FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE STD 1528:2003

SAR EVALUATION REPORT

For
MC7700 PCI Express Mini Card
(Tested inside of Panasonic Tablet PC CF-H2)

MODEL NUMBER: MC7700
FCC ID: N7NMC7700

REPORT NUMBER: 11J14039-1C

ISSUE DATE: 3-29-2012

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	10-26-2011	Initial Issue	--
A	1-18-2012	1. Sec. 5: Added Statement 2. Sec. 5.1: Updated Table 3. Sec. 11.1 and 11.2: Updated Output Power Table based on the correct Cable Loss. 4. Sec. 11.3: Added Measured MPR on LTE Output Power Table 5. Sec. 11.3.1: Added Spectrum Plot for 10MHz 6. Sec. 12.1 and 12.2: Added Note 7. Sec. 12.3 and 12.4: o Additional Testing was performed for LTE Band 4 and Band 17. o Removed unnecessary SAR Data for Secondary Landscape and Bottom Configuration o Revised Note to indicate Test Reduction 8. Sec. 13: Updated Table 9. Sec. 14: Updated Appendixes 10. Sec. 15: Updated Table 11. Sec. 16: Revised Device Diagram 12. Sec. 17: Added Base/Tilt Set-up Photo	Bobby Bayani
B	2-6-2012	Updated report based on reviewer's comments. 1. Sec. 5.1: Updated LTE Table 2. Sec. 12.2: Additional Testing for LTE – 16QAM performed	Bobby Bayani
C	3-29-2012	Updated report based upon reviewer's comments. 1. Sec. 5.1: Updated Statement on item no. 9. 2. Sec. 12.3 and 12.4: Added Measured MPR to the SAR Results Table. Added note for 10MHz Bandwidth Testing. 3. Sec. 11.5.1: Removed 5MHz Bandwidth LTE Spectrum Plots.	Bobby Bayani

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1. Attestation of Test Results

Applicant name:	Sierra Wireless Inc.
EUT description:	The EUT is the Sierra Wireless MC7700 850/1900 GSM/WCDMA/GPRS/EDGE and 700/1700 LTE Module (Tested inside of Panasonic Tablet PC, Model CF-H2)
Model number:	MC7700
Device category:	Portable
Exposure category:	General Population/Uncontrolled Exposure
Date tested:	October 7-20, 2011 December 19-21, 2011 (Additional Testing) January 11-12, 2012 (Additional Testing) January 31-February 2, 2012 (Additional Testing)

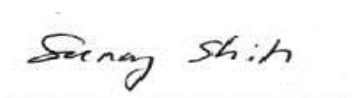
FCC Rule Parts	Freq. Range [MHz]	Highest 1g SAR (mW/g)	Limit (mW/g)
27 (LTE Band 17)	704 – 716	0.246 (Base/Tilt)	1.6
22H	824 – 849	0.567 (Base/Tilt)	
27 (LTE Band 4)	1710 – 1755	0.416 (Base/Tilt)	
24E	1850 – 1910	0.420 (Base/Tilt)	

Applicable Standards	Test Results
OET Bulletin 65 Supplement C 01-01, IEEE STD 1528: 2003	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 CCS By:



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

Tested By:

Bobby Bayani
SAR 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 Edition 01-01, IEEE STD 1528:2003 and the following KDBs Procedures.

- 447498 D01 Mobile Portable RF Exposure v04
- 941225 D01 SAR test for 3G devices v02
- 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
Dielectric Probe Kit	HP	85070C	N/A	N/A		
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
Thermometer	EXTECH	Thermometer	SCL29766	5	17	2012
Data Acquisition Electronics	SPEAG	DAE3	500	7	14	2012
Data Acquisition Electronics	SPEAG	DAE4	1258	5	2	2012
Data Acquisition Electronics	SPEAG	DAE4	1239	10	18	2012
System Validation Dipole	SPEAG	D750V3	1024	4	20	2012
System Validation Dipole	SPEAG	D835V2	4d117	4	15	2012
System Validation Dipole	SPEAG	D1750V2	1050	4	19	2012
System Validation Dipole	SPEAG	D1900V2	5d140	4	18	2012
Power Meter	HP	437B	3125U16345	5	13	2012
Power Sensor	HP	8481A	1834588	5	13	2012
Directional Coupler	Warlatone	C8060-102	2141	N/A		
Radio Communication Analyzer	R&S	CMU200	838114/032	3	1	2012
Radio Communication Analyzer	Anritsu	MT8820C	8200985430	6	17	2012
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	SPEAG	MSL750	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	MSL900	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	MSL1750	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	MSL1900	N/A	Within 24 hrs of first test		

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	4.98	Normal	1	0.64	3.19
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement	4.74	Normal	1	0.6	2.84
Combined Standard Uncertainty Uc(y) =					10.36
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				20.72	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.64	dB

5. Equipment Under Test

The EUT is the Sierra Wireless MC7700 850/1900 for GSM/WCDMA/GPRS/EDGE and 700/1700 for LTE Module. Tested inside Panasonic Tablet PC, CF-H2 Rubber Handle located at the back of the Device is non-removable.	
Normal operation:	Multiple display orientations supporting both portrait and landscape configurations.
Antenna tested:	Manufactured: Part Number: Panasonic Chain A: DFUP2071ZA(1)
Antenna-to-antenna/user separation distances:	See Section 16 for details of antenna locations and separation distances.
Simultaneous transmission:	• WWAN can transmit simultaneously with WiFi • WWAN can transmit simultaneously with Bluetooth • WiFi can transmit simultaneously with Bluetooth
Assessment for SAR evaluation for Simultaneous transmission:	**WiFi and BT** Due to Bluetooth's maximum output is < 60/f(GHz) mW and standalone SAR is not required, that WiFi and Bluetooth are not considered as co-located transmitters each other. (Bluetooth – FCC ID: ACJ9TGBT11A, IC: 216ACFBT11A) **WWAN and BT** Same as WiFi and BT **WWAN and WiFi** SAR is not required due to $\sum (SAR_{1g})$ < SAR limit. (Refer to Sec. 13 Simultaneous Transmission SAR Analyses.)

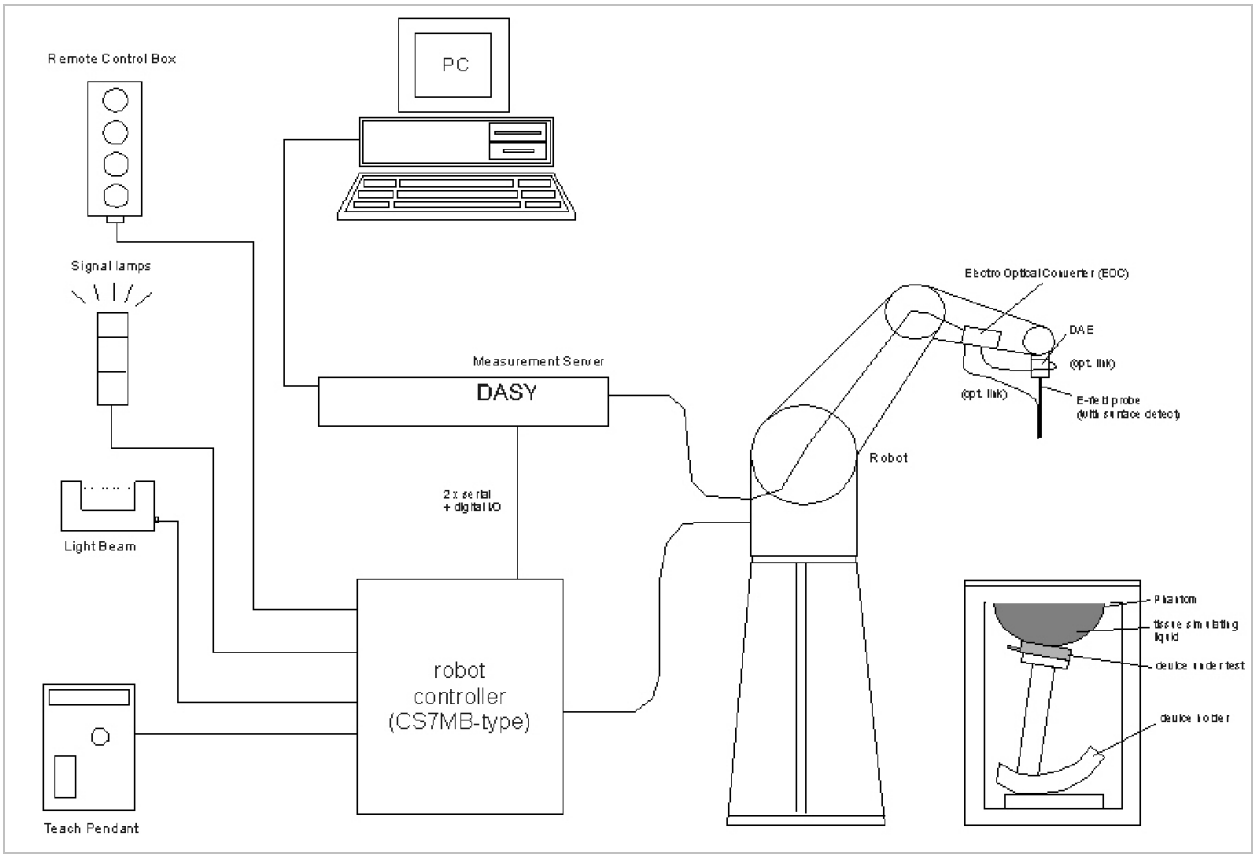
5.1. KDB 941225 D05 "SAR for LTE Devices v01"

#	Description	Parameter
1	Identify the operating frequency range of each LTE transmission band used by the device	Band 4: 1712.5 - 1752.5 MHz (5 MHz BW) 1710 - 1755 MHz (10MHz BW) Band 17: 706.5 - 713.5 MHz (5 MHz BW) 710 MHz (10MHz BW)
2	Identify the channel bandwidths used in each frequency band; 1.4, 3, 5, 10, 15, 20 MHz etc	5MHz, 10MHz
3	Identify the high, middle and low (H, M, L) channel numbers and frequencies in each LTE frequency band	Please refer to section 11.5
4	Specify the UE category and uplink modulations used	The UE Category is 3 Uplink modulations: QPSK, 16QAM
5	Descriptions of the LTE transmitter and antenna implementation & identify whether it is a standalone transmitter operating independently of other wireless transmitters in the device or sharing hardware components and/or antenna(s) with other transmitters etc.	Please refer Sec. 16 Antenna locations and distance
6	Identify the LTE voice/data requirements in each operating mode and exposure condition with respect to head and body test configurations, antenna locations, handset flip-cover or slide positions, antenna diversity conditions, etc.	Voice mode is not supported for the module incorporated in this host device.
7	Identify if Maximum Power Reduction (MPR) is optional or mandatory, i.e. built-in by design: a) only mandatory MPR may be considered during SAR testing, when the maximum output power is permanently limited by the MPR implemented within the UE; and only for the applicable RB (resource block) configurations specified in LTE standards b) A-MPR (additional MPR) must be disabled.	• Built-in by design • A-MPR was disabled Please refer to Tables in section 12
8	Include the maximum average conducted output power measured on the required test channels for each channel bandwidth and UL modulation used in each frequency band: a) with 1 RB allocated at the upper edge of a channel b) with 1 RB allocated at the lower edge of a channel c) using 50% RB allocation centered within a channel d) using 100% RB allocation	Refer to section 11.5 RF output power table
9	Identify all other U.S. wireless operating modes (3G, Wi-Fi, WiMax, Bluetooth etc), device/exposure configurations (head and body, antenna and handset flip-cover or slide positions, antenna diversity conditions etc.) and frequency bands used for these modes	850/1900 GSM/WCDMA/GPRS/EDGE and LTE functions are contained within the module. Only one band/mode can be operational at a time
10	Include the maximum average conducted output power measured for the other wireless mode and frequency bands	See section 11 RF output power measurements in SAR report.
11	Identify the simultaneous transmission conditions for the voice and data configurations supported by all wireless modes, device configurations and frequency bands, for the head and body exposure conditions and device operating configurations (handset flip or cover positions, antenna diversity conditions etc.)	Voice mode is not supported

KDB 941225 D05 "SAR for LTE Devices v01" (continued)

12	When power reduction is applied to certain wireless modes to satisfy SAR compliance for simultaneous transmission conditions, other equipment certification or operating requirements, include the maximum average conducted output power measured in each power reduction mode applicable to the simultaneous voice/data transmission configurations for such wireless configurations and frequency bands; and also include details of the power reduction implementation and measurement setup	Not Applicable
13	Include descriptions of the test equipment, test software, built-in test firmware etc. required to support testing the device when power reduction is applied to one or more transmitters/antennas for simultaneous voice/data transmission	Not Applicable
14	When appropriate, include a SAR test plan proposal with respect to the above	Not Applicable
15	If applicable, include preliminary SAR test data and/or supporting information in laboratory testing inquiries to address specific issues and concerns or for requesting further test reduction considerations appropriate for the device; for example, simultaneous transmission configurations	Not applicable

6. System Specification



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 MSL750
Type No	SL AAH 075
Manufacturer	SPEAG
The item is composed of the following ingredients:	
H^2O	Water, 35 – 58%
Sucrese	Sugar, white, refined, 40-60%
NaCl	Sodium Chloride, 0-6%
Hydroxyethel-cellulsoe	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-methyyl-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 MSL1750
Type No	SL AAM 175
Manufacturer	SPEAG
The item is composed of the following ingredients:	
H^2O	Water, 52 – 75%
C8H18O3	Diethylene glycol monobutyl ether (DGBE), 25-48%
NaCl	Sodium Chloride, <1.0%

8. 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 ± 5% of the target values. For frequencies above 2 GHz the measured conductivity was within ± 5% of the target values. The measured relative permittivity tolerance was within ± 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 ρ = 1000 kg/m^3)

8.1. Simulating Liquid Check Results

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
10/07/2011	Body 750	e'	54.5557	Relative Permittivity (ϵ_r):	54.56	55.55	-1.78	5
		e"	22.7298	Conductivity (σ):	0.95	0.96	-1.58	5
10/10/2011	Body 750	e'	56.4550	Relative Permittivity (ϵ_r):	56.46	55.55	1.64	5
		e"	22.8974	Conductivity (σ):	0.95	0.96	-0.85	5
10/11/2011	Body 750	e'	54.6474	Relative Permittivity (ϵ_r):	54.65	55.55	-1.62	5
		e"	22.8697	Conductivity (σ):	0.95	0.96	-0.97	5
10/12/2011	Body 1750	e'	53.6642	Relative Permittivity (ϵ_r):	53.66	53.44	0.42	5
		e"	14.7408	Conductivity (σ):	1.43	1.49	-3.49	5
10/13/2011	Body 1750	e'	53.5857	Relative Permittivity (ϵ_r):	53.59	53.44	0.27	5
		e"	14.7798	Conductivity (σ):	1.44	1.49	-3.23	5
10/13/2011	Body 750	e'	55.3231	Relative Permittivity (ϵ_r):	55.32	55.55	-0.40	5
		e"	22.6438	Conductivity (σ):	0.94	0.96	-1.95	5
10/14/2011	Body 1750	e'	53.4090	Relative Permittivity (ϵ_r):	53.41	53.44	-0.06	5
		e"	15.0344	Conductivity (σ):	1.46	1.49	-1.56	5
10/14/2011	Body 835	e'	53.7277	Relative Permittivity (ϵ_r):	53.73	55.20	-2.67	5
		e"	21.3137	Conductivity (σ):	0.99	0.97	2.02	5
10/17/2011	Body 835	e'	54.7023	Relative Permittivity (ϵ_r):	54.70	55.20	-0.90	5
		e"	21.1107	Conductivity (σ):	0.98	0.97	1.05	5
10/17/2011	Body 1900	e'	53.2359	Relative Permittivity (ϵ_r):	53.24	53.30	-0.12	5
		e"	13.7904	Conductivity (σ):	1.46	1.52	-4.15	5
12/19/2011	Body 1720	e'	52.2949	Relative Permittivity (ϵ_r):	52.29	53.52	-2.29	5
		e"	15.7679	Conductivity (σ):	1.51	1.47	2.75	5
	Body 1735	e'	52.2431	Relative Permittivity (ϵ_r):	52.24	53.48	-2.31	5
		e"	15.8034	Conductivity (σ):	1.52	1.48	3.23	5
	Body 1750	e'	52.1776	Relative Permittivity (ϵ_r):	52.18	53.44	-2.36	5
		e"	15.8364	Conductivity (σ):	1.54	1.49	3.69	5
12/20/2011	Body 1720	e'	52.2042	Relative Permittivity (ϵ_r):	52.20	53.52	-2.45	5
		e"	15.4544	Conductivity (σ):	1.48	1.47	0.70	5
	Body 1735	e'	52.1402	Relative Permittivity (ϵ_r):	52.14	53.48	-2.50	5
		e"	15.4900	Conductivity (σ):	1.49	1.48	1.18	5
	Body 1750	e'	52.0817	Relative Permittivity (ϵ_r):	52.08	53.44	-2.54	5
		e"	15.5262	Conductivity (σ):	1.51	1.49	1.66	5
12/21/2011	Body 750	e'	57.8312	Relative Permittivity (ϵ_r):	57.83	55.55	4.11	5
		e"	22.9530	Conductivity (σ):	0.96	0.96	-0.61	5
	Body 700	e'	58.3819	Relative Permittivity (ϵ_r):	58.38	55.74	4.74	5
		e"	23.4170	Conductivity (σ):	0.91	0.96	-4.98	5
	Body 710	e'	58.2648	Relative Permittivity (ϵ_r):	58.26	55.70	4.60	5
		e"	23.3127	Conductivity (σ):	0.92	0.96	-4.13	5

Liquid Check Results (Continued)

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1/11/2012	Body 835	e'	55.0397	Relative Permittivity (ϵ_r):	55.04	55.20	-0.29	5
		e''	21.1472	Conductivity (σ):	0.98	0.97	1.22	5
1/11/2012	Body 1900	e'	54.0922	Relative Permittivity (ϵ_r):	54.09	53.30	1.49	5
		e''	14.4810	Conductivity (σ):	1.53	1.52	0.65	5
1/12/2012	Body 750	e'	56.8175	Relative Permittivity (ϵ_r):	56.82	55.55	2.29	5
		e''	23.1472	Conductivity (σ):	0.97	0.96	0.23	5
	Body 700	e'	57.3658	Relative Permittivity (ϵ_r):	57.37	55.74	2.92	5
		e''	23.6420	Conductivity (σ):	0.92	0.96	-4.07	5
	Body 710	e'	57.2528	Relative Permittivity (ϵ_r):	57.25	55.70	2.79	5
		e''	23.5339	Conductivity (σ):	0.93	0.96	-3.22	5
1/12/2012	Body 1720	e'	51.3155	Relative Permittivity (ϵ_r):	51.32	53.52	-4.12	5
		e''	14.9189	Conductivity (σ):	1.43	1.47	-2.79	5
	Body 1735	e'	51.2627	Relative Permittivity (ϵ_r):	51.26	53.48	-4.15	5
		e''	14.9484	Conductivity (σ):	1.44	1.48	-2.36	5
	Body 1750	e'	51.2172	Relative Permittivity (ϵ_r):	51.22	53.44	-4.16	5
		e''	14.9851	Conductivity (σ):	1.46	1.49	-1.89	5
1/31/2012	Body 1720	e'	53.4571	Relative Permittivity (ϵ_r):	53.46	53.52	-0.11	5
		e''	15.1497	Conductivity (σ):	1.45	1.47	-1.28	5
	Body 1735	e'	53.4894	Relative Permittivity (ϵ_r):	53.49	53.48	0.02	5
		e''	15.1848	Conductivity (σ):	1.46	1.48	-0.81	5
	Body 1750	e'	53.4393	Relative Permittivity (ϵ_r):	53.44	53.44	0.00	5
		e''	15.2235	Conductivity (σ):	1.48	1.49	-0.32	5
2/1/2012	Body 1720	e'	52.0705	Relative Permittivity (ϵ_r):	52.07	53.52	-2.70	5
		e''	15.4102	Conductivity (σ):	1.47	1.47	0.42	5
	Body 1735	e'	51.9717	Relative Permittivity (ϵ_r):	51.97	53.48	-2.82	5
		e''	15.3891	Conductivity (σ):	1.48	1.48	0.52	5
	Body 1750	e'	51.9068	Relative Permittivity (ϵ_r):	51.91	53.44	-2.87	5
		e''	15.4424	Conductivity (σ):	1.50	1.49	1.11	5
2/2/2012	Body 700	e'	57.7262	Relative Permittivity (ϵ_r):	57.73	55.74	3.57	5
		e''	24.1286	Conductivity (σ):	0.94	0.96	-2.09	5
	Body 710	e'	57.7728	Relative Permittivity (ϵ_r):	57.77	55.70	3.72	5
		e''	24.0228	Conductivity (σ):	0.95	0.96	-1.21	5
	Body 750	e'	57.2450	Relative Permittivity (ϵ_r):	57.25	55.55	3.06	5
		e''	23.4539	Conductivity (σ):	0.98	0.96	1.56	5

9. 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 ±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 DASY5 system with an Isotropic E-Field Probe EX3DV4 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 (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 2.5 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:	Freq.	Head	Body
D750V3 SN: 1024	D750V3-1024_Apr11	4/20/11	1g SAR:	750 MHz	8.52	8.8
			10g SAR:		5.56	5.84
D835V2 SN: 4d117	D835V2-4d117_Apr11	4/15/11	1g SAR:	835 MHz	9.64	10.1
			10g SAR:		6.28	6.6
D1750V2 SN: 1050	D1750V2-1050_Apr11	4/19/11	1g SAR:	1.75 GHz	36.8	36.4
			10g SAR:		19.6	19.4
D1900V2 SN: 5d140	D1900V2-5d140_Apr11	4/18/11	1g SAR:	1.9 GHz	41.6	41.2
			10g SAR:		21.5	21.6

9.1. System Check Results

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D750V3 SN: 1024	10/07/11	1g SAR:	8.73	8.80	-0.80	±10
		10g SAR:	5.81	5.84	-0.51	
D750V3 SN: 1024	10/10/11	1g SAR:	9.06	8.80	2.95	±10
		10g SAR:	6.02	5.84	3.08	
D750V3 SN: 1024	10/11/11	1g SAR:	8.97	8.80	1.93	±10
		10g SAR:	5.95	5.84	1.88	
D1750V2 SN: 1050	10/12/11	1g SAR:	34.7	36.4	-4.67	±10
		10g SAR:	18.6	19.4	-4.12	
D1750V2 SN: 1050	10/13/11	1g SAR:	34.6	36.4	-4.95	±10
		10g SAR:	18.6	19.4	-4.12	
D750V3 SN: 1024	10/13/11	1g SAR:	8.83	8.80	0.34	±10
		10g SAR:	5.86	5.84	0.34	
D1750V2 SN: 1050	10/14/11	1g SAR:	35.30	36.4	-3.02	±10
		10g SAR:	18.90	19.4	-2.58	
D835V2 SN: 4d117	10/14/11	1g SAR:	10.2	10.1	0.99	±10
		10g SAR:	6.7	6.6	1.52	
D835V2 SN: 4d117	10/17/11	1g SAR:	9.94	10.1	-1.58	±10
		10g SAR:	6.52	6.6	-1.21	
D1900V2 SN: 5d140	10/17/11	1g SAR:	39.4	41.2	-4.37	±10
		10g SAR:	20.7	21.6	-4.17	
D1750V2 SN: 1050	12/19/11	1g SAR:	38.20	36.4	4.95	±10
		10g SAR:	20.00	19.4	3.09	
D1750V2 SN: 1050	12/20/11	1g SAR:	36.70	36.4	0.82	±10
		10g SAR:	19.30	19.4	-0.52	
D750V3 SN: 1024	12/21/11	1g SAR:	9.16	8.80	4.09	±10
		10g SAR:	6.09	5.84	4.28	
D835V2 SN: 4d117	01/11/12	1g SAR:	10.30	10.1	1.98	±10
		10g SAR:	6.79	6.6	2.88	
D1900V2 SN: 5d140	01/11/12	1g SAR:	38.60	41.2	-6.31	±10
		10g SAR:	20.10	21.6	-6.94	
D750V3 SN: 1024	01/12/12	1g SAR:	9.38	8.80	6.59	±10
		10g SAR:	6.22	5.84	6.51	
D1750V2 SN: 1050	01/12/12	1g SAR:	37.7	36.4	3.57	±10
		10g SAR:	20.0	19.4	3.09	
D1750V2 SN: 1050	01/31/12	1g SAR:	36.5	36.4	0.27	±10
		10g SAR:	19.3	19.4	-0.52	

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D1750V2 SN: 1050	02/01/12	1g SAR:	37.3	36.4	2.47	±10
		10g SAR:	19.7	19.4	1.55	
D750V3 SN: 1024	02/02/12	1g SAR:	8.93	8.80	1.48	±10
		10g SAR:	5.92	5.84	1.37	

10. 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 DASY5 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 ≥ 7x7x9 (above 4.5 GHz) or 5x5x7 (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.

11. RF Output Power Verification

11.1. GSM

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slot	Frame Avg Pwr
GSM850	128	824.2	32.5	23.5	32.7	**26.7**
	190	836.6	32.9	23.9	33.0	**27.0**
	251	848.8	32.6	23.6	32.9	**26.9**
GSM1900	512	1850.2	29.9	20.9	29.8	**23.8**
	661	1880	29.9	20.9	29.8	**23.8**
	810	1909.8	29.8	20.8	29.8	**23.8**

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slot	Frame Avg Pwr
GSM850	128	824.2	27.7	18.7	27.7	21.7
	190	836.6	27.7	18.7	27.7	21.7
	251	848.8	27.8	18.8	27.7	21.7
GSM1900	512	1850.2	26.6	17.6	26.6	20.6
	661	1880	26.8	17.8	26.8	20.8
	810	1909.8	26.6	17.6	26.6	20.6

Note(s):

1. 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.
2. Based on output power above and time slots, the following worst-case configurations were chosen for Body SAR testing.
    a. GPRS850 2 time slots
    b. GPRS1900 2 time slots

11.2. UMTS Release 99

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

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

Results

Rel 99 (12.2kps RMC)

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	Avg Tx Pwr (dBm)
UMTS850 (Band V)	Rel 99 12.2kbps RMC	4132	4357	826.4	24.86
		4183	4408	836.6	24.96
		4233	4458	846.6	24.87
UMTS1900 (Band II)	Rel 99 12.2kps RMC	9262	9662	1852.4	24.81
		9400	9800	1880.0	24.87
		9538	9938	1907.6	24.77

11.3. UMTS HSDPA

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121 specification. A summary of these settings are illustrated below:

	Mode	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm2			
	β_c	2/15	12/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	β_d (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	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	$A_{hs} = \beta_{hs}/ \beta_c$	30/15			

Test Results

Band	Mode	UL Ch#	DL Ch#	Freq. (MHz)	Avg Tx Power (dBm)
UMTS850 (Band V)	Subtest 1	4132	4357	826.4	23.79
		4182	4408	836.6	23.91
		4233	4458	846.6	24.30
	Subtest 2	4132	4357	826.4	24.11
		4182	4408	836.6	24.23
		4233	4458	846.6	24.26
	Subtest 3	4132	4357	826.4	23.17
		4182	4408	836.6	23.50
		4233	4458	846.6	23.70
	Subtest 4	4132	4357	826.4	22.44
		4182	4408	836.6	23.56
		4233	4458	846.6	23.26
UMTS1900 (Band II)	Subtest 1	9262	9662	1852.4	24.59
		9400	9800	1880	24.40
		9538	9938	1907.6	24.55
	Subtest 2	9262	9662	1852.4	23.92
		9400	9800	1880	24.63
		9538	9938	1907.6	24.52
	Subtest 3	9262	9662	1852.4	24.58
		9400	9800	1880	24.21
		9538	9938	1907.6	23.86
	Subtest 4	9262	9662	1852.4	24.51
		9400	9800	1880	24.02
		9538	9938	1907.6	23.94

Test mode reduction consideration per KDB 941225

Per 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 and the maximum SAR for 12.2 kbps RMC is < 75% of the SAR limit.

11.4. UMTS HSDPA and HSUPA

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

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c. For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with β_{hs} = 5/15 * β_c.
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.
Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

Test Results

Band	Mode	UL Ch#	DL Ch#	Freq. (MHz)	Avg Tx Power (dBm)
UMTS 850 (Band V)	Subtest 1	4132	4357	826.4	23.31
		4182	4408	836.6	23.88
		4233	4458	846.6	23.64
	Subtest 2	4132	4357	826.4	22.50
		4182	4408	836.6	22.60
		4233	4458	846.6	22.92
	Subtest 3	4132	4357	826.4	23.20
		4182	4408	836.6	23.34
		4233	4458	846.6	23.40
	Subtest 4	4132	4357	826.4	23.11
		4182	4408	836.6	23.24
		4233	4458	846.6	23.44
	Subtest 5	4132	4357	826.4	23.89
		4182	4408	836.6	23.76
		4233	4458	846.6	23.72
UMTS 1900 (Band II)	Subtest 1	9262	9662	1852.4	23.32
		9400	9800	1880	23.72
		9538	9938	1907.6	23.44
	Subtest 2	9262	9662	1852.4	23.92
		9400	9800	1880	23.34
		9538	9938	1907.6	23.15
	Subtest 3	9262	9662	1852.4	23.41
		9400	9800	1880	23.68
		9538	9938	1907.6	23.33
	Subtest 4	9262	9662	1852.4	24.00
		9400	9800	1880	23.87
		9538	9938	1907.6	23.75
	Subtest 5	9262	9662	1852.4	23.99
		9400	9800	1880	24.11
		9538	9938	1907.6	23.83

*HSPA modes are only possible in UMTS MRAB mode

Test mode reduction consideration per KDB 941225

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

11.5. LTE Band 4 & Band 17

Output power for LTE Band 4 Low-Ch

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Target MPR	Measure MPR	Max. Avg. Power (dBm)
5	19975	1712.5	QPSK	1	0	0	0	24.5
				1	24	0	0	24.5
				12	6	1	1	24.0
				25	0	1	1	23.3
			16QAM	1	0	1	1	24.0
				1	24	1	1	23.4
				12	6	2	1	23.4
				25	0	2	2	22.5
10	20000	1715.0	QPSK	1	0	0	0	24.6
				1	49	0	0	24.6
				25	12	1	1	23.6
				50	0	1	1	23.6
			16QAM	1	0	1	1	23.8
				1	49	1	1	23.6
				25	12	2	2	22.7
				50	0	2	2	22.8

Output power for LTE Band 4 Mid-Ch

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Target MPR	Measure MPR	Max. Avg. Power (dBm)
5	20175	1732.5	QPSK	1	0	0	0	24.8
				1	24	0	0	24.7
				12	6	1	1	24.2
				25	0	1	1	23.8
			16QAM	1	0	1	1	24.0
				1	24	1	1	23.8
				12	6	2	1	23.6
				25	0	2	2	22.9
10	20175	1732.5	QPSK	1	0	0	0	24.6
				1	49	0	0	24.4
				25	12	1	1	23.7
				50	0	1	1	23.5
			16QAM	1	0	1	1	23.5
				1	49	1	1	23.4
				25	12	2	1	23.2
				50	0	2	2	23.0

Output power for LTE Band 4 High-Ch

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Target MPR	Measure MPR	Max. Avg. Power (dBm)
5	20375	1752.5	QPSK	1	0	0	0	24.5
				1	24	0	0	24.2
				12	6	1	1	23.9
				25	0	1	1	23.1
			16QAM	1	0	1	1	23.2
				1	24	1	1	23.2
				12	6	2	1	23.1
				25	0	2	2	22.2
10	20350	1750.0	QPSK	1	0	0	0	24.7
				1	49	0	0	24.4
				25	12	1	2	23.2
				50	0	1	2	23.2
			16QAM	1	0	1	1	23.6
				1	49	1	1	23.6
				25	12	2	2	22.5
				50	0	2	2	22.3

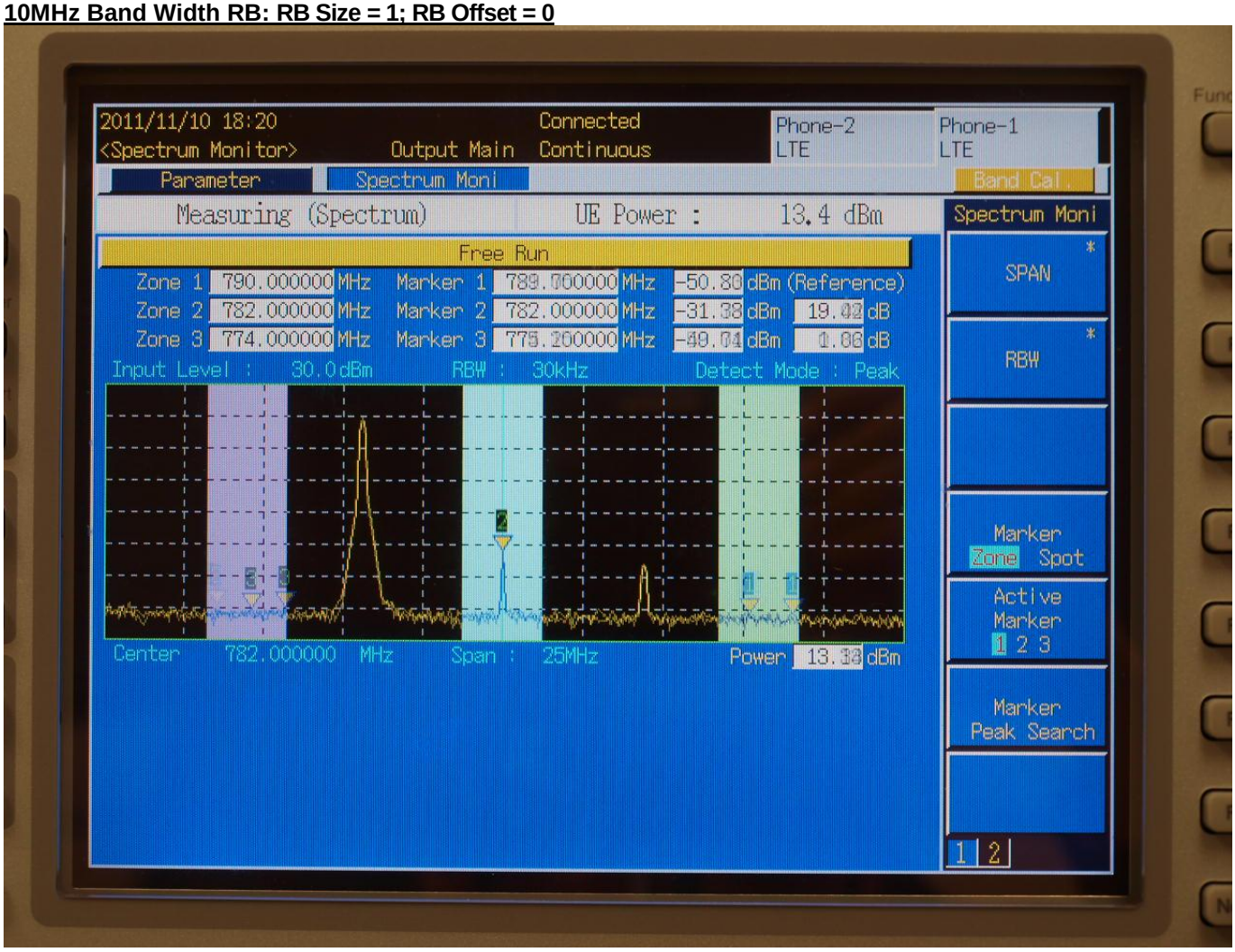
Output power for LTE Band 17

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Target MPR	Measure MPR	Max. Avg. Power (dBm)
5	23755	706.5	QPSK	1	0	0	0	24.2
				1	24	0	0	24.2
				12	6	1	0	23.8
				25	0	1	1	23.1
			16QAM	1	0	1	1	23.3
				1	24	1	1	23.4
				12	6	2	1	23.0
				25	0	2	2	22.2
10	23790	710.0	QPSK	1	0	0	0	24.4
				1	49	0	0	24.4
				25	12	1	0	24.3
				50	0	1	1	23.4
			16QAM	1	0	1	1	23.2
				1	49	1	1	23.3
				25	12	2	1	23.1
				50	0	2	2	22.2
5	23825	713.5	QPSK	1	0	0	0	24.3
				1	24	0	0	24.1
				12	6	1	1	23.6
				25	0	1	1	23.1
			16QAM	1	0	1	1	23.5
				1	24	1	1	23.5
				12	6	2	1	23.3
				25	0	2	1	23.3

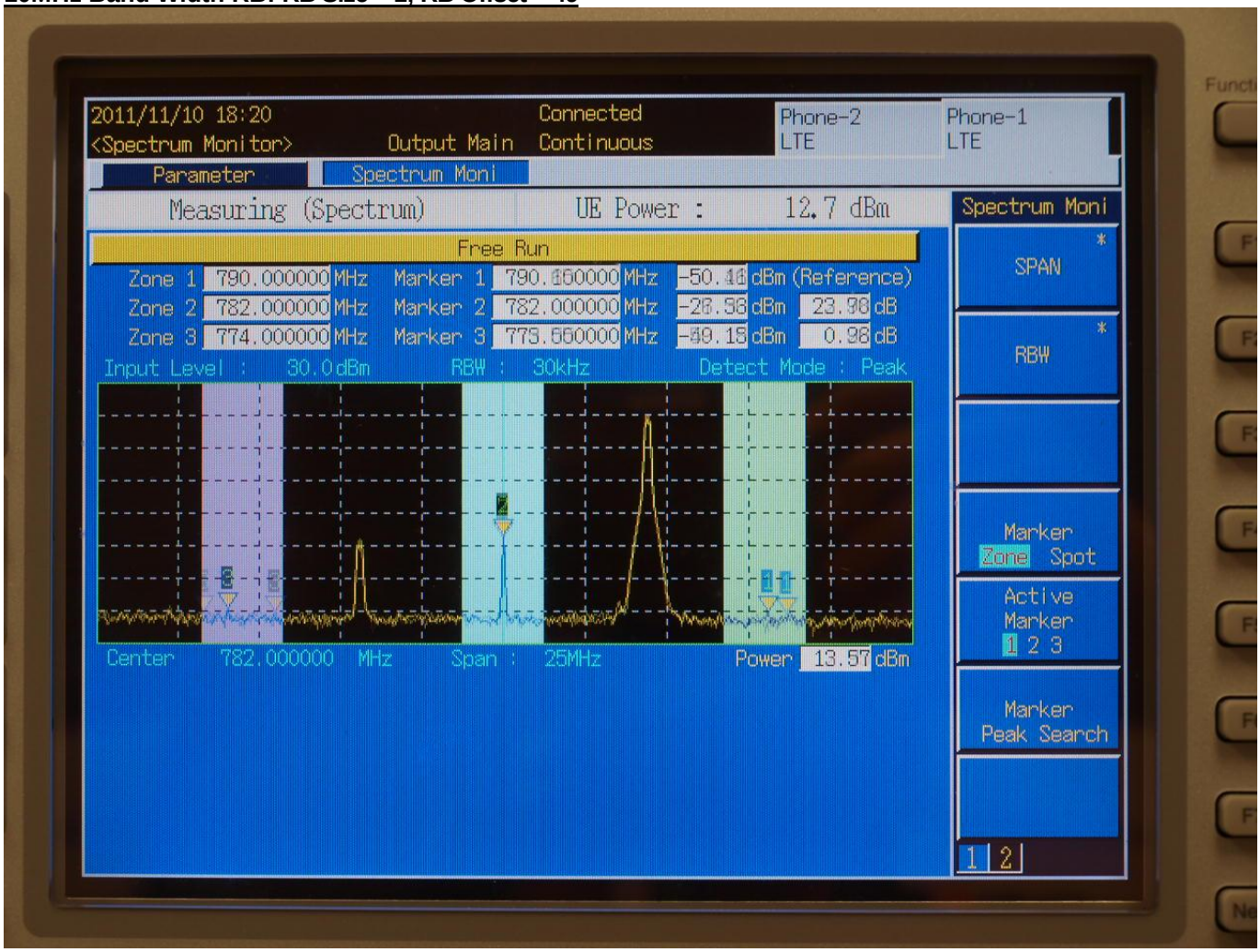
11.5.1. Spectrum Plots for the Test RB allocations

The following plots are to demonstrate the tested RB allocations have been established correctly at the maximum output power conditions.

10MHz Band Width RB: RB Size = 1; RB Offset = 0

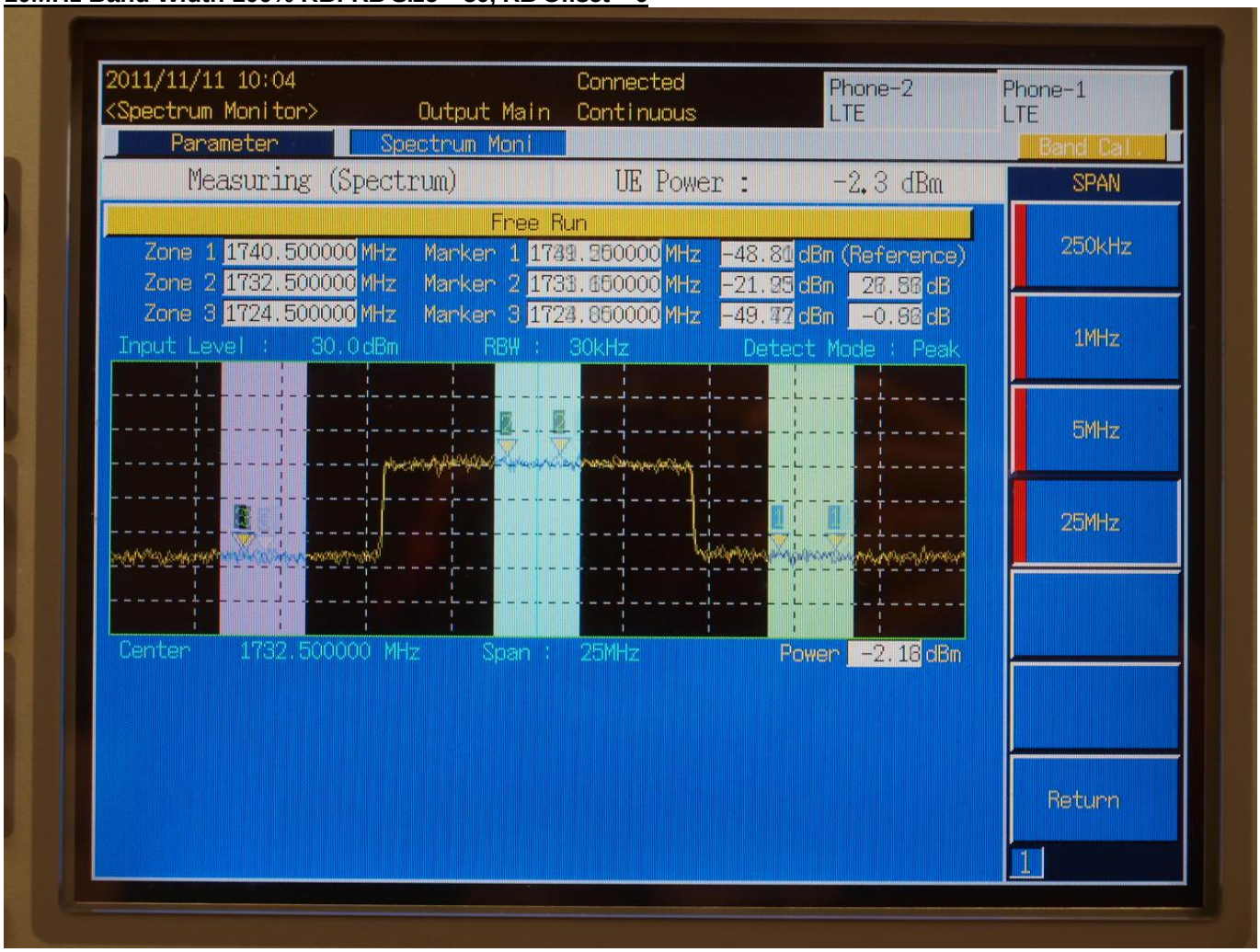


10MHz Band Width RB: RB Size = 1; RB Offset = 49



10MHz Band Width 50% RB: RB Size = 25; RB Offset = 12

10MHz Band Width 100% RB: RB Size = 50; RB Offset = 0



12. Summary of Test Results

12.1. GPRS850 & 1900

Primary Portrait

Band	Mode	Ch No.	Freq. (MHz)	SAR (mW/g)	
				1-g	10-g
GPRS850	2 slot CS1	128	824.2		
		190	836.6	0.437	0.280
		251	848.8		
GPRS1900	2 slot CS1	512	1850.2		
		661	1880.0	0.049	0.031
		810	1909.8		

Secondary Landscape

Band	Mode	Ch No.	Freq. (MHz)	SAR (mW/g)	
				1-g	10-g
GPRS850	2 slot CS1	128	824.2		
		190	836.6	0.091	0.061
		251	848.8		
GPRS1900	2 slot CS1	512	1850.2		
		661	1880.0	0.032	0.020
		810	1909.8		

Bottom

Band	Mode	Ch No.	Freq. (MHz)	SAR (mW/g)	
				1-g	10-g
GPRS850	2 slot CS1	128	824.2		
		190	836.6	0.069	0.050
		251	848.8		
GPRS1900	2 slot CS1	512	1850.2		
		661	1880.0	*1	*1
		810	1909.8		

*1 SAR was not detected.

Base/Tilt

Band	Mode	Ch No.	Freq. (MHz)	SAR (mW/g)	
				1-g	10-g
GPRS850	2 slot CS1	128	824.2		
		190	836.6	**0.567**	**0.393**
		251	848.8		
GPRS1900	2 slot CS1	512	1850.2		
		661	1880.0	0.291	0.175
		810	1909.8		

Note(s):

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC “Public Notice DA 02-1438” by the SCC-34/SC-2. Testing in the low and high channel is optional.

12.2. UMTS BAND V & II

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

Primary Portrait

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
					1-g	10-g
Band V	R99	4132	4357	826.4		
	12.2kbps	4183	4408	836.6	0.241	0.155
	RMC	4233	4458	846.6		
Band II	R99	9262	9662	1850.2		
	12.2kbps	9400	9800	1880.0	0.048	0.028
	RMC	9538	9938	1907.6		

Secondary Landscape

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
					1-g	10-g
Band V	R99	4132	4357	826.4		
	12.2kbps	4183	4408	836.6	0.045	0.030
	RMC	4233	4458	846.6		
Band II	R99	9262	9662	1850.2		
	12.2kbps	9400	9800	1880.0	0.071	0.045
	RMC	9538	9938	1907.6		

Bottom

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
					1-g	10-g
Band V	R99	4132	4357	826.4		
	12.2kbps	4183	4408	836.6	0.037	0.027
	RMC	4233	4458	846.6		
Band II	R99	9262	9662	1850.2		
	12.2kbps	9400	9800	1880.0	0.026	0.017
	RMC	9538	9938	1907.6		

Base/Tilt

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
					1-g	10-g
Band V	R99	4132	4357	826.4		
	12.2kbps	4183	4408	836.6	0.300	0.208
	RMC	4233	4458	846.6		
Band II	R99	9262	9662	1850.2		
	12.2kbps	9400	9800	1880.0	**0.420**	**0.253**
	RMC	9538	9938	1907.6		

Note(s):

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC “Public Notice DA 02-1438” by the SCC-34/SC-2. Testing in the low and high channel is optional.

12.3. LTE BAND 4

The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

Primary Portrait

BAND 4, 10 MHz BW - Middle Channel

Mode	UL Ch #.	Freq. (MHz)	RB SIze	RB Offset	Avg Pwr (dBm)	MPR	Measured MPR	Separation Distance (mm)	SAR (mW/g)		Note
									1-g	10-g	
QPSK	20175	1732.5	1	0	24.6	0	0	0	0.235	0.148	
QPSK	20175	1732.5	1	49	24.4	0	0	0	0.171	0.105	
QPSK	20175	1732.5	25	12	23.7	1	1	0	0.147	0.093	
QPSK	20175	1732.5	50	0	23.5	1	1	0			
16QAM	20175	1732.5	1	0	23.5	1	1	0	0.201	0.126	
16QAM	20175	1732.5	1	49	23.4	1	1	0	0.145	0.091	
16QAM	20175	1732.5	25	12	23.2	2	1	0	0.123	0.078	
16QAM	20175	1732.5	50	0	23.0	2	2	0			

Note(s):
Testing for 100% RB allocation is not required because the SAR value for 50% RB allocation is ≤ 1.45W/Kg.
Testing was only performed on the middle channel because the output power variance over low/middle/high channels is ≤ ½ dB and the measured SAR for the middle channel is ≤ 0.8W/Kg.
Testing for 5MHz Bandwidth is not required as the SAR for the Largest Channel Bandwidth (10MHz) measured is < 1.45 W/kg and the output power for the 5MHz channel bandwidth is within +/- ½dB of the output power for the widest (10MHz) bandwidth.

Secondary Landscape

The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

BAND 4, 10 MHz BW - Middle Channel

Mode	UL Ch #.	Freq. (MHz)	RB SIze	RB Offset	Avg Pwr (dBm)	MPR	Measured MPR	Separation Distance (mm)	SAR (mW/g)		Note
									1-g	10-g	
QPSK	20175	1732.5	1	0	24.6	0	0	0	0.063	0.041	
QPSK	20175	1732.5	1	49	24.4	0	0	0	0.085	0.054	
QPSK	20175	1732.5	25	12	23.7	1	1	0	0.069	0.043	
QPSK	20175	1732.5	50	0	23.5	1	1	0			
16QAM	20175	1732.5	1	0	23.5	1	1	0	0.055	0.036	
16QAM	20175	1732.5	1	49	23.4	1	1	0	0.047	0.031	
16QAM	20175	1732.5	25	12	23.2	2	1	0	0.036	0.024	
16QAM	20175	1732.5	50	0	23.0	2	2	0			

Note(s):
Testing for 100% RB allocation is not required because the SAR value for 50% RB allocation is ≤ 1.45W/Kg.
Testing was only performed on the middle channel because the output power variance over low/middle/high channels is ≤ ½ dB and the measured SAR for the middle channel is ≤ 0.8W/Kg.
Testing for 5MHz Bandwidth is not required as the SAR for the Largest Channel Bandwidth (10MHz) measured is < 1.45 W/kg and the output power for the 5MHz channel bandwidth is within +/- ½dB of the output power for the widest (10MHz) bandwidth.

Bottom

The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

BAND 4, 10 MHz BW - Middle Channel

Mode	UL Ch #.	Freq. (MHz)	RB SIze	RB Offset	Avg Pwr (dBm)	MPR	Measured MPR	Separation Distance (mm)	SAR (mW/g)		Note
									1-g	10-g	
QPSK	20175	1732.5	1	0	24.6	0	0	0	0.033	0.022	
QPSK	20175	1732.5	1	49	24.4	0	0	0	0.054	0.036	
QPSK	20175	1732.5	25	12	23.7	1	1	0	0.044	0.030	
QPSK	20175	1732.5	50	0	23.5	1	1	0			
16QAM	20175	1732.5	1	0	23.5	1	1	0	0.029	0.019	
16QAM	20175	1732.5	1	49	23.4	1	1	0	0.046	0.030	
16QAM	20175	1732.5	25	12	23.2	2	1	0	0.035	0.023	
16QAM	20175	1732.5	50	0	23.0	2	2	0			

Note(s):
Testing for 100% RB allocation is not required because the SAR value for 50% RB allocation is ≤ 1.45W/Kg.
Testing was only performed on the middle channel because the output power variance over low/middle/high channels is ≤ ½ dB and the measured SAR for the middle channel is ≤ 0.8W/Kg.
Testing for 5MHz Bandwidth is not required as the SAR for the Largest Channel Bandwidth (10MHz) measured is < 1.45 W/kg and the output power for the 5MHz channel bandwidth is within +/- ½dB of the output power for the widest (10MHz) bandwidth.

Base/Tilt

The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

BAND 4, 10 MHz BW - Middle Channel

Mode	UL Ch #.	Freq. (MHz)	RB SIze	RB Offset	Avg Pwr (dBm)	MPR	Measured MPR	Separation Distance (mm)	SAR (mW/g)		Note
									1-g	10-g	
QPSK	20175	1732.5	1	0	24.6	0	0	0	**0.416**	**0.258**	
QPSK	20175	1732.5	1	49	24.4	0	0	0	0.334	0.205	
QPSK	20175	1732.5	25	12	23.7	1	1	0	0.261	0.162	
QPSK	20175	1732.5	50	0	23.5	1	1	0			
16QAM	20175	1732.5	1	0	23.5	1	1	0	0.346	0.217	
16QAM	20175	1732.5	1	49	23.4	1	1	0	0.281	0.174	
16QAM	20175	1732.5	25	12	23.2	2	1	0	0.213	0.133	
16QAM	20175	1732.5	50	0	23.0	2	2	0			

Note(s):
Testing for 100% RB allocation is not required because the SAR value for 50% RB allocation is ≤ 1.45W/Kg.
Testing was only performed on the middle channel because the output power variance over low/middle/high channels is ≤ ½ dB and the measured SAR for the middle channel is ≤ 0.8W/Kg.
Testing for 5MHz Bandwidth is not required as the SAR for the Largest Channel Bandwidth (10MHz) measured is < 1.45 W/kg and the output power for the 5MHz channel bandwidth is within +/- ½dB of the output power for the widest (10MHz) bandwidth.

LTE BAND 17

Primary Portrait (Worst-case position)

The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

BAND 17, 10 MHz BW - Middle Channel

Mode	UL Ch #.	Freq. (MHz)	RB SIze	RB Offset	Avg Pwr (dBm)	MPR	Measured MPR	Separation Distance (mm)	SAR (mW/g)		Note
									1-g	10-g	
QPSK	23790	710	1	0	24.4	0	0	0	0.177	0.111	
QPSK	23790	710	1	49	24.4	0	0	0	0.181	0.114	
QPSK	23790	710	25	12	24.3	1	0	0	0.174	0.109	
QPSK	23790	710	50	0	23.4	1	1	0			
16QAM	23790	710	1	0	23.2	1	1	0	0.158	0.099	
16QAM	23790	710	1	49	23.3	1	1	0	0.162	0.101	
16QAM	23790	710	25	12	23.1	2	1	0	0.142	0.089	
16QAM	23790	710	50	0	22.2	2	2	0			

Note(s):
Testing for 100% RB allocation is not required because the SAR value for 50% RB allocation is ≤ 1.45W/Kg.
Testing was only performed on the middle channel because the output power variance over low/middle/high channels is ≤ ½ dB and the measured SAR for the middle channel is ≤ 0.8W/Kg.
Testing for 5MHz Bandwidth is not required as the SAR for the Largest Channel Bandwidth (10MHz) measured is < 1.45 W/kg and the output power for the 5MHz channel bandwidth is within +/- ½dB of the output power for the widest (10MHz) bandwidth.

Secondary Landscape

The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

BAND 17, 10 MHz BW - Middle Channel

Mode	UL Ch #.	Freq. (MHz)	RB SIze	RB Offset	Avg Pwr (dBm)	MPR	Measured MPR	Separation Distance (mm)	SAR (mW/g)		Note
									1-g	10-g	
QPSK	23790	710	1	0	24.4	0	0	0	0.040	0.027	
QPSK	23790	710	1	49	24.4	0	0	0	0.043	0.029	
QPSK	23790	710	25	12	24.3	1	0	0	0.036	0.024	
QPSK	23790	710	50	0	23.4	1	1	0			
16QAM	23790	710	1	0	23.2	1	1	0	0.019	0.014	
16QAM	23790	710	1	49	23.3	1	1	0	0.031	0.021	
16QAM	23790	710	25	12	23.1	2	1	0	0.018	0.013	
16QAM	23790	710	50	0	22.2	2	2	0			

Note(s):
Testing for 100% RB allocation is not required because the SAR value for 50% RB allocation is ≤ 1.45W/Kg.
Testing was only performed on the middle channel because the output power variance over low/middle/high channels is ≤ ½ dB and the measured SAR for the middle channel is ≤ 0.8W/Kg.
Testing for 5MHz Bandwidth is not required as the SAR for the Largest Channel Bandwidth (10MHz) measured is < 1.45 W/kg and the output power for the 5MHz channel bandwidth is within +/- ½dB of the output power for the widest (10MHz) bandwidth.

Bottom

The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

BAND 17, 10 MHz BW - Middle Channel

Mode	UL Ch #.	Freq. (MHz)	RB SIze	RB Offset	Avg Pwr (dBm)	MPR	Measured MPR	Separation Distance (mm)	SAR (mW/g)		Note
									1-g	10-g	
QPSK	23790	710	1	0	24.4	0	0	0	0.044	0.035	
QPSK	23790	710	1	49	24.4	0	0	0	0.049	0.038	
QPSK	23790	710	25	12	24.3	1	0	0	0.036	0.028	
QPSK	23790	710	50	0	23.4	1	1	0			
16QAM	23790	710	1	0	23.2	1	1	0	0.027	0.020	
16QAM	23790	710	1	49	23.3	1	1	0	0.043	0.034	
16QAM	23790	710	25	12	23.1	2	1	0	0.023	0.017	
16QAM	23790	710	50	0	22.2	2	2	0			

Note(s):
Testing for 100% RB allocation is not required because the SAR value for 50% RB allocation is ≤ 1.45W/Kg.
Testing was only performed on the middle channel because the output power variance over low/middle/high channels is ≤ ½ dB and the measured SAR for the middle channel is ≤ 0.8W/Kg.
Testing for 5MHz Bandwidth is not required as the SAR for the Largest Channel Bandwidth (10MHz) measured is < 1.45 W/kg and the output power for the 5MHz channel bandwidth is within +/- ½dB of the output power for the widest (10MHz) bandwidth.

Base/Tilt

The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

BAND 17, 10 MHz BW - Middle Channel

Mode	UL Ch #.	Freq. (MHz)	RB SIze	RB Offset	Avg Pwr (dBm)	MPR	Measured MPR	Separation Distance (mm)	SAR (mW/g)		Note
									1-g	10-g	
QPSK	23790	710	1	0	24.4	0	0	0	0.238	0.173	
QPSK	23790	710	1	49	24.4	0	0	0	**0.246**	**0.179**	
QPSK	23790	710	25	12	24.3	1	0	0	0.208	0.150	
QPSK	23790	710	50	0	23.4	1	1	0			
16QAM	23790	710	1	0	23.2	1	1	0	0.189	0.135	
16QAM	23790	710	1	49	23.3	1	1	0	0.192	0.139	
16QAM	23790	710	25	12	23.1	2	1	0	0.161	0.117	
16QAM	23790	710	50	0	22.2	2	2	0			

Note(s):
Testing for 100% RB allocation is not required because the SAR value for 50% RB allocation is ≤ 1.45W/Kg.
Testing was only performed on the middle channel because the output power variance over low/middle/high channels is ≤ ½ dB and the measured SAR for the middle channel is ≤ 0.8W/Kg.
Testing for 5MHz Bandwidth is not required as the SAR for the Largest Channel Bandwidth (10MHz) measured is < 1.45 W/kg and the output power for the 5MHz channel bandwidth is within +/- ½dB of the output power for the widest (10MHz) bandwidth.

13. Simultaneous Transmission SAR Analysis

WWAN + WiFi 2.4 GHz

Test Configuration	(1) GPRS850	(2) GPRS1900	(3) UMTS Band V	(4) UMTS Band II	(5) LTE Band 4	(6) LTE Band 17	(7) WiFi Main	(8) WiFi Aux	Sum of 1g SAR (mW/g)
Base	0.069						0.021	0.05	0.140
		-					0.021	0.05	0.071
			0.037				0.021	0.05	0.108
				0.026			0.021	0.05	0.097
					0.056		0.021	0.05	0.127
						0.049	0.021		0.070
Base/Tilt	0.567						0.065		0.632
		0.291					0.065		0.356
			0.300				0.065		0.365
				0.420			0.065		0.485
					0.416		0.065		0.481
						0.246	0.065		0.311
Primary Portrait	0.437							0.173	0.610
		0.049						0.173	0.222
			0.241					0.173	0.414
				0.048				0.173	0.221
					0.235			0.173	0.408
						0.200		0.173	0.373

WWAN + WiFi 5.2 GHz

Test Configuration	(1) GPRS850	(2) GPRS1900	(3) UMTS Band V	(4) UMTS Band II	(5) LTE Band 4	(6) LTE Band 17	(7) WiFi Main	(8) WiFi Aux	Sum of 1g SAR (mW/g)
Base	0.069						0.022	0.118	0.209
		-					0.022	0.118	0.140
			0.037				0.022	0.118	0.177
				0.026			0.022	0.118	0.166
					0.056		0.022	0.118	0.196
						0.049	0.022		0.071
Base/Tilt	0.567						0.253		0.820
		0.291					0.253		0.544
			0.300				0.253		0.553
				0.420			0.253		0.673
					0.416		0.253		0.669
						0.246	0.253		0.499
Primary Portrait	0.437							0.297	0.734
		0.049						0.297	0.346
			0.241					0.297	0.538
				0.048				0.297	0.345
					0.235			0.297	0.532
						0.200		0.297	0.497

WWAN + WiFi 5.3 GHz

Test Configuration	(1) GPRS850	(2) GPRS1900	(3) UMTS Band V	(4) UMTS Band II	(5) LTE Band 4	(6) LTE Band 17	(7) WiFi Main	(8) WiFi Aux	Sum of 1g SAR (mW/g)
Base	0.069						0.025	0.180	0.274
		-					0.025	0.180	0.205
			0.037				0.025	0.180	0.242
				0.026			0.025	0.180	0.231
					0.056		0.025	0.180	0.261
						0.049	0.025		0.074
Base/Tilt	0.567						0.265		0.832
		0.291					0.265		0.556
			0.300				0.265		0.565
				0.420			0.265		0.685
					0.416		0.265		0.681
						0.246	0.265		0.511
Primary Portrait	0.437							0.471	0.908
		0.049						0.471	0.520
			0.241					0.471	0.712
				0.048				0.471	0.519
					0.235			0.471	0.706
						0.200		0.471	0.671

WWAN + WiFi 5.5 GHz

Test Configuration	(1) GPRS850	(2) GPRS1900	(3) UMTS Band V	(4) UMTS Band II	(5) LTE Band 4	(6) LTE Band 17	(7) WiFi Main	(8) WiFi Aux	Sum of 1g SAR (mW/g)
Base	0.069						0.031	0.130	0.230
		-					0.031	0.130	0.161
			0.037				0.031	0.130	0.198
				0.026			0.031	0.130	0.187
					0.056		0.031	0.130	0.217
						0.049	0.031		0.080
Base/Tilt	0.567						0.411		0.978
		0.291					0.411		0.702
			0.300				0.411		0.711
				0.420			0.411		0.831
					0.416		0.411		0.827
						0.246	0.411		0.657
Primary Portrait	0.437							0.557	0.994
		0.049						0.557	0.606
			0.241					0.557	0.798
				0.048				0.557	0.605
					0.235			0.557	0.792
						0.200		0.557	0.757

WWAN + WiFi 5.8 GHz

Test Configuration	(1) GPRS850	(2) GPRS1900	(3) UMTS Band V	(4) UMTS Band II	(5) LTE Band 4	(6) LTE Band 17	(7) WiFi Main	(8) WiFi Aux	Sum of 1g SAR (mW/g)
Base	0.069						0.024	0.151	0.244
		-					0.024	0.151	0.175
			0.037				0.024	0.151	0.212
				0.026			0.024	0.151	0.201
					0.056		0.024	0.151	0.231
						0.049	0.024		0.073
Base/Tilt	0.567						0.295		0.862
		0.291					0.295		0.586
			0.300				0.295		0.595
				0.420			0.295		0.715
					0.416		0.295		0.711
						0.246	0.295		0.541
Primary Portrait	0.437							0.681	1.118
		0.049						0.681	0.730
			0.241					0.681	0.922
				0.048				0.681	0.729
					0.235			0.681	0.916
						0.200		0.681	0.881

Note(s)

1. *: WiFi max. 1g SAR from SAR report "11J13820-4A SAR report" submitted under FCC ID: ACJ9TGWL11A (Panasonic Corporation of North America).
   This WiFi module supports MIMO operation in all bands in 802.11n modes and the simultaneous evaluation has included an evaluation with both WLAN antennas operational with the WWAN antenna based on the worst case SAR in each band for each individual WLAN antenna.

2. The RFID transmitter (RFID transmitter, which is approved under FCC ID ACJ9TGRI11A against FCC Part 15C (15.225) with a field strength at the operating frequency of 13.56MHz of 56.94dBuV/m @ 30m. This device is not subject to SAR test requirements based on the low operating power and excluded from simultaneous SAR evaluation for this reason.

Conclusion:

Simultaneous transmission SAR is not required because the sum of the 1-g SAR is < 1.6 W/kg

14. Appendixes

Refer to separated files for the following appendixes

14.1. Appendix A: System Check Plots

14.2. Appendix B: SAR Test Plots for GSM 850 & 1900

14.3. Appendix C: SAR Test Plots for UMTS Band II & V

14.4. Appendix D: SAR Test Plots for LTE Band 4

14.5. Appendix E: SAR Test Plots for LTE Band 17

14.6. Appendix F: Calibration Certificate for EX3DV4 SN 3772

14.7. Appendix G: Calibration Certificate for EX3DV4 SN 3773

14.8. Appendix H: Calibration Certificate for D750V3 SN1024

14.9. Appendix I: Calibration Certificate for D835V2 SN 4d117

14.10. Appendix J: Calibration Certificate for D1750V2 SN 1050

14.11. Appendix K: Calibration Certificate for D1900V2 SN 5d140

15. Summary of Test configurations

Configuration	Antenna-to-User distance	SAR Require	Comments
(1) Bottom/Base	78.8 mm From WWAN antenna to user.	Yes	
(2) Bottom/Base/Tilt	8 mm From WWAN antenna to user.	Yes	The handle is not-removable and that is why the tilt position was used rather than a touch position during testing.
Primary Landscape	215 mm From WWAN antenna to user.	No	This is not the most conservative antenna to user distance.
(3) Secondary Landscape	11 mm From WWAN antenna to user.	Yes	
Secondary Portrait	220 mm From WWAN antenna to user.	No	This is not the most conservative antenna to user distance.
(4) Primary Portrait	13 mm From WWAN antenna to user.	Yes	