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SAR TEST REPORT

REPORT NO.: SA110715C25

MODEL NO.: F-04D

FCC ID: VQK-F04D

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TESTED: Jul. 22, 2011

ISSUED: Aug. 29, 2011

APPLICANT: FUJITSU LIMITED

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	NA	Aug. 29, 2011



A D T

1. CERTIFICATION

PRODUCT: Mobile Phone
MODEL NO.: F-04D
FCC ID: VQK-F04D
BRAND: FOMA
APPLICANT: FUJITSU LIMITED
TESTED: Jul. 22, 2011
STANDARDS: **FCC Part 2 (Section 2.1093)**
FCC OET Bulletin 65, Supplement C (01-01)
IEEE 1528:2003
RSS-102 Issue 4 (2010-03)

The above equipment have been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report.

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2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

EUT	Mobile Phone
MODEL NO.	F-04D
FCC ID	VQK-F04D
CLASSIFICATION	Engineering Sample
UPLINK MODULATION TYPE	GSM: GMSK WCDMA: QPSK
TX FREQUENCY RANGE	GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz
ANTENNA TYPE	Fixed Internal antenna
ACCESSORY DEVICES	Battery

NOTE:

- The EUT use the following internal Li-ion battery:

BRAND	Fujitsu Limited
MODEL	F19
RATING	3.7Vdc, 830mAh

- The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

2.2 SUMMARY OF PEAK SAR RESULTS

Band	Position	SAR _{1g} (W/kg)
WCDMA Band V	Head	0.283
	Body (Body Worn)	0.49
	Body (Hotspot)	0.49
GSM1900	Head	0.561
	Body (Body Worn)	0.401
	Body (Hotspot)	0.401

2.3 TEST CONFIGURATION

The device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the DUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of DUT. The DUT was set from the emulator to radiate maximum output power during all tests.

In general, the crest factor is 8.3 for GSM and GPRS multi-slot class 8, and 1 for WCDMA.

This device supports WiFi hotspot function, so body SAR was tested under 1 cm for the surfaces/slide edges where a transmitting antenna is within 2.5 cm from the edge.

The WWAN antenna is located on top edge of the phone on close mode. Bottom edge is not tested since the distance between antenna and bottom edge is > 2.5 cm.

2.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to the specifications of the manufacturer, this product must comply with the requirements of the following standards:

FCC 47 CFR Part 2 (2.1093)

FCC OET Bulletin 65, Supplement C (01- 01)

RSS-102 Issue 4 (2010-03)

IEEE 1528-2003

All test items have been performed and recorded as per the above standards.



2.5 GENERAL INFORMATION OF THE SAR SYSTEM

DASY4/5 consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY4/5 software defined. The DASY4/5 software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC.

EX3DV4 ISOTROPIC E-FIELD PROBE

CONSTRUCTION	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
FREQUENCY	10 MHz to > 6 GHz 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: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
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%.

NOTE

1. The Probe parameters have been calibrated by the SPEAG. Please reference "APPENDIX D" for the Calibration Certification Report.



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TWIN SAM V4.0

CONSTRUCTION The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

SHELL THICKNESS 2 ± 0.2 mm

FILLING VOLUME Approx. 25 liters

DIMENSIONS Height: 810 mm; Length: 1000 mm; Width: 500 mm

SYSTEM VALIDATION KITS:

CONSTRUCTION Symmetrical dipole with 1/4 balun
Enables measurement of feedpoint impedance with NWA
Matched for use near flat phantoms filled with brain simulating solutions
Includes distance holder and tripod adaptor

CALIBRATION Calibrated SAR value for specified position and input power at the flat phantom in brain simulating solutions

FREQUENCY 835, 1900

RETURN LOSS > 20 dB at specified validation position

POWER CAPABILITY > 100 W ($f < 1\text{GHz}$); > 40 W ($f > 1\text{GHz}$)

OPTIONS Dipoles for other frequencies or solutions and other calibration conditions upon request

DEVICE HOLDER FOR SAM TWIN PHANTOM

CONSTRUCTION The device holder for the GSM900/DCS1800/PCS1900 GSM/GPRS/CDMA Mobile Phone device is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles. The holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity $\varepsilon = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered. The device holder for the portable device makes up of the polyethylene foam. The dielectric parameters of material close to the dielectric parameters of the air.

DATA ACQUISITION ELECTRONICS

CONSTRUCTION The data acquisition electronics (DAE3) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplex, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe is mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE3 box is 200M Ω ; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.



2.6 TEST EQUIPMENT

FOR SAR MEASUREMENT

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	SAM Phantom	S & P	QD000 P40 CA	TP-1485	NA	NA
2	SAM Phantom	S & P	QD000 P40 CA	TP-1202	NA	NA
3	Signal Generator	Agilent	E8257C	MY43320668	Dec. 27, 2010	Dec. 26, 2011
6	E-Field Probe	S & P	EX3DV4	3753	Dec. 13, 2010	Dec. 12, 2011
8	DAE	S & P	DAE3	510	Oct. 04, 2010	Oct. 03, 2011
9	Robot Positioner	Staubli Unimation	NA	NA	NA	NA
10	Validation Dipole	S & P	D835V2	4d021	Mar. 23, 2011	Mar. 22, 2012
			D1900V2	5d022	Jan. 26, 2011	Jan. 25, 2012

NOTE: Before starting the measurement, all test equipment shall be warmed up for 30min.

FOR TISSUE PROPERTY

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	Network Analyzer	Agilent	E8358A	US41480538	Dec. 30, 2010	Dec. 29, 2011
2	Dielectric Probe	Agilent	85070D	US01440176	NA	NA

NOTE:

1. Before starting, all test equipment shall be warmed up for 30min.
2. The tolerance (k=1) specified by Agilent for general dielectric measurements, deriving from inaccuracies in the calibration data, analyzer drift, and random errors, are usually $\pm 2.5\%$ and $\pm 5\%$ for measured permittivity and conductivity, respectively. However, the tolerances for the conductivity is smaller for material with large loss tangents, i.e., less than $\pm 2.5\%$ (k=1). It can be substantially smaller if more accurate methods are applied.



2.7 GENERAL DESCRIPTION OF THE SPATIAL PEAK SAR EVALUATION

The DASY4/DASY5 post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the micro-volt 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	dcp _i
Device parameters:	- Frequency	F
	- Crest factor	Cf
Media parameters:	- Conductivity	σ
	- Density	ρ

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:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

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:

$$\text{E-fieldprobes: } E_i = \sqrt{\frac{V_i}{\text{Norm}_i \cdot \text{ConvF}}}$$

$$\text{H-fieldprobes: } H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

- V_i = compensated signal of channel I (i = x, y, z)
- Norm_i = sensor sensitivity of channel i $\mu\text{V}/(\text{V/m})^2$ for (i = x, y, z) 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):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

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

$$\text{SAR} = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

- 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 set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid. The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. The extraction of the measured data (grid and values) from the Zoom Scan
2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. The generation of a high-resolution mesh within the measured volume
4. The interpolation of all measured values from the measurement grid to the high-resolution grid
5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. The calculation of the averaged SAR within masses of 1 g and 10 g.

The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated. The angle between the probe axis and the surface normal line is less than 30 degree.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extreme of the SAR distribution. The uncertainty on the locations of the extreme is less than 1/20 of the grid size. Only local maximum within -2 dB of the global maximum are searched and passed for the Cube Scan measurement. In the Cube Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5mm.



The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 5 x 5 x 7 scans. The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 32 x 32 x 30mm contains about 30g of tissue. The first procedure is an extrapolation (incl. boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume in a 1mm grid (42875 points). In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

2.8 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.
1	Universal Radio Communication Tester	R&S	CMU200	101372

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA

NOTE: All power cords of the above support units are non shielded (1.8m).

3. DESCRIPTION OF TEST POSITION

3.1 DESCRIPTION OF TEST POSITION

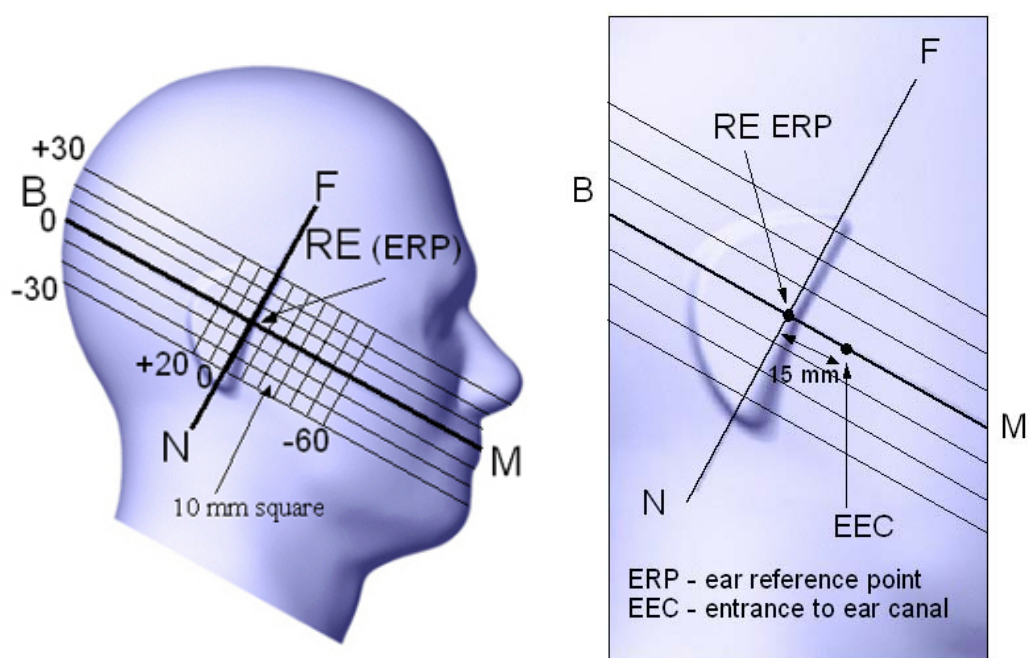


FIGURE 3.1

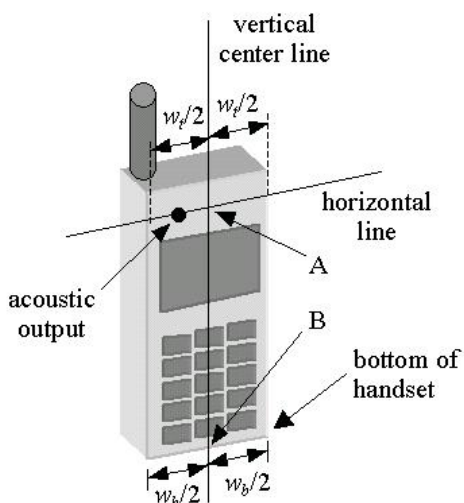


FIGURE 3.1a

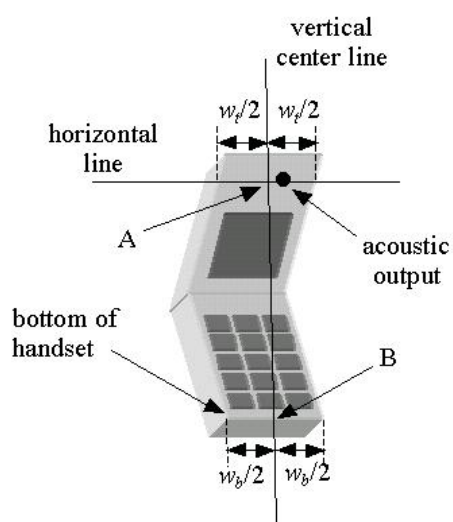
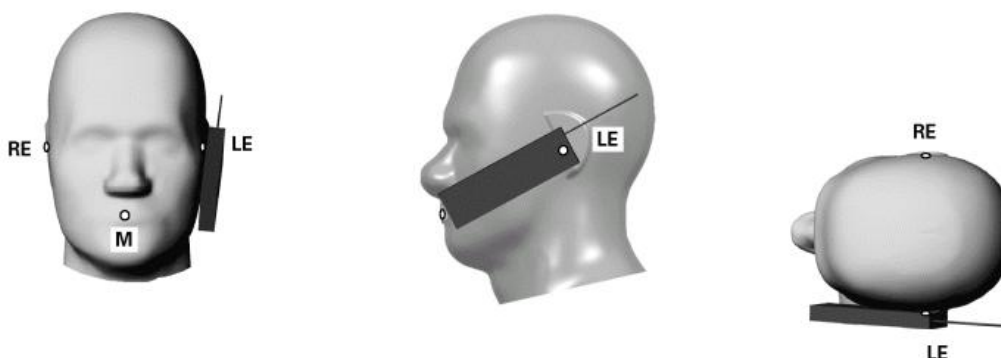


FIGURE 3.1b

3.1.1 TOUCH/CHEEK TEST POSITION

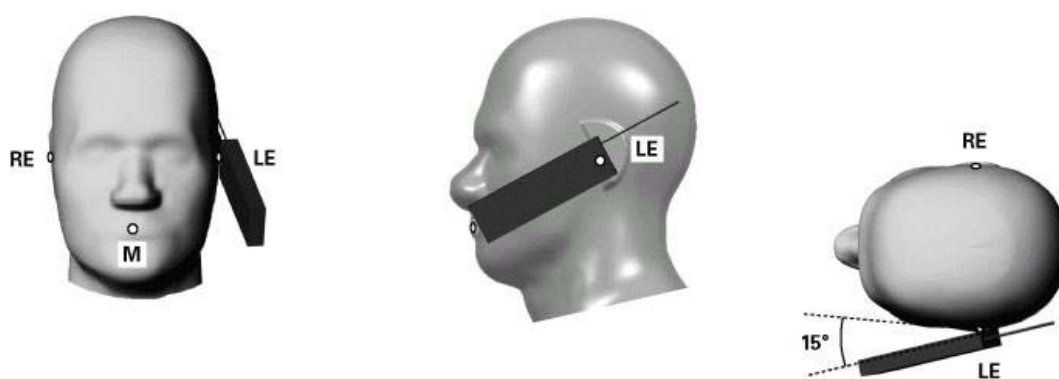
The head position in Figure 3.1, the ear reference points ERP are 15mm above entrance to ear canal along the B-M line. The line N-F (Neck-Front) is perpendicular to the B-M (Back Mouth) line. The handset device in Figure 3.1a and 3.1b, The vertical centerline pass through two points on the front side of handset: the midpoint of the width w_t of the handset at the level of the acoustic output (point A) and the midpoint of the width w_b of the bottom of the handset (point B). The vertical centerline is perpendicular to the horizontal line and pass through the center of the acoustic output. The point A touches the ERP and the vertical centerline of the handset is parallel to the B-M line. While maintaining the point A contact with the ear(ERP), rotate the handset about the line NF until any point on handset is in contact with the cheek of the phantom



TOUCH/CHEEK POSITION FIGURE

3.1.2 TILT TEST POSITION

Adjust the device in the cheek position. While maintaining a point of the handset contact in the ear, move the bottom of the handset away from the mouth by an angle of 15 degrees.



TILT POSITION FIGURE

3.1.3 BODY-WORN CONFIGURATION

The handset device attached the belt clip or the holster. The keypad face of the handset is against with the bottom of the flat phantom face and the bottom of the keypad face contact to the bottom of the flat phantom.

When multiple accessories that do not contain metallic components are supplied with the device, the device may be tested with only the accessory that dictates the closest spacing to the body. When multiple accessories that contain metallic components are supplied with the device, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (e.g., the same metallic belt-clip used with different holsters with no other metallic components), only accessory that dictates the closest spacing to the body must be tested.

If the device supports WiFi hotspot function, the body SAR will test under 1 cm for the surfaces/slide edges where a transmitting antenna is within 2.5 cm from the edge.

4. RECIPES FOR TISSUE SIMULATING LIQUIDS

For the measurement of the field distribution inside the SAM phantom, the phantom must be filled with 25 liters of tissue simulation liquid.

The following ingredients are used :

- **WATER-** Deionized water (pure H₂O), resistivity ≥ 16 M - as basis for the liquid
- **SUGAR-** Refined sugar in crystals, as available in food shops - to reduce relative permittivity
- **SALT-** Pure NaCl - to increase conductivity
- **CELLULOSE-** Hydroxyethyl-cellulose, medium viscosity (75-125 mPa.s, 2% in water, 20_C),
CAS # 54290 - to increase viscosity and to keep sugar in solution
- **PRESERVATIVE-** Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS # 55965-84-9 - to prevent the spread of bacteria and molds
- **DGMBE-** Diethylenglycol-monobuthyl ether (DGMBE), Fluka Chemie GmbH, CAS # 112-34-5 - to reduce relative permittivity

THE RECIPES FOR 750MHZ SIMULATING LIQUID TABLE

INGREDIENT	HEADSIMULATING LIQUID 700MHz (HSL-700)	BODY SIMULATING LIQUID 700MHz (MSL-700)
Water	41%	52%
Sugar	57%	47%
Cellulose	0.3%	0%
Salt	1.5%	0.9%
Preventol	0.2%	0.1%

THE RECIPES FOR 835MHz SIMULATING LIQUID TABLE

INGREDIENT	HEAD SIMULATING LIQUID 835MHz (HSL-835)	MUSCLE SIMULATING LIQUID 835MHz (MSL-835)
Water	40.28%	50.07%
Cellulose	2.41%	NA
Salt	1.38%	0.94%
Preventtol D-7	0.18%	0.09%
Sugar	57.97%	48.2%
Dielectric Parameters at 22°C	f = 835MHz $\epsilon = 41.5 \pm 5\%$ $\sigma = 0.9 \pm 5\%$ S/m	f = 835MHz $\epsilon = 55.2 \pm 5\%$ $\sigma = 0.97 \pm 5\%$ S/m

THE RECIPES FOR 1900MHz SIMULATING LIQUID TABLE

INGREDIENT	HEAD SIMULATING LIQUID 1900MHz (HSL-1900)	MUSCLE SIMULATING LIQUID 1900MHz (MSL-1900)
Water	55.24%	70.16%
DGMBE	44.45%	29.44%
Salt	0.306%	00.39%
Dielectric Parameters at 22°C	f= 1900MHz $\epsilon = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ S/m	f= 1900MHz $\epsilon = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\%$ S/m

Testing the liquids using the Agilent Network Analyzer E8358A and Agilent Dielectric Probe Kit 85070D. The testing procedure is following as

1. Turn Network Analyzer on and allow at least 30 min. warm up.
2. Mount dielectric probe kit so that interconnecting cable to Network Analyzer will not be moved during measurements or calibration.
3. Pour de-ionized water and measure water temperature ($\pm 1^\circ$).
4. Set water temperature in Agilent-Software (Calibration Setup).
5. Perform calibration.
6. Validate calibration with dielectric material of known properties (e.g. polished ceramic slab with >8mm thickness $\epsilon' = 10.0$, $\epsilon'' = 0.0$). If measured parameters do not fit within tolerance, repeat calibration (± 0.2 for ϵ' : ± 0.1 for ϵ'').
7. Conductivity can be calculated from ϵ'' by $\sigma = \omega \epsilon_0 \epsilon'' = \epsilon'' f [\text{GHz}] / 18$.
8. Measure liquid shortly after calibration. Repeat calibration every hour.
9. Stir the liquid to be measured. Take a sample (~50ml) with a syringe from the center of

the liquid container.

10. Pour the liquid into a small glass flask. Hold the syringe at the bottom of the flask to avoid air bubbles.
11. Put the dielectric probe in the glass flask. Check that there are no air bubbles in front of the opening in the dielectric probe kit.
12. Perform measurements.
13. Adjust medium parameters in DAS4/5 for the frequencies necessary for the measurements ('Setup Config', select medium (e.g. Brain 900 MHz) and press 'Option'-button.

Select the current medium for the frequency of the validation (e.g. Setup Medium Brain 900 MHz).

FOR SIMULATING LIQUID

Frequency (MHz)	Liquid Type	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (ϵ_r)	Date
835	Head	21.5	0.87	40.24	Jul. 22, 2011
835	Body	21.5	0.94	54.48	Jul. 22, 2011
1900	Head	21.4	1.35	38.29	Jul. 22, 2011
1900	Body	21.2	1.50	51.94	Jul. 22, 2011

5. SYSTEM VALIDATION

The system validation was performed in the flat phantom with equipment listed in the following table. Since the SAR value is calculated from the measured electric field, dielectric constant and conductivity of the body tissue and the SAR is proportional to the square of the electric field. So, the SAR value will be also proportional to the RF power input to the system validation dipole under the same test environment. In our system validation test, 250mW RF input power was used.

5.1 TEST PROCEDURE

Before you start the system performance check, need only to tell the system with which components (probe, medium, and device) are performing the system performance check; the system will take care of all parameters. The dipole must be placed beneath the flat phantom section of the SAM Twin Phantom with the correct distance holder in place. The distance holder should touch the phantom surface with a light pressure at the reference marking (little cross) and be oriented parallel to the long side of the phantom. Accurate positioning is not necessary, since the system will search for the peak SAR location, except that the dipole arms should be parallel to the surface. The device holder for the EUT can be left in place but should be rotated away from the dipole.

1.The "Power Reference Measurement" and "Power Drift Measurement" jobs 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 amplifier output power. If it is too high (above ± 0.1 dB), the system performance check should be repeated; some amplifiers have very high drift during warm-up. A stable amplifier gives drift results in the DASY system below ± 0.02 dB.

2.The "Surface Check" job tests the optical surface detection system of the DASY system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1 mm). In that case it is better to abort the system performance check and stir the liquid.

3. The "Area Scan" job measures the SAR above the dipole on a plane parallel to the surface. It is used to locate the approximate location of the peak SAR. The proposed scan uses large grid spacing for faster measurement; due to the symmetric field, the peak detection is reliable. If a finer graphic is desired, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result.

4. The "Zoom Scan" job measures the field in a volume around the peak SAR value assessed in the previous "Area Scan" job (for more information see the application note on SAR evaluation).

About the validation dipole positioning uncertainty, the constant and low loss dielectric spacer is used to establish the correct distance between the top surface of the dipole and the bottom surface of the phantom, the error component introduced by the uncertainty of the distance between the liquid (i.e., phantom shell) and the validation dipole in the DASY4/DASY5 system is less than $\pm 0.1\text{mm}$.

$$SAR_{tolerance} [\%] = 100 \times \left(\frac{(a + d)^2}{a^2} - 1 \right)$$

As the closest distance is 10mm, the resulting tolerance $SAR_{tolerance}[\%]$ is $<2\%$.

5.2 VALIDATION RESULTS

Date	Frequency (MHz)	Targeted SAR (W/kg)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
Jul. 22, 2011	835	9.65	2.27	9.08	-5.9
Jul. 22, 2011	835	10.10	2.41	9.64	-4.6
Jul. 22, 2011	1900	40.90	10.00	40.00	-2.2
Jul. 22, 2011	1900	40.90	10.30	41.20	0.7

NOTE:

1. Comparing to the original SAR value provided by SPEAG, the validation data should be within its specification of 10 %. Above table shows the target SAR and measured SAR after normalized to 1W input power.
2. Please see Appendix for the photo of system validation test.

5.3 SYSTEM VALIDATION UNCERTAINTIES

In the table below, the system validation uncertainty with respect to the analytically assessed SAR value of a dipole source as given in the IEEE 1528 standard is given. This uncertainty is smaller than the expected uncertainty for mobile phone measurements due to the simplified setup and the symmetric field distribution.

Error Description	Tolerance (±%)	Probability Distribution	Divisor	(C _i)		Standard Uncertainty (±%)		(v _i)
				(1g)	(10g)	(1g)	(10g)	
Measurement System								
Probe Calibration	5.50	Normal	1	1	1	5.50	5.50	∞
Axial Isotropy	0.25	Rectangular	√3	0.7	0.7	0.10	0.10	∞
Hemispherical Isotropy	1.30	Rectangular	√3	0.7	0.7	0.53	0.53	∞
Boundary effects	1.00	Rectangular	√3	1	1	0.58	0.58	∞
Linearity	0.30	Rectangular	√3	1	1	0.17	0.17	∞
System Detection Limits	1.00	Rectangular	√3	1	1	0.58	0.58	∞
Readout Electronics	0.30	Normal	1	1	1	0.30	0.30	∞
Response Time	0.80	Rectangular	√3	1	1	0.46	0.46	∞
Integration Time	2.60	Rectangular	√3	1	1	1.50	1.50	∞
RF Ambient Noise	3.00	Rectangular	√3	1	1	1.73	1.73	9
RF Ambient Reflections	3.00	Rectangular	√3	1	1	1.73	1.73	9
Probe Positioner	0.40	Rectangular	√3	1	1	0.23	0.23	∞
Probe Positioning	2.90	Rectangular	√3	1	1	1.67	1.67	∞
Max. SAR Eval.	1.00	Rectangular	√3	1	1	0.58	0.58	∞
Test sample related								
Sample positioning	1.90	Normal	1	1	1	1.90	1.90	4
Device holder uncertainty	2.80	Normal	1	1	1	2.80	2.80	4
Output power variation-SAR drift measurement	4.50	Rectangular	√3	1	1	2.60	2.60	1
Dipole Related								
Dipole Axis to Liquid Distance	1.60	Rectangular	√3	1	1	0.92	0.92	4
Input Power Drift	4.30	Rectangular	√3	1	1	2.48	2.48	1
Phantom and Tissue parameters								
Phantom Uncertainty	4.00	Rectangular	√3	1	1	2.31	2.31	∞
Liquid Conductivity (target)	5.00	Rectangular	√3	0.64	0.43	1.85	1.24	∞
Liquid Conductivity (measurement)	4.12	Normal	1	0.64	0.43	2.64	1.77	9
Liquid Permittivity (target)	5.00	Rectangular	√3	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	4.32	Normal	1	0.6	0.49	2.59	2.12	9
Combined Standard Uncertainty						9.68	9.20	
Coverage Factor for 95%						Kp=2		
Expanded Uncertainty (K=2)						19.35	18.41	

6. TEST RESULTS

6.1 TEST PROCEDURES

The EUT makes a phone call to the communication simulator station. Establish the simulation communication configuration rather the actual communication. Then the EUT could continuous the transmission mode. Adjust the PCL of the base station could controlled the EUT to transmitted the maximum output power. The base station also could control the transmission channel. The SAR value was calculated via the 3D spline interpolation algorithm that has been implemented in the software of DASY4/5 SAR measurement system manufactured and calibrated by SPEAG. According to the IEEE 1528, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- Power reference measurement
- Verification of the power reference measurement
- Area scan
- Zoom scan
- Power reference measurement



A D T

In the zoom scan, the distance between the measurement point at the probe sensor location (geometric center behind the probe tip) and the phantom surface is 2.0 mm and maintained at a constant distance of ± 1.0 mm during a zoom scan to determine peak SAR locations. The distance is 2mm between the first measurement point and the bottom surface of the phantom.

The measurement time is 0.5 s at each point of the zoom scan. The probe boundary effect compensation shall be applied during the SAR test. Because of the tip of the probe to the Phantom surface separated distances are longer than half a tip probe diameter.

In the area scan, the separation distance is 2mm between the each measurement point and the phantom surface. The scan size shall be included the transmission portion of the EUT. The measurement time is the same as the zoom scan. At last the reference power drift shall be less than $\pm 5\%$.

6.2 MEASURED CONDUCTED POWER OF DUT

Band	GSM1900		
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
GSM	29.1	29.5	29.3
GPRS 8	29.1	29.5	29.3

Band	WCDMA Band V		
Channel	4132	4182	4233
Frequency (MHz)	826.4	836.4	846.6
RMC 12.2K	23.4	23.7	23.4
HSDPA	21.2	21.7	21.2
HSUPA	23.3	23.3	23.0

Band	802.11b			802.11g		
Channel	1	6	11	1	6	11
Frequency (MHz)	2412	2437	2462	2412	2437	2462
Peak Power (dBm)	12.40	12.60	12.90	11.38	11.60	11.66

Band	802.11n (BW 20MHz)			-		
Channel	1	6	11	-	-	-
Frequency (MHz)	2412	2437	2462	-	-	-
Peak Power (dBm)	11.30	11.10	11.40	-	-	-

6.3 MEASURED SAR RESULTS

<Head SAR>

Stand-alone SAR _{1g} (W/kg)				
HEAD	RIGHT		LEFT	
Position	CHEEK	TILT	CHEEK	TILT
WCDMA 850				
CH 4182	0.281	0.051	0.283	0.059
GSM 1900				
CH 661	0.561	0.079	0.546	0.341

<Body SAR: Body Worn Mode>

Stand-alone SAR _{1g} (W/kg)					
EUT to phantom	Body 10mm				
Position	Front	Back	-	-	-
WCDMA 850					
CH 4182	0.217	0.490	-	-	-
GPRS 1900					
CH 661	0.256	0.401	-	-	-

<Body SAR: Hotspot Mode>

Stand-alone SAR _{1g} (W/kg)					
EUT to phantom	Body 10mm				
Position	Front	Back	Right Edge	Left Edge	Top Edge
WCDMA 850					
CH 4182	0.217	0.49	0.241	0.218	0.066
GPRS 1900					
CH 661	0.256	0.401	0.072	0.142	0.247



6.4 SIMULTANEOUS TRANSMISSION EVALUATION

Summary:

According to KDB 648474, the WLAN/BT standalone SAR and simultaneous transmission SAR for WWAN and WLAN/BT were not required, because the closest separation distance (10.5 cm) between WWAN and WLAN/BT antennas are larger than 5 cm and WLAN/BT power is less than $2P_{\text{Ref}}$. The WLAN and BT cannot transmit simultaneously, so there is no co-location test requirement for WLAN and BT. The RFID standalone SAR and simultaneous transmission SAR for WWAN and RFID were not required, because the closest separation distance between WWAN and RFID antennas are 2.5 cm and RFID power is less than P_{Ref} . Simultaneous transmission SAR for WLAN/BT and RFID was not required, because their power are less than $60/f$.



6.5 SAR LIMITS

HUMAN EXPOSURE	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / controlled Exposure Environment)
Spatial Average (whole body)	0.08	0.4
Spatial Peak (averaged over 1 g)	1.6	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

NOTE: This limits accord to 47 CFR 2.1093 – Safety Limit.



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7. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5.phtml. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab:

Tel: 886-3-3183232

Fax: 886-3-3185050

Email: service.adt@tw.bureauveritas.com

Web Site: www.adt.com.tw

The address and road map of all our labs can be found in our web site also.



香港商立德國際商品試驗有限公司桃園分公司

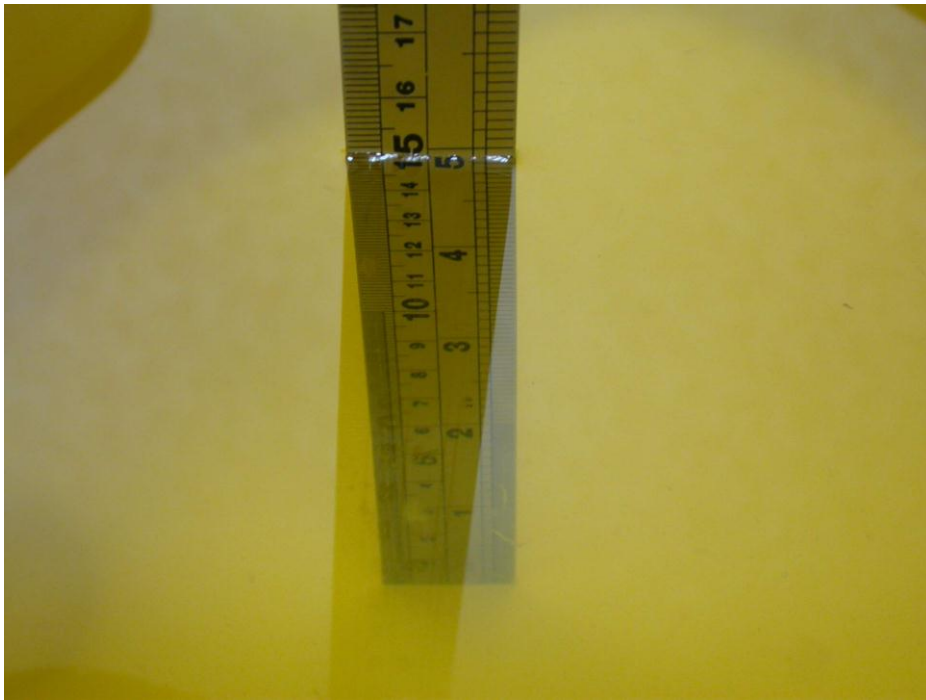
Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

Appendix A: TEST DATA

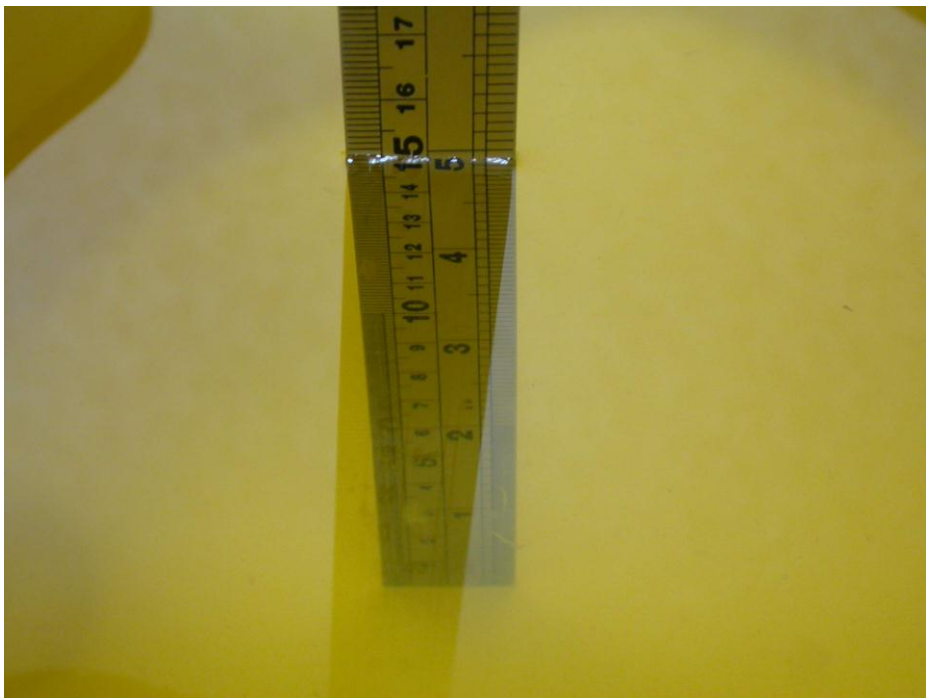
Product Name: Mobile Phone ; Type: F-04D

Liquid Level Photo

HSL835MHz D=151mm



MSL835MHz D=150mm





HSL1900MHz D=151mm



MSL1900MHz D=150mm



M01-Right Head-Cheek-WCDMA850-Ch4182

DUT: Mobile Phone ; Type: F-04D

Communication System: WCDMA ; Frequency: 836.4 MHz ; Duty Cycle: 1:1

Medium: HSL850 Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.94$ mho/m; $\epsilon_r = 40.23$; $\rho = 1000$ kg/m³

Phantom section: Right Section ; DUT test position : Cheek ; Modulation type: BPSK

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.06, 9.06, 9.06); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Right-Hand-Side HSL/Touch Position - Mid/Area Scan (7x17x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.339 mW/g

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

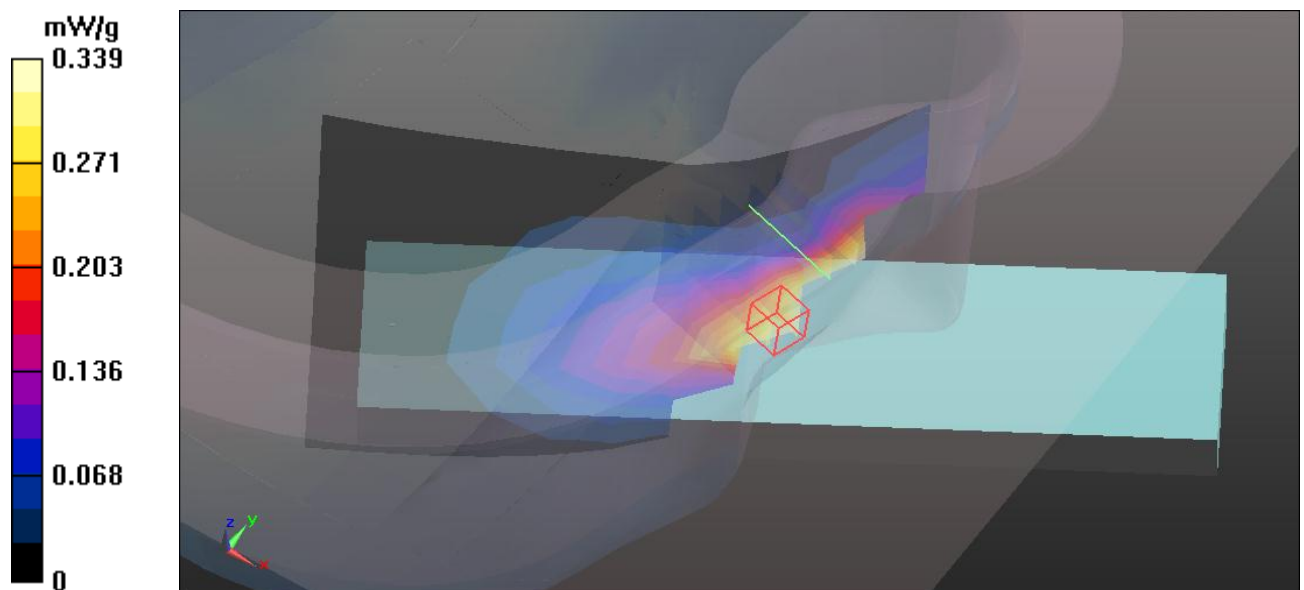
grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 2.832 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 0.460 W/kg

SAR(1 g) = 0.281 mW/g; SAR(10 g) = n.a.

Maximum value of SAR (measured) = 0.373 mW/g



M02-Right Head-Tilt-WCDMA850-Ch4182

DUT: Mobile Phone ; Type: F-04D

Communication System: WCDMA ; Frequency: 836.4 MHz ; Duty Cycle: 1:1

Medium: HSL850 Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.94$ mho/m; $\epsilon_r = 40.23$; $\rho = 1000$ kg/m³

Phantom section: Right Section ; DUT test position : Tilt ; Modulation type: BPSK

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.06, 9.06, 9.06); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Right-Hand-Side HSL/Tilt Position - Mid/Area Scan (7x17x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.056 mW/g

Right-Hand-Side HSL/Tilt Position - Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 4.121 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.064 W/kg

SAR(1 g) = 0.051 mW/g; SAR(10 g) = 0.040 mW/g

Maximum value of SAR (measured) = 0.058 mW/g

Right-Hand-Side HSL/Tilt Position - Mid/Zoom Scan (5x5x7)/Cube 1: Measurement grid:

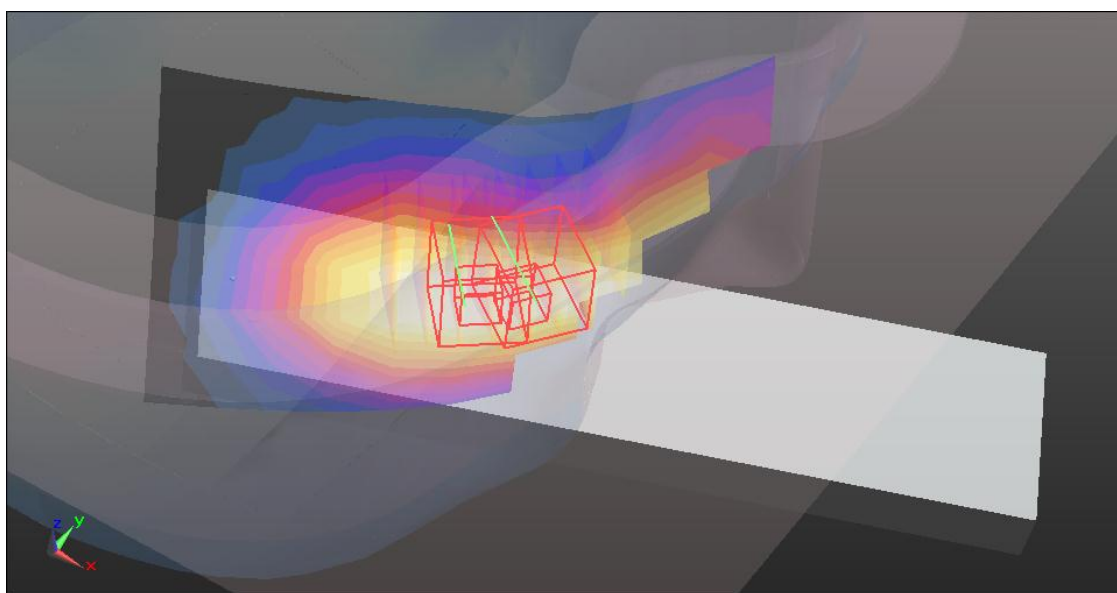
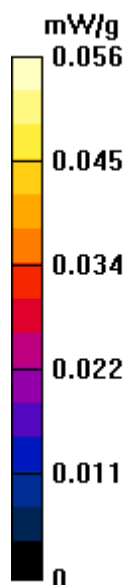
$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 4.121 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.062 W/kg

SAR(1 g) = 0.050 mW/g; SAR(10 g) = 0.039 mW/g

Maximum value of SAR (measured) = 0.057 mW/g



M03-Left Head-Cheek-WCDMA850-Ch4182

DUT: Mobile Phone ; Type: F-04D

Communication System: WCDMA ; Frequency: 836.4 MHz ; Duty Cycle: 1:1

Medium: HSL850 Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.94$ mho/m; $\epsilon_r = 40.23$; $\rho = 1000$ kg/m³

Phantom section: Left Section ; DUT test position : Cheek ; Modulation type: BPSK

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.06, 9.06, 9.06); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Right-Hand-Side HSL/Touch Position - Mid/Area Scan (7x17x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.331 mW/g

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

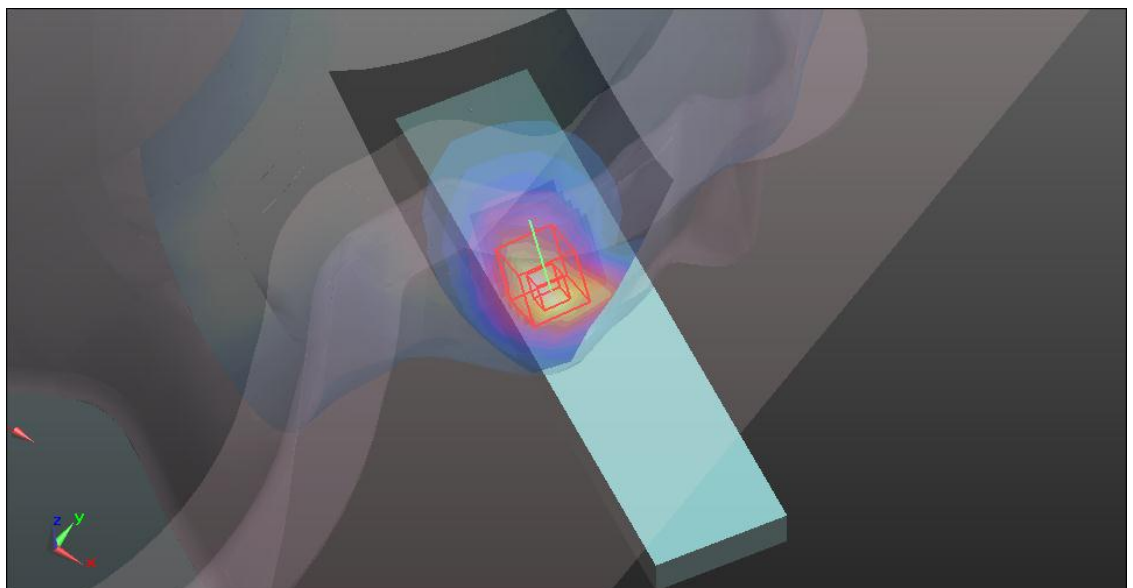
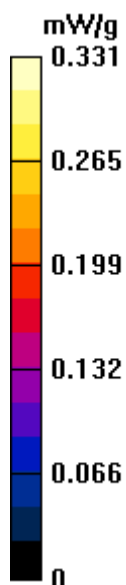
grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 3.235 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 0.418 W/kg

SAR(1 g) = 0.283 mW/g; SAR(10 g) = 0.185 mW/g

Maximum value of SAR (measured) = 0.356 mW/g



M04-Left Head-Tilt-WCDMA850-Ch4182

DUT: Mobile Phone ; Type: F-04D

Communication System: WCDMA ; Frequency: 836.4 MHz ; Duty Cycle: 1:1

Medium: HSL850 Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.94$ mho/m; $\epsilon_r = 40.23$; $\rho = 1000$ kg/m³

Phantom section: Left Section ; DUT test position : Tilt ; Modulation type: BPSK

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.06, 9.06, 9.06); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Right-Hand-Side HSL/Tilt Position - Mid/Area Scan (7x17x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.067 mW/g

Right-Hand-Side HSL/Tilt Position - Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

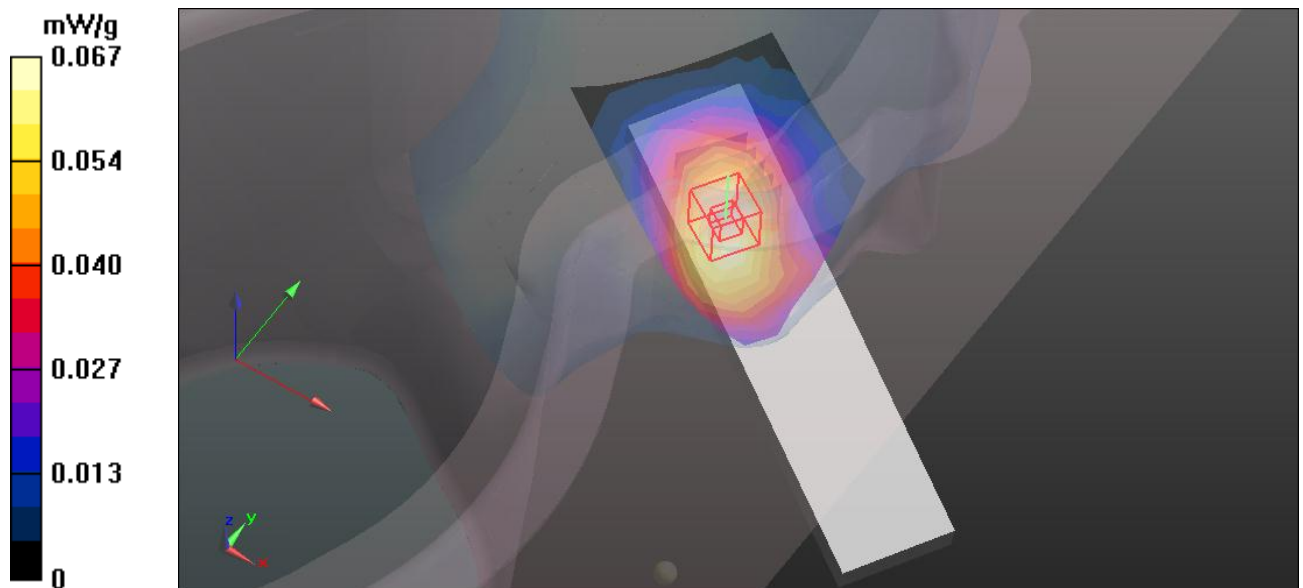
$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 4.358 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.074 W/kg

SAR(1 g) = 0.059 mW/g; SAR(10 g) = 0.046 mW/g

Maximum value of SAR (measured) = 0.068 mW/g



M05-Body-Front-WCDMA850-Ch4182

DUT: Mobile Phone ; Type: F-04D

Communication System: WCDMA ; Frequency: 836.4 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL850 Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 54.47$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; Separation distance : 10 mm (The front face side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.07, 9.07, 9.07); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Flat-Section MSL/Flat Section 10mm Mid/Area Scan (6x11x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.237 mW/g

Flat-Section MSL/Flat Section 10mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

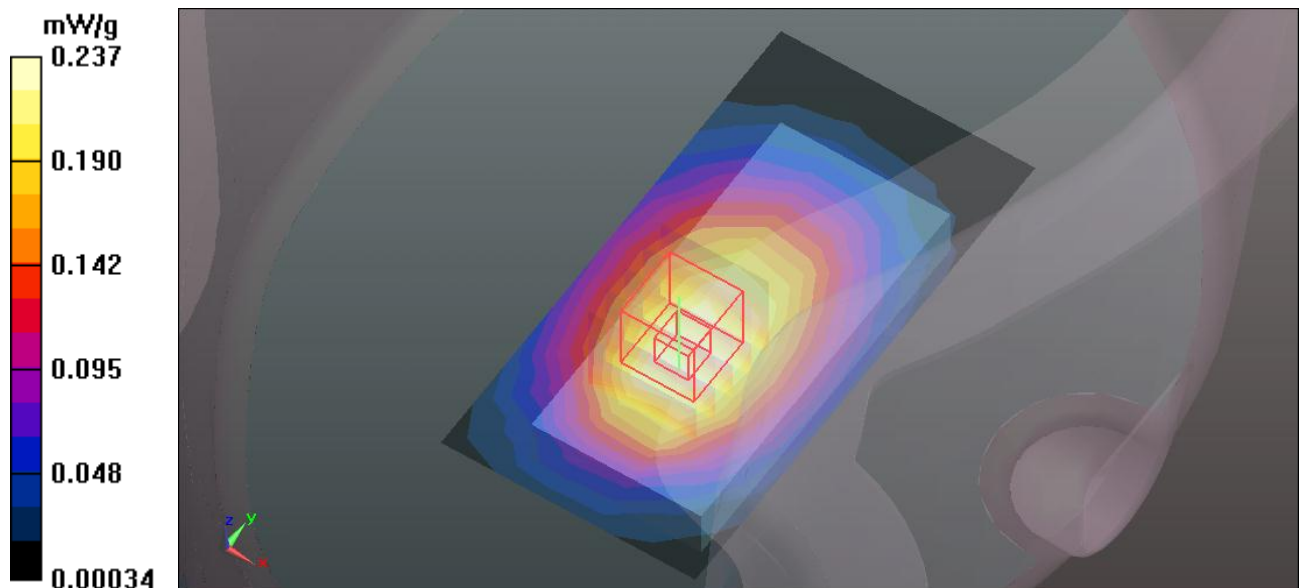
$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 15.119 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.292 W/kg

SAR(1 g) = 0.217 mW/g; SAR(10 g) = 0.156 mW/g

Maximum value of SAR (measured) = 0.260 mW/g



M06-Body-Back-WCDMA850-Ch4182

DUT: Mobile Phone ; Type: F-04D

Communication System: WCDMA ; Frequency: 836.4 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL850 Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 54.47$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; Separation distance : 10 mm (The back face side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.07, 9.07, 9.07); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Flat-Section MSL/Flat Section 10mm Mid/Area Scan (6x11x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.587 mW/g

Flat-Section MSL/Flat Section 10mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

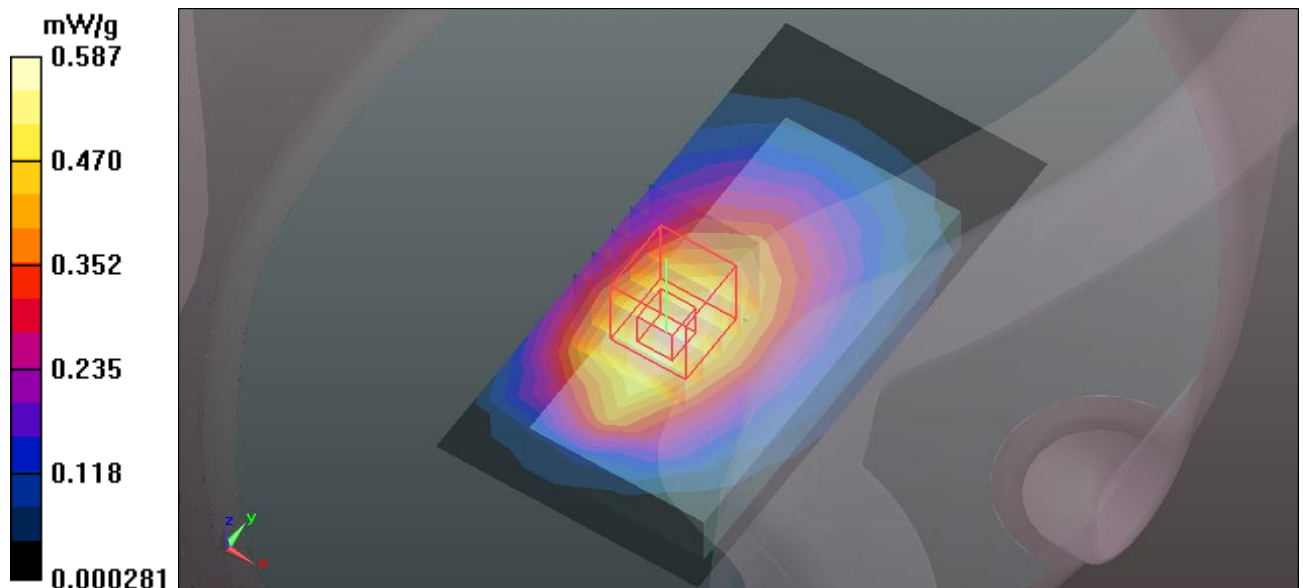
$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 21.649 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.684 W/kg

SAR(1 g) = 0.490 mW/g; SAR(10 g) = 0.344 mW/g

Maximum value of SAR (measured) = 0.594 mW/g



M07-Body-Right-WCDMA850-Ch4182

DUT: Mobile Phone ; Type: F-04D

Communication System: WCDMA ; Frequency: 836.4 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL850 Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 54.47$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; Separation distance : 10 mm (The right side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.07, 9.07, 9.07); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Flat-Section MSL/Flat Section 10mm Mid/Area Scan (6x11x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.298 mW/g

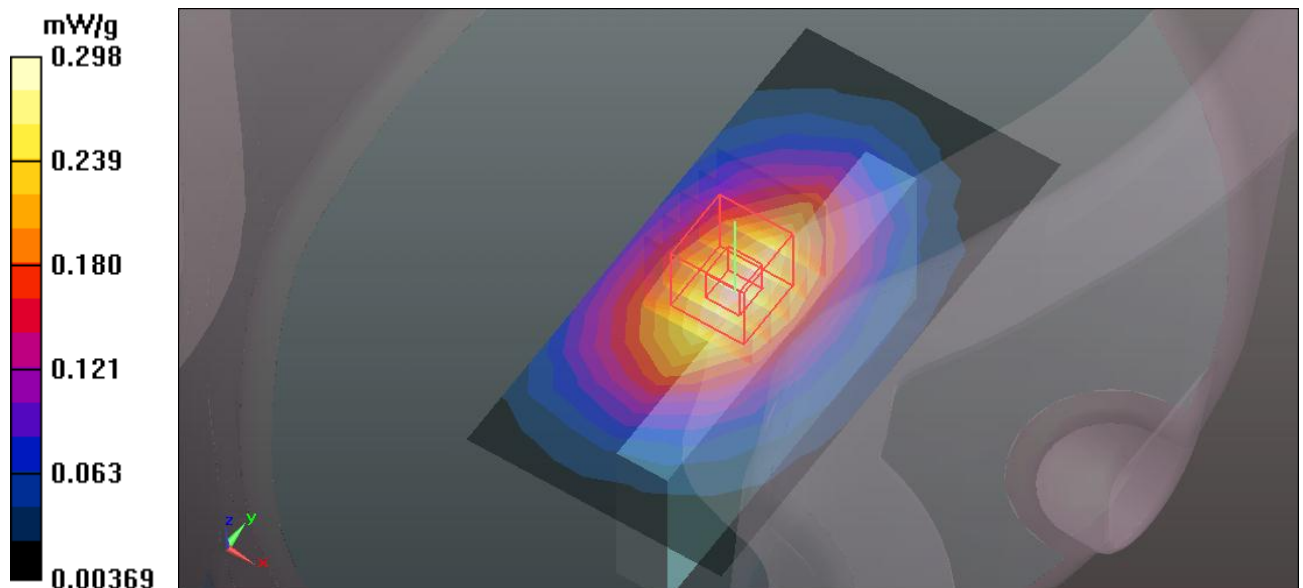
Flat-Section MSL/Flat Section 10mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 16.994 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.345 W/kg

SAR(1 g) = 0.241 mW/g; SAR(10 g) = 0.166 mW/g



M08-Body-Left-WCDMA850-Ch4182

DUT: Mobile Phone ; Type: F-04D

Communication System: WCDMA ; Frequency: 836.4 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL850 Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 54.47$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; Separation distance : 10 mm (The left side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.07, 9.07, 9.07); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Flat-Section MSL/Flat Section 10mm Mid/Area Scan (6x11x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.271 mW/g

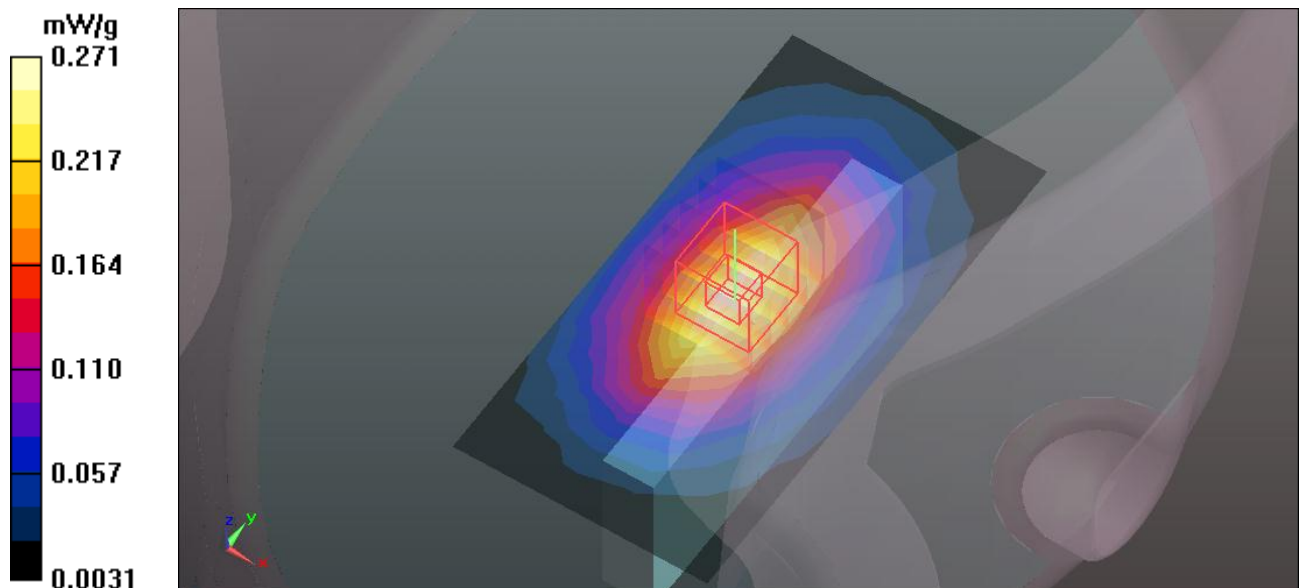
Flat-Section MSL/Flat Section 10mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 16.615 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.315 W/kg

SAR(1 g) = 0.218 mW/g; SAR(10 g) = 0.148 mW/g



M10-Body-Top-WCDMA850-Ch4182

DUT: Mobile Phone ; Type: F-04D

Communication System: WCDMA ; Frequency: 836.4 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL850 Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 54.47$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; Separation distance : 10 mm (The top side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.07, 9.07, 9.07); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Flat-Section MSL/Flat Section 10mm Mid/Area Scan (5x9x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.064 mW/g

Flat-Section MSL/Flat Section 10mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

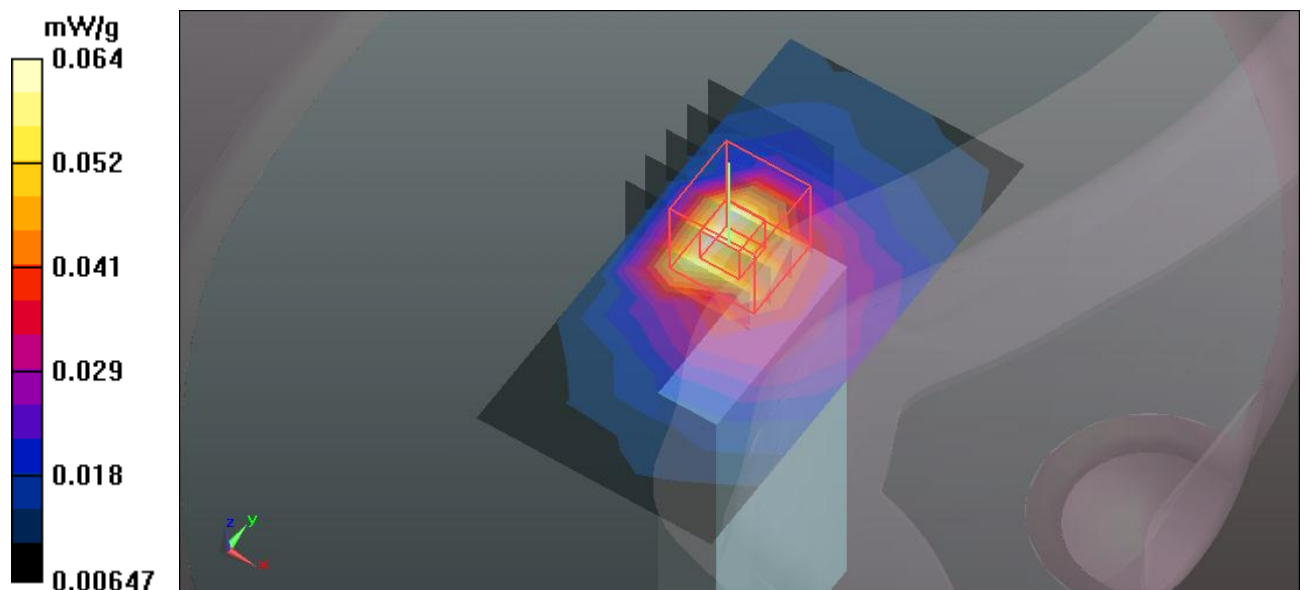
$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 6.818 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 0.154 W/kg

SAR(1 g) = 0.066 mW/g; SAR(10 g) = 0.033 mW/g

Maximum value of SAR (measured) = 0.108 mW/g



M10-Right Head-Cheek-GSM1900-Ch661

DUT: Mobile Phone ; Type: F-04D

Communication System: Generic GSM ; Frequency: 1880 MHz ; Duty Cycle: 1:8.30042

Medium: HSL1900 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.34 \text{ mho/m}$; $\epsilon_r = 38.35$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section ; DUT test position : Cheek ; Modulation type: GMSK

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.90, 7.90, 7.90); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Right-Hand-Side HSL/Touch Position - Mid/Area Scan (7x17x1): Measurement grid:

$dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (measured) = 0.641 mW/g

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

grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 5.710 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 0.813 W/kg

SAR(1 g) = 0.561 mW/g; SAR(10 g) = 0.368 mW/g

Maximum value of SAR (measured) = 0.693 mW/g

Right-Hand-Side HSL/Touch Position - Mid/Zoom Scan (5x5x7)/Cube 1: Measurement

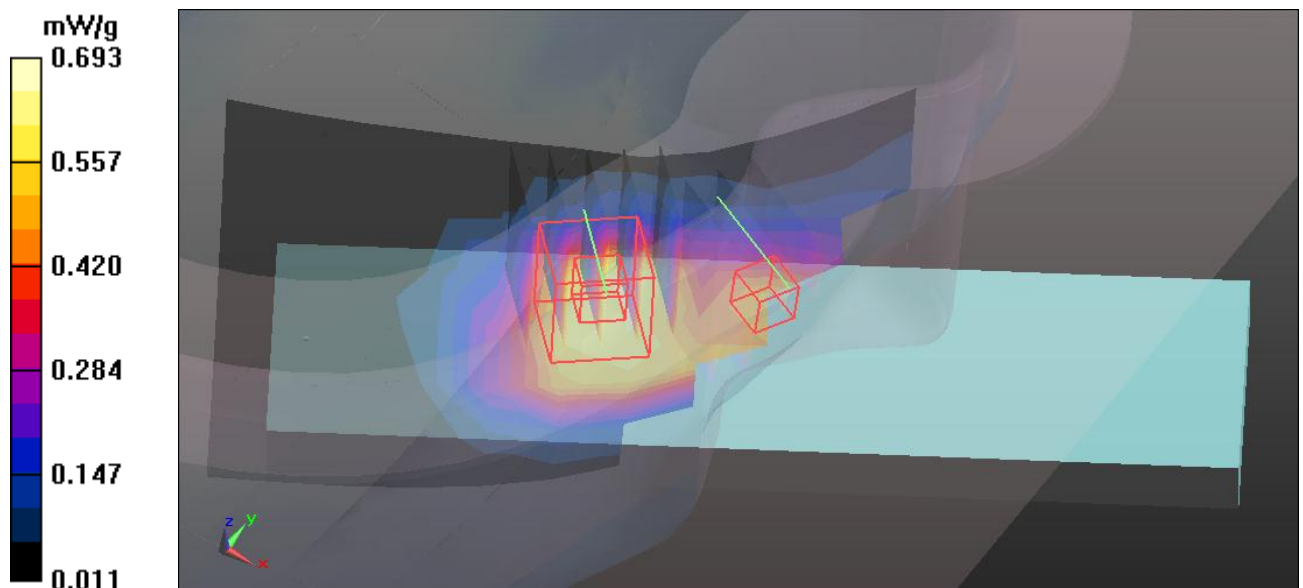
grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 5.710 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 0.720 W/kg

SAR(1 g) = 0.426 mW/g; SAR(10 g) = n.a.

Maximum value of SAR (measured) = 0.557 mW/g



M11-Right Head-Tilt-GSM1900-Ch661

DUT: Mobile Phone ; Type: F-04D

Communication System: Generic GSM ; Frequency: 1880 MHz ; Duty Cycle: 1:8.30042

Medium: HSL1900 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.34$ mho/m; $\epsilon_r = 38.35$; $\rho = 1000$ kg/m³

Phantom section: Right Section ; DUT test position : Tilt ; Modulation type: GMSK

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.90, 7.90, 7.90); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Right-Hand-Side HSL/Tilt Position - Mid/Area Scan (7x17x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.100 mW/g

Right-Hand-Side HSL/Tilt Position - Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

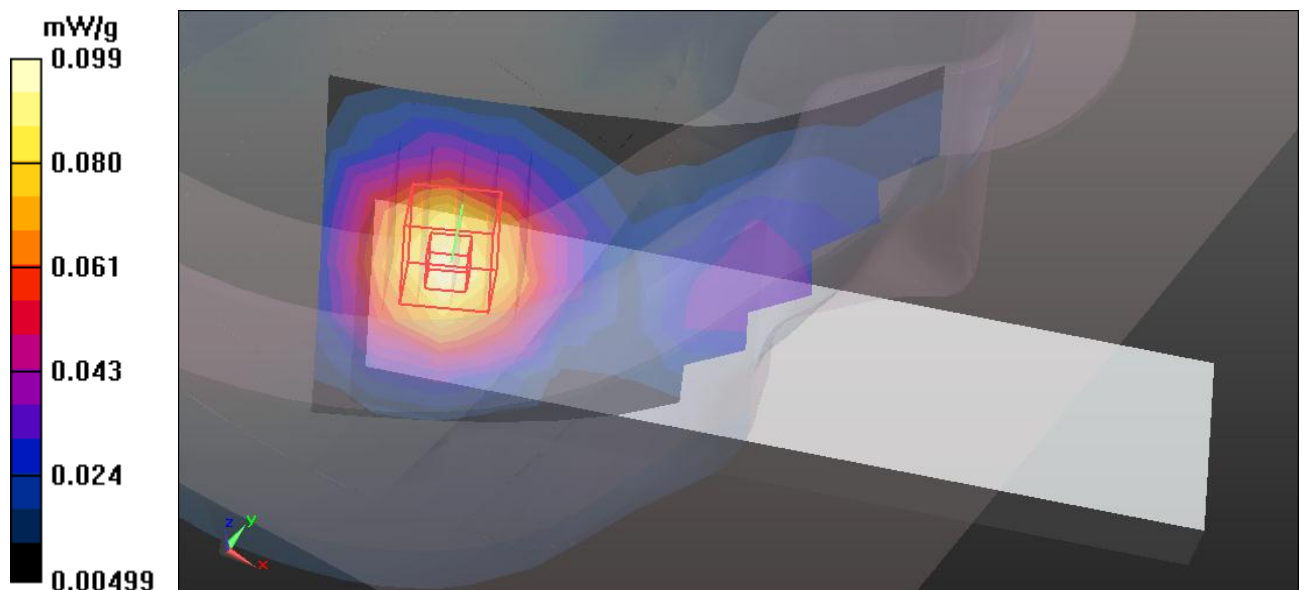
$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 7.875 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.115 W/kg

SAR(1 g) = 0.079 mW/g; SAR(10 g) = 0.052 mW/g

Maximum value of SAR (measured) = 0.099 mW/g



M12-Left Head-Cheek-GSM1900-Ch661

DUT: Mobile Phone ; Type: F-04D

Communication System: Generic GSM ; Frequency: 1880 MHz ; Duty Cycle: 1:8.30042

Medium: HSL1900 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.34$ mho/m; $\epsilon_r = 38.35$; $\rho = 1000$ kg/m³

Phantom section: Left Section ; DUT test position : Cheek ; Modulation type: GMSK

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.90, 7.90, 7.90); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Right-Hand-Side HSL/Touch Position - Mid/Area Scan (7x17x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.697 mW/g

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

grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 5.760 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.904 W/kg

SAR(1 g) = 0.546 mW/g; SAR(10 g) = 0.332 mW/g

Maximum value of SAR (measured) = 0.750 mW/g

Right-Hand-Side HSL/Touch Position - Mid/Zoom Scan (5x5x7)/Cube 1: Measurement

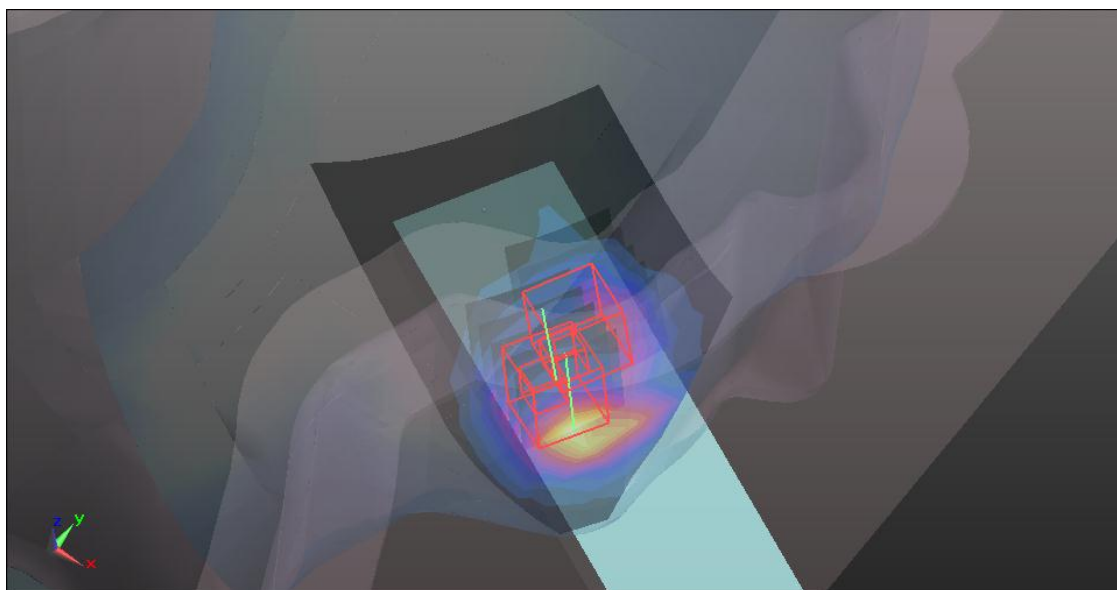
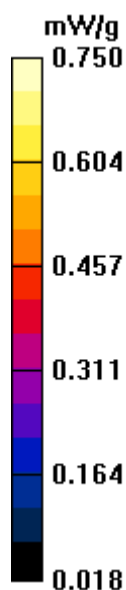
grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 5.760 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.696 W/kg

SAR(1 g) = 0.426 mW/g; SAR(10 g) = 0.268 mW/g

Maximum value of SAR (measured) = 0.601 mW/g



M13-Left Head-Tilt-GSM1900-Ch661

DUT: Mobile Phone ; Type: F-04D

Communication System: Generic GSM ; Frequency: 1880 MHz ; Duty Cycle: 1:8.30042

Medium: HSL1900 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.34$ mho/m; $\epsilon_r = 38.35$; $\rho = 1000$ kg/m³

Phantom section: Left Section ; DUT test position : Tilt ; Modulation type: GMSK

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.90, 7.90, 7.90); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Right-Hand-Side HSL/Tilt Position - Mid/Area Scan (7x17x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.435 mW/g

Right-Hand-Side HSL/Tilt Position - Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

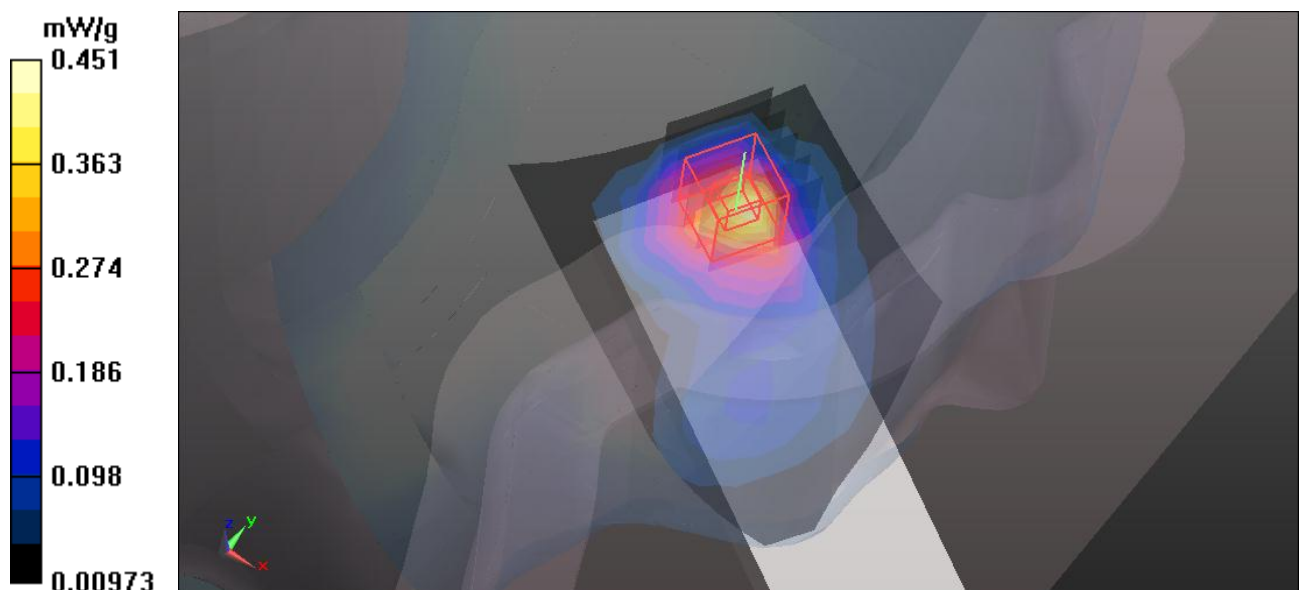
$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 14.093 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.550 W/kg

SAR(1 g) = 0.341 mW/g; SAR(10 g) = 0.196 mW/g

Maximum value of SAR (measured) = 0.451 mW/g



M14-Body-Front-GPRS1900-Ch661

DUT: Mobile Phone ; Type: F-04D

Communication System: Generic GSM ; Frequency: 1880 MHz ; Duty Cycle: 1:8.30042 ; Modulation type: GPRS

Medium: MSL1900 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.49$ mho/m; $\epsilon_r = 52.03$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; Separation distance : 10 mm (The front face side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.17, 7.17, 7.17); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Flat-Section MSL/Flat Section 10mm Mid TS1/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.333 mW/g

Flat-Section MSL/Flat Section 10mm Mid TS1/Zoom Scan (5x5x7)/Cube 0:

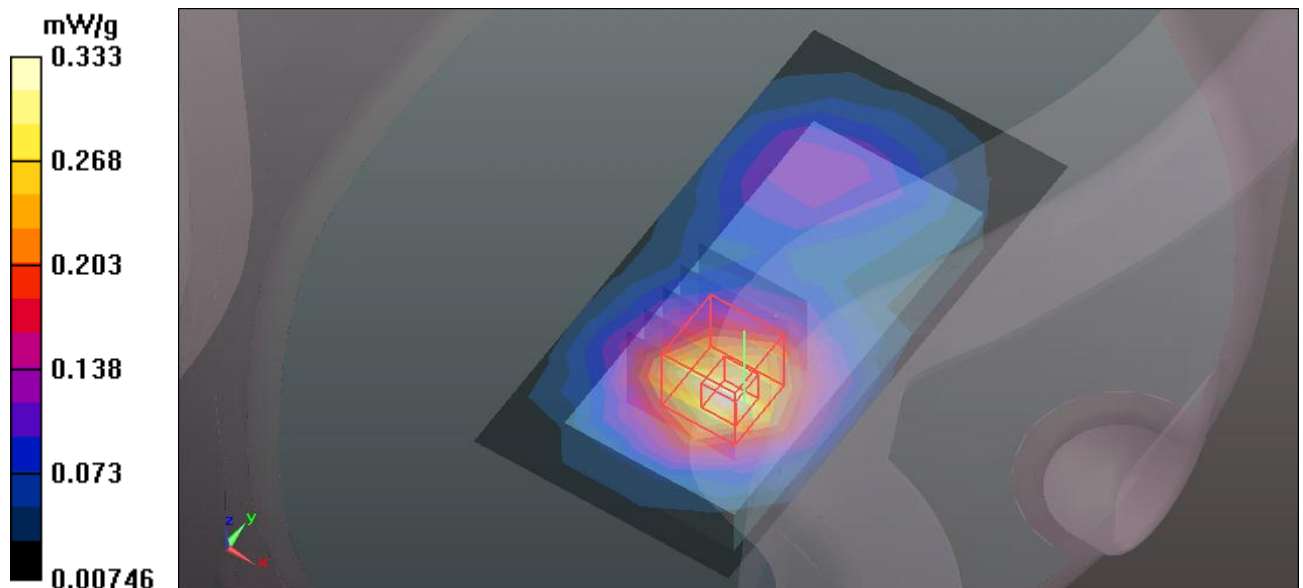
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 7.597 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 0.401 W/kg

SAR(1 g) = 0.256 mW/g; SAR(10 g) = 0.159 mW/g

Maximum value of SAR (measured) = 0.326 mW/g



M15-Body-Back-GPRS1900-Ch661

DUT: Mobile Phone ; Type: F-04D

Communication System: Generic GSM ; Frequency: 1880 MHz ; Duty Cycle: 1:8.30042 ; Modulation type: GPRS

Medium: MSL1900 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.49$ mho/m; $\epsilon_r = 52.03$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; Separation distance : 10 mm (The back face side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.17, 7.17, 7.17); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Flat-Section MSL/Flat Section 10mm Mid/Area Scan (6x11x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.453 mW/g

Flat-Section MSL/Flat Section 10mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

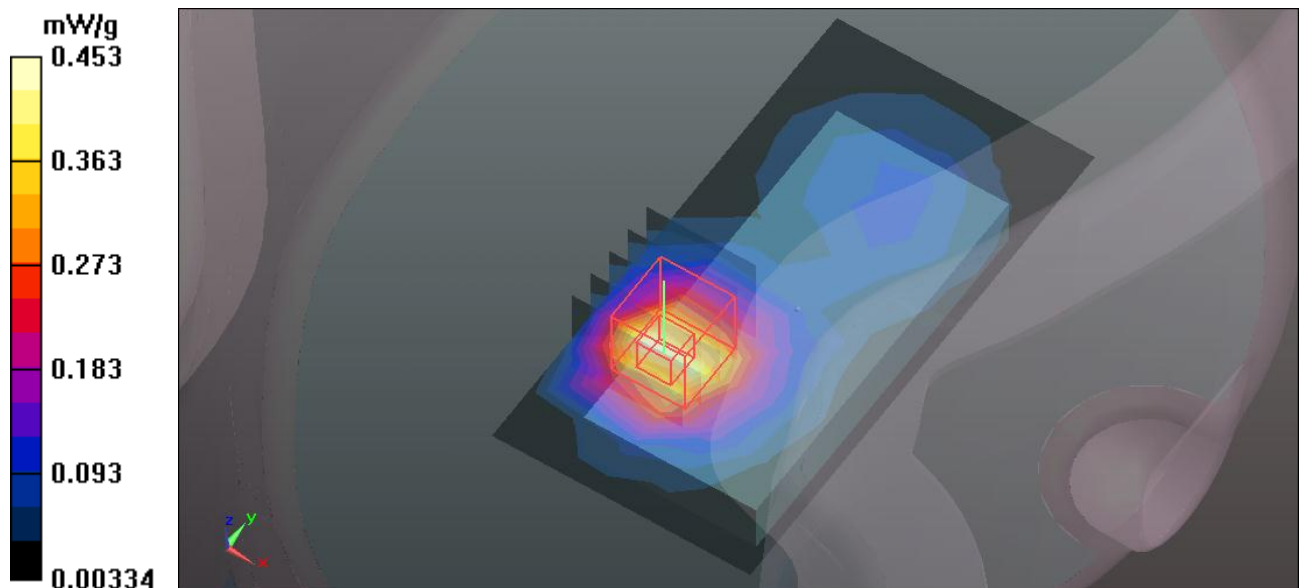
$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 6.143 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.653 W/kg

SAR(1 g) = 0.401 mW/g; SAR(10 g) = 0.228 mW/g

Maximum value of SAR (measured) = 0.538 mW/g



M16-Body-Right-GPRS1900-Ch661

DUT: Mobile Phone ; Type: F-04D

Communication System: Generic GSM ; Frequency: 1880 MHz ; Duty Cycle: 1:8.30042 ; Modulation type: GPRS

Medium: MSL1900 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.49$ mho/m; $\epsilon_r = 52.03$; $\rho = 1000$ kg/m³
Phantom section: Flat Section ; Separation distance : 10 mm (The right side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.17, 7.17, 7.17); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Flat-Section MSL/Flat Section 10mm Mid/Area Scan (6x11x1): Measurement grid:
dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.091 mW/g

Flat-Section MSL/Flat Section 10mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.962 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.110 W/kg

SAR(1 g) = 0.072 mW/g; SAR(10 g) = 0.045 mW/g

Maximum value of SAR (measured) = 0.093 mW/g

Flat-Section MSL/Flat Section 10mm Mid/Zoom Scan (5x5x7)/Cube 1: Measurement grid:

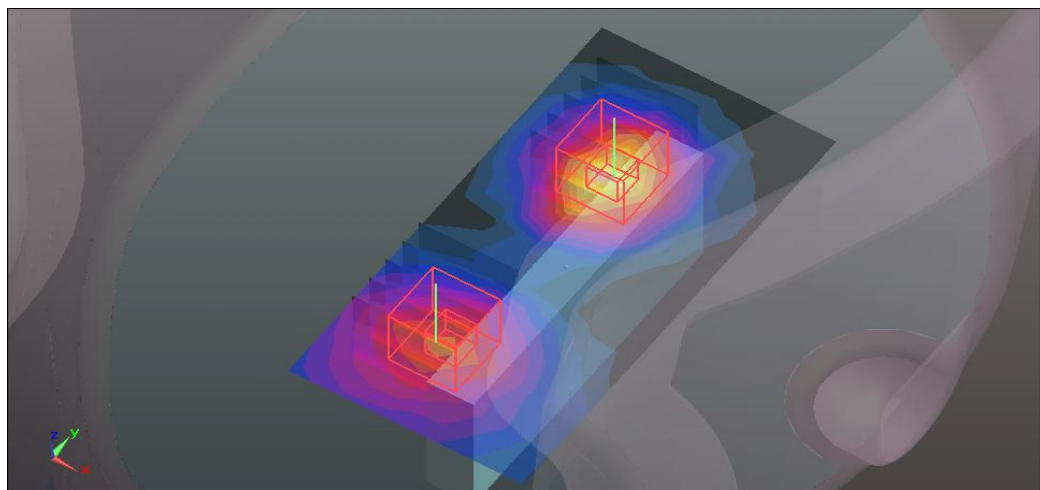
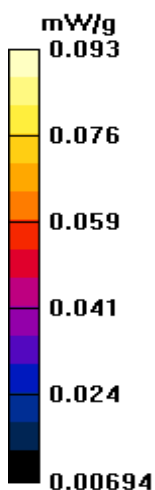
dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.962 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.074 W/kg

SAR(1 g) = 0.051 mW/g; SAR(10 g) = 0.034 mW/g

Maximum value of SAR (measured) = 0.063 mW/g



M17-Body-Left-GPRS1900-Ch661

DUT: Mobile Phone ; Type: F-04D

Communication System: Generic GSM ; Frequency: 1880 MHz ; Duty Cycle: 1:8.30042 ; Modulation type: GPRS

Medium: MSL1900 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.49$ mho/m; $\epsilon_r = 52.03$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; Separation distance : 10 mm (The left side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.17, 7.17, 7.17); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Flat-Section MSL/Flat Section 10mm Mid/Area Scan (6x11x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.189 mW/g

Flat-Section MSL/Flat Section 10mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

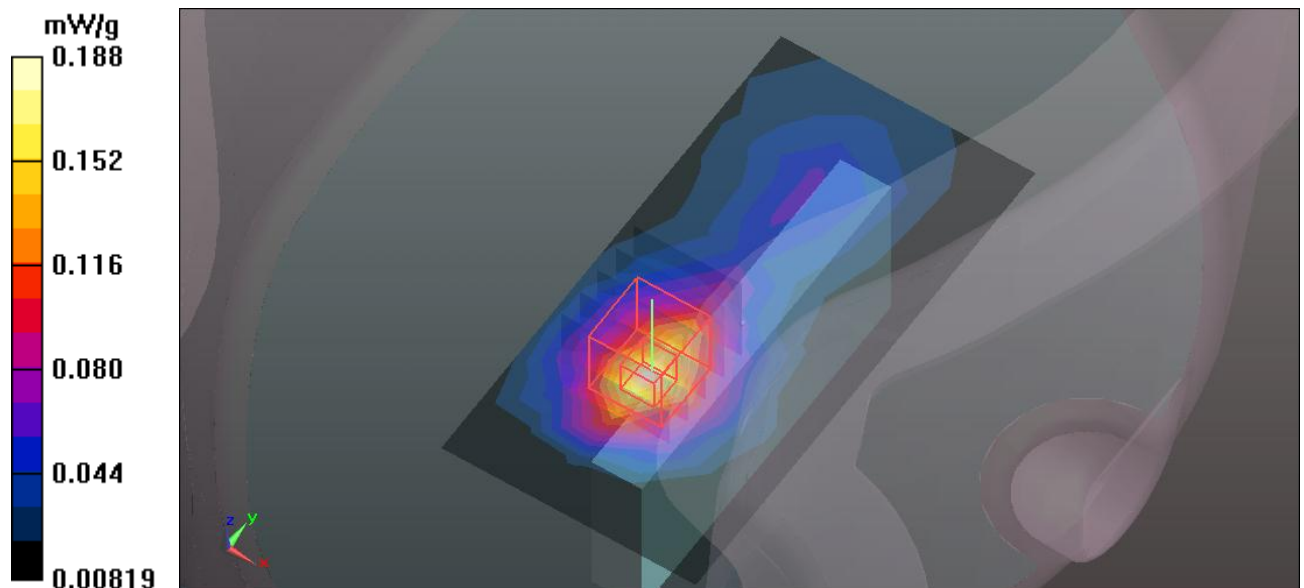
$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 6.278 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 0.229 W/kg

SAR(1 g) = 0.142 mW/g; SAR(10 g) = 0.085 mW/g

Maximum value of SAR (measured) = 0.188 mW/g



M18-Body-Top-GPRS1900-Ch661

DUT: Mobile Phone ; Type: F-04D

Communication System: Generic GSM ; Frequency: 1880 MHz ; Duty Cycle: 1:8.30042 ; Modulation type: GPRS

Medium: MSL1900 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.49$ mho/m; $\epsilon_r = 52.03$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; Separation distance : 10 mm (The top side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.17, 7.17, 7.17); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Flat-Section MSL/Flat Section 10mm Mid/Area Scan (6x8x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.313 mW/g

Flat-Section MSL/Flat Section 10mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

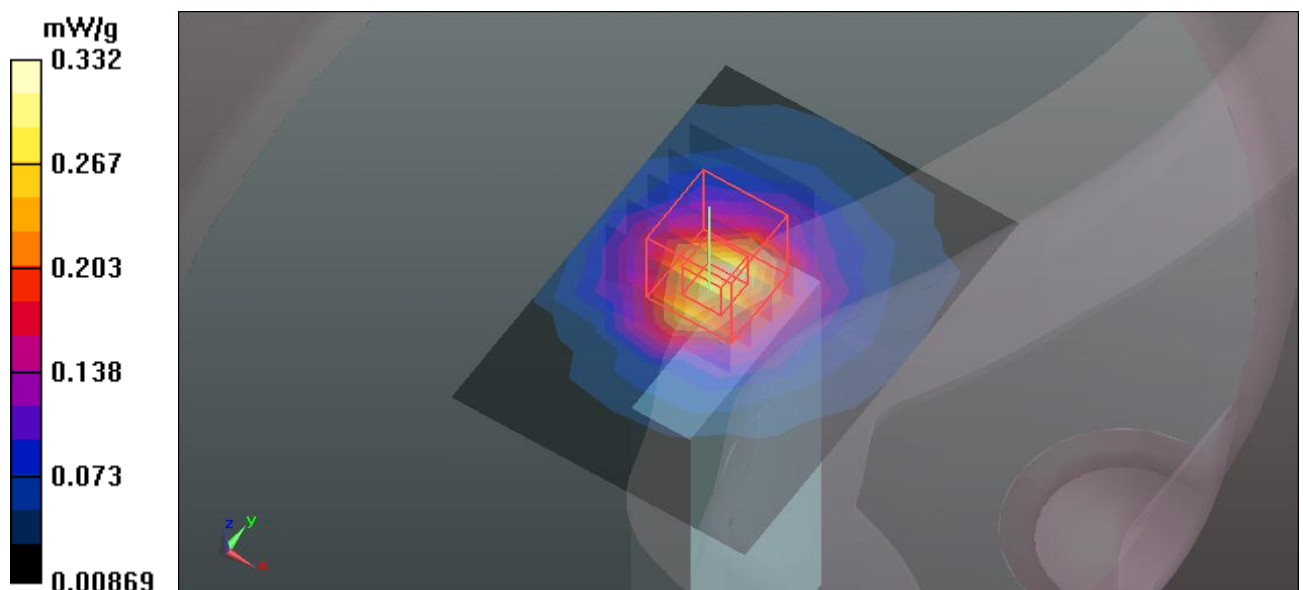
$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 14.153 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.408 W/kg

SAR(1 g) = 0.247 mW/g; SAR(10 g) = 0.142 mW/g

Maximum value of SAR (measured) = 0.332 mW/g



System Performance Check-D835V2-HSL835 MHz

DUT: Dipole 835 MHz D835V2 ; Type: D835V2 ; Serial: D835V2 - SN:4d021 ; Test Frequency: 835 MHz

Communication System: CW ; Frequency: 835 MHz; Duty Cycle: 1:1; Modulation type: CW
 Medium: HSL850; Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.87 \text{ mho/m}$; $\epsilon_r = 40.24$; $\rho = 1000 \text{ kg/m}^3$;
 Liquid level : 151 mm
 Phantom section: Flat Section ; Separation distance : 15 mm (The feetpoint of the dipole to the Phantom)
 Air temp. : 22.6 degrees ; Liquid temp. : 21.5 degrees

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.06, 9.06, 9.06); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (measured) = 2.870 mW/g

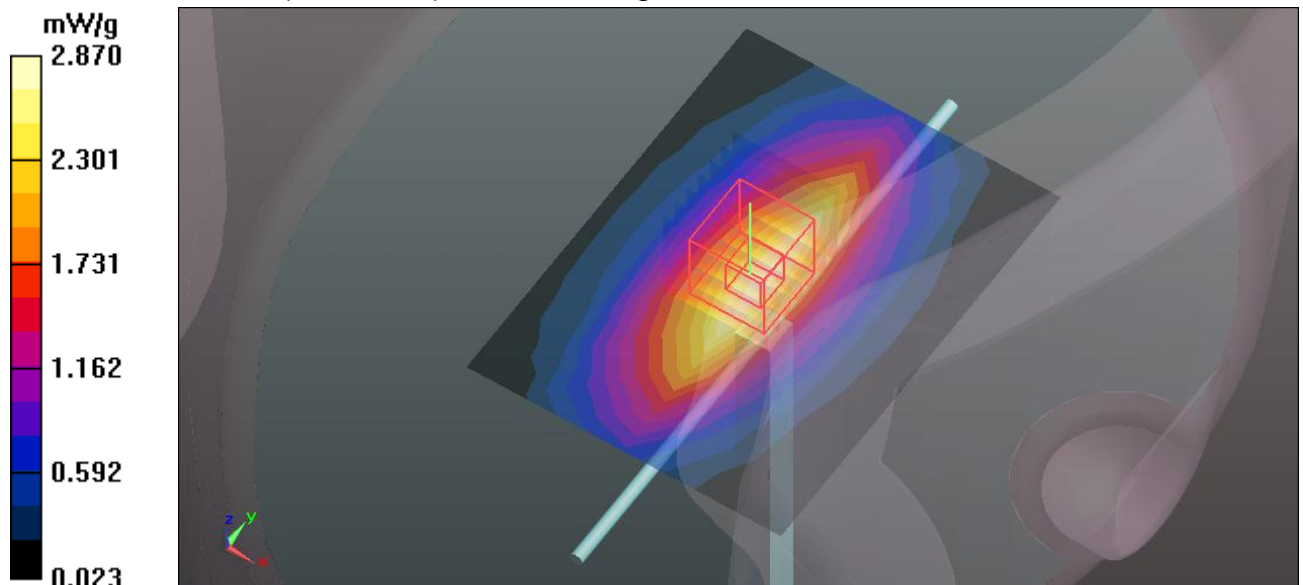
System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.370 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 3.412 W/kg

SAR(1 g) = 2.27 mW/g; SAR(10 g) = 1.48 mW/g

Maximum value of SAR (measured) = 2.456 mW/g



SystemPerformanceCheck-D835V2-MSL835 MHz

DUT: Dipole 835 MHz D835V2 ; Type: D835V2 ; Serial: D835V2 - SN:4d021 ; Test Frequency: 835 MHz

Communication System: CW ; Frequency: 835 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL850;Medium parameters used: $f = 835$ MHz; $\sigma = 0.94$ mho/m; $\epsilon_r = 54.48$; $\rho = 1000$ kg/m³ ; Liquid level : 150 mm

Phantom section: Flat Section ; Separation distance : 15 mm (The feetpoint of the dipole to the Phantom)Air temp. : 22.5 degrees ; Liquid temp. : 21.5 degrees

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(9.07, 9.07, 9.07); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 3.039 mW/g

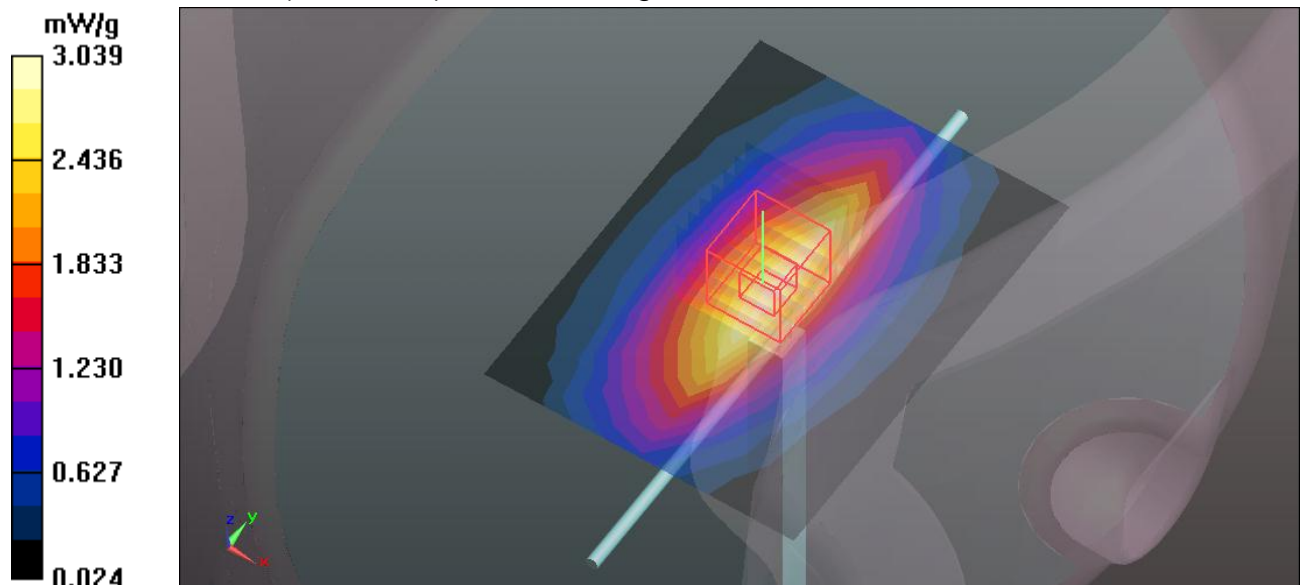
System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.093 V/m; Power Drift = 0.0054 dB

Peak SAR (extrapolated) = 3.604 W/kg

SAR(1 g) = 2.41 mW/g; SAR(10 g) = 1.57 mW/g

Maximum value of SAR (measured) = 2.603 mW/g



System Performance Check-D1900V2-HSL1900 MHz

DUT: Dipole 1900 MHz D1900V2 ; Type: D1900V2 ; Serial: D1900V2 - SN:5d022 ; Test Frequency: 1900 MHz

Communication System: CW ; Frequency: 1900 MHz; Duty Cycle: 1:1; Modulation type: CW
 Medium: HSL1900; Medium parameters used: $f = 1900$ MHz; $\sigma = 1.35$ mho/m; $\epsilon_r = 38.29$; $\rho = 1000$ kg/m³ ; Liquid level : 151 mm
 Phantom section: Flat Section ; Separation distance : 10 mm (The feetpoint of the dipole to the Phantom) Air temp. : 22.5 degrees ; Liquid temp. : 21.4 degrees

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.90, 7.90, 7.90); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (measured) = 14.143 mW/g

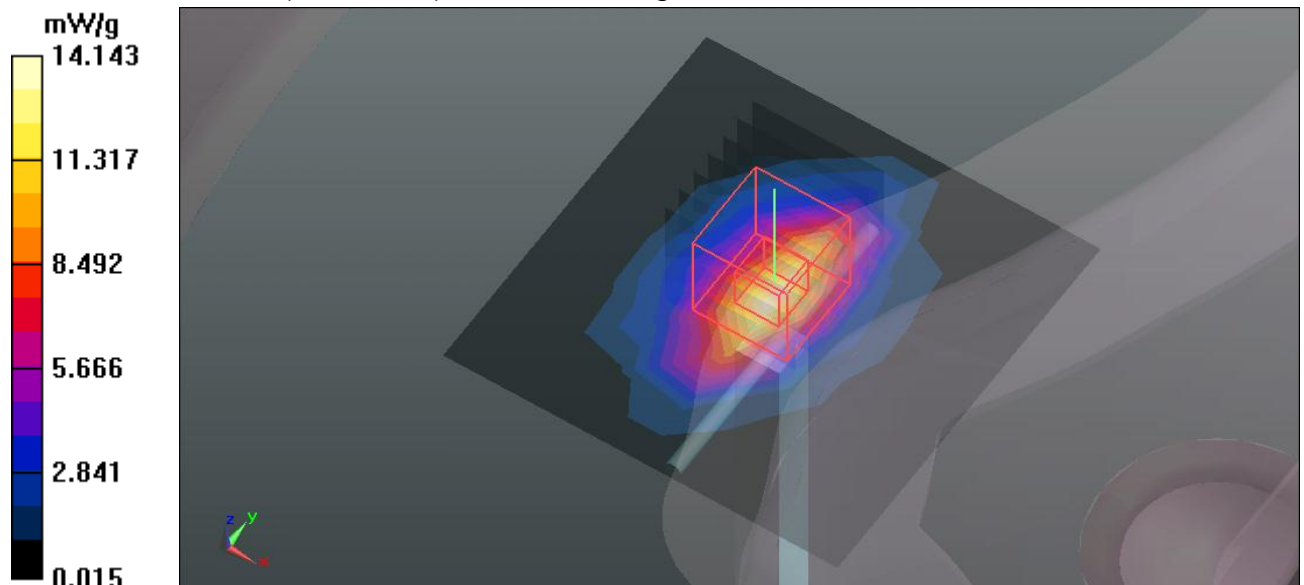
System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.8 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 18.967 W/kg

SAR(1 g) = 10 mW/g; SAR(10 g) = 5.18 mW/g

Maximum value of SAR (measured) = 11.329 mW/g





System Performance Check-D1900V2-MSL1900 MHz

DUT: Dipole 1900 MHz ; Type: D1900V2 ; Serial: 5d022 ; Test Frequency: 1900 MHz

Communication System: CW ; Frequency: 1900 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL1900;Medium parameters used: f = 1900 MHz; $\sigma = 1.5$ mho/m; $\epsilon_r = 51.94$; $\rho = 1000$ kg/m³ ; Liquid level : 150 mm
Phantom section: Flat Section ; Separation distance : 10 mm (The feetpoint of the dipole to the Phantom)Air temp. : 22.4 degrees ; Liquid temp. : 21.2 degrees

DASY5 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.17, 7.17, 7.17); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 C; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 14.530 mW/g

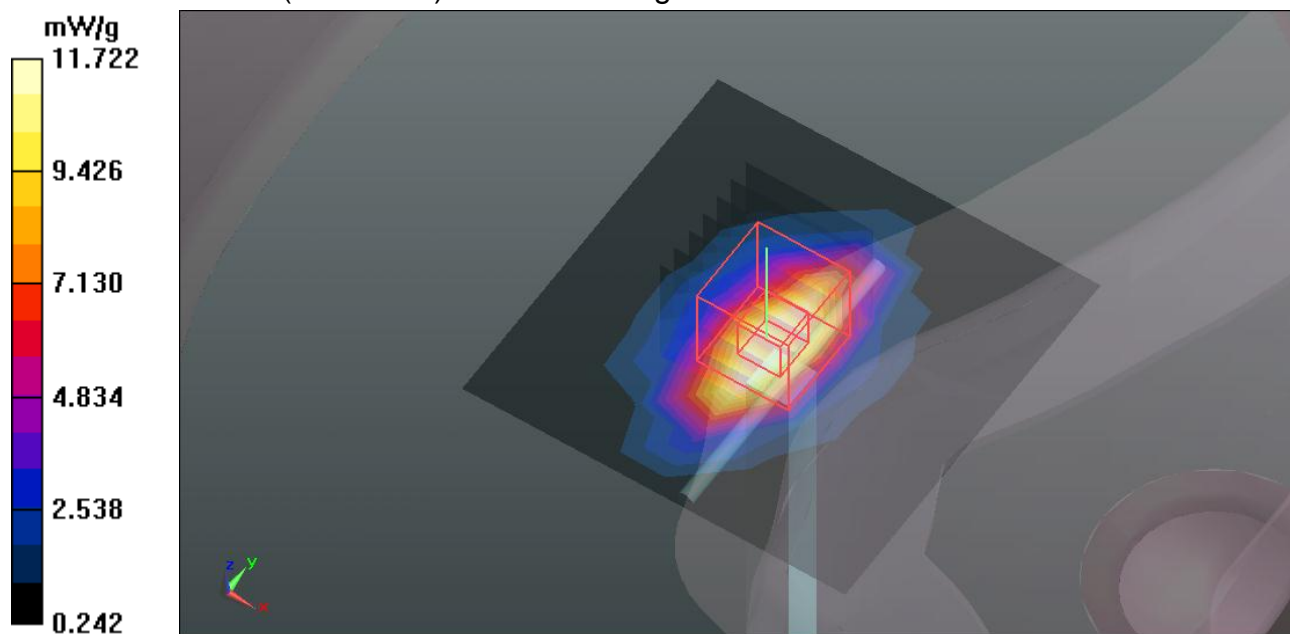
System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.5 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 18.998 W/kg

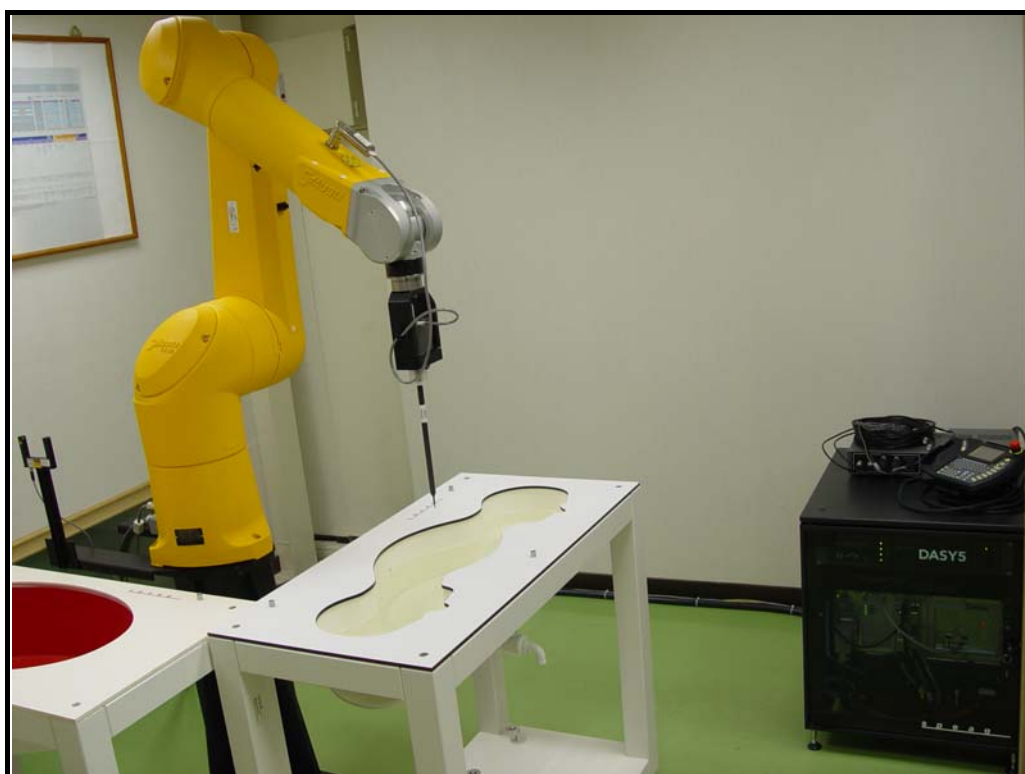
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.37 mW/g

Maximum value of SAR (measured) = 11.722 mW/g



APPENDIX B: BV ADT SAR MEASUREMENT SYSTEM

DASY5



DASY4



APPENDIX C: PHOTOGRAPHS OF SYSTEM VALIDATION

DASY5



DASY4





APPENDIX D: SYSTEM CERTIFICATE & CALIBRATION

D1: DOSIMETRIC E-FIELD PROBE



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Auden**

Certificate No. **EX3-3753_Dec10**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3753**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2
Calibration procedure for dosimetric E-field probes**

Calibration date: **December 13, 2010**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Kate Pokornic** Technical Manager

Approved by: **Heidi Kuster** Quality Manager

[Handwritten Signature]

Issued: December 14, 2010

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV4

SN:3753

Manufactured:	March 16, 2010
Calibrated:	December 13, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 SN:3753**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.34	0.49	0.52	$\pm 10.1\%$
DCP (mV) ^B	99.3	98.8	103.0	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	120.2	$\pm 2.9\%$
			Y	0.00	0.00	1.00	111.7	
			Z	0.00	0.00	1.00	118.9	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 SN:3753

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz] ^c	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	41.9 ± 5%	0.89 ± 5%	9.52	9.52	9.52	0.52	0.72 ± 11.0%
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	9.06	9.06	9.06	0.58	0.70 ± 11.0%
1750	± 50 / ± 100	40.1 ± 5%	1.37 ± 5%	8.25	8.25	8.25	0.67	0.64 ± 11.0%
1900	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	7.90	7.90	7.90	0.54	0.71 ± 11.0%
2000	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	7.82	7.82	7.82	0.62	0.65 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	7.11	7.11	7.11	0.38	0.83 ± 11.0%
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	4.96	4.96	4.96	0.32	1.90 ± 13.1%
5300	± 50 / ± 100	35.9 ± 5%	4.76 ± 5%	4.69	4.69	4.69	0.40	1.90 ± 13.1%
5500	± 50 / ± 100	35.6 ± 5%	4.96 ± 5%	4.43	4.43	4.43	0.45	1.90 ± 13.1%
5600	± 50 / ± 100	35.5 ± 5%	5.07 ± 5%	4.44	4.44	4.44	0.45	1.90 ± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	4.32	4.32	4.32	0.45	1.90 ± 13.1%

^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

DASY/EASY - Parameters of Probe: EX3DV4 SN:3753

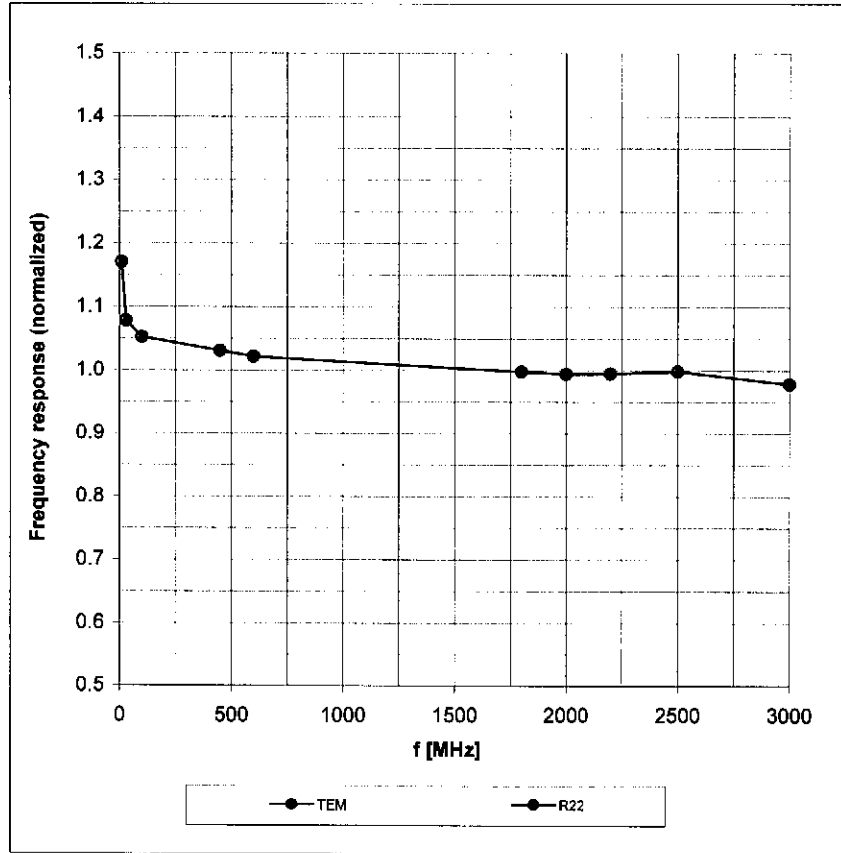
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz] ^c	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	9.25	9.25	9.25	0.54	0.74 ± 11.0%
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	9.07	9.07	9.07	0.55	0.73 ± 11.0%
1750	± 50 / ± 100	53.4 ± 5%	1.49 ± 5%	7.48	7.48	7.48	0.32	1.19 ± 11.0%
1900	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	7.17	7.17	7.17	0.55	0.96 ± 11.0%
2000	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	7.22	7.22	7.22	0.96	0.52 ± 11.0%
2300	± 50 / ± 100	52.8 ± 5%	1.85 ± 5%	7.11	7.11	7.11	0.54	0.75 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	6.91	6.91	6.91	0.54	0.88 ± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	6.86	6.86	6.86	0.97	0.34 ± 11.0%
3500	± 50 / ± 100	51.3 ± 5%	3.31 ± 5%	6.19	6.19	6.19	0.35	1.20 ± 13.1%
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	4.21	4.21	4.21	0.55	1.95 ± 13.1%
5300	± 50 / ± 100	48.9 ± 5%	5.42 ± 5%	4.02	4.02	4.02	0.55	1.95 ± 13.1%
5500	± 50 / ± 100	48.6 ± 5%	5.65 ± 5%	3.69	3.69	3.69	0.55	1.95 ± 13.1%
5600	± 50 / ± 100	48.5 ± 5%	5.77 ± 5%	3.41	3.41	3.41	0.60	1.95 ± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	3.90	3.90	3.90	0.60	1.95 ± 13.1%

^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

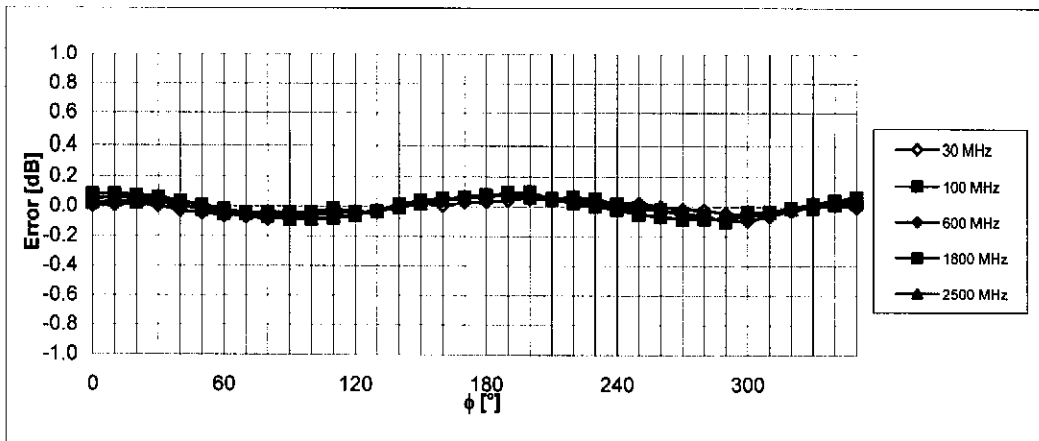
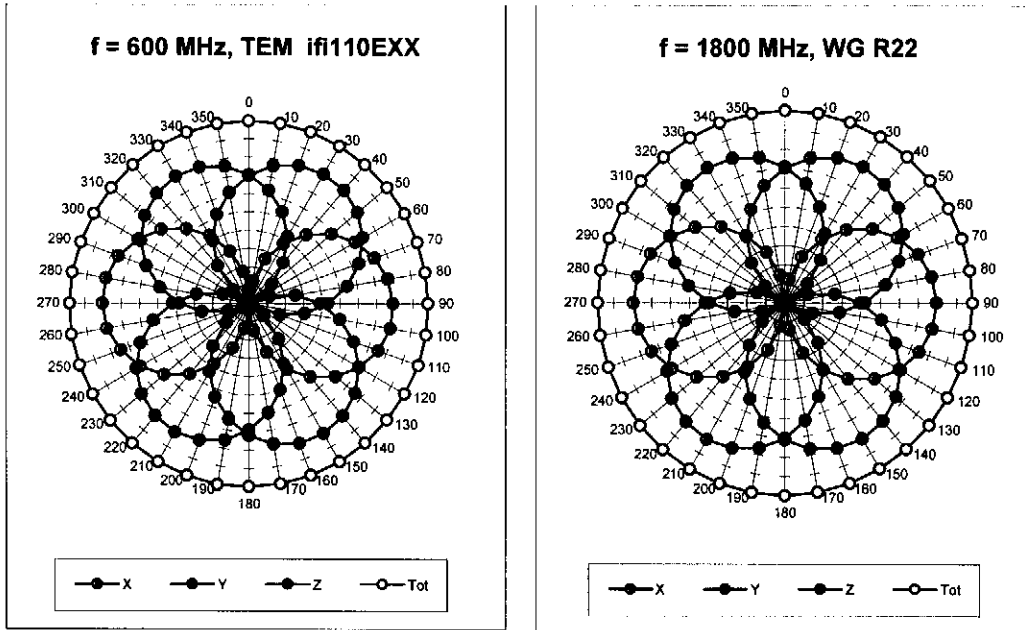
Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)



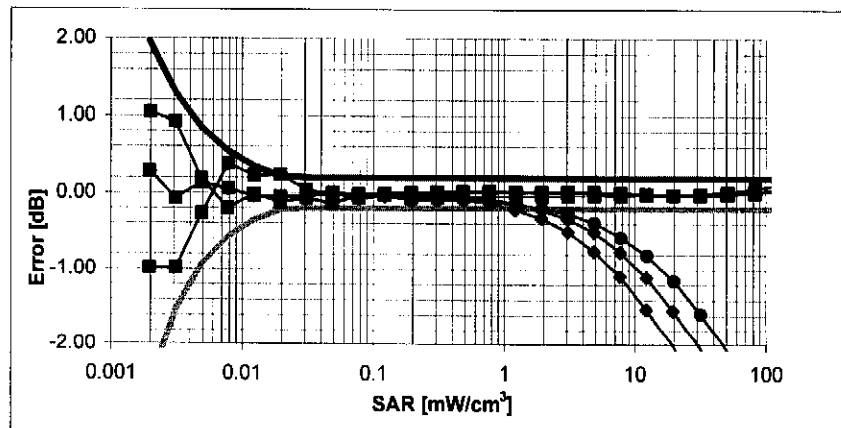
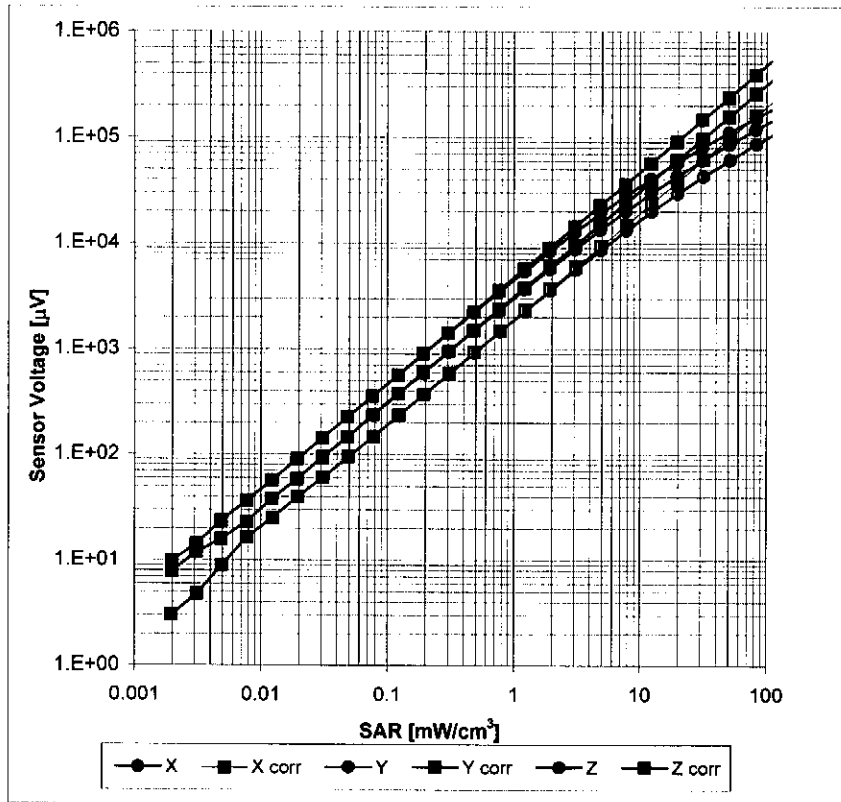
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$



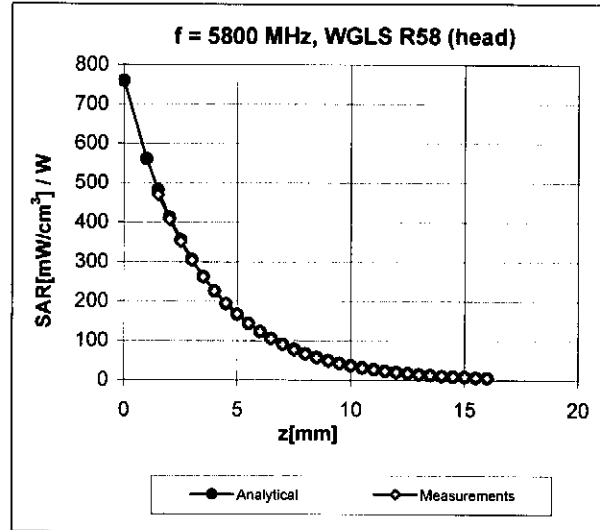
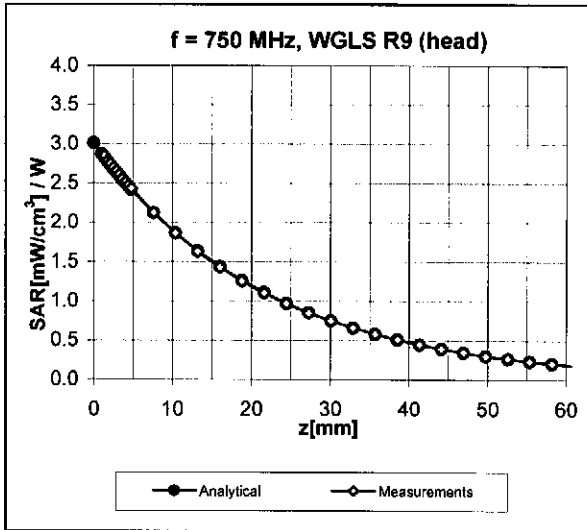
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f = 900 \text{ MHz}$)



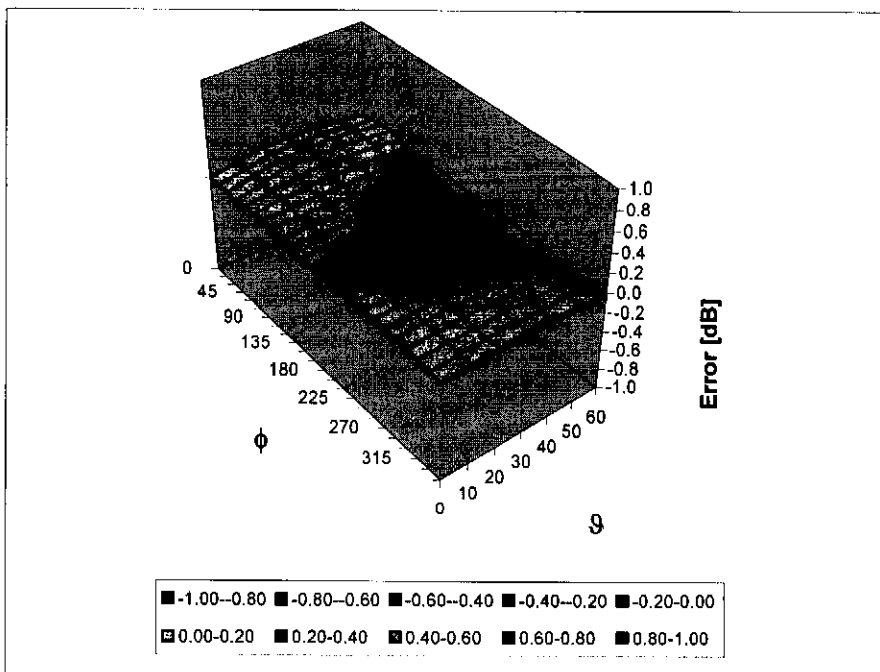
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ (k=2)

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm



D2: DAE



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **ADT (Auden)**

Certificate No: **DAE3-510_Oct10**

CALIBRATION CERTIFICATE

Object **DAE3 - SD 000 D03 AA - SN: 510**

Calibration procedure(s) **QA CAL-06.v22
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **October 4, 2010**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	28-Sep-10 (No:10376)	Sep-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	07-Jun-10 (in house check)	In house check: Jun-11

Calibrated by: **Dominique Steffen**

Function
Technician

Signature

Approved by: **Fin Bomholt**

R&D Director

Issued: October 4, 2010

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Glossary

DAE data acquisition electronics
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity*: Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity*: Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation*: Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted*: Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current*: Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance*: Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage*: Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption*: Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.204 \pm 0.1% (k=2)	404.261 \pm 0.1% (k=2)	404.619 \pm 0.1% (k=2)
Low Range	3.97841 \pm 0.7% (k=2)	3.96431 \pm 0.7% (k=2)	3.98318 \pm 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	280.0 $^{\circ}$ \pm 1 $^{\circ}$
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Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200002.6	1.33	0.00
Channel X	+ Input	20001.52	1.72	0.01
Channel X	- Input	-19997.99	1.81	-0.01
Channel Y	+ Input	200010.4	0.89	0.00
Channel Y	+ Input	20000.89	1.39	0.01
Channel Y	- Input	-19998.10	1.60	-0.01
Channel Z	+ Input	200007.2	-1.37	-0.00
Channel Z	+ Input	19998.21	-1.29	-0.01
Channel Z	- Input	-20001.73	-2.13	0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.1	0.23	0.01
Channel X	+ Input	200.27	0.27	0.13
Channel X	- Input	-199.76	0.04	-0.02
Channel Y	+ Input	2000.8	0.66	0.03
Channel Y	+ Input	199.56	-0.44	-0.22
Channel Y	- Input	-200.06	-0.16	0.08
Channel Z	+ Input	1999.4	-0.75	-0.04
Channel Z	+ Input	199.53	-0.57	-0.28
Channel Z	- Input	-201.06	-1.16	0.58

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	17.87	16.44
	- 200	-15.36	-17.11
Channel Y	200	14.99	14.97
	- 200	-16.63	-16.47
Channel Z	200	-8.65	-8.74
	- 200	7.23	7.63

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	4.37	-3.14
Channel Y	200	6.07	-	3.36
Channel Z	200	3.03	-0.24	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15917	15639
Channel Y	16112	16210
Channel Z	16121	16322

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	0.61	0.06	2.59	0.30
Channel Y	1.72	-0.56	3.01	0.39
Channel Z	-1.94	-2.73	-0.59	0.30

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9



D3: SYSTEM VALIDATION DIPOLE



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Accreditation No.: **SCS 108**

Client **B.V. ADT (Auden)**

Certificate No: **D835V2-4d021_Mar11**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d021**

Calibration procedure(s) **QA CAL-05.v8
Calibration procedure for dipole validation kits**

Calibration date: **March 23, 2011**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Dimce Iliev** Name: **Dimce Iliev** Function: **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Issued: March 23, 2011

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power.
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	41.0 \pm 6 %	0.89 mho/m \pm 6 %
Head TSL temperature during test	(21.8 \pm 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.40 mW / g
SAR normalized	normalized to 1W	9.60 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.65 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.57 mW / g
SAR normalized	normalized to 1W	6.28 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.31 mW / g \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.3 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature during test	(21.7 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.56 mW / g
SAR normalized	normalized to 1W	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	10.1 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.68 mW / g
SAR normalized	normalized to 1W	6.72 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.63 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.0 Ω - 2.0 j Ω
Return Loss	- 31.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.9 Ω - 4.2 j Ω
Return Loss	- 26.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.393 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Design Modification by End User

The dipole has been modified with Teflon Rings (TR) placed within identified markings close to the end of each dipole arm. Calibration has been performed with TR attached to the dipole.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	April 22, 2004

DASY5 Validation Report for Head TSL

Date/Time: 18.03.2011 11:51:13

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d021

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL900

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 40.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.03, 6.03, 6.03); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

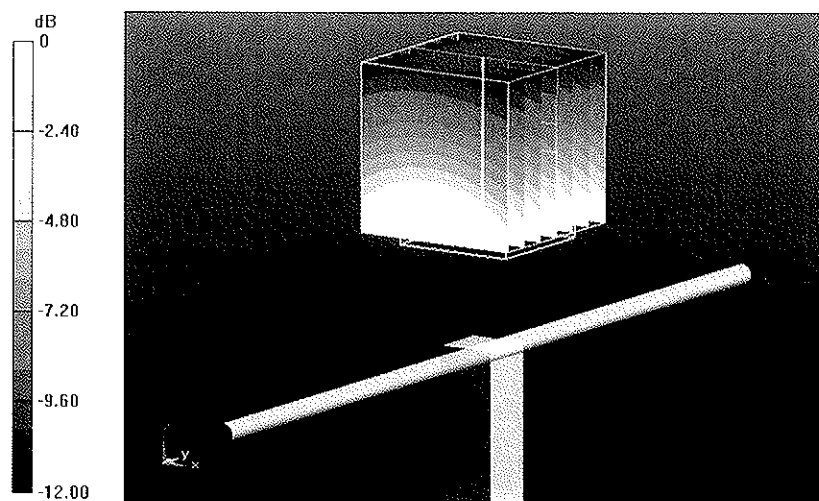
Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 57.571 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.583 W/kg

SAR(1 g) = 2.4 mW/g; SAR(10 g) = 1.57 mW/g

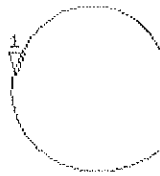
Maximum value of SAR (measured) = 2.792 mW/g



Impedance Measurement Plot for Head TSL

18 Mar 2011 10:32:43
S11 1 U FS 1: 51.996 ω -2.0469 ω 93.120 μ F 835.000 000 MHz

8
De1
Cor



avg
1.6

↑

CH2 S11 L06 5 dB/REF -20 dB 1: -31.025 dB 835.000 000 MHz

Cor

avg
1.6

↑

START 835.000 000 MHz

STOP 1.188.000 000 MHz

DASY5 Validation Report for Body TSL

Date/Time: 23.03.2011 10:45:49

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d021

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.99 \text{ mho/m}$; $\epsilon_r = 54.3$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.86, 5.86, 5.86); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

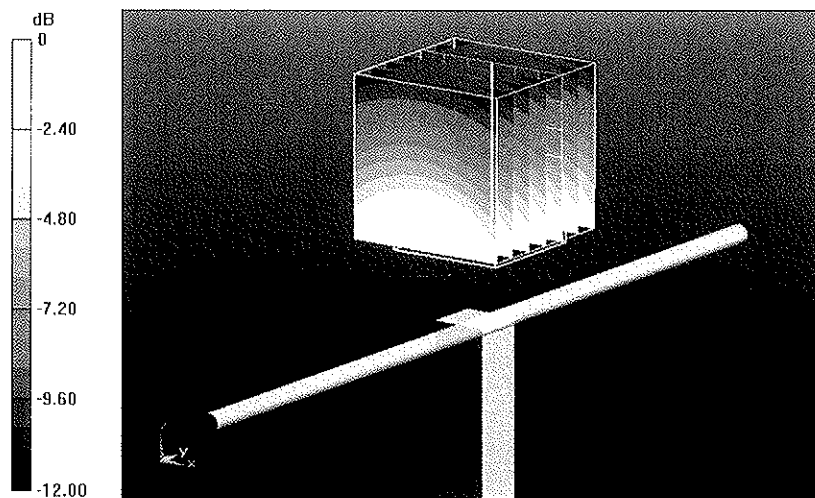
Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.615 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.794 W/kg

SAR(1 g) = 2.56 mW/g; SAR(10 g) = 1.68 mW/g

Maximum value of SAR (measured) = 2.981 mW/g



0 dB = 2.980mW/g

Impedance Measurement Plot for Body TSL

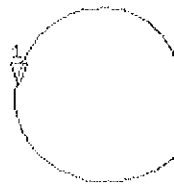
23 Mar 2011 10:18:11
[CH1] S11 1 U FS 1: 47.865 Ω -4.1953 Ω 45.433 pF 835.000 000 MHz

*
De 1

Cor

Avg
16

↑

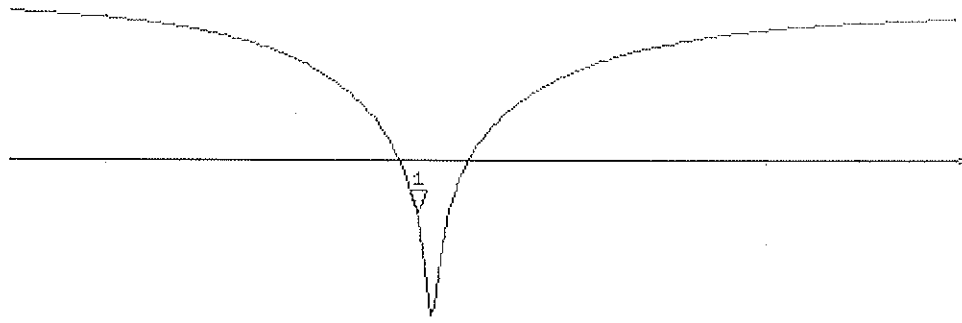


CH2 S11 L06 5 dB/REF -20 dB 1: -25.372 dB 835.000 000 MHz

Cor

Avg
16

↑



START 635.000 000 MHz

STOP 1 100.000 000 MHz



Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **B.V. ADT (Auden)**

Certificate No: **D1900V2-5d022_Jan11**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d022**

Calibration procedure(s) **QA CAL-05.v8
Calibration procedure for dipole validation kits**

Calibration date: **January 26, 2011**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Dimce Iliev** Name: **Dimce Iliev** Function: **Laboratory Technician**

Signature:

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Signature:

Issued: January 27, 2011

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	38.5 \pm 6 %	1.43 mho/m \pm 6 %
Head TSL temperature during test	(20.5 \pm 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.4 mW / g
SAR normalized	normalized to 1W	41.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.9 mW /g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.37 mW / g
SAR normalized	normalized to 1W	21.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.3 mW /g \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	1.56 mho/m ± 6 %
Body TSL temperature during test	(20.8 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.4 mW / g
SAR normalized	normalized to 1W	41.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	40.9 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.48 mW / g
SAR normalized	normalized to 1W	21.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.7 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.5 Ω + 4.0 j Ω
Return Loss	- 27.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.2 Ω + 4.0 j Ω
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.193 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 29, 2002

DASY5 Validation Report for Head TSL

Date/Time: 24.01.2011 11:20:43

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d022

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U12 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.42$ mho/m; $\epsilon_r = 38.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

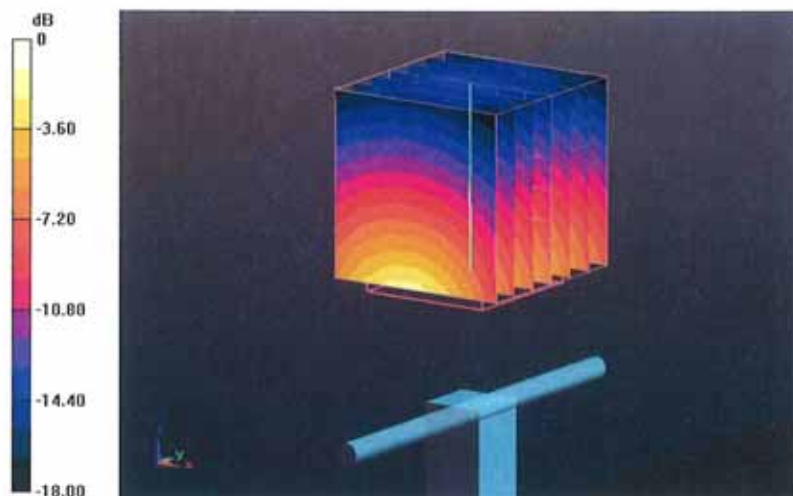
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.002 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 19.131 W/kg

SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.37 mW/g

Maximum value of SAR (measured) = 12.963 mW/g



Impedance Measurement Plot for Head TSL

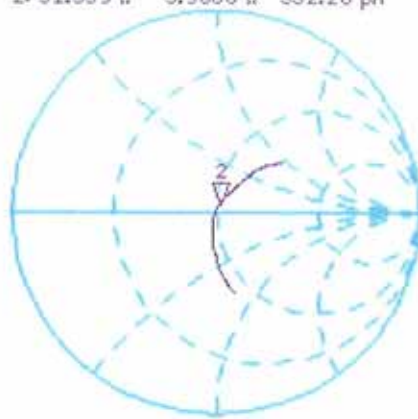
24 Jan 2011 10:16:09

CH1 S11 1 U FS 2: 51.539 Ω 3.9668 Ω 332.28 μH 1 900.000 000 MHz

De 1
CA

Avg
16

↑

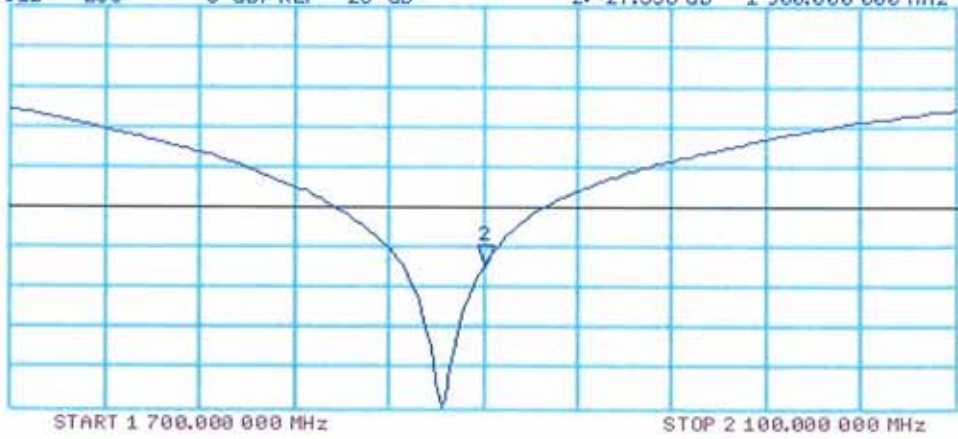


CH2 S11 LOG 5 dB/REF -20 dB 2:-27.558 dB 1 900.000 000 MHz

CA

Avg
16

↑



DASY5 Validation Report for Body TSL

Date/Time: 26.01.2011 12:06:07

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d022

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL U12 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 53.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

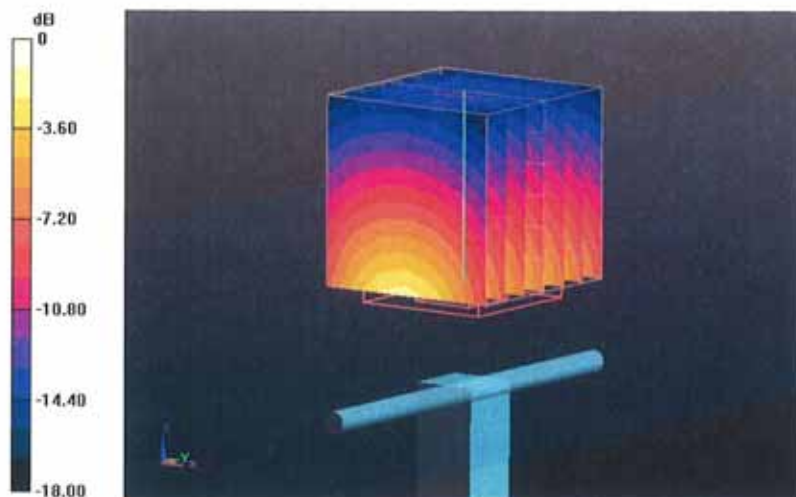
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.936 V/m; Power Drift = -0.0021 dB

Peak SAR (extrapolated) = 17.774 W/kg

SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.48 mW/g

Maximum value of SAR (measured) = 13.186 mW/g



Impedance Measurement Plot for Body TSL

26 Jan 2011 10:44:12

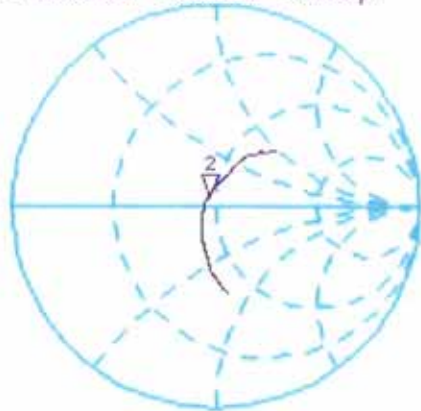
CH1 S11 1 U FS 2: 46.244 Ω 4.0215 Ω 336.86 pF 1 900.000 000 MHz

De1

CA

avg
16

↑

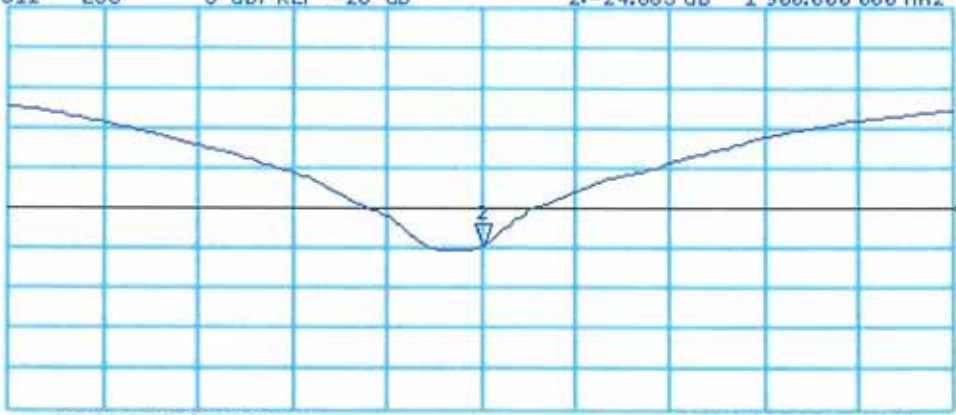


CH2 S11 LOG 5 dB/REF -20 dB 2:-24.853 dB 1 900.000 000 MHz

CA

avg
16

↑



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz