



SAR EVALUATION REPORT

**FCC 47 CFR § 2.1093
IEEE Std 1528-2013**

For

GSM/WCDMA/LTE Phone + Bluetooth, WLAN 2.4GHz b/g/n and ANT+

**Model: SM-G7200
FCC ID: A3LSMG7200**

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Prepared for

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NVLAP LAB CODE 200065-0

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--	11/11/2014	Initial Issue	--
A	11/19/2014	Revised based on Reviewer's comments: 1. Sec. 6.3: Updated Bluetooth LE (BLE) power.	Chakrit Thammanavarat

Table of Contents

1.	Attestation of Test Results	5
2.	Test Specification, Methods and Procedures.....	6
3.	Facilities and Accreditation	6
4.	SAR Measurement System & Test Equipment	7
4.1.	SAR Measurement System	7
4.2.	SAR Scan Procedure	8
4.3.	Test Equipment.....	10
5.	Measurement Uncertainty.....	11
6.	Device Under Test (DUT) Information	12
6.1.	DUT Description.....	12
6.2.	Wireless Technologies	12
6.3.	Nominal and Maximum Output Power	13
6.4.	Simultaneous Transmission Condition	14
6.5.	General LTE SAR Test and Reporting Considerations.....	15
6.6.	LTE (TDD) Considerations.....	16
7.	RF Exposure Conditions (Test Configurations)	17
8.	Conducted Output Power Measurements.....	18
8.1.	GSM850 and GSM1900.....	18
8.2.	W-CDMA Band V and II	20
8.3.	LTE Band 41.....	28
8.4.	Wi-Fi (2.4 GHz Band).....	37
8.5.	Bluetooth.....	37
9.	Dielectric Property Measurements.....	38
9.1.	Tissue Dielectric Parameters	38
9.2.	Dielectric Property Measurements Results.....	39
10.	System Check.....	41
10.1.	System Performance Check Measurement Conditions	41
10.2.	Reference Target SAR Values	41
10.3.	System Check Results	42
11.	Measured and Reported (Scaled) SAR Results.....	43
11.1.	GSM850.....	44
11.2.	GSM1900.....	44
11.3.	W-CDMA Band V	44

11.4.	W-CDMA Band II	45
11.5.	LTE Band 41 (20MHz Bandwidth)	45
11.6.	Wi-Fi (DTS Band)	45
11.7.	Bluetooth	46
11.7.1.	Standalone SAR Test Exclusion Considerations	46
11.7.2.	Estimated SAR	46
12.	SAR Measurement Variability	47
12.1.	The Highest Measured SAR Configuration in Each Frequency Band	47
12.2.	Repeated Measurement Results	47
13.	Simultaneous Transmission SAR Analysis	48
13.1.	Sum of the SAR for GSM850 & Wi-Fi & BT	49
13.2.	Sum of the SAR for GSM1900 & Wi-Fi & BT	49
13.3.	Sum of the SAR for WCDMA Band V & Wi-Fi & BT	49
13.4.	Sum of the SAR for WCDMA Band II & Wi-Fi & BT	50
13.5.	Sum of the SAR for LTE Band 41 & Wi-Fi & BT	50
Appendixes		51
Appendix A:	SAR Photos & Ant. Locations	51
Appendix B:	SAR System Check Plots	51
Appendix C:	SAR Highest SAR Test Plots	51
Appendix D:	SAR Tissue Ingredients	51
Appendix E:	SAR Probe Cal. Certificates	51
Appendix F:	SAR Dipole Cal. Certificates	51

1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO., LTD.			
FCC ID	A3LSMG7200			
DUT Description	GSM/WCDMA/LTE Phone + Bluetooth, WLAN 2.4GHz b/g/n and ANT+			
Exposure Category	General Population/Uncontrolled Exposure			
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
Date tested	10/27/2014 - 11/03/2014			
The highest reported SAR (W/kg)				
RF Exposure Conditions	Equipment Class			
	Licensed	DSSS (BT)	DTS	UNII
Head	0.138 W/kg	N/A	0.253 W/kg	N/A
Body-worn or Body	0.613 W/kg	N/A	0.256 W/kg	N/A
Hotspot	0.613 W/kg	N/A	0.256 W/kg	N/A
Simultaneous TX	Head: 0.391 W/kg Body: 0.696 W/kg	N/A	Head: 0.391 W/kg Body: 0.696 W/kg	N/A
UL Verification Services Inc. 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 Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 By:		Prepared By:		
				
Bobby Bayani Senior Engineer UL Verification Services Inc.		Krishelle Aurelio Laboratory Technician UL Verification Services Inc.		

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 941225 D01 SAR test for 3G devices v02
- 941225 D02 HSPA and 1x Advanced v02r02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D04 SAR for GSM E GPRS Dual Xfer Mode v01
- 941225 D05 SAR for LTE Devices v02r03
- 941225 D06 Hotspot Mode SAR v01r01
- 248227 D01 SAR Meas for 802 11abg v01r02
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- 865664 D02 SAR Reporting v01r01
- 690783 D01 SAR Listings on Grants v01r03

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

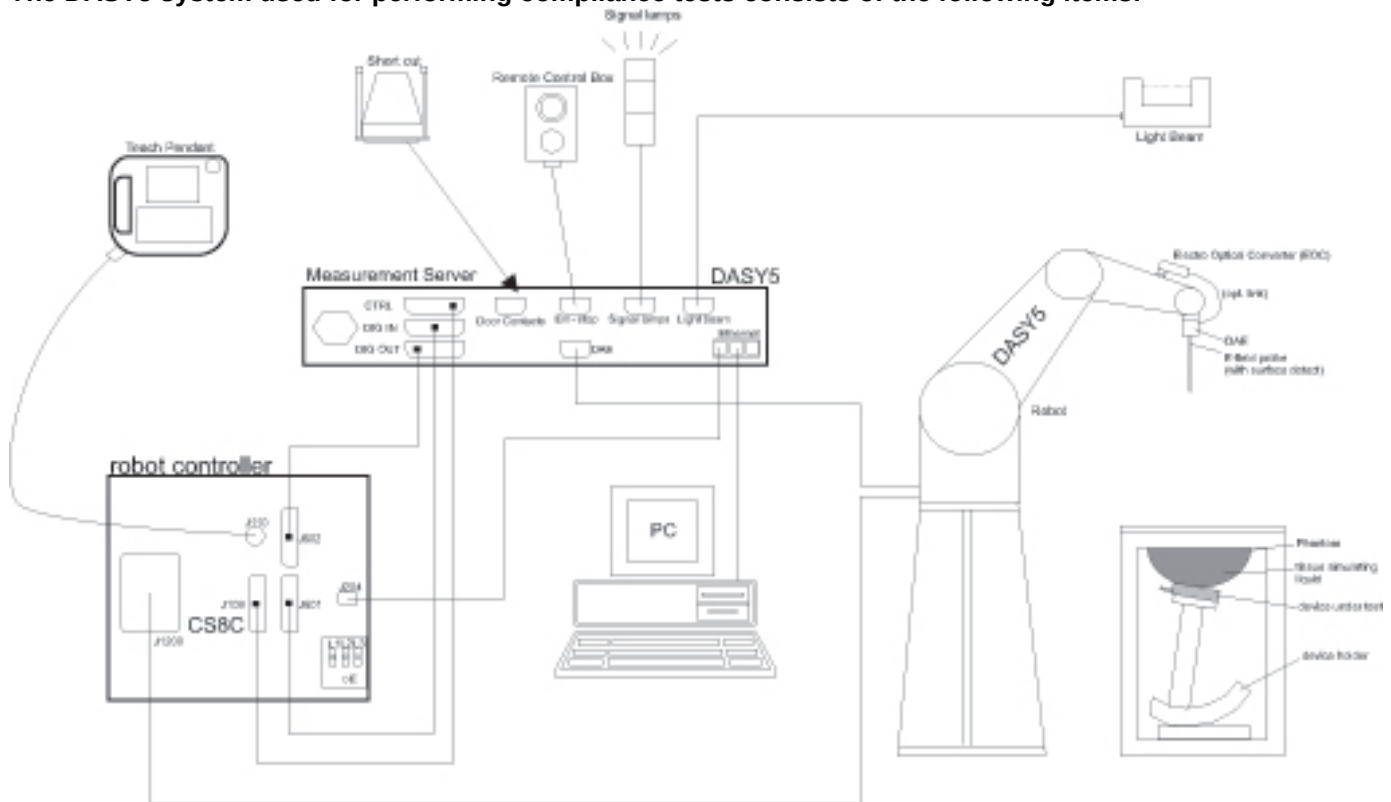
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- 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 Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- 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.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. SAR Scan Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$	≤ 2 GHz: ≤ 15 mm $2 - 3$ GHz: ≤ 12 mm	$3 - 4$ GHz: ≤ 12 mm $4 - 6$ GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

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 points (refer to table below) 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.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{\text{Zoom}}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{\text{Zoom}}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{\text{Zoom}}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <i>reported</i> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

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 (FCC only)

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.

4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	8753ES	MY40001647	7/17/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1103	2/18/2015
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Control Company	4242	122529162	10/8/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/20/2015
Power Meter	Agilent	N1912A	MY53040016	5/5/2015
Power Sensor	Agilent	E9323A	MY53070005	5/1/2015
Power Sensor	Agilent	E9323A	MY53070009	5/28/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	AMETEK	XT 15-4	1319A02778	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/12/2015
Power Meter	HP	437B	3125U11364	8/27/2015
Power Meter	HP	437B	3125U12345	8/15/2015
Power Sensor	HP	8481A	2702A76223	9/17/2015
Power Sensor	HP	8481A	1926A27048	8/15/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795092	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	BK PRECISION	1611	215-02292	N/A
E-Field Probe	SPEAG	EX3DV4	3772	2/26/2015
E-Field Probe	SPEAG	EX3DV4	3749	1/29/2015
Data Acquisition Electronics	SPEAG	DAE4	1259	1/23/2015
Data Acquisition Electronics	SPEAG	DAE4	500	5/15/2015
System Validation Dipole	SPEAG	D835V2	4d142	9/9/2015
System Validation Dipole	SPEAG	D1900V2	5d163	9/11/2015
System Validation Dipole	SPEAG	D2450V2	899	9/10/2015
System Validation Dipole	SPEAG	D2600V2	1006	9/10/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	124593-ss	7/31/2015
Base Station Simulator	R & S	CMW500	135387-ng	7/8/2015
Power Meter	Agilent	N1911A	MY53060009	5/5/2015
Power Sensor	Agilent	N1921A	MY52260009	12/12/2014

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: SM-G7200	
Device Dimension	Overall (Length x Width): 146.19 mm x 69.60 mm Overall Diagonal: 156.77 mm Display Diagonal: 132.89 mm
Battery Back Cover	☒ Normal Battery Cover ☐ Normal Battery Cover with NFC ☐ Wireless Charger Battery Cover ☐ Wireless Charger Battery Cover with NFC
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.85Vdc, 9.63Wh ☐ Extended (large capacity)
Accessory	Headset
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ☒ Mobile Hotspot (Wi-Fi 2.4 GHz) ☐ Mobile Hotspot (Wi-Fi 5 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☐ Wi-Fi Direct (Wi-Fi 5 GHz)

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
GSM	850, 1900	Voice (GMSK) GPRS (GMSK) EGPRS (8PSK)	GSM Voice: 12.5%; GPRS/EGPRS: 1 Slot: 12.5%; 2 Slots: 25%, 3 Slots: 37.5%, 4 Slots: 50%,
	GPRS Multi-Slot Class: ☐ Class 8 - One Up ☐ Class 10 - Two Up ☐ Class 12 - Four Up ☒ Class 33 - Four Up DTM (Dual Transfer Mode): Not support		
W-CDMA (UMTS)	Band V and II	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 7, CAT 24) HSUPA (Rel. 6, CAT 6) DC-HSDPA (Rel. 8, CAT 21)	100%
LTE (TDD)	Band 41	QPSK, 16QAM (Rel.10) Does not support Carrier Aggregation (CA).	63.3%
	Does this device SV-LTE (1xRTT-LTE)? ☐ Yes ☒ No		
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
Bluetooth	2.4 GHz	Version 4.0 LE	N/A

6.3. Nominal and Maximum Output Power

Upper limit (dB): -1.5 ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	32.5	33.0
	GPRS 1 slot	32.5	33.0
	GPRS 2 slots	30.0	30.5
	GPRS 3 slots	27.0	27.5
	GPRS 4 slots	25.5	26.0
	EGPRS 1 slot	27.0	27.5
	EGPRS 2 slots	26.0	26.5
	EGPRS 3 slots	23.5	24.0
	EGPRS 4 slots	23.5	24.0
GSM1900	Voice	30.0	30.5
	GPRS 1 slot	30.0	30.5
	GPRS 2 slots	27.5	28.0
	GPRS 3 slots	25.5	26.0
	GPRS 4 slots	24.0	24.5
	EGPRS 1 slot	26.0	26.5
	EGPRS 2 slots	25.5	26.0
	EGPRS 3 slots	23.0	23.5
	EGPRS 4 slots	23.0	23.5
W-CDMA Band V	R99	23.5	24.0
	HSDPA	23.5	24.0
	HSUPA	22.5	23.0
	DC-HSDPA	23.5	24.0
W-CDMA Band II	R99	22.0	22.5
	HSDPA	22.5	23.0
	HSUPA	22.0	22.5
	DC-HSDPA	21.5	22.0
LTE Band 41	QPSK	22.5	23.0

Upper limit (dB): ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	17.0	17.5
	802.11g	13.0	13.5
	802.11n HT20	12.0	12.5
Bluetooth		9.0	9.5
Bluetooth LE		0.0	0.5

6.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	1. GSM 850/1900 Voice + Wi-Fi 2.4GHz 2. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 3. WCDMA Band 2/5 + Wi-Fi 2.4GHz 4. LTE B41 + Wi-Fi 2.4GHz
Body-worn Accessory	1. GSM 850/1900 Voice + Wi-Fi 2.4GHz 2. GSM 850/1900 Voice + BT 3. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 4. GSM 850/1900 (GPRS/EDGE) + BT 5. WCDMA Band 2/5 + Wi-Fi 2.4GHz 6. WCDMA Band 2/5 + BT 7. LTE B41 + Wi-Fi 2.4GHz 8. LTE B41 + BT
Wireless Router (Hotspot)	1. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 2. WCDMA Band 2/5 + Wi-Fi 2.4GHz 3. LTE B41 + Wi-Fi 2.4GHz
Notes: 1. Wi-Fi only 2.4GHz supports Hotspot. 2. GPRS/EDGE, WCDMA and LTE support Hotspot. 3. VoIP is supported in LTE, WCDMA and GPRS. 4. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio.	

6.5. General LTE SAR Test and Reporting Considerations

Item	Description																																												
Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 41	Frequency range: 2555 - 2635 MHz																																											
		Channel Bandwidth																																											
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz																																						
	Low	40340/ 2565	40315/ 2562.5	40290/ 2560	40265/ 2557.5																																								
	Mid	40640/ 2595	40640/ 2595	40640/ 2595	40640/ 2595																																								
	High	40940/ 2625	40620/ 2672.5	40620/ 2630	41015/ 2632.5																																								
LTE transmitter and antenna implementation	LTE has one (1) TX/RX antennas and one (1) RX antennas Refer to "Appendix A: SAR Photos & Ant. Locations."																																												
Maximum power reduction (MPR)	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3 <table border="1"> <thead> <tr> <th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th><th rowspan="2">MPR (dB)</th></tr> <tr> <th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr> </thead> <tbody> <tr> <td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr> <tr> <td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr> <tr> <td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr> </tbody> </table> MPR Built-in by design A-MPR (additional MPR) was disabled during SAR testing							Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1	16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1	16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)																																						
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz																																							
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1																																						
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1																																						
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2																																						
Power reduction	No																																												
Spectrum plots for RB configurations	A properly configured base station simulator was used for the SAR and power measurements; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.																																												

6.6. LTE (TDD) Considerations

According to KDB 941225 D05 SAR for LTE Devices for Time-Division Duplex (TDD) systems, SAR must be tested using a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by the defined 3GPP LTE TDD configurations.

SAR was tested with the highest transmission duty factor (63.33%) using Uplink-downlink configuration 0 and Special subframe configuration 7.

LTE TDD Band 41 supports 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations and Table 4.2-1 for Special subframe configurations.

Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS).

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21952 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$			$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$		
8	$24144 \cdot T_s$			-	-	-
9	$13168 \cdot T_s$			-	-	-

Table 4.2-2: Uplink-downlink configurations.

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

Calculated Duty Cycle

Uplink-Downlink Configuration	Downlink-to-Uplink Switch-point Periodicity	Subframe Number										Calculated Duty Cycle (%)
		0	1	2	3	4	5	6	7	8	9	
0	5 ms	D	S	U	U	U	D	S	U	U	U	63.33
1	5 ms	D	S	U	U	D	D	S	U	U	D	43.33
2	5 ms	D	S	U	D	D	D	S	U	D	D	23.33
3	10 ms	D	S	U	U	U	D	D	D	D	D	31.67
4	10 ms	D	S	U	U	D	D	D	D	D	D	21.67
5	10 ms	D	S	U	D	D	D	D	D	D	D	11.67
6	5 ms	D	S	U	U	U	D	S	U	U	D	53.33

Calculated Duty Cycle = Extended cyclic prefix in uplink $\times (T_s) \times \#$ of S + $\#$ of U

Example for Calculated Duty Cycle for Uplink-Downlink Configuration 0:

Calculated Duty Cycle = $5120 \times [1/(15000 \times 2048)] \times 2 + 6 \text{ ms} = 63.33\%$

where

$T_s = 1/(15000 \times 2048)$ seconds

7. RF Exposure Conditions (Test Configurations)

Refer to "SAR Photos & Ant. Locations" for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

Wireless technologies	RF Exposure Conditions	DUT-to-User Separation	Test Position	Antenna-to-edge/surface	SAR Required	Note
WWAN	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	10 mm	Rear	N/A	Yes	
			Front	N/A	Yes	
	Hotspot	10 mm	Rear	< 25 mm	Yes	
			Front	< 25 mm	Yes	
			Edge 1 (Top)	> 25 mm	No	1
			Edge 2 (Right)	< 25 mm	Yes	
			Edge 3 (Bottom)	< 25 mm	Yes	
			Edge 4 (Left)	< 25 mm	Yes	
WLAN	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	10 mm	Rear	N/A	Yes	
			Front	N/A	Yes	
	Hotspot / Wi-Fi Direct	10 mm	Rear	< 25 mm	Yes	
			Front	< 25 mm	Yes	
			Edge 1 (Top)	< 25 mm	Yes	
			Edge 2 (Right)	> 25 mm	No	1
			Edge 3 (Bottom)	> 25 mm	No	1
			Edge 4 (Left)	< 25 mm	Yes	

Notes:

1. SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR. KDB 648474 D04 Handset SAR (Wi-Fi Direct).

8. Conducted Output Power Measurements

8.1. GSM850 and GSM1900

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
850	GSM (Voice)	CS1	1	128	824.2	33.0	23.9
				190	836.6	33.0	24.0
				251	848.8	33.0	24.0
	GPRS (GMSK)	CS1	1	128	824.2	33.0	23.9
				190	836.6	33.0	24.0
				251	848.8	33.0	24.0
			2	128	824.2	29.9	23.9
				190	836.6	29.9	23.9
				251	848.8	29.8	23.8
			3	128	824.2	27.4	23.1
				190	836.6	27.4	23.1
				251	848.8	27.3	23.0
			4	128	824.2	25.9	22.9
				190	836.6	25.9	22.9
				251	848.8	25.8	22.8
	EGPRS (8PSK)	MCS5	1	128	824.2	27.3	18.3
				190	836.6	27.3	18.3
				251	848.8	27.3	18.3
			2	128	824.2	24.8	18.8
				190	836.6	24.8	18.8
				251	848.8	24.8	18.8
			3	128	824.2	22.2	17.9
				190	836.6	22.2	17.9
				251	848.8	22.2	17.9
			4	128	824.2	22.1	19.1
				190	836.6	22.1	19.1
				251	848.8	22.0	19.0

Notes:

The worst-case configuration and mode for SAR testing is determined to be as follows:

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 1 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
1900	GSM (Voice)	CS1	1	512	1850.2	30.5	21.5
				661	1880.0	30.5	21.5
				810	1909.8	30.4	21.4
	GPRS (GMSK)	CS1	1	512	1850.2	30.5	21.5
				661	1880.0	30.5	21.5
				810	1909.8	30.4	21.4
			2	512	1850.2	27.4	21.4
				661	1880.0	27.4	21.4
				810	1909.8	27.3	21.3
			3	512	1850.2	25.7	21.4
				661	1880.0	25.7	21.4
				810	1909.8	25.6	21.3
			4	512	1850.2	24.2	21.2
				661	1880.0	24.1	21.1
				810	1909.8	24.1	21.1
	EGPRS (8PSK)	MCS5	1	512	1850.2	25.6	16.6
				661	1880.0	25.6	16.6
				810	1909.8	25.6	16.6
			2	512	1850.2	24.4	18.4
				661	1880.0	24.4	18.4
				810	1909.8	24.3	18.3
			3	512	1850.2	21.7	17.4
				661	1880.0	21.7	17.4
				810	1909.8	21.6	17.3
			4	512	1850.2	21.7	18.7
				661	1880.0	21.7	18.7
				810	1909.8	21.6	18.6

Notes:

The worst-case configuration and mode for SAR testing is determined to be as follows:

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 1 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

8.2. W-CDMA Band V and II

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 DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c/β_d	8/15

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	23.4
		4183	836.6	23.4
		4233	846.6	23.2
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	22.3
		9400	1880.0	22.3
		9538	1907.6	22.3

HSDPA

The following 4 Sub-tests were completed according to Release 7 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm 2			
	β_c	2/15	11/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	12/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
HSDPA Specific Settings	MPR (dB)	0	0	0.5	0.5
	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	$A_{hs} = \beta_{hs}/\beta_c$	30/15			

For the E-MPR setting, the table below was used referencing from 3GPP TS34.121-1 version 11.1.1 Release 11 specification.

Table 5.2B.5: Maximum Output Powers with HS-DPCCH and E-DCH for test

Sub-test in table C.11.1.3	Power Class 3		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
1	+24	+1.7/-6.7	+21	+2.7/-5.7
2	+22	+3.7/-5.2	+19	+4.7/-4.2
3	+23	+2.7/-5.2	+20	+3.7/-4.2
4	+22	+3.7/-5.2	+19	+4.7/-4.2
5	+24	+1.7/-3.7	+21	+2.7/-2.7

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	23.4
		4183	836.6	23.3
		4233	846.6	23.2
	Subtest 2	4132	826.4	23.2
		4183	836.6	23.3
		4233	846.6	23.2
	Subtest 3	4132	826.4	23.3
		4183	836.6	23.3
		4233	846.6	23.2
	Subtest 4	4132	826.4	23.2
		4183	836.6	23.4
		4233	846.6	23.2
W-CDMA Band II	Subtest 1	9262	1852.4	22.3
		9400	1880.0	22.2
		9538	1907.6	21.2
	Subtest 2	9262	1852.4	22.3
		9400	1880.0	22.2
		9538	1907.6	22.2
	Subtest 3	9262	1852.4	22.3
		9400	1880.0	22.3
		9538	1907.6	22.3
	Subtest 4	9262	1852.4	22.3
		9400	1880.0	22.2
		9538	1907.6	22.3

Maximum output power levels that are possible for all subtests reported.

HSPA (HSDPA & HSUPA)

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

	Mode	HSPA				
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2 kbps RMC				
	HSDPA FRC	H-Set 1				
	HSUPA Test	HSPA				
	Power Control Algorithm	Algorithm 2				Algorithm 1
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	0
	β_{ec}	209/225	12/15	30/15	2/15	5/15
	β_c/β_d	11/15	11/15	15/9	2/15	15/0
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	β_{ed}	1309/225	94/75	47/15 47/15	56/75	47/15
HSDPA Specific Settings	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
HSUPA Specific Settings	CQI Repetition Factor (Table 5.2B.4)	2				
	A _{hs} = β_{hs}/β_c	30/15				
	E-DPDCCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E-TFCIs	5	5	2	5	1
	Reference E-TFCI	11	11	11	11	67
	Reference E-TFCI PO	4	4	4	4	18
	Reference E-TFCI	67	67	92	67	67
	Reference E-TFCI PO	18	18	18	18	18
	Reference E-TFCI	71	71	71	71	71
	Reference E-TFCI PO	23	23	23	23	23
	Reference E-TFCI	75	75	75	75	75
	Reference E-TFCI PO	26	26	26	26	26
	Reference E-TFCI	81	81	81	81	81
	Reference E-TFCI PO	27	27	27	27	27
	Maximum Channelisation Codes	2xSF2				SF4

For the E-MPR setting, the table below was used referencing from 3GPP TS34.121-1 version 11.1.1 Release 11 specification.

Table 5.2B.5: Maximum Output Powers with HS-DPCCH and E-DCH for test

Sub-test in table C.11.1.3	Power Class 3		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
1	+24	+1.7/-6.7	+21	+2.7/-5.7
2	+22	+3.7/-5.2	+19	+4.7/-4.2
3	+23	+2.7/-5.2	+20	+3.7/-4.2
4	+22	+3.7/-5.2	+19	+4.7/-4.2
5	+24	+1.7/-3.7	+21	+2.7/-2.7

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	22.2
		4183	836.6	21.8
		4233	846.6	22.1
	Subtest 2	4132	826.4	21.0
		4183	836.6	21.0
		4233	846.6	21.0
	Subtest 3	4132	826.4	21.1
		4183	836.6	21.3
		4233	846.6	21.2
	Subtest 4	4132	826.4	21.0
		4183	836.6	21.1
		4233	846.6	21.0
W-CDMA Band II	Subtest 1	4132	826.4	22.2
		4183	836.6	22.3
		4233	846.6	22.1
	Subtest 2	9262	1852.4	20.7
		9400	1880.0	20.7
		9538	1907.6	20.6
	Subtest 3	9262	1852.4	20.5
		9400	1880.0	20.6
		9538	1907.6	20.5
	Subtest 4	9262	1852.4	20.5
		9400	1880.0	20.6
		9538	1907.6	20.5
	Subtest 5	9262	1852.4	20.5
		9400	1880.0	20.6
		9538	1907.6	20.6

DC-HSDPA

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

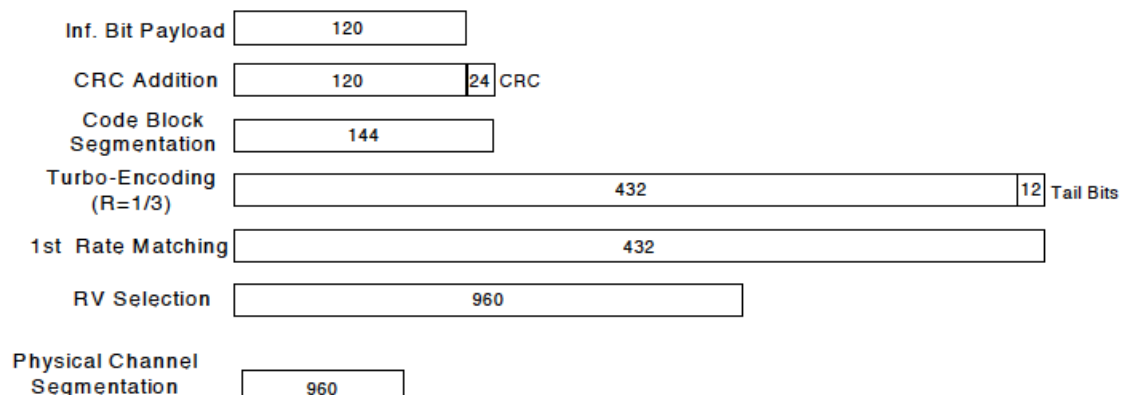
Parameter During Connection setup	Unit	Value
P-CPICH E_c/I_{or}	dB	-10
P-CCPCH and SCH E_c/I_{or}	dB	-12
PICH E_c/I_{or}	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH E_c/I_{or}	dB	-5
OCNS E_c/I_{or}	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table.		
Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

**Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)**

The following 4 Sub-tests for HSDPA were completed according to Release 8 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm2			
	β_c	2/15	11/15	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
HSDPA Specific Settings	MPR (dB)	0	0	0.5	0.5
	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs = β_{hs}/β_c	30/15			

Up commands are set continuously to set the UE to Max power.

For the E-MPR setting, the table below was used referencing from 3GPP TS34.121-1 version 11.1.1 Release 11 specification.

Table 5.2B.5: Maximum Output Powers with HS-DPCCH and E-DCH for test

Sub-test in table C.11.1.3	Power Class 3		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
1	+24	+1.7/-6.7	+21	+2.7/-5.7
2	+22	+3.7/-5.2	+19	+4.7/-4.2
3	+23	+2.7/-5.2	+20	+3.7/-4.2
4	+22	+3.7/-5.2	+19	+4.7/-4.2
5	+24	+1.7/-3.7	+21	+2.7/-2.7

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	23.3
		4183	836.6	23.3
		4233	846.6	23.2
	Subtest 2	4132	826.4	23.1
		4183	836.6	23.1
		4233	846.6	23.0
	Subtest 3	4132	826.4	23.3
		4183	836.6	23.2
		4233	846.6	23.2
	Subtest 4	4132	826.4	23.2
		4183	836.6	23.3
		4233	846.6	23.2
W-CDMA Band II	Subtest 1	9262	1852.4	21.4
		9400	1880.0	21.4
		9538	1907.6	21.2
	Subtest 2	9262	1852.4	21.5
		9400	1880.0	21.5
		9538	1907.6	21.4
	Subtest 3	9262	1852.4	21.4
		9400	1880.0	21.4
		9538	1907.6	21.4
	Subtest 4	9262	1852.4	21.4
		9400	1880.0	21.3
		9538	1907.6	21.4

8.3. LTE Band 41

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

The allowed A-MPR values specified below in Table 6.2.4-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signalling Value of "NS_01".

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4, 10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3	13	10	Table 6.2.4-2	Table 6.2.4-2
	6.6.3.3.2				
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23 ¹	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-

Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.

LTE Band 41 Measured Results**Procedure used to establish SAR test signal for LTE TDD Band 41**

Set to CMW-500 with following parameters:

- Turn the LTE Signaling off using “ON | OFF” key
- Operating Band: Select Band 41 and TDD
- Go to “Config....”

LTE Signaling 1 - X3.2.10.6

Connection Status

Cell: OFF

Packet Switched: OFF

RRC State: Idle

Event Log

- 03:21:26 State 'Cell Off'
- 03:21:17 State 'Cell On'
- 03:21:16 Signaling Failure
- 03:21:13 Network Originated Detach
- 03:21:02 State 'Connection Established'
- 03:21:02 EPS Dedicated Bearer Established
- 03:20:57 State 'Attached'
- 03:20:57 EPS Default Bearer Established

UE Info

IMEI: ---

IMSI: ---

UE IPv4 Address [0]: ---

UE IPv6 Prefix [0]: ---

Connection Setup

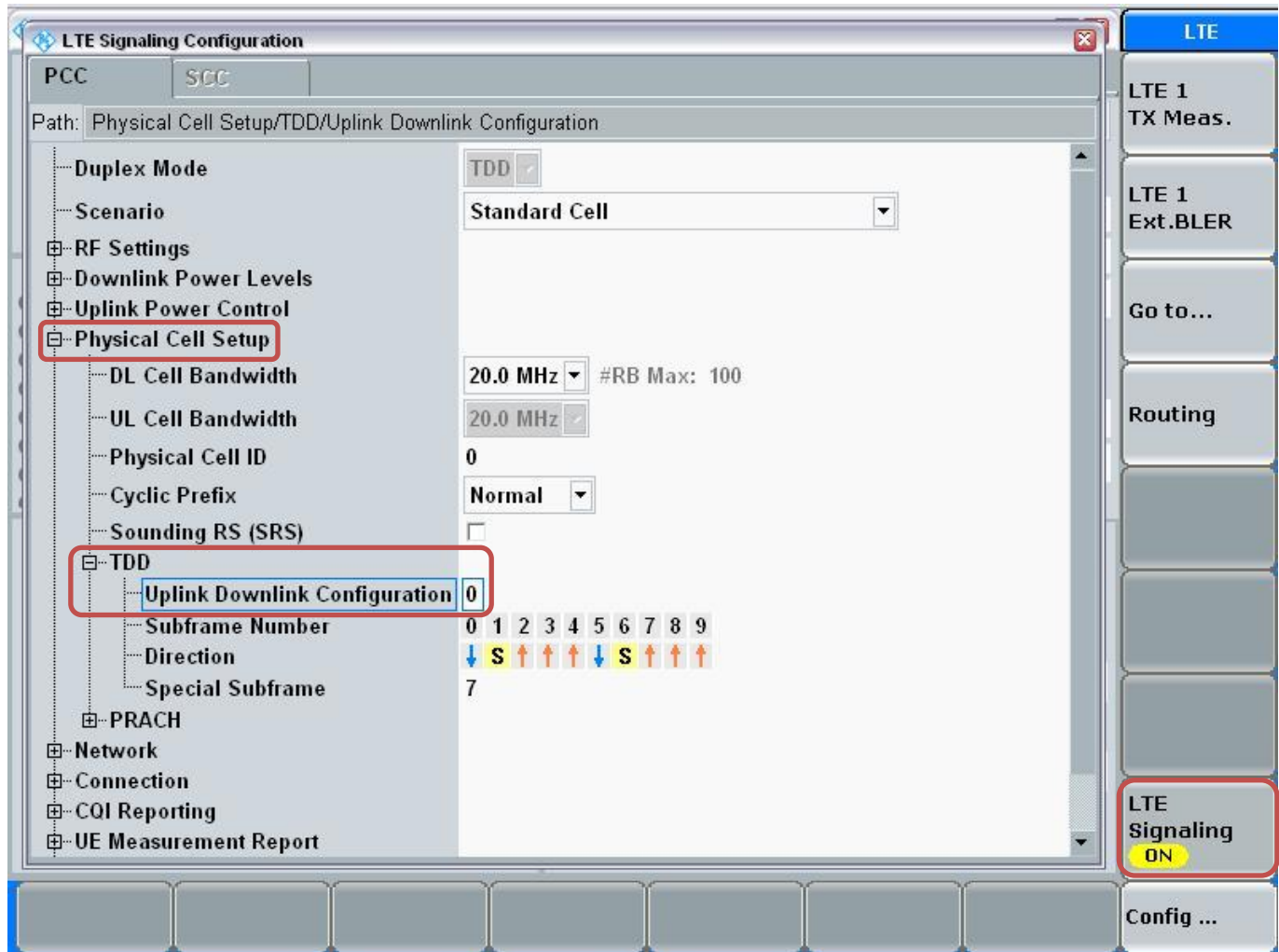
Scheduling: **RMC**

	Downlink	Uplink
Operating Band	Band 41	TDD
Channel	40620 Ch	40620 Ch
Frequency	2593.0 MHz	2593.0 MHz
Cell Bandwidth	20.0 MHz	20.0 MHz
RS EPRE	-85.8 dBm/15kHz	
Full Cell BW Pow.	-55.0 dBm	
PUSCH Open Loop Nom.Power		23 dBm
PUSCH Closed Loop Target Power		23.0 dBm
# RB	100	100
RB Pos./Start RB	low	low
Modulation	QPSK	QPSK
TBS Idx / Value	5 / 8760	2 / 4584
Throughput	3.970 Mbit/s	1.834 Mbit/s

LTE Signaling
OFF

Config ...

- Go to "Physical Cell Setup"
- Select "TDD" and Set "Uplink Downlink Configuration" to "0"
- Turn the cell on using "ON | OFF" key



Connect to EUT

- Turn the cell on using "ON | OFF" key
- After EUT is Attached
- Select "Connect"

LTE Signaling 1 - X3.2.10.6

Connection Status

Cell 

Packet Switched 

RRC State 

Attached

Event Log

03:31:31 State 'Attached'

03:31:31 EPS Default Bearer Established

03:31:31 RRC Connection Established

03:31:02 State 'Cell On'

03:31:00 State 'Cell Off'

03:30:23 State 'Cell On'

03:30:22 Signaling Failure

03:30:19 Network Originated Detach

UE Info

IMEI 001027009999998

IMSI 001010123456789

UE IPv4 Address [0] 192.168.48.129

UE IPv6 Prefix [0] fc01:abab:cdcd:efe0::

PCC

Operating Band **Band 41** TDD

Channel **40620 Ch** **40620 Ch**

Frequency **2593.0 MHz** **2593.0 MHz**

Cell Bandwidth **20.0 MHz** **20.0 MHz**

RS EPRE **-85.8 dBm/15kHz**

Full Cell BW Pow. **-55.0 dBm**

PUSCH Open Loop Nom.Power **23 dBm**

PUSCH Closed Loop Target Power **23.0 dBm**

Connection Setup

Scheduling **RMC**

RB **100** **100**

RB Pos./Start RB **low** 0 **low** 0

Modulation **QPSK** **QPSK**

TBS Idx / Value **5** 8760 **2** 4584

Throughput **3.970 Mbit/s** **1.834 Mbit/s**

LTE

LTE 1 TX Meas.

LTE 1 Ext.BLER

Go to...

Routing

LTE Signaling ON

Detach **Connect** **Send SMS** **Handover ...** **Config ...**

Max Power Setting

- Select "LTE 1 TX Meas."
- Press "RESTART | STOP" Soft key

LTE Signaling 1 - X3.2.10.6

Connection Status

Cell: Connection Established

Packet Switched: Connection Established

RRC State: Connected

Event Log

03:33:07 [i] State 'Connection Established'

03:33:07 [i] EPS Dedicated Bearer Established

03:31:31 [i] State 'Attached'

03:31:31 [i] EPS Default Bearer Established

03:31:31 [i] RRC Connection Established

03:31:02 [i] State 'Cell On'

03:31:00 [i] State 'Cell Off'

03:30:23 [i] State 'Cell On'

UE Info

IMEI: 001027009999998

IMSI: 001010123456789

UE IPv4 Address [0]: 192.168.48.129

UE IPv6 Prefix [0]: fc01:abab:cdcd:efe0::

Connection Setup

Scheduling: RMC

Operating Band: Band 41 TDD

Channel: 40620 Ch

Frequency: 2593.0 MHz

Cell Bandwidth: 20.0 MHz

RS EPRE: -85.8 dBm/15kHz

Full Cell BW Pow.: -55.0 dBm

PUSCH Open Loop Nom.Power: 23 dBm

PUSCH Closed Loop Target Power: 23.0 dBm

RB: 100

RB Pos./Start RB: low 0

Modulation: QPSK

TBS Idx / Value: 5 8760 2 4584

Throughput: 3.970 Mbit/s 1.834 Mbit/s

LTE

LTE 1 TX Meas.

LTE 1 Ext.BLER

Go to...

Routing

LTE Signaling ON

Detach Disconnect Send SMS Handover ... Config ...

- Select “Signaling Parameter”
- Select “TX Power Control (TPC)” > Select “Active TPC Setup” to “Max Power” > Set “Closed Loop Target Power” to “23 dBm”

LTE Measurement - X3.2.10.6 - TX Measurement

Multi Evaluation PRACH SRS

Mode: TDD Freq.: 2593.0 MHz Ref. Level: 44.80 dBm Bandwidth: 20.0 MHz Cyclic Prefix: Normal Meas Subfr.: 0

EVM

Inband Emissions

Equalizer Spectrum Flatness

Spectrum ACLR

Spectrum

TX Measu

TX Power

PS:

Cell Setup ... Connection Setup ... DL Error Insertion ... TPC ... Power ... Enable ... Config ...

Signaling TPC

TX Power Control (TPC)

Active TPC Setup Max Power

Closed Loop Target Power 23.0 dBm

Signaling Parameter

LTE

Multi Evaluation RUN

RF Settings

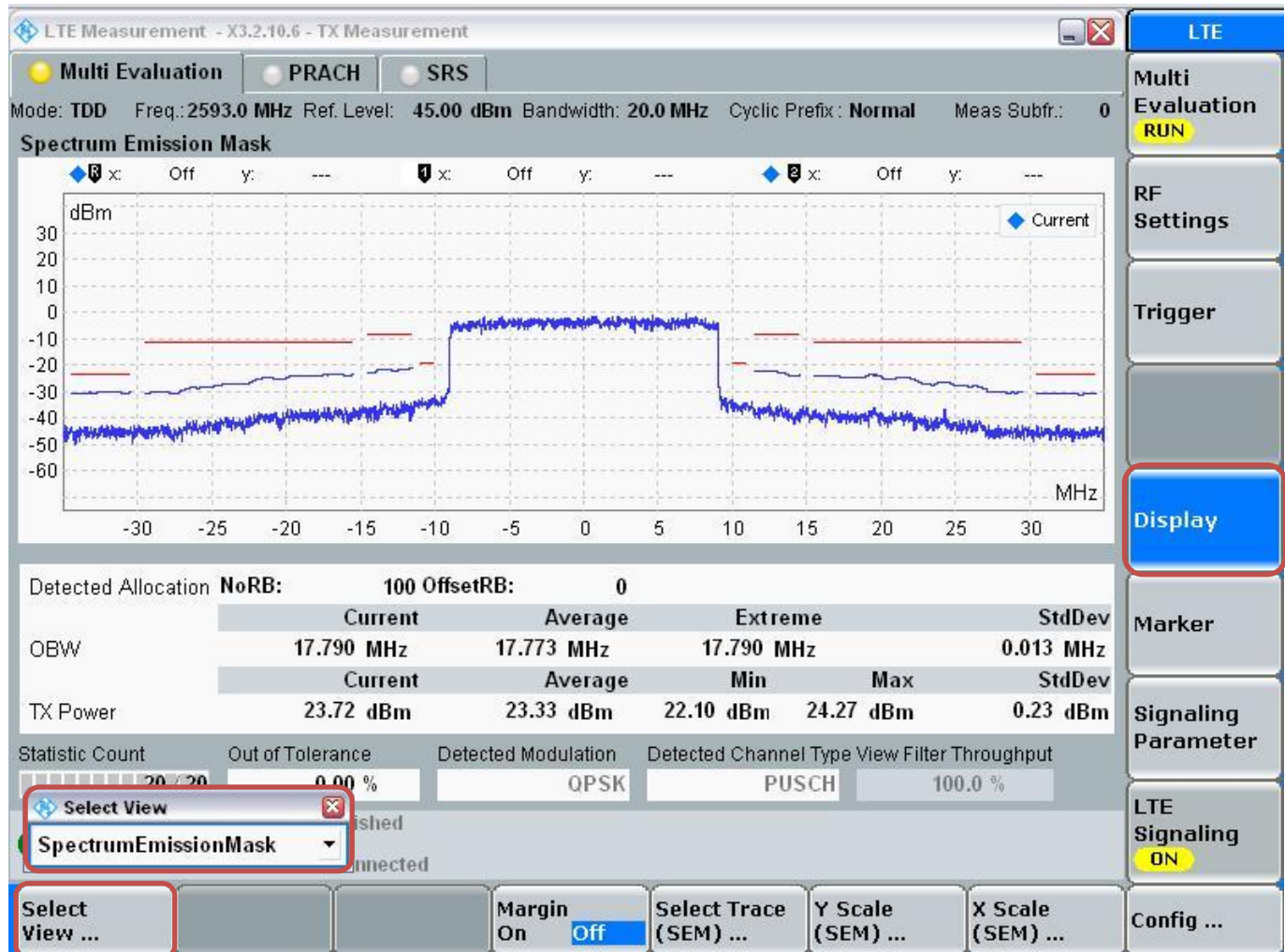
Trigger

Display

LTE Signaling ON

View TX Power

- Go to “Display”
- Select “Select View...”
- Select “Spectrum Emission Mask”



LTE Band 41 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							2565 MHz	2595 MHz	2625 MHz
LTE Band 41	20	QPSK	1	0	0	0	21.9	22.2	21.6
			1	50	0	0	22.1	22.1	22.1
			1	99	0	0	22.2	22.2	22.2
			50	0	1	1	21.0	21.3	21.2
			50	25	1	1	21.1	21.1	21.1
			50	50	1	1	21.2	21.2	21.1
			100	0	1	1	21.0	21.1	21.0
		16QAM	1	0	1	1	21.3	21.3	21.3
			1	50	1	1	21.2	21.3	21.2
			1	99	1	1	21.2	21.3	21.2
			50	0	2	2	20.2	20.3	20.1
			50	25	2	2	20.2	20.2	20.3
			50	50	2	2	20.2	20.2	20.1
			100	0	2	2	20.2	20.2	20.2
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							2562.5 MHz	2595 MHz	2627.5 MHz
LTE Band 41	15	QPSK	1	0	0	0	21.8	22.2	21.6
			1	36	0	0	22.1	22.1	22.1
			1	74	0	0	22.2	22.2	22.1
			36	0	1	1	21.0	21.3	21.2
			36	18	1	1	21.1	21.1	21.1
			36	37	1	1	21.2	21.2	21.1
			75	0	1	1	21.0	21.1	21.0
		16QAM	1	0	1	1	21.2	21.3	21.3
			1	36	1	1	21.2	21.3	21.2
			1	74	1	1	21.2	21.2	21.2
			36	0	2	2	20.2	20.2	20.1
			36	18	2	2	20.2	20.2	20.2
			36	37	2	2	20.2	20.2	20.0
			75	0	2	2	20.2	20.2	20.1
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							2560 MHz	2595 MHz	2630 MHz
LTE Band 41	10	QPSK	1	0	0	0	21.8	22.2	21.6
			1	25	0	0	22.1	22.1	22.1
			1	49	0	0	22.2	22.2	22.1
			25	0	1	1	21.0	21.3	21.2
			25	12	1	1	21.1	21.1	21.1
			25	25	1	1	21.2	21.2	21.1
			50	0	1	1	21.0	21.1	21.0
		16QAM	1	0	1	1	21.2	21.3	21.3
			1	25	1	1	21.2	21.3	21.2
			1	49	1	1	21.2	21.2	21.2
			25	0	2	2	20.2	20.2	20.1
			25	12	2	2	20.2	20.2	20.2
			25	25	2	2	20.2	20.2	20.0
			50	0	2	2	20.2	20.2	20.1

LTE Band 41 Measured Results (continued)

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							2557.5 MHz	2595 MHz	2632.5 MHz
LTE Band 41	5	QPSK	1	0	0	0	21.8	22.2	21.6
			1	12	0	0	22.1	22.1	22.1
			1	24	0	0	22.2	22.2	22.1
			12	0	1	1	21.0	21.3	21.2
			12	7	1	1	21.1	21.1	21.1
			12	13	1	1	21.2	21.2	21.1
			25	0	1	1	21.0	21.1	21.0
		16QAM	1	0	1	1	21.2	21.3	21.3
			1	12	1	1	21.2	21.3	21.2
			1	24	1	1	21.2	21.2	21.2
			12	0	2	2	20.2	20.2	20.1
			12	7	2	2	20.2	20.2	20.2
			12	13	2	2	20.2	20.2	20.0
			25	0	2	2	20.2	20.2	20.1

8.4. Wi-Fi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
2.4 (DTS)	802.11b	1 Mbps	1	2412	17.2	Yes
			6	2437	17.2	
			11	2462	17.5	
	802.11g	6 Mbps	1	2412	13.0	No
			6	2437	13.1	
			11	2462	12.6	
	802.11n (HT20)	MCS0	1	2412	12.1	No
			6	2437	12.1	
			11	2462	11.6	

Note(s):

- Per KDB 248227 D01, SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

Power measurements to determine worst-case data rates

Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
802.11b	6	2437	1 Mbps	17.2	Yes
			2 Mbps	17.0	No
			5.5 Mbps	17.0	No
			11 Mbps	16.7	No

8.5. Bluetooth

Maximum tune-up tolerance limit is 9.5 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

9. Dielectric Property Measurements

9.1. Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

9.2. Dielectric Property Measurements Results

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within $\pm 2^\circ\text{C}$ of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

SAR Lab A

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
10/27/2014	Head 835	e'	40.2800	Relative Permittivity (ϵ_r):	40.28	41.50	-2.94	5
		e"	19.1900	Conductivity (σ):	0.89	0.90	-1.00	5
	Head 820	e'	40.4500	Relative Permittivity (ϵ_r):	40.45	41.60	-2.77	5
		e"	19.2300	Conductivity (σ):	0.88	0.90	-2.41	5
	Head 850	e'	40.0700	Relative Permittivity (ϵ_r):	40.07	41.50	-3.45	5
		e"	19.1500	Conductivity (σ):	0.91	0.92	-1.08	5
10/27/2014	Body 835	e'	53.8900	Relative Permittivity (ϵ_r):	53.89	55.20	-2.37	5
		e"	21.5800	Conductivity (σ):	1.00	0.97	3.29	5
	Body 820	e'	53.9700	Relative Permittivity (ϵ_r):	53.97	55.28	-2.36	5
		e"	21.6400	Conductivity (σ):	0.99	0.97	1.88	5
	Body 850	e'	53.7100	Relative Permittivity (ϵ_r):	53.71	55.16	-2.62	5
		e"	21.4700	Conductivity (σ):	1.01	0.99	2.79	5
10/29/2014	Head 1900	e'	39.7100	Relative Permittivity (ϵ_r):	39.71	40.00	-0.72	5
		e"	13.5000	Conductivity (σ):	1.43	1.40	1.87	5
	Head 1850	e'	40.1700	Relative Permittivity (ϵ_r):	40.17	40.00	0.43	5
		e"	13.4000	Conductivity (σ):	1.38	1.40	-1.54	5
	Head 1910	e'	39.6000	Relative Permittivity (ϵ_r):	39.60	40.00	-1.00	5
		e"	13.5100	Conductivity (σ):	1.43	1.40	2.48	5
10/29/2014	Body 1900	e'	51.6000	Relative Permittivity (ϵ_r):	51.60	53.30	-3.19	5
		e"	14.9900	Conductivity (σ):	1.58	1.52	4.19	5
	Body 1850	e'	52.2000	Relative Permittivity (ϵ_r):	52.20	53.30	-2.06	5
		e"	15.3000	Conductivity (σ):	1.57	1.52	3.54	5
	Body 1910	e'	51.4100	Relative Permittivity (ϵ_r):	51.41	53.30	-3.55	5
		e"	14.8500	Conductivity (σ):	1.58	1.52	3.76	5
10/30/2014	Head 835	e'	40.0000	Relative Permittivity (ϵ_r):	40.00	41.50	-3.61	5
		e"	19.3100	Conductivity (σ):	0.90	0.90	-0.38	5
	Head 820	e'	40.2000	Relative Permittivity (ϵ_r):	40.20	41.60	-3.37	5
		e"	19.1600	Conductivity (σ):	0.87	0.90	-2.77	5
	Head 850	e'	39.7600	Relative Permittivity (ϵ_r):	39.76	41.50	-4.19	5
		e"	19.7000	Conductivity (σ):	0.93	0.92	1.76	5
10/30/2014	Body 835	e'	54.3200	Relative Permittivity (ϵ_r):	54.32	55.20	-1.59	5
		e"	21.7700	Conductivity (σ):	1.01	0.97	4.20	5
	Body 820	e'	54.6500	Relative Permittivity (ϵ_r):	54.65	55.28	-1.13	5
		e"	22.0200	Conductivity (σ):	1.00	0.97	3.67	5
	Body 850	e'	53.8000	Relative Permittivity (ϵ_r):	53.80	55.16	-2.46	5
		e"	21.5800	Conductivity (σ):	1.02	0.99	3.32	5

SAR Lab B

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
10/28/2014	Head 2600	e'	37.9000	Relative Permittivity (ϵ_r):	37.90	39.01	-2.85	5
		e"	14.0000	Conductivity (σ):	2.02	1.96	3.15	5
	Head 2500	e'	38.2500	Relative Permittivity (ϵ_r):	38.25	39.14	-2.27	5
		e"	13.7700	Conductivity (σ):	1.91	1.85	3.24	5
	Head 2700	e'	37.5200	Relative Permittivity (ϵ_r):	37.52	38.88	-3.51	5
		e"	14.2100	Conductivity (σ):	2.13	2.07	3.05	5
10/28/2014	Body 2600	e'	50.1500	Relative Permittivity (ϵ_r):	50.15	52.51	-4.50	5
		e"	14.7100	Conductivity (σ):	2.13	2.16	-1.58	5
	Body 2500	e'	50.4100	Relative Permittivity (ϵ_r):	50.41	52.64	-4.23	5
		e"	14.4600	Conductivity (σ):	2.01	2.02	-0.51	5
	Body 2700	e'	49.8800	Relative Permittivity (ϵ_r):	49.88	52.38	-4.78	5
		e"	14.9100	Conductivity (σ):	2.24	2.30	-2.73	5
11/3/2014	Head 2450	e'	38.9300	Relative Permittivity (ϵ_r):	38.93	39.20	-0.69	5
		e"	13.6200	Conductivity (σ):	1.86	1.80	3.08	5
	Head 2410	e'	39.0900	Relative Permittivity (ϵ_r):	39.09	39.28	-0.48	5
		e"	13.5300	Conductivity (σ):	1.81	1.76	2.99	5
	Head 2475	e'	38.8600	Relative Permittivity (ϵ_r):	38.86	39.17	-0.79	5
		e"	13.6600	Conductivity (σ):	1.88	1.83	2.89	5
11/3/2014	Body 2450	e'	50.5800	Relative Permittivity (ϵ_r):	50.58	52.70	-4.02	5
		e"	14.7100	Conductivity (σ):	2.00	1.95	2.76	5
	Body 2410	e'	50.7400	Relative Permittivity (ϵ_r):	50.74	52.76	-3.83	5
		e"	14.6500	Conductivity (σ):	1.96	1.91	2.92	5
	Body 2475	e'	50.5700	Relative Permittivity (ϵ_r):	50.57	52.67	-3.98	5
		e"	14.8700	Conductivity (σ):	2.05	1.99	3.08	5

10. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

10.1. System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 $\pm$ 0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be $\geq$ 15.0 cm for SAR measurements $\leq$ 3 GHz and $\geq$ 10.0 cm for measurements $>$ 3 GHz.
- The DASY system with an E-Field Probe 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 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 3 mm.
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

10.2. Reference Target SAR Values

The reference SAR values are obtained from the calibration certificate of system validation dipoles. The measured values are normalised to 1 Watt.

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d142	9/9/2014	835	1g	8.91	9.22
				10g	5.77	6.05
D1900V2	5d163	9/11/2014	1900	1g	40.8	40.6
				10g	21.2	21.4
D2450V2	899	9/10/2014	2450	1g	52.3	50.5
				10g	24.3	23.5
D2600V2	1006	9/10/2014	2600	1g	58.6	56.3
				10g	26.1	25.1

10.3. System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

SAR Lab A

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta $\pm 10\%$	Plot No.
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W			
10/27/2014	D835V2	4d142	Head	1g	0.956	9.56	8.91	7.30
				10g	0.627	6.27	5.77	8.67
10/27/2014	D835V2	4d142	Body	1g	0.888	8.88	9.22	-3.69
				10g	0.584	5.84	6.05	-3.47
10/29/2014	D1900V2	5d163	Head	1g	4.03	40.3	40.8	-1.23
				10g	2.06	20.6	21.2	-2.83
10/29/2014	D1900V2	5d163	Body	1g	4.06	40.6	40.6	0.00
				10g	2.09	20.9	21.4	-2.34
10/30/2014	D835V2	4d142	Head	1g	0.953	9.53	8.91	6.96
				10g	0.625	6.25	5.77	8.32
10/30/2014	D835V2	4d142	Body	1g	0.999	9.99	9.22	8.35
				10g	0.657	6.57	6.05	8.60

SAR Lab B

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta $\pm 10\%$	Plot No.
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W			
10/28/2014	D2600V2	1006	Head	1g	6.21	62.1	58.6	5.97
				10g	2.75	27.5	26.1	5.36
10/28/2014	D2600V2	1006	Body	1g	6.06	60.6	56.3	7.64
				10g	2.65	26.5	25.1	5.58
11/3/2014	D2450V2	899	Head	1g	5.24	52.4	52.3	0.19
				10g	2.43	24.3	24.3	0.00
11/3/2014	D2450V2	899	Body	1g	5.03	50.3	50.5	-0.40
				10g	2.31	23.1	23.5	-1.70

11. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 648474 D04 Handset SAR:

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

KDB 941225 D01 SAR test for 3G devices:

Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least $\frac{1}{4}$ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2.

KDB 941225 D05 SAR for LTE Devices:

SAR test reduction is applied using the following criteria:

- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel.
- When the reported SAR is > 0.8 W/kg, testing for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
- Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
- Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
- Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

11.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.0	33.0	0.085	0.085	0.065	0.065	1
			Left Tilt	190	836.6	33.0	33.0	0.044	0.044	0.034	0.034	
			Right Touch	190	836.6	33.0	33.0	0.070	0.070	0.054	0.054	
			Right Tilt	190	836.6	33.0	33.0	0.052	0.052	0.040	0.040	
Head VoIP	GPRS 1 Slots	0	Left Touch	190	836.6	33.0	33.0	0.084	0.084	0.064	0.064	2
			Left Tilt	190	836.6	33.0	33.0	0.044	0.044	0.035	0.035	
			Right Touch	190	836.6	33.0	33.0	0.051	0.051	0.040	0.040	
			Right Tilt	190	836.6	33.0	33.0	0.036	0.036	0.028	0.028	
Body-worn	Voice	10	Rear	190	836.6	33.0	33.0	0.187	0.187	0.109	0.109	3
			Front	190	836.6	33.0	33.0	0.116	0.116	0.068	0.068	
Body-worn(VoIP) & Hotspot	GPRS 1 Slots	10	Rear	190	836.6	33.0	33.0	0.179	0.179	0.104	0.104	4
Front			190	836.6	33.0	33.0	0.106	0.106	0.062	0.062		
Hotspot			Edge 2	190	836.6	33.0	33.0	0.041	0.041	0.028	0.028	
			Edge 3	190	836.6	33.0	33.0	0.048	0.048	0.028	0.028	
			Edge 4	190	836.6	33.0	33.0	0.118	0.118	0.082	0.082	

11.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	30.5	30.5	0.052	0.052	0.032	0.032	5
			Left Tilt	661	1880.0	30.5	30.5	0.024	0.024	0.014	0.014	
			Right Touch	661	1880.0	30.5	30.5	0.047	0.047	0.030	0.030	
			Right Tilt	661	1880.0	30.5	30.5	0.027	0.027	0.017	0.017	
Head VoIP	GPRS 1 Slots	0	Left Touch	661	1880.0	30.5	30.5	0.056	0.056	0.033	0.033	6
			Left Tilt	661	1880.0	30.5	30.5	0.024	0.024	0.014	0.014	
			Right Touch	661	1880.0	30.5	30.5	0.054	0.054	0.033	0.033	
			Right Tilt	661	1880.0	30.5	30.5	0.032	0.032	0.020	0.020	
Body-worn	Voice	10	Rear	661	1880.0	30.5	30.5	0.172	0.172	0.092	0.092	
			Front	661	1880.0	30.5	30.5	0.218	0.218	0.115	0.115	7
Body-worn(VoIP) & Hotspot	GPRS 1 Slots	10	Rear	661	1880.0	30.5	30.5	0.185	0.185	0.098	0.098	
Front			661	1880.0	30.5	30.5	0.202	0.202	0.108	0.108	8	
Hotspot			Edge 2	661	1880.0	30.5	30.5	0.024	0.024	0.014	0.014	
			Edge 3	661	1880.0	30.5	30.5	0.199	0.199	0.190	0.190	
			Edge 4	661	1880.0	30.5	30.5	0.048	0.048	0.028	0.028	

11.3. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	24.0	23.4	0.095	0.110	0.088	0.101	9
			Left Tilt	4183	836.6	24.0	23.4	0.051	0.059	0.047	0.054	
			Right Touch	4183	836.6	24.0	23.4	0.066	0.076	0.061	0.070	
			Right Tilt	4183	836.6	24.0	23.4	0.046	0.053	0.067	0.077	
Body-worn & Hptspot	Rel 99 RMC	10	Rear	4183	836.6	24.0	23.4	0.171	0.196	0.101	0.116	10
			Front	4183	836.6	24.0	23.4	0.150	0.172	0.085	0.098	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	24.0	23.4	0.048	0.055	0.032	0.037	
			Edge 3	4183	836.6	24.0	23.4	0.061	0.070	0.079	0.091	
			Edge 4	4183	836.6	24.0	23.4	0.059	0.068	0.040	0.046	

11.4. W-CDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	9400	1880.0	22.5	22.3	0.128	0.134	0.077	0.081	
			Left Tilt	9400	1880.0	22.5	22.3	0.062	0.065	0.036	0.037	
			Right Touch	9400	1880.0	22.5	22.3	0.132	0.138	0.082	0.086	11
			Right Tilt	9400	1880.0	22.5	22.3	0.086	0.090	0.053	0.056	
Body-worn & Htpspot	Rel 99 RMC	10	Rear	9400	1880.0	22.5	22.3	0.420	0.440	0.225	0.236	
			Front	9400	1880.0	22.5	22.3	0.550	0.576	0.291	0.305	12
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	22.5	22.3	0.066	0.069	0.039	0.041	
			Edge 3	9400	1880.0	22.5	22.3	0.429	0.449	0.242	0.253	
			Edge 4	9400	1880.0	22.5	22.3	0.121	0.127	0.070	0.073	

11.5. LTE Band 41 (20MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	QPSK	0	Left Touch	40640	2595.0	1	0	23.0	22.2	0.080	0.096	0.042	0.050	
						50	0	22.0	21.3	0.058	0.068	0.031	0.036	
			Left Tilt	40640	2595.0	1	0	23.0	22.2	0.035	0.042	0.018	0.022	
						50	0	22.0	21.3	0.026	0.031	0.013	0.015	
			Right Touch	40640	2595.0	1	0	23.0	22.2	0.106	0.127	0.057	0.068	13
						50	0	22.0	21.3	0.087	0.102	0.047	0.055	
			Right Tilt	40640	2595.0	1	0	23.0	22.2	0.052	0.062	0.192	0.230	
						50	0	22.0	21.3	0.038	0.045	0.152	0.179	
Body-worn & Hotspot	QPSK	10	Rear	40640	2595.0	1	0	23.0	22.2	0.356	0.426	0.192	0.230	
						50	0	22.0	21.3	0.283	0.332	0.152	0.179	
			Front	40640	2595.0	1	0	23.0	22.2	0.512	0.613	0.267	0.320	14
						50	0	22.0	21.3	0.367	0.431	0.193	0.227	
Hotspot	QPSK	10	Edge 2	40640	2595.0	1	0	23.0	22.2	0.080	0.096	0.036	0.043	
						50	0	22.0	21.3	0.064	0.075	0.046	0.054	
			Edge 3	40640	2595.0	1	0	23.0	22.2	0.450	0.539	0.234	0.280	
						50	0	22.0	21.3	0.380	0.446	0.195	0.229	
			Edge 4	40640	2595.0	1	0	23.0	22.2	0.134	0.160	0.069	0.083	
						50	0	22.0	21.3	0.103	0.121	0.053	0.062	

11.6. Wi-Fi (DTS Band)

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
2.4 GHz	Head	802.11b 1 Mbps	0	Left Touch	6	2437.0	17.5	17.2	0.067	0.072	0.037	0.039	
				Left Tilt	6	2437.0	17.5	17.2	0.075	0.080	0.039	0.042	
				Right Touch	6	2437.0	17.5	17.2	0.236	0.253	0.107	0.115	15
				Right Tilt	6	2437.0	17.5	17.2	0.107	0.115	0.055	0.059	
	Body-worn & Hotspot	802.11b 1 Mbps	10	Rear	6	2437.0	17.5	17.2	0.239	0.256	0.110	0.118	16
				Front	6	2437.0	17.5	17.2	0.055	0.059	0.029	0.031	
	Hotspot	802.11b 1 Mbps	10	Edge 1	6	2437.0	17.5	17.2	0.036	0.038	0.019	0.020	
				Edge 4	6	2437.0	17.5	17.2	0.144	0.154	0.068	0.073	

11.7. Bluetooth

11.7.1. Standalone SAR Test Exclusion Considerations

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(\text{GHz})}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
9.5	9	10	2.480	1.4

Conclusion:

The computed value is < 3 ; therefore, Bluetooth qualifies for Standalone SAR test exclusion.

11.7.2. Estimated SAR

When the standalone SAR test exclusion is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{(\text{GHz})}/x}]$ W/kg for test separation distances ≤ 50 mm; where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.
- 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

Estimated SAR Result for Body-worn Accessory Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Rear/Front	9	10	2.480	0.187

12. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

- 1) Repeated measurement is not required when the original highest measured SAR is <1.6 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 1.6 or 2 W/kg (1-g or 10-g respectively), repeat that measurement once.
- 3) Perform a second repeated measurement only if the **ratio of largest to smallest SAR** for the original and first repeated measurements is > 1.20 or 3 (1-g or 10-g respectively) or when the original or repeated measurement is ≥ 1.45 or 3.6 W/kg ($\sim 10\%$ from the 1-g or 10-g respective SAR limit).
- 4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 or 3 (1-g or 10-g respectively).

12.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Head (W/kg)	Body-worn Accessory (W/kg)	Wireless Router (Hotspot) (W/kg)	Repeated SAR (Yes/No)
850	GSM 850				
	WCDMA Band V		0.196	0.196	No
1900	GSM 1900				
	WCDMA Band II		0.576	0.576	No
2400	Wi-Fi 802.11b/g/n		0.256	0.256	No
2600	LTE Band 41		0.613	0.613	No

12.2. Repeated Measurement Results

Head

N/A

Body-worn Accessory

N/A

Wireless Router (Hotspot)

N/A

Note(s):

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20 .

13. Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / Ri$$

Where:

SAR₁ is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR₂ is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of $[(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2]$

A new threshold of 0.04 is also introduced in the draft KDB. Thus, in order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / Ri < 0.04$$

13.1. Sum of the SAR for GSM850 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM850	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.085	0.072		0.157	No
	Left Tilt	① + ②	0.044	0.080		0.124	No
	Right Touch	① + ②	0.070	0.253		0.323	No
	Right Tilt	① + ②	0.052	0.115		0.166	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.187	0.256		0.443	No
		① + ③	0.187		0.187	0.374	No
	Front	① + ②	0.116	0.059		0.175	No
		① + ③	0.116		0.187	0.303	No
Hotspot	Edge 4	① + ②	0.118	0.154		0.272	No

13.2. Sum of the SAR for GSM1900 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.056	0.072		0.128	No
	Left Tilt	① + ②	0.024	0.080		0.104	No
	Right Touch	① + ②	0.054	0.253		0.307	No
	Right Tilt	① + ②	0.032	0.115		0.147	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.185	0.256		0.441	No
		① + ③	0.185		0.187	0.372	No
	Front	① + ②	0.218	0.059		0.277	No
		① + ③	0.218		0.187	0.405	No
Hotspot	Edge 4	① + ②	0.048	0.154		0.202	No

13.3. Sum of the SAR for WCDMA Band V & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band V	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.110	0.072		0.182	No
	Left Tilt	① + ②	0.059	0.080		0.139	No
	Right Touch	① + ②	0.076	0.253		0.329	No
	Right Tilt	① + ②	0.053	0.115		0.168	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.196	0.256		0.452	No
		① + ③	0.196		0.187	0.383	No
	Front	① + ②	0.172	0.059		0.231	No
		① + ③	0.172		0.187	0.359	No
Hotspot	Edge 4	① + ②	0.068	0.154		0.222	No

13.4. Sum of the SAR for WCDMA Band II & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band II	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.134	0.072		0.206	No
	Left Tilt	① + ②	0.065	0.080		0.145	No
	Right Touch	① + ②	0.138	0.253		0.391	No
	Right Tilt	① + ②	0.090	0.115		0.204	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.440	0.256		0.696	No
		① + ③	0.440		0.187	0.627	No
	Front	① + ②	0.576	0.059		0.635	No
		① + ③	0.576		0.187	0.763	No
Hotspot	Edge 4	① + ②	0.127	0.154		0.281	No

13.5. Sum of the SAR for LTE Band 41 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① LTE Band 41	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.096	0.072		0.168	No
	Left Tilt	① + ②	0.042	0.080		0.122	No
	Right Touch	① + ②	0.127	0.253		0.380	No
	Right Tilt	① + ②	0.062	0.115		0.177	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.426	0.256		0.682	No
		① + ③	0.426		0.187	0.613	No
	Front	① + ②	0.613	0.059		0.672	No
		① + ③	0.613		0.187	0.800	No
	Edge 4	① + ②	0.160	0.154		0.314	No

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because either the sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

Appendixes

Refer to separated files for the following appendixes.

Appendix A: SAR Photos & Ant. Locations

Appendix B: SAR System Check Plots

Appendix C: SAR Highest SAR Test Plots

Appendix D: SAR Tissue Ingredients

Appendix E: SAR Probe Cal. Certificates

Appendix F: SAR Dipole Cal. Certificates

END OF REPORT