SAR Evaluation Report

IN ACCORDANCE WITH THE REQUIREMENTS OF
FCC OET BULLETIN 65 SUPPLEMENT C
IC RSS 102 ISSUE 2 : NOVERMBER 2005

FOR

USB WIRELESS MODEM

MODEL: COMPASS 885

FCC ID: N7NC885
IC: 2417C-C885

REPORT NUMBER: 08U11646-3

ISSUE DATE: APRIL 10, 2008

Prepared for

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issued date	Revisions	Revised By
--	April 10, 2008	Initial issue	Sunny Shih

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

DATES OF TEST: APRIL 6TH, 9TH, AND 10TH.

APPLICANT: ADDRESS:	Sierra Wireless, Inc. 13811 Wireless Way Richmond, BC V6V 3A4 Canada
FCC ID: IC NUMBER:	N7NC885 2417C-C885
DEVICE CATEGORY: EXPOSURE CATEGORY:	Portable Device General Population/Uncontrolled Exposure

USB wireless modem model Compass 885 is installed in 3 different host laptops for SAR testing.

Test Sample is a:	Production unit	
Rule Parts	Frequency Range [MHz]	The Highest SAR Values [1g_mW/g]
FCC 22H	824 - 849	Gateway: 0.785 Toshiba: 0.693 Compaq: 0.334
FCC 24E	1850 - 1910	Gateway: 1.092 Toshiba: 0.622 Compaq: 0.633

Testing has been carried out in accordance with:

47CFR §2.1093 - Radiofrequency Radiation Exposure Evaluation: Portable Devices

FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01) - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

RSS-102 - Evaluation Procedure for Mobile and Portable Radio Transmitters with Respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields

IEEE 1528_2003 - IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques

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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1 DEVICE UNDER TEST (DUT) DESCRIPTION

USB wireless modem is installed in 3 different host laptops for SAR testing.			
Normal operation:	Lap-held position		
Duty cycle:	12.5% for GPRS & EGPRS, single slot 25% for GPRS & EGPRS, 2 slots 37.5% for GPRS & EGPRS, 3 slots 50% for GPRS & EGPRS, 4 slots 100% for WCDMA		
Host Device(s):	Host	USB Orientation	Separation Distance
	Gateway W350I	Horizontal	16 mm
	Toshiba Satellite	Vertical	15 mm
	Compaq Presario R3000	Horizontal	24 mm
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.

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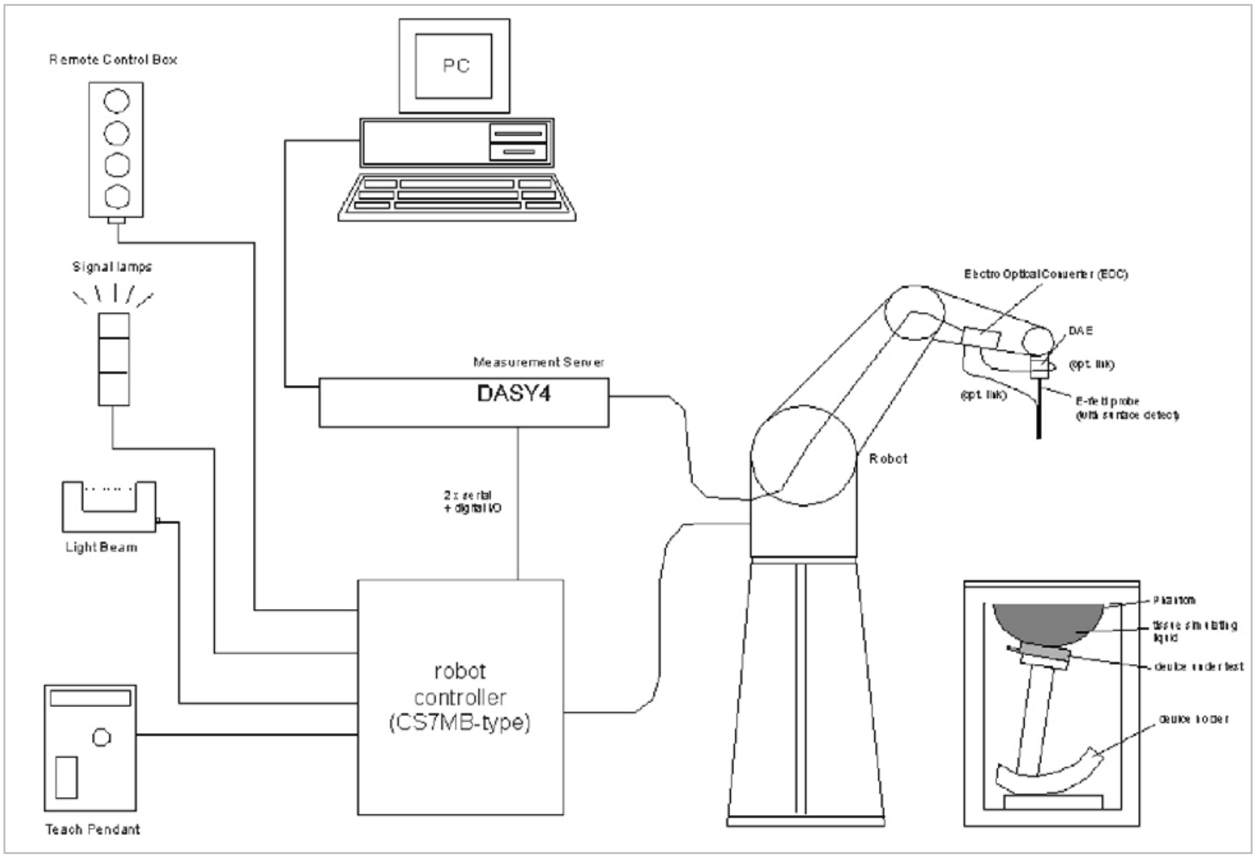
3 SYSTEM DESCRIPTION



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

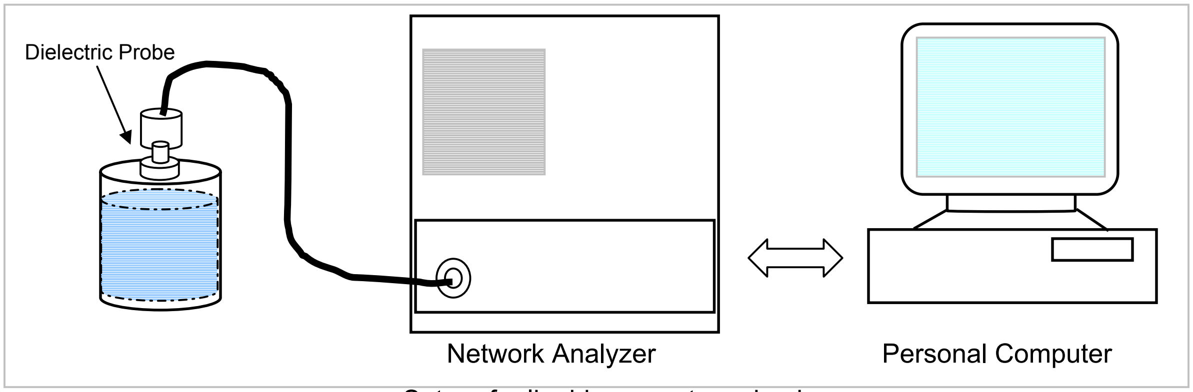
The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

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)

4.1 SIMULATING LIQUID PARAMETER CHECK RESULT

Simulating Liquid Dielectric Parameters Check Result @ Muscle 835 MHz

Room Ambient Temperature = 23°C; Relative humidity = 35% Measured by: Jonathan King

Simulating Liquid			Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)							
835	22	15	e'	54.269	Relative Permittivity (ε_r):	54.2690	55.2	-1.69	± 5
			e"	20.4647	Conductivity (σ):	0.95063	0.97	-2.00	± 5

Liquid Check
Ambient temperature: 23 deg. C; Liquid temperature: 22 deg. C
April 06, 2008 11:22 AM

Frequency	e'	e"
800000000.	54.6475	20.5044
805000000.	54.6155	20.4808
810000000.	54.5549	20.4844
815000000.	54.5005	20.4859
820000000.	54.4602	20.4768
825000000.	54.3808	20.4487
830000000.	54.3550	20.4125
835000000.	**54.2690**	**20.4647**
840000000.	54.2138	20.4178
845000000.	54.1774	20.4188
850000000.	54.1158	20.4076
855000000.	54.0494	20.4091
860000000.	53.9735	20.3822
865000000.	53.9304	20.3540
870000000.	53.8710	20.3643
875000000.	53.8184	20.3614
880000000.	53.7392	20.3689
885000000.	53.7015	20.3711
890000000.	53.6393	20.3618
895000000.	53.6145	20.3381
900000000.	53.5904	20.3143
905000000.	53.5266	20.3063
910000000.	53.4594	20.2999
915000000.	53.3799	20.2986
920000000.	53.3141	20.2768
925000000.	53.2581	20.3025
930000000.	53.2040	20.2918
935000000.	53.1560	20.2686
940000000.	53.0950	20.2612
945000000.	53.0296	20.2155
950000000.	52.9761	20.2457

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 Parameters Check Result @ Muscle 835 MHz

Room Ambient Temperature = 22°C; Relative humidity = 30% Measured by: Jonathan King

Simulating Liquid			Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)							
835	21	15	e'	53.24	Relative Permittivity (ϵ_r):	53.2400	55.2	-3.55	± 5
			e"	20.6861	Conductivity (σ):	0.96091	0.97	-0.94	± 5

Liquid Check
Ambient temperature: 22 deg. C; Liquid temperature: 21 deg C
April 9, 2008 08:22 PM

Frequency	e'	e"
800000000.	53.5133	20.6649
805000000.	53.5082	20.6691
810000000.	53.4663	20.6298
815000000.	53.4411	20.6353
820000000.	53.4068	20.6438
825000000.	53.3209	20.6595
830000000.	53.2525	20.6581
835000000.	**53.2400**	**20.6861**
840000000.	53.2002	20.6362
845000000.	53.1036	20.6074
850000000.	53.0345	20.5909
855000000.	52.9976	20.5412
860000000.	52.9569	20.4506
865000000.	52.8968	20.4213
870000000.	52.8481	20.4201
875000000.	52.7993	20.3872
880000000.	52.7825	20.3532
885000000.	52.7295	20.3330
890000000.	52.6719	20.3253
895000000.	52.6620	20.3308
900000000.	52.6069	20.3380
905000000.	52.5549	20.3233
910000000.	52.4725	20.3207
915000000.	52.4096	20.3518
920000000.	52.3517	20.3400
925000000.	52.3009	20.3563
930000000.	52.2335	20.3537
935000000.	52.1725	20.3388
940000000.	52.0952	20.3307
945000000.	52.0465	20.2914
950000000.	51.9747	20.2918

The conductivity (σ) can be given as:

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

where f = target $f * 10^6$

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

Simulating Liquid Dielectric Parameters Check Result @ Muscle 1900 MHz

Room Ambient Temperature = 23°C; Relative humidity = 35% Measured by: Jonathan King

Simulating Liquid			Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)							
1900	22	15	e'	51.1284	Relative Permittivity (ϵ_r):	51.1284	53.3	-4.07	± 5
			e''	14.2611	Conductivity (σ):	1.50739	1.52	-0.83	± 5

Liquid Check
Ambient temperature: 23 deg. C; Liquid temperature: 22 deg. C
April 06, 2008 12:57 PM

Frequency	e'	e''
1710000000.	51.8123	13.5149
1720000000.	51.7563	13.5624
1730000000.	51.7328	13.6164
1740000000.	51.6936	13.6436
1750000000.	51.6458	13.6887
1760000000.	51.6210	13.7154
1770000000.	51.5915	13.7601
1780000000.	51.5532	13.7873
1790000000.	51.5278	13.8147
1800000000.	51.4763	13.8640
1810000000.	51.4634	13.8847
1820000000.	51.4079	13.9201
1830000000.	51.3782	13.9836
1840000000.	51.3335	14.0352
1850000000.	51.2943	14.0824
1860000000.	51.2748	14.1130
1870000000.	51.2433	14.1399
1880000000.	51.2210	14.1874
1890000000.	51.1678	14.2337
1900000000.	**51.1284**	**14.2611**
1910000000.	51.0801	14.3004

The conductivity (σ) can be given as:

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

where $f = target\ f * 10^6$

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

Simulating Liquid Dielectric Parameters Check Result @ Muscle 1900 MHz

Room Ambient Temperature = 22°C; Relative humidity = 36% Measured by: Ekta Budhbhatti

Simulating Liquid			Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)							
1900	21	15	e'	50.9056	Relative Permittivity (ϵ_r):	50.9056	53.3	-4.49	± 5
			e"	14.2236	Conductivity (σ):	1.50343	1.52	-1.09	± 5

Liquid Check
Ambient temperature: 22 deg. C; Liquid temperature: 21 deg. C
April 09, 2008 12:13 PM

Frequency	e'	e"
1710000000.	51.5556	13.6626
1720000000.	51.5250	13.7091
1730000000.	51.5048	13.7795
1740000000.	51.4582	13.7959
1750000000.	51.4160	13.8376
1760000000.	51.3845	13.8281
1770000000.	51.3500	13.8568
1780000000.	51.3192	13.8791
1790000000.	51.2626	13.8979
1800000000.	51.2198	13.9483
1810000000.	51.1728	13.9740
1820000000.	51.1133	14.0248
1830000000.	51.0770	14.0881
1840000000.	51.0085	14.1189
1850000000.	50.9841	14.1411
1860000000.	50.9861	14.1303
1870000000.	50.9757	14.1690
1880000000.	50.9858	14.1968
1890000000.	50.9328	14.1984
1900000000.	**50.9056**	**14.2236**
1910000000.	50.8643	14.2509

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 Parameters Check Result @ Muscle 1900 MHz

Room Ambient Temperature = 22°C; Relative humidity = 36% Measured by: Ekta Budhbhatti

Simulating Liquid			Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)							
1900	21	15	e'	51.3708	Relative Permittivity (ϵ_r):	51.3708	53.3	-3.62	± 5
			e''	14.2636	Conductivity (σ):	1.50765	1.52	-0.81	± 5

Liquid Check
Ambient temperature: 22 deg. C; Liquid temperature: 21 deg. C
April 10, 2008 09:25 AM

Frequency	e'	e''
1710000000.	52.0468	13.6891
1720000000.	51.9910	13.7135
1730000000.	51.9715	13.7628
1740000000.	51.9180	13.8072
1750000000.	51.8724	13.8276
1760000000.	51.8394	13.8523
1770000000.	51.8100	13.8921
1780000000.	51.7671	13.9217
1790000000.	51.7213	13.9540
1800000000.	51.6842	13.9900
1810000000.	51.6473	14.0154
1820000000.	51.6036	14.0431
1830000000.	51.5468	14.0824
1840000000.	51.5031	14.1180
1850000000.	51.4689	14.1458
1860000000.	51.4464	14.1603
1870000000.	51.4415	14.1809
1880000000.	51.4107	14.2063
1890000000.	51.4106	14.2404
1900000000.	**51.3708**	**14.2636**
1910000000.	51.3572	14.3062

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.

5.1 SYSTEM PERFORMANCE CHECK RESULTS

System Validation Dipole: D835V2 SN:4d002

Date: April 6, 2008

Ambient Temperature = 23°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)						
835	22	15	1g	2.59	10.36	9.71	6.69	± 10
			10g	1.7	6.8	6.38	6.58	± 10

Date: April 9, 2008

Ambient Temperature = 22°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)						
835	21	15	1g	2.37	9.48	9.71	-2.37	± 10
			10g	1.56	6.24	6.38	-2.19	± 10

System Validation Dipole: D1900V2 SN:5d043

Date: April 9, 2008

Ambient Temperature = 22°C; Relative humidity =36 % Measured by: Ekta Budhbhatti

Body Simulating Liquid			SAR (mW/g)		Normalized to 1 W	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
1900	21	15	1g	10.10	40.4	39.8	1.51	± 10
			10g	5.22	20.88	20.8	0.38	± 10

Date: April 10, 2008

Ambient Temperature = 22°C; Relative humidity =36 % Measured by: Ekta Budhbhatti

Body Simulating Liquid			SAR (mW/g)		Normalized to 1 W	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
1900	21	15	1g	10.20	40.8	39.8	2.51	± 10
			10g	5.27	21.08	20.8	1.35	± 10

Date: April 6, 2008

Ambient Temperature = 23°C; Relative humidity = 35% Measured by: Jonathan King

Body Simulating Liquid			SAR (mW/g)		Normalized to 1 W	Target	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
1900	22	15	1g	9.96	39.84	39.8	0.10	± 10
			10g	5.18	20.72	20.8	-0.38	± 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

GSM/EGSM Procedure

The following settings were used to configure the Radio Communication Tester, CMU200. The offset of 0.3 dB was used for Cell band cable loss and 0.7 dB was used to PCS band.

<u>GPRS/EGPRS</u>

Function: Menu select > GSM Mobile Station > GSM 850/900/1800/1900

Press **Connection control** to choose the different menus
Press **RESET** > choose all to reset all settings

Connection	Press **Signal Off** to turn off the signal and change settings Network Support > GSM+GPRS or GSM+EGPRS Main Service > Packet Data Service selection > Test Mode A – Auto Slot Config. off	
MS Signal	Press Slot Config bottom on the right twice to select and change the number of time slots and power setting	
	> Slot configuration	> Uplink/Gamma > 33 dBm for GPRS 850/900 > 27 dBm for EGPRS 850/900 > 30 dBm for GPRS1800/1900 > 26 dBm for EGPRS1800/1900
BS Signal	Enter the same channel number for TCH channel (test channel) and BCCH channel	
	Frequency Offset >	+ 0 Hz
	Mode >	BCCH and TCH
	BCCH Level >	-85 dBm (May need to adjust if link is not stable)
	BCCH Channel >	choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]
	Channel Type >	Off
	P0>	4 dB
	Slot Config >	Unchanged (if already set under MS Signal)
	TCH >	choose desired test channel
	Hopping >	Off
	Main Timeslot >	3 (Default)
Network	Coding Scheme >	CS4 (GPRS) and MCS9 (EGPRS)
	Bit Stream >	2E9-1PSR Bit Pattern
AF/RF	Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input	
Connection	Press **Signal On** to turn on the signal and change settings	

GSM850

Channel	Frequency (MHz)	GPRS			
		1 slot Power (dBm)	2 slots Power (dBm)	3 slots Power (dBm)	4 slots Power (dBm)
128	824.2	31.7	31.6	28.6	25.6
190	836.6	31.6	31.5	28.5	25.6
251	848.8	31.6	31.5	28.5	25.6

Channel	Frequency (MHz)	EGPRS			
		1 slot Power (dBm)	2 slots Power (dBm)	3 slots Power (dBm)	4 slots Power (dBm)
128	824.2	27.0	26.9	26.9	26.8
190	836.6	26.9	26.8	26.9	26.8
251	848.8	26.9	26.8	26.8	26.8

GSM1900

Channel	Frequency (MHz)	GPRS			
		1 slot Power (dBm)	2 slots Power (dBm)	3 slots Power (dBm)	4 slots Power (dBm)
512	1850.2	28.7	28.6	28.6	28.4
661	1880.0	28.7	28.6	28.6	28.4
810	1909.8	28.9	28.8	28.7	28.6

Channel	Frequency (MHz)	EGPRS			
		1 slot Power (dBm)	2 slots Power (dBm)	3 slots Power (dBm)	4 slots Power (dBm)
512	1850.2	25.6	25.6	25.5	25.4
661	1880.0	25.6	25.6	25.6	25.5
810	1909.8	25.9	25.9	25.7	25.6

WCDMA + HSDPA Procedure
The following settings were used to configure the Radio Communication Tester, CMU200.

- Connection
    - Dedicated Chan (CS): RMC
    - Band Select:
        - Band VI for US Cell Band
        - Band II for US PCS Band
        - Band I for 2100MHz band
- Network
    - Requested UE Data
        - Authentication: Off
        - Security: Off
        - IMEI: ON
        - RLC Reestablish: Off
- BS Signal
    - Node –B Setting
        - RF Channel Downlink
            - Band VI: 4357 / 4407 / 4458
            - Band II: 9662 / 9800 / 9938
            - Band I: 10562 / 10700 / 10838
    - Circuit Switched
        - RMC Setting
            - Reference Channel Type: 12.2Kbps
            - Test Mode: Loop Mode 1 RLC TM
            - Channel Data Source DTCH: All One
        - Signaling RAB Setting
            - SRB Cell DCH: 13.6 Kbps
    - HSDPA HS-DSCH
        - Fixed Reference Channel
            - H-Set Selection: H-Set 1 QPSK
- UE Signal
    - Analyzer Setting
        - RF Channel Uplink:
            - Band VI: 4132 / 4182 / 4233
            - Band II: 9262 / 9400 / 9538
            - Band I; 9612 / 9750 / 9888
        - UE power Control
            - Max Allowed UE Power: 25

WCDMA + HSDUPA Procedure
The following settings were used to configure the Radio Communication Tester, CMU200.

- Connection
  - Dedicated Chan (CS): RMC
  - Band Select:
    - Band VI for US Cell Band
    - Band II for US PCS Band
    - Band I for 2100MHz band
- Network
  - Requested UE Data
    - Authentication: Off
    - Security: Off
    - IMEI: ON
    - RLC Reestablish: Off
- BS Signal
  - Node –B Setting
    - RF Channel Downlink
      - Band VI: 4357 / 4407 / 4458
      - Band II: 9662 / 9800 / 9938
      - Band I: 10562 / 10700 / 10838
  - Circuit Switched
    - RMC Setting
      - Reference Channel Type: 12.2Kbps
      - Test Mode: Loop Mode 1 RLC TM
      - Channel Data Source DTCH: All One
    - Signaling RAB Setting
      - SRB Cell DCH: 13.6 Kbps
  - HSDPA HS-DSCH
    - Fixed Reference Channel
      - H-Set Selection: H-Set 1 QPSK
- UE Signal
  - Analyzer Setting
    - RF Channel Uplink:
      - Band VI: 4132 / 4182 / 4233
      - Band II: 9262 / 9400 / 9538
      - Band I; 9612 / 9750 / 9888
    - UE power Control
      - Max Allowed UE Power: 25

WCDMA Rel 99

	Cell Band			PCS Band		
Channel	Low	Middle	High	Low	Middle	High
Peak(dBm)	26.1	26.5	26.2	26.4	26.5	26.5
Avg.(dBm)	22.2	22.5	22.2	22.8	22.7	22.7

WCDMA + HSDPA

		Cell Band			PCS Band		
Sub Test	Channel	Low	Middle	High	Low	Middle	High
1	Peak(dBm)	25.6	26.2	25.6	25.9	26.0	26.0
	Avg.(dBm)	22.0	22.4	22.1	22.2	22.3	22.5
2	Peak(dBm)	25.4	26.0	25.3	25.7	25.9	25.7
	Avg.(dBm)	22.2	22.4	22.3	22.4	22.3	22.3
3	Peak(dBm)	25.6	25.9	25.4	25.8	26.0	25.9
	Avg.(dBm)	21.9	22.3	21.9	22.0	22.3	22.2
4	Peak(dBm)	25.7	25.9	25.3	25.9	26.1	26.0
	Avg.(dBm)	21.9	22.2	21.3	22.2	22.2	22.2

WCDMA + HSUPA

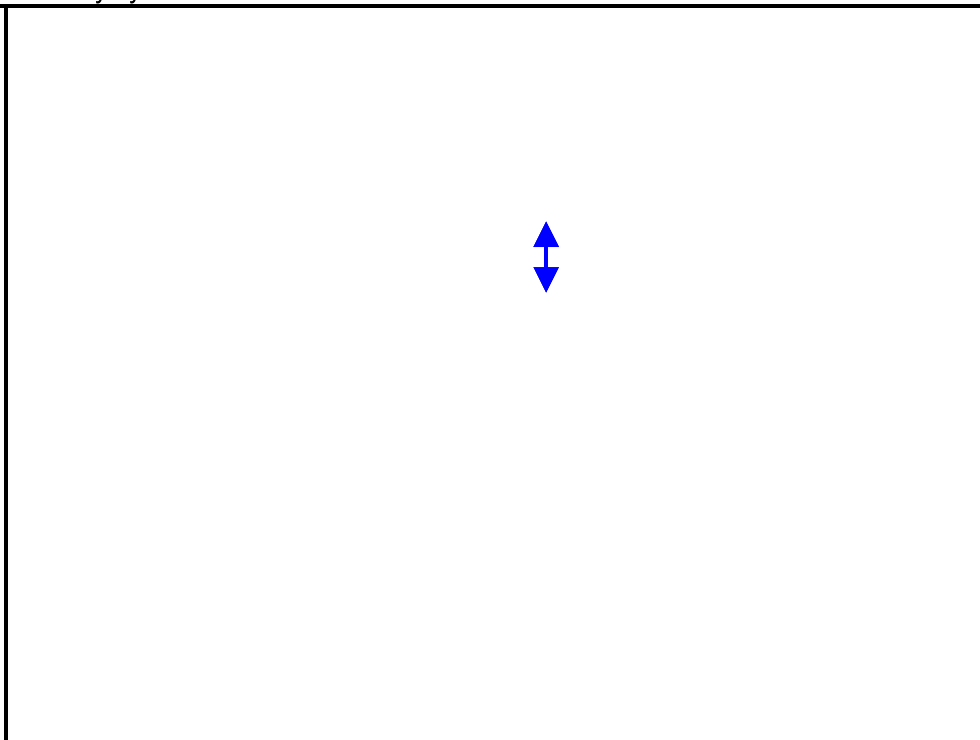
		Cell Band			PCS Band		
Sub Test	Channel	Low	Middle	High	Low	Middle	High
1	Peak(dBm)	25.5	26.1	25.7	25.7	26.1	26.0
	Avg.(dBm)	21.9	22.3	22.1	21.6	22.1	21.8
2	Peak(dBm)	25.8	26.1	25.5	25.9	26.2	26.1
	Avg.(dBm)	21.7	22.3	21.79	22.3	22.4	22.2
3	Peak(dBm)	25.6	26.0	25.4	25.9	26.1	26.0
	Avg.(dBm)	21.9	22.2	21.8	22.0	22.2	22.0
4	Peak(dBm)	25.5	25.8	25.4	25.9	26.0	26.0
	Avg.(dBm)	21.98	22.1	21.3	22.2	22.3	22.4
5	Peak(dBm)	25.4	25.8	25.4	26.0	26.1	26.2
	Avg.(dBm)	21.4	21.8	21.6	22.2	22.2	22.4

8 SAR MEASURMENT RESULTS

8.1 CELL BAND

8.1.1 Host Toshiba

Note: The worst case chosen for testing was based on the mode with the highest output power and highest duty cycle.



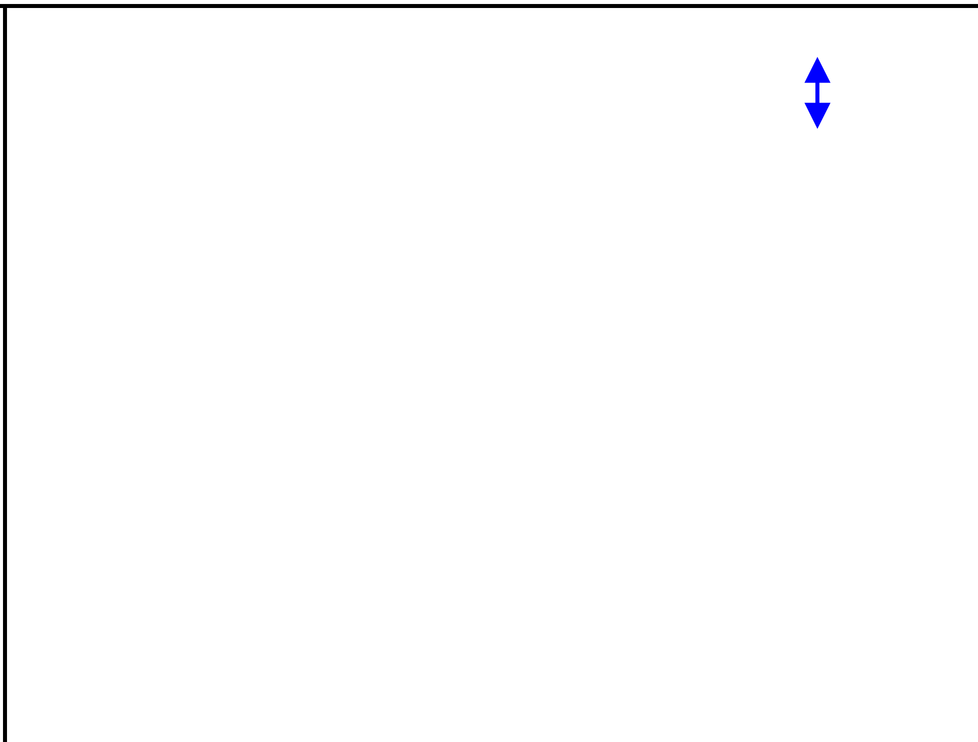
Separation distance = 10 mm

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
GPRS 2 Slots				
128	824.20	0.649	-0.015	0.651
190	**836.60**	**0.666**	**0.000**	**0.666**
251	848.80	0.591	0.000	0.591
WCDMA12.2k RMC				
4182	836.40	0.434	0.000	0.434

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) Please see attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.

8.1.2 HOST GATEWAY



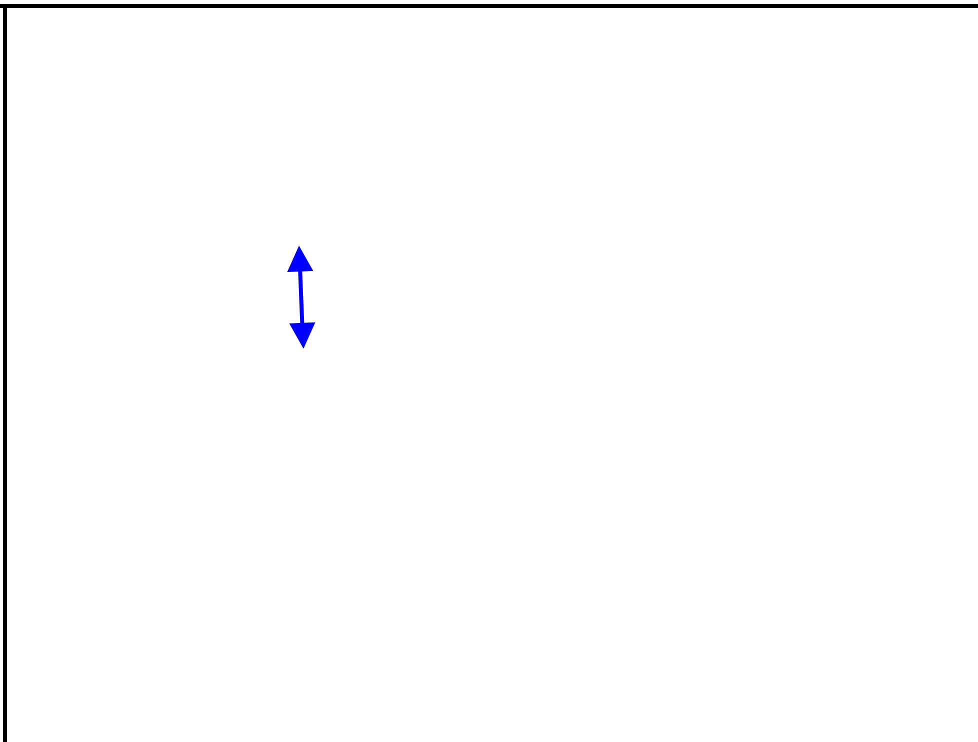
Separation distance = 16 mm

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1] SAR 1g (mW/g)
GPRS 2 Slots				
128	**824.20**	**0.746**	**-0.222**	**0.785**
190	836.60	0.668	0.000	0.668
251	848.80	0.606	-0.209	0.636
WCDMA 12.2k RMC				
4182	836.40	0.472	-0.177	0.492

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) Please see attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.

8.1.3 HOST COMPAQ



Separation distance = 24 mm

Channel	**f (MHz)**	**Measured SAR 1g (mW/g)**	**Power Drift (dB)**	**Extrapolated[1)] SAR 1g (mW/g)**
GPRS 2 Slots				
128	824.20	0.329	0.000	0.329
190	**836.60**	**0.334**	**0.000**	**0.334**
251	848.80	0.290	0.000	0.290
WCDMA12.2k RMC				
4182	836.40	0.207	0.000	0.207

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) Please see attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.

8.2 PCS BAND

8.2.1 HOST TOSHIBA

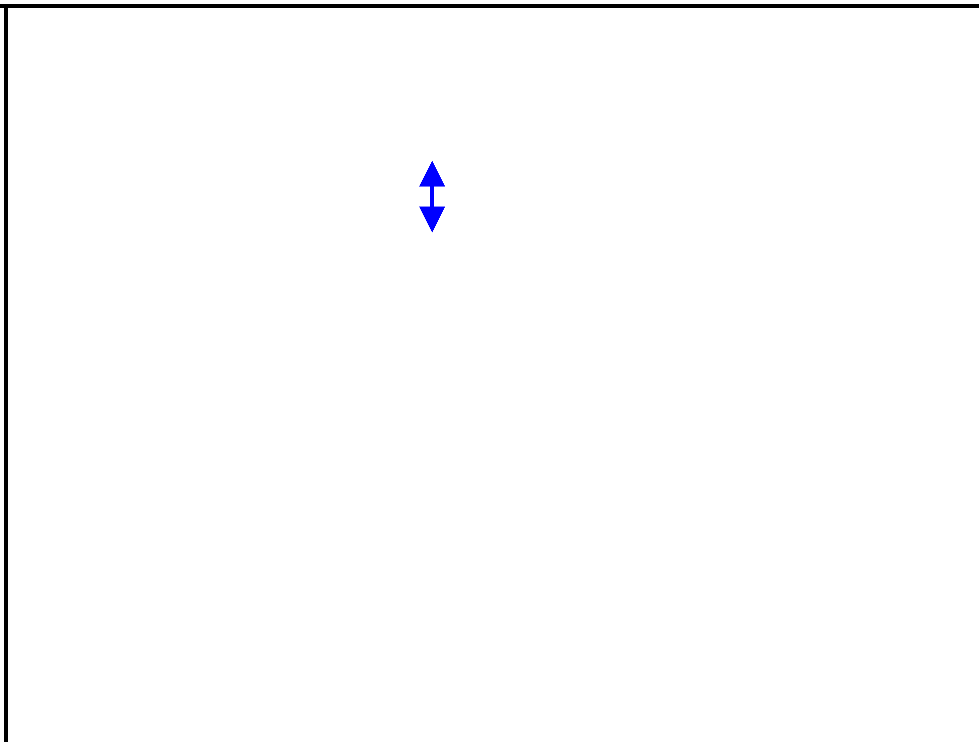
Separation distance = 10 mm

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
GPRS 2 Slots				
512	1850.20	0.619	-0.023	0.622
661	**1880.00**	**0.679**	**-0.087**	**0.693**
810	1909.80	0.648	-0.017	0.651
WCDMA12.2k RMC				
9400	1880.00	0.308	0.000	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) Please see attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.

8.2.2 HOST GATEWAY



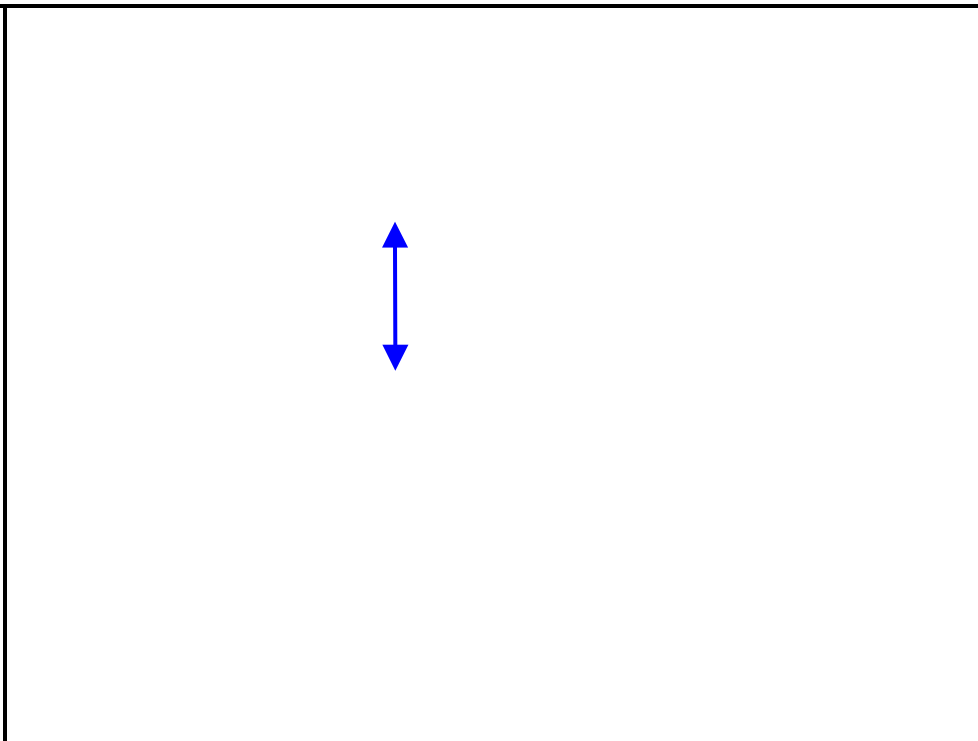
Separation distance = 16 mm

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
GPRS 2 Slots				
512	1850.20	0.905	0.000	0.905
661	1880.00	0.969	0.000	0.969
810	**1909.80**	**1.090**	**-0.006**	**1.092**
WCDMA12.2k RMC				
9400	1880.00	0.695	0.000	0.695

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) Please see attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.

8.2.3 HOST COMPAQ



Separation distance = 24 mm

Channel	f (MHz)	Measured SAR 1g (mW/g)	Power Drift (dB)	Extrapolated[1)] SAR 1g (mW/g)
GPRS 2 Slots				
512	1850.20	0.500	0.000	0.500
661	1880.00	0.546	0.000	0.546
810	**1909.80**	**0.632**	**-0.005**	**0.633**
WCDMA12.2k RMC				
9400	1880.00	0.410	-0.104	0.420

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) 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		
				MM	DD	Year
Robot - Six Axes	Stäubli	RX90BL	N/A	N/A		
Robot Remote Control	Stäubli	CS7MB	3403-91535	N/A		
DASY4 Measurement Server	SPEAG	SEUMS001BA	1041	N/A		
Probe Alignment Unit	SPEAG	LB (V2)	261	N/A		
SAM Phantom (SAM1)	SPEAG	QD000P40CA	1185	N/A		
SAM Phantom (SAM2)	SPEAG	QD000P40CA	1050	N/A		
Oval Flat Phantom (ELI 4.0)	SPEAG	QD OVA001 B	1003	N/A		
Electronic Probe kit	HP	85070C	N/A	N/A		
S-Parameter Network Analyzer	Agilent	8753ES-6	MY40001647	11	14	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	D835V2	4d002	6	22	2009
System Validation Dipole	SPEAG	D1900V2	5d043	1	29	2010
Signal Generator	R&S	SMP 04	DE34210	2	16	2009
Power Meter	HP	438B	3125U11347	10	18	2008
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Radio Communication Tester	R &S	CMU 200	106291	4	16	2008
Simulating Liquid	CCS	M835	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M1900	N/A	Within 24 hrs of first test		

11 ATTACHMENTS

No.	Contents	No. Of Pages
1	System Performance Check Plots	6
2-1	SAR Test Plots – Cell Band	13
2-2	SAR Test Plots – PCS Band	13
3	Certificate of E-Field Probe - EX3DV4SN3554	10
4	Certificate of System Validation Dipole - D835V2 SN:4d002	9
5	Certificate of System Validation Dipole - D1900V2 SN:5d043	9

12 PHOTOS

Compass 885

END OF REPORT