



**FCC OET BULLETIN 65 SUPPLEMENT C
IEEE STD 1528:2003
IC RSS-102 ISSUE 4**

SAR EVALUATION REPORT

For
iPhone

MODEL: A1332

**FCC ID: BCG-E2380A
IC: 579C-E2380A**

REPORT NUMBER: 11U13664-1B

ISSUE DATE: March 8, 2011

Prepared for
**APPLE INC
1 INFINITE LOOP, MS-26A
CUPERTINO, CA 95014**

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NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	February 8, 2011	Initial Issue	--
A	February 21, 2011	Revised based upon FCC review comments	Sunny Shih
B	March 8, 2011	Revised based upon FCC review comments	Sunny Shih

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	7
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i>	7
5. EQUIPMENT UNDER TEST	13
5.1. <i>Mode of operation supported</i>	13
6. SYSTEM SPECIFICATIONS	14
7. LIQUID PARAMETERS CHECK	15
7.1. <i>LIQUID CHECK RESULTS FOR 835 MHZ</i>	16
7.2. <i>LIQUID CHECK RESULTS FOR 1900 MHZ</i>	18
7.3. <i>LIQUID CHECK RESULTS FOR 2450 MHZ</i>	19
8. SYSTEM VERIFICATION	20
8.1. <i>SYSTEM CHECK RESULTS FOR D835V2</i>	21
8.2. <i>SYSTEM CHECK RESULTS FOR D1900V2</i>	21
8.3. <i>SYSTEM CHECK RESULTS FOR D2450V2</i>	21
9. OUTPUT POWER VERIFICATION	22
9.1. <i>GSM</i>	22
9.2. <i>UMTS RELEASE 99</i>	23
9.3. <i>UMTS HSDPA</i>	24
9.4. <i>UMTS Rel 6 HSPA (HSDPA & HSUPA)</i>	25
9.5. <i>WIFI RF OUTPUT POWER</i>	27
10. SUMMARY OF TEST RESULTS	28
10.1. <i>GSM850</i>	28
10.2. <i>GSM1900</i>	28
10.3. <i>UMTS BAND V</i>	29
10.4. <i>UMTS BAND II</i>	29
10.5. <i>WIFI</i>	30
11. WORST-CASE SAR TEST PLOTS	31
12. KDB 648474 SIMULTANEOUS TRANSMISSION CONSIDERATION	36
13. ATTACHMENTS	47

14.	ANTENNA LOCATIONS.....	48
15.	TEST SETUP PHOTOS.....	49
16.	EXTERNAL PHOTOS.....	52

1. ATTESTATION OF TEST RESULTS

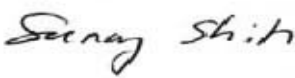
Applicant name:	APPLE INC 1 INFINITE LOOP, MS-26A CUPERTINO, CA 95014
EUT description:	iPhone
Model number:	A1332
Device category:	Portable
Exposure category:	General Population/Uncontrolled Exposure
Date tested:	February 4 - 7, 2011

FCC / IC Rule Parts	Freq. Range [MHz]	Highest 1-g SAR (mW/g)	Limit (mW/g)
22H / RSS-132	824 - 849	Body: 1.03 (Left edge w/ 1.0 cm Separation distance)	1.6
24E / RSS-133	1850 - 1910	Body: 0.661 (Face up w/ 1.0 cm Separation distance)	
15.247 / RSS-102	2400 - 2483.5	Body: 0.142 (Face down w/ 1.0 cm Separation distance)	

Applicable Standards	Test Results
FCC OET Bulletin 65 Supplement C 01-01 IEEE STD 1528:2003 IC RSS 102 Issue 4	Pass

Compliance Certification Services, Inc. (UL 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 UL 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 UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL 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 (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released For UL CCS By:


Tested By:


Sunny Shih
 Engineering Team Leader
 Compliance Certification Services (UL CCS)

Devin Chang
 EMC Engineer
 Compliance Certification Services (UL CCS)

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C 01-01, IC RSS 102 Issue 4 and the following specific FCC Test Procedures.

- KDB 941225 D01 SAR test for 3G devices v02
- KDB 941225 D03 SAR Test Reduction GSM/GPRS/EDGE vo1
- KDB 648474 D01 SAR Handsets Multi Xmitter and Ant, v01r05
- KDB 248227 D01 SAR meas for 802 11abg v01r02
- Oct 2010 TCB Council Workshop – FCC Personal Hot Spot Presentation

3. FACILITIES AND ACCREDITATION

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

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

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		
Dielectric Probe kit	HP	85070C	N/A	N/A		
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	8	2	2011
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3749	11	13	2011
Thermometer	ERTCO	639-1S	1718	7	19	2011
Data Acquisition Electronics	SPEAG	DAE3 V1	427	7	21	2011
System Validation Dipole	SPEAG	D835V2	4d002	4	22	2011
System Validation Dipole	SPEAG	D1900V2	5d043	11	23	2011
System Validation Dipole	SPEAG	D2450V2	748	4	13	2011
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	CCS	M1900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M835	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	M2450	N/A	Within 24 hrs of first test		

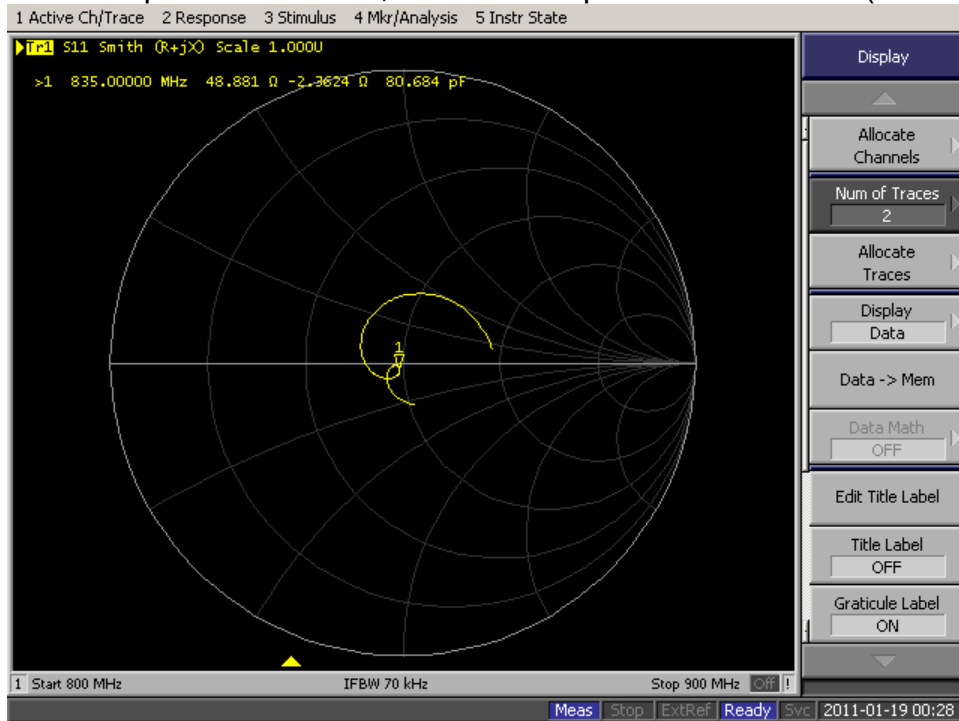
Note: Per KDB 450824 D02 requirements for dipole calibration, UL CCS has adopted two years calibration intervals. On annual basis, each measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement
4. Impedance is within 5Ω of calibrated measurement

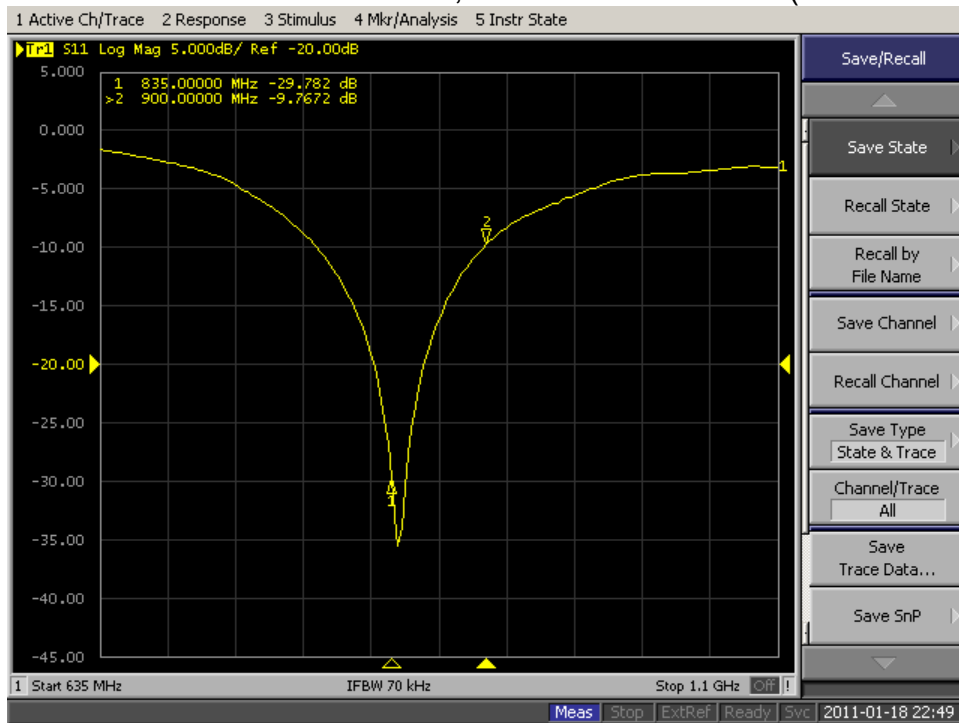
Impedance Plot for D835V2 SN: 4d002

835 Head

Calibrated impedance: 51.8 Ω ; Measured impedance: 48.881 Ω (within 5 Ω)

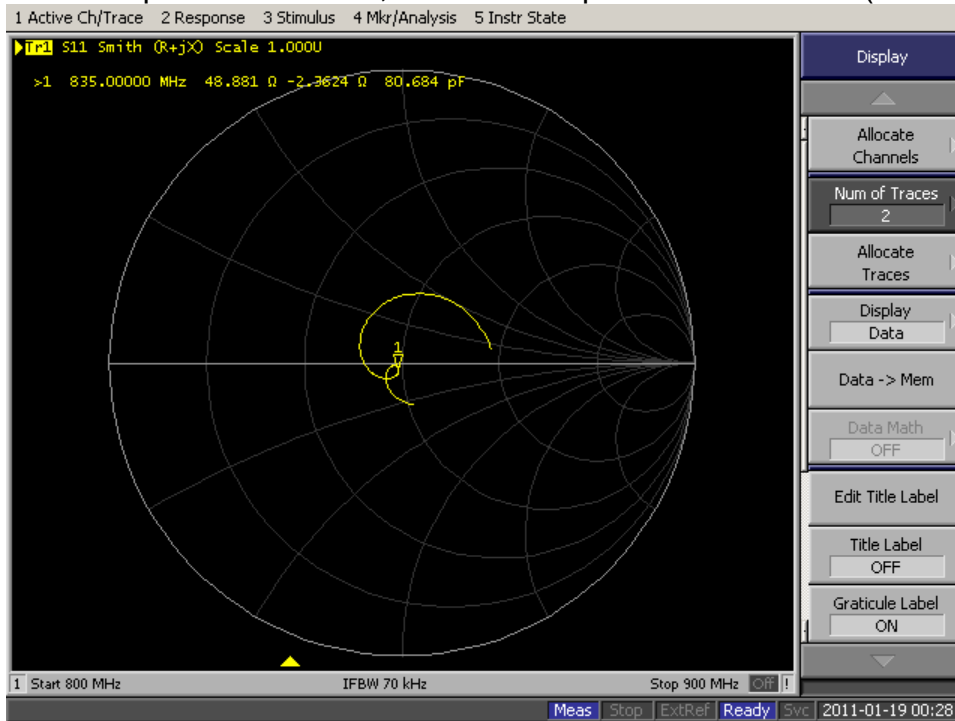


Calibrated return Loss: -28.5 dB; Measured:-29.782 dB (within 20%)

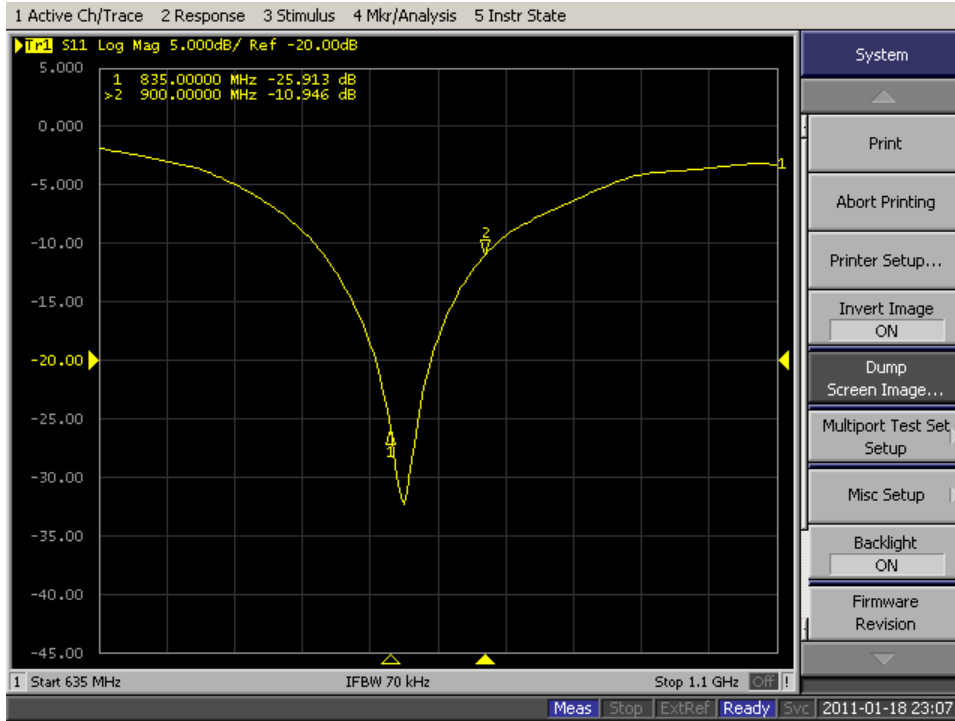


835 Body

Calibrated impedance: 48.2 Ω; Measured impedance: 48.881 Ω (within 5Ω)



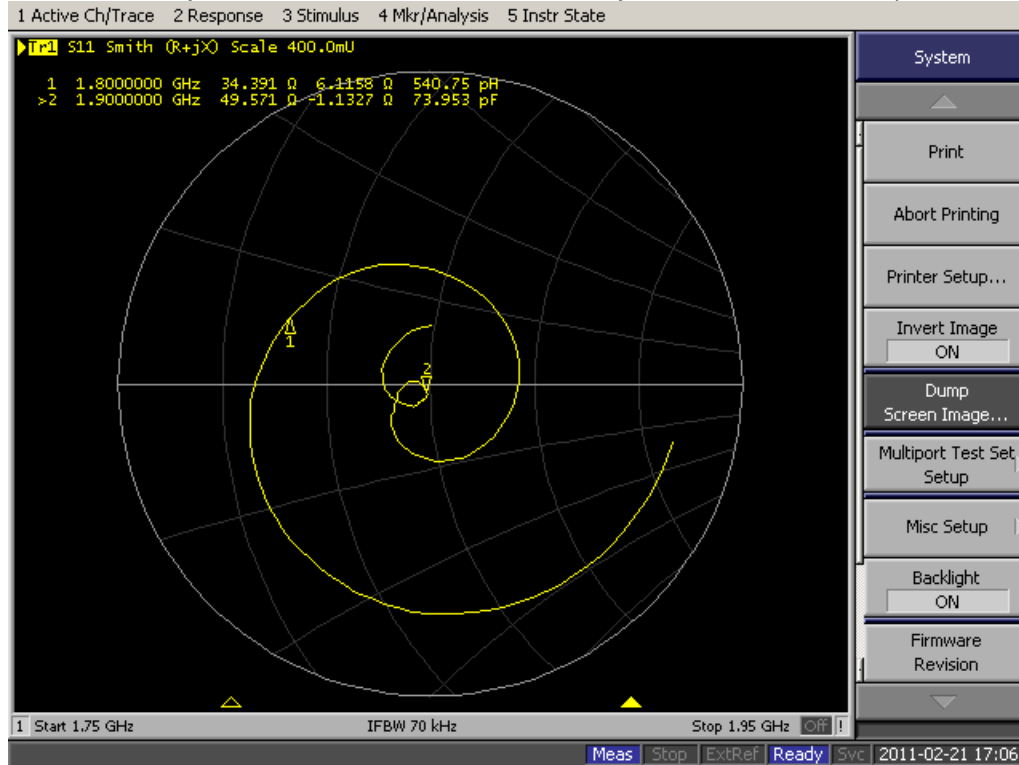
Calibrated return Loss: -25.9 dB; Measured:-25.913 dB (within 20%)



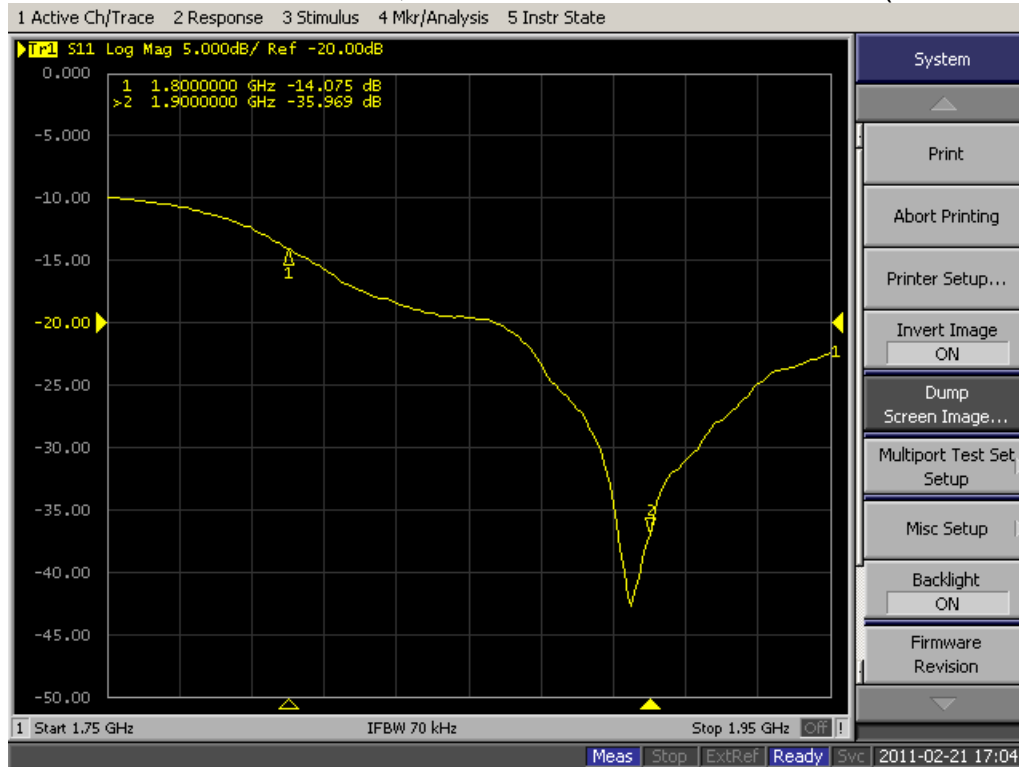
Impedance Plot for D1900V2 SN: 5d043

1900 Head

Calibrated Impedance: 52.1Ω; Measured impedance: 49.571Ω (within 5Ω)

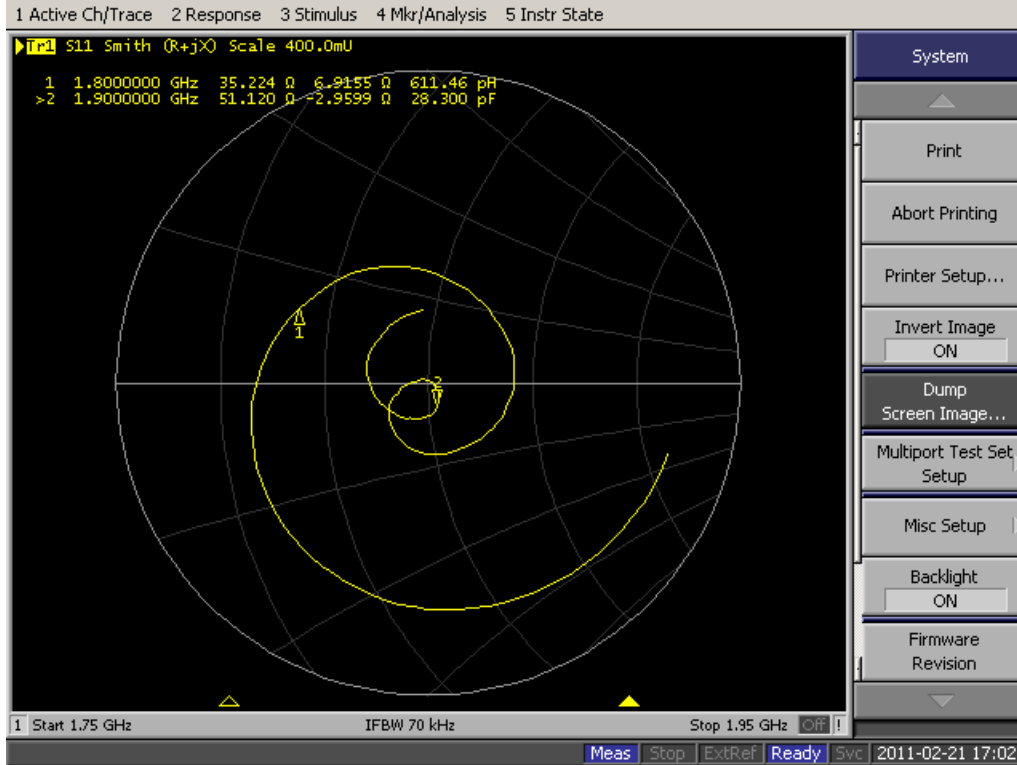


Calibrated return loss: -30 dB; Measured return loss: -35.969 dB (within 20%)

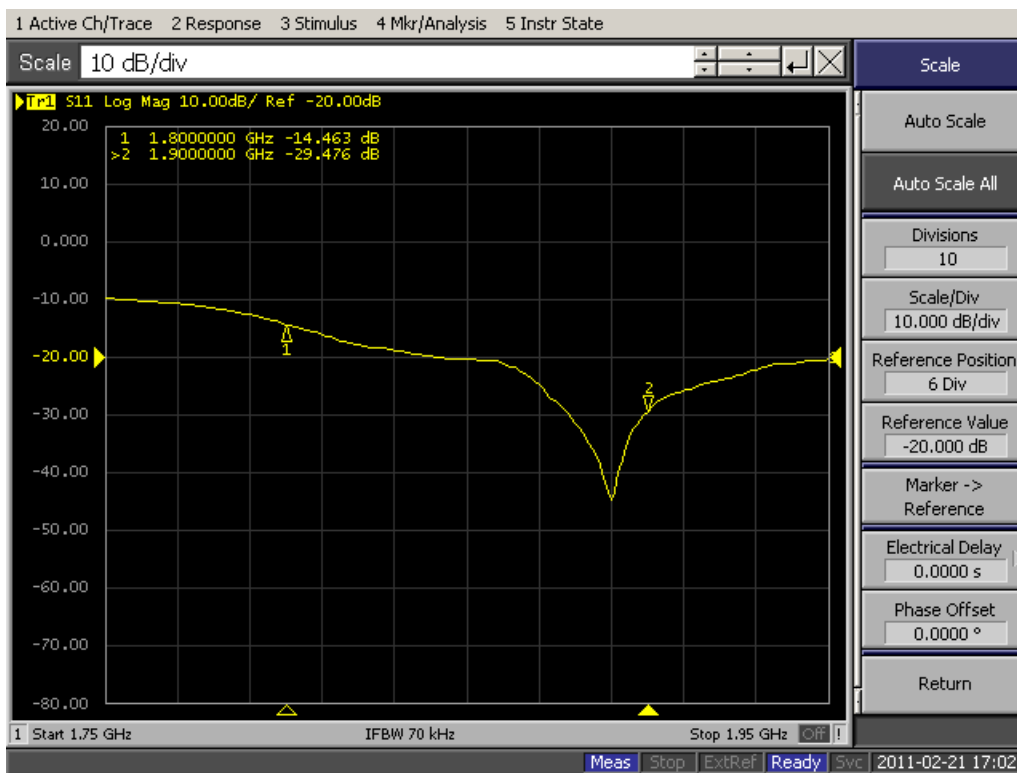


1900 Body

Calibrated impedance: 46.6Ω; Measured impedance: 51.12Ω (within 5Ω)



Calibrated return loss: -24.9 dB; Measured return loss: -29.476 dB (within 20%)



MEASUREMENT UNCERTAINTY

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	5.50	Normal	1	1	5.50
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement (Body 850 MHz)	3.91	Normal	1	0.64	2.50
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty (Body 2450 MHz)	-3.06	Normal	1	0.6	-1.84
Combined Standard Uncertainty U _c (y) =					9.94
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =					19.87 %
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =					1.57 dB

5. EQUIPMENT UNDER TEST

iPhone with 802.11bgn and Bluetooth radio modules.	
Mobile phone capability:	Class B
GPRS Multi-slot class:	Class 10
Serial Number	88012096FRZ
Firmware Version	04.10.01
Dual Transfer Mode (DTM) per 3GPP 51.010	Not supported
Normal operation:	Held to head, Worn on body (LCD facing-up; LCD facing-down) with 15 mm separation distance and Personal Hot Spot Mode with 10 mm separation distance
Body Worn Accessory	Headset
Antenna tested:	<u>Antenna</u> <u>Apple part number</u> 3G 817-0286 WiFi/BT 817-0286 (shared with BT)
Antenna-to-antenna separation distances:	8.7 cm from 3G main antenna-to-WiFi/BT main antenna
Simultaneous transmission:	- 3G can transmit simultaneously with WiFi - 3G can transmit simultaneously with Bluetooth - WiFi can not transmit simultaneously with Bluetooth

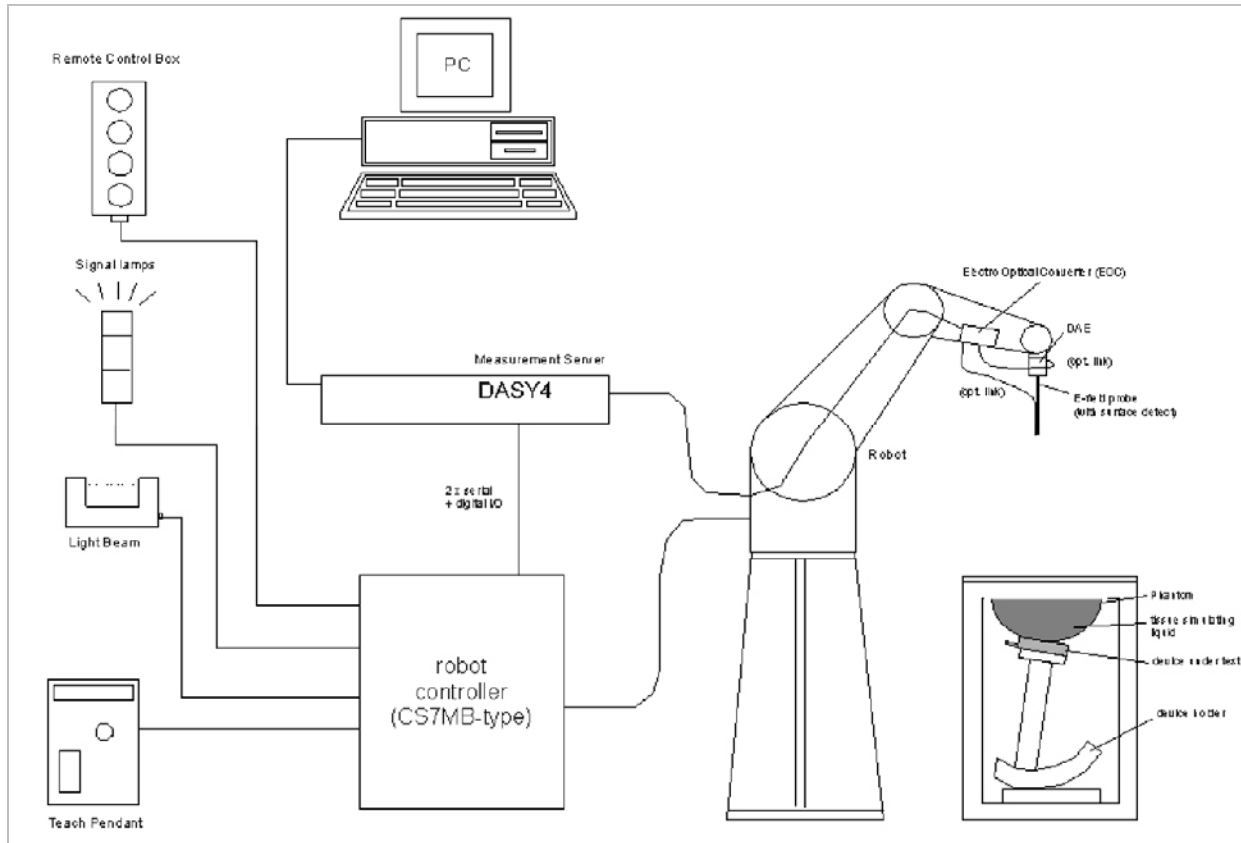
5.1. Mode of operation supported

WIFI HotSpot ON - Simultaneous Transmission					
	GSM voice	GPRS/Edge	UMTS voice	HSDPA/HSUPA	WIFI 2.4 GHz
GSM Voice	N/A	N	N	N	N
GPRS/Edge	N	N/A	N	N	Y
UMTS voice	N	N	N/A	Y	Y
HSDPA/HSUPA	N	N	Y	N/A	Y
WIFI 2.4	N	Y	Y	Y	N/A

Notes:

- BT and WIFI time-share same antenna and cannot transmit simultaneously.
- GSM voice call with Hotspot mode is not a supported configuration.

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 validating the proper functioning of the system.

7. LIQUID PARAMETERS CHECK

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. For frequencies in 300 MHz to just under 2 GHz, the measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values. For frequencies in the range of 2–3 GHz and above the measured conductivity should be within $\pm 5\%$ of the target values. The measured relative permittivity tolerance can be relaxed to no more than $\pm 10\%$.

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	0.8
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 $\rho = 1000 \text{ kg/m}^3$)

7.1. LIQUID CHECK RESULTS FOR 835 MHZ

Simulating Liquid Dielectric Parameters for Body 835 MHz

Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
835	e'	55.03	Relative Permittivity (ϵ_r):	55.027	55.2	-0.31	± 5
	e"	21.70	Conductivity (σ):	1.008	0.97	3.91	± 5

Liquid Check

Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 40%

February 05, 2011 02:07 PM

Frequency	e'	e"
800000000.	55.3870	21.8787
805000000.	55.3359	21.8567
810000000.	55.2863	21.8268
815000000.	55.2367	21.8040
820000000.	55.1830	21.7751
825000000.	55.1331	21.7530
830000000.	55.0798	21.7242
835000000.	55.0274	21.6973
840000000.	54.9821	21.6749
845000000.	54.9328	21.6461
850000000.	54.8886	21.6191
855000000.	54.8424	21.5979
860000000.	54.8016	21.5766
865000000.	54.7569	21.5607
870000000.	54.7145	21.5394
875000000.	54.6703	21.5149
880000000.	54.6198	21.4909
885000000.	54.5795	21.4758
890000000.	54.5288	21.4599
895000000.	54.4771	21.4360
900000000.	54.4333	21.4196
905000000.	54.3823	21.4018
910000000.	54.3366	21.3889
915000000.	54.2870	21.3698
920000000.	54.2397	21.3556
925000000.	54.1942	21.3335
930000000.	54.1412	21.3148
935000000.	54.0948	21.2973
940000000.	54.0547	21.2824
945000000.	54.0066	21.2634
950000000.	53.9576	21.2418

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

Simulating Liquid Dielectric Parameters for Body 835 MHz

Measured by: David Lee

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
835	e'	53.86	Relative Permittivity (ϵ_r):	53.861	55.2	-2.43	± 5
	e''	21.20	Conductivity (σ):	0.985	0.97	1.51	± 5

Liquid Check

Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 40%

February 07, 2011 10:39 AM

Frequency	e'	e''
800000000.	54.2293	21.3446
805000000.	54.1719	21.3210
810000000.	54.1220	21.3029
815000000.	54.0694	21.2749
820000000.	54.0104	21.2564
825000000.	53.9625	21.2378
830000000.	53.9140	21.2190
835000000.	53.8613	21.1966
840000000.	53.8136	21.1748
845000000.	53.7657	21.1564
850000000.	53.7159	21.1353
855000000.	53.6697	21.1157
860000000.	53.6241	21.1018
865000000.	53.5741	21.0810
870000000.	53.5207	21.0609
875000000.	53.4722	21.0464
880000000.	53.4208	21.0228
885000000.	53.3693	21.0038
890000000.	53.3201	20.9827
895000000.	53.2714	20.9707
900000000.	53.2245	20.9481
905000000.	53.1651	20.9327
910000000.	53.1236	20.9117
915000000.	53.0751	20.8921
920000000.	53.0243	20.8751
925000000.	52.9776	20.8512
930000000.	52.9344	20.8386
935000000.	52.8871	20.8200
940000000.	52.8408	20.8013
945000000.	52.7983	20.7812
950000000.	52.7547	20.7681

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

7.2. LIQUID CHECK RESULTS FOR 1900 MHZ

Simulating Liquid Dielectric Parameters for Body 1900 MHz

Measured by: David Lee

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
1900	e'	51.747	Relative Permittivity (ϵ_r):	51.7470	53.3	-2.91	± 5
	e"	14.089	Conductivity (σ):	1.48919	1.52	-2.03	± 5

Liquid Check

Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 39%

February 04, 2011 2:11 PM

Frequency	e'	e"
1710000000.	52.3984	13.4233
1720000000.	52.3632	13.4516
1730000000.	52.3302	13.4788
1740000000.	52.3040	13.5143
1750000000.	52.2771	13.5480
1760000000.	52.2478	13.5868
1770000000.	52.2195	13.6245
1780000000.	52.1934	13.6647
1790000000.	52.1594	13.7034
1800000000.	52.1270	13.7423
1810000000.	52.0912	13.7791
1820000000.	52.0541	13.8181
1830000000.	52.0140	13.8521
1840000000.	51.9702	13.8897
1850000000.	51.9307	13.9215
1860000000.	51.8915	13.9561
1870000000.	51.8541	13.9903
1880000000.	51.8164	14.0246
1890000000.	51.7791	14.0565
1900000000.	51.7470	14.0889
1910000000.	51.7120	14.1175

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

7.3. LIQUID CHECK RESULTS FOR 2450 MHZ

Simulating Liquid Dielectric Parameter Check Result @ Body 2450 MHZ

Measured by: Devin Chang

f (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit (%)	
2450	e'	51.09	Relative Permittivity (ϵ_r):	51.087	52.7	-3.06	± 5
	e"	14.18	Conductivity (σ):	1.933	1.95	-0.86	± 5

Liquid Check

Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 41%

February 06, 2011 01:03 PM

Frequency	e'	e"
2400000000.	51.2490	13.9887
2405000000.	51.2335	14.0099
2410000000.	51.2162	14.0296
2415000000.	51.2029	14.0500
2420000000.	51.1860	14.0683
2425000000.	51.1701	14.0874
2430000000.	51.1538	14.1060
2435000000.	51.1383	14.1259
2440000000.	51.1219	14.1462
2445000000.	51.1037	14.1657
2450000000.	51.0870	14.1843
2455000000.	51.0711	14.2029
2460000000.	51.0513	14.2210
2465000000.	51.0365	14.2424
2470000000.	51.0190	14.2607
2475000000.	51.0005	14.2819
2480000000.	50.9810	14.3018
2485000000.	50.9668	14.3223
2490000000.	50.9488	14.3421
2495000000.	50.9347	14.3596
2500000000.	50.9159	14.3802

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

8. SYSTEM VERIFICATION

The system performance check is performed prior to any usage of the system in order to verify SAR system measurement accuracy. The system performance check verifies that the system operates within its specifications of $\pm 10\%$.

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 100 mW
- The results are normalized to 1 W input power.

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.

System validation dipole	Cal. certificate #	Cal. date	Cal. Freq. (GHz)	SAR Avg (mW/g)		
				Tissue:	Head	Body
D835V2	D835V2-4d002_Apr09	04/23/09	0.835	SAR _{1g} :	9.64	9.96
				SAR _{10g} :	6.28	6.56
D1900V2	D1900V2-5d043_Nov09	11/24/09	1.9	SAR _{1g} :	39.8	40.4
				SAR _{10g} :	20.7	21.4
D2450V2	D2450V2-706_Apr10	4/19/10	2.4	SAR _{1g} :	51.6	52.4
				SAR _{10g} :	24.4	24.5

8.1. SYSTEM CHECK RESULTS FOR D835V2

Measured by: Devin Chang

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D835V2	02/05/11	SAR _{1g} :	10.6	9.96	6.43	±10
		SAR _{10g} :	6.97	6.56	6.25	
D835V2	02/07/11	SAR _{1g} :	10.5	9.96	5.42	±10
		SAR _{10g} :	6.89	6.56	5.03	

8.2. SYSTEM CHECK RESULTS FOR D1900V2

Measured by: Devin Chang

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D1900V2	02/04/11	SAR _{1g} :	39.7	40.4	-1.73	±10
		SAR _{10g} :	20.5	21.4	-4.21	

8.3. SYSTEM CHECK RESULTS FOR D2450V2

Measured by: Devin Chang

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D2450V2	02/06/11	SAR _{1g} :	51.7	52.4	-1.34	±10
		SAR _{10g} :	24.0	24.5	-2.04	

9. OUTPUT POWER VERIFICATION

9.1. GSM

GSM (GMSK)

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)
GSM850	128	824.2	32.4
	190	836.6	32.5
	251	848.8	32.5
GSM1900	512	1850.2	30.4
	661	1880	30.3
	810	1909.8	30.4

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	*2 slot	*Frame Avg Pwr
GSM850	128	824.2	32.50	23.50	30.00	24.00
	190	836.6	32.40	23.40	30.00	24.00
	251	848.8	32.50	23.50	30.00	24.00
GSM1900	512	1850.2	30.40	21.40	28.60	22.60
	661	1880	30.40	21.40	28.70	22.70
	810	1909.8	30.30	21.30	28.70	22.70

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slot	Frame Avg Pwr
GSM850	128	824.2	27.00	18.00	27.10	21.10
	190	836.6	27.00	18.00	27.00	21.00
	251	848.8	27.00	18.00	27.10	21.10
GSM1900	512	1850.2	26.10	20.10	26.10	20.10
	661	1880	26.10	20.10	26.10	20.10
	810	1909.8	26.10	20.10	26.10	20.10

Note: For GPRS/EGPRS (MCS 1-4) 2 slots GMSK, output power is programmed to be reduced by 1.5dB from original power setting.

Note: The testing was not done for MCS 1-4 as the power back-off is the same as GPRS CS1-4.

Note: There is no power back-off for MCS 5-9 (8PSK).

9.2. UMTS RELEASE 99

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

WCDMA General Settings	Mode	Rel99
	Subtest	-
	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c/β_d	8/15

Results

Rel 99 (12.2kps RMC)					
Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	Avg Tx Pwr (dBm)
UMTS850 (Band V)	Rel 99 12.2kbps RMC	4132	4357	826.4	23.69
		4183	4408	836.6	23.43
		4233	4458	846.6	23.61
UMTS1900 (Band II)	Rel 99 12.2kbps RMC	9262	9662	1852.4	22.85
		9400	9800	1880.0	22.86
		9538	9938	1907.6	22.81

9.3. UMTS HSDPA

The following 4 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 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			
	Power Control Algorithm	Algorithm 2			
	β_c	2/15	12/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	12/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
CM (dB)	0	1	1.5	1.5	
HSDPA Specific Settings	D _{ACK}	8			
	D _{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	A _{hs} = β_{hs}/β_c	30/15			

Results

Rel 6 HSDPA

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	Avg Tx Pwr (dBm)
UMTS850 (Band V)	Subtest 1	4132	4357	826.4	23.65
		4183	4408	836.6	23.42
		4233	4458	846.6	23.60
	Subtest 2	4132	4357	826.4	22.69
		4183	4408	836.6	22.43
		4233	4458	846.6	22.61
	Subtest 3	4132	4357	826.4	22.29
		4183	4408	836.0	22.13
		4233	4458	846.6	22.21
	Subtest 4	4132	4357	826.4	22.19
		4183	4408	836.4	22.03
		4233	4458	846.6	22.11
UMTS1900 (Band II)	Subtest 1	9262	9662	1852.4	22.84
		9400	9800	1880.0	22.83
		9538	9938	1907.6	22.81
	Subtest 2	9262	9662	1852.4	21.85
		9400	9800	1880.0	21.85
		9538	9938	1907.6	21.81
	Subtest 3	9262	9662	1852.4	21.45
		9400	9800	1880.0	21.55
		9538	9938	1907.6	21.41
	Subtest 4	9262	9662	1852.4	21.55
		9400	9800	1880.0	21.45
		9538	9938	1907.6	21.51

Note: KDB 941225 D01 – Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is < 75% of the SAR limit.

9.4. 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					
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	15/15
	β_{ec}	209/225	12/15	30/15	2/15	24/15
β_c/β_d	11/15	6/15	15/9	2/15	15/15	
β_{hs}	22/15	12/15	30/15	4/15	30/15	
β_{ed}	1309/225	94/75	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					
	DPAK					
	8					
	DCQI					
	8					
	Ack-Nack repetition factor					
3						
CQI Feedback (Table 5.2B.4)						
4ms						
CQI Repetition Factor (Table 5.2B.4)						
2						
Ahs = β_{hs}/β_c						
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
	ETFICI (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 HSDPA/HSUPA

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	Avg Tx Pwr (dBm)
UMTS850 (Band V)	Subtest 1	4132	4357	826.4	23.66
		4182	4407	836.4	23.42
		4233	4458	846.6	23.62
	Subtest 2	4132	4357	826.4	21.96
		4182	4407	836.4	21.82
		4233	4458	846.6	21.92
	Subtest 3	4132	4357	826.4	22.76
		4182	4407	836.4	22.62
		4233	4458	846.6	22.72
	Subtest 4	4132	4357	826.4	21.86
		4182	4407	836.4	21.72
		4233	4458	846.6	21.77
	Subtest 5	4132	4357	826.4	23.61
		4182	4407	836.4	23.38
		4233	4458	846.6	23.58
UMTS1900 (Band II)	Subtest 1	9262	9662	1852.4	22.83
		9400	9800	1880.0	22.82
		9538	9938	1907.6	22.82
	Subtest 2	9262	9662	1852.4	21.13
		9400	9800	1880.0	21.12
		9538	9938	1907.6	21.02
	Subtest 3	9262	9662	1852.4	21.93
		9400	9800	1880.0	21.97
		9538	9938	1907.6	21.95
	Subtest 4	9262	9662	1852.4	21.03
		9400	9800	1880.0	21.05
		9538	9938	1907.6	21.04
	Subtest 5	9262	9662	1852.4	22.81
		9400	9800	1880.0	22.81
		9538	9938	1907.6	22.80

Note: KDB 941225 D01 – Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2kbps RMC is ≤ 75% of the SAR limit.

9.5. WIFI RF OUTPUT POWER

MURATA unit

802.11b

Channel #	Freq. (MHz)	Avg Power (dBm)
Low	2412	16.5
Middle	2437	16.6
High	2462	16.6

802.11g

Low	2412	13.0
Middle	2437	16.5
High	2462	14.0

802.11n HT20

Low	2412	13.0
Middle	2437	16.5
High	2462	14.1

Note: KDB 248227 - SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

10. SUMMARY OF TEST RESULTS

10.1. GSM850

Body with 1.0 cm separation distance (Wireless routers incorporated in device)

Test position	Mode	UL Ch No.	f (MHz)	SAR (mW/g)	
				1-g	10-g
Front side (Face up)	GPRS 2 slots	128	824.2	0.730	0.532
		190	836.6	0.825	0.606
		251	848.8	0.889	0.661
	GPRS 1 slots	190	836.6	0.757	0.556
Back side (Face down)	GPRS 2 slots	128	824.2	0.790	0.567
		190	836.6	0.901	0.652
		251	848.8	0.984	0.720
	GPRS 1 slots	190	836.6	0.796	0.575
	EGPRS 2 slots	190	836.6	0.506	0.361
	EGPRS 1 slots	190	836.6	0.253	0.184
Left edge	GPRS 2 slots	190	836.6	0.703	0.486
	GPRS 1 slots	190	836.6	0.622	0.431
Right edge	GPRS 2 slots	190	836.6	0.409	0.270
	GPRS 1 slots	190	836.6	0.382	0.253
Bottom edge	GPRS 2 slots	190	836.6	0.236	0.135
	GPRS 1 slots	190	836.6	0.207	0.119

10.2. GSM1900

Body with 1.0 cm separation distance (Wireless routers incorporated in device)

Test position	Mode	UL Ch No.	f (MHz)	SAR (mW/g)	
				1-g	10-g
Front side (Face up)	GPRS 2 slots	661	1880.0	0.552	0.333
	GPRS 1 slots	661	1880.0	0.408	0.248
	EGPRS 2 slots	661	1880.0	0.301	0.181
	EGPRS 1 slots	661	1880.0	0.145	0.092
Back side (Face down)	GPRS 2 slots	661	1880.0	0.539	0.321
	GPRS 1 slots	661	1880.0	0.394	0.234
Left edge	GPRS 2 slots	661	1880.0	0.524	0.281
	GPRS 1 slots	661	1880.0	0.385	0.207
Right edge	GPRS 2 slots	661	1880.0	0.247	0.138
	GPRS 1 slots	661	1880.0	0.188	0.105
Bottom edge	GPRS 2 slots	661	1880.0	0.333	0.186
	GPRS 1 slots	661	1880.0	0.249	0.138

Note:

WWAN antenna is located at bottom edge; antenna-to-top edge distance is more than 2.5 cm. Based upon Oct. 2010 TCB council workshop - FCC presentation on personal hot spot SAR evaluation guideline, when the antenna-to-edge distance is greater than 2.5, such position does not need to be tested. Top Edge with 1 cm separation distance is excluded from SAR evaluation.

10.3. UMTS BAND V

Body with 1.0 cm separation distance (Wireless routers incorporated in device)

Test position	Mode	UL Ch No.	f (MHz)	SAR (mW/g)	
				1-g	10-g
Front side (Face up)	R99 12.2kbps RMC	4132	826.4		
		4183	836.6	0.795	0.584
		4233	846.6		
Back side (Face down)	R99 12.2kbps RMC	4132	826.4	0.719	0.516
		4183	836.6	0.862	0.626
		4233	846.6	0.820	0.592
Left edge	R99 12.2kbps RMC	4132	826.4	0.893	0.616
		4183	836.6	0.917	0.629
		4233	846.6	1.030	0.705
Right edge	R99 12.2kbps RMC	4132	826.4		
		4183	836.6	0.601	0.402
		4233	846.6		
Bottom edge	R99 12.2kbps RMC	4132	826.4		
		4183	836.6	0.239	0.136
		4233	846.6		

10.4. UMTS BAND II

Body with 1.0 cm separation distance (Wireless routers incorporated in device)

Test position	Mode	UL Ch No.	f (MHz)	SAR (mW/g)	
				1-g	10-g
Front side (Face up)	R99 12.2kbps RMC	9262	1850.2		
		9400	1880.0	0.661	0.399
		9538	1907.6		
Back side (Face down)	R99 12.2kbps RMC	9262	1850.2		
		9400	1880.0	0.660	0.401
		9538	1907.6		
Left edge	R99 12.2kbps RMC	9262	1850.2		
		9400	1880.0	0.607	0.327
		9538	1907.6		
Right edge	R99 12.2kbps RMC	9262	1850.2		
		9400	1880.0	0.265	0.150
		9538	1907.6		
Bottom edge	R99 12.2kbps RMC	9262	1850.2		
		9400	1880.0	0.404	0.221
		9538	1907.6		

Note:

WWAN antenna is located at bottom edge; antenna-to-top edge distance is more than 2.5 cm. Based upon Oct. 2010 TCB council workshop - FCC presentation on personal hot spot SAR evaluation guideline, when the antenna-to-edge distance is greater than 2.5, such position does not need to be tested. Top Edge with 1 cm separation distance is excluded from SAR evaluation.

10.5. WIFI

Body with 1.0 cm separation distance (Wireless routers incorporated in device)

Test position	Mode	UL Ch No.	f (MHz)	SAR (mW/g)	
				1-g	10-g
Front side (Face up)	802.11b	1	2412		
		6	2437	0.121	0.060
		11	2462		
Back side (Face down)	802.11b	1	2412		
		6	2437	0.142	0.075
		11	2462		
Left edge	802.11b	1	2412		
		6	2437	0.047	0.024
		11	2462		
Right edge	802.11b	1	2412		
		6	2437	0.038	0.020
		11	2462		
Top edge	802.11b	1	2412		
		6	2437	0.121	0.061
		11	2462		

Note:

WLAN antenna is located at Left top edge; antenna-to-bottom edge distance are more than 2.5 cm. Based upon Oct. 2010 TCB council workshop - FCC presentation on personal hot spot SAR evaluation guideline, when the antenna-to-edge distance is greater than 2.5, such position does not need to be tested. Bottom edge with 1 cm separation distances are excluded from SAR evaluation.

11. WORST-CASE SAR TEST PLOTS

Worst-case BODY SAR plot for Part 22

Date/Time: 2/5/2011 5:46:11 PM

Test Laboratory: Compliance Certification Services (UL CCS)

UMTS band V_Body

DUT: Apple; Type: NA; Serial: NA

Communication System: UMTS Band V; Frequency: 846.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 846.6$ MHz; $\sigma = 1.02$ mho/m; $\epsilon_r = 54.9$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 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 - SN3749; ConvF(8.79, 8.79, 8.79); Calibrated: 12/13/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Left edge_H-ch/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.18 mW/g

Left edge_H-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

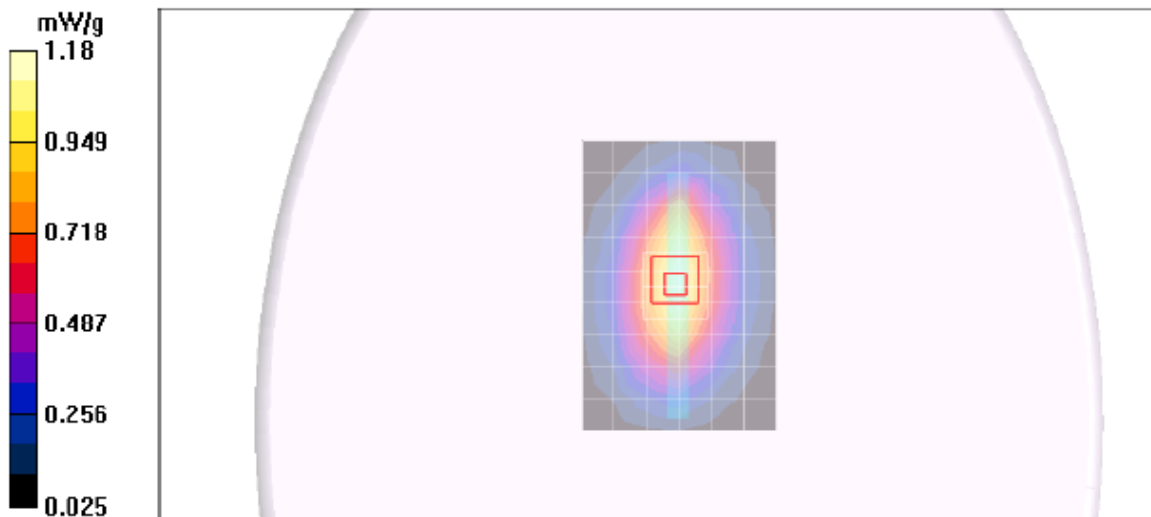
Reference Value = 34.3 V/m; Power Drift = -0.068 dB

Peak SAR (extrapolated) = 1.50 W/kg

SAR(1 g) = 1.03 mW/g; SAR(10 g) = 0.705 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.19 mW/g



Date/Time: 2/5/2011 6:07:35 PM

Test Laboratory: Compliance Certification Services (UL CCS)

UMTS band V_Body

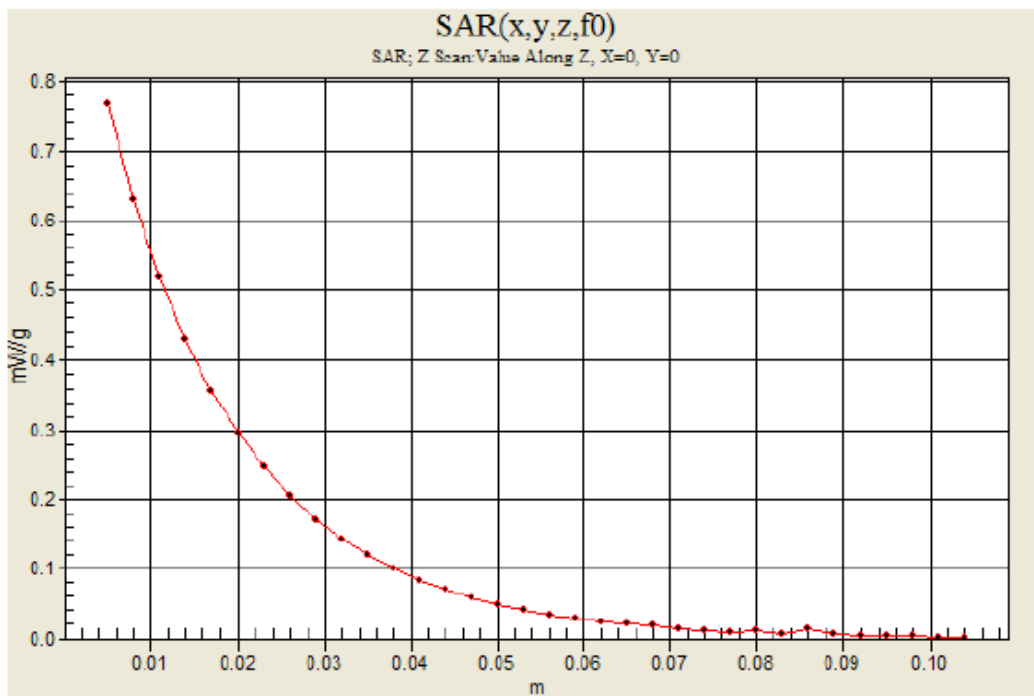
DUT: Apple; Type: NA; Serial: NA

Communication System: UMTS Band V; Frequency: 846.6 MHz; Duty Cycle: 1:1

Left edge_H-ch/Z Scan (1x1x34): Measurement grid: dx=20mm, dy=20mm, dz=3mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.769 mW/g



Worst-case BODY SAR plot for Part 24

Date/Time: 2/4/2011 11:49:56 PM

Test Laboratory: Compliance Certification Services (UL CCS)

UMTS band II_Body

DUT: Apple; Type: NA; Serial: NA

Communication System: UMTS Band II; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.47$ mho/m; $\epsilon_r = 51.8$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

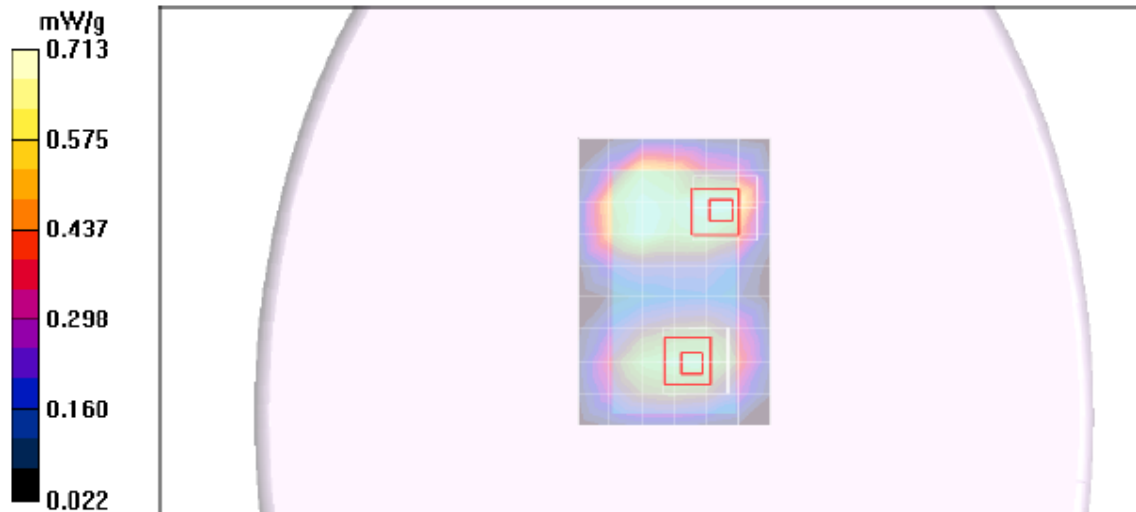
DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(7.33, 7.33, 7.33); Calibrated: 12/13/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Front side_M-ch/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.713 mW/g

Front side_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 22.1 V/m; Power Drift = 0.020 dB
Peak SAR (extrapolated) = 1.14 W/kg
SAR(1 g) = 0.661 mW/g; SAR(10 g) = 0.399 mW/g
Maximum value of SAR (measured) = 0.810 mW/g

Front side_M-ch/Zoom Scan 2 (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 22.1 V/m; Power Drift = 0.020 dB
Peak SAR (extrapolated) = 0.848 W/kg
SAR(1 g) = 0.575 mW/g; SAR(10 g) = 0.376 mW/g
Maximum value of SAR (measured) = 0.667 mW/g



Date/Time: 2/5/2011 12:26:12 AM

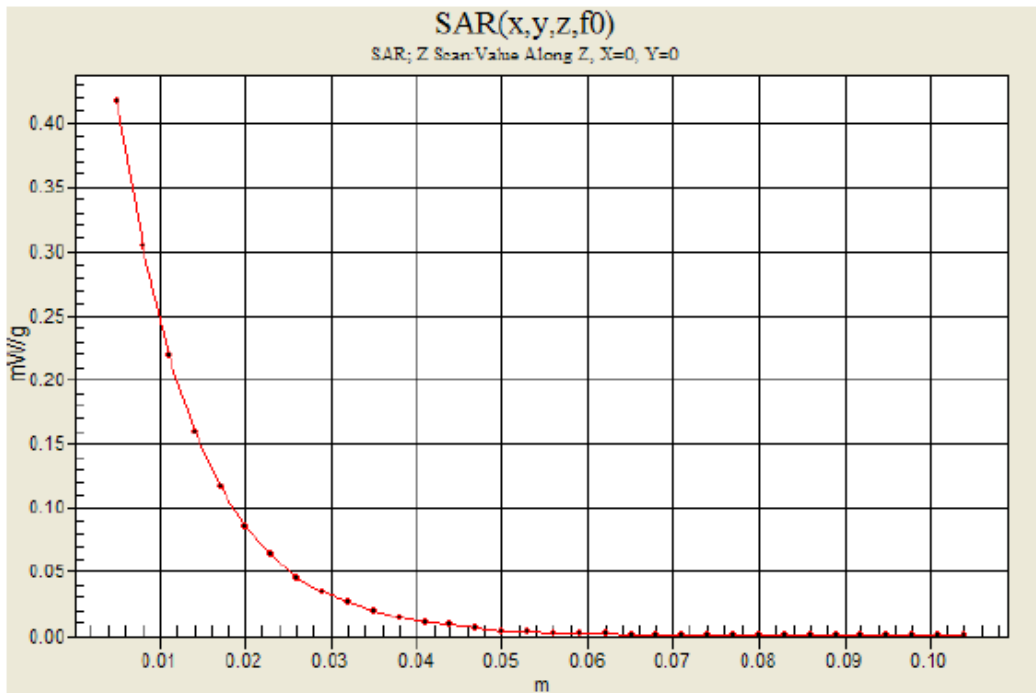
Test Laboratory: Compliance Certification Services (UL CCS)

UMTS band II_Body

DUT: Apple; Type: NA; Serial: NA

Communication System: UMTS Band II; Frequency: 1880 MHz; Duty Cycle: 1:1

Front side_M-ch/Z Scan (1x1x34): Measurement grid: dx=20mm, dy=20mm, dz=3mm
Maximum value of SAR (measured) = 0.417 mW/g



Worst-case BODY SAR plot for Part 15 C

Date/Time: 2/6/2011 3:54:09 PM

Test Laboratory: Compliance Certification Services (UL CCS)

WiFi_Body

DUT: Apple; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.92$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 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 - SN3749; ConvF(6.9, 6.9, 6.9); Calibrated: 12/13/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back side_M-ch/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.160 mW/g

Back side_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

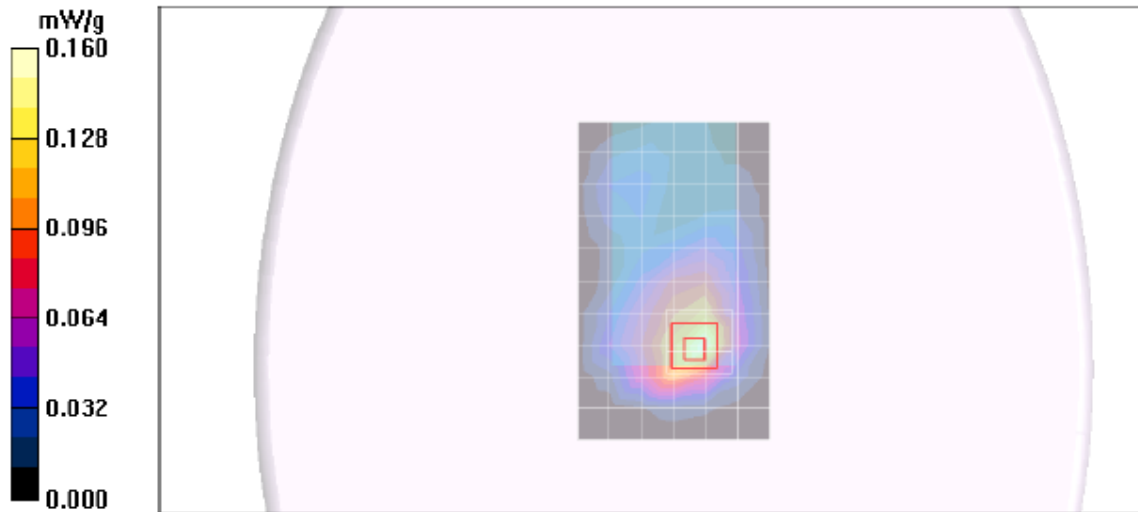
Reference Value = 9.19 V/m; Power Drift = 0.180 dB

Peak SAR (extrapolated) = 0.264 W/kg

SAR(1 g) = 0.142 mW/g; SAR(10 g) = 0.075 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.175 mW/g



12. KDB 648474 SIMULTANEOUS TRANSMISSION CONSIDERATION

SUMMARY OF SAR EVALUATION FOR A CELL PHONE WITH MULTIPLE TRANSMITTERS

<u>Individual Transmitter</u>	<u>Stand-alone SAR</u>
3G	Yes
WiFi	Yes
Bluetooth	Not required (average output is < P _{Ref} / 12mW)

SIMULTANEOUS TRANSMISSION

- 3G can transmit simultaneously with WiFi
- 3G can transmit simultaneously with Bluetooth
- WiFi can not transmit simultaneously with Bluetooth

Simultaneous Transmission – Head

Test Position	Band	Cellular	Wi-Fi	∑ 1-g SAR (W/kg)
Head (LHS Touch)	UMTS Band V	1.00	0.651	1.651*
Head (RHS Touch)	UMTS Band V	0.833	0.583	1.416
Head (LHS Touch)	UMTS Band II	1.17	0.651	1.821*
Head (RHS Touch)	UMTS Band II	1.17	0.583	1.753*
Head (LHS Tilt)	UMTS Band V	0.433	0.871	1.304
Head (RHS Tilt)	UMTS Band V	0.45	0.698	1.148
Head (LHS Tilt)	UMTS Band II	0.411	0.871	1.282
Head (RHS Tilt)	UMTS Band II	0.549	0.698	1.247

NOTE:

- “LHS” means Left-Hand Side; “RHS” means Right-Hand Side.
- GSM Voice call with Hotspot Mode is not a supported configuration.
- All combinations in Hotspot Mode against the head where ∑ 1-g SAR is > 1.6 W/kg are represented in the table above.

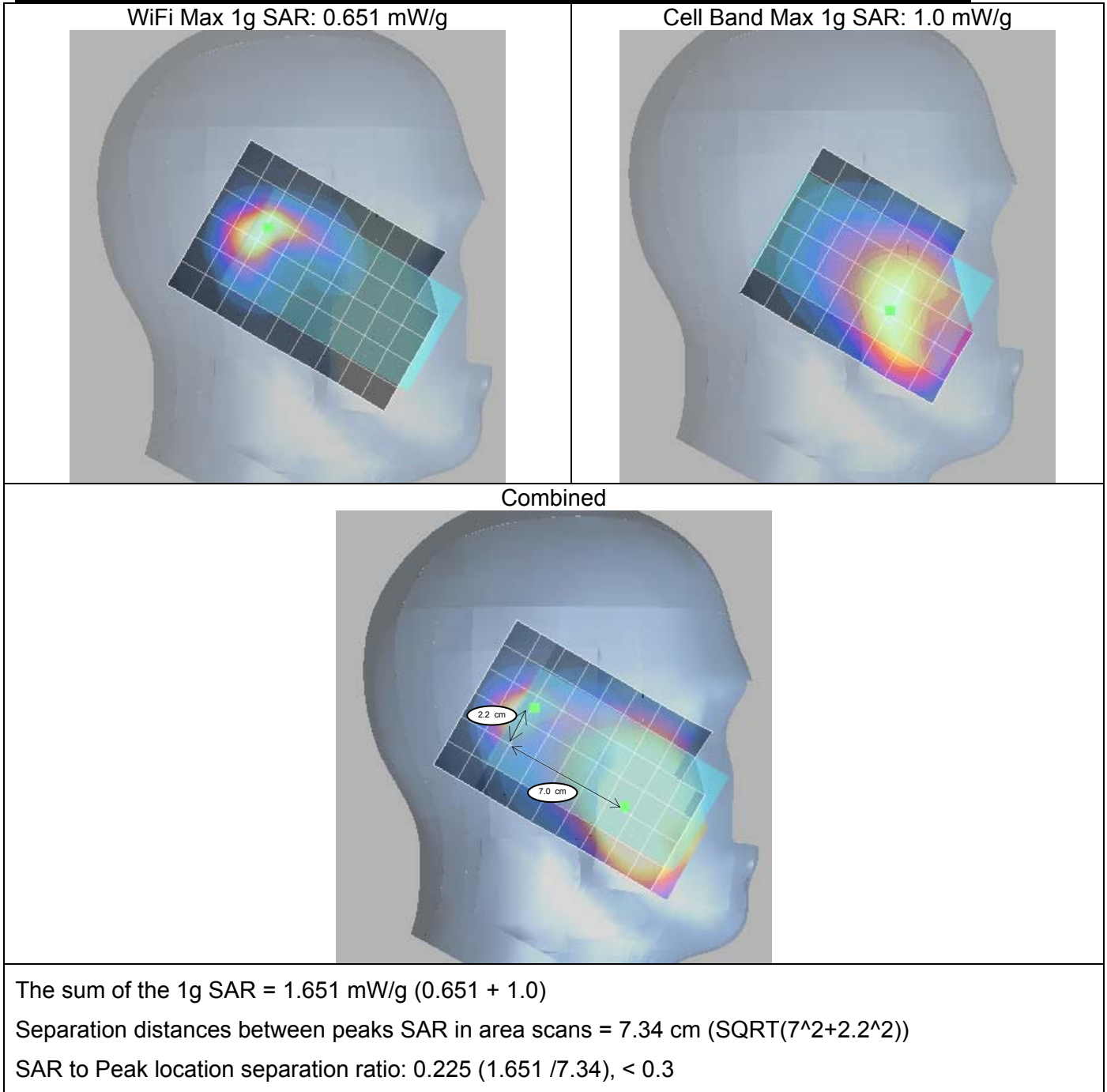
*Antenna Pair SAR to Peak Location Separation Ratio ∑ 1-g SAR > 1.6 W/kg:

∑ 1-g SAR (W/kg)	Separation distance (cm) 3G-to-WiFi antenna	Antenna Pair SAR to Peak Location Separation Ratio
1.651	7.34	0.22
1.821	7.02	0.26
1.753	7.04	0.25

NOTE: This table indicates the actual measured distance between peak SAR locations.

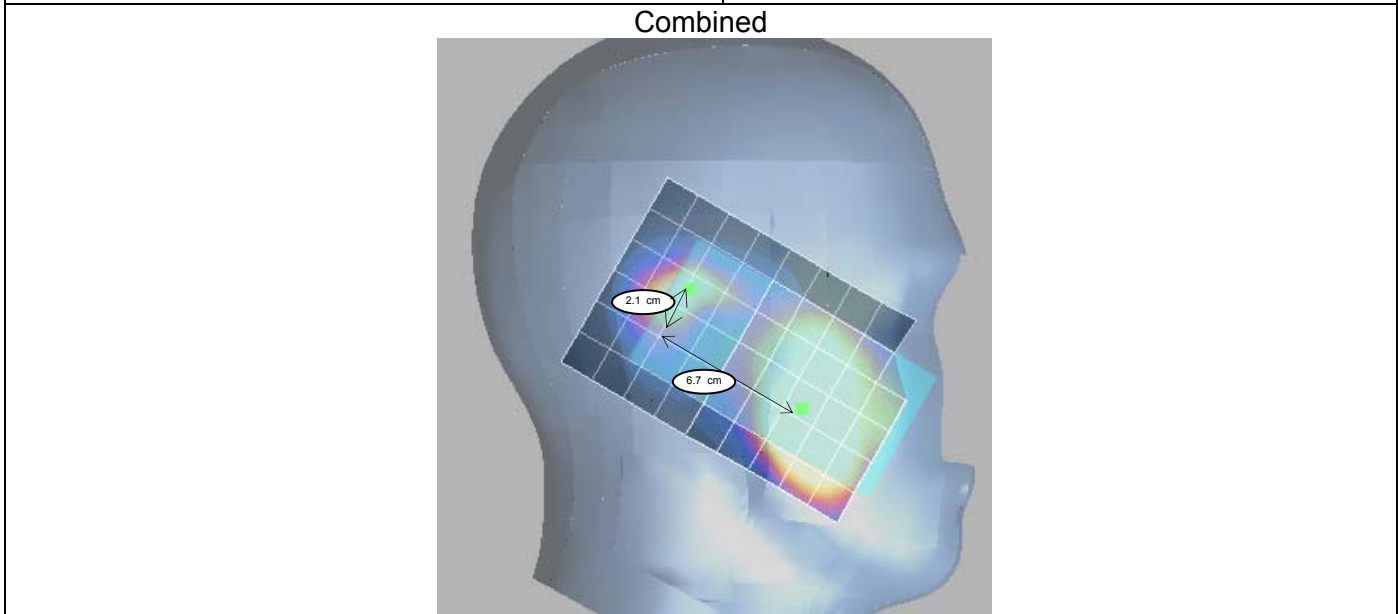
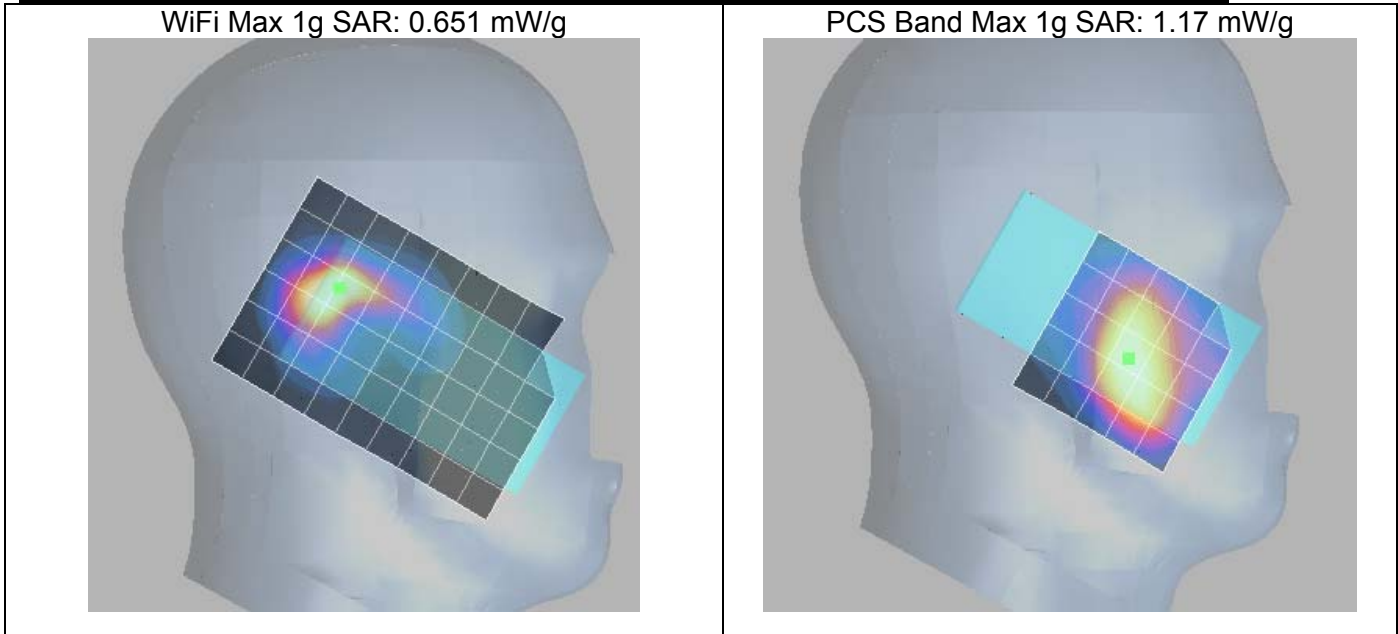
UMTS Band V

Separation distances between Peaks SAR in area scans for Head (LHS Touch) position



UMTS Band V

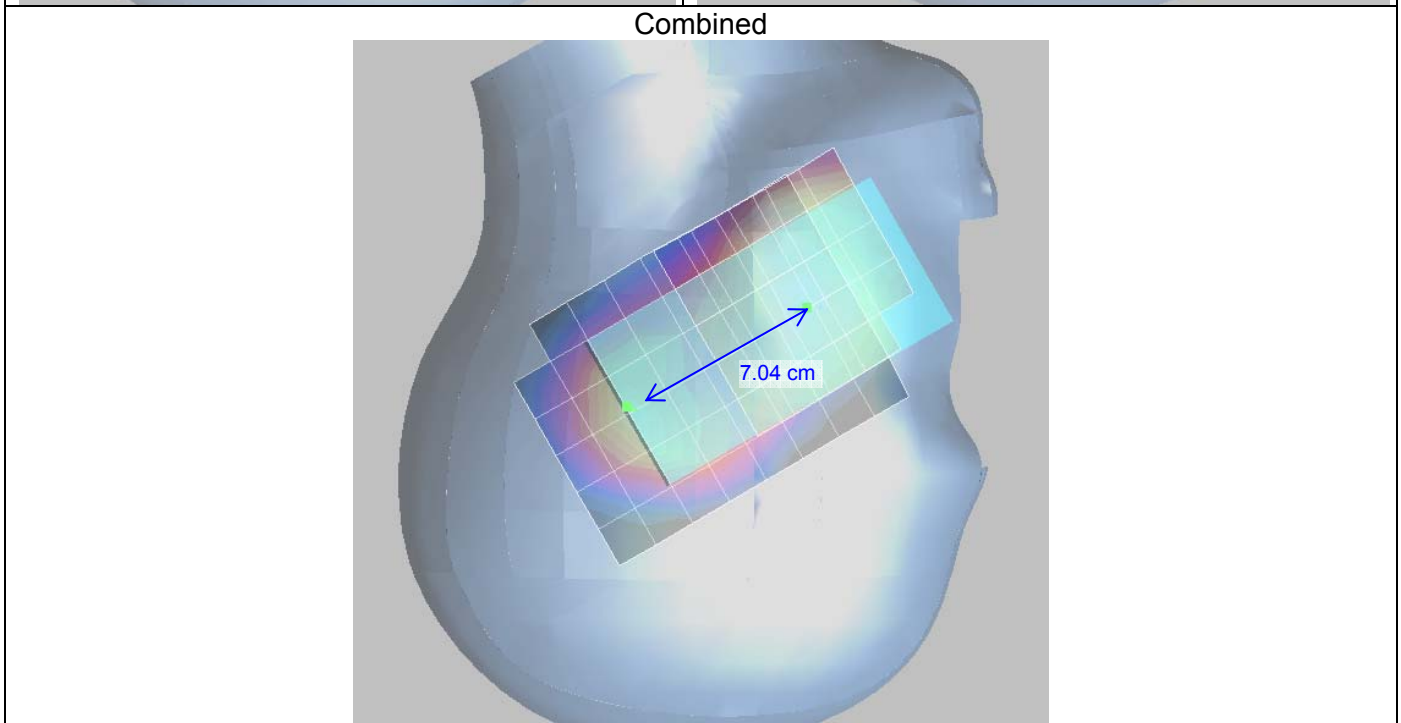
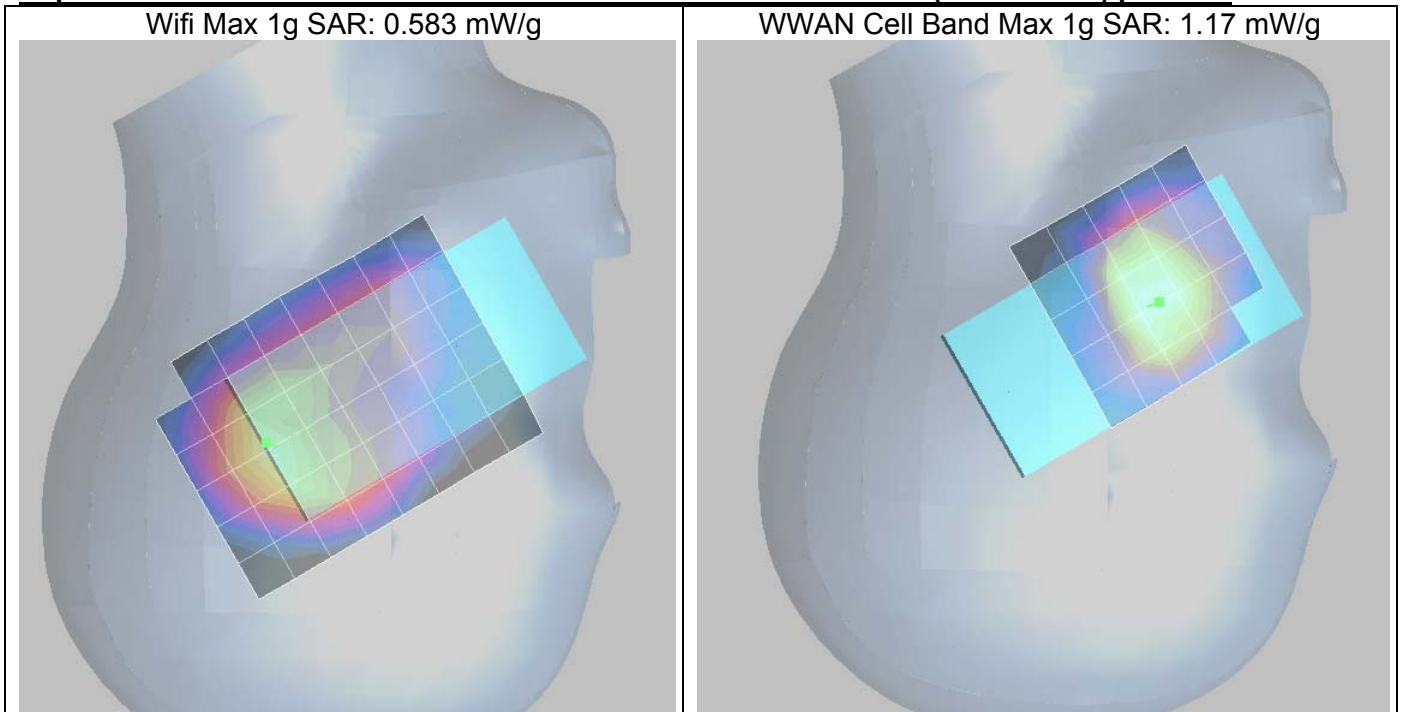
Separation distances between Peaks SAR in area scans for Head (LHS Touch) position



The sum of the 1g SAR = 1.821 mW/g (0.651 + 1.17)
Separation distances between peaks SAR in area scans = 7.02 cm (SQRT(6.7^2)+(2.1^2))
SAR to Peak location separation ratio: 0.259 (1.821 / 7.02), < 0.3

UMTS Band II

Separation distances between Peaks SAR in area scans for Head (RHS Touch) position



The sum of the 1g SAR = 1.753 mW/g (1.17 + 0.583)
Separation distances between peaks SAR in area scans = 7.04 cm [SQRT((X)^2+(Y)^2+(Z)^2)]
SAR to Peak location separation ratio: 0.249 (1.753 /7.04), < 0.3

$$d = \sqrt{(X1 - X2)^2 + (Y1 - Y2)^2 + (Z1 - Z2)^2}$$

Simultaneous Transmission – Body-worn at 15 mm Separation Distance

Test Position	Band	3G	Wi-Fi	\sum 1-g SAR (W/kg)
Body (LCD Down)	GPRS850 2 slots	1.11	0.073	1.183
Body (LCD Down)	UMTS Band II	0.433	0.073	0.506

NOTE:

- Simultaneous transmission SAR is not required for body-worn accessory or Wi-Fi Hotspot Mode because \sum 1-g SAR < 1.6 W/kg.
- The above table reflects the worst-case SAR for body-worn Hotspot Mode and under no conditions will \sum 1-g SAR be > 1.6 W/kg.

The following are the detailed test results taken from Section 10 of Report 10U13135-2C1, dated June 17, 2010:

GSM850

Body with 1.5 cm separation distance

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM850	GSM	Face up	190	836.6	0.760	0.559
		Face down	128	824.2	0.740	0.540
			190	836.6	0.824	0.603
			251	848.8	0.838	0.615
		w/ headset	251	848.8	0.586	0.407
	GPRS 1 slots	Face up	190	836.6	0.620	0.456
		Face down	190	836.6	0.635	0.464
	GPRS 2 slots	Face up	128	824.2	0.937	0.688
			190	836.6	0.994	0.732
			251	848.8	1.020	0.751
		Face down	128	824.2	0.953	0.693
			190	836.6	1.050	0.766
			251	848.8	1.110	0.809
	w/ headset	251	848.8	0.871	0.618	
	EGPRS 1 slots	Face up	190	836.6	0.193	0.141
		Face down	190	836.6	0.198	0.143
	EGPRS 2 slots	Face up	190	836.6	0.378	0.280
		Face down	190	836.6	0.392	0.286
		w/ headset	190	836.6	0.229	0.161

GSM1900

Body with 1.5 cm separation distance

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM1900	GSM	Face up	661	1880.0	0.271	0.170
		w/ headset	661	1880.0	0.200	0.131
		Face down	661	1880.0	0.267	0.174
	GPRS 1 slots	Face up	661	1880.0	0.255	0.163
		Face down	661	1880.0	0.263	0.173
	GPRS 2 slots	Face up	661	1880.0	0.321	0.211
		Face down	661	1880.0	0.346	0.227
		w/ headset	661	1880.0	0.281	0.177
	EGPRS 1 slots	Face up	661	1880.0	0.090	0.060
		Face down	661	1880.0	0.096	0.063
	EGPRS 2 slots	Face up	661	1880.0	0.183	0.121
		Face down	661	1880.0	0.195	0.127
		w/ headset	661	1880.0	0.162	0.107

UMTS Band V

Body with 1.5 cm separation distance

Band	Mode	Test position	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
						1-g	10-g
Band V	R99 12.2kbps RMC	Face up	4132	4357	826.4		
			4183	4408	836.6	0.728	0.536
			4233	4458	846.6		
		Face down	4132	4357	826.4		
			4183	4408	836.6	0.774	0.567
			4233	4458	846.6		
w/ headset	4233	4458	846.6	0.540	0.385		

UMTS Band II

Body with 1.5 cm separation distance

Band	Mode	Test position	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
						1-g	10-g
Band II	R99 12.2kbps RMC	Face up	9262	9662	1850.2		
			9400	9800	1880.0	0.424	0.275
			9538	9938	1907.6		
		Face down	9262	9662	1850.2		
			9400	9800	1880.0	0.433	0.283
			9538	9938	1907.6		
w/ headset	9400	9800	1880.0	0.331	0.219		

WiFi

Body with 1.5 cm separation distance

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
2.4 GHz	802.11b	Face up	1	2412		
			6	2437	0.055	0.030
			11	2462		
		Face down	1	2412		
			6	2437	0.073	0.041
			11	2462		
w/ headset	6	2437	0.072	0.040		

Simultaneous Transmission – Hotspot Mode at 10 mm Separation Distance

Test Position	Band	3G	Wi-Fi	Σ 1-g SAR (W/kg)
Left edge	UMTS Band V	1.03	0.047	1.077
Front side	UMTS Band II	0.661	0.121	0.782
Back side	GPRS850 2 slots	0.984	0.142	1.126
Back side	UMTS Band II	0.660	0.142	0.802

NOTE:

- Simultaneous transmission SAR is not required for body-worn accessory or Wi-Fi Hotspot Mode because Σ 1-g SAR is < 1.6 W/kg.
- The above table reflects the worst-case SAR for Hotspot Mode and under no conditions will Σ 1-g SAR be > 1.6 W/kg.

The following are the detailed test results taken from Section 10 of Report 11U13664-1A, dated February 21, 2011:

GSM850

Body with 1.0 cm separation distance (Wireless routers incorporated in device)

Test position	Mode	UL Ch No.	f (MHz)	SAR (mW/g)	
				1-g	10-g
Front side (Face up)	GPRS 2 slots	128	824.2	0.730	0.532
		190	836.6	0.825	0.606
		251	848.8	0.889	0.661
	GPRS 1 slots	190	836.6	0.757	0.556
Back side (Face down)	GPRS 2 slots	128	824.2	0.790	0.567
		190	836.6	0.901	0.652
		251	848.8	0.984	0.720
	GPRS 1 slots	190	836.6	0.796	0.575
	EGPRS 2 slots	190	836.6	0.506	0.361
	EGPRS 1 slots	190	836.6	0.253	0.184
Left edge	GPRS 2 slots	190	836.6	0.703	0.486
	GPRS 1 slots	190	836.6	0.622	0.431
Right edge	GPRS 2 slots	190	836.6	0.409	0.270
	GPRS 1 slots	190	836.6	0.382	0.253
Bottom edge	GPRS 2 slots	190	836.6	0.236	0.135
	GPRS 1 slots	190	836.6	0.207	0.119

GSM1900

Body with 1.0 cm separation distance (Wireless routers incorporated in device)

Test position	Mode	UL Ch No.	f (MHz)	SAR (mW/g)	
				1-g	10-g
Front side (Face up)	GPRS 2 slots	661	1880.0	0.552	0.333
	GPRS 1 slots	661	1880.0	0.408	0.248
	EGPRS 2 slots	661	1880.0	0.301	0.181
	EGPRS 1 slots	661	1880.0	0.145	0.092
Back side (Face down)	GPRS 2 slots	661	1880.0	0.539	0.321
	GPRS 1 slots	661	1880.0	0.394	0.234
Left edge	GPRS 2 slots	661	1880.0	0.524	0.281
	GPRS 1 slots	661	1880.0	0.385	0.207
Right edge	GPRS 2 slots	661	1880.0	0.247	0.138
	GPRS 1 slots	661	1880.0	0.188	0.105
Bottom edge	GPRS 2 slots	661	1880.0	0.333	0.186
	GPRS 1 slots	661	1880.0	0.249	0.138

UMTS Band V

Body with 1.0 cm separation distance (Wireless routers incorporated in device)

Test position	Mode	UL Ch No.	f (MHz)	SAR (mW/g)	
				1-g	10-g
Front side (Face up)	R99 12.2kbps RMC	4132	826.4		
		4183	836.6	0.795	0.584
		4233	846.6		
Back side (Face down)	R99 12.2kbps RMC	4132	826.4	0.719	0.516
		4183	836.6	0.862	0.626
		4233	846.6	0.820	0.592
Left edge	R99 12.2kbps RMC	4132	826.4	0.893	0.616
		4183	836.6	0.917	0.629
		4233	846.6	1.030	0.705
Right edge	R99 12.2kbps RMC	4132	826.4		
		4183	836.6	0.601	0.402
		4233	846.6		
Bottom edge	R99 12.2kbps RMC	4132	826.4		
		4183	836.6	0.239	0.136
		4233	846.6		

UMTS Band II

Body with 1.0 cm separation distance (Wireless routers incorporated in device)

Test position	Mode	UL Ch No.	f (MHz)	SAR (mW/g)	
				1-g	10-g
Front side (Face up)	R99 12.2kbps RMC	9262	1850.2		
		9400	1880.0	0.661	0.399
		9538	1907.6		
Back side (Face down)	R99 12.2kbps RMC	9262	1850.2		
		9400	1880.0	0.660	0.401
		9538	1907.6		
Left edge	R99 12.2kbps RMC	9262	1850.2		
		9400	1880.0	0.607	0.327
		9538	1907.6		
Right edge	R99 12.2kbps RMC	9262	1850.2		
		9400	1880.0	0.265	0.150
		9538	1907.6		
Bottom edge	R99 12.2kbps RMC	9262	1850.2		
		9400	1880.0	0.404	0.221
		9538	1907.6		

WiFi

Body with 1.0 cm separation distance (Wireless routers incorporated in device)

Test position	Mode	UL Ch No.	f (MHz)	SAR (mW/g)	
				1-g	10-g
Front side (Face up)	802.11b	1	2412		
		6	2437	0.121	0.060
		11	2462		
Back side (Face down)	802.11b	1	2412		
		6	2437	0.142	0.075
		11	2462		
Left edge	802.11b	1	2412		
		6	2437	0.047	0.024
		11	2462		
Right edge	802.11b	1	2412		
		6	2437	0.038	0.020
		11	2462		
Top edge	802.11b	1	2412		
		6	2437	0.121	0.061
		11	2462		

13. ATTACHMENTS

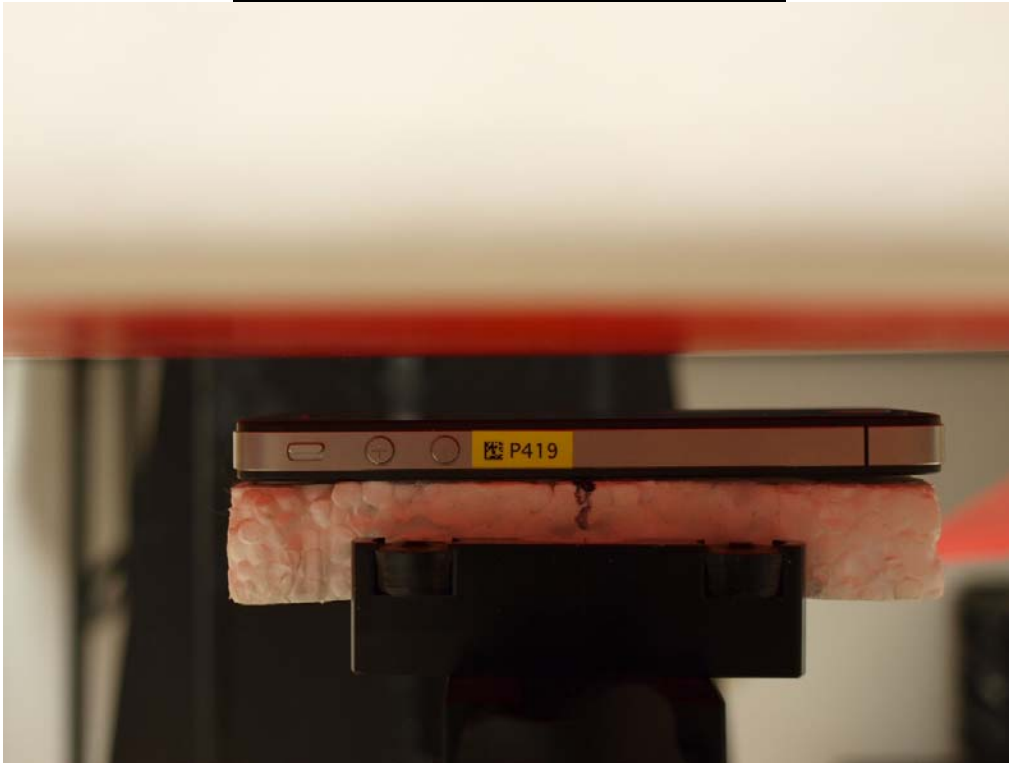
<u>No.</u>	<u>Contents</u>	<u>No. of page (s)</u>
1	System Performance Check Plots	8
2-1	SAR Test Plots for GSM850	17
2-2	SAR Test Plots for GSM1900	17
2-3	SAR Test Plots for UMTS BAND V	10
2-4	SAR Test Plots for UMTS BAND II	6
2-5	SAR Test Plots for WiFi	6
3	Certificate of E-Field Probe - EX3DV4 SN 3749	11
4	Certificate of System Validation Dipole - D835V2 SN:4d002	9
5	Certificate of System Validation Dipole - D1900V2 SN:5d043	9
6	Certificate of System Validation Dipole - D2450V2 SN:748	6

14. ANTENNA LOCATIONS

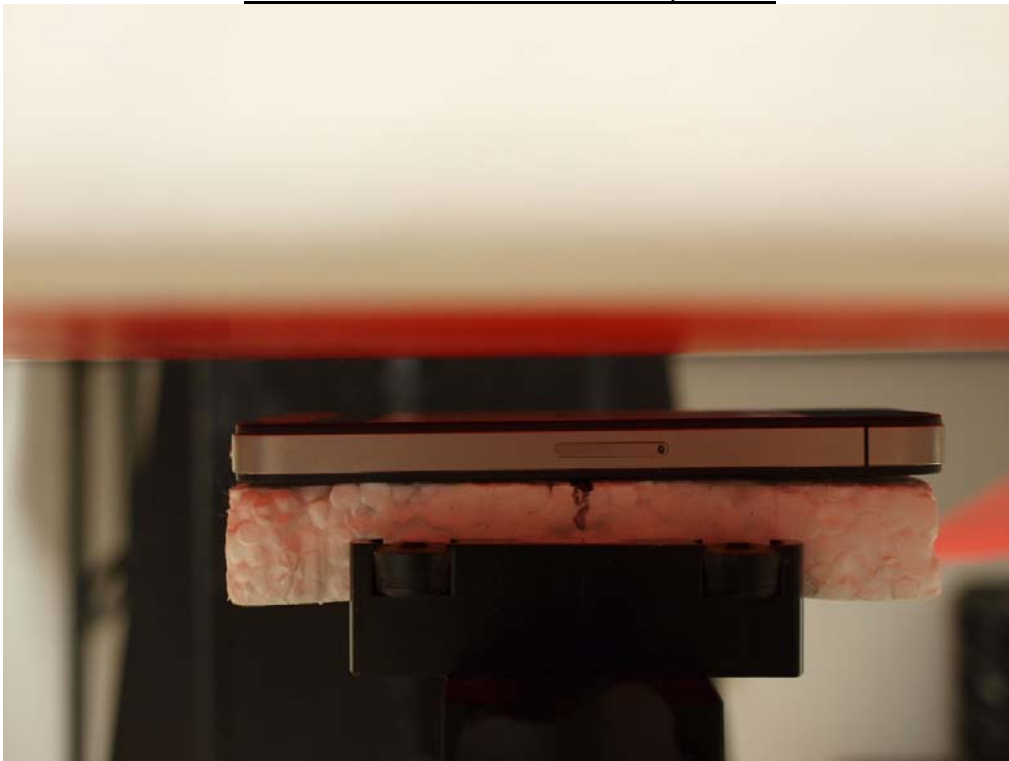


15. TEST SETUP PHOTOS

BODY – FRONT SIDE w/ 1 cm Separation



BODY – BACK SIDE w/ 1 cm Separation



BODY – LEFT EDGE w/ 1 cm Separation



BODY – RIGHT EDGE w/ 1 cm Separation



BODY – TOP EDGE w/ 1 cm Separation



BODY – BOTTOM EDGE w/ 1 cm Separation



16. EXTERNAL PHOTOS

FACE UP



FACE DOWN



END OF REPORT