SAR Evaluation Report

IN ACCORDANCE WITH THE REQUIREMENTS OF
FCC OET BULLETIN 65 SUPPLEMENT C
IC RSS 102 ISSUE 1 : 1999

FOR

802.11 a/b/g/n WLAN WITH BLUETOOTH 2.1 PCI-E CARD

MODEL: BCM94321COEX2

FCC ID: QDS-BRCM1027

IC: 4324A-BRCM1027

REPORT NUMBER: 07U11490-1

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Prepared for

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issued date	Revisions	Revised By
--	12/13/07	Initial issue	HSIN FU SHIH

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

DATES OF TEST: November 29th and 30th, December 5th, 6th, and 7th 2007.

APPLICANT: ADDRESS:	Broadcom Corporation 190 Mathilda Place, Sunnyvale, CA 94086
FCC ID: IC: MODEL:	QDS-BRCM1027 4324A-BRCM1027 BCM94321COEX2
DEVICE CATEGORY: EXPOSURE CATEGORY:	Portable Device General Population/Uncontrolled Exposure

802.11 a/b/g/n WLAN WITH BLUETOOTH 2.1 PCI-E CARD, MODEL BCM94321COEX2, FCC ID: QDS-BRCM1027, IC: 4324A-BRCM1027 IS INSTALLED IN THE APPLE LAPTOP MACBOOK SERIES.

Test Sample is a:	Production unit
Modulation type:	Direct Sequence Spread Spectrum (DSSS) for 802.11b Orthogonal Frequency Division Multiplexing (OFDM) for 802.11agn Frequency Hopping Spread Spectrum (FHSS) for Bluetooth module

Rule Parts	Frequency Range [MHz]	The Highest SAR Values [1g_mW/g]	Collocation SAR Values [1g_mW/g]
FCC 15.247	2400 - 2483.5	0.472	0.536
	5725 - 5850	0.714	0.791
FCC 15.407	5150 - 5250	0.549	0.587
	5250 - 5350	0.497	0.565
	5470 - 5425	0.761	0.764

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC OET 65 Supplement C (Edition 01-01) and RSS 102.

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 Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

Hsin Fu Shih
Engineering Supervisor
Compliance Certification Services

Tested By:

Jonathan King
EMC Engineer
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TABLE OF CONTENTS

1 DEVICE UNDER TEST (DUT) DESCRIPTION

802.11 a/b/g/n WLAN With Bluetooth 2.1 PCI-E Card, Model BCM94321COEX2, FCC ID: QDS-BRCM1027, IC: 4324A-BRCM1027 is installed in the Apple Laptop Macbook series.	
Normal operation:	Lap-held position.
Duty cycle:	802.11b mode – 97% 802.11agn mode – 91%
Host Device(s):	Apple Laptop Macbook Series
Antenna(s)	Manufacturer: Tyco - Left Side Antenna (Main) – Tyco PN: 631-0434 - Right Side Antenna (Aux) – Tyco PN: 631-0481 - Bluetooth Antenna – Tyco PN: 631-0482
Power supply:	Power supplied through the laptop computer (host device).

2 FACILITIES AND ACCREDITATION

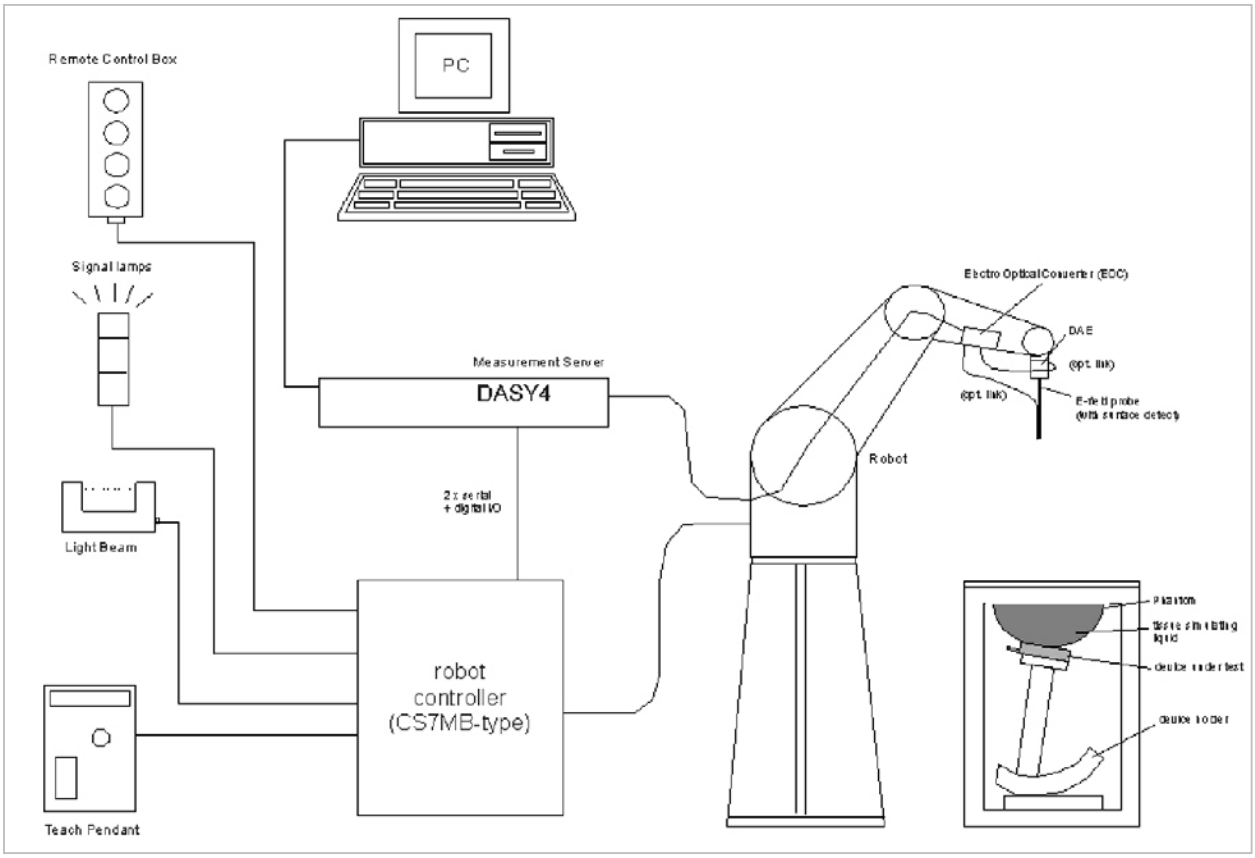
The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, CA 94538 USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

NVLAP LAB CODE 200065-0

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

No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

3 SYSTEM DESCRIPTION



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.

3.1 COMPOSITION OF INGREDIENTS FOR TISSUE SIMULATING LIQUIDS

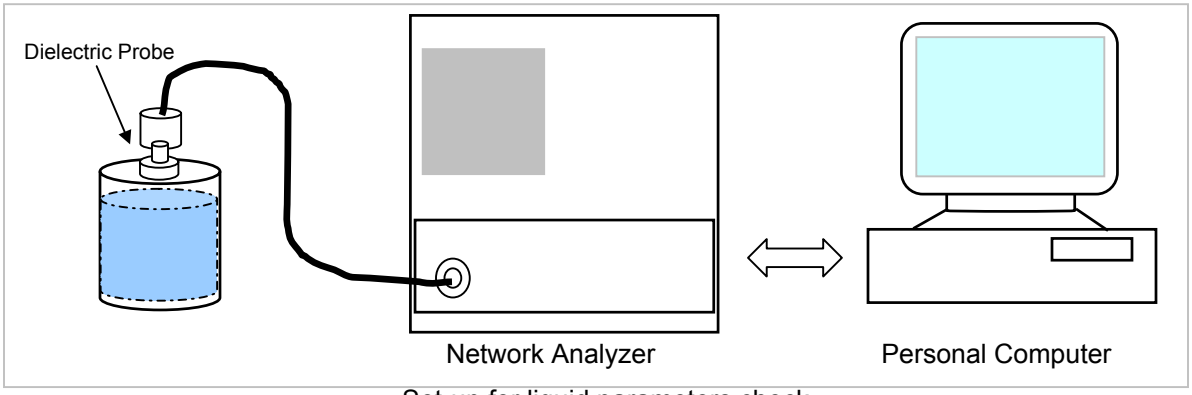
The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

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

4 SIMULATING 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.



Set-up for liquid parameters check

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	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

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

Reference Values of Tissue Dielectric Parameters for Head and 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 emulgators. Dielectric parameters of these liquids were measured suing a HP 8570C Dielectric Probe Kit in conjunction with 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)	Head Tissue		Body Tissue		Reference
	rel. permitivity	conductivity	rel. permitivity	conductivity	
3000	38.5	2.40	52.0	2.73	Standard
5800	35.3	5.27	48.2	6.00	Standard
5000	36.2	1.45	49.3	5.07	Interpolated
5100	36.1	4.55	49.1	5.18	Interpolated
5200	36.0	4.66	49.0	5.30	Interpolated
5300	35.9	4.76	48.9	5.42	Interpolated
5400	35.8	4.86	48.7	5.53	Interpolated
5500	35.6	4.96	48.6	5.65	Interpolated
5600	35.5	5.07	48.5	5.77	Interpolated
5700	35.4	5.17	48.3	5.88	Interpolated

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

4.1 SIMULATING LIQUID PARAMETER CHECK RESULT

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature = 24°C; Relative humidity = 30% Measured by: Jonathan King

Simulating Liquid			Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)							
2450	23	15	e'	50.7181	Relative Permittivity (ε_r):	50.7181	52.7	-3.76	± 5
			e"	14.8681	Conductivity (σ):	2.02647	1.95	3.92	± 5

Liquid Check
Ambient temperature: 23 deg. C; Liquid temperature: 22 deg. C
November 30, 2007 05:58 PM

Frequency	e'	e"
2400000000.	50.9151	14.6426
2405000000.	50.8981	14.6769
2410000000.	50.8879	14.6921
2415000000.	50.8643	14.7201
2420000000.	50.8441	14.7293
2425000000.	50.8111	14.7762
2430000000.	50.7948	14.8032
2435000000.	50.7960	14.8201
2440000000.	50.7786	14.8304
2445000000.	50.7362	14.8530
2450000000.	**50.7181**	**14.8681**
2455000000.	50.6996	14.9097
2460000000.	50.6813	14.9181
2465000000.	50.6567	14.9271
2470000000.	50.6272	14.9496
2475000000.	50.6009	14.9685
2480000000.	50.5874	14.9975
2485000000.	50.5590	15.0083
2490000000.	50.5377	15.0363
2495000000.	50.5268	15.0516
2500000000.	50.5136	15.0588

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 Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature = 23°C; Relative humidity = 55% Measured by: Jonathan King

Simulating Liquid			Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)							
2450	22	15	e'	50.9484	Relative Permittivity (ε_r):	50.9484	52.7	-3.32	± 5
			e"	14.9033	Conductivity (σ):	2.03127	1.95	4.17	± 5

Liquid Check
Ambient temperature: 23 deg. C; Liquid temperature: 22 deg. C
December 05, 2007 09:29 AM

Frequency	e'	e"
2400000000.	51.1371	14.6846
2405000000.	51.1185	14.7205
2410000000.	51.0927	14.7468
2415000000.	51.0872	14.7745
2420000000.	51.0561	14.7928
2425000000.	51.0281	14.8224
2430000000.	51.0203	14.8349
2435000000.	51.0188	14.8584
2440000000.	51.0045	14.8681
2445000000.	50.9728	14.8994
2450000000.	50.9484	14.9033
2455000000.	50.9212	14.9405
2460000000.	50.9027	14.9486
2465000000.	50.8664	14.9420
2470000000.	50.8433	14.9637
2475000000.	50.8183	14.9657
2480000000.	50.8087	14.9858
2485000000.	50.7896	15.0068
2490000000.	50.7728	15.0325
2495000000.	50.7592	15.0543
2500000000.	50.7382	15.0671

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 Parameter Check Result @ Muscle 5GHz

Room Ambient Temperature = 25°C; Relative humidity = 30% Measured by: Jonathan King

Simulating Liquid			Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)							
5200	24	15	e'	46.8255	Relative Permittivity (ϵ_r):	46.8255	49.0	-4.44	± 10
			e"	19.0067	Conductivity (σ):	5.49831	5.30	3.74	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
November 29, 2007 2:26 PM

Frequency	e'	e"
4600000000.	48.0519	18.0001
4650000000.	48.5718	18.2296
4700000000.	47.8922	18.0843
4750000000.	48.1554	18.4252
4800000000.	48.0113	18.2923
4850000000.	47.6180	18.4754
4900000000.	48.1239	18.6262
4950000000.	47.3308	18.4856
5000000000.	47.8595	18.9515
5050000000.	47.4142	18.6009
5100000000.	47.3740	19.0378
5150000000.	47.5747	18.9588
5200000000.	**46.8255**	**19.0067**
5250000000.	47.5093	19.2502
5300000000.	46.7783	19.0057
5350000000.	46.9868	19.4124
5400000000.	46.9507	19.0999
5450000000.	46.4597	19.4598
5500000000.	47.0851	19.3720
5550000000.	46.1653	19.3804
5600000000.	46.8022	19.6185
5650000000.	46.2016	19.4498
5700000000.	46.3119	19.6950
5750000000.	46.2699	19.5846
5800000000.	45.8107	19.7253
5850000000.	46.2529	19.7716
5900000000.	45.4644	19.6114
5950000000.	45.8661	19.9894
6000000000.	45.5864	19.7042

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 Parameter Check Result @ Muscle 5GHz

Room Ambient Temperature = 25°C; Relative humidity = 50% Measured by: Jonathan King

Simulating Liquid			Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)							
5500	24	15	e'	46.2345	Relative Permittivity (ϵ_r):	46.2345	48.6	-4.87	± 10
			e"	19.3089	Conductivity (σ):	5.90798	5.65	4.57	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
December 06, 2007 10:50 AM

Frequency	e'	e"
4600000000.	47.5495	18.2876
4650000000.	47.8956	18.2754
4700000000.	47.2170	18.3265
4750000000.	47.7228	18.5848
4800000000.	47.1865	18.4007
4850000000.	47.2273	18.7460
4900000000.	47.3911	18.5726
4950000000.	46.6768	18.7333
5000000000.	47.3307	18.9020
5050000000.	46.5919	18.7391
5100000000.	46.9342	19.1429
5150000000.	46.6957	18.8887
5200000000.	46.2073	19.2309
5250000000.	46.8202	19.1716
5300000000.	45.8602	19.0974
5350000000.	46.5074	19.4513
5400000000.	45.9519	19.0580
5450000000.	45.9078	19.6170
5500000000.	46.2345	19.3089
5550000000.	45.3306	19.5030
5600000000.	46.0788	19.6724
5650000000.	45.1992	19.4207
5700000000.	45.5836	19.9256
5750000000.	45.3733	19.5033
5800000000.	44.9614	20.0114
5850000000.	45.5987	19.8281
5900000000.	44.5366	19.8043
5950000000.	45.2871	20.2546
6000000000.	44.7284	19.7205

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 Parameter Check Result @ Muscle 5GHz

Room Ambient Temperature = 25°C; Relative humidity = 50% Measured by: Jonathan King

Simulating Liquid			Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)							
5800	24	15	e'	45.9198	Relative Permittivity (ϵ_r):	45.9198	48.2	-4.73	± 10
			e"	19.4614	Conductivity (σ):	6.27944	6.00	4.66	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
December 07, 2007 08:39 AM

Frequency	e'	e"
4600000000.	48.2794	17.8477
4650000000.	48.6538	17.8244
4700000000.	47.9780	17.8680
4750000000.	48.4789	18.0951
4800000000.	47.9680	17.9303
4850000000.	48.0209	18.2455
4900000000.	48.1945	18.0926
4950000000.	47.4757	18.2324
5000000000.	48.1529	18.4015
5050000000.	47.4235	18.2468
5100000000.	47.7794	18.6294
5150000000.	47.5559	18.4151
5200000000.	47.0771	18.7165
5250000000.	47.6877	18.6811
5300000000.	46.7523	18.5915
5350000000.	47.3765	18.9307
5400000000.	46.8614	18.5529
5450000000.	46.7988	19.0891
5500000000.	47.1588	18.7979
5550000000.	46.2385	18.9629
5600000000.	47.0372	19.1423
5650000000.	46.1491	18.8764
5700000000.	46.5193	19.3835
5750000000.	46.3438	18.9779
5800000000.	45.9198	19.4614
5850000000.	46.6065	19.3003
5900000000.	45.5304	19.2621
5950000000.	46.3274	19.7191
6000000000.	45.7374	19.1758

The conductivity (σ) can be given as:

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

where f = target $f * 10^6$

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

5 SYSTEM PERFORMANCE 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 Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV3-SN: 3554 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 5 x 5 x 7 fine cube was chosen for cube integration(dx=dy=7.5mm; dz=5mm).
  For 5 GHz band - Special 8x8x8 fine cube was chosen for cube integration(dx=dy=4.3mm; dz=3mm)
- Distance between probe sensors and phantom surface was set to 4 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.0mm
- The dipole input power (forward power) was 250 mW±3%.
- The results are normalized to 1 W input power.

In the table below, the numerical reference SAR values of a SPEAG validation dipoles placed below the flat phantom filled with body-tissue simulating liquid are given. The reference SAR values were calculated using the finite-difference time-domain method and the geometry parameters.

Dipole Type	Distance (mm)	Frequency (MHz)	SAR (1g) [W/kg]	SAR (10g) [W/kg]	SAR (peak) [W/kg]
D450V2	15	450	5.01	3.36	7.22
D835V2	15	835	9.71	6.38	14.1
D900V2	15	900	11.1	7.17	16.3
D1450V2	10	1450	29.6	16.6	49.8
D1800V2	10	1800	38.5	20.3	67.5
D1900V2	10	1900	39.8	20.8	69.6
D2000V2	10	2000	40.9	21.2	71.5
D2450V2	10	2450	51.2	23.7	97.6

Note: All SAR values normalized to 1 W forward power.

Reference SAR Values for body-tissue

In the table below, the numerical reference SAR values of a SPEAG validation dipoles placed below the flat phantom filled with body-tissue simulating liquid are given. The reference SAR values were calculated using finite-difference time-domain FDTD method (feed point-impedance set to 50 ohms) and the mechanical dimensions of the D5GHzV2 dipole (manufactured by SPEAG).

f (MHz)	Head Tissue		Body Tissue		
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}	SAR_{Peak}
5000	72.9	20.7	68.1	19.2	260.3
5100	74.6	21.1	78.8	19.6	272.3
5200	76.5	21.6	71.8	20.1	284.7
5500	83.3	23.4	79.1	22.0	326.3
5800	78.0	21.9	74.1	20.5	324.7

Note: All SAR values normalized to 1 W forward power.

5.1 SYSTEM PERFORMANCE CHECK RESULTS

System Validation Dipole: D2450V2 SN: 706

Date: November 30, 2007

Ambient Temperature = 24°C; Relative humidity = 30% Measured by: Jonathan King

Body Simulating Liquid			SAR (mW/g)		Normalized to 1 W	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	23	15	1g	13.90	55.6	51.2	8.59	± 10
			10g	6.27	25.08	23.7	5.82	± 10

Date: December 5, 2007

Ambient Temperature = 23°C; Relative humidity = 55% Measured by: Jonathan King

Body Simulating Liquid			SAR (mW/g)		Normalized to 1 W	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	22	15	1g	13.70	54.8	51.2	7.03	± 10
			10g	6.21	24.84	23.7	4.81	± 10

System Validation Dipole: D5GHzV2 SN 1003

Date: November 29, 2007

Ambient Temperature = 25°C; Relative humidity = 30% Measured by: Jonathan King

Body Simulating Liquid			SAR (mW/g)		Normalized to 1 W	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
5200	24	15	1g	18.20	72.8	71.8	1.39	± 10
			10g	5.37	21.48	20.1	6.87	± 10

Date: December 6, 2007

Ambient Temperature = 25°C; Relative humidity = 50% Measured by: Jonathan King

Body Simulating Liquid			SAR (mW/g)		Normalized to 1 W	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
5500	24	15	1g	19.80	79.2	79.1	0.13	± 10
			10g	5.75	23	22.0	4.55	± 10

Date: December 7, 2007

Ambient Temperature = 25°C; Relative humidity = 50% Measured by: Jonathan King

Body Simulating Liquid			SAR (mW/g)		Normalized to 1 W	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
5800	24	15	1g	18.80	75.2	74.1	1.48	± 10
			10g	5.35	21.4	20.5	4.39	± 10

6 SAR MEASURMENT PROCEDURE

A summary of the procedure follows:

a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the EUT. The SAR at this point is measured at the start of the test, and then again at the end of the test.

b) The SAR distribution at the exposed flat section of the flat phantom is measured at a distance of 4 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 15 mm x 15 mm. Based on this data, the area of the maximum absorption is determined by Spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

   For 5 GHz band - The SAR distribution at the exposed flat section of the flat phantom is measured at a distance of 2.0 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 10 mm x 10 mm. Based on this data, the area of the maximum absorption is determined by Spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

c) Around this point, a volume of X=Y= 30 and Z=21 mm is assessed by measuring 5 x 5 x 7 mm points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:

   For 5 GHz band - Around this point, a volume of X=Y=24 and Z=20 mm is assessed by measuring 7 x 7 x 9 mm points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:

   (i) The data at the surface are extrapolated, since the centre of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.

   (ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot”- condition (in x, y and z-direction). The volume is integrated with the trapezoidal – algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.

   (iii) All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.

   (iv) The SAR value at the same location as in Step (a) is again measured to evaluate the actual power drift.

6.1 DASY4 SAR MEASURMENT PROCEDURE

Step 1: Power Reference Measurement

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

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures 5 x 5 x 7 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.

For 5 GHz band – Same as above except the Zoom Scan measures 7 x 7 x 9 points.

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.

7 PROCEDURE USED TO ESTABLISH TEST SIGNAL

The following procedures had been used to prepare the EUT for the SAR test.

The client provided a special driver and program, w1_tools, which enables a user to control the frequency and output power of the module.

2412 - 2463 GHz Band			
Channel	**Frequency (MHz)**	**Average Power Main (dBm)**	**Average Power Aux (dBm)**
802.11b Legacy			
Low	2412	19.0	19.0
Middle	2437	19.0	19.0
High	2462	19.0	19.0
802.11g Legacy			
Low	2412	19.0	19.0
Middle	2437	19.0	19.0
High	2462	17.0	17.0
802.11n 20MHz SISO			
Low	2412	19.0	19.0
Middle	2437	19.0	19.0
High	2462	17.5	17.5
802.11n 40MHz SISO			
Low	2422	15.5	15.5
Middle	2437	16.5	16.5
High	2452	14.5	14.5
802.11g Legacy CDD			
Low	2412	19.0	19.0
Middle	2437	19.0	19.0
High	2462	17.0	17.0
802.11n 20MHz CDD			
Low	2412	14.0	14.0
Middle	2437	19.0	19.0
High	2462	13.5	13.5
802.11n 40MHz CDD/SDM			
Low	2422	12.5	12.5
Middle	2437	13.0	13.0
High	2352	12.0	12.0

The cable assembly insertion loss of 10.3 dB (including attenuator and connectors) was entered as an offset in the power meter to allow for direct reading of power.

UNII Band 5180 to 5240			
Channel	**Frequency (MHz)**	**Average Power Main (dBm)**	**Average Power Aux (dBm)**
802.11a Legacy			
Low	5180	14.0	14.0
Middle	5220	17.5	17.5
High	5240	17.5	17.5
802.11a CDD			
Low	5180	10.0	10.0
Middle	5220	16.0	16.0
High	5240	16.0	16.0
802.11n 20MHz SISO			
Low	5180	14.0	14.0
Middle	5220	17.5	17.5
High	5240	17.5	17.5
802.11n 40MHz SISO			
Low	5190	13.0	13.0
High	5230	16.5	16.5
802.11n 20MHz CDD			
Low	5180	9.0	9.0
Middle	5220	10.0	10.0
High	5240	10.0	10.0
802.11n 40MHz CDD			
Low	5190	13.0	13.0
High	5230	15.5	15.5

The cable assembly insertion loss of 10.3 dB (including attenuator and connectors) was entered as an offset in the power meter to allow for direct reading of power.

UNII Band 5260 to 5320			
Channel	**Frequency (MHz)**	**Average Power Main (dBm)**	**Average Power Aux (dBm)**
802.11a Legacy			
Low	5260	17.5	17.5
Middle	5300	17.5	17.5
High	5320	14.5	14.5
802.11a CDD			
Low	5260	16.0	16.0
Middle	5300	16.0	16.0
High	5320	13.0	13.0
802.11n 20MHz SISO			
Low	5260	17.5	17.5
Middle	5300	17.5	17.5
High	5320	14.5	14.5
802.11n 40MHz SISO			
Low	5270	17.0	17.0
High	5320	13.0	13.0
802.11n 20MHz CDD			
Low	5260	16.0	16.0
Middle	5300	16.0	16.0
High	5320	13.0	13.0
802.11n 40MHz CDD/SDM			
Low	5270	15.5	15.5
High	5320	12.0	12.0

The cable assembly insertion loss of 10.3 dB (including attenuator and connectors) was entered as an offset in the power meter to allow for direct reading of power.

5470 to 5725 Band			
Channel	**Frequency (MHz)**	**Average Power Main (dBm)**	**Average Power Aux (dBm)**
802.11a Legacy			
Low	5500	17.0	17.0
Middle	5600	17.5	17.5
High	5700	18.0	18.0
802.11a CDD			
Low	5500	16.5	16.5
Middle	5600	17.0	17.0
High	5700	17.0	17.0
802.11n 20MHz SISO			
Low	5500	17.0	17.0
Middle	5600	17.5	17.5
High	5700	17.5	17.5
802.11n 40MHz SISO			
Low	5510	15.5	15.5
Middle	5590	18.0	18.0
High	5670	18.0	18.0
802.11n 20MHz CDD			
Low	5500	16.5	16.5
Middle	5600	17.0	17.0
High	5700	17.0	17.0
802.11n 40MHz CDD			
Low	5510	15.5	15.5
Middle	5590	18.5	18.5
High	5670	18.5	18.5

The cable assembly insertion loss of 10.3 dB (including attenuator and connectors) was entered as an offset in the power meter to allow for direct reading of power.

5725 to 5825 Band			
Channel	**Frequency (MHz)**	**Average Power Main (dBm)**	**Average Power Aux (dBm)**
802.11a Legacy			
Low	5745	17.5	17.5
Middle	5785	17.5	17.5
High	5825	17.5	17.5
802.11a CDD			
Low	5745	17.0	17.0
Middle	5785	17.5	17.5
High	5825	17.5	17.5
802.11n 20MHz SISO			
Low	5745	17.5	17.5
Middle	5785	17.5	17.5
High	5825	17.5	17.5
802.11n 40MHz SISO			
Low	5755	18.5	18.5
High	5795	18.5	18.5
802.11n 20MHz CDD			
Low	5745	17.0	17.0
Middle	5785	17.5	17.5
High	5825	17.5	17.5
802.11n 40MHz CDD			
Low	5755	18.0	18.0
High	5795	18.5	18.5

8 SAR MEASURMENT RESULTS

8.1 2.4 GHZ BAND (2.412 – 2462 GHZ) - LAP-HELD POSITION

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
802.11b - Main Antenna				
6	**2437**	**0.472**	**0.000**	**0.472**
6[4)]	**2437**	**0.534**	**-0.013**	**0.536**
802.11g - Main Antenna				
6	2437	0.394	-0.120	0.405
802.11b - Aux Antenna				
6	2437	0.260	-0.155	0.269
802.11g - Aux Antenna				
6	2437	0.370	0.000	0.370
802.11n - 40MHz SISO				
6	2437	0.111	0.000	0.111
802.11n - 20MHz CDD MCS 0				
6	2437	0.425	0.000	0.425
802.11n - 40MHz SDM MCS 15				
6	2437	0.112	0.000	0.112

Notes:

1) The exact method of extrapolation is Measured SAR x 10^(-drift/10). The SAR reported at the end of the measurement process by the DASY4 system can be scaled up by the Power drift to determine the SAR at the beginning of the measurement process.
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower (0.8 mW/g) than SAR limit (1.6 mW/g), thus testing at low & high channel is optional.
3) Please see attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) **Collocation with Broadcom WLAN/Bluetooth combination card FCC ID: QDS-BRCM1027**
5) **20 MHz SISO mode was skipped because it is covered by the g mode legacy testing results.**
6) **G mode legacy CDD mode was skipped because it is covered by the g mode legacy results.**
7) **N mode 40 MHz CDD mode was skilled because it is covered by the n mode 20MHz CDD results.**

8.2 5.2 GHZ BAND (5.15 – 5.25GHZ) – LAP HELD POSITION

802.11a 5.2 GHz Legacy Mode - Main Antenna				
Channel	**f (MHz)**	**Measured SAR 1g (mW/g)**	**Power Drift (dB)**	**Extrapolated[1)] SAR 1g (mW/g)**
44	**5220**	**0.536**	**-0.104**	**0.549**
44[4)]	**5220**	**0.573**	**-0.108**	**0.587**
802.11a 5.2 GHz Legacy Mode - Aux Antenna				
44	5220	0.285	0.000	0.285
802.11n 5.2 GHz SISO 40MHz				
46	5230	0.341	-0.135	0.352
802.11n 5.2 GHz MIMO 40MHz				
46	5230	0.396	0.000	0.396

Notes:

1) The exact method of extrapolation is Measured SAR x 10^(-drift/10). The SAR reported at the end of the measurement process by the DASY4 system can be scaled up by the Power drift to determine the SAR at the beginning of the measurement process.
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower (0.8 mW/g) than SAR limit (1.6 mW/g), thus testing at low & high channel is optional.
3) Please see attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) **Collocation with Broadcom WLAN/Bluetooth combination card FCC ID: QDS-BRCM1027**
5) **20MHz SISO mode was skipped because it is covered by the legacy results.**
6) **MIMO 20MHz CDD mode was skipped because it is covered by the MIMO 40MHz CDD results.**

8.3 5.3 GHZ BAND (5.25 – 5.35GHZ) – LAP HELD POSITION

802.11a 5.2 GHz Legacy Mode - Main Antenna				
Channel	**f (MHz)**	**Measured SAR 1g (mW/g)**	**Power Drift (dB)**	**Extrapolated[1)] SAR 1g (mW/g)**
60	**5300**	**0.497**	**0.000**	**0.497**
60[4)]	**5300**	**0.565**	**0.000**	**0.565**
802.11n 5.2 GHz SISO 40MHz				
54	5270	0.337	0.000	0.337
802.11n 5.2 GHz MIMO 20MHz				
60	5300	0.303	0.000	0.303

Notes:

1) The exact method of extrapolation is Measured SAR x 10^(-drift/10). The SAR reported at the end of the measurement process by the DASY4 system can be scaled up by the Power drift to determine the SAR at the beginning of the measurement process.
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower (0.8 mW/g) than SAR limit (1.6 mW/g), thus testing at low & high channel is optional.
3) Please see attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) **Collocation with Broadcom WLAN/Bluetooth combination card FCC ID: QDS-BRCM1027**
5) **20MHz SISO mode was skipped because it is covered by the legacy results.**
6) **MIMO 40MHz CDD mode was skipped because it is covered by results to MIMO 20 MHz CDD.**

8.4 5.5 GHZ BAND (5.470 – 5.725GHZ) – LAP HELD POSITION

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
802.11a 5.5 GHz Legacy Mode - Main Antenna				
120	5600	0.680	0.000	0.680
802.11a 5.5 GHz Legacy Mode - Aux Antenna				
120	5600	0.443	0.000	0.443
802.11n 5.5 GHz SISO 40MHz				
118	5590	0.418	0.000	0.418
802.11n 5.5 GHz MIMO 40MHz				
118	**5590**	**0.761**	**0.000**	**0.761**
118[4)]	**5590**	**0.764**	**0.000**	**0.764**

Notes:

1) The exact method of extrapolation is Measured SAR x 10^(-drift/10). The SAR reported at the end of the measurement process by the DASY4 system can be scaled up by the Power drift to determine the SAR at the beginning of the measurement process.
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower (0.8 mW/g) than SAR limit (1.6 mW/g), thus testing at low & high channel is optional.
3) Please see attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) **Collocation with Broadcom WLAN/Bluetooth combination card FCC ID: QDS-BRCM1027**
5) **20MHz SISO mode was skipped because it is covered by the legacy results.**
6) **MIMO 20MHz CDD mode was skipped due to lower power compared to MIMO 40 MHz CDD.**

8.5 5.8 GHZ BAND (5.725 – 5.825GHZ) – LAP HELD POSITION

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
802.11a 5.8 GHz Legacy Mode - Main Antenna				
157	5785	0.654	0.000	0.654
802.11a 5.8 GHz Legacy Mode - Aux Antenna				
157	5785	0.368	0.000	0.368
802.11n 5.8 GHz SISO 40MHz				
159	5795	0.588	0.000	0.588
802.11n 5.8 GHz MIMO 40MHz				
159	**5795**	**0.714**	**0.000**	**0.714**
159[4)]	**5795**	**0.791**	**0.000**	**0.791**

Notes:

1) The exact method of extrapolation is Measured SAR x 10^(-drift/10). The SAR reported at the end of the measurement process by the DASY4 system can be scaled up by the Power drift to determine the SAR at the beginning of the measurement process.
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower (0.8 mW/g) than SAR limit (1.6 mW/g), thus testing at low & high channel is optional.
3) Please see attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) **Collocation with Broadcom WLAN/Bluetooth combination card FCC ID: QDS-BRCM1027**
5) **20MHz SISO mode was skipped because it is covered by the legacy results.**
6) **MIMO 20MHz CDD mode was skipped because it is covered by the MIMO 40 MHz CDD.**

9 MEASURMENT UNCERTAINTY

9.1 MEASURMENT 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

9.2 MEASURMENT UNCERTAINTY 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

10 EQUIPMENT LIST AND CALIBRATION

Name of Equipment	Manufacturer	Type/Model	Serial Number	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	US39173569	2	14	2008
E-Field Probe	SPEAG	EX3DV4	3554	4	24	2008
Thermometer	ERTCO	639-1S	1718	8	30	2008
Data Acquisition Electronics	SPEAG	DAE3 V1	500	11	16	2008
System Validation Dipole	SPEAG	D2450V2	706	4	27	2008
System Validation Dipole	SPEAG	D5GHzV2	1003	11	21	2009
Signal Generator	R&S	SMP 04	DE34210	2	16	2009
Power Meter	Giga-tronics	8651A	8651404	4	3	2008
Power Sensor	Giga-tronics	80701A	1834588	4	17	2008
Amplifier	Mini-Circuits	ZVE-8G	360		N/A	
Amplifier	Mini-Circuits	ZHL-42W	D072701-5		N/A	
Simulating Liquid	CCS	M2450	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	M5200-5800	N/A	Within 24 hrs of first test		

11 PHOTOS

EUT

EUT Location

Antenna Location

12 ATTACHMENTS

No.	Contents	No. Of Pages
1	System Performance Check Plots	10
2-1	SAR Test Plots – 2.4 GHz Band	10
2-2	SAR Test Plots – 5 GHz Bands	27
3	Certificate of E-Field Probe - EX3DV4SN3554	10
4	Certificate of System Validation Dipole - D2450 SN:706	9
5	Certificate of System Validation Dipole - D5GHzV2 SN:1003	15

END OF REPORT