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 Laptop PC CF-19)

MODEL NUMBER: MC7700
FCC ID: N7NMC7700

REPORT NUMBER: 11J13999-1C

ISSUE DATE: 3-21-2012

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Revision History

Rev.	Issue Date	Revisions	Revised By
--	10-7-11	Initial Issue	--
A	11-7-11	Updated report based upon reviewer's comments. 1. Sec. 11: Added additional power data for HSUPA and HSPA (HSUPA & HSDPA).	Sunny Shih
A1	2-14-12	1. Sec. 2: Added 616217 D03 SAR Supp Note and Netbook Laptop V01 2. Sec. 5.1: Added LTE Table 3. Sec. 11.2: Updated Output Power Table based on the correct Cable Loss. 4. Sec. 11.5: Updated LTE Output Power Table 5. Sec. 11.5.1: Added Spectrum Plots for LTE. 6. Sec. 12: Additional SAR Test performed for Base and Lapheld configuration. 7. Sec. 12.3 & 12.4: Removed unnecessary Data. Added LTE Test Reduction Note. 8. Sec. 13: Updated 13. Simultaneous Transmission SAR Analysis Table. 9. Sec. 15: Updated Summary of Test Configuration Table.	Bobby Bayani
B	2-24-12	Updated report based upon reviewer's comments. 1. Sec. 1: Updated .Table for Highest 1g SAR. 2. Sec. 5: Updated Chain A Antenna Description. 3. Sec. 11: Updated Output Power Table. 4. Sec. 12.1 & 12.2: Added Test Reduction Note. 5. Sec. 13: Updated Reference Report no. 6. Sec. 15: Corrected Antenna Distance for Primary and Secondary Portrait.	Bobby Bayani
B1	2-28-12	Updated report based upon reviewer's comments. 1. Sec. 4.1: Updated correct Calibration Date for Network Analyzer. 2. Sec. 11.1: Re-measured Output Power for EGPRS (8PSK).	Bobby Bayani
C	3-21-12	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

Table of Contents

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 Laptop PC, Model CF-19)
Model number:	MC7700
Device category:	Portable
Exposure category:	General Population/Uncontrolled Exposure
Date tested:	September 23 – October 4, 2011 February 3 – February 7, 2012 (Additional Testing) February 28, 2012 (Additional Testing)

FCC / IC Rule Parts	Freq. Range [MHz]	Highest 1g SAR (mW/g)	Limit (mW/g)
27 (LTE Band 17)	704 – 716	0.307 mW/g (Primary Portrait)	1.6
22H / RSS-132	824 – 849	0.504 mW/g (Primary Portrait)	
27 (LTE Band 4) / RSS-139	1710 – 1755	0.562 mW/g (Primary Portrait)	
24E / RSS-133	1850 – 1910	0.510 mW/g (Primary Portrait)	

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:

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Engineering Team Leader
Compliance Certification Services (UL CCS)

Tested By:

Keisuke Kawamura
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
- 616217 D03 SAR Supp Note and Netbook Laptop V01
- 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	11	2013
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3773	5	3	2012
Thermometer	EXTECH	Thermometer	SCL29766	5	17	2012
Data Acquisition Electronics	SPEAG	DAE4	1258	5	2	2012
Data Acquisition Electronics	SPEAG	DAE3	500	7	14	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
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	-4.34	Normal	1	0.64	-2.78
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement	3.95	Normal	1	0.6	2.37
				Combined Standard Uncertainty Uc(y) =	10.12
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 20.24	%
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 1.60	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 Laptop PC, CF-19	
Normal operation:	• Laptop mode (notebook) • Tablet with Multiple display orientations supporting both portrait and landscape configurations.
Antenna tested:	Manufactured: Part Number: Panasonic Chain A (Aux) - Rx only: DFUP2067ZA(1) Chain B: DFUP2067ZA(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 Analysis)

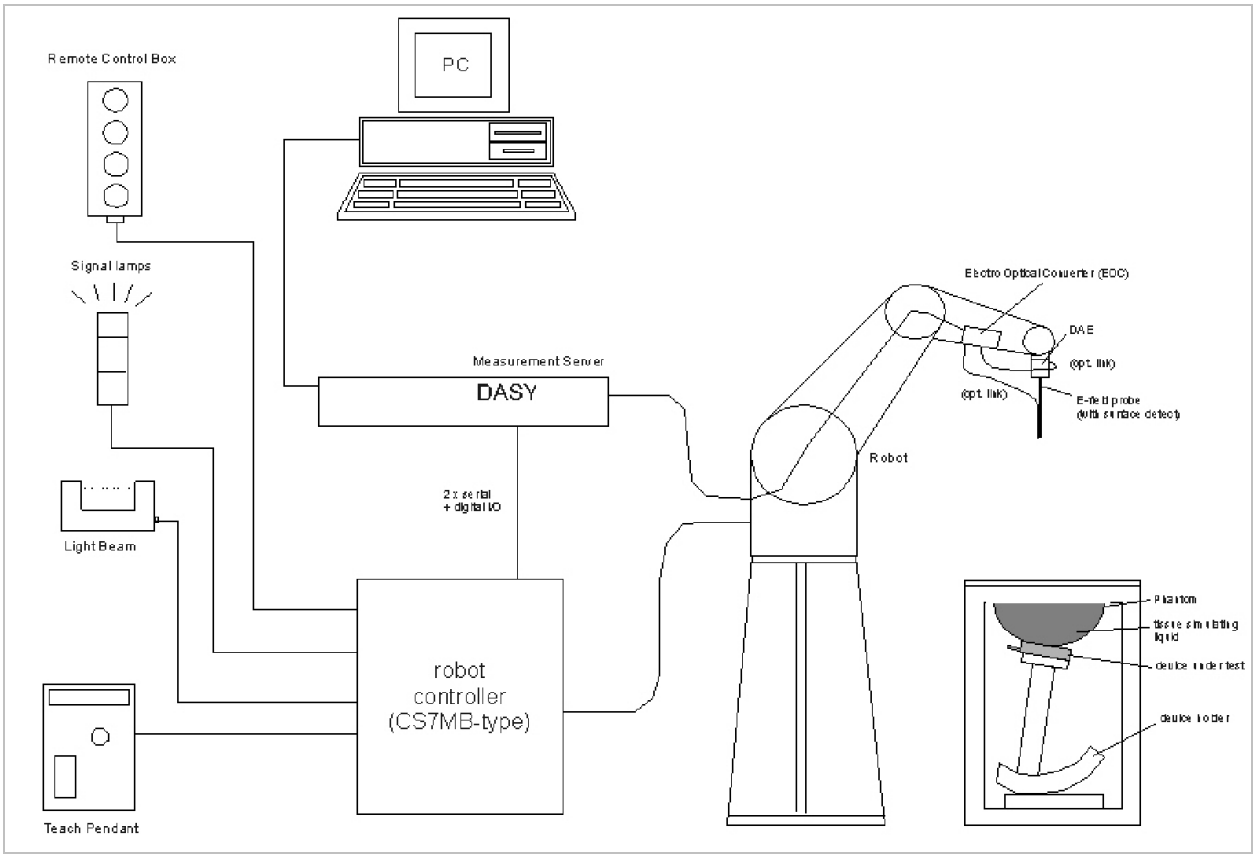
5.1. KDB 941225 D05 "SAR for LTE Devices v01"

#	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 ±(%)
09/23/2011	Body 1750	e'	51.5563	Relative Permittivity (ϵ_r):	51.56	53.44	-3.53	5
		e"	14.9123	Conductivity (σ):	1.45	1.49	-2.36	5
09/24/2011	Body 1750	e'	51.5173	Relative Permittivity (ϵ_r):	51.52	53.44	-3.60	5
		e"	14.9474	Conductivity (σ):	1.45	1.49	-2.13	5
09/26/2011	Body 1750	e'	51.3305	Relative Permittivity (ϵ_r):	51.33	53.44	-3.95	5
		e"	15.0347	Conductivity (σ):	1.46	1.49	-1.56	5
09/27/2011	Body 1750	e'	52.4485	Relative Permittivity (ϵ_r):	52.45	53.44	-1.86	5
		e"	15.0414	Conductivity (σ):	1.46	1.49	-1.52	5
09/27/2011	Body 750	e'	55.8750	Relative Permittivity (ϵ_r):	55.88	55.55	0.59	5
		e"	23.1130	Conductivity (σ):	0.96	0.96	0.08	5
09/28/2011	Body 750	e'	55.4271	Relative Permittivity (ϵ_r):	55.43	55.55	-0.21	5
		e"	22.9710	Conductivity (σ):	0.96	0.96	-0.53	5
09/29/2011	Body 750	e'	54.2693	Relative Permittivity (ϵ_r):	54.27	55.55	-2.30	5
		e"	22.5315	Conductivity (σ):	0.94	0.96	-2.44	5
10/03/2011	Body 1900	e'	52.5396	Relative Permittivity (ϵ_r):	52.54	53.30	-1.43	5
		e"	14.2893	Conductivity (σ):	1.51	1.52	-0.68	5
10/04/2011	Body 835	e'	54.6926	Relative Permittivity (ϵ_r):	54.69	55.20	-0.92	5
		e"	21.5932	Conductivity (σ):	1.00	0.97	3.35	5
02/03/2012	Body 1720	e'	51.8522	Relative Permittivity (ϵ_r):	51.85	53.52	-3.11	5
		e"	14.9912	Conductivity (σ):	1.43	1.47	-2.31	5
	Body 1735	e'	51.8840	Relative Permittivity (ϵ_r):	51.88	53.48	-2.98	5
		e"	14.9403	Conductivity (σ):	1.44	1.48	-2.41	5
	Body 1750	e'	51.7645	Relative Permittivity (ϵ_r):	51.76	53.44	-3.14	5
		e"	15.1001	Conductivity (σ):	1.47	1.49	-1.13	5
02/06/2012	Body 700	e'	56.7800	Relative Permittivity (ϵ_r):	56.78	55.74	1.87	5
		e"	24.4518	Conductivity (σ):	0.95	0.96	-0.78	5
	Body 710	e'	56.3965	Relative Permittivity (ϵ_r):	56.40	55.70	1.25	5
		e"	24.3053	Conductivity (σ):	0.96	0.96	-0.05	5
	Body 750	e'	56.2132	Relative Permittivity (ϵ_r):	56.21	55.55	1.20	5
		e"	23.8520	Conductivity (σ):	0.99	0.96	3.28	5
02/07/2012	Body 700	e'	57.3732	Relative Permittivity (ϵ_r):	57.37	55.74	2.93	5
		e"	24.1696	Conductivity (σ):	0.94	0.96	-1.93	5
	Body 710	e'	57.1249	Relative Permittivity (ϵ_r):	57.12	55.70	2.56	5
		e"	24.0943	Conductivity (σ):	0.95	0.96	-0.92	5
	Body 750	e'	56.7038	Relative Permittivity (ϵ_r):	56.70	55.55	2.08	5
		e"	23.4721	Conductivity (σ):	0.98	0.96	1.64	5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
02/07/2012	Body 835	e'	55.9899	Relative Permittivity (ε_r):	55.99	55.20	1.43	5
		e''	21.2129	Conductivity (σ):	0.98	0.97	1.53	5
	Body 820	e'	56.2259	Relative Permittivity (ε_r):	56.23	55.28	1.72	5
		e''	21.3694	Conductivity (σ):	0.97	0.97	0.61	5
	Body 830	e'	55.8761	Relative Permittivity (ε_r):	55.88	55.24	1.15	5
		e''	21.3021	Conductivity (σ):	0.98	0.97	1.43	5
	Body 850	e'	55.7295	Relative Permittivity (ε_r):	55.73	55.16	1.04	5
		e''	21.1851	Conductivity (σ):	1.00	0.99	1.43	5
02/07/2012	Body 1900	e'	52.2520	Relative Permittivity (ε_r):	52.25	53.30	-1.97	5
		e''	14.4485	Conductivity (σ):	1.53	1.52	0.42	5
	Body 1850	e'	52.4026	Relative Permittivity (ε_r):	52.40	53.30	-1.68	5
		e''	14.1345	Conductivity (σ):	1.45	1.52	-4.34	5
	Body 1880	e'	52.2722	Relative Permittivity (ε_r):	52.27	53.30	-1.93	5
		e''	14.3575	Conductivity (σ):	1.50	1.52	-1.26	5
	Body 1910	e'	52.2195	Relative Permittivity (ε_r):	52.22	53.30	-2.03	5
		e''	14.4511	Conductivity (σ):	1.53	1.52	0.97	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 phantom filled with Body 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			
D1750V2 SN: 1050	09/23/11	1g SAR:	36.2	36.4	-0.55	±10
		10g SAR:	19.2	19.4	-1.03	
D1750V2 SN: 1050	09/24/11	1g SAR:	36.3	36.4	-0.27	±10
		10g SAR:	19.2	19.4	-1.03	
D1750V2 SN: 1050	09/26/11	1g SAR:	36.5	36.4	0.27	±10
		10g SAR:	19.4	19.4	0.00	
D1750V2 SN: 1050	09/27/11	1g SAR:	35.1	36.4	-3.57	±10
		10g SAR:	18.6	19.4	-4.12	
D750V3 SN: 1024	09/27/11	1g SAR:	8.84	8.80	0.45	±10
		10g SAR:	5.87	5.84	0.51	
D750V3 SN: 1024	09/28/11	1g SAR:	8.75	8.80	-0.57	±10
		10g SAR:	5.80	5.84	-0.68	
D750V3 SN: 1024	09/29/11	1g SAR:	8.57	8.80	-2.61	±10
		10g SAR:	5.68	5.84	-2.74	
D1900V2 SN: 5d140	10/03/11	1g SAR:	39.5	41.2	-4.13	±10
		10g SAR:	20.6	21.6	-4.63	
D835V2 SN: 4d117	10/04/11	1g SAR:	10.20	10.10	0.99	±10
		10g SAR:	6.67	6.60	1.06	
D1750V2 SN: 1050	02/03/12	1g SAR:	36.6	36.4	0.55	±10
		10g SAR:	19.4	19.4	0.00	
D750V3 SN: 1024	02/06/12	1g SAR:	8.6	8.80	-2.39	±10
		10g SAR:	5.7	5.84	-2.40	
D750V3 SN: 1024	02/07/12	1g SAR:	9.0	8.80	2.05	±10
		10g SAR:	5.95	5.84	1.88	
D835V2 SN: 4d117	02/07/12	1g SAR:	9.95	10.10	-1.49	±10
		10g SAR:	6.53	6.60	-1.06	
D1900V2 SN: 5d140	02/07/12	1g SAR:	43.0	41.2	4.37	±10
		10g SAR:	22.4	21.6	3.70	

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

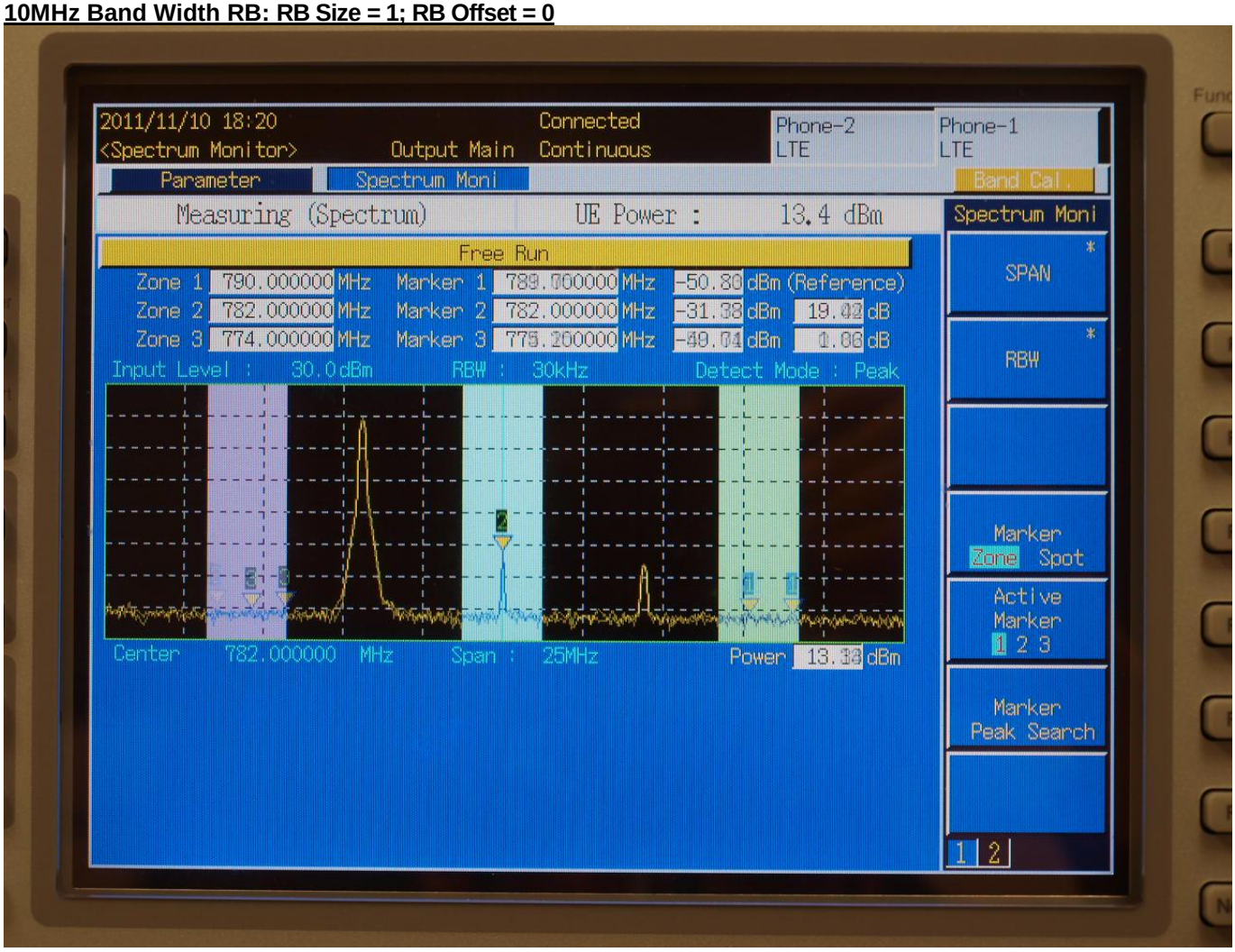
Output power for LTE Band 17

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

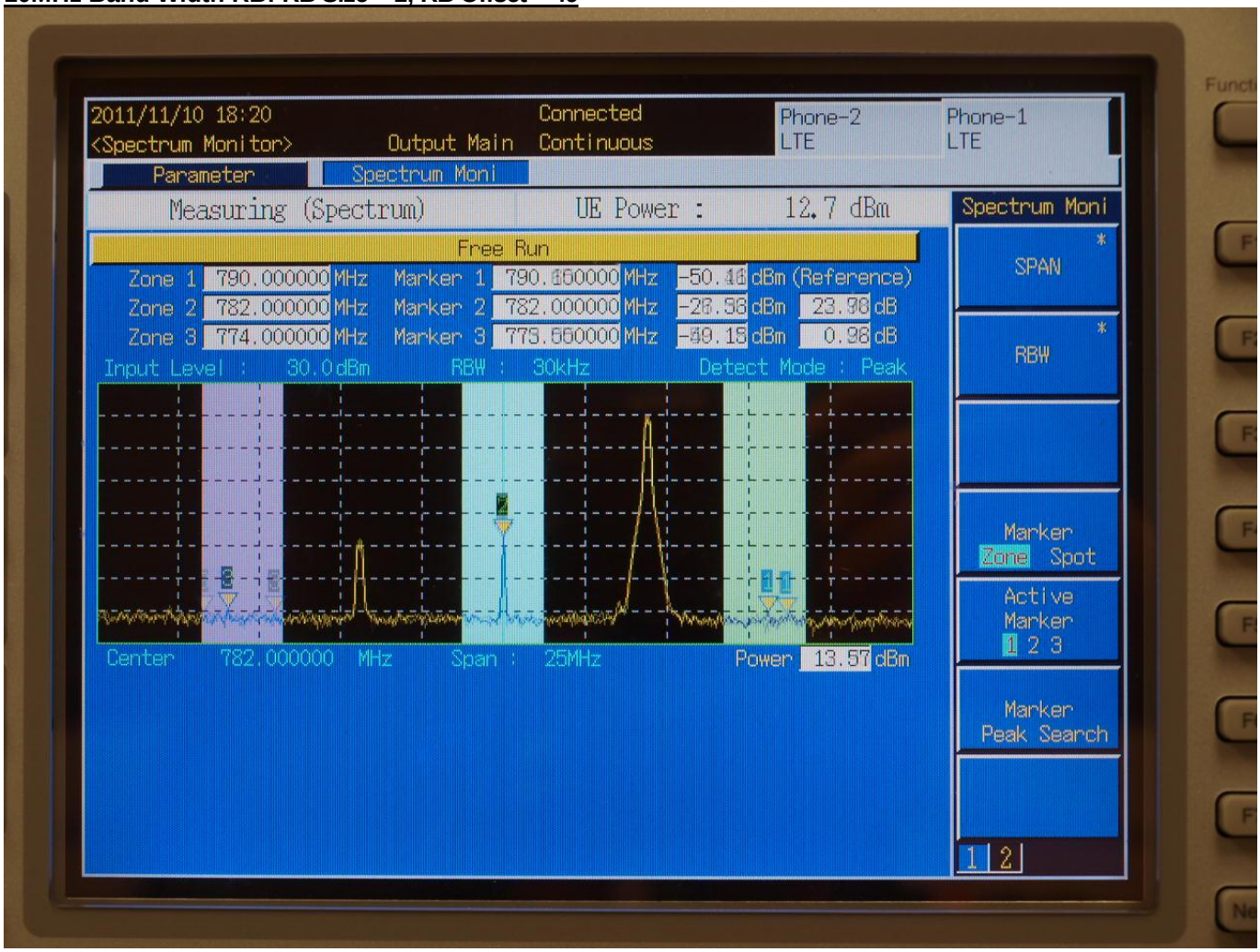
11.5.1. Spectrum Plots for the Test RB allocations

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

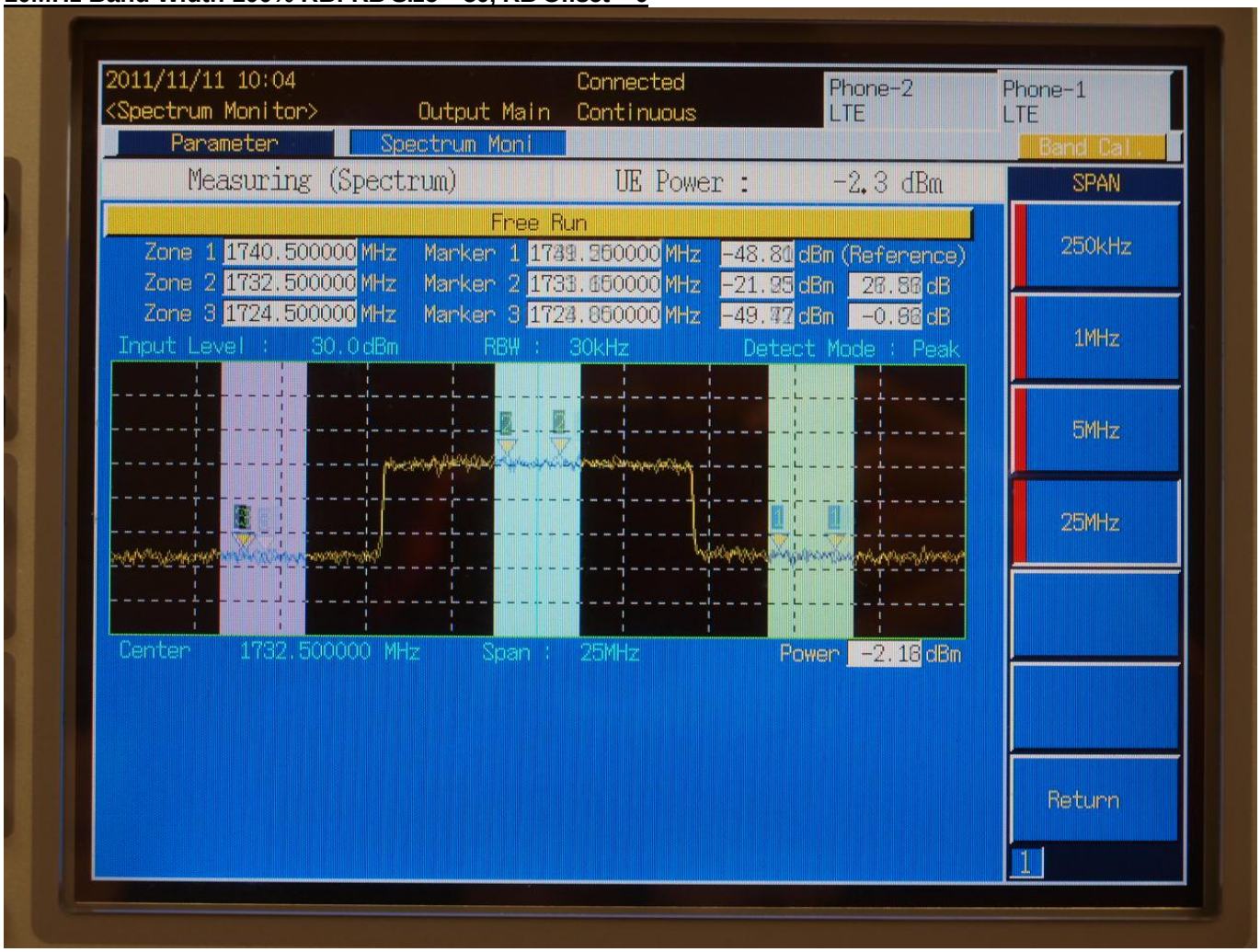


10MHz Band Width RB: RB Size = 1; RB Offset = 49



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	**0.504**	**0.310**
		251	848.8		
GPRS1900	2 slot CS1	512	1850.2		
		661	1880.0	**0.510**	**0.288**
		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	0.135	0.090
		251	848.8		
GPRS1900	2 slot CS1	512	1850.2		
		661	1880.0	0.169	0.090
		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	0.082	0.056
		251	848.8		
GPRS1900	2 slot CS1	512	1850.2		
		661	1880.0	0.058	0.030
		810	1909.8		

Lapheld

Band	Mode	Ch No.	Freq. (MHz)	SAR (mW/g)	
				1-g	10-g
GPRS850	2 slot CS1	128	824.2		
		190	836.6	0.01210	0.00828
		251	848.8		
GPRS1900	2 slot CS1	512	1850.2		
		661	1880.0	0.00502	0.00308
		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	0.483	0.302
	RMC	4233	4458	846.6		
Band II	R99	9262	9662	1850.2		
	12.2kbps	9400	9800	1880.0	0.461	0.263
	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	0.152	0.099
	RMC	4233	4458	846.6		
Band II	R99	9262	9662	1850.2		
	12.2kbps	9400	9800	1880.0	0.170	0.092
	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	0.098	0.066
	RMC	4233	4458	846.6		
Band II	R99	9262	9662	1850.2		
	12.2kbps	9400	9800	1880.0	0.136	0.091
	RMC	9538	9938	1907.6		

Lapheld

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	0.00468	0.00330
	RMC	4233	4458	846.6		
Band II	R99	9262	9662	1850.2		
	12.2kbps	9400	9800	1880.0	0.00382	0.00233
	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. In addition, per KDB 941225 D05 SAR for LTE Devices v01, 12/15/2010, page 3, Item 3, we have performed the Testing on the Largest Channel Bandwidth (10MHz), therefore testing for 5MHz Bandwidth is not required.

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	0.536	0.314	
QPSK	20175	1732.5	1	49	24.4	0	0	0	**0.562**	**0.327**	
QPSK	20175	1732.5	25	12	23.7	1	1	0	0.409	0.239	
QPSK	20175	1732.5	50	0	23.5	1	1	0			
16QAM	20175	1732.5	1	0	23.5	1	1	0	0.436	0.253	
16QAM	20175	1732.5	1	49	23.4	1	1	0	0.453	0.264	
16QAM	20175	1732.5	25	12	23.2	2	1	0	0.322	0.188	
16QAM	20175	1732.5	50	0	23.0	2	2	0			

Secondary Landscape

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	0.259	0.146	
QPSK	20175	1732.5	1	49	24.4	0	0	0	0.261	0.147	
QPSK	20175	1732.5	25	12	23.7	1	1	0	0.201	0.113	
QPSK	20175	1732.5	50	0	23.5	1	1	0			
16QAM	20175	1732.5	1	0	23.5	1	1	0	0.216	0.121	
16QAM	20175	1732.5	1	49	23.4	1	1	0	0.218	0.121	
16QAM	20175	1732.5	25	12	23.2	2	1	0	0.155	0.087	
16QAM	20175	1732.5	50	0	23.0	2	2	0			

Bottom

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	0.084	0.052	
QPSK	20175	1732.5	1	49	24.4	0	0	0	0.087	0.054	
QPSK	20175	1732.5	25	12	23.7	1	1	0	0.064	0.039	
QPSK	20175	1732.5	50	0	23.5	1	1	0			
16QAM	20175	1732.5	1	0	23.5	1	1	0	0.069	0.041	
16QAM	20175	1732.5	1	49	23.4	1	1	0	0.070	0.042	
16QAM	20175	1732.5	25	12	23.2	2	1	0	0.047	0.029	
16QAM	20175	1732.5	50	0	23.0	2	2	0			

Lapheld

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	0.010	0.00629	
QPSK	20175	1732.5	1	49	24.4	0	0	0	0.0091	0.00582	
QPSK	20175	1732.5	25	12	23.7	1	1	0	0.00731	0.00461	
QPSK	20175	1732.5	50	0	23.5	1	1	0			
16QAM	20175	1732.5	1	0	23.5	1	1	0	0.00845	0.00538	
16QAM	20175	1732.5	1	49	23.4	1	1	0	0.00852	0.00508	
16QAM	20175	1732.5	25	12	23.2	2	1	0	0.00685	0.00407	
16QAM	20175	1732.5	50	0	23.0	2	2	0			

12.4. LTE BAND 17

The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01. In addition, per KDB 941225 D05 SAR for LTE Devices v01, 12/15/2010, page 3, Item 3, we have performed the Testing on the Largest Channel Bandwidth (10MHz), therefore testing for 5MHz Bandwidth is not required.

Primary Portrait (Worst-case position)

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	0.301	0.194	
QPSK	23790	710	1	49	24.4	0	0	0	**0.307**	**0.197**	
QPSK	23790	710	25	12	24.3	1	0	0	0.215	0.137	
QPSK	23790	710	50	0	23.4	1	1	0			
16QAM	23790	710	1	0	23.2	1	1	0	0.242	0.155	
16QAM	23790	710	1	49	23.3	1	1	0	0.249	0.159	
16QAM	23790	710	25	12	23.1	2	1	0	0.164	0.105	
16QAM	23790	710	50	0	22.2	2	2	0			

Secondary Landscape

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	0.061	0.042	
QPSK	23790	710	1	49	24.4	0	0	0	0.065	0.043	
QPSK	23790	710	25	12	24.3	1	0	0	0.044	0.030	
QPSK	23790	710	50	0	23.4	1	1	0			
16QAM	23790	710	1	0	23.2	1	1	0	0.050	0.033	
16QAM	23790	710	1	49	23.3	1	1	0	0.052	0.035	
16QAM	23790	710	25	12	23.1	2	1	0	0.033	0.022	
16QAM	23790	710	50	0	22.2	2	2	0			

Bottom

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	0.036	0.025	
QPSK	23790	710	1	49	24.4	0	0	0	0.035	0.025	
QPSK	23790	710	25	12	24.3	1	0	0	0.026	0.018	
QPSK	23790	710	50	0	23.4	1	1	0			
16QAM	23790	710	1	0	23.2	1	1	0	0.029	0.020	
16QAM	23790	710	1	49	23.3	1	1	0	0.028	0.019	
16QAM	23790	710	25	12	23.1	2	1	0	0.020	0.014	
16QAM	23790	710	50	0	22.2	2	2	0			

Lapheld

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	0.00846	0.00587	
QPSK	23790	710	1	49	24.4	0	0	0	0.00928	0.00664	
QPSK	23790	710	25	12	24.3	1	0	0	0.00558	0.00404	
QPSK	23790	710	50	0	23.4	1	1	0			
16QAM	23790	710	1	0	23.2	1	1	0	0.00581	0.00419	
16QAM	23790	710	1	49	23.3	1	1	0	0.00716	0.00530	
16QAM	23790	710	25	12	23.1	2	1	0	0.00425	0.00310	
16QAM	23790	710	50	0	22.2	2	2	0			

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)
Laptop Mode Lapheld	0.01210						0.031	0.025	0.07
		0.00502					0.031	0.025	0.06
			0.00468				0.031	0.025	0.06
				0.00382			0.031	0.025	0.06
					0.010		0.031	0.025	0.07
						0.00928	0.031	0.025	0.07
Tablet Mode Bottom Face	0.082						0.018	0.072	0.17
		0.058					0.018	0.072	0.15
			0.098				0.018	0.072	0.19
				0.136			0.018	0.072	0.23
					0.087		0.018	0.072	0.18
						0.036	0.018	0.072	0.13
Primary Portrait	0.504						- *2	0.093	0.60
		0.510					- *2	0.093	0.60
			0.483				- *2	0.093	0.58
				0.461			- *2	0.093	0.55
					0.562		- *2	0.093	0.66
						0.307	- *2	0.093	0.40

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)
Laptop Mode Lapheld	0.01210						0.000104	0.018	0.03
		0.00502					0.000104	0.018	0.02
			0.00468				0.000104	0.018	0.02
				0.00382			0.000104	0.018	0.02
					0.010		0.000104	0.018	0.03
						0.00928	0.000104	0.018	0.03
Tablet Mode Bottom Face	0.082						0.024	0.033	0.14
		0.058					0.024	0.033	0.12
			0.098				0.024	0.033	0.16
				0.136			0.024	0.033	0.19
					0.087		0.024	0.033	0.14
						0.036	0.024	0.033	0.09
Primary Portrait	0.504						- *2	0.565	1.07
		0.510					- *2	0.565	1.08
			0.483				- *2	0.565	1.05
				0.461			- *2	0.565	1.03
					0.562		- *2	0.565	1.13
						0.307	- *2	0.565	0.87

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)
Laptop Mode Lapheld	0.01210						0.000383	0.0193	0.03
		0.00502					0.000383	0.0193	0.02
			0.00468				0.000383	0.0193	0.02
				0.00382			0.000383	0.0193	0.02
					0.010		0.000383	0.0193	0.03
						0.00928	0.000383	0.0193	0.03
Tablet Mode Bottom Face	0.082						0.033	0.038	0.15
		0.058					0.033	0.038	0.13
			0.098				0.033	0.038	0.17
				0.136			0.033	0.038	0.21
					0.087		0.033	0.038	0.16
						0.036	0.033	0.038	0.11
Primary Portrait	0.504						- *2	0.718	1.22
		0.510					- *2	0.718	1.23
			0.483				- *2	0.718	1.20
				0.461			- *2	0.718	1.18
					0.562		- *2	0.718	1.28
						0.307	- *2	0.718	1.03

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)
Laptop Mode Lapheld	0.01210						0.002220	0.297	0.31
		0.00502					0.002220	0.297	0.30
			0.00468				0.002220	0.297	0.30
				0.00382			0.002220	0.297	0.30
					0.010		0.002220	0.297	0.31
						0.00928	0.002220	0.297	0.31
Tablet Mode Bottom Face	0.082						0.046	0.058	0.19
		0.058					0.046	0.058	0.16
			0.098				0.046	0.058	0.20
				0.136			0.046	0.058	0.24
					0.087		0.046	0.058	0.19
						0.036	0.046	0.058	0.14
Primary Portrait	0.504						- *2	0.857	1.36
		0.510					- *2	0.857	1.37
			0.483				- *2	0.857	1.34
				0.461			- *2	0.857	1.32
					0.562		- *2	0.857	1.42
						0.307	- *2	0.857	1.16

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)
Laptop Mode Lapheld	0.01210						0.014	0.029	0.06
		0.00502					0.014	0.029	0.05
			0.00468				0.014	0.029	0.05
				0.00382			0.014	0.029	0.05
					0.010		0.014	0.029	0.05
						0.00928	0.014	0.029	0.05
Tablet Mode Bottom Face	0.082						0.028	0.049	0.16
		0.058					0.028	0.049	0.14
			0.098				0.028	0.049	0.18
				0.136			0.028	0.049	0.21
					0.087		0.028	0.049	0.16
						0.036	0.028	0.049	0.11
Primary Portrait	0.504						- *2	0.665	1.17
		0.510					- *2	0.665	1.18
			0.483				- *2	0.665	1.15
				0.461			- *2	0.665	1.13
					0.562		- *2	0.665	1.23
						0.307	- *2	0.665	0.97

Note(s)

1. *: WiFi max. 1g SAR from SAR report "11J14001-2A1 SAR report" submitted under FCC ID: ACJ9TGWL11A (Panasonic Corporation of North America)
2. *: This test configuration was not applied or WiFi measure.

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.

Conclusions:

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

☐ Simultaneous transmission SAR is not required because the SAR to peak location separation ratios is < 0.3.

14. Appendixes

Refer to separated files for the following appendixes

14.1. System Check Plots

14.2. SAR Test Plots for GSM 850 & 1900

14.3. SAR Test Plots for UMTS Band II & V

14.4. SAR Test Plots for LTE Band 4

14.5. SAR Test Plots for LTE Band 17

14.6. Calibration Certificate for EX3DV4 SN 3773

14.7. Calibration Certificate for D750V3 SN1024

14.8. Calibration Certificate for D835V2 SN 4d117

14.9. Calibration Certificate for D1750V2 SN 1050

14.10. Calibration Certificate for D1900V2 SN 5d140

15. Summary of Test configurations

Configuration	Antenna-to-User distance	SAR Require	Comments
(1) Bottom/Base Tablet mode	45 mm from Main to user.	Yes	
	45 mm from Aux to user.	No	WWAN Aux is Rx only.
Primary Landscape	135 mm from Main to user.	No	This is not the most conservative antenna to user distance
	135 mm from Aux to user.	No	WWAN Aux is Rx only.
(2) Secondary Landscape	25 mm from Main to user.	Yes	
	25 mm from Aux to user.	No	WWAN Aux is Rx only.
(3) Primary Portrait	16 mm from Main to user.	Yes	
	284 mm from Aux to user.	No	WWAN Aux is Rx only.
Secondary Portrait	284 mm from Main to user.	No	This is not the most conservative antenna to user distance
	16 mm from Aux to user.	No	WWAN Aux is Rx only.
(4) Lap-held (Laptop mode)	170 mm from Main to user.	Yes	
	170 mm from Aux to user.	No	WWAN Aux is Rx only.