ELEMENT MATERIALS TECHNOLOGY

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SAR EVALUATION REPORT

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

Date of Testing:
05/30/2023 – 06/21/2023
Test Site/Location:
Element, Columbia, MD, USA
Document Serial No.:
1M2305260071-01.A3L

FCC ID: **A3LSMF731B**

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

DUT Type: Portable Handset
Application Type: Class II Permissive Change
FCC Rule Part(s): CFR §2.1093
Model(s): SM-F731B
Permissive Change(s): See FCC Change Document
Date of Original Certification: 06/23/2023

Equipment Class	Band & Mode	Tx Frequency	SAR			
			1g Head (W/kg)	1g Body-Worn (W/kg)	1g Hotspot (W/kg)	10g Phablet (W/kg)
DTS	2.4 GHz WLAN	2412 - 2472 MHz	0.10	N/A	N/A	N/A
NII	U-NII-1	5180 - 5240 MHz	N/A	N/A	N/A	N/A
NII	U-NII-2A	5260 - 5320 MHz	0.35*	N/A	N/A	N/A
NII	U-NII-2C	5500 - 5720 MHz	0.30*	N/A	N/A	N/A
NII	U-NII-3	5745 - 5825 MHz	0.33*	N/A	N/A	N/A
NII	U-NII-4	5845 - 5885 MHz	0.25*	N/A	N/A	N/A
DSS/DTS	Bluetooth	2402 - 2480 MHz	0.10	N/A	N/A	N/A
Simultaneous SAR per KDB 690783 D01v01r03:			1.34	0.79	1.52	3.99

* Note: * SAR values represent RF exposure during MIMO operations.

Only operations relevant to this permissive change were evaluated for compliance. Please see the original compliance evaluation in RF Exposure Technical Report S/N: 1M2303170032-19-R1.A3Lfor complete evaluation of all other operating modes. The operation description includes a description of all changed items.

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

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CERT #2041.01

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TABLE OF CONTENTS

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/EDGE 1900	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 13	Voice/Data	779.5 - 784.5 MHz
LTE Band 26 (Cell)	Voice/Data	814.7 - 848.3 MHz
LTE Band 5 (Cell)	Voice/Data	824.7 - 848.3 MHz
LTE Band 66 (AWS)	Voice/Data	1710.7 - 1779.3 MHz
LTE Band 4 (AWS)	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 25 (PCS)	Voice/Data	1850.7 - 1914.3 MHz
LTE Band 2 (PCS)	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
NR Band n25	Voice/Data	1852.5 - 1912.5 MHz
NR Band n2	Voice/Data	1852.5 - 1907.5 MHz
NR Band n41	Voice/Data	2501.01 - 2685 MHz
NR Band n77	Voice/Data	3455.01 - 3544.98 MHz 3705 - 3975 MHz
2.4 GHz WLAN	Voice/Data	2412 - 2472 MHz
U-NII-1	Voice/Data	5180 - 5240 MHz
U-NII-2A	Voice/Data	5260 - 5320 MHz
U-NII-2C	Voice/Data	5500 - 5720 MHz
U-NII-3	Voice/Data	5745 - 5825 MHz
U-NII-4	Voice/Data	5845 - 5885 MHz
U-NII-5	Voice/Data	5935 - 6415 MHz
U-NII-6	Voice/Data	6435 - 6515 MHz
U-NII-7	Voice/Data	6535 - 6875 MHz
U-NII-8	Voice/Data	6895 - 7115 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz

1.2 Power Reduction for SAR

This device uses an independent fixed level power reduction mechanism for WLAN/BT operations during voice or VoIP held to ear scenarios and when 5G NR is active. Per FCC Guidance, the held-to-ear exposure conditions were evaluated at reduced power according to the head SAR positions described in IEEE 1528-2013. Detailed descriptions of the power reduction mechanism are included in the operational description.

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 D01v06.

Only operations relevant to this permissive change were evaluated for compliance. No other target changes have been made. Targets for all other bands/exposure conditions can be found in the original filing.

Note: Targets for 802.11ax RU operations can be found in 802.11ax RU SAR Exclusion Appendix.

1.3.1 2.4 GHz SISO/MIMO WLAN Output Power

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

- Simultaneous conditions with 5G NR and/or 5/6 GHz WLAN

Mode	Band	IEEE 802.11 Modulated Output Power (in dBm)																			
		SISO										MIMO									
		Antenna 2										Antenna 1 & Antenna 2 in MIMO									
		b		g		n		ac		ax (SU)		b CDD + STBC		g (CDD + STBC)		n (CDD+STBC, SDM)		ac (CDD+STBC, SDM)		ax (SU) (CDD+STBC, SDM)	
Maximum / Nominal Power		Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.
2.4 GHz WIFI	2.45 GHz	13.0 ch. 12: 6.0 ch. 13: 0.0	12.0 5.0 -1.0	13.0 ch. 12: 6.0 ch. 13: 0.0	12.0 5.0 -1.0	13.0 ch. 12: 6.0 ch. 13: 0.0	12.0 5.0 -1.0	13.0 ch. 12: 6.0 ch. 13: 0.0	12.0 5.0 -1.0	13.0 ch. 12: 6.0 ch. 13: 0.0	12.0 5.0 -1.0	13.0 ch. 12: 6.0 ch. 13: 0.0	12.0 5.0 -1.0	13.0 ch. 12: 6.0 ch. 13: 0.0	12.0 5.0 -1.0	13.0 ch. 12: 6.0 ch. 13: 0.0	12.0 5.0 -1.0	13.0 ch. 12: 6.0 ch. 13: 0.0	12.0 5.0 -1.0	13.0 ch. 12: 6.0 ch. 13: 0.0	12.0 5.0 -1.0

(Upper tolerance: Target +1.0 dB)

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

- RCV Active
- RCV Active during simultaneous conditions with 5G NR and/or 5/6 GHz WLAN

Mode	Band	IEEE 802.11 Modulated Output Power (in dBm)																			
		SISO										MIMO									
		Antenna 2										Antenna 1 & Antenna 2 in MIMO									
		b		g		n		ac		ax (SU)		b CDD + STBC		g (CDD + STBC)		n (CDD+STBC, SDM)		ac (CDD+STBC, SDM)		ax (SU) (CDD+STBC, SDM)	
Maximum / Nominal Power		Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.
2.4 GHz WIFI	2.45 GHz	9.0 ch. 12: 6.0 ch. 13: 0.0	8.0 5.0 -1.0	9.0 ch. 12: 6.0 ch. 13: 0.0	8.0 5.0 -1.0	9.0 ch. 12: 6.0 ch. 13: 0.0	8.0 5.0 -1.0	9.0 ch. 12: 6.0 ch. 13: 0.0	8.0 5.0 -1.0	9.0 ch. 12: 6.0 ch. 13: 0.0	8.0 5.0 -1.0	9.0 ch. 12: 6.0 ch. 13: 0.0	8.0 5.0 -1.0	9.0 ch. 12: 6.0 ch. 13: 0.0	8.0 5.0 -1.0	9.0 ch. 12: 6.0 ch. 13: 0.0	8.0 5.0 -1.0	9.0 ch. 12: 6.0 ch. 13: 0.0	8.0 5.0 -1.0	9.0 ch. 12: 6.0 ch. 13: 0.0	8.0 5.0 -1.0

(Upper tolerance: Target +1.0 dB)

1.3.2 5 GHz MIMO WLAN Output Power

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

- RCV Active
- RCV Active during simultaneous conditions with 5G NR and/or 2.4 GHz WLAN/BT
- During simultaneous conditions with 5G NR and/or 2.4 GHz WLAN/BT

Mode	IEEE 802.11 Modulated Output Power (in dBm)							
	MIMO							
	Antenna 1 & Antenna 2 in MIMO							
	a		n		ac		ax (SU)	
Maximum / Nominal Power	Max	Nom.	Max	Nom.	Max	Nom.	Max	Nom.
5 GHz WIFI (20MHz BW)	12.0	11.0	12.0	11.0	12.0	11.0	12.0	11.0
5 GHz WIFI (40MHz BW)			12.0	11.0	12.0	11.0	12.0	11.0
5 GHz WIFI (80MHz BW)					12.0	11.0	12.0	11.0
5 GHz WIFI (160MHz BW)					12.0	11.0	12.0	11.0

1.3.3 2.4 GHz Bluetooth Output Power

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

- RCV Active

Mode	Data Rate	Modulated Output Power (in dBm)			
		Single Antenna			
		Antenna 1		Antenna 2	
Maximum / Nominal Power		Max	Nom.	Max	Nom.
Bluetooth	1Mbps	7.0	6.0	10.0	9.0
Bluetooth EDR	2Mbps	7.0	6.0	10.0	9.0
Bluetooth EDR	3Mbps	7.0	6.0	10.0	9.0
Bluetooth LE	1Mbps	7.0	6.0	10.0	9.0
Bluetooth LE	2Mbps	7.0	6.0	10.0	9.0
Bluetooth LE	125kbps	7.0	6.0	8.0	7.0
Bluetooth LE	500kbps	7.0	6.0	8.0	7.0

(Upper tolerance: Target +1.0 dB)

1.4 DUT Antenna Locations

A diagram showing the location of the device antennas for both open and closed configurations can be found in DUT Antenna Diagram and SAR Test Setup Photographs Appendix.

1.5 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the device for this model. Therefore, all SAR tests were performed with the device which already incorporates the NFC antenna. A diagram showing the location of the NFC antenna can be found in DUT Antenna Diagram and SAR Test Setup Photographs Appendix.

1.6 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, 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 D01v06 procedures.

Table 1-1
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router	Phablet	Notes
1	GSM voice + 2.4 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
2	GSM voice + 5 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
3	GSM voice + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
4	GSM voice + 2.4 GHz Bluetooth Ant 1	Yes	Yes	N/A	Yes	
5	GSM voice + 2.4 GHz Bluetooth Ant 2	Yes	Yes	N/A	Yes	
6	GSM voice + 2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
7	GSM voice + 2.4 GHz WLAN MIMO + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
8	GSM voice + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2	Yes	Yes	N/A	Yes	
9	GSM voice + 2.4 GHz Bluetooth Ant 1 + 5 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
10	GSM voice + 2.4 GHz Bluetooth Ant 1 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
11	GSM voice + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
12	GSM voice + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
13	GSM voice + 2.4 GHz Bluetooth Ant 2 + 5 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
14	GSM voice + 2.4 GHz Bluetooth Ant 2 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
15	UMTS + 2.4 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
16	UMTS + 5 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
17	UMTS + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
18	UMTS + 2.4 GHz Bluetooth Ant 1	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
19	UMTS + 2.4 GHz Bluetooth Ant 2	Yes	Yes	N/A	Yes	
20	UMTS + 2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
21	UMTS + 2.4 GHz WLAN MIMO + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
22	UMTS + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
23	UMTS + 2.4 GHz Bluetooth Ant 1 + 5 GHz WLAN MIMO	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
24	UMTS + 2.4 GHz Bluetooth Ant 1 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
25	UMTS + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
26	UMTS + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
27	UMTS + 2.4 GHz Bluetooth Ant 2 + 5 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
28	UMTS + 2.4 GHz Bluetooth Ant 2 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
29	LTE + 2.4 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
30	LTE + 5 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
31	LTE + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
32	LTE + 2.4 GHz Bluetooth Ant 1	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
33	LTE + 2.4 GHz Bluetooth Ant 2	Yes	Yes	N/A	Yes	
34	LTE + 2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
35	LTE + 2.4 GHz WLAN MIMO + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
36	LTE + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
37	LTE + 2.4 GHz Bluetooth Ant 1 + 5 GHz WLAN MIMO	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
38	LTE + 2.4 GHz Bluetooth Ant 1 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
39	LTE + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
40	LTE + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
41	LTE + 2.4 GHz Bluetooth Ant 2 + 5 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
42	LTE + 2.4 GHz Bluetooth Ant 2 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
43	LTE + NR	Yes	Yes	N/A	Yes	
44	LTE + NR + 2.4 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
45	LTE + NR + 5 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
46	LTE + NR + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
47	LTE + NR + 2.4 GHz Bluetooth Ant 1	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
48	LTE + NR + 2.4 GHz Bluetooth Ant 2	Yes	Yes	N/A	Yes	
49	LTE + NR + 2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
50	LTE + NR + 2.4 GHz WLAN MIMO + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
51	LTE + NR + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
52	LTE + NR + 2.4 GHz Bluetooth Ant 1 + 5 GHz WLAN MIMO	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
53	LTE + NR + 2.4 GHz Bluetooth Ant 1 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
54	LTE + NR + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
55	LTE + NR + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
56	LTE + NR + 2.4 GHz Bluetooth Ant 2 + 5 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
57	LTE + NR + 2.4 GHz Bluetooth Ant 2 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
58	NR + 2.4 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
59	NR + 5 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
60	NR + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
61	NR + 2.4 GHz Bluetooth Ant 1	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
62	NR + 2.4 GHz Bluetooth Ant 2	Yes	Yes	N/A	Yes	
63	NR + 2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO	Yes	Yes	Yes	Yes	
64	NR + 2.4 GHz WLAN MIMO + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
65	NR + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
66	NR + 2.4 GHz Bluetooth Ant 1 + 5 GHz WLAN MIMO	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
67	NR + 2.4 GHz Bluetooth Ant 1 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
68	NR + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO	Yes	Yes	Yes^	Yes	^ Bluetooth Tethering is considered
69	NR + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
70	NR + 2.4 GHz Bluetooth Ant 2 + 5 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
71	NR + 2.4 GHz Bluetooth Ant 2 + 6 GHz WLAN MIMO	Yes	Yes	N/A	Yes	
72	GPRS/EDGE + 2.4 GHz WLAN MIMO	N/A	N/A	Yes	Yes	
73	GPRS/EDGE + 5 GHz WLAN MIMO	N/A	N/A	Yes	Yes	
74	GPRS/EDGE + 6 GHz WLAN MIMO	N/A	N/A	N/A	Yes	
75	GPRS/EDGE + 2.4 GHz Bluetooth Ant 1	N/A	N/A	Yes^	Yes	^ Bluetooth Tethering is considered
76	GPRS/EDGE + 2.4 GHz Bluetooth Ant 2	N/A	N/A	N/A	Yes	
77	GPRS/EDGE + 2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO	N/A	N/A	Yes	Yes	
78	GPRS/EDGE + 2.4 GHz WLAN MIMO + 6 GHz WLAN MIMO	N/A	N/A	N/A	Yes	
79	GPRS/EDGE + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2	N/A	N/A	Yes^	Yes	^ Bluetooth Tethering is considered
80	GPRS/EDGE + 2.4 GHz Bluetooth Ant 1 + 5 GHz WLAN MIMO	N/A	N/A	Yes^	Yes	^ Bluetooth Tethering is considered
81	GPRS/EDGE + 2.4 GHz Bluetooth Ant 1 + 6 GHz WLAN MIMO	N/A	N/A	N/A	Yes	
82	GPRS/EDGE + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO	N/A	N/A	Yes^	Yes	^ Bluetooth Tethering is considered
83	GPRS/EDGE + 2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 6 GHz WLAN MIMO	N/A	N/A	N/A	Yes	
84	GPRS/EDGE + 2.4 GHz Bluetooth Ant 2 + 5 GHz WLAN MIMO	N/A	N/A	N/A	Yes	
85	GPRS/EDGE + 2.4 GHz Bluetooth Ant 2 + 6 GHz WLAN MIMO	N/A	N/A	N/A	Yes	

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, U-NII-2C, and U-NII-4 were not evaluated for wireless router conditions.
5. This device supports 2x2 MIMO Tx for WLAN 802.11a/b/g/n/ac/ax. 802.11a/b/g/n/ac/ax supports CDD and STBC and 802.11n/ac/ax additionally supports SDM.
6. This device supports VoWIFI.
7. This device supports Bluetooth Tethering on ant 1 only.
8. This device supports VoLTE.
9. This device supports VoNR.
10. LTE + 5G NR FR1 Scenarios are limited to EN-DC combinations with anchor bands as shown in the NR FR1 checklist.
11. NFC was evaluated for phablet based on expected usage conditions.
12. 6 GHz Wireless Router is not supported, therefore it was not evaluated for wireless router conditions.

1.7 Miscellaneous SAR Test Considerations

When on the device dimensions when closed, hotspot SAR in the closed configuration was performed at 5mm per KDB Publication 941225 D06v02r01.

(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, U-NII-2C, and U-NII-4 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 802.11ax with the following features:

a) Up to 160 MHz Bandwidth only for 5/6 GHz
b) Up to 20 MHz Bandwidth only for 2.4 GHz
c) 2 Tx antenna output
d) Up to 1024 QAM is supported
e) TDWR and Band gap channels are supported for 5 GHz
f) MU-MIMO UL Operations are not supported

Per FCC KDB Publication 648474 D04v01r03, this device is considered a "phablet" in open configuration since the diagonal dimension is greater than 160mm 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, U-NII-2C, and U-NII-4 WLAN, phablet SAR tests were performed. Phablet SAR was not evaluated for 2.4 GHz and U-NII-3 WLAN operations since wireless router 1g SAR was < 1.2 W/kg.

Per April 2019 TCB Workshop Notes, SAR testing was not required for 802.11ax when applying the initial test configuration procedures of KDB 248227, with 802.11ax considered a higher order 802.11 mode.

This device supports 6 GHz WIFI Operations. RF Exposure assessment for these bands can be found in the WIFI 6E RF Exposure Report (report SN can be found in Section 1.11 – Bibliography). Simultaneous transmission analysis is addressed in Multi-Tx and Antenna SAR Considerations Appendix of this report.

1.8 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 D01v06 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)
- April 2019 TCB Workshop Notes (IEEE 802.11ax)

1.9 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 11.

1.10 Bibliography

Report Type	Report Serial Number
RF Exposure Part 2 Test Report	1M2305260071-03.A3L
Original Filing RF Exposure Part 1 Test Report	1M2303170032-19-R1.A3L
Original Filing WIFI 6 GHz RF Exposure	1M2303170032-21.A3L
RF Exposure Compliance Summary Report	1M2305260071-04.A3L

2 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 13 (779.5 - 784.5 MHz)				
	LTE Band 26 (Cell) (814.7 - 848.3 MHz)				
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)				
	LTE Band 66 (AWS) (1710.7 - 1779.3 MHz)				
	LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)				
	LTE Band 25 (PCS) (1850.7 - 1914.3 MHz)				
	LTE Band 2 (PCS) (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 13: 5 MHz, 10 MHz				
	LTE Band 26 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz				
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 66 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 25 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 2 (PCS): 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 13: 5 MHz	779.5 (23205)		782 (23230)	784.5 (23255)	
LTE Band 13: 10 MHz	N/A		782 (23230)	N/A	
LTE Band 26 (Cell): 1.4 MHz	814.7 (26697)		831.5 (26865)	848.3 (27033)	
LTE Band 26 (Cell): 3 MHz	815.5 (26705)		831.5 (26865)	847.5 (27025)	
LTE Band 26 (Cell): 5 MHz	816.5 (26715)		831.5 (26865)	846.5 (27015)	
LTE Band 26 (Cell): 10 MHz	819 (26740)		831.5 (26865)	844 (26990)	
LTE Band 26 (Cell): 15 MHz	821.5 (26765)		831.5 (26865)	841.5 (26965)	
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)		836.5 (20525)	848.3 (20643)	
LTE Band 5 (Cell): 3 MHz	825.5 (20415)		836.5 (20525)	847.5 (20635)	
LTE Band 5 (Cell): 5 MHz	826.5 (20425)		836.5 (20525)	846.5 (20625)	
LTE Band 5 (Cell): 10 MHz	829 (20450)		836.5 (20525)	844 (20600)	
LTE Band 66 (AWS): 1.4 MHz	1710.7 (131979)		1745 (132322)	1779.3 (132665)	
LTE Band 66 (AWS): 3 MHz	1711.5 (131987)		1745 (132322)	1778.5 (132657)	
LTE Band 66 (AWS): 5 MHz	1712.5 (131997)		1745 (132322)	1777.5 (132647)	
LTE Band 66 (AWS): 10 MHz	1715 (132022)		1745 (132322)	1775 (132622)	
LTE Band 66 (AWS): 15 MHz	1717.5 (132047)		1745 (132322)	1772.5 (132597)	
LTE Band 66 (AWS): 20 MHz	1720 (132072)		1745 (132322)	1770 (132572)	
LTE Band 4 (AWS): 1.4 MHz	1710.7 (19957)		1732.5 (20175)	1754.3 (20393)	
LTE Band 4 (AWS): 3 MHz	1711.5 (19965)		1732.5 (20175)	1753.5 (20385)	
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)		1732.5 (20175)	1752.5 (20375)	
LTE Band 4 (AWS): 10 MHz	1715 (20000)		1732.5 (20175)	1750 (20350)	
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)		1732.5 (20175)	1747.5 (20325)	
LTE Band 4 (AWS): 20 MHz	1720 (20050)		1732.5 (20175)	1745 (20300)	
LTE Band 25 (PCS): 1.4 MHz	1850.7 (26047)		1882.5 (26365)	1914.3 (26683)	
LTE Band 25 (PCS): 3 MHz	1851.5 (26055)		1882.5 (26365)	1913.5 (26675)	
LTE Band 25 (PCS): 5 MHz	1852.5 (26065)		1882.5 (26365)	1912.5 (26665)	
LTE Band 25 (PCS): 10 MHz	1855 (26090)		1882.5 (26365)	1910 (26640)	
LTE Band 25 (PCS): 15 MHz	1857.5 (26115)		1882.5 (26365)	1907.5 (26615)	
LTE Band 25 (PCS): 20 MHz	1860 (26140)		1882.5 (26365)	1905 (26590)	
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)		1880 (18900)	1909.3 (19193)	
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)		1880 (18900)	1908.5 (19185)	
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)		1880 (18900)	1907.5 (19175)	
LTE Band 2 (PCS): 10 MHz	1855 (18650)		1880 (18900)	1905 (19150)	
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)		1880 (18900)	1902.5 (19125)	
LTE Band 2 (PCS): 20 MHz	1860 (18700)		1880 (18900)	1900 (19100)	
LTE Band 41: 5 MHz	2506 (39750)	2549.5 (40185)	2549.5 (40185)	2593 (40620)	2636.5 (41055)
LTE Band 41: 10 MHz	2506 (39750)	2549.5 (40185)	2549.5 (40185)	2593 (40620)	2636.5 (41055)
LTE Band 41: 15 MHz	2506 (39750)	2549.5 (40185)	2549.5 (40185)	2593 (40620)	2636.5 (41055)
LTE Band 41: 20 MHz	2506 (39750)	2549.5 (40185)	2549.5 (40185)	2593 (40620)	2636.5 (41055)
UE Category	DL UE Cat 20, UL UE Cat 18				
Modulations Supported in UL	QPSK, 16QAM, 64QAM, 256QAM				
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 16. 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 in the original filing. All uplink communications are identical to the Release 8 Specifications. Uplink communications are done on the PCC. The following LTE Release 16 Features are not supported: Relay, HetNet, Enhanced MIMO, eICIC, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA, WIFI Offloading				

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)					
	NR Band n25 (1852.5 - 1912.5 MHz)					
	NR Band n2 (1852.5 - 1907.5 MHz)					
	NR Band n41 (2501.01 - 2685 MHz)					
	NR Band n77 (3455.01 - 3544.98 MHz, 3705 - 3975 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					
	NR Band n25: 5 MHz, 10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz					
	NR Band n2: 5 MHz, 10 MHz, 15 MHz, 20 MHz					
	NR Band n41: 10 MHz, 15 MHz, 20 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 MHz					
	NR Band n77: 10 MHz, 15 MHz, 20 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 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)	
NR Band n25: 5 MHz	1852.5 (370500)		1882.5 (376500)		1912.5 (382500)	
NR Band n25: 10 MHz	1855 (371000)		1882.5 (376500)		1910 (382000)	
NR Band n25: 15 MHz	1857.5 (371500)		1882.5 (376500)		1907.5 (381500)	
NR Band n25: 20 MHz	1860 (372000)		1882.5 (376500)		1905 (381000)	
NR Band n25: 25 MHz	1862.5 (372500)		1882.5 (376500)		1902.5 (380500)	
NR Band n25: 30 MHz	1865 (373000)		1882.5 (376500)		1900 (380000)	
NR Band n25: 40 MHz	1870 (374000)		1882.5 (376500)		1895 (379000)	
NR Band n2: 5 MHz	1852.5 (370500)		1880 (376000)		1907.5 (381500)	
NR Band n2: 10 MHz	1855 (371000)		1880 (376000)		1905 (381000)	
NR Band n2: 15 MHz	1857.5 (371500)		1880 (376000)		1902.5 (380500)	
NR Band n2: 20 MHz	1860 (372000)		1880 (376000)		1900 (380000)	
NR Band n41: 10 MHz	2501.01 (500202)	2547 (509400)	2592.99 (518598)		2639.01 (527802)	2685 (537000)
NR Band n41: 15 MHz	2503.5 (500700)	2548.26 (509652)	2592.99 (518598)		2637.75 (527550)	2682.51 (536502)
NR Band n41: 20 MHz	2506.02 (501204)	2549.49 (509898)	2592.99 (518598)		2636.49 (527298)	2679.99 (535998)
NR Band n41: 30 MHz	2511 (502200)	2552.01 (510402)	2592.99 (518598)		2634 (526800)	2674.98 (534996)
NR Band n41: 40 MHz	2516.01 (503202)	2567.34 (513468)	N/A		2618.67 (523734)	2670 (534000)
NR Band n41: 50 MHz	2521.02 (504204)		2592.99 (518598)		2664.99 (532998)	
NR Band n41: 60 MHz	2526 (505200)		2592.99 (518598)		2659.98 (531996)	
NR Band n41: 70 MHz	2531.01 (506202)		N/A		2655 (531000)	
NR Band n41: 80 MHz	2536.02 (507204)		N/A		2649.99 (529998)	
NR Band n41: 90 MHz	2541 (508200)		N/A		2644.98 (528996)	
NR Band n41: 100 MHz	2546.01 (509202)		2592.99 (518598)		2640 (528000)	
NR Band n77 DoD: 10 MHz	3455.01 (630334)		3500.01 (633334)		3544.98 (636332)	
NR Band n77 DoD: 15 MHz	3457.5 (630500)		3500.01 (633334)		3542.49 (636166)	
NR Band n77 DoD: 20 MHz	3460.02 (630668)		3500.01 (633334)		3540 (636000)	
NR Band n77 DoD: 30 MHz	3465 (631000)		3500.01 (633334)		3534.99 (635666)	
NR Band n77 DoD: 40 MHz	3470.01 (631334)		N/A		3470.01 (631334)	
NR Band n77 DoD: 50 MHz	3475.02 (631668)		N/A		3475.02 (631668)	
NR Band n77 DoD: 60 MHz	N/A		3500.01(633334)		N/A	
NR Band n77 DoD: 70 MHz	N/A		3500.01(633334)		N/A	
NR Band n77 DoD: 80 MHz	N/A		3500.01(633334)		N/A	
NR Band n77 DoD: 90 MHz	N/A		3500.01(633334)		N/A	
NR Band n77 DoD: 100 MHz	N/A		3500.01(633334)		N/A	
NR Band n77: 10 MHz	3705 (647000)	3759 (650600)	3813 (654200)	3867 (657800)	3921 (661400)	3975 (665000)
NR Band n77: 15 MHz	3707.52 (647168)	3760.5 (650700)	3813.51 (654234)	3866.49 (657766)	3919.5 (661300)	3972.48 (664832)
NR Band n77: 20 MHz	3710.01 (647334)	3762 (650800)	3813.99 (654266)	3866.01 (657734)	3918 (661200)	3969.99 (664666)
NR Band n77: 30 MHz	3715.02 (647668)	3765 (651000)	3815.01 (654334)	3864.99 (657666)	3915 (661000)	3964.98 (664332)
NR Band n77: 40 MHz	3720 (648000)	3768 (651200)	3816 (654400)	3864 (657600)	3912 (660800)	3960 (664000)
NR Band n77: 50 MHz	3725.01 (648334)	3782.49 (652166)	3840 (656000)		3897.51 (659834)	3954.99 (663666)
NR Band n77: 60 MHz	3730.02 (648668)	3803.34 (653556)	N/A	N/A	3876.66 (658444)	3949.98 (663332)
NR Band n77: 70 MHz	3735 (649000)	3804.99 (653666)	N/A		3875.01 (658334)	3945 (663000)
NR Band n77: 80 MHz	3740.01 (649334)	N/A	3840 (656000)		N/A	3939.99 (662666)
NR Band n77: 90 MHz	3745.02 (649668)	N/A	3840 (656000)		N/A	3934.98 (662332)
NR Band n77: 100 MHz	3750 (650000)	N/A	N/A	N/A	N/A	3930 (662000)
SCS for NR Band: n5/n66/n25/n2	15 kHz					
SCS for NR Band: n41/n77	30 kHz					
Modulations Supported in UL	DFT-s-OFDM: π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM CP-OFDM: QPSK, 16QAM, 64QAM, 256QAM					
A-MPR (Additional MPR) disabled for SAR Testing?	YES					
EN-DC 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 12/13/5/2					
LTE Anchor Bands for NR Band n25	LTE Band 12/13					
LTE Anchor Bands for NR Band n2	LTE Band 12/13/5/66/4					
LTE Anchor Bands for NR Band n41	LTE Band 12/66/4					
LTE Anchor Bands for NR Band n77	LTE Band 12/13/5/66/25/2					

3 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.

3.1 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 3-1).

Equation 3-1
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]

4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

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

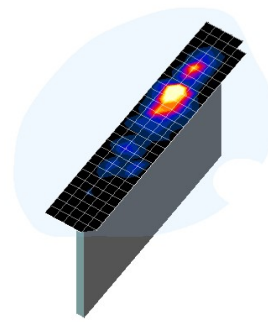

Figure 4-1
Sample SAR Area Scan

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 4-1) 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 4-1) 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 4-1. 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 4-1
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*$\Delta z_{zoom}(n-1)$	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 22

*Also compliant to IEEE 1528-2013 Table 6

5 DEFINITION OF REFERENCE POINTS

5.1 EAR REFERENCE POINT

Figure 5-2 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 5-1. 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 5-1). 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].

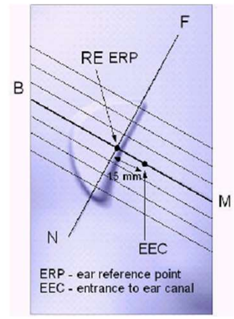

Figure 5-1
Close-Up Side view of ERP

5.2 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 5-3). 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 5-2
Front, back and side view of SAM Twin Phantom

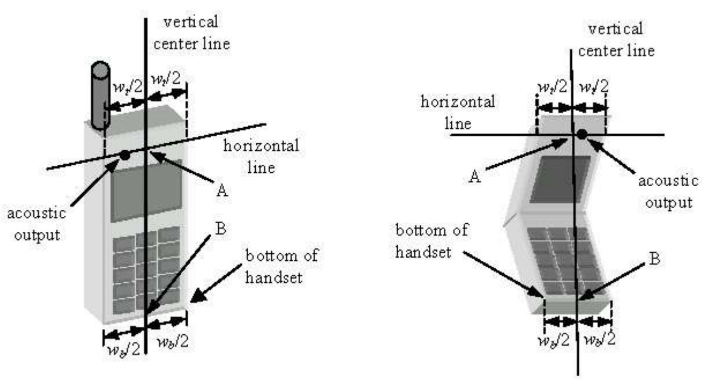

Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

6 TEST CONFIGURATION POSITIONS

6.1 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.

6.2 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 6-1), 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 6-1 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 6-2).

6.3 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 6-2).

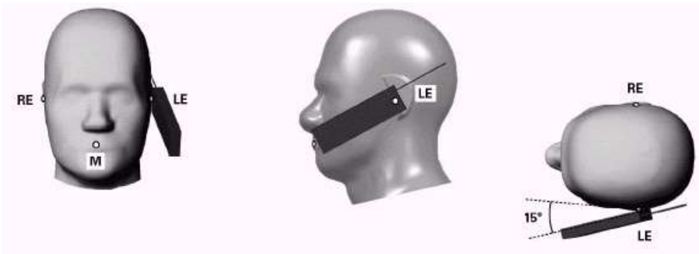

Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

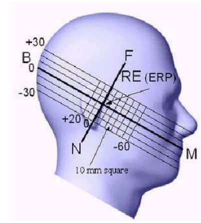

Figure 6-3
Side view w/ relevant markings

6.4 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 RF EXPOSURE LIMITS

7.1 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.

7.2 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 7-1
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.

8 FCC MEASUREMENT PROCEDURES

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8.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, 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.

8.2 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.

8.3 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.

8.3.1 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.

8.3.2 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.

8.3.3 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.

8.3.4 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.

8.3.5 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.

8.3.6 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.

8.3.7 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 8.3.6). When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

8.3.8 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.

8.3.9 MIMO SAR considerations

Per KDB Publication 248227 D01v02r02, the simultaneous SAR provisions in KDB Publication 447498 D01v06 should be applied to determine simultaneous transmission SAR test exclusion for WIFI MIMO. If the sum of 1g single transmission chain SAR measurements is <1.6 W/kg, no additional SAR measurements for MIMO are required. Alternatively, SAR for MIMO can be measured with all antennas transmitting simultaneously at the specified maximum output power of MIMO operation. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

9 RF CONDUCTED POWERS

9.1 WLAN Conducted Powers

Table 9-1
2.4 GHz WLAN Reduced Average RF Power with RCV Active and/or During Conditions with 5/6 GHz WLAN and/or 5G NR– Ant 2

2.4GHz Conducted Power [dBm]						
Freq [MHz]	Channel	IEEE Transmission Mode				
		802.11b	802.11g	802.11n	802.11ac	802.11ax
		Average	Average	Average	Average	Average
2412	1	8.92	8.45	8.12	8.11	8.27
2437	6	8.59	8.63	8.49	8.51	8.44
2462	11	8.83	8.41	8.36	8.41	8.39

Table 9-2
2.4 GHz WLAN Reduced Average RF Power with RCV Active and/or During Conditions with 5/6 GHz WLAN and/or 5G NR– MIMO

2.4GHz 802.11n Conducted Power [dBm]				
Freq [MHz]	Channel	ANT1	ANT2	MIMO
2412	1	8.86	8.66	11.77
2437	6	8.61	8.40	11.52
2462	11	8.69	8.50	11.61

Table 9-3
5 GHz WLAN Reduced Average RF Power with RCV Active and/or During Conditions with 2.4 GHz WLAN/BT and/or 5G NR– MIMO

5GHz (80MHz) 802.11ac Conducted Power [dBm]				
Freq [MHz]	Channel	ANT1	ANT2	MIMO
5210	42	11.79	11.51	14.66
5290	58	11.65	11.45	14.56
5530	106	11.85	11.69	14.78
5610	122	11.76	11.55	14.67
5690	138	11.71	11.67	14.70
5775	155	11.91	11.81	14.87
5855	171	11.88	11.74	14.82

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.

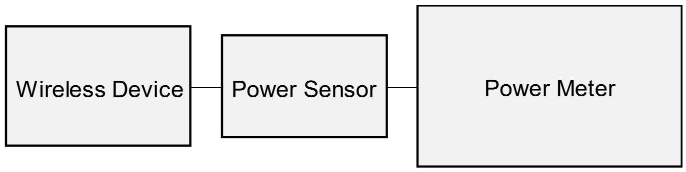

Figure 9-1
Power Measurement Setup

9.1 Bluetooth Conducted Powers

Table 9-4
Bluetooth Measured Average RF Power with RCV Active – Antenna 1

Frequency [MHz]	Data Rate [Mbps]	Mod.	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	1.0	GFSK	0	**5.46**	3.513
2441	1.0	GFSK	39	**6.49**	4.459
2480	1.0	GFSK	78	**5.37**	3.442

Table 9-5
Bluetooth Measured Average RF Power with RCV Active – Antenna 2

Frequency [MHz]	Data Rate [Mbps]	Mod.	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	1.0	GFSK	0	**9.00**	7.936
2441	1.0	GFSK	39	**9.62**	9.163
2480	1.0	GFSK	78	**8.33**	6.801

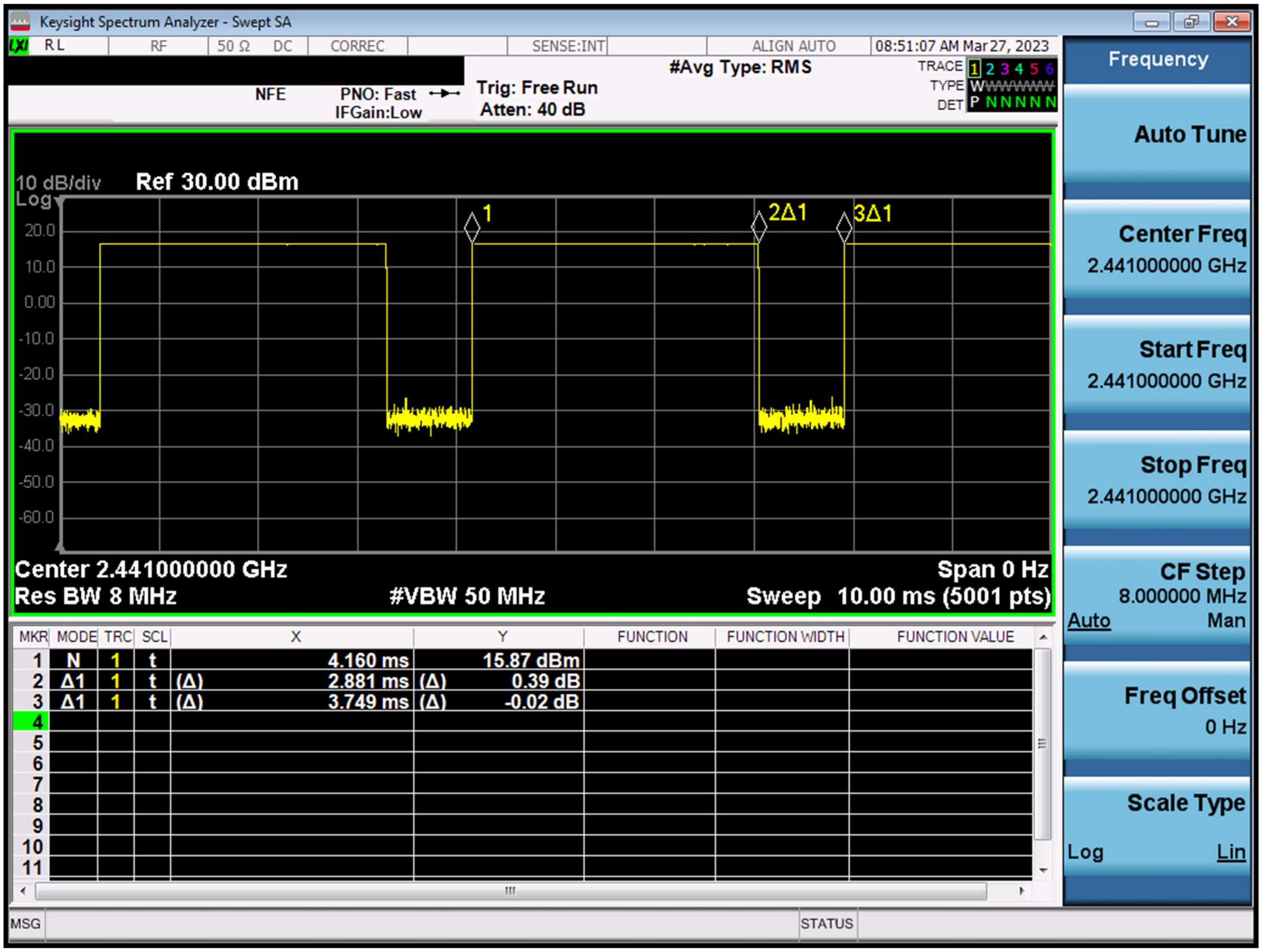

Figure 9-2
Bluetooth Antenna 1 Transmission Plot

Equation 9-1
Bluetooth Antenna 1 Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.881ms}{3.749ms} * 100\% = 76.8\%$$

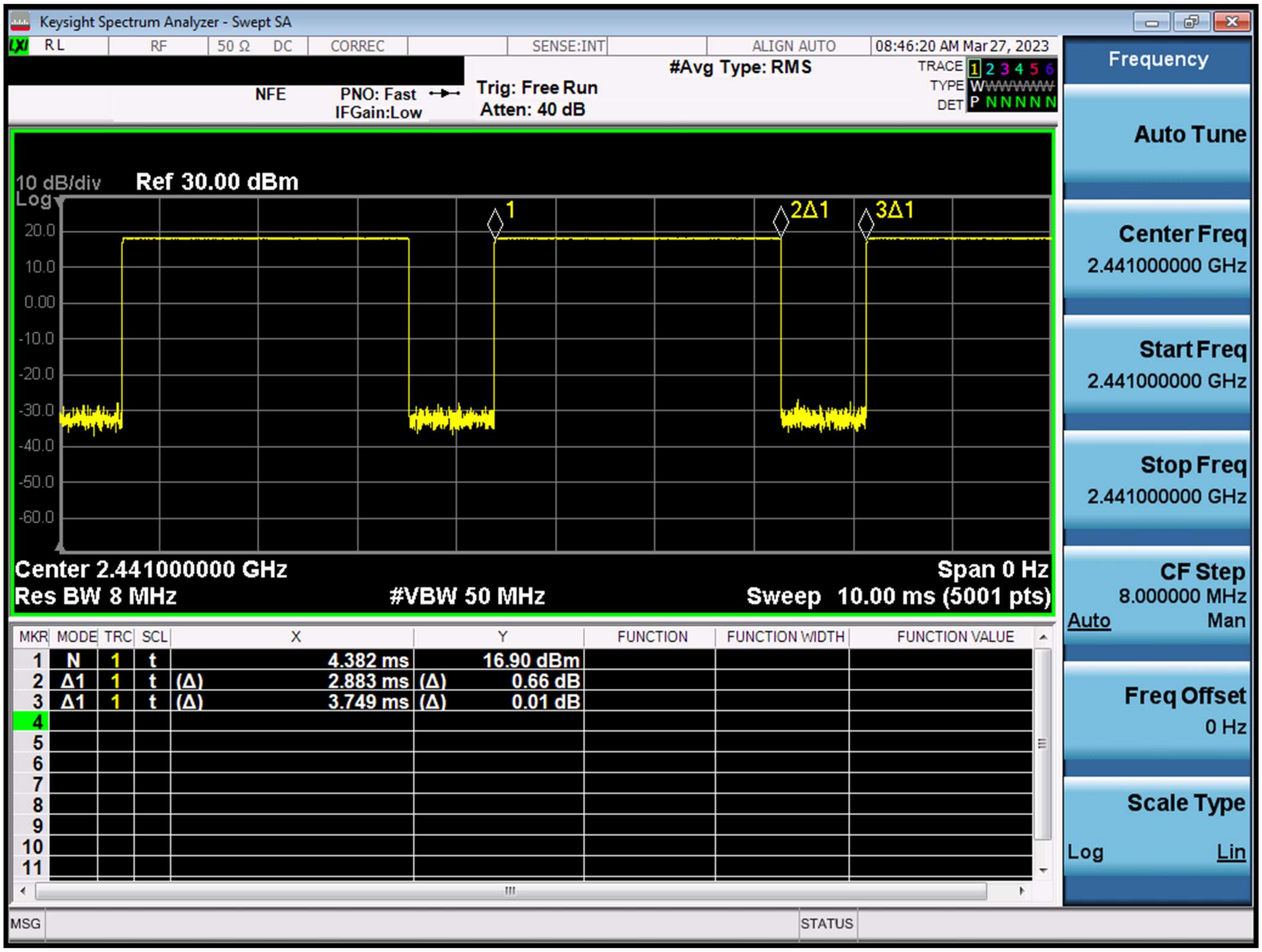

Figure 9-3
Bluetooth Antenna 2 Transmission Plot

Equation 9-2
Bluetooth Antenna 2 Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.883ms}{3.749ms} * 100\% = 76.9\%$$

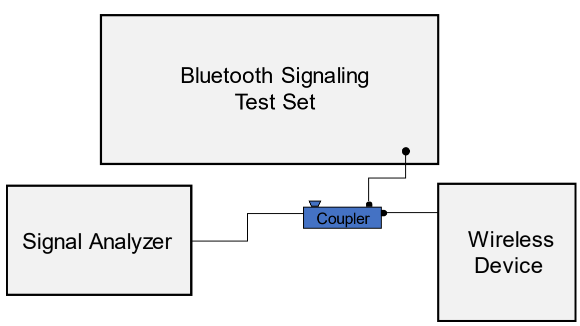

Figure 9-4
Power Measurement Setup

10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
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
06/20/2023	2450 Head	22.9	2300	1.696	38.953	1.670	39.500	1.56%	-1.38%
			2310	1.703	38.940	1.679	39.480	1.43%	-1.37%
			2320	1.710	38.927	1.687	39.460	1.36%	-1.35%
			2400	1.769	38.822	1.756	39.289	0.74%	-1.19%
			2450	1.808	38.745	1.800	39.200	0.44%	-1.16%
			2480	1.830	38.694	1.833	39.162	-0.16%	-1.20%
			2500	1.844	38.660	1.855	39.136	-0.59%	-1.22%
			2510	1.851	38.645	1.866	39.123	-0.80%	-1.22%
			2535	1.871	38.601	1.893	39.092	-1.16%	-1.26%
			2550	1.883	38.578	1.909	39.073	-1.36%	-1.27%
			2560	1.892	38.563	1.920	39.060	-1.46%	-1.27%
			2600	1.922	38.509	1.964	39.009	-2.14%	-1.28%
			2650	1.958	38.398	2.018	38.945	-2.97%	-1.40%
			2680	1.984	38.356	2.051	38.907	-3.27%	-1.42%
			2700	1.998	38.344	2.073	38.882	-3.62%	-1.38%
06/21/2023	2450 Head	20.2	2300	1.728	39.745	1.670	39.500	3.47%	0.62%
			2310	1.736	39.732	1.679	39.480	3.39%	0.64%
			2320	1.743	39.718	1.687	39.460	3.32%	0.65%
			2400	1.803	39.615	1.756	39.289	2.68%	0.83%
			2450	1.841	39.536	1.800	39.200	2.28%	0.86%
			2480	1.863	39.499	1.833	39.162	1.64%	0.86%
			2500	1.877	39.470	1.855	39.136	1.19%	0.85%
			2510	1.885	39.455	1.866	39.123	1.02%	0.85%
			2535	1.905	39.412	1.893	39.092	0.63%	0.82%
			2550	1.917	39.391	1.909	39.073	0.42%	0.81%
			2560	1.925	39.380	1.920	39.060	0.26%	0.82%
			2600	1.955	39.321	1.964	39.009	-0.46%	0.80%
			2650	1.994	39.230	2.018	38.945	-1.19%	0.73%
			2680	2.018	39.191	2.051	38.907	-1.61%	0.73%
			2700	2.031	39.157	2.073	38.882	-2.03%	0.71%
05/30/2023	5200-5800 Head	19.1	5180	4.687	36.521	4.635	36.009	1.12%	1.42%
			5190	4.684	36.518	4.645	35.998	0.84%	1.44%
			5200	4.683	36.489	4.655	35.986	0.60%	1.40%
			5210	4.683	36.430	4.666	35.975	0.36%	1.26%
			5220	4.689	36.356	4.676	35.963	0.28%	1.09%
			5240	4.728	36.241	4.696	35.940	0.68%	0.84%
			5250	4.755	36.212	4.706	35.929	1.04%	0.79%
			5260	4.782	36.208	4.717	35.917	1.38%	0.81%
			5270	4.803	36.242	4.727	35.906	1.61%	0.94%
			5280	4.818	36.282	4.737	35.894	1.71%	1.08%
			5290	4.828	36.311	4.748	35.883	1.68%	1.19%
			5300	4.826	36.298	4.758	35.871	1.43%	1.19%
			5310	4.819	36.270	4.768	35.860	1.07%	1.14%
			5320	4.813	36.223	4.778	35.849	0.73%	1.04%
			5500	5.074	35.808	4.963	35.643	2.24%	0.46%
			5510	5.082	35.846	4.973	35.632	2.19%	0.60%
			5520	5.080	35.869	4.983	35.620	1.95%	0.70%
			5530	5.080	35.850	4.994	35.609	1.72%	0.68%
			5540	5.082	35.794	5.004	35.597	1.56%	0.55%
			5550	5.085	35.716	5.014	35.586	1.42%	0.37%
			5560	5.094	35.631	5.024	35.574	1.39%	0.16%
			5580	5.138	35.542	5.045	35.551	1.84%	-0.03%
			5600	5.182	35.552	5.065	35.529	2.31%	0.06%
			5610	5.198	35.586	5.076	35.518	2.40%	0.19%
			5620	5.206	35.604	5.086	35.506	2.36%	0.28%
			5640	5.212	35.584	5.106	35.483	2.08%	0.28%
			5660	5.226	35.468	5.127	35.460	1.93%	0.02%
			5670	5.241	35.392	5.137	35.449	2.02%	-0.16%
			5680	5.263	35.344	5.147	35.437	2.25%	-0.26%
			5690	5.282	35.337	5.158	35.426	2.40%	-0.25%
			5700	5.301	35.348	5.168	35.414	2.57%	-0.19%
			5710	5.316	35.363	5.178	35.403	2.67%	-0.11%
			5720	5.327	35.376	5.188	35.391	2.68%	-0.04%
			5745	5.329	35.351	5.214	35.363	2.21%	-0.03%
			5750	5.330	35.324	5.219	35.357	2.13%	-0.09%
			5755	5.333	35.290	5.224	35.351	2.09%	-0.17%
			5765	5.345	35.206	5.234	35.340	2.12%	-0.38%
			5775	5.367	35.132	5.245	35.329	2.33%	-0.56%
			5785	5.391	35.083	5.255	35.317	2.59%	-0.66%
			5795	5.415	35.078	5.265	35.305	2.85%	-0.64%
			5800	5.428	35.090	5.270	35.300	3.00%	-0.59%
			5805	5.439	35.105	5.275	35.294	3.11%	-0.54%
			5825	5.462	35.186	5.296	35.271	3.13%	-0.24%
			5835	5.455	35.216	5.305	35.230	2.83%	-0.04%
			5845	5.445	35.219	5.315	35.210	2.45%	0.03%
			5855	5.439	35.181	5.325	35.197	2.14%	-0.05%
			5865	5.443	35.096	5.336	35.190	2.01%	-0.27%
			5875	5.453	35.002	5.347	35.183	1.98%	-0.51%
			5885	5.473	34.926	5.357	35.177	2.17%	-0.71%
			5905	5.538	34.878	5.379	35.163	2.96%	-0.81%

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.

10.2 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 10-2
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 (%)
O	2450	HEAD	06/20/2023	24.6	22.9	0.10	981	7570	1558	4.940	53.900	49.400	-8.35%	2.330	25.400	23.300	-8.27%
K2	2450	HEAD	06/21/2023	19.7	20.2	0.10	945	7565	1466	5.530	51.900	55.300	6.55%	2.540	24.600	25.400	3.25%
G	5250	HEAD	05/30/2023	21.1	20.1	0.05	1191	7417	665	3.660	80.400	73.200	-8.96%	1.040	23.100	20.800	-9.96%
G	5600	HEAD	05/30/2023	21.1	20.1	0.05	1191	7417	665	3.990	81.900	79.800	-2.56%	1.130	23.300	22.600	-3.00%
G	5750	HEAD	05/30/2023	21.1	20.1	0.05	1191	7417	665	3.580	78.400	71.600	-8.67%	1.020	22.300	20.400	-8.52%
G	5800	HEAD	05/30/2023	21.1	20.1	0.05	1191	7417	665	3.600	79.000	72.000	-8.86%	1.030	22.300	20.600	-7.62%

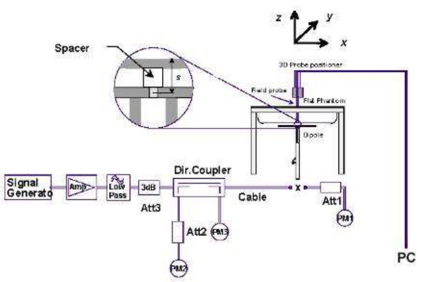

Figure 10-1
System Verification Setup Diagram

Figure 10-2
System Verification Setup Photo

11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
DTS Head SISO SAR

MEASUREMENT RESULTS																				
FREQUENCY		Side	Test Position	Mode	Service	Antenna Config.	Form Factor	Device Serial Number	Bandwidth [MHz]	Data Rate (Mbps)	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Maximum Duty Cycle (%)	Duty Cycle (%)	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)			(W/kg)	
2412	1	Right	Cheek	802.11b	DSSS	2	Open	1319M	22	1	9.0	8.92	0.12	100.00	98.74	0.030	1.019	1.013	0.031	
2412	1	Right	Tilt	802.11b	DSSS	2	Open	1319M	22	1	9.0	8.92	0.01	100.00	98.74	0.028	1.019	1.013	0.029	
2412	1	Left	Cheek	802.11b	DSSS	2	Open	1319M	22	1	9.0	8.92	-0.06	100.00	98.74	0.096	1.019	1.013	**0.099**	A1
2412	1	Left	Tilt	802.11b	DSSS	2	Open	1319M	22	1	9.0	8.92	0.06	100.00	98.74	0.056	1.019	1.013	0.058	
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 11-2
NII MIMO Head SAR

MEASUREMENT RESULTS																					
FREQUENCY		Side	Test Position	Mode	Service	Antenna Config.	Device Serial Number	Bandwidth [MHz]	Data Rate (Mbps)	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Maximum Duty Cycle (%)	Duty Cycle (%)	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.																(W/kg)			(W/kg)	
5290	58	Right	Cheek	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.65	12.0	11.45	0.04	100.00	99.80	0.309	1.135	1.002	**0.351**	
5290	58	Right	Tilt	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.65	12.0	11.45	-0.02	100.00	99.80	0.213	1.135	1.002	0.242	
5290	58	Left	Cheek	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.65	12.0	11.45	0.17	100.00	99.80	0.093	1.135	1.002	0.106	
5290	58	Left	Tilt	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.65	12.0	11.45	-0.16	100.00	99.80	0.077	1.135	1.002	0.088	
5530	106	Right	Cheek	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.85	12.0	11.69	-0.03	100.00	99.80	0.282	1.074	1.002	0.303	
5530	106	Right	Tilt	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.85	12.0	11.69	0.12	100.00	99.80	0.254	1.074	1.002	0.273	
5530	106	Left	Cheek	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.85	12.0	11.69	-0.02	100.00	99.80	0.113	1.074	1.002	0.122	
5530	106	Left	Tilt	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.85	12.0	11.69	-0.17	100.00	99.80	0.104	1.074	1.002	0.112	
5775	155	Right	Cheek	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.91	12.0	11.81	0.02	100.00	99.80	0.312	1.045	1.002	0.327	A2
5775	155	Right	Tilt	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.91	12.0	11.81	0.04	100.00	99.80	0.304	1.045	1.002	0.318	
5775	155	Left	Cheek	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.91	12.0	11.81	0.15	100.00	99.80	0.133	1.045	1.002	0.139	
5775	155	Left	Tilt	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.91	12.0	11.81	-0.07	100.00	99.80	0.158	1.045	1.002	0.165	
5855	171	Right	Cheek	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.88	12.0	11.74	0.01	100.00	99.80	0.234	1.062	1.002	0.249	
5855	171	Right	Tilt	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.88	12.0	11.74	0.06	100.00	99.80	0.222	1.062	1.002	0.236	
5855	171	Left	Cheek	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.88	12.0	11.74	-0.07	100.00	99.80	0.167	1.062	1.002	0.178	
5855	171	Left	Tilt	802.11ac	OFDM	MIMO	1391M	80	58.5	12.0	11.88	12.0	11.74	-0.05	100.00	99.80	0.125	1.062	1.002	0.133	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Head 1.6 W/kg (mW/g) averaged over 1 gram										

Note: To achieve the 15.0 dBm maximum allowed MIMO power shown in the documentation, each antenna transmits at a maximum allowed power of 12.0 dBm.

Table 11-3
DSS Head SISO SAR

MEASUREMENT RESULTS																			
FREQUENCY		Side	Test Position	Mode	Service	Antenna Config.	Form Factor	Device Serial Number	Data Rate (Mbps)	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Maximum Duty Cycle (%)	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.														(W/kg)			(W/kg)	
2441	39	Right	Cheek	Bluetooth	FHSS	1	Open	1365M	1	7.0	6.49	0.02	78.00	76.85	0.059	1.125	1.015	0.067	
2441	39	Right	Tilt	Bluetooth	FHSS	1	Open	1365M	1	7.0	6.49	0.01	78.00	76.85	0.035	1.125	1.015	0.040	
2441	39	Left	Cheek	Bluetooth	FHSS	1	Open	1365M	1	7.0	6.49	0.03	78.00	76.85	0.010	1.125	1.015	0.011	
2441	39	Left	Tilt	Bluetooth	FHSS	1	Open	1365M	1	7.0	6.49	0.07	78.00	76.85	0.007	1.125	1.015	0.008	
2441	39	Right	Cheek	Bluetooth	FHSS	2	Open	1365M	1	10.0	9.62	0.19	78.00	76.90	0.028	1.091	1.014	0.031	
2441	39	Right	Tilt	Bluetooth	FHSS	2	Open	1365M	1	10.0	9.62	0.01	78.00	76.90	0.026	1.091	1.014	0.029	
2441	39	Left	Cheek	Bluetooth	FHSS	2	Open	1365M	1	10.0	9.62	0.08	78.00	76.90	0.090	1.091	1.014	0.100	A3
2441	39	Left	Tilt	Bluetooth	FHSS	2	Open	1365M	1	10.0	9.62	0.20	78.00	76.90	0.046	1.091	1.014	0.051	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram									

11.2 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 D01v06.
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 D01v06.
6. Per FCC KDB 865664 D01v01r04, variability SAR tests were not required since measured SAR for all frequency bands were less than 0.8 W/kg.
7. 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.
8. This device uses Qualcomm Smart Transmit for WWAN 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 (DSI).

WLAN Notes:

1. 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 8.3.5 for more information.
2. 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 8.3.6 for more information.
3. Per KDB Publication 248227 D01v02r02, SAR for MIMO was evaluated by following the simultaneous SAR provisions from KDB Publication 447498 D01v06 by either evaluating the sum of the 1g SAR values of each antenna transmitting independently or making a SAR measurement with both antennas transmitting simultaneously. Please see Multi-Tx and Antenna SAR Consideration Appendix for complete analysis.

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 Section 9 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.
3. The highest frame average power configurations for both Bluetooth and Bluetooth LE were evaluated for SAR. The worst case configuration was used for the remaining test positions as the most conservative scenario.
4. Bluetooth LE was not evaluated since additional checks on Bluetooth LE in the original filing was found to be lower than Bluetooth

12 SAR MEASUREMENT VARIABILITY

12.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability is assessed when the highest measured SAR is ≥ 0.80 W/kg. Since all measured SAR values are < 0.80 W/kg for this device, SAR measurement variability was not assessed

12.2 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.

13 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	1/18/2023	Annual	1/18/2024	MY47270002
Agilent	E4438C	ESG Vector Signal Generator	4/25/2023	Annual	4/25/2024	US41460739
Agilent	N5182A	MXG Vector Signal Generator	11/30/2022	Annual	11/30/2023	MY47420603
Agilent	N5182A	MXG Vector Signal Generator	4/1/2023	Annual	4/1/2024	MY47420837
Agilent	N5182A	MXG Vector Signal Generator	7/4/2022	Annual	7/4/2023	MY48180366
Agilent	8753ES	S-Parameter Vector Network Analyzer	1/12/2023	Annual	1/12/2024	MY40001472
Agilent	8753ES	S-Parameter Vector Network Analyzer	6/14/2022	Annual	6/14/2023	US39170118
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB46170464
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Amplifier Research	150A100C	Amplifier	CBT	N/A	CBT	350132
Anritsu	ML2496A	Power Meter	4/4/2023	Annual	4/4/2024	1840005
Anritsu	ML2496A	Power Meter	8/16/2022	Annual	8/16/2023	1351001
Anritsu	MA2411B	Pulse Power Sensor	1/10/2023	Annual	1/10/2024	1315051
Anritsu	MA2411B	Pulse Power Sensor	10/21/2022	Annual	10/21/2023	1207364
Anritsu	MA24106A	USB Power Sensor	2/9/2023	Annual	2/9/2024	1520505
Anritsu	MA24106A	USB Power Sensor	4/21/2023	Annual	4/21/2024	1244515
Anritsu	MA24106A	USB Power Sensor	1/13/2023	Annual	1/13/2024	1344557
Mini-Circuits	PWR-4GHS	USB Power Sensor	11/11/2022	Annual	11/11/2023	11710030062
Control Company	4352	Long Stem Thermometer	9/10/2021	Biennial	9/10/2023	210774678
Control Company	4352	Long Stem Thermometer	9/10/2021	Biennial	9/10/2023	210774685
Control Company	4352	Long Stem Thermometer	9/10/2021	Biennial	9/10/2023	210774675
Control Company	4040	Therm./ Clock/ Humidity Monitor	1/17/2023	Annual	1/17/2024	160574418
Mitutoyo	500-196-30	CD-6"ASX 6Inch Digital Caliper	2/16/2022	Triennial	2/16/2025	A20238413
Keysight Technologies	N6705B	DC Power Analyzer	5/5/2021	Triennial	5/5/2024	MY53004059
Keysight Technologies	N9020A	MXA Signal Analyzer	3/15/2023	Annual	3/15/2024	US46470561
Keysight Technologies	N9020A	MXA Signal Analyzer	4/6/2023	Annual	4/6/2024	MY48010233
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
Mini-Circuits	VLF-6000+	Low Pass Filter DC to 6000 MHz	CBT	N/A	CBT	31634
Mini-Circuits	VLF-6000+	Low Pass Filter DC to 6000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	CBT	N/A	CBT	2050
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	CBT	N/A	CBT	2111
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Seekonk	TSF-100	Torque Wrench	7/11/2022	Annual	7/11/2023	47639-29
SPEAG	DAK-3.5	Dielectric Assessment Kit	12/15/2022	Annual	12/15/2023	1278
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/15/2022	Annual	8/15/2023	1041
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	9/19/2022	Annual	9/19/2023	1045
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	7/5/2022	Annual	7/5/2023	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	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1237
SPEAG	D2450V2	2450 MHz SAR Dipole	5/11/2023	Annual	5/11/2024	945
SPEAG	D2450V2	2450 MHz SAR Dipole	11/25/2021	Biennial	11/25/2023	981
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/18/2023	Annual	1/18/2024	1191
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/15/2023	Annual	2/15/2024	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/20/2023	Annual	1/20/2024	1466
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/17/2023	Annual	1/17/2024	1558
SPEAG	EX3DV4	SAR Probe	2/8/2023	Annual	2/8/2024	7417
SPEAG	EX3DV4	SAR Probe	1/12/2023	Annual	1/12/2024	7565
SPEAG	EX3DV4	SAR Probe	1/11/2023	Annual	1/11/2024	7570

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.

14 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

15 CONCLUSION

15.1 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]

16 REFERENCES

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