



SAR TEST REPORT

REPORT NO.: SA110104E07

MODEL NO.: Dolphin 6000

FCC ID: HD5D6000

RECEIVED: Jan. 04, 2011

TESTED: Feb. 16, 2011

ISSUED: Feb. 21, 2011

APPLICANT: Honeywell International Inc

ADDRESS: 9680 OLD BAILES RD FORT MILL SC 29707
UNITED STATES

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

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TABLE OF CONTENTS

RELEASE CONTROL RECORD.....	3
1. CERTIFICATION	4
2. GENERAL INFORMATION	5
2.1 GENERAL DESCRIPTION OF EUT.....	5
2.2 GENERAL DESCRIPTION OF APPLIED STANDARDS.....	7
2.3 GENERAL INOFRMATION OF THE SAR SYSTEM	7
2.4 TEST EQUIPMENT	11
2.5 GENERAL DESCRIPTION OF THE SPATIAL PEAK SAR EVALUATION	12
2.6 DESCRIPTION OF SUPPORT UNITS.....	15
3. DESCRIPTION OF ANTENNA LOCATION.....	16
4. RECIPES FOR TISSUE SIMULATING LIQUIDS.....	17
5. SYSTEM VALIDATION.....	20
5.1 TEST PROCEDURE	20
5.2 VALIDATION RESULTS	21
5.3 SYSTEM VALIDATION UNCERTAINTIES	22
6. TEST RESULTS	23
6.1 TEST PROCEDURES.....	23
6.2 CONDUCTED POWER.....	25
6.3 DESCRIPTION OF TEST CONDITION.....	25
6.4 MEASURED SAR RESULT	26
6.5 NO SIMULTANEOUS SAR JUSTIFICATION	27
6.6 SAR LIMITS	29
7. INFORMATION ON THE TESTING LABORATORIES.....	30

APPENDIX A: TEST CONFIGURATIONS AND TEST DATA

APPENDIX B: ADT SAR MEASUREMENT SYSTEM

APPENDIX C: PHOTOGRAPHS OF SYSTEM VALIDATION

APPENDIX D: SYSTEM CERTIFICATE & CALIBRATION



A D T

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	NA	Feb. 21, 2011



1. CERTIFICATION

PRODUCT: Mobile Computer

MODEL: Dolphin 6000

BRAND: Honeywell

APPLICANT: Honeywell International Inc

TESTED: Feb. 16, 2011

TEST SAMPLE: ENGINEERING SAMPLE

STANDARDS: FCC Part 2 (Section 2.1093)

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

RSS-102 Issue 4 (2010-03)

The above equipment (model: Dolphin 6000) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

PREPARED BY : *Andrea Hsia*
Andrea Hsia / Specialist , **DATE:** Feb. 21, 2011

APPROVED BY : *Gary Chang*
Gary Chang / Assistant Manager , **DATE:** Feb. 21, 2011



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

EUT	Mobile Computer	
MODEL NO.	Dolphin 6000	
FCC ID	HD5D6000	
POWER SUPPLY	5.0Vdc (Car charger or power adapter) 3.7Vdc (battery)	
MODULATION TYPE	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM	
MODULATION TECHNOLOGY	DSSS, OFDM	
TRANSFER RATE	802.11b:11.0/ 5.5/ 2.0/ 1.0Mbps 802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps	
OPERATING FREQUENCY	2412 ~ 2462MHz	
NUMBER OF CHANNEL	11	
MAXIMUM SAR (1g)	Head: 0.086W/kg	Body: 0.061W/kg
ANTENNA TYPE	PIFA antenna with 3dBi gain	
DATA CABLE	1.2m USB charger shielded cable with one core	
I/O PORTS	Refer to user's manual	
ACCESSORY DEVICES	Adapter, Battery, Holder cable, Car Charger	

NOTE:

1. The test data are separated into following test reports.

	REFERENCE REPORT
WLAN 802.11b/g, 802.11n	SA110104E07
GSM850, GPRS850 & GSM1900, GPRS1900	SA110104E07-1

2. The EUT could be supplied with a power adapter or a rechargeable battery as the following table:

Item	Brand	Model No.	Spec.
Adapter	Sunfone	ACW010A3-05Z	I/P: 100~240V, 50~60Hz, 0.4A O/P: 5Vdc, 2A Power cable: 1.4m non-shielded cable without core
Car Charger	Atech OEM Inc	C15C-0520CD0-S3	I/P: 12-24V O/P: 5Vdc, 2A Power cable: 1.5m non-shielded cable without core
battery	Palladium	Dolphin 6000 Battery	3.7Vdc, 1530mAh, 5.7Wh



3. The EUT was manufactured by following manufacture and factory:

Manufacturer	Manufacturer Address
Honeywell International Inc	9680 OLD BAILES RD FORT MILL SC 29707 UNITED STATES
Factory	Factory Address
Universal Scientific Industrial Co., Ltd.	141, Lane 351, Taiping Rd., Sec. 1, Tsao Tuen, Nan-Tou Hsien, Taiwan
Universal Scientific Industrial de Mexico, S.A de C.V.	Periferico Manuel Gomez Morin #656 R. Santa Isabel, Anillo 44290 Guadalajara, Jal Mexico
USI Electronics (Shenzhen)Co., Ltd.	USI Electronics Park, North of High-Tech Industry Park, Nanshan District, Shenzhen, Guangdong, China
Universal Scientific Industrial (Shanghai) Co., Ltd.	NO. 1558, ZHANGDONG RD. PUDONG SHANGHAI 201203 CHINA
Universal Global Technology (Shenzhen) Co., Ltd.	1&2&4 Floor of Building B and 2 Floor of Building C, USI Electronics Park NanShan District, ShenZhen, P.R.C 518057
Universal Scientific Industrial Co., Ltd.	1F&4F No.135, Lane 351, Taiping Road, Sec. 1, Tsao Tuen Nan-Tou, Taiwan
Universal Global Scientific Industrial Co., Ltd.	B1, 1~3F & 5F, No.135, Lane 351, Taiping Road, Sec. 1, Tsao Tuen Nan-Tou, Taiwan

4. The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.



2.2 GENERAL DESCRIPTION OF APPLIED STANDARDS

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

FCC Part 2 (2.1093)

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

RSS-102 Issue 4 (2010-03)

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 (software 4.7 Build 80) consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY4 software defined. The DASY4 software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion 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 \pm 0.2mm
FILLING VOLUME	Approx. 25liters
DIMENSIONS	Height: 810mm; Length: 1000mm; Width: 500mm

SYSTEM VALIDATION KITS:

CONSTRUCTION	Symmetrical dipole with 1/4 balun enables measurement of feedpoint impedance with NWA matched for use near flat phantoms filled with brain simulating solutions. Includes distance holder and tripod adaptor
CALIBRATION	Calibrated SAR value for specified position and input power at the flat phantom in brain simulating solutions
FREQUENCY	2450MHz
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 =3 and loss tangent =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered. The device holder for the portable device makes up of the polyethylene foam. The dielectric parameters of material close to the dielectric parameters of the air.
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A D T

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 MEASUREMENT

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	SAM Phantom	S & P	QD000 P40 CA	TP-1202	NA	NA
2	Signal Generator	Agilent	E8257C	MY43320668	Feb. 23, 2010	Feb. 22, 2011
3	E-Field Probe	S & P	EX3DV4	3753	Dec. 13, 2010	Dec. 12, 2011
4	DAE	S & P	DAE 3	579	Sep. 20, 2010	Sep. 19, 2011
5	Robot Positioner	Staubli Unimation	NA	NA	NA	NA
6	Validation Dipole	S & P	D2450V2	737	Feb. 19, 2010	Feb. 18, 2011

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	E5071C	MY46104190	Apr. 06, 2010	Apr. 05, 2011
2	Dielectric Probe	Agilent	85070D	NA	NA	NA

NOTE:

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

2.5 GENERAL DESCRIPTION OF THE SPATIAL PEAK SAR EVALUATION

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

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

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:

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

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

V_i = compensated signal of channel i ($i = x, y, z$)

Norm_i = sensor sensitivity of channel i $\mu\text{V}/(\text{V}/\text{m})^2$ 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

= conductivity in [mho/m] or [$\text{Siemens}/\text{m}$]

= equivalent tissue density in g/cm^3

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

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

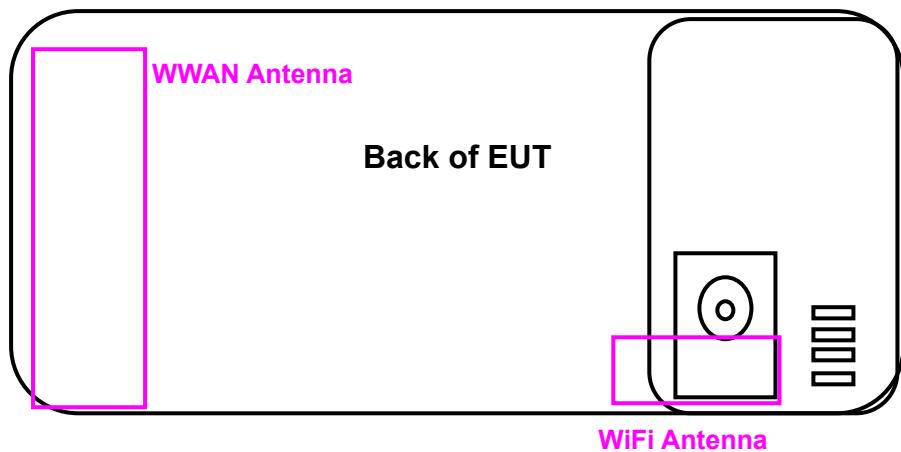
The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration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

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

2.6 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

3. DESCRIPTION OF ANTENNA LOCATION



4. RECIPES FOR TISSUE SIMULATING LIQUIDS

For the measurement of the field distribution inside the SAM phantom, the phantom must be filled with 25 litters of tissue simulation liquid.

The following ingredients are used :

- **WATER-** Deionized water (pure H₂O), resistivity \geq 16 M - as basis for the liquid
- **DGMBE-** Diethylenglycol-monobutyl ether (DGMBE), Fluka Chemie GmbH, CAS # 112-34-5 - to reduce relative permittivity

THE RECIPES FOR 2450MHz SIMULATING LIQUID TABLE

INGREDIENT	HEAD SIMULATING LIQUID 2450MHz (HSL-2450)	MUSCLE SIMULATING LIQUID 2450MHz (MSL-2450)
Water	45%	69.83%
DGMBE	55%	30.17%

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

1. Turn Network Analyzer on and allow at least 30min. warm up.
2. Mount dielectric probe kit so that interconnecting cable to Network Analyzer will not be moved during measurements or calibration.
3. Pour de-ionized water and measure water temperature ($\pm 1^\circ$).
4. Set water temperature in Agilent-Software (Calibration Setup).
5. Perform calibration.
6. Validate calibration with dielectric material of known properties (e.g. polished ceramic slab with >8mm thickness $\epsilon' = 10.0$, $\epsilon'' = 0.0$). If measured parameters do not fit within tolerance, repeat calibration (± 0.2 for ϵ' : ± 0.1 for ϵ'').
7. Conductivity can be calculated from ϵ'' by $\sigma = \omega \epsilon_0 \epsilon'' = \epsilon'' f [\text{GHz}] / 18$.
8. Measure liquid shortly after calibration. Repeat calibration every hour.
9. Stir the liquid to be measured. Take a sample ($\sim 50\text{ml}$) with a syringe from the center of the liquid container.
10. Pour the liquid into a small glass flask. Hold the syringe at the bottom of the flask to avoid air bubbles.
11. Put the dielectric probe in the glass flask. Check that there are no air bubbles in front of the opening in the dielectric probe kit.
12. Perform measurements.
13. Adjust medium parameters in DASY4 for the frequencies necessary for the measurements ('Setup Config', select medium (e.g. Brain 900MHz) and press 'Option'-button).
14. Select the current medium for the frequency of the validation (e.g. Setup Medium Brain 900MHz).



FOR SIMULATING LIQUID

LIQUID TYPE		HSL-2450			
SIMULATING LIQUID TEMP.		20.6			
TEST DATE		Feb. 16, 2011			
TESTED BY		Van Lin			
FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	ERROR PERCENTAGE (%)	LIMIT(%)
2450	Permitivity	39.20	40.43	3.14	±5
2462	()	39.18	40.32	2.91	
2450	Conductivity	1.80	1.83	1.67	
2462	() S/m	1.81	1.85	2.21	

LIQUID TYPE		MSL-2450			
SIMULATING LIQUID TEMP.		20.5			
TEST DATE		Feb. 16, 2011			
TESTED BY		Van Lin			
FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	ERROR PERCENTAGE (%)	LIMIT(%)
2450	Permitivity	52.70	54.65	3.70	±5
2462	()	52.68	54.52	3.49	
2450	Conductivity	1.95	1.98	1.54	
2462	() S/m	1.97	1.99	1.02	

5. 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.

5.1 TEST PROCEDURE

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

1. The "Power Reference Measurement" and "Power Drift Measurement" jobs are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the amplifier output power. If it is too high (above ± 0.1 dB), the system performance check should be repeated; some amplifiers have very high drift during warm-up. A stable amplifier gives drift results in the DASY system below ± 0.02 dB.
2. The "Surface Check" job tests the optical surface detection system of the DASY system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1 mm). In that case it is better to abort the system performance check and stir the liquid.



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

About the validation dipole positioning uncertainty, the constant and low loss dielectric spacer is used to establish the correct distance between the top surface of the dipole and the bottom surface of the phantom, the error component introduced by the uncertainty of the distance between the liquid (i.e., phantom shell) and the validation dipole in the DASY4 system is less than $\pm 0.1\text{mm}$.

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

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

5.2 VALIDATION RESULTS

SYSTEM VALIDATION TEST OF SIMULATING LIQUID					
FREQUENCY (MHz)	REQUIRED SAR (mW/g)	MEASURED SAR (mW/g)	DEVIATION (%)	SEPARATION DISTANCE	TESTED DATE
HSL2450	13.50 (1g)	13.6	0.74	10mm	Feb. 16, 2011
MSL2450	13.10 (1g)	13.3	1.53	10mm	Feb. 16, 2011

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

5.3 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	3	0.7	0.7	0.10	0.10	
Hemispherical Isotropy	1.30	Rectangular	3	0.7	0.7	0.53	0.53	
Boundary effects	1.00	Rectangular	3	1	1	0.58	0.58	
Linearity	0.30	Rectangular	3	1	1	0.17	0.17	
System Detection Limits	1.00	Rectangular	3	1	1	0.58	0.58	
Readout Electronics	0.30	Normal	1	1	1	0.30	0.30	
Response Time	0.80	Rectangular	3	1	1	0.46	0.46	
Integration Time	2.60	Rectangular	3	1	1	1.50	1.50	
RF Ambient Noise	3.00	Rectangular	3	1	1	1.73	1.73	9
RF Ambient Reflections	3.00	Rectangular	3	1	1	1.73	1.73	9
Probe Positioner	0.40	Rectangular	3	1	1	0.23	0.23	
Probe Positioning	2.90	Rectangular	3	1	1	1.67	1.67	
Max. SAR Eval.	1.00	Rectangular	3	1	1	0.58	0.58	
Test sample related								
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	3	1	1	2.60	2.60	1
Dipole Related								
Dipole Axis to Liquid Distance	1.60	Rectangular	3	1	1	0.92	0.92	4
Input Power Drift	2.92	Rectangular	3	1	1	1.69	1.69	1
Phantom and Tissue parameters								
Phantom Uncertainty	4.00	Rectangular	3	1	1	2.31	2.31	
Liquid Conductivity (target)	5.00	Rectangular	3	0.64	0.43	1.85	1.24	
Liquid Conductivity (measurement)	2.21	Normal	1	0.64	0.43	1.41	0.95	9
Liquid Permittivity (target)	5.00	Rectangular	3	0.6	0.49	1.73	1.41	
Liquid Permittivity (measurement)	3.70	Normal	1	0.6	0.49	2.22	1.81	9
Combined Standard Uncertainty						9.14	8.83	
Coverage Factor for 95%						K _p =2		
Expanded Uncertainty (K=2)						18.28	17.66	

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

6. TEST RESULTS

6.1 TEST PROCEDURES

Use the software to control the EUT channel and transmission power. Then record the conducted power before the testing. Place the EUT to the specific test location. After the testing, must writing down the conducted power of the EUT into the report. The SAR value was calculated via the 3D spline interpolation algorithm that has been implemented in the software of DASY4 SAR measurement system manufactured and calibrated by SPEAG. According to the IEEE 1528 standards, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

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

The area scan was performed for the highest spatial SAR location. The zoom scan 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 2mm and maintained at a constant distance of ± 0.5 mm 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 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 $\pm 5\%$.



6.2 CONDUCTED POWER

TEST MODE		802.11b		802.11g	
CHAN.	FREQ. (MHz)	PEAK (dBm)	AVG (dBm)	PEAK (dBm)	AVG (dBm)
1	2412 (Low)	13.9	12.0	19.7	10.5
6	2437 (Mid.)	14.4	12.7	19.6	11.1
11	2462 (High)	14.7	13.0	19.2	10.8

NOTE: SAR is not required for 802.11g channels since the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels

6.3 DESCRIPTION OF TEST CONDITION

TEST DATE	TEMPERATURE(°C)		HUMIDITY(%RH)	TESTED BY
	AMBIENT	LIQUID		
Feb. 16, 2011	21.6	20.6	57	Van Lin
Feb. 16, 2011	21.6	20.5	57	Van Lin

6.4 MEASURED SAR RESULT

HEAD	RIGHT		LEFT	
	Position	CHEEK	TIILT	CHEEK
11b				
Ch 11: 2462MHz	0.086	0.032	0.035	0.027

Body 15mm		
Position	Bottom	Front
11b		
Ch 11: 2462MHz	0.061	0.025

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. Per KDB 447498, when 1-g SAR for the highest output channel is less than 0.8 W/kg, testing for the other channels is not required.

6.5 NO SIMULTANEOUS SAR JUSTIFICATION

SAR evaluation for Transmitter

WWAN / Wi-Fi

Output power > 60/f(GHz), SAR is necessary.

Bluetooth

The max output power is 1.6 mW < 24 mW (2.P_{Ref}) and antenna separation between WWAN and Bluetooth is > 5 cm. Therefore, SAR evaluation is not necessary.

Simultaneous transmission mode

- 1) GSM 850 + Wi-Fi + Bluetooth
- 2) GSM 1900 + Wi-Fi + Bluetooth

Antenna separation distance (cm)

	Wi-Fi antenna	WWAN antenna	BT antenna
Wi-Fi antenna	-	7.7	0
WWAN antenna	7.7	-	7.7
BT antenna	0	7.7	-

* Wi-Fi and Bluetooth use same antenna, but they can not work at the same time.

Σ of the highest measured 1-g SAR for each portable transmitter

HEAD POSITION:

Mode	RIGHT		LEFT	
	CHEEK	TIILT	CHEEK	TIILT
Wi-Fi	0.086	0.032	0.035	0.027
850MHz band	0.43	0.239	0.396	0.214
Bluetooth	0	0	0	0
Sum of each TX	0.516	0.271	0.431	0.241

Mode	RIGHT		LEFT	
	CHEEK	TIILT	CHEEK	TIILT
Wi-Fi	0.086	0.032	0.035	0.027
1900 MHz band	0.49	0.131	0.403	0.207
Bluetooth	0	0	0	0
Sum of each TX	0.576	0.163	0.438	0.234

BODY POSITION:

Position	Bottom	Front
Wi-Fi	0.061	0.025
850MHz band	0.548	0.603
Bluetooth	0	0
Sum of each TX	0.609	0.628

Position	Bottom	Front
Wi-Fi	0.061	0.025
1900MHz band	0.245	0.568
Bluetooth	0	0
Sum of each TX	0.306	0.593

*Max SAR value of WWAN is shown on Report No.: SA110104E07-1

Conclusion

- 1) Antenna separation distance for each transmission simultaneous pair is > 5cm
- 2) Sum of SAR is < 1.6 W/ kg

Accordingly, simultaneous Transmission SAR is not required for this device.

6.6 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: These limits accord to 47 CFR 2.1093 – Safety Limit.



7. INFORMATION ON THE TESTING LABORATORIES

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

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

Linko EMC/RF Lab:

Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:

Tel: 886-3-5935343
Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab:

Tel: 886-3-3183232
Fax: 886-3-3185050

Web Site: www.adt.com.tw

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

---END---



香港商立德國際商品試驗有限公司桃園分公司

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

APPENDIX A: TEST DATA

Product Name: Mobile Computer ; Model Number: Dolphin 6000

Liquid Level Photo

Tissue 2450MHz D=150mm





M01-Right Head-Cheek-11b-Ch11

Communication System: 802.11b ; Frequency: 2462 MHz ; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used : $f = 2462$ MHz; $\sigma = 1.85$ mho/m; $\epsilon_r = 40.32$; $\rho = 1000$ kg/m³

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

DASY4 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.11, 7.11, 7.11); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 CA; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch position - High/Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm

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

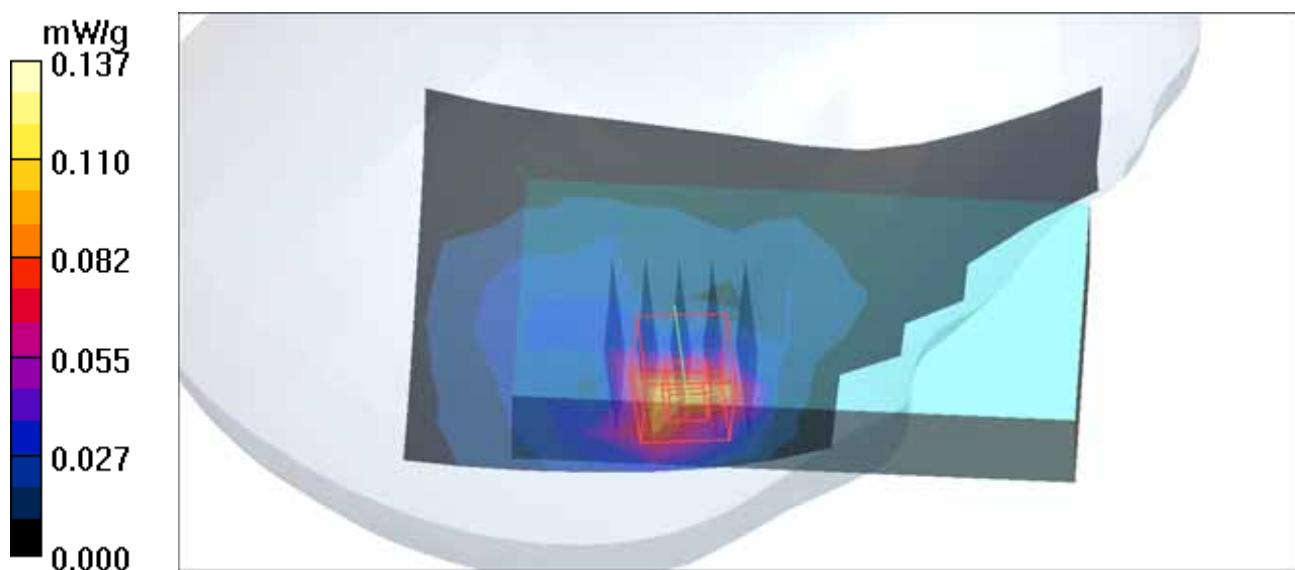
Touch position - High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.80 V/m; Power Drift = 0.096 dB

Peak SAR (extrapolated) = 0.198 W/kg

SAR(1 g) = 0.086 mW/g; SAR(10 g) = 0.039 mW/g

Maximum value of SAR (measured) = 0.137 mW/g





M02-Right Head-Tilt-11b-Ch11

Communication System: 802.11b ; Frequency: 2462 MHz ; Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used : $f = 2462$ MHz; $\sigma = 1.85$ mho/m; $\epsilon_r = 40.32$; $\rho = 1000$ kg/m³
Phantom section: Right Section ; DUT test position : Tilt ; Modulation type: DBPSK

DASY4 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.11, 7.11, 7.11); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 CA; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Tilt position - High/Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.043 mW/g

Tilt position - High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.40 V/m; Power Drift = 0.184 dB

Peak SAR (extrapolated) = 0.092 W/kg

SAR(1 g) = 0.032 mW/g; SAR(10 g) = 0.014 mW/g

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

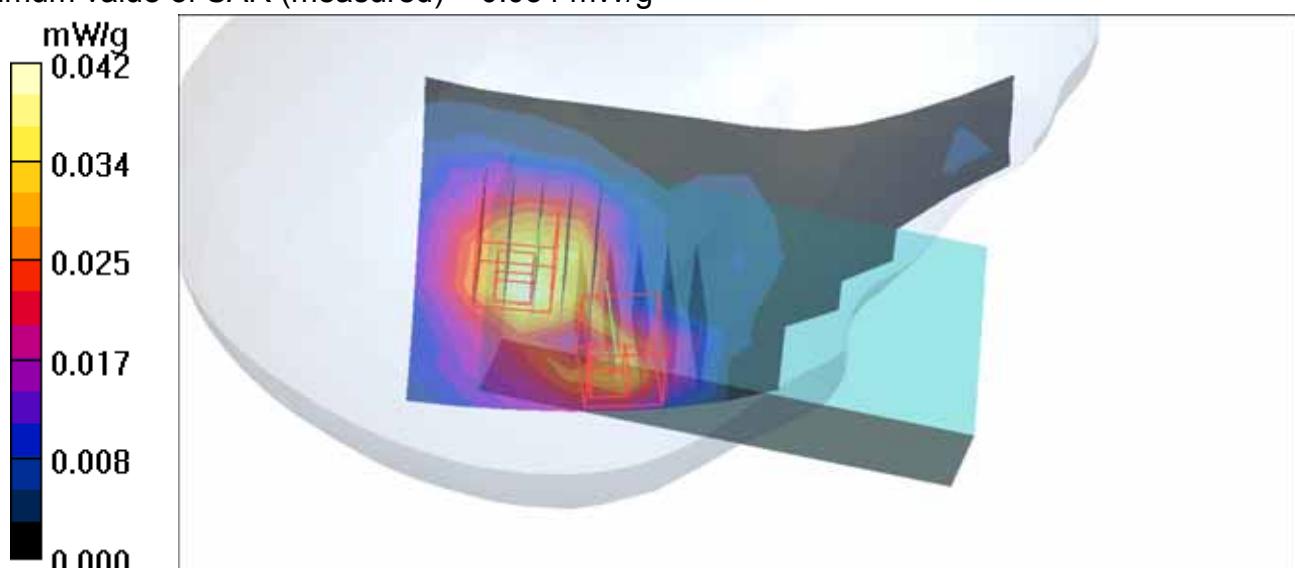
Tilt position - High/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.40 V/m; Power Drift = 0.184 dB

Peak SAR (extrapolated) = 0.076 W/kg

SAR(1 g) = 0.022 mW/g; SAR(10 g) = 0.00674 mW/g

Maximum value of SAR (measured) = 0.034 mW/g





M03-Left Head-Cheek-11b-Ch11

Communication System: 802.11b ; Frequency: 2462 MHz ; Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used : $f = 2462$ MHz; $\sigma = 1.85$ mho/m; $\epsilon_r = 40.32$; $\rho = 1000$ kg/m³
Phantom section: Left Section ; DUT test position : Cheek ; Modulation type: DBPSK

DASY4 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.11, 7.11, 7.11); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 CA; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch position - High/Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.050 mW/g

Touch position - High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.63 V/m; Power Drift = 0.112 dB

Peak SAR (extrapolated) = 0.074 W/kg

SAR(1 g) = 0.035 mW/g; SAR(10 g) = 0.018 mW/g

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

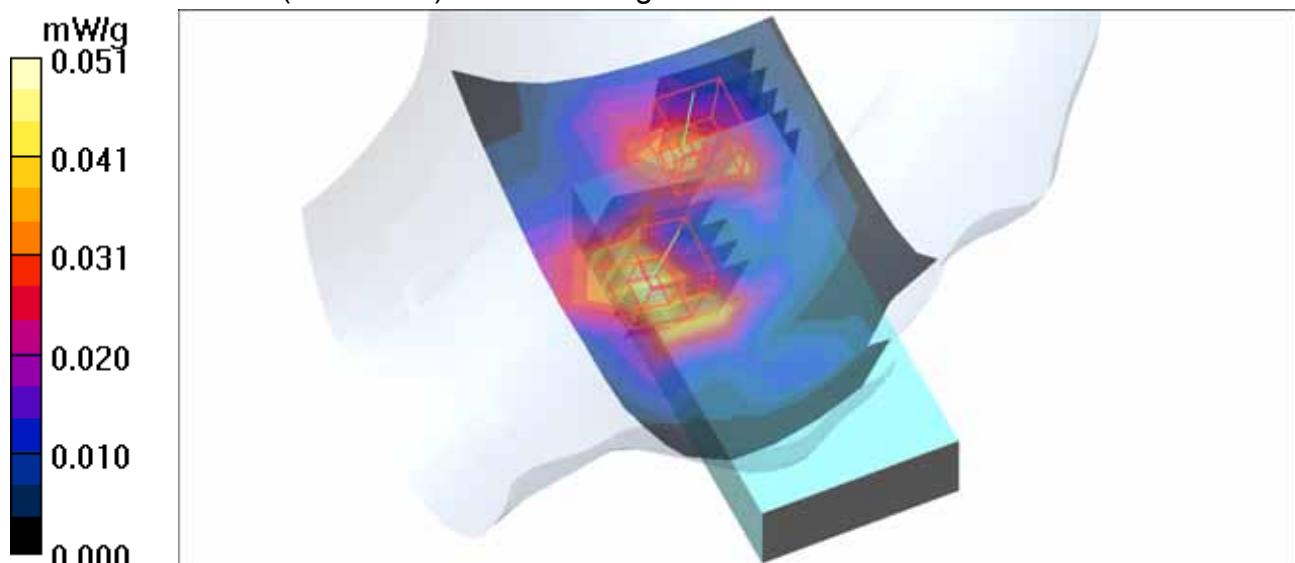
Touch position - High/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.63 V/m; Power Drift = 0.112 dB

Peak SAR (extrapolated) = 0.055 W/kg

SAR(1 g) = 0.028 mW/g; SAR(10 g) = 0.014 mW/g

Maximum value of SAR (measured) = 0.039 mW/g





Date/Time: 2011/2/16 20:40:49

M04-Left Head-Tilt-11b-Ch11

Communication System: 802.11b ; Frequency: 2462 MHz ; Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used : $f = 2462$ MHz; $\sigma = 1.85$ mho/m; $\epsilon_r = 40.32$; $\rho = 1000$ kg/m³
Phantom section: Left Section ; DUT test position : Tilt ; Modulation type: DBPSK

DASY4 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.11, 7.11, 7.11); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 CA; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Tilt position - High/Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.039 mW/g

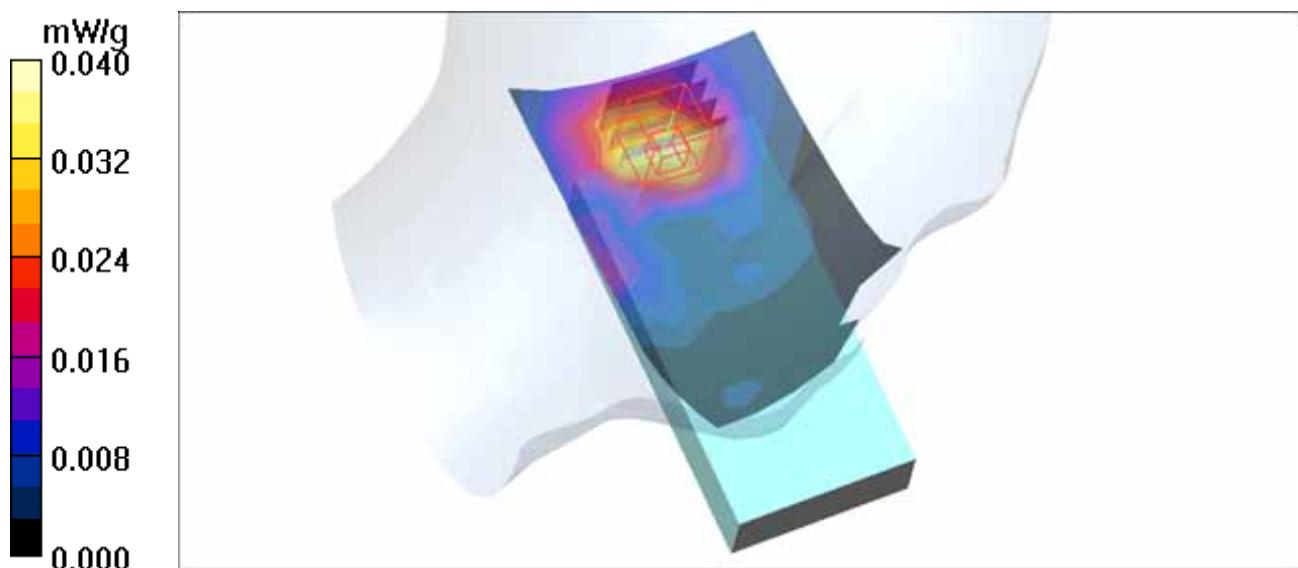
Tilt position - High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.57 V/m; Power Drift = 0.101 dB

Peak SAR (extrapolated) = 0.055 W/kg

SAR(1 g) = 0.027 mW/g; SAR(10 g) = 0.015 mW/g

Maximum value of SAR (measured) = 0.040 mW/g





Date/Time: 2011/2/16 22:32:56

M05-Body-11b-Ch11

Communication System: 802.11b ; Frequency: 2462 MHz ; Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: $f = 2462$ MHz; $\sigma = 1.99$ mho/m; $\epsilon_r = 54.52$; $\rho = 1000$ kg/m³
Phantom section: Flat Section ; DUT test position : Body ; Modulation Type: DBPSK
Separation Distance : 15 mm (The bottom side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(6.91, 6.91, 6.91); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 CA; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Position - High/Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm

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

Body Position - High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.37 V/m; Power Drift = 0.097 dB

Peak SAR (extrapolated) = 0.116 W/kg

SAR(1 g) = 0.061 mW/g; SAR(10 g) = 0.033 mW/g

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

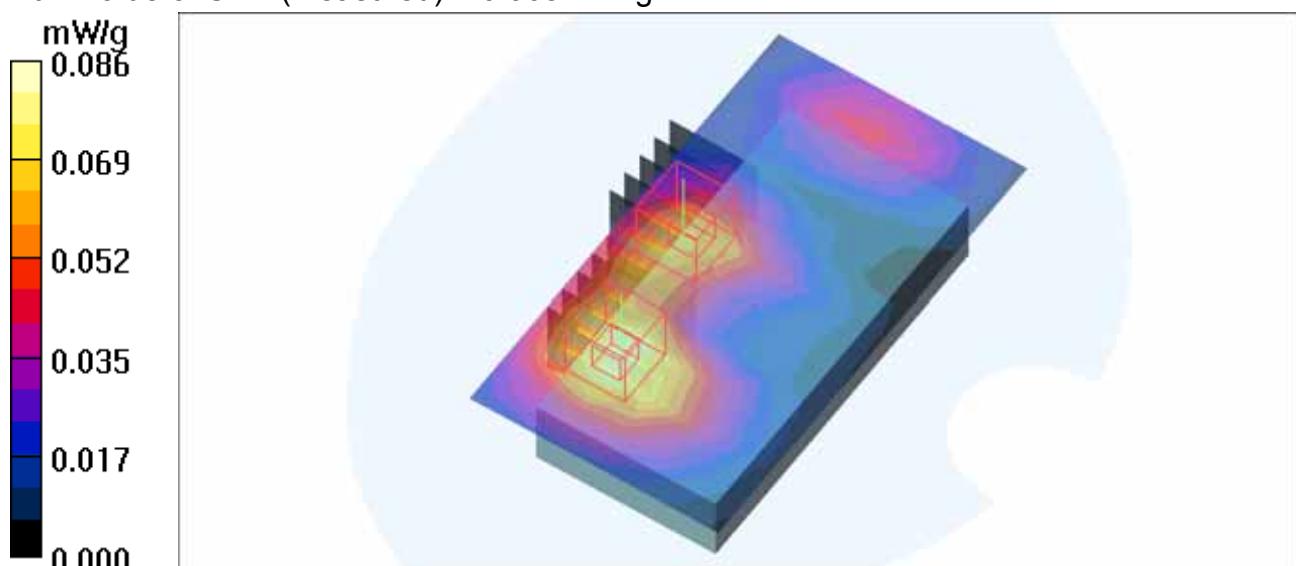
Body Position - High/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.37 V/m; Power Drift = 0.097 dB

Peak SAR (extrapolated) = 0.093 W/kg

SAR(1 g) = 0.048 mW/g; SAR(10 g) = 0.026 mW/g

Maximum value of SAR (measured) = 0.068 mW/g





M06-Body-11b-Ch11

Communication System: 802.11b ; Frequency: 2462 MHz ; Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: $f = 2462$ MHz; $\sigma = 1.99$ mho/m; $\epsilon_r = 54.52$; $\rho = 1000$ kg/m³
Phantom section: Flat Section ; DUT test position : Body ; Modulation Type: DBPSK
Separation Distance : 15 mm (The Front side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(6.91, 6.91, 6.91); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 CA; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body Position - High/Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.033 mW/g

Body Position - High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.64 V/m; Power Drift = 0.159 dB

Peak SAR (extrapolated) = 0.046 W/kg

SAR(1 g) = 0.025 mW/g; SAR(10 g) = 0.012 mW/g

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

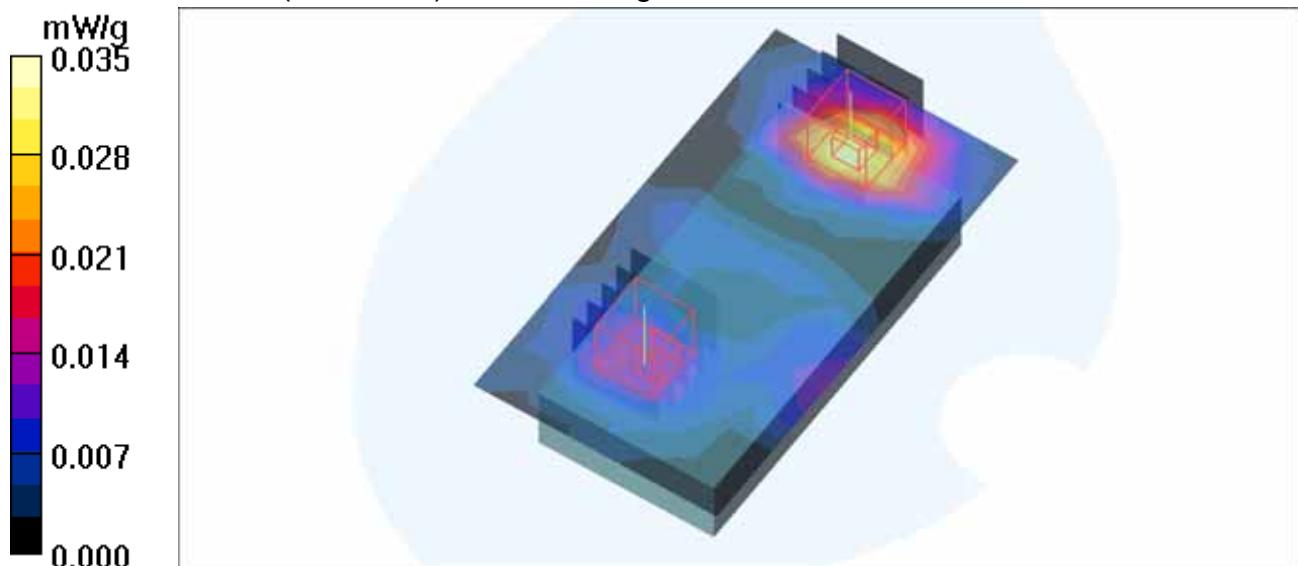
Body Position - High/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.64 V/m; Power Drift = 0.159 dB

Peak SAR (extrapolated) = 0.031 W/kg

SAR(1 g) = 0.011 mW/g; SAR(10 g) = 0.00468 mW/g

Maximum value of SAR (measured) = 0.017 mW/g





SystemPerformanceCheck-D2450V2-HSL2450MHz

DUT: Dipole 2450 MHz ; Type: D2450V2 ; Serial: D2450V2 - SN:737 ; Test Frequency: 2450 MHz

Communication System: CW ; Frequency: 2450 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: HSL2450; Medium parameters used: $f = 2450$ MHz; $\sigma = 1.83$ mho/m; $\epsilon_r = 40.43$; $\rho = 1000$ kg/m³ ; Liquid level : 150 mm

Phantom section: Flat Section ; Separation distance : 10 mm (The feet point of the dipole to the Phantom) Air temp. : 21.6 degrees ; Liquid temp. : 20.6 degrees

DASY4 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(7.11, 7.11, 7.11); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 CA; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 21.1 mW/g

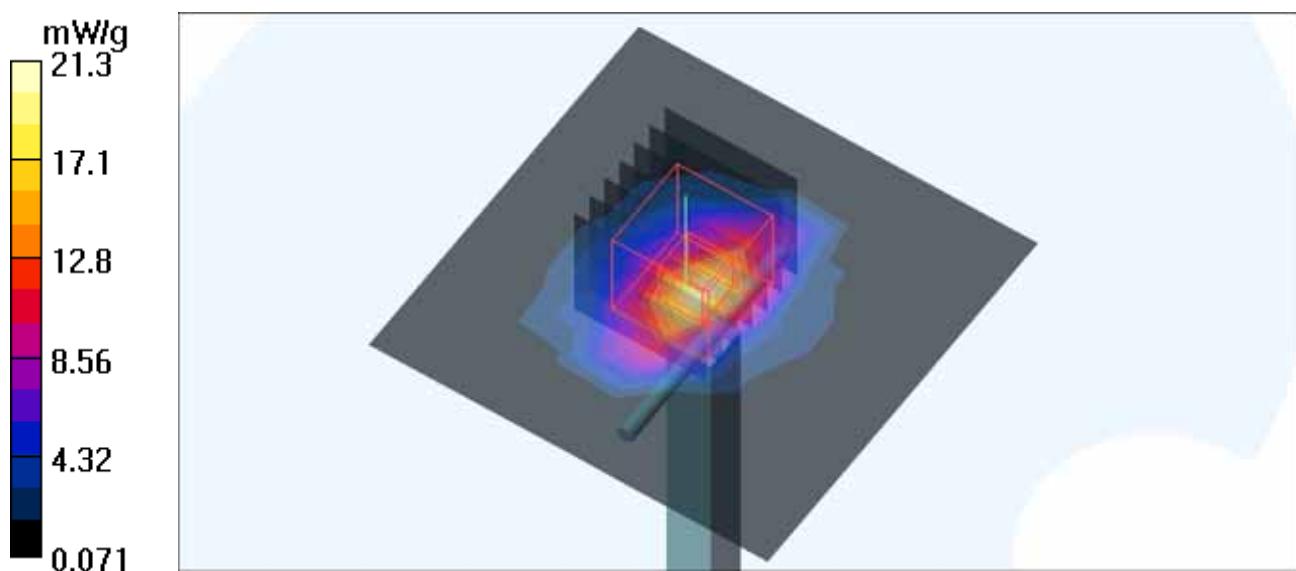
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 108.2 V/m; Power Drift = 0.125 dB

Peak SAR (extrapolated) = 30.7 W/kg

SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.06 mW/g

Maximum value of SAR (measured) = 21.3 mW/g





Date/Time: 2011/2/16 21:40:33

System Performance Check-D2450V2-MSL2450MHz

DUT: Dipole 2450 MHz ; Type: D2450V2 ; Serial: D2450V2 - SN:737 ; Test Frequency: 2450 MHz

Communication System: CW ; Frequency: 2450 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL2450; Medium parameters used: $f = 2450$ MHz; $\sigma = 1.98$ mho/m; $\epsilon_r = 54.65$; $\rho = 1000$ kg/m³ ; Liquid level : 150 mm

Phantom section: Flat Section ; Separation distance : 10 mm (The feet point of the dipole to the Phantom) Air temp. : 21.6 degrees ; Liquid temp. : 20.5 degrees

DASY4 Configuration:

- Probe: EX3DV4 - SN3753; ConvF(6.91, 6.91, 6.91); Calibrated: 2010/12/13
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: SAM Twin Phantom V4.0; Type: QD 000 P40 CA; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 14.9 mW/g

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

Reference Value = 106.0 V/m; Power Drift = -0.112 dB

Peak SAR (extrapolated) = 28.5 W/kg

SAR(1 g) = 13.3 mW/g; SAR(10 g) = 5.95 mW/g

Maximum value of SAR (measured) = 20.6 mW/g

