SAR TEST REPORT

REPORT NO.: SA980812L01-1

MODEL NO.: PoMMeS

RECEIVED: Aug. 12, 2009

TESTED: Jan. 06, 2010

ISSUED: Jan. 08, 2010

APPLICANT: Thomson Inc

ADDRESS: 101 West 103rd Street, Indianapolis, Indiana 46290, United States

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

AB 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.

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Testing Laboratory
2021

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1. CERTIFICATION

PRODUCT: WiFi Photo Frame
MODEL: PoMMeS
BRAND: THOMSON
APPLICANT: Thomson Inc
TESTED: Jan. 06, 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: PoMMeS) 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 : Joanna Wang / Senior Specialist , **DATE :** Jan. 08, 2010

TECHNICAL ACCEPTANCE : Mason Chang / Engineer , **DATE :** Jan. 08, 2010
Responsible for RF

APPROVED BY : Gary Chang / Assistant Manager , **DATE :** Jan. 08, 2010

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

<table>
<tr><td>EUT</td><td colspan="2">WiFi Photo Frame</td></tr>
<tr><td>MODEL NO.</td><td colspan="2">PoMMeS</td></tr>
<tr><td>FCC ID</td><td colspan="2">G95TWTG001</td></tr>
<tr><td>POWER SUPPLY</td><td colspan="2">15Vdc (Adapter)
3.7Vdc (Battery)</td></tr>
<tr><td>MODULATION TYPE</td><td colspan="2">CCK, DQPSK, DBPSK for DSSS
64QAM, 16QAM, QPSK, BPSK for OFDM</td></tr>
<tr><td>MODULATION TECHNOLOGY</td><td colspan="2">DSSS, OFDM</td></tr>
<tr><td>TRANSFER RATE</td><td colspan="2">802.11b:11.0/ 5.5/ 2.0/ 1.0Mbps
802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps</td></tr>
<tr><td>FREQUENCY RANGE</td><td colspan="2">2412 ~ 2462MHz</td></tr>
<tr><td>NUMBER OF CHANNEL</td><td colspan="2">11</td></tr>
<tr><td rowspan="2">CHANNEL FREQUENCIES UNDER TEST AND ITS CONDUCTED OUTPUT POWER</td><td>ANT 1</td><td>ANT 2</td></tr>
<tr><td>802.11b:
17.5dBm / Ch11: 2462MHz
802.11g:
22.0dBm / Ch11: 2462MHz</td><td>802.11b:
17.4dBm / Ch11: 2462MHz
802.11g:
21.9dBm / Ch11: 2462MHz</td></tr>
<tr><td>MAXIMUM SAR (1g)</td><td colspan="2">0.4W/kg</td></tr>
<tr><td>ANTENNA TYPE</td><td colspan="2">ANT 1: Printed antenna with 0.81dBi gain
ANT 2: Wire antenna with -0.30dBi gain</td></tr>
<tr><td>ANTENNA CONNECTOR</td><td colspan="2">NA</td></tr>
<tr><td>DATA CABLE</td><td colspan="2">NA</td></tr>
<tr><td>I/O PORTS</td><td colspan="2">Refer to users' manual</td></tr>
<tr><td>ACCESSORY DEVICES</td><td colspan="2">Adapter, battery, docking</td></tr>
</table>

NOTE:

1. The EUT was powered by the following adapter and battery.

ADAPTER	
BRAND:	OEM
MODEL:	ADS18B-W 150120
INPUT:	100-240Vac, 50-60Hz, 0.5A
OUTPUT:	15Vdc, 1.2A
POWER LINE:	2.0m non-shielded cable without core

BATTERY	
BRAND:	H605590H
RATING:	3.7Vdc, 3900mAh, 14.4Wh

2. The USB port is for external disk access and cannot establish link with PC.
3. The EUT, operates in the 2.4GHz frequency range, lets you connect IEEE 802.11g or IEEE 802.11b devices to the network. With its high-speed data transmissions of up to 54Mbps.
4. 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	Agilent	68247B	984703	May 21, 2009	May 20, 2010
3	E-Field Probe	S & P	EX3DV4	3590	Apr. 28, 2009	Apr. 27, 2010
4	DAE	S & P	DAE3	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, all test equipment shall be warmed up for 30min.

FOR TISSUE PROPERTY

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	Network Analyzer	Agilent	E5071C	MY46104190	Apr. 10, 2009	Apr. 09, 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.

$$SAR = E_{tot}^2 \cdot \frac{s}{r \cdot 1'000}$$

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.

4. DESCRIPTION OF TEST MODES AND CONFIGURATIONS

4.1. DESCRIPTION OF TEST CONDITION

TEST DATE	TEST ITEM	TEMPERATURE(°C)		HUMIDITY(%RH)	TESTED BY
		AMBIENT	LIQUID		
Jan. 06, 2010	1 ~ 8	23.1	22.7	62	Aaron Liang

4.2. ENHANCED ENERGY COUPLING AT INCREASED SEPARATION DISTANCES

INITIAL POSITION:

The probe tip is positioned at the peak SAR location of in test mode 2, 6, at a distance of one half the probe tip diameter from the phantom surface. Under this condition to get a single sar value.

5mm INCREMENTS FROM INITIAL POSITION:

With the probe fixed at this location, the device is moved away from the phantom in 5 mm increments from the initial touching or minimum separation position. A single point SAR is measured for each of these device positions until the SAR is less than 50% of that measured at the initial position.

CHANNEL	FREQUENCY (MHZ)	TEST MODE	INITIAL POSITION MEASURED 1g SAR (W/kg)	5 mm INCREMENTS FROM INITIAL POSITION MEASURED 1g SAR (W/kg)
6	2437	2	0.6650	0.3127
11	2462	6	0.1437	0.0708

RESULT: No Enhancement Energy Coupling observed.

4.3. DESCRIPTION OF TEST MODE

Test Tool:

Test tool is DutApiUDP83xxp 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 is 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 2 test positions in the report.

- Body / Tip
- Body / Bottom

Test Mode Table:

ITEM	TEST MODE	MODULATION	ASSESSMENT POSTITION	TESTED CHANNEL	REMARK
1	802.11b	DBPSK	Body / Tip	11	ANT 1
2	802.11g	BPSK		11	ANT 1
3	802.11b	DBPSK		11	ANT 2
4	802.11g	BPSK		11	ANT 2
5	802.11b	DBPSK	Body / Bottom	11	ANT 1
6	802.11g	BPSK		11	ANT 1
7	802.11b	DBPSK		11	ANT 2
8	802.11g	BPSK		11	ANT 2

NOTE: Please refer to the test set up photo.

4.4. SUMMARY OF TEST RESULTS

ITEM		1	2	3	4
TEST MODE		802.11b	802.11g	802.11b	802.11g
CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)			
11	2462 (High)	0.265	**0.368**	0.101	0.132

ITEM		5	6	7	8
TEST MODE		802.11b	802.11g	802.11b	802.11g
CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)			
11	2462 (High)	0.053	0.088	0.015	0.023

NOTE: The worst value has been marked by boldface.

5. TEST RESULTS

5.1 TEST PROCEDURES

Use the software to control the EUT channel and transmission power. Then record the conducted power before the testing. Place the EUT to the specific test location. After the testing, must writing down the conducted power of the EUT into the report. The SAR value was calculated via the 3D spline interpolation algorithm that has been implemented in the software of DASY4 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 SAR LIMITS

HUMAN EXPOSURE	SAR (W/kg)	
	(GENERAL POPULATION / UNCONTROLLED EXPOSURE ENVIRONMENT)	(OCCUPATIONAL / CONTROLLED EXPOSURE ENVIRONMENT)
Spatial Peak (averaged over 1 g)	**1.6**	8.0

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.

5.3 MEASURED SAR RESULTS

TEST MODE	CHAN.	FREQ. (MHz)	MODULATION	TEST POSITION	CONDUCTED POWER (dBm) BEGIN TEST	POWER DRIFT (dB)	MEASURED 1g SAR (W/kg)
1	11	2462	802.11b	Body / Tip	17.5	-0.056	0.265
2	11	2462	802.11g	Body / Tip	22.0	0.051	**0.368**
3	11	2462	802.11b	Body / Tip	17.4	0.068	0.101
4	11	2462	802.11g	Body / Tip	21.9	0.069	0.132
5	11	2462	802.11b	Body / Bottom	17.5	-0.087	0.053
6	11	2462	802.11g	Body / Bottom	22.0	-0.019	0.088
7	11	2462	802.11b	Body / Bottom	17.4	-0.096	0.015
8	11	2462	802.11g	Body / Bottom	21.9	-0.013	0.023

NOTE:

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

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 E5071C and Agilent Dielectric Probe Kit 85070D.The testing procedure is following as

1. Turn Network Analyzer on and allow at least 30min. warm up.
2. Mount dielectric probe kit so that interconnecting cable to Network Analyzer will not be moved during measurements or calibration.
3. Pour de-ionized water and measure water temperature (±1°).
4. Set water temperature in Agilent-Software (Calibration Setup).
5. Perform calibration.
6. Validate calibration with dielectric material of known properties (e.g. polished ceramic slab with >8mm thickness ε'=10.0, ε''=0.0). If measured parameters do not fit within tolerance, repeat calibration (±0.2 for ε': ±0.1 for ε'').
7. Conductivity can be calculated from ε'' by $\sigma = \omega \varepsilon_0 \varepsilon'' = \varepsilon'' f [GHz] / 18$.
8. Measure liquid shortly after calibration. Repeat calibration every hour.
9. Stir the liquid to be measured. Take a sample (~ 50ml) with a syringe from the center of the liquid container.
10. Pour the liquid into a small glass flask. Hold the syringe at the bottom of the flask to avoid air bubbles.
11. Put the dielectric probe in the glass flask. Check that there are no air bubbles in front of the opening in the dielectric probe kit.
12. Perform measurements.
13. Adjust medium parameters in 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.	22.7
TEST DATE	Jan. 06, 2010
TESTED BY	Aaron Liang

FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	ERROR PERCENTAGE (%)	LIMIT(%)
2450.0	Permitivity (ε)	52.70	53.10	0.76	±5
2462.0		52.70	53.00	0.57	
2450.0	Conductivity (σ) S/m	1.95	1.97	1.03	
2462.0		1.97	2.01	2.03	

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	13.3 (1g)	13.0	-2.26	10mm	Jan. 06, 2010
TESTED BY	Aaron Liang				

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	0.00	Rectangular	$\sqrt{3}$	1	1	0.00	0.00	∞
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)	2.86	Normal	1	0.64	0.43	1.83	1.23	∞
Liquid Permittivity (target)	5.00	Rectangular	$\sqrt{3}$	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	2.16	Normal	1	0.6	0.49	1.30	1.06	∞
Combined Standard Uncertainty						**9.64**	**9.36**	
Coverage Factor for 95%						**Kp=2**		
Expanded Uncertainty (K=2)						**19.27**	**18.72**	

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 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

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

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

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:

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

where Tm is 500 ms, i.e., the time between measurement samples, and $_T$ the time constant. The response time $_T$ 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. INTEGRATION TIME UNCERTAINTY

If the device under test does not emit a CW signal, the integration time applied to measure the electric field at a specific point may introduce additional uncertainties due to the discretization and can be assessed as follows

$$SAR_{tolerance}[\%] = 100 \times \sum_{allsub-frames} \frac{t_{frame}}{t_{integration}} \frac{slot_{idle}}{slot_{total}}$$

The EUT transmit 100 % duty cycle test signal under SAR test. Therefore, the Integration Time Uncertainty is 0.

7.8. 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:

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

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).

7.9. PROBE POSITIONING

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

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

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.

7.10. 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%.

7.11. 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)	2.86	Normal	1	0.64	0.43	1.83	1.23	∞
Liquid Permittivity (target)	5.00	Rectangular	$\sqrt{3}$	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	2.16	Normal	1	0.6	0.49	1.30	1.06	∞
Combined Standard Uncertainty						**10.37**	**10.11**	
Coverage Factor for 95%						**Kp=2**		
Expanded Uncertainty (K=2)						**20.74**	**20.23**	

TABLE 7.2

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

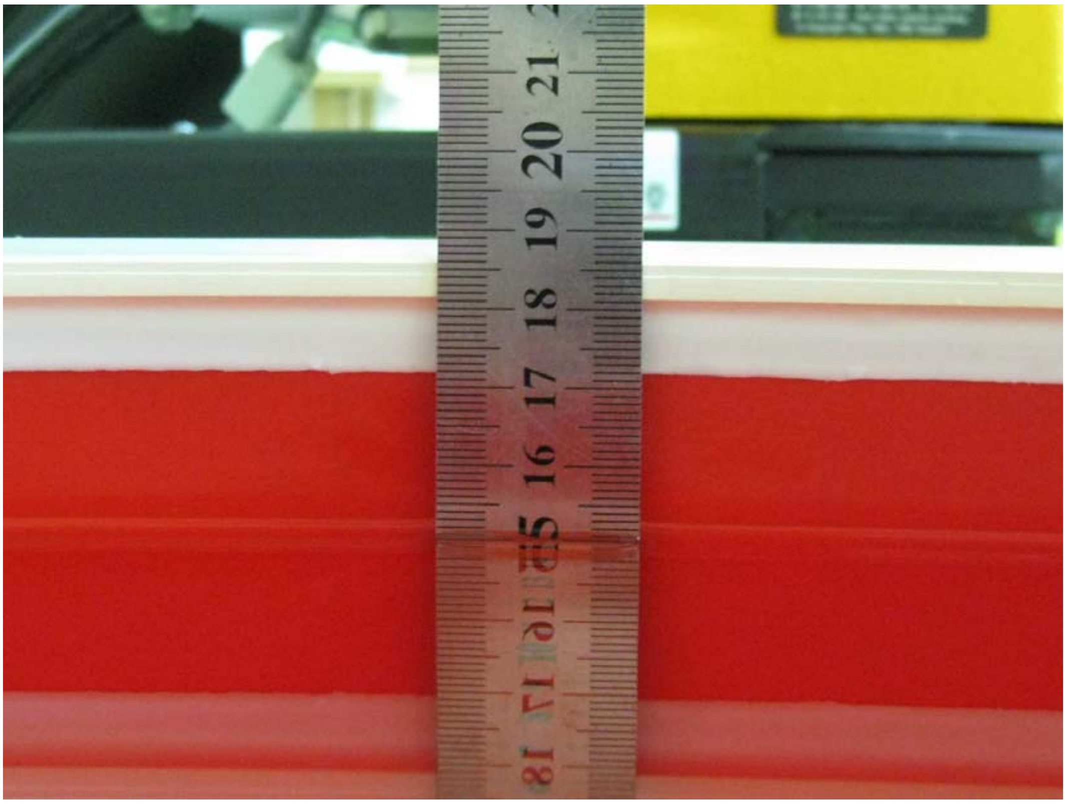
The address and road map of all our labs can be found in our web site also.

---END---

APPENDIX A: TEST DATA

Liquid Level Photo

MSL 2450MHz D=151mm



Date/Time: 2010/1/6 10:30:47

Test Laboratory: Bureau Veritas ADT

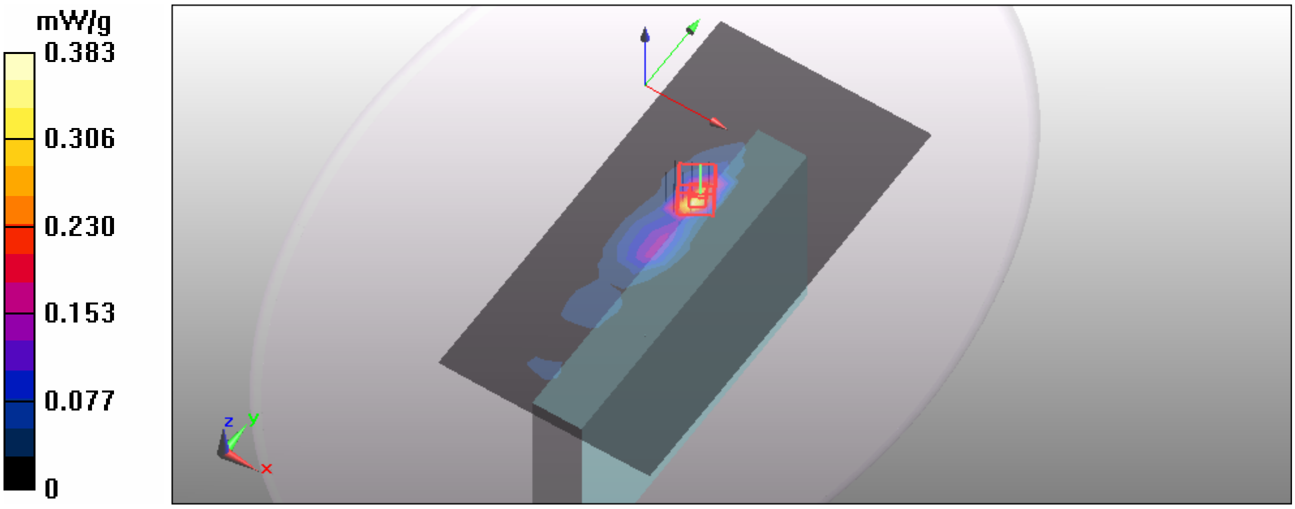
M01-ANT 1-Body-Tip-11B-Ch 11

DUT: WiFi Photo Frame ; Type: PoMMeS
Communication System: 802.11B ; Frequency: 2462 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 0 mm (The Tip side of the EUT to the Phantom)

DASY5 Configuration:
- Probe: EX3DV4 - SN3590 ; ConvF(7.96, 7.96, 7.96) ; Calibrated: 2009/4/28
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510 ; Calibrated: 2009/12/16
- Phantom: ELI 4.0 ; Type: QDOVA001BB ; Serial: 1043
- Measurement SW: DASY5, V5.2 Build 157 ; SEMCAD X Version 14.0 Build 57

High Channel /Area Scan (11x21x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.372 mW/g

High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.76 V/m; Power Drift = -0.056 dB
Peak SAR (extrapolated) = 0.721 W/kg
SAR(1 g) = 0.265 mW/g; SAR(10 g) = 0.095 mW/g
Maximum value of SAR (measured) = 0.383 mW/g



Date/Time: 2010/1/6 11:30:06

Test Laboratory: Bureau Veritas ADT

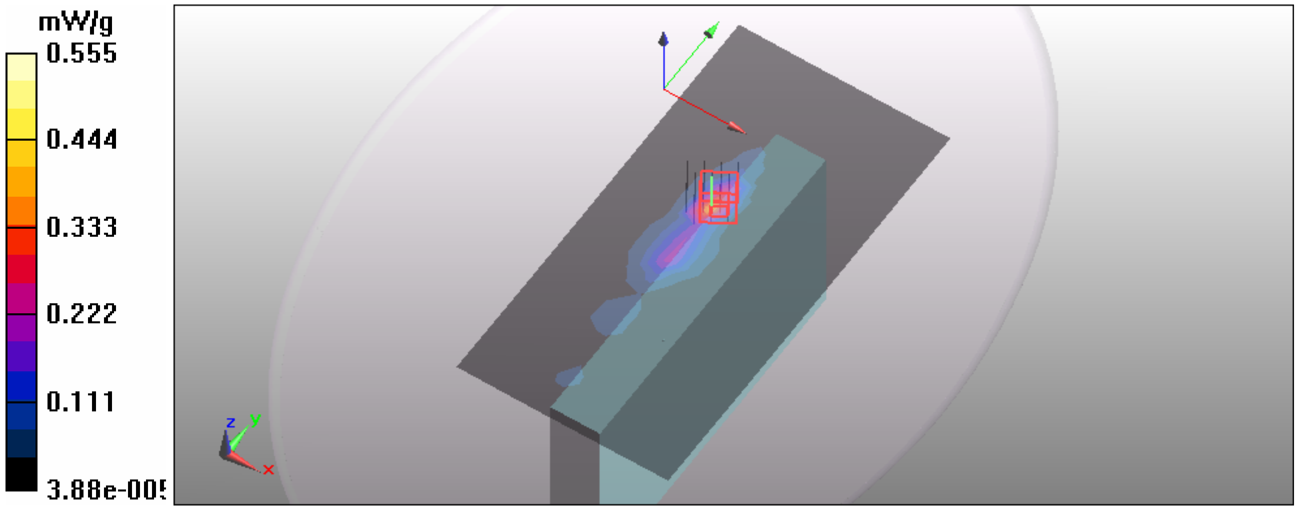
M02-ANT 1-Body-Tip-11G-Ch 11

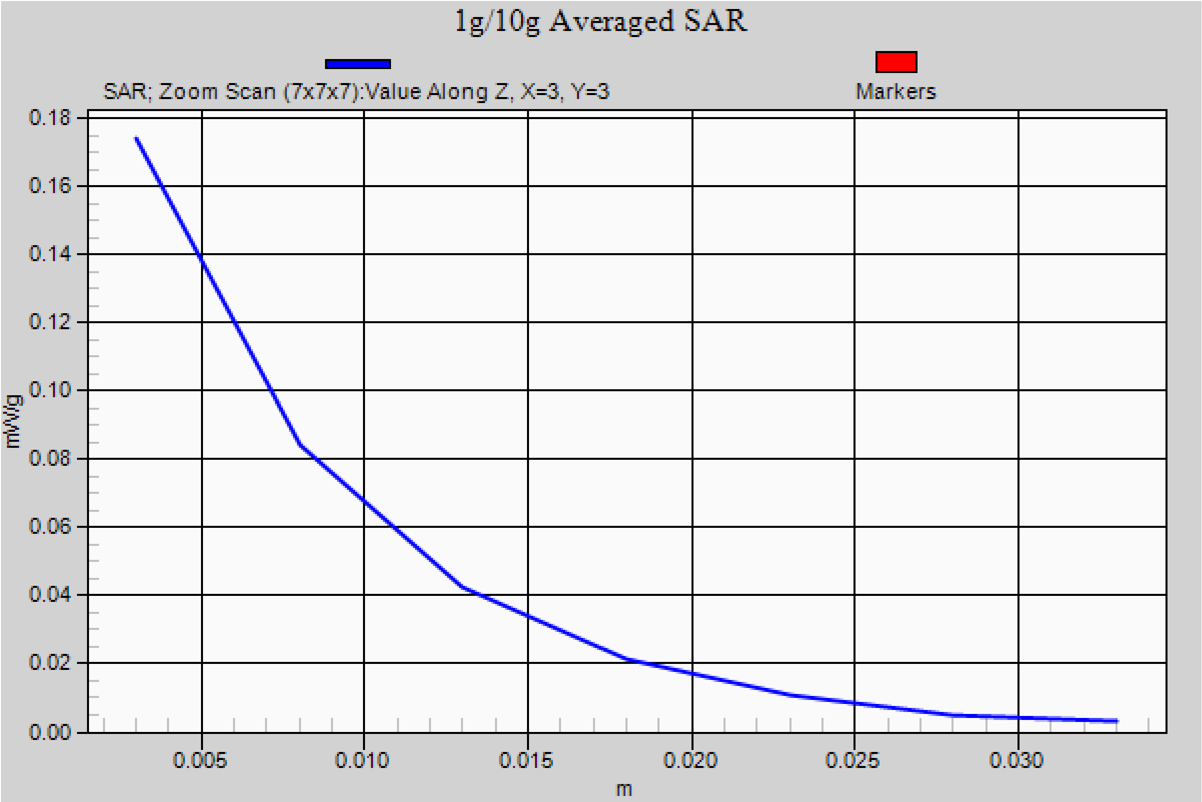
DUT: WiFi Photo Frame ; Type: PoMMeS
Communication System: 802.11G ; Frequency: 2462 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 0 mm (The Tip side of the EUT to the Phantom)

DASY5 Configuration:
- Probe: EX3DV4 - SN3590 ; ConvF(7.96, 7.96, 7.96) ; Calibrated: 2009/4/28
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510 ; Calibrated: 2009/12/16
- Phantom: ELI 4.0 ; Type: QDOVA001BB ; Serial: 1043
- Measurement SW: DASY5, V5.2 Build 157 ; SEMCAD X Version 14.0 Build 57

High Channel /Area Scan (11x21x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.407 mW/g

High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.91 V/m; Power Drift = 0.051 dB
Peak SAR (extrapolated) = 0.996 W/kg
SAR(1 g) = 0.368 mW/g; SAR(10 g) = 0.132 mW/g
Maximum value of SAR (measured) = 0.555 mW/g




1g/10g Averaged SAR
SAR; Zoom Scan (7x7x7):Value Along Z, X=3, Y=3
Markers
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
mW/g
0.005
0.010
0.015
0.020
0.025
0.030
m

Date/Time: 2010/1/6 14:00:03

Test Laboratory: Bureau Veritas ADT

M03-ANT 2-Body-Tip-11B-Ch 11

DUT: WiFi Photo Frame ; Type: PoMMeS

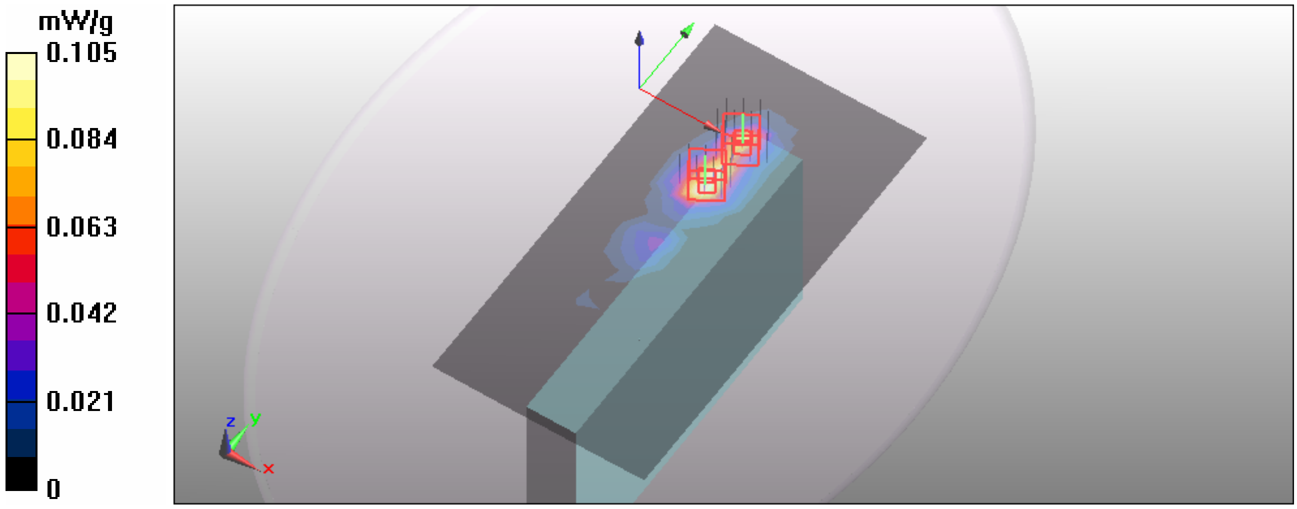
Communication System: 802.11B ; Frequency: 2462 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 0 mm (The Tip side of the EUT to the Phantom)

DASY5 Configuration:
- Probe: EX3DV4 - SN3590 ; ConvF(7.96, 7.96, 7.96) ; Calibrated: 2009/4/28
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510 ; Calibrated: 2009/12/16
- Phantom: ELI 4.0 ; Type: QDOVA001BB ; Serial: 1043
- Measurement SW: DASY5, V5.2 Build 157 ; SEMCAD X Version 14.0 Build 57

High Channel /Area Scan (11x21x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.118 mW/g

High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.57 V/m; Power Drift = 0.068 dB
Peak SAR (extrapolated) = 0.209 W/kg
SAR(1 g) = 0.101 mW/g; SAR(10 g) = 0.048 mW/g
Maximum value of SAR (measured) = 0.132 mW/g

High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.57 V/m; Power Drift = 0.068 dB
Peak SAR (extrapolated) = 0.175 W/kg
SAR(1 g) = 0.077 mW/g; SAR(10 g) = 0.033 mW/g
Maximum value of SAR (measured) = 0.105 mW/g



Date/Time: 2010/1/6 16:00:24

Test Laboratory: Bureau Veritas ADT

M04-ANT 2-Body-Tip-11G-Ch 11

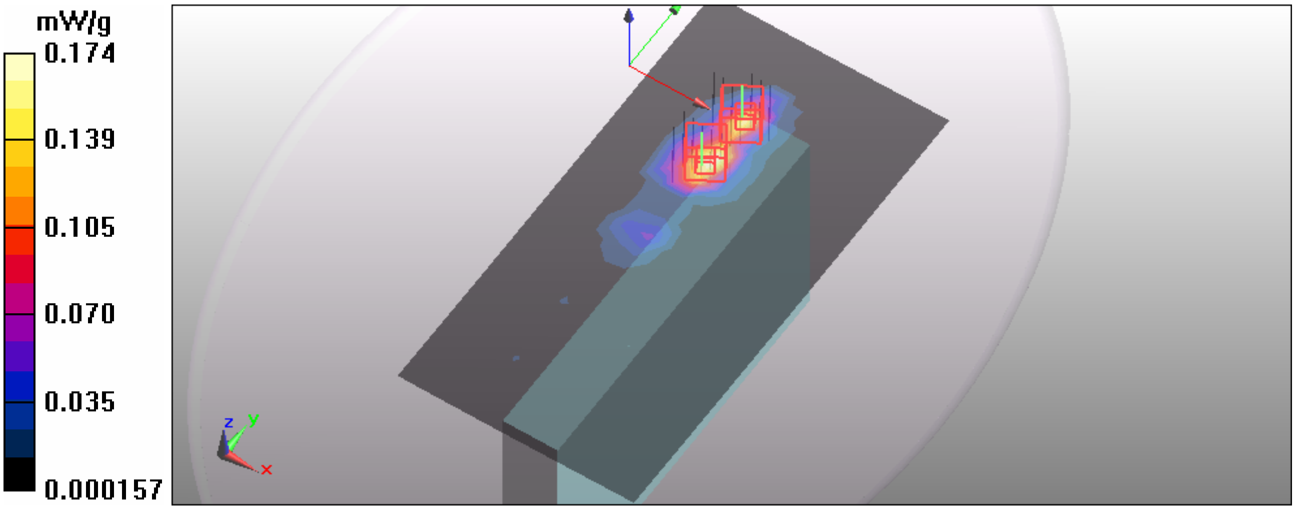
DUT: WiFi Photo Frame ; Type: PoMMeS
Communication System: 802.11G ; Frequency: 2462 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 0 mm (The Tip side of the EUT to the Phantom)

DASY5 Configuration:
- Probe: EX3DV4 - SN3590 ; ConvF(7.96, 7.96, 7.96) ; Calibrated: 2009/4/28
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510 ; Calibrated: 2009/12/16
- Phantom: ELI 4.0 ; Type: QDOVA001BB ; Serial: 1043
- Measurement SW: DASY5, V5.2 Build 157 ; SEMCAD X Version 14.0 Build 57

High Channel /Area Scan (11x21x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.155 mW/g

High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.73 V/m; Power Drift = 0.069 dB
Peak SAR (extrapolated) = 0.277 W/kg
SAR(1 g) = 0.132 mW/g; SAR(10 g) = 0.062 mW/g
Maximum value of SAR (measured) = 0.174 mW/g

High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.73 V/m; Power Drift = 0.069 dB
Peak SAR (extrapolated) = 0.249 W/kg
SAR(1 g) = 0.107 mW/g; SAR(10 g) = 0.046 mW/g
Maximum value of SAR (measured) = 0.144 mW/g



Date/Time: 2010/1/6   17:00:34

Test Laboratory: Bureau Veritas ADT

M05-ANT 1 Body-Bottom-11B-Ch 11

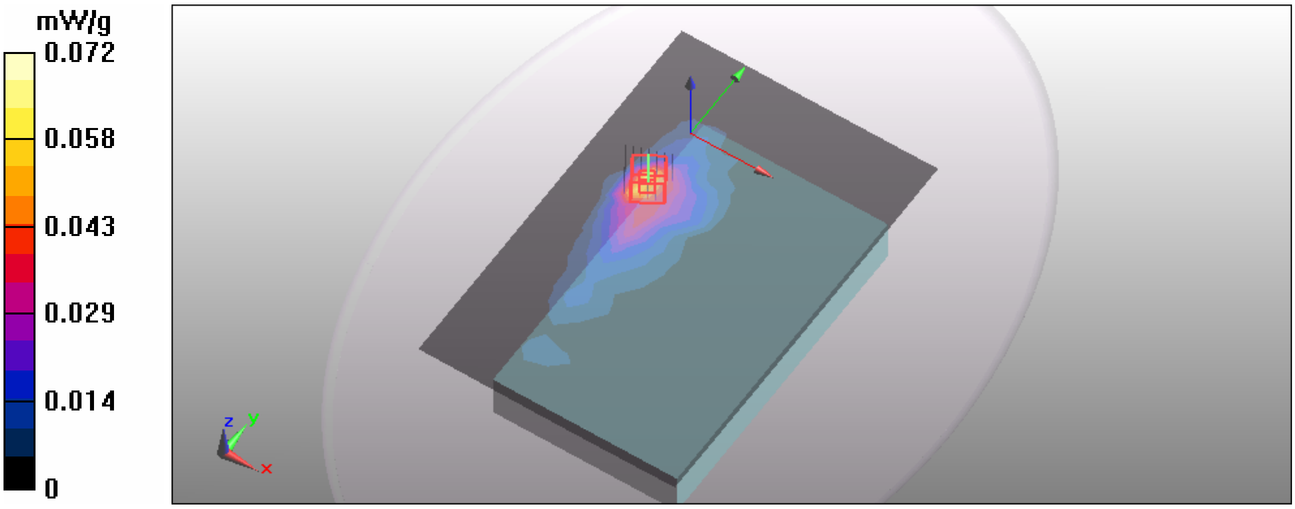
DUT: WiFi Photo Frame ; Type: PoMMeS

Communication System: 802.11B ; Frequency: 2462 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 0 mm (The bottom side of the EUT to the Phantom)

DASY5 Configuration:
- Probe: EX3DV4 - SN3590 ; ConvF(7.96, 7.96, 7.96) ; Calibrated: 2009/4/28
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510 ; Calibrated: 2009/12/16
- Phantom: ELI 4.0 ; Type: QDOVA001BB ; Serial: 1043
- Measurement SW: DASY5, V5.2 Build 157 ; SEMCAD X Version 14.0 Build 57

High Channel /Area Scan (14x21x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.059 mW/g

High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.531 V/m; Power Drift = -0.087 dB
Peak SAR (extrapolated) = 0.119 W/kg
SAR(1 g) = 0.053 mW/g; SAR(10 g) = 0.023 mW/g
Maximum value of SAR (measured) = 0.072 mW/g



Date/Time: 2010/1/6 18:00:58

Test Laboratory: Bureau Veritas ADT

M06-ANT 1-Body-Bottom-11G-Ch 11

DUT: WiFi Photo Frame ; Type: PoMMeS

Communication System: 802.11G ; Frequency: 2462 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 53; ρ = 1000 kg/m^3

Phantom section: Flat Section ; Separation distance : 0 mm (The bottom side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590 ; ConvF(7.96, 7.96, 7.96) ; Calibrated: 2009/4/28
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510 ; Calibrated: 2009/12/16
- Phantom: ELI 4.0 ; Type: QDOVA001BB ; Serial: 1043
- Measurement SW: DASY5, V5.2 Build 157 ; SEMCAD X Version 14.0 Build 57

High Channel /Area Scan (14x21x1): Measurement grid: dx=15mm, dy=15mm

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

High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 0.472 V/m; Power Drift = -0.019 dB

Peak SAR (extrapolated) = 0.305 W/kg

SAR(1 g) = 0.067 mW/g; SAR(10 g) = 0.024 mW/g

Maximum value of SAR (measured) = 0.096 mW/g

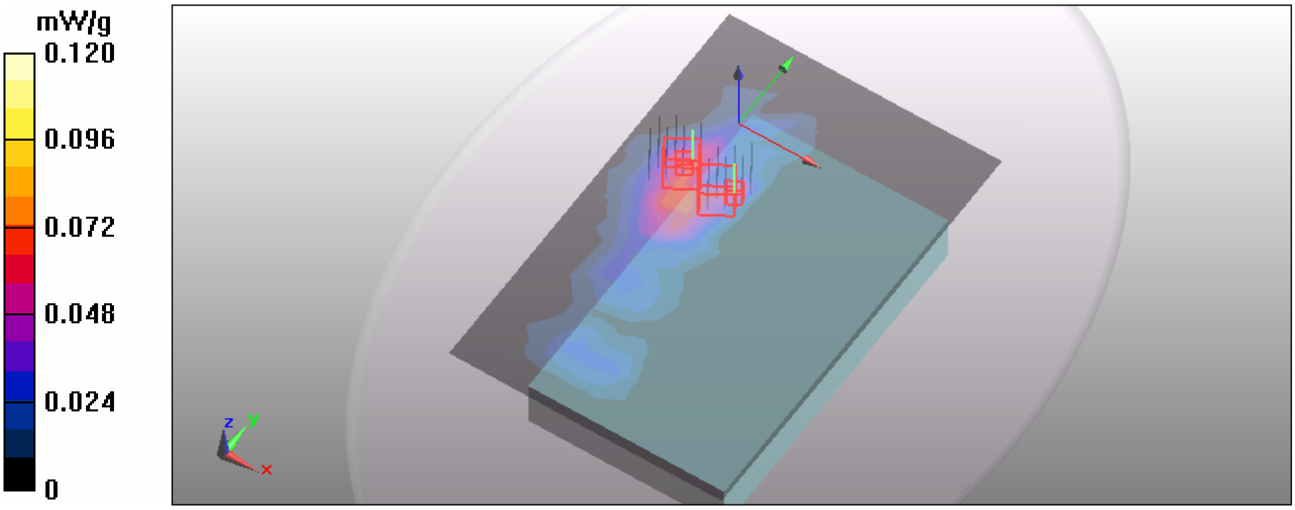
High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 0.472 V/m; Power Drift = -0.019 dB

Peak SAR (extrapolated) = 0.183 W/kg

SAR(1 g) = 0.088 mW/g; SAR(10 g) = 0.043 mW/g

Maximum value of SAR (measured) = 0.120 mW/g



Date/Time: 2010/1/6   19:00:15

Test Laboratory: Bureau Veritas ADT

M07-ANT 2-Body-Bottom-11B-Ch 11

DUT: WiFi Photo Frame ; Type: PoMMeS

Communication System: 802.11B ; Frequency: 2462 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK

Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 53; ρ = 1000 kg/m^3

Phantom section: Flat Section ; Separation distance : 0 mm (The bottom side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV4 - SN3590 ; ConvF(7.96, 7.96, 7.96) ; Calibrated: 2009/4/28
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510 ; Calibrated: 2009/12/16
- Phantom: ELI 4.0 ; Type: QDOVA001BB ; Serial: 1043
- Measurement SW: DASY5, V5.2 Build 157 ; SEMCAD X Version 14.0 Build 57

High Channel /Area Scan (14x21x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.013 mW/g

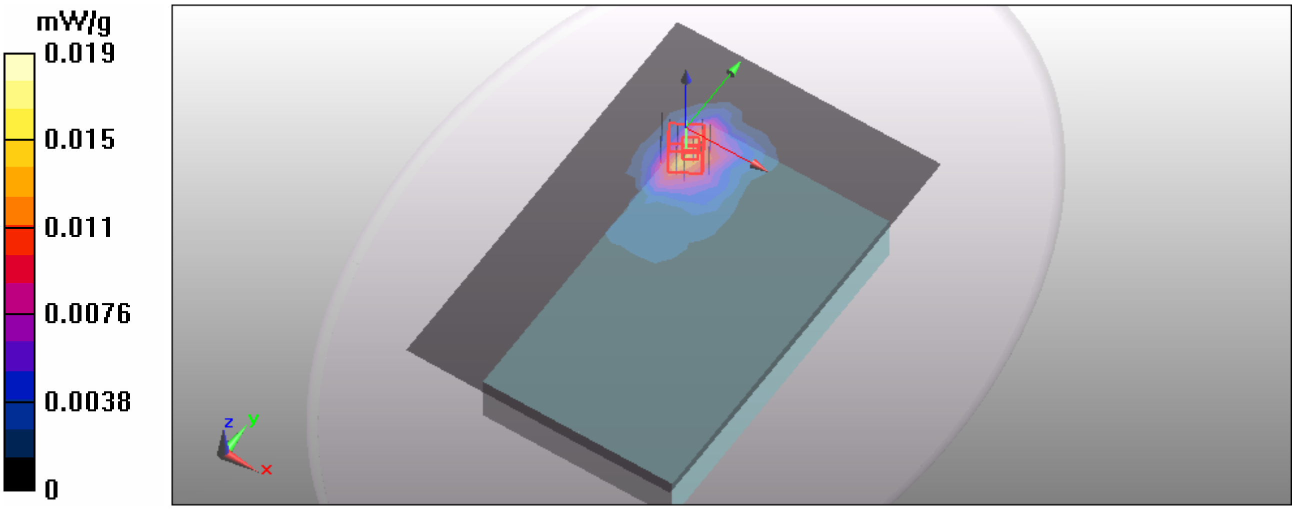
High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 0.727 V/m; Power Drift = -0.096 dB

Peak SAR (extrapolated) = 0.030 W/kg

SAR(1 g) = 0.015 mW/g; SAR(10 g) = 0.00762 mW/g

Maximum value of SAR (measured) = 0.019 mW/g



Date/Time: 2010/1/6 20:00:11

Test Laboratory: Bureau Veritas ADT

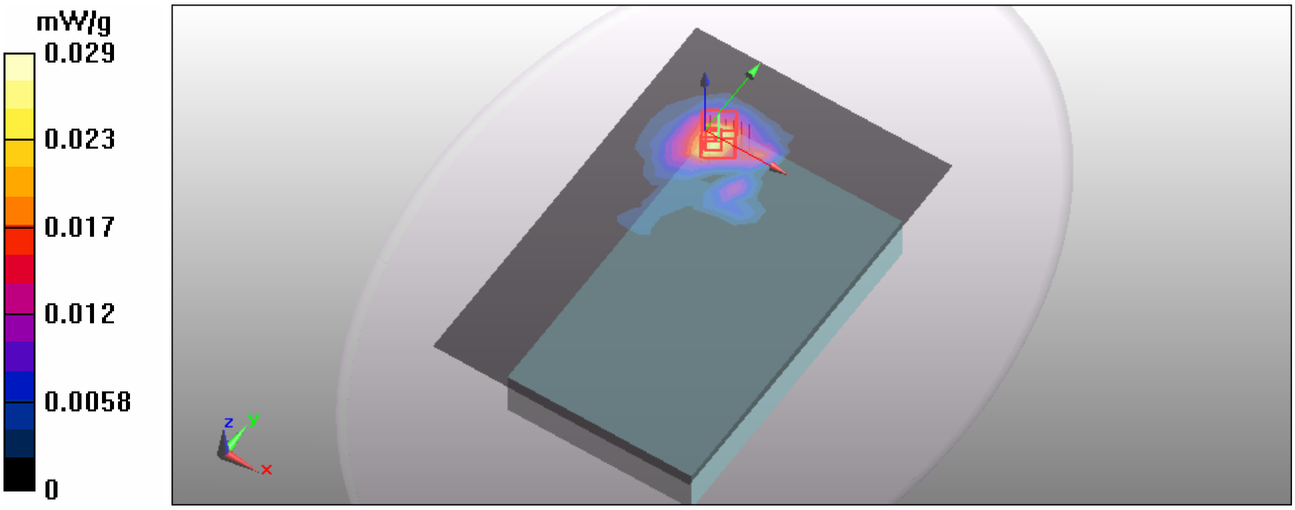
M08-ANT 2-Body-Bottom-11G-Ch 11

DUT: WiFi Photo Frame ; Type: PoMMeS
Communication System: 802.11G ; Frequency: 2462 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Separation distance : 0 mm (The bottom side of the EUT to the Phantom)

DASY5 Configuration:
- Probe: EX3DV4 - SN3590 ; ConvF(7.96, 7.96, 7.96) ; Calibrated: 2009/4/28
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510 ; Calibrated: 2009/12/16
- Phantom: ELI 4.0 ; Type: QDOVA001BB ; Serial: 1043
- Measurement SW: DASY5, V5.2 Build 157 ; SEMCAD X Version 14.0 Build 57

High Channel /Area Scan (14x21x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.026 mW/g

High Channel /Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = -0.013 dB
Peak SAR (extrapolated) = 0.043 W/kg
SAR(1 g) = 0.023 mW/g; SAR(10 g) = 0.011 mW/g
Maximum value of SAR (measured) = 0.029 mW/g



Date/Time: 2010/1/6 09:30:07

Test Laboratory: Bureau Veritas ADT

System Validation MSL2450MHz

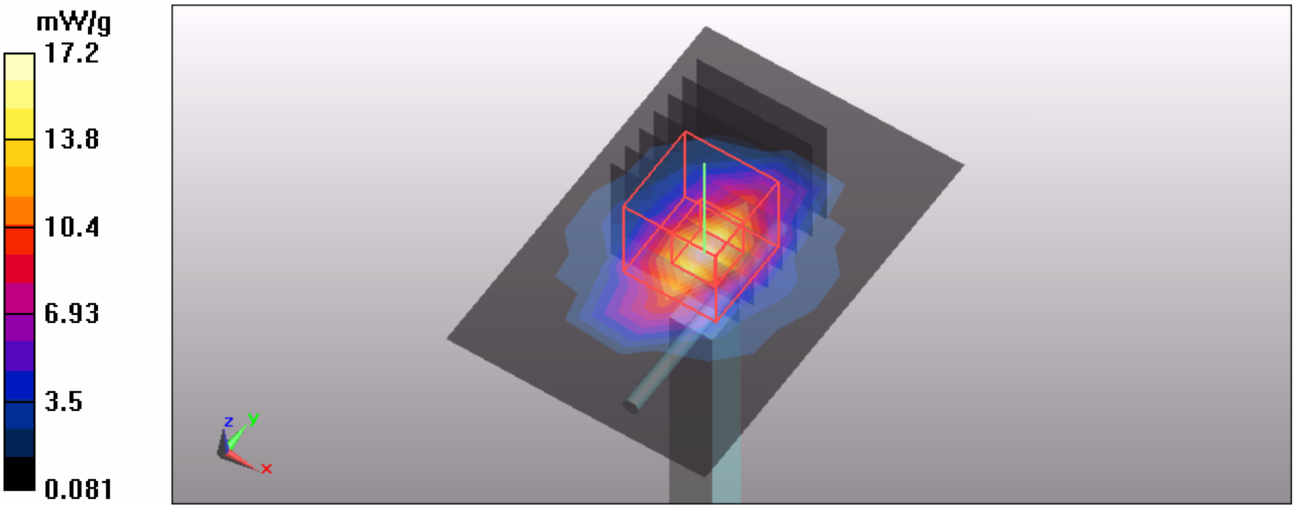
DUT: Dipole 2450 MHz ; Type: D2450V2 ; Serial: 716 ; Test Frequency: 2450 MHz

Communication System: CW ; Frequency: 2450 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL2450;Medium parameters used: f = 2450 MHz; σ = 1.97 mho/m; ε_r = 53.1; ρ = 1000 kg/m^3 ; Liquid level : 151 mm
Phantom section: Flat Section ; Separation distance : 10 mm (The feetpoint of the dipole to the Phantom)Air temp. : 23.1 degrees ; Liquid temp. : 22.7 degrees

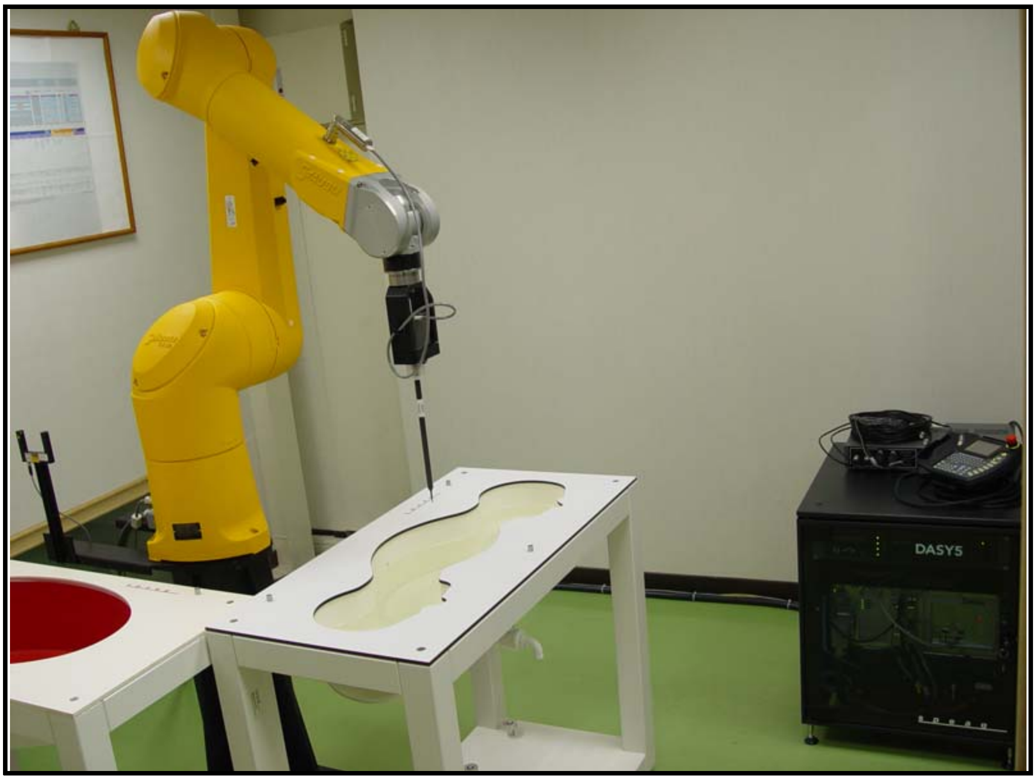
DASY5 Configuration:
- Probe: EX3DV4 - SN3590 ; ConvF(7.96, 7.96, 7.96) ; Calibrated: 2009/4/28
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510 ; Calibrated: 2009/12/16
- Phantom: ELI 4.0 ; Type: QDOVA001BB ; Serial: 1043
- Measurement SW: DASY5, V5.2 Build 157 ; SEMCAD X Version 14.0 Build 57

d=10mm, Pin=250mW/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 17.3 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.3 V/m; Power Drift = -0.079 dB
Peak SAR (extrapolated) = 26.7 W/kg
SAR(1 g) = 13 mW/g; SAR(10 g) = 5.91 mW/g
Maximum value of SAR (measured) = 17.2 mW/g



APPENDIX B: BV ADT SAR MEASUREMENT SYSTEM



APPENDIX C: PHOTOGRAPHS OF SYSTEM VALIDATION

APPENDIX D: SYSTEM CERTIFICATE & CALIBRATION

D1: PHANTOM

Schmid & Partner Engineering AG
s p e a g

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