SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
GSM/WCDMA/LTE Phone + BT/BLE, DTS b/g/n, NFC and ANT+

FCC ID: A3LSMA310M
Model Name: SM-A310M/DS, SM-A310M

Report Number: 15K22210-S1V3
Issue Date: 12/5/2015

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ACCREDITED

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Revision History

Rev.	Date	Revisions	Revised By
V1	11/28/2015	Initial Issue	Sunghoon Kim
V2	12/1/2015	Corrected model name. Sec.2 : Updated latest version of KDB. Sec.6.3 : Corrected mis-word. Updated FCC Report SAR_App A - Included body-worn testing photo at 10mm. - Corrected “Antenna Dimensions & Separation Distances”	Sunghoon Kim
V3	12/5/2015	Sec 10.1 ,10.3, 10.4, 10.5 15mm Body-Worn exposure was re-tested	Sunghoon Kim

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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO.,LTD.
FCC ID	A3LSMA310M
Model Name	SM-A310M/DS, SM-A310M
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013
SAR Limits (W/Kg)	
Exposure Category	Peak spatial-average(1g of tissue)
General population / Uncontrolled exposure	1.6

The Highest Reported SAR (W/kg)

RF Exposure Conditions		**Equipment Class**			
		Licensed	**DTS**	**U-NII**	**DSS (BT)**
Head		0.358	0.668	N/A	N/A
Body-worn		0.797	0.097		
Hotspot/Wi-Fi Direct		1.077	0.212		
Simultaneous TX	Head	1.026	1.026		
	Body-worn	0.894	0.894		
	Hotspot/ Wi-Fi Direct	1.289	1.289		

Date Tested	11/9/2015 to 12/5/2015
Test Results	Pass

UL Korea, Ltd. 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 Korea, Ltd. 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 Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released By:	Prepared By:
JiHo Choi Operations Manager UL Korea, Ltd Suwon Laboratory	Sunghoon Kim Laboratory Engineer UL Korea, Ltd Suwon Laboratory

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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:

- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 648474 D04 Handset SAR v01r03
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 941225 D01 3G SAR Procedures v03r01
- 941225 D05 SAR for LTE Devices v02r04
- 941225 D06 Hotspot Mode v02r01

3. Facilities and Accreditation

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

Suwon
SAR 1 Room
SAR 2 Room
SAR 3 Room

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.
The full scope of accreditation can be viewed at http://www.iasonline.org/PDF/TL/TL-637.pdf.

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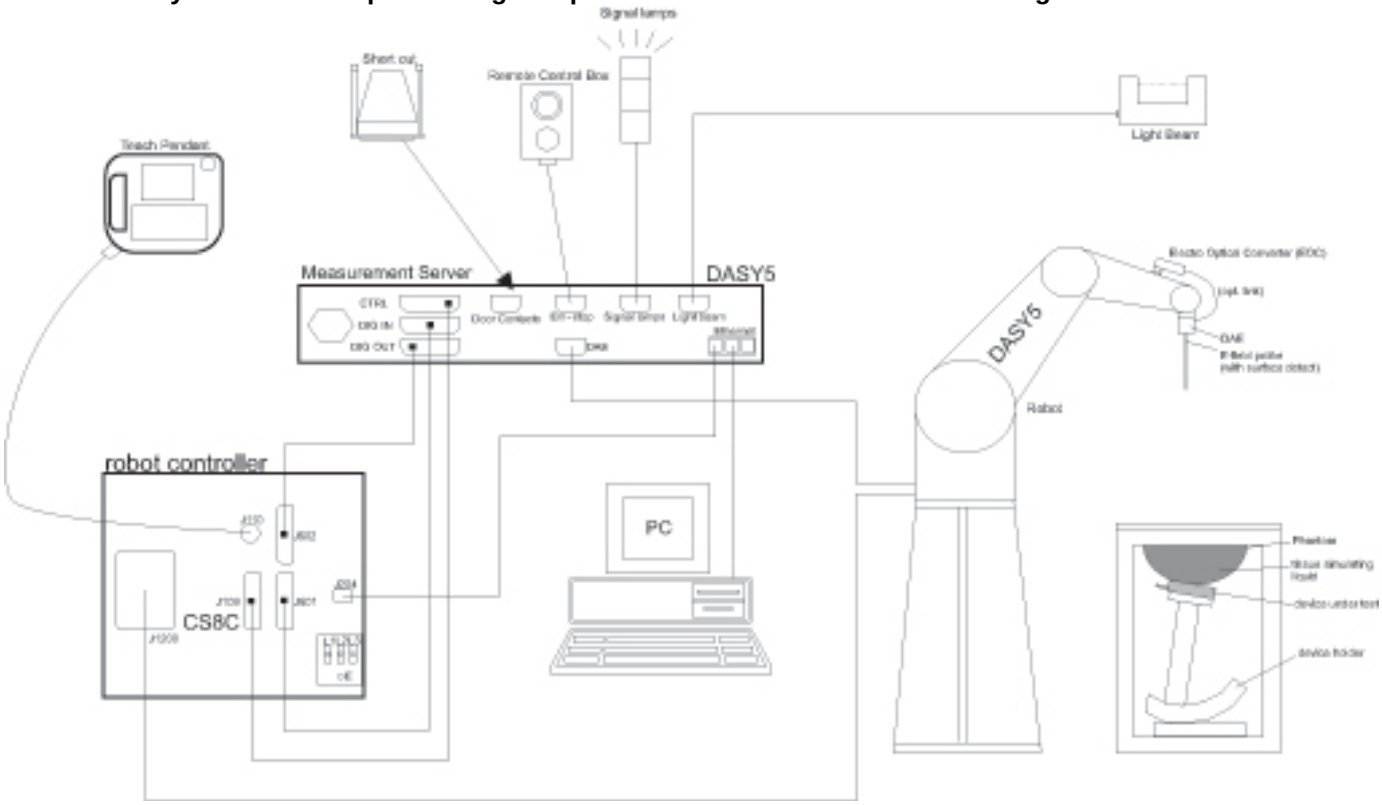
4. SAR Measurement System & Test Equipment

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.

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4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

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

Step 2: Area Scan

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

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	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{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 ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

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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: Δx_{Zoom}, Δy_{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: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
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 *reported* 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.

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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	E5071C	MY46522054	8-18-2016
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	8-4-2016
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3424	8-19-2016
Thermometer	Lutron	MHB-382SD	AH.91478	8-12-2016

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Agilent	N5181A	MY50145882	8-18-2016
Power Sensor	Agilent	U2000A	MY54260010	8-18-2016
Power Sensor	Agilent	U2000A	MY54260007	8-18-2016
Power Amplifier	EXODUS	1410025-AMP2027-10003	10003	8-18-2016
Directional Coupler	Agilent	772D	MY52180193	8-18-2016
Directional Coupler	Agilent	778D	MY52180432	8-18-2016
Low Pass Filter	MICROLAB	LA-15N	03943	8-18-2016
Low Pass Filter	FILTRON	L14012FL	1410003S	8-18-2016
Low Pass Filter	MICROLAB	LA-60N	03942	8-18-2016
Attenuator	Agilent	8491B/003	MY39269292	8-18-2016
Attenuator	Agilent	8491B/010	MY39269315	8-18-2016
Attenuator	Agilent	8491B/020	MY39269298	8-18-2016
E-Field Probe (SAR1)	SPEAG	EX3DV4	7314	9-25-2016
E-Field Probe (SAR2)	SPEAG	EX3DV4	7376	9-2-2016
E-Field Probe (SAR3)	SPEAG	EX3DV4	7330	2-12-2016
Data Acquisition Electronics (SAR1)	SPEAG	DAE4	1447	9-23-2016
Data Acquisition Electronics (SAR2)	SPEAG	DAE4	1468	9-15-2016
Data Acquisition Electronics (SAR3)	SPEAG	DAE4	1446	8-17-2016
System Validation Dipole	SPEAG	D750V3	1122	8-17-2016
System Validation Dipole	SPEAG	D835V2	4d194	9-17-2016
System Validation Dipole	SPEAG	D1750V2	1125	8-20-2016
System Validation Dipole	SPEAG	D1900V2	5d199	2-6-2016
System Validation Dipole	SPEAG	D2450V2	960	2-5-2016
Thermometer (SAR1)	Lutron	MHB-382SD	AH.91463	8-12-2016
Thermometer (SAR2)	Lutron	MHB-382SD	AH.50215	8-19-2016
Thermometer (SAR3)	Lutron	MHB-382SD	AH.50213	8-24-2016

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	150313	8-18-2016
Base Station Simulator	R & S	CMW500	150314	8-18-2016

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.

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6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Overall (Length x Width): 132 mm x 64 mm Overall Diagonal: 142 mm Display Diagonal: 121 mm
Back Cover	☒ The rechargeable battery is not user accessible.
Battery Options	☒ The rechargeable battery is not user accessible.
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)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 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)	GPRS Multi-Slot Class: ☐ Class 8 - 1 Up, 4 Down ☐ Class 10 - 2 Up, 4 Down ☐ Class 12 - 4 Up, 4 Down ☒ Class 33 - 4 Up, 5 Down	GSM Voice: 12.5% (E)GPRS: 1 Slot: 12.5% 2 Slots: 25% 3 Slots: 37.5% 4 Slots: 50%
	Does this device support DTM (Dual Transfer Mode)? ☐ Yes ☒ No			
W-CDMA (UMTS)	Band II Band IV Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 5) HSUPA (Rel. 6) DC-HSDPA (Rel. 8) HSPA+ (Rel. 7)		100%
LTE	FDD Band 2 FDD Band 4 FDD Band 5 FDD Band 17	QPSK 16QAM		100%
	Does this device support SV-LTE (1xRTT-LTE)? ☐ Yes ☒ No			
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)		100%
Bluetooth	2.4 GHz	Version 4.1 LE		N/A

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6.3. Nominal and Maximum Output Power

KDB 447498 sec.4.1.(3) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit

Upper limit (dB): -1.5 ~ 0.5		Max. RF Output Power (dBm)		Reduce. RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit	Target	Max. tune-up tolerance limit
GSM850	Voice (1 slot)	33.5	**34.0**	**N/A**	
	GPRS 1 slot	33.5	**34.0**		
	GPRS 2 slots	30.5	**31.0**		
	GPRS 3 slots	29.6	**30.1**		
	GPRS 4 slots	28.0	**28.5**		
	EGPRS 1 slot	27.5	**28.0**		
	EGPRS 2 slots	25.5	**26.0**		
	EGPRS 3 slots	24.0	**24.5**		
	EGPRS 4 slots	23.0	**23.5**		
GSM1900	Voice (1 slot)	30.4	**30.9**	30.4	**30.9**
	GPRS 1 slot	30.4	**30.9**	29.0	**29.5**
	GPRS 2 slots	28.0	**28.5**	25.5	**26.0**
	GPRS 3 slots	27.0	**27.5**	25.0	**25.5**
	GPRS 4 slots	26.0	**26.5**	24.0	**24.5**
	EGPRS 1 slot	26.5	**27.0**	24.5	**25.0**
	EGPRS 2 slots	24.5	**25.0**	22.0	**22.5**
	EGPRS 3 slots	23.5	**24.0**	21.0	**21.5**
	EGPRS 4 slots	22.5	**23.0**	19.5	**20.0**
W-CDMA Band V	R99	23.5	**24.0**	**N/A**	
	HSDPA	22.5	**23.0**		
	HSUPA	22.5	**23.0**		
	DC-HSDPA	22.5	**23.0**		
W-CDMA Band IV	R99	23.0	**23.5**	21.5	**22.0**
	HSDPA	23.0	**23.5**	21.5	**22.0**
	HSUPA	22.5	**23.0**	21.5	**22.0**
	DC-HSDPA	23.0	**23.5**	21.5	**22.0**
W-CDMA Band II	R99	23.0	**23.5**	20.8	**21.3**
	HSDPA	23.0	**23.5**	20.8	**21.3**
	HSUPA	22.5	**23.0**	20.8	**21.3**
	DC-HSDPA	23.0	**23.5**	20.8	**21.3**
LTE Band 2	QPSK, 16QAM	22.8	**23.3**	19.9	**20.4**
LTE Band 4	QPSK, 16QAM	23.3	**23.8**	21.3	**21.8**
LTE Band 5	QPSK, 16QAM	23.5	**24.0**	**N/A**	
LTE Band 17	QPSK, 16QAM	23.5	**24.0**	**N/A**	

Note(s):

The device utilizes power reduction under some portable hotspot conditions for SAR compliance.
There is power reduction for GSM1900, WCDMA Band II, IV, LTE Band 2, 4.
The reduced powers were confirmed via conducted power measurements the RF port.
Detailed description of the hotspot power reduction mechanism is included in the operational description.

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Upper limit (dB):	0.5	Max. RF Output Pow er (dBm)		Reduce RF Output Pow er (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	17.0	**17.5**	14.0	**14.5**
	802.11g	14.0	**14.5**	14.0	**14.5**
	802.11n HT20	13.0	**13.5**	13.0	**13.5**
Bluetooth		9.5	**10.0**	**N/A**	
Bluetooth LE		7.5	**8.0**	**N/A**	

Note(s):

This device utilizes independent power reduction mechanisms for SAR compliance for the licensed transmitter and the WLAN transmitter.

Additionally, the device uses an independent single-step fixed level power reduction mechanism for WLAN operations were evaluated at reduced power according to the head SAR positions described in IEEE 1528.

The reduced powers for the power reduction mechanisms were confirmed via conducted power measurements at the RF port.

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6.4. General LTE SAR Test and Reporting Considerations

Item	Description						
Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 2	Frequency range: 1850-1910 MHz					
		Channel Bandwidth					
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz
	Low	18700 /1860	18675/ 1857.5	18650/ 1855	18625/ 1852.5	18615/ 1851.5	18607/ 1850.7
	Mid	18900/ 1880	18900/ 1880	18900/ 1880	18900/ 1880	18900/ 1880	18900/ 1880
	High	19100/ 1900	19125/ 1902.5	19150/ 1905	19175/ 1907.5	19185/ 1908.5	19193/ 1909.3
	Band 4	Frequency range: 1710 - 1755 MHz					
		Channel Bandwidth					
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz
	Low	20050/ 1720	20025/ 1717.5	20000/ 1715	19975/ 1712.5	19965/ 1711.5	19957/ 1710.7
	Mid	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5
	High	20300/ 1745	20325/ 1747.5	20350/ 1750	20375/ 1752.5	20385/ 1753.5	20393/ 1754.3
	Band 5	Frequency range: 824 - 849 MHz					
		Channel Bandwidth					
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz
	Low			20450/ 829	20425/ 826.5	20415/ 825.5	20407/ 824.7
	Mid			20525/ 836.5	20525/ 836.5	20525/ 836.5	20525/ 836.5
	High			20600/ 844	20625/ 846.5	20635/ 847.5	20643/ 848.3
	Band 17	Frequency range: 704 - 716 MHz					
		Channel Bandwidth					
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz
	Low				23755/ 706.5		
	Mid			23790/ 710	23790/ 710		
	High				23825/ 713.5		
LTE transmitter and antenna implementation	LTE has 1 Main TX/RX Ant and 2 Diversity RX Ant Refer to Appendix A...						
Maximum power reduction (MPR)	**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
	MPR Built-in by design A-MPR (additional MPR) was disabled during SAR testing						
Power reduction	Yes						
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.						

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7. RF Exposure Conditions (Test Configurations)

Refer to “SAR Photos and Ant locations” Appendix 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	15 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	15 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.

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8. Dielectric Property Measurements & System Check

8.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°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.

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

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Dielectric Property Measurements Results:

SAR 1 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11-22-2015	Head 2450	e'	38.92	Relative Permittivity (εr):	38.92	39.20	-0.71	5
		e''	13.04	Conductivity (σ):	1.78	1.80	-1.31	5
	Head 2410	e'	39.03	Relative Permittivity (εr):	39.03	39.28	-0.63	5
		e''	12.94	Conductivity (σ):	1.73	1.76	-1.50	5
	Head 2475	e'	38.83	Relative Permittivity (εr):	38.83	39.17	-0.86	5
		e''	13.11	Conductivity (σ):	1.80	1.83	-1.25	5
12-3-2015	Body 2450	e'	52.5000	Relative Permittivity (εr):	52.50	52.70	-0.38	5
		e''	14.3400	Conductivity (σ):	1.95	1.95	0.18	5
	Body 2410	e'	52.6100	Relative Permittivity (εr):	52.61	52.76	-0.28	5
		e''	14.1800	Conductivity (σ):	1.90	1.91	-0.38	5
	Body 2475	e'	52.4400	Relative Permittivity (εr):	52.44	52.67	-0.43	5
		e''	14.4500	Conductivity (σ):	1.99	1.99	0.17	5

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SAR 2 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11-13-2015	Body 835	e'	53.0800	Relative Permittivity (εr):	53.08	55.20	-3.84	5
		e''	21.1200	Conductivity (σ):	0.98	0.97	1.09	5
	Body 820	e'	53.2000	Relative Permittivity (εr):	53.20	55.28	-3.76	5
		e''	21.1700	Conductivity (σ):	0.97	0.97	-0.33	5
	Body 850	e'	52.9900	Relative Permittivity (εr):	52.99	55.16	-3.93	5
		e''	21.1200	Conductivity (σ):	1.00	0.99	1.12	5
11-15-2015	Head 835	e'	40.8000	Relative Permittivity (εr):	40.80	41.50	-1.69	5
		e''	19.0200	Conductivity (σ):	0.88	0.90	-1.88	5
	Head 820	e'	40.9900	Relative Permittivity (εr):	40.99	41.60	-1.47	5
		e''	19.0600	Conductivity (σ):	0.87	0.90	-3.28	5
	Head 850	e'	40.6500	Relative Permittivity (εr):	40.65	41.50	-2.05	5
		e''	18.9900	Conductivity (σ):	0.90	0.92	-1.91	5
11-17-2015	Body 835	e'	53.8200	Relative Permittivity (εr):	53.82	55.20	-2.50	5
		e''	21.1400	Conductivity (σ):	0.98	0.97	1.19	5
	Body 820	e'	53.9600	Relative Permittivity (εr):	53.96	55.28	-2.38	5
		e''	21.1700	Conductivity (σ):	0.97	0.97	-0.33	5
	Body 850	e'	53.7700	Relative Permittivity (εr):	53.77	55.16	-2.51	5
		e''	21.1400	Conductivity (σ):	1.00	0.99	1.21	5
11-21-2015	Body 2450	e'	51.2300	Relative Permittivity (εr):	51.23	52.70	-2.79	5
		e''	14.9300	Conductivity (σ):	2.03	1.95	4.30	5
	Body 2410	e'	51.4100	Relative Permittivity (εr):	51.41	52.76	-2.56	5
		e''	14.7600	Conductivity (σ):	1.98	1.91	3.69	5
	Body 2475	e'	51.1200	Relative Permittivity (εr):	51.12	52.67	-2.94	5
		e''	15.0300	Conductivity (σ):	2.07	1.99	4.19	5
11-22-2015	Head 1750	e'	41.3300	Relative Permittivity (εr):	41.33	40.08	3.11	5
		e''	13.5600	Conductivity (σ):	1.32	1.37	-3.62	5
	Head 1710	e'	41.4700	Relative Permittivity (εr):	41.47	40.15	3.30	5
		e''	13.5300	Conductivity (σ):	1.29	1.35	-4.45	5
	Head 1785	e'	41.2000	Relative Permittivity (εr):	41.20	40.03	2.92	5
		e''	13.5800	Conductivity (σ):	1.35	1.39	-2.94	5
11-22-2015	Head 1900	e'	40.9000	Relative Permittivity (εr):	40.90	40.00	2.25	5
		e''	13.7900	Conductivity (σ):	1.46	1.40	4.06	5
	Head 1850	e'	41.0400	Relative Permittivity (εr):	41.04	40.00	2.60	5
		e''	13.6800	Conductivity (σ):	1.41	1.40	0.51	5
	Head 1910	e'	40.8600	Relative Permittivity (εr):	40.86	40.00	2.15	5
		e''	13.8300	Conductivity (σ):	1.47	1.40	4.91	5
11-25-2015	Body 835	e'	53.2100	Relative Permittivity (εr):	53.21	55.20	-3.61	5
		e''	21.7100	Conductivity (σ):	1.01	0.97	3.91	5
	Body 820	e'	53.3400	Relative Permittivity (εr):	53.34	55.28	-3.50	5
		e''	21.9200	Conductivity (σ):	1.00	0.97	3.20	5
	Body 850	e'	53.0500	Relative Permittivity (εr):	53.05	55.16	-3.82	5
		e''	21.5200	Conductivity (σ):	1.02	0.99	3.03	5
11-28-2015	Body 1900	e'	51.0500	Relative Permittivity (εr):	51.05	53.30	-4.22	5
		e''	14.6700	Conductivity (σ):	1.55	1.52	1.96	5
	Body 1850	e'	51.1500	Relative Permittivity (εr):	51.15	53.30	-4.03	5
		e''	14.5700	Conductivity (σ):	1.50	1.52	-1.40	5
	Body 1910	e'	51.0100	Relative Permittivity (εr):	51.01	53.30	-4.30	5
		e''	14.7000	Conductivity (σ):	1.56	1.52	2.71	5
12-3-2015	Body 835	e'	54.4800	Relative Permittivity (εr):	54.48	55.20	-1.30	5
		e''	21.5700	Conductivity (σ):	1.00	0.97	3.24	5
	Body 820	e'	54.5600	Relative Permittivity (εr):	54.56	55.28	-1.30	5
		e''	21.6400	Conductivity (σ):	0.99	0.97	1.88	5
	Body 850	e'	54.3000	Relative Permittivity (εr):	54.30	55.16	-1.55	5
		e''	21.5200	Conductivity (σ):	1.02	0.99	3.03	5

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SAR 3 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11-9-2015	Head 750	e'	42.7100	Relative Permittivity (εr):	42.71	41.96	1.78	5
		e"	21.5300	Conductivity (σ):	0.90	0.89	0.53	5
	Head 700	e'	43.2700	Relative Permittivity (εr):	43.27	42.22	2.49	5
		e"	21.8300	Conductivity (σ):	0.85	0.89	-4.45	5
	Head 790	e'	42.1400	Relative Permittivity (εr):	42.14	41.76	0.92	5
		e"	21.2000	Conductivity (σ):	0.93	0.90	3.92	5
11-9-2015	Body 750	e'	56.4200	Relative Permittivity (εr):	56.42	55.55	1.57	5
		e"	23.3300	Conductivity (σ):	0.97	0.96	1.02	5
	Body 700	e'	56.9100	Relative Permittivity (εr):	56.91	55.74	2.10	5
		e"	23.8000	Conductivity (σ):	0.93	0.96	-3.43	5
	Body 790	e'	55.9300	Relative Permittivity (εr):	55.93	55.39	0.97	5
		e"	22.9500	Conductivity (σ):	1.01	0.97	4.34	5
11-14-2015	Body 1750	e'	52.1800	Relative Permittivity (εr):	52.18	53.44	-2.36	5
		e"	14.9200	Conductivity (σ):	1.45	1.49	-2.31	5
	Body 1710	e'	52.3000	Relative Permittivity (εr):	52.30	53.54	-2.32	5
		e"	14.8800	Conductivity (σ):	1.41	1.46	-3.20	5
	Body 1755	e'	52.1600	Relative Permittivity (εr):	52.16	53.43	-2.37	5
		e"	14.9300	Conductivity (σ):	1.46	1.49	-2.17	5
11-14-2015	Body 1900	e'	51.8100	Relative Permittivity (εr):	51.81	53.30	-2.80	5
		e"	14.9300	Conductivity (σ):	1.58	1.52	3.77	5
	Body 1850	e'	51.8600	Relative Permittivity (εr):	51.86	53.30	-2.70	5
		e"	14.9400	Conductivity (σ):	1.54	1.52	1.11	5
	Body 1910	e'	51.8100	Relative Permittivity (εr):	51.81	53.30	-2.80	5
		e"	14.9500	Conductivity (σ):	1.59	1.52	4.46	5
11-17-2015	Head 1750	e'	41.4400	Relative Permittivity (εr):	41.44	40.08	3.38	5
		e"	13.6300	Conductivity (σ):	1.33	1.37	-3.12	5
	Head 1710	e'	41.6300	Relative Permittivity (εr):	41.63	40.15	3.70	5
		e"	13.6600	Conductivity (σ):	1.30	1.35	-3.54	5
	Head 1755	e'	41.4200	Relative Permittivity (εr):	41.42	40.08	3.35	5
		e"	13.6300	Conductivity (σ):	1.33	1.37	-3.04	5
11-17-2015	Head 1900	e'	41.0500	Relative Permittivity (εr):	41.05	40.00	2.62	5
		e"	13.8000	Conductivity (σ):	1.46	1.40	4.14	5
	Head 1850	e'	41.1900	Relative Permittivity (εr):	41.19	40.00	2.97	5
		e"	13.7200	Conductivity (σ):	1.41	1.40	0.81	5
	Head 1910	e'	41.0200	Relative Permittivity (εr):	41.02	40.00	2.55	5
		e"	13.8300	Conductivity (σ):	1.47	1.40	4.91	5
11-18-2015	Body 1900	e'	52.2600	Relative Permittivity (εr):	52.26	53.30	-1.95	5
		e"	14.9600	Conductivity (σ):	1.58	1.52	3.98	5
	Body 1850	e'	52.4500	Relative Permittivity (εr):	52.45	53.30	-1.59	5
		e"	14.8900	Conductivity (σ):	1.53	1.52	0.77	5
	Body 1910	e'	52.2100	Relative Permittivity (εr):	52.21	53.30	-2.05	5
		e"	14.9900	Conductivity (σ):	1.59	1.52	4.73	5
11-21-2015	Head 1900	e'	38.9500	Relative Permittivity (εr):	38.95	40.00	-2.62	5
		e"	13.4900	Conductivity (σ):	1.43	1.40	1.80	5
	Head 1850	e'	39.1100	Relative Permittivity (εr):	39.11	40.00	-2.23	5
		e"	13.4400	Conductivity (σ):	1.38	1.40	-1.25	5
	Head 1910	e'	38.9100	Relative Permittivity (εr):	38.91	40.00	-2.73	5
		e"	13.5000	Conductivity (σ):	1.43	1.40	2.41	5
11-22-2015	Head 750	e'	42.0300	Relative Permittivity (εr):	42.03	41.96	0.16	5
		e"	21.4600	Conductivity (σ):	0.89	0.89	0.21	5
	Head 700	e'	42.7700	Relative Permittivity (εr):	42.77	42.22	1.31	5
		e"	21.7900	Conductivity (σ):	0.85	0.89	-4.62	5
	Head 790	e'	41.4700	Relative Permittivity (εr):	41.47	41.76	-0.69	5
		e"	21.2100	Conductivity (σ):	0.93	0.90	3.96	5

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SAR 3 Room(continued)

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11-23-2015	Body 1900	e'	51.1100	Relative Permittivity (εr):	51.11	53.30	-4.11	5
		e''	14.8300	Conductivity (σ):	1.57	1.52	3.07	5
	Body 1850	e'	51.2000	Relative Permittivity (εr):	51.20	53.30	-3.94	5
		e''	14.7800	Conductivity (σ):	1.52	1.52	0.02	5
	Body 1910	e'	51.0900	Relative Permittivity (εr):	51.09	53.30	-4.15	5
		e''	14.8500	Conductivity (σ):	1.58	1.52	3.76	5
12-3-2015	Body 750	e'	56.5900	Relative Permittivity (εr):	56.59	55.55	1.88	5
		e''	23.1000	Conductivity (σ):	0.96	0.96	0.03	5
	Body 700	e'	57.0700	Relative Permittivity (εr):	57.07	55.74	2.39	5
		e''	23.6000	Conductivity (σ):	0.92	0.96	-4.24	5
	Body 790	e'	56.2000	Relative Permittivity (εr):	56.20	55.39	1.46	5
		e''	22.7200	Conductivity (σ):	1.00	0.97	3.30	5
12-3-2015	Body 1900	e'	51.2100	Relative Permittivity (εr):	51.21	53.30	-3.92	5
		e''	14.7400	Conductivity (σ):	1.56	1.52	2.45	5
	Body 1850	e'	51.7600	Relative Permittivity (εr):	51.76	53.30	-2.89	5
		e''	14.8800	Conductivity (σ):	1.53	1.52	0.70	5
	Body 1910	e'	50.8900	Relative Permittivity (εr):	50.89	53.30	-4.52	5
		e''	14.6500	Conductivity (σ):	1.56	1.52	2.36	5

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8.2. 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.

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 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.

Reference Target SAR Values

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D750V3	1122	8-17-2015	750	1g	8.23	8.60
				10g	5.37	5.67
D835V2	4d194	9-17-2015	835	1g	9.38	9.49
				10g	6.09	6.18
D1750V2	1125	8-20-2015	1750	1g	36.70	37.20
				10g	19.50	20.00
D1900V2	5d199	2-6-2015	1900	1g	41.00	40.60
				10g	21.40	21.60
D2450V2	960	2-5-2015	2450	1g	53.30	50.80
				10g	24.80	23.60

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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 1 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
11-22-2015	D2450V2	960	Head	1g	4.98	49.80	53.30	-6.57	1,2
				10g	2.24	22.40	24.80	-9.68	
12-3-2015	D2450V2	960	Body	1g	4.83	48.30	50.80	-4.92	3,4
				10g	2.22	22.20	23.60	-5.93	

SAR 2 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
11-13-2015	D835V2	4d194	Body	1g	0.98	9.76	9.49	2.85	
				10g	0.64	6.43	6.18	4.05	
11-15-2015	D835V2	4d194	Head	1g	0.99	9.92	9.38	5.76	5,6
				10g	0.66	6.56	6.09	7.72	
11-17-2015	D835V2	4d194	Body	1g	0.99	9.91	9.49	4.43	
				10g	0.65	6.52	6.18	5.50	
11-21-2015	D2450V2	960	Body	1g	5.53	55.30	50.80	8.86	
				10g	2.53	25.30	23.60	7.20	
11-22-2015	D1900V2	5d199	Head	1g	4.10	41.00	41	0.00	
				10g	2.09	20.90	21.4	-2.34	
11-22-2015	D1750V2	1125	Head	1g	3.54	35.40	36.70	-3.54	
				10g	1.88	18.80	19.50	-3.59	
11-25-2015	D835V2	4d194	Body	1g	1.00	9.97	9.49	5.06	
				10g	0.66	6.55	6.18	5.99	
11-28-2015	D1900V2	5d199	Body	1g	3.96	39.60	40.6	-2.46	
				10g	2.00	20.00	21.6	-7.41	
12-3-2015	D835V2	4d194	Body	1g	1.01	10.10	9.49	6.43	7,8
				10g	0.67	6.67	6.18	7.93	

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SAR 3 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
11-9-2015	D750V3	1122	Head	1g	0.79	7.86	8.23	-4.50	
				10g	0.52	5.21	5.37	-2.98	
11-9-2015	D750V3	1122	Body	1g	0.91	9.08	8.6	5.58	9,10
				10g	0.61	6.05	5.67	6.70	
11-14-2015	D1900V2	5d199	Body	1g	3.89	38.90	40.6	-4.19	
				10g	1.98	19.80	21.6	-8.33	
11-14-2015	D1750V2	1125	Body	1g	3.54	35.40	37.20	-4.84	11,12
				10g	1.85	18.50	20.00	-7.50	
11-17-2015	D1750V2	1125	Head	1g	3.80	38.00	36.70	3.54	
				10g	2.03	20.30	19.50	4.10	
11-17-2015	D1900V2	5d199	Head	1g	3.98	39.80	41	-2.93	
				10g	2.05	20.50	21.4	-4.21	
11-18-2015	D1900V2	5d199	Body	1g	3.98	39.80	40.6	-1.97	
				10g	2.03	20.30	21.6	-6.02	
11-21-2015	D1900V2	5d199	Head	1g	3.89	38.90	41	-5.12	13,14
				10g	1.98	19.80	21.4	-7.48	
11-22-2015	D750V3	1122	Head	1g	0.785	7.85	8.23	-4.62	
				10g	0.520	5.20	5.37	-3.17	
11-23-2015	D1900V2	5d199	Body	1g	4.01	40.10	40.6	-1.23	
				10g	2.02	20.20	21.6	-6.48	
12-3-2015	D750V3	1122	Body	1g	0.90	8.95	8.6	4.07	15,16
				10g	0.60	5.97	5.67	5.29	
12-3-2015	D1900V2	5d199	Body	1g	3.93	39.30	40.6	-3.20	17,18
				10g	1.99	19.90	21.6	-7.87	

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9. Conducted Output Power Measurements

9.1. GSM

Per KDB 941225 D01 3G SAR Procedures:

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Max. Pwr	
						Burst (dBm)	Frame (dBm)
850	GSM (Voice)	CS1	1	128	824.2	33.5	24.5
				190	836.6	33.6	24.6
				251	848.8	33.4	24.4
	GPRS (GMSK)	CS1	1	128	824.2	33.6	24.6
				190	836.6	33.6	24.6
				251	848.8	33.5	24.5
			2	128	824.2	30.8	24.8
				190	836.6	31.0	25.0
				251	848.8	30.7	24.7
			3	128	824.2	30.0	25.7
				190	836.6	30.0	25.7
				251	848.8	29.8	25.5
			4	128	824.2	27.8	24.8
				190	836.6	27.8	24.8
				251	848.8	27.7	24.7
	EGPRS (8PSK)	MCS5	1	128	824.2	27.2	18.2
				190	836.6	27.2	18.2
				251	848.8	26.9	17.9
			2	128	824.2	25.5	19.5
				190	836.6	25.4	19.4
				251	848.8	25.3	19.3
			3	128	824.2	24.3	20.0
				190	836.6	24.3	20.0
				251	848.8	24.1	19.8
			4	128	824.2	23.2	20.2
				190	836.6	22.8	19.8
				251	848.8	22.6	19.6

Notes:

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

- Head & Body-worn: GMSK Voice Mode
- Head VoIP & Hotspot mode: GMSK (GPRS) mode with 3 time slots for Max power, 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

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GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Max. Pwr		Reduce. Pwr	
						Burst (dBm)	Frame (dBm)	Burst (dBm)	Frame (dBm)
1900	GSM (Voice)	CS1	1	512	1850.2	30.9	21.9	30.9	21.9
				661	1880.0	30.9	21.9	30.9	21.9
				810	1909.8	30.7	21.7	30.7	21.7
	GPRS (GMSK)	CS1	1	512	1850.2	30.9	21.9	29.5	20.5
				661	1880.0	30.9	21.9	29.4	20.4
				810	1909.8	30.7	21.7	29.4	20.3
			2	512	1850.2	27.7	21.7	25.9	19.9
				661	1880.0	27.5	21.5	25.7	19.7
				810	1909.8	27.7	21.7	25.8	19.8
			3	512	1850.2	27.0	22.7	25.2	20.9
				661	1880.0	26.8	22.5	25.0	20.7
				810	1909.8	26.9	22.7	25.1	20.8
			4	512	1850.2	26.2	23.2	24.2	21.2
				661	1880.0	26.0	23.0	24.0	21.0
				810	1909.8	26.2	23.2	24.0	21.0
	EGPRS (8PSK)	MCS5	1	512	1850.2	26.4	17.4	24.7	15.6
				661	1880.0	26.2	17.2	24.2	15.2
				810	1909.8	26.3	17.3	24.3	15.3
			2	512	1850.2	24.9	18.9	22.4	16.4
				661	1880.0	24.7	18.7	22.1	16.1
				810	1909.8	24.8	18.8	22.2	16.2
			3	512	1850.2	23.6	19.4	21.1	16.8
				661	1880.0	23.4	19.1	20.9	16.6
				810	1909.8	23.5	19.2	20.9	16.7
			4	512	1850.2	22.3	19.3	19.8	16.8
				661	1880.0	22.1	19.1	19.5	16.5
				810	1909.8	22.1	19.1	19.6	16.6

Notes:

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

- Head & Body-worn: GMSK Voice Mode
- Head VoIP : GMSK (GPRS) mode with 4 time slots for Max power, based on the output power measurements above.
- Hotspot mode : GMSK (GPRS) mode with 4 time slots for Reduce power, 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

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9.2. W-CDMA

Release 99 Setup Procedures used to establish the test signals

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
	βc/βd	8/15

HSDPA Setup Procedures used to establish the test signals

The following 4 Sub-tests were completed according to Release 5 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			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs=βhs/βc	30/15			

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HSPA (HSDPA & HSUPA) Setup Procedures used to establish the test signals

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
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/βd	11/15	6/15	15/9	2/15	15/1
	βhs	22/15	12/15	30/15	4/15	5/15
	βed	1309/225	94/75	47/15	56/75	47/15
	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	E-DPDCCH	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

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DC-HSDPA Setup Procedures used to establish the test signals

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_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH _Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	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.		

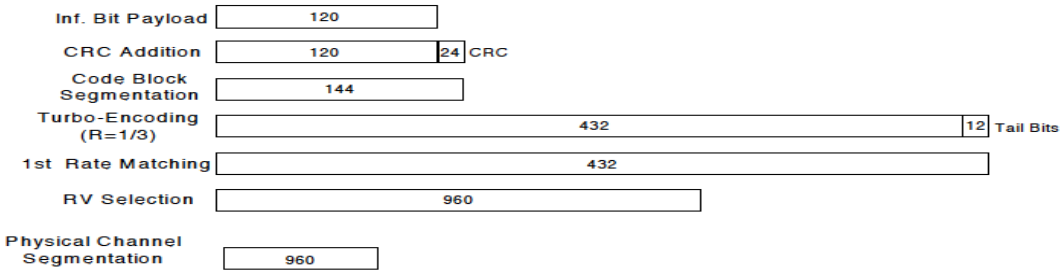

Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	βd (SF)	64			
	βc/βd	2/15	11/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs = βhs/ βc	30/15			

HSPA+

Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., Rel. 7 Therefore, the RF conducted power is not measured.

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W-CDMA Band II Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Max. Pwr (dBm)	Reduce. Pwr (dBm)
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	22.7	20.6
			9400	1880.0	N/A	22.7	20.7
			9538	1907.6	N/A	22.9	20.8
	HSDPA	Subtest 1	9262	1852.4	0	22.4	20.5
			9400	1880.0	0	22.7	20.6
			9538	1907.6	0	22.8	20.7
		Subtest 2	9262	1852.4	0	22.5	20.7
			9400	1880.0	0	22.8	20.8
			9538	1907.6	0	22.9	20.7
		Subtest 3	9262	1852.4	0.5	22.8	20.5
			9400	1880.0	0.5	22.7	20.7
			9538	1907.6	0.5	22.8	20.8
		Subtest 4	9262	1852.4	0.5	22.0	20.4
			9400	1880.0	0.5	22.2	20.7
			9538	1907.6	0.5	22.4	20.8
	HSUPA	Subtest 1	9262	1852.4	0	21.7	19.8
			9400	1880.0	0	21.8	19.8
			9538	1907.6	0	21.9	19.8
		Subtest 2	9262	1852.4	2	19.0	17.7
			9400	1880.0	2	19.1	18.2
			9538	1907.6	2	19.2	18.2
		Subtest 3	9262	1852.4	1	21.4	19.7
			9400	1880.0	1	21.7	19.7
			9538	1907.6	1	21.7	19.8
		Subtest 4	9262	1852.4	2	19.3	18.1
			9400	1880.0	2	19.7	18.6
			9538	1907.6	2	19.8	18.8
		Subtest 5	9262	1852.4	0	22.9	20.8
			9400	1880.0	0	22.8	20.8
			9538	1907.6	0	22.6	20.9
	DC-HSDPA	Subtest 1	9262	1852.4	0	22.6	20.3
			9400	1880.0	0	22.7	20.6
			9538	1907.6	0	22.9	20.6
		Subtest 2	9262	1852.4	0	22.6	20.5
			9400	1880.0	0	22.9	20.8
			9538	1907.6	0	23.0	20.8
		Subtest 3	9262	1852.4	0.5	22.7	20.8
			9400	1880.0	0.5	22.8	20.8
			9538	1907.6	0.5	23.0	20.7
		Subtest 4	9262	1852.4	0.5	22.3	20.8
			9400	1880.0	0.5	22.6	20.8
			9538	1907.6	0.5	22.7	20.8

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W-CDMA Band IV Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Max. Pwr (dBm)	MPR (dB)	Reduce. Pwr (dBm)
W-CDMA Band IV	Rel 99	RMC, 12.2 kbps	1312	1712.4	N/A	22.6	N/A	21.6
			1413	1732.6	N/A	22.8	N/A	21.9
			1513	1752.6	N/A	22.8	N/A	21.9
	HSDPA	Subtest 1	1312	1712.4	0	22.5	0	21.1
			1413	1732.6	0	22.8	0	21.7
			1513	1752.6	0	22.9	0	21.7
		Subtest 2	1312	1712.4	0	22.7	0	21.3
			1413	1732.6	0	22.9	0	21.8
			1513	1752.6	0	22.9	0	21.9
		Subtest 3	1312	1712.4	0.5	22.5	0	21.3
			1413	1732.6	0.5	22.8	0	21.9
			1513	1752.6	0.5	22.8	0	22.0
		Subtest 4	1312	1712.4	0.5	22.2	0	21.3
			1413	1732.6	0.5	22.5	0	21.8
			1513	1752.6	0.5	22.5	0	21.9
	HSUPA	Subtest 1	1312	1712.4	0	21.5	0	20.5
			1413	1732.6	0	21.8	0	20.8
			1513	1752.6	0	21.7	0	20.9
		Subtest 2	1312	1712.4	2	19.8	0	20.6
			1413	1732.6	2	19.8	0	20.9
			1513	1752.6	2	19.9	0	20.9
		Subtest 3	1312	1712.4	1	21.6	0	20.6
			1413	1732.6	1	21.9	0	20.9
			1513	1752.6	1	22.0	0	20.9
		Subtest 4	1312	1712.4	2	19.8	0	20.6
			1413	1732.6	2	19.9	0	20.9
			1513	1752.6	2	19.9	0	20.9
		Subtest 5	1312	1712.4	0	22.5	0	21.6
			1413	1732.6	0	22.8	0	21.8
			1513	1752.6	0	22.8	0	22.0
	DC-HSDPA	Subtest 1	1312	1712.4	0	21.5	0	21.4
			1413	1732.6	0	21.7	0	21.7
			1513	1752.6	0	21.7	0	21.8
		Subtest 2	1312	1712.4	0	21.6	0	21.7
			1413	1732.6	0	21.8	0	21.9
			1513	1752.6	0	21.8	0	21.9
		Subtest 3	1312	1712.4	0.5	21.6	0	21.7
			1413	1732.6	0.5	21.9	0	21.9
			1513	1752.6	0.5	21.9	0	22.0
		Subtest 4	1312	1712.4	0.5	21.7	0	21.5
			1413	1732.6	0.5	21.9	0	22.0
			1513	1752.6	0.5	21.9	0	22.0

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W-CDMA Band V Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Max. Pwr (dBm)
W-CDMA Band V	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	23.6
			4183	836.6	N/A	23.9
			4233	846.6	N/A	23.8
	HSDPA	Subtest 1	4132	826.4	0	22.1
			4183	836.6	0	22.3
			4233	846.6	0	22.2
		Subtest 2	4132	826.4	0	22.6
			4183	836.6	0	23.0
			4233	846.6	0	22.9
		Subtest 3	4132	826.4	0.5	21.7
			4183	836.6	0.5	22.1
			4233	846.6	0.5	22.1
		Subtest 4	4132	826.4	0.5	20.9
			4183	836.6	0.5	21.3
			4233	846.6	0.5	21.3
	HSUPA	Subtest 1	4132	826.4	0	21.4
			4183	836.6	0	21.5
			4233	846.6	0	21.6
		Subtest 2	4132	826.4	2	19.4
			4183	836.6	2	19.8
			4233	846.6	2	19.8
		Subtest 3	4132	826.4	1	20.7
			4183	836.6	1	20.7
			4233	846.6	1	20.8
		Subtest 4	4132	826.4	2	19.4
			4183	836.6	2	19.7
			4233	846.6	2	19.8
		Subtest 5	4132	826.4	0	22.5
			4183	836.6	0	22.8
			4233	846.6	0	22.7
	HSDPA	Subtest 1	4132	826.4	0	22.0
			4183	836.6	0	22.1
			4233	846.6	0	22.2
		Subtest 2	4132	826.4	0	22.8
			4183	836.6	0	22.9
			4233	846.6	0	22.9
		Subtest 3	4132	826.4	0.5	21.9
			4183	836.6	0.5	22.1
			4233	846.6	0.5	22.1
		Subtest 4	4132	826.4	0.5	21.2
			4183	836.6	0.5	21.3
			4233	846.6	0.5	21.3

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9.3. LTE

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 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
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.					

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LTE Band 2 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1860 MHz	1880 MHz	1900 MHz	1860 MHz	1880 MHz	1900 MHz
LTE Band 2	20	QPSK	1	0	0	23.1	22.9	23.0	20.0	20.0	20.1
			1	49	0	23.1	22.9	23.1	20.0	20.0	20.1
			1	99	0	23.1	22.9	23.1	20.0	20.1	20.1
			50	0	1	21.2	21.0	21.0	18.1	18.0	17.9
			50	24	1	21.1	21.1	21.1	18.0	18.0	17.9
			50	50	1	21.1	21.0	21.0	18.0	18.0	17.9
			100	0	1	21.1	21.0	21.0	18.0	17.9	17.9
		16QAM	1	0	1	20.6	20.6	20.6	17.5	17.6	17.7
			1	49	1	20.6	20.5	20.7	17.5	17.6	17.7
			1	99	1	20.6	20.6	20.7	17.5	17.6	17.8
			50	0	2	20.0	19.9	20.0	17.1	17.1	17.1
			50	24	2	20.1	19.9	20.0	17.2	17.1	17.1
			50	50	2	20.1	19.9	19.9	17.0	17.0	17.1
			100	0	2	20.1	20.0	20.0	17.1	17.0	17.1
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1857.5 MHz	1880 MHz	1902.5 MHz	1857.5 MHz	1880 MHz	1902.5 MHz
LTE Band 2	15	QPSK	1	0	0	23.2	23.0	22.8	20.2	20.1	19.8
			1	37	0	23.1	22.9	22.9	20.1	20.0	20.0
			1	74	0	23.2	23.0	22.9	20.1	20.0	19.9
			36	0	1	21.2	21.0	21.0	18.1	18.0	18.0
			36	20	1	21.2	21.0	20.9	18.1	18.0	18.0
			36	39	1	21.2	20.9	21.0	18.1	18.0	18.0
			75	0	1	21.1	20.9	21.0	18.1	17.9	18.0
		16QAM	1	0	1	21.0	21.0	20.8	17.9	17.7	17.5
			1	37	1	21.0	21.0	20.9	17.9	17.6	17.7
			1	74	1	21.0	21.0	20.9	17.9	17.7	17.7
			36	0	2	20.0	19.9	20.0	17.0	17.0	17.2
			36	20	2	20.1	19.9	20.0	17.2	17.0	17.1
			36	39	2	20.0	19.9	19.9	17.1	17.0	17.1
			75	0	2	20.0	19.9	20.0	17.1	17.0	17.1
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1855 MHz	1880 MHz	1905 MHz	1855 MHz	1880 MHz	1905 MHz
LTE Band 2	10	QPSK	1	0	0	23.0	22.9	23.0	20.0	19.9	20.0
			1	25	0	23.0	22.9	23.0	20.1	19.9	20.0
			1	49	0	23.1	23.0	23.0	20.1	19.9	20.0
			25	0	1	21.2	21.0	21.1	18.0	17.9	18.0
			25	12	1	21.2	21.1	20.9	18.1	17.9	18.0
			25	25	1	21.1	21.0	20.9	18.1	17.9	18.0
			50	0	1	21.1	21.0	21.1	18.1	17.9	18.1
		16QAM	1	0	1	21.1	20.7	21.1	17.9	17.8	17.9
			1	25	1	21.1	20.5	21.0	17.8	17.8	17.8
			1	49	1	21.1	20.6	21.1	17.9	17.8	17.9
			25	0	2	20.1	20.0	20.0	17.2	17.0	17.2
			25	12	2	20.2	20.0	20.0	17.2	17.1	17.1
			25	25	2	20.1	19.9	20.0	17.2	17.1	17.1
			50	0	2	20.1	19.9	20.0	17.1	17.0	17.2

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LTE Band 2 Measured Results (continued)

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1852.5 MHz	1880 MHz	1907.5 MHz	1852.5 MHz	1880 MHz	1907.5 MHz
LTE Band 2	5	QPSK	1	0	0	23.1	23.1	23.0	20.3	20.0	20.1
			1	12	0	23.1	23.0	22.9	20.3	20.0	20.1
			1	24	0	23.1	23.1	23.0	20.4	20.1	20.2
			12	0	1	21.2	21.0	21.1	18.1	18.0	18.0
			12	7	1	21.2	21.0	21.0	18.2	18.0	17.9
			12	13	1	21.3	21.0	21.0	18.2	18.0	17.9
			25	0	1	21.2	21.0	21.1	18.2	18.0	17.9
		16QAM	1	0	1	20.9	21.0	20.7	18.0	18.2	17.5
			1	12	1	20.8	21.0	20.6	18.1	18.1	17.4
			1	24	1	20.9	21.0	20.7	18.1	18.2	17.5
			12	0	2	20.1	19.9	19.9	17.2	17.0	17.1
			12	7	2	20.1	19.9	19.9	17.2	16.9	17.0
			12	13	2	20.1	19.8	19.9	17.2	16.9	16.9
			25	0	2	20.2	19.9	20.0	17.2	17.1	17.0
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1851.5 MHz	1880 MHz	1908.5 MHz	1851.5 MHz	1880 MHz	1908.5 MHz
LTE Band 2	3	QPSK	1	0	0	23.2	23.1	23.2	20.3	20.0	20.2
			1	8	0	23.2	23.0	23.1	20.3	20.0	20.1
			1	14	0	23.2	23.2	23.2	20.3	20.1	20.2
			8	0	1	21.2	21.0	21.1	18.2	18.0	18.0
			8	4	1	21.2	21.0	21.0	18.2	18.0	17.9
			8	7	1	21.3	21.0	21.0	18.2	18.0	18.0
			15	0	1	21.3	21.0	21.1	18.2	17.9	18.0
		16QAM	1	0	1	21.3	20.8	21.2	18.1	17.9	18.1
			1	8	1	21.3	20.8	21.0	18.1	17.9	18.0
			1	14	1	21.3	20.8	21.1	18.1	17.9	18.1
			8	0	2	20.1	19.9	19.7	17.1	17.0	16.9
			8	4	2	20.2	19.8	19.7	17.1	16.9	16.8
			8	7	2	20.2	19.8	19.7	17.1	16.9	16.8
			15	0	2	20.1	19.9	19.9	17.1	16.9	17.0
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1850.7 MHz	1880 MHz	1909.3 MHz	1850.7 MHz	1880 MHz	1909.3 MHz
LTE Band 2	1.4	QPSK	1	0	0	23.0	23.0	23.0	20.1	20.0	20.0
			1	3	0	23.0	22.9	23.0	20.1	19.9	20.1
			1	5	0	23.0	23.0	23.1	20.0	20.0	20.1
			3	0	0	23.0	23.0	23.0	20.1	20.0	20.0
			3	1	0	23.1	23.0	22.9	20.1	20.0	20.0
			3	3	0	23.1	23.0	23.0	20.1	19.9	20.0
			6	0	1	21.2	21.0	21.0	18.1	18.0	18.0
		16QAM	1	0	1	20.9	20.6	21.0	17.8	18.0	17.6
			1	3	1	20.9	20.6	21.0	17.8	18.0	17.7
			1	5	1	20.9	20.6	21.1	17.8	18.0	17.7
			3	0	1	20.9	20.8	20.9	17.9	17.8	17.8
			3	1	1	21.0	21.0	20.8	18.0	17.8	17.9
			3	3	1	21.0	20.9	20.8	17.9	17.9	17.7
			6	0	2	20.1	20.0	19.8	17.0	17.0	17.0

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LTE Band 4 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1720 MHz	1732.5 MHz	1745 MHz	1720 MHz	1732.5 MHz	1745 MHz
LTE Band 4	20	QPSK	1	0	0	23.2	23.5	23.4	21.2	21.6	21.2
			1	49	0	23.3	23.6	23.4	21.2	21.6	21.2
			1	99	0	23.3	23.6	23.5	21.3	21.7	21.3
			50	0	1	21.4	21.5	21.5	19.4	19.6	19.6
			50	24	1	21.4	21.5	21.6	19.4	19.6	19.6
			50	50	1	21.4	21.4	21.5	19.4	19.6	19.6
			100	0	1	21.3	21.4	21.5	19.4	19.5	19.6
		16QAM	1	0	1	20.9	21.2	21.0	18.9	19.1	19.2
			1	49	1	20.8	21.2	20.9	18.9	19.2	19.2
			1	99	1	20.9	21.2	20.9	19.0	19.3	19.3
			50	0	2	20.4	20.5	20.6	18.4	18.5	18.7
			50	24	2	20.4	20.6	20.6	18.4	18.6	18.7
			50	50	2	20.3	20.5	20.5	18.4	18.5	18.6
			100	0	2	20.4	20.6	20.6	18.4	18.6	18.7

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1717.5 MHz	1732.5 MHz	1747.5 MHz	1717.5 MHz	1732.5 MHz	1747.5 MHz
LTE Band 4	15	QPSK	1	0	0	23.2	23.4	23.3	21.4	21.4	21.4
			1	37	0	23.1	23.3	23.4	21.4	21.4	21.4
			1	74	0	23.2	23.4	23.3	21.4	21.5	21.4
			36	0	1	21.3	21.5	21.6	19.4	19.6	19.6
			36	20	1	21.4	21.4	21.5	19.4	19.7	19.6
			36	39	1	21.4	21.5	21.6	19.4	19.7	19.6
			75	0	1	21.3	21.4	21.6	19.4	19.5	19.7
		16QAM	1	0	1	21.0	21.2	21.3	19.2	19.3	19.4
			1	37	1	21.0	21.2	21.2	19.2	19.3	19.5
			1	74	1	21.0	21.2	21.3	19.2	19.3	19.5
			36	0	2	20.3	20.4	20.6	18.3	18.7	18.6
			36	20	2	20.3	20.5	20.6	18.4	18.7	18.6
			36	39	2	20.3	20.5	20.6	18.5	18.7	18.5
			75	0	2	20.4	20.5	20.6	18.4	18.6	18.6

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1715 MHz	1732.5 MHz	1750 MHz	1715 MHz	1732.5 MHz	1750 MHz
LTE Band 4	10	QPSK	1	0	0	23.2	23.4	23.5	21.5	21.4	21.6
			1	25	0	23.2	23.4	23.5	21.5	21.4	21.6
			1	49	0	23.3	23.4	23.5	21.5	21.6	21.6
			25	0	1	21.2	21.4	21.6	19.4	19.5	19.7
			25	12	1	21.3	21.4	21.6	19.4	19.7	19.7
			25	25	1	21.3	21.5	21.6	19.5	19.5	19.7
			50	0	1	21.3	21.5	21.6	19.0	19.5	19.7
		16QAM	1	0	1	21.0	21.3	21.4	19.5	19.4	19.6
			1	25	1	21.1	21.2	21.3	19.4	19.4	19.6
			1	49	1	21.0	21.3	21.4	19.5	19.4	19.7
			25	0	2	20.3	20.6	20.6	18.5	18.6	18.7
			25	12	2	20.4	20.6	20.7	18.4	18.6	18.7
			25	25	2	20.4	20.6	20.6	18.4	18.6	18.6
			50	0	2	20.4	20.5	20.6	18.4	18.5	18.7

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LTE Band 4 Measured Results (continued)

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1712.5 MHz	1732.5 MHz	1752.5 MHz	1712.5 MHz	1732.5 MHz	1752.5 MHz
LTE Band 4	5	QPSK	1	0	0	23.2	23.5	23.6	21.4	21.6	21.6
			1	12	0	23.2	23.5	23.5	21.3	21.5	21.6
			1	24	0	23.2	23.5	23.5	21.5	21.6	21.7
			12	0	1	21.3	21.5	21.6	19.4	19.6	19.7
			12	7	1	21.4	21.5	21.5	19.5	19.6	19.6
			12	13	1	21.3	21.5	21.6	19.4	19.6	19.7
			25	0	1	21.3	21.5	21.6	19.4	19.6	19.7
		16QAM	1	0	1	21.0	21.0	21.4	19.1	19.2	19.2
			1	12	1	20.9	20.9	21.3	19.1	19.1	19.3
			1	24	1	21.0	21.1	21.3	19.1	19.2	19.3
			12	0	2	20.2	20.5	20.6	18.3	18.4	18.5
			12	7	2	20.2	20.5	20.6	18.2	18.4	18.6
			12	13	2	20.2	20.6	20.5	18.3	18.5	18.5
			25	0	2	20.4	20.5	20.6	18.4	18.6	18.5
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1711.5 MHz	1732.5 MHz	1753.5 MHz	1711.5 MHz	1732.5 MHz	1753.5 MHz
LTE Band 4	3	QPSK	1	0	0	23.4	23.6	23.6	21.4	21.6	21.6
			1	8	0	23.4	23.6	23.6	21.4	21.6	21.6
			1	14	0	23.4	23.6	23.7	21.5	21.6	21.6
			8	0	1	21.4	21.5	21.6	19.4	19.6	19.7
			8	4	1	21.4	21.5	21.6	19.4	19.6	19.6
			8	7	1	21.4	21.5	21.6	19.4	19.6	19.6
			15	0	1	21.4	21.5	21.6	19.4	19.6	19.6
		16QAM	1	0	1	21.4	21.4	21.4	19.4	19.7	19.8
			1	8	1	21.3	21.3	21.4	19.3	19.6	19.7
			1	14	1	21.4	21.3	21.5	19.4	19.7	19.8
			8	0	2	20.2	20.5	20.6	18.3	18.3	18.5
			8	4	2	20.2	20.5	20.6	18.3	18.3	18.5
			8	7	2	20.2	20.5	20.6	18.3	18.3	18.6
			15	0	2	20.3	20.5	20.6	18.3	18.5	18.5
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)			Reduce. Avg Pwr (dBm)		
						1710.7 MHz	1732.5 MHz	1754.3 MHz	1710.7 MHz	1732.5 MHz	1754.3 MHz
LTE Band 4	1.4	QPSK	1	0	0	23.3	23.6	23.5	21.2	21.5	21.5
			1	3	0	23.3	23.6	23.5	21.2	21.5	21.5
			1	5	0	23.3	23.6	23.5	21.2	21.4	21.5
			3	0	0	23.2	23.4	23.4	21.2	21.4	21.4
			3	1	0	23.2	23.5	23.4	21.3	21.4	21.5
			3	3	0	23.2	23.4	23.4	21.2	21.4	21.5
			6	0	1	21.3	21.6	21.6	19.4	19.5	19.5
		16QAM	1	0	1	20.8	21.2	21.1	19.1	19.5	19.3
			1	3	1	20.8	21.2	21.1	19.1	19.5	19.3
			1	5	1	20.9	21.3	21.1	19.1	19.5	19.4
			3	0	1	21.2	21.4	21.5	19.2	19.3	19.4
			3	1	1	21.3	21.4	21.6	19.2	19.3	19.4
			3	3	1	21.1	21.3	21.5	19.2	19.3	19.4
			6	0	2	20.4	20.3	20.6	18.3	18.5	18.5

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LTE Band 5 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)		
						829 MHz	836.5 MHz	844 MHz
LTE Band 5	10	QPSK	1	0	0	23.9	23.7	23.7
			1	25	0	23.8	23.6	23.6
			1	49	0	23.8	23.6	23.8
			25	0	1	21.7	21.5	21.7
			25	12	1	21.7	21.5	21.5
			25	25	1	21.7	21.4	21.5
			50	0	1	21.6	21.4	21.6
		16QAM	1	0	1	21.6	21.4	21.4
			1	25	1	21.4	21.3	21.3
			1	49	1	21.4	21.3	21.4
			25	0	2	20.7	20.5	20.7
			25	12	2	20.7	20.6	20.6
			25	25	2	20.6	20.5	20.5
			50	0	2	20.7	20.5	20.6

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)		
						826.5 MHz	836.5 MHz	846.5 MHz
LTE Band 5	5	QPSK	1	0	0	23.8	23.6	23.6
			1	12	0	23.5	23.5	23.5
			1	24	0	23.5	23.6	23.5
			12	0	1	21.7	21.5	21.6
			12	6	1	21.6	21.5	21.5
			12	11	1	21.6	21.4	21.5
			25	0	1	21.6	21.5	21.5
		16QAM	1	0	1	21.4	21.1	21.3
			1	12	1	21.3	21.0	21.2
			1	24	1	21.3	21.1	21.2
			12	0	2	20.5	20.4	20.4
			12	6	2	20.4	20.5	20.3
			12	11	2	20.5	20.4	20.4
			25	0	2	20.6	20.4	20.4

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)		
						825.5 MHz	836.5 MHz	847.5 MHz
LTE Band 5	3	QPSK	1	0	0	23.9	23.8	23.9
			1	8	0	23.8	23.8	23.8
			1	14	0	23.8	23.9	23.8
			8	0	1	21.7	21.6	21.5
			8	4	1	21.6	21.6	21.5
			8	7	1	21.5	21.6	21.5
			15	0	1	21.6	21.6	21.5
		16QAM	1	0	1	21.4	21.5	21.5
			1	8	1	21.3	21.4	21.4
			1	14	1	21.3	21.5	21.5
			8	0	2	20.5	20.4	20.3
			8	4	2	20.5	20.5	20.3
			8	7	2	20.4	20.4	20.2
			15	0	2	20.5	20.5	20.5

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LTE Band 5 Measured Results (continued)

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)		
						824.7 MHz	836.5 MHz	848.3 MHz
LTE Band 5	1.4	QPSK	1	0	0	23.8	23.7	23.7
			1	3	0	23.7	23.7	23.7
			1	5	0	23.7	23.6	23.7
			3	0	0	23.7	23.7	23.7
			3	1	0	23.7	23.6	23.7
			3	3	0	23.7	23.6	23.7
			6	0	1	21.5	21.4	21.6
		16QAM	1	0	1	21.2	21.2	21.1
			1	3	1	21.2	21.3	21.1
			1	5	1	21.2	21.3	21.1
			3	0	1	21.3	21.5	21.3
			3	1	1	21.4	21.3	21.4
			3	3	1	21.2	21.4	21.4
			6	0	2	20.5	20.3	20.5

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LTE Band 17 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)
						710 MHz
LTE Band 17	10	QPSK	1	0	0	23.5
			1	25	0	23.4
			1	49	0	23.3
			25	0	1	21.6
			25	12	1	21.6
			25	25	1	21.5
			50	0	1	21.5
		16QAM	1	0	1	21.5
			1	25	1	21.3
			1	49	1	21.3
			25	0	2	20.7
			25	12	2	20.6
			25	25	2	20.5
			50	0	2	20.5
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)
						710 MHz
LTE Band 17	5	QPSK	1	0	0	23.7
			1	12	0	23.7
			1	24	0	23.7
			12	0	1	21.7
			12	6	1	21.7
			12	11	1	21.7
			25	0	1	21.7
		16QAM	1	0	1	21.6
			1	12	1	21.5
			1	24	1	21.6
			12	0	2	20.6
			12	6	2	20.6
			12	11	2	20.6
			25	0	2	20.7

Note(s):

10/5 MHz Bandwidths does not support at least three non-overlapping channels in certain channel bandwidths. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing per KDB 941225 D05 SAR for LTE Devices

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9.4. Wi-Fi 2.4GHz (DTS Band)

Measured Results (Max Power)

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
2.4	802.11b	1 Mbps	1	2412	16.9	17.5	Yes	
			6	2437	17.3			
			11	2462	16.8			
	802.11g	6 Mbps	1	2412	Not Require	14.5	No	1
			6	2437				
			11	2462				
	802.11n (HT20)	6.5 Mbps	1	2412	Not Require	13.5	No	1
			6	2437				
			11	2462				

Measured Results (Reduce Power)

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
2.4	802.11b	1 Mbps	1	2412	14.3	14.5	Yes	
			6	2437	13.8			
			11	2462	14.2			
	802.11g	6 Mbps	1	2412	14.0	14.5	No	1
			6	2437	14.3			
			11	2462	13.9			
	802.11n (HT20)	6 Mbps	1	2412	Not Require	13.5	No	1
			6	2437				
			11	2462				

Note(s):

1. Output Power and SAR is not required for 802.11g/n HT20 channels when the highest *reported* SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

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9.5. Bluetooth

Maximum tune-up tolerance limit is 10 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

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10. 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.

Additional 1-g SAR testing at 5 mm is not required. For hotspot mode, 10-g extremity SAR is not required for the surfaces and edges since all 1-g reported SAR < 1.2 W/kg. **(for Phablet only)**

KDB 941225 D01 SAR test for 3G devices:
When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

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.

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KDB 248227 D01 SAR meas for 802.11:

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the *initial test position(s)* by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The *initial test position(s)* is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the *reported* SAR for the *initial test position* is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the *initial test position* to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the *reported* SAR is ≤ 0.8 W/kg or all required test positions are tested.
  - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
  - When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the *initial test position* and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required test channels are considered.
  - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the *initial test position*, Area Scans were performed to determine the position with the *Maximum Value of SAR (measured)*. The position that produced the highest *Maximum Value of SAR* is considered the worst case position; thus used as the *initial test position*.

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10.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	34.0	33.6	0.229	0.252	
			Left Tilt	190	836.6	34.0	33.6	0.119	0.131	
			Right Touch	190	836.6	34.0	33.6	0.175	0.192	
			Right Tilt	190	836.6	34.0	33.6	0.090	0.099	
Head VoIP	GPRS 3 Slots	0	Left Touch	190	836.6	30.1	30.0	0.252	0.258	1
			Left Tilt	190	836.6	30.1	30.0	0.118	0.121	
			Right Touch	190	836.6	30.1	30.0	0.200	0.205	
			Right Tilt	190	836.6	30.1	30.0	0.102	0.104	
Body-worn	Voice	15	Rear	190	836.6	34.0	33.6	0.375	0.412	
			Front	190	836.6	34.0	33.6	0.343	0.377	
Body-worn(VoIP)	GPRS 3 Slots	15	Rear	190	836.6	30.1	30.0	0.417	0.427	2
			Front	190	836.6	30.1	30.0	0.372	0.381	
Hotspot		10	Rear	190	836.6	30.1	30.0	0.751	0.768	3
			Front	190	836.6	30.1	30.0	0.607	0.621	
			Edge 2	190	836.6	30.1	30.0	0.432	0.442	
			Edge 3	190	836.6	30.1	30.0	0.421	0.431	
			Edge 4	190	836.6	30.1	30.0	0.188	0.192	

10.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	30.9	30.9	0.075	0.075	
			Left Tilt	661	1880.0	30.9	30.9	0.016	0.016	
			Right Touch	661	1880.0	30.9	30.9	0.083	0.083	
			Right Tilt	661	1880.0	30.9	30.9	0.029	0.029	
Head VoIP	GPRS 4 Slots	0	Left Touch	661	1880.0	26.5	26.0	0.130	0.146	
			Left Tilt	661	1880.0	26.5	26.0	0.030	0.034	
			Right Touch	661	1880.0	26.5	26.0	0.139	0.156	4
			Right Tilt	661	1880.0	26.5	26.0	0.054	0.060	
Body-worn	Voice	15	Rear	661	1880.0	30.9	30.9	0.221	0.221	
			Front	661	1880.0	30.9	30.9	0.193	0.193	
Body-worn(VoIP)	GPRS 4 Slots	15	Rear	661	1880.0	26.5	26.0	0.371	0.416	5
			Front	661	1880.0	26.5	26.0	0.325	0.365	
Hotspot		10	Rear	661	1880.0	24.5	24.0	0.568	0.641	
			Front	661	1880.0	24.5	24.0	0.495	0.559	
			Edge 2	661	1880.0	24.5	24.0	0.102	0.115	
			Edge 3	512	1850.2	24.5	24.2	0.784	0.840	
				661	1880.0	24.5	24.0	0.843	0.952	6
				810	1909.8	24.5	24.0	0.785	0.871	
			Edge 4	661	1880.0	24.5	24.0	0.087	0.099	

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10.3. W-CDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	9400	1880.0	23.5	22.7	0.298	0.358	7
			Left Tilt	9400	1880.0	23.5	22.7	0.068	0.081	
			Right Touch	9400	1880.0	23.5	22.7	0.235	0.283	
			Rightt Tilt	9400	1880.0	23.5	22.7	0.125	0.150	
Body-worn	Rel 99 RMC	15	Rear	9400	1880.0	23.5	22.7	0.663	0.797	8
			Front	9400	1880.0	23.5	22.7	0.606	0.729	
Hotspot	Rel 99 RMC	10	Rear	9262	1852.4	21.3	20.6	0.540	0.636	
				9400	1880.0	21.3	20.7	0.701	0.813	
				9538	1907.6	21.3	20.8	0.619	0.691	
			Front	9400	1880.0	21.3	20.7	0.632	0.733	
			Edge 2	9400	1880.0	21.3	20.7	0.079	0.092	
			Edge 3	9262	1852.4	21.3	20.6	0.887	1.044	
				9400	1880.0	21.3	20.7	0.928	1.077	9
				9538	1907.6	21.3	20.8	0.925	1.033	
			Edge 4	9400	1880.0	21.3	20.7	0.088	0.102	

10.4. W-CDMA Band IV

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	1413	1732.6	23.5	22.8	0.236	0.276	10
			Left Tilt	1413	1732.6	23.5	22.8	0.084	0.098	
			Right Touch	1413	1732.6	23.5	22.8	0.212	0.248	
			Rightt Tilt	1413	1732.6	23.5	22.8	0.086	0.100	
Body-worn	Rel 99 RMC	15	Rear	1413	1732.6	23.5	22.8	0.528	0.617	11
			Front	1413	1732.6	23.5	22.8	0.422	0.493	
Hotspot	Rel 99 RMC	10	Rear	1413	1732.6	22.0	21.9	0.578	0.588	
			Front	1413	1732.6	22.0	21.9	0.480	0.489	
			Edge 2	1413	1732.6	22.0	21.9	0.062	0.063	
			Edge 3	1413	1732.6	22.0	21.9	0.784	0.798	12
			Edge 4	1413	1732.6	22.0	21.9	0.122	0.124	

10.5. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	24.0	23.9	0.221	0.227	13
			Left Tilt	4183	836.6	24.0	23.9	0.085	0.088	
			Right Touch	4183	836.6	24.0	23.9	0.187	0.192	
			Rightt Tilt	4183	836.6	24.0	23.9	0.086	0.088	
Body-worn	Rel 99 RMC	15	Rear	4183	836.6	24.0	23.9	0.346	0.356	
			Front	4183	836.6	24.0	23.9	0.371	0.382	14
Hotspot	Rel 99 RMC	10	Rear	4183	836.6	24.0	23.9	0.558	0.574	15
			Front	4183	836.6	24.0	23.9	0.518	0.533	
			Edge 2	4183	836.6	24.0	23.9	0.323	0.332	
			Edge 3	4183	836.6	24.0	23.9	0.287	0.295	
			Edge 4	4183	836.6	24.0	23.9	0.191	0.196	

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10.6. LTE Band 2 (20MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	18900	1880.0	1	99	23.3	22.9	0.147	0.160	
						50	24	22.3	21.1	0.102	0.136	
			Left Tilt	18900	1880.0	1	99	23.3	22.9	0.039	0.042	
						50	24	22.3	21.1	0.026	0.034	
			Right Touch	18900	1880.0	1	99	23.3	22.9	0.199	0.217	16
						50	24	22.3	21.1	0.123	0.164	
			Right Tilt	18900	1880.0	1	99	23.3	22.9	0.067	0.073	
						50	24	22.3	21.1	0.043	0.057	
Body-worn	QPSK	15	Rear	18900	1880.0	1	99	23.3	22.9	0.488	0.532	17
						50	24	22.3	21.1	0.305	0.406	
			Front	18900	1880.0	1	99	23.3	22.9	0.407	0.444	
						50	24	22.3	21.1	0.282	0.376	
Hotspot	QPSK	10	Rear	18900	1880.0	1	99	20.4	20.1	0.602	0.649	
						50	50	19.4	18.0	0.396	0.546	
			Front	18900	1880.0	1	99	20.4	20.1	0.437	0.471	
						50	50	19.4	18.0	0.295	0.407	
			Edge 2	18900	1880.0	1	99	20.4	20.1	0.078	0.084	
						50	50	19.4	18.0	0.052	0.072	
			Edge 3	18700	1860.0	1	99	20.4	20.0	0.863	0.939	
				18900	1880.0	1	99	20.4	20.1	0.874	0.942	
						50	50	19.4	18.0	0.577	0.796	
				19100	1900.0	1	99	20.4	20.1	0.932	0.993	18
			Edge 4	18900	1880.0	1	99	20.4	20.1	0.096	0.104	
						50	50	19.4	18.0	0.061	0.084	

10.7. LTE Band 4 (20MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	20175	1732.5	1	99	23.8	23.6	0.174	0.181	19
						50	24	22.8	21.5	0.122	0.165	
			Left Tilt	20175	1732.5	1	99	23.8	23.6	0.055	0.057	
						50	24	22.8	21.5	0.040	0.054	
			Right Touch	20175	1732.5	1	99	23.8	23.6	0.166	0.172	
						50	24	22.8	21.5	0.107	0.145	
			Right Tilt	20175	1732.5	1	99	23.8	23.6	0.053	0.055	
						50	24	22.8	21.5	0.038	0.051	
Body-worn	QPSK	15	Rear	20175	1732.5	1	99	23.8	23.6	0.393	0.408	20
						50	24	22.8	21.5	0.244	0.331	
			Front	20175	1732.5	1	99	23.8	23.6	0.373	0.387	
						50	24	22.8	21.5	0.230	0.312	
Hotspot	QPSK	10	Rear	20175	1732.5	1	99	21.8	21.7	0.492	0.504	
						50	50	20.8	19.6	0.304	0.403	
			Front	20175	1732.5	1	99	21.8	21.7	0.478	0.489	
						50	50	20.8	19.6	0.304	0.403	
			Edge 2	20175	1732.5	1	99	21.8	21.7	0.084	0.086	
						50	50	20.8	19.6	0.052	0.069	
			Edge 3	20175	1732.5	1	99	21.8	21.7	0.631	0.646	21
						50	50	20.8	19.6	0.406	0.538	
			Edge 4	20175	1732.5	1	99	21.8	21.7	0.175	0.179	
						50	50	20.8	19.6	0.111	0.147	

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10.8. LTE Band 5 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	20525	836.5	1	0	24.0	23.7	0.196	0.212	22
						25	0	23.0	21.5	0.127	0.179	
			Left Tilt	20525	836.5	1	0	24.0	23.7	0.127	0.138	
						25	0	23.0	21.5	0.074	0.104	
			Right Touch	20525	836.5	1	0	24.0	23.7	0.169	0.183	
						25	0	23.0	21.5	0.102	0.144	
			Right Tilt	20525	836.5	1	0	24.0	23.7	0.104	0.113	
						25	0	23.0	21.5	0.062	0.088	
Body-worn	QPSK	15	Rear	20525	836.5	1	0	24.0	23.7	0.359	0.389	23
						25	0	23.0	21.5	0.225	0.317	
			Front	20525	836.5	1	0	24.0	23.7	0.308	0.334	
						25	0	23.0	21.5	0.203	0.286	
Hotspot	QPSK	10	Rear	20525	836.5	1	0	24.0	23.7	0.538	0.583	24
						25	0	23.0	21.5	0.354	0.498	
			Front	20525	836.5	1	0	24.0	23.7	0.464	0.503	
						25	0	23.0	21.5	0.308	0.433	
			Edge 2	20525	836.5	1	0	24.0	23.7	0.382	0.414	
						25	0	23.0	21.5	0.249	0.350	
			Edge 3	20525	836.5	1	0	24.0	23.7	0.264	0.286	
						25	0	23.0	21.5	0.166	0.234	
			Edge 4	20525	836.5	1	0	24.0	23.7	0.106	0.115	
						25	0	23.0	21.5	0.069	0.097	

10.9. LTE Band 17 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	23790	710.0	1	0	24.0	23.5	0.113	0.127	25
						25	0	23.0	21.5	0.076	0.107	
			Left Tilt	23790	710.0	1	0	24.0	23.5	0.049	0.055	
						25	0	23.0	21.5	0.031	0.044	
			Right Touch	23790	710.0	1	0	24.0	23.5	0.100	0.112	
						25	0	23.0	21.5	0.064	0.089	
			Right Tilt	23790	710.0	1	0	24.0	23.5	0.055	0.061	
						25	0	23.0	21.5	0.028	0.039	
Body-worn	QPSK	15	Rear	23790	710.0	1	0	24.0	23.5	0.261	0.293	26
						25	0	23.0	21.5	0.181	0.255	
			Front	23790	710.0	1	0	24.0	23.5	0.222	0.249	
						25	0	23.0	21.5	0.145	0.204	
Hotspot	QPSK	10	Rear	23790	710.0	1	0	24.0	23.5	0.427	0.479	27
						25	0	23.0	21.5	0.270	0.380	
			Front	23790	710.0	1	0	24.0	23.5	0.349	0.392	
						25	0	23.0	21.5	0.232	0.326	
			Edge 2	23790	710.0	1	0	24.0	23.5	0.058	0.066	
						25	0	23.0	21.5	0.041	0.057	
			Edge 3	23790	710.0	1	0	24.0	23.5	0.145	0.163	
						25	0	23.0	21.5	0.094	0.133	
			Edge 4	23790	710.0	1	0	24.0	23.5	0.116	0.130	
						25	0	23.0	21.5	0.076	0.108	

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10.10. Wi-Fi (DTS Band)

Frequency Band	Mode	RF Exposure Conditions	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
2.4GHz	802.11b 1 Mbps	Head	0	Left Touch	1	2412	0.452	14.5	14.3			
				Left Tilt	1	2412	0.358	14.5	14.3			
				Right Touch	1	2412	0.838	14.5	14.3	0.631	0.668	28
				Rightt Tilt	1	2412	0.723	14.5	14.3	0.528	0.559	
		Body-worn	15	Rear	6	2437	0.115	17.5	17.3			
				Front	6	2437	0.131	17.5	17.3	0.092	0.097	29
		Hotspot & Wi-Fi Direct	10	Rear	6	2437	0.286	17.5	17.3	0.201	0.212	30
				Front	6	2437	0.273	17.5	17.3			
				Edge 1	6	2437	0.208	17.5	17.3			
				Edge 4	6	2437	0.173	17.5	17.3			

Note(s):

1. Highest *reported* SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.
2. Highest *reported* SAR is > 0.4 W/kg. Due to the highest *reported* SAR for this test position, other test positions in Head exposure condition were evaluated until a SAR ≤ 0.8 W/kg was *reported*.
3. Testing for a second channel was required because the *reported* SAR for this test position was >0.8 W/kg.
4. Additional testing required in order satisfying FCC simultaneous transmission limit criteria.

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10.11. Bluetooth

Standalone SAR Test Exclusion Considerations & Estimated SAR

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:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(GHz)}$ 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.

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:

- *(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√$f_{(GHz)}$/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.

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	SAR test exclusion Result*	Test Configuration	Estimated 1-g SAR (W/kg)
(dBm)	(mW)					
10.0	10	10	2.480	1.6	Rear/Front	0.210

Conclusion:

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

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11. SAR Measurement Variability

In accordance with published RF Exposure KDB 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 < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, 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 when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
700	LTE Band 17	Hotspot	Rear	No	0.427	N/A	N/A
850	GSM850	Hotspot	Rear	No	0.772	N/A	N/A
	WCDMA Band V	Hotspot	Rear	No	0.558	N/A	N/A
	LTE Band 5	Hotspot	Rear	No	0.538	N/A	N/A
1700	WCDMA Band IV	Hotspot	Edge 3	No	0.784	N/A	N/A
	LTE Band 4	Hotspot	Edge 3	No	0.631	N/A	N/A
1900	GSM 1900	Hotspot	Edge 3	Yes	0.843	0.813	1.04
	WCDMA Band II	Hotspot	Edge 3	Yes	0.928	0.927	1.00
	LTE Band 2	Hotspot	Edge 3	Yes	0.932	0.931	1.00
2400	Wi-Fi 802.11b/g/n	Head	Right Touch	No	0.631	N/A	N/A

Note(s):

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.

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12. 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:

SAR_1 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

SAR_2 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 $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$

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:

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

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations		
Head	1	GSM(Voice)	+	DTS
	3	GSM(GPRS)	+	DTS
	5	W-CDMA	+	DTS
	7	LTE	+	DTS
Body-worn	9	GSM(Voice)	+	DTS
	11	GSM(Voice)	+	BT
	12	GSM(GPRS)	+	DTS
	14	GSM(GPRS)	+	BT
	15	W-CDMA	+	DTS
	17	W-CDMA	+	BT
	18	LTE	+	DTS
	20	LTE	+	BT
Hotspot & Wi-Fi Direct	21	GSM(GPRS)	+	DTS
	23	W-CDMA	+	DTS
	25	LTE	+	DTS

Notes:
1. DTS support Hotspot and Wi-Fi Direct.
2. GPRS, W-CDMA and LTE support Hotspot.
3. VoIP is supported in GPRS, W-CDMA and LTE.
4. DTS Radio cannot transmit simultaneously with Bluetooth Radio.

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12.1. Sum of the SAR for WWAN & Wi-Fi & BT

RF Exposure conditions	① WWAN	② DTS	③ BT	① + ② WWAN + DTS		① + ③ WWAN + BT	
				∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Head	0.358	0.668		1.026	No		
Body-worn	0.797	0.097	0.210	0.894	No	1.007	No
Hotspot	1.077	0.212	0.210	1.289	No	1.287	No

Conclusion:

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

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Appendixes

Refer to separated files for the following appendixes.

15K22210-S1V3 FCC Report SAR_App A_Photos & Ant. Locations

15K22210-S1V3 FCC Report SAR_App B_Highest SAR Test Plots

15K22210-S1V3 FCC Report SAR_App C_System Check Plots

15K22210-S1V3 FCC Report SAR_App D_SAR Tissue Ingredients

15K22210-S1V3 FCC Report SAR_App E_Probe Cal. Certificates

15K22210-S1V3 FCC Report SAR_App F_Dipole Cal. Certificates

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