



A Test Lab Techno Corp.

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SAR EVALUATION REPORT



Test Report No.	: 1305FS14-03
Applicant	: Qualcomm Atheros, Inc.
Product Type	: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card
Trade Name	: Qualcomm Atheros
Model Number	: AR5B22
Date of Received	: May 02, 2013
Test Period	: May 03 ~ May 22, 2013
Date of Issued	: May 23, 2013
Test Environment	: Ambient Temperature : $22 \pm 2^{\circ} \text{C}$ Relative Humidity : 40 - 70 %
Standard	: ANSI/IEEE C95.1-1999 IEEE Std. 1528-2003 IEEE Std. 1528a-2005 47 CFR Part §2.1093; FCC/OET Bulletin 65 Supplement C [July 2001] CANADA RSS-102 Issue 4 March 2010
Max. Reported SAR	: 1.34 W/kg Body SAR
Test Lab Location	: Chang-an Lab



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1. Description of Equipment under Test (EUT)

Applicant	Qualcomm Atheros, Inc.	
Applicant Address	1700 Technology Drive, San Jose, CA 95110	
Manufacture	Qualcomm Atheros, Inc.	
Manufacture Address	1700 Technology Drive, San Jose, CA 95110	
Product Type	PCI-E 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card	
Trade Name	Qualcomm Atheros	
Model Number	AR5B22	
FCC ID	PPD-AR5B22	
Host Used	Host Brand: Razer Model number: RZ09-0099	
RF Function	IEEE 802.11b / 802.11g / 802.11n (2.4GHz) 20MHz / 40MHz IEEE 802.11a / 802.11n (5GHz) 20MHz / 40MHz Bluetooth v3.0 / Bluetooth v4.0 LE	
Tx Frequency	Band	Operate Frequency (MHz)
	IEEE 802.11b / 802.11g / 802.11n (2.4GHz) 20MHz	2412 - 2462
	IEEE 802.11n (2.4GHz) 40MHz	2422 - 2452
	IEEE 802.11a / 802.11n (5GHz) 20MHz	5180 - 5825
	IEEE 802.11n (5GHz) 40MHz	5190 - 5795
	Bluetooth v3.0 / Bluetooth v4.0 LE	2402 - 2480
Max. RF Conducted Power (Avg.)	Band	Power (W / dBm)
	IEEE 802.11b	0.138 / 21.40
	IEEE 802.11g	0.132 / 21.20
	IEEE 802.11n (2.4GHz) 20MHz	0.132 / 21.20
	IEEE 802.11n (2.4GHz) 40MHz	0.081 / 19.10
	IEEE 802.11a	0.123 / 20.90
	IEEE 802.11n (5GHz) 20MHz	0.083 / 19.20
	IEEE 802.11n (5GHz) 40MHz	0.058 / 17.60
	Bluetooth v3.0	0.003 / 4.20
	Bluetooth v4.0 LE	0.003 / 4.00
Max. Reported SAR	1.34 W/kg Body SAR	
Device Category	Portable Device	
RF Exposure Environment	General Population / Uncontrolled	
Application Type	Certification	

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment / general population exposure limits specified in Standard C95.1-1999 and had been tested in accordance with the measurement procedures specified in IEEE Std. 1528-2003 and IEEE Std. 1528a-2005.

2. Introduction

The A Test Lab Techno Corp. has performed measurements of the maximum potential exposure to the user of **Qualcomm Atheros, Inc. Trade Name : Qualcomm Atheros Model(s) : AR5B22**. The test procedures, as described in American National Standards, Institute C95.1-1999 [1] , FCC/OET Bulletin 65 Supplement C [July 2001] were employed and they specify the maximum exposure limit of 1.6mW/g as averaged over any 1 gram of tissue for portable devices being used within 20cm between user and EUT in the uncontrolled environment. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment used are included within this test report.

2.1 SAR Definition

Specific Absorption Rate (SAR) is defined as 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). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Figure 2).

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

Figure 2. SAR Mathematical Equation

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

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

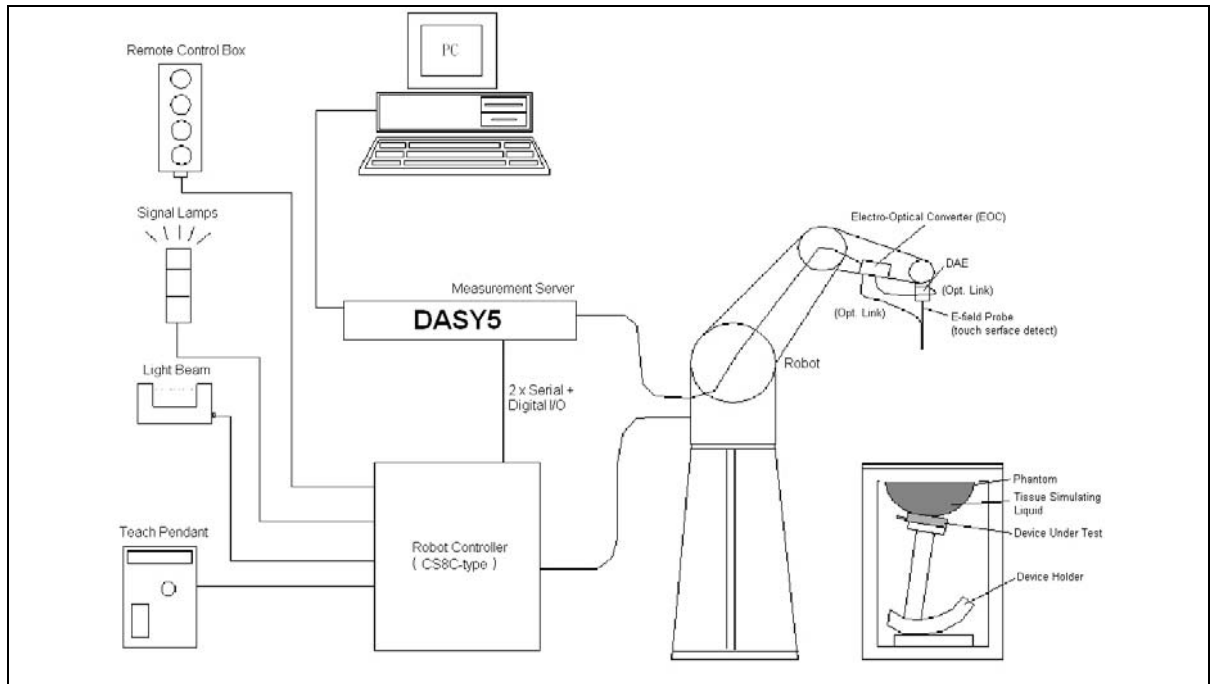
Where :

- σ = conductivity of the tissue (S/m)
- ρ = mass density of the tissue (kg/m³)
- E = RMS electric field strength (V/m)

* Note :

The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane [2]

3. SAR Measurement Setup



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

1. A standard high precision 6-axis robot (Stäubli TX family) with controller, teach pendant 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 electronics (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. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
5. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
6. A computer operating Windows 2000 or Windows XP.
7. DASY5 software.
8. Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
9. The SAM twin phantom enabling testing 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. Validation dipole kits allowing validating the proper functioning of the system.



3.1 DASY E-Field Probe System

The SAR measurements were conducted with the dosimetric probe (manufactured by SPEAG), designed in the classical triangular configuration [3] and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

3.1.1 E-Field Probe Specification

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.q., glycol)
Calibration	In air from 10 MHz to 6 GHz In brain and muscle simulating tissue at frequencies of 2450MHz, 5200MHz, 5300MHz, 5600MHz and 5800MHz (accuracy $\pm 8\%$) Calibration for other liquids and frequencies upon request
Frequency	± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in brain tissue (rotation around probe axis) ± 0.5 dB in brain tissue (rotation normal probe axis) Dynamic Range 10μW/g to > 100mW/g; Linearity: ± 0.2dB
Dimensions	Overall length: 337mm Tip length: 9mm Body diameter: 10mm Tip diameter: 2.5mm Distance from probe tip to dipole centers: 1.0mm
Application	General dosimetry up to 6GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms



Figure 3. E-field Probe

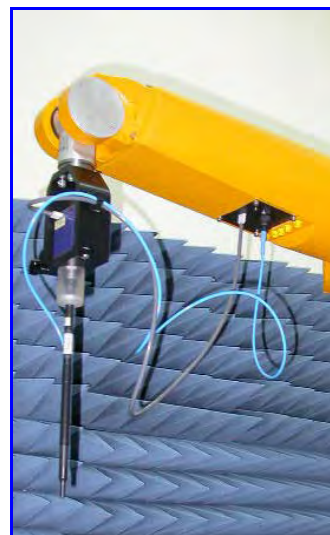


Figure 4. Probe setup on robot



3.1.2 E-Field Probe Calibration process

Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm²) using an RF Signal generator, TEM cell, and RF Power Meter.

Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies 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 rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm².

Temperature Assessment

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

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

Where :

Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (head or body),

ΔT = Temperature increase due to RF exposure.

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

Where :

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m³).



3.2 Data Acquisition Electronic (DAE) System

Cell Controller

Processor : Intel Core(TM)2 CPU
Clock Speed : @ 1.86GHz
Operating System : Windows XP Professional

Data Converter

Features : Signal Amplifier, multiplexer, A/D converter, and control logic
Software : DASY5 v5.0 (Build 125) & SEMCAD X Version 13.4 Build 125
Connecting Lines : Optical downlink for data and status info
Optical uplink for commands and clock

3.3 Robot

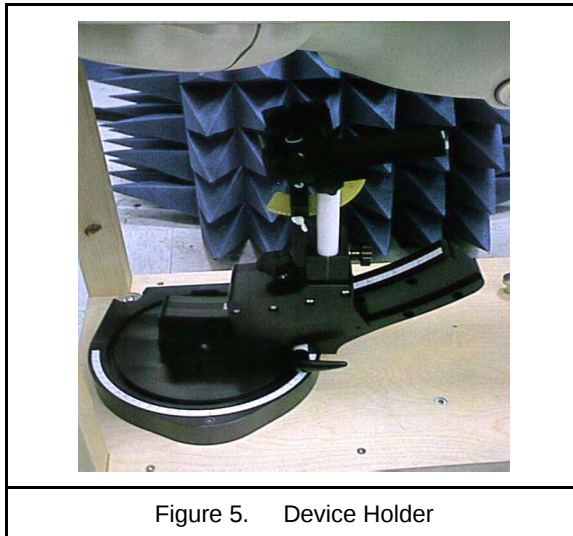
Positioner : Stäubli Unimation Corp. Robot Model: TX90XL
Repeatability : ± 0.02 mm
No. of Axis : 6

3.4 Measurement Server

Processor : PC/104 with a 400MHz intel ULV Celeron
I/O-board : Link to DAE4 (or DAE3)
16-bit A/D converter for surface detection system
Digital I/O interface
Serial link to robot
Direct emergency stop output for robot

3.5 Device Holder

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon=3$ 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.



3.6 Phantom - SAM v4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	1000x500 mm (LxW)
Table 1. Specification of SAM v4.0	



Figure 6. SAM Twin Phantom

3.7 Oval Flat Phantom - ELI 4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (Oval Flat) phantom defined in IEEE 1528-2003, IEEE Std. 1528a-2005, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of wireless portable device usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 30 liters
Dimensions	190×600×400 mm (H×L×W)
Table 2. Specification of ELI 4.0	

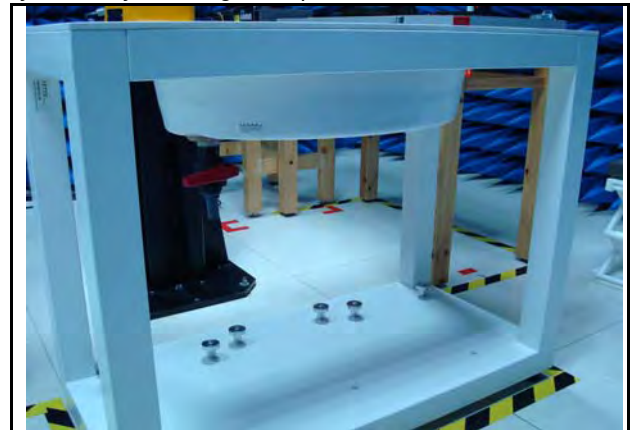


Figure 7. Oval Flat Phantom

3.8 Data Storage and Evaluation

3.8.1 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 with the extension DA4 or DA5. 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.

3.8.2 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 $Norm_i, ai0, ai1, ai2$
 - Conversion factor $ConvFi$
 - 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 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 :

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

- 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 :

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

$$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

H-field probes :

with V_i = compensated signal of channel i (i = x, y, z)
 $Norm_i$ = sensor sensitivity of channel i (i = x, y, z)
 $\mu V/(V/m)^2$ 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) :

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

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

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

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/cm³

* Note : That the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

The power flow density is calculated assuming the excitation field to be a free space field.

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

with P_{pwe} = equivalent power density of a plane wave in mW/cm²
 E_{tot} = total electric field strength in V/m
 H_{tot} = total magnetic field strength in A/m

4. Tissue Simulating Liquids

The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue.

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an E5071B Network Analyzer.

IEEE SCC-34/SC-2 in 1528 recommended Tissue Dielectric Parameters

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in human head. Other head and body tissue parameters that have not been specified in 1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equation and extrapolated according to the head parameter specified in 1528.

Target Frequency	Head		Body	
(MHz)	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 - 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00
(ϵ_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m ³)				

Table 3. Tissue dielectric parameters for head and body phantoms



4.1 Ingredients

The following ingredients are used:

- Water: deionized water (pure H₂O), resistivity $\geq 16 \text{ M } \Omega$ -as basis for the liquid
- Sugar: refied white sugar (typically 99.7 % sucrose, available as crystal sugar in food shops)
-to reduce relative permittivity
- Salt: pure NaCl -to increase conductivity
- Cellulose: Hydroxyethyl-cellulose, medium viscosity (75-125 mPa.s, 2% in water, 20 °C), CAS # 54290 -to increase viscosity and to keep sugar in solution.
- Preservative: Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS # 55965-84-9 -to prevent the spread of bacteria and molds
- DGBE: Diethylenglycol-monobuthyl ether (DGBE), Fluka Chemie GmbH, CAS # 112-34-5 -to reduce relative permittivity

4.2 Recipes

The following tables give the recipes for tissue simulating liquids to be used in different frequency bands.

Note: The goal dielectric parameters (at 22 °C) must be achieved within a tolerance of $\pm 5\%$ for ϵ and $\pm 5\%$ for σ .

Ingredients (% by weight)	Frequency (MHz)											
	750		835		1750		1900		2450		2600	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	39.28	51.30	41.45	52.40	54.50	40.20	54.90	40.40	62.70	73.20	60.30	71.40
Salt (NaCl)	1.47	1.42	1.45	1.50	0.17	0.49	0.18	0.50	0.50	0.10	0.60	0.20
Sugar	58.15	46.18	56.00	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEC	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bactericide	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DGBE	0.00	0.00	0.00	0.00	45.33	59.31	44.92	59.10	36.80	26.70	39.10	28.40
Dielectric Constant	41.88	54.60	42.54	56.10	40.10	53.60	39.90	54.00	39.80	52.50	39.80	52.50
Conductivity (S/m)	0.90	0.97	0.91	0.95	1.39	1.49	1.42	1.45	1.88	1.78	1.88	1.78

Salt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized, $16 \text{ M } \Omega$ resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

4.3 Liquid Depth

The liquid level was during measurement 15cm ± 0.5 cm.

According to KDB865664 ,the depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm ± 0.5 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm ± 0.5 cm for measurements > 3 GHz.

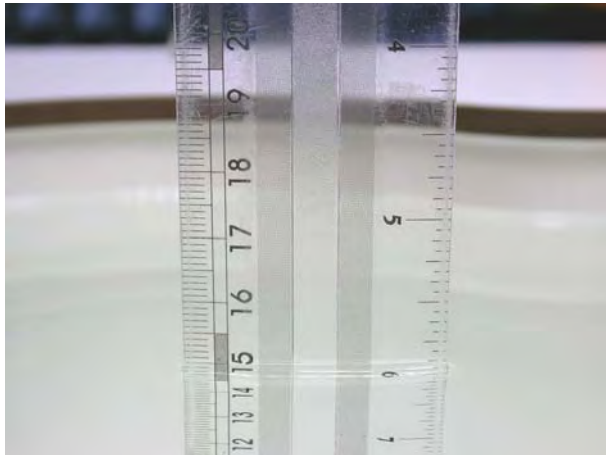


Figure 8. Head-Position



Figure 9. Body-Position



5. SAR Testing with RF Transmitters

5.1 Power Reduction

No power reduction issue.

5.2 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 b/g transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable.

5.3 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

Frequency Channel Configurations

802.11 a/b/g and 4.9 GHz operating modes are tested independently according to the service requirements in each frequency band. 802.11 b/g modes are tested on channels 1, 6 and 11. 802.11a is tested for UNII operations on channels 36 and 48 in the 5.15-5.25 GHz band; channels 52 and 64 in the 5.25-5.35 GHz band; channels 104, 116, 124 and 136 in the 5.470-5.725 GHz band; and channels 149 and 161 in the 5.8 GHz band. When 5.8 GHz §15.247 is also available, channels 149, 157 and 165 should be tested instead of the UNII channels. 4.9 GHz is tested on channels 1, 10 and 5 or 6, whichever has the higher output power, for 5 MHz channels; channels 11, 15 and 19 for 10 MHz channels; and channels 21 and 25 for 20 MHz channels. These are referred to as the “default test channels”. 802.11g mode was evaluated only if the output power was 0.25 dB higher than the 802.11b mode.



IEEE 802.11 Test Channels per FCC Requirement							
Mode		GHz	Channel	Turbo Channel	Default Test "Channels"		
					§15.247		UNII
					802.11b	802.11g	
IEEE 802.11 b/g		2412	1		✓	▽	
		2437	6	6	✓	▽	
		2462	11		✓	▽	
IEEE 802.11a	UNII	5.18	36				✓
		5.20	40	42 (5.21 GHz)			*
		5.22	44				*
		5.24	48	50 (5.25 GHz)			
		5.26	52				✓
		5.28	56	58 (5.29 GHz)			*
		5.30	60				*
		5.32	64				✓
		5.500	100	Unknown			*
		5.520	104				✓
		5.540	108				*
		5.560	112				*
		5.580	116				✓
		5.600	120				*
		5.620	124				✓
		5.640	128				*
		5.660	132				*
		5.680	136				✓
		5.700	140				*
	UNII or §15.247	5.745	149		✓		✓
		5.765	153	152 (5.76 GHz)		*	*
		5.785	157		✓		*
		5.805	161	160 (5.80 GHz)		*	✓
	§15.247	5.825	165		✓		

5.4 Conducted Power

Band	Data Rate	CH	Frequency (MHz)	Average Conducted Output Power (dBm)	
				Antenna 1	Antenna 0+1
IEEE 802.11b	1 M	1	2412.0	17.82	20.80
		6	2437.0	18.34	21.40
		11	2462.0	17.95	21.00
	2 M	1	2412.0	17.98	21.00
		6	2437.0	18.30	21.30
		11	2462.0	17.96	21.00
	5.5 M	1	2412.0	17.91	20.90
		6	2437.0	18.31	21.30
		11	2462.0	17.98	21.00
	11 M	1	2412.0	17.88	20.90
		6	2437.0	18.24	21.30
		11	2462.0	17.96	21.00
IEEE 802.11g	6 M	1	2412.0	14.24	17.30
		6	2437.0	18.21	21.20
		11	2462.0	13.73	16.70
	9 M	1	2412.0	14.15	17.20
		6	2437.0	18.15	21.20
		11	2462.0	13.52	16.50
	12 M	1	2412.0	14.10	17.10
		6	2437.0	18.12	21.10
		11	2462.0	13.62	16.60
	18 M	1	2412.0	14.12	17.10
		6	2437.0	18.10	21.10
		11	2462.0	13.60	16.60
	24 M	1	2412.0	14.11	17.10
		6	2437.0	18.10	21.10
		11	2462.0	13.61	16.60
	36 M	1	2412.0	14.08	17.10
		6	2437.0	18.10	21.10
		11	2462.0	13.70	16.70
	48 M	1	2412.0	14.07	17.10
		6	2437.0	18.08	21.10
		11	2462.0	13.77	16.80
	54 M	1	2412.0	14.05	17.10
		6	2437.0	18.05	21.10
		11	2462.0	13.75	16.80

Band	Data Rate	CH	Frequency (MHz)	Average Conducted Output Power (dBm)	
				Antenna 1	Antenna 0+1
IEEE 802.11n 20MHz (2.4 GHz)	6.5 M	1	2412.0	14.44	17.50
		6	2437.0	18.15	21.20
		11	2462.0	13.11	16.10
	13.0 M	1	2412.0	14.03	17.00
		6	2437.0	18.13	21.10
		11	2462.0	13.03	16.00
	19.5 M	1	2412.0	14.00	17.00
		6	2437.0	18.09	21.10
		11	2462.0	13.02	16.00
	26.0 M	1	2412.0	14.03	17.00
		6	2437.0	18.08	21.10
		11	2462.0	13.08	16.10
	39.0 M	1	2412.0	14.02	17.00
		6	2437.0	18.05	21.10
		11	2462.0	13.02	16.00
	52.0 M	1	2412.0	14.01	17.00
		6	2437.0	18.06	21.10
		11	2462.0	13.02	16.00
	58.5 M	1	2412.0	14.03	17.00
		6	2437.0	18.03	21.00
		11	2462.0	13.04	16.10
	65.0 M	1	2412.0	14.02	17.00
		6	2437.0	18.02	21.00
		11	2462.0	13.03	16.00
IEEE 802.11n 40MHz (2.4 GHz)	13 M	3	2422.0	10.95	14.00
		6	2437.0	15.71	18.70
		9	2452.0	12.65	15.70
	27 M	3	2422.0	10.91	13.90
		6	2437.0	15.60	18.60
		9	2452.0	12.70	15.70
	40.5 M	3	2422.0	10.89	13.90
		6	2437.0	16.02	19.00
		9	2452.0	12.71	15.70
	54 M	3	2422.0	10.86	13.90
		6	2437.0	16.02	19.00
		9	2452.0	12.77	15.80
	81 M	3	2422.0	10.86	13.90
		6	2437.0	16.07	19.10
		9	2452.0	12.72	15.70
	108 M	3	2422.0	10.82	13.80
		6	2437.0	16.02	19.00
		9	2452.0	12.74	15.80
	121.5 M	3	2422.0	10.81	13.80
		6	2437.0	16.04	19.10
		9	2452.0	12.68	15.70
	135 M	3	2422.0	10.82	13.80
		6	2437.0	16.05	19.10
		9	2452.0	12.73	15.70

Band	Data Rate	CH	Frequency (MHz)	Average Conducted Output Power (dBm)	
				Antenna 1	Antenna 0+1
IEEE 802.11a	6 M	36	5180.0	12.75	15.80
		40	5200.0	12.84	15.90
		44	5220.0	12.45	15.50
		48	5240.0	12.70	15.70
		52	5260.0	17.88	20.90
		56	5280.0	12.51	15.50
		60	5300.0	12.65	15.70
		64	5320.0	12.75	15.80
		100	5500.0	12.83	15.80
		104	5520.0	15.72	18.70
		108	5540.0	15.75	18.80
		112	5560.0	15.97	19.00
		116	5580.0	15.94	19.00
		120	5600.0	15.73	18.70
		124	5620.0	15.80	18.80
		128	5640.0	15.92	18.90
		132	5660.0	15.88	18.90
		136	5680.0	15.32	18.30
		140	5700.0	11.58	14.60
		149	5745.0	12.98	16.00
		153	5765.0	12.70	15.70
		157	5785.0	12.70	15.70
		161	5805.0	12.83	15.80
		165	5825.0	12.76	15.80

Band	Data Rate	CH	Frequency (MHz)	Average Conducted Output Power (dBm)	
				Antenna 1	Antenna 0+1
IEEE 802.11a	54 M	36	5180.0	12.74	15.80
		40	5200.0	12.75	15.80
		44	5220.0	12.81	15.80
		48	5240.0	12.68	15.70
		52	5260.0	17.67	20.70
		56	5280.0	12.55	15.60
		60	5300.0	12.73	15.70
		64	5320.0	12.54	15.60
		100	5500.0	12.68	15.70
		104	5520.0	15.50	18.50
		108	5540.0	15.70	18.70
		112	5560.0	15.86	18.90
		116	5580.0	15.56	18.60
		120	5600.0	15.92	18.90
		124	5620.0	15.79	18.80
		128	5640.0	15.71	18.70
		132	5660.0	15.87	18.90
		136	5680.0	15.45	18.50
		140	5700.0	11.51	14.50
		149	5745.0	12.88	15.90
		153	5765.0	12.63	15.60
		157	5785.0	12.71	15.70
		161	5805.0	12.81	15.80
		165	5825.0	12.80	15.80

Band	Data Rate	CH	Frequency (MHz)	Average Conducted Output Power (dBm)	
				Antenna 1	Antenna 0+1
IEEE 802.11n (5GHz) 20MHz	MCS0	36	5180.0	12.63	15.60
		40	5200.0	12.70	15.70
		44	5220.0	12.82	15.80
		48	5240.0	12.81	15.80
		52	5260.0	16.03	19.00
		56	5280.0	12.65	15.70
		60	5300.0	12.62	15.60
		64	5320.0	12.68	15.70
		100	5500.0	14.23	17.20
		104	5520.0	15.70	18.70
		108	5540.0	15.62	18.60
		112	5560.0	15.91	18.90
		116	5580.0	15.72	18.70
		120	5600.0	15.81	18.80
		124	5620.0	15.75	18.80
		128	5640.0	15.87	18.90
		132	5660.0	15.74	18.80
		136	5680.0	15.74	18.80
		140	5700.0	14.03	17.00
		149	5745.0	14.82	17.80
		153	5765.0	15.15	18.20
		157	5785.0	15.22	18.20
		161	5805.0	15.18	18.20
		165	5825.0	15.47	18.50

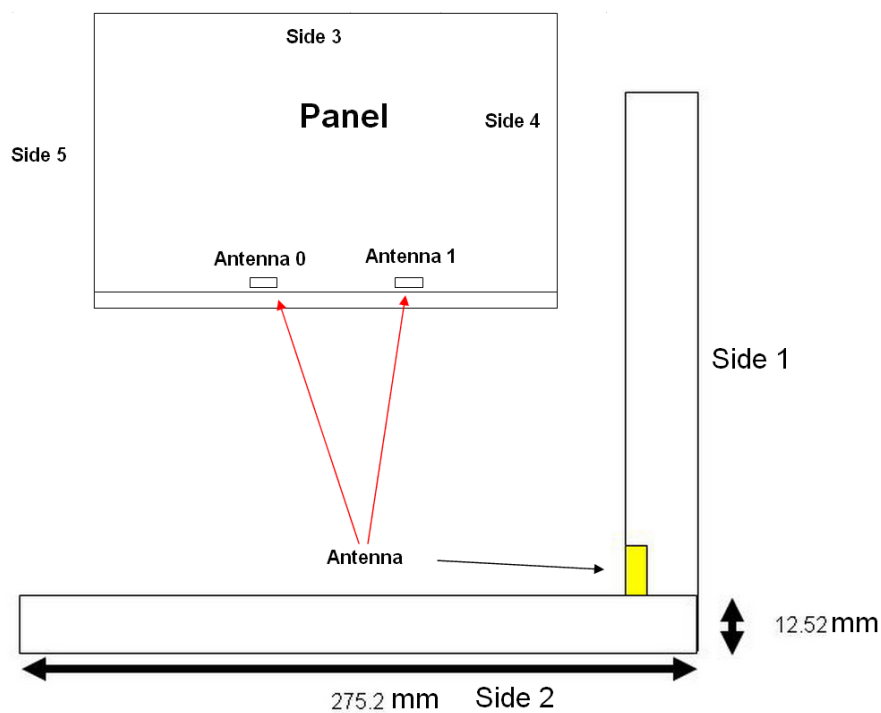
Band	Data Rate	CH	Frequency (MHz)	Average Conducted Output Power (dBm)	
				Antenna 1	Antenna 0+1
IEEE 802.11n (5GHz) 20MHz	MCS7	36	5180.0	12.73	15.70
		40	5200.0	12.77	15.80
		44	5220.0	12.65	15.70
		48	5240.0	12.55	15.60
		52	5260.0	16.23	19.20
		56	5280.0	12.72	15.70
		60	5300.0	12.68	15.70
		64	5320.0	12.74	15.80
		100	5500.0	14.42	17.40
		104	5520.0	15.94	19.00
		108	5540.0	15.63	18.60
		112	5560.0	15.86	18.90
		116	5580.0	15.94	19.00
		120	5600.0	15.70	18.70
		124	5620.0	15.55	18.60
		128	5640.0	15.74	18.80
		132	5660.0	15.84	18.90
		136	5680.0	15.61	18.60
		140	5700.0	14.32	17.30
		149	5745.0	14.72	17.70
		153	5765.0	15.20	18.20
		157	5785.0	15.21	18.20
		161	5805.0	15.15	18.20
		165	5825.0	15.11	18.10

Band	Data Rate	CH	Frequency (MHz)	Average Conducted Output Power (dBm)	
				Antenna 1	Antenna 0+1
IEEE 802.11n (5GHz) 40MHz	MCS8	38	5190.0	10.74	13.80
		46	5230.0	12.51	15.50
		54	5270.0	10.55	13.60
		62	5310.0	10.83	13.80
		102	5510.0	10.47	13.50
		110	5550.0	14.15	17.20
		118	5590.0	14.17	17.20
		126	5630.0	14.10	17.10
		134	5670.0	14.60	17.60
		151	5755.0	13.04	16.10
		159	5795.0	12.53	15.50
	MCS15	38	5190.0	10.71	13.70
		46	5230.0	14.00	17.00
		54	5270.0	10.55	13.60
		62	5310.0	10.82	13.80
		102	5510.0	10.01	13.00
		110	5550.0	14.13	17.10
		118	5590.0	14.13	17.10
		126	5630.0	14.13	17.10
		134	5670.0	14.43	17.40
		151	5755.0	14.50	17.50
		159	5795.0	13.97	17.00

Band	CH	Frequency (MHz)	Average Conducted Output Power (dBm)
Bluetooth v3.0 (GFSK)	0	2402.0	2.90
	39	2440.0	3.40
	78	2480.0	4.00
Bluetooth v3.0 (8DPSK)	0	2402.0	3.00
	39	2440.0	3.70
	78	2480.0	4.20
Bluetooth v4.0 LE	0	2402.0	2.80
	19	2440.0	3.30
	39	2480.0	4.00

5.5 Antenna location

Antenna-User			
Antenna 0 (Distance of WLAN & BT to edge bottom)		Antenna 1 (Distance of WLAN to edge bottom)	
Antenna to Side 2	12.52mm	Antenna to Side 2	12.52mm
Antenna to Side 5	140mm	Antenna to Side 4	140mm
Antenna to Side 3	252mm	Antenna to Side 3	252mm
Antenna-Antenna			
Antenna account		Distance (cm)	
Antenna 0 to Antenna 1		5.5	



5.6 Stand-alone SAR Evaluate

Transmitter and antenna implementation as below:

Band	Antenna 0	Antenna 1
WLAN	V	V
Bluetooth	V	X

Note : 1Tx mode supports antenna 1 transmission , 2Tx mode support antenna 0+1 transmission

Stand-alone transmission configurations as below:

Band	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6
IEEE 802.11a/b/g/n	-	V	-	-	-	-
Bluetooth	-	V	-	-	-	-

Band	Channel	Power (dBm)	Frequency (GHz)	Distance (mm)	Power (mW)	Result	Limit	Exclusion Considerations SAR ¹⁹
Bluetooth v3.0	78	4.2	2.48	12.52	3	0.4	3	SAR is not required
Bluetooth v4.0 LE	39	4.0	2.48	12.52	3	0.4	3	SAR is not required

5.7 Simultaneous Transmitting Evaluate

Simultaneous transmission configurations as below:

Condition	Side	Frequency Band		
		WLAN Antenna 0	WLAN Antenna 1	Bluetooth v3.0 / Bluetooth v4.0 LE Antenna 0
1	2	V	V	V

5.7.1 Estimated SAR

Band	Channel	Power-Tune up (dBm)	Frequency (GHz)	Distance (mm)	Power (mW)	Estimated SAR ¹⁹ (mW/g)
Bluetooth v3.0	78	4.2	2.48			0.05
Bluetooth v4.0 LE	39	4.0	2.48			0.05

5.7.2 Sum of 1-g SAR of all simultaneously transmitting

When the sum of 1-g SAR of all simultaneously transmitting antennas in and operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

Sum of 1-g SAR of summary as below:

Phantom Position		Spacing (mm)	ASSY	Simult Tx 1		Simult Tx 2		Simult Tx 3		Σ SAR ^{1g} (mW/g)	Event
				Band	SAR ^{1g} (mW/g)	Band	SAR ^{1g} (mW/g)	Band	SAR ^{1g} (mW/g)		
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.08	WLAN (Ant 1)	0.06	Bluetooth v3.0 / v4.0 LE	0.05	0.19	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.11	WLAN (Ant 1)	0.06	Bluetooth v3.0 / v4.0 LE	0.05	0.22	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.29	WLAN (Ant 1)	0.26	Bluetooth v3.0 / v4.0 LE	0.05	0.6	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.08	WLAN (Ant 1)	0.23	Bluetooth v3.0 / v4.0 LE	0.05	0.36	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.15	WLAN (Ant 1)	0.23	Bluetooth v3.0 / v4.0 LE	0.05	0.43	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.17	WLAN (Ant 1)	0.34	Bluetooth v3.0 / v4.0 LE	0.05	0.56	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.24	WLAN (Ant 1)	0.26	Bluetooth v3.0 / v4.0 LE	0.05	0.55	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.22	WLAN (Ant 1)	0.25	Bluetooth v3.0 / v4.0 LE	0.05	0.52	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.22	WLAN (Ant 1)	0.19	Bluetooth v3.0 / v4.0 LE	0.05	0.46	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.24	WLAN (Ant 1)	0.21	Bluetooth v3.0 / v4.0 LE	0.05	0.5	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0)	0.26	WLAN (Ant 1)	0.22	Bluetooth v3.0 / v4.0 LE	0.05	0.53	<1.6

Sum of 1-g SAR of summary (MIMO Mode) as below:

Phantom Position		Spacing (mm)	ASSY	Simult Tx 1		Simult Tx 2		Σ SAR ^{1g} (mW/g)	Event
				Band	SAR ^{1g} (mW/g)	Band	SAR ^{1g} (mW/g)		
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	0.134	Bluetooth v3.0 / v4.0 LE	0.05	0.184	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	0.182	Bluetooth v3.0 / v4.0 LE	0.05	0.232	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	0.336	Bluetooth v3.0 / v4.0 LE	0.05	0.386	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	0.362	Bluetooth v3.0 / v4.0 LE	0.05	0.412	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	0.304	Bluetooth v3.0 / v4.0 LE	0.05	0.354	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	0.250	Bluetooth v3.0 / v4.0 LE	0.05	0.3	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	1.016	Bluetooth v3.0 / v4.0 LE	0.05	1.066	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	1.340	Bluetooth v3.0 / v4.0 LE	0.05	1.39	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	1.137	Bluetooth v3.0 / v4.0 LE	0.05	1.187	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	0.564	Bluetooth v3.0 / v4.0 LE	0.05	0.614	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	0.692	Bluetooth v3.0 / v4.0 LE	0.05	0.742	<1.6
Flat	Side 2	0	N/A	WLAN (Ant 0+1)	0.719	Bluetooth v3.0 / v4.0 LE	0.05	0.769	<1.6

5.7.3 SAR to peak location separation ratio (SPLSR)

When the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The ratio is determined by $(SAR1 + SAR2)^{1.5/R_i}$, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

All of sum of SAR < 1.6 W/Kg, therefore SPLSR is not required.



5.8 SAR test reduction according to KDB

General:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to FCC/OET Bulletin 65, Supplement C [June 2001], IEEE1528-2003 and IEEE Std. 1528a-2005.
- All modes of operation were investigated, and worst-case results are reported.
- Tissue parameters and temperatures are listed on the SAR plots.
- Batteries are fully charged for all readings.
- When the Channel's SAR 1g of maximum conducted power is > 0.8 mW/g, low, middle and high channel are supposed to be tested.

KDB 447498:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to FCC/OET Bulletin 65, Supplement C [June 2001], IEEE1528-2003 and IEEE Std. 1528a-2005.

KDB 865664:

- Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg.
- When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg.
- Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

KDB 248227:

- If the conducted power of (802.11g and 802.11n) are higher than 802.11b 0.25dB, (802.11g and 802.11n) are supposed to be tested.

6. System Verification and Validation

6.1 Symmetric Dipoles for System Verification

Construction	Symmetrical dipole with 1/4 balun enables measurement of feed point impedance with NWA matched for use near flat phantoms filled with head simulating solutions Includes distance holder and tripod adaptor Calibration Calibrated SAR value for specified position and input power at the flat phantom in head simulating solutions.
Frequency	2450MHz, 5200MHz, 5300MHz, 5600MHz and 5800MHz
Return Loss	> 20 dB at specified verification position
Power Capability	> 100 W ($f < 1\text{GHz}$); > 40 W ($f > 1\text{GHz}$)
Options	Dipoles for other frequencies or solutions and other calibration conditions are available upon request
Dimensions	D2450V2: dipole length 51.5 mm; overall height 300 mm D5GHzV2: dipole length 20.6 mm; overall height 300 mm

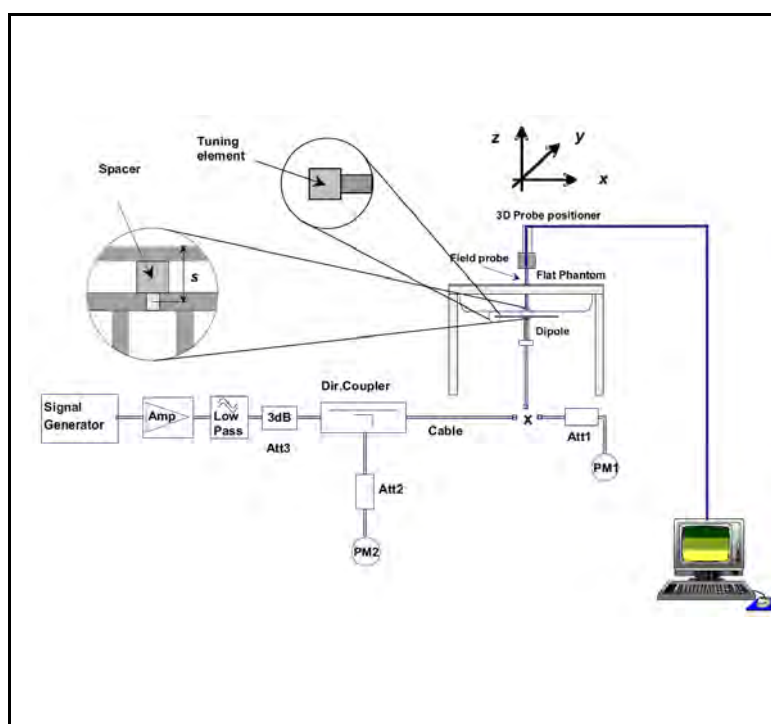


Figure 10. System Verification Setup Diagram



Figure 11. Validation Kit

6.2 Liquid Parameters

Liquid Verify								
Ambient Temperature : 22 ± 2 °C ; Relative Humidity : 40 -70%								
Liquid Type	Frequency	Temp (°C)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
2450MHz (Body)	2400MHz	22.0	ϵ_r	52.77	52.13	-1.21	± 5	May 03, 2013
			σ	1.902	1.889	-0.68	± 5	
	2450MHz	22.0	ϵ_r	52.70	51.92	-1.48	± 5	
			σ	1.950	1.964	0.72	± 5	
	2500MHz	22.0	ϵ_r	52.64	51.77	-1.65	± 5	
			σ	2.021	2.038	0.84	± 5	
2450MHz (Body)	2400MHz	22.0	ϵ_r	52.77	52.13	-1.21	± 5	May 08, 2013
			σ	1.902	1.889	-0.68	± 5	
	2450MHz	22.0	ϵ_r	52.70	51.92	-1.48	± 5	
			σ	1.950	1.964	0.72	± 5	
	2500MHz	22.0	ϵ_r	52.64	51.77	-1.65	± 5	
			σ	2.021	2.038	0.84	± 5	
2450MHz (Body)	2400MHz	22.0	ϵ_r	52.77	52.13	-1.21	± 5	May 19, 2013
			σ	1.902	1.889	-0.68	± 5	
	2450MHz	22.0	ϵ_r	52.70	51.92	-1.48	± 5	
			σ	1.950	1.964	0.72	± 5	
	2500MHz	22.0	ϵ_r	52.64	51.77	-1.65	± 5	
			σ	2.021	2.038	0.84	± 5	
5200MHz (Body)	5150MHz	22.0	ϵ_r	49.08	47.89	-2.43	± 5	May 06, 2013
			σ	5.241	5.460	4.18	± 5	
	5200MHz	22.0	ϵ_r	49.01	47.76	-2.55	± 5	
			σ	5.299	5.520	4.17	± 5	
	5250MHz	22.0	ϵ_r	48.95	47.63	-2.70	± 5	
			σ	5.358	5.550	3.58	± 5	
5200MHz (Body)	5150MHz	22.0	ϵ_r	49.08	47.89	-2.43	± 5	May 07, 2013
			σ	5.241	5.460	4.18	± 5	
	5200MHz	22.0	ϵ_r	49.01	47.76	-2.55	± 5	
			σ	5.299	5.520	4.17	± 5	
	5250MHz	22.0	ϵ_r	48.95	47.63	-2.70	± 5	
			σ	5.358	5.550	3.58	± 5	

Table 4. Measured Tissue dielectric parameters for body phantoms -1

Liquid Verify								
Ambient Temperature : 22 ± 2 °C ; Relative Humidity : 40 -70%								
Liquid Type	Frequency	Temp (°C)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
5200MHz (Body)	5150MHz	22.0	ϵ_r	49.08	47.89	-2.43	± 5	May 19, 2013
			σ	5.241	5.460	4.18	± 5	
	5200MHz	22.0	ϵ_r	49.01	47.76	-2.55	± 5	
			σ	5.299	5.520	4.17	± 5	
	5250MHz	22.0	ϵ_r	48.95	47.63	-2.70	± 5	
			σ	5.358	5.550	3.58	± 5	
5200MHz (Body)	5150MHz	22.0	ϵ_r	49.08	47.89	-2.43	± 5	May 21, 2013
			σ	5.241	5.460	4.18	± 5	
	5200MHz	22.0	ϵ_r	49.01	47.76	-2.55	± 5	
			σ	5.299	5.520	4.17	± 5	
	5250MHz	22.0	ϵ_r	48.95	47.63	-2.70	± 5	
			σ	5.358	5.550	3.58	± 5	
5300MHz (Body)	5250MHz	22.0	ϵ_r	48.95	47.63	-2.70	± 5	May 06, 2013
			σ	5.358	5.550	3.58	± 5	
	5300MHz	22.0	ϵ_r	48.88	47.52	-2.78	± 5	
			σ	5.416	5.650	4.32	± 5	
	5350MHz	22.0	ϵ_r	48.81	47.41	-2.87	± 5	
			σ	5.474	5.720	4.49	± 5	
5300MHz (Body)	5250MHz	22.0	ϵ_r	48.95	47.63	-2.70	± 5	May 07, 2013
			σ	5.358	5.550	3.58	± 5	
	5300MHz	22.0	ϵ_r	48.88	47.52	-2.78	± 5	
			σ	5.416	5.650	4.32	± 5	
	5350MHz	22.0	ϵ_r	48.81	47.41	-2.87	± 5	
			σ	5.474	5.720	4.49	± 5	
5300MHz (Body)	5250MHz	22.0	ϵ_r	48.95	47.63	-2.70	± 5	May 19, 2013
			σ	5.358	5.550	3.58	± 5	
	5300MHz	22.0	ϵ_r	48.88	47.52	-2.78	± 5	
			σ	5.416	5.650	4.32	± 5	
	5350MHz	22.0	ϵ_r	48.81	47.41	-2.87	± 5	
			σ	5.474	5.720	4.49	± 5	

Table 5. Measured Tissue dielectric parameters for body phantoms -2

Liquid Verify								
Ambient Temperature : 22 ± 2 °C ; Relative Humidity : 40 -70%								
Liquid Type	Frequency	Temp (°C)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
5600MHz (Body)	5550MHz	22.0	ϵ_r	48.54	46.93	-3.32	± 5	May 06, 2013
			σ	5.708	5.930	3.89	± 5	
	5600MHz	22.0	ϵ_r	48.47	46.87	-3.30	± 5	
			σ	5.766	6.020	4.41	± 5	
	5650MHz	22.0	ϵ_r	48.40	46.74	-3.43	± 5	
			σ	5.825	6.040	3.69	± 5	
5600MHz (Body)	5550MHz	22.0	ϵ_r	48.54	46.93	-3.32	± 5	May 07, 2013
			σ	5.708	5.930	3.89	± 5	
	5600MHz	22.0	ϵ_r	48.47	46.87	-3.30	± 5	
			σ	5.766	6.020	4.41	± 5	
	5650MHz	22.0	ϵ_r	48.40	46.74	-3.43	± 5	
			σ	5.825	6.040	3.69	± 5	
5600MHz (Body)	5550MHz	22.0	ϵ_r	48.54	46.93	-3.32	± 5	May 20, 2013
			σ	5.708	5.930	3.89	± 5	
	5600MHz	22.0	ϵ_r	48.47	46.87	-3.30	± 5	
			σ	5.766	6.020	4.41	± 5	
	5650MHz	22.0	ϵ_r	48.40	46.74	-3.43	± 5	
			σ	5.825	6.040	3.69	± 5	
5600MHz (Body)	5550MHz	22.0	ϵ_r	48.54	46.93	-3.32	± 5	May 21, 2013
			σ	5.708	5.930	3.89	± 5	
	5600MHz	22.0	ϵ_r	48.47	46.87	-3.30	± 5	
			σ	5.766	6.020	4.41	± 5	
	5650MHz	22.0	ϵ_r	48.40	46.74	-3.43	± 5	
			σ	5.825	6.040	3.69	± 5	
5800MHz (Body)	5750MHz	22.0	ϵ_r	48.27	46.54	-3.58	± 5	May 06, 2013
			σ	5.942	6.210	4.51	± 5	
	5800MHz	22.0	ϵ_r	48.20	46.40	-3.73	± 5	
			σ	6.000	6.270	4.50	± 5	
	5850MHz	22.0	ϵ_r	48.20	46.35	-3.84	± 5	
			σ	6.000	6.290	4.83	± 5	

Table 6. Measured Tissue dielectric parameters for body phantoms -3

Liquid Verify								
Ambient Temperature : 22 ± 2 °C ; Relative Humidity : 40 -70%								
Liquid Type	Frequency	Temp (°C)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
5800MHz (Body)	5750MHz	22.0	ϵ_r	48.27	46.54	-3.58	± 5	May 08, 2013
			σ	5.942	6.210	4.51	± 5	
	5800MHz	22.0	ϵ_r	48.20	46.40	-3.73	± 5	
			σ	6.000	6.270	4.50	± 5	
	5850MHz	22.0	ϵ_r	48.20	46.35	-3.84	± 5	
			σ	6.000	6.290	4.83	± 5	
5800MHz (Body)	5750MHz	22.0	ϵ_r	48.27	46.54	-3.58	± 5	May 20, 2013
			σ	5.942	6.210	4.51	± 5	
	5800MHz	22.0	ϵ_r	48.20	46.40	-3.73	± 5	
			σ	6.000	6.270	4.50	± 5	
	5850MHz	22.0	ϵ_r	48.20	46.35	-3.84	± 5	
			σ	6.000	6.290	4.83	± 5	
5800MHz (Body)	5750MHz	22.0	ϵ_r	48.27	46.54	-3.58	± 5	May 22, 2013
			σ	5.942	6.210	4.51	± 5	
	5800MHz	22.0	ϵ_r	48.20	46.40	-3.73	± 5	
			σ	6.000	6.270	4.50	± 5	
	5850MHz	22.0	ϵ_r	48.20	46.35	-3.84	± 5	
			σ	6.000	6.290	4.83	± 5	

Table 7. Measured Tissue dielectric parameters for body phantoms -4

6.3 Verification Summary

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of $\pm 7\%$. The verification was performed at 2450MHz, 5200MHz, 5300MHz, 5600MHz and 5800MHz.

Mixture Type	Frequency (MHz)	Power	SAR _{1g} (mW/g)	SAR _{10g} (mW/g)	Drift (dB)	Difference percentage		Probe Model / Serial No.	Dipole Model / Serial No.	1W Target		Date
						1g	10g			SAR _{1g} (mW/g)	SAR _{10g} (mW/g)	
Body	2450	250 mW	12	5.62	0.025	-4.6%	-4.6%	EX3DV3 SN:3519	D2450V2 SN:712	50.30	23.50	May 03, 2013
		Normalize to 1 Watt	48.00	22.48								
Body	2450	250 mW	12.9	6.01	-0.123	2.6%	2.3%	EX3DV3 SN:3519	D2450V2 SN:712	50.30	23.50	May 08, 2013
		Normalize to 1 Watt	51.60	24.04								
Body	2450	250 mW	12.9	6.03	-0.041	2.6%	2.6%	EX3DV3 SN:3519	D2450V2 SN:712	50.30	23.50	May 19, 2013
		Normalize to 1 Watt	51.60	24.12								
Body	5200	100 mW	7.42	2.1	-0.031	-0.3%	1.4%	EX3DV3 SN:3519	D5GHZV2 SN:1021	74.40	20.70	May 06, 2013
		Normalize to 1 Watt	74.20	21.00								
Body	5200	100 mW	7.52	2.13	0.016	1.1%	2.9%	EX3DV3 SN:3519	D5GHZV2 SN:1021	74.40	20.70	May 07, 2013
		Normalize to 1 Watt	75.20	21.30								
Body	5200	100 mW	7.42	2.1	-0.131	-0.3%	1.4%	EX3DV3 SN:3519	D5GHZV2 SN:1021	74.40	20.70	May 19, 2013
		Normalize to 1 Watt	74.20	21.00								
Body	5200	100 mW	7.52	2.13	0.016	1.1%	2.9%	EX3DV3 SN:3519	D5GHZV2 SN:1021	74.40	20.70	May 21, 2013
		Normalize to 1 Watt	75.20	21.30								
Body	5300	100 mW	7.81	2.19	-0.083	3.6%	3.8%	EX3DV3 SN:3519	D5GHZV2 SN:1021	75.40	21.10	May 06, 2013
		Normalize to 1 Watt	78.10	21.90								
Body	5300	100 mW	7.49	2.11	-0.036	-0.7%	0.0%	EX3DV3 SN:3519	D5GHZV2 SN:1021	75.40	21.10	May 07, 2013
		Normalize to 1 Watt	74.90	21.10								
Body	5300	100 mW	7.63	2.14	-0.136	1.2%	1.4%	EX3DV3 SN:3519	D5GHZV2 SN:1021	75.40	21.10	May 19, 2013
		Normalize to 1 Watt	76.30	21.40								
Body	5600	100 mW	8.14	2.26	-0.081	1.8%	2.3%	EX3DV3 SN:3519	D5GHZV2 SN:1021	80.00	22.10	May 06, 2013
		Normalize to 1 Watt	81.40	22.60								
Body	5600	100 mW	7.95	2.22	-0.067	-0.6%	0.5%	EX3DV3 SN:3519	D5GHZV2 SN:1021	80.00	22.10	May 07, 2013
		Normalize to 1 Watt	79.50	22.20								
Body	5600	100 mW	8.02	2.23	-0.075	0.2%	0.9%	EX3DV3 SN:3519	D5GHZV2 SN:1021	80.00	22.10	May 20, 2013
		Normalize to 1 Watt	80.20	22.30								
Body	5600	100 mW	7.95	2.22	-0.067	-0.6%	0.5%	EX3DV3 SN:3519	D5GHZV2 SN:1021	80.00	22.10	May 21, 2013
		Normalize to 1 Watt	79.50	22.20								

Mixture Type	Frequency (MHz)	Power	SAR _{1g} (mW/g)	SAR _{10g} (mW/g)	Drift (dB)	Difference percentage		Probe Model / Serial No.	Dipole Model / Serial No.	1W Target		Date
						1g	10g			SAR _{1g} (mW/g)	SAR _{10g} (mW/g)	
Body	5800	100 mW	7.03	1.95	-0.067	-4.7%	-4.4%	EX3DV3 SN:3519	D5GHzV2 SN:1021	73.80	20.40	May 06, 2013
		Normalize to 1 Watt	70.30	19.50								
Body	5800	100 mW	7.56	2.1	-0.033	2.4%	2.9%	EX3DV3 SN:3519	D5GHzV2 SN:1021	73.80	20.40	May 08, 2013
		Normalize to 1 Watt	75.60	21.00								
Body	5800	100 mW	7.42	2.07	-0.137	0.5%	1.5%	EX3DV3 SN:3519	D5GHzV2 SN:1021	73.80	20.40	May 20, 2013
		Normalize to 1 Watt	74.20	20.70								
Body	5800	100 mW	7.56	2.1	-0.033	2.4%	2.9%	EX3DV3 SN:3519	D5GHzV2 SN:1021	73.80	20.40	May 22, 2013
		Normalize to 1 Watt	75.60	21.00								



6.4 Validation Summary

Per FCC KDB 865664 D02v01, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in IEEE 1528-2003 and FCC KDB 865664 D01v01. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters as below.

Probe Type Model / Serial No.	Prob Cal. Point (MHz)	Head / Body	Cond.	Perm.	CW Validation			Mod. Validation			Date
			εr	σ	Sensitivity	Probe	Probe	Mod. Type	Duty Factor	PAR	
						Linearity	Isotropy				
EX3DV3 SN:3519	2450	Body	51.92	1.964	Pass	Pass	Pass	OFDM	N/A	Pass	May 03, 2013
EX3DV3 SN:3519	2450	Body	51.92	1.964	Pass	Pass	Pass	OFDM	N/A	Pass	May 08, 2013
EX3DV3 SN:3519	2450	Body	51.92	1.964	Pass	Pass	Pass	OFDM	N/A	Pass	May 19, 2013
EX3DV3 SN:3519	5200	Body	47.76	5.520	Pass	Pass	Pass	OFDM	N/A	Pass	May 06, 2013
EX3DV3 SN:3519	5200	Body	47.76	5.520	Pass	Pass	Pass	OFDM	N/A	Pass	May 07, 2013
EX3DV3 SN:3519	5200	Body	47.76	5.520	Pass	Pass	Pass	OFDM	N/A	Pass	May 19, 2013
EX3DV3 SN:3519	5200	Body	47.76	5.520	Pass	Pass	Pass	OFDM	N/A	Pass	May 21, 2013
EX3DV3 SN:3519	5300	Body	47.52	5.650	Pass	Pass	Pass	OFDM	N/A	Pass	May 06, 2013
EX3DV3 SN:3519	5300	Body	47.52	5.650	Pass	Pass	Pass	OFDM	N/A	Pass	May 07, 2013
EX3DV3 SN:3519	5300	Body	47.52	5.650	Pass	Pass	Pass	OFDM	N/A	Pass	May 19, 2013
EX3DV3 SN:3519	5600	Body	46.87	6.020	Pass	Pass	Pass	OFDM	N/A	Pass	May 06, 2013
EX3DV3 SN:3519	5600	Body	46.87	6.020	Pass	Pass	Pass	OFDM	N/A	Pass	May 07, 2013
EX3DV3 SN:3519	5600	Body	46.87	6.020	Pass	Pass	Pass	OFDM	N/A	Pass	May 20, 2013
EX3DV3 SN:3519	5600	Body	46.87	6.020	Pass	Pass	Pass	OFDM	N/A	Pass	May 21, 2013
EX3DV3 SN:3519	5800	Body	46.40	6.270	Pass	Pass	Pass	OFDM	N/A	Pass	May 06, 2013
EX3DV3 SN:3519	5800	Body	46.40	6.270	Pass	Pass	Pass	OFDM	N/A	Pass	May 08, 2013
EX3DV3 SN:3519	5800	Body	46.40	6.270	Pass	Pass	Pass	OFDM	N/A	Pass	May 20, 2013
EX3DV3 SN:3519	5800	Body	46.40	6.270	Pass	Pass	Pass	OFDM	N/A	Pass	May 22, 2013



7. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	2450MHz System Validation Kit	D2450V2	712	Feb. 19, 2013	Feb. 19, 2014
SPEAG	5GHz System Validation Kit	D5GHZV2	1021	Feb. 21, 2013	Feb. 21, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV3	3519	Feb. 20, 2013	Feb. 20, 2014
SPEAG	Data Acquisition Electronics	DAE4	779	Feb. 13, 2013	Feb. 13, 2014
SPEAG	Device Holder	N/A	N/A	NCR	
SPEAG	Measurement Server	SE UMS 011 AA	1025	NCR	
SPEAG	Phantom	ELI v5.0	TP-1133	NCR	
SPEAG	Robot	Staubli TX90XL	F07/564ZA1/C/01	NCR	
SPEAG	Software	DASY5 V5.0 Build 125	N/A	NCR	
SPEAG	Software	SEMCAD V13.4 Build 125	N/A	NCR	
Agilent	Dielectric Probe Kit	85070C	US99360094	NCR	
Agilent	ENA Series Network Analyzer	E5071B	MY42404655	Apr. 05, 2012	Apr. 05, 2014
R&S	Power Sensor	NRP-Z22	100179	May 16, 2012	May 16, 2013
Agilent	MXG Vector Signal Generator	N5182A	MY47420962	May 24, 2012	May 24, 2014
Agilent	Dual Directional Coupler	778D	50334	NCR	
Mini-Circuits	Power Amplifier	ZHL-42W-SMA	D111103#5	NCR	
Mini-Circuits	Power Amplifier	ZVE-8G-SMA	D042005 671800514	NCR	
Aisi	Attenuator	IEAT 3dB	N/A	NCR	

Table 8. Test Equipment List



8. Measurement Uncertainty

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR to be less than $\pm 19.62\%$ [8]. The frequency range of the measurement uncertainty is 750 ~ 5800MHz $\pm 10.1\%$

According to Std. C95.3 [9], the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of ± 1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ± 2 dB can be expected.

According to CENELEC [10], typical worst-case uncertainty of field measurements is ± 5 dB. For well-defined modulation characteristics the uncertainty can be reduced to ± 3 dB.

Item	Uncertainty Component	Uncertainty Value	Prob. Dist	Div.	C_i (1g)	C_i (10g)	Std. Unc. (1-g)	Std. Unc. (10-g)	V_i or V_{eff}
Measurement System									
u1	Probe Calibration ($k=1$)	$\pm 5.05\%$	Normal	1	1	1	$\pm 5.05\%$	$\pm 5.05\%$	∞
u2	Probe Isotropy	$\pm 7.6\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 3.1\%$	$\pm 3.1\%$	∞
u3	Boundary Effect	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
u4	Linearity	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
u5	System Detection Limit	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.58\%$	$\pm 0.58\%$	∞
u6	Readout Electronics	$\pm 0.3\%$	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
u7	Response Time	$\pm 0.8\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.5\%$	$\pm 0.5\%$	∞
u8	Integration Time	$\pm 2.6\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5\%$	$\pm 1.5\%$	∞
u9	RF Ambient Conditions	$\pm 0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0\%$	$\pm 0\%$	∞
u10	RF Ambient Reflections	$\pm 0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0\%$	$\pm 0\%$	∞
u11	Probe Positioner Mechanical Tolerance	$\pm 0.4\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.2\%$	$\pm 0.2\%$	∞
u12	Probe Positioning with respect to Phantom Shell	$\pm 2.9\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
u13	Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Test sample Related									
u14	Test sample Positioning	$\pm 3.6\%$	Normal	1	1	1	$\pm 3.6\%$	$\pm 3.6\%$	89
u15	Device Holder Uncertainty	$\pm 3.5\%$	Normal	1	1	1	$\pm 3.5\%$	$\pm 3.5\%$	5
u16	Output Power Variation - SAR drift measurement	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9\%$	$\pm 2.9\%$	∞
Phantom and Tissue Parameters									
u17	Phantom Uncertainty (shape and thickness tolerances)	$\pm 4.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3\%$	$\pm 2.3\%$	∞
u18	Liquid Conductivity - deviation from target values	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8\%$	$\pm 1.2\%$	∞
u19	Liquid Conductivity - measurement uncertainty	$\pm 1.93\%$	Normal	1	0.64	0.43	$\pm 1.24\%$	$\pm 0.83\%$	69
u20	Liquid Permittivity - deviation from target values	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.6	0.49	$\pm 1.7\%$	$\pm 1.4\%$	∞
u21	Liquid Permittivity - measurement uncertainty	$\pm 1.4\%$	Normal	1	0.6	0.49	$\pm 0.84\%$	$\pm 1.69\%$	69
Combined standard uncertainty			RSS				$\pm 9.81\%$	$\pm 9.62\%$	313
Expanded uncertainty (95% CONFIDENCE LEVEL)			$k=2$				$\pm 19.62\%$	$\pm 19.24\%$	

Table 9. Uncertainty Budget of DASY

9. Measurement Procedure

The measurement procedures are as follows:

1. For WLAN function, engineering testing software installed on Notebook can provide continuous transmitting signal.
2. Measure output power through RF cable and power meter
3. Set scan area, grid size and other setting on the DASY software
4. Find out the largest SAR result on these testing positions of each band
5. 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:

1. Power reference measurement
2. Area scan
3. Zoom scan
4. Power drift measurement

9.1 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

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



9.2 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 points and step size follow as below. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

Grid Type	Frequency		Step size (mm)			X*Y*Z (Point)	Cube size			Step size		
			X	Y	Z		X	Y	Z	X	Y	Z
uniform grid	$\leq 3\text{GHz}$	$\leq 2\text{GHz}$	≤ 8	≤ 8	≤ 5	5*5*7	32	32	30	8	8	5
		2G - 3G	≤ 5	≤ 5	≤ 5	7*7*7	30	30	30	5	5	5
	3 - 6GHz	3 - 4GHz	≤ 5	≤ 5	≤ 4	7*7*8	30	30	28	5	5	4
		4 - 5GHz	≤ 4	≤ 4	≤ 3	8*8*10	28	28	27	4	4	3
		5 - 6GHz	≤ 4	≤ 4	≤ 2	8*8*12	28	28	22	4	4	2

(Our measure settings are refer KDB Publication 865664 D01v01)

9.3 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. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

9.4 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.

9.5 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.



10. SAR Test Results Summary

10.1 Head Measurement SAR

Evaluated head SAR is not available.

10.2 Body Measurement SAR

Index.	Position	Band	Ch.	Data Rate	Side to Phantom	Spacing (mm)	SAR _{1g} (mW/g)	Power Drift	Burst Avg Power	Max tune-up	Reported SAR _{1g} (mW/g)
#1	Flat	IEEE 802.11b (ANT0)	6	1M	2	0	0.064	0.132	18.37	18.5	0.07
#2	Flat	IEEE 802.11b (ANT1)	6	1M	2	0	0.088	0.030	18.34	18.5	0.09
#3	Flat	IEEE 802.11a (ANT0)	36	6M	2	0	0.080	0.157	12.99	13.0	0.08
#4	Flat		48	6M	2	0	0.111	-0.048	12.98	13.0	0.11
#5	Flat		52	6M	2	0	0.277	-0.166	17.85	18.0	0.29
#6	Flat		60	6M	2	0	0.080	0.022	12.88	13.0	0.08
#7	Flat		104	6M	2	0	0.146	-0.101	15.97	16.0	0.15
#8	Flat		112	6M	2	0	0.164	0.039	15.89	16.0	0.17
#9	Flat		116	6M	2	0	0.213	-0.088	15.56	16.0	0.24
#10	Flat		124	6M	2	0	0.198	0.111	15.54	16.0	0.22
#14	Flat	IEEE 802.11a (ANT1)	36	6M	2	0	0.055	0.164	12.75	13.0	0.06
#15	Flat		40	6M	2	0	0.057	-0.107	12.84	13.0	0.06
#16	Flat		52	6M	2	0	0.256	0.015	17.88	18.0	0.26
#17	Flat		64	6M	2	0	0.216	0.137	12.75	13.0	0.23
#18	Flat		104	6M	2	0	0.214	0.014	15.72	16.0	0.23
#19	Flat		112	6M	2	0	0.333	-0.090	15.97	16.0	0.34
#20	Flat		116	6M	2	0	0.254	0.153	15.94	16.0	0.26
#21	Flat		124	6M	2	0	0.236	0.067	15.8	16.0	0.25
#11	Flat	IEEE 802.11n (5GHz) 20MHz (ANT0)	153	MCS0	2	0	0.219	-0.034	15.45	15.5	0.22
#12	Flat		157	MCS0	2	0	0.227	0.142	15.31	15.5	0.24
#13	Flat		165	MCS0	2	0	0.241	-0.040	15.12	15.5	0.26
#22	Flat	IEEE 802.11n (5GHz) 20MHz (ANT1)	157	MCS0	2	0	0.176	0.038	15.22	15.5	0.19
#23	Flat		161	MCS0	2	0	0.197	0.159	15.18	15.5	0.21
#24	Flat		165	MCS0	2	0	0.223	0.037	15.47	15.5	0.22

- Note: 1. According KDB 447498 D01 V05 section 4.1.4, the "Reported" explanation as below:
 "When SAR or MPE is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported."
 2. If actual power less than tune-up power that Scaling SAR is required.
 3. The formula of Reported SAR, that represent as below:

$$\text{Reported SAR} = \text{Original SAR} * 10^{[(\text{Tune-up power} - \text{Actual power})/10]}$$

 4. If the Channel's SAR_{1g} of maximum conducted power is > 0.8 mW/g, low, middle and high channel are supposed to be tested.
 5. Bystander SAR is not required when the distance of antenna to edge 4 or edge 5 is more than 25mm.
 6. If the conducted power of (IEEE 802.11g & IEEE 802.11n) are higher than IEEE 802.11b 0.25dB, (IEEE 802.11g & IEEE 802.11n) are supposed to be tested.

Index.	Position	Band	Ch.	Data Rate	Side to Phantom	Spacing (mm)	SAR _{1g} (mW/g)	Power Drift	Burst Avg Power	Max tune-up	Reported SAR _{1g} (mW/g)
#25	Flat	IEEE 802.11n (5GHz) 40MHz (ANT0+1)	6	1M	2	0	0.131	-0.180	21.4	21.5	0.13
#26	Flat		38	MCS8	2	0	0.174	-0.190	13.8	14.0	0.18
#27	Flat		46	MCS15	2	0	0.238	0.014	17.0	18.5	0.34
#28	Flat		54	MCS8	2	0	0.330	-0.035	13.6	14.0	0.36
#29	Flat		62	MCS8	2	0	0.290	-0.123	13.8	14.0	0.30
#30	Flat		102	MCS8	2	0	0.250	0.148	13.5	13.5	0.25
#31	Flat		110	MCS8	2	0	0.533	-0.164	17.2	20.0	1.02
#32	Flat		118	MCS8	2	0	0.703	-0.131	17.2	20.0	1.34
#33	Flat		126	MCS8	2	0	0.583	-0.128	17.1	20.0	1.14
#34	Flat		134	MCS8	2	0	0.564	-0.019	17.6	17.5	0.56
#35	Flat		151	MCS15	2	0	0.490	-0.060	17.5	19.0	0.69
#36	Flat		159	MCS15	2	0	0.509	0.187	17.0	18.5	0.72

- Note: 1. According KDB 447498 D01 V05 section 4.1.4, the "Reported" explanation as below:
 "When SAR or MPE is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported."
 2. If actual power less than tune-up power that Scaling SAR is required.
 3. The formula of Reported SAR, that represent as below:

$$\text{Reported SAR} = \text{Original SAR} * 10^{[(\text{Tune-up power} - \text{Actual power})/10]}$$

 4. If the Channel's SAR_{1g} of maximum conducted power is > 0.8 mW/g, low, middle and high channel are supposed to be tested.
 5. Bystander SAR is not required when the distance of antenna to edge 4 or edge 5 is more than 25mm.
 6. If the conducted power of (IEEE 802.11g & IEEE 802.11n) are higher than IEEE 802.11b 0.25dB, (IEEE 802.11g & IEEE 802.11n) are supposed to be tested.

10.3 Hot-spot mode Measurement SAR

Hot-spot mode SAR is not available.

10.4 Extremity Measurement SAR

Evaluated extremity SAR is not available.

10.5 SAR Measurement Variability

Detailed evaluations please refer KDB 865664 on 2.8.1 section.

SAR Measurement Variability is not available.



10.6 Std. C95.1-1999 RF Exposure Limit

Human Exposure	Population Uncontrolled Exposure (W/kg) or (mW/g)	Occupational Controlled Exposure (W/kg) or (mW/g)
Spatial Peak SAR* (head)	1.60	8.00
Spatial Peak SAR** (Whole Body)	0.08	0.40
Spatial Peak SAR*** (Partial-Body)	1.60	8.00
Spatial Peak SAR**** (Hands / Feet / Ankle / Wrist)	4.00	20.00

Table 10. Safety Limits for Partial Body Exposure

Notes :

- * The Spatial Peak value of the SAR averaged over any 1 gram of tissue.
(defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
- ** The Spatial Average value of the SAR averaged over the whole – body.
- *** The Spatial Average value of the SAR averaged over the partial – body.
- **** The Spatial Peak value of the SAR averaged over any 10 grams of tissue.
(defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Population / Uncontrolled Environments : are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Occupational / Controlled Environments : are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

11. Conclusion

The SAR test values found for the portable mobile phone **Qualcomm Atheros, Inc. Trade Name : Qualcomm Atheros Model(s) : AR5B22** is below the maximum recommended level of 1.6 W/kg (mW/g).

12. References

- [1] Std. C95.1-1999, "American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300KHz to 100GHz", New York.
- [2] NCRP, National Council on Radiation Protection and Measurements, "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields", NCRP report NO. 86, 1986.
- [3] T. Schmid, O. Egger, and N. Kuster, "Automatic E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp, 105-113, Jan. 1996.
- [4] K. Pokovi^c, T. Schmid, and N. Kuster, "Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequency", in ICECOM'97, Dubrovnik, October 15-17, 1997, pp.120-124.
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- [6] N. Kuster, and Q. Balzano, "Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz", IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [7] Robert J. Renka, "Multivariate Interpolation Of Large Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988 , pp. 139-148.
- [8] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.
- [9] Std. C95.3-1991, "IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, Aug. 1992.
- [10] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10KHz-300GHz, Jan. 1995.
- [11] IEEE Std 1528™-2003 - IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head From Wireless Communications Devices: Measurement Techniques
- [12] IEEE Std 1528a™-2005 (Amendment to IEEE Std 1528™-2003), IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques

13. SAR Measurement Guidance

- [1] KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01
- [2] KDB 447498 D01 General RF Exposure Guidance v05
- [3] KDB 248227 D01 SAR meas for 802 11 a b g v01r02.
- [4] KDB 616217 D04 SAR for laptop and tablets v01



Appendix A - System Performance Check

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/3/2013 6:47:10 PM

System Performance Check at 2450MHz_20130503_Body

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:712

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(7.88, 7.88, 7.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 2450MH/Area Scan (61x61x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (interpolated) = 18.1 mW/g

System Performance Check at 2450MH/Zoom Scan (7x7x7)/Cube 0:

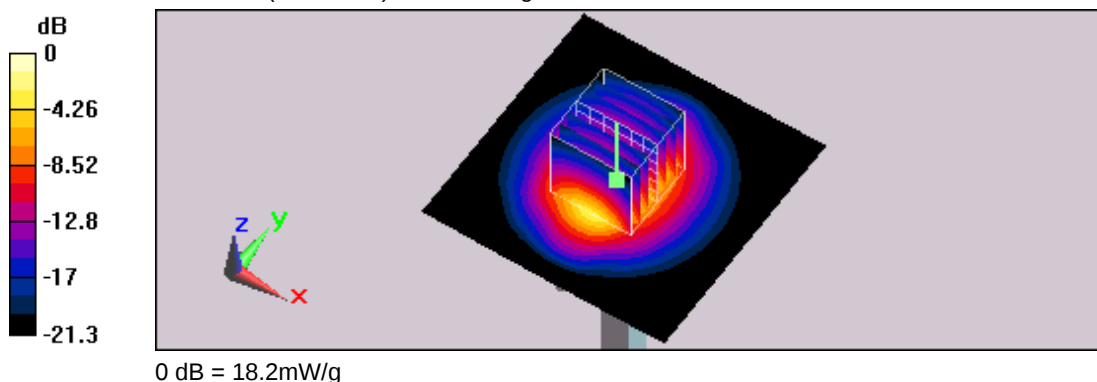
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 96.2 V/m; Power Drift = 0.025 dB

Peak SAR (extrapolated) = 24.6 W/kg

SAR(1 g) = 12 mW/g; SAR(10 g) = 5.62 mW/g

Maximum value of SAR (measured) = 18.2 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 10:08:22 PM

System Performance Check at 2450MHz_20130508_Body

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:712

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(7.88, 7.88, 7.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 2450MHz/Area Scan (61x61x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 20.1 mW/g

System Performance Check at 2450MHz/Zoom Scan (7x7x7)/Cube 0:

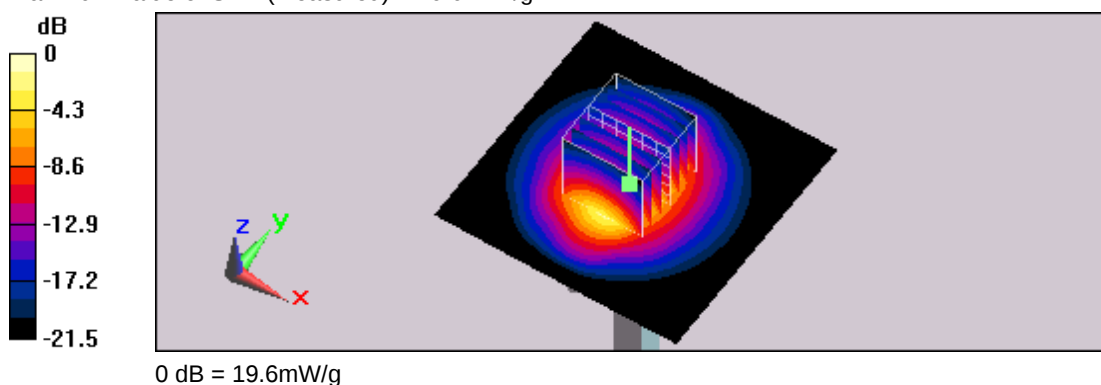
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.3 V/m; Power Drift = -0.123 dB

Peak SAR (extrapolated) = 26.7 W/kg

SAR(1 g) = 12.9 mW/g; SAR(10 g) = 6.01 mW/g

Maximum value of SAR (measured) = 19.6 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/19/2013 3:51:54 AM

System Performance Check at 2450MHz_20130519_Body

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:712

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(7.88, 7.88, 7.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 2450MH/Area Scan (61x61x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (interpolated) = 20.2 mW/g

System Performance Check at 2450MH/Zoom Scan (7x7x7)/Cube 0:

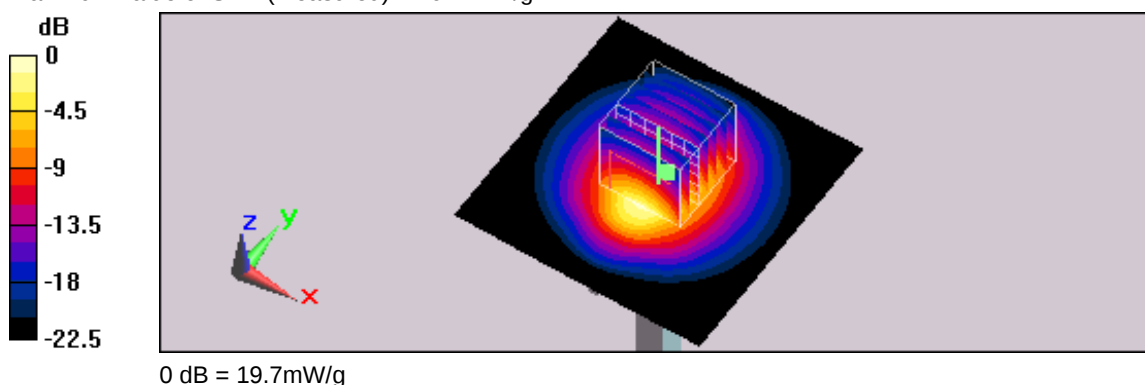
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 101.0 V/m; Power Drift = -0.041 dB

Peak SAR (extrapolated) = 26.8 W/kg

SAR(1 g) = 12.9 mW/g; SAR(10 g) = 6.03 mW/g

Maximum value of SAR (measured) = 19.7 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/6/2013 8:55:51 PM

System Performance Check at 5200MHz_20130506_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.52$ mho/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.49, 4.49, 4.49); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5200MH/Area Scan (91x91x1):

Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (interpolated) = 18.7 mW/g

System Performance Check at 5200MH/Zoom Scan (8x8x7)/Cube 0:

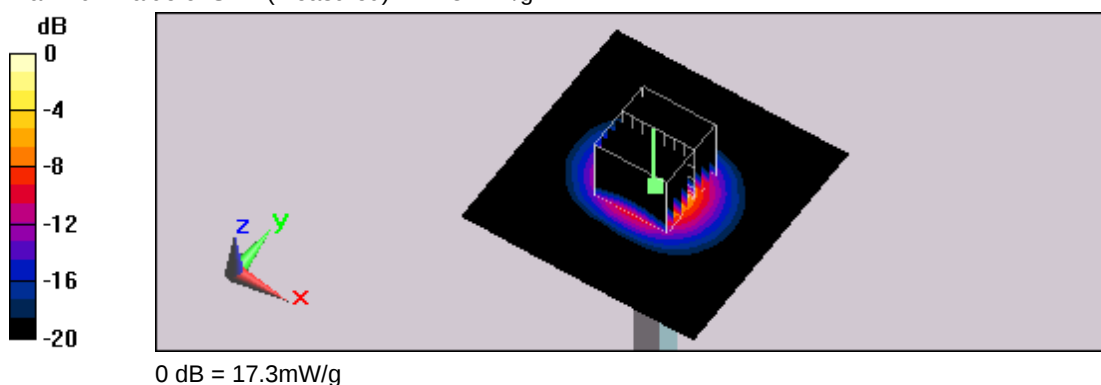
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm

Reference Value = 68.4 V/m; Power Drift = -0.031 dB

Peak SAR (extrapolated) = 29.9 W/kg

SAR(1 g) = 7.42 mW/g; SAR(10 g) = 2.1 mW/g

Maximum value of SAR (measured) = 17.3 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 9:45:10 PM

System Performance Check at 5200MHz_20130507_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.52$ mho/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.49, 4.49, 4.49); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5200MH/Area Scan (91x91x1):

Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (interpolated) = 18.8 mW/g

System Performance Check at 5200MH/Zoom Scan (8x8x7)/Cube 0:

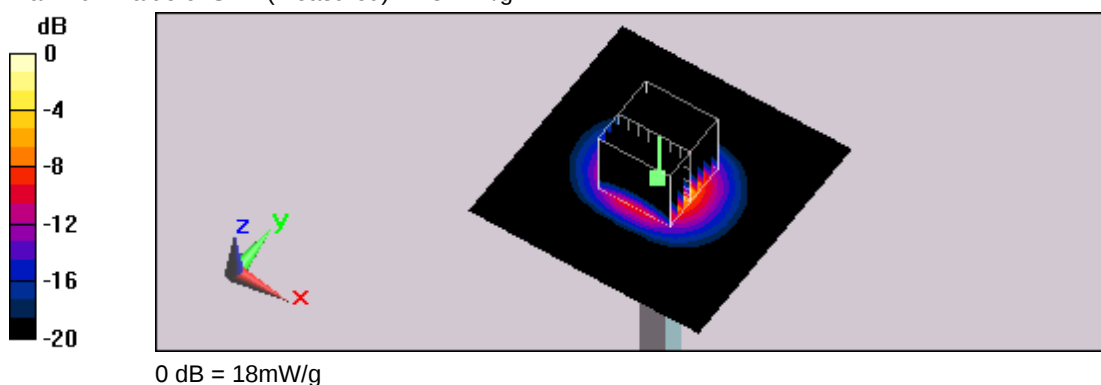
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm

Reference Value = 68.4 V/m; Power Drift = 0.016 dB

Peak SAR (extrapolated) = 30.2 W/kg

SAR(1 g) = 7.52 mW/g; SAR(10 g) = 2.13 mW/g

Maximum value of SAR (measured) = 18 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/19/2013 6:27:32 AM

System Performance Check at 5200MHz_20130519_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.52$ mho/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.49, 4.49, 4.49); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5200MH/Area Scan (91x91x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 17.8 mW/g

System Performance Check at 5200MH/Zoom Scan (8x8x7)/Cube 0:

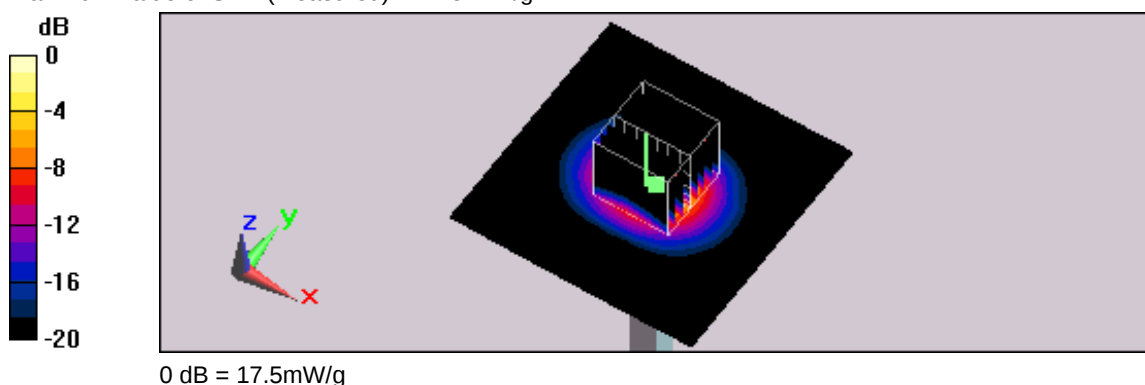
Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 67 V/m; Power Drift = -0.131 dB

Peak SAR (extrapolated) = 30 W/kg

SAR(1 g) = 7.42 mW/g; SAR(10 g) = 2.1 mW/g

Maximum value of SAR (measured) = 17.5 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/6/2013 9:48:10 PM

System Performance Check at 5300MHz_20130506_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5300$ MHz; $\sigma = 5.65$ mho/m; $\epsilon_r = 47.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.27, 4.27, 4.27); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5300MH/Area Scan (91x91x1):

Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (interpolated) = 19.1 mW/g

System Performance Check at 5300MH/Zoom Scan (8x8x7)/Cube 0:

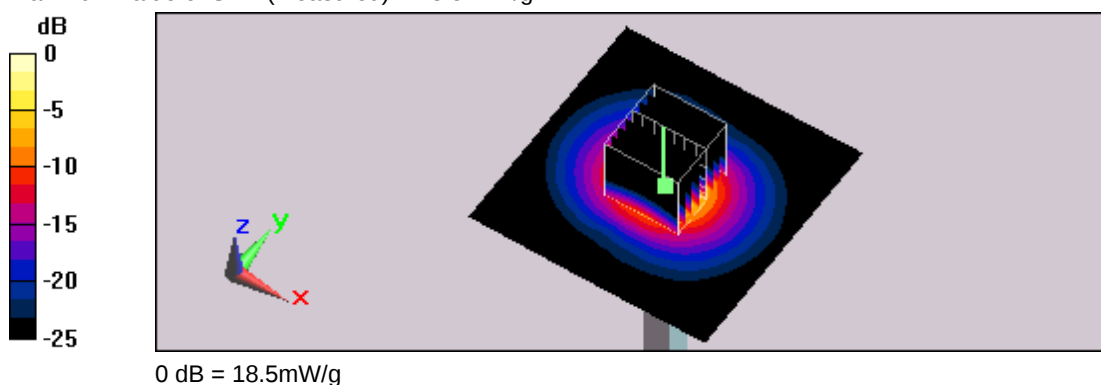
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm

Reference Value = 68.7 V/m; Power Drift = -0.083 dB

Peak SAR (extrapolated) = 32.4 W/kg

SAR(1 g) = 7.81 mW/g; SAR(10 g) = 2.19 mW/g

Maximum value of SAR (measured) = 18.5 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 10:42:58 PM

System Performance Check at 5300MHz_20130507_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5300$ MHz; $\sigma = 5.65$ mho/m; $\epsilon_r = 47.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.27, 4.27, 4.27); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5300MH/Area Scan (91x91x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 18 mW/g

System Performance Check at 5300MH/Zoom Scan (8x8x7)/Cube 0:

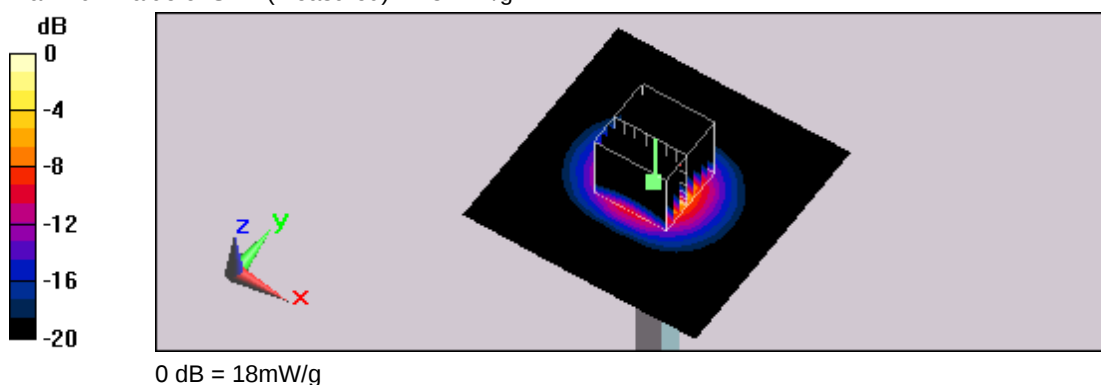
Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.8 V/m; Power Drift = -0.036 dB

Peak SAR (extrapolated) = 31.2 W/kg

SAR(1 g) = 7.49 mW/g; SAR(10 g) = 2.11 mW/g

Maximum value of SAR (measured) = 18 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/19/2013 6:59:10 AM

System Performance Check at 5300MHz_20130519_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5300$ MHz; $\sigma = 5.65$ mho/m; $\epsilon_r = 47.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.27, 4.27, 4.27); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5300MH/Area Scan (91x91x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 18.5 mW/g

System Performance Check at 5300MH/Zoom Scan (8x8x7)/Cube 0:

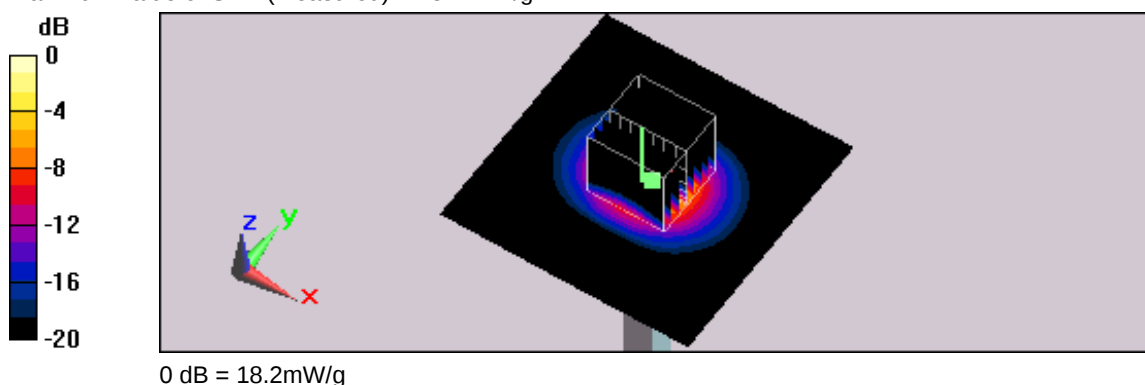
Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 67.5 V/m; Power Drift = -0.136 dB

Peak SAR (extrapolated) = 31.8 W/kg

SAR(1 g) = 7.63 mW/g; SAR(10 g) = 2.14 mW/g

Maximum value of SAR (measured) = 18.2 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/6/2013 10:33:55 PM

System Performance Check at 5600MHz_20130506_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5600$ MHz; $\sigma = 6.02$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5600MH/Area Scan (91x91x1):

Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (interpolated) = 21.9 mW/g

System Performance Check at 5600MH/Zoom Scan (8x8x7)/Cube 0:

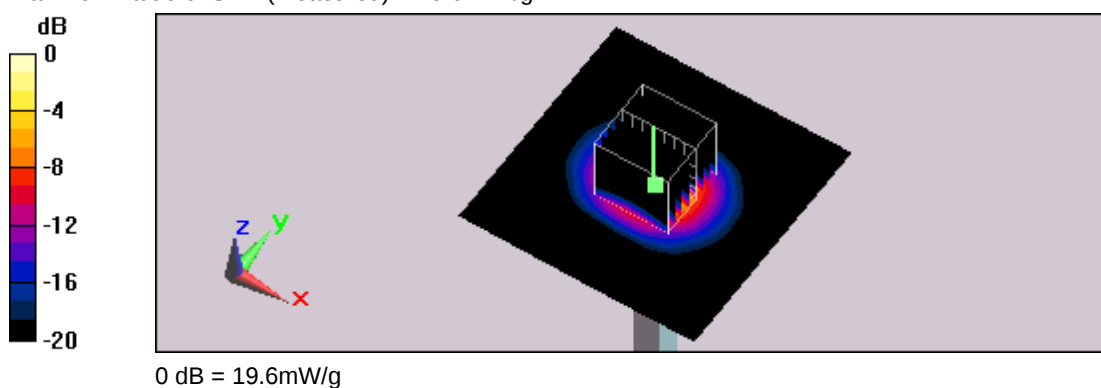
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm

Reference Value = 73.2 V/m; Power Drift = -0.081 dB

Peak SAR (extrapolated) = 34.3 W/kg

SAR(1 g) = 8.14 mW/g; SAR(10 g) = 2.26 mW/g

Maximum value of SAR (measured) = 19.6 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 11:25:59 PM

System Performance Check at 5600MHz_20130507_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5600$ MHz; $\sigma = 6.02$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5600MH/Area Scan (91x91x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 21.2 mW/g

System Performance Check at 5600MH/Zoom Scan (8x8x7)/Cube 0:

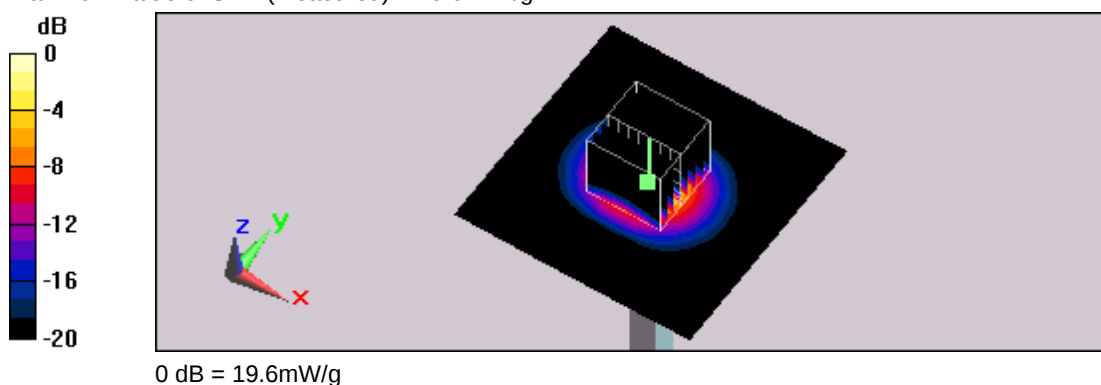
Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 72.4 V/m; Power Drift = -0.067 dB

Peak SAR (extrapolated) = 33.5 W/kg

SAR(1 g) = 7.95 mW/g; SAR(10 g) = 2.22 mW/g

Maximum value of SAR (measured) = 19.6 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/20/2013 8:44:44 AM

System Performance Check at 5600MHz_20130520_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5600$ MHz; $\sigma = 6.02$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5600MH/Area Scan (91x91x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 19.8 mW/g

System Performance Check at 5600MH/Zoom Scan (8x8x7)/Cube 0:

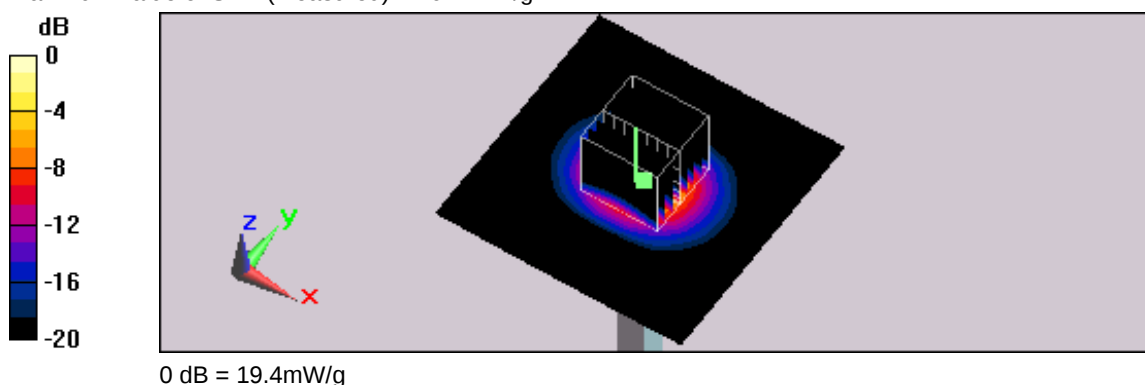
Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 69.6 V/m; Power Drift = -0.075 dB

Peak SAR (extrapolated) = 33.4 W/kg

SAR(1 g) = 8.02 mW/g; SAR(10 g) = 2.23 mW/g

Maximum value of SAR (measured) = 19.4 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/6/2013 11:44:35 PM

System Performance Check at 5800MHz_20130507_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5800$ MHz; $\sigma = 6.27$ mho/m; $\epsilon_r = 46.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5800MH/Area Scan (91x91x1):

Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (interpolated) = 19.6 mW/g

System Performance Check at 5800MH/Zoom Scan (8x8x7)/Cube 0:

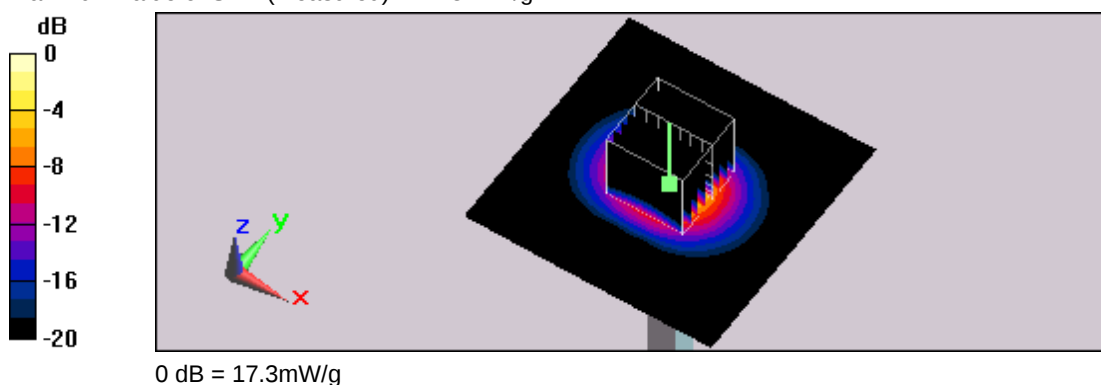
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm

Reference Value = 68.5 V/m; Power Drift = -0.067 dB

Peak SAR (extrapolated) = 31.8 W/kg

SAR(1 g) = 7.03 mW/g; SAR(10 g) = 1.95 mW/g

Maximum value of SAR (measured) = 17.3 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 12:18:08 AM

System Performance Check at 5800MHz_20130508_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5800$ MHz; $\sigma = 6.27$ mho/m; $\epsilon_r = 46.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5800MH/Area Scan (91x91x1):

Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (interpolated) = 19.3 mW/g

System Performance Check at 5800MH/Zoom Scan (8x8x7)/Cube 0:

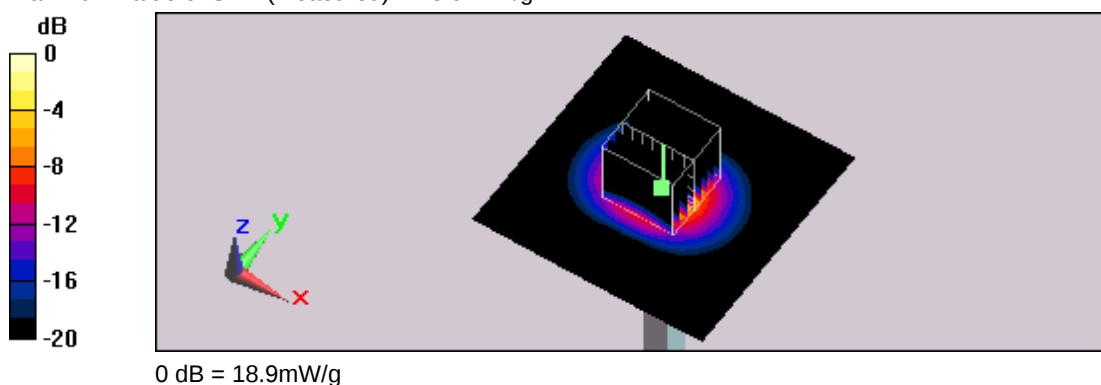
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm

Reference Value = 68 V/m; Power Drift = -0.033 dB

Peak SAR (extrapolated) = 33.9 W/kg

SAR(1 g) = 7.56 mW/g; SAR(10 g) = 2.1 mW/g

Maximum value of SAR (measured) = 18.9 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/20/2013 9:48:27 AM

System Performance Check at 5800MHz_20130520_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5800 \text{ MHz}$; $\sigma = 6.27 \text{ mho/m}$; $\epsilon_r = 46.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5800MH/Area Scan (91x91x1):

Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (interpolated) = 18.4 mW/g

System Performance Check at 5800MH/Zoom Scan (8x8x7)/Cube 0:

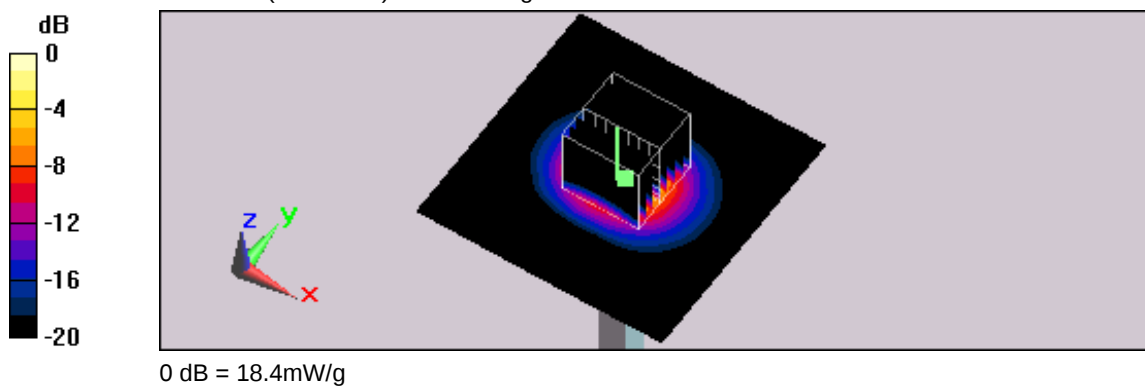
Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$

Reference Value = 66.1 V/m; Power Drift = -0.137 dB

Peak SAR (extrapolated) = 33.2 W/kg

SAR(1 g) = 7.42 mW/g; SAR(10 g) = 2.07 mW/g

Maximum value of SAR (measured) = 18.4 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/21/2013 10:45:10 PM

System Performance Check at 5200MHz_20130521_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.52$ mho/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.49, 4.49, 4.49); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5200MH/Area Scan (91x91x1):

Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (interpolated) = 18.8 mW/g

System Performance Check at 5200MH/Zoom Scan (8x8x7)/Cube 0:

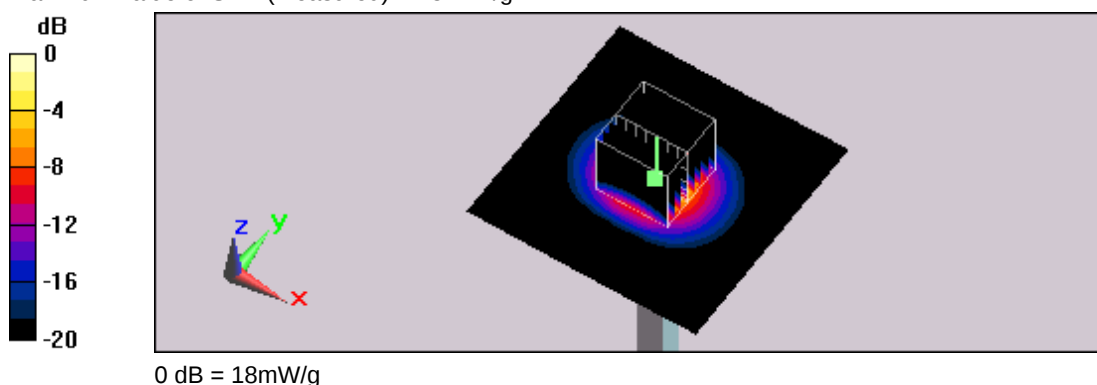
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm

Reference Value = 68.4 V/m; Power Drift = 0.016 dB

Peak SAR (extrapolated) = 30.2 W/kg

SAR(1 g) = 7.52 mW/g; SAR(10 g) = 2.13 mW/g

Maximum value of SAR (measured) = 18 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/21/2013 11:25:59 PM

System Performance Check at 5600MHz_20130521_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5600$ MHz; $\sigma = 6.02$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5600MH/Area Scan (91x91x1):

Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (interpolated) = 21.2 mW/g

System Performance Check at 5600MH/Zoom Scan (8x8x7)/Cube 0:

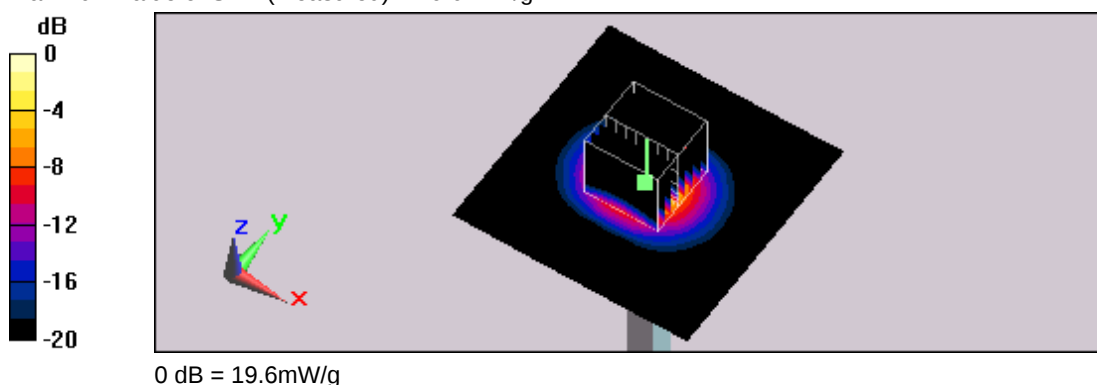
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm

Reference Value = 72.4 V/m; Power Drift = -0.067 dB

Peak SAR (extrapolated) = 33.5 W/kg

SAR(1 g) = 7.95 mW/g; SAR(10 g) = 2.22 mW/g

Maximum value of SAR (measured) = 19.6 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/22/2013 12:18:08 AM

System Performance Check at 5800MHz_20130522_Body

DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1021

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

Medium parameters used: $f = 5800 \text{ MHz}$; $\sigma = 6.27 \text{ mho/m}$; $\epsilon_r = 46.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 5800MH/Area Scan (91x91x1):

Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (interpolated) = 19.3 mW/g

System Performance Check at 5800MH/Zoom Scan (8x8x7)/Cube 0:

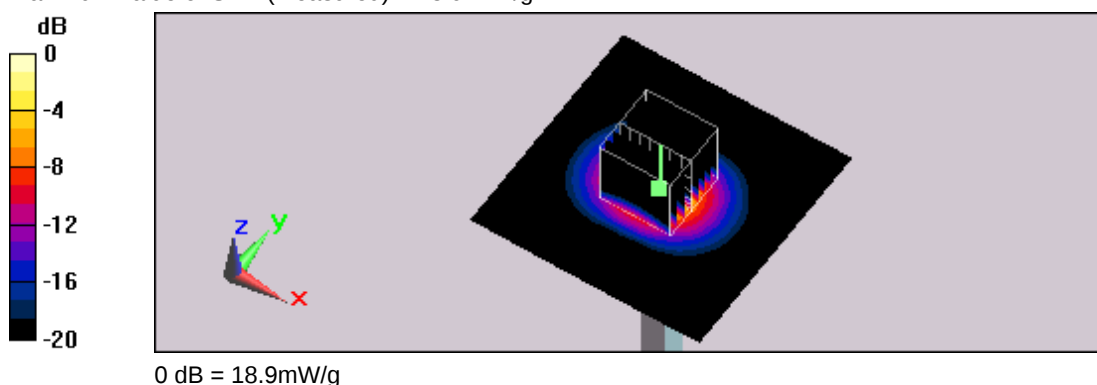
Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$

Reference Value = 68 V/m; Power Drift = -0.033 dB

Peak SAR (extrapolated) = 33.9 W/kg

SAR(1 g) = 7.56 mW/g; SAR(10 g) = 2.1 mW/g

Maximum value of SAR (measured) = 18.9 mW/g



Appendix B - SAR Measurement Data

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/4/2013 1:50:01 PM

#1_Flat_802.11b CH6_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(7.88, 7.88, 7.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: $dx=10$ mm, $dy=10$ mm

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

Flat/Zoom Scan (7x7x7)/Cube 0:

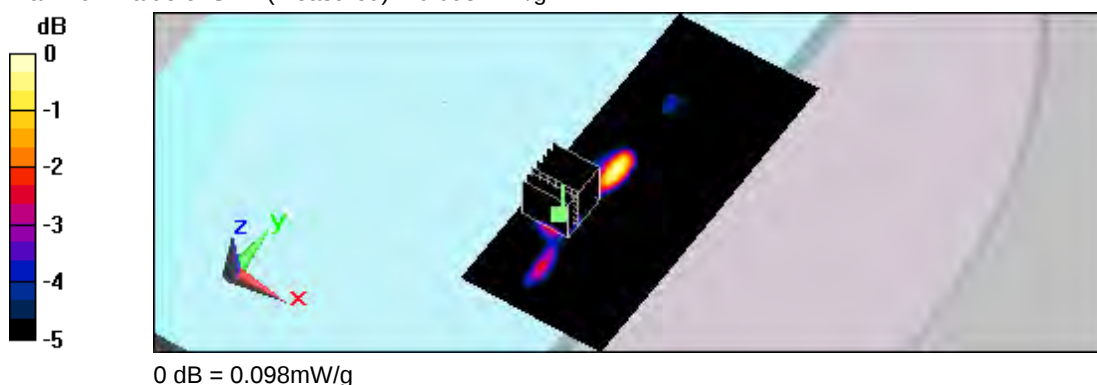
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 6.86 V/m; Power Drift = 0.132 dB

Peak SAR (extrapolated) = 0.143 W/kg

SAR(1 g) = 0.064 mW/g; SAR(10 g) = 0.032 mW/g

Maximum value of SAR (measured) = 0.098 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/4/2013 3:49:56 PM

#2_Flat_802.11b CH6_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(7.88, 7.88, 7.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.132 mW/g

Flat/Zoom Scan (7x7x7)/Cube 0:

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

Reference Value = 3.3 V/m; Power Drift = 0.030 dB

Peak SAR (extrapolated) = 0.190 W/kg

SAR(1 g) = 0.088 mW/g; SAR(10 g) = 0.045 mW/g

Maximum value of SAR (measured) = 0.135 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 2:15:34 AM

#3_Flat_802.11a CH36_6M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5180 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5180$ MHz; $\sigma = 5.5$ mho/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.49, 4.49, 4.49); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.162 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

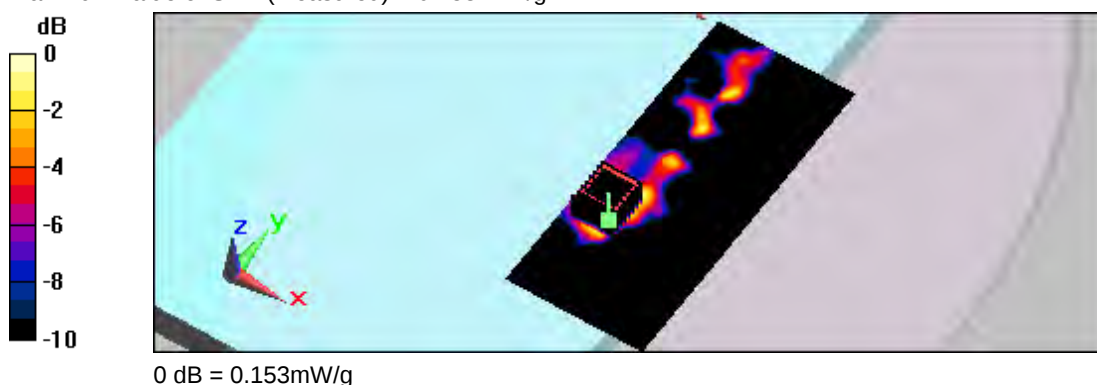
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 3.31 V/m; Power Drift = 0.157 dB

Peak SAR (extrapolated) = 0.328 W/kg

SAR(1 g) = 0.080 mW/g; SAR(10 g) = 0.029 mW/g

Maximum value of SAR (measured) = 0.153 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 5:09:59 AM

#4_Flat_802.11a CH48_6M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5240 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5240$ MHz; $\sigma = 5.54$ mho/m; $\epsilon_r = 47.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.49, 4.49, 4.49); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

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

Flat/Zoom Scan (8x8x12)/Cube 0:

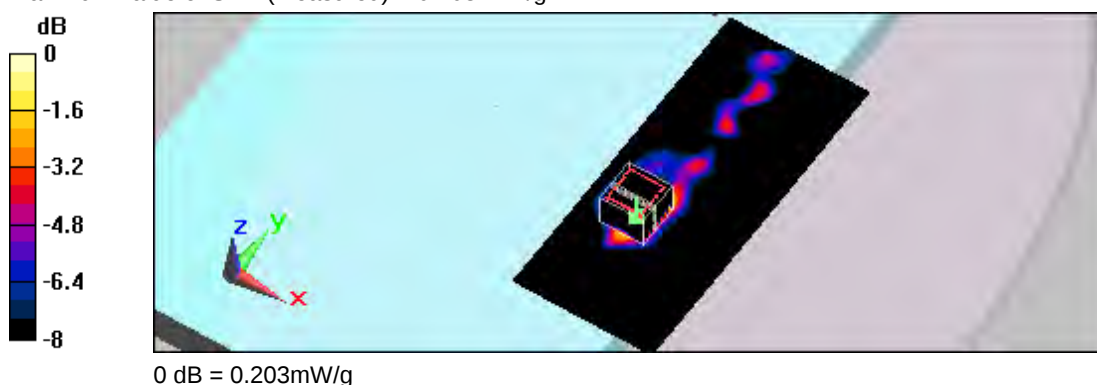
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 2.93 V/m; Power Drift = -0.048 dB

Peak SAR (extrapolated) = 0.466 W/kg

SAR(1 g) = 0.111 mW/g; SAR(10 g) = 0.043 mW/g

Maximum value of SAR (measured) = 0.203 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 6:12:57 AM

#5_Flat_802.11a CH52_6M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5260 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5260$ MHz; $\sigma = 5.57$ mho/m; $\epsilon_r = 47.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.27, 4.27, 4.27); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.524 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

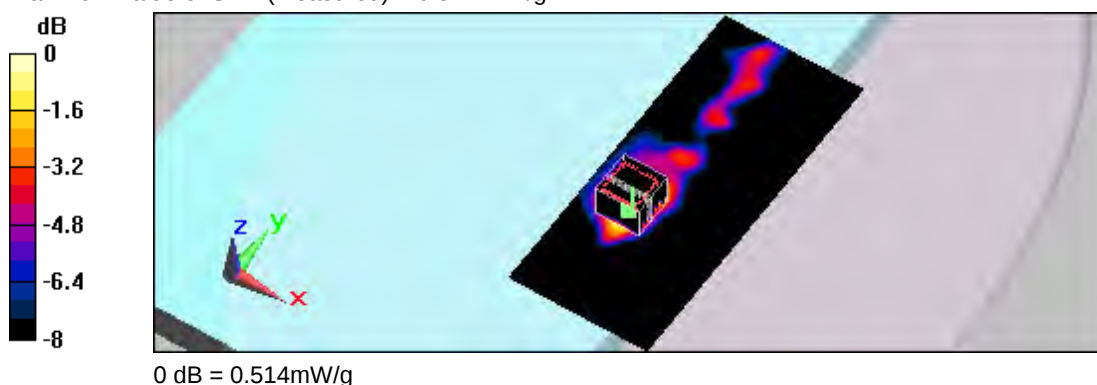
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.09 V/m; Power Drift = -0.166 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.277 mW/g; SAR(10 g) = 0.111 mW/g

Maximum value of SAR (measured) = 0.514 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 7:11:11 AM

#6_Flat_802.11a CH60_6M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5300$ MHz; $\sigma = 5.65$ mho/m; $\epsilon_r = 47.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.27, 4.27, 4.27); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.148 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

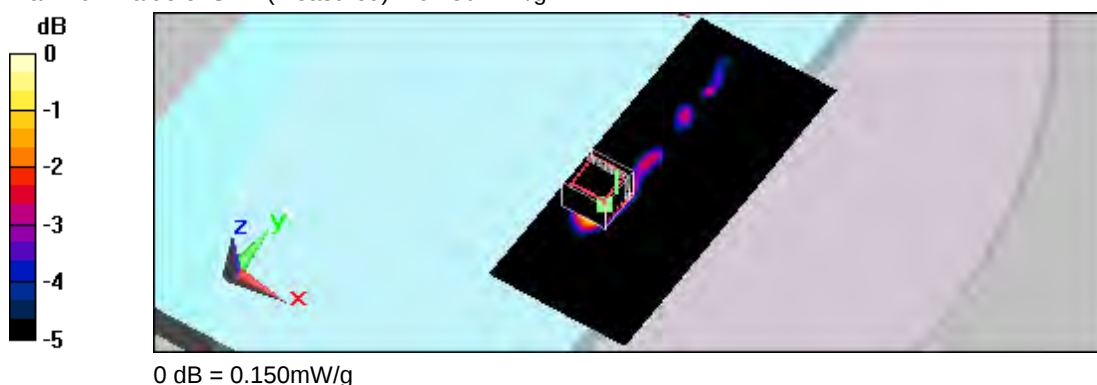
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 3.87 V/m; Power Drift = 0.022 dB

Peak SAR (extrapolated) = 0.355 W/kg

SAR(1 g) = 0.080 mW/g; SAR(10 g) = 0.033 mW/g

Maximum value of SAR (measured) = 0.150 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 9:19:29 AM

#7_Flat_802.11a CH104_6M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5520 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5520$ MHz; $\sigma = 5.91$ mho/m; $\epsilon_r = 47$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.96, 3.96, 3.96); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.276 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

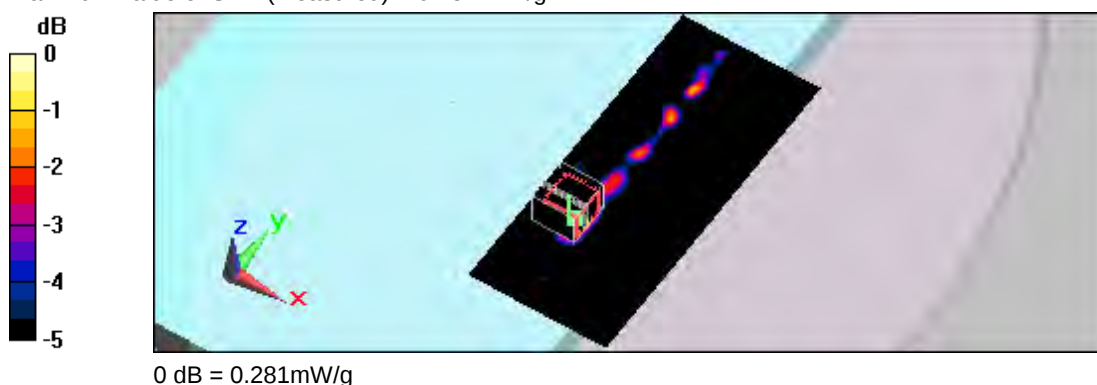
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 5.88 V/m; Power Drift = -0.101 dB

Peak SAR (extrapolated) = 0.623 W/kg

SAR(1 g) = 0.146 mW/g; SAR(10 g) = 0.051 mW/g

Maximum value of SAR (measured) = 0.281 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 1:23:08 PM

#8_Flat_802.11a CH112_6M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5560 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5560$ MHz; $\sigma = 5.95$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.302 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

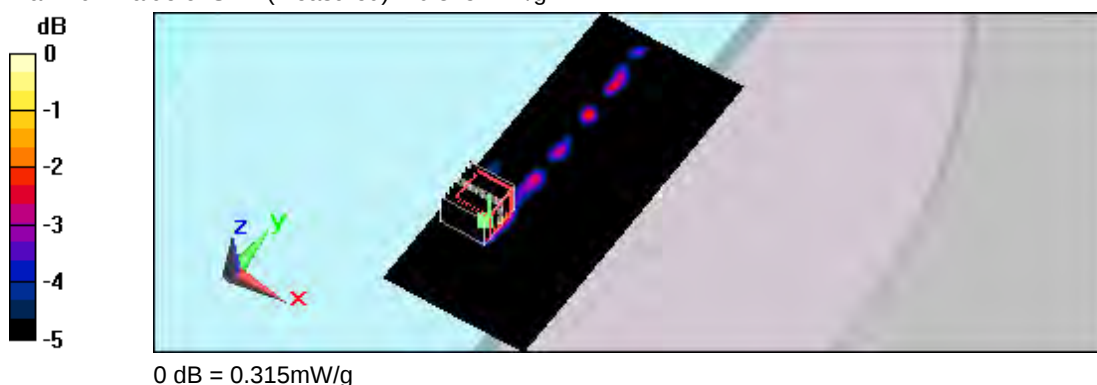
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.04 V/m; Power Drift = 0.039 dB

Peak SAR (extrapolated) = 0.656 W/kg

SAR(1 g) = 0.164 mW/g; SAR(10 g) = 0.058 mW/g

Maximum value of SAR (measured) = 0.315 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 10:30:33 AM

#9_Flat_802.11a CH116_6M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5580$ MHz; $\sigma = 5.98$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.436 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

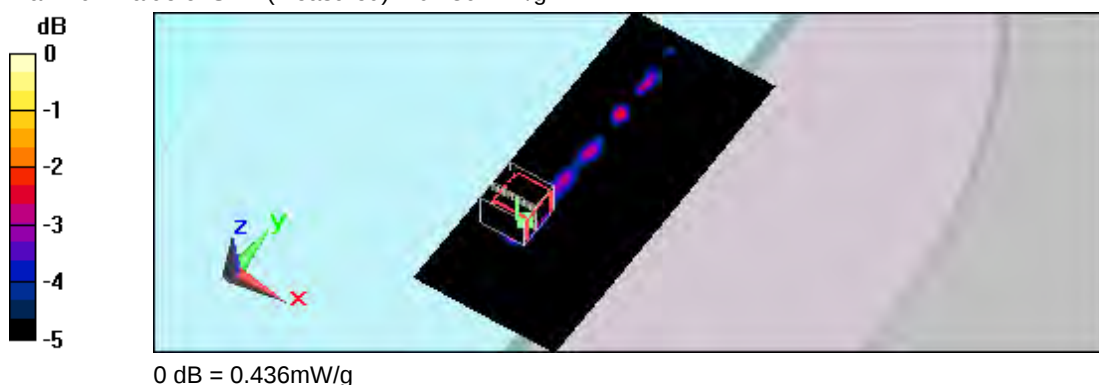
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.76 V/m; Power Drift = -0.088 dB

Peak SAR (extrapolated) = 0.823 W/kg

SAR(1 g) = 0.213 mW/g; SAR(10 g) = 0.070 mW/g

Maximum value of SAR (measured) = 0.436 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 11:39:09 AM

#10_Flat_802.11a CH124_6M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5620 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5620$ MHz; $\sigma = 6.03$ mho/m; $\epsilon_r = 46.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.354 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

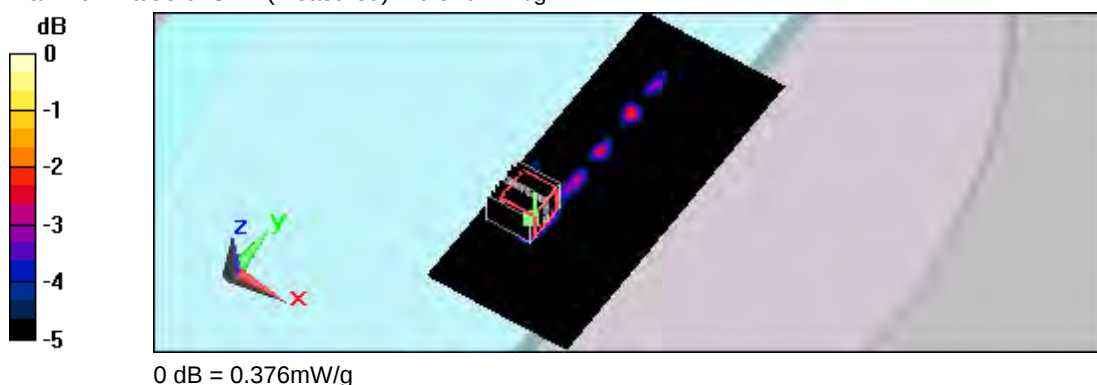
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.18 V/m; Power Drift = 0.111 dB

Peak SAR (extrapolated) = 0.796 W/kg

SAR(1 g) = 0.198 mW/g; SAR(10 g) = 0.071 mW/g

Maximum value of SAR (measured) = 0.376 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 5:56:43 PM

#14_Flat_802.11a CH36_6M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5180 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5180$ MHz; $\sigma = 5.5$ mho/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.49, 4.49, 4.49); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection) /13/2013
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

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

Flat/Zoom Scan (8x8x12)/Cube 0:

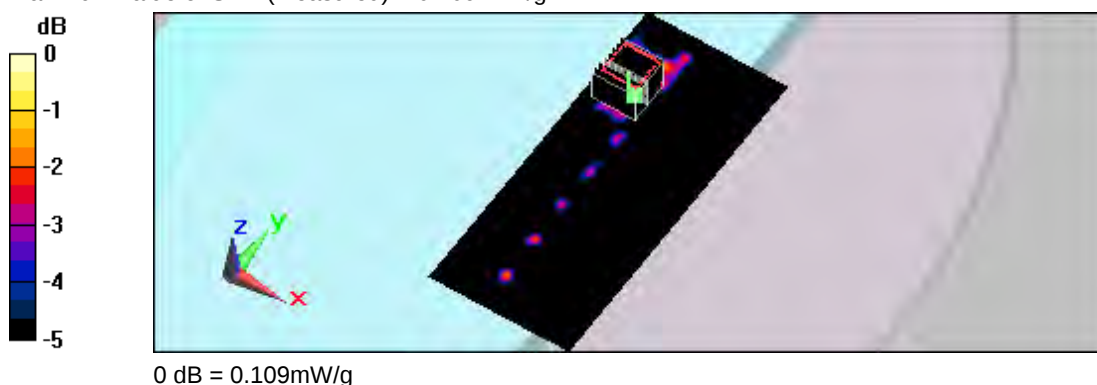
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 2.94 V/m; Power Drift = 0.164 dB

Peak SAR (extrapolated) = 0.230 W/kg

SAR(1 g) = 0.055 mW/g; SAR(10 g) = 0.019 mW/g

Maximum value of SAR (measured) = 0.109 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 7:03:30 PM

#15_Flat_802.11a CH40_6M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.52$ mho/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.49, 4.49, 4.49); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.109 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

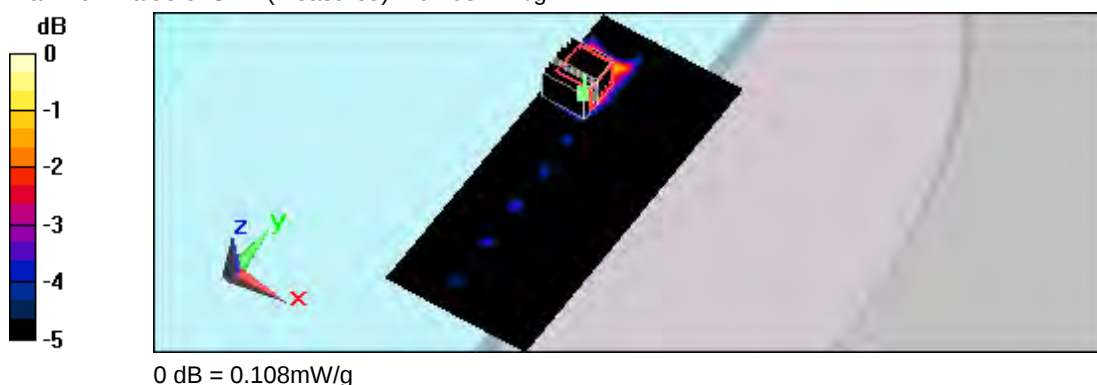
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 2.98 V/m; Power Drift = -0.107 dB

Peak SAR (extrapolated) = 0.232 W/kg

SAR(1 g) = 0.057 mW/g; SAR(10 g) = 0.020 mW/g

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



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 1:29:51 AM

#16_Flat_802.11a CH52_6M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5260 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5260$ MHz; $\sigma = 5.57$ mho/m; $\epsilon_r = 47.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.27, 4.27, 4.27); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.453 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

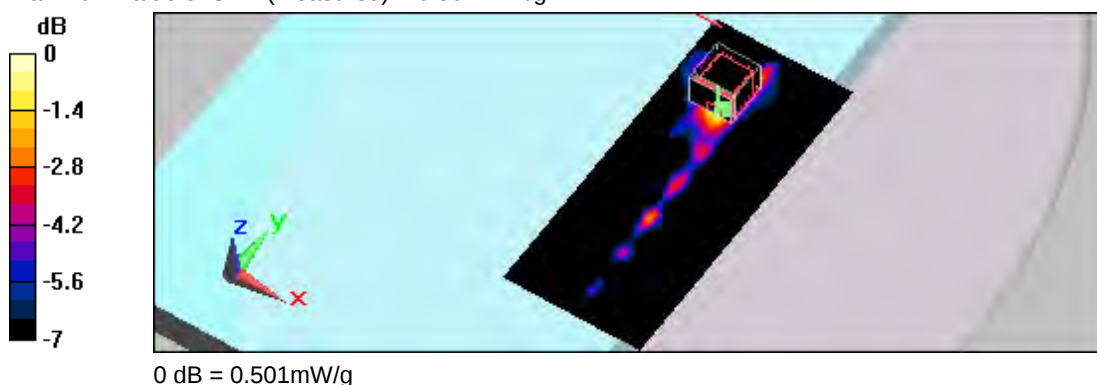
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 5.74 V/m; Power Drift = 0.015 dB

Peak SAR (extrapolated) = 1.02 W/kg

SAR(1 g) = 0.256 mW/g; SAR(10 g) = 0.099 mW/g

Maximum value of SAR (measured) = 0.501 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 3:11:45 AM

#17_Flat_802.11a CH64_6M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5320 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5320$ MHz; $\sigma = 5.68$ mho/m; $\epsilon_r = 47.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.27, 4.27, 4.27); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.422 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

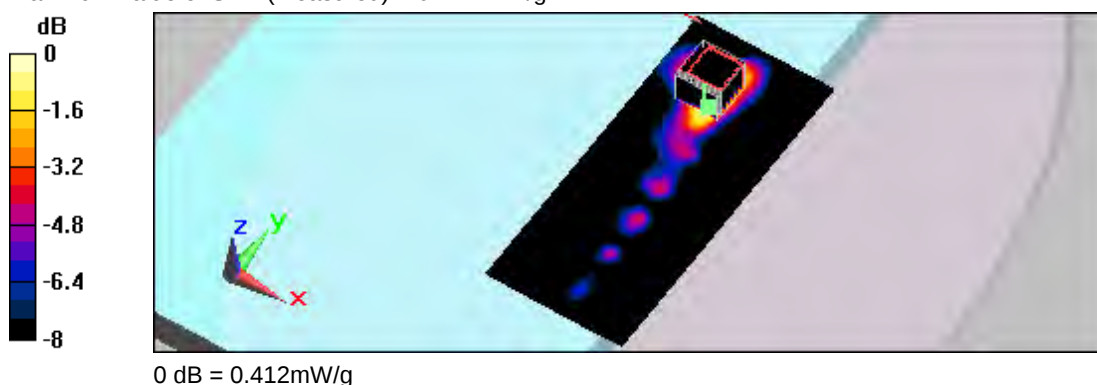
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 4.86 V/m; Power Drift = 0.137 dB

Peak SAR (extrapolated) = 0.875 W/kg

SAR(1 g) = 0.216 mW/g; SAR(10 g) = 0.092 mW/g

Maximum value of SAR (measured) = 0.412 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 4:48:55 AM

#18_Flat_802.11a CH104_6M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5520 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5520$ MHz; $\sigma = 5.91$ mho/m; $\epsilon_r = 47$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.96, 3.96, 3.96); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.401 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

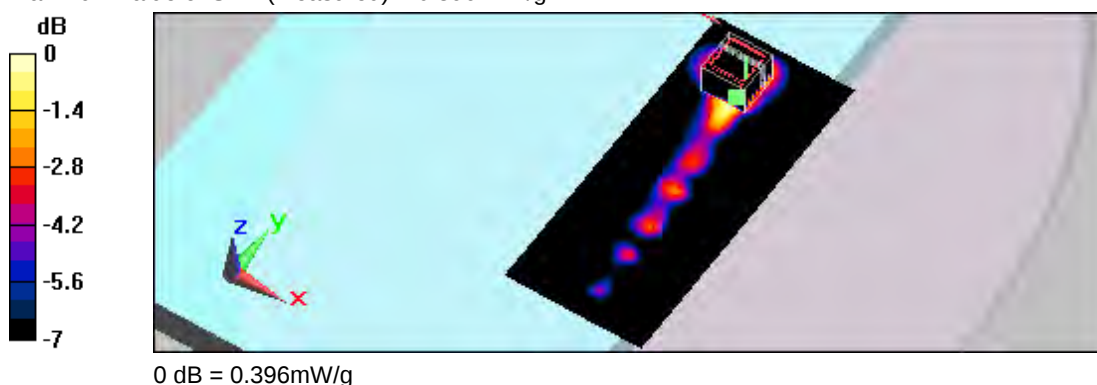
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.46 V/m; Power Drift = 0.014 dB

Peak SAR (extrapolated) = 0.814 W/kg

SAR(1 g) = 0.214 mW/g; SAR(10 g) = 0.091 mW/g

Maximum value of SAR (measured) = 0.396 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 7:35:00 AM

#19_Flat_802.11a CH112_6M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5560 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5560$ MHz; $\sigma = 5.95$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.600 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 9.14 V/m; Power Drift = -0.090 dB

Peak SAR (extrapolated) = 1.36 W/kg

SAR(1 g) = 0.333 mW/g; SAR(10 g) = 0.129 mW/g

Maximum value of SAR (measured) = 0.652 mW/g

Flat/Zoom Scan (8x8x12)/Cube 1:

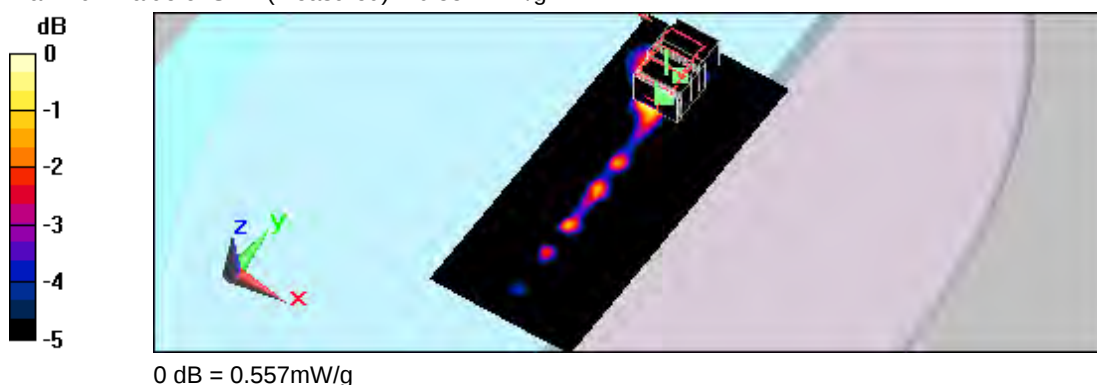
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 9.14 V/m; Power Drift = -0.090 dB

Peak SAR (extrapolated) = 1.09 W/kg

SAR(1 g) = 0.301 mW/g; SAR(10 g) = 0.120 mW/g

Maximum value of SAR (measured) = 0.557 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 10:16:34 AM

#20_Flat_802.11a CH116_6M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5580$ MHz; $\sigma = 5.98$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.462 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

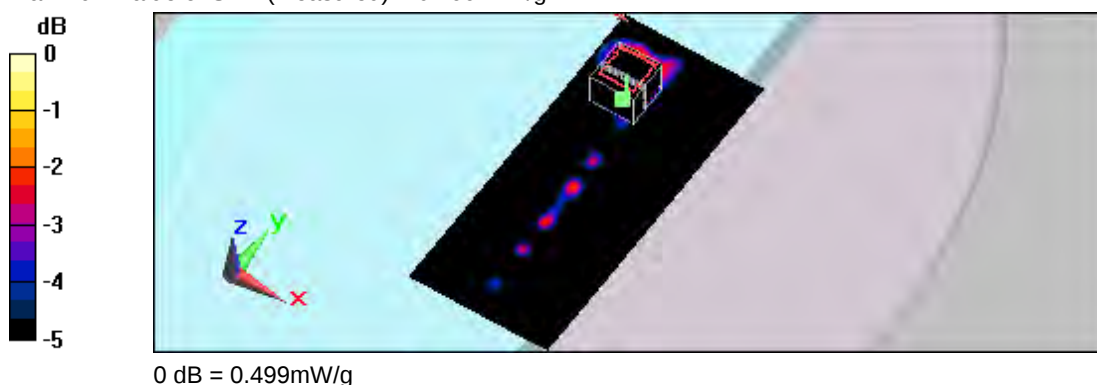
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 7.91 V/m; Power Drift = 0.153 dB

Peak SAR (extrapolated) = 1.05 W/kg

SAR(1 g) = 0.254 mW/g; SAR(10 g) = 0.097 mW/g

Maximum value of SAR (measured) = 0.499 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 11:20:17 AM

#21_Flat_802.11a CH124_6M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11a; Frequency: 5620 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5620$ MHz; $\sigma = 6.03$ mho/m; $\epsilon_r = 46.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.466 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

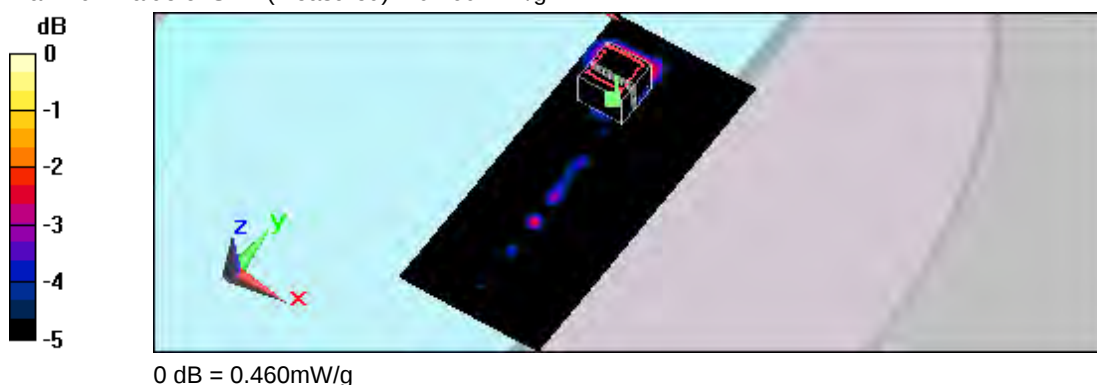
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.19 V/m; Power Drift = 0.067 dB

Peak SAR (extrapolated) = 0.986 W/kg

SAR(1 g) = 0.236 mW/g; SAR(10 g) = 0.090 mW/g

Maximum value of SAR (measured) = 0.460 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 2:35:39 PM

#11_Flat_802.11n CH153_HT20_6.5M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT20; Frequency: 5765 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5765$ MHz; $\sigma = 6.23$ mho/m; $\epsilon_r = 46.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.394 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

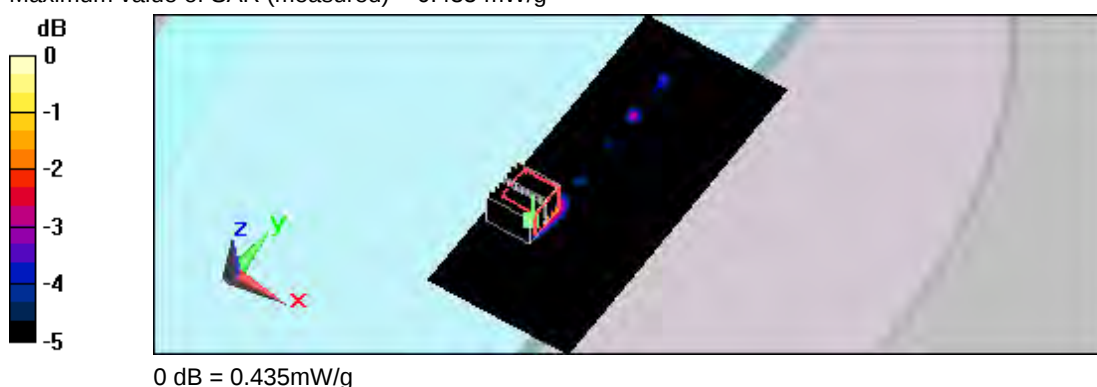
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 5.83 V/m; Power Drift = -0.034 dB

Peak SAR (extrapolated) = 0.941 W/kg

SAR(1 g) = 0.219 mW/g; SAR(10 g) = 0.078 mW/g

Maximum value of SAR (measured) = 0.435 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 3:43:13 PM

#12_Flat_802.11n CH157_HT20_6.5M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT20; Frequency: 5785 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5785$ MHz; $\sigma = 6.25$ mho/m; $\epsilon_r = 46.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.414 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 5.73 V/m; Power Drift = 0.142 dB

Peak SAR (extrapolated) = 0.995 W/kg

SAR(1 g) = 0.227 mW/g; SAR(10 g) = 0.079 mW/g

Maximum value of SAR (measured) = 0.457 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/7/2013 4:49:15 PM

#13_Flat_802.11n CH165_HT20_6.5M_Side 2 to phantom 0mm_Antenna 0

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT20; Frequency: 5825 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5825 \text{ MHz}$; $\sigma = 6.28 \text{ mho/m}$; $\epsilon_r = 46.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (interpolated) = 0.433 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Reference Value = 5.8 V/m; Power Drift = -0.040 dB

Peak SAR (extrapolated) = 1.08 W/kg

SAR(1 g) = 0.241 mW/g; SAR(10 g) = 0.086 mW/g

Maximum value of SAR (measured) = 0.463 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 1:15:08 PM

#22_Flat_802.11n CH157_HT20_6.5M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT20; Frequency: 5785 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5785 \text{ MHz}$; $\sigma = 6.25 \text{ mho/m}$; $\epsilon_r = 46.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (interpolated) = 0.320 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

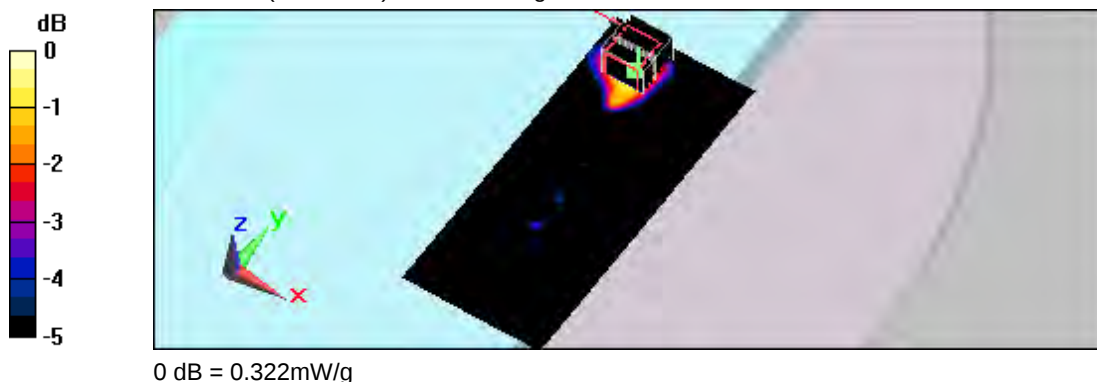
Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Reference Value = 4.6 V/m; Power Drift = 0.038 dB

Peak SAR (extrapolated) = 0.695 W/kg

SAR(1 g) = 0.176 mW/g; SAR(10 g) = 0.071 mW/g

Maximum value of SAR (measured) = 0.322 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 2:29:31 PM

#23_Flat_802.11n CH161_HT20_6.5M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT20; Frequency: 5805 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5805$ MHz; $\sigma = 6.27$ mho/m; $\epsilon_r = 46.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.360 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 4.25 V/m; Power Drift = 0.159 dB

Peak SAR (extrapolated) = 0.746 W/kg

SAR(1 g) = 0.197 mW/g; SAR(10 g) = 0.077 mW/g

Maximum value of SAR (measured) = 0.363 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/8/2013 3:33:40 PM

#24_Flat_802.11n CH165_HT20_6.5M_Side 2 to phantom 0mm_Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT20; Frequency: 5825 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5825$ MHz; $\sigma = 6.28$ mho/m; $\epsilon_r = 46.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x211x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.411 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 4.36 V/m; Power Drift = 0.037 dB

Peak SAR (extrapolated) = 0.859 W/kg

SAR(1 g) = 0.223 mW/g; SAR(10 g) = 0.088 mW/g

Maximum value of SAR (measured) = 0.416 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/19/2013 4:35:43 AM

#25_Flat_802.11b CH6_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(7.88, 7.88, 7.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.181 mW/g

Flat/Zoom Scan (7x7x7)/Cube 0:

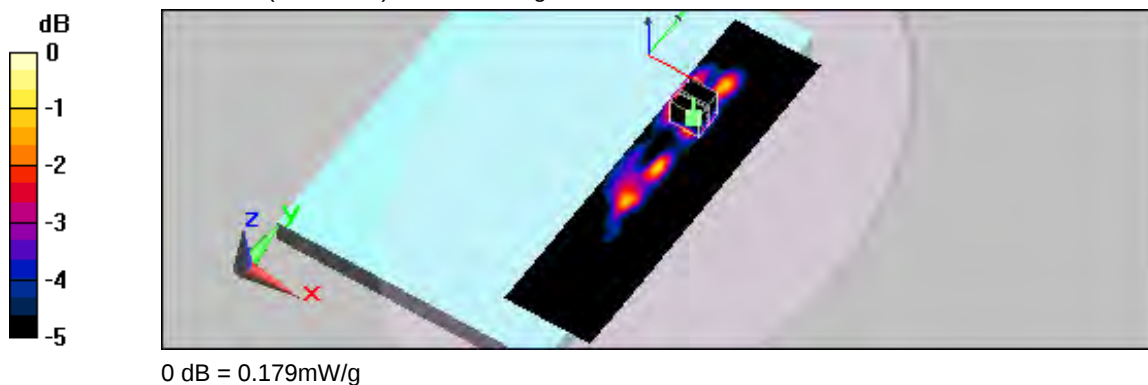
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.82 V/m; Power Drift = -0.180 dB

Peak SAR (extrapolated) = 0.240 W/kg

SAR(1 g) = 0.131 mW/g; SAR(10 g) = 0.088 mW/g

Maximum value of SAR (measured) = 0.179 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/19/2013 12:34:10 PM

#26_Flat_802.11n CH38_HT40_27M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5190 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5190$ MHz; $\sigma = 5.51$ mho/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.49, 4.49, 4.49); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.209 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

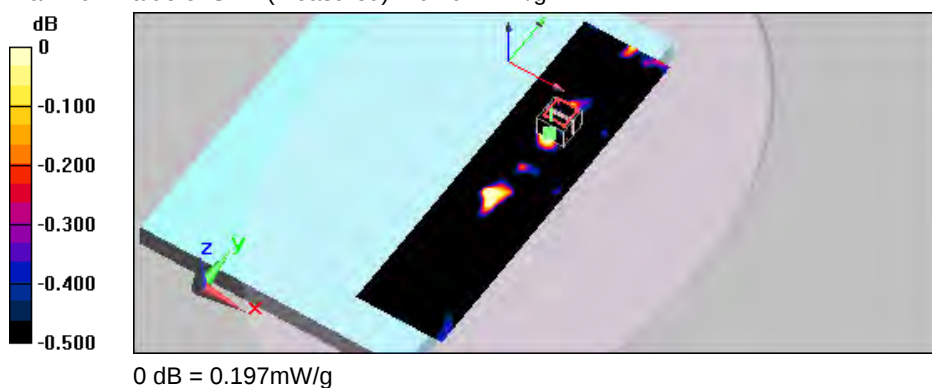
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.49 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 0.354 W/kg

SAR(1 g) = 0.174 mW/g; SAR(10 g) = 0.167 mW/g

Maximum value of SAR (measured) = 0.197 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/22/2013 2:54:50 AM

#27_Flat_802.11n CH46_HT40_270M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5230 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5230$ MHz; $\sigma = 5.54$ mho/m; $\epsilon_r = 47.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.49, 4.49, 4.49); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.345 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 7.85 V/m; Power Drift = 0.014 dB

Peak SAR (extrapolated) = 0.813 W/kg

SAR(1 g) = 0.238 mW/g; SAR(10 g) = 0.201 mW/g

Maximum value of SAR (measured) = 0.303 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/19/2013 11:14:13 PM

#28_Flat_802.11n CH54_HT40_27M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5270 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5270$ MHz; $\sigma = 5.59$ mho/m; $\epsilon_r = 47.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.27, 4.27, 4.27); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.446 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 8.21 V/m; Power Drift = -0.035 dB

Peak SAR (extrapolated) = 0.858 W/kg

SAR(1 g) = 0.330 mW/g; SAR(10 g) = 0.250 mW/g

Maximum value of SAR (measured) = 0.441 mW/g



0 dB = 0.441mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/20/2013 12:27:32 AM

#29_Flat_802.11n CH62_HT40_27M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5310 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5310$ MHz; $\sigma = 5.66$ mho/m; $\epsilon_r = 47.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(4.27, 4.27, 4.27); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.355 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

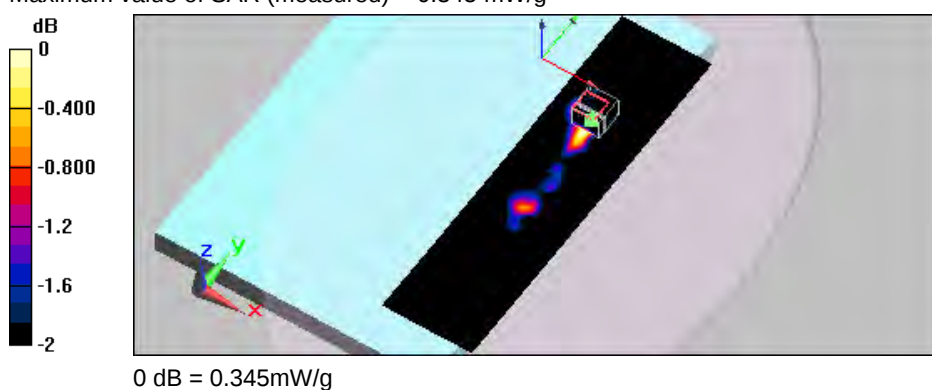
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 7.22 V/m; Power Drift = -0.123 dB

Peak SAR (extrapolated) = 0.792 W/kg

SAR(1 g) = 0.290 mW/g; SAR(10 g) = 0.240 mW/g

Maximum value of SAR (measured) = 0.345 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/20/2013 2:13:19 AM

#30_Flat_802.11n CH102_HT40_27M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5510 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5510$ MHz; $\sigma = 5.91$ mho/m; $\epsilon_r = 47.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.96, 3.96, 3.96); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.266 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.7 V/m; Power Drift = 0.148 dB

Peak SAR (extrapolated) = 0.342 W/kg

SAR(1 g) = 0.250 mW/g; SAR(10 g) = 0.234 mW/g

Maximum value of SAR (measured) = 0.282 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/20/2013 3:26:36 AM

#31_Flat_802.11n CH110_HT40_27M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5550 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 5550$ MHz; $\sigma = 5.93$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.96, 3.96, 3.96); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.783 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 10.5 V/m; Power Drift = -0.164 dB

Peak SAR (extrapolated) = 1.53 W/kg

SAR(1 g) = 0.533 mW/g; SAR(10 g) = 0.357 mW/g

Maximum value of SAR (measured) = 0.782 mW/g

Flat/Zoom Scan (8x8x12)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 10.5 V/m; Power Drift = -0.164 dB

Peak SAR (extrapolated) = 1.58 W/kg

SAR(1 g) = 0.525 mW/g; SAR(10 g) = 0.357 mW/g

Maximum value of SAR (measured) = 0.786 mW/g



0 dB = 0.786mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/20/2013 5:08:47 AM

#32_Flat_802.11n CH118_HT40_27M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5590 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5590$ MHz; $\sigma = 6$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.11 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 12.3 V/m; Power Drift = -0.131 dB

Peak SAR (extrapolated) = 2.31 W/kg

SAR(1 g) = 0.703 mW/g; SAR(10 g) = 0.400 mW/g

Maximum value of SAR (measured) = 1.12 mW/g

Flat/Zoom Scan (8x8x12)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 12.3 V/m; Power Drift = -0.131 dB

Peak SAR (extrapolated) = 2.25 W/kg

SAR(1 g) = 0.666 mW/g; SAR(10 g) = 0.390 mW/g

Maximum value of SAR (measured) = 1.1 mW/g



0 dB = 1.1mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/20/2013 6:51:08 AM

#33_Flat_802.11n CH126_HT40_27M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5630 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5630$ MHz; $\sigma = 6.03$ mho/m; $\epsilon_r = 46.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.855 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 9.65 V/m; Power Drift = -0.128 dB

Peak SAR (extrapolated) = 1.84 W/kg

SAR(1 g) = 0.583 mW/g; SAR(10 g) = 0.376 mW/g

Maximum value of SAR (measured) = 0.871 mW/g

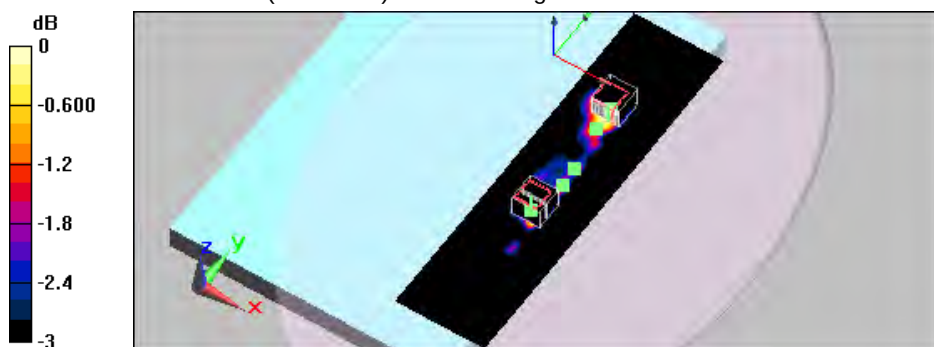
Flat/Zoom Scan (8x8x12)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 9.65 V/m; Power Drift = -0.128 dB

Peak SAR (extrapolated) = 1.74 W/kg

SAR(1 g) = 0.530 mW/g; SAR(10 g) = 0.373 mW/g

Maximum value of SAR (measured) = 0.784 mW/g



0 dB = 0.784mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/20/2013 11:26:05 AM

#34_Flat_802.11n CH134_HT40_27M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5670 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5670$ MHz; $\sigma = 6.04$ mho/m; $\epsilon_r = 46.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.63, 3.63, 3.63); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.852 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 11.1 V/m; Power Drift = -0.019 dB

Peak SAR (extrapolated) = 1.63 W/kg

SAR(1 g) = 0.564 mW/g; SAR(10 g) = 0.363 mW/g

Maximum value of SAR (measured) = 0.814 mW/g

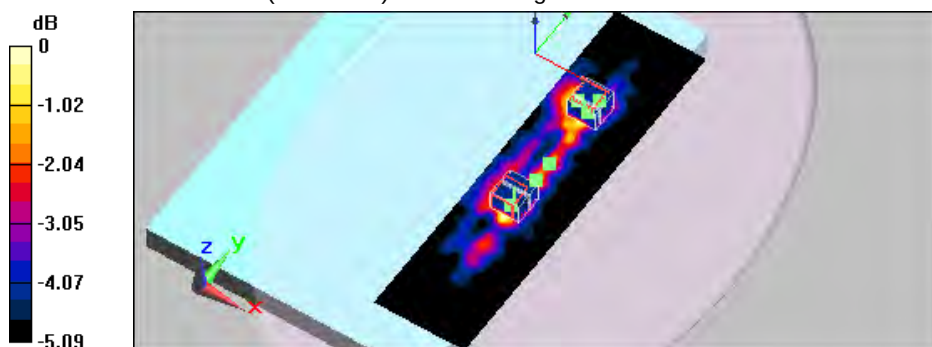
Flat/Zoom Scan (8x8x12)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 11.1 V/m; Power Drift = -0.019 dB

Peak SAR (extrapolated) = 1.44 W/kg

SAR(1 g) = 0.488 mW/g; SAR(10 g) = 0.349 mW/g

Maximum value of SAR (measured) = 0.699 mW/g



0 dB = 0.699mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/22/2013 4:38:04 AM

#35_Flat_802.11n CH151_HT40_270M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5755 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5755$ MHz; $\sigma = 6.22$ mho/m; $\epsilon_r = 46.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.725 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 9.07 V/m; Power Drift = -0.060 dB

Peak SAR (extrapolated) = 1.67 W/kg

SAR(1 g) = 0.490 mW/g; SAR(10 g) = 0.316 mW/g

Maximum value of SAR (measured) = 0.729 mW/g

Flat/Zoom Scan (8x8x12)/Cube 1:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 9.07 V/m; Power Drift = -0.060 dB

Peak SAR (extrapolated) = 1.12 W/kg

SAR(1 g) = 0.391 mW/g; SAR(10 g) = 0.292 mW/g

Maximum value of SAR (measured) = 0.553 mW/g



0 dB = 0.553mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 5/22/2013 6:22:55 AM

#36_Flat_802.11n_CH159_HT40_270M_Side 2 to phantom 0mm_Antenna 0 and Antenna 1

DUT: AR5B22; Type: PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card; FCC ID: PPD-AR5B22

Communication System: IEEE 802.11n(5GHz)HT40; Frequency: 5795 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5795$ MHz; $\sigma = 6.26$ mho/m; $\epsilon_r = 46.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(3.88, 3.88, 3.88); Calibrated: 2/20/2013
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2/13/2013
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (91x361x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.753 mW/g

Flat/Zoom Scan (8x8x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 9 V/m; Power Drift = 0.187 dB

Peak SAR (extrapolated) = 1.83 W/kg

SAR(1 g) = 0.509 mW/g; SAR(10 g) = 0.317 mW/g

Maximum value of SAR (measured) = 0.759 mW/g

Flat/Zoom Scan (8x8x12)/Cube 1:

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 9 V/m; Power Drift = 0.187 dB

Peak SAR (extrapolated) = 1.44 W/kg

SAR(1 g) = 0.427 mW/g; SAR(10 g) = 0.295 mW/g

Maximum value of SAR (measured) = 0.605 mW/g



0 dB = 0.605mW/g



Appendix C - Calibration

All of the instruments Calibration information are listed below.

- Dipole _ D2450V2 SN:712 Calibration No.D2450V2-712_Feb13
- Dipole _ D5GHzV2 SN:1021 Calibration No.D5GHzV2-1021_Feb13
- Probe _ EX3DV3 SN:3519 Calibration No.EX3-3519_Feb13
- DAE _ DAE4 SN:779 Calibration No.DAE4-779_Feb13

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



S Schweizerischer Kalibrierdienst
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S Swiss Calibration Service

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

Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **D2450V2-712_Feb13**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 712**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **February 19, 2013**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01840)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 20, 2013

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

Certificate No: D2450V2-712_Feb13

Page 1 of 8

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



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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.9 $\pm$ 6 %	1.85 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.5 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.9 $\pm$ 6 %	2.02 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.9 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.3 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.95 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.5 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.8 \Omega + 1.3 j\Omega$
Return Loss	- 26.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$49.4 \Omega + 5.0 j\Omega$
Return Loss	- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.158 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
Manufactured on	July 05, 2002

DASY5 Validation Report for Head TSL

Date: 19.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 712

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.85$ S/m; $\epsilon_r = 37.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

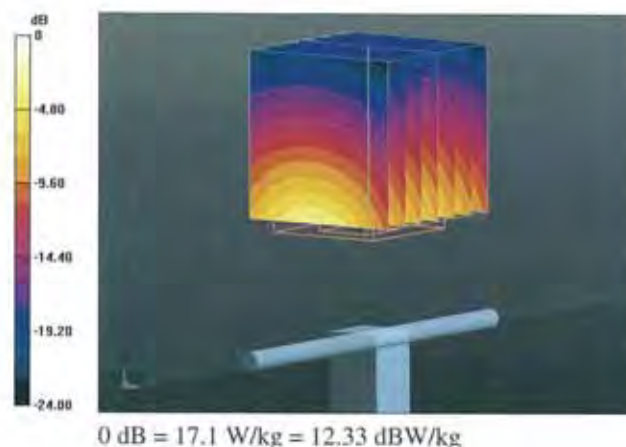
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.359 V/m; Power Drift = 0.05 dB

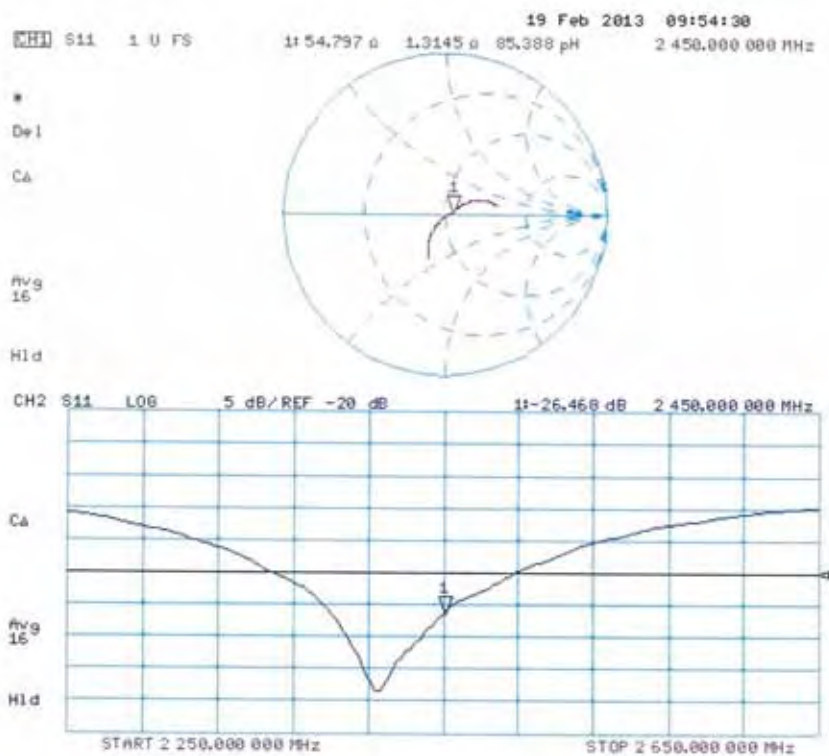
Peak SAR (extrapolated) = 28.2 W/kg

SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.2 W/kg

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



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 18.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 712

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ S/m; $\epsilon_r = 50.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

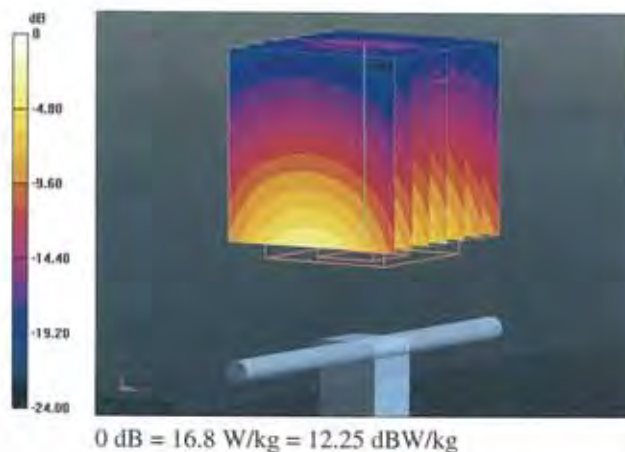
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.989 V/m; Power Drift = 0.02 dB

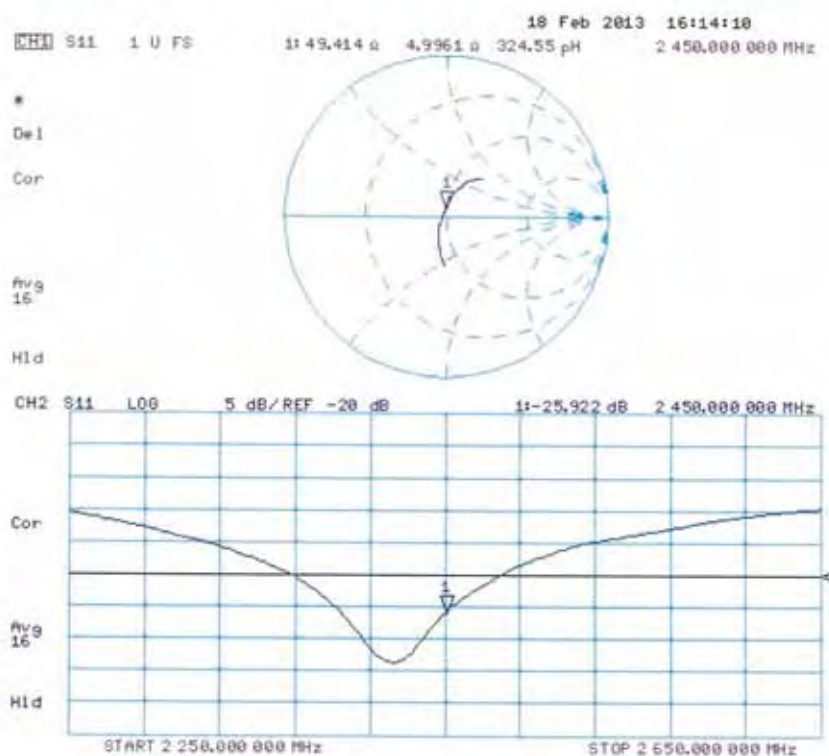
Peak SAR (extrapolated) = 27.1 W/kg

SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.95 W/kg

Maximum value of SAR (measured) = 16.8 W/kg



Impedance Measurement Plot for Body TSL



ST-007
Calibration Laboratory of
Schmid & Partner
Engineering AG
 Zeughausstrasse 43, 8004 Zurich, Switzerland



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **D5GHzV2-1021_Feb13**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1021**

Calibration procedure(s) **QA CAL-22.v2**
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: **February 21, 2013**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe EX3DV4	SN: 3503	28-Dec-12 (No. EX3-3503_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 21, 2013

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

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



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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz $\pm$ 1 MHz 5300 MHz $\pm$ 1 MHz 5600 MHz $\pm$ 1 MHz 5800 MHz $\pm$ 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	34.7 $\pm$ 6 %	4.47 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.8 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.5 W/kg $\pm$ 19.5 % (k=2)

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.5 ± 6 %	4.57 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.8 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.4 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.1 ± 6 %	4.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.5 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.9 ± 6 %	5.05 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.48 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	74.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.9 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.36 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.51 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	74.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.7 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.7 ± 6 %	5.48 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.1 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.2 ± 6 %	5.83 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	80.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.1 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	45.9 ± 6 %	6.12 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	73.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.4 W/kg ± 19.5 % (k=2)

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.6 Ω - 8.1 j Ω
Return Loss	- 21.8 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	52.6 Ω - 3.3 j Ω
Return Loss	- 27.7 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.1 Ω - 2.3 j Ω
Return Loss	- 24.2 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	57.9 Ω - 2.2 j Ω
Return Loss	- 22.4 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	51.4 Ω - 6.6 j Ω
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	52.0 Ω - 2.8 j Ω
Return Loss	- 29.3 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	57.2 Ω - 1.2 j Ω
Return Loss	- 23.4 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	58.7 Ω + 0.6 j Ω
Return Loss	- 21.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 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
Manufactured on	February 05, 2004

DASY5 Validation Report for Head TSL

Date: 20.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1021

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.47$ S/m; $\epsilon_r = 34.7$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 4.57$ S/m; $\epsilon_r = 34.5$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 4.83$ S/m; $\epsilon_r = 34.1$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.05$ S/m; $\epsilon_r = 33.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 28.12.2012, ConvF(5.1, 5.1, 5.1); Calibrated: 28.12.2012, ConvF(4.76, 4.76, 4.76); Calibrated: 28.12.2012, ConvF(4.81, 4.81, 4.81); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.605 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 29.5 W/kg

SAR(1 g) = 7.95 W/kg; SAR(10 g) = 2.28 W/kg

Maximum value of SAR (measured) = 18.9 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.943 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 31.2 W/kg

SAR(1 g) = 8.26 W/kg; SAR(10 g) = 2.37 W/kg

Maximum value of SAR (measured) = 19.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.906 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 33.0 W/kg

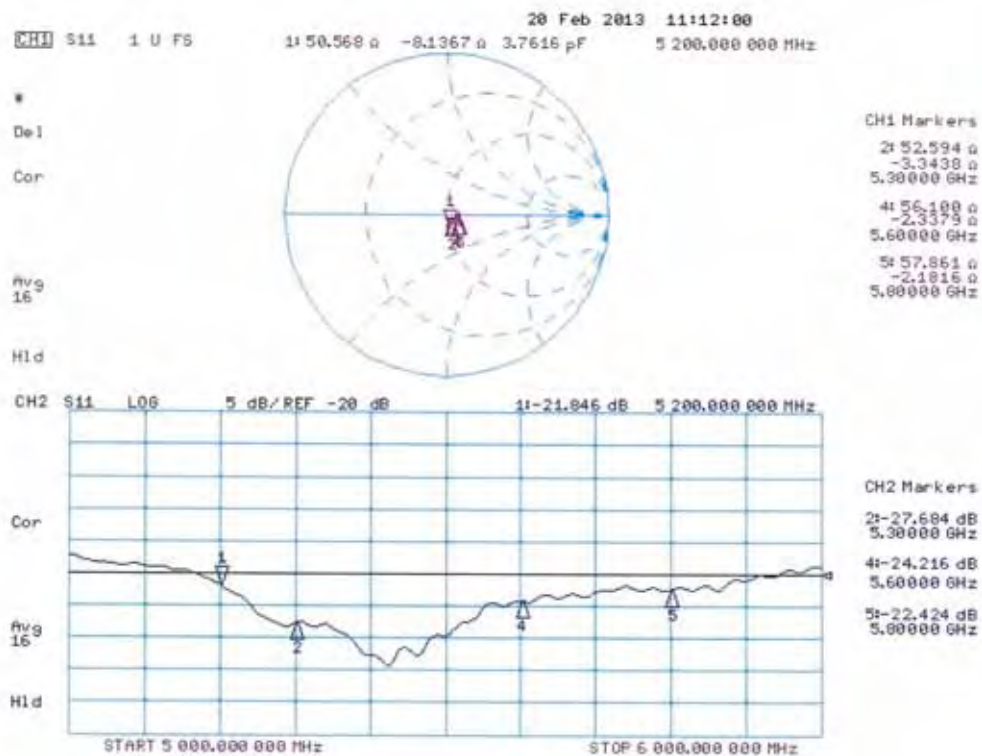
SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.28 W/kg

Maximum value of SAR (measured) = 19.9 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
 Reference Value = 60.489 V/m; Power Drift = 0.04 dB
 Peak SAR (extrapolated) = 32.4 W/kg
SAR(1 g) = 7.48 W/kg; SAR(10 g) = 2.12 W/kg
 Maximum value of SAR (measured) = 19.0 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1021

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.36$ S/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 5.48$ S/m; $\epsilon_r = 46.7$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 5.83$ S/m; $\epsilon_r = 46.2$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 6.12$ S/m; $\epsilon_r = 45.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.67, 4.67, 4.67); Calibrated: 28.12.2012, ConvF(4.22, 4.22, 4.22); Calibrated: 28.12.2012, ConvF(4.38, 4.38, 4.38); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 59.460 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 30.0 W/kg

SAR(1 g) = 7.51 W/kg; SAR(10 g) = 2.09 W/kg

Maximum value of SAR (measured) = 17.7 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 59.360 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 30.9 W/kg

SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.13 W/kg

Maximum value of SAR (measured) = 18.0 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

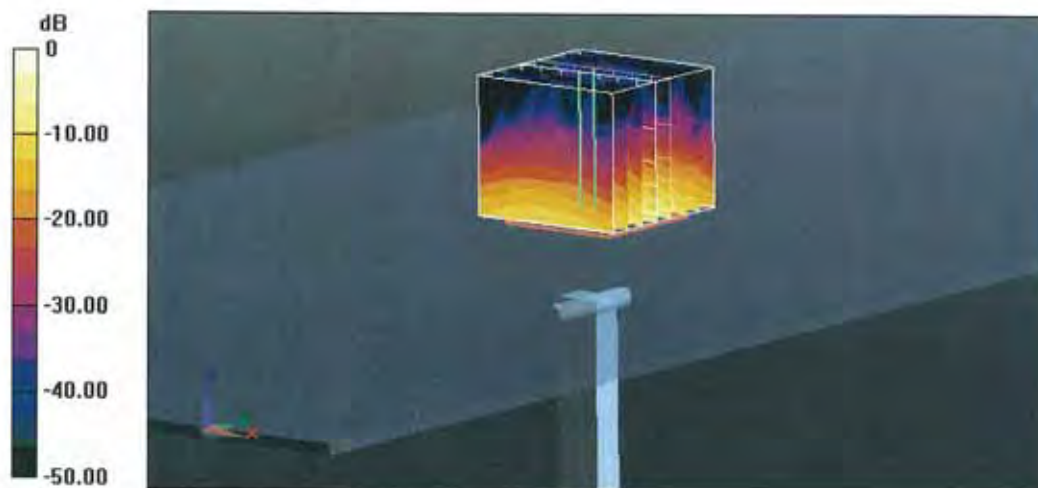
Reference Value = 59.565 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 35.9 W/kg

SAR(1 g) = 8.08 W/kg; SAR(10 g) = 2.24 W/kg

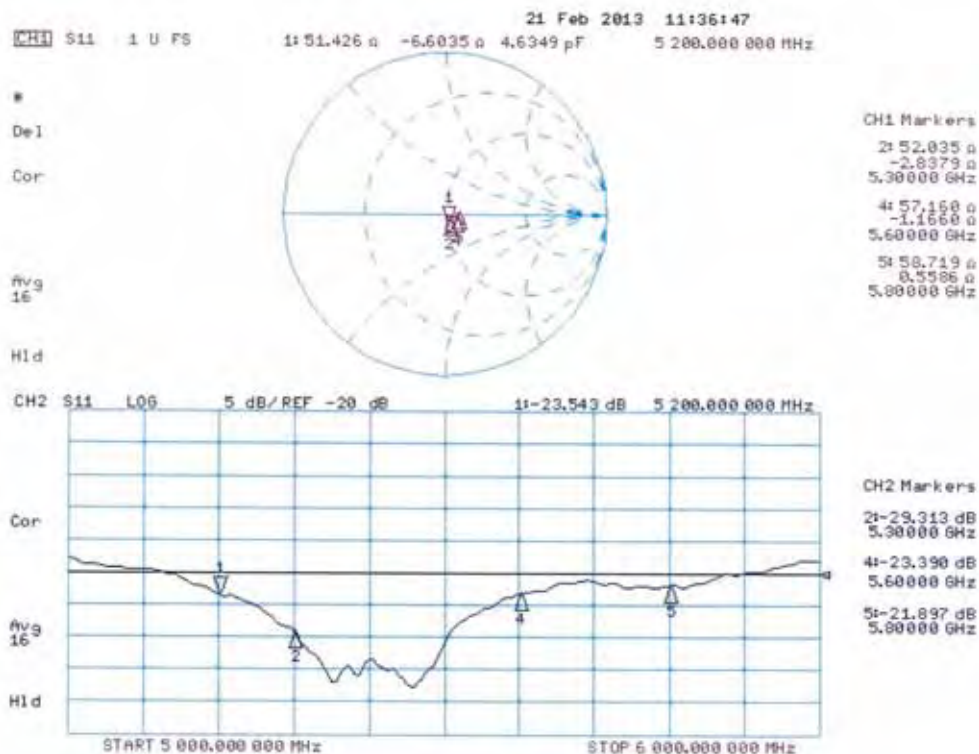
Maximum value of SAR (measured) = 19.9 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
 Reference Value = 56.060 V/m; Power Drift = -0.01 dB
 Peak SAR (extrapolated) = 34.8 W/kg
SAR(1 g) = 7.45 W/kg; SAR(10 g) = 2.06 W/kg
 Maximum value of SAR (measured) = 18.5 W/kg



0 dB = 18.5 W/kg = 12.67 dBW/kg

Impedance Measurement Plot for Body TSL



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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **EX3-3519_Feb13**

CALIBRATION CERTIFICATE

Object **EX3DV3 - SN:3519**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-12.v7, QA CAL-14.v3, QA CAL-23.v4,
QA CAL-25.v4
Calibration procedure for dosimetric E-field probes**

Calibration date: **February 20, 2013**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498067	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: February 22, 2013			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Certificate No: EX3-3519_Feb13

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Engineering AG**
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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D 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 $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.



EX3DV3 – SN:3519

February 20, 2013

Probe EX3DV3

SN:3519

Manufactured: March 8, 2004
Calibrated: February 20, 2013

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

DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.82	0.70	0.72	$\pm 10.1 \%$
DCP (mV) ^B	100.2	99.1	102.5	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^C (k=2)
0	CW	X	0.0	0.0	1.0	0.00	112.7	$\pm 3.0 \%$
		Y	0.0	0.0	1.0		116.6	
		Z	0.0	0.0	1.0		142.1	

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

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

^B Numerical linearization parameter; uncertainty not required.

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

DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	43.5	0.87	10.80	10.80	10.80	0.13	1.43	± 13.4 %
750	41.9	0.89	11.12	11.12	11.12	0.18	1.41	± 12.0 %
835	41.5	0.90	10.73	10.73	10.73	0.12	1.92	± 12.0 %
900	41.5	0.97	10.72	10.72	10.72	0.31	0.90	± 12.0 %
1750	40.1	1.37	9.03	9.03	9.03	0.30	0.91	± 12.0 %
1810	40.0	1.40	8.85	8.85	8.85	0.46	0.72	± 12.0 %
1900	40.0	1.40	8.79	8.79	8.79	0.34	0.83	± 12.0 %
2000	40.0	1.40	8.76	8.76	8.76	0.38	0.83	± 12.0 %
2100	39.8	1.49	8.93	8.93	8.93	0.76	0.57	± 12.0 %
2300	39.5	1.67	8.40	8.40	8.40	0.39	0.80	± 12.0 %
2450	39.2	1.80	7.94	7.94	7.94	0.31	0.92	± 12.0 %
2600	39.0	1.96	7.69	7.69	7.69	0.36	0.89	± 12.0 %
5200	36.0	4.66	4.99	4.99	4.99	0.41	1.80	± 13.1 %
5300	35.9	4.76	4.86	4.86	4.86	0.42	1.80	± 13.1 %
5500	35.6	4.96	4.51	4.51	4.51	0.45	1.80	± 13.1 %
5600	35.5	5.07	4.31	4.31	4.31	0.45	1.80	± 13.1 %
5800	35.3	5.27	4.28	4.28	4.28	0.48	1.80	± 13.1 %

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

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

DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

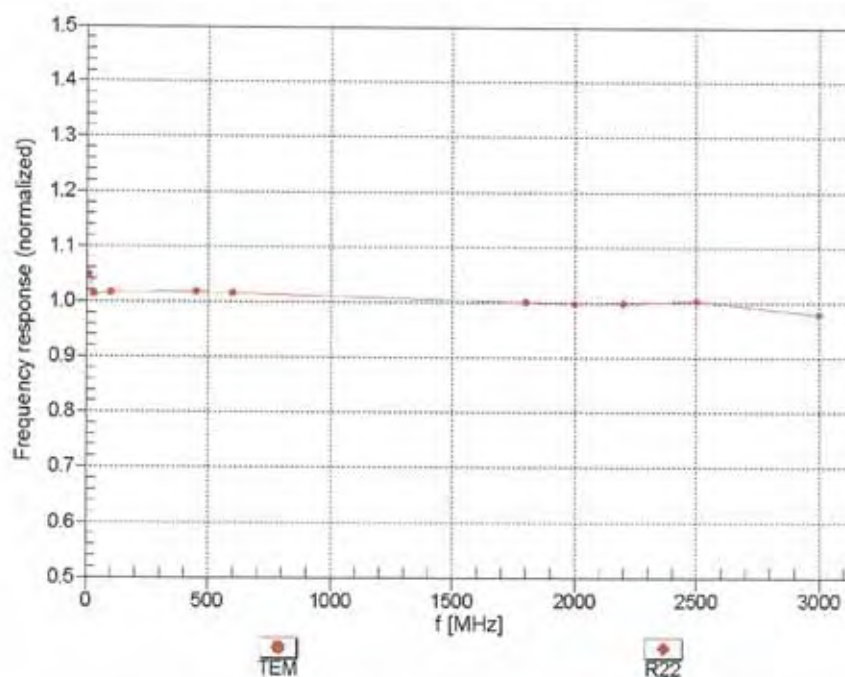
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	11.79	11.79	11.79	0.05	1.25	± 13.4 %
750	55.5	0.96	10.78	10.78	10.78	0.42	0.86	± 12.0 %
835	55.2	0.97	10.56	10.56	10.56	0.20	1.37	± 12.0 %
900	55.0	1.05	10.46	10.46	10.46	0.36	0.93	± 12.0 %
1750	53.4	1.49	8.99	8.99	8.99	0.49	0.69	± 12.0 %
1810	53.3	1.52	8.79	8.79	8.79	0.54	0.68	± 12.0 %
1900	53.3	1.52	8.58	8.58	8.58	0.26	1.00	± 12.0 %
2000	53.3	1.52	8.61	8.61	8.61	0.38	0.80	± 12.0 %
2100	53.2	1.62	8.72	8.72	8.72	0.24	1.09	± 12.0 %
2300	52.9	1.81	8.13	8.13	8.13	0.57	0.67	± 12.0 %
2450	52.7	1.95	7.88	7.88	7.88	0.80	0.50	± 12.0 %
2600	52.5	2.16	7.61	7.61	7.61	0.62	0.50	± 12.0 %
3500	51.3	3.31	7.14	7.14	7.14	0.33	1.24	± 13.1 %
5200	49.0	5.30	4.49	4.49	4.49	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.27	4.27	4.27	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.96	3.96	3.96	0.55	1.90	± 13.1 %
5600	48.5	5.77	3.63	3.63	3.63	0.60	1.90	± 13.1 %
5800	48.2	6.00	3.88	3.88	3.88	0.59	1.90	± 13.1 %

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

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

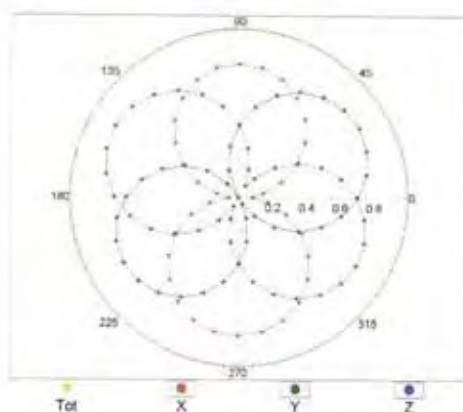
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



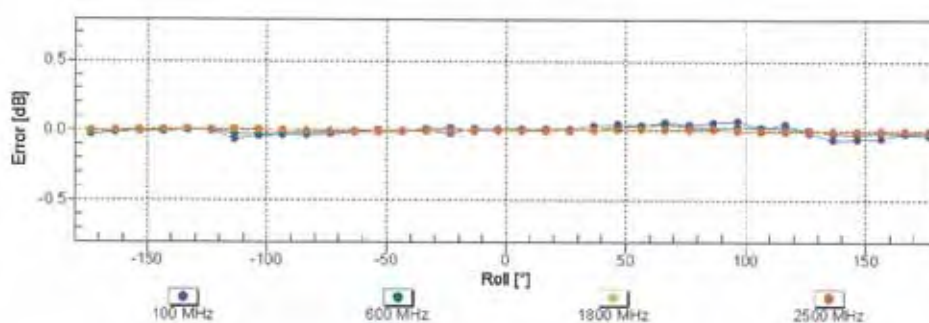
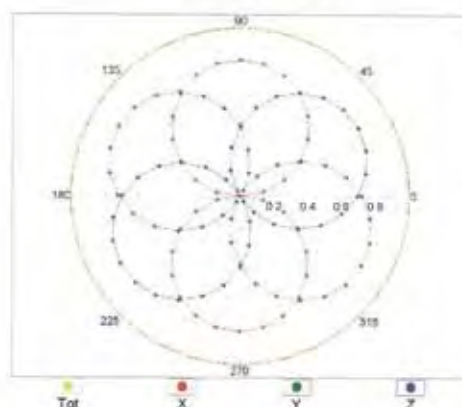
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz,TEM

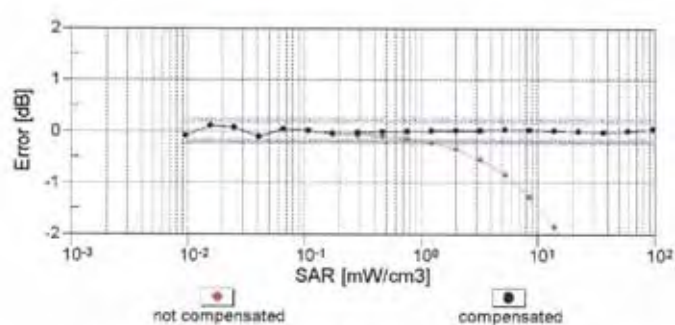
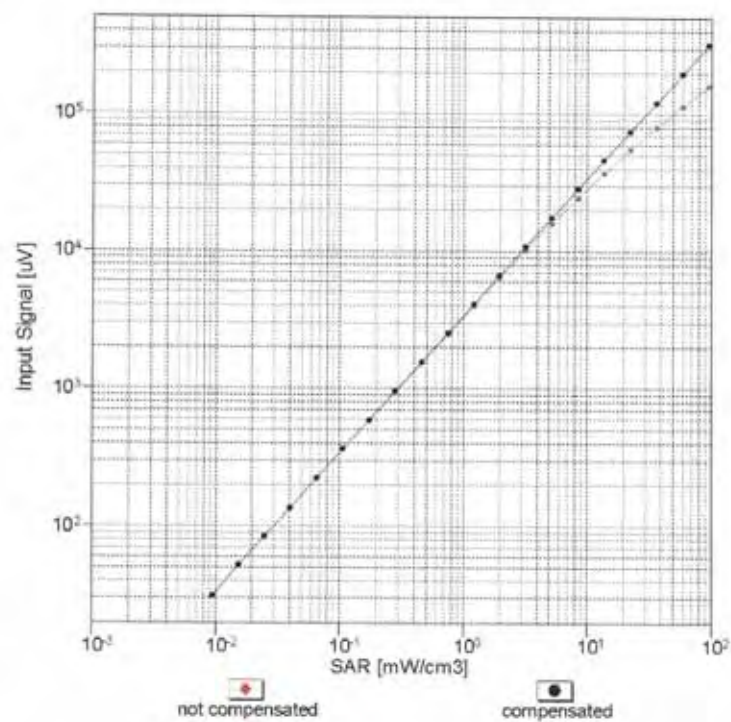


f=1800 MHz,R22



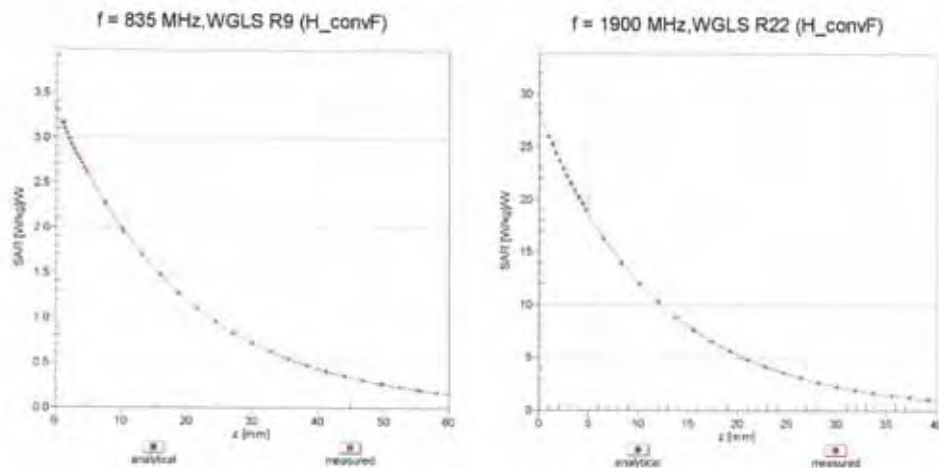
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$)

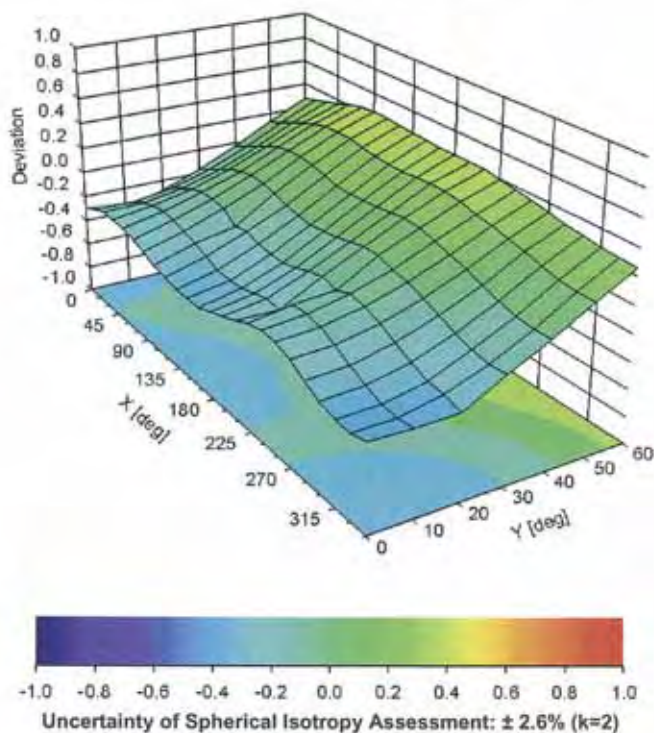


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, θ), $f = 900 \text{ MHz}$





EX3DV3- SN:3519

February 20, 2013

DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-93.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm



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Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **DAE4-779_Feb13**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BJ - SN: 779**

Calibration procedure(s) **QA CAL-06.v25**
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: **February 13, 2013**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	02-Oct-12 (No:12728)	Oct-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit Calibrator Box V2.1	SE UWS 053 AA 1001	07-Jan-13 (in house check)	In house check: Jan-14
	SE UMS 006 AA 1002	07-Jan-13 (in house check)	In house check: Jan-14

Calibrated by:	Name Eric Hainfeld	Function Technician	Signature
Approved by:	Fin Bornholt	Deputy Technical Manager	

Issued: February 13, 2013

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Certificate No: DAE4-779_Feb13

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Accreditation No.: **SCS 108**

Glossary

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

Methods Applied and Interpretation of Parameters

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



DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	404.452 $\pm$ 0.02% (k=2)	403.694 $\pm$ 0.02% (k=2)	403.914 $\pm$ 0.02% (k=2)
Low Range	3.96902 $\pm$ 1.55% (k=2)	3.97887 $\pm$ 1.55% (k=2)	3.99319 $\pm$ 1.55% (k=2)

Connector Angle

Connector Angle to be used in DASY system	156.5 $^{\circ}$ $\pm$ 1 $^{\circ}$
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Appendix

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	189996.96	1.92	0.00
Channel X + Input	20001.89	1.69	0.01
Channel X - Input	-19996.92	3.97	-0.02
Channel Y + Input	199996.16	1.24	0.00
Channel Y + Input	19999.20	-0.93	-0.00
Channel Y - Input	-20000.26	0.76	-0.00
Channel Z + Input	199997.40	2.46	0.00
Channel Z + Input	20001.63	1.50	0.01
Channel Z - Input	-19998.30	2.69	-0.01

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2001.21	0.58	0.03
Channel X + Input	201.35	0.31	0.15
Channel X - Input	-198.61	0.26	-0.13
Channel Y + Input	2000.66	0.18	0.01
Channel Y + Input	200.39	-0.58	-0.29
Channel Y - Input	-199.01	0.03	-0.01
Channel Z + Input	2000.62	0.22	0.01
Channel Z + Input	200.34	-0.52	-0.26
Channel Z - Input	-199.81	-0.83	0.42

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	-2.78	-4.73
	-200	5.70	4.22
Channel Y	200	14.58	13.79
	-200	-15.41	-15.51
Channel Z	200	2.91	3.09
	-200	-4.86	-4.74

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	-2.01	-3.72
Channel Y	200	10.67	-	-0.58
Channel Z	200	7.80	8.55	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15602	13837
Channel Y	15845	15843
Channel Z	16202	15651

5. Input Offset Measurement

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

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	0.26	-0.87	2.39	0.52
Channel Y	-0.70	-2.45	1.01	0.66
Channel Z	-0.84	-1.90	0.45	0.44

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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