-09	2014-07-10
2450	Saarbrücken / SAR-1	V52.8.7	D2450V2 / 710	ET3DV6 / SN1554	CW	DAE3 / 413	2015-01-20	2015-01-20
5200	Saarbrücken / SAR-2	V52.8.7	D5GHzV2 / 1055	EX3DV4 / 3944	CW	DAE3 / 413	2015-03-09	2015-03-05
5500	Saarbrücken / SAR-2	V52.8.7	D5GHzV2 / 1055	EX3DV4 / 3944	CW	DAE3 / 413	2015-03-09	2015-03-06
5800	Saarbrücken / SAR-2	V52.8.7	D5GHzV2 / 1055	EX3DV4 / 3944	CW	DAE3 / 413	2015-03-10	2015-03-06

6.1.14 Tissue simulating liquids: dielectric properties

The following materials are used for producing the tissue-equivalent materials.

(Liquids used for tests described in section 7. are marked with ☒) :

Ingredients (% of weight)	Frequency (MHz)								
	<input type="checkbox"/> 450	<input type="checkbox"/> 750	<input checked="" type="checkbox"/> 835	<input type="checkbox"/> 900	<input type="checkbox"/> 1450	<input type="checkbox"/> 1750	<input checked="" type="checkbox"/> 1900	<input checked="" type="checkbox"/> 2450	<input checked="" type="checkbox"/> 5000
frequency band									
Water	38.56	41.1	41.45	40.92	54.37	55.35	55.19	54.7	64 - 78
Salt (NaCl)	3.95	1.4	1.45	1.48	0.63	0.38	0.19	0.0	2 - 3
Sugar	56.32	57.0	56.0	56.5	0.0	0.0	0.0	0.0	0.0
HEC	0.98	0.2	1.0	1.0	0.0	0.0	0.0	0.0	0.0
Bactericide	0.19	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Tween 20	0.0	0.0	0.0	0.0	44.90	44.17	44.52	45.2	0.0
Emulsifiers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9 - 15
Mineral Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11 - 18

Table 11: Head tissue dielectric properties

Ingredients (% of weight)	Frequency (MHz)								
	<input type="checkbox"/> 450	<input type="checkbox"/> 750	<input checked="" type="checkbox"/> 835	<input type="checkbox"/> 900	<input type="checkbox"/> 1450	<input type="checkbox"/> 1750	<input checked="" type="checkbox"/> 1900	<input checked="" type="checkbox"/> 2450	<input checked="" type="checkbox"/> 5000
frequency band									
Water	51.16	51.7	52.4	56.0	71.40	71.45	71.56	71.65	64 - 78
Salt (NaCl)	1.49	0.9	1.40	0.76	0.55	0.5	0.39	0.3	2 - 3
Sugar	46.78	47.2	45.0	41.76	0.0	0.0	0.0	0.0	0.0
HEC	0.52	0.0	1.0	1.21	0.0	0.0	0.0	0.0	0.0
Bactericide	0.05	0.1	0.1	0.27	0.1	0.1	0.1	0.1	0.0
Tween 20	0.0	0.0	0.0	0.0	27.95	27.95	27.95	27.95	0.0
Emulsifiers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9 - 15
Mineral Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11 - 18

Table 12: Body tissue dielectric properties

Salt: 99+% Pure Sodium Chloride
 Sugar: 98+% Pure Sucrose
 Tween 20: Polyoxyethylene (20) sorbitan monolaurate
 Water: De-ionized, 16MΩ+ resistivity
 HEC: Hydroxyethyl Cellulose

6.1.15 Tissue simulating liquids: parameters

Liquid HSL	Freq. (MHz)	Target head tissue		Measurement head tissue					Measurement date
		Permittivity	Conductivity (S/m)	Permittivity	Dev.	Conductivity		Dev.	
						ϵ''	(S/m)		
850/900	824	41.56	0.90	41.1	-1.0%	19.45	0.89	-0.9%	2015-01-21
	825	41.55	0.90	41.1	-1.1%	19.44	0.89	-0.8%	
	835	41.50	0.90	41.0	-1.3%	19.44	0.90	0.3%	
	837	41.50	0.90	40.9	-1.4%	19.43	0.90	0.3%	
	847	41.50	0.91	40.8	-1.6%	19.42	0.91	0.2%	
	849	41.50	0.92	40.8	-1.7%	19.40	0.92	0.1%	
1900	1850	40.00	1.40	39.9	-0.3%	13.01	1.34	-4.4%	2013-01-19
	1880	40.00	1.40	39.8	-0.5%	13.12	1.37	-2.0%	
	1900	40.00	1.40	39.6	-0.9%	13.31	1.41	0.5%	
	1910	40.00	1.40	39.6	-1.0%	13.27	1.41	0.7%	
2450	2412	39.27	1.77	39.0	-0.7%	12.92	1.73	-1.9%	2015-01-22
	2437	39.22	1.79	38.9	-0.8%	12.91	1.75	-2.1%	
	2450	39.20	1.80	38.9	-0.8%	12.89	1.76	-2.4%	
	2462	39.18	1.81	38.8	-1.0%	12.90	1.77	-2.6%	
5GHz	5200	35.99	4.66	35.9	-0.2%	15.72	4.55	-2.3%	2015-03-16
	5240	35.94	4.70	35.9	-0.2%	15.73	4.58	-2.4%	
	5320	35.85	4.78	35.8	-0.2%	15.75	4.66	-2.4%	
	5500	35.64	4.96	35.6	-0.2%	15.89	4.86	-2.1%	
	5660	35.46	5.13	35.3	-0.4%	15.95	5.02	-2.0%	
	5765	35.34	5.23	35.1	-0.5%	16.06	5.15	-1.6%	
	5800	35.30	5.27	35.1	-0.5%	16.05	5.18	-1.8%	

Table 13: Parameter of the head tissue simulating liquid

Liquid MSL	Freq. (MHz)	Target body tissue		Measurement body tissue					Measurement date
		Permittivity	Conductivity (S/m)	Permittivity	Dev.	Conductivity		Dev.	
						ϵ''	(S/m)		
850/900	824	55.24	0.97	54.6	-1.2%	21.76	1.00	2.9%	2015-01-21
	825	55.24	0.97	54.6	-1.2%	21.73	1.00	2.9%	
	835	55.20	0.97	54.5	-1.3%	21.79	1.01	4.3%	
	837	55.19	0.97	54.5	-1.3%	21.77	1.01	4.2%	
	847	55.16	0.98	54.4	-1.5%	21.66	1.02	3.6%	
	849	55.16	0.99	54.4	-1.5%	21.62	1.02	3.4%	
1900	1850	53.30	1.52	53.5	0.4%	14.15	1.46	-4.2%	2013-01-19
	1880	53.30	1.52	53.4	0.2%	14.16	1.48	-2.6%	
	1900	53.30	1.52	53.4	0.2%	14.25	1.51	-0.9%	
	1910	53.30	1.52	53.4	0.1%	14.24	1.51	-0.5%	
2450	2412	52.75	1.91	50.8	-3.7%	14.49	1.94	1.6%	2015-01-22
	2437	52.72	1.94	51.1	-3.1%	14.67	1.99	2.6%	
	2450	52.70	1.95	51.1	-3.0%	14.69	2.00	2.7%	
	2462	52.68	1.97	51.1	-3.0%	14.73	2.02	2.6%	
5GHz	5200	49.01	5.30	50.5	3.0%	17.92	5.18	-2.2%	2015-03-18
	5240	48.96	5.35	50.4	2.9%	17.97	5.24	-2.0%	
	5320	48.85	5.44	50.3	3.0%	18.09	5.35	-1.6%	
	5500	48.61	5.65	50.0	2.9%	18.24	5.58	-1.2%	
	5660	48.39	5.84	49.7	2.7%	18.45	5.81	-0.5%	
	5765	48.25	5.96	49.5	2.6%	18.57	5.95	-0.1%	
	5800	48.20	6.00	49.5	2.7%	18.66	6.02	0.3%	

Table 14: Parameter of the body tissue simulating liquid

Note: The dielectric properties have been measured using the contact probe method at 22°C.

7 Detailed Test Results

7.1 Conducted power measurements

For the measurements the Rohde & Schwarz Radio Communication Tester CMU 200 and CMW500 were used.

The output power was measured using an integrated RF connector and attached RF cable.

The conducted output power was also checked before and after each SAR measurement. The resulting power values were within a 0.2 dB tolerance of the values shown below.

Note: CMU200 measures GSM peak and average output power for active timeslots.

For SAR the time based average power is relevant. The difference in-between depends on the duty cycle of the TDMA signal:

No. of timeslots	1	2	3	4
Duty Cycle	1 : 8	1 : 4	1 : 2.66	1 : 2
time based avg. power compared to slotted avg. power	- 9 dB	- 6 dB	- 4.25 dB	- 3 dB

The signalling modes differ as follows :

mode	coding scheme	modulation
GPRS	CS1 to CS4	GMSK
EGPRS (EDGE)	MCS1 to MCS4	GMSK
EGPRS (EDGE)	MCS5 to MCS9	8PSK

Apart from modulation change (GMSK/8PSK) coding schemes differ in code rate without influence on the RF signal. Therefore one coding scheme per mode was selected for conducted power measurements.

7.1.1 Conducted power measurements GSM 850 MHz

Channel / frequency	modulation	timeslots	slotted avg. power	time based avg. Power (calculated)
128 / 824.2 MHz	GMSK	1	32.8 dBm	23.8 dBm
190 / 836.6 MHz	GMSK	1	32.9 dBm	23.9 dBm
251 / 848.0 MHz	GMSK	1	32.6 dBm	23.6 dBm
128 / 824.2 MHz	GMSK	2	30.1 dBm	24.1 dBm
190 / 836.6 MHz	GMSK	2	30.0 dBm	24.0 dBm
251 / 848.0 MHz	GMSK	2	29.7 dBm	23.7 dBm
128 / 824.2 MHz	GMSK	3	28.2 dBm	23.95 dBm
190 / 836.6 MHz	GMSK	3	28.0 dBm	23.75 dBm
251 / 848.0 MHz	GMSK	3	27.8 dBm	23.55 dBm
128 / 824.2 MHz	GMSK	4	26.8 dBm	23.8 dBm
190 / 836.6 MHz	GMSK	4	27.0 dBm	24.0 dBm
251 / 848.0 MHz	GMSK	4	26.6 dBm	23.6 dBm
128 / 824.2 MHz	8PSK	1	27.2 dBm	18.2 dBm
190 / 836.6 MHz	8PSK	1	27.2 dBm	18.2 dBm
251 / 848.0 MHz	8PSK	1	27.0 dBm	18.0 dBm
128 / 824.2 MHz	8PSK	2	24.2 dBm	18.2 dBm
190 / 836.6 MHz	8PSK	2	24.2 dBm	18.2 dBm
251 / 848.0 MHz	8PSK	2	24.0 dBm	18.0 dBm
128 / 824.2 MHz	8PSK	3	22.4 dBm	18.15 dBm
190 / 836.6 MHz	8PSK	3	22.4 dBm	18.15 dBm
251 / 848.0 MHz	8PSK	3	22.1 dBm	17.85 dBm
128 / 824.2 MHz	8PSK	4	21.4 dBm	18.4 dBm
190 / 836.6 MHz	8PSK	4	21.2 dBm	18.2 dBm
251 / 848.0 MHz	8PSK	4	21.1 dBm	18.1 dBm

Table 15: Test results conducted power measurement GSM 850 MHz

7.1.2 Conducted power measurements GSM 1900 MHz

Channel / frequency	modulation	timeslots	slotted avg. power	time based avg. Power (calculated)
512 / 1850.2 MHz	GMSK	1	29.7 dBm	20.7 dBm
661 / 1880.0 MHz	GMSK	1	29.8 dBm	20.8 dBm
810 / 1909.8 MHz	GMSK	1	29.7 dBm	20.7 dBm
512 / 1850.2 MHz	GMSK	2	26.3 dBm	20.3 dBm
661 / 1880.0 MHz	GMSK	2	26.6 dBm	20.6 dBm
810 / 1909.8 MHz	GMSK	2	26.6 dBm	20.6 dBm
512 / 1850.2 MHz	GMSK	3	24.2 dBm	19.95 dBm
661 / 1880.0 MHz	GMSK	3	24.2 dBm	19.95 dBm
810 / 1909.8 MHz	GMSK	3	24.7 dBm	20.45 dBm
512 / 1850.2 MHz	GMSK	4	23.1 dBm	20.1 dBm
661 / 1880.0 MHz	GMSK	4	23.1 dBm	20.1 dBm
810 / 1909.8 MHz	GMSK	4	23.7 dBm	20.7 dBm
512 / 1850.2 MHz	8PSK	1	22.4 dBm	13.4 dBm
661 / 1880.0 MHz	8PSK	1	22.7 dBm	13.7 dBm
810 / 1909.8 MHz	8PSK	1	22.8 dBm	13.8 dBm
512 / 1850.2 MHz	8PSK	2	22.5 dBm	16.5 dBm
661 / 1880.0 MHz	8PSK	2	22.7 dBm	16.7 dBm
810 / 1909.8 MHz	8PSK	2	22.7 dBm	16.7 dBm
512 / 1850.2 MHz	8PSK	3	20.6 dBm	16.35 dBm
661 / 1880.0 MHz	8PSK	3	20.8 dBm	16.55 dBm
810 / 1909.8 MHz	8PSK	3	21.1 dBm	16.85 dBm
512 / 1850.2 MHz	8PSK	4	19.4 dBm	16.4 dBm
661 / 1880.0 MHz	8PSK	4	19.6 dBm	16.6 dBm
810 / 1909.8 MHz	8PSK	4	19.7 dBm	16.7 dBm

Table 16: Test results conducted power measurement GSM 1900 MHz

7.1.3 Justification of SAR measurements in GSM mode

SAR measurements were performed in the configuration with highest calculated time based averaged output power.

7.1.4 Conducted power measurements WCDMA FDD V (850 MHz)

mode	Max. RMS output power 850 MHz (FDD V) / dBm		
	4132 / 826.4 MHz	Channel / frequency 4182 / 836.6 MHz	4233 / 846.6 MHz
RMC 12.2 kbit/s	23.5	23.7	23.7
RMC 64 kbit/s	23.5	23.6	23.7
RMC 144 kbit/s	23.4	23.7	23.6
RMC 384 kbit/s	23.4	23.6	23.7
AMR 4.75 kbit/s	23.5	23.7	23.6
AMR 5.15 kbit/s	23.4	23.7	23.7
AMR 5.9 kbit/s	23.5	23.7	23.7
AMR 6.7 kbit/s	23.5	23.7	23.6
AMR 7.4 kbit/s	23.4	23.7	23.7
AMR 7.95 kbit/s	23.4	23.6	23.6
AMR 10.2 kbit/s	23.5	23.6	23.7
AMR 12.2 kbit/s	23.5	23.6	23.7
HSDPA Sub test 1	23.5	23.4	23.5
HSDPA Sub test 2	22.0	22.0	22.1
HSDPA Sub test 3	20.7	20.7	20.9
HSDPA Sub test 4	20.8	20.6	20.6
HSUPA Sub test 1	22.8	22.7	22.7
HSUPA Sub test 2	20.6	20.5	20.5
HSUPA Sub test 3	21.7	21.5	21.6
HSUPA Sub test 4	20.6	20.5	20.4
HSUPA Sub test 5	22.8	22.7	22.7

Table 17: Test results conducted power measurement UMTS FDD V 850MHz

Remark: None of the HSDPA/HSUPA settings leads to conducted power values exceeding the conducted power in RMC mode by more than 0.25 dB.

Therefore no additional SAR measurements were performed in HSDPA/HSUPA mode.

7.1.5 Test-set-up information for WCDMA / HSPDA / HSUPA

a) WCDMA RMC

In RMC (reference measurement channel) mode the conducted power at 4 different bit rates was measured. They correspond with the used spreading factors as follows:

Bit rate	12.2 kbit/s	64 kbit/s	144 kbit/s	384 kbit/s
Spreading factor (SF)	64	16	8	4

In RMC mode only DPCCH and DPDCH are active. As bit rate changes do not influence the relative power of any code channel the measured RMS output power remains on the same level which is set to maximum by TPC (Transmit power control) pattern type 'All 1'.

b) HSDPA

HSDPA adds the HS-DPCCH in uplink as a control channel for high speed data transfer in downlink. In HSDPA mode 4 sub-tests are defined by 3GPP 34.121 according to the following table:

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(1)}$	CM(dB)⁽²⁾
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 ⁽³⁾	15/15 ⁽³⁾	64	12/15 ⁽³⁾	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

Note 1: $\Delta_{ACK}, \Delta_{NACK}, \Delta_{CQI} = 8 \iff A_{hs} = \beta_{hs}/\beta_c = 30/15 \iff \beta_{hs} = 30/15 * \beta_c$

Note 2 : CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$

Note 3 : For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$

Table 18: Sub-tests for UMTS Release 5 HSDPA

The β_c and β_d gain factors for DPCCH and DPDCH were set according to the values in the above table, β_{hs} for HS-DPCCH is set automatically to the correct value when $\Delta_{ACK}, \Delta_{NACK}, \Delta_{CQI} = 8$. The variation of the β_c/β_d ratio causes a power reduction at sub-tests 2 - 4.

The measurements were performed with a Fixed Reference Channel (FRC) and H-Set 1 QPSK.

Parameter	Value
Nominal average inf. bit rate	534 kbit/s
Inter-TTI Distance	3 TTI's
Number of HARQ Processes	2 Processes
Information Bit Payload	3202 Bits
MAC-d PDU size	336 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	4800 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	9600 SMLs
Coding Rate	0.67
Number of Physical Channel Codes	5

Table 19: settings of required H-Set 1 QPSK acc. to 3GPP 34.121

c) HSUPA

In HSUPA mode additional code channels (E-DPCCH, E-DPDCHn) are added for data transfer in uplink at higher bit rates.

5 sub-tests are defined by 3GPP 34.121 according to the following table :

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(1)}$	β_{ec}	β_{ed}	β_{ec} (SF)	β_{ed} (code)	CM ⁽²⁾ (dB)	MPR (dB)	AG ⁽⁴⁾ Index	E-TFCI
1	11/15 ⁽³⁾	15/15 ⁽³⁾	64	11/15 ⁽³⁾	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}:47/15$ $\beta_{ed2}:47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 ⁽⁴⁾	15/15 ⁽⁴⁾	64	15/15 ⁽⁴⁾	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1 : $\Delta_{ACK}, \Delta_{NACK}, \Delta_{CQI} = 8 \iff A_{hs} = \beta_{hs}/\beta_c = 30/15 \iff \beta_{hs} = 30/15 * \beta_c$
 Note 2 : CM = 1 for $\beta_c/\beta_d = 12/15, \beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference
 Note 3 : For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$
 Note 4 : For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$
 Note 5 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g
 Note 6 : β_{ed} can not be set directly; it is set by Absolute Grant Value

Table 20: Subtests for UMTS Release 6 HSUPA

To achieve the settings above some additional procedures were defined by 3GPP 34.121. Those have been included in an application note for the CMU200 and were exactly followed :

- Test mode connection (BS signal tab) :
- RMC 12.2 kbit/s + HSPA 34.108 with loop mode 1
- HS-DSCH settings (BS signal tab):
- FRC with H-set 1 QPSK
- ACK-NACK repetition factor = 3
- CQI feedback cycle = 4ms
- CQI repetition factor = 2
- HSUPA-specific signalling settings (UE signal tab) :
- E-TFCI table index = 0
- E-DCH minimum set E-TFCI = 9
- Puncturing limit non-max = 0.84
- max. number of channelisation codes = 2x SF4
- Initial Serving Grant Value = Off
- HSDPA and HSUPA Gain factors (UE signal tab)

Sub-test	β_c	β_d	$\Delta_{ACK}, \Delta_{NACK}, \Delta_{CQI}$	$\Delta E-DPCCH$)*
1	10	15	8	6
2	6	15	8	8
3	15	9	8	8
4	2	15	8	5
5	14	15	8	7

)* : β_{ec} and β_{ed} ratios (relative to β_c and β_d) are set by $\Delta E-DPCCH$

- HSUPA Reference E-TFCIs (UE signal tab > HSUPA gain factors) :

Sub-test	1, 2, 4, 5				
Number of E-TFCIs	5				
Reference E-TFCI	11	67	71	75	81
Reference E-TFCI power offset	4	18	23	26	27

Sub-test	3	
Number of E-TFCIs	2	
Reference E-TFCI	11	92
Reference E-TFCI power offset	4	18

- HSUPA-specific generator parameters (BS Signal tab > HSUPA > E-AGCH > AG Pattern)

Sub-test	Absolute Grant Value (AG Index)
1	20
2	12
3	15
4	17
5	21

- Power Level settings (BS Signal tab > Node B-settings):

- Level reference : Output Channel Power (Ior)
- Output Channel Power (Ior) : -86 dBm

- Downlink Physical Channel Settings (BS signal tab)

- P-CPICH : -10 dB
- S-CPICH : Off
- P-SCH : -15 dB
- S-SCH : -15 dB
- P-CCPCH : -12 dB
- S-CCPCH : -12 dB
- PICH : -15 dB
- AICH : -12 dB
- DPDCH : -10 dB
- HS-SCCH : -8 dB
- HS-PDSCH : -3 dB
- E-AGCH : -20 dB
- E-RGCH/E-HICH - 20 dB
- E-RGCH Active : Off

The settings above were stored once for each sub-test and recalled before the measurement.

HSUPA test procedure :

To reach maximum output power in HSUPA mode the following procedures were followed:

3 different TPC patterns were defined :

Set 1 : Closed loop with target power 10 dBm

Set 2 : Single Pattern+Alternating with binary pattern '11111' for 1 dB steps 'up'

Set 3 : Single Pattern+Alternating with binary pattern '00000' for 1 dB steps 'down'

After recalling a certain HSUPA sub-test the HSUPA E-AGCH graph with E-TFCI event counter is displayed. After starting with the closed loop command the power is increased in 1 dB steps by activating pattern set 2 until the UE decreases the transmitted E-TFCI.

At this point set 3 is activated once to reduce the output power to the value at which the original E-TFCI, which is required for the sub-test, appears again.

For conducted power measurements the same steps are repeated in the power menu to read out the corresponding maximum RMS output power with the target E-TFCI.

For SAR measurements it is useful to switch to Code Domain Power vs. Time display.

Here the CMU200 shows relative power values (max. and min.) of each code channel which should roughly correspond to the numerators of the gain factors e.g. :

Sub-test	β_c	β_d	β_{hs}	β_{ec}	β_{ed}
5	15	15	30	24	134

By this way a surveillance of signalling conditions is possible to make sure that HSUPA code channels are active during the complete SAR measurement.

7.1.6 Conducted power measurements WLAN 2.4 GHz

802.11b		maximum average conducted output power [dBm]			
Band	Ch	1Mbps	2Mbps	5.5Mbps	11Mbps
2450MHz	1	16.4	16.2	15.7	15.7
	6	16.2	16.0	15.5	15.6
	11	15.5	15.3	15.0	15.0

Table 21: Test results conducted power measurement 802.11b

802.11g		maximum average conducted output power [dBm]							
Band	Ch	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
2450MHz	1	12.6	12.5	12.5	12.6	12.5	12.6	12.5	12.5
	6	14.1	13.7	13.7	13.6	13.6	13.5	13.4	13.4
	11	11.9	11.9	11.8	11.9	11.7	11.8	11.8	11.7

Table 22: Test results conducted power measurement 802.11g

802.11n HT-20		maximum average conducted output power [dBm]							
Band	Ch	MCS-0 6.5Mbps	MCS-1 13Mbps	MCS-2 19.5Mbps	MCS-3 26Mbps	MCS-4 39Mbps	MCS-5 52Mbps	MCS-6 58.5Mbps	MCS-7 65Mbps
2450MHz	12.4	12.0	12.0	11.8	11.8	11.9	11.8	11.7	12.4
	13.8	13.6	13.5	13.5	13.4	13.3	13.3	13.3	13.8
	10.8	10.9	10.8	10.6	10.6	10.7	10.7	10.6	10.8

Table 23: Test results conducted power measurement 802.11n HT-20

7.1.7 Conducted power measurements WLAN 5 GHz

802.11a		maximum average conducted output power [dBm]							
Band	Ch	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
5200	36	10.4	10.3	10.3	10.3	10.2	10.3	10.3	10.2
	40	10.6	10.4	10.5	10.5	10.5	10.4	10.5	10.5
	44	10.8	10.7	10.6	10.7	10.6	10.7	10.6	10.5
	48	11.0	10.9	10.9	10.9	10.9	10.9	10.9	10.9
5300	52	9.6	9.4	9.5	9.5	9.5	9.5	9.5	9.5
	56	9.8	9.7	9.7	9.7	9.7	9.7	9.7	9.7
	60	9.9	9.8	9.7	9.8	9.8	9.8	9.8	9.8
	64	10.0	9.9	9.9	9.9	9.9	9.9	9.9	9.7
5600	100	9.3	9.1	9.2	9.2	9.2	9.2	9.2	9.2
	104	9.1	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	108	8.7	8.6	8.6	8.5	8.6	8.6	8.6	8.6
	112	8.4	8.3	8.3	8.3	8.3	8.2	8.3	8.3
	116	8.3	8.2	8.2	8.2	8.2	8.2	8.2	8.2
	120	7.5	7.4	7.4	7.4	7.4	7.4	7.4	7.4
	124	7.0	6.9	6.9	6.9	6.9	6.9	6.9	6.9
	128	6.5	6.4	6.4	6.4	6.4	6.4	6.4	6.4
	132	10.7	10.6	10.6	10.6	10.6	10.6	10.6	10.6
	136	10.1	10.0	9.9	10.0	9.9	10.0	9.9	10.0
5800	140	9.6	9.5	9.5	9.5	9.5	9.4	9.3	9.2
	149	8.2	8.1	8.0	8.1	8.1	8.1	8.1	8.1
	153	9.4	9.3	9.3	9.3	9.3	9.3	9.3	9.2
	157	8.8	8.7	8.7	8.7	8.7	8.7	8.7	8.7
	161	8.2	8.1	8.1	8.1	8.1	8.0	8.1	8.1
	165	7.9	7.7	7.8	7.8	7.8	7.8	7.8	7.8

Table 24: Test results conducted power measurement 802.11a

802.11n HT-20 / 802.11ac VHT-20										
maximum average conducted output power [dBm]										
Band [MHz]	Ch	MCS-0 6.5Mbps	MCS-1 13Mbps	MCS-2 19.5Mbps	MCS-3 26Mbps	MCS-4 39Mbps	MCS-5 52Mbps	MCS-6 58.5Mbps	MCS-7 65Mbps	MCS-8 78Mbps
5200	36	10.7	10.5	10.6	10.6	10.6	10.6	10.6	10.5	10.6
	40	10.8	10.7	10.6	10.7	10.6	10.7	10.7	10.7	10.7
	44	10.9	10.7	10.8	10.7	10.8	10.7	10.7	10.7	10.7
	48	11.0	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9
5300	52	9.5	9.4	9.4	9.4	9.3	9.4	9.3	9.2	9.3
	56	9.7	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
	60	9.7	9.6	9.6	9.6	9.6	9.5	9.6	9.6	9.5
	64	9.8	9.7	9.7	9.6	9.7	9.6	9.5	9.5	9.5
5600	100	9.0	8.9	8.9	8.9	8.8	8.9	8.9	8.9	8.9
	104	8.7	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
	108	8.3	8.2	8.2	8.2	8.2	8.2	8.1	8.2	8.2
	112	7.9	7.8	7.7	7.8	7.8	7.8	7.8	7.8	7.8
	116	7.5	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.3
	120	7.0	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.8
	124	6.5	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
	128	6.0	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
	132	10.0	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
	136	9.3	9.1	9.2	9.1	9.2	9.1	9.2	9.2	9.2
5800	140	8.7	8.6	8.5	8.4	8.6	8.5	8.4	8.3	8.3
	149	7.3	7.2	7.2	7.2	7.2	7.1	7.2	7.2	7.1
	153	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.0	8.0
	157	7.6	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
	161	7.0	6.9	6.8	6.9	6.9	6.9	6.9	6.9	6.8
	165	6.3	6.2	6.2	6.2	6.1	6.2	6.2	6.2	6.2

Table 25: Test results conducted power measurement 802.11n HT-20 / 802.11ac VHT-20

7.2 SAR test results

7.2.1 Results overview

measured / extrapolated SAR numbers - Head - GSM 850 MHz											
Ch.	Freq. (MHz)	time slots	Position	cond. P _{max} (dBm)		SAR _{1g} results(W/kg)		SAR _{10g} (W/kg)		power drift (dB)	liquid (°C)
				declared**	measured	meas.	extrap.	meas.	extrap.		
190	836.6	1	left cheek	34.0	32.9	0.331	0.426	0.250	0.322	0.000	22.2
190	836.6	1	left tilted 15°	34.0	32.9	0.215	0.277	0.162	0.209	0.000	22.2
128	824.2	1	right cheek	34.0	32.8	0.284	0.374	0.221	0.291	0.010	22.2
190	836.6	1	right cheek	34.0	32.9	0.374	0.482	0.287	0.370	0.080	22.2
251	848.8	1	right cheek	34.0	32.6	0.420	0.580	0.327	0.451	0.030	22.2
190	836.6	1	right tilted 15°	34.0	32.9	0.239	0.308	0.182	0.234	-0.050	22.2

Table 26: Test results head SAR GSM 850MHz (see max. SAR plot in GSM 850MHzAnnex B.1: GSM 850MHz page 64)

measured / extrapolated SAR numbers - body worn - GSM 850 MHz												
Ch.	Freq. (MHz)	time slots	Position	cond. P _{max} (dBm)		SAR _{1g} results(W/kg)		SAR _{10g} (W/kg)		power drift (dB)	liquid (°C)	dist. (mm)
				declared**	measured	meas.	extrap.	meas.	extrap.			
190	836.6	2	front	31.0	30.0	0.516	0.650	0.308	0.388	-0.030	22.2	0
128	824.2	2	rear	31.0	30.1	0.641	0.789	0.479	0.589	-0.010	22.2	0
190	836.6	2	rear	31.0	30.0	0.689	0.867	0.514	0.647	-0.020	22.2	0
251	848.8	2	rear	31.0	29.7	0.698	0.942	0.522	0.704	-0.020	22.2	0
251	848.8	2	rear	31.0	29.7	0.689	0.929	0.517	0.697	-0.020	22.2	0

Table 27: Test results body worn SAR GSM 850 MHz (see max. SAR plot in see max. SAR plot in GSM 850MHzAnnex B.1: GSM 850MHz)

* - repeated at the highest SAR measurement according to the FCC KDB 865664

** - maximum possible output power declared by manufacturer

measured / extrapolated SAR numbers - Head - GSM 1900 MHz											
Ch.	Freq. (MHz)	time slots	Position	cond. P _{max} (dBm)		SAR _{1g} results(W/kg)		SAR _{10g} (W/kg)		power drift (dB)	liquid (°C)
				declared**	measured	meas.	extrap.	meas.	extrap.		
512	1850.2	1	left cheek	31.0	29.7	0.405	0.546	0.246	0.332	0.030	20.1
661	1880.0	1	left cheek	31.0	29.8	0.321	0.423	0.195	0.257	0.040	20.1
810	1909.8	1	left cheek	31.0	29.7	0.236	0.318	0.141	0.190	0.010	20.1
661	1880.0	1	left tilted 15°	31.0	29.8	0.117	0.154	0.071	0.094	0.020	20.1
661	1880.0	1	right cheek	31.0	29.8	0.240	0.316	0.158	0.208	0.010	20.1
661	1880.0	1	right tilted 15°	31.0	29.8	0.116	0.153	0.065	0.085	0.070	20.1

Table 28: Test results head SAR GSM 1900MHz (see max. SAR plot Annex B.2: GSM 1900MHz page 66)

measured / extrapolated SAR numbers - body worn - GSM 1900 MHz												
Ch.	Freq. (MHz)	time slots	Position	cond. P _{max} (dBm)		SAR _{1g} results(W/kg)		SAR _{10g} (W/kg)		power drift (dB)	liquid (°C)	dist. (mm)
				declared**	measured	meas.	extrap.	meas.	extrap.			
512	1850.2	1	front	31.0	29.7	0.911	1.229	0.464	0.626	0.030	20.1	0
661	1880.0	1	front	31.0	29.8	0.685	0.903	0.345	0.455	0.000	20.1	0
810	1909.8	1	front	31.0	29.7	0.504	0.680	0.258	0.348	-0.070	20.1	0
661	1880.0	1	rear	31.0	29.8	0.383	0.505	0.239	0.315	0.030	20.1	0
512	1850.2	1	front	31.0	29.8	0.901	1.188	0.454	0.598	0.010	20.1	0

Table 29: Test results body worn SAR GSM 1900 MHz (see max. SAR plot Annex B.2: GSM 1900MHz)

* - repeated at the highest SAR measurement according to the FCC KDB 865664

** - maximum possible output power declared by manufacturer

measured / extrapolated SAR numbers - Head - UMTS FDD V 850 MHz											
Ch.	Freq. (MHz)	test cond.	Position	cond. P _{max} (dBm)		SAR _{1g} results(W/kg)		SAR _{10g} (W/kg)		power drift (dB)	liquid (°C)
				declared**	measured	meas.	extrap.	meas.	extrap.		
4182	836.4	RMC	left cheek	24.0	23.7	0.308	0.330	0.239	0.256	0.030	22.2
4182	836.4	RMC	left tilted 15°	24.0	23.7	0.208	0.223	0.157	0.168	0.010	22.2
4132	826.4	RMC	right cheek	24.0	23.5	0.278	0.312	0.213	0.239	0.070	22.2
4182	836.4	RMC	right cheek	24.0	23.7	0.333	0.357	0.258	0.276	0.080	22.2
4233	846.6	RMC	right cheek	24.0	23.7	0.402	0.431	0.308	0.330	0.020	22.2
4182	836.4	RMC	right tilted 15°	24.0	23.7	0.204	0.219	0.154	0.165	0.010	22.2

Table 30: Test results head SAR UMTS FDD V 850 MHz (see max. SAR plot Annex B.3: UMTS FDD V page 68)

measured / extrapolated SAR numbers - body worn - UMTS FDD V 850 MHz												
Ch.	Freq. (MHz)	test cond.	Position	cond. P _{max} (dBm)		SAR _{1g} results(W/kg)		SAR _{10g} (W/kg)		power drift (dB)	liquid (°C)	dist. (mm)
				declared**	measured	meas.	extrap.	meas.	extrap.			
4182	836.4	RMC	front	24.0	23.7	0.721	0.773	0.428	0.459	-0.050	22.2	0
4132	826.4	RMC	rear	24.0	23.5	0.779	0.874	0.581	0.652	-0.050	22.2	0
4182	836.4	RMC	rear	24.0	23.7	0.830	0.889	0.617	0.661	-0.030	22.2	0
4233	846.6	RMC	rear	24.0	23.7	0.820	0.879	0.610	0.654	-0.120	22.2	0
4182	836.4	RMC	rear*	24.0	23.7	0.808	0.866	0.599	0.642	0.000	22.2	0

Table 31: Test results body worn SAR UMTS FDD V 850 MHz (see max. SAR plot Annex B.3: UMTS FDD V)

* - repeated at the highest SAR measurement according to the FCC KDB 865664

** - maximum possible output power declared by manufacturer

measured / extrapolated SAR numbers - Head - WLAN 2450 MHz											
Ch.	Freq. (MHz)	test cond.	Position	cond. P _{max} (dBm)		SAR _{1g} results(W/kg)		SAR _{10g} (W/kg)		power drift (dB)	liquid (°C)
				declared**	measured	meas.	extrap.	meas.	extrap.		
1	2412	1Mbit/s	left cheek	18.4	16.4	0.208	0.330	0.102	0.162	0.010	22.2
1	2412	1Mbit/s	left tilted 15°	18.4	16.4	0.160	0.254	0.080	0.127	-0.030	22.2
1	2412	1Mbit/s	right cheek	18.4	16.4	0.225	0.357	0.116	0.184	-0.070	22.2
6	2437	1Mbit/s	right cheek	18.4	16.2	0.201	0.334	0.102	0.169	-0.090	22.2
11	2462	1Mbit/s	right cheek	18.4	15.5	0.233	0.454	0.114	0.222	0.160	22.2
1	2412	1Mbit/s	right tilted 15°	18.4	16.4	0.191	0.303	0.009	0.015	0.040	22.2

Table 32: Test results head SAR WLAN 2450 MHz (see max. SAR plot Annex B.4: WLAN 2450MHz page 70)

measured / extrapolated SAR numbers - body worn - WLAN 2450 MHz												
Ch.	Freq. (MHz)	test cond.	Position	cond. P _{max} (dBm)		SAR _{1g} results(W/kg)		SAR _{10g} (W/kg)		power drift (dB)	liquid (°C)	dist. (mm)
				declared**	measured	meas.	extrap.	meas.	extrap.			
1	2412	1Mbit/s	front	18.4	16.4	0.368	0.583	0.162	0.257	0.000	22.3	0
6	2437	1Mbit/s	front	18.4	16.2	0.324	0.538	0.142	0.236	0.040	22.3	0
11	2462	1Mbit/s	front	18.4	15.5	0.289	0.564	0.126	0.246	0.020	22.3	0
1	2412	1Mbit/s	rear	18.4	16.4	0.312	0.494	0.162	0.257	-0.020	22.3	0

Table 33: Test results body worn SAR WLAN 2450 MHz (see max. SAR plot Annex B.4: WLAN 2450MHz)

** - maximum possible output power declared by manufacturer

measured / extrapolated SAR numbers - Head - WLAN 5 GHz											
Ch.	Freq. (MHz)	test cond.	Position	cond. P _{max} (dBm)		SAR _{1g} results(W/kg)		SAR _{10g} (W/kg)		power drift (dB)	liquid (°C)
				declared**	measured	meas.	extrap.	meas.	extrap.		
48	5240	6Mbit/s	left cheek	12.0	11.0	0.186	0.234	0.067	0.084	-0.03	21.5
64	5320	6Mbit/s	left cheek	12.0	10.0	0.118	0.187	0.042	0.066	-0.18	21.5
132	5660	6Mbit/s	left cheek	12.0	10.7	0.058	0.078	0.018	0.025	0.02	21.5
153	5765	6Mbit/s	left cheek	11.0	9.4	0.018	0.026	0.006	0.008	0.10	21.5
48	5240	6Mbit/s	left tilted 15°	12.0	11.0	0.161	0.203	0.055	0.069	0.13	21.5
64	5320	6Mbit/s	left tilted 15°	12.0	10.0	0.087	0.137	0.031	0.050	-0.12	21.5
132	5660	6Mbit/s	left tilted 15°	12.0	10.7	0.043	0.058	0.015	0.020	0.08	21.5
153	5765	6Mbit/s	left tilted 15°	11.0	9.4	0.011	0.016	0.003	0.005	0.02	21.5
48	5240	6Mbit/s	right cheek	12.0	11.0	0.192	0.242	0.063	0.079	0.13	21.5
64	5320	6Mbit/s	right cheek	12.0	10.0	0.190	0.301	0.062	0.098	-0.09	21.5
132	5660	6Mbit/s	right cheek	12.0	10.7	0.065	0.088	0.022	0.030	0.04	21.5
153	5765	6Mbit/s	right cheek	11.0	9.4	0.019	0.028	0.006	0.009	0.04	21.5
48	5240	6Mbit/s	right tilted 15°	12.0	11.0	0.171	0.215	0.052	0.066	0.02	21.5
64	5320	6Mbit/s	right tilted 15°	12.0	10.0	0.102	0.162	0.036	0.057	-0.10	21.5
132	5660	6Mbit/s	right tilted 15°	12.0	10.7	0.063	0.085	0.020	0.027	-0.03	21.5
153	5765	6Mbit/s	right tilted 15°	11.0	9.4	0.015	0.021	0.005	0.007	0.05	21.5

Table 34: Test results head SAR WLAN 5 GHz (see max. SAR plot Annex B.5: WLAN 5GHz page 72)

measured / extrapolated SAR numbers - body worn - WLAN 5 GHz												
Ch.	Freq. (MHz)	test cond.	Position	cond. P _{max} (dBm)		SAR _{1g} results(W/kg)		SAR _{10g} (W/kg)		power drift (dB)	liquid (°C)	dist. (mm)
				declared**	measured	meas.	extrap.	meas.	extrap.			
48	5240	6Mbit/s	front	12.0	11.0	0.249	0.313	0.084	0.105	-0.10	21.6	0
64	5320	6Mbit/s	front	12.0	10.0	0.223	0.353	0.082	0.130	0.13	21.6	0
124	5620	6Mbit/s	front	12.0	10.7	0.084	0.114	0.029	0.039	0.12	21.6	0
149	5745	6Mbit/s	front	11.0	9.4	0.027	0.038	0.009	0.013	0.11	21.6	0
48	5240	6Mbit/s	rear	12.0	11.0	0.085	0.107	0.026	0.032	-0.02	21.6	0
64	5320	6Mbit/s	rear	12.0	10.0	0.093	0.148	0.028	0.044	-0.14	21.6	0
124	5620	6Mbit/s	rear	12.0	10.7	0.042	0.057	0.015	0.020	-0.16	21.6	0
149	5745	6Mbit/s	rear	11.0	9.4	0.021	0.030	0.008	0.011	0.15	21.6	0

Table 35: Test results body worn SAR WLAN 5 GHz (see max. SAR plot Annex B.5: WLAN 5GHz)

** - maximum possible output power declared by manufacturer

7.2.2 General description of test procedures

- The DUT is tested using CMU 200 communication tester as controller unit to set test channels and maximum output power to the DUT, as well as for measuring the conducted peak power.
- Test positions as described in the tables above are in accordance with the specified test standard.
- Tests in body position were performed in that configuration, which generates the highest time based averaged output power (see conducted power results).
- Tests in head position with GSM were performed in voice mode with 1 timeslot unless GPRS/EGPRS/DTM function allows parallel voice and data traffic on 2 or more timeslots (see section 2.4 for details).
- UMTS was tested in RMC mode with 12.2 kbit/s and TPC bits set to 'all 1'.
- WLAN was tested in 802.11a/b mode with 1 MBit/s and 6 MBit/s. According to KDB 248227 the SAR testing for 802.11g/n is not required since the maximum power of 802.11g/n is less ¼ dB higher than maximum power of 802.11a/b.
- Required WLAN test channels were selected according to KDB 248227
- For body worn operation, this device has been tested and meets FCC RF exposure guidelines when used with a minimum of 0 mm from the body.
- According to IEEE 1528 the SAR test shall be performed at middle channel. Testing of top and bottom channel is optional.
- According to KDB 447498 D01 testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:
 - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
 - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
 - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
- IEEE 1528-2003 require the middle channel to be tested first. This generally applies to wireless devices that are designed to operate in technologies with tight tolerances for maximum output power variations across channels in the band. When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.

7.2.3 Multiple Transmitter Information

The following tables list information which is relevant for the decision if a simultaneous transmit evaluation is necessary according to FCC KDB 447498D01 General RF Exposure Guidance v05.

reported SAR WWAN and WLAN 2.4GHz , Σ SAR evaluation, SPLSRi						
Frequency band	Position	SAR _{max} /W/kg		Σ SAR <1.6W/kg	distance R _i , mm	ratio ≤ 0.04
		WWAN	WLAN			
GSM 850	left cheek	0.426	0.330	0.756		
	left tilted 15°	0.277	0.254	0.531		
	right cheek	0.580	0.454	1.034		
	right tilted 15°	0.308	0.303	0.611		
	front	0.650	0.583	1.233		
	rear	0.942	0.494	1.436		
GSM 1900	left cheek	0.546	0.330	0.876		
	left tilted 15°	0.154	0.254	0.408		
	right cheek	0.316	0.454	0.771		
	right tilted 15°	0.153	0.303	0.456		
	front	1.229	0.583	1.812	100.1	0.02
	rear	0.505	0.494	0.999		
WCDMA FDD V	left cheek	0.330	0.330	0.660		
	left tilted 15°	0.223	0.254	0.476		
	right cheek	0.431	0.454	0.885		
	right tilted 15°	0.219	0.303	0.521		
	front	0.773	0.583	1.356		
	rear	0.889	0.494	1.384		

Table 36: SAR_{max} WWAN and **WLAN 2.4GHz**, Σ SAR evaluation, **SPLSRi**;

reported SAR WWAN and WLAN 5GHz , Σ SAR evaluation, SPLSR_i						
Frequency band	Position	SAR _{max} /W/kg		Σ SAR <1.6W/kg	distance R_i , mm	ratio ≤ 0.04
		WWAN	WLAN			
GSM 850	left cheek	0.426	0.234	0.661		
	left tilted 15°	0.277	0.137	0.414		
	right cheek	0.580	0.242	0.821		
	right tilted 15°	0.308	0.162	0.470		
	front	0.650	0.114	0.763		
	rear	0.942	0.042	0.984		
GSM 1900	left cheek	0.546	0.234	0.780		
	left tilted 15°	0.154	0.137	0.291		
	right cheek	0.316	0.242	0.558		
	right tilted 15°	0.153	0.162	0.315		
	front	1.229	0.114	1.343		
	rear	0.505	0.057	0.562		
WCDMA FDD V	left cheek	0.330	0.234	0.564		
	left tilted 15°	0.223	0.137	0.360		
	right cheek	0.431	0.242	0.672		
	right tilted 15°	0.219	0.162	0.380		
	front	0.773	0.114	0.886		
	rear	0.889	0.057	0.947		

Table 37: SAR_{max} WWAN and **WLAN 5GHz**, Σ SAR evaluation, **SPLSR_i****Conclusion:**

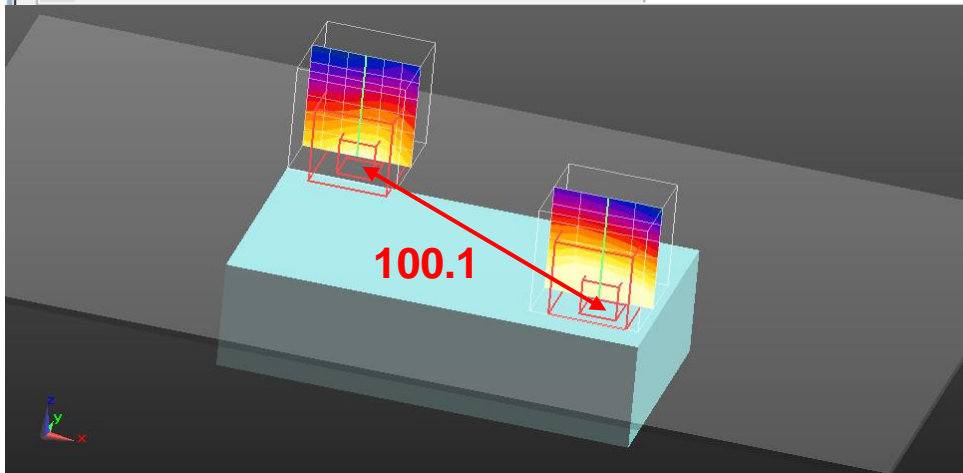
Σ SAR > 1.6 W/kg, but SAR-to-(peak-locations spacing) **ratio** (**SPLSR_i**) is less than **0.04** therefore simultaneous transmissions SAR measurement with the enlarged zoom scan measurement and volume scan post-processing procedures is **not** required.

7.2.4 SAR peak location separation

GSM1900 + WLAN2450 front body

Find distance of maxima

Maxima and position w.r.t. Grid Reference Point		associated 1g averages
Zoom Scan (R:\Projekte2014\1-9110-1-2\FCC GSM1900 body.da52:0/Front Low)		
Max. 1 at (4.65, -2.25, 0.45) cm		0.91 W/kg
Zoom Scan (R:\Projekte2014\1-9110-1-2\FCC WLAN2450 body (GSM-Sample).da52:0/Front Low)		
Max. 2 at (-3.80, 3.20, 0.40) cm		0.37 W/kg
Distances and Separation Ratios		
Max. 1 - Max. 2		Distance [cm]: 10.06 / Separation ratio [W/kg/cm]: 0.14



8 Test equipment and ancillaries used for tests

To simplify the identification of the test equipment and/or ancillaries which were used, the reporting of the relevant test cases only refer to the test item number as specified in the table below.

Equipment	Type	Manufacturer	Serial No.	Last Calibration	Frequency (months)
Dosimetric E-Field Probe	ET3DV6	Schmid & Partner Engineering AG	1554	May 08, 2014	12
Dosimetric E-Field Probe	ES3DV3	Schmid & Partner Engineering AG	3320	May 09, 2014	12
Dosimetric E-Field Probe	EX3DV4	Schmid & Partner Engineering AG	3944	August 19, 2014	12
835 MHz System Validation Dipole	D835V2	Schmid & Partner Engineering AG	4d153	June 06, 2013	24
1900 MHz System Validation Dipole	D1900V2	Schmid & Partner Engineering AG	5d009	May 15, 2013	24
2450 MHz System Validation Dipole	D2450V2	Schmid & Partner Engineering AG	710	August 11, 2014	24
5 GHz System Validation Dipole	D5GHzV2	Schmid & Partner Engineering AG	1055	August 19, 2013	24
Data acquisition electronics	DAE3V1	Schmid & Partner Engineering AG	413	May 22, 2014	12
Data acquisition electronics	DAE3V1	Schmid & Partner Engineering AG	477	May 14, 2014	12
Software	DASY52 52.8.7	Schmid & Partner Engineering AG	---	N/A	--
Triple Modular Flat Phantom V5.1	QD 000 P51 C	Schmid & Partner Engineering AG	1154	N/A	--
SAM Twin Phantom V5.0	QD 000 P40 C	Schmid & Partner Engineering AG	1813	N/A	--
Universal Radio Communication Tester	CMU 200	Rohde & Schwarz	106826	January 27, 2014	24
Network Analyser 300 kHz to 6 GHz	8753ES	Hewlett Packard)*	US39174436	January 28, 2014	24
Dielectric Probe Kit	85070C	Hewlett Packard	US99360146	N/A	12
Signal Generator	8671B	Hewlett Packard	2823A00656	January 22, 2014	24
Amplifier	25S1G4 (25 Watt)	Amplifier Reasearch	20452	N/A	--
Power Meter	NRP	Rohde & Schwarz	101367	January 21, 2014	24
Power Meter Sensor	NRP Z22	Rohde & Schwarz	100227	January 21, 2014	12
Power Meter Sensor	NRP Z22	Rohde & Schwarz	100234	January 21, 2014	12
Directional Coupler	778D	Hewlett Packard	19171	January 21, 2014	12

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

9 Observations

No observations exceeding those reported with the single test cases have been made.

Annex A: System performance check

Date/Time: 21.01.2015 11:52:55

SystemPerformanceCheck-D835 head 2015-01-21

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d153

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 835$ MHz; $\sigma = 0.903$ S/m; $\epsilon_r = 40.959$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(6.15, 6.15, 6.15); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: SAM front; Type: QD000P40CC; Serial: TP-1042
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

HSL900/d=10mm, Pin=1000 mW, dist=4.0mm/Area Scan (51x51x1): Interpolated

grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 10.2 W/kg

HSL900/d=10mm, Pin=1000 mW, dist=4.0mm/Zoom Scan (7x7x7)/Cube 0:

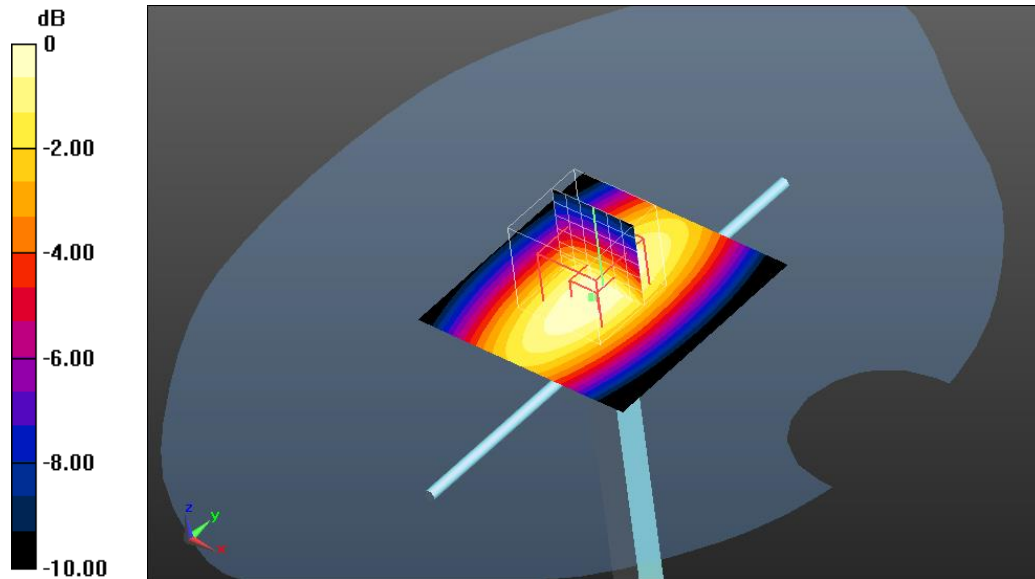
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 109.2 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 13.7 W/kg

SAR(1 g) = 9.55 W/kg; SAR(10 g) = 6.33 W/kg

Maximum value of SAR (measured) = 10.3 W/kg



0 dB = 10.3 W/kg = 10.13 dBW/kg

Additional information:

ambient temperature: 23.4°C; liquid temperature: 22.2°C

SystemPerformanceCheck-D835 body 2015-01-21

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d153

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 835$ MHz; $\sigma = 1.012$ S/m; $\epsilon_r = 54.499$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(6.14, 6.14, 6.14); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

MSL900/d=15mm, Pin=1000 mW, dist=4.0mm/Area Scan (51x51x1):

Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 10.7 W/kg

MSL900/d=15mm, Pin=1000 mW, dist=4.0mm/Zoom Scan (7x7x7)/Cube 0:

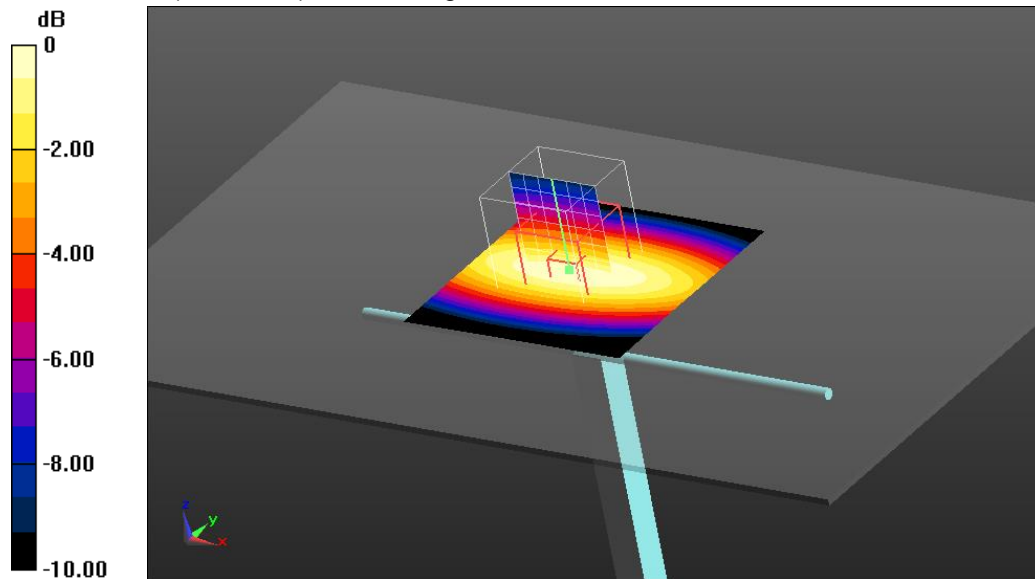
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 104.3 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 14.3 W/kg

SAR(1 g) = 9.99 W/kg; SAR(10 g) = 6.64 W/kg

Maximum value of SAR (measured) = 10.8 W/kg



0 dB = 10.8 W/kg = 10.33 dBW/kg

Additional information:

ambient temperature: 23.4°C; liquid temperature: 22.2°C

Date/Time: 19.01.2015 10:28:31

SystemPerformanceCheck-D1900 head 2015-01-19

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d009

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.407$ S/m; $\epsilon_r = 39.643$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS5

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(4.94, 4.94, 4.94); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: SAM front; Type: QD000P40CC; Serial: TP-1042
- DASYS52 52.8.7(1137); SEMCAD X 14.6.10(7164)

HSL1900/d=10mm, Pin=1000 mW, dist=4.0mm/Area Scan (51x51x1):

Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 56.5 W/kg

HSL1900/d=10mm, Pin=1000 mW, dist=4.0mm/Zoom Scan (7x7x7)/Cube 0:

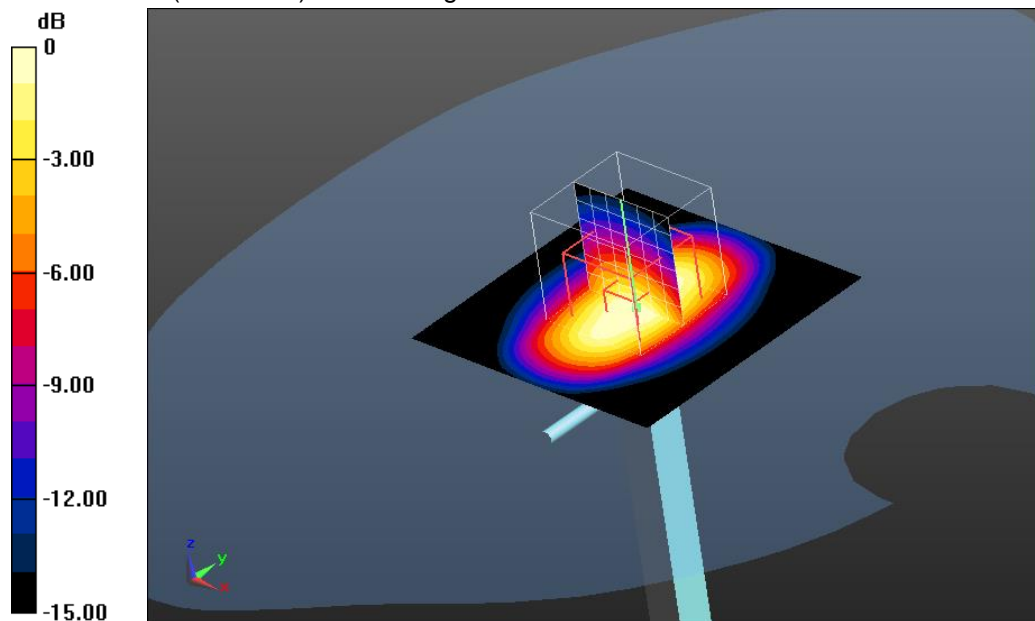
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 183.5 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 78.7 W/kg

SAR(1 g) = 41.4 W/kg; SAR(10 g) = 21.4 W/kg

Maximum value of SAR (measured) = 46.6 W/kg



0 dB = 46.6 W/kg = 16.68 dBW/kg

Additional information:

ambient temperature: 20.4°C; liquid temperature: 20.1°C

SystemPerformanceCheck-D1900 body 2015-01-19

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d009

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.506$ S/m; $\epsilon_r = 53.207$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(4.7, 4.7, 4.7); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

HSL1900/d=10mm, Pin=1000 mW, dist=4.0mm/Area Scan (51x51x1):

Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 52.9 W/kg

HSL1900/d=10mm, Pin=1000 mW, dist=4.0mm/Zoom Scan (7x7x7)/Cube 0:

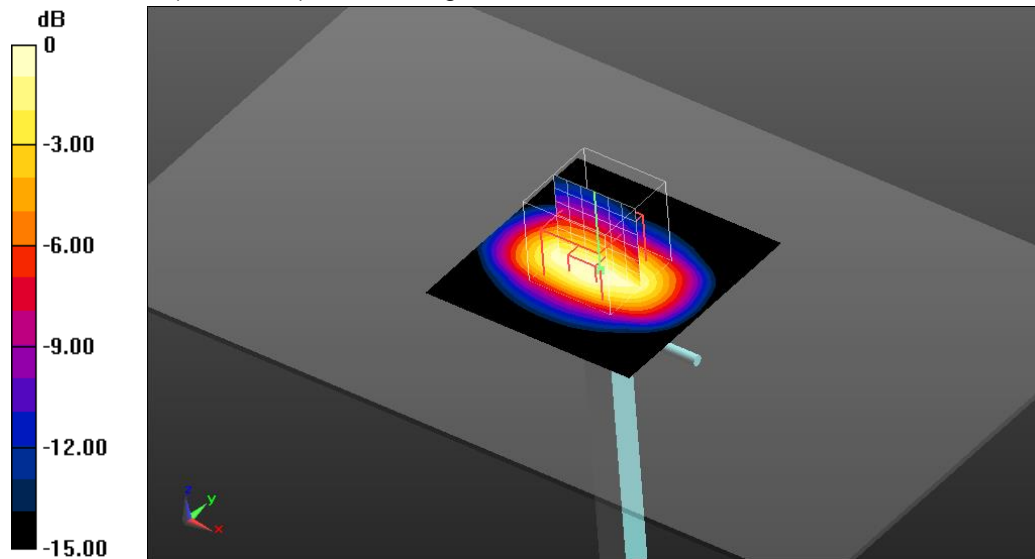
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 172.3 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 67.0 W/kg

SAR(1 g) = 37.8 W/kg; SAR(10 g) = 20 W/kg

Maximum value of SAR (measured) = 42.3 W/kg



0 dB = 42.3 W/kg = 16.26 dBW/kg

Additional information:

ambient temperature: 20.4°C; liquid temperature: 20.1°C

SystemPerformanceCheck-D2450 head 2015-01-22

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

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.757$ S/m; $\epsilon_r = 38.87$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS

DASY5 Configuration:

- Probe: ET3DV6 - SN1554; ConvF(4.25, 4.25, 4.25); Calibrated: 08.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.7, 32.7$
- Electronics: DAE3 Sn413; Calibrated: 22.05.2014
- Phantom: SAM; Type: SAM; Serial: 1043
- DASYS52 52.8.7(1137); SEMCAD X 14.6.10(7164)

HSL2450/d=10mm, Pin=1000 mW, dist=4.0mm/Area Scan (81x81x1):

Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 59.2 W/kg

HSL2450/d=10mm, Pin=1000 mW, dist=4.0mm/Zoom Scan (7x7x7)/Cube 0:

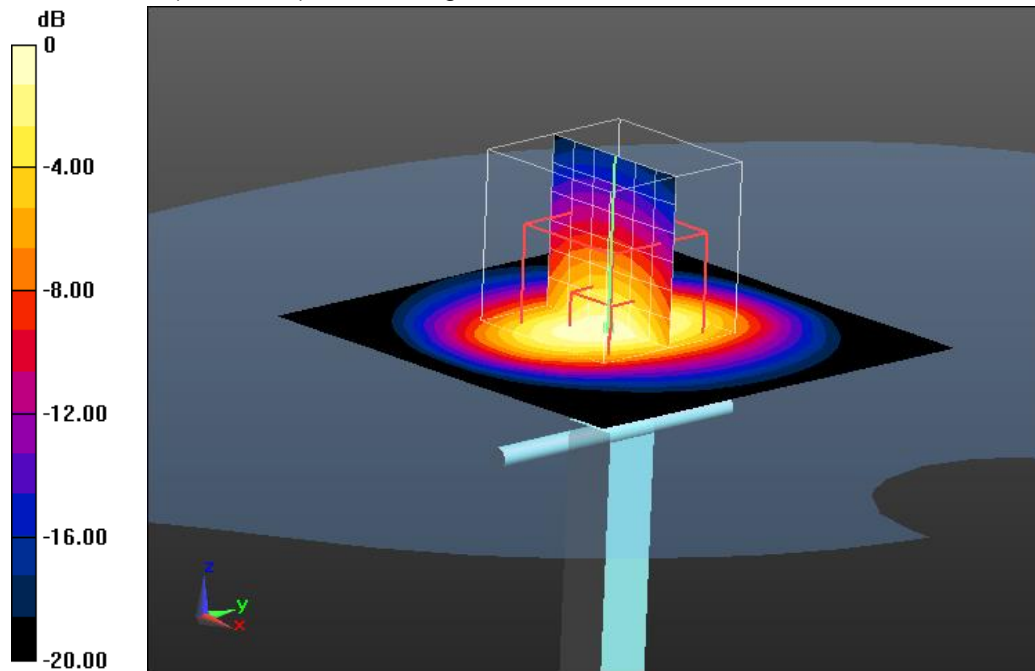
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 183.2 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 115 W/kg

SAR(1 g) = 53.5 W/kg; SAR(10 g) = 25 W/kg

Maximum value of SAR (measured) = 60.6 W/kg



0 dB = 60.6 W/kg = 17.82 dBW/kg

Additional information:

ambient temperature: 22.5°C; liquid temperature: 22.2°C

SystemPerformanceCheck-D2450 body 2015-01-22

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

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.003$ S/m; $\epsilon_r = 51.123$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(4.3, 4.3, 4.3); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASYS52 52.8.7(1137); SEMCAD X 14.6.10(7164)

MSL2450/d=10mm, Pin=1000 mW, dist=4.0mm/Area Scan (51x51x1):

Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 74.8 W/kg

MSL2450/d=10mm, Pin=1000 mW, dist=4.0mm/Zoom Scan (7x7x7)/Cube 0:

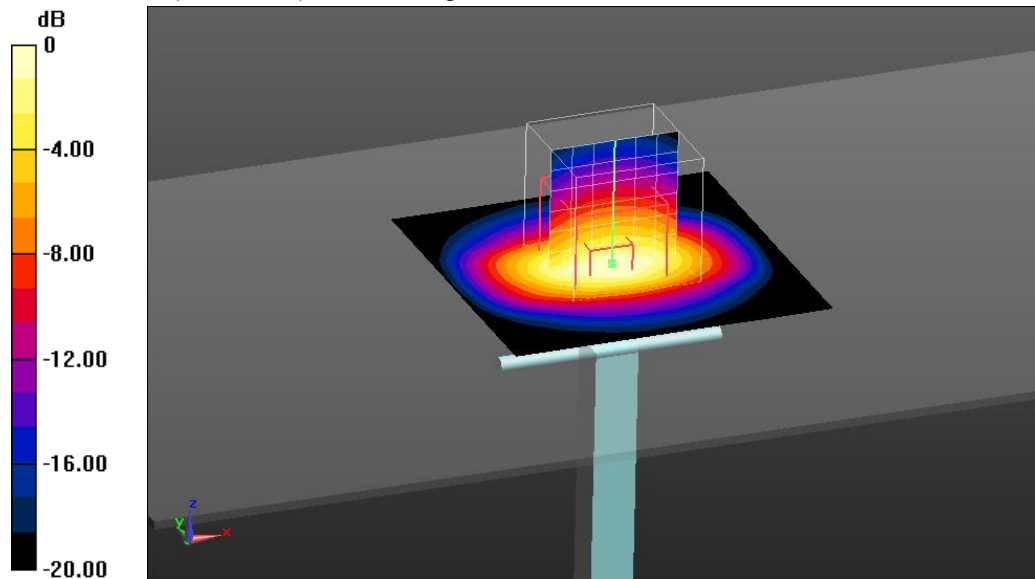
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 170.7 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 107 W/kg

SAR(1 g) = 51.1 W/kg; SAR(10 g) = 23.6 W/kg

Maximum value of SAR (measured) = 58.0 W/kg



0 dB = 58.0 W/kg = 17.63 dBW/kg

Additional information:

ambient temperature: 22.6°C; liquid temperature: 22.3°C

Date/Time: 16.03.2015 11:23:23

SystemPerformanceCheck-D5GHz head 2015-03-16

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1055

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz);

Frequency: 5200 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.547$ S/m; $\epsilon_r = 35.926$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS

DASY5 Configuration:

- Probe: EX3DV4 - SN3944; ConvF(5.28, 5.28, 5.28); Calibrated: 19.08.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$
- Electronics: DAE3 Sn413; Calibrated: 15.01.2015
- Phantom: SAM; Type: SAM; Serial: 1043
- DASYS52 52.8.7(1137); SEMCAD X 14.6.10(7164)

HSL 5GHz/d=10mm, Pin=100mW 5.2GHz/Area Scan (61x61x1): Interpolated grid:

$dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 18.1 W/kg

HSL 5GHz/d=10mm, Pin=100mW 5.2GHz/Zoom Scan (9x9x12)/Cube 0:

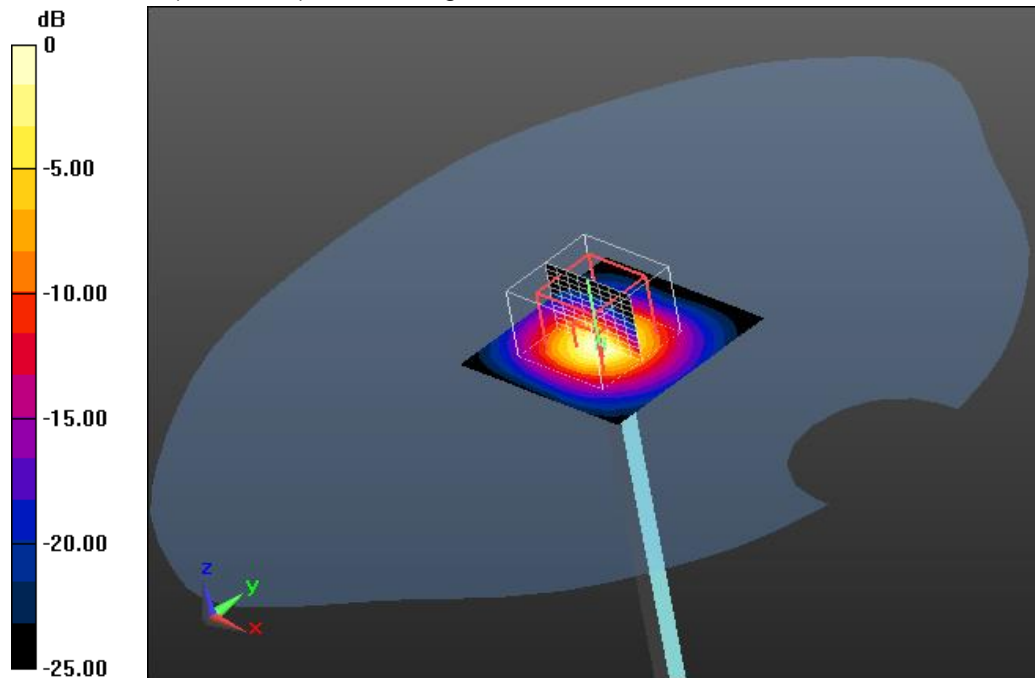
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 63.885 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 33.6 W/kg

SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.37 W/kg

Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 16.9 W/kg = 12.28 dBW/kg

Additional information:

ambient temperature: 21.9°C; liquid temperature: 21.5°C

Date/Time: 16.03.2015 12:00:52

SystemPerformanceCheck-D5GHz head 2015-03-16

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1055

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
Frequency: 5500 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5500$ MHz; $\sigma = 4.861$ S/m; $\epsilon_r = 35.554$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: EX3DV4 - SN3944; ConvF(4.87, 4.87, 4.87); Calibrated: 19.08.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$
- Electronics: DAE3 Sn413; Calibrated: 15.01.2015
- Phantom: SAM; Type: SAM; Serial: 1043
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

HSL 5GHz/d=10mm, Pin=100mW 5.5GHz/Area Scan (61x61x1): Interpolated grid:

$dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 18.5 W/kg

HSL 5GHz/d=10mm, Pin=100mW 5.5GHz/Zoom Scan (7x7x12)/Cube 0:

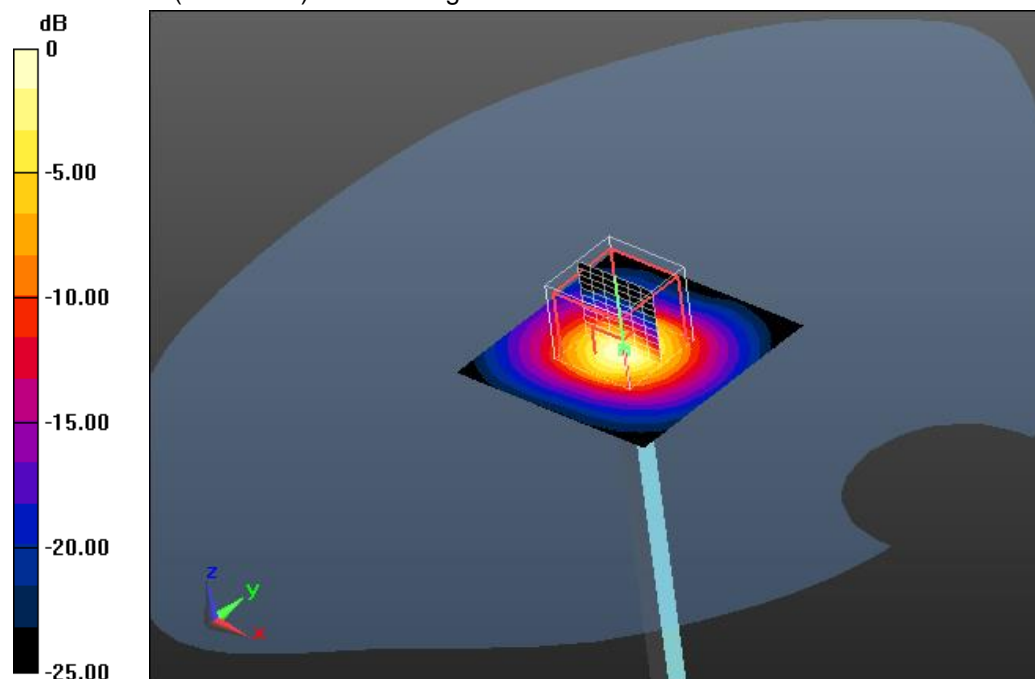
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 66.379 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 38.8 W/kg

SAR(1 g) = 8.89 W/kg; SAR(10 g) = 2.48 W/kg

Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.9 W/kg = 12.76 dBW/kg

Additional information:

ambient temperature: 21.9°C; liquid temperature: 21.5°C

Date/Time: 16.03.2015 13:45:12

SystemPerformanceCheck-D5GHz head 2015-03-16

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1055

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
Frequency: 5800 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.178$ S/m; $\epsilon_r = 35.119$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS

DASY5 Configuration:

- Probe: EX3DV4 - SN3944; ConvF(4.76, 4.76, 4.76); Calibrated: 19.08.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$
- Electronics: DAE3 Sn413; Calibrated: 15.01.2015
- Phantom: SAM; Type: SAM; Serial: 1043
- DASYS52 52.8.7(1137); SEMCAD X 14.6.10(7164)

HSL 5GHz/d=10mm, Pin=100mW 5.8GHz/Area Scan (61x61x1): Interpolated grid:

$dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 16.2 W/kg

HSL 5GHz/d=10mm, Pin=100mW 5.8GHz/Zoom Scan (8x8x12)/Cube 0:

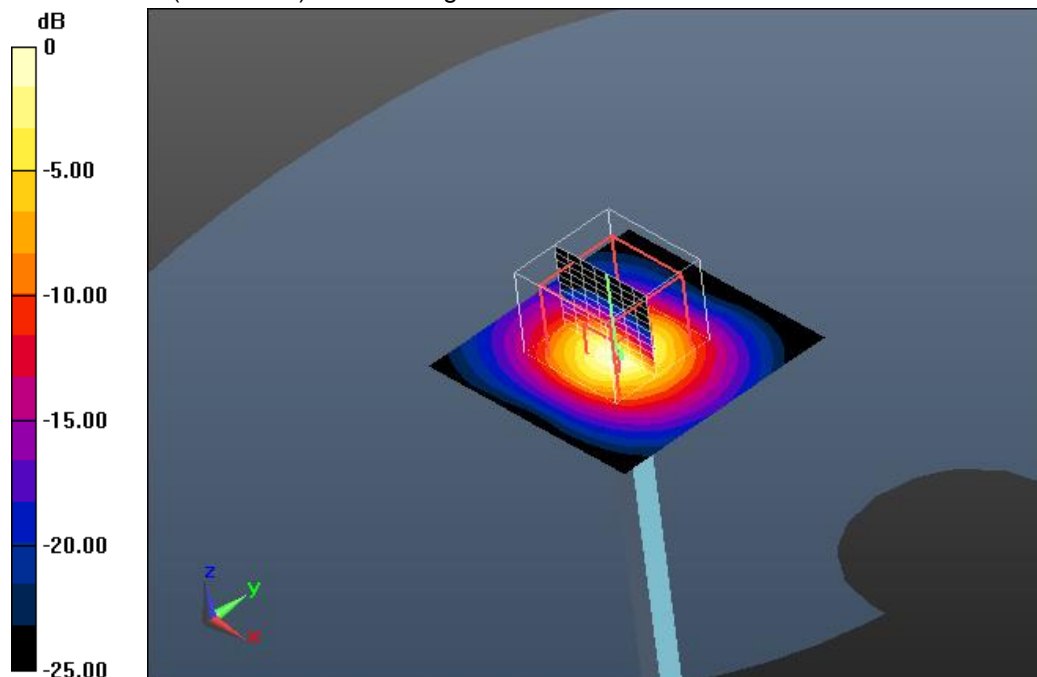
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 60.106 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 36.1 W/kg

SAR(1 g) = 7.95 W/kg; SAR(10 g) = 2.22 W/kg

Maximum value of SAR (measured) = 16.5 W/kg



0 dB = 16.5 W/kg = 12.17 dBW/kg

Additional information:

ambient temperature: 21.9°C; liquid temperature: 21.5°C

Date/Time: 18.03.2015 15:05:05

SystemPerformanceCheck-D5GHz body 2015-03-18

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1055

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
Frequency: 5200 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.183$ S/m; $\epsilon_r = 50.481$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS

DASY5 Configuration:

- Probe: EX3DV4 - SN3944; ConvF(4.56, 4.56, 4.56); Calibrated: 19.08.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$
- Electronics: DAE3 Sn413; Calibrated: 15.01.2015
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASYS52 52.8.7(1137); SEMCAD X 14.6.10(7164)

MSL 5GHz/d=10mm, Pin=100mW 5.2GHz/Area Scan (61x61x1): Interpolated grid:

$dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 16.6 W/kg

MSL 5GHz/d=10mm, Pin=100mW 5.2GHz/Zoom Scan (8x8x12)/Cube 0:

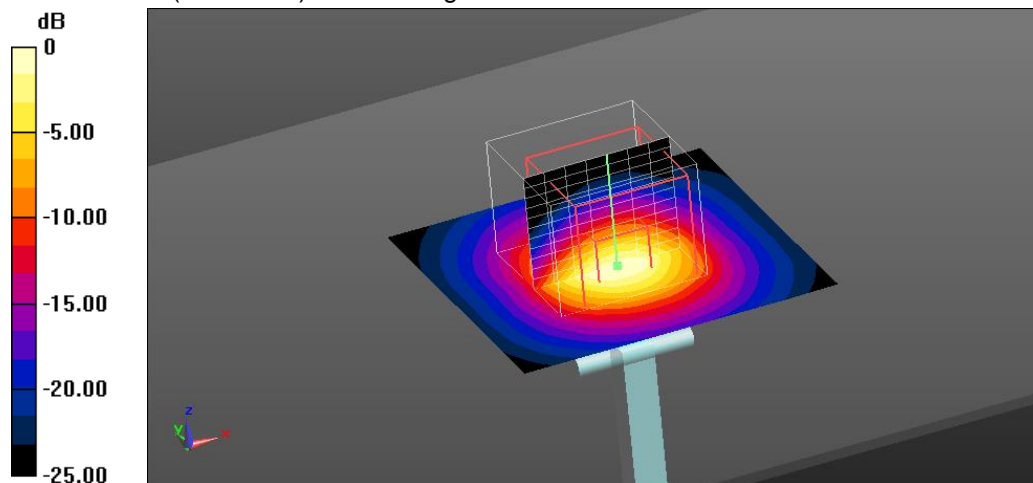
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 57.987 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 29.6 W/kg

SAR(1 g) = 7.37 W/kg; SAR(10 g) = 2.08 W/kg

Maximum value of SAR (measured) = 15.3 W/kg



0 dB = 15.3 W/kg = 11.85 dBW/kg

Additional information:

ambient temperature: 22.2°C; liquid temperature: 21.6°C

Date/Time: 17.03.2015 15:59:30

SystemPerformanceCheck-D5GHz body 2015-03-18

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1055

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
Frequency: 5500 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.582$ S/m; $\epsilon_r = 49.997$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: EX3DV4 - SN3944; ConvF(4.15, 4.15, 4.15); Calibrated: 19.08.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$
- Electronics: DAE3 Sn413; Calibrated: 15.01.2015
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

MSL 5GHz/d=10mm, Pin=100mW 5.5GHz/Area Scan (61x61x1): Interpolated grid:

$dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 16.5 W/kg

MSL 5GHz/d=10mm, Pin=100mW 5.5GHz/Zoom Scan (8x8x12)/Cube 0:

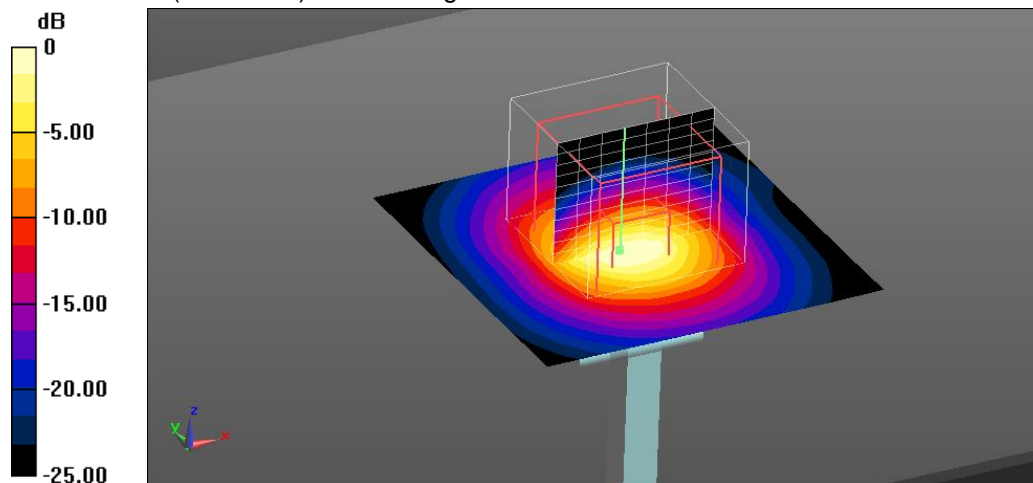
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 56.170 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 29.2 W/kg

SAR(1 g) = 7.12 W/kg; SAR(10 g) = 1.99 W/kg

Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.76 dBW/kg

Additional information:

ambient temperature: 22.2°C; liquid temperature: 21.6°C

SystemPerformanceCheck-D5GHz body 2015-03-18

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1055

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
 Frequency: 5800 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5800$ MHz; $\sigma = 6.02$ S/m; $\epsilon_r = 49.493$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: EX3DV4 - SN3944; ConvF(4.02, 4.02, 4.02); Calibrated: 19.08.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$
- Electronics: DAE3 Sn413; Calibrated: 15.01.2015
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

MSL 5GHz 2/d=10mm, Pin=100mW 5.8GHz/Area Scan (61x61x1): Interpolated

grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 14.1 W/kg

MSL 5GHz 2/d=10mm, Pin=100mW 5.8GHz/Zoom Scan (8x8x12)/Cube 0:

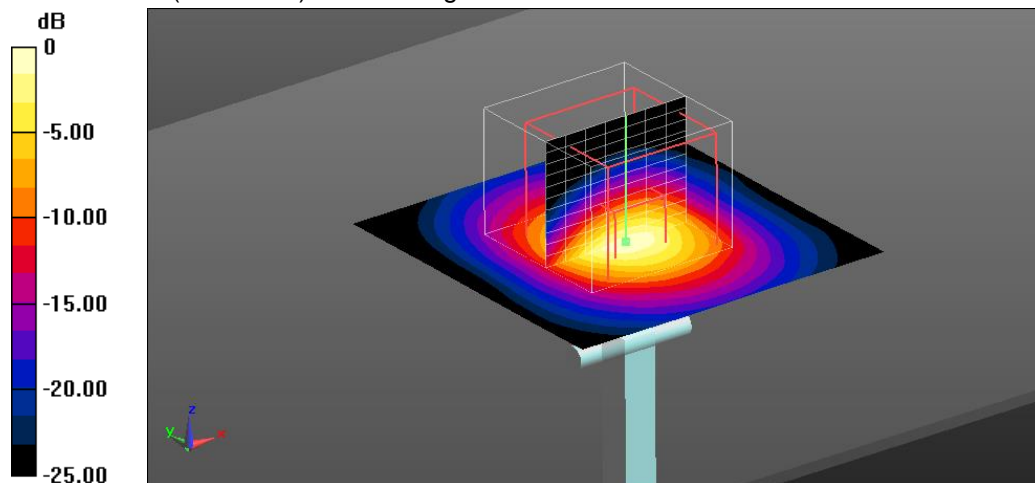
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 52.634 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 28.9 W/kg

SAR(1 g) = 7.19 W/kg; SAR(10 g) = 2.04 W/kg

Maximum value of SAR (measured) = 15.3 W/kg



0 dB = 15.3 W/kg = 11.85 dBW/kg

Additional information:

ambient temperature: 22.2°C; liquid temperature: 21.6°C

Annex B: DASY5 measurement results

SAR plots for **the highest measured SAR** in each exposure configuration, wireless mode and frequency band combination according to FCC KDB 865664 D02

Annex B.1: GSM 850MHz

Date/Time: 21.01.2015 10:11:46

IEEE1528-GSM850 head

DUT: Ascom; Type: SH1 - ACAA/PF; Serial: T26105EBL0

Communication System: UID 0, GSM (0); Communication System Band: GSM 850 (824.0 - 849.0 MHz);

Frequency: 848.8 MHz; Communication System PAR: 9.191 dB; PMF: 2.88104

Medium parameters used: $f = 849$ MHz; $\sigma = 0.916$ S/m; $\epsilon_r = 40.784$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(6.15, 6.15, 6.15); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: SAM front; Type: QD000P40CC; Serial: TP-1042
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Right-Hand-Side HSL/Touch Position - High/Area Scan (71x121x1):

Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.448 W/kg

Right-Hand-Side HSL/Touch Position - High/Zoom Scan (5x5x7)/Cube 0:

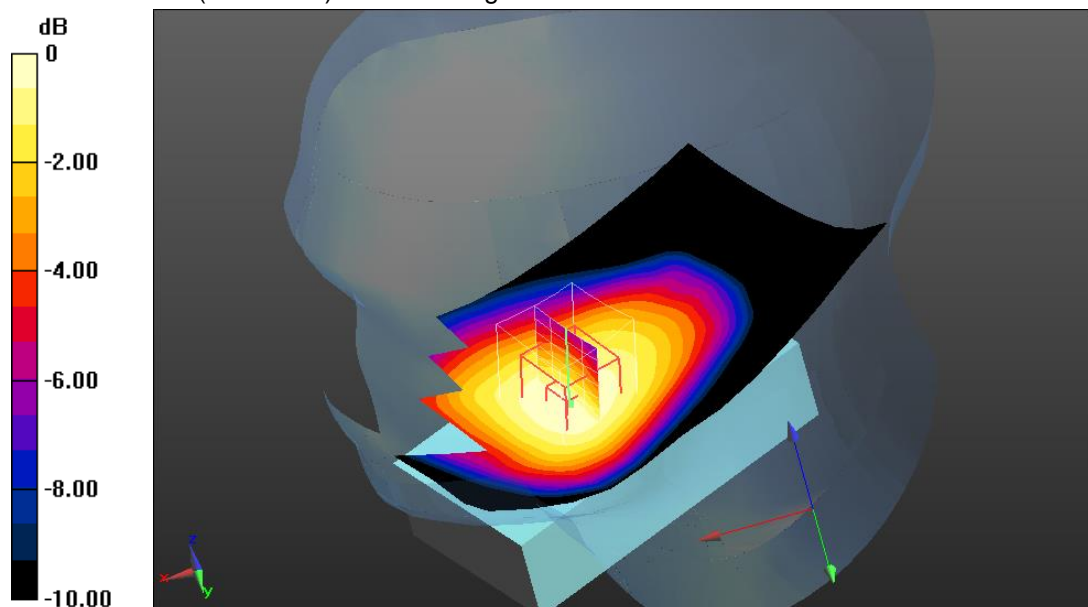
Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 21.692 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.491 W/kg

SAR(1 g) = 0.420 W/kg; SAR(10 g) = 0.327 W/kg

Maximum value of SAR (measured) = 0.440 W/kg



0 dB = 0.440 W/kg = -3.57 dBW/kg

Additional information:

ambient temperature: 23.4°C; liquid temperature: 22.2°C

FCC GSM 850 body

DUT: Ascom; Type: SH1 - ACAA/PF; Serial: T26105EBL0

Communication System: UID 0, GSM/GPRS 2TS (0); Communication System Band: GSM 850; Frequency: 848.8 MHz; Communication System PAR: 6.021 dB; PMF: 2.00009

Medium parameters used: $f = 849$ MHz; $\sigma = 1.021$ S/m; $\epsilon_r = 54.352$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(6.14, 6.14, 6.14); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASYS2 52.8.7(1137); SEMCAD X 14.6.10(7164)

MSL900/Rear High/Area Scan (81x121x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.700 W/kg

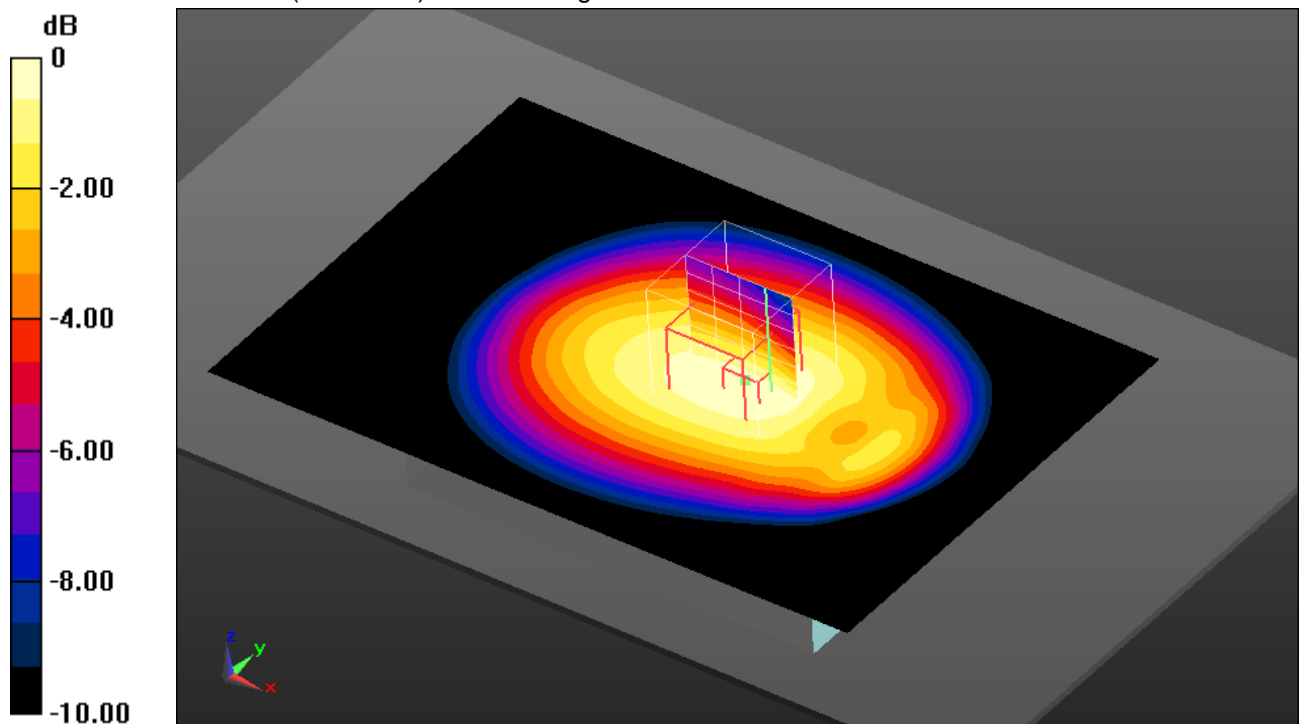
MSL900/Rear High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 27.178 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.874 W/kg

SAR(1 g) = 0.698 W/kg; SAR(10 g) = 0.522 W/kg

Maximum value of SAR (measured) = 0.729 W/kg



0 dB = 0.729 W/kg = -1.37 dBW/kg

Additional information:

position or distance of DUT to SAM: 0 mm

ambient temperature: 23.4°C; liquid temperature: 22.2°C

Annex B.2: GSM 1900MHz

Date/Time: 19.01.2015 10:00:21

IEEE1528-GSM1900 head

DUT: Ascum; Type: SH1 - ACA/PF; Serial: T26105EBLO

Communication System: UID 0, GSM (0); Communication System Band: PCS 1900 (1850.0 - 1910.0 MHz);

Frequency: 1850.2 MHz; Communication System PAR: 9.191 dB; PMF: 2.88104

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.339$ S/m; $\epsilon_r = 39.896$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(4.94, 4.94, 4.94); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: SAM front; Type: QD000P40CC; Serial: TP-1042
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Left-Hand-Side HSL/Touch Position - Low/Area Scan (71x121x1): Interpolated

grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.465 W/kg

Left-Hand-Side HSL/Touch Position - Low/Zoom Scan (5x5x7)/Cube 0:

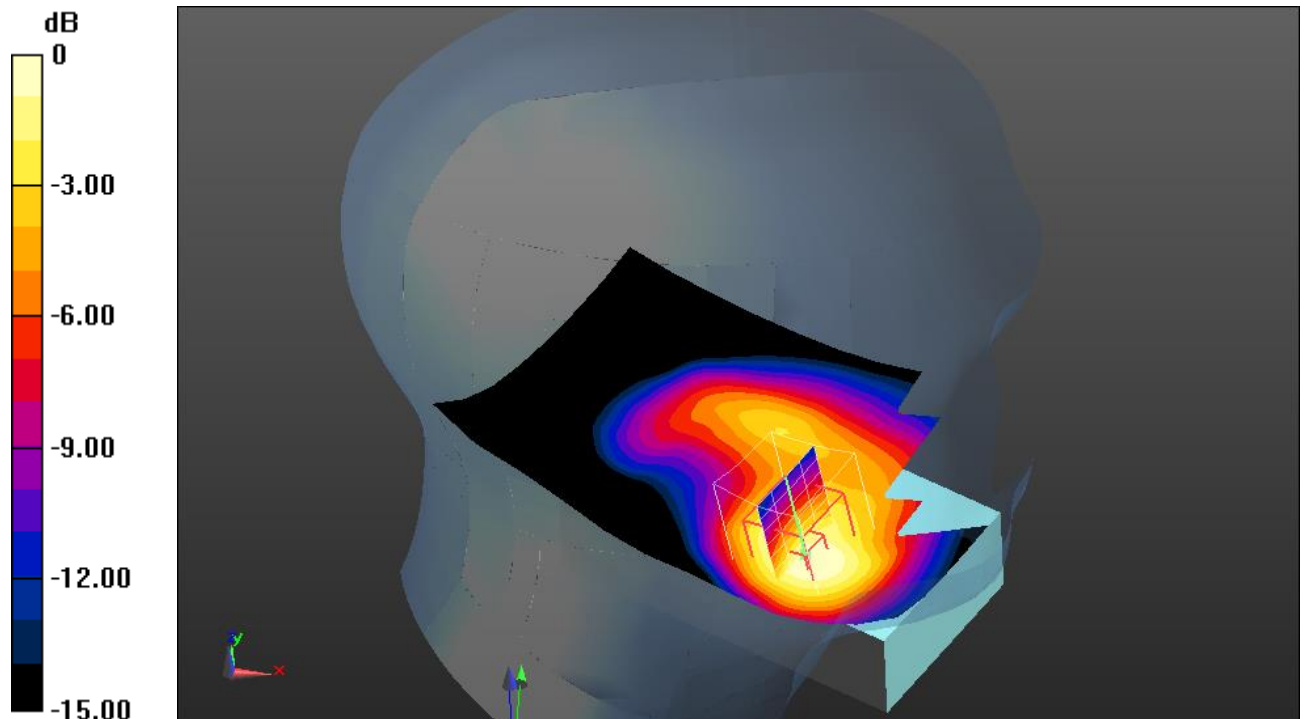
Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 18.071 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.639 W/kg

SAR(1 g) = 0.405 W/kg; SAR(10 g) = 0.246 W/kg

Maximum value of SAR (measured) = 0.440 W/kg



0 dB = 0.440 W/kg = -3.57 dBW/kg

Additional information:

ambient temperature: 20.4°C; liquid temperature: 20.1°C

FCC GSM1900 body

DUT: Ascom; Type: SH1 - ACAA/PF; Serial: T26105EBL0

Communication System: UID 0, GSM/GPRS 1TS (0); Communication System Band: PCS 1900 (1850.0 - 1910.0 MHz); Frequency: 1850.2 MHz; Communication System PAR: 9.191 dB; PMF: 2.88104

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.456$ S/m; $\epsilon_r = 53.307$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(4.7, 4.7, 4.7); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASYS2 52.8.7(1137); SEMCAD X 14.6.10(7164)

HSL1900/Front Low/Area Scan (81x121x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 1.05 W/kg

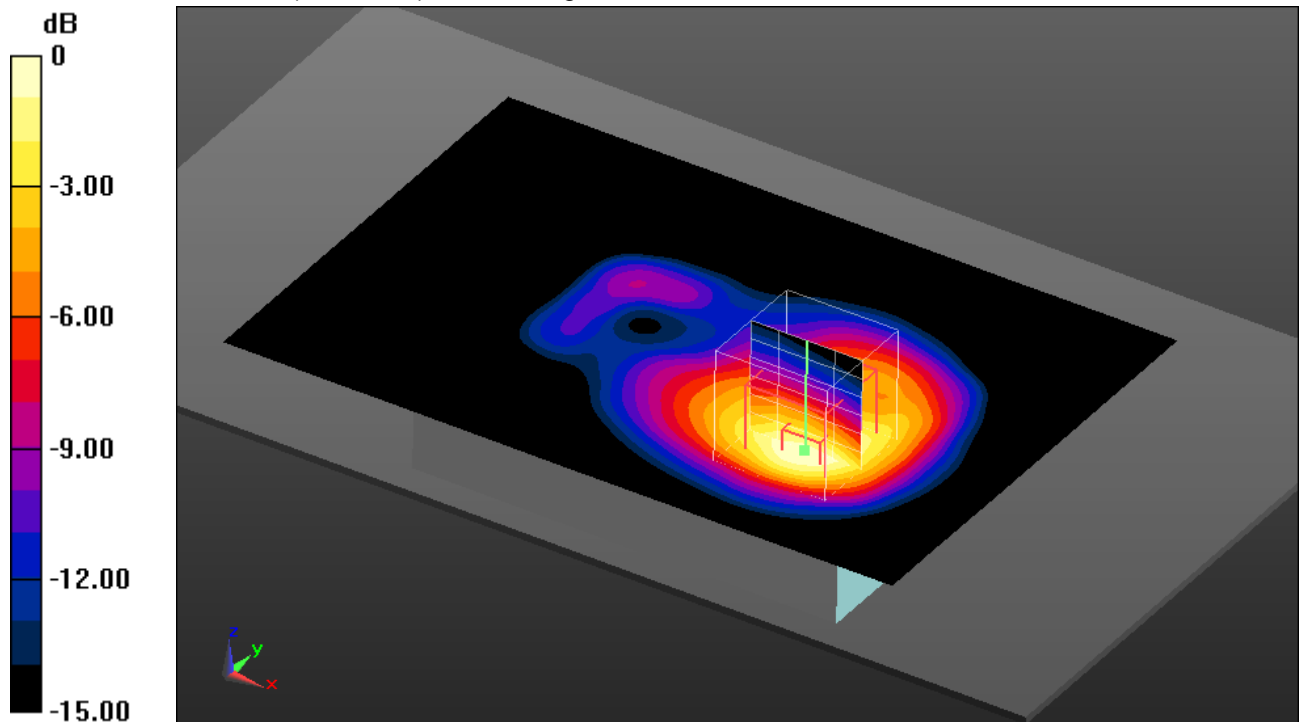
HSL1900/Front Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 22.111 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 1.81 W/kg

SAR(1 g) = 0.911 W/kg; SAR(10 g) = 0.464 W/kg

Maximum value of SAR (measured) = 1.01 W/kg



0 dB = 1.01 W/kg = 0.04 dBW/kg

Additional information:

position or distance of DUT to SAM: 0 mm

ambient temperature: 20.4°C; liquid temperature: 20.1°C

Annex B.3: UMTS FDD V

Date/Time: 21.01.2015 11:27:53

IEEE1528-UMTS FDD V head

DUT: Ascom; Type: SH1 - ACA/PF; Serial: T26105EBL0

Communication System: UID 0, UMTS FDD (0); Communication System Band: UMTS FDD V; Frequency: 846.6 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 847$ MHz; $\sigma = 0.915$ S/m; $\epsilon_r = 40.843$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(6.15, 6.15, 6.15); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: SAM front; Type: QD000P40CC; Serial: TP-1042
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Right-Hand-Side HSL/Touch Position - High/Area Scan (71x121x1):

Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.387 W/kg

Right-Hand-Side HSL/Touch Position - High/Zoom Scan (5x5x7)/Cube 0:

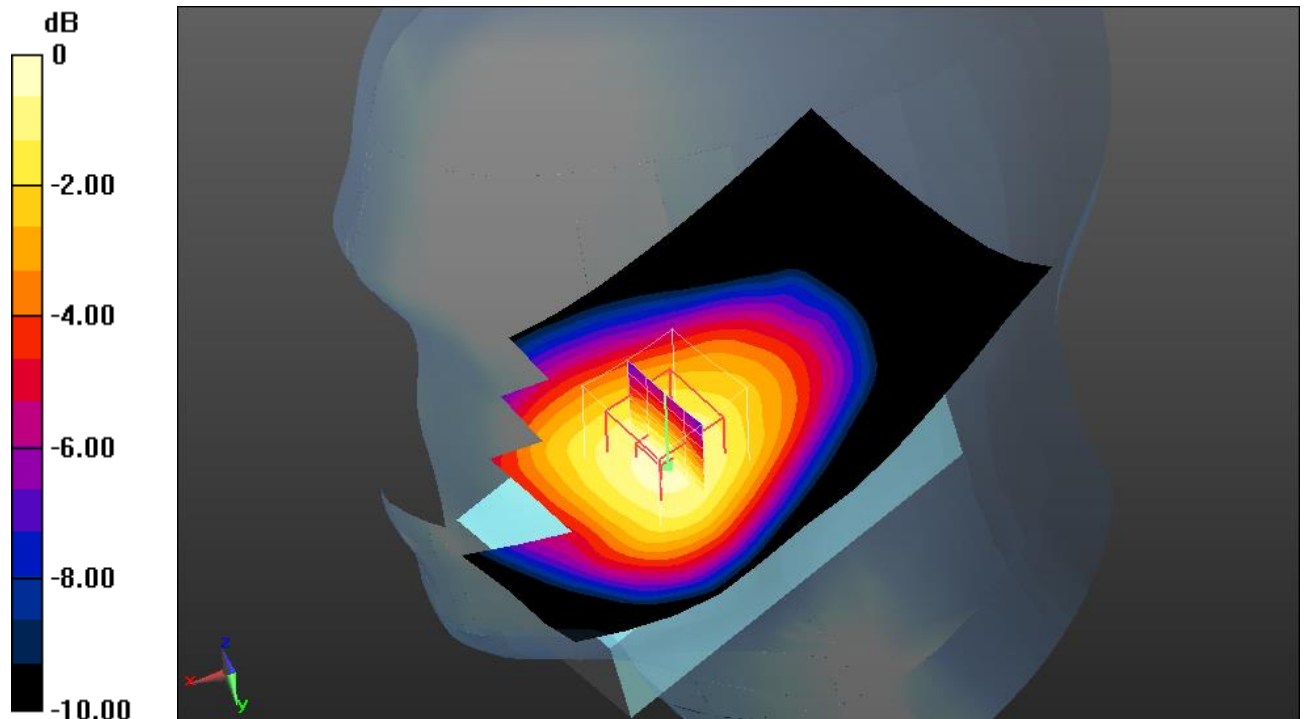
Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 21.913 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.479 W/kg

SAR(1 g) = 0.402 W/kg; SAR(10 g) = 0.308 W/kg

Maximum value of SAR (measured) = 0.419 W/kg



0 dB = 0.419 W/kg = -3.78 dBW/kg

Additional information:

ambient temperature: 23.4°C; liquid temperature: 22.2°C

Date/Time: 21.01.2015 14:05:21

FCC UMTS FDD V body

DUT: Ascom; Type: SH1 - ACAA/PF; Serial: T26105EBL0

Communication System: UID 0, UMTS FDD (0); Communication System Band: UMTS FDD V; Frequency: 836.4 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 1.014$ S/m; $\epsilon_r = 54.446$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(6.14, 6.14, 6.14); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

MSL900/Rear Middle/Area Scan (81x121x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.862 W/kg

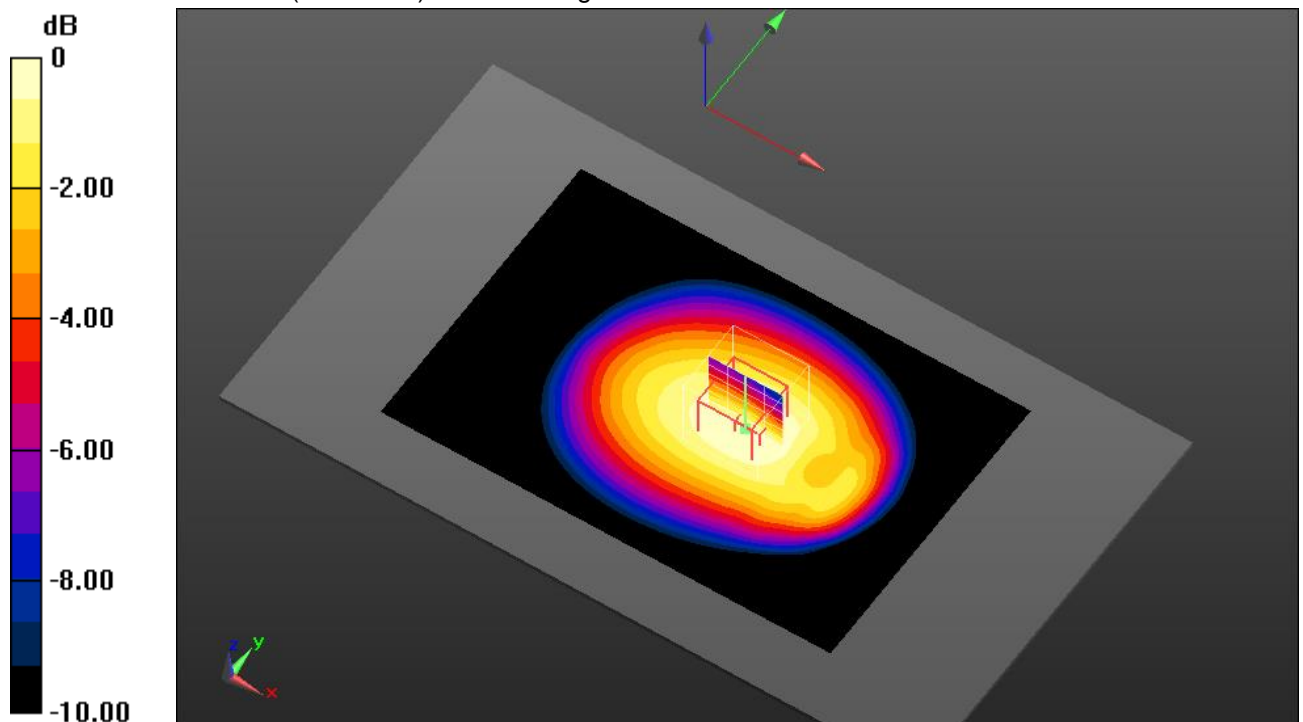
MSL900/Rear Middle/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 29.605 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.830 W/kg; SAR(10 g) = 0.617 W/kg

Maximum value of SAR (measured) = 0.868 W/kg



0 dB = 0.868 W/kg = -0.61 dBW/kg

Additional information:

position or distance of DUT to SAM: 0 mm

ambient temperature: 23.4°C; liquid temperature: 22.2°C

Annex B.4: WLAN 2450MHz

Date/Time: 22.01.2015 11:16:28

IEEE1528-WLAN2450 head (GSM-Sample)

DUT: Ascum; Type: SH1 - ACA/PF; Serial: T26105EBL0

Communication System: UID 0, WLAN 2450 (0); Communication System Band: 2.4 GHz; Frequency: 2462 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 2462$ MHz; $\sigma = 1.767$ S/m; $\epsilon_r = 38.842$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASYS5

DASY5 Configuration:

- Probe: ET3DV6 - SN1554; ConvF(4.25, 4.25, 4.25); Calibrated: 08.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.7, 32.7$
- Electronics: DAE3 Sn413; Calibrated: 22.05.2014
- Phantom: SAM; Type: SAM; Serial: 1043
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Right-Hand-Side HSL/Touch Position - High/Area Scan (101x181x1):

Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 0.200 W/kg

Right-Hand-Side HSL/Touch Position - High/Zoom Scan (7x8x7)/Cube 0:

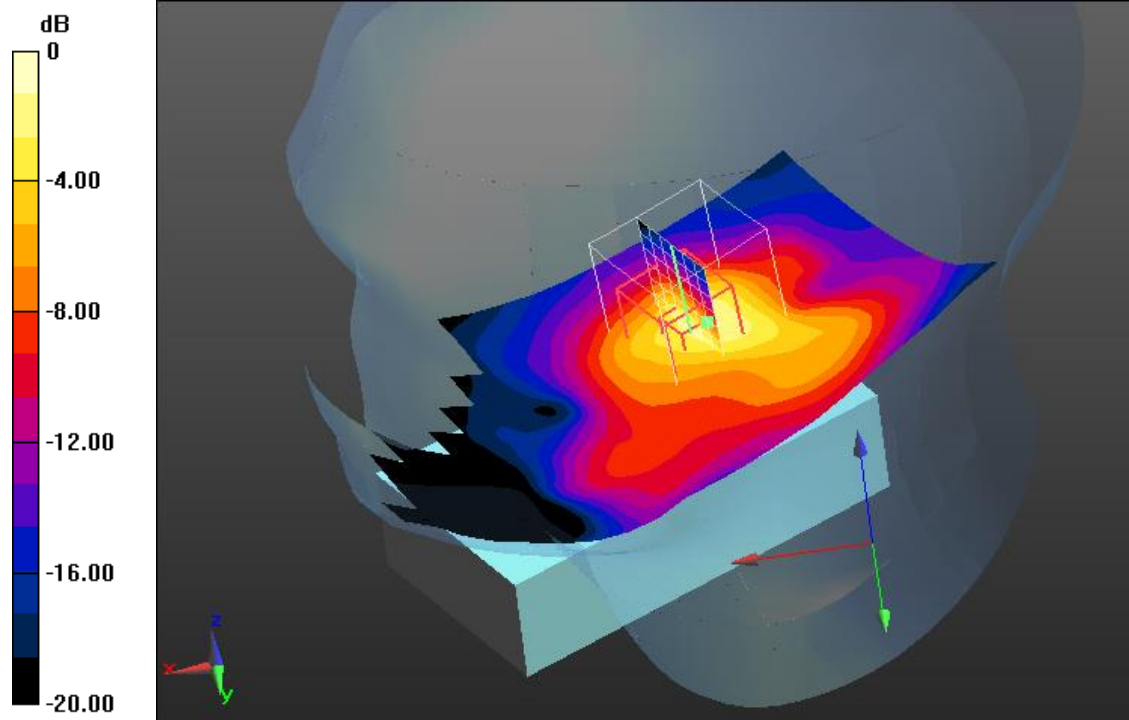
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 12.002 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 0.456 W/kg

SAR(1 g) = 0.233 W/kg; SAR(10 g) = 0.114 W/kg

Maximum value of SAR (measured) = 0.267 W/kg



0 dB = 0.267 W/kg = -5.73 dBW/kg

Additional information:

ambient temperature: 22.5°C; liquid temperature: 22.2°C

Date/Time: 22.01.2015 16:17:03

FCC WLAN2450 body (GSM-Sample)

DUT: Ascom; Type: SH1 - ACAA/PF; Serial: T26105EBL0

Communication System: UID 0, WLAN 2450 (0); Communication System Band: 2.4 GHz; Frequency: 2412 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.944$ S/m; $\epsilon_r = 50.796$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: ES3DV3 - SN3320; ConvF(4.3, 4.3, 4.3); Calibrated: 09.05.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$
- Electronics: DAE3 Sn477; Calibrated: 14.05.2014
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

MSL2450/Front Low/Area Scan (121x181x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 0.407 W/kg

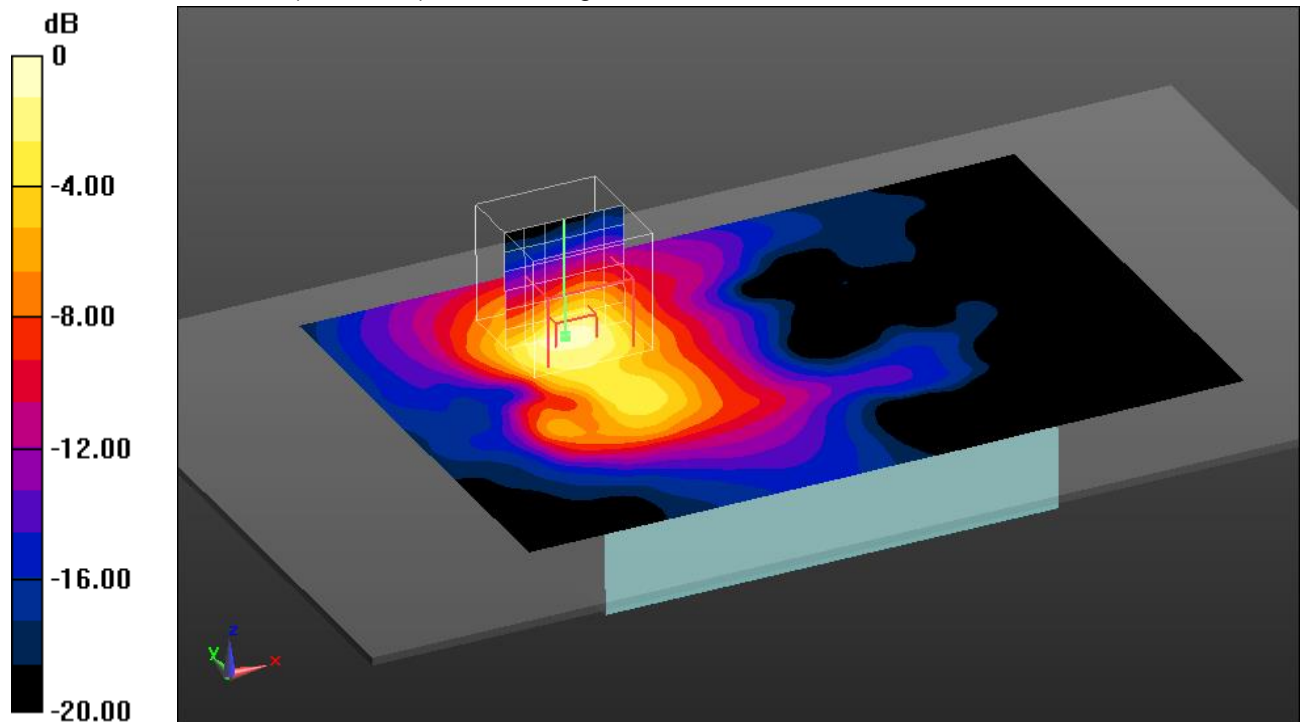
MSL2450/Front Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 14.446 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.866 W/kg

SAR(1 g) = 0.368 W/kg; SAR(10 g) = 0.162 W/kg

Maximum value of SAR (measured) = 0.429 W/kg



0 dB = 0.429 W/kg = -3.68 dBW/kg

Additional information:

position or distance of DUT to SAM: 0mm

ambient temperature: 22.6°C; liquid temperature: 22.3°C

Annex B.5: WLAN 5GHz

Date/Time: 16.03.2015 16:20:01

EN62209-1-WLAN5GHz head (GSM)

DUT: Ascom; Type: SH1 - ACAA/PF; Serial: T26105EBL0

Communication System: UID 0, WLAN 5GHz (0); Communication System Band: 5 GHz Band; Frequency: 5240 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5240$ MHz; $\sigma = 4.585$ S/m; $\epsilon_r = 35.878$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5

DASY5 Configuration:

- Probe: EX3DV4 - SN3944; ConvF(5.28, 5.28, 5.28); Calibrated: 19.08.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$
- Electronics: DAE3 Sn413; Calibrated: 15.01.2015
- Phantom: SAM; Type: SAM; Serial: 1043
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Right-Hand-Side HSL/Touch Position - Ch48/Area Scan (101x151x1):

Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 0.401 W/kg

Right-Hand-Side HSL/Touch Position - Ch48/Zoom Scan (8x8x12)/Cube 0:

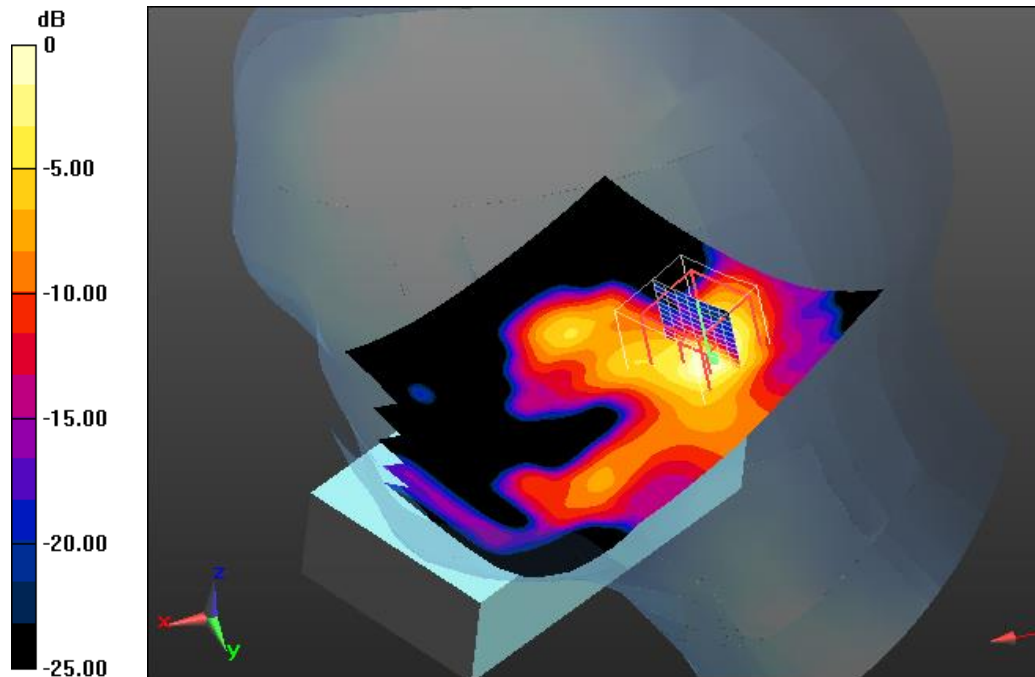
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 8.958 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.55 W/kg

SAR(1 g) = 0.192 W/kg; SAR(10 g) = 0.063 W/kg

Maximum value of SAR (measured) = 0.386 W/kg



0 dB = 0.386 W/kg = -4.13 dBW/kg

Additional information:

ambient temperature: 21.9°C; liquid temperature: 21.5°C

Date/Time: 16.03.2015 07:54:05

EN62209-1-WLAN5GHz head (GSM)

DUT: Ascom; Type: SH1 - ACAA/PF; Serial: T26105EBL0

Communication System: UID 0, WLAN 5GHz (0); Communication System Band: 5 GHz Band; Frequency: 5320 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5320$ MHz; $\sigma = 4.662$ S/m; $\epsilon_r = 35.767$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASYS5

DASY5 Configuration:

- Probe: EX3DV4 - SN3944; ConvF(5.08, 5.08, 5.08); Calibrated: 19.08.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$
- Electronics: DAE3 Sn413; Calibrated: 15.01.2015
- Phantom: SAM; Type: SAM; Serial: 1043
- DASYS5 52.8.7(1137); SEMCAD X 14.6.10(7164)

Right-Hand-Side HSL/Touch Position - Ch64/Area Scan (101x151x1):

Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 0.442 W/kg

Right-Hand-Side HSL/Touch Position - Ch64/Zoom Scan (8x8x12)/Cube 0:

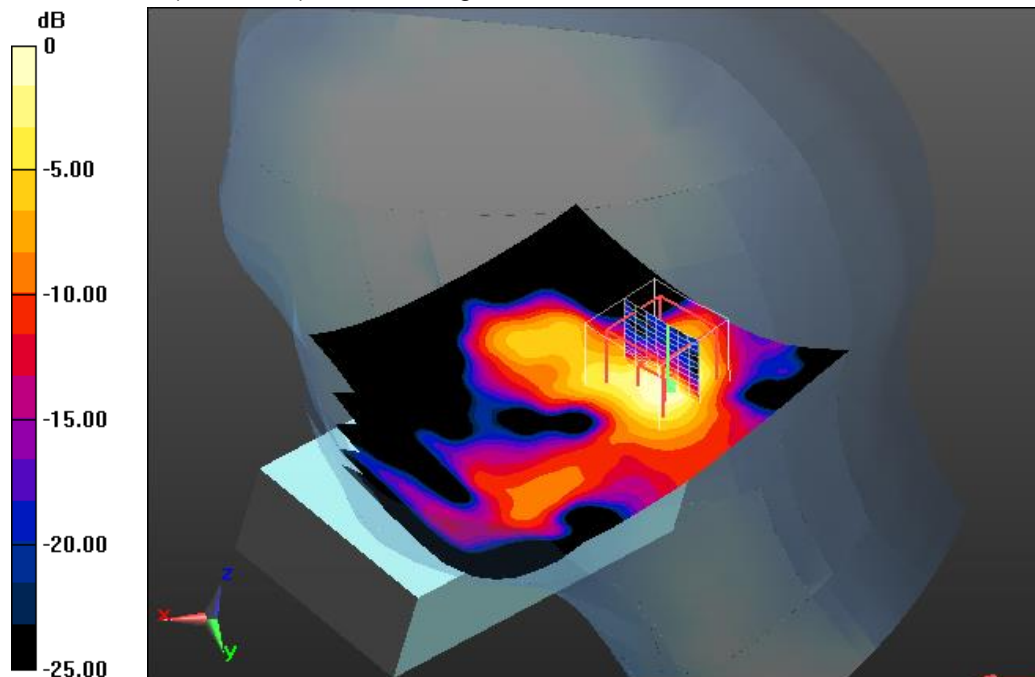
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 8.837 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.731 W/kg

SAR(1 g) = 0.190 W/kg; SAR(10 g) = 0.062 W/kg

Maximum value of SAR (measured) = 0.367 W/kg



0 dB = 0.367 W/kg = -4.35 dBW/kg

Additional information:

ambient temperature: 21.9°C; liquid temperature: 21.5°C

Date/Time: 18.03.2015 10:22:25

FCC WLAN5GHz body triple

DUT: Ascom; Type: SH1 - ACAA/PF; Serial: T26105EBLO

Communication System: UID 0, WLAN 5GHz (0); Communication System Band: 5 GHz Band; Frequency: 5240 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5240$ MHz; $\sigma = 5.239$ S/m; $\epsilon_r = 50.36$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS

DASY5 Configuration:

- Probe: EX3DV4 - SN3944; ConvF(4.56, 4.56, 4.56); Calibrated: 19.08.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$
- Electronics: DAE3 Sn413; Calibrated: 15.01.2015
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASYS2 52.8.7(1137); SEMCAD X 14.6.10(7164)

MSL5000/Front Ch 48/Area Scan (101x171x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 0.448 W/kg

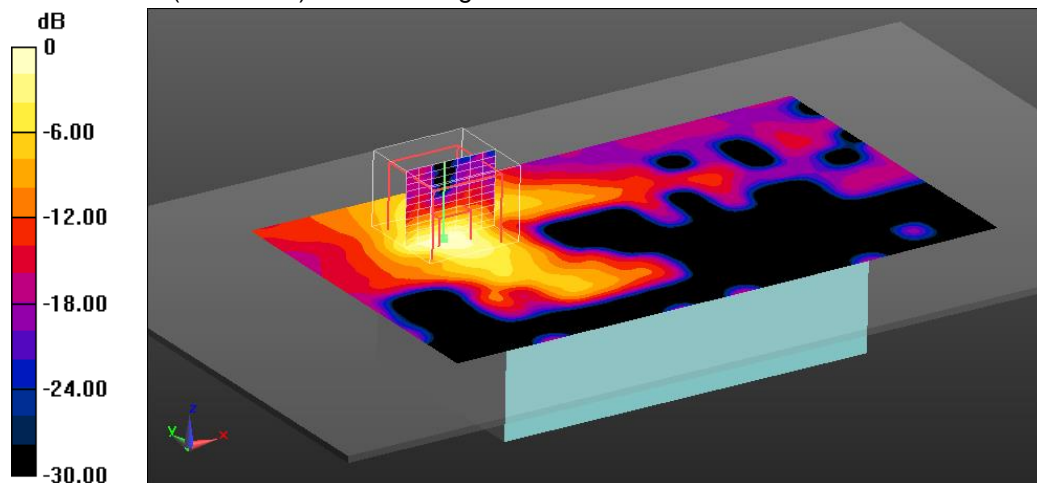
MSL5000/Front Ch 48/Zoom Scan (8x8x12)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 7.287 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 1.62 W/kg

SAR(1 g) = 0.249 W/kg; SAR(10 g) = 0.084 W/kg

Maximum value of SAR (measured) = 0.486 W/kg



0 dB = 0.486 W/kg = -3.13 dBW/kg

Additional information:

position or distance of DUT to SAM: 0mm

ambient temperature: 22.2°C; liquid temperature: 21.6°C

FCC WLAN5GHz body triple

DUT: Ascom; Type: SH1 - ACAA/PF; Serial: T26105EBL0

Communication System: UID 0, WLAN 5GHz (0); Communication System Band: 5 GHz Band; Frequency: 5320 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5320$ MHz; $\sigma = 5.355$ S/m; $\epsilon_r = 50.332$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS

DASY5 Configuration:

- Probe: EX3DV4 - SN3944; ConvF(4.4, 4.4, 4.4); Calibrated: 19.08.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$
- Electronics: DAE3 Sn413; Calibrated: 15.01.2015
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1154
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

MSL5000/Front Ch 64/Area Scan (101x171x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 0.449 W/kg

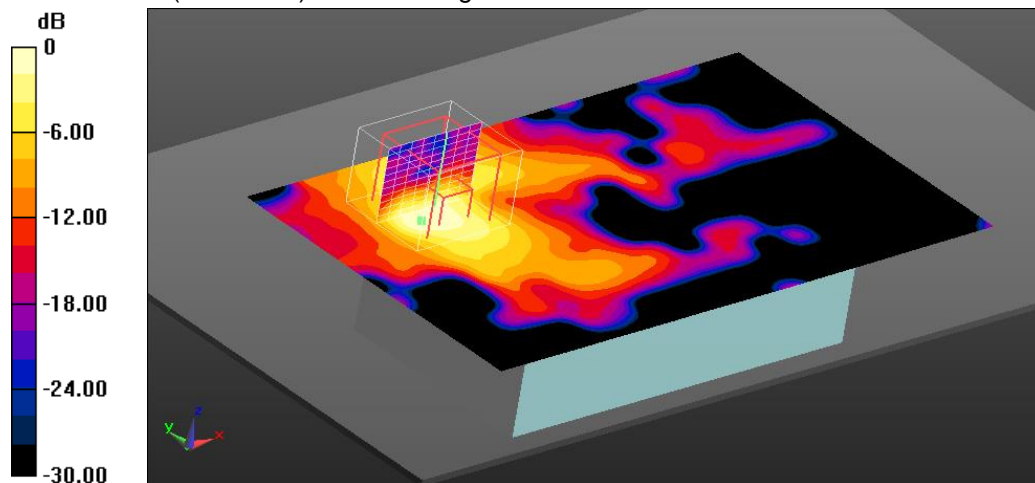
MSL5000/Front Ch 64/Zoom Scan (9x8x12)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 6.943 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.807 W/kg

SAR(1 g) = 0.223 W/kg; SAR(10 g) = 0.081 W/kg

Maximum value of SAR (measured) = 0.467 W/kg



0 dB = 0.467 W/kg = -3.31 dBW/kg

Additional information:

position or distance of DUT to SAM: 0mm

ambient temperature: 22.2°C; liquid temperature: 21.6°C

Annex B.6: Liquid depth

Photo 1: Liquid depth 850 MHz head simulating liquid

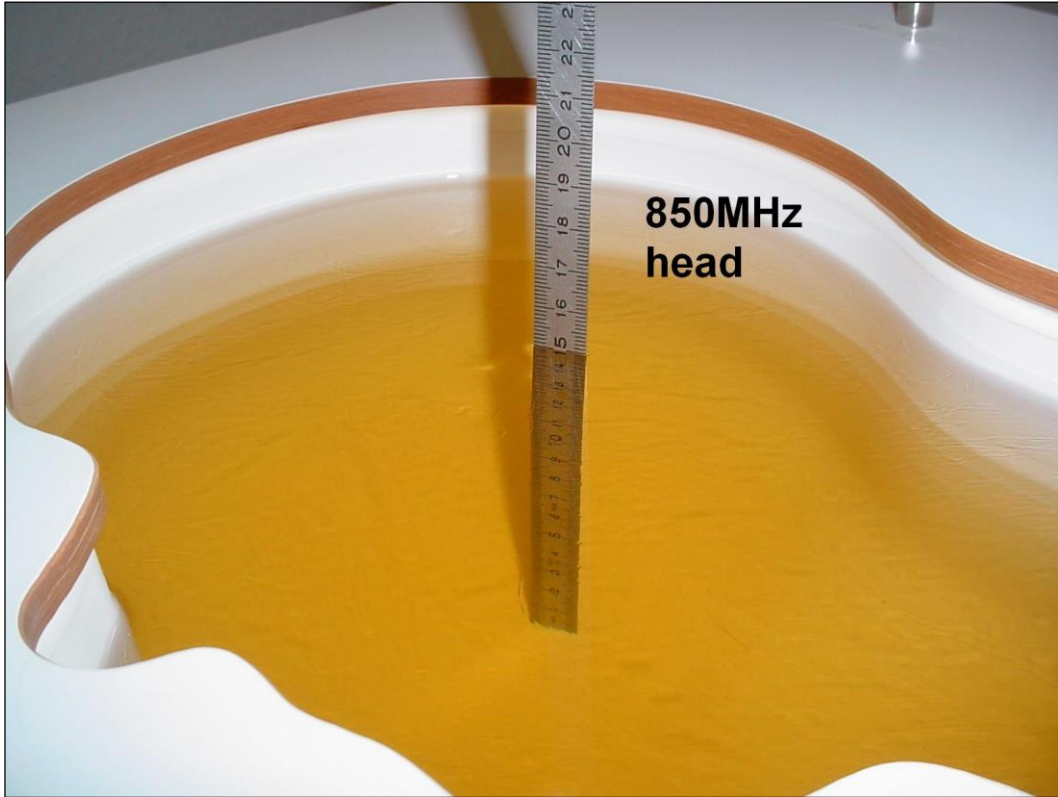


Photo 2: Liquid depth 850 MHz body simulating liquid

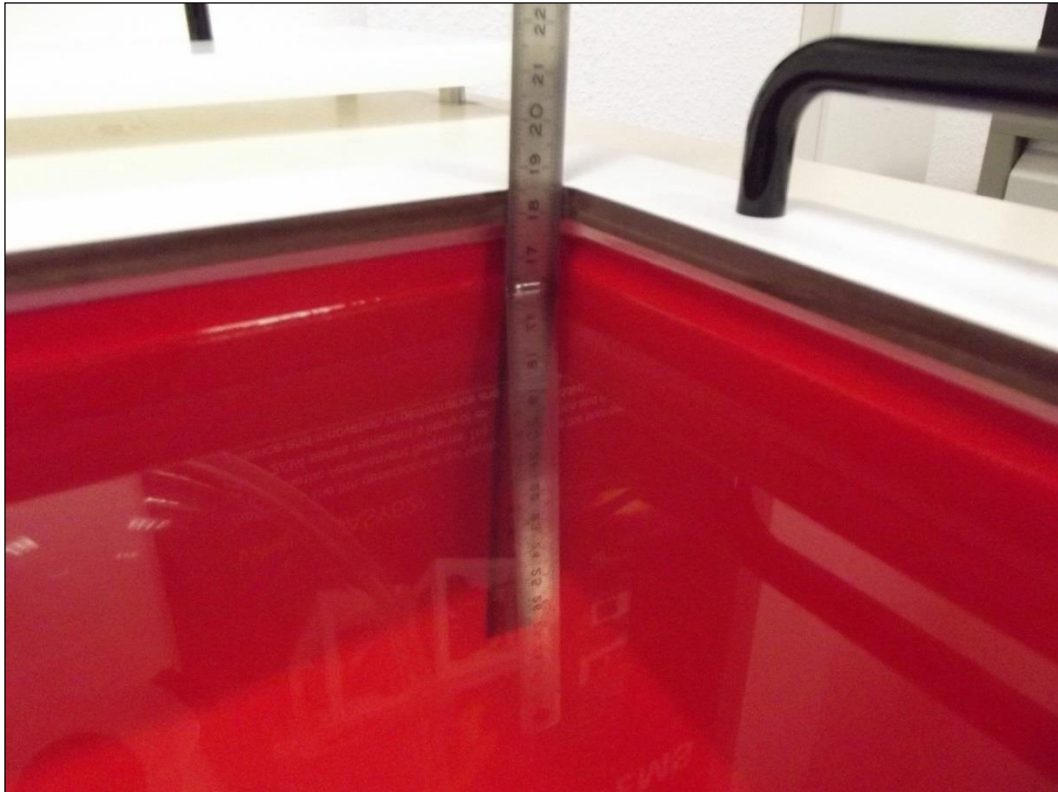


Photo 3: Liquid depth 1900MHz head simulating liquid

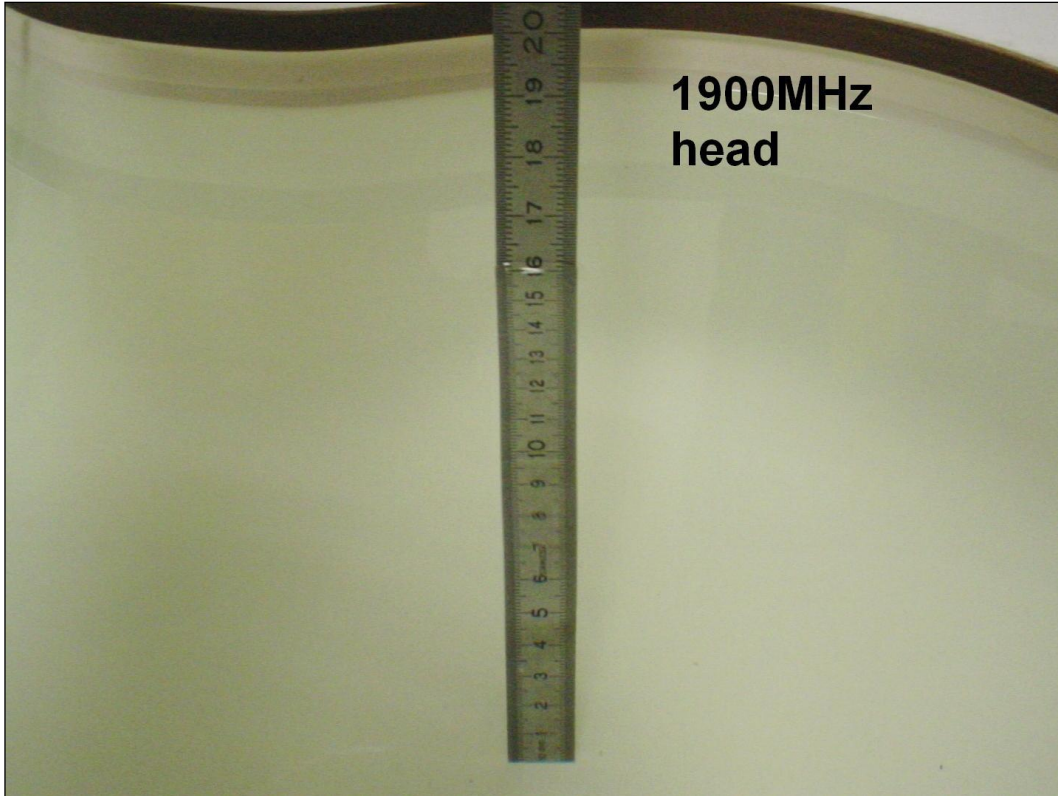


Photo 4: Liquid depth 1900 MHz body simulating liquid

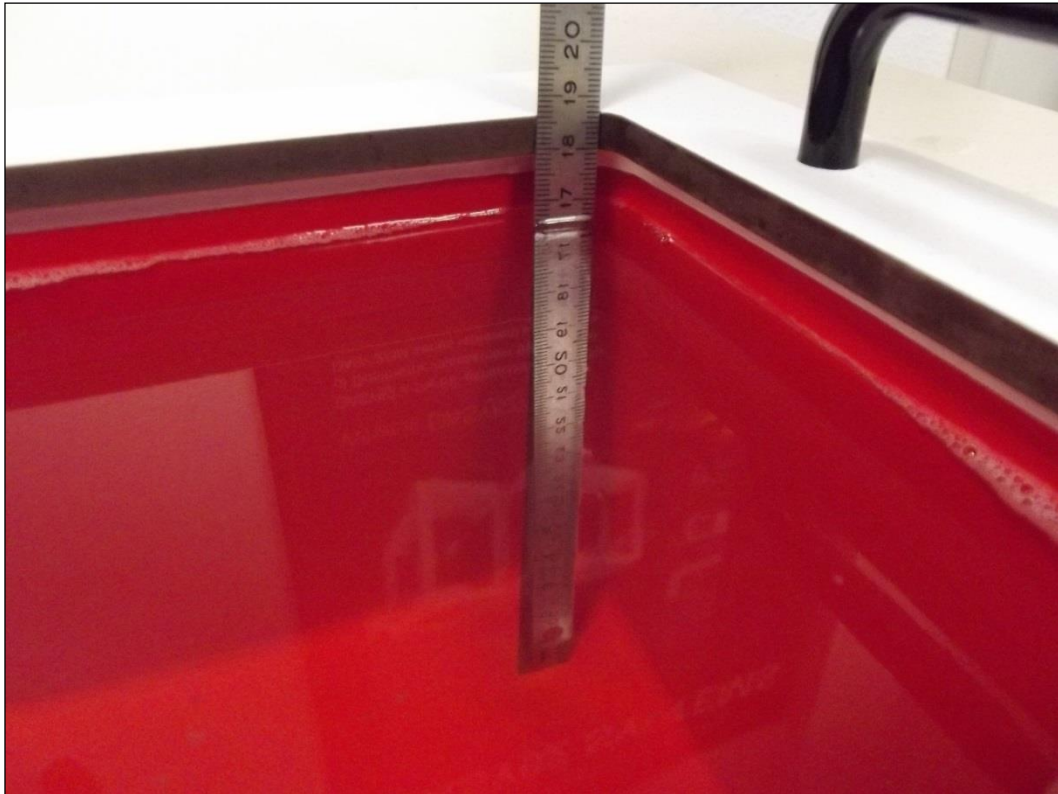


Photo 5: Liquid depth 2450MHz head simulating liquid

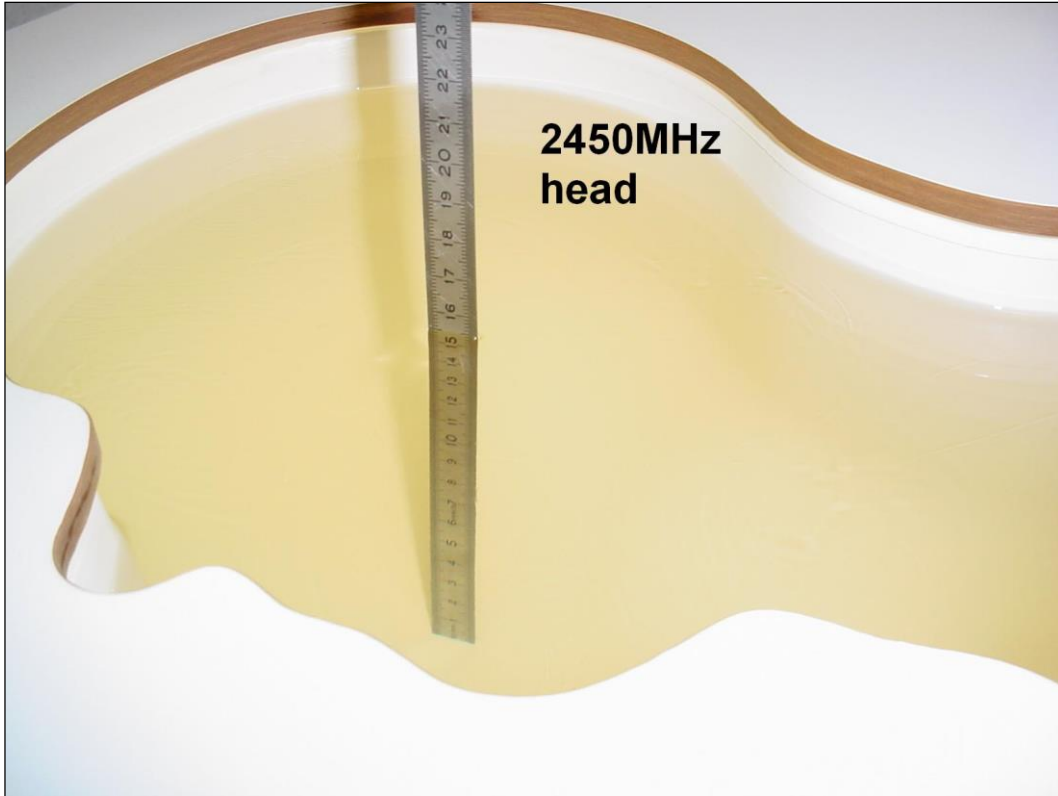


Photo 6: Liquid depth 2450 MHz body simulating liquid

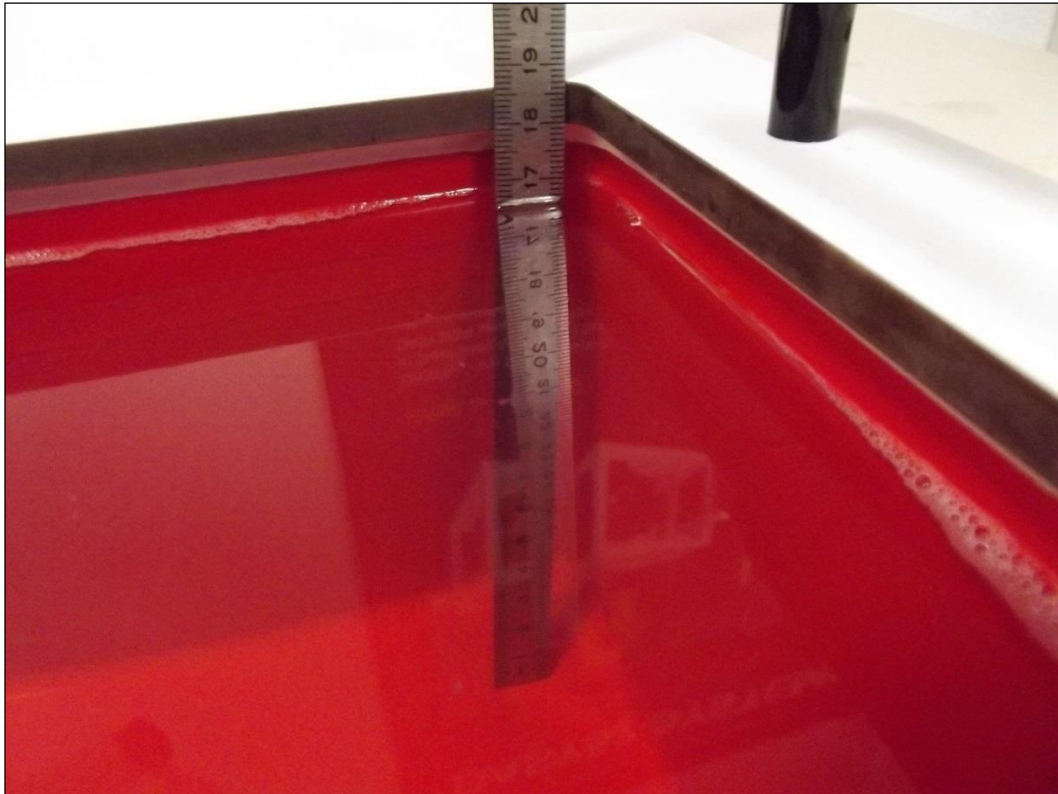
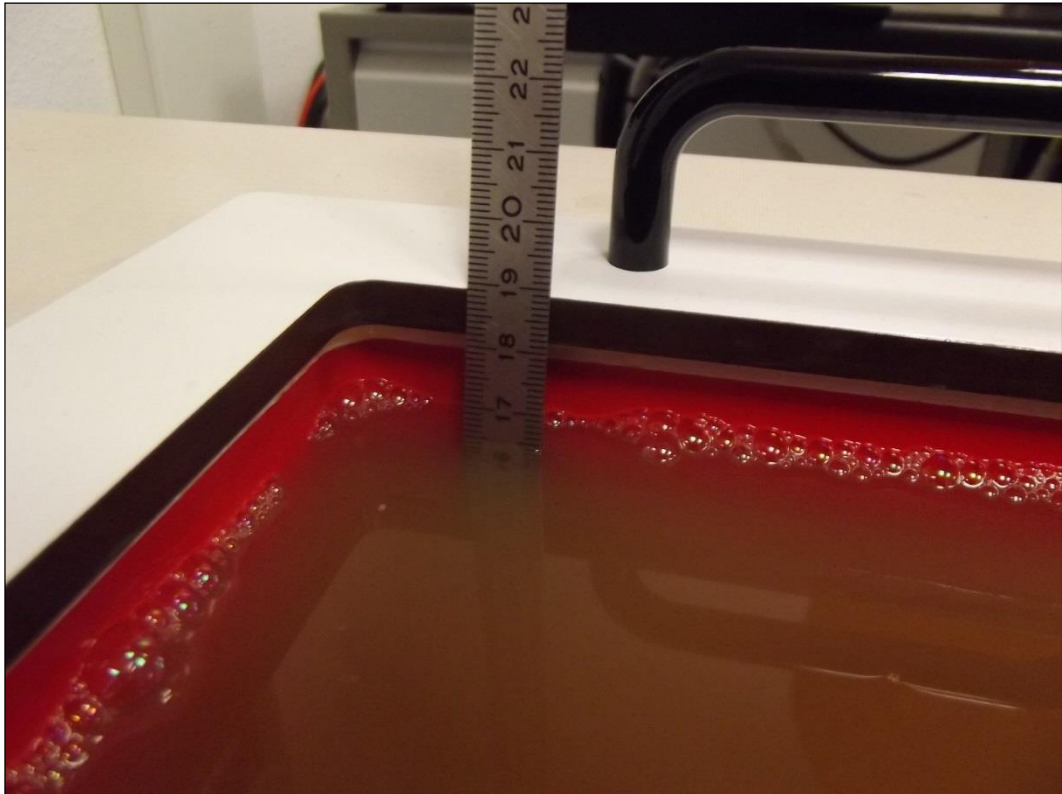


Photo 7: Liquid depth 5 GHz head simulating liquid



Photo 8: Liquid depth 5 GHz body simulating liquid



Annex C: Photo documentation

Photo 1: Measurement System DASY 5



Photo 2: DUT - front view



Photo 3: DUT – left side view



Photo 4: DUT – right side view



Photo 5: DUT – top side view



Photo 6: DUT - rear view



Photo 7: DUT - rear view open (without battery)



Photo 8: DUT - rear view (label)



Photo 9: Test position left hand touched

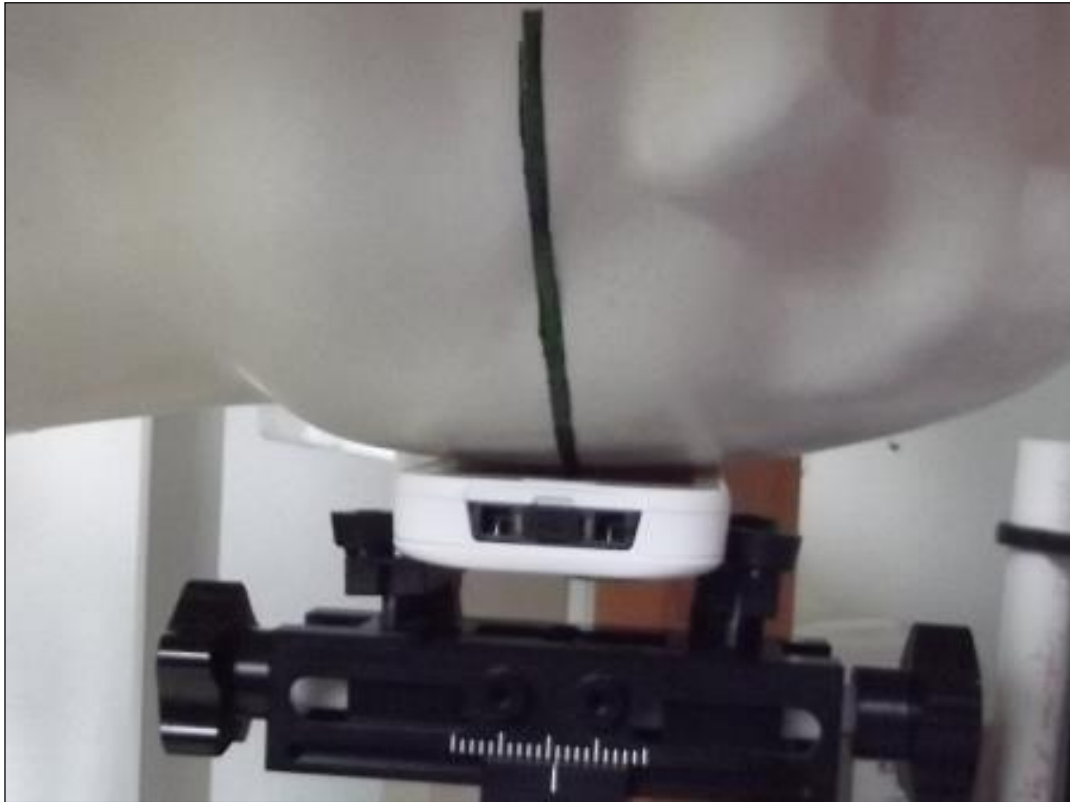


Photo 10: Test position left hand touched



Photo 11: Test position left hand touched



Photo 12: Test position left hand tilted 15°

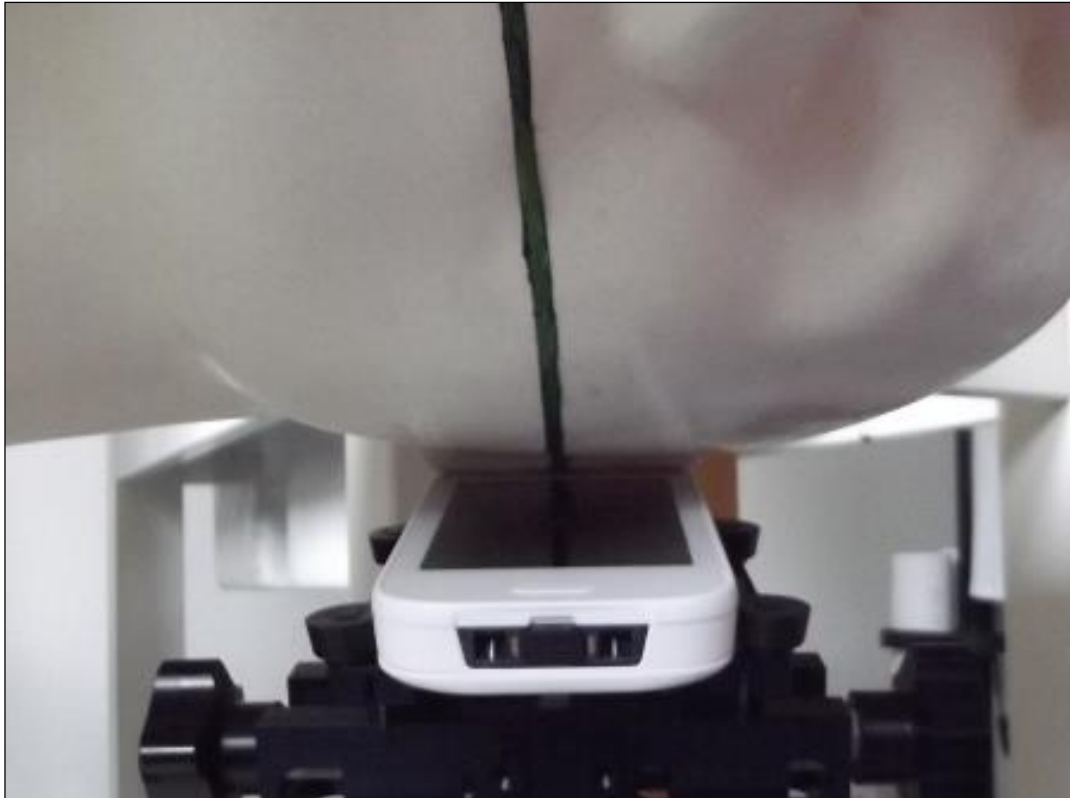


Photo 13: Test position left hand tilted 15°



Photo 14: Test position right hand touched



Photo 15: Test position right hand touched



Photo 16: Test position right hand touched



Photo 17: Test position right hand tilted 15°



Photo 18: Test position right hand tilted 15°



Photo 19: Test position body worn front side with 0 mm distance



Photo 20: Test position body worn rear side with 0 mm distance



Annex D: Calibration parameters

Calibration parameters are described in the additional document:

**Appendix to test report no. 1-9110/14-01-02-C
Calibration data, Phantom certificate
and detail information of the DASY5 System**

Annex E: RF Technical Brief Cover Sheet acc. to RSS-102 Annex A

- 1. COMPANY NUMBER: **3724B**
- 2. PRODUCT MARKETING NAME (PNM): **ASCOM MYCO CELLULAR + WIFI**
- 3. HARDWARE VERSION IDENTIFICATION NO. (HVIN): **SH1-903138**
- 4. FIRMWARE VERSION IDENTIFICATION NO. (FVIN): N/A
- 5. HOST MARKETING NAME (HMN): N/A
- 6. IC CERTIFICATION NUMBER: **3724B-SH1C**
- 7. APPLICANT: **ASCOM AB**
- 8. SAR/RF EXPOSURE TEST LABORATORY: **CETECOM ICT Services GmbH**

9. TYPE OF EVALUATION:

(a) SAR Evaluation: **Device Used in the Vicinity of the Human Head**

- Multiple transmitters: Yes No
- Evaluated against exposure limits: General Public Use Controlled Use
- Duty cycle used in evaluation: 12.5 %
- Standards used for evaluation:

RSS-102 Issue 5	(2015-04)	IEEE C95-3	(2002)
IEEE 1528-2013	(2014-06)	IEEE C95-1	(2005)
Safety Code No.6	(2015-03)		

KDBs and further information follow in separate table below.

- SAR value: **0.580 W/kg.** Measured Computed Calculated

(b) SAR Evaluation: **Body-Worn Device**

- Multiple transmitters: Yes No
- Evaluated against exposure limits: General Public Use Controlled Use
- Duty cycle used in evaluation: 12.5 %
- Standard used for evaluation:

RSS-102 Issue 5	(2015-04)	IEEE C95-3	(2002)
IEEE 1528-2013	(2014-06)	IEEE C95-1	(2005)
Safety Code No.6	(2015-03)	IEC 62209-2	(2010)

KDBs and further information follow in separate table below.

- SAR value: **1.229 W/kg.** Measured Computed Calculated

Annex E.1: Declaration of RF Exposure Compliance

ATTESTATION: I attest that the information provided in Annex E: 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:

NAME : **Oleksandr Hnatovskiy**

TITLE : Dipl.-Ing. (FH)

COMPANY : CETECOM ICT Services GmbH

PRODUCT MARKETING NAME (PMN): **ASCOM MYCO CELLULAR + WIFI**

HARDWARE VERSION IDENTIFICATION NO. (HVIN): **SH1-903138**

FIRMWARE VERSION IDENTIFICATION NO. (FVIN): N/A

HOST MARKETING NAME (HMN): N/A

IC CERTIFICATION NUMBER: **3724B-SH1C**

Test Standard	Version	FCC KDBs	Version
IEEE 1528-2003	2003-04	KDB 865664D01v01	February 7, 2014
IEEE 1528-2013	2014-06	KDB 865664D02v01	May 28, 2013
RSS-102 Issue 5	2015-04	KDB 447498D01v05	February 7, 2014
Canada's Safety Code No. 6	2015-03	KDB 648474D04v01	December 4, 2013
IEEE Std. C95-3	2002	KDB 248227D01v02	March 16, 2015
IEEE Std. C95-1	2005	KDB 941225D01v03	October 16, 2014
IEC 62209-2	2010		

Annex F: Document History

Version	Applied Changes	Date of Release
	Initial Release	2015-04-15
-A	Hardware status was corrected on page 1.	2015-04-30
-B	Corrected chapter 3 Test standards/ procedures references on page 7 and Annex E: RF Technical Brief Cover Sheet acc. to RSS-102 Annex A on page 91.	2010-05-29
-C	Corrected SW Version, Applicant- and Manufacturer-Address on page 1 and in Annex E: RF Technical Brief Cover Sheet acc. to RSS-102 Annex A on page 91.	2015-06-03

Annex G: Further Information

Glossary

BW	-	Bandwidth
DTS	-	Distributed Transmission System
DUT	-	Device under Test
EUT	-	Equipment under Test
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
LTE	-	Long Term Evolution
N/A	-	not applicable
PCE	-	Personal Consumption Expenditure
OET	-	Office of Engineering and Technology
RB	-	resource block(s)
SAR	-	Specific Absorption Rate
S/N	-	Serial Number
SPLSR _i	-	SAR-to-(peak-locations spacing) ratio
SW	-	Software
UNII	-	Unlicensed National Information Infrastructure