FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE STD 1528:2003
RSS-102 Issue 4, March 2010
RSS-102 Supplementary Procedures (SPR)-001, January 1, 2011

SAR EVALUATION REPORT

For
Intel® Centrino® Ultimate-N 6300
(Tested inside of Samsung Notebook PC, NP900X3A)

MODEL: 633ANHMW
FCC ID: A3L633ANH
IC: 649E-633ANH

REPORT NUMBER: 11I13883-1

ISSUE DATE: July 27, 2011

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	July 27, 2011	Initial Issue	--

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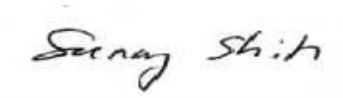
1. ATTESTATION OF TEST RESULTS

Company name:	Samsung Electronics Co., LTD 416, Maetan 3-Dong, Yeongtong-Gu Suwon-City, GyeongGi-Do 443-742, South Korea		
EUT Description:	Intel® Centrino® Ultimate-N 6300 (Tested inside of Samsung Notebook PC, NP900X3A)		
Model number:	633ANHMW		
Device Category:	Portable		
Exposure category:	General Population/Uncontrolled Exposure		
Date of tested:	July 09 – July 21, 2011		
FCC/IC Rule Parts	Freq. Range [MHz]	The Highest 1g SAR	Limit (mW/g)
15.247 / RSS-102	2412 – 2462	0.059 mW/g (Lap held Ant B)	1.6
	5725 – 5850	0.220 mW/g (Lap held Ant B)	
15.407 / RSS-102	5150 – 5250	0.255 mW/g (Lap held Ant A)	
	5250 – 5350	0.202 mW/g (Lap held Ant B)	
	5470 – 5725	0.242 mW/g (Lap held Ant C)	
Applicable Standards			Test Results
OET Bulletin 65 Supplement C 01-01, IEEE STD 1528: 2003, RSS-102 Issue 4, March 2010, RSS-102 Supplementary Procedures (SPR)-001, January 1, 2011			Pass

Compliance Certification Services (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 to the applicable standards stated above.

Approved & Released For UL CCS By:



Sunny Shih
Engineering Team Leader
Compliance Certification Services (UL CCS)

Tested By:

David Rodgers
SAR Engineer
Compliance Certification Services (UL CCS)

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C Edition 01-01, IEEE STD 1528:2003, RSS-102 Issue 4, March 2010, and RSS-102 Supplementary Procedures (SPR)-001, January 1, 2011 and the following KDB Procedures.

- 248227 SAR measurement procedures for 802.11a/b/g transmitters
- 616217 D03 SAR Supp Note and Netbook Laptop V01

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
Robot - Six Axes	Stäubli	RX90BL	N/A	N/A		
Robot Remote Control	Stäubli	CS7MB	S-0396	N/A		
DASY4 Measurement Server	SPEAG	SEUMS001BA	1246	N/A		
Probe Alignment Unit	SPEAG	LB5/80	SE UKS 030 AA	N/A		
SAM Twin Phantom	SPEAG	QDOOOP40CD	1629	N/A		
Oval Flat Phantom (ELI 5.0) A	SPEAG	QDOVA001BB	1120	N/A		
Oval Flat Phantom (ELI 5.0) B	SPEAG	QDOVA001BB	1118	N/A		
Dielectric Probe kit	HP	85070C	N/A	N/A		
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	8	2	2011
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3773	5	3	2012
Thermometer	ERTCO	639-1S	1718	8	19	2011
Data Acquisition Electronics	SPEAG	DAE4	1258	5	2	2012
System Validation Dipole	SPEAG	*D5GHzV2	1075	9	3	2011
System Validation Dipole	SPEAG	*D2450V2	706	4	19	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	M2450	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	M5GHz	N/A	Within 24 hrs of first test		

***Note:**

Per KDB 450824 D02 requirements for dipole calibration, UL CCS has adopted two year calibration intervals. On an annual basis each measurement dipole is evaluated for compliance with the following criteria:

1. There is no physical damage to the dipole.
2. System validation with a specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement (See appendix)
4. Impedance is within 5Ω of calibrated measurement (See appendix)

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	1.10	Normal	1	0.64	0.70
Liquid Permittivity - deviation from target		Rectangular	1.732	0.6	0.00
Liquid Permittivity - measurement uncertainty	0.21	Normal	1	0.6	0.13
				Combined Standard Uncertainty Uc(y) =	9.31
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 18.62	%
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 1.48	dB

Measurement uncertainty for 3 to 6 GHz averaged over 1 gram

Component	error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	6.55	Normal	1	1	6.55
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	1.00	Normal	1	1	1.00
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	3.90	Rectangular	1.732	1	2.25
Test Sample Related					
Test Sample Positioning	1.10	Normal	1	1	1.10
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	4.55	Normal	1	0.64	2.91
Liquid Permittivity - deviation from target	10.00	Rectangular	1.732	0.6	3.46
Liquid Permittivity - measurement uncertainty	7.91	Normal	1	0.6	4.75
				Combined Standard Uncertainty Uc(y), %:	11.84
				Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence = 23.21	%
				Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence = 1.81	dB

5. EQUIPMENT UNDER TEST

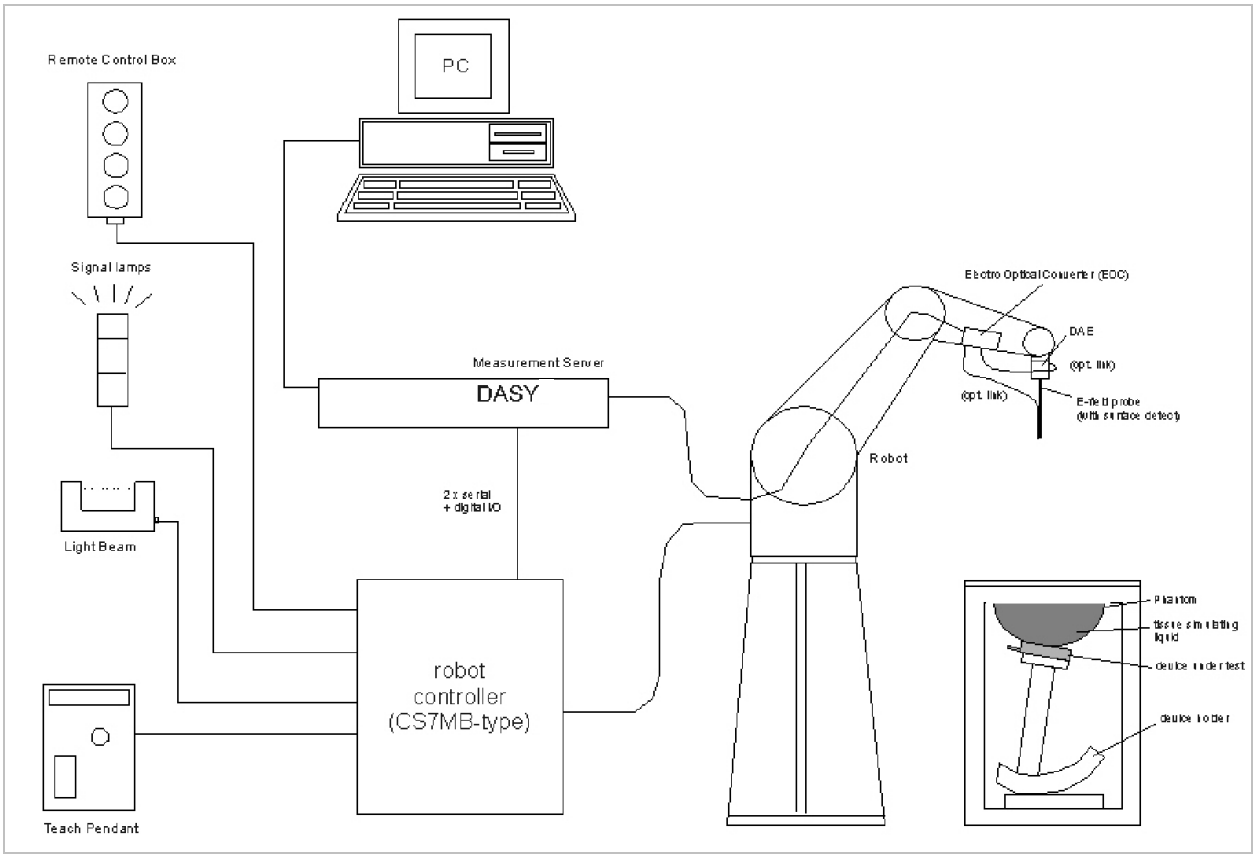
The Intel® Centrino® Ultimate-N 6300 is an embedded IEEE 802.11a/b/g/n 3x3 MIMO wireless network adapter that operates in the 2.4 GHz and 5.0 GHz spectrum.

(Tested inside of Samsung Notebook PC, NP900X3A)

Normal operation:	Lap-held (with display open at 90° to the keyboard)
Antenna tested:	Manufacturer / Part number Wistron / ☒Main (Chain A): 81.EHD15.G32 Wistron / ☒Aux1 (Chain B): 81.EHD15.G31 TE / ☒Aux2 (Chain C): 2108262
Antenna-to-antenna/user separation distances:	Refer to Sec. 15 for details of antenna locations and separation distances.
Simultaneous transmission:	WiFi can transmit simultaneously with Bluetooth.
Assessment for SAR evaluation for Simultaneous transmission:	As the Bluetooth module's (Broadcom BCM92070MD_REF FCC ID: QDS-BRCM1043, IC : 4324A-BRCM1043) maximum output is < 60/f(GHz) mW, stand-alone SAR is not required. Thus, simultaneous SAR evaluation is not required.

Gain:	2.4GHz	5.15 - 5.35GHz	5.47 - 5.725GHz	5.725 - 5.850GHz
Main (Chain A):	.70	1.6	0.0	-4.2
Aux1 (Chain B):	-3.85	1.0	4.9	4.4
Aux2 (Chain C):	1.20	-2.8	-2.3	-1.3

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		915		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. TISSUE DIELECTRIC PARAMETERS

The simulating liquids are checked at the beginning of a series of SAR measurements to determine if 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 were within ± 5% of the target values. For frequencies above 2 GHz the measured conductivity was within ± 5% of the target values. The measured relative permittivity tolerance was within ± 10% of the target value.

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

(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 emulsifier. Dielectric parameters of these liquids were measured using an HP 8570C Dielectric Probe Kit in conjunction with an 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.

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

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

8.1. TISSUE PARAMETERS CHECK RESULTS

Measured by: David Rodgers

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
7/9/2011	Body 2450	e'	51.3274	Relative Permittivity (ϵ_r):	51.33	52.70	-2.60	5
		e''	14.4712	Conductivity (σ):	1.97	1.95	1.10	5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C; Relative humidity = 40%
July 09, 2011 10:25 AM

Frequency	e'	e''
2300000000.	51.8120	13.8145
2310000000.	51.7841	13.8629
2320000000.	51.7547	13.9029
2330000000.	51.7248	13.9462
2340000000.	51.6931	13.9870
2350000000.	51.6598	14.0314
2360000000.	51.6263	14.0722
2370000000.	51.5874	14.1151
2380000000.	51.5511	14.1611
2390000000.	51.5172	14.2057
2400000000.	51.4878	14.2558
2410000000.	51.4574	14.3009
2420000000.	51.4266	14.3446
2430000000.	51.3968	14.3858
2440000000.	51.3622	14.4273
2450000000.	**51.3274**	**14.4712**
2460000000.	51.2928	14.5150
2470000000.	51.2559	14.5622
2480000000.	51.2156	14.6078
2490000000.	51.1774	14.6566
2500000000.	51.1418	14.7023
2510000000.	51.1069	14.7504
2520000000.	51.0743	14.7932
2530000000.	51.0387	14.8298
2540000000.	51.0013	14.8685
2550000000.	50.9617	14.9033

The conductivity (σ) can be given as:

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

where $f = target\ f * 10^6$
$\varepsilon_0 = 8.854 * 10^{-12}$

Measured by: David Rodgers

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
7/11/2011	Body 2450	e'	52.8125	Relative Permittivity (ε_r):	52.81	52.70	0.21	5
		e''	14.0775	Conductivity (σ):	1.92	1.95	-1.65	5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C; Relative humidity = 40%
July 11, 2011 08:47 AM

Frequency	e'	e''
2350000000.	53.1332	13.6441
2355000000.	53.1173	13.6652
2360000000.	53.0987	13.6881
2365000000.	53.0826	13.7078
2370000000.	53.0641	13.7320
2375000000.	53.0481	13.7537
2380000000.	53.0300	13.7754
2385000000.	53.0145	13.8004
2390000000.	52.9974	13.8244
2395000000.	52.9816	13.8477
2400000000.	52.9688	13.8733
2405000000.	52.9523	13.8979
2410000000.	52.9392	13.9185
2415000000.	52.9261	13.9398
2420000000.	52.9107	13.9555
2425000000.	52.8961	13.9763
2430000000.	52.8812	13.9952
2435000000.	52.8634	14.0154
2440000000.	52.8481	14.0365
2445000000.	52.8303	14.0576
2450000000.	**52.8125**	**14.0775**
2455000000.	52.7955	14.0997
2460000000.	52.7787	14.1217
2465000000.	52.7628	14.1425
2470000000.	52.7445	14.1651
2475000000.	52.7240	14.1882
2480000000.	52.7079	14.2114
2485000000.	52.6917	14.2350
2490000000.	52.6758	14.2583
2495000000.	52.6610	14.2832
2500000000.	52.6474	14.3072

The conductivity (σ) can be given as:

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

where f = target $f * 10^6$
$\varepsilon_0 = 8.854 * 10^{-12}$

Measured by: David Rodgers

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
7/11/2011	Body 5200	e'	49.0875	Relative Permittivity (ϵ_r):	49.09	49.02	0.14	10
		e''	18.5294	Conductivity (σ):	5.36	5.29	1.19	5
7/11/2011	Body 5500	e'	48.2808	Relative Permittivity (ϵ_r):	48.28	48.61	-0.68	10
		e''	19.0234	Conductivity (σ):	5.82	5.64	3.07	5
7/11/2011	Body 5800	e'	47.4935	Relative Permittivity (ϵ_r):	47.49	48.20	-1.47	10
		e''	19.4506	Conductivity (σ):	6.27	6.00	4.55	5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C; Relative humidity = 40%
July 11, 2011 03:23 PM

Frequency	e'	e''
5150000000.	49.2653	18.4775
5155000000.	49.2508	18.4816
5160000000.	49.2366	18.4848
5165000000.	49.2228	18.4917
5170000000.	49.2061	18.4955
5175000000.	49.1883	18.5017
5180000000.	49.1677	18.5053
5185000000.	49.1494	18.5124
5190000000.	49.1279	18.5182
5195000000.	49.1052	18.5243
5200000000.	**49.0875**	**18.5294**
5450000000.	48.3927	18.8981
5455000000.	48.3770	18.9076
5460000000.	48.3563	18.9194
5485000000.	48.2973	18.9866
5490000000.	48.2896	19.0006
5495000000.	48.2849	19.0131
5500000000.	**48.2808**	**19.0234**
5750000000.	47.6532	19.3607
5755000000.	47.6345	19.3663
5760000000.	47.6157	19.3737
5765000000.	47.5986	19.3802
5770000000.	47.5810	19.3853
5775000000.	47.5658	19.3931
5780000000.	47.5503	19.4010
5785000000.	47.5335	19.4103
5790000000.	47.5195	19.4258
5795000000.	47.5033	19.4390
5800000000.	**47.4935**	**19.4506**

The conductivity (σ) can be given as:

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

where f = target $f * 10^6$
$\varepsilon_0 = 8.854 * 10^{-12}$

Measured by: David Rodgers

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
7/12/2011	Body 5200	e'	52.8987	Relative Permittivity (ε_r):	52.90	49.02	7.91	10
		e''	18.2243	Conductivity (σ):	5.27	5.29	-0.48	5
7/12/2011	Body 5500	e'	52.2432	Relative Permittivity (ε_r):	52.24	48.61	7.47	10
		e''	18.6100	Conductivity (σ):	5.69	5.64	0.83	5
7/12/2011	Body 5800	e'	51.6094	Relative Permittivity (ε_r):	51.61	48.20	7.07	10
		e''	18.9512	Conductivity (σ):	6.11	6.00	1.86	5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C; Relative humidity = 40%
July 12, 2011 04:29 PM

Frequency	e'	e''
5150000000.	53.0281	18.0808
5155000000.	53.0113	18.0852
5160000000.	52.9896	18.0947
5165000000.	52.9717	18.1088
5170000000.	52.9537	18.1237
5175000000.	52.9382	18.1400
5180000000.	52.9240	18.1563
5185000000.	52.9145	18.1758
5190000000.	52.9058	18.1940
5195000000.	52.9020	18.2098
5200000000.	**52.8987**	**18.2243**
5450000000.	52.3173	18.5038
5455000000.	52.3020	18.5119
5460000000.	52.2890	18.5220
5465000000.	52.2793	18.5306
5470000000.	52.2696	18.5463
5475000000.	52.2590	18.5578
5480000000.	52.2547	18.5690
5485000000.	52.2490	18.5832
5490000000.	52.2461	18.5939
5495000000.	52.2430	18.6030
5500000000.	**52.2432**	**18.6100**
5765000000.	51.6594	18.8363
5770000000.	51.6404	18.8472
5775000000.	51.6287	18.8632
5780000000.	51.6180	18.8808
5785000000.	51.6089	18.8963
5790000000.	51.6066	18.9202
5795000000.	51.6034	18.9384
5800000000.	**51.6094**	**18.9512**

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

Measured by: David Rodgers

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
7/13/2011	Body 5200	e'	50.4052	Relative Permittivity (ε_r):	50.41	49.02	2.83	10
		e''	18.2827	Conductivity (σ):	5.29	5.29	-0.16	5
7/13/2011	Body 5500	e'	49.7468	Relative Permittivity (ε_r):	49.75	48.61	2.33	10
		e''	18.7566	Conductivity (σ):	5.74	5.64	1.62	5
7/13/2011	Body 5800	e'	49.1137	Relative Permittivity (ε_r):	49.11	48.20	1.90	10
		e''	19.2177	Conductivity (σ):	6.20	6.00	3.29	5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C; Relative humidity = 40%
July 13, 2011 12:06 AM

Frequency	e'	e''
5175000000.	50.4580	18.2221
5180000000.	50.4413	18.2322
5185000000.	50.4322	18.2461
5190000000.	50.4213	18.2580
5195000000.	50.4128	18.2708
5200000000.	**50.4052**	**18.2827**
5450000000.	49.8634	18.6734
5455000000.	49.8515	18.6797
5460000000.	49.8410	18.6864
5465000000.	49.8280	18.6925
5470000000.	49.8158	18.7029
5475000000.	49.8012	18.7083
5480000000.	49.7890	18.7168
5485000000.	49.7763	18.7265
5490000000.	49.7650	18.7371
5495000000.	49.7546	18.7472
5500000000.	**49.7468**	**18.7566**
5750000000.	49.2271	19.1396
5755000000.	49.2179	19.1477
5760000000.	49.2078	19.1553
5765000000.	49.1976	19.1617
5770000000.	49.1850	19.1646
5775000000.	49.1756	19.1703
5780000000.	49.1627	19.1762
5785000000.	49.1485	19.1831
5790000000.	49.1369	19.1938
5795000000.	49.1232	19.2075
5800000000.	**49.1137**	**19.2177**

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

Measured by: David Rodgers

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
7/14/2011	Body 5200	e'	48.5593	Relative Permittivity (ε_r):	48.56	49.02	-0.94	10
		e''	17.9829	Conductivity (σ):	5.20	5.29	-1.80	5
7/14/2011	Body 5500	e'	47.8752	Relative Permittivity (ε_r):	47.88	48.61	-1.52	10
		e''	18.4472	Conductivity (σ):	5.64	5.64	-0.05	5
7/14/2011	Body 5800	e'	47.2097	Relative Permittivity (ε_r):	47.21	48.20	-2.05	10
		e''	18.8896	Conductivity (σ):	6.09	6.00	1.53	5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C; Relative humidity = 40%
July 14, 2011 12:34 AM

Frequency	e'	e''
5200000000.	**48.5593**	**17.9829**
5210000000.	48.5465	18.0001
5220000000.	48.5283	18.0108
5230000000.	48.5037	18.0260
5240000000.	48.4769	18.0439
5250000000.	48.4590	18.0622
5450000000.	48.0016	18.3907
5460000000.	47.9858	18.3991
5470000000.	47.9637	18.4091
5480000000.	47.9335	18.4157
5490000000.	47.9027	18.4307
5500000000.	**47.8752**	**18.4472**
5510000000.	47.8512	18.4713
5520000000.	47.8298	18.4871
5530000000.	47.8054	18.5081
5540000000.	47.7862	18.5277
5550000000.	47.7705	18.5459
5750000000.	47.3478	18.8326
5760000000.	47.3303	18.8444
5770000000.	47.3074	18.8487
5780000000.	47.2791	18.8526
5790000000.	47.2433	18.8650
5800000000.	**47.2097**	**18.8896**
5810000000.	47.1860	18.9159
5820000000.	47.1640	18.9345
5830000000.	47.1468	18.9491
5840000000.	47.1313	18.9668
5850000000.	47.1151	18.9809

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^6$

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

Measured by: David Rodgers

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
7/14/2011	Body 5200	e'	47.0760	Relative Permittivity (ε_r):	47.08	49.02	-3.96	10
		e''	17.5253	Conductivity (σ):	5.07	5.29	-4.30	5
7/14/2011	Body 5500	e'	46.4683	Relative Permittivity (ε_r):	46.47	48.61	-4.41	10
		e''	18.0054	Conductivity (σ):	5.51	5.64	-2.45	5
7/14/2011	Body 5800	e'	45.8785	Relative Permittivity (ε_r):	45.88	48.20	-4.82	10
		e''	18.4597	Conductivity (σ):	5.95	6.00	-0.78	5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C; Relative humidity = 40%
July 14, 2011 08:01 PM

Frequency	e'	e''
5200000000.	**47.0760**	**17.5253**
5210000000.	47.0639	17.5378
5220000000.	47.0440	17.5428
5230000000.	47.0141	17.5497
5240000000.	46.9835	17.5660
5250000000.	46.9594	17.5897
5260000000.	46.9429	17.6069
5270000000.	46.9274	17.6286
5280000000.	46.9072	17.6490
5290000000.	46.8909	17.6717
5300000000.	46.8768	17.6904
5400000000.	46.6817	17.8577
5410000000.	46.6765	17.8732
5420000000.	46.6656	17.8770
5430000000.	46.6386	17.8827
5440000000.	46.6064	17.8945
5450000000.	46.5738	17.9104
5460000000.	46.5469	17.9249
5470000000.	46.5196	17.9436
5480000000.	46.4959	17.9617
5490000000.	46.4805	17.9850
5500000000.	**46.4683**	**18.0054**
5700000000.	46.0691	18.3072
5710000000.	46.0570	18.3295
5720000000.	46.0453	18.3407
5730000000.	46.0318	18.3466
5740000000.	46.0097	18.3571
5750000000.	45.9900	18.3723
5760000000.	45.9718	18.3885
5770000000.	45.9483	18.4010
5780000000.	45.9250	18.4153
5790000000.	45.9002	18.4347
5800000000.	**45.8785**	**18.4597**

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

Measured by: David Rodgers

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
7/20/2011	Body 5200	e'	48.1312	Relative Permittivity (ϵ_r):	48.13	49.02	-1.81	10
		e''	18.2219	Conductivity (σ):	5.27	5.29	-0.49	5
7/20/2011	Body 5500	e'	47.3665	Relative Permittivity (ϵ_r):	47.37	48.61	-2.56	10
		e''	18.7315	Conductivity (σ):	5.73	5.64	1.49	5
7/20/2011	Body 5800	e'	46.5966	Relative Permittivity (ϵ_r):	46.60	48.20	-3.33	10
		e''	19.0927	Conductivity (σ):	6.16	6.00	2.62	5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C; Relative humidity = 40%
July 20, 2011 10:24 AM

Frequency	e'	e''
5200000000.	**48.1312**	**18.2219**
5210000000.	48.0935	18.2218
5220000000.	48.0496	18.2219
5230000000.	48.0046	18.2324
5240000000.	47.9705	18.2649
5250000000.	47.9549	18.3080
5260000000.	47.9503	18.3446
5270000000.	47.9497	18.3807
5280000000.	47.9440	18.4008
5290000000.	47.9318	18.4108
5300000000.	47.9110	18.4075
5400000000.	47.6513	18.5831
5410000000.	47.6430	18.5772
5420000000.	47.6158	18.5570
5430000000.	47.5627	18.5413
5440000000.	47.4991	18.5409
5450000000.	47.4438	18.5537
5460000000.	47.4000	18.5803
5470000000.	47.3689	18.6194
5480000000.	47.3548	18.6614
5490000000.	47.3557	18.7026
5500000000.	**47.3665**	**18.7315**
5700000000.	46.8217	18.9670
5710000000.	46.8204	19.0095
5720000000.	46.8240	19.0342
5730000000.	46.8238	19.0482
5740000000.	46.8176	19.0516
5750000000.	46.7991	19.0534
5760000000.	46.7691	19.0504
5770000000.	46.7265	19.0463
5780000000.	46.6821	19.0472
5790000000.	46.6320	19.0602
5800000000.	**46.5966**	**19.0927**

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 measurement accuracy. The system performance check verifies that the system operates within its specifications of ±10%.

Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Head or Body simulating liquid of the following parameters.
- The DASY5 system with an Isotropic E-Field EX3DV4 probe 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 fine cube was chosen for cube
- 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 power (forward power) was 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 SN 706	D2450V2-706_Apr10	4/19/10	2.4	1g SAR:	51.6	52.4
				10g SAR:	24.4	24.5
D5GHzV2 SN 1075	D5GHzV2-1075_Sep09	9/3/09	5.2	1g SAR:		79.0
				10g SAR:		22.0
			5.5	1g SAR:		85.4
				10g SAR:		23.5
			5.8	1g SAR:		73.2
				10g SAR:		20.1

9.1. SYSTEM CHECK RESULTS

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D2450V2 (2.45GHz)	07/09/11	1g SAR:	53.9	52.4	2.86	±10
		10g SAR:	24.9	24.5	1.63	
D2450V2 (2.45GHz)	07/11/11	1g SAR:	53.2	52.4	1.53	±10
		10g SAR:	25.2	24.5	2.86	
D5GHzV2 (5.2GHz)	07/11/11	1g SAR:	80.2	79.0	1.52	±10
		10g SAR:	22.8	22.0	3.64	
D5GHzV2 (5.5GHz)	07/11/11	1g SAR:	90.2	85.4	5.62	±10
		10g SAR:	25.5	23.5	8.51	
D5GHzV2 (5.8GHz)	07/11/11	1g SAR:	73.8	73.2	0.82	±10
		10g SAR:	20.9	20.1	3.98	
D5GHzV2 (5.2GHz)	07/12/11	1g SAR:	78.6	79.0	-0.51	±10
		10g SAR:	22.5	22.0	2.27	
D5GHzV2 (5.5GHz)	07/12/11	1g SAR:	89.2	85.4	4.45	±10
		10g SAR:	25.3	23.5	7.66	
D5GHzV2 (5.2GHz)	07/13/11	1g SAR:	77.3	79.0	-2.15	±10
		10g SAR:	22.2	22.0	0.91	
D5GHzV2 (5.5GHz)	07/13/11	1g SAR:	86.5	85.4	1.29	±10
		10g SAR:	24.6	23.5	4.68	
D5GHzV2 (5.8GHz)	07/13/11	1g SAR:	74.4	73.2	1.64	±10
		10g SAR:	21.0	20.1	4.48	
D5GHzV2 (5.2GHz)	07/14/11	1g SAR:	78.7	79.0	-0.38	±10
		10g SAR:	22.5	22.0	2.27	
D5GHzV2 (5.5GHz)	07/14/11	1g SAR:	85.4	85.4	0.00	±10
		10g SAR:	24.3	23.5	3.40	
D5GHzV2 (5.8GHz)	07/14/11	1g SAR:	71.2	73.2	-2.73	±10
		10g SAR:	20.1	20.1	0.00	
D5GHzV2 (5.2GHz)	07/20/11	1g SAR:	73.2	79.0	-7.34	±10
		10g SAR:	21.0	22.0	-4.55	
D5GHzV2 (5.5GHz)	07/20/11	1g SAR:	87.8	85.4	2.81	±10
		10g SAR:	24.8	23.5	5.53	
D5GHzV2 (5.8GHz)	07/20/11	1g SAR:	73.3	73.2	0.14	±10
		10g SAR:	20.6	20.1	2.49	

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 ≥ 7x7x9 (above 4.5 GHz) or 5x5x7 (below 3 GHz) 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. RF 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, Intel DRTU v1.3.12-0263, which enabled the user to control the frequency and output power of the module.

11.1. RF OUTPUT POWER FOR 2.4 GHZ BAND

2.4 GHz Band								
Mode	Ch. #	Freq. (MHz)	Original Target Pwr (dBm)			Actual Measured Pwr (dBm)		
			Chain A	Chain B	Chain C	Chain A	Chain B	Chain C
802.11b	1	2412	16.54					
	6	2437	**16.47**			**16.63**		
	11	2462	16.38					
	1	2412		16.59				
	6	2437		**16.46**			**16.90**	
	11	2462		16.43				
	1	2412			16.58			
	6	2437			**16.48**			**16.70**
	11	2462			16.45			
802.11g	1	2412	15.46					
	6	2437	16.47					
	11	2462	14.48					
	1	2412		14.57				
	6	2437		16.43				
	11	2462		14.61				
	1	2412			15.35			
	6	2437			16.47			
	11	2462			14.43			
802.11n HT20	1	2412	14.51					
	6	2437	16.50					
	11	2462	14.45					
	1	2412		14.47				
	6	2437		16.47				
	11	2462		14.41				
	1	2412			15.50			
	6	2437			16.33			
	11	2462			15.46			
802.11n HT40	3	2422	11.98					
	6	2437	16.40					
	9	2450	12.06					
	3	2422		12.04				
	6	2437		16.33				
	9	2450		12.19				
	3	2422			11.99			
	6	2437			16.40			
	9	2450			12.09			

2.4 GHz Band Triple Chain ABC				
Mode	Ch. #	Freq. (MHz)	Original Target Pwr (dBm)	Actual Measured
			Chain ABC	Chain ABC
802.11b	1	2412	16.49	
	6	2437	**16.58**	**16.67**
	11	2462	16.45	
802.11n HT40	3	2422	16.49	
	6	2437	16.51	
	9	2452	16.51	

Notes:

1. The modes with highest output power channel were chosen for the conducted output power.
2. Original target power is from EMC report. Please refer to original report (FCC ID: PD9633ANH for Average Power information as documented in the original filing.

11.2. RF OUTPUT POWER FOR 5 GHZ BANDS

5.2 GHz Band								
Mode	Ch. #	Freq. (MHz)	Original Target Pwr			Actual Measured Pwr (dBm)		
			Chain A	Chain B	Chain C	Chain A	Chain B	Chain C
802.11a	36	5180	16.52					
	40	5200	**16.56**			**16.80**		
	48	5240	16.61					
	36	5180		16.37				
	40	5200		**16.45**			**16.60**	
	48	5240		16.58				
	36	5180			16.44			
	40	5200			**16.42**			**16.65**
	48	5240			16.63			
802.11n HT20	36	5180	16.00					
	40	5200	16.55					
	48	5240	16.36					
	36	5180		16.57				
	40	5200		16.55				
	48	5240		16.43				
	36	5180			16.56			
	40	5200			16.58			
	48	5240			16.51			
802.11n HT40	38	5190	16.65					
	46	5230	16.43					
	38	5190		16.65				
	46	5230		16.61				
	38	5190			16.50			
	46	5230			16.66			

5.3 GHz Band								
Mode	Ch. #	Freq. (MHz)	Original Target Pwr			Actual Measured Pwr (dBm)		
			Chain A	Chain B	Chain C	Chain A	Chain B	Chain C
802.11a	52	5260	16.47					
	56	5280	**16.62**			**16.70**		
	64	5320	16.45					
	52	5260		16.42				
	56	5280		**16.49**			**16.70**	
	64	5320		16.45				
	52	5260			16.56			
	56	5280			**16.47**			**16.60**
	64	5320			16.40			
802.11n HT20	52	5260	16.53					
	56	5280	16.42					
	64	5320	16.61					
	52	5260		16.49				
	56	5280		16.41				
	64	5320		16.48				
	52	5260			16.49			
	56	5280			16.62			
	64	5320			16.46			
802.11n HT40	54	5270	16.56					
	62	5310	16.50					
	54	5270		16.52				
	62	5310		16.49				
	54	5270			16.53			
	62	5310			16.65			

5.5 GHz Band								
Mode	Ch. #	Freq. (MHz)	Original Target Pwr			Actual Measured Pwr (dBm)		
			Chain A	Chain B	Chain C	Chain A	Chain B	Chain C
802.11a	100	5500	16.49					
	120	5600	**16.60**			**17.00**		
	140	5700	16.57					
	100	5500		16.36				
	120	5600		**16.48**			**16.50**	
	140	5700		16.44				
	100	5500			16.42			
	120	5600			**16.47**			**16.50**
	140	5700			16.56			
802.11n HT20	100	5500	16.53					
	120	5600	16.50					
	140	5700	16.59					
	100	5500		16.55				
	120	5600		16.41				
	140	5700		16.47				
	100	5500			16.55			
	120	5600			16.48			
	140	5700			16.63			
802.11n HT40	102	5510	16.49					
	118	5590	16.58					
	134	5670	16.67					
	102	5510		16.55				
	118	5590		16.60				
	134	5670		16.64				
	102	5510			16.76			
	118	5590			16.57			
	134	5670			16.52			

5.8 GHz Band								
Mode	Ch. #	Freq. (MHz)	Original Target Pwr			Actual Measured Pwr (dBm)		
			Chain A	Chain B	Chain C	Chain A	Chain B	Chain C
802.11a	149	5745	16.61					
	157	5785	**16.64**			**16.85**		
	165	5825	16.36					
	149	5745		16.49				
	157	5785		**16.56**			**16.56**	
	165	5825		16.62				
	149	5745			16.49			
	157	5785			**16.40**			**16.46**
	165	5825			16.61			
802.11n HT20	149	5745	16.47					
	157	5785	16.63					
	165	5825	16.58					
	149	5745		16.59				
	157	5785		16.44				
	165	5825		16.56				
	149	5745			16.58			
	157	5785			16.54			
	165	5825			16.51			
802.11n HT40	151	5755	16.48					
	159	5795	16.62					
	151	5755		16.47				
	159	5795		16.51				
	151	5755			16.50			
	159	5795			16.64			

5 GHz Band Triple Chain ABC				
Mode	Ch. #	Freq. (MHz)	Original Target Chain ABC	Actual Measured Chain ABC
802.11n HT20	36	5180	16.44	
	40	5200	**16.46**	**16.57**
	48	5240	16.45	
	52	5260	16.53	
	56	5280	**16.33**	**16.50**
	64	5320	16.54	
	100	5500	16.45	
	120	5600	**16.38**	**16.48**
	140	5700	16.50	
	149	5745	16.53	
	157	5785	**16.34**	**16.51**
	165	5825	16.41	
802.11n HT40	38	5190	16.52	
	46	5230	16.44	
	54	5270	16.57	
	62	5310	16.52	
	102	5510	16.57	
	118	5590	16.47	
	134	5670	16.44	
	151	5785	16.49	
	159	5825	16.47	

Notes:

1. The modes with highest output power channel were chosen for the conducted output power.
2. Original target power is from EMC report. Please refer to original report (FCC ID: PD9633ANH) for Average Power information as documented in the original filing.

12. SUMMARY OF SAR TEST RESULTS

12.1. SUMMARY OF SAR TEST CONFIGURATIONS

Configuration	Antenna-to-User distance	SAR Required	Comments
Lap held	8 mm From all antennas-to-user	Yes	Primary configuration.
Bystander	15 mm From antenna 3 to bystanders	Yes	SAR tested with 15 mm distance from back of the display. Per RSS-102 Supplementary Procedures (SPR)-001 January 1, 2011. IC requires SAR measurements to be performed if the integrated antenna(s) are located in the back side of the display screen.

12.2. 2.4 GHZ

Lap Held 1x1

Mode	Channel	f (MHz)	Avg. Output Power (dBm)			Measured Result (mW/g)	
			Chain A	Chain B	Chain C	1g-SAR	10g-SAR
802.11b	1	2412					
	6	2437	16.63			0.051	0.026
	11	2462					
	1	2412					
	6	2437		17.00		**0.059**	0.053
	11	2462					
	1	2412					
	6	2437			16.70	0.000025	0.000003
	11	2462					

Lap Held 3x3

Mode	Channel	f (MHz)	Avg. Power (dBm)	Measured Result (mW/g)					
			Chain A/B/C	Ch.A 1g	Ch.A 10g	Ch.B 1g	Ch.B 10g	Ch.C 1g	Ch.C 10g
802.11b	1	2412							
	6	2437	16.67	0.049	0.042	0.047	0.043	0.053	0.041
	11	2462							

(2) Bystanders

Mode	Channel	f (MHz)	Avg. Output Power (dBm)			Measured Result (mW/g)	
			Chain A	Chain B	Chain C	1g-SAR	10g-SAR
802.11b	1	2412					
	6	2437			16.70	0.0087	0.0030
	11	2462					

Notes:

1. The modes with highest output power channel were chosen for the conducted output power.
2. SAR is not required for 802.11g channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

12.3. 5 GHZ BANDS

Lap Held 1X1

5.2 GHz Band							
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)			Measured Result (mW/g)	
			Chain A	Chain B	Chain C	1g-SAR	10g-SAR
802.11a	36	5180					
	40	5200	16.80			**0.255**	0.223
	48	5240					
	36	5180					
	40	5200		16.60		0.187	0.170
	48	5240					
	36	5180					
	40	5200			16.65	0.169	0.145
	48	5240					

Lap Held 3x3

Mode	Channel	f (MHz)	Avg. Power (dBm)	Measured Result (mW/g)					
			Chain A/B/C	Ch.A 1g	Ch.A 10g	Ch.B 1g	Ch.B 10g	Ch.C 1g	Ch.C 10g
802.11a	36	5180							
	40	5200	16.57	0.161	0.146	0.175	0.161	0.174	0.155
	48	5240							

Bystanders

Mode	Channel	f (MHz)	Avg. Output Power (dBm)			Measured Result (mW/g)	
			Chain A	Chain B	Chain C	1g-SAR	10g-SAR
802.11a	36	5180					
	40	5200			16.650	0.0689	0.0542
	48	5240					

Notes:

3. The modes with highest output power channel were chosen for the conducted output power.

Lap Held 1X1

5.3 GHz Band							
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)			Measured Result (mW/g)	
			Chain A	Chain B	Chain C	1g-SAR	10g-SAR
802.11a	52	5260					
	56	5280	16.70			0.183	0.155
	64	5320					
	52	5260					
	56	5280		16.70		**0.202**	0.162
	64	5320					
	52	5260					
	56	5280			16.60	0.157	0.131
	64	5320					

Lap Held 3x3

Mode	Channel	f (MHz)	Avg. Power (dBm)	Measured Result (mW/g)					
			Chain A/B/C	Ch.A 1g	Ch.A 10g	Ch.B 1g	Ch.B 10g	Ch.C 1g	Ch.C 10g
802.11a	52	5260							
	56	5280	16.50	0.162	0.143	0.172	0.153	0.161	0.148
	64	5320							

Bystanders

Mode	Channel	f (MHz)	Avg. Output Power (dBm)			Measured Result (mW/g)	
			Chain A	Chain B	Chain C	1g-SAR	10g-SAR
802.11a	52	5260					
	56	5280			16.65	0.0620	0.0470
	64	5320					

Notes:

4. The modes with highest output power channel were chosen for the conducted output power.

Lap Held 1X1

5.5 GHz Band							
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)			Measured Result (mW/g)	
			Chain A	Chain B	Chain C	1g-SAR	10g-SAR
802.11a	100	5500					
	120	5600	16.90			0.205	0.176
	140	5700					
	100	5500					
	120	5600		16.50		0.211	0.188
	140	5700					
	100	5500					
	120	5600			16.50	**0.242**	0.213
	140	5700					

Lap Held 3x3

Mode	Channel	f (MHz)	Avg. Power (dBm)	Measured Result (mW/g)					
			Chain A/B/C	Ch.A 1g	Ch.A 10g	Ch.B 1g	Ch.B 10g	Ch.C 1g	Ch.C 10g
802.11a	100	5500							
	120	5600	16.48	0.217	0.194	0.220	0.198	0.226	0.203
	140	5700							

Bystanders

Mode	Channel	f (MHz)	Avg. Output Power (dBm)			Measured Result (mW/g)	
			Chain A	Chain B	Chain C	1g-SAR	10g-SAR
802.11a	100	5500					
	120	5600			16.50	0.1160	0.1030
	140	5700					

Notes:

5. The modes with highest output power channel were chosen for the conducted output power.

Lap Held 1X1

5.8 GHz Band							
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)			Measured Result (mW/g)	
			Chain A	Chain B	Chain C	1g-SAR	10g-SAR
802.11a	149	5745					
	157	5785	16.70			0.209	0.189
	165	5825					
	149	5745					
	157	5785		16.80		**0.220**	0.199
	165	5825					
	149	5745					
	157	5785			16.60	0.207	0.186
	165	5825					

Lap Held 3x3

Mode	Channel	f (MHz)	Avg. Power (dBm)	Measured Result (mW/g)					
			Chain A/B/C	Ch.A 1g	Ch.A 10g	Ch.B 1g	Ch.B 10g	Ch.C 1g	Ch.C 10g
802.11a	149	5745							
	157	5785	16.51	0.202	0.184	0.210	0.192	0.205	0.185
	165	5825							

Bystanders

Mode	Channel	f (MHz)	Avg. Output Power (dBm)			Measured Result (mW/g)	
			Chain A	Chain B	Chain C	1g-SAR	10g-SAR
802.11a	149	5745					
	157	5785			16.600	0.1090	0.0891
	165	5825					

Notes:

6. The modes with highest output power channel were chosen for the conducted output power.

13. WORST-CASE SAR TEST PLOTS

2.4 GHz

Date: 7/9/2011

Test Laboratory: UL CCS SAR Lab B

002_Lap held Ch 6 Ant B

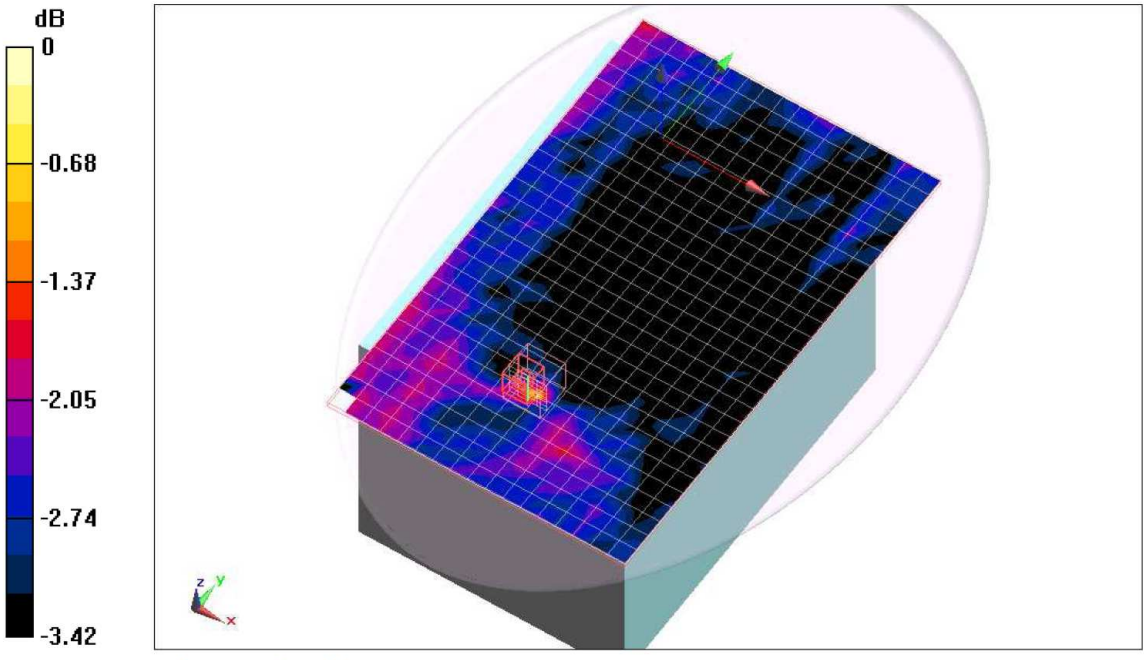
Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.954 mho/m; ε_r = 51.373; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV4 - SN3773; ConvF(6.87, 6.87, 6.87); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1118
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

802.11b/Ch 6_Ant B/Area Scan (18x28x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.059 mW/g

802.11b/Ch 6_Ant B/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.631 V/m; Power Drift = 0.21 dB
Peak SAR (extrapolated) = 0.068 W/kg
SAR(1 g) = 0.059 mW/g; SAR(10 g) = 0.053 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.068 mW/g



0 dB = 0.070mW/g

5.2 GHz

Date: 7/20/2011

Test Laboratory: UL CCS SAR Lab B

006_Lap held

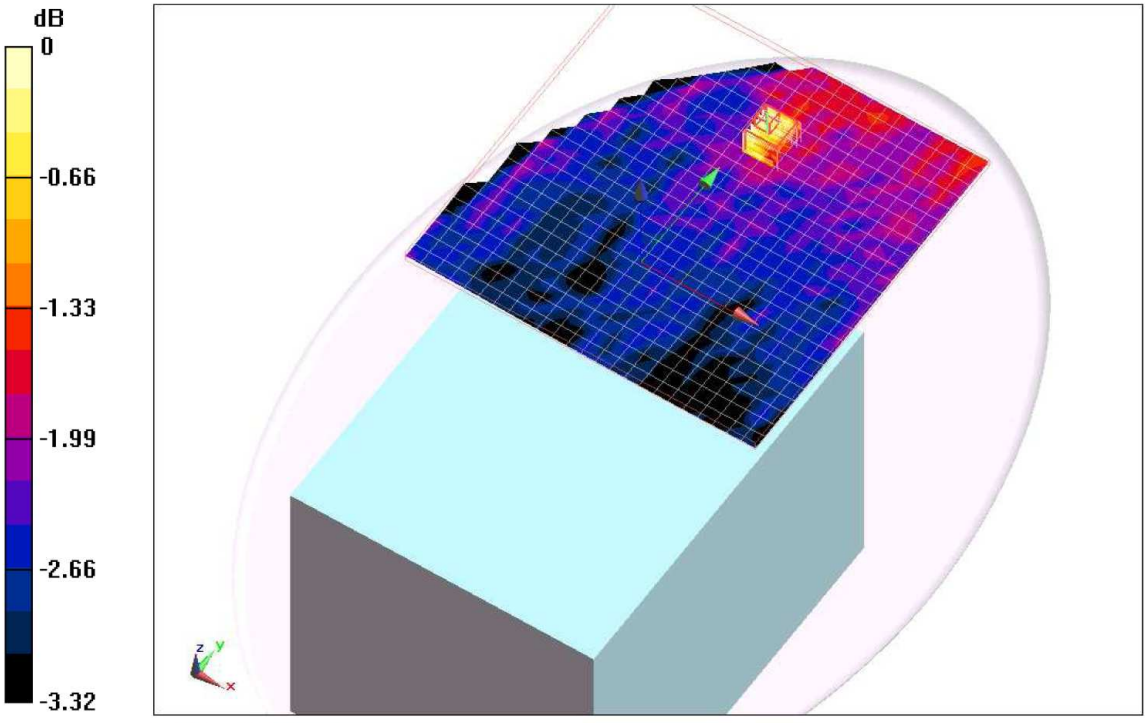
Communication System: IEEE 802.11 a/n; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.271 mho/m; ε_r = 48.131; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 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: EX3DV4 - SN3773; ConvF(4.1, 4.1, 4.1); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1120
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

802.11a/Ch 40_Ant A/Area Scan (25x25x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.197 mW/g

802.11a/Ch 40_Ant A/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 5.504 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.274 W/kg
SAR(1 g) = 0.255 mW/g; SAR(10 g) = 0.223 mW/g
Maximum value of SAR (measured) = 0.274 mW/g



0 dB = 0.270mW/g

5.3 GHz

Date: 7/13/2011

Test Laboratory: UL CCS SAR Lab B

012_Lap held

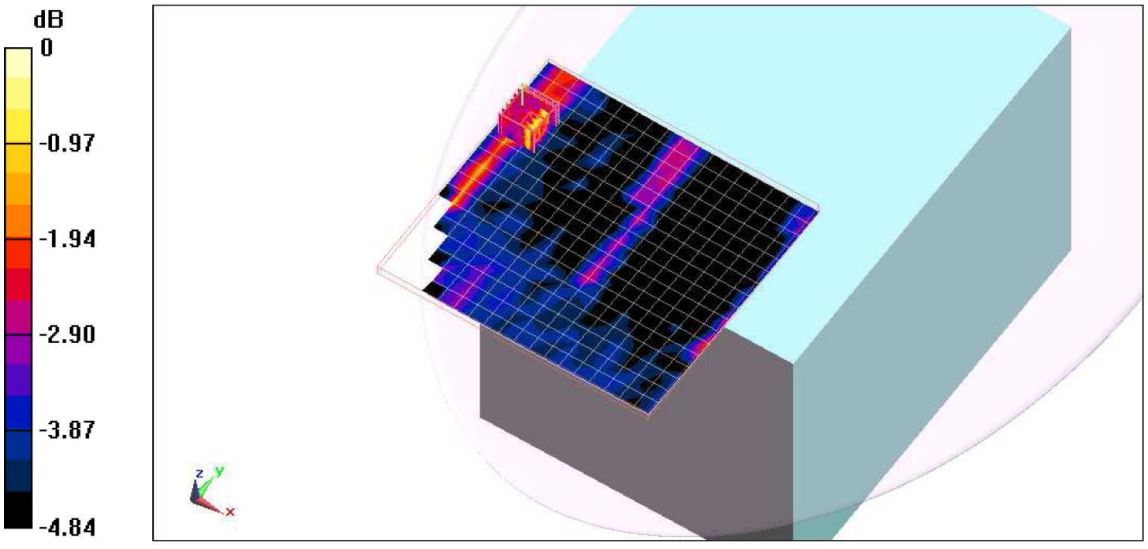
Communication System: WLAN_5GHz; Frequency: 5280 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5280 MHz; σ = 5.404 mho/m; ε_r = 50.22; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 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: EX3DV4 - SN3773; ConvF(3.88, 3.88, 3.88); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1120
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

802.11a/Ch 56_Ant B/Area Scan (19x18x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.210 mW/g

802.11a/Ch 56_Ant B/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 5.367 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.294 W/kg
SAR(1 g) = 0.202 mW/g; SAR(10 g) = 0.162 mW/g
Maximum value of SAR (measured) = 0.294 mW/g



0 dB = 0.290mW/g

5.5 GHz

Date: 7/14/2011

Test Laboratory: UL CCS SAR Lab B

018_Lap held

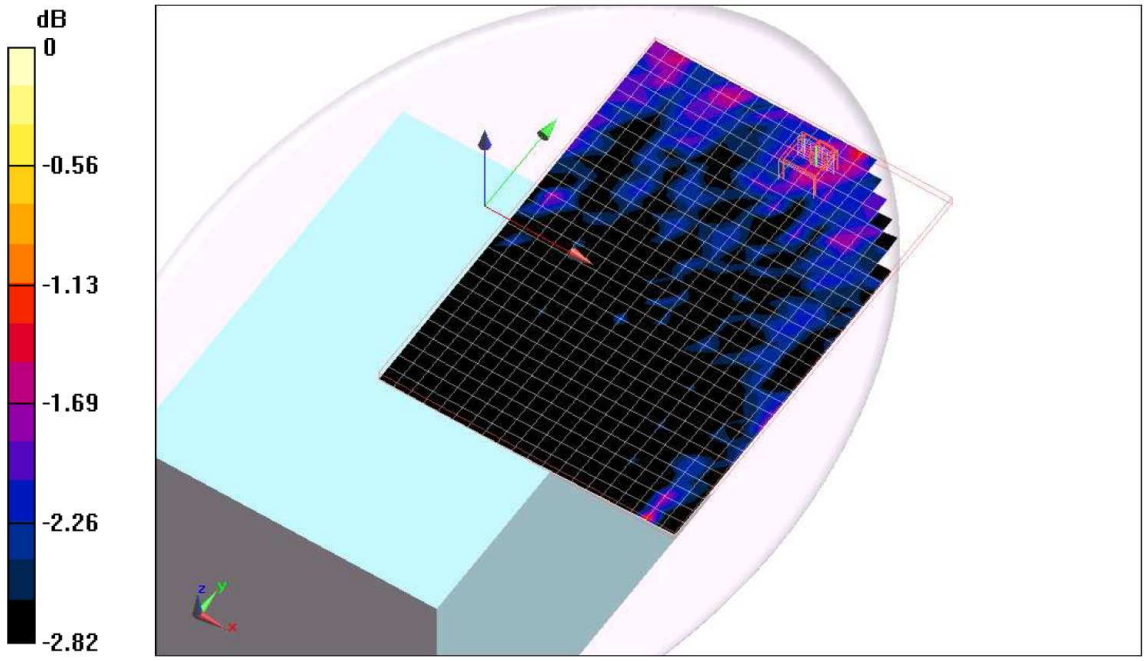
Communication System: WLAN_5GHz; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.794 mho/m; ε_r = 47.666; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 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: EX3DV4 - SN3773; ConvF(3.26, 3.26, 3.26); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1120
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

802.11a/Ch 120_Ant C/Area Scan 2 (21x29x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.211 mW/g

802.11a/Ch 120_Ant C/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 6.247 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.266 W/kg
SAR(1 g) = 0.242 mW/g; SAR(10 g) = 0.213 mW/g
Maximum value of SAR (measured) = 0.266 mW/g



0 dB = 0.270mW/g

5.8 GHz

7/21/2011

Test Laboratory: UL CCS SAR Lab B

022_Lap held

Communication System: WLAN_5GHz; Frequency: 5785 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5785 MHz; σ = 5.93 mho/m; ε_r = 45.913; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

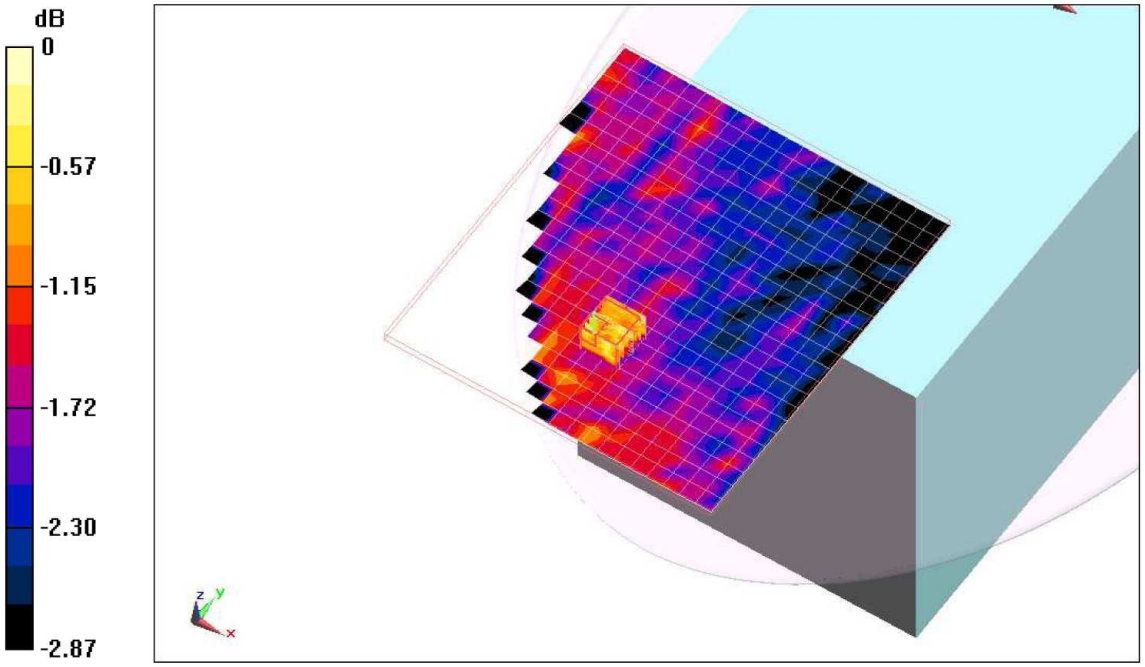
DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3773; ConvF(3.58, 3.58, 3.58); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1120
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

802.11a/Ch 157_Ant B/Area Scan (21x23x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.212 mW/g

802.11a/Ch 157_Ant B/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 5.603 V/m; Power Drift = 0.22 dB
Peak SAR (extrapolated) = 0.255 W/kg
SAR(1 g) = 0.220 mW/g; SAR(10 g) = 0.199 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.255 mW/g



0 dB = 0.260mW/g

14. ATTACHMENTS

No.	Contents	No. of page (s)
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