FCC OET BULLETIN 65 SUPPLEMENT C
IC RSS-102 ISSUE 3

SAR EVALUATION REPORT

For

ExpressCard Wireless Modem
MODEL: AirCard 504
FCC ID: N7NAC500
IC: 2417C-AC500

REPORT NUMBER: 09U12860-3B

ISSUE DATE: Dec. 07, 2009

Prepared for

SIERRA WIRELESS, INC
13811 WIRELESS WAY
RICHMOND, BC V6V 3A4 CANADA

Prepared by

COMPLIANCE CERTIFICATION SERVICES
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	November 9, 2009	Initial Issue	--
	Dec. 01, 2009	Adding explanation for MPR implementation on page	S.H.
	Dec. 07, 2009	Replacing statement in page 26 to protect confidential information and refer to operational description for more information	S.H.

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SIERRA WIRELESS, INC 13811 WIRELESS WAY RICHMOND, BC V6V 3A4 CANADA
EUT DESCRIPTION:	ExpressCard Wireless Modem
MODEL NUMBER:	AirCard 504
DEVICE CATEGORY:	Portable
EXPOSURE CATEGORY:	General Population/Uncontrolled Exposure
DATE TESTED:	October 19 – 20, 2009

THE HIGHEST SAR VALUES:

FCC / IC Rule Parts	Frequency Range [MHz]	The Highest SAR Values (1g_mW/g)	Limit (mW/g)
22H / RSS-132	824 - 849	1.29 (Antenna Wide Open)	1.6
24E / RSS-133	1850 - 1910	1.14 (Antenna Wide Open)	

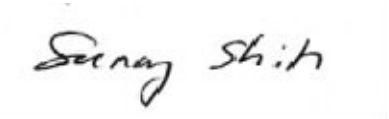
APPLICABLE STANDARDS AND TEST PROCEDURES:

STANDARDS AND TEST PROCEDURES	TEST RESULTS
• FCC OET Bulletin 65 Supplement C and the following specific Test Procedures: o KDB 941225 SAR test for 3G devices o 447498 D02 Mobile Portable RF Exposure Procedures	Pass
• RSS-102 ISSUE 3	Pass

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

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

Approved & Released For CCS By:



SUNNY SHIH
ENGINEERING SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

CHAO YEN LIN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C, IC RSS 102 Issue 3 and the following specific FCC Test Procedures.

- KDB 941225 SAR test for 3G devices
- KDB447498 D02 Mobile Portable RF Exposure Procedures.

3. FACILITIES AND ACCREDITATION

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

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/Standards/scopes/2000650.htm.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
Robot - Six Axes	Stäubli	RX90BL	N/A	N/A		
Robot Remote Control	Stäubli	CS7MB	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	2009
Signal Generator	Agilent	8753ES-6	MY40001647	11	14	2009
E-Field Probe	SPEAG	EX3DV4	3686	3	23	1010
Thermometer	ERTCO	639-1S	1718	5	1	2010
Data Acquisition Electronics	SPEAG	DAE3 V1	427	10	20	2009
System Validation Dipole	SPEAG	D835V2	4d002	6	22	2009
System Validation Dipole	SPEAG	D900V2	108	1	21	2010
System Validation Dipole	SPEAG	D1800V2	294	1	29	2010
System Validation Dipole	SPEAG	D1900V2	5d043	1	29	2010
System Validation Dipole	SPEAG	D2450V2	748	4	14	2010
System Validation Dipole	SPEAG	D5GHzV2	1003	11	21	2009
MXA Signal Analyzer	Agilent	N9020A	US48350984	10	23	2009
ESG Vector Signal Generator	Agilent	E4438C	US44271090	9	17	2010
Power Meter	Giga-tronics	8651A	8651404	1	11	2010
Power Sensor	Giga-tronics	80701A	1834588	1	11	2010
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	CCS	H1900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M1900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	H1800	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M1800	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	H1700	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M1700	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	H835	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M835	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	H900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M900	N/A	Within 24 hrs of first test		

4.2. MEASUREMENT UNCERTAINTY

Measurement 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
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

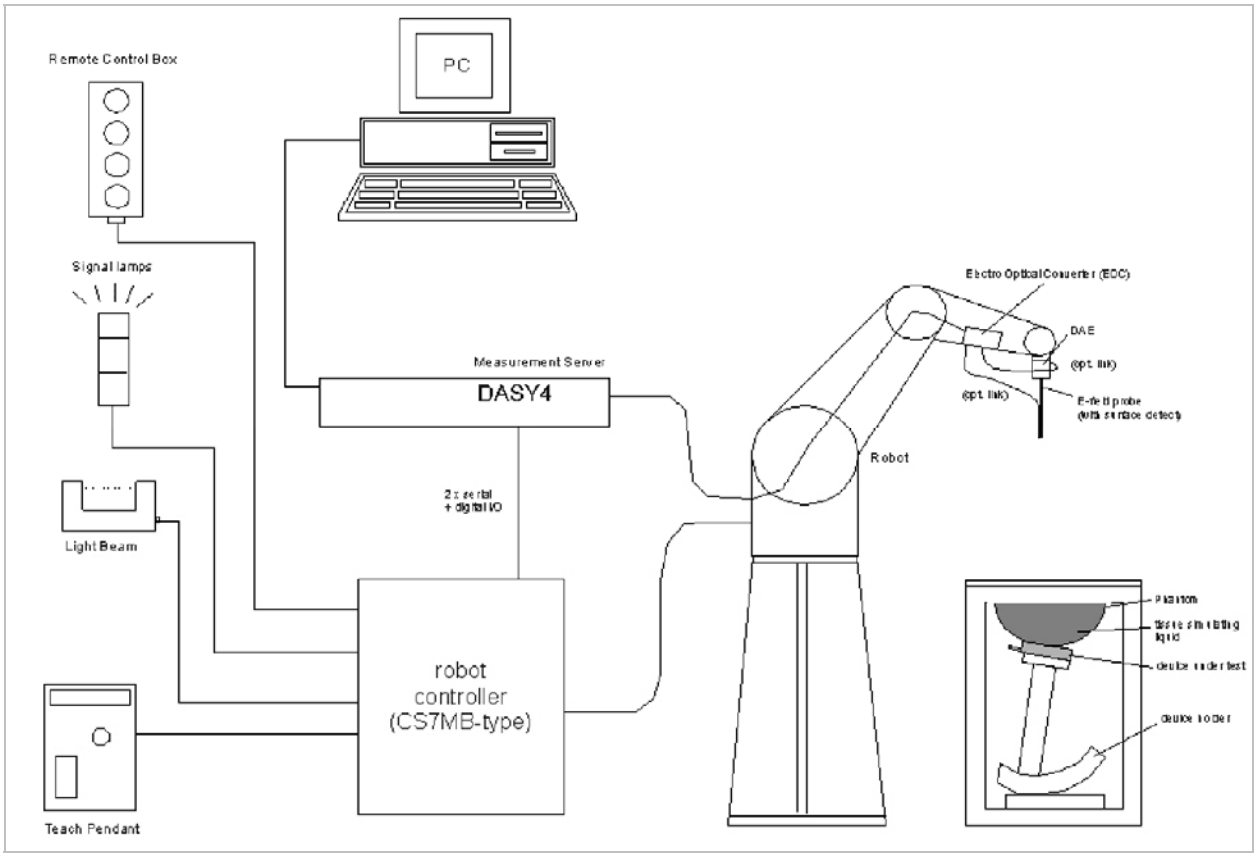
5. EQUIPMENT UNDER TEST

ExpressCard Wireless Modem

Model: AirCard 504

Network:	UMTS (W-CDMA) 850/1900/2100 GSM850/900/1800/1900
GPRS Multi-slot class:	(E)GPRS: Class 12
Host devices:	1. Fujitsu (Model: E1) 2. IBM (Model: KEU), with PC Card adaptor

6. SYSTEM SPECIFICATIONS



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.

7. COMPOSITION OF INGREDIENTS FOR TISSUE SIMULATING LIQUIDS

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

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

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

8. 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.

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	0.8
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.9	55.2	0.97
900	41.5	0.97	55	1.05
915	41.5	0.98	55	1.06
1450	40.5	1.2	54	1.3
1610	40.3	1.29	53.8	1.4
1800 – 2000	40	1.4	53.3	1.52
2450	39.2	1.8	52.7	1.95
3000	38.5	2.4	52	2.73
5800	35.3	5.27	48.2	6

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

8.1. LIQUID CHECK RESULTS FOR 1900 MHZ

Simulating Liquid Dielectric Parameters for Muscle 1900 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Chaoyen Lin

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
1900	e'	53.965	Relative Permittivity (ϵ_r):	53.9645	53.3	1.25	± 5
	e"	14.145	Conductivity (σ):	1.49515	1.52	-1.63	± 5

Liquid temperature: 23 deg. C
October 19, 2009 8:14 AM

Frequency	e'	e"
1710000000	54.5664	13.6144
1720000000	54.5557	13.6799
1730000000	54.5545	13.7668
1740000000	54.5512	13.8479
1750000000	54.5508	13.8817
1760000000	54.4943	13.8825
1770000000	54.459	13.8504
1780000000	54.3977	13.8121
1790000000	54.3389	13.8128
1800000000	54.2754	13.8477
1810000000	54.2025	13.9025
1820000000	54.1349	13.9607
1830000000	54.0824	14.0573
1840000000	54.0781	14.1473
1850000000	54.0541	14.1966
1860000000	54.0266	14.2235
1870000000	54.0115	14.2097
1880000000	54.0118	14.1634
1890000000	53.9853	14.1385
1900000000	**53.9645**	**14.1453**
1910000000	53.8853	14.1818

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 for Muscle 1900 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Chaoyen Lin

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
1900	e'	53.797	Relative Permittivity (ϵ_r):	53.7967	53.3	0.93	± 5
	e"	14.180	Conductivity (σ):	1.49883	1.52	-1.39	± 5

Liquid temperature: 23 deg. C
October 27, 2009 4:14 PM

Frequency	e'	e"
1710000000	54.3986	13.6492
1720000000	54.3879	13.7147
1730000000	54.3867	13.8016
1740000000	54.3834	13.8827
1750000000	54.383	13.9165
1760000000	54.3265	13.9173
1770000000	54.2912	13.8852
1780000000	54.2299	13.8469
1790000000	54.1711	13.8476
1800000000	54.1076	13.8825
1810000000	54.0347	13.9373
1820000000	53.9671	13.9955
1830000000	53.9146	14.0921
1840000000	53.9103	14.1821
1850000000	53.8863	14.2314
1860000000	53.8588	14.2583
1870000000	53.8437	14.2445
1880000000	53.844	14.1982
1890000000	53.8175	14.1733
1900000000	**53.7967**	**14.1801**
1910000000	53.7175	14.2166

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

8.2. LIQUID CHECK RESULTS FOR 835 MHZ

Simulating Liquid Dielectric Parameters for Muscle 835 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Chaoyen Lin

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
835	e'	53.74	Relative Permittivity (ϵ_r):	53.744	55.2	-2.64	± 5
	e"	20.83	Conductivity (σ):	0.968	0.97	-0.24	± 5

Liquid temperature: 23 deg. C
October 20, 2009 8:10 AM

Frequency	e'	e"
800000000	54.2191	21.0162
805000000	54.1239	20.9916
810000000	54.0585	20.9515
815000000	53.9914	20.9349
820000000	53.9311	20.8716
825000000	53.8845	20.8595
830000000	53.8115	20.8627
835000000	**53.7437**	**20.8312**
840000000	53.6771	20.7997
845000000	53.644	20.7673
850000000	53.6126	20.7671
855000000	53.5551	20.7225
860000000	53.5185	20.7029
865000000	53.4956	20.689
870000000	53.4536	20.6503
875000000	53.4265	20.6489
880000000	53.4059	20.6343
885000000	53.3746	20.6449
890000000	53.3519	20.6206
895000000	53.3152	20.6123
900000000	53.2974	20.5967
905000000	53.2382	20.5662
910000000	53.1825	20.5553
915000000	53.095	20.5264
920000000	53.0637	20.4809
925000000	53.0153	20.4426
930000000	52.9721	20.3771
935000000	52.9001	20.3644
940000000	52.8551	20.3411
945000000	52.8231	20.3228
950000000	52.8003	20.3009

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 for Muscle 835 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Chaoyen Lin

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
835	e'	53.88	Relative Permittivity (ϵ_r):	53.883	55.2	-2.39	± 5
	e"	20.87	Conductivity (σ):	0.969	0.97	-0.06	± 5

Liquid temperature: 23 deg. C
October 27, 2009 1:30 PM

Frequency	e'	e"
800000000	54.358	21.0552
805000000	54.2628	21.0306
810000000	54.1974	20.9905
815000000	54.1303	20.9739
820000000	54.07	20.9106
825000000	54.0234	20.8985
830000000	53.9504	20.9017
835000000	**53.8826**	**20.8702**
840000000	53.816	20.8387
845000000	53.7829	20.8063
850000000	53.7515	20.8061
855000000	53.694	20.7615
860000000	53.6574	20.7419
865000000	53.6345	20.728
870000000	53.5925	20.6893
875000000	53.5654	20.6879
880000000	53.5448	20.6733
885000000	53.5135	20.6839
890000000	53.4908	20.6596
895000000	53.4541	20.6513
900000000	53.4363	20.6357
905000000	53.3771	20.6052
910000000	53.3214	20.5943
915000000	53.2339	20.5654
920000000	53.2026	20.5199
925000000	53.1542	20.4816
930000000	53.111	20.4161
935000000	53.039	20.4034
940000000	52.994	20.3801
945000000	52.962	20.3618
950000000	52.9392	20.3399

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

8.3. LIQUID CHECK RESULTS FOR 2000 MHZ

Simulating Liquid Dielectric Parameters for Muscle 2000 MHz

Room Ambient Temperature = 24°C; Relative humidity = 38% Measured by: Chaoyen Lin

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
1950	e'	53.24	Relative Permittivity (ϵ_r):	53.238	53.3	-0.12	± 5
	e"	13.83	Conductivity (σ):	1.500	1.52	-1.29	± 5
2000	e'	53.32	Relative Permittivity (ϵ_r):	53.324	53.3	0.04	± 5
	e"	13.98	Conductivity (σ):	1.555	1.52	2.32	± 5

Liquid temperature: 23 deg. C
October 19, 2009 7:25 PM

Frequency	e'	e"
1900000000	53.5777	13.5028
1905000000	53.5276	13.5175
1910000000	53.4743	13.5244
1915000000	53.4282	13.5576
1920000000	53.3673	13.5976
1925000000	53.3182	13.634
1930000000	53.2695	13.6702
1935000000	53.2468	13.7254
1940000000	53.2286	13.7619
1945000000	53.2366	13.7988
1950000000	**53.2377**	**13.8315**
1955000000	53.261	13.8754
1960000000	53.2941	13.9025
1965000000	53.311	13.9197
1970000000	53.3334	13.9533
1975000000	53.3581	13.9699
1980000000	53.3757	13.9788
1985000000	53.3752	13.9837
1990000000	53.364	13.9735
1995000000	53.353	13.9742
2000000000	**53.3239**	**13.9784**
2005000000	53.2951	13.9387
2010000000	53.2557	13.9389
2015000000	53.2056	13.921
2020000000	53.1487	13.9248
2025000000	53.1175	13.9466
2030000000	53.0901	13.9429
2035000000	53.0525	13.9861
2040000000	53.0222	14.0111
2045000000	53.0051	14.0484
2050000000	53.0008	14.0763

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 for Muscle 2000 MHz

Room Ambient Temperature = 24°C; Relative humidity = 38% Measured by: Chaoyen Lin

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
1950	e'	53.10	Relative Permittivity (ϵ_r):	53.103	53.3	-0.37	± 5
	e"	13.77	Conductivity (σ):	1.494	1.52	-1.70	± 5
2000	e'	53.19	Relative Permittivity (ϵ_r):	53.189	53.3	-0.21	± 5
	e"	13.92	Conductivity (σ):	1.549	1.52	1.90	± 5

Liquid temperature: 23 deg. C
October 27, 2009 6:15 PM

Frequency	e'	e"
1900000000	53.4428	13.4449
1905000000	53.3927	13.4596
1910000000	53.3394	13.4665
1915000000	53.2933	13.4997
1920000000	53.2324	13.5397
1925000000	53.1833	13.5761
1930000000	53.1346	13.6123
1935000000	53.1119	13.6675
1940000000	53.0937	13.704
1945000000	53.1017	13.7409
1950000000	**53.1028**	**13.7736**
1955000000	53.1261	13.8175
1960000000	53.1592	13.8446
1965000000	53.1761	13.8618
1970000000	53.1985	13.8954
1975000000	53.2232	13.912
1980000000	53.2408	13.9209
1985000000	53.2403	13.9258
1990000000	53.2291	13.9156
1995000000	53.2181	13.9163
2000000000	**53.189**	**13.9205**
2005000000	53.1602	13.8808
2010000000	53.1208	13.881
2015000000	53.0707	13.8631
2020000000	53.0138	13.8669
2025000000	52.9826	13.8887
2030000000	52.9552	13.885
2035000000	52.9176	13.9282
2040000000	52.8873	13.9532
2045000000	52.8702	13.9905
2050000000	52.8659	14.0184

The conductivity (σ) can be given as:

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

where f = target f * 10^6

ε_0 = 8.854 * 10^{-12}

9. SYSTEM 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 Head or Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV3 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube
- Distance between probe sensors and phantom surface was set to 3 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 250 mW±3%.
- The results are normalized to 1 W input power.

450 to 2450 MHz Reference SAR Values for Body-tissue (From SPEAG)

Dipole Type	Distance	Frequency	SAR (1g)	SAR (10g)	SAR (peak)
	(mm)	(MHz)	[W/kg]	[W/kg]	[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.

9.1. SYSTEM CHECK RESULTS FOR D1900V2

System Validation Dipole: D1900V2 SN: 5d043

Date: October 19, 2009

Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Chaoyen Lin

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	1900	250	1g SAR:	38.1	39.8	-4.27	±10
			10g SAR:	20.2	20.8	-2.88	

Date: October 27, 2009

Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Chaoyen Lin

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	1900	250	1g SAR:	37.9	39.8	-4.77	±10
			10g SAR:	20.0	20.8	-3.85	

9.2. SYSTEM CHECK RESULTS FOR D835V2

System Validation Dipole: D835V2 SN:4d002

Date: October 20, 2009

Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Chaoyen Lin

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	835	250	1g SAR:	10.1	9.71	4.02	±10
			10g SAR:	6.58	6.38	3.13	

Date: October 27, 2009

Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Chaoyen Lin

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	835	250	1g SAR:	10.2	9.71	5.05	±10
			10g SAR:	6.63	6.38	3.92	

9.3. SYSTEM CHECK RESULTS FOR D2000V2

System Validation Dipole: D2000V2 SN: 1016

Date: October 19, 2009

Ambient Temperature = 24°C; Relative humidity = 35% Measured by: Chaoyen Lin

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	2000	250	1g SAR:	39.5	40.9	-3.42	±10
			10g SAR:	20.7	21.2	-2.36	

Date: October 27, 2009

Ambient Temperature = 24°C; Relative humidity = 35% Measured by: Chaoyen Lin

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	2000	250	1g SAR:	39.6	40.9	-3.18	±10
			10g SAR:	20.8	21.2	-1.89	

10. OUTPUT POWER VERIFICATION

10.1. GSM

GPRS (GMSK) - Coding Scheme: MCS4

Band	Ch No.	f (MHz)	Conducted output power (dBm)							
			1 slot	Time Average power	2 slot	Time Average power	3 slot	Time Average power	4 slot	Time Average power
GSM850	128	824.2	31.90	22.90	31.80	25.80	29.90	25.64	27.90	24.90
	190	836.6	32.00	23.00	32.00	26.00	30.00	25.74	28.00	25.00
	251	848.8	32.00	23.00	31.90	25.90	30.00	25.74	28.00	25.00
GSM1900	512	1850.2	29.10	20.10	29.10	23.10	29.10	24.84	28.00	25.00
	661	1880	29.30	20.30	29.30	23.30	29.20	24.94	28.20	25.20
	810	1909.8	29.10	20.10	29.10	23.10	29.00	24.74	28.00	25.00

EGPRS (8PSK) - Coding Scheme: MCS9

Band	Ch No.	f (MHz)	Conducted output power (dBm)							
			1 slot	Time Average power	2 slot	Time Average power	3 slot	Time Average power	4 slot	Time Average power
GSM850	128	824.2	27.20	18.20	27.00	21.00	27.00	22.74	27.00	24.00
	190	836.6	27.30	18.30	27.20	21.20	27.10	22.84	27.10	24.10
	251	848.8	27.30	18.30	27.20	21.20	27.10	22.84	27.10	24.10
GSM1900	512	1850.2	26.30	17.30	26.20	20.20	26.10	21.84	26.10	23.10
	661	1880	26.50	17.50	26.40	20.40	26.30	22.04	26.30	23.30
	810	1909.8	26.30	17.30	26.20	20.20	26.10	21.84	26.10	23.10

10.2. UMTS RELEASE 99

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 V7.5.0 specification. The EUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7). A summary of these settings are illustrated below:

	Mode	Rel99
	Subtest	-
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	HSDPA FRC	Not Applicable
	HSUPA Test	Not Applicable
	Power Control Algorithm	Algorithm2
	βc	Not Applicable
	βd	Not Applicable
	βec	Not Applicable
	βc/βd	8/15
	βhs	Not Applicable
	βed	Not Applicable

Results

Rel 99 (12.2kps RMC)

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	O/P Power (dBm)
UMTS850 (Band V)	Rel 99 12.2kps RMC	4132	4357	826.4	23.19
		4182	4407	836.4	23.11
		4233	4458	846.6	23.11
UMTS1900 (Band II)	Rel 99 12.2kps RMC	9262	9662	1852.4	22.96
		9400	9800	1880.0	22.83
		9538	9938	1907.6	22.92

10.3. UMTS HSDPA

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	HSUPA Test	Not Applicable			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βec	-	-	-	-
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	βed	Not Applicable			
	CM (dB)	0	1	1.5	1.5
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs = βhs/βc	30/15			

Results

Rel 6 HSDPA

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	O/P Power (dBm)
UMTS850 (Band V)	Subtest 1	4132	4357	826.4	23.10
		4182	4407	836.4	23.09
		4233	4458	846.6	23.07
	Subtest 2	4132	4357	826.4	22.90
		4182	4407	836.4	22.93
		4233	4458	846.6	22.88
	Subtest 3	4132	4357	826.4	22.22
		4182	4407	836.4	22.20
		4233	4458	846.6	22.33
	Subtest 4	4132	4357	826.4	22.14
		4182	4407	836.4	22.15
		4233	4458	846.6	22.15
UMTS1900 (Band II)	Subtest 1	9262	9662	1852.4	22.87
		9400	9800	1880.0	22.80
		9538	9938	1907.6	22.93
	Subtest 2	9262	9662	1852.4	22.31
		9400	9800	1880.0	22.38
		9538	9938	1907.6	22.53
	Subtest 3	9262	9662	1852.4	21.88
		9400	9800	1880.0	21.75
		9538	9938	1907.6	21.97
	Subtest 4	9262	9662	1852.4	21.74
		9400	9800	1880.0	21.74
		9538	9938	1907.6	21.61

10.4. UMTS Rel 6 HSPA (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	Rel6 HSPA	Rel6 HSPA	Rel6 HSPA	Rel6 HSPA	Rel6 HSPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	15/15
	βec	209/225	12/15	30/15	2/15	24/15
	βc/βd	11/15	6/15	15/9	2/15	15/15
	βhs	22/15	12/15	30/15	4/15	30/15
	βed	1309/225	94/75	47/15 47/15	56/75	134/15
	CM (dB)	1.0	3.0	2.0	3.0	1.0
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

Results

Rel 6 HSPA

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	O/P Power (dBm)
UMTS850 (Band V)	Subtest 1	4132	4357	826.4	21.84
		4182	4407	836.4	22.80
		4233	4458	846.6	22.54
	Subtest 2	4132	4357	826.4	21.38
		4182	4407	836.4	21.59
		4233	4458	846.6	21.56
	Subtest 3	4132	4357	826.4	22.12
		4182	4407	836.4	22.15
		4233	4458	846.6	22.11
	Subtest 4	4132	4357	826.4	21.58
		4182	4407	836.4	22.06
		4233	4458	846.6	22.01
	Subtest 5	4132	4357	826.4	22.00
		4182	4407	836.4	22.98
		4233	4458	846.6	22.94
UMTS1900 (Band II)	Subtest 1	9262	9662	1852.4	22.12
		9400	9800	1880.0	22.10
		9538	9938	1907.6	22.29
	Subtest 2	9262	9662	1852.4	21.37
		9400	9800	1880.0	21.10
		9538	9938	1907.6	21.25
	Subtest 3	9262	9662	1852.4	21.97
		9400	9800	1880.0	21.68
		9538	9938	1907.6	22.06
	Subtest 4	9262	9662	1852.4	21.92
		9400	9800	1880.0	22.84
		9538	9938	1907.6	22.97
	Subtest 5	9262	9662	1852.4	22.10
		9400	9800	1880.0	21.15
		9538	9938	1907.6	21.28

Please refer to section 2.2.2 of operational description (confidential exhibit) for the discrepancies between measured MPR and target MPR values.

11. SUMMARY OF TEST RESULTS

If the SAR measured at the middle channel for each test configuration is at least 3.0 dB (0.8 mW/g) lower than the SAR limit (1.6 mW/g), testing at the high and low channels is optional for such test configuration(s).

Express Card (without PC card adaptor)

11.1. GPRS1900

Test configuration	Sep. dist. (mm)	Mode	Ch No.	f (MHz)	1g SAR (mW/g)	Limit (mW/g)
Antenna wide open	10	GPRS 4 slots	512	1850.2	1.140	1.6
			661	1880.0	1.100	
			810	1909.8	0.965	
Antenna closed	10	GPRS 4 slots	512	1850.2		1.6
			661	1880.0	0.160	
			810	1909.8		
Antenna half open	10	GPRS 4 slots	512	1850.2	1.000	1.6
			661	1880.0	0.992	
			810	1909.8	0.875	

11.2. UMTS BAND II (1900 MHZ)

Test configuration	Sep. dist. (mm)	Mode	UL Ch No.	DL Ch No.	f (MHz)	1g SAR (mW/g)	Limit (mW/g)
Antenna wide open	10	R99 12.2kps RMC	9262	9662	1852.4		1.6
			9400	9800	1880.0	0.734	
			9538	9938	1907.6		

11.3. UMTS BAND I (2100 MHZ)

Test configuration	Sep. dist. (mm)	Mode	UL Ch No.	DL Ch No.	f (MHz)	1g SAR (mW/g)	Limit (mW/g)
Antenna wide open	10	R99 12.2kps RMC	9613	10563	1922.6		1.6
			9750	10700	1950.0	0.69	
			9887	10837	1977.4		

11.4. UMTS BAND V (850 MHZ)

Test configuration	Sep. dist. (mm)	Mode	UL Ch No.	DL Ch No.	f (MHz)	1g SAR (mW/g)	Limit (mW/g)
Antenna wide open	10	R99 12.2kps RMC	4132	4357	826.4		1.6
			4182	4407	836.4	0.561	
			4233	4458	846.6		

11.5. GPRS850

Test configuration	Sep. dist. (mm)	Mode	Ch No.	f (MHz)	1g SAR (mW/g)	Limit (mW/g)
Antenna wide open	10	GPRS 2 slots	128	824.2	1.030	1.6
			190	836.6	1.130	
			251	848.8	1.290	
Antenna closed	10	GPRS 2 slots	128	824.2		1.6
			190	836.6	0.398	
			251	848.8		
Antenna half open	10	GPRS 2 slots	128	824.2		1.6
			190	836.6	0.608	
			251	848.8		

With PC card adaptor

11.6. GPRS1900

Test configuration	Sep. dist. (mm)	Mode	Ch No.	f (MHz)	1g SAR (mW/g)	Limit (mW/g)
Antenna wide open	10	GPRS 4 slots	512	1850.2		1.6
			661	1880.0	0.658	
			810	1909.8		
Antenna closed	10	GPRS 4 slots	512	1850.2		1.6
			661	1880.0	0.072	
			810	1909.8		
Antenna half open	10	GPRS 4 slots	512	1850.2		1.6
			661	1880.0	0.494	
			810	1909.8		

11.7. UMTS BAND II (1900 MHZ)

Test configuration	Sep. dist. (mm)	Mode	UL Ch No.	DL Ch No.	f (MHz)	1g SAR (mW/g)	Limit (mW/g)
Antenna wide open	10	R99 12.2kps RMC	9262	9662	1852.4		1.6
			9400	9800	1880.0	0.35	
			9538	9938	1907.6		

11.8. UMTS BAND I (2100 MHZ)

Test configuration	Sep. dist. (mm)	Mode	UL Ch No.	DL Ch No.	f (MHz)	1g SAR (mW/g)	Limit (mW/g)
Antenna wide open	10	R99 12.2kps RMC	9613	10563	1922.6		1.6
			9750	10700	1950.0	0.34	
			9887	10837	1977.4		

11.9. UMTS BAND V (850 MHZ)

Test configuration	Sep. dist. (mm)	Mode	UL Ch No.	DL Ch No.	f (MHz)	1g SAR (mW/g)	Limit (mW/g)
Antenna wide open	10	R99 12.2kps RMC	4132	4357	826.4		1.6
			4182	4407	836.4	0.232	
			4233	4458	846.6		

11.10. GPRS850

Test configuration	Sep. dist. (mm)	Mode	Ch No.	f (MHz)	1g SAR (mW/g)	Limit (mW/g)
Antenna wide open	10	GPRS 2 slots	128	824.2		1.6
			190	836.6	0.669	
			251	848.8		

12. Enhanced Energy Coupling (KDB 447498)

According to KDB 447498, the test configuration with the highest 1-g SAR must be used to determine if additional SAR evaluation is required due to enhanced energy coupling at increased separation distances.

From the test results below, additional 1-g SAR evaluation is not required.

Mode	Antenna-to-person distance (cm)		Peak SAR (mW/g)	E-field (V/m)	Lower than Initial (%)
GPRS1900	Initial	1.0	1.36	25.36	
	1	1.5	0.76	19.01	56.2%
	2	2.0	0.52	15.67	38.2%
GPRS835	Initial	1.0	1.51	32.91	
	1	1.5	0.78	23.67	51.7%
	2	2.0	0.46	18.14	30.4%

13. WORST-CASE SAR TEST PLOTS

WORST-CASE SAR PLOT for Part 22H - **BODY** POSITION

Date/Time: 10/20/2009 1:17:21 PM

Test Laboratory: Compliance Certification Services

GSM850_2TS

DUT: Sierra Wireless; Type: AirCard504; Serial: F9E26290179E20C

Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:4
Medium parameters used (interpolated): f = 848.8 MHz; σ = 0.981 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 23.0 deg. C; Liquid Temperature: 22.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(8.7, 8.7, 8.7); Calibrated: 3/23/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

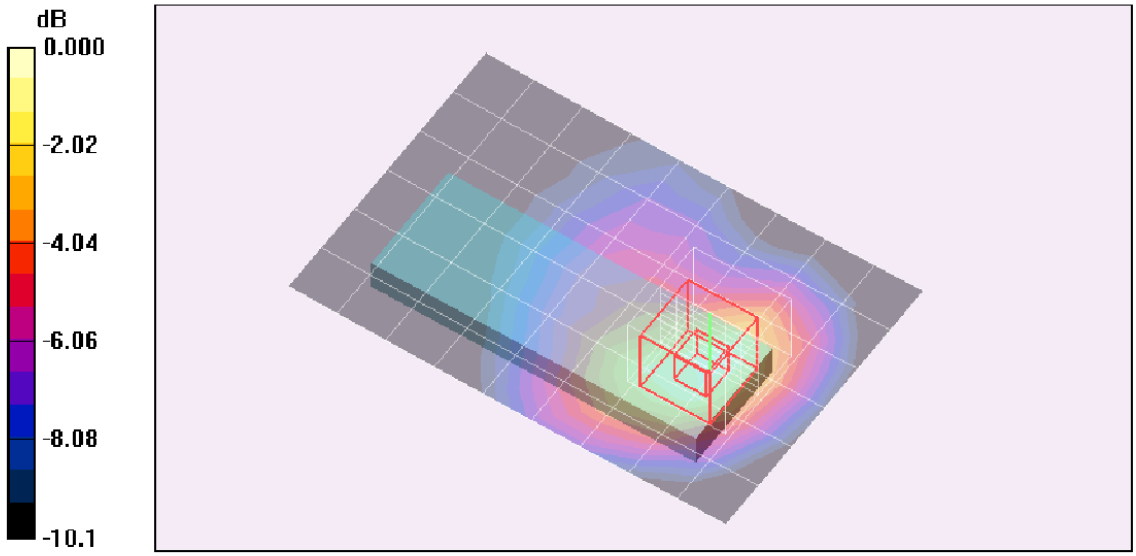
H-ch_2 slot/Area Scan (10x7x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.41 mW/g

H-ch_2 slot/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 22.8 V/m; Power Drift = -0.155 dB
Peak SAR (extrapolated) = 2.06 W/kg
SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.789 mW/g

Maximum value of SAR (measured) = 1.51 mW/g



0 dB = 1.51mW/g

WORST-CASE SAR PLOT for Part 24E- **BODY** POSITION

Date/Time: 10/19/2009 10:49:59 AM

Test Laboratory: Compliance Certification Services

GPRS1900 Ant wide open

DUT: Sierra Wireless; Type: AirCard504; Serial: F9E26290179E20C

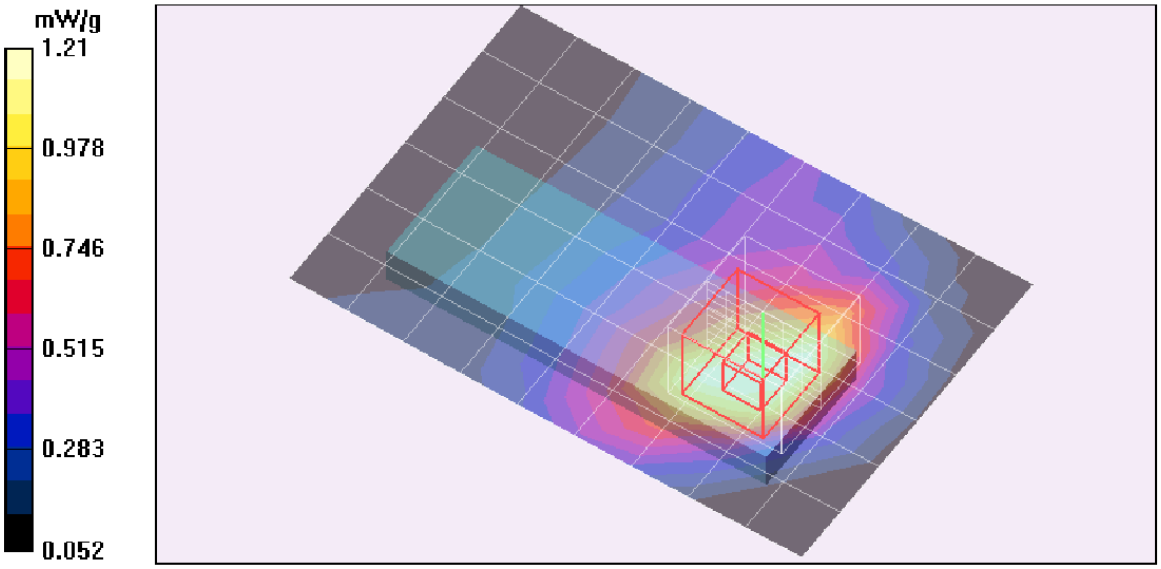
Communication System: DCS 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:2
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.46 mho/m; ε_r = 54.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 23.0 deg. C; Liquid Temperature: 22.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(6.85, 6.85, 6.85); Calibrated: 3/23/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

L-ch_4 slot/Area Scan (10x7x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.21 mW/g

L-ch_4 slot/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 21.4 V/m; Power Drift = -0.151 dB
Peak SAR (extrapolated) = 1.76 W/kg
SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.699 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.36 mW/g



14. ATTACHMENTS

No.	Contents	No. of page (s)
1	System Performance Check Plots	12
2-1	SAR Test Plots for UMTS1900	2
2-2	SAR Test Plots for GSM1900	11
2-3	SAR Test Plots for UMTS850	2
2-4	SAR Test Plots for GSM850	7
3	Certificate of E-Field Probe – EX3DV4 SN3686	10
4	Certificate of System Validation Dipole - D835V2 SN:4d002	9
5	Certificate of System Validation Dipole - D1900V2 SN:5d043	9