FCC 47 CFR § 2.1093
IEEE Std 1528-2013

SAR EVALUATION REPORT

FOR

GSM/WCDMA/LTE Phone + BT/BLE, DTS b/g/n

MODEL NUMBER: SM-J260MU/DS, SM-J260MU

FCC ID: A3LSMJ260MU

REPORT NUMBER: 4789294522-S1V1

ISSUE DATE: 1/17/2020

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Testing Laboratory

TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	1/17/2020	Initial Issue	--

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1. Attestation of Test Results

Applicant Name		SAMSUNG ELECTRONICS CO.,LTD.		
FCC ID		A3LSMJ260MU		
Model Number		SM-J260MU/DS, SM-J260MU		
Applicable Standards		FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013		
Exposure Category		**SAR Limits (W/Kg)**		
		Peak spatial-average (1g of tissue)		
General population / Uncontrolled exposure		1.6		
RF Exposure Conditions		**Equipment Class – The Highest Reported SAR (W/kg)**		
		Licensed	**DTS**	**DSS(BT)**
Head		0.54	1.15	0.16
Body-worn		0.56	0.16	N/A
Hotspot		0.92	0.35	
Standalone Tx	Head	1.58	1.58	0.70
	Body-worn	0.72		N/A
	Hotspot	1.23		
Date Tested		12/20/2019 to 1/16/2020		
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:
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1.1. The Highest Reported SAR for RF exposure conditions for each bands

Equipment Class	Band	The Highest Reported SAR (W/kg)		
		1g of tissue		
		Head Exposure condition	Body-worn Exposure condition	Hotspot Exposure condition
PCE	GSM 850	0.291	0.472	0.549
	GSM 1900	0.254	0.260	0.446
	WCDMA Band II	**0.543**	0.528	0.515
	WCDMA Band IV	0.426	0.369	0.425
	WCDMA Band V	0.337	**0.558**	0.636
	LTE Band 2	0.487	0.462	**0.924**
	LTE Band 4	0.410	0.383	0.745
	LTE Band 5	0.272	0.414	0.464
	LTE Band 12	0.154	0.310	0.403
	LTE Band 17	N/A	N/A	N/A
DTS	2.4GHz WLAN	**1.154**	**0.161**	**0.351**
DSS	Bluetooth	**0.156**	**N/A**	**N/A**

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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 v02r05
- 941225 D06 Hotspot Mode v02r01
- 971168 D01 Power Measurement License Digital System v03r01

In addition to the above, the following information was used:

- TCB workshop October, 2016; Page 7, RF Exposure Procedures (Bluetooth Duty Factor)
- TCB workshop October, 2016; Page 18, RF Exposure Procedures (DUT Holder Perturbations)
- TCB workshop October, 2014; Page 36, RF Exposure Procedures Update (Overlapping LTE Bands)
- TCB workshop April, 2019; Page 19, RF Exposure Procedures (Tissue Simulating Liquids (TSL))

3. Facilities and Accreditation

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

Suwon
SAR 1 Room
SAR 3 Room
SAR 4 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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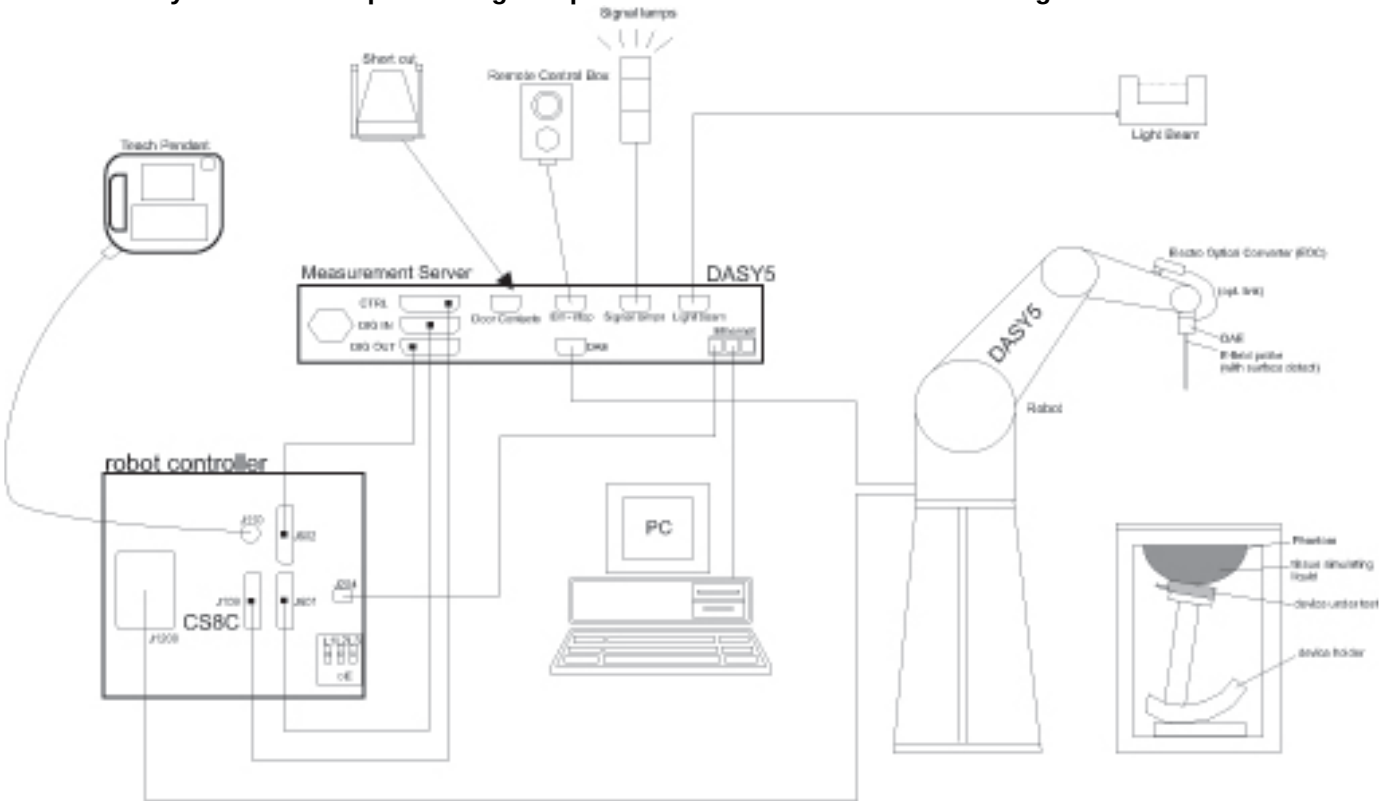
4. SAR Measurement System & Test Equipment

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	8-7-2020
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	6-18-2020
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3424	8-9-2020

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Agilent	N5181A	MY50145882	8-6-2020
Power Sensor	Agilent	U2000A	MY54260010	8-9-2020
Power Sensor	Agilent	U2000A	MY54260007	8-9-2020
Power Amplifier	EXODUS	1410025-AMP2027-10003	10003	8-8-2020
Directional Coupler	Agilent	772D	MY52180193	8-7-2020
Directional Coupler	Agilent	778D	MY52180432	8-7-2020
Low Pass Filter	MICROLAB	LA-15N	03943	8-7-2020
Low Pass Filter	FILTRON	L14012FL	1410003S	8-7-2020
Attenuator	Agilent	8491B/003	MY39269292	8-7-2020
Attenuator	Agilent	8491B/010	MY39269315	8-7-2020
Attenuator	Agilent	8491B/020	MY39269298	8-7-2020
E-Field Probe (SAR1)	SPEAG	EX3DV4	7376	9-27-2020
E-Field Probe (SAR3)	SPEAG	EX3DV4	7314	8-29-2020
E-Field Probe (SAR4)	SPEAG	EX3DV4	7545	9-23-2020
Data Acquisition Electronics (SAR1)	SPEAG	DAE4	1494	7-18-2020
Data Acquisition Electronics (SAR3)	SPEAG	DAE4	1468	9-20-2020
Data Acquisition Electronics (SAR4)	SPEAG	DAE4	1591	9-11-2020
System Validation Dipole	SPEAG	D750V3	1122	2-19-2020
System Validation Dipole	SPEAG	D835V2	4d174	1-23-2021
System Validation Dipole	SPEAG	D1750V2	1125	2-16-2020
System Validation Dipole	SPEAG	D1900V2	5d190	10-23-2020
System Validation Dipole	SPEAG	D2450V2	939	7-25-2021
Thermometer (SAR1)	Lutron	MHB-382SD	AH.91463	8-8-2020
Thermometer (SAR3)	Lutron	MHB-382SD	AH.50213	8-8-2020
Thermometer (SAR4)	Lutron	MHB-382SD	AJ.45903	5-17-2020

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	150313	8-8-2020
Base Station Simulator	R & S	CMW500	150314	8-8-2020
Base Station Simulator	R & S	CMW500	162790	8-9-2020
Wireless Connectivity Tester	R & S	CMW270	100982	8-5-2020

Note(s):

Refer to Appendix F that mentioned about justification for Extended SAR Dipole Calibrations
(D750V3, S/N : 1122, D1750V2, S/N : 1125, D1900V2, S/N : 5d190)

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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 and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

5.1. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Refer to Appendix A		
Back Cover	☒ Normal Battery Cover		
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.8 V, 1.5 A		
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 (Ch. 1 ~ Ch. 11)		
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz (Ch. 1 ~ Ch. 11)		
Test Sample Information	**No.**	**S/N**	**Notes**
	1	R38MC02TC1L	Main Conducted
	2	R38MC02TBTW	Wi-Fi Conducted
	3	R38MC08F19E	SAR
	4	R38MC08F0NZ	SAR
	5	R38MC08F18J	SAR

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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 Slot: 25% 3 Slot: 37.5% 4 Slot: 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 (Release 9) HSUPA (Release 9) DC-HSDPA (Release 9) HSPA+ (DL Only)		100%
LTE	FDD Band 2 FDD Band 4 FDD Band 5 FDD Band 12 FDD Band 17	QPSK 16QAM Rel. 10 Does not support Carrier Aggregation (CA)		100% (FDD)
	Does this device support SV-LTE (1xRTT-LTE)? ☐ Yes ☒ No			
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)		99.4% (802.11b) 96.6% (802.11g)
Bluetooth	2.4 GHz	Version 4.2 LE		76.9% (DH5)

Notes:

1. The Bluetooth protocol is considered source-based averaging. Bluetooth GFSK (DH5) was verified to have the highest duty cycle of 76.9% and was considered and used for SAR Testing.
2. For SAR evaluation of determined 802.11 modes according to KDB 248227, Duty cycle for Wi-Fi is referenced from DTS report.

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6.3. Nominal and Maximum Output Power

KDB 447498 sec.4.1. 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.

RF Air interface	Antenna	Mode	Time Slots	Max. RF Output Power (dBm)	
				Tune-up Limit	Frame Pwr
GSM850	Main Ant	Voice	1	**34.0**	**25.0**
		GPRS	1	**34.0**	**25.0**
		GPRS	2	**30.5**	**24.5**
		GPRS	3	**28.5**	**24.2**
		GPRS	4	**27.5**	**24.5**
		EGPRS	1	**26.0**	**17.0**
		EGPRS	2	**24.0**	**18.0**
		EGPRS	3	**23.0**	**18.7**
		EGPRS	4	**22.0**	**19.0**
GSM1900	Main Ant	Voice	1	**30.5**	**21.5**
		GPRS	1	**30.5**	**21.5**
		GPRS	2	**28.0**	**22.0**
		GPRS	3	**26.0**	**21.7**
		GPRS	4	**25.0**	**22.0**
		EGPRS	1	**25.5**	**16.5**
		EGPRS	2	**24.5**	**18.5**
		EGPRS	3	**22.5**	**18.2**
		EGPRS	4	**21.0**	**18.0**

RF Air interface	Antenna	Mode	Max. RF Output Power (dBm)	Reduced. RF Output Power (dBm)
W-CDMA Band II	Main Ant	R99	**23.5**	**20.5**
		HSDPA	**22.0**	**19.0**
		HSUPA	**22.0**	**19.0**
		DC-HSDPA	**21.5**	**18.5**
W-CDMA Band IV	Main Ant	R99	**23.5**	**20.5**
		HSDPA	**22.0**	**19.0**
		HSUPA	**21.5**	**18.5**
		DC-HSDPA	**21.5**	**18.5**
W-CDMA Band V	Main Ant	R99	**24.5**	
		HSDPA	**23.0**	
		HSUPA	**22.0**	
		DC-HSDPA	**22.0**	

Note(s):

1. The device utilizes power reduction under some portable hotspot conditions for SAR compliance. There is power reduction for WCDMA Band II and WCDMA Band IV. 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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RF Air interface	Antenna	Mode	Max. RF Output Power (dBm)
LTE Band 2	Main Ant	QPSK	**23.5**
LTE Band 4	Main Ant	QPSK	**24.0**
LTE Band 5	Main Ant	QPSK	**23.5**
LTE Band 12	Main Ant	QPSK	**24.0**
LTE Band 17	Main Ant	QPSK	**24.0**

Note(s):.

1. LTE QPSK configuration has the highest maximum average output power per 3GPP standard.

RF Air interface	Mode	WLAN mode power (dBm)	
		Max. RF Output Power	Reduced. RF Output Power
WiFi 2.4 GHz (Ch.1)	802.11b	**19.0**	**16.0**
	802.11g	**15.0**	**15.0**
	802.11n HT20	**15.0**	**15.0**
WiFi 2.4 GHz (Ch.2)	802.11b	**19.0**	**16.0**
	802.11g	**18.0**	**18.0**
	802.11n HT20	**16.0**	**16.0**
WiFi 2.4 GHz (Ch.3 - Ch.10)	802.11b	**19.0**	**16.0**
	802.11g	**18.0**	**18.0**
	802.11n HT20	**17.0**	**17.0**
WiFi 2.4 GHz (Ch.11)	802.11b	**19.0**	**16.0**
	802.11g	**16.0**	**16.0**
	802.11n HT20	**16.0**	**16.0**
WiFi 2.4 GHz (Ch.12)	802.11b	**19.0**	**16.0**
	802.11g	**14.0**	**14.0**
	802.11n HT20	**14.0**	**14.0**
WiFi 2.4 GHz (Ch.13)	802.11b	**14.0**	**14.0**
	802.11g	**8.0**	**8.0**
	802.11n HT20	**8.0**	**8.0**
Bluetooth		**10.0**	
Bluetooth-EDR		**2.0**	

Note(s):

1. This device uses an independent fixed level power reduction mechanism for only 802.11b mode operations during voice or VoIP held to ear scenarios. Per FCC Guidance, the held-to-ear exposure conditions were evaluated at reduce power according to the head SAR positions described in IEEE 1528-2013. Detailed descriptions of the power reductions mechanism are included in the operational description.

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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 12	Frequency range: 699 – 716 MHz					
		Channel Bandwidth					
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz
	Low			23060/ 704	23035/ 701.5	23025/ 700.5	23017/ 699.7
	Mid			23095/ 707.5	23095/ 707.5	23095/ 707.5	23095/ 707.5
	High			23130/ 711	23155/ 713.5	23165/ 714.5	23173/ 715.3
	Band 17	Frequency range: 704 - 716 MHz					
		Channel Bandwidth					
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz
	Low			23780/ 709	23205/ 706.5		
	Mid			23790/ 710	23790/ 710		
	High			23800 711	23255/ 713.5		

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General LTE SAR Test and Reporting Considerations (Continued)

LTE transmitter and antenna implementation	Refer to Appendix A.
Maximum power reduction (MPR)	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3 Modulation: Channel bandwidth / Transmission bandwidth (N_{RB}) 1.4 MHz, 3.0 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz; MPR (dB) 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 64 QAM: ≤ 5, ≤ 4, ≤ 8, ≤ 12, ≤ 16, ≤ 18, ≤ 2 64 QAM: > 5, > 4, > 8, > 12, > 16, > 18, ≤ 3 256 QAM: ≥ 1, ≤ 5 MPR Built-in by design The manufacturer MPR values are always within the 3GPP maximum MPR allowance but may not follow the default MPR values. A-MPR (additional MPR) was disabled during SAR testing
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.

Note(s):

1. SAR Testing for LTE was performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
2. Maximum bandwidth 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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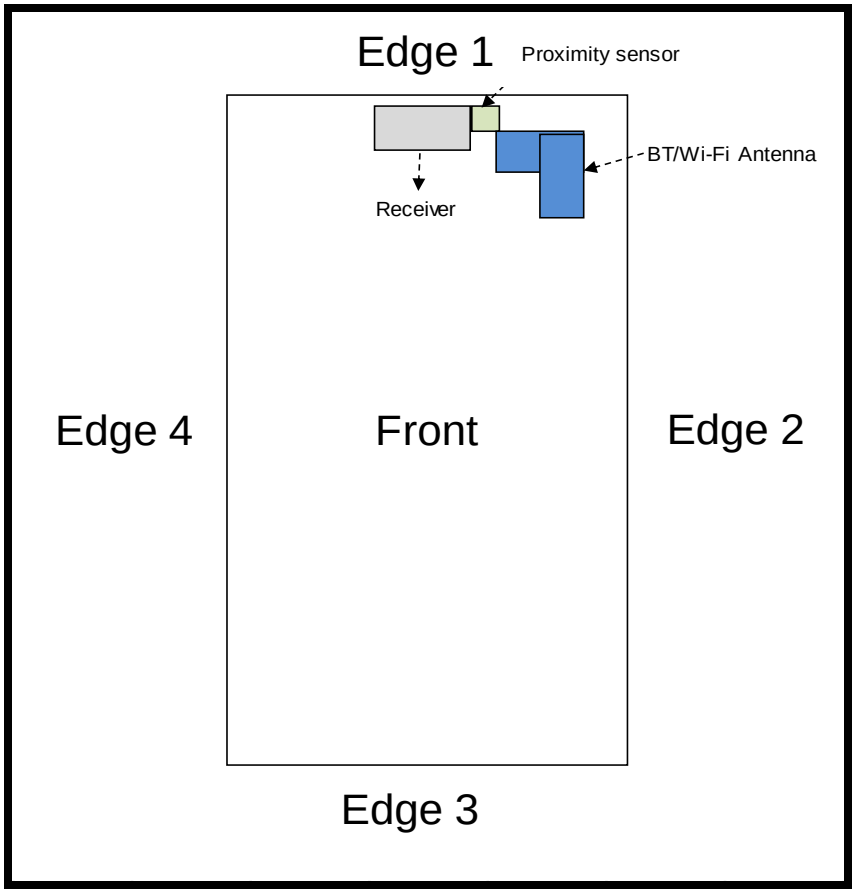
6.5. Proximity sensor feature

The DUT has one proximity sensor to reduce the output power. The position of the sensor and antenna are as shown in the graphic.



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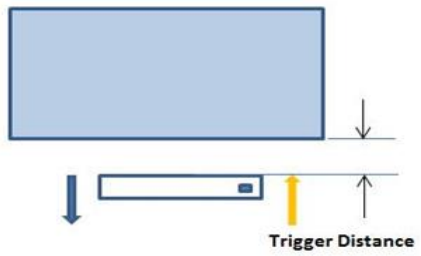
6.5.1. Proximity Sensor Triggering Distance (KDB 616217 §6.2)

Front of the DUT was placed directly below the flat phantom. The DUT was moved toward the phantom in accordance with the steps outlined in KDB 616217 §6.2 to determine the trigger distance for enabling power reduction. The DUT was moved away from the phantom to determine the trigger distance for resuming full power.

The DUT featured a visual indicator on its display that showed the status of the proximity sensor (Triggered or not triggered). This was used to determine the status of the sensor during the proximity sensor assessment as monitoring the output power directly was not practical without affecting the measurement.

It was confirmed separately that the output power was altered according to the proximity sensor status indication. This was achieved by observing the proximity sensor status at the same time as monitoring the conducted power. Section 9 contains both the full and reduced conducted power measurements.



Proximity Sensor Trigger Distance Assessment
KDB 616217 §6.2, Front

LEGEND

Direction of DUT travel for determination of power reduction triggering point

Direction of DUT travel for determination of full power resumption triggering point

Summary of Trigger Distances

Tissue Simulating Liquid	Trigger distance - Front	
	Moving toward phantom	Moving from phantom
2450 Head	70 mm	79 mm

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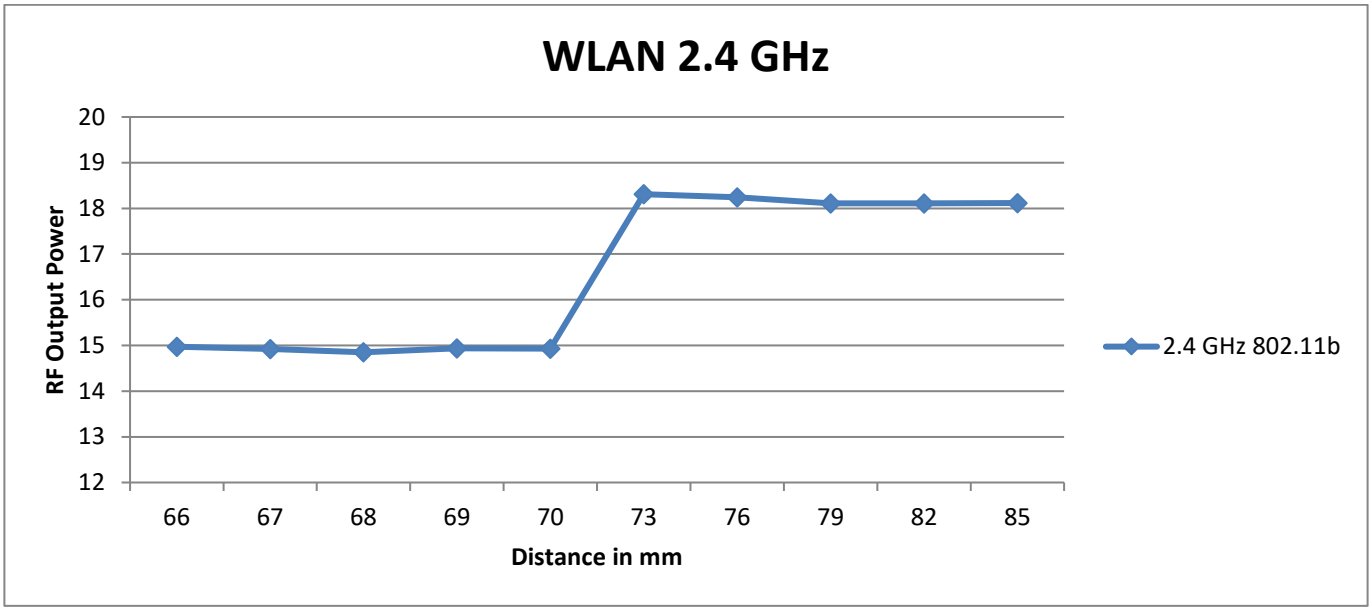
Proximity Sensor Triggering Distance Measurement Results

WLAN 2.4 GHz

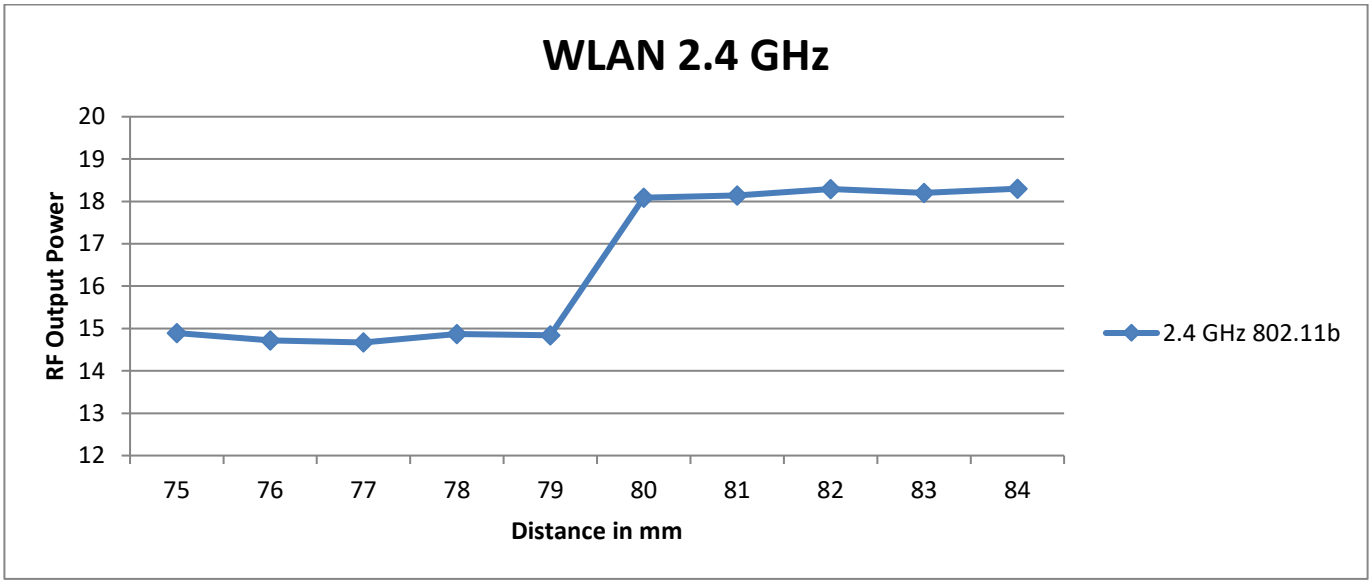
Front, DUT Moving Toward (Trigger) from the Phantom

	Distance to DUT vs. Output Power in dBm										
Antenna	Distance	66	67	68	69	70	73	76	79	82	85
2.4 GHz	2.4 GHz 802.11b	15.0	14.9	14.9	14.9	14.9	18.3	18.2	18.1	18.1	18.1



Front, DUT Moving Away (Release) from the Phantom

	Distance to DUT vs. Output Power in dBm										
Antenna	Distance (mm)	75	76	77	78	79	80	81	82	83	84
2.4 GHz	2.4 GHz 802.11b	14.9	14.7	14.7	14.9	14.8	18.1	18.1	18.3	18.2	18.3



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6.5.2. Resulting test positions for SAR measurements

Wireless technologies	Position	§6.2 Triggering Distance	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for SAR
WLAN	Front	70 mm	N/A	N/A	69 mm

Notes:

1. Worst case distance for SAR is not considered for body exposure condition. Because Power reduction is applied only voice or VoIP held to ear scenarios.
2. This proximity sensor is only operating in Head exposure condition. so tilt (15 degree) position of Head exposure was additional verified.

7. RF Exposure Conditions (Test Configurations)

Refer to Appendix A for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

Wireless technologies	RF Exposure Conditions	Antenaa	DUT-to-User Separation	Test Position	Antenna-to-edge/surface	SAR Required	Note
WWAN	Head	Main.	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-worn	Main.	15 mm	Rear	N/A	Yes	
				Front	N/A	Yes	
	Hotspot	Main.	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 & BT	Head	Wi-Fi & BT Ant.	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-worn		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	Yes	
				Edge 2 (Right)	< 25 mm	Yes	
				Edge 3 (Bottom)	> 25 mm	No	1
				Edge 4 (Left)	> 25 mm	No	1

Notes:

1. SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hotspot 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

SAR test were performed in all RF exposure conditions using Head tissue according to TCB workshop note in April, 2019.

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 ±(%)
1-09-2020	Head 835	e'	42.0600	Relative Permittivity (ε_r):	42.06	41.50	1.35	5
		e''	19.6500	Conductivity (σ):	0.91	0.90	1.37	5
	Head 820	e'	42.2100	Relative Permittivity (ε_r):	42.21	41.60	1.46	5
		e''	19.6900	Conductivity (σ):	0.90	0.90	-0.08	5
	Head 850	e'	41.9100	Relative Permittivity (ε_r):	41.91	41.50	0.99	5
		e''	19.6000	Conductivity (σ):	0.93	0.92	1.24	5
1-13-2020	Head 835	e'	42.0500	Relative Permittivity (ε_r):	42.05	41.50	1.33	5
		e''	19.2800	Conductivity (σ):	0.90	0.90	-0.54	5
	Head 820	e'	42.2200	Relative Permittivity (ε_r):	42.22	41.60	1.48	5
		e''	19.3100	Conductivity (σ):	0.88	0.90	-2.01	5
	Head 850	e'	41.8700	Relative Permittivity (ε_r):	41.87	41.50	0.89	5
		e''	19.2600	Conductivity (σ):	0.91	0.92	-0.52	5
1-16-2020	Head 835	e'	40.4400	Relative Permittivity (ε_r):	40.44	41.50	-2.55	5
		e''	19.7200	Conductivity (σ):	0.92	0.90	1.73	5
	Head 820	e'	40.6200	Relative Permittivity (ε_r):	40.62	41.60	-2.36	5
		e''	19.7500	Conductivity (σ):	0.90	0.90	0.23	5
	Head 850	e'	40.2600	Relative Permittivity (ε_r):	40.26	41.50	-2.99	5
		e''	19.7000	Conductivity (σ):	0.93	0.92	1.76	5

SAR 3 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1-08-2020	Head 750	e'	41.6600	Relative Permittivity (ε_r):	41.66	41.96	-0.72	5
		e''	21.7800	Conductivity (σ):	0.91	0.89	1.70	5
	Head 700	e'	41.7600	Relative Permittivity (ε_r):	41.76	42.22	-1.08	5
		e''	22.7600	Conductivity (σ):	0.89	0.89	-0.38	5
	Head 790	e'	41.5100	Relative Permittivity (ε_r):	41.51	41.76	-0.59	5
		e''	20.9000	Conductivity (σ):	0.92	0.90	2.44	5
1-09-2020	Head 2450	e'	39.1900	Relative Permittivity (ε_r):	39.19	39.20	-0.03	5
		e''	13.2800	Conductivity (σ):	1.81	1.80	0.51	5
	Head 2400	e'	39.2600	Relative Permittivity (ε_r):	39.26	39.30	-0.09	5
		e''	13.2600	Conductivity (σ):	1.77	1.75	1.02	5
	Head 2480	e'	39.1400	Relative Permittivity (ε_r):	39.14	39.16	-0.06	5
		e''	13.3000	Conductivity (σ):	1.83	1.83	0.09	5
1-13-2020	Head 2450	e'	38.1700	Relative Permittivity (ε_r):	38.17	39.20	-2.63	5
		e''	13.3300	Conductivity (σ):	1.82	1.80	0.88	5
	Head 2400	e'	38.2500	Relative Permittivity (ε_r):	38.25	39.30	-2.66	5
		e''	13.2800	Conductivity (σ):	1.77	1.75	1.17	5
	Head 2480	e'	38.1100	Relative Permittivity (ε_r):	38.11	39.16	-2.69	5
		e''	13.3800	Conductivity (σ):	1.85	1.83	0.69	5

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SAR 4 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1-08-2020	Head 1750	e'	39.9900	Relative Permittivity (ε_r):	39.99	40.08	-0.24	5
		e"	13.8900	Conductivity (σ):	1.35	1.37	-1.27	5
	Head 1710	e'	40.0300	Relative Permittivity (ε_r):	40.03	40.15	-0.29	5
		e"	14.0100	Conductivity (σ):	1.33	1.35	-1.06	5
	Head 1755	e'	39.9800	Relative Permittivity (ε_r):	39.98	40.08	-0.24	5
		e"	13.8800	Conductivity (σ):	1.35	1.37	-1.26	5
1-08-2020	Head 1900	e'	39.8200	Relative Permittivity (ε_r):	39.82	40.00	-0.45	5
		e"	13.6800	Conductivity (σ):	1.45	1.40	3.23	5
	Head 1850	e'	39.8900	Relative Permittivity (ε_r):	39.89	40.00	-0.27	5
		e"	13.7200	Conductivity (σ):	1.41	1.40	0.81	5
	Head 1910	e'	39.7900	Relative Permittivity (ε_r):	39.79	40.00	-0.53	5
		e"	13.6800	Conductivity (σ):	1.45	1.40	3.77	5
1-13-2020	Head 1750	e'	40.0800	Relative Permittivity (ε_r):	40.08	40.08	-0.01	5
		e"	13.7700	Conductivity (σ):	1.34	1.37	-2.12	5
	Head 1710	e'	40.1300	Relative Permittivity (ε_r):	40.13	40.15	-0.04	5
		e"	13.8200	Conductivity (σ):	1.31	1.35	-2.41	5
	Head 1755	e'	40.0700	Relative Permittivity (ε_r):	40.07	40.08	-0.02	5
		e"	13.7700	Conductivity (σ):	1.34	1.37	-2.05	5
1-13-2020	Head 1900	e'	39.8100	Relative Permittivity (ε_r):	39.81	40.00	-0.47	5
		e"	13.6800	Conductivity (σ):	1.45	1.40	3.23	5
	Head 1850	e'	39.9100	Relative Permittivity (ε_r):	39.91	40.00	-0.23	5
		e"	13.7100	Conductivity (σ):	1.41	1.40	0.73	5
	Head 1910	e'	39.7900	Relative Permittivity (ε_r):	39.79	40.00	-0.53	5
		e"	13.6800	Conductivity (σ):	1.45	1.40	3.77	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 2.5 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 1.4 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
D750V3	1122	2-19-2018	750	1g	8.22
				10g	5.35
D835V2	4d174	1-23-2019	835	1g	9.28
				10g	6.04
D1750V2	1125	2-16-2018	1750	1g	36.50
				10g	19.30
D1900V2	5d190	10-23-2018	1900	1g	39.10
				10g	20.40
D2450V2	939	7-25-2019	2450	1g	53.20
				10g	25.10

Note(s):

Refer to Appendix F that mentioned about justification for Extended SAR Dipole Calibrations
(D750V3, S/N : 1122, D1750V2, S/N : 1125, D1900V2, S/N : 5d190)

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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			
1-09-2020	D835V2	4d174	Head	1g	0.91	9.05	9.28	-2.48	
				10g	0.60	5.97	6.04	-1.16	
1-13-2020	D835V2	4d174	Head	1g	0.95	9.54	9.28	2.80	1,2
				10g	0.63	6.28	6.04	3.97	
1-16-2020	D835V2	4d174	Head	1g	0.93	9.27	9.28	-0.11	
				10g	0.61	6.11	6.04	1.16	

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			
1-08-2020	D750V3	1122	Head	1g	0.85	8.54	8.22	3.89	3,4
				10g	0.57	5.65	5.35	5.61	
1-09-2020	D2450V2	939	Head	1g	5.28	52.80	53.20	-0.75	
				10g	2.45	24.50	25.10	-2.39	
1-13-2020	D2450V2	939	Head	1g	5.17	51.70	53.20	-2.82	5,6
				10g	2.39	23.90	25.10	-4.78	

SAR 4 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			
1-08-2020	D1750V2	1125	Head	1g	3.73	37.30	36.50	2.19	7,8
				10g	1.97	19.70	19.30	2.07	
1-08-2020	D1900V2	5d190	Head	1g	3.76	37.60	39.10	-3.84	9,10
				10g	1.93	19.30	20.40	-5.39	
1-13-2020	D1750V2	1125	Head	1g	3.71	37.10	36.50	1.64	
				10g	1.99	19.90	19.30	3.11	
1-13-2020	D1900V2	5d190	Head	1g	3.84	38.40	39.10	-1.79	
				10g	2.00	20.00	20.40	-1.96	

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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

Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Maximum Average Power (dBm)			
					Measured		Tune-up Limit	
					Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr
GSM (Voice)	CS1	1	128	824.2	33.0	24.0	34.0	25.0
			190	836.6	33.2	24.2		
			251	848.8	33.4	24.4		
GPRS (GMSK)	CS1	1	128	824.2	33.4	24.4	34.0	**25.0**
			190	836.6	33.3	24.3		
			251	848.8	33.4	24.4		
		2	128	824.2	29.2	23.2	30.5	24.5
			190	836.6	29.4	23.4		
			251	848.8	29.6	23.6		
		3	128	824.2	27.4	23.2	28.5	24.2
			190	836.6	27.6	23.4		
			251	848.8	27.8	23.5		
		4	128	824.2	26.4	23.4	27.5	24.5
			190	836.6	26.4	23.4		
			251	848.8	26.5	23.5		
EGPRS (8PSK)	MCS5	1	128	824.2	25.5	16.5	26.0	17.0
			190	836.6	25.7	16.7		
			251	848.8	25.7	16.6		
		2	128	824.2	22.9	16.9	24.0	18.0
			190	836.6	23.2	17.2		
			251	848.8	23.1	17.1		
		3	128	824.2	21.9	17.6	23.0	18.7
			190	836.6	22.1	17.9		
			251	848.8	22.1	17.9		
		4	128	824.2	21.0	18.0	22.0	19.0
			190	836.6	21.1	18.1		
			251	848.8	21.2	18.2		

Notes:

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

- GMSK (GPRS) mode with 1 time slot for Max power, based on the Tune-up Procedure. Refer to §6.3.
- SAR is not required for EGPRS (8PSK) mode because the maximum output power and tune-up limit is ≤ 1/4dB higher than GMSK GPRS or the adjusted SAR of the highest reported SAR of GMSK GPRS is ≤ 1.2W/kg.

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GSM1900 Measured Results

Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Maximum Average Power (dBm)			
					Measured		Tune-up Limit	
					Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr
GSM (Voice)	CS1	1	512	1850.2	29.2	20.2	30.5	21.5
			661	1880.0	29.3	20.3		
			810	1909.8	29.1	20.1		
GPRS (GMSK)	CS1	1	512	1850.2	29.2	20.2	30.5	21.5
			661	1880.0	29.4	20.4		
			810	1909.8	29.2	20.2		
		2	512	1850.2	26.6	20.6	28.0	22.0
			661	1880.0	26.7	20.7		
			810	1909.8	26.8	20.7		
		3	512	1850.2	24.7	20.4	26.0	21.7
			661	1880.0	24.7	20.5		
			810	1909.8	24.5	20.3		
		4	512	1850.2	23.3	20.3	25.0	**22.0**
			661	1880.0	23.2	20.2		
			810	1909.8	23.0	20.0		
EGPRS (8PSK)	MCS5	1	512	1850.2	24.7	15.6	25.5	16.5
			661	1880.0	24.7	15.7		
			810	1909.8	24.5	15.4		
		2	512	1850.2	23.4	17.4	24.5	18.5
			661	1880.0	23.5	17.4		
			810	1909.8	23.2	17.2		
		3	512	1850.2	21.5	17.3	22.5	18.2
			661	1880.0	21.5	17.2		
			810	1909.8	21.3	17.0		
		4	512	1850.2	20.1	17.1	21.0	18.0
			661	1880.0	20.1	17.1		
			810	1909.8	19.9	16.9		

Notes:

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

- GMSK (GPRS) mode with 4 time slots for Max power, based on the Tune-up Procedure. Refer to §6.3.
- SAR is not required for EGPRS (8PSK) mode because the maximum output power and tune-up limit is ≤ 1/4dB higher than GMSK GPRS or the adjusted SAR of the highest reported SAR of GMSK GPRS is ≤ 1.2W/kg.

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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	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	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 table C,11.1.3 of 3GPP TS 34.121-1 v13.
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	-
	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-DPCCH	6	8	8	5	0
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	12
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	67
	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 Channelization 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.		

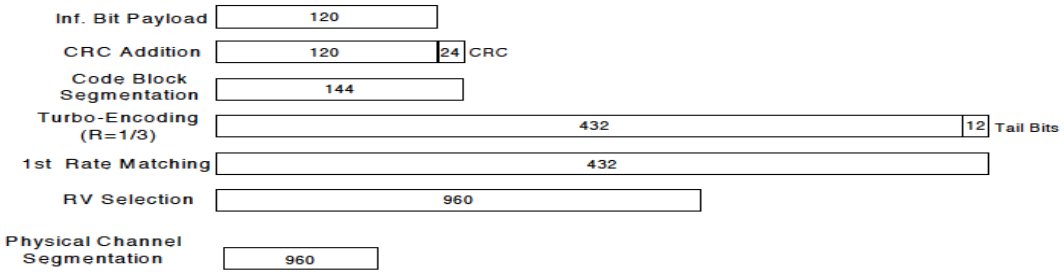

Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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 12			
	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+

HSPA+ is only support to down link. Therefore, the RF conducted power is not measured

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W-CDMA Band II Measured Results

Mode		UL Ch No.	Freq. (MHz)	Maximum Average Power (dBm)			Reduced Average Power (dBm) Hotspot back-off (state 3)		
				Measured Pw r	MPR	Tune-up Limit	Measured Pw r	MPR	Tune-up Limit
Release 99	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	22.0	N/A	23.5	18.9	N/A	20.5
		9400	1880.0	22.1			19.1		
		9538	1907.6	22.0			19.3		
HSDPA	Subtest 1	9262	1852.4	20.9	0	22.0	17.9	0	19.0
		9400	1880.0	21.1			18.1		
		9538	1907.6	21.0			18.2		
	Subtest 2	9262	1852.4	21.0	0	22.0	17.9	0	19.0
		9400	1880.0	21.1			18.0		
		9538	1907.6	21.0			18.2		
	Subtest 3	9262	1852.4	20.5	0.5	21.5	17.4	0.5	18.5
		9400	1880.0	20.6			17.6		
		9538	1907.6	20.6			17.8		
	Subtest 4	9262	1852.4	20.4	0.5	21.5	17.4	0.5	18.5
		9400	1880.0	20.7			17.6		
		9538	1907.6	20.6			17.8		
HSUPA	Subtest 1	9262	1852.4	20.5	0	22.0	17.9	0	19.0
		9400	1880.0	21.0			17.8		
		9538	1907.6	20.6			18.1		
	Subtest 2	9262	1852.4	19.9	1	21.0	16.6	1	18.0
		9400	1880.0	19.8			16.5		
		9538	1907.6	19.9			16.8		
	Subtest 3	9262	1852.4	19.9	1	21.0	16.8	1	18.0
		9400	1880.0	19.5			16.2		
		9538	1907.6	19.9			16.5		
	Subtest 4	9262	1852.4	19.9	1	21.0	16.8	1	18.0
		9400	1880.0	19.8			17.4		
		9538	1907.6	19.9			17.1		
	Subtest 5	9262	1852.4	20.5	0	22.0	17.4	0	19.0
		9400	1880.0	20.6			17.5		
		9538	1907.6	20.5			17.7		
DC-HSDPA	Subtest 1	9262	1852.4	21.0	0	21.5	18.0	0	18.5
		9400	1880.0	21.0			18.1		
		9538	1907.6	21.1			18.2		
	Subtest 2	9262	1852.4	20.9	0	21.5	17.9	0	18.5
		9400	1880.0	21.0			18.0		
		9538	1907.6	21.0			18.1		
	Subtest 3	9262	1852.4	20.4	0.5	21.0	17.4	0.5	18.0
		9400	1880.0	20.6			17.5		
		9538	1907.6	20.5			17.7		
	Subtest 4	9262	1852.4	20.4	0.5	21.0	17.4	0.5	18.0
		9400	1880.0	20.6			17.5		
		9538	1907.6	20.6			17.7		

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W-CDMA Band IV Measured Results

Mode		UL Ch No.	Freq. (MHz)	Maximum Average Power (dBm)			Reduced Average Power (dBm) Hotspot back-off		
				Measured Pwr	MPR	Tune-up Limit	Measured Pwr	MPR	Tune-up Limit
Release 99	Rel 99 (RMC, 12.2 kbps)	1312	1712.4	21.9	N/A	23.5	19.1	N/A	20.5
		1413	1732.6	22.1			19.1		
		1513	1752.6	22.2			19.4		
HSDPA	Subtest 1	1312	1712.4	20.3	0	22.0	17.6	0	19.0
		1413	1732.6	20.5			17.6		
		1513	1752.6	20.6			17.8		
	Subtest 2	1312	1712.4	20.3	0	22.0	17.6	0	19.0
		1413	1732.6	20.5			17.6		
		1513	1752.6	20.6			17.8		
	Subtest 3	1312	1712.4	19.9	0.5	21.5	17.0	0.5	18.5
		1413	1732.6	20.0			17.0		
		1513	1752.6	20.1			17.3		
	Subtest 4	1312	1712.4	19.9	0.5	21.5	17.0	0.5	18.5
		1413	1732.6	20.1			17.0		
		1513	1752.6	20.1			17.3		
HSUPA	Subtest 1	1312	1712.4	19.0	0	21.5	17.3	0	18.5
		1413	1732.6	19.1			17.3		
		1513	1752.6	19.8			16.5		
	Subtest 2	1312	1712.4	19.0	1	20.5	16.1	1	17.5
		1413	1732.6	19.1			16.0		
		1513	1752.6	19.1			16.4		
	Subtest 3	1312	1712.4	18.7	1	20.5	15.7	1	17.5
		1413	1732.6	18.8			15.7		
		1513	1752.6	19.0			16.1		
	Subtest 4	1312	1712.4	19.9	1	20.5	17.1	1	17.5
		1413	1732.6	19.8			16.9		
		1513	1752.6	20.1			17.0		
	Subtest 5	1312	1712.4	20.0	0	21.5	17.2	0	18.5
		1413	1732.6	20.0			16.6		
		1513	1752.6	20.1			16.8		
DC-HSDPA	Subtest 1	1312	1712.4	20.4	0	21.5	17.6	0	18.5
		1413	1732.6	20.5			17.6		
		1513	1752.6	20.6			17.8		
	Subtest 2	1312	1712.4	20.3	0	21.5	17.7	0	18.5
		1413	1732.6	20.5			17.6		
		1513	1752.6	20.6			17.8		
	Subtest 3	1312	1712.4	19.9	0.5	21.0	17.1	0.5	18.0
		1413	1732.6	20.0			17.0		
		1513	1752.6	20.1			17.3		
	Subtest 4	1312	1712.4	19.9	0.5	21.0	17.1	0.5	18.0
		1413	1732.6	20.0			17.0		
		1513	1752.6	20.1			17.3		

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W-CDMA Band V Measured Results

Mode		UL Ch No.	Freq. (MHz)	Maximum Average Power (dBm)		
				Measured Pwr	MPR	Tune-up Limit
Release 99	Rel 99 (RMC, 12.2 kbps)	4132	826.4	23.1	N/A	24.5
		4183	836.6	23.2		
		4233	846.6	23.2		
HSDPA	Subtest 1	4132	826.4	21.6	0	23.0
		4183	836.6	21.7		
		4233	846.6	21.8		
	Subtest 2	4132	826.4	21.6	0	23.0
		4183	836.6	21.7		
		4233	846.6	21.8		
	Subtest 3	4132	826.4	21.1	0.5	22.5
		4183	836.6	21.1		
		4233	846.6	21.2		
	Subtest 4	4132	826.4	21.1	0.5	22.5
		4183	836.6	21.1		
		4233	846.6	21.2		
HSUPA	Subtest 1	4132	826.4	21.4	0	22.0
		4183	836.6	21.0		
		4233	846.6	21.3		
	Subtest 2	4132	826.4	20.2	1	21.0
		4183	836.6	20.2		
		4233	846.6	20.4		
	Subtest 3	4132	826.4	20.3	1	21.0
		4183	836.6	19.8		
		4233	846.6	20.0		
	Subtest 4	4132	826.4	20.5	1	21.0
		4183	836.6	20.4		
		4233	846.6	20.7		
	Subtest 5	4132	826.4	21.1	0	22.0
		4183	836.6	21.2		
		4233	846.6	21.3		
DC-HSDPA	Subtest 1	4132	826.4	21.6	0	22.0
		4183	836.6	21.7		
		4233	846.6	21.6		
	Subtest 2	4132	826.4	21.7	0	22.0
		4183	836.6	21.7		
		4233	846.6	21.8		
	Subtest 3	4132	826.4	21.1	0.5	21.5
		4183	836.6	21.2		
		4233	846.6	21.3		
	Subtest 4	4132	826.4	21.1	0.5	21.5
		4183	836.6	21.2		
		4233	846.6	21.2		

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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 1, 2 and 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{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
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
256 QAM	≥ 1						≤ 5

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 Signaling Value of “NS_01”.

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

Network Signalling value	Requirements (subclause)	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	N/A

<u>Maximum Output Power (Tune-up Limit) for LTE</u>

According to April 2015 TCB workshop, SAR test exclusion can be applied for testing overlapping LTE bands as follows :

a) The maximum output power, including tolerance, for the smaller band must be ≤ the larger band to qualify for the SAR test exclusion.
b) The channel bandwidth and other operating parameters for the smaller band must be fully supported by the larger band.

- LTE Band 17 (704 – 716 MHz) is covered by LTE Band 12 (699 – 716 MHz)

Maximum bandwidth 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.

LTE QPSK configuration has the highest maximum average output power per 3GPP standard.

SAR measurement is not required for Higher order modulations. When the highest maximum output power for Higher order modulations are ≤ 0.5 dB higher than the QPSK or when the reported SAR for QPSK configuration is ≤ 1.45 W/kg.

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Max power Results

LTE Band 2 Measured Results

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				Measured Pwr (dBm)			MPR	Tune-up Limit
				18700	18900	19100		
				1860 MHz	1880 MHz	1900 MHz		
20 MHz	QPSK	1	0	22.0	21.9	22.2	0.0	23.5
		1	49	22.2	22.0	22.3	0.0	23.5
		1	99	21.9	21.7	22.3	0.0	23.5
		50	0	21.2	21.2	21.2	1.0	22.5
		50	24	21.1	21.1	21.1	1.0	22.5
		50	50	21.1	21.2	21.2	1.0	22.5
		100	0	21.1	21.1	21.1	1.0	22.5
	16QAM	1	0	21.6	21.4	21.3	1.0	22.5
		1	49	21.6	21.3	21.2	1.0	22.5
		1	99	21.0	20.6	20.7	1.0	22.5
		50	0	20.1	20.4	20.0	2.0	21.5
		50	24	20.2	20.3	20.3	2.0	21.5
		50	50	20.1	20.3	20.1	2.0	21.5
		100	0	20.0	20.3	20.2	2.0	21.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				18675	18900	19125		
				1857.5 MHz	1880 MHz	1902.5 MHz		
15 MHz	QPSK	1	0	21.9	22.5	22.0	0.0	23.5
		1	37	22.4	22.4	22.4	0.0	23.5
		1	74	22.1	22.3	22.1	0.0	23.5
		36	0	21.2	21.2	21.2	1.0	22.5
		36	20	21.3	21.2	21.3	1.0	22.5
		36	39	21.2	21.1	21.2	1.0	22.5
		75	0	21.3	21.2	21.1	1.0	22.5
	16QAM	1	0	21.2	21.4	21.4	1.0	22.5
		1	37	21.6	21.5	21.7	1.0	22.5
		1	74	21.8	21.3	20.6	1.0	22.5
		36	0	20.1	20.4	20.1	2.0	21.5
		36	20	20.2	20.3	20.5	2.0	21.5
		36	39	20.1	20.1	20.2	2.0	21.5
		75	0	20.1	20.3	20.2	2.0	21.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				18650	18900	19150		
				1855 MHz	1880 MHz	1905 MHz		
10 MHz	QPSK	1	0	21.7	22.3	22.3	0.0	23.5
		1	25	22.3	22.5	22.4	0.0	23.5
		1	49	22.4	22.3	22.1	0.0	23.5
		25	0	21.3	21.2	21.2	1.0	22.5
		25	12	21.4	21.2	21.4	1.0	22.5
		25	25	21.2	21.0	21.3	1.0	22.5
		50	0	21.2	21.2	21.2	1.0	22.5
	16QAM	1	0	20.9	21.5	21.1	1.0	22.5
		1	25	21.2	21.6	20.7	1.0	22.5
		1	49	21.2	21.2	20.6	1.0	22.5
		25	0	20.6	20.2	20.3	2.0	21.5
		25	12	20.6	20.2	20.5	2.0	21.5
		25	25	20.2	20.1	20.5	2.0	21.5
		50	0	20.3	20.2	20.2	2.0	21.5

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LTE Band 2 Measured Results (continued)

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				18625	18900	19175		
				1852.5 MHz	1880 MHz	1907.5 MHz		
5 MHz	QPSK	1	0	21.8	22.0	22.1	0.0	23.5
		1	12	22.1	22.3	22.3	0.0	23.5
		1	24	22.0	22.2	22.1	0.0	23.5
		12	0	21.2	21.2	21.2	1.0	22.5
		12	7	21.2	21.2	21.3	1.0	22.5
		12	13	21.2	21.1	21.3	1.0	22.5
		25	0	21.1	21.1	21.2	1.0	22.5
	16QAM	1	0	20.6	20.8	20.6	1.0	22.5
		1	12	20.7	20.8	20.7	1.0	22.5
		1	24	20.9	20.5	20.5	1.0	22.5
		12	0	20.0	20.2	20.2	2.0	21.5
		12	7	20.1	20.0	20.2	2.0	21.5
		12	13	20.2	20.0	20.2	2.0	21.5
		25	0	20.1	20.1	20.3	2.0	21.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				18615	18900	19185		
				1851.5 MHz	1880 MHz	1908.5 MHz		
3 MHz	QPSK	1	0	22.0	22.0	22.3	0.0	23.5
		1	8	22.1	22.2	22.2	0.0	23.5
		1	14	22.1	22.1	22.4	0.0	23.5
		8	0	21.1	21.2	21.3	1.0	22.5
		8	4	21.1	21.1	21.2	1.0	22.5
		8	7	21.2	21.1	21.2	1.0	22.5
		15	0	21.2	21.2	21.2	1.0	22.5
	16QAM	1	0	20.7	20.9	21.2	1.0	22.5
		1	8	20.7	21.1	21.3	1.0	22.5
		1	14	20.7	21.0	21.1	1.0	22.5
		8	0	20.1	20.0	20.7	2.0	21.5
		8	4	20.1	20.1	20.2	2.0	21.5
		8	7	20.2	20.0	20.3	2.0	21.5
		15	0	20.1	20.1	20.3	2.0	21.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				18607	18900	19193		
				1850.7 MHz	1880 MHz	1909.3 MHz		
1.4 MHz	QPSK	1	0	21.8	22.2	22.1	0.0	23.5
		1	3	21.9	22.2	22.2	0.0	23.5
		1	5	21.8	22.1	22.1	0.0	23.5
		3	0	22.0	22.2	22.2	0.0	23.5
		3	1	22.1	22.4	22.3	0.0	23.5
		3	3	22.2	22.1	22.3	0.0	23.5
		6	0	21.1	21.2	21.2	1.0	22.5
	16QAM	1	0	20.4	21.1	21.1	1.0	22.5
		1	3	20.5	21.3	21.0	1.0	22.5
		1	5	20.3	21.2	20.9	1.0	22.5
		3	0	20.9	21.5	21.2	1.0	22.5
		3	1	20.9	21.5	21.2	1.0	22.5
		3	3	21.2	21.4	21.3	1.0	22.5
		6	0	20.0	20.3	20.5	2.0	21.5

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LTE Band 4 Measured Results

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)			MPR	Tune-up Limit
				Measured Pwr (dBm)				
				[redacted]	20175	[redacted]		
				[redacted]	1732.5 MHz	[redacted]		
20 MHz	QPSK	1	0	[redacted]	22.2	[redacted]	0.0	24.0
		1	49	[redacted]	22.7	[redacted]	0.0	24.0
		1	99	[redacted]	22.5	[redacted]	0.0	24.0
		50	0	[redacted]	21.5	[redacted]	1.0	23.0
		50	24	[redacted]	21.7	[redacted]	1.0	23.0
		50	50	[redacted]	21.5	[redacted]	1.0	23.0
		100	0	[redacted]	21.6	[redacted]	1.0	23.0
	16QAM	1	0	[redacted]	21.5	[redacted]	1.0	23.0
		1	49	[redacted]	21.7	[redacted]	1.0	23.0
		1	99	[redacted]	20.9	[redacted]	1.0	23.0
		50	0	[redacted]	20.6	[redacted]	2.0	22.0
		50	24	[redacted]	20.8	[redacted]	2.0	22.0
		50	50	[redacted]	20.7	[redacted]	2.0	22.0
		100	0	[redacted]	20.6	[redacted]	2.0	22.0

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				20025	20175	20325		
				1717.5 MHz	1732.5 MHz	1747.5 MHz		
15 MHz	QPSK	1	0	22.6	22.5	22.7	0.0	24.0
		1	37	22.5	22.9	22.6	0.0	24.0
		1	74	22.3	22.8	22.6	0.0	24.0
		36	0	21.7	21.5	21.6	1.0	23.0
		36	20	21.6	21.7	21.6	1.0	23.0
		36	39	21.4	21.5	21.6	1.0	23.0
		75	0	21.6	21.5	21.6	1.0	23.0
	16QAM	1	0	22.0	21.4	21.5	1.0	23.0
		1	37	22.1	22.1	21.8	1.0	23.0
		1	74	21.8	21.7	22.2	1.0	23.0
		36	0	20.6	20.5	20.7	2.0	22.0
		36	20	20.5	20.6	20.7	2.0	22.0
		36	39	20.2	20.4	20.7	2.0	22.0
		75	0	20.5	20.6	20.7	2.0	22.0

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				20000	20175	20350		
				1715 MHz	1732.5 MHz	1750 MHz		
10 MHz	QPSK	1	0	22.9	22.7	22.6	0.0	24.0
		1	25	22.7	23.0	22.9	0.0	24.0
		1	49	22.2	22.6	22.9	0.0	24.0
		25	0	21.8	21.6	21.7	1.0	23.0
		25	12	21.8	21.6	21.9	1.0	23.0
		25	25	21.6	21.6	21.7	1.0	23.0
		50	0	21.7	21.6	21.9	1.0	23.0
	16QAM	1	0	21.6	21.5	21.4	1.0	23.0
		1	25	21.7	21.7	21.4	1.0	23.0
		1	49	21.2	21.3	21.7	1.0	23.0
		25	0	20.6	20.5	20.8	2.0	22.0
		25	12	20.6	20.6	20.9	2.0	22.0
		25	25	20.5	20.5	20.9	2.0	22.0
		50	0	20.6	20.5	20.8	2.0	22.0

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LTE Band 4 Measured Results (Continued)

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				19975	20175	20375		
				1712.5 MHz	1732.5 MHz	1752.5 MHz		
5 MHz	QPSK	1	0	22.4	22.6	22.7	0.0	24.0
		1	12	22.4	22.7	22.9	0.0	24.0
		1	24	22.5	22.7	22.8	0.0	24.0
		12	0	21.8	21.5	21.8	1.0	23.0
		12	7	21.8	21.7	21.8	1.0	23.0
		12	13	21.7	21.7	21.9	1.0	23.0
		25	0	21.7	21.7	21.7	1.0	23.0
	16QAM	1	0	21.3	21.2	21.1	1.0	23.0
		1	12	21.1	21.3	21.7	1.0	23.0
		1	24	20.9	21.2	21.3	1.0	23.0
		12	0	20.7	20.4	20.9	2.0	22.0
		12	7	20.7	20.8	20.8	2.0	22.0
		12	13	20.4	20.7	20.9	2.0	22.0
		25	0	20.6	20.7	21.0	2.0	22.0

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				19965	20175	20385		
				1711.5 MHz	1732.5 MHz	1753.5 MHz		
3 MHz	QPSK	1	0	22.8	22.6	22.7	0.0	24.0
		1	8	22.8	22.8	23.0	0.0	24.0
		1	14	22.8	22.8	22.7	0.0	24.0
		8	0	21.7	21.6	21.8	1.0	23.0
		8	4	21.7	21.7	21.8	1.0	23.0
		8	7	21.8	21.7	21.8	1.0	23.0
		15	0	21.7	21.6	21.8	1.0	23.0
	16QAM	1	0	21.7	21.4	21.4	1.0	23.0
		1	8	21.9	21.6	22.0	1.0	23.0
		1	14	21.4	21.5	21.5	1.0	23.0
		8	0	20.7	20.6	20.8	2.0	22.0
		8	4	20.6	20.7	20.8	2.0	22.0
		8	7	20.6	20.8	20.9	2.0	22.0
		15	0	20.7	20.5	20.8	2.0	22.0

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				19957	20175	20393		
				1710.7 MHz	1732.5 MHz	1754.3 MHz		
1.4 MHz	QPSK	1	0	22.6	22.5	22.8	0.0	24.0
		1	3	22.6	22.7	22.9	0.0	24.0
		1	5	22.6	22.4	22.8	0.0	24.0
		3	0	22.6	22.7	22.8	0.0	24.0
		3	1	22.8	22.7	22.9	0.0	24.0
		3	3	22.7	22.8	22.9	0.0	24.0
		6	0	21.8	21.6	21.7	1.0	23.0
	16QAM	1	0	21.7	21.9	21.7	1.0	23.0
		1	3	21.8	21.5	21.8	1.0	23.0
		1	5	21.6	22.0	21.8	1.0	23.0
		3	0	21.7	21.6	21.9	1.0	23.0
		3	1	21.7	21.7	21.9	1.0	23.0
		3	3	21.7	21.7	22.1	1.0	23.0
		6	0	20.8	20.4	21.0	2.0	22.0

Note(s):

20 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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LTE Band 5 Measured Results

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				Measured Pwr (dBm)			MPR	Tune-up Limit
				[redacted]	20525	[redacted]		
				[redacted]	836.5 MHz	[redacted]		
10 MHz	QPSK	1	0	[redacted]	22.4	[redacted]	0.0	23.5
		1	25	[redacted]	22.6	[redacted]	0.0	23.5
		1	49	[redacted]	22.5	[redacted]	0.0	23.5
		25	0	[redacted]	20.3	[redacted]	2.0	21.5
		25	12	[redacted]	20.2	[redacted]	2.0	21.5
		25	25	[redacted]	20.2	[redacted]	2.0	21.5
		50	0	[redacted]	20.2	[redacted]	2.0	21.5
	16QAM	1	0	[redacted]	20.3	[redacted]	2.0	21.5
		1	25	[redacted]	20.7	[redacted]	2.0	21.5
		1	49	[redacted]	20.3	[redacted]	2.0	21.5
		25	0	[redacted]	19.3	[redacted]	3.0	20.5
		25	12	[redacted]	19.3	[redacted]	3.0	20.5
		25	25	[redacted]	19.3	[redacted]	3.0	20.5
		50	0	[redacted]	19.3	[redacted]	3.0	20.5

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				20425	20525	20625		
				826.5 MHz	836.5 MHz	846.5 MHz		
5 MHz	QPSK	1	0	22.5	22.2	21.9	0.0	23.5
		1	12	22.6	22.5	22.6	0.0	23.5
		1	24	22.7	22.4	22.1	0.0	23.5
		12	0	20.4	20.2	20.1	2.0	21.5
		12	7	20.4	20.1	20.2	2.0	21.5
		12	13	20.3	20.2	20.0	2.0	21.5
		25	0	20.3	20.1	20.2	2.0	21.5
	16QAM	1	0	20.1	19.8	19.9	2.0	21.5
		1	12	20.2	19.9	19.8	2.0	21.5
		1	24	19.9	19.8	19.6	2.0	21.5
		12	0	19.4	19.2	19.3	3.0	20.5
		12	7	19.5	19.3	19.2	3.0	20.5
		12	13	19.5	19.4	19.1	3.0	20.5
		25	0	19.5	19.5	19.2	3.0	20.5

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				20415	20525	20635		
				825.5 MHz	836.5 MHz	847.5 MHz		
3 MHz	QPSK	1	0	22.4	22.3	22.4	0.0	23.5
		1	8	22.5	22.6	22.4	0.0	23.5
		1	14	22.4	22.4	22.5	0.0	23.5
		8	0	20.3	20.2	20.2	2.0	21.5
		8	4	20.3	20.2	20.1	2.0	21.5
		8	7	20.2	20.2	20.1	2.0	21.5
		15	0	20.2	20.1	20.2	2.0	21.5
	16QAM	1	0	20.7	20.4	20.2	2.0	21.5
		1	8	20.0	20.4	20.3	2.0	21.5
		1	14	20.6	20.5	20.2	2.0	21.5
		8	0	19.5	19.3	19.5	3.0	20.5
		8	4	19.6	19.3	19.3	3.0	20.5
		8	7	19.5	19.3	19.3	3.0	20.5
		15	0	19.3	19.2	19.3	3.0	20.5

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LTE Band 5 Measured Results (Continued)

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				20407	20525	20643		
				824.7 MHz	836.5 MHz	848.3 MHz		
1.4 MHz	QPSK	1	0	22.4	22.2	22.3	0.0	23.5
		1	3	22.4	22.5	22.4	0.0	23.5
		1	5	22.4	22.1	22.4	0.0	23.5
		3	0	22.4	22.4	22.3	0.0	23.5
		3	1	22.5	22.5	22.3	0.0	23.5
		3	3	22.6	22.4	22.2	0.0	23.5
		6	0	20.3	20.3	20.2	2.0	21.5
	16QAM	1	0	20.3	20.5	20.3	2.0	21.5
		1	3	20.6	20.4	20.2	2.0	21.5
		1	5	20.3	20.6	20.2	2.0	21.5
		3	0	20.4	20.3	20.5	2.0	21.5
		3	1	20.5	20.4	20.5	2.0	21.5
		3	3	20.5	20.3	20.5	2.0	21.5
		6	0	19.7	19.3	19.2	3.0	20.5

Note(s):

10 MHz Bandwidths do 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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LTE Band 12 Measured Results

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				Measured Pwr (dBm)			MPR	Tune-up Limit
				[redacted]	23095	[redacted]		
				[redacted]	707.5 MHz	[redacted]		
10 MHz	QPSK	1	0	[redacted]	22.8	[redacted]	0.0	24.0
		1	25	[redacted]	23.1	[redacted]	0.0	24.0
		1	49	[redacted]	22.8	[redacted]	0.0	24.0
		25	0	[redacted]	22.1	[redacted]	1.0	23.0
		25	12	[redacted]	22.1	[redacted]	1.0	23.0
		25	25	[redacted]	21.8	[redacted]	1.0	23.0
		50	0	[redacted]	22.0	[redacted]	1.0	23.0
	16QAM	1	0	[redacted]	22.1	[redacted]	1.0	23.0
		1	25	[redacted]	22.3	[redacted]	1.0	23.0
		1	49	[redacted]	21.6	[redacted]	1.0	23.0
		25	0	[redacted]	21.3	[redacted]	2.0	22.0
		25	12	[redacted]	21.3	[redacted]	2.0	22.0
		25	25	[redacted]	21.0	[redacted]	2.0	22.0
		50	0	[redacted]	21.0	[redacted]	2.0	22.0

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				23035	23095	23155		
				701.5 MHz	707.5 MHz	713.5 MHz		
5 MHz	QPSK	1	0	22.8	23.2	22.7	0.0	24.0
		1	12	23.0	23.3	23.1	0.0	24.0
		1	24	23.2	22.9	23.1	0.0	24.0
		12	0	22.2	22.0	22.1	1.0	23.0
		12	7	22.1	22.1	22.1	1.0	23.0
		12	13	22.1	22.1	22.1	1.0	23.0
		25	0	22.2	22.0	22.1	1.0	23.0
	16QAM	1	0	21.6	21.6	21.4	1.0	23.0
		1	12	21.8	21.8	21.5	1.0	23.0
		1	24	21.9	21.2	21.4	1.0	23.0
		12	0	21.0	21.0	21.1	2.0	22.0
		12	7	21.0	20.9	21.0	2.0	22.0
		12	13	21.1	21.1	21.0	2.0	22.0
		25	0	21.1	21.2	21.0	2.0	22.0

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				23025	23095	23165		
				700.5 MHz	707.5 MHz	714.5 MHz		
3 MHz	QPSK	1	0	23.0	23.2	23.1	0.0	24.0
		1	8	23.2	23.2	23.3	0.0	24.0
		1	14	23.2	23.1	23.0	0.0	24.0
		8	0	22.1	22.0	22.1	1.0	23.0
		8	4	22.2	22.1	22.1	1.0	23.0
		8	7	22.1	22.0	22.1	1.0	23.0
		15	0	22.1	22.0	22.1	1.0	23.0
	16QAM	1	0	22.0	22.0	22.3	1.0	23.0
		1	8	22.0	22.1	22.3	1.0	23.0
		1	14	21.9	21.9	21.9	1.0	23.0
		8	0	21.0	21.1	21.2	2.0	22.0
		8	4	20.9	20.7	21.2	2.0	22.0
		8	7	20.9	21.0	21.3	2.0	22.0
		15	0	21.0	21.0	21.2	2.0	22.0

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LTE Band 12 Measured Results (Continued)

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				23017	23095	23173		
				699.7 MHz	707.5 MHz	715.3 MHz		
1.4 MHz	QPSK	1	0	22.9	22.9	22.8	0.0	24.0
		1	3	23.1	23.0	23.1	0.0	24.0
		1	5	23.0	23.0	22.9	0.0	24.0
		3	0	22.9	22.9	23.0	0.0	24.0
		3	1	23.0	23.0	23.2	0.0	24.0
		3	3	23.1	23.1	23.2	0.0	24.0
		6	0	22.1	22.1	22.2	1.0	23.0
	16QAM	1	0	21.9	21.8	21.7	1.0	23.0
		1	3	22.0	21.9	22.5	1.0	23.0
		1	5	21.9	21.9	21.7	1.0	23.0
		3	0	22.1	22.0	21.9	1.0	23.0
		3	1	22.4	21.9	22.0	1.0	23.0
		3	3	22.2	22.0	22.0	1.0	23.0
		6	0	21.2	21.2	21.0	2.0	22.0

Note(s):

10 MHz Bandwidths do 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 2.4 GHz (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)
2.4	802.11b	1 Mbps	1	2412	18.6	19.0	Yes
			6	2437	18.7		
			11	2462	18.5		
			12	2467	18.7	19.0	
			13	2472	13.3	14.0	
	802.11g	6 Mbps	1	2412	Not Required	15.0	No
			2	2417		18.0	
			6	2437			
			10	2457			
			11	2462		16.0	
			12	2467		14.0	
			13	2472		8.0	
	802.11n (HT20)	6.5 Mbps	1	2412	Not Required	15.0	No
			2	2417		16.0	
			3	2422		17.0	
			6	2437			
			10	2457			
			11	2462		16.0	
			12	2467		14.0	
			13	2472		8.0	

Measured Results (Reduced power)

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)
2.4	802.11b	1 Mbps	1	2412	15.2	16.0	Yes
			6	2437	15.3		
			11	2462	15.1		
			12	2467	15.2	16.0	
			13	2472	13.3	14.0	
	802.11g	6 Mbps	1	2412	14.3	15.0	Yes
			2	2417	17.7	18.0	
			6	2437	17.7		
			10	2457	17.6		
			11	2462	15.9	16.0	
			12	2467	13.8	14.0	
			13	2472	7.5	8.0	
	802.11n (HT20)	6.5 Mbps	1	2412	Not Required	15.0	No
			2	2417		16.0	
			3	2422		17.0	
			6	2437			
			10	2457			
			11	2462		16.0	
			12	2467		14.0	
			13	2472		7.0	

Note(s):

1. SAR is not required for 802.11g/n modes when the adjusted SAR for 802.11b is < 1.2 W/kg. but 802.11g are additionally tested at Head exposure condition. Because 802.11g mode output power is higher than 802.11b mode is in reduced power condition.
2. For “Not required”, SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.

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9.5. Bluetooth

Average Power Measured Results

Band (GHz)	Mode	Ch #	Freq. (MHz)	Meas. Avg Pwr (dBm)	Tune-up Limit
2.4	GFSK	0	2402	9.2	10.0
		39	2441	10.0	
		78	2480	9.0	
	EDR, 8-DPSK	0	2402	8.1	
		39	2441	8.7	
		78	2480	7.8	
	EDR π/4 DQPSK	0	2402	8.0	
		19	2440	8.7	
		39	2480	7.8	
	LE, GFSK, 1Mbps	0	2402	0.2	2.0
		19	2440	1.0	
		39	2480	0.3	

Note(s):

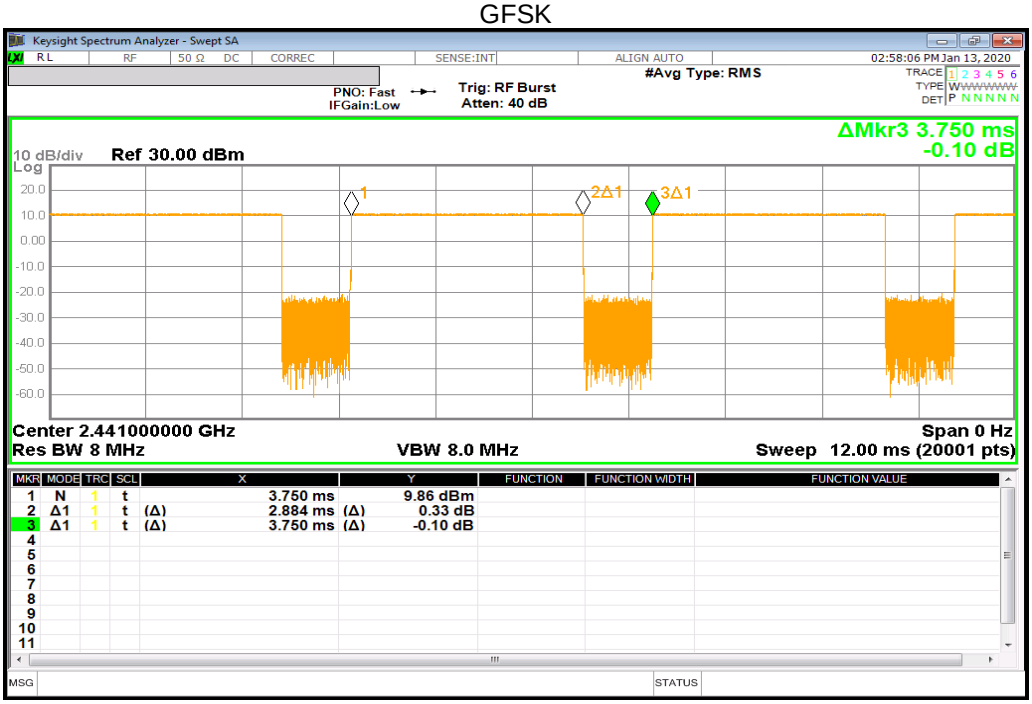
SAR test is evaluated at GFSK mode in Bluetooth

Duty Factor Measured Results

Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
GFSK	DH5	2.884	3.750	76.9%	1.30

Duty Cycle plots

GFSK



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10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

Reported SAR(W/kg) for WWAN= Measured SAR *Tune-up Scaling Factor

Reported SAR(W/kg) for Wi-Fi and Bluetooth= Measured SAR * Tune-up scaling factor * Duty Cycle scaling factor

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 648474 D04 Handset SAR (Phablet Only):

When hotspot mode does not apply, 10-g Extremity SAR is required for all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge in direct contact with a flat phantom, to address interactive hand use exposure conditions. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg .

Additional 1-g SAR testing at 5 mm is not required when hotspot mode 10-g extremity SAR is not required for the surfaces and edges; since all 1-g reported SAR < 1.2 W/kg.

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.
- For LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, test the available non-overlapping channels instead. 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; therefore, the requirement for H, M and L channels may not fully apply.

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KDB 248227 D01 SAR measurement 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. GSM 850

Antenna	RF Exposure Conditions	Mode	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Main	Head	GPRS 1 Slot	N/A	0	Left Touch	190	836.6	34.0	33.3	0.247	0.291	1
					Left Tilt	190	836.6	34.0	33.3	0.193	0.227	
					Right Touch	190	836.6	34.0	33.3	0.221	0.260	
					Right Tilt	190	836.6	34.0	33.3	0.141	0.166	
	Body-worn	GPRS 1 Slot	N/A	15	Rear	190	836.6	34.0	33.3	0.401	0.472	2
					Front	190	836.6	34.0	33.3	0.298	0.351	
	Hotspot	GPRS 1 Slot	N/A	10	Rear	190	836.6	34.0	33.3	0.466	0.549	3
					Front	190	836.6	34.0	33.3	0.312	0.368	
					Edge 2	190	836.6	34.0	33.3	0.250	0.294	
					Edge 3	190	836.6	34.0	33.3	0.122	0.144	
					Edge 4	190	836.6	34.0	33.3	0.287	0.338	

10.2. GSM 1900

Antenna	RF Exposure Conditions	Mode	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Main	Head	GPRS 4 Slots	N/A	0	Left Touch	661	1880.0	25.0	23.2	0.169	0.254	4
					Left Tilt	661	1880.0	25.0	23.2	0.031	0.046	
					Right Touch	661	1880.0	25.0	23.2	0.103	0.155	
					Right Tilt	661	1880.0	25.0	23.2	0.051	0.076	
	Body-worn	GPRS 4 Slots	N/A	15	Rear	661	1880.0	25.0	23.2	0.173	0.260	5
					Front	661	1880.0	25.0	23.2	0.165	0.248	
	Hotspot	GPRS 4 Slots	N/A	10	Rear	661	1880.0	25.0	23.2	0.297	0.446	6
					Front	661	1880.0	25.0	23.2	0.270	0.405	
					Edge 2	661	1880.0	25.0	23.2	0.038	0.057	
					Edge 3	661	1880.0	25.0	23.2	0.235	0.353	
					Edge 4	661	1880.0	25.0	23.2	0.182	0.273	

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10.3. W-CDMA Band II

Antenna	RF Exposure Conditions	Mode	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Main	Head	Rel.99 RMC	Off	0	Left Touch	9400	1880.0	23.5	22.1	0.391	0.543	7
					Left Tilt	9400	1880.0	23.5	22.1	0.103	0.143	
					Right Touch	9400	1880.0	23.5	22.1	0.215	0.299	
					Right Tilt	9400	1880.0	23.5	22.1	0.110	0.153	
	Body-worn	Rel.99 RMC	Off	15	Rear	9400	1880.0	23.5	22.1	0.380	0.528	8
					Front	9400	1880.0	23.5	22.1	0.377	0.524	
	Hotspot	Rel.99 RMC	On	10	Rear	9400	1880.0	20.5	19.1	0.370	0.515	9
					Front	9400	1880.0	20.5	19.1	0.324	0.451	
					Edge 2	9400	1880.0	20.5	19.1	0.046	0.064	
					Edge 3	9400	1880.0	20.5	19.1	0.261	0.363	
					Edge 4	9400	1880.0	20.5	19.1	0.201	0.280	

10.4. W-CDMA Band IV

Antenna	RF Exposure Conditions	Mode	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Main	Head	Rel.99 RMC	Off	0	Left Touch	1413	1732.6	23.5	22.1	0.306	0.426	10
					Left Tilt	1413	1732.6	23.5	22.1	0.049	0.068	
					Right Touch	1413	1732.6	23.5	22.1	0.160	0.223	
					Right Tilt	1413	1732.6	23.5	22.1	0.042	0.059	
	Body-worn	Rel.99 RMC	Off	15	Rear	1413	1732.6	23.5	22.1	0.265	0.369	11
					Front	1413	1732.6	23.5	22.1	0.209	0.291	
	Hotspot	Rel.99 RMC	On	10	Rear	1413	1732.6	20.5	19.1	0.306	0.425	12
					Front	1413	1732.6	20.5	19.1	0.230	0.320	
					Edge 2	1413	1732.6	20.5	19.1	0.018	0.024	
					Edge 3	1413	1732.6	20.5	19.1	0.159	0.221	
					Edge 4	1413	1732.6	20.5	19.1	0.166	0.231	

10.5. W-CDMA Band V

Antenna	RF Exposure Conditions	Mode	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Main	Head	Rel.99 RMC	N/A	0	Left Touch	4183	836.6	24.5	23.2	0.250	0.337	13
					Left Tilt	4183	836.6	24.5	23.2	0.192	0.259	
					Right Touch	4183	836.6	24.5	23.2	0.228	0.307	
					Right Tilt	4183	836.6	24.5	23.2	0.182	0.245	
	Body-worn	Rel.99 RMC	N/A	15	Rear	4183	836.6	24.5	23.2	0.414	0.558	14
					Front	4183	836.6	24.5	23.2	0.304	0.410	
	Hotspot	Rel.99 RMC	N/A	10	Rear	4183	836.6	24.5	23.2	0.472	0.636	15
					Front	4183	836.6	24.5	23.2	0.341	0.459	
					Edge 2	4183	836.6	24.5	23.2	0.257	0.346	
					Edge 3	4183	836.6	24.5	23.2	0.139	0.187	
					Edge 4	4183	836.6	24.5	23.2	0.284	0.383	

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10.6. LTE Band 2(20MHz Bandwidth)

Antenna	RF Exposure Conditions	Mode	PWR Back-off	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	
Main	Head	QPSK	N/A	0	Left Touch	19100	1900.0	1	99	23.5	22.3	0.370	0.487	16
								50	50	22.5	21.2	0.311	0.416	
					Left Tilt	19100	1900.0	1	99	23.5	22.3	0.101	0.133	
								50	50	22.5	21.2	0.091	0.122	
					Right Touch	19100	1900.0	1	99	23.5	22.3	0.236	0.310	
								50	50	22.5	21.2	0.188	0.251	
					Right Tilt	19100	1900.0	1	99	23.5	22.3	0.124	0.163	
								50	50	22.5	21.2	0.094	0.126	
	Body-worn	QPSK	N/A	15	Rear	19100	1900.0	1	99	23.5	22.3	0.351	0.462	17
								50	50	22.5	21.2	0.301	0.402	
					Front	19100	1900.0	1	99	23.5	22.3	0.329	0.433	
								50	50	22.5	21.2	0.284	0.380	
	Hotspot	QPSK	N/A	10	Rear	18700	1860.0	1	99	23.5	21.9	0.540	0.787	
						18900	1880.0	1	99	23.5	21.7	0.614	0.924	18
						19100	1900.0	1	99	23.5	22.3	0.634	0.834	
								50	50	22.5	21.2	0.519	0.694	
					Front	19100	1900.0	1	99	23.5	22.3	0.554	0.729	
								50	50	22.5	21.2	0.466	0.623	
					Edge 2	19100	1900.0	1	99	23.5	22.3	0.086	0.113	
								50	50	22.5	21.2	0.079	0.105	
					Edge 3	19100	1900.0	1	99	23.5	22.3	0.539	0.709	
								50	50	22.5	21.2	0.444	0.593	
					Edge 4	19100	1900.0	1	99	23.5	22.3	0.359	0.472	
								50	50	22.5	21.2	0.310	0.414	

10.7. LTE Band 4 (20MHz Bandwidth)

Antenna	RF Exposure Conditions	Mode	PWR Back-off	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	
Main	Head	QPSK	N/A	0	Left Touch	20175	1732.5	1	49	24.0	22.7	0.301	0.410	19
								50	24	23.0	21.7	0.258	0.347	
					Left Tilt	20175	1732.5	1	49	24.0	22.7	0.059	0.080	
								50	24	23.0	21.7	0.046	0.061	
					Right Touch	20175	1732.5	1	49	24.0	22.7	0.181	0.246	
								50	24	23.0	21.7	0.148	0.199	
					Right Tilt	20175	1732.5	1	49	24.0	22.7	0.055	0.075	
								50	24	23.0	21.7	0.043	0.058	
	Body-worn	QPSK	N/A	15	Rear	20175	1732.5	1	49	24.0	22.7	0.281	0.383	20
								50	24	23.0	21.7	0.215	0.289	
					Front	20175	1732.5	1	49	24.0	22.7	0.217	0.295	
								50	24	23.0	21.7	0.183	0.246	
	Hotspot	QPSK	N/A	10	Rear	20175	1732.5	1	49	24.0	22.7	0.547	0.745	21
								50	24	23.0	21.7	0.465	0.626	
					Front	20175	1732.5	1	49	24.0	22.7	0.410	0.558	
								50	24	23.0	21.7	0.349	0.470	
					Edge 2	20175	1732.5	1	49	24.0	22.7	0.033	0.045	
								50	24	23.0	21.7	0.027	0.037	
					Edge 3	20175	1732.5	1	49	24.0	22.7	0.285	0.388	
								50	24	23.0	21.7	0.233	0.314	
					Edge 4	20175	1732.5	1	49	24.0	22.7	0.295	0.402	
								50	24	23.0	21.7	0.249	0.335	

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10.8. LTE Band 5 (10MHz Bandwidth)

Antenna	RF Exposure Conditions	Mode	PWR Back-off	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	
Main	Head	QPSK	N/A	0	Left Touch	20525	836.5	1	25	23.5	22.6	0.223	0.272	22
								25	0	21.5	20.3	0.165	0.218	
					Left Tilt	20525	836.5	1	25	23.5	22.6	0.099	0.120	
								25	0	21.5	20.3	0.067	0.089	
					Right Touch	20525	836.5	1	25	23.5	22.6	0.172	0.210	
								25	0	21.5	20.3	0.140	0.185	
					Right Tilt	20525	836.5	1	25	23.5	22.6	0.136	0.166	
								25	0	21.5	20.3	0.109	0.144	
	Body-worn	QPSK	N/A	15	Rear	20525	836.5	1	25	23.5	22.6	0.339	0.414	23
								25	0	21.5	20.3	0.260	0.344	
					Front	20525	836.5	1	25	23.5	22.6	0.243	0.297	
								25	0	21.5	20.3	0.188	0.249	
	Hotspot	QPSK	N/A	10	Rear	20525	836.5	1	25	23.5	22.6	0.380	0.464	24
								25	0	21.5	20.3	0.296	0.392	
					Front	20525	836.5	1	25	23.5	22.6	0.283	0.345	
								25	0	21.5	20.3	0.218	0.289	
					Edge 2	20525	836.5	1	25	23.5	22.6	0.205	0.250	
								25	0	21.5	20.3	0.169	0.224	
					Edge 3	20525	836.5	1	25	23.5	22.6	0.063	0.077	
								25	0	21.5	20.3	0.051	0.068	
					Edge 4	20525	836.5	1	25	23.5	22.6	0.180	0.220	
								25	0	21.5	20.3	0.133	0.176	

10.9. LTE Band 12 (10MHz Bandwidth)

Antenna	RF Exposure Conditions	Mode	PWR Back-off	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	
Main	Head	QPSK	N/A	0	Left Touch	23095	707.5	1	25	24.0	23.1	0.124	0.154	25
								25	0	23.0	22.1	0.092	0.112	
					Left Tilt	23095	707.5	1	25	24.0	23.1	0.088	0.109	
								25	0	23.0	22.1	0.066	0.081	
					Right Touch	23095	707.5	1	25	24.0	23.1	0.100	0.124	
								25	0	23.0	22.1	0.079	0.097	
					Right Tilt	23095	707.5	1	25	24.0	23.1	0.070	0.086	
								25	0	23.0	22.1	0.058	0.071	
	Body-worn	QPSK	N/A	15	Rear	23095	707.5	1	25	24.0	23.1	0.249	0.310	26
								25	0	23.0	22.1	0.166	0.203	
					Front	23095	707.5	1	25	24.0	23.1	0.136	0.169	
								25	0	23.0	22.1	0.103	0.126	
	Hotspot	QPSK	N/A	10	Rear	23095	707.5	1	25	24.0	23.1	0.324	0.403	27
								25	0	23.0	22.1	0.231	0.282	
					Front	23095	707.5	1	25	24.0	23.1	0.174	0.216	
								25	0	23.0	22.1	0.125	0.153	
					Edge 2	23095	707.5	1	25	24.0	23.1	0.103	0.128	
								25	0	23.0	22.1	0.077	0.094	
					Edge 3	23095	707.5	1	25	24.0	23.1	0.052	0.064	
								25	0	23.0	22.1	0.036	0.044	
					Edge 4	23095	707.5	1	25	24.0	23.1	0.200	0.249	
								25	0	23.0	22.1	0.142	0.173	

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10.10. Wi-Fi (DTS Band)

Frequency Band	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle (%)	Power (dBm)		1-g SAR (W/kg)		Note	Plot No.
										Tune-up limit	Meas.	Meas.	Scaled		
2.4 GHz	802.11b 1 Mbps	Head	On	0	Left Touch	6	2437.0	0.957	99.4%	16.0	15.3	0.647	0.774		
					Left Tilt	6	2437.0	0.795	99.4%	16.0	15.3	0.532	0.636	2	
					Right Touch	6	2437.0	0.644	99.4%	16.0	15.3				
					Right Tilt	6	2437.0	0.520	99.4%	16.0	15.3				
	802.11g 6 Mbps	Head	N/A	0	Left Touch	2	2417.0	0.989	96.6%	18.0	17.7	0.666	0.732	3,6	
						6	2437.0	1.534	96.6%	18.0	17.7	1.040	1.154		28
					Left Tilt	2	2417.0	0.870	96.6%	18.0	17.7	0.600	0.660	3,6	
						6	2437.0	1.284	96.6%	18.0	17.7	0.858	0.952	2	
					Right Touch	2	2417.0	0.683	96.6%	18.0	17.7	0.520	0.572	3,6	
						6	2437.0	1.004	96.6%	18.0	17.7	0.749	0.831	2	
					Right Tilt	6	2437.0	0.839	96.6%	18.0	17.7	0.633	0.702	2	
	802.11b 1 Mbps	Body-worn	Off	15	Rear	6	2437.0	0.204	99.4%	19.0	18.7	0.151	0.161	1	29
					Front	6	2437.0	0.131	99.4%	19.0	18.7				
		Hotspot	Off	10	Rear	6	2437.0	0.421	99.4%	19.0	18.7	0.329	0.351	1	30
					Front	6	2437.0	0.257	99.4%	19.0	18.7				
					Edge 1	6	2437.0	0.388	99.4%	19.0	18.7				
					Edge 2	6	2437.0	0.058	99.4%	19.0	18.7				

Note(s):

1. When the Highest reported SAR is ≤ 0.4 or 1.0 W/kg (1-g or 10-g respectively). Therefore, further SAR measurements within this exposure condition are not required.
2. Highest reported SAR is > 0.4 or 1.0 W/kg (1-g or 10-g respectively). Due to the highest reported SAR for this test position, other test positions in this exposure condition were evaluated until a SAR ≤ 0.8 or 2.0 W/kg (1-g or 10-g respectively) was reported.
3. Testing for a second channel was required because the reported SAR for this test position was > 0.8 or 2.0 W/kg (1-g or 10-g respectively).
4. Additional testing required in order satisfying FCC simultaneous transmission limit criteria.
5. SAR testing is not required for OFDM mode(s) 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. But 802.11g target power is higher than 802.11b in Head exposure condition. So, we additionally tested for 802.11g in Head exposure condition.
6. For testing a second channel according to “Note 3”, ch.2 is higher than the output power of other default channels, so we tested the ch.2 instead of ch.1 & ch.11. Please refer to output power table in sec.9.4

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10.11. Bluetooth

Frequency Band	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle (%)	Power (dBm)		1-g SAR (W/kg)	
									Tune-up limit	Meas.	Meas.	Scaled
2.4 GHz	GFSK	Head	N/A	0	Left Touch	39	2441.0	76.9%	10.0	10.0	0.119	0.156
					Left Tilt	39	2441.0	76.9%	10.0	10.0	0.100	0.131
					Right Touch	39	2441.0	76.9%	10.0	10.0	0.088	0.115
					Right Tilt	39	2441.0	76.9%	10.0	10.0	0.076	0.099

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)]·[*$\sqrt{f_{(GHz)}}/x$*]* 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.

RF Air interface	RF Exposure Conditions	Frequency (GHz)	Max. tune-up tolerance Power		Min. test separation distance (mm)	SAR test exclusion Result*	Estimated 1-g SAR (W/kg)
			(dBm)	(mW)			
Bluetooth	Body-worn	2.480	10.0	10	15	1.0	0.140
	Hotspot	2.480	10.0	10	10	1.6	0.210

Conclusion:

*: The computed value is ≤ 3; therefore, this 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 <0.8 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 ≥ 0.8 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 when the original or repeated measurement is ≥ 1.45 or 3.6 W/kg (~ 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.

Peak spatial-average (1g of tissue)

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
750	LTE Band 12	Hotspot	Rear	No	0.324	N/A	N/A
850	W-CDMA Band V	Hotspot	Rear	No	0.472	N/A	N/A
	GSM850	Hotspot	Rear	No	0.466	N/A	N/A
	LTE Band 5	Hotspot	Rear	No	0.380	N/A	N/A
1750	W-CDMA Band IV	Hotspot	Rear	No	0.306	N/A	N/A
	LTE Band 4	Hotspot	Rear	No	0.547	N/A	N/A
1900	LTE Band 2	Hotspot	Rear	No	0.634	N/A	N/A
	GSM 1900	Hotspot	Rear	No	0.297	N/A	N/A
	W-CDMA Band II	Head	Left Touch	No	0.391	N/A	N/A
2450	Wi-Fi 802.11b/g/n	Head	Left Touch	Yes	1.040	1.040	1.00
	Bluetooth	Head	Left Touch	No	0.119	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. DUT Holder Perturbations

In accordance with published DUT Holder Perturbations in Oct.2016 TCB workshop,

When Highest reported SAR is over 1.2 or 3.0 W/kg (1-g or 10-g respectively), Holder perturbation verification is required for each antenna, using the highest configuration among all applicable frequency bands. Both Head test and Body test (Edge 1-4 sides) are evaluated with DUT holder. Both Front and Rear sides are evaluated without DUT holder. (Details of test setup are refer to Appendix A.)

So we are only consider about Head test and Body test (Edge 1-4 sides).

All highest SAR level is not over 1.2 or 3.0 W/kg (1-g or 10-g respectively) in All bands.

Please refer to Section 10. **So DUT Holder perturbations verification are not required.**

13. Simultaneous Transmission SAR Analysis

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations		
Head	1	GSM (Voice/GPRS)	+	DTS
	2	GSM (Voice/GPRS)	+	BT
	3	W-CDMA	+	DTS
	4	W-CDMA	+	BT
	5	LTE	+	DTS
	6	LTE	+	BT
Body worn	1	GSM (Voice/GPRS)	+	DTS
	2	GSM (Voice/GPRS)	+	BT
	3	W-CDMA	+	DTS
	4	W-CDMA	+	BT
	5	LTE	+	DTS
	6	LTE	+	BT
Hotspot	7	GSM (GPRS)	+	DTS
	8	GSM (GPRS)	+	BT
	9	W-CDMA	+	DTS
	10	W-CDMA	+	BT
	11	LTE	+	DTS
	12	LTE	+	BT

Notes:

1. DTS supports Wi-Fi Direct, Hotspot and VoIP.
2. GPRS, W-CDMA and LTE support Hotspot and VoIP.
3. DTS Radio cannot transmit simultaneously with Bluetooth Radio.
4. BT tethering is consider about each RF exposure conditions.

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Simultaneous transmission SAR test exclusion considerations

KDB 447498 D01 General RF Exposure Guidance provides two procedures for determining simultaneous transmission SAR test exclusion: Sum of SAR and SAR to Peak Location Ratio (SPLSR)

Sum of SAR

To qualify for simultaneous transmission SAR test exclusion based upon Sum of SAR the sum of the reported standalone SARs for all simultaneously transmitting antennas shall be below the applicable standalone SAR limit. If the sum of the SARs is above the applicable limit then simultaneous transmission SAR test exclusion may still apply if the requirements of the SAR to Peak Location Ratio (SPLSR) evaluation are met.

SAR to Peak Location Ratio (SPLSR)

KDB 447498 D01 General RF Exposure Guidance explains how to calculate 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 reported 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 reported 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:

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

When an individual antenna transmits at on two bands simultaneously, the sum of the highest *reported* SAR for the frequency bands should be used to determine SAR_1.or SAR_2. When SPLSR is necessary, the smallest distance between the peak SAR locations for the antenna pair with respect to the peaks from each antenna should be used.

The antennas in all antenna pairs that do not qualify for simultaneous transmission SAR test exclusion must be tested for SAR compliance, according to the enlarged zoom scan and volume scan post-processing procedures in KDB Publication 865664 D01

The antennas for the unlicensed transmitters are closely situated. As a result, the associated SAR hotspots are also closely situated. Some of the sum of SAR calculations yielded results over 1.6 W/kg. The SPSLR calculations for these situations were performed by treating the unlicensed SAR values as a single transmitter. The most conservative distance between all the unlicensed hotspots to the licensed hotspot was used for the value of *d* in the SPSLR calculation.

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Simultaneous transmission SAR measurement

When simultaneous transmission SAR measurements are required in different frequency bands not covered by a single probe calibration point then separate tests for each frequency band are performed. The tests are performed using enlarged zoom scans which are processed, by means of superposition, using the DASY5 volume scan postprocessing procedures to determine the 1-g SAR for the aggregate SAR distribution.

The spatial resolution used for all enlarged zoom scans is the same as used for the most stringent zoom scans. I.E. the scan parameters required for the highest frequency assessed are used for all enlarged zoom scans. The scans cover the complete area of the device to ensure all transmitting antennas and radiating structures are assessed.

DASY5 provides the ability to perform Multiband Evaluations according to the latest standards using the Volume Scan job as well as appropriate routines for the Post-processing.

In order to extract and process measurements within different frequency bands, the SEMCAD X Post-processor performs the combination and subsequent superposition of these measurement data via DASY5= Combined Multi-Band Averaged SAR.

Combined Multi Band Averaged SAR allows - in addition to the data extraction - an evaluation of the 1 g, 10 g and/or arbitrary averaged mass SAR.
Power Scaling Factor is used to allow the volume scans to be scaled by a value other than "1", this is important when the results need to be scaled to different maximum power levels. The Power Scaling Factor is applied to each individual point of the scan. When power scaling is used in multi-band combinations the scaling factor is applied to each individual point of the first scan, the second factor is then applied to each individual point of the second scan and so on. The scans are then combined.

13.1. Sum of the SAR for GSM 850 & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)			① + ② WWAN + DTS		① + ③ WWAN + BT	
		① WWAN	② DTS	③ BT	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)
Head	Left touch	0.291	1.154	0.156	1.445	No	0.447	No
	Left tilt	0.227	0.952	0.131	1.179	No	0.358	No
	Right touch	0.260	0.831	0.115	1.091	No	0.375	No
	Right tilt	0.166	0.702	0.099	0.868	No	0.265	No
Body-Worn	All position	0.472	0.161	0.140	0.633	No	0.612	No
Hotspot	All position	0.549	0.351	0.210	0.900	No	0.759	No

13.2. Sum of the SAR for GSM 1900 & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)			① + ② WWAN + DTS		① + ③ WWAN + BT	
		① WWAN	② DTS	③ BT	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)
Head	Left touch	0.254	1.154	0.156	1.408	No	0.410	No
	Left tilt	0.046	0.952	0.131	0.998	No	0.177	No
	Right touch	0.155	0.831	0.115	0.986	No	0.270	No
	Right tilt	0.076	0.702	0.099	0.778	No	0.175	No
Body-Worn	All position	0.260	0.161	0.140	0.421	No	0.400	No
Hotspot	All position	0.446	0.351	0.210	0.797	No	0.656	No

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13.3. Sum of the SAR for W-CDMA Band II & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)			① + ② WWAN + DTS		① + ③ WWAN + BT	
		① WWAN	② DTS	③ BT	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)
Head	Left touch	0.543	1.154	0.156	1.697	Yes	0.699	No
	Left tilt	0.143	0.952	0.131	1.095	No	0.274	No
	Right touch	0.299	0.831	0.115	1.130	No	0.414	No
	Right tilt	0.153	0.702	0.099	0.855	No	0.252	No
Body-Worn	All position	0.528	0.161	0.140	0.689	No	0.668	No
Hotspot	All position	0.515	0.351	0.210	0.866	No	0.725	No

SAR to Peak Location Separation Ratio (SPLSR)

Test Position	Standalone SAR (W/kg)		∑ 1-g SAR (W/kg)		Calculated distance (mm)	SPLSR (≤ 0.04)	Volume Scan (Yes/ No)	Figure
	① WWAN	② DTS						
Left touch	0.543	1.154	① + ②	1.697	89.8	0.02	No	1

13.4. Sum of the SAR for W-CDMA Band IV & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)			① + ② WWAN + DTS		① + ③ WWAN + BT	
		① WWAN	② DTS	③ BT	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)
Head	Left touch	0.426	1.154	0.156	1.580	No	0.582	No
	Left tilt	0.068	0.952	0.131	1.020	No	0.199	No
	Right touch	0.223	0.831	0.115	1.054	No	0.338	No
	Right tilt	0.059	0.702	0.099	0.761	No	0.158	No
Body-Worn	All position	0.369	0.161	0.140	0.530	No	0.509	No
Hotspot	All position	0.425	0.351	0.210	0.776	No	0.635	No

13.5. Sum of the SAR for W-CDMA Band V & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)			① + ② WWAN + DTS		① + ③ WWAN + BT	
		① WWAN	② DTS	③ BT	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)
Head	Left touch	0.337	1.154	0.156	1.491	No	0.493	No
	Left tilt	0.259	0.952	0.131	1.211	No	0.390	No
	Right touch	0.307	0.831	0.115	1.138	No	0.422	No
	Right tilt	0.245	0.702	0.099	0.947	No	0.344	No
Body-Worn	All position	0.558	0.161	0.140	0.719	No	0.698	No
Hotspot	All position	0.636	0.351	0.210	0.987	No	0.846	No

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13.6. Sum of the SAR for LTE Band 2 & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)			① + ② WWAN + DTS		① + ③ WWAN + BT	
		① WWAN	② DTS	③ BT	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)
Head	Left touch	0.487	1.154	0.156	1.641	Yes	0.643	No
	Left tilt	0.133	0.952	0.131	1.085	No	0.264	No
	Right touch	0.310	0.831	0.115	1.141	No	0.425	No
	Right tilt	0.163	0.702	0.099	0.865	No	0.262	No
Body-Worn	All position	0.462	0.161	0.140	0.623	No	0.602	No
Hotspot	All position	0.924	0.351	0.210	1.275	No	1.134	No

SAR to Peak Location Separation Ratio (SPLSR)

Test Position	Standalone SAR (W/kg)		∑ 1-g SAR (W/kg)		Calculated distance (mm)	SPLSR (≤ 0.04)	Volume Scan (Yes/ No)	Figure
	① WWAN	② DTS						
Left touch	0.487	1.154	① + ②	1.641	81.4	0.03	No	2

13.7. Sum of the SAR for LTE Band 4 & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)			① + ② WWAN + DTS		① + ③ WWAN + BT	
		① WWAN	② DTS	③ BT	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)
Head	Left touch	0.410	1.154	0.156	1.564	No	0.566	No
	Left tilt	0.080	0.952	0.131	1.032	No	0.211	No
	Right touch	0.246	0.831	0.115	1.077	No	0.361	No
	Right tilt	0.075	0.702	0.099	0.777	No	0.174	No
Body-Worn	All position	0.383	0.161	0.140	0.544	No	0.523	No
Hotspot	All position	0.745	0.351	0.210	1.096	No	0.955	No

13.8. Sum of the SAR for LTE Band 5 & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)			① + ② WWAN + DTS		① + ③ WWAN + BT	
		① WWAN	② DTS	③ BT	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)
Head	Left touch	0.272	1.154	0.156	1.426	No	0.428	No
	Left tilt	0.120	0.952	0.131	1.072	No	0.251	No
	Right touch	0.210	0.831	0.115	1.041	No	0.325	No
	Right tilt	0.166	0.702	0.099	0.868	No	0.265	No
Body-Worn	All position	0.414	0.161	0.140	0.575	No	0.554	No
Hotspot	All position	0.464	0.351	0.210	0.815	No	0.674	No

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13.9. Sum of the SAR for LTE Band 12 & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)			① + ② WWAN + DTS		① + ③ WWAN + BT	
		① WWAN	② DTS	③ BT	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/No)
Head	Left touch	0.154	1.154	0.156	1.308	No	0.310	No
	Left tilt	0.109	0.952	0.131	1.061	No	0.240	No
	Right touch	0.124	0.831	0.115	0.955	No	0.239	No
	Right tilt	0.086	0.702	0.099	0.788	No	0.185	No
Body-Worn	All position	0.310	0.161	0.140	0.471	No	0.450	No
Hotspot	All position	0.403	0.351	0.210	0.754	No	0.613	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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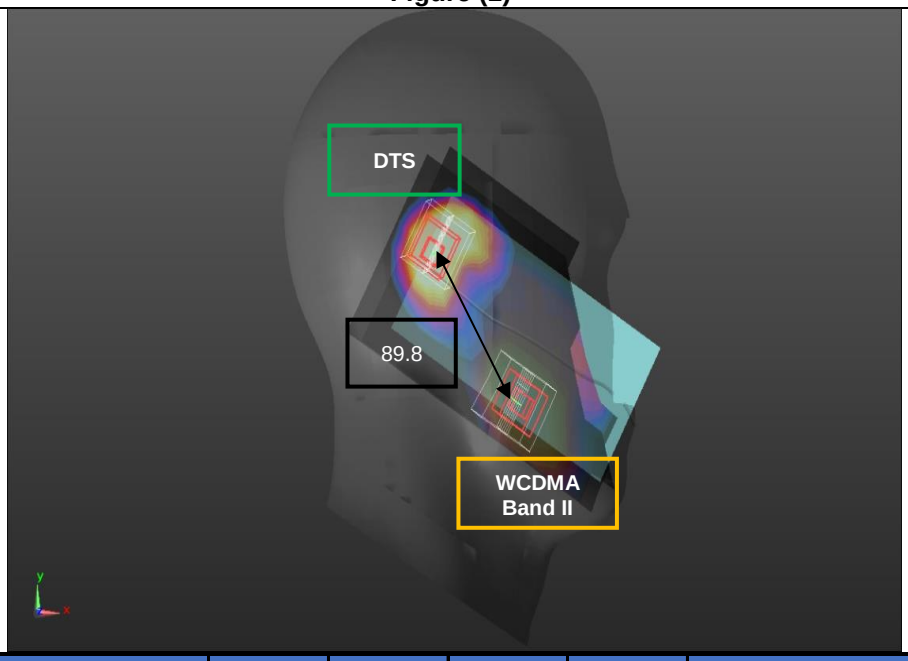
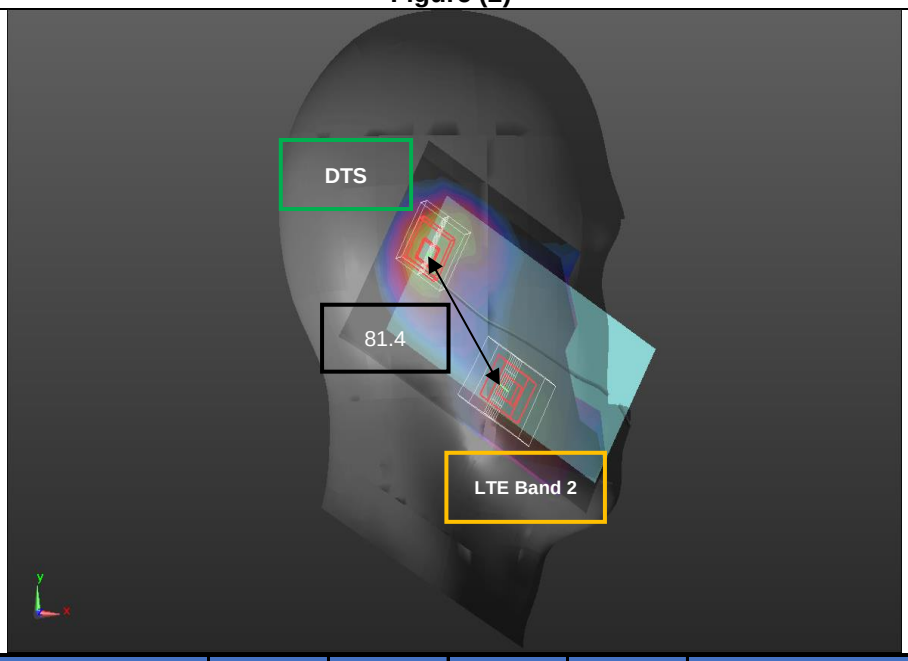
Figure (1)



Mode		SAR	X	Y	Z	d: Calculated distance (mm)	
		W/kg	m	m	m		
WCDMA Band II	①	0.543	0.05294	-0.06408	-0.00014	① + ②	89.8
DTS	②	1.154	0.00067	0.00896	-0.00071		

The Peak Location Separation Distance is computed by using the SQRT((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)

Figure (2)



Mode		SAR	X	Y	Z	d: Calculated distance (mm)	
		W/kg	m	m	m		
LTE Band 2	①	0.487	0.04849	-0.0569	-0.00191	① + ②	81.4
DTS	②	1.154	0.00067	0.00896	-0.00071		

The Peak Location Separation Distance is computed by using the SQRT((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)

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Appendixes

Refer to separated files for the following appendixes.

4789294522-S1V1 FCC Report SAR_App A_Photos & Ant. Locations

4789294522-S1V1 FCC Report SAR_App B_Highest SAR Test Plots

4789294522-S1V1 FCC Report SAR_App C_System Check Plots

4789294522-S1V1 FCC Report SAR_App D_SAR Tissue Ingredients

4789294522-S1V1 FCC Report SAR_App E_Probe Cal. Certificates

4789294522-S1V1 FCC Report SAR_App F_Dipole Cal. Certificates

END OF REPORT

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