ELEMENT MATERIALS TECHNOLOGY
(formerly PCTEST)
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. +1.410.290.6652 / Fax +1.410.290.6654
http://www.element.com

SAR EVALUATION REPORT

Applicant Name:
Samsung Electronics Co., Ltd.
129, Samsung-ro, Maetan dong,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
10/19/23 - 11/17/23
Test Site/Location:
Element, Columbia, MD, USA
Document Serial No.:
1M2309270105-17.A3L(R1)

FCC ID: **A3LSMA156E**

APPLICANT: **SAMSUNG ELECTRONICS CO., LTD.**

DUT Type: Portable Handset
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model(s): SM-A156E/DS

Equipment Class	Band & Mode	Tx Frequency	SAR			
			1g Head (W/kg)	1g Body-Worn (W/kg)	1g Hotspot (W/kg)	10g Phablet (W/kg)
PCE	GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	0.22	0.52	0.45	N/A
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	0.14	0.50	**0.57**	N/A
PCE	UMTS 850	826.40 - 846.60 MHz	0.20	0.52	0.52	N/A
PCE	UMTS 1750	1712.4 - 1752.6 MHz	0.15	0.19	0.27	N/A
PCE	UMTS 1900	1852.4 - 1907.6 MHz	0.24	0.36	0.46	N/A
PCE	LTE Band 12	699.7 - 715.3 MHz	0.21	0.45	0.45	N/A
PCE	LTE Band 17	706.5 - 713.5 MHz	N/A	N/A	N/A	N/A
PCE	LTE Band 26	814.7 - 848.3 MHz	0.32	0.33	0.37	N/A
PCE	LTE Band 5	824.7 - 848.3 MHz	N/A	N/A	N/A	N/A
PCE	LTE Band 66	1710.7 - 1779.3 MHz	0.21	0.18	0.22	N/A
PCE	LTE Band 4	1710.7 - 1754.3 MHz	N/A	N/A	N/A	N/A
PCE	LTE Band 2	1850.7 - 1909.3 MHz	**0.45**	**0.56**	0.56	N/A
PCE	LTE Band 41	2502.5 - 2680 MHz	0.33	0.36	0.36	N/A
PCE	NR Band n5	826.5 - 846.5 MHz	0.25	0.49	0.49	N/A
PCE	NR Band n66	1712.5 - 1777.5 MHz	0.23	0.15	0.17	N/A
DTS	2.4 GHz WIFI	2412 - 2462 MHz	**0.24**	**0.16**	**0.16**	N/A
NII	5 GHz WIFI	U-NII-1: 5180 - 5240 MHz U-NII-2A: 5260 - 5320 MHz U-NII-2C: 5500 - 5720 MHz U-NII-3: 5745 - 5825 MHz	**0.59**	**0.37**	**0.59**	**0.76**
DSS	2.4 GHz Bluetooth	2402 - 2480 MHz	**<0.1**	**<0.1**	**<0.1**	N/A
Simultaneous SAR per KDB 690783 D01v01r03:			**1.56**	1.53	1.53	**3.80**

Note: This revised Test Report supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.9 of this report; for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

RJ Ortanez
Executive Vice President

The SAR Tick is an initiative of the Mobile & Wireless Forum (MWF). While a product may be considered eligible, use of the SAR Tick logo requires an agreement with the MWF. Further details can be obtained by emailing: sartick@mwfai.info.

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
GSM/GPRS/EDGE1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1750	Voice/Data	1712.4 - 1752.6 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 12	Voice/Data	699.7 - 715.3 MHz
LTE Band 17	Voice/Data	706.5 - 713.5 MHz
LTE Band 26	Voice/Data	814.7 - 848.3 MHz
LTE Band 5	Voice/Data	824.7 - 848.3 MHz
LTE Band 66	Voice/Data	1710.7 - 1779.3 MHz
LTE Band 4	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 2	Voice/Data	1850.7 - 1909.3 MHz
LTE Band 41	Voice/Data	2498.5 - 2687.5 MHz
NR Band n5	Voice/Data	826.5 - 846.5 MHz
NR Band n66	Voice/Data	1712.5 - 1777.5 MHz
2.4 GHz WIFI	Voice/Data	2412 - 2472 MHz
5 GHz WIFI	Voice/Data	U-NII-1: 5180 - 5240 MHz U-NII-2A: 5260 - 5320 MHz U-NII-2C: 5500 - 5720 MHz U-NII-3: 5745 - 5825 MHz
2.4 GHz Bluetooth	Data	2402 - 2480 MHz

1.2 Time-Averaging Algorithm for RF Exposure Compliance

The purpose of this report is to show SAR Characterization of WWAN sub-6/WLAN (Part0) and to demonstrate that the EUT meets FCC SAR limits when transmitting in static transmission scenario at maximum allowable time-averaged power levels (Part1).

1.2.1 Nomenclature

Technology	Term	Description
WWAN Sub-6 /WLAN	P_{limit}	Power level that corresponds to the exposure design target (*SAR_design_target)* after accounting for all device design related uncertainties
	P_{max}	Maximum tune up output power
	SAR_design_target	Target SAR level < FCC SAR limit after accounting for all device design related uncertainties
	SAR Char	Table containing *Plimit* for all technologies and bands

1.2.2 Time-Averaged Algorithm

This Device is enabled with MediaTek TAS feature for WWAN modes and WLAN technologies. These features perform time averaging algorithm in real time to control and manage transmitting power and ensure the time-averaged RF exposure is in compliance with FCC requirements all the time. Refer to Compliance Summary document for detailed description of MediaTek TAS feature (report SN could be found in Section 1.11 – Bibliography).

Note that Bluetooth operation is not enabled with TAS.

The TAS algorithm maintains the time-averaged transmit power, in turn, time-averaged RF exposure of *SAR_design_target*, below the predefined time-averaged power limit (i.e., P_{limit} for WWAN sub-6/WLAN radio), for each characterized technology and band. Characterization is achieved by determining P_{limit} for WWAN sub-6/WLAN/BT that corresponds to the exposure design targets after accounting for all device design related uncertainties, i.e., SAR_design_target (<FCC SAR Limit) for sub-6 radio. The SAR characterization is denoted as SAR char in this report (see SAR Summary Section and Part 0 SAR Test Results for P_{limit} Calculations Appendix).

TAS allows the device to transmit at higher power instantaneously, as high as Pmax, when needed, but enforces power limiting to maintain time-averaged transmit power to Plimit. Below table shows Final Plimit settings and maximum tune up output power Pmax configured for this EUT for various transmit conditions (Exposure Condition Index ECI for MediaTek). Note that the device uncertainty for sub-6GHz WWAN is 1.0dB for this EUT.

The maximum time-averaged output power (dBm) for any WWAN sub-6/WLAN technology, band, and ECI is the minimum of ("Plimit" and "Maximum tune up output power Pmax") + 1dB device uncertainty. SAR values in this report were scaled to this maximum time-averaged output power to determine compliance per KDB Publication 447498 D01v06.

1.3 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D04v01.

1.3.1 Licensed Output Power

GSM/GPRS/EDGE 850										
Antenna A										
Power Level		Voice (in dBm)	Data - Burst Average GMSK (in dBm)				Data - Burst Average 8-PSK (in dBm)			
		1 TX Slot	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots
Pmax	Max Allowed Power	34.0	34.0	32.0	30.0	29.0	26.5	25.5	23.5	22.5
	Nominal	33.0	33.0	31.0	29.0	28.0	25.5	24.5	22.5	21.5
ECI = 4 (Body-Worn or Phablet)	Max Allowed Power	34.0	34.0	31.0	29.2	28.0	26.5	25.5	23.5	22.5
	Nominal	33.0	33.0	30.0	28.2	27.0	25.5	24.5	22.5	21.5
ECI = 1 (Head)	Max Allowed Power	34.0	34.0	32.0	30.0	29.0	26.5	25.5	23.5	22.5
	Nominal	33.0	33.0	31.0	29.0	28.0	25.5	24.5	22.5	21.5
ECI = 2 (Hotspot)	Max Allowed Power	N/A	34.0	31.0	29.2	28.0	26.5	25.5	23.5	22.5
	Nominal	N/A	33.0	30.0	28.2	27.0	25.5	24.5	22.5	21.5
ECI = 3 (Earjack)	Max Allowed Power	34.0	34.0	31.0	29.2	28.0	26.5	25.5	23.5	22.5
	Nominal	33.0	33.0	30.0	28.2	27.0	25.5	24.5	22.5	21.5
GSM/GPRS/EDGE 1900										
Antenna B										
Power Level		Voice (in dBm)	Data - Burst Average GMSK (in dBm)				Data - Burst Average 8-PSK (in dBm)			
		1 TX Slot	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots
Pmax	Max Allowed Power	31.0	31.0	29.0	27.0	26.0	25.5	24.5	22.5	21.5
	Nominal	30.0	30.0	28.0	26.0	25.0	24.5	23.5	21.5	20.5
ECI = 4 (Body-Worn or Phablet)	Max Allowed Power	30.0	30.0	27.0	25.2	24.0	25.5	24.5	22.5	21.5
	Nominal	29.0	29.0	26.0	24.2	23.0	24.5	23.5	21.5	20.5
ECI = 1 (Head)	Max Allowed Power	31.0	31.0	29.0	27.0	26.0	25.5	24.5	22.5	21.5
	Nominal	30.0	30.0	28.0	26.0	25.0	24.5	23.5	21.5	20.5
ECI = 2 (Hotspot)	Max Allowed Power	N/A	30.0	27.0	25.2	24.0	25.5	24.5	22.5	21.5
	Nominal	N/A	29.0	26.0	24.2	23.0	24.5	23.5	21.5	20.5
ECI = 3 (Earjack)	Max Allowed Power	30.0	30.0	27.0	25.2	24.0	25.5	24.5	22.5	21.5
	Nominal	29.0	29.0	26.0	24.2	23.0	24.5	23.5	21.5	20.5

For GSM, the above powers listed are GSM burst average values.

UMTS Band 5 (850 MHz)					
Antenna A					
Power Level		Modulated Average Output Power			
		3GPP WCDMA Rel 99	3GPP HSDPA Rel 5	3GPP HSUPA Rel 6	3GPP DC-HSDPA Rel 8
Pmax	Max Allowed Power	25.0	24.0	22.5	24.0
	Nominal	24.0	23.0	21.5	23.0
ECI = 4 (Body-Worn or Phablet)	Max Allowed Power	24.0	23.0	21.5	23.0
	Nominal	23.0	22.0	20.5	22.0
ECI = 1 (Head)	Max Allowed Power	25.0	24.0	22.5	24.0
	Nominal	24.0	23.0	21.5	23.0
ECI = 2 (Hotspot)	Max Allowed Power	24.0	23.0	21.5	23.0
	Nominal	23.0	22.0	20.5	22.0
ECI = 3 (Earjack)	Max Allowed Power	24.0	23.0	21.5	23.0
	Nominal	23.0	22.0	20.5	22.0
UMTS Band 4 (1750 MHz)					
Antenna B					
Power Level		Modulated Average Output Power			
		3GPP WCDMA Rel 99	3GPP HSDPA Rel 5	3GPP HSUPA Rel 6	3GPP DC-HSDPA Rel 8
Pmax	Max Allowed Power	24.0	23.0	21.5	23.0
	Nominal	23.0	22.0	20.5	22.0
ECI = 4 (Body-Worn or Phablet)	Max Allowed Power	21.0	20.0	19.5	20.0
	Nominal	20.0	19.0	18.5	19.0
ECI = 1 (Head)	Max Allowed Power	24.0	23.0	21.5	23.0
	Nominal	23.0	22.0	20.5	22.0
ECI = 2 (Hotspot)	Max Allowed Power	21.0	20.0	19.5	20.0
	Nominal	20.0	19.0	18.5	19.0
ECI = 3 (Earjack)	Max Allowed Power	21.0	20.0	19.5	20.0
	Nominal	20.0	19.0	18.5	19.0
UMTS Band 2 (1900 MHz)					
Antenna B					
Power Level		Modulated Average Output Power			
		3GPP WCDMA Rel 99	3GPP HSDPA Rel 5	3GPP HSUPA Rel 6	3GPP DC-HSDPA Rel 8
Pmax	Max Allowed Power	23.0	22.0	21.5	22.0
	Nominal	22.0	21.0	20.5	21.0
ECI = 4 (Body-Worn or Phablet)	Max Allowed Power	21.0	20.0	19.5	20.0
	Nominal	20.0	19.0	18.5	19.0
ECI = 1 (Head)	Max Allowed Power	23.0	22.0	21.5	22.0
	Nominal	22.0	21.0	20.5	21.0
ECI = 2 (Hotspot)	Max Allowed Power	21.0	20.0	19.5	20.0
	Nominal	20.0	19.0	18.5	19.0
ECI = 3 (Earjack)	Max Allowed Power	21.0	20.0	19.5	20.0
	Nominal	20.0	19.0	18.5	19.0

Mode / Band	Antenna		Modulated Average Output Power (in dBm)				
			Pmax	ECI = 4 (Body-Worn or Phablet)	ECI = 1 (Head)	ECI = 2 (Hotspot)	ECI = 3 (Earjack)
LTE Band 12	A	Max Allowed Power	25.0	25.0	25.0	25.0	25.0
		Nominal	24.0	24.0	24.0	24.0	24.0
LTE Band 17	A	Max Allowed Power	25.0	21.0	25.0	21.0	21.0
		Nominal	24.0	20.0	24.0	20.0	20.0
LTE Band 26/5	A	Max Allowed Power	25.0	25.0	25.0	25.0	25.0
		Nominal	24.0	24.0	24.0	24.0	24.0
LTE Band 66/4	B	Max Allowed Power	25.0	19.5	25.0	19.5	19.5
		Nominal	24.0	18.5	24.0	18.5	18.5
LTE Band 2	B	Max Allowed Power	24.0	18.5	24.0	18.5	18.5
		Nominal	23.0	17.5	23.0	17.5	17.5
LTE Band 2	C	Max Allowed Power	24.0	22.0	24.0	22.0	22.0
		Nominal	23.0	21.0	23.0	21.0	21.0
LTE Band 41	B	Max Allowed Power	24.0	23.0	24.0	23.0	23.0
		Nominal	23.0	22.0	23.0	22.0	22.0
Mode / Band	Antenna		Modulated Average Output Power (in dBm)				
			Pmax	ECI = 4 (Body-Worn or Phablet)	ECI = 1 (Head)	ECI = 2 (Hotspot)	ECI = 3 (Earjack)
NR Band n5	A	Max Allowed Power	25.0	24.0	25.0	24.0	24.0
		Nominal	24.0	23.0	24.0	23.0	23.0
NR Band n66	B	Max Allowed Power	25.0	18.5	25.0	18.5	18.5
		Nominal	24.0	17.5	24.0	17.5	17.5

For LTE TDD, the above powers listed are TDD burst average values.

1.3.2 2.4 GHz WLAN Output Power

The below table is applicable is applicable in the following conditions:

- Pmax, ECI=0 (Body-worn or Phablet or Hotspot or Earjack)

Band	Power Level	IEEE 802.11 Modulated Output Power (in dBm)					
		SISO					
		Antenna E					
		b		g		n	
Maximum / Nominal Power		Max	Nom.	Max	Nom.	Max	Nom.
2.4 GHz WLAN	2.45 GHz	20.0	19.0	18.0	17.0	18.0	17.0
		ch. 12: 6.0	5.0	ch. 12: 6.0	5.0	ch. 12: 6.0	5.0
		ch. 13: 6.0	5.0	ch. 13: 6.0	5.0	ch. 13: 6.0	5.0

The below table is applicable is applicable in the following conditions:

- ECI=1 (RCV)

Band	Power Level	IEEE 802.11 Modulated Output Power (in dBm)					
		SISO					
		Antenna E					
		b		g		n	
Maximum / Nominal Power		Max	Nom.	Max	Nom.	Max	Nom.
2.4 GHz WLAN	2.45 GHz	16.0	15.0	16.0	15.0	16.0	15.0
		ch. 12: 6.0	5.0	ch. 12: 6.0	5.0	ch. 12: 6.0	5.0
		ch. 13: 6.0	5.0	ch. 13: 6.0	5.0	ch. 13: 6.0	5.0

1.3.3 5 GHz WLAN Output Power

The below table is applicable is applicable in the following conditions:

- Pmax

Mode	Band	IEEE 802.11 Modulated Output Power (in dBm)					
		SISO					
		Antenna E					
		a		n		ac	
Maximum / Nominal Power		Max	Nom.	Max	Nom.	Max	Nom.
5 GHz WIFI (20MHz BW)	UNII-1	18.0	17.0	18.0	17.0	18.0	17.0
	UNII-2A	18.0 ch. 64: 16.0	17.0 15.0	18.0 ch. 64: 16.0	17.0 15.0	18.0 ch. 64: 16.0	17.0 15.0
	UNII-2C	18.0	17.0	18.0	17.0	18.0	17.0
	UNII-3	18.0	17.0	18.0	17.0	18.0	17.0
5 GHz WIFI (40MHz BW)	UNII-1			16.0	15.0	16.0	15.0
	UNII-2A			16.0	15.0	16.0	15.0
	UNII-2C			16.0	15.0	16.0	15.0
	UNII-3			16.0	15.0	16.0	15.0
5 GHz WIFI (80MHz BW)	UNII-1					15.0	14.0
	UNII-2A					15.0	14.0
	UNII-2C					15.0 ch. 106: 13.5	14.0 12.5
	UNII-3					15.0	14.0

The below table is applicable is applicable in the following conditions:

- ECI=0 (Body-worn or Phablet or Hotspot or Earjack)

Mode	Band	IEEE 802.11 Modulated Output Power (in dBm)					
		SISO					
		Antenna E					
		a		n		ac	
Maximum / Nominal Power		Max	Nom.	Max	Nom.	Max	Nom.
5 GHz WIFI (20MHz BW)	UNII-1	15.0	14.0	15.0	14.0	15.0	14.0
	UNII-2A	15.0	14.0	15.0	14.0	15.0	14.0
	UNII-2C	15.0	14.0	15.0	14.0	15.0	14.0
	UNII-3	15.0	14.0	15.0	14.0	15.0	14.0
5 GHz WIFI (40MHz BW)	UNII-1			15.0	14.0	15.0	14.0
	UNII-2A			15.0	14.0	15.0	14.0
	UNII-2C			15.0	14.0	15.0	14.0
	UNII-3			15.0	14.0	15.0	14.0
5 GHz WIFI (80MHz BW)	UNII-1					15.0	14.0
	UNII-2A					15.0	14.0
	UNII-2C					15.0 ch. 106: 13.5	14.0 12.5
	UNII-3					15.0	14.0

The below table is applicable is applicable in the following conditions:

- ECI=1(RCV)

Mode	Band	IEEE 802.11 Modulated Output Power (in dBm)					
		SISO					
		Antenna E					
		a		n		ac	
Maximum / Nominal Power		Max	Nom.	Max	Nom.	Max	Nom.
5 GHz WIFI (20MHz BW)	UNII-1	13.0	12.0	13.0	12.0	13.0	12.0
	UNII-2A	13.0	12.0	13.0	12.0	13.0	12.0
	UNII-2C	13.0	12.0	13.0	12.0	13.0	12.0
	UNII-3	13.0	12.0	13.0	12.0	13.0	12.0
5 GHz WIFI (40MHz BW)	UNII-1			13.0	12.0	13.0	12.0
	UNII-2A			13.0	12.0	13.0	12.0
	UNII-2C			13.0	12.0	13.0	12.0
	UNII-3			13.0	12.0	13.0	12.0
5 GHz WIFI (80MHz BW)	UNII-1					13.0	12.0
	UNII-2A					13.0	12.0
	UNII-2C					13.0	12.0
	UNII-3					13.0	12.0

1.3.4 2.4 GHz Maximum Bluetooth Output Power

Mode	Data Rate	Modulated Output Power (in dBm)	
		SISO	
		Antenna E	
Maximum / Nominal Power		Max	Nom.
Bluetooth	1Mbps	12.5	11.5
Bluetooth EDR	2Mbps	8.5	7.5
Bluetooth EDR	3Mbps	8.5	7.5
Bluetooth LE	1Mbps	7.5	6.5
Bluetooth LE	2Mbps	7.5	6.5
Bluetooth LE	125kbps	7.5	6.5
Bluetooth LE	500kbps	7.5	6.5

1.4 DUT Antenna Locations

The overall dimensions of this device are > 9 x 5 cm. A diagram showing the location of the device antennas can be found in DUT Antenna Diagram & SAR Test Setup Photographs Appendix. Since the display diagonal dimension of this device is > 150 mm and <200 mm, it is considered a “phablet.” Exact antenna dimensions and separation distances are shown in the Technical Descriptions in the FCC filing.

Table 1-1
Device Edges/Sides for SAR Testing

Antenna	Back	Front	Top	Bottom	Right	Left
A	Yes	Yes	No	Yes	Yes	Yes
B	Yes	Yes	No	Yes	No	Yes
C	Yes	Yes	Yes	No	No	Yes
E	Yes	Yes	Yes	No	No	Yes

Note: Particular DUT edges were not required to be evaluated for wireless router SAR or phablet SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v02r01 Section III and FCC KDB Publication 648474 D04v01r03. The distances between the transmit antennas and the edges of the device are included in the filing. When wireless router mode is enabled, U-NII-1, U-NII-2A, and U-NII-2C operations are disabled.

1.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D04v01, transmitters are considered to be operating simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D04v01 procedures.

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router	Phablet	Notes
1	GSM voice + 2.4 GHz WLAN	Yes	Yes	N/A	Yes	
2	GSM voice + 5 GHz WLAN	Yes	Yes	N/A	Yes	
3	GSM voice + 2.4 GHz Bluetooth	Yes^	Yes	N/A	Yes	^ Bluetooth Tethering is considered
4	GSM voice + 5 GHz WLAN + 2.4 GHz Bluetooth	Yes^	Yes	N/A	Yes	^ Bluetooth Tethering is considered
5	UMTS + 2.4 GHz WLAN	Yes	Yes	Yes	Yes	
6	UMTS + 5 GHz WLAN	Yes	Yes	Yes	Yes	
7	UMTS + 2.4 GHz Bluetooth	Yes^	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
8	UMTS + 5 GHz WLAN + 2.4 GHz Bluetooth	Yes^	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
9	LTE + 2.4 GHz WLAN	Yes	Yes	Yes	Yes	
10	LTE + 5 GHz WLAN	Yes	Yes	Yes	Yes	
11	LTE + 2.4 GHz Bluetooth	Yes^	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
12	LTE + 5 GHz WLAN + 2.4 GHz Bluetooth	Yes^	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
13	LTE + NR	Yes	Yes	N/A	Yes	
14	LTE + NR + 2.4 GHz WLAN	Yes	Yes	Yes	Yes	
15	LTE + NR + 5 GHz WLAN	Yes	Yes	Yes	Yes	
16	LTE + NR + 2.4 GHz Bluetooth	Yes^	Yes	N/A	Yes	^ Bluetooth Tethering is considered
17	LTE + NR + 5 GHz WLAN + 2.4 GHz Bluetooth	Yes^	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
18	NR + 2.4 GHz WLAN	Yes	Yes	Yes	Yes	
19	NR + 5 GHz WLAN	Yes	Yes	Yes	Yes	
20	NR + 2.4 GHz Bluetooth	Yes^	Yes	N/A	Yes	^ Bluetooth Tethering is considered
21	NR + 5 GHz WLAN + 2.4 GHz Bluetooth	Yes^	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
22	GPRS/EDGE + 2.4 GHz WLAN	N/A	N/A	Yes	Yes	
23	GPRS/EDGE + 5 GHz WLAN	N/A	N/A	Yes	Yes	
24	GPRS/EDGE + 2.4 GHz Bluetooth	N/A	N/A	Yes^	Yes	^ Bluetooth Tethering is considered
25	GPRS/EDGE + 5 GHz WLAN + 2.4 GHz Bluetooth	N/A	N/A	Yes^	Yes	^ Bluetooth Tethering is considered

1. No other simultaneous scenarios besides described above is supported for this model.
2. When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [DPCCH]) and power control will be adjusted to meet the needs of both services. Therefore, the UMTS+WLAN scenario also represents the UMTS Voice/DATA + WLAN Hotspot scenario.
3. Per the manufacturer, WIFI Direct is not expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Therefore, there are no simultaneous transmission scenarios involving WIFI direct beyond that listed in the above table.
4. 5 GHz Wireless Router is only supported for the U-NII-3 by S/W, therefore U-NII-1, U-NII-2A, and U-NII-2C were not evaluated for wireless router conditions.
5. This device supports VoWIFI.
6. This device supports Bluetooth Tethering.
7. This device supports VoLTE.
8. This device supports VoNR.
9. LTE + 5G NR FR1 Scenarios are limited to EN-DC combinations with anchor bands as shown in the NR FR1 checklist.

1.6 Miscellaneous SAR Test Considerations

(A) WIFI/BT

Since U-NII-1 and U-NII-2A bands have the same maximum output power and the highest reported SAR for U-NII-2A is less than 1.2 W/kg, SAR is not required for U-NII-1 band according to FCC KDB Publication 248227 D01v02r02.

This device supports channel 1-13 for 2.4 GHz WLAN. However, because channel 12/13 targets are not higher than that of channels 1-11, channels 1, 6, and 11 were considered for SAR testing per FCC KDB 248227 D01V02r02.

Since Wireless Router operations are not allowed by the chipset firmware using U-NII-1, U-NII-2A, and U-NII-2C, WIFI, only 2.4 GHz WIFI, 2.4 GHz Bluetooth, and U-NII-3 WIFI Hotspot SAR tests and combinations are considered for SAR with respect to Wireless Router configurations according to FCC KDB 941225 D06v02r01.

This device supports IEEE 802.11ac with the following features:

a) Up to 80 MHz Bandwidth only for 5 GHz
b) Up to 256 QAM is supported
c) TDWR and Band gap channels are supported for 5 GHz

Per FCC KDB Publication 648474 D04v01r03, this device is considered a "phablet" since the display diagonal dimension is greater than 150mm and less than 200mm. Phablet SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg. Because wireless router operations are not supported for U-NII-1, U-NII-2A, and U-NII-2C WLAN, phablet SAR tests were performed. Phablet SAR was not evaluated for 2.4 GHz WLAN, 2.4 GHz Bluetooth, and U-NII-3 WLAN operations since wireless router 1g SAR was < 1.2 W/kg.

(B) Licensed Transmitter(s)

GSM/GPRS/EDGE DTM is not supported for US bands. Therefore, the GSM Voice modes in this report do not transmit simultaneously with GPRS/EDGE Data.

This device is only capable of QPSK HSUPA in the uplink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01v03r01.

LTE SAR for the higher modulations and lower bandwidths were not tested since the maximum average output power of all required channels and configurations was not more than 0.5 dB higher than the highest bandwidth; and the reported LTE SAR for the highest bandwidth was less than 1.45 W/kg for all configurations according to FCC KDB 941225 D05v02r04.

This device supports LTE Carrier Aggregation (CA) in the downlink. All uplink communications are identical to Release 8 specifications. Per FCC KDB Publication 941225 D05A v01r02, SAR for LTE CA operations was not needed since the maximum average output power in LTE CA mode was not >0.25 dB higher than the maximum output power when downlink carrier aggregation was inactive. The downlink carrier aggregation exclusion analysis can be found in Downlink LTE CA RF Conducted Powers Appendix.

Per FCC KDB Publication 648474 D04v01r03, this device is considered a "phablet" since the display diagonal dimension is greater than 150mm and less than 200mm. Therefore, phablet SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg.

This device supports downlink 4x4 MIMO operations for some LTE Bands. Per May 2017 TCB Workshop Notes, SAR for 4x4 DL MIMO was not needed since the maximum average output power in 4x4 DL MIMO mode was not more than 0.25 dB higher than the maximum output power with 4x4 DL MIMO inactive.

This device supports LTE capabilities with overlapping transmission frequency ranges. When the supported frequency range of an LTE Band falls completely within an LTE band with a larger transmission frequency range, both LTE bands have the same target power (or the band with the larger transmission frequency range has a higher target power), and both LTE bands share the same transmission path and signal characteristics, SAR was only assessed for the band with the larger transmission frequency range.

This device can transmit with antenna C for LTE B2. SAR tests for antenna C, were additionally performed for this LTE band to ensure compliance.

NR implementation supports SA and NSA mode. In EN-DC mode, NR operates with the LTE Bands shown in the NR FR1 checklist acting as anchor bands. Per FCC guidance, SAR tests for NR Bands and LTE Anchors Bands were performed separately due to limitations in SAR probe calibration factors.

1.7 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 941225 D01v03r01, D05v02r05, D05Av01r02, D06v02r01 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D04v01 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 648474 D04v01r03 (Phablet Procedures)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)
- November 2017, April 2018, October 2018 TCB Workshop Notes (LTE Carrier Aggregation)

1.8 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units. The serial numbers used for each test are indicated alongside the results in Section 122.

1.9 Bibliography

Report Type	Report Serial Number
RF Exposure Compliance Summary Report	1M2309270105-18.A3L
RF Exposure Part 2 Test Report	TESA2310000628ES

2 PART 0 SAR CHARACTERIZATION

2.1 SAR Characterization

2.1.1 ECI and SAR Determination

This device uses different Exposure Condition Index (ECI) to configure different time averaged power levels based on certain exposure scenarios. Depending on the detection scheme implemented in the smartphone, the worst-case SAR was determined by measurements for the relevant exposure conditions for that ECI. Detailed descriptions of the detection mechanisms are included in the operational description.

When 1g SAR and 10g SAR exposure comparison is needed, the worst-case was determined from SAR normalized to 1g or 10g SAR limit.

The exposure condition index (ECI) conditions used in Table 2-1and Table 2-2 represent different exposure scenarios.

Table 2-1
ECI and Corresponding Exposure Scenarios WWAN

Scenario	Description	SAR Test Cases
Head (ECI = 1)	▪ Device positioned next to head ▪ Receiver Active	*Head SAR per KDB Publication 648474 D04*
Hotspot mode (ECI = 2)	▪ Device transmits in hotspot mode near body ▪ Hotspot Mode Active	*Hotspot SAR per KDB Publication 941225 D06*
Phablet (ECI = 4)	▪ Device is held with hand	*Phablet SAR per KDB Publication 648474 D04 & KDB Publication 616217 D04*
Body-worn (ECI = 4)	▪ Device being used with a body-worn accessory	*Body-worn SAR per KDB Publication 648474 D04*

Table 2-2
ECI and Corresponding Exposure Scenarios WLAN

Scenario	Description	SAR Test Cases
Head (ECI = 1)	▪ Device positioned next to head ▪ Receiver Active	*Head SAR per KDB Publication 648474 D04*
Hotspot mode (ECI = 0)	▪ Device transmits in hotspot mode near body ▪ Hotspot Mode Active	*Hotspot SAR per KDB Publication 941225 D06*
Phablet (ECI = 0)	▪ Device is held with hand	*Phablet SAR per KDB Publication 648474 D04 & KDB Publication 616217 D04*
Body-worn (ECI = 0)	▪ Device being used with a body-worn accessory	*Body-worn SAR per KDB Publication 648474 D04*

2.1.2 SAR_Design_Target

SAR_design_target is determined by ensuring that it is less than FCC SAR limit after accounting for total device designed related uncertainties specified by the manufacturer (see Table 2-3).

Table 2-3
***SAR_design_target* Calculations**

SAR_design_target			
$SAR\_design\_target < SAR\_regulatory\_limit \times 10^{\frac{-Total\ Uncertainty}{10}}$			
1g SAR (W/kg)		**10g SAR (W/kg)**	
Total Uncertainty	1.0 dB	*Total Uncertainty*	1.0 dB
SAR_regulatory_limit	1.6 W/kg	*SAR_regulatory_limit*	4.0 W/kg
WWAN SAR_design_target	0.65 W/kg	*WWAN SAR_design_target*	1.625 W/kg
WLAN SAR_design_target	0.55 W/kg	*WLAN SAR_design_target*	1.375 W/kg

2.1.3 SAR Char

SAR test results corresponding to *Pmax/Plimit* for each antenna/technology/band/ECI can be found in SAR Summary Section and Part 0 SAR Test Results for Plimit Calculations Appendix.

Plimit is calculated by linearly scaling with the measured SAR at the Part0 to correspond to the *SAR_design_target*. When *Plimit* < *Pmax*, *Part0* was used as Plimit in the TAS. When *Plimit* > *Pmax* and *Part0*=Pmax, calculated *Plimit* was used in the TAS. All reported SAR obtained from the Part0 SAR tests was less than *SAR_Design_target*+ 1 dB Uncertainty. The final *Plimit* determination for each exposure scenario corresponding to *SAR_design_target* are shown in Table 2-4 and Table 2-5.

Table 2-4
***PLimit* Determination WWAN**

Exposure Condition Index (ECI)	***PLimit* Determination Scenarios**
4 or 3	The worst-case SAR exposure is determined as maximum SAR normalized to the limit (i.e. lowest P_{limit}) among: 1. Body Worn SAR 2. Extremity SAR measured at 0 mm for all surfaces.
1	P_{limit} is calculated based on 1g Head SAR
2	P_{limit} is calculated based on 1g Hotspot SAR at 10 mm

Table 2-5
***PLimit* Determination WLAN**

Exposure Condition Index (ECI)	***PLimit* Determination Scenarios**
0	The worst-case SAR exposure is determined as maximum SAR normalized to the limit (i.e. lowest P_{limit}) among: 1. Body Worn SAR 2. Extremity SAR measured at 0 mm for all surfaces. 3. Hotspot SAR at 10 mm
1	P_{limit} is calculated based on 1g Head SAR

Table 2-6
SAR Characterizations

Exposure Scenario		Maximum Tune-Up Output Power*	Body-Worn or Phablet	Head	Hotspot	Earjack
Averaging Volume			1g/10g	1g	1g	1g/10g
Spacing			10mm, 0mm	0mm	10mm	10mm, 0mm
Configuration						
ECI			4	1	2	3
Technology/Band	Antenna	Pmax				
GSM 850	A	24.8	23.8	29.4	23.8	23.8
GSM 1900	B	21.8	19.8	28.4	19.8	19.8
UMTS 850	A	24.0	23.0	30.1	23.0	23.0
UMTS 1750	B	23.0	20.0	30.3	20.0	20.0
UMTS 1900	B	22.0	20.0	27.3	20.0	20.0
LTE Band 12	A	24.0	26.1	29.7	26.1	26.1
LTE Band 26/5	A	24.0	27.4	28.1	27.4	27.4
LTE Band 66/4	B	24.0	18.5	29.6	18.5	18.5
LTE Band 2	B	23.0	17.5	27.4	17.5	17.5
LTE Band 2	C	23.0	21.0	25.1	21.0	21.0
LTE Band 41	B	21.0	20.0	25.0	20.0	20.0
NR Band n5	A	24.0	23.0	28.5	23.0	23.0
NR Band n66	B	24.0	17.5	29.5	17.5	17.5

Exposure Scenario		Maximum Tune-Up Output Power*	Body-Worn or Phablet or Hotspot or Earjack	Head
Averaging Volume			1g/10g	1g
Spacing			10mm, 0mm	0mm
Configuration				
ECI			0	1
Technology/Band	Antenna	Pmax		
2.4 GHz WIFI	E	19.0	20.7	15.0
5 GHz WIFI	E	17.0	14.0	12.0

Notes:

- When $P_{max} < P_{limit}$, the DUT will operate at a power level up to P_{max}

- All P_{limit} and maximum tune up output power P_{max} levels entered in above Table correspond to average power levels after accounting for duty cycle in the case of TDD, GMSK, or OFDM modulation schemes (e.g. GSM, LTE TDD and WLAN).

- Maximum tune up output power P_{max} is used to configure EUT during RF tune up procedure. The maximum allowed output power is equal to maximum Tune up output power + 1dB device design uncertainty.

3 LTE AND NR INFORMATION

LTE Information					
Form Factor	Portable Handset				
Frequency Range of each LTE transmission band	LTE Band 12: 699.7 - 715.3 MHz				
	LTE Band 17: 706.5 - 713.5 MHz				
	LTE Band 26: 814.7 - 848.3 MHz				
	LTE Band 5: 824.7 - 848.3 MHz				
	LTE Band 66: 1710.7 - 1779.3 MHz				
	LTE Band 4: 1710.7 - 1754.3 MHz				
	LTE Band 2: 1850.7 - 1909.3 MHz				
	LTE Band 41: 2498.5 - 2687.5 MHz				
Channel Bandwidths	LTE Band 12: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 17: 5 MHz, 10 MHz				
	LTE Band 26: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz				
	LTE Band 5: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 66: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 4: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 2: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 41: 5 MHz, 10 MHz, 15 MHz, 20 MHz				
Channel Numbers and Frequencies (MHz)	Low	Low-Mid	Mid	Mid-High	High
LTE Band 12: 1.4 MHz	699.7 (23017)		707.5 (23095)	715.3 (23173)	
LTE Band 12: 3 MHz	700.5 (23025)		707.5 (23095)	714.5 (23165)	
LTE Band 12: 5 MHz	701.5 (23035)		707.5 (23095)	713.5 (23155)	
LTE Band 12: 10 MHz	704 (23060)		707.5 (23095)	711 (23130)	
LTE Band 17: 5 MHz	706.5 (23755)		710 (23790)	713.5 (23825)	
LTE Band 17: 10 MHz	709 (23780)		710 (23790)	711 (23800)	
LTE Band 26: 1.4 MHz	814.7 (26697)		831.5 (26865)	848.3 (27033)	
LTE Band 26: 3 MHz	815.5 (26705)		831.5 (26865)	847.5 (27025)	
LTE Band 26: 5 MHz	816.5 (26715)		831.5 (26865)	846.5 (27015)	
LTE Band 26: 10 MHz	819 (26740)		831.5 (26865)	844 (26990)	
LTE Band 26: 15 MHz	821.5 (26765)		831.5 (26865)	841.5 (26965)	
LTE Band 5: 1.4 MHz	824.7 (20407)		836.5 (20525)	848.3 (20643)	
LTE Band 5: 3 MHz	825.5 (20415)		836.5 (20525)	847.5 (20635)	
LTE Band 5: 5 MHz	826.5 (20425)		836.5 (20525)	846.5 (20625)	
LTE Band 5: 10 MHz	829 (20450)		836.5 (20525)	844 (20600)	
LTE Band 66: 1.4 MHz	1710.7 (131979)		1745 (132322)	1779.3 (132665)	
LTE Band 66: 3 MHz	1711.5 (131987)		1745 (132322)	1778.5 (132657)	
LTE Band 66: 5 MHz	1712.5 (131997)		1745 (132322)	1777.5 (132647)	
LTE Band 66: 10 MHz	1715 (132022)		1745 (132322)	1775 (132622)	
LTE Band 66: 15 MHz	1717.5 (132047)		1745 (132322)	1772.5 (132597)	
LTE Band 66: 20 MHz	1720 (132072)		1745 (132322)	1770 (132572)	
LTE Band 4: 1.4 MHz	1710.7 (19957)		1732.5 (20175)	1754.3 (20393)	
LTE Band 4: 3 MHz	1711.5 (19965)		1732.5 (20175)	1753.5 (20385)	
LTE Band 4: 5 MHz	1712.5 (19975)		1732.5 (20175)	1752.5 (20375)	
LTE Band 4: 10 MHz	1715 (20000)		1732.5 (20175)	1750 (20350)	
LTE Band 4: 15 MHz	1717.5 (20025)		1732.5 (20175)	1747.5 (20325)	
LTE Band 4: 20 MHz	1720 (20050)		1732.5 (20175)	1745 (20300)	
LTE Band 2: 1.4 MHz	1850.7 (18607)		1880 (18900)	1909.3 (19193)	
LTE Band 2: 3 MHz	1851.5 (18615)		1880 (18900)	1908.5 (19185)	
LTE Band 2: 5 MHz	1852.5 (18625)		1880 (18900)	1907.5 (19175)	
LTE Band 2: 10 MHz	1855 (18650)		1880 (18900)	1905 (19150)	
LTE Band 2: 15 MHz	1857.5 (18675)		1880 (18900)	1902.5 (19125)	
LTE Band 2: 20 MHz	1860 (18700)		1880 (18900)	1900 (19100)	
LTE Band 41: 5 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 10 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 15 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 20 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
UE Category	UL Cat.18 / DL Cat.13				
Modulations Supported in UL	QPSK, 16 QAM, 64 QAM, 256 QAM				
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES				
A-MPR (Additional MPR) disabled for SAR Testing?	YES				
LTE Carrier Aggregation Possible Combinations	The technical description includes all the possible carrier aggregation combinations				
LTE Additional Information	This device does not support full CA features on 3GPP Release 15. It supports carrier aggregation, downlink MIMO features as shown in the RF Conducted Powers section of this report and the Downlink LTE CA RF Conducted Powers Appendix. All uplink communications are identical to the Release 8 Specifications. Uplink communications are done on the PCC. The following LTE Release 15 Features are not supported: Relay, HetNet, Enhanced MIMO, eICIC, eMBMS, Wifi Offloading, Cross-Carrier Scheduling, Enhanced SC-FDMA.				

NR Information			
Form Factor	Portable Handset		
Frequency Range of each NR transmission band	NR Band n5: 826.5 - 846.5 MHz		
	NR Band n66: 1712.5 - 1777.5 MHz		
Channel Bandwidths	NR Band n5: 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	NR Band n66: 5 MHz, 10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz		
Channel Numbers and Frequencies (MHz)			
NR Band n5: 5 MHz	826.5 (165300)	836.5 (167300)	846.5 (169300)
NR Band n5: 10 MHz	829 (165800)	836.5 (167300)	844 (168800)
NR Band n5: 15 MHz	831.5 (166300)	836.5 (167300)	841.5 (168300)
NR Band n5: 20 MHz	834 (166800)	836.5 (167300)	839 (167800)
NR Band n66: 5 MHz	1712.5 (342500)	1745 (349000)	1777.5 (355500)
NR Band n66: 10 MHz	1715 (343000)	1745 (349000)	1775 (355000)
NR Band n66: 15 MHz	1717.5 (343500)	1745 (349000)	1772.5 (354500)
NR Band n66: 20 MHz	1720 (344000)	1745 (349000)	1770 (354000)
NR Band n66: 25 MHz	1722.5 (344500)	1745 (349000)	1767.5 (353500)
NR Band n66: 30 MHz	1725 (345000)	1745 (349000)	1765 (353000)
NR Band n66: 40 MHz	1730 (346000)	1745 (349000)	1760 (352000)
SCS for NR Band n5, n66	15 kHz		
Modulations Supported in UL	DFT-s-OFDM: π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM CP-OFDM: QPSK, 16QAM, 64QAM, 256QAMNR		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		
EN-DC and NR Carrier Aggregation Possible Combinations	The technical description includes all the possible carrier aggregation combinations		
LTE Anchor Bands for NR Band n5	LTE Band 2/66		
LTE Anchor Bands for NR Band n66	LTE Band 2/5/12		

4 INTRODUCTION

The FCC and Innovation, Science, and Economic Development Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [22]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

4.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 4-1).

Equation 4-1
SAR Mathematical Equation

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m^3)
E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

5 DOSIMETRIC ASSESSMENT

5.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013:

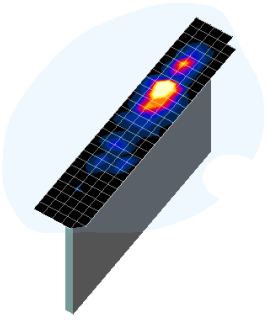


Figure 5-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 5-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See Table 5-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

   a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 5-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).

   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.

   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

Table 5-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

Frequency	Maximum Area Scan Resolution (mm) (Δx_{area}, Δy_{area})	Maximum Zoom Scan Resolution (mm) (Δx_{zoom}, Δy_{zoom})	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x,y,z)
			Uniform Grid	Graded Grid		
			$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)$*	$\Delta z_{zoom}(n>1)$*	
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	≤ 1.5*Δz_{zoom}(n-1)	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5*Δz_{zoom}(n-1)	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5*Δz_{zoom}(n-1)	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5*Δz_{zoom}(n-1)	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5*Δz_{zoom}(n-1)	≥ 22

*Also compliant to IEEE 1528-2013 Table 6

6 DEFINITION OF REFERENCE POINTS

6.1 EAR REFERENCE POINT

Figure 6-2 shows the front, back and side views of the SAM Twin Phantom. The point "M" is the reference point for the center of the mouth, "LE" is the left ear reference point (ERP), and "RE" is the right ERP. The ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 6-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front), also called the Reference Pivoting Line, is not perpendicular to the reference plane (see Figure 6-1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].

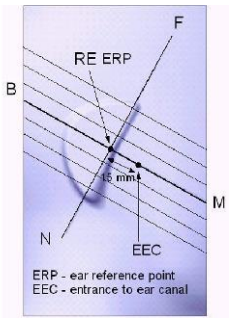


Figure 6-1
Close-Up Side view of ERP

6.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the acoustic output located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (See Figure 6-3). The acoustic output was than located at the same level as the center of the ear reference point. The test device was positioned so that the "vertical centerline" was bisecting the front surface of the handset at its top and bottom edges, positioning the "ear reference point" on the outer surface of the both the left and right head phantoms on the ear reference point.

Figure 6-2
Front, back and side view of SAM Twin Phantom

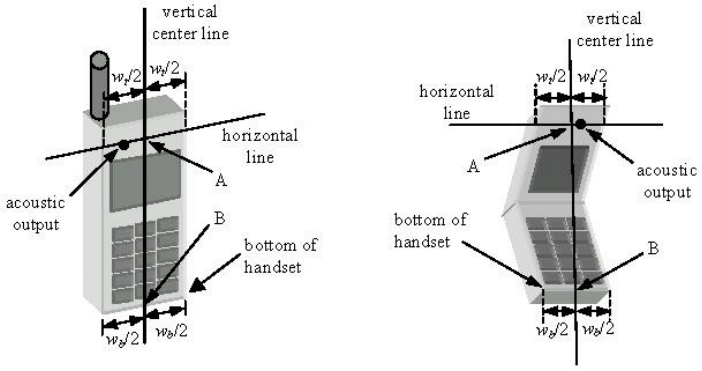


Figure 6-3
Handset Vertical Center & Horizontal Line Reference Points

7 TEST CONFIGURATION POSITIONS

7.1 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02.

7.2 Positioning for Cheek

1. The test device was positioned with the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 7-1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

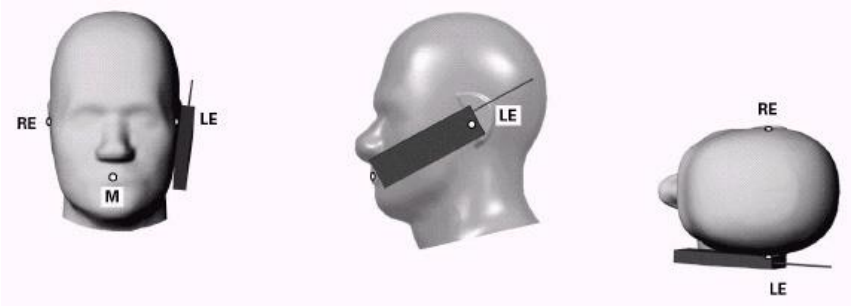


Figure 7-1 Front, Side and Top View of Cheek Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the pinna.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the reference plane.
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the device contact with the ear, the device was rotated about the NF line until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 7-2).

7.3 Positioning for Ear / 15º Tilt

With the test device aligned in the “Cheek Position”:

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. In this situation, the tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 7-2).

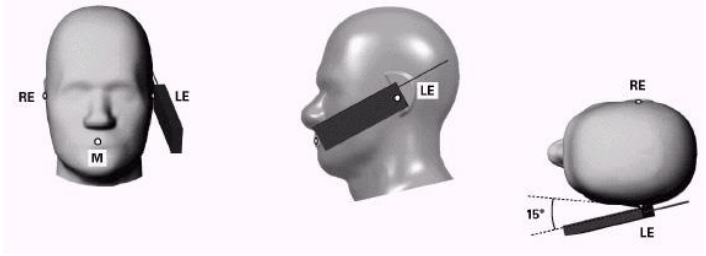


Figure 7-2 Front, Side and Top View of Ear/15º Tilt Position

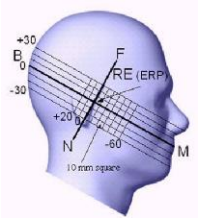


Figure 7-3
Side view w/ relevant markings

7.4 SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones. Per IEEE 1528-2013, a rotated SAM phantom is necessary to allow probe access to such regions. Both SAM heads of the TwinSAM-Chin20 are rotated 20 degrees around the NF line. Each head can be removed from the table for emptying and cleaning.

Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document FCC KDB Publication 648474 D04v01r03. The SAR required in these regions of SAM should be measured using a flat phantom. The phone should be positioned with a separation distance of 4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. While maintaining this distance at the ERP location, the low (bottom) edge of the phone should be lowered from the phantom to establish the same separation distance between the peak SAR location identified by the truncated partial SAR distribution measured with the SAM phantom. The distance from the peak SAR location to the phone is determined by the straight line passing perpendicularly through the phantom surface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing the required separation at the peak SAR location, the top edge of the phone will be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right while placed in this inclined position to the flat phantom.

7.5 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 7-4). Per FCC KDB Publication 648474 D04v01r03, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D04v01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a 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.

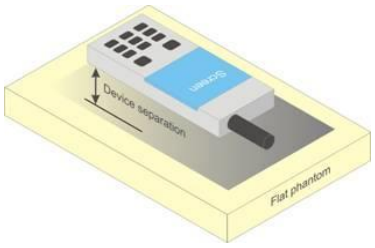


Figure 7-4
Sample Body-Worn Diagram

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not

contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented.
Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

7.6 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1g body and 10g extremity SAR Exclusion Thresholds found in KDB Publication 447498 D04v01 should be applied to determine SAR test requirements.

Per KDB Publication 447498 D04v01, Cell phones (handsets) are not normally designed to be used on extremities or operated in extremity only exposure conditions. The maximum output power levels of handsets generally do not require extremity SAR testing to show compliance. Therefore, extremity SAR was not evaluated for this device.

7.7 Wireless Router Configurations

Some battery-operated handsets have the capability to transmit and receive user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06v02r01 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D04v01 procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

7.8 Phablet Configurations

For smart phones with a display diagonal dimension > 150 mm or an overall diagonal dimension > 160 mm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that

support voice calls next to the ear, the phablets procedures outlined in KDB Publication 648474 D04v01r03 should be applied to evaluate SAR compliance. A device marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance. In addition to the normally required head and body-worn accessory SAR test procedures required for handsets, the UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna <=25 mm from that surface or edge, in direct contact with the phantom, for 10g SAR. The UMPC mini-tablet 1g SAR at 5 mm is not required. When hotspot mode applies, 10g SAR is required only for the surfaces and edges with hotspot mode 1g SAR > 1.2 W/kg.

8 RF EXPOSURE LIMITS

8.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

8.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 8-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

9 FCC MEASUREMENT PROCEDURES

Power measurements for licensed transmitters are performed using a base station simulator under digital average power.

9.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D04v01, when SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

9.2 3G SAR Test Reduction Procedure

In FCC KDB Publication 941225 D01v03r01, certain transmission modes within a frequency band and wireless mode evaluated for SAR are defined as primary modes. The equivalent modes considered for SAR test reduction are denoted as secondary modes. When the maximum output power including tune-up tolerance specified for production units in a secondary mode is ≤ 0.25 dB higher than the primary mode or when the highest reported SAR of the primary mode, scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode, is ≤ 1.2 W/kg, SAR measurements are not required for the secondary mode. These criteria are referred to as the 3G SAR test reduction procedure. When the 3G SAR test reduction procedure is not satisfied, SAR measurements are additionally required for the secondary mode.

9.3 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01v03r01 “3G SAR Measurement Procedures.”

The device is placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test are evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device is tested throughout the SAR test at maximum output power, the SAR measurement system measures a “point SAR” at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviates by more than 5%, the SAR test and drift measurements are repeated.

9.4 SAR Measurement Conditions for UMTS

9.4.1 Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC with TPC (transmit power control) set to all “1s” or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HS-DPCCH etc) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.

9.4.2 Head SAR Measurements

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's". The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

9.4.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all "1s". The 3G SAR test reduction procedure is applied to other spreading codes and multiple $DPDCH_n$ configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or $DPDCH_n$, for the highest reported SAR configuration in 12.2 kbps RMC.

9.4.4 SAR Measurements with Rel 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, for the highest reported SAR configuration in 12.2 kbps RMC without HSDPA. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

9.4.5 SAR Measurements with Rel 6 HSUPA

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 and power control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA.

When VOIP applies to head exposure, the 3G SAR test reduction procedure is applied with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body SAR measurements are applied to head exposure testing.

9.4.6 SAR Measurement Conditions for DC-HSDPA

SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel. 5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.

9.5 SAR Measurement Conditions for LTE

LTE modes are tested according to FCC KDB 941225 D05v02r04 publication. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 or Anritsu MT8820C simulators are used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

9.5.1 Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

9.5.2 MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

9.5.3 A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

9.5.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r04:

a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
    i. The required channel and offset combination with the highest maximum output power is required for SAR.
    ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
    iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.

9.5.5 TDD

LTE TDD testing is performed using the SAR test guidance provided in FCC KDB 941225 D05v02r04. TDD is tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225 D05v02r04. SAR testing is performed using the extended cyclic prefix listed in 3GPP TS 36.211 Section 4.

9.5.6 Downlink Only Carrier Aggregation

Conducted power measurements with LTE Carrier Aggregation (CA) (downlink only) active are made in accordance to KDB Publication 941225 D05Av01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s) (SCC) on the downlink only. All uplink communications and acknowledgements remain identical to specifications when downlink

carrier aggregation is inactive on the PCC. Additional conducted output powers are measured with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band. Per FCC KDB Publication 941225 D05Av01r02, no SAR measurements are required for downlink only carrier aggregation configurations when the average output power with downlink only carrier aggregation active is not more than 0.25 dB higher than the average output power with downlink only carrier aggregation inactive.

9.6 SAR Testing with 802.11 Transmitters

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v02r02 for more details.

9.6.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

9.6.2 U-NII-1 and U-NII-2A

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, SAR measurement using OFDM SAR test procedures is not required for U-NII-1 unless the highest reported SAR for U-NII-2A is > 1.2 W/kg. When different maximum output powers are specified for the bands, SAR measurement for the U-NII band with the lower maximum output power is not required unless the highest reported SAR for the U-NII band with the higher maximum output power, adjusted by the ratio of lower to higher specified maximum output power for the two bands, is > 1.2 W/kg. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

9.6.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification. Unless band gap channels are permanently disabled, SAR must be considered for these channels. Each band is tested independently according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

9.6.4 Initial Test Position Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all

positions in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

9.6.5 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

2) When the reported SAR is > 0.8 W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11 g/n/ax OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

9.6.6 OFDM Transmission Mode and SAR Test Channel Selection

When the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a, 802.11n and 802.11ac or 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 802.11n and 802.11ac or 802.11g then 802.11n, is used for SAR measurement. Per April 2019 TCB Workshop guidance, 802.11ax was considered the highest order 802.11 mode. When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

9.6.7 Initial Test Configuration Procedure

For OFDM, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order IEEE 802.11 mode. The channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration.

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest

802.11 mode is considered for SAR measurements (See Section 9.6.6). When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

9.6.8 Subsequent Test Configuration Procedures

For OFDM configurations in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure. When the highest reported SAR (for the initial test configuration), adjusted by the ratio of the specified maximum output power of the subsequent test configuration to initial test configuration, is ≤ 1.2 W/kg, no additional SAR tests for the subsequent test configurations are required. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

10 RF CONDUCTED POWERS

10.1 GSM Conducted Powers

Table 10-1
Measured P_{max} for ECI=1 (Head) for GSM 850 & GSM 1900

Maximum Burst-Averaged Output Power										
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	33.15	33.14	30.94	28.92	**27.93**	25.61	24.81	22.84	21.44
	190	33.21	33.21	30.99	29.01	**27.95**	25.84	24.86	22.67	21.47
	251	33.16	33.14	30.97	28.92	**27.90**	25.70	24.71	22.70	21.45
GSM 1900	512	30.49	30.48	27.78	25.70	**24.70**	24.38	23.12	21.55	20.09
	661	30.45	30.43	27.79	25.73	**24.68**	24.35	23.05	21.40	20.23
	810	30.20	30.19	27.62	25.49	**24.52**	24.35	23.65	21.41	20.30
Calculated Maximum Frame-Averaged Output Power										
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	23.95	23.94	24.75	24.49	**24.75**	16.41	18.62	18.41	18.26
	190	24.01	24.01	24.80	24.58	**24.77**	16.64	18.67	18.24	18.29
	251	23.96	23.94	24.78	24.49	**24.72**	16.50	18.52	18.27	18.27
GSM 1900	512	21.29	21.28	21.59	21.27	**21.52**	15.18	16.93	17.12	16.91
	661	21.25	21.23	21.60	21.30	**21.50**	15.15	16.86	16.97	17.05
	810	21.00	20.99	21.43	21.06	**21.34**	15.15	17.46	16.98	17.12
GSM 850	**Frame Avg.Targets:**	23.80	23.80	24.81	24.57	**24.82**	16.30	18.31	18.07	18.32
GSM 1900		20.80	20.80	21.81	21.57	**21.82**	15.30	17.31	17.07	17.32

Table 10-2
Measured P_{limit} for ECI= 4 (Body-worn or Phablet) and/or DSI=2 (Hotspot) and/or DSI=3 (Earjack) for GSM850 & GSM1900

Maximum Burst-Averaged Output Power										
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	33.15	33.14	30.74	28.81	**27.81**	25.61	24.81	22.84	21.44
	190	33.21	33.21	30.76	28.80	**27.83**	25.84	24.86	22.67	21.47
	251	33.16	33.14	30.80	28.76	**27.81**	25.70	24.71	22.70	21.45
GSM 1900	512	28.26	28.26	25.70	23.63	**22.61**	24.38	23.12	21.55	20.09
	661	28.25	28.24	25.73	23.60	**22.57**	24.35	23.05	21.40	20.23
	810	28.15	28.14	25.63	23.45	**22.39**	24.35	23.65	21.41	20.30
Calculated Maximum Frame-Averaged Output Power										
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	23.95	23.94	24.55	24.38	**24.63**	16.41	18.62	18.41	18.26
	190	24.01	24.01	24.57	24.37	**24.65**	16.64	18.67	18.24	18.29
	251	23.96	23.94	24.61	24.33	**24.63**	16.50	18.52	18.27	18.27
GSM 1900	512	19.06	19.06	19.51	19.20	**19.43**	15.18	16.93	17.12	16.91
	661	19.05	19.04	19.54	19.17	**19.39**	15.15	16.86	16.97	17.05
	810	18.95	18.94	19.44	19.02	**19.21**	15.15	17.46	16.98	17.12
GSM 850	**Frame Avg.Targets:**	23.80	23.80	23.81	23.77	**23.82**	16.30	18.31	18.07	18.32
GSM 1900		19.80	19.80	19.81	19.77	**19.82**	15.30	17.31	17.07	17.32

Note:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
2. GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.
3. EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8-PSK modulation do not have an impact on output power.

GSM Class: B
GPRS Multislot class: 33 (Max 4 Tx uplink slots)
EDGE Multislot class: 33 (Max 4 Tx uplink slots)
DTM Multislot Class: N/A

Figure 10-1
Power Measurement Setup

10.2 UMTS Conducted Powers

Table 10-3
Measured P_{max} for ECI = 1 (Head) for UMTS 850, UMTS 1750 & UMTS 1900

Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			AWS Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
		4132	4183	4233	1312	1412	1513	9262	9400	9538	
WCDMA	12.2 kbps RMC	24.12	**24.17**	24.10	**23.45**	23.18	23.30	22.95	**23.00**	22.89	-
	12.2 kbps AMR	24.10	24.16	24.08	23.41	23.15	23.27	22.96	23.00	22.87	-
HSDPA	Subtest 1	23.29	23.37	23.42	22.60	22.46	22.41	21.92	21.85	21.49	0
	Subtest 2	23.30	23.38	23.41	22.61	22.49	22.43	21.96	21.88	21.52	0
	Subtest 3	22.86	22.94	22.97	22.16	22.04	21.98	21.50	21.46	21.09	0.5
	Subtest 4	22.80	22.90	22.94	22.14	22.02	21.94	21.49	21.40	21.03	0.5
HSUPA	Subtest 1	21.62	21.89	21.93	21.49	21.43	21.38	20.91	20.86	20.47	0
	Subtest 2	21.34	21.40	21.45	20.06	19.95	19.89	19.90	19.85	19.49	2
	Subtest 3	22.34	22.42	22.46	21.07	20.94	20.90	20.90	20.85	20.50	1
	Subtest 4	20.89	20.95	20.94	20.59	20.44	20.42	20.40	20.33	19.97	2
	Subtest 5	22.31	22.36	22.42	21.45	21.43	21.38	21.50	21.49	21.36	0
DC-HSDPA	Subtest 1	23.35	23.41	23.50	22.61	22.47	22.41	21.92	21.85	21.50	0
	Subtest 2	23.30	23.42	23.48	22.60	22.44	22.39	21.90	21.84	21.48	0
	Subtest 3	22.78	22.87	22.96	22.06	21.91	21.81	21.37	21.31	20.97	0.5
	Subtest 4	22.77	22.92	22.93	22.08	21.92	21.85	21.37	21.31	20.96	0.5

Table 10-4
Measured P_{limit} for ECI = 4 (Body-Worn or Phablet) and/or ECI = 2 (Hotpsot) and/or ECI=3 (Earjack) for UMTS 850, UMTS 1750 & UMTS 1900

Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			AWS Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
		4132	4183	4233	1312	1412	1513	9262	9400	9538	
WCDMA	12.2 kbps RMC	23.10	**23.12**	23.10	**20.46**	20.32	20.26	19.97	**20.07**	19.81	-
	12.2 kbps AMR	23.09	23.08	23.10	20.48	20.36	20.31	19.94	20.04	19.80	-
HSDPA	Subtest 1	22.34	22.41	22.45	19.59	19.45	19.40	18.91	18.92	18.48	0
	Subtest 2	22.37	22.43	22.46	19.61	19.48	19.42	18.95	18.87	18.52	0
	Subtest 3	21.93	21.98	22.01	19.15	19.05	18.98	18.49	18.41	18.08	0.5
	Subtest 4	21.89	21.95	21.99	19.13	19.02	18.96	18.47	18.40	18.02	0.5
HSUPA	Subtest 1	20.33	20.91	20.96	18.57	18.42	18.36	17.89	17.84	17.50	0
	Subtest 2	20.34	20.40	20.46	17.05	16.94	16.88	16.88	16.84	16.49	2
	Subtest 3	21.34	21.43	21.47	18.06	17.95	17.89	17.90	17.81	17.48	1
	Subtest 4	19.88	19.93	19.97	17.59	17.44	17.40	17.40	17.33	16.98	2
	Subtest 5	21.32	21.39	21.42	19.04	18.95	18.89	18.89	18.82	18.46	0
DC-HSDPA	Subtest 1	22.35	22.42	22.51	19.61	19.46	19.41	18.91	18.84	18.51	0
	Subtest 2	22.33	22.44	22.46	19.59	19.42	19.38	18.87	18.82	18.49	0
	Subtest 3	21.78	21.88	21.97	19.04	18.91	18.86	18.38	18.31	17.95	0.5
	Subtest 4	21.79	21.90	21.92	19.06	18.92	18.89	18.36	18.28	17.96	0.5

DC-HSDPA considerations

- 3GPP Specification 34.121-1 Release 8 Ver 8.10.0 was used for DC-HSDPA guidance
- H-Set 12 (QPSK) was confirmed to be used during DC-HSDPA measurements
- The DUT supports UE category 24 for HSDPA

It is expected by the manufacturer that MPR for some HSPA subtests may be up to 2 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model.

Figure 10-2
Power Measurement Setup

10.3 LTE Conducted Powers

Note: Per FCC KDB Publication 941225 D05v02r05, LTE SAR for the lower bandwidths was not required for testing since the maximum average output power of all required channels and configurations was not more than 0.5 dB higher than the highest bandwidth and the reported LTE SAR for the highest bandwidth was less than 1.45 W/kg. Lower bandwidth conducted powers for all LTE bands can be found in LTE and NR Lower Bandwidth RF Conducted Powers Appendix.

Note: Some bands do not support three non-overlapping channels. Per KDB Publication 941225 D05v02, 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.

10.3.1 LTE Band 12

Table 10-5
LTE Band 12 Measured P_{Max} for all ECI - 10 MHz Bandwidth

LTE Band 12 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23095 (707.5 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	**23.76**	0	0
	1	25	23.71		0
	1	49	23.74		0
	25	0	**22.74**	0-1	1
	25	12	22.71		1
	25	25	22.67		1
	50	0	22.73		1
16QAM	1	0	23.04	0-1	1
	1	25	23.07		1
	1	49	23.23		1
	25	0	21.74	0-2	2
	25	12	21.70		2
	25	25	21.68		2
	50	0	21.74		2
64QAM	1	0	22.03	0-2	2
	1	25	21.91		2
	1	49	22.00		2
	25	0	20.71	0-3	3
	25	12	20.68		3
	25	25	20.68		3
	50	0	20.73		3
256QAM	1	0	18.84	0-5	5
	1	25	18.85		5
	1	49	18.89		5
	25	0	18.66		5
	25	12	18.66		5
	25	25	18.66		5
	50	0	18.69		5

10.3.2 LTE Band 26

Table 10-6
LTE Band 26 (Cell) Measured P_{Max} for all ECI - 15 MHz Bandwidth

LTE Band 26 (Cell) 15 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 26865 (831.5 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	23.73	0	0
	1	36	**23.81**		0
	1	74	23.71		0
	36	0	22.78	0-1	1
	36	18	**22.79**		1
	36	37	22.77		1
	75	0	22.77		1
16QAM	1	0	23.14	0-1	1
	1	36	23.12		1
	1	74	23.08		1
	36	0	21.77	0-2	2
	36	18	21.80		2
	36	37	21.72		2
	75	0	21.77		2
64QAM	1	0	22.01	0-2	2
	1	36	22.01		2
	1	74	21.92		2
	36	0	20.78	0-3	3
	36	18	20.81		3
	36	37	20.75		3
	75	0	20.78		3
256QAM	1	0	18.86	0-5	5
	1	36	18.93		5
	1	74	18.87		5
	36	0	18.75		5
	36	18	18.77		5
	36	37	18.73		5
	75	0	18.75		5

10.3.3 LTE Band 66 Antenna B

Table 10-7
LTE Band 66 (AWS) Antenna B Measured P_{Max} for ECI = 1 (Head) – 20 MHz Bandwidth

LTE Band 66 (AWS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 132072 (1720.0 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132572 (1770.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	23.61	23.69	23.64	0	0
	1	50	23.68	23.68	23.68		0
	1	99	**23.72**	**23.72**	23.58		0
	50	0	22.74	**22.78**	22.72	0-1	1
	50	25	22.73	22.77	22.71		1
	50	50	**22.78**	22.74	22.71		1
	100	0	22.74	22.75	22.72		1
16QAM	1	0	23.17	23.06	23.00	0-1	1
	1	50	23.09	23.05	23.05		1
	1	99	23.08	23.10	23.11		1
	50	0	21.72	21.73	21.70	0-2	2
	50	25	21.73	21.74	21.68		2
	50	50	21.76	21.73	21.67		2
	100	0	21.77	21.77	21.72		2
64QAM	1	0	21.85	21.90	21.88	0-2	2
	1	50	21.87	21.94	21.81		2
	1	99	21.96	21.98	21.89		2
	50	0	20.70	20.75	20.67	0-3	3
	50	25	20.73	20.75	20.66		3
	50	50	20.76	20.75	20.71		3
	100	0	20.75	20.76	20.71		3
256QAM	1	0	18.78	18.92	18.97	0-5	5
	1	50	18.93	18.92	18.84		5
	1	99	18.89	18.95	18.84		5
	50	0	18.75	18.81	18.71		5
	50	25	18.75	18.83	18.72		5
	50	50	18.80	18.77	18.75		5
	100	0	18.79	18.80	18.75		5

Table 10-8
LTE Band 66 (AWS) Antenna B Measured P_{Limit} for ECI = 4 (Body-Worn or Phablet) and/or ECI = 2 (Hotspot) and/or ECI = 3 (Earjack) - 20 MHz Bandwidth

LTE Band 66 (AWS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 132072 (1720.0 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132572 (1770.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	17.85	17.89	17.79	0	0
	1	50	17.82	17.87	17.77		0
	1	99	**17.90**	17.82	17.82		0
	50	0	17.88	**17.90**	17.82	0-1	0
	50	25	17.86	17.87	17.81		0
	50	50	**17.90**	17.88	17.84		0
	100	0	17.88	17.69	17.82		0
16QAM	1	0	17.88	17.81	17.72	0-1	0
	1	50	17.89	17.87	17.79		0
	1	99	17.80	17.79	17.73		0
	50	0	17.84	17.78	17.79	0-2	0
	50	25	17.86	17.78	17.72		0
	50	50	17.81	17.76	17.78		0
	100	0	17.87	17.80	17.76		0
64QAM	1	0	17.87	17.81	17.77	0-2	0
	1	50	17.82	17.84	17.79		0
	1	99	17.88	17.87	17.80		0
	50	0	17.84	17.79	17.81	0-3	0
	50	25	17.85	17.79	17.81		0
	50	50	17.85	17.77	17.82		0
	100	0	17.87	17.81	17.74		0
256QAM	1	0	17.84	17.76	17.73	0-5	0
	1	50	17.79	17.79	17.78		0
	1	99	17.86	17.81	17.76		0
	50	0	17.85	17.86	17.79		0
	50	25	17.84	17.78	17.81		0
	50	50	17.89	17.85	17.75		0
	100	0	17.89	17.78	17.75		0

10.3.4 LTE Band 2 Antenna B

Table 10-9
LTE Band 2 Antenna B Measured P_{Max} for ECI = 1 (Head) – 20 MHz Bandwidth

LTE Band 2 (PCS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18700 (1860.0 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19100 (1900.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	22.87	22.87	22.90	0	0
	1	50	**23.00**	22.97	22.82		0
	1	99	22.88	22.83	22.58		0
	50	0	21.96	21.91	21.88	0-1	1
	50	25	21.95	21.91	21.82		1
	50	50	**22.01**	21.88	21.76		1
	100	0	21.93	21.89	21.82		1
16QAM	1	0	22.29	22.25	22.16	0-1	1
	1	50	22.34	22.23	22.10		1
	1	99	22.14	22.19	22.01		1
	50	0	20.92	20.89	20.84	0-2	2
	50	25	20.93	20.87	20.82		2
	50	50	20.95	20.88	20.75		2
	100	0	20.96	20.90	20.82		2
64QAM	1	0	21.14	21.06	21.06	0-2	2
	1	50	21.18	21.16	21.02		2
	1	99	21.14	21.06	20.83		2
	50	0	19.92	19.89	19.86	0-3	3
	50	25	19.93	19.87	19.81		3
	50	50	19.96	19.89	19.75		3
	100	0	19.95	19.89	19.81		3
256QAM	1	0	18.24	18.07	18.02	0-5	5
	1	50	18.20	18.08	18.01		5
	1	99	18.08	18.10	17.88		5
	50	0	17.96	17.91	17.91		5
	50	25	17.96	17.87	17.89		5
	50	50	17.99	17.90	17.81		5
	100	0	18.02	17.91	17.89		5

Table 10-10
LTE Band 2 Antenna B Measured P_{Limit} for ECI = 4 (Body-Worn or Phablet) and/or ECI = 2 (Hotspot) and/or ECI = 3 (Earjack) - 20 MHz Bandwidth

LTE Band 2 (PCS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18700 (1860.0 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19100 (1900.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	17.43	17.43	17.29	0	0
	1	50	**17.44**	17.37	17.23		0
	1	99	17.40	17.38	17.08		0
	50	0	17.41	17.41	17.30	0-1	0
	50	25	17.41	17.36	17.27		0
	50	50	**17.44**	17.37	17.20		0
	100	0	17.40	17.34	17.24		0
16QAM	1	0	17.42	17.23	17.28	0-1	0
	1	50	17.36	17.22	17.22		0
	1	99	17.42	17.17	17.25		0
	50	0	17.39	17.37	17.27	0-2	0
	50	25	17.40	17.33	17.27		0
	50	50	17.41	17.35	17.16		0
	100	0	17.41	17.37	17.28		0
64QAM	1	0	17.39	17.39	17.25	0-2	0
	1	50	17.38	17.38	17.21		0
	1	99	17.33	17.38	17.22		0
	50	0	17.39	17.37	17.20	0-3	0
	50	25	17.38	17.35	17.25		0
	50	50	17.42	17.33	17.17		0
	100	0	17.41	17.36	17.26		0
256QAM	1	0	17.41	17.26	17.19	0-5	0
	1	50	17.43	17.21	17.17		0
	1	99	17.42	17.20	17.19		0
	50	0	17.38	17.38	17.18		0
	50	25	17.39	17.34	17.22		0
	50	50	17.39	17.33	17.16		0
	100	0	17.43	17.39	17.26		0

10.3.5 LTE Band 2 Antenna C

Table 10-11
LTE Band 2 Antenna C Measured P_{Max} for ECI = 1 (Head) – 20 MHz Bandwidth

LTE Band 2 (PCS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18700 (1860.0 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19100 (1900.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	**23.59**	23.46	23.08	0	0
	1	50	23.43	23.50	23.00		0
	1	99	23.45	23.49	22.96		0
	50	0	**22.55**	22.52	22.12	0-1	1
	50	25	22.50	22.49	22.11		1
	50	50	22.51	22.49	22.09		1
	100	0	22.52	22.49	22.13		1
16QAM	1	0	22.92	22.82	22.34	0-1	1
	1	50	22.86	22.85	22.49		1
	1	99	22.74	22.83	22.30		1
	50	0	21.63	21.55	21.16	0-2	2
	50	25	21.55	21.53	21.18		2
	50	50	21.57	21.52	21.15		2
	100	0	21.54	21.51	21.12		2
64QAM	1	0	21.77	21.70	21.26	0-2	2
	1	50	21.71	21.74	21.41		2
	1	99	21.65	21.64	21.25		2
	50	0	20.57	20.58	20.12	0-3	3
	50	25	20.50	20.50	20.09		3
	50	50	20.54	20.49	20.10		3
	100	0	20.52	20.49	20.09		3
256QAM	1	0	18.73	18.65	18.28	0-5	5
	1	50	18.58	18.70	18.31		5
	1	99	18.59	18.64	18.34		5
	50	0	18.60	18.58	18.22		5
	50	25	18.58	18.56	18.23		5
	50	50	18.59	18.57	18.19		5
	100	0	18.61	18.56	18.24		5

Table 10-12
LTE Band 2 Antenna C Measured P_{Limit} for ECI = 4 (Body-Worn or Phablet) and/or ECI = 2 (Hotspot) and/or ECI = 3 (Earjack) - 20 MHz Bandwidth

LTE Band 2 (PCS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18700 (1860.0 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19100 (1900.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	21.62	21.62	21.53	0	0
	1	50	21.57	21.62	21.39		0
	1	99	**21.64**	21.56	21.25		0
	50	0	21.60	21.62	21.47	0-1	0
	50	25	21.61	21.61	21.37		0
	50	50	**21.63**	21.58	21.29		0
	100	0	21.59	21.62	21.37		0
16QAM	1	0	21.56	21.58	21.60	0-1	0
	1	50	21.57	21.50	21.55		0
	1	99	21.59	21.52	21.56		0
	50	0	21.56	21.58	21.43	0-2	0
	50	25	21.57	21.59	21.36		0
	50	50	21.61	21.58	21.28		0
	100	0	21.57	21.62	21.39		0
64QAM	1	0	21.52	21.54	21.58	0-2	0
	1	50	21.56	21.51	21.51		0
	1	99	21.58	21.56	21.43		0
	50	0	20.56	20.60	20.44	0-3	1
	50	25	20.55	20.58	20.35		1
	50	50	20.61	20.56	20.26		1
	100	0	20.59	20.59	20.39		1
256QAM	1	0	18.73	18.73	18.73	0-5	3
	1	50	18.81	18.84	18.53		3
	1	99	18.78	18.67	18.46		3
	50	0	18.60	18.64	18.51		3
	50	25	18.66	18.65	18.43		3
	50	50	18.65	18.57	18.34		3
	100	0	18.69	18.65	18.46		3

10.3.6 LTE Band 41 Antenna B

Table 10-13
LTE Band 41 Antenna B Measured P_{Max} for ECI = 1 (Head) – 20 MHz Bandwidth

LTE Band 41 20 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel 39750 (2506.0 MHz)	Low-Mid Channel 40185 (2549.5 MHz)	Mid Channel 40620 (2593.0 MHz)	Mid-High Channel 41055 (2636.5 MHz)	High Channel 41490 (2680.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]						
QPSK	1	0	22.37	22.46	**22.53**	22.12	22.12	0	0
	1	50	22.38	22.48	22.47	22.04	22.27		0
	1	99	22.43	22.44	22.24	22.07	22.33		0
	50	0	21.42	**21.46**	**21.46**	21.10	21.21	0-1	1
	50	25	21.43	21.43	21.39	21.02	21.25		1
	50	50	21.45	21.44	21.38	21.00	21.31		1
	100	0	21.45	21.43	21.39	21.04	21.26		1
16QAM	1	0	21.71	21.70	21.78	21.36	21.38	0-1	1
	1	50	21.65	21.68	21.70	21.25	21.51		1
	1	99	21.71	21.68	21.49	21.22	21.59		1
	50	0	20.45	20.48	20.48	20.11	20.26	0-2	2
	50	25	20.47	20.45	20.43	20.03	20.29		2
	50	50	20.46	20.48	20.40	20.02	20.34		2
	100	0	20.52	20.52	20.47	20.12	20.34		2
64QAM	1	0	20.43	20.48	20.53	20.13	20.13	0-2	2
	1	50	20.47	20.47	20.48	20.07	20.32		2
	1	99	20.46	20.45	20.25	20.00	20.35		2
	50	0	19.52	19.57	19.57	19.22	19.36	0-3	3
	50	25	19.53	19.57	19.52	19.16	19.39		3
	50	50	19.55	19.56	19.47	19.13	19.43		3
	100	0	19.53	19.53	19.49	19.14	19.38		3
256QAM	1	0	17.51	17.50	17.70	17.42	17.29	0-5	5
	1	50	17.54	17.51	17.66	17.36	17.37		5
	1	99	17.49	17.51	17.47	17.30	17.46		5
	50	0	17.59	17.61	17.76	17.55	17.46		5
	50	25	17.64	17.63	17.71	17.49	17.51		5
	50	50	17.62	17.63	17.69	17.46	17.52		5
	100	0	17.60	17.58	17.71	17.46	17.44		5

Table 10-14
LTE Band 41 Antenna B Measured P_{Limit} for ECI = 4 (Body-Worn or Phablet) and/or ECI = 2 (Hotspot) and/or ECI = 3 (Earjack) - 20 MHz Bandwidth

LTE Band 41 20 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel 39750 (2506.0 MHz)	Low-Mid Channel 40185 (2549.5 MHz)	Mid Channel 40620 (2593.0 MHz)	Mid-High Channel 41055 (2636.5 MHz)	High Channel 41490 (2680.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]						
QPSK	1	0	21.38	21.36	21.64	21.51	21.87	0	0
	1	50	21.39	21.38	21.69	21.48	22.00		0
	1	99	21.40	21.36	21.59	21.46	**22.08**		0
	50	0	21.45	21.31	21.62	21.50	21.91	0-1	0
	50	25	21.43	21.30	21.61	21.43	21.96		0
	50	50	21.40	21.34	21.63	21.42	**22.01**		0
	100	0	21.44	21.30	21.60	21.45	21.95		0
16QAM	1	0	21.71	21.57	21.84	21.72	22.07	0-1	0
	1	50	21.66	21.58	21.87	21.67	22.19		0
	1	99	21.67	21.57	21.82	21.67	22.33		0
	50	0	20.46	20.36	20.63	20.52	20.94	0-2	1
	50	25	20.44	20.34	20.62	20.47	20.99		1
	50	50	20.44	20.36	20.64	20.46	21.03		1
	100	0	20.50	20.38	20.67	20.53	21.03		1
64QAM	1	0	20.44	20.35	20.60	20.49	20.85	0-2	1
	1	50	20.43	20.37	20.69	20.48	21.00		1
	1	99	20.41	20.32	20.56	20.44	21.08		1
	50	0	19.52	19.42	19.71	19.60	20.05	0-3	2
	50	25	19.52	19.42	19.71	19.55	20.10		2
	50	50	19.52	19.45	19.73	19.56	20.13		2
	100	0	19.51	19.40	19.68	19.55	20.07		2
256QAM	1	0	17.48	17.38	17.80	17.79	17.98	0-5	4
	1	50	17.51	17.38	17.88	17.77	18.07		4
	1	99	17.43	17.39	17.80	17.73	18.17		4
	50	0	17.61	17.46	17.94	17.92	18.16		4
	50	25	17.63	17.50	17.93	17.89	18.20		4
	50	50	17.57	17.50	17.97	17.86	18.20		4
	100	0	17.58	17.47	17.91	17.86	18.15		4

Figure 10-3
Power Measurement Setup

10.4 NR Conducted Powers

Per October 2020 TCB Workshop Guidance, NR FR1 SAR evaluations are being generally based on adapting the existing LTE SAR procedures (FCC KDB Publication 941225 D05v02r05). Therefore, NR SAR for the lower bandwidths was not required for testing based on the measured output power and the reported NR SAR for the highest bandwidth. Lower bandwidth conducted powers for all NR bands can be found in LTE and NR Lower Bandwidth RF Conducted Powers Appendix.

Note: Some bands do not support non-overlapping channels. Per FCC Guidance, 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.

10.4.1 NR Band n5

Table 10-15
NR Band n5 Measured P_{Max} for ECI = 1 (Head) – 20 MHz Bandwidth

NR Band n5 20 MHz Bandwidth					
			Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
Modulation	RB Size	RB Offset	167300 (836.5 MHz) Conducted Power [dBm]		
DFT-s-OFDM QPSK	1	1	23.92	0	0.0
	1	53	**23.95**		0.0
	1	104	23.88		0.0
	50	0	23.13	0-1	1.0
	50	28	**24.11**	0	0.0
	50	56	23.04	0-1	1.0
	100	0	23.12		1.0
DFT-s-OFDM 16QAM	1	1	23.26	0-1	1.0
CP-OFDM QPSK	1	1	22.44	0-1.5	1.5

Table 10-16
NR Band n5 Measured P_{Limit} for ECI = 4 (Body-Worn or Phablet) and/or ECI = 2 (Hotspot) and/or ECI = 3 (Earjack) - 20 MHz Bandwidth

NR Band n5 20 MHz Bandwidth					
			Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
Modulation	RB Size	RB Offset	167300 (836.5 MHz) Conducted Power [dBm]		
DFT-s-OFDM QPSK	1	1	22.72	0	0.0
	1	53	**22.80**		0.0
	1	104	22.67		0.0
	50	0	**22.82**	0-1	0.0
	50	28	22.79	0	0.0
	50	56	22.73	0-1	0.0
	100	0	22.74		0.0
DFT-s-OFDM 16QAM	1	1	22.97	0-1	0.0
CP-OFDM QPSK	1	1	22.17	0-1.5	0.5

10.4.2 NR Band n66 Antenna B

Table 10-17
NR Band n66 Antenna B Measured P_{Limit} for ECI = 1 (Head) – 40 MHz Bandwidth

NR Band n66 40 MHz Bandwidth					
			Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
Modulation	RB Size	RB Offset	349000 (1745 MHz) Conducted Power [dBm]		
DFT-s-OFDM QPSK	1	1	22.42	0	0.0
	1	108	**22.58**		0.0
	1	214	22.45		0.0
	108	0	**22.71**	0-1	0.0
	108	54	22.69	0	0.0
	108	108	22.56	0-1	0.0
	216	0	22.55		0.0
DFT-s-OFDM 16QAM	1	1	22.15	0-1	0.0
CP-OFDM QPSK	1	1	21.96	0-1.5	0.0

Table 10-18
NR Band n66 Antenna B Measured P_{Limit} for ECI = 4 (Body-Worn or Phablet) and/or ECI = 2 (Hotspot) and/or ECI = 3 (Earjack) - 40 MHz Bandwidth

NR Band n66 40 MHz Bandwidth					
			Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
Modulation	RB Size	RB Offset	349000 (1745 MHz) Conducted Power [dBm]		
DFT-s-OFDM QPSK	1	1	18.19	0	0.0
	1	108	**18.49**		0.0
	1	214	18.20		0.0
	108	0	18.38	0-1	0.0
	108	54	**18.50**	0	0.0
	108	108	18.37	0-1	0.0
	216	0	18.46		0.0
DFT-s-OFDM 16QAM	1	1	18.21	0-1	0.0
CP-OFDM QPSK	1	1	18.05	0-1.5	0.0

Figure 10-4
Power Measurement Setup – NR FDD

10.5 WLAN Conducted Powers

Table 10-19
2.4 GHz WLAN Measured P_{Max} Average RF Power for ECI = 4 (Body-worn or Phablet) and/or ECI = 2 (Hotspot) and/or ECI = 3 (Earjack Active)

2.4GHz WIFI (20MHz 802.11b SISO ANT E)			
Freq. [MHz]	**Channel**	**Detector**	**Conducted Power [dBm]**
2412	1	Average	19.65
2437	6		19.81
2462	11		19.47
2.4GHz WIFI (20MHz 802.11g SISO ANT E)			
Freq. [MHz]	**Channel**	**Detector**	**Conducted Power [dBm]**
2412	1	Average	17.63
2437	6		17.75
2462	11		17.40
2.4GHz WIFI (20MHz 802.11n SISO ANT E)			
Freq. [MHz]	**Channel**	**Detector**	**Conducted Power [dBm]**
2412	1	Average	17.52
2437	6		17.62
2462	11		17.03

Table 10-20
2.4 GHz WLAN Measured P_{Limit} Average RF Power for ECI = 1 (Head)

2.4GHz WIFI (20MHz 802.11b SISO ANT E)			
Freq. [MHz]	**Channel**	**Detector**	**Conducted Power [dBm]**
2412	1	Average	15.42
2437	6		15.64
2462	11		15.33
2.4GHz WIFI (20MHz 802.11g SISO ANT E)			
Freq. [MHz]	**Channel**	**Detector**	**Conducted Power [dBm]**
2412	1	Average	15.40
2437	6		15.47
2462	11		15.35
2.4GHz WIFI (20MHz 802.11n SISO ANT E)			
Freq. [MHz]	**Channel**	**Detector**	**Conducted Power [dBm]**
2412	1	Average	15.45
2437	6		15.54
2462	11		15.29

Table 10-21
5 GHz WLAN Measured P_{Limit} Average RF Power for ECI = 4 (Body-worn or Phablet) and/or ECI = 2 (Hotspot) and/or ECI = 3 (Earjack Active)

5GHz WIFI (80MHz 802.11ac SISO ANT E)			
Band	**Freq. [MHz]**	**Channel**	**Avg. Conducted Power [dBm]**
UNII-1	5210	42	14.96
UNII-2A	5290	58	14.68
UNII-2C	5530	106	13.31
	5610	122	14.50
	5690	138	14.76
UNII-3	5775	155	14.44

Table 10-22
5 GHz WLAN Measured P_{Limit} Average RF Power for ECI = 1 (Head)

5GHz WIFI (80MHz 802.11ac SISO ANT E)			
Band	**Freq. [MHz]**	**Channel**	**Avg. Conducted Power [dBm]**
UNII-1	5210	42	12.86
UNII-2A	5290	58	12.96
UNII-2C	5530	106	12.57
	5610	122	12.88
	5690	138	12.56
UNII-3	5775	155	12.73

Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.
- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, due to an even number of channels, both channels were measured.

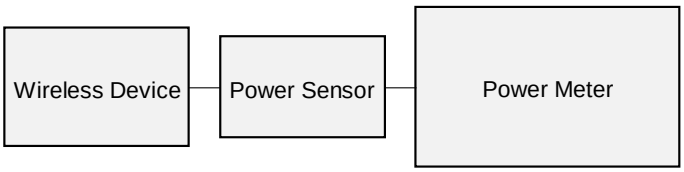


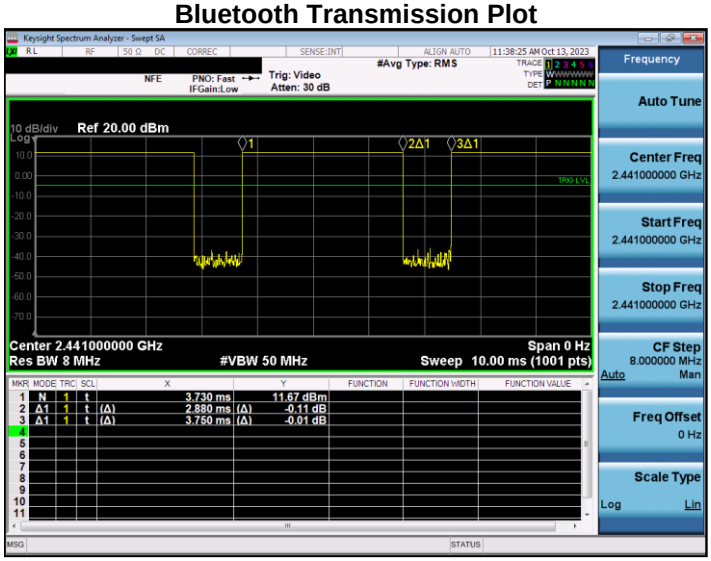
Figure 10-5
Power Measurement Setup

10.6 Bluetooth Conducted Powers

Table 10-23
Bluetooth Maximum Average RF Power

Frequency [MHz]	Data Rate [Mbps]	Mod.	Power Scheme	Channel No.	Avg Conducted Power	
					[dBm]	[mW]
2402	1.0	GFSK	ePA	0	10.34	10.814
2441	1.0	GFSK	ePA	39	11.53	14.223
2480	1.0	GFSK	ePA	78	12.03	15.959

Figure 10-6
Bluetooth Transmission Plot



Equation 10-1
Bluetooth Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.880ms}{3.750ms} * 100\% = 76.80\%$$

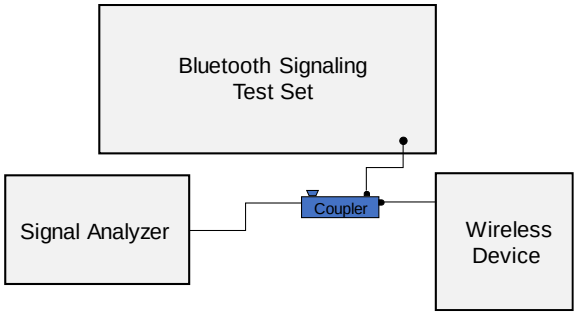


Figure 10-7
Power Measurement Setup

11 SYSTEM VERIFICATION

11.1 Tissue Verification

Table 11-1
Measured Head Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
10/19/2023	750 Head	19.2	680	0.861	41.349	0.888	42.305	-3.04%	-2.26%
			695	0.866	41.305	0.889	42.227	-2.59%	-2.18%
			700	0.868	41.293	0.889	42.201	-2.36%	-2.15%
			710	0.871	41.266	0.890	42.149	-2.13%	-2.09%
			725	0.876	41.223	0.891	42.071	-1.68%	-2.02%
			750	0.885	41.148	0.894	41.942	-1.01%	-1.89%
			770	0.893	41.092	0.895	41.838	-0.22%	-1.78%
			785	0.898	41.056	0.896	41.760	0.22%	-1.69%
			800	0.904	41.019	0.897	41.682	0.78%	-1.59%
10/23/2023	750 Head	21.1	680	0.896	41.928	0.888	42.305	0.90%	-0.89%
			695	0.900	41.883	0.889	42.227	1.24%	-0.81%
			700	0.902	41.868	0.889	42.201	1.46%	-0.79%
			710	0.905	41.834	0.890	42.149	1.69%	-0.75%
			725	0.910	41.781	0.891	42.071	2.13%	-0.69%
			750	0.919	41.702	0.894	41.942	2.80%	-0.57%
			770	0.926	41.644	0.895	41.838	3.46%	-0.46%
			785	0.931	41.609	0.896	41.760	3.91%	-0.36%
			800	0.936	41.574	0.897	41.682	4.35%	-0.26%
10/19/2023	835 Head	24.3	815	0.897	40.761	0.898	41.594	-0.11%	-2.00%
			820	0.899	40.747	0.899	41.578	0.00%	-2.00%
			835	0.905	40.710	0.900	41.500	0.56%	-1.90%
			850	0.910	40.666	0.916	41.500	-0.66%	-2.01%
10/24/2023	835 Head	20.5	815	0.904	42.541	0.898	41.594	0.67%	2.28%
			820	0.906	42.528	0.899	41.578	0.78%	2.28%
			835	0.912	42.487	0.900	41.500	1.33%	2.38%
			850	0.917	42.454	0.916	41.500	0.11%	2.30%
10/26/2023	835 Head	20.5	815	0.892	41.747	0.898	41.594	-0.67%	0.37%
			820	0.894	41.732	0.899	41.578	-0.56%	0.37%
			835	0.900	41.692	0.900	41.500	0.00%	0.46%
			850	0.906	41.655	0.916	41.500	-1.09%	0.37%
10/30/2023	835 Head	22.0	815	0.911	40.203	0.898	41.594	1.45%	-3.34%
			820	0.913	40.186	0.899	41.578	1.56%	-3.35%
			835	0.918	40.138	0.900	41.500	2.00%	-3.28%
			850	0.924	40.100	0.916	41.500	0.87%	-3.37%
11/01/2023	835 Head	23.2	815	0.929	39.534	0.898	41.594	3.45%	-4.95%
			820	0.931	39.520	0.899	41.578	3.56%	-4.95%
			835	0.936	39.478	0.900	41.500	4.00%	-4.87%
			850	0.942	39.448	0.916	41.500	2.84%	-4.94%
11/17/2023	835 Head	21.4	815	0.901	41.474	0.898	41.594	0.33%	-0.29%
			820	0.902	41.461	0.899	41.578	0.33%	-0.28%
			835	0.908	41.417	0.900	41.500	0.89%	-0.20%
			850	0.913	41.374	0.916	41.500	-0.33%	-0.30%

Table 11-2
Measured Head Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
10/18/2023	1750 Head	20.2	1710	1.337	40.015	1.348	40.142	-0.82%	-0.32%
			1720	1.343	39.997	1.354	40.126	-0.81%	-0.32%
			1745	1.357	39.957	1.368	40.087	-0.80%	-0.32%
			1750	1.360	39.950	1.371	40.079	-0.80%	-0.32%
			1770	1.371	39.918	1.383	40.047	-0.87%	-0.32%
			1790	1.383	39.880	1.394	40.016	-0.79%	-0.34%
10/30/2023	1750 Head	21.2	1710	1.333	40.268	1.348	40.142	-1.11%	0.31%
			1720	1.339	40.243	1.354	40.126	-1.11%	0.29%
			1745	1.355	40.199	1.368	40.087	-0.95%	0.28%
			1750	1.358	40.195	1.371	40.079	-0.95%	0.29%
			1770	1.369	40.184	1.383	40.047	-1.01%	0.34%
			1790	1.379	40.167	1.394	40.016	-1.08%	0.38%
10/31/2023	1750 Head	21.0	1710	1.332	39.987	1.348	40.142	-1.19%	-0.39%
			1720	1.337	39.966	1.354	40.126	-1.26%	-0.40%
			1745	1.351	39.907	1.368	40.087	-1.24%	-0.45%
			1750	1.354	39.897	1.371	40.079	-1.24%	-0.45%
			1770	1.368	39.864	1.383	40.047	-1.08%	-0.46%
			1790	1.380	39.836	1.394	40.016	-1.00%	-0.45%
11/09/2023	1750 Head	22.5	1700	1.343	39.719	1.343	40.145	0.00%	-1.06%
			1705	1.346	39.712	1.345	40.141	0.07%	-1.07%
			1710	1.349	39.703	1.348	40.136	0.07%	-1.08%
			1720	1.354	39.681	1.354	40.126	0.00%	-1.11%
			1745	1.367	39.631	1.368	40.087	-0.07%	-1.14%
			1750	1.369	39.623	1.371	40.079	-0.15%	-1.14%
			1770	1.380	39.599	1.383	40.047	-0.22%	-1.12%
			1790	1.391	39.580	1.394	40.016	-0.22%	-1.09%
10/31/2023	1900 Head	23.1	1850	1.416	38.093	1.400	40.000	1.14%	-4.77%
			1860	1.422	38.082	1.400	40.000	1.57%	-4.80%
			1880	1.436	38.057	1.400	40.000	2.57%	-4.86%
			1900	1.450	38.035	1.400	40.000	3.57%	-4.91%
			1905	1.453	38.030	1.400	40.000	3.79%	-4.93%
			1910	1.456	38.025	1.400	40.000	4.00%	-4.94%
			1920	1.463	38.014	1.400	40.000	4.50%	-4.96%
10/31/2023	1900 Head	21.0	1850	1.412	39.763	1.400	40.000	0.86%	-0.59%
			1860	1.419	39.751	1.400	40.000	1.36%	-0.62%
			1880	1.434	39.729	1.400	40.000	2.43%	-0.68%
			1900	1.449	39.710	1.400	40.000	3.50%	-0.72%
			1905	1.452	39.707	1.400	40.000	3.71%	-0.73%
			1910	1.456	39.703	1.400	40.000	4.00%	-0.74%
			1920	1.462	39.694	1.400	40.000	4.43%	-0.76%
11/02/2023	1900 Head	19.4	1850	1.424	39.441	1.400	40.000	1.71%	-1.40%
			1860	1.430	39.427	1.400	40.000	2.14%	-1.43%
			1880	1.443	39.399	1.400	40.000	3.07%	-1.50%
			1900	1.456	39.379	1.400	40.000	4.00%	-1.55%
			1905	1.460	39.375	1.400	40.000	4.29%	-1.56%
			1910	1.463	39.371	1.400	40.000	4.50%	-1.57%
			1920	1.470	39.363	1.400	40.000	5.00%	-1.59%
11/02/2023	1900 Head	20.3	1850	1.404	39.776	1.400	40.000	0.29%	-0.56%
			1860	1.410	39.762	1.400	40.000	0.71%	-0.59%
			1880	1.423	39.739	1.400	40.000	1.64%	-0.65%
			1900	1.436	39.727	1.400	40.000	2.57%	-0.68%
			1905	1.439	39.724	1.400	40.000	2.79%	-0.69%
			1910	1.442	39.721	1.400	40.000	3.00%	-0.70%
			1920	1.449	39.713	1.400	40.000	3.50%	-0.72%

element

Table 11-3
Measured Head Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
10/23/2023	2450 Head	21.3	2300	1.705	38.507	1.670	39.500	2.10%	-2.51%
			2310	1.713	38.505	1.679	39.480	2.03%	-2.47%
			2320	1.721	38.498	1.687	39.460	2.02%	-2.44%
			2400	1.781	38.375	1.756	39.289	1.42%	-2.33%
			2450	1.820	38.316	1.800	39.200	1.11%	-2.26%
			2480	1.843	38.257	1.833	39.162	0.55%	-2.31%
			2500	1.860	38.205	1.855	39.136	0.27%	-2.38%
			2510	1.868	38.184	1.866	39.123	0.11%	-2.40%
			2535	1.887	38.151	1.893	39.092	-0.32%	-2.41%
			2550	1.897	38.137	1.909	39.073	-0.63%	-2.40%
			2560	1.904	38.124	1.920	39.060	-0.83%	-2.40%
			2600	1.937	38.028	1.964	39.009	-1.37%	-2.51%
			2650	1.977	37.962	2.018	38.945	-2.03%	-2.52%
			2680	2.001	37.913	2.051	38.907	-2.44%	-2.55%
			2700	2.017	37.860	2.073	38.882	-2.70%	-2.63%
10/24/2023	2450 Head	21.4	2300	1.721	38.683	1.670	39.500	3.05%	-2.07%
			2310	1.729	38.665	1.679	39.480	2.98%	-2.06%
			2320	1.737	38.643	1.687	39.460	2.96%	-2.07%
			2400	1.794	38.531	1.756	39.289	2.16%	-1.93%
			2450	1.837	38.445	1.800	39.200	2.06%	-1.93%
			2480	1.857	38.430	1.833	39.162	1.31%	-1.87%
			2500	1.872	38.399	1.855	39.136	0.92%	-1.88%
			2510	1.880	38.378	1.866	39.123	0.75%	-1.90%
			2535	1.903	38.320	1.893	39.092	0.53%	-1.97%
			2550	1.916	38.294	1.909	39.073	0.37%	-1.99%
			2560	1.924	38.286	1.920	39.060	0.21%	-1.98%
			2600	1.954	38.246	1.964	39.009	-0.51%	-1.96%
			2650	1.995	38.139	2.018	38.945	-1.14%	-2.07%
			2680	2.020	38.101	2.051	38.907	-1.51%	-2.07%
			2700	2.034	38.083	2.073	38.882	-1.88%	-2.05%
11/02/2023	2450 Head	19.7	2300	1.658	37.768	1.670	39.500	-0.72%	-4.38%
			2310	1.666	37.758	1.679	39.480	-0.77%	-4.36%
			2320	1.673	37.746	1.687	39.460	-0.83%	-4.34%
			2400	1.733	37.612	1.756	39.289	-1.31%	-4.27%
			2450	1.773	37.533	1.800	39.200	-1.50%	-4.25%
			2480	1.796	37.484	1.833	39.162	-2.02%	-4.28%
			2500	1.812	37.453	1.855	39.136	-2.32%	-4.30%
			2510	1.819	37.436	1.866	39.123	-2.52%	-4.31%
			2535	1.840	37.386	1.893	39.092	-2.80%	-4.36%
			2550	1.853	37.356	1.909	39.073	-2.93%	-4.39%
			2560	1.861	37.336	1.920	39.060	-3.07%	-4.41%
			2600	1.893	37.280	1.964	39.009	-3.62%	-4.43%
			2650	1.933	37.174	2.018	38.945	-4.21%	-4.55%
			2680	1.960	37.121	2.051	38.907	-4.44%	-4.59%
			2700	1.975	37.105	2.073	38.882	-4.73%	-4.57%
11/08/2023	2450 Head	21.7	2300	1.680	38.126	1.670	39.500	0.60%	-3.48%
			2310	1.687	38.115	1.679	39.480	0.48%	-3.46%
			2320	1.693	38.103	1.687	39.460	0.36%	-3.44%
			2400	1.749	37.993	1.756	39.289	-0.40%	-3.30%
			2450	1.786	37.922	1.800	39.200	-0.78%	-3.26%
			2480	1.808	37.889	1.833	39.162	-1.36%	-3.25%
			2500	1.822	37.861	1.855	39.136	-1.78%	-3.26%
			2510	1.830	37.845	1.866	39.123	-1.93%	-3.27%
			2535	1.850	37.800	1.893	39.092	-2.27%	-3.31%
			2550	1.863	37.777	1.909	39.073	-2.41%	-3.32%
			2560	1.872	37.764	1.920	39.060	-2.50%	-3.32%
			2600	1.903	37.725	1.964	39.009	-3.11%	-3.29%
			2650	1.941	37.616	2.018	38.945	-3.82%	-3.41%
			2680	1.969	37.571	2.051	38.907	-4.00%	-3.43%
			2700	1.984	37.560	2.073	38.882	-4.29%	-3.40%

Table 11-4
Measured Head Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
11/13/2023	5200-5800 Head	19.2	5180	4.603	35.745	4.635	36.009	-0.69%	-0.73%
			5190	4.613	35.727	4.645	35.998	-0.69%	-0.75%
			5200	4.625	35.715	4.655	35.986	-0.64%	-0.75%
			5210	4.634	35.700	4.666	35.975	-0.69%	-0.76%
			5220	4.645	35.672	4.676	35.963	-0.66%	-0.81%
			5240	4.673	35.605	4.696	35.940	-0.49%	-0.93%
			5250	4.687	35.592	4.706	35.929	-0.40%	-0.94%
			5260	4.699	35.577	4.717	35.917	-0.38%	-0.95%
			5270	4.710	35.565	4.727	35.906	-0.36%	-0.95%
			5280	4.720	35.547	4.737	35.894	-0.36%	-0.97%
			5290	4.731	35.524	4.748	35.883	-0.36%	-1.00%
			5300	4.742	35.508	4.758	35.871	-0.34%	-1.01%
			5310	4.753	35.486	4.768	35.860	-0.31%	-1.04%
			5320	4.763	35.472	4.778	35.849	-0.31%	-1.05%
			5500	4.967	35.101	4.963	35.643	0.08%	-1.52%
			5510	4.980	35.084	4.973	35.632	0.14%	-1.54%
			5520	4.995	35.061	4.983	35.620	0.24%	-1.57%
			5530	5.009	35.043	4.994	35.609	0.30%	-1.59%
			5540	5.021	35.025	5.004	35.597	0.34%	-1.61%
			5550	5.032	35.008	5.014	35.586	0.36%	-1.62%
			5560	5.043	34.995	5.024	35.574	0.38%	-1.63%
			5580	5.066	34.963	5.045	35.551	0.42%	-1.65%
			5600	5.087	34.908	5.065	35.529	0.43%	-1.75%
			5610	5.100	34.880	5.076	35.518	0.47%	-1.80%
			5620	5.116	34.855	5.086	35.506	0.59%	-1.83%
			5640	5.136	34.803	5.106	35.483	0.59%	-1.92%
			5660	5.162	34.785	5.127	35.460	0.68%	-1.90%
			5670	5.175	34.776	5.137	35.449	0.74%	-1.90%
			5680	5.184	34.766	5.147	35.437	0.72%	-1.89%
			5690	5.197	34.742	5.158	35.426	0.76%	-1.93%
			5700	5.209	34.724	5.168	35.414	0.79%	-1.95%
			5710	5.221	34.696	5.178	35.403	0.83%	-2.00%
			5720	5.233	34.670	5.188	35.391	0.87%	-2.04%
			5745	5.264	34.604	5.214	35.363	0.96%	-2.15%
			5750	5.270	34.595	5.219	35.357	0.98%	-2.16%
			5755	5.275	34.582	5.224	35.351	0.98%	-2.18%
			5765	5.288	34.565	5.234	35.340	1.03%	-2.19%
			5775	5.301	34.555	5.245	35.329	1.07%	-2.19%
			5785	5.312	34.544	5.255	35.317	1.08%	-2.19%
			5795	5.326	34.527	5.265	35.305	1.16%	-2.20%
			5800	5.333	34.518	5.270	35.300	1.20%	-2.22%
			5800	5.333	34.518	5.270	35.300	1.20%	-2.22%
			5805	5.339	34.512	5.275	35.294	1.21%	-2.22%
			5825	5.359	34.479	5.296	35.271	1.19%	-2.25%
			5835	5.367	34.452	5.305	35.230	1.17%	-2.21%
			5845	5.378	34.422	5.315	35.210	1.19%	-2.24%
			5855	5.388	34.395	5.325	35.197	1.18%	-2.28%
			5865	5.401	34.376	5.336	35.190	1.22%	-2.31%
			5865	5.401	34.376	5.336	35.190	1.22%	-2.31%
			5865	5.401	34.376	5.336	35.190	1.22%	-2.31%
			5865	5.401	34.376	5.336	35.190	1.22%	-2.31%
			5875	5.415	34.364	5.347	35.183	1.27%	-2.33%
			5885	5.428	34.350	5.357	35.177	1.33%	-2.35%
			5905	5.453	34.327	5.379	35.163	1.38%	-2.38%

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04 and IEEE 1528-2013 6.6.1.2. The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

11.2 Test System Verification

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in SAR System Validation Appendix.

Table 11-5
System Verification Results – Head

SAR System	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp. (C)	Liquid Temp. (C)	Input Power (W)	Source SN	Probe SN	DAE	Measured SAR 1g (W/kg)	1W Target SAR 1g (W/kg)	1W Normalized SAR 1g (W/kg)	Deviation 1g (%)	Measured SAR 10g (W/kg)	1W Target SAR 10g (W/kg)	1W Normalized SAR 10g (W/kg)	Deviation 10g (%)
K4	750	HEAD	10-19-2023	20.4	19.2	0.20	1046	7640	1645	1.660	8.690	8.300	-4.49%	1.100	5.700	5.500	-3.51%
K4	750	HEAD	10-23-2023	22.5	21.1	0.20	1046	7640	1645	1.820	8.690	9.100	4.72%	1.190	5.700	5.950	4.39%
AM7	835	HEAD	10-19-2023	21.0	22.7	0.20	460	7532	501	1.950	9.720	9.750	0.31%	1.290	6.340	6.450	1.74%
K6	835	HEAD	10-24-2023	21.1	20.5	0.20	4d119	7491	1532	1.930	9.720	9.650	-0.72%	1.270	6.380	6.350	-0.47%
K6	835	HEAD	10-26-2023	21.6	20.5	0.20	4d119	7491	1532	2.010	9.720	10.050	3.40%	1.310	6.380	6.550	2.66%
K2	835	HEAD	10-30-2023	22.2	22.0	0.20	4d180	7565	1466	2.020	9.630	10.100	4.88%	1.310	6.270	6.550	4.47%
K2	835	HEAD	11-01-2023	22.7	23.2	0.20	4d180	7565	1466	1.890	9.630	9.450	-1.87%	1.240	6.270	6.200	-1.12%
K4	835	HEAD	11-17-2023	21.8	21.4	0.20	4d119	7640	1645	2.010	9.720	10.050	3.40%	1.300	6.380	6.500	1.88%
S	1750	HEAD	10-18-2023	21.6	20.2	0.10	1148	7713	1530	3.750	37.200	37.500	0.81%	2.000	19.400	20.000	3.09%
K3	1750	HEAD	10-30-2023	20.1	21.2	0.10	1051	7558	1364	3.710	36.100	37.100	2.77%	1.980	19.000	19.800	4.21%
K6	1750	HEAD	10-31-2023	21.6	21.0	0.10	1051	7491	1532	3.610	36.100	36.100	0.00%	1.910	19.000	19.100	0.53%
K6	1750	HEAD	11-09-2023	22.8	22.5	0.10	1092	7491	1532	3.680	36.200	36.800	1.66%	1.940	19.100	19.400	1.57%
K4	1900	HEAD	10-31-2023	22.7	22.4	0.10	5d141	7640	1645	4.200	39.900	42.000	5.26%	2.150	20.800	21.500	3.37%
K6	1900	HEAD	10-31-2023	21.6	21.0	0.10	5d141	7491	1532	4.160	39.900	41.600	4.26%	2.140	20.800	21.400	2.88%
K4	1900	HEAD	11-02-2023	20.0	19.4	0.10	5d141	7640	1645	4.300	39.900	43.000	7.77%	2.200	20.800	22.000	5.77%
K6	1900	HEAD	11-02-2023	20.5	20.3	0.10	5d141	7491	1532	4.130	39.900	41.300	3.51%	2.100	20.800	21.000	0.96%
K2	2450	HEAD	10-23-2023	20.0	21.3	0.10	882	7565	1466	5.170	51.700	51.700	0.00%	2.410	24.200	24.100	-0.41%
K4	2450	HEAD	10-24-2023	20.7	21.4	0.10	945	7640	1645	5.190	51.900	51.900	0.00%	2.400	24.600	24.000	-2.44%
S	2450	HEAD	11-02-2023	23.9	19.6	0.10	981	7713	1530	4.940	53.900	49.400	-8.35%	2.320	25.400	23.200	-8.66%
S	2450	HEAD	11-08-2023	24.0	22.2	0.10	981	7713	1530	4.860	53.900	48.600	-9.83%	N/A	N/A	N/A	N/A
K2	2600	HEAD	10-23-2023	20.0	21.3	0.10	1126	7565	1466	5.930	56.000	59.300	5.89%	2.680	25.300	26.800	5.93%
K4	2600	HEAD	10-24-2023	20.7	21.4	0.10	1009	7640	1645	5.500	57.300	55.000	-4.01%	2.460	25.800	24.600	-4.65%
O	5250	HEAD	11-13-2023	19.1	19.2	0.05	1191	7570	1558	3.710	80.400	74.200	-7.71%	1.060	23.100	21.200	-8.23%
O	5600	HEAD	11-13-2023	19.1	19.2	0.05	1191	7570	1558	4.030	81.900	80.600	-1.59%	1.150	23.300	23.000	-1.29%
O	5750	HEAD	11-13-2023	19.1	19.2	0.05	1191	7570	1558	3.600	78.400	72.000	-8.16%	1.030	22.300	20.600	-7.62%

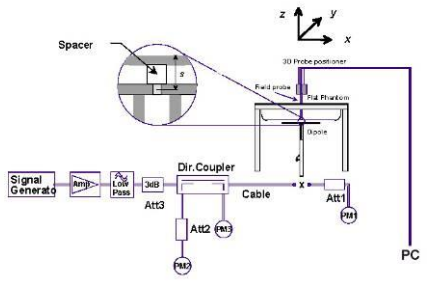


Figure 11-1
System Verification Setup Diagram

Figure 11-2
System Verification Setup Photo

12 SAR DATA SUMMARY

12.1 GSM 850 Standalone SAR

Table 12-1

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	GSM 850	GSM	A	00101	1:8.3	0.07	836.60	190	34.0	33.21	Right Cheek	0	0.185	1.199	0.222	A1	29.4	29.4
Head	GSM 850	GSM	A	00101	1:8.3	0.02	836.60	190	34.0	33.21	Right Tilt	0	0.106	1.199	0.127		31.8	
Head	GSM 850	GSM	A	00101	1:8.3	-0.01	836.60	190	34.0	33.21	Left Cheek	0	0.176	1.199	0.211		29.6	
Head	GSM 850	GSM	A	00101	1:8.3	-0.03	836.60	190	34.0	33.21	Left Tilt	0	0.100	1.199	0.120		32.1	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-2

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn	GSM 850	GSM	A	00101	1:8.3	-0.02	836.60	190	34.0	33.21	Back	10	0.431	1.199	0.517	A2	25.8	25.8
Hotspot	GPRS 850	GPRS 4 Tx Slots	A	00101	1:2.076	-0.02	836.60	190	28.0	27.83	Back	10	0.430	1.040	0.447	A3	26.4	
Hotspot	GPRS 850	GPRS 4 Tx Slots	A	00101	1:2.076	-0.03	836.60	190	28.0	27.83	Front	10	0.205	1.040	0.213		29.7	
Hotspot	GPRS 850	GPRS 4 Tx Slots	A	00101	1:2.076	-0.01	836.60	190	28.0	27.83	Bottom	10	0.317	1.040	0.330		27.8	
Hotspot	GPRS 850	GPRS 4 Tx Slots	A	00101	1:2.076	-0.01	836.60	190	28.0	27.83	Right	10	0.256	1.040	0.266		28.7	
Hotspot	GPRS 850	GPRS 4 Tx Slots	A	00101	1:2.076	0.02	836.60	190	28.0	27.83	Left	10	0.132	1.040	0.137		31.6	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.2 GSM 1900 Standalone SAR

Table 12-3

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	GSM 1900	GSM	B	00911	1:8.3	0.01	1850.20	512	31.0	30.49	Right Cheek	0	0.107	1.125	0.120		29.1	28.4
Head	GSM 1900	GSM	B	00911	1:8.3	0.07	1850.20	512	31.0	30.49	Right Tilt	0	0.080	1.125	0.090		30.3	
Head	GSM 1900	GSM	B	00911	1:8.3	0.04	1850.20	512	31.0	30.49	Left Cheek	0	0.125	1.125	0.141	A4	28.4	
Head	GSM 1900	GSM	B	00911	1:8.3	-0.05	1850.20	512	31.0	30.49	Left Tilt	0	0.095	1.125	0.107		29.6	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-4

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn	GSM 1900	GSM	B	00911	1:8.3	0.02	1850.20	512	30.0	28.26	Back	10	0.332	1.493	0.496	A5	21.9	21.3
Hotspot	GPRS 1900	GPRS 4 Tx Slots	B	00911	1:2.076	0.00	1850.20	512	24.0	22.61	Back	10	0.344	1.377	0.474		22.1	
Hotspot	GPRS 1900	GPRS 4 Tx Slots	B	00911	1:2.076	0.01	1850.20	512	24.0	22.61	Front	10	0.280	1.377	0.386		23.0	
Hotspot	GPRS 1900	GPRS 4 Tx Slots	B	00911	1:2.076	0.00	1850.20	512	24.0	22.61	Bottom	10	0.416	1.377	0.573	A6	21.3	
Hotspot	GPRS 1900	GPRS 4 Tx Slots	B	00911	1:2.076	0.02	1850.20	512	24.0	22.61	Left	10	0.223	1.377	0.307		24.0	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.3 UMTS 850 Standalone SAR

Table 12-5

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	UMTS 850	RMC	A	00101	1:1	-0.01	836.60	4183	25.0	24.17	Right Cheek	0	0.164	1.211	0.199	A7	30.1	30.1
Head	UMTS 850	RMC	A	00101	1:1	-0.01	836.60	4183	25.0	24.17	Right Tilt	0	0.087	1.211	0.105		32.9	
Head	UMTS 850	RMC	A	00101	1:1	-0.10	836.60	4183	25.0	24.17	Left Cheek	0	0.144	1.211	0.174		30.7	
Head	UMTS 850	RMC	A	00101	1:1	-0.15	836.60	4183	25.0	24.17	Left Tilt	0	0.081	1.211	0.098		33.2	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-6

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	UMTS 850	RMC	A	00101	1:1	-0.03	836.60	4183	24.0	23.12	Back	10	0.426	1.225	0.522	A8	24.9	24.9
Hotspot	UMTS 850	RMC	A	00101	1:1	0.04	836.60	4183	24.0	23.12	Front	10	0.153	1.225	0.187		29.4	
Hotspot	UMTS 850	RMC	A	00101	1:1	-0.02	836.60	4183	24.0	23.12	Bottom	10	0.295	1.225	0.361		26.5	
Hotspot	UMTS 850	RMC	A	00101	1:1	0.01	836.60	4183	24.0	23.12	Right	10	0.168	1.225	0.206		28.9	
Hotspot	UMTS 850	RMC	A	00101	1:1	-0.03	836.60	4183	24.0	23.12	Left	10	0.088	1.225	0.108		31.8	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.4 UMTS 1750 Standalone SAR

Table 12-7

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	UMTS 1750	RMC	B	00911	1:1	0.07	1712.40	1312	24.0	23.45	Right Cheek	0	0.099	1.135	0.112		31.6	30.3
Head	UMTS 1750	RMC	B	00911	1:1	0.01	1712.40	1312	24.0	23.45	Right Tilt	0	0.070	1.135	0.079		33.1	
Head	UMTS 1750	RMC	B	00911	1:1	-0.01	1712.40	1312	24.0	23.45	Left Cheek	0	0.132	1.135	0.150	A9	30.3	
Head	UMTS 1750	RMC	B	00911	1:1	-0.06	1712.40	1312	24.0	23.45	Left Tilt	0	0.098	1.135	0.111		31.6	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-8

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	UMTS 1750	RMC	B	00127	1:1	-0.06	1712.40	1312	21.0	20.46	Back	10	0.166	1.132	0.188	A10	26.3	24.8
Hotspot	UMTS 1750	RMC	B	00127	1:1	0.01	1712.40	1312	21.0	20.46	Front	10	0.183	1.132	0.207		25.9	
Hotspot	UMTS 1750	RMC	B	00127	1:1	0.00	1712.40	1312	21.0	20.46	Bottom	10	0.234	1.132	0.265	A11	24.8	
Hotspot	UMTS 1750	RMC	B	00127	1:1	-0.07	1712.40	1312	21.0	20.46	Left	10	0.140	1.132	0.158		27.1	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.5 UMTS 1900 Standalone SAR

Table 12-9

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	UMTS 1900	RMC	B	00911	1:1	0.04	1880.00	9400	23.0	23.00	Right Cheek	0	0.202	1.000	0.202		28.0	27.3
Head	UMTS 1900	RMC	B	00911	1:1	-0.08	1880.00	9400	23.0	23.00	Right Tilt	0	0.116	1.000	0.116		30.4	
Head	UMTS 1900	RMC	B	00911	1:1	-0.02	1880.00	9400	23.0	23.00	Left Cheek	0	0.240	1.000	0.240	A12	27.3	
Head	UMTS 1900	RMC	B	00911	1:1	-0.05	1880.00	9400	23.0	23.00	Left Tilt	0	0.166	1.000	0.166		28.9	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-10

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	UMTS 1900	RMC	B	00911	1:1	0.00	1880.00	9400	21.0	20.07	Back	10	0.292	1.239	0.362	A13	23.5	22.5
Hotspot	UMTS 1900	RMC	B	00911	1:1	0.00	1880.00	9400	21.0	20.07	Front	10	0.236	1.239	0.292		24.4	
Hotspot	UMTS 1900	RMC	B	00911	1:1	-0.02	1880.00	9400	21.0	20.07	Bottom	10	0.369	1.239	0.457	A14	22.5	
Hotspot	UMTS 1900	RMC	B	00911	1:1	0.00	1880.00	9400	21.0	20.07	Left	10	0.178	1.239	0.221		25.6	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.6 LTE Band 12 Standalone SAR

Table 12-11

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	LTE Band 12	10	QPSK	A	00127	1:1	0.05	707.50	23095	0.0	25.0	23.76	1	0	Right Cheek	0	0.161	1.330	0.214	A15	29.8	29.7
Head	LTE Band 12	10	QPSK	A	00127	1:1	-0.01	707.50	23095	1.0	24.0	22.74	25	0	Right Cheek	0	0.128	1.337	0.171		29.7	
Head	LTE Band 12	10	QPSK	A	00127	1:1	-0.13	707.50	23095	0.0	25.0	23.76	1	0	Right Tilt	0	0.079	1.330	0.105		32.9	
Head	LTE Band 12	10	QPSK	A	00127	1:1	0.00	707.50	23095	1.0	24.0	22.74	25	0	Right Tilt	0	0.063	1.337	0.084		32.8	
Head	LTE Band 12	10	QPSK	A	00127	1:1	0.01	707.50	23095	0.0	25.0	23.76	1	0	Left Cheek	0	0.128	1.330	0.170		30.8	
Head	LTE Band 12	10	QPSK	A	00127	1:1	-0.04	707.50	23095	1.0	24.0	22.74	25	0	Left Cheek	0	0.097	1.337	0.130		31.0	
Head	LTE Band 12	10	QPSK	A	00127	1:1	-0.07	707.50	23095	0.0	25.0	23.76	1	0	Left Tilt	0	0.063	1.330	0.084		33.8	
Head	LTE Band 12	10	QPSK	A	00127	1:1	-0.02	707.50	23095	1.0	24.0	22.74	25	0	Left Tilt	0	0.048	1.337	0.064		34.0	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-12

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	LTE Band 12	10	QPSK	A	00127	1:1	-0.01	707.50	23095	0.0	25.0	23.76	1	0	Back	10	0.338	1.330	0.450	A16	26.5	26.5
Body-worn/Hotspot	LTE Band 12	10	QPSK	A	00127	1:1	0.00	707.50	23095	1.0	24.0	22.74	25	0	Back	10	0.267	1.337	0.357		26.6	
Hotspot	LTE Band 12	10	QPSK	A	00127	1:1	-0.04	707.50	23095	0.0	25.0	23.76	1	0	Front	10	0.170	1.330	0.226		29.5	
Hotspot	LTE Band 12	10	QPSK	A	00127	1:1	-0.03	707.50	23095	1.0	24.0	22.74	25	0	Front	10	0.131	1.337	0.175		29.6	
Hotspot	LTE Band 12	10	QPSK	A	00127	1:1	0.00	707.50	23095	0.0	25.0	23.76	1	0	Bottom	10	0.184	1.330	0.245		29.2	
Hotspot	LTE Band 12	10	QPSK	A	00127	1:1	0.00	707.50	23095	1.0	24.0	22.74	25	0	Bottom	10	0.141	1.337	0.189		29.3	
Hotspot	LTE Band 12	10	QPSK	A	00127	1:1	0.00	707.50	23095	0.0	25.0	23.76	1	0	Right	10	0.334	1.330	0.444		26.6	
Hotspot	LTE Band 12	10	QPSK	A	00127	1:1	0.02	707.50	23095	1.0	24.0	22.74	25	0	Right	10	0.258	1.337	0.345		26.7	
Hotspot	LTE Band 12	10	QPSK	A	00127	1:1	0.02	707.50	23095	0.0	25.0	23.76	1	0	Left	10	0.201	1.330	0.267		28.8	
Hotspot	LTE Band 12	10	QPSK	A	00127	1:1	-0.01	707.50	23095	1.0	24.0	22.74	25	0	Left	10	0.158	1.337	0.211		28.8	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.7 LTE Band 26 (Cell) Standalone SAR

Table 12-13

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	LTE Band 26	15	QPSK	A	00127	1:1	0.03	831.50	26865	0.0	25.0	23.81	1	36	Right Cheek	0	0.240	1.315	0.316	A17	28.1	28.1
Head	LTE Band 26	15	QPSK	A	00127	1:1	0.06	831.50	26865	1.0	24.0	22.79	36	18	Right Cheek	0	0.191	1.321	0.252		28.1	
Head	LTE Band 26	15	QPSK	A	00127	1:1	0.07	831.50	26865	0.0	25.0	23.81	1	36	Right Tilt	0	0.117	1.315	0.154		31.2	
Head	LTE Band 26	15	QPSK	A	00127	1:1	0.00	831.50	26865	1.0	24.0	22.79	36	18	Right Tilt	0	0.092	1.321	0.122		31.2	
Head	LTE Band 26	15	QPSK	A	00127	1:1	0.01	831.50	26865	0.0	25.0	23.81	1	36	Left Cheek	0	0.207	1.315	0.272		28.7	
Head	LTE Band 26	15	QPSK	A	00127	1:1	0.02	831.50	26865	1.0	24.0	22.79	36	18	Left Cheek	0	0.161	1.321	0.213		28.8	
Head	LTE Band 26	15	QPSK	A	00127	1:1	0.02	831.50	26865	0.0	25.0	23.81	1	36	Left Tilt	0	0.107	1.315	0.141		31.6	
Head	LTE Band 26	15	QPSK	A	00127	1:1	0.06	831.50	26865	1.0	24.0	22.79	36	18	Left Tilt	0	0.084	1.321	0.111		31.6	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-14

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	LTE Band 26	15	QPSK	A	00226	1:1	-0.06	831.50	26865	0.0	25.0	23.81	1	36	Back	10	0.250	1.315	0.329	A18	27.9	27.4
Body-worn/Hotspot	LTE Band 26	15	QPSK	A	00226	1:1	-0.02	831.50	26865	1.0	24.0	22.79	36	18	Back	10	0.198	1.321	0.262		27.9	
Hotspot	LTE Band 26	15	QPSK	A	00226	1:1	-0.02	831.50	26865	0.0	25.0	23.81	1	36	Front	10	0.154	1.315	0.203		30.0	
Hotspot	LTE Band 26	15	QPSK	A	00226	1:1	-0.02	831.50	26865	1.0	24.0	22.79	36	18	Front	10	0.125	1.321	0.165		29.9	
Hotspot	LTE Band 26	15	QPSK	A	00226	1:1	-0.10	831.50	26865	0.0	25.0	23.81	1	36	Bottom	10	0.280	1.315	0.368	A19	27.4	
Hotspot	LTE Band 26	15	QPSK	A	00226	1:1	-0.02	831.50	26865	1.0	24.0	22.79	36	18	Bottom	10	0.218	1.321	0.288		27.5	
Hotspot	LTE Band 26	15	QPSK	A	00226	1:1	-0.07	831.50	26865	0.0	25.0	23.81	1	36	Right	10	0.215	1.315	0.283		28.6	
Hotspot	LTE Band 26	15	QPSK	A	00226	1:1	-0.01	831.50	26865	1.0	24.0	22.79	36	18	Right	10	0.166	1.321	0.219		28.7	
Hotspot	LTE Band 26	15	QPSK	A	02266	1:1	-0.04	831.50	26865	0.0	25.0	23.81	1	36	Left	10	0.141	1.315	0.185		30.4	
Hotspot	LTE Band 26	15	QPSK	A	02266	1:1	-0.02	831.50	26865	1.0	24.0	22.79	36	18	Left	10	0.106	1.321	0.140		30.6	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.8 LTE Band 66 (AWS) Standalone SAR

Table 12-15

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	LTE Band 66	20	QPSK	B	00101	1:1	-0.10	1720.00	132072	0.0	25.0	23.72	1	99	Right Cheek	0	0.134	1.343	0.180		30.5	29.6
Head	LTE Band 66	20	QPSK	B	00101	1:1	0.05	1720.00	132072	1.0	24.0	22.78	50	50	Right Cheek	0	0.111	1.324	0.147		30.4	
Head	LTE Band 66	20	QPSK	B	00101	1:1	-0.11	1720.00	132072	0.0	25.0	23.72	1	99	Right Tilt	0	0.116	1.343	0.156		31.2	
Head	LTE Band 66	20	QPSK	B	00101	1:1	-0.02	1720.00	132072	1.0	24.0	22.78	50	50	Right Tilt	0	0.101	1.324	0.134		30.8	
Head	LTE Band 66	20	QPSK	B	00101	1:1	-0.15	1720.00	132072	0.0	25.0	23.72	1	99	Left Cheek	0	0.156	1.343	0.210	A20	29.9	
Head	LTE Band 66	20	QPSK	B	00101	1:1	-0.05	1720.00	132072	1.0	24.0	22.78	50	50	Left Cheek	0	0.135	1.324	0.179		29.6	
Head	LTE Band 66	20	QPSK	B	00101	1:1	-0.01	1720.00	132072	0.0	25.0	23.72	1	99	Left Tilt	0	0.119	1.343	0.160		31.0	
Head	LTE Band 66	20	QPSK	B	00101	1:1	-0.03	1720.00	132072	1.0	24.0	22.78	50	50	Left Tilt	0	0.107	1.324	0.142		30.6	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-16

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	LTE Band 66	20	QPSK	B	00911	1:1	0.01	1720.00	132072	0.0	19.5	17.90	1	99	Back	10	0.117	1.445	0.169		25.3	24.1
Body-worn/Hotspot	LTE Band 66	20	QPSK	B	00911	1:1	0.00	1720.00	132072	0.0	19.5	17.90	50	50	Back	10	0.122	1.445	0.176	A21	25.1	
Hotspot	LTE Band 66	20	QPSK	B	00911	1:1	0.02	1720.00	132072	0.0	19.5	17.90	1	99	Front	10	0.111	1.445	0.160		25.5	
Hotspot	LTE Band 66	20	QPSK	B	00911	1:1	0.03	1720.00	132072	0.0	19.5	17.90	50	50	Front	10	0.113	1.445	0.163		25.4	
Hotspot	LTE Band 66	20	QPSK	B	00911	1:1	0.02	1720.00	132072	0.0	19.5	17.90	1	99	Bottom	10	0.153	1.445	0.221		24.1	
Hotspot	LTE Band 66	20	QPSK	B	00911	1:1	0.00	1720.00	132072	0.0	19.5	17.90	50	50	Bottom	10	0.153	1.445	0.221	A22	24.1	
Hotspot	LTE Band 66	20	QPSK	B	00911	1:1	0.00	1720.00	132072	0.0	19.5	17.90	1	99	Left	10	0.079	1.445	0.114		27.0	
Hotspot	LTE Band 66	20	QPSK	B	00911	1:1	-0.01	1720.00	132072	0.0	19.5	17.90	50	50	Left	10	0.080	1.445	0.116		26.9	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.9 LTE Band 2 Standalone SAR

Table 12-17

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	LTE Band 2	20	QPSK	B	00267	1:1	0.00	1860.00	18700	0.0	24.0	23.00	1	50	Right Cheek	0	0.164	1.259	0.206		28.9	27.4
Head	LTE Band 2	20	QPSK	B	00267	1:1	0.00	1860.00	18700	1.0	23.0	22.01	50	50	Right Cheek	0	0.137	1.256	0.172		28.7	
Head	LTE Band 2	20	QPSK	B	00267	1:1	0.07	1860.00	18700	0.0	24.0	23.00	1	50	Right Tilt	0	0.094	1.259	0.118		31.3	
Head	LTE Band 2	20	QPSK	B	00267	1:1	-0.06	1860.00	18700	1.0	23.0	22.01	50	50	Right Tilt	0	0.082	1.256	0.103		31.0	
Head	LTE Band 2	20	QPSK	B	00267	1:1	0.02	1860.00	18700	0.0	24.0	23.00	1	50	Left Cheek	0	0.223	1.259	0.281		27.6	
Head	LTE Band 2	20	QPSK	B	00267	1:1	0.07	1860.00	18700	1.0	23.0	22.01	50	50	Left Cheek	0	0.184	1.256	0.231		27.4	
Head	LTE Band 2	20	QPSK	B	00267	1:1	0.06	1860.00	18700	0.0	24.0	23.00	1	50	Left Tilt	0	0.158	1.259	0.199		29.1	
Head	LTE Band 2	20	QPSK	B	00267	1:1	-0.16	1860.00	18700	1.0	23.0	22.01	50	50	Left Tilt	0	0.127	1.256	0.160		29.1	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-18

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	LTE Band 2	20	QPSK	B	00267	1:1	-0.02	1860.00	18700	0.0	18.5	17.44	1	50	Back	10	0.108	1.276	0.138		25.2	22.2
Body-worn/Hotspot	LTE Band 2	20	QPSK	B	00267	1:1	-0.02	1860.00	18700	0.0	18.5	17.44	50	50	Back	10	0.107	1.276	0.137		25.2	
Hotspot	LTE Band 2	20	QPSK	B	00267	1:1	0.00	1860.00	18700	0.0	18.5	17.44	1	50	Front	10	0.106	1.276	0.135		25.3	
Hotspot	LTE Band 2	20	QPSK	B	00267	1:1	0.00	1860.00	18700	0.0	18.5	17.44	50	50	Front	10	0.104	1.276	0.133		25.3	
Hotspot	LTE Band 2	20	QPSK	B	00267	1:1	-0.06	1860.00	18700	0.0	18.5	17.44	1	50	Bottom	10	0.214	1.276	0.273		22.2	
Hotspot	LTE Band 2	20	QPSK	B	00267	1:1	-0.03	1860.00	18700	0.0	18.5	17.44	50	50	Bottom	10	0.217	1.276	0.277		22.2	
Hotspot	LTE Band 2	20	QPSK	B	00267	1:1	-0.01	1860.00	18700	0.0	18.5	17.44	1	50	Left	10	0.102	1.276	0.130		25.4	
Hotspot	LTE Band 2	20	QPSK	B	00267	1:1	0.01	1860.00	18700	0.0	18.5	17.44	50	50	Left	10	0.100	1.276	0.128		25.5	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Body 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-19

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	LTE Band 2	20	QPSK	C	00101	1:1	-0.01	1860.00	18700	0.0	24.0	23.59	1	0	Right Cheek	0	0.411	1.099	0.452	A23	25.5	25.1
Head	LTE Band 2	20	QPSK	C	00101	1:1	-0.04	1860.00	18700	1.0	23.0	22.55	50	0	Right Cheek	0	0.359	1.109	0.398		25.1	
Head	LTE Band 2	20	QPSK	C	00101	1:1	-0.09	1860.00	18700	0.0	24.0	23.59	1	0	Right Tilt	0	0.151	1.099	0.166		29.9	
Head	LTE Band 2	20	QPSK	C	00101	1:1	-0.08	1860.00	18700	1.0	23.0	22.55	50	0	Right Tilt	0	0.130	1.109	0.144		29.5	
Head	LTE Band 2	20	QPSK	C	00101	1:1	0.05	1860.00	18700	0.0	24.0	23.59	1	0	Left Cheek	0	0.158	1.099	0.174		29.7	
Head	LTE Band 2	20	QPSK	C	00101	1:1	0.02	1860.00	18700	1.0	23.0	22.55	50	0	Left Cheek	0	0.132	1.109	0.146		29.4	
Head	LTE Band 2	20	QPSK	C	00101	1:1	0.05	1860.00	18700	0.0	24.0	23.59	1	0	Left Tilt	0	0.095	1.099	0.104		31.9	
Head	LTE Band 2	20	QPSK	C	00101	1:1	-0.12	1860.00	18700	1.0	23.0	22.55	50	0	Left Tilt	0	0.068	1.109	0.075		32.3	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-20

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	LTE Band 2	20	QPSK	C	00101	1:1	0.00	1860.00	18700	0.0	22.0	21.64	1	99	Back	10	0.493	1.086	0.535		22.8	22.6
Body-worn/Hotspot	LTE Band 2	20	QPSK	C	00101	1:1	0.00	1860.00	18700	0.0	22.0	21.63	50	50	Back	10	0.517	1.089	0.563	A24	22.6	
Hotspot	LTE Band 2	20	QPSK	C	00101	1:1	0.04	1860.00	18700	0.0	22.0	21.64	1	99	Front	10	0.039	1.086	0.042		33.8	
Hotspot	LTE Band 2	20	QPSK	C	00101	1:1	0.11	1860.00	18700	0.0	22.0	21.63	50	50	Front	10	0.041	1.089	0.045		33.6	
Hotspot	LTE Band 2	20	QPSK	C	00101	1:1	0.07	1860.00	18700	0.0	22.0	21.64	1	99	Top	10	0.013	1.086	0.014		38.6	
Hotspot	LTE Band 2	20	QPSK	C	00101	1:1	0.04	1860.00	18700	0.0	22.0	21.63	50	50	Top	10	0.013	1.089	0.014		38.6	
Hotspot	LTE Band 2	20	QPSK	C	00101	1:1	-0.03	1860.00	18700	0.0	22.0	21.64	1	99	Left	10	0.265	1.086	0.288		25.5	
Hotspot	LTE Band 2	20	QPSK	C	00101	1:1	-0.03	1860.00	18700	0.0	22.0	21.63	50	50	Left	10	0.281	1.089	0.306		25.2	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.10 LTE Band 41 Standalone SAR

Table 12-21

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	LTE Band 41	20	QPSK	B	00127	1:1.58	0.01	2593.00	40620	0.0	24.0	22.53	1	0	Right Cheek	0	0.137	1.403	0.192		27.3	25.0
Head	LTE Band 41	20	QPSK	B	00127	1:1.58	-0.10	2593.00	40620	1.0	23.0	21.46	50	0	Right Cheek	0	0.108	1.426	0.154		27.2	
Head	LTE Band 41	20	QPSK	B	00127	1:1.58	0.02	2593.00	40620	0.0	24.0	22.53	1	0	Right Tilt	0	0.139	1.403	0.195		27.2	
Head	LTE Band 41	20	QPSK	B	00127	1:1.58	0.03	2593.00	40620	1.0	23.0	21.46	50	0	Right Tilt	0	0.114	1.426	0.163		27.0	
Head	LTE Band 41	20	QPSK	B	00127	1:1.58	-0.02	2593.00	40620	0.0	24.0	22.53	1	0	Left Cheek	0	0.232	1.403	0.325	A25	25.0	
Head	LTE Band 41	20	QPSK	B	00127	1:1.58	0.02	2593.00	40620	1.0	23.0	21.46	50	0	Left Cheek	0	0.176	1.426	0.251		25.1	
Head	LTE Band 41	20	QPSK	B	00127	1:1.58	0.09	2593.00	40620	0.0	24.0	22.53	1	0	Left Tilt	0	0.081	1.403	0.114		29.5	
Head	LTE Band 41	20	QPSK	B	00127	1:1.58	-0.02	2593.00	40620	1.0	23.0	21.46	50	0	Left Tilt	0	0.059	1.426	0.084		29.8	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-22

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	LTE Band 41	20	QPSK	B	00101	1:1.58	0.02	2680.00	41490	0.0	23.0	22.08	1	99	Back	10	0.292	1.236	0.361	A26	23.5	23.5
Body-worn/Hotspot	LTE Band 41	20	QPSK	B	00101	1:1.58	0.01	2680.00	41490	0.0	23.0	22.01	50	50	Back	10	0.286	1.256	0.359		23.5	
Hotspot	LTE Band 41	20	QPSK	B	00101	1:1.58	0.03	2680.00	41490	0.0	23.0	22.08	1	99	Front	10	0.184	1.236	0.227		25.5	
Hotspot	LTE Band 41	20	QPSK	B	00101	1:1.58	0.01	2680.00	41490	0.0	23.0	22.01	50	50	Front	10	0.182	1.256	0.229		25.5	
Hotspot	LTE Band 41	20	QPSK	B	00101	1:1.58	-0.01	2680.00	41490	0.0	23.0	22.08	1	99	Bottom	10	0.208	1.236	0.257		25.0	
Hotspot	LTE Band 41	20	QPSK	B	00101	1:1.58	0.01	2680.00	41490	0.0	23.0	22.01	50	50	Bottom	10	0.200	1.256	0.251		25.1	
Hotspot	LTE Band 41	20	QPSK	B	00101	1:1.58	0.04	2680.00	41490	0.0	23.0	22.08	1	99	Left	10	0.143	1.236	0.177		26.6	
Hotspot	LTE Band 41	20	QPSK	B	00101	1:1.58	0.03	2680.00	41490	0.0	23.0	22.01	50	50	Left	10	0.140	1.256	0.176		26.6	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.11 NR Band n5 Standalone SAR

Table 12-23

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Waveform	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	NR Band n5	20	QPSK	A	00127	1:1	-0.03	836.50	167300	DFT-s-OFDM	0.0	25.0	23.95	1	53	Right Cheek	0	0.194	1.274	0.247		29.2	28.5
Head	NR Band n5	20	QPSK	A	00127	1:1	-0.03	836.50	167300	DFT-s-OFDM	0.0	25.0	24.11	50	28	Right Cheek	0	0.198	1.227	0.243	A27	29.2	
Head	NR Band n5	20	QPSK	A	00127	1:1	-0.01	836.50	167300	CP-OFDM	1.5	23.5	22.44	1	1	Right Cheek	0	0.158	1.276	0.202		28.5	
Head	NR Band n5	20	QPSK	A	00127	1:1	0.01	836.50	167300	DFT-s-OFDM	0.0	25.0	23.95	1	53	Right Tilt	0	0.089	1.274	0.113		32.5	
Head	NR Band n5	20	QPSK	A	00127	1:1	0.03	836.50	167300	DFT-s-OFDM	0.0	25.0	24.11	50	28	Right Tilt	0	0.089	1.227	0.109		32.7	
Head	NR Band n5	20	QPSK	A	00127	1:1	0.14	836.50	167300	DFT-s-OFDM	0.0	25.0	23.95	1	53	Left Cheek	0	0.150	1.274	0.191		30.3	
Head	NR Band n5	20	QPSK	A	00127	1:1	-0.02	836.50	167300	DFT-s-OFDM	0.0	25.0	24.11	50	28	Left Cheek	0	0.153	1.227	0.188		30.3	
Head	NR Band n5	20	QPSK	A	00127	1:1	0.01	836.50	167300	DFT-s-OFDM	0.0	25.0	23.95	1	53	Left Tilt	0	0.088	1.274	0.112		32.6	
Head	NR Band n5	20	QPSK	A	00127	1:1	0.02	836.50	167300	DFT-s-OFDM	0.0	25.0	24.11	50	28	Left Tilt	0	0.088	1.227	0.108		32.7	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population																Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-24

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Waveform	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	NR Band n5	20	QPSK	A	00127	1:1	-0.01	836.50	167300	DFT-s-OFDM	0.0	24.0	22.80	1	53	Back	10	0.370	1.318	0.488	A28	25.2	25.2
Body-worn/Hotspot	NR Band n5	20	QPSK	A	00127	1:1	-0.01	836.50	167300	DFT-s-OFDM	0.0	24.0	22.82	50	0	Back	10	0.336	1.312	0.441		25.6	
Body-worn/Hotspot	NR Band n5	20	QPSK	A	00127	1:1	-0.01	836.50	167300	CP-OFDM	0.5	23.5	22.17	1	1	Back	10	0.302	1.358	0.410		25.4	
Hotspot	NR Band n5	20	QPSK	A	00127	1:1	0.02	836.50	167300	DFT-s-OFDM	0.0	24.0	22.80	1	53	Front	10	0.132	1.318	0.174		29.7	
Hotspot	NR Band n5	20	QPSK	A	00127	1:1	0.02	836.50	167300	DFT-s-OFDM	0.0	24.0	22.82	50	0	Front	10	0.129	1.312	0.169		29.8	
Hotspot	NR Band n5	20	QPSK	A	00127	1:1	0.09	836.50	167300	DFT-s-OFDM	0.0	24.0	22.80	1	53	Bottom	10	0.217	1.318	0.286		27.5	
Hotspot	NR Band n5	20	QPSK	A	00127	1:1	-0.02	836.50	167300	DFT-s-OFDM	0.0	24.0	22.82	50	0	Bottom	10	0.199	1.312	0.261		27.9	
Hotspot	NR Band n5	20	QPSK	A	00127	1:1	0.00	836.50	167300	DFT-s-OFDM	0.0	24.0	22.80	1	53	Right	10	0.170	1.318	0.224		28.6	
Hotspot	NR Band n5	20	QPSK	A	00127	1:1	0.02	836.50	167300	DFT-s-OFDM	0.0	24.0	22.82	50	0	Right	10	0.208	1.312	0.273		27.7	
Hotspot	NR Band n5	20	QPSK	A	00127	1:1	0.04	836.50	167300	DFT-s-OFDM	0.0	24.0	22.80	1	53	Left	10	0.116	1.318	0.153		30.2	
Hotspot	NR Band n5	20	QPSK	A	00127	1:1	-0.06	836.50	167300	DFT-s-OFDM	0.0	24.0	22.82	50	0	Left	10	0.116	1.312	0.152		30.3	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population																Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.12 NR Band n66 Standalone SAR

Table 12-25

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Waveform	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	NR Band n66	40	QPSK	B	00697	1:1	0.04	1745.00	349000	DFT-s-OFDM	0.0	25.0	23.91	1	108	Right Cheek	0	0.167	1.285	0.215		29.8	29.5
Head	NR Band n66	40	QPSK	B	00697	1:1	-0.03	1745.00	349000	DFT-s-OFDM	0.0	25.0	24.45	108	54	Right Cheek	0	0.165	1.135	0.187		30.4	
Head	NR Band n66	40	QPSK	B	00697	1:1	0.02	1745.00	349000	DFT-s-OFDM	0.0	25.0	23.91	1	108	Right Tilt	0	0.147	1.285	0.189		30.3	
Head	NR Band n66	40	QPSK	B	00697	1:1	0.08	1745.00	349000	DFT-s-OFDM	0.0	25.0	24.45	108	54	Right Tilt	0	0.155	1.135	0.176		30.6	
Head	NR Band n66	40	QPSK	B	00697	1:1	0.01	1745.00	349000	DFT-s-OFDM	0.0	25.0	23.91	1	108	Left Cheek	0	0.179	1.285	0.230		29.5	
Head	NR Band n66	40	QPSK	B	00698	1:1	-0.02	1745.00	349000	DFT-s-OFDM	0.0	25.0	24.45	108	54	Left Cheek	0	0.202	1.135	0.229	A29	29.5	
Head	NR Band n66	40	QPSK	B	00697	1:1	-0.13	1745.00	349000	CP-OFDM	1.5	23.5	22.01	1	1	Left Cheek	0	0.096	1.409	0.135		30.3	
Head	NR Band n66	40	QPSK	B	00697	1:1	0.04	1745.00	349000	DFT-s-OFDM	0.0	25.0	23.91	1	108	Left Tilt	0	0.142	1.285	0.182		30.5	
Head	NR Band n66	40	QPSK	B	00697	1:1	0.02	1745.00	349000	DFT-s-OFDM	0.0	25.0	24.45	108	54	Left Tilt	0	0.192	1.135	0.218		29.7	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population																Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-26

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle	Power Drift [dB]	Frequency [MHz]	Channel #	Waveform	MPR [dB]	Max Allowed Power [dBm]	Conducted Power [dBm]	RB Size	RB Offset	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	NR Band n66	40	QPSK	B	00697	1:1	0.04	1745.00	349000	DFT-s-OFDM	0.0	18.5	18.49	1	108	Back	10	0.145	1.002	0.145	A30	25.0	24.3
Body-worn/Hotspot	NR Band n66	40	QPSK	B	00697	1:1	-0.05	1745.00	349000	DFT-s-OFDM	0.0	18.5	18.50	108	54	Back	10	0.141	1.000	0.141		25.1	
Hotspot	NR Band n66	40	QPSK	B	00697	1:1	-0.04	1745.00	349000	DFT-s-OFDM	0.0	18.5	18.49	1	108	Front	10	0.141	1.002	0.141		25.1	
Hotspot	NR Band n66	40	QPSK	B	00697	1:1	-0.06	1745.00	349000	DFT-s-OFDM	0.0	18.5	18.50	108	54	Front	10	0.143	1.000	0.143		25.0	
Hotspot	NR Band n66	40	QPSK	B	00697	1:1	0.02	1745.00	349000	DFT-s-OFDM	0.0	18.5	18.49	1	108	Bottom	10	0.167	1.002	0.167		24.3	
Hotspot	NR Band n66	40	QPSK	B	00697	1:1	0.00	1745.00	349000	DFT-s-OFDM	0.0	18.5	18.50	108	54	Bottom	10	0.168	1.000	0.168	A31	24.3	
Hotspot	NR Band n66	40	QPSK	B	00697	1:1	0.16	1745.00	349000	CP-OFDM	0.0	18.5	18.05	1	1	Bottom	10	0.144	1.109	0.160		24.5	
Hotspot	NR Band n66	40	QPSK	B	00697	1:1	-0.01	1745.00	349000	DFT-s-OFDM	0.0	18.5	18.49	1	108	Left	10	0.088	1.002	0.088		27.1	
Hotspot	NR Band n66	40	QPSK	B	00697	1:1	-0.02	1745.00	349000	DFT-s-OFDM	0.0	18.5	18.50	108	54	Left	10	0.085	1.000	0.085		27.3	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population																Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.13 DTS SISO Standalone SAR

Table 12-27

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle [%]	Power Drift [dB]	Frequency [MHz]	Channel #	Data Rate [Mbps]	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Duty Cycle Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	2.4 GHz WIFI/ IEEE 802.11b	20	DSSS	E	00268	99.51	0.04	2437.00	6	1	16.0	15.64	Right Cheek	0	0.222	1.086	1.005	0.242	A32	19.5	19.5
Head	2.4 GHz WIFI/ IEEE 802.11b	20	DSSS	E	00268	99.51	0.00	2437.00	6	1	16.0	15.64	Right Tilt	0	0.220	1.086	1.005	0.240		19.5	
Head	2.4 GHz WIFI/ IEEE 802.11b	20	DSSS	E	00268	99.51	0.04	2437.00	6	1	16.0	15.64	Left Cheek	0	0.130	1.086	1.005	0.142		21.8	
Head	2.4 GHz WIFI/ IEEE 802.11b	20	DSSS	E	00268	99.51	0.00	2437.00	6	1	16.0	15.64	Left Tilt	0	0.139	1.086	1.005	0.152		21.5	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Head 1.6 W/kg (mW/g) averaged over 1 gram						

Table 12-28

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle [%]	Power Drift [dB]	Frequency [MHz]	Channel #	Data Rate [Mbps]	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Duty Cycle Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn/Hotspot	2.4 GHz WIFI/ IEEE 802.11b	22	DSSS	E	01513	99.51	-0.06	2437.00	6	1	20.0	19.81	Back	10	0.156	1.045	1.005	0.164	A33	25.2	25.2
Hotspot	2.4 GHz WIFI/ IEEE 802.11b	22	DSSS	E	01513	99.51	-0.15	2437.00	6	1	20.0	19.81	Front	10	0.080	1.045	1.005	0.084		28.1	
Hotspot	2.4 GHz WIFI/ IEEE 802.11b	22	DSSS	E	01513	99.51	0.09	2437.00	6	1	20.0	19.81	Top	10	0.120	1.045	1.005	0.126		26.4	
Hotspot	2.4 GHz WIFI/ IEEE 802.11b	22	DSSS	E	01513	99.51	-0.14	2437.00	6	1	20.0	19.81	Left	10	0.051	1.045	1.005	0.054		30.1	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Body 1.6 W/kg (mW/g) averaged over 1 gram						

12.14 NII SISO Standalone SAR

Table 12-29

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle [%]	Power Drift [dB]	Frequency [MHz]	Channel #	U-NII band	Data Rate [Mbps]	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Duty Cycle Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	-0.10	5290.00	58	U-NII-2A	29.3	13.0	12.96	Right Cheek	0	0.212	1.009	1.074	0.230		16.7	12.6
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	0.00	5610.00	122	U-NII-2C	29.3	13.0	12.88	Right Cheek	0	0.399	1.028	1.074	0.441		13.9	
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	-0.04	5775.00	155	U-NII-3	29.3	13.0	12.73	Right Cheek	0	0.388	1.064	1.074	0.443		13.9	
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	0.13	5290.00	58	U-NII-2A	29.3	13.0	12.96	Right Tilt	0	0.238	1.009	1.074	0.258		16.2	
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	0.05	5610.00	122	U-NII-2C	29.3	13.0	12.88	Right Tilt	0	0.460	1.028	1.074	0.508		13.3	
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	0.05	5775.00	155	U-NII-3	29.3	13.0	12.73	Right Tilt	0	0.465	1.064	1.074	0.531		13.1	
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	-0.11	5290.00	58	U-NII-2A	29.3	13.0	12.96	Left Cheek	0	0.182	1.009	1.074	0.197		17.4	
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	-0.03	5610.00	122	U-NII-2C	29.3	13.0	12.88	Left Cheek	0	0.354	1.028	1.074	0.391		14.4	
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	0.01	5775.00	155	U-NII-3	29.3	13.0	12.73	Left Cheek	0	0.394	1.064	1.074	0.450		13.8	
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	0.12	5290.00	58	U-NII-2A	29.3	13.0	12.96	Left Tilt	0	0.237	1.009	1.074	0.257		16.3	
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	-0.04	5610.00	122	U-NII-2C	29.3	13.0	12.88	Left Tilt	0	0.453	1.028	1.074	0.500		13.4	
Head	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00671	93.10	-0.12	5775.00	155	U-NII-3	29.3	13.0	12.73	Left Tilt	0	0.519	1.064	1.074	0.593	A34	12.6	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population														Head 1.6 W/kg (mW/g) averaged over 1 gram								

Table 12-30

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle [%]	Power Drift [dB]	Frequency [MHz]	Channel #	U-NII band	Data Rate [Mbps]	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Duty Cycle Scaling Factor	Reported 1g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Body-worn	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	-0.17	5290.00	58	U-NII-2A	29.3	15.0	14.68	Back	10	0.125	1.076	1.074	0.144		20.8	14.7
Body-worn	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	-0.04	5690.00	138	U-NII-2C	29.3	15.0	14.76	Back	10	0.281	1.057	1.074	0.319		17.3	
Body-worn/Hotspot	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	-0.02	5775.00	155	U-NII-3	29.3	15.0	14.44	Back	10	0.301	1.138	1.074	0.368	A35	16.7	
Hotspot	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	-0.02	5775.00	155	U-NII-3	29.3	15.0	14.44	Front	10	0.104	1.138	1.074	0.127		21.3	
Hotspot	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	-0.09	5775.00	155	U-NII-3	29.3	15.0	14.44	Top	10	0.482	1.138	1.074	0.589	A36	14.7	
Hotspot	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	-0.10	5775.00	155	U-NII-3	29.3	15.0	14.44	Left	10	0.090	1.138	1.074	0.110		21.9	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population														Body 1.6 W/kg (mW/g) averaged over 1 gram								

Table 12-31

Exposure	Band / Mode	Bandwidth [MHz]	Service / Modulation	Ant.	Serial Number	Duty Cycle [%]	Power Drift [dB]	Frequency [MHz]	Channel #	U-NII band	Data Rate [Mbps]	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 10g SAR [W/kg]	Power Scaling Factor	Duty Cycle Scaling Factor	Reported 10g SAR [W/kg]	Plot #	Plimit [dBm]	Overall Plimit [dBm]
Phablet	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	-0.06	5290.00	58	U-NII-2A	29.3	15.0	14.68	Back	0	0.178	1.076	1.074	0.206		23.2	17.5
Phablet	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	-0.07	5690.00	138	U-NII-2C	29.3	15.0	14.76	Back	0	0.471	1.057	1.074	0.535		19.1	
Phablet	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	-0.01	5290.00	58	U-NII-2A	29.3	15.0	14.68	Front	0	0.089	1.076	1.074	0.103		26.2	
Phablet	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	0.00	5690.00	138	U-NII-2C	29.3	15.0	14.76	Front	0	0.237	1.057	1.074	0.269		22.0	
Phablet	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	0.03	5290.00	58	U-NII-2A	29.3	15.0	14.68	Top	0	0.292	1.076	1.074	0.337		21.0	
Phablet	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	0.02	5690.00	138	U-NII-2C	29.3	15.0	14.76	Top	0	0.672	1.057	1.074	0.763	A37	17.5	
Phablet	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	-0.05	5290.00	58	U-NII-2A	29.3	15.0	14.68	Left	0	0.081	1.076	1.074	0.094		26.6	
Phablet	5 GHz WIFI/ IEEE 802.11ac	80	OFDM	E	00268	93.10	0.03	5690.00	138	U-NII-2C	29.3	15.0	14.76	Left	0	0.213	1.057	1.074	0.242		22.5	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population														Phablet 4.0 W/kg (mW/g) averaged over 10 grams								

12.15 DSS SISO Standalone SAR

Table 12-32

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle [%]	Power Drift [dB]	Frequency [MHz]	Channel #	Data Rate [Mbps]	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Duty Cycle Scaling Factor	Reported 1g SAR [W/kg]	Plot #
Head	2.4 GHz Bluetooth	FHSS	E	00671	76.80	0.04	2480.00	78	1	12.5	12.03	Right Cheek	0	0.045	1.114	1.016	0.051	
Head	2.4 GHz Bluetooth	FHSS	E	00671	76.80	0.07	2480.00	78	1	12.5	12.03	Right Tilt	0	0.048	1.114	1.016	0.054	A38
Head	2.4 GHz Bluetooth	FHSS	E	00671	76.80	0.01	2480.00	78	1	12.5	12.03	Left Cheek	0	0.033	1.114	1.016	0.037	
Head	2.4 GHz Bluetooth	FHSS	E	00671	76.80	0.06	2480.00	78	1	12.5	12.03	Left Tilt	0	0.047	1.114	1.016	0.053	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population												Head 1.6 W/kg (mW/g) averaged over 1 gram						

Table 12-33

Exposure	Band / Mode	Service / Modulation	Ant.	Serial Number	Duty Cycle [%]	Power Drift [dB]	Frequency [MHz]	Channel #	Data Rate [Mbps]	Max Allowed Power [dBm]	Conducted Power [dBm]	Test Position	Spacing [mm]	Measured 1g SAR [W/kg]	Power Scaling Factor	Duty Cycle Scaling Factor	Reported 1g SAR [W/kg]	Plot #
Body-worn/Hotspot	2.4 GHz Bluetooth	FHSS	E	00671	76.80	0.13	2480.00	78	1	12.5	12.03	Back	10	0.018	1.114	1.016	0.020	A39
Hotspot	2.4 GHz Bluetooth	FHSS	E	00671	76.80	0.01	2480.00	78	1	12.5	12.03	Front	10	0.009	1.114	1.016	0.010	
Hotspot	2.4 GHz Bluetooth	FHSS	E	00671	76.80	0.02	2480.00	78	1	12.5	12.03	Top	10	0.013	1.114	1.016	0.015	
Hotspot	2.4 GHz Bluetooth	FHSS	E	00671	76.80	0.09	2480.00	78	1	12.5	12.03	Left	10	0.004	1.114	1.016	0.005	
ANSI/IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population												Body 1.6 W/kg (mW/g) averaged over 1 gram						

12.16 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D04v01.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D04v01.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01r03, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was ≤ 1.2 W/kg, no additional body-worn SAR evaluations using a headset cable were required.
8. Per FCC KDB 865664 D01v01r04, variability SAR tests were not performed since the measured SAR results for a frequency band were less than 0.8 W/kg for 1g and 2 W/kg for 10g. Please see Section 13 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v02r01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 7.7 for more details).
10. Per FCC KDB Publication 648474 D04v01r03, this device is considered a "phablet" since the display diagonal dimension is > 150 mm and < 200 mm. Therefore, phablet SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg.
11. Unless otherwise noted, when 10g SAR measurement is considered, a factor of 2.5 is applied to the 1g thresholds for the equivalent test cases.
12. This device uses MediaTek TAS feature for WWAN operations and for WLAN operations to control and manage transmitting power in real time to ensure RF Exposure compliance. Per FCC Guidance, compliance for was assessed at the minimum of the time averaged power and the maximum output power for each band/mode/exposure condition (ECI).

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. Justification for reduced test configurations per KDB Publication 941225 D01v03r01 and October 2013 TCB Workshop Notes: The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for hotspot SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.
3. Per FCC KDB Publication 447498 D04v01, if the reported (scaled) SAR measured at the highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s).

UMTS Notes:

1. UMTS mode was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. AMR and HSPA SAR was not required per the 3G Test Reduction Procedure in KDB Publication 941225 D01v03r01.
2. Per FCC KDB Publication 447498 D04v01, if the reported (scaled) SAR measured at the highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s).

LTE Notes:

1. LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r04. The general test procedures used for testing can be found in Section 9.5.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 and MCC=001 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
4. Per FCC KDB Publication 447498 D04v01, when the reported 1g SAR measured at the highest output power channel in a given a test configuration was > 0.6 W/kg for LTE B41, testing at the other channels was required for such test configurations.
5. TDD LTE was tested per the guidance provided in FCC KDB Publication 941225 D05v02r04. Testing was performed using UL-DL configuration 0 with 6 UL subframes and 2 S subframes using extended cyclic prefix only and special subframe configuration 6. SAR tests were performed at maximum output power and worst-case transmission duty factor in extended cyclic prefix. Per 3GPP 36.211 Section 4, the duty factor for special subframe configuration 6 using extended cyclic prefix is 0.633.
6. Per KDB Publication 941225 D05Av01r02, SAR for downlink only LTE CA operations was not needed since the maximum average output power in LTE CA mode was not >0.25 dB higher than the maximum output power when downlink carrier aggregation was inactive.

NR Notes:

1. NR implementation supports SA and NSA mode. In EN-DC mode, NR operates with the LTE Bands shown in the NR FR1 checklist acting as anchor bands. Per FCC guidance, SAR tests for NR Bands and LTE Anchors Bands were performed separately due to limitations in SAR probe calibration factors.
2. Simultaneous transmission analysis for EN-DC operations is addressed in the Part 2 Test Report (Serial Number can be found in the bibliography).
3. This device additionally supports some EN-DC conditions where additional LTE carriers are added on the downlink only.
4. Per FCC Guidance, NR modulations and RB Sizes/Offsets were selected for testing such that configurations with the highest output power were evaluated for SAR tests.

WLAN Notes:

1. For held-to-ear, hotspot, and phablet operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg for 1g evaluations, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 GHz WIFI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n/ax) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 9.6.5 for more information.

3. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 GHz WIFI operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg for 1g evaluations. See Section 9.6.6 for more information.
4. When the maximum reported 1g averaged SAR is ≤0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g evaluations or all test channels were measured.
5. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.
6. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

Bluetooth Notes

1. Bluetooth SAR was measured with the device connected to a call box with hopping disabled with DH5 operation and Tx Tests test mode type. Per October 2016 TCB Workshop Notes, the reported SAR was scaled to the 78% transmission duty factor for Bluetooth to determine compliance. See RF Conducted Power Section for the time domain plot and calculation for the duty factor of the device.
2. Head and Hotspot Bluetooth SAR were evaluated for BT BDR tethering applications.

13 SAR MEASUREMENT VARIABILITY

13.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, all measured 1 g SAR values were <0.8 W/kg and all measured 10 g SAR values were <2.0 W/kg. Therefore, no SAR measurement variability analysis was required.

13.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for 1g and <3.75 W/kg for 10g for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 was not required.

14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E4404B	Spectrum Analyzer	N/A	N/A	N/A	MY45113242
Agilent	E4438C	ESG Vector Signal Generator	2023-10-10	Annual	2024-10-10	MY42082659
Agilent	N5182A	MXG Vector Signal Generator	2023-07-04	Annual	2024-07-04	MY48180366
Agilent	N5182A	MXG Vector Signal Generator	2023-04-01	Annual	2024-04-01	MY47420837
Agilent	8753ES	S-Parameter Vector Network Analyzer	2023-02-08	Annual	2024-02-08	US39170122
Agilent	8753ES	S-Parameter Vector Network Analyzer	2023-07-21	Annual	2024-07-21	US39170118
Agilent	E5515C	Wireless Communications Test Set	2023-01-12	Annual	2024-01-12	MY50262130
Amplifier Research	15S1G6	Amplifier	2023-07-04	Annual	2024-07-04	433971
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	ML2496A	Power Meter	2023-06-15	Annual	2024-06-15	1138001
Anritsu	MA2411B	Pulse Power Sensor	2023-01-10	Annual	2024-01-10	1315051
Anritsu	MA2411B	Pulse Power Sensor	2023-06-15	Annual	2024-06-15	1126066
Anritsu	MT8821C	Radio Communication Analyzer MT8821C	2023-01-10	Annual	2024-01-10	6201524637
Anritsu	MT8821C	Radio Communication Analyzer MT8821C	2022-11-28	Annual	2023-11-28	6262150047
Anritsu	MT8000A	RADIO COMMUNICATION TEST STATION	2023-03-20	Annual	2024-03-20	6261987986
Anritsu	MA24106A	USB Power Sensor	2023-04-21	Annual	2024-04-21	1349503
Anritsu	MA24106A	USB Power Sensor	2023-07-04	Annual	2024-07-04	1244512
Anritsu	MA24106A	USB Power Sensor	2023-06-15	Annual	2024-06-15	1827530
Control Company	4040	Therm./ Clock/ Humidity Monitor	2023-01-17	Annual	2024-01-17	160574418
Mitutoyo	500-196-30	CD-6"ASX 6Inch Digital Caliper	2022-02-16	Triennial	2025-02-16	A20238413
Keysight Technologies	N6705B	DC Power Analyzer	2021-05-05	Triennial	2024-05-05	MY53004059
Keysight Technologies	N9020A	MXA Signal Analyzer	2023-03-15	Annual	2024-03-15	US46470561
Mini-Circuits	VLF-6000+	Low Pass Filter DC to 6000 MHz	2023-07-05	Annual	2024-07-05	31634
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	CBT	N/A	CBT	2050
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	2023-07-05	Annual	2024-07-05	2111
Seekonk	TSF-100	Torque Wrench	2023-06-30	Annual	2024-06-30	47639-29
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	2023-07-04	Annual	2024-07-04	166818
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	2023-06-01	Annual	2024-06-01	108843
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	2023-08-10	Annual	2024-08-10	140144
SPEAG	DAK-3.5	Dielectric Assessment Kit	2022-12-15	Annual	2023-12-15	1278
SPEAG	DAK-3.5	Dielectric Assessment Kit	2023-05-09	Annual	2024-05-09	1070
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	2023-08-14	Annual	2024-08-14	1041
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	2023-07-04	Annual	2024-07-04	1039
SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1379
SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1243
SPEAG	D750V3	750 MHz SAR Dipole	2023-02-13	Annual	2024-02-13	1046
SPEAG	D835V2	835 MHz SAR Dipole	2023-04-13	Annual	2024-04-13	4d119
SPEAG	D835V2	835 MHz SAR Dipole	2023-05-11	Annual	2024-05-11	4d180
SPEAG	D835V2	835 MHz SAR Dipole	2022-05-16	Biennial	2024-05-16	460
SPEAG	D1750V2	1750 MHz SAR Dipole	2023-04-19	Annual	2024-04-19	1051
SPEAG	D1750V2	1750 MHz SAR Dipole	2023-05-17	Annual	2024-05-17	1092
SPEAG	D1750V2	1750 MHz SAR Dipole	2022-01-18	Biennial	2024-01-18	1148
SPEAG	D1900V2	1900 MHz SAR Dipole	2023-04-18	Annual	2024-04-18	5d141
SPEAG	D2450V2	2450 MHz SAR Dipole	2023-05-11	Annual	2024-05-11	945
SPEAG	D2450V2	2450 MHz SAR Dipole	2023-02-13	Annual	2024-02-13	882
SPEAG	D2450V2	2450 MHz SAR Dipole	2021-11-25	Biennial	2023-11-25	981
SPEAG	D2600V2	2600 MHz SAR Dipole	2023-06-12	Annual	2024-06-12	1009
SPEAG	D2600V2	2600 MHz SAR Dipole	2023-08-10	Annual	2024-08-10	1126
SPEAG	D5GHzV2	5 GHz SAR Dipole	2023-01-18	Annual	2024-01-18	1191
SPEAG	DAE4	Dasy Data Acquisition Electronics	2023-06-15	Annual	2024-06-15	1532
SPEAG	DAE4	Dasy Data Acquisition Electronics	2023-02-16	Annual	2024-02-16	1645
SPEAG	DAE4	Dasy Data Acquisition Electronics	2023-09-06	Annual	2024-09-06	1364
SPEAG	DAE4	Dasy Data Acquisition Electronics	2023-01-20	Annual	2024-01-20	1466
SPEAG	DAE4	Dasy Data Acquisition Electronics	2023-05-11	Annual	2024-05-11	728
SPEAG	DAE4	Dasy Data Acquisition Electronics	2023-01-18	Annual	2024-01-18	1530
SPEAG	DAE4	Dasy Data Acquisition Electronics	2023-01-17	Annual	2024-01-17	1558
SPEAG	DAE4	Dasy Data Acquisition Electronics	2023-04-14	Annual	2024-04-14	501
SPEAG	EX3DV4	SAR Probe	2023-06-08	Annual	2024-06-08	7491
SPEAG	EX3DV4	SAR Probe	2023-02-10	Annual	2024-02-10	7640
SPEAG	EX3DV4	SAR Probe	2023-09-12	Annual	2024-09-12	7558
SPEAG	EX3DV4	SAR Probe	2023-01-12	Annual	2024-01-12	7565
SPEAG	EX3DV4	SAR Probe	2023-06-14	Annual	2024-06-14	7661
SPEAG	EX3DV4	SAR Probe	2023-01-17	Annual	2024-01-17	7713
SPEAG	EX3DV4	SAR Probe	2023-01-11	Annual	2024-01-11	7570
SPEAG	EX3DV4	SAR Probe	2023-04-18	Annual	2024-04-18	7532

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.
Note: All equipment was used solely within its respective calibration period.

15 MEASUREMENT UNCERTAINTIES

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	10gms u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1	7	N	1	1	1	7.0	7.0	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	E.2.3	2	R	1.732	1	1	1.2	1.2	∞
Linearity	E.2.4	0.3	N	1	1	1	0.3	0.3	∞
System Detection Limits	E.2.4	0.25	R	1.732	1	1	0.1	0.1	∞
Modulation Response	E.2.5	4.8	R	1.732	1	1	2.8	2.8	∞
Readout Electronics	E.2.6	0.3	N	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0.8	R	1.732	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.732	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	E.6.1	3	R	1.732	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	3	R	1.732	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.8	R	1.732	1	1	0.5	0.5	∞
Probe Positioning w/ respect to Phantom	E.6.3	6.7	R	1.732	1	1	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	4	R	1.732	1	1	2.3	2.3	∞
Test Sample Related									
Test Sample Positioning	E.4.2	3.12	N	1	1	1	3.1	3.1	35
Device Holder Uncertainty	E.4.1	1.67	N	1	1	1	1.7	1.7	5
Output Power Variation - SAR drift measurement	E.2.9	5	R	1.732	1	1	2.9	2.9	∞
SAR Scaling	E.6.5	0	R	1.732	1	1	0.0	0.0	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	E.3.3	4.3	N	1	0.78	0.71	3.3	3.0	76
Liquid Permittivity - measurement uncertainty	E.3.3	4.2	N	1	0.23	0.26	1.0	1.1	75
Liquid Conductivity - Temperature Uncertainty	E.3.4	3.4	R	1.732	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	E.3.4	0.6	R	1.732	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)			RSS				12.2	12.0	191
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.4	24.0	

The above measurement uncertainties are according to IEEE Std. 1528-2013

16 CONCLUSION

16.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Innovation, Science, and Economic Development Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

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