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RSS-102 Supplementary Procedures (SPR)-001, January 1, 2011
IEC 62209-2:2010**

SAR EVALUATION REPORT

For

PCI Express Mini Card

MODEL: E371

FCC ID: PKRNVWE371

IC: 3229A-E371

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Prepared for

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Revision History

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--	September 21, 2011	Initial Issue	--
A	October 5, 2011	Updated report based on reviewer's comments. <ol style="list-style-type: none">1. Added Sec. 14.8 "Scaled SAR due to some of the plots with power drifts over 5% limit"2. Updated uncertainty value from "5%" to "5.7%" of Output Power Variation - SAR drift, due to power drifts over 5%.3. Added test reduction explanation in this report.	Sunny Shih
B	December 8, 2011	Additional test with (E)GPRS mode	Sunny Shih
B1	December 15, 2011	<ul style="list-style-type: none">- Added Phantom thickness and tolerance information in Sec. 10- Added IC reference standard IEC 62209-2	Sunny Shih

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1. Attestation of Test Results

Company name:	NOVATEL WIRELESS INC.		
EUT Description:	E371 Mini Card		
Model number:	E371		
Device Category:	Portable		
Exposure category:	General Population/Uncontrolled Exposure		
Date of tested:	August 15- September 13, 2011 November 9 & 29, 2011 (additional test for (E)GPRS mode)		
FCC / IC Rule Parts	Freq. Range [MHz]	The Highest 1g SAR W/kg	Limit (W/kg)
22H/RSS-132	824 - 849	0.285 mW/g (Horizontal Up)	1.6
24E/RSS-133	1850 - 1910	0.383 mW/g (Horizontal Up)	
Part 27(UMTS Band IV)/RSS-139	1710 - 1755	0.211 mW/g (Horizontal Up)	
Part 27(LTE Band 4)/RSS-139	1710 - 1755	0.339 mW/g (Horizontal Up)	
Part 27(LTE Band 17)	704 - 716	0.080 mW/g (Horizontal Up)	
The most conservative antenna-to-user separation distances used during the test:		25 mm	
Applicable Standards			Test Results
FCC OET Bulletin 65 Supplement C 01-01, IEEE STD 1528:2003, RSS-102 Issue 4, March 2010 and RSS-102 Supplementary Procedures (SPR)-001, January 1, 2011 and IEC 62209-2:2010			Pass
<p>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.</p> <p>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.</p>			
Approved & Released For UL CCS By:		Tested By:	
			
Sunny Shih Engineering Team Leader Compliance Certification Services (UL CCS)		Chakrit Thammanavarat 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, IEEE STD 1528:2003, RSS-102 Issue 4, March 2010, RSS-102 Supplementary Procedures (SPR)-001, January 1, 2011, ICE 62209-2:2010 and the following specific FCC Test Procedures.

- 616217 D03 Supp Note and Netbook Laptop v01
- 447498 D01 Mobile Portable RF Exposure v04
- 941225 D01 SAR test for 3G devices
- 941225 D02 Guidance for 3GPP R6 and R7 HSPA v02v01
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D05 SAR for LTE Devices v01

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
Dielectronic Probe kit	HP	85070C	N/A	N/A		
Base Station Simulator	Agilent	8960	GB46160222	6	17	2012
Base Station Simulator	R & S	CMU 200	106291	6	24	2012
Base Station Simulator	Anritsu	MT8820C	6200985430	6	17	2012
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	2	2	2012
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3772	5	3	2012
E-Field Probe	SPEAG	EX3DV4	3773	5	3	2012
E-Field Probe	SPEAG	EX3DV4	3886	1	24	2012
Thermometer	ERTCO	639-1S	1718	7	19	2012
Data Acquisition Electronics	SPEAG	DAE4	1258	5	2	2012
Data Acquisition Electronics	SPEAG	DAE4	1239	10	18	2012
System Validation Dipole	SPEAG	D835V2	4d117	4	15	2012
System Validation Dipole	SPEAG	D1900V2	5d140	4	18	2012
Power Meter	Giga-tronics	8651A	8651404	5	13	2012
Power Sensor	Giga-tronics	80701A	1834588	5	13	2012
Power Meter	HP	437B	3125U16345	5	13	2012
Power Sensor	HP	8481A	2702A60780	5	13	2012
Amplifier	MITEQ	4D00400600-50-30P	1620606	N/A		
Directional coupler	Werlatone	C8060-102	2141	N/A		

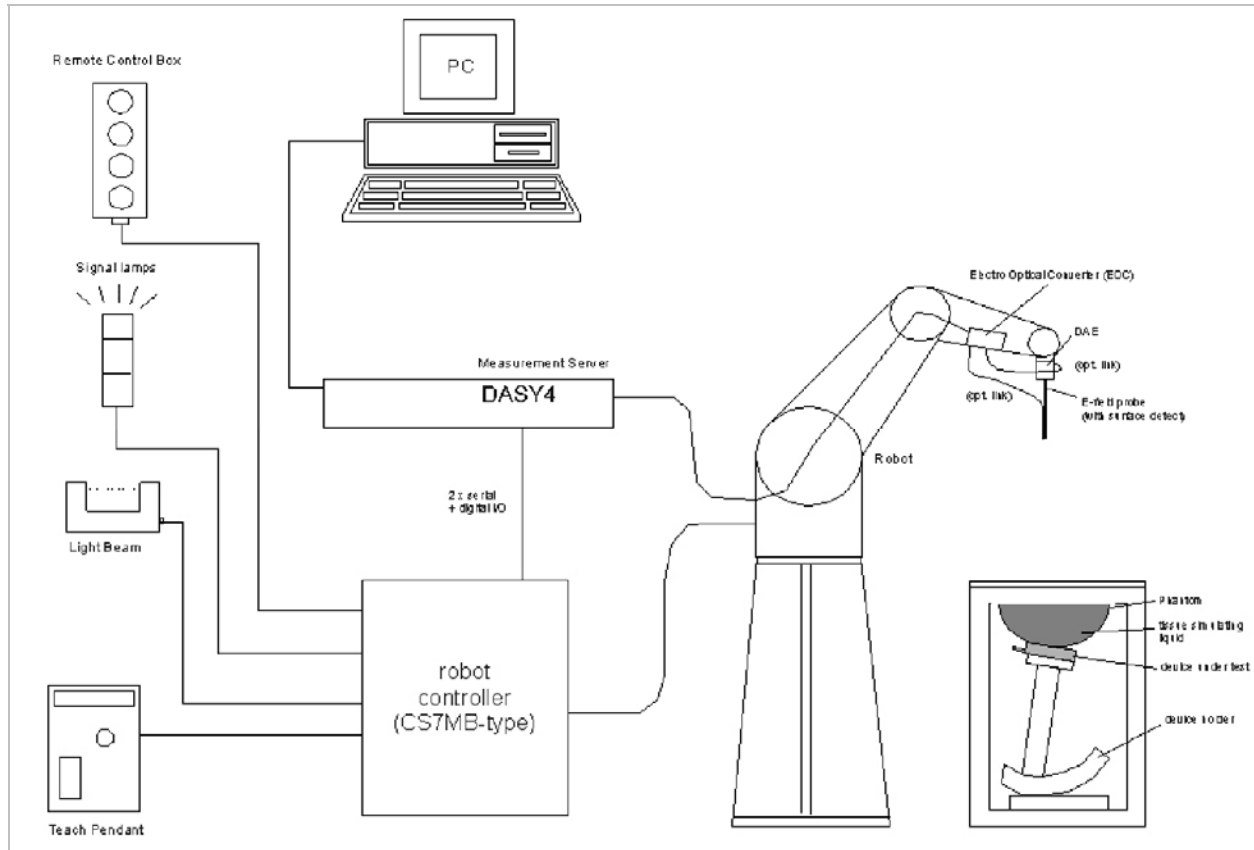
4.2. Measurement Uncertainty

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) @ Body 2450 MHz	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	5.70	Rectangular	1.732	1	3.29
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	1.76	Normal	1	0.64	1.13
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement	-4.33	Normal	1	0.6	-2.60
Combined Standard Uncertainty Uc(y) =					9.98
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				19.96	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.58	dB

5. Equipment Under Test

PCI Express Mini Card, Model: E371			
Antenna tested:	<u>Manufactured</u> Smart Approach	<u>Antenna type</u> PIFA	<u>Part number</u> SE-079A0-ECAL5
The most conservative antenna-to-user separation distances used during the test:	25 mm from antenna-to-user (refer to test setup photos)		
Antenna-to-flat phantom physical separation distances used during the test:	Separation distances from antenna-to-flat phantom: <ul style="list-style-type: none"> • GPRS mode (850/1900): 25 mm • UMTS (WCDMA) Bands (Band V, IV and II): 20 mm • LTE (Band 5 and 17): 20 mm 		
Antenna-to-antenna physical separation distances used during the test with Vertical placement:	Only one antenna provided.		
Antenna-to-antenna physical separation distances used during the test with Horizontal placement:	Only one antenna provided.		
The most conservative physical separation distance between Main/Aux antennas to avoid SAR distribution overlap:	Only one antenna provided.		

6. System Specifications



The DASY 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.
- DASY 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

MSL/HSL750 (Body and Head liquids for 700 – 800 MHz)

Item	Head Tissue Simulation Liquids HSL750 Muscle (body) Tissue Simulation Liquids HSL750
Type No	SL AAH 075
Manufacturer	SPEAG
The item is composed of the following ingredients:	
H ² O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40-60%
NaCl	Sodium Chloride, 0-6%
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyl-3(2H)-isothiazolone, 0.1-0.7%

MSL/HSL1750 (Body and Head liquids for 1700 – 1800 MHz)

Item	Head Tissue Simulation Liquids HSL1750 Muscle (body) Tissue Simulation Liquids HSL1750
Type No	SL AAM 175
Manufacturer	SPEAG
The item is composed of the following ingredients:	
H ² O	Water, 52 – 75%
C8H18O3	Diethylene glycol monobutyl ether (DGBE), 25-48%
NaCl	Sodium Chloride, <1.0%

8. Simulating Liquid Parameters

The simulating liquids are 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 were within $\pm 5\%$ of the target values. For frequencies above 2 GHz the measured conductivity was within $\pm 5\%$ of the target values. The measured relative permittivity tolerance was within $\pm 10\%$ of the target value.

Reference Values of Tissue Dielectric Parameters for Head & Body Phantom

The 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
750	41.96	0.89	55.6	0.96
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
1750	40.08	1.37	53.44	1.49
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

(ϵ_r = relative permittivity, σ = conductivity and $\rho = 1000 \text{ kg/m}^3$)

9. Tissue Parameters Check results

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
8/12/2011	Body 1900	e'	54.1972	Relative Permittivity (ϵ_r):	54.20	53.30	1.68	5
		e"	14.6410	Conductivity (σ):	1.55	1.52	1.76	5
8/26/2011	Body 1900	e'	51.6962	Relative Permittivity (ϵ_r):	51.70	53.30	-3.01	5
		e"	14.2799	Conductivity (σ):	1.51	1.52	-0.75	5
8/30/2011	Body 1750	e'	54.3737	Relative Permittivity (ϵ_r):	54.37	53.44	1.75	5
		e"	14.6110	Conductivity (σ):	1.42	1.49	-4.33	5
8/31/2011	Body 850	e'	55.1747	Relative Permittivity (ϵ_r):	55.17	55.16	0.03	5
		e"	21.1406	Conductivity (σ):	1.00	0.99	1.22	5
9/8/2011	Body 1750	e'	52.6654	Relative Permittivity (ϵ_r):	52.67	53.44	-1.45	5
		e"	15.5215	Conductivity (σ):	1.51	1.49	1.63	5
9/10/2011	Body 750	e'	56.3602	Relative Permittivity (ϵ_r):	56.36	55.55	1.47	5
		e"	23.4175	Conductivity (σ):	0.98	0.96	1.40	5
11/9/2011	Body 835	e'	53.5618	Relative Permittivity (ϵ_r):	53.56	55.20	-2.97	5
		e"	20.8929	Conductivity (σ):	0.97	0.97	0.00	5
11/9/2011	Body 825	e'	53.6766	Relative Permittivity (ϵ_r):	53.68	55.26	-2.86	5
		e"	20.9252	Conductivity (σ):	0.96	0.97	-0.92	5
11/9/2011	Body 850	e'	53.4066	Relative Permittivity (ϵ_r):	53.41	55.16	-3.17	5
		e"	20.8449	Conductivity (σ):	0.99	0.99	-0.20	5
11/29/2011	Body 1900	e'	50.9485	Relative Permittivity (ϵ_r):	50.95	53.30	-4.41	5
		e"	14.3203	Conductivity (σ):	1.51	1.52	-0.47	5
11/29/2011	Body 1850	e'	51.1055	Relative Permittivity (ϵ_r):	51.11	53.30	-4.12	5
		e"	14.1655	Conductivity (σ):	1.46	1.52	-4.14	5
11/29/2011	Body 1880	e'	51.0040	Relative Permittivity (ϵ_r):	51.00	53.30	-4.31	5
		e"	14.2561	Conductivity (σ):	1.49	1.52	-1.96	5
11/29/2011	Body 1910	e'	50.9168	Relative Permittivity (ϵ_r):	50.92	53.30	-4.47	5
		e"	14.3484	Conductivity (σ):	1.52	1.52	0.25	5

10. System Verification

The system performance check is performed prior to any usage of the system in order to verify SAR system 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 TWIN SAM or ELI phantom, shell thickness: 2.0 ± 0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The DASY system with an Isotropic E-Field Probe EX3DV4-SN: 3686 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 5x5x7 (2.4 GHz) fine cube was chosen for cube integration and Special 8x8x10 (5 GHz) fine cube was chosen for cube integration
- 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 powers (forward power) were 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 SN: 4d117	D835V2-4d117_Apr11	4/15/11	1g SAR:	9.64	10.1
			10g SAR:	6.28	6.6
D1900V2 SN: 5d140	D1900V2-5d140_Apr11	4/18/11	1g SAR:	41.6	41.2
			10g SAR:	21.5	21.6
D1750V2 SN: 1053	D1750V2-1053_May11	5/27/11	1g SAR:	36.08	36.88
			10g SAR:	19.16	19.72
D750 SN: 1019	D750V3-1019_Dec10	12/16/11	1g SAR:	8.16	8.64
			10g SAR:	5.32	5.72

10.1. System Check Results

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D1900V2 SN: 5d043	08/12/11	1g SAR:	43.10	41.2	4.61	±10
		10g SAR:	22.50	21.6	4.17	
D1900V2 SN: 5d043	08/26/11	1g SAR:	39.20	41.2	-4.85	±10
		10g SAR:	20.60	21.6	-4.63	
D1750V2 SN: 1053	08/30/11	1g SAR:	36.90	36.88	0.05	±10
		10g SAR:	19.80	19.72	0.41	
D835V2 SN: 4d117	08/31/11	1g SAR:	10.50	10.1	3.96	±10
		10g SAR:	6.92	6.6	4.85	
D1750V2 SN: 1053	09/08/11	1g SAR:	38.00	36.88	3.04	±10
		10g SAR:	20.00	19.72	1.42	
D750V3 SN: 1019	09/10/11	1g SAR:	8.93	8.64	3.36	±10
		10g SAR:	5.92	5.72	3.50	
D835V2 SN: 4d117	11/09/11	1g SAR:	9.92	10.1	-1.78	±10
		10g SAR:	6.53	6.6	-1.06	
D1900V2 SN: 5d140	11/29/11	1g SAR:	40.40	41.2	-1.94	±10
		10g SAR:	21.10	21.6	-2.31	

11. SAR Measurement Procedures

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.

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 DASY 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, 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 $\geq 7 \times 7 \times 9$ (above 4.5 GHz) or $5 \times 5 \times 7$ (below 3 GHz) 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.

12. Output Power Measurements

12.1. GSM/(E)GPRS850 & 1900

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)				Power Reduction Enable			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr	3 slots	Frame Avg Pwr	4 slots	Frame Avg Pwr
GSM850	128	824.2	32.4	23.4	32.3	26.3				
	190	836.6	32.4	23.4	32.4	26.4				
	251	848.8	32.4	23.4	32.5	26.5				
GSM1900	512	1850.2	29.2	20.2	29.2	23.2				
	661	1880	29.3	20.3	29.3	23.3				
	810	1909.8	29.3	20.3	29.3	23.3				

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)				No Power Reduction Supported			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr	3 slots	Frame Avg Pwr	4 slots	Frame Avg Pwr
GSM850	128	824.2	26.1	17.1	26.1	20.1	26.1	21.8	26.1	23.1
	190	836.6	26.1	17.1	26.1	20.1	26.1	21.8	26.1	23.1
	251	848.8	26.2	17.2	26.2	20.2	26.2	21.9	26.2	23.2
GSM1900	512	1850.2	24.9	15.9	24.9	18.9	24.9	20.6	24.9	21.9
	661	1880	25.1	16.1	25.1	19.1	25.1	20.8	25.1	22.1
	810	1909.8	25.1	16.1	25.1	19.1	25.1	20.8	25.1	22.1

Note(s):

The Following worst case modes are based on output power measurements above.

- GPRS850: 2 times slots
- GPRS1900: 2 times slots

12.2. UMTS (WCDMA) Release99

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

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	Avg Tx Pwr (dBm)
UMTS (WCDMA) Band V	Rel 99 12.2kbps RMC	4132	4357	826.4	24.18
		4183	4408	836.6	24.28
		4233	4458	846.6	24.33
UMTS (WCDMA) Band II	Rel 99 12.2kps RMC	9262	9662	1852.4	23.53
		9400	9800	1880.0	23.45
		9538	9938	1907.6	23.20
UMTS (WCDMA) Band IV	Rel 99 (RMC, 12.2 kbps)	1312	1537	1712.4	23.95
		1412	1637	1732.4	23.75
		1513	1738	1754.0	24.05

12.3. UMTS (WCDMA) 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			
	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
MPR (dB)	0	0	0.5	0.5	
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			
$A_{hs} = \beta_{hs}/\beta_c$	30/15				

Results

Band	Mode	UL Ch No.	f (MHz)	Avg Tx Pwr (dBm)
UMTS850 (Band V)	Subtest 1	4132	826.4	23.52
		4182	836.4	23.75
		4233	846.6	23.50
	Subtest 2	4132	826.4	24.17
		4182	836.4	24.35
		4233	846.6	24.30
	Subtest 3	4132	826.4	23.43
		4182	836.4	23.77
		4233	846.6	23.76
	Subtest 4	4132	826.4	23.80
		4182	836.4	23.42
		4233	846.6	23.70
UMTS1900 (Band II)	Subtest 1	9262	1852.4	21.60
		9400	1880.0	22.86
		9538	1907.6	23.00
	Subtest 2	9262	1852.4	22.50
		9400	1880.0	23.70
		9538	1907.6	22.87
	Subtest 3	9262	1852.4	27.75
		9400	1880.0	22.75
		9538	1907.6	22.16
	Subtest 4	9262	1852.4	22.43
		9400	1880.0	23.18
		9538	1907.6	21.77
UMTS1700 (Band IV)	Subtest 1	1312	1712.4	23.75
		1412	1732.4	23.58
		1513	1754.0	23.60
	Subtest 2	1312	1712.4	23.90
		1412	1732.4	23.50
		1513	1754.0	23.67
	Subtest 3	1312	1712.4	23.51
		1412	1732.4	22.97
		1513	1754.0	23.18
	Subtest 4	1312	1712.4	23.37
		1412	1732.4	23.03
		1513	1754.0	23.23

Note(s):

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.

12.4. UMTS (WCDMA) HSPA (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2B of 3GPP TS34.121-1. A summary of these settings are illustrated below:

Mode	HSPA	HSPA	HSPA	HSPA	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 47/15	56/75	134/15
	CM (dB)	1.0	3.0	2.0	3.0	1.0
MPR (dB)	0	2	1	2	0	
HSDPA Specific Settings	DACK					8
	DNAK					8
	DCQI					8
	Ack-Nack repetition factor					3
	CQI Feedback (Table 5.2B.4)					4ms
	CQI Repetition Factor (Table 5.2B.4)					2
	Ahs = 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
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

Results

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	Avg Tx Pwr (dBm)
UMTS850 (Band V)	Subtest 1	4132	4357	826.4	23.57
		4182	4407	836.4	23.74
		4233	4458	846.6	23.45
	Subtest 2	4132	4357	826.4	23.50
		4182	4407	836.4	23.55
		4233	4458	846.6	23.60
	Subtest 3	4132	4357	826.4	23.69
		4182	4407	836.4	23.64
		4233	4458	846.6	23.68
	Subtest 4	4132	4357	826.4	23.48
		4182	4407	836.4	23.56
		4233	4458	846.6	23.65
	Subtest 5	4132	4357	826.4	22.45
		4182	4407	836.4	23.70
		4233	4458	846.6	23.60
UMTS1900 (Band II)	Subtest 1	9262	9662	1852.4	21.35
		9400	9800	1880.0	22.92
		9538	9938	1907.6	22.24
	Subtest 2	9262	9662	1852.4	21.60
		9400	9800	1880.0	22.95
		9538	9938	1907.6	22.10
	Subtest 3	9262	9662	1852.4	21.63
		9400	9800	1880.0	22.90
		9538	9938	1907.6	22.57
	Subtest 4	9262	9662	1852.4	21.58
		9400	9800	1880.0	22.97
		9538	9938	1907.6	22.13
	Subtest 5	9262	9662	1852.4	21.75
		9400	9800	1880.0	22.90
		9538	9938	1907.6	22.85
UMTS1700 (Band IV)	Subtest 1	1312	1537	1712.4	23.74
		1412	1637	1732.4	23.03
		1513	1738	1754.0	24.18
	Subtest 2	1312	1537	1712.4	22.58
		1412	1637	1732.4	22.46
		1513	1738	1754.0	22.89
	Subtest 3	1312	1537	1712.4	23.05
		1412	1637	1732.4	23.05
		1513	1738	1754.0	23.40
	Subtest 4	1312	1537	1712.4	22.78
		1412	1637	1732.4	22.50
		1513	1738	1754.0	22.83
	Subtest 5	1312	1537	1712.4	23.77
		1412	1637	1732.4	23.69
		1513	1738	1754.0	24.02

Note(s):

KDB 941225 D01, Body SAR is not required for device 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.

12.5. LTE Band 17

5 MHz BW

Ch. BW (MHz)	UL Ch #.	Freq. (MHz)	Mode	RB Size	RB Offset	MPR	Actual Average Pwr (dBm)
5	23755	706.5	QPSK	1	0	0	23.54
				1	24	0	23.45
				12	6	1	22.37
				25	0	1	22.46
			16QAM	1	0	1	22.13
				1	24	1	21.99
				12	6	2	21.23
5	23790	710.0	QPSK	1	0	0	23.41
				1	24	0	23.80
				12	6	1	22.41
				25	0	1	22.46
			16QAM	1	0	1	22.18
				1	24	1	22.14
				12	6	2	21.28
5	23825	713.5	QPSK	1	0	0	23.60
				1	24	0	23.36
				12	6	1	22.52
				25	0	1	22.42
			16QAM	1	0	1	22.46
				1	24	1	22.05
				12	6	2	21.34
				25	0	2	21.85

10 MHz BW

Ch. BW (MHz)	UL Ch #.	Freq. (MHz)	Mode	RB Size	RB Offset	MPR	Actual Average Pwr (dBm)
10	23780	709.0	QPSK	1	0	0	23.52
				1	49	0	23.59
				25	12	1	22.18
				50	0	1	22.05
			16QAM	1	0	1	23.13
				1	49	1	23.10
				25	12	2	21.40
10	23790	710.0	QPSK	1	0	0	23.50
				1	49	0	23.40
				25	12	1	22.50
				50	0	1	22.42
			16QAM	1	0	1	22.72
				1	49	1	22.37
				25	12	2	21.50
10	23800	711.0	QPSK	1	0	0	23.85
				1	49	0	23.42
				25	12	1	22.43
				50	0	1	22.35
			16QAM	1	0	1	23.54
				1	49	1	22.38
				25	12	2	21.40
				50	0	2	21.58

12.6. LTE Band 4

1.4 MHz BW

Ch. BW (MHz)	UL Ch #.	Freq. (MHz)	Mode	RB Size	RB Offset	MPR	Actual Average Pwr (dBm)
1.4	19957	1710.7	QPSK	1	0	0	23.81
				1	5	0	23.71
				3	1	1	23.68
				6	0	1	22.79
			16QAM	1	0	1	23.01
				1	5	1	22.99
				3	1	2	23.16
				6	0	2	22.1
1.4	20175	1732.5	QPSK	1	0	0	23.40
				1	5	0	23.55
				3	1	1	23.30
				6	0	1	22.37
			16QAM	1	0	1	22.15
				1	5	1	22.10
				3	1	2	22.66
				6	0	2	21.59
1.4	20393	1754.3	QPSK	1	0	0	23.70
				1	5	0	23.43
				3	1	1	23.71
				6	0	1	22.50
			16QAM	1	0	1	22.9
				1	5	1	22.72
				3	1	2	22.95
				6	0	2	22.07

3 MHz BW

Ch. BW (MHz)	UL Ch #.	Freq. (MHz)	Mode	RB Size	RB Offset	MPR	Actual Average Pwr (dBm)
3	19965	1711.5	QPSK	1	0	0	23.82
				1	14	0	23.80
				8	4	1	22.84
				15	0	1	22.7
			16QAM	1	0	1	22.79
				1	14	1	22.68
				8	4	2	21.6
				15	0	2	21.81
3	20175	1732.5	QPSK	1	0	0	23.42
				1	14	0	23.50
				8	4	1	22.45
				15	0	1	22.33
			16QAM	1	0	1	21.81
				1	14	1	21.92
				8	4	2	21.55
				15	0	2	21.41
3	20385	1753.5	QPSK	1	0	0	23.66
				1	14	0	23.9
				8	4	1	22.55
				15	0	1	22.60
			16QAM	1	0	1	22.20
				1	14	1	22.17
				8	4	2	21.55
				15	0	2	21.26

5 MHz BW

Ch. BW (MHz)	UL Ch #.	Freq. (MHz)	Mode	RB Size	RB Offset	MPR	Actual Average Pwr (dBm)
5	19975	1712.5	QPSK	1	0	0	23.53
				1	24	0	23.55
				12	6	1	22.40
				25	0	1	22.42
			16QAM	1	0	1	22.42
				1	24	1	22.56
				12	6	2	21.31
5	20175	1732.5	QPSK	25	0	2	21.85
				1	0	0	23.12
				1	24	0	23.27
				12	6	1	22.11
			16QAM	25	0	1	22.19
				1	0	1	22.24
				1	24	1	22.31
5	20375	1752.5	QPSK	12	6	2	21.03
				25	0	2	21.63
				1	0	0	23.45
				1	24	0	23.38
			16QAM	12	6	1	22.48
				25	0	1	22.35
				1	0	1	22.68
16QAM	1	24	1	22.47			
	12	6	2	21.19			
	25	0	2	21.52			
	25	0	2	21.52			

10 MHz BW

Ch. BW (MHz)	UL Ch #.	Freq. (MHz)	Mode	RB Size	RB Offset	MPR	Actual Average Pwr (dBm)
10	20000	1715.0	QPSK	1	0	0	23.60
				1	49	0	23.55
				25	12	1	22.47
				50	0	1	22.47
			16QAM	1	0	1	22.36
				1	49	1	22.39
				25	12	2	21.64
10	20175	1732.5	QPSK	50	0	2	21.65
				1	0	0	23.27
				1	49	0	23.49
				25	12	1	22.30
			16QAM	50	0	1	22.00
				1	0	1	21.89
				1	49	1	22.12
10	20350	1750.0	QPSK	25	12	2	21.33
				50	0	2	21.39
				1	0	0	23.75
				1	49	0	23.70
			16QAM	25	12	1	22.50
				50	0	1	22.42
				1	0	1	21.58
16QAM	1	49	1	22.23			
	25	12	2	21.47			
	50	0	2	21.58			
	50	0	2	21.58			

15 MHz BW

Ch. BW (MHz)	UL Ch #.	Freq. (MHz)	Mode	RB Size	RB Offset	MPR	Actual Average Pwr (dBm)
15	20025	1717.5	QPSK	1	0	0	23.38
				1	74	0	23.15
				36	18	1	22.12
				75	0	1	22.10
			16QAM	1	0	1	22.52
				1	74	1	22.40
				36	18	2	21.40
				75	0	2	22.11
15	20175	1732.5	QPSK	1	0	0	23.53
				1	74	0	23.50
				36	18	1	22.15
				75	0	1	22.25
			16QAM	1	0	1	22.53
				1	74	1	22.65
				36	18	2	20.99
				75	0	2	21.15
15	20325	1747.5	QPSK	1	0	0	23.27
				1	74	0	23.25
				36	18	1	22.40
				75	0	1	22.45
			16QAM	1	0	1	22.57
				1	74	1	23.02
				36	18	2	21.5
				75	0	2	21.38

20 MHz BW

Ch. BW (MHz)	UL Ch #.	Freq. (MHz)	Mode	RB Size	RB Offset	MPR	Actual Average Pwr (dBm)
20	20050	1720.0	QPSK	1	0	0	23.50
				1	99	0	23.15
				50	19	1	22.42
				100	0	1	22.4
			16QAM	1	0	1	22.87
				1	99	1	22.43
				50	19	2	21.21
			100	0	2	21.45	
20	20175	1732.5	QPSK	1	0	0	23.53
				1	99	0	23.40
				50	19	1	22.30
				100	0	1	22.37
			16QAM	1	0	1	22.80
				1	99	1	22.77
				50	19	2	21.16
				100	0	2	21.42
20	20030	1745.0	QPSK	1	0	0	23.45
				1	99	0	23.53
				50	19	1	22.50
				100	0	1	22.39
			16QAM	1	0	1	22.83
				1	99	1	22.82
				50	19	2	21.49
				100	0	2	21.37

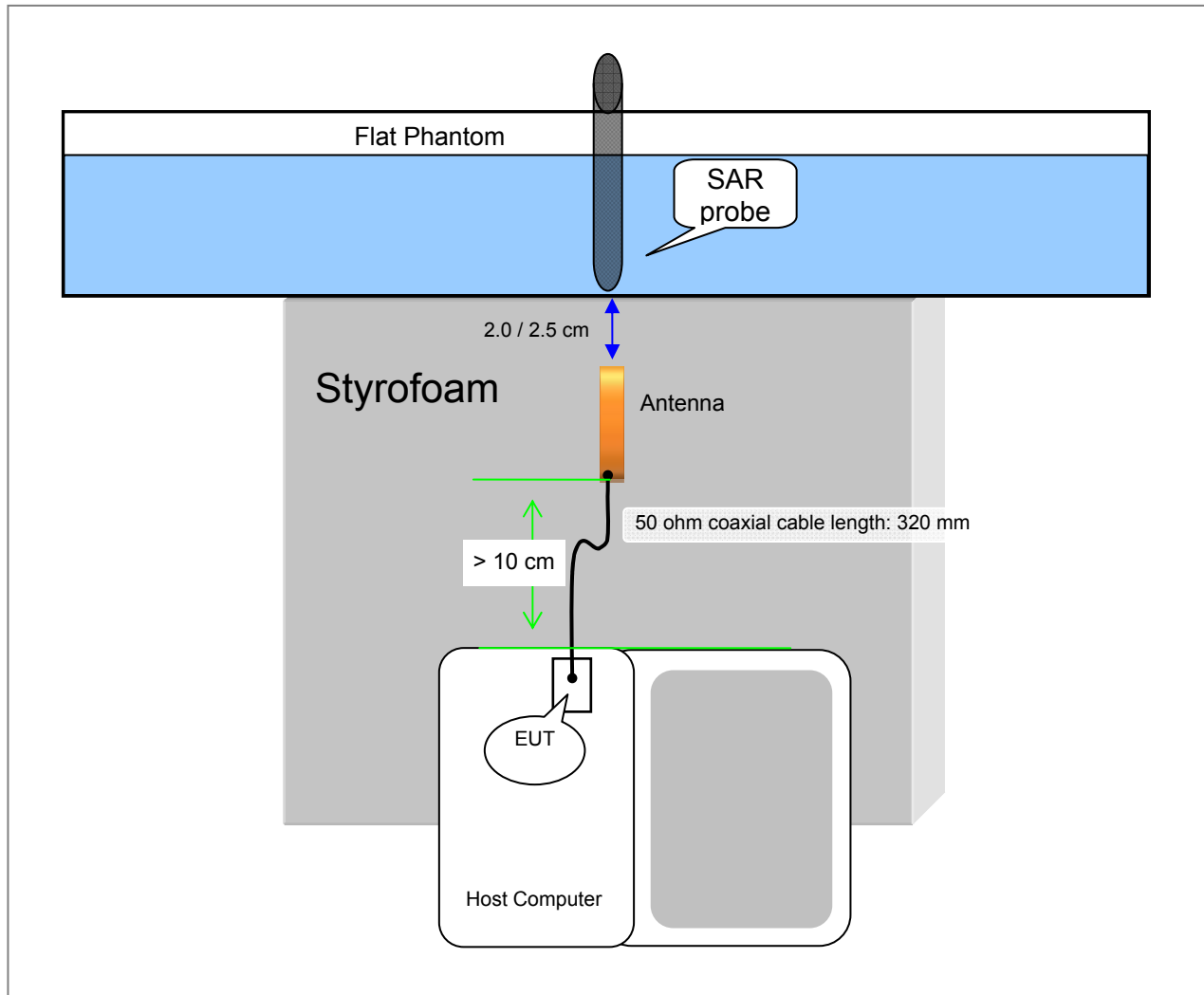
13. Test Configurations

Separation distances from antenna-to-flat phantom:

- GPRS mode (850/1900): 25 mm
- UMTS (WCDMA) Bands (Band V, IV and II): 20 mm
- LTE (Band 5 and 17): 20 mm

13.1. Antenna Positioned Vertically

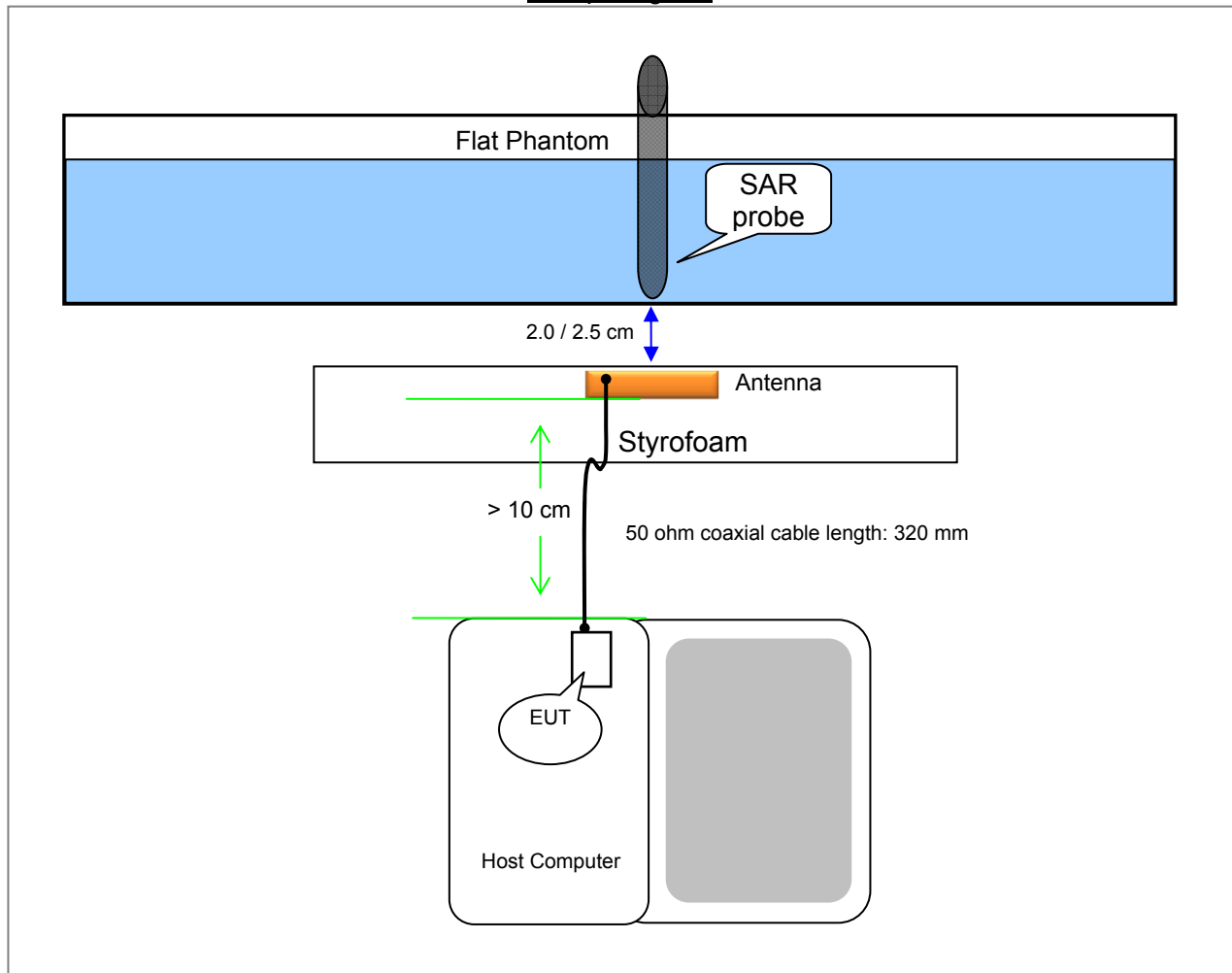
Setup diagram



Test setup: The EUT is installed in a host laptop computer during the tests. Test software exercised the radio card.
Test software: RF NV Manager 1.4.34

13.1. Antenna Positioned Horizontally

Setup diagram



Test setup: The EUT is installed in a host laptop computer during the tests. Test software exercised the radio card.
Test software: RF NV Manager 1.4.34

14. Summary of SAR Test Results

Separation distances from antenna-to-flat phantom during SAR testing

- GPRS mode (850/1900): 25 mm
- UMTS (WCDMA) Bands (Band V, IV and II): 20 mm
- LTE (Band 5 and 17): 20 mm

14.1. GPRS850

Configuration	Mode	Channel	f (MHz)	Avg Pwr	Results (mW/g)	
				(dBm)	1g-SAR	10g-SAR
Vertical Down	GPRS 2 slots	128	824.2	32.3		
		190	836.6	32.4	0.00645	0.00431
		251	848.8	32.5		
Vertical Up	GPRS 2 slots	128	824.2	32.3		
		190	836.6	32.4	0.00596	0.02930
		251	848.8	32.5		
Horizontal Up	GPRS 2 slots	128	824.2	32.3		
		190	836.6	32.4	0.285	0.199
		251	848.8	32.5		
Horizontal Down	GPRS 2 slots	128	824.2	32.3		
		190	836.6	32.4	0.156	0.108
		251	848.8	32.5		
Horizontal Front	GPRS 2 slots	128	824.2	32.3		
		190	836.6	32.4	0.029	0.020
		251	848.8	32.5		
Horizontal Back	GPRS 2 slots	128	824.2	32.3		
		190	836.6	32.4	0.053	0.037
		251	848.8	32.5		

14.2. GPRS1900

Configuration	Mode	Channel	f (MHz)	Avg Pwr	Results (mW/g)	
				(dBm)	1g-SAR	10g-SAR
Vertical Down	GPRS 2 slots	512	1850.20	29.2		
		661	1880.00	29.3	0.019	0.010
		810	1909.80	29.3		
Vertical Up	GPRS 2 slots	512	1850.20	29.2		
		661	1880.00	29.3	0.039	0.024
		810	1909.80	29.3		
Horizontal Up	GPRS 2 slots	512	1850.20	29.2		
		661	1880.00	29.3	0.383	0.211
		810	1909.80	29.3		
Horizontal Down	GPRS 2 slots	512	1850.20	29.2		
		661	1880.00	29.3	0.292	0.169
		810	1909.80	29.3		
Horizontal Front	GPRS 2 slots	512	1850.20	29.2		
		661	1880.00	29.3	0.061	0.030
		810	1909.80	29.3		
Horizontal Back	GPRS 2 slots	512	1850.20	29.2		
		661	1880.00	29.3	0.266	0.159
		810	1909.80	29.3		

Note(s):

1. Tested middle channel only. Testing for the other channels is not required due to SAR value is less than 50% of 1.6 mW/g.

14.3. UMTS (WCDMA) Band V

Configuration	Mode	Channel	f (MHz)	Avg Pwr	Results (mW/g)	
				(dBm)	1g-SAR	10g-SAR
Vertical Down	Rel.99	4132	826.40	27.5		
	RMC	4183	836.60	27.8	0.014	0.00666
	12.2kbs	4233	846.60	27.8		
Vertical Up	Rel.99	4132	826.40	27.5		
	RMC	4183	836.60	27.8	0.014	0.00983
	12.2kbs	4233	846.60	27.8		
Horizontal Up	Rel.99	4132	826.40	27.5		
	RMC	4183	836.60	27.8	0.150	0.099
	12.2kbs	4233	846.60	27.8		
Horizontal Down	Rel.99	4132	826.40	27.5		
	RMC	4183	836.60	27.8	0.136	0.094
	12.2kbs	4233	846.60	27.8		
Horizontal Front	Rel.99	4132	826.40	27.5		
	RMC	4183	836.60	27.8	0.038	0.026
	12.2kbs	4233	846.60	27.8		
Horizontal Back	Rel.99	4132	826.40	27.5		
	RMC	4183	836.60	27.8	0.062	0.043
	12.2kbs	4233	846.60	27.8		

14.4. UMTS (WCDMA) Band IV

Configuration	Mode	Channel	f (MHz)	Avg Pwr	Results (mW/g)	
				(dBm)	1g-SAR	10g-SAR
Vertical Down	Rel.99	1312	1712.4	27.1		
	RMC	1412	1732.4	26.5	0.0027	0.000835
	12.2kbs	1513	1754.0	27.0		
Vertical Up	Rel.99	1312	1712.4	27.1		
	RMC	1412	1732.4	26.5	0.0180	0.00801
	12.2kbs	1513	1754.0	27.0		
Horizontal Up	Rel.99	1312	1712.4	27.1		
	RMC	1412	1732.4	26.5	0.211	0.123
	12.2kbs	1513	1754.0	27.0		
Horizontal Down	Rel.99	1312	1712.4	27.1		
	RMC	1412	1732.4	26.5	0.207	0.120
	12.2kbs	1513	1754.0	27.0		
Horizontal Front	Rel.99	1312	1712.4	27.1		
	RMC	1412	1732.4	26.5	0.028	0.018
	12.2kbs	1513	1754.0	27.0		
Horizontal Back	Rel.99	1312	1712.4	27.1		
	RMC	1412	1732.4	26.5	0.201	0.124
	12.2kbs	1513	1754.0	27.0		

Note(s):

1. Tested middle channel only. Testing for the other channels is not required due to SAR value is less than 50% of 1.6 mW/g.

14.5. UMTS (WCDMA) Band II

Configuration	Mode	Channel	f (MHz)	Avg Pwr	Results (mW/g)	
				(dBm)	1g-SAR	10g-SAR
Vertical Down	Rel.99	9662	1852.4	26.5		
	RMC	9800	1880.0	26.8	0.039	0.025
	12.2kbs	9938	1907.6	26.7		
Vertical Up	Rel.99	9662	1852.4	26.5		
	RMC	9800	1880.0	26.8	0.025	0.013
	12.2kbs	9938	1907.6	26.7		
Horizontal Up	Rel.99	9662	1852.4	26.5		
	RMC	9800	1880.0	26.8	0.374	0.219
	12.2kbs	9938	1907.6	26.7		
Horizontal Down	Rel.99	9662	1852.4	26.5		
	RMC	9800	1880.0	26.8	0.282	0.167
	12.2kbs	9938	1907.6	26.7		
Horizontal Front	Rel.99	9662	1852.4	26.5		
	RMC	9800	1880.0	26.8	0.117	0.074
	12.2kbs	9938	1907.6	26.7		
Horizontal Back	Rel.99	9662	1852.4	26.5		
	RMC	9800	1880.0	26.8	0.361	0.216
	12.2kbs	9938	1907.6	26.7		

Note(s):

1. Tested middle channel only. Testing for the other channels is not required due to SAR value is less than 50% of 1.6 mW/g.

14.6. LTE Band 17

Preliminary test results with 5 MHz BW at Mid Channel

Configuration	Mode	Channel	f (MHz)	Avg Pwr	Results (mW/g)	
				(dBm)	1g-SAR	10g-SAR
Vertical Down	QPSK RB#1,RBO#0	23755	706.5	23.5		
		23790	710.0	23.4	0.00735	0.00275
		23825	713.5	23.6		
Vertical Up	QPSK RB#1,RBO#0	23755	706.5	23.5		
		23790	710.0	23.4	0.039	0.004
		23825	713.5	23.6		
Horizontal Up	QPSK RB#1,RBO#0	23755	706.5	23.5		
		23790	710.0	23.4	0.080	0.057
		23825	713.5	23.6		
Horizontal Down	QPSK RB#1,RBO#0	23755	706.5	23.5		
		23790	710.0	23.4	0.070	0.049
		23825	713.5	23.6		
Horizontal Front	QPSK RB#1,RBO#0	23755	706.5	23.5		
		23790	710.0	23.4	0.044	0.031
		23825	713.5	23.6		
Horizontal Back	QPSK RB#1,RBO#0	23755	706.5	23.5		
		23790	710.0	23.4	0.047	0.033
		23825	713.5	23.6		

Full tests at worst-case configuration based on the Preliminary test results above.

5 MHz BW - Middle Channel

Test Configuration	Mode	UL Ch #.	Freq. (MHz)	RB Size	RB Offset	Avg Pwr (dBm)	MPR	Separation Distance (mm)	SAR (mW/g)	
									1-g	10-g
Horizontal Up	QPSK	23790	710.0	1	24	23.80	0	20	0.0831	0.0593
		23790	710.0	12	6	22.41	1	20	0.0494	0.0290
		23790	710.0	25	0	22.46	1	20	0.0337	0.0198
	16QAM	23790	710.0	1	0	22.18	1	20	0.0715	0.0510
		23790	710.0	1	24	22.14	1	20	0.0685	0.0493
		23790	710.0	12	6	21.28	2	20	0.0284	0.0188
		23790	710.0	25	0	21.93	2	20	0.0449	0.0297

10 MHz BW - Middle Channel

Test Configuration	Mode	UL Ch #.	Freq. (MHz)	RB Size	RB Offset	Avg Pwr (dBm)	MPR	Separation Distance (mm)	SAR (mW/g)	
									1-g	10-g
Horizontal Up	QPSK	23790	710.0	1	0	23.27	0	20	0.080	0.057
		23790	710.0	1	49	23.49	0	20	0.072	0.051
	16QAM	23790	710.0	1	0	21.89	1	20	0.074	0.052
		23790	710.0	1	49	22.12	1	20	0.059	0.042

Note(s):

1. Tested middle channel only. Testing for the other channels is not required due to SAR value is less than 50% of 1.6 mW/g.

14.7. LTE Band 4

Preliminary test results with 10 MHz BW at Mid Channel

Configuration	Mode	Channel	f (MHz)	Avg Pwr	Results (mW/g)	
				(dBm)	1g-SAR	10g-SAR
Vertical Down	QPSK RB#1,RB=0	1710.7	1710.7	23.53		
		1732.5	1732.5	23.12	0.00763	0.00513
		1754.3	1754.3	23.45		
Vertical Up	QPSK RB#1,RB=0	1710.7	1710.7	23.53		
		1732.5	1732.5	23.12	0.027	0.018
		1754.3	1754.3	23.45		
Horizontal Up	QPSK RB#1,RB=0	1710.7	1710.7	23.53		
		1732.5	1732.5	23.12	0.339	0.201
		1754.3	1754.3	23.45		
Horizontal Down	QPSK RB#1,RB=0	1710.7	1710.7	23.53		
		1732.5	1732.5	23.12	0.296	0.173
		1754.3	1754.3	23.45		
Horizontal Front	QPSK RB#1,RB=0	1710.7	1710.7	23.53		
		1732.5	1732.5	23.12	0.089	0.055
		1754.3	1754.3	23.45		
Horizontal Back	QPSK RB#1,RB=0	1710.7	1710.7	23.53		
		1732.5	1732.5	23.12	0.268	0.161
		1754.3	1754.3	23.45		

Full tests at worst-case configuration based on the Preliminary test results above

1.4 MHz BW - Middle Channel

Test Configuration	Mode	UL Ch #.	Freq. (MHz)	RB Size	RB Offset	Avg Pwr (dBm)	MPR	Separation Distance (mm)	SAR (mW/g)	
									1-g	10-g
Horizontal Up	QPSK	20175	1732.5	1	0	23.40	0	20	0.339	0.201
		20175	1732.5	1	5	23.55	0	20	0.265	0.160
	16QAM	20175	1732.5	1	0	22.15	1	20	0.198	0.120
		20175	1732.5	1	5	22.10	1	20	0.049	0.031

3 MHz BW - Middle Channel

Test Configuration	Mode	UL Ch #.	Freq. (MHz)	RB Size	RB Offset	Avg Pwr (dBm)	MPR	Separation Distance (mm)	SAR (mW/g)	
									1-g	10-g
Horizontal Up	QPSK	20175	1732.5	1	0	23.42	0	20	0.351	0.208
		20175	1732.5	1	14	23.50	0	20	0.332	0.196
	16QAM	20175	1732.5	1	0	21.81	1	20	0.271	0.161
		20175	1732.5	1	14	21.92	1	20	0.261	0.155

5 MHz BW - Middle Channel

Test Configuration	Mode	UL Ch #.	Freq. (MHz)	RB Size	RB Offset	Avg Pwr (dBm)	MPR	Separation Distance (mm)	SAR (mW/g)	
									1-g	10-g
Horizontal Up	QPSK	20175	1732.5	1	0	23.12	0	20	0.316	0.187
		20175	1732.5	1	24	23.27	0	20	0.299	0.177
	16QAM	20175	1732.5	1	0	22.24	1	20	0.260	0.154
		20175	1732.5	1	24	22.31	1	20	0.245	0.145

Note(s):

1. Tested middle channel only. Testing for the other channels is not required due to SAR value is less than 50% of 1.6 mW/g.

10 MHz BW - Middle Channel

Test Configuration	Mode	UL Ch #.	Freq. (MHz)	RB Size	RB Offset	Avg Pwr (dBm)	MPR	Separation Distance (mm)	SAR (mW/g)	
									1-g	10-g
Horizontal Up	QPSK	20175	1732.5	1	49	23.49	0	20	0.321	0.190
		20175	1732.5	25	12	22.30	1	20	0.143	0.085
		20175	1732.5	50	0	22.00	1	20	0.141	0.084
	16QAM	20175	1732.5	1	0	21.89	1	20	0.291	0.170
		20175	1732.5	1	49	22.12	1	20	0.262	0.155
		20175	1732.5	25	12	21.33	2	20	0.113	0.067
		20175	1732.5	50	0	21.39	2	20	0.116	0.069

15 MHz BW - Middle Channel

Test Configuration	Mode	DL Ch No.	Freq. (MHz)	RB Size	RB Offset	Avg Pwr (dBm)	MPR	Separation Distance (mm)	SAR (mW/g)	
									1-g	10-g
Horizontal Up	QPSK	2175	1732.5	1	0	23.38	0	20	0.360	0.213
		2175	1732.5	1	74	23.15	0	20	0.312	0.185
	16QAM	2175	1732.5	1	0	22.52	1	20	0.242	0.149
		2175	1732.5	1	74	22.40	1	20	0.249	0.151

20 MHz BW - Middle Channel

Test Configuration	Mode	UL Ch #.	Freq. (MHz)	RB Size	RB Offset	Avg Pwr (dBm)	MPR	Separation Distance (mm)	SAR (mW/g)	
									1-g	10-g
Horizontal Up	QPSK	20175	1732.5	1	0	23.50	0	20	0.340	0.207
		20175	1732.5	1	99	23.15	0	20	0.354	0.214
	16QAM	20175	1732.5	1	0	22.87	1	20	0.282	0.171
		20175	1732.5	1	99	22.43	1	20	0.286	0.173

Note(s):

1. Tested middle channel only. Testing for the other channels is not required due to SAR value is less than 50% of 1.6 mW/g.

14.8. Scaled SAR Values with Power Drift over 5% Limit

Test Configuration	Band	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)	Power Drift (dB)	SAR Results			
						Measured		Scaled up	
						1-g	10-g	1-g	10-g
Vertical Down	GPRS 850	190	836.6	23.48	-0.210	0.00645	0.00431	0.00677	0.00452

Test Configuration	Band	Modulation	UL Ch No.	Freq. (MHz)	RB Size	RB Offset	Avg Pwr (dBm)	Power Drift (dB)	SAR Results			
									Measured		Scaled up	
									1-g	10-g	1-g	10-g
Horizontal Up	LTE Band 4	1.4 MHz, QPSK	20175	1732.5	1	5	23.55	-0.240	0.265	0.160	0.280	0.169

15. Summary of the Highest 1g SAR

Technology	Test configuration	Mode	Separation distance (mm)	Highest 1g SAR (W/kg)
GPRS850 (Part 22)	Horizontal Up	GPRS 2 time slots, CS1	25	0.285
GPRS1900 (Part 24)	Horizontal Up	GPRS 2 time slots, CS1	25	0.383
UMTS (WCDMA) Band V (Part 22)	Horizontal Up	R99, RMC 12.2kbps	20	0.150
UMTS (WCDMA) Band IV (Part 27)	Horizontal Up	R99, RMC 12.2kbps	20	0.211
UMTS (WCDMA) Band II (Part 24)	Horizontal Up	R99, RMC 12.2kbps	20	0.374
LTE Band 17 (Part 27)	Horizontal Up	QPSK RB#1,RBO#0	20	0.080
LTE Band 4 (Part 27)	Horizontal Up	QPSK RB#1,RBO#0	20	0.339

16. Worst Case SAR Plots

GPRS850

Date: 11/9/2011

Test Laboratory: UL CCS SAR Lab A

1_Horizontal Ant_UP

Communication System: GPRS-FDD (2 slot); Frequency: 836.6 MHz; Duty Cycle: 1:4.00037
Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.972$ mho/m; $\epsilon_r = 53.544$; $\rho = 1000$ 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 - SN3749; ConvF(8.79, 8.79, 8.79); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Phantom: ELI v4.0(A); Type: QDOVA001BB; Serial: 1119
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

GPRS 850 2 slots/Area Scan (51x81x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (interpolated) = 0.318 mW/g

GPRS 850 2 slots/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

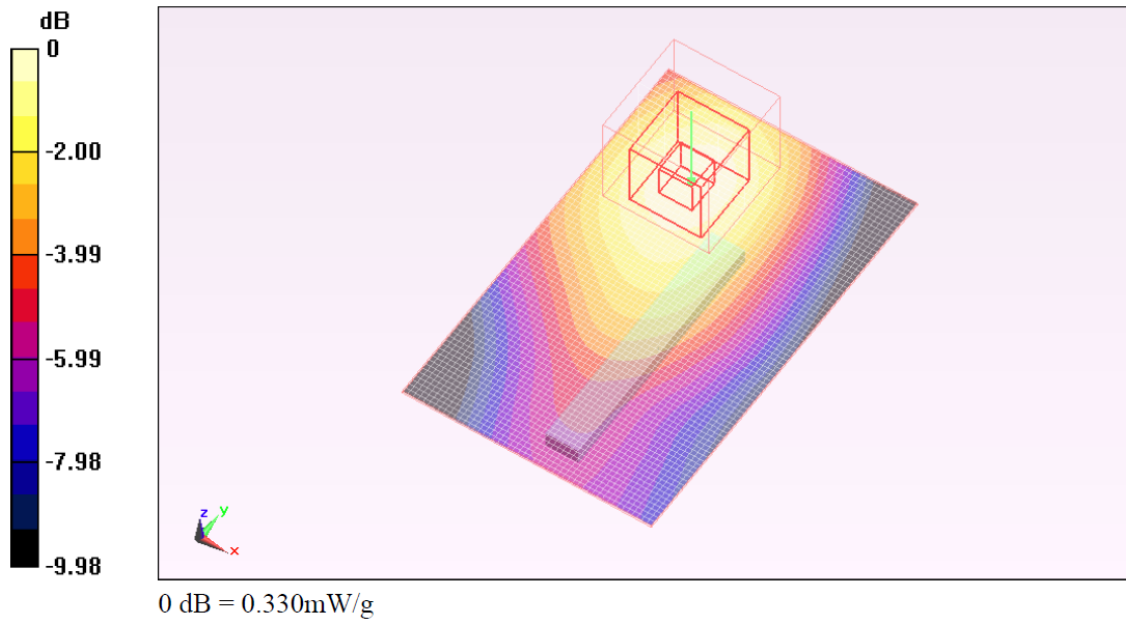
Reference Value = 18.243 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.397 W/kg

SAR(1 g) = 0.285 mW/g; SAR(10 g) = 0.199 mW/g

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

Maximum value of SAR (measured) = 0.335 mW/g



Z plots

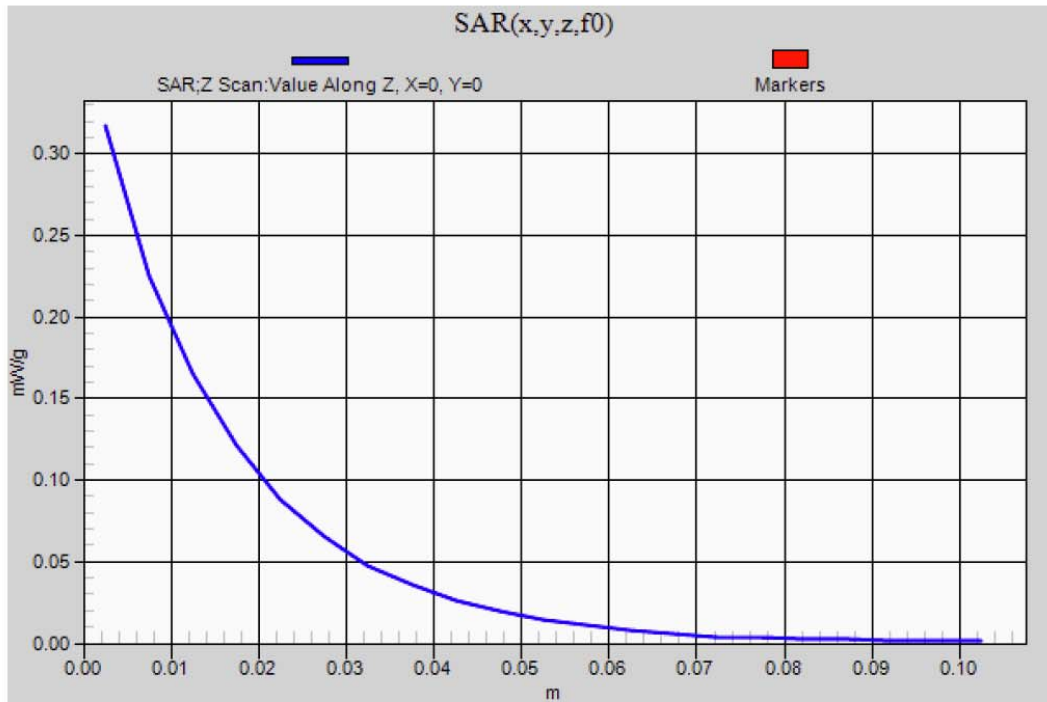
Date: 11/9/2011

Test Laboratory: UL CCS SAR Lab A

1_Horizontal Ant_UP

Communication System: GPRS-FDD (2 slot); Frequency: 836.6 MHz; Duty Cycle: 1:4.00037

GPRS 850 2 slots/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: [Interpolated medium parameters used for SAR evaluation.](#)
Maximum value of SAR (measured) = 0.317 mW/g



GPRS1900

Date: 11/29/2011

Test Laboratory: UL CCS SAR Lab B

1_Horizontal Ant_UP

Communication System: GPRS-FDD (TDMA, GMSK, 2 slot); Frequency: 1880 MHz; Duty Cycle: 1:4.00037
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.491$ mho/m; $\epsilon_r = 51.004$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

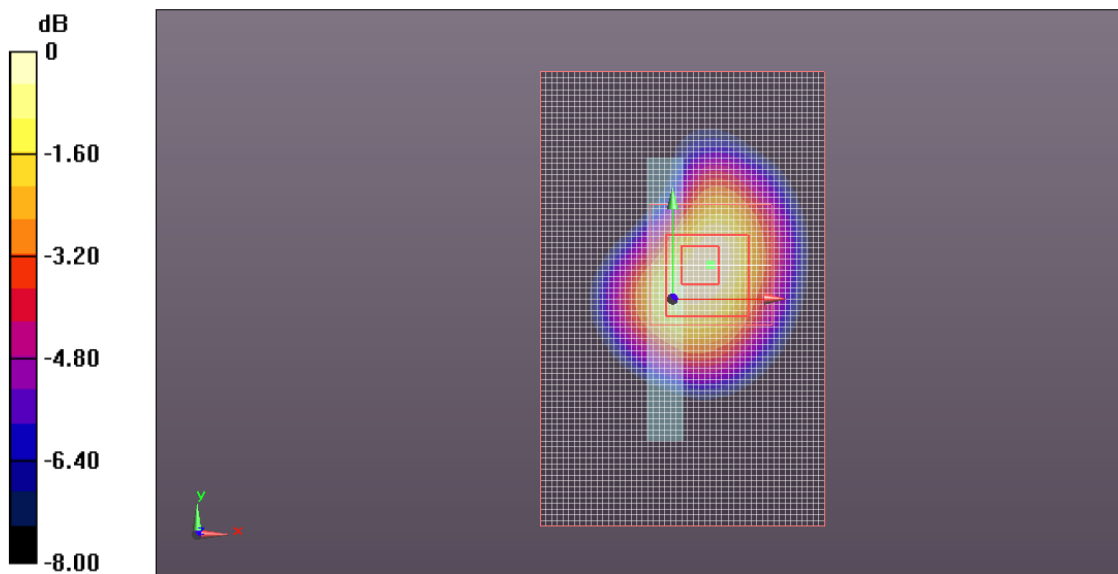
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

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 - SN3773; ConvF(7.37, 7.37, 7.37); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (A); Type: QDOVA002BB; Serial: 1120
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

GPRS 1900 2 slots/Area Scan (51x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.470 mW/g

GPRS 1900 2 slots/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.979 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 0.689 W/kg
SAR(1 g) = 0.383 mW/g; SAR(10 g) = 0.211 mW/g
Maximum value of SAR (measured) = 0.462 mW/g



Z plots

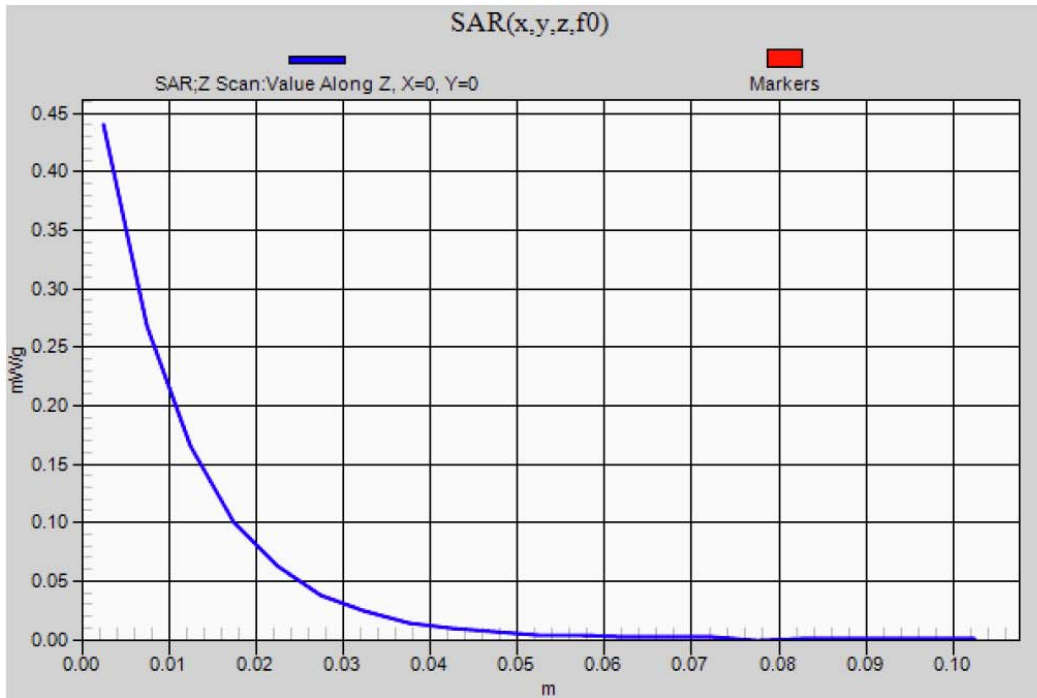
Date: 11/29/2011

Test Laboratory: UL CCS SAR Lab B

1_Horizontal Ant_UP

Communication System: GPRS-FDD (TDMA, GMSK, 2 slot); Frequency: 1880 MHz; Duty Cycle: 1:4.00037

GPRS 1900 2 slots/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.440 mW/g



UMTS (WCDMA) Band V

Date: 8/31/2011

Test Laboratory: UL CCS SAR Lab B

3_Horizontal Ant_UP

Communication System: UMTS-FDD (WCDMA); Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.983$ mho/m; $\epsilon_r = 55.117$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

DASY5 Configuration:

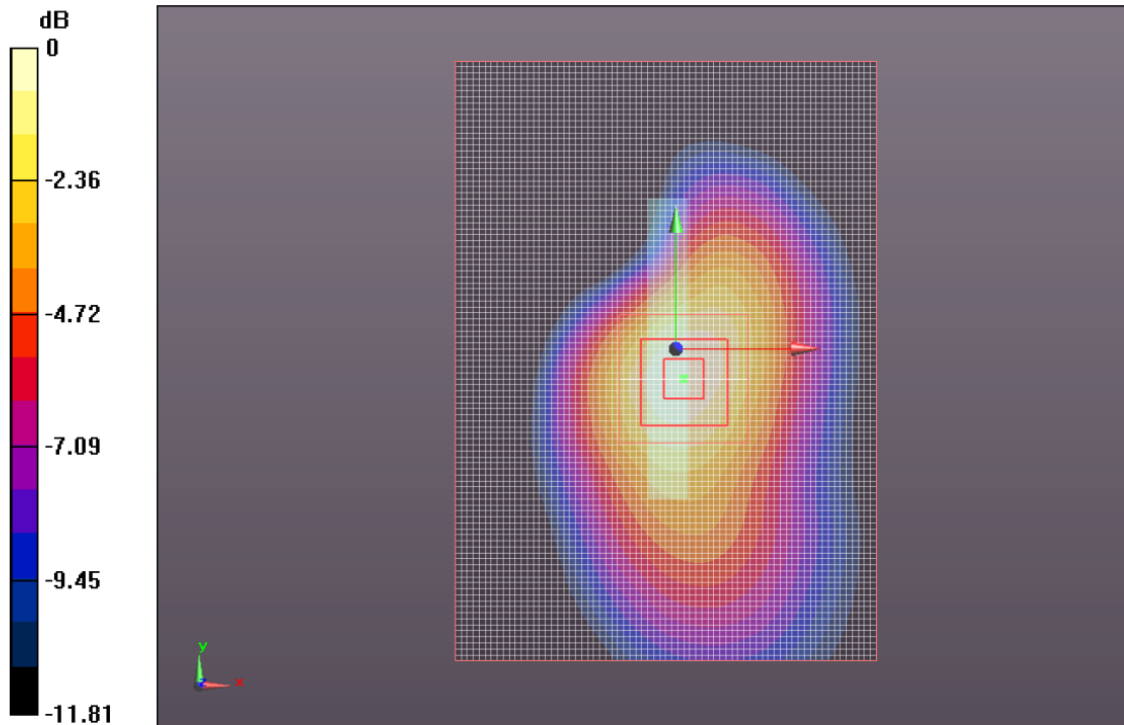
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3773; ConvF(8.67, 8.67, 8.67); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1117
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

UMTS Band V Rel.99 RMC 12.2 kbs/Main_Ant_M-CH/Area Scan (71x101x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm
Maximum value of SAR (interpolated) = 0.181 mW/g

UMTS Band V Rel.99 RMC 12.2 kbs/Main_Ant_M-CH/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm
Reference Value = 13.419 V/m; Power Drift = -0.0019 dB
Peak SAR (extrapolated) = 0.216 W/kg
SAR(1 g) = 0.150 mW/g; SAR(10 g) = 0.099 mW/g
Maximum value of SAR (measured) = 0.180 mW/g



0 dB = 0.180mW/g

Z plots

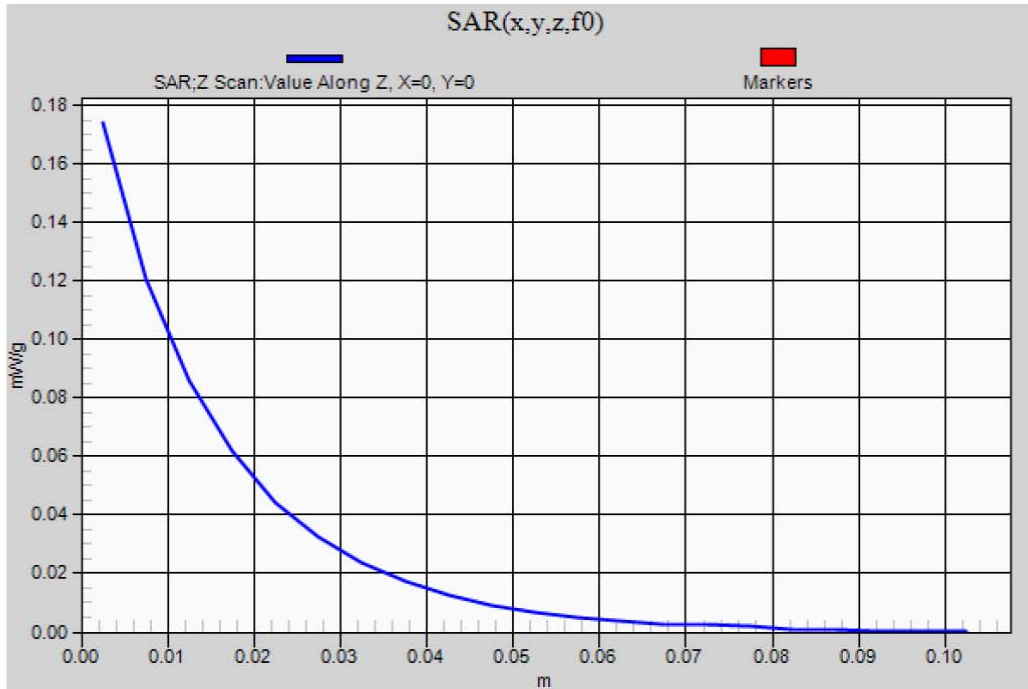
Date: 8/31/2011

Test Laboratory: UL CCS SAR Lab B

3_Horizontal Ant_UP

Communication System: UMTS-FDD (WCDMA); Frequency: 836.6 MHz; Duty Cycle: 1:1

UMTS Band V Rel.99 RMC 12.2 kbs/Main_Ant_M-CH/Z Scan (1x1x21): Measurement grid:
dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.174 mW/g



UMTS (WCDMA) Band IV

Date: 8/30/2011

Test Laboratory: UL CCS SAR Lab B

3_Horizontal Ant_UP

Communication System: UMTS-FDD (WCDMA); Frequency: 1732.4 MHz; Duty Cycle: 1:2.18776
Medium parameters used (interpolated): $f = 1732.6$ MHz; $\sigma = 1.404$ mho/m; $\epsilon_r = 54.426$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

DASY5 Configuration:

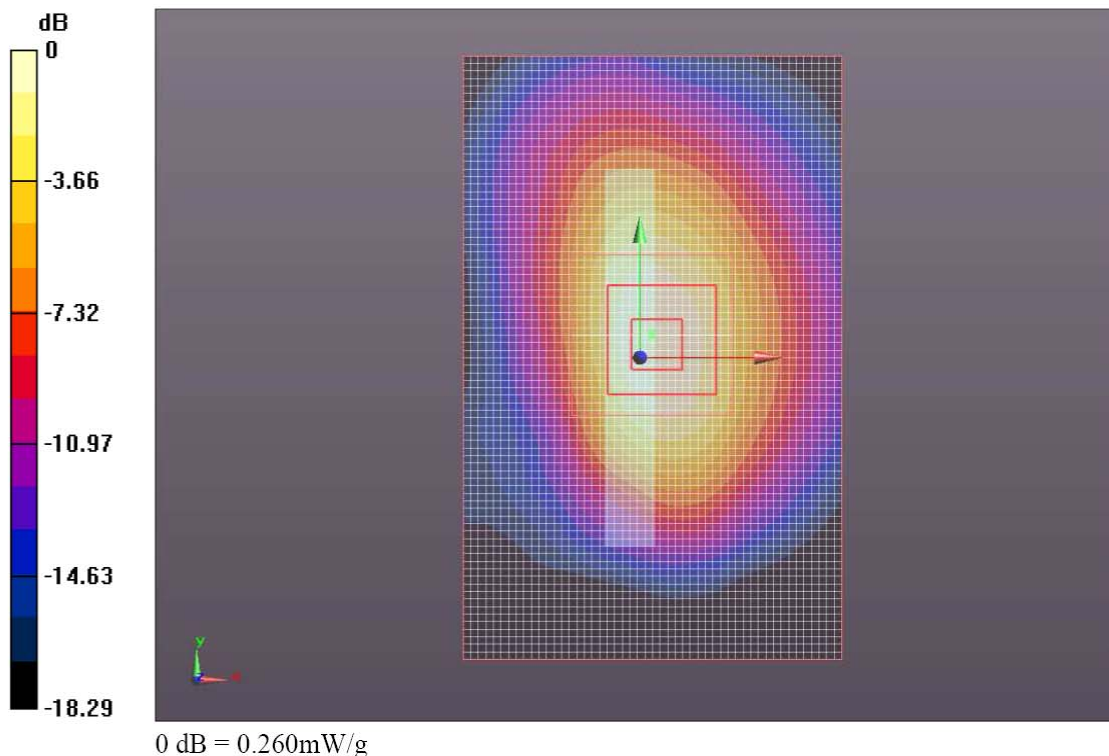
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3773; ConvF(7.72, 7.72, 7.72); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1117
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

UMTS Band IV Rel 99 RMC 12.2 kbs/Main_Ant_Ch-M/Area Scan (51x81x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm
Maximum value of SAR (interpolated) = 0.278 mW/g

UMTS Band IV Rel 99 RMC 12.2 kbs/Main_Ant_Ch-M/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm
Reference Value = 12.573 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.337 W/kg
SAR(1 g) = 0.211 mW/g; SAR(10 g) = 0.123 mW/g
Maximum value of SAR (measured) = 0.264 mW/g



Z plots

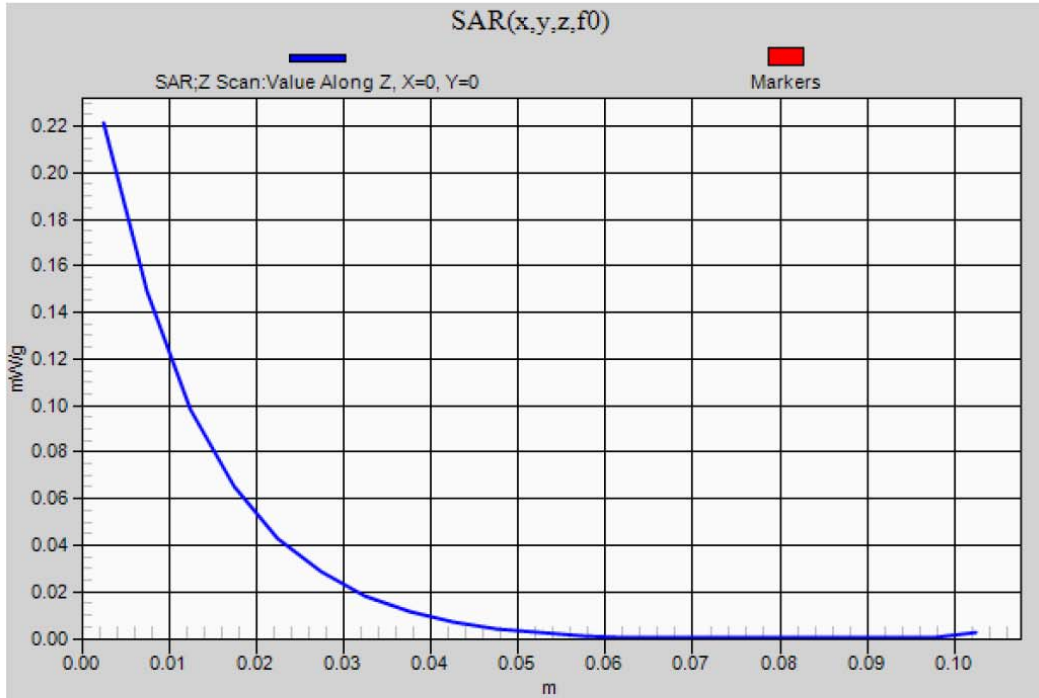
Date: 8/30/2011

Test Laboratory: UL CCS SAR Lab B

3_Horizontal Ant_UP

Communication System: UMTS-FDD (WCDMA); Frequency: 1732.4 MHz; Duty Cycle: 1:2.18776

UMTS Band IV Rel 99 RMC 12.2 kbs/Main_Ant_Ch-M/Z Scan (1x1x21): Measurement grid:
dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.221 mW/g



UMTS (WCDMA) Band II

Date: 8/26/2011

Test Laboratory: UL CCS SAR Lab B

3_Horizontal Ant_UP

Communication System: UMTS-FDD (WCDMA); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.487$ mho/m; $\epsilon_r = 51.788$; $\rho = 1000$ 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 - SN3773; ConvF(7.37, 7.37, 7.37); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1117
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

UMTS Band II Rel 99 RMC 12.2 kbs/Main_Ant_Ch-M/Area Scan (51x81x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (interpolated) = 0.461 mW/g

UMTS Band II Rel 99 RMC 12.2 kbs/Main_Ant_Ch-M/Zoom Scan (5x5x7)/Cube 0:

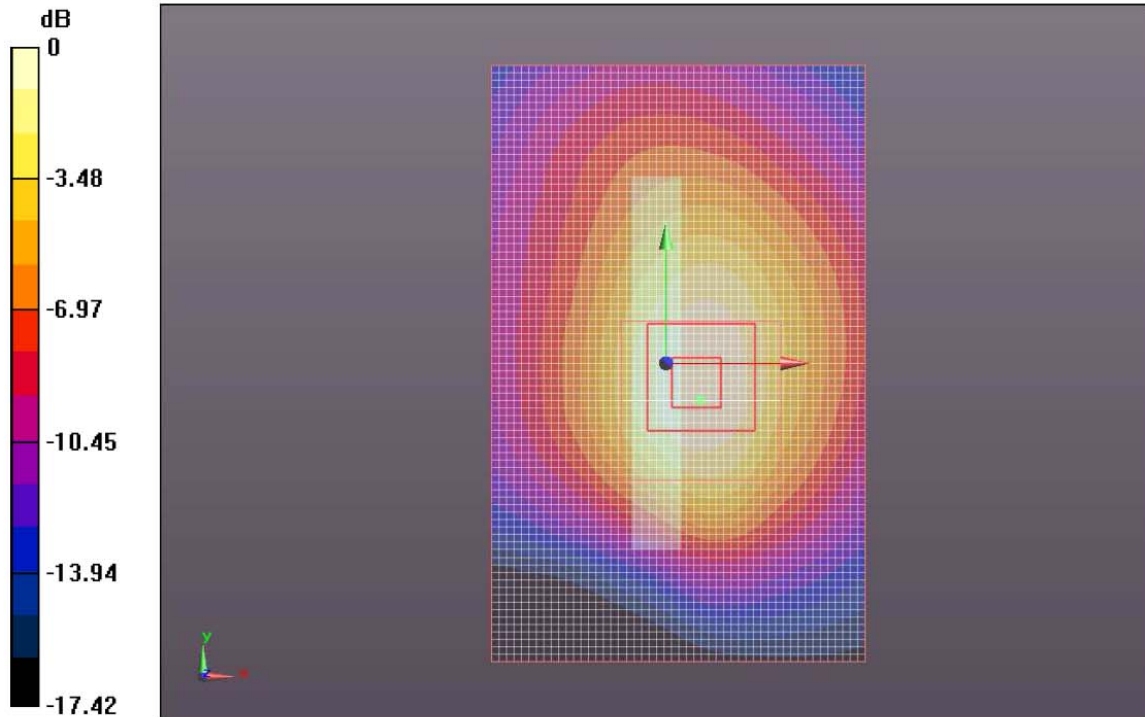
Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 17.840 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.604 W/kg

SAR(1 g) = 0.374 mW/g; SAR(10 g) = 0.219 mW/g

Maximum value of SAR (measured) = 0.473 mW/g



0 dB = 0.450mW/g

Z plots

Date: 8/26/2011

Test Laboratory: UL CCS SAR Lab B

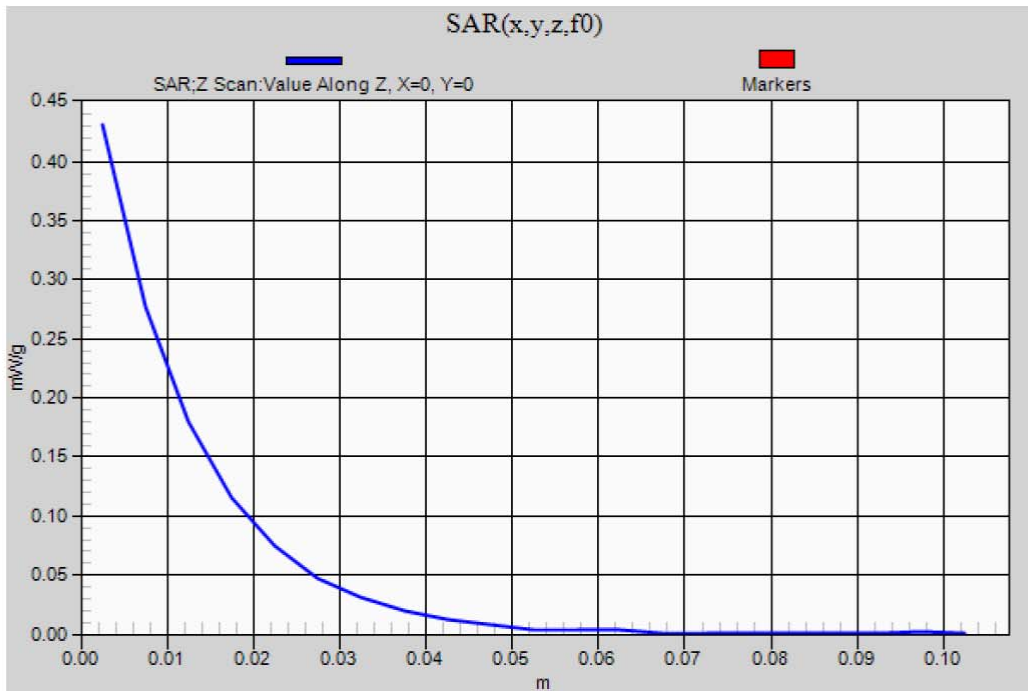
3_Horizontal Ant_UP

Communication System: UMTS-FDD (WCDMA); Frequency: 1880 MHz; Duty Cycle: 1:1

UMTS Band II Rel 99 RMC 12.2 kbs/Main_Ant_Ch-M/Z Scan (1x1x21): Measurement grid:

dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 0.431 mW/g



LTE Band 17

Date: 9/10/2011

Test Laboratory: UL CCS SAR Lab B

3_Horizontal Ant_UP

Communication System: LTE; Frequency: 710 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 710$ MHz; $\sigma = 0.937$ mho/m; $\epsilon_r = 56.663$; $\rho = 1000$ 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 - SN3773; ConvF(8.74, 8.74, 8.74); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1118
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

LTE Band 17 5MHz/QPSK__RBS#1_RBO#0_Main_Ant_M-CH_20MM/Area Scan

(71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.090 mW/g

LTE Band 17 5MHz/QPSK__RBS#1_RBO#0_Main_Ant_M-CH_20MM/Zoom Scan

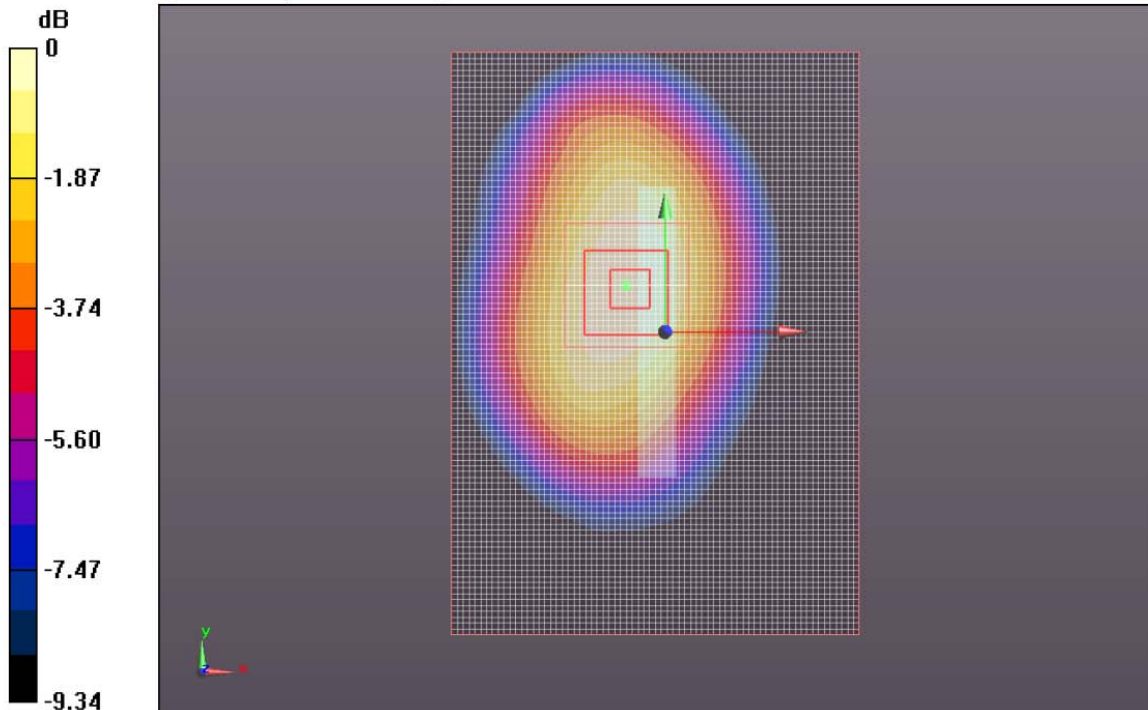
(5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.021 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 0.113 W/kg

SAR(1 g) = 0.080 mW/g; SAR(10 g) = 0.057 mW/g

Maximum value of SAR (measured) = 0.095 mW/g



0 dB = 0.090mW/g

Z plots

Date: 9/10/2011

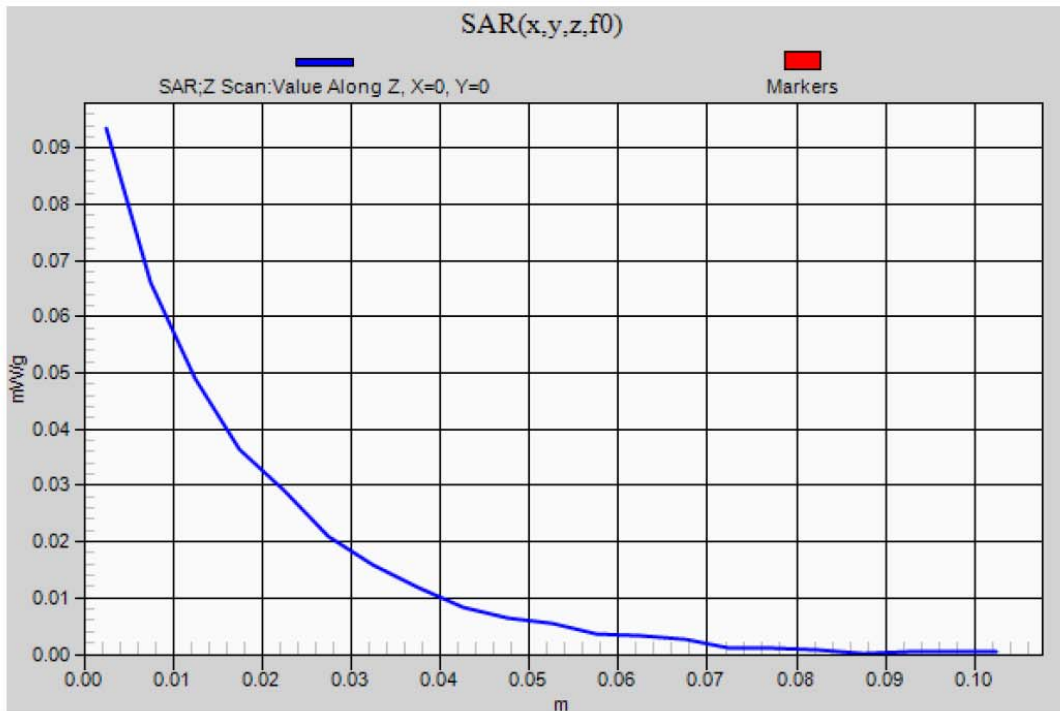
Test Laboratory: UL CCS SAR Lab B

3_Horizontal Ant_UP

Communication System: LTE; Frequency: 710 MHz; Duty Cycle: 1:1

LTE Band 17 5MHz/QPSK__RBS#1_RBO#0_Main_Ant_M-CH_20MM/Z Scan (1x1x21):

Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.094 mW/g



LTE Band 4

Date: 9/8/2011

Test Laboratory: UL CCS SAR Lab B

3_Horizontal Ant_UP

Communication System: LTE; Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 1732.5$ MHz; $\sigma = 1.464$ mho/m; $\epsilon_r = 52.68$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

DASY5 Configuration:

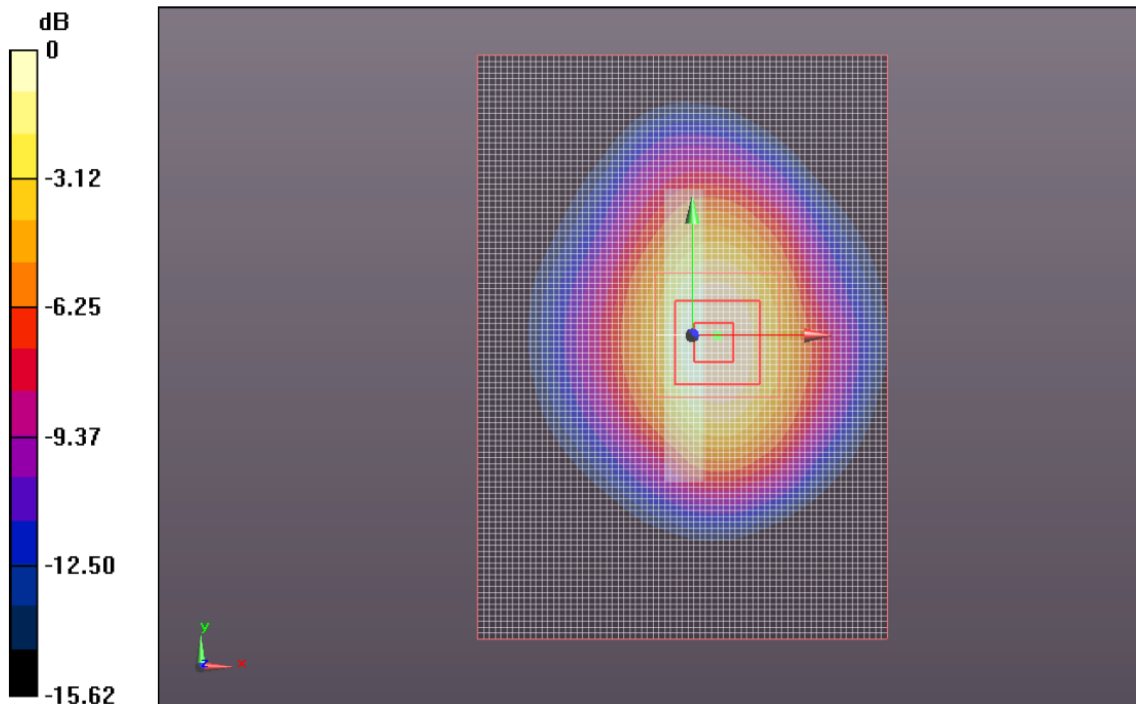
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3773; ConvF(7.72, 7.72, 7.72); Calibrated: 5/3/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1258; Calibrated: 5/2/2011
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1118
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

LTE Band 4 10MHz/QPSK__RBS#1_RBO#0_Main_Ant_M-CH_20MM 2/Area Scan

(71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.442 mW/g

LTE Band 4 10MHz QPSK__RBS#1_RBO#0_Main_Ant_M-CH_20MM 2/Zoom Scan

(5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.201 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.540 W/kg
SAR(1 g) = 0.339 mW/g; SAR(10 g) = 0.201 mW/g
Maximum value of SAR (measured) = 0.424 mW/g



0 dB = 0.420mW/g

Z plots

Date: 9/8/2011

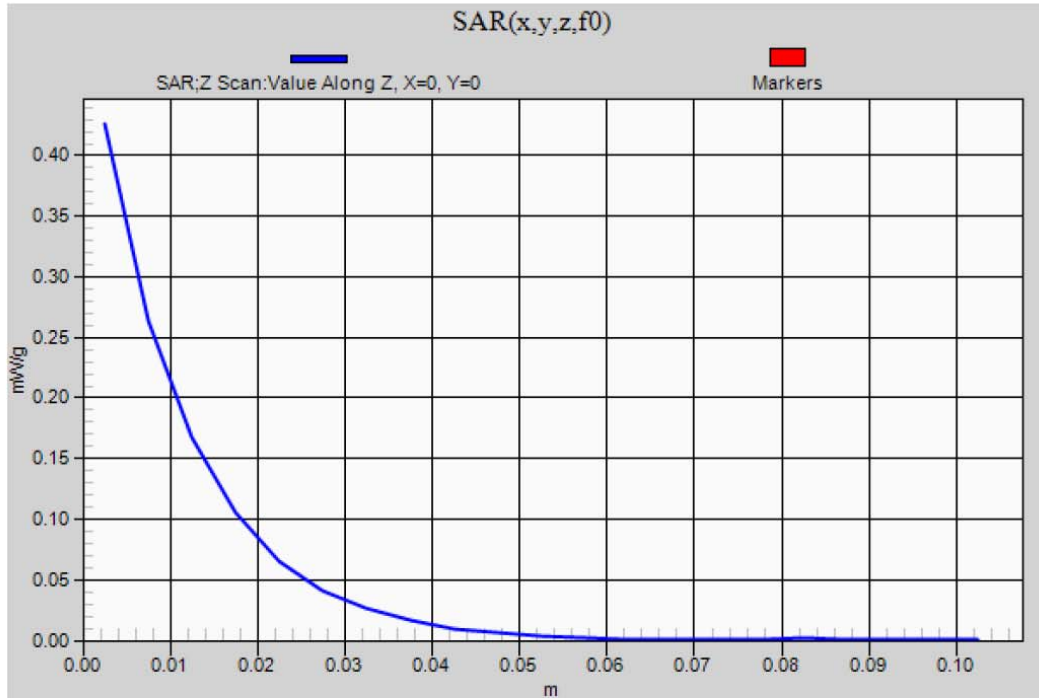
Test Laboratory: UL CCS SAR Lab B

3_Horizontal Ant_UP

Communication System: LTE; Frequency: 1732.5 MHz; Duty Cycle: 1:1

LTE Band 4 5MHz/QPSK__RBS#1_RBO#0_Main_Ant_M-CH_20MM 2/Z Scan (1x1x21):

Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.426 mW/g



17. Enhanced Energy Coupling

According to KDB 616217 in referencing to KDB 447498, the test configuration with the highest 1-g SAR must be used to determine if additional SAR evaluation is required due to enhanced energy coupling at increased separation distances.

GSM850

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

Worst-case test configuration	Mode	Antenna-to-person distance (mm)		Peak SAR (mW/g)	E-field (V/m)	Lower than Initial (%)
		Initial				
Vertical Down	GPRS 2 slots	Initial	20	0.00645	2.71	
		1	25	0.00	2.25	69.1%
		2	30	0.00	1.70	39.5%
Vertical UP	GPRS 2 slots	Initial	38	0.00596	2.22	
		1	43	0.00	1.40	39.9%
Horizontal Up	GPRS 2 slots	Initial	20	0.285	14.02	
		1	25	0.20	11.65	69.1%
		2	30	0.10	8.35	35.5%
Horizontal Down	GPRS 2 slots	Initial	20	0.156	9.604	
		1	25	0.08	6.94	52.3%
		2	30	0.05	5.59	33.9%
Horizontal Front	GPRS 2 slots	Initial	20	0.029	5.77	
		1	25	0.02	4.85	70.6%
		2	30	0.01	3.81	43.6%
Horizontal Back	GPRS 2 slots	Initial	20	0.053	7.99	
		1	25	0.03	6.45	65.2%
		2	30	0.02	5.43	46.2%

GSM1900

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

Worst-case test configuration	Mode	Antenna-to-person distance (mm)		Peak SAR (mW/g)	E-field (V/m)	Lower than Initial (%)
		Initial				
Vertical Down	GPRS 2slots	Initial	20	0.019	4.72	
		1	25	0.013	3.90	68.2%
		2	30	0.009	3.33	49.7%
Vertical Up	GPRS 2slots	Initial	38	0.023	4.12	
		1	43	0.010	2.71	43.4%
Horizontal Up	GPRS 2slots	Initial	20	0.400	14.75	
		1	25	0.289	12.54	72.2%
		2	30	0.197	10.35	49.2%
Horizontal Down	GPRS 2slots	Initial	20	0.300	14.45	
		1	25	0.208	12.03	69.3%
		2	30	0.140	9.87	46.7%
Horizontal Front	GPRS 2slots	Initial	20	0.061	7.13	
		1	25	0.040	5.79	66.0%
		2	30	0.029	4.89	47.1%
Horizontal Back	GPRS 2slots	Initial	20	0.270	13.73	
		1	25	0.215	12.24	79.5%
		2	30	0.163	10.67	60.4%
		3	35	0.102	8.43	47.4%

UMTS (WCDMA) Band V

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

Worst-case test configuration	Mode	Antenna-to-person distance (mm)		Peak SAR (mW/g)	E-field (V/m)	Lower than Initial (%)
		Initial				
Vertical Down	Rel. 99 RMC 12.2kbs	Initial	20	0.0140	3.611	
		1	25	0.012	3.29	83.0%
		2	30	0.009	2.89	64.1%
		3	35	0.005	2.19	44.3%
Vertical Up	Rel. 99 RMC 12.2kbs	Initial	38	0.014	3.32	
		1	43	0.004	1.84	30.8%
Horizontal Up	Rel. 99 RMC 12.2kbs	Initial	20	0.150	13.42	
		1	25	0.097	10.78	64.5%
		2	30	0.062	8.61	41.2%
Horizontal Down	Rel. 99 RMC 12.2kbs	Initial	20	0.136	12.80	
		1	25	0.092	10.52	67.5%
		2	30	0.056	8.21	41.1%
Horizontal Front	Rel. 99 RMC 12.2kbs	Initial	20	0.038	6.62	
		1	25	0.024	5.28	63.5%
		2	30	0.015	4.14	39.1%
Horizontal Back	Rel. 99 RMC 12.2kbs	Initial	20	0.062	8.36	
		1	25	0.039	6.63	62.8%
		2	30	0.026	5.38	41.4%

WCDMA UMTS Band IV

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

Worst-case test configuration	Mode	Antenna-to-person distance (mm)		Peak SAR (mW/g)	E-field (V/m)	Lower than Initial (%)
		Initial				
Vertical Down	Rel.99 RMC 12.2kbs	Initial	20	0.00270	1.84	
		1	25	0.00	1.39	57.1%
		2	30	0.00	1.27	47.7%
Vertical UP	Rel.99 RMC 12.2kbs	Initial	38	0.018	3.996	
		1	43	0.00	1.91	22.8%
Horizontal Up	Rel.99 RMC 12.2kbs	Initial	20	0.211	12.57	
		1	25	0.18	11.71	86.7%
		2	30	0.10	8.69	47.8%
Horizontal Down	Rel.99 RMC 12.2kbs	Initial	20	0.207	12.14	
		1	25	0.14	10.01	68.0%
		2	30	0.08	7.72	40.4%
Horizontal Front	Rel.99 RMC 12.2kbs	Initial	20	0.028	4.93	
		1	25	0.02	4.12	69.8%
		2	30	0.01	3.40	47.5%
Horizontal Back	Rel.99 RMC 12.2kbs	Initial	20	0.201	14.34	
		1	25	0.13	11.45	63.7%
		2	30	0.09	9.83	47.0%

WCDMA UMTS Band II

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

Worst-case test configuration	Mode	Antenna-to-person distance (mm)		Peak SAR (mW/g)	E-field (V/m)	Lower than Initial (%)
Vertical Down	Rel.99 RMC 12.2kbs	Initial	20	0.039	5.56	
		1	25	0.02	4.03	52.6%
		2	30	0.01	3.43	38.1%
Vertical Up	Rel.99 RMC 12.2kbs	Initial	38	0.025	5.82	
		1	43	0.01	3.55	37.3%
Horizontal Up	Rel.99 RMC 12.2kbs	Initial	20	0.374	17.84	
		1	25	0.32	16.57	86.3%
		2	30	0.26	14.96	70.3%
		3	35	0.15	11.38	47.2%
Horizontal Down	Rel.99 RMC 12.2kbs	Initial	20	0.282	14.42	
		1	25	0.24	13.34	85.6%
		2	30	0.18	11.67	65.5%
		3	35	0.13	9.69	45.2%
Horizontal Front	Rel.99 RMC 12.2kbs	Initial	20	0.117	9.87	
		1	25	0.07	7.53	58.2%
		2	30	0.05	6.53	43.8%
Horizontal Back	Rel.99 RMC 12.2kbs	Initial	20	0.361	17.17	
		1	25	0.27	14.83	74.6%
		2	30	0.15	10.91	40.4%

LTE Band 17

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

Worst-case test configuration	Mode	Antenna-to-person distance (mm)		Peak SAR (mW/g)	E-field (V/m)	Lower than Initial (%)
		Initial				
Vertical Down	QPSK RB#1,RBO#0	Initial	20	0.00735	2.97	
		1	25	0.00	1.60	29.2%
Vertical Up	QPSK RB#1,RBO#0	Initial	38	0.039	8.96	
		1	41	0.01	5.15	33.1%
Horizontal Up	QPSK RB#1,RBO#0	Initial	20	0.080	10.02	
		1	25	0.05	8.23	67.5%
		2	30	0.04	7.29	52.8%
		3	35	0.02	5.51	44.8%
Horizontal Down	QPSK RB#1,RBO#0	Initial	20	0.070	9.25	
		1	25	0.05	7.82	71.5%
		2	30	0.03	6.28	46.0%
Horizontal Front	QPSK RB#1,RBO#0	Initial	20	0.044	7.46	
		1	25	0.03	6.19	68.9%
		2	30	0.02	5.01	45.1%
Horizontal Back	QPSK RB#1,RBO#0	Initial	20	0.047	7.22	
		1	25	0.03	6.06	70.6%
		2	30	0.02	4.94	46.8%

LTE Band 4

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

Worst-case test configuration	Mode	Antenna-to-person distance (mm)		Peak SAR (mW/g)	E-field (V/m)	Lower than Initial (%)
		Initial				
Vertical Down	QPSK RB#1,RBO#0	Initial	20	0.008	2.47	
		1	25	0.01	2.28	85.4%
		2	30	0.00	1.77	51.4%
		3	35	0.00	1.41	38.3%
Vertical Up	QPSK RB#1,RBO#0	Initial	38	0.027	4.56	
		1	41	0.00	1.92	17.8%
Horizontal Up	QPSK RB#1,RBO#0	Initial	20	0.339	17.20	
		1	25	0.17	12.35	51.6%
		2	30	0.12	10.30	35.9%
Horizontal Down	QPSK RB#1,RBO#0	Initial	20	0.269	16.10	
		1	25	0.16	12.26	58.0%
		2	30	0.10	9.86	37.5%
Horizontal Front	QPSK RB#1,RBO#0	Initial	20	0.089	8.81	
		1	25	0.05	6.80	59.6%
		2	30	0.04	5.78	43.0%
Horizontal Back	QPSK RB#1,RBO#0	Initial	20	0.268	16.22	
		1	25	0.20	13.90	73.4%
		2	30	0.10	10.11	38.9%

18. Appendixes

Refer to separated files for the following appendixes.

- 18.1. Appendix A: System Check
- 18.2. Appendix B: SAR Test plots for GSM 850
- 18.3. Appendix C: SAR Test plots for GSM 1900
- 18.4. Appendix D: SAR Test plots for UMTS (WCDMA) Band V
- 18.5. Appendix E: SAR Test plots for UMTS (WCDMA) Band IV
- 18.6. Appendix F: SAR Test plots for UMTS (WCDMA) Band II
- 18.7. Appendix G: SAR Test plots for LTE Band 17
- 18.8. Appendix H: SAR Test plots for LTE Band 4
- 18.9. Appendix I: Calibration Certificate - E-Field Probe EX3DV4 - SN 3686
- 18.10. Appendix J: Calibration Certificate - E-Field Probe EX3DV4 - SN 3772
- 18.11. Appendix K: Calibration Certificate - Validation Dipole D750V3 - SN 1019
- 18.12. Appendix L: Calibration Certificate - Validation Dipole D835V2 - SN 4d117
- 18.13. Appendix M: Calibration Certificate - Validation Dipole D1750V2 - SN 1053
- 18.14. Appendix N: Calibration Certificate - Validation Dipole D1900V2 - SN 5d140