



FCC OET BULLETIN 65 SUPPLEMENT C

**SAR EVALUATION REPORT
(WiFi Portion)**

For

**Intel WiFi/Wimax Link 5150 Series
(Tested inside of Lenovo IdeaPad S10-2)**

**FCC ID: PD9512ANXMU
Model: 512ANXMMW**

**REPORT NUMBER: 09U12587-2
ISSUE DATE: June 3, 2009**

Prepared for

**INTEL CORPORATION
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	June 3, 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

FCC ID: PD9512ANXMU

MODEL: 512ANXMMW

DEVICE CATEGORY: Portable

EXPOSURE CATEGORY: General Population/Uncontrolled Exposure

DATE TESTED: June 1 - 2, 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	0.047	1.6
	5725 – 5850	0.050	
15.407 / RSS-102	5150 – 5250	0.026	
	5250 – 5350	0.039	
	5470 – 5725	0.016	

APPLICABLE STANDARDS AND TEST PROCEDURES:

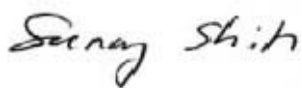
STANDARD	TEST RESULTS
FCC OET BULLETIN 65 SUPPLEMENT C	Pass

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:

Tested By:




SUNNY SHIH
ENGINEERING SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

CHAO YEN LIN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C, Specific FCC Procedure KDB 248227 SAR Measurement Procedure for 820.11abg Transmitters.

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://ts.nist.gov/Standards/scopes/2000650.htm>.

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	14	2009
Signal Generator	Agilent	8753ES-6	MY40001647	11	14	2009
E-Field Probe	SPEAG	EX3DV4	3686	3	23	1010
Thermometer	ERTCO	639-1S	1718	5	1	2010
Data Acquisition Electronics	SPEAG	DAE3 V1	427	10	20	2009
System Validation Dipole	SPEAG	D835V2	4d002	6	22	2009
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	D5GH $\pm$ V2	1003	11	21	2009
MXA Signal Analyzer	Agilent	N9020A	US48350984	10	23	2009
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 Mechanical 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 Mechanical 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
Notes for table							
1. Tol. - tolerance in influence quaity							
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 WiFi/Wimax Link 5150 Series (Tested inside of LENOVO IdeaPad S10-2)
820.11abgn MISO with HT20 and HT40

**Normal
operation:**

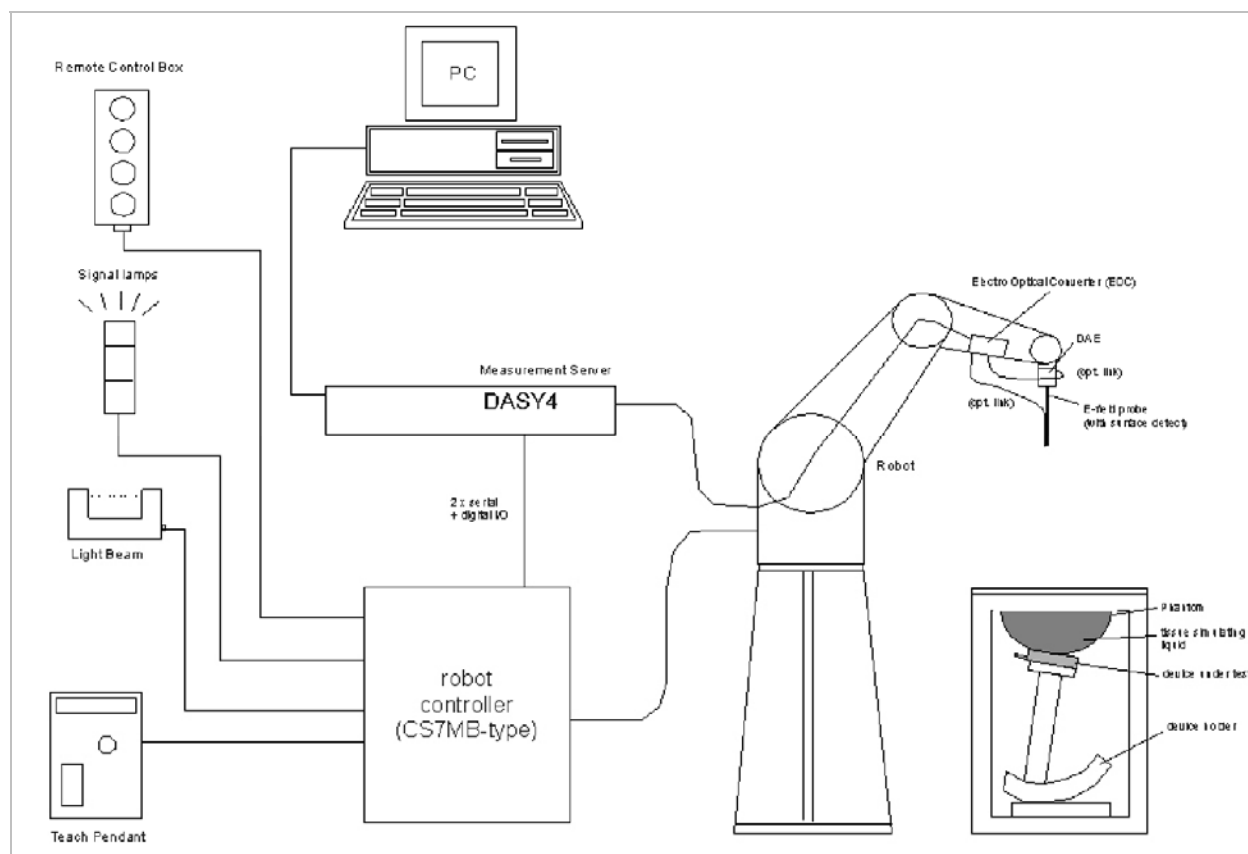
Lap-held only

Note: SAR test with display open at 90° to the keyboard

Antenna tested:

WNC, TX 1 Antenna, Part Number: 81.EK515.G01

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 if the dielectric parameters are within the tolerances of the specified target values. The relative permittivity and conductivity of the tissue material should be within $\pm 5\%$ 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 $\rho = 1000 \text{ kg/m}^3$)

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'	52.49	Relative Permittivity (ϵ_r):	52.489	52.7	-0.40	± 5
	e''	14.05	Conductivity (σ):	1.915	1.95	-1.80	± 5

Liquid Temperature: 23 deg. C

June 01, 2009 11:55 AM

Frequency	e'	e''
2400000000.	52.5419	13.8255
2405000000.	52.5387	13.9333
2410000000.	52.5366	14.0058
2415000000.	52.5403	14.0675
2420000000.	52.5324	14.0871
2425000000.	52.5327	14.0888
2430000000.	52.5252	14.0931
2435000000.	52.5280	14.0727
2440000000.	52.5310	14.0903
2445000000.	52.5203	14.0914
2450000000.	52.4893	14.0502
2455000000.	52.3952	14.0307
2460000000.	52.3544	13.9876
2465000000.	52.2853	13.9287
2470000000.	52.2507	13.8555
2475000000.	52.2216	13.8212
2480000000.	52.2287	13.8114
2485000000.	52.2400	13.8305
2490000000.	52.2496	13.8940
2495000000.	52.2456	13.9873
2500000000.	52.2467	14.1356

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

8.2. LIQUID CHECK RESULTS FOR 5 GHZ

Simulating Liquid Dielectric Parameters for Muscle 5800 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Sunny Shih

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	48.1325	Relative Permittivity (ϵ_r)	48.1325	49.0	-1.77	± 10
	e''	18.5404	Conductivity (σ)	5.36342	5.30	1.20	± 5
5500	e'	47.9419	Relative Permittivity (ϵ_r)	47.9419	48.6	-1.35	± 10
	e''	18.8695	Conductivity (σ)	5.77354	5.65	2.19	± 5
5800	e'	46.9501	Relative Permittivity (ϵ_r)	46.9501	48.2	-2.59	± 10
	e''	19.3946	Conductivity (σ)	6.25789	6.00	4.30	± 5

Liquid temperature: 24 deg. C

June 01, 2009 04:41 PM

Frequency	e'	e''
4600000000.	49.4402	17.8496
4650000000.	49.4560	18.0338
4700000000.	49.2909	17.9059
4750000000.	49.0767	18.1795
4800000000.	49.2551	18.0906
4850000000.	48.8940	18.1465
4900000000.	48.9435	18.3681
4950000000.	48.5988	18.2393
5000000000.	48.5012	18.5220
5050000000.	48.4179	18.4499
5100000000.	48.0849	18.5309
5150000000.	48.2301	18.4793
5200000000.	48.1325	18.5404
5250000000.	48.3176	18.7158
5300000000.	48.0977	18.7776
5350000000.	48.1450	18.9324
5400000000.	48.0296	18.8181
5450000000.	47.8621	19.0214
5500000000.	47.9419	18.8695
5550000000.	47.6327	19.0473
5600000000.	47.6502	19.0860
5650000000.	47.3374	19.0558
5700000000.	47.4421	19.2882
5750000000.	47.3537	19.1667
5800000000.	46.9501	19.3946
5850000000.	47.2062	19.4714
5900000000.	46.8705	19.3680
5950000000.	46.6793	19.5113
6000000000.	47.0161	19.7933

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

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 $\pm 10\%$.

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 EX3DV3 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 $250 \text{ mW} \pm 3\%$.
- The results are normalized to 1 W input power.

IEEE Standard 1528-2003 Numerical reference SAR values (W/kg) for reference dipole and flat phantom

Frequency (MHz)	Distance (mm)	1g SAR [W/kg]	10g SAR [W/kg]	Local SAR at surface (above feed-point)
300	15	3	2	4.4
450	15	4.9	3.3	7.2
835	15	9.5	6.2	4.1
900	15	10.8	6.9	16.4
1450	10	29	16	5.02
1800	10	38.1	19.8	69.5
1900	10	39.7	20.5	72.1
2000	10	41.1	21.1	74.6
2450	10	52.4	24	104.2
3000	10	63.8	25.7	104.2

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG. Certificate no: D5GHzV2-1003_Nov07

f (MHz)	Head Tissue		Body Tissue	
	SAR _{1g}	SAR _{10g}	SAR _{1g}	SAR _{10g}
5200	78.6	22.1	74.7	21.1
5500	80.4	22.7	80.1	22.5
5800	79.9	22.4	70.8	19.8

9.1. SYSTEM CHECK RESULTS FOR D2450V2

System Validation Dipole: D2450V2 SN: 748

Date: June 1, 2009

Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Sunny Shih

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Head	2450	250	1g SAR:	54.4	51.2	6.25	±10
			10g SAR:	25.3	23.7	6.67	

9.2. SYSTEM CHECK RESULTS FOR D5GHzV2

System Validation Dipole: D5GHzV2 SN 1003

Date: June 1, 2009

Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Chaoyen Lin

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Muscle	5200	250	1g SAR:	73.5	74.7	-1.61	±10
			10g SAR:	21.0	21.1	-0.47	
Muscle	5500	250	1g SAR:	76.4	80.1	-4.62	±10
			10g SAR:	21.5	22.5	-4.44	
Muscle	5800	250	1g SAR:	68.3	70.8	-3.53	±10
			10g SAR:	19.3	19.8	-2.53	

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 v5.0.67.0, 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	f (MHz)	Average Output Power	Duty Cycle (%)
802.11b	6	2437 (M)	16.9	100
802.11n 40 MHz	6	2437 (M)	16.8	98

802.11an mode (5.8 GHz band)

Mode	Channel	f (MHz)	Average Output Power	Duty Cycle (%)
802.11n 40 MHz	159	5795	16.8	98

802.11an mode (5.2 GHz band)

Mode	Channel	f (MHz)	Average Output Power	Duty Cycle (%)
802.11a	40	5200	16.7	99

802.11an mode (5.3 GHz band)

Mode	Channel	f (MHz)	Average Output Power	Duty Cycle (%)
802.11a	56	5280	16.8	99

802.11an mode (5.5 GHz band)

Mode	Channel	f (MHz)	Average Output Power	Duty Cycle (%)
802.11n 20 MHz	140	5700	17.0	9

11. SUMMARY OF TEST RESULTS

If the SAR measured at the middle channel for each test configuration is at least 3.0 dB (0.8 mW/g) lower than the SAR limit (1.6 mW/g), testing at the high and low channels is optional for such test configuration(s).

11.1. SAR TEST RESULT FOR THE 2.4 GHZ BAND

Mode	Channel	f (MHz)	Antenna	Measured SAR 1g (mW/g)	Limit
802.11b	6	2437 (M)	TX 1	0.047	1.6
802.11n 40 MHz	6	2437 (M)	TX 1	0.044	

11.2. SAR TEST RESULT FOR THE 5 GHZ BANDS

Mode	Channel	f (MHz)	Antenna	Measured SAR 1g (mW/g)	Limit
802.11a	40	5200 (M)	TX 1	0.026	1.6
	56	5280 (M)	TX 1	0.039	
	100	5500 (L)	TX 1	0.016	
	157	5785 (M)	TX 1	0.050	

12. WORST-CASE SAR TEST PLOTS

WORST-CASE SAR PLOT for 2.4 GHz Band

Date/Time: 6/1/2009 3:53:14 PM

Test Laboratory: Compliance Certification Services

802.11bg for Lapheld

DUT: Lenovo; Type: ideaPad S10-2; Serial: NA

Communication System: 802.11bg; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 52.5$; $\rho = 1000$ kg/m³

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 Sn427; Calibrated: 10/20/2008
- Phantom: SAM 2 (Twin); Type: SAM 2; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Lapheld, 802.11b M-ch/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mmInfo: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.051 mW/g

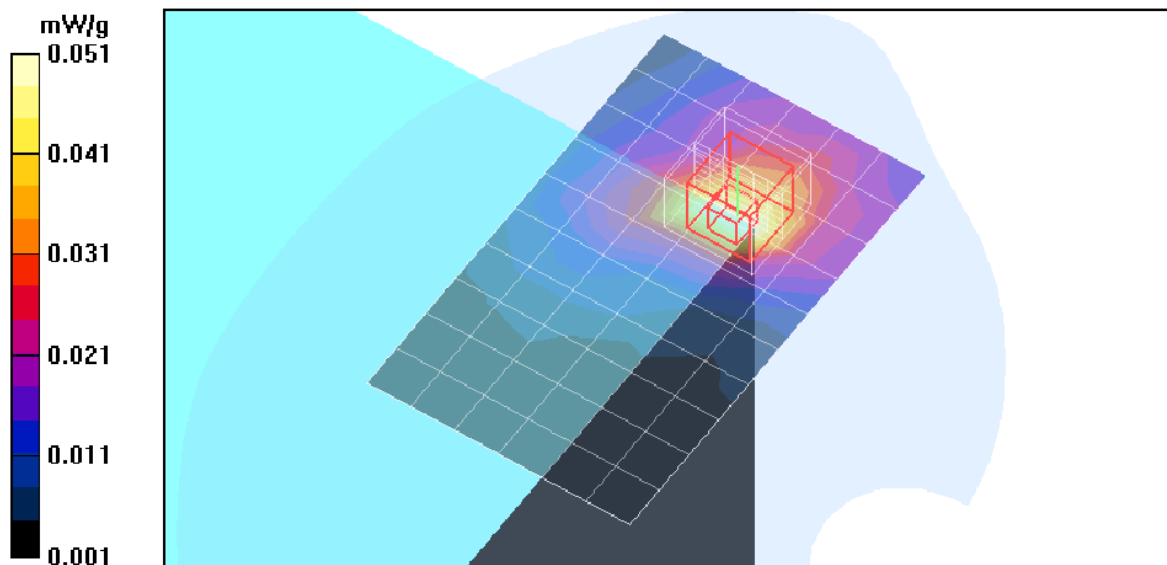
Lapheld, 802.11b M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 1.04 V/m; Power Drift = 0.041 dB

Peak SAR (extrapolated) = 0.095 W/kg

SAR(1 g) = 0.047 mW/g; SAR(10 g) = 0.023 mW/gInfo: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.059 mW/g



WORST-CASE SAR PLOT for 5.2 GHz Band

Date/Time: 6/1/2009 8:43:01 PM

Test Laboratory: Compliance Certification Services

802.11a 5.2GHz

DUT: Lenovo; Type: ideaPad S10-2; Serial: NA

Communication System: 802.11abgn; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.36$ mho/m; $\epsilon_r = 48.1$; $\rho = 1000$ kg/m³

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(4.08, 4.08, 4.08); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Lapheld - 5.2G/Area Scan (12x16x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.053 mW/g

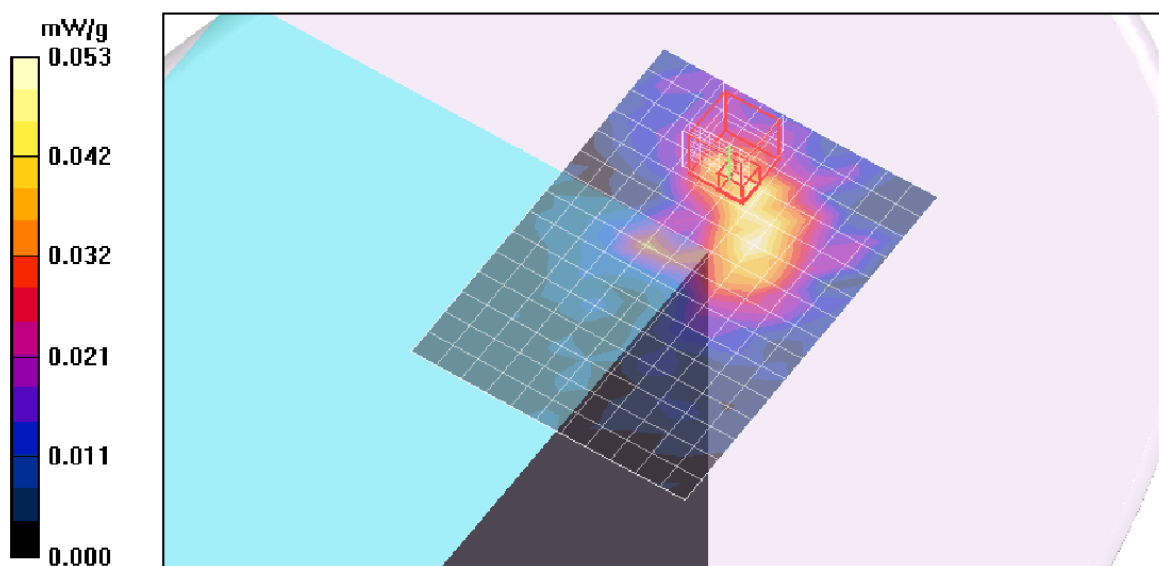
Lapheld - 5.2G/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 1.12 V/m; Power Drift = -1.20 dB

Peak SAR (extrapolated) = 0.091 W/kg

SAR(1 g) = 0.026 mW/g; SAR(10 g) = 0.00925 mW/g

Maximum value of SAR (measured) = 0.043 mW/g



WORST-CASE SAR PLOT for 5.3 GHz Band

Date/Time: 6/1/2009 9:22:07 PM

Test Laboratory: Compliance Certification Services

802.11a 5.3GHz

DUT: Lenovo; Type: ideaPad S10-2; Serial: NA

Communication System: 802.11abgn; Frequency: 5280 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5280$ MHz; $\sigma = 5.51$ mho/m; $\epsilon_r = 48.2$; $\rho = 1000$ kg/m³

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(3.81, 3.81, 3.81); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Lapheld - 5.3G/Area Scan (12x16x1): Measurement grid: dx=10mm, dy=10mm[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.052 mW/g

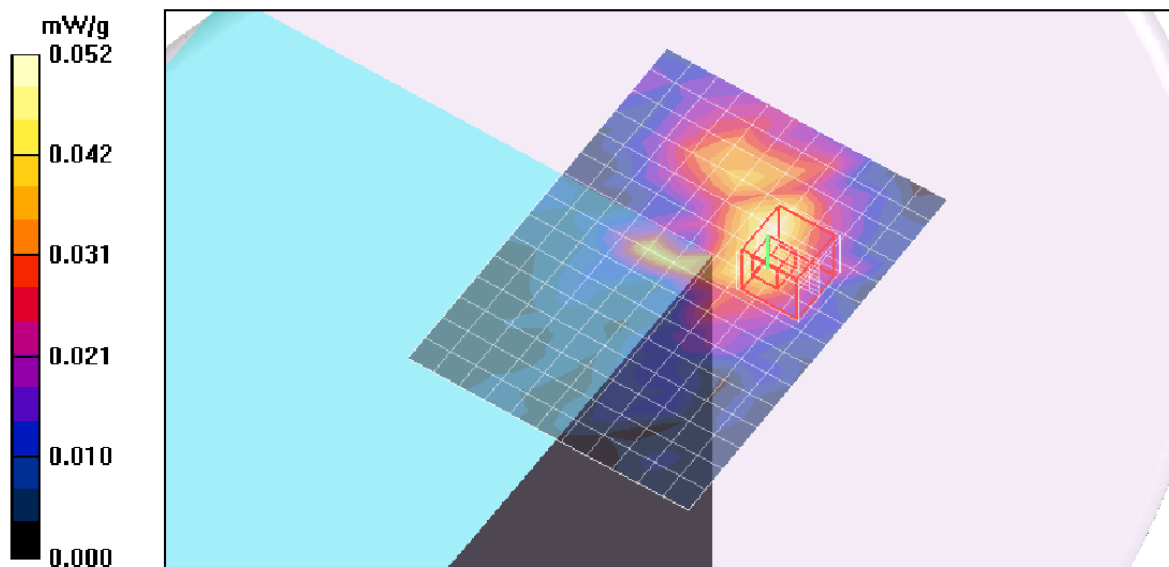
Lapheld - 5.3G/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 0.550 V/m; Power Drift = 5.20 dB

Peak SAR (extrapolated) = 0.425 W/kg

SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.00841 mW/g[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.045 mW/g



WORST-CASE SAR PLOT for 5.5 GHz Band

Date/Time: 6/1/2009 10:01:59 PM

Test Laboratory: Compliance Certification Services

802.11a 5.5 GHz

DUT: Lenovo; Type: ideaPad S10-2; Serial: NA

Communication System: 802.11abgn; Frequency: 5700 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5700$ MHz; $\sigma = 6.12$ mho/m; $\epsilon_r = 47.4$; $\rho = 1000$ kg/m³

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(3.84, 3.84, 3.84); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Lapheld - 5.5G/Area Scan (12x16x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.049 mW/g

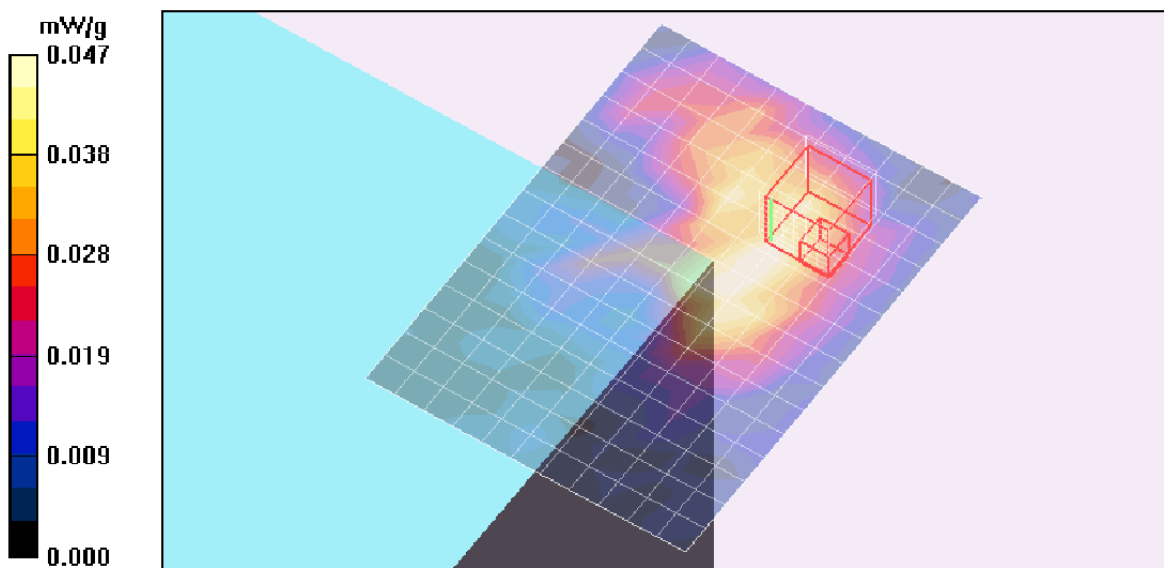
Lapheld - 5.5G/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 0.793 V/m; Power Drift = 3.92 dB

Peak SAR (extrapolated) = 0.230 W/kg

SAR(1 g) = 0.016 mW/g; SAR(10 g) = 0.00172 mW/g

Maximum value of SAR (measured) = 0.047 mW/g



WORST-CASE SAR PLOT for 5.8 GHz Band

Date/Time: 6/1/2009 11:20:04 PM

Test Laboratory: Compliance Certification Services

802.11a 5.8 GHz

DUT: Lenovo; Type: ideaPad S10-2; Serial: NA

Communication System: 802.11abgn; Frequency: 5795 MHz; Duty Cycle: 1:1.02

Medium parameters used (interpolated): $f = 5795$ MHz; $\sigma = 6.25$ mho/m; $\epsilon_r = 47$; $\rho = 1000$ kg/m³

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(3.84, 3.84, 3.84); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Lapheld - 5.8G/Area Scan (12x16x1): Measurement grid: dx=10mm, dy=10mmInfo: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.061 mW/g

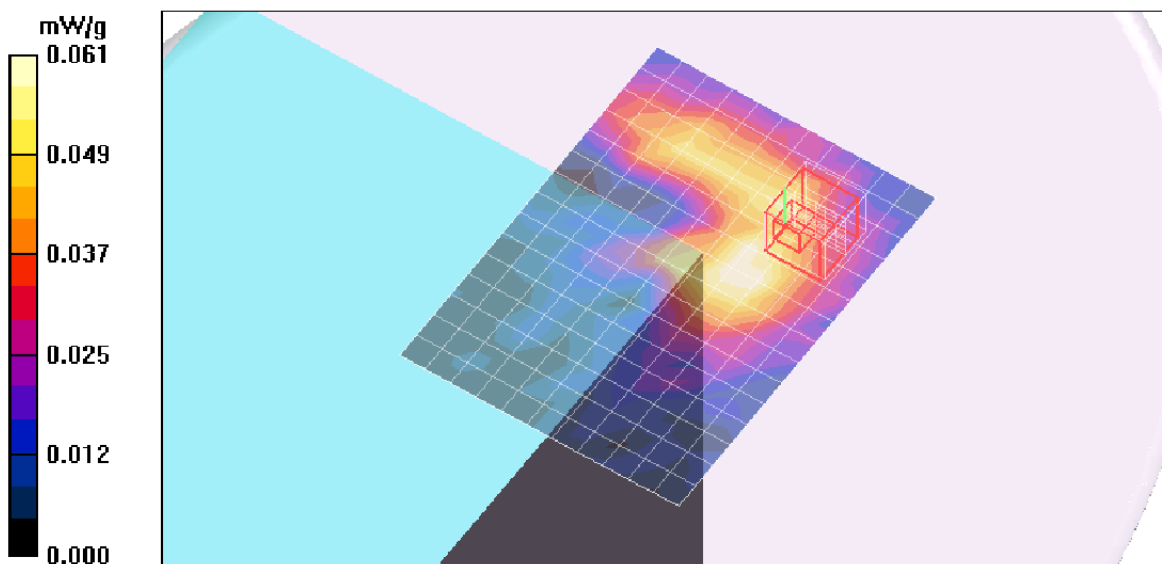
Lapheld - 5.8G/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 0.417 V/m; Power Drift = 9.43 dB

Peak SAR (extrapolated) = 0.469 W/kg

SAR(1 g) = 0.050 mW/g; SAR(10 g) = 0.016 mW/gInfo: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.055 mW/g



13. ATTACHMENTS

No.	Contents	No. of page (s)
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2	SAR Test Plots	8
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 1003	15