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# SAR TEST REPORT

<b>Applicant Name:</b> <b>SAMSUNG Electronics Co., Ltd.</b> 129, Samsung-ro, Yeongtong-gu, Suwon-Si, Gyeonggi-do, 16677 Rep. of Korea	<b>Date of Issue:</b> Dec. 14, 2021 <b>Test Report No.:</b> HCT-SR-2111-FC016-R1 <b>Test Site:</b> HCT CO., LTD.
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**FCC ID:**

**A3LSMX800**

<b>Equipment Type:</b>	<b>Tablet</b>
<b>Application Type</b>	<b>Certification</b>
<b>FCC Rule Part(s):</b>	<b>CFR §2.1093</b>
<b>Model Name:</b>	<b>SM-X800</b>
<b>Date of Test:</b>	<b>Nov. 16. 2021 ~ Nov. 29. 2021</b>

This device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in FCC KDB procedures and had been tested in accordance with the measurement procedures specified in FCC KDB procedures.

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.

Tested By

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**REVISION HISTORY**

The revision history for this test report is shown in table.

<b>Revision No.</b>	<b>Date of Issue</b>	<b>Description</b>
0	Nov. 30, 2021	Initial Release
1	Dec. 14, 2021	Revised sec.4. ,sec.11, sec.13 and Appendix.H

This test results were applied only to the test methods required by the standard.

The above Test Report is not related to the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA.

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Appendix A. DUT Ant. Information & Test SETUP PHOTO

Appendix B. SAR Test Plots

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Appendix D. SAR Tissue Characterization

Appendix E. SAR System Validation

Appendix F. Probe Calibration Data

Appendix G. Dipole Calibration Data

Appendix H. Power reduction verification

## 1. Test Regulations

The tests documented in this report were performed in accordance with FCC CFR § 2.1093, IEEE 1528-2013, ANSI C63.26-2015 the following FCC Published RF exposure KDB procedures:

- FCC KDB Publication 941225 D01 3G SAR Procedures v03r01
- FCC KDB Publication 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB Publication 447498 D01 General SAR Guidance v06
- FCC KDB Publication 616217 D04 SAR Tablets v01r02
- FCC KDB Publication 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- FCC KDB Publication 865664 D02 SAR Reporting v01r02
- FCC KDB Publication 690783 D01 SAR Listings on Grants v01r03
- FCC KDB Publication 971168 D01 Power Meas License Digital Systems v03r01

In Addition to the above, the following information was used.

- April 2015 TCB Workshop Notes (Simultaneous transmission summation clarified)
- October 2016 TCB Workshop Notes (Bluetooth Duty Factor)
- April 2019 TCBC Workshop Notes (IEEE 802.11 ax)

## 2. Test Location

### 2.1 Test Laboratory

<b>Company Name</b>	HCT Co., Ltd.
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### 2.2 Test Facilities

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

<b>Korea</b>	National Radio Research Agency (Designation No. KR0032)
	KOLAS (Testing No. KT197)

### 3. Information of the EUT

#### 3.1 General Information of the EUT

<b>Model Name</b>	SM-X800
<b>Equipment Type</b>	Tablet
<b>FCC ID</b>	A3LSMX800
<b>Application Type</b>	Certification
<b>Applicant</b>	SAMSUNG Electronics Co., Ltd.

#### 3.2 Attestation of test result of device under test

Band	Tx. Frequency	Equipment Class	SAR (W/kg)
			Reported 1g Body SAR
802.11b	2 412 MHz ~ 2 472 MHz	DTS	1.33
U-NII-1	5 180 MHz ~ 5 240 MHz	NII	N/A
U-NII-2A	5 260 MHz ~ 5 320 MHz	NII	0.94
U-NII-2C	5 500 MHz ~ 5 720 MHz	NII	0.90
U-NII-3	5 745 MHz ~ 5 825 MHz	NII	0.91
U-NII-4	5 845 MHz ~ 5 885 MHz	NII	0.98
Bluetooth	2 402 MHz ~ 2 480 MHz	DSS	0.60
Simultaneous SAR per KDB 690783 D01v01r03			<b>1.595</b>
Date(s) of Tests:	Nov. 16. 2021 ~ Nov. 29. 2021		

## 4. Device Under Test Description

### 4.1 DUT specification

Device Wireless specification overview		
Band & Mode	Operating Mode	Tx Frequency
802.11b	Data	2 412 MHz ~ 2 472 MHz
U-NII-1	Data	5 180 MHz ~ 5 240 MHz
U-NII-2A	Data	5 260 MHz ~ 5 320 MHz
U-NII-2C	Data	5 500 MHz ~ 5 720 MHz
U-NII-3	Data	5 745 MHz ~ 5 825 MHz
U-NII-4	Data	5 845 MHz ~ 5 885 MHz
U-NII-5	Data	5 935 MHz ~ 6 415 MHz
U-NII-6	Data	6 435 MHz ~ 6 525 MHz
U-NII-7	Data	6 535 MHz ~ 6 875 MHz
U-NII-8	Data	6 895 MHz ~ 7 115 MHz
Bluetooth	Data	2 402 MHz ~ 2 480 MHz
S-PEN	Data	530 kHz
Device Description		
H/W	REV0.2	
S/W	X800.001	
Device Serial Numbers	Mode	Serial Number
	Bluetooth	UJM1784M/ UJM1781M
	WLAN	UJM1781M/ UJM1784M
		UJM1781M/ UJM1784M
		UJJ1517M
The manufacturer has confirmed that the devices tested have the same physical, mechanical and thermal characteristics are within operational tolerances expected for production units.		

### 4.2 Power Reduction for SAR

This device uses an independent fixed level power reduction mechanism for WLAN operations When 2.4 GHz WLAN mode and 5 GHz/6 GHz WLAN mode are simultaneously transmitted, and also during activating in close proximity to the user’s Body

FCC KDB Publication 616217 D04v01r02 Sec.6 was used as a guideline for selection SAR test distances for device

The reduced powers for the power reduction mechanisms were conformed via conducted power measurements at the RF Port.

### 4.3 Nominal and Maximum Output Power Specifications

This device operates using the following maximum output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB publication 447498 D01v06.

#### 4.3.1 Maximum 2.4 GHz, 5 GHz WIFI output power

Mode	SISO						MIMO					
	a	b	g	n	ac	ax(SU)	a	b	g	n	ac	ax(SU)
2.4GHz		15.0 (12ch:5) (13ch:1)	16.0 (12ch:5) (13ch:1)	17.0 (11ch:15.5) (12ch:5) (13ch:1)		17.0 (11ch:15.5) (12ch:5) (13ch:1)		18.0 (12ch:8) (13ch:2)	19.0 (12ch:8) (13ch:2)	20.0 (11ch:18.5) (12ch:8) (13ch:2)		20.0 (11ch:18.5) (12ch:8) (13ch:2)
5GHz (20MHz BW)	16.0 (48ch : 11) (149-177ch:1 4)			16.0 (48ch : 11) (149-177ch:1 4)	16.0 (48ch : 11) (149-177ch:1 4)	16.0 (48ch : 11) (149-177ch:1 4)	19.0 (48ch :14) (149-177ch:1 7)			19.0 (48ch : 14) (149-177ch:1 7)	19.0 (48ch : 14) (149-177ch:1 7)	19.0 (48ch : 14) (149-177ch:1 7)
5GHz (40MHz BW)				16.0 (38ch: 15) (46ch: 13) (62ch: 14) (102ch: 14) (151-175ch:1 4)	16.0 (38ch: 15) (46ch: 13) (62ch: 14) (102ch: 14) (151-175ch:1 4)	16.0 (46ch: 13) (151-175ch:1 4)				19.0 (38ch: 18) (46ch: 16) (62ch: 17) (102ch: 17) (151-175ch:1 7)	19.0 (38ch: 18) (46ch: 16) (62ch: 17) (102ch: 17) (151-175ch:1 7)	19.0 (46ch: 16) (151-175ch:1 7)
5GHz (80MHz BW)					15.0 (42ch 14) (58ch 13) (106ch 14) (155-171ch:1 4)	15.0 (155-171ch:1 4)					18.0 (42ch 17) (58ch 16) (106ch 17) (155-171ch:1 7)	18.0 (155-171ch:1 7)
5GHz (160MHz BW)						14.0						17.0

(Upper Tolerance: target ~ +1.0 dB)

**4.3.2 Reduced 2.4 GHz, 5 GHz WIFI output power -Grip Active.**

Mode	SISO						MIMO					
	a	b	g	n	ac	ax(SU)	a	b	g	n	ac	ax(SU)
2.4GHz		12.0	12.0	12.0		12.0		15.0	15.0	15.0		15.0
2.4GHz (CH11)		12.0	12.0	12.0		12.0		15.0	15.0	15.0		15.0
2.4GHz (CH12/13)		5.0/-1.0	5.0/-1.0	5.0/-1.0		5.0/-1.0		8.0/2.0	8.0/2.0	8.0/2.0		8.0/2.0
5GHz (20MHz BW)	8.0			8.0	8.0	8.0	11.0			11.0	11.0	11.0
5GHz (40MHz BW)				8.0	8.0	8.0				11.0	11.0	11.0
5GHz (80MHz BW)					8.0	8.0					11.0	11.0
5GHz (160MHz BW)						8.0						11.0

(Upper Tolerance: target ~ +1.0 dB)

**4.3.3 2.4 GHz, 5 GHz WIFI output power –RSDB mode**

Mode	SISO						MIMO					
	a	b	g	n	ac	ax(SU)	a	b	g	n	ac	ax(SU)
2.4GHz		10.0	10.0	10.0		10.0		13.0	13.0	13.0		13.0
2.4GHz (CH11)		10.0	10.0	10.0		10.0		13.0	13.0	13.0		13.0
2.4GHz (CH12/13)		5.0/-1.0	5.0/-1.0	5.0/-1.0		5.0/-1.0		8.0/2.0	8.0/2.0	8.0/2.0		8.0/2.0
5GHz (20MHz BW)	6.0			6.0	6.0	6.0	9.0			9.0	9.0	9.0
5GHz (40MHz BW)				6.0	6.0	6.0				9.0	9.0	9.0
5GHz (80MHz BW)					6.0	6.0					9.0	9.0
5GHz (160MHz BW)						6.0						9.0

(Upper Tolerance: target ~ +1.0 dB)

### 4.3.4 802.11ax RU Power

Tones	SISO (ANT1/2) /in dBm					MIMO (ALL) /in dBm				
	2.4G	5G/20Mhz	5G/40Mhz	5G/80Mhz	5G/160Mhz	2.4G	5G/20Mhz	5G/40Mhz	5G/80Mhz	5G/160Mhz
26T	12.0 (12ch: 5.0) (13ch: -4)					15.0 (12ch: 8.0) (13ch: -1)	10.0 (48Ch: 6)	10.0 (46Ch: 6)	10.0	10.0
52T	13.0 (12ch: 5.0) (13ch: -2)					16.0 (12ch: 8.0) (13ch: 1)	12.5 (48Ch: 8)	12.5 (46Ch: 8)	12.5	12.5 114ch 11
106T	15.0 (12ch: 5.0) (13ch: -1.0)					18.0 (12ch: 8.0) (13ch: 2.0)	14.0 (48Ch: 11)	14.0 (46Ch: 11)	14.0	13.0 114ch 11
242T	15.0 (12ch: 5.0) (13ch: -1.0)					18.0 (12ch: 8.0) (13ch: 2.0)	15.0	15.0	14.0	13.0 114ch 11
484T								15.0	14.0	13.0 114ch 11
996T									14.0	13.0 114ch 11

(Upper Tolerance: target ~ +1.0 dB)

### 4.3.5 Reduced Power 802.11ax RU Tx power – Grip Active

Tones	SISO (ANT1/2) /in dBm					MIMO (ALL) /in dBm				
	2.4G	5G/20Mhz	5G/40Mhz	5G/80Mhz	5G/160 Mhz	2.4G	5G/20Mhz	5G/40Mhz	5G/80Mhz	5G/160Mhz
26T	12.0 12ch: 5.0 13ch -4					15.0 12ch: 8.0 13ch: -1	10.0 (48Ch: 6)	10.0 (46Ch: 6)	10.0	10.0
52T	13.0 12ch: 5.0 13ch: -2					15.0 12ch: 8.0 13ch: 1	11.0 (48Ch: 8)	11.0 (46Ch: 8)	11.0	11.0
106T	12.0 12ch: 5.0 13ch: -1.0					15.0 12ch: 8.0 13ch: 2.0	11.0	11.0	11.0	11.0
242T	12.0 12ch: 5.0 13ch: -1.0					15.0 12ch: 8.0 13ch: 2.0	11.0	11.0	11.0	11.0
484T								11.0	11.0	11.0
996T									11.0	11.0

(Upper Tolerance: target ~ +1.0 dB)

### 4.3.6 802.11ax RU Tx output power – RSDB Mode

Tones	SISO (ANT1/2) /in dBm					MIMO (ALL) /in dBm				
	2.4G	5G/20Mhz	5G/40Mhz	5G/80Mhz	5G/160Mhz	2.4G	5G/20Mhz	5G/40Mhz	5G/80Mhz	5G/160Mhz
26T	10.0 12ch: 5.0 13ch: -4					13.0 12ch: 8.0 13ch: -1	9.0	9.0	9.0	9.0
52T	10.0 12ch: 5.0 13ch: -2					13.0 12ch: 8.0 13ch: 1	9.0	9.0	9.0	9.0
106T	10.0 12ch: 5.0 13ch: -1.0					13.0 12ch: 8.0 13ch: 2.0	9.0	9.0	9.0	9.0
242T	10.0 12ch: 5.0 13ch: -1.0					13.0 12ch: 8.0 13ch: 2.0	9.0	9.0	9.0	9.0
484T								9.0	9.0	9.0
996T									9.0	9.0

(Upper Tolerance: target ~ +1.0 dB)

### 4.3.7 Maximum 6 GHz WIFI output power

Mode	MIMO			
	802.11a		802.11 Ax(SU)	
	Nominal	Maximum	Nominal	Maximum
U-NII 6-7 GHz (20MHz BW)	12	13	12	13
U-NII 6-7 GHz (40MHz BW)			11.5	12.5
U-NII 6-7 GHz (80MHz BW)			11.5	12.5
U-NII 6-7 GHz (160MHz BW)			11.5	12.5

### 4.3.8 Reduced Power 6 GHz WIFI output power -Grip Active.

Mode	MIMO			
	802.11a		802.11 Ax(SU)	
	Nominal	Maximum	Nominal	Maximum
U-NII 6-7 GHz (20MHz BW)	11	12	11	12
U-NII 6-7 GHz (40MHz BW)			10.5	11.5
U-NII 6-7 GHz (80MHz BW)			10.5	11.5
U-NII 6-7 GHz (160MHz BW)			10.5	11.5

### 4.3.9 6 GHz WIFI output power – RSDB mode

Mode	MIMO			
	802.11a		802.11 Ax(SU)	
	Nominal	Maximum	Nominal	Maximum
U-NII 6-7 GHz (20MHz BW)	9	10	9	10
U-NII 6-7 GHz (40MHz BW)			8.5	9.5
U-NII 6-7 GHz (80MHz BW)			8.5	9.5
U-NII 6-7 GHz (160MHz BW)			8.5	9.5

### 4.3.10 Maximum 6 GHz 802.11ax RU Power

Tones	MIMO			
	6G/20Mhz	6G/40Mhz	6G/80Mhz	6G/160Mhz
26T	3.0	3.0	3.0	3.0
52T	6.0	6.0	6.0	6.0
106T	9.0	9.0	9.0	9.0
242T	12.0	11.5	11.5	11.5
484T		11.5	11.5	11.5
996T			11.5	11.5

(Upper Tolerance: target ~ +1.0 dB)

### 4.3.11 Reduced Power 6 GHz 802.11ax RU Power- Grip Active.

Tones	MIMO			
	6G/20Mhz	6G/40Mhz	6G/80Mhz	6G/160Mhz
26T	3.0	3.0	3.0	3.0
52T	6.0	6.0	6.0	6.0
106T	9.0	9.0	9.0	9.0
242T	11.0	10.5	10.5	10.5
484T		10.5	10.5	10.5
996T			10.5	10.5

(Upper Tolerance: target ~ +1.0 dB)

### 4.3.12 6 GHz 802.11ax RU output power – RSDB mode.

Tones	MIMO			
	6G/20Mhz	6G/40Mhz	6G/80Mhz	6G/160Mhz
26T	3.0	3.0	3.0	3.0
52T	6.0	6.0	6.0	6.0
106T	9.0	8.5	8.5	8.5
242T	9.0	8.5	8.5	8.5
484T		8.5	8.5	8.5
996T			8.5	8.5

(Upper Tolerance: target ~ +1.0 dB)

**4.3.13 Maximum Bluetooth Power**

Mode / Band		Modulated Average (dBm)	
		Ant.1	Ant.2
Bluetooth BDR DH5	2402	16.0	15.5
	2440		
	2480		
Bluetooth EDR 2-DH5	2402	14.0	13
	2440		
	2480		
Bluetooth EDR 3-DH5	2402	9.0	7.5
	2440		
	2480		
Bluetooth LE Low Power		9.0	7.5
Bluetooth LE High Power 1M		16.0	15
Bluetooth LE High Power 2M			15.3

(Upper Tolerance: target ~ +1.0 dB)

**4.3.14 Reduced Bluetooth Power – Grip Active**

Mode / Band		Modulated Average (dBm)	
		Ant.1	Ant.2
Bluetooth BDR DH5	2402	9	9.5
	2440		
	2480		
Bluetooth EDR 2-DH5	2402	10	9.5
	2440	10	
	2480	10	
Bluetooth EDR 3-DH5	2402	10	9.5
	2440	10	
	2480	10	
Bluetooth LE 1M(37)	0	8.5	7.5
	19	8.5	7.5
	39	8.5	7.5
Bluetooth LE 1M(255)	0	8.5	7.5
	19	8.5	7.5
	39	8.5	7.5
Bluetooth LE 2M(37)	0	8.5	7.5
	19	8.5	7.5
	39	8.5	7.5
Bluetooth LE 2M(255)	0	8.5	7.5
	19	8.5	7.5
	39	8.5	7.5

(Upper Tolerance: target ~ +1.0 dB)

**4.3.15 Bluetooth Power – RSDB mode**

Mode / Band		Modulated Average (dBm)	
		Ant.1	Ant.2
Bluetooth BDR DH5	2402	8	8
	2440	8	
	2480	8	
Bluetooth EDR 2-DH5	2402	7.5	8
	2440	7.5	
	2480	7.5	
Bluetooth EDR 3-DH5	2402	7.5	8
	2440	7.5	
	2480	7.5	
Bluetooth LE 1M(37)	0	7.5	6.5
	19	7.5	6.5
	39	7.5	6.5
Bluetooth LE 1M(255)	0	7.5	6.5
	19	7.5	6.5
	39	7.5	6.5
Bluetooth LE 2M(37)	0	7.5	6.5
	19	7.5	6.5
	39	7.5	6.5
Bluetooth LE 2M(255)	0	7.5	6.5
	19	7.5	6.5
	39	7.5	6.5

(Upper Tolerance: target ~ +1.0 dB)

#### 4.4 SAR Test Configurations for DUT Antenna Locations

Since the Dedicated Host Approach is applied, the standalone SAR test exclusion procedure in KDB447498 4.3.1 is applied in conjunction with KDB 616217 4.3 to determine the minimum test separation distance:

When the separation distance from the antenna to an adjacent edge is  $\leq 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.

When the separation distance from the antenna to an adjacent edge is  $> 5$  mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion

Antenna	Band	Device Configurations for SAR Testing				
		Rear	Top	Left	Right	Bottom
WLAN 1	2.4 GHz	YES	YES	YES	YES	NO
WLAN 1	5 /6 GHz	YES	YES	YES	YES	NO
WLAN 2	2.4 GHz	YES	YES	YES	YES	NO
WLAN 2	5 /6GHz	YES	YES	YES	YES	NO

#### Additional Test Scenarios

Test Configurations	SAR Required	Note
Left Corner	Yes	2.4 GHz/ / 5 GHz/BT WLAN 2 Ant
Right Corner	Yes	2.4 GHz/ / 5 GHz/BT WLAN 1 Ant

Note; All test configurations are based on front view.

Per FCC KDB Publication 616217 D04v01r02, the rear surface and edges of tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR Exclusion Threshold in KDB 447498 D01v06 can be applied to determine SAR test exclusion for adjacent edge configurations. The closet distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

Since the Dedicated Host Approach is applied, the standalone SAR test exclusion procedure in KDB447498 4.3.1 is applied in conjunction with KDB 616217 D04v01r02 4.3 to determine the minimum test separation distance:

This device was tested considering the Rear/left/right/top/bottom side for simultaneous transmission analysis of multiple transmitter conditions. The bottom side of the upper antenna and the top surface of the lower antenna excluded according to KDB 616217.

Top surface and bottom, excluding SAR test by FCC KDB 616217 D04v01r02, were analyzed by applying 0.4 w/kg according to FCC KDB 447498 D01v06 during simultaneous transmission analysis.

**4.5 SAR Summation Scenario**

According to FCC KDB 447498 D01v06, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the EUT are shown below paths and are mode in same rectangle to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB 447498 D01v06.

No.	Capable Transmit Configuration	Body
1	Bluetooth ANT 2 + WI-FI 6E MIMO	Yes
2	Bluetooth ANT 2 + 5GHz WI-FI MIMO	Yes
3	Bluetooth ANT 1 + WI-FI 6E MIMO	Yes
4	Bluetooth ANT 1 + 5GHz WI-FI MIMO	Yes
5	Bluetooth ANT 1 + 2.4GHz WI-FI Ant 2	Yes
6	Bluetooth ANT 1 + 2.4GHz WI-FI Ant 2 + 5GHz WI-FI MIMO	Yes
7	Bluetooth ANT 1 + 2.4GHz WI-FI Ant 2 + WI-FI 6E MIMO	Yes
8	2.4 WI-FI MIMO + WI-FI 6E MIMO	Yes
9	2.4 WI-FI MIMO + 5GHz WI-FI MIMO	Yes

**Note:**

1. 2.4GHz bluetooth ANT1 and 2.4GHz Bluetooth ANT 2 cannot transmit simultaneously
2. This device supports Bluetooth tethering...
3. This device supports 2x2 MIMO Tx for WLAN 802.11a/g/n/ac/ax. 802.11a/g/n/ac/ax supports CDD and STBC and 802.11n/ac/ax additionally supports SDM. Each WLAN antenna can transmit independently or together when operating with MIMO.

## 4.6 SAR Test Considerations

### 4.6.1 Un-Licensed Transmitter(s)

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 for 1g SAR and is less than 3.0 W/kg for 10g SAR, SAR is not required for U-NII-1 band according to FCC KDB 248227D01v02r02.

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) No aggregate channel configurations
- d) 2 Tx antenna output
- e) Up to 1024 QAM is supported
- f) TDWR and Band gap channels are supported for 5/6 GHz
- g) MU-MIMO UL Operations are not supported

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.

## 5. Introduction

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices.

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. 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York 10017. The measurement procedure described in IEEE/ANSI C95.3-1992 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave is used for guidance in measuring 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 National Council on Radiation Protection and Measurements (NCRP) in Biological Effects and Exposure Criteria for Radio Frequency Electromagnetic Fields," NCRP Report No. 86 NCRP, 1986, Bethesda, MD 20814. 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.

### SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative of the incremental electromagnetic energy ( $dW$ ) absorbed by (dissipated in) an incremental mass ( $dm$ ) contained in a volume element ( $dV$ ) of a given density ( $r$ ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body.

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

Figure 1. SAR Mathematical Equation  
*SAR is expressed in units of Watts per Kilogram (W/kg)*

Where:

- = conductivity of the tissue-simulant material (S/m)
- = mass density of the tissue-simulant material (kg/m<sup>3</sup>)
- = 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 relations 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. Description of test equipment

### 6.1 SAR MEASUREMENT SETUP

These measurements are performed using the DASY4 automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Staubli), robot controller, Pentium III computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Figure.2).

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The PC with Windows XP or Windows 7 is working with SAR Measurement system DASY4 & DASY5, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

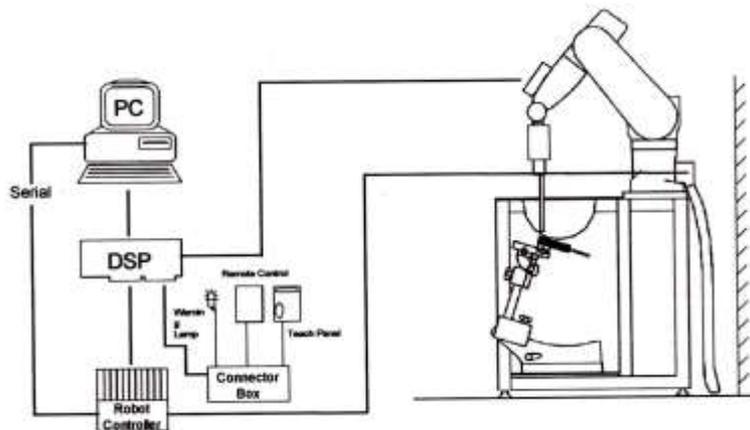


Figure 2. HCT SAR Lab. Test Measurement Set-up

The DAE consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own DSP controller with a built in VME-bus computer. The system is described in detail in.

## 7. SAR Measurement Procedure

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

1. The SAR distribution at the exposed side of the head or body was measured at a distance no more than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the DUT's head and body area and the horizontal grid resolution was depending on the FCC KDB 865664 D01v01r04 table 4-1 & IEEE 1528-2013.
2. Based on step, the area of the maximum absorption was determined by sophisticated interpolations routines implemented in DASY software. When an Area Scan has measured all reachable point. DASY system computes the field maximal found in the scanned are, within a range of the maximum. SAR at this fixed point was measured and used as a reference value.
3. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB 865664 D01v01r04 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 (reference from the DASY manual.)
  - a. The data at the surface were extrapolated, since the center of the dipoles is no more than 2.7 mm away from the tip of the probe (it is different from the probe type) and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
  - b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed using the 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 integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
  - 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. If the value changed by more than 5 %, the SAR evaluation and drift measurements were repeated.

Area scan and zoom scan resolution setting follow KDB 865664 D01v01r04 quoted below.

		≤ 3 GHz	> 3 GHz	
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5±1 mm	$\delta \cdot \ln(2) \pm 0.5$ mm	
Maximum probe angle from probe axis to phantom surface normal at the measurement location		30°±1°	20°±1°	
Maximum area scan Spatial resolution: $\Delta x_{Area}, \Delta y_{Area}$		≤ 2 GHz: ≤15 mm 2-3 GHz: ≤12 mm	3-4 GHz: ≤12 mm 4-6 GHz: ≤10 mm	
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.		
Maximum zoom scan Spatial resolution: $\Delta x_{zoom}, \Delta y_{zoom}$		≤ 2 GHz: ≤8mm 2-3 GHz: ≤5mm*	3-4 GHz: ≤5 mm* 4-6 GHz: ≤4 mm*	
Maximum zoom scan Spatial resolution normal to phantom surface	uniform grid: $\Delta z_{zoom}(n)$	≤ 5 mm	3-4 GHz: ≤4 mm 4-5 GHz: ≤3 mm 5-6 GHz: ≤2 mm	
	graded grid	$\Delta z_{zoom}(1)$ : between 1 <sup>st</sup> two Points closest to phantom surface	≤ 4 mm	3-4 GHz: ≤3 mm 4-5 GHz: ≤2.5 mm 5-6 GHz: ≤2 mm
		$\Delta z_{zoom}(n>1)$ : between subsequent Points	≤1.5 · $\Delta z_{zoom}(n-1)$	
Minimum zoom scan volume	x, y, z	≥ 30 mm	3-4 GHz: ≥28 mm 4-5 GHz: ≥25 mm 5-6 GHz: ≥22 mm	
<p>Note: <math>\delta</math> is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.</p> <p>* When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</p>				

## 8. Description of Test Position

### 8.1 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity  $\epsilon$  and loss tangent  $\delta=0.02$ .

### 8.2 SAR Testing for Tablet Per KDB Publication 616217 D04v01r02

Per FCC KDB Publication 616217 D04v01r02, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR Exclusion Threshold in KDB 447498 D01v06 can be applied to determine SAR test exclusion for adjacent edge configuration. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

### 8.3 Proximity Sensor Considerations.

This device uses a sensor to reduce output powers in certain use conditions when the device is used close the user's body.

When the sensor detects a user is touching the device on or near to the antenna the device reduces the maximum allowed output power. However, the proximity sensor is not active when the device is moved beyond the sensor triggering distance and the maximum output power is no longer limited. Therefore, an additional exposure condition is needed in the vicinity of the triggering distance to ensure SAR is compliant when the device is allowed to operate at a non-reduced output power level.

FCC KDB 616217 D04 Section 8 and additional FCC guidance were used as a guideline for selecting SAR test distances for this device at these additional exposure conditions. The smallest separation distance determined by the sensor triggering and sensor coverage for each applicable edge, minus 1 mm. was used as the test separation distance for SAR testing. Sensor triggering distance evaluation is provided in a separate document.

The required separation distance to evaluate SAR at full powers were:

Wireless technologies	Position	§6.2 Triggering Distance [mm]	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for Body SAR [mm]
WLAN /BT Ant 1	Rear	20	N/A	N/A	19
	Right	8	N/A	N/A	7
	Right Corner	9	N/A	N/A	8
	Top	24	N/A	N/A	23
WLAN /BT Ant 2	Rear	18	N/A	N/A	17
	Left	8	N/A	N/A	7
	Left Corner	9	N/A	N/A	8
	Top	21	N/A	N/A	20

## 9. RF Exposure Limits

HUMAN EXPOSURE	UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT Occupational (W/kg) or (mW/g)
SPATIAL PEAK SAR * (Partial Body)	1.6	8.0
SPATIAL AVERAGE SAR ** (Whole Body)	0.08	0.4
SPATIAL PEAK SAR *** (Hands / Feet / Ankle / Wrist)	4.0	20.0

**NOTES:**

\* The Spatial Peak value of the SAR averaged over any 1 g of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

\*\* The Spatial Average value of the SAR averaged over the whole-body.

\*\*\* The Spatial Peak value of the SAR averaged over any 10 g of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

**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.

**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.

## 10. FCC SAR General Measurement Procedures

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

### 10.1 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.

### 10.2 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.

#### 10.2.1 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 system 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.

#### 10.2.2 U-NII-1 and U-NII-2A

For devices that operate in both U-NII-1 and U-NII2A 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 for 1g SAR or  $> 3.0$  W/kg for 10g SAR. 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 for 1g SAR or  $> 3.0$  W/kg for 10g SAR.

#### 10.2.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 GHz – 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 GHz – 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.

#### 10.2.4 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  $\leq 0.4$  W/kg for 1g SAR and  $\leq 1.0$  W/kg for 10g SAR, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is  $\leq 0.8$  W/kg for 1g SAR and  $\leq 2.0$  W/kg for 10g SAR or all test positions are measured.

#### 10.2.5 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  $\leq 0.8$  W/kg, no further SAR testing is required for 802.11b DSSS is 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.

#### 10.2.6 OFDM Transmission Mode and SAR Test Channel Selection

For the 2.4 GHz and 5 GHz bands, 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 and lowest order 802.11 a/g/n/ac mode. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a, 802.11n and 802.11 ac 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.

#### 10.2.7 Initial Test Configuration Procedure

For OFDM, in both 2.4 GHz and 5 GHz bands, 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, and lowest data rate. If the average RF output powers of the highest identical transmission modes are within 0.25 dB of each other, mid channel of the transmission mode with highest average RF output power is the initial test channel. Otherwise, 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  $\leq 0.8$  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.

#### **10.2.8 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 on 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  $\leq 1.2$  W/kg for 1g SAR and  $\leq 3.0$  W/kg for 10g SAR, no additional SAR tests for the subsequent test configurations are required.

#### **10.2.9 MIMO SAR Considerations**

Per KDB Publication 248227 D01v02r02, the simultaneous SAR provisions in KDB publication 447498D01v06 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.

## 11. WIFI Conducted Power

### 11.1 WIFI Conducted Power measurement method

#### Un-Licensed bands (DTS Band)

Test Description	Test Procedure Used
Conducted Output Power	- KDB 558074 v05 - Section 8.3.2.3 - ANSI 63.10-2013 - Section 11.9.2.3

#### Test Procedure

1. Measure the duty cycle.
2. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
3. Add  $10 \log(1/x)$ , where  $x$  is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

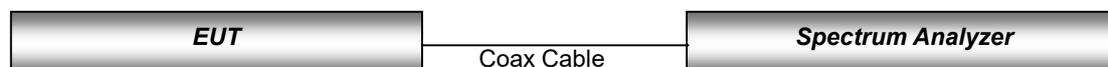
#### Un-Licensed bands (NII Band)

Test Description	Test Procedure Used
Conducted Output Power	- KDB 789033 D02 v02r01 - Section E.3.a

#### Test Procedure

1. Measure the duty cycle.
2. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
3. Add  $10 \log(1/x)$ , where  $x$  is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

#### Test setup



**11.2 IEEE 802.11 (2.4 GHz) Maximum Conducted Power**

Mode	Frequency [MHz]	Channel	IEEE 802.11 (2.4 GHz) Average RF Conducted Power [dBm]		
			Ant.1	Ant.2	MIMO
802.11b	2 412	1	14.98	15.38	18.20
	2 437	6	15.12	15.74	18.45
	2 462	11	14.89	15.59	18.27
	2 467	12	4.98	5.01	8.01
	2 472	13	-0.46	-0.28	2.64
802.11g	2 412	1	15.90	16.45	19.19
	2 437	6	16.08	16.77	19.45
	2 462	11	15.93	16.65	19.32
	2 467	12	4.77	4.91	7.85
	2 472	13	-0.96	-0.77	2.15
802.11n (HT20)	2 412	1	16.79	17.30	20.06
	2 437	6	16.92	17.51	20.24
	2 462	11	15.50	16.27	18.98
	2 467	12	4.83	5.16	8.01
	2 472	13	-0.50	-0.27	2.63

**11.3 IEEE 802.11 (2.4 GHz) Reduced Conducted Power (Grip Active)**

Mode	Frequency [MHz]	Channel	IEEE 802.11 (2.4 GHz) Average RF Conducted Power [dBm]		
			Ant.1	Ant.2	MIMO
802.11b	2 412	1	11.77	12.23	15.02
	2 437	6	12.19	12.39	15.30
	2 462	11	12.02	12.51	15.28
	2 467	12	4.98	5.01	8.01
	2 472	13	-0.46	-0.28	2.64
802.11g	2 412	1	11.62	12.17	14.91
	2 437	6	12.13	12.28	15.22
	2 462	11	11.87	12.37	15.14
	2 467	12	4.77	4.91	7.85
	2 472	13	-0.96	-0.77	2.15
802.11n (HT20)	2 412	1	11.97	12.49	15.25
	2 437	6	12.42	12.68	15.56
	2 462	11	12.15	12.71	15.45
	2 467	12	4.83	5.16	8.01
	2 472	13	-0.50	-0.27	2.63

**11.4 IEEE 802.11 (2.4 GHz) Conducted Power (RSDB Mode)**

Mode	Frequency [MHz]	Channel	IEEE 802.11 (2.4 GHz) Average RF Conducted Power [dBm]		
			Ant.1	Ant.2	MIMO
802.11b	2 412	1	9.28	9.67	12.49
	2 437	6	9.46	9.92	12.71
	2 462	11	9.21	9.95	12.61
	2 467	12	4.98	5.01	8.01
	2 472	13	-0.46	-0.28	2.64
802.11g	2 412	1	9.22	9.67	12.46
	2 437	6	9.46	9.95	12.72
	2 462	11	9.21	9.81	12.53
	2 467	12	4.77	4.91	7.85
	2 472	13	-0.96	-0.77	2.15
802.11n (HT20)	2 412	1	9.88	10.47	13.20
	2 437	6	10.31	10.39	13.36
	2 462	11	10.01	10.60	13.33
	2 467	12	4.83	5.16	8.01
	2 472	13	-0.50	-0.27	2.63

**11.5 IEEE 802.11 (5 GHz) Maximum Conducted Power**

Frequency [MHz]	Channel	IEEE 802.11 a(20 MHz BW) Conducted Power [dBm]		
		Ant.1	Ant.2	MIMO
5 180	36	15.71	16.10	18.92
5 200	40	15.50	16.01	18.78
5 220	44	15.60	16.34	19.00
5 240	48	11.35	11.43	14.40
5 260	52	15.67	16.10	18.90
5 280	56	15.54	16.01	18.79
5 300	60	15.41	15.93	18.69
5 320	64	15.82	15.84	18.84
5 500	100	15.71	15.89	18.81
5 600	120	16.28	16.61	19.46
5 620	124	16.26	16.60	19.45
5 720	144	16.52	16.67	19.61
5 745	149	14.45	14.29	17.38
5 785	157	14.58	14.01	17.32
5 825	165	14.09	14.55	17.34
5 846	169	14.123	14.53	17.34
5 865	173	13.973	14.42	17.21
5 885	177	14.553	13.40	17.03

Frequency [MHz]	Channel	IEEE 802.11 n(20 MHz BW) Conducted Power [dBm]		
		Ant.1	Ant.2	MIMO
5 180	36	16.82	16.62	19.73
5 200	40	16.71	16.55	19.64
5 220	44	16.85	16.92	19.89
5 240	48	10.92	10.67	13.80
5 260	52	16.63	16.73	19.69
5 280	56	16.49	16.67	19.59
5 300	60	16.36	16.58	19.48
5 320	64	16.70	16.46	19.59
5 500	100	16.62	16.50	19.57
5 600	120	16.72	16.53	19.63
5 620	124	16.55	16.46	19.51
5 720	144	16.54	16.50	19.53
5 745	149	13.95	13.63	16.80
5 785	157	14.43	13.91	17.18
5 825	165	13.71	13.90	16.81
5 846	169	13.65	13.85	16.76
5 865	173	13.52	13.73	16.63
5 885	177	14.60	13.04	16.89

Frequency [MHz]	Channel	IEEE 802.11 ac(20 MHz BW) Conducted Power [dBm]		
		Ant.1	Ant.2	MIMO
5 180	36	16.83	16.63	19.74
5 200	40	16.71	16.52	19.62
5 220	44	16.90	16.93	19.92
5 240	48	10.90	10.65	13.78
5 260	52	16.69	16.72	19.71
5 280	56	16.54	16.63	19.59
5 300	60	16.45	16.58	19.52
5 320	64	16.75	16.46	19.61
5 500	100	16.65	16.49	19.58
5 600	120	16.55	16.66	19.61
5 620	124	16.60	16.45	19.53
5 720	144	16.69	16.80	19.75
5 745	149	13.97	13.61	16.80
5 785	157	14.44	13.90	17.18
5 825	165	13.68	13.91	16.80
5 846	169	13.65	13.84	16.75
5 865	173	13.52	13.71	16.62
5 885	177	14.52	13.02	16.84

Frequency [MHz]	Channel	IEEE 802.11 n(40 MHz BW) Conducted Power [dBm]		
		Ant.1	Ant.2	MIMO
5190	38	15.54	15.71	18.64
5230	46	13.78	13.97	16.89
5270	54	16.45	16.99	19.74
5310	62	14.40	14.57	17.50
5510	102	14.78	14.50	17.65
5590	118	16.62	16.59	19.62
5630	126	15.90	16.99	19.49
5670	134	16.80	16.93	19.88
5710	142	16.89	16.95	19.93
5755	151	14.89	14.59	17.75
5795	159	14.75	14.30	17.54
5835	167	14.97	14.96	17.98
5875	175	14.74	14.92	17.84

Frequency [MHz]	Channel	IEEE 802.11 ac(40 MHz BW) Conducted Power [dBm]		
		Ant.1	Ant.2	MIMO
5190	38	15.96	15.76	18.87
5230	46	13.77	13.52	16.66
5270	54	15.75	15.70	18.74
5310	62	14.64	14.25	17.46
5510	102	14.81	14.56	17.70
5590	118	16.66	16.65	19.67
5630	126	16.22	16.99	19.63
5710	142	16.23	16.48	19.37
5755	151	14.92	14.54	17.74
5795	159	14.78	14.25	17.53
5835	167	14.85	14.66	17.77
5875	175	14.63	14.46	17.56

Frequency [MHz]	Channel	IEEE 802.11 ac(80 MHz BW) Conducted Power [dBm]		
		Ant.1	Ant.2	MIMO
5 210	42	14.68	14.63	17.66
5 290	58	13.66	13.63	16.65
5 530	106	14.43	14.33	17.39
5 610	122	15.90	15.97	18.94
5 690	138	15.87	15.79	18.84
5 775	155	14.45	13.90	17.19
5 855	171	14.46	14.57	17.52

**11.6 IEEE 802.11 (5 GHz) Reduced Conducted Power (Grip Active)**

Frequency [MHz]	Channel	IEEE 802.11 ac(80 MHz BW) Conducted Power [dBm]		
		Ant.1	Ant.2	MIMO
5 210	42	8.36	8.10	11.24
5 290	58	8.30	8.37	11.34
5 530	106	8.17	7.89	11.04
5 610	122	8.50	8.39	11.45
5 690	138	8.27	8.23	11.26
5 775	155	8.59	8.04	11.33
5 855	171	8.92	8.24	11.60

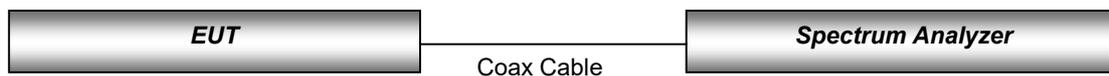
**11.7 IEEE 802.11 (5 GHz) Conducted Power (RSDB mode)**

Frequency [MHz]	Channel	IEEE 802.11 ac(80 MHz BW) Conducted Power [dBm]		
		Ant.1	Ant.2	MIMO
5 210	42	6.50	6.16	9.34
5 290	58	5.91	5.79	8.86
5 530	106	6.33	6.07	9.21
5 610	122	6.67	6.60	9.64
5 690	138	6.44	6.30	9.38
5 775	155	6.76	6.28	9.53
5 855	171	6.17	6.43	9.31

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 mode 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.

**Test Configuration**



**11.8 Bluetooth Conducted Power**

**The Burst averaged- Maximum Conducted Power**

Mode	Channel	Bluetooth Power [dBm]	
		Ant1	Ant2
DH5	0	15.54	14.02
	39	15.79	14.58
	78	15.32	13.35
2-DH5	0	12.72	11.74
	39	12.32	12.02
	78	12.80	11.56
3-DH5	0	12.63	11.68
	39	12.29	11.97
	78	12.75	11.59

**The Burst averaged-Reduced conducted power (Grip Active)**

Mode	Channel	Bluetooth Power [dBm]	
		Ant1	Ant2
DH5	0	8.57	8.26
	39	8.74	9.32
	78	8.71	7.64
2-DH5	0	10.67	9.23
	39	10.76	10.49
	78	10.74	8.29
3-DH5	0	10.28	9.14
	39	10.49	10.33
	78	10.41	8.08

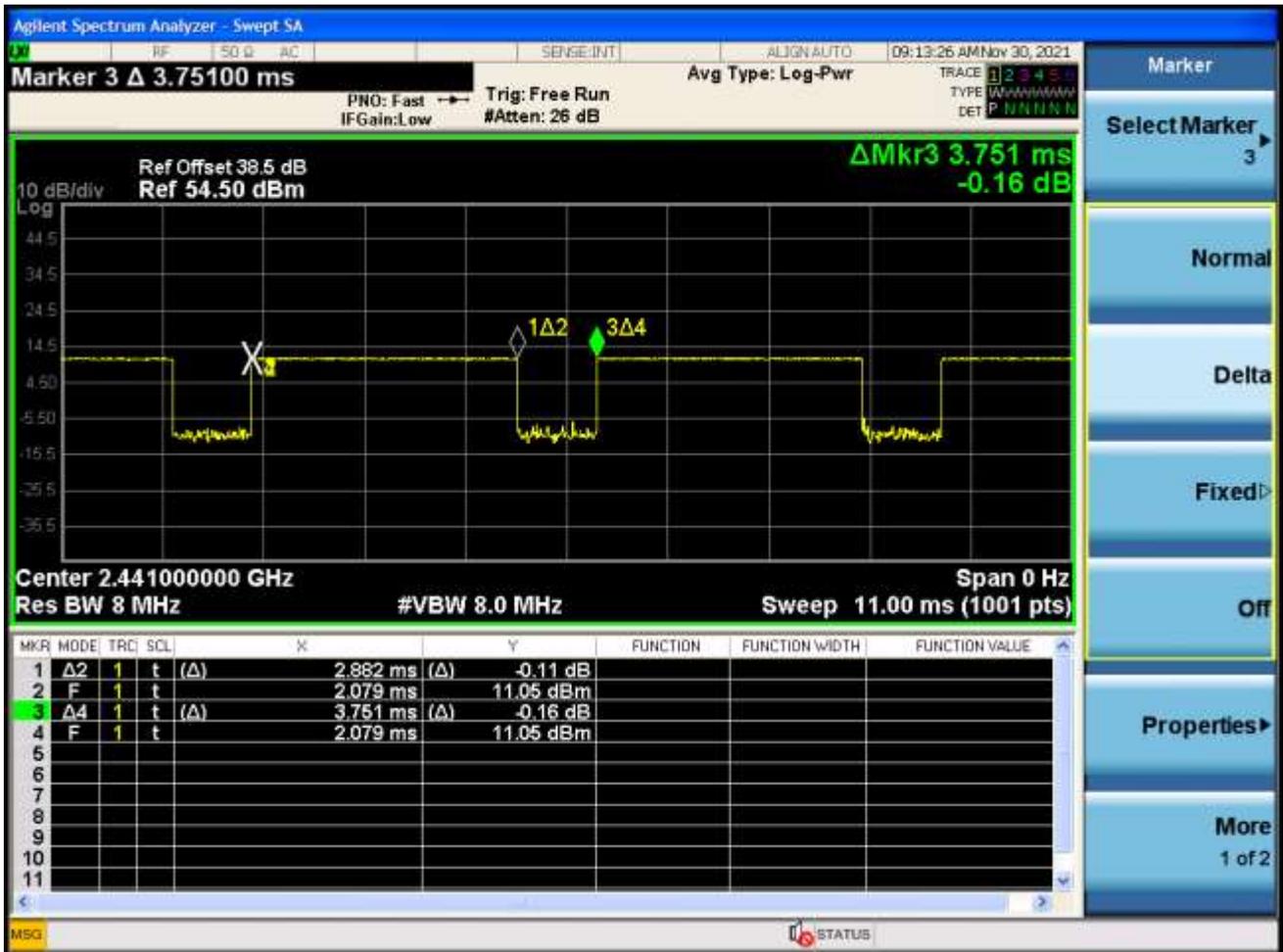
**The Burst averaged-conducted power (RSDB moe)**

Mode	Channel	Bluetooth Power [dBm]	
		Ant1	Ant2
DH5	0	7.01	6.53
	39	7.58	7.58
	78	7.1	5.60
2-DH5	0	7.6	6.52
	39	7.2	6.77
	78	7.69	6.34
3-DH5	0	7.3	5.97
	39	7.14	6.67
	78	7.62	5.37

Per October 2016 TCB Workshop Notes:

When call box and Bluetooth protocol are used for Bluetooth SAR measurement, time-domain plot is required to identify duty factor for supporting the test setup and result.

Bluetooth duty cycle was measured using Bluetooth tester equipment (CBT / R&S) with Bluetooth protocol. DH5 mode is the highest duty cycle and conducted power. SAR test were performed at DH5 mode.



Bluetooth

Duty Cycle

$$= (\text{BT-On time} / \text{BT-Full time}) = (2.882 / 3.751) = 0.768 \text{ (DH5)}$$

Duty factor = 1/Duty cycle : 1.302



Duty Cycle

$$= (\text{BT-On time} / \text{BT-Full time}) = (2.882 / 3.751) = 0.768 \text{ (2-DH5)}$$

Duty factor= 1/Duty cycle : 1.302



Duty Cycle

= (BT-On time /BT-Full time) =(2.882/3.751) = 0.768 (3-DH5)

Duty factor= 1/Duty cycle : 1.302

## 12. System Verification

### 12.1 Tissue Verification

The body simulating material is calibrated by HCT using the DAKS 3.5 to determine the conductivity and permittivity.

Table for Head Tissue Verification									
Date of Tests	Tissue Temp. (°C)	Tissue Type	Freq. (MHz)	Measured Conductivity $\sigma$ (S/m)	Measured Dielectric Constant, $\epsilon$	Target Conductivity $\sigma$ (S/m)	Target Dielectric Constant, $\epsilon$	% dev $\sigma$	% dev $\epsilon$
1/29/2021	21.0	2450H	2400	1.774	38.097	1.756	39.290	1.03	-3.04
			2450	1.831	37.874	1.800	39.200	1.72	-3.38
			2500	1.883	37.731	1.855	39.140	1.51	-3.60
11/16/2021	20.2	2450H	2400	1.774	38.115	1.756	39.290	1.03	-2.99
			2450	1.827	37.835	1.800	39.200	1.50	-3.48
			2500	1.883	37.709	1.855	39.140	1.51	-3.66
11/22/2021	21.2	2450H	2400	1.752	38.176	1.756	39.290	-0.23	-2.84
			2450	1.823	37.828	1.800	39.200	1.28	-3.50
			2500	1.882	37.709	1.855	39.140	1.46	-3.66
11/18/2021	21.7	2450H	2400	1.766	38.078	1.756	39.290	0.57	-3.08
			2450	1.834	37.811	1.800	39.200	1.89	-3.54
			2500	1.882	37.726	1.855	39.140	1.46	-3.61
11/19/2021	22.0	2450H	2400	1.764	38.173	1.756	39.290	0.46	-2.84
			2450	1.824	37.859	1.800	39.200	1.33	-3.42
			2500	1.883	36.697	1.886	39.140	1.51	-3.69

Table for Head Tissue Verification									
Date of Tests	Tissue Temp. (°C)	Tissue Type	Freq. (MHz)	Measured Conductivity $\sigma$ (S/m)	Measured Dielectric Constant, $\epsilon$	Target Conductivity $\sigma$ (S/m)	Target Dielectric Constant, $\epsilon$	% dev $\sigma$	% dev $\epsilon$
11/26/2021	21.1	5180H-5320H	5180	4.679	36.675	4.635	36.010	0.95	1.85
			5250	4.837	36.591	4.706	35.930	2.78	1.84
			5280	4.809	36.840	4.737	35.894	1.52	2.64
			5320	4.883	36.969	4.778	35.846	2.20	3.13
11/26/2021	21.1	5500H-5600H	5500	5.098	36.439	4.963	35.640	2.72	2.24
			5600	5.118	36.144	5.065	35.530	1.05	1.73
11/26/2021	21.1	5750H-5835H	5750	5.359	36.246	5.219	35.360	2.68	2.51
			5800	5.373	36.784	5.270	35.300	1.95	4.20
			5825	5.244	36.118	5.296	35.270	-0.98	2.40
11/26/2021	20.8	5845H-5885H	5835	5.244	36.054	5.306	35.258	-1.17	2.26
			5845	5.298	36.368	5.316	35.246	-0.34	3.18
			5855	5.303	36.217	5.326	35.235	-0.43	2.79
			5865	5.363	36.207	5.337	35.225	0.49	2.79
11/23/2021	20.7	5180H-5320H	5750	5.460	36.034	5.347	35.215	2.11	2.33
			5875	5.438	36.064	5.357	35.205	1.51	2.44
			5180	4.550	37.023	4.635	36.010	-1.83	2.81
			5250	4.737	37.029	4.706	35.930	0.66	3.06
11/23/2021	20.7	5500H-5600H	5280	4.568	36.858	4.737	35.894	-3.57	2.69
			5320	4.705	37.408	4.778	35.846	-1.53	4.36
			5500	4.809	36.968	4.963	35.640	-3.10	3.73
			5600	4.992	36.860	5.065	35.530	-1.44	3.74
11/23/2021	20.7	5750H-5835H	5750	5.328	36.915	5.219	35.360	2.09	4.40
			5800	5.323	36.744	5.270	35.300	1.01	4.09
			5825	5.232	36.840	5.296	35.270	-1.21	4.45
			5835	5.151	36.724	5.306	35.258	-2.92	4.16
11/24/2021	21.6	5845H-5885H	5845	5.262	36.199	5.316	35.246	-1.02	2.70
			5855	5.329	36.244	5.326	35.235	0.06	2.86
			5865	5.376	36.232	5.337	35.225	0.73	2.86
			5875	5.422	35.889	5.347	35.215	1.40	1.91
11/24/2021	20.4	5180H-5320H	5885	5.370	35.918	5.357	35.205	0.24	2.03
			5180	4.699	37.029	4.635	36.010	1.38	2.83
			5250	4.791	37.012	4.706	35.930	1.81	3.01
			5280	4.694	37.074	4.737	35.894	-0.91	3.29
11/24/2021	20.4	5500H-5600H	5320	4.732	36.773	4.778	35.846	-0.96	2.59
			5500	4.983	36.823	4.963	35.640	0.40	3.32
			5600	5.118	36.827	5.065	35.530	1.05	3.65
			5750	5.194	36.362	5.219	35.360	-0.48	2.83
11/24/2021	20.4	5750H-5835H	5800	5.386	36.254	5.270	35.300	2.20	2.70
			5825	5.184	36.222	5.296	35.270	-2.11	2.70
			5835	5.118	36.001	5.306	35.258	-3.54	2.11
			5845	5.330	35.770	5.316	35.246	0.26	1.49
11/25/2021	21.4	5845H-5885H	5855	5.346	35.616	5.326	35.235	0.38	1.08
			5865	5.360	35.774	5.337	35.225	0.43	1.56
			5875	5.410	35.632	5.347	35.215	1.18	1.18
			5885	5.400	35.668	5.357	35.205	0.80	1.32

## 12.2 System Verification

Input Power: 50 mW

Freq. [MHz]	Date	Probe (S/N)	Dipole (S/N)	Liquid	Amb. Temp. [°C]	Liquid Temp. [°C]	1 W Target SAR <sub>1g</sub> (SPEAG) [W/kg]	50mW Measured SAR <sub>1g</sub> [W/kg]	1 W Normalized SAR <sub>1g</sub> [W/kg]	Deviation [%]	Limit [%]
2 450	11/29/2021	7679	965	Head	21.1	21.0	53.3	2.65	53.0	- 0.56	± 10
2 450	11/16/2021	7679		Head	20.3	20.2	53.3	2.65	53.0	- 0.56	± 10
2 450	11/22/2021	7679		Head	21.3	21.2	53.3	2.64	52.8	- 0.94	± 10
2 450	11/18/2021	3076		Head	21.8	21.7	53.3	2.58	51.6	- 3.19	± 10
2 450	11/19/2021	3076		Head	22.1	22.0	53.3	2.57	51.4	- 3.56	± 10
5 250	11/26/2021	7679	1107	Head	21.2	21.1	80.6	3.97	79.4	- 1.49	± 10
5 600	11/26/2021	7679		Head	21.2	21.1	84.2	4.41	88.2	+ 4.75	± 10
5 750	11/26/2021	7679		Head	21.2	21.1	80.9	4.06	81.2	+ 0.37	± 10
5 250	11/23/2021	7679		Head	20.8	20.7	80.6	3.89	77.8	- 3.47	± 10
5 600	11/23/2021	7679		Head	20.8	20.7	84.2	4.34	86.8	+ 3.09	± 10
5 750	11/23/2021	7679		Head	20.8	20.7	80.9	4.04	80.8	- 0.12	± 10
5 250	11/24/2021	7679		Head	20.5	20.4	80.6	3.92	78.4	- 2.73	± 10
5 600	11/24/2021	7679		Head	20.5	20.4	84.2	4.44	88.8	+ 5.46	± 10
5 750	11/24/2021	7679		Head	20.5	20.4	80.9	3.93	78.6	- 2.84	± 10
5 800	11/26/2021	7309		Head	20.9	20.8	80.9	3.96	79.2	- 2.10	± 10
5 800	11/24/2021	7309	1317	Head	21.7	21.6	80.9	3.97	79.4	- 1.85	± 10
5 800	11/25/2021	7309		Head	21.5	21.4	80.9	3.98	79.6	- 1.61	± 10

## 12.3 System Verification Procedure

SAR measurement was prior to assessment; the system is verified to the ± 10 % of the specifications at each frequency band by using the system verification kit. (Graphic Plots Attached)

- Cabling the system, using the verification kit equipment.
- Generate about 50 mW Input level from the signal generator to the Dipole Antenna.
- Dipole antenna was placed below the flat phantom.
- The measured one-gram SAR at the surface of the phantom above the dipole feed-point should be within 10 % of the target reference value.
- The results are normalized to 1 W input power.

Note;

SAR Verification was performed according to the FCC KDB 865664 D01v01r04.

### 13. SAR Test Data Summary

#### 13.1 SAR Measurement Results

Wi-Fi (DTS) Body_Max-Power																	
Frequency		Mode	Band width (MHz)	Data Rate (Mbps)	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Ant Config.	Duty Cycle	Distance (mm)	Area Scan Peak SAR (W/kg)	Meas. SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
Mhz	Ch.																
2 437	6	802.11n	20	MCS0	18	17.51	-0.01	Rear	Ant2	92.2	17	0.0669	0.042	1.119	1.085	0.051	-
2 437	6	802.11n	20	MCS0	18	17.51	0.06	Left	Ant2	92.2	7	0.344	0.206	1.119	1.085	0.250	-
2 437	6	802.11n	20	MCS0	18	17.51	-0.03	Top	Ant2	92.2	20	0.0181	0.01	1.119	1.085	0.012	-
2 437	6	802.11n	20	MCS0	18	17.51	0.00	Bottom	Ant2	92.2	0	0.0648	0.028	1.119	1.085	0.034	-
2 437	6	802.11n	20	MCS0	18	17.51	0.09	Left Corner	Ant2	92.2	8	0.14	0.091	1.119	1.085	0.110	-
2 437	6	802.11n	20	MCS0	21	20.24	-0.07	Rear	MIMO	92.2	17	0.112	0.073	1.282	1.085	0.102	-
2 437	6	802.11n	20	MCS0	21	20.24	0.06	Left	MIMO	92.2	7	0.325	0.206	1.282	1.085	0.287	-
2 437	6	802.11n	20	MCS0	21	20.24	0.07	Right	MIMO	92.2	7	0.54	0.337	1.282	1.085	<b>0.469</b>	1
2 437	6	802.11n	20	MCS0	21	20.24	0.01	Top	MIMO	92.2	20	0.0836	0.050	1.282	1.085	0.070	-
2 437	6	802.11n	20	MCS0	21	20.24	-0.03	Bottom	MIMO	92.2	0	0.102	0.041	1.282	1.085	0.057	-
2 437	6	802.11n	20	MCS0	21	20.24	0.17	Left Corner	MIMO	92.2	8	0.151	0.095	1.282	1.085	0.132	-
2 437	6	802.11n	20	MCS0	21	20.24	-0.09	Right Corner	MIMO	92.2	8	0.255	0.177	1.282	1.085	0.246	-
ANSI/ IEEE C95.1 - 2005 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population											Body 1.6 W/kg Averaged over 1 gram						

Wi-Fi (DTS) Body SAR – Grip Active																	
Frequency		Mode	Band width (MHz)	Data Rate (Mbps)	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Ant Config.	Duty Cycle	Distance (mm)	Area Scan Peak SAR (W/kg)	Meas. SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
Mhz	Ch.																
2 462	11	802.11b	20	1	13.0	12.51	0.00	Rear	Ant2	98.6	0	1.64	0.605	1.119	1.014	0.687	-
2 462	11	802.11b	20	1	13.0	12.51	0.04	Left	Ant2	98.6	0	3.11	1.17	1.119	1.014	<b>1.328</b>	2
2 437	6	802.11b	20	1	13.0	12.39	0.01	Left	Ant2	98.6	0	2.83	1.05	1.151	1.014	1.225	-
2 412	1	802.11b	20	1	13.0	12.23	0.04	Left	Ant2	98.6	0	2.86	1.04	1.194	1.014	1.259	-
2 462	11	802.11b	20	1	13.0	12.51	-0.01	Top	Ant2	98.6	0	0.428	0.172	1.119	1.014	0.195	-
2 462	11	802.11b	20	1	13.0	12.51	-0.06	Left Corner	Ant2	98.6	0	0.174	0.145	1.119	1.014	0.165	-
2 437	6	802.11b	20	1	16.0	15.30	0.00	Rear	MIMO	98.6	0	1.64	0.72	12.19	1.014	0.880	-
2 462	11	802.11b	20	1	16.0	15.28	0.00	Rear	MIMO	98.6	0	1.64	0.557	12.02	1.014	0.708	-
2 437	6	802.11b	20	1	16.0	15.30	0.06	Left	MIMO	98.6	0	2.43	0.996	12.19	1.014	1.217	-
2 462	11	802.11b	20	1	16.0	15.28	-0.02	Left	MIMO	98.6	0	2.51	1.04	12.02	1.014	1.322	-
2 412	1	802.11b	20	1	16.0	15.02	0.10	Left	MIMO	98.6	0	2.29	0.941	11.77	1.014	1.267	-
2 437	6	802.11b	20	1	16.0	15.30	-0.10	Right	MIMO	98.6	0	1.78	0.816	12.19	1.014	0.997	-
2 462	11	802.11b	20	1	16.0	15.28	0.12	Right	MIMO	98.6	0	1.96	0.889	12.02	1.014	1.130	-
2 437	6	802.11b	20	1	16.0	15.30	0.00	Top	MIMO	98.6	0	1.38	0.458	12.19	1.014	0.560	-
2 437	6	802.11b	20	1	16.0	15.30	-0.09	Left Corner	MIMO	98.6	0	0.159	0.116	12.19	1.014	0.142	-
2 437	6	802.11b	20	1	16.0	15.30	-0.05	Right Corner	MIMO	98.6	0	0.461	0.379	12.19	1.014	0.463	-
2 462	11	802.11b	20	1	13.0	12.51	0.04	Left	Ant2	98.6	0	2.44	1	12.51	1.014	1.135	**
ANSI/ IEEE C95.1 - 2005 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population												Body 1.6 W/kg Averaged over 1 gram					

\*\* Data entry indicate Device holder perturbation measurement.

**Wi-Fi (DTS) Body SAR – RSDB Mode**

Frequency		Mode	Bandwidth (MHz)	Data Rate (Mbps)	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Ant Config.	Duty Cycle	Distance (mm)	Area Scan Peak SAR (W/kg)	Meas. SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
Mhz	Ch.																
2 462	11	802.11b	20	1	11.0	10.48	0.00	Rear	Ant2	98.6	0	1.03	0.344	1.127	1.014	0.393	-
2 462	11	802.11b	20	1	11.0	10.48	0.01	Left	Ant2	98.6	0	0.99	<b>0.636</b>	1.127	1.014	0.727	3
2 437	6	802.11b	20	1	11.0	10.25	0.02	Left	Ant2	98.6	0	1.02	0.634	1.127	1.014	0.764	-
2 462	11	802.11b	20	1	11.0	10.48	0.00	Top	Ant2	98.6	0	0.254	0.094	1.127	1.014	0.107	-
2 462	11	802.11b	20	1	11.0	10.48	0.14	Left Corner	Ant2	98.6	0	0.152	0.093	1.127	1.014	0.106	-
2 437	6	802.11b	20	1	14.0	12.71	0.00	Rear	MIMO	98.6	0	1.02	0.383	1.426	1.014	0.554	-
2 437	6	802.11b	20	1	14.0	12.71	0.04	Left	MIMO	98.6	0	0.961	0.587	1.426	1.014	0.849	-
2 462	11	802.11b	20	1	14.0	12.61	0.12	Left	MIMO	98.6	0	0.907	0.573	1.510	1.014	<b>0.878</b>	4
2 437	6	802.11b	20	1	14.0	12.71	0.19	Right	MIMO	98.6	0	1.09	0.418	1.426	1.014	0.604	-
2 437	6	802.11b	20	1	14.0	12.71	-0.10	Top	MIMO	98.6	0	0.716	0.235	1.426	1.014	0.340	-
2 437	6	802.11b	20	1	14.0	12.71	0.13	Left Corner	MIMO	98.6	0	0.0881	0.065	1.426	1.014	0.094	-
2 437	6	802.11b	20	1	14.0	12.71	0.11	Right Corner	MIMO	98.6	0	0.245	0.193	1.426	1.014	0.279	-
ANSI/ IEEE C95.1 - 2005 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population											Body 1.6 W/kg Averaged over 1 gram						

Wi-Fi (NII) Body SAR_Max-Power																	
Frequency		Mode	Band width (MHz)	Data Rate (Mbps)	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Ant Config.	Duty Cycle	Distance (mm)	Area Scan Peak SAR (W/kg)	Meas. SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
Mhz	Ch.																
5270	54	802.11n	40	MCS0	20.0	19.74	0.01	Rear	MIMO	93.0	17	0.164	0.036	1.135	1.075	0.044	-
5270	54	802.11n	40	MCS0	20.0	19.74	-0.02	Left	MIMO	93.0	7	0.168	0.067	1.135	1.075	0.082	-
5270	54	802.11n	40	MCS0	20.0	19.74	0.06	Right	MIMO	93.0	7	1.24	0.536	1.135	1.075	0.654	-
5270	54	802.11n	40	MCS0	20.0	19.74	0.04	Top	MIMO	93.0	20	0.093	0.036	1.135	1.075	0.044	-
5270	54	802.11n	40	MCS0	20.0	19.74	0.00	Bottom	MIMO	93.0	0	0.0995	0.019	1.135	1.075	0.023	-
5270	54	802.11n	40	MCS0	20.0	19.74	-0.02	Left Corner	MIMO	93.0	8	0.274	0.115	1.135	1.075	0.140	-
5270	54	802.11n	40	MCS0	20.0	19.74	-0.00	Right Corner	MIMO	93.0	8	0.861	0.37	1.135	1.075	0.451	-
5710	142	802.11n	40	MCS0	20.0	19.93	-0.06	Rear	MIMO	93.0	17	0.184	0.071	1.288	1.075	0.098	-
5710	142	802.11n	40	MCS0	20.0	19.93	0.12	Left	MIMO	93.0	7	0.456	0.188	1.288	1.075	0.260	-
5710	142	802.11n	40	MCS0	20.0	19.93	0.06	Right	MIMO	93.0	7	1.44	0.606	1.288	1.075	<b>0.839</b>	5
5710	142	802.11n	40	MCS0	20.0	19.93	0.10	Top	MIMO	93.0	20	0.134	0.044	1.288	1.075	0.061	-
5710	142	802.11n	40	MCS0	20.0	19.93	-0.03	Left Corner	MIMO	93.0	8	0.634	0.249	1.288	1.075	0.345	-
5710	142	802.11n	40	MCS0	20.0	19.93	0.12	Right Corner	MIMO	93.0	8	0.891	0.383	1.288	1.075	0.530	-
5775	155	802.11ac	80	MCS0	18.0	17.19	-0.03	Rear	MIMO	86.2	17	0.134	0.037	1.288	1.160	0.055	-
5775	155	802.11ac	80	MCS0	18.0	17.19	-0.10	Left	MIMO	86.2	7	0.399	0.144	1.288	1.160	0.215	-
5775	155	802.11ac	80	MCS0	18.0	17.19	-0.04	Right	MIMO	86.2	7	0.951	0.378	1.288	1.160	0.565	-
5775	155	802.11ac	80	MCS0	18.0	17.19	-0.03	Top	MIMO	86.2	20	0.0933	0.028	1.288	1.160	0.042	-
5775	155	802.11ac	80	MCS0	18.0	17.19	0.03	Left Corner	MIMO	86.2	8	0.198	0.074	1.288	1.160	0.111	-
5775	155	802.11ac	80	MCS0	18.0	17.19	-0.01	Right Corner	MIMO	86.2	8	0.488	0.187	1.288	1.160	0.279	-
5 855	171	802.11ac	80	MCS0	18.0	17.52	0.00	Rear	MIMO	86.2	17	0.0929	0.012	1.132	1.160	0.016	-
5 855	171	802.11ac	80	MCS0	18.0	17.52	0.08	Left	MIMO	86.2	7	0.306	0.067	1.132	1.160	0.088	-
5 855	171	802.11ac	80	MCS0	18.0	17.52	0.04	Right	MIMO	86.2	7	0.753	0.306	1.132	1.160	0.402	-
5 855	171	802.11ac	80	MCS0	18.0	17.52	0.10	Top	MIMO	86.2	20	0.0887	0.019	1.132	1.160	0.025	-
5 855	171	802.11ac	80	MCS0	18.0	17.52	-0.09	Left Corner	MIMO	86.2	8	0.224	0.093	1.132	1.160	0.122	-
5 855	171	802.11ac	80	MCS0	18.0	17.52	0.13	Right Corner	MIMO	86.2	8	0.614	0.264	1.132	1.160	0.347	-
ANSI/ IEEE C95.1 - 2005- Safety Limit Spatial Peak Uncontrolled Exposure/ General Population												Body 1.6 W/kg Averaged over 1 gram					

Wi-Fi (NII) Body SAR - Grip Active																	
Frequency		Mode	Band width (MHz)	Data Rate (Mbps)	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Ant Config.	Duty Cycle	Distance (mm)	Area Scan Peak SAR (W/kg)	Meas. SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
Mhz	Ch.																
5 290	58	802.11ac	80	MCS0	12.0	11.34	0.04	Rear	MIMO	86.2	0	1.92	0.686	1.175	1.160	0.935	-
5 290	58	802.11ac	80	MCS0	12.0	11.34	-0.04	Left	MIMO	86.2	0	0.645	0.195	1.175	1.160	0.266	-
5 290	58	802.11ac	80	MCS0	12.0	11.34	-0.09	Right	MIMO	86.2	0	1.45	0.443	1.175	1.160	0.604	-
5 290	58	802.11ac	80	MCS0	12.0	11.34	0.14	Top	MIMO	86.2	0	0.442	0.126	1.175	1.160	0.172	-
5 290	58	802.11ac	80	MCS0	12.0	11.34	-0.03	Left Corner	MIMO	86.2	0	0.18	0.058	1.175	1.160	0.079	-
5 290	58	802.11ac	80	MCS0	12.0	11.34	-0.11	Right Corner	MIMO	86.2	0	0.695	0.213	1.175	1.160	0.290	-
5 610	122	802.11ac	80	MCS0	12.0	11.45	0.01	Rear	MIMO	86.2	0	2.07	0.673	1.151	1.160	0.899	-
5 690	138	802.11ac	80	MCS0	12.0	11.26	0.00	Rear	MIMO	86.2	0	1.7	0.472	1.194	1.160	0.654	-
5 530	106	802.11ac	80	MCS0	12.0	11.04	-0.05	Rear	MIMO	86.2	0	1.39	0.365	1.194	1.160	0.506	-
5 610	122	802.11ac	80	MCS0	12.0	11.45	0.08	Left	MIMO	86.2	0	0.321	0.106	1.151	1.160	0.142	-
5 610	122	802.11ac	80	MCS0	12.0	11.45	-0.02	Right	MIMO	86.2	0	1.35	0.381	1.151	1.160	0.509	-
5 610	122	802.11ac	80	MCS0	12.0	11.45	0.00	Top	MIMO	86.2	0	0.401	0.088	1.151	1.160	0.117	-
5 610	122	802.11ac	80	MCS0	12.0	11.45	-0.08	Left Corner	MIMO	86.2	0	0.371	0.096	1.151	1.160	0.128	-
5 610	122	802.11ac	80	MCS0	12.0	11.45	0.12	Right Corner	MIMO	86.2	0	0.554	0.210	1.151	1.160	0.280	-
5 775	155	802.11ac	80	MCS0	12.0	11.33	-0.10	Rear	MIMO	86.2	0	2.42	0.631	1.247	1.160	0.913	-
5 775	155	802.11ac	80	MCS0	12.0	11.33	-0.08	Left	MIMO	86.2	0	0.306	0.057	1.247	1.160	0.082	-
5 775	155	802.11ac	80	MCS0	12.0	11.33	-0.02	Right	MIMO	86.2	0	1.85	0.506	1.247	1.160	0.732	-
5 775	155	802.11ac	80	MCS0	12.0	11.33	0.00	Top	MIMO	86.2	0	0.391	0.083	1.247	1.160	0.120	-
5 775	155	802.11ac	80	MCS0	12.0	11.33	0.12	Left Corner	MIMO	86.2	0	0.731	0.156	1.247	1.160	0.226	-
5 775	155	802.11ac	80	MCS0	12.0	11.33	-0.02	Right Corner	MIMO	86.2	0	1.13	0.391	1.247	1.160	0.566	-
5 855	171	802.11ac	80	MCS0	12.0	11.60	0.01	Rear	MIMO	86.2	0	2.4	0.711	1.191	1.160	<b>0.982</b>	6
5 855	171	802.11ac	80	MCS0	12.0	11.60	-0.17	Left	MIMO	86.2	0	0.146	0.077	1.191	1.160	0.106	-
5 855	171	802.11ac	80	MCS0	12.0	11.60	0.12	Right	MIMO	86.2	0	1.66	0.518	1.191	1.160	0.716	-
5 855	171	802.11ac	80	MCS0	12.0	11.60	-0.03	Top	MIMO	86.2	0	0.315	0.106	1.191	1.160	0.146	-
5 855	171	802.11ac	80	MCS0	12.0	11.60	0.01	Left Corner	MIMO	86.2	0	0.349	0.151	1.191	1.160	0.209	-
5 855	171	802.11ac	80	MCS0	12.0	11.60	-0.06	Right Corner	MIMO	86.2	0	1.01	0.484	1.191	1.160	0.669	-
ANSI/ IEEE C95.1 - 2005- Safety Limit Spatial Peak Uncontrolled Exposure/ General Population												Body 1.6 W/kg Averaged over 1 gram					

Wi-Fi (NII) Body SAR – RSDB Mode																	
Frequency		Mode	Band width (MHz)	Data Rate (Mbps)	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Ant Config.	Duty Cycle	Distance (mm)	Area Scan Peak SAR (W/kg)	Meas. SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
Mhz	Ch.																
5 290	58	802.11ac	80	MCS0	10.0	8.86	0.00	Rear	MIMO	86.2	0	1.1	0.212	1.321	1.160	0.325	-
5 290	58	802.11ac	80	MCS0	10.0	8.86	-0.04	Left	MIMO	86.2	0	0.379	0.082	1.321	1.160	0.126	-
5 290	58	802.11ac	80	MCS0	10.0	8.86	0.09	Right	MIMO	86.2	0	0.45	0.108	1.321	1.160	0.166	-
5 290	58	802.11ac	80	MCS0	10.0	8.86	-0.10	Top	MIMO	86.2	0	0.266	0.093	1.321	1.160	0.143	-
5 290	58	802.11ac	80	MCS0	10.0	8.86	-0.08	Left Corner	MIMO	86.2	0	0.159	0.032	1.321	1.160	0.049	-
5 290	58	802.11ac	80	MCS0	10.0	8.86	-0.11	Right Corner	MIMO	86.2	0	0.482	0.146	1.321	1.160	0.224	-
5 610	122	802.11ac	80	MCS0	10.0	9.64	0.00	Rear	MIMO	86.2	0	1.32	0.327	1.096	1.160	0.417	-
5 610	122	802.11ac	80	MCS0	10.0	9.64	0.13	Left	MIMO	86.2	0	0.293	0.065	1.096	1.160	0.083	-
5 610	122	802.11ac	80	MCS0	10.0	9.64	-0.07	Right	MIMO	86.2	0	0.823	0.213	1.096	1.160	0.272	-
5 610	122	802.11ac	80	MCS0	10.0	9.64	0.00	Top	MIMO	86.2	0	0.329	0.093	1.096	1.160	0.119	-
5 610	122	802.11ac	80	MCS0	10.0	9.64	0.10	Left Corner	MIMO	86.2	0	0.287	0.059	1.096	1.160	0.075	-
5 610	122	802.11ac	80	MCS0	10.0	9.64	-0.01	Right Corner	MIMO	86.2	0	0.63	0.168	1.096	1.160	0.214	-
5 775	155	802.11ac	80	MCS0	10.0	9.53	0.00	Rear	MIMO	86.2	0	1.2	0.213	1.180	1.160	0.292	-
5 775	155	802.11ac	80	MCS0	10.0	9.53	0.13	Left	MIMO	86.2	0	0.321	0.074	1.180	1.160	0.102	-
5 775	155	802.11ac	80	MCS0	10.0	9.53	-0.12	Right	MIMO	86.2	0	1.02	0.325	1.180	1.160	0.446	-
5 775	155	802.11ac	80	MCS0	10.0	9.53	0.00	Top	MIMO	86.2	0	0.171	0.056	1.180	1.160	0.077	-
5 775	155	802.11ac	80	MCS0	10.0	9.53	-0.01	Left Corner	MIMO	86.2	0	0.464	0.087	1.180	1.160	0.119	-
5 775	155	802.11ac	80	MCS0	10.0	9.53	-0.03	Right Corner	MIMO	86.2	0	0.764	0.217	1.180	1.160	0.298	-
5 855	171	802.11ac	80	MCS0	10.0	9.91	-0.10	Rear	MIMO	86.2	0	1.64	0.509	1.026	1.160	<b>0.606</b>	7
5 855	171	802.11ac	80	MCS0	10.0	9.91	-0.14	Left	MIMO	86.2	0	0.0867	0.078	1.026	1.160	0.093	-
5 855	171	802.11ac	80	MCS0	10.0	9.91	-0.12	Right	MIMO	86.2	0	0.98	0.332	1.026	1.160	0.395	-
5 855	171	802.11ac	80	MCS0	10.0	9.91	-0.10	Top	MIMO	86.2	0	0.368	0.067	1.026	1.160	0.080	-
5 855	171	802.11ac	80	MCS0	10.0	9.91	-0.03	Left Corner	MIMO	86.2	0	0.287	0.101	1.026	1.160	0.120	-
5 855	171	802.11ac	80	MCS0	10.0	9.91	-0.03	Right Corner	MIMO	86.2	0	0.812	0.253	1.026	1.160	0.301	-
ANSI/ IEEE C95.1 - 2005 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population												Body 1.6 W/kg Averaged over 1 gram					

DSS Body SAR													
Frequency		Mode	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Ant Config.	Distance (mm)	Meas. SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
Mhz	Ch.												
2 441	39	Bluetooth DH5	17.0	15.79	0.04	Rear	Ant1	19	0.031	1.321	1.302	0.053	-
2 441	39	Bluetooth DH5	17.0	15.79	0.01	Right	Ant1	7	0.253	1.321	1.302	<b>0.435</b>	8
2 441	39	Bluetooth DH5	17.0	15.79	0.12	Top	Ant1	23	0.020	1.321	1.302	0.035	-
2 441	39	Bluetooth DH5	17.0	15.79	0.02	Right Corner	Ant1	8	0.000364	1.321	1.302	0.001	-
2 441	39	Bluetooth DH5	16.5	14.58	0.15	Rear	Ant2	17	0.00431	1.556	1.302	0.009	-
2 441	39	Bluetooth DH5	16.5	14.58	0.16	Left	Ant2	7	0.101	1.556	1.302	0.205	-
2 441	39	Bluetooth DH5	16.5	14.58	0.10	Top	Ant2	20	0.000838	1.556	1.302	0.002	-
2 441	39	Bluetooth DH5	16.5	14.58	0.05	Left Corner	Ant2	8	0.046	1.556	1.302	0.093	-
ANSI/ IEEE C95.1 - 2005 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population									Body 1.6 W/kg Averaged over 1 gram				

**DSS Body SAR – Grip Active**

Frequency		Mode	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Ant Config.	Distance (mm)	Meas. SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
Mhz	Ch.												
2 441	39	Bluetooth 3DH5	11.0	10.76	0.00	Rear	Ant1	0	0.433	1.057	1.302	<b>0.596</b>	9
2 441	39	Bluetooth 3DH5	11.0	10.76	-0.19	Right	Ant1	0	0.418	1.057	1.302	0.575	-
2 441	39	Bluetooth 3DH5	11.0	10.76	0.07	Top	Ant1	0	0.203	1.057	1.302	0.279	-
2 441	39	Bluetooth 3DH5	11.0	10.76	0.02	Right Corner	Ant1	0	0.00544	1.057	1.302	0.007	-
2 441	39	Bluetooth 2DH5	10.5	10.49	0.14	Rear	Ant2	0	0.198	1.002	1.302	0.258	-
2 441	39	Bluetooth 2DH5	10.5	10.49	0.01	Left	Ant2	0	0.307	1.002	1.302	0.401	-
2 441	39	Bluetooth 2DH5	10.5	10.49	0.10	Top	Ant2	0	0.045	1.002	1.302	0.059	-
2 441	39	Bluetooth 2DH5	10.5	10.49	0.11	Left Corner	Ant2	0	0.043	1.002	1.302	0.056	-
ANSI/ IEEE C95.1 - 2005 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population								Body 1.6 W/kg Averaged over 1 gram					

**DSS Body SAR – RSDB, mmWave, Sub6**

Frequency		Mode	Tune-Up Limit (dBm)	Meas. Power (dBm)	Power Drift (dB)	Test Position	Ant Config.	Distance (mm)	Meas. SAR (W/kg)	Scaling Factor	Scaling Factor (Duty)	Reported SAR (W/kg)	Plot No.
MHz	Ch.												
2 441	39	Bluetooth DH5	9.0	7.58	0.00	Rear	Ant1	0	<b>0.281</b>	1.236	1.302	0.452	10
2 441	39	Bluetooth DH5	9.0	7.58	-0.03	Right	Ant1	0	0.273	1.236	1.302	0.439	-
2 441	39	Bluetooth DH5	9.0	7.58	0.04	Top	Ant1	0	0.115	1.236	1.302	0.185	-
2 441	39	Bluetooth DH5	9.0	7.58	0.04	Right Corner	Ant1	0	0.129	1.236	1.302	0.208	-
2 441	39	Bluetooth DH5	9.0	7.58	0.10	Rear	Ant2	0	0.168	1.236	1.302	0.303	-
2 441	39	Bluetooth DH5	9.0	7.58	0.02	Left	Ant2	0	0.214	1.236	1.302	<b>0.386</b>	11
2 441	39	Bluetooth DH5	9.0	7.58	0.10	Top	Ant2	0	0.032	1.236	1.302	0.058	-
2 441	39	Bluetooth DH5	9.0	7.58	-0.01	Left Corner	Ant2	0	0.203	1.236	1.302	0.367	-
ANSI/ IEEE C95.1 - 2005 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population								Body 1.6 W/kg Averaged over 1 gram					

## 13.6 SAR Test Notes

### General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in FCC KDB Publication 616217 D04v01r02 and KDB Publication 447498 D01v06
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all 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 447498 D01v06.
6. Per FCC KDB 865664 D01v01r04, variability SAR measurement were performed when not the measured SAR results for a frequency band were greater than or equal to 0.8 W/kg for 1g SAR and >2 for 10g SAR Please see Section 15 for variability analysis. the maximum tune-up tolerance limit.
7. This device utilizes power reduction for some wireless mode and technologies, as outlined in sec. 4.3 The maximum output power allowed for each transmitter and exposure condition was evaluated for SAR compliance based on expected use conditions and simultaneous scenarios.
8. FCC KDB Publication 616217 D04v01r02 Section 4.3, SAR tests are required for the back surface and edges of the tablet with the tablet touching the phantom. The SAR Exclusion Threshold in FCC KDB 447498 D01v06 was applied to determine SAR test exclusion for adjacent edge configurations

### WLAN Notes:

1. Per KDB 2482227 D01v02r02 justification for test configurations of 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 802.11 g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR.
2. Per KDB 2482227 D01v02r02 justification for test configurations of 5 GHz WiFi Single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission mode were not investigated since the highest reported SAR for initial test configuration adjusted by the ration of maximum output powers is less than 1.2 W/kg for 1g SAR and less than 3.0 W/kg for 10 g SAR.
3. When the maximum reported 1g averaged SAR is  $\leq 0.8$  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  $\leq 1.20$  W/kg or all test channels were measured.
4. The device was configured to transmit continuously at the required data rated, 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 WLAN test reports.

### Bluetooth Notes:

1. Bluetooth SAR was measured with the device connected to a call box with hopping disabled with DH5 / 2DH5/ 3DH5 operation and Tx Tests mode type. Per October 2016 TCBC Workshop Notes, the reported SAR was scaled to 100% transmission duty factor to determine compliance. Please see sec.11 for the time-domain plot and calculation for duty factor of the device.

## 14. Simultaneous SAR Analysis

### 14.1 Body SAR Simultaneous Transmission Analysis

#### 14.1.1 Simultaneous Teransmission Scenario with Bluetooth Ant.2 and 5 GHz MIMO WLAN and 6 GHz MIMO WLAN (Inactive)

Band		Bluetooth Ant.1 SAR	2.4GHz Ant.2 WLAN SAR	5GHz MIMO WLAN SAR	6GHz MIMO WLAN SAR	∑ 1-g SAR	SPLSR					
		(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(Yes/No)
		1	2	4	5	1+2	1+4	1+5	1+2+4	1+3+5		
Bluetooth Ant1	Rear	0.053	0.045	0.093	0.014	0.098	0.146	0.067	0.191	0.112	No	
	Left	0	0.222	0.421	0.03	0.222	0.421	0.03	0.643	0.252	No	
	Right	0.435	0	0.756	0.087	0.435	1.191	0.522	1.191	0.522	No	
	Top	0.035	0.011.	0.062	0.02	0.046	0.097	0.055	0.108	0.066	No	
	Left Corner	0	0.098	0.295	0.02	0.098	0.295	0.02	0.393	0.118	No	
	Right Corner	0.001	0.003	0.484	0.036	0.004	0.485	0.037	0.488	0.040	No	

Band		Bluetooth Ant.2 SAR	5GHz MIMO WLAN SAR	6GHz MIMO WLAN SAR	∑ 1-g SAR	∑ 1-g SAR	SPLSR
		(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(Yes/No)
		1	2	3	1+2	1+3	
Bluetooth Ant2	Rear	0.007	0.093	0.014	0.1	0.021	No
	Left	0.157	0.421	0.03	0.578	0.187	No
	Right	0	0.756	0.087	0.756	0.087	No
	Top	0.001	0.062	0.02	0.063	0.021	No
	Left Corner	0.072	0.295	0.02	0.367	0.092	No
	Right Corner	0.	0.484	0.036	0.484	0.036	No

0

Band		2.4GHz MIMO WLAN SAR	5GHz MIMO WLAN SAR	6GHz MIMO WLAN SAR	∑ 1-g SAR	∑ 1-g SAR	SPLSR
		(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(Yes/No)
		1	2	3	1+2	1+3	
2.4GHz MIMO WLAN	Rear	0.102	0.093	0.014	0.195	0.116	No
	Left	0.287	0.421	0.03	0.708	0.317	No
	Right	0.469	0.756	0.087	1.225	0.556	No
	Top	0.07	0.062	0.02	0.132	0.09	No
	Left Corner	0.132	0.295	0.02	0.427	0.152	No
	Right Corner	0.246	0.484	0.036	0.73	0.282	No

## 14.2 Body SAR Simultaneous Transmission Analysis (Active).

### 14.2.1 Simultaneous Teransmission Scenario with Bluetooth Ant.2 and 5 GHz MIMO WLAN and 6 GHz MIMO WLAN (Active)

Band		Bluetooth Ant.1 SAR	2.4GHz Ant.2 WLAN SAR	2.4GHz MIMO WLAN SAR	5GHz MIMO WLAN SAR	6GHz MIMO WLAN SAR	∑ 1-g SAR	SPLSR					
		(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(Yes/No)
		1	2	3	4	5	1+2	1+4	1+5	1+2+4	1+3+5	No	
Bluetooth Ant1	Rear	0.596	0.393	0.606	0.583	0.989	1.202	1.179	1.595	1.572	1.572	No	
	Left	0	0.764	0.126	0.062	0.764	0.126	0.062	0.89	0.826	0.789	No	
	Right	0.575	0	0.446	0.264	0.575	1.021	0.839	1.021	0.839	0.839	No	
	Top	0.279	0.107	0.143	0.069	0.386	0.422	0.348	0.529	0.455	0.455	No	
	Left Corner	0	0.106	0.12	0.079	0.106	0.12	0.079	0.226	0.185	0.185	No	
	Right Corner	0.007	0	0.301	0.104	0.007	0.308	0.111	0.308	0.111	0.111	No	

Band		Bluetooth Ant.2 SAR	5GHz MIMO WLAN SAR	6GHz MIMO WLAN SAR	∑ 1-g SAR	∑ 1-g SAR	SPLSR
		(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(Yes/No)
		1	2	3	1+2	1+3	No
Bluetooth Ant2	Rear	0.258	0.606	0.583	0.864	0.841	No
	Left	0.401	0.126	0.062	0.527	0.463	No
	Right	0	0.446	0.264	0.446	0.264	No
	Top	0.059	0.143	0.069	0.202	0.128	No
	Left Corner	0.056	0.12	0.079	0.176	0.135	No
	Right Corner	0	0.301	0.104	0.301	0.104	No

Band		2.4GHz MIMO WLAN SAR	5GHz MIMO WLAN SAR	6GHz MIMO WLAN SAR	∑ 1-g SAR	∑ 1-g SAR	SPLSR
		(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(Yes/No)
		1	2	3	1+2	1+3	No
2.4GHz MIMO WLAN	Rear	0.554	0.606	0.583	1.160	1.137	No
	Left	0.878	0.126	0.062	1.004	0.940	No
	Right	0.60	0.446	0.264	1.050	0.868	No
	Top	0.340	0.143	0.069	0.483	0.409	No
	Left Corner	0.094	0.12	0.079	0.214	0.173	No
	Right Corner	0.279	0.301	0.104	0.580	0.383	No

### **14.3 Simultaneous Transmission Conclusion**

The above numerical summed SAR Results are sufficient to determine that simultaneous transmission cases will not exceed the SAR Limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06 and IEEE1528-2013.

## 15. SAR Measurement Variability and Uncertainty

In accordance with KDB procedure 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz, SAR additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement variability was assessed using the following procedures for each frequency band:

- 1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg for 1g SAR or < 2.0 W/kg for 10g SAR; steps 2) through 4) do not apply.
- 2) When the original highest measured 1g SAR is  $\geq 0.80$  W/kg or 10g SAR  $\geq 2.0$ W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is  $\geq 1.45$  W/kg for 1g SAR or  $\geq 3.625$  W/kg for 10g SAR (~ 10% from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg for 1g SAR or  $\geq 3.75$  W/kg for 10g SAR and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

SAR measurement variability Results

Frequency		Mode/Band	Configuration	Measured SAR	Repeated SAR	SAR Ratio
Mhz	Channel			(W/kg)	(W/kg)	
2 462	11	2.4GHz	Left	1.328	1.135	1.17

## 16. Measurement Uncertainty

The measured SAR was  $<1.5$  W/Kg for 1g SAR and  $<3.75$  W/Kg For 10g SAR for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE1528-2013 was not required.

## 17. Device Holder Perturbation Verification.

In accordance with published DUT Holder Perturbations in Oct.2016 TCB Workshop.  
When Highest reported SAR is over 1.2 W/kg, Holder Perturbation Verification is required for each antenna, using the highest configuration among all applicable frequency bands.

Frequency		Mode/Band	Configuration	Highest Reported SAR		Deviation (%)
MHz	Channel			(without Device Holder)	(with Device Holder)	
				(W/kg)	(W/kg)	
2462	11	2.4GHz WLAN	802.11b	1.328	1.135	17.00

### 18. SAR Test Equipment

Manufacturer	Type / Model	S/N	Calib. Date	Calib.Interval	Calib.Due
SPEAG	SAM Phantom	-	N/A	N/A	N/A
SPEAG	ELI Phantom	-	N/A	N/A	N/A
HP	SAR System Control PC	-	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F11/ 5K3RA1/ C/ 01	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F12/ 5K9GA1/ C/ 01	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F13/ 5SD0A1/ C/ 01	N/A	N/A	N/A
Staubli	TX90 XLspeag	F11/ 5K3RA1/ A/ 01	N/A	N/A	N/A
Staubli	TX90 XLspeag	F12/ 5K9GA1/ A/ 01	N/A	N/A	N/A
Staubli	TX90 XLspeag	F13/ 5SD0A1/ A/ 01	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	S-1203 0309	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	SE UKS 030 AA	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)/SP2	SE UKS 030 AA	N/A	N/A	N/A
TESTO	175-H1/Thermometer	40331936309	01/26/2021	Annual	01/26/2022
TESTO	175-H1/Thermometer	40331939309	01/26/2021	Annual	01/26/2022
TESTO	608-H1/Thermometer	83348029	11/15/2021	Annual	01/26/2022
SPEAG	DAE4	1417	02/22/2021	Annual	02/22/2022
SPEAG	DAE4	911	03/22/2021	Annual	03/22/2022
SPEAG	DAE4	504	02/19/2021	Annual	02/19/2022
SPEAG	E-Field Probe EX3DV4	7309	04/20/2021	Annual	04/20/2022
SPEAG	E-Field Probe ES3DV3	3076	07/28/2021	Annual	07/28/2022
SPEAG	E-Field Probe EX3DV4	7679	09/10/2021	Annual	09/10/2022
SPEAG	Dipole D2450V2	965	06/15/2021	Annual	06/15/2022
SPEAG	Dipole D5GHzV2	1107	07/22/2021	Annual	07/22/2022
SPEAG	Dipole D5GHzV2	1317	08/28/2020	Biennial	08/28/2022
SPEAG	Dipole D6.5GHzV2	1012	09/24/2021	Annual	09/24/2022
Agilent	Power Meter E4419B	MY41291386	10/06/2021	Annual	10/06/2022
Agilent	Power Meter N1911A	MY45101406	07/08/2021	Annual	07/08/2022
Agilent	Power Sensor 8481A	SG1091286	10/06/2021	Annual	10/06/2022
Agilent	Power Sensor 8481A	MY41090675	10/06/2021	Annual	10/06/2022
Agilent	Power Sensor N1921A	MY55220026	08/05/2021	Annual	08/05/2022
SPEAG	DAKS 3.5	1038	03/17/2021	Annual	03/17/2022
ROHDE&SCHWARZ	Signal Generator SMB100A	177633	07/05/2021	Annual	07/05/2022
Agilent	WIRELESS COMMUNICATION E5515C	MY48360252	07/23/2021	Annual	07/23/2022
R&S	CMW-Z800A Up/Down converter	100218	N/A	N/A	N/A
Agilent	11636B/Power Divider	58698	02/26/2021	Annual	02/26/2022
OSI	Power Divider	#1	06/24/2021	Annual	06/24/2022
OSI	Power Divider	#2	06/24/2021	Annual	06/24/2022
OSI	Power Divider	#3	06/24/2021	Annual	06/24/2022
OSI	Power Divider	#4	06/24/2021	Annual	06/24/2022
OSI	Power Divider	#5	06/24/2021	Annual	06/24/2022
OSI	Power Divider	#6	06/24/2021	Annual	06/24/2022
EMPOWER	RF Power Amplifier	1084	06/25/2021	Annual	06/25/2022
EMPOWER	RF Power Amplifier	1041D/C0508	06/24/2021	Annual	06/24/2022
EMPOWER	RF Power Amplifier	BBS5K8CAJ	10/05/2021	Annual	10/05/2022
MICRO LAB	LP Filter / LA-30N	-	10/06/2021	Annual	10/06/2022
MICRO LAB	LP Filter / LA-60N	32011	10/06/2021	Annual	10/06/2022
HP	Attenuator (3dB) 333340A	02427	09/06/2021	Annual	09/06/2022
HP	Attenuator (20dB) 8493C	09271	09/06/2021	Annual	09/17/2022
Agilent	Directional Bridge 86205A	3140A03878	05/28/2021	Annual	05/28/2022
Agilent	MXA Signal Analyzer N9020A	MY50510407	10/20/2021	Annual	10/20/2022
ROHDE&SCHWARZ	BLUETOOTH TESTER CBT	100272	02/26/2021	Annual	02/26/2022

\* The E-field probe was calibrated by SPEAG, by the waveguide technique procedure. Dipole Verification measurement is performed by HCT Lab. before each test. The brain/body simulating material is calibrated by HCT using the DAKS 3.5 to determine the conductivity and permittivity (dielectric constant) of the brain/body-equivalent material.

## 19. Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the ANSI/ IEEE C95.1 - 2005.

These measurements were taken to simulate the RF effects 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.

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## 21. Appendix A. DUT Ant. Information & SETUP PHOTO

Please refer to test DUT Ant. Information & setup photo file no. as follows:

No.	Description
0	HCT-SR-2111-FC016-P