



FCC OET BULLETIN 65 SUPPLEMENT C 01-01

IEEE STD 1528:2003

SAR EVALUATION REPORT

For

**850/1900 GSM/GPRS, EDGE RX ONLY PHONE WITH BLUETOOTH AND WLAN
TRANSCEIVER**

MODEL: GT-C6712

FCC ID: A3LGTC6712

REPORT NUMBER: 11I13692-3A

ISSUE DATE: March 111, 2011

Prepared for

**SAMSUNG ELECTRONICS CO., LTD.
416, MAETAN 3-DONG, YEONGTONG-GU
SUWON-CITY, GYEONGGI-DO 443-742, SOUTH KOREA**

Prepared by

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



NVLAP LAB CODE 200065-0

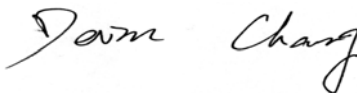
Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	March 10, 2011	Initial Issue	--
A	March 11, 2011	Revised Section 5.1 based on TCB review comment.	Sunny Shih

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS.....	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION.....	5
4. CALIBRATION AND UNCERTAINTY.....	6
4.1. MEASURING INSTRUMENT CALIBRATION.....	6
4.2. MEASUREMENT UNCERTAINTY.....	7
5. EQUIPMENT UNDER TEST	8
6. SYSTEM SPECIFICATIONS.....	9
7. COMPOSITION OF INGREDIENTS FOR TISSUE SIMULATING LIQUIDS	10
8. LIQUID PARAMETERS.....	11
8.1. LIQUID CHECK RESULTS	12
9. SYSTEM VERIFICATION.....	19
9.1. SYSTEM CHECK RESULTS	20
10. SAR MEASUREMENT PROCEDURE.....	21
11. RF OUTPUT POWER VERIFICATION.....	22
11.1. GSM850 and GSM1900.....	22
11.2. WIFI RF OUTPUT POWER.....	23
11.3. BLUETOOTH RF OUTPUT POWER	23
12. SUMMARY OF SAR TEST RESULTS	24
12.1. GSM850.....	24
12.2. GSM1900.....	25
12.3. WIFI.....	26
13. WORST-CASE SAR TEST PLOTS	27
14. KDB 648474 SIMULTANEOUS TRANSMISSION CONSIDERATION	39
15. ATTACHMENTS.....	40
16. ANTENNA LOCATIONS AND SEPARATION DISTANCES	41
17. EST SETUP PHOTOS	42
18. EUT PHOTOS.....	46

1. ATTESTATION OF TEST RESULTS

Applicant:	SAMSUNG ELECTRONICS CO., LTD. 416, MAETAN 3-DONG, YEONGTONG-GU SUWON-CITY, GYEONGGI-DO 443-742, SOUTH KOREA		
EUT description:	850/1900 GSM/GPRS, EDGE Rx only Phone with Bluetooth and WLAN Transceiver		
Model number:	GT-C6712		
Device category:	Portable		
Exposure category:	General Population/Uncontrolled Exposure		
Date tested:	March 2 - 10, 2011		
FCC / IC Rule Parts	Freq. Band [MHz]	Highest 1-g SAR (mW/g)	Limit (mW/g)
22H / RSS-132	824 - 849	Head: 0.311 (RHS Touch) Body: 1.090 (Face Down)	1.6
24E / RSS-133	1850 - 1910	Head: 0.472 (LHS Touch) Body: 0.329 (Face Up)	
15.247 / RSS-102	2412 - 2462	Head: 0.00649 (LHS Tilt) Body: 0.00758 (Face Down)	
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 Associate RF 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, IEEE 1528:2003 and the following specific FCC Test Procedures.

- 648474 D01 SAR Handsets Multi Xmitter and Ant v01r05
- 648474 D02 SAR Policy Handsets Multi Xmitter Ant v01r01
- KDB 248227 D01 SAR meas for 802 11abg v01r02

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
S-Parameter Network Analyzer	Agilent	E5071B	MY42100131	8	2	2011
Signal Generator	Agilent	883732B	US3440599	7	14	2012
E-Field Probe	SPEAG	EX3DV3	3686	1	24	2012
E-Field Probe	SPEAG	EX3DV4	3749	11	13	2011
Data Acquisition Electronics	SPEAG	DAE3 V1	427	7	21	2011
Data Acquisition Electronics	SPEAG	DAE4	1239	11	11	2011
Thermometer	ERTCO	639-1S	1718	7	19	2011
System Validation Dipole	SPEAG	*D835V2	4d002	4	23	2012
System Validation Dipole	SPEAG	*D1900V2	5d043	11	24	2012
System Validation Dipole	SPEAG	D2450V2	706	4	19	2013
Wireless communication test set	Agilent	E5515C (8960)	GB46160222	6	17	2012
Power Meter	Giga-tronics	8651A	8651404	3	13	2012
Power Sensor	Giga-tronics	80701A	1834588	3	13	2012
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	SPEAG	H1900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M1900	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	H900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M900	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	H2450	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 (test data on file in UL CCS)
4. Impedance is within 5Ω of calibrated measurement (test data on file in UL CCS)

4.2. 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 (Head 1900 MHz)	-4.03	Normal	1	0.64	-2.58
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty (Head 835 MHz)	4.00	Normal	1	0.6	2.40
Combined Standard Uncertainty Uc(y) =					10.08
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				20.15	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.59	dB

5. EQUIPMENT UNDER TEST

850/1900 GSM/GPRS, EDGE Rx only Phone with Bluetooth and WLAN Transceiver.

MODEL: GT-C6712

Mobile phone capability: ☐ Class A¹ ☒ Class B² ☐ Class C³

GPRS Multi-slot class: ☒ Class 12 ☐ Class 10 ☐ Class 8

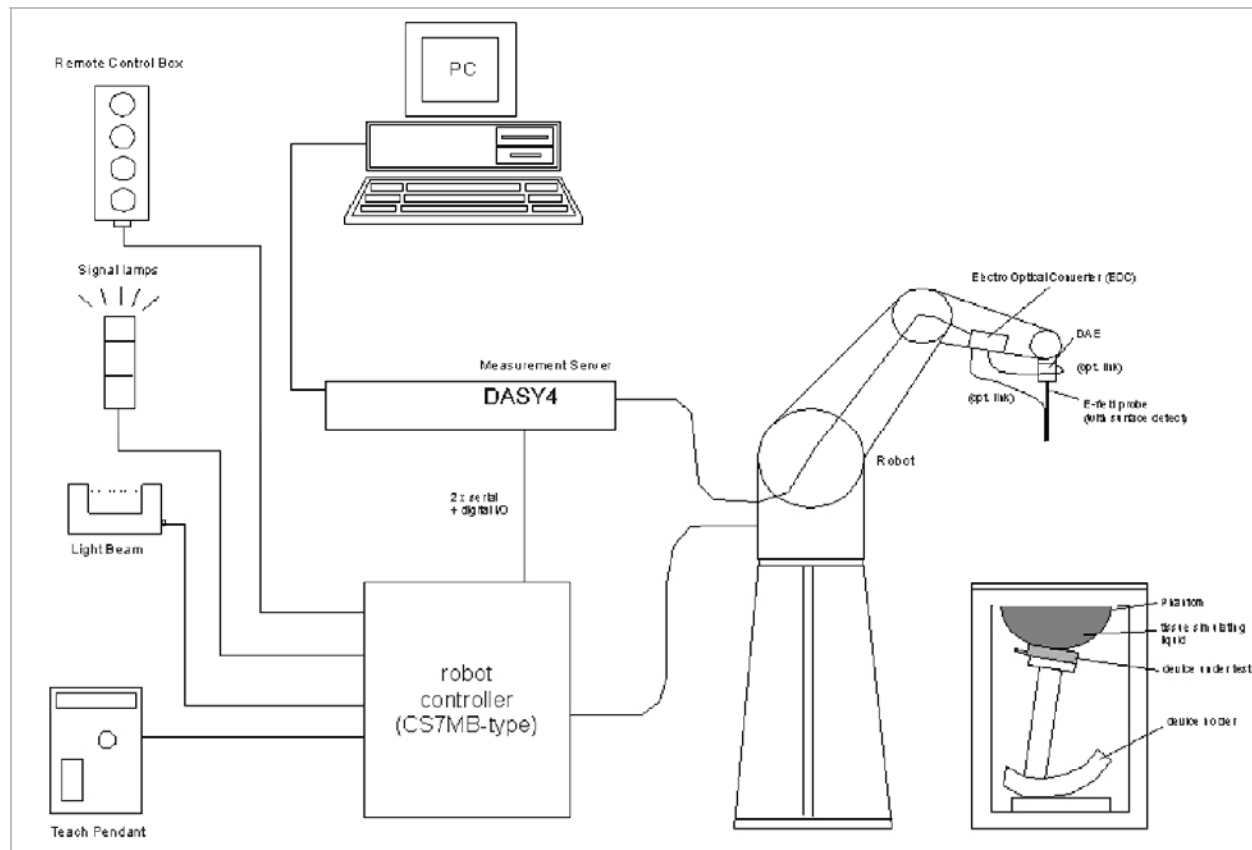
Normal operation:	Held to head Worn on body (Facing-up and Facing-down) with 1.5 cm separation distance
Body Worn Accessory	Headset
Antenna-to-antenna separation distances:	Refer to section 16, Antenna locations and separation distances.
Simultaneous transmission:	○ WWAN can transmit simultaneously with WiFi ○ WWAN can transmit simultaneously with Bluetooth ○ WiFi cannot transmit simultaneously with Bluetooth
WiFi Hot Spot:	This device is not capable of operation as a Personal Wireless Hotspot

¹ Class A mobile phones can be connected to both GPRS and GSM services simultaneously.

² Class B mobile phones can be attached to both GPRS and GSM services, using one service at a time.

³ Class C mobile phones are attached to either GPRS or GSM voice service. You need to switch manually between services

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. 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

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

8.1. LIQUID CHECK RESULTS

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
03/02/2011	Head 2450	e'	39.0753	Relative Permittivity (ϵ_r):	39.08	39.20	-0.32	5
		e''	13.2926	Conductivity (σ):	1.81	1.80	0.60	5

Liquid Check

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

March 02, 2011 10:59 AM

Frequency	e'	e''
2410000000.	39.2864	13.2612
2415000000.	39.2749	13.2685
2420000000.	39.2576	13.2765
2425000000.	39.2346	13.2777
2430000000.	39.2112	13.2806
2435000000.	39.1799	13.2815
2440000000.	39.1461	13.2842
2445000000.	39.1107	13.2884
2450000000.	39.0753	13.2926
2455000000.	39.0359	13.3009
2460000000.	39.0032	13.3084
2465000000.	38.9732	13.3258
2470000000.	38.9458	13.3402
2475000000.	38.9200	13.3625
2480000000.	38.8970	13.3875
2485000000.	38.8816	13.4143

The conductivity (σ) can be given as:

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

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

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

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
03/02/2011	Body 2450	e'	52.0379	Relative Permittivity (ϵ_r):	52.04	52.70	-1.26	5
		e''	14.5636	Conductivity (σ):	1.98	1.95	1.74	5

Liquid Check

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

March 02, 2011 09:31 AM

Frequency	e'	e''
2410000000.	52.1651	14.3776
2415000000.	52.1475	14.3998
2420000000.	52.1273	14.4228
2425000000.	52.1100	14.4457
2430000000.	52.0964	14.4689
2435000000.	52.0797	14.4934
2440000000.	52.0655	14.5186
2445000000.	52.0513	14.5394
2450000000.	52.0379	14.5636
2455000000.	52.0244	14.5846
2460000000.	52.0132	14.6045
2465000000.	51.9985	14.6240
2470000000.	51.9827	14.6418
2475000000.	51.9638	14.6601
2480000000.	51.9457	14.6766
2485000000.	51.9293	14.6922

The conductivity (σ) can be given as:

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

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

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

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)
03/02/2011	Head 835	e'	43.1591	Relative Permittivity (ε _r):	43.16	41.50	4.00
		e''	19.3311	Conductivity (σ):	0.90	0.90	-0.28

Liquid Check

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

March 02, 2011 02:42 PM

Frequency	e'	e''
800000000.	43.5661	19.4098
805000000.	43.5124	19.4061
810000000.	43.4572	19.3962
815000000.	43.3978	19.3858
820000000.	43.3407	19.3734
825000000.	43.2840	19.3633
830000000.	43.2228	19.3450
835000000.	43.1591	19.3311
840000000.	43.0996	19.3174
845000000.	43.0364	19.3049
850000000.	42.9736	19.2856
855000000.	42.9076	19.2748
860000000.	42.8392	19.2503
865000000.	42.7732	19.2434
870000000.	42.7075	19.2288
875000000.	42.6360	19.2105
880000000.	42.5659	19.2007
885000000.	42.5036	19.1916
890000000.	42.4445	19.1778
895000000.	42.3795	19.1742
900000000.	42.3333	19.1671
905000000.	42.2785	19.1576
910000000.	42.2361	19.1408
915000000.	42.1798	19.1323
920000000.	42.1321	19.1208
925000000.	42.0850	19.1059
930000000.	42.0374	19.0921
935000000.	41.9893	19.0790
940000000.	41.9460	19.0722
945000000.	41.8945	19.0530
950000000.	41.8392	19.0396

The conductivity (σ) can be given as:

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

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

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

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)
03/03/2011	Head 1900	e'	40.9181	Relative Permittivity (ε _r):	40.92	40.00	2.30
		e''	12.7175	Conductivity (σ):	1.34	1.40	-4.03

Liquid Check

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

March 04, 2011 09:41 AM

Frequency	e'	e''
1710000000.	41.7391	12.0122
1720000000.	41.6939	12.0533
1730000000.	41.6503	12.0933
1740000000.	41.6045	12.1355
1750000000.	41.5633	12.1783
1760000000.	41.5214	12.2158
1770000000.	41.4818	12.2531
1780000000.	41.4355	12.2918
1790000000.	41.3911	12.3266
1800000000.	41.3469	12.3630
1810000000.	41.2989	12.3962
1820000000.	41.2480	12.4310
1830000000.	41.1989	12.4684
1840000000.	41.1495	12.5023
1850000000.	41.1080	12.5416
1860000000.	41.0662	12.5796
1870000000.	41.0300	12.6145
1880000000.	40.9934	12.6519
1890000000.	40.9588	12.6849
1900000000.	40.9181	12.7175
1910000000.	40.8773	12.7468

The conductivity (σ) can be given as:

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

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

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

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
03/04/2011	Head 1900	e'	40.9181	Relative Permittivity (ε _r):	40.92	40.00	2.30	5
		e''	12.7175	Conductivity (σ):	1.34	1.40	-4.03	5

Liquid Check

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

March 04, 2011 09:41 AM

Frequency	e'	e''
1710000000.	41.7391	12.0122
1720000000.	41.6939	12.0533
1730000000.	41.6503	12.0933
1740000000.	41.6045	12.1355
1750000000.	41.5633	12.1783
1760000000.	41.5214	12.2158
1770000000.	41.4818	12.2531
1780000000.	41.4355	12.2918
1790000000.	41.3911	12.3266
1800000000.	41.3469	12.3630
1810000000.	41.2989	12.3962
1820000000.	41.2480	12.4310
1830000000.	41.1989	12.4684
1840000000.	41.1495	12.5023
1850000000.	41.1080	12.5416
1860000000.	41.0662	12.5796
1870000000.	41.0300	12.6145
1880000000.	40.9934	12.6519
1890000000.	40.9588	12.6849
1900000000.	40.9181	12.7175
1910000000.	40.8773	12.7468

The conductivity (σ) can be given as:

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

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

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

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
835	e'	53.31	Relative Permittivity (ϵ_r):	53.307	55.2	-3.43	± 5
	e''	21.11	Conductivity (σ):	0.981	0.97	1.10	± 5

Liquid Check

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

March 09, 2011 09:31 AM

Frequency	e'	e''
800000000.	53.6474	21.2781
805000000.	53.5937	21.2542
810000000.	53.5436	21.2281
815000000.	53.4959	21.2033
820000000.	53.4464	21.1781
825000000.	53.4052	21.1517
830000000.	53.3549	21.1304
835000000.	53.3066	21.1114
840000000.	53.2582	21.0904
845000000.	53.2120	21.0692
850000000.	53.1652	21.0501
855000000.	53.1149	21.0320
860000000.	53.0698	21.0141
865000000.	53.0203	20.9977
870000000.	52.9765	20.9785
875000000.	52.9328	20.9718
880000000.	52.8880	20.9571
885000000.	52.8321	20.9465
890000000.	52.7775	20.9364
895000000.	52.7258	20.9189
900000000.	52.6849	20.9073
905000000.	52.6300	20.8926
910000000.	52.5816	20.8735
915000000.	52.5310	20.8575
920000000.	52.4915	20.8524
925000000.	52.4352	20.8343
930000000.	52.3863	20.8218
935000000.	52.3379	20.8078
940000000.	52.2878	20.7913
945000000.	52.2405	20.7809
950000000.	52.1870	20.7675

The conductivity (σ) can be given as:

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

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

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

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
03/10/2011	Body 1900	e'	52.0345	Relative Permittivity (ε _r):	52.03	53.30	-2.37	5
		e''	14.1774	Conductivity (σ):	1.50	1.52	-1.46	5

Liquid Check

Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 42%

March 10, 2011 07:17 AM

Frequency	e'	e''
1710000000.	52.7404	13.5716
1720000000.	52.7055	13.6014
1730000000.	52.6683	13.6308
1740000000.	52.6324	13.6633
1750000000.	52.5979	13.6974
1760000000.	52.5622	13.7313
1770000000.	52.5238	13.7703
1780000000.	52.4882	13.8073
1790000000.	52.4485	13.8444
1800000000.	52.4118	13.8799
1810000000.	52.3719	13.9186
1820000000.	52.3318	13.9470
1830000000.	52.2930	13.9763
1840000000.	52.2553	14.0084
1850000000.	52.2166	14.0345
1860000000.	52.1798	14.0625
1870000000.	52.1407	14.0902
1880000000.	52.1036	14.1201
1890000000.	52.0646	14.1499
1900000000.	52.0345	14.1774
1910000000.	52.0027	14.2063

The conductivity (σ) can be given as:

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

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

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

9. 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 SN3531 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	SAR Avg (mW/g)		
			Tissue:	Head	Body
D835V2	D835V2-4d002_Apr09	04/23/09	SAR _{1g} :	9.64	9.96
			SAR _{10g} :	6.28	6.56
D1900V2	D1900V2-5d043_Nov09	11/24/09	SAR _{1g} :	39.8	40.4
			SAR _{10g} :	20.7	21.4
D2450V2	D2450V2-706_Apr10	04/19/10	SAR _{1g} :	51.6	52.4
			SAR _{10g} :	24.4	24.5

9.1. SYSTEM CHECK RESULTS

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Head			
D835V2	03/02/11	SAR _{1g} :	9.45	9.64	-1.97	±10
		SAR _{10g} :	6.18	6.28	-1.59	
System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D835V2	03/09/11	SAR _{1g} :	9.53	9.96	-4.32	±10
		SAR _{10g} :	6.26	6.56	-4.57	
System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D1900V2	03/10/11	SAR _{1g} :	42.0	40.4	3.96	±10
		SAR _{10g} :	22.0	21.4	2.80	
System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Head			
D1900V2	03/04/11	SAR _{1g} :	38.4	39.8	-3.52	±10
		SAR _{10g} :	20.2	20.7	-2.42	
System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D2450V2	03/02/11	SAR _{1g} :	53.8	52.4	2.67	±10
		SAR _{10g} :	24.8	24.5	1.22	

10. 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 $\geq 7 \times 7 \times 9$ 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.

11. RF OUTPUT POWER VERIFICATION

11.1. GSM850 and GSM1900

GSM (GMSK)

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)
GSM850	128	824.2	32.4
	190	836.6	32.2
	251	848.8	32.1
GSM1900	512	1850.2	28.7
	661	1880	28.4
	810	1909.8	28.7

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)				Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slot	Frame Avg Pwr	3 slot	Frame Avg Pwr	4 slot	Frame Avg Pwr
GSM850	128	824.2	32.5	23.5	32.4	26.4	29.6	25.3	28.0	25.0
	190	836.6	32.3	23.3	32.2	26.2	29.5	25.2	27.4	24.4
	251	848.8	32.2	23.2	32.2	26.2	29.3	25.0	27.7	24.7
GSM1900	512	1850.2	28.8	19.8	28.8	22.8	25.2	20.9	23.3	20.3
	661	1880	28.5	19.5	28.5	22.5	25.0	20.7	23.0	20.0
	810	1909.8	28.8	19.8	28.8	22.8	25.2	20.9	23.3	20.3

Note:

- Since the source-based time-averaged output power for EGPRS mode is lower than that in the GPRS mode, therefore Body SAR test reduction is applicable for this device.
- Based on output power above and time slots, the following worst-case configurations were chosen for Body SAR testing.
 - GPRS850 2 time slots
 - GPRS1900 2 time slots

11.2. WIFI RF OUTPUT POWER

802.11b			
Channel #	Freq. (MHz)	Conducted Avg Power	
		(dBm)	(mW)
1	2412	16.60	45.7
6	2437	16.50	44.7
11	2462	16.50	44.7
802.11g			
1	2412	14.06	25.5
6	2437	14.00	25.1
11	2462	14.02	25.2
802.11n HT20			
1	2412	13.2	20.9
6	2437	13.1	20.2
11	2462	13.1	20.4

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

11.3. BLUETOOTH RF OUTPUT POWER

GFSK

Channel #	Freq. (MHz)	Conducted Avg Power	
		(dBm)	(mW)
0	2402	6.90	4.9
39	2442	7.20	5.2
78	2480	7.30	5.4

8PSK

Channel #	Freq. (MHz)	Conducted Avg Power	
		(dBm)	(mW)
0	2402	5.20	3.3
39	2442	5.50	3.5
78	2480	5.60	3.6

Note: According to KDB 648474, Table 2, Unlicensed transmitters

When there is simultaneous transmission, Stand-alone SAR not required when

- ☐ Output $\leq 2 \cdot P_{\text{Ref}}$ (24 mW) and antenna is ≥ 5.0 cm from other antennas
- ☒ Output $\leq P_{\text{Ref}}$ (12 mW) and antenna is ≥ 2.5 cm from other antennas
- ☐ Output $\leq P_{\text{Ref}}$ (12 mW) and antenna is < 2.5 cm from other antennas, each with either output power $\leq P_{\text{Ref}}$ or 1-g SAR < 1.2 W/kg

12. SUMMARY OF SAR TEST RESULTS

12.1. GSM850

Left Hand Side (LHS)

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM850	GSM	Touch	128	824.2		
			190	836.6	0.278	0.207
			251	848.8		
		Tilt (15°C)	128	824.2		
			190	836.6	0.159	0.120
			251	848.8		

Right Hand Side (RHS)

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM850	GSM	Touch	128	824.2		
			190	836.6	0.311	0.227
			251	848.8		
		Tilt (15°C)	128	824.2		
			190	836.6	0.174	0.131
			251	848.8		

Body with 1.5 cm separation distance

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM850	GPRS 2 slots	Face up	128	824.2	0.760	0.563
			190	836.6	0.614	0.455
			251	848.8	0.376	0.277
		Face down	128	824.2	1.090	0.773
			190	836.6	0.762	0.539
			251	848.8	0.461	0.327
		w/ headset	128	824.2	0.661	0.440

Note: Based on output power and time slot, GPRS850 2 time slots was chosen for Body SAR testing.

12.2. GSM1900

Left Hand Side (LHS)

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM1900	GSM	Touch	512	1850.2		
			661	1880.0	0.472	0.279
			810	1909.8		
		Tilt (15°C)	512	1850.2		
			661	1880.0	0.129	0.073
			810	1909.8		

Right Hand Side (RHS)

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM1900	GSM	Touch	512	1850.2		
			661	1880.0	0.425	0.242
			810	1909.8		
		Tilt (15°C)	512	1850.2		
			661	1880.0	0.148	0.084
			810	1909.8		

Body with 1.5 cm separation distance

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM1900	GPRS 2 slots	Face up	512	1850.2		
			661	1880.0	0.329	0.200
			810	1909.8		
		w/ headset	810	1909.8	0.325	0.208
		Face down	512	1850.2		
			661	1880.0	0.293	0.175
			810	1909.8		

Note: Based on output power and time slot, GPRS1900 2 time slots was chosen for Body SAR testing.

12.3. WIFI

Left Hand Side (LHS)

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
2.4 GHz	802.11b	Touch	1	2412		
			6	2437	0.00484	0.00217
			11	2462		
		Tilt (15°C)	1	2412		
			6	2437	0.00649	0.00317
			11	2462		

Right Hand Side (RHS)

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
2.4 GHz	802.11b	Touch	1	2412		
			6	2437	0.00476	0.00222
			11	2462		
		Tilt (15°C)	1	2412		
			6	2437	0.00592	0.00278
			11	2462		

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	0.000333	0.000109
			11	2462		
		Face down	1	2412		
			6	2437	0.00758	0.00282
			11	2462		
		w/ headset	6	2437	0.00545	0.00225

Note: Per KDB 248227, SAR is not required for 802.11g channels when the maximum average output power is less than 1/4 dBm (0.25 dBm) higher than that measured on the corresponding 802.11b channels.

13. WORST-CASE SAR TEST PLOTS

Worst-case Head SAR plot for part 22H

Date/Time: 3/3/2011 9:54:38 AM

Test Laboratory: UL CCS

GSM850_Right Hand Side

DUT: Samsung; Type: NA; Serial: FI 032 C

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.00018
Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.899$ mho/m; $\epsilon_r = 43.14$; $\rho = 1000$ kg/m³
Phantom section: Right Section

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

DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(10.13, 10.13, 10.13); Calibrated: 2/23/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1239; Calibrated: 11/17/2010
- Phantom: SAM with CRP; Type: SAM; Serial: 1602
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

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

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

Maximum value of SAR (measured) = 0.349 mW/g

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

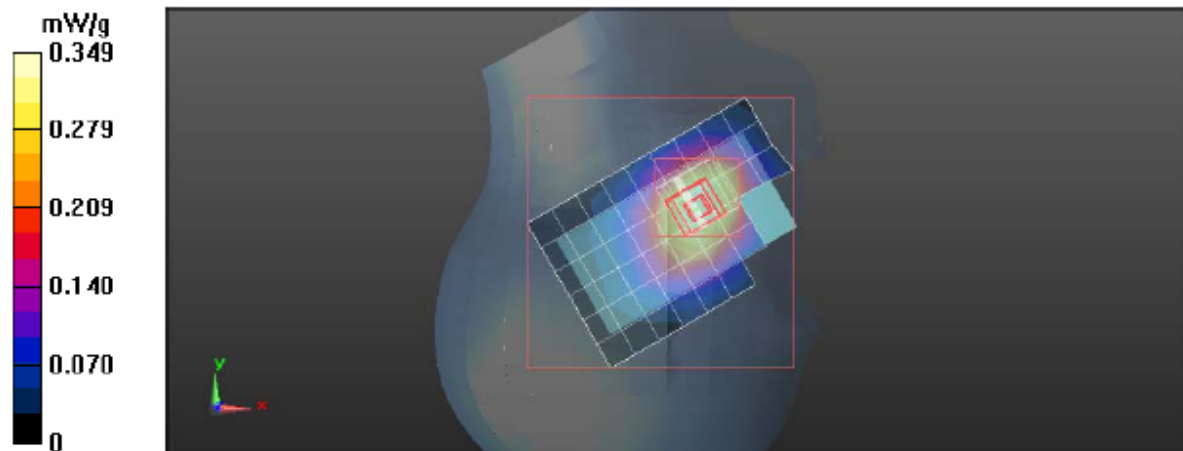
Reference Value = 19.831 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.422 W/kg

SAR(1 g) = 0.311 mW/g; SAR(10 g) = 0.227 mW/g

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

Maximum value of SAR (measured) = 0.355 mW/g



Worst-case Head SAR Z-axis plot for part 22H

Date/Time: 3/3/2011 10:12:47 AM

Test Laboratory: UL CCS

GSM850_Right Hand Side

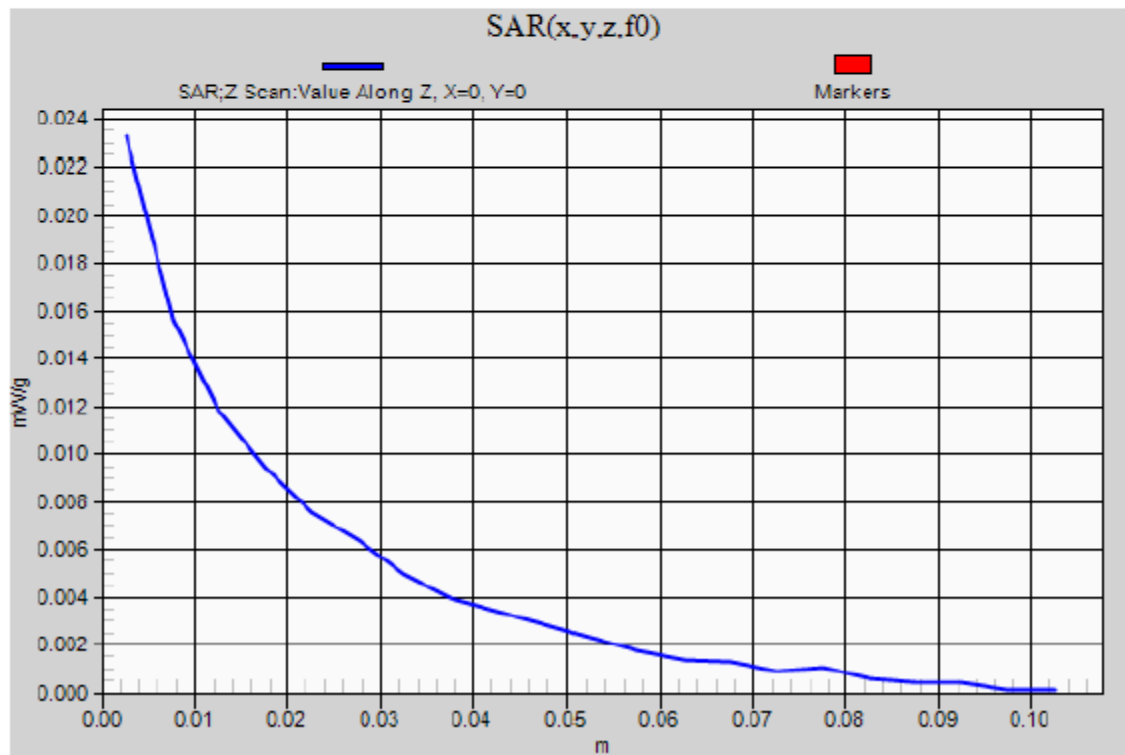
DUT: Samsung; Type: NA; Serial: FI 032 C

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.00018

Touch_M-ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.023 mW/g



Worst-case Body SAR plot for part 22H

Date/Time: 3/9/2011 9:31:44 PM

Test Laboratory: UL CCS

GPRS850 (2slot)

DUT: Samsung; Type: NA; Serial: FI 032 C

Communication System: GPRS850 2slot; Frequency: 824.2 MHz; Duty Cycle: 1:4.00037
Medium parameters used: $f = 825$ MHz; $\sigma = 0.971$ mho/m; $\epsilon_r = 53.405$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

DASY5 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(8.78, 8.78, 8.78); Calibrated: 1/24/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1239; Calibrated: 11/17/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1099
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Face Down/L-ch/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.247 mW/g

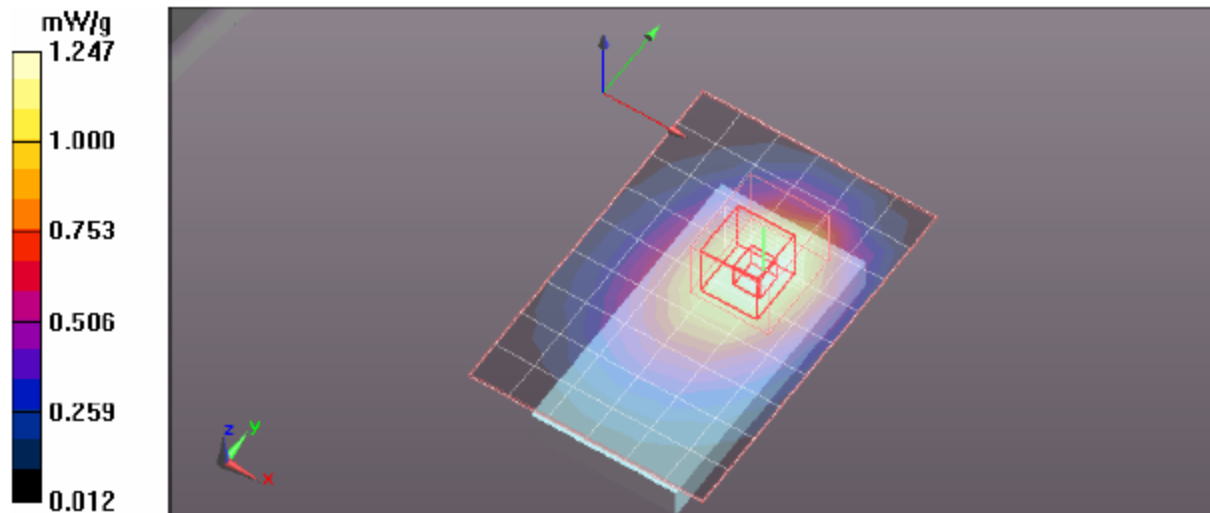
Face Down/L-ch/Zoom Scan (7x8x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 36.144 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.546 W/kg

SAR(1 g) = 1.09 mW/g; SAR(10 g) = 0.773 mW/g

Maximum value of SAR (measured) = 1.279 mW/g



Worst-case Body SAR Z-axis plot for part 22H

Date/Time: 3/9/2011 9:52:29 PM

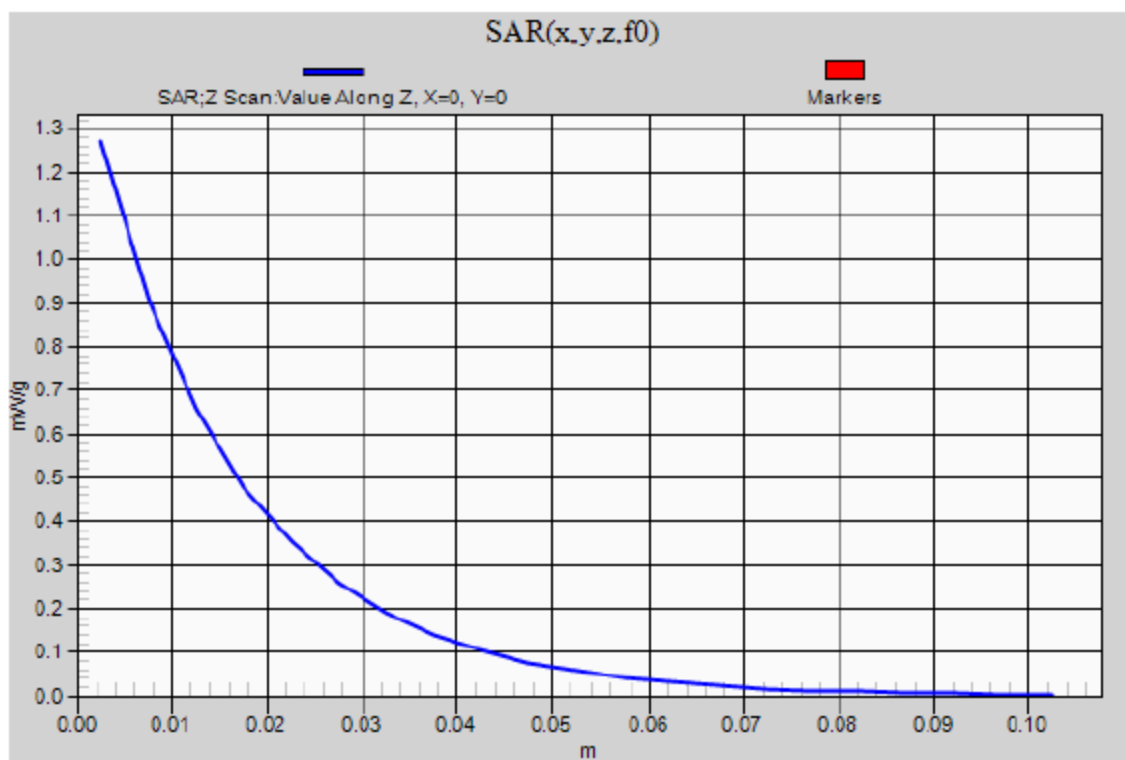
Test Laboratory: UL CCS

GPRS850 (2slot)

DUT: Samsung; Type: NA; Serial: FI 032 C

Communication System: GPRS850 2slot; Frequency: 824.2 MHz; Duty Cycle: 1:4.00037

Face Down/L-ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.270 mW/g



Worst-case Head SAR plot for part 24E

Date/Time: 3/4/2011 1:12:10 PM

Test Laboratory: UL CCS

GSM1900_Left Hand Side

DUT: Samsung; Type: NA; Serial: FI 032 C

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.00018
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.323$ mho/m; $\epsilon_r = 40.993$; $\rho = 1000$ kg/m³
Phantom section: Left Section

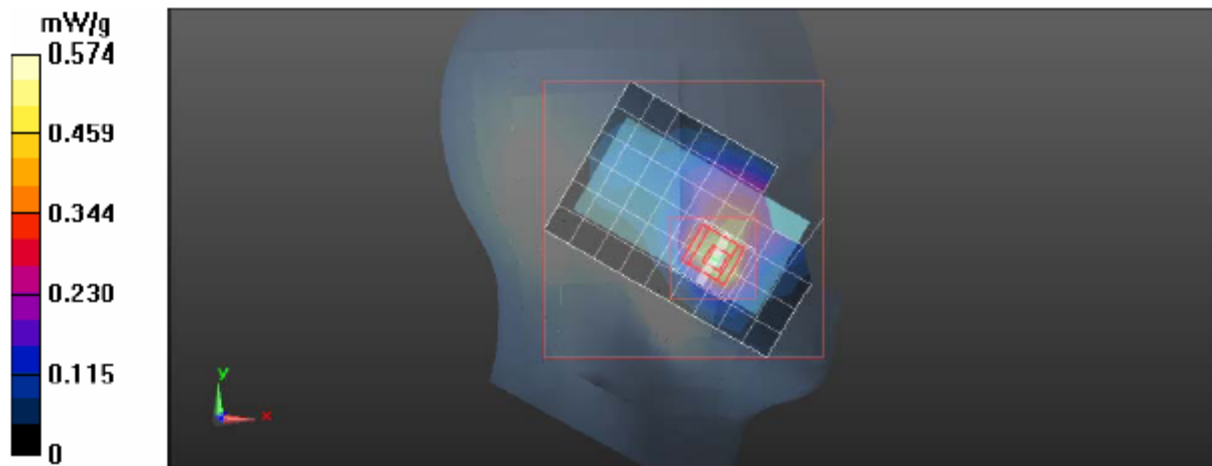
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 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(7.42, 7.42, 7.42); Calibrated: 1/24/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1239; Calibrated: 11/17/2010
- Phantom: SAM with CRP; Type: SAM; Serial: 1602
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Touch_M-ch/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.574 mW/g

Touch_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 21.021 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.723 W/kg
SAR(1 g) = 0.472 mW/g; SAR(10 g) = 0.279 mW/g
Maximum value of SAR (measured) = 0.585 mW/g



Worst-case Head SAR Z-axis plot for part 24E

Date/Time: 3/4/2011 1:30:19 PM

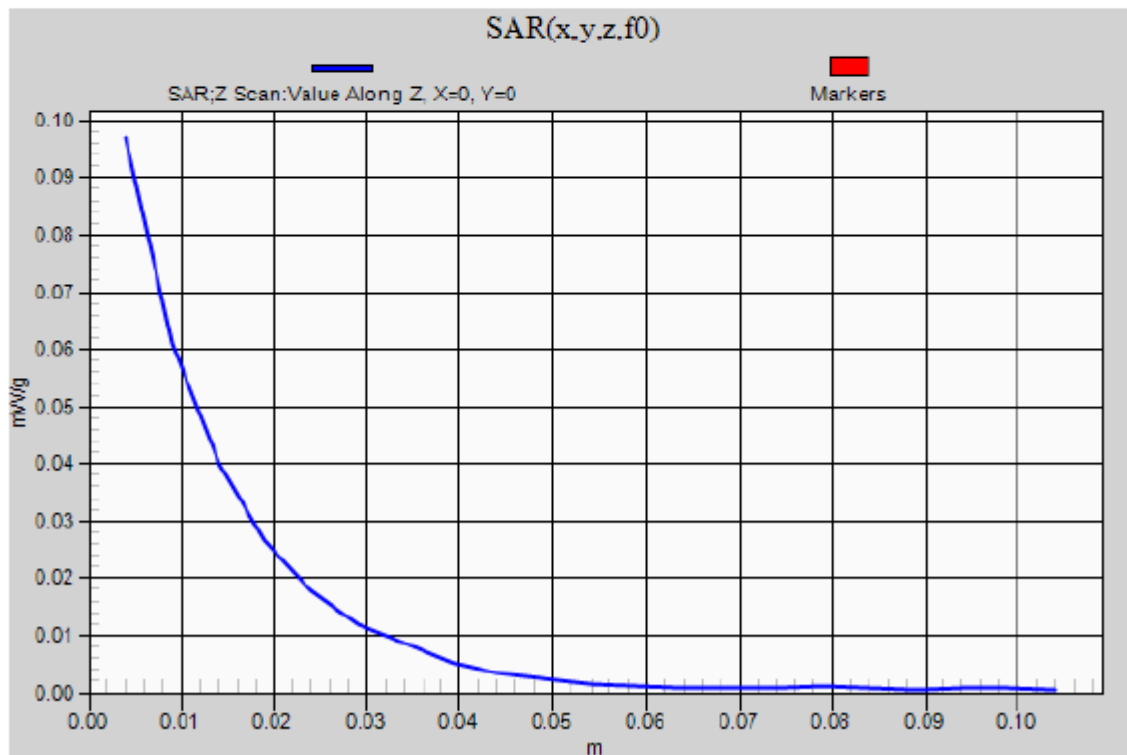
Test Laboratory: UL CCS

GSM1900_Left Hand Side

DUT: Samsung; Type: NA; Serial: FI 032 C

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.00018

Touch_M-ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.097 mW/g



Worst-case Body SAR plot for part 24E

Date/Time: 3/10/2011 2:03:16 PM

Test Laboratory: UL CCS

GPRS1900 (2 slot)

DUT: Samsung; Type: NA; Serial: FI 032 C

Communication System: PCS1900; Frequency: 1880 MHz; Duty Cycle: 1:4.00037
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.477$ mho/m; $\epsilon_r = 52.104$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

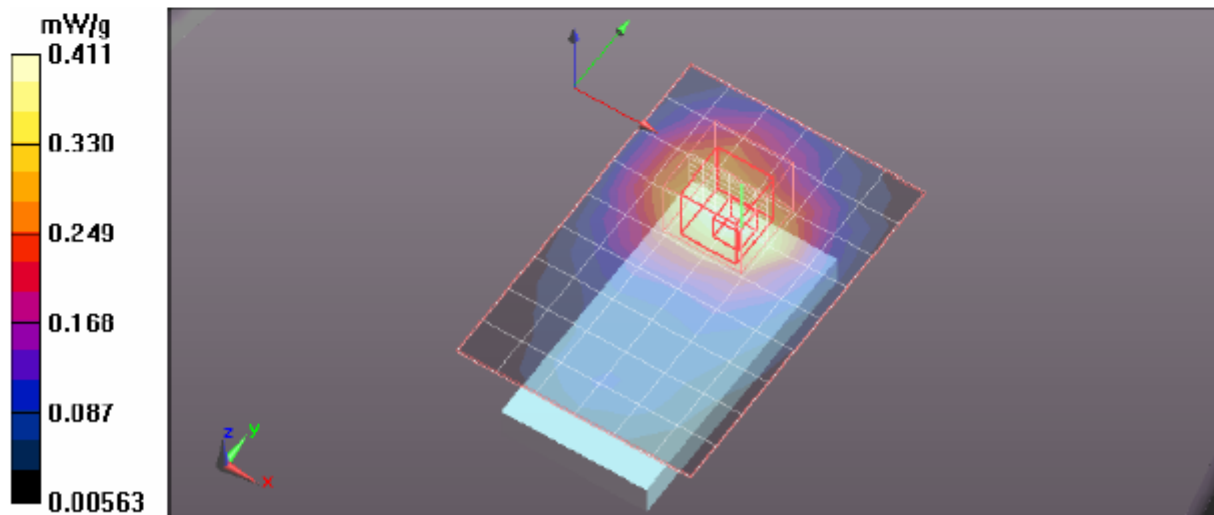
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 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(6.99, 6.99, 6.99); Calibrated: 1/24/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1239; Calibrated: 11/17/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1099
- Measurement SW: DASY52, Version 52.6 (1); SEMCAD X Version 14.4.2 (2595)

Face Up/M-ch/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.411 mW/g

Face Up/M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 16.757 V/m; Power Drift = 1.01 dB
Peak SAR (extrapolated) = 0.528 W/kg
SAR(1 g) = 0.329 mW/g; SAR(10 g) = 0.200 mW/g
Maximum value of SAR (measured) = 0.409 mW/g



Worst-case Body SAR Z-axis plot for part 24E

Date/Time: 3/10/2011 2:21:20 PM

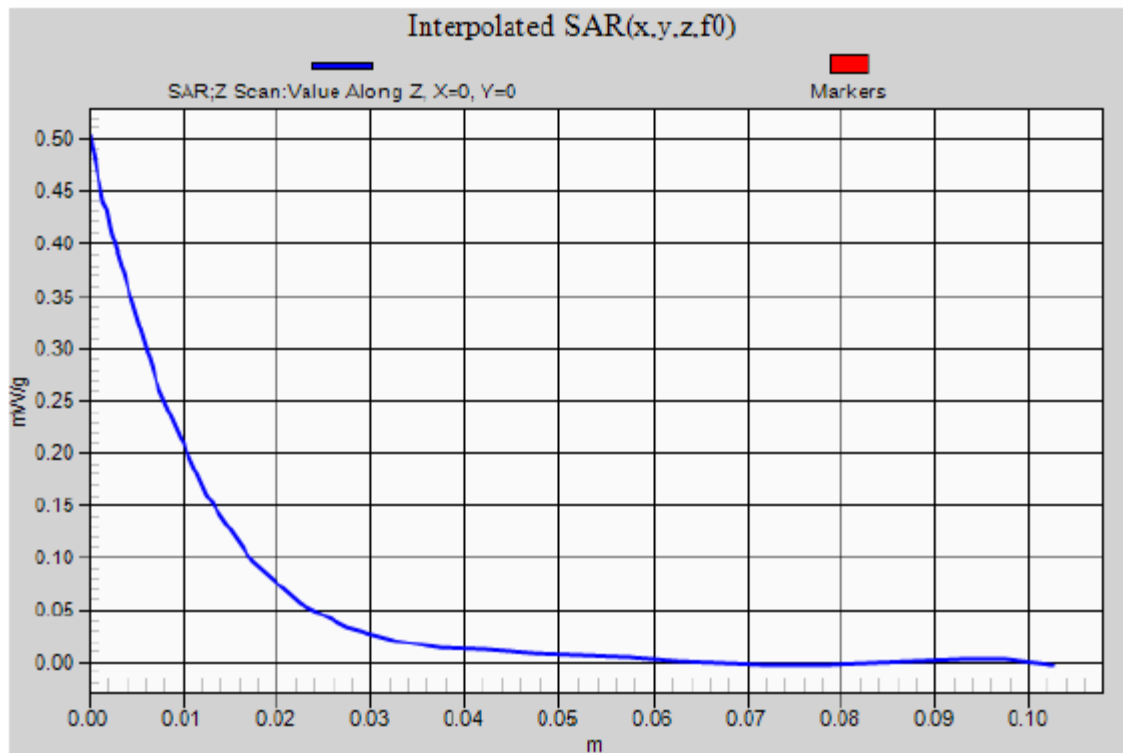
Test Laboratory: UL CCS

GPRS1900 (2 slot)

DUT: Samsung; Type: NA; Serial: FI 032 C

Communication System: PCS1900; Frequency: 1880 MHz; Duty Cycle: 1:4.00037

Face Up/M-ch/Z Scan (1x1x32): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (interpolated) = 0.504 mW/g



Worst-case Head SAR plot for part 15 C

Date/Time: 3/2/2011 1:52:12 PM

Test Laboratory: Compliance Certification Services (UL CCS)

WiFi_Left Hand Side

DUT: Samsung; 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; $\sigma = 1.8$ mho/m; $\epsilon_r = 39.2$; $\rho = 1000$ kg/m³

Phantom section: Left 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(6.69, 6.69, 6.69); Calibrated: 12/13/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: SAM 2 (Twin); Type: SAM 2; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

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

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

Maximum value of SAR (measured) = 0.008 mW/g

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

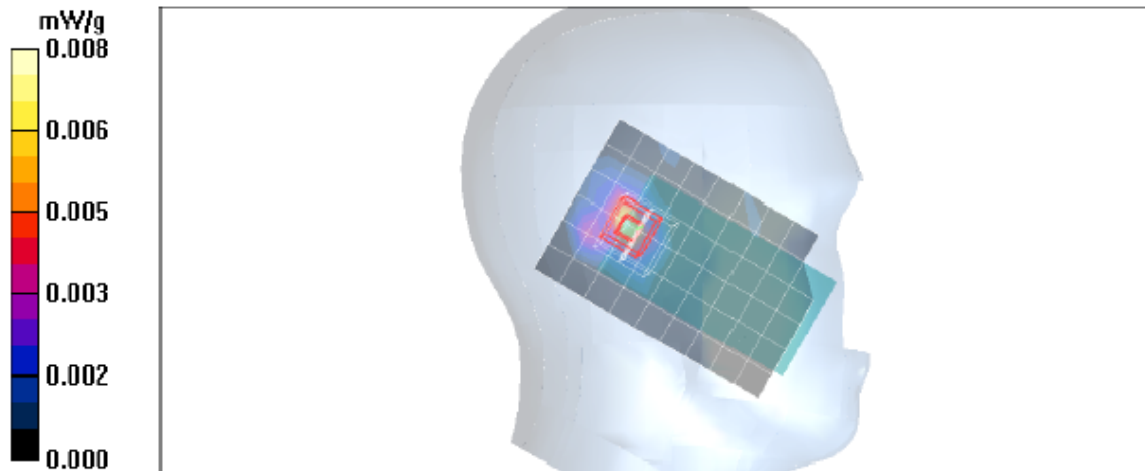
Reference Value = 2.08 V/m; Power Drift = 0.201 dB

Peak SAR (extrapolated) = 0.020 W/kg

SAR(1 g) = 0.00649 mW/g; SAR(10 g) = 0.00317 mW/g

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

Maximum value of SAR (measured) = 0.009 mW/g



Worst-case Head SAR Z-axis plot for part 15 C

Date/Time: 3/2/2011 2:23:37 PM

Test Laboratory: Compliance Certification Services (UL CCS)

WiFi_Left Hand Side

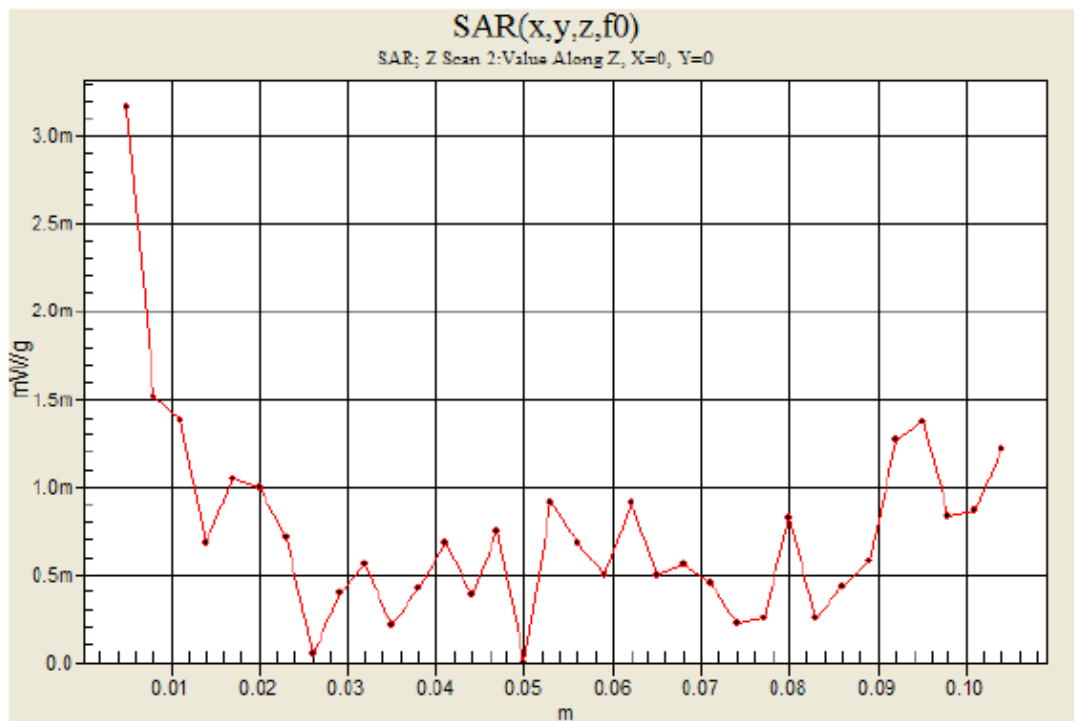
DUT: Samsung; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Tilt_M-ch/Z Scan 2 (1x1x34): Measurement grid: dx=20mm, dy=20mm, dz=3mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.003 mW/g



Worst-case Body SAR plot for part 15 C

Date/Time: 3/2/2011 2:51:30 PM

Test Laboratory: Compliance Certification Services (UL CCS)

WiFi_Body

DUT: Samsung; 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; $\sigma = 1.97$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ 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

Face down_M-ch/Area Scan (6x10x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.012 mW/g

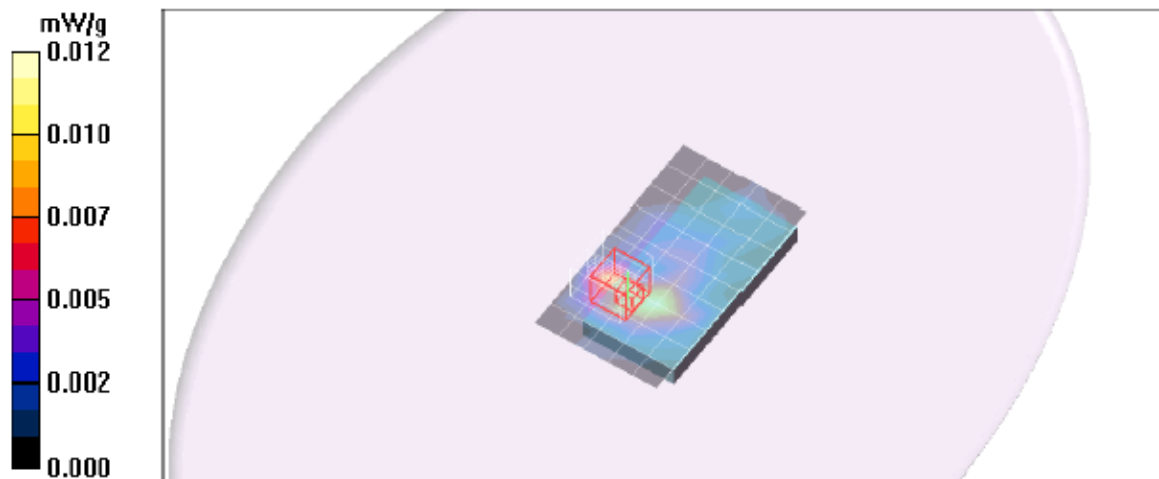
Face down_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 1.87 V/m; Power Drift = 0.176 dB

Peak SAR (extrapolated) = 0.019 W/kg

SAR(1 g) = 0.00758 mW/g; SAR(10 g) = 0.00282 mW/g

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



Worst-case Body SAR Z-axis plot for part 15 C

Date/Time: 3/2/2011 3:12:13 PM

Test Laboratory: Compliance Certification Services (UL CCS)

WiFi_Body

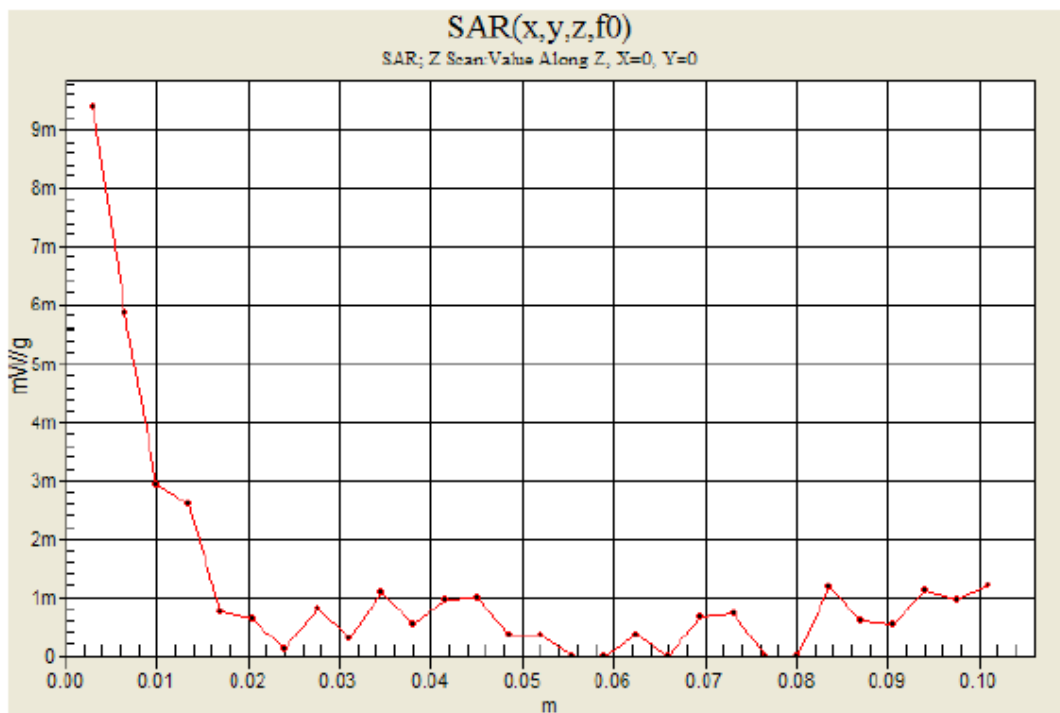
DUT: Samsung; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Face down_M-ch/Z Scan (1x1x29): Measurement grid: dx=20mm, dy=20mm, dz=3.5mm

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

Maximum value of SAR (measured) = 0.009 mW/g



14. 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>
WWAN	Yes
WiFi	Yes
Bluetooth	Not required [average output is < P _{Ref} (12 mW)]

SIMULTANEOUS TRANSMISSION

- WWAN can transmit simultaneously with WiFi
- WWAN can transmit simultaneously with Bluetooth
- WiFi can transmit simultaneously with Bluetooth (WiFi and Bluetooth shared same common antenna)

SIMULTANEOUS SAR TEST DATA SUMMARY

Band	Test Position	Cellular SAR	Wi-Fi SAR	Σ 1-g SAR (W/kg)
GSM850	Head (LHS Touch)	0.278	0.00484	0.283
GSM850	Head (LHS Tilt)	0.159	0.00649	0.165
GSM850	Head (RHS Touch)	0.311	0.00476	0.316
GSM850	Head (RHS Tilt)	0.174	0.00592	0.180
GPRS850	Body (Face up)	0.76	0.000333	0.760
GPRS850	Body (Face down)	1.09	0.00758	1.098
GSM1900	Head (LHS Touch)	0.472	0.00484	0.477
GSM1900	Head (LHS Tilt)	0.129	0.00649	0.135
GSM1900	Head (RHS Touch)	0.425	0.00476	0.430
GSM1900	Head (RHS Tilt)	0.148	0.00592	0.154
GPRS1900	Body (Face up)	0.329	0.000333	0.329
GPRS1900	Body (Face down)	0.293	0.00758	0.301

CONCLUSIONS:

WWAN & WiFi: Simultaneous transmission SAR is not required for WWAN & WiFi because the sum of the 1-g SA is < 1.6 W/kg.

WWAN & Bluetooth: Simultaneous transmission SAR is not required for WWAN & Bluetooth because stand-alone SAR is not required for Bluetooth.

WiFi & Bluetooth: Simultaneous transmission SAR is not required for WiFi & Bluetooth because stand-alone SAR is not required for Bluetooth.

15. ATTACHMENTS

<u>No.</u>	<u>Contents</u>	<u>No. of page (s)</u>
1	System Check Plots	10
2-1	SAR Test Plots for GSM850	13
2-2	SAR Test Plots for GSM1900	9
2-3	SAR Test Plots for WiFi	9
3-1	Certificate of E-Field Probe - EX3DV4 SN 3749	11
3-2	Certificate of E-Field Probe - EX3DV3 SN 3686	11
4	Certificate of System Validation Dipole - D835V2 SN:4d002	11
5	Certificate of System Validation Dipole - D1800V2 SN:294	11
6	Certificate of System Validation Dipole - D2450 SN:706	9