FCC OET BULLETIN 65 SUPPLEMENT C

SAR EVALUATION REPORT
(WiFi Portion)

For

Intel® Centrino® Advanced-N + WiMAX 6250
(Tested inside of Lenovo ThinkPad X200/X201 Tablet Series)

FCC ID: PD9622ANXHU

MODEL: 622ANXHMW

REPORT NUMBER: 09U12797-4

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Prepared for

INTEL CORPORATION
2111 N.E. 25TH AVENUE
HILLSBORO, OR 97124, USA

Prepared by

COMPLIANCE CERTIFICATION SERVICES
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	December 7, 2009	Initial Issue	--

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	INTEL CORPORATION 2111 N.E. 25TH AVENUE HILLSBORO, OR 97124, USA
EUT DESCRIPTION:	Intel® Centrino® Advanced-N + WiMAX 6250 (Tested inside of Lenovo ThinkPad X200/X201 Tablet Series)
FCC ID:	PD9622ANXHU
MODEL:	622ANXHMW
DEVICE CATEGORY:	Portable
EXPOSURE CATEGORY:	General Population/Uncontrolled Exposure
DATE TESTED:	November 16 - 21 , 2009

THE HIGHEST SAR VALUES:

FCC / IC Rule Parts	Frequency Range [MHz]	The Highest SAR Values (1g_mW/g)	Limit (mW/g)
15.247 / RSS-102	2400 – 2483.5	0.099 (Tablet – Secondary landscape)	1.6
	5725 – 5850	0.205 (Primary portrait)	
15.407 / RSS-102	5150 – 5250	0.202 (Primary portrait)	
	5250 – 5350	0.153 (Primary Portrait)	
	5470 – 5725	0.298 (Primary Portrait)	

APPLICABLE STANDARDS AND TEST PROCEDURES:

STANDARD	TEST RESULTS
FCC OET BULLETIN 65 SUPPLEMENT C and KDB SAR test procedures: o KDB 248227 SAR Measurement Procedure for 820.11abg Transmitters v0r02 o KDB 447498 D01 Mobile Portable RF Exposure v04 o KDB 616217 D01 SAR for Laptop with Screen Ant v01r01	Pass
RSS-102 ISSUE 3	Pass

Compliance Certification Services, Inc. (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 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by 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.

Approved & Released For CCS By:

SUNNY SHIH
ENGINEERING SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C, and the following specific FCC Test Procedures.

- KDB 248227 SAR Measurement Procedure for 820.11abg Transmitters v0r02
- KDB 447498 D01 Mobile Portable RF Exposure v04
- KDB 616217 D01 SAR for Laptop with Screen Ant v01r01

3. FACILITIES AND ACCREDITATION

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

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	3403-91535	N/A		
DASY4 Measurement Server	SPEAG	SEUMS001BA	1041	N/A		
Probe Alignment Unit	SPEAG	LB (V2)	261	N/A		
SAM Phantom (SAM1)	SPEAG	QD000P40CA	1185	N/A		
SAM Phantom (SAM2)	SPEAG	QD000P40CA	1050	N/A		
Oval Flat Phantom (ELI 4.0)	SPEAG	QD OVA001 B	1003	N/A		
Electronic Probe kit	HP	85070C	N/A	N/A		
S-Parameter Network Analyzer	Agilent	8753ES-6	MY40001647	11	22	2010
Signal Generator	Agilent	8753ES-6	MY40001647	11	22	2010
E-Field Probe	SPEAG	EX3DV4	3686	3	23	1010
Data Acquisition Electronics	SPEAG	DAE3 V1	500	9	15	2010
System Validation Dipole	SPEAG	D900V2	108	1	21	2010
System Validation Dipole	SPEAG	D1800V2	294	1	29	2010
System Validation Dipole	SPEAG	D1900V2	5d043	1	29	2010
System Validation Dipole	SPEAG	D2450V2	748	4	14	2010
System Validation Dipole	SPEAG	D5GHzV2	1075	9	3	2011
ESG Vector Signal Generator	Agilent	E4438C	US44271090	9	17	2010
Power Meter	Giga-tronics	8651A	8651404	1	11	2010
Power Sensor	Giga-tronics	80701A	1834588	1	11	2010
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	SPAEG	H2450	N/A	Within 24 hrs of first test		
Simulating Liquid	SPAEG	M2450	N/A	Within 24 hrs of first test		
Simulating Liquid	SPAEG	M5800	N/A	Within 24 hrs of first test		

4.2. MEASUREMENT UNCERTAINTY

Measurement uncertainty for 300 MHz – 3000 MHz

Uncertainty component	Tol. (±%)	Probe Dist.	Div.	Ci (1g)	Ci (10g)	Std. Unc.(±%)	
						Ui (1g)	Ui(10g)
Measurement System							
Probe Calibration	4.80	N	1	1	1	4.80	4.80
Axial Isotropy	4.70	R	1.732	0.707	0.707	1.92	1.92
Hemispherical Isotropy	9.60	R	1.732	0.707	0.707	3.92	3.92
Boundary Effects	1.00	R	1.732	1	1	0.58	0.58
Linearity	4.70	R	1.732	1	1	2.71	2.71
System Detection Limits	1.00	R	1.732	1	1	0.58	0.58
Readout Electronics	1.00	N	1	1	1	1.00	1.00
Response Time	0.80	R	1.732	1	1	0.46	0.46
Integration Time	2.60	R	1.732	1	1	1.50	1.50
RF Ambient Conditions - Noise	1.59	R	1.732	1	1	0.92	0.92
RF Ambient Conditions - Reflections	0.00	R	1.732	1	1	0.00	0.00
Probe Positioner Mechnical Tolerance	0.40	R	1.732	1	1	0.23	0.23
Probe Positioning With Respect to Phantom Shell	2.90	R	1.732	1	1	1.67	1.67
algorithms for max. SAR evaluation	3.90	R	1.732	1	1	2.25	2.25
Test sample Related							
Test Sample Positioning	1.10	N	1	1	1	1.10	1.10
Device Holder Uncertainty	3.60	N	1	1	1	3.60	3.60
Power and SAR Drift Measurement	5.00	R	1.732	1	1	2.89	2.89
Phantom and Tissue Parameters							
Phantom Uncertainty	4.00	R	1.732	1	1	2.31	2.31
Liquid Conductivity - Target	5.00	R	1.732	0.64	0.43	1.85	1.24
Liquid Conductivity - Meas.	8.60	N	1	0.64	0.43	5.50	3.70
Liquid Permittivity - Target	5.00	R	1.732	0.6	0.49	1.73	1.41
Liquid Permittivity - Meas.	3.30	N	1	0.6	0.49	1.98	1.62
Combined Standard Uncertainty	RSS					11.44	10.49
Expanded Uncertainty (95% Confidence Interval)	K=2					22.87	20.98

Notesfor table
1. Tol. - tolerance in influence quaitity
2. N - Nomal
3. R - Rectangular
4. Div. - Divisor used to obtain standard uncertainty
5. Ci - is te sensitivity coefficient

Measurement uncertainty for 3 GHz – 6 GHz

Uncertainty component	Tol. (±%)	Probe Dist.	Div.	Ci (1g)	Ci (10g)	Std. Unc.(±%)	
						Ui (1g)	Ui(10g)
Measurement System							
Probe Calibration	4.80	N	1	1	1	4.80	4.80
Axial Isotropy	4.70	R	1.732	0.707	0.707	1.92	1.92
Hemispherical Isotropy	9.60	R	1.732	0.707	0.707	3.92	3.92
Boundary Effects	1.00	R	1.732	1	1	0.58	0.58
Linearity	4.70	R	1.732	1	1	2.71	2.71
System Detection Limits	1.00	R	1.732	1	1	0.58	0.58
Readout Electronics	1.00	N	1	1	1	1.00	1.00
Response Time	0.80	R	1.732	1	1	0.46	0.46
Integration Time	2.60	R	1.732	1	1	1.50	1.50
RF Ambient Conditions - Noise	3.00	R	1.732	1	1	1.73	1.73
RF Ambient Conditions - Reflections	3.00	R	1.732	1	1	1.73	1.73
Probe Positioner Mechnical Tolerance	0.40	R	1.732	1	1	0.23	0.23
Probe Positioning With Respect to Phantom Shell	2.90	R	1.732	1	1	1.67	1.67
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	3.90	R	1.732	1	1	2.25	2.25
Test sample Related							
Test Sample Positioning	1.10	N	1	1	1	1.10	1.10
Device Holder Uncertainty	3.60	N	1	1	1	3.60	3.60
Power and SAR Drift Measurement	5.00	R	1.732	1	1	2.89	2.89
Phantom and Tissue Parameters							
Phantom Uncertainty	4.00	R	1.732	1	1	2.31	2.31
Liquid Conductivity - Target	5.00	R	1.732	0.64	0.43	1.85	1.24
Liquid Conductivity - Meas.	8.60	N	1	0.64	0.43	5.50	3.70
Liquid Permittivity - Target	5.00	R	1.732	0.6	0.49	1.73	1.41
Liquid Permittivity - Meas.	3.30	N	1	0.6	0.49	1.98	1.62
Combined Standard Uncertainty	RSS					11.66	10.73
Expanded Uncertainty (95% Confidence Interval)	K=2					23.32	21.46

Notesfor table
1. Tol. - tolerance in influence quaitity
2. N - Nomal
3. R - Rectangular
4. Div. - Divisor used to obtain standard uncertainty
5. Ci - is te sensitivity coefficient

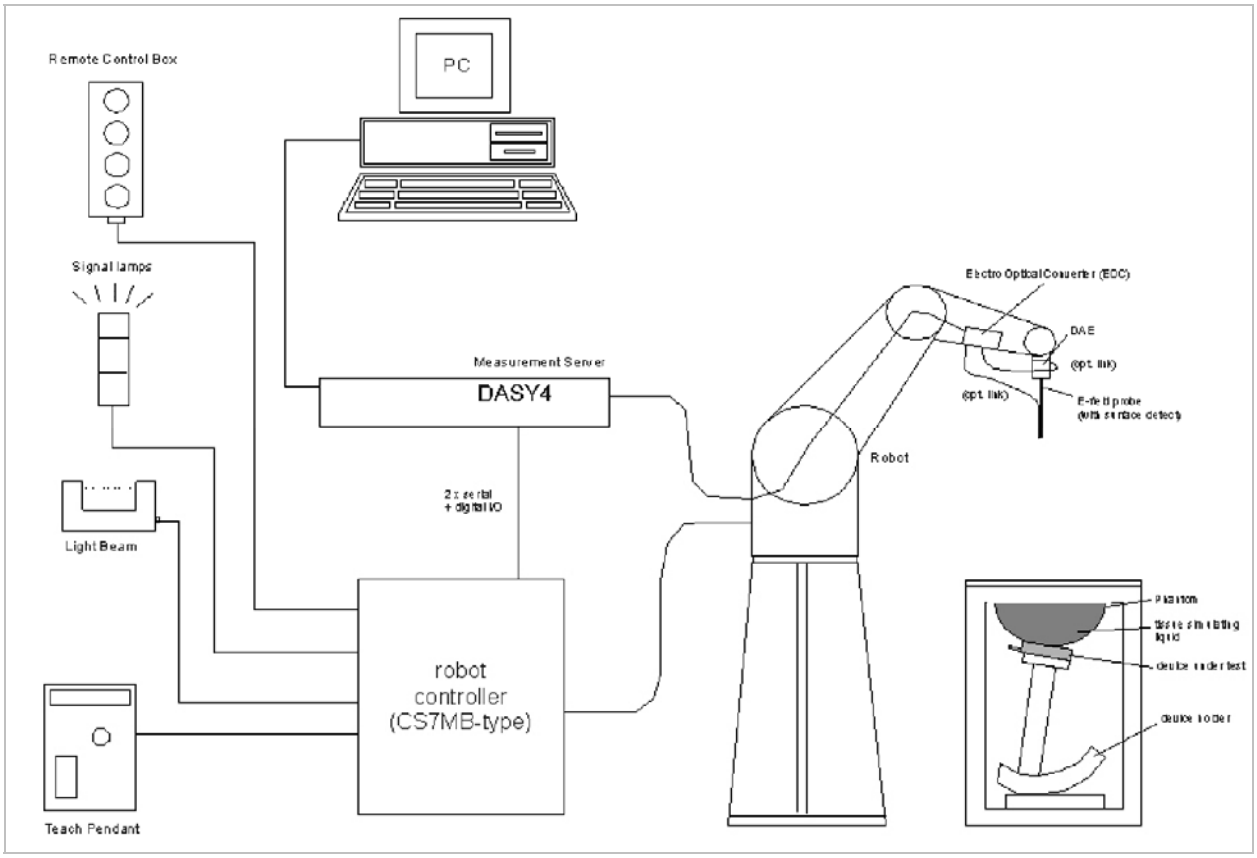
5. EQUIPMENT UNDER TEST

Intel® Centrino® Advanced-N + WiMAX 6250

(Tested inside of Lenovo ThinkPad X200/X201 Tablet Series)

LCD Sizes:	>12"			
Normal operation:	Laptop - Lap-held, Tablet - Edge (underarm) & lap-held			
Antenna tested:	Vendor	Antenna	Part Number	Test software ID
	ACON	Main	25.90675.001	A
	ACON	Auxiliary	25.90676.001	B
	WNC	Main	25.90669.001	A
	WNC	Auxiliary	25.90670.001	B
Antenna-to-user separation distance:	Please see Section 11 and antenna specification for antenna-to-user separation distances.			
Require SAR evaluation for Simultaneous transmission?	WWAN co-located RF exposure assessment will be addressed in a separate FCC application filed under WWAN application			
Power supply:	Power supplied through laptop computer (host device)			

6. SYSTEM SPECIFICATIONS



The DASY4 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.
- DASY4 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 to validate 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

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. The relative permittivity and conductivity of the tissue material should be within ± 5% of the values given in the table below.

Reference Values of Tissue Dielectric Parameters for Head and Body Phantom (for 150 – 3000 MHz and 5800 MHz)

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in IEEE Standard 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 a human head. Other head and 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)

8.1. LIQUID CHECK RESULTS FOR 2450 MHZ

Simulating Liquid Dielectric Parameters for Muscle 2450 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Sunny Shih

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	52.539	Relative Permittivity (ε_r):	52.539	52.7	-0.31	± 5
	e"	14.851	Conductivity (σ):	2.024	1.95	3.80	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C
November 16, 2009 02:00 PM

Frequency	e'	e"
2400000000.	52.7314	14.6642
2405000000.	52.7092	14.6751
2410000000.	52.6899	14.7091
2415000000.	52.6734	14.7208
2420000000.	52.6643	14.7501
2425000000.	52.6542	14.7423
2430000000.	52.6266	14.7803
2435000000.	52.6041	14.8042
2440000000.	52.5993	14.8324
2445000000.	52.5838	14.8401
2450000000.	**52.5388**	**14.8514**
2455000000.	52.5286	14.8834
2460000000.	52.5197	14.8983
2465000000.	52.4960	14.9251
2470000000.	52.4868	14.9332
2475000000.	52.4495	14.9550
2480000000.	52.4415	14.9811
2485000000.	52.4268	15.0047
2490000000.	52.4052	15.0375
2495000000.	52.3863	15.0631
2500000000.	52.3794	15.0653

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

8.2. LIQUID CHECK RESULTS FOR 5 GHZ

Simulating Liquid Dielectric Parameters for Muscle 5 GHz

Room Ambient Temperature = 25°C; Relative humidity = 38% Measured by: Sunny Shih

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	48.6839	Relative Permittivity (ε_r):	48.6839	49.0	-0.65	± 10
	e"	17.5816	Conductivity (σ):	5.08605	5.30	-4.04	± 5
5500	e'	48.0596	Relative Permittivity (ε_r):	48.0596	48.6	-1.11	± 10
	e"	18.0677	Conductivity (σ):	5.52821	5.65	-2.16	± 5
5800	e'	47.4529	Relative Permittivity (ε_r):	47.4529	48.2	-1.55	± 10
	e"	18.4047	Conductivity (σ):	5.93849	6.00	-1.03	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
November 19, 2009 10:37 AM

Frequency	e'	e"
4600000000.	49.7726	16.5986
4650000000.	49.6844	16.6159
4700000000.	49.5899	16.7998
4750000000.	49.5476	16.7908
4800000000.	49.3934	16.9508
4850000000.	49.3740	17.0051
4900000000.	49.2121	17.1416
4950000000.	49.0807	17.2117
5000000000.	49.0568	17.2949
5050000000.	48.9381	17.3909
5100000000.	48.8587	17.4236
5150000000.	48.7243	17.5781
5200000000.	**48.6839**	**17.5816**
5250000000.	48.5447	17.7022
5300000000.	48.4680	17.7336
5350000000.	48.3377	17.8374
5400000000.	48.2761	17.9197
5450000000.	48.1643	17.9733
5500000000.	**48.0596**	**18.0677**
5550000000.	47.9277	18.0120
5600000000.	47.8712	18.1818
5650000000.	47.7858	18.1549
5700000000.	47.6343	18.3449
5750000000.	47.6145	18.3436
5800000000.	**47.4529**	**18.4047**
5850000000.	47.4870	18.5274
5900000000.	47.3355	18.5265
5950000000.	47.2541	18.7168
6000000000.	47.1451	18.6621

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

Simulating Liquid Dielectric Parameters for Muscle 5 GHz

Room Ambient Temperature = 25°C; Relative humidity = 38% Measured by: Sunny Shih

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	47.3243	Relative Permittivity (ε_r):	47.3243	49.0	-3.42	± 10
	e"	17.6882	Conductivity (σ):	5.11689	5.30	-3.45	± 5
5500	e'	46.834	Relative Permittivity (ε_r):	46.8340	48.6	-3.63	± 10
	e"	17.9659	Conductivity (σ):	5.49706	5.65	-2.71	± 5
5800	e'	46.2417	Relative Permittivity (ε_r):	46.2417	48.2	-4.06	± 10
	e"	18.3911	Conductivity (σ):	5.93410	6.00	-1.10	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
November 21, 2009 10:26 AM

Frequency	e'	e"
4600000000.	48.6337	16.5613
4650000000.	48.6148	16.7483
4700000000.	48.4828	16.7036
4750000000.	48.3318	16.9771
4800000000.	48.3131	16.9236
4850000000.	48.0606	17.0527
4900000000.	48.0870	17.0966
4950000000.	47.8853	17.1472
5000000000.	47.8720	17.3445
5050000000.	47.7554	17.2662
5100000000.	47.6127	17.5524
5150000000.	47.6279	17.5466
5200000000.	**47.3243**	**17.6882**
5250000000.	47.3083	17.7066
5300000000.	47.1332	17.7116
5350000000.	47.1051	17.8738
5400000000.	46.9803	17.8001
5450000000.	46.8364	17.9829
5500000000.	**46.8340**	**17.9659**
5550000000.	46.6633	18.1373
5600000000.	46.6069	18.1762
5650000000.	46.4681	18.2406
5700000000.	46.4789	18.2619
5750000000.	46.2715	18.3385
5800000000.	**46.2417**	**18.3911**
5850000000.	45.9586	18.4238
5900000000.	45.9574	18.5061
5950000000.	45.8183	18.5111
6000000000.	45.7560	18.6315

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 CHECK

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. 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 Head or Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV4 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) were 100 mW (5GHz) and 250 mW (2.4GHz) ±3%
- The results are normalized to 1 W input power.

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.
Certificate no: D2450V2-748_April 14, 2008

f (MHz)	Head Tissue		Body Tissue	
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
2450			49.5	23.3

Reference SAR Values for BODY-tissue from calibration certificate of SPEAG.
Certificate no: D5GHzV2-1075_Sep09

f (MHz)	Head Tissue		Body Tissue	
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
5200			78.7	21.9
5500			85.0	23.4
5800			72.9	20.0

9.1. SYSTEM CHECK RESULTS FOR D2450V2

System Validation Dipole: D2450V2 SN: 748

Date: November 16, 2009

Ambient Temperature = 24°C; Relative humidity = 38% Measured by: Sunny Shih

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	2450	250	1g SAR:	53.6	49.5	8.28	±10
			10g SAR:	24.7	23.3	6.01	

9.2. SYSTEM CHECK RESULTS FOR D5GHzV2

System Validation Dipole: D5GHzV2 SN: 1075

Date: November 19, 2009

Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Sunny Shih

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Muscle	5200	100	1g SAR:	74.4	78.7	-5.46	±10
			10g SAR:	21.3	21.9	-2.74	
Muscle	5500	100	1g SAR:	80.3	85.0	-5.53	±10
			10g SAR:	22.5	23.4	-3.85	
Muscle	5800	100	1g SAR:	69.5	72.9	-4.66	±10
			10g SAR:	19.6	20.0	-2.00	

Date: November 21, 2009

Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Sunny Shih

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Muscle	5200	100	1g SAR:	71.0	78.7	-9.78	±10
			10g SAR:	20.5	21.9	-6.39	
Muscle	5500	100	1g SAR:	78.7	85.0	-7.41	±10
			10g SAR:	22.4	23.4	-4.27	
Muscle	5800	100	1g SAR:	66.9	72.9	-8.23	±10
			10g SAR:	18.7	20.0	-6.50	

10. 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, CRTU v5.15.36.0, which enable a user to control the frequency and output power of the module.

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

Results

802.11bgn mode (2.4 GHz band)

Mode	Channel	Chain	f (MHz)	Average Output Power	Duty Cycle (%)
802.11b	6	A	2437	16.80	100
802.11b	6	B	2437	16.80	100

802.11a mode (5.8 GHz band)

Mode	Channel	Chain	f (MHz)	Average Output Power	Duty Cycle (%)
802.11a	157	A	5785	16.80	99
802.11a	165	B	5825	16.70	99

802.11an mode (5.2 GHz band)

Mode	Channel	chain	f (MHz)	Average Output Power	Duty Cycle (%)
802.11a	40	A	5200	16.80	99
802.11a	48	B	5240	16.70	99

802.11an mode (5.3 GHz band)

Mode	Channel	chain	f (MHz)	Average Output Power	Duty Cycle (%)
802.11n 20MHz	52	A	5260	16.80	99
802.11n 40MHz	62	B	5310	16.80	99

802.11an mode (5.5 GHz band)

Mode	Channel	Chain	f (MHz)	Average Output Power	Duty Cycle (%)
802.11a	120	A	5600	16.80	99
802.11a	140	B	5700	16.80	99

11. SUMMARY OF TEST RESULTS

11.1. SAR TEST RESULT FOR THE 2.4 GHZ BAND

1) Laptop mode: Lap-held (16.98 cm from main antenna-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	A (Main)	0.036	0.029

2) Tablet Mode: Primary Landscape (14 cm from main antenna-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	A (Main)	0.0310	0.0240

3) Tablet Mode: Secondary Landscape (4.0 cm from main antenna-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	A (Main)	0.099	0.047
WNC Antenna	6	2437	A (Main)	0.016	0.014

4) Tablet Mode: Primary Portrait (7.8 cm from Aux antenna-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	B (Aux)	0.072	0.045

5) Tablet Mode: Secondary Portrait (18.2 cm from Aux antenna-to-user)

Skip SAR testing at this configuration due to:

1. Main antenna disabled by software
2. The large distance (> 18 cm) from Aux antenna-to-user

6) Tablet Mode: Lap-held (3.05 cm from Main/Aux antenna-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	B (Aux)	0.068	0.050
			A (Main)	0.013	0.006

11.2. WORST-CASE SAR PLOT FOR 2.4 GHZ

WORST-CASE SAR PLOT 2.4 GHz Band

Date/Time: 11/16/2009 5:38:10 PM

Test Laboratory: Compliance Certification Services

Tablet - Secondary landscape

DUT: Lenovo; Type: NA; Serial: NA

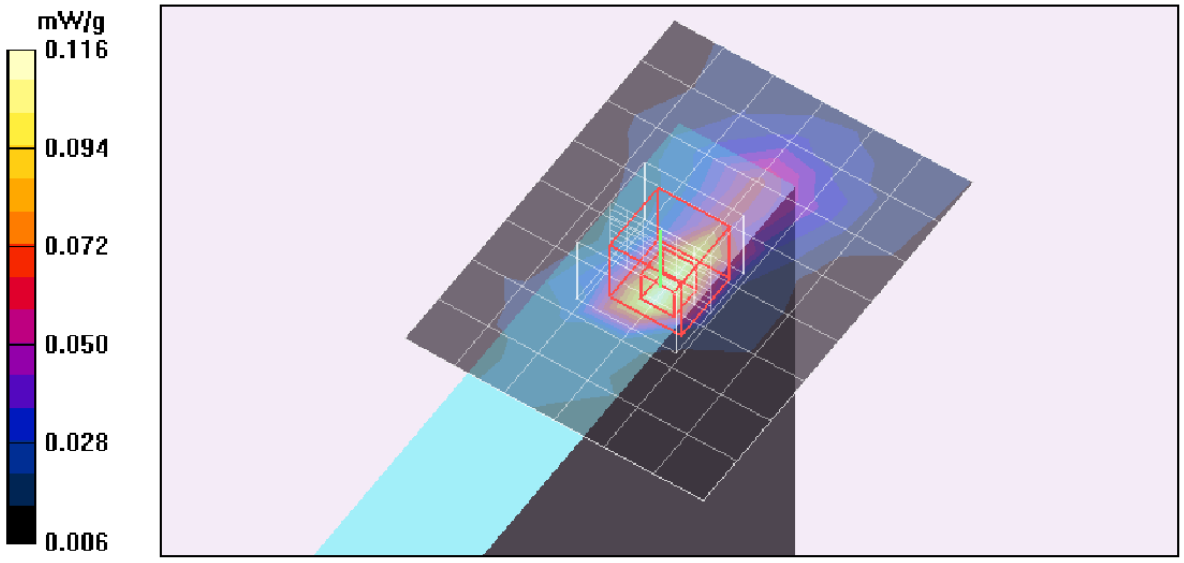
Communication System: 802.11bgn; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 2.01 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

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

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(6.48, 6.48, 6.48); Calibrated: 3/23/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11b M-ch/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.116 mW/g

802.11b M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 6.13 V/m; Power Drift = 0.246 dB
Peak SAR (extrapolated) = 0.240 W/kg
SAR(1 g) = 0.099 mW/g; SAR(10 g) = 0.047 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.132 mW/g



11.3. SAR TEST RESULT FOR THE 5 GHZ BAND

1) Laptop Mode: Lap-held (16.98 cm from main antenna-to-user)

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2 GHz	802.11a	40	5200	A (Main)	0.064	0.0310
5.3 GHz	802.11a	60	5300	A (Main)	0.004	0.0006
5.5 GHz	802.11a	120	5600	A (Main)	0.011	0.0037
5.8 GHz	802.11a	157	5785	A (Main)	0.008	0.0046

2) Tablet mode: - Primary Landscape (14 cm between main antenna-to-user)

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2 GHz	802.11a	40	5200	A (Main)	0.028	0.010
5.3 GHz	802.11a	60	5300	A (Main)	0.029	0.005
5.5 GHz	802.11a	120	5600	A (Main)	0.046	0.007
5.8 GHz	802.11a	157	5785	A (Main)	0.090	0.080

3) Tablet Mode: Secondary Landscape (4.0 cm from main antenna-to-user)

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2 GHz	802.11a	40	5200	A (Main)	0.082	0.045
5.3 GHz	802.11a	60	5300	A (Main)	0.0023	0.0002
5.5 GHz	802.11a	120	5600	A (Main)	0.100	0.0280
5.8 GHz	802.11a	157	5785	A (Main)	0.073	0.042

4) Tablet Mode: Primary Portrait (7.8 cm from Aux antenna-to-user)

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2 GHz	802.11a	40	5200	B (Main)	0.202	0.117
5.3 GHz	802.11a	60	5300	B (Main)	0.153	0.094
5.5 GHz	802.11a	120	5600	B (Main)	0.298	0.147
5.5 GHz	WNC Antenna	120	5600	B (Main)	0.239	0.145
5.8 GHz	802.11a	157	5785	B (Main)	0.205	0.121

5) Tablet Mode: Secondary Portrait (18.2 cm from Aux antenna-to-user)

Skip SAR testing at this configuration due to:

1. Main antenna disabled by software
2. The large distance (> 18 cm) from Aux antenna-to-user

6) Tablet Mode: Lap-held (3.05 cm from Main/Aux antenna-to-user)

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2	802.11a	40	5200	A (Main)	0.027	0.012
5.2	802.11a	40	5200	B (Main)	0.040	0.015
5.3	802.11a	60	5300	B (Main)	0.027	0.012
5.5	802.11a	120	5600	B (Main)	0.045	0.020
5.8	802.11a	157	5785	B (Main)	0.025	0.010

11.4. WORST-CASE SAR PLOT FOR 5 GHZ

WORST-CASE SAR PLOT 5.2 GHz Band

Date/Time: 11/20/2009 12:24:20 AM

Test Laboratory: Compliance Certification Services

Tablet - Primary Portrait_5.2G

DUT: Lenovo; Type: NA; Serial: NA

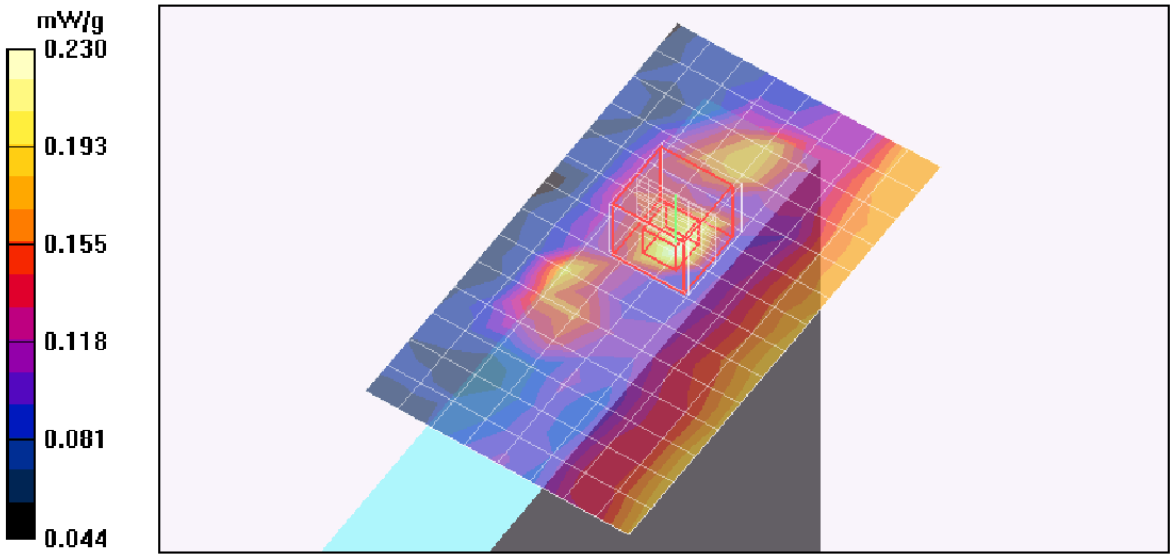
Communication System: 802.11abgn; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.09 mho/m; ε_r = 48.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

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

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(4.08, 4.08, 4.08); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a M-ch/Area Scan (9x15x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.230 mW/g

802.11a M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 6.46 V/m; Power Drift = -2.08 dB
Peak SAR (extrapolated) = 0.566 W/kg
SAR(1 g) = 0.202 mW/g; SAR(10 g) = 0.117 mW/g
Maximum value of SAR (measured) = 0.297 mW/g



WORST-CASE SAR PLOT 5.3 GHz Band

Date/Time: 11/20/2009 1:26:07 AM

Test Laboratory: Compliance Certification Services

Tablet - Primary Portrait_5.3G

DUT: Lenovo; Type: NA; Serial: NA

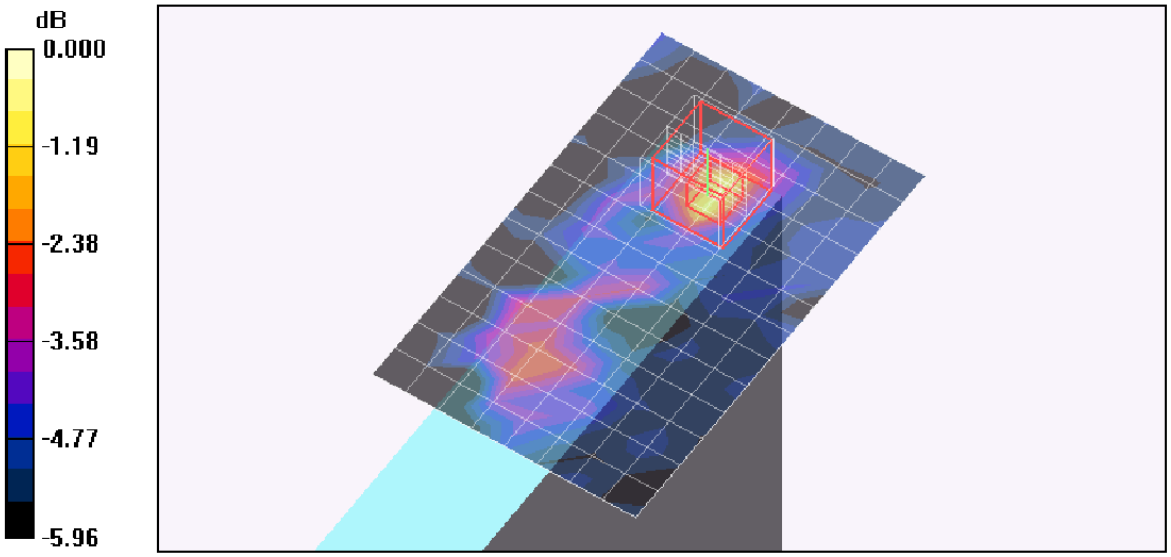
Communication System: 802.11abgn; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.23 mho/m; ε_r = 48.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

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

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(3.81, 3.81, 3.81); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a M-ch/Area Scan (9x14x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.173 mW/g

802.11a M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 3.88 V/m; Power Drift = 0.974 dB
Peak SAR (extrapolated) = 0.615 W/kg
SAR(1 g) = 0.153 mW/g; SAR(10 g) = 0.094 mW/g
Maximum value of SAR (measured) = 0.217 mW/g



0 dB = 0.217mW/g

WORST-CASE SAR PLOT 5.5 GHz Band

Date/Time: 11/20/2009 2:58:44 AM

Test Laboratory: Compliance Certification Services

Tablet - Primary Portrait_5.5G

DUT: Lenovo; Type: NA; Serial: NA

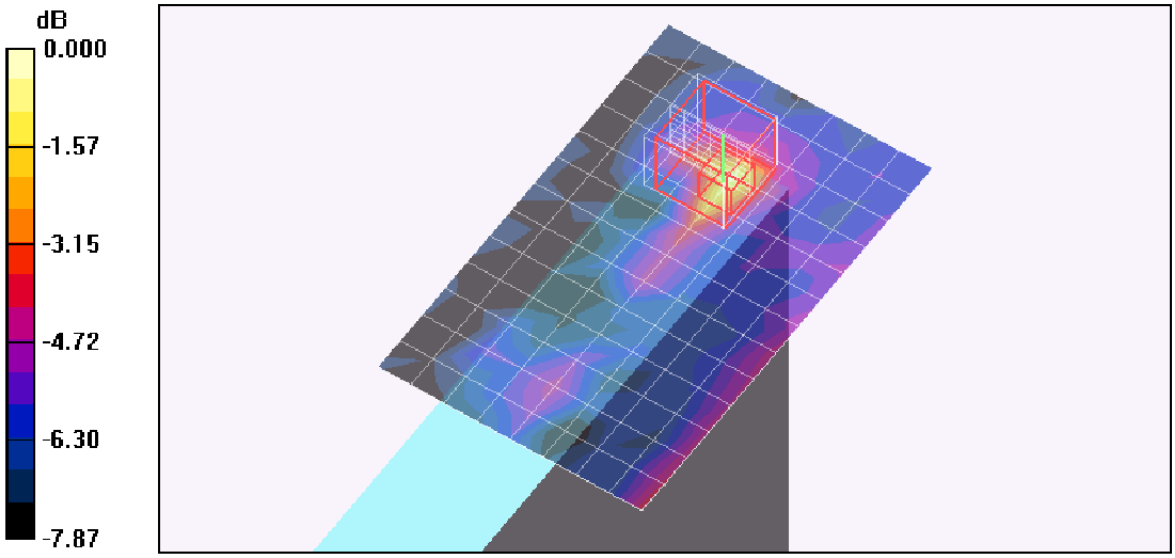
Communication System: 802.11abgn; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.66 mho/m; ε_r = 47.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

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

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(3.61, 3.61, 3.61); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a M-ch/Area Scan (9x14x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.383 mW/g

802.11a M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 5.23 V/m; Power Drift = -0.184 dB
Peak SAR (extrapolated) = 1.65 W/kg
SAR(1 g) = 0.298 mW/g; SAR(10 g) = 0.147 mW/g
Maximum value of SAR (measured) = 0.442 mW/g



0 dB = 0.442mW/g

WORST-CASE SAR PLOT 5.8 GHz Band

Date/Time: 11/20/2009 3:37:46 AM

Test Laboratory: Compliance Certification Services

Tablet - Primary Portrait_5.8G

DUT: Lenovo; Type: NA; Serial: NA

Communication System: 802.11abgn; Frequency: 5785 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5785 MHz; σ = 5.92 mho/m; ε_r = 47.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

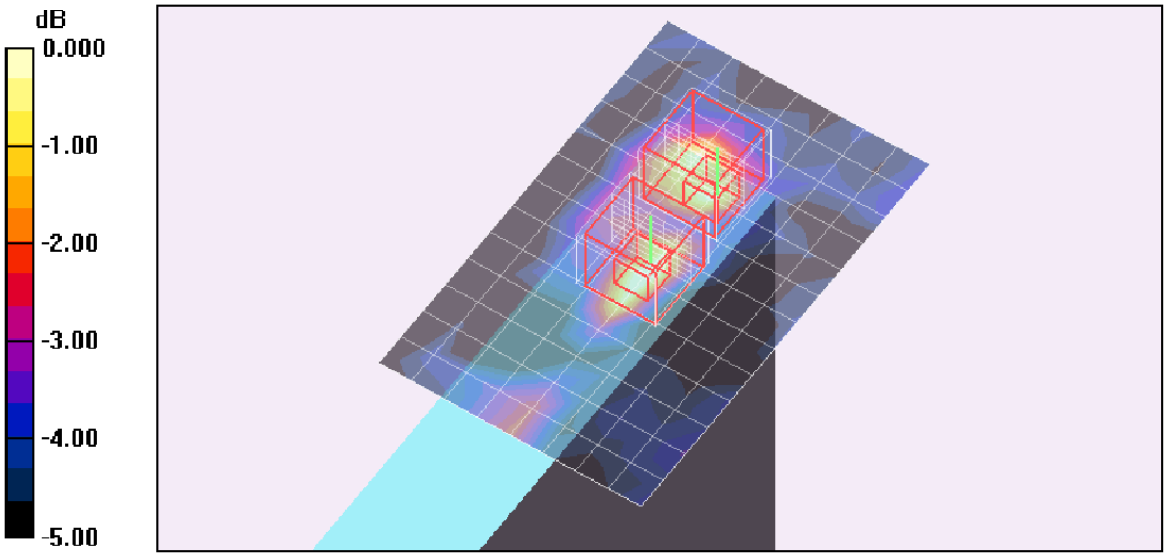
Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(3.84, 3.84, 3.84); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a M-ch/Area Scan (9x14x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.274 mW/g

802.11a M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 4.40 V/m; Power Drift = -0.114 dB
Peak SAR (extrapolated) = 1.09 W/kg
SAR(1 g) = 0.205 mW/g; SAR(10 g) = 0.121 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.265 mW/g

802.11a M-ch/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 4.40 V/m; Power Drift = -0.114 dB
Peak SAR (extrapolated) = 0.905 W/kg
SAR(1 g) = 0.173 mW/g; SAR(10 g) = 0.126 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.236 mW/g



0 dB = 0.236mW/g

12. ENHANCED ENERGY COUPLING (KDB 447498)

According to KDB 447498, the test configuration with the highest 1-g SAR must be used to determine if additional SAR evaluation is required due to enhanced energy coupling at increased separation distances.

From the test results below, additional 1-g SAR evaluation is not required.

Test configuration	Band	Antenna-to-person distance (cm)		Peak SAR (mW/g)	E-field (V/m)	Lower than Initial (%)
Tablet mode Secondary landscape	2.4 GHz	Initial	Touch	0.132	8.45	
		Increased	5	0.023	3.54	17.6%
Tablet mode Primary portrait	5.5 GHz	Initial	Touch	0.442	6.36	
		Increased	5	0.145	3.64	32.7%

13. ATTACHMENTS

No.	Contents	No. of page (s)
1	System Performance Check Plots	2
2-1	SAR Test Plots for 2.4 GHz	8
2-2	SAR Test Plots for 5 GHz Bands	18
3	Certificate of E-Field Probe – EX3DV4 SN 3686	10
4	Certificate of System Validation Dipole - D2450V2 SN:748	6
5	Certificate of System Validation Dipole - D5GHzV2 SN:1075	9