FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE STD 1528:2003

SAR EVALUATION REPORT

For
802.11n 2x2 PCIe Mini Card Transceiver
(Tested inside of Panasonic Tablet PC CF-U1)

MODEL NUMBER: WL11F
FCC ID: ACJ9TGWL11F

REPORT NUMBER: 11J13900-2

ISSUE DATE: August 3, 2011

Prepared for
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Revision History

Rev.	Issue Date	Revisions	Revised By
--	August 3, 2011	Initial Issue	--

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1. Attestation of Test Results

Applicant name:	Panasonic Corporation Of North America One Panasonic Way, 4b-8 Secaucus, New Jersey 07094, U.S.A.		
EUT description:	802.11n 2x2 PCIe Minicard Transceiver (Tested inside of Panasonic Tablet PC, Model CF-U1)		
Model number:	WL11F		
Device category:	Portable		
Exposure category:	General Population/Uncontrolled Exposure		
Date tested:	July 26 – August 3 , 2011		
FCC / IC Rule Parts	Freq. Range [MHz]	Highest 1g SAR (mW/g)	Limit (mW/g)
15.247 / RSS-102	2412 – 2462	0.034 W/kg (Primary Portrait)	1.6
	5725 – 5850	0.689 W/kg (Secondary Portrait)	
15.407 / RSS-102	5150 – 5250	0.310 W/kg (Secondary Portrait)	
	5250 – 5350	0.875 W/kg (Primary Portrait)	
	5470 – 5725	1.490 W/kg (Secondary Portrait)	
Applicable Standards			Test Results
OET Bulletin 65 Supplement C 01-01, IEEE STD 1528: 2003, RSS-102 Issue 4, March 2010			Pass

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

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

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

2. Test Methodology

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C Edition 01-01, IEEE STD 1528:2003, and the following KDB Procedures.

- 248227 SAR measurement procedures for 802.11a/b/g transmitters
- 447498 D01 Mobile Portable RF Exposure v04

3. Facilities and Accreditation

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

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

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

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

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
Robot - Six Axes	Stäubli	RX90BL	N/A	N/A		
Robot Remote Control	Stäubli	CS7MB	S-0396	N/A		
DASY4 Measurement Server	SPEAG	SEUMS001BA	1246	N/A		
Probe Alignment Unit	SPEAG	LB5/ 80	SE UKS 030 AA	N/A		
SAM Twin Phantom	SPEAG	QDOOOP40CD	1629	N/A		
Oval Flat Phantom (ELI 5.0) A	SPEAG	QDOVA001BB	1120	N/A		
Oval Flat Phantom (ELI 5.0) B	SPEAG	QDOVA001BB	1118	N/A		
Dielectric Probe kit	HP	85070C	N/A	N/A		
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	8	2	2011
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3773	5	3	2012
Thermometer	ERTCO	639-1S	1718	8	19	2011
Data Acquisition Electronics	SPEAG	DAE4	1258	5	2	2012
System Validation Dipole	SPEAG	*D2450V2	706	4	19	2012
System Validation Dipole	SPEAG	*D5GHzV2	1075	9	3	2011
Power Meter	Giga-tronics	8651A	8651404	3	13	2012
Power Sensor	Giga-tronics	80701A	1834588	3	13	2012
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	SPEAG	MSL2450	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	MSL5800	N/A	Within 24 hrs of first test		

Note:

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

1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement. (Verification data include with D2450V2 and 5GHzV2 calibration certificates)
4. Impedance is within 5Ω of calibrated measurement. (Verification data include with dipole D2450V2 and 5GHzV2 calibration certificates)

4.2. Measurement Uncertainty

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

Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	5.50	Normal	1	1	5.50
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement	1.31	Normal	1	0.64	0.84
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement	3.47	Normal	1	0.6	2.08
Combined Standard Uncertainty Uc(y) =					9.70
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				19.41	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.54	dB

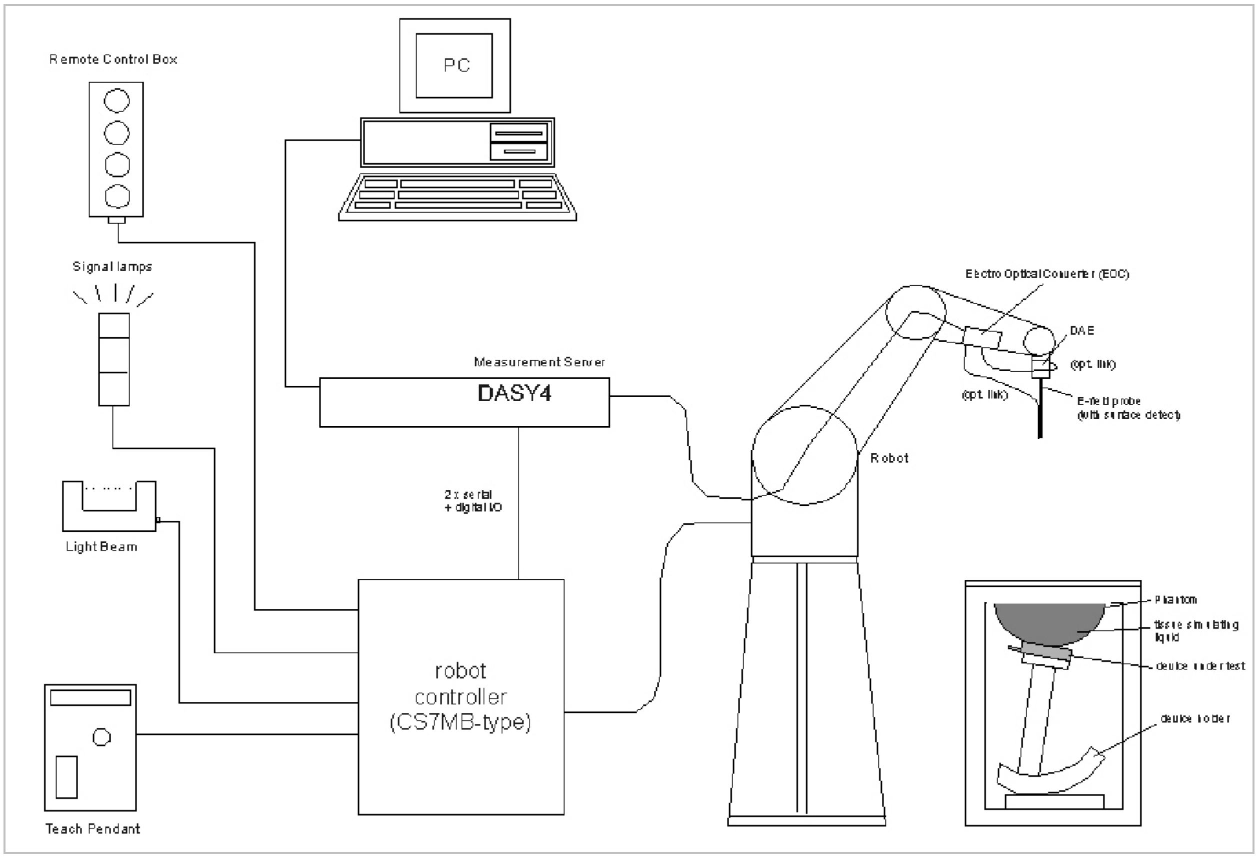
3 to 6 GHz averaged over 1 gram

Component	error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1) @ 5GHz	6.55	Normal	1	1	6.55
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	1.00	Normal	1	1	1.00
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	3.90	Rectangular	1.732	1	2.25
Test Sample Related					
Test Sample Positioning	1.10	Normal	1	1	1.10
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement	3.64	Normal	1	0.64	2.33
Liquid Permittivity - deviation from target	10.00	Rectangular	1.732	0.6	3.46
Liquid Permittivity - measurement uncertainty	4.84	Normal	1	0.6	2.90
Combined Standard Uncertainty Uc(y), %:					11.09
Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =				21.74	%
Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =				1.71	dB

5. Equipment Under Test

802.11n 2x2 PCIe Minicard Transceiver, Model WL11F (Tested inside of Panasonic Tablet PC, Model CF-U1)	
Normal operation:	Multiple display orientations supporting both portrait and landscape configurations.
Antenna tested:	Manufactured: Panasonic Part number: Main (Chain A): DFUP2055ZA(1) Aux (Chain B): DFUP2055ZA(2)
Antenna-to-antenna/user separation distances:	See Section 14 for details of antenna locations and separation distances.
Simultaneous transmission:	• WWAN can transmit simultaneously with WiFi • WWAN can transmit simultaneously with Bluetooth • WiFi can transmit simultaneously with Bluetooth
Assessment for SAR evaluation for Simultaneous transmission:	**WiFi and BT** The Bluetooth's maximum output power is ≤ $60/f_{(GHz)}$ mW. Therefore stand-alone SAR evaluation is not required. Thus, simultaneous transmission SAR testing is not required. (Bluetooth - FCC ID: ACJ9TGBT11A; IC: 216A-CFBT11A) **WWAN and BT** Same as WiFi and BT **WWAN and WiFi** SAR is not required due to $\sum (SAR_{1g})$ < SAR limit.

6. System Specification



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

- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY software.
- Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

7. Composition of Ingredients for Tissue Simulating Liquids

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

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99+% Pure Sodium Chloride　　Sugar: 98+% Pure Sucrose
Water: De-ionized, 16 MΩ+ resistivity　　HEC: Hydroxyethyl Cellulose
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

8. Tissue Dielectric Parameters

The simulating liquids are checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. For frequencies in 300 MHz to just under 2 GHz, the measured conductivity and relative permittivity were within ± 5% of the target values. For frequencies above 2 GHz the measured conductivity was within ± 5% of the target values. The measured relative permittivity tolerance was within ± 10% of the target value.

Reference Values of Tissue Dielectric Parameters for Head & Body Phantom

The body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

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

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

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

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

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

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

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

8.1. Liquid Check Results

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
07/26/2011	Body 2450	e'	50.8696	Relative Permittivity (ϵ_r):	50.87	52.70	-3.47	5
		e"	14.5025	Conductivity (σ):	1.98	1.95	1.31	5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
07/26/2011	Body 5200	e'	49.6870	Relative Permittivity (ϵ_r):	49.69	49.02	1.36	10
		e"	17.4251	Conductivity (σ):	5.04	5.29	-4.84	5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
08/01/2011	Body 5500	e'	49.5336	Relative Permittivity (ϵ_r):	49.53	48.61	1.89	10
		e"	18.6759	Conductivity (σ):	5.71	5.64	1.19	5
08/01/2011	Body 5800	e'	49.0649	Relative Permittivity (ϵ_r):	49.06	48.20	1.79	10
		e"	18.9776	Conductivity (σ):	6.12	6.00	2.00	5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
8/2/2011	Body 5500	e'	50.9668	Relative Permittivity (ϵ_r):	50.97	48.61	4.84	10
		e"	18.6690	Conductivity (σ):	5.71	5.64	1.15	5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
08/03/2011	Body 5200	e'	51.3559	Relative Permittivity (ϵ_r):	51.36	49.02	4.77	10
		e"	17.6461	Conductivity (σ):	5.10	5.29	-3.64	5

9. System Verification

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

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Body simulating liquid of the following parameters.
- The DASY5 system with an Isotropic E-Field Probe EX3DV4-SN: 3773 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (2.4 GHz) fine cube was chosen for cube integration and Special 8x8x10 (5 GHz) fine cube was chosen for cube integration
- Distance between probe sensors and phantom surface was set to 2.5 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input powers (forward power) were 100 mW.
- The results are normalized to 1 W input power.

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

System validation dipole	Cal. certificate #	Cal. date	SAR Avg (mW/g)			
			Tissue:	Freq.	Head	Body
D2450V2 SN 706	D2450V2-706_Apr10	4/19/10	1g SAR:	2.4 GHz	51.6	52.4
			10g SAR:		24.4	24.5
D5GHzV2 SN 1075	D5GHzV2-1075_Sep09	9/3/09	1g SAR:	5.2 GHz		79.0
			10g SAR:			22.0
			1g SAR:	5.5 GHz		85.4
			10g SAR:			23.5
			1g SAR:	5.8 GHz		73.2
			10g SAR:			20.1

9.1. System Check Results

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D2450V2 (2.45GHz)	07/26/11	1g SAR:	54.7	52.4	4.39	±10
		10g SAR:	25.4	24.5	3.67	
D5GHzV2 (5.2GHz)	07/26/11	1g SAR:	71.8	79.0	-9.11	±10
		10g SAR:	20.5	22.0	-6.82	
D5GHzV2 (5.5GHz)	08/01/11	1g SAR:	83.8	85.4	-1.87	±10
		10g SAR:	23.8	23.5	1.28	
D5GHzV2 (5.8GHz)	08/01/11	1g SAR:	72.6	73.2	-0.82	±10
		10g SAR:	20.4	20.1	1.49	
D5GHzV2 (5.5GHz)	08/02/11	1g SAR:	84.4	85.4	-1.17	±10
		10g SAR:	23.9	23.5	1.70	
D5GHzV2 (5.2GHz)	08/03/11	1g SAR:	75.9	79.0	-3.92	±10
		10g SAR:	21.8	22.0	-0.91	

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10. SAR Measurement Procedures

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

Step 2: Area Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY5 software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures ≥ 7x7x9 (above 4.5 GHz) or 5x5x7 (below 3 GHz) points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

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

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

11. RF Output Power Verification

11.1. RF OUTPUT POWER FOR 2.4 GHz BAND

2.4 GHz Band						
Mode	Ch. #	Freq. (MHz)	Target Pwr (dBm)		Actual Measured Pwr	
			Chain A	Chain B	Chain A	Chain B
802.11b	1	2412	18.0		18.38	
	6	2437	**18.0**		**18.08**	
	11	2462	18.0		18.25	
	1	2412		18.0		18.26
	6	2437		**18.0**		**18.34**
	11	2462		18.0		18.12
802.11g	1	2412	13.5			
	6	2437	17.0		17.17	
	11	2462	15.0			
	1	2412		13.5		
	6	2437		17.0		17.11
	11	2462		15.0		
802.11n HT20	1	2412	13.5	13.5		
	6	2437	17.0	17.0	17.11	17.03
	11	2462	13.5	13.5		
802.11n HT40	3	2422	10.5	10.5		
	6	2437	16.5	16.5	16.69	16.76
	9	2450	12.0	12.0		

Note:

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

11.2. RF OUTOUT POWER FOR 5GHz BANDS

5.2 GHz Band						
Mode	Ch. #	Freq. (MHz)	Target Pwr (dBm)		Actual Measured Pwr	
			Chain A	Chain B	Chain A	Chain B
802.11a	36	5180	12.0			
	40	5200	12.0		12.15	
	48	5240	12.0			
	36	5180		12.0		
	40	5200		12.0		12.27
	48	5240		12.0		
802.11n HT20	36	5180	13.0	13.0		
	40	5200	13.0	13.0	13.08	13.20
	48	5240	13.0	13.0		
802.11n HT40	38	5190	11.0	11.0	11.11	11.14
	46	5230	**14.0**	**14.0**	**14.12**	**14.22**

Notes:

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

5.3 GHz Band						
Mode	Ch. #	Freq. (MHz)	Target Pwr (dBm)		Actual Measured Pwr	
			Chain A	Chain B	Chain A	Chain B
802.11a	52	5260	17.0			
	60	5300	11.0		11.02	
	64	5320	11.0			
	52	5260		17.0		
	60	5300		11.0		11.38
	64	5320		11.0		
802.11n HT20	52	5260	17.0	17.0		
	60	5300	13.0	13.0	13.11	13.11
	64	5320	13.0	13.0		
802.11n HT40	54	5270	**17.0**	**17.0**	**17.07**	**17.28**
	62	5310	13.5	13.5	13.71	13.80

Notes:

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

5.5 GHz Band						
Mode	Ch. #	Freq. (MHz)	Original Target Pwr (dBm)		Actual Measured Pwr	
			Chain A	Chain B	Chain A	Chain B
802.11a	100	5500	17.0		17.30	
	120	5600	**17.0**		**17.31**	
	140	5700	15.0		15.41	
	100	5500		17.0		17.37
	120	5600		**17.0**		**17.37**
	140	5700		15.0		15.11
802.11n HT20	100	5500	16.0	16.0		
	120	5600	17.0	17.0	17.02	17.10
	140	5700	14.0	14.0		
802.11n HT40	102	5510	13.5	13.5		
	118	5590	17.0	17.0	17.02	17.04
	134	5670	14.0	14.0		

Notes:

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

5.8 GHz Band						
Mode	Ch. #	Freq. (MHz)	Original Target Pwr (dBm)		Actual Measured Pwr	
			Chain A	Chain B	Chain A	Chain B
802.11a	149	5745	14.0			
	157	5785	**14.0**		**14.38**	
	165	5825	14.0			
	149	5745		14.0		
	157	5785		**14.0**		**14.41**
	165	5825		14.0		
802.11n HT20	149	5745	14.0	14.0		
	157	5785	14.0	14.0	14.04	14.08
	165	5825	14.0	14.0		
802.11n HT40	151	5755	14	14.0	14.08	14.01
	159	5795	14	14.0		

Notes:

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

12. Summary of Test Results

12.1. Summary of Test Configurations

Configuration	Antenna-to-User distance	SAR Require	Comments
(1) Primary Portrait	10 mm From Sub (B) antenna-to-user	Yes	
(2) Secondary Portrait	10 mm From Main (A) antenna-to-user	Yes	
Primary Landscape	123 mm From both Main and Sub antenna-to-user	No	This is not the most conservative position.
Secondary Landscape	19 mm From both Main and Sub antenna-to-user	No	This is not the most conservative position.
(3) Base	20 mm From both Main and Sub antenna-to-user	Yes	

12.2. SAR Test Results for 2.4 GHz

(1) Primary Portrait

Mode	Channel	f (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11b	1	2412				
	6	2437		18.34	0.034	0.015
	11	2462				

(2) Secondary Portrait

Mode	Channel	f (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11b	1	2412				
	6	2437	18.08		0.025	0.012
	11	2462				

(3) Base

Mode	Channel	f (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11b	1	2412				
	6	2437	18.08		0.010	0.004
	11	2462				

12.3. SAR Test Results for 5 GHz BANDS

(1) Primary Portrait

5.2 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Pwr (dBm)		Results (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11n HT40	38	5190				
	46	5230	14.12	14.22	0.273	0.096

5.3 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11n HT40	54	5270	17.07	17.28	0.875	0.317
	62	5310	13.71	13.80	0.398	0.141

5.5 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11a	100	5500		17.37	1.260	0.421
	120	5600		17.31	1.170	0.367
	140	5700		15.11	1.200	0.398

5.8 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11a	149	5745				
	157	5785		14.41	0.654	0.182
	165	5825				

(2) Secondary Portrait

5.2 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Pwr (dBm)		Results (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11n HT40	38	5190				
	46	5230	14.12	14.22	0.310	0.095

5.3 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11n HT40	54	5270	17.07	17.28	0.850	0.285
	62	5310	13.71	13.80	0.360	0.120

5.5 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11a	100	5500	17.30		1.430	0.453
	120	5600	17.31		1.490	0.446
	140	5700	15.41		1.310	0.375

5.8 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11a	149	5745				
	157	5785	14.38		0.689	0.187
	165	5825				

(3) Base

5.2 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Pwr (dBm)		Results (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11n HT40	38	5190				
	46	5230	14.12	14.22	0.049	0.019

5.3 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11n HT40	54	5270	17.07	17.28	0.064	0.025
	62	5310	13.71	13.80		

5.5 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11a	100	5500	17.30			
	120	5600	17.31		0.047	0.014
	140	5700	15.41			
	100	5500		17.37		
	120	5600		17.31	0.188	0.050
	140	5700		15.11		

5.8 GHz Band						
Mode	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)	
			Chain A	Chain B	1g-SAR	10g-SAR
802.11a	149	5745				
	157	5785	14.38		0.036	0.009
	165	5825				
	149	5745				
	157	5785		14.41	0.169	0.039
	165	5825				

13. Appendixes

13.1. Appendix A: System Check Plots

13.2. Appendix B: SAR Test Plots

13.3. Appendix C: Calibration Certificate for EX3DV4 SN 3773

13.4. Appendix D: Calibration Certificate for D2450V2 SN 706

13.5. Appendix E: Calibration Certificate for D5GHzV2 SN 1075

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