FCC 47 CFR § 2.1093
IEEE Std 1528-2013

SAR EVALUATION REPORT

FOR

GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac and NFC

MODEL NUMBER: SM-A135F/DSN

FCC ID: A3LSMA135FDSN

REPORT NUMBER: 4790215260-S1V1

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Prepared for
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IAS ACCREDITED

Testing Laboratory

TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	1/21/2022	Initial Issue	--

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1. Attestation of Test Results

Applicant Name		SAMSUNG ELECTRONICS CO.,LTD.			
FCC ID		A3LSMA135FDSN			
Model Number		SM-A135F/DSN			
Applicable Standards		FCC 47 CFR § 2.1093 IEEE Std 1528-2013 Published RF exposure KDB procedures			
Exposure Category		SAR Limits (W/Kg)			
		Peak spatial-average (1g of tissue)		Product Specific 10g (10g of tissue)	
General population / Uncontrolled exposure		1.6		4.0	
RF Exposure Conditions		Equipment Class - The Highest Reported SAR (W/kg)			
		PCE	DTS	NII	DSS
Head		0.52	0.13	0.44	< 0.10
Body-worn		0.51	0.22	0.59	< 0.10
Hotspot		1.09	0.50	0.85	< 0.10
Product Specific 10g		N/A	N/A	2.28	N/A
Simultaneous TX	Head	1.00	0.64	1.00	1.00
	Body-worn	1.12	0.72	1.12	1.12
	Hotspot	1.59	1.59	1.22	1.22
	Product Specific 10g	N/A	N/A	N/A	N/A
Date Tested		12/20/2021 to 1/21/2022			
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:
	
Justin Park Operations Leader UL Korea, Ltd. Suwon Laboratory	Seungyeon Kim Laboratory Technician UL Korea, Ltd. Suwon Laboratory

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			10g of tissue
		Head Exposure condition	Body-worn Exposure condition	Hotspot Exposure condition	Product Specific Exposure condition
PCE	GSM 850	0.425	0.443	0.969	N/A
	GSM 1900	0.153	0.233	0.308	N/A
	WCDMA Band V	**0.517**	**0.505**	0.950	N/A
	LTE Band 5	0.453	0.442	0.920	N/A
	LTE Band 41	0.442	0.479	**1.088**	N/A
DTS	2.4GHz WLAN	**0.126**	**0.218**	**0.499**	N/A
UNII	5GHz WLAN	**0.435**	**0.593**	**0.847**	**2.278**
DSS	Bluetooth	**0.044**	**0.017**	**0.068**	N/A

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, ANSI C63.26-2015 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
- 941225 D07 UMPC Mini Tablet v01r02
- 971168 D01 Power Meas License Digital System v03r01

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

- TCB workshop October, 2014; RF Exposure Procedures Update (Other LTE Considerations)
- TCB workshop October, 2016; RF Exposure Procedures (Bluetooth Duty Factor)
- TCB workshop October, 2016; RF Exposure Procedures (DUT Holder Perturbations)
- TCB workshop May, 2017; RF Exposure Procedures (LTE Test Conditions)
- TCB workshop April, 2019; RF Exposure Procedures (Tissue Simulating Liquids (TSL))

3. Facilities and Accreditation

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

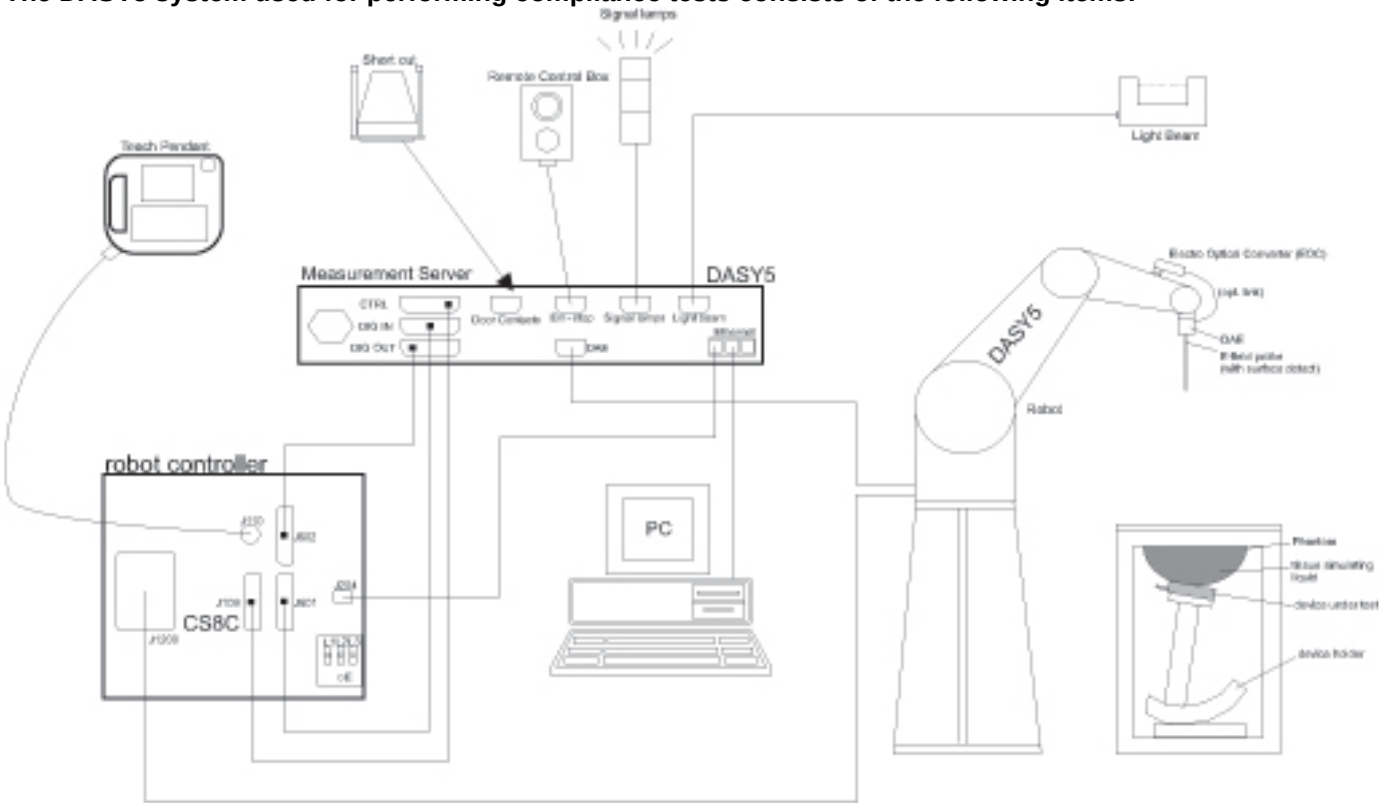
Suwon
SAR 1 Room
SAR 4 Room
SAR 5 Room

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.
The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

4. SAR Measurement System & Test Equipment

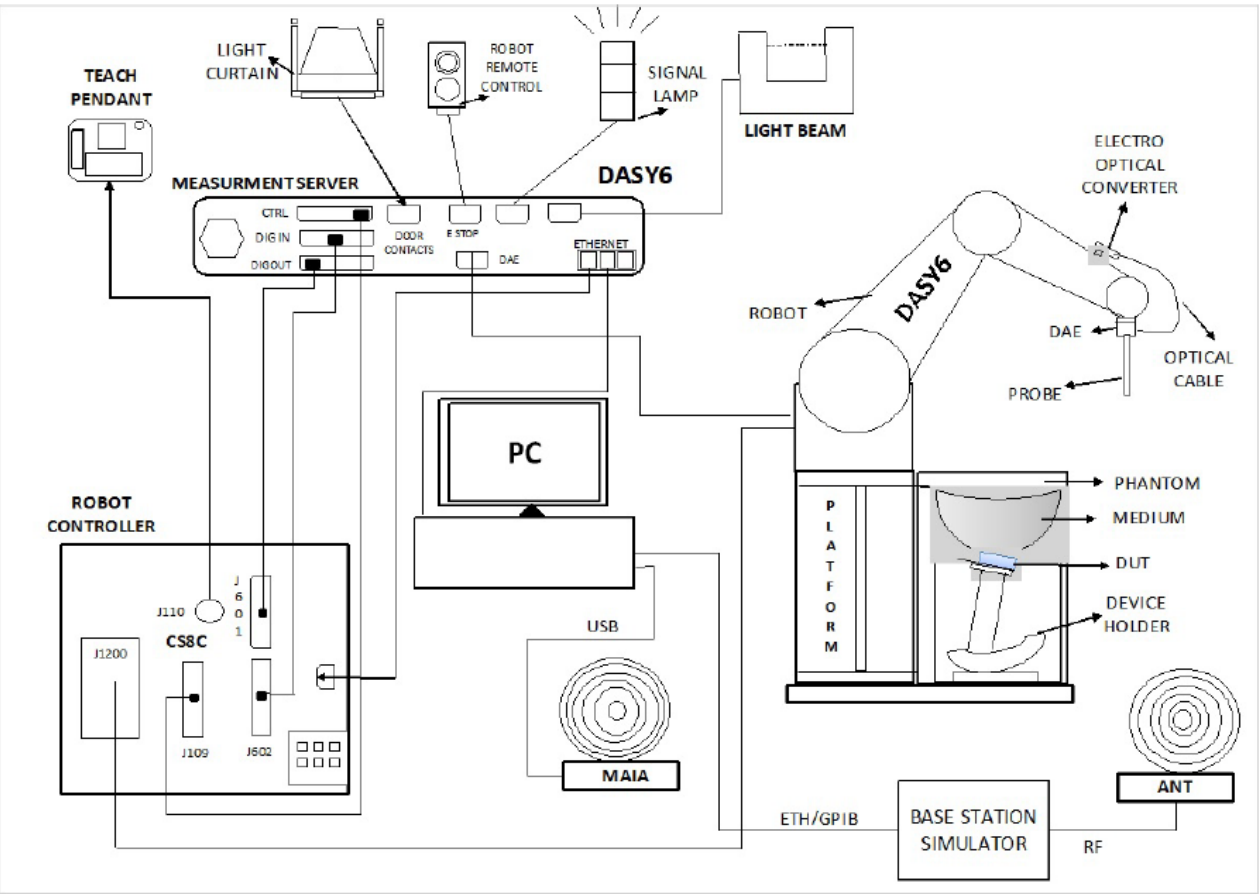
4.1. SAR Measurement System

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.

The DASY6 & 8 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 Win10 and the DASY6 or 8 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. SAR Scan 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.	

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	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
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.

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	8-6-2022
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	7-21-2022
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3851	8-4-2022

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Agilent	N5181A	MY50145882	8-4-2022
Power Sensor	Agilent	U2000A	MY54260007	8-4-2022
Power Sensor	Agilent	U2000A	MY60180020	8-4-2022
Power Amplifier	EXODUS	1410025-AMP2027-10003	10003	8-4-2022
Directional Coupler	Agilent	772D	MY52180193	8-3-2022
Directional Coupler	Agilent	778D	MY52180432	8-3-2022
Low Pass Filter	MINI-CIRCUITS	NLP-1200	VUU19301915	8-4-2022
Low Pass Filter	MICROLAB	LA-15N	3943	8-3-2022
Low Pass Filter	FILTRON	L14012FL	1410003S	8-3-2022
Low Pass Filter	MICROLAB	LA-60N	3942	8/4/2022
Attenuator	MINI-CIRCUITS	BW-N3W5+	N/A	8-4-2022
Attenuator	Agilent	8491B/003	MY39272275	8-17-2022
Attenuator	Agilent	8491B/010	MY39272011	8-4-2022
Attenuator	Agilent	8491B/020	MY39271973	8-4-2022
E-Field Probe	SPEAG	EX3DV4	7314	5/31/2022
E-Field Probe	SPEAG	EX3DV4	7313	2/23/2022
E-Field Probe	SPEAG	EX3DV4	7330	9/29/2022
E-Field Probe	SPEAG	EX3DV4	7376	7/30/2022
Data Acquisition Electronics	SPEAG	DAE4	1494	7/27/2022
Data Acquisition Electronics	SPEAG	DAE4	1591	3/26/2022
Data Acquisition Electronics	SPEAG	DAE4	1343	8/23/2022
System Validation Dipole	SPEAG	D835V2	4d194	3/20/2022
System Validation Dipole	SPEAG	D1900V2	5d199	3/19/2022
System Validation Dipole	SPEAG	D2450V2	960	3/20/2022
System Validation Dipole	SPEAG	D2600V2	1178	4/23/2023
System Validation Dipole	SPEAG	D5GHzV2	1184	12/3/2022
Thermometer	Lutron	MHB-382SD	AH.50213	8-4-2022
Thermometer	Lutron	MHB-382SD	AJ.45903	8-3-2022
Thermometer	Lutron	MHB-382SD	AH.50215	8-3-2022
Thermometer	Lutron	MHB-382SD	AK.12123	8-3-2022
Thermometer	Lutron	MHB-382SD	AK.18789	8-3-2022

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	169801	8-3-2022
Base Station Simulator	R & S	CMW500	169799	8-3-2022
Base Station Simulator	R & S	CMW500	169800	8-3-2022
Base Station Simulator	R & S	CMW500	169798	8-3-2022
Base Station Simulator	R & S	CMW500	169797	8-3-2022
Base Station Simulator	R & S	CMW500	150313	8-3-2022
Base Station Simulator	R & S	CMW500	150314	8-4-2022
Base Station Simulator	R & S	CMW500	162790	8-3-2022

Note(s):

1. For System Validation Dipole, Calibration interval applied every 2 years according to referencing KDB 865664 guidance.
2. Refer to Appendix F that mentioned about justification for Extended SAR Dipole Calibrations.

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 Procedures 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	☒ The Back Cover is not removable.		
Battery Options	☒ The rechargeable battery is not user accessible		
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ☒ Mobile Hotspot (Wi-Fi 2.4 GHz : Ch.1 – Ch.11) ☒ Mobile Hotspot (Wi-Fi 5.8 GHz_UNII-3 (Ch.149(20MHz)/Ch.151(40MHz)/Ch.155(80MHz)))		
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☒ Wi-Fi Direct (Wi-Fi 5.2 GHz_UNII-1 (Ch.36 – 48), Wi-Fi 5.8 GHz_UNII-3 (Ch. 149 – 165))		
Test Sample Information	**No.**	**S/N**	**Notes**
	1	R38RB002W7X	Main Conducted
	2	R38RB01SSKW	Main Conducted
	3	R38RB002VFR	Wi-Fi & BT Conducted
	4	R38RA00PTXK	Wi-Fi & BT Conducted
	5	R38RB01SVER	SAR
	6	R38RB01SS4J	SAR
	7	R38RA00PVMY	SAR
	8	R38RA00PTKD	SAR

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode		Duty Cycle used for SAR testing
GSM	850 1900	Voice (GMSK) GPRS (GMSK) EGPRS (8PSK)	GPRS Multi-Slot Class: ☐ Class 8 - 1 Up, 4 Down ☐ Class 10 - 2 Up, 4 Down ☐ Class 12 - 4 Up, 4 Down ☒ Class 33 - 4 Up, 5 Down	GSM Voice: 12.5% (E)GPRS: 1 Slot: 12.5% 2 Slots: 25% 3 Slots: 37.5% 4 Slots: 50%
	Does this device support DTM (Dual Transfer Mode)? ☐ Yes ☒ No			
W-CDMA (UMTS)	Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Category 24) HSUPA (Category 6) DC-HSDPA (Category 24) HSPA+ (DL only)		100%
LTE	FDD Band 5 TDD Band 41	QPSK 16QAM		100% (FDD) 63.3% (TDD)
	Does this device support SV-LTE (1xRTT-LTE)? ☐ Yes ☒ No			
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)		SISO mode : 99.3 % (802.11b)
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT20) 802.11ac (VHT40) 802.11ac (VHT80)		SISO mode: 97.3 % (802.11a) 94.5% (802.11ac (VHT80))
	Does this device support bands 5.60 ~ 5.65 GHz? ☒ Yes ☐ No			
	Does this device support Band gap channel(s)? ☒ Yes ☐ No			
Bluetooth	2.4 GHz	Version 5.0 LE		76.7% (DH5)
NFC	13.56 MHz	Type A/B/F		N/A[3]

Notes:

1. The Bluetooth protocol is considered source-based averaging. Bluetooth GFSK (DH5) was verified to have the highest duty cycle of 76.7% and was considered and used for SAR Testing.
2. Duty cycle for Wi-Fi is referenced from the DTS and UNII report.
3. Measured Duty Cycle is not required due to SAR test exemption.

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)		Reduced. RF Output Power (Hotspot & Proximity sensor & Earjack back-off) (dBm)	
				Tune-up Limit	Frame Pwr	Tune-up Limit	Frame Pwr
GSM850	Main 1 Ant.	Voice	1	**33.5**	**24.5**		
		GPRS	1	**33.0**	**24.0**		
		GPRS	2	**31.0**	**25.0**		
		GPRS	3	**29.5**	**25.2**		
		GPRS	4	**28.0**	**25.0**		
		EGPRS	1	**27.5**	**18.5**		
		EGPRS	2	**25.5**	**19.5**		
		EGPRS	3	**24.5**	**20.2**		
		EGPRS	4	**23.0**	**20.0**		
GSM1900	Main 2 Ant.	Voice	1	**31.5**	**22.5**	**30.0**	**21.0**
		GPRS	1	**31.5**	**22.5**	**30.0**	**21.0**
		GPRS	2	**29.0**	**23.0**	**27.5**	**21.5**
		GPRS	3	**27.5**	**23.2**	**26.0**	**21.7**
		GPRS	4	**26.0**	**23.0**	**24.5**	**21.5**
		EGPRS	1	**26.5**	**17.5**	**24.5**	**15.5**
		EGPRS	2	**24.5**	**18.5**	**22.5**	**16.5**
		EGPRS	3	**23.0**	**18.7**	**21.0**	**16.7**
		EGPRS	4	**21.5**	**18.5**	**19.5**	**16.5**

RF Air interface	Antenna	Mode	Max. RF Output Power (dBm)
W-CDMA Band V	Main 1 Ant.	R99	**25.5**
		HSDPA	**23.0**
		HSUPA	**22.5**
		DC-HSDPA	**23.0**

RF Air interface	Antenna	Mode	Max. RF Output Power (dBm)
LTE Band 5	Main 1 Ant.	QPSK	**25.5**
LTE Band 41	Main 2 Ant.	QPSK	**24.5**

WLAN power

Band	Mode	Max (dBm)	Reduce (dBm)	Max (dBm)				Reduce (dBm)			
		b	b	a	g	n	ac	a	g	n	ac
2.4GHz	1Ch	19	13		14	14			13	13	
2.4GHz	2-10Ch	19	13		17	17			13	13	
2.4GHz	11Ch	19	13		16	16			13	13	
2.4GHz	12Ch	19	8		13	13			8	6	
2.4GHz	13Ch	16	8		9	9			8	6	
5GHz (20MHz)	UNII-1			13		13	13	11		11	11
	UNII-2A			13		13	13	11		11	11
	UNII-2C			13		13	13	11		11	11
	UNII-3			13		13	13	11		11	11
5GHz (40MHz)	UNII-1					12	12			11	11
	UNII-2A					12	12			11	11
	UNII-2C					12	12			11	11
	UNII-3					12	12			11	11
5GHz (80MHz)	UNII-1						11				11
	UNII-2A						11				11
	UNII-2C						11				11
	UNII-3						11				11

Bluetooth-Maximum power

Band	Mode	Maximum output power (dBm)
2.4GHz	Bluetooth_GFSK	9.5
2.4GHz	Bluetooth_EDR	8.5
2.4GHz	Bluetooth_LE 1M	6.5
2.4GHz	Bluetooth_LE 2M	6.5

Note(s):.

1. This device uses an independent fixed level power reduction mechanism for WLAN mode and Bluetooth operations during RCV operation. Detailed descriptions of the power reduction mechanism are included in the operational description.
2. WLAN operation scenarios are refer to section.12.

6.4. Power Back-off Operation

This device supports multiple power back-off modes: WWAN (Hotspot), WWAN (Proximity sensor), and WLAN (RCV). Each of the power back-off operates within specific exposure conditions for certain technologies. For full details on how each power back-off mode operates, refer to the Operational Description.

Power Back-off mode	Technologies Supported	Exposure Conditions Active			
		Head	Body-worn	Hotspot	Product Specific 10-g
WWAN (Hotspot)[1]	GSM 1900	N/A	N/A	✓	N/A
WWAN (Proximity sensor)[1]	GSM 1900	N/A	N/A	N/A	✓
WLAN (RCV)	Wi-Fi 2.4GHz Wi-Fi 5GHz	✓	N/A	N/A	N/A

Notes:

1. Tune-up Limits for WWAN (Hotspot) and WWAN (Proximity Sensor) are all Reduced Average Powers. Please refer to Sec.9 for all conducted power measurements.
2. WWAN Back-off priority: Hotspot < Earjack < Proximity Sensor
3. Body-worn SAR with ear-jack connected is not required due to Body-worn measured at max power is not over 1.2 W/kg.

Product Specific 10g Adjusted SAR Calculation

Wireless technologies	Max Tune-up Limit (dBm)	Reduced Tune-Up Limit (dBm)	Power Factor	Reported SAR Limit (W/kg)
GSM 1900	23.2	21.7	1.41	0.850

Notes:

1. Tune-up limit powers for GSM 1900 are frame power(dBm).
2. Hotspot mode supports power reduction. When the measured SAR is scaled to the maximum tune-up limit, the adjusted SAR is < 1.2 W/kg. Therefore, Extremity SAR testing is not required for this band in accordance with KDB 648474 §2.5 b. Refer to §10 for Reported SAR results. If the Reported SAR 1g value in §10 is less than the Reported SAR Limit listed above, then Extremity SAR is not required.
3. LTE 50% RB is scaled up to the Max Tune-Up Limit with MPR included.
4. For Reported SAR limit in above table, it was calculated using Max tune-up Limit & Reduced Tune-up limit & Reported SAR 1.2 W/kg. (Reported SAR Limit = 1.2 W/kg / Power factor, Power factor = 10^((Max tune-up limit – Reduced tune-up limit)/10)

6.5. General LTE SAR Test and Reporting Considerations

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Frequency range, Channel Bandwidth, Numbers and Frequencies</td><td>
<table>
<tr><td rowspan="3">Band 5</td><td colspan="6">Frequency range: 824 - 849 MHz</td></tr>
<tr><td colspan="6">Channel Bandwidth</td></tr>
<tr><td>20 MHz</td><td>15 MHz</td><td>10 MHz</td><td>5 MHz</td><td>3 MHz</td><td>1.4 MHz</td></tr>
<tr><td>Low</td><td></td><td></td><td>20450/ 829</td><td>20425/ 826.5</td><td>20415/ 825.5</td><td>20407/ 824.7</td></tr>
<tr><td>Mid</td><td></td><td></td><td>20525/ 836.5</td><td>20525/ 836.5</td><td>20525/ 836.5</td><td>20525/ 836.5</td></tr>
<tr><td>High</td><td></td><td></td><td>20600/ 844</td><td>20625/ 846.5</td><td>20635/ 847.5</td><td>20643/ 848.3</td></tr>
<tr><td rowspan="3">Band 41</td><td colspan="6">Frequency range: 2496 - 2690 MHz</td></tr>
<tr><td colspan="6">Channel Bandwidth</td></tr>
<tr><td>20 MHz</td><td>15 MHz</td><td>10 MHz</td><td>5 MHz</td><td>3 MHz</td><td>1.4 MHz</td></tr>
<tr><td>Low</td><td colspan="4">39750 / 2506.0</td><td></td><td></td></tr>
<tr><td>Low-Mid</td><td colspan="4">40185 / 2549.5</td><td></td><td></td></tr>
<tr><td>Mid</td><td colspan="4">40620 / 2593.0</td><td></td><td></td></tr>
<tr><td>Mid-High</td><td colspan="4">41055 / 2636.5</td><td></td><td></td></tr>
<tr><td>High</td><td colspan="4">41490 / 2680.0</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>LTE transmitter and antenna implementation</td><td>Refer to Appendix A.</td></tr>
<tr><td>Maximum power reduction (MPR)</td><td>
Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3
<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (N_{RB})</th><th rowspan="2">MPR (dB)</th></tr>
<tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr>
<tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr>
<tr><td>64 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 2</td></tr>
<tr><td>64 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 3</td></tr>
<tr><td>256 QAM</td><td colspan="6">≥ 1</td><td>≤ 5</td></tr>
</table>
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
</td></tr>
<tr><td>Power reduction</td><td>Yes</td></tr>
<tr><td>Spectrum plots for RB configurations</td><td>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.</td></tr>
</table>

Notes:

1. 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.
2. LTE Band 41 test channels in accordance with October 2014 TCB workshop for all channels bandwidths.
3. SAR Testing for LTE was performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

6.6. LTE (TDD) Considerations

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

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

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

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

Calculated Duty Cycle

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

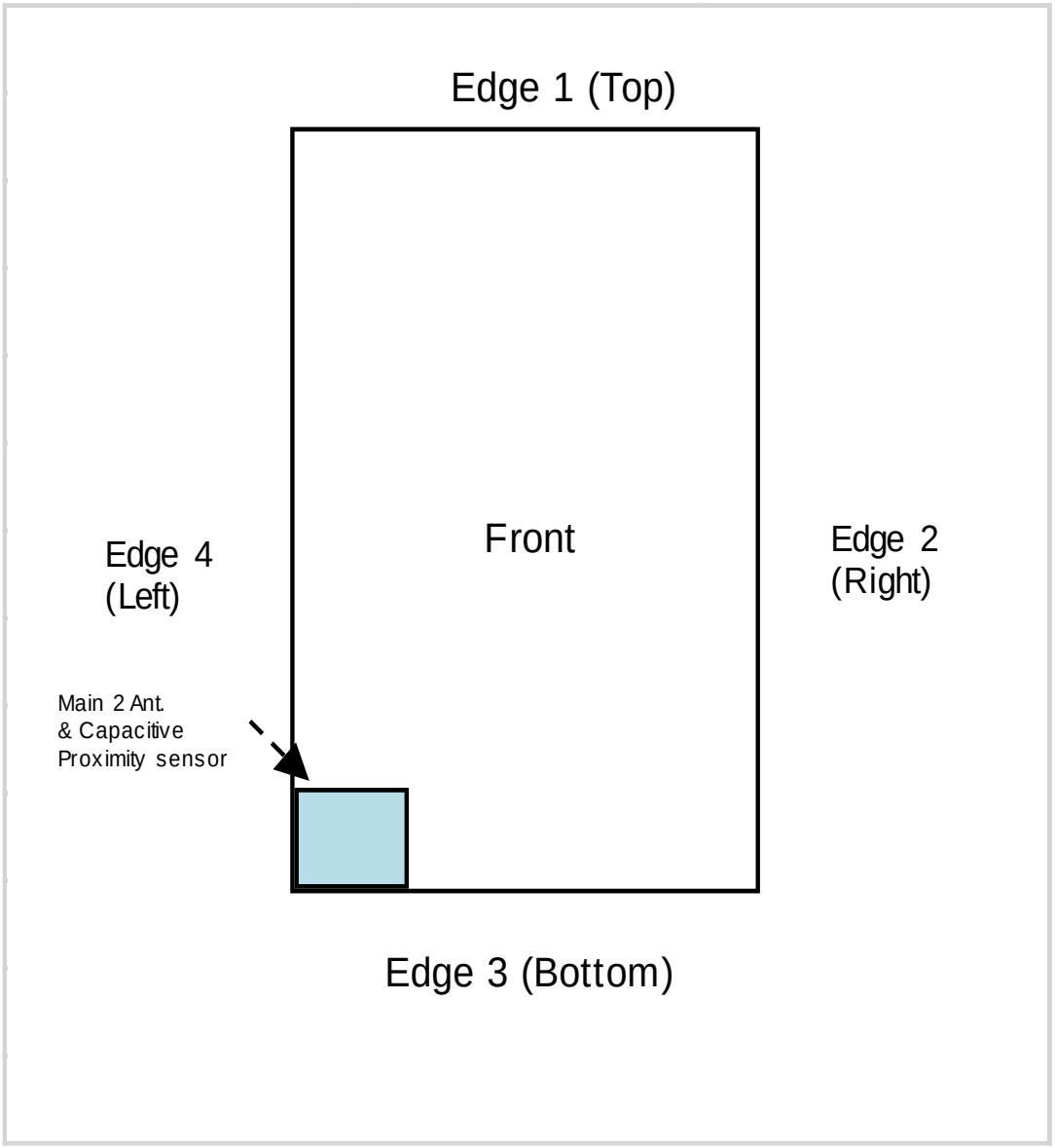
Calculated Duty Cycle = Extended cyclic prefix in uplink x (T_s) x # of S + # of U

Example for Calculated Duty Cycle for Uplink-Downlink Configuration 0:
Calculated Duty Cycle = 5120 x [1/(15000 x 2048)] x 2 + 6 ms = 63.33%
where
T_s = 1/(15000 x 2048) seconds

Note(s):
This device supports uplink-downlink configurations 0-6. The configuration with highest duty cycle was used for SAR Testing: configuration 0 at 63.3% duty cycle.

6.7. 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.

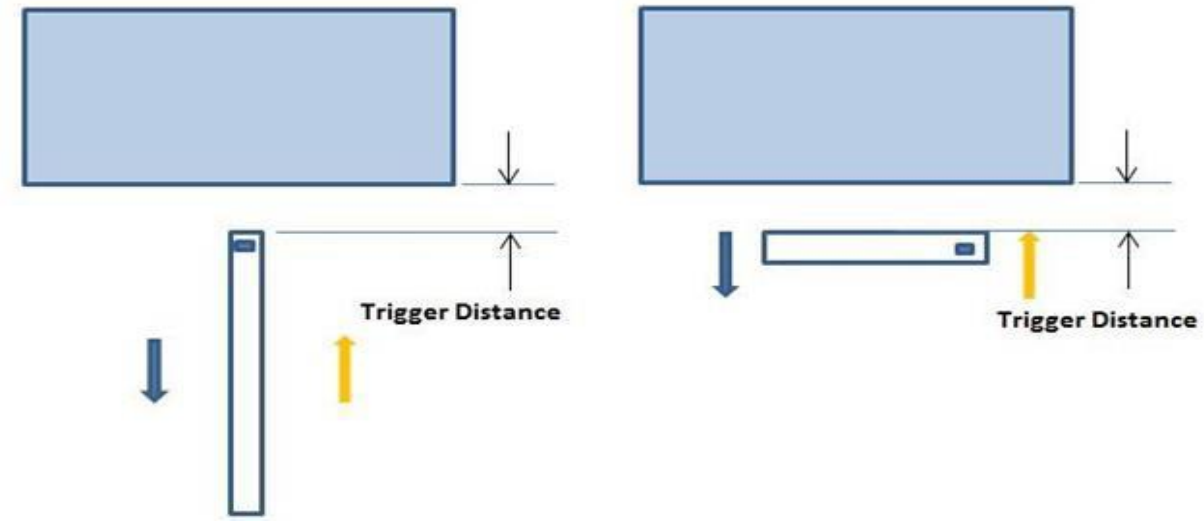


6.7.1. Proximity Sensor Triggering Distance (KDB 616217 §6.2)

Rear, Front and Edge 3 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 (Triggeredor 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 theconducted power. Section 9 contains both the full and reduced conducted power measurements.



Proximity Sensor Trigger Distance Assessment KDB 616217 Sec.6.2

LEGEND

Direction of DUT travel for determination of power reduction triggering point

Direction of DUT travel for determination of full power triggering point

Summary of Trigger Distances

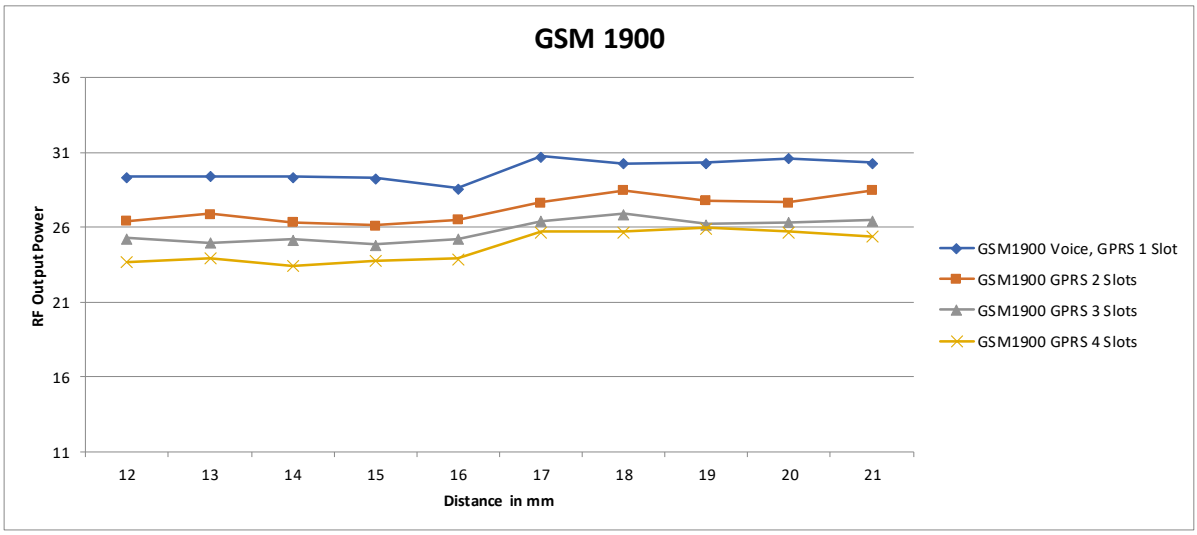
Antenna	Trigger distance - Rear		Trigger distance – Left (Edge 4)		Trigger distance - Bottom	
	Moving toward phantom	Moving from phantom	Moving toward phantom	Moving from phantom	Moving toward phantom	Moving from phantom
Main 2 Ant.	16 mm	16 mm	7 mm	7 mm	12 mm	12 mm

Proximity Sensor Triggering Distance Measurement Results

WWAN Bands

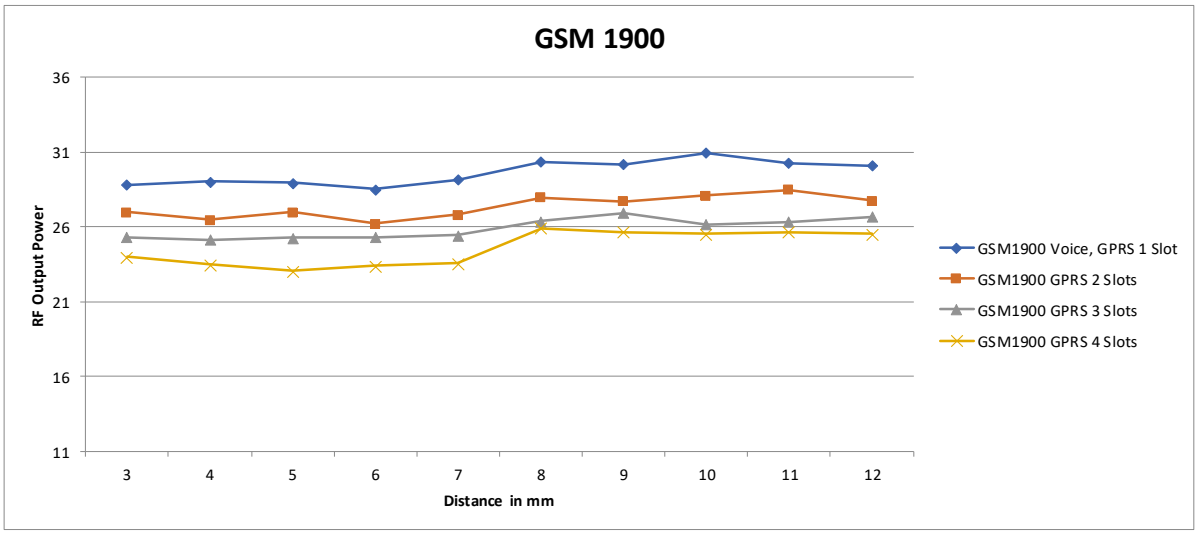
Rear, DUT Moving Toward (Trigger) and Away (Release) from Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	12	13	14	15	16	17	18	19	20	21
GSM1900 Voice, GPRS 1 Slot	29.4	29.4	29.4	29.3	28.6	30.7	30.3	30.3	30.6	30.3
GSM1900 GPRS 2 Slots	26.4	26.9	26.3	26.1	26.5	27.7	28.5	27.8	27.6	28.5
GSM1900 GPRS 3 Slots	25.3	25.0	25.2	24.8	25.2	26.4	26.9	26.2	26.3	26.5
GSM1900 GPRS 4 Slots	23.7	24.0	23.4	23.8	23.9	25.7	25.7	25.9	25.7	25.4



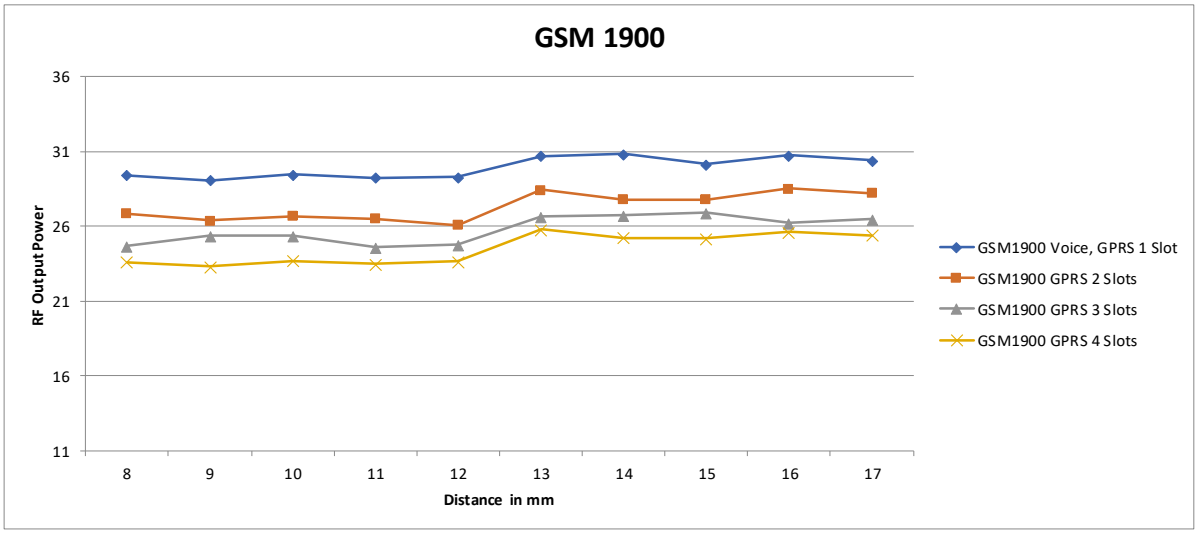
Left, DUT Moving Toward (Trigger) and Away (Release) from Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	3	4	5	6	7	8	9	10	11	12
GSM1900 Voice, GPRS 1 Slot	28.8	29.0	28.9	28.5	29.2	30.4	30.2	31.0	30.3	30.1
GSM1900 GPRS 2 Slots	27.0	26.5	27.0	26.2	26.8	28.0	27.7	28.1	28.5	27.7
GSM1900 GPRS 3 Slots	25.3	25.1	25.3	25.3	25.5	26.4	27.0	26.2	26.3	26.7
GSM1900 GPRS 4 Slots	24.0	23.5	23.0	23.4	23.6	25.9	25.7	25.5	25.6	25.5



Bottom, DUT Moving Toward (Trigger) and Away (Release) from Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	8	9	10	11	12	13	14	15	16	17
GSM1900 Voice, GPRS 1 Slot	29.4	29.1	29.5	29.2	29.3	30.7	30.8	30.1	30.7	30.4
GSM1900 GPRS 2 Slots	26.8	26.4	26.7	26.5	26.1	28.4	27.8	27.8	28.5	28.2
GSM1900 GPRS 3 Slots	24.7	25.3	25.4	24.6	24.8	26.7	26.7	26.9	26.2	26.5
GSM1900 GPRS 4 Slots	23.6	23.3	23.7	23.5	23.6	25.8	25.2	25.2	25.6	25.4



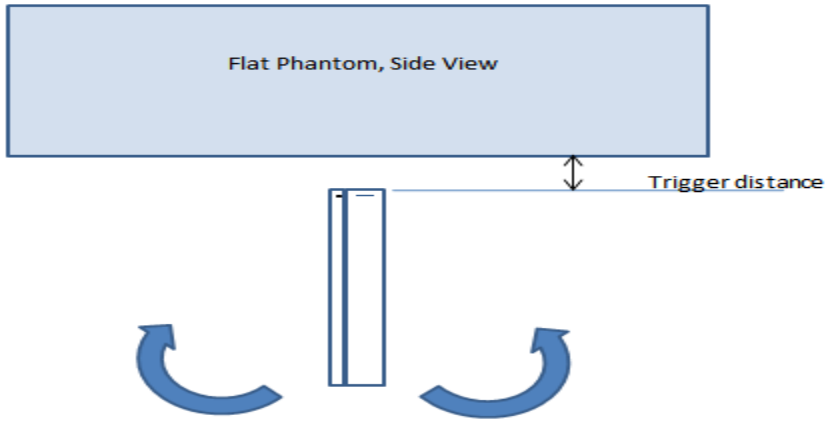
6.7.2. Proximity Sensor Coverage (KDB 616217 Sec.6.3)

As there is no spatial offset between the antenna and the proximity sensor element, proximity sensor coverage did not need to be assessed.

6.7.3. Proximity Sensor Tilt Angle Assessment (KDB 616217 Sec.6.4)

The DUT was positioned directly below the flat phantom at the minimum measured trigger distance with Edge 3 parallel to the base of the flat phantom for each band.

The EUT was rotated about Edge 3 for angles up to +/- 45°. If the output power increased during the rotation the DUT was moved 1mm toward the phantom and the rotation repeated. This procedure was repeated until the power remained reduced for all angles up to +/- 45°.



Proximity sensor tilt angle assessment (Edge 3) KDB 616217 §6.4

Summary of Tablet Tilt Angle Influence to Proximity Sensor Triggering (Edge 3)

Antenna	Minimum trigger distance measured according to KDB 616217 §6.2	Minimum distance at which power reduction was maintained over +/-45°	Power reduction status										
			-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
Main 2 Ant	12 mm	12 mm	On	On	On	On	On	On	On	On	On	On	On

6.7.4. 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
Main 2 Ant	Rear	16 mm	N/A	N/A	15 mm
	Left	7 mm	N/A	N/A	6 mm
	Bottom	12 mm	N/A	12 mm	11 mm

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 1 Ant. & Main 2 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	Main 1 Ant. & Main 2 Ant.	15 mm	Rear	N/A	Yes	
				Front	N/A	Yes	
	Hotspot	Main 1 Ant.	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	
	Hotspot	Main 2 Ant.	10 mm	Rear	< 25 mm	Yes	
				Front	< 25 mm	Yes	
				Edge 1 (Top)	> 25 mm	No	1
				Edge 2 (Right)	> 25 mm	No	1
				Edge 3 (Bottom)	< 25 mm	Yes	
				Edge 4 (Left)	< 25 mm	Yes	
	Product Specific 10-g	Main 1 Ant. & Main 2 Ant.	0 mm	Rear	Refer to notes 2 & 3		
				Front			
				Edge 1 (Top)			
				Edge 2 (Right)			
				Edge 3 (Bottom)			
				Edge 4 (Left)			
WLAN/BT&BLE	Head	WiFi 2.4G & WiFi 5G	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	WiFi 2.4G & WiFi 5G	15 mm	Rear	N/A	Yes	
				Front	N/A	Yes	
	Hotspot	WiFi 2.4G & WiFi 5G	10 mm	Rear	< 25 mm	Yes	
				Front	< 25 mm	Yes	
				Edge 1 (Top)	< 25 mm	Yes	
				Edge 2 (Right)	> 25 mm	No	1
				Edge 3 (Bottom)	> 25 mm	No	1
				Edge 4 (Left)	< 25 mm	Yes	
	Product Specific 10-g	WiFi 2.4G & WiFi 5G	0 mm	Rear	Refer to notes 2 & 4		
				Front			
				Edge 1 (Top)			
				Edge 2 (Right)			
				Edge 3 (Bottom)			
				Edge 4 (Left)			

Notes:

1. SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR.
2. For Phablet devices: When hotspot mode applies, Product specific 10-g SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.
3. For Phablet devices: When hotspot mode applies and power reduction applies to hotspot mode, Product specific 10-g SAR is required for each test position that has and adjusted SAR to maximum power that is > 1.2 W/kg.
4. For Phablet devices: When hotspot mode is not supported, Product specific 10-g SAR is required for all surfaces and edges with an antenna located at ≤ 25mm from that surface or edge in direct contact with a flat phantom, to address interactive hand use exposure conditions.

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	
	ε_r	σ (S/m)
150	52.3	0.76
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
915	41.5	0.98
1450	40.5	1.20
1610	40.3	1.29
1800 – 2000	40.0	1.40
2450	39.2	1.80
3000	38.5	2.40
5000	36.2	4.45
5100	36.1	4.55
5200	36.0	4.66
5300	35.9	4.76
5400	35.8	4.86
5500	35.6	4.96
5600	35.5	5.07
5700	35.4	5.17
5800	35.3	5.27
6000	35.1	5.48
NOTE: For convenience, permittivity and conductivity values at some frequencies that are not part of the original data from Drossos et al. [B60] or the extension to 5800 MHz are provided (i.e., the values shown in italics). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6000 MHz that were linearly extrapolated from the values at 3000 MHz and 5800 MHz.		

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

IEEE Std 1528-2013
Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

SAR 1 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/30/2021	Head 835	e'	41.6900	Relative Permittivity (ε_r):	41.69	41.50	0.46	5
		e"	20.1000	Conductivity (σ):	0.93	0.90	3.69	5
	Head 820	e'	41.7600	Relative Permittivity (ε_r):	41.76	41.60	0.38	5
		e"	20.3200	Conductivity (σ):	0.93	0.90	3.12	5
	Head 850	e'	41.6500	Relative Permittivity (ε_r):	41.65	41.50	0.36	5
		e"	19.8700	Conductivity (σ):	0.94	0.92	2.63	5
1/3/2022	Head 835	e'	41.0900	Relative Permittivity (ε_r):	41.09	41.50	-0.99	5
		e"	19.0000	Conductivity (σ):	0.88	0.90	-1.98	5
	Head 820	e'	41.1100	Relative Permittivity (ε_r):	41.11	41.60	-1.18	5
		e"	19.1800	Conductivity (σ):	0.87	0.90	-2.67	5
	Head 850	e'	41.1100	Relative Permittivity (ε_r):	41.11	41.50	-0.94	5
		e"	18.8300	Conductivity (σ):	0.89	0.92	-2.74	5
1/12/2022	Head 2450	e'	39.4400	Relative Permittivity (ε_r):	39.44	39.20	0.61	5
		e"	12.9700	Conductivity (σ):	1.77	1.80	-1.84	5
	Head 2400	e'	39.5200	Relative Permittivity (ε_r):	39.52	39.30	0.57	5
		e"	12.9600	Conductivity (σ):	1.73	1.75	-1.27	5
	Head 2480	e'	39.3900	Relative Permittivity (ε_r):	39.39	39.16	0.58	5
		e"	12.9800	Conductivity (σ):	1.79	1.83	-2.32	5
1/13/2022	Head 5250	e'	35.1300	Relative Permittivity (ε_r):	35.13	35.93	-2.24	5
		e"	15.8500	Conductivity (σ):	4.63	4.70	-1.60	5
	Head 5260	e'	35.1000	Relative Permittivity (ε_r):	35.10	35.92	-2.29	5
		e"	15.8700	Conductivity (σ):	4.64	4.71	-1.50	5
	Head 5600	e'	34.4300	Relative Permittivity (ε_r):	34.43	35.53	-3.11	5
		e"	16.1600	Conductivity (σ):	5.03	5.06	-0.56	5
	Head 5750	e'	34.2000	Relative Permittivity (ε_r):	34.20	35.36	-3.29	5
		e"	16.2700	Conductivity (σ):	5.20	5.21	-0.23	5
	Head 5825	e'	34.0500	Relative Permittivity (ε_r):	34.05	35.30	-3.54	5
		e"	16.3300	Conductivity (σ):	5.29	5.27	0.36	5
1/17/2022	Head 5250	e'	35.6800	Relative Permittivity (ε_r):	35.68	35.93	-0.70	5
		e"	16.1700	Conductivity (σ):	4.72	4.70	0.39	5
	Head 5260	e'	35.6700	Relative Permittivity (ε_r):	35.67	35.92	-0.70	5
		e"	16.1700	Conductivity (σ):	4.73	4.71	0.36	5
	Head 5600	e'	34.6800	Relative Permittivity (ε_r):	34.68	35.53	-2.40	5
		e"	16.4200	Conductivity (σ):	5.11	5.06	1.04	5
	Head 5750	e'	34.5000	Relative Permittivity (ε_r):	34.50	35.36	-2.44	5
		e"	16.6600	Conductivity (σ):	5.33	5.21	2.16	5
	Head 5825	e'	34.4300	Relative Permittivity (ε_r):	34.43	35.30	-2.46	5
		e"	16.6700	Conductivity (σ):	5.40	5.27	2.45	5
1/20/2022	Head 2450	e'	38.3200	Relative Permittivity (ε_r):	38.32	39.20	-2.24	5
		e"	13.3400	Conductivity (σ):	1.82	1.80	0.96	5
	Head 2400	e'	38.4000	Relative Permittivity (ε_r):	38.40	39.30	-2.28	5
		e"	13.3100	Conductivity (σ):	1.78	1.75	1.40	5
	Head 2480	e'	38.2800	Relative Permittivity (ε_r):	38.28	39.16	-2.25	5
		e"	13.3400	Conductivity (σ):	1.84	1.83	0.39	5
1/20/2022	Head 5250	e'	35.3900	Relative Permittivity (ε_r):	35.39	35.93	-1.51	5
		e"	15.7400	Conductivity (σ):	4.59	4.70	-2.28	5
	Head 5260	e'	35.4000	Relative Permittivity (ε_r):	35.40	35.92	-1.45	5
		e"	15.8700	Conductivity (σ):	4.64	4.71	-1.50	5
	Head 5600	e'	34.5600	Relative Permittivity (ε_r):	34.56	35.53	-2.74	5
		e"	15.9600	Conductivity (σ):	4.97	5.06	-1.79	5
	Head 5750	e'	34.4600	Relative Permittivity (ε_r):	34.46	35.36	-2.55	5
		e"	15.8900	Conductivity (σ):	5.08	5.21	-2.56	5
	Head 5825	e'	34.0800	Relative Permittivity (ε_r):	34.08	35.30	-3.46	5
		e"	16.0600	Conductivity (σ):	5.20	5.27	-1.30	5

SAR 4 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/27/2021	Head 2450	e'	40.7200	Relative Permittivity (ϵ_r):	40.72	39.20	3.88	5
		e"	13.0400	Conductivity (σ):	1.78	1.80	-1.31	5
	Head 2400	e'	40.7500	Relative Permittivity (ϵ_r):	40.75	39.30	3.70	5
		e"	12.9700	Conductivity (σ):	1.73	1.75	-1.19	5
	Head 2480	e'	40.7100	Relative Permittivity (ϵ_r):	40.71	39.16	3.95	5
		e"	12.9600	Conductivity (σ):	1.79	1.83	-2.47	5
1/17/2022	Head 1750	e'	41.7000	Relative Permittivity (ϵ_r):	41.70	40.08	4.03	5
		e"	13.7400	Conductivity (σ):	1.34	1.37	-2.34	5
	Head 1710	e'	41.7600	Relative Permittivity (ϵ_r):	41.76	40.15	4.02	5
		e"	13.9000	Conductivity (σ):	1.32	1.35	-1.84	5
	Head 1755	e'	41.7000	Relative Permittivity (ϵ_r):	41.70	40.08	4.05	5
		e"	13.7200	Conductivity (σ):	1.34	1.37	-2.40	5

SAR 5 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1/13/2022	Head 2600	e'	40.5600	Relative Permittivity (ϵ_r):	40.56	39.01	3.97	5
		e"	13.2300	Conductivity (σ):	1.91	1.96	-2.52	5
	Head 2500	e'	40.6500	Relative Permittivity (ϵ_r):	40.65	39.14	3.87	5
		e"	13.2200	Conductivity (σ):	1.84	1.85	-0.88	5
	Head 2700	e'	40.4100	Relative Permittivity (ϵ_r):	40.41	38.88	3.92	5
		e"	13.3100	Conductivity (σ):	2.00	2.07	-3.48	5
1/17/2022	Head 2600	e'	38.6500	Relative Permittivity (ϵ_r):	38.65	39.01	-0.92	5
		e"	13.6300	Conductivity (σ):	1.97	1.96	0.42	5
	Head 2500	e'	39.1800	Relative Permittivity (ϵ_r):	39.18	39.14	0.11	5
		e"	13.7000	Conductivity (σ):	1.90	1.85	2.72	5
	Head 2700	e'	38.5400	Relative Permittivity (ϵ_r):	38.54	38.88	-0.89	5
		e"	13.3700	Conductivity (σ):	2.01	2.07	-3.05	5

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	Cal. Due.Date	Freq. (MHz)	Target SAR Values (W/kg)	
					1g/10g	Head
D835V2	4d194	3/20/2020	3/20/2022	835	1g	9.76
					10g	6.42
D1900V2	5d199	3/19/2020	3/19/2022	1900	1g	40.50
					10g	21.00
D2450V2	960	3/20/2020	3/20/2022	2450	1g	53.20
					10g	24.80
D2600V2	1178	4/23/2021	4/23/2022	2600	1g	57.10
					10g	25.50
D5GHzV2	1184	12/3/2020	12/3/2022	5250	1g	79.10
					10g	22.70
				5600	1g	82.40
					10g	23.30
				5750	1g	79.90
					10g	22.60

Note(s):

Refer to Appendix F that mentioned about justification for Extended SAR Dipole Calibrations.

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			
12/30/2021	D835V2	4d194	Head	1g	0.99	9.9	9.76	1.13	
				10g	0.65	6.5	6.42	1.25	
1/3/2022	D835V2	4d194	Head	1g	1.04	10.4	9.76	6.56	1, 2
				10g	0.69	6.9	6.42	7.94	
1/12/2022	D2450V2	960	Head	1g	5.42	54.2	53.20	1.88	
				10g	2.55	25.5	24.80	2.82	
1/13/2022	D5GHzV2 (5250)	1184	Head	1g	7.95	79.5	79.10	0.51	
				10g	2.34	23.4	22.70	3.08	
1/13/2022	D5GHzV2 (5600)	1184	Head	1g	8.48	84.8	82.40	2.91	
				10g	2.47	24.7	23.30	6.01	
1/13/2022	D5GHzV2 (5750)	1184	Head	1g	8.16	81.6	79.90	2.13	
				10g	2.38	23.8	22.60	5.31	
1/17/2022	D5GHzV2 (5250)	1184	Head	1g	7.28	72.8	79.10	-7.96	3, 4
				10g	2.14	21.4	22.70	-5.73	
1/17/2022	D5GHzV2 (5600)	1184	Head	1g	8.41	84.1	82.40	2.06	
				10g	2.43	24.3	23.30	4.29	
1/17/2022	D5GHzV2 (5750)	1184	Head	1g	8.25	82.5	79.90	3.25	
				10g	2.39	23.9	22.60	5.75	
1/20/2022	D2450V2	960	Head	1g	5.43	54.3	53.20	2.07	5,6
				10g	2.54	25.4	24.80	2.42	
1/20/2022	D5GHzV2 (5750)	1184	Head	1g	7.95	79.5	79.90	-0.50	
				10g	2.32	23.2	22.60	2.65	

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			
12/27/2021	D2450V2	960	Head	1g	5.22	52.2	53.20	-1.88	
				10g	2.39	23.9	24.80	-3.63	
1/17/2022	D1900V2	5d199	Head	1g	4.22	42.2	40.50	4.20	7, 8
				10g	2.19	21.9	21.00	4.29	

SAR 5 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			
1/13/2022	D2600V2	1178	Head	1g	6.02	60.2	56.60	6.36	9, 10
				10g	2.77	27.7	25.40	9.06	
1/17/2022	D2600V2	1178	Head	1g	5.42	54.2	56.60	-4.24	
				10g	2.50	25.0	25.40	-1.57	

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	31.9	22.9	33.5	24.5
			190	836.6	32.1	23.1		
			251	848.8	32.6	23.6		
GPRS (GMSK)	CS1	1	128	824.2	31.9	22.9	33.0	24.0
			190	836.6	32.2	23.2		
			251	848.8	32.6	23.5		
		2	128	824.2	29.8	23.7	31.0	25.0
			190	836.6	29.9	23.9		
			251	848.8	30.1	24.1		
		3	128	824.2	28.4	24.1	29.5	25.2
			190	836.6	28.3	24.0		
			251	848.8	28.5	24.2		
		4	128	824.2	27.0	24.0	28.0	25.0
			190	836.6	26.9	23.9		
			251	848.8	27.1	24.1		
EGPRS (8PSK)	MCS5	1	128	824.2	26.3	17.3	27.5	18.5
			190	836.6	26.5	17.4		
			251	848.8	26.5	17.5		
		2	128	824.2	24.6	18.5	25.5	19.5
			190	836.6	24.6	18.5		
			251	848.8	24.8	18.8		
		3	128	824.2	23.4	19.1	24.5	20.2
			190	836.6	23.5	19.2		
			251	848.8	23.7	19.4		
		4	128	824.2	21.9	18.9	23.0	20.0
			190	836.6	21.6	18.6		
			251	848.8	21.9	18.9		

Notes:

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

- GMSK (GPRS) mode with 3 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.

GSM1900 Measured Results

Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Maximum Average Power (dBm)				Reduced Average Power (dBm) Hotspot back-off				Reduced Average Power (dBm) Proximity sensor back-off			
					Measured		Tune-up Limit		Measured		Tune-up Limit		Measured		Tune-up Limit	
					Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr
GSM (Voice)	CS1	1	512	1850.2	31.2	22.2	31.5	22.5	29.8	20.8	30.0	21.0	29.8	20.8	30.0	21.0
			661	1880.0	30.5	21.4			29.2	20.2			29.1	20.1		
			810	1909.8	29.6	20.6			28.3	19.3			28.2	19.2		
GPRS (GMSK)	CS1	1	512	1850.2	31.1	22.1	31.5	22.5	29.8	20.7	30.0	21.0	29.7	20.6	30.0	21.0
			661	1880.0	30.7	21.6			29.0	20.0			29.0	20.0		
			810	1909.8	29.9	20.9			28.0	19.0			28.2	19.1		
		2	512	1850.2	28.7	22.7	29.0	23.0	26.3	20.3	27.5	21.5	26.3	20.3	27.5	21.5
			661	1880.0	28.0	22.0			26.8	20.8			26.8	20.8		
			810	1909.8	27.2	21.2			26.7	20.6			26.7	20.7		
		3	512	1850.2	26.4	22.1	27.5	23.2	24.5	20.2	26.0	21.7	24.5	20.2	26.0	21.7
			661	1880.0	26.9	22.6			24.9	20.7			25.0	20.7		
			810	1909.8	26.8	22.5			24.8	20.6			24.9	20.6		
		4	512	1850.2	25.1	22.1	26.0	23.0	23.2	20.2	24.5	21.5	23.2	20.2	24.5	21.5
			661	1880.0	25.6	22.5			23.7	20.7			23.6	20.6		
			810	1909.8	25.6	22.6			23.7	20.7			23.6	20.6		
EGPRS (8PSK)	MCS5	1	512	1850.2	25.2	16.2	26.5	17.5	22.7	13.6	24.5	15.5	22.8	13.7	24.5	15.5
			661	1880.0	25.6	16.6			22.8	13.7			22.9	13.9		
			810	1909.8	25.5	16.4			22.9	13.9			22.8	13.8		
		2	512	1850.2	23.3	17.2	24.5	18.5	20.5	14.4	22.5	16.5	20.6	14.6	22.5	16.5
			661	1880.0	23.5	17.5			20.7	14.7			20.8	14.8		
			810	1909.8	23.6	17.6			20.9	14.9			20.8	14.7		
		3	512	1850.2	21.8	17.6	23.0	18.7	19.0	14.8	21.0	16.7	18.9	14.7	21.0	16.7
			661	1880.0	22.1	17.8			19.3	15.0			19.4	15.1		
			810	1909.8	22.0	17.7			19.2	14.9			19.3	15.0		
		4	512	1850.2	20.4	17.4	21.5	18.5	17.4	14.4	19.5	16.5	17.5	14.5	19.5	16.5
			661	1880.0	20.6	17.6			17.6	14.6			17.8	14.7		
			810	1909.8	20.8	17.8			17.8	14.8			17.7	14.7		

Notes:

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

- GMSK (GPRS) mode with 3 time slots for Max & Reduced 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.

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			

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-DPDCH	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

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.

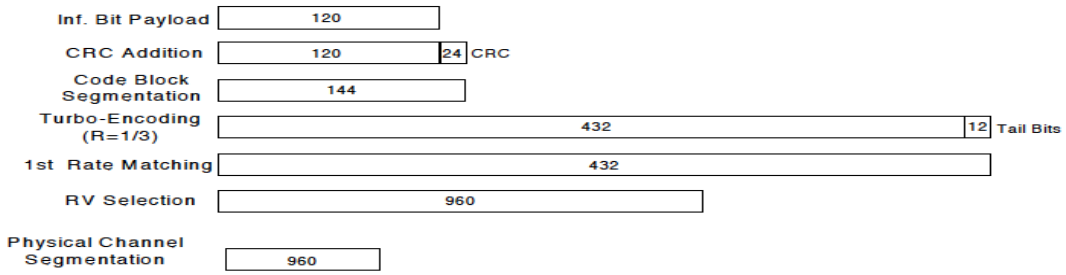


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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 supported to down link. Therefore, the RF conducted power is not measured.

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	24.7	N/A	25.5
		4183	836.6	24.9		
		4233	846.6	24.8		
HSDPA	Subtest 1	4132	826.4	22.3	0	23.0
		4183	836.6	22.4		
		4233	846.6	22.4		
	Subtest 2	4132	826.4	22.4	0	23.0
		4183	836.6	22.4		
		4233	846.6	22.4		
	Subtest 3	4132	826.4	21.2	0.5	22.5
		4183	836.6	21.4		
		4233	846.6	21.3		
	Subtest 4	4132	826.4	21.6	0.5	22.5
		4183	836.6	21.8		
		4233	846.6	21.7		
HSUPA	Subtest 1	4132	826.4	21.8	0	22.5
		4183	836.6	21.9		
		4233	846.6	21.8		
	Subtest 2	4132	826.4	19.7	2	20.5
		4183	836.6	19.8		
		4233	846.6	19.8		
	Subtest 3	4132	826.4	20.8	1	21.5
		4183	836.6	20.8		
		4233	846.6	20.7		
	Subtest 4	4132	826.4	19.7	2	20.5
		4183	836.6	19.8		
		4233	846.6	19.8		
	Subtest 5	4132	826.4	21.8	0	22.5
		4183	836.6	21.9		
		4233	846.6	21.8		
DC-HSDPA	Subtest 1	4132	826.4	22.3	0	23.0
		4183	836.6	22.4		
		4233	846.6	22.3		
	Subtest 2	4132	826.4	22.3	0	23.0
		4183	836.6	22.4		
		4233	846.6	22.3		
	Subtest 3	4132	826.4	20.7	0.5	22.5
		4183	836.6	20.8		
		4233	846.6	20.7		
	Subtest 4	4132	826.4	21.6	0.5	22.5
		4183	836.6	21.7		
		4233	846.6	21.6		

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

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.

1. Max power

LTE Band 5 Measured Results

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)			MPR	Tune-up Limit
				Measured Pwr (dBm)				
				[redacted]	20525	[redacted]		
					836.5 MHz			
10 MHz	QPSK	1	0		24.7		0.0	25.5
		1	25		24.7		0.0	25.5
		1	49		24.6		0.0	25.5
		25	0		23.9		1.0	24.5
		25	12		23.9		1.0	24.5
		25	25		23.8		1.0	24.5
		50	0		23.9		1.0	24.5
	16QAM	1	0		23.9		1.0	24.5
		1	25		23.8		1.0	24.5
		1	49		23.8		1.0	24.5
		25	0		22.9		2.0	23.5
		25	12		22.9		2.0	23.5
		25	25		22.9		2.0	23.5
		50	0		22.9		2.0	23.5

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	24.8	24.7	24.6	0.0	25.5
		1	12	24.7	24.6	24.5	0.0	25.5
		1	24	24.7	24.6	24.5	0.0	25.5
		12	0	23.9	23.9	23.7	1.0	24.5
		12	7	23.9	23.9	23.7	1.0	24.5
		12	13	23.9	23.9	23.7	1.0	24.5
		25	0	23.9	23.9	23.7	1.0	24.5
	16QAM	1	0	23.7	23.6	23.6	1.0	24.5
		1	12	23.7	23.6	23.6	1.0	24.5
		1	24	23.7	23.6	23.6	1.0	24.5
		12	0	23.0	22.9	22.7	2.0	23.5
		12	7	23.0	22.9	22.7	2.0	23.5
		12	13	23.0	22.9	22.7	2.0	23.5
		25	0	22.9	22.9	22.7	2.0	23.5

LTE Band 5 Measured Results (Continued)

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	24.8	24.7	24.6	0.0	25.5
		1	8	24.7	24.7	24.6	0.0	25.5
		1	14	24.7	24.7	24.6	0.0	25.5
		8	0	23.9	23.9	23.7	1.0	24.5
		8	4	23.9	23.9	23.7	1.0	24.5
		8	7	23.9	23.9	23.6	1.0	24.5
		15	0	23.9	23.9	23.7	1.0	24.5
	16QAM	1	0	23.6	23.7	23.7	1.0	24.5
		1	8	23.6	23.7	23.7	1.0	24.5
		1	14	23.6	23.7	23.7	1.0	24.5
		8	0	22.8	23.0	22.7	2.0	23.5
		8	4	22.9	23.1	22.7	2.0	23.5
		8	7	22.8	23.0	22.7	2.0	23.5
		15	0	22.8	22.9	22.7	2.0	23.5

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	24.9	24.8	24.6	0.0	25.5
		1	3	24.8	24.8	24.6	0.0	25.5
		1	5	24.9	24.8	24.6	0.0	25.5
		3	0	24.7	24.7	24.5	0.0	25.5
		3	1	24.7	24.7	24.5	0.0	25.5
		3	3	24.7	24.7	24.5	0.0	25.5
		6	0	23.9	23.9	23.8	1.0	24.5
	16QAM	1	0	23.8	23.8	23.6	1.0	24.5
		1	3	23.8	23.8	23.6	1.0	24.5
		1	5	23.9	23.8	23.6	1.0	24.5
		3	0	24.0	23.9	23.7	1.0	24.5
		3	1	24.0	23.9	23.7	1.0	24.5
		3	3	24.0	23.9	23.7	1.0	24.5
		6	0	22.9	23.0	22.7	2.0	23.5

LTE Band 41 Measured Results

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)						
				Measured Pwr (dBm)					MPR	Tune-up Limit
				39750	40185	40620	41055	41490		
				2506 MHz	2549.5 MHz	2593 MHz	2636.5 MHz	2680 MHz		
20 MHz	QPSK	1	0	22.9	23.3	24.0	23.2	22.5	0.0	24.5
		1	49	22.9	23.3	23.9	23.1	22.4	0.0	24.5
		1	99	22.9	23.4	23.9	23.0	22.5	0.0	24.5
		50	0	21.9	22.3	23.0	22.2	21.5	1.0	23.5
		50	24	21.9	22.3	23.0	22.1	21.5	1.0	23.5
		50	50	21.9	22.3	22.9	22.1	21.5	1.0	23.5
		100	0	21.9	22.3	23.0	22.1	21.5	1.0	23.5
	16QAM	1	0	21.7	22.4	22.9	22.0	21.5	1.0	23.5
		1	49	21.7	22.3	22.9	22.2	21.3	1.0	23.5
		1	99	21.9	22.0	22.7	22.0	21.3	1.0	23.5
		50	0	21.0	21.4	22.0	21.2	20.5	2.0	22.5
		50	24	21.0	21.4	22.0	21.2	20.5	2.0	22.5
		50	50	20.9	21.3	22.0	21.1	20.5	2.0	22.5
		100	0	21.0	21.4	22.0	21.2	20.5	2.0	22.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)					MPR	Tune-up Limit
				39750	40185	40620	41055	41490		
				2506 MHz	2549.5 MHz	2593 MHz	2636.5 MHz	2680 MHz		
15 MHz	QPSK	1	0	23.0	23.3	24.1	23.1	22.6	0.0	24.5
		1	37	22.8	23.3	23.9	23.1	22.5	0.0	24.5
		1	74	22.9	23.3	24.0	23.1	22.5	0.0	24.5
		36	0	21.9	22.3	23.0	22.2	21.5	1.0	23.5
		36	20	21.9	22.4	23.0	22.2	21.5	1.0	23.5
		36	39	21.9	22.3	22.9	22.2	21.5	1.0	23.5
		75	0	21.9	22.3	23.0	22.2	21.5	1.0	23.5
	16QAM	1	0	22.1	22.3	22.7	22.3	21.5	1.0	23.5
		1	37	21.7	22.1	23.1	22.2	21.2	1.0	23.5
		1	74	22.0	22.1	22.7	22.0	21.3	1.0	23.5
		36	0	21.0	21.4	22.0	21.3	20.5	2.0	22.5
		36	20	21.0	21.3	22.0	21.2	20.5	2.0	22.5
		36	39	21.0	21.3	22.0	21.2	20.5	2.0	22.5
		75	0	21.0	21.3	22.0	21.2	20.6	2.0	22.5

LTE Band 41 Measured Results (Continued)

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)					MPR	Tune-up Limit
				39750	40185	40620	41055	41490		
				2506 MHz	2549.5 MHz	2593 MHz	2636.5 MHz	2680 MHz		
10 MHz	QPSK	1	0	22.8	23.3	24.0	23.2	22.5	0.0	24.5
		1	25	22.9	23.3	24.0	23.1	22.5	0.0	24.5
		1	49	22.9	23.3	23.9	23.1	22.5	0.0	24.5
		25	0	21.9	22.3	23.0	22.2	21.5	1.0	23.5
		25	12	21.9	22.3	23.0	22.1	21.5	1.0	23.5
		25	25	21.8	22.3	23.0	22.1	21.4	1.0	23.5
		50	0	21.8	22.3	23.0	22.1	21.5	1.0	23.5
	16QAM	1	0	22.0	22.0	22.9	22.2	21.5	1.0	23.5
		1	25	22.0	22.0	22.8	22.2	21.5	1.0	23.5
		1	49	21.9	22.0	22.8	22.1	21.5	1.0	23.5
		25	0	21.0	21.4	22.0	21.2	20.5	2.0	22.5
		25	12	20.9	21.4	22.0	21.2	20.5	2.0	22.5
		25	25	20.9	21.4	22.0	21.2	20.5	2.0	22.5
		50	0	20.9	21.4	22.0	21.2	20.5	2.0	22.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)					MPR	Tune-up Limit
				39750	40185	40620	41055	41490		
				2506 MHz	2549.5 MHz	2593 MHz	2636.5 MHz	2680 MHz		
5 MHz	QPSK	1	0	22.8	23.3	24.0	23.2	22.5	0.0	24.5
		1	12	22.8	23.3	24.0	23.2	22.5	0.0	24.5
		1	24	22.8	23.3	24.0	23.1	22.4	0.0	24.5
		12	0	21.8	22.3	23.0	22.2	21.5	1.0	23.5
		12	7	21.8	22.3	23.0	22.1	21.5	1.0	23.5
		12	13	21.8	22.3	23.0	22.1	21.5	1.0	23.5
		25	0	21.8	22.3	22.9	22.1	21.5	1.0	23.5
	16QAM	1	0	21.6	21.9	22.9	22.1	21.4	1.0	23.5
		1	12	21.6	21.9	23.0	22.1	21.3	1.0	23.5
		1	24	21.6	21.9	23.0	22.1	21.3	1.0	23.5
		12	0	20.9	21.3	22.0	21.2	20.5	2.0	22.5
		12	7	20.9	21.3	21.9	21.2	20.5	2.0	22.5
		12	13	20.9	21.3	21.9	21.2	20.5	2.0	22.5
		25	0	20.9	21.4	22.0	21.2	20.6	2.0	22.5

9.4. Wi-Fi 2.4 GHz (DTS Band)

When the RCV is activated in a held-to-ear user scenario, the output power level is reduced. The maximum allowed output powers in all conditions are included in the maximum power document.
Refer to Operational Description for WLAN explanation.

Normal WLAN SISO output power results

Antenna	Mode	Data Rate	Ch #	Freq. (MHz)	WLAN mode power					
					Max.Average Power			Reduced Average Power		
					Meas. Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)	Meas. Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)
WiFi 2.4G Ant	802.11b	1 Mbps	1	2412.0	18.5	19.0	Yes	12.4	13.0	Yes
			6	2437.0	18.9			12.5		
			11	2462.0	18.9			12.7		
			12	2467.0	17.9				8.0	
			13	2472.0	15.0	16.0			8.0	

Note(s):

1. SAR is not required for 802.11g/n modes when the adjusted SAR for 802.11b is < 1.2 W/kg.
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 802.11n/g/ax 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.
3. Additionally, SAR is not required for Channels 12 and 13 because the tune-up limit and the measured output power for these two channels are no greater than those for the default test channels. Refer to §6.3.

9.5. Wi-Fi 5GHz (U-NII Bands)

When the RCV is active in a held-to-ear user scenario, the output power level is reduced. The maximum allowed output powers in all conditions are included in the maximum power document.
Refer to Operational Description for WLAN explanation.

Normal WLAN SISO output power results

Antenna	Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	WLAN mode power					
						Max. Average Power			Reduced Average Power		
						Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)	Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)
5GHz Ant	5.3 (UNII 2A)	802.11a	6 Mbps	52	5260	12.8	13.0	Yes	Not Required	11.0	No
				56	5280	12.8					
				60	5300	12.8					
				64	5320	12.5					
		802.11n (HT20)	6.5 Mbps	Not Required			13.0	No	Not Required	11.0	No
		802.11n (HT40)	13.5 Mbps	Not Required			13.0	No	Not Required	11.0	No
		802.11ac (VHT20)	6.5 Mbps	Not Required			13.0	No	Not Required	11.0	No
		802.11ac (VHT40)	13.5 Mbps	Not Required			12.0	No	Not Required	11.0	No
		802.11ac (VHT80)	29.3 Mbps	58.0	5290.0	Not Required	11.0	No	10.2	11.0	Yes
	5.5 (U-NII 2C)	802.11a	6 Mbps	100	5500	12.6	13.0	Yes	Not Required	11.0	No
				120	5600	12.8					
				124	5620	12.9					
				144	5720	12.8					
		802.11n (HT20)	6.5 Mbps	Not Required			13.0	No	Not Required	11.0	No
		802.11n (HT40)	13.5 Mbps	Not Required			12.0	No	Not Required	11.0	No
		802.11ac (VHT20)	6.5 Mbps	Not Required			13.0	No	Not Required	11.0	No
		802.11ac (VHT40)	13.5 Mbps	Not Required			12.0	No	Not Required	11.0	No
		802.11ac (VHT80)	29.3 Mbps	106	5530	Not Required	11.0	No	10.5	11.0	Yes
				122	5610				10.4		
				138	5690				10.2		
	5.8 (UNII 3)	802.11a	6 Mbps	149	5745	12.4	13.0	Yes	Not Required	11.0	No
				157	5785	12.4					
				165	5825	12.7					
		802.11n (HT20)	6.5 Mbps	Not Required			13.0	No	Not Required	11.0	No
		802.11n (HT40)	13.5 Mbps	Not Required			12.0	No	Not Required	11.0	No
		802.11ac (VHT20)	6.5 Mbps	Not Required			13.0	No	Not Required	11.0	No
		802.11ac (VHT40)	13.5 Mbps	Not Required			12.0	No	Not Required	11.0	No
		802.11ac (VHT80)	29.3 Mbps	155	5775.0	Not Required	11.0	No	10.3	11.0	Yes

Note(s):

1. 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.
2. When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n ac then ax) is selected.
3. When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is
   - ≤ 1.2 W/kg, SAR is not required for UNII band I
   - > 1.2 W/kg, both bands should be tested independently for SAR.

9.6. Bluetooth

Measured Results

Band (GHz)	Mode	Ch #	Freq. (MHz)	Maximum Average Power (dBm)	
				BT Ant.1	
				Meas Pwr	Tune-up Limit
2.4	GFSK	0	2402	8.5	9.5
		39	2441	8.6	
		78	2480	8.2	
	EDR, 8-DPSK	0	2402	7.2	8.5
		39	2441	7.1	
		78	2480	6.7	
	LE, GFSK, 1M	0	2402	5.5	6.5
		19	2440	6.3	
		39	2480	5.7	
	LE, GFSK, 2M	0	2402	5.3	
		19	2440	6.1	
		39	2480	5.5	

Note(s):

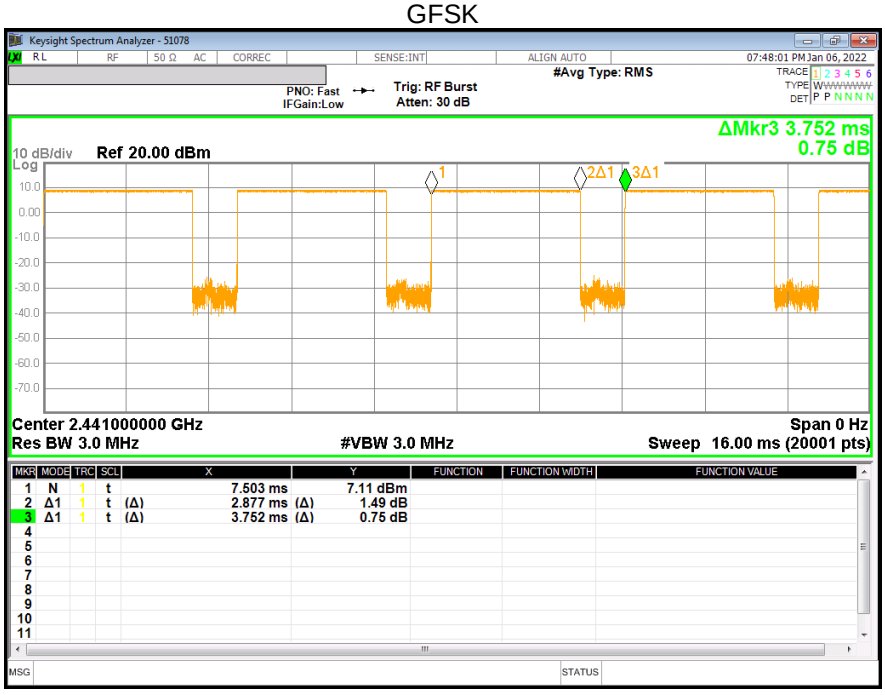
For All exposure conditions, SAR test is evaluated at GFSK mode in Bluetooth using maximum power condition.

Duty Factor Measured Results

Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
GFSK	DH5	2.877	3.752	76.7%	1.30

Duty Cycle plots

GFSK



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
- Duty Cycle scaling factor = 1 / Duty cycle (%)

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):

For smart phones, with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm.
When hotspot mode does not apply, 10-g extremity SAR is required for all surfaces and edges with an antenna located at ≤ 25mm 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; However, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, Including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold.

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.

KDB 248227 D01 SAR meas for 802.11:

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

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

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

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

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 1 Ant.	Head	GPRS 3 Slots	N/A	0	Left Touch	190	836.6	29.5	28.3	0.240	0.318	
					Let Tilt	190	836.6	29.5	28.3	0.148	0.196	
					Right Touch	190	836.6	29.5	28.3	0.321	0.425	1
					Right Tilt	190	836.6	29.5	28.3	0.195	0.258	
	Body-worn	GPRS 3 Slots	N/A	15	Rear	190	836.6	29.5	28.3	0.335	0.443	2
					Front	190	836.6	29.5	28.3	0.269	0.356	
	Hotspot	GPRS 3 Slots	N/A	10	Rear	128	824.4	29.5	28.4	0.622	0.803	
						190	836.6	29.5	28.3	0.658	0.871	
						251	848.8	29.5	28.5	0.769	0.969	3
					Front	190	836.6	29.5	28.3	0.246	0.325	
					Edge 2	190	836.6	29.5	28.3	0.303	0.401	
					Edge 3	190	836.6	29.5	28.3	0.361	0.478	
					Edge 4	190	836.6	29.5	28.3	0.204	0.270	

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 2 Ant.	Head	GPRS 3 Slots	Off	0	Left Touch	661	1880.0	27.5	26.9	0.132	0.153	4
					Left Tilt	661	1880.0	27.5	26.9	0.103	0.119	
					Right Touch	661	1880.0	27.5	26.9	0.124	0.144	
					Right Tilt	661	1880.0	27.5	26.9	0.079	0.092	
	Body-worn	GPRS 3 Slots	Off	15	Rear	661	1880.0	27.5	26.9	0.201	0.233	5
					Front	661	1880.0	27.5	26.9	0.128	0.148	
	Hotspot	GPRS 3 Slots	On	10	Rear	661	1880.0	26.0	24.9	0.241	0.308	6
					Front	661	1880.0	26.0	24.9	0.129	0.165	
					Edge 3	661	1880.0	26.0	24.9	0.191	0.244	
					Edge 4	661	1880.0	26.0	24.9	0.158	0.202	

10.3. 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 1 Ant.	Head	Rel 99 RMC	N/A	0	Left Touch	4183	836.6	25.5	24.9	0.317	0.365	
					Left Tilt	4183	836.6	25.5	24.9	0.222	0.256	
					Right Touch	4183	836.6	25.5	24.9	0.449	0.517	7
					Right Tilt	4183	836.6	25.5	24.9	0.282	0.325	
	Body-worn	Rel 99 RMC	N/A	15	Rear	4183	836.6	25.5	24.9	0.439	0.505	8
					Front	4183	836.6	25.5	24.9	0.352	0.405	
	Hotspot	Rel 99 RMC	N/A	10	Rear	4132	826.4	25.5	24.7	0.770	0.923	
						4183	836.6	25.5	24.9	0.825	0.950	9
						4233	846.6	25.5	24.8	0.798	0.942	
					Front	4183	836.6	25.5	24.9	0.334	0.385	
					Edge 2	4183	836.6	25.5	24.9	0.418	0.481	
					Edge 3	4183	836.6	25.5	24.9	0.537	0.618	
					Edge 4	4183	836.6	25.5	24.9	0.235	0.271	

10.4. LTE Band 5 (10MHz Bandwidth)

Antenna	RF Exposure Conditions	Mode	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
										Tune-up limit	Meas.	Meas.	Scaled	
Main 1 Ant.	Head	QPSK	N/A	0	Left Touch	20525	836.5	1	0	25.5	24.7	0.295	0.353	
								25	0	24.5	23.9	0.251	0.287	
					Left Tilt	20525	836.5	1	0	25.5	24.7	0.210	0.251	
								25	0	24.5	23.9	0.176	0.202	
					Right Touch	20525	836.5	1	0	25.5	24.7	0.379	0.453	10
								25	0	24.5	23.9	0.315	0.361	
					Right Tilt	20525	836.5	1	0	25.5	24.7	0.234	0.280	
								25	0	24.5	23.9	0.192	0.220	
	Body-worn	QPSK	N/A	15	Rear	20525	836.5	1	0	25.5	24.7	0.370	0.442	11
								25	0	24.5	23.9	0.312	0.357	
					Front	20525	836.5	1	0	25.5	24.7	0.337	0.403	
								25	0	24.5	23.9	0.278	0.318	
	Hotspot	QPSK	N/A	10	Rear	20525	836.5	1	0	25.5	24.7	0.769	0.920	12
								25	0	24.5	23.9	0.649	0.743	
					Front	20525	836.5	1	0	25.5	24.7	0.318	0.380	
								25	0	24.5	23.9	0.261	0.299	
					Edge 2	20525	836.5	1	0	25.5	24.7	0.381	0.456	
								25	0	24.5	23.9	0.312	0.357	
					Edge 3	20525	836.5	1	0	25.5	24.7	0.358	0.428	
								25	0	24.5	23.9	0.318	0.364	
					Edge 4	20525	836.5	1	0	25.5	24.7	0.218	0.261	
								25	0	24.5	23.9	0.178	0.204	

10.5. LTE Band 41 (20MHz Bandwidth)

Antenna	RF Exposure Conditions	Mode	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
										Tune-up limit	Meas.	Meas.	Scaled	
Main 2 Ant.	Head	QPSK	N/A	0	Left Touch	40620	2593.0	1	0	24.5	24.0	0.390	0.442	13
								50	24	23.5	23.0	0.297	0.335	
					Left Tilt	40620	2593.0	1	0	24.5	24.0	0.129	0.146	
								50	24	23.5	23.0	0.100	0.113	
					Right Touch	40620	2593.0	1	0	24.5	24.0	0.270	0.306	
								50	24	23.5	23.0	0.209	0.236	
					Right Tilt	40620	2593.0	1	0	24.5	24.0	0.256	0.290	
								50	24	23.5	23.0	0.191	0.216	
	Body-worn	QPSK	N/A	15	Rear	40620	2593.0	1	0	24.5	24.0	0.423	0.479	14
								50	24	23.5	23.0	0.319	0.360	
					Front	40620	2593.0	1	0	24.5	24.0	0.317	0.359	
								50	24	23.5	23.0	0.245	0.277	
	Hotspot	QPSK	N/A	10	Rear	39750	2506.0	1	0	24.5	22.9	0.682	0.976	
								50	24	23.5	21.9	0.527	0.763	
						40185	2549.5	1	0	24.5	24.0	0.614	0.696	
								50	24	23.5	23.0	0.477	0.539	
						40620	2593.0	1	0	24.5	24.0	0.960	1.088	15
								50	24	23.5	23.0	0.733	0.828	
								100	0	23.5	23.0	0.704	0.797	
						41055	2636.5	1	0	24.5	24.0	0.687	0.779	
								50	24	23.5	23.0	0.564	0.637	
						41490	2680.0	1	0	24.5	24.0	0.634	0.719	
								50	24	23.5	23.0	0.471	0.532	
					Front	39750	2506.0	1	0	24.5	22.9	0.512	0.732	
						40185	2549.5	1	0	24.5	24.0	0.421	0.477	
						40620	2593.0	1	0	24.5	24.0	0.620	0.703	
								50	24	23.5	23.0	0.483	0.545	
						41055	2636.5	1	0	24.5	24.0	0.531	0.602	
						41490	2680.0	1	0	24.5	24.0	0.403	0.457	
					Edge 3	40620	2593.0	1	0	24.5	24.0	0.464	0.526	
								50	24	23.5	23.0	0.366	0.413	
					Edge 4	40620	2593.0	1	0	24.5	24.0	0.470	0.533	
								50	24	23.5	23.0	0.382	0.431	

10.6. Wi-Fi (DTS Band)

Antenna	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		
WLAN	2.4GHz	802.11b 1 Mbps	Head	On	0	Left Touch	11	2462.0	0.097	99.3%	13.0	12.7				
						Left Tilt	11	2462.0	0.090	99.3%	13.0	12.7				
						Right Touch	11	2462.0	0.195	99.3%	13.0	12.7	0.118	0.126	1	16
						Right Tilt	11	2462.0	0.178	99.3%	13.0	12.7				
			Body-worn	Off	15	Rear	6	2437.0	0.342	99.3%	19.0	18.9	0.212	0.218	1	17
						Front	6	2437.0	0.128	99.3%	19.0	18.9				
			Hotspot	Off	10	Rear	6	2437.0	0.789	99.3%	19.0	18.9	0.484	0.499		18
						Front	6	2437.0	0.235	99.3%	19.0	18.9				
						Edge 1	6	2437.0	0.167	99.3%	19.0	18.9				
						Edge 4	6	2437.0	0.267	99.3%	19.0	18.9	0.190	0.196	2	

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.

10.7. Wi-Fi (U-NII Bands)

U-NII 2A Results

Antenna	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)		10-g SAR (W/kg)		Note	Plot No.
											Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled		
WLAN	5.3 GHz U-NII 2A	802.11ac (VHT80) MCS0	Head	On	0	Left Touch	58	5290.0	0.368	94.5%	11.0	10.2						
						Left Tilt	58	5290.0	0.499	94.5%	11.0	10.2	0.215	0.271			1	19
						Right Touch	58	5290.0	0.312	94.5%	11.0	10.2						
						Right Tilt	58	5290.0	0.426	94.5%	11.0	10.2						
		802.11a 6Mbps	Body-worn	Off	15	Rear	60	5300.0	0.812	97.3%	13.0	12.8	0.393	0.422				20
						Front	60	5300.0	0.093	97.3%	13.0	12.8	0.044	0.047			2	
			Product Specific 10-g	Off	0	Rear	60	5300.0	12.322	97.3%	13.0	12.8			1.340	1.439		21
						Front	60	5300.0	1.069	97.3%	13.0	12.8						
						Edge 1	60	5300.0	5.235	97.3%	13.0	12.8			0.582	0.625	2	
						Edge 4	60	5300.0	1.675	97.3%	13.0	12.8						

U-NII 2C Results

Antenna	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)		10-g SAR (W/kg)		Note	Plot No.
											Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled		
WLAN	5.5 GHz U-NII 2C	802.11ac (VHT80) MCS0	Head	On	0	Left Touch	106	5530.0	0.457	94.5%	11.0	10.5						
						Left Tilt	106	5530.0	0.493	94.5%	11.0	10.5	0.230	0.273			1	22
						Right Touch	106	5530.0	0.485	94.5%	11.0	10.5						
						Right Tilt	106	5530.0	0.440	94.5%	11.0	10.5						
		802.11a 6Mbps	Body-worn	Off	15	Rear	124	5620.0	1.193	97.3%	13.0	12.9	0.565	0.593				23
						Front	124	5620.0	0.138	97.3%	13.0	12.9	0.069	0.072			2	
			Product Specific 10-g	Off	0	Rear	120	5600.0	24.689	97.3%	13.0	12.8			2.110	2.251	3	
							124	5620.0	21.273	97.3%	13.0	12.9			2.170	2.278		24
						Front	124	5620.0	1.648	97.3%	13.0	12.9						
						Edge 1	124	5620.0	8.162	97.3%	13.0	12.9			0.870	0.913	2	
						Edge 4	124	5620.0	3.945	97.3%	13.0	12.9						

U-NII 3 Results

Antenna	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		
WLAN	5.8 GHz U-NII 3	802.11ac (VHT80) MCS0	Head	On	0	Left Touch	155	5775.0	0.489	94.5%	11.0	10.3				
						Left Tilt	155	5775.0	0.704	94.5%	11.0	10.3	0.351	0.435		25
						Right Touch	155	5775.0	0.436	94.5%	11.0	10.3				
						Right Tilt	155	5775.0	0.567	94.5%	11.0	10.3	0.298	0.370	2	
		802.11a 6Mbps	Body-worn	Off	15	Rear	165	5825.0	0.712	97.3%	13.0	12.7	0.323	0.360	1	26
						Front	165	5825.0	0.115	97.3%	13.0	12.7				
			Hotspot	Off	10	Rear	149	5745.0	1.489	97.3%	13.0	12.4	0.719	0.847		27
						Front	149	5745.0	0.174	97.3%	13.0	12.4	0.082	0.096	4	
						Edge 1	149	5745.0	0.906	97.3%	13.0	12.4	0.433	0.510	2	
						Edge 4	149	5745.0	0.376	97.3%	13.0	12.4				

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.

10.8. Bluetooth

Antenna	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)		Plot No.
										Tune-up limit	Meas.	Meas.	Scaled	
BT	2.4 GHz	GFSK	Head	On	0	Left Touch	39	2441.0	76.7%	9.5	8.6	0.017	0.027	
						Left Tilt	39	2441.0	76.7%	9.5	8.6	0.015	0.024	
						Right Touch	39	2441.0	76.7%	9.5	8.6	0.027	0.044	28
						Right Tilt	39	2441.0	76.7%	9.5	8.6	0.025	0.041	
		GFSK	Body-worn	Off	15	Rear	39	2441.0	76.7%	9.5	8.6	0.010	0.017	29
						Front	39	2441.0	76.7%	9.5	8.6	0.003	0.005	
		GFSK	Hotspot	Off	10	Rear	39	2441.0	76.7%	9.5	8.6	0.042	0.068	30
						Front	39	2441.0	76.7%	9.5	8.6	0.011	0.017	
						Edge 1	39	2441.0	76.7%	9.5	8.6	0.001	0.001	
						Edge 4	39	2441.0	76.7%	9.5	8.6	0.016	0.026	

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
835	GSM 850	Hotspot	Rear	No	0.769	N/A	N/A
	WCDMA Band V	Hotspot	Rear	Yes	0.825	0.819	1.01
	LTE Band 5	Hotspot	Rear	No	0.769	N/A	N/A
1900	GSM 1900	Hotspot	Rear	No	0.241	N/A	N/A
2400	Wi-Fi 802.11b/g/n	Hotspot	Rear	No	0.484	N/A	N/A
	Bluetooth	Hotspot	Rear	No	0.042	N/A	N/A
2600	LTE Band 41	Hotspot	Rear	Yes	0.960	0.913	1.05
5300	Wi-Fi 802.11a/n	Body-worn	Rear	No	0.393	N/A	N/A
5500	Wi-Fi 802.11a/n	Body-worn	Rear	No	0.565	N/A	N/A
5800	Wi-Fi 802.11a/n	Hotspot	Rear	No	0.719	N/A	N/A

Peak spatial-average (10g 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
5300	Wi-Fi 802.11a/n	Product Specific 10g	Rear	No	1.340	N/A	N/A
5500	Wi-Fi 802.11a/n	Product Specific 10g	Rear	Yes	2.170	2.14	1.01

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.

12. Simultaneous Transmission SAR Analysis

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations					
Head & Body-worn & Hotspot & Phablet-10g	1	WWAN (2G/3G/LTE)	+	DTS			Scenarios
	2	WWAN (2G/3G/LTE)	+	UNII			
	3	WWAN (2G/3G/LTE)	+	BT			
	4	WWAN (2G/3G/LTE)	+	UNII	+	BT	

Notes:

1. DTS supports Wi-Fi Direct, Hotspot and VoIP.
2. U-NII supports Wi-Fi Direct, Hotspot and VoIP.
3. GPRS, W-CDMA, LTE supports Hotspot and VoIP
4. U-NII Radio can transmit simultaneously with Bluetooth Radio.
5. DTS Radio cannot transmit simultaneously with UNII Radio.
6. DTS Radio cannot transmit simultaneously with Bluetooth Radio.
7. BT tethering is considered about each RF exposure conditions.

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.

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 MultiBand 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.

SPLSR Hotspot Combination

Per November 2019 TCB Workshop Notes, SPLSR Hotspot Combination procedure can be applied to evaluate to simultaneous transmission SAR analysis.
Hybrid SPLSR and enlarged zoom scan (Volume scan) can be applied when Simultaneous transmission SAR is over 1.6 or 4.0 W/kg (1-g or 10-g respectively), it does not meet SPLSR criteria, and antenna pair is co-located. Antenna co-location means that SAR distributions overlap because the antennas are not significantly spatially separated.

Test procedure

Step.1 Perform enlarged zoom scan (Volume scan) on the co-located antenna pair to determine 1g/10g aggregate SAR.

Step.2 Apply SPLSR procedure for the spatially separated antenna and aggregate SAR distribution of the co-located antenna pair.

12.1 Sum of the SAR for GSM850 & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)				Sum of SAR (W/kg)			
		WWAN	DTS	UNII	BT	WWAN + DTS	WWAN + UNII	WWAN + BT	WWAN + BT + UNII
		1	2	3	4	1 + 2	1 + 3	1 + 4	1 + 3 + 4
Head (1-g SAR)	All position	0.425	0.126	0.435	0.044	0.551	0.860	0.469	0.904
Body-Worn (1-g SAR)	All position	0.443	0.218	0.593	0.017	0.661	1.036	0.460	1.053
Hotspot (1-g SAR)	Rear	0.969	0.499	0.847	0.068	1.468	1.816	1.037	1.884
	Front	0.325	0.499	0.096	0.017	0.824	0.421	0.342	0.438
	Edge 1		0.499	0.510	0.001				0.511
	Edge 2	0.401							
	Edge 3	0.478							
	Edge 4	0.270	0.196	0.847	0.026	0.466	1.117	0.296	1.143
Product Specific 10-g (10-g SAR)	All position			2.278					

SAR to Peak Location Separation Ratio (SPLSR)

RF Exposure	Test Position	Standalone SAR (W/kg)				∑ SAR (W/kg)		Calculated distance (mm)	SPLSR (≤ 0.04)	Volume Scan (Yes/ No)	Figure
		WWAN	DTS	UNII	BT						
		1	2	3	4						
Hotspot (1-g SAR)	Rear	0.969		0.847	0.068	1+3+4	1.884				1, 2
		0.969		0.847		1+3	1.816	159.4	0.02	No	
		0.969			0.068	1+4	1.037	150.9	0.01	No	
				0.847	0.068	3+4	0.915	10.1	0.09	Yes	
Hybrid SPLSR Note.3		0.969		0.771		1+(3+4)	1.740	155.3	0.01	No	

Note(s):

1. Green value is estimated SAR value.
2. SPLSR Hotspot Combination Step.1) Perform enlarged zoom scan (Volume scan) on the co-located antenna pair to determine 1g/10g aggregate SAR. Refer to the Sec.12.6 for detailed Volume Scan Result.
3. SPLSR Hotspot Combination Step.2) Apply SPLSR procedure for the spatially separated antenna and aggregate SAR distribution of the co-located antenna pair. Hybrid SPLSR procedure was applied for the spatially separated main bands and unlicensed bands for Multi-band Combined results.

12.2 Sum of the SAR for GSM1900 & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)				Sum of SAR (W/kg)			
		WWAN	DTS	UNII	BT	WWAN + DTS	WWAN + UNII	WWAN + BT	WWAN + BT + UNII
		1	2	3	4	1 + 2	1 + 3	1 + 4	1 + 3 + 4
Head (1-g SAR)	All position	0.153	0.126	0.435	0.044	0.279	0.588	0.197	0.632
Body-Worn (1-g SAR)	All position	0.233	0.218	0.593	0.017	0.451	0.826	0.250	0.843
Hotspot (1-g SAR)	Rear	0.308	0.499	0.847	0.068	0.807	1.155	0.376	1.223
	Front	0.165	0.499	0.096	0.017	0.664	0.261	0.182	0.278
	Edge 1		0.499	0.510	0.001				0.511
	Edge 2								
	Edge 3	0.244							
	Edge 4	0.202	0.196	0.847	0.026	0.398	1.049	0.228	1.075
Product Specific 10-g (10-g SAR)	All position			2.278					

Note(s):

1. Green values are reference from highest SAR value of *initial test position* procedure in each RF exposure of each bands.

12.3 Sum of the SAR for WCDMA V & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)				Sum of SAR (W/kg)			
		WWAN	DTS	UNII	BT	WWAN + DTS	WWAN + UNII	WWAN + BT	WWAN + BT + UNII
		1	2	3	4	1 + 2	1 + 3	1 + 4	1 + 3 + 4
Head (1-g SAR)	All position	0.517	0.126	0.435	0.044	0.643	0.952	0.561	0.996
Body-Worn (1-g SAR)	All position	0.505	0.218	0.593	0.017	0.723	1.098	0.522	1.115
Hotspot (1-g SAR)	Rear	0.950	0.499	0.847	0.068	1.449	1.797	1.018	1.865
	Front	0.385	0.499	0.096	0.017	0.884	0.481	0.402	0.498
	Edge 1		0.499	0.510	0.001				0.511
	Edge 2	0.481							
	Edge 3	0.618							
	Edge 4	0.271	0.196	0.847	0.026	0.467	1.118	0.297	1.144
Product Specific 10-g (10-g SAR)	All position			2.278					

SAR to Peak Location Separation Ratio (SPLSR)

RF Exposure	Test Position	Standalone SAR (W/kg)				∑ SAR (W/kg)		Calculated distance (mm)	SPLSR (≤ 0.04)	Volume Scan (Yes/ No)	Figure
		WWAN	DTS	UNII	BT						
		1	2	3	4						
Hotspot (1-g SAR)	Rear	0.950		0.847	0.068	1+3+4	1.865				3, 4
		0.950		0.847		1+3	1.797	160.6	0.02	No	
		0.950			0.068	1+4	1.018	152.0	0.01	No	
				0.847	0.068	3+4	0.915	10.1	0.09	Yes	
Hybrid SPLSR Note.3		0.950		0.771		1+(3+4)	1.721	156.5	0.01	No	

Note(s):

1. Green value is estimated SAR value.
2. SPLSR Hotspot Combination Step.1) Perform enlarged zoom scan (Volume scan) on the co-located antenna pair to determine 1g/10g aggregate SAR. Refer to the Sec.12.6 for detailed Volume Scan Result.
3. SPLSR Hotspot Combination Step.2) Apply SPLSR procedure for the spatially separated antenna and aggregate SAR distribution of the co-located antenna pair. Hybrid SPLSR procedure was applied for the spatially separated main bands and unlicensed bands for Multi-band Combined results.

12.4 Sum of the SAR for LTE5 & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)				Sum of SAR (W/kg)			
		WWAN	DTS	UNII	BT	WWAN + DTS	WWAN + UNII	WWAN + BT	WWAN + BT + UNII
		1	2	3	4	1 + 2	1 + 3	1 + 4	1 + 3 + 4
Head (1-g SAR)	All position	0.453	0.126	0.435	0.044	0.579	0.888	0.497	0.932
Body-Worn (1-g SAR)	All position	0.442	0.218	0.593	0.017	0.660	1.035	0.459	1.052
Hotspot (1-g SAR)	Rear	0.920	0.499	0.847	0.068	1.419	1.767	0.988	1.835
	Front	0.380	0.499	0.096	0.017	0.879	0.476	0.397	0.493
	Edge 1		0.499	0.510	0.001				0.511
	Edge 2	0.456							
	Edge 3	0.428							
	Edge 4	0.261	0.196	0.847	0.026	0.457	1.108	0.287	1.134
Product Specific 10-g (10-g SAR)	All position			2.278					

SAR to Peak Location Separation Ratio (SPLSR)

RF Exposure	Test Position	Standalone SAR (W/kg)				∑ SAR (W/kg)		Calculated distance (mm)	SPLSR (≤ 0.04)	Volume Scan (Yes/ No)	Figure
		WWAN	DTS	UNII	BT						
		1	2	3	4						
Hotspot (1-g SAR)	Rear	0.920		0.847	0.068	1+3+4	1.835				5, 6
		0.920		0.847		1+3	1.767	161.8	0.01	No	
		0.920			0.068	1+4	0.988	153.2	0.01	No	
				0.847	0.068	3+4	0.915	10.1	0.09	Yes	
Hybrid SPLSR Note.3		0.920		0.771		1+(3+4)	1.691	157.8	0.01	No	

Note(s):

1. Green value is estimated SAR value.
2. SPLSR Hotspot Combination Step.1) Perform enlarged zoom scan (Volume scan) on the co-located antenna pair to determine 1g/10g aggregate SAR. Refer to the Sec.12.6 for detailed Volume Scan Result.
3. SPLSR Hotspot Combination Step.2) Apply SPLSR procedure for the spatially separated antenna and aggregate SAR distribution of the co-located antenna pair. Hybrid SPLSR procedure was applied for the spatially separated main bands and unlicensed bands for Multi-band Combined results.

12.5 Sum of the SAR for LTE41 & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)				Sum of SAR (W/kg)			
		WWAN	DTS	UNII	BT	WWAN + DTS	WWAN + UNII	WWAN + BT	WWAN + BT + UNII
		1	2	3	4	1 + 2	1 + 3	1 + 4	1 + 3 + 4
Head (1-g SAR)	All position	0.442	0.126	0.435	0.044	0.568	0.877	0.486	0.921
Body-Worn (1-g SAR)	All position	0.479	0.218	0.593	0.017	0.697	1.072	0.496	1.089
Hotspot (1-g SAR)	Rear	1.088	0.499	0.847	0.068	1.587	1.935	1.156	2.003
	Front	0.732	0.499	0.096	0.017	1.231	0.828	0.749	0.845
	Edge 1		0.499	0.510	0.001				0.511
	Edge 2								
	Edge 3	0.526							
	Edge 4	0.533	0.196	0.847	0.026	0.729	1.380	0.559	1.406
Product Specific 10-g (10-g SAR)	All position			2.278					

SAR to Peak Location Separation Ratio (SPLSR)

RF Exposure	Test Position	Standalone SAR (W/kg)				∑ SAR (W/kg)		Calculated distance (mm)	SPLSR (≤ 0.04)	Volume Scan (Yes/ No)	Figure
		WWAN	DTS	UNII	BT						
		1	2	3	4						
Hotspot (1-g SAR)	Rear	1.088		0.847	0.068	1+3+4	2.003				7, 8
		1.088		0.847		1+3	1.935	140.2	0.02	No	
		1.088			0.068	1+4	1.156	130.6	0.01	No	
				0.847	0.068	3+4	0.915	10.1	0.09	Yes	
Hybrid SPLSR Note.3		1.088		0.771		1+(3+4)	1.859	140.4	0.02	No	

Note(s):
1. Green value is estimated SAR value.
2. SPLSR Hotspot Combination Step.1) Perform enlarged zoom scan (Volume scan) on the co-located antenna pair to determine 1g/10g aggregate SAR. Refer to the Sec.12.6 for detailed Volume Scan Result.
3. SPLSR Hotspot Combination Step.2) Apply SPLSR procedure for the spatially separated antenna and aggregate SAR distribution of the co-located antenna pair. Hybrid SPLSR procedure was applied for the spatially separated main bands and unlicensed bands for Multi-band Combined results.

12.6 Volume Scan Results

RF Exposure	Test Position	Configuration	Band	Original Measured SAR (W/kg)	Volume Scan Result	Plot No.	Multi-Band Combined factor	Multi-Band Combined Result	Plot No.
Hotspot	**Rear**	**UNII + BT**	UNII	**0.719**	**0.629**	**1**	**1.178**	**0.771**	**3**
			BT	**0.042**	**0.047**	**2**	**1.617**		

Note(s):
1. Multi-band Combined factor is the compensation value of power and duty.
2. For Volume Scan plot number in this section, please refer to the Appendix G.

Conclusion:

Simultaneous Transmission SAR analysis results is satisfied the FCC Limit requirement according to follow procedures with "Sum of SAR" or "SPLSR" or "SPLSR Hotspot combination(including Volume Scan)".

Appendixes

Refer to separated files for the following appendixes.

4790215260-S1 FCC Report SAR_App A_Photos & Ant. Locations

4790215260-S1 FCC Report SAR_App B_Highest SAR Test Plots

4790215260-S1 FCC Report SAR_App C_System Check Plots

4790215260-S1 FCC Report SAR_App D_SAR Tissue Ingredients

4790215260-S1 FCC Report SAR_App E_Probe Cal. Certificates

4790215260-S1 FCC Report SAR_App F_Dipole Cal. Certificates

4790215260-S1 FCC Report SAR_App G_Volume Scan Results

4790215260-S1 FCC Report SAR App H_SPLSR criteria plots

END OF REPORT