

# FCC SAR Test Report

## FCC ID: 2ADPBID117

**Project No.** : 1411C072  
**Equipment** : Wireless Enabled Hard Drive  
**Model Name** : IDrive WiFi; IDriveWiFi-XXXXGB  
**Applicant** : IDrive Inc.  
**Address** : 26115 Mureau Road, Suite A, Calabasas, CA 91302

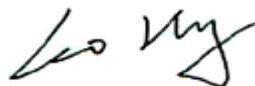
**Date of Receipt** : Nov. 10, 2014  
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**Issued Date** : Nov. 28, 2014  
**Tested by** : BTL Inc.

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# **B T L I N C .**

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### REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCC-SAR-1411C072	Original Issue.	Nov. 28, 2014

## 1. GENERAL SUMMARY

Equipment	Wireless Enabled Hard Drive
Model Name	IDrive WiFi; IDriveWiFi-XXXXGB
Brand Name	IDrive; IDrive WiFi
Model Difference	Only differ in the hard drive capacity.
Manufacturer	IDrive Inc.
Address	26115 Mureau Road, Suite A, Calabasas, CA 91302
Factory	Power7 Technology(Dongguan) Co.,Ltd
Address	No.28 BinjiangSt.ShishuikouVillage,QiaotouTown, DongguanCity, GuangDong Province P.R.China
Standard(s)	<p><b>FCC 47CFR §2.1093</b> Radio frequency Radiation Exposure Evaluation: Portable Devices</p> <p><b>ANSI C95.1, 1999</b> Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.(IEEE Std C95.1-1999)</p> <p><b>KDB 248227 D01 v01r02 SAR meas for 802 11 a b g v01r02:</b> SAR Measurement Procedures for 802.11a/b/g Transmitters</p> <p><b>KDB 447498 D01 General RF Exposure Guidance v05r02:</b> Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies.</p> <p><b>KDB 865664 D01 SAR measurement 100 MHz to 6GHz v01r03:</b> SAR Measurement Requirements for 100MHz to 6GHz</p>

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCC-SAR-1411C072) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

## 2. RF EMISSIONS MEASUREMENT

### 2.1 TEST FACILITY

The test facilities used to collect the test data in this report is **SAR room** at the location of No.3,Jinshagang 1st Road, ShiXia, Dalang Town, Dong Guan, China.523792

### 2.2 MEASUREMENT UNCERTAINTY

Uncertainty Component	Uncertainty Value	Probability Distribution	Divisor	C <sub>i</sub> (1g)	Standard Uncertainty ±1%	V <sub>i</sub> or V <sub>eff</sub>
<b>Measurement System</b>						
Probe Calibration (k=1)	5.9	Normal	1	1	5.9	∞
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	$\sqrt{0.5}$	1.9	∞
Hemispherical Isotropy	9.6	Rectangular	$\sqrt{3}$	$\sqrt{0.5}$	3.9	∞
Boundary Effect	1.0	Rectangular	$\sqrt{3}$	1	0.6	∞
Linearity	4.7	Rectangular	$\sqrt{3}$	1	2.7	∞
System Detection Limit	1.0	Rectangular	$\sqrt{3}$	1	0.6	∞
Readout Electronics	0.3	Normal	1	1	0.3	∞
Response Time	0.8	Rectangular	$\sqrt{3}$	1	0.5	∞
Integration Time	2.6	Rectangular	$\sqrt{3}$	1	1.5	∞
RF Ambient Conditions-Noise	3.0	Rectangular	$\sqrt{3}$	1	1.7	∞
RF Ambient Reflections	3.0	Rectangular	$\sqrt{3}$	1	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	Rectangular	$\sqrt{3}$	1	0.2	∞
Probe Positioning with respect to Phantom Shell	2.9	Rectangular	$\sqrt{3}$	1	1.7	∞
Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	1.0	Rectangular	$\sqrt{3}$	1	0.6	∞
<b>Test Sample Related</b>						
Test sample Positioning	2.9	Normal	1	1	2.9	145
Device Holder Uncertainty	3.6	Normal	1	1	3.6	5
Output Power Variation - SAR drift measurement	5.0	Rectangular	$\sqrt{3}$	1	2.9	∞
<b>Phantom and Setup</b>						
Phantom Uncertainty ( shape and thickness tolerances)	4.0	Rectangular	$\sqrt{3}$	1	2.3	∞
Liquid Conductivity - deviation from target values	5.0	Rectangular	$\sqrt{3}$	0.64	1.8	∞
Liquid Conductivity - measurement uncertainty	2.5	Normal	1	0.64	1.6	∞
Liquid Permittivity - deviation from target values	5.0	Rectangular	$\sqrt{3}$	0.6	1.7	∞
Liquid Permittivity - measurement uncertainty	2.5	Normal	1	0.6	1.5	∞
<b>Combined standard uncertainty</b>		RSS	-	-	10.9	387
<b>Expanded uncertainty</b>		k=2	-	-	21.9	-

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

Tested Mode(s)	WiFi(802.11b/g/n)
Operation Frequency	2412 MHz ~2462 MHz
Modulation Technology	802.11b:DSSS 802.11g:OFDM 802.11n:OFDM
Bit Rate of Transmitter	802.11b :1, 2, 5.5, 11 Mbps 802.11g : 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n : up to 300 Mbps
Number Of Channel	Please refer to note 1
Antenna Type	Please refer to note 2
Power Source	#1 DC voltage supplied from AC Adapter. Brand/Model: Ktec / KSA29B0500200D5 #2 Supplied from lithium battery. Model: SP 954856
Power Rating	#1 I/P: AC 100-240V~ 50/60Hz 0.5A O/P: DC 5.0V 2.0A #2 DC 3.7V 3000mAh 11.1Wh

**Note:**

#### 1. Number Of Channel(WIFI)

802.11b / g / n 20MHz / n 40MHz							
CH 01 – CH 11 for 802.11b, 802.11g, 802.11n(20MHz)							
CH 03 – CH 09 for 802.11n(40MHz)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	04	2427	07	2442	10	2457
02	2417	05	2432	08	2447	11	2462
03	2422	06	2437	09	2452		

#### 2. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Note
0(A)	N/A	SLB-201560040	Integral	N/A	2.24	TX/RX
1(B)	N/A	SLB-201570170	Integral	N/A	2.71	TX/RX



### 3.2 THE MAXIMUM SAR<sub>1G</sub> VALUES

Body SAR Configuration

Test Mode	Frequency (MHz)	Test Position	Separation Distance	Reported Result SAR <sub>1g</sub> (W/kg)	Limit SAR <sub>1g</sub> (W/kg)
802.11b	2462	Test Position 2	0mm	0.947	1.6

### 3.3 LABORATORY ENVIRONMENT

Temperature	Min. = 18°C, Max. = 25°C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

### 3.4 MAIN TEST INSTRUMENTS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Data Acquisition Electronics	Speag	DAE4	1390	Sep. 15, 2015
2	E-field Probe	Speag	EX3DV4	3898	Mar. 10, 2015
3	Electro Optical Converter	Speag	ECO90	1151	N/A
4	SAM Twin Phantom	Speag	SAM	1784	N/A
5	System Validation Dipole	Speag	D2450V2	919	Sep. 17, 2015
6	Power Amplifier	Speag	ZHL-42W	N/A	N/A
7	Power Amplifier	Speag	ZVE-8G	N/A	N/A
8	ENA Network Analyzer	Agilent	E5071C	MY46102965	Mar. 29, 2015
9	Dielectric Probe Kit	Agilent	85070E	2593	N/A
10	P-series power meter	Agilent	N1911A	MY45100473	Mar. 29, 2015
11	wideband power sensor	Agilent	N1921A	MY51100041	Mar. 29, 2015
12	Power Meter	Anritsu	ML2487A	6K00004714	Mar. 16, 2015
13	Power Meter Sensor	Anritsu	MA2491A	34138	Mar. 16, 2015
14	MXG Analog Signal Generator	Agilent	N5181A	MY49060710	Nov. 02, 2015
15	Low pass filter	Mini-Circuits	SLP-2950+	M108294	Mar. 29, 2015
16	Attenuator	Mini-Circuits	VAT-10+	31317-1	Mar. 29, 2015
17	Attenuator	Mini-Circuits	VAT-10+	31317-2	Mar. 29, 2015
18	Attenuator	MEB	300-affn-03	314	Mar. 29, 2015
19	Dual directional coupler	Agilent	777D	50208	Mar. 29, 2015

Remark: " N/A" denotes no model name, serial No. or calibration specified.

All calibration period of equipment list is one year.

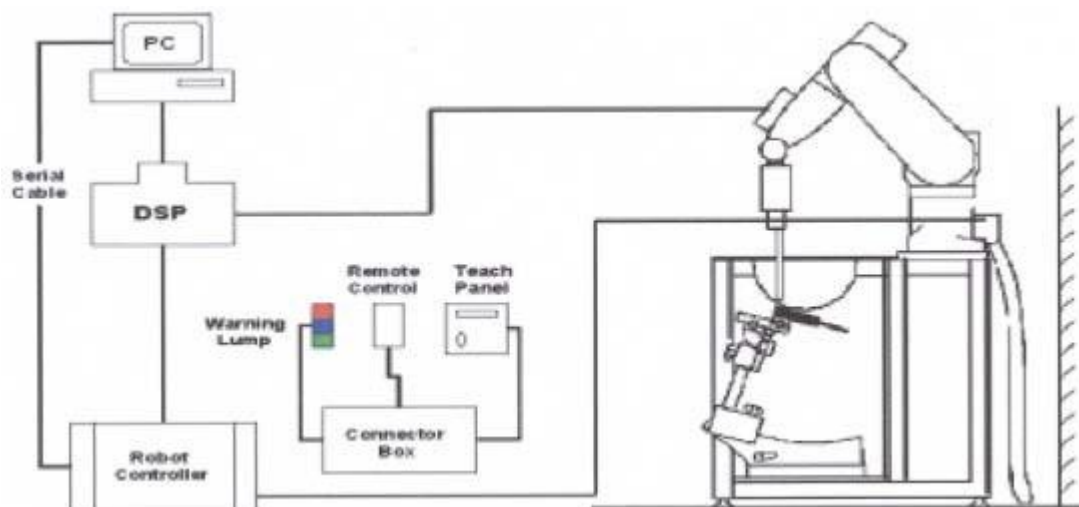
## 4. SAR MEASUREMENTS SYSTEM CONFIGURATION

### 4.1 SAR MEASUREMENT SET-UP

The DASY5 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
6. The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 7
7. DASY5 software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

#### 4.1.1 Test Setup Layout



## 4.2 DASY5 E-FIELD PROBE SYSTEM

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

### 4.2.1 EX3DV4 PROBE SPECIFICATION

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to 6 GHz Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)
Directivity	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 $\mu$ W/g to > 100 mW/g Linearity: $\pm 0.2$ dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm



**EX3DV4 E-field Probe**

#### 4.2.2 E-FIELD PROBE CALIBRATION

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm 10\%$ . The spherical isotropy was evaluated and found to be better than  $\pm 0.25\text{dB}$ . The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$\text{SAR} = C \frac{\Delta T}{\Delta t}$$

Where:  $\Delta t$  = Exposure time (30 seconds),

$C$  = Heat capacity of tissue (brain or muscle),

$\Delta T$  = Temperature increase due to RF exposure.

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

Where:  $\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density ( $\text{kg/m}^3$ ).

### 4.2.3 OTHER TEST EQUIPMENT

#### 4.2.3.1. Device Holder for Transmitters

**Construction:** Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices (e.g., laptops, cameras, etc.) It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.

**Material:** POM, Acrylic glass, Foam

#### 4.2.3.2 Phantom

The SAM twin phantom is a berglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6 mm). The phantom has three measurement areas:

- \_ Left hand
- \_ Right hand
- \_ Flat phantom

The bottom plate contains three pairs 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 cover the phantom during o -periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on top of this phantom cover are possible.



**SAM twin Phantom**

#### 4.2.4 SCANNING PROCEDURE

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements 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 DUT’s output power and should vary max.  $\pm 5\%$ .

The “surface check” measurement tests the optical surface detection system of the DASY5 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  $\pm 0.1\text{mm}$ ). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within  $\pm 30^\circ$ .)

- Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 10 mm x 10 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

- Zoom Scan

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

- Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard’s method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

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. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard’s method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

## 4.2.5 DATA STORAGE AND EVALUATION

### 4.2.5.1 Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “.DAE4”. The 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 incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm<sup>2</sup>], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.



#### 4.4.2 Data Evaluation by SEMCAD

The SEMCAD software 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	Normi, $a_{i0}$ , $a_{i1}$ , $a_{i2}$
	Conversion factor	ConvF <sub>i</sub>
	Diode compression point	Dcp <sub>i</sub>
Device parameters:	Frequency	f
	Crest factor	cf
Media parameters:	Conductivity	
	Density	

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 DASY5 components. In the direct measuring mode of the multimeter 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:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

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 <sub>i</sub> = diode compression point	(DASY parameter)

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

$$\text{E-field probes: } E_i = (V_i / \text{Norm}_i \cdot \text{ConvF})^{1/2}$$

$$\text{H-field probes: } H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$$

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

$\text{Norm}_i$  = sensor sensitivity of channel i (i = x, y, z)  
[mV/(V/m)<sup>2</sup>] for E-field Probes

$\text{ConvF}$  = 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):

$$E_{\text{tot}} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

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

$$\text{SAR} = (E_{\text{tot}})^2 \cdot \sigma / (\rho \cdot 1000)$$

With  $\text{SAR}$  = local specific absorption rate in mW/g

$E_{\text{tot}}$  = total field strength in V/m  
= conductivity in [mho/m] or [Siemens/m]  
= equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{\text{pwe}} = E_{\text{tot}}^2 / 3770 \text{ or } P_{\text{pwe}} = H_{\text{tot}}^2 \cdot 37.7$$

With  $P_{\text{pwe}}$  = equivalent power density of a plane wave in mW/cm<sup>2</sup>

$E_{\text{tot}}$  = total field strength in V/m

$H_{\text{tot}}$  = total magnetic field strength in A/m

## 5. TISSUE-EQUIVALENT LIQUID

### 5.1 TISSUE-EQUIVALENT LIQUID INGREDIENTS

The liquid is consisted of water, salt and Glycol. The liquid has previously been proven to be suited for worst-case. The Table 2 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed

#### Composition of the body Tissue Equivalent Matter

MIXTURE%	FREQUENCY 2450MHz
Water	73.2
Glycol	26.7
Salt	0.1
Dielectric Parameters Target Value	f=2450MHz $\epsilon=52.70$ $\sigma=1.95$

### 5.2 TISSUE-EQUIVALENT LIQUID PROPERTIES

#### Dielectric Performance of Tissue Simulating Liquid

Frequency (MHz)	Description	Dielectric Parameters		Temp °C
		$\epsilon_r$	$\sigma$ (s/m)	
2450	Target value $\pm 5\%$ within	52.70 50.07-55.34	1.95 1.85-2.048	22.0
	Measurement value <b>2014-11-26</b>	<b>50.95</b>	<b>1.92</b>	<b>20.8</b>

## 6. SYSTEM CHECK

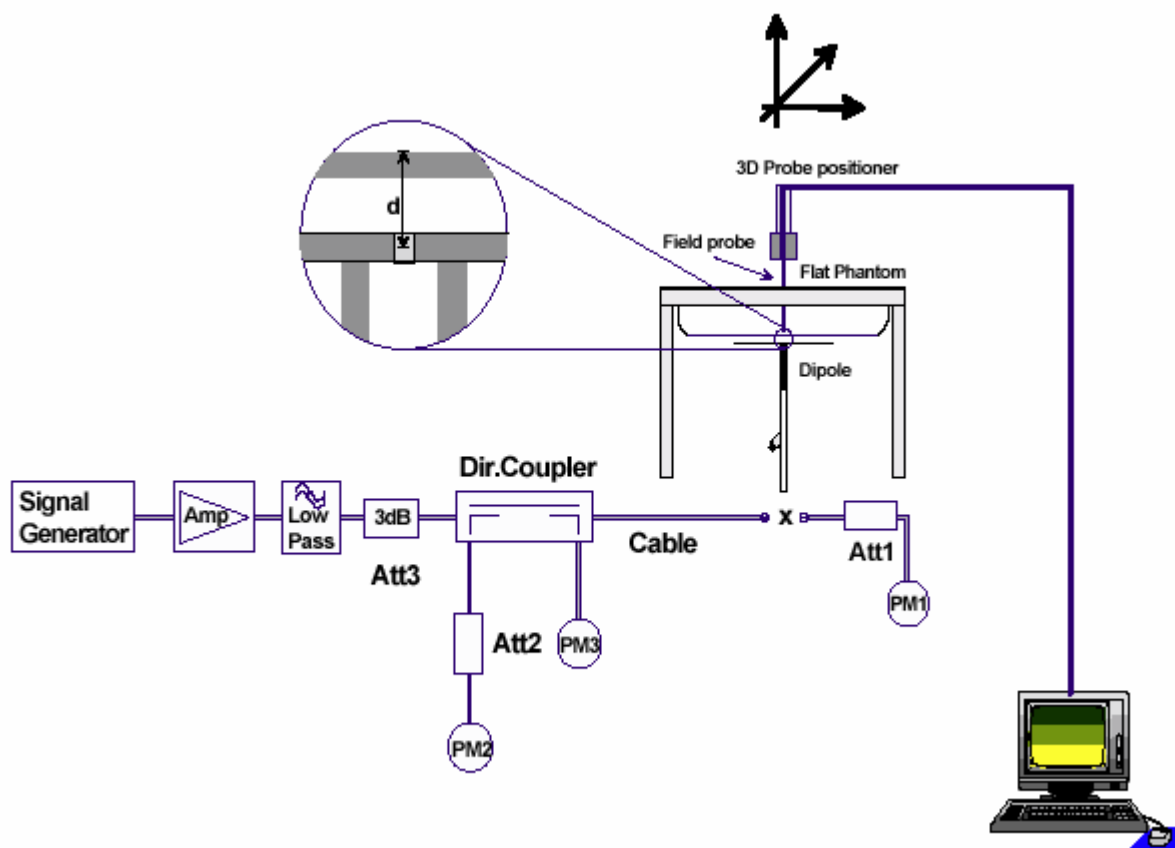
### 6.1 DESCRIPTION OF SYSTEM CHECK

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the 6.2.

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ( $\pm 10\%$ ).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.

**System Check Set-up**



## 6.2 DESCRIPTION OF SYSTEM CHECK

### System Check in Tissue Simulating Liquid

Frequency (MHz)	Test Date	Dielectric Parameters		Temp	250mW Measured SAR <sub>1g</sub>	1W Normaliz ed SAR <sub>1g</sub>	1W Target SAR <sub>1g</sub> (±10% deviation)
		$\epsilon_r$	$\sigma$ (s/m)	(°C)	(W/kg)		
2450	2014-11-26	50.95	1.92	20.80	12.50	50.00	49.30 (44.37~54.23)

Note: 1. The graph results see Appendix 2.  
2. Target Value derives from the calibration certificate

## 7. OPERATIONAL CONDITIONS DURING TEST

### 7.1 General Description of Test Procedures

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal. This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1.

For the 802.11b/g/n SAR tests, a communication link is set up with the test mode software for WIFI mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate. Testing at higher data rates is not required when the maximum average output power is less than 0.25dB higher than those measured at the lowest data rate.

802.11b/g operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g modes are tested on channels 1, 6, 11; however, if output power reduction is necessary for channels 1 and/or 11 to meet restricted band requirements the highest output channels closest to each of these channels must be tested instead.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

### 7.2 Test Position

The SAR Exclusion Threshold in KDB 447498 D01 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned adjacent the phantom and the edge containing the antenna positioned perpendicular to the phantom.

#### 7.2.2 SAR test reduction and exclusion guidance

(1) The SAR exclusion threshold for distances < 50mm is defined by the following equation:

$$\frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} \sqrt{\text{Frequency (GHz)}} \leq 3.0$$

(2) The SAR exclusion threshold for distances > 50mm is defined by the following equation, as illustrated in KDB 447498 D01 Appendix B:

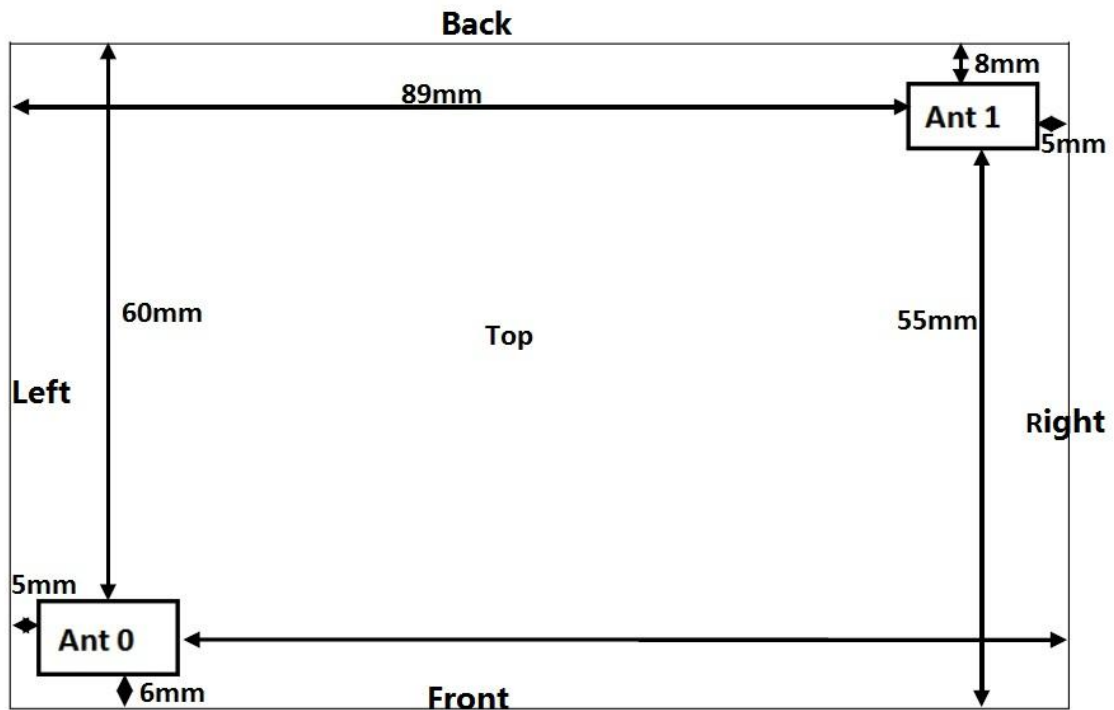
a) at 100 MHz to 1500 MHz

$$[\text{Power allowed at numeric Threshold at 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot (f_{\text{(MHz)}}/150)] \text{ mW}$$

b) at > 1500 MHz and ≤ 6 GHz

$$[\text{Power allowed at numeric Threshold at 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot 10] \text{ mW}$$

The location of the antenna inside EUT is shown in APPENDIX 7.



- **Test Position 1:** The top side of the EUT towards the bottom of the flat phantom. The distance between the top side of the EUT and the bottom of the flat phantom is 0mm.

SAR is not required for Ant0 and Ant1 in this position.

$$\text{Evaluation}_{(\text{Ant0})} = [10^{(13.5/10)}/25] * (2.462^{1/2}) = 1.41 < 3.0$$

$$\text{Evaluation}_{(\text{Ant1})} = [10^{(13.5/10)}/25] * (2.462^{1/2}) = 1.41 < 3.0$$

- **Test Position 2:** The bottom side of the EUT towards the bottom of the flat phantom. The distance between the bottom side of the EUT and the bottom of the flat phantom is 0mm. (APPENDIX 7)

SAR is required for Ant0 and Ant1 in this position.

$$\text{Evaluation}_{(\text{Ant0})} = [10^{(13.5/10)}/5] * (2.462^{1/2}) = 7.025 > 3.0$$

$$\text{Evaluation}_{(\text{Ant1})} = [10^{(13.5/10)}/5] * (2.462^{1/2}) = 7.025 > 3.0$$

- **Test Position 3:** The back side of the EUT towards the bottom of the flat phantom. The distance between the back side of the EUT and the bottom of the flat phantom is 0mm. (APPENDIX 7)

SAR is not required for Ant0 in this position.

SAR is required for Ant1 in this position.

$$\text{Evaluation}_{(\text{Ant0})} = 95.6 + (60 - 50) * 10 = 195.60 \text{mW} = 22.9 \text{dBm} > 13.5 \text{dBm} (\text{max.power})$$

$$\text{Evaluation}_{(\text{Ant1})} = [10^{(13.5/10)/8}] * (2.462^{1/2}) = 4.391 > 3.0$$

- **Test Position 4:** The front side of the EUT towards the bottom of the flat phantom. The distance between the front side of the EUT and the bottom of the flat phantom is 0mm. (APPENDIX 7)

SAR is required for Ant0 in this position.

SAR is not required for Ant1 in this position.

$$\text{Evaluation}_{(\text{Ant0})} = [10^{(13.5/10)/6}] * (2.462^{1/2}) = 5.855 > 3.0$$

$$\text{Evaluation}_{(\text{Ant1})} = 95.6 + (55 - 50) * 10 = 145.60 \text{mW} = 21.63 \text{dBm} > 13.5 \text{dBm} (\text{max.power})$$

- **Test Position 5:** The left side of the EUT towards the bottom of the flat phantom. The distance between the left side of the EUT and the bottom of the flat phantom is 0mm. (APPENDIX 7)

SAR is required for Ant0 in this position.

SAR is not required for Ant1 in this position.

$$\text{Evaluation}_{(\text{Ant0})} = [10^{(13.5/10)/5}] * (2.462^{1/2}) = 7.025 > 3.0$$

$$\text{Evaluation}_{(\text{Ant1})} = 95.6 + (89 - 50) * 10 = 485.60 \text{mW} = 26.86 \text{dBm} > 13.5 \text{dBm} (\text{max.power})$$

- **Test Position 6:** The right side of the EUT towards the bottom of the flat phantom. The distance between the right side of the EUT and the bottom of the flat phantom is 0mm. (APPENDIX 7)

SAR is not required for Ant0 in this position.

SAR is required for Ant1 in this position.

$$\text{Evaluation}_{(\text{Ant0})} = 95.6 + (89 - 50) * 10 = 485.60 \text{mW} = 26.86 \text{dBm} > 13.5 \text{dBm} (\text{max.power})$$

$$\text{Evaluation}_{(\text{Ant1})} = [10^{(13.5/10)/5}] * (2.462^{1/2}) = 7.025 > 3.0$$



## 8. TEST RESULT

### 8.1 CONDUCTED POWER RESULTS

WiFi 2.4G	Ant	Data Rate (Mbps) Frequency (MHz)	Test Results (dBm)							
			Conducted AV							
			1	2	5.5	11				
802.11b	Ant 0	2412	12.79	12.74	12.68	12.63				
		2437	12.69	12.85	12.81	12.75				
		2462	12.61	12.56	12.47	12.41				
	Ant 1	2412	12.73	12.68	12.57	12.51				
		2437	12.52	12.46	12.38	12.33				
		2462	12.83	12.77	12.72	12.65				

WiFi 2.4G	Ant	Data Rate (Mbps) Frequency (MHz)	Test Results (dBm)							
			Conducted AV							
			6	9	12	18	24	36	48	54
802.11g	Ant 0	2412	10.78	10.74	10.67	10.56	10.53	10.48	10.40	10.35
		2437	10.73	10.67	10.63	10.58	10.51	10.46	10.38	10.32
		2462	10.78	10.73	10.66	10.62	10.57	10.53	10.47	10.39
	Ant 1	2412	10.70	10.65	10.58	10.52	10.48	10.42	10.37	10.34
		2437	10.65	10.59	10.55	10.48	10.44	10.38	10.32	10.28
		2462	10.57	10.53	10.48	10.42	10.38	10.34	10.27	10.23

WiFi 2.4G	Ant	Data Rate (Mbps) Frequency (MHz)	Test Results (dBm)							
			Conducted AV							
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n HT20	Ant 0	2412	10.68	10.65	10.6	10.56	10.52	10.47	10.43	10.37
		2437	10.72	10.68	10.63	10.58	10.53	10.47	10.42	10.37
		2462	10.94	10.88	10.83	10.79	10.74	10.7	10.67	10.62
	Ant 1	2412	10.74	10.69	10.65	10.61	10.58	10.54	10.49	10.45
		2437	10.78	10.74	10.68	10.63	10.59	10.52	10.47	10.43
		2462	8.82	8.78	8.73	8.65	8.61	8.56	8.52	8.47

WiFi 2.4G	Ant	Data Rates Frequency (MHz)	Average Power (dBm)							
			MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
802.11n HT20	Ant 0	2412	10.53	10.49	10.43	10.39	10.35	10.28	10.24	10.18
		2437	10.64	10.61	10.57	10.49	10.44	10.38	10.34	10.29
		2462	10.87	10.83	10.76	10.72	10.67	10.62	10.57	10.48
	Ant 1	2412	10.62	10.58	10.49	10.45	10.41	10.38	10.34	10.29
		2437	10.67	10.63	10.59	10.53	10.47	10.42	10.38	10.34
		2462	8.75	8.72	8.68	8.61	8.57	8.52	8.48	8.44

WiFi 2.4G	Ant	Data Rate (Mbps) Frequency (MHz)	Test Results (dBm)							
			Conducted AV							
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n HT40	Ant 0	2422	8.81	8.77	8.72	8.68	8.62	8.59	8.65	8.58
		2437	8.78	8.74	8.69	8.62	8.58	8.53	8.49	8.42
		2452	8.88	8.82	8.76	8.71	8.67	8.62	8.55	8.52
	Ant 1	2422	8.46	8.43	8.39	8.35	8.3	8.27	8.23	8.18
		2437	9.35	9.32	9.28	9.24	9.19	9.15	9.11	8.88
		2452	7.46	7.41	7.39	7.32	7.26	7.23	7.18	7.11

WiFi 2.4G	Ant	Data Rates Frequency (MHz)	Average Power (dBm)							
			MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
802.11n HT40	Ant 0	2422	8.72	8.68	8.63	8.57	8.54	8.49	8.43	8.38
		2437	8.6	8.58	8.55	8.46	8.42	8.37	8.33	8.28
		2452	8.74	8.68	8.62	8.56	8.52	8.48	8.43	8.37
	Ant 1	2422	8.08	7.89	7.83	7.79	7.73	7.68	7.61	7.56
		2437	8.97	8.94	8.88	8.82	8.75	8.71	8.69	8.63
		2452	6.35	6.32	6.29	6.25	6.17	6.13	6.06	6.00

## 8.2 SAR TEST RESULTS

### 8.2.1 WIFI

Test Position	Channel Frequency (MHz)	Duty Cycle	Maximum Allowed Power (dBm)	Conducted power (dBm)	Drift ±0.21dB	Limit of SAR 1.6 W/kg			
					Drift (dB)	Measured SAR (W/kg)	Scaling factor	Reported SAR (W/kg)	Graph Results
Test Position of Body, 802.11b (Ant0 Distance=0mm)									
2	2437	1:1	13.5	12.79	-0.01	0.435	1.178	0.512	1
4	2437	1:1	13.5	12.79	-0.03	0.064	1.178	0.075	2
5	2437	1:1	13.5	12.79	-0.01	0.029	1.178	0.034	3
Test Position of Body, 802.11b (Ant1 Distance=0mm)									
2	2462	1:1	13.5	12.83	-0.02	0.812	1.167	0.947	4
	2412	1:1	13.5	12.73	-0.01	0.529	1.194	0.632	5
	2437	1:1	13.5	12.52	-0.03	0.537	1.253	0.673	6
3	2462	1:1	13.5	12.83	-0.03	0.07	1.167	0.082	7
6	2462	1:1	13.5	12.83	-0.01	0.018	1.167	0.021	8

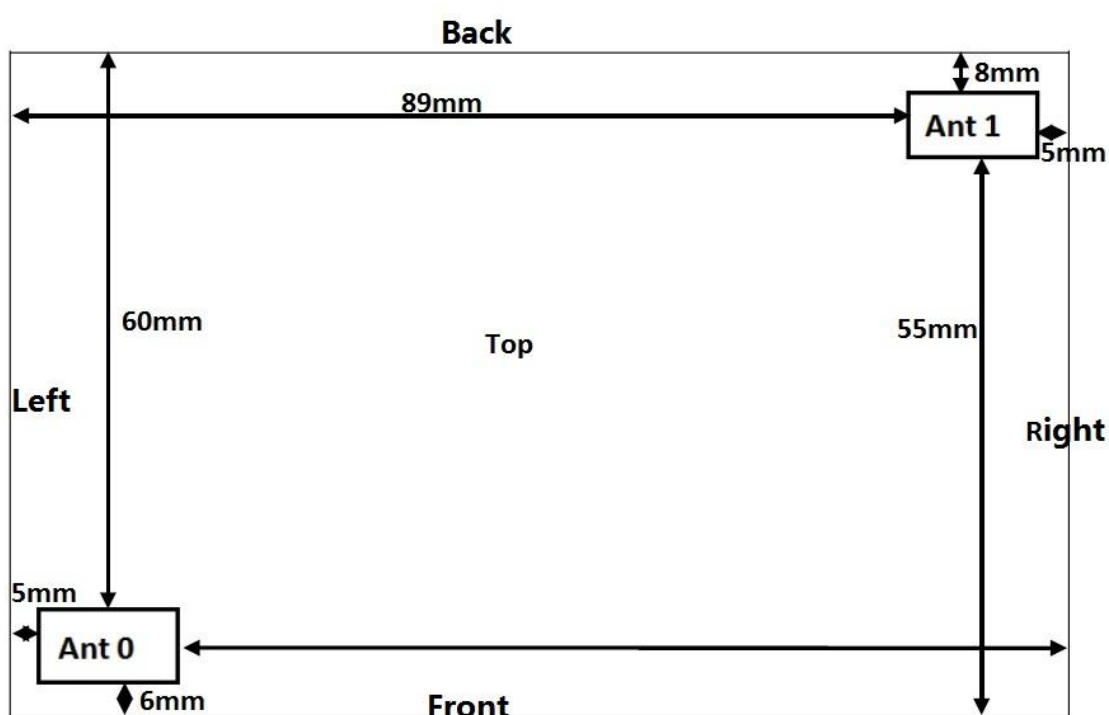
Note:

1. The value with boldface is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is 0.8 W/kg then testing at the other channels is not required for such test configuration(s).
3. KDB 248227-SAR is not required for 802.11g/n channels when the maximum average output power is less than 1/4dB higher than measured on the corresponding 802.11b channels.

### 8.3 SIMULTANEOUS TRANSMISSION CONDITIONS

Antenna		Simultaneous transmission
Ant 0	Ant 1	YES

The location of the antenna inside EUT is shown in APPENDIX 7.



Estimated SAR

(1)for test separation distances  $\leq 50\text{mm}$

When standalone SAR is not required to be measured per FCC KDB 447498 D01, the following Equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter for test separation distances  $\leq 50\text{mm}$ .

$$\text{Estimated SAR} = \frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} \times \frac{\sqrt{f \text{ (GHz)}}}{7.5}$$

(2)for test separation distances  $\geq 50\text{mm}$

**0.4W/Kg for 1g SAR**

Estimated SAR<sub>Max.Ant0.Test Position1</sub>=[10(13.5/10)/25]\*(2.4621/2/7.5)=0.187W/Kg

Estimated SAR<sub>Max.Ant0.Test Position3</sub>≤0.4W/Kg

Estimated SAR<sub>Max.Ant0.Test Position6</sub>≤0.4W/Kg

Estimated SAR<sub>Max.Ant1.Test Position1</sub>=[10(13.5/10)/25]\*(2.4621/2/7.5)=0.187W/Kg

Estimated SAR<sub>Max.Ant1.Test Position4</sub>≤0.4W/Kg

Estimated SAR<sub>Max.Ant1.Test Position5</sub>≤0.4W/Kg

Per FCC KDB 447498 D01, simultaneous transmission SAR test exclusion may be applied when the sum of 1g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit(≤1.6W/Kg), When the sum is greater than the SAR limit, SAR test exclusion is determined by the SAR to peak location separation ratio.

$$\text{Ratio} = \frac{(\text{SAR}_1 + \text{SAR}_2)^{1.5}}{(\text{min. test separation distance, mm})} < 0.04$$

Reported SAR <sub>1g(W/Kg)</sub> Test Position	Ant 0	Ant 1	MAX. ΣSAR <sub>1g</sub>
Test Position 1	0.187	0.187	0.374
Test Position 2	0.512	0.947	<b>1.459</b>
Test Position 3	0.4	0.082	0.482
Test Position 4	0.075	0.4	0.475
Test Position 5	0.034	0.4	0.434
Test Position 6	0.4	0.021	0.421
Note:1. The value with boldface is the maximum ΣSAR <sub>1g</sub> Value. 2. MAX. ΣSAR <sub>1g</sub> =Report SAR <sub>Max.Ant0</sub> + Report SAR <sub>Max.Ant1</sub>			

MAX. ΣSAR<sub>1g</sub> =1.459W/Kg<1.6W/kg, so the simultaneous transmission SAR are not required for Ant 0 and Ant 1.

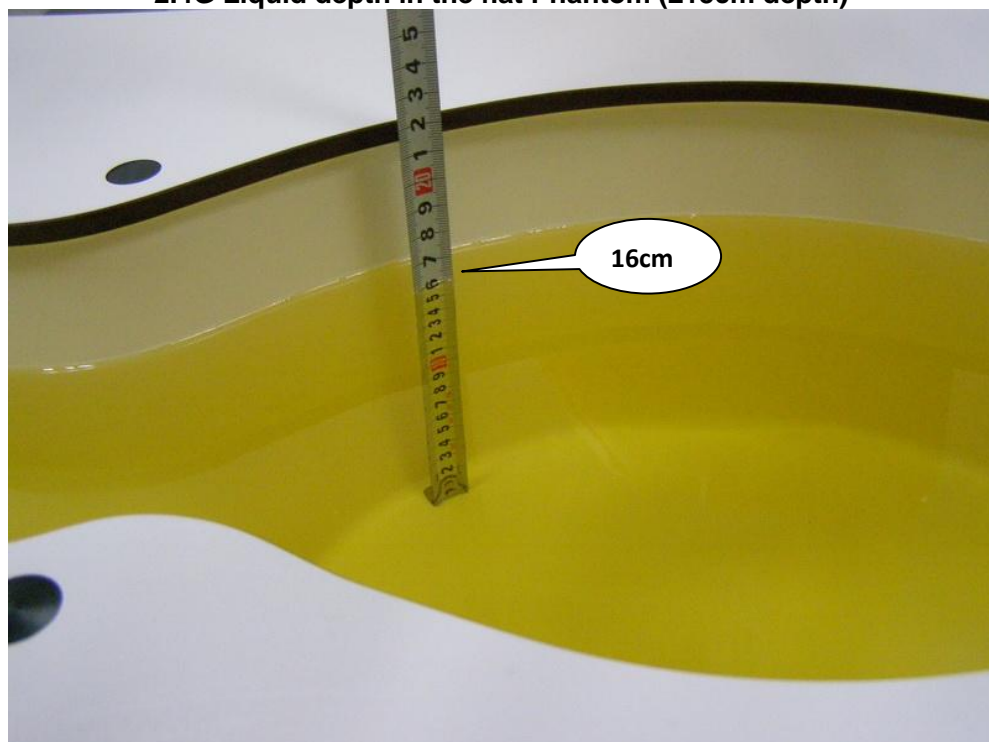
## APPENDIX

### 1. Test Layout

#### Specific Absorption Rate Test Layout



#### 2.4G Liquid depth in the flat Phantom ( $\geq 15\text{cm}$ depth)



## 2. System Check Results

Date/Time: 11/26/2014 08:33:21

**Test Laboratory: BTL Inc.**

**System Performance Check Body 2450 MHz**

**DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:919**

Communication System: UID 0, CW (0); Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.92$  S/m;  $\epsilon_r = 50.95$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3898; ConvF(7.49, 7.49, 7.49); Calibrated: 03/10/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/15/2014
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**System Performance Check at 2450MHz/Area Scan (5x7x1):** Measurement grid:  $dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (measured) = 19.1 W/kg

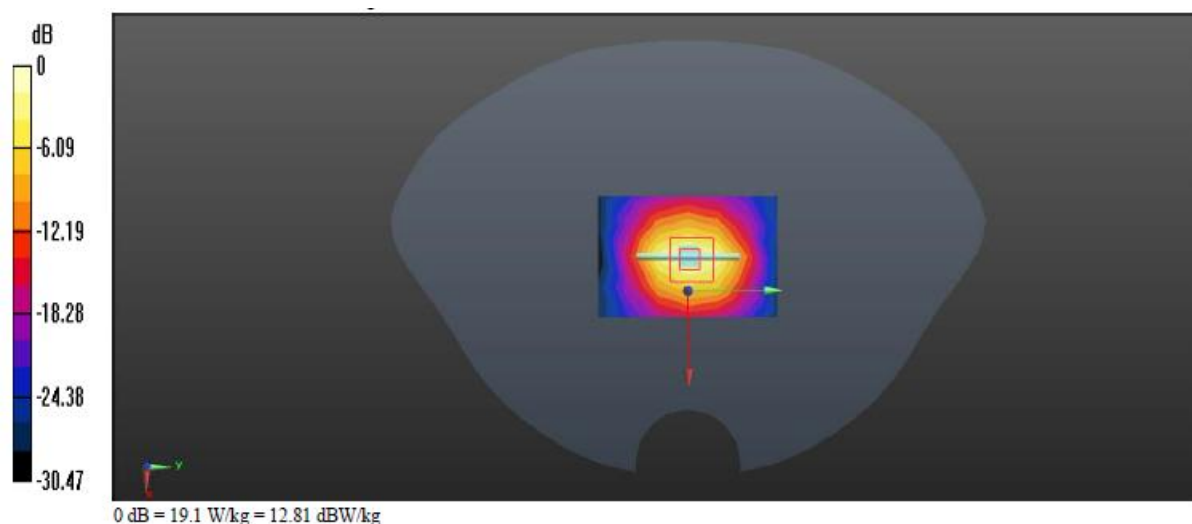
**System Performance Check at 2450MHz/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 98.325 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 25.8 W/kg

**SAR(1 g) = 12.5 W/kg; SAR(10 g) = 5.68 W/kg**

Maximum value of SAR (measured) = 17.8 W/kg



### 3. Graph Results

Date/Time: 11/26/2014 15:00:12

**Test Laboratory: BTL Inc.**

**Wireless Enabled Hard Drive IDrive WiFi 802.11b ant0 2437MHz CH6 Test Position 2 distance=0mm**

**DUT: Wireless Enabled Hard Drive; Type: IDrive WiFi; Serial: NA**

Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2437 MHz

Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.913$  S/m;  $\epsilon_r = 51.045$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3898; ConvF(7.51, 7.51, 7.51); Calibrated: 03/10/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/15/2014
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Test Position 2/Wireless Enabled Hard Drive IDrive WiFi/Area Scan (12x16x1):** Measurement grid:

$dx=10$ mm,  $dy=10$ mm

Maximum value of SAR (measured) = 0.539 W/kg

**Test Position 2/Wireless Enabled Hard Drive IDrive WiFi/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

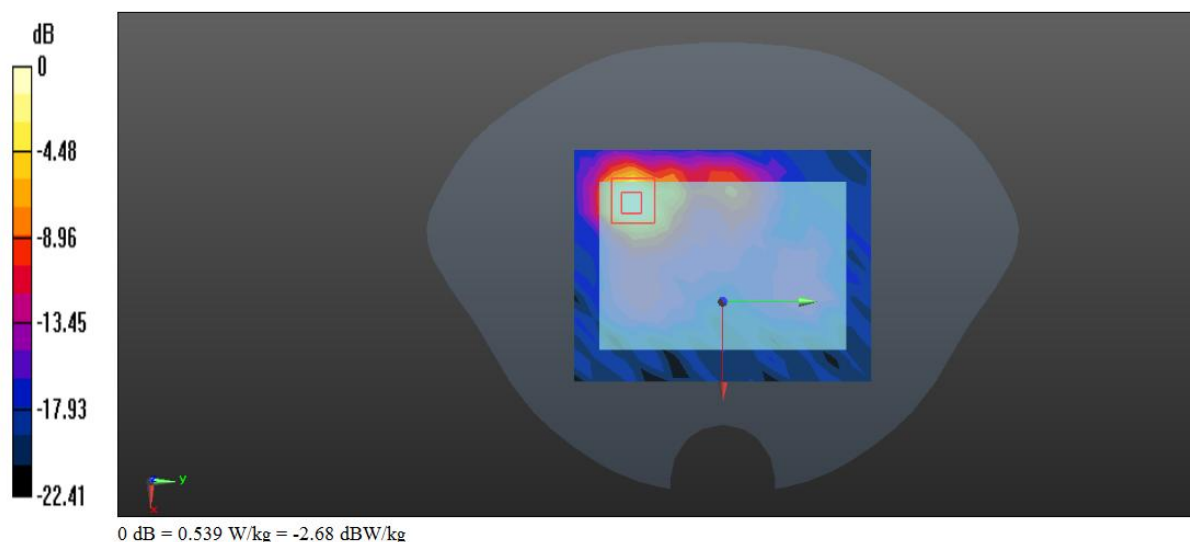
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 2.953 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 1.10 W/kg

**SAR(1 g) = 0.435 W/kg; SAR(10 g) = 0.156 W/kg**

Maximum value of SAR (measured) = 0.734 W/kg





Date/Time: 11/26/2014 17:48:48

**Test Laboratory: BTL Inc.**

**Wireless Enabled Hard Drive IDrive WiFi 802.11b ant0 2437MHz CH6 Test Position 4 distance=0mm**

**DUT: Wireless Enabled Hard Drive; Type: IDrive WiFi; Serial: NA**

Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2437 MHz

Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.913$  S/m;  $\epsilon_r = 51.045$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY Configuration:

- Probe: EX3DV4 - SN3898; ConvF(7.51, 7.51, 7.51); Calibrated: 03/10/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/15/2014
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Test Position 4/Wireless Enabled Hard Drive IDrive WiFi/Area Scan (7x16x1):** Measurement grid:

$dx=10$ mm,  $dy=10$ mm

Maximum value of SAR (measured) = 0.0999 W/kg

**Test Position 4/Wireless Enabled Hard Drive IDrive WiFi/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

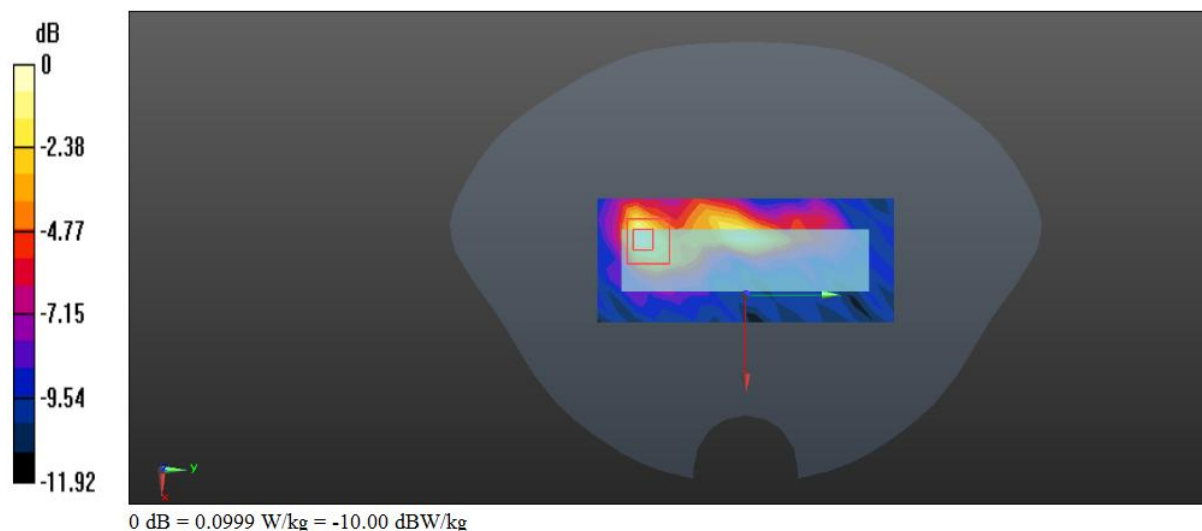
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 2.523 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.181 W/kg

**SAR(1 g) = 0.064 W/kg; SAR(10 g) = 0.026 W/kg**

Maximum value of SAR (measured) = 0.109 W/kg



Date/Time: 11/26/2014 18:31:03

**Test Laboratory: BTL Inc.**

**Wireless Enabled Hard Drive IDrive WiFi 802.11b ant0 2437MHz CH6 Test Position 5 distance=0mm**

**DUT: Wireless Enabled Hard Drive; Type: IDrive WiFi; Serial: NA**

Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2437 MHz

Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.913$  S/m;  $\epsilon_r = 51.045$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY Configuration:

- Probe: EX3DV4 - SN3898; ConvF(7.51, 7.51, 7.51); Calibrated: 03/10/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/15/2014
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Test Position 5/Wireless Enabled Hard Drive IDrive WiFi/Area Scan (7x12x1):** Measurement grid:

$dx=10$ mm,  $dy=10$ mm

Maximum value of SAR (measured) = 0.0424 W/kg

**Test Position 5/Wireless Enabled Hard Drive IDrive WiFi/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

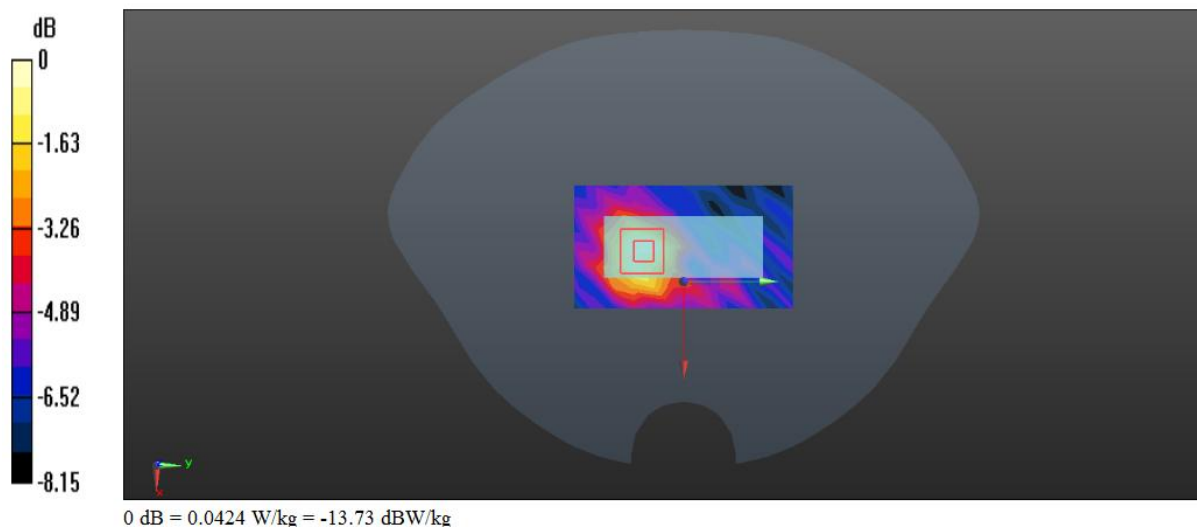
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 2.913 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.0710 W/kg

**SAR(1 g) = 0.029 W/kg; SAR(10 g) = 0.015 W/kg**

Maximum value of SAR (measured) = 0.0472 W/kg



Date/Time: 11/26/2014 09:55:05

**Test Laboratory: BTL Inc.**

**Wireless Enabled Hard Drive IDrive WiFi 802.11b ant1 2462MHz CH11 Test Position 2 distance=0mm**

DUT: Wireless Enabled Hard Drive; Type: IDrive WiFi; Serial: NA

Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2462 MHz

Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.93$  S/m;  $\epsilon_r = 50.81$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY Configuration:

- Probe: EX3DV4 - SN3898; ConvF(7.34, 7.34, 7.34); Calibrated: 03/10/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/15/2014
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASYS 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Test Position 2/Wireless Enabled Hard Drive IDrive WiFi/Area Scan (12x16x1):** Measurement grid:

$dx=10$ mm,  $dy=10$ mm

Maximum value of SAR (measured) = 1.28 W/kg

**Test Position 2/Wireless Enabled Hard Drive IDrive WiFi/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

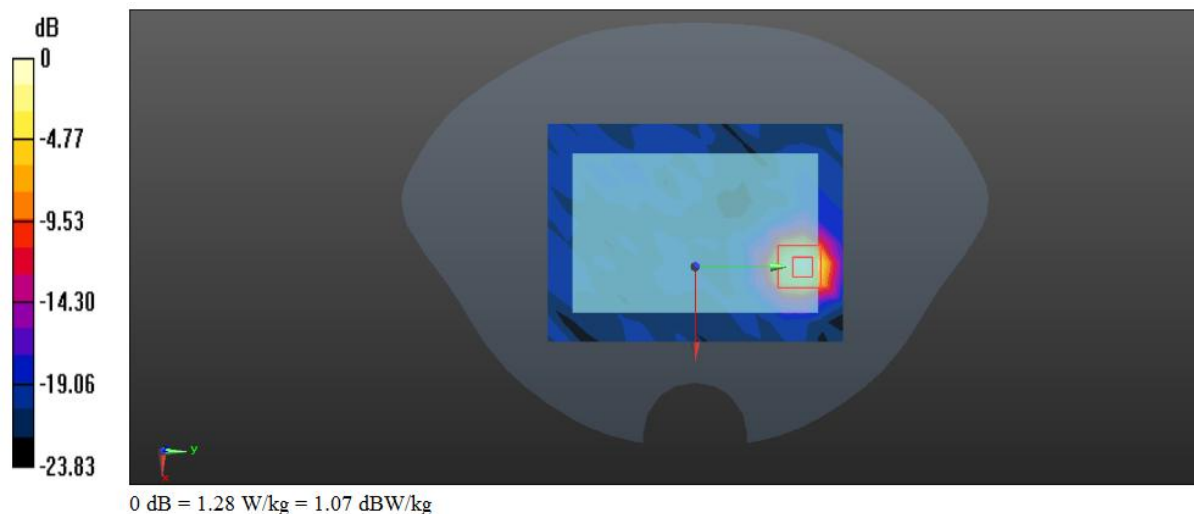
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 2.208 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.88 W/kg

**SAR(1 g) = 0.812 W/kg; SAR(10 g) = 0.304 W/kg**

Maximum value of SAR (measured) = 1.30 W/kg



Date/Time: 11/27/2014 11:09:53

**Test Laboratory: BTL Inc.**

**Wireless Enabled Hard Drive IDrive WiFi 802.11b ant1 2412MHz CH1 Test Position 2 distance=0mm**

**DUT: Wireless Enabled Hard Drive; Type: IDrive WiFi; Serial: NA**

Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2412 MHz

Medium parameters used:  $f = 2412$  MHz;  $\sigma = 1.892$  S/m;  $\epsilon_r = 51.895$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY Configuration:

- Probe: EX3DV4 - SN3898; ConvF(7.54, 7.54, 7.54); Calibrated: 03/10/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/15/2014
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Test Position 2/Wireless Enabled Hard Drive IDrive WiFi/Area Scan (12x16x1):** Measurement grid:

$dx=10$ mm,  $dy=10$ mm

Maximum value of SAR (measured) = 0.815 W/kg

**Test Position 2/Wireless Enabled Hard Drive IDrive WiFi/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

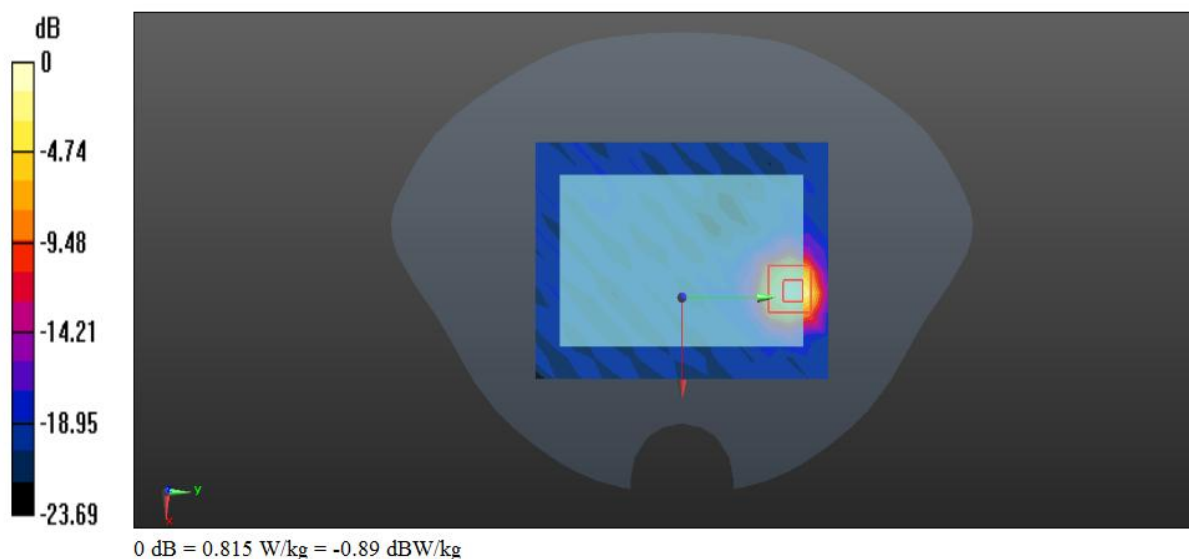
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 1.474 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 1.22 W/kg

**SAR(1 g) = 0.529 W/kg; SAR(10 g) = 0.196 W/kg**

Maximum value of SAR (measured) = 0.863 W/kg



Date/Time: 11/27/2014 11:49:46

**Test Laboratory: BTL Inc.**

**Wireless Enabled Hard Drive IDrive WiFi 802.11b ant1 2437MHz CH6 Test Position 2 distance=0mm**

DUT: Wireless Enabled Hard Drive; Type: IDrive WiFi; Serial: NA

Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2437 MHz

Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.913$  S/m;  $\epsilon_r = 51.045$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY Configuration:

- Probe: EX3DV4 - SN3898; ConvF(7.51, 7.51, 7.51); Calibrated: 03/10/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/15/2014
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Test Position 2/Wireless Enabled Hard Drive IDrive WiFi/Area Scan (12x16x1):** Measurement grid:

$dx=10$ mm,  $dy=10$ mm

Maximum value of SAR (measured) = 0.825 W/kg

**Test Position 2/Wireless Enabled Hard Drive IDrive WiFi/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

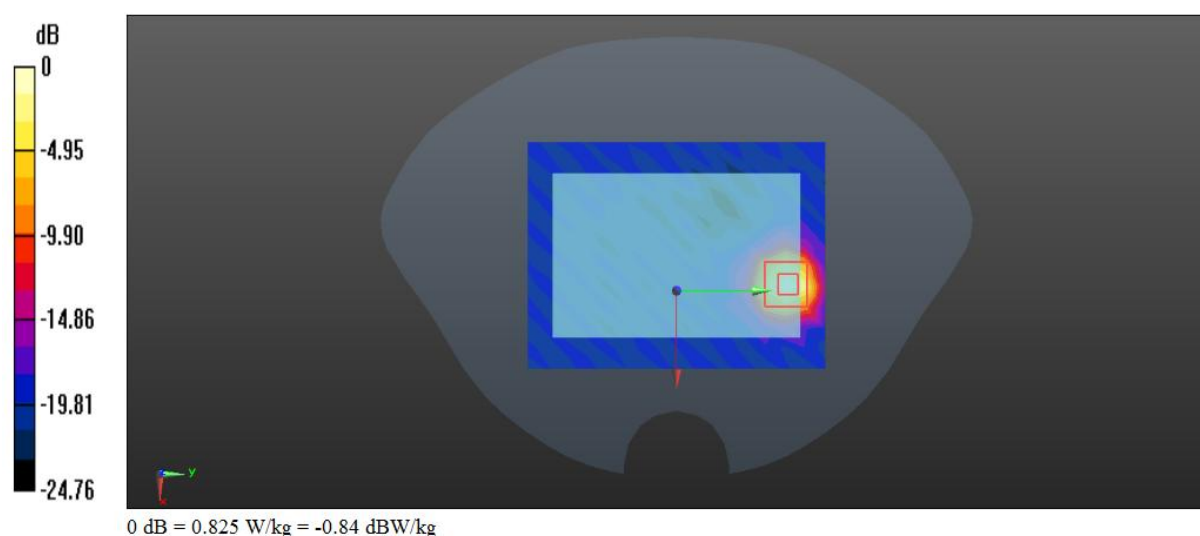
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 1.443 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.25 W/kg

**SAR(1 g) = 0.537 W/kg; SAR(10 g) = 0.199 W/kg**

Maximum value of SAR (measured) = 0.868 W/kg



Date/Time: 11/26/2014 16:43:28

**Test Laboratory: BTL Inc.**

**Wireless Enabled Hard Drive IDrive WiFi 802.11b ant1 2462MHz CH11 Test Position 3 distance=0mm**

**DUT: Wireless Enabled Hard Drive; Type: IDrive WiFi; Serial: NA**

Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2462 MHz

Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.93$  S/m;  $\epsilon_r = 50.81$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY Configuration:

- Probe: EX3DV4 - SN3898; ConvF(7.34, 7.34, 7.34); Calibrated: 03/10/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/15/2014
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Test Position 3/Wireless Enabled Hard Drive IDrive WiFi/Area Scan (7x16x1):** Measurement grid:

$dx=10$ mm,  $dy=10$ mm

Maximum value of SAR (measured) = 0.0989 W/kg

**Test Position 3/Wireless Enabled Hard Drive IDrive WiFi/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

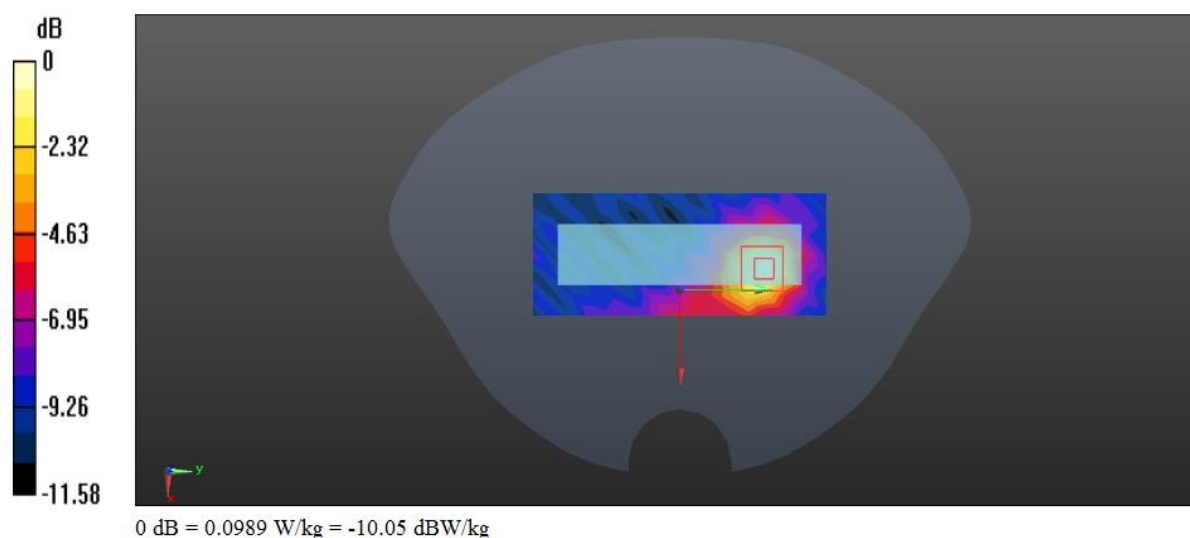
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 2.089 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.158 W/kg

**SAR(1 g) = 0.070 W/kg; SAR(10 g) = 0.033 W/kg**

Maximum value of SAR (measured) = 0.110 W/kg



Date/Time: 11/26/2014 19:05:42

**Test Laboratory: BTL Inc.**

**Wireless Enabled Hard Drive IDrive WiFi 802.11b ant1 2462MHz CH11 Test Position 6 distance=0mm**

**DUT: Wireless Enabled Hard Drive; Type: IDrive WiFi; Serial: NA**

Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2462 MHz

Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.93$  S/m;  $\epsilon_r = 50.81$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY Configuration:

- Probe: EX3DV4 - SN3898; ConvF(7.34, 7.34, 7.34); Calibrated: 03/10/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/15/2014
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Test Position 6/Wireless Enabled Hard Drive IDrive WiFi/Area Scan (7x12x1):** Measurement grid:

$dx=10$ mm,  $dy=10$ mm

Maximum value of SAR (measured) = 0.0276 W/kg

**Test Position 6/Wireless Enabled Hard Drive IDrive WiFi/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

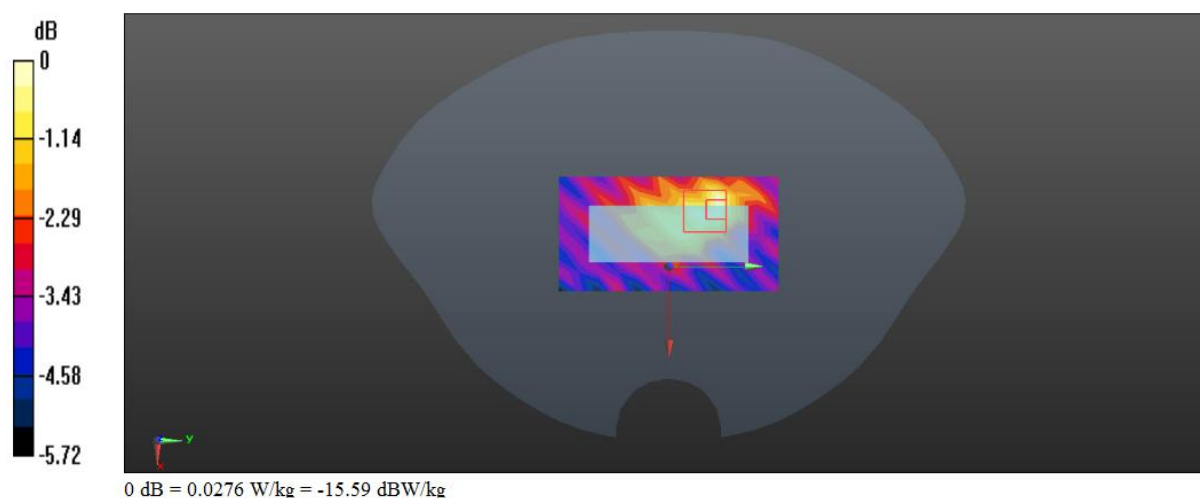
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 3.030 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.0480 W/kg

**SAR(1 g) = 0.018 W/kg; SAR(10 g) = 0.00952 W/kg**



Maximum value of SAR (measured) = 0.0289 W/kg





## 4. Probe Calibration Certificate

EX3DV4 - 3898

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Client	Auden	Certificate No: Z14-97001	

CALIBRATION CERTIFICATE


Object	EX3DV4 - SN:3898
Calibration Procedure(s)	TMC-OS-E-02-195 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	March 10, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101547	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101548	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Reference10dBAttenuator	BT0520	12-Dec-12(TMC,No.JZ12-867)	Dec-14
Reference20dBAttenuator	BT0267	12-Dec-12(TMC,No.JZ12-866)	Dec-14
Reference Probe EX3DV4	SN 3846	03-Sep-13(SPEAG,No.EX3-3846_Sep13)	Sep-14
DAE4	SN 777	22-Feb-13 (SPEAG, DAE4-777_Feb13)	Feb -14
DAE4	SN 905	11-Jun-13 (SPEAG, DAE4-905_Jun13)	Jun -14
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	01-Jul-13 (TMC, No.JW13-045)	Jun-14
Network Analyzer E5071C	MY46110673	15-Feb-14 (TMC, No.JZ14-781)	Feb-15

Calibrated by:	Name	Function	Signature
	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: March 12, 2014

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

Certificate No: Z14-97001

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## Glossary:

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

Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system

## Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005

## Methods Applied and Interpretation of Parameters:

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



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# Probe EX3DV4

## SN: 3898

Calibrated: March 10, 2014

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



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## DASY – Parameters of Probe: EX3DV4 - SN: 3898

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm( $\mu V/(V/m)^2$ ) <sup>A</sup>	0.50	0.54	0.48	±10.8%
DCP(mV) <sup>B</sup>	106.5	104.9	101.2	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/μV	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	203.2	±2.1%
		Y	0.0	0.0	1.0		211.8	
		Z	0.0	0.0	1.0		194.9	

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

<sup>A</sup> The uncertainties of Norm X, Y, Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 5 and Page 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

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





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## DASY – Parameters of Probe: EX3DV4 - SN: 3898

### Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	41.9	0.89	10.32	10.32	10.32	2.94	0.48	± 12%
850	41.5	0.92	9.85	9.85	9.85	0.09	1.71	± 12%
900	41.5	0.97	9.83	9.83	9.83	0.29	0.92	± 12%
1750	40.1	1.37	8.38	8.38	8.38	0.19	1.35	± 12%
1900	40.0	1.40	8.20	8.20	8.20	0.19	1.43	± 12%
2000	40.0	1.40	8.19	8.19	8.19	0.18	1.54	± 12%
2450	39.2	1.80	7.55	7.55	7.55	0.50	0.76	± 12%
2600	39.0	1.96	7.34	7.34	7.34	0.80	0.59	± 12%
5200	36.0	4.66	5.52	5.52	5.52	0.39	1.24	± 13%
5300	35.9	4.76	5.23	5.23	5.23	0.39	1.01	± 13%
5500	35.6	4.96	4.95	4.95	4.95	0.41	1.10	± 13%
5600	35.5	5.07	4.74	4.74	4.74	0.42	1.16	± 13%
5800	35.3	5.27	4.84	4.84	4.84	0.44	1.07	± 13%

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

<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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## DASY – Parameters of Probe: EX3DV4 - SN: 3898

### Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz] <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	10.18	10.18	10.18	0.95	0.64	± 12%
850	55.2	0.99	9.63	9.63	9.63	0.19	1.33	± 12%
900	55.0	1.05	9.63	9.63	9.63	0.23	1.14	± 12%
1750	53.4	1.49	8.16	8.16	8.16	0.19	1.57	± 12%
1900	53.3	1.52	7.83	7.83	7.83	0.19	1.63	± 12%
2000	53.3	1.52	8.10	8.10	8.10	0.15	3.04	± 12%
2450	52.7	1.95	7.49	7.49	7.49	0.61	0.75	± 12%
2600	52.5	2.16	7.06	7.06	7.06	0.58	0.77	± 12%
5200	49.0	5.30	4.80	4.80	4.80	0.47	1.05	± 13%
5300	48.9	5.42	4.60	4.60	4.60	0.42	1.43	± 13%
5500	48.6	5.65	4.25	4.25	4.25	0.45	1.56	± 13%
5600	48.5	5.77	4.22	4.22	4.22	0.46	1.41	± 13%
5800	48.2	6.00	4.34	4.34	4.34	0.50	1.27	± 13%

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

<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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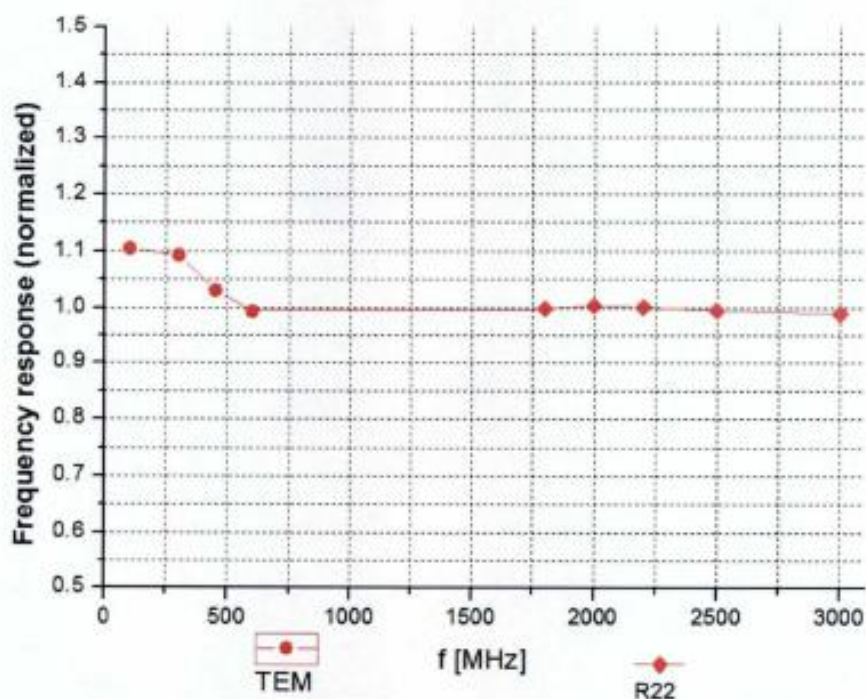
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## Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field:  $\pm 7.5\%$  ( $k=2$ )



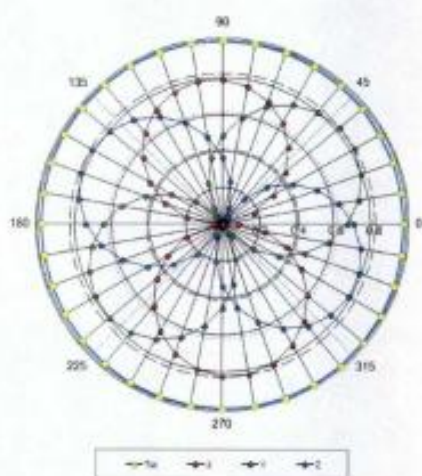


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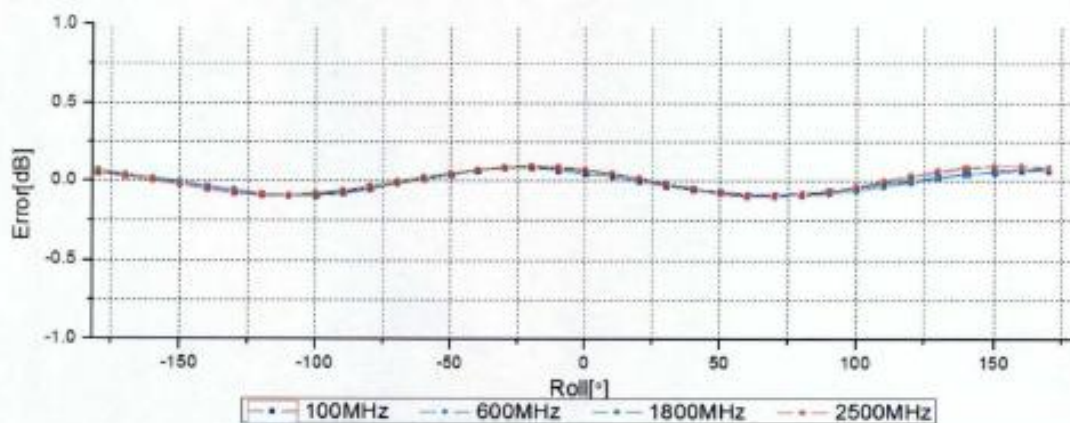
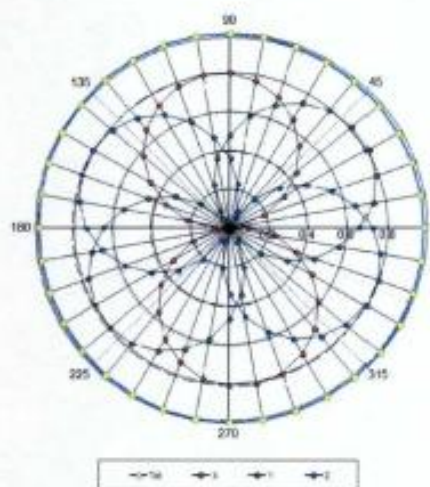
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## Receiving Pattern ( $\Phi$ ), $\theta=0^\circ$

**f=600 MHz, TEM**



**f=1800 MHz, R22**



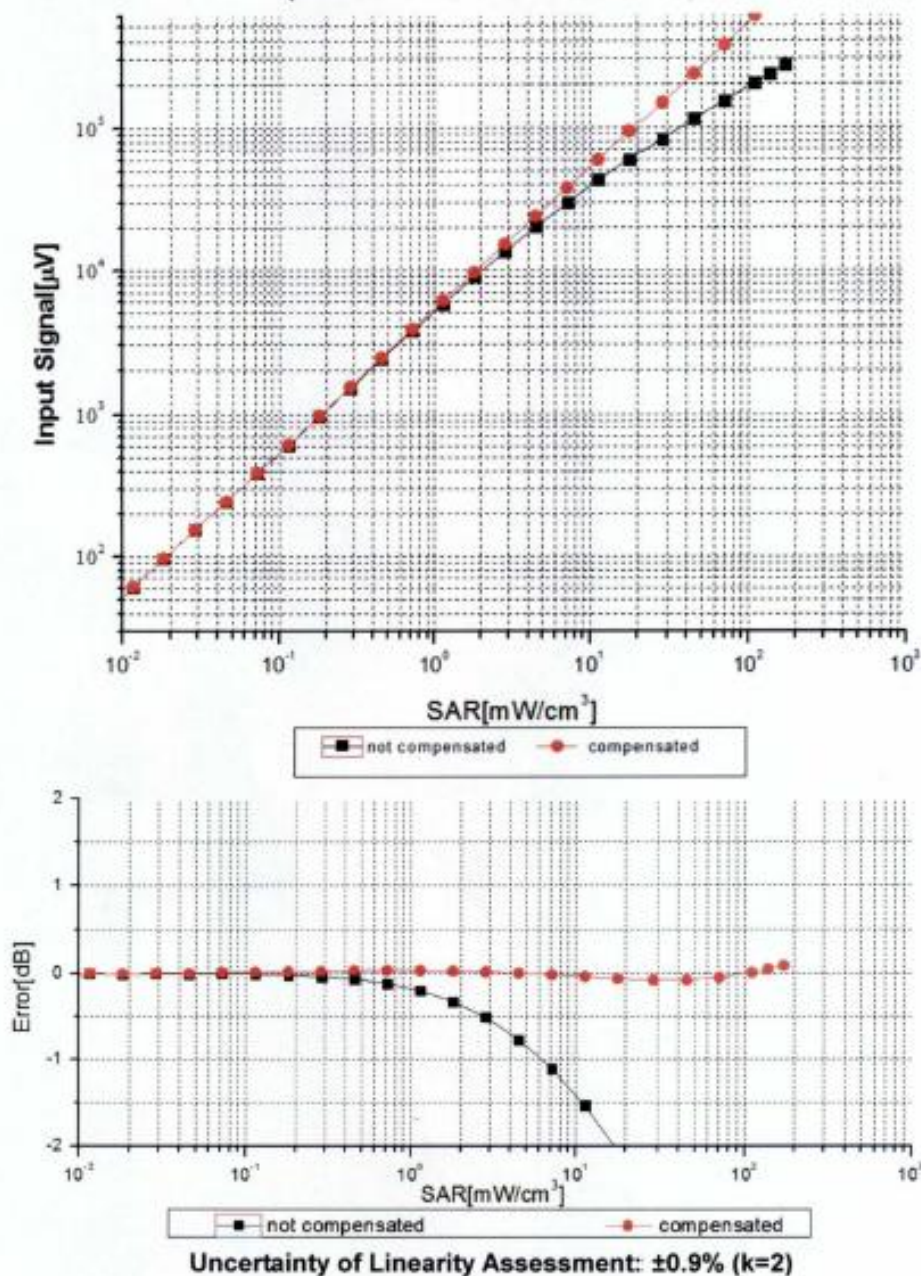
Uncertainty of Axial Isotropy Assessment:  $\pm 0.9\%$  (k=2)



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### Dynamic Range f(SAR<sub>head</sub>) (TEM cell, f = 900 MHz)







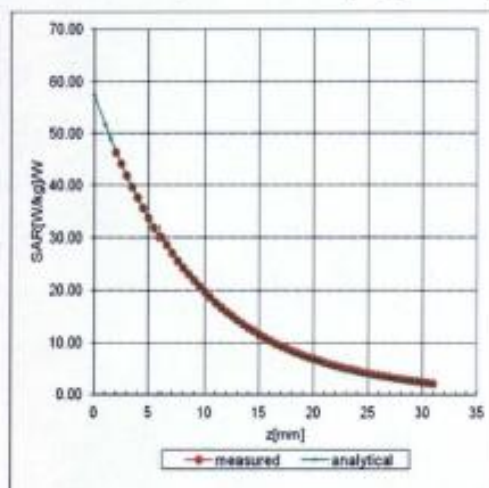
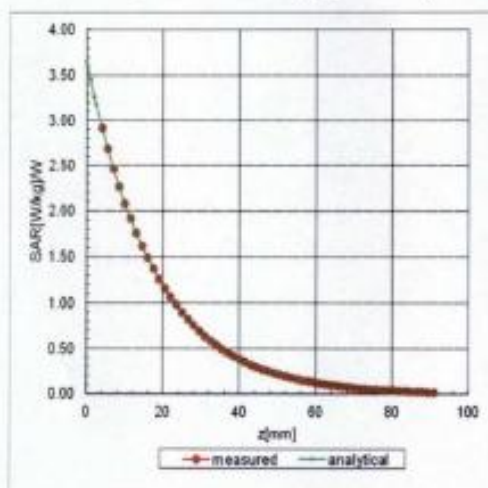
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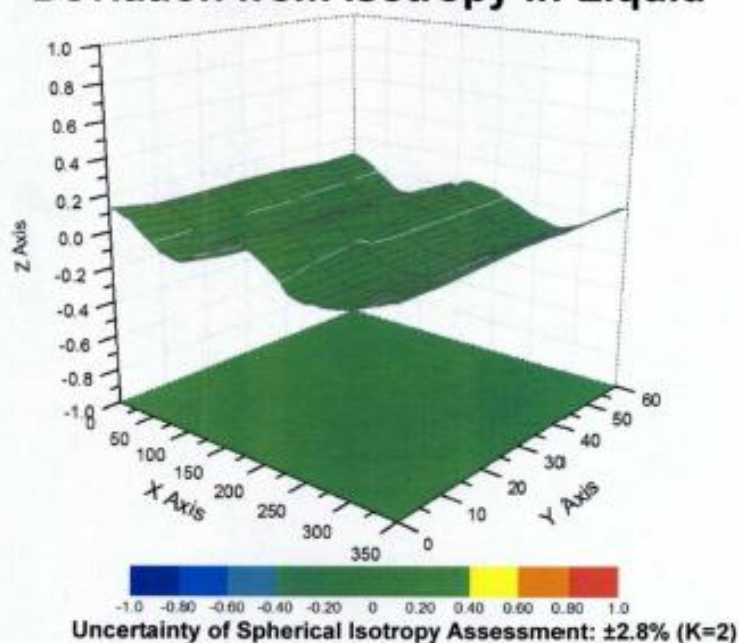
## Conversion Factor Assessment

f=900 MHz, WGLS R9(H\_convF)

f=2450 MHz, WGLS R26(H\_convF)



## Deviation from Isotropy in Liquid



Certificate No: Z14-97001

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## DASY - Parameters of Probe: EX3DV4 - SN: 3898

### Other Probe Parameters



Sensor Arrangement	Triangular
Connector Angle (°)	71
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	2mm

## 5. (1) D2450V2 Dipole Calibration Certificate



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**CALIBRATION**  
**No. L0570**

Client **NIM**
Certificate No: **Z14-97101**

**CALIBRATION CERTIFICATE**

Object **D2450V2 - SN: 919**

Calibration Procedure(s) **TMC-OS-E-02-194**  
**Calibration procedure for dipole validation kits**

Calibration date: **September 17, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102196	14-Mar-14 (CTTL, No.JZ14-896)	Mar-15
Power sensor NRV-Z5	100596	14-Mar-14 (CTTL, No. JZ14-896)	Mar -15
Reference Probe ES3DV3	SN 3142	1- Sep-14 (CTTL-SPEAG, No.JZ14-97079)	Aug-15
DAE3	SN 536	23-Jan-14 (SPEAG, DAE3-536_Jan14)	Jan -15
Signal Generator E4438C	MY49070393	13-Nov-13 (TMC, No.JZ13-394)	Nov-14
Network Analyzer E8362B	MY43021135	19-Oct-13 (TMC, No..JZ13-278)	Oct-14

Calibrated by: **Zhao Jing**

Reviewed by: **Qi Dianyuan**

Approved by: **Lu Bingsong**

Name                      Function                      Signature

**Zhao Jing**                      SAR Test Engineer

**Qi Dianyuan**                      SAR Project Leader

**Lu Bingsong**                      Deputy Director of the laboratory

Issued: September 30, 2014

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

Certificate No: Z14-97101
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#### Glossary:

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

#### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation:

- DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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



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## Measurement Conditions

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

DASY Version	DASY52	52.8.8.1222
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.8 $\pm$ 6 %	1.85 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	---	---

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	51.5 mW / g $\pm$ 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.03 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.0 mW / g $\pm$ 20.4 % (k=2)

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.2 $\pm$ 6 %	1.97 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	---	---

## SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	50.7 mW / g $\pm$ 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.02 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	23.9 mW / g $\pm$ 20.4 % (k=2)





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## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.6Ω- 0.44jΩ
Return Loss	- 24.1dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	56.2Ω+ 2.77jΩ
Return Loss	- 23.9dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.117 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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

### Additional EUT Data

Manufactured by	SPEAG
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Date: 17.09.2014

# **DASY5 Validation Report for Head TSL**

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 919**

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.852$  S/m;  $\epsilon_r = 39.76$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3142; ConvF(4.58, 4.58, 4.58); Calibrated: 2014-09-01;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/2
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

## **System Performance Check /d=10mm, Pin=250 mW, dist=3.0mm**

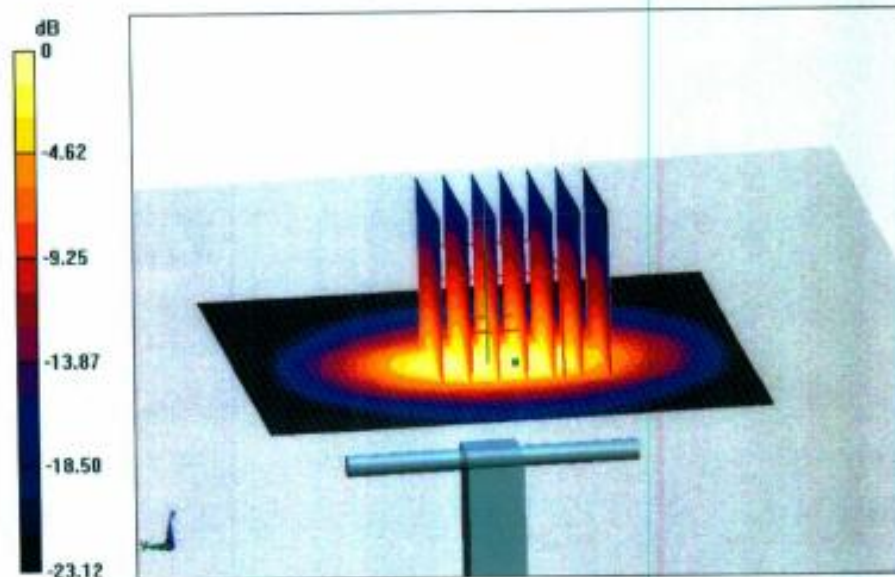
(ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.50 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 27.8 W/kg

**SAR(1 g) = 13 W/kg; SAR(10 g) = 6.03 W/kg**

Maximum value of SAR (measured) = 17.1 W/kg



0 dB = 17.1 W/kg = 12.33 dBW/kg

Certificate No: Z14-97101

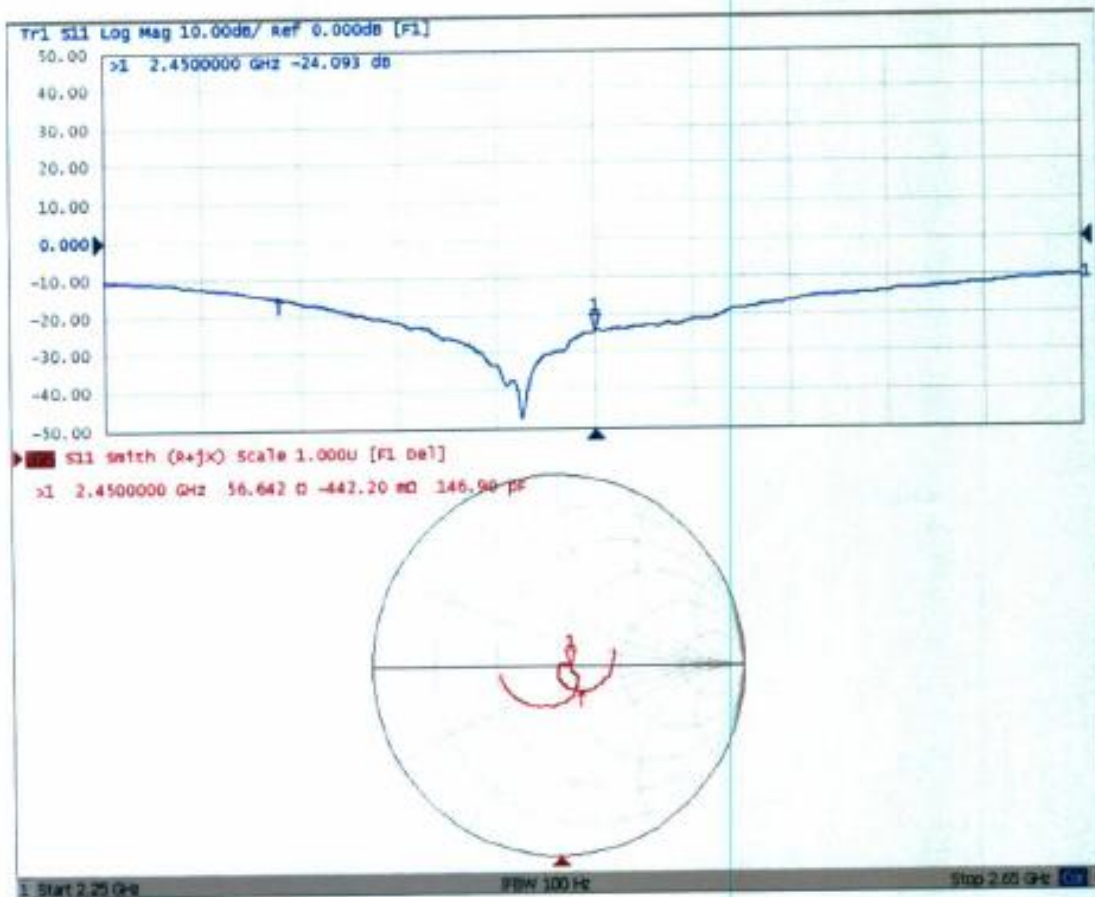
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### Impedance Measurement Plot for Head TSL







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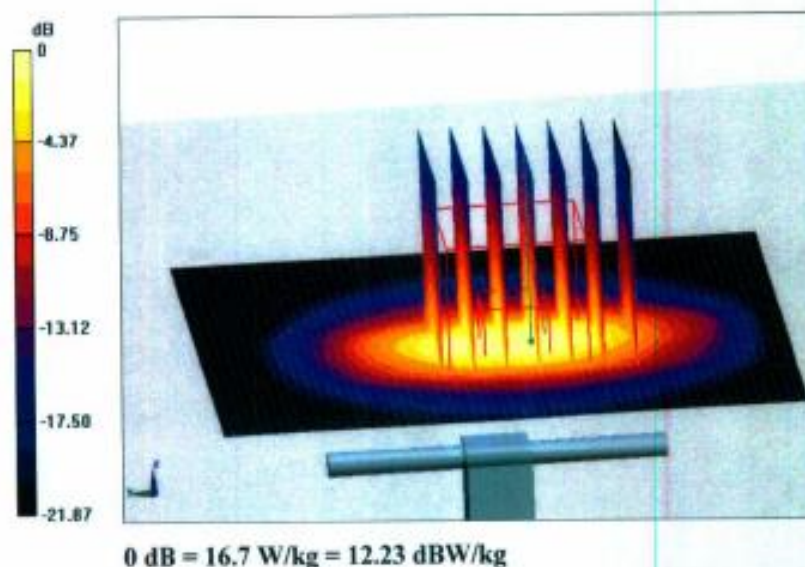


Date: 17.09.2014

**DASY5 Validation Report for Body TSL**  
 Test Laboratory: CTTL, Beijing, China  
**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 919**  
 Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.966$  S/m;  $\epsilon_r = 51.18$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Right Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5 Configuration:

- Probe: ES3DV3 - SN3142; ConvF(4.29, 4.29, 4.29); Calibrated: 2014-09-01;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/3
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**System Performance Check /d=10mm, Pin=250 mW, dist=3.0mm**  
**(ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm,**  
 dy=5mm, dz=5mm  
 Reference Value = 94.44 V/m; Power Drift = -0.03 dB  
 Peak SAR (extrapolated) = 25.7 W/kg  
**SAR(1 g) = 12.8 W/kg; SAR(10 g) = 6.02 W/kg**  
 Maximum value of SAR (measured) = 16.7 W/kg

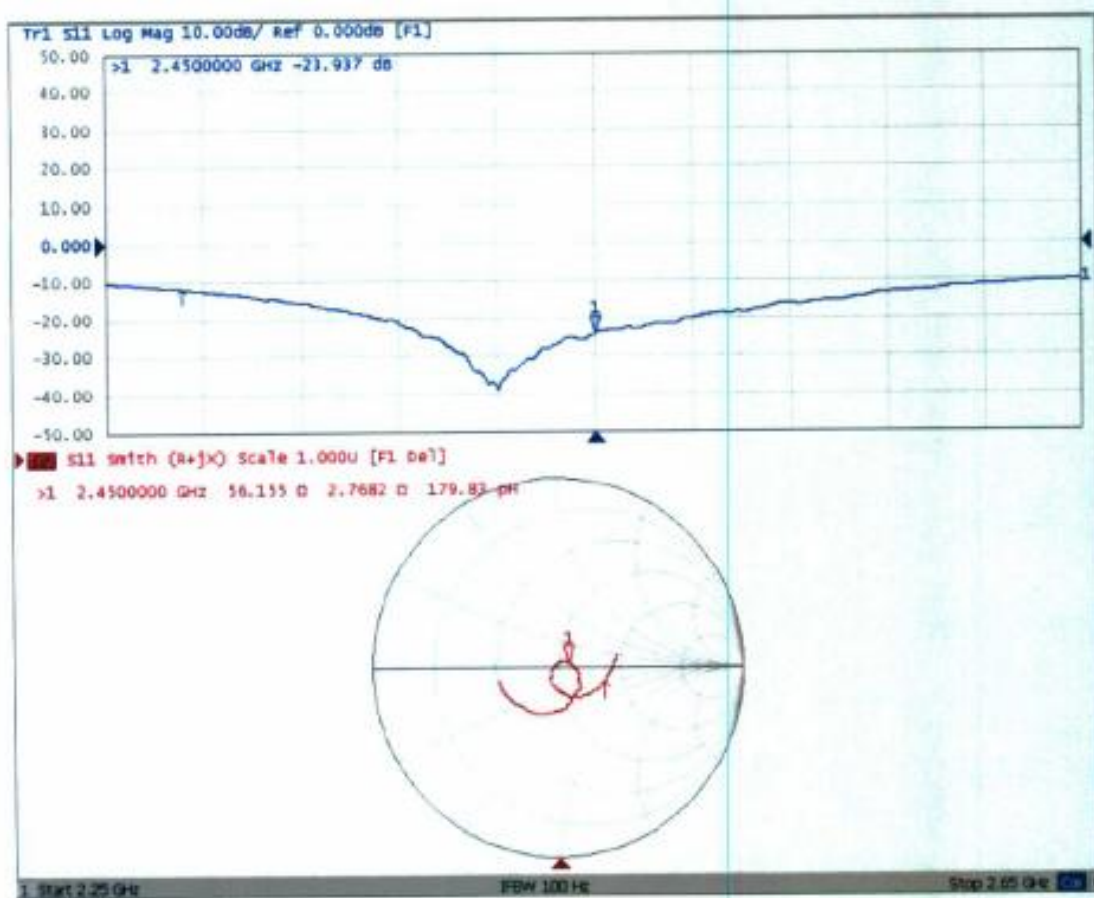




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### Impedance Measurement Plot for Body TSL







## 6. DAE4 Calibration Certificate



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CALIBRATION  
No. L0570

Client : **NIM**

Certificate No: **Z14-97093**

**CALIBRATION CERTIFICATE**

Object: **DAE4 - SN: 1390**

Calibration Procedure(s): **TMC-OS-E-01-198**  
**Calibration Procedure for the Data Acquisition Electronics (DAEx)**

Calibration date: **September 15, 2014**

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

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


Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	01-July-14 (CTTL, No:J14X02147)	July-15

Calibrated by: **Yu Zongying** SAR Test Engineer

Reviewed by: **Qi Dianyuan** SAR Project Leader

Approved by: **Lu Bingsong** Deputy Director of the laboratory



Signature

Issued: September 17, 2014

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#### Glossary:

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

#### Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.



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### DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	403.699 ± 0.15% (k=2)	403.423 ± 0.15% (k=2)	404.3 ± 0.15% (k=2)
Low Range	3.96442 ± 0.7% (k=2)	3.98241 ± 0.7% (k=2)	3.98276 ± 0.7% (k=2)

### Connector Angle

Connector Angle to be used in DASY system	72° ± 1°
---	----------



## 7. EUT Testing Position and Antenna Location

Test Position 2



Test Position 3



Test Position 4



Test Position 5



Test Position 6

