FCC SAR Test Report

APPLICANT	:	**Ericsson AB**
EQUIPMENT	:	**Mobile Broadband Module**
BRAND NAME	:	**Ericsson AB**
MODEL NAME	:	**F5321**
FCC ID	:	**VV7-MBMF5321**
STANDARD	:	**FCC 47 CFR Part 2 (2.1093)** **IEEE C95.1-1991** **IEEE 1528-2003** **FCC OET Bulletin 65 Supplement C (Edition 01-01)**

The product was installed into Notebook PC (Brand Name: hp, Model Name: HSTNN-W90C) during test.

The product was received on Mar. 10, 2012 and completely tested on Mar. 10, 2012. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:

Jones Tsai

Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA230618	Rev. 01	Initial issue of report	Mar. 26, 2012

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Ericsson AB Mobile Broadband Module F5321** are as follows.

Band	Position	SAR_{1g} (W/kg)
GSM850	Body (0 cm)	0.039
GSM1900	Body (0 cm)	0.01
WCDMA Band V	Body (0 cm)	0.023
WCDMA Band II	Body (0 cm)	0.008

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1991, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003 and FCC OET Bulletin 65 Supplement C (Edition 01-01).

2. Administration Data

2.1 Testing Laboratory

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978

2.2 Applicant

Company Name	Ericsson AB
Address	Lindholmspiren 11 SE-417 56 Gothenburg, Sweden

2.3 Manufacturer

Company Name	Ericsson AB
Address	Lindholmspiren 11 SE-417 56 Gothenburg, Sweden

2.4 Application Details

Date of Receipt of Application	Mar. 10, 2012
Date of Start during the Test	Mar. 10, 2012
Date of End during the Test	Mar. 10, 2012

3. General Information

3.1 Description of Device Under Test (DUT)

Product Feature & Specification	
DUT	Mobile Broadband Module
Brand Name	Ericsson AB
Model Name	F5321
FCC ID	VV7-MBMF5321
Host Notebook PC	Brand Name: hp Model Name: HSTNN-W90C
Sample 1	Brand name: Acom Model name: APP8P-700366
Sample 2	Brand name: Yageo Model name: CAN4313HW0628LTA1
Tx Frequency	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz
Rx Frequency	GSM850: 869.2 MHz ~ 893.8 MHz GSM1900: 1930.2 MHz ~ 1989.8 MHz WCDMA Band V: 871.4 MHz ~ 891.6 MHz WCDMA Band II: 1932.4 MHz ~ 1987.6 MHz
Maximum Average Output Power to Antenna	GSM850: 33.48 dBm GSM1900: 30.14 dBm WCDMA Band V: 23.84 dBm WCDMA Band II: 23.10 dBm
Antenna Type	PIFA Antenna
Type of Modulation	GPRS: GMSK EDGE: GMSK / 8PSK WCDMA : QPSK (uplink) HSDPA : QPSK (uplink) HSUPA : QPSK (uplink)

Remark:
1. The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. GSM voice call is not supported. DTM not supported.

3.2 Product Photos

Please refer to Appendix D

3.3 Applied Standards

The Specific Absorption Rate (SAR) testing specification, method and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- IEEE C95.1-1991
- IEEE 1528-2003
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- FCC KDB 447498 D01 v04
- FCC KDB 616217 D01 v01r01
- FCC KDB 616217 D03 v01
- FCC KDB 941225 D01 v02
- FCC KDB 941225 D03 v01

3.4 Device Category and SAR Limits

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

3.5 Test Conditions

3.5.1 Ambient Condition

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

3.5.2 Test Configuration

For WWAN SAR testing, the device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the DUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of DUT. The DUT was set from the emulator to radiate maximum output power during all tests.

4. Specific Absorption Rate (SAR)

4.1 Introduction

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

4.2 SAR Definition

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

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

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

SAR measurement can be either related to the temperature elevation in tissue by

$$\mathbf{SAR} = \mathbf{C}\left(\frac{\boldsymbol{\delta}\mathbf{T}}{\boldsymbol{\delta}\mathbf{t}}\right)$$

Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

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

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

5. SAR Measurement System

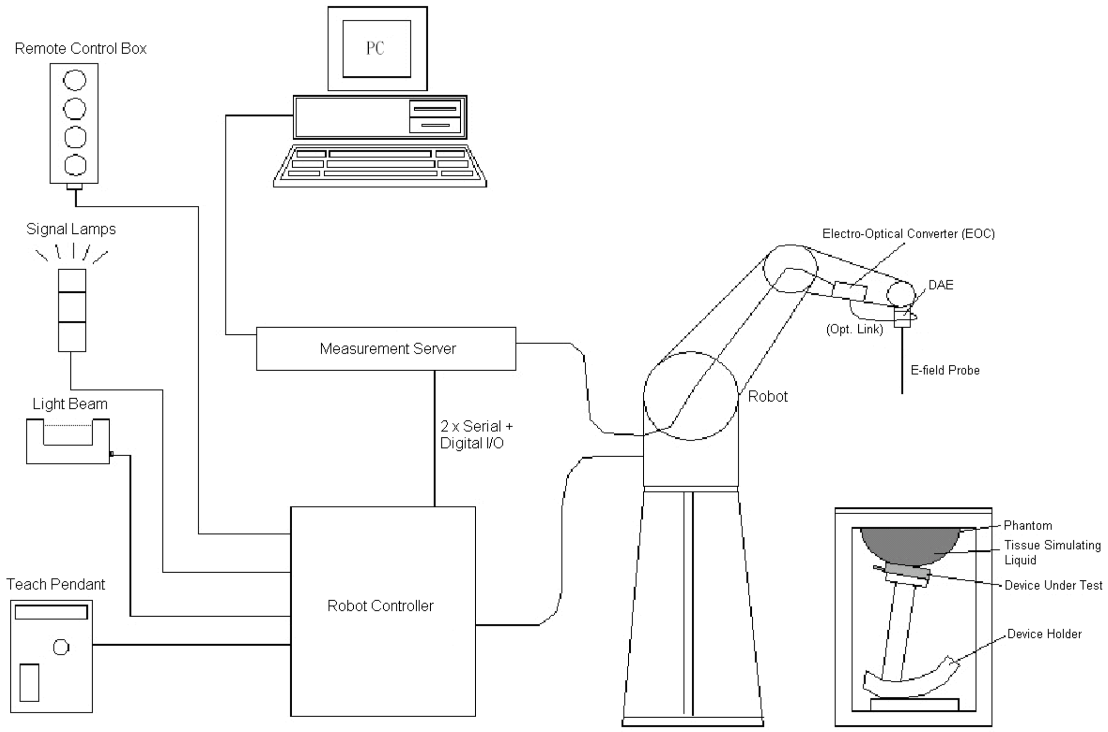


Fig 5.1 SPEAG DASY System Configurations

The DASY system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (ECO) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY software
- Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

Some of the components are described in details in the following sub-sections.

5.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

5.1.1 E-Field Probe Specification

<ET3DV6 Probe >

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz to 3 GHz; Linearity: ± 0.2 dB
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic Range	5 µW/g to 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm

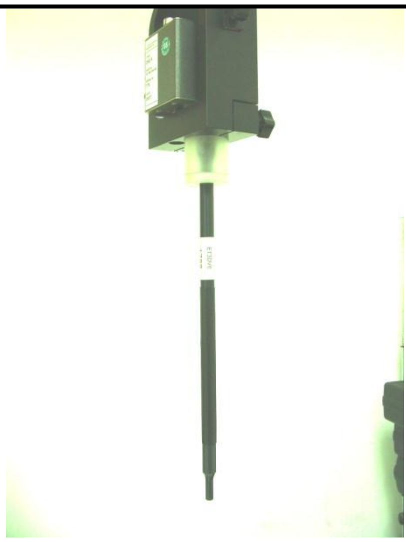


Fig 5.2 Photo of ET3DV6

<EX3DV4 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
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

Fig 5.3 Photo of EX3DV4

5.1.2 E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 0.25 dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

5.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, 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 input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig 5.4 Photo of DAE

5.3 Robot

The SPEAG DASY system uses the high precision robots (DASY4: RX90BL; DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

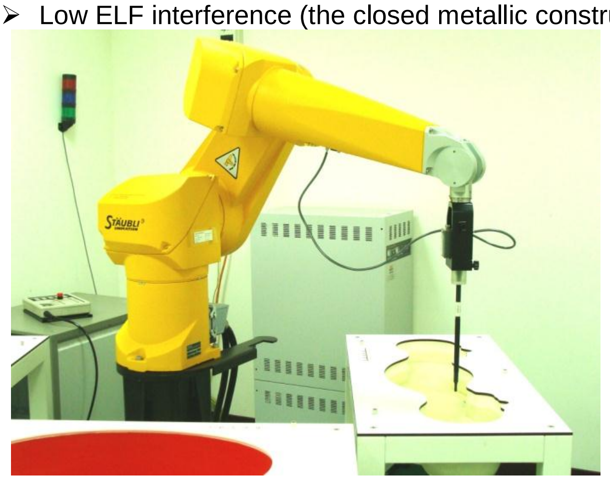


Fig 5.1 Photo of DASY4

Fig 5.2 Photo of DASY5

5.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.

Fig 5.1 Photo of Server for DASY4

Fig 5.2 Photo of Server for DASY5

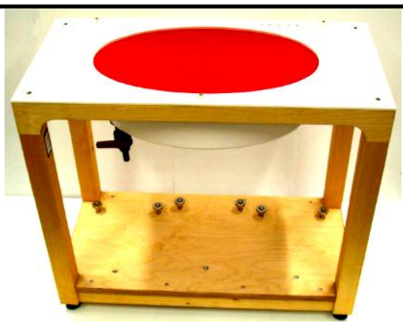
5.5 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	 **Fig 5.3 Photo of SAM Phantom**
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI4 Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)	 Fig 5.4 Photo of ELI4 Phantom
Filling Volume	Approx. 30 liters	
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm	

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

5.6 Device Holder

<Device Holder for SAM Twin Phantom>

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder 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 center for both scales is the ear reference point (EPR). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity $\varepsilon = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

Fig 5.5 Device Holder

<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

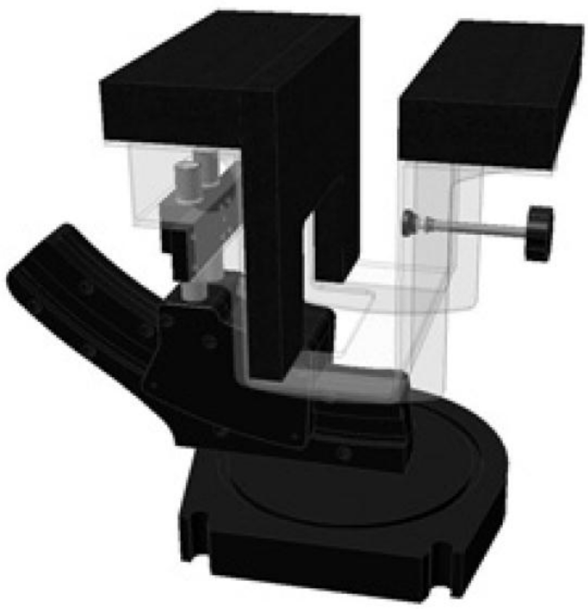


Fig 5.6 Laptop Extension Kit

5.7 Data Storage and Evaluation

5.7.1 Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

5.7.2 Data Evaluation

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

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

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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：

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

with 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：

E-field Probes： $\mathbf{E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}}$

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

with V_i = compensated signal of channel i, (i = x, y, z)
$Norm_i$ = sensor sensitivity of channel i, (i = x, y, z), μV/(V/m)^2 for E-field Probes
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)：

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

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

$$\mathbf{SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}}$$

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

5.8 Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Dosimetric E-Field Probe	ET3DV6	1787	May 20, 2011	May 19, 2012
SPEAG	835MHz System Validation Kit	D835V2	499	Mar. 22, 2010	Mar. 21, 2012
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Mar. 23, 2010	Mar. 22, 2012
SPEAG	Data Acquisition Electronics	DAE3	495	Apr. 28, 2011	Apr. 27, 2012
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1303	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1383	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1446	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1478	NCR	NCR
SPEAG	SAM Phantom	QD 000 P41 C	TP-1150	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 CD	TP-1644	NCR	NCR
SPEAG	SAM Phantom	SM 000 T01 DA	TP-1542	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 001 BB	1026	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 001 BA	1029	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 002 AA	TP-1127	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 002 AA	TP-1131	NCR	NCR
Agilent	ENA Series Network Analyzer	E5071C	MY46100746	Jun. 10, 2011	Jun. 09, 2012
Agilent	ESG Vector Series Signal Generator	E4438C	MY49070755	Oct. 17, 2011	Oct. 16, 2012
Anritsu	Power Meter	ML2495A	932001	Sep. 21, 2011	Sep. 20, 2012
Anritsu	Radio Communication Analyzer	MT8820C	6201074414	Dec. 21, 2011	Dec. 20, 2012
Agilent	Wireless Communication Test Set	E5515C	MY48360820	Jan. 05, 2012	Jan. 04, 2014
Agilent	Wireless Communication Test Set	E5515C	GB46311322	Mar. 23, 2011	Mar. 22, 2013
Agilent	Wireless Communication Test Set	E5515C	MY50264370	Apr. 19, 2011	Apr. 18, 2013
Agilent	Wireless Communication Test Set	E5515C	MY50266977	Nov. 13, 2011	Nov. 12, 2013
R&S	Universal Digital Radio communication Tester	CMU200	117995	Jul. 28, 2011	Jul. 27, 2012
R&S	Spectrum Analyzer	FSP7	101131	Jul. 29, 2011	Jul. 28, 2012
R&S	Spectrum Analyzer	FSP30	101329	May 03, 2011	May 02, 2012

Table 5.1 Test Equipment List

Note:

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. Referring to KDB 450824 D02, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The justification data of dipole D1900V2, SN: 5d041 and D835V2, SN: 499 can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.

6. Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.2.

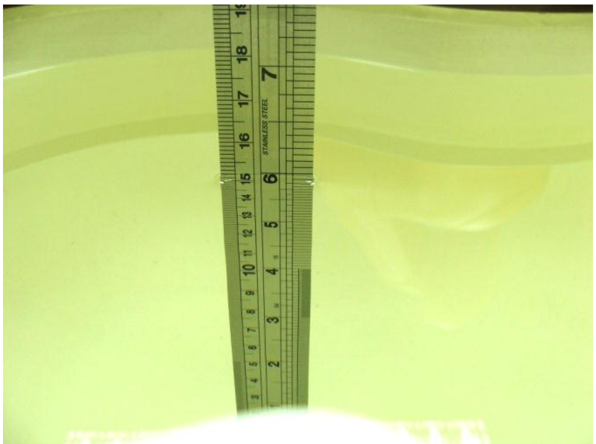


Fig 6.1 Photo of Liquid Height for Head SAR

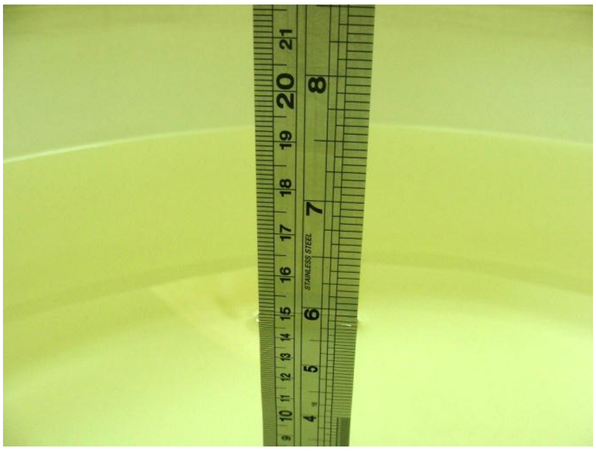


Fig 6.2 Photo of Liquid Height for Body SAR

The following table gives the recipes for tissue simulating liquid.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ε_r)
For Head								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
For Body								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3

Table 6.1 Recipes of Tissue Simulating Liquid

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

The following table shows the measuring results for simulating liquid.

Freq.	Liquid Type	Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Body	21.6	0.975	52.9	0.97	55.2	0.52	-4.17	±5	Mar. 10, 2012
1900	Body	21.5	1.54	53.9	1.52	53.3	1.32	1.13	±5	Mar. 10, 2012

Table 6.3 Measuring Results for Simulating Liquid

7. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 7.1

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor[(a)]	1/k[(b)]	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

Table 7.1 Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is showed in Table 7.2.

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Standard Uncertainty (1g)
Measurement System					
Probe Calibration	6.0	Normal	1	1	± 6.0 %
Axial Isotropy	4.7	Rectangular	√3	0.7	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	± 3.9 %
Boundary Effects	1.0	Rectangular	√3	1	± 0.6 %
Linearity	4.7	Rectangular	√3	1	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	± 0.6 %
Readout Electronics	0.3	Normal	1	1	± 0.3 %
Response Time	0.8	Rectangular	√3	1	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	± 1.7 %
Probe Positioner	0.4	Rectangular	√3	1	± 0.2 %
Probe Positioning	2.9	Rectangular	√3	1	± 1.7 %
Max. SAR Eval.	1.0	Rectangular	√3	1	± 0.6 %
Test Sample Related					
Device Positioning	2.9	Normal	1	1	± 2.9 %
Device Holder	3.6	Normal	1	1	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	± 2.9 %
Phantom and Setup					
Phantom Uncertainty	4.0	Rectangular	√3	1	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	± 1.8 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	± 1.6 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	± 1.7 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	± 1.5 %
Combined Standard Uncertainty					± 11.0 %
Coverage Factor for 95 %					K = 2
Expanded Uncertainty					**± 22.0 %**

Table 7.2 Uncertainty Budget of DASY for frequency range 300 MHz to 3 GHz

8. SAR Measurement Evaluation

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

8.1 Purpose of System Performance check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

8.2 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:

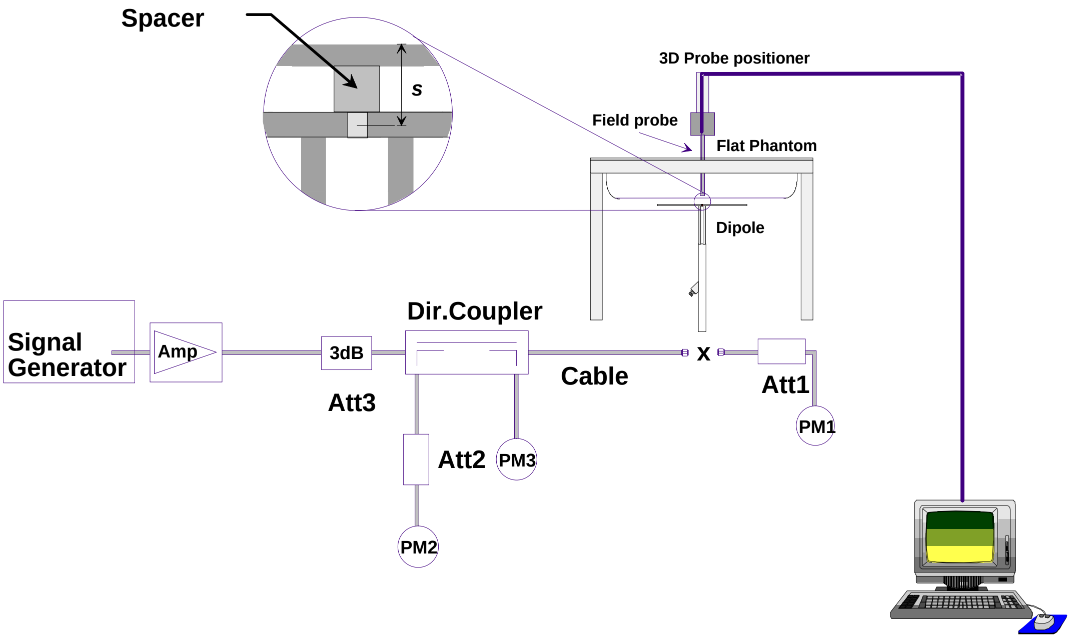


Fig 8.1 System Setup for System Evaluation

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. Calibrated Dipole

The output power on dipole port must be calibrated to 24 dBm (250 mW) before dipole is connected.

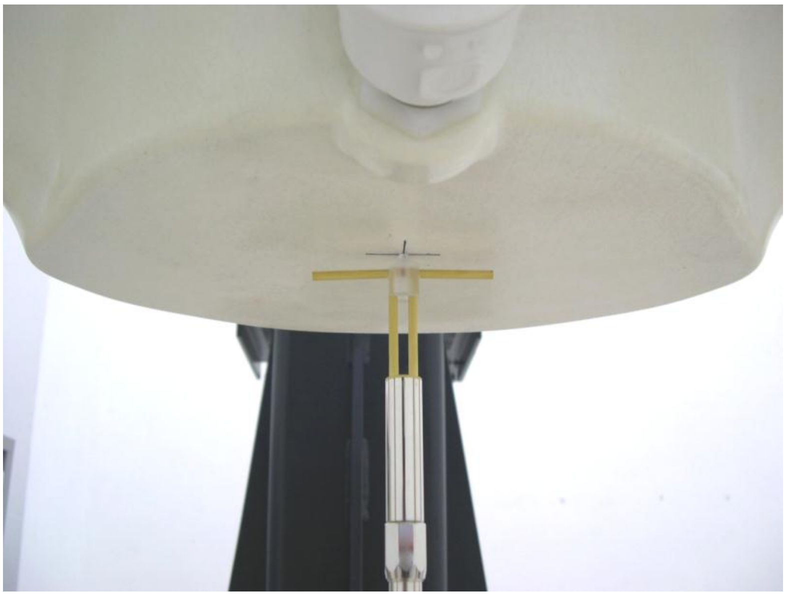


Fig 8.2 Photo of Dipole Setup

8.3 Validation Results

Comparing to the original SAR value provided by SPEAG, the validation data should be within its specification of 10 %. Table 8.1 shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Measurement Date	Frequency (MHz)	Liquid Type	Targeted SAR_{1g} (W/kg)	Measured SAR_{1g} (W/kg)	Normalized SAR_{1g} (W/kg)	Deviation (%)
Mar. 10, 2012	835	Body	9.82	2.47	9.88	0.61
Mar. 10, 2012	1900	Body	40.0	10.7	42.80	7.00

Table 8.1 Target and Measurement SAR after Normalized

9. DUT Testing Position

This DUT was tested in one position. It is notebook bottom touching with 0 cm air gap. Please refer to Appendix E for the test setup photos.

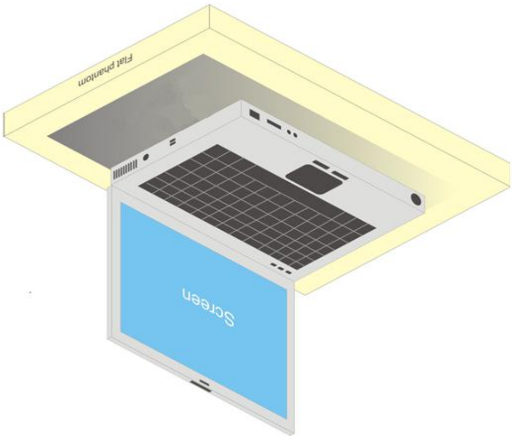


Fig 9.1 Illustration for Lap-touching Position

10. Measurement Procedures

The measurement procedures are as follows:

(a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the highest power channel.
(b) Keep DUT to radiate maximum output power or 100% duty factor (if applicable)
(c) Measure output power through RF cable and power meter.
(d) Place the DUT in the positions as Appendix E demonstrates.
(e) Set scan area, grid size and other setting on the DASY software.
(f) Measure SAR results for the highest power channel on each testing position.
(g) Find out the largest SAR result on these testing positions of each band
(h) Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

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

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

10.1 Spatial Peak SAR Evaluation

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

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

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

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

10.2 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures 5x5x7 points with step size 8, 8 and 5 mm for 300 MHz to 3 GHz, and 8x8x8 points with step size 4, 4 and 2.5 mm for 3 GHz to 6 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

10.3 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the DUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing (step-size is 4, 4 and 2.5 mm). When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

10.4 SAR Averaged Methods

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

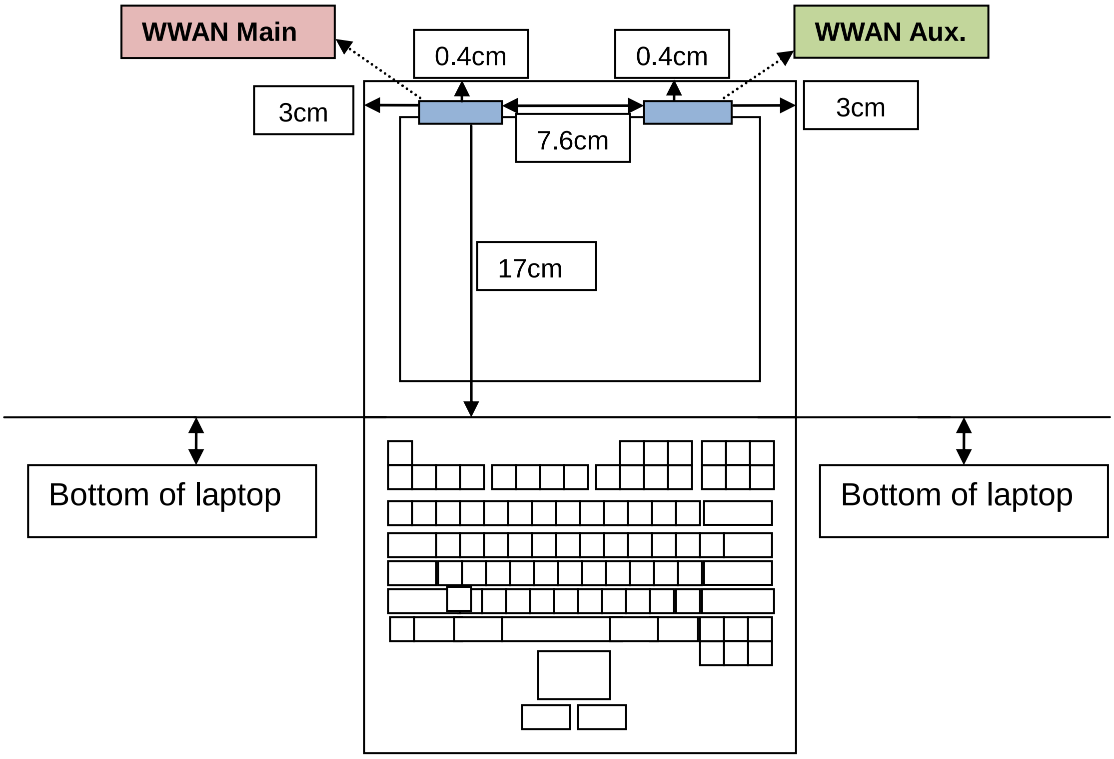
Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty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

10.5 Power Drift Monitoring

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

11. SAR Test Configurations

11.1 Exposure Positions Consideration



Antenna	Length	Width
WWAN Main Antenna	9cm	1.2cm
WWAM Aux. Antenna	6.5cm	1.2cm

12. SAR Test Results

12.1 Conducted Power (Unit: dBm)

<GSM>

Burst Average Power						
Band	**GSM850**			**GSM1900**		
Channel	**128**	**189**	**251**	**512**	**661**	**810**
Frequency (MHz)	**824.2**	**836.4**	**848.8**	**1850.2**	**1880.0**	**1909.8**
GPRS 8 (1 Uplink) – CS1	33.48	33.40	33.29	29.87	30.14	30.09
GPRS 10 (2 Uplink) – CS1	33.35	33.26	33.19	29.82	30.09	30.05
EDGE 8 (GMSK, 1 Uplink) – MCS1	33.39	33.29	33.19	29.86	30.13	30.08
EDGE 10 (GMSK, 2 Uplink) – MCS1	33.30	33.22	33.15	29.81	30.08	30.04
EDGE 8 (8PSK, 1 Uplink) – MCS9	27.74	27.64	27.53	26.64	26.94	27.00
EDGE 10 (8PSK, 2 Uplink) – MCS9	27.71	27.61	27.51	26.61	26.91	26.98

Note: Maximum burst average power in the table above.

Source-Based Time-Averaged Power						
Band	**GSM850**			**GSM1900**		
Channel	**128**	**189**	**251**	**512**	**661**	**810**
Frequency (MHz)	**824.2**	**836.4**	**848.8**	**1850.2**	**1880.0**	**1909.8**
GPRS 8 (1 Uplink) – CS1	24.48	24.40	24.29	20.87	21.14	21.09
GPRS 10 (2 Uplink) – CS1	**27.35**	27.26	27.19	23.82	**24.09**	24.05
EDGE 8 (GMSK, 1 Uplink) – MCS1	24.39	24.29	24.19	20.86	21.13	21.08
EDGE 10 (GMSK, 2 Uplink) – MCS1	27.30	27.22	27.15	23.81	24.08	24.04
EDGE 8 (8PSK, 1 Uplink) – MCS9	18.74	18.64	18.53	17.64	17.94	18.00
EDGE 10 (8PSK, 2 Uplink) – MCS9	21.71	21.61	21.51	20.61	20.91	20.98
Remark: The source-based time-averaged power is linearly scaled the maximum burst averaged power based on time slots. The calculated method are shown as below: Source based time averaged power = Maximum burst averaged power (1 Uplink) - 9 dB Source based time averaged power = Maximum burst averaged power (2 Uplink) - 6 dB						

Note:

1. For Body SAR testing, GPRS, EDGE should be evaluated, therefore the DUT was set in GPRS 10 for GSM850 and set in GPRS 10 for GSM1900 due to its highest source-based time-average power.
2. Per KDB 447498, the maximum output power channel is used for SAR testing and for further SAR test reduction.
3. EDGE tests with MCS1 setting, GMSK modulation. Burst average power with MCS9 setting 8 PSK modulation, is provided voluntary for reference.

<WCDMA>

Band	WCDMA Band V			WCDMA Band II		
Channel	4132	4182	4233	9262	9400	9538
Frequency (MHz)	826.4	836.4	846.6	1852.4	1880.0	1907.6
RMC 12.2K	23.66	23.67	23.84	22.93	23.10	23.00
HSDPA Subtest-1	23.65	23.66	23.81	22.01	22.15	22.06
HSDPA Subtest-2	23.64	23.63	23.78	21.92	22.14	22.03
HSDPA Subtest-3	23.20	23.21	23.31	21.48	21.66	21.54
HSDPA Subtest-4	23.15	23.14	23.27	21.40	21.61	21.52
HSUPA Subtest-1	23.68	23.72	23.83	22.22	22.27	22.18
HSUPA Subtest-2	21.58	21.70	21.84	20.05	20.28	20.16
HSUPA Subtest-3	22.63	22.66	22.86	21.24	21.40	21.12
HSUPA Subtest-4	21.71	21.75	21.92	20.13	20.36	20.23
HSUPA Subtest-5	23.20	23.21	23.39	21.88	21.90	21.82

MPR							
3GPP Requirement		WCDMA band V			WCDMA band II		
0	HSDPA Subtest-1	0.00	0.00	0.00	0.00	0.00	0.00
0	HSDPA Subtest-2	0.01	0.03	0.03	0.09	0.01	0.03
0.5	HSDPA Subtest-3	0.45	0.45	0.50	0.53	0.49	0.52
0.5	HSDPA Subtest-4	0.50	0.52	0.54	0.61	0.54	0.54
0	HSUPA Subtest-1	-0.48	-0.51	-0.44	-0.34	-0.37	-0.36
2	HSUPA Subtest-2	1.62	1.51	1.55	1.83	1.62	1.66
1	HSUPA Subtest-3	0.57	0.55	0.53	0.64	0.50	0.70
2	HSUPA Subtest-4	1.49	1.46	1.47	1.75	1.54	1.59
0	HSUPA Subtest-5	0.00	0.00	0.00	0.00	0.00	0.00

Note:

1. For Body SAR, per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA subset-1 and HSUPA subset-5 output power is < 1/4 dB higher than RMC, and SAR with RMC 12.2kbps setting is ≦1.2W/kg, HSDPA and HSUPA SAR evaluation can be excluded.
2. DUT is declared to follow the MPR of 3GPP Table 5.2B.1 specification, and the specification will set during the production. Since there is tolerance in measuring 3G output power, the difference between the measured value and the specification is treated as tolerance. According to KDB 941225 D02 v02, 1)b), the MPR implementation information is provided here.

12.2 Test Records for Body SAR Test

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Sample	SAR_{1g} (W/kg)
1	GSM850	GPRS10	Bottom	0	128	1	0.028
2	**GSM850**	**GPRS10**	**Bottom**	**0**	**128**	**2**	**0.039**
3	**GSM1900**	**GPRS10**	**Bottom**	**0**	**661**	**1**	**0.01**
4	GSM1900	GPRS10	Bottom	0	661	2	0.00787
5	WCDMA V	RMC 12.2K	Bottom	0	4233	1	0.014
6	**WCDMA V**	**RMC 12.2K**	**Bottom**	**0**	**4233**	**2**	**0.023**
7	**WCDMA II**	**RMC 12.2K**	**Bottom**	**0**	**9400**	**1**	**0.008**
8	WCDMA II	RMC 12.2K	Bottom	0	9400	2	0.00637

Note: Per KDB 447498, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.

Test Engineer： Jack Wu and Ted Sun

13. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] IEEE Std. C95.1-1991, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, 1991

[3] IEEE Std. 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, December 2003

[4] FCC OET Bulletin 65 (Edition 97-01) Supplement C (Edition 01-01), “Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields”, June 2001

[5] SPEAG DASY System Handbook

[6] FCC KDB 248227 D01 v01r02, “SAR Measurement Procedures for 802.11 a/b/g Transmitters”, May 2007

[7] FCC KDB 447498 D01 v04, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, November 2009

[8] FCC KDB 616217 D01 v01r01, "SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens", November 2009

[9] FCC KDB 616217 D03 v01, “SAR Evaluation Considerations for Laptop/Notebook/Netbook and Tablet Computers”, November 2009

[10] FCC KDB 941225 D01 v02, “SAR Measurement Procedures for 3G Devices – CDMA 2000 / Ev-Do / WCDMA / HSDPA / HSPA”, October 2007

[11] FCC KDB 941225 D03 v01, “Recommended SAR Test Reduction Procedures for GSM / GPRS / EDGE”, December 2008

[12] FCC KDB 941225 D04 v01, “Evaluating SAR for GSM/(E)GPRS Dual Transfer Mode”, January 27 2010

Appendix A. Plots of System Performance Check

The plots are shown as follows.

System Check_Body_835MHz_120310

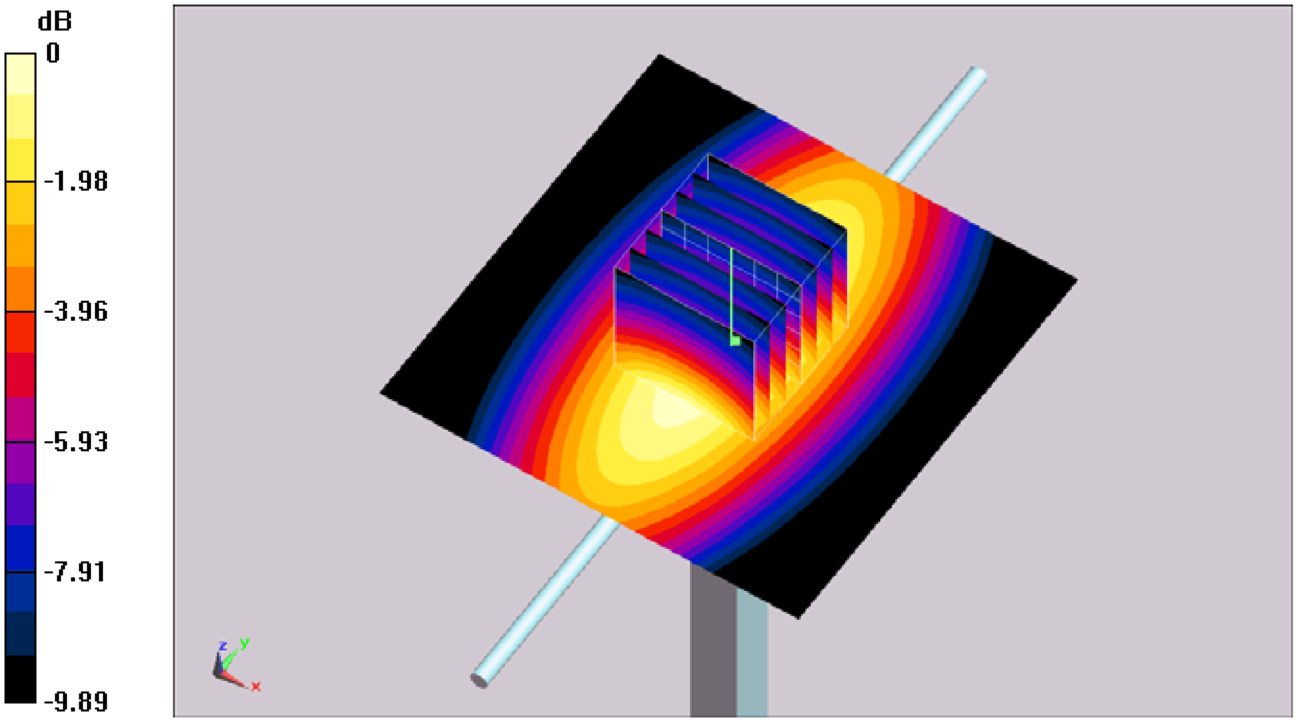
DUT: Dipole 835 MHz (SN: 499)

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: MSL_850_120310 Medium parameters used: f = 835 MHz; σ = 0.975 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Ambient Temperature：22.6 °C; Liquid Temperature：21.6 °C

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(6.22, 6.22, 6.22); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0_Front; Type: QD 0VA 002 AA; Serial: TP-1131
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.67 mW/g

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.7 V/m; Power Drift = -0.021 dB
Peak SAR (extrapolated) = 3.4 W/kg
SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.65 mW/g
Maximum value of SAR (measured) = 2.67 mW/g



0 dB = 2.67mW/g

System Check_Body_1900MHz_120310

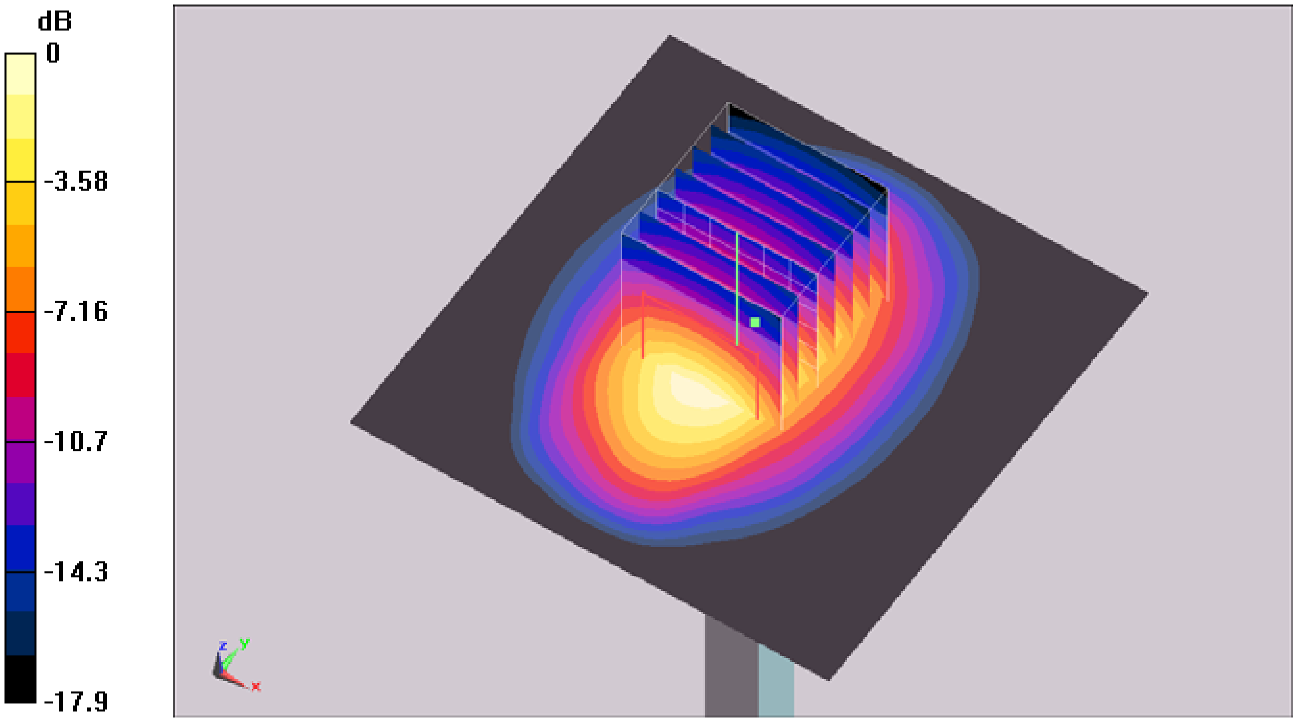
DUT: Dipole 1900 MHz (SN: 5d041)

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL_1900_120310 Medium parameters used: f = 1900 MHz; σ = 1.54 mho/m; ε_r = 53.9; ρ = 1000 kg/m^3
Ambient Temperature：22.5 °C; Liquid Temperature：21.5 °C

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.48, 4.48, 4.48); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.8 mW/g

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.6 V/m; Power Drift = -0.0023 dB
Peak SAR (extrapolated) = 18.4 W/kg
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 5.67 mW/g
Maximum value of SAR (measured) = 12.2 mW/g



0 dB = 12.2mW/g

Appendix B. Plots of SAR Measurement

The plots are shown as follows.

01 GSM850_GPRS10_Bottom_0cm_Ch128_Sample 1

DUT: 230618

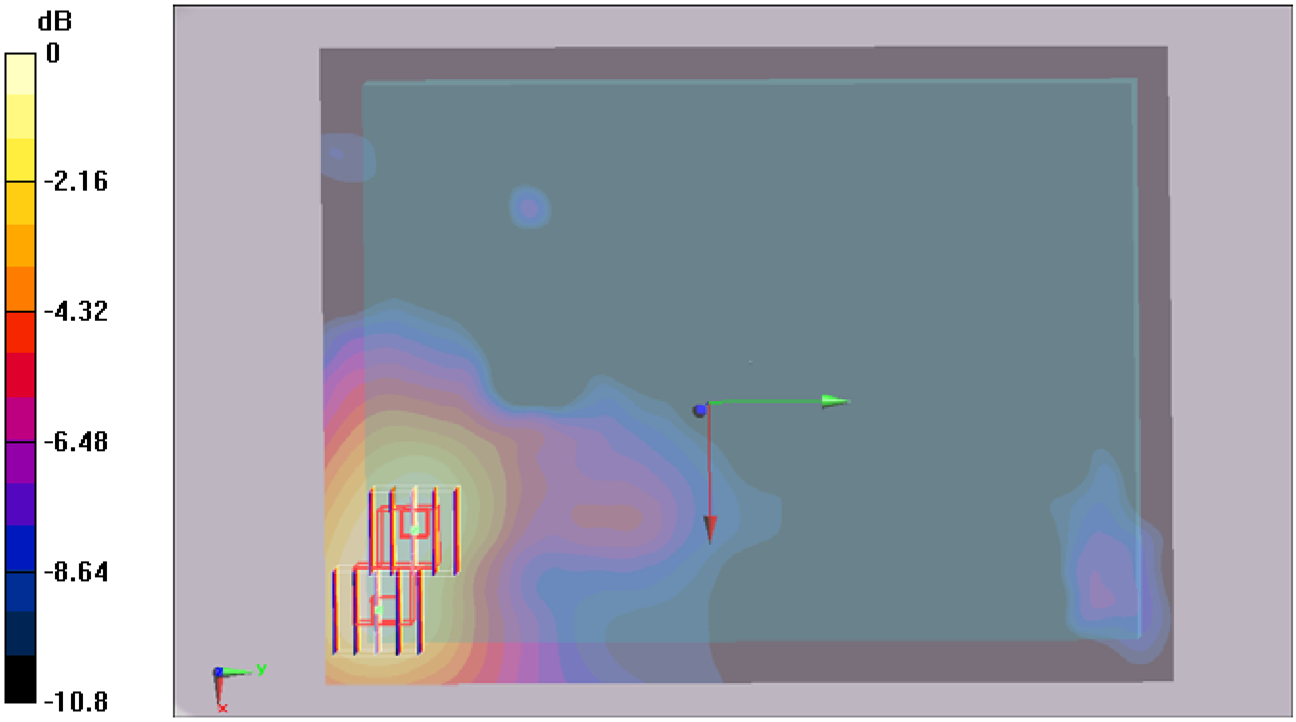
Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:4
Medium: MSL_850_120310 Medium parameters used : f = 824.2 MHz; σ = 0.963 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Ambient Temperature：22.6 ℃; Liquid Temperature：21.6 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(6.22, 6.22, 6.22); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0_Front; Type: QD 0VA 002 AA; Serial: TP-1131
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch128/Area Scan (121x161x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.029 mW/g

Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.680 V/m; Power Drift = 0.084 dB
Peak SAR (extrapolated) = 0.039 W/kg
SAR(1 g) = 0.028 mW/g; SAR(10 g) = 0.020 mW/g
Maximum value of SAR (measured) = 0.028 mW/g

Ch128/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.680 V/m; Power Drift = 0.084 dB
Peak SAR (extrapolated) = 0.041 W/kg
SAR(1 g) = 0.028 mW/g; SAR(10 g) = 0.019 mW/g
Maximum value of SAR (measured) = 0.030 mW/g



0 dB = 0.030mW/g

02 GSM850_GPRS10_Bottom_0cm_Ch128_Sample 2

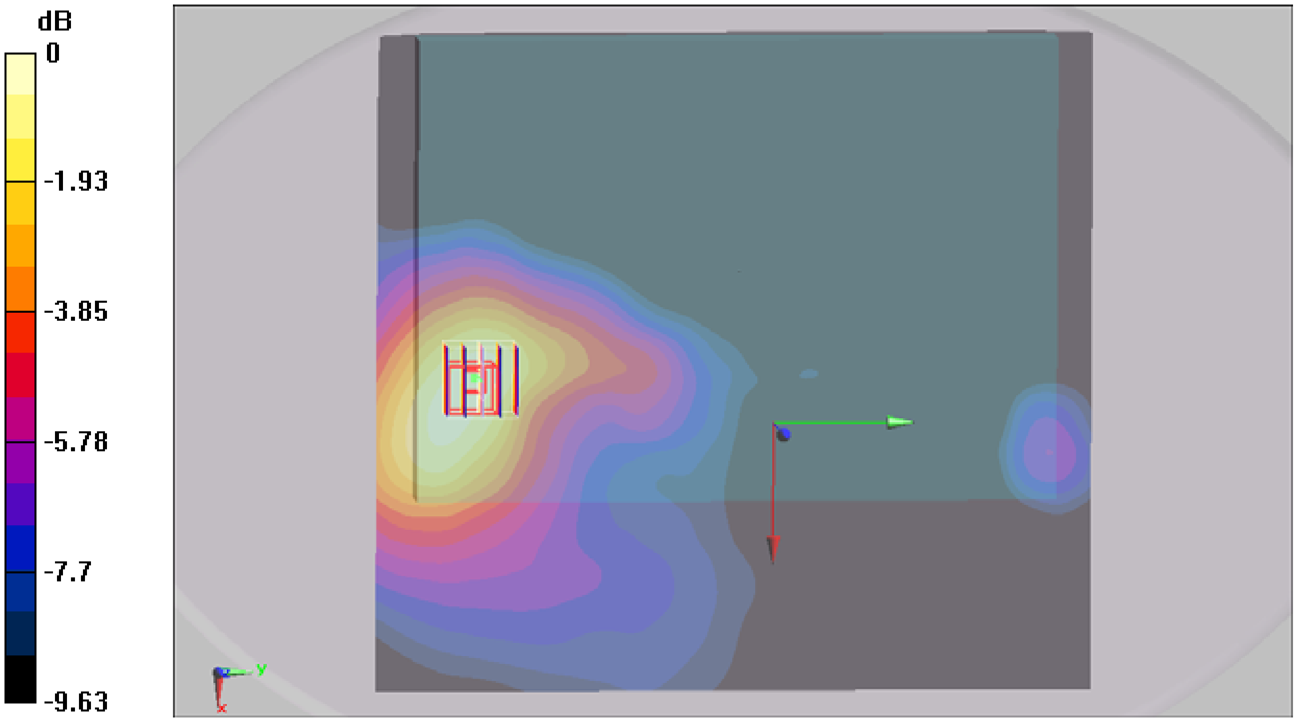
DUT: 230618

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:4
Medium: MSL_850_120310 Medium parameters used: f = 824.2 MHz; σ = 0.963 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Ambient Temperature：22.6 ℃; Liquid Temperature：21.6 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(6.22, 6.22, 6.22); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0_Front; Type: QD 0VA 002 AA; Serial: TP-1131
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch128/Area Scan (151x171x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.040 mW/g

Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.79 V/m; Power Drift = -0.031 dB
Peak SAR (extrapolated) = 0.052 W/kg
SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.028 mW/g
Maximum value of SAR (measured) = 0.041 mW/g



0 dB = 0.041mW/g

02 GSM850_GPRS10_Bottom_0cm_Ch128_Sample 1

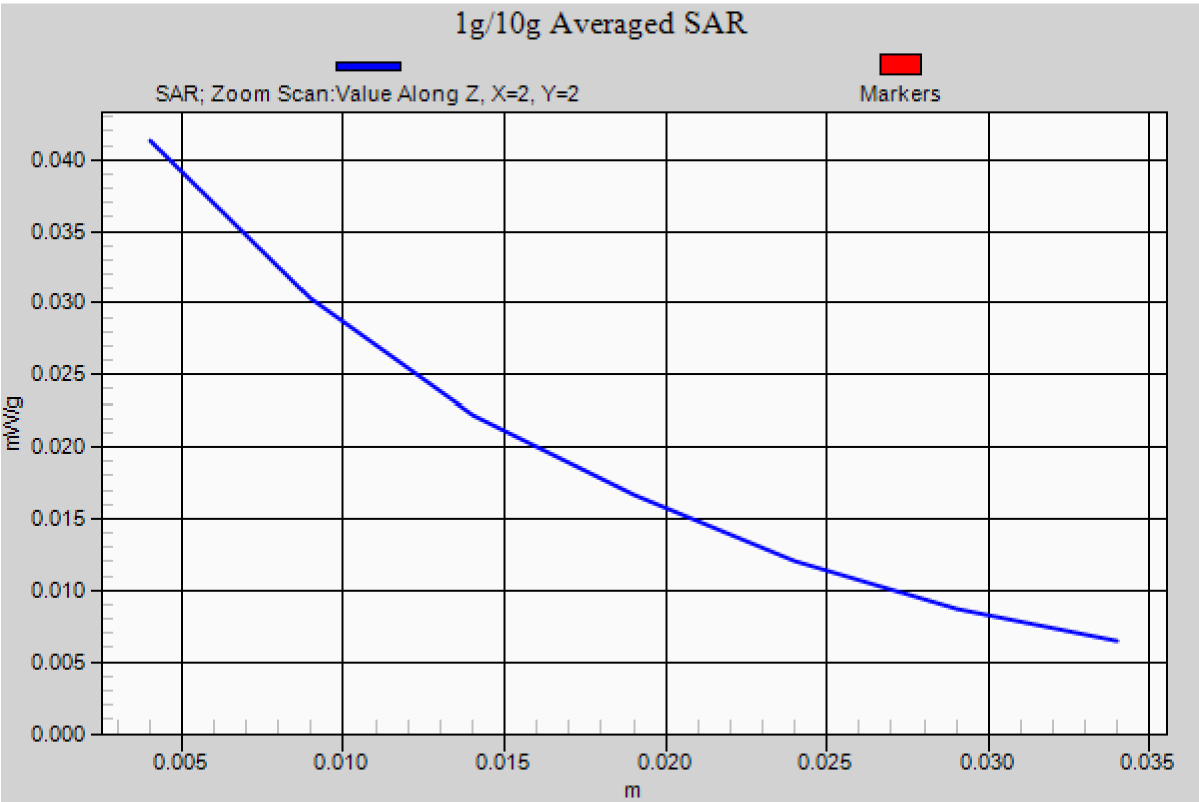
DUT: 230618

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:4
Medium: MSL_850_120310 Medium parameters used: f = 824.2 MHz; σ = 0.963 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Ambient Temperature：22.6 ℃; Liquid Temperature：21.6 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(6.22, 6.22, 6.22); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0_Front; Type: QD 0VA 002 AA; Serial: TP-1131
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch128/Area Scan (151x171x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.040 mW/g

Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.79 V/m; Power Drift = -0.031 dB
Peak SAR (extrapolated) = 0.052 W/kg
SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.028 mW/g
Maximum value of SAR (measured) = 0.041 mW/g



03 GSM1900_GPRS10_Bottom_0cm_Ch661_Sample 1

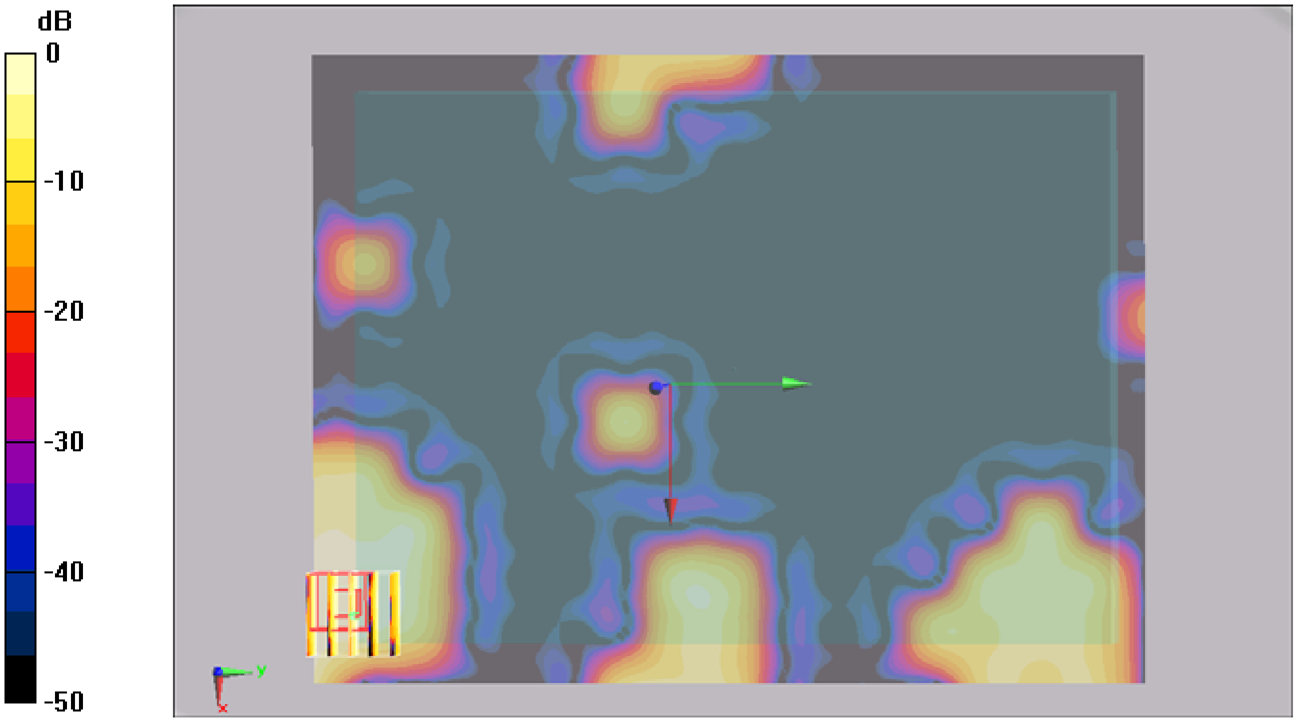
DUT: 230618

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:4
Medium: MSL_1900_120310 Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 54; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.48, 4.48, 4.48); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch661/Area Scan (121x161x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.014 mW/g

Ch661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.393 V/m; Power Drift = -0.051 dB
Peak SAR (extrapolated) = 0.015 W/kg
SAR(1 g) = 0.010 mW/g; SAR(10 g) = 0.00608 mW/g
Maximum value of SAR (measured) = 0.011 mW/g



0 dB = 0.011mW/g

03 GSM1900_GPRS10_Bottom_0cm_Ch661_Sample 1

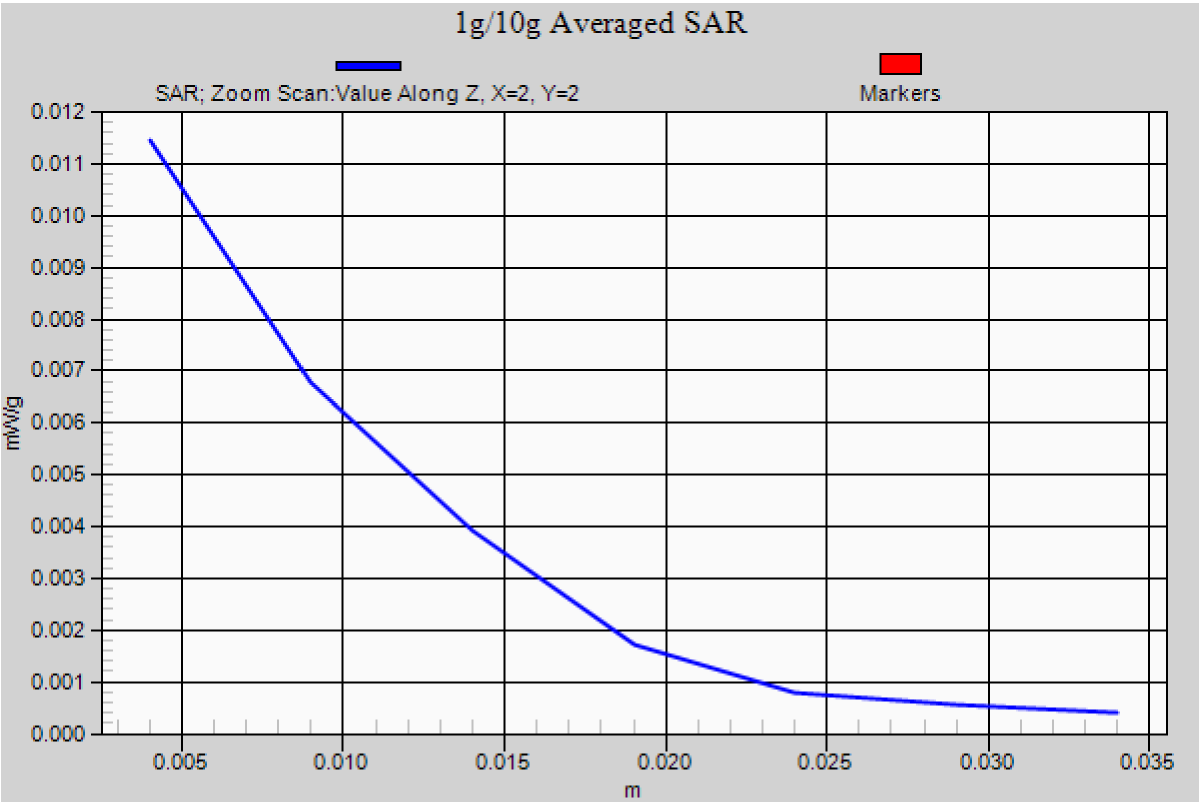
DUT: 230618

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:4
Medium: MSL_1900_120310 Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 54; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.48, 4.48, 4.48); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch661/Area Scan (121x161x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.014 mW/g

Ch661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.393 V/m; Power Drift = -0.051 dB
Peak SAR (extrapolated) = 0.015 W/kg
SAR(1 g) = 0.010 mW/g; SAR(10 g) = 0.00608 mW/g
Maximum value of SAR (measured) = 0.011 mW/g



04 GSM1900_GPRS10_Bottom_0cm_Ch661_Sample 2

DUT: 230618

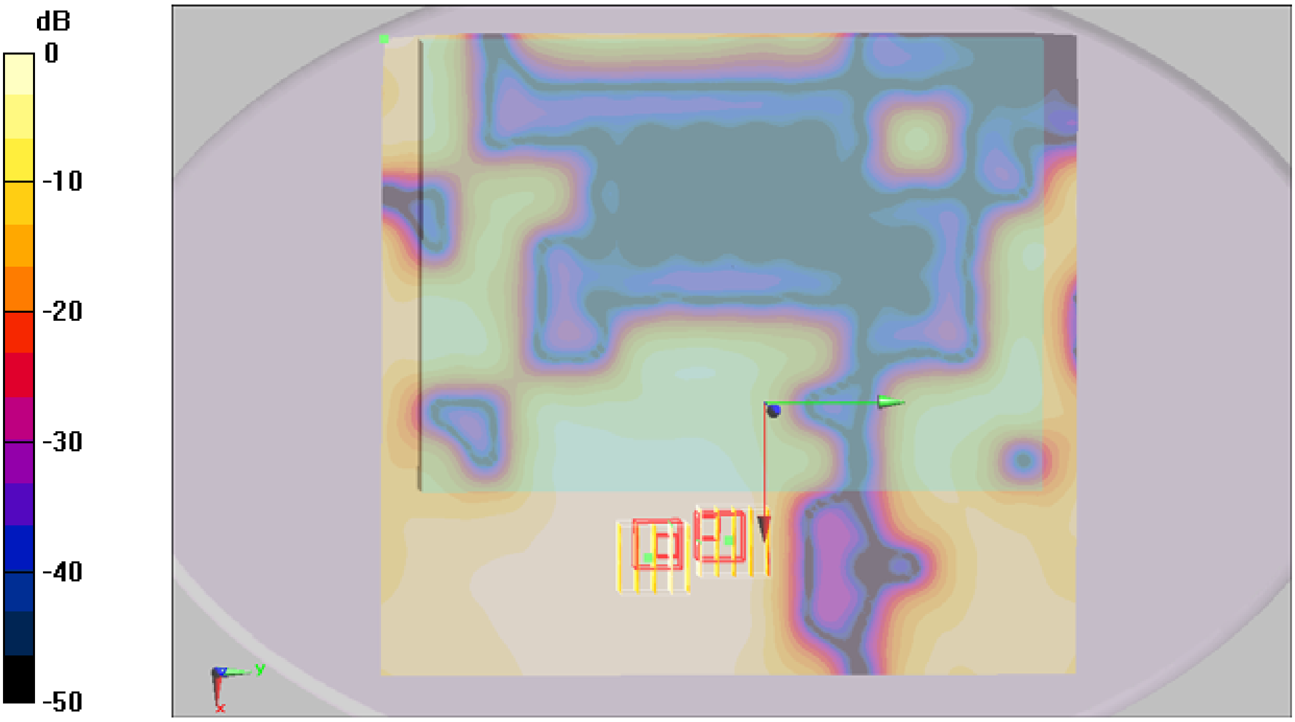
Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:4
Medium: MSL_1900_120310 Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 54; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.48, 4.48, 4.48); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch661/Area Scan (151x171x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.00785 mW/g

Ch661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.3 V/m; Power Drift = -0.132 dB
Peak SAR (extrapolated) = 0.014 W/kg
SAR(1 g) = 0.00787 mW/g; SAR(10 g) = 0.00501 mW/g
Maximum value of SAR (measured) = 0.0088 mW/g

Ch661/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.3 V/m; Power Drift = -0.132 dB
Peak SAR (extrapolated) = 0.014 W/kg
SAR(1 g) = 0.00658 mW/g; SAR(10 g) = 0.00383 mW/g
Maximum value of SAR (measured) = 0.00759 mW/g



0 dB = 0.00759mW/g

05 WCDMA V_RMC 12.2K_Bottom_0cm_Ch4233_Sample 1

DUT: 230618

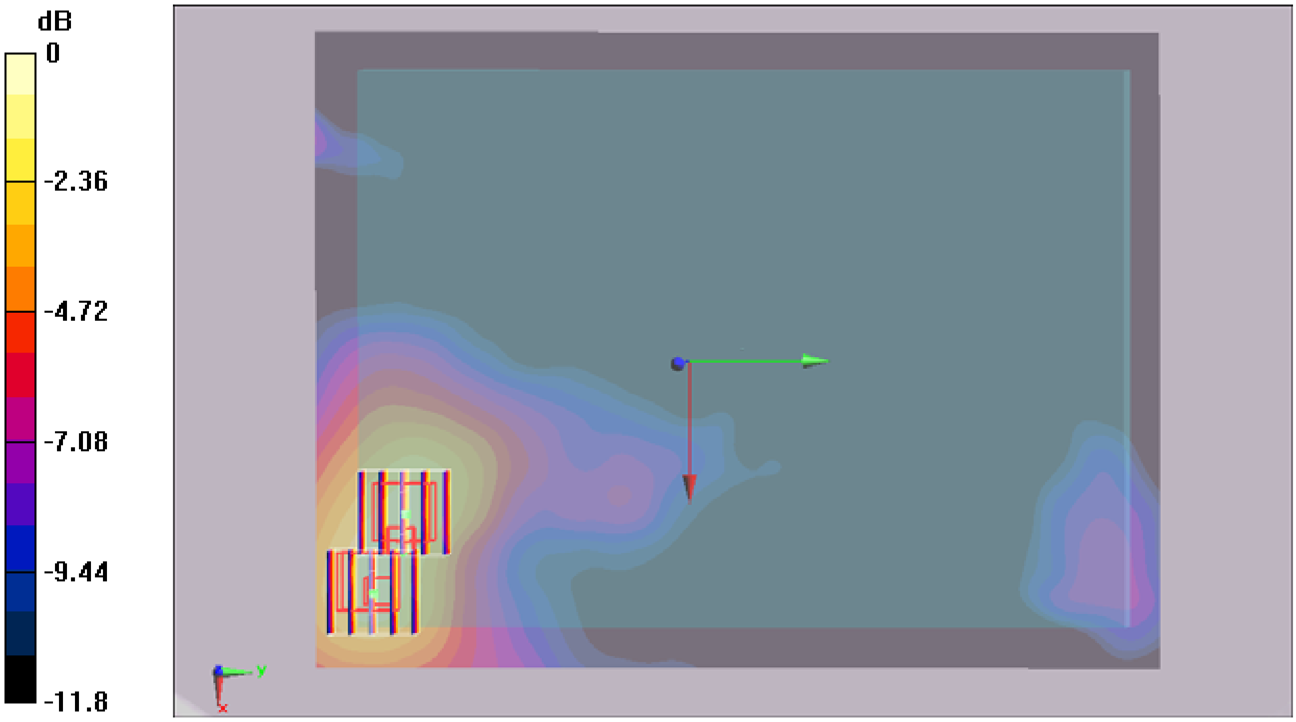
Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1
Medium: MSL_850_120310 Medium parameters used: f = 847 MHz; σ = 0.987 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.6 ℃; Liquid Temperature：21.6 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(6.22, 6.22, 6.22); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0_Front; Type: QD 0VA 002 AA; Serial: TP-1131
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch4233/Area Scan (121x161x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.014 mW/g

Ch4233/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.404 V/m; Power Drift = -0.035 dB
Peak SAR (extrapolated) = 0.020 W/kg
SAR(1 g) = 0.014 mW/g; SAR(10 g) = 0.00847 mW/g
Maximum value of SAR (measured) = 0.015 mW/g

Ch4233/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.404 V/m; Power Drift = -0.035 dB
Peak SAR (extrapolated) = 0.022 W/kg
SAR(1 g) = 0.013 mW/g; SAR(10 g) = 0.00911 mW/g
Maximum value of SAR (measured) = 0.017 mW/g



0 dB = 0.017mW/g

06 WCDMA V_RMC 12.2K_Bottom_0cm_Ch4233_Sample 2

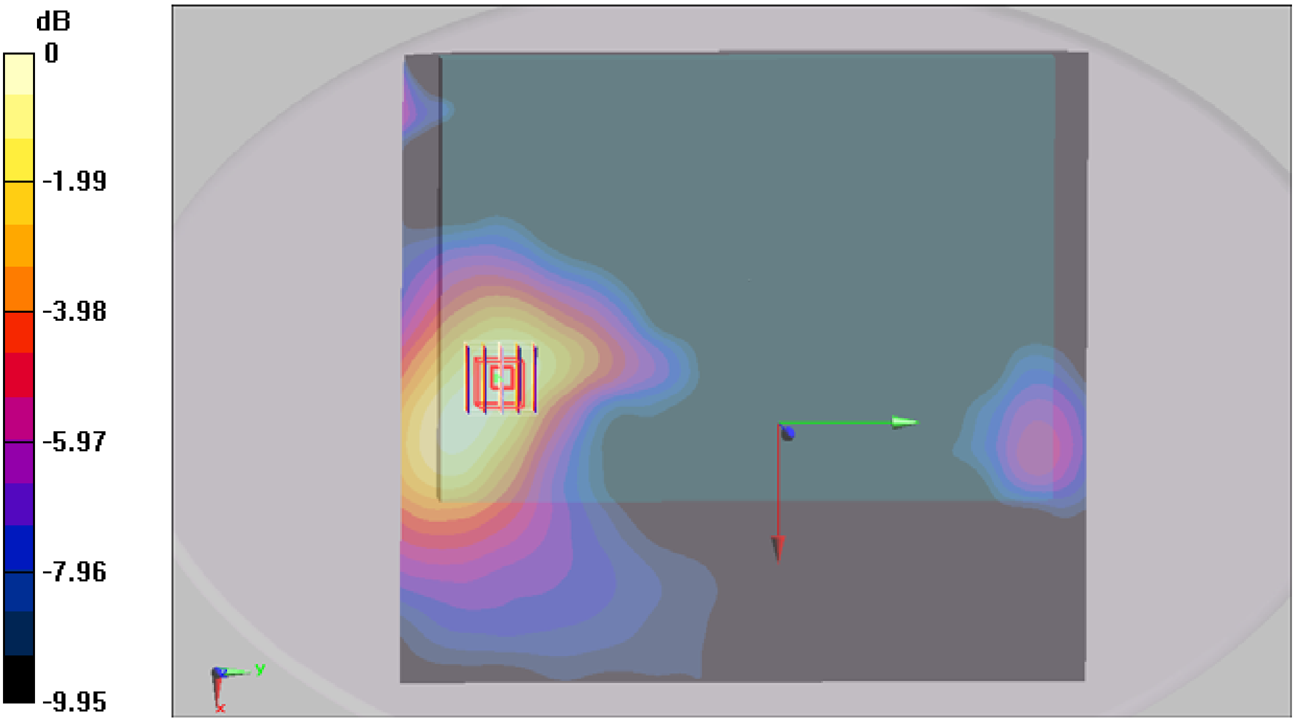
DUT: 230618

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1
Medium: MSL_850_120310 Medium parameters used: f = 847 MHz; σ = 0.987 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.6 ℃; Liquid Temperature：21.6 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(6.22, 6.22, 6.22); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0_Front; Type: QD 0VA 002 AA; Serial: TP-1131
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch4233/Area Scan (151x171x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.023 mW/g

Ch4233/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.28 V/m; Power Drift = 0.130 dB
Peak SAR (extrapolated) = 0.031 W/kg
SAR(1 g) = 0.023 mW/g; SAR(10 g) = 0.016 mW/g
Maximum value of SAR (measured) = 0.024 mW/g



0 dB = 0.024mW/g

06 WCDMA V_RMC 12.2K_Bottom_0cm_Ch4233_Sample 2

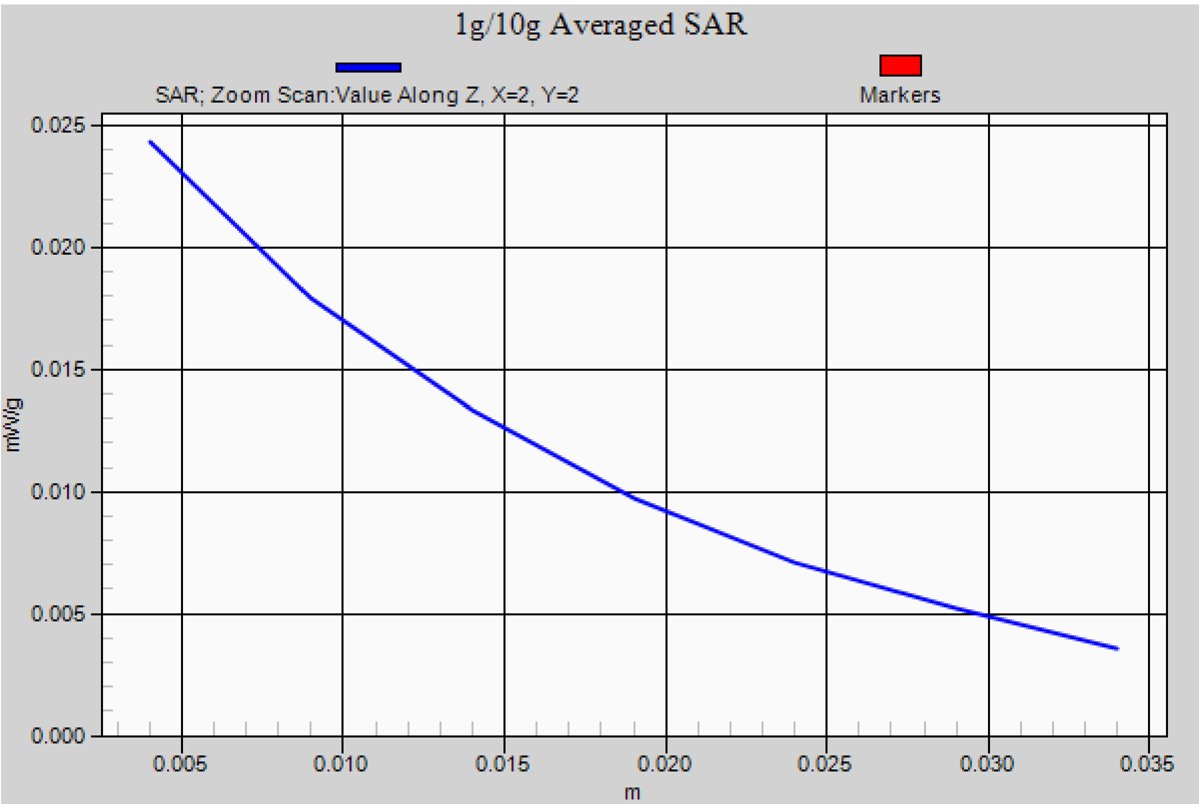
DUT: 230618

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1
Medium: MSL_850_120310 Medium parameters used: f = 847 MHz; σ = 0.987 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.6 ℃; Liquid Temperature：21.6 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(6.22, 6.22, 6.22); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0_Front; Type: QD 0VA 002 AA; Serial: TP-1131
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch4233/Area Scan (151x171x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.023 mW/g

Ch4233/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.28 V/m; Power Drift = 0.130 dB
Peak SAR (extrapolated) = 0.031 W/kg
SAR(1 g) = 0.023 mW/g; SAR(10 g) = 0.016 mW/g
Maximum value of SAR (measured) = 0.024 mW/g



07 WCDMA II_RMC 12.2K_Bottom_0cm_Ch9400_Sample 1

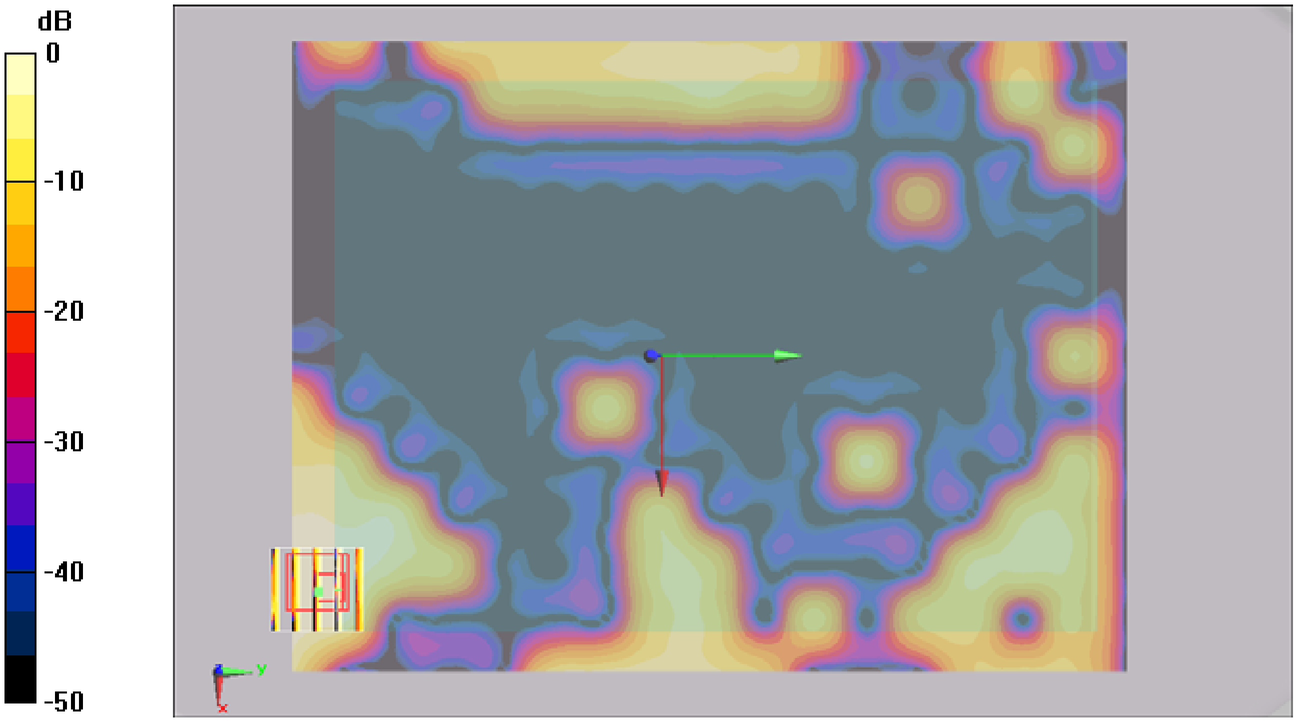
DUT: 230618

Communication System: WCDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: MSL_1900_120310 Medium parameters used: f = 1880 MHz; $\sigma = 1.52$ mho/m; $\varepsilon_r = 54$; $\rho = 1000$ kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.48, 4.48, 4.48); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch9400/Area Scan (121x161x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.012 mW/g

Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.755 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.013 W/kg
SAR(1 g) = 0.008 mW/g; SAR(10 g) = 0.0045 mW/g
Maximum value of SAR (measured) = 0.00931 mW/g



0 dB = 0.00931mW/g

07 WCDMA II_RMC 12.2K_Bottom_0cm_Ch9400_Sample 1

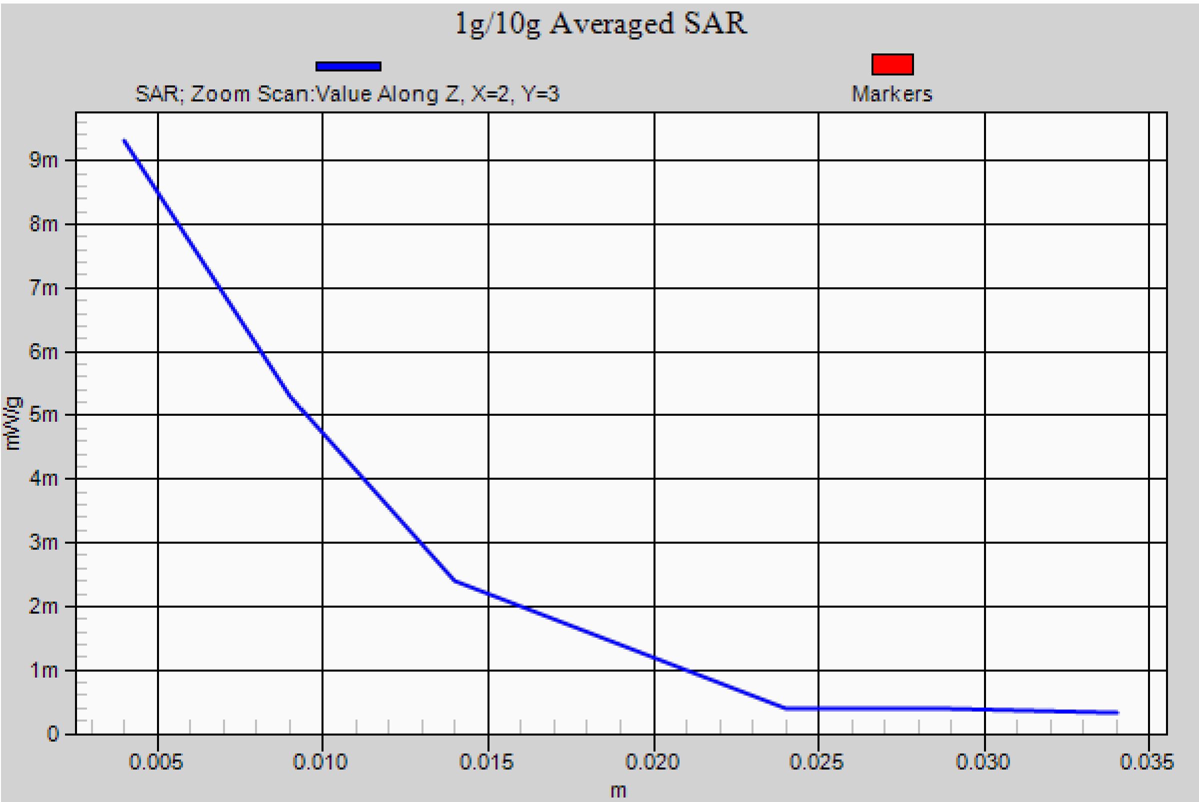
DUT: 230618

Communication System: WCDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: MSL_1900_120310 Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 54; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.48, 4.48, 4.48); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch9400/Area Scan (121x161x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.012 mW/g

Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.755 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.013 W/kg
SAR(1 g) = 0.008 mW/g; SAR(10 g) = 0.0045 mW/g
Maximum value of SAR (measured) = 0.00931 mW/g



08 WCDMA II_RMC 12.2K_Bottom_0cm_Ch9400_Sample 2

DUT: 230618

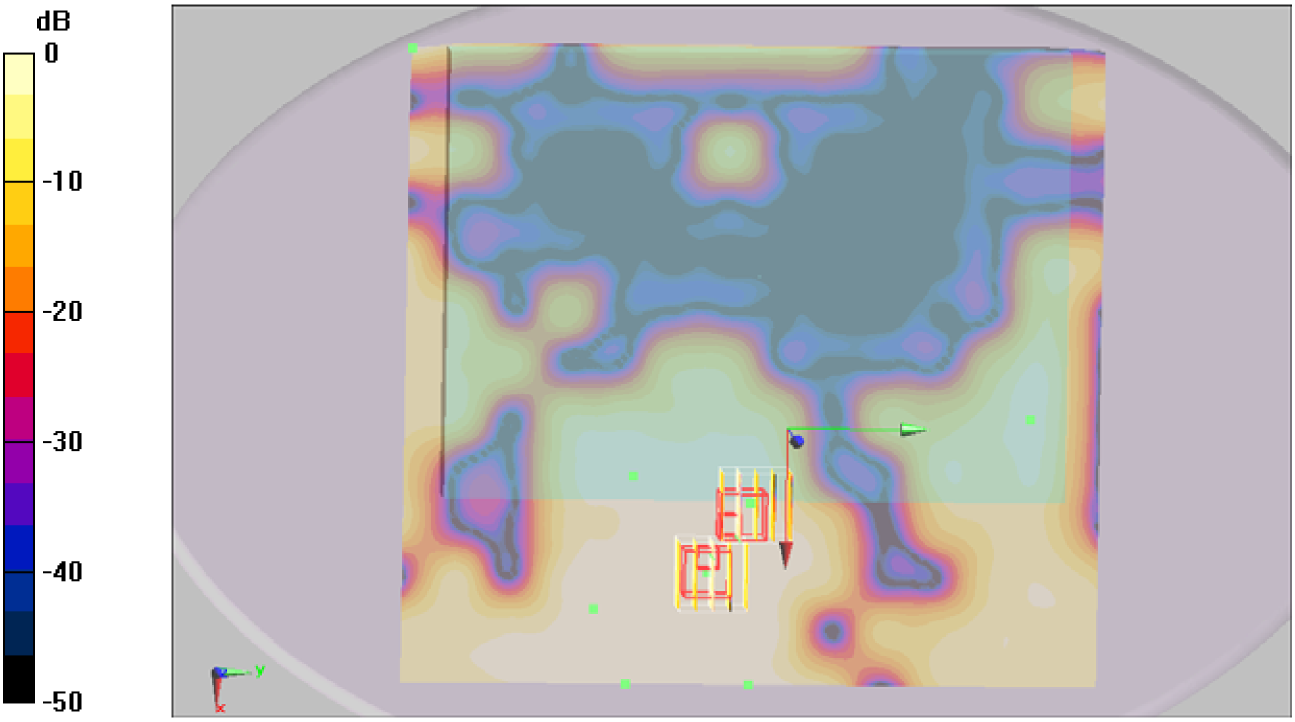
Communication System: WCDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: MSL_1900_120310 Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 54; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.48, 4.48, 4.48); Calibrated: 2011/5/20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2011/4/28
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Ch9400/Area Scan (151x171x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.0599 mW/g

Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.734 V/m; Power Drift = -0.172 dB
Peak SAR (extrapolated) = 0.013 W/kg
SAR(1 g) = 0.00637 mW/g; SAR(10 g) = 0.00388 mW/g
Maximum value of SAR (measured) = 0.00723 mW/g

Ch9400/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.734 V/m; Power Drift = -0.172 dB
Peak SAR (extrapolated) = 0.012 W/kg
SAR(1 g) = 0.0052 mW/g; SAR(10 g) = 0.00283 mW/g
Maximum value of SAR (measured) = 0.00598 mW/g



0 dB = 0.00598mW/g