

FCC SAR Test Report

Report No. : SA110907E02
Applicant : Qualcomm Atheros, Inc.
Address : 1700 Technology Drive, San Jose, CA 95110
Product : PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card
FCC ID : PPD-AR5B22
Brand : Atheros
Model No. : AR5B22
Standards : FCC 47 CFR Part 2 (2.1093) / IEEE C95.1:1991 / IEEE 1528:2003
FCC OET Bulletin 65 Supplement C (Edition 01-01)
KDB 248227 D01 v01r02 / KDB 447498 D01 v04
Date of Testing : Dec. 10, 2011 ~ Jan. 04, 2012

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

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Release Control Record

Issue No.	Reason for Change	Date Issued
R01	Original release	Jan. 06, 2012

1. Summary of Maximum SAR Value

Mode / Band	Test Position	SAR-1g (W/kg)
WLAN 2.4GHz	Body (2 cm Gap)	0.157
WLAN 5GHz	Body (2 cm Gap)	0.347
Bluetooth	Body (2 cm Gap)	N/A

Note:

The SAR limit (**1.6 W/kg**) for general population/uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1991.

2. Description of Equipment Under Test

DUT Type	PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card
FCC ID	PPD-AR5B22
Brand Name	Atheros
Model Name	AR5B22
Tx Frequency Bands (Unit: MHz)	WLAN : 2400 ~ 2483.5, 5150 ~ 5350, 5470 ~ 5725, 5725 ~ 5850 Bluetooth : 2400 ~ 2483.5
Uplink Modulations	802.11b : DSSS 802.11a/g/n : OFDM Bluetooth : GFSK, π /4-DQPSK, 8DPSK
Maximum AVG Conducted Power (Unit: dBm)	802.11b : 19.8 802.11g : 19.9 802.11n HT20 (2.4GHz) : 19.8 802.11n HT40 (2.4GHz) : 17.0 802.11a : 20.0 802.11n HT20 (5GHz) : 18.6 802.11n HT40 (5GHz) : 17.3 Bluetooth : 4.4
Antenna Type	Refer to Note 1
DUT Stage	Identical Prototype

Note:

- Please refer to the following table for the antenna list.

Brand	Model	Antenna Type	Connector	Antenna Gain (dBi)			
				For 2.4GHz	For 5GHz (5.15~5.35)	For 5GHz (5.47~5.725)	For 5GHz (5.725~5.850)
WNC	81.EBJ15.001	PIFA	IPEX	3.62	3.08	4.76	4.76

- The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.
- The Operation mode of this EUT is listed as below.

Operation Condition	Antenna Port	WLAN	Bluetooth
1	Port 0 & 1	802.11a/b/g/n	Off
2	Port 0 & 1	802.11a/b/g/n	On
3	Port 0	802.11a/b/g	On

Note: The WLAN and Bluetooth share the same antenna and their transmission are used by time sharing and no overlap. Therefore, there is no simultaneous transmission for WLAN and Bluetooth.

3. SAR Measurement System

3.1 Definition of Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$SAR = \frac{d}{dt} \left(\frac{dW}{dm} \right) = \frac{d}{dt} \left(\frac{dW}{\rho dv} \right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be related to the electrical field in the tissue by

$$SAR = \frac{\sigma |E|^2}{\rho}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

3.2 SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY4/5 software defined. The DASY 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.



The DASY system uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- 
- Fig-3.2 DASY4**

Fig-3.2 DASY4

Fig-3.3 DASY5

3.2.2 Probes

The SAR measurement is conducted with the dosimetric probe. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

Model	EX3DV4	
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	
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: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

Model	ES3DV3	
Construction	Symmetrical design with triangular core. Interleaved sensors. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).	
Frequency	10 MHz to 4 GHz Linearity: ± 0.2 dB	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	5 μ W/g to 100 mW/g Linearity: ± 0.2 dB	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	

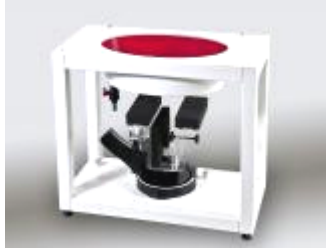
3.2.3 Data Acquisition Electronics (DAE)

Model	DAE3, DAE4	
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY4/5 embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.	
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)	
Input Offset Voltage	< 5 μ V (with auto zero)	
Input Bias Current	< 50 fA	
Dimensions	60 x 60 x 68 mm	

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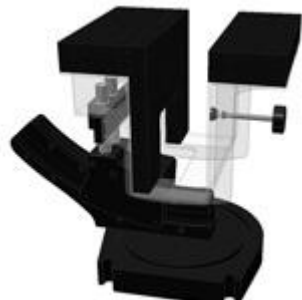
3.2.4 Phantoms

Model	Twin SAM	
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. 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 teaching three points with the robot.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)	
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet	
Filling Volume	approx. 25 liters	

Model	ELI	
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2.0 ± 0.2 mm (bottom plate)	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	
Filling Volume	approx. 30 liters	

3.2.5 Device Holder

Model	Mounting Device	
Construction	In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).	
Material	POM	

Model	Laptop Extensions Kit	
Construction	Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner.	
Material	POM, Acrylic glass, Foam	

3.2.6 System Validation Dipoles

Model	D-Serial	
Construction	Symmetrical dipole with 1/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.	
Frequency	750 MHz to 5800 MHz	
Return Loss	> 20 dB	
Power Capability	> 100 W (f < 1GHz), > 40 W (f > 1GHz)	

3.2.7 Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in below table.

The body tissue parameters that have not been specified in IEEE 1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE 1528.

The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using an Agilent 85070D Dielectric Probe Kit and an Agilent Network Analyzer.

Table-3.1 Targets of Tissue Simulating Liquid

Frequency (MHz)	Target Permittivity	Range of $\pm 5\%$	Target Conductivity	Range of $\pm 5\%$
For Head				
2450	39.2	37.2 ~ 41.2	1.80	1.71 ~ 1.89
5200	36.0	34.2 ~ 37.8	4.66	4.43 ~ 4.89
5300	35.9	34.1 ~ 37.7	4.76	4.52 ~ 5.00
5500	35.6	33.8 ~ 37.4	4.96	4.71 ~ 5.21
5600	35.5	33.7 ~ 37.3	5.07	4.82 ~ 5.32
5800	35.3	33.5 ~ 37.1	5.27	5.01 ~ 5.53
For Body				
2450	52.7	50.1 ~ 55.3	1.95	1.85 ~ 2.05
5200	49.0	46.6 ~ 51.5	5.30	5.04 ~ 5.57
5300	48.9	46.5 ~ 51.3	5.42	5.15 ~ 5.69
5500	48.6	46.2 ~ 51.0	5.65	5.37 ~ 5.93
5600	48.5	46.1 ~ 50.9	5.77	5.48 ~ 6.06
5800	48.2	45.8 ~ 50.6	6.00	5.70 ~ 6.30

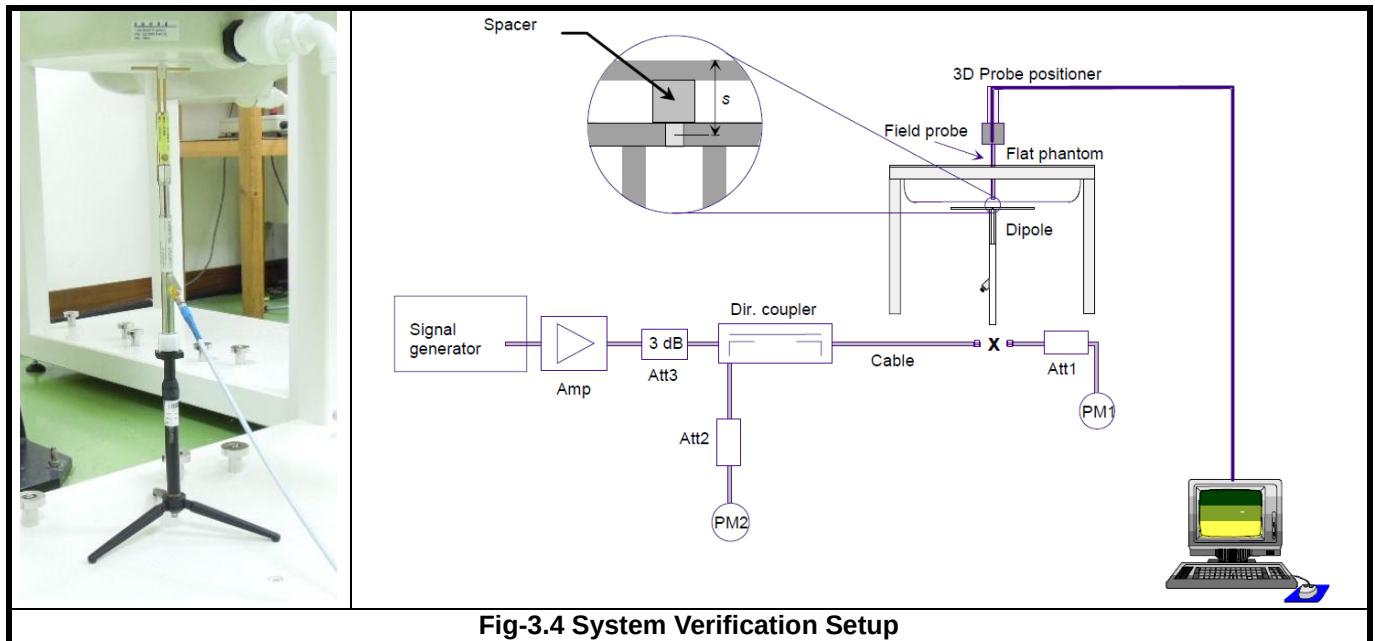
The following table gives the recipes for tissue simulating liquids.

Table-3.2 Recipes of Tissue Simulating Liquid

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
H2450	-	45.0	-	0.1	-	-	54.9	-
H5G	-	-	-	-	-	17.2	65.5	17.3
B2450	-	31.4	-	0.1	-	-	68.5	-
B5G	-	-	-	-	-	10.7	78.6	10.7

3.3 SAR System Verification

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.



The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The power meter PM1 measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz, 100 mW is used for 3.5 GHz to 6 GHz) at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2.

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

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3.4 SAR Measurement Procedure

According to the SAR test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

The SAR measurement procedures for each of test conditions are as follows:

- (a) Make EUT to transmit maximum output power
- (b) Measure conducted output power through RF cable
- (c) Place the EUT in the specific position of phantom
- (d) Perform SAR testing steps on the DASY system
- (e) Record the SAR value

3.4.1 Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures 5x5x7 points with step size 8, 8 and 5 mm for below 3 GHz, and 7x7x9 points with step size 4, 4 and 2.5 mm for above 5 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

3.4.2 Volume Scan Procedure

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the DUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

3.4.3 Power Drift Monitoring

All SAR testing is under the DUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of DUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

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3.4.4 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

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:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
- (f) Calculation of the averaged SAR within masses of 1g and 10g

3.4.5 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

4. SAR Measurement Evaluation

4.1 EUT Configuration and Setting

For WLAN SAR testing, the EUT has installed WLAN engineering testing software which can provide continuous transmitting RF signal. This RF signal utilized in SAR measurement has almost 100% duty cycle. The data rates for WLAN SAR testing were set in lowest data rate as 1 Mbps for 802.11b, 6 Mbps for 802.11g, 6Mbps for 802.11a, and MCS0 for 802.11n per KDB 248227 requirement, and the measured power of higher data rate is less than 1/4 dB higher than the measured power of lowest data rate.

4.2 EUT Testing Position

The PIFA antennas were tested in four different orientations. They are antenna horizontal-up, antenna horizontal-down, antenna vertical-up, and antenna vertical-down. The test configurations were tested with 20 mm separation distance between antenna and the flat phantom.

4.3 Tissue Verification

The measuring results for tissue simulating liquid are shown as below.

Tissue Type	Frequency (MHz)	Liquid Temp. (°C)	Measured Conductivity (σ)	Measured Permittivity (ϵ_r)	Target Conductivity (σ)	Target Permittivity (ϵ_r)	Conductivity Deviation (%)	Permittivity Deviation (%)	Test Date
B2450	2450	21.3	1.97	51.273	1.95	52.7	1.03	-2.71	Dec. 10, 2011
B2450	2437	21.3	1.953	51.318	1.937	52.71	0.83	-2.64	Dec. 10, 2011
B5G	5200	21.0	5.171	47.998	5.3	49.0	-2.43	-2.04	Dec. 12, 2011
B5G	5240	21.0	5.27	47.946	5.348	48.96	-1.46	-2.07	Dec. 12, 2011
B5G	5300	21.0	5.333	48.209	5.42	48.9	-1.61	-1.41	Dec. 12, 2011
B5G	5500	21.0	5.669	47.877	5.65	48.6	0.34	-1.49	Dec. 12, 2011
B5G	5580	21.0	5.786	47.417	5.746	48.52	0.70	-2.27	Dec. 12, 2011
B5G	5500	21.6	5.665	47.358	5.65	48.6	0.27	-2.56	Jan. 04, 2012
B5G	5580	21.6	5.777	46.903	5.746	48.52	0.54	-3.33	Jan. 04, 2012
B5G	5800	21.0	6.266	47.192	6	48.2	4.43	-2.09	Dec. 12, 2011
B5G	5755	21.0	6.276	47.248	5.948	48.26	5.51	-2.10	Dec. 12, 2011
B5G	5825	21.0	6.3	47.015	6.028	48.16	4.51	-2.38	Dec. 12, 2011
B5G	5800	21.5	6.253	46.677	6	48.2	4.22	-3.16	Jan. 04, 2012
B5G	5825	21.6	6.285	46.493	6.028	48.16	4.26	-3.46	Jan. 04, 2012

Note:

The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within $\pm 5\%$ of the target values. Liquid temperature during the SAR testing must be within $\pm 2^\circ\text{C}$.

4.4 System Verification

The measuring results for system check are shown as below.

Test Date	Frequency (MHz)	1W Target SAR-1g (W/kg)	Measured SAR-1g (W/kg)	Normalized to 1W SAR-1g (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Dec. 10, 2011	2450	53.30	14.40	57.60	8.07	716	3590	861
Dec. 12, 2011	5200	77.10	8.28	82.80	7.39	1019	3590	861
Dec. 12, 2011	5500	82.40	8.21	82.10	-0.36	1019	3590	861
Dec. 12, 2011	5800	73.40	7.39	73.90	0.68	1019	3590	861

Note:

Comparing to the reference SAR value provided by SPEAG, the validation data should be within its specification of 10 %. The result indicates the system check can meet the variation criterion and the plots can be referred to Appendix A of this report.

4.5 Conducted Power Results

The measuring conducted power (Unit: dBm) are shown as below.

Band	802.11b			802.11g		
Channel	1	6	11	1	6	11
Frequency (MHz)	2412	2437	2462	2412	2437	2462
Avg. Power (Port 0)	19.60	19.80	19.60	16.10	19.90	15.90
Avg. Power (Port 0+1)	19.80	19.80	19.80	15.80	19.70	15.40

Band	802.11n (HT20)			802.11n (HT40)		
Channel	1	6	11	3	6	9
Frequency (MHz)	2412	2437	2462	2422	2437	2452
Avg. Power (Port 0+1)	15.80	19.80	14.70	12.30	17.00	14.00

Band	802.11a							
Channel	36	40	44	48	52	56	60	64
Frequency (MHz)	5180	5200	5220	5240	5260	5280	5300	5320
Avg. Power (Port 0)	14.80	14.70	14.60	14.80	19.90	19.70	20.00	17.60
Avg. Power (Port 0+1)	14.50	14.40	14.30	14.50	19.50	19.40	19.90	17.40

Band	802.11a							
Channel	100	104	108	112	116	132	136	140
Frequency (MHz)	5500	5520	5540	5560	5580	5660	5680	5700
Avg. Power (Port 0)	14.60	14.70	14.50	17.30	17.50	16.80	16.90	13.70
Avg. Power (Port 0+1)	14.50	14.60	14.20	14.30	17.50	16.80	17.00	13.70

Band	802.11a							
Channel	149	153	157	161	165	-	-	-
Frequency (MHz)	5745	5765	5785	5805	5825	-	-	-
Avg. Power (Port 0)	14.30	14.20	14.70	15.10	15.20	-	-	-
Avg. Power (Port 0+1)	15.30	15.40	15.40	15.60	15.70	-	-	-

Band	802.11n (HT20)							
Channel	36	40	44	48	52	56	60	64
Frequency (MHz)	5180	5200	5220	5240	5260	5280	5300	5320
Avg. Power (Port 0+1)	14.2	14.2	14.1	14.0	14.2	14.20	14.1	14.0

Band	802.11n (HT20)							
Channel	100	104	108	112	116	132	136	140
Frequency (MHz)	5500	5520	5540	5560	5580	5660	5680	5700
Avg. Power (Port 0+1)	15.6	15.9	15.7	18.4	18.6	17.7	17.6	15.3

Band	802.11n (HT20)							
Channel	149	153	157	161	165	-	-	-
Frequency (MHz)	5745	5765	5785	5805	5825	-	-	-
Avg. Power (Port 0+1)	16.5	16.3	16.9	16.9	17.0	-	-	-

Band	802.11n (HT40)							
Channel	38	46	54	62	102	110	114	134
Frequency (MHz)	5190	5230	5270	5310	5510	5550	5570	5670
Avg. Power (Port 0+1)	12.5	16.5	18.0	12.6	11.7	14.8	14.9	15.1

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Band	802.11n (HT40)							
Channel	151	159	167	-	-	-	-	-
Frequency (MHz)	5755	5795	5835	-	-	-	-	-
Avg. Power (Port 0+1)	17.3	17.1	17.0	-	-	-	-	-

4.6 SAR Testing Results

4.6.1 SAR Results for Body

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Channel	Ant. Status	SAR-1g (W/kg)
48	802.11b	-	Horizontal Up	2	6	Chain 1	0.075
49	802.11b	-	Horizontal Down	2	6	Chain 1	0.157
50	802.11b	-	Vertical UP	2	6	Chain 1	0.031
51	802.11b	-	Vertical Down	2	6	Chain 1	0.061
60	802.11a	-	Horizontal Up	2	60	Chain 1	0.224
61	802.11a	-	Horizontal Down	2	60	Chain 1	0.347
62	802.11a	-	Vertical UP	2	60	Chain 1	0.071
63	802.11a	-	Vertical Down	2	60	Chain 1	0.093
68	802.11a	-	Horizontal Up	2	48	Chain 1	0.107
69	802.11a	-	Horizontal Down	2	48	Chain 1	0.118
70	802.11a	-	Vertical UP	2	48	Chain 1	0.026
71	802.11a	-	Vertical Down	2	48	Chain 1	0.056
72	802.11a	-	Horizontal Up	2	116	Chain 1	0.327
73	802.11a	-	Horizontal Down	2	116	Chain 1	0.272
74	802.11a	-	Vertical UP	2	116	Chain 1	0.078
75	802.11a	-	Vertical Down	2	116	Chain 1	0.082
81	802.11n	HT20	Horizontal Up	2	116	Chain 0+1	0.131
84	802.11n	HT20	Horizontal Down	2	116	Chain 0+1	0.049
85	802.11n	HT20	Vertical UP	2	116	Chain 0+1	0.007
86	802.11n	HT20	Vertical Down	2	116	Chain 0+1	0.018
76	802.11a	-	Horizontal Up	2	165	Chain 1	0.138
77	802.11a	-	Horizontal Down	2	165	Chain 1	0.147
78	802.11a	-	Vertical UP	2	165	Chain 1	0.054
79	802.11a	-	Vertical Down	2	165	Chain 1	0.05
80	802.11a	-	Horizontal Down	2	165	Chain 0+1	0.05
87	802.11n	HT20	Horizontal Up	2	165	Chain 0+1	0.032
82	802.11n	HT20	Horizontal Down	2	165	Chain 0+1	0.059
88	802.11n	HT20	Vertical UP	2	165	Chain 0+1	0.042
89	802.11n	HT20	Vertical Down	2	165	Chain 0+1	0.026
83	802.11n	HT40	Horizontal Down	2	151	Chain 0+1	0.062

Note:

1. According to KDB 248227, SAR testing for 802.11g/n is not required when the maximum average power of 802.11g/n is less than 1/4 dB higher than maximum average power of 802.11b.
2. SAR testing for 802.11n is not required when the maximum average power of 802.11n is less than 1/4 dB higher than maximum average power of 802.11a.
3. Since the maximum output power of Bluetooth is less than 60/f, SAR testing for Bluetooth is not required.
4. According to KDB 248227, When the extrapolated maximum peak SAR for the maximum output channel is ≤ 1.6 W/kg and the 1g averaged SAR is ≤ 0.8 W/kg, testing of other channels is not required.

Test Engineer : Eli Hsu, Morrison Huang and Jerone Chang

5. Calibration of Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
Dosimetric E-Field Probe	SPEAG	EX3DV4	3590	Feb. 25, 2011	Annual
System Validation Kit	SPEAG	D2450V2	716	Jan. 26, 2011	Annual
System Validation Kit	SPEAG	D5GHzV2	1019	Jan. 25, 2011	Annual
Data Acquisition Electronics	SPEAG	DAE4	861	Aug. 29, 2011	Annual
SAM Phantom	SPEAG	QD 000 P40	N/A	N/A	N/A
ELI Phantom	SPEAG	QD OVA 001B	N/A	N/A	N/A
ENA Series Network Analyzer	Agilent	E5071C	MY46104190	Apr. 15, 2011	Annual
Signal Generator	Agilent	E8257C	MY43320668	Dec. 20, 2011	Annual
Power Meter	Anritsu	ML2487A	6K00001571	May 25, 2011	Annual
Power Sensor	Anritsu	MA2491A	030954	May 25, 2011	Annual
Dielectric Probe Kit	Agilent	85070D	N/A	N/A	N/A

6. Measurement Uncertainty

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Standard Uncertainty (1g)	Vi
Measurement System						
Probe Calibration	6.0	Normal	1	1	± 6.0 %	∞
Axial Isotropy	4.7	Rectangular	√3	0.7	± 1.9 %	∞
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	± 3.9 %	∞
Boundary Effects	1.0	Rectangular	√3	1	± 0.6 %	∞
Linearity	4.7	Rectangular	√3	1	± 2.7 %	∞
System Detection Limits	1.0	Rectangular	√3	1	± 0.6 %	∞
Readout Electronics	0.6	Normal	1	1	± 0.6 %	∞
Response Time	0.0	Rectangular	√3	1	± 0.0 %	∞
Integration Time	1.7	Rectangular	√3	1	± 1.0 %	∞
RF Ambient Noise	3.0	Rectangular	√3	1	± 1.7 %	∞
RF Ambient Reflections	3.0	Rectangular	√3	1	± 1.7 %	∞
Probe Positioner	0.5	Rectangular	√3	1	± 0.3 %	∞
Probe Positioning	2.9	Rectangular	√3	1	± 1.7 %	∞
Max. SAR Eval.	2.3	Rectangular	√3	1	± 1.3 %	∞
Test Sample Related						
Device Positioning	3.9	Normal	1	1	± 3.9 %	31
Device Holder	2.7	Normal	1	1	± 2.7 %	19
Power Drift	5.0	Rectangular	√3	1	± 2.9 %	∞
Phantom and Setup						
Phantom Uncertainty	4.0	Rectangular	√3	1	± 2.3 %	∞
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	± 1.8 %	∞
Liquid Conductivity (Meas.)	5.0	Normal	1	0.64	± 3.2 %	29
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	± 1.7 %	∞
Liquid Permittivity (Meas.)	5.0	Normal	1	0.6	± 3.0 %	29
Combined Standard Uncertainty					± 11.7 %	
Expanded Uncertainty (K=2)					± 23.4 %	

Uncertainty budget for frequency range 300 MHz to 3 GHz

FCC SAR Test Report

A D T

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Standard Uncertainty (1g)	Vi
Measurement System						
Probe Calibration	6.55	Normal	1	1	± 6.55 %	∞
Axial Isotropy	4.7	Rectangular	√3	0.7	± 1.9 %	∞
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	± 3.9 %	∞
Boundary Effects	2.0	Rectangular	√3	1	± 1.2 %	∞
Linearity	4.7	Rectangular	√3	1	± 2.7 %	∞
System Detection Limits	1.0	Rectangular	√3	1	± 0.6 %	∞
Readout Electronics	0.3	Normal	1	1	± 0.3 %	∞
Response Time	0.8	Rectangular	√3	1	± 0.5 %	∞
Integration Time	2.6	Rectangular	√3	1	± 1.5 %	∞
RF Ambient Noise	3.0	Rectangular	√3	1	± 1.7 %	∞
RF Ambient Reflections	3.0	Rectangular	√3	1	± 1.7 %	∞
Probe Positioner	0.8	Rectangular	√3	1	± 0.5 %	∞
Probe Positioning	9.9	Rectangular	√3	1	± 5.7 %	∞
Max. SAR Eval.	4.0	Rectangular	√3	1	± 2.3 %	∞
Test Sample Related						
Device Positioning	3.9	Normal	1	1	± 3.9 %	31
Device Holder	2.7	Normal	1	1	± 2.7 %	19
Power Drift	5.0	Rectangular	√3	1	± 2.9 %	∞
Phantom and Setup						
Phantom Uncertainty	4.0	Rectangular	√3	1	± 2.3 %	∞
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	± 1.8 %	∞
Liquid Conductivity (Meas.)	5.0	Normal	1	0.64	± 3.2 %	29
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	± 1.7 %	∞
Liquid Permittivity (Meas.)	5.0	Normal	1	0.6	± 3.0 %	29
Combined Standard Uncertainty					± 13.4 %	
Expanded Uncertainty (K=2)					± 26.8 %	

Uncertainty budget for frequency range 3 GHz to 6 GHz

7. Information on the Testing Laboratories

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

Copies of accreditation and authorization certificates of our laboratories obtained from approval agencies can be downloaded from our web site. If you have any comments, please feel free to contact us at the following:

Taiwan HwaYa EMC/RF/Safety/Telecom Lab:

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

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Appendix A. SAR Plots of System Verification

The plots for system verification are shown as follows.

System Check_B2450_111210**DUT: Dipole 2450 MHz; Type: D2450V2; SN: 716**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: B2450_1210 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.97$ mho/m; $\epsilon_r = 51.273$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.4 °C; Liquid Temperature : 21.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(7.91, 7.91, 7.91); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 22.462 mW/g

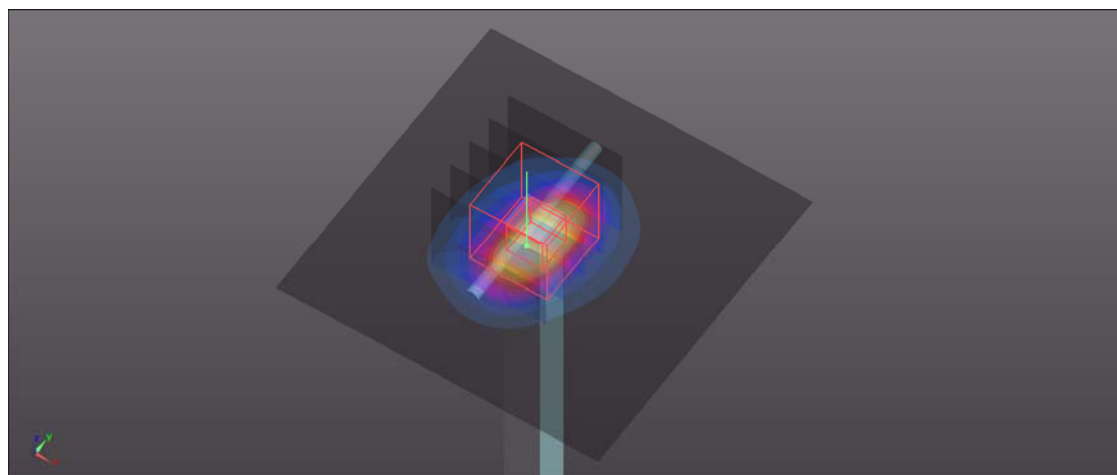
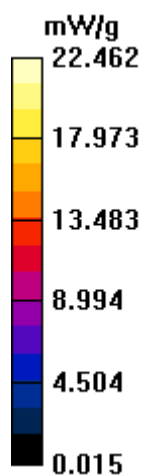
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 106.2 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 29.454 W/kg

SAR(1 g) = 14.4 mW/g; SAR(10 g) = 6.64 mW/g

Maximum value of SAR (measured) = 21.638 mW/g



System Check_B5200_111212**DUT: Dipole 5 GHz; Type: D5GHzV2; SN: 1019**

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5200$ MHz; $\sigma = 5.171$ mho/m; $\epsilon_r = 47.998$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.81, 4.81, 4.81); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 17.575 mW/g

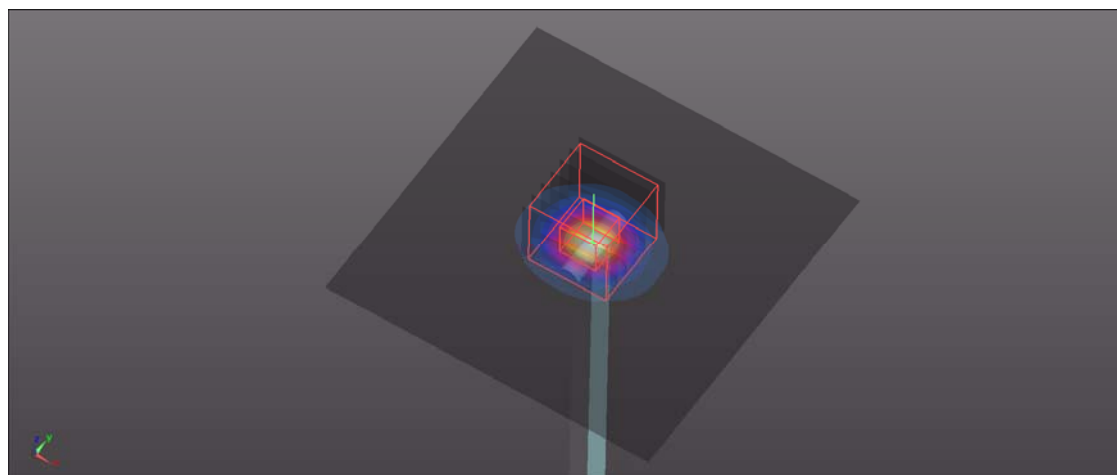
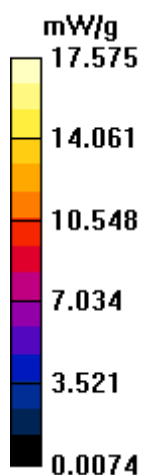
Pin=100mW/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 64.894 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 31.528 W/kg

SAR(1 g) = 8.28 mW/g; SAR(10 g) = 2.33 mW/g

Maximum value of SAR (measured) = 17.490 mW/g



System Check_B5500_111212**DUT: Dipole 5 GHz; Type: D5GHzV2; SN: 1019**

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5500$ MHz; $\sigma = 5.669$ mho/m; $\epsilon_r = 47.877$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.32, 4.32, 4.32); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 17.334 mW/g

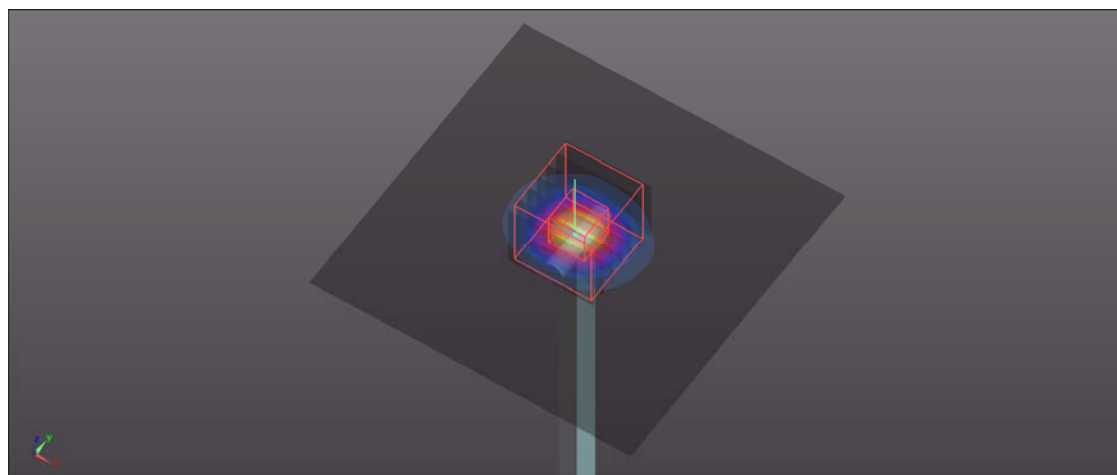
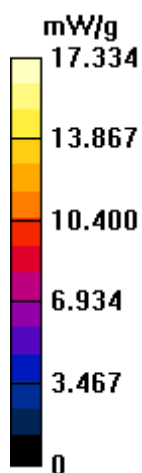
Pin=100mW/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 60.423 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 31.090 W/kg

SAR(1 g) = 8.21 mW/g; SAR(10 g) = 2.22 mW/g

Maximum value of SAR (measured) = 17.237 mW/g



System Check_B5500_120104**DUT: Dipole 5 GHz; Type: D5GHzV2; SN: 1019**

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: B5G_0104 Medium parameters used: $f = 5500$ MHz; $\sigma = 5.665$ mho/m; $\epsilon_r = 47.358$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.2 °C; Liquid Temperature : 21.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.32, 4.32, 4.32); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: SAM Phantom_Left; Type: SAM; Serial: 1202
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

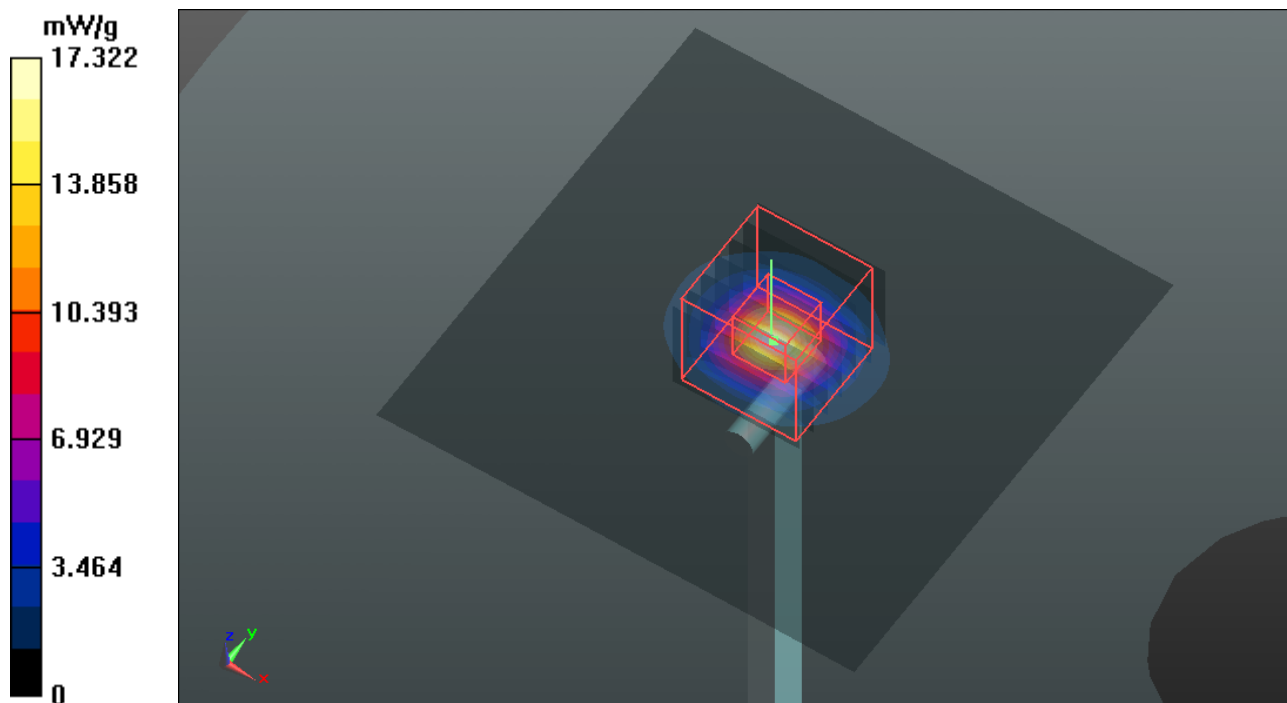
Pin=100mW, f=5500 MHz/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 17.322 mW/g**Pin=100mW, f=5500 MHz/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 60.423 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 31.0680

SAR(1 g) = 8.2 mW/g; SAR(10 g) = 2.22 mW/g

Maximum value of SAR (measured) = 17.225 mW/g



System Check_B5800_111212**DUT: Dipole 5 GHz; Type: D5GHzV2; SN: 1019**

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5800$ MHz; $\sigma = 6.266$ mho/m; $\epsilon_r = 47.192$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 15.685 mW/g

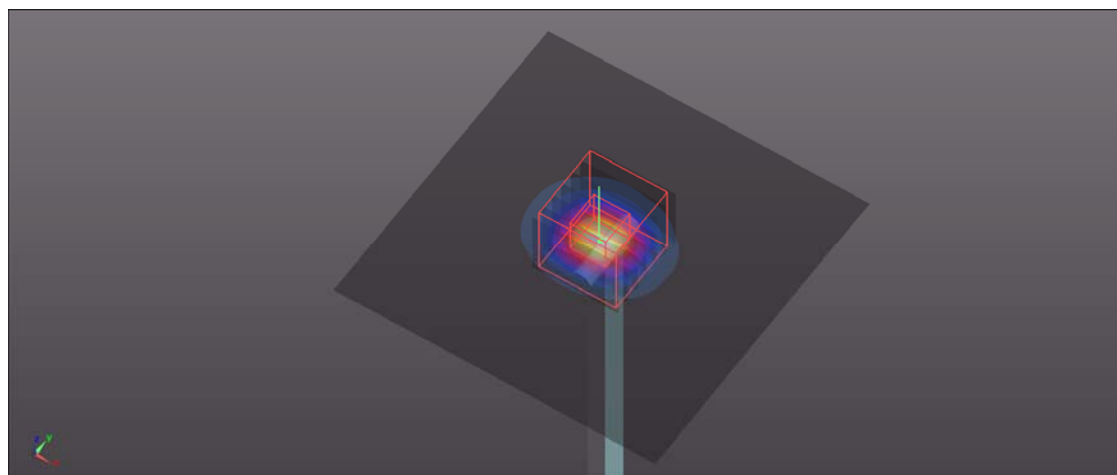
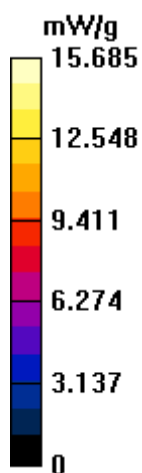
Pin=100mW/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 54.855 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 29.956 W/kg

SAR(1 g) = 7.39 mW/g; SAR(10 g) = 2 mW/g

Maximum value of SAR (measured) = 15.831 mW/g



System Check_B5800_120104**DUT: Dipole 5 GHz; Type: D5GHzV2; SN: 1019**

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: B5G_0104 Medium parameters used: $f = 5800$ MHz; $\sigma = 6.253$ mho/m; $\epsilon_r = 46.677$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.2 °C; Liquid Temperature : 21.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: SAM Phantom_Left; Type: SAM; Serial: 1202
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

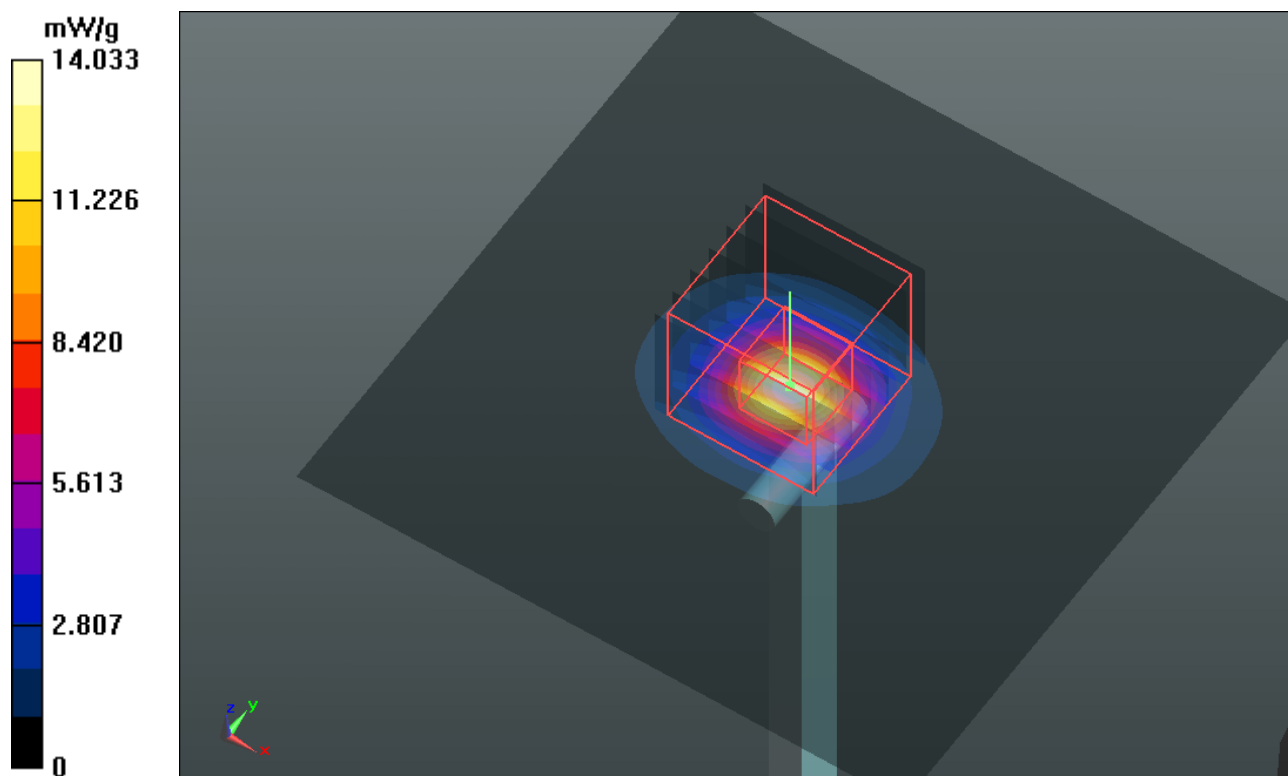
Pin=100mW, f=5800 MHz/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 14.033 mW/g**Pin=100mW, f=5800 MHz/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 52.093 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 30.6180

SAR(1 g) = 7.58 mW/g; SAR(10 g) = 2.19 mW/g

Maximum value of SAR (measured) = 16.013 mW/g





Appendix B. SAR Plots of SAR Measurement

The plots for SAR measurement are shown as follows.

P48 802.11b_Horizontal Up_2cm_Ch6_0x2**DUT: 111012E09**

Communication System: WLAN_2.4G; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: B2450_1210 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.953$ mho/m; $\epsilon_r = 51.318$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.4 °C; Liquid Temperature : 21.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(7.91, 7.91, 7.91); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch6/Area Scan (61x101x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.106 mW/g

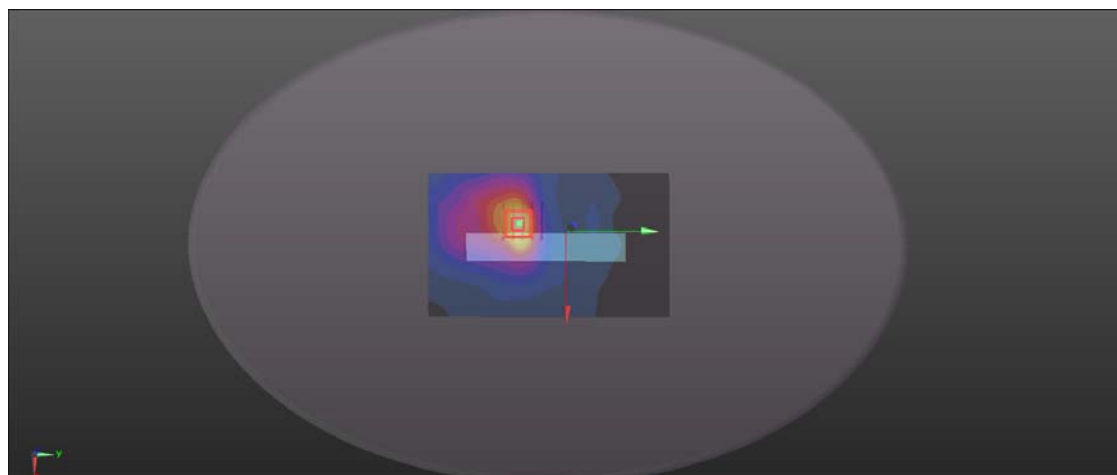
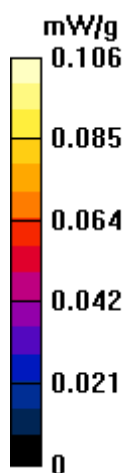
Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.524 V/m; Power Drift = -0.068 dB

Peak SAR (extrapolated) = 0.138 W/kg

SAR(1 g) = 0.075 mW/g; SAR(10 g) = 0.041 mW/g

Maximum value of SAR (measured) = 0.103 mW/g



P49 802.11b_Horizontal Down_2cm_Ch6_0x2**DUT: 111012E09**

Communication System: WLAN_2.4G; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: B2450_1210 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.953$ mho/m; $\epsilon_r = 51.318$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.4 °C; Liquid Temperature : 21.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(7.91, 7.91, 7.91); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch6/Area Scan (61x101x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.201 mW/g

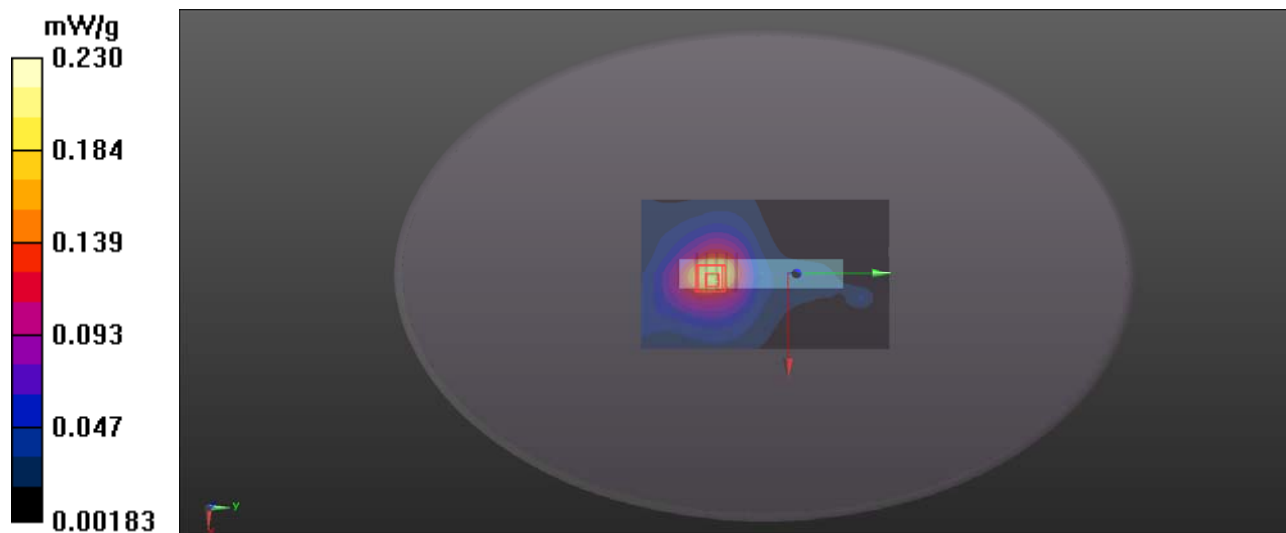
Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.445 V/m; Power Drift = 0.15 dB

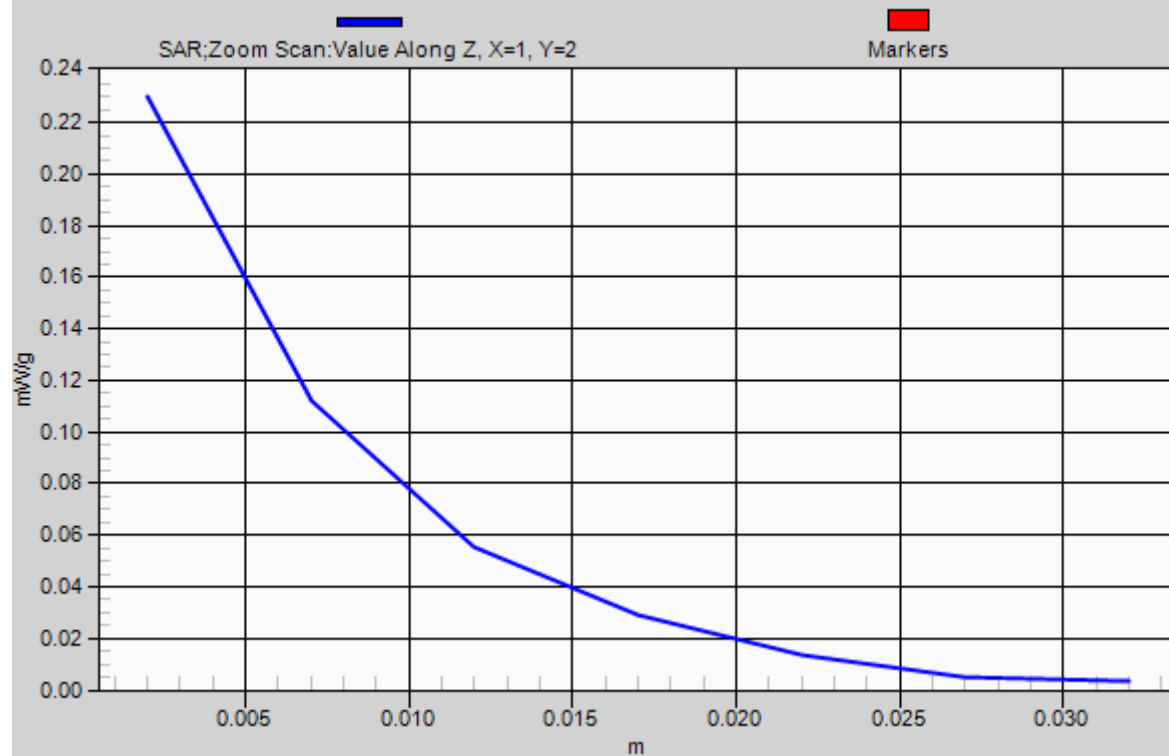
Peak SAR (extrapolated) = 0.290 W/kg

SAR(1 g) = 0.157 mW/g; SAR(10 g) = 0.082 mW/g

Maximum value of SAR (measured) = 0.230 mW/g



1g/10g Averaged SAR



P50 802.11b_Vertictal Up_2cm_Ch6_0x2**DUT: 111012E09**

Communication System: WLAN_2.4G; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: B2450_1210 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.953$ mho/m; $\epsilon_r = 51.318$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.4 °C; Liquid Temperature : 21.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(7.91, 7.91, 7.91); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch6/Area Scan (41x81x1): Measurement grid: dx=20mm, dy=20mm

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

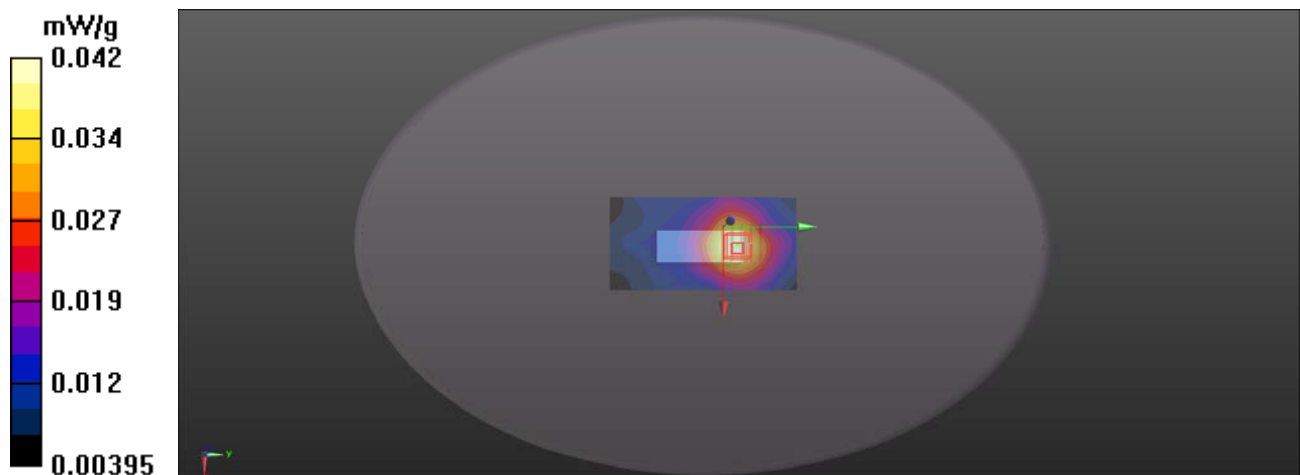
Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.463 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.055 W/kg

SAR(1 g) = 0.031 mW/g; SAR(10 g) = 0.019 mW/g

Maximum value of SAR (measured) = 0.041 mW/g



P51 802.11b_Vertictal Down_2cm_Ch6_0x2**DUT: 111012E09**

Communication System: WLAN_2.4G; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: B2450_1210 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.953$ mho/m; $\epsilon_r = 51.318$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.4 °C; Liquid Temperature : 21.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(7.91, 7.91, 7.91); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch6/Area Scan (41x81x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.083 mW/g

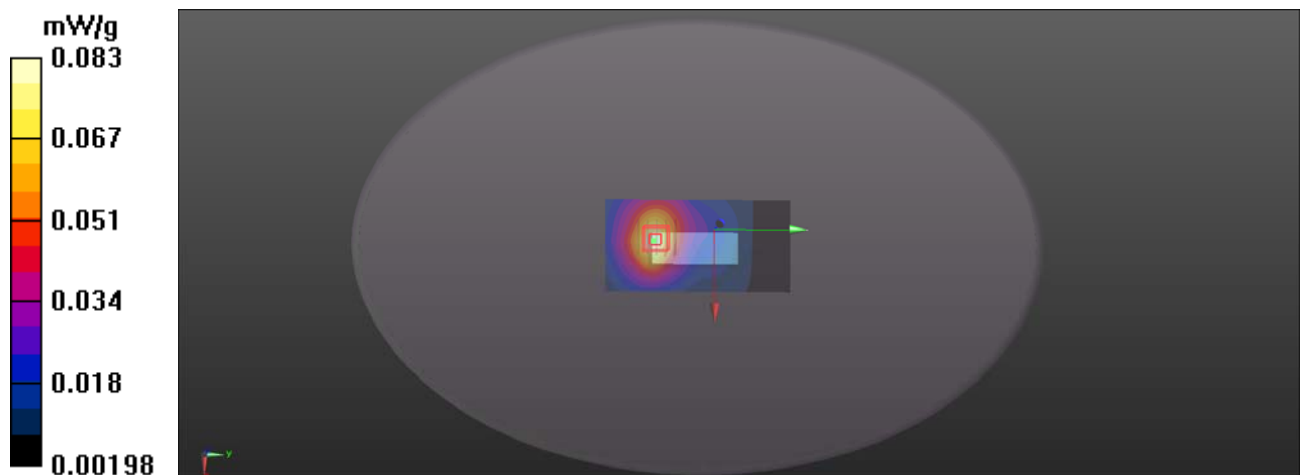
Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.543 V/m; Power Drift = -0.138 dB

Peak SAR (extrapolated) = 0.111 W/kg

SAR(1 g) = 0.061 mW/g; SAR(10 g) = 0.036 mW/g

Maximum value of SAR (measured) = 0.083 mW/g



P60 802.11a_Horizontal Up_2cm_Ch60_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5300$ MHz; $\sigma = 5.333$ mho/m; $\epsilon_r = 48.209$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.56, 4.56, 4.56); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch60/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.361 mW/g

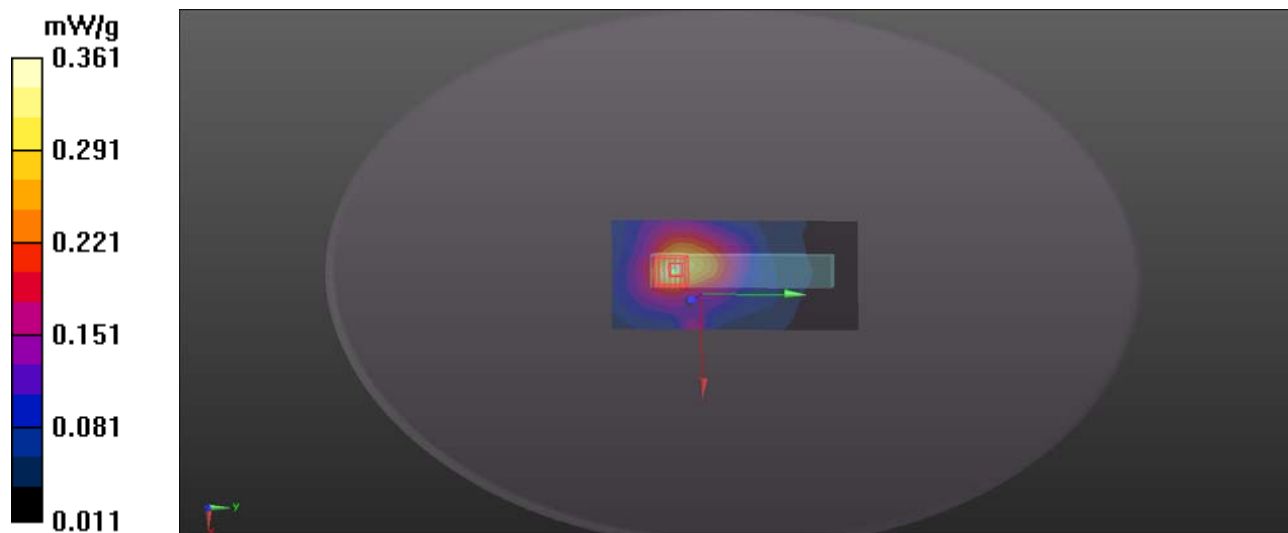
Ch60/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 5.680 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.667 W/kg

SAR(1 g) = 0.224 mW/g; SAR(10 g) = 0.103 mW/g

Maximum value of SAR (measured) = 0.391 mW/g



P61 802.11a_Horizontal Down_2cm_Ch60_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5300$ MHz; $\sigma = 5.333$ mho/m; $\epsilon_r = 48.209$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.56, 4.56, 4.56); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch60/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.516 mW/g

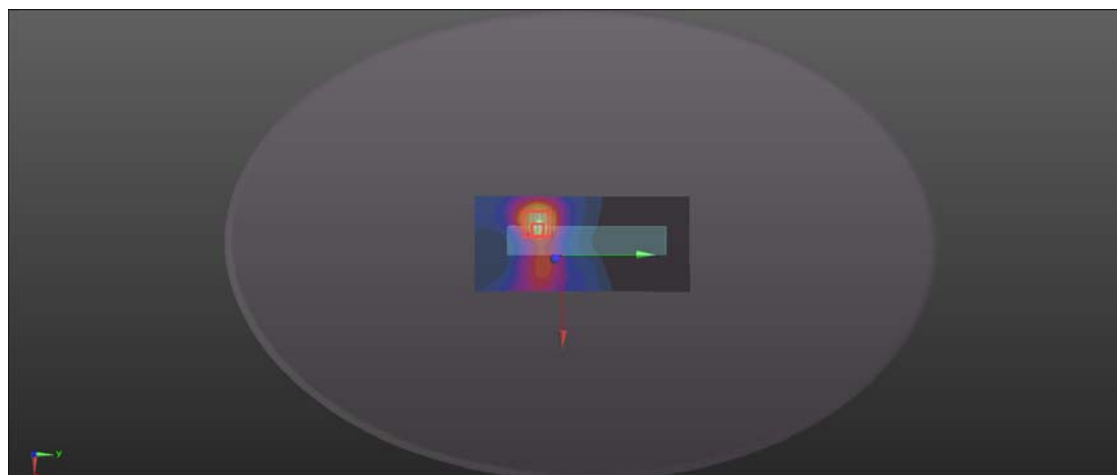
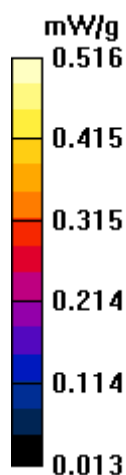
Ch60/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 3.370 V/m; Power Drift = -0.17 dB

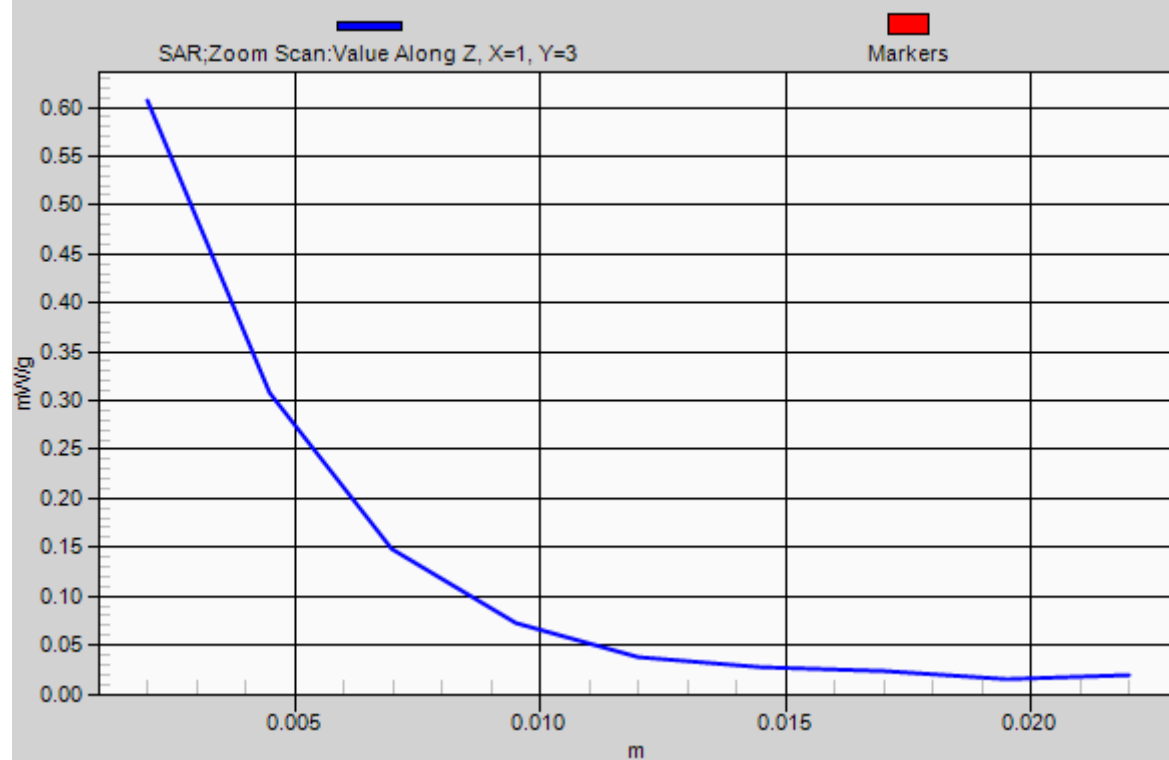
Peak SAR (extrapolated) = 1.070 W/kg

SAR(1 g) = 0.347 mW/g; SAR(10 g) = 0.149 mW/g

Maximum value of SAR (measured) = 0.607 mW/g



1g/10g Averaged SAR



P62 802.11a_Vertictal Up_2cm_Ch60_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5300$ MHz; $\sigma = 5.333$ mho/m; $\epsilon_r = 48.209$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.56, 4.56, 4.56); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch60/Area Scan (101x141x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.106 mW/g

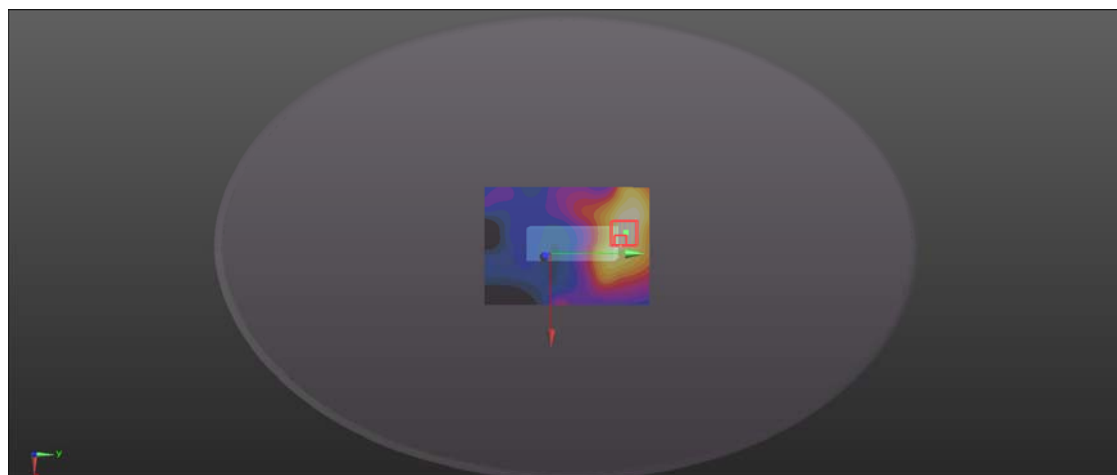
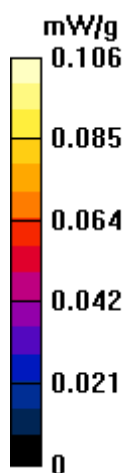
Ch60/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 0.956 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.210 W/kg

SAR(1 g) = 0.071 mW/g; SAR(10 g) = 0.038 mW/g

Maximum value of SAR (measured) = 0.118 mW/g



P63 802.11a_Vertictal Down_2cm_Ch60_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5300$ MHz; $\sigma = 5.333$ mho/m; $\epsilon_r = 48.209$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.2 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.56, 4.56, 4.56); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Configuration/Ch60/Area Scan (101x141x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.136 mW/g

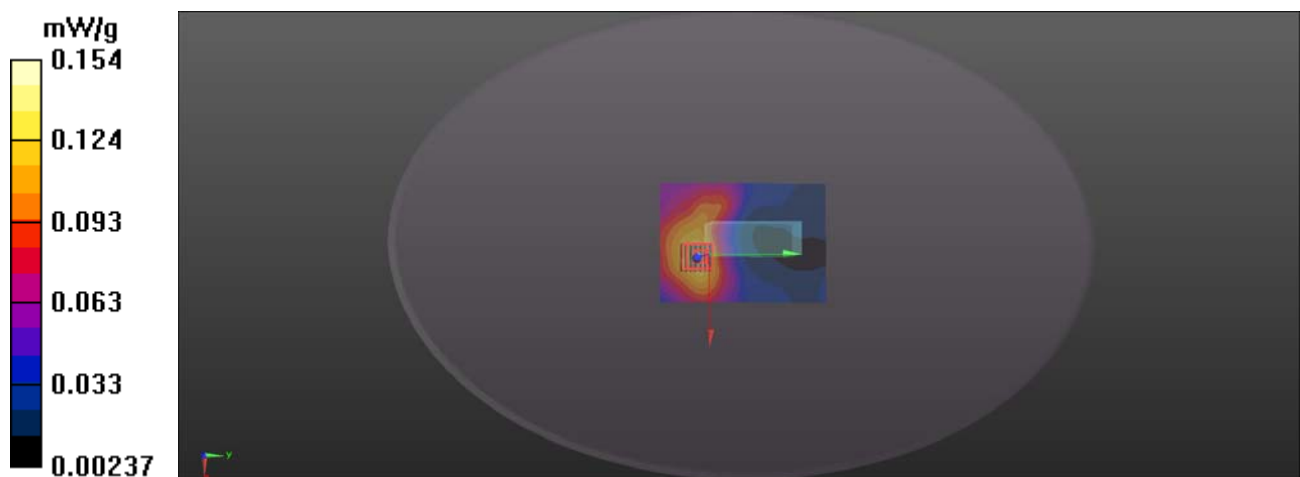
Ch60/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.411 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.314 W/kg

SAR(1 g) = 0.093 mW/g; SAR(10 g) = 0.046 mW/g

Maximum value of SAR (measured) = 0.154 mW/g



P68 802.11a_Horizontal Up_2cm_Ch48_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5240 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5240$ MHz; $\sigma = 5.27$ mho/m; $\epsilon_r = 47.946$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.3 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.81, 4.81, 4.81); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch48/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.190 mW/g

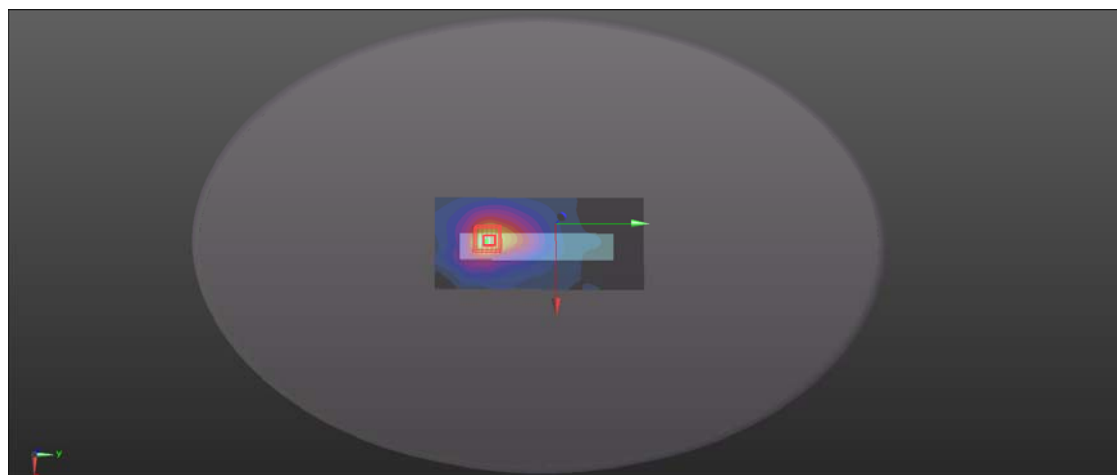
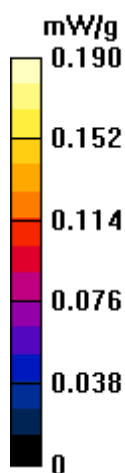
Ch48/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 3.685 V/m; Power Drift = -0.127 dB

Peak SAR (extrapolated) = 0.358 W/kg

SAR(1 g) = 0.107 mW/g; SAR(10 g) = 0.041 mW/g

Maximum value of SAR (measured) = 0.202 mW/g



P69 802.11a_Horizontal Down_2cm_Ch48_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5240 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5240$ MHz; $\sigma = 5.27$ mho/m; $\epsilon_r = 47.946$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.81, 4.81, 4.81); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch48/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.214 mW/g

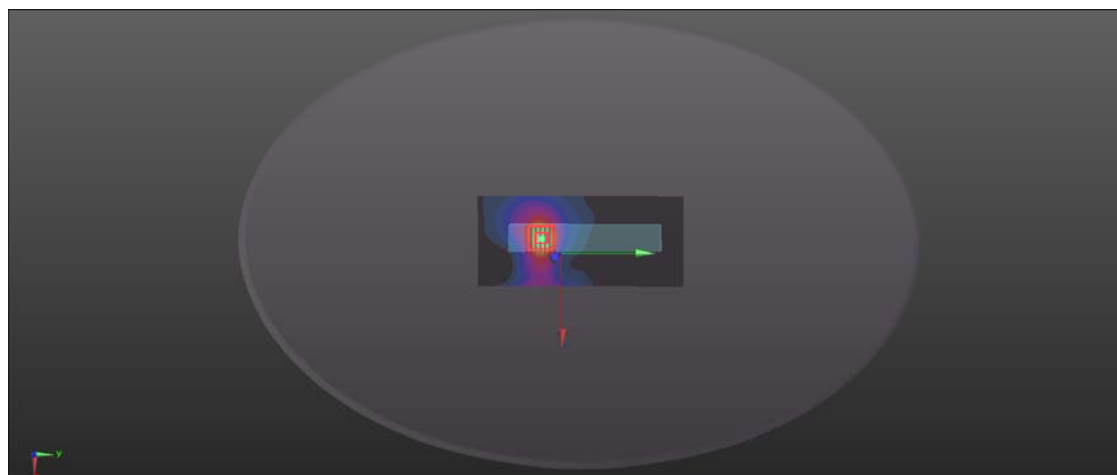
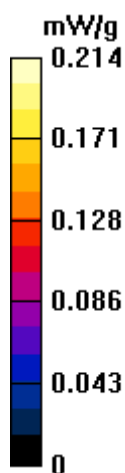
Ch48/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.514 V/m; Power Drift = 0.15 dB

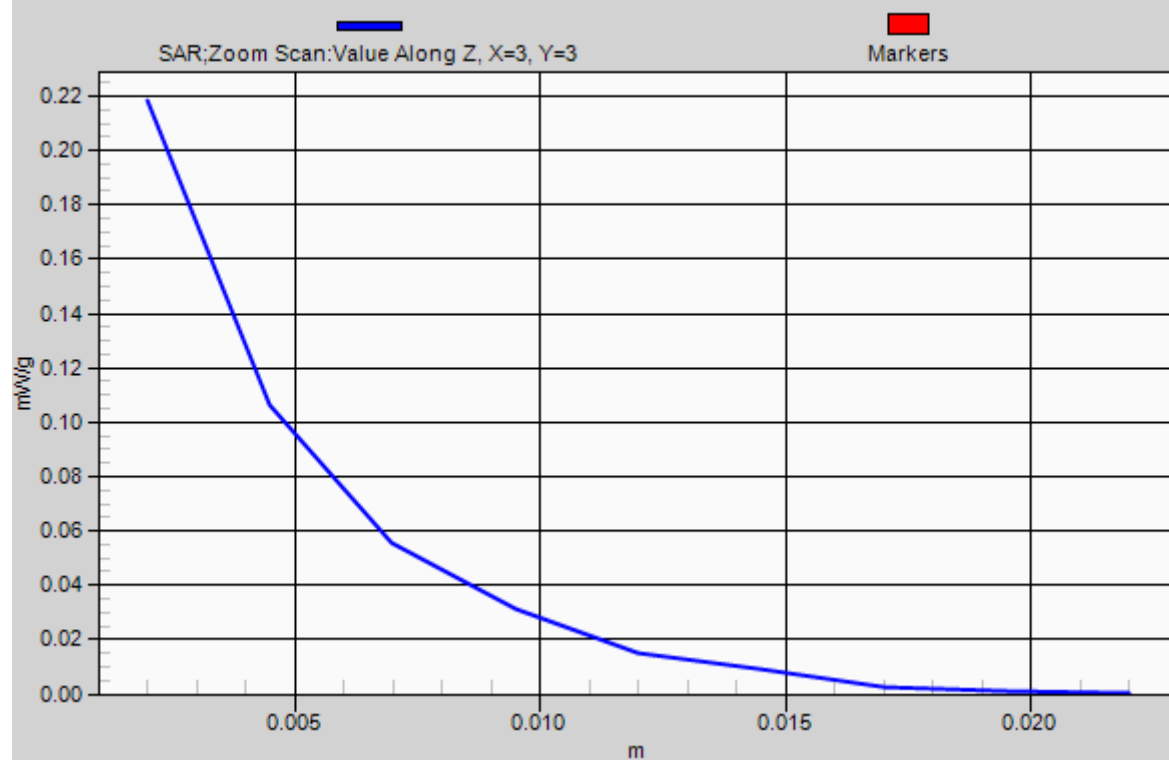
Peak SAR (extrapolated) = 0.393 W/kg

SAR(1 g) = 0.118 mW/g; SAR(10 g) = 0.046 mW/g

Maximum value of SAR (measured) = 0.218 mW/g



1g/10g Averaged SAR



P70 802.11a_Vertictal Up_2cm_Ch48_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5240 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5240$ MHz; $\sigma = 5.27$ mho/m; $\epsilon_r = 47.946$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.81, 4.81, 4.81); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch48/Area Scan (101x141x1): Measurement grid: dx=10mm, dy=10mm

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

Ch48/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.629 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 0.084 W/kg

SAR(1 g) = 0.026 mW/g; SAR(10 g) = 0.018 mW/g

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

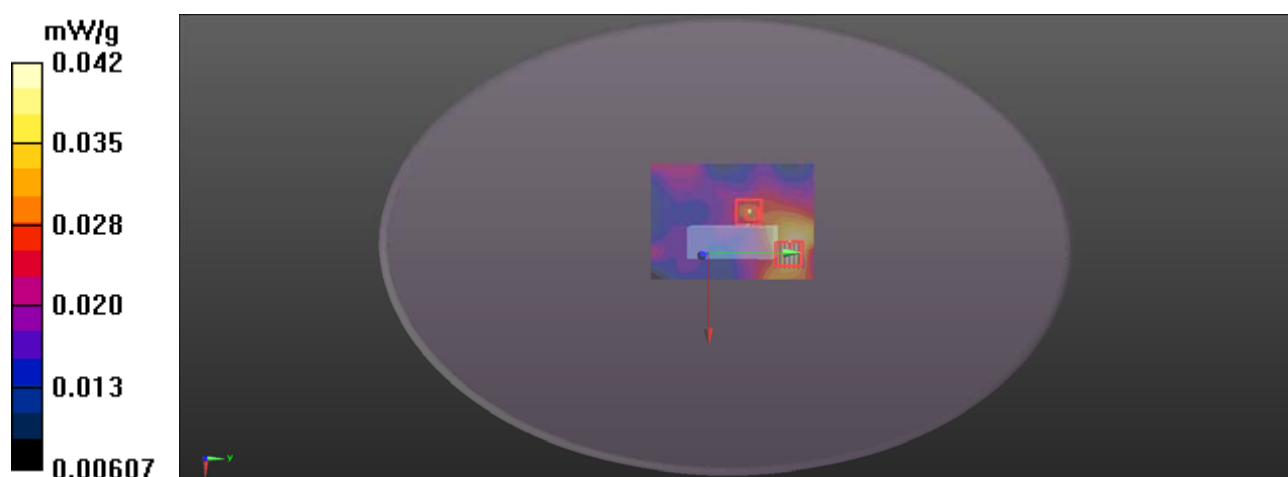
Ch48/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.629 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 0.079 W/kg

SAR(1 g) = 0.021 mW/g; SAR(10 g) = 0.017 mW/g

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



P71 802.11a_Vertictal Down_2cm_Ch48_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5240 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5240$ MHz; $\sigma = 5.27$ mho/m; $\epsilon_r = 47.946$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.81, 4.81, 4.81); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch48/Area Scan (101x141x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.095 mW/g

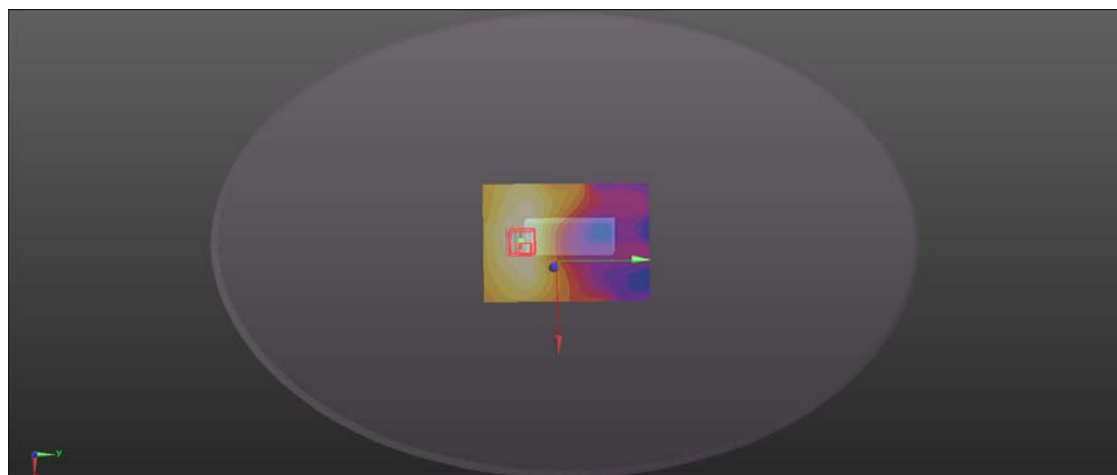
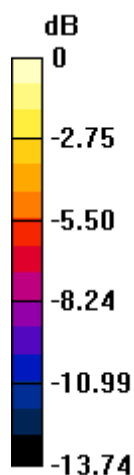
Ch48/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.170 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.172 W/kg

SAR(1 g) = 0.056 mW/g; SAR(10 g) = 0.031 mW/g

Maximum value of SAR (measured) = 0.095 mW/g



0 dB = 0.090mW/g

P72 802.11a_Horizontal Up_2cm_Ch116_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5580$ MHz; $\sigma = 5.786$ mho/m; $\epsilon_r = 47.417$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.01, 4.01, 4.01); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch116/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.562 mW/g

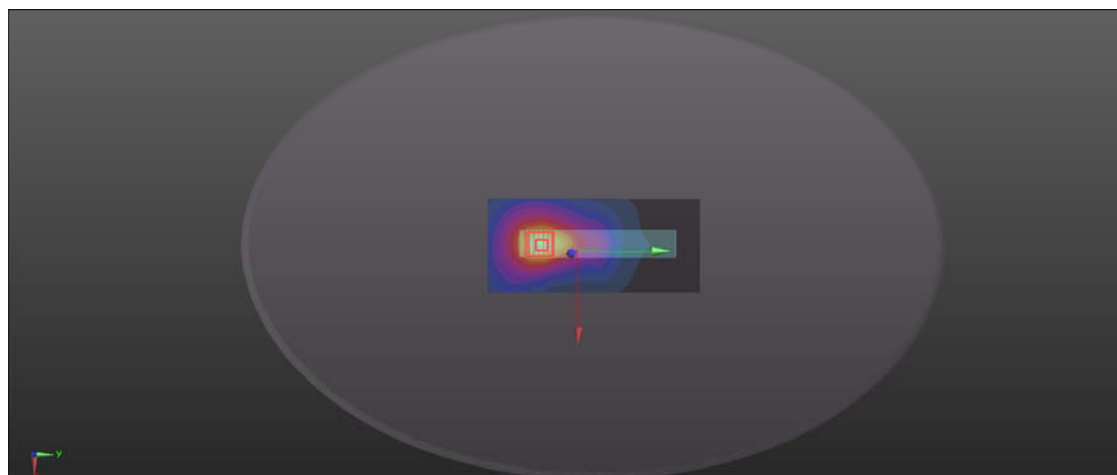
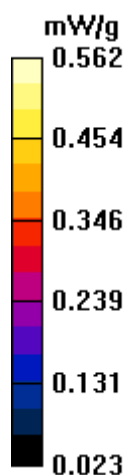
Ch116/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 7.468 V/m; Power Drift = -0.16 dB

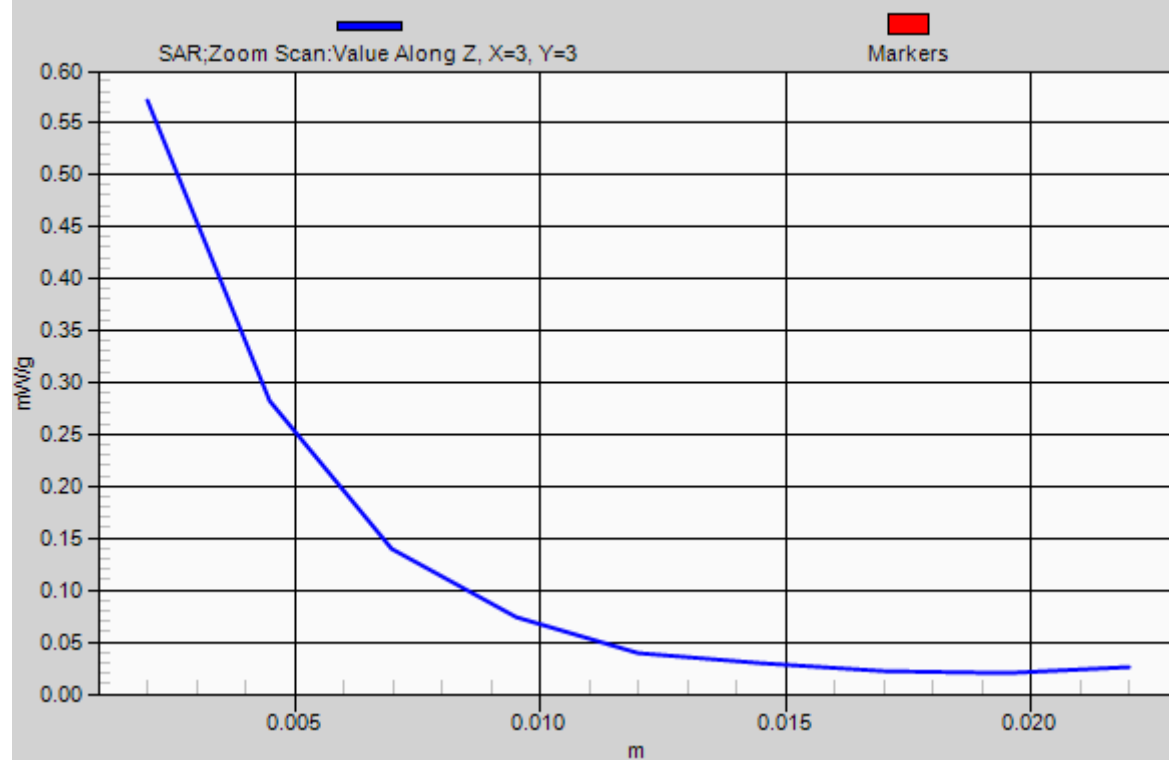
Peak SAR (extrapolated) = 1.049 W/kg

SAR(1 g) = 0.327 mW/g; SAR(10 g) = 0.150 mW/g

Maximum value of SAR (measured) = 0.571 mW/g



1g/10g Averaged SAR



P73 802.11a_Horizontal Down_2cm_Ch116_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5580$ MHz; $\sigma = 5.786$ mho/m; $\epsilon_r = 47.417$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.3 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.01, 4.01, 4.01); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch116/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.506 mW/g

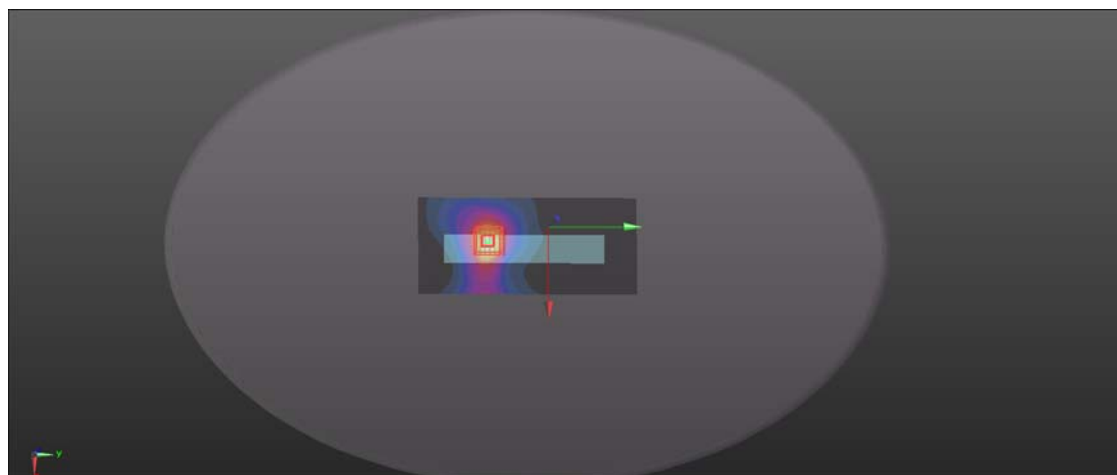
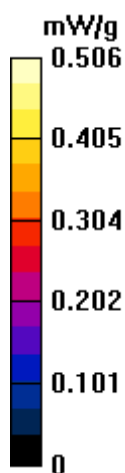
Ch116/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 3.532 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.910 W/kg

SAR(1 g) = 0.272 mW/g; SAR(10 g) = 0.106 mW/g

Maximum value of SAR (measured) = 0.505 mW/g



P74 802.11a_Vertictal Up_2cm_Ch116_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5580$ MHz; $\sigma = 5.786$ mho/m; $\epsilon_r = 47.417$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.4 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.01, 4.01, 4.01); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch116/Area Scan (121x161x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.166 mW/g

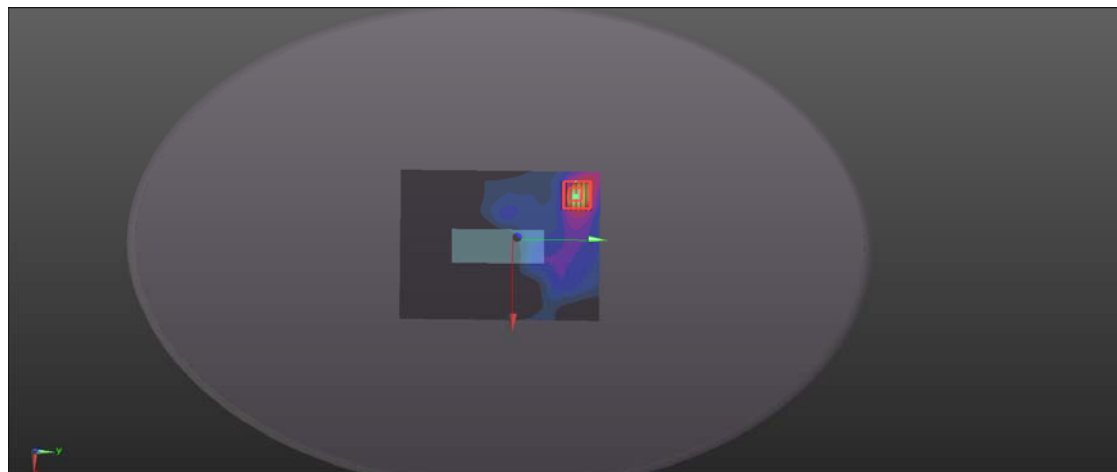
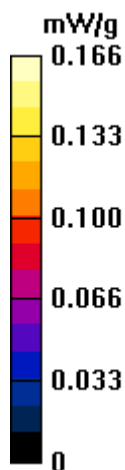
Ch116/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.950 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.410 W/kg

SAR(1 g) = 0.078 mW/g; SAR(10 g) = 0.025 mW/g

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



P75 802.11a_Vertictal Down_2cm_Ch116_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5580$ MHz; $\sigma = 5.786$ mho/m; $\epsilon_r = 47.417$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.3 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.01, 4.01, 4.01); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch116/Area Scan (101x141x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.143 mW/g

Ch116/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 2.764 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 0.311 W/kg

SAR(1 g) = 0.082 mW/g; SAR(10 g) = 0.034 mW/g

Maximum value of SAR (measured) = 0.311 mW/g

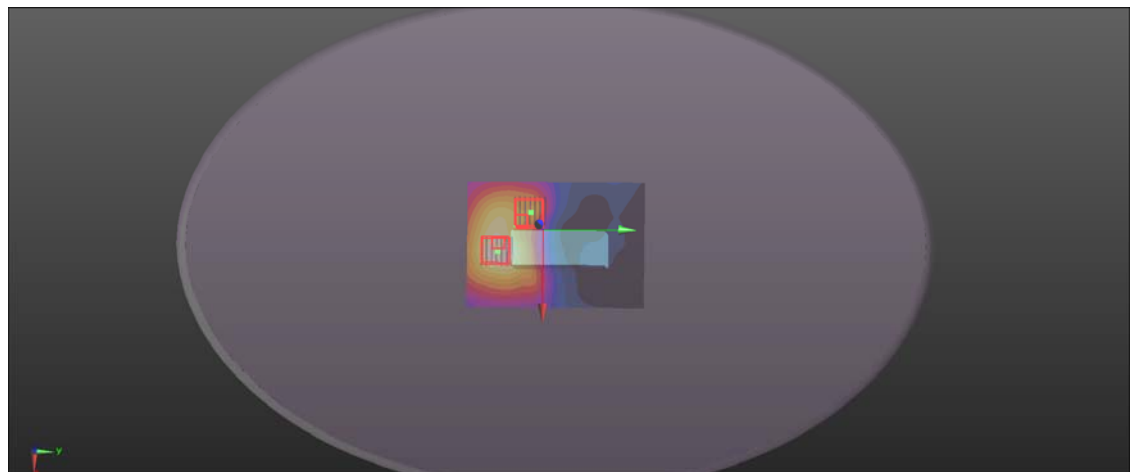
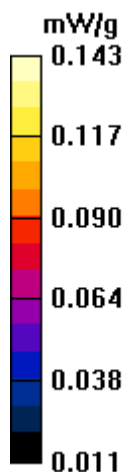
Ch116/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 2.764 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 0.229 W/kg

SAR(1 g) = 0.071 mW/g; SAR(10 g) = 0.034 mW/g

Maximum value of SAR (measured) = 0.125 mW/g



P81 802.11n_HT20_Horizontal Up_2cm_Ch116_0x3**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5580$ MHz; $\sigma = 5.786$ mho/m; $\epsilon_r = 47.417$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.2 °C ; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.01, 4.01, 4.01); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch116/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.212 mW/g

Ch116/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 4.510 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 0.454 W/kg

SAR(1 g) = 0.131 mW/g; SAR(10 g) = 0.068 mW/g

Maximum value of SAR (measured) = 0.230 mW/g

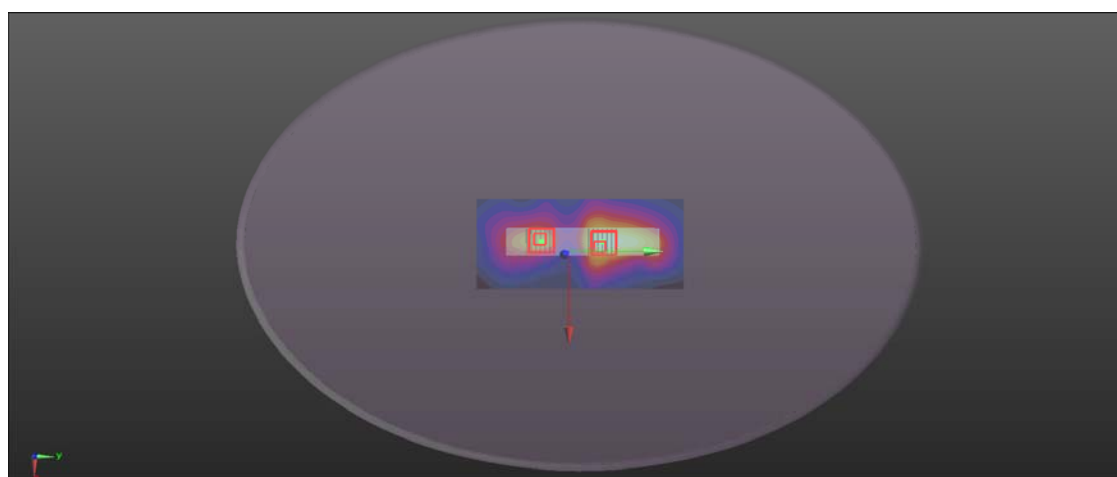
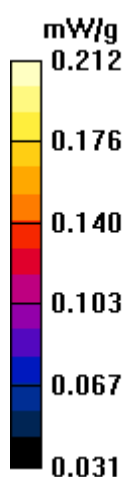
Ch116/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 4.510 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 0.395 W/kg

SAR(1 g) = 0.105 mW/g; SAR(10 g) = 0.051 mW/g

Maximum value of SAR (measured) = 0.173 mW/g



P84 802.11n_HT20_Horizontal Down_2cm_Ch116_0x3**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium: B5G_0104 Medium parameters used: $f = 5580$ MHz; $\sigma = 5.777$ mho/m; $\epsilon_r = 46.903$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.2 °C ; Liquid Temperature : 21.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.01, 4.01, 4.01); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: SAM Phantom_Left; Type: SAM; Serial: 1202
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Ch116/Area Scan (101x181x1): Measurement grid: dx=10mm, dy=10mm

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

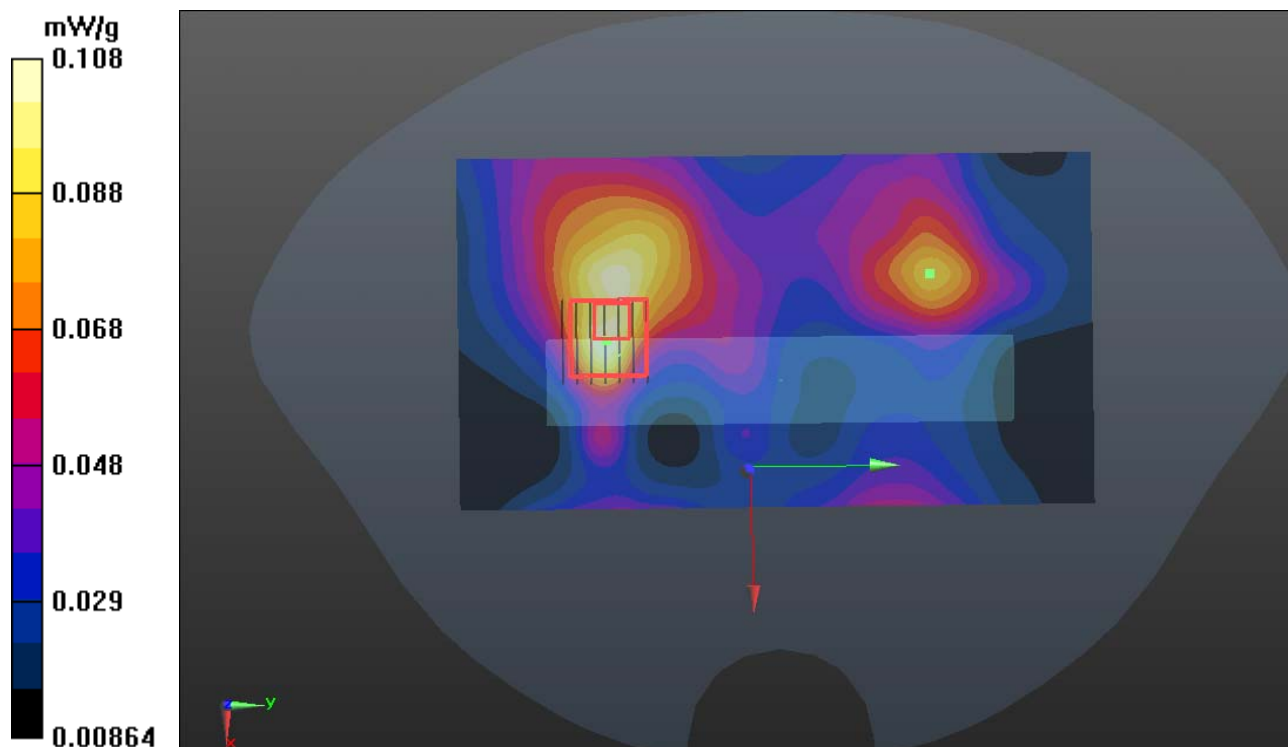
Ch116/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.819 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.3270

SAR(1 g) = 0.049 mW/g; SAR(10 g) = 0.022 mW/g

Maximum value of SAR (measured) = 0.103 mW/g



P85 802.11n_HT20_Vertictal Up_2cm_Ch116_0x3**DUT: 111012E09**

Communication System: WLAN 5G; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium: B5G_0104 Medium parameters used: $f = 5580$ MHz; $\sigma = 5.777$ mho/m; $\epsilon_r = 46.903$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C ; Liquid Temperature : 21.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.01, 4.01, 4.01); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: SAM Phantom_Left; Type: SAM; Serial: 1202
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Ch116/Area Scan (121x161x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.083 mW/g

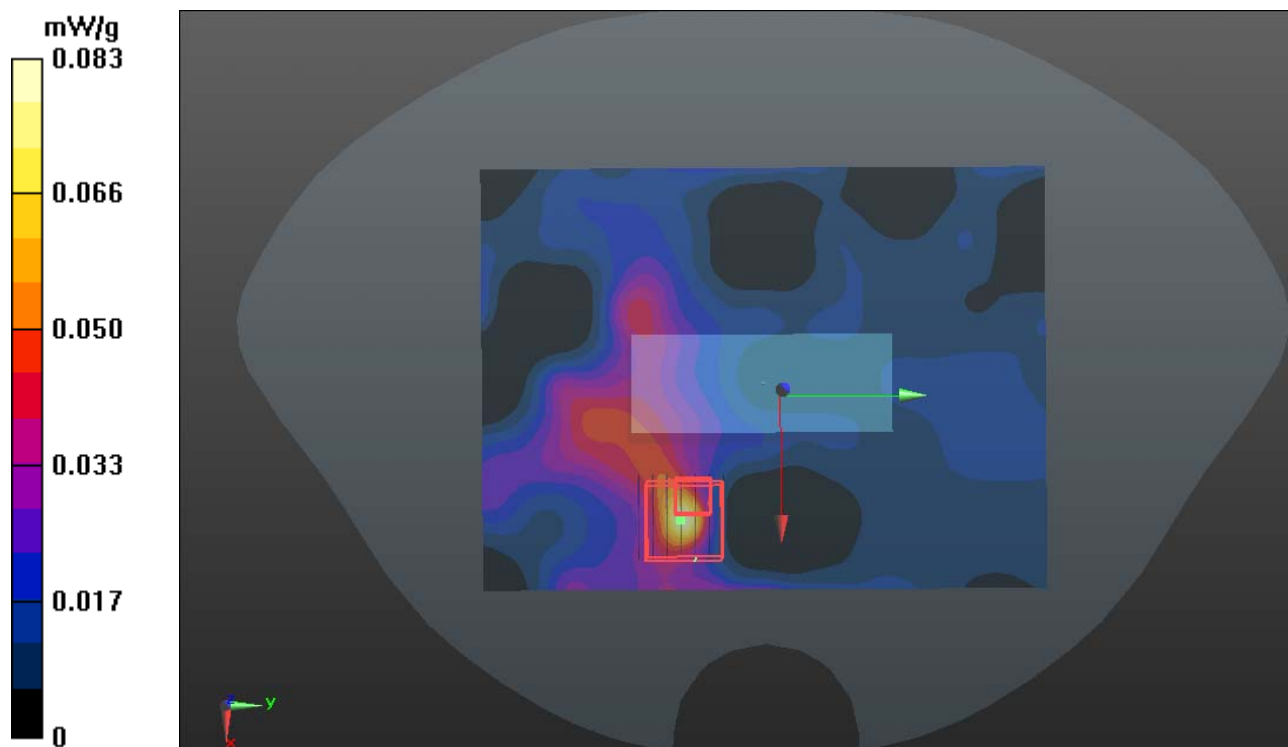
Ch116/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 2.139 V/m; Power Drift = -0.30 dB

Peak SAR (extrapolated) = 0.9880

SAR(1 g) = 0.007 mW/g; SAR(10 g) = 0.000995 mW/g

Maximum value of SAR (measured) = 0.988 mW/g



P86 802.11n_HT20_Vertictal Down_2cm_Ch116_0x3**DUT: 111012E09**

Communication System: WLAN 5G; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium: B5G_0104 Medium parameters used: $f = 5580$ MHz; $\sigma = 5.777$ mho/m; $\epsilon_r = 46.903$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.2 °C ; Liquid Temperature : 21.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.01, 4.01, 4.01); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: SAM Phantom_Left; Type: SAM; Serial: 1202
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Ch116/Area Scan (121x161x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.045 mW/g

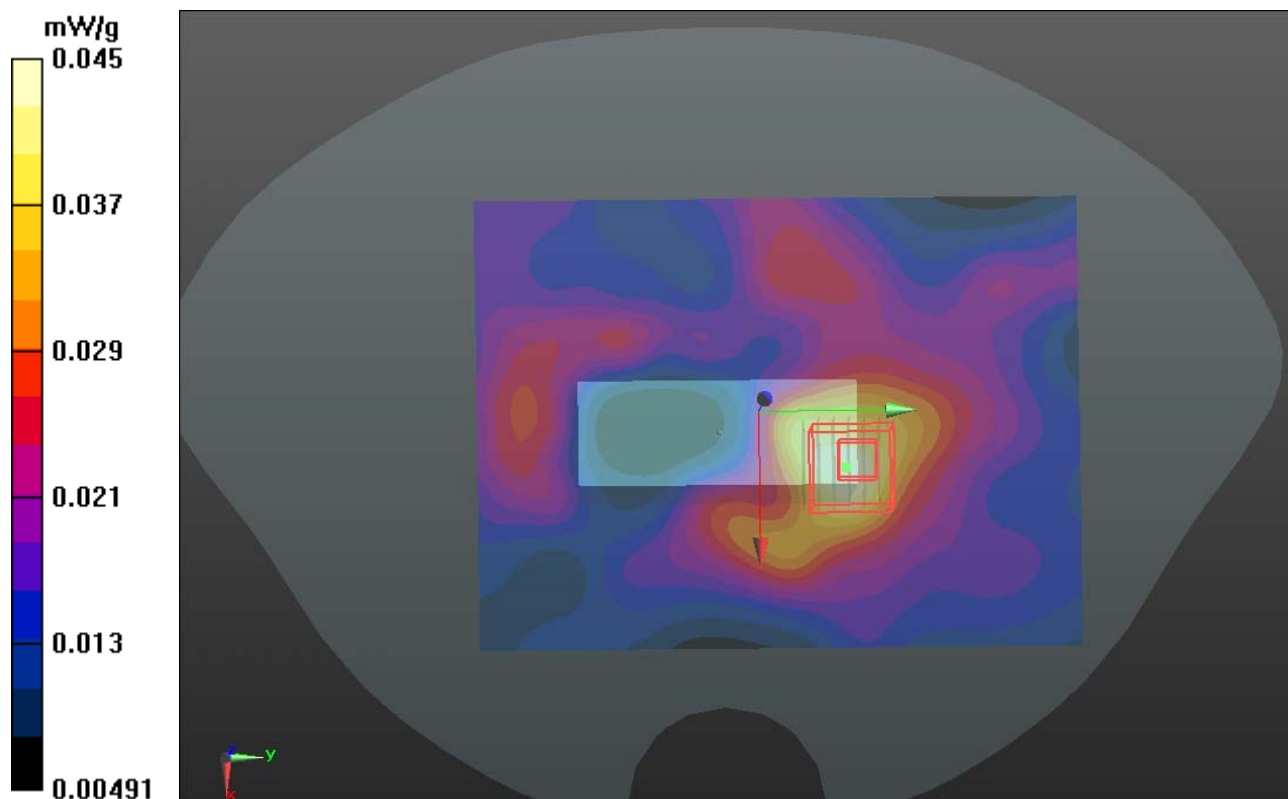
Ch116/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.028 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.3050

SAR(1 g) = 0.018 mW/g; SAR(10 g) = 0.00846 mW/g

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



P76 802.11a_Horizontal Up_2cm_Ch165_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5825$ MHz; $\sigma = 6.3$ mho/m; $\epsilon_r = 47.015$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.3 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch165/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

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

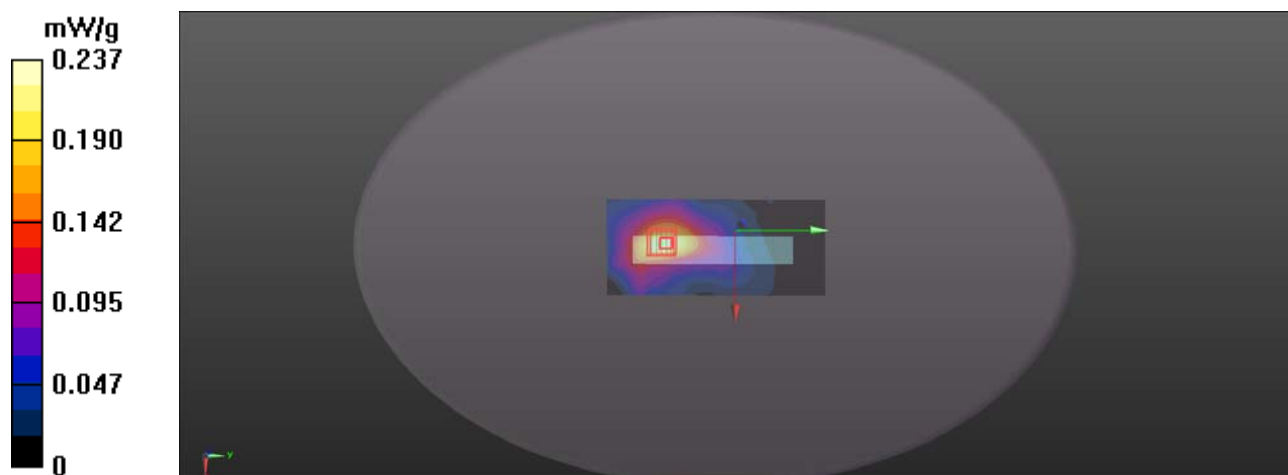
Ch165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 3.925 V/m; Power Drift = -0.126 dB

Peak SAR (extrapolated) = 0.577 W/kg

SAR(1 g) = 0.138 mW/g; SAR(10 g) = 0.053 mW/g

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



P77 802.11a_Horizontal Down_2cm_Ch165_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5825$ MHz; $\sigma = 6.3$ mho/m; $\epsilon_r = 47.015$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.1 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch165/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.272 mW/g

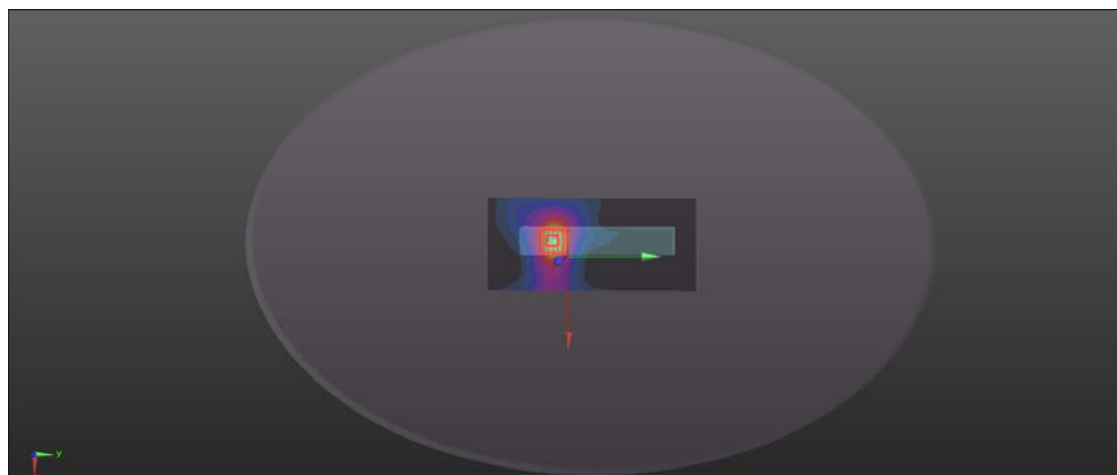
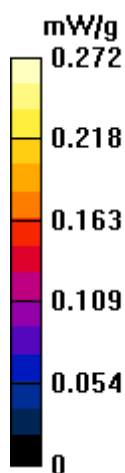
Ch165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

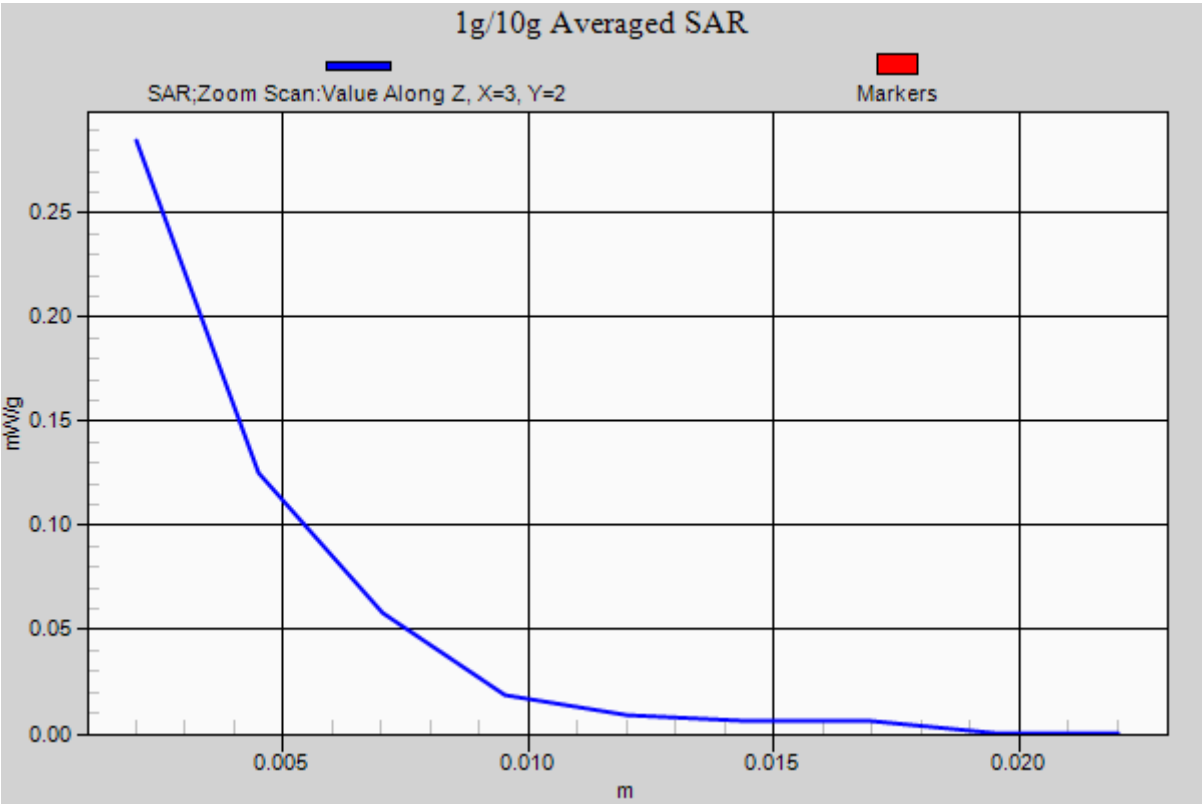
Reference Value = 1.904 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.530 W/kg

SAR(1 g) = 0.147 mW/g; SAR(10 g) = 0.056 mW/g

Maximum value of SAR (measured) = 0.285 mW/g





P78 802.11a_Vertictal Up_2cm_Ch165_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5825$ MHz; $\sigma = 6.3$ mho/m; $\epsilon_r = 47.015$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.3 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch165/Area Scan (121x161x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.129 mW/g

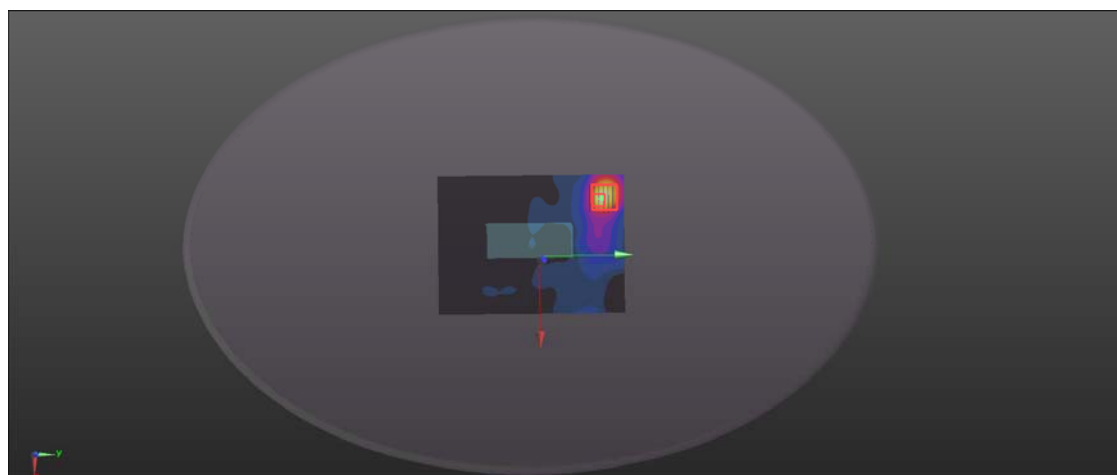
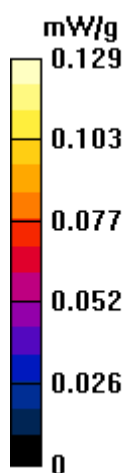
Ch165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.320 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.281 W/kg

SAR(1 g) = 0.054 mW/g; SAR(10 g) = 0.018 mW/g

Maximum value of SAR (measured) = 0.133 mW/g



P79 802.11a_Vertictal Down_2cm_Ch165_0x2**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5825$ MHz; $\sigma = 6.3$ mho/m; $\epsilon_r = 47.015$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.2 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch165/Area Scan (101x141x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.083 mW/g

Ch165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.599 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.206 W/kg

SAR(1 g) = 0.050 mW/g; SAR(10 g) = 0.028 mW/g

Maximum value of SAR (measured) = 0.084 mW/g

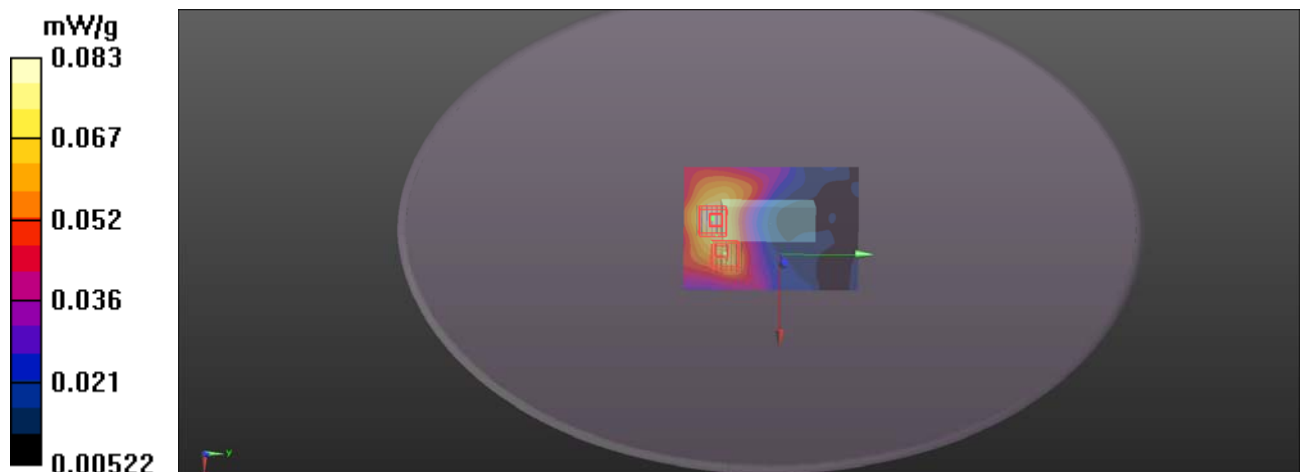
Ch165/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.599 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.196 W/kg

SAR(1 g) = 0.046 mW/g; SAR(10 g) = 0.022 mW/g

Maximum value of SAR (measured) = 0.083 mW/g



P80 802.11a_Horizontal Down_2cm_Ch165_0x3**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5825$ MHz; $\sigma = 6.3$ mho/m; $\epsilon_r = 47.015$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.3 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch165/Area Scan (101x181x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.088 mW/g

Ch165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.590 V/m; Power Drift = -0.046 dB

Peak SAR (extrapolated) = 0.209 W/kg

SAR(1 g) = 0.050 mW/g; SAR(10 g) = 0.019 mW/g

Maximum value of SAR (measured) = 0.097 mW/g

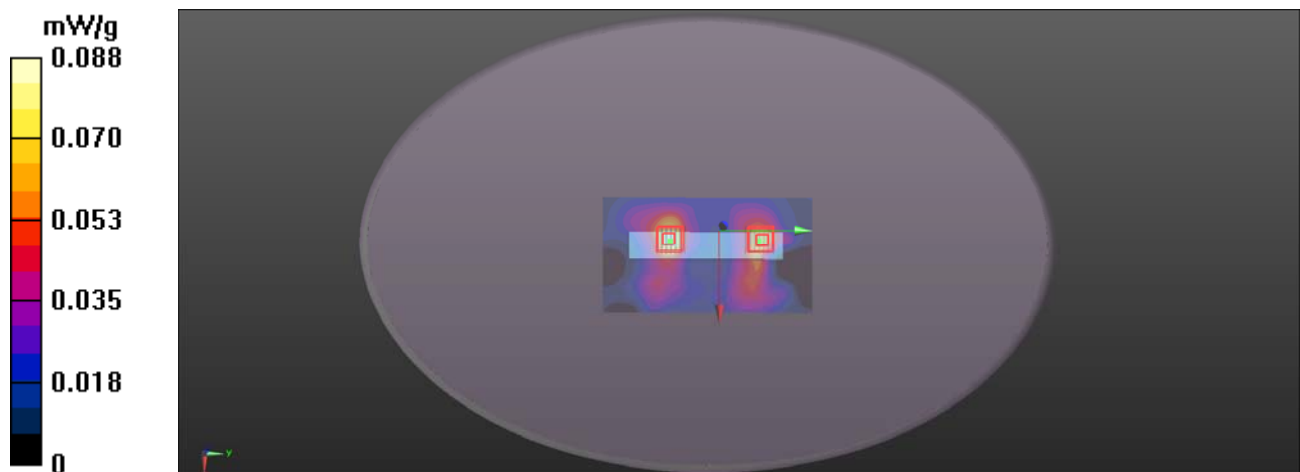
Ch165/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.590 V/m; Power Drift = -0.046 dB

Peak SAR (extrapolated) = 0.144 W/kg

SAR(1 g) = 0.035 mW/g; SAR(10 g) = 0.013 mW/g

Maximum value of SAR (measured) = 0.071 mW/g



P82 802.11n_HT20_Horizontal Down_2cm_Ch165_0x3**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5825$ MHz; $\sigma = 6.3$ mho/m; $\epsilon_r = 47.015$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.3 °C; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch165/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

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

Ch165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 2.488 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 0.214 W/kg

SAR(1 g) = 0.059 mW/g; SAR(10 g) = 0.028 mW/g

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

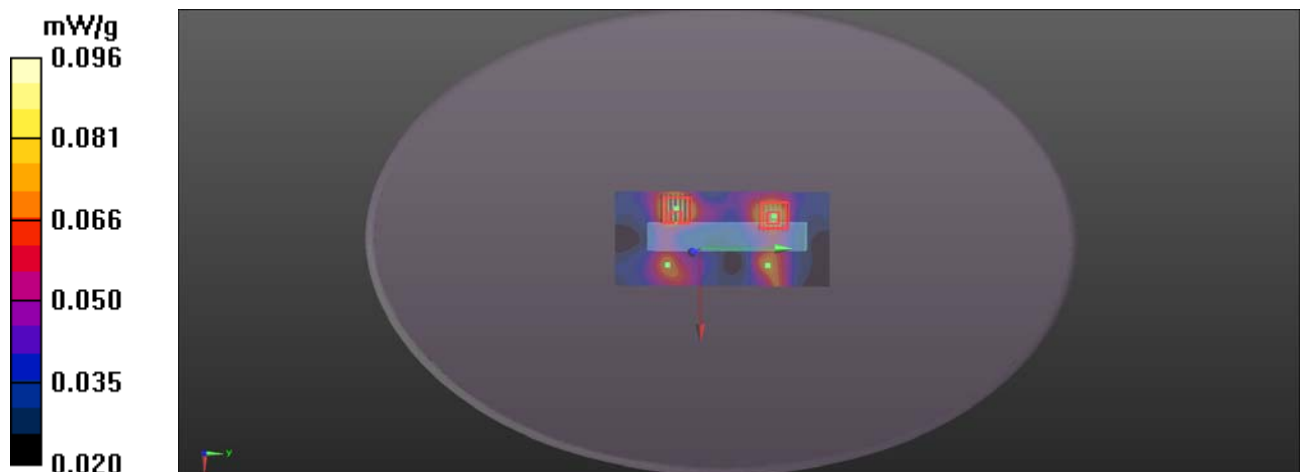
Ch165/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 2.488 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 0.196 W/kg

SAR(1 g) = 0.055 mW/g; SAR(10 g) = 0.025 mW/g

Maximum value of SAR (measured) = 0.097 mW/g



P83 802.11n_HT40_Horizontal Down_2cm_Ch151_0x3**DUT: 111012E09**

Communication System: WLAN_5G; Frequency: 5755 MHz; Duty Cycle: 1:1

Medium: B5G_1212 Medium parameters used: $f = 5755$ MHz; $\sigma = 6.276$ mho/m; $\epsilon_r = 47.248$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.3 °C ; Liquid Temperature : 21 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: ELI v4.0; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch151/Area Scan (81x181x1): Measurement grid: dx=10mm, dy=10mm

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

Ch151/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 2.055 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.263 W/kg

SAR(1 g) = 0.062 mW/g; SAR(10 g) = 0.032 mW/g

Maximum value of SAR (measured) = 0.107 mW/g

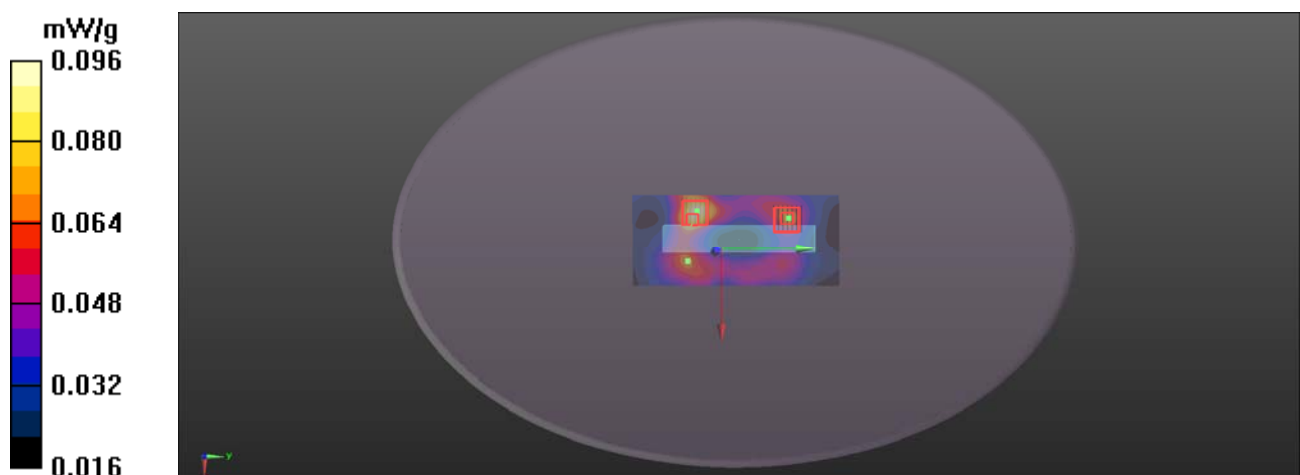
Ch151/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 2.055 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.216 W/kg

SAR(1 g) = 0.050 mW/g; SAR(10 g) = 0.026 mW/g

Maximum value of SAR (measured) = 0.090 mW/g



P87 802.11n_HT20_Horizontal Up_2cm_Ch165_0x3**DUT: 111012E09**

Communication System: WLAN 5G; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: B5G_0104 Medium parameters used: $f = 5825$ MHz; $\sigma = 6.285$ mho/m; $\epsilon_r = 46.493$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.2 °C ; Liquid Temperature : 21.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: SAM Phantom_Left; Type: SAM; Serial: 1202
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Ch165/Area Scan (101x181x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.087 mW/g

Ch165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 3.202 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.1940

SAR(1 g) = 0.032 mW/g; SAR(10 g) = 0.012 mW/g

Maximum value of SAR (measured) = 0.083 mW/g

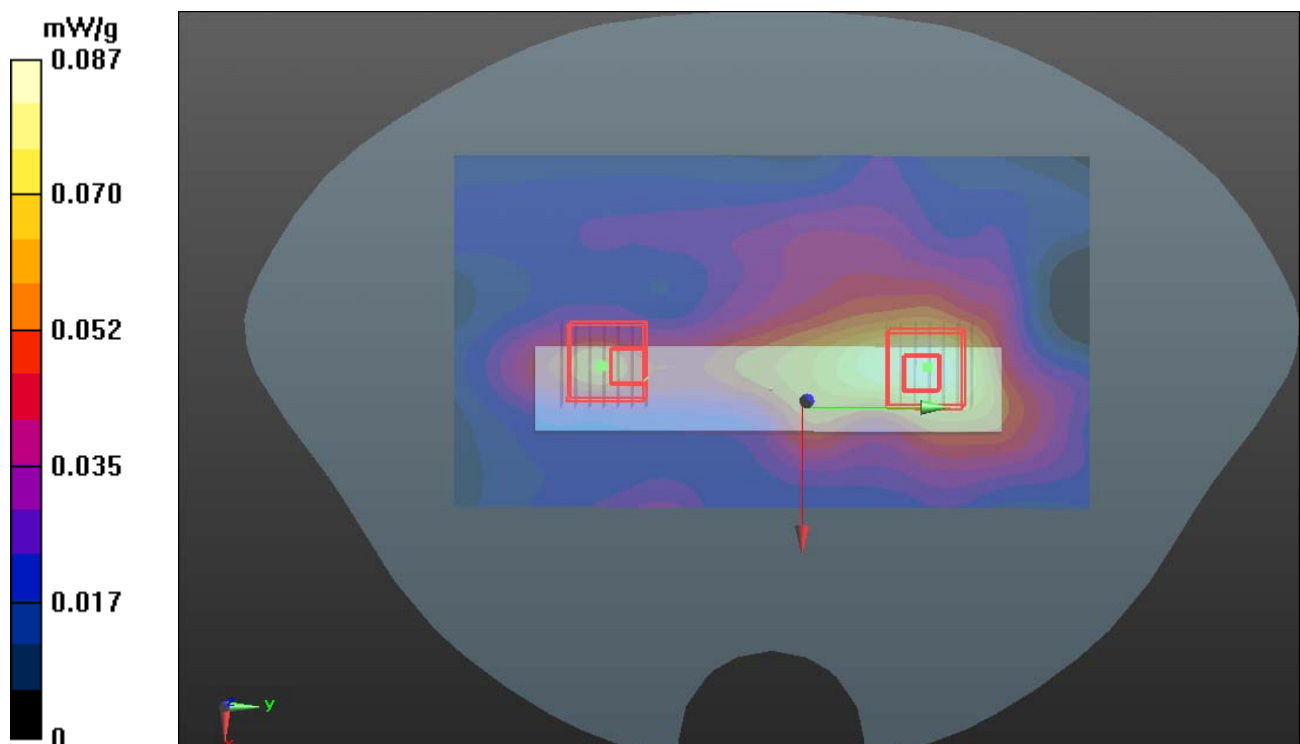
Ch165/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 3.202 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.2570

SAR(1 g) = 0.026 mW/g; SAR(10 g) = 0.010 mW/g

Maximum value of SAR (measured) = 0.051 mW/g



P88 802.11n_HT20_Vertictal Up_2cm_Ch165_0x3

DUT: 111012E09

Communication System: WLAN 5G; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: B5G_0104 Medium parameters used: $f = 5825$ MHz; $\sigma = 6.285$ mho/m; $\epsilon_r = 46.493$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.2 °C; Liquid Temperature : 21.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: SAM Phantom_Left; Type: SAM; Serial: 1202
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Ch165/Area Scan (121x161x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.079 mW/g

Ch165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.461 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.4350

SAR(1 g) = 0.042 mW/g; SAR(10 g) = 0.00992 mW/g

Maximum value of SAR (measured) = 0.314 mW/g

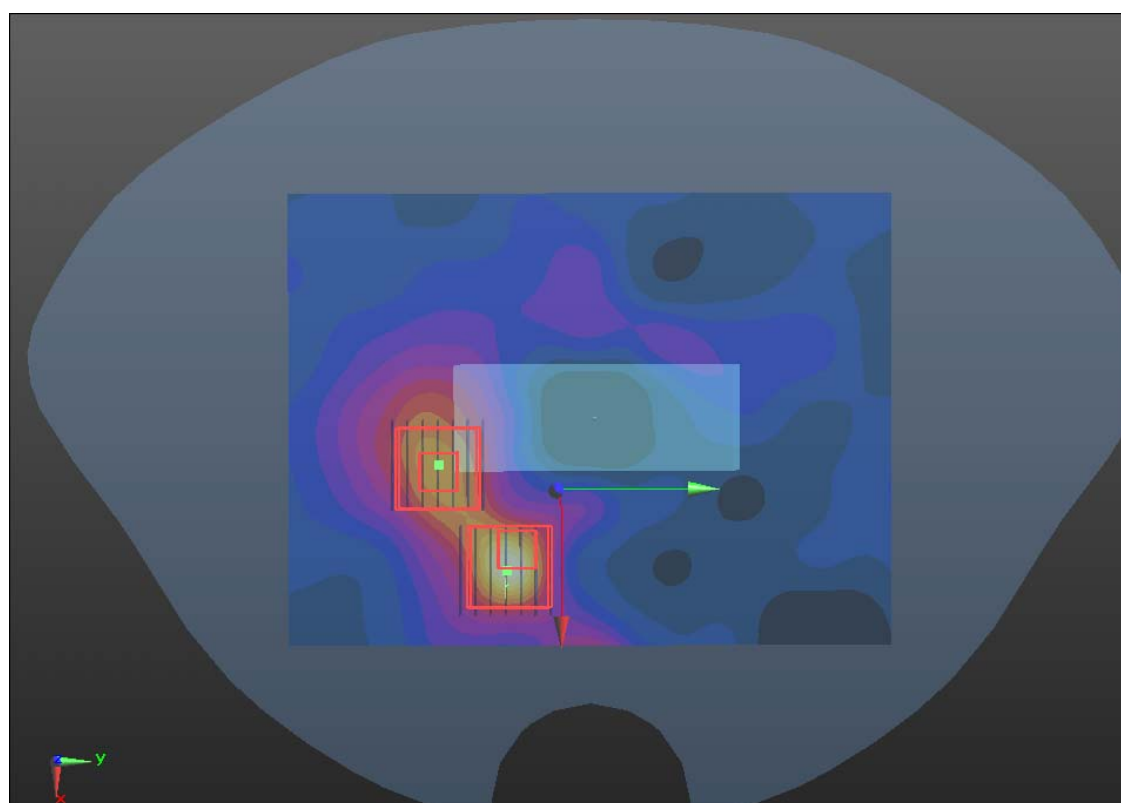
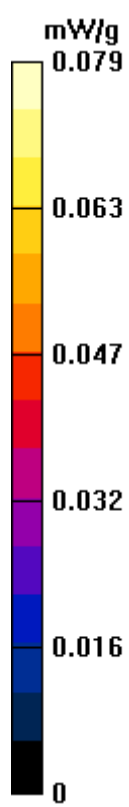
Ch165/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.461 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.2960

SAR(1 g) = 0.031 mW/g; SAR(10 g) = 0.013 mW/g

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



P89 802.11n_HT20_Vertictal Down_2cm_Ch165_0x3

DUT: 111012E09

Communication System: WLAN 5G; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: B5G_0104 Medium parameters used: $f = 5825$ MHz; $\sigma = 6.285$ mho/m; $\epsilon_r = 46.493$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.2 °C; Liquid Temperature : 21.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3590; ConvF(4.55, 4.55, 4.55); Calibrated: 2011/02/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/08/29
- Phantom: SAM Phantom_Left; Type: SAM; Serial: 1202
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Ch165/Area Scan (121x161x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.059 mW/g

Ch165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.611 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.2470

SAR(1 g) = 0.026 mW/g; SAR(10 g) = 0.011 mW/g

Maximum value of SAR (measured) = 0.059 mW/g

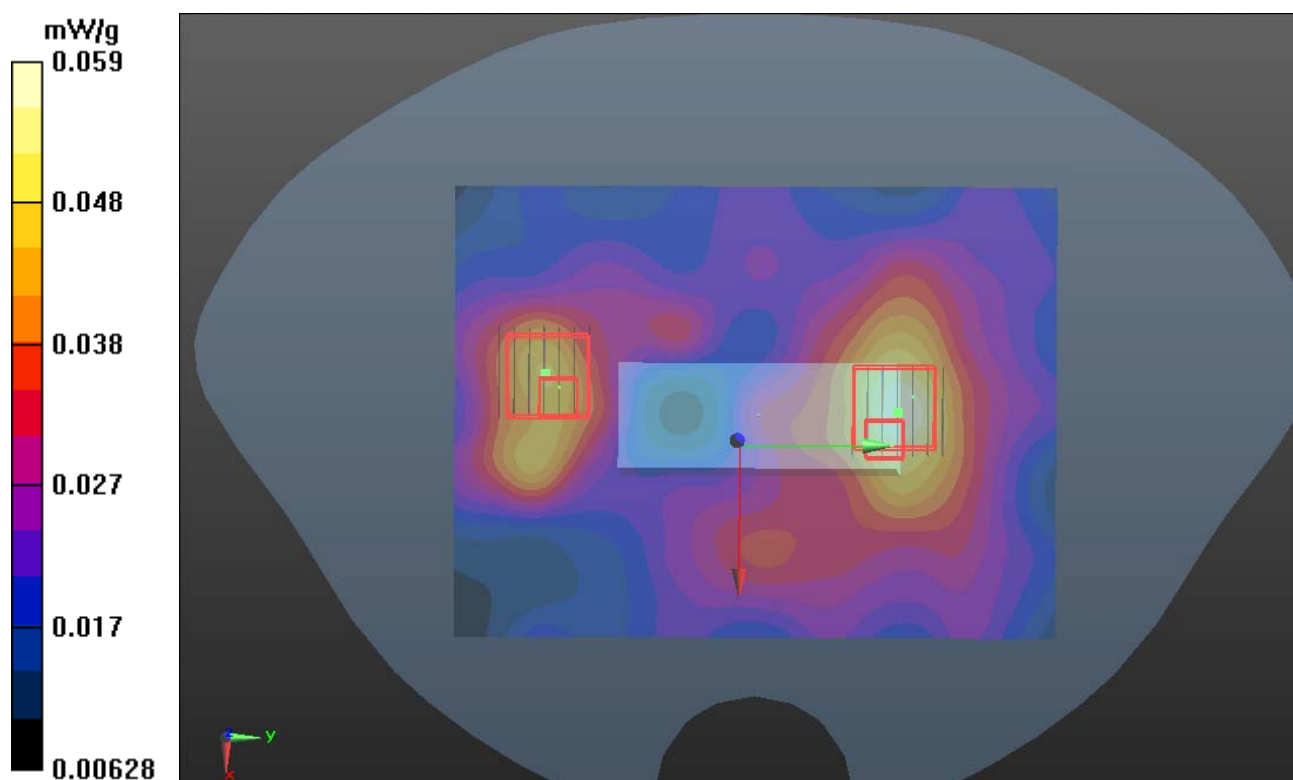
Ch165/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.611 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.2010

SAR(1 g) = 0.021 mW/g; SAR(10 g) = 0.00944 mW/g

Maximum value of SAR (measured) = 0.046 mW/g





Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG calibration certificates are shown as follows.



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Client **BV ADT (Auden)**

Certificate No: **EX3-3590_Feb11**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3590**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v3
 Calibration procedure for dosimetric E-field probes**

Calibration date: **February 25, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	01-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	
Issued: February 25, 2011			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}** are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- VR**: VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV4

SN:3590

Manufactured: March 23, 2009
Calibrated: February 25, 2011

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3590

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V/m})^2$) ^A	0.51	0.48	0.51	$\pm 10.1 \%$
DCP (mV) ^B	94.6	95.5	92.8	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	119.0	$\pm 2.7 \%$
			Y	0.00	0.00	1.00	141.4	
			Z	0.00	0.00	1.00	115.0	

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

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

^B Numerical linearization parameter; uncertainty not required.

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3590

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	41.5	0.90	10.21	10.21	10.21	0.56	0.68	± 12.0 %
1640	40.3	1.29	9.25	9.25	9.25	0.68	0.60	± 12.0 %
1750	40.1	1.37	9.03	9.03	9.03	0.79	0.58	± 12.0 %
1950	40.0	1.40	8.45	8.45	8.45	0.55	0.66	± 12.0 %
2300	39.5	1.67	8.14	8.14	8.14	0.40	0.80	± 12.0 %
2450	39.2	1.80	7.73	7.73	7.73	0.29	1.00	± 12.0 %
2600	39.0	1.96	7.53	7.53	7.53	0.28	1.06	± 12.0 %
3500	37.9	2.91	7.55	7.55	7.55	0.36	1.03	± 13.1 %
5200	36.0	4.66	5.51	5.51	5.51	0.30	1.80	± 13.1 %
5300	35.9	4.76	5.17	5.17	5.17	0.30	1.80	± 13.1 %
5500	35.6	4.96	5.00	5.00	5.00	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.52	4.52	4.52	0.50	1.80	± 13.1 %
5800	35.3	5.27	4.53	4.53	4.53	0.50	1.80	± 13.1 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: EX3DV4- SN:3590

Calibration Parameter Determined in Body Tissue Simulating Media

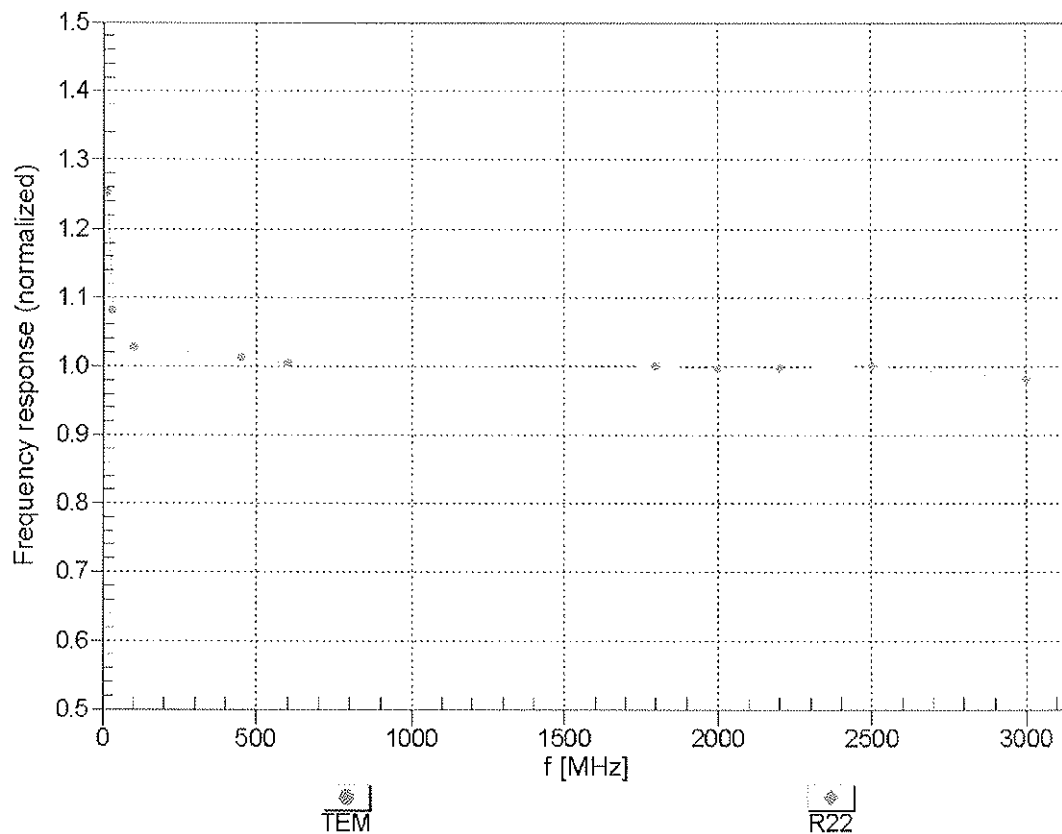
f (MHz) ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	10.32	10.32	10.32	0.38	0.82	± 12.0 %
1640	53.8	1.40	9.72	9.72	9.72	0.51	0.79	± 12.0 %
1750	53.4	1.49	8.77	8.77	8.77	0.37	0.92	± 12.0 %
1950	53.3	1.52	8.49	8.49	8.49	0.60	0.67	± 12.0 %
2300	52.9	1.81	8.08	8.08	8.08	0.30	1.00	± 12.0 %
2450	52.7	1.95	7.91	7.91	7.91	0.42	0.82	± 12.0 %
2600	52.5	2.16	7.78	7.78	7.78	0.25	1.17	± 12.0 %
3500	51.3	3.31	7.14	7.14	7.14	0.43	0.96	± 13.1 %
5200	49.0	5.30	4.81	4.81	4.81	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.56	4.56	4.56	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.32	4.32	4.32	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.01	4.01	4.01	0.60	1.90	± 13.1 %
5800	48.2	6.00	4.55	4.55	4.55	0.50	1.90	± 13.1 %

^c Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^f At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

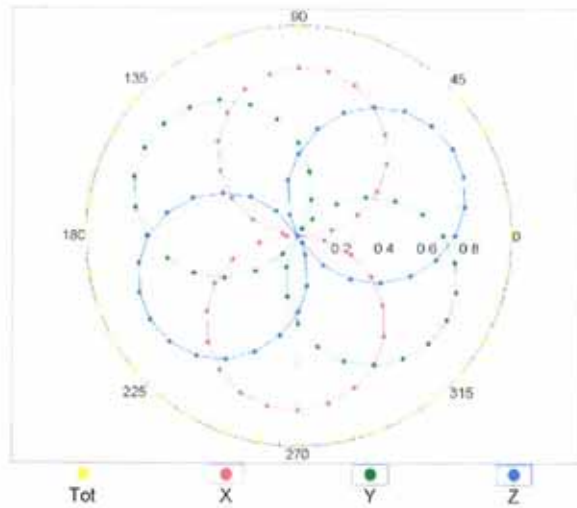
(TEM-Cell:ifi110 EXX, Waveguide: R22)



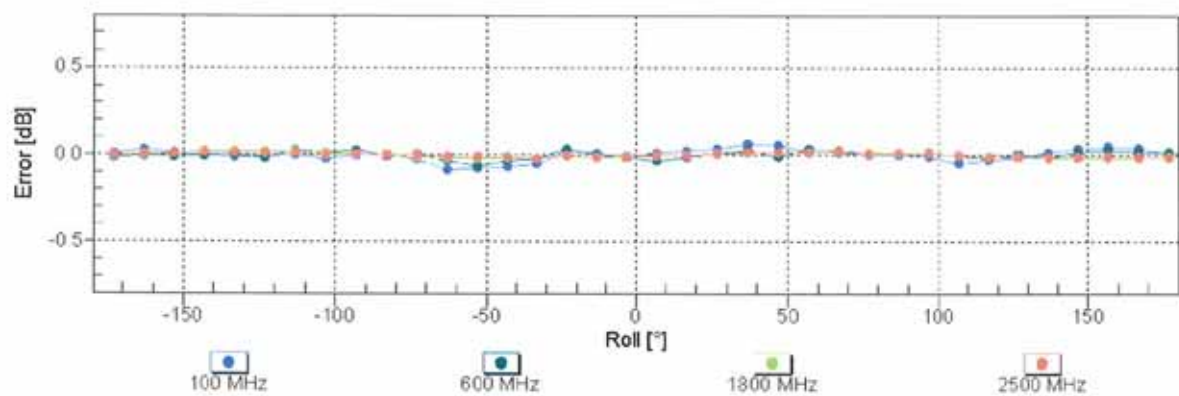
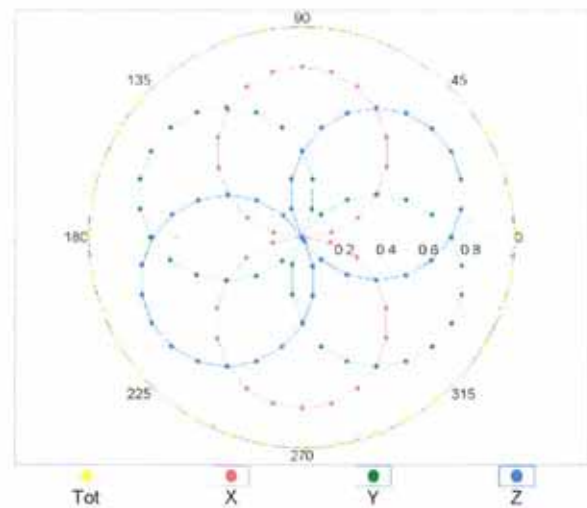
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz, TEM



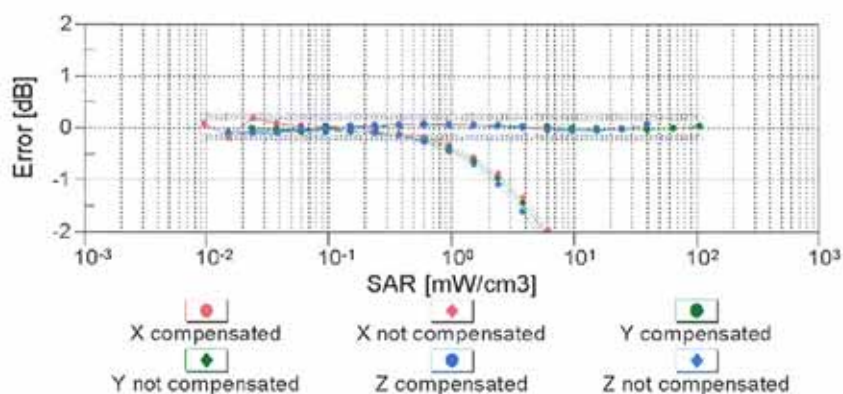
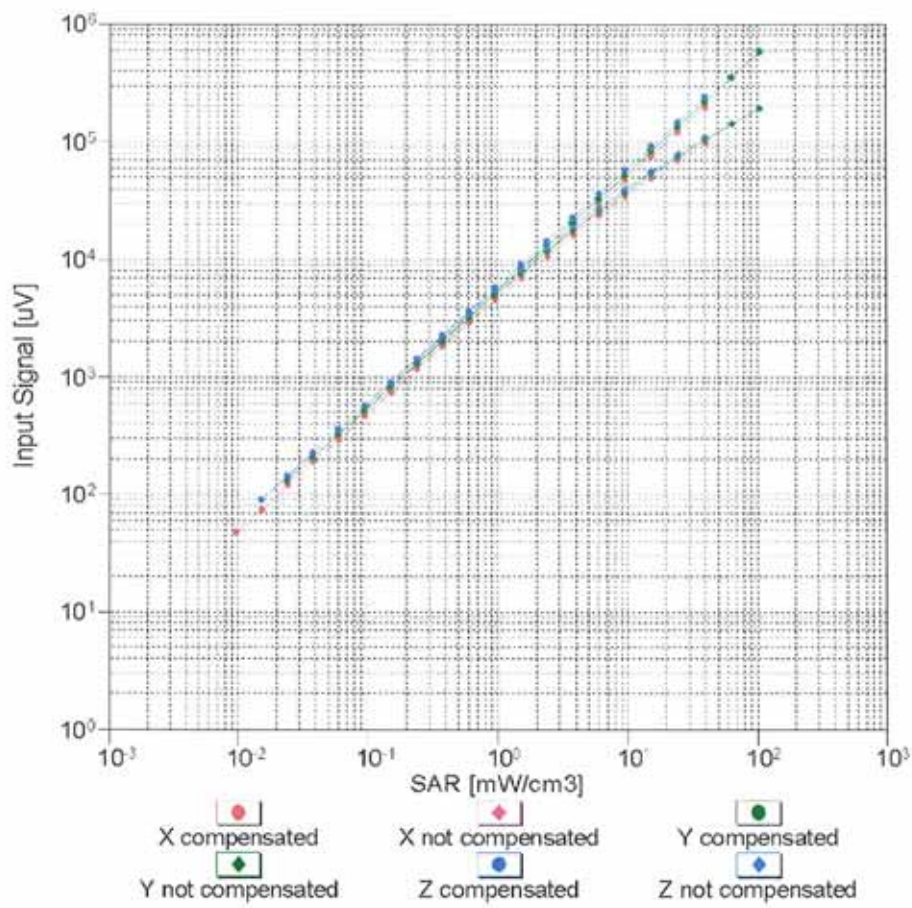
f=1800 MHz, R22



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

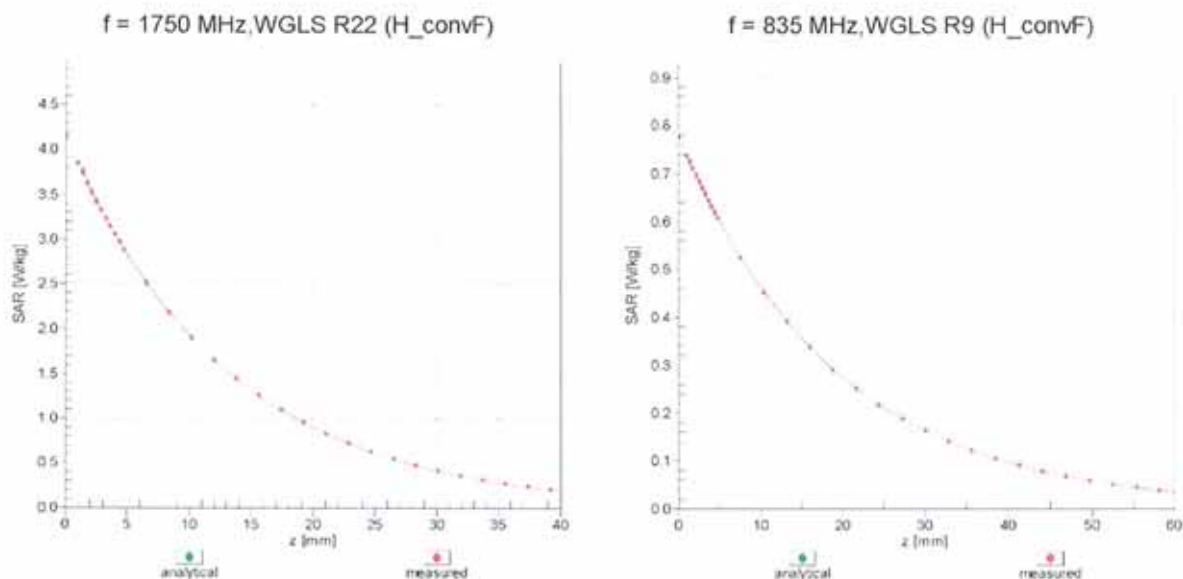
Dynamic Range f(SAR_{head})

(TEM cell , f = 900 MHz)



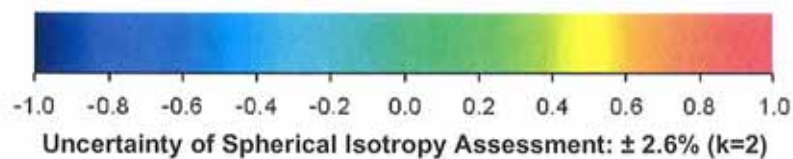
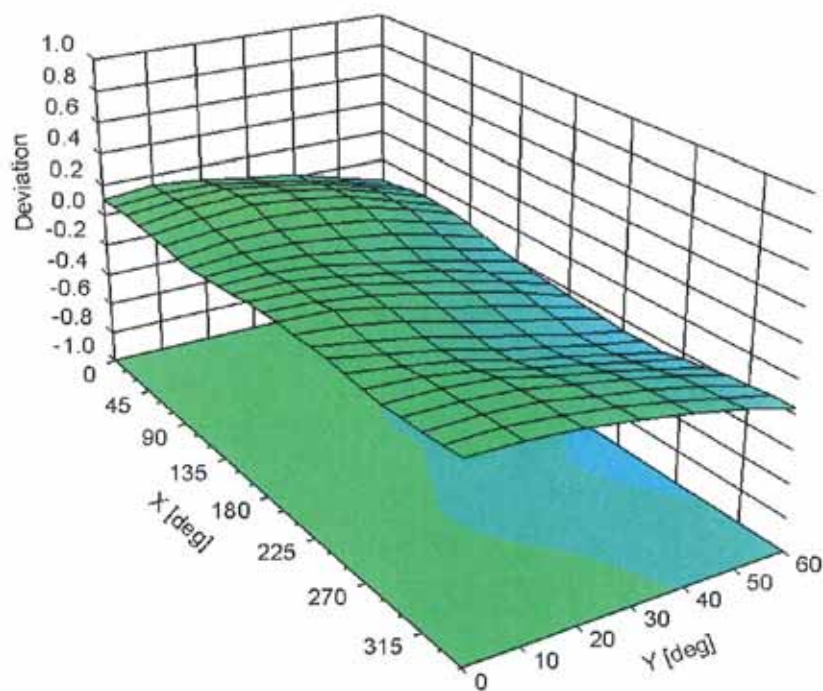
Uncertainty of Linearity Assessment: $\pm 0.6\%$ (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Air

Error (ϕ, ϑ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3590

Other Probe Parameters

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



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

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

Certificate No: **D2450V2-716_Jan11**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 716**

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

Calibration date: **January 26, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 27, 2011

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



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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.9 $\pm$ 6 %	1.74 mho/m $\pm$ 6 %
Head TSL temperature during test	(20.5 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 mW / g
SAR normalized	normalized to 1W	54.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	54.8 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.37 mW / g
SAR normalized	normalized to 1W	25.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.5 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.5 ± 6 %	1.96 mho/m ± 6 %
Body TSL temperature during test	(20.8 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.4 mW / g
SAR normalized	normalized to 1W	53.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	53.3 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.22 mW / g
SAR normalized	normalized to 1W	24.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.8 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$55.0\ \Omega + 2.1\ j\Omega$
Return Loss	- 25.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.1\ \Omega + 4.4\ j\Omega$
Return Loss	- 27.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.143 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date/Time: 24.01.2011 13:05:38

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL U12 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.75$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

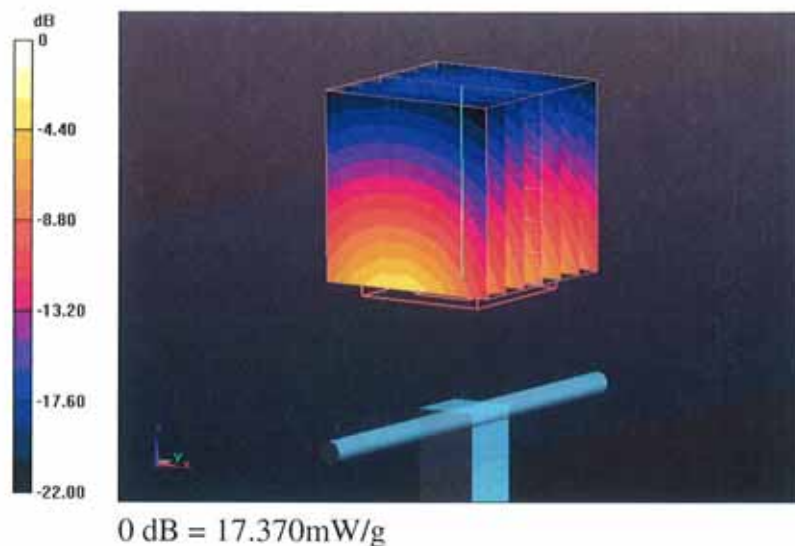
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.2 V/m; Power Drift = 0.05 dB

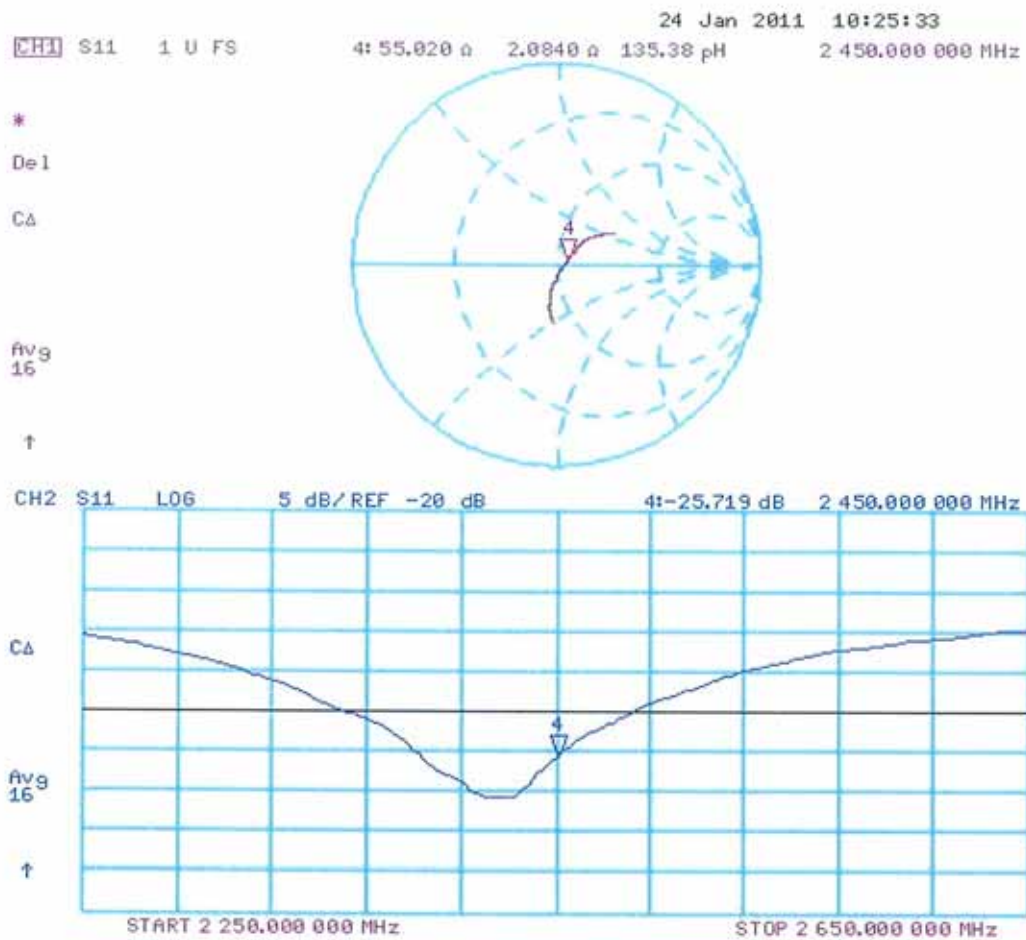
Peak SAR (extrapolated) = 27.976 W/kg

SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.37 mW/g

Maximum value of SAR (measured) = 17.366 mW/g



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 26.01.2011 13:56:41

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: MSL U12 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.97$ mho/m; $\epsilon_r = 52.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

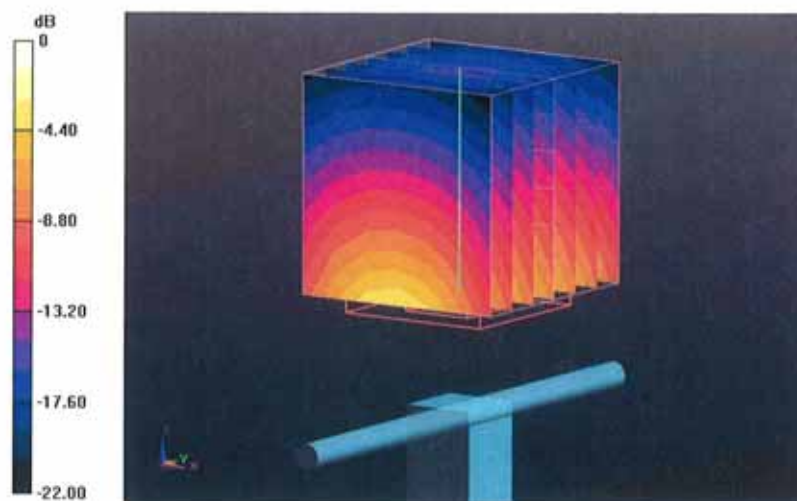
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.445 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 28.276 W/kg

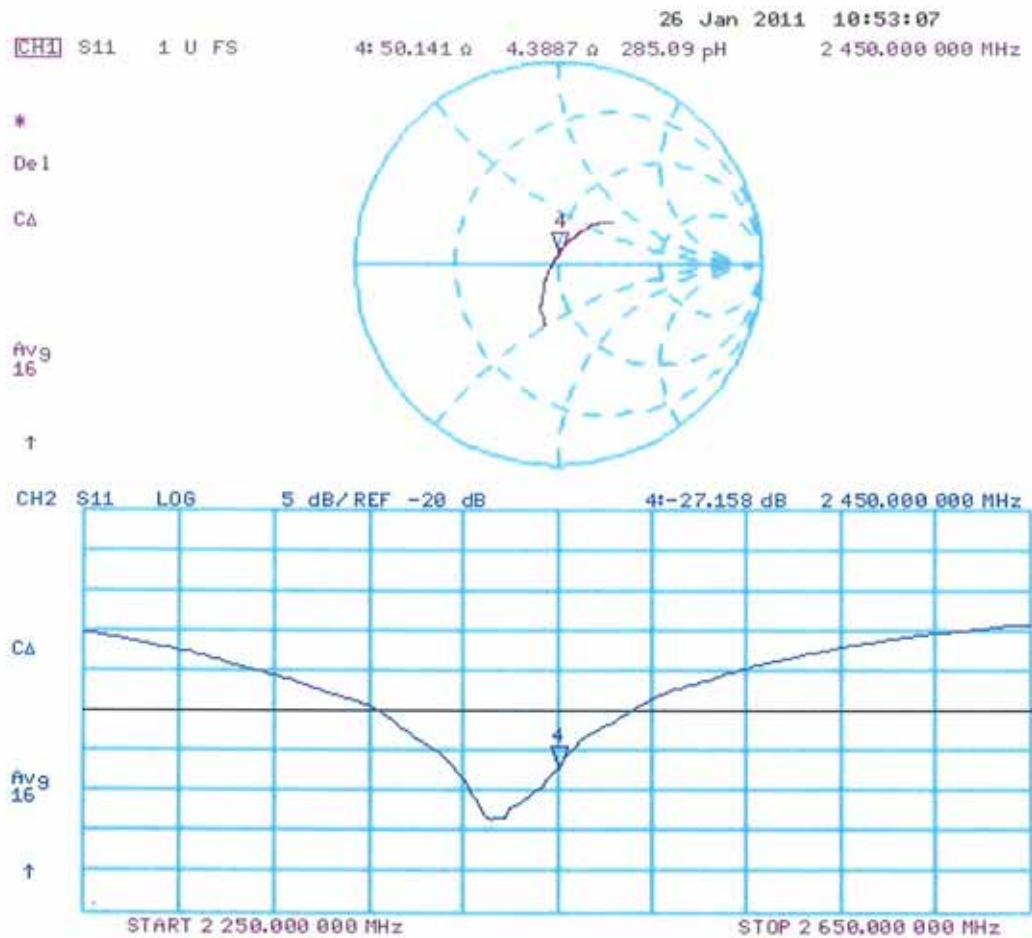
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.22 mW/g

Maximum value of SAR (measured) = 17.680 mW/g



0 dB = 17.680mW/g

Impedance Measurement Plot for Body TSL





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

Accreditation No.: **SCS 108**

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

Certificate No: **D5GHzV2-1019_Jan11**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1019**

Calibration procedure(s) **QA CAL-22.v1**
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: **January 25, 2011**

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

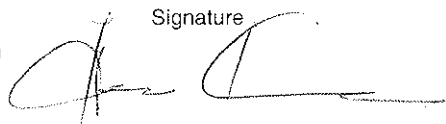
All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe EX3DV4	SN: 3503	05-Mar-10 (No. EX3-3503_Mar10)	Mar-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Jeton Kastrati** Name
 Laboratory Technician Function

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

Signature



Issued: January 25, 2011

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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
- b) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan resolution	dx, dy = 10 mm	
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 2.0 mm	
Frequency	5200 MHz $\pm$ 1 MHz 5500 MHz $\pm$ 1 MHz 5800 MHz $\pm$ 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	35.3 $\pm$ 6 %	4.50 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.8 $\pm$ 0.2) °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.21 mW / g
SAR normalized	normalized to 1W	82.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	81.8 mW / g $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 mW / g
SAR normalized	normalized to 1W	23.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	23.1 mW / g $\pm$ 19.5 % (k=2)

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.2 ± 6 %	4.86 mho/m ± 6 %
Head TSL temperature during test	(21.8 ± 0.2) °C	-----	-----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.87 mW / g
SAR normalized	normalized to 1W	88.7 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	88.9 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.49 mW / g
SAR normalized	normalized to 1W	24.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.9 mW / g ± 19.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	5.17 mho/m ± 6 %
Head TSL temperature during test	(21.8 ± 0.2) °C	-----	-----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.32 mW / g
SAR normalized	normalized to 1W	83.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	83.2 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 mW / g
SAR normalized	normalized to 1W	23.3 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	23.3 mW / g ± 19.5 % (k=2)

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.2 ± 6 %	5.37 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	7.77 mW / g
SAR normalized	normalized to 1W	77.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	77.1 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.15 mW / g
SAR normalized	normalized to 1W	21.5 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.3 mW / g ± 19.5 % (k=2)

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.6 ± 6 %	5.75 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	8.31 mW / g
SAR normalized	normalized to 1W	83.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	82.4 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.29 mW / g
SAR normalized	normalized to 1W	22.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	22.7 mW / g ± 19.5 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.1 ± 6 %	6.14 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	7.40 mW / g
SAR normalized	normalized to 1W	74.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	73.4 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.02 mW / g
SAR normalized	normalized to 1W	20.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.0 mW / g ± 19.5 % (k=2)

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	$51.9\ \Omega - 8.4\ j\Omega$
Return Loss	-21.5 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	$51.4\ \Omega - 2.1\ j\Omega$
Return Loss	-31.9 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	$56.3\ \Omega + 2.6\ j\Omega$
Return Loss	-23.9 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	$51.8\ \Omega - 6.7\ j\Omega$
Return Loss	-23.3 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	$51.6\ \Omega - 0.4\ j\Omega$
Return Loss	-36.0 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	$56.4\ \Omega + 3.9\ j\Omega$
Return Loss	-23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.204 ns
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After long term use with 40 W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 05, 2004

DASY5 Validation Report for Head TSL

Date/Time: 25.01.2011 15:44:08

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHz; Serial: D5GHzV2 - SN:1019

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: HSL 5000

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.51$ mho/m; $\epsilon_r = 35.3$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5500$ MHz; $\sigma = 4.87$ mho/m; $\epsilon_r = 36.2$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.18$ mho/m; $\epsilon_r = 35.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.36, 5.36, 5.36), ConvF(4.85, 4.85, 4.85), ConvF(4.74, 4.74, 4.74); Calibrated: 05.03.2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=100mW/d=10mm, f=5200 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 63.766 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 31.432 W/kg

SAR(1 g) = 8.21 mW/g; SAR(10 g) = 2.32 mW/g

Maximum value of SAR (measured) = 16.241 mW/g

Pin=100mW/d=10mm, f=5500 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 64.225 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 36.205 W/kg

SAR(1 g) = 8.87 mW/g; SAR(10 g) = 2.49 mW/g

Maximum value of SAR (measured) = 17.917 mW/g

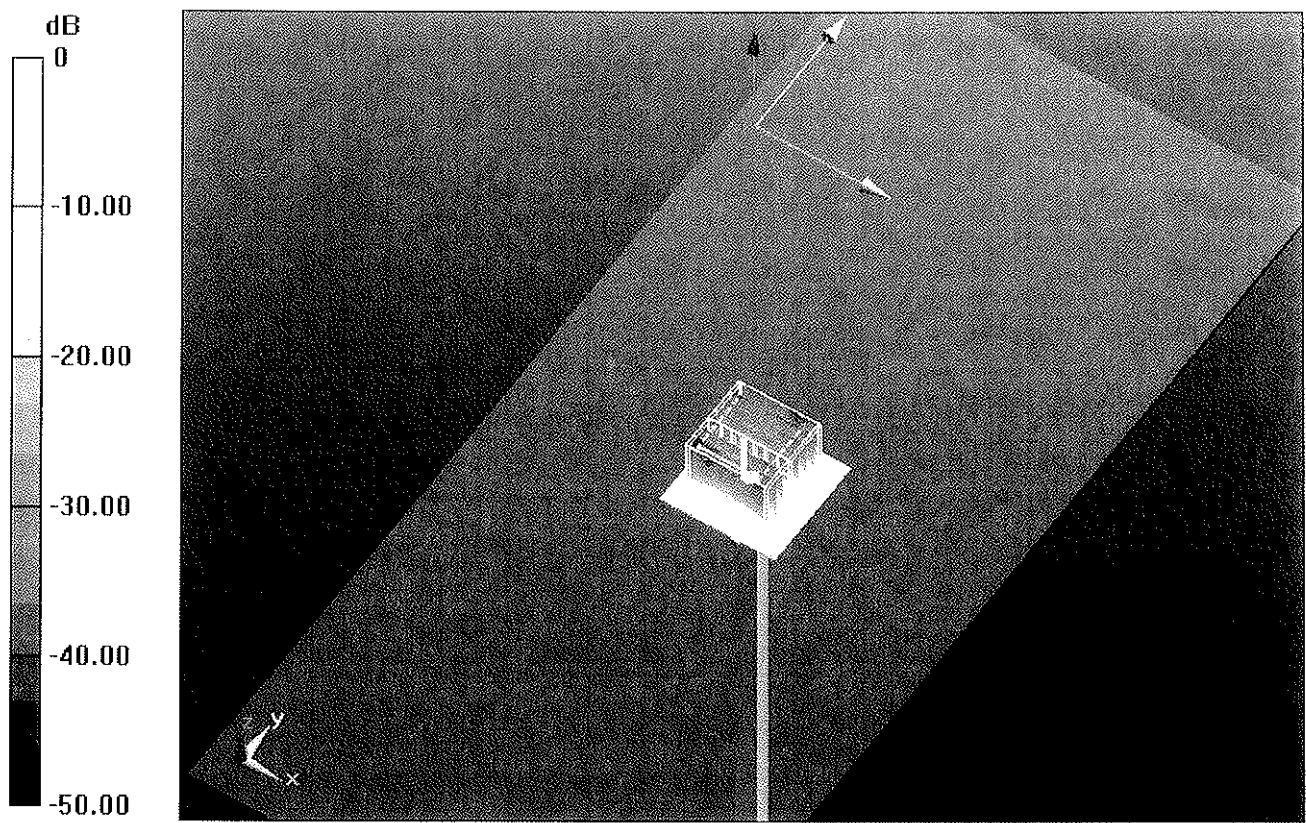
Pin=100mW/d=10mm, f=5800 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 60.818 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 37.120 W/kg

SAR(1 g) = 8.32 mW/g; SAR(10 g) = 2.33 mW/g

Maximum value of SAR (measured) = 16.571 mW/g



0 dB = 16.570mW/g

Impedance Measurement Plot for Head TSL

17 Jan 2011 17:42:04

[CH1] S11 1 U F8 1: 51.904 Ω -8.3555 Ω 3.6631 pF 5 200.000 000 MHz

*

De1

Cor

1
2

CH1 Markers

2: 51.426 Ω
-2.1426 Ω
5.50000 GHz
3: 56.254 Ω
2.5820 Ω
5.80000 GHz

avg
16

↑

CH2 S11 LOG 5 dB/REF -20 dB 1: -21.534 dB 5 200.000 000 MHz

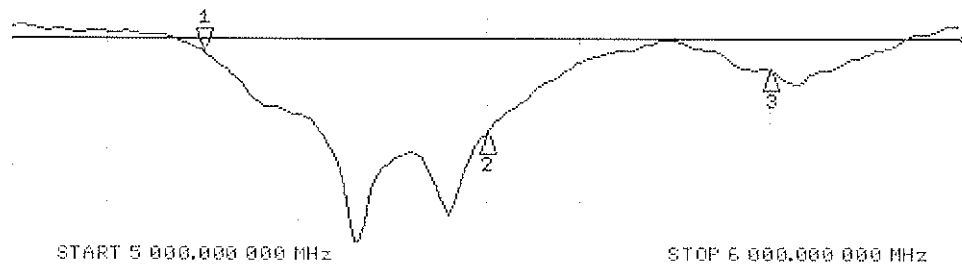
Cor

avg
16

↑

CH2 Markers

2: -31.912 dB
5.50000 GHz
3: -23.923 dB
5.80000 GHz



DASY5 Validation Report for Body TSL

Date/Time: 19.01.2011 11:41:41

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHz; Serial: D5GHzV2 - SN:1019

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: MSL 5000 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.4$ mho/m; $\epsilon_r = 47.2$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.78$ mho/m; $\epsilon_r = 46.6$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5800$ MHz; $\sigma = 6.18$ mho/m; $\epsilon_r = 46.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.88, 4.88, 4.88), ConvF(4.37, 4.37, 4.37), ConvF(4.57, 4.57, 4.57); Calibrated: 05.03.2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=100mW/d=10mm, f=5200 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 60.081 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 30.750 W/kg

SAR(1 g) = 7.77 mW/g; SAR(10 g) = 2.15 mW/g

Maximum value of SAR (measured) = 15.289 mW/g

Pin=100mW/d=10mm, f=5500 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 60.368 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 35.267 W/kg

SAR(1 g) = 8.31 mW/g; SAR(10 g) = 2.29 mW/g

Maximum value of SAR (measured) = 16.599 mW/g

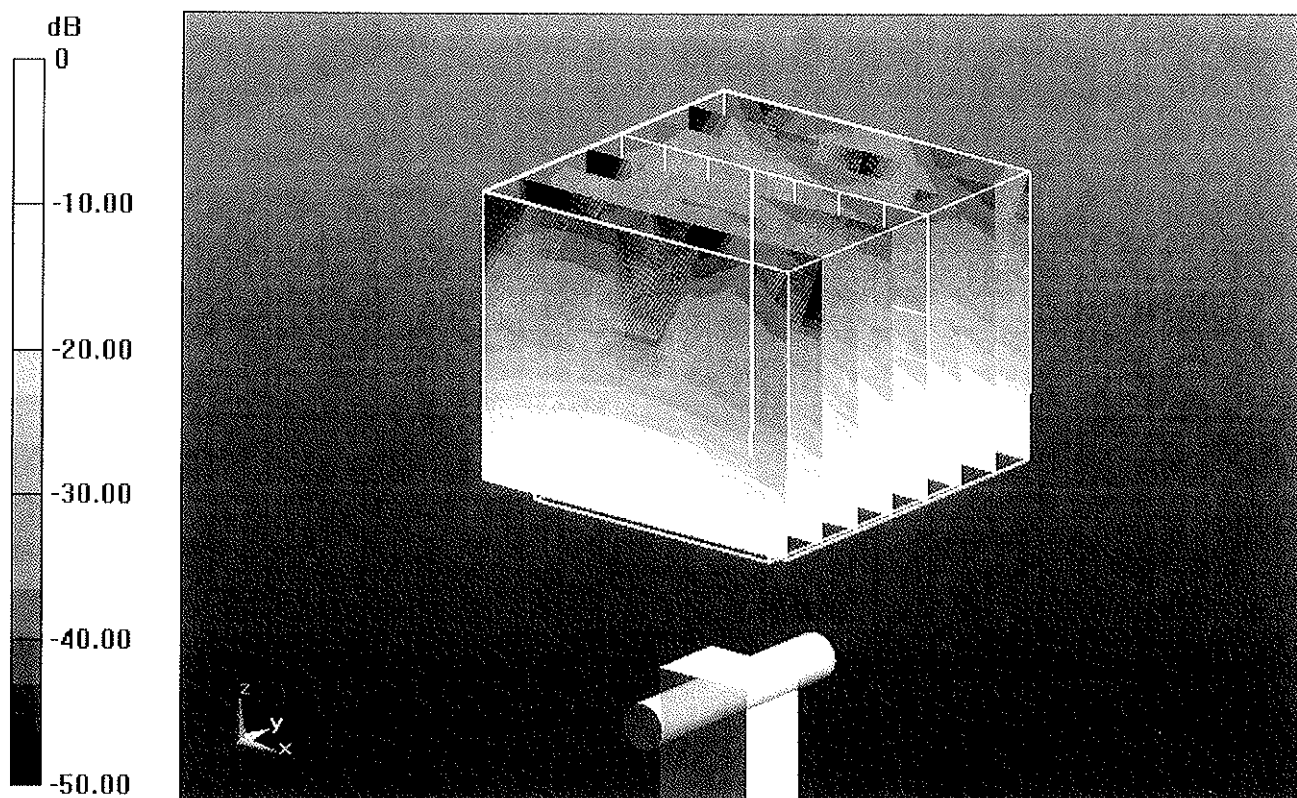
Pin=100mW/d=10mm, f=5800 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 54.998 V/m; Power Drift = -0.0083 dB

Peak SAR (extrapolated) = 35.336 W/kg

SAR(1 g) = 7.4 mW/g; SAR(10 g) = 2.02 mW/g

Maximum value of SAR (measured) = 14.674 mW/g



0 dB = 14.670mW/g

Impedance Measurement Plot for Body TSL

