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SAR TEST REPORT (WLAN)

REPORT NO.: SA981217L06

MODEL NO.: PB31200

RECEIVED: Dec. 17, 2009

TESTED: Dec. 24, 2009

ISSUED: Jan. 08, 2010

APPLICANT: HTC Corporation

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TABLE OF CONTENTS

1.	CERTIFICATION	3
2.	GENERAL INFORMATION	4
2.1	GENERAL DESCRIPTION OF EUT.....	4
2.2	GENERAL DESCRIPTION OF APPLIED STANDARDS.....	6
2.3	GENERAL INFORMATION OF THE SAR SYSTEM.....	6
2.4	TEST EQUIPMENT	10
2.5	GENERAL DESCRIPTION OF THE SPATIAL PEAK SAR EVALUATION	11
3.	DESCRIPTION OF SUPPORT UNITS.....	14
4.	DESCRIPTION OF TEST MODES AND CONFIGURATIONS.....	15
4.1.	DESCRIPTION OF TEST CONDITION.....	15
4.2.	DESCRIPTION OF TEST MODE.....	15
4.3.	SUMMARY OF TEST RESULTS.....	17
5.	TEST RESULTS	18
5.1	TEST PROCEDURES.....	18
5.2	SAR LIMITS	19
5.3	MEASURED SAR RESULTS	20
5.4	RECIPES FOR TISSUE SIMULATING LIQUIDS	21
6.	SYSTEM VALIDATION.....	24
6.1	TEST PROCEDURE	24
6.2	VALIDATION RESULTS	25
6.3	SYSTEM VALIDATION UNCERTAINTIES.....	26
7.	MEASUREMENT SAR PROCEDURE UNCERTAINTIES	27
7.1.	PROBE CALIBRATION UNCERTAINTY	27
7.2.	ISOTROPY UNCERTAINTY	28
7.3.	BOUNDARY EFFECT UNCERTAINTY	28
7.4.	PROBE LINEARITY UNCERTAINTY	29
7.5.	READOUT ELECTRONICS UNCERTAINTY.....	29
7.6.	RESPONSE TIME UNCERTAINTY	29
7.7.	PROBE POSITIONER MECHANICAL TOLERANCE	30
7.8.	PROBE POSITIONING	30
7.9.	PHANTOM UNCERTAINTY.....	31
7.10.	DASY4 UNCERTAINTY BUDGET	32
8.	INFORMATION ON THE TESTING LABORATORIES.....	33
	APPENDIX A: TEST CONFIGURATIONS AND TEST DATA	
	APPENDIX B: ADT SAR MEASUREMENT SYSTEM	
	APPENDIX C: PHOTOGRAPHS OF SYSTEM VALIDATION	
	APPENDIX D: SYSTEM CERTIFICATE & CALIBRATION	



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1. CERTIFICATION

PRODUCT: Smartphone
MODEL NO.: PB31200
BRAND: HTC
APPLICANT: HTC Corporation
TESTED: Dec. 24, 2009
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: PB31200) 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.

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2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

EUT	Smartphone
MODEL NO.	PB31200
FCC ID	NM8PB31200
POWER SUPPLY	3.7Vdc from rechargeable lithium battery 5.0Vdc from power adapter 5.0Vdc from host equipment
MODULATION TYPE	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
RADIO TECHNOLOGY	DSSS, OFDM
TRANSFER RATE	802.11b:11/5.5/2/1Mbps 802.11g: 54/48/36/24/18/12/9/6Mbps
OPERATING FREQUENCY	2412MHz ~ 2462MHz
NUMBER OF CHANNEL	11
CHANNEL FREQUENCIES UNDER TEST AND ITS CONDUCTED OUTPUT POWER	802.11b: 19.4dBm (87.1mW) / Ch6: 2437MHz 802.11g: 21.3dBm (134.9mW) / Ch6: 2437MHz
MAXIMUM SAR (1g)	Head: 0.407W/kg Body: 0.069W/kg
ANTENNA TYPE	PIFA antenna
ANTENNA GAIN	-4dBi
DATA CABLE	Refer to NOTE
I/O PORTS	Refer to user's manual
ACCESSORY DEVICES	Refer to NOTE

NOTE:

1. The EUT is a Smartphone. The functions of EUT listed as below:

	REFERENCE REPORT
WLAN 802.11b/g	SA981217L06
CDMA 850 + CDMA 1900	SA981217L06-1
BLUETOOTH	SA981217L06-2



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2. The EUT has following accessories.

NO.	PRODUCT	BRAND	MODEL	DESCRIPTION	REMARK
1	Power Adapter	Delta	TC P300	I/P: 100-240Vac, 50-60Hz, 0.2A O/P: 5Vdc, 1A	-
2			TC U250		-
3		Emerson	TC U250		-
4	USB cable	MEC	DC M410	1.4m shielded cable without core (For data transmission & charging use)	For TC P300 only
5		Foxlink			For TC U250 only
6	Battery	HT ENERGY	BB96100	Rating: 3.7Vdc, 1300mAh	See NOTE*
7			BTR6300B		
8		Formosa	BB96100		
9			BTR6300B		

NOTE*: Two models of battery are electrically identical, different model names are for marketing purpose. Therefore, we pre-tested two manufacturers and HT ENERGY battery was found to be the worst case for final test.

3. MEID code: A1000007EE

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 INFORMATION OF THE SAR SYSTEM

DASY4 (**Software 4.7 Build 80**) consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY4 software defined. The DASY4 software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC.



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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 > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
DIRECTIVITY	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
DYNAMIC RANGE	10 μ W/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μ W/g)
DIMENSIONS	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
APPLICATION	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

NOTE

1. The Probe parameters have been calibrated by the SPEAG. Please reference "APPENDIX D" for the Calibration Certification Report.
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 ± 0.2 mm
FILLING VOLUME	Approx. 25liters
DIMENSIONS	Height: 810mm; Length: 1000mm; Width: 500mm

SYSTEM VALIDATION KITS:

CONSTRUCTION	Symmetrical dipole with 1/4 balun enables measurement of feedpoint impedance with NWA matched for use near flat phantoms filled with brain simulating solutions. Includes distance holder and tripod adaptor
CALIBRATION	Calibrated SAR value for specified position and input power at the flat phantom in brain simulating solutions
FREQUENCY	2450MHz, 5800MHz
RETURN LOSS	> 20dB at specified validation position
POWER CAPABILITY	> 100W (f < 1GHz); > 40W (f > 1GHz)
OPTIONS	Dipoles for other frequencies or solutions and other calibration conditions upon request

DEVICE HOLDER FOR SAM TWIN PHANTOM

CONSTRUCTION	The device holder for the mobile phone device is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centers for both scales 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 $\epsilon = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered. The device holder for the portable device makes up of the polyethylene foam. The dielectric parameters of material close to the dielectric parameters of the air.
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DATA ACQUISITION ELECTRONICS

CONSTRUCTION

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



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2.4 TEST EQUIPMENT

FOR SAR MEASUREMENT

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	SAM Phantom	S & P	QD000 P40 CA	TP-1150	NA	NA
2	Signal Generator	Agilent	E8257C	MY43320668	Dec. 31, 2008	Dec. 30, 2009
3	E-Field Probe	S & P	EX3DV3	3504	Jan. 21, 2009	Jan. 20, 2010
4	DAE	S & P	DAE3	579	Jul. 17, 2009	Jul. 16, 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	E8358A	US41480538	Dec. 03, 2009	Dec. 02, 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 $\pm 2.5\%$ and $\pm 5\%$ for measured permittivity and conductivity, respectively. However, the tolerances for the conductivity is smaller for material with large loss tangents, i.e., less than $\pm 2.5\%$ (k=1). It can be substantially smaller if more accurate methods are applied

2.5 GENERAL DESCRIPTION OF THE SPATIAL PEAK SAR EVALUATION

The DASY4 post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the micro-volt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Norm _i , a _{i0} , a _{i1} , a _{i2}
	- Conversion factor	ConvF _i
	- Diode compression point	dcp _i
Device parameters:	- Frequency	F
	- Crest factor	Cf
Media parameters:	- Conductivity	σ
	- Density	ρ

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

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

V _i	=compensated signal of channel i	(i = x, y, z)
U _i	=input signal of channel i	(i = x, y, z)
Cf	=crest factor of exciting field	(DASY parameter)
dcp _i	=diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

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

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

- V_i = compensated signal of channel I (i = x, y, z)
 Norm_i = sensor sensitivity of channel i $\mu\text{V}/(\text{V/m})^2$ for 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 then 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	TISSUE TYPE / FREQ.	TEST MODE	TEMPERATURE (°C)		HUMIDITY (%RH)	TESTED BY
			AIMBENT	LIQUID		
Dec. 24, 2009	HSL2450	1-4, 7-10, 13	22.3	21.0	55	Sam Onn
Dec. 24, 2009	MSL2450	5-6, 11-12	22.5	21.3	55	Sam Onn

4.2. DESCRIPTION OF TEST MODE

Test Tool:

Test tool is **Remote 4325/29 controller socket 1.06m** 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 $\frac{1}{4}$ 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 1.6W/kg, where the transmission band corresponding to all channels is \leq 100 MHz, testing for the other channels is not required.”

According to test data from the following test mode table, SAR value of highest output power channel is less than 0.8W/kg and peak SAR is less than 1.6W/kg. Therefore, testing for other channels is not required.

**TEST MODE TABLE**

TEST MODE	COMMUNICATION MODE	MODULATION TYPE	ASSESSMENT POSITION	TESTED CHANNEL	REMARK
1	802.11b	DBPSK	Right Head / Cheek	6	HT ENERGY Battery
2	802.11b	DBPSK	Right Head / Tilt	6	HT ENERGY Battery
3	802.11b	DBPSK	Left Head / Cheek	6	HT ENERGY Battery
4	802.11b	DBPSK	Left Head / Tilt	6	HT ENERGY Battery
5	802.11b	DBPSK	Body / Back 15mm-separation	6	HT ENERGY Battery
6	802.11b	DBPSK	Body / Front 15mm-separation	6	HT ENERGY Battery
7	802.11g	BPSK	Right Head / Cheek	6	HT ENERGY Battery
8	802.11g	BPSK	Right Head / Tilt	6	HT ENERGY Battery
9	802.11g	BPSK	Left Head / Cheek	6	HT ENERGY Battery
10	802.11g	BPSK	Left Head / Tilt	6	HT ENERGY Battery
11	802.11g	BPSK	Body / Back 15mm-separation	6	HT ENERGY Battery
12	802.11g	BPSK	Body / Front 15mm-separation	6	HT ENERGY Battery
13	802.11b	DBPSK	Right Head / Cheek	6	Formosa Battery



4.3. SUMMARY OF TEST RESULTS

PART OF ASSESSMENT		HEAD POSITION				BODY POSITION	
COMMUNICATION MODE		802.11b					
TEST MODE		1	2	3	4	5	6
		MEASURED VALUE OF 1g SAR (W/kg)					
		RIGHT		LEFT		BACK	FRONT
Chan.	Freq. (MHz)	CHEEK	TILT	CHEEK	TILT	15mm	15mm
6	2437 (Mid.)	0.407	0.301	0.268	0.244	0.069	0.033

PART OF ASSESSMENT		HEAD POSITION				BODY POSITION	
COMMUNICATION MODE		802.11g					
TEST MODE		7	8	9	10	11	12
		MEASURED VALUE OF 1g SAR (W/kg)					
		RIGHT		LEFT		BACK	FRONT
Chan.	Freq. (MHz)	CHEEK	TILT	CHEEK	TILT	15mm	15mm
6	2437 (Mid.)	0.160	0.123	0.102	0.097	0.029	0.014

PART OF ASSESSMENT		HEAD POSITION
COMMUNICATION MODE		802.11b
TEST MODE		13
		MEASURED VALUE OF 1g SAR (W/kg)
		RIGHT
Chan.	Freq. (MHz)	CHEEK
6	2437 (Mid.)	0.398

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 ± 0.5 mm 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 $\pm 5\%$.

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.



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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	6	2437	802.11b	Right Head / Cheek	19.4	0.090	0.407
2	6	2437	802.11b	Right Head / Tilt	19.4	-0.039	0.301
3	6	2437	802.11b	Left Head / Cheek	19.4	-0.178	0.268
4	6	2437	802.11b	Left Head / Tilt	19.4	-0.055	0.244
5	6	2437	802.11b	Body / Back	19.4	0.086	0.069
6	6	2437	802.11b	Body / Front	19.4	0.051	0.033
7	6	2437	802.11g	Right Head / Cheek	21.3	0.045	0.160
8	6	2437	802.11g	Right Head / Tilt	21.3	-0.035	0.123
9	6	2437	802.11g	Left Head / Cheek	21.3	0.065	0.102
10	6	2437	802.11g	Left Head / Tilt	21.3	0.072	0.097
11	6	2437	802.11g	Body / Back	21.3	0.062	0.029
12	6	2437	802.11g	Body / Front	21.3	0.032	0.014
13	6	2437	802.11b	Right Head / Cheek	19.4	0.026	0.398

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 liters of tissue simulation liquid.

The following ingredients are used :

- **WATER-** Deionized water (pure H₂O), 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°C	f= 2450MHz $\epsilon = 39.2 \pm 5\%$ $\sigma = 1.80 \pm 5\%$ S/m	f= 2450MHz $\epsilon = 52.7 \pm 5\%$ $\sigma = 1.95 \pm 5\%$ S/m

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

1. Turn Network Analyzer on and allow at least 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 ($\pm 1^\circ$).
4. Set water temperature in Agilent-Software (Calibration Setup).
5. Perform calibration.
6. Validate calibration with dielectric material of known properties (e.g. polished ceramic slab with $>8\text{mm}$ thickness $\epsilon' = 10.0$, $\epsilon'' = 0.0$). If measured parameters do not fit within tolerance, repeat calibration (± 0.2 for ϵ' : ± 0.1 for ϵ'').
7. Conductivity can be calculated from ϵ'' by $\sigma = \omega \epsilon_0 \epsilon'' = \epsilon'' f [\text{GHz}] / 18$.
8. Measure liquid shortly after calibration. Repeat calibration every hour.
9. Stir the liquid to be measured. Take a sample ($\sim 50\text{ml}$) 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 DASY4 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).



A D T

FOR 2.4GHz BAND SIMULATING LIQUID

LIQUID TYPE		HSL-2450			
SIMULATING LIQUID TEMP.		21.0			
TEST DATE		Dec. 24, 2009			
TESTED BY		Sam Onn			
FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	ERROR PERCENTAGE (%)	LIMIT(%)
2437.0	Permittivity (ϵ)	39.20	40.40	3.06	±5
2450.0		39.20	40.30	2.81	
2437.0	Conductivity (σ) S/m	1.79	1.77	-1.12	
2450.0		1.80	1.79	-0.56	

LIQUID TYPE		MSL-2450			
SIMULATING LIQUID TEMP.		21.3			
TEST DATE		Dec. 24, 2009			
TESTED BY		Sam Onn			
FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	ERROR PERCENTAGE (%)	LIMIT(%)
2437.0	Permittivity (ϵ)	52.70	54.60	3.61	±5
2450.0		52.70	54.50	3.42	
2437.0	Conductivity (σ) S/m	1.94	1.97	1.55	
2450.0		1.95	1.99	2.05	



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 ± 0.02 dB.
2. The "Surface Check" job tests the optical surface detection system of the DASY system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1 mm). In that case it is better to abort the system performance check and stir the liquid.

3. The "Area Scan" job measures the SAR above the dipole on a plane parallel to the surface. It is used to locate the approximate location of the peak SAR. The proposed scan uses large grid spacing for faster measurement; due to the symmetric field, the peak detection is reliable. If a finer graphic is desired, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result.
4. The "Zoom Scan" job measures the field in a volume around the peak SAR value assessed in the previous "Area Scan" job (for more information see the application note on SAR evaluation).

About the validation dipole positioning uncertainty, the constant and low loss dielectric spacer is used to establish the correct distance between the top surface of the dipole and the bottom surface of the phantom, the error component introduced by the uncertainty of the distance between the liquid (i.e., phantom shell) and the validation dipole in the DASy4 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
HSL2450	13.50 (1g)	12.80	-5.19	10mm	Dec. 24, 2009
MSL2450	13.30 (1g)	12.90	-3.01	10mm	Dec. 24, 2009
TESTED BY	Sam Onn				

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)	2.88	Normal	1	0.64	0.43	1.84	1.24	∞
Liquid Permittivity (target)	5.00	Rectangular	$\sqrt{3}$	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	4.14	Normal	1	0.6	0.49	2.48	2.03	∞
Combined Standard Uncertainty						9.98	9.64	
Coverage Factor for 95%						Kp=2		
Expanded Uncertainty (K=2)						19.97	19.27	

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 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 or a more accurate method.
- 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 $\pm 0.20\text{dB}$, while the maximum deviation of hemispherical isotropy is $\pm 0.40\text{dB}$, corresponding to $\pm 4.7\%$ and $\pm 9.6\%$, respectively. A weighting factor of c_p 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

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

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

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., $\delta = 13.95\text{mm}$ 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 $SAR_{ref.DASY4}$. DASY4 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 $< \pm 0.8\%$.

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 $< \pm 0.20\text{dB}$ ($< \pm 4.7\%$).

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 $\pm 1.0\%$.

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 T_m is 500 ms, i.e., the time between measurement samples, and τ the time constant. The response time τ of SPEAG's probes is $< 5\text{ms}$. In the current implementation, DAS4 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. ROBE 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 center 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 DASY4 systems is $\pm 25\mu\text{m}$. The absolute accuracy for short distance movements is better than $\pm 0.1\text{mm}$, 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 DASY4 system.

7.9. PHANTOM UNCERTAINTY

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

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

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



7.10. DASY4 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	√3	0.7	0.7	1.90	1.90	∞
Hemispherical Isotropy	9.60	Rectangular	√3	0.7	0.7	3.88	3.88	∞
Boundary effects	1.00	Rectangular	√3	1	1	0.58	0.58	∞
Linearity	4.70	Rectangular	√3	1	1	2.71	2.71	∞
System Detection Limits	1.00	Rectangular	√3	1	1	0.58	0.58	∞
Readout Electronics	0.30	Normal	1	1	1	0.30	0.30	∞
Response Time	0.80	Rectangular	√3	1	1	0.46	0.46	∞
Integration Time	2.60	Rectangular	√3	1	1	1.50	1.50	∞
RF Ambient Noise	3.00	Rectangular	√3	1	1	1.73	1.73	∞
RF Ambient Reflections	3.00	Rectangular	√3	1	1	1.73	1.73	∞
Probe Positioner	0.40	Rectangular	√3	1	1	0.23	0.23	∞
Probe Positioning	2.90	Rectangular	√3	1	1	1.67	1.67	∞
Max. SAR Eval.	1.00	Rectangular	√3	1	1	0.58	0.58	∞
Test Sample Related								
Device Positioning	0.69	Normal	1	1	1	0.69	0.69	10
Device Holder	3.60	Normal	1	1	1	3.60	3.60	5
Power Drift	5.00	Rectangular	√3	1	1	2.89	2.89	∞
Phantom and Tissue parameters								
Phantom Uncertainty	4.00	Rectangular	√3	1	1	2.31	2.31	∞
Liquid Conductivity (target)	5.00	Rectangular	√3	0.64	0.43	1.85	1.24	∞
Liquid Conductivity (measurement)	2.88	Normal	1	0.64	0.43	1.84	1.24	∞
Liquid Permittivity (target)	5.00	Rectangular	√3	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	4.14	Normal	1	0.6	0.49	2.48	2.03	∞
Combined Standard Uncertainty						10.57	10.25	
Coverage Factor for 95%						Kp=2		
Expanded Uncertainty (K=2)						21.14	20.49	

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---

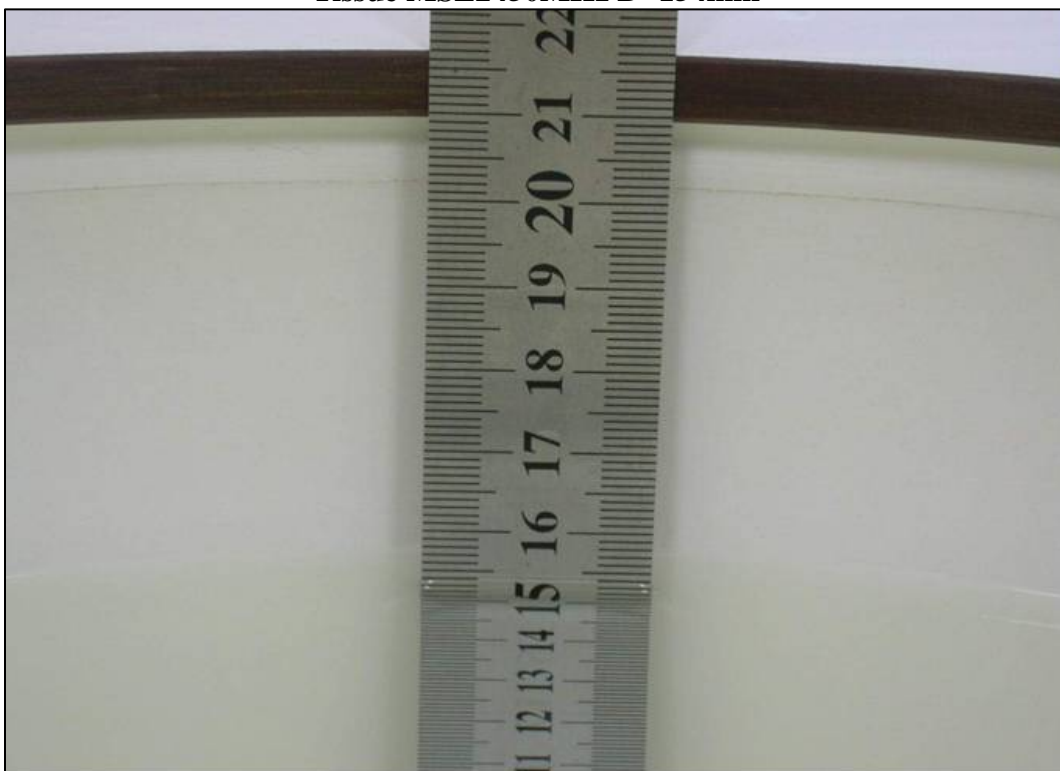
APPENDIX A: TEST DATA

Liquid Level Photo

Tissue HSL2450MHz D=151mm



Tissue MSL2450MHz D=154mm



Test Laboratory: Bureau Veritas ADT

M01-Right Head-Cheek-11b-Ch6

DUT: Smartphone ; Type: PB31200

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

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

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.67, 7.67, 7.67) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

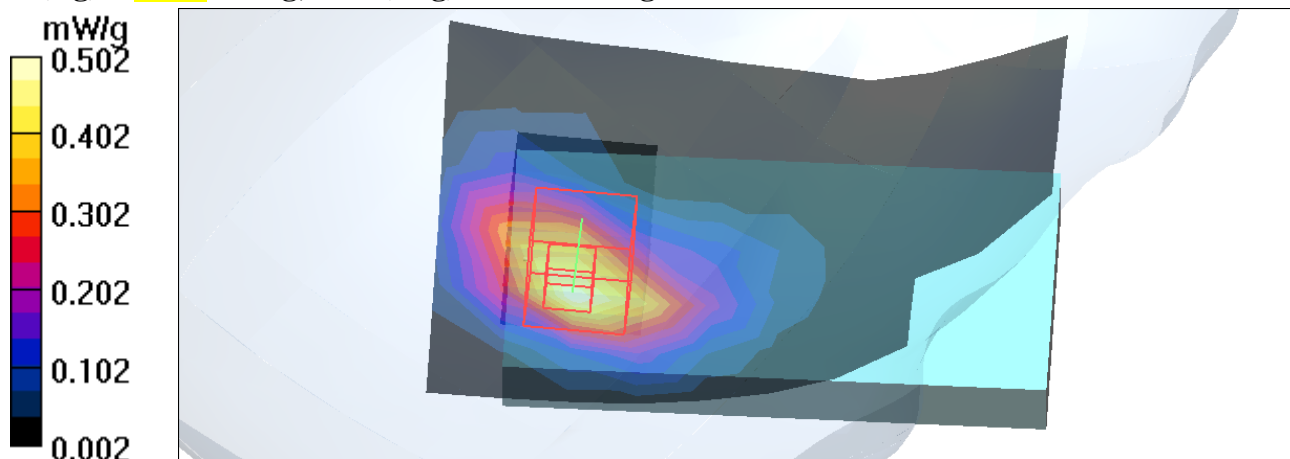
Touch position - Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.502 mW/g

Touch position - Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
dx=5mm, dy=5mm, dz=5mm

Reference Value = 16.6 V/m; Power Drift = 0.090 dB

Peak SAR (extrapolated) = 0.765 W/kg

SAR(1 g) = **0.407** mW/g; SAR(10 g) = 0.207 mW/g



Test Laboratory: Bureau Veritas ADT

M02-Right Head-Tilt-11b-Ch6**DUT: Smartphone ; Type: PB31200**

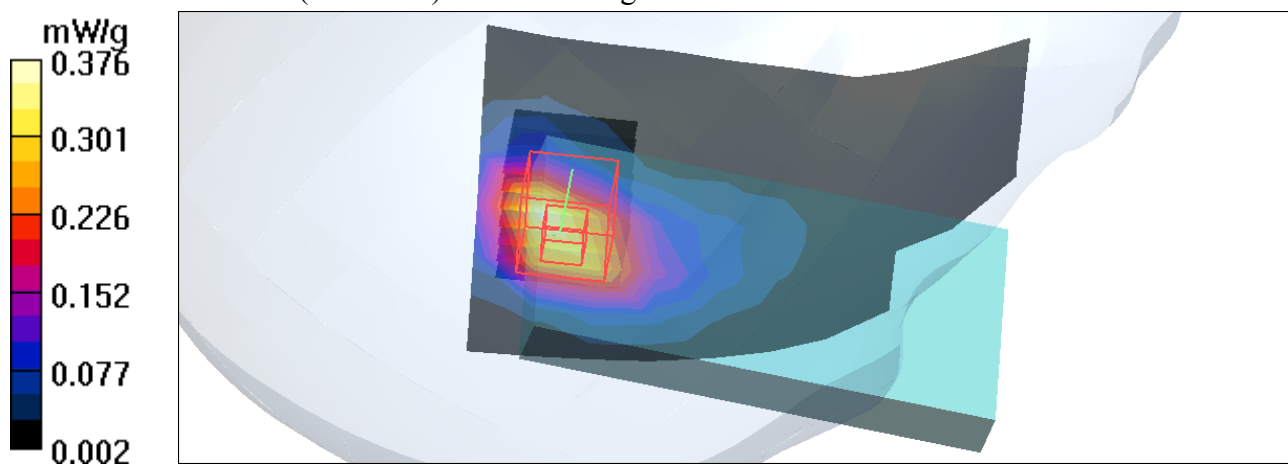
Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

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

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.67, 7.67, 7.67) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Tilt position - Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.365 mW/g**Tilt position - Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:
dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.2 V/m; Power Drift = -0.039 dB
Peak SAR (extrapolated) = 0.601 W/kg
SAR(1 g) = 0.301 mW/g; SAR(10 g) = 0.153 mW/g
Maximum value of SAR (measured) = 0.376 mW/g

Test Laboratory: Bureau Veritas ADT

M03-Left Head-Cheek-11b-Ch6**DUT: Smartphone ; Type: PB31200**

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

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

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.67, 7.67, 7.67) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

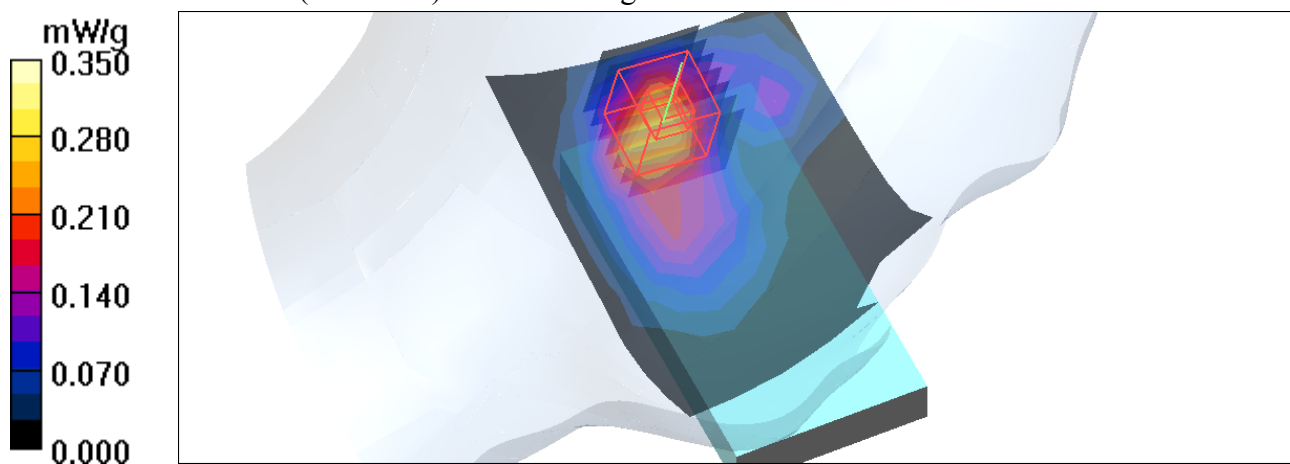
Touch position - Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.295 mW/g**Touch position - Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:
dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.0 V/m; Power Drift = -0.178 dB

Peak SAR (extrapolated) = 0.578 W/kg

SAR(1 g) = **0.268 mW/g**; SAR(10 g) = 0.137 mW/g

Maximum value of SAR (measured) = 0.350 mW/g



Test Laboratory: Bureau Veritas ADT

M04-Left Head-Tilt-11b-Ch6

DUT: Smartphone ; Type: PB31200

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

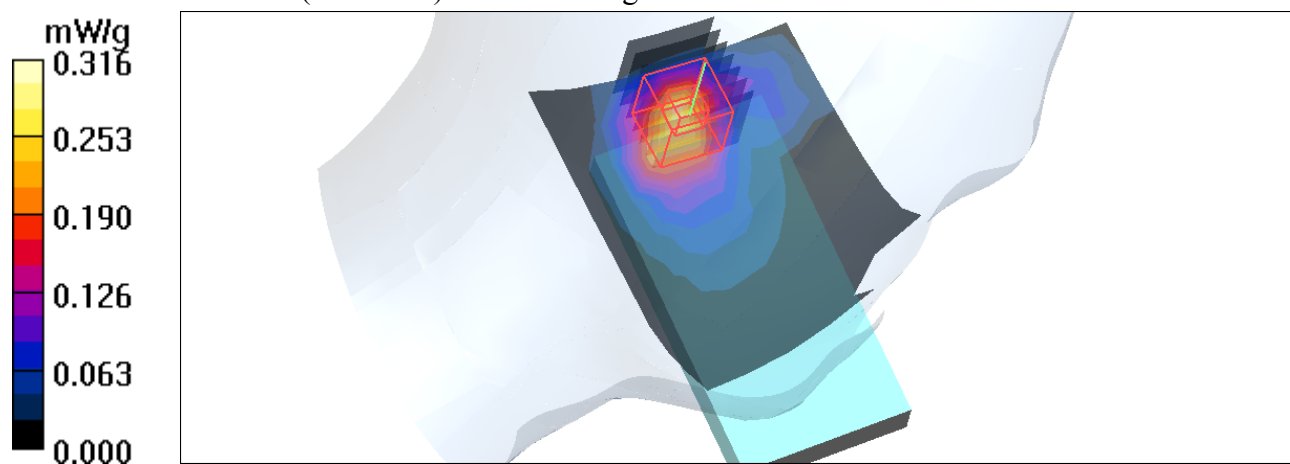
Phantom section: Left Section ; DUT test position : Tilt ; Modulation type: DBPSK

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.67, 7.67, 7.67) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Tilt position - Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.294 mW/g

Tilt position - Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.1 V/m; Power Drift = -0.055 dB
Peak SAR (extrapolated) = 0.525 W/kg
SAR(1 g) = 0.244 mW/g; SAR(10 g) = 0.120 mW/g
Maximum value of SAR (measured) = 0.316 mW/g



Test Laboratory: Bureau Veritas ADT

M05-Body-11b-Ch6**DUT: Smartphone ; Type: PB31200**

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: MSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.97$ mho/m; $\epsilon_r = 54.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; DUT test position : Body ; Modulation Type: DBPSK

Separation Distance : 15 mm (The back side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.53, 7.53, 7.53) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12 ; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80 ; Postprocessing SW: SEMCAD, V1.8 Build 186

Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.070 mW/g

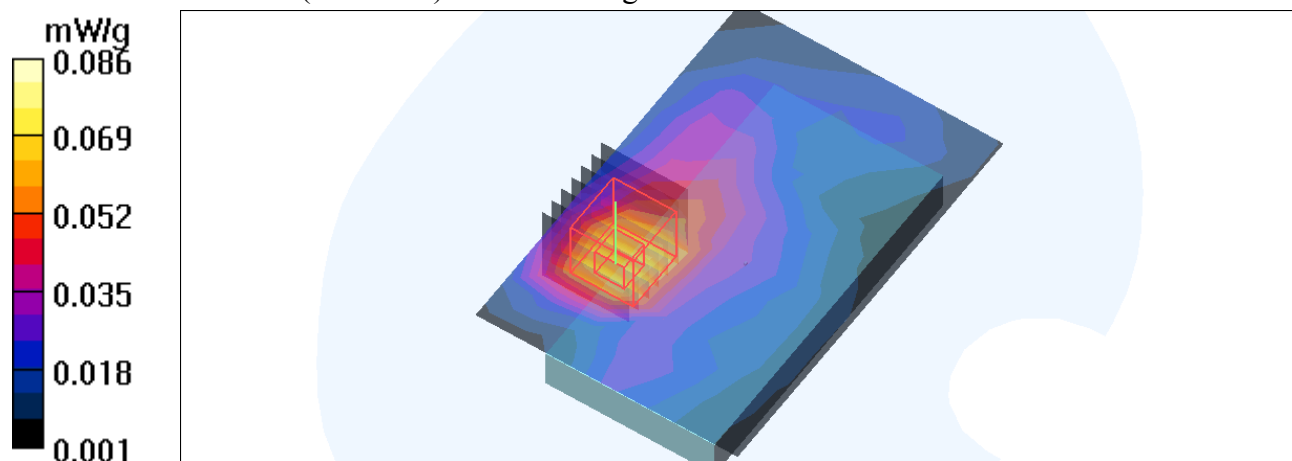
Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.20 V/m; Power Drift = 0.086 dB

Peak SAR (extrapolated) = 0.133 W/kg

SAR(1 g) = 0.069 mW/g; SAR(10 g) = 0.037 mW/g

Maximum value of SAR (measured) = 0.086 mW/g



Test Laboratory: Bureau Veritas ADT

M06-Body-11b-Ch6 / Keypad Up

DUT: Smartphone ; Type: PB31200

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: MSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.97$ mho/m; $\epsilon_r = 54.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; DUT test position : Body ; Modulation Type: DBPSK

Separation Distance : 15 mm (The front side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.53, 7.53, 7.53) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12 ; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80 ; Postprocessing SW: SEMCAD, V1.8 Build 186

Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.038 mW/g

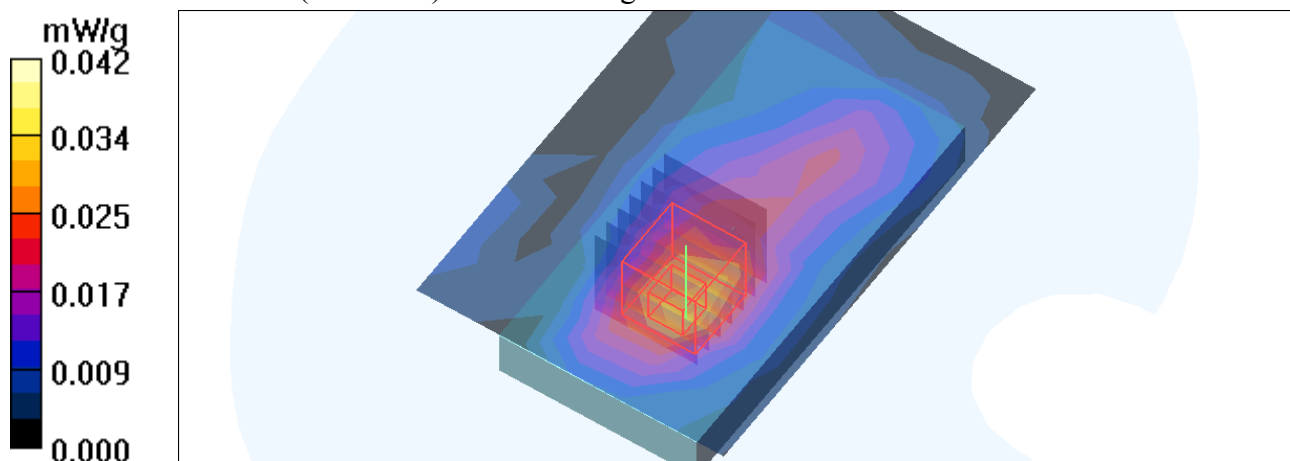
Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.40 V/m; Power Drift = 0.051 dB

Peak SAR (extrapolated) = 0.062 W/kg

SAR(1 g) = 0.033 mW/g; SAR(10 g) = 0.018 mW/g

Maximum value of SAR (measured) = 0.042 mW/g



Test Laboratory: Bureau Veritas ADT

M07-Right Head-Cheek-11g-Ch6

DUT: Smartphone ; Type: PB31200

Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

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

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.67, 7.67, 7.67) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch position - Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.205 mW/g

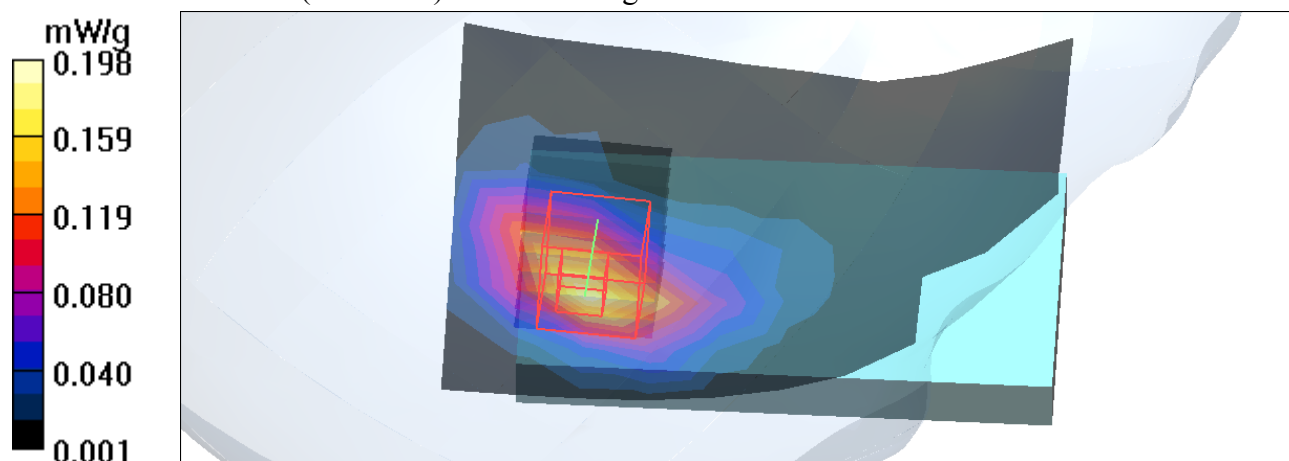
Touch position - Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.6 V/m; Power Drift = 0.045 dB

Peak SAR (extrapolated) = 0.304 W/kg

SAR(1 g) = **0.160 mW/g**; SAR(10 g) = 0.082 mW/g

Maximum value of SAR (measured) = 0.198 mW/g



Test Laboratory: Bureau Veritas ADT

M08-Right Head-Tilt-11g-Ch6

DUT: Smartphone ; Type: PB31200

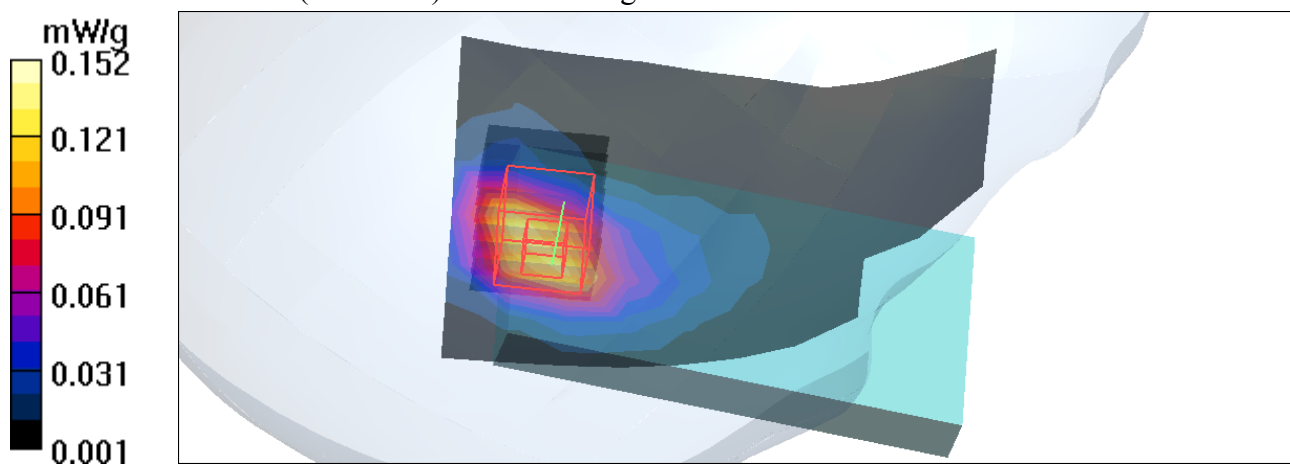
Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³
Phantom section: Right Section ; DUT test position : Tilt ; Modulation type: BPSK

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.67, 7.67, 7.67) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Tilt position - Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.132 mW/g

Tilt position - Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.87 V/m; Power Drift = -0.035 dB
Peak SAR (extrapolated) = 0.237 W/kg
SAR(1 g) = 0.123 mW/g; SAR(10 g) = 0.062 mW/g
Maximum value of SAR (measured) = 0.152 mW/g



Test Laboratory: Bureau Veritas ADT

M09-Left Head-Cheek-11g-Ch6**DUT: Smartphone ; Type: PB31200**

Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

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

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.67, 7.67, 7.67) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

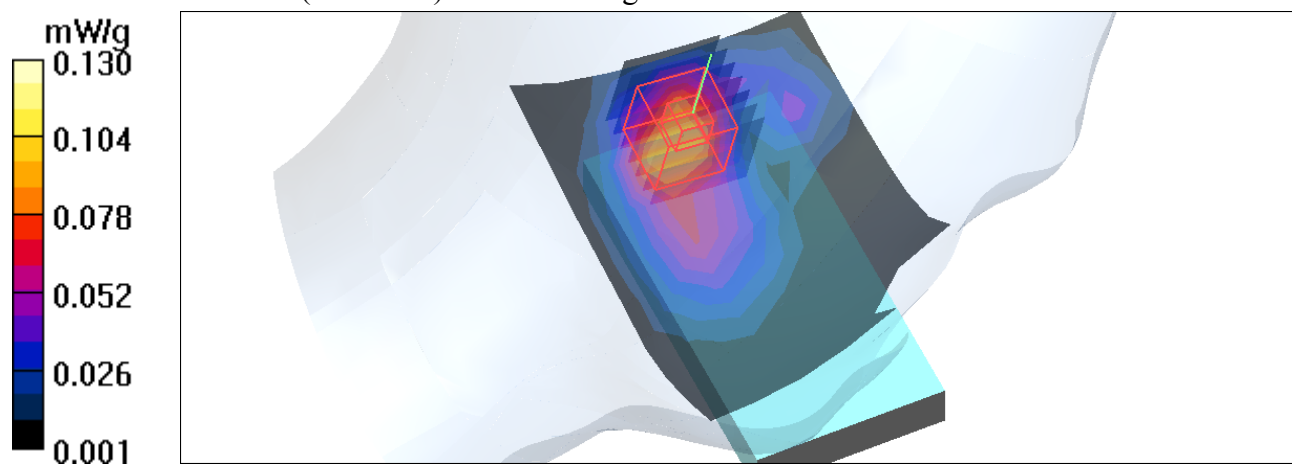
Touch position - Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.110 mW/g**Touch position - Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:
dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.97 V/m; Power Drift = 0.065 dB

Peak SAR (extrapolated) = 0.215 W/kg

SAR(1 g) = 0.102 mW/g; SAR(10 g) = 0.053 mW/g

Maximum value of SAR (measured) = 0.130 mW/g



Test Laboratory: Bureau Veritas ADT

M10-Left Head-Tilt-11g-Ch6

DUT: Smartphone ; Type: PB31200

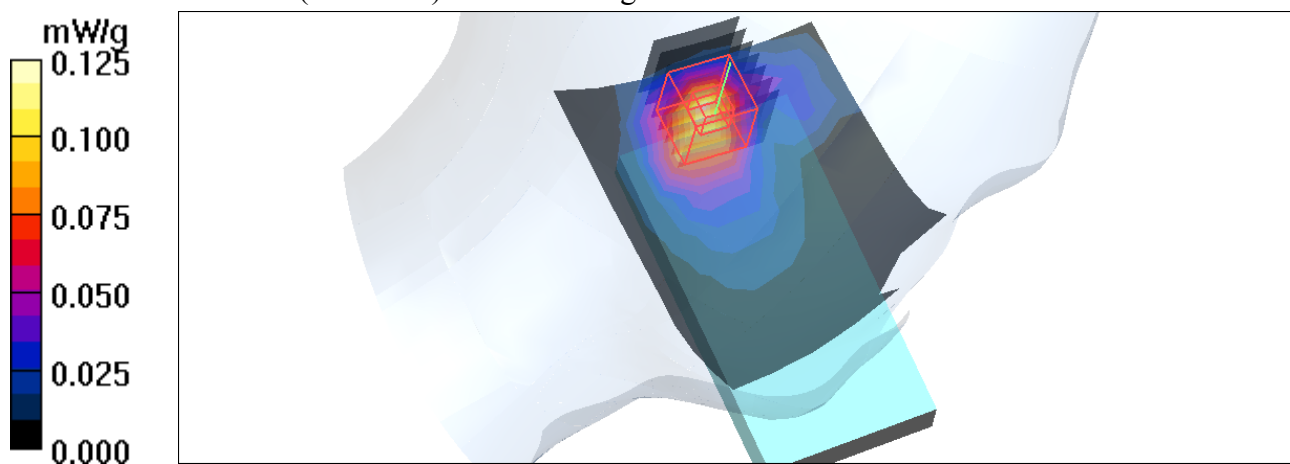
Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³
Phantom section: Left Section ; DUT test position : Tilt ; Modulation type: BPSK

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.67, 7.67, 7.67) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Tilt position - Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.120 mW/g

Tilt position - Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.26 V/m; Power Drift = 0.072 dB
Peak SAR (extrapolated) = 0.211 W/kg
SAR(1 g) = **0.097 mW/g**; SAR(10 g) = 0.048 mW/g
Maximum value of SAR (measured) = 0.125 mW/g



Test Laboratory: Bureau Veritas ADT

M11-Body-11g-Ch6

DUT: Smartphone ; Type: PB31200

Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: MSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.97$ mho/m; $\epsilon_r = 54.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; DUT test position : Body ; Modulation Type: BPSK

Separation Distance : 15 mm (The back side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.53, 7.53, 7.53) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12 ; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80 ; Postprocessing SW: SEMCAD, V1.8 Build 186

Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.031 mW/g

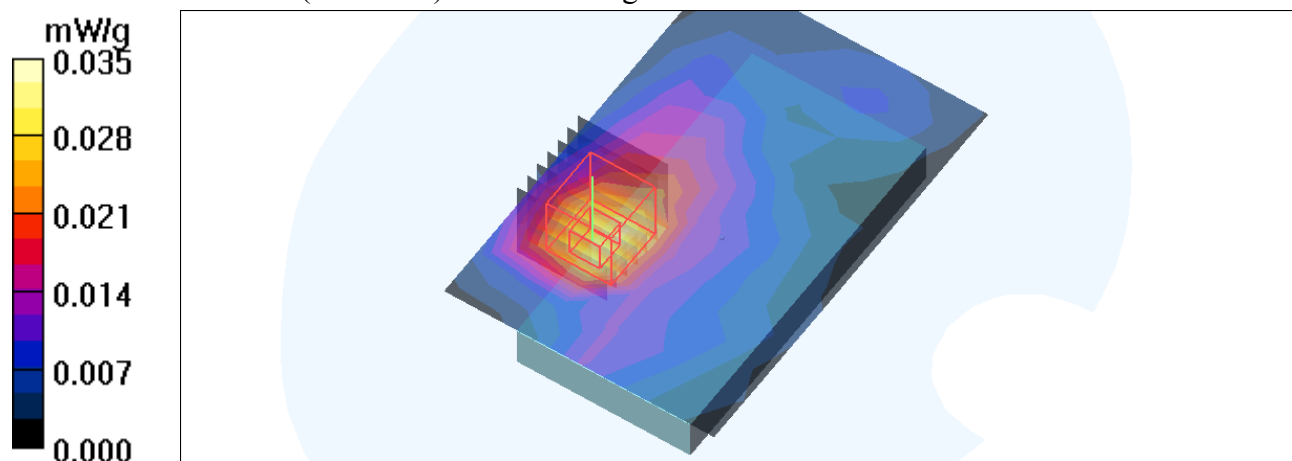
Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.94 V/m; Power Drift = 0.062 dB

Peak SAR (extrapolated) = 0.055 W/kg

SAR(1 g) = 0.029 mW/g; SAR(10 g) = 0.015 mW/g

Maximum value of SAR (measured) = 0.035 mW/g



Test Laboratory: Bureau Veritas ADT

M12-Body-11g-Ch6 / Keypad Up

DUT: Smartphone ; Type: PB31200

Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: MSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.97$ mho/m; $\epsilon_r = 54.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section ; DUT test position : Body ; Modulation Type: BPSK

Separation Distance : 15 mm (The front side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.53, 7.53, 7.53) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12 ; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80 ; Postprocessing SW: SEMCAD, V1.8 Build 186

Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.015 mW/g

Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.95 V/m; Power Drift = 0.032 dB

Peak SAR (extrapolated) = 0.026 W/kg

SAR(1 g) = 0.014 mW/g; SAR(10 g) = 0.00761 mW/g

Maximum value of SAR (measured) = 0.018 mW/g

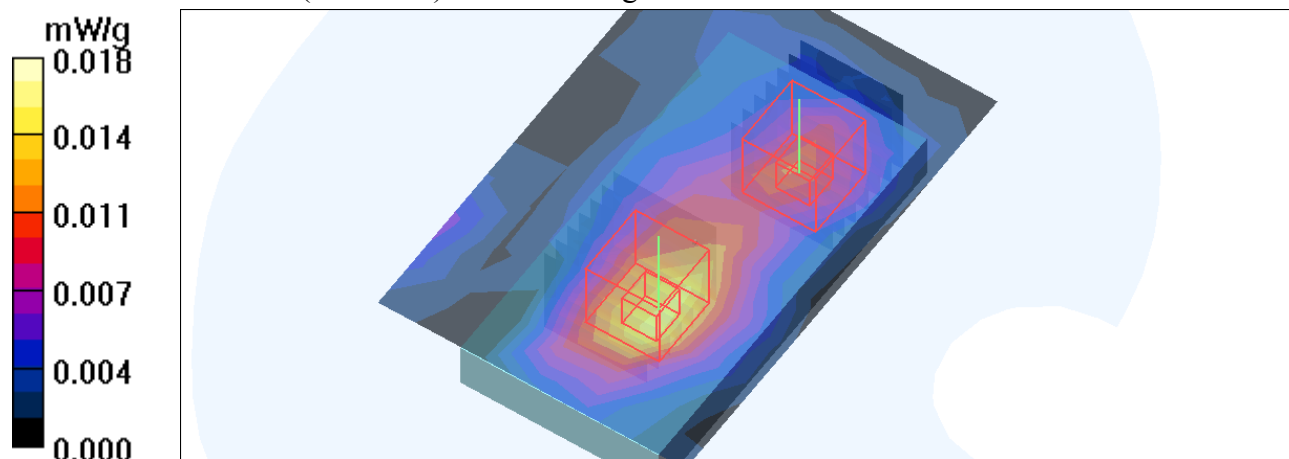
Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.95 V/m; Power Drift = 0.032 dB

Peak SAR (extrapolated) = 0.017 W/kg

SAR(1 g) = 0.00963 mW/g; SAR(10 g) = 0.00544 mW/g

Maximum value of SAR (measured) = 0.012 mW/g



Test Laboratory: Bureau Veritas ADT

M13-Right Head-Cheek-11b-Ch6 (Formosa)**DUT: Smartphone ; Type: PB31200**

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

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

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.67, 7.67, 7.67) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

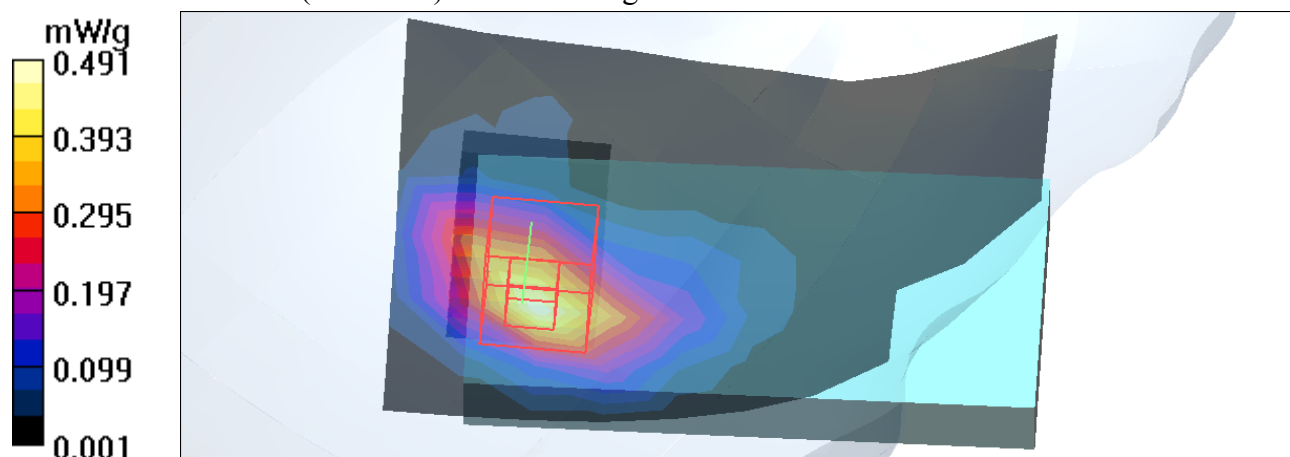
Touch position - Mid Channel 6/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.476 mW/g**Touch position - Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:
dx=5mm, dy=5mm, dz=5mm

Reference Value = 16.1 V/m; Power Drift = 0.026 dB

Peak SAR (extrapolated) = 0.765 W/kg

SAR(1 g) = **0.398 mW/g**; SAR(10 g) = 0.202 mW/g

Maximum value of SAR (measured) = 0.491 mW/g



Test Laboratory: Bureau Veritas ADT

System Validation Check-HSL 2450MHz

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: HSL2450; Medium parameters used : $f = 2450$ MHz; $\sigma = 1.79$ mho/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³ ; Liquid level : 151 mm
Phantom section: Flat Section ; Separation distance : 10 mm (The feetpoint of the dipole to the Phantom)
Air temp. : 22.3 degrees ; Liquid temp. : 21.0 degrees

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.67, 7.67, 7.67) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 16.5 mW/g

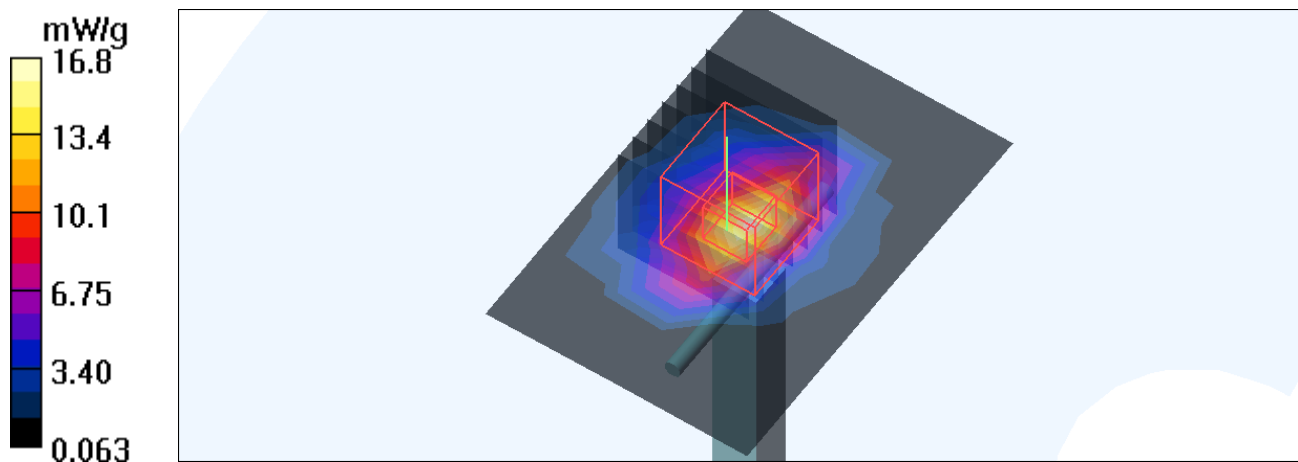
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.6 V/m; Power Drift = -0.081 dB

Peak SAR (extrapolated) = 29.3 W/kg

SAR(1 g) = 12.8 mW/g; SAR(10 g) = 5.88 mW/g

Maximum value of SAR (measured) = 16.8 mW/g



Test Laboratory: Bureau Veritas ADT

System Validation Check-MSL 2450MHz

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; $\sigma = 1.99$ mho/m; $\epsilon_r = 54.5$; $\rho = 1000$ kg/m³ ; Liquid level : 154 mm
Phantom section: Flat Section ; Separation distance : 10 mm (The feetpoint of the dipole to the Phantom)
Air temp. : 22.5 degrees ; Liquid temp. : 21.3 degrees

DASY4 Configuration:

- Probe: EX3DV3 - SN3504 ; ConvF(7.53, 7.53, 7.53) ; Calibrated: 2009/1/21
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2009/7/17
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 16.0 mW/g

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

Reference Value = 90.8 V/m; Power Drift = 0.028 dB

Peak SAR (extrapolated) = 27.7 W/kg

SAR(1 g) = 12.9 mW/g; SAR(10 g) = 5.98 mW/g

Maximum value of SAR (measured) = 16.8 mW/g

