SAR Evaluation Report

IN ACCORDANCE WITH THE REQUIREMENTS OF
FCC REPORT AND ORDER:
ET DOCKET 93-62 AND OET BULLETIN 65 SUPPLEMENT C
And RSS-102 Issue 1 (Provisional) September 25, 1999

FOR

850/900/1800/1900/2100 MHz 5-Band Mini Card Module

Model: MC8755

FCC ID: N7NMC8755

REPORT NUMBER: 05U3781-3

ISSUE DATE: DECEMEBER 9, 2005

Prepared for

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LAB CODE:200065-0

Revision History

Rev.	Issued date	Revisions	Revised By
A	December 9, 2005	Initial Issue	HS

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

DATES OF TEST: December 7-8, 2005

APPLICANT: ADDRESS:	Sierra Wireless, Inc. 13811 Wireless Way Richmond, British Columbia V6V 3A4, Canada
FCC ID: MODEL:	N7NMC8755 MC8755
DEVICE CATEGORY: EXPOSURE CATEGORY:	Portable Device General Population/Uncontrolled Exposure

850/900/1800/1900/2100 MHz 5-Band Mini Card is installed on 14” & 15” Lenovo Davinch Laptops, include collocated with WLNA (Gwinette, FCC ID: PPD-AR5BXB6)

Note: This device contains 900/1800/2100 MHz bands are not operational in US territories. This report is applicable to 850 and 1900 MHz bands.

Test Sample is a:	Production unit	
Host devices:	14” & 15” Lenovo Davinch	
FCC Rule Parts	Frequency range (MHz)	The highest SAR values
22H	824.7 – 848.31	The highest reported SAR values are: Body-worn: 0.083 W/kg, Collocated: 0.089 W/kg
24E	1851.25 – 1908.75	The highest reported SAR values are: Body-worn: 0.065 W/kg, Collocated: 0.067 W/kg

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 Issue 1 (Provisional) September 25, 1999.

The maximum 1g SAR level measured for all the tests performed did not exceed the limits for General Population/Uncontrolled Exposure (W/kg) Partial Body of 1.6 W/kg. Level defined in Supplement C (Edition 01-01) to OET Bulletin 65 (97-01).

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:	Tested By:
Hsin Fu Shih Senior Engineer Compliance Certification Services	Ninous Davoudi EMC Engineer Compliance Certification Services

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1 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

850/900/1800/1900/2100 MHz 5-Band Mini Card is installed on 14” & 15” Lenovo Davinch Laptops, include collocated with WLNA (Gwinette, FCC ID: PPD-AR5BXB6) Note: This device contains 900/1800/2100 MHz bands are not operational in US territories. This report is applicable to 850 and 1900 MHz bands.	
Host devices:	14” & 15” Lenovo Davinch
Power supply:	Power supplied through the laptop computer (host device)
Normal operation:	Lap-held position Photos are confidential, please see a seperate file
CDMA Antenna:	1) For 14 inch laptop - FOXCONN, Type WDAN-B1DA1003 2) For 15 inch laptop - FOXCONN, Type WDAN-B1DA2003

2 FACILITIES AND ACCREDITATION

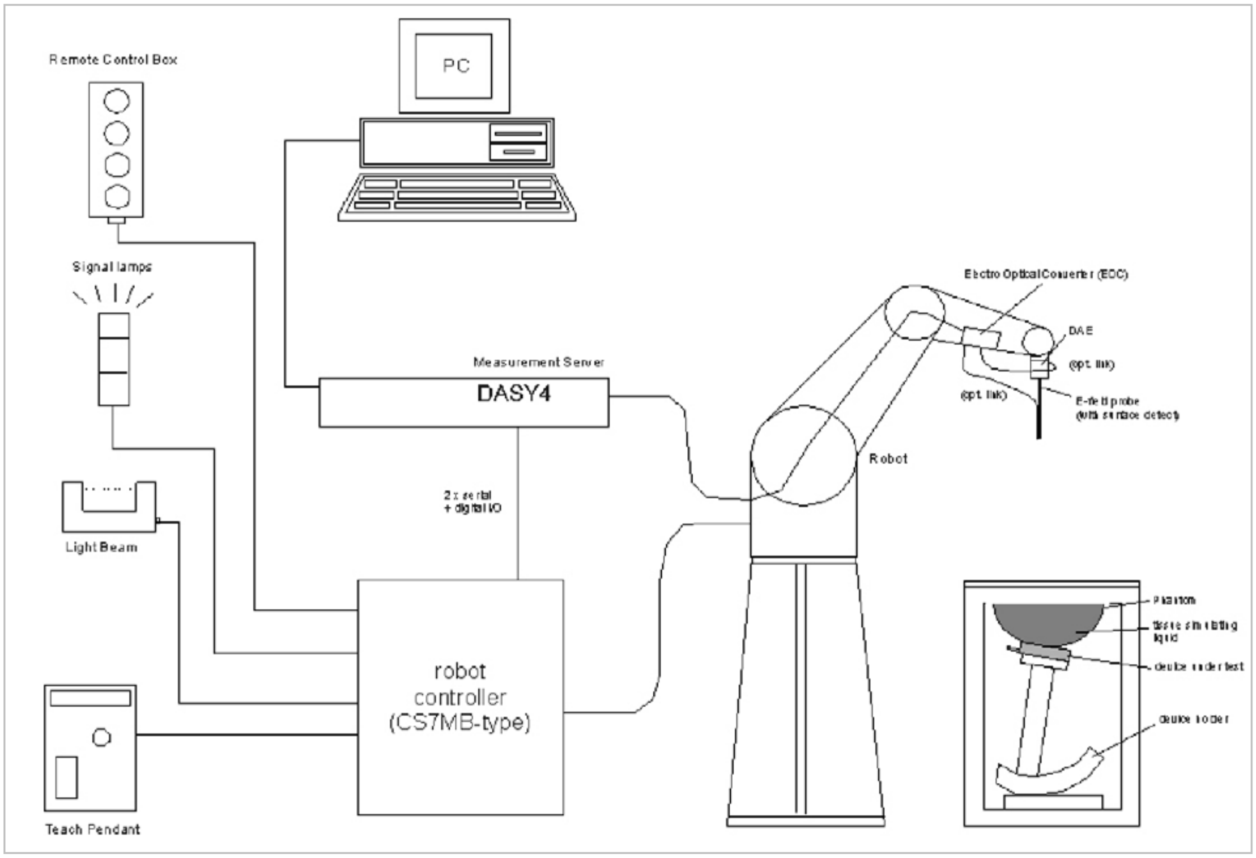
The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1,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

4 SYSTEM COMPONENT

4.1 DASY4 MEASUREMENT SERVER

The DASY4 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

4.2 DATA ACQUISITION ELECTRONICS (DAE)

The data acquisition electronics (DAE3) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

4.3 EX3DV3 ISOTROPIC E-FIELD PROBE FOR DOSIMETRIC MEASUREMENTS

Construction: Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

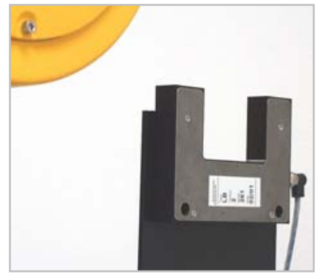
Directivity: ± 0.3 dB in HSL (rotation around probe axis);
± 0.5 dB in tissue material (rotation normal to probe axis)

Dynamic Range: 10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)

Dimensions: Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5 mm (Body: 12 mm)
Typical distance from probe tip to dipole centers: 1 mm

Application: High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

4.4 LIGHT BEAM UNIT



The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, so that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

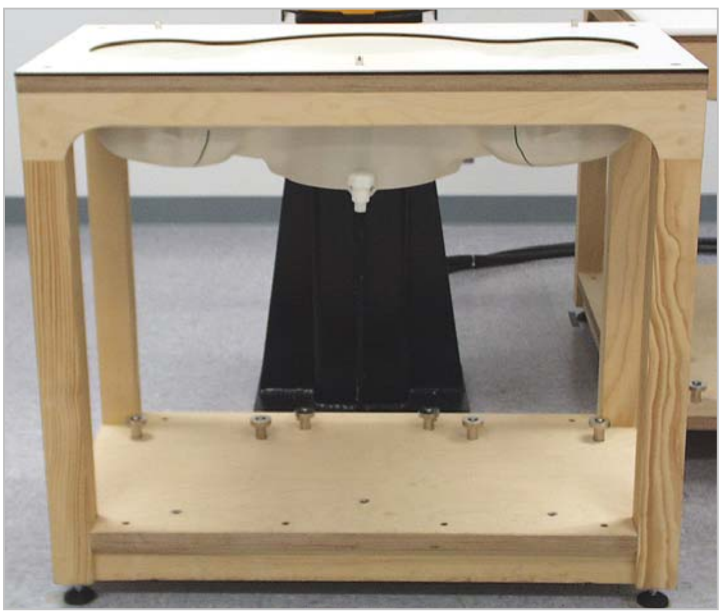
4.5 SAM PHANTOM (V4.0)

Construction: The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness: 2 ±0.2 mm

Filling Volume: Approx. 25 liters

Dimensions: Height: 810mm; Length: 1000mm; Width: 500mm



4.6 DEVICE HOLDER FOR SAM TWIN PHANTOM

Construction: In combination with the Twin SAM Phantom V4.0 or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

4.7 SYSTEM VALIDATION KITS

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.
Frequency: 450, 900, 1800, 2450, 5800 MHz
Return loss: > 20 dB at specified validation position
Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)
Dimensions: 450V2: dipole length: 270 mm; overall height: 330 mm
D900V2: dipole length: 149 mm; overall height: 330 mm
D1800V2: dipole length: 72 mm; overall height: 300 mm
D835V2: dipole length: 161; overall height: 330
D1900V2: dipole length: 68; overall height: 300
D2450V2: dipole length: 51.5 mm; overall height: 300 mm D5GHzV2: dipole length: 25.5 mm; overall height: 290 mm

4.8 COMPOSITION OF INGREDIENTS FOR TISSUE SIMULATING LIQUID

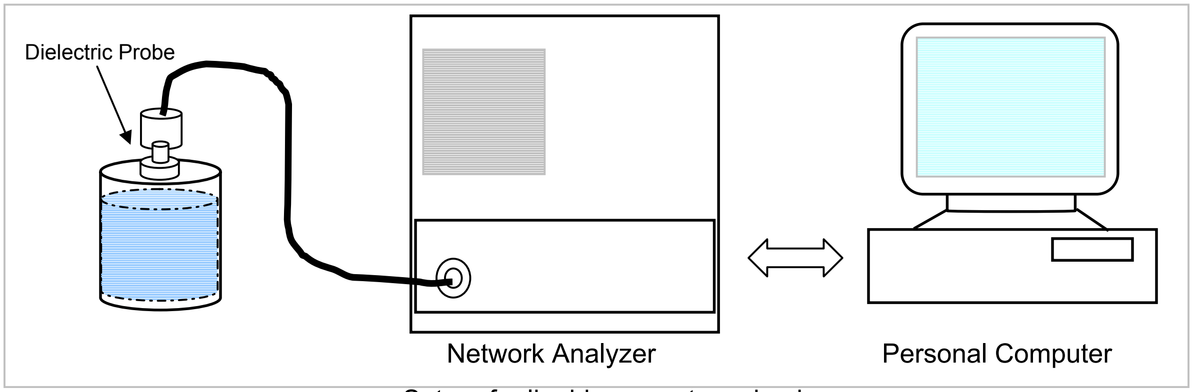
The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

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

5 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

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)

5.1 SIMULATING LIQUID PARAMETER CHECK RESULT

Simulating Liquid Parameter Check Result @ Muscle 835 MHz

Room Ambient Temperature = 22.0 °C; Relative humidity = 30% Measured by: Ninous Davoudi

Simulating Liquid f (MHz)	Temp. (°C)	Depth (cm)	Parameters		Target	Measured	Deviation (%)	Limit (%)
835	21.8	15	e'	Relative Permittivity (e"):	55.2	53.5219	-3.04	± 5
			21.1009	Conductivity (σ):	0.97	0.9802	1.05	± 5

Liquid Check
Ambient temperature: 22.0 deg. C; Liquid temperature: 21.8 deg C
December 07, 2005 08:55 AM

Frequency	e'	e"
750000000.	54.3723	21.5183
755000000.	54.3110	21.4897
760000000.	54.2473	21.4858
765000000.	54.2203	21.4463
770000000.	54.1835	21.4103
775000000.	54.1199	21.3954
780000000.	54.0608	21.3560
785000000.	53.9996	21.3410
790000000.	53.9499	21.3222
795000000.	53.9013	21.3032
800000000.	53.8609	21.3044
805000000.	53.8204	21.2376
810000000.	53.7798	21.2165
815000000.	53.7235	21.1956
820000000.	53.6722	21.2012
825000000.	53.6321	21.1416
830000000.	53.5527	21.1244
835000000.	53.5219	21.1009
840000000.	53.4664	21.0976
845000000.	53.4015	21.0652
850000000.	53.3734	21.0414
855000000.	53.3271	21.0245
860000000.	53.2628	21.0145
865000000.	53.2372	20.9902
870000000.	53.1644	20.9518
875000000.	53.1161	20.9473
880000000.	53.0687	20.9425
885000000.	53.0166	20.9502
890000000.	52.9656	20.9576
895000000.	52.9654	20.9036
900000000.	52.9031	20.8633
905000000.	52.8422	20.8646
910000000.	52.8076	20.8506
915000000.	52.7658	20.8293

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 = 30% Measured by: Ninous Davoudi

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
1900	21.2	15	ε"	Relative Permittivity (ε_r):	53.3	51.6976	-3.01	± 5
			14.0802	Conductivity (σ):	1.52	1.48827	-2.09	± 5

Liquid Check
Ambient temperature: 22.0 deg. C; Liquid temperature: 21.2 deg C
December 07, 2005 09:41 AM

Frequency	e'	e"
1710000000.	52.4125	13.3513
1720000000.	52.3640	13.3789
1730000000.	52.3314	13.4191
1740000000.	52.2903	13.4771
1750000000.	52.2599	13.5191
1760000000.	52.2239	13.5516
1770000000.	52.1740	13.5994
1780000000.	52.1428	13.6497
1790000000.	52.1079	13.6675
1800000000.	52.0720	13.7114
1810000000.	52.0356	13.7523
1820000000.	51.9835	13.7640
1830000000.	51.9497	13.8032
1840000000.	51.9005	13.8345
1850000000.	51.8803	13.9052
1860000000.	51.8433	13.9336
1870000000.	51.7718	13.9570
1880000000.	51.7552	14.0001
1890000000.	51.7217	14.0300
1900000000.	51.6976	14.0802
1910000000.	51.6476	14.1111

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 835 MHz

Room Ambient Temperature = 22.5 °C; Relative humidity = 30% Measured by: Ninous Davoudi

Simulating Liquid f (MHz)	Temp. (°C)	Depth (cm)	Parameters		Target	Measured	Deviation (%)	Limit (%)
835	22	15	e'	Relative Permittivity (e"):	55.2	53.5095	-3.06	± 5
			21.1275	Conductivity (σ):	0.97	0.9814	1.18	± 5

Liquid Check

Ambient temperature: 22.5 deg. C; Liquid temperature: 22.0 deg C

December 08, 2005 09:12 AM

Frequency	e'	e''
750000000.	54.3651	21.5327
755000000.	54.3467	21.4897
760000000.	54.2438	21.4397
765000000.	54.1814	21.4358
770000000.	54.1765	21.4244
775000000.	54.1163	21.3850
780000000.	54.0468	21.3492
785000000.	54.0206	21.3684
790000000.	53.9637	21.3289
795000000.	53.8947	21.3169
800000000.	53.8574	21.2942
805000000.	53.8280	21.2915
810000000.	53.7689	21.2655
815000000.	53.7324	21.2205
820000000.	53.6754	21.1945
825000000.	53.6078	21.1670
830000000.	53.5366	21.1412
835000000.	53.5095	21.1275
840000000.	53.4955	21.0871
845000000.	53.4208	21.0582
850000000.	53.3744	21.0736
855000000.	53.3116	21.0411
860000000.	53.2817	21.0074
865000000.	53.2055	20.9914
870000000.	53.1153	20.9916
875000000.	53.0904	20.9357
880000000.	53.0467	20.9403
885000000.	53.0039	20.9445
890000000.	52.9642	20.9266
895000000.	52.9275	20.8867
900000000.	52.8769	20.8630
905000000.	52.8206	20.8626
910000000.	52.7801	20.8200
915000000.	52.7562	20.7918

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 = 22.5°C; Relative humidity = 30% Measured by: Ninous Davoudi

Simulating Liquid f (MHz)	Temp. (°C)	Depth (cm)	Parameters		Target	Measured	Deviation (%)	Limit (%)
1900	22	15	ε"	Relative Permittivity (ε_r):	53.3	53.0261	-0.51	± 5
			14.1511	Conductivity (σ):	1.52	1.49576	-1.59	± 5

Liquid Check
Ambient temperature: 22.5 deg. C; Liquid temperature: 22.0 deg C
December 08, 2005 08:31 AM

Frequency	e'	e"
1710000000.	53.7003	13.4481
1720000000.	53.6614	13.4711
1730000000.	53.6487	13.5053
1740000000.	53.6172	13.5625
1750000000.	53.5719	13.5876
1760000000.	53.5189	13.6269
1770000000.	53.4902	13.6749
1780000000.	53.4524	13.7054
1790000000.	53.4283	13.7534
1800000000.	53.3814	13.7812
1810000000.	53.3688	13.8414
1820000000.	53.3081	13.8528
1830000000.	53.2795	13.8982
1840000000.	53.2407	13.9419
1850000000.	53.1965	13.9691
1860000000.	53.1731	14.0251
1870000000.	53.1414	14.0415
1880000000.	53.0947	14.0792
1890000000.	53.0791	14.1287
1900000000.	53.0261	14.1511
1910000000.	52.9958	14.2038

The conductivity (σ) can be given as:

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

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

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

6 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.
- Special 5 x 5 x 7 fine cube was chosen for cube integration(dx=dy=7.5mm; dz=5mm).
- Distance between probe sensors and phantom surface was set to 2.5 (below 3 G) mm.
- 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	850	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.

6.1 SYSTEM PERFORMANCE CHECK RESULTS

System Validation Dipole: D835V2 SN:4d002

Date: December 7, 2005

Ambient Temperature = 22°C; Relative humidity = 30% Measured by: Ninous Davoudi

Muscle Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
835	21.8	15	2.39	9.56	9.71	-1.54	± 10
			10g	Normalized to 1 W	Target_10g	Deviation[%]	Limit [%]
			1.57	6.28	6.38	-1.57	± 10

Date: December 8, 2005

Ambient Temperature = 22.5°C; Relative humidity = 30% Measured by: Ninous Davoudi

Muscle Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
835	22	15	2.38	9.52	9.71	-1.96	± 10
			10g	Normalized to 1 W	Target_10g	Deviation[%]	Limit [%]
			1.56	6.24	6.38	-2.19	± 10

System Validation Dipole: D1900V2 SN:5d043

Date: December 7, 2005

Ambient Temperature = 22°C; Relative humidity = 30% Measured by: Ninous Davoudi

Muscle Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
1900	21.2	15	9.17	36.68	39.8	-7.84	± 10
			10g	Normalized to 1 W	Target_10g	Deviation[%]	Limit [%]
			4.84	19.36	20.8	-6.92	± 10

Date: December 8, 2005

Ambient Temperature = 22.5°C; Relative humidity = 30% Measured by: Ninous Davoudi

Muscle Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
1900	22	15	9.62	38.48	39.8	-3.32	± 10
			10g	Normalized to 1 W	Target_10g	Deviation[%]	Limit [%]
			5.09	20.36	20.8	-2.12	± 10

7 SAR MEASUREMENT 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 2.5 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 Spine 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=Z=30 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:

(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.

DASY4 SAR MEASUREMENT 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 mm points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Step 4: Power drift measurement

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

Step 5: Z-Scan

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

8 PROCEDURES USED TO ESTABLISH TEST SIGNAL

The manufacturer supplied a special driving program (Procomm Plus) by using the following commands to turn the transmitter on and change the channels and bands:

MC8755_TX_GSM850_xxx

MC8755_TX_EDGE850_xxx

MC8755_TX_GSM1900_xxx

MC8755_TX_EDGE1900_xxx

Conducted powers were measured prior to SAR measurement.

GSM850 [GPRS Class: Class 10 (2 slot)] & WCDMA850

The cable assembly insertion loss of 10.58 dB (including 9.81 dB pad and 0.77dB cable) was entered as an offset in the power meter to allow for direct reading of power.

GPRS mode:		
		Conducted Power
Ch	f (MHz)	Avg Power
128	824.2	31.93
192	837.0	32.07
251	848.8	31.78
EGPRS (EDGE) mode:		
		Conducted Power
Ch	f (MHz)	Avg Power
128	824.2	26.75
192	837.0	26.77
251	848.8	26.91

GSM190 [GPRS Class: Class 10 (2 slot)] & WCDMA1900

The cable assembly insertion loss of 10.7 dB (including 10.02 dB pad and 0.86 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

GPRS mode:		
		Conducted Power
Ch	f (MHz)	Avg Power
512	1850.20	29.12
661	1880.00	28.95
810	1909.80	29.90
EGPRS (EDGE) mode:		
		Conducted Power
Ch	f (MHz)	Avg Power
512	1850.20	26.01
661	1880.00	25.65
810	1909.80	25.44

9 SAR TEST SUMMARY @ 850 MHZ BNAD

9.1 14” LENOVO

Photos are confidential, please see a seperate file

GSM850

Test mode	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dB)	Extrapolated 1g (mW/g)	Limit (mW/g)
GPRS	128	824.2	0.058	-0.128	0.060	1.6
	192	837.0	0.079	0.000	0.079	1.6
	251	848.8	0.083	-0.010	**0.083**	1.6
	251[4)]	848.8	0.087	-0.086	**0.089**	1.6
EGPRS	128	824.2	0.024	-0.053	0.025	1.6
	192	837.0				
	251	848.8				

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 measurement system can be scaled up by the measured 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 than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) Co-location with WLAN Atheros FCC ID: PPD-AR5BXB6

9.2 15" LENOVO

Photos are confidential, please see a seperate file

GSM850						
Test mode	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dB)	Extrapolated 1g (mW/g)	Limit (mW/g)
GPRS	128	824.2	0.0422	0.000	0.042	1.6
	192	837.0	0.0423	0.000	0.042	1.6
	251	848.8	0.0507	-0.004	0.051	1.6
	251[4)]	848.8	0.0537	-0.016	0.054	1.6
EGPRS	128 192 251	824.2 837.0 848.8	0.0150	0.000	0.015	1.6

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 measurement system can be scaled up by the measured 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 than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) Co-location with WLAN Atheros FCC ID: PPD-AR5BXB6

10 SAR TEST SUMMARY @ 1900 MHZ BNAD

10.1 14" LENOVO

Photos are confidential, please see a seperate file

GSM1900

Test mode	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dB)	Extrapolated 1g (mW/g)	Limit (mW/g)
GPRS	512	1850.20	0.049	-0.073	0.049	1.6
	661	1880.00	0.046	-0.034	0.046	1.6
	810	1909.80	0.065	0.000	**0.065**	1.6
	810 [4)]	1909.80	0.067	0.000	**0.067**	1.6
EGPRS	812 661 810	1850.20 1880.00 1909.80	0.026	0.000	0.026	1.6

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 measurement system can be scaled up by the measured 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 than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) Co-location with WLAN Atheros FCC ID: PPD-AR5BXB6.

10.2 15" LENOVO

Photos are confidential, please see a seperate file

GSM1900						
Test mode	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dB)	Extrapolated 1g (mW/g)	Limit (mW/g)
GPRS	512	1850.20	0.0332	-0.062	0.034	1.6
	661	1880.00	0.0233	0.000	0.023	1.6
	810	1909.80	0.0200	-0.131	0.021	1.6
	512[4)]	1850.20	0.0361	-0.135	0.037	1.6
EGPRS	812	1850.20				
	661	1880.00	0.0188	-0.050	0.019	1.6
	810	1909.80				

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 measurement system can be scaled up by the measured 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 than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) Co-location with WLAN Atheros FCC ID: PPD-AR5BXB6.

11 PHOTO

11.1 EUT

Photos are confidential, please see a seperate file

Photos are confidential, please see a seperate file

11.2 HOST DEVICE

LENOVO 14 INCH

Photos are confidential, please see a seperate file

LENOVO 15 INCH

Photos are confidential, please see a seperate file

LENOVO 14 INCH

Photos are confidential, please see a seperate file

LENOVO 15 INCH

Photos are confidential, please see a seperate file

LENOVO 14 INCH

Photos are confidential, please see a seperate file

Photos are confidential, please see a seperate file

LENOVO 14 INCH

Photos are confidential, please see a seperate file

LENOVO 15 INCH

Photos are confidential, please see a seperate file

12 MEASUREMENT UNCERTAINTY

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

13 EQUIPMENT LIST

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
SAM Phantom (SAM1)	SPEAG	TP-1185	QD000P40CA	N/A
SAM Phantom (SAM2)	SPEAG	TP-1015	N/A	N/A
Data Acquisition Electronics	SPEAG	DAE3 V1	500	2/7/06
System Validation Dipole	SPEAG	D835V2	4d002	2/11/06
System Validation Dipole	SPEAG	D1900V2	5d043	2/16/06
Signal General	R&H	SMP 04	DE34210	6/2/06
Power Meter	Giga-tronics	8651A	8651404	12/27/06
Power Sensor	Giga-tronics	80701A	1834588	12/27/07
Amplifier	Mini-Circuits	ZVE-8G	0360	N/A
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A
Simulating Liquid	CCS	M835	N/A	Within 24 hrs of first test
Simulating Liquid	CCS	M1900	N/A	Within 24 hrs of first test

14 ATTACHMENT

No.	Contents	No. of page (s)
1	System Performance Check Plot	8
2-1	SAR Test Plot – 14” Lenovo	12
2-2	SAR Test Plot – 15” Lenovo	12
3	Certificate of E-filed Probe EX3DV4 SN 3531	10
4	Certificate of System Validation Dipole D835V2 SN 4d002	6
5	Certificate of System Validation Dipole D1900V2 SN 5d043	6

END OF REPORT