FCC OET BULLETIN 65 SUPPLEMENT C
IC RSS-102 ISSUE 4
IEEE 1528:2003
Class II Permissive Change

SAR EVALUATION REPORT

For

802.11g / Draft 802.11n WLAN + Bluetooth PCI-E Minicard
(Tested inside of SAMSUNG Notebook PC, NP-NC110 & NP-NC210)

MODEL: BCM94313HMGB

FCC ID: QDS-BRCM1051
IC: 4324A-BRCM1051

REPORT NUMBER: 10I13602-2A

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Prepared for

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	February 12, 2011	Initial Issue	--
A	February 16, 2011	Updated report based on reviewer's comments, includes 1. Page 7, removed KDB447498 and added model different description. 2. Page 16, updated average power table. 3. Page 17, removed "HT40" and added note "Samsung PC Model NP-NC110 is used for all SAR testing"	Sunny Shih

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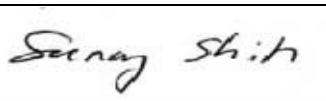
1. ATTESTATION OF TEST RESULTS

Applicant name:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086		
EUT description:	802.11g / Draft 802.11n WLAN + Bluetooth PCI-E Minicard (Tested inside of SAMSUNG Notebook PC, NP-NC110 & NP-NC210)		
Model number:	BCM94313HMGB Samsung PC., Serial number: AZAE93KZC00036N		
Device category:	Portable		
Exposure category:	General Population/Uncontrolled Exposure		
Date tested:	February 3-4, 2011		
FCC / IC Rule Parts	Freq. Range [MHz]	The Highest 1g SAR mW/g	Limit (mW/g)
15.247 / RSS-102	2412 – 2472	0.018 (Lap-held) 0.118 (Nearby person w/ 2.5 cm separation distance)	1.6
Applicable Standards			Test Results
FCC OET Bulletin 65 Supplement C 01-01, IEEE Std 1528:2003, IC RSS 102 Issue 4			Pass

Compliance Certification Services, Inc. (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released For CCS By:	Tested By:
	
Sunny Shih Engineering Team Leader Compliance Certification Services (UL CCS)	Norihisa Hashimoto SAR Engineer Compliance Certification Services (UL CCS)

2. TEST METHODOLOGY

FCC OET Bulletin 65 Supplement C 01-01, IEEE STD 1528: 2003, IC RSS-102 ISSUE 4 and the following specific FCC test procedures:

- KDB 248227 SAR measurement procedures for 802.11a/b/g transmitters
- KDB 616217 Laptop Computer SAR Procedures

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
S-Parameter Network Analyzer	Agilent	E5071B	MY42100131	8	2	2011
Signal Generator	Agilent	883732B	US3440599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3749	11	13	2011
E-Field Probe	SPEAG	EX3DV4	3531	2	23	2011
Data Acquisition Electronics	SPEAG	DAE3 V1	427	7	21	2011
Data Acquisition Electronics	SPEAG	DAE4	1239	11	11	2011
Thermometer	ERTCO	639-1S	1718	7	19	2011
System Validation Dipole	SPEAG	D835V2	4d002	4	23	2012
System Validation Dipole	SPEAG	D1900V2	5d043	11	24	2012
System Validation Dipole	SPEAG	D2450V2	706	4	19	2012
Wireless comunication test set	Agilent	E5515C (8960)	GB46160222	6	17	2012
Power Meter	Giga-tronics	8651A	8651404	3	13	2012
Power Sensor	Giga-tronics	80701A	1834588	3	13	2012
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	SPEAG	H1900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M1900	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	H900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M900	N/A	Within 24 hrs of first test		

Note: Per KDB 450824 D02 requirements for dipole calibration, ULCCS has adopted two years calibration intervals. On annual basis, each measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement (test data on file in UL CCS)
4. Impedance is within 5Ω of calibrated measurement (test data on file in ULCCS)

4.2. MEASUREMENT UNCERTAINTY

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	5.50	Normal	1	1	5.50
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement (Body 2450 MHz)	1.73	Normal	1	0.64	1.11
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty (Body 1900 MHz)	-2.74	Normal	1	0.6	-1.64
				Combined Standard Uncertainty Uc(y) =	9.65
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 19.29 %	
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 1.53 dB	

5. EQUIPMENT UNDER TEST

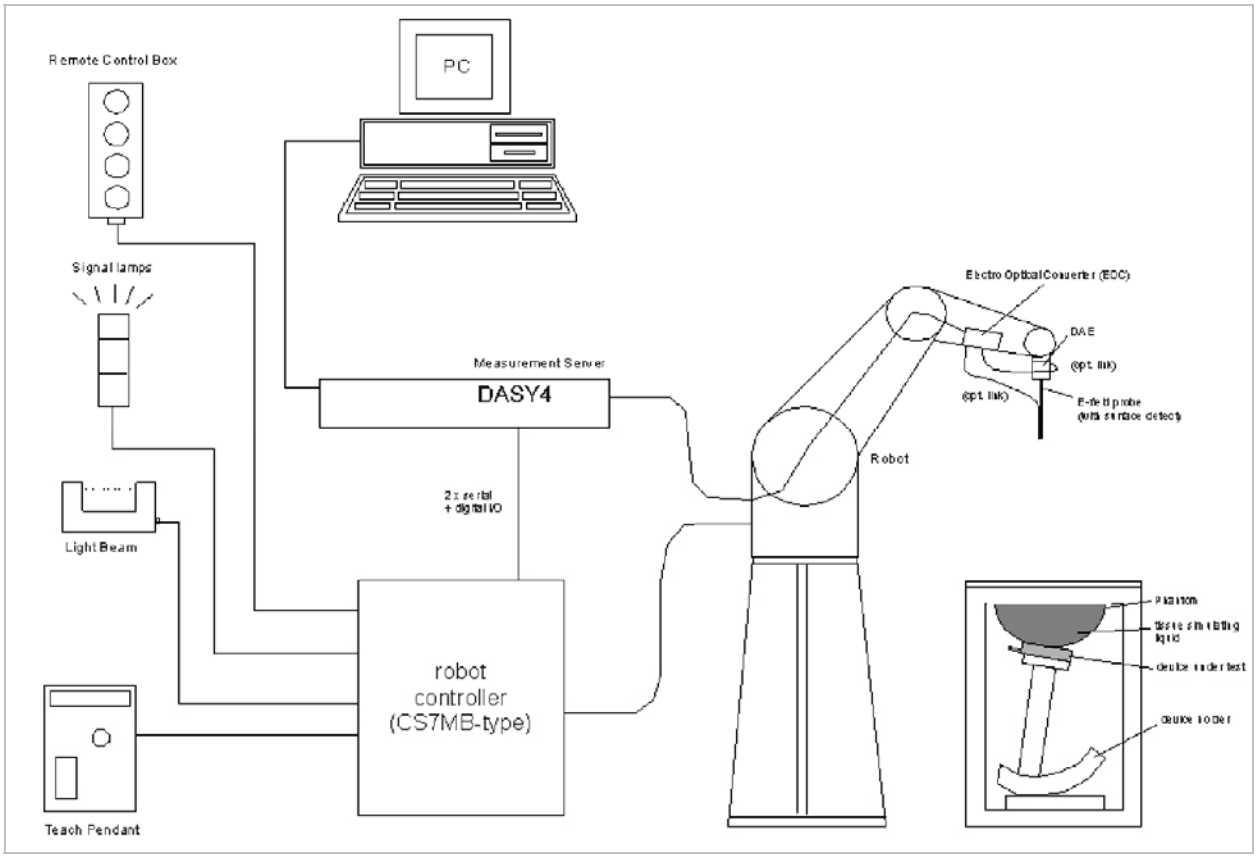
802.11g / Draft 802.11n WLAN + Bluetooth PCI-E Minicard

(Tested inside of SAMSUNG Notebook PC, NP-NC110 & NP-NC210)

Note: Mode NP-NC110 is identical to NP-NC210 except model designation.

Normal operation:	Laptop mode (display open at 90° to the keyboard)
Antenna tested:	Manufactured / Part number / 2.4 Gain Wistron / Main: 81.EHD15.G09 / 0.31 Foxconn / ☒Main: WDAN-M1PB1001-DF / 0.54 Auden / Main: 220177-09 / 0.45 Wistron / Aux: 81.EHD15.G20 / 0.31 Foxconn / Aux: WDAN-M1JM4002-DH / -0.66 Auden / ☒Main: 220393-09 / 2.48
Antenna-to-antenna/user separation distances:	See Section 15 for details of antenna locations and separation distances
Simultaneous transmission:	WiFi can transmit simultaneously with Bluetooth (Bluetooth - FCC ID: QDS-BRCM1051; IC ID: 4324A- BRCM1051) WiFi can transmit simultaneously with WWAN
Assessment for SAR evaluation for Simultaneous transmission:	**WiFi and BT** The Bluetooth's output power (2.79mW) is ≤ 60/f(GHz) mW, which stand-alone SAR evaluation is not required. Thus, simultaneous transmission SAR evaluation is not required for WiFi and Bluetooth antenna pair. **WiFi and WWAN** WWAN co-located RF exposure assessment will be addressed in a separate FCC application filed under WWAN application.

6. SYSTEM SPECIFICATIONS



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

- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- 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.
- 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.
- 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY software.
- Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

7. COMPOSITION OF INGREDIENTS FOR TISSUE SIMULATING LIQUIDS

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		900		1800 - 1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99+% Pure Sodium Chloride Sugar: 98+% Pure Sucrose
Water: De-ionized, 16 MΩ+ 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

8. LIQUID PARAMETERS CHECK

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values. For frequencies in 300 MHz to just under 2 GHz, the measured conductivity and relative permittivity should be within ± 5% of the target values. For frequencies in the range of 2–3 GHz and above the measured conductivity should be within ± 5% of the target values. The measured relative permittivity tolerance can be relaxed to no more than ± 10%.

Reference Values of Tissue Dielectric Parameters for Head & Body Phantom
The body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.8
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.9	55.2	0.97
900	41.5	0.97	55	1.05
915	41.5	0.98	55	1.06
1450	40.5	1.2	54	1.3
1610	40.3	1.29	53.8	1.4
1800 – 2000	40	1.4	53.3	1.52
2450	39.2	1.8	52.7	1.95
3000	38.5	2.4	52	2.73
5800	35.3	5.27	48.2	6

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

Reference Values of Tissue Dielectric Parameters for Body Phantom (for 3000 MHz – 5800 MHz)
In the current guidelines and draft standards for compliance testing of mobile phones (i.e., IEEE P1528, OET 65 Supplement C), the dielectric parameters suggested for head and body tissue simulating liquid are given only at 3.0 GHz and 5.8 GHz. As an intermediate solution, dielectric parameters for the frequencies between 5 to 5.8 GHz were obtained using linear interpolation (see table below).

SPEAG has developed suitable head and body tissue simulating liquids consisting of the following ingredients: de-ionized water, salt and a special composition including mineral oil and an emulgators. Dielectric parameters of these liquids were measured suing a HP 8570C Dielectric Probe Kit in conjunction with HP 8753ES Network Analyzer (30 kHz – 6G Hz). The differences with respect to the interpolated values were well within the desired ±5% for the whole 5 to 5.8 GHz range.

f (MHz)	Body Tissue		Reference
	rel. permitivity	conductivity	
3000	52.0	2.73	Standard
5100	49.1	5.18	Interpolated
5200	49.0	5.30	Interpolated
5300	48.9	5.42	Interpolated
5400	48.7	5.53	Interpolated
5500	48.6	5.65	Interpolated
5600	48.5	5.77	Interpolated
5700	48.3	5.88	Interpolated
5800	48.2	6.00	Standard

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

8.1. TISSUE PARAMETERS CHECK RESULTS FOR 2450 MHZ

Simulating Liquid Dielectric Parameter Check Result @ Body 2450 MHz Measured by: Sunny Shih

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	51.26	Relative Permittivity (ϵ_r):	51.257	52.7	-2.74	± 5
	e"	14.55	Conductivity (σ):	1.984	1.95	1.73	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 41%
February 04, 2011 07:11 PM

Frequency	e'	e''
2400000000.	51.4349	14.3660
2405000000.	51.4156	14.3875
2410000000.	51.3985	14.4096
2415000000.	51.3830	14.4269
2420000000.	51.3637	14.4437
2425000000.	51.3472	14.4618
2430000000.	51.3301	14.4809
2435000000.	51.3116	14.4993
2440000000.	51.2936	14.5175
2445000000.	51.2736	14.5348
2450000000.	**51.2572**	**14.5541**
2455000000.	51.2373	14.5727
2460000000.	51.2218	14.5895
2465000000.	51.2007	14.6104
2470000000.	51.1848	14.6269
2475000000.	51.1655	14.6459
2480000000.	51.1473	14.6626
2485000000.	51.1293	14.6816
2490000000.	51.1105	14.7000
2495000000.	51.0941	14.7197
2500000000.	51.0791	14.7396

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

9. SYSTEM VERIFICATION

The system performance check is performed prior to any usage of the system in order to verify SAR system accuracy. The system performance check verifies that the system operates within its specifications of ±10%.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV3-SN: 3531 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (2.4 GHz) fine cube was chosen for cube integration and Special 8x8x10 (5 GHz) fine cube was chosen for cube integration
- Distance between probe sensors and phantom surface was set to 3 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input powers (forward power) were 100 mW.
- The results are normalized to 1 W input power.

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.

System validation dipole	Cal. certificate #	Cal. date	Cal. Freq. (GHz)	SAR Avg (mW/g)		
				Tissue:	Head	Body
D2450V2	D2450V2-706_Apr10	4/19/10	2.4	SAR_{1g}:	51.6	52.4
				SAR_{10g}:	24.4	24.5

9.1. SYSTEM CHECK RESULTS FOR D2450V2

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D2450V2	02/04/11	SAR_{1g}:	53.0	52.4	1.15	±10
		SAR_{10g}:	24.5	24.5	0.00	

System Check Plot

Date/Time: 2/4/2011 7:51:01 PM, Date/Time: 2/4/2011 7:54:35 PM

Test Laboratory: The name of your organization

System Performance Check D2450 V2 SN706

DUT: D2450V2; Type: D2450V2; Serial: 706

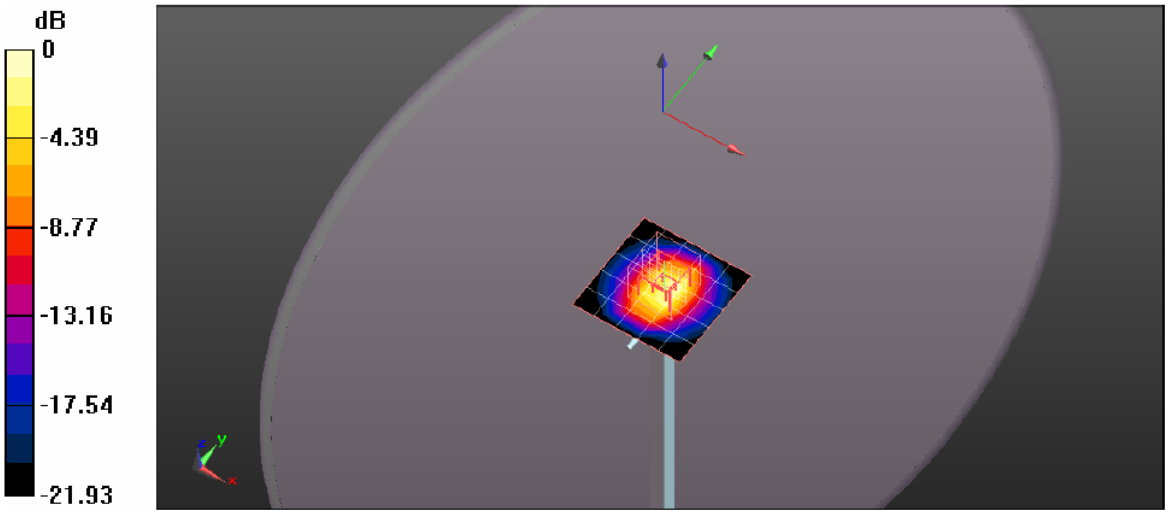
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.984 mho/m; ε_r = 51.257; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1239; Calibrated: 11/17/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1099
- Measurement SW: DASY52, Version 52.6 (1);SEMCAD X Version 14.4.2 (2595)

D2450V2 SN 706/Pin=100 mW (EX-Probe)/Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.539 mW/g

D2450V2 SN 706/Pin=100 mW (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 64.074 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 10.888 W/kg
SAR(1 g) = 5.3 mW/g; SAR(10 g) = 2.45 mW/g
Maximum value of SAR (measured) = 8.110 mW/g



0 dB = 8.110mW/g

Date/Time: 2/4/2011 7:51:01 PM, Date/Time: 2/4/2011 7:54:35 PM, Date/Time: 2/4/2011 8:12:00 PM

Test Laboratory: UL CCS

System Check below D2450 V2 SN706

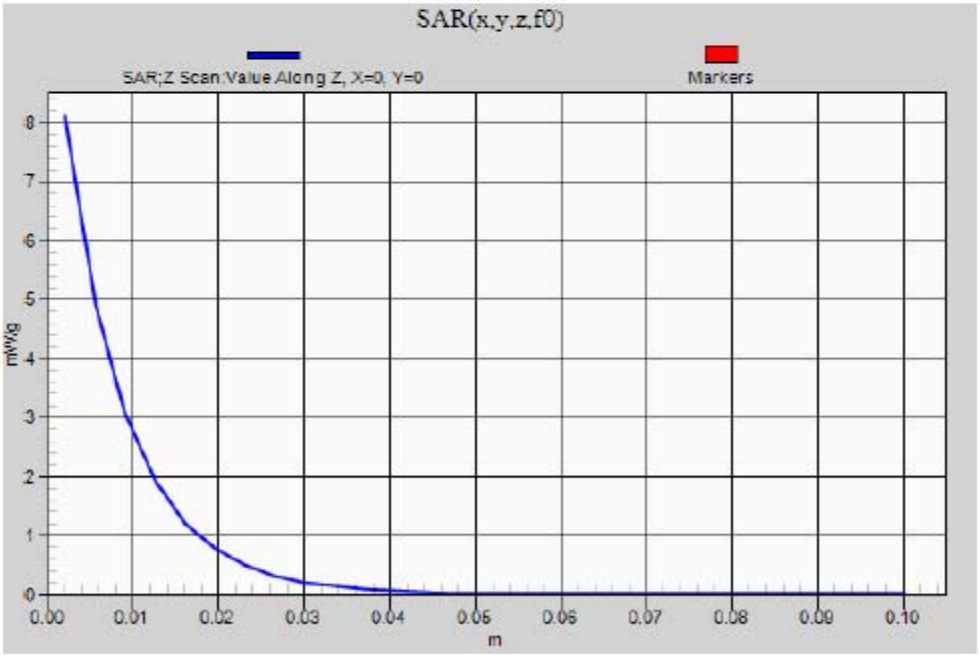
DUT: SUMSUNG; Type: NP900X3A; Serial: ZZRB93GZC00080D

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

D2450V2 SN 706/Pin=100 mW (EX-Probe)/Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.539 mW/g

D2450V2 SN 706/Pin=100 mW (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 64.074 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 10.888 W/kg
SAR(1 g) = 5.3 mW/g; SAR(10 g) = 2.45 mW/g
Maximum value of SAR (measured) = 8.110 mW/g

D2450V2 SN 706/Pin=100 mW (EX-Probe)/Z Scan (1x1x29): Measurement grid: dx=20mm, dy=20mm, dz=3.5mm
Maximum value of SAR (measured) = 8.119 mW/g



10. SAR MEASUREMENT PROCEDURES

Step 1: Power Reference Measurement
The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties (for example, 1.2 mm for an EX3DV3 probe type).

Step 2: Area Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures $\geq$ 7 x 7 x 9 points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Step 4: Power drift measurement
The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan
The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation, the extrapolated distance should not be larger than the step size in Z-direction.

11. OUTPUT POWER VERIFICATION

The following procedures had been used to prepare the EUT for the SAR test.
The client provided a special driver and program, wl_tools, which enable a tester to control the frequency and output power of the module.

802.11b			
Channel #	Freq. (MHz)	Conducted Avg Power	
		(dBm)	(mW)
1	2412	19.23	83.8
6	2437	**19.30**	85.1
13	2472	18.00	63.1
802.11g			
1	2412	18.58	72.1
6	2437	**18.60**	72.4
13	2472	10.11	10.3
802.11n 20 MHz (SISO)			
1	2412	Same as 11g	
6	2437	Same as 11g	
13	2472	Same as 11g	

12. SUMMARY OF SAR TEST RESULT

Lap-held

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	1	2412	Main		
	6	2437	Main	0.030	0.023
	13	2472	Main		
802.11g	1	2412	Aux		
	6	2437	Aux	0.018	0.016
	13	2472	Aux		

Nearby Person w/ 1.5 cm separation distance

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	1	2412	Main		
	6	2437	Main	0.118	0.066
	13	2472	Main		
802.11g	1	2412	Aux		
	6	2437	Aux	0.070	0.043
	13	2472	Aux		

Notes:

1. Samsung PC Model NP-NC110 is used for all SAR testing.
2. 802.11b doesn't operate for Aux antenna. Thus, 802.11g is performed for Aux antenna instead.
3. According to KDB 248227, SAR is not required for 802.11n HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

13. SAR TEST PLOTS

Date/Time: 2/4/2011 11:01:39 PM, Date/Time: 2/4/2011 11:08:10 PM

Test Laboratory: UL CCS

lapheld

DUT: SUMSUNG; Type: NP-NC110 ; Serial: AZAE93KZC00036N

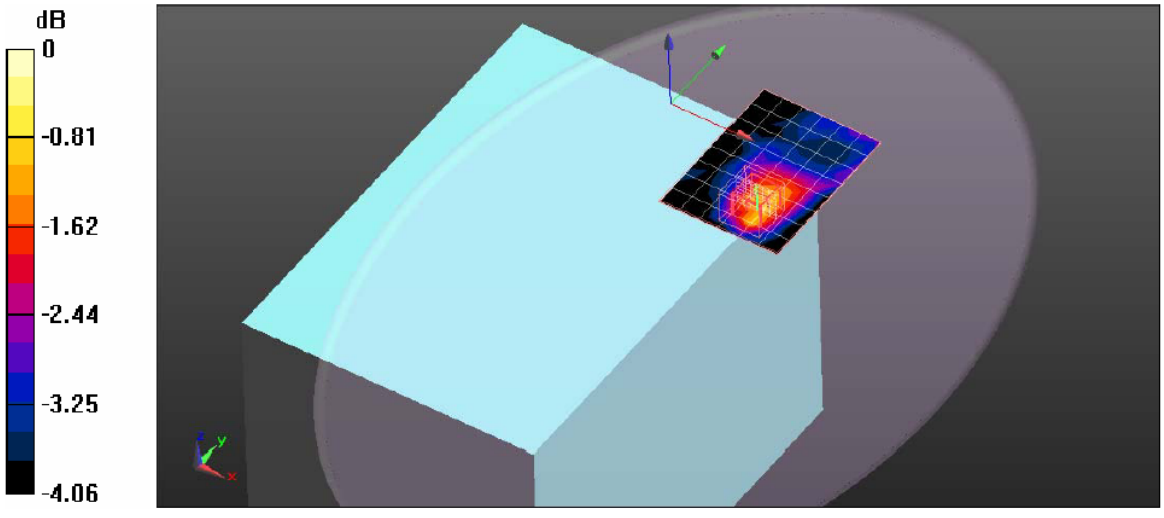
Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.916 mho/m; ε_r = 51.132; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1239; Calibrated: 11/17/2010
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.6 (1);SEMCAD X Version 14.4.2 (2595)

Lap-Held/11b_Main_ch 6/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.032 mW/g

Lap-Held/11b_Main_ch 6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 4.189 V/m; Power Drift = -0.148 dB
Peak SAR (extrapolated) = 0.047 W/kg
SAR(1 g) = 0.030 mW/g; SAR(10 g) = 0.023 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.035 mW/g



0 dB = 0.040mW/g

Date/Time: 2/5/2011 12:27:44 AM, Date/Time: 2/5/2011 12:35:58 AM, Date/Time: 2/5/2011 12:54:03 AM

Test Laboratory: UL CCS

lapheld

DUT: SUMSUNG; Type: NP-NC110; Serial: AZAE93KZC00036N

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.916 mho/m; ε_r = 51.132; ρ = 1000 kg/m^3
Phantom section: Flat Section

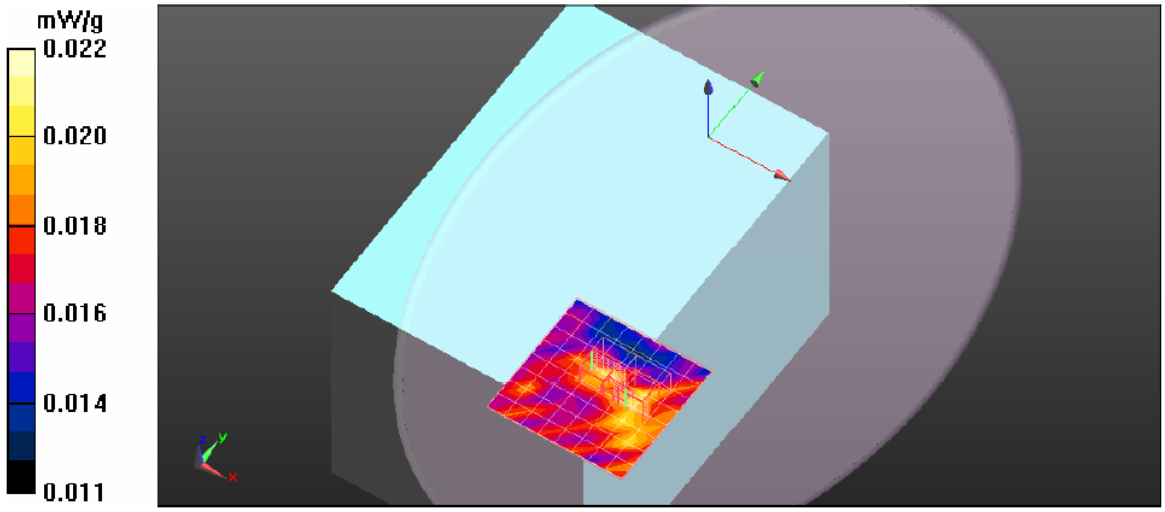
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1239; Calibrated: 11/17/2010
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.6 (1);SEMCAD X Version 14.4.2 (2595)

Lap-Held/11g_Aux_ch 6/Area Scan (9x9x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.020 mW/g

Lap-Held/11g_Aux_ch 6/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 3.066 V/m; Power Drift = -0.136 dB
Peak SAR (extrapolated) = 0.042 W/kg
SAR(1 g) = 0.018 mW/g; SAR(10 g) = 0.016 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.022 mW/g

Lap-Held/11g_Aux_ch 6/Zoom Scan 2 (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 3.066 V/m; Power Drift = -0.136 dB
Peak SAR (extrapolated) = 0.027 W/kg
SAR(1 g) = 0.018 mW/g; SAR(10 g) = 0.017 mW/g
Info: Interpolated medium parameters used for SAR evaluation.



Date/Time: 2/5/2011 2:55:10 AM, Date/Time: 2/5/2011 3:02:16 AM, Date/Time: 2/5/2011 3:17:04 AM

Test Laboratory: UL CCS

Nearby Person

DUT: SUMSUNG; Type: NP-NC110; Serial: AZAE93KZC00036N

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.92 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

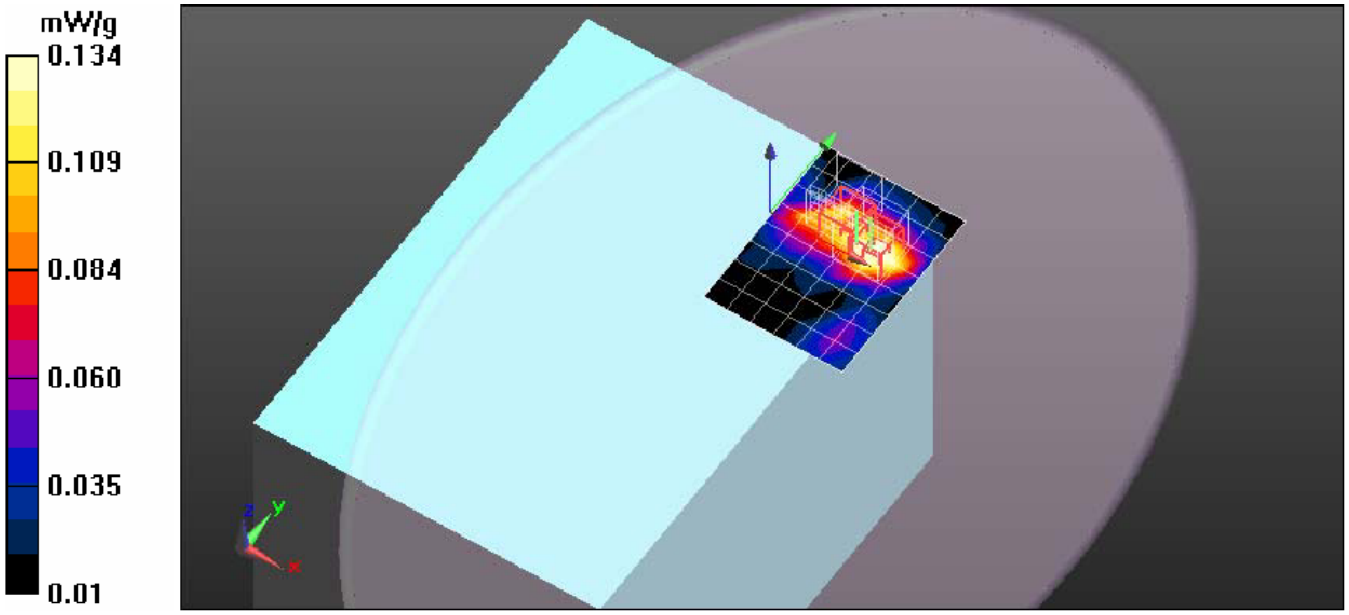
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1239; Calibrated: 11/17/2010
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, V52.2 Build 0;Postprocessing SW: SEMCAD X, V14.2 Build 2Version 14.2.2 (1685) (Deployment Build)

11b_Main_ch 6/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.182 mW/g

11b_Main_ch 6/Zoom Scan 1 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.16 V/m; Power Drift = -0.312 dB
Peak SAR (extrapolated) = 0.211 W/kg
SAR(1 g) = 0.118 mW/g; SAR(10 g) = 0.066 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.134 mW/g

11b_Main_ch 6/Zoom Scan 2 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.16 V/m; Power Drift = -0.312 dB
Peak SAR (extrapolated) = 0.166 W/kg
SAR(1 g) = 0.086 mW/g; SAR(10 g) = 0.053 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.096 mW/g



Date/Time: 2/5/2011 3:43:43 AM

Test Laboratory: The name of your organization

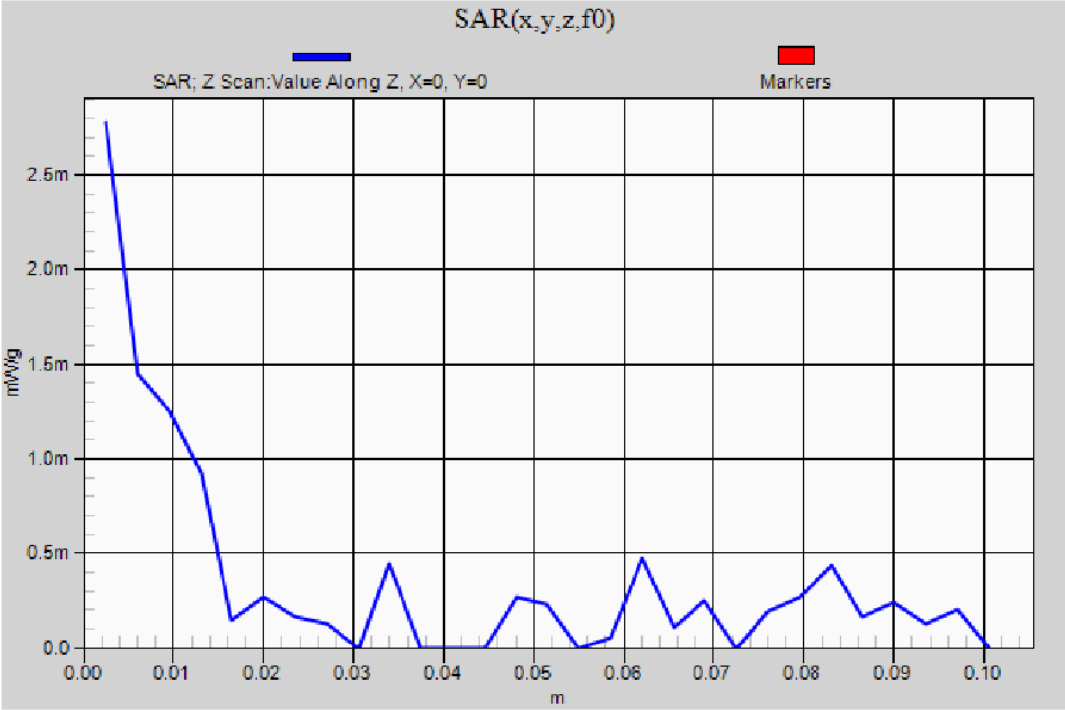
Nearby Person

DUT: SUMSUNG; Type: NP-NC110; Serial: AZAE93KZC00036N

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz;Duty Cycle: 1:1

11b_Main_ch 6/Z Scan (1x1x29): Measurement grid: dx=20mm, dy=20mm, dz=3.5mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.00278 mW/g



Date/Time: 2/5/2011 3:56:30 AM, Date/Time: 2/5/2011 4:05:32 AM

Test Laboratory: UL CCS

Nearby Person

DUT: SUMSUNG; Type: NP-NC110; Serial: A2AE93KZC00036N

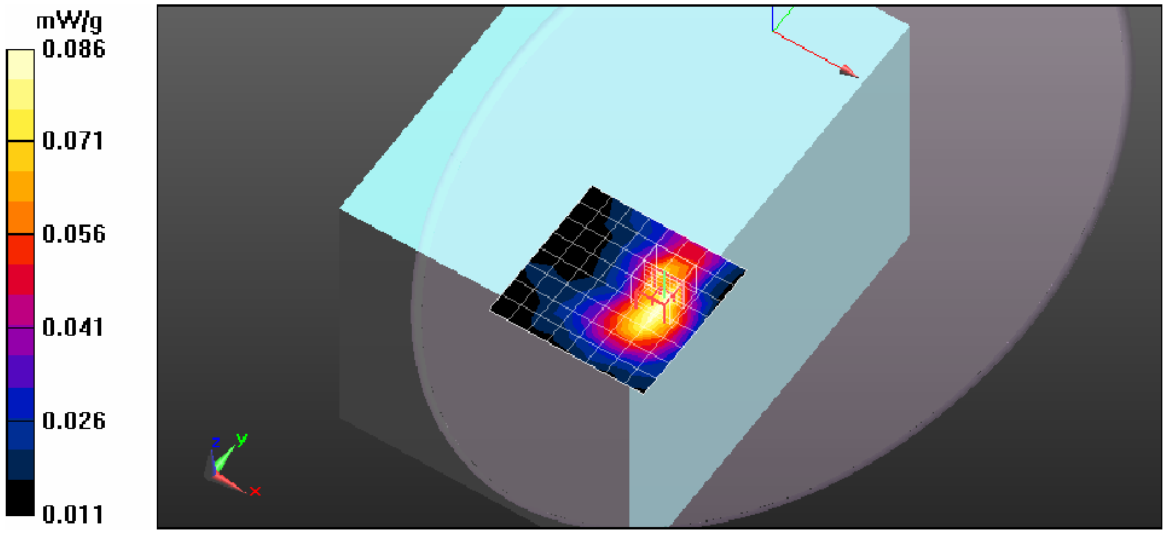
Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.92 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1239; Calibrated: 11/17/2010
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, V52.2 Build 0;Postprocessing SW: SEMCAD X, V14.2 Build 2Version 14.2.2 (1685) (Deployment Build)

11g_Aux_ch 6/Area Scan (9x9x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.086 mW/g

11g_Aux_ch 6/Zoom Scan 1 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.12 V/m; Power Drift = 0.126 dB
Peak SAR (extrapolated) = 0.129 W/kg
SAR(1 g) = 0.070 mW/g; SAR(10 g) = 0.043 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.076 mW/g



14. ATTACHMENTS

No.	Contents	No. of page (s)
1	Certificate of E-Field Probe - EX3DV3 SN 3531	10
2	Certificate of System Validation Dipole - D2450 SN:706	8