SAR TEST REPORT

REPORT NO.: SA110718C17

(BRAND)MODEL NO.: (Gemtek)WIXFMM-121
(Huawei)BM3012

FCC ID: MXF-WIXFMM-121

RECEIVED: May 28, 2011

TESTED: Aug. 19 ~ Oct. 13, 2011

ISSUED: Oct. 13, 2011

APPLICANT: Gemtek Technology Co., Ltd.

ADDRESS: No. 15-1, Zhonghua Rd, Hsinchu Industrial Park, Hsinchu County, Taiwan, R.O.C. 303

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

LAB ADDRESS: No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang, Taipei Hsien 244, Taiwan, R.O.C.

TEST LOCATION: No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

Testing Laboratory
2021

TABLE OF CONTENTS

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	N/A	Aug. 26, 2011
R02	Retest SAR for left side position for antenna 1	Oct. 13, 2011

1. CERTIFICATION

PRODUCT:	4G WiFi Spot
(BRAND)MODEL NO.:	(Gemtek)WIXFMM-121 (Huawei)BM3012
APPLICANT:	Gemtek Technology Co., Ltd.
TESTED:	Aug. 19 ~ Oct. 13, 2011
STANDARDS:	**FCC Part 2 (Section 2.1093)** **FCC OET Bulletin 65, Supplement C (01-01)** **IEEE 1528-2003**

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

PREPARED BY : Andrea Hsia / Specialist , **DATE :** Oct. 13, 2011

APPROVED BY : Gary Chang / Technical Manager , **DATE :** Oct. 13, 2011

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

EUT	4G WiFi Spot
(BRAND)MODEL NO.	(Gemtek)WIXFMM-121 (Huawei)BM3012 *refer to note as below
FCC ID	MXF-WIXFMM-121
POWER SUPPLY	5Vdc (adapter, host equipment) 3.7Vdc (battery)
MODULATION TYPE	UL: QPSK1/2, QPSK 3/4, 16QAM1/2, 16QAM 3/4 DL: QPSK1/2, QPSK 3/4, 16QAM1/2, 16QAM 3/4, 64QAM1/2, 64QAM2/3, 64QAM3/4, 64QAM5/6
MODULATION TECHNOLOGY	S-OFDMA
MULTIPLE ACCESS METHOD	TDMA
DUPLEX METHOD	TDD
OPERATING RANGE	2502.5MHz ~ 2687.5MHz
CHANNEL BANDWIDTH	5MHz, 10MHz
AVERAGE SAR (1g)	0.509 W/kg
ANTENNA TYPE	PIFA antenna with 2dBi gain
ACCESSORY DEVICES	Adapter, Battery

NOTE:

1. All models are electrically identical, different model names are for marketing purpose.

Brand	Model
Gemtek	WIXFMM-121
Huawei	BM3012

2. The EUT uses following adapter & battery.

ADAPTER	
BRAND:	DVE
MODEL:	DSC-6PFA-05 FUS 050100
INPUT:	100-240Vac, 50/60Hz, 0.2A
OUTPUT:	5Vdc, 1A
POWER LINE:	1.5m non-shielded cable without core

BATTERY	
MODEL:	GT-2200
RATING:	3.7Vdc, 8.14WH Maximum Charge Current:2.2A Maximum Charge Voltage:4.2V

3. The EUT can supports different UL / DL ratio, max transmit ratio is up to 18 (UL): 29 (DL). After pretesting of output power and spurious emission, 18 (UL): 29 (DL) was found to be worst case and was selected for the final test configuration.

Modulation	Coding Rate	Frequency (MHz)	Main Antenna			Aux Antenna		
			Peak Power	Average Power	PAPR	Peak Power	Average Power	PAPR
QPSK (BW 5MHz)	1/2	**2502.5**	34.55	25.41	9.14	34.23	**25.49**	8.74
		2595.0	34.28	25.36	8.92	34.26	25.48	8.78
		2687.5	34.22	25.41	8.81	33.82	25.47	8.35
	3/4	**2502.5**	34.67	25.32	9.35	34.47	25.34	9.13
		2595.0	34.50	25.31	9.19	34.42	25.33	9.09
		2687.5	34.27	25.31	8.96	34.04	25.34	8.70
16QAM (BW 5MHz)	1/2	**2502.5**	34.33	25.30	9.03	34.15	25.35	8.80
		2595.0	34.21	25.32	8.89	34.15	25.32	8.83
		2687.5	34.06	25.30	8.76	33.86	25.34	8.52
	3/4	**2502.5**	34.20	25.35	8.85	34.08	25.37	8.71
		2595.0	34.16	25.34	8.82	34.01	25.35	8.66
		2687.5	34.00	25.35	8.65	33.72	25.38	8.34
QPSK (BW 10MHz)	1/2	**2505.0**	34.22	25.41	8.81	34.12	25.47	8.65
		2595.0	34.22	25.36	8.86	34.16	25.48	8.68
		2685.0	34.14	25.41	8.73	34.14	25.47	8.67
	3/4	**2505.0**	34.32	25.41	8.91	34.24	25.34	8.90
		2595.0	34.36	25.34	9.02	34.15	25.32	8.83
		2685.0	34.17	25.34	8.83	33.95	25.32	8.63
16QAM (BW 10MHz)	1/2	**2505.0**	34.33	25.36	8.97	34.40	25.34	9.06
		2595.0	34.43	25.31	9.12	34.27	25.36	8.91
		2685.0	34.17	25.32	8.85	33.96	25.37	8.59
	3/4	**2505.0**	34.45	25.36	9.09	34.24	25.35	8.89
		2595.0	34.32	25.31	9.01	34.18	25.31	8.87
		2685.0	34.17	25.35	8.82	33.90	25.36	8.54

4. 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.

2.2 GENERAL DESCRIPTION OF APPLIED STANDARDS

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

FCC Part 2 (2.1093)

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

IEEE 1528-2003

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

2.3 GENERAL INOFRMATION OF THE SAR SYSTEM

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

EX3DV4 ISOTROPIC E-FIELD PROBE

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

NOTE

1. The Probe parameters have been calibrated by the SPEAG. Please reference "APPENDIX D" for the Calibration Certification Report.
2. For frequencies above 800MHz, calibration in a rectangular wave-guide is used, because wave-guide size is manageable.
3. For frequencies below 800MHz, temperature transfer calibration is used because the wave-guide size becomes relatively large.

TWIN SAM V4.0

CONSTRUCTION	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, EN 62209-1 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.
SHELL THICKNESS	2 ± 0.2mm
FILLING VOLUME	15 cm deep from the ERP
DIMENSIONS	Height: 810mm; Length: 1000mm; Width: 500mm

SYSTEM VALIDATION KITS:

CONSTRUCTION	Symmetrical dipole with l/4 balun enables measurement of feedpoint impedance with NWA matched for use near flat phantoms filled with brain simulating solutions. Includes distance holder and tripod adaptor
CALIBRATION	Calibrated SAR value for specified position and input power at the flat phantom in brain simulating solutions
FREQUENCY	2600MHz
RETURN LOSS	> 20dB at specified validation position
POWER CAPABILITY	> 100W (f < 1GHz); > 40W (f > 1GHz)
OPTIONS	Dipoles for other frequencies or solutions and other calibration conditions upon request

DEVICE HOLDER FOR SAM TWIN PHANTOM

CONSTRUCTION	The device holder for the mobile phone device is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles. The holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε =3 and loss tangent δ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered. The device holder for the portable device makes up of the polyethylene foam. The dielectric parameters of material close to the dielectric parameters of the air.

DATA ACQUISITION ELECTRONICS

CONSTRUCTION

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

2.4 TEST EQUIPMENT

FOR SAR MEASURENENT

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	SAM Phantom	S & P	QD000 P40 C	TP 1485	NA	NA
2	Signal Generator	Agilent	E8257C	MY43320668	Dec. 27, 2010	Dec. 26, 2011
3	E-Field Probe	S & P	EX3DV4	3590	Feb. 25, 2011	Feb. 24, 2012
4	DAE	S & P	DAE3	579	Sep. 20, 2010	Sep. 19, 2011
5	DAE	S & P	DAE4	861	Aug. 29, 2011	Aug. 28, 2012
6	Robot Positioner	Staubli Unimation	NA	NA	NA	NA
7	Validation Dipole	S & P	D2600V2	1003	Jan. 27, 2011	Jan. 26, 2012

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

FOR TISSUE PROPERTY

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	Network Analyzer	Agilent	E8358A	US41480539	Dec. 30, 2010	Dec. 29, 2011
2	Dielectric Probe	Agilent	85070D	US01440176	NA	NA

NOTE:

1. Before starting, all test equipment shall be warmed up for 30min.
2. The tolerance (k=1) specified by Agilent for general dielectric measurements, deriving from inaccuracies in the calibration data, analyzer drift, and random errors, are usually ±2.5% and ±5% for measured permittivity and conductivity, respectively. However, the tolerances for the conductivity is smaller for material with large loss tangents, i.e., less than ±2.5% (k=1). It can be substantially smaller if more accurate methods are applied.

2.5 GENERAL DESCRIPTION OF THE SPATIAL PEAK SAR EVALUATION

The DASY52 post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the micro-volt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

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

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

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

V_i	=compensated signal of channel i	(i = x, y, z)
U_i	=input signal of channel I	(i = x, y, z)
Cf	=crest factor of exciting field	(DASY parameter)
dcp_i	=diode compression point	(DASY parameter)

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

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

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

V_i	=compensated signal of channel I	(i = x, y, z)
$Norm_i$	=sensor sensitivity of channel i μV/(V/m)2 for E-field Probes	(i = x, y, z)
ConvF	= sensitivity enhancement in solution	
a_{ij}	= sensor sensitivity factors for H-field probes	
F	= carrier frequency [GHz]	
E_i	= electric field strength of channel i in V/m	
H_i	= magnetic field strength of channel i in A/m	

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

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

SAR	= local specific absorption rate in mW/g
E_{tot}	= total field strength in V/m
ζ	= conductivity in [mho/m] or [Siemens/m]
ρ	= equivalent tissue density in g/cm3

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid. The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. The extraction of the measured data (grid and values) from the Zoom Scan
2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. The generation of a high-resolution mesh within the measured volume
4. The interpolation of all measured values from the measurement grid to the high-resolution grid
5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. The calculation of the averaged SAR within masses of 1g and 10g.

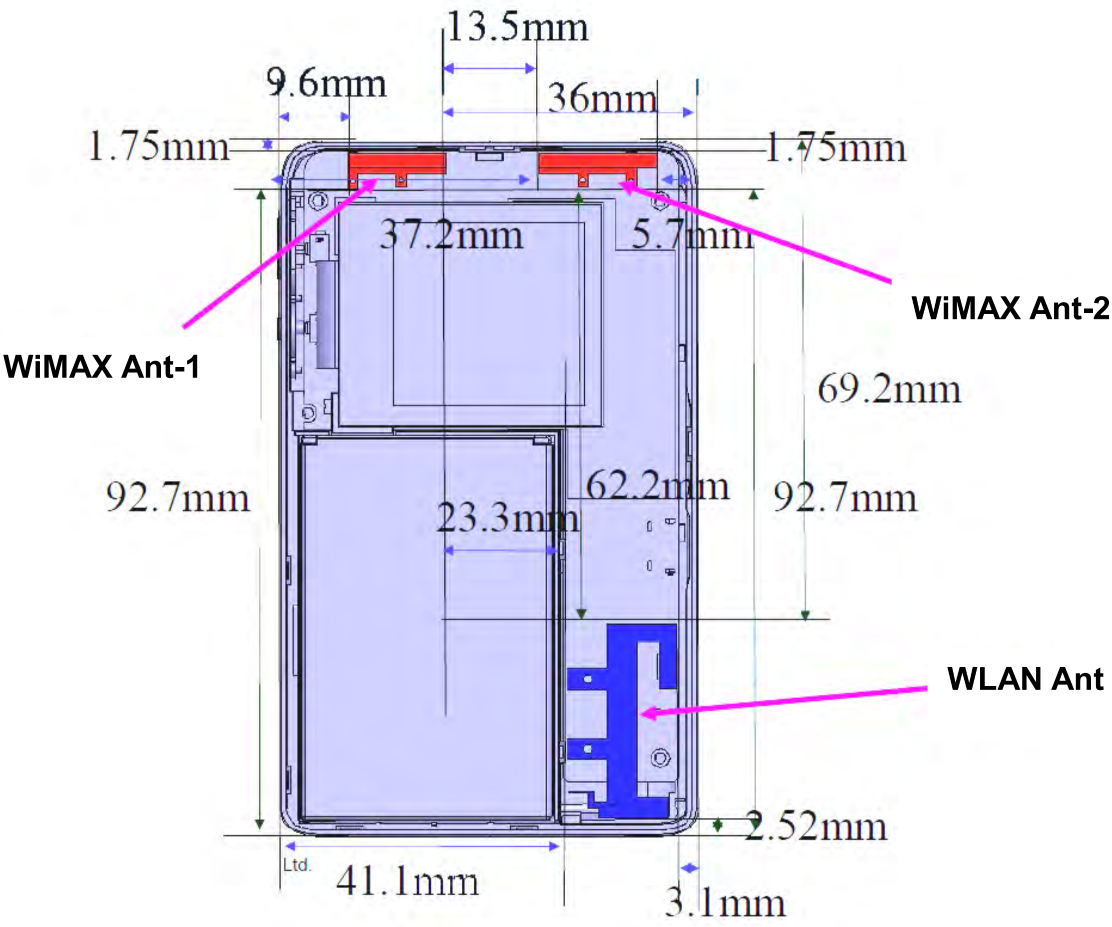
The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated. The angle between the probe axis and the surface normal line is less than 30 degree.

The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 5 x 5 x 7 scans. The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 32 x 32 x 30mm contains about 30g of tissue. The first procedure is an extrapolation (incl. boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume in a 1mm grid (42875 points). In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

3. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

4. DESCRIPTION OF ANTENNA LOCATION



<Evaluation for Hotspot SAR>

Bottom edge is not tested for WiMAX SAR since the distance between WiMAX antenna and bottom edge is > 2.5 cm. According to TCB workshop on April 2011, this DUT was tested with 1.0 cm separation distance because the size of this wireless router is larger than 9 cm x 5 cm.

Since the separation distance between WiMAX and WLAN antennas are larger than 5 cm and the maximum average output power of WLAN is less than $2P_{Ref}$ (13.8 dBm), the standalone WLAN SAR is not required.

5. RECIPES FOR TISSUE SIMULATING LIQUIDS

For the measurement of the field distribution inside the SAM phantom, the phantom must be filled with tissue simulation liquid to a depth of 15 cm

The following ingredients are used：

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

THE RECIPES FOR 2600MHz SIMULATING LIQUID TABLE

Ingredient	Muscle Simulating Liquid 2600MHz (MSL-2600)
Water	69.83%
DGMBE	30.17%
Salt	NA
Dielectric Parameters at 22℃	f= 2600MHz ε= 52.5 ± 5% ζ= 2.16 ± 5% S/m

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

1. Turn Network Analyzer on and allow at least 30min. warm up.
2. Mount dielectric probe kit so that interconnecting cable to Network Analyzer will not be moved during measurements or calibration.
3. Pour de-ionized water and measure water temperature (±1°).
4. Set water temperature in Agilent-Software (Calibration Setup).
5. Perform calibration.
6. Validate calibration with dielectric material of known properties (e.g. polished ceramic slab with >8mm thickness ε'=10.0, ε''=0.0). If measured parameters do not fit within tolerance, repeat calibration (±0.2 for ε': ±0.1 for ε'').
7. Conductivity can be calculated from ε'' by $\zeta = \omega\ \varepsilon_0\ \varepsilon'' = \varepsilon''\ f\ [GHz] / 18$.
8. Measure liquid shortly after calibration. Repeat calibration every hour.
9. Stir the liquid to be measured. Take a sample (~ 50ml) with a syringe from the center of the liquid container.
10. Pour the liquid into a small glass flask. Hold the syringe at the bottom of the flask to avoid air bubbles.
11. Put the dielectric probe in the glass flask. Check that there are no air bubbles in front of the opening in the dielectric probe kit.
12. Perform measurements.
13. Adjust medium parameters in DASY52 for the frequencies necessary for the measurements.
14. Select the current medium for the frequency of the validation.

FOR SIMULATING LIQUID

LIQUID TYPE	MSL-2600				
SIMULATING LIQUID TEMP.	21.2				
TEST DATE	Aug. 19, 2011				
TESTED BY	Van Lin				
FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	ERROR PERCENTAGE (%)	LIMIT (%)
2600	Permittivity (ε r)	52.5	51.1	-2.67	±5
	Conductivity (ζ) S/m	2.16	2.21	2.31	

LIQUID TYPE	MSL-2600				
SIMULATING LIQUID TEMP.	21.2				
TEST DATE	Aug. 22, 2011				
TESTED BY	Van Lin				
FREQ. (MHZ)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	ERROR PERCENTAGE (%)	LIMIT (%)
2600	Permittivity (ε r)	52.5	52.8	0.57	±5
	Conductivity (ζ) S/m	2.16	2.20	1.85	

LIQUID TYPE		MSL-2600			
SIMULATING LIQUID TEMP.		21.5			
TEST DATE		Oct. 13, 2011			
TESTED BY		Van Lin			
FREQ. (MHZ)	**LIQUID PARAMETER**	**STANDARD VALUE**	**MEASUREMENT VALUE**	**ERROR PERCENTAGE (%)**	**LIMIT (%)**
2600	Permittivity (ε r)	52.5	51.123	-2.62	±5
	Conductivity (ζ) S/m	2.16	2.209	2.27	

6. SYSTEM VALIDATION

The system validation was performed in the flat phantom with equipment listed in the following table. Since the SAR value is calculated from the measured electric field, dielectric constant and conductivity of the body tissue and the SAR is proportional to the square of the electric field. So, the SAR value will be also proportional to the RF power input to the system validation dipole under the same test environment. In our system validation test, 250mW RF input power was used.

6.1. TEST PROCEDURE

Before the system performance check, we need only to tell the system which components (probe, medium, and device) are used for the system performance check; the system will take care of all parameters. The dipole must be placed beneath the flat section of the SAM Twin Phantom with the correct distance holder in place. The distance holder should touch the phantom surface with a light pressure at the reference marking (little cross) and be oriented parallel to the long side of the phantom. Accurate positioning is not necessary, since the system will search for the peak SAR location, except that the dipole arms should be parallel to the surface. The device holder for mobile phones can be left in place but should be rotated away from the dipole.

1. The ”Power Reference Measurement” and ”Power Drift Measurement” jobs are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the amplifier output power. If it is too high (above ±0.1 dB), the system performance check should be repeated; some amplifiers have very high drift during warm-up. A stable amplifier gives drift results in the DASY system below ±0.02dB.

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

3. The ”Area Scan” job measures the SAR above the dipole on a plane parallel to the surface. It is used to locate the approximate location of the peak SAR. The proposed scan uses large grid spacing for faster measurement; due to the symmetric field, the peak detection is reliable. If a finer graphic is desired, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result.

4. The ”Zoom Scan” job measures the field in a volume around the peak SAR value assessed in the previous ”Area Scan” job (for more information see the application note on SAR evaluation).

About the validation dipole positioning uncertainty, the constant and low loss dielectric spacer is used to establish the correct distance between the top surface of the dipole and the bottom surface of the phantom, the error component introduced by the uncertainty of the distance between the liquid (i.e., phantom shell) and the validation dipole in the DASY52 system is less than ±0.1mm.

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

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

6.2. VALIDATION RESULTS

Date	Frequency (MHz)	Targeted SAR (W/kg)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
Aug. 19, 2011	2600	58.1	14.8	59.2	1.89
Aug. 22, 2011	2600	58.1	14.7	58.8	1.20
Oct. 13, 2011	2600	58.1	13.4	53.6	-7.75

NOTE:

1. The target SAR is derived from validation dipole certificate report and it is calculated with nominal tissue parameter and normalized to 1W.
2. Comparing to the original SAR value provided by SPEAG, the validation data should be within its specification of 10 %. Above table shows the target SAR and measured SAR after normalized to 1W input power.
3. Please see Appendix for the photo of system validation test.

6.3. SYSTEM VALIDATION UNCERTAINTIES

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

Error Description	Tolerance (±%)	Probability Distribution	Divisor	(C_i)		Standard Uncertainty (±%)		(v_i)
				(1g)	(10g)	(1g)	(10g)	
Measurement System								
Probe Calibration	5.50	Normal	1	1	1	5.50	5.50	∞
Axial Isotropy	0.25	Rectangular	$\sqrt{3}$	0.7	0.7	0.10	0.10	∞
Hemispherical Isotropy	1.30	Rectangular	$\sqrt{3}$	0.7	0.7	0.53	0.53	∞
Boundary effects	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	0.30	Rectangular	$\sqrt{3}$	1	1	0.17	0.17	∞
System Detection Limits	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	0.30	Normal	1	1	1	0.30	0.30	∞
Response Time	0.80	Rectangular	$\sqrt{3}$	1	1	0.46	0.46	∞
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1	1.50	1.50	∞
RF Ambient Noise	3.00	Rectangular	$\sqrt{3}$	1	1	1.73	1.73	9
RF Ambient Reflections	3.00	Rectangular	$\sqrt{3}$	1	1	1.73	1.73	9
Probe Positioner	0.40	Rectangular	$\sqrt{3}$	1	1	0.23	0.23	∞
Probe Positioning	2.90	Rectangular	$\sqrt{3}$	1	1	1.67	1.67	∞
Max. SAR Eval.	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Test sample related								
Sample positioning	1.90	Normal	1	1	1	1.90	1.90	4
Device holder uncertainty	2.80	Normal	1	1	1	2.80	2.80	4
Output power variation-SAR drift measurement	4.50	Rectangular	$\sqrt{3}$	1	1	2.60	2.60	1
Dipole Related								
Dipole Axis to Liquid Distance	1.60	Rectangular	$\sqrt{3}$	1	1	0.92	0.92	4
Input Power Drift	3.04	Rectangular	$\sqrt{3}$	1	1	1.75	1.75	1
Phantom and Tissue parameters								
Phantom Uncertainty	4.00	Rectangular	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid Conductivity (target)	5.00	Rectangular	$\sqrt{3}$	0.64	0.43	1.85	1.24	∞
Liquid Conductivity (measurement)	2.48	Normal	1	0.64	0.43	1.59	1.07	9
Liquid Permittivity (target)	5.00	Rectangular	$\sqrt{3}$	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	3.50	Normal	1	0.6	0.49	2.10	1.72	9
Combined Standard Uncertainty						**9.15**	**8.84**	
Coverage Factor for 95%						**Kp=2**		
Expanded Uncertainty (K=2)						**18.31**	**17.67**	

7. 802.16e/WiMax DEVICE AND SYSTEM OPERATING PARAMETERS

Description	Parameter		Comment
FCC ID	MXF-WIXFMM-121		Identify all related FCC ID
Radio Service	Part 27 Subpart M		Rule parts
Transmit Frequency Range (MHz)	5MHz BW : 2502.5 MHz to 2687.5 MHz 10MHz BW : 2505.0 MHz to 2685.0 MHz		System parameter
System/Channel Bandwidth (MHz)	5 MHz	10 MHz	System parameter
System Profile	Revision 1.7.0		Defined by WiMAX Forum
Modulation Schemes	QPSK, 16QAM		Identify all applicable UL modulations
Sampling Factor	28/25		System parameter
Sampling Frequency (MHz)	5.6 MHz	11.2 MHz	(F_S)
Sample Time (ns)	178.57 ns	89.29 ns	($1/F_S$)
FFT Size (N_{FFT})	512	1024	(N_{FFT})
Sub-Carrier Spacing (kHz)	10.94 kHz		(Δ f)
Useful Symbol Time (μs)	91.4286 μs		($T_b=1/\Delta f$)
Guard Time (μs)	11.4286 μs		(T_g=Tb/cp); cp = cyclic prefix
OFDMA Symbol Time (μs)	102.857 μs		($T_S=T_b+T_g$)
Frame Size (ms)	5 ms		System parameter
TTG + RTG (μs or number of symbols)	165.72 μs		Idle time, system parameter
Number of DL OFDMA Symbols per Frame	29		Identify the allowed & maximum symbols, including both traffic & control symbols
Number of UL OFDMA Symbols per Frame	18		
DL:UL Symbol Ratios	29:18		For determining UL duty factor
Power Class (dBm)	Power Class 2, 25.0±0.5 dBm		Identify power class and tolerance
Wave1 / Wave2	Wave2: Two antennas for Tx/Rx diversity. ANT1 and ANT2 cannot transmit simultaneously.		Describe antenna diversity info and MIMO requirements separately
UL Zone Types (FUSC, PUSC, OFUSC, OPUSC, AMC, TUSC1, TUSC2)	PUSC mode only for current FW.		Describe separately the symbol and sub-carrier/sub-channel structures applicable to each zone type
Maximum Number of UL Sub-Carriers	420	840	Identify the allowed and tested / to be tested parameters; include separate explanations on the types of control symbols and how the power levels are determined
Measured UL Burst Maximum Average Conducted Power	25.49 dBm		
UL Control Symbol Configuration	3 PUSC symbols (used for ranging, CQICH and ACK/NACK)		
UL Control Symbol Maximum Conducted Average Power	104.36 mW	50.69 mW	
UL Burst Peak-to-Average (Conducted) Power Ratio (PAPR)	PAPR is between 8.34 ~ 9.35 dB		Identify the expected range and measured/tested PAR; explain separately the methods used / to be used to address SAR probe calibration and measurement error issues
Frame Averaged UL Transmission Duty Factor (%)	18/48 * 100 % = 37.5 %		Show calculations separately and explain how the applicable CF (*crest factor*) used / to be use in the SAR measurements is derived and how the control symbols are accounted for

8. WIMAX/802.16e DEVICE SPECIFICATION

8.1. WIMAX ZONE TYPES

The device and its system are both transmitting using only PUSC zone type. This enables multiple users to transmit simultaneously within the system. FUSC, AMC and other zone types are not used by the test device for uplink transmission. The maximum DL:UL symbol ratio can be determined according to the PUSC requirements. The system transmit an odd number of symbols using DL-PUSC consisting of even multiples of traffics and control symbols plus one symbol for the preamble. Multiples of three symbols are transmitted by the device using UL-PUSC. The OFDMA symbol time allows up to 48 downlink and uplink symbols in each 5 ms frame. TTG and RTG are also included in each frame as DL/UL transmission gaps; therefore, the system can only allow 47 or less symbols per frame

8.2. POWER MEASUREMENT

Set the transmitter under transmission condition continuously at specific mode with maximum output.

The power meter was used to read the response of the power sensor. Record the power level and PK to AV ratio. The maximum conducted output power is measured for the uplink burst at DL:UL ratio=**29:18** that is measured for the uplink bursts through triggering and gating.

The measured results are as below table:

Modulation	Coding Rate	Frequency (MHz)	Main Antenna			Aux Antenna		
			Peak Power	Average Power	PAPR	Peak Power	Average Power	PAPR
QPSK (BW 5MHz)	**1/2**	**2502.5**	34.55	25.41	9.14	34.23	**25.49**	8.74
		2595.0	34.28	25.36	8.92	34.26	25.48	8.78
		2687.5	34.22	25.41	8.81	33.82	25.47	8.35
	3/4	**2502.5**	34.67	25.32	9.35	34.47	25.34	9.13
		2595.0	34.50	25.31	9.19	34.42	25.33	9.09
		2687.5	34.27	25.31	8.96	34.04	25.34	8.70
16QAM (BW 5MHz)	**1/2**	**2502.5**	34.33	25.30	9.03	34.15	25.35	8.80
		2595.0	34.21	25.32	8.89	34.15	25.32	8.83
		2687.5	34.06	25.30	8.76	33.86	25.34	8.52
	3/4	**2502.5**	34.20	25.35	8.85	34.08	25.37	8.71
		2595.0	34.16	25.34	8.82	34.01	25.35	8.66
		2687.5	34.00	25.35	8.65	33.72	25.38	8.34
QPSK (BW 10MHz)	**1/2**	**2505.0**	34.22	25.41	8.81	34.12	25.47	8.65
		2595.0	34.22	25.36	8.86	34.16	25.48	8.68
		2685.0	34.14	25.41	8.73	34.14	25.47	8.67
	3/4	**2505.0**	34.32	25.41	8.91	34.24	25.34	8.90
		2595.0	34.36	25.34	9.02	34.15	25.32	8.83
		2685.0	34.17	25.34	8.83	33.95	25.32	8.63
16QAM (BW 10MHz)	**1/2**	**2505.0**	34.33	25.36	8.97	34.40	25.34	9.06
		2595.0	34.43	25.31	9.12	34.27	25.36	8.91
		2685.0	34.17	25.32	8.85	33.96	25.37	8.59
	3/4	**2505.0**	34.45	25.36	9.09	34.24	25.35	8.89
		2595.0	34.32	25.31	9.01	34.18	25.31	8.87
		2685.0	34.17	25.35	8.82	33.90	25.36	8.54

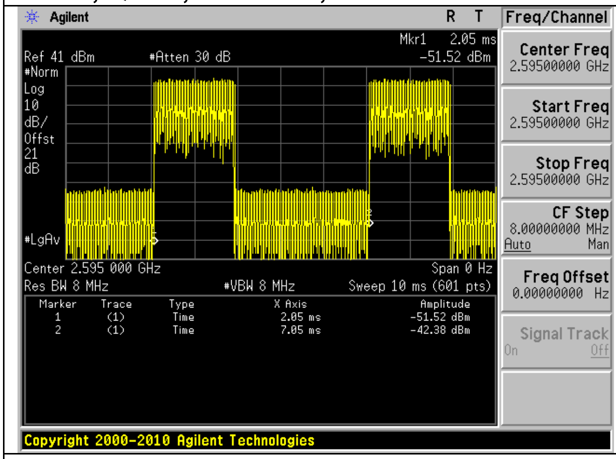
8.3. DUTY FACTOR

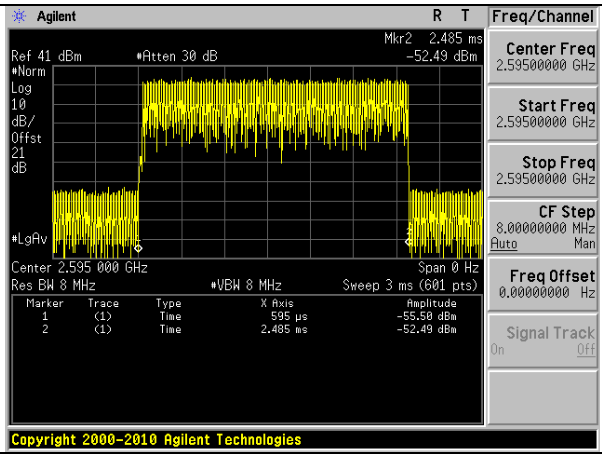
Theoretical duty cycle is

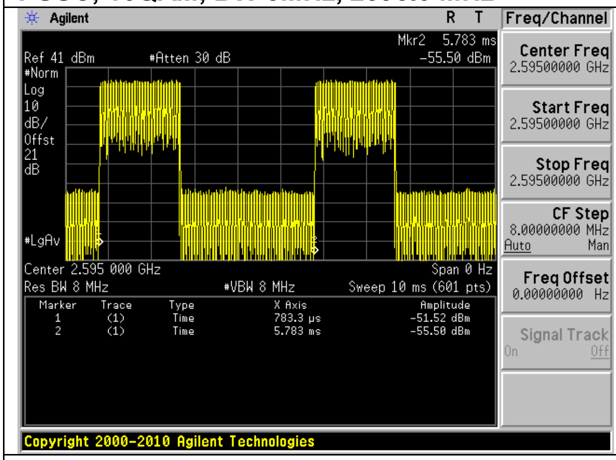
UL Data Symbols x Symbol Time / Frame Size
= 18 x 102.857 us / 5000 us
= 37 %

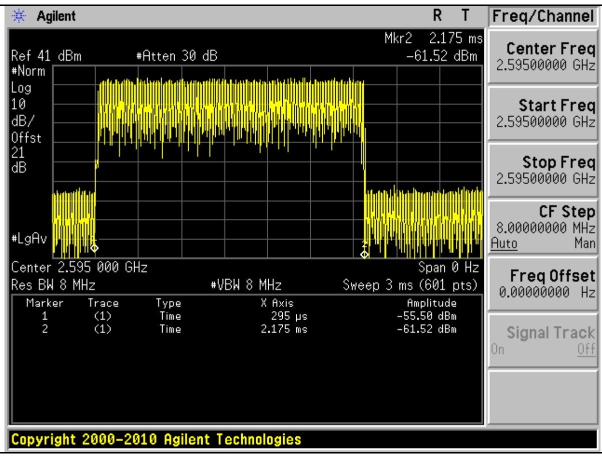
Crest Factor = 1 / Duty Cycle = 2.7
This cf was used for SAR evaluation.

The WiMAX time domain waveform used for SAR testing is shown as below.

<table>
<tr><td colspan="2">PUSC, QPSK, BW 5MHz, 2595.0 MHz</td></tr>
<tr><td>


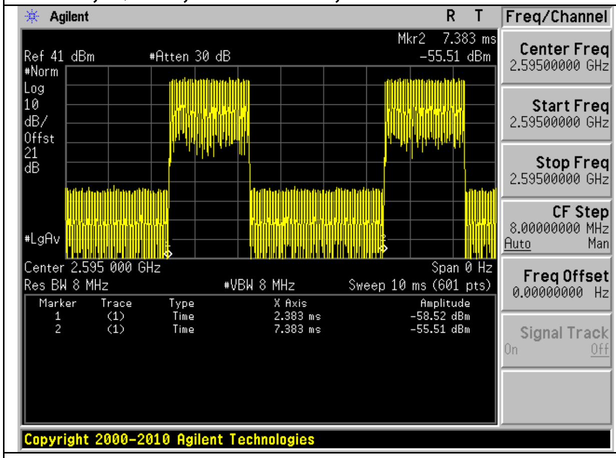
</td><td>


</td></tr>
<tr><td>Frame Length
= Mark 2 – Mark 1
= 7.05 ms – 2.05 ms = 5 ms</td><td>Control Symbol + UL Data Symbols (18 symbols)
= Mark 2 – Mark 1 = 2.485 ms – 595 us = 1.890 us
Duty Cycle
= 18 symbols UL time / Frame Length x 100%
= 1.890 / 5 x 100% = 37.8 %</td></tr>
<tr><td colspan="2">PUSC, 16QAM, BW 5MHz, 2595.0 MHz</td></tr>
<tr><td>


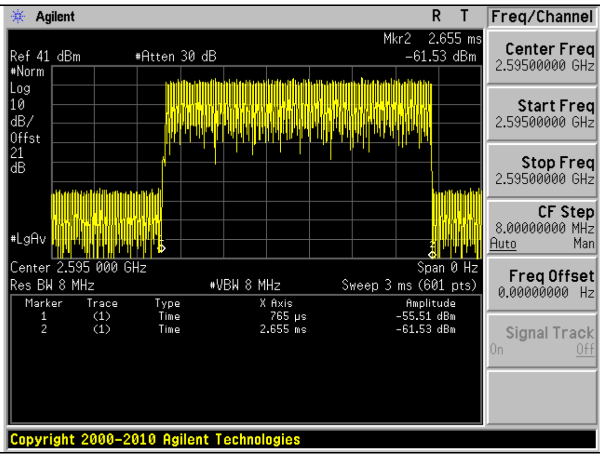
</td><td>


</td></tr>
<tr><td>Frame Length
= Mark 2 – Mark 1
= 5.783 ms – 783.3 us = 4.9997 ms</td><td>Control Symbol + UL Data Symbols (18 symbols)
= Mark 2 – Mark 1 = 2.175 ms – 295 us = 1.880 us
Duty Cycle
= 18 symbols UL time / Frame Length x 100%
= 1.880 / 5 x 100% = 37.6 %</td></tr>
</table>

PUSC, QPSK, BW 10MHz, 2595.0 MHz

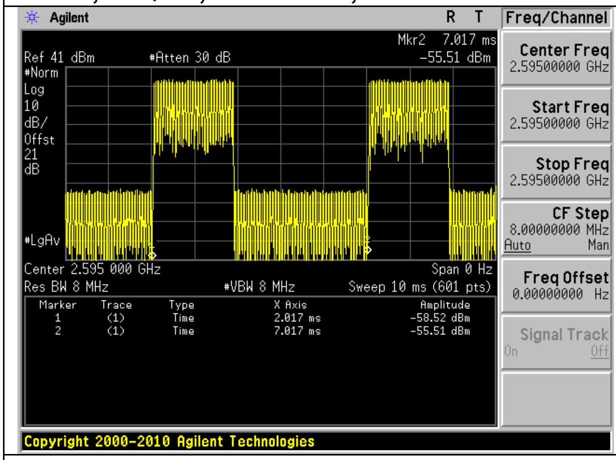


Frame Length
= Mark 2 – Mark 1
= 7.383 ms – 2.383 ms = 5 ms

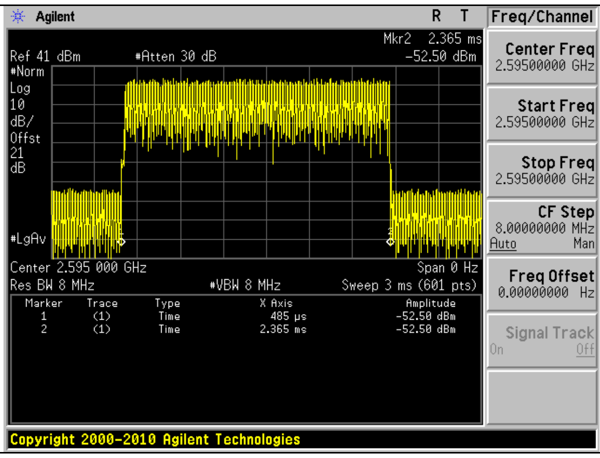


Control Symbol + UL Data Symbols (18 symbols)
= Mark 2 – Mark 1 = 2.655 ms – 765 us = 1.890 us
Duty Cycle
= 18 symbols UL time / Frame Length x 100%
= 1.890 / 5 x 100% = 37.8 %

PUSC, 16QAM, BW 10MHz, 2595.0 MHz



Frame Length
= Mark 2 – Mark 1
= 7.017 ms – 2.017 ms = 5 ms

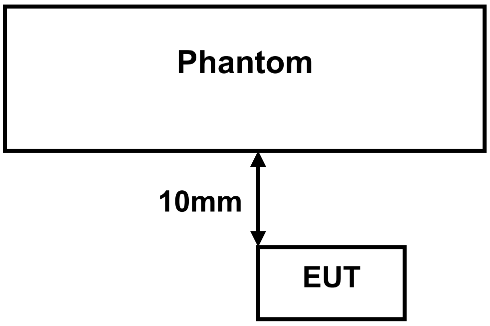


Control Symbol + UL Data Symbols (18 symbols)
= Mark 2 – Mark 1 = 2.365 ms – 485 us = 1.880 us
Duty Cycle
= 18 symbols UL time / Frame Length x 100%
= 1.880 / 5 x 100% = 37.6 %

9. TEST SETUP

Test setup

The test set-up is shown in the following picture. The WiMAX Router (DUT) is connected to the notebook computer by a USB cable. MTK Test tool is provided by client. This tool can control EUT to transmit at specific channel bandwidth, modulation type, coding rate, power level and frequency without signal generator. When EUT starts to transmit, the USB cable can be disconnected and removed during SAR test period.



Test Signal detail

The WIXFMM-121 is 2.5 GHz WiMAX transceiver in a USB Router configuration using Mediatek chipset which supports 1Tx (Tx Switching Diversity) and 2Rx for this device. Its uplink is capable of both 10 MHz and 5 MHz bandwidths.

PUSC zone type

For the 10 MHz bandwidth, it has 35 sub-channels structured from 1024 subcarriers per OFDMA symbol and each sub-channel is spanned over 3 OFDMA symbols and consists of 72 subcarriers including 48 data and 24 pilot subcarriers. For each symbol, there are 184 guard subcarriers, leaving 840 available subcarriers for transmission. For the 5 MHz bandwidth, it contains 17 sub-channels using 512 subcarriers including 104 guard subcarriers per symbol and leaving 408 available subcarriers for transmission.

The control channels may occupy up to 5 slots during normal operation. A slot is a sub-channel with the duration of 3 symbols. There are a total of 35 (17) slots in the 10 MHz (5 MHz) channel configuration. The maximum power for each control symbol has been determined to be 50.69 (5/35 of 354.81 mW) for 10MHz and 104.36 (5/17 of 354.81 mW) for 5MHz. A maximum of two simultaneous CQICH reports are possible, which can occupy up to 2 slots. A maximum of three slots can be used for HARQ ACK/NAK by the five possible DL HARQ bursts in the previous DL frame. The 5 ACK/NAK bits each occupies ½ a slot. These 5 slots correspond to 5/35 (5/17) of the total number of uplink slots. When the device is transmitting at its maximum rated power of 25.5 dBm (354.81 mW), the output power for these control channels is 50.69 (5/35 of 354.81 mW) for 10MHz and 104.36 (5/17 of 354.81 mW) for 5MHz. Due to the limitation of the test mode software which cannot control the device to output typical control symbols (3 symbols with 5 slots occupied). The EUT was programmed to output full power at 25.5 dBm per symbol and this represents the max worst case power which a transmitted symbol can get (no mater it is data symbol or control symbol, the 25.5 dBm is the max output power that this device can output). Since max output power was used during the SAR test, we concluded that no further SAR scaling up is required after the SAR measurement.

The up-link sub-frame is triggered by an Allocation Start Time contained in the information of UL-MAP. This information specifies the starting times of the Uplink and Downlink frames. In any UL sub-frame, the duty factor and bandwidth information is used to ensure optimal system operation. In the real usage, the data burst power will be adjusted according to the signal strength of the communication. In this way, by using the test mode arrangement we are transmitting at a worst case RF level.

The test mode instructs the mobile station MS to transmit for 18 symbols in the UL data zone. This UL transmission is repeated every 5 milliseconds. The TX power of the mobile station is set to maximum power.

As mentioned above that all 18 symbols (3 control symbols plus and 15 data symbols) were all transmitted at full power, so we are sure that the device is working at worst SAR condition and no further SAR scaling up is required.

10. TEST RESULTS

10.1. TEST PROCEDURES

Use the software to control the EUT channel and transmission power. Then record the conducted power before the testing. Place the EUT to the specific test location. After the testing, must writing down the conducted power of the EUT into the report. The SAR value was calculated via the 3D spline interpolation algorithm that has been implemented in the software of DASY SAR measurement system manufactured and calibrated by SPEAG. According to the IEEE 1528 standards, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- Power reference measurement
- Verification of the power reference measurement
- Area scan
- Zoom scan
- Power reference measurement

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

In the zoom scan, the distance between the measurement point at the probe sensor location (geometric center behind the probe tip) and the phantom surface is 3mm and maintained at a constant distance of ±0.5mm during a zoom scan to determine peak SAR locations. The distance is 2mm between the first measurement point and the bottom surface of the phantom. The secondary measurement point to the bottom surface of the phantom is with 7mm separation distance. The cube size is 5 x 5 x 7 points consists of 343 points and the grid space is 5mm.

The measurement time is 0.5s at each point of the zoom scan. The probe boundary effect compensation shall be applied during the SAR test. Because of the tip of the probe to the Phantom surface separated distances are longer than half a tip probe diameter.

In the area scan, the separation distance is 2mm between the each measurement point and the phantom surface. The scan size shall be included the transmission portion of the EUT. The measurement time is the same as the zoom scan. At last the reference power drift shall be less than ±5%.

10.2. MEASURED SAR RESULTS

Plot No.	BW	Mode	Test Position	Separation Distance (cm)	Channel	Ant Status	SAR_{1g} (W/kg)
1	5M	QPSK1/2	Front Face	1	2502.5	1	0.491
2	5M	QPSK1/2	Rear Face	1	2502.5	1	0.417
28	5M	QPSK1/2	Left Side	1	2502.5	1	0.126
4	5M	QPSK1/2	Right Side	1	2502.5	1	0.041
5	5M	QPSK1/2	Top Side	1	2502.5	1	0.29
6	5M	QPSK1/2	Front Face	1	2502.5	2	0.349
7	5M	QPSK1/2	Rear Face	1	2502.5	2	0.378
8	5M	QPSK1/2	Left Side	1	2502.5	2	0.056
9	5M	QPSK1/2	Right Side	1	2502.5	2	0.209
10	5M	QPSK1/2	Top Side	1	2502.5	2	0.207
11	10M	QPSK1/2	Front Face	1	2505.0	1	**0.509**
12	10M	QPSK1/2	Rear Face	1	2505.0	1	0.411
27	10M	QPSK1/2	Left Side	1	2505.0	1	0.118
14	10M	QPSK1/2	Right Side	1	2505.0	1	0.039
15	10M	QPSK1/2	Top Side	1	2505.0	1	0.208
16	10M	QPSK1/2	Front Face	1	2595.0	2	0.384
17	10M	QPSK1/2	Rear Face	1	2595.0	2	0.414
18	10M	QPSK1/2	Left Side	1	2595.0	2	0.024
19	10M	QPSK1/2	Right Side	1	2595.0	2	0.198
20	10M	QPSK1/2	Top Side	1	2595.0	2	0.229

NOTE:

1. In this testing, the limit for General Population Spatial Peak averaged over 1g, **1.6 W/kg**, is applied.
2. Please see the Appendix A for the data.
3. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.
4. When scaled SAR is less than 0.4W/kg, SAR of other channels under the same configuration will be reduced.
5. Use the lowest coding rate for each modulation is mentioned on TCB workshop April, 2010 RF Exposure Procedures Update. Therefore only coding rate 1/2 is tested
6. 16QAM maximum output power is < ¼ dB higher than QPSK and QPSK SAR is < 0.8 W/kg, so SAR for 16QAM is not required. This reduction condition is mentioned on TCB workshop Oct, 2010 RF Exposure Procedures Update

10.3. SIMULTANEOUS TRANSMISSION SAR EVALUATION

Conducted Output Power of WLAN

Band	802.11b			802.11g		
Channel	1	4	8	1	4	8
Frequency (MHz)	2412	2427	2447	2412	2427	2447
Peak Power	14.2	14.5	14.2	19.9	20.1	20.2
Average Power	11.0	11.3	11.0	11.4	11.5	11.4

SUMMARY:

Since the separation distance between WiMAX and WLAN antennas are larger than 5 cm and the maximum average output power of WLAN is less than $2P_{Ref}$ (13.8 dBm), the standalone WLAN SAR and simultaneous transmission SAR are not required.

11. SAR LIMITS

HUMAN EXPOSURE	SAR (W/kg)	
	(GENERAL POPULATION / UNCONTROLLED EXPOSURE ENVIRONMENT)	(OCCUPATIONAL / CONTROLLED EXPOSURE ENVIRONMENT)
Spatial Average (whole body)	0.08	0.4
Spatial Peak (averaged over 1 g)	**1.6**	8.0
Spatial Peak (hands / wrists / feet / ankles averaged over 10 g)	4.0	20.0

NOTE:

1. This limits accord to 47 CFR 2.1093 – Safety Limit.

12. SAR ERROR CONSIDERATION

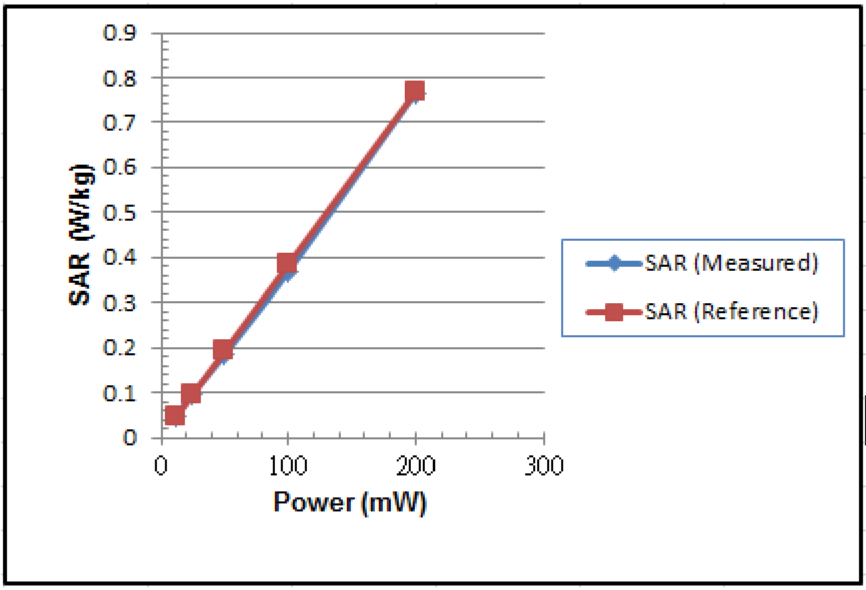
In order to estimate the measurement error due to PAR issues, the configuration with the highest SAR in each channel bandwidth and frequency band is measured at various power level. Test conditions are as below

Test position:	Front side
Test distance:	10mm
TX antenna:	Antenna 1
Test frequency:	2505MHz for 10MHz bandwidth
Modulation:	QPSK 1/2

By tuning different power on this EUT and measuring the relative SAR to verify the high PAR of OFDM/OFDMA is as below:

10MHz / QPSK 1/2

Power (mW)	12.5	25	50	100	200
Point SAR	0.048	0.098	0.185	0.369	0.766
Linear line	0.048	0.096	0.192	0.384	0.768
Deviation(%)	0.00%	2.08%	-3.65%	-3.91%	-0.26%



13. INFORMATION ON THE TESTING LABORATORIES

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

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5.phtml. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:
Tel: 886-3-5935343
Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab:
Tel: 886-3-3183232
Fax: 886-3-3185050

Email:service.adt@tw.bureauveritas.com
Web Site: www.adt.com.tw

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

---END---

System Check_MSL2600_20110819

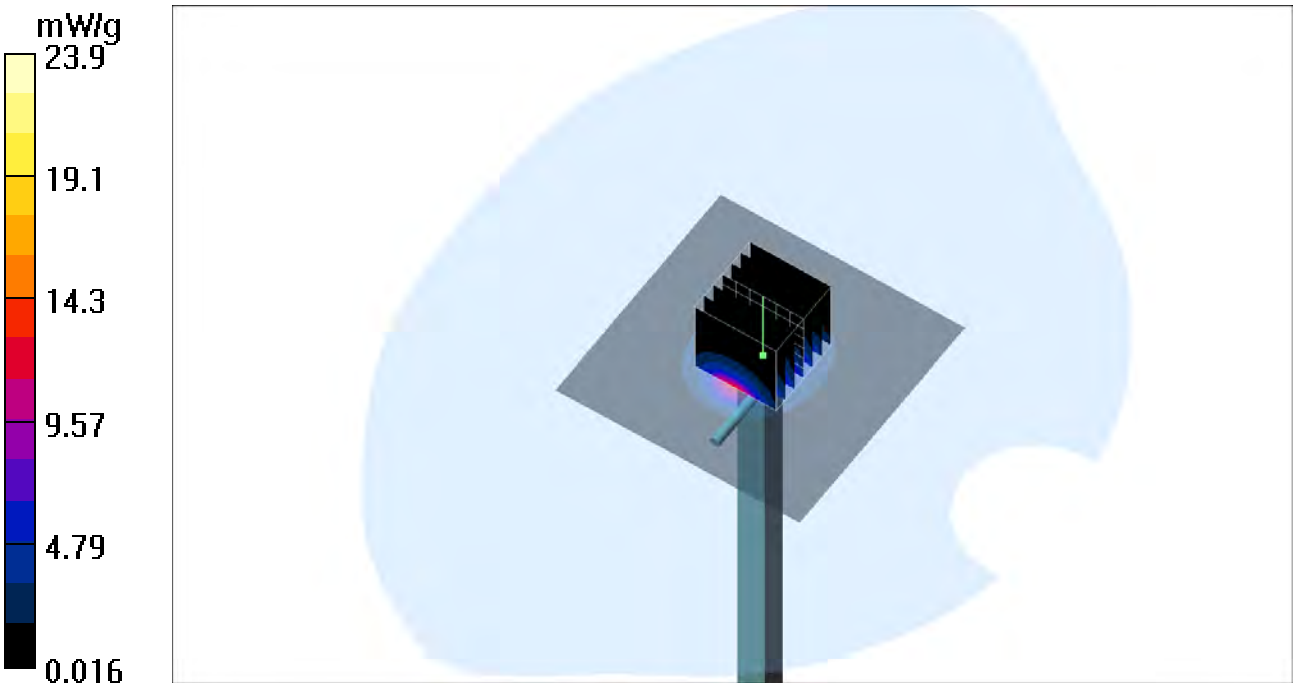
DUT: Dipole D2600V2; Serial Number: 1003

Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: MSL2600_0819 Medium parameters used: f = 2600 MHz; σ = 2.21 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Ambient Temperature：22.4 ℃; Liquid Temperature：21.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 23.9 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.2 V/m; Power Drift = -0.049 dB
Peak SAR (extrapolated) = 32.9 W/kg
SAR(1 g) = 14.8 mW/g; SAR(10 g) = 6.37 mW/g
Maximum value of SAR (measured) = 23.5 mW/g



System Check_MSL2600_20110822

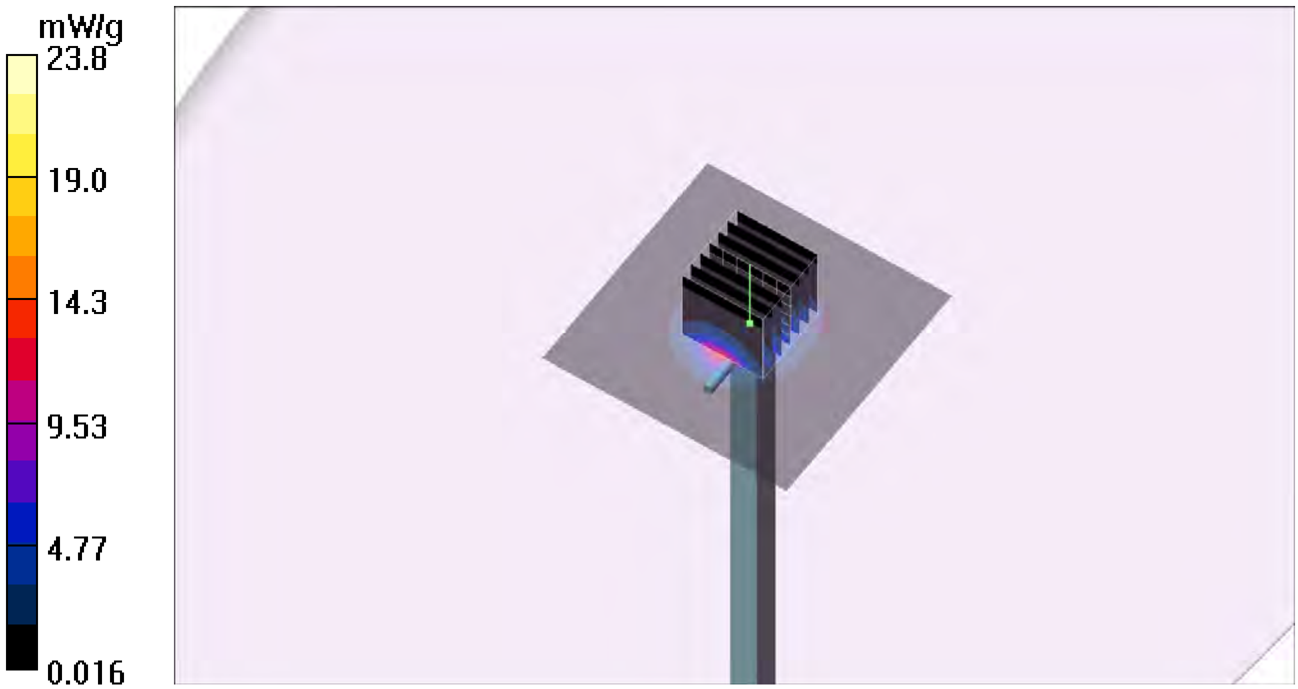
DUT: Dipole D2600V2; Serial Number: 1003

Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: MSL2600_0822 Medium parameters used: f = 2600 MHz; σ = 2.2 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.2 ℃; Liquid Temperature：21.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 23.8 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.2 V/m; Power Drift = -0.049 dB
Peak SAR (extrapolated) = 32.8 W/kg
SAR(1 g) = 14.7 mW/g; SAR(10 g) = 6.35 mW/g
Maximum value of SAR (measured) = 23.4 mW/g



System Check_MSL2600_111013

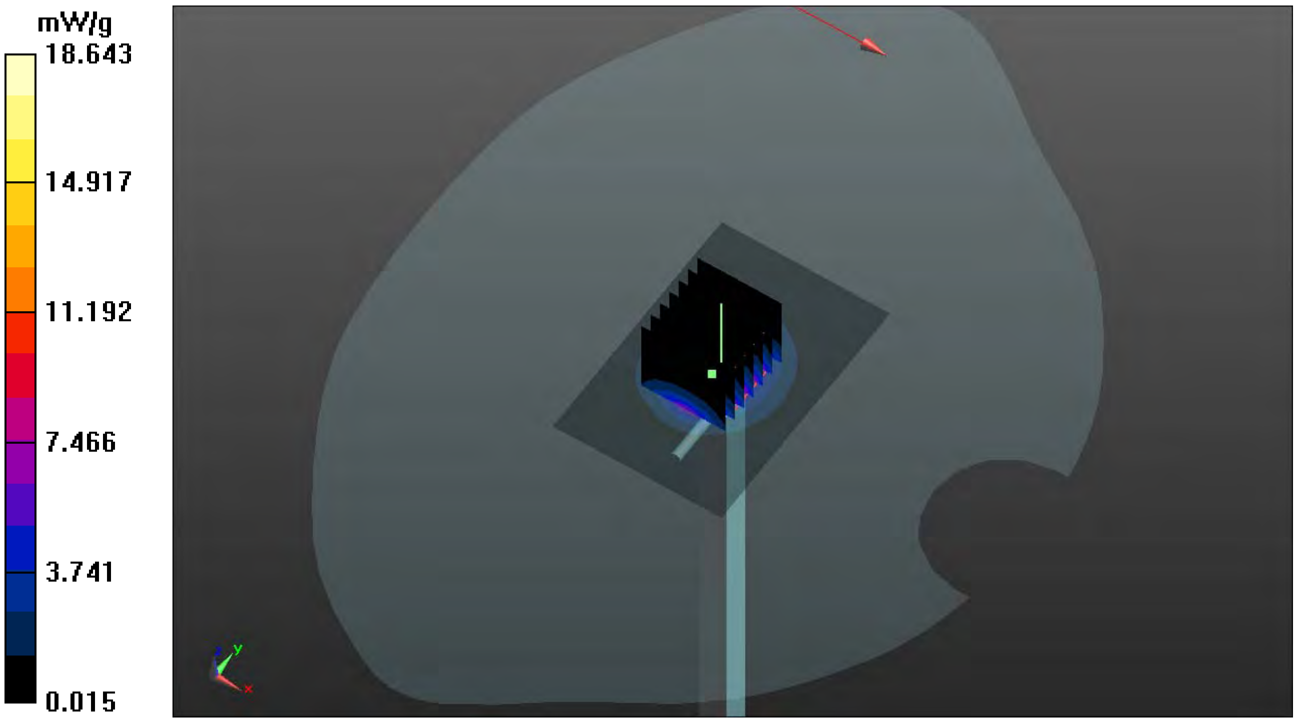
DUT: Dipole D2600V2; Serial Number: 1003

Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: MSL2600_1013 Medium parameters used: f = 2600 MHz; σ = 2.209 mho/m; ε_r = 51.123; ρ = 1000 kg/m^3
Ambient Temperature：22.8 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/8/29
- Phantom: SAM Phantom_Front; Type: SAM; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Pin=250mW/Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 18.643 mW/g

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.681 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 31.256 W/kg
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 5.69 mW/g
Maximum value of SAR (measured) = 17.999 mW/g



P01 Wimax_5M_2.5GHz_QPSK1/2_Front Face_1cm_Ch01_Ant1

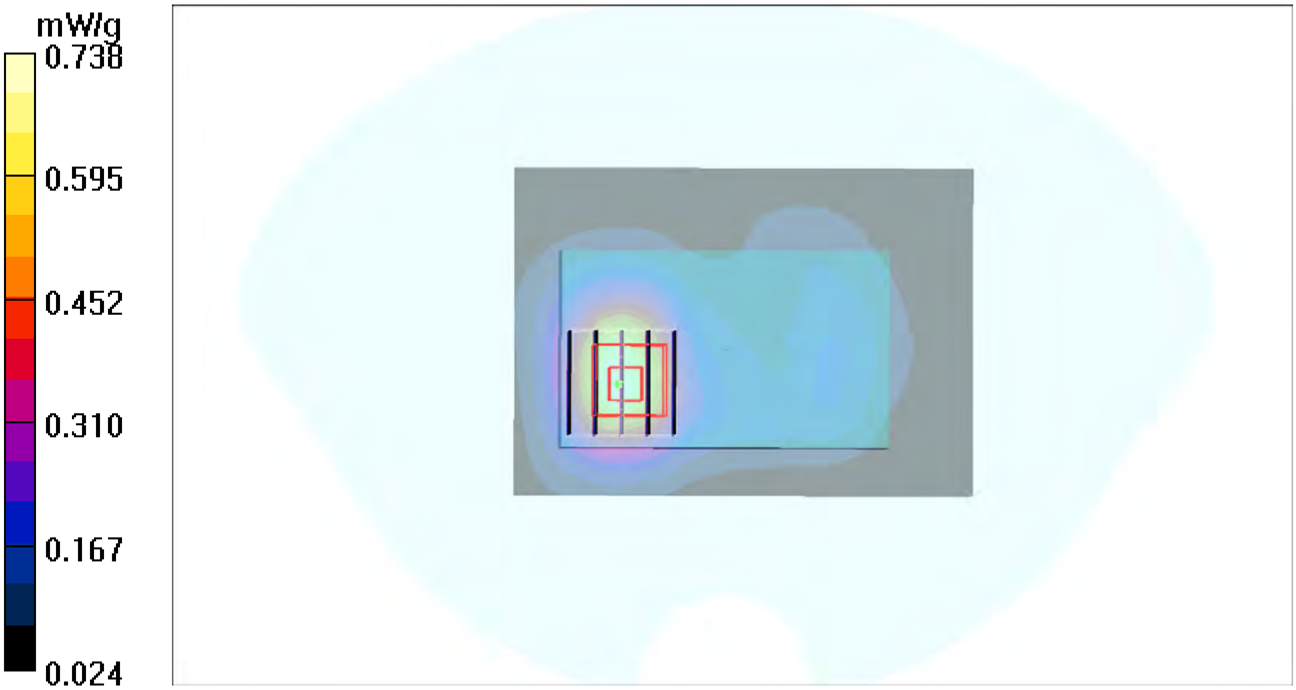
DUT: 110718C17

Communication System: Wimax_2.5GHz 5M; Frequency: 2502.5 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used : f = 2502.5 MHz; σ = 2.1 mho/m;
ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.738 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.12 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 0.876 W/kg
SAR(1 g) = 0.491 mW/g; SAR(10 g) = 0.278 mW/g
Maximum value of SAR (measured) = 0.677 mW/g



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2011/8/19

P02 Wimax_5M_2.5GHz_QPSK1/2_Rear Face_1cm_Ch01_Ant1

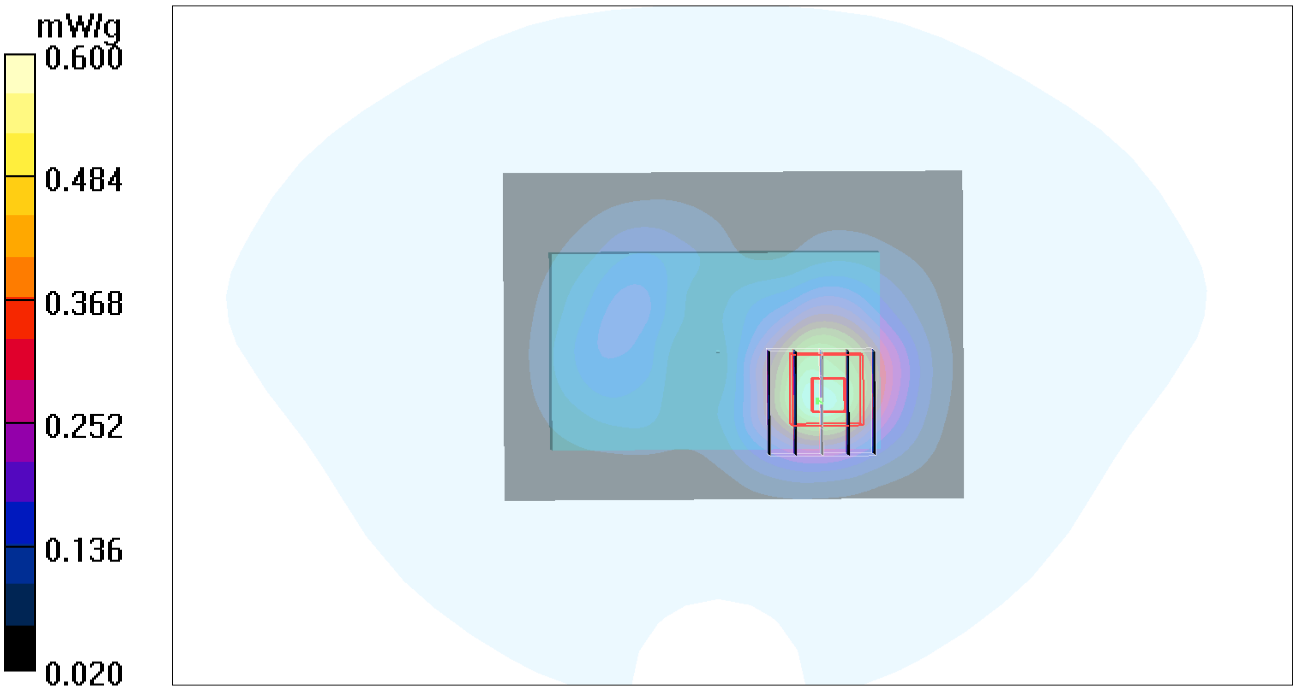
DUT: 110718C17

Communication System: Wimax_2.5GHz 5M; Frequency: 2502.5 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used : f = 2502.5 MHz; σ = 2.1 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.7 ℃; Liquid Temperature：21.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.600 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.19 V/m; Power Drift = -0.146 dB
Peak SAR (extrapolated) = 0.779 W/kg
SAR(1 g) = 0.417 mW/g; SAR(10 g) = 0.235 mW/g
Maximum value of SAR (measured) = 0.571 mW/g



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2011/10/13

P28 WiMax_5M_2.5GHz_QPSK1/2_Left Side_1cm_Ch16_Ant 1

DUT: 110718C17

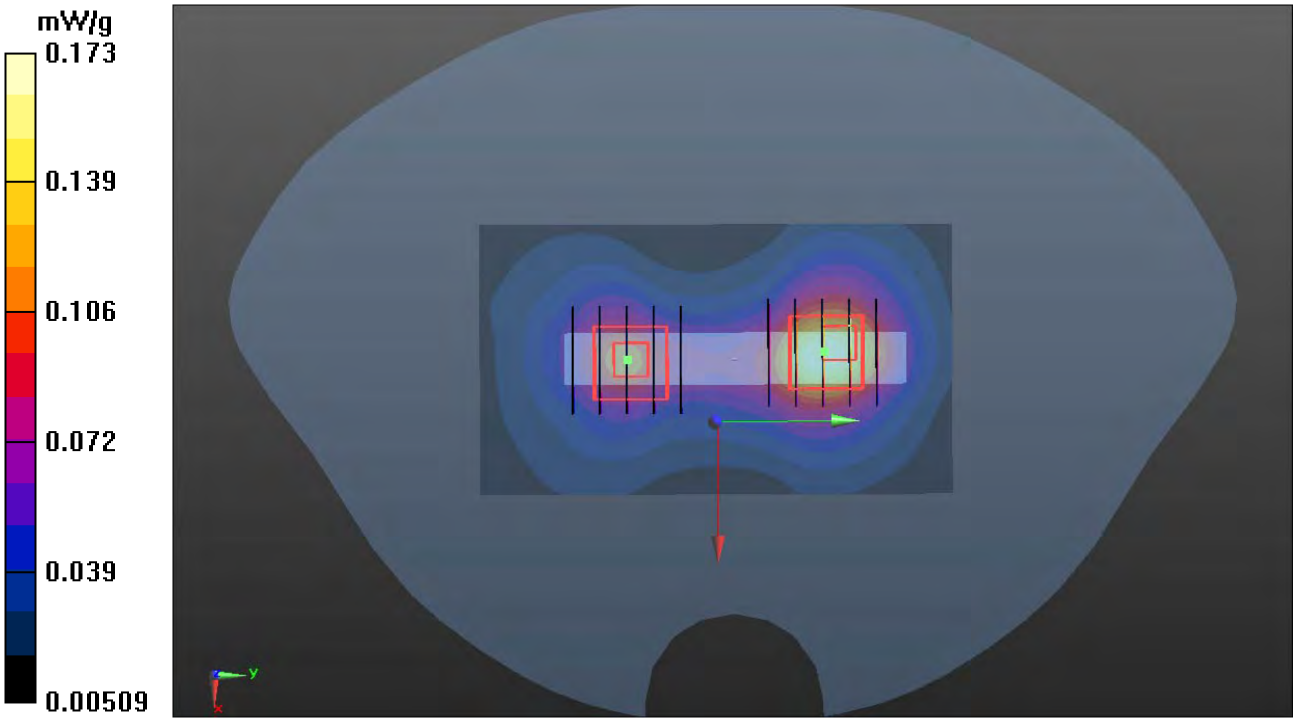
Communication System: WiMax FCC; Frequency: 2502.5 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_1013 Medium parameters used : f = 2502.5 MHz; σ = 2.102 mho/m; ε_r = 51.307; ρ = 1000 kg/m^3
Ambient Temperature：22.8 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/8/29
- Phantom: SAM Phantom_Front; Type: SAM; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch16 /Area Scan (41x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.173 mW/g

Ch16 /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.151 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.343 W/kg
SAR(1 g) = 0.126 mW/g; SAR(10 g) = 0.067 mW/g
Maximum value of SAR (measured) = 0.232 mW/g

Ch16 /Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.151 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.151 W/kg
SAR(1 g) = 0.082 mW/g; SAR(10 g) = 0.044 mW/g
Maximum value of SAR (measured) = 0.117 mW/g



P04 Wimax_5M_2.5GHz_QPSK1/2_Right Side_1cm_Ch01_Ant1

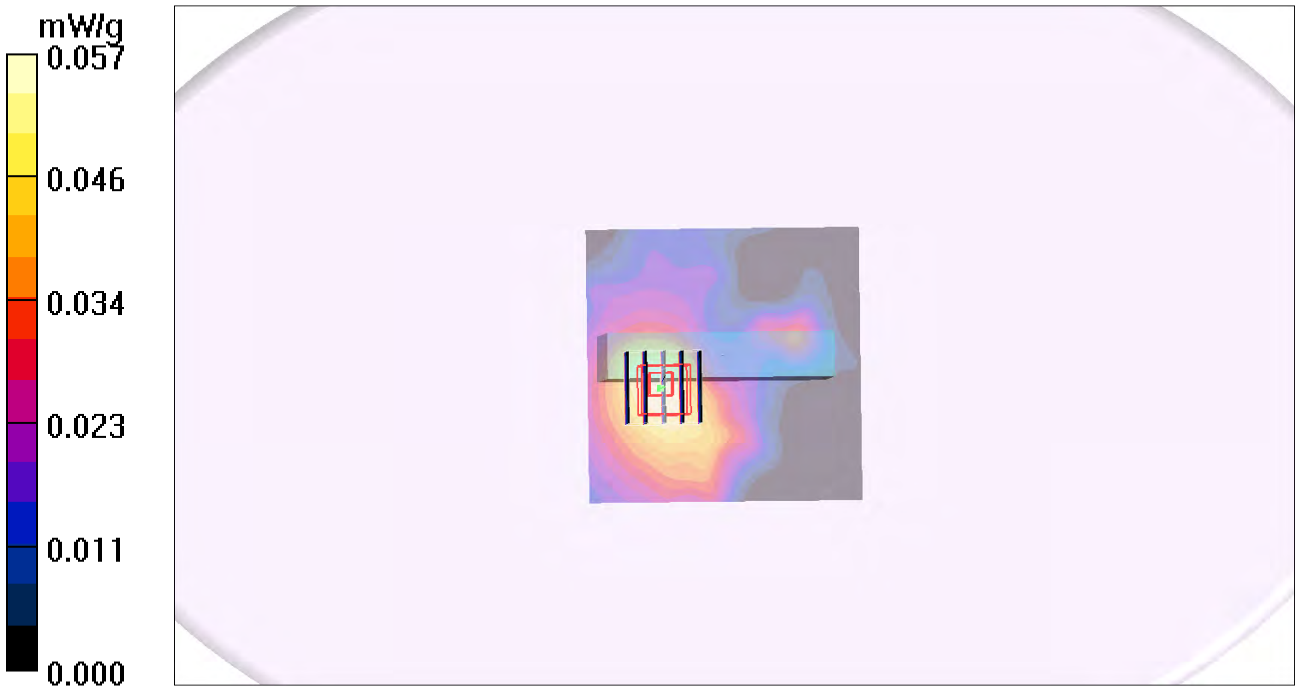
DUT: 110718C17

Communication System: Wimax_2.5GHz 5M; Frequency: 2502.5 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0822 Medium parameters used : f = 2502.5 MHz; σ = 2.07 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Ambient Temperature：22.1 ℃; Liquid Temperature：21.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (61x61x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.057 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.78 V/m; Power Drift = 0.010 dB
Peak SAR (extrapolated) = 0.076 W/kg
SAR(1 g) = 0.041 mW/g; SAR(10 g) = 0.024 mW/g
Maximum value of SAR (measured) = 0.057 mW/g



P05 Wimax_5M_2.5GHz_QPSK1/2_Top Side_1cm_Ch01_Ant1

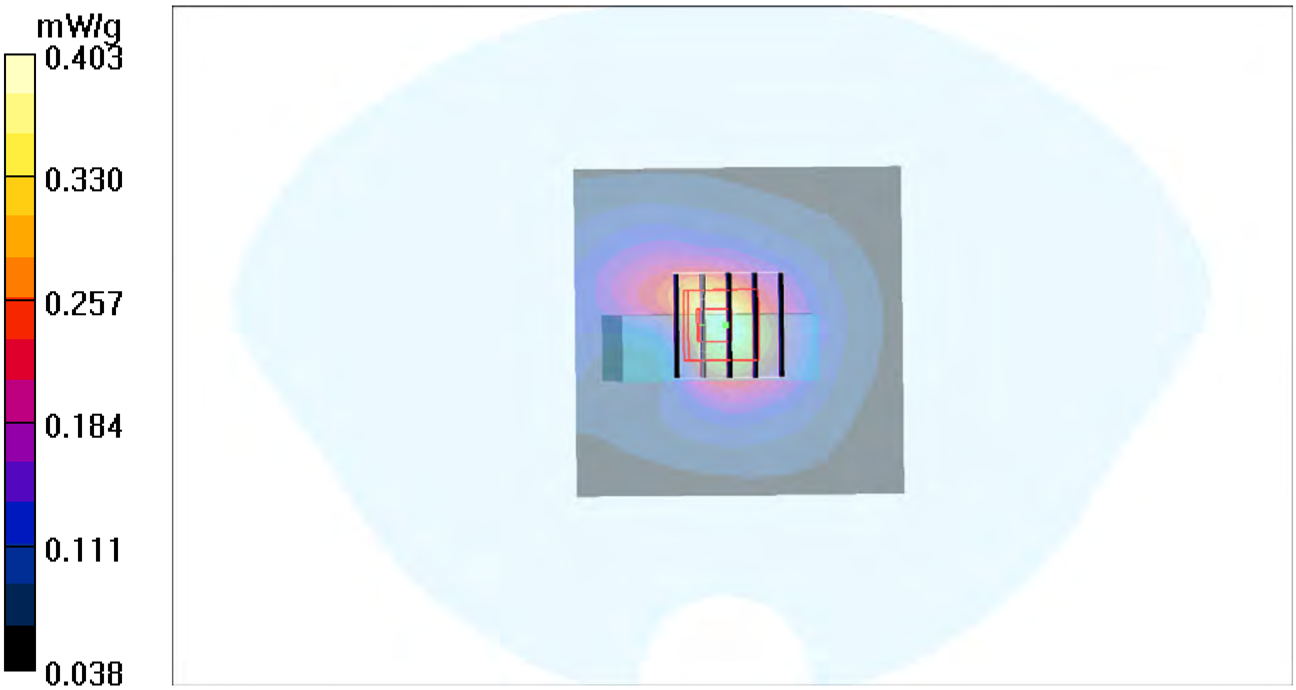
DUT: 110718C17

Communication System: Wimax_2.5GHz 5M; Frequency: 2502.5 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used : f = 2502.5 MHz; σ = 2.1 mho/m;
ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.7 ℃; Liquid Temperature：21.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (71x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.403 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.6 V/m; Power Drift = 0.105 dB
Peak SAR (extrapolated) = 0.564 W/kg
SAR(1 g) = 0.290 mW/g; SAR(10 g) = 0.159 mW/g
Maximum value of SAR (measured) = 0.405 mW/g



P06 Wimax_5M_2.5GHz_QPSK1/2_Front Face_1cm_Ch01_Ant2

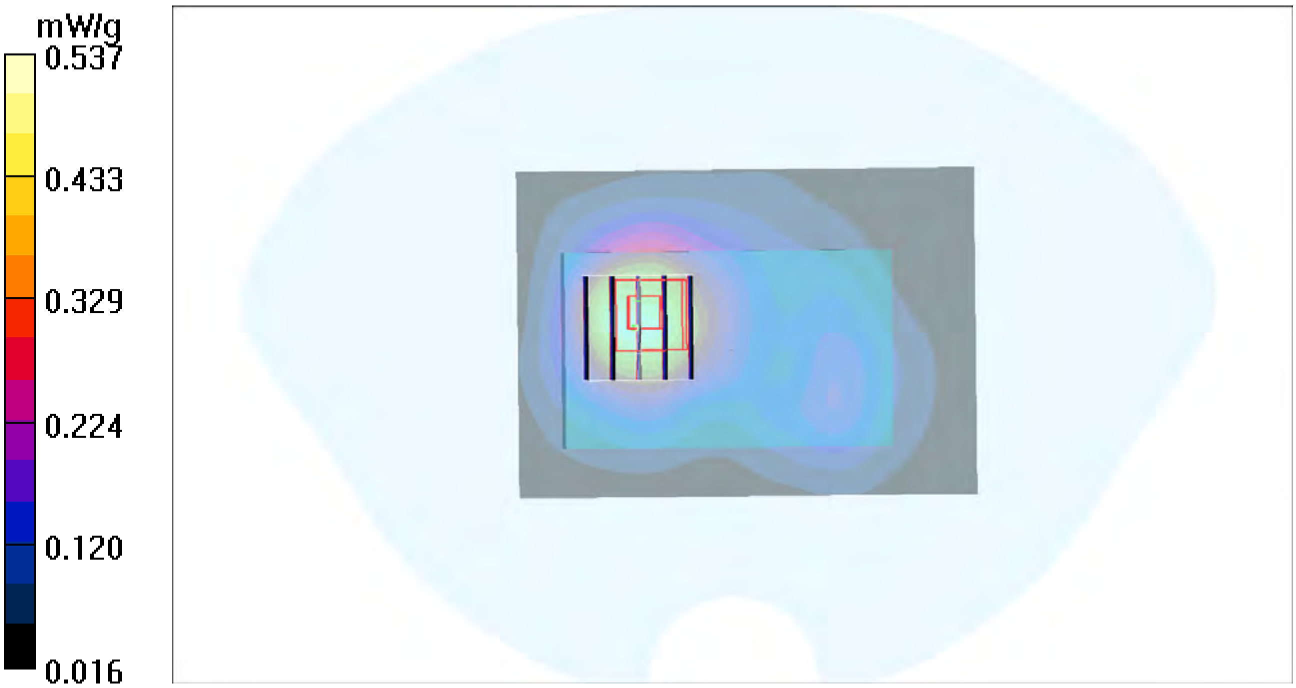
DUT: 110718C17

Communication System: Wimax_2.5GHz 5M; Frequency: 2502.5 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used : f = 2502.5 MHz; σ = 2.1 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.537 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.68 V/m; Power Drift = 0.033 dB
Peak SAR (extrapolated) = 0.617 W/kg
SAR(1 g) = 0.349 mW/g; SAR(10 g) = 0.209 mW/g
Maximum value of SAR (measured) = 0.466 mW/g



P07 Wimax_5M_2.5GHz_QPSK1/2_Rear Face_1cm_Ch01_Ant2

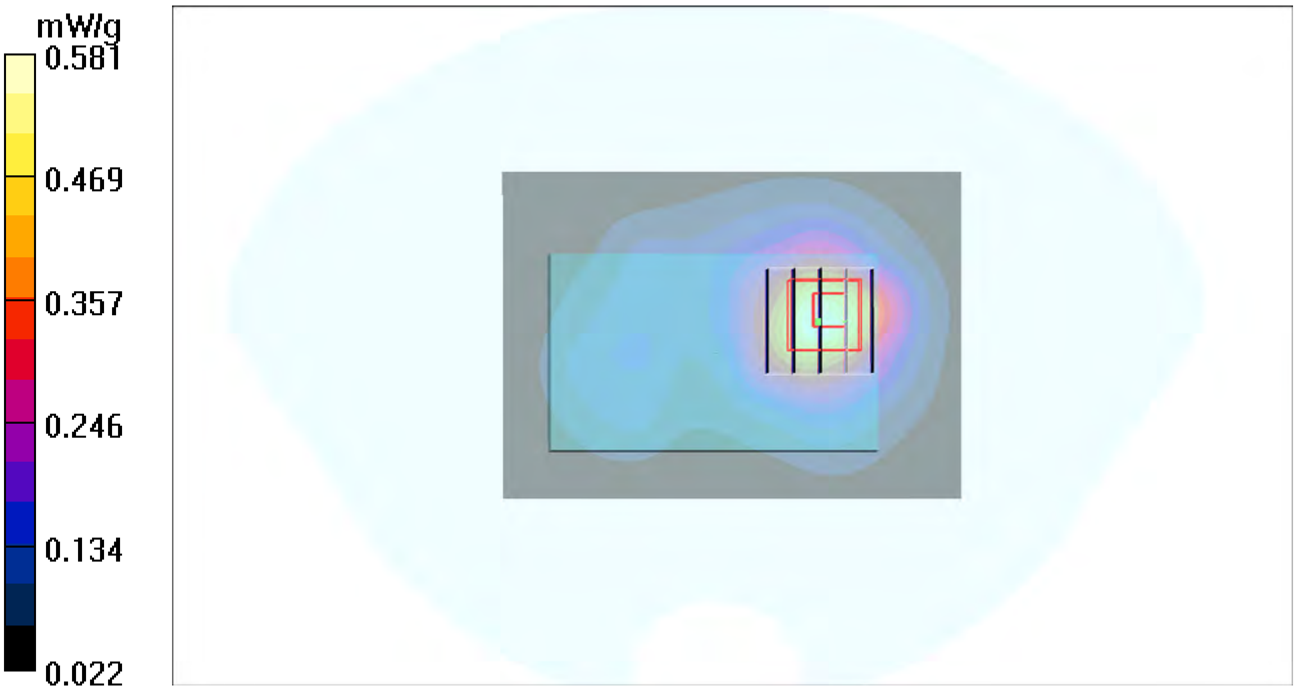
DUT: 110718C17

Communication System: Wimax_2.5GHz 5M; Frequency: 2502.5 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used : f = 2502.5 MHz; σ = 2.1 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.581 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.75 V/m; Power Drift = 0.156 dB
Peak SAR (extrapolated) = 0.679 W/kg
SAR(1 g) = 0.378 mW/g; SAR(10 g) = 0.220 mW/g
Maximum value of SAR (measured) = 0.499 mW/g



P08 Wimax_5M_2.5GHz_QPSK1/2_Left Side_1cm_Ch01_Ant2

DUT: 110718C17

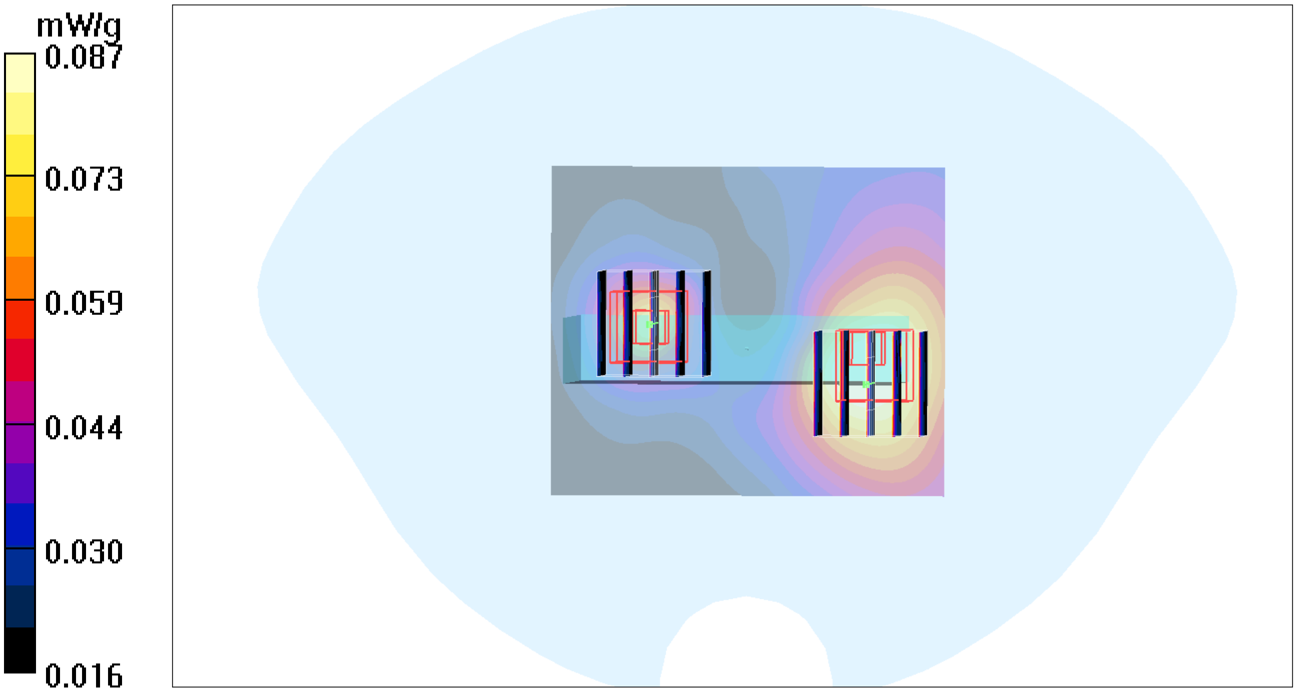
Communication System: Wimax_2.5GHz 5M; Frequency: 2502.5 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used : f = 2502.5 MHz; σ = 2.1 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Phantom_Left; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (71x81x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.087 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.37 V/m; Power Drift = -0.039 dB
Peak SAR (extrapolated) = 0.093 W/kg
SAR(1 g) = 0.056 mW/g; SAR(10 g) = 0.030 mW/g
Maximum value of SAR (measured) = 0.074 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.37 V/m; Power Drift = -0.039 dB
Peak SAR (extrapolated) = 0.217 W/kg
SAR(1 g) = 0.051 mW/g; SAR(10 g) = 0.020 mW/g
Maximum value of SAR (measured) = 0.088 mW/g



P09 Wimax_5M_2.5GHz_QPSK1/2_Right Side_1cm_Ch01_Ant2

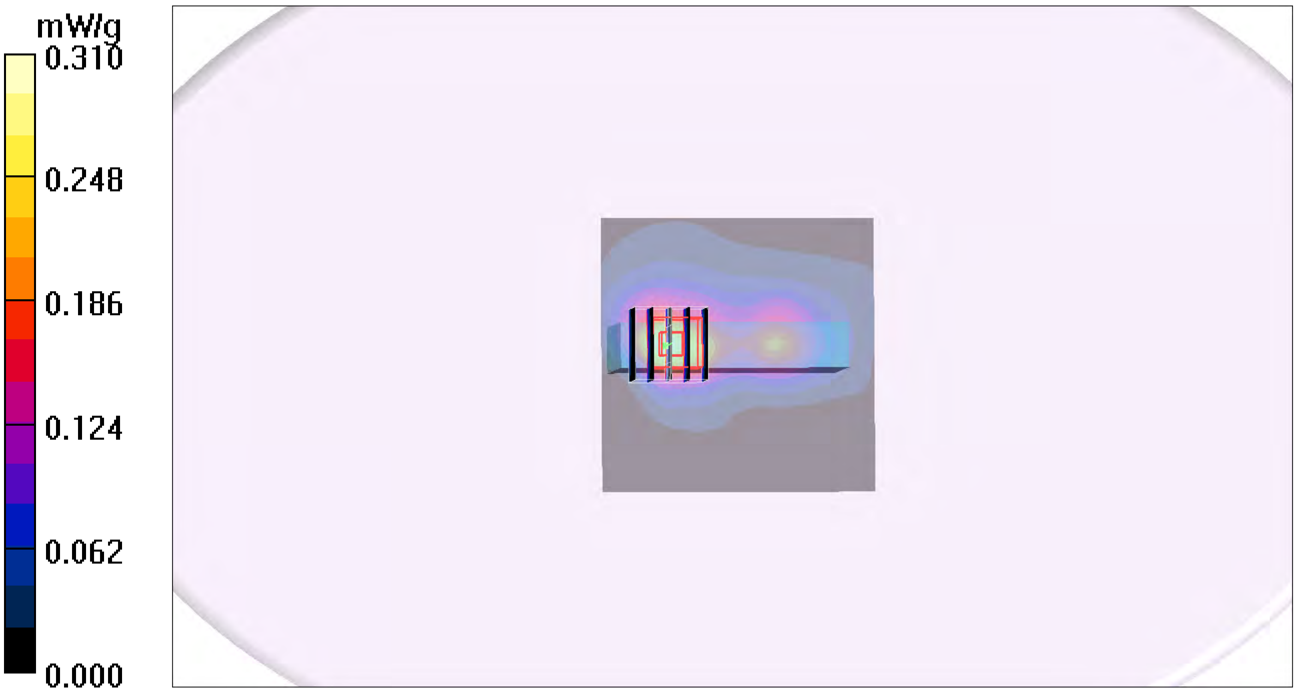
DUT: 110718C17

Communication System: Wimax_2.5GHz 5M; Frequency: 2502.5 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0822 Medium parameters used : f = 2502.5 MHz; σ = 2.07 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Ambient Temperature：22.3 ℃; Liquid Temperature：21.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (81x81x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.310 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.98 V/m; Power Drift = -0.116 dB
Peak SAR (extrapolated) = 0.418 W/kg
SAR(1 g) = 0.209 mW/g; SAR(10 g) = 0.105 mW/g
Maximum value of SAR (measured) = 0.306 mW/g



P10 Wimax_5M_2.5GHz_QPSK1/2_Top Side_1cm_Ch01_Ant2

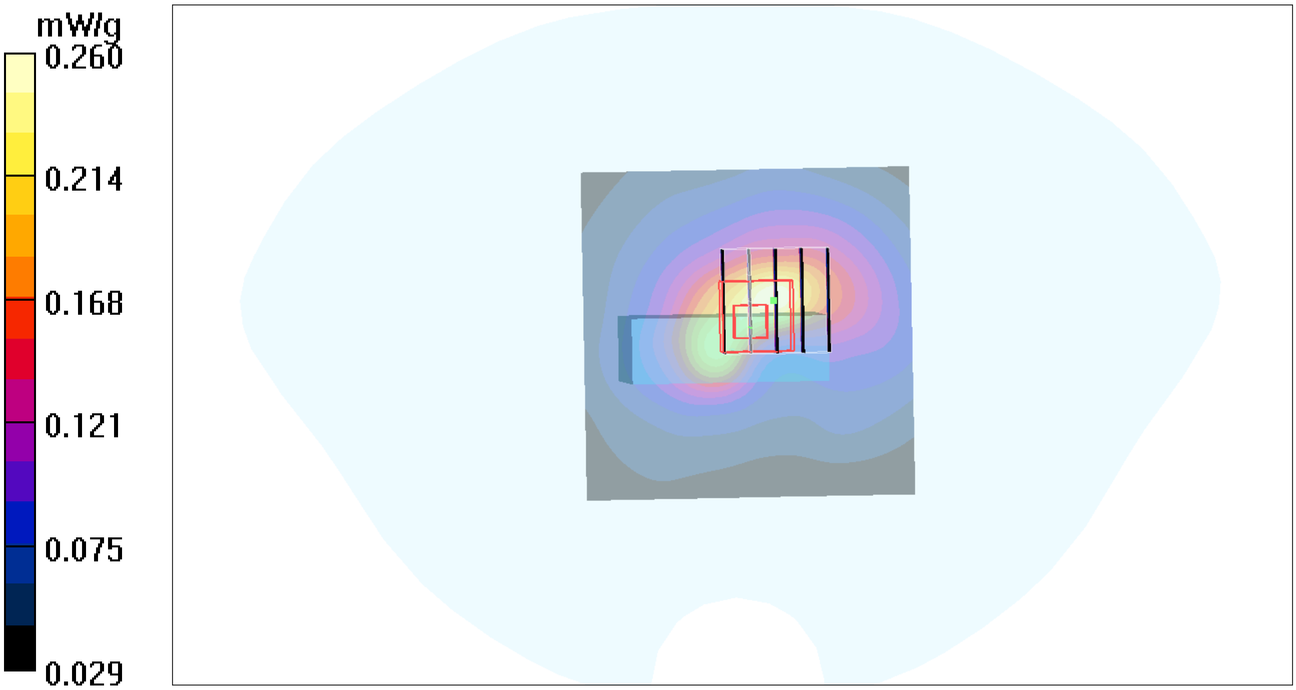
DUT: 110718C17

Communication System: Wimax_2.5GHz 5M; Frequency: 2502.5 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used : f = 2502.5 MHz; σ = 2.1 mho/m;
ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.8 ℃; Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Phantom_Left; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (71x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.260 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.3 V/m; Power Drift = 0.014 dB
Peak SAR (extrapolated) = 0.402 W/kg
SAR(1 g) = 0.207 mW/g; SAR(10 g) = 0.112 mW/g
Maximum value of SAR (measured) = 0.292 mW/g



P11 Wimax_10M_2.5GHz_QPSK1/2_Front Face_1cm_Ch01_Ant1

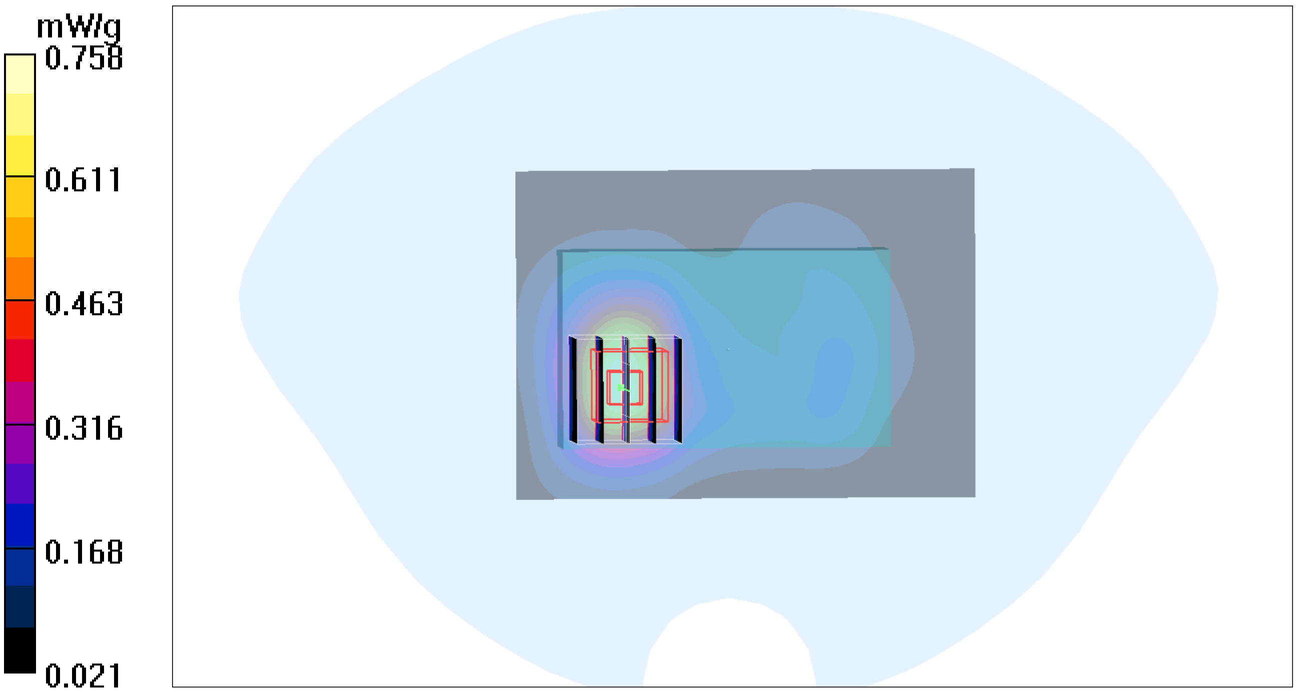
DUT: 110718C17

Communication System: Wimax_2.5GHz 10M; Frequency: 2505 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used: f = 2505 MHz; σ = 2.11 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.758 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.46 V/m; Power Drift = -0.154 dB
Peak SAR (extrapolated) = 0.912 W/kg
SAR(1 g) = 0.509 mW/g; SAR(10 g) = 0.287 mW/g
Maximum value of SAR (measured) = 0.705 mW/g



P11 Wimax_10M_2.5GHz_QPSK1/2_Front Face_1cm_Ch01_Ant1_2D

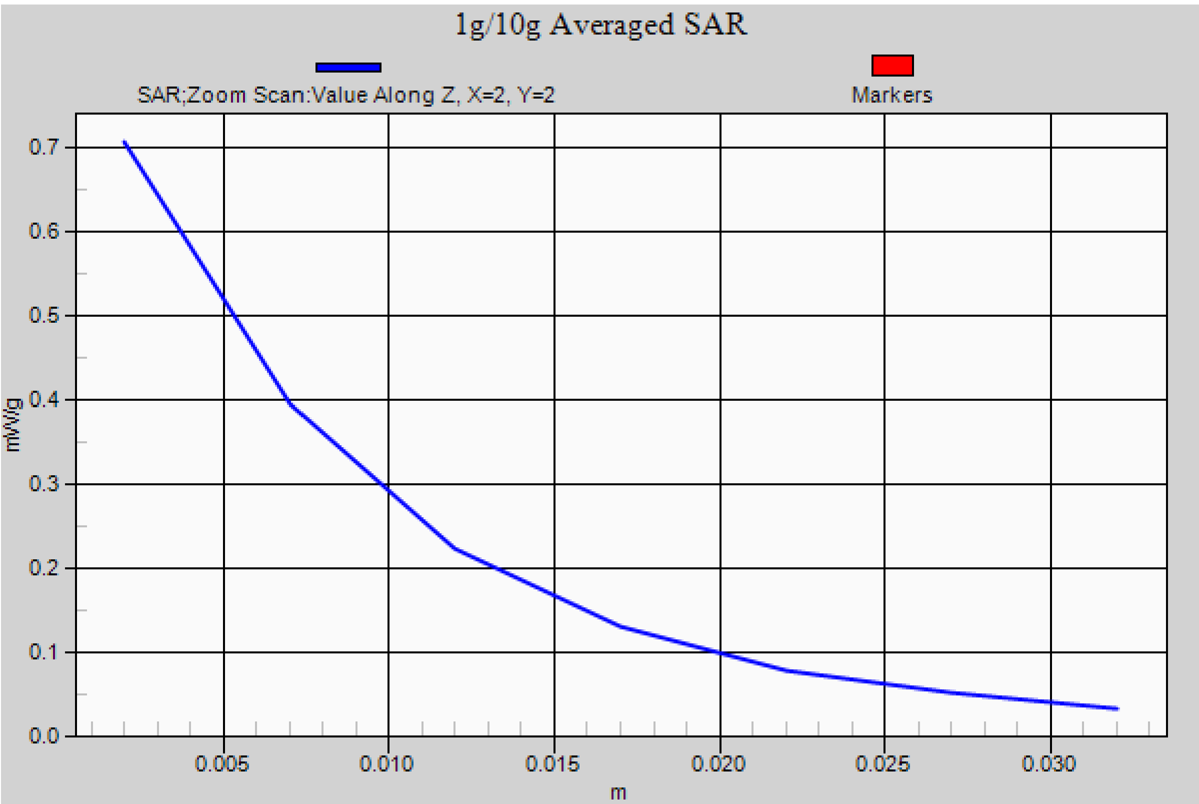
DUT: 110718C17

Communication System: Wimax_2.5GHz 10M; Frequency: 2505 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used: f = 2505 MHz; σ = 2.11 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.758 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.46 V/m; Power Drift = -0.154 dB
Peak SAR (extrapolated) = 0.912 W/kg
SAR(1 g) = 0.509 mW/g; SAR(10 g) = 0.287 mW/g
Maximum value of SAR (measured) = 0.705 mW/g



P12 Wimax_10M_2.5GHz_QPSK_Rear Face_1cm_Ch01_Ant1

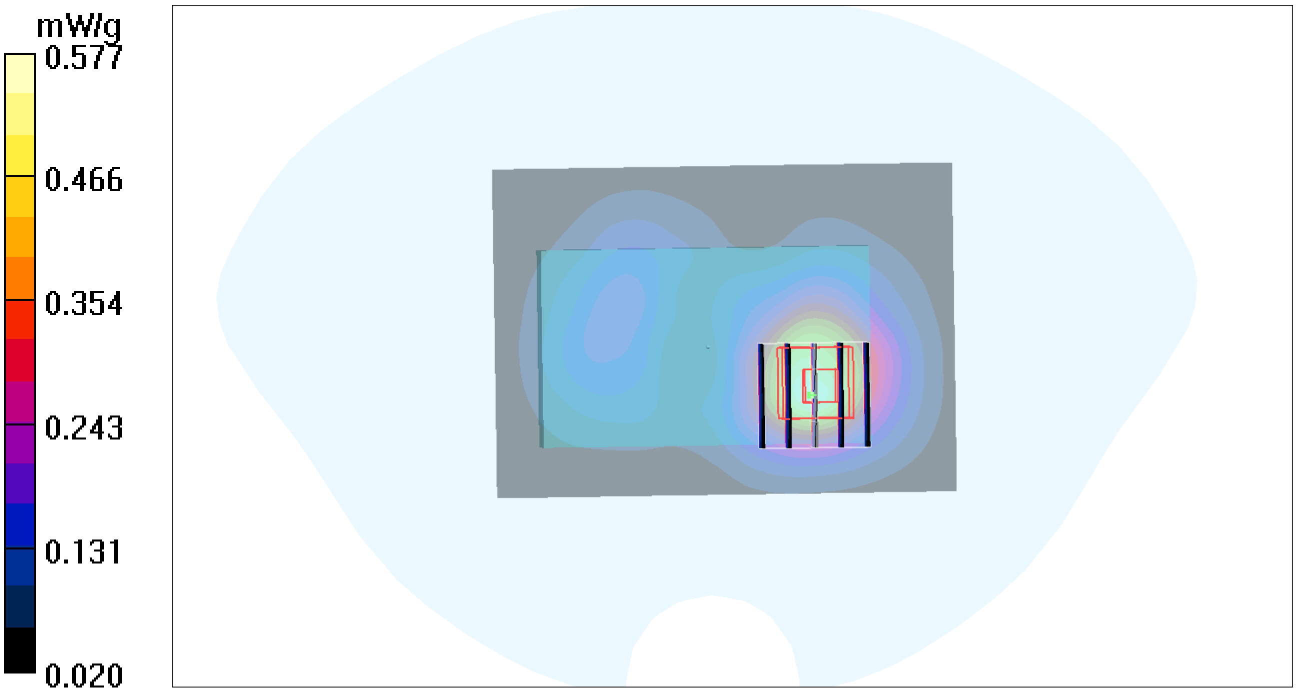
DUT: 110718C17

Communication System: Wimax_2.5GHz 10M; Frequency: 2505 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used: f = 2505 MHz; σ = 2.11 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.7 ℃; Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.577 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.11 V/m; Power Drift = -0.151 dB
Peak SAR (extrapolated) = 0.770 W/kg
SAR(1 g) = 0.411 mW/g; SAR(10 g) = 0.232 mW/g
Maximum value of SAR (measured) = 0.563 mW/g



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2011/10/13

P27 WiMax_10M_2.5GHz_QPSK1/2_Left Side_1cm_Ch16_Ant 1

DUT: 110718C17

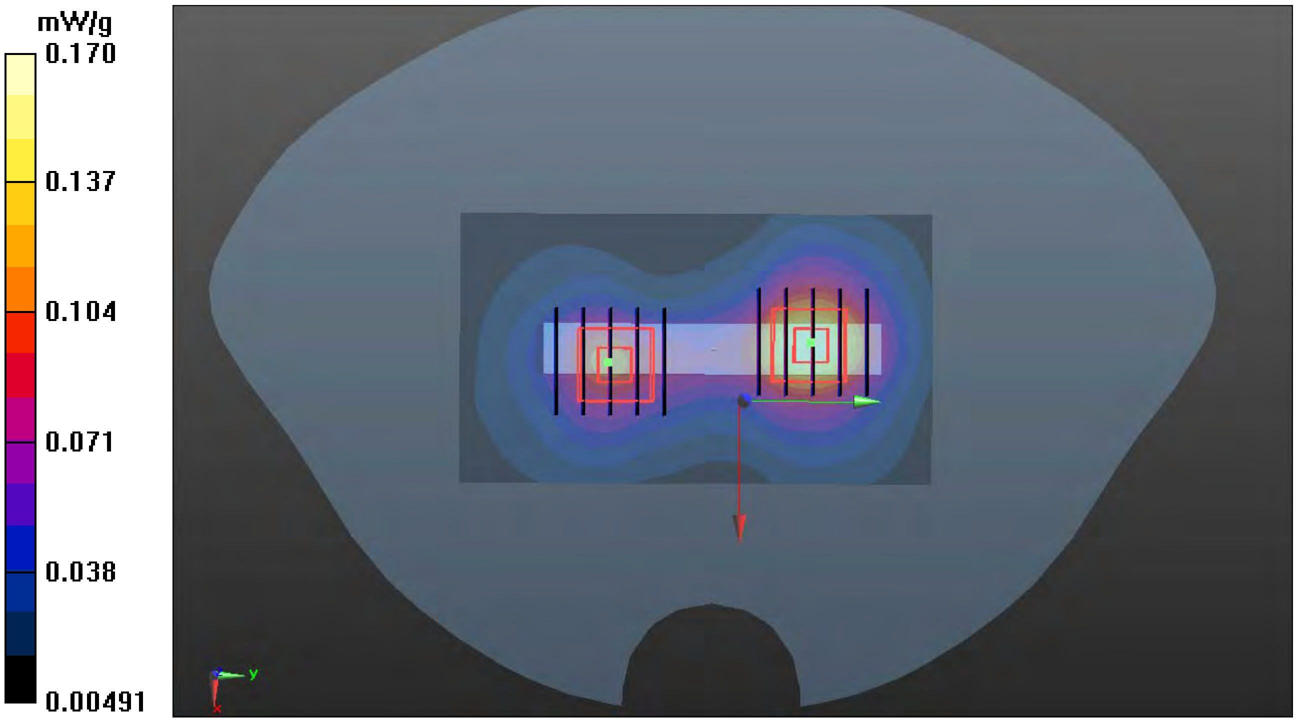
Communication System: WiMax FCC; Frequency: 2505 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_1013 Medium parameters used: f = 2505 MHz; σ = 2.106 mho/m; ε_r = 51.305; ρ = 1000 kg/m^3
Ambient Temperature：22.8 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2011/8/29
- Phantom: SAM Phantom_Front; Type: SAM; Serial: TP-1485
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch16/Area Scan (41x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.170 mW/g

Ch16/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.830 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.222 W/kg
SAR(1 g) = 0.118 mW/g; SAR(10 g) = 0.063 mW/g
Maximum value of SAR (measured) = 0.169 mW/g

Ch16/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.830 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.146 W/kg
SAR(1 g) = 0.079 mW/g; SAR(10 g) = 0.043 mW/g
Maximum value of SAR (measured) = 0.112 mW/g



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2011/8/22

P14 Wimax_10M_2.5GHz_QPSK_Right Side_1cm_Ch01_Ant1

DUT: 110718C17

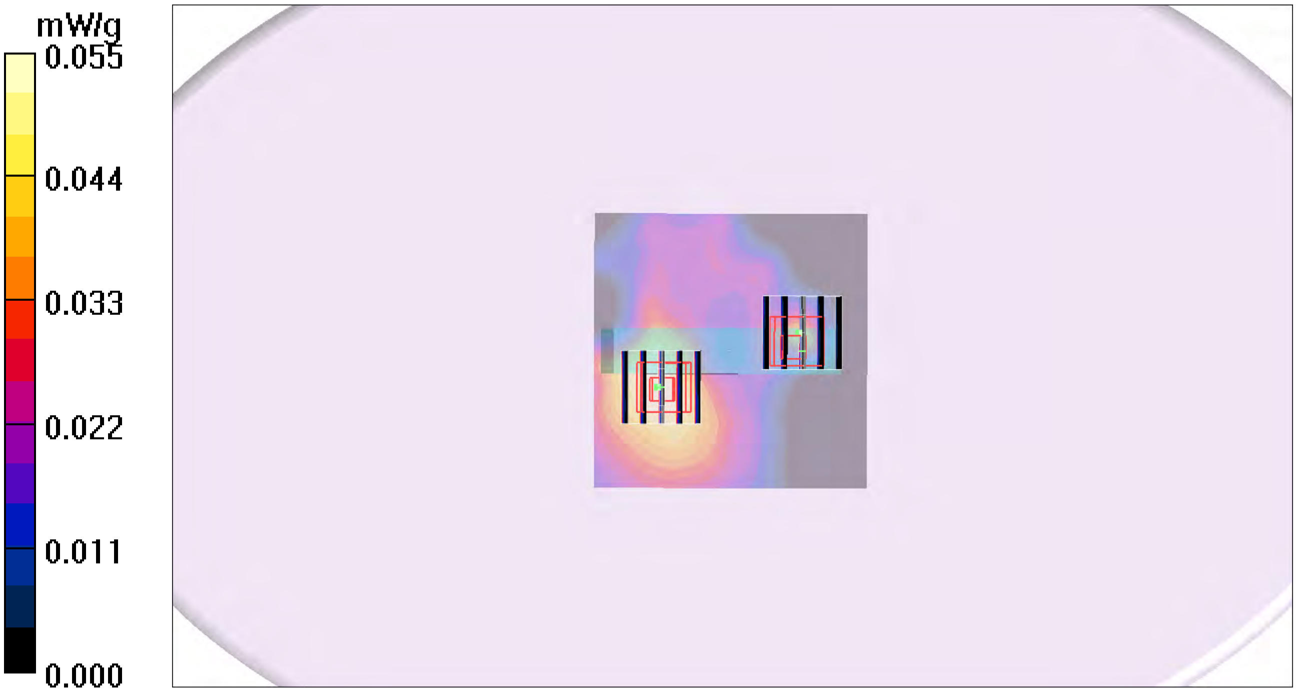
Communication System: Wimax_2.5GHz 10M; Frequency: 2505 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0822 Medium parameters used: f = 2505 MHz; σ = 2.08 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (81x81x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.055 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.24 V/m; Power Drift = 0.921 dB
Peak SAR (extrapolated) = 0.071 W/kg
SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.021 mW/g
Maximum value of SAR (measured) = 0.054 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.24 V/m; Power Drift = 0.921 dB
Peak SAR (extrapolated) = 0.035 W/kg
SAR(1 g) = 0.019 mW/g; SAR(10 g) = 0.0096 mW/g
Maximum value of SAR (measured) = 0.028 mW/g



P15 Wimax_10M_2.5GHz_QPSK1/2_Top Side_1cm_Ch01_Ant1

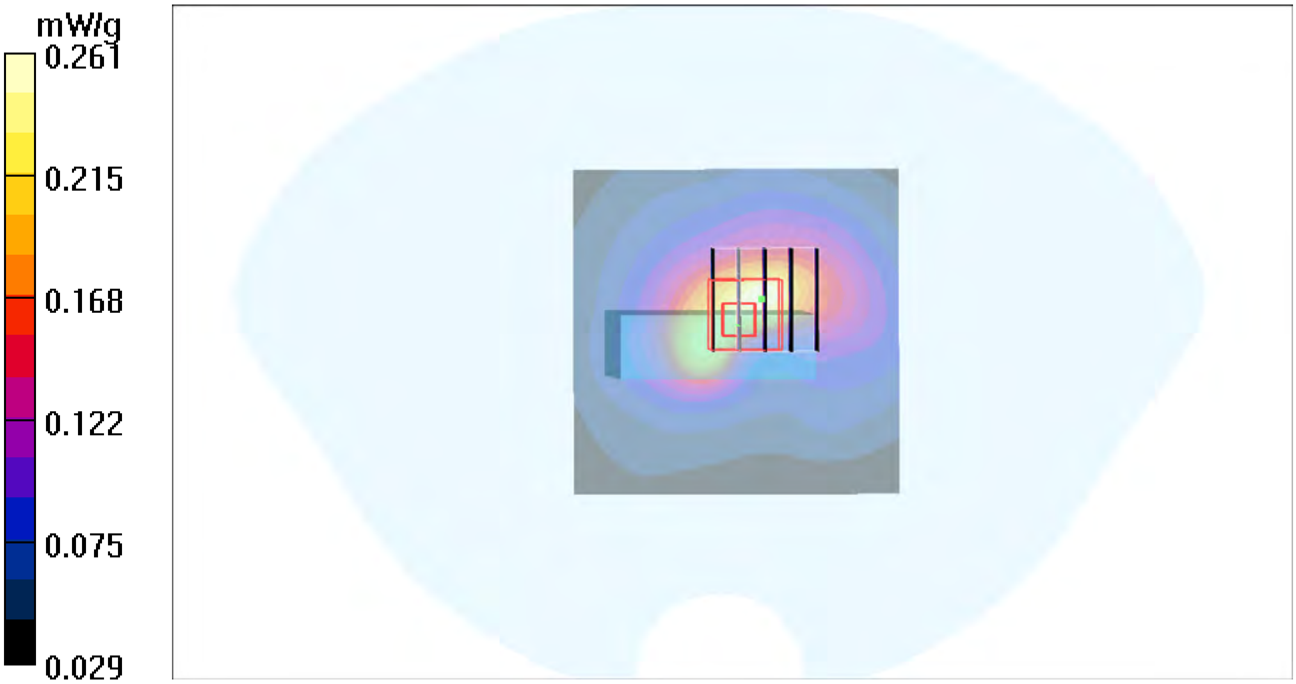
DUT: 110718C17

Communication System: Wimax_2.5GHz 10M; Frequency: 2505 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used: f = 2505 MHz; σ = 2.11 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Ambient Temperature：22.2 ℃; Liquid Temperature：21.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Phantom_Left; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch01/Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.261 mW/g

Ch01/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.3 V/m; Power Drift = 0.014 dB
Peak SAR (extrapolated) = 0.404 W/kg
SAR(1 g) = 0.208 mW/g; SAR(10 g) = 0.113 mW/g
Maximum value of SAR (measured) = 0.293 mW/g



P16 Wimax_10M_2.5GHz_QPSK_Front Face_1cm_Ch02_Ant2

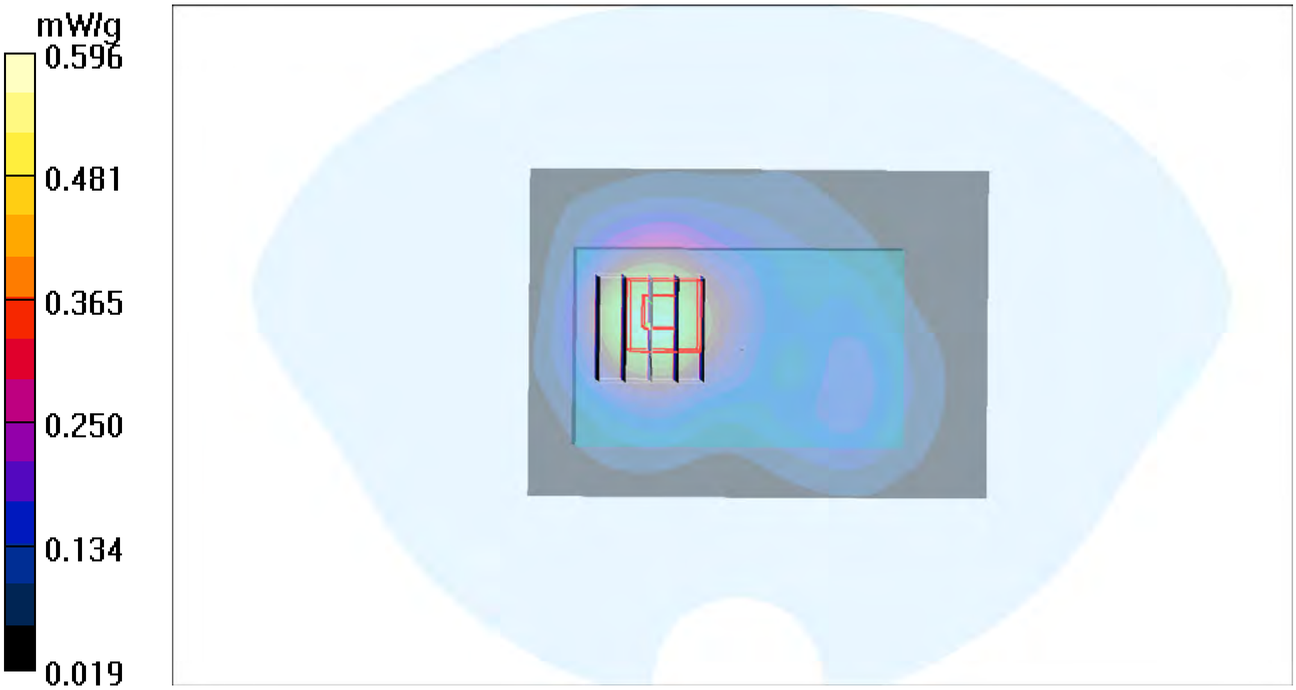
DUT: 110718C17

Communication System: Wimax_2.5GHz 10M; Frequency: 2595 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used: f = 2595 MHz; σ = 2.2 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch02/Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.596 mW/g

Ch02/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.97 V/m; Power Drift = 0.049 dB
Peak SAR (extrapolated) = 0.671 W/kg
SAR(1 g) = 0.384 mW/g; SAR(10 g) = 0.230 mW/g
Maximum value of SAR (measured) = 0.511 mW/g



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2011/8/19

P17 Wimax_10M_2.5GHz_QPSK_Rear Face_1cm_Ch02_Ant2

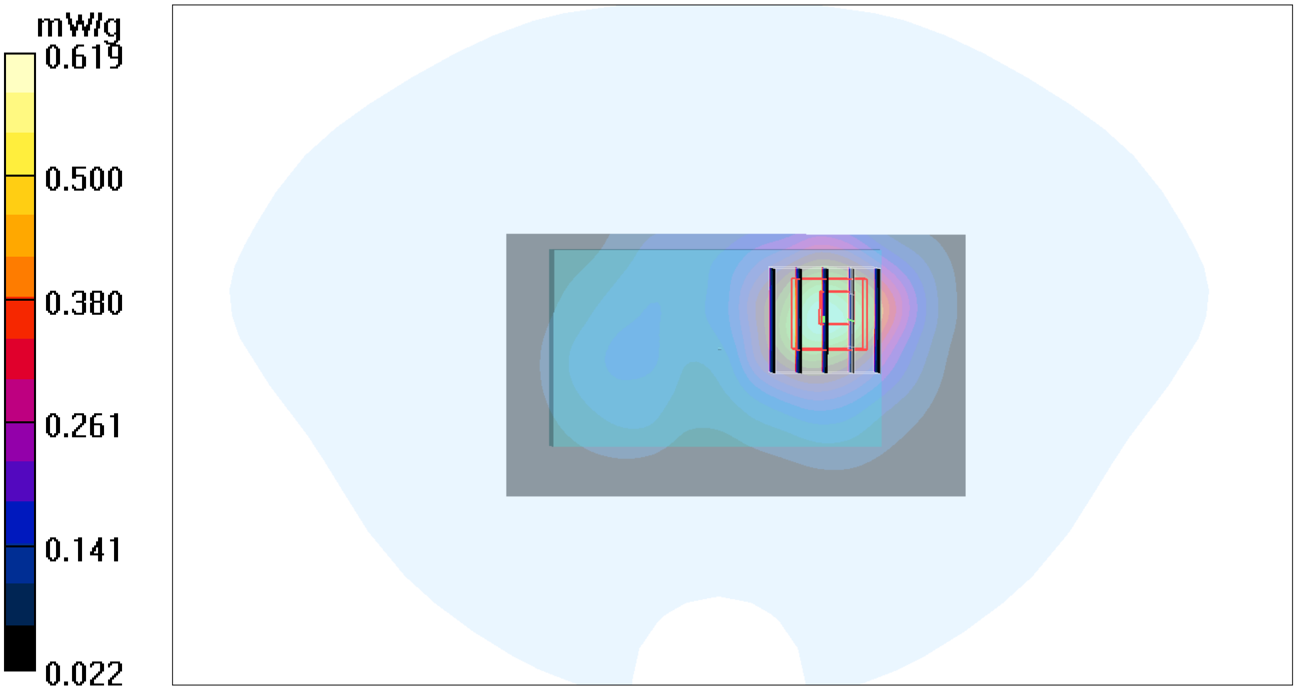
DUT: 110718C17

Communication System: Wimax_2.5GHz 10M; Frequency: 2595 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used: f = 2595 MHz; σ = 2.2 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Ambient Temperature：22.6 ℃; Liquid Temperature：21.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch02/Area Scan (61x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.619 mW/g

Ch02/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.07 V/m; Power Drift = -0.025 dB
Peak SAR (extrapolated) = 0.761 W/kg
SAR(1 g) = 0.414 mW/g; SAR(10 g) = 0.240 mW/g
Maximum value of SAR (measured) = 0.555 mW/g



P18 Wimax_10M_2.5GHz_QPSK_Left Side_1cm_Ch02_Ant2

DUT: 110718C17

Communication System: Wimax_2.5GHz 10M; Frequency: 2595 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0822 Medium parameters used: f = 2595 MHz; σ = 2.2 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch02/Area Scan (51x61x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.043 mW/g

Ch02/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.35 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 0.044 W/kg
SAR(1 g) = 0.024 mW/g; SAR(10 g) = 0.013 mW/g
Maximum value of SAR (measured) = 0.034 mW/g

P19 Wimax_10M_2.5GHz_QPSK_Right Side_1cm_Ch02_Ant2

DUT: 110718C17

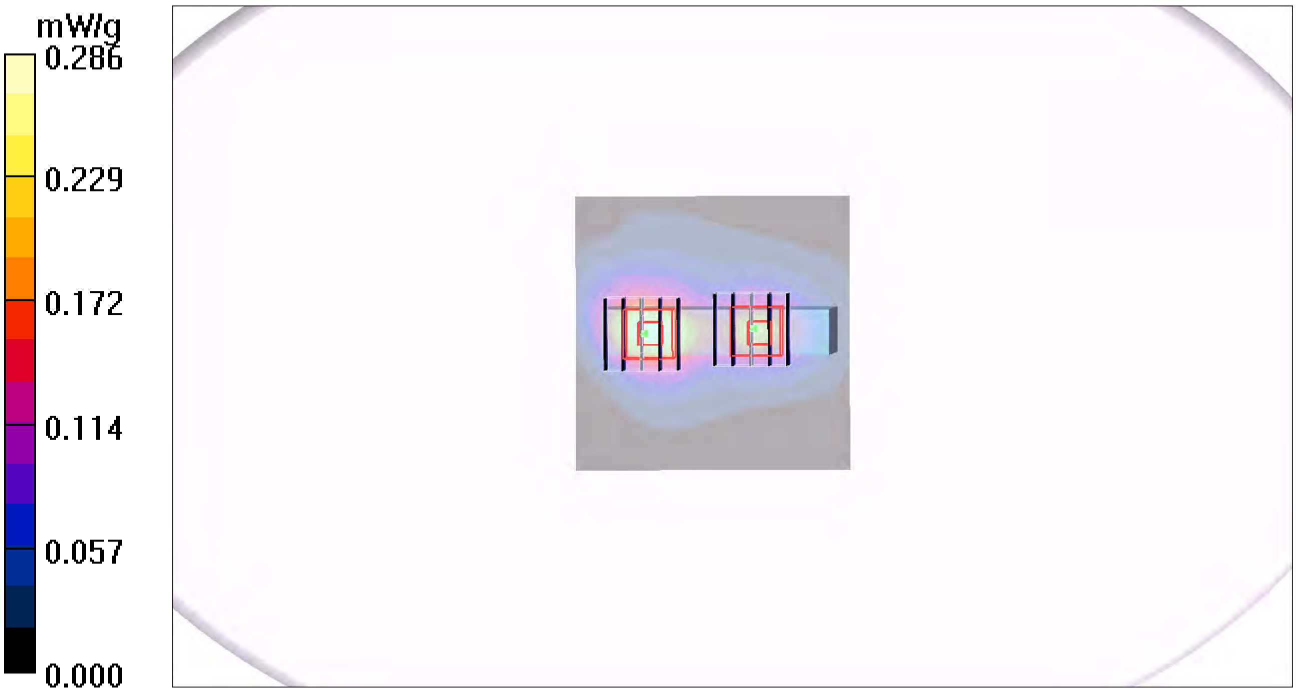
Communication System: Wimax_2.5GHz 10M; Frequency: 2595 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0822 Medium parameters used: f = 2595 MHz; σ = 2.2 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch02/Area Scan (81x81x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.286 mW/g

Ch02/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.36 V/m; Power Drift = 0.023 dB
Peak SAR (extrapolated) = 0.398 W/kg
SAR(1 g) = 0.198 mW/g; SAR(10 g) = 0.100 mW/g
Maximum value of SAR (measured) = 0.290 mW/g

Ch02/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.36 V/m; Power Drift = 0.023 dB
Peak SAR (extrapolated) = 0.276 W/kg
SAR(1 g) = 0.141 mW/g; SAR(10 g) = 0.073 mW/g
Maximum value of SAR (measured) = 0.202 mW/g



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2011/8/19

P20 Wimax_10M_2.5GHz_QPSK_Top Side_1cm_Ch02_Ant2

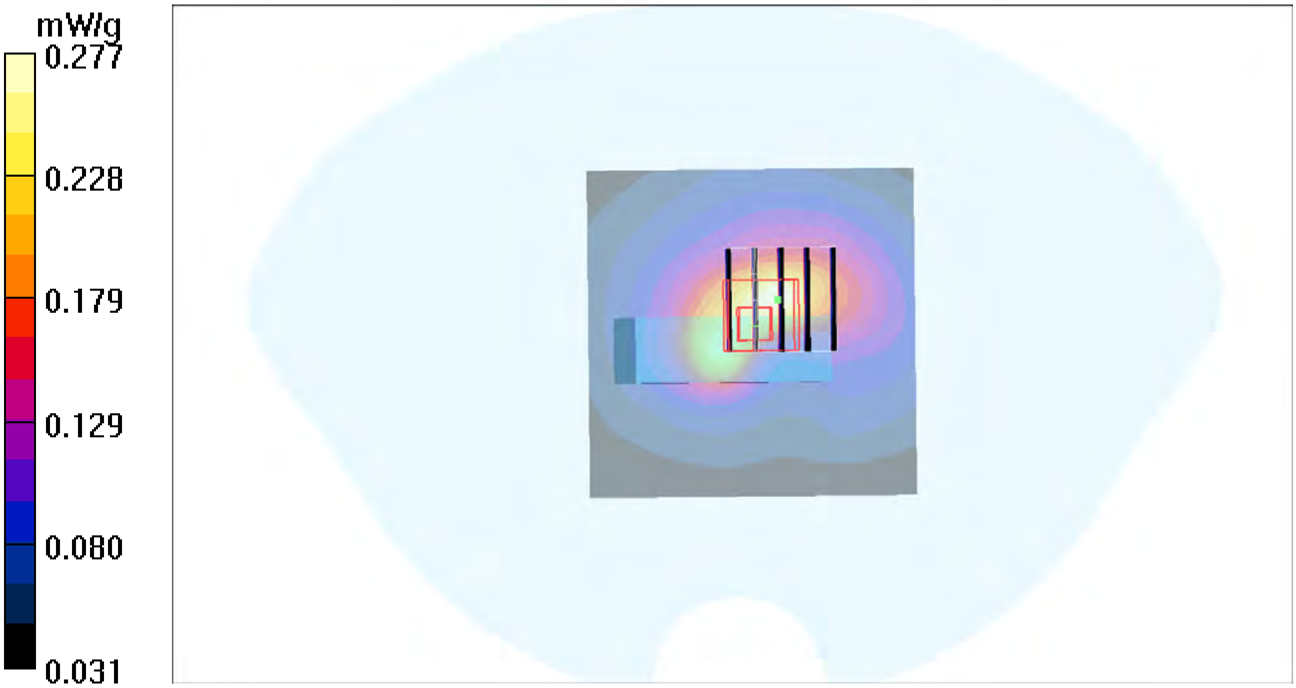
DUT: 110718C17

Communication System: Wimax_2.5GHz 10M; Frequency: 2595 MHz;Duty Cycle: 1:2.70
Medium: MSL2600_0819 Medium parameters used: f = 2595 MHz; σ = 2.2 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.2 ℃

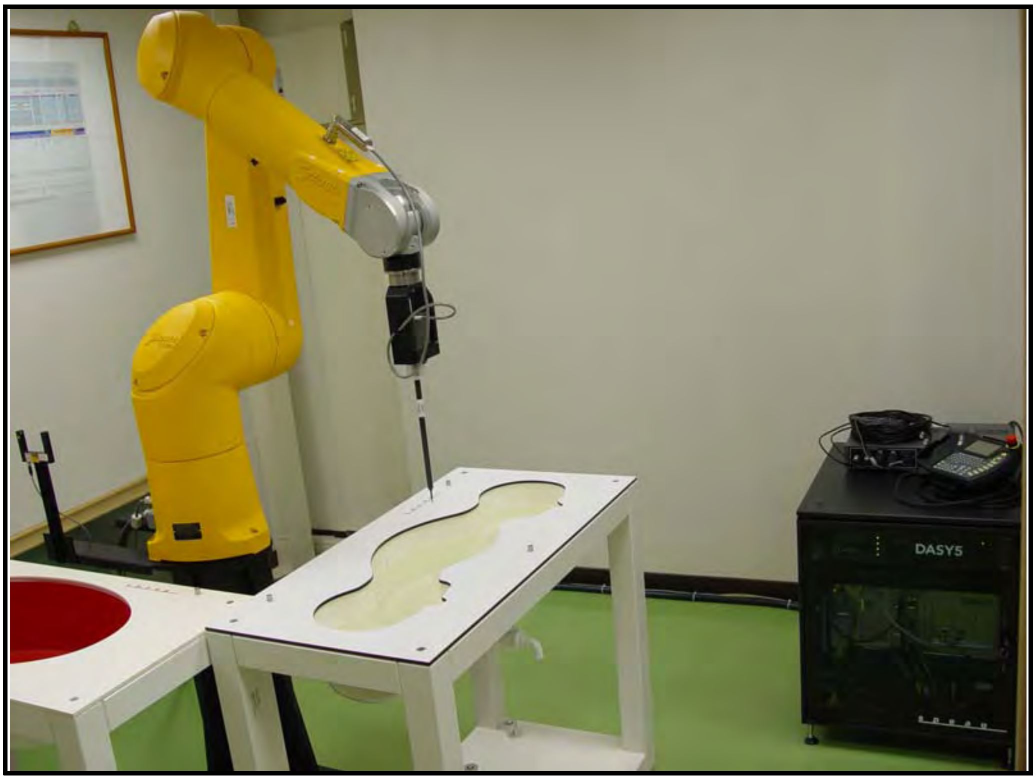
DASY4 Configuration:
- Probe: EX3DV4 - SN3590; ConvF(7.78, 7.78, 7.78); Calibrated: 2011/2/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Phantom_Left; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch02/Area Scan (71x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.277 mW/g

Ch02/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.6 V/m; Power Drift = 0.030 dB
Peak SAR (extrapolated) = 0.441 W/kg
SAR(1 g) = 0.229 mW/g; SAR(10 g) = 0.123 mW/g
Maximum value of SAR (measured) = 0.320 mW/g



APPENDIX B: BV ADT SAR MEASUREMENT SYSTEM



APPENDIX C: PHOTOGRAPHS OF SYSTEM VALIDATION

APPENDIX D: SYSTEM CERTIFICATE & CALIBRATION

D1: PHANTOM

Schmid & Partner Engineering AG

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

Certificate of Conformity / First Article Inspection

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

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

Test	Requirement	Details	Units tested
Dimensions	Compliant with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness of shell	Compliant with the requirements according to the standards	2mm +/- 0.2mm in flat and specific areas of head section	First article, Samples, TP-1314 ff.
Material thickness at ERP	Compliant with the requirements according to the standards	6mm +/- 0.2mm at ERP	First article, All items
Material parameters	Dielectric parameters for required frequencies	300 MHz – 6 GHz: Relative permittivity < 5, Loss tangent < 0.05	Material samples
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions. Observe technical Note for material compatibility.	DEGMBE based simulating liquids	Pre-series, First article, Material samples
Sagging	Compliant with the requirements according to the standards. Sagging of the flat section when filled with tissue simulating liquid.	< 1% typical < 0.8% if filled with 155mm of HSL900 and without DUT below	Prototypes, Sample testing

Standards

[1] CENELEC EN 50361
[2] IEEE Std 1528-2003
[3] IEC 62209 Part I
[4] FCC OET Bulletin 65, Supplement C, Edition 01-01
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents.

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

Date 07.07.2005

Signature / Stamp

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

Certificate of Conformity / First Article Inspection

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

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

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

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

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

Date 07.07.2005

Signature / Stamp

s p e a g
Schmid & Partner Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

D2: DOSIMETRIC E-FIELD PROBE

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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **BV ADT (Auden)**

Certificate No: EX3-3590_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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3590

Manufactured: March 23, 2009
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 ($\mu V/(V/m)^2$)[A]	0.51	0.48	0.51	± 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	±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

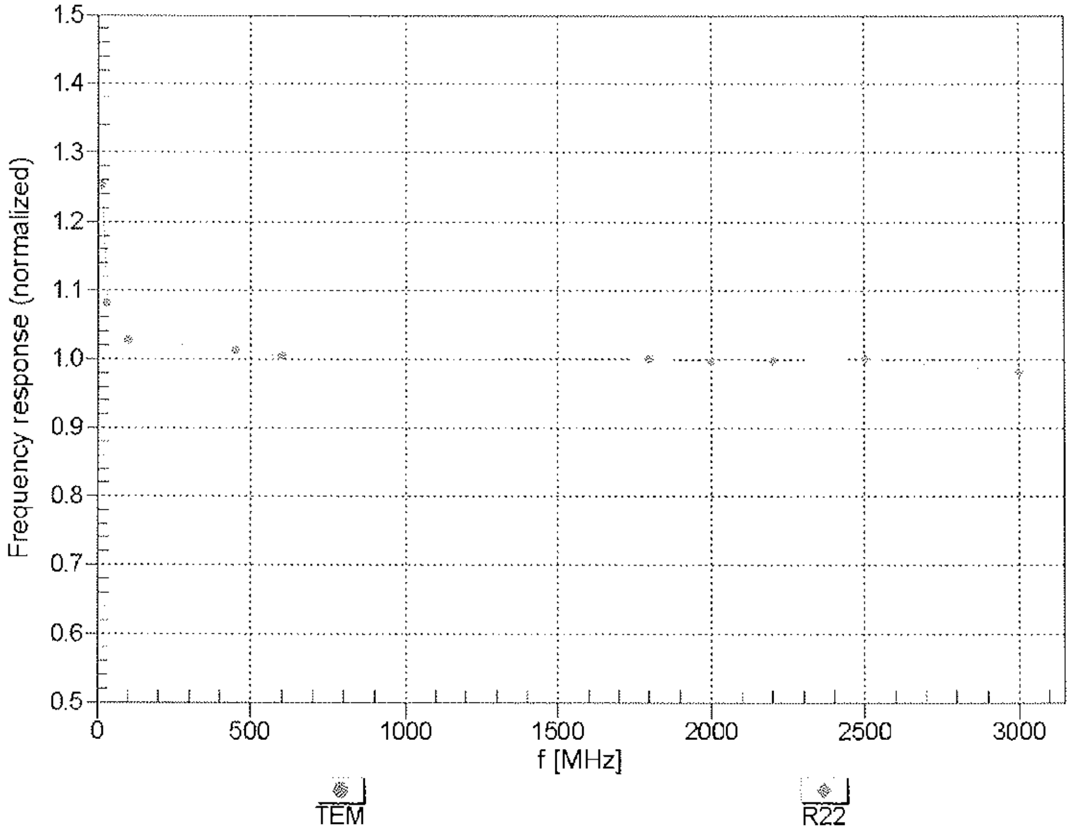
Calibration Parameter Determined in Body Tissue Simulating Media

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.

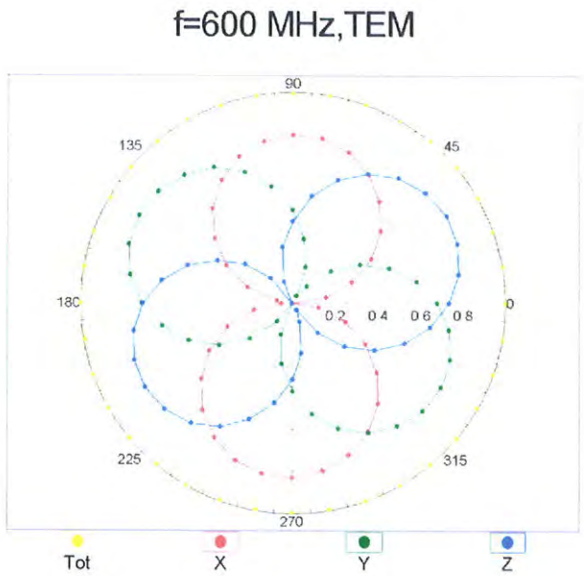
Frequency Response of E-Field

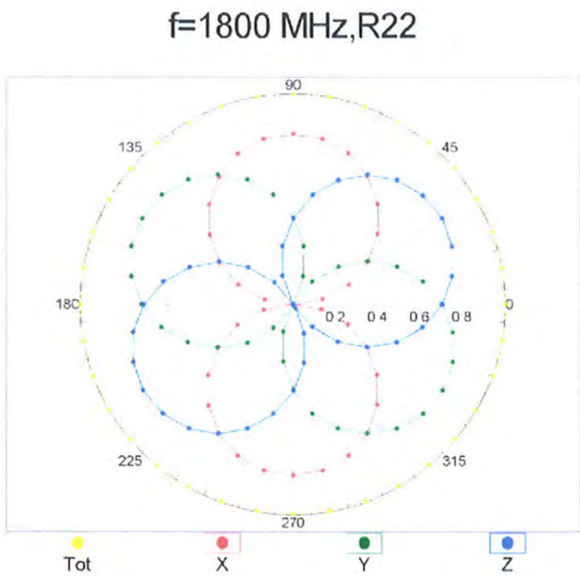
(TEM-Cell:ifi110 EXX, Waveguide: R22)

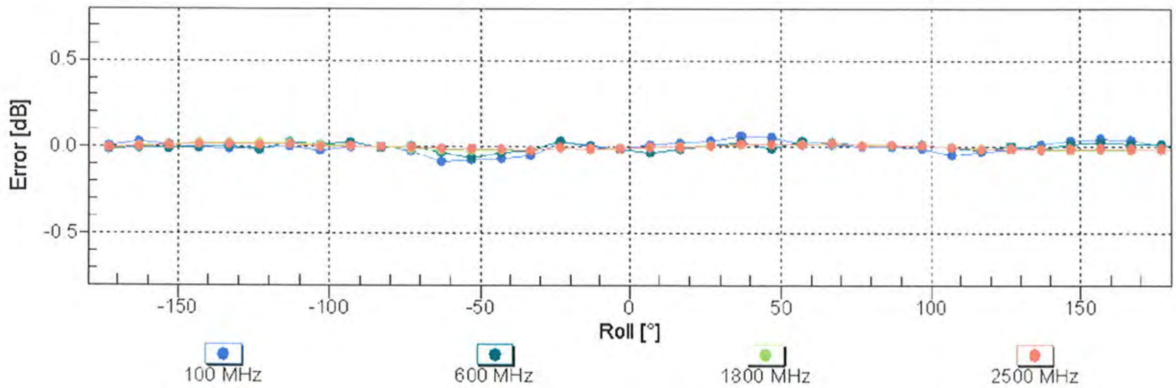


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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

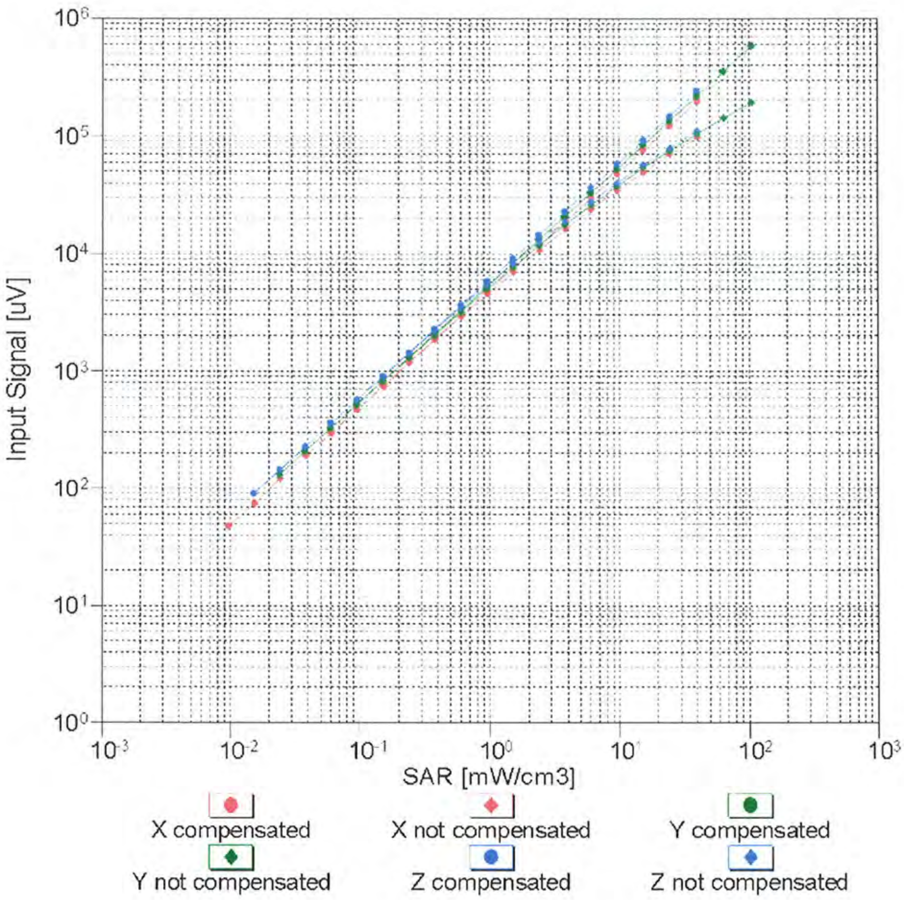


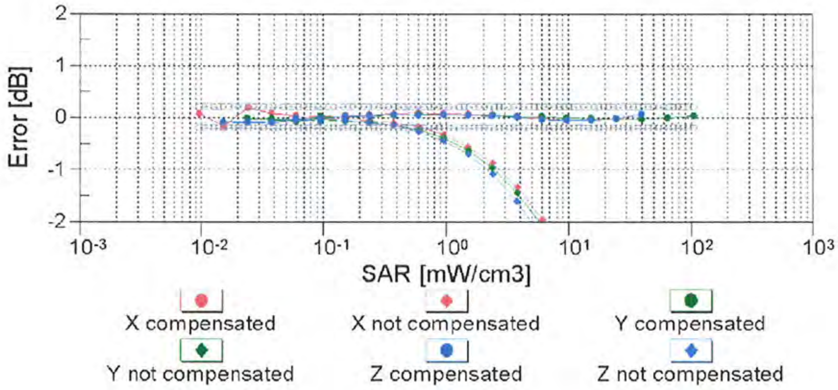




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

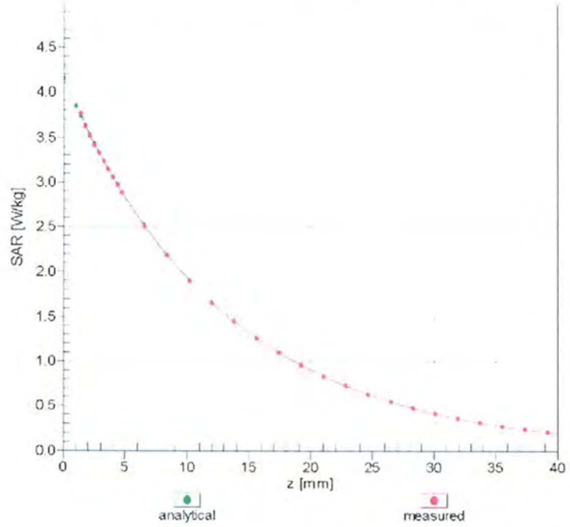




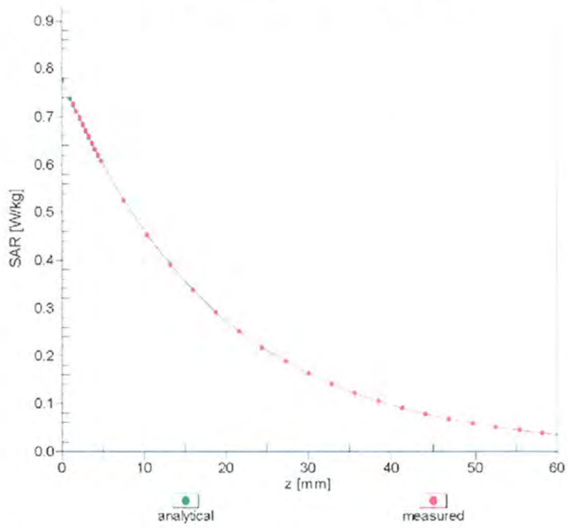
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 1750 MHz,WGLS R22 (H_convF)

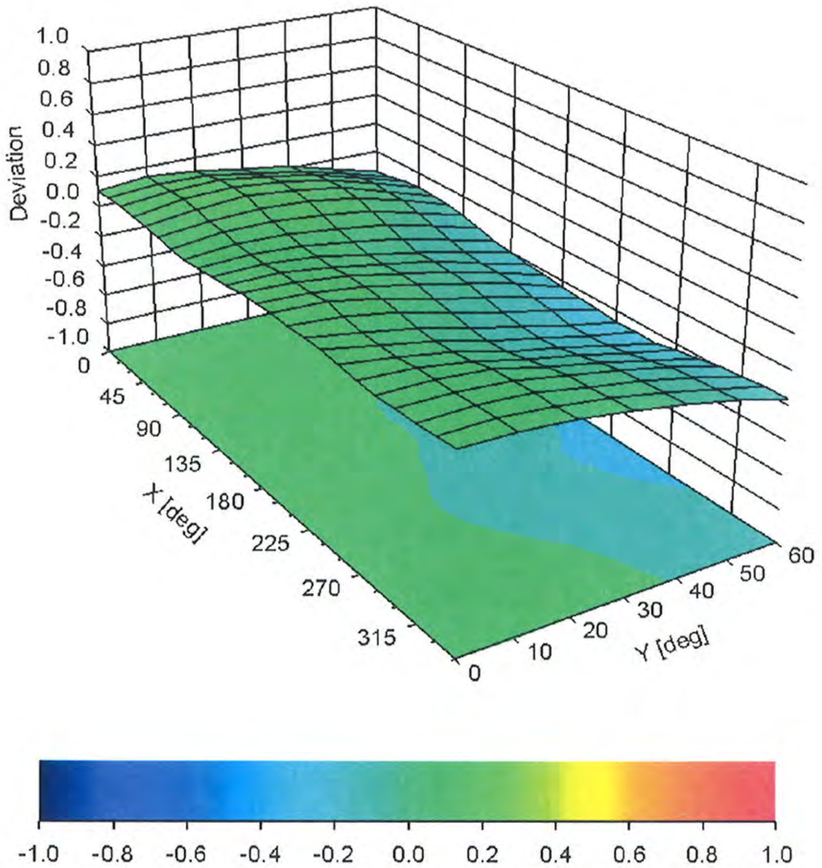


f = 835 MHz,WGLS R9 (H_convF)



Deviation from Isotropy in Air

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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

D3: DAE

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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **BV-ADT (Auden)**

Certificate No: DAE3-579_Sep10

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 579
Calibration procedure(s)	QA CAL-06.v22 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	September 20, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	1-Oct-09 (No: 9055)	Oct-10
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	07-Jun-10 (in house check)	In house check: Jun-11

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

Issued: September 20, 2010

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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
    - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
    - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
    - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
    - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
    - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
    - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
    - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
    - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
    - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.327 ± 0.1% (k=2)	404.379 ± 0.1% (k=2)	404.160 ± 0.1% (k=2)
Low Range	3.98675 ± 0.7% (k=2)	3.99301 ± 0.7% (k=2)	3.94834 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	358.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200003.9	0.96	0.00
Channel X	+ Input	20003.19	3.09	0.02
Channel X	- Input	-19994.55	4.75	-0.02
Channel Y	+ Input	199992.4	-0.09	-0.00
Channel Y	+ Input	19999.51	0.41	0.00
Channel Y	- Input	-19997.22	3.18	-0.02
Channel Z	+ Input	200002.0	0.91	0.00
Channel Z	+ Input	20001.93	2.03	0.01
Channel Z	- Input	-19997.58	2.82	-0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.0	0.02	0.00
Channel X	+ Input	199.82	0.12	0.06
Channel X	- Input	-200.46	-0.56	0.28
Channel Y	+ Input	2000.3	0.47	0.02
Channel Y	+ Input	199.12	-0.78	-0.39
Channel Y	- Input	-201.36	-1.16	0.58
Channel Z	+ Input	1999.9	-0.07	-0.00
Channel Z	+ Input	199.18	-0.72	-0.36
Channel Z	- Input	-201.47	-1.47	0.73

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	7.07	5.75
	- 200	-4.60	-6.25
Channel Y	200	9.48	9.62
	- 200	-10.39	-10.96
Channel Z	200	8.79	8.42
	- 200	-9.64	-9.80

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	0.03	0.35
Channel Y	200	1.14	-	2.31
Channel Z	200	2.01	0.80	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16343	16314
Channel Y	16194	16427
Channel Z	15816	16265

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.70	-1.94	0.80	0.49
Channel Y	-1.55	-2.12	-0.66	0.27
Channel Z	0.57	-0.11	5.61	0.62

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

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

9. Power Consumption (Typical values for information)

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

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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client B.V. ADT (Auden)

Certificate No: DAE4-861_Aug11

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BJ - SN: 861
Calibration procedure(s)	QA CAL-06.v23 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	August 29, 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
Keithley Multimeter Type 2001	SN: 0810278	28-Sep-10 (No:10376)	Sep-11
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	08-Jun-11 (in house check)	In house check: Jun-12

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

Issued: August 29, 2011

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.369 ± 0.1% (k=2)	404.758 ± 0.1% (k=2)	405.720 ± 0.1% (k=2)
Low Range	4.01191 ± 0.7% (k=2)	4.00807 ± 0.7% (k=2)	4.02061 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	126.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200003.7	2.18	0.00
Channel X	+ Input	19998.70	-2.10	-0.01
Channel X	- Input	-20000.72	-0.82	0.00
Channel Y	+ Input	200003.3	3.09	0.00
Channel Y	+ Input	19997.06	-2.54	-0.01
Channel Y	- Input	-20001.61	-1.81	0.01
Channel Z	+ Input	200001.0	1.32	0.00
Channel Z	+ Input	19998.31	-1.39	-0.01
Channel Z	- Input	-20000.55	-0.75	0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.2	0.12	0.01
Channel X	+ Input	200.25	0.05	0.02
Channel X	- Input	-198.30	1.80	-0.90
Channel Y	+ Input	2000.4	0.44	0.02
Channel Y	+ Input	198.69	-1.21	-0.60
Channel Y	- Input	-200.48	-0.48	0.24
Channel Z	+ Input	2000.1	0.13	0.01
Channel Z	+ Input	199.88	-0.22	-0.11
Channel Z	- Input	-201.71	-1.81	0.91

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	5.00	3.52
	- 200	-2.54	-4.10
Channel Y	200	0.95	1.43
	- 200	-2.77	-2.63
Channel Z	200	-9.47	-9.71
	- 200	7.61	7.59

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	4.12	-0.79
Channel Y	200	2.04	-	4.95
Channel Z	200	1.95	-0.33	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15976	16003
Channel Y	16064	16134
Channel Z	16042	16211

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.28	-2.06	1.31	0.64
Channel Y	-0.44	-1.89	2.45	0.60
Channel Z	-1.18	-2.63	1.47	0.74

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

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

9. Power Consumption (Typical values for information)

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

D4: SYSTEM VALIDATION DIPOLE

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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

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

Certificate No: **D2600V2_1003_Jan11**

CALIBRATION CERTIFICATE

Object	D2600V2 - SN: 1003
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits
Calibration date:	January 27, 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-09 (No. 217-01086)	Oct-10
Power sensor HP 8481A	US37292783	06-Oct-09 (No. 217-01086)	Oct-10
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:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 27, 2011

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	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	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	2.03 mho/m ± 6 %
Head TSL temperature during test	(21.5 ± 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	15.0 mW / g
SAR normalized	normalized to 1W	60.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**58.9 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.57 mW / g
SAR normalized	normalized to 1W	26.3 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**26.1 mW / g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.3 ± 6 %	2.10 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	14.4 mW / g
SAR normalized	normalized to 1W	57.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**58.1 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.41 mW / g
SAR normalized	normalized to 1W	25.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**25.7 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.5 Ω - 0.4 jΩ
Return Loss	- 44.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.2 Ω + 0.0 jΩ
Return Loss	- 28.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.147 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	December 23, 2006

DASY5 Validation Report for Head TSL

Date/Time: 27.01.2011 15:40:46

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1003

Communication System: CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: HSL BB1.9
Medium parameters used: f = 2600 MHz; σ = 2.04 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

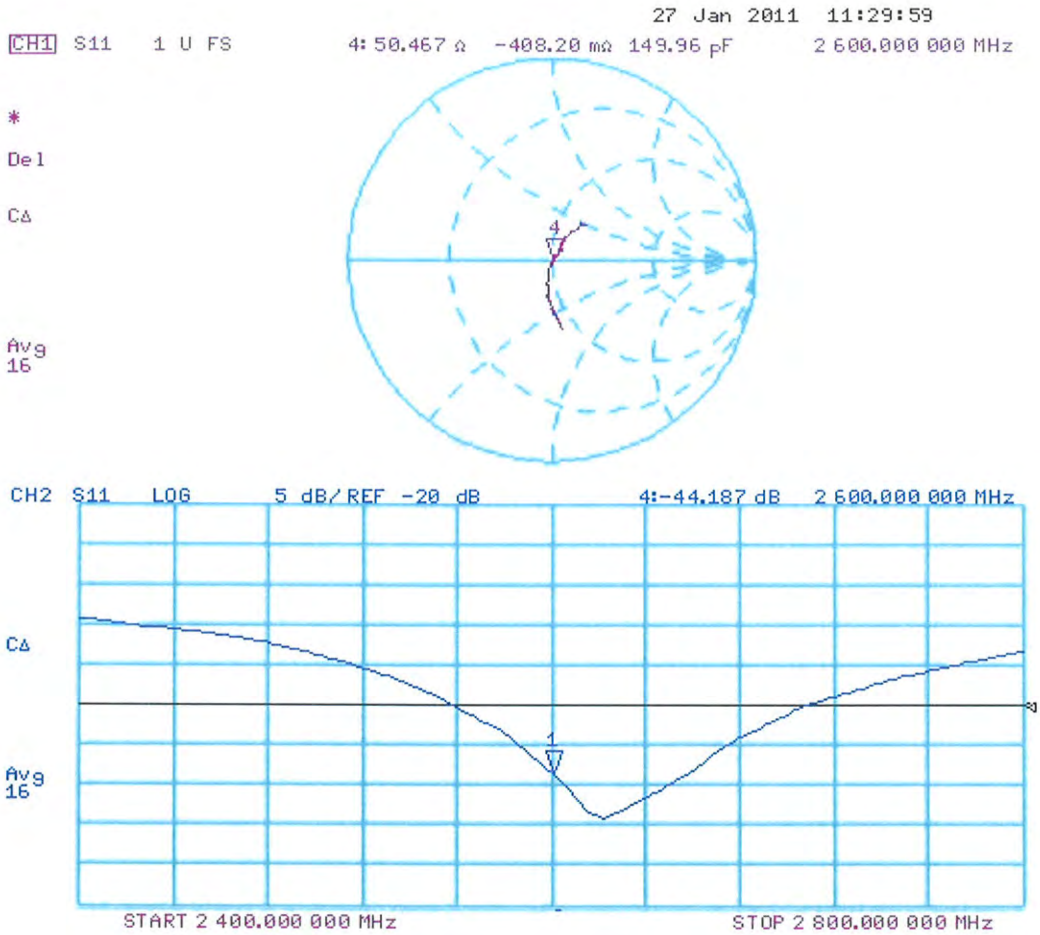
DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.47, 4.47, 4.47); 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 = 102.3 V/m; Power Drift = 0.00081 dB
Peak SAR (extrapolated) = 32.976 W/kg
SAR(1 g) = 15 mW/g; SAR(10 g) = 6.57 mW/g
Maximum value of SAR (measured) = 19.719 mW/g

0 dB = 19.720mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 05.01.2011 14:25:38

Test Laboratory: SPEAG, Zurich, Switzerland

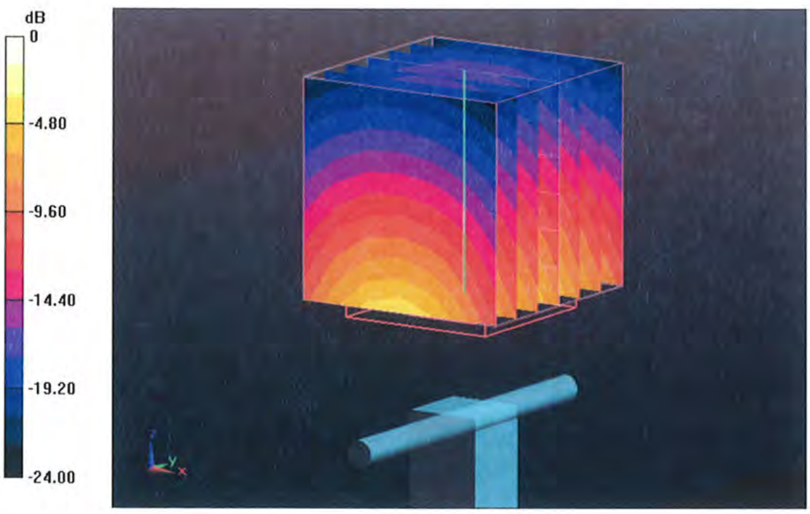
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1003

Communication System: CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 2600 MHz; σ = 2.12 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.18, 4.18, 4.18); 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 = 97.717 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 31.466 W/kg
SAR(1 g) = 14.4 mW/g; SAR(10 g) = 6.41 mW/g
Maximum value of SAR (measured) = 19.133 mW/g



0 dB = 19.130mW/g

Impedance Measurement Plot for Body TSL