SAR TEST REPORT

REPORT NO.:	SA110111C23
MODEL NO.:	RDJ21WW
FCC ID:	L6ARDJ20WW
IC ID:	2503A-RDJ20WW
RECEIVED:	Jan. 12, 2011
TESTED:	Feb. 09 ~ Feb. 11, 2011
ISSUED:	Feb. 16, 2011

APPLICANT:	Research In Motion Limited
ADDRESS:	295 Phillip Street, Waterloo, Ontario, Canada

ISSUED BY:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
LAB ADDRESS:	No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang, Taipei Hsien 244, Taiwan, R.O.C.
TEST LOCATION:	No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

TABLE OF CONTENTS

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	N/A	Feb. 16, 2011

1. CERTIFICATION

PRODUCT:	Tablet Device
MODEL:	RDJ21WW
BRAND:	RIM
APPLICANT:	Research In Motion Limited
TESTED:	Feb. 09 ~ Feb. 11, 2011
TEST SAMPLE:	ENGINEERING SAMPLE
STANDARDS:	**FCC Part 2 (Section 2.1093)**
	FCC OET Bulletin 65, Supplement C (01-01)
	RSS-102 Issue 4 (March 2010)

The above equipment (Model: RDJ21WW) has 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 EMC characteristics under the conditions specified in this report.

PREPARED BY : _____ , DATE : Feb. 16, 2011
Joanna Wang / Senior Specialist

APPROVED BY : _____ , DATE : Feb. 16, 2011
Gary Chang / Assistant Manager

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

EUT	Tablet Device
MODEL NO.	RDJ21WW
FCC ID	L6ARDJ20WW
IC ID	2503A-RDJ20WW
POWER SUPPLY	5Vdc (adapter) 3.7Vdc (battery)
MODULATION TYPE	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
MODULATION TECHNOLOGY	DSSS, OFDM
TRANSFER RATE	802.11b:11.0/ 5.5/ 2.0/ 1.0Mbps 802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n (20MHz): up to 72.0Mbps
OPERATING FREQUENCY	**2.4GHz:** 2412 ~ 2462MHz **5.0GHz:** 5745 ~ 5825MHz
NUMBER OF CHANNEL	**2.4GHz:** 11 **5.0GHz:** 5
MAXIMUM SAR (1g)	**2.4GHz:** 1.38W/kg **5.0GHz:** 1.15W/kg
ANTENNA TYPE	**2.4GHz:** PIFA antenna with -1.2dBi gain **5.0GHz:** PIFA antenna with -0.1dBi gain
ANTENNA CONNECTOR	I-pex
DATA CABLE	Refer to users' manual
I/O PORTS	0.3m non-shielded USB cable without core 1.0m non-shielded USB cable without core 1.2m non-shielded USB cable without core 1.5m non-shielded USB cable without core
ACCESSORY DEVICES	Adapter, battery

NOTE:

1. The EUT is a Tablet Device. The test data are separated into following test reports.

	REFERENCE REPORT
WLAN 802.11b/g, 802.11n	SA110111C23
WLAN 802.11a, 802.11n (5745~5825 MHz)	
WLAN 802.11a, 802.11n (5180~5320MHz & 5500 ~5700MHz)	SA110111C23-1

2. The frequency bands used in this EUT are listed as follows:

Frequency Band (MHz)	2412~2462	5180~5320	5500~5700	5745~5825
802.11b	√	-	-	-
802.11g	√	-	-	-
802.11a	-	√	√	√
802.11n (20MHz)	√	√	√	√

3. The EUT provides one completed transmitter and one receiver.

MODULATION MODE	TX FUNCTION
802.11b	1TX
802.11g	1TX
802.11a	1TX
802.11n (20MHz)	1TX

4. The EUT was powered by the following adapters and battery:

ADAPTER 1	
BRAND	Phihong(BlackBerry)
MODEL	PSAC10R-050QT
INPUT POWER	100-240Vac, 50-60Hz, 0.3A
OUTPUT POWER	5Vdc, 2A
POWER LINE	DC: 2m non-shielded cable without core

ADAPTER 2	
BRAND	Tamura(BlackBerry)
MODEL	RQT050180
INPUT POWER	100-240Vac, 50/60Hz, 0.4A
OUTPUT POWER	5Vdc, 1.8A
POWER LINE	DC: 2m non-shielded cable without core

ADAPTER 3	
BRAND	Phihong(BlackBerry)
MODEL	PSM09A-050RIM
INPUT POWER	100-240Vac, 50/60Hz, 0.3A
OUTPUT POWER	5Vdc, 1.8A
POWER LINE	DC: 2m non-shielded cable without core

ADAPTER 4	
BRAND	PI Electronics
MODEL	AD8213HF
INPUT POWER	100-240Vac, 50/60Hz, 0.3A
OUTPUT POWER	5Vdc, 1.8A
POWER LINE	DC: 2m non-shielded cable without core

* The above adapters had been pre-tested and adapter 1 was found and chose to be the worst case for final test.

BATTERY	
RATING	3.7Vdc, 5400mAH

5. 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 GENERAL DESCRIPTION OF APPLIED STANDARDS

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

FCC Part 2 (2.1093)

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

RSS-102 Issue 4 (March 2010)

IEEE 1528-2003

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

2.3 GENERAL INOFRMATION OF THE SAR SYSTEM

DASY52 (Version 52.6) 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 DASY52 software defined. The DASY52 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 form 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 μW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μW/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.
2. For frequencies above 800MHz, calibration in a rectangular wave-guide is used, because wave-guide size is manageable.
3. For frequencies below 800MHz, temperature transfer calibration is used because the wave-guide size becomes relatively large.

TWIN SAM V4.0

CONSTRUCTION	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, EN 62209-1 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 ± 0.2mm
FILLING VOLUME	Approx. 25liters
DIMENSIONS	Height: 810mm; Length: 1000mm; Width: 500mm

SYSTEM VALIDATION KITS:

CONSTRUCTION	Symmetrical dipole with l/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	2450, 5800MHz
RETURN LOSS	> 20dB at specified validation position
POWER CAPABILITY	> 100W (f < 1GHz); > 40W (f > 1GHz)
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 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 are 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 ε =3 and loss tangent δ =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 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

2.4 TEST EQUIPMENT

FOR SAR MEASURENENT

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	ELI 4.0 Phantom	S & P	QDOVA001BA	1043	NA	NA
2	Signal Generator	Agilent	E8257C	MY43320668	Feb. 23, 2010	Feb. 22, 2011
3	E-Field Probe	S & P	EX3DV4	3590	Mar. 25, 2010	Mar. 24, 2011
4	DAE	S & P	DAE 3	510	Oct. 04, 2010	Oct. 03, 2011
5	Robot Positioner	Staubli Unimation	NA	NA	NA	NA
6	Validation Dipole	S & P	D2450V2	737	Feb. 19, 2010	Feb. 18, 2011
7	Validation Dipole	S & P	D5GHzV2	1019	Jan. 25, 2011	Jan. 24, 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	E5071C	MY46104190	Apr. 06, 2010	Apr. 05, 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 ±2.5% and ±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 ±2.5% (k=1). It can be substantially smaller if more accurate methods are applied.

2.5 GENERAL DESCRIPTION OF THE SPATIAL PEAK SAR EVALUATION

The DASY52 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:

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

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:

$$\text{E-fieldprobes: } E_i = \sqrt{\frac{V_1}{Norm_i \cdot ConvF}}$$

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

V_i	=compensated signal of channel I	(i = x, y, z)
$Norm_i$	=sensor sensitivity of channel i μV/(V/m)2 for E-field Probes	(i = x, y, z)
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.

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

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 1g and 10g 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 1g and 10g.

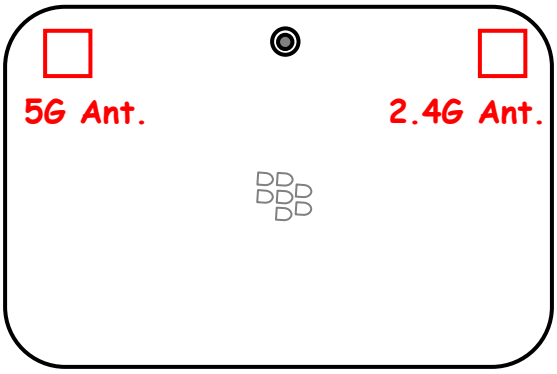
The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration 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.

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 7 x 7 x 7 scans. The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 30 x 30 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.

2.6 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

3. DESCRIPTION OF ANTENNA LOCATION



4. RECIPES FOR TISSUE SIMULATING LIQUIDS

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

The following ingredients are used：

- **WATER-** Deionized water (pure H20), resistivity _16 M - as basis for the liquid
- **DGMBE-** Diethylenglycol-monobuthyl ether (DGMBE), Fluka Chemie GmbH, CAS # 112-34-5 - to reduce relative permittivity

THE RECIPES FOR 2450MHz SIMULATING LIQUID TABLE

INGREDIENT	BODY SIMULATING LIQUID 2450MHz (MSL-2450)
Water	69.83%
DGMBE	30.17%
Dielectric Parameters at 22℃	f= 2450MHz ε= 52.7 ± 5% σ= 1.95 ± 5% S/m

THE INFORMATION FOR 5GHz SIMULATING LIQUID

The 5GHz liquids was purchased from SPEAG.

Body liquid model: HSL 5800, P/N: SL AAH 5800 AA

Head liquid model: M 5800, P/N: SL AAM 580 AD

5GHz liquids contain the following ingredients:

Water 64 - 78%

Mineral Oil 11 - 18%

Emulsifiers 9 - 15%

Additives and Salt 2 - 3%

Testing the liquids using the Agilent Network Analyzer E5071C and Agilent Dielectric Probe Kit 85070D.The testing procedure is following as

1. Turn Network Analyzer on and allow at least 30min. 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 (±1°).
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 ε'=10.0, ε"=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 $\sigma = \omega \varepsilon_0 \varepsilon'' = \varepsilon'' f$ [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 DASY52 for the frequencies necessary for the measurements (‘Setup Config’, select medium (e.g. Brain 900MHz) and press ‘Option’-button.
14. Select the current medium for the frequency of the validation (e.g. Setup Medium Brain 900MHz).

FOR 2.4GHz BAND SIMULATING LIQUID

LIQUID TYPE		MSL-2450			
SIMULATING LIQUID TEMP.		21.6			
TEST DATE		Feb. 09, 2011			
TESTED BY		Morrison Huang			
FREQ. (MHz)	**LIQUID PARAMETER**	**STANDARD VALUE**	**MEASUREMENT VALUE**	**ERROR PERCENTAGE (%)**	**LIMIT(%)**
2412	Permitivity (ε)	52.75	53.67	1.74	±5
2437		52.72	53.57	1.61	
2450		52.70	53.37	1.27	
2462		52.68	53.27	1.12	
2412	Conductivity (σ) S/m	1.91	1.92	0.52	
2437		1.94	1.96	1.03	
2450		1.95	1.99	2.05	
2462		1.97	2.00	1.52	

FOR 5GHz BAND SIMULATING LIQUID

LIQUID TYPE		MSL-5800			
SIMULATING LIQUID TEMP.		22.1			
TEST DATE		Feb. 10, 2011			
TESTED BY		Morrison Huang			
FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	ERROR PERCENTAGE (%)	LIMIT(%)
5200	Permitivity (ε)	49.01	50.16	2.35	±5
5300		48.88	49.96	2.21	
5500		48.61	49.76	2.37	
5520		48.58	49.46	1.81	
5580		48.50	49.36	1.77	
5620		48.44	49.26	1.69	
5680		48.36	49.16	1.65	
5745		48.27	49.06	1.64	
5785		48.22	48.96	1.53	
5800		48.20	48.92	1.49	
5825		48.17	48.87	1.45	
5200	Conductivity (σ) S/m	5.30	5.21	-1.70	
5300		5.42	5.36	-1.11	
5500		5.65	5.68	0.53	
5520		5.67	5.69	0.35	
5580		5.74	5.76	0.35	
5620		5.79	5.83	0.69	
5680		5.86	5.91	0.85	
5745		5.94	6.01	1.18	
5785		5.98	6.07	1.51	
5800		6.00	6.10	1.67	
5825		6.03	6.13	1.66	

LIQUID TYPE		MSL-5800			
SIMULATING LIQUID TEMP.		21.8			
TEST DATE		Feb. 11, 2011			
TESTED BY		Morrison Huang			
FREQ. (MHz)	**LIQUID PARAMETER**	**STANDARD VALUE**	**MEASUREMENT VALUE**	**ERROR PERCENTAGE (%)**	**LIMIT(%)**
5200	Permitivity (ε)	49.01	50.03	2.08	±5
5300		48.88	49.83	1.94	
5500		48.61	49.63	2.10	
5520		48.58	49.33	1.54	
5580		48.50	49.23	1.51	
5620		48.44	49.13	1.42	
5680		48.36	49.03	1.39	
5745		48.27	48.93	1.37	
5785		48.22	48.83	1.27	
5800		48.20	48.78	1.20	
5825		48.17	48.72	1.14	
5200	Conductivity (σ) S/m	5.30	5.23	-1.32	
5300		5.42	5.38	-0.74	
5500		5.65	5.70	0.88	
5520		5.67	5.71	0.71	
5580		5.74	5.78	0.70	
5620		5.79	5.85	1.04	
5680		5.86	5.93	1.19	
5745		5.94	6.03	1.52	
5785		5.98	6.09	1.84	
5800		6.00	6.12	2.00	
5825		6.03	6.15	1.99	

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 the system performance check, we need only to tell the system which components (probe, medium, and device) are used for the system performance check; the system will take care of all parameters. The dipole must be placed beneath the flat 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 mobile phones 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 ±0.02dB.

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 ±0.1mm). 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 DASY52 system is less than ±0.1mm.

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

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

5.2. VALIDATION RESULTS

SYSTEM VALIDATION TEST OF SIMULATING LIQUID					
FREQUENCY (MHz)	**REQUIRED SAR (mW/g)**	**MEASURED SAR (mW/g)**	**DEVIATION (%)**	**SEPARATION DISTANCE**	**TESTED DATE**
MSL 2450	13.10 (1g)	13.3	1.53	10mm	Feb. 09, 2011
MSL 5800	7.40 (1g)	7.23	-2.30	10mm	Feb. 10, 2011
MSL 5800	7.40 (1g)	7.17	-3.11	10mm	Feb. 11, 2011

NOTE: 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	6.55	Normal	1	1	1	6.55	6.55	∞
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 measrurement	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	4.47	Rectangular	√3	1	1	2.58	2.58	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)	2.50	Normal	1	0.64	0.43	1.28	0.86	9
Liquid Permittivity (target)	5.00	Rectangular	√3	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	2.35	Normal	1	0.6	0.49	1.42	1.16	9
Combined Standard Uncertainty						**9.84**	**9.61**	
Coverage Factor for 95%						**Kp=2**		
Expanded Uncertainty (K=2)						**19.67**	**19.22**	

NOTE: About the system validation uncertainty assessment, please reference the section 7.

6. TEST RESULTS

6.1 TEST PROCEDURES

Use the software to control the EUT channel and transmission power. Then record the conducted power before the testing. Place the EUT to the specific test location. After the testing, must writing down the conducted power of the EUT into the report. The SAR value was calculated via the 3D spline interpolation algorithm that has been implemented in the software of DASY52 SAR measurement system manufactured and calibrated by SPEAG. According to the IEEE 1528 standards, 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

The area scan was performed for the highest spatial SAR location. The zoom scan with volume was performed for SAR value averaged over 1g and 10g spatial volumes.

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 2mm and maintained at a constant distance of ±0.5mm 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 0.5s 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 ±5%.

6.2 CONDUCTED POWER

TEST MODE		802.11b		802.11g		802.11n (20MHz)	
CHAN.	FREQ. (MHz)	PEAK (dBm)	AVG (dBm)	PEAK (dBm)	AVG (dBm)	PEAK (dBm)	AVG (dBm)
1	2412 (Low)	20.4	18.4	24.3	17.4	24.0	17.1
6	2437 (Mid.)	20.8	18.7	24.9	17.6	24.3	17.3
11	2462 (High)	20.7	18.5	24.8	17.5	24.4	17.2

TEST MODE		802.11a		802.11n (20MHz)	
CHAN.	FREQ. (MHz)	PEAK (dBm)	AVG (dBm)	PEAK (dBm)	AVG (dBm)
149	5745 (Low)	24.2	16.6	24.3	16.7
157	5785 (Mid.)	24.5	16.8	24.5	16.8
165	5825 (High)	24.1	16.5	24.2	16.6

NOTE: SAR is not required for 802.11g and 802.11n (20MHz) channels since the maximum average output power is less than ¼ dB higher than that measured on the corresponding 802.11b channels

6.3 DESCRIPTION OF TEST CONDITION

TEST DATE	TEMPERATURE(°C)		HUMIDITY(%RH)	TESTED BY
	AIMBENT	LIQUID		
Feb. 09, 2011	22.7	21.6	61	Morrison Huang
Feb. 10, 2011	23.0	22.1	58	Morrison Huang
Feb. 11, 2011	22.7	21.8	60	Morrison Huang

6.4 MEASURED SAR RESULT

FCC accept the device to follow Interim SAR Test for UMPC Mini Mini-Tablets shown on RF Exposure Procedures Update Oct, 2010 in KDB 261713.

“A composite test separation distance of 5 mm should be applied to test all sides and edges of the device with an antenna closer than 2.5 cm from the surface or edge”. Therefore, 5 mm is used to be the test distance.

Distance between EUT and phantom is 5mm				
802.11b				
CHAN.	FREQ. (MHz)	Top	Bottom	Left Edge
1	2412 (Low)		**1.380**	0.934
6	2437 (Mid.)	0.144	1.370	0.894
11	2462 (High)		**1.380**	0.921
802.11a				
CHAN.	FREQ. (MHz)	Top	Bottom	Right Edge
149	5745 (Low)		0.870	1.130
157	5785 (Mid.)	0.342	0.868	1.140
165	5825 (High)		0.921	**1.150**
802.11an (20MHz)				
CHAN.	FREQ. (MHz)	Top	Bottom	Right Edge
149	5745 (Low)		0.879	1.010
157	5785 (Mid.)	0.322	0.904	1.110
165	5825 (High)		0.958	1.120

NOTE:

1. In this testing, the limit for General Population Spatial Peak averaged over 1g, 1.6 W/kg, is applied.
2. Please see the Appendix A for the data.
3. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.
4. Per KDB 447498, when 1-g SAR for the highest output channel is less than 0.8 W/kg, testing for the other channels is not required.

6.5 NO SIMULTANEOUS SAR JUSTIFICATION

The device has 2.4 / 5GHz WiFi and Bluetooth. 2.4GHz and 5GHz can not work at the same time. Below transmission simultaneous mode is supported for the device.

1) 2.4GHz WiFi + Bluetooth
   Max SAR value at 3 test positions

Mode	Position		
	Top	Bottom	Right edge
2.4GHz WiFi	0.144	1.38	0.934
Bluetooth	0	0	0
2.4GHz WiFi +Bluetooth	0.144	0.138	0.934

2) 5GHz WiFi+ Bluetooth
   Max SAR value at 3 test positions

Mode	Position		
	Top	Bottom	Right edge
5GHz WiFi	0.484	1.26	1.41
Bluetooth	0	0	0
5GHz WiFi +Bluetooth	0.484	1.26	1.41

*Max SAR value of 5GHz is shown on Report No.: SA110111C23-1.

SAR evaluation for Transmitter

2.4 / 5 GHz WiFi
Since the output power > 60/f(GHz), SAR is necessary.

Bluetooth
The max output power is 6.6 mW < 24 mW ($2.P_{Ref}$) and antenna separation between WiFi and Bluetooth is > 5 cm. Therefore, SAR evaluation is not necessary.

Antenna separation distance (cm)

	2.4GHz antenna	5GHz antenna	BT antenna
2.4GHz antenna		16.537	7.41
5GHz antenna	16.537		18.48
BT antenna	7.41	18.48	

Conclusion

1) Antenna separation distance for each transmission simultaneous pair is > 5cm
2) Sum of SAR is < 1.6 W/ kg

Accordingly, simultaneous Transmission SAR is not required for this device.

6.6 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.

6. 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

Web Site: www.adt.com.tw

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

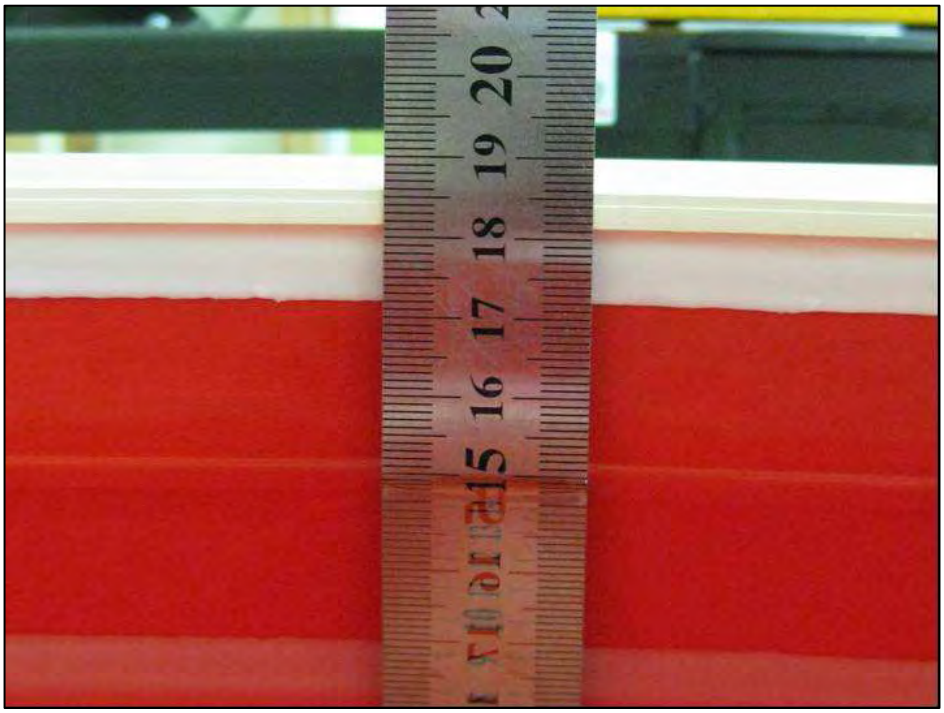
---END---

APPENDIX A: TEST DATA

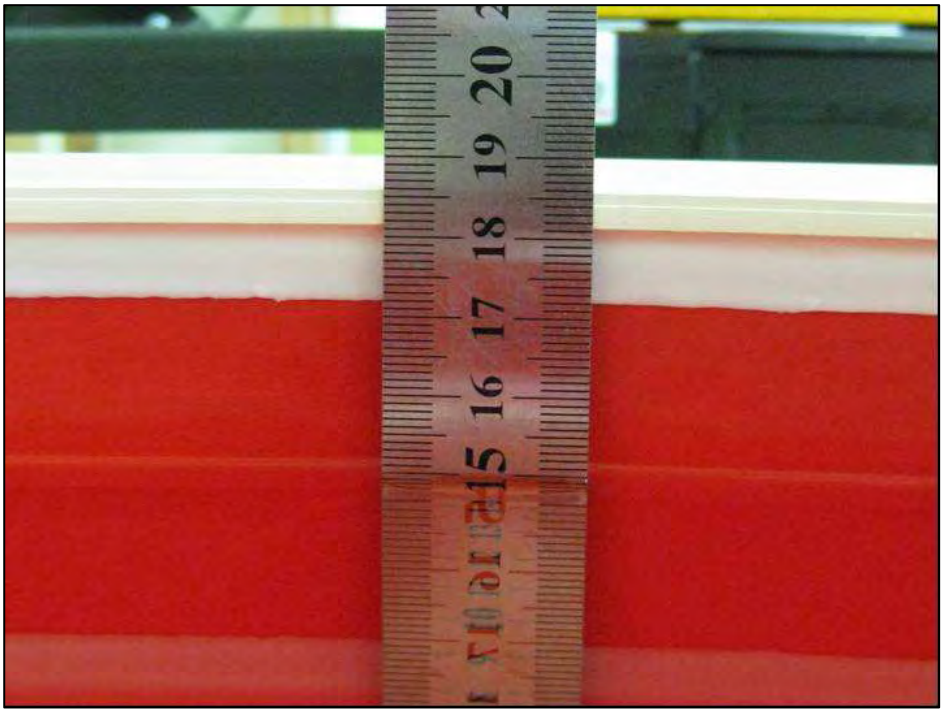
Product Name: Wireless Handheld Devices ; Model Number: RDJ21WW

Liquid Level Photo

Tissue 2450MHz D=150mm



Tissue 5800MHz D=150mm



Date/Time: 2011/2/9 02:20:32

M01-11b-Ch1

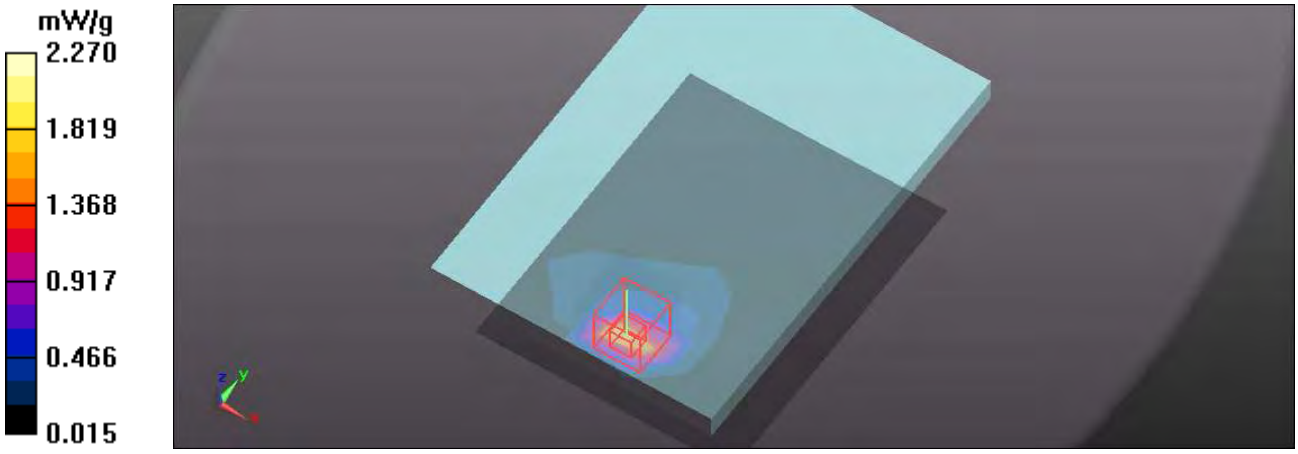
Communication System: 802.11b ; Frequency: 2412 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2412 MHz; σ = 1.92 mho/m; εr = 53.67; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(8.2, 8.2, 8.2); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.868 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.530 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 3.514 W/kg
SAR(1 g) = 1.38 mW/g; SAR(10 g) = 0.531 mW/g
Maximum value of SAR (measured) = 2.270 mW/g



Date/Time: 2011/2/9 03:33:12

M01-11b-Ch6

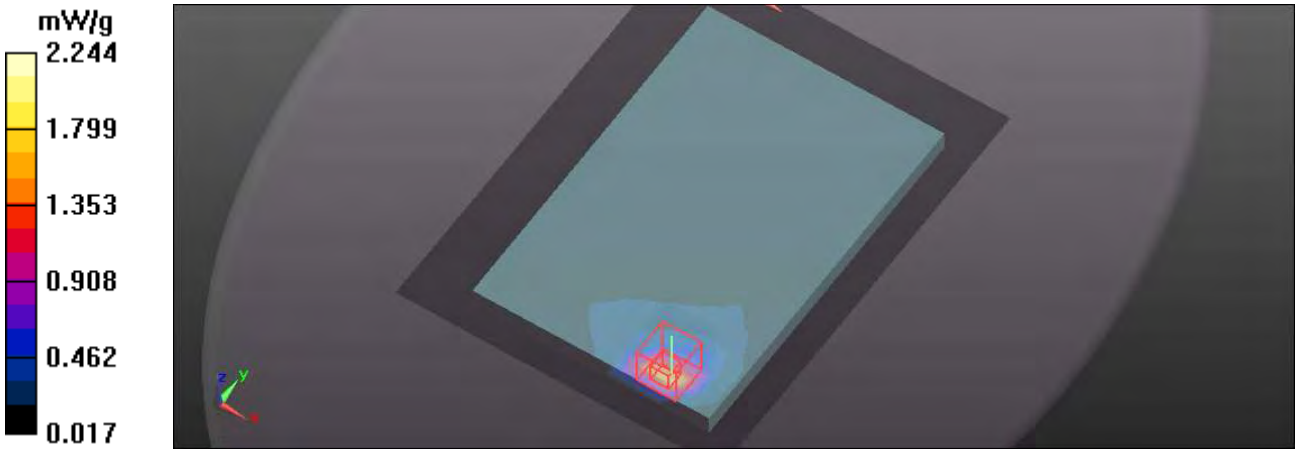
Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.96 mho/m; ε_r = 53.57; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(8.2, 8.2, 8.2); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (13x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.751 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.303 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 3.398 W/kg
SAR(1 g) = 1.37 mW/g; SAR(10 g) = 0.540 mW/g
Maximum value of SAR (measured) = 2.244 mW/g



Date/Time: 2011/2/9 04:26:31

M01-11b-Ch11

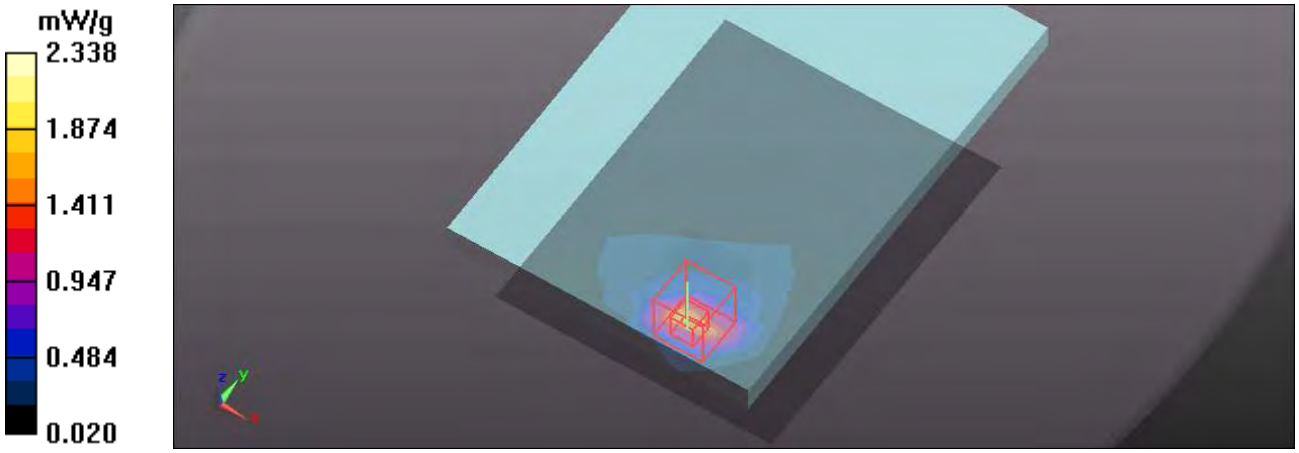
Communication System: 802.11b ; Frequency: 2462 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2 mho/m; ε_r = 53.27; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(8.2, 8.2, 8.2); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.815 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.439 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.508 W/kg
SAR(1 g) = 1.38 mW/g; SAR(10 g) = 0.535 mW/g
Maximum value of SAR (measured) = 2.338 mW/g



Date/Time: 2011/2/9 05:18:15

M02-11b-Ch6

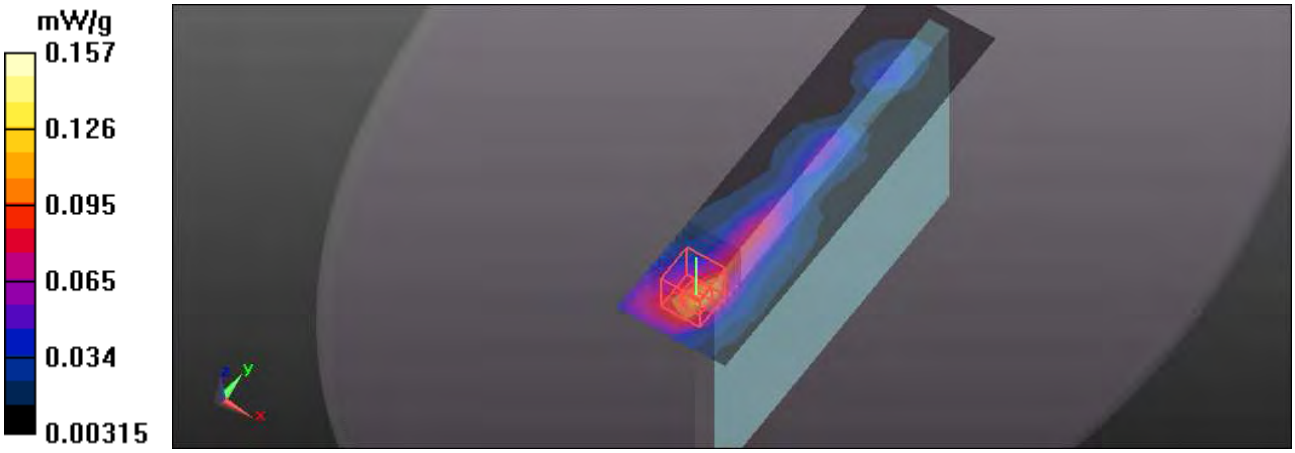
Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.96 mho/m; ε_r = 53.57; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The top side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(8.2, 8.2, 8.2); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (5x16x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.205 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.984 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.281 W/kg
SAR(1 g) = 0.144 mW/g; SAR(10 g) = 0.075 mW/g
Maximum value of SAR (measured) = 0.157 mW/g



Date/Time: 2011/2/9 05:55:14

M03-11b-Ch1

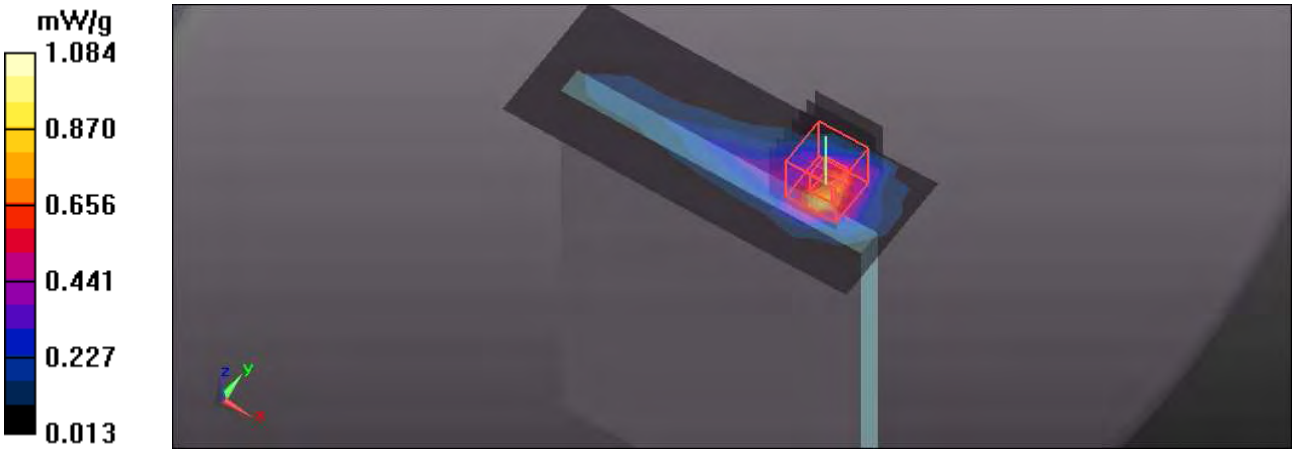
Communication System: 802.11b ; Frequency: 2412 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2412 MHz; σ = 1.92 mho/m; ε_r = 53.67; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The left edge side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(8.2, 8.2, 8.2); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (11x5x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.929 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.124 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 2.245 W/kg
SAR(1 g) = 0.934 mW/g; SAR(10 g) = 0.372 mW/g
Maximum value of SAR (measured) = 1.084 mW/g



Date/Time: 2011/2/9 06:35:35

M03-11b-Ch6

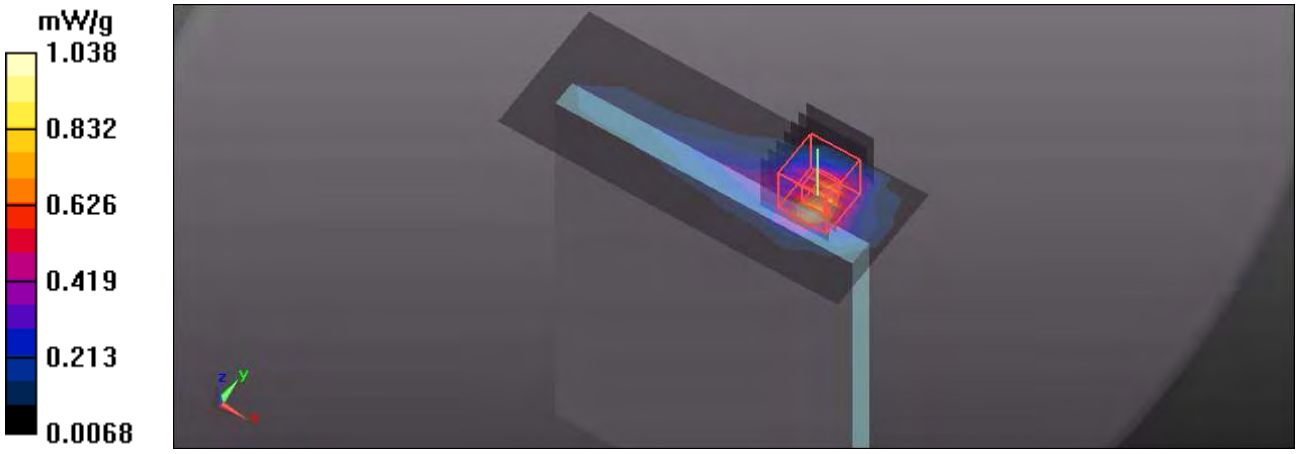
Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.96 mho/m; ε_r = 53.57; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The left edge side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(8.2, 8.2, 8.2); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (11x5x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.889 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.069 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 2.149 W/kg
SAR(1 g) = 0.894 mW/g; SAR(10 g) = 0.356 mW/g
Maximum value of SAR (measured) = 1.038 mW/g



Date/Time: 2011/2/9 07:19:46

M03-11b-Ch11

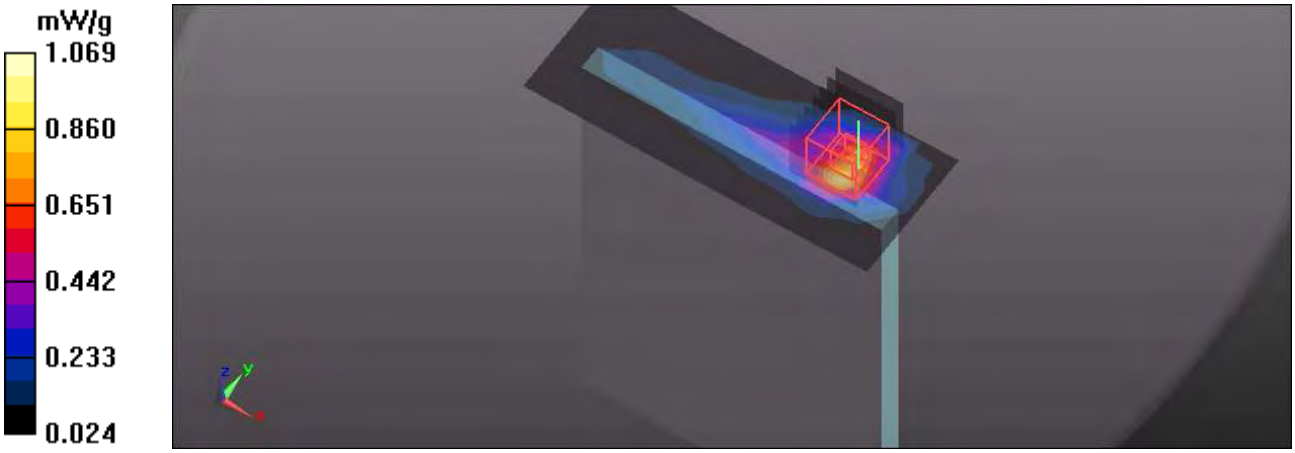
Communication System: 802.11b ; Frequency: 2462 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2 mho/m; ε_r = 53.27; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The left edge side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(8.2, 8.2, 8.2); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (11x5x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.916 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.826 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 2.214 W/kg
SAR(1 g) = 0.921 mW/g; SAR(10 g) = 0.367 mW/g
Maximum value of SAR (measured) = 1.069 mW/g



Date/Time: 2011/2/10 08:55:53

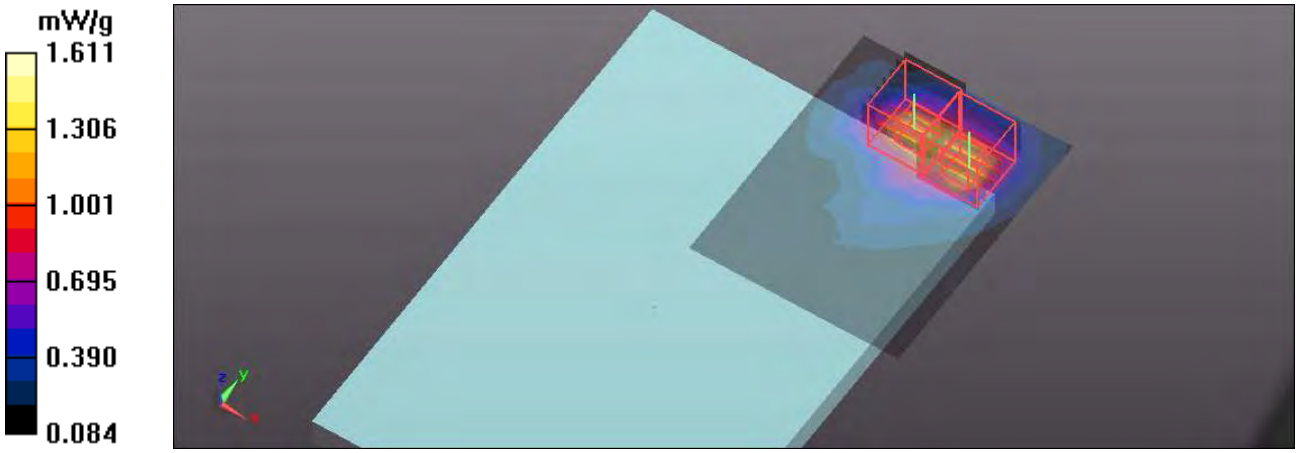
M04-11a_Ch149

Communication System: 802.11a ; Frequency: 5745 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5745 MHz; σ = 6.01 mho/m; εr = 49.06; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.359 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.123 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 2.915 W/kg
SAR(1 g) = 0.870 mW/g; SAR(10 g) = 0.368 mW/g
Maximum value of SAR (measured) = 1.611 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.123 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 2.908 W/kg
SAR(1 g) = 0.834 mW/g; SAR(10 g) = 0.360 mW/g
Maximum value of SAR (measured) = 1.550 mW/g



Date/Time: 2011/2/10 09:42:36

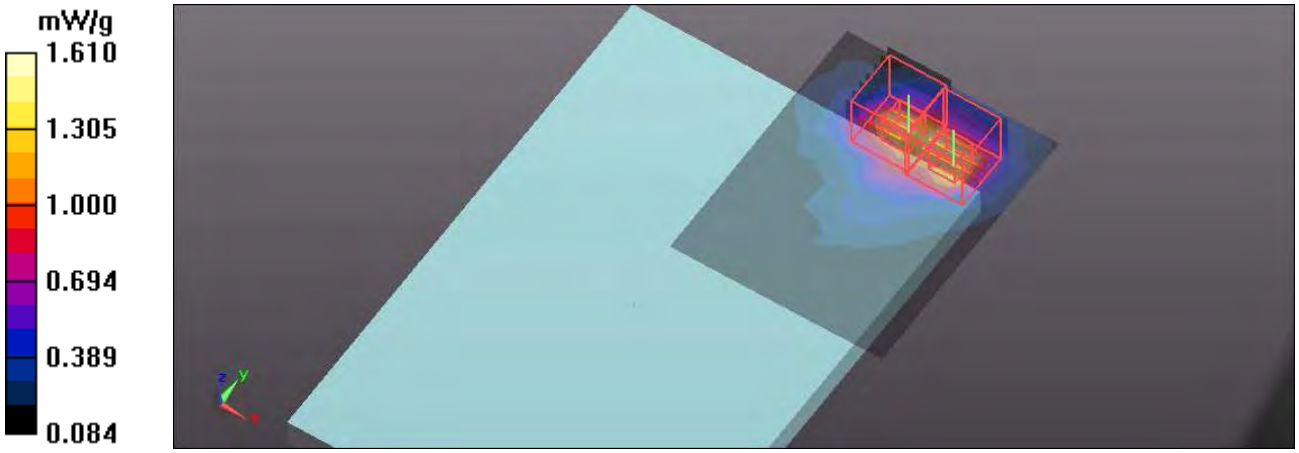
M04-11a_Ch157

Communication System: 802.11a ; Frequency: 5785 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5785 MHz; σ = 6.07 mho/m; εr = 48.96; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.412 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.770 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 2.949 W/kg
SAR(1 g) = 0.868 mW/g; SAR(10 g) = 0.371 mW/g
Maximum value of SAR (measured) = 1.608 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.770 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 3.000 W/kg
SAR(1 g) = 0.867 mW/g; SAR(10 g) = 0.371 mW/g
Maximum value of SAR (measured) = 1.610 mW/g



Date/Time: 2011/2/10 10:29:41

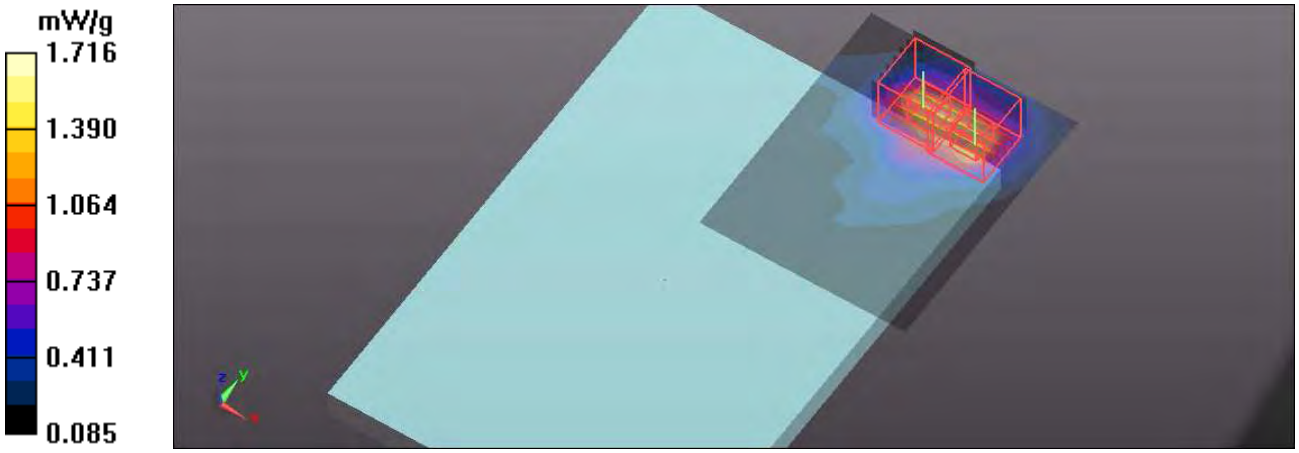
M04-11a_Ch165

Communication System: 802.11a ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used : f = 5825 MHz; σ = 6.13 mho/m; εr = 48.87; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.570 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.417 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 3.200 W/kg
SAR(1 g) = 0.921 mW/g; SAR(10 g) = 0.392 mW/g
Maximum value of SAR (measured) = 1.716 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.417 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 3.108 W/kg
SAR(1 g) = 0.899 mW/g; SAR(10 g) = 0.386 mW/g
Maximum value of SAR (measured) = 1.671 mW/g



Date/Time: 2011/2/10 15:49:52

M05-11a_B4-Ch157

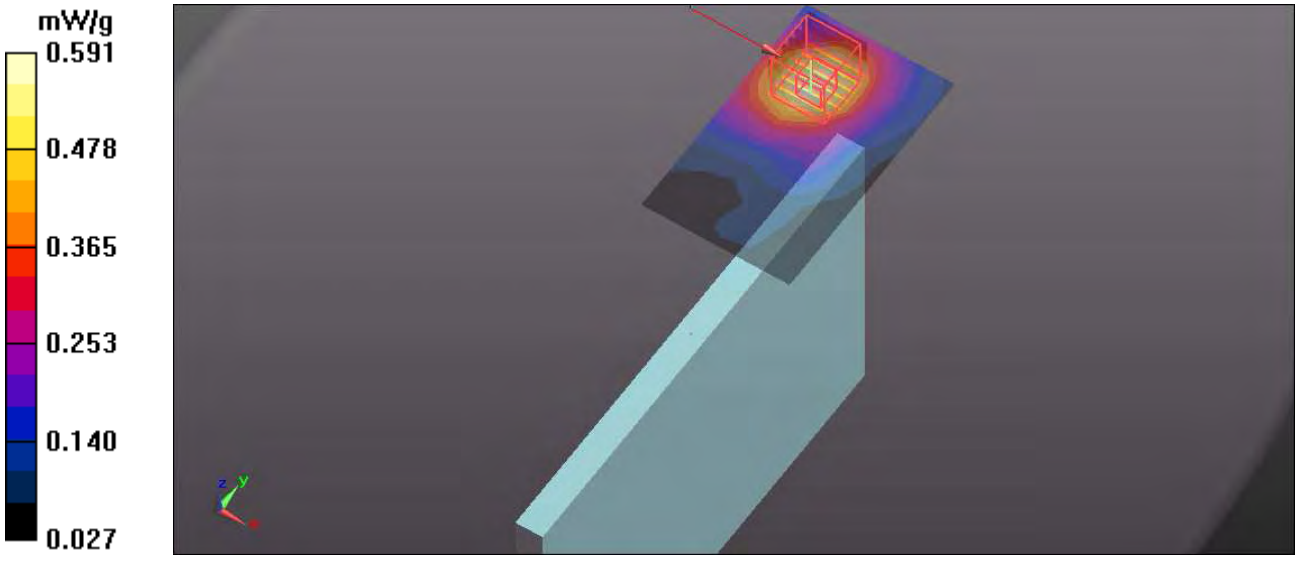
Communication System: 802.11a ; Frequency: 5785 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5785 MHz; σ = 6.07 mho/m; εr = 48.96; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The top side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.570 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.199 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.032 W/kg
SAR(1 g) = 0.342 mW/g; SAR(10 g) = 0.168 mW/g
Maximum value of SAR (measured) = 0.591 mW/g



Date/Time: 2011/2/10 20:38:15

M06-11a_B4-Ch149

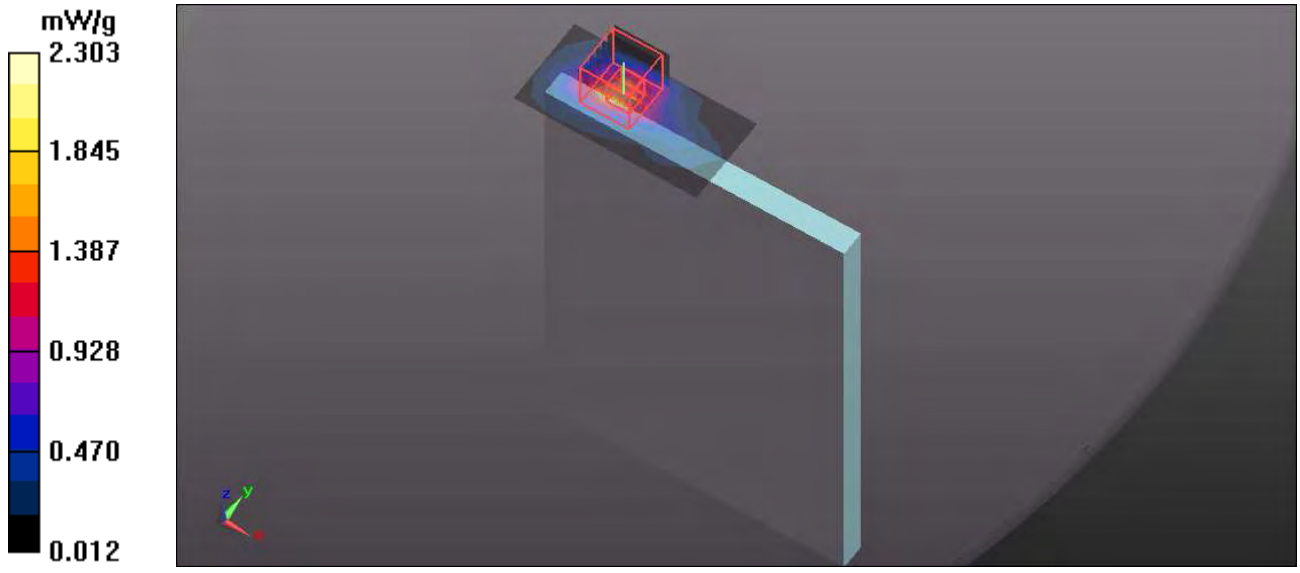
Communication System: 802.11a ; Frequency: 5745 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5745 MHz; σ = 6.01 mho/m; εr = 49.06; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The right edge side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x5x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.780 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 7.727 V/m; Power Drift = -0.0083 dB
Peak SAR (extrapolated) = 4.273 W/kg
SAR(1 g) = 1.13 mW/g; SAR(10 g) = 0.384 mW/g
Maximum value of SAR (measured) = 2.303 mW/g



Date/Time: 2011/2/10 21:01:42

M06-11a_B4-Ch157

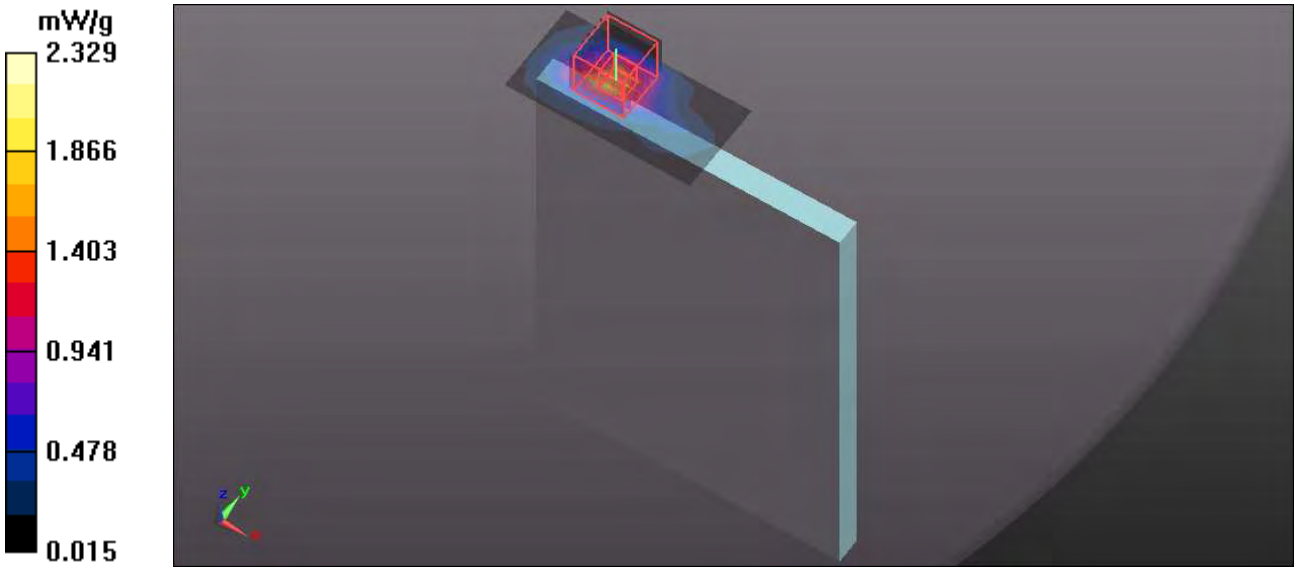
Communication System: 802.11a ; Frequency: 5785 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5785 MHz; σ = 6.07 mho/m; εr = 48.96; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The right edge side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x5x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.807 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 7.708 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 4.372 W/kg
SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.385 mW/g
Maximum value of SAR (measured) = 2.329 mW/g



Date/Time: 2011/2/10 21:25:54

M06-11a_B4-Ch165

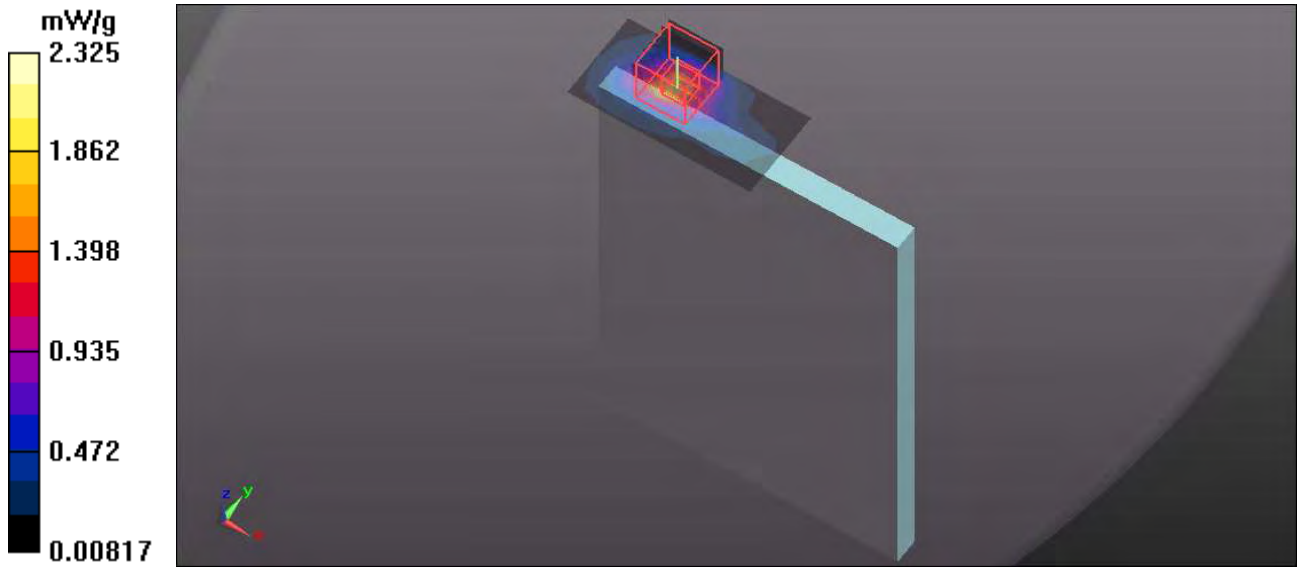
Communication System: 802.11a ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used : f = 5825 MHz; σ = 6.13 mho/m; εr = 48.87; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The right edge side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x5x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.800 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 7.521 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 4.455 W/kg
SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.388 mW/g
Maximum value of SAR (measured) = 2.325 mW/g



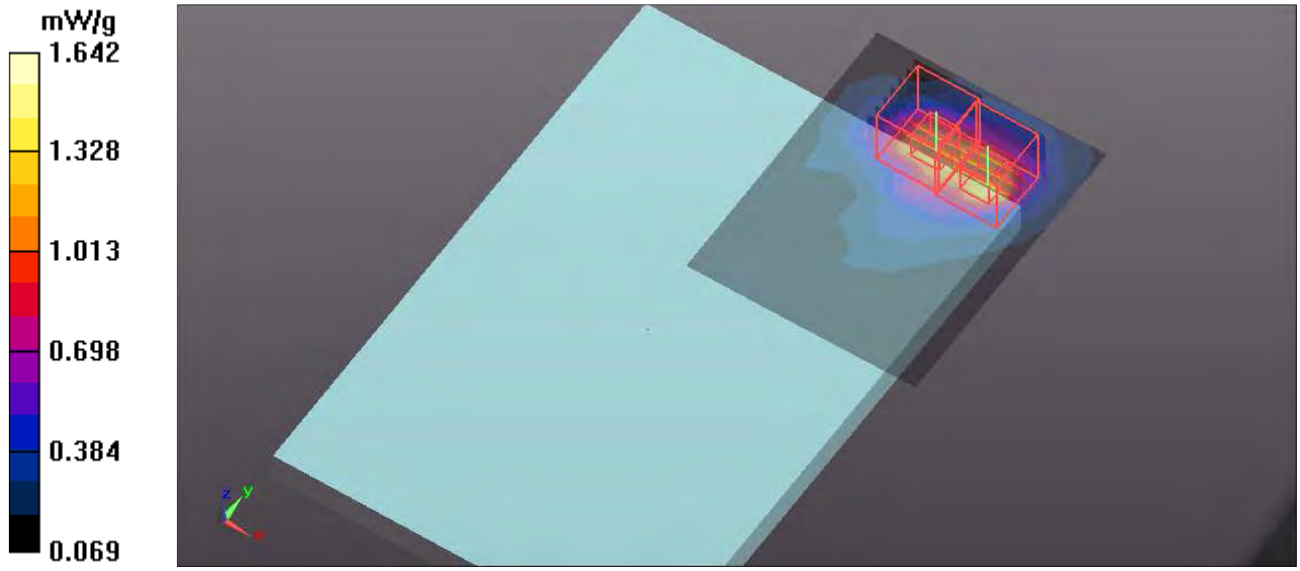
Date/Time: 2011/2/11 06:49:45

M07-11an20_B4-Ch149

Communication System: 802.11a ; Frequency: 5745 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5745 MHz; σ = 6.03 mho/m; εr = 48.93; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)
DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.425 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.071 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 2.970 W/kg
SAR(1 g) = 0.879 mW/g; SAR(10 g) = 0.362 mW/g
Maximum value of SAR (measured) = 1.642 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.071 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 2.946 W/kg
SAR(1 g) = 0.848 mW/g; SAR(10 g) = 0.352 mW/g
Maximum value of SAR (measured) = 1.615 mW/g



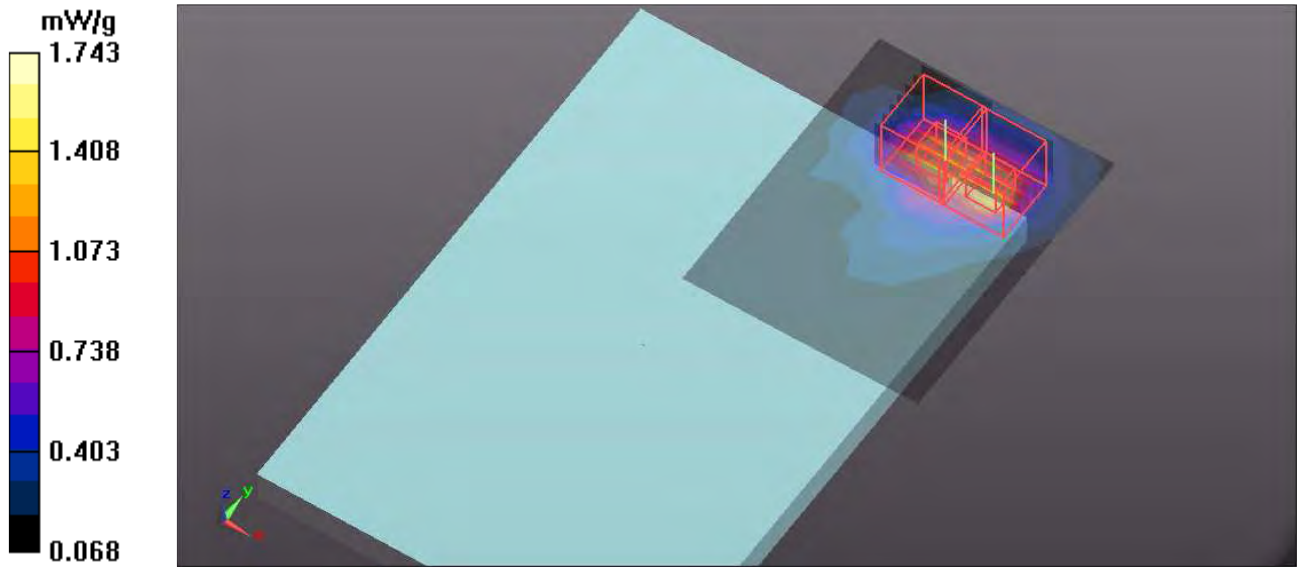
Date/Time: 2011/2/11 07:53:14

M07-11an20_B4-Ch157

Communication System: 802.11a ; Frequency: 5785 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5785 MHz; σ = 6.09 mho/m; εr = 48.83; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)
DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.414 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.042 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 3.058 W/kg
SAR(1 g) = 0.897 mW/g; SAR(10 g) = 0.367 mW/g
Maximum value of SAR (measured) = 1.692 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.042 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 3.245 W/kg
SAR(1 g) = 0.904 mW/g; SAR(10 g) = 0.371 mW/g
Maximum value of SAR (measured) = 1.743 mW/g



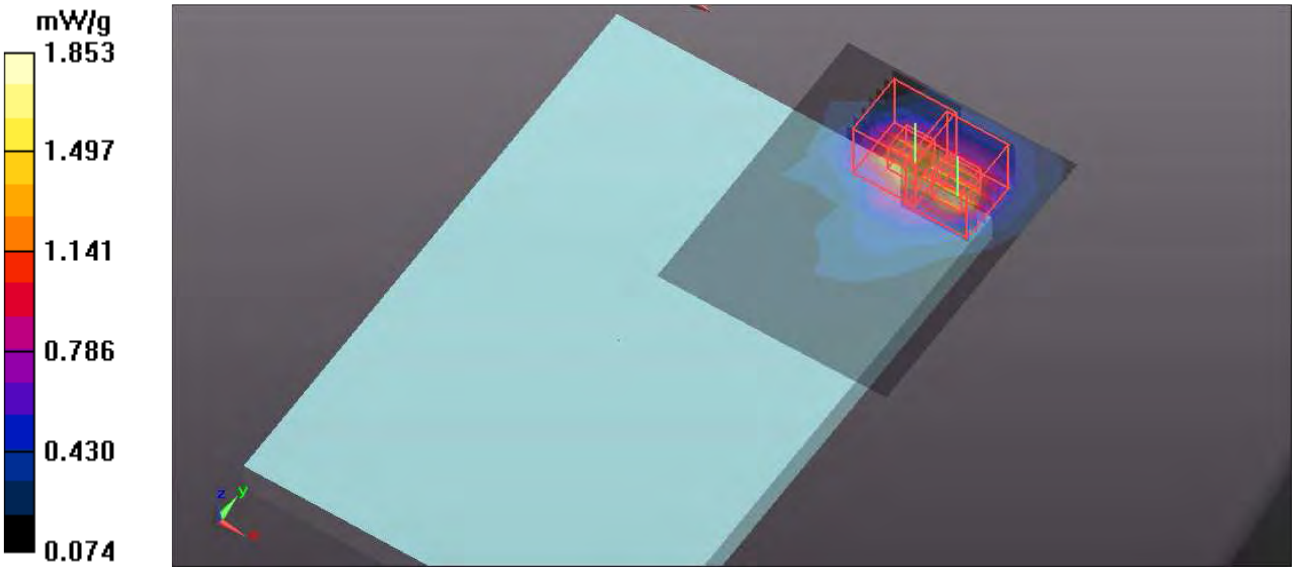
Date/Time: 2011/2/11 08:39:42

M07-11an20_B4-Ch165

Communication System: 802.11a ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used : f = 5825 MHz; σ = 6.15 mho/m; εr = 48.72; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)
DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.506 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 2.505 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 3.125 W/kg
SAR(1 g) = 0.915 mW/g; SAR(10 g) = 0.384 mW/g
Maximum value of SAR (measured) = 1.702 mW/g
Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 2.505 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 3.400 W/kg
SAR(1 g) = 0.958 mW/g; SAR(10 g) = 0.392 mW/g
Maximum value of SAR (measured) = 1.853 mW/g



Date/Time: 2011/2/11 13:19:46

M08-11an20_B4-Ch157

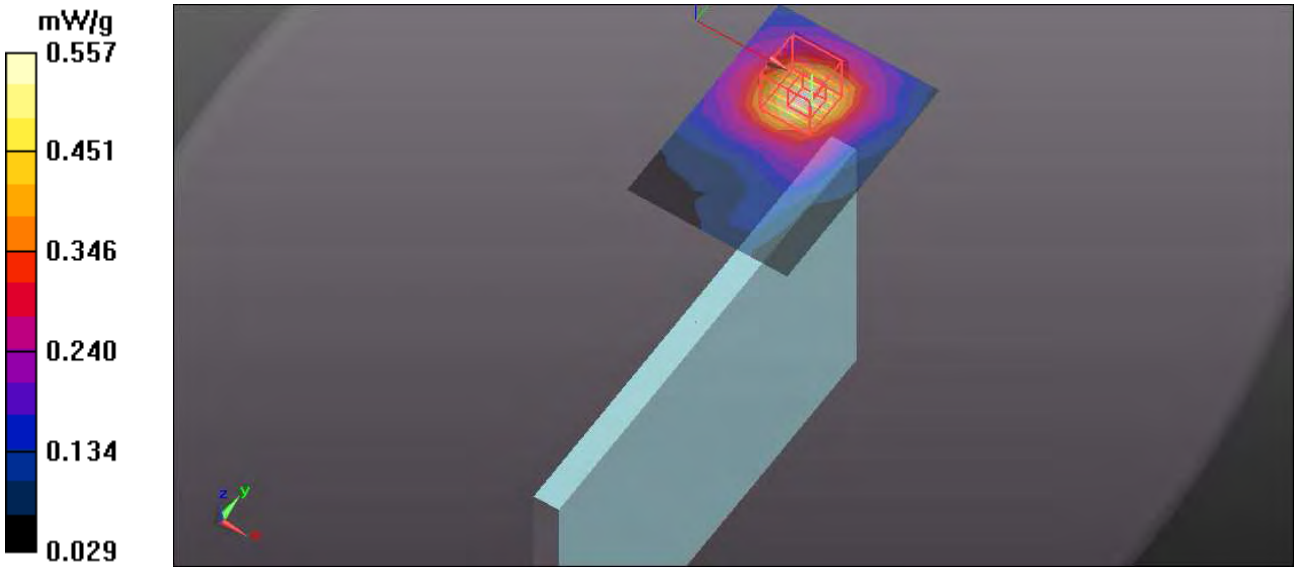
Communication System: 802.11a ; Frequency: 5785 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5785 MHz; σ = 6.09 mho/m; εr = 48.83; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The top side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (8x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.565 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.687 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.983 W/kg
SAR(1 g) = 0.322 mW/g; SAR(10 g) = 0.159 mW/g
Maximum value of SAR (measured) = 0.557 mW/g



Date/Time: 2011/2/11 17:46:31

M09-11an20_B4-Ch149

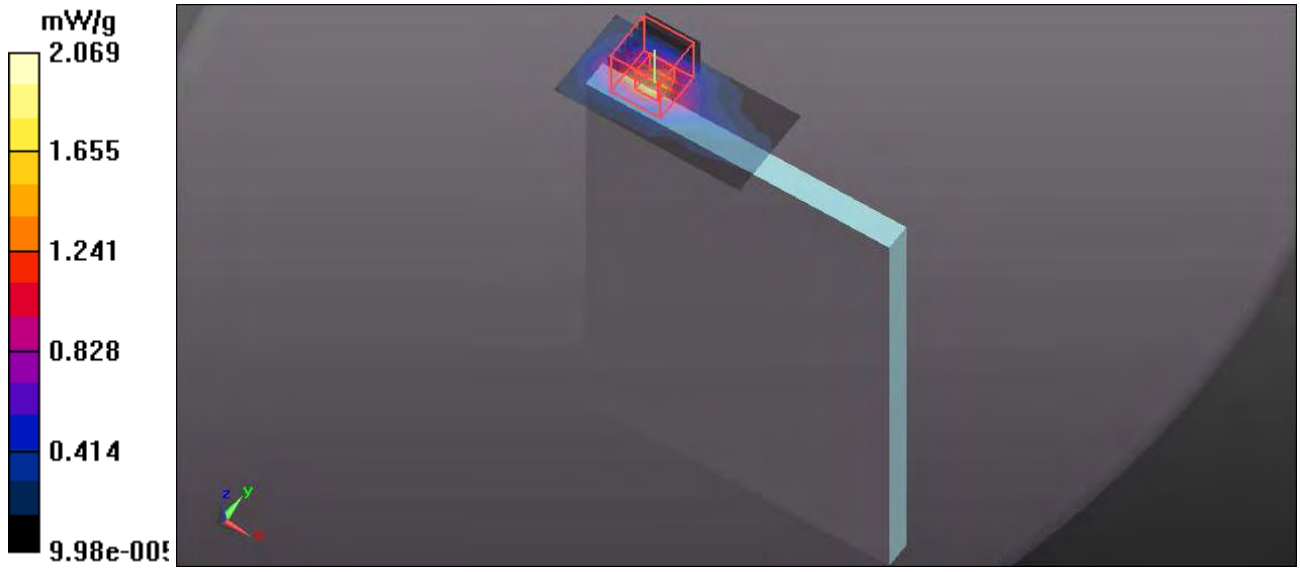
Communication System: 5G 11n 20M ; Frequency: 5745 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5745 MHz; σ = 6.03 mho/m; εr = 48.93; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The right edge side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x5x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.749 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 7.734 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 3.725 W/kg
SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.345 mW/g
Maximum value of SAR (measured) = 2.069 mW/g



Date/Time: 2011/2/11 18:23:01

M09-11an20_B4-Ch157

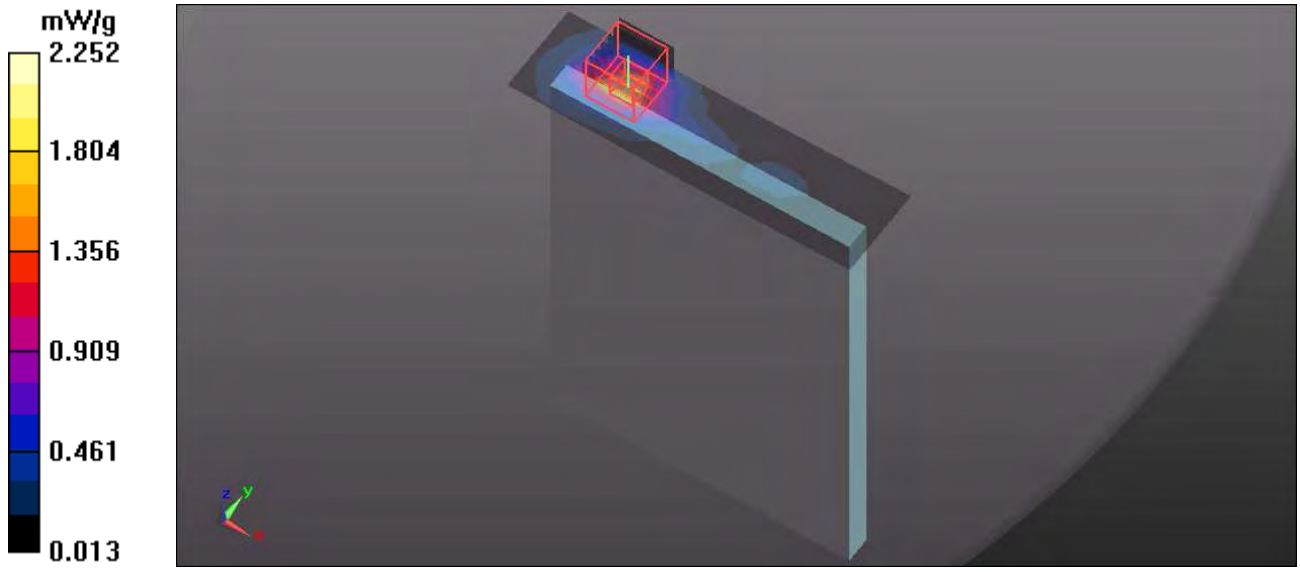
Communication System: 5G 11n 20M ; Frequency: 5785 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5785 MHz; σ = 6.09 mho/m; εr = 48.83; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The right edge side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (16x5x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.754 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 8.513 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 4.163 W/kg
SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.387 mW/g
Maximum value of SAR (measured) = 2.252 mW/g



Date/Time: 2011/2/11 18:46:23

M09-11an20_B4-Ch165

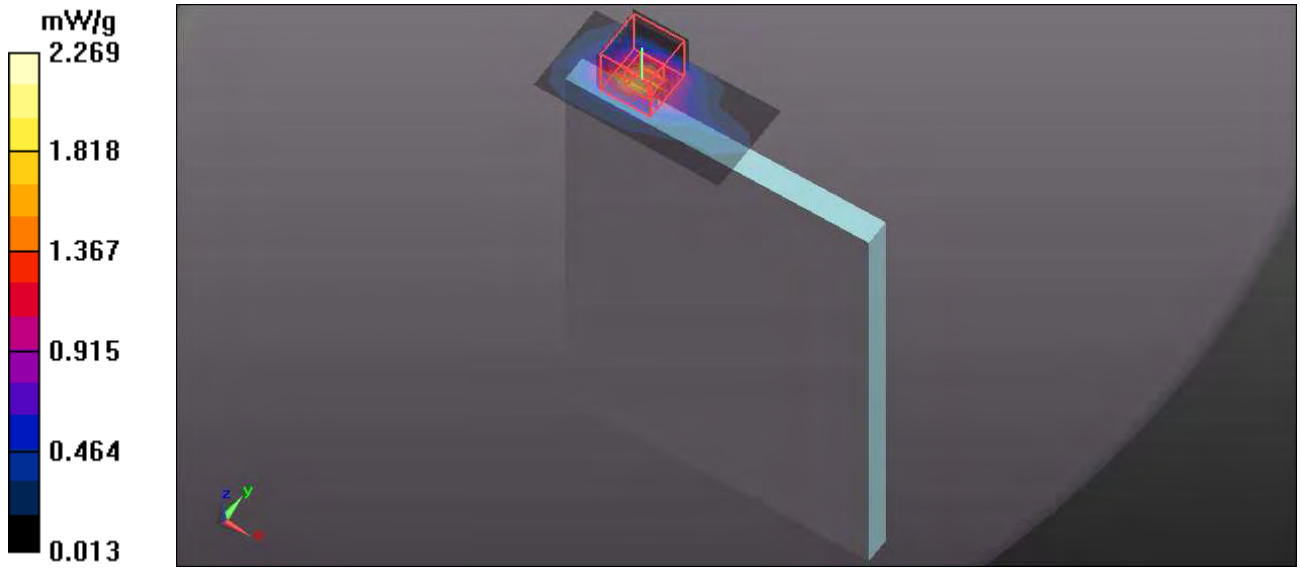
Communication System: 5G 11n 20M ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used : f = 5825 MHz; σ = 6.15 mho/m; εr = 48.72; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The right edge side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA;Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Flat-Section MSL/Flat Section 5mm /Area Scan (9x5x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.850 mW/g

Flat-Section MSL/Flat Section 5mm /Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 8.634 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 4.312 W/kg
SAR(1 g) = 1.12 mW/g; SAR(10 g) = 0.387 mW/g
Maximum value of SAR (measured) = 2.269 mW/g



Date/Time: 2011/2/9 01:05:09

SystemPerformanceCheck-D2450V2-MSL2450 MHz

DUT: Dipole 2450 MHz D2450V2 ; Type: D2450V2 ; Serial: D2450V2 - SN:737 ; Test Frequency: 2450 MHz

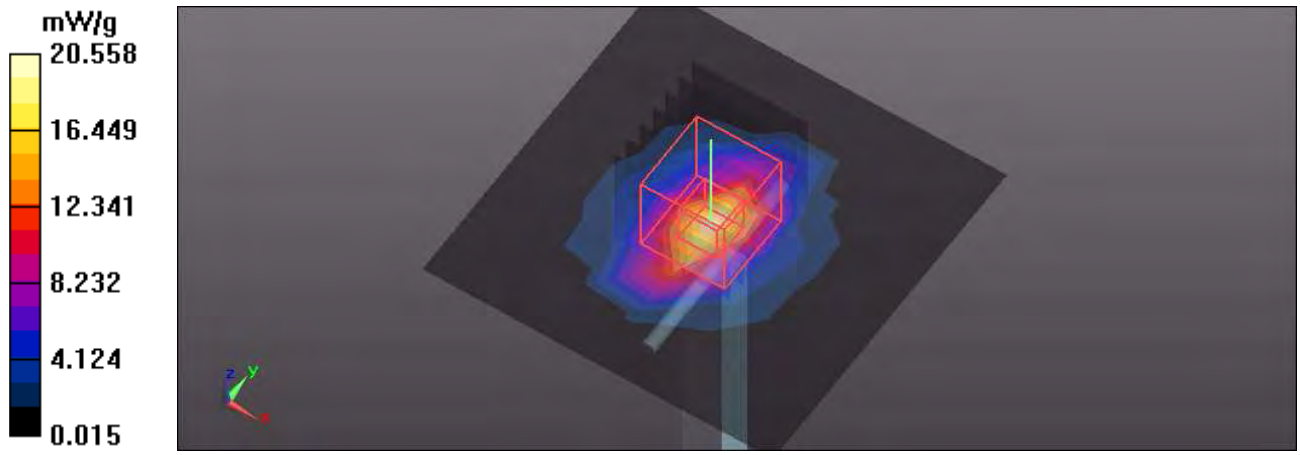
Communication System: CW ; Frequency: 2450 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL2450;Medium parameters used: f = 2450 MHz; σ = 1.99 mho/m; ε_r = 53.37; ρ = 1000 kg/m^3 ; Liquid level : 150 mm
Phantom section: Flat Section ; Separation distance : 10 mm (The feet point of the dipole to the Phantom)Air temp. : 22.7 degrees ; Liquid temp. : 21.6 degrees

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(8.2, 8.2, 8.2); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

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) = 20.558 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 = 101.1 V/m; Power Drift = -0.00043 dB
Peak SAR (extrapolated) = 30.374 W/kg
SAR(1 g) = 13.3 mW/g; SAR(10 g) = 5.95 mW/g
Maximum value of SAR (measured) = 15.074 mW/g



Date/Time: 2011/2/10 02:00:05

SystemPerformanceCheck-D5GHz-uniform-MSL5800 MHz

DUT: Dipole D5GHzV2 ; Type: D5GHzV2 ; Serial: D5GHzV2 - SN:1019 ; Test Frequency: 5800 MHz

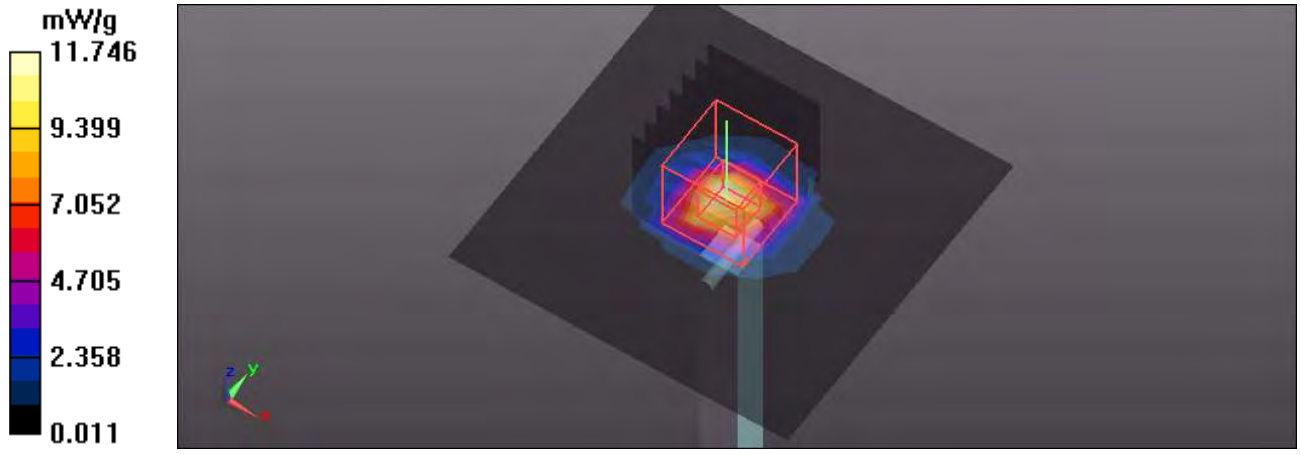
Communication System: CW-5GHz ; Frequency: 5800 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL5800;Medium parameters used: f = 5800 MHz; σ = 6.1 mho/m; ε_r = 48.92; ρ = 1000 kg/m^3 ; Liquid level : 150 mm
Phantom section: Flat Section ; Separation distance : 10 mm (The feet point of the dipole to the Phantom)Air temp. : 23 degrees ; Liquid temp. : 22.1 degrees

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

System Performance Check with D5GHzV2 Dipole (uniform grid)/d=10mm, Pin=100mW, f=5800 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 11.746 mW/g

System Performance Check with D5GHzV2 Dipole (uniform grid)/d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (4x4x2.5mm), dist=2mm (8x8x10)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 59.644 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 23.731 W/kg
SAR(1 g) = 7.23 mW/g; SAR(10 g) = 1.95 mW/g
Maximum value of SAR (measured) = 9.303 mW/g



Date/Time: 2011/2/11 01:16:08

SystemPerformanceCheck-D5GHz-uniform-MSL5800 MHz

DUT: Dipole D5GHzV2 ; Type: D5GHzV2 ; Serial: D5GHzV2 - SN:1019 ; Test Frequency: 5800 MHz

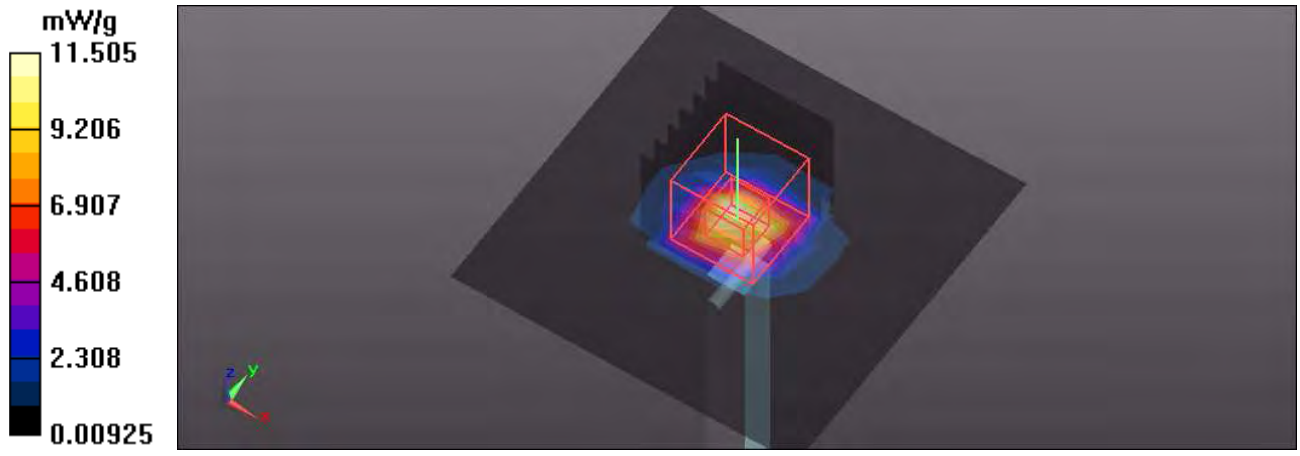
Communication System: CW-5GHz ; Frequency: 5800 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL5800;Medium parameters used: f = 5800 MHz; σ = 6.12 mho/m; ε_r = 48.78; ρ = 1000 kg/m^3 ; Liquid level : 150 mm
Phantom section: Flat Section ; Separation distance : 10 mm (The feet point of the dipole to the Phantom)Air temp. : 22.7 degrees ; Liquid temp. : 21.8 degrees

DASY5 Configuration:

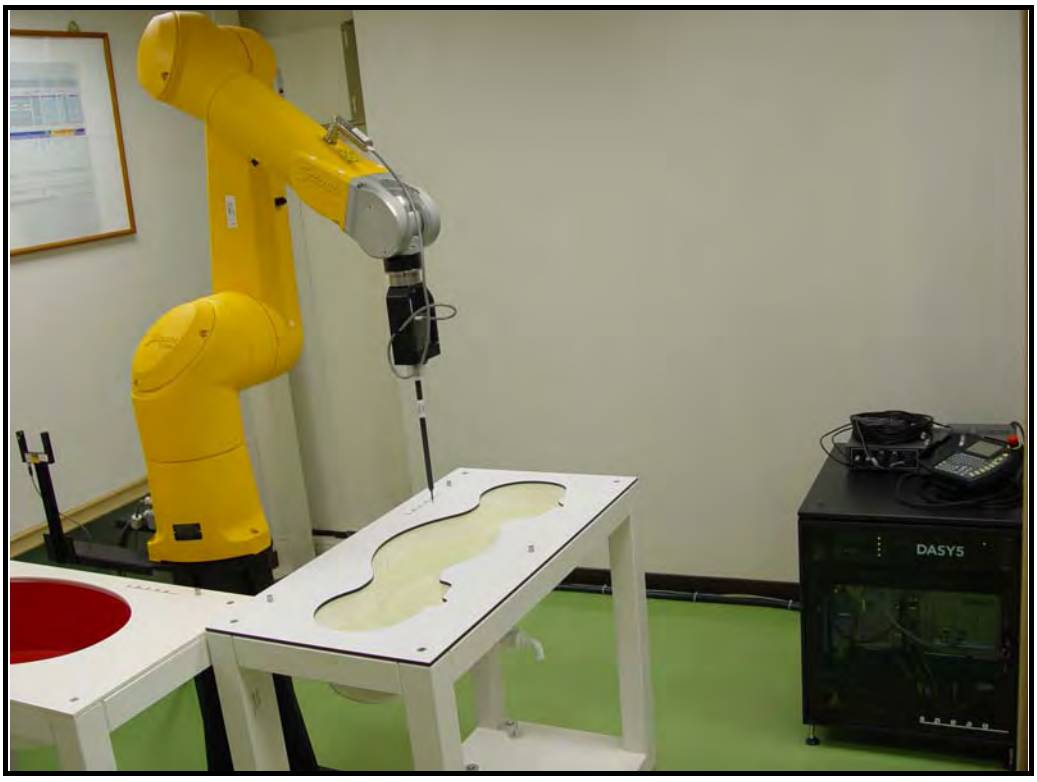
- Probe: EX3DV4 - SN3590; ConvF(4.41, 4.41, 4.41); Calibrated: 2010/3/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2010/10/4
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1043
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

System Performance Check with D5GHzV2 Dipole (uniform grid)/d=10mm, Pin=100mW, f=5800 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 11.505 mW/g

System Performance Check with D5GHzV2 Dipole (uniform grid)/d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (4x4x2.5mm), dist=2mm (8x8x10)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 58.844 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 24.058 W/kg
SAR(1 g) = 7.17 mW/g; SAR(10 g) = 1.95 mW/g
Maximum value of SAR (measured) = 9.208 mW/g



APPENDIX B: BV ADT SAR MEASUREMENT SYSTEM



APPENDIX C: PHOTOGRAPHS OF SYSTEM VALIDATION

APPENDIX D: SYSTEM CERTIFICATE & CALIBRATION

D1: PHANTOM

Schmid & Partner Engineering AG

s p e a g

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Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Certificate of Conformity / First Article Inspection

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

Tests

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

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

Standards

[1] IEC 62209 – 2, Draft Version 0.9, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation and Procedures
Part 2: Procedure to determine the Specific Absorption Rate (SAR) for ... including accessories and multiple transmitters", December 2004

Conformity

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

Date 07.07.2005

Signature / Stamp

s p e a g

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

D2: DOSIMETRIC E-FIELD PROBE

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

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 **BV-ADT (Auden)**

Certificate No: EX3-3590_Mar10

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3590

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: March 25, 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-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	29-Sep-09 (No. DAE4-660_Sep09)	Sep-10

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-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: March 25, 2010

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

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

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,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:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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*.
- *DCPx,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.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,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 *NORMx,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:3590

Manufactured:	March 23, 2009
Last calibrated:	April 28, 2009
Recalibrated:	March 25, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: EX3DV4 SN:3590

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.49	0.49	0.50	± 10.1%
DCP (mV)[B]	88.1	87.5	87.6	

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	300	± 1.5%
			Y	0.00	0.00	1.00	300	
			Z	0.00	0.00	1.00	300	

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 - Parameters of Probe: EX3DV4 SN:3590

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)
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	10.25	10.25	10.25	0.74	0.61 ± 11.0%
1750	± 50 / ± 100	40.1 ± 5%	1.37 ± 5%	8.89	8.89	8.89	0.76	0.58 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	8.33	8.33	8.33	0.62	0.64 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	7.90	7.90	7.90	0.36	0.84 ± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	7.79	7.79	7.79	0.19	1.32 ± 11.0%
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	5.30	5.30	5.30	0.40	1.90 ± 13.1%
5300	± 50 / ± 100	35.9 ± 5%	4.76 ± 5%	4.92	4.92	4.92	0.45	1.90 ± 13.1%
5500	± 50 / ± 100	35.6 ± 5%	4.96 ± 5%	4.93	4.93	4.93	0.45	1.90 ± 13.1%
5600	± 50 / ± 100	35.5 ± 5%	5.07 ± 5%	4.63	4.63	4.63	0.50	1.90 ± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	4.54	4.54	4.54	0.50	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 - Parameters of Probe: EX3DV4 SN:3590

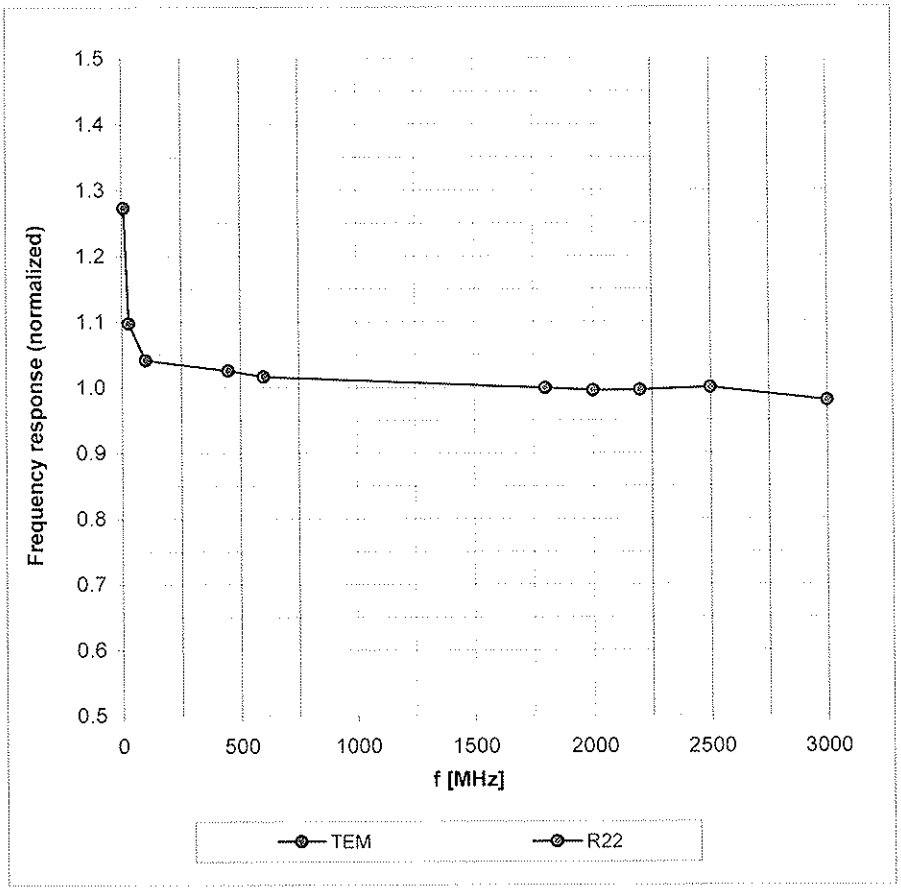
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	10.20	10.20	10.20	0.60	0.71 ± 11.0%
1750	± 50 / ± 100	53.4 ± 5%	1.49 ± 5%	8.69	8.69	8.69	0.79	0.58 ± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	8.61	8.61	8.61	0.40	0.80 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	8.20	8.20	8.20	0.28	1.02 ± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	8.04	8.04	8.04	0.21	1.25 ± 11.0%
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	4.80	4.80	4.80	0.53	1.95 ± 13.1%
5300	± 50 / ± 100	48.5 ± 5%	5.42 ± 5%	4.50	4.50	4.50	0.53	1.95 ± 13.1%
5500	± 50 / ± 100	48.6 ± 5%	5.65 ± 5%	4.32	4.32	4.32	0.55	1.95 ± 13.1%
5600	± 50 / ± 100	48.5 ± 5%	5.77 ± 5%	4.16	4.16	4.16	0.50	1.95 ± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	4.41	4.41	4.41	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.

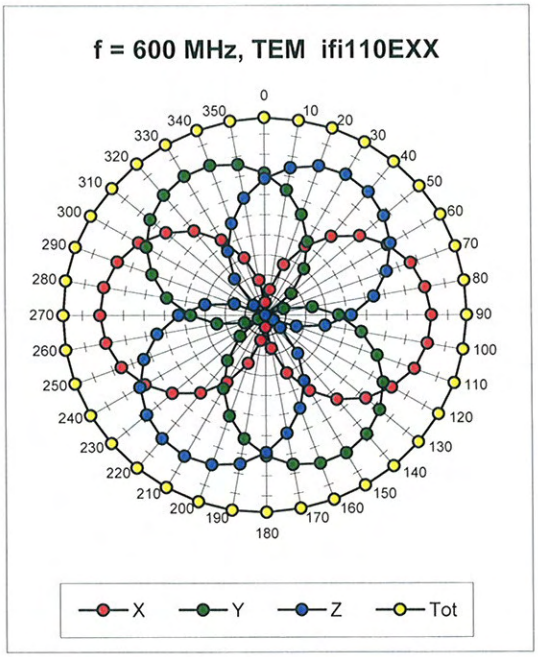
Frequency Response of E-Field

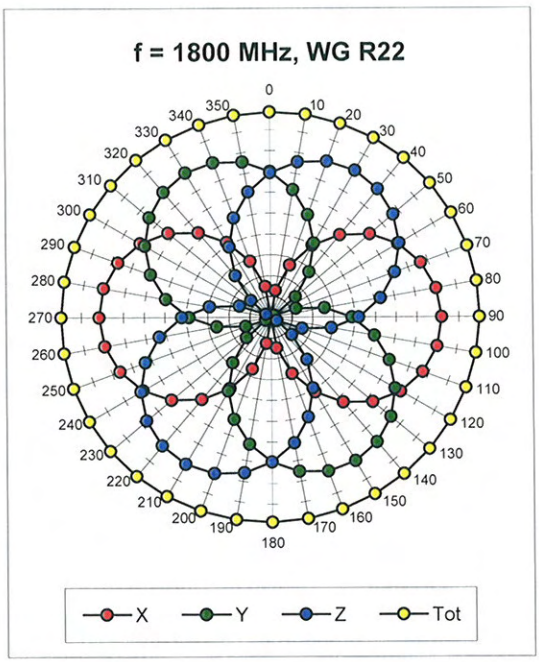
(TEM-Cell:ifi110 EXX, Waveguide: R22)

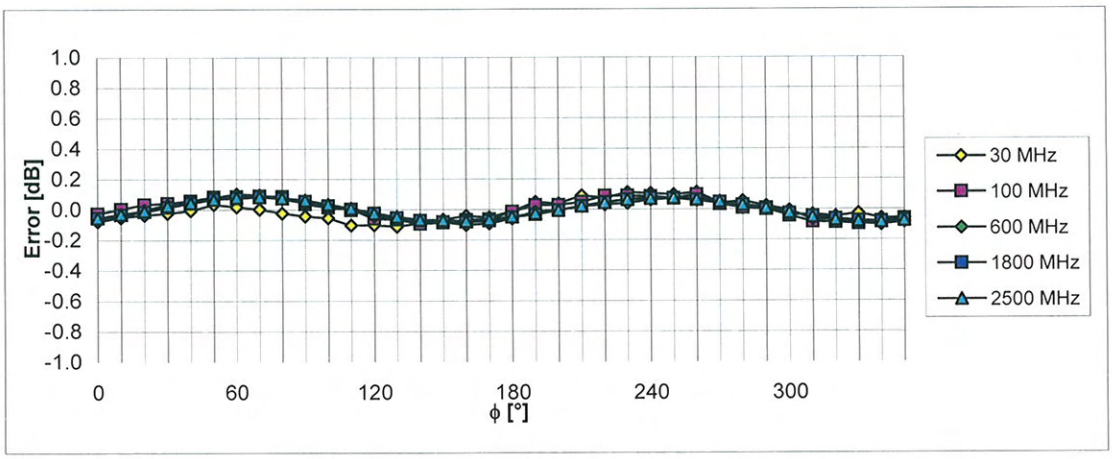


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



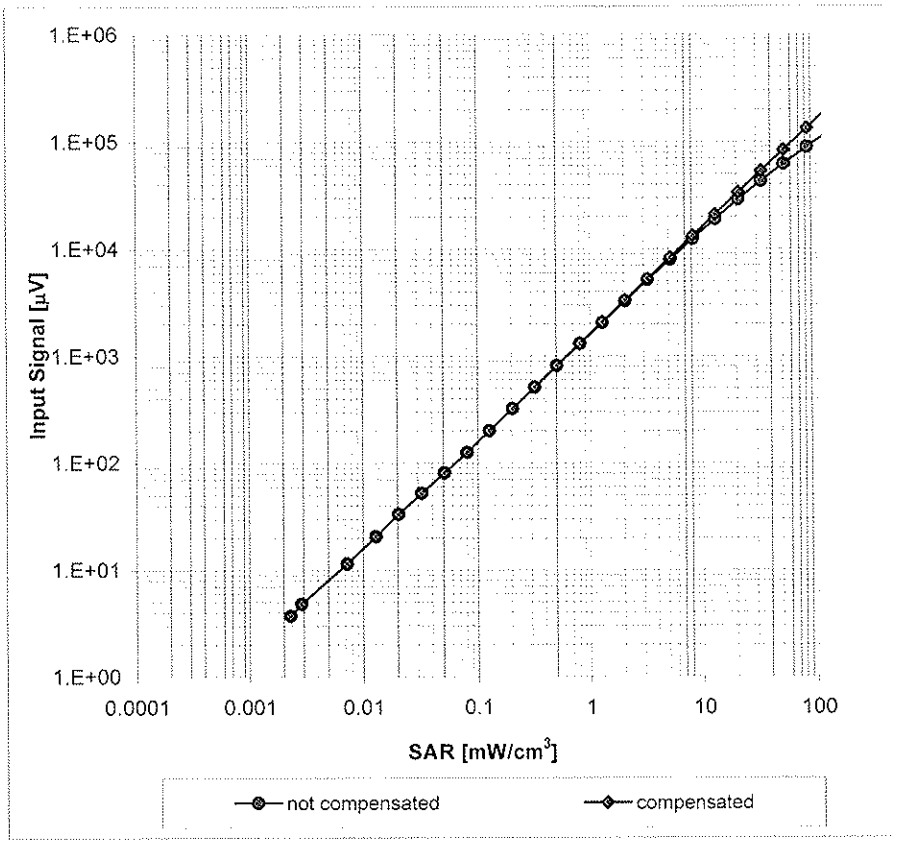


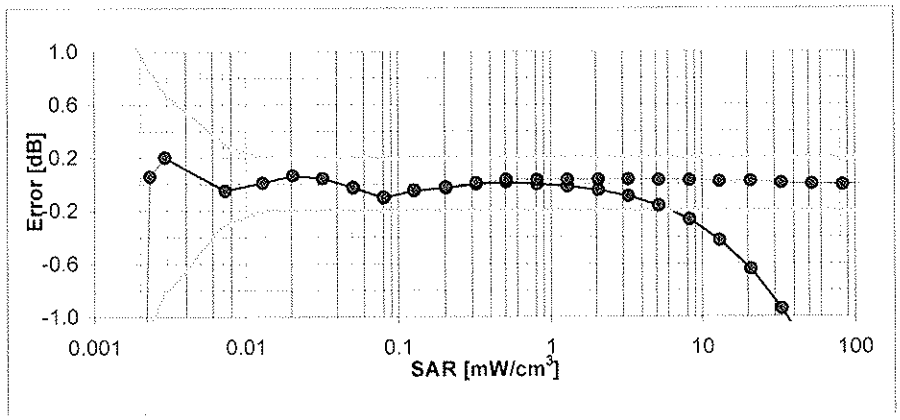


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

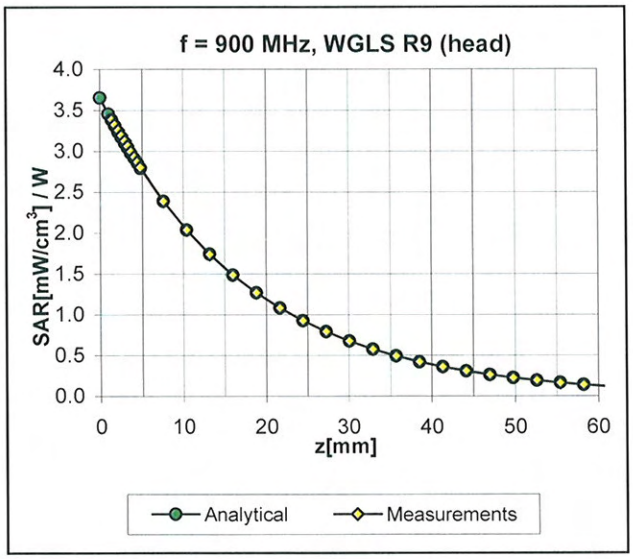
(Waveguide R22, f = 1800 MHz)

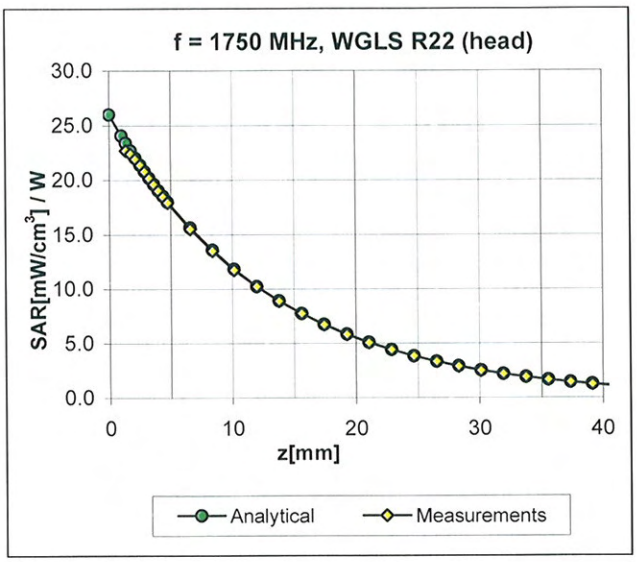




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

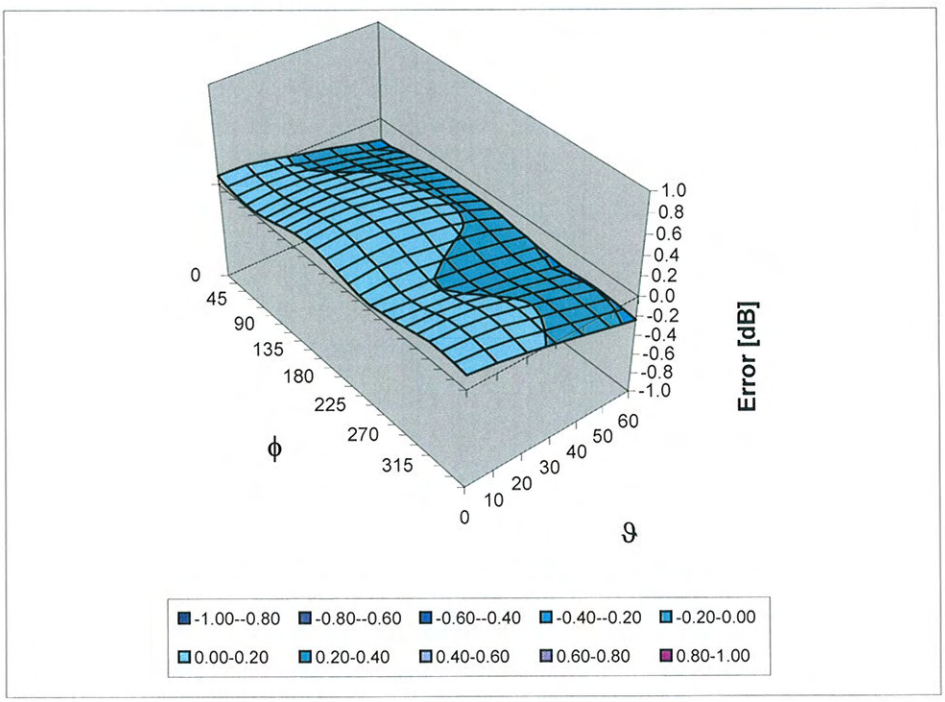
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 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

D3: DAE

Schmid & Partner Engineering AG

s p e a g

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IMPORTANT NOTICE

USAGE OF THE DAE 3

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE3 unit is connected to a fragile 3-pin battery connector. Customer is responsible to apply outmost caution not to bend or damage the connector when changing batteries.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration the customer shall remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, Customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Calibration Laboratory of
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S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

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 **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

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: October 4, 2010

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 =	6.1μV ,	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 ± 0.1% (k=2)	404.261 ± 0.1% (k=2)	404.619 ± 0.1% (k=2)
Low Range	3.97841 ± 0.7% (k=2)	3.96431 ± 0.7% (k=2)	3.98318 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	280.0 ° ± 1 °

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 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
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