SAR Evaluation Report

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

FOR

BROADCOM 2.4 GHz 802.11g / DRAFT 802.11n WLAN CARDBUS CARD

MODEL: BCM94321CB2

FCC ID: QDS-BRCM1023

IC ID: 4324A-BRCM1023

REPORT NUMBER: 06U10256-1B

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LAB CODE:200065-0

Revision History

Rev.	Issued date	Revisions	Revised By
--	April 25, 2006	Initial issue	HS
B	April 26, 2006	Corrected table labeled in page 16 of 35 of RF power	HS

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

DATES OF TEST: April 20, 21, and 24, 2006

APPLICANT: ADDRESS:	BROADCOM CORPORATION 190 Mathilda Place, Sunnyvale, CA 94086, USA
FCC ID: IC: MODEL:	QDS-BRCM1023 4324A-BRCM1023 BCM94321CB2
DEVICE CATEGORY: EXPOSURE CATEGORY:	Portable Device General Population/Uncontrolled Exposure

Broadcom 2.4 GHz 802.11g / Draft 802.11n WLAN Cardbus Card is installed in three host laptops.		
Test Sample is a:	Production unit	
Modulation type:	Direct Sequence Spread Spectrum (DSSS) for 802.11b Orthogonal Frequency Division Multiplexing (OFDM) for 802.11ag Orthogonal Frequency Division Multiplexing (OFDM) for 802.11n	
Host Laptops	<u>Host # / Brand name</u> Host 1 / HP Pavilion zv6000 Host 2 / Compaq nx7000 Host 3 / Dell Inspiron 6000	<u>Spacing between EUT & Phantom</u> 19 mm 13 mm 17 mm
Rule Parts	Frequency Range [MHz]	The Highest SAR Values (1g)
FCC 15.247 RSS102	2412 - 2462	Host 1: HP Pavilion zv6000 0.554 mW/g Host 2: Compaq nx7000 1.370 mW/g Host 3: Dell Inspiron 6000 0.599 mW/g

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:

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Senior Engineer
Compliance Certification Services

Tested By:

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EMC Engineer
Compliance Certification Services

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1 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Broadcom 2.4 GHz 802.11g / Draft 802.11n WLAN Cardbus Card installed in three host laptops.	
Normal operation:	Lap-held position
Duty cycle:	98 % for b mode 91% for g and 802.11n
Host Device(s):	Host 1: HP Pavilion zv6000 Host 2: Compaq nx7000 Host 3: Dell Inspiron 6000
Antenna(s)	3 Broadcom PCB antennas
Power supply:	Power supplied through the laptop computer (host device).

Spacing between EUT and Phantom

Host devices	Spacing between EUT and Phantom (mm)
HP Pavilion zv6000	19
Compaq nx7000	13
Dell Inspiron 6000	17

2 FACILITIES AND ACCREDITATION

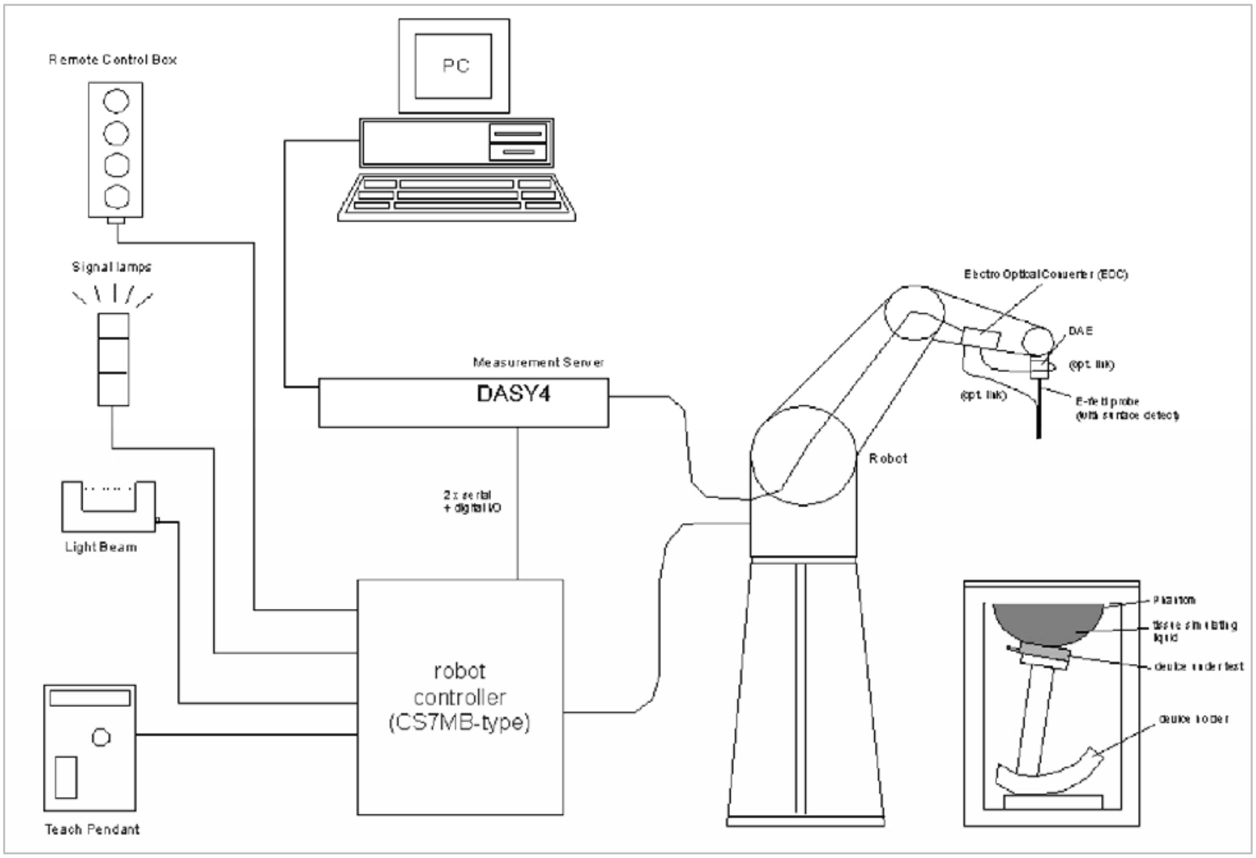
The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

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 SIMULATIG LIQUIDS

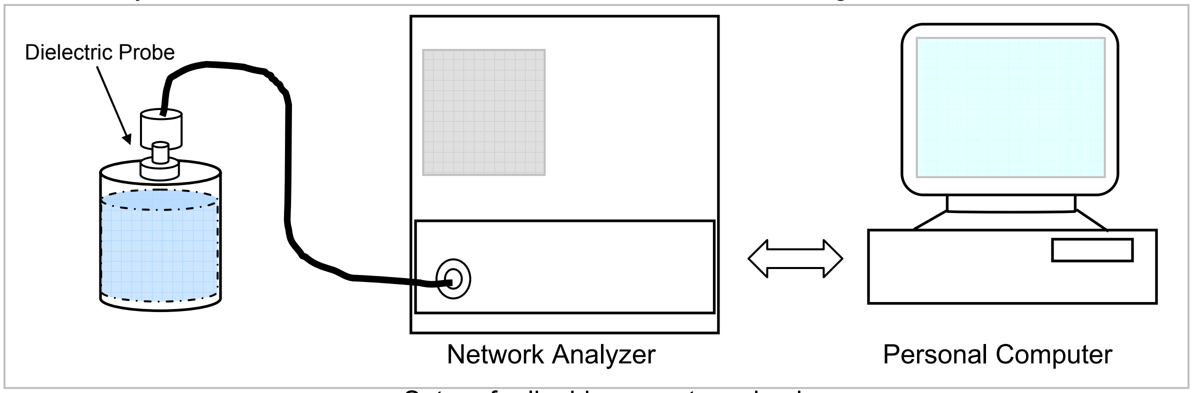
The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

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 check 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)

4.1 SIMULATING LIQUID PARAMETER CHECK RESULT

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature = 23.5°C; Relative humidity = 40% Measured by: Ninous Davoudi

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	22.5	15	e"	Relative Permittivity (e'):	52.7	52.2930	-0.77	± 5
			14.5709	Conductivity (σ):	1.95	1.98596	1.84	± 5

Liquid Check
Ambient temperature: 23.5 deg. C; Liquid temperature: 22.5 deg C
April 20, 2006 12:01 PM

Frequency	e'	e''
2400000000.	52.4724	14.3703
2410000000.	52.4266	14.3950
2420000000.	52.3822	14.4375
2430000000.	52.3646	14.4581
2440000000.	52.3475	14.5015
2450000000.	52.2930	14.5709
2460000000.	52.2596	14.6138
2470000000.	52.1936	14.6540
2480000000.	52.1773	14.6840
2490000000.	52.1380	14.7334
2500000000.	52.1150	14.7735

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^{6}$
$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature = 23°C; Relative humidity = 40% Measured by: Ninous Davoudi

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	22	15	e"	Relative Permittivity (e'):	52.7	52.6963	-0.01	± 5
			14.6786	Conductivity (σ):	1.95	2.00064	2.60	± 5

Liquid Check
Ambient temperature: 23.0 deg. C; Liquid temperature: 22.0 deg C
April 21, 2006 09:30 AM

Frequency	e'	e"
2400000000.	52.8580	14.4470
2410000000.	52.8290	14.5022
2420000000.	52.7821	14.5541
2430000000.	52.7559	14.5879
2440000000.	52.7140	14.6350
2450000000.	52.6963	14.6786
2460000000.	52.6397	14.7119
2470000000.	52.6127	14.7458
2480000000.	52.5753	14.7943
2490000000.	52.5221	14.8295
2500000000.	52.5050	14.8760

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 = 40% Measured by: Ninous Davoudi

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	22	15	e"	Relative Permittivity (e'):	52.7	52.6892	-0.02	± 5
			14.7148	Conductivity (σ):	1.95	2.00558	2.85	± 5

Liquid Check
Ambient temperature: 23.0 deg. C; Liquid temperature: 22.0 deg C
April 24, 2006 08:44 AM

Frequency	e'	e''
2400000000.	52.8704	14.4809
2410000000.	52.8363	14.5350
2420000000.	52.7890	14.5835
2430000000.	52.7695	14.6164
2440000000.	52.7325	14.6612
2450000000.	52.6892	14.7148
2460000000.	52.6514	14.7505
2470000000.	52.6217	14.7881
2480000000.	52.5891	14.8225
2490000000.	52.5388	14.8656
2500000000.	52.5091	14.9171

The conductivity (σ) can be given as:

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

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

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

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: 3531 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.

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 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.

5.1 SYSTEM PERFORMANCE CHECK RESULTS

System Validation Dipole: D2450V2 SN: 748

Date: April 20, 2006

Ambient Temperature = 23.5°C; Relative humidity = 40% Measured by: Ninous Davoudi

Body Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	22.5	15	12.50	50	51.2	-2.34	± 10
			10g	Normalized to 1 W	Target_10g	Deviation[%]	Limit [%]
			5.75	23	23.7	-2.95	± 10

Date: April 21, 2006

Ambient Temperature = 23°C; Relative humidity = 40% Measured by: Ninous Davoudi

Body Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	22	15	13.10	52.4	51.2	2.34	± 10
			10g	Normalized to 1 W	Target_10g	Deviation[%]	Limit [%]
			6	24	23.7	1.27	± 10

Date: April 24, 2006

Ambient Temperature = 23°C; Relative humidity = 40% Measured by: Ninous Davoudi

Body Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	22	15	13.00	52	51.2	1.56	± 10
			10g	Normalized to 1 W	Target_10g	Deviation[%]	Limit [%]
			5.99	23.96	23.7	1.10	± 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=Z=30 mm is assessed by measuring 8 x 8 x 8 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 8 x 8 x 8 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 procedure used to prepare the EUT for the SAR test.

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

The cable assembly insertion loss of 21.3 dB (including 20 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of average power.

Note: Middle Antenna is not operational in b and g modes.

802.11g, Main Port			
f (MHz)	**Peak power (dBm)**		
	Main	-	-
2412	17.4		
2437	18.5		
2462	17.1		
802.11b, Main Port			
f (MHz)	**Peak power (dBm)**		
	Main	-	-
2412	18.9		
2437	18.7		
2462	18.2		
802.11n (20MHz), Main and Middle Ports			
f (MHz)	**Peak power (dBm)**		
	Main	Middle	Total
2412	18.4	17.9	21.1
2437	18.0	17.6	20.8
2462	16.7	16.9	19.8
802.11n (20MHz), Aux and Middle Ports			
f (MHz)	**Peak power (dBm)**		
	Aux	Middle	Total
2412	18.3	18.4	21.3
2437	18.2	18.5	21.4
2462	16.6	16.9	19.8
802.11n (40MHz), Main and Middle Ports			
	Peak power (dBm)		
f (MHz)	Main	Middle	Total
2422	14.9	15.0	18.0
2437	15.6	15.9	18.8
2452	15.0	15.4	18.2
802.11n (40MHz), Aux and Middle Ports			
f (MHz)	**Peak power (dBm)**		
	Aux	Middle	Total
2422	14.9	14.9	17.9
2437	16.0	14.9	18.5
2452	15.1	15.2	18.2

8 SAR MEASURMENT RESULTS

Middle Antenna is not operational in b and g modes.

8.1 HOST 1 - HP PAVILION ZV6000

8.1.1 b MODE

MAIN ANTENNA

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.281	-0.097	0.287
11	2462			

AUX ANTENNA

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.310	-0.150	0.321
11	2462			

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) Middle antenna is not operational in b and g modes.

8.1.2 g MODE

MAIN ANTENNA				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.171	-0.121	0.176
11	2462			

AUX ANTENNA				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.279	-0.161	0.290
11	2462			

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) Middle antenna is not operational in b and g modes.

8.1.3 802.11n 20 MHz

Main & AUX				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412	0.463	-0.171	0.482
6	2437	0.547	-0.058	**0.554**
11	2462	0.344	-0.166	0.357
Main & Middle				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.474	-0.173	0.493
11	2462			
AUX & middle				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.513	-0.198	0.537
11	2462			

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.

8.1.4 802.11n 40 MHz

Main & AUX

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
3 6 9	2422 2437 2452	0.168	-0.154	0.174

Main & Middle

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
3 6 9	2422 2437 2452	0.252	-0.145	0.261

AUX & middle

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
3 6 9	2422 2437 2452	0.296	-0.172	0.308

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.

8.2 HOST 2 - COMPAQ NX7000

8.2.1 b MODE

MAIN ANTENNA				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412	0.517	0.000	0.517
6	2437	0.913	0.000	0.913
11	2462	0.781	0.000	0.781

AUX ANTENNA				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.689	-0.112	0.707
11	2462			

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) Middle antenna is not operational in b and g modes.

8.2.2 g MODE

MAIN ANTENNA				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1 6 11	2412 2437 2462	0.507	0.000	0.507
AUX ANTENNA				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1 6 11	2412 2437 2462	0.574	-0.120	0.590

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) Middle antenna is not operational in b and g modes.

8.2.3 802.11n 20 MHz

Main & AUX

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412	1.13	-0.123	1.16
6	2437	1.32	-0.094	1.35
11	2462	0.75	0.000	0.75

Main & Middle

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412	1.13	0.000	1.13
6	2437	1.15	-0.116	1.18
11	2462	0.68	-0.048	0.68

AUX & Middle

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412	1.26	-0.108	1.29
6	2437	1.34	-0.097	**1.37**
11	2462	0.62	-0.083	0.64

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.

8.2.4 802.11n 40 MHz

Main & AUX

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
3 6 9	2422 2437 2452	0.607	-0.121	0.624

Main & Middle

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
3 6 9	2422 2437 2452	0.570	0.000	0.570

AUX & Middle

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
3 6 9	2422 2437 2452	0.600	-0.056	0.608

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.

8.3 HOST 3 - DELL INSPIRON 6000

8.3.1 b MODE

MAIN ANTENNA

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.501	0.000	0.501
11	2462			

AUX ANTENNA

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.281	-0.144	0.290
11	2462			

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) Middle antenna is not operational in b and g modes.

8.3.2 g MODE

MAIN ANTENNA				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.280	0.000	0.280
11	2462			
AUX ANTENNA				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.218	-0.012	0.219
11	2462			

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) Middle antenna is not operational in b and g modes.

8.3.3 802.11n 20 MHz

Main & AUX				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412	0.490	-0.132	0.505
6	2437	0.573	-0.196	**0.599**
11	2462	0.340	-0.147	0.352
Main & Middle				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.485	-0.147	0.502
11	2462			
AUX & Middle				
Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
1	2412			
6	2437	0.487	-0.130	0.502
11	2462			

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.

8.3.4 802.11n 40 MHz

Main & AUX

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
3 6 9	2422 2437 2452	0.178	-0.171	0.185

Main & Middle

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
3 6 9	2422 2437 2452	0.171	-0.132	0.176

AUX & Middle

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
3 6 9	2422 2437 2452	0.199	0.000	0.199

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.

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

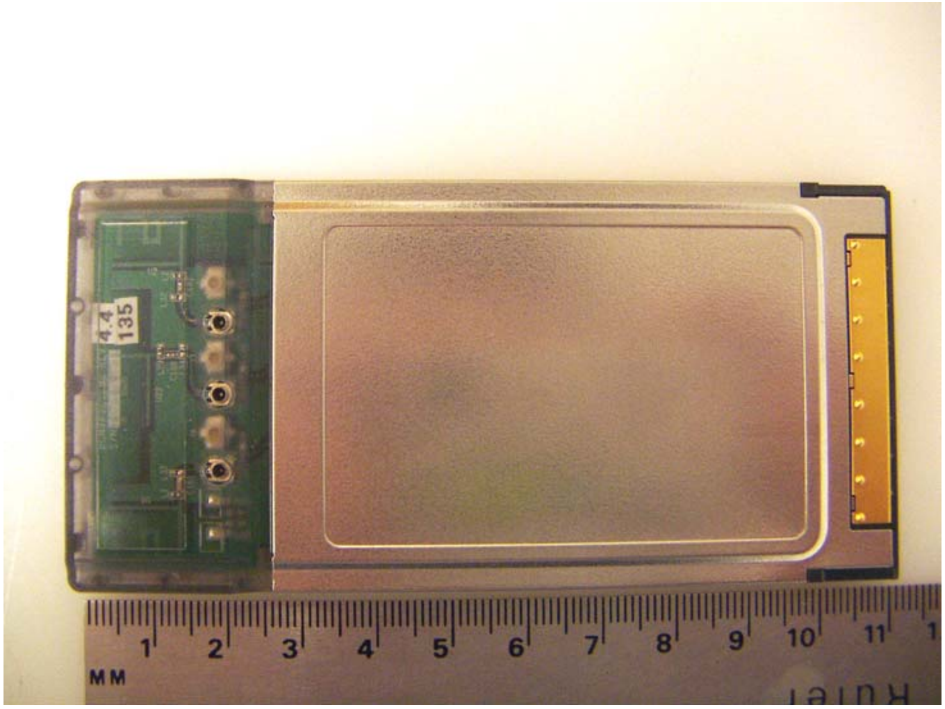
Notesfor table
1. Tol. - tolerance in influence quaitity
2. N - Nomal
3. R - Rectangular
4. Div. - Divisor used to obtain standard uncertainty
5. Ci - is te sensitivity coefficient

10 EQUIPMENT LIST AND CALIBRATION

Name of Equipment	Manufacturer	Type/Model	Serial Number	Cal. Due date
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
S-Parameter Network Analyzer	Agilent	8753ES-6	US39173569	2/9/07
Electronic Probe kit	Hewlett Packard	85070C	N/A	N/A
E-Field Probe	SPEAG	EX3DV3	3531	7/21/06
Thermometer	ERTCO	639-1S	1718	1/11/07
SAM Phantom (SAM1)	SPEAG	TP-1185	QD000P40CA	N/A
SAM Phantom (SAM2)	SPEAG	TP-1015	N/A	N/A
Data Acquisition Electronics	SPEAG	DAE4	558	1/20/07
System Validation Dipole	SPEAG	D2450V2	748	5/14/06
Power Meter	Agilent / HP	E4416A	GB41291160	12/2/2007
Power Sensor	Agilent	E9327A	US40440755	12/2/2007
Amplifier	Mini-Circuits	ZVE-8G	0360	N/A
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A
Radio Communication Tester	Rohde & Schwarz	CMU 200	838114/032	3/21/07
Simulating Liquid	CCS	M2450	N/A	Within 24 hrs of first test

11 EUT PHOTOS

Broadcom 2.4 GHz 802.11g / Draft 802.11n WLAN Cardbus Card



Laptop 1 - HP Pavilion zv6000

Laptop 2 - Compaq nx7000

Laptop 3 - Dell Inspiron 6000

12 ATTACHMENTS

No.	Contents	No. of Pages
1	System Performance Check Plots	6
2-1	SAR Test Plots - Laptop 1 HP	13
2-2	SAR Test Plots - Laptop 2 Compaq	19
2-3	SAR Test Plots - Laptop 3 Dell	13
3	Certificate of E - Field Probe - EX3DV3SN3531	10
4	Certificate of System Validation Dipole - D2450V2 SN:748	9

END OF REPORT