FCC OET BULLETIN 65 SUPPLEMENT C
IC RSS-102 ISSUE 3

SAR EVALUATION REPORT

For

802.11 a/b/g/n 2x2 PCIe Minicard
(Tested inside of Table PC Portege M780)

FCC ID: CJ6UPA3795WL
IC: 248H-DPA3795W

Model: PA3795U-1MPC

REPORT NUMBER: 09U12972-3C

ISSUE DATE: January 15, 2010

Prepared for

TOSHIBA AMERICA INFORMATION SYSTEMS, INC.
9740 IRVINE BLVD. IRVINE,
CA 92618, USA

Prepared by

COMPLIANCE CERTIFICATION SERVICES
47173 BENICIA STREET
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	January 11, 2010	Initial Issue	--
B	January 14, 2010	Revised EUT description	A. Zaffar
A	January 15, 2010	Updated KDB447498 statement in Section 9	Sunny Shih

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	TOSHIBA AMERICA INFORMATION SYSTEMS, INC. 9740 IRVINE BLVD. IRVINE, CA 92618, USA
EUT DESCRIPTION:	802.11 a/b/g/n 2x2 PCIe Minicard (Tested inside of Table PC Portege M780)
MODEL:	PA3722U-1MPC
DEVICE CATEGORY:	Portable
EXPOSURE CATEGORY:	General Population/Uncontrolled Exposure
DATE TESTED:	January 5 - 8, 2010

THE HIGHEST SAR VALUES:

FCC / IC Rule Parts	Frequency Range [MHz]	1-g SAR (mW/g)	Limit (mW/g)
15.247 / RSS-102	2400 – 2483.5	0.305 (Secondary landscape)	1.6
	5725 – 5850	1.26 (Secondary landscape)	
15.407 / RSS-102	5150 – 5250	1.31 (Secondary landscape)	
	5250 – 5350	1.41 (Secondary landscape)	
	5470 – 5725	1.51 (Secondary landscape)	

APPLICABLE STANDARDS AND TEST PROCEDURES:

STANDARD	TEST RESULTS
FCC OET BULLETIN 65 SUPPLEMENT C and the following Test Procedures: o KDB 248227 SAR measurement procedures for 802.11a/b/g transmitters o KDB 447498 D01 Mobile Portable RF Exposure v04, suppl. to KDB 616217 D03	Pass
RSS-102 ISSUE 3	Pass

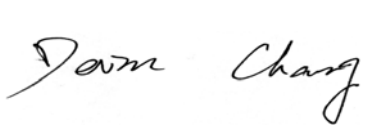
Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. Measurement Uncertainties 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

Tested By:



DEVIN CHANG
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 802.11abg Transmitters, KDB 447498 D01 Mobile Portable RF Exposure v04, supplemental to KDB 616217 D03 and IC RSS 102 Issue 3.

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	St酶bli	RX90BL	N/A	N/A		
Robot Remote Control	St酶bli	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	2010
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
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					11.44	10.49
Expanded Uncertainty (95% Confidence Interval)	K=2					22.87	20.98

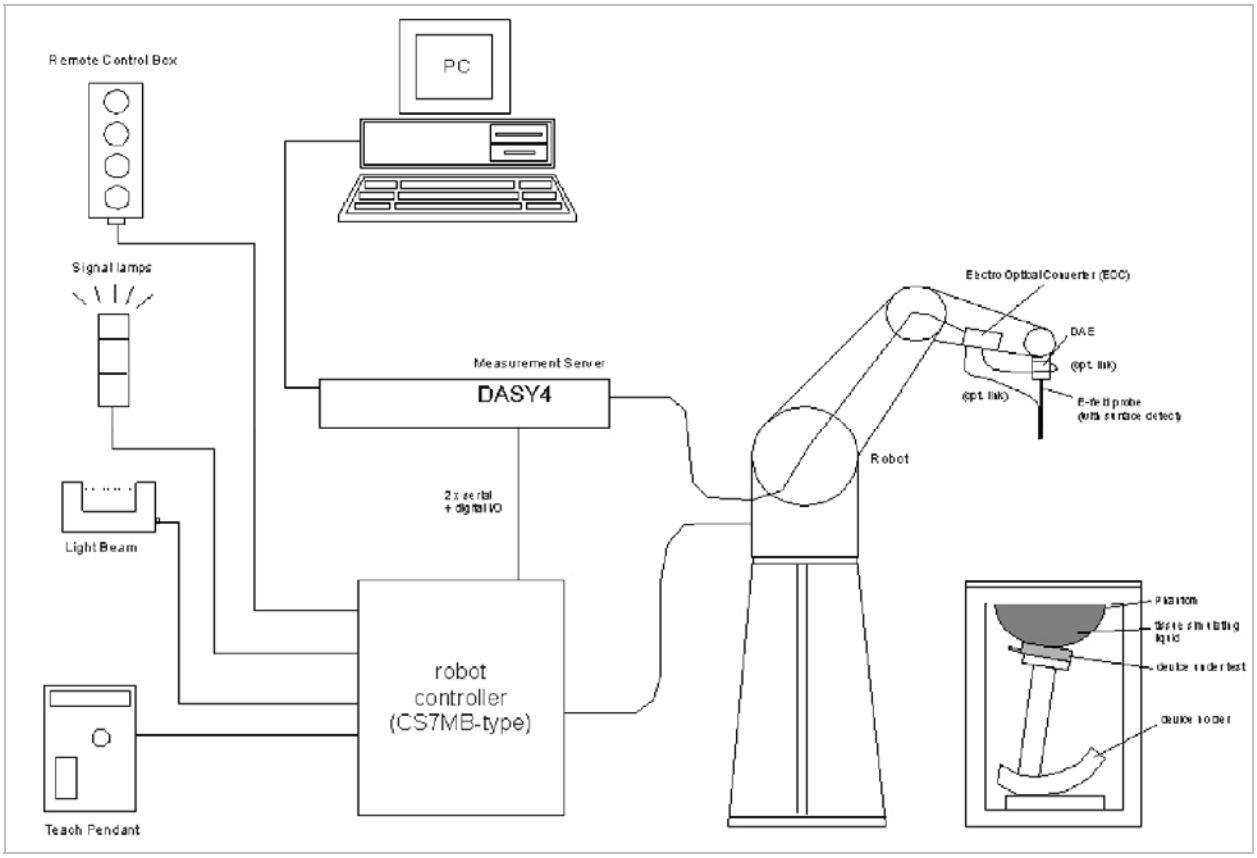
Notesfor table
1. Tol. - tolerance in influence quaitity
2. N - Nomal
3. R - Rectangular
4. Div. - Divisor used to obtain standard uncertainty
5. Ci - is te sensitivity coefficient

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. 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.

6. 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

7. 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)

7.1. LIQUID CHECK RESULTS FOR 2450 MHZ

Simulating Liquid Dielectric Parameters for Body 2450 MHz

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

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	52.86	Relative Permittivity (ϵ_r):	52.858	52.7	0.30	± 5
	e"	14.48	Conductivity (σ):	1.974	1.95	1.23	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C
January 05, 2010 09:13 AM

Frequency	e'	e"
2400000000.	54.0635	14.8457
2405000000.	54.0834	14.7464
2410000000.	54.0803	14.6658
2415000000.	54.0256	14.5942
2420000000.	53.9220	14.5247
2425000000.	53.7790	14.4610
2430000000.	53.5864	14.4367
2435000000.	53.3832	14.4274
2440000000.	53.1863	14.4340
2445000000.	53.0131	14.4490
2450000000.	**52.8582**	**14.4833**
2455000000.	52.7442	14.5807
2460000000.	52.6570	14.6896
2465000000.	52.6225	14.8148
2470000000.	52.6194	14.9459
2475000000.	52.6307	15.1053
2480000000.	52.6851	15.2319
2485000000.	52.7794	15.3378
2490000000.	52.8772	15.4160
2495000000.	53.0309	15.4551
2500000000.	53.1741	15.4765

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

7.2. LIQUID CHECK RESULTS FOR 5 GHZ

Simulating Liquid Dielectric Parameters for Body 5 GHz

Room Ambient Temperature = 25°C; Relative humidity = 38% Measured by: Devin Chang

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	47.6714	Relative Permittivity (ε_r):	47.6714	49.0	-2.71	± 10
	e"	18.1482	Conductivity (σ):	5.24996	5.30	-0.94	± 5
5500	e'	48.1375	Relative Permittivity (ε_r):	48.1375	48.6	-0.95	± 10
	e"	17.6473	Conductivity (σ):	5.39958	5.65	-4.43	± 5
5800	e'	46.903	Relative Permittivity (ε_r):	46.9030	48.2	-2.69	± 10
	e"	18.4807	Conductivity (σ):	5.96301	6.00	-0.62	± 5

Liquid temperature: 24 deg. C
January 06, 2010 01:59 PM

Frequency	e'	e"
4600000000.	48.5938	17.0828
4650000000.	50.1295	17.3855
4700000000.	48.5128	16.7245
4750000000.	49.4672	17.8506
4800000000.	49.1801	16.7590
4850000000.	48.5287	17.7900
4900000000.	49.6199	17.3219
4950000000.	47.8884	17.4130
5000000000.	49.3533	17.9111
5050000000.	47.9709	17.2103
5100000000.	48.4268	18.2272
5150000000.	48.4796	17.3156
5200000000.	**47.6714**	**18.1482**
5250000000.	48.8653	17.7389
5300000000.	47.4578	17.9014
5350000000.	48.6062	18.2822
5400000000.	47.6686	17.6592
5450000000.	47.8596	18.4954
5500000000.	**48.1375**	**17.6473**
5550000000.	47.2511	18.3596
5600000000.	48.1444	18.1262
5650000000.	46.9988	18.1239
5700000000.	47.8395	18.5243
5750000000.	47.4231	18.0402
5800000000.	**46.9030**	**18.4807**
5850000000.	47.5188	18.3901
5900000000.	46.7377	18.2389
5950000000.	46.7642	18.4594
6000000000.	46.8300	18.6063

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: Devin Chang

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	47.4539	Relative Permittivity (ε_r):	47.4539	49.0	-3.16	± 10
	e"	18.3625	Conductivity (σ):	5.31195	5.30	0.23	± 5
5500	e'	47.9034	Relative Permittivity (ε_r):	47.9034	48.6	-1.43	± 10
	e"	17.9241	Conductivity (σ):	5.48427	5.65	-2.93	± 5
5800	e'	46.6568	Relative Permittivity (ε_r):	46.6568	48.2	-3.20	± 10
	e"	18.7335	Conductivity (σ):	6.04458	6.00	0.74	± 5

Liquid temperature: 24 deg. C
January 07, 2010 04:38 PM

Frequency	e'	e"
4600000000.	48.3735	17.2808
4650000000.	49.9026	17.5916
4700000000.	48.3093	16.9155
4750000000.	49.2317	18.0616
4800000000.	48.9647	16.9837
4850000000.	48.3230	17.9929
4900000000.	49.3894	17.5509
4950000000.	47.6607	17.6220
5000000000.	49.1083	18.1388
5050000000.	47.7517	17.4377
5100000000.	48.2096	18.4396
5150000000.	48.2544	17.5550
5200000000.	**47.4539**	**18.3625**
5250000000.	48.6313	17.9857
5300000000.	47.2248	18.1211
5350000000.	48.3438	18.5130
5400000000.	47.4464	17.9050
5450000000.	47.6171	18.7381
5500000000.	**47.9034**	**17.9241**
5550000000.	47.0055	18.5979
5600000000.	47.8895	18.3805
5650000000.	46.7553	18.3488
5700000000.	47.5692	18.7839
5750000000.	47.1833	18.2911
5800000000.	**46.6568**	**18.7335**
5850000000.	47.2852	18.6656
5900000000.	46.4934	18.4965
5950000000.	46.5031	18.7250
6000000000.	46.5775	18.8737

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: Devin Chang

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	46.0047	Relative Permittivity (ε_r):	46.0047	49.0	-6.11	± 10
	e"	18.8043	Conductivity (σ):	5.43976	5.30	2.64	± 5
5500	e'	46.3271	Relative Permittivity (ε_r):	46.3271	48.6	-4.68	± 10
	e"	18.5209	Conductivity (σ):	5.66688	5.65	0.30	± 5
5800	e'	44.998	Relative Permittivity (ε_r):	44.9980	48.2	-6.64	± 10
	e"	19.3247	Conductivity (σ):	6.23533	6.00	3.92	± 5

Liquid temperature: 24 deg. C
January 08, 2010 04:44 PM

Frequency	e'	e"
4600000000.	47.1337	17.5947
4650000000.	48.5234	17.9020
4700000000.	47.0386	17.3054
4750000000.	47.8251	18.3672
4800000000.	47.5918	17.3979
4850000000.	46.9440	18.3133
4900000000.	47.9793	17.9670
4950000000.	46.3127	17.9999
5000000000.	47.6513	18.5465
5050000000.	46.3740	17.8808
5100000000.	46.7703	18.8293
5150000000.	46.8181	18.0808
5200000000.	**46.0047**	**18.8043**
5250000000.	47.0805	18.5570
5300000000.	45.7488	18.6155
5350000000.	46.7409	19.0471
5400000000.	45.9377	18.4350
5450000000.	46.0431	19.2641
5500000000.	**46.3271**	**18.5209**
5550000000.	45.4278	19.1384
5600000000.	46.2555	18.9636
5650000000.	45.1755	18.9234
5700000000.	45.8879	19.3665
5750000000.	45.5334	18.9249
5800000000.	**44.9980**	**19.3247**
5850000000.	45.5912	19.3274
5900000000.	44.8148	19.1021
5950000000.	44.7893	19.3539
6000000000.	44.8432	19.5039

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. 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) was 100 mW±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_Apr08

f (MHz)	Head Tissue		Body Tissue	
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
2450			50.8	23.7

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

8.1. SYSTEM CHECK RESULTS FOR D2450V2

System Validation Dipole: D2450V2 SN: 748

Date: January 5, 2010

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

Medium	CW Signal (MHz)	Forward Pwr (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	2450	100	1g SAR:	54.2	50.8	6.69	? 0
			10g SAR:	25.0	23.7	5.49	

8.2. SYSTEM CHECK RESULTS FOR D5GHzV2

System Validation Dipole: D5GHzV2 SN: 1075

Date: January 6, 2010

Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Devin Chang

Medium	CW Signal (MHz)	Forward Pwr (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	5200	100	1g SAR:	71.5	78.7	-9.15	±10
			10g SAR:	20.2	21.9	-7.76	
Body	5500	100	1g SAR:	80.9	85.0	-4.82	±10
			10g SAR:	22.9	23.4	-2.14	
Body	5800	100	1g SAR:	72.5	72.9	-0.55	±10
			10g SAR:	20.7	20.0	3.50	

9. EQUIPMENT UNDER TEST

802.11 a/b/g/n 2x2 PCIe Minicard (Tested inside of Table PC Portege M780)			
Normal operation:	Laptop - Lap-held, Tablet - Edge (underarm) & lap-held		
Antenna tested:	Vendor	Antenna	Part number
	Tyco	TX 1 (Main)	TBN003
		TX 2 (Aux)	TBN003
Separation distances from Tx antenna-to-user:	Refer to Section 11 for separation distances form Tx antenna-to-user.		
Co-located Tx:	802.11abgn can transmit simultaneously with Bluetooth		
Require SAR evaluation for Simultaneous transmission?	According to KDB447498 2) a) i).. Bluetooth's output power is ≤ 60/f(GHz) mW, therefore simultaneous transmission SAR evaluation is not required.		

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 version 5.15.36.0, 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	Freq. (MHz)	Antenna		
			A	B	A+B
802.11b	6	2437	17.20		
802.11b	6	2437		16.80	
802.11n 20 MHz	6	2437	14.03	13.99	17.02

802.11an mode (5 GHz bands)

Band	Mode	Channel	Freq. (MHz)	Antenna		
				A	B	A+B
5.2 GHz	802.11a	36	5180	16.60		
		40	5200	16.78		
		48	5240	16.40		
	802.11a	36	5180		16.60	
		40	5200		16.85	
		48	5240		16.50	
	802.11n 20 MHz	40	5200	13.69	13.66	16.69
5.3 GHz	802.11a	52	5260	16.60		
		56	5280	16.61		
		64	5320	16.60		
	802.11a	52	5260		16.50	
		56	5280		16.60	
		64	5320		16.40	
	802.11n 20 MHz	56	5280	13.92	14.11	17.03
5.5 GHz	802.11a	100	5500	16.40		
		120	5600	16.74		
		140	5700	16.50		
	802.11a	100	5500		16.60	
		120	5600		16.78	
		140	5700		16.70	
	802.11n 20 MHz	120	5600	13.68	13.90	16.80
5.8 GHz	802.11a	149	5745	16.60		
		157	5785	16.73		
		165	5825	16.40		
	802.11a	149	5745		16.50	
		157	5785		16.62	
		165	5825		16.60	
	802.11n 20 MHz	157	5785	13.83	13.69	16.77

11. SUMMARY OF TEST RESULTS FOR 802.11bgn

Results

1) Laptop - Lap-held (with the display open at 90° to the keyboard)

SAR is not required due to separation distance form Tx Antenna-to-user is more than 20 cm (21.7 cm)

2) Tablet - Lap-held (3.2 cm from A and B antennas-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	A	0.015	0.008
802.11b	6	2437	B	0.021	0.013

3) Tablet - Primary Landscape

SAR is not required due to separation distance form Tx Antenna-to-user is more than 20 cm (20.5 cm)

4) Tablet - Secondary Landscape (0.3 cm from A and B antennas-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	A	0.222	0.102
802.11b	6	2437	B	0.305	0.135
802.11n	6	2437	A+B	0.160	0.071

5) Tablet - Primary Portrait (3.5 cm from A antenna-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	A	0.056	0.036

6) Tablet– Secondary Portrait (3.5 cm from B antenna-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	B	0.052	0.023

12. SUMMARY OF TEST RESULTS FOR 802.11an

Results

1) Laptop - Lap-held (with the display open at 90° to the keyboard)

SAR is not required due to separation distance form Tx Antenna-to-user is more than 20 cm (21.7 cm)

2) Tablet - Lap-held (3.2 cm from A and B antennas-to-user)

band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2GHz	802.11a	36	5180	A		
		40	5200	A	0.02	0.003
		48	5240	A		
5.2GHz	802.11a	36	5180	B		
		40	5200	B	0.02	0.004
		48	5240	B		

3) Tablet - Primary Landscape

SAR is not required due to separation distance form Tx Antenna-to-user is more than 20 cm (20.5 cm)

4) Tablet - Secondary Landscape (0.3 cm from A and B antennas-to-user)

band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2GHz	802.11a	36	5180	A	**1.31**	0.419
		40	5200	A	1.30	0.415
		48	5240	A	1.29	0.412
5.3GHz	802.11a	52	5260	A	1.31	0.427
		56	5280	A	1.37	0.438
		64	5320	A	**1.41**	0.453
5.6GHz	802.11a	100	5500	A	1.07	0.375
		120	5600	A	0.79	0.299
		140	5700	A	0.68	0.260
5.8GHz	802.11a	149	5745	A	0.65	0.237
		157	5785	A	0.61	0.241
		165	5825	A	0.77	0.287
5.2GHz	802.11a	36	5180	B	1.26	0.426
		40	5200	B	1.23	0.419
		48	5240	B	0.98	0.338
5.3GHz	802.11a	52	5260	B	0.92	0.321
		56	5280	B	0.88	0.307
		64	5320	B	1.07	0.360
5.6GHz	802.11a	100	5500	B	1.22	0.401
		120	5600	B	**1.51**	0.487
		140	5700	B	0.82	0.297
5.8GHz	802.11a	149	5745	B	1.00	0.357
		157	5785	B	**1.26**	0.431
		165	5825	B	0.85	0.315
5.3GHz	802.11n 20 MHz	52	5260	A + B		
		56	5280	A + B	0.77	0.286
		64	5320	A + B		
5.6GHz	802.11n 20 MHz	100	5500	A + B		
		120	5600	A + B	0.73	0.281
		140	5700	A + B		

5) Tablet - Primary Portrait (3.5 cm from A antenna-to-user)

band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2GHz	802.11a	36	5180	A		
		40	5200	A	0.11	0.074
		48	5240	A		

6) Tablet– Secondary Portrait (3.5 cm from B antenna-to-user)

band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2GHz	802.11a	36	5180	B		
		40	5200	B	0.13	0.086
		48	5240	B		

13. WORST-CASE SAR TEST PLOTS

WORST-CASE SAR PLOT FOR 2.4 GHz Band

Date/Time: 1/5/2010 5:32:06 PM

Test Laboratory: Compliance Certification Services

Tablet - Secondary Landscape

DUT: Toshiba; Type: NA; Serial: NA

Communication System: 802.11bg; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.96 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

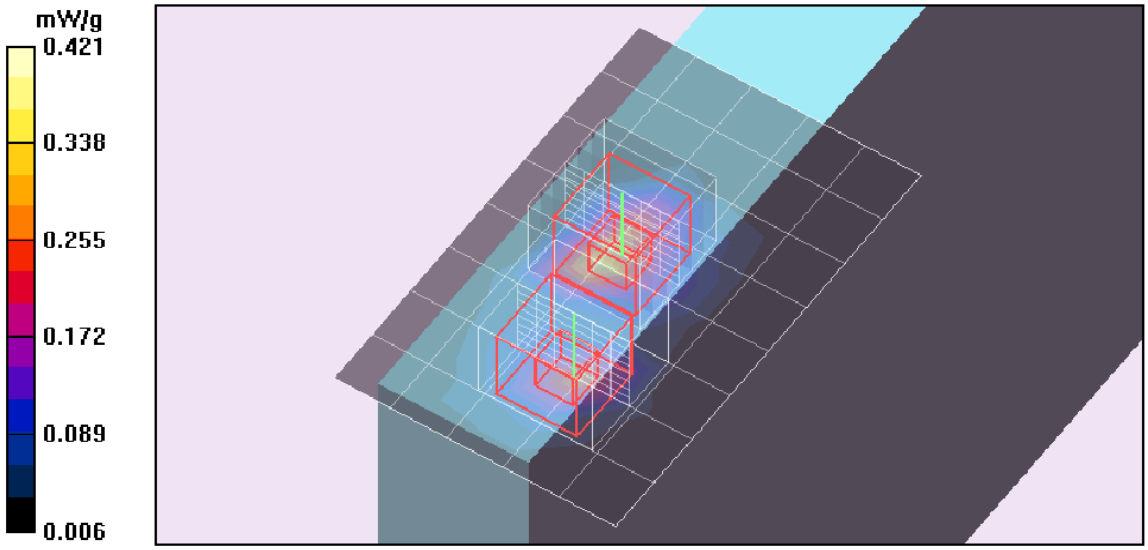
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

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_B Ant/Area Scan (6x9x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.350 mW/g

802.11b_B Ant/Zoom Scan B (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 13.5 V/m; Power Drift = -0.536 dB
Peak SAR (extrapolated) = 0.687 W/kg
SAR(1 g) = 0.305 mW/g; SAR(10 g) = 0.135 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.421 mW/g

802.11b_B Ant/Zoom Scan B 2 (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 13.5 V/m; Power Drift = -0.536 dB
Peak SAR (extrapolated) = 0.506 W/kg
SAR(1 g) = 0.233 mW/g; SAR(10 g) = 0.099 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.299 mW/g



WORST-CASE SAR PLOT FOR 5.2 GHz Band

Date/Time: 1/6/2010 5:53:05 PM

Test Laboratory: Compliance Certification Services

Secondary landscape_A_5.2GHz

DUT: Toshiba; Type: NA; Serial: NA

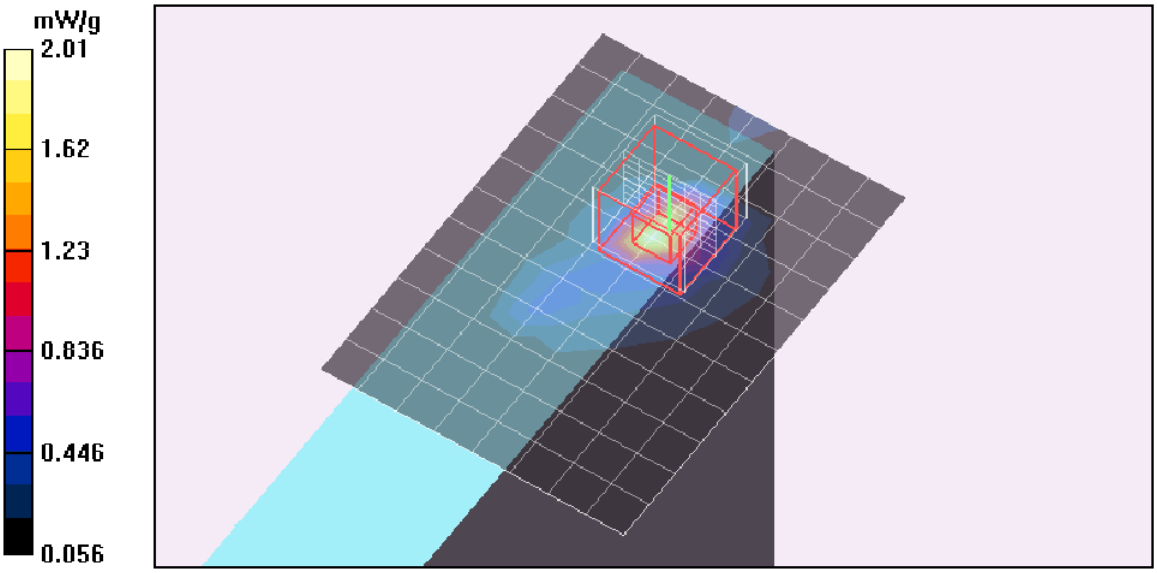
Communication System: 802.11abgn; Frequency: 5180 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5180 MHz; σ = 5.13 mho/m; ε_r = 48; ρ = 1000 kg/m^3
Phantom section: Flat Section

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(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_Ant A_Ch 36/Area Scan (9x12x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 2.01 mW/g

802.11a_Ant A_Ch 36/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 21.2 V/m; Power Drift = -0.563 dB
Peak SAR (extrapolated) = 4.38 W/kg
SAR(1 g) = 1.31 mW/g; SAR(10 g) = 0.419 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 2.25 mW/g



WORST-CASE SAR PLOT FOR 5.3 GHz Band

Date/Time: 1/7/2010 10:30:16 PM

Test Laboratory: Compliance Certification Services

Secondary landscape_A_5.3GHz

DUT: Toshiba; Type: NA; Serial: NA

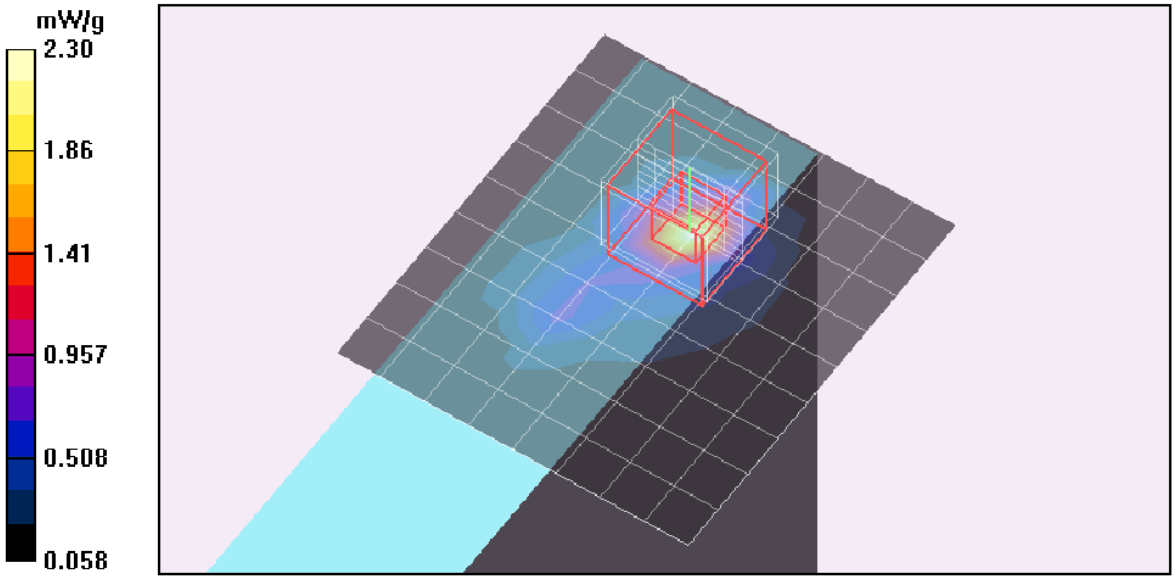
Communication System: 802.11abgn; Frequency: 5320 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5320 MHz; σ = 5.41 mho/m; ε_r = 47.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

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(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_Ant A_Ch 64 2/Area Scan (9x10x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 2.30 mW/g

802.11a_Ant A_Ch 64 2/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 22.4 V/m; Power Drift = 0.148 dB
Peak SAR (extrapolated) = 4.90 W/kg
SAR(1 g) = 1.41 mW/g; SAR(10 g) = 0.453 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 2.51 mW/g



WORST-CASE SAR PLOT FOR 5.6 GHz Band

Date/Time: 1/8/2010 10:27:12 AM

Test Laboratory: Compliance Certification Services

Secondary landscape_B_5.6GHz

DUT: Toshiba; Type: NA; Serial: NA

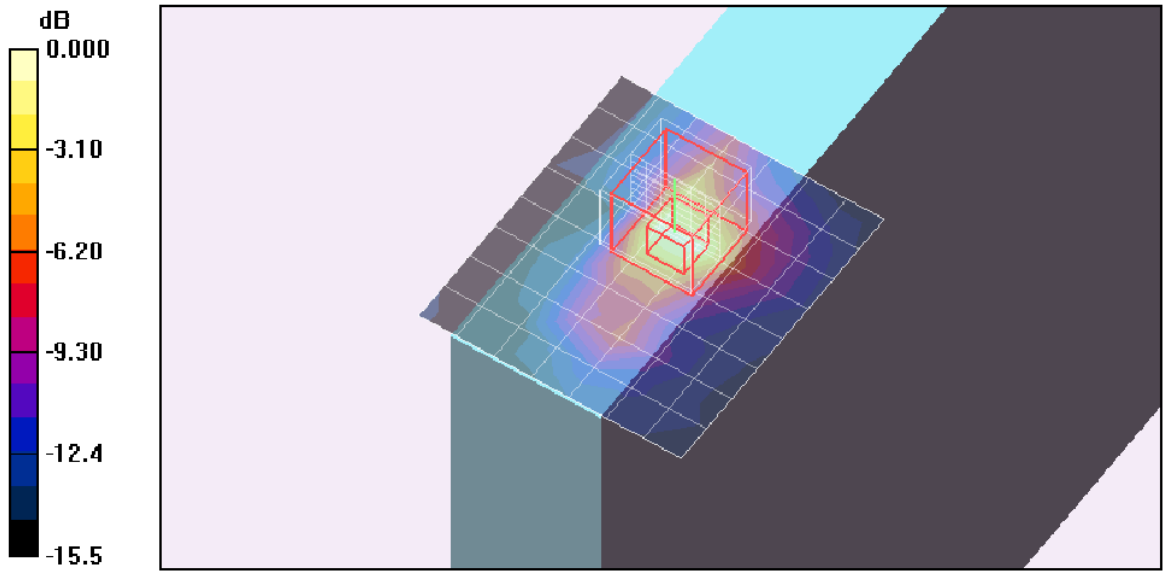
Communication System: 802.11abgn; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.65 mho/m; ε_r = 48.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

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(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_Ant B_Ch 120/Area Scan (8x9x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 2.35 mW/g

802.11a_Ant B_Ch 120/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 21.7 V/m; Power Drift = 0.057 dB
Peak SAR (extrapolated) = 4.98 W/kg
SAR(1 g) = 1.51 mW/g; SAR(10 g) = 0.487 mW/g
Maximum value of SAR (measured) = 2.51 mW/g



0 dB = 2.51mW/g

WORST-CASE SAR PLOT FOR 5.8 GHz Band

Date/Time: 1/8/2010 12:30:52 PM

Test Laboratory: Compliance Certification Services

Secondary landscape_B_5.8GHz

DUT: Toshiba; Type: NA; Serial: NA

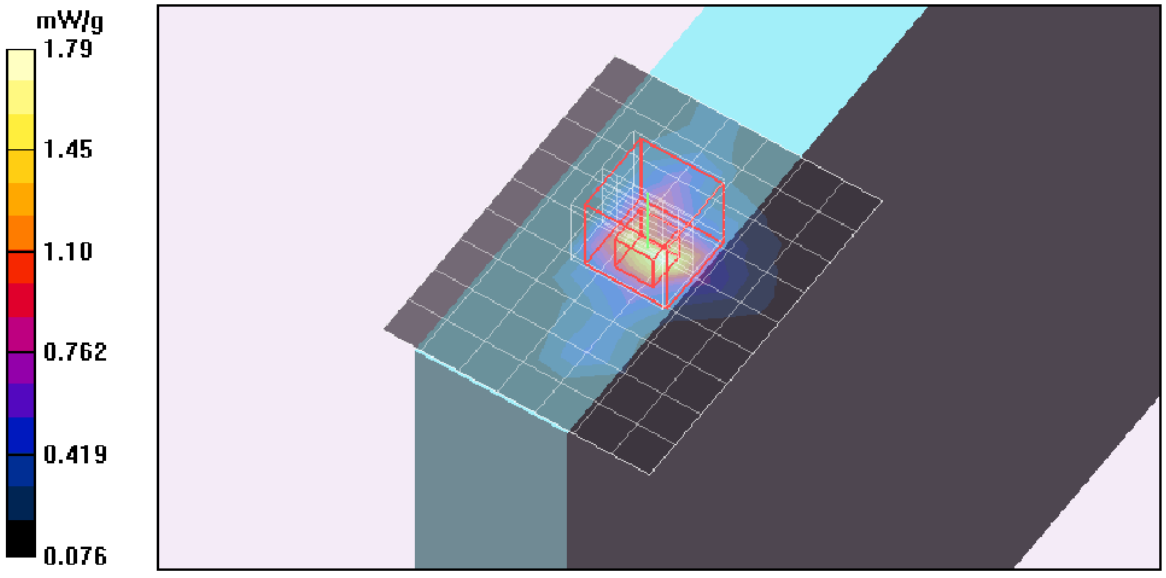
Communication System: 802.11abgn; Frequency: 5785 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5785 MHz; σ = 5.91 mho/m; ε_r = 47.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

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(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_Ant B_Ch 157/Area Scan (8x10x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.79 mW/g

802.11a_Ant B_Ch 157/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 18.9 V/m; Power Drift = 0.375 dB
Peak SAR (extrapolated) = 4.84 W/kg
SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.431 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.99 mW/g



14. ATTACHMENTS

No.	Contents	No. of page (s)
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3	Certificate of E-Field Probe – EX3DV4 SN 3686	10
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5	Certificate of System Validation Dipole - D5GHzV2 SN: 1075	9