SAR TEST REPORT

REPORT NO.: SA981023L02A

MODEL NO.: TEW-624UB

RECEIVED: Oct. 01, 2009

TESTED: Feb. 03, 2010

ISSUED: Feb. 08, 2010

APPLICANT: TRENDNET, Inc.

ADDRESS: 20675 Manhattan Place, Torrance, CA 90501, USA

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.

Testing Laboratory
2021

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1. CERTIFICATION

PRODUCT:	Wireless N USB 2.0 Adapter
MODEL:	TEW-624UB
BRAND:	TRENDnet
APPLICANT:	TRENDNET, Inc.
TESTED:	Feb. 03, 2010
TEST SAMPLE:	ENGINEERING SAMPLE
STANDARDS:	**FCC Part 2 (Section 2.1093)**
	FCC OET Bulletin 65, Supplement C (01-01)
	RSS-102

The above equipment (model: TEW-624UB) 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	: Ivy Lin / Specialist	, **DATE:**	Feb. 08, 2010
TECHNICAL ACCEPTANCE Responsible for RF	: Mason Chang / Engineer	, **DATE:**	Feb. 08, 2010
APPROVED BY	: Gary Chang / Assistant Manager	, **DATE:**	Feb. 08, 2010

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

EUT	Wireless N USB 2.0 Adapter
MODEL NO.	TEW-624UB
FCC ID	XU8TEW624UB
POWER SUPPLY	5Vdc
MODULATION TYPE	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
MODULATION TECHNOLOGY	DSSS, OFDM
TRANSFER RATE	802.11b:11/5.5/2/1Mbps 802.11g: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 270Mbps
OPERATING FREQUENCY	2412 ~ 2462MHz
NUMBER OF CHANNEL	11 for 802.11b, 802.11g, 802.11n (20MHz) 7 for 802.11n (40MHz)
CHANNEL FREQUENCIES UNDER TEST AND ITS CONDUCTED OUTPUT POWER	**802.11b:** 21.8dBm / Ch6: 2437MHz **802.11g:** 25.2dBm / Ch6: 2437MHz **802.11n (20MHz):** 27.7dBm / Ch6: 2437MHz **802.11n (40MHz):** 27.4dBm / Ch4: 2437MHz
MAXIMUM SAR (1g)	0.581W/kg
ANTENNA TYPE	Printed antenna with 1.8dBi gain
ANTENNA CONNECTOR	NA
DATA CABLE	NA
I/O PORTS	USB
ACCESSORY DEVICES	NA

NOTE:

1. This report is a supplementary report of SA981023L02. The differences compared with original report are changing applicant, product name, brand name, model and external case. Therefore, the EUT was re-tested in the report
2. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

MODULATION MODE	TX FUNCTION
802.11b	1TX
802.11g	1TX
802.11n (20MHz)	2TX
802.11n (40MHz)	2TX

3. The above EUT information was 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

IEEE 1528-2003

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

2.3 GENERAL INOFRMATION OF THE SAR SYSTEM

DASY5 (software 5.2 Build 157) 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 DASY5 software defined. The DASY5 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	2450MHz
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 is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles. The holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity 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	SAM Phantom	S & P	QD000 P40 CA	TP-1150	NA	NA
2	Signal Generator	Anritsu	68247B	984703	May 21, 2009	May 20, 2010
3	E-Field Probe	S & P	EX3DV4	3661	Dec. 30, 2009	Dec. 29, 2010
4	DAE	S & P	DAE 3	510	Dec. 16, 2009	Dec. 15, 2010
5	Robot Positioner	Staubli Unimation	NA	NA	NA	NA
6	Validation Dipole	S & P	D2450V2	716	Mar. 17, 2009	Mar. 16, 2010

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

FOR TISSUE PROPERTY

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	Network Analyzer	Agilent	E8358A	US41480538	Nov. 26, 2009	Nov. 25, 2010
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 DASY5 post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the micro-volt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters:	- Frequency	F
	- Crest factor	Cf
Media parameters:	- Conductivity	σ
	- Density	ρ

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

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

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.

3. DESCRIPTION OF SUPPORT UNITS

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

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK	DELL	PP18L	29144041120	CXSMM01BRD02D330

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

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

4. DESCRIPTION OF TEST MODES AND CONFIGURATIONS

4.1. DESCRIPTION OF TEST CONDITION

TEST DATE	TEST ITEM	TEMPERATURE(°C)		HUMIDITY(%RH)	TESTED BY
		AIMBENT	LIQUID		
Feb. 03, 2010	1 ~ 20	22.1	21.3	58	Sam Onn

4.2. CHECK FOR SCAN RESOLUTION

Compare with different scan resolution

With EUT hold on the worst case configuration with no any change in position or setting, 2 scans with different resolutions are preformed to evaluate the impact on the SAR value.

Test data as below:

AREA SCAN RESOLUTION	ZOOM SCAN RESOLUTION	SAR VALUE(W/KG
5mm	5mm	0.581
5mm	2.5mm	0.584

Conclusion: No meaningful change detected.

4.3. DESCRIPTION OF TEST MODE

Test Tool:

Test tool is RELTEK 11n USB WLAN 0.0025.0508.2009 provided by client. It can control EUT to transmit continuously at specific channel, output power level, data rates and 100 % duty signal.

Test Date Rate:

"Per KDB 248277, for each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than ¼ dB higher than those measured at the lowest data rate."
Comparing output power of all modulations and data rates of each mode can find the lowest data rates has max output power. Therefore, EUT will set under lowest data rates to test.

Test Channel:

"Per KDB 447498, when the SAR procedures require multiple channels to be tested and the 1-g SAR for the highest output channel is less than 0.8 W/kg and peak SAR is less than 1.6 W/kg, where the transmission band corresponding to all channels is ≤ 100 MHz, testing for the other channels is not required."
According to test data from table of section 4.4, SAR value of highest output power channel are less than 0.8 W/kg and Peak SAR values are less than 1.6W/kg. Therefore, testing for other channels is not required.

Test Position:

There are 5 test positions in the report.

- Horizontal-Up
- Horizontal-Down
- Vertical-Front
- Vertical-Back
- Tip

Test Mode Table:

ITEM	TEST MODE	MODULATION	ASSESSMENT POSTITION	TESTED CHANNEL	ANTENNA
1	802.11b	DBPSK	Horizontal-Down	6	Ant A
2	802.11g	BPSK		6	Ant A
3	802.11n (20MHz)	BPSK		6	Ant A, Ant B
4	802.11n (40MHz)	BPSK		4	Ant A, Ant B
5	802.11b	DBPSK	Vertical-Front	6	Ant A
6	802.11g	BPSK		6	Ant A
7	802.11n (20MHz)	BPSK		6	Ant A, Ant B
8	802.11n (40MHz)	BPSK		4	Ant A, Ant B
9	802.11b	DBPSK	Horizontal-Up	6	Ant A
10	802.11g	BPSK		6	Ant A
11	802.11n (20MHz)	BPSK		6	Ant A, Ant B
12	802.11n (40MHz)	BPSK		4	Ant A, Ant B
13	802.11b	DBPSK	Vertical-Back	6	Ant A
14	802.11g	BPSK		6	Ant A
15	802.11n (20MHz)	BPSK		6	Ant A, Ant B
16	802.11n (40MHz)	BPSK		4	Ant A, Ant B
17	802.11b	DBPSK	Tip	6	Ant A
18	802.11g	BPSK		6	Ant A
19	802.11n (20MHz)	BPSK		6	Ant A, Ant B
20	802.11n (40MHz)	BPSK		4	Ant A, Ant B

NOTE:

1. Assessment position of the EUT please refer to the test set up photo.
2. TX diversity function is not supported for this product .Only antenna A can transmit under 11b/g mode.

4.4. SUMMARY OF TEST RESULTS

ITEM		1	2	3	ITEM		4
TEST MODE		802.11b	802.11g	802.11n (20MHz)	TEST MODE		802.11n (40MHz)
CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)			CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)
1	2412 (Low)	-	-	-	1	2422 (Low)	-
6	2437 (Mid.)	0.554	0.514	0.324	4	2437 (Mid.)	0.259
11	2462 (High)	-	-	-	7	2452 (High)	-

ITEM		5	6	7	ITEM		8
TEST MODE		802.11b	802.11g	802.11n (20MHz)	TEST MODE		802.11n (40MHz)
CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)			CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)
1	2412 (Low)	-	-	-	1	2422 (Low)	-
6	2437 (Mid.)	0.141	0.131	0.175	4	2437 (Mid.)	0.137
11	2462 (High)	-	-	-	7	2452 (High)	-

ITEM		9	10	11	ITEM		12
TEST MODE		802.11b	802.11g	802.11n (20MHz)	TEST MODE		802.11n (40MHz)
CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)			CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)
1	2412 (Low)	-	-	-	1	2422 (Low)	-
6	2437 (Mid.)	**0.581**	0.560	0.407	4	2437 (Mid.)	0.313
11	2462 (High)	-	-	-	7	2452 (High)	-

ITEM		13	14	15	ITEM		16
TEST MODE		802.11b	802.11g	802.11n (20MHz)	TEST MODE		802.11n (40MHz)
CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)			CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)
1	2412 (Low)	-	-	-	1	2422 (Low)	-
6	2437 (Mid.)	0.123	0.121	0.112	4	2437 (Mid.)	0.090
11	2462 (High)	-	-	-	7	2452 (High)	-

NOTE: The worst value has been marked by boldface.

ITEM		17	18	19	ITEM		20
TEST MODE		802.11b	802.11g	802.11n (20MHz)	TEST MODE		802.11n (40MHz)
CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)			CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)
1	2412 (Low)	-	-	-	1	2422 (Low)	-
6	2437 (Mid.)	0.158	0.152	0.072	4	2437 (Mid.)	0.057
11	2462 (High)	-	-	-	7	2452 (High)	-

NOTE: The worst value has been marked by boldface.

5. TEST RESULTS

5.1 TEST PROCEDURES

The EUT plugged into the notebook. 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 DASY5 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 30mm x 30mm x 30mm 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 3mm and maintained at a constant distance of ±0.5mm during a zoom scan to determine peak SAR locations. The distance is 3mm between the first measurement point and the bottom surface of the phantom. The secondary measurement point to the bottom surface of the phantom is with 8mm separation distance. The cube size is 7 x 7 x 7 points consists of 343 points and the grid space is 5mm.

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 3mm 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%.

5.2 MEASURED SAR RESULT

TEST MODE	TX MODE	FREQ. (MHz)	CHAN.	TX POWER (dBm)	POWER DRIFT (dB)	TEST POSITION	MEASURED 1g SAR (W/kg)
1	802.11b	2437 (Mid.)	6	21.8	0.030	Horizontal-Down	0.554
2	802.11g	2437 (Mid.)	6	25.2	-0.084		0.514
3	802.11n (20MHz)	2437 (Mid.)	6	27.7	-0.124		0.324
4	802.11n (40MHz)	2437 (Mid.)	4	27.4	-0.119		0.259
5	802.11b	2437 (Mid.)	6	21.8	-0.024	Vertical-Front	0.141
6	802.11g	2437 (Mid.)	6	25.2	-0.121		0.131
7	802.11n (20MHz)	2437 (Mid.)	6	27.7	-0.101		0.175
8	802.11n (40MHz)	2437 (Mid.)	4	27.4	-0.133		0.137
9	802.11b	2437 (Mid.)	6	21.8	-0.109	Horizontal-Up	**0.581**
10	802.11g	2437 (Mid.)	6	25.2	-0.079		0.560
11	802.11n (20MHz)	2437 (Mid.)	6	27.7	-0.123		0.407
12	802.11n (40MHz)	2437 (Mid.)	4	27.4	-0.014		0.313
13	802.11b	2437 (Mid.)	6	21.8	0.152	Vertical-Back	0.123
14	802.11g	2437 (Mid.)	6	25.2	0.031		0.121
15	802.11n (20MHz)	2437 (Mid.)	6	27.7	-0.121		0.112
16	802.11n (40MHz)	2437 (Mid.)	4	27.4	-0.060		0.090
17	802.11b	2437 (Mid.)	6	21.8	-0.114	Tip	0.158
18	802.11g	2437 (Mid.)	6	25.2	-0.030		0.152
19	802.11n (20MHz)	2437 (Mid.)	6	27.7	-0.136		0.072
20	802.11n (40MHz)	2437 (Mid.)	4	27.4	-0.085		0.057

NOTE:

1. Test configuration of each mode is described in section 4.3.
2. In this testing, the limit for General Population Spatial Peak averaged over 1g, 1.6 W/kg, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

5.3 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:

1. This limits accord to 47 CFR 2.1093 – Safety Limit.
2. The EUT property been complied with the partial body exposure limit under the general population environment.

5.4 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	HEAD SIMULATING LIQUID 2450MHz (HSL-2450)	MUSCLE SIMULATING LIQUID 2450MHz (MSL-2450)
Water	45%	69.83%
DGMBE	55%	30.17%
Dielectric Parameters at 22℃	f= 2450MHz ε= 39.2 ± 5% σ= 1.80 ± 5% S/m	f= 2450MHz ε= 52.7 ± 5% σ= 1.95 ± 5% S/m

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

1. Turn Network Analyzer on and allow at least 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 DASY5 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.	21.3				
TEST DATE	Feb. 03, 2010				
TESTED BY	Sam Onn				
FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	ERROR PERCENTAGE (%)	LIMIT(%)
2437.0	Permitivity (ε)	52.70	54.20	2.85	±5
2450.0		52.70	54.10	2.66	
2437.0	Conductivity (σ) S/m	1.94	1.97	1.55	
2450.0		1.95	1.98	1.54	

6. 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.

6.1 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 DASY5 system is less than ±0.1mm.

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

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

6.2 VALIDATION RESULTS

SYSTEM VALIDATION TEST OF SIMULATING LIQUID					
FREQUENCY (MHz)	**REQUIRED SAR (mW/g)**	**MEASURED SAR (mW/g)**	**DEVIATION (%)**	**SEPARATION DISTANCE**	**TESTED DATE**
MSL2450	13.30 (1g)	13.50	1.50	10mm	Feb. 03, 2010

NOTE: Please see Appendix for the photo of system validation test.

6.3 SYSTEM VALIDATION UNCERTAINTIES

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

Error Description	Tolerance (±%)	Probability Distribution	Divisor	(C_i)		Standard Uncertainty (±%)		(v_i)
				(1g)	(10g)	(1g)	(10g)	
Measurement System								
Probe Calibration	5.50	Normal	1	1	1	5.50	5.50	∞
Axial Isotropy	4.70	Rectangular	$\sqrt{3}$	0.7	0.7	1.90	1.90	∞
Hemispherical Isotropy	9.60	Rectangular	$\sqrt{3}$	0.7	0.7	3.88	3.88	∞
Boundary effects	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.70	Rectangular	$\sqrt{3}$	1	1	2.71	2.71	∞
System Detection Limits	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	0.30	Normal	1	1	1	0.30	0.30	∞
Response Time	0.80	Rectangular	$\sqrt{3}$	1	1	0.46	0.46	∞
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1	1.50	1.50	∞
RF Ambient Noise	3.00	Rectangular	$\sqrt{3}$	1	1	1.73	1.73	∞
RF Ambient Reflections	3.00	Rectangular	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe Positioner	0.40	Rectangular	$\sqrt{3}$	1	1	0.23	0.23	∞
Probe Positioning	2.90	Rectangular	$\sqrt{3}$	1	1	1.67	1.67	∞
Max. SAR Eval.	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Dipole Related								
Dipole Axis to Liquid Distance	2.00	Rectangular	$\sqrt{3}$	1	1	1.15	1.15	145
Input Power Drift	5.00	Rectangular	$\sqrt{3}$	1	1	2.89	2.89	∞
Phantom and Tissue parameters								
Phantom Uncertainty	4.00	Rectangular	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid Conductivity (target)	5.00	Rectangular	$\sqrt{3}$	0.64	0.43	1.85	1.24	∞
Liquid Conductivity (measurement)	2.55	Normal	1	0.64	0.43	1.63	1.10	∞
Liquid Permittivity (target)	5.00	Rectangular	$\sqrt{3}$	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	3.49	Normal	1	0.6	0.49	2.09	1.71	∞
Combined Standard Uncertainty						**9.86**	**9.56**	
Coverage Factor for 95%						**Kp=2**		
Expanded Uncertainty (K=2)						**19.71**	**19.12**	

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

7. MEASUREMENT SAR PROCEDURE UNCERTAINTIES

The assessment of spatial peak SAR of the hand handheld devices is according to IEEE 1528 / EN 62209-1. All testing situation shall be met below these requirements.

- The system is used by an experienced engineer who follows the manual and the guidelines taught during the training provided by SPEAG.
- The probe has been calibrated within the requested period and the stated uncertainty for the relevant frequency bands does not exceed 4.8% (k=1).
- The validation dipole has been calibrated within the requested period and the system performance check has been successful.
- The DAE unit has been calibrated within the requested period.
- The minimum distance between the probe sensor and inner phantom shell is selected to be 3mm.
- The operational mode of the DUT is 802.11b/ g/ n (20MHz)/ n (40MHz) and the measurement/ integration time per point is >500 ms.
- The dielectric parameters of the liquid have been assessed using Agilent 85070D dielectric probe kit.
- The dielectric parameters are within 5% of the target values.
- The DUT has been positioned as described in section 3.

7.1. PROBE CALIBRATION UNCERTAINTY

SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN 62209-1, IEC 62209, etc.) under ISO17025. The uncertainties are stated on the calibration certificate. For the most relevant frequency bands, these values do not exceed 4.8% (k=1). If evaluations of other bands are performed for which the uncertainty exceeds these values, the uncertainty tables given in the summary have to be revised accordingly.

7.2. ISOTROPY UNCERTAINTY

The axial isotropy tolerance accounts for probe rotation around its axis while the hemispherical isotropy error includes all probe orientations and field polarizations. These parameters are assessed by SPEAG during initial calibration. In 2001, SPEAG further tightened its quality controls and warrants that the maximal deviation from axial isotropy is ±0.20dB, while the maximum deviation of hemispherical isotropy is ±0.40dB, corresponding to ±4.7% and ±9.6%, respectively. A weighting factor of cp equal to 0.5 can be applied, since the axis of the probe deviates less than 30 degrees from the normal surface orientation.

7.3. BOUNDARY EFFECT UNCERTAINTY

The effect can be estimated according to the following error approximation formula

$$SAR_{tolerance}[\%] = SAR_{be}[\%] \times \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{e^{-\frac{d_{be}}{\delta/2}}}{\delta/2}$$

$$d_{be} + d_{step} < 10mm$$

The parameter d_{be} is the distance in mm between the surface and the closest measurement point used in the averaging process; d_{step} is the separation distance in mm between the first and second measurement points; δ is the minimum penetration depth in mm within the head tissue equivalent liquids (i.e., δ= 13.95mm at 3GHz); SAR_{be} is the deviation between the measured SAR value at the distance d_{be} from the boundary and the wave-guide analytical value SAR_{ref}.DASY5 applies a boundary effect compensation algorithm according to IEEE 1528, which is possible since the axis of the probe never deviates more than 30 degrees from the normal surface orientation. SAR_{be}[%] is assessed during the calibration process and SPEAG warrants that the uncertainty at distances larger than 4mm is always less than 1%.In summary, the worst case boundary effect SAR tolerance[%] for scanning distances larger than 4mm is < ± 0.8%.

7.4. PROBE LINEARITY UNCERTAINTY

Field probe linearity uncertainty includes errors from the assessment and compensation of the diode compression effects for CW and pulsed signals with known duty cycles. This error is assessed using the procedure described in IEEE 1528 / EN 62209-1. For SPEAG field probes, the measured difference between CW and pulsed signals, with pulse frequencies between 10Hz and 1kHz and duty cycles between 1 and 100, is < ±0.20dB (< ±4.7%).

7.5. READOUT ELECTRONICS UNCERTAINTY

All uncertainties related to the probe readout electronics (DAE unit), including the gain and linearity of the instrumentation amplifier, its loading effect on the probe, and accuracy of the signal conversion algorithm, have been assessed accordingly to IEEE 1528 / EN 62209-1.The combination (root-sum-square RSS method) of these components results in an overall maximum error of ±1.0%.

7.6. RESPONSE TIME UNCERTAINTY

The time response of the field probes is assessed by exposing the probe to a well-controlled electric field producing SAR larger than 2.0W/kg at the tissue medium surface. The signal response time is evaluated as the time required by the system to reach 90% of the expected final value after an on/of switch of the power source. Analytically, it can be expressed as:

$$SAR_{tolerance}[\%] = 100 \times \left(\frac{T_m}{T_m + \tau e^{-T_m/\tau} - \tau} - 1 \right)$$

where Tm is 500 ms, i.e., the time between measurement samples, and τ the time constant. The response time τ of SPEAG's probes is <5ms. In the current implementation, DASY5 waits longer than 100 ms after having reached the grid point before starting a measurement, i.e., the response time uncertainty is negligible.

7.7. PROBE POSITIONER MECHANICAL TOLERANCE

The mechanical tolerance of the field probe positioner can introduce probe positioning uncertainties. The resulting SAR uncertainty is assessed by comparing the SAR obtained according to the specifications of the probe positioner with respect to the actual position defined by the geometric enter of the probe sensors. The tolerance is determined as:

$$SAR_{tolerance}[\%] = 100 \times \frac{d_{ph}}{\delta/2}$$

The specified repeatability of the RX robot family used in DASY5 systems is ±25µm. The absolute accuracy for short distance movements is better than ±0.1mm, i.e., the $SAR_{tolerance}$[%] is better than 1.5% (rectangular).

7.8. PROBE POSITIONING

The probe positioning procedures affect the tolerance of the separation distance between the probe tip and the phantom surface as:

$$SAR_{tolerance}[\%] = 100 \times \frac{d_{ph}}{\delta/2}$$

where d_{ph} is the maximum deviation of the distance between the probe tip and the phantom surface. The optical surface detection has a precision of better than 0.2mm, resulting in an $SAR_{tolerance}$[%] of <2.9% (rectangular distribution). Since the mechanical detection provides better accuracy, 2.9% is a worst-case figure for DASY5 system.

7.9. PHANTOM UNCERTAINTY

The SAR measurement uncertainty due to SPEAG phantom shell production tolerances has been evaluated using

$$SAR_{tolerance}[\%] \cong 100 \times \frac{2d}{a}, \qquad d << a$$

For a maximum deviation d of the inner and outer shell of the phantom from that specified in the CAD file of ±0.2mm, and a 10mm spacing a between source and tissue liquid, the calculated phantom uncertainty is ±4.0%.

7.10. DASY5 UNCERTAINTY BUDGET

Error Description	Tolerance (±%)	Probability Distribution	Divisor	(C_i)		Standard Uncertainty (±%)		(v_i)
				(1g)	(10g)	(1g)	(10g)	
Measurement Equipment								
Probe Calibration	5.50	Normal	1	1	1	5.50	5.50	∞
Axial Isotropy	4.70	Rectangular	$\sqrt{3}$	0.7	0.7	1.90	1.90	∞
Hemispherical Isotropy	9.60	Rectangular	$\sqrt{3}$	0.7	0.7	3.88	3.88	∞
Boundary effects	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.70	Rectangular	$\sqrt{3}$	1	1	2.71	2.71	∞
System Detection Limits	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	0.30	Normal	1	1	1	0.30	0.30	∞
Response Time	0.80	Rectangular	$\sqrt{3}$	1	1	0.46	0.46	∞
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1	1.50	1.50	∞
RF Ambient Noise	3.00	Rectangular	$\sqrt{3}$	1	1	1.73	1.73	∞
RF Ambient Reflections	3.00	Rectangular	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe Positioner	0.40	Rectangular	$\sqrt{3}$	1	1	0.23	0.23	∞
Probe Positioning	2.90	Rectangular	$\sqrt{3}$	1	1	1.67	1.67	∞
Max. SAR Eval.	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Test Sample Related								
Device Positioning	0.89	Normal	1	1	1	0.89	0.89	9
Device Holder	3.60	Normal	1	1	1	3.60	3.60	5
Power Drift	5.00	Rectangular	$\sqrt{3}$	1	1	2.89	2.89	∞
Phantom and Tissue parameters								
Phantom Uncertainty	4.00	Rectangular	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid Conductivity (target)	5.00	Rectangular	$\sqrt{3}$	0.64	0.43	1.85	1.24	∞
Liquid Conductivity (measurement)	2.55	Normal	1	0.64	0.43	1.63	1.10	∞
Liquid Permittivity (target)	5.00	Rectangular	$\sqrt{3}$	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	3.49	Normal	1	0.6	0.49	2.09	1.71	∞
Combined Standard Uncertainty						**10.47**	**10.19**	
Coverage Factor for 95%						**Kp=2**		
Expanded Uncertainty (K=2)						**20.93**	**20.37**	

TABLE 7.2

The table 7.2: Worst-Case uncertainty budget for DASY5 assessed according to IEEE 1528. The budget is valid for the frequency range 300MHz ~ 3GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerable smaller.

8. 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

Liquid Level Photo

Tissue MSL2450MHz D=150mm

Date/Time: 2010/2/3 01:41:28

Test Laboratory: Bureau Veritas ADT

M01-11b-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

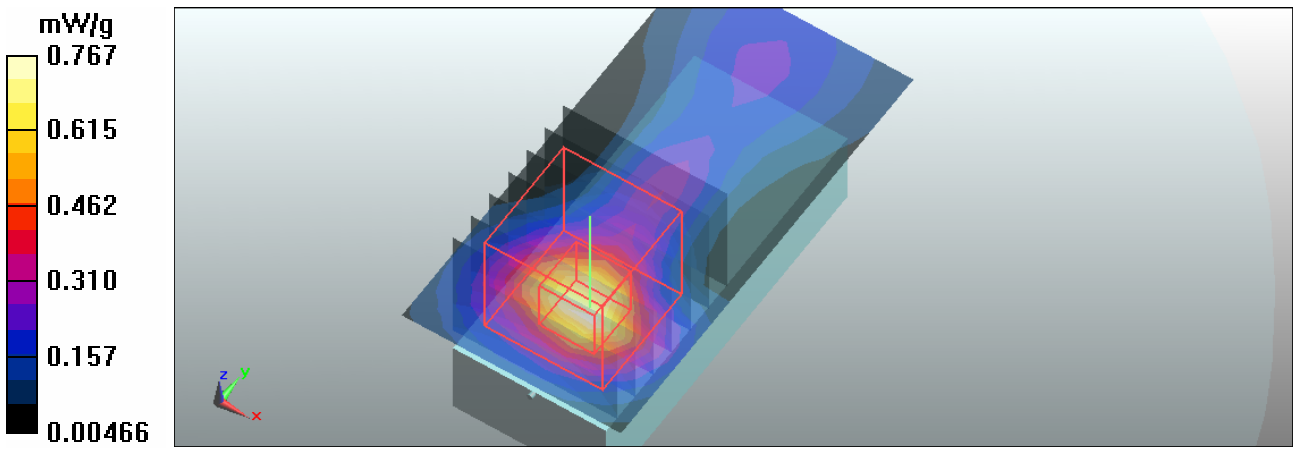
Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used : f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Horizontal-Down side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch6/Area Scan (9x17x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.735 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 18.4 V/m; Power Drift = 0.030 dB
Peak SAR (extrapolated) = 1.17 W/kg
SAR(1 g) = 0.554 mW/g; SAR(10 g) = 0.227 mW/g
Maximum value of SAR (measured) = 0.767 mW/g



Date/Time: 2010/2/3 02:18:49

Test Laboratory: Bureau Veritas ADT

M02-11g-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

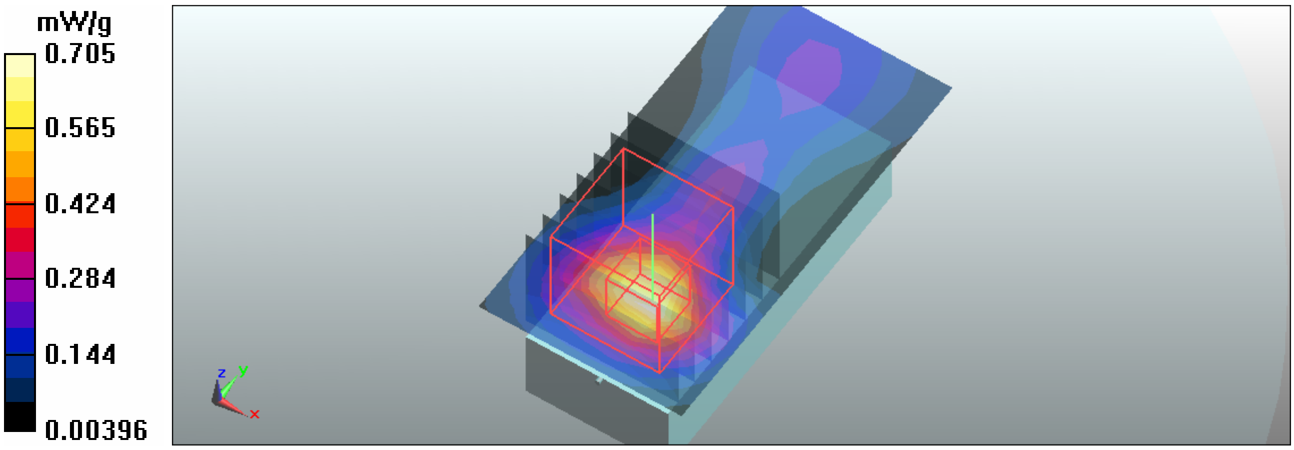
Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used : f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Horizontal-Down side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch6/Area Scan (9x17x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.673 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 18.5 V/m; Power Drift = -0.084 dB
Peak SAR (extrapolated) = 1.08 W/kg
SAR(1 g) = 0.514 mW/g; SAR(10 g) = 0.218 mW/g
Maximum value of SAR (measured) = 0.705 mW/g



Date/Time: 2010/2/3 03:12:24

Test Laboratory: Bureau Veritas ADT

M03-11n 20M-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

Communication System: 802.11n 20M ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Horizontal-Down side of the EUT to the Phantom)

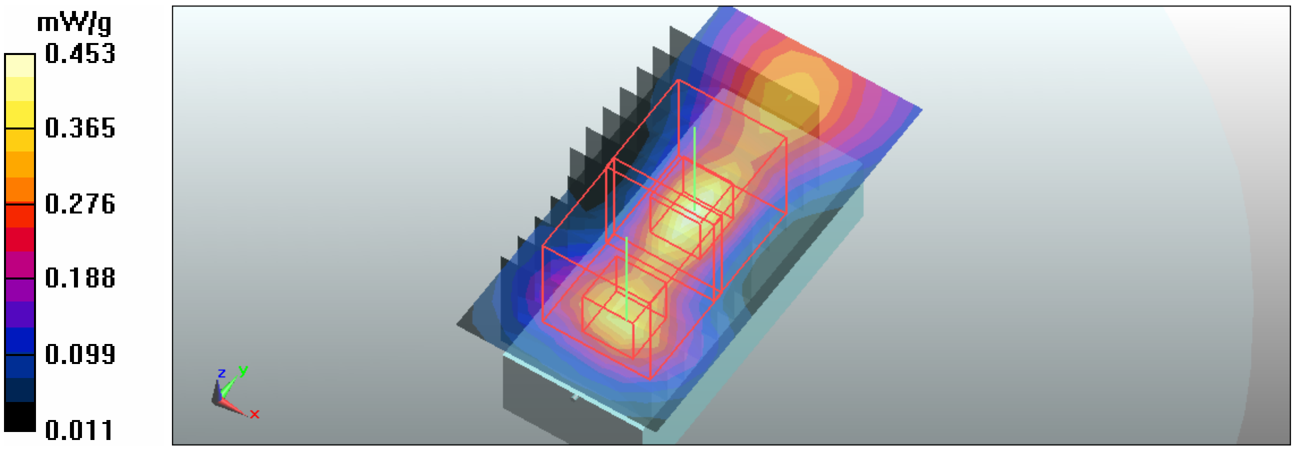
DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch6/Area Scan (9x17x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.453 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 16 V/m; Power Drift = -0.124 dB
Peak SAR (extrapolated) = 0.661 W/kg
SAR(1 g) = 0.324 mW/g; SAR(10 g) = 0.132 mW/g
Maximum value of SAR (measured) = 0.446 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 16 V/m; Power Drift = -0.124 dB
Peak SAR (extrapolated) = 0.589 W/kg
SAR(1 g) = 0.286 mW/g; SAR(10 g) = 0.131 mW/g
Maximum value of SAR (measured) = 0.389 mW/g



Date/Time: 2010/2/3 04:04:53

Test Laboratory: Bureau Veritas ADT

M04-11n 40M-Ch4

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

Communication System: 802.11n 40MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Horizontal-Down side of the EUT to the Phantom)

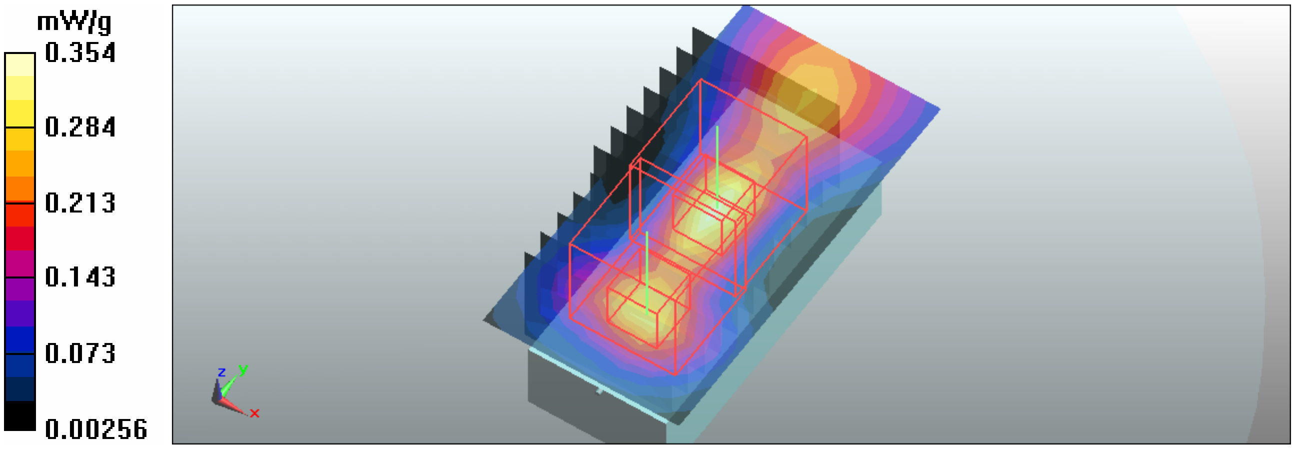
DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch4/Area Scan (9x17x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.348 mW/g

Mid. Ch4/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 12.7 V/m; Power Drift = -0.119 dB
Peak SAR (extrapolated) = 0.523 W/kg
SAR(1 g) = 0.259 mW/g; SAR(10 g) = 0.106 mW/g
Maximum value of SAR (measured) = 0.354 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 12.7 V/m; Power Drift = -0.119 dB
Peak SAR (extrapolated) = 0.456 W/kg
SAR(1 g) = 0.224 mW/g; SAR(10 g) = 0.103 mW/g
Maximum value of SAR (measured) = 0.306 mW/g



Date/Time: 2010/2/3 05:18:52

Test Laboratory: Bureau Veritas ADT

M05-11b-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Vertical-Front side of the EUT to the Phantom)

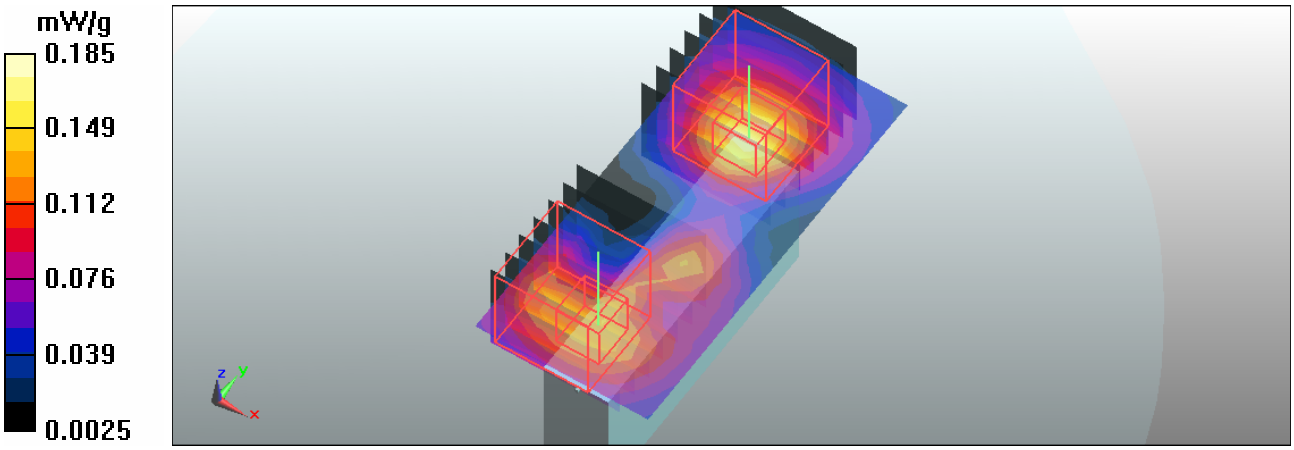
DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch6/Area Scan (9x19x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.185 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 7.9 V/m; Power Drift = -0.024 dB
Peak SAR (extrapolated) = 0.274 W/kg
SAR(1 g) = 0.141 mW/g; SAR(10 g) = 0.070 mW/g
Maximum value of SAR (measured) = 0.181 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 7.9 V/m; Power Drift = -0.024 dB
Peak SAR (extrapolated) = 0.232 W/kg
SAR(1 g) = 0.111 mW/g; SAR(10 g) = 0.059 mW/g
Maximum value of SAR (measured) = 0.142 mW/g



Date/Time: 2010/2/3 06:14:04

Test Laboratory: Bureau Veritas ADT

M06-11g-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Vertical-Front side of the EUT to the Phantom)

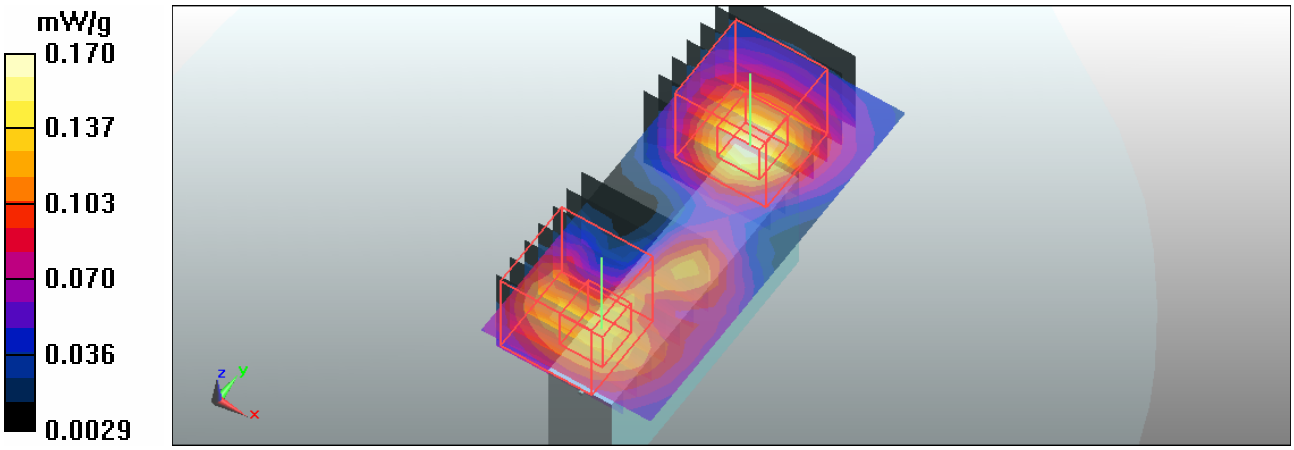
DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch6/Area Scan (9x19x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.167 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 7.76 V/m; Power Drift = -0.121 dB
Peak SAR (extrapolated) = 0.257 W/kg
SAR(1 g) = 0.131 mW/g; SAR(10 g) = 0.065 mW/g
Maximum value of SAR (measured) = 0.170 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 7.76 V/m; Power Drift = -0.121 dB
Peak SAR (extrapolated) = 0.219 W/kg
SAR(1 g) = 0.104 mW/g; SAR(10 g) = 0.055 mW/g
Maximum value of SAR (measured) = 0.134 mW/g



Date/Time: 2010/2/3 07:13:40

Test Laboratory: Bureau Veritas ADT

M07-11n 20M-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

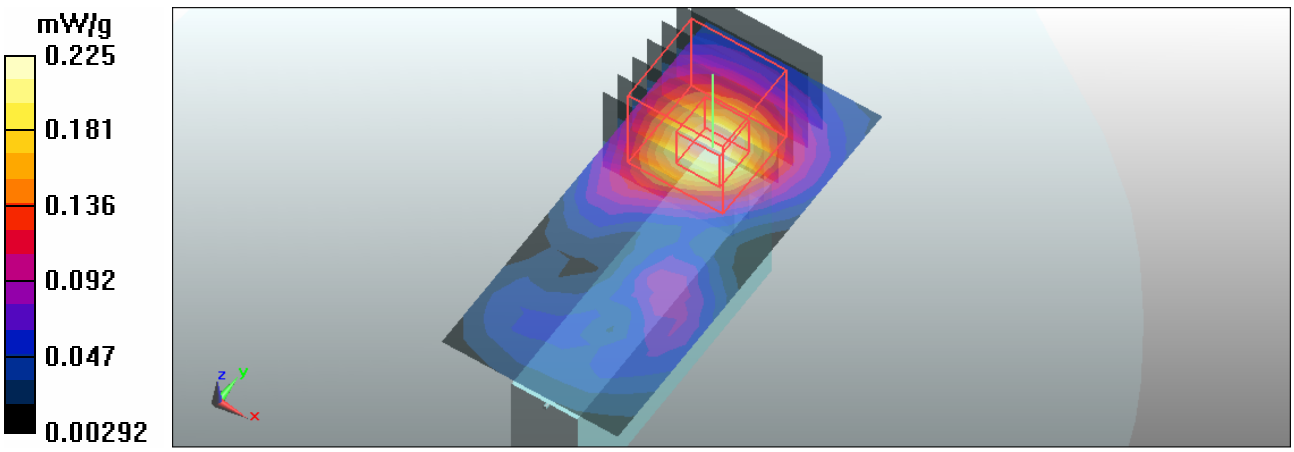
Communication System: 802.11n 20M ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Vertical-Front side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch6/Area Scan (9x19x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.219 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 5.39 V/m; Power Drift = -0.101 dB
Peak SAR (extrapolated) = 0.332 W/kg
SAR(1 g) = 0.175 mW/g; SAR(10 g) = 0.089 mW/g
Maximum value of SAR (measured) = 0.225 mW/g



Date/Time: 2010/2/3 08:22:09

Test Laboratory: Bureau Veritas ADT

M08-11n 40M-Ch4

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

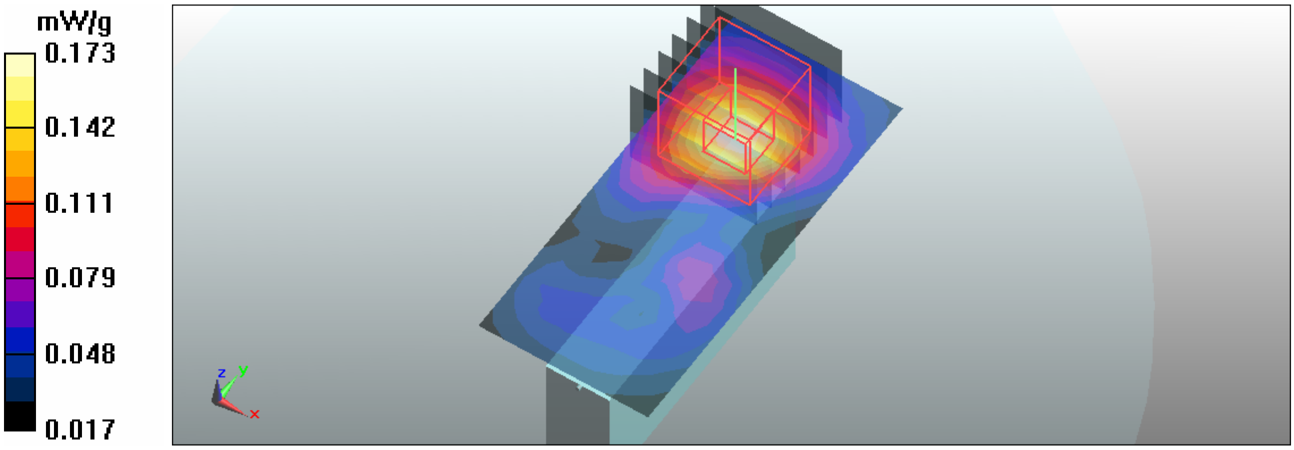
Communication System: 802.11n 40MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Vertical-Front side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch4/Area Scan (9x19x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.173 mW/g

Mid. Ch4/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 4.71 V/m; Power Drift = -0.133 dB
Peak SAR (extrapolated) = 0.258 W/kg
SAR(1 g) = 0.137 mW/g; SAR(10 g) = 0.070 mW/g



Date/Time: 2010/2/3 09:05:28

Test Laboratory: Bureau Veritas ADT

M09-11b-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

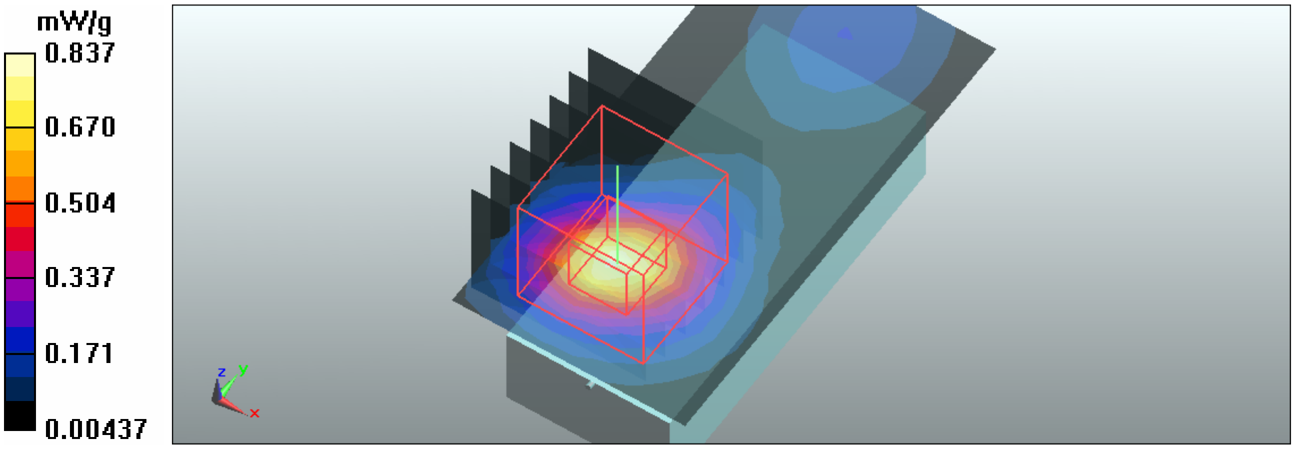
Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Horizontal-Up side of the EUT to the Phantom)

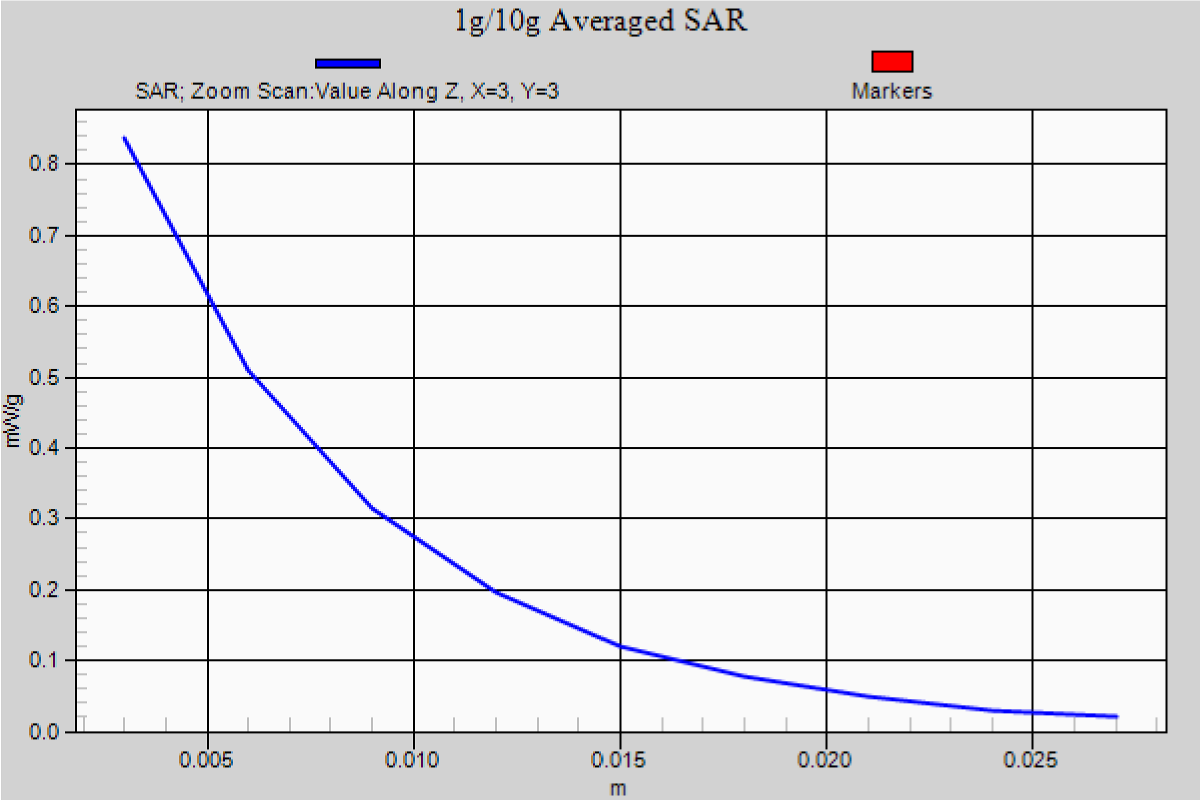
DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch6/Area Scan (9x17x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.821 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 20.5 V/m; Power Drift = -0.109 dB
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.581 mW/g; SAR(10 g) = 0.234 mW/g
Maximum value of SAR (measured) = 0.837 mW/g




1g/10g Averaged SAR
SAR; Zoom Scan:Value Along Z, X=3, Y=3
Markers
mW/g
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.005
0.010
0.015
0.020
0.025
m

Date/Time: 2010/2/3 09:41:34

Test Laboratory: Bureau Veritas ADT

M10-11g-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

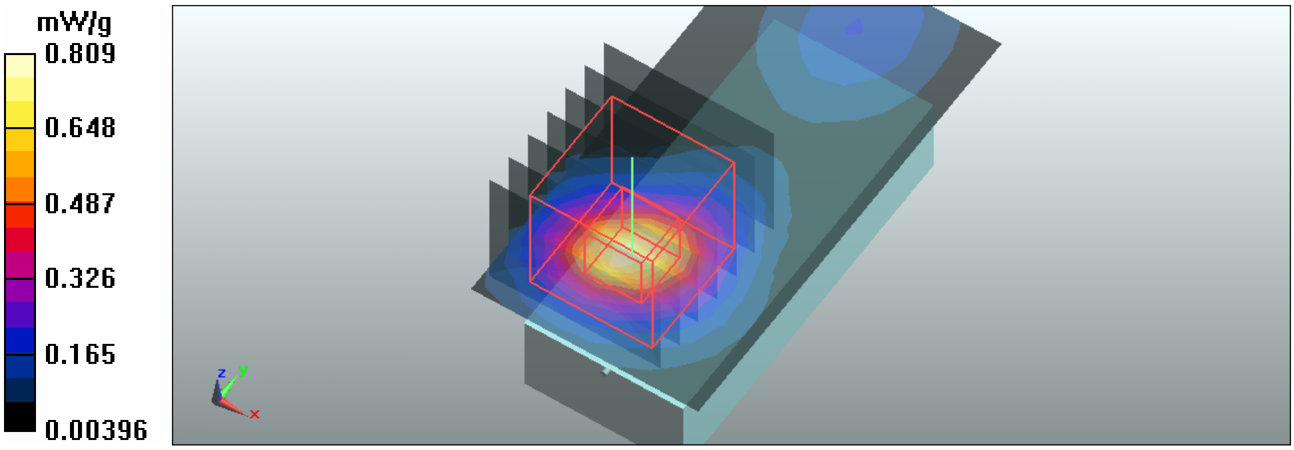
Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Horizontal-Up side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch6/Area Scan (9x17x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.775 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 20.1 V/m; Power Drift = -0.079 dB
Peak SAR (extrapolated) = 1.37 W/kg
SAR(1 g) = 0.560 mW/g; SAR(10 g) = 0.217 mW/g
Maximum value of SAR (measured) = 0.809 mW/g



Date/Time: 2010/2/3 10:18:26

Test Laboratory: Bureau Veritas ADT

M11-11n 20M-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

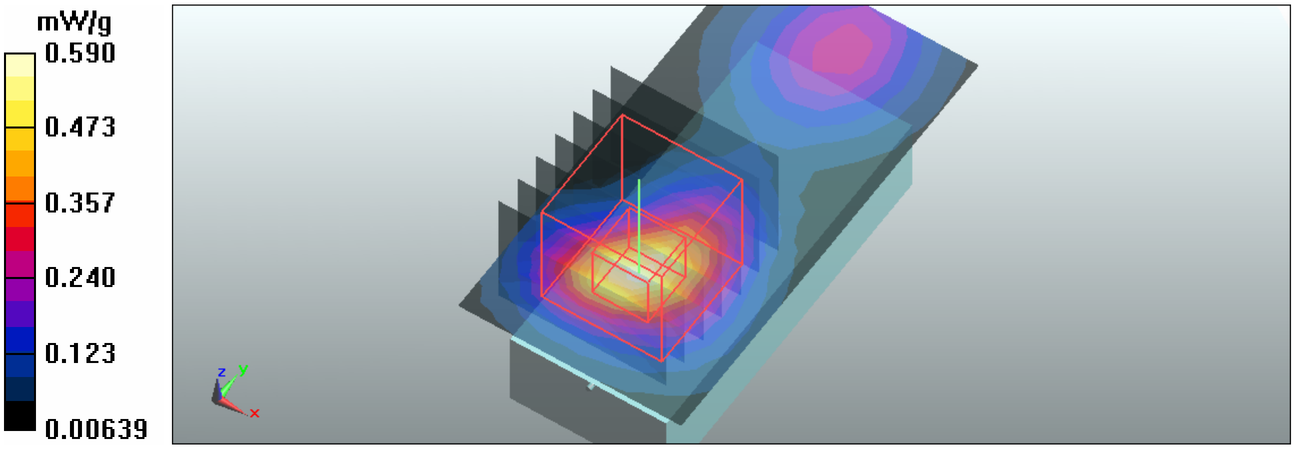
Communication System: 802.11n 20M ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Horizontal-Up side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch6/Area Scan (9x17x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.590 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 18 V/m; Power Drift = -0.123 dB
Peak SAR (extrapolated) = 0.913 W/kg
SAR(1 g) = 0.407 mW/g; SAR(10 g) = 0.169 mW/g
Maximum value of SAR (measured) = 0.567 mW/g



Date/Time: 2010/2/3 10:54:28

Test Laboratory: Bureau Veritas ADT

M12-11n 40M-Ch4

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

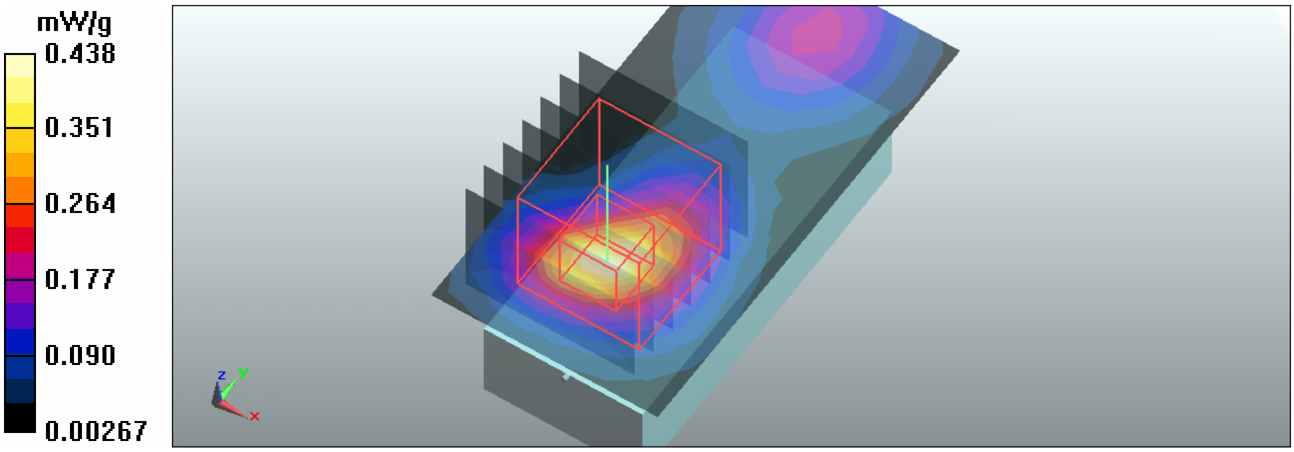
Communication System: 802.11n 40MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Horizontal-Up side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Mid. Ch4/Area Scan (9x17x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.429 mW/g

Mid. Ch4/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 14.4 V/m; Power Drift = -0.014 dB
Peak SAR (extrapolated) = 0.703 W/kg
SAR(1 g) = 0.313 mW/g; SAR(10 g) = 0.130 mW/g
Maximum value of SAR (measured) = 0.438 mW/g



Date/Time: 2010/2/3 13:01:09

Test Laboratory: Bureau Veritas ADT

M13-11b-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

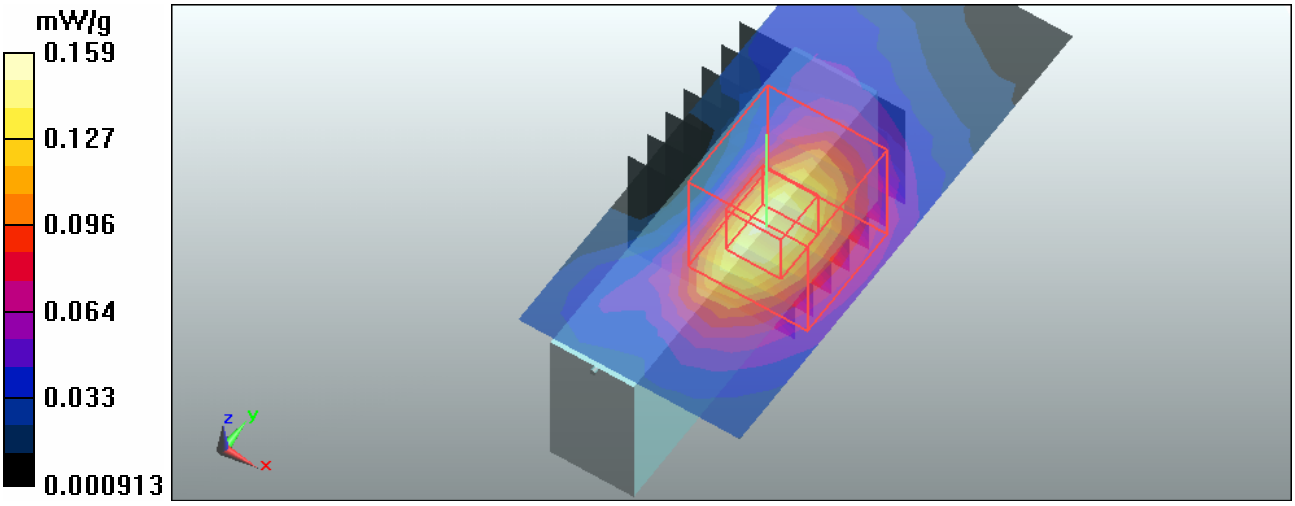
Communication System: 802.11B ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Vertical-Back of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Mid. Ch6/Area Scan (9x19x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.156 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 8.85 V/m; Power Drift = 0.152 dB
Peak SAR (extrapolated) = 0.243 W/kg
SAR(1 g) = 0.123 mW/g; SAR(10 g) = 0.059 mW/g
Maximum value of SAR (measured) = 0.159 mW/g



Date/Time: 2010/2/3 14:01:15

Test Laboratory: Bureau Veritas ADT

M14-11g-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

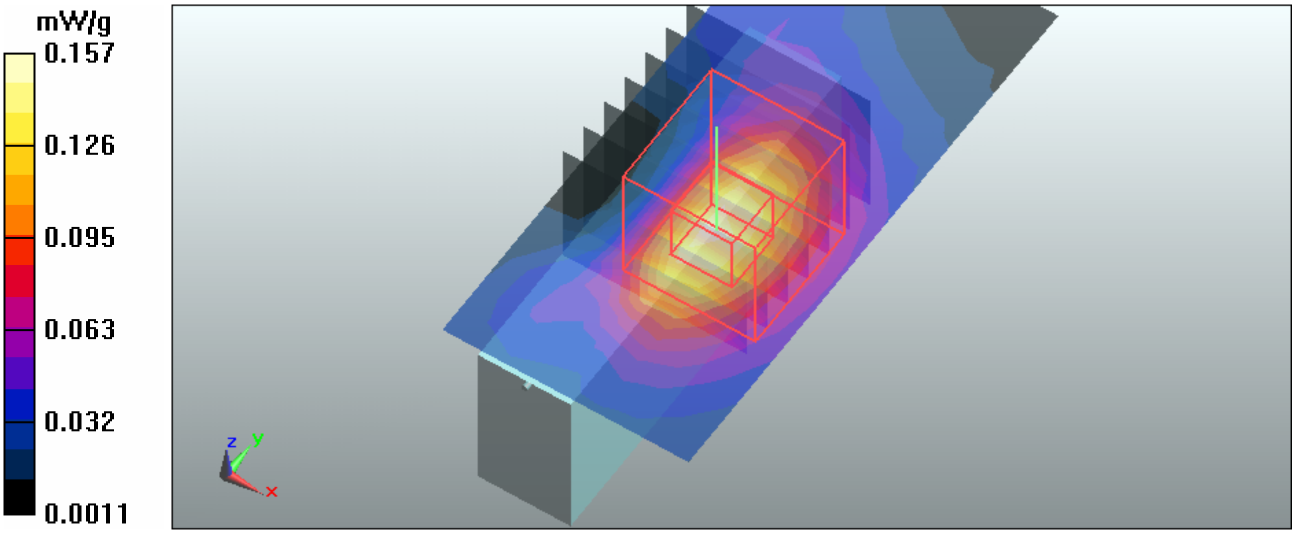
Communication System: 802.11G ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Vertical-Back of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Mid. Ch6/Area Scan (9x19x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.151 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 8.88 V/m; Power Drift = 0.031 dB
Peak SAR (extrapolated) = 0.237 W/kg
SAR(1 g) = 0.121 mW/g; SAR(10 g) = 0.058 mW/g
Maximum value of SAR (measured) = 0.157 mW/g



Date/Time: 2010/2/3 14:56:52

Test Laboratory: Bureau Veritas ADT

M15-11n 20M-Ch6

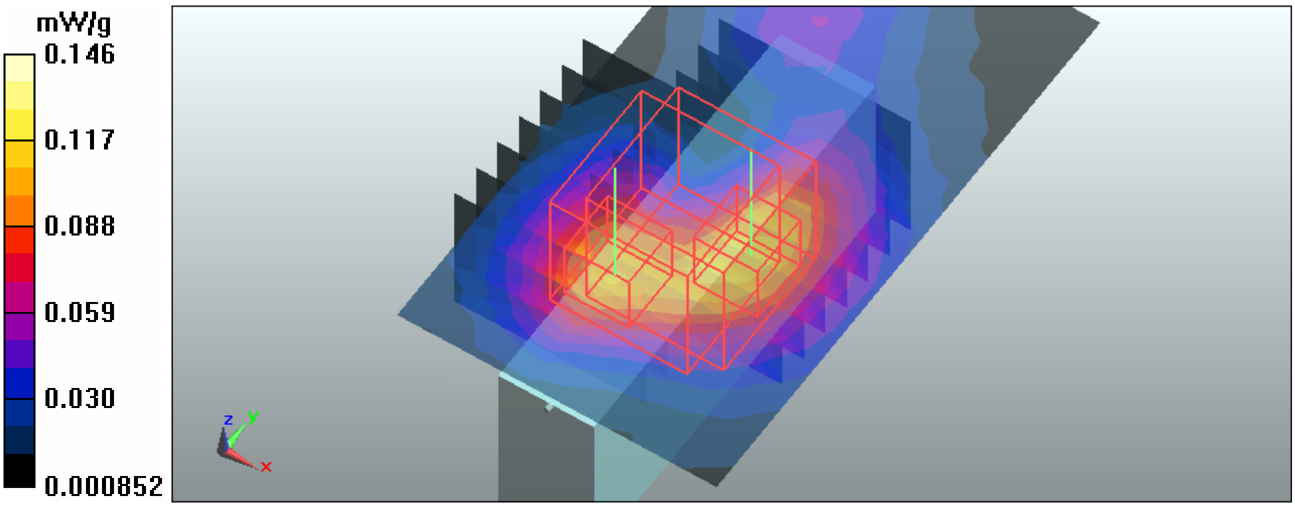
DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

Communication System: 2.4G 11n 20MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma = 1.97$ mho/m; $\varepsilon_r = 54.2$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Vertical-Back of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Mid. Ch6/Area Scan (11x19x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.149 mW/g
Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 9.39 V/m; Power Drift = -0.121 dB
Peak SAR (extrapolated) = 0.229 W/kg
SAR(1 g) = 0.112 mW/g; SAR(10 g) = 0.056 mW/g
Maximum value of SAR (measured) = 0.145 mW/g
Mid. Ch6/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 9.39 V/m; Power Drift = -0.121 dB
Peak SAR (extrapolated) = 0.235 W/kg
SAR(1 g) = 0.110 mW/g; SAR(10 g) = 0.057 mW/g
Maximum value of SAR (measured) = 0.146 mW/g



Date/Time: 2010/2/3 15:50:32

Test Laboratory: Bureau Veritas ADT

M16-11n 40M-Ch4

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

Communication System: 2.4G 11n 40MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3

Phantom section: Flat Section ; Separation distance : 5 mm (The Vertical-Back of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Mid. Ch4/Area Scan (11x19x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of SAR (measured) = 0.116 mW/g

Mid. Ch4/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 7.86 V/m; Power Drift = -0.060 dB

Peak SAR (extrapolated) = 0.180 W/kg

SAR(1 g) = 0.090 mW/g; SAR(10 g) = 0.045 mW/g

Maximum value of SAR (measured) = 0.117 mW/g

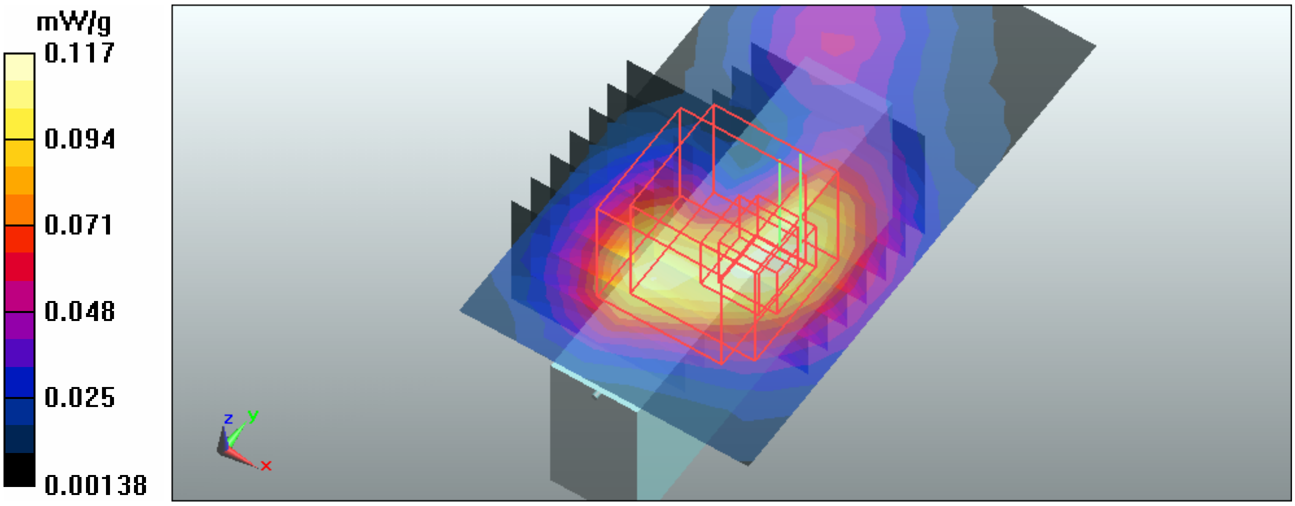
Mid. Ch4/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 7.86 V/m; Power Drift = -0.060 dB

Peak SAR (extrapolated) = 0.178 W/kg

SAR(1 g) = 0.086 mW/g; SAR(10 g) = 0.044 mW/g

Maximum value of SAR (measured) = 0.114 mW/g



Date/Time: 2010/2/3 16:28:39

Test Laboratory: Bureau Veritas ADT

M17-11b-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

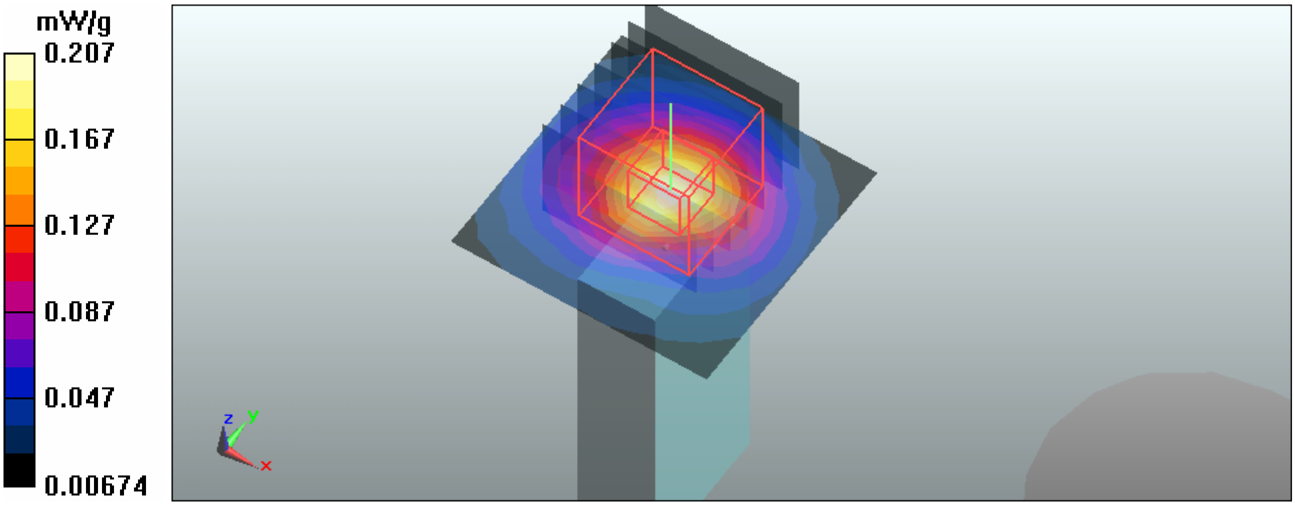
Communication System: 802.11B ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The tip side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Mid. Ch6/Area Scan (11x11x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.207 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 10.2 V/m; Power Drift = -0.114 dB
Peak SAR (extrapolated) = 0.304 W/kg
SAR(1 g) = 0.158 mW/g; SAR(10 g) = 0.075 mW/g



Date/Time: 2010/2/3 17:04:55

Test Laboratory: Bureau Veritas ADT

M18-11g-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

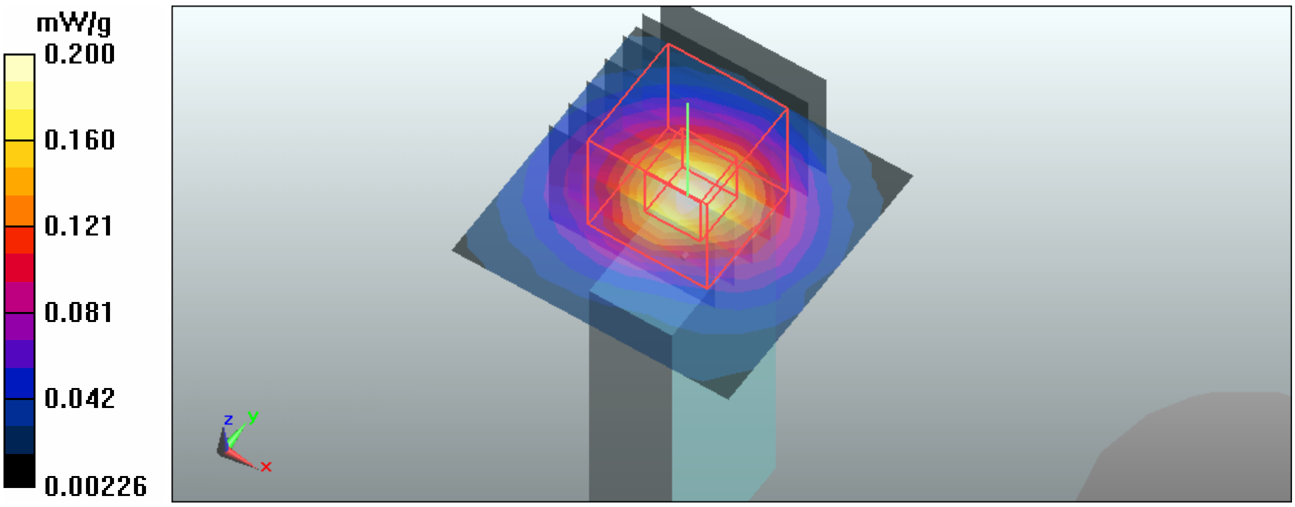
Communication System: 802.11G ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The tip side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Mid. Ch6/Area Scan (11x11x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.198 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 9.91 V/m; Power Drift = -0.030 dB
Peak SAR (extrapolated) = 0.292 W/kg
SAR(1 g) = 0.152 mW/g; SAR(10 g) = 0.071 mW/g
Maximum value of SAR (measured) = 0.200 mW/g



Date/Time: 2010/2/3 17:37:57

Test Laboratory: Bureau Veritas ADT

M19-11n 20M-Ch6

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

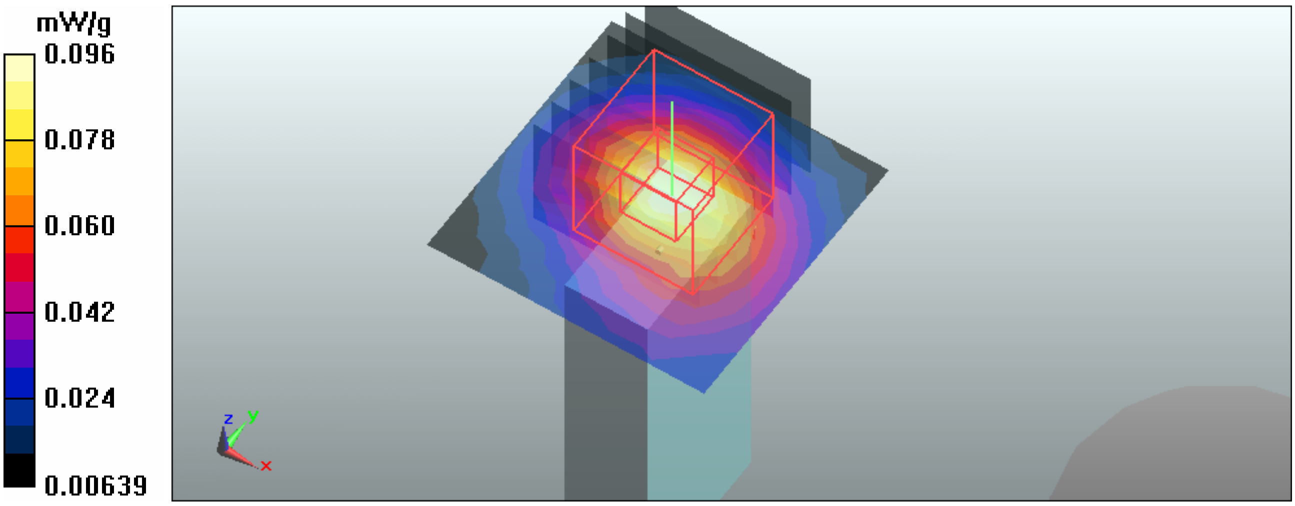
Communication System: 2.4G 11n 20MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The tip side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Mid. Ch6/Area Scan (11x11x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.096 mW/g

Mid. Ch6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 7.51 V/m; Power Drift = -0.136 dB
Peak SAR (extrapolated) = 0.132 W/kg
SAR(1 g) = 0.072 mW/g; SAR(10 g) = 0.036 mW/g
Maximum value of SAR (measured) = 0.093 mW/g



Date/Time: 2010/2/3 18:10:57

Test Laboratory: Bureau Veritas ADT

M20-11n 40M-Ch4

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

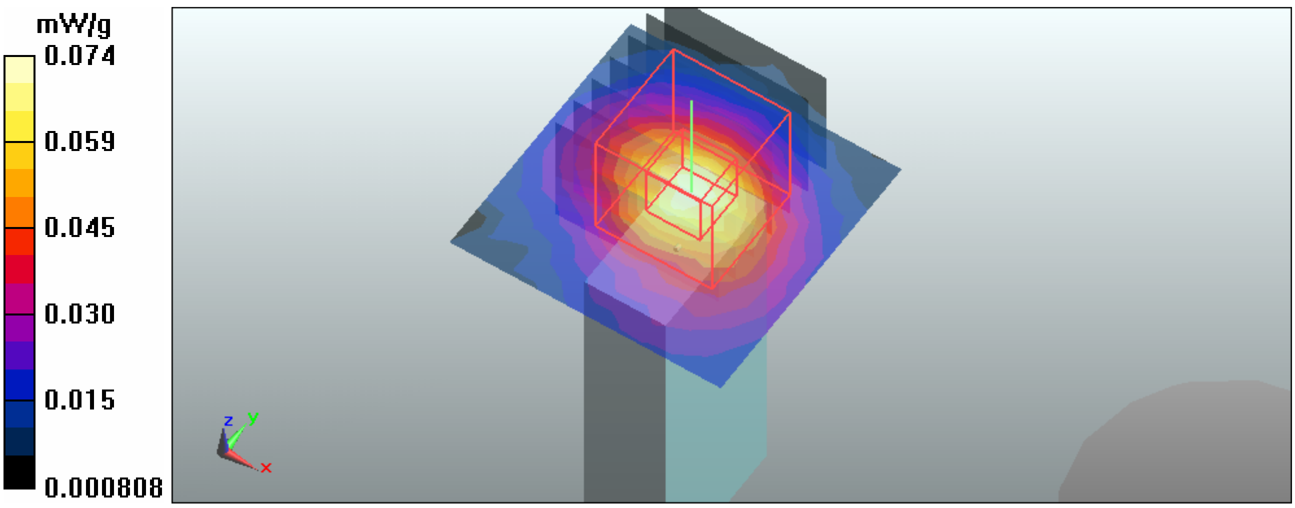
Communication System: 2.4G 11n 40MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The tip side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Mid. Ch4/Area Scan (11x11x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.074 mW/g

Mid. Ch4/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 6.08 V/m; Power Drift = -0.085 dB
Peak SAR (extrapolated) = 0.103 W/kg
SAR(1 g) = 0.057 mW/g; SAR(10 g) = 0.029 mW/g
Maximum value of SAR (measured) = 0.073 mW/g



Date/Time: 2010/2/3 12:03:11

Test Laboratory: Bureau Veritas ADT

11b-Ch6 / step size minimum

DUT: Wireless N USB 2.0 Adapter ; Type: TEW-624UB

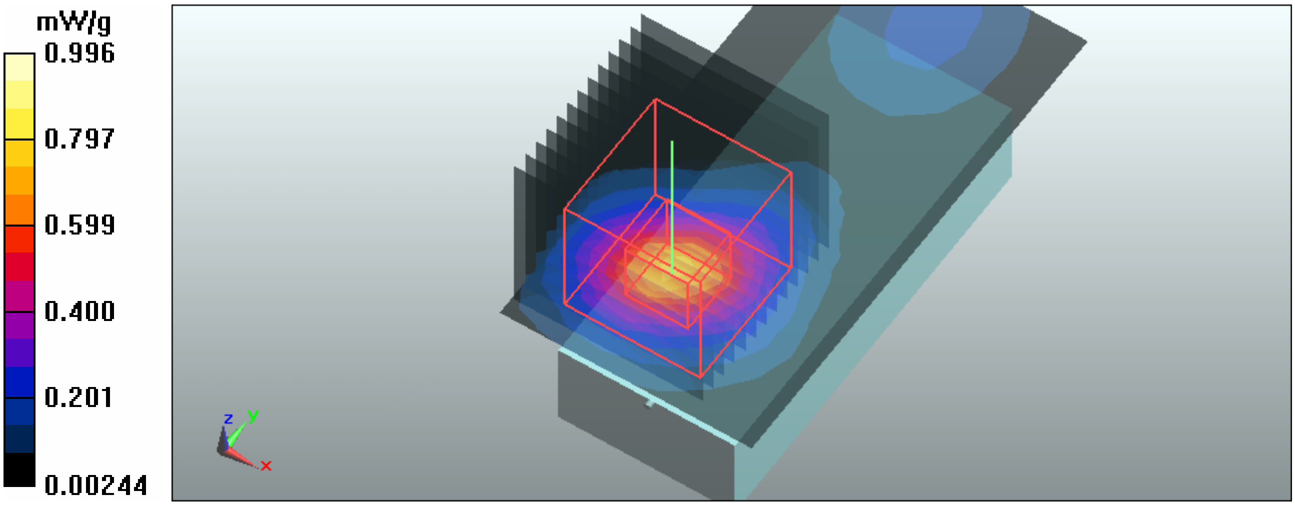
Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 5 mm (The Horizontal-Up side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34);
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Mid. Ch6/Area Scan (9x17x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of SAR (measured) = 0.794 mW/g

Mid. Ch6/Zoom Scan (13x13x13)/Cube 0: Measurement grid: dx=2.5mm, dy=2.5mm, dz=2.5mm
Reference Value = 19.4 V/m; Power Drift = 0.176 dB
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.584 mW/g; SAR(10 g) = 0.226 mW/g
Maximum value of SAR (measured) = 0.996 mW/g



Date/Time: 2010/2/3 00:40:27

Test Laboratory: Bureau Veritas ADT

SystemPerformanceCheck-MSL2450 MHz

DUT: Dipole 2450 MHz ; Type: D2450V2 ; Serial: 716 ; Test Frequency: 2450 MHz

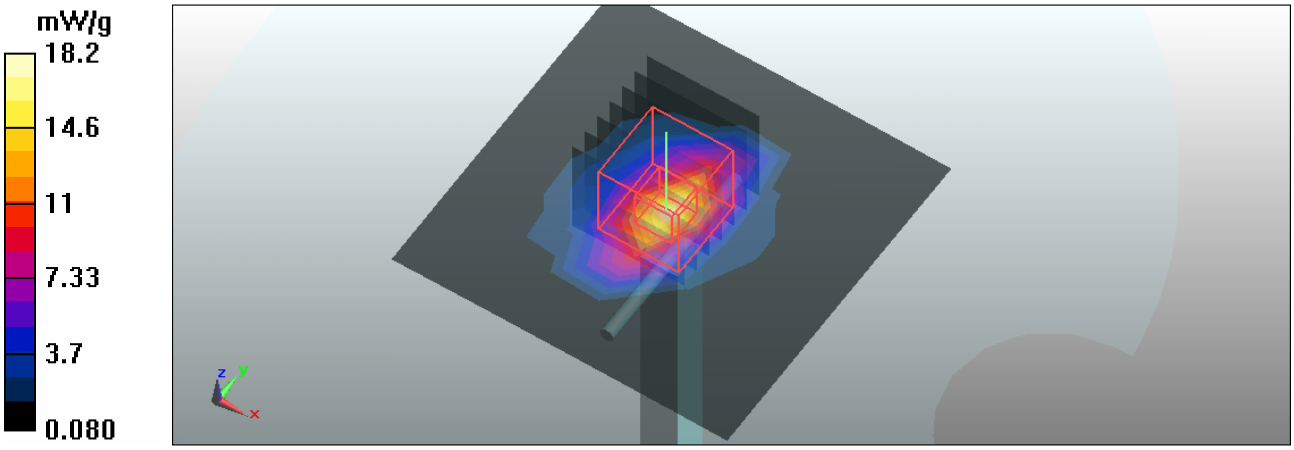
Communication System: CW ; Frequency: 2450 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL2450;Medium parameters used: f = 2450 MHz; σ = 1.98 mho/m; ε_r = 54.1; ρ = 1000 kg/m^3 ; Liquid level : 150 mm
Phantom section: Flat Section ; Separation distance : 10 mm (The feetpoint of the dipole to the Phantom)Air temp. : 22.1 degrees ; Liquid temp. : 21.3 degrees

DASY5 Configuration:

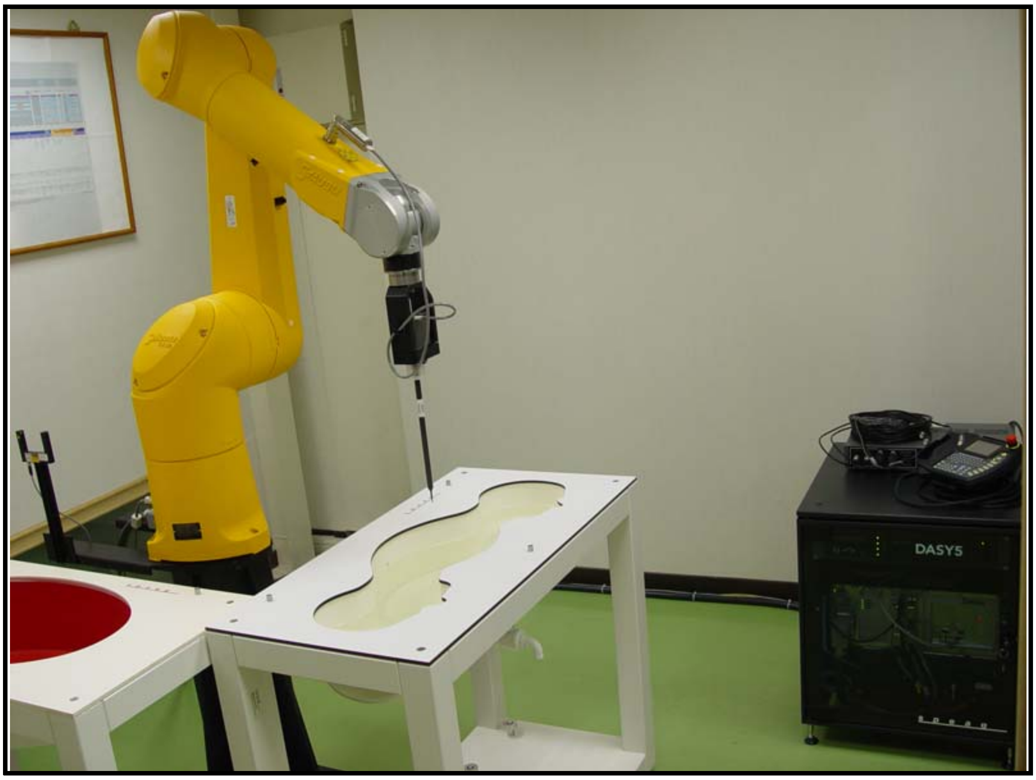
- Probe: EX3DV4 - SN3661; ConvF(7.34, 7.34, 7.34); Calibrated: 2009/12/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

System Performance Check at Frequencies 2.45 GHz/d=10mm, Pin=250 mW, dist=3.0mm /Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 17.8 mW/g

System Performance Check at Frequencies 2.45 GHz/d=10mm, Pin=250 mW, dist=3.0mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.8 V/m; Power Drift = 0.028 dB
Peak SAR (extrapolated) = 29.7 W/kg
SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.22 mW/g
Maximum value of SAR (measured) = 18.2 mW/g



APPENDIX B: BV ADT SAR MEASUREMENT SYSTEM



APPENDIX C: PHOTOGRAPHS OF SYSTEM VALIDATION

APPENDIX D: SYSTEM CERTIFICATE & CALIBRATION

D1: PHANTOM

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Certificate of Conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 C
Series No	TP-1150 and higher
Manufacturer	SPEAG Zeughausstrasse 43 CH-8004 Zürich Switzerland

Tests
The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series items (called samples) or are tested at each item.

Test	Requirement	Details	Units tested
Dimensions	Compliant with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness of shell	Compliant with the requirements according to the standards	2mm +/- 0.2mm in flat and specific areas of head section	First article, Samples, TP-1314 ff.
Material thickness at ERP	Compliant with the requirements according to the standards	6mm +/- 0.2mm at ERP	First article, All items
Material parameters	Dielectric parameters for required frequencies	300 MHz – 6 GHz: Relative permittivity < 5, Loss tangent < 0.05	Material samples
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	Pre-series, First article, Material samples
Sagging	Compliant with the requirements according to the standards. 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] CENELEC EN 50361
[2] IEEE Std 1528-2003
[3] IEC 62209 Part I
[4] FCC OET Bulletin 65, Supplement C, Edition 01-01
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents.

Conformity
Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standards [1] to [4].

Date 07.07.2005

Signature / Stamp

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**
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 **Auden**

Certificate No: EX3-3661_Dec09

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3661
Calibration procedure(s)	QA CAL-01.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	December 30, 2009

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	2-Jan-09 (No. ES3-3013_Jan09)	Jan-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: December 30, 2009

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

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., ϑ = 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 ϑ = 0 (f ≤ 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 ≤ 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:3661

Manufactured:	October 20, 2008
Calibrated:	December 30, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: EX3DV4 SN:3661

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.46	0.52	0.48	± 10.1%
DCP (mV)[B]	89.4	91.4	90.5	

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:3661

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)
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	9.34	9.34	9.34	0.69	0.64 ± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	9.06	9.06	9.06	0.72	0.64 ± 11.0%
1750	± 50 / ± 100	40.1 ± 5%	1.37 ± 5%	8.19	8.19	8.19	0.59	0.63 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	7.77	7.77	7.77	0.83	0.56 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	7.22	7.22	7.22	0.35	0.83 ± 11.0%
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	5.01	5.01	5.01	0.45	1.75 ± 13.1%
5500	± 50 / ± 100	35.6 ± 5%	4.96 ± 5%	4.38	4.38	4.38	0.48	1.75 ± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	4.26	4.26	4.26	0.45	1.75 ± 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:3661

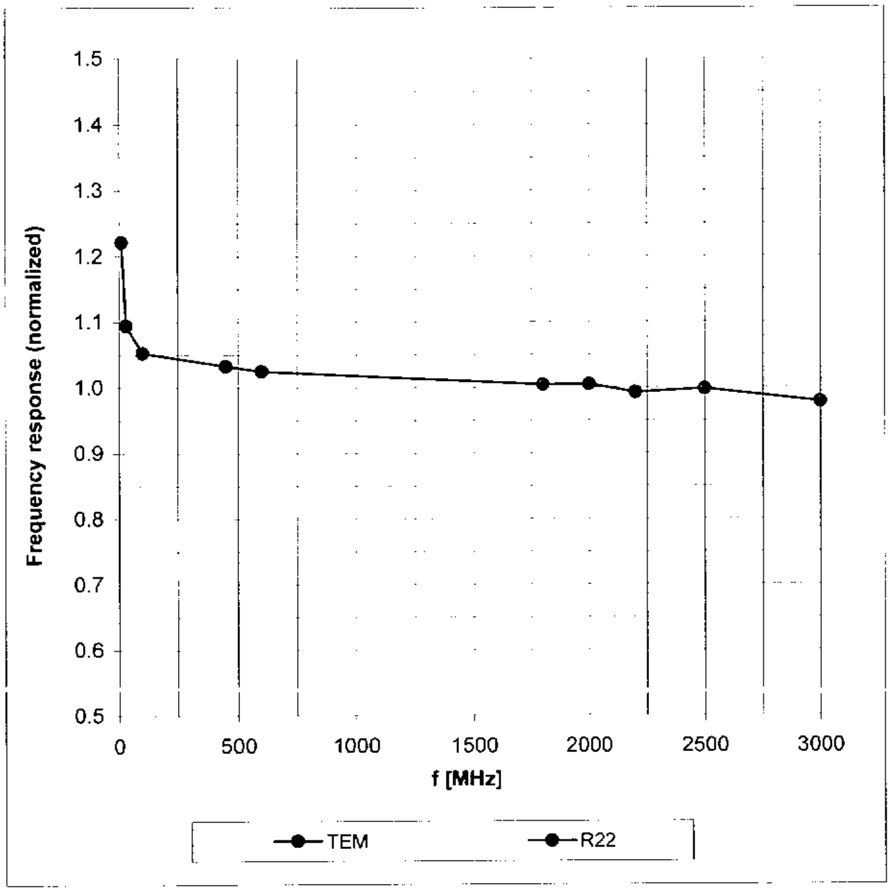
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	9.24	9.24	9.24	0.54	0.73 ± 11.0%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	8.97	8.97	8.97	0.53	0.72 ± 11.0%
1750	± 50 / ± 100	53.4 ± 5%	1.49 ± 5%	7.93	7.93	7.93	0.67	0.65 ± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	7.60	7.60	7.60	0.60	0.69 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	7.34	7.34	7.34	0.26	1.12 ± 11.0%
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	4.59	4.59	4.59	0.46	1.75 ± 13.1%
5500	± 50 / ± 100	48.6 ± 5%	5.65 ± 5%	4.11	4.11	4.11	0.46	1.75 ± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	4.12	4.12	4.12	0.48	1.75 ± 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.

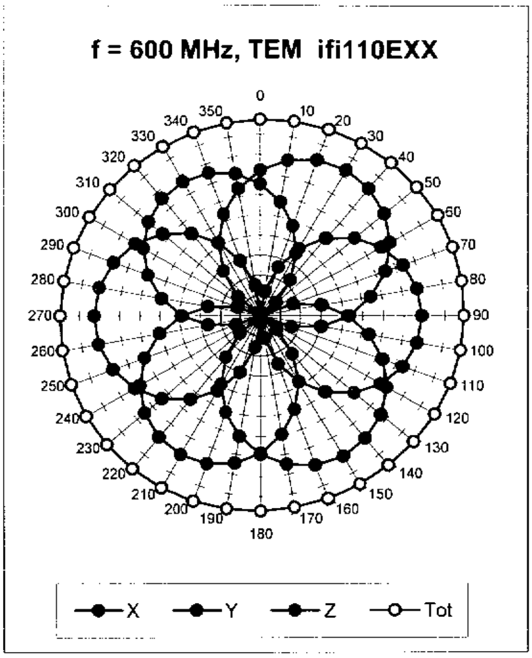
Frequency Response of E-Field

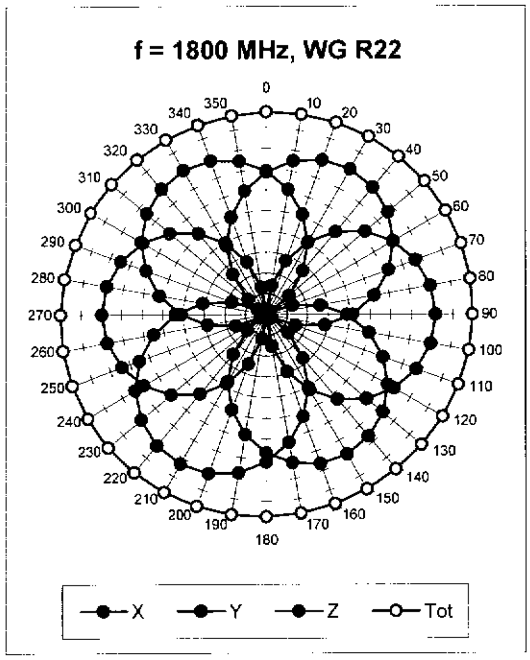
(TEM-Cell:ifi110 EXX, Waveguide: R22)

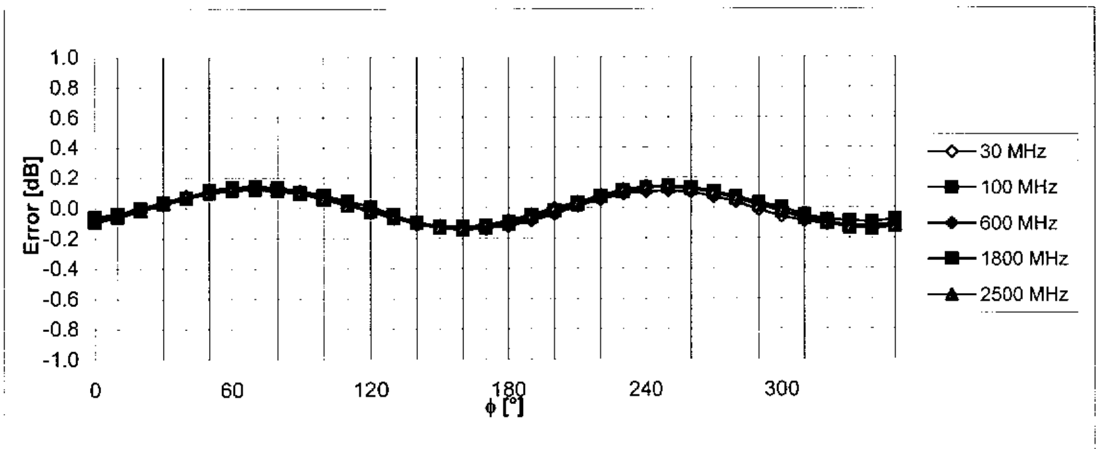


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$



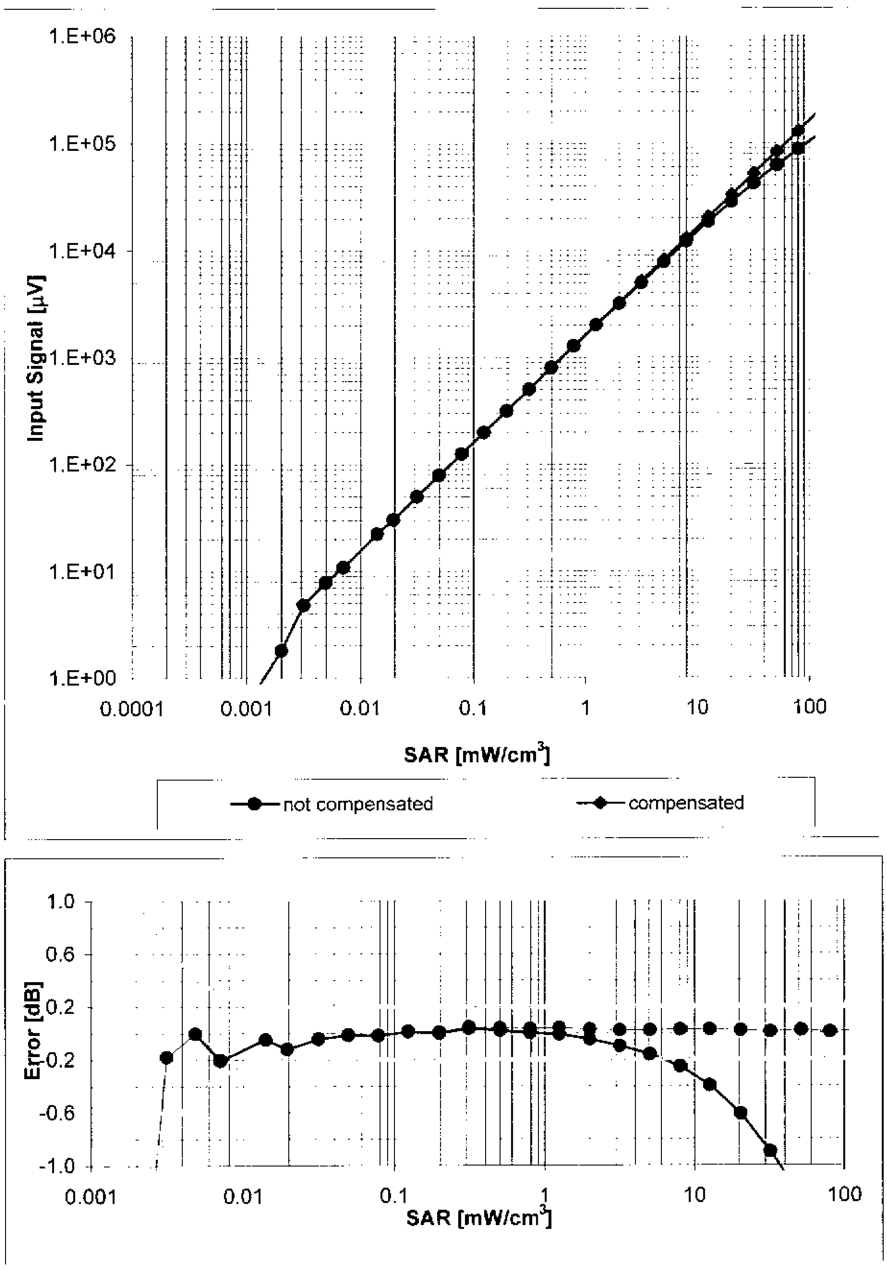




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

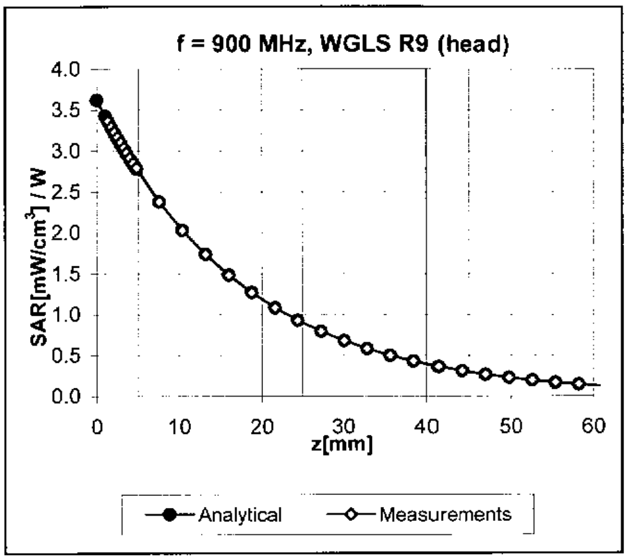
Dynamic Range f(SAR_{head})

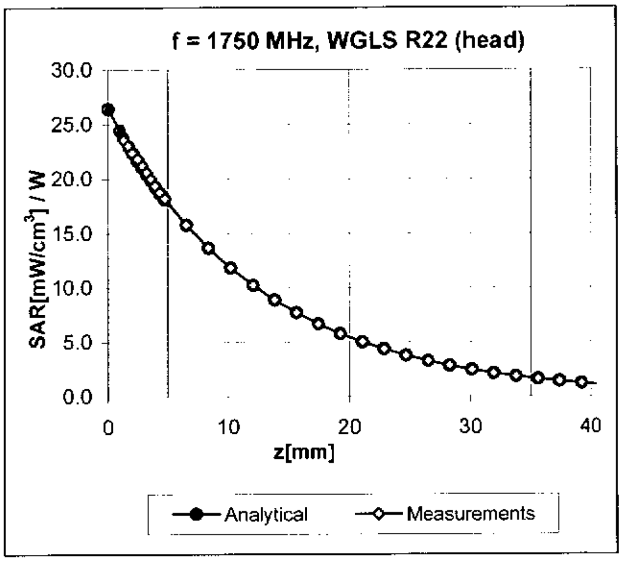
(Waveguide R22, f = 1800 MHz)



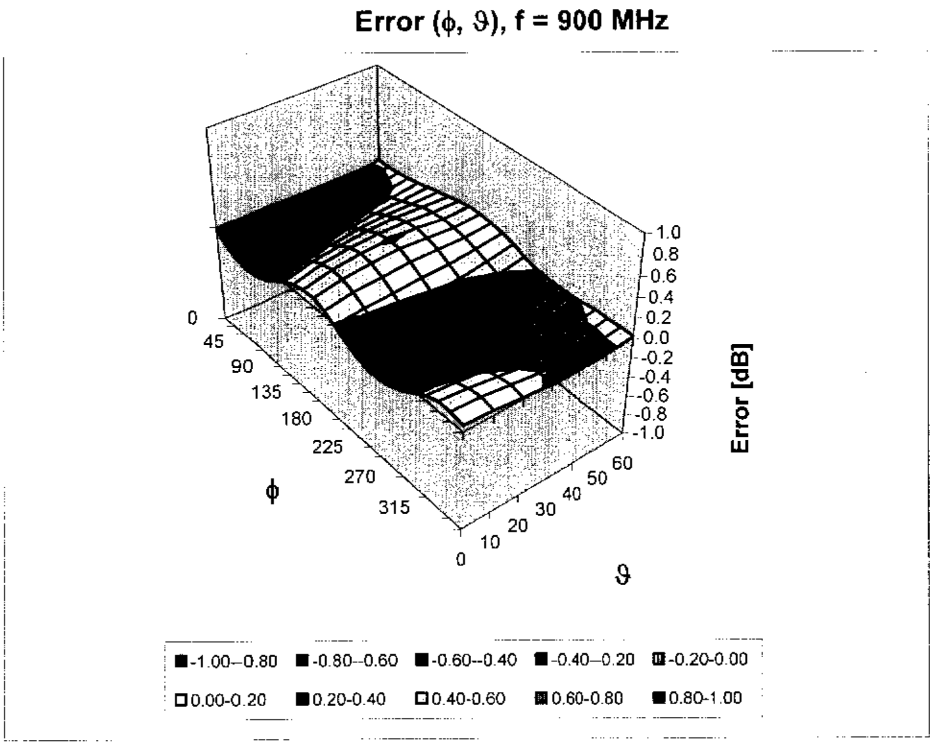
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment





Deviation from Isotropy in HSL



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

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

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.

Schmid & Partner Engineering

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
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: DAE3-510_Dec09

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 510
Calibration procedure(s)	QA CAL-06.v12 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	December 16, 2009

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	1-Oct-09 (No: 9055)	Oct-10
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	05-Jun-09 (in house check)	In house check: Jun-10

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

Issued: December 16, 2009

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

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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

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:* 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	404.187 ± 0.1% (k=2)	404.248 ± 0.1% (k=2)	404.614 ± 0.1% (k=2)
Low Range	3.97892 ± 0.7% (k=2)	3.96605 ± 0.7% (k=2)	3.98005 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	41.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199990.9	-2.38	-0.00
Channel X	+ Input	20002.91	2.61	0.01
Channel X	- Input	-19997.79	1.41	-0.01
Channel Y	+ Input	199996.6	-5.01	-0.00
Channel Y	+ Input	20001.94	2.24	0.01
Channel Y	- Input	-19996.34	2.86	-0.01
Channel Z	+ Input	200008.9	-1.41	-0.00
Channel Z	+ Input	20002.05	2.25	0.01
Channel Z	- Input	-19999.79	-0.00	-0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.2	0.23	0.01
Channel X	+ Input	199.97	-0.33	-0.16
Channel X	- Input	-199.93	-0.13	0.06
Channel Y	+ Input	2000.4	0.32	0.02
Channel Y	+ Input	199.22	-0.88	-0.44
Channel Y	- Input	-200.89	-0.89	0.45
Channel Z	+ Input	1999.8	-0.20	-0.01
Channel Z	+ Input	198.70	-1.10	-0.55
Channel Z	- Input	-201.24	-1.14	0.57

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	18.38	16.64
	- 200	-15.57	-17.08
Channel Y	200	15.00	14.68
	- 200	-16.18	-16.11
Channel Z	200	-8.28	-8.46
	- 200	8.35	7.64

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	-	1.05	0.90
Channel Y	200	3.00	-	2.06
Channel Z	200	1.57	0.45	-

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	15923	16300
Channel Y	16079	15537
Channel Z	16073	16363

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	-0.00	-0.83	0.76	0.27
Channel Y	-0.64	-1.12	1.85	0.32
Channel Z	-0.15	-1.15	1.76	0.36

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2001	201.0
Channel Y	0.2001	199.9
Channel Z	0.2001	200.4

8. Low Battery Alarm Voltage (verified during pre test)

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

9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	-0.01	-8	-9

D4: SYSTEM VALIDATION DIPOLE

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

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Accreditation No.: **SCS 108**

Client **BV-ADT (Auden)**

Certificate No: **D2450V2-716_Mar09**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 716
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	March 17, 2009
Condition of the calibrated item	In Tolerance

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	01-Jul-08 (No. 217-00864)	Jul-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 18, 2009

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.0 ± 6 %	1.82 mho/m ± 6 %
Head TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 mW / g
SAR normalized	normalized to 1W	54.0 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**53.3 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.24 mW / g
SAR normalized	normalized to 1W	25.0 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**24.8 mW /g ± 16.5 % (k=2)**

[1] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.3 ± 6 %	1.99 mho/m ± 6 %
Body TSL temperature during test	(21.1 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.3 mW / g
SAR normalized	normalized to 1W	53.2 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**52.9 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.24 mW / g
SAR normalized	normalized to 1W	25.0 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**25.0 mW /g ± 16.5 % (k=2)**

[2] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.9 Ω + 1.4 jΩ
Return Loss	- 26.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.2 Ω + 4.3 jΩ
Return Loss	- 27.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.144 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date/Time: 17.03.2009 15:42:29

Test Laboratory: SPEAG, Zurich, Switzerland

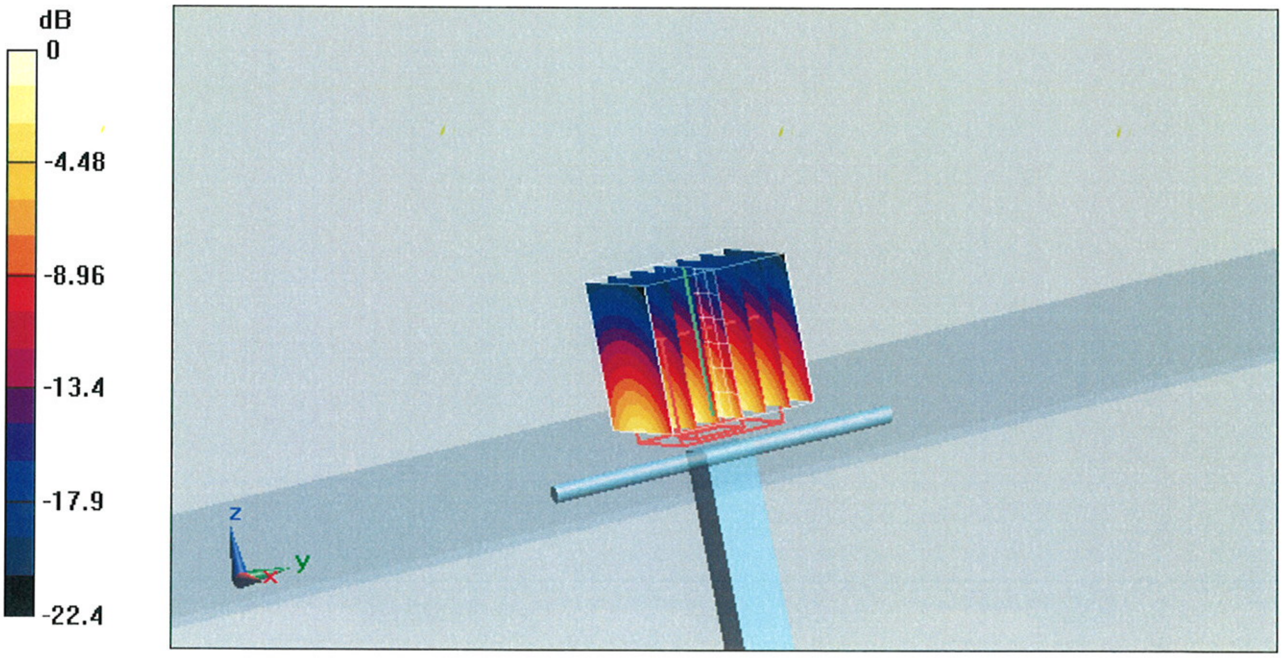
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN716

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U10 BB
Medium parameters used: f = 2450 MHz; $\sigma = 1.83$ mho/m; $\varepsilon_r = 38.1$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

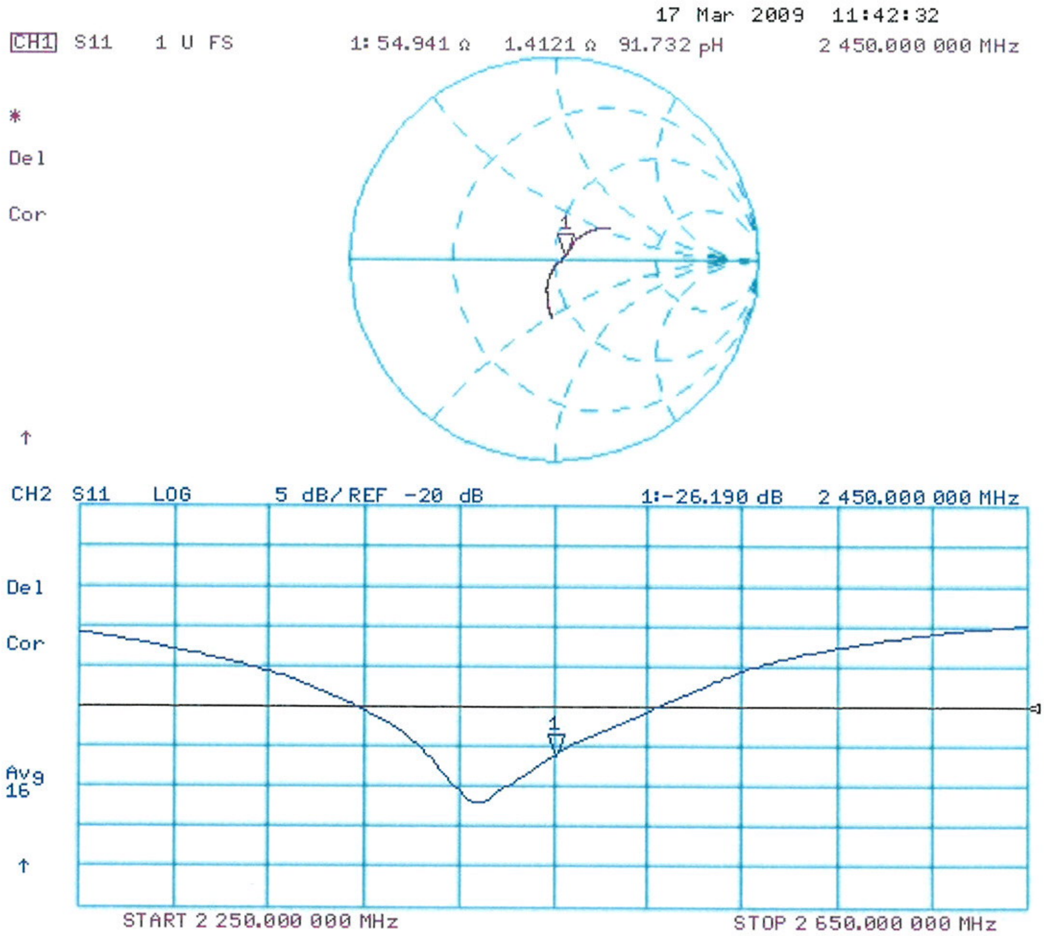
- Probe: ES3DV2 - SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.5 V/m; Power Drift = 0.040 dB
Peak SAR (extrapolated) = 28.2 W/kg
SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.24 mW/g
Maximum value of SAR (measured) = 16.1 mW/g



0 dB = 16.1mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 10.03.2009 14:20:02

Test Laboratory: SPEAG, Zurich, Switzerland

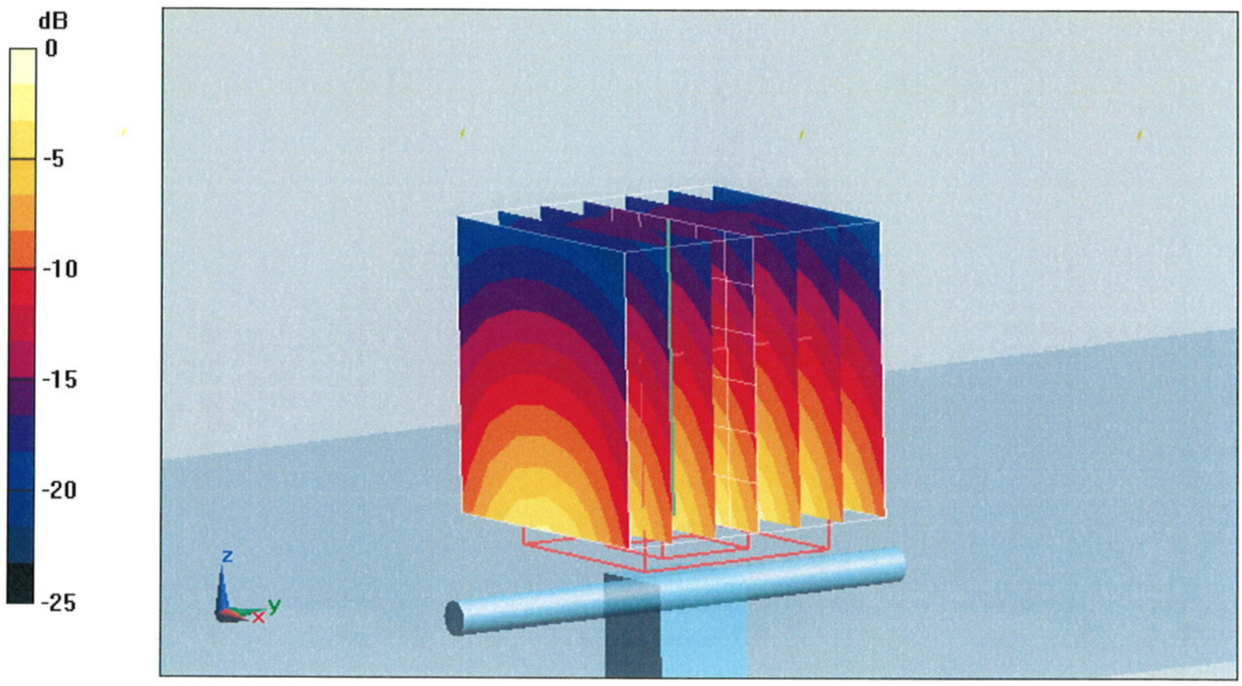
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:716

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U10 BB
Medium parameters used: f = 2450 MHz; σ = 2 mho/m; ε_r = 54.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.07, 4.07, 4.07); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.7 V/m; Power Drift = -0.00384 dB
Peak SAR (extrapolated) = 26.8 W/kg
SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.24 mW/g
Maximum value of SAR (measured) = 16.5 mW/g



0 dB = 16.5mW/g

Impedance Measurement Plot for Body TSL