



SAR EVALUATION REPORT

Applicant Name:
Apple, Inc.
One Apple Park Way
Cupertino, CA 95014 USA

Date of Testing:
06/22/2022 – 07/25/2022
Test Site/Location:
Element Lab, Morgan Hill, CA, USA
Document Serial No.:
1C2205090022-11.BCG (Rev 1)

FCC ID: BCGA2696
APPLICANT: APPLE, INC.

DUT Type: Tablet Device
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model: A2696

Equipment Class	Band & Mode	Operating Modes	Tx Frequency	SAR
				1g Body (W/kg)
DTS	2.4 GHz WLAN	Data	2412 - 2472 MHz	1.14
NII	U-NII-1	Data	5180 - 5240 MHz	1.14
NII	U-NII-2A	Data	5260 - 5320 MHz	1.19
NII	U-NII-2C	Data	5500 - 5720 MHz	1.12
NII	U-NII-3	Data	5745 - 5825 MHz	1.18
DSS/DTS	Bluetooth	Data	2402 - 2480 MHz	0.65
Simultaneous SAR per KDB 690783 D01v01r03:				1.52

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

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.7 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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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
2.4 GHz WLAN	Data	2412 - 2472 MHz
U-NII-1	Data	5180 - 5240 MHz
U-NII-2A	Data	5260 - 5320 MHz
U-NII-2C	Data	5500 - 5720 MHz
U-NII-3	Data	5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz

1.2 Power Reduction for SAR

This device utilizes an independent single step power reduction mechanism for Bluetooth operations. When Bluetooth is operating simultaneously with 5 GHz WLAN, the output power of Bluetooth is reduced for the duration of simultaneous operation. SAR evaluation was additionally performed at the maximum allowed output power for Bluetooth which is applicable for all other use cases.

This device used an independent mechanism that limits WIFI powers to a time-averaged output power. For the purposes of this test report, all SAR measurements were performed with the algorithm disabled at the maximum time-averaged output power level. Appendix G includes verification data for this time-averaged SAR mechanism.

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.

1.3.1 Maximum Time-Averaged Output Power

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

Mode/ Band			IEEE 802.11b (2.4 GHz)		IEEE 802.11g (2.4 GHz)		IEEE 802.11n (2.4 GHz)		IEEE 802.11ax SU (2.4 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - Single Tx Chain (dBm) - Antenna WF8	20 MHz Bandwidth	1	20.50	19.00	15.50	14.00	15.50	14.00	14.50	13.00
		2	20.50	19.00	19.50	18.00	19.50	18.00	18.00	16.50
		3	20.50	19.00	20.50	19.00	20.50	19.00	20.00	18.50
		4	20.50	19.00	20.50	19.00	20.50	19.00	20.50	19.00
		5	20.50	19.00	20.50	19.00	20.50	19.00	20.50	19.00
		6	20.50	19.00	20.50	19.00	20.50	19.00	20.50	19.00
		7	20.50	19.00	20.50	19.00	20.50	19.00	20.50	19.00
		8	20.50	19.00	20.50	19.00	20.50	19.00	20.50	19.00
		9	20.50	19.00	20.50	19.00	20.50	19.00	20.50	19.00
		10	20.50	19.00	20.50	19.00	20.50	19.00	18.50	17.00
		11	20.50	19.00	17.50	16.00	17.50	16.00	15.00	13.50
		12	17.50	16.00	14.50	13.00	14.50	13.00	12.00	10.50
		13	16.00	14.50	10.50	9.00	10.50	9.00	NS	NS

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Mode/ Band			IEEE 802.11g (2.4 GHz)		IEEE 802.11n (2.4 GHz)		IEEE 802.11ax SU (2.4 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) - Antenna WF8	20 MHz Bandwidth	1	14.25	12.75	14.25	12.75	13.75	12.25
		2	18.75	17.25	18.75	17.25	17.50	16.00
		3	20.00	18.50	20.00	18.50	19.50	18.00
		4	20.50	19.00	20.50	19.00	20.00	18.50
		5	20.50	19.00	20.50	19.00	20.50	19.00
		6	20.50	19.00	20.50	19.00	20.50	19.00
		7	20.50	19.00	20.50	19.00	20.50	19.00
		8	20.50	19.00	20.50	19.00	20.50	19.00
		9	20.50	19.00	20.50	19.00	19.50	18.00
		10	19.00	17.50	19.00	17.50	18.50	17.00
		11	14.50	13.00	14.50	13.00	14.50	13.00
		12	12.00	10.50	12.00	10.50	11.50	10.00
		13	8.50	7.00	8.50	7.00	NS	NS

Note: In MIMO operations, each antenna transmits at maximum allowed powers as indicated above.

Mode/ Band			IEEE 802.11b (2.4 GHz)		IEEE 802.11g (2.4 GHz)		IEEE 802.11n (2.4 GHz)		IEEE 802.11ax SU (2.4 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - Single Tx Chain (dBm) - Antenna WF7B	20 MHz Bandwidth	1	20.25	18.75	15.50	14.00	15.50	14.00	14.50	13.00
		2	20.25	18.75	19.50	18.00	19.50	18.00	18.00	16.50
		3	20.25	18.75	20.25	18.75	20.25	18.75	20.00	18.50
		4	20.25	18.75	20.25	18.75	20.25	18.75	20.25	18.75
		5	20.25	18.75	20.25	18.75	20.25	18.75	20.25	18.75
		6	20.25	18.75	20.25	18.75	20.25	18.75	20.25	18.75
		7	20.25	18.75	20.25	18.75	20.25	18.75	20.25	18.75
		8	20.25	18.75	20.25	18.75	20.25	18.75	20.25	18.75
		9	20.25	18.75	20.25	18.75	20.25	18.75	20.25	18.75
		10	20.25	18.75	20.25	18.75	20.25	18.75	18.50	17.00
		11	20.25	18.75	17.50	16.00	17.50	16.00	15.00	13.50
		12	17.50	16.00	14.50	13.00	14.50	13.00	12.00	10.50
		13	16.00	14.50	10.50	9.00	10.50	9.00	NS	NS

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Mode/ Band			IEEE 802.11g (2.4 GHz)		IEEE 802.11n (2.4 GHz)		IEEE 802.11ax SU (2.4 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) - Antenna WF7B	20 MHz Bandwidth	1	14.25	12.75	14.25	12.75	13.75	12.25
		2	18.75	17.25	18.75	17.25	17.50	16.00
		3	20.00	18.50	20.00	18.50	19.50	18.00
		4	20.25	18.75	20.25	18.75	20.00	18.50
		5	20.25	18.75	20.25	18.75	20.25	18.75
		6	20.25	18.75	20.25	18.75	20.25	18.75
		7	20.25	18.75	20.25	18.75	20.25	18.75
		8	20.25	18.75	20.25	18.75	20.25	18.75
		9	20.25	18.75	20.25	18.75	19.50	18.00
		10	19.00	17.50	19.00	17.50	18.50	17.00
		11	14.50	13.00	14.50	13.00	14.50	13.00
		12	12.00	10.50	12.00	10.50	11.50	10.00
		13	8.50	7.00	8.50	7.00	NS	NS

Note: In MIMO operations, each antenna transmits at maximum allowed powers as indicated above.

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Mode/ Band			IEEE 802.11a (5 GHz)		IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)		IEEE 802.11ax SU (5 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - Single Tx Chain (dBm) - 5GHz Antenna WF8	20 MHz Bandwidth	36	16.75	15.25	16.75	15.25	16.75	15.25	16.75	15.25
		40	16.75	15.25	16.75	15.25	16.75	15.25	16.75	15.25
		44	16.75	15.25	16.75	15.25	16.75	15.25	16.75	15.25
		48	16.75	15.25	16.75	15.25	16.75	15.25	16.75	15.25
		52	17.50	16.00	17.50	16.00	17.50	16.00	17.50	16.00
		56	17.50	16.00	17.50	16.00	17.50	16.00	17.50	16.00
		60	17.50	16.00	17.50	16.00	17.50	16.00	17.50	16.00
		64	17.50	16.00	17.50	16.00	17.50	16.00	17.00	15.50
		100	16.50	15.00	16.50	15.00	16.50	15.00	14.75	13.25
		104	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		108	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		112	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		116	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		120	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		124	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		128	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		132	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		136	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		140	14.00	12.50	14.00	12.50	14.00	12.50	12.00	10.50
		144	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		149	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		153	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		157	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		161	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		165	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
	40 MHz Bandwidth	38			12.50	11.00	12.50	11.00	11.75	10.25
		46			16.75	15.25	16.75	15.25	16.75	15.25
		54			17.50	16.00	17.50	16.00	17.50	16.00
		62			12.00	10.50	12.00	10.50	11.75	10.25
		102			11.25	9.75	11.25	9.75	11.00	9.50
		110			17.25	15.75	17.25	15.75	17.25	15.75
		118			17.25	15.75	17.25	15.75	17.25	15.75
		126			17.25	15.75	17.25	15.75	17.25	15.75
		134			17.00	15.50	17.00	15.50	15.50	14.00
		142			17.25	15.75	17.25	15.75	17.25	15.75
		151			17.25	15.75	17.25	15.75	17.25	15.75
		159			17.25	15.75	17.25	15.75	17.25	15.75
	80 MHz Bandwidth	42					13.50	12.00	12.25	10.75
		58					11.50	10.00	11.00	9.50
		106					11.00	9.50	11.00	9.50
		122					17.25	15.75	17.25	15.75
		138					17.25	15.75	17.25	15.75
		155					17.25	15.75	17.25	15.75

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Mode/ Band		Channel	IEEE 802.11a (5 GHz)		IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)		IEEE 802.11ax SU (5 GHz)	
			Maximum	Nominal	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) CDD - 5GHz Antenna WF8	20 MHz Bandwidth	36	16.50	15.00	16.50	15.00	16.50	15.00	15.50	14.00
		40	16.75	15.25	16.75	15.25	16.75	15.25	16.75	15.25
		44	16.75	15.25	16.75	15.25	16.75	15.25	16.75	15.25
		48	16.75	15.25	16.75	15.25	16.75	15.25	16.75	15.25
		52	16.75	15.25	16.75	15.25	16.75	15.25	16.75	15.25
		56	16.75	15.25	16.75	15.25	16.75	15.25	16.75	15.25
		60	16.75	15.25	16.75	15.25	16.75	15.25	16.75	15.25
		64	16.75	15.25	16.75	15.25	16.75	15.25	16.25	14.75
		100	16.50	15.00	16.50	15.00	16.50	15.00	14.75	13.25
		104	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		108	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		112	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		116	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		120	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		124	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		128	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		132	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		136	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		140	12.00	10.50	12.00	10.50	12.00	10.50	11.00	9.50
		144	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		149	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
	40 MHz Bandwidth	153	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		157	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		161	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		165	17.25	15.75	17.25	15.75	17.25	15.75	17.25	15.75
		38			11.25	9.75	11.25	9.75	10.50	9.00
		46			16.75	15.25	16.75	15.25	16.75	15.25
		54			17.50	16.00	17.50	16.00	17.50	16.00
		62			11.50	10.00	11.50	10.00	10.50	9.00
		102			10.50	9.00	10.50	9.00	10.00	8.50
		110			17.25	15.75	17.25	15.75	17.25	15.75
		118			17.25	15.75	17.25	15.75	17.25	15.75
	80 MHz Bandwidth	126			17.25	15.75	17.25	15.75	17.25	15.75
		134			14.75	13.25	14.75	13.25	15.00	13.50
		142			17.25	15.75	17.25	15.75	17.25	15.75
		151			17.25	15.75	17.25	15.75	17.25	15.75
		159			17.25	15.75	17.25	15.75	17.25	15.75
		42					11.00	9.50	10.50	9.00
		58					10.50	9.00	10.25	8.75
		106					10.25	8.75	10.50	9.00
		122					17.25	15.75	17.00	15.50
		138					17.25	15.75	17.25	15.75
		155					16.50	15.00	16.50	15.00

Note: In MIMO operations, each antenna transmits at maximum allowed powers as indicated above.

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Mode/ Band		Channel	IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)		IEEE 802.11ax SU (5 GHz)	
			Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) SDM - 5GHz Antenna WF8	20 MHz Bandwidth	36	16.50	15.00	16.50	15.00	15.50	14.00
		40	16.75	15.25	16.75	15.25	16.75	15.25
		44	16.75	15.25	16.75	15.25	16.75	15.25
		48	16.75	15.25	16.75	15.25	16.75	15.25
		52	17.00	15.50	17.00	15.50	17.00	15.50
		56	17.00	15.50	17.00	15.50	17.00	15.50
		60	17.00	15.50	17.00	15.50	17.00	15.50
		64	17.00	15.50	17.00	15.50	16.25	14.75
		100	15.50	14.00	15.50	14.00	14.75	13.25
		104	17.00	15.50	17.00	15.50	17.00	15.50
		108	17.00	15.50	17.00	15.50	17.00	15.50
		112	17.00	15.50	17.00	15.50	17.00	15.50
		116	17.00	15.50	17.00	15.50	17.00	15.50
		120	17.00	15.50	17.00	15.50	17.00	15.50
		124	17.00	15.50	17.00	15.50	17.00	15.50
		128	17.00	15.50	17.00	15.50	17.00	15.50
		132	17.00	15.50	17.00	15.50	17.00	15.50
		136	17.00	15.50	17.00	15.50	17.00	15.50
		140	12.00	10.50	12.00	10.50	11.00	9.50
		144	17.00	15.50	17.00	15.50	17.00	15.50
		149	17.25	15.75	17.25	15.75	17.25	15.75
		153	17.25	15.75	17.25	15.75	17.25	15.75
		157	17.25	15.75	17.25	15.75	17.25	15.75
		161	17.25	15.75	17.25	15.75	17.25	15.75
		165	17.25	15.75	17.25	15.75	17.25	15.75
	40 MHz Bandwidth	38	11.25	9.75	11.25	9.75	10.50	9.00
		46	16.75	15.25	16.75	15.25	16.75	15.25
		54	17.50	16.00	17.50	16.00	17.50	16.00
		62	11.50	10.00	11.50	10.00	10.50	9.00
		102	10.50	9.00	10.50	9.00	10.00	8.50
		110	17.25	15.75	17.25	15.75	17.25	15.75
		118	17.25	15.75	17.25	15.75	17.25	15.75
		126	17.25	15.75	17.25	15.75	17.25	15.75
		134	14.75	13.25	14.75	13.25	15.00	13.50
		142	17.25	15.75	17.25	15.75	17.25	15.75
		151	17.25	15.75	17.25	15.75	17.25	15.75
		159	17.25	15.75	17.25	15.75	17.25	15.75
	80 MHz Bandwidth	42			11.00	9.50	10.50	9.00
		58			10.50	9.00	10.25	8.75
		106			10.25	8.75	10.50	9.00
		122			17.25	15.75	17.00	15.50
		138			17.25	15.75	17.25	15.75
		155			16.50	15.00	16.50	15.00

Note: In MIMO operations, each antenna transmits at maximum allowed powers as indicated above.

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Mode/ Band			IEEE 802.11a (5 GHz)		IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)		IEEE 802.11ax SU (5 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - Single Tx Chain (dBm) - 5GHz Antenna WF7A	20 MHz Bandwidth	36	16.00	14.50	16.00	14.50	16.00	14.50	16.00	14.50
		40	16.00	14.50	16.00	14.50	16.00	14.50	16.00	14.50
		44	16.00	14.50	16.00	14.50	16.00	14.50	16.00	14.50
		48	16.00	14.50	16.00	14.50	16.00	14.50	16.00	14.50
		52	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		56	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		60	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		64	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		100	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		104	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		108	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		112	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		116	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		120	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		124	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		128	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		132	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		136	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		140	14.00	12.50	14.00	12.50	14.00	12.50	12.00	10.50
		144	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		149	13.75	12.25	13.75	12.25	13.75	12.25	13.75	12.25
	40 MHz Bandwidth	153	13.75	12.25	13.75	12.25	13.75	12.25	13.75	12.25
		157	13.75	12.25	13.75	12.25	13.75	12.25	13.75	12.25
		161	13.75	12.25	13.75	12.25	13.75	12.25	13.75	12.25
		165	13.75	12.25	13.75	12.25	13.75	12.25	13.75	12.25
		38			12.50	11.00	12.50	11.00	11.75	10.25
		46			16.00	14.50	16.00	14.50	16.00	14.50
		54			15.25	13.75	15.25	13.75	15.25	13.75
		62			12.00	10.50	12.00	10.50	11.75	10.25
		102			11.25	9.75	11.25	9.75	11.00	9.50
		110			14.00	12.50	14.00	12.50	14.00	12.50
	80 MHz Bandwidth	118			14.00	12.50	14.00	12.50	14.00	12.50
		126			14.00	12.50	14.00	12.50	14.00	12.50
		134			14.00	12.50	14.00	12.50	14.00	12.50
		142			14.00	12.50	14.00	12.50	14.00	12.50
		151			13.75	12.25	13.75	12.25	13.75	12.25
		159			13.75	12.25	13.75	12.25	13.75	12.25
		42					13.50	12.00	12.25	10.75
		58					11.50	10.00	11.00	9.50
		106					11.00	9.50	11.00	9.50
		122					14.00	12.50	14.00	12.50
		138					14.00	12.50	14.00	12.50
		155					13.75	12.25	13.75	12.25

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Mode/ Band		Channel	IEEE 802.11a (5 GHz)		IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)		IEEE 802.11ax SU (5 GHz)	
			Maximum	Nominal	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) CDD - 5GHz Antenna WF7A	20 MHz Bandwidth	36	16.00	14.50	16.00	14.50	16.00	14.50	15.50	14.00
		40	16.00	14.50	16.00	14.50	16.00	14.50	16.00	14.50
		44	16.00	14.50	16.00	14.50	16.00	14.50	16.00	14.50
		48	16.00	14.50	16.00	14.50	16.00	14.50	16.00	14.50
		52	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		56	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		60	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		64	15.25	13.75	15.25	13.75	15.25	13.75	15.25	13.75
		100	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		104	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		108	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		112	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		116	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		120	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		124	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		128	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		132	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		136	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		140	12.00	10.50	12.00	10.50	12.00	10.50	11.00	9.50
		144	14.00	12.50	14.00	12.50	14.00	12.50	14.00	12.50
		149	13.75	12.25	13.75	12.25	13.75	12.25	13.75	12.25
		153	13.75	12.25	13.75	12.25	13.75	12.25	13.75	12.25
		157	13.75	12.25	13.75	12.25	13.75	12.25	13.75	12.25
		161	13.75	12.25	13.75	12.25	13.75	12.25	13.75	12.25
		165	13.75	12.25	13.75	12.25	13.75	12.25	13.75	12.25
	40 MHz Bandwidth	38			11.25	9.75	11.25	9.75	10.50	9.00
		46			16.00	14.50	16.00	14.50	16.00	14.50
		54			15.25	13.75	15.25	13.75	15.25	13.75
		62			11.50	10.00	11.50	10.00	10.50	9.00
		102			10.50	9.00	10.50	9.00	10.00	8.50
		110			14.00	12.50	14.00	12.50	14.00	12.50
		118			14.00	12.50	14.00	12.50	14.00	12.50
		126			14.00	12.50	14.00	12.50	14.00	12.50
		134			14.00	12.50	14.00	12.50	14.00	12.50
		142			14.00	12.50	14.00	12.50	14.00	12.50
	80 MHz Bandwidth	151			13.75	12.25	13.75	12.25	13.75	12.25
		159			13.75	12.25	13.75	12.25	13.75	12.25
		42					11.00	9.50	10.50	9.00
		58					10.50	9.00	10.25	8.75
		106					10.25	8.75	10.50	9.00
		122					14.00	12.50	14.00	12.50
		138					14.00	12.50	14.00	12.50
		155					13.75	12.25	13.75	12.25

Note: In MIMO operations, each antenna transmits at maximum allowed powers as indicated above.

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Mode/ Band			IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)		IEEE 802.11ax SU (5 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) SDM - 5GHz Antenna WF7A	20 MHz Bandwidth	36	16.00	14.50	16.00	14.50	15.50	14.00
		40	16.00	14.50	16.00	14.50	16.00	14.50
		44	16.00	14.50	16.00	14.50	16.00	14.50
		48	16.00	14.50	16.00	14.50	16.00	14.50
		52	15.25	13.75	15.25	13.75	15.25	13.75
		56	15.25	13.75	15.25	13.75	15.25	13.75
		60	15.25	13.75	15.25	13.75	15.25	13.75
		64	15.25	13.75	15.25	13.75	15.25	13.75
		100	14.00	12.50	14.00	12.50	14.00	12.50
		104	14.00	12.50	14.00	12.50	14.00	12.50
		108	14.00	12.50	14.00	12.50	14.00	12.50
		112	14.00	12.50	14.00	12.50	14.00	12.50
		116	14.00	12.50	14.00	12.50	14.00	12.50
		120	14.00	12.50	14.00	12.50	14.00	12.50
		124	14.00	12.50	14.00	12.50	14.00	12.50
		128	14.00	12.50	14.00	12.50	14.00	12.50
		132	14.00	12.50	14.00	12.50	14.00	12.50
		136	14.00	12.50	14.00	12.50	14.00	12.50
		140	12.00	10.50	12.00	10.50	11.00	9.50
		144	14.00	12.50	14.00	12.50	14.00	12.50
		149	13.75	12.25	13.75	12.25	13.75	12.25
		153	13.75	12.25	13.75	12.25	13.75	12.25
		157	13.75	12.25	13.75	12.25	13.75	12.25
		161	13.75	12.25	13.75	12.25	13.75	12.25
		165	13.75	12.25	13.75	12.25	13.75	12.25
	40 MHz Bandwidth	38	11.25	9.75	11.25	9.75	10.50	9.00
		46	16.00	14.50	16.00	14.50	16.00	14.50
		54	15.25	13.75	15.25	13.75	15.25	13.75
		62	11.50	10.00	11.50	10.00	10.50	9.00
		102	10.50	9.00	10.50	9.00	10.00	8.50
		110	14.00	12.50	14.00	12.50	14.00	12.50
		118	14.00	12.50	14.00	12.50	14.00	12.50
		126	14.00	12.50	14.00	12.50	14.00	12.50
		134	14.00	12.50	14.00	12.50	14.00	12.50
		142	14.00	12.50	14.00	12.50	14.00	12.50
		151	13.75	12.25	13.75	12.25	13.75	12.25
		159	13.75	12.25	13.75	12.25	13.75	12.25
	80 MHz Bandwidth	42			11.00	9.50	10.50	9.00
		58			10.50	9.00	10.25	8.75
		106			10.25	8.75	10.50	9.00
		122			14.00	12.50	14.00	12.50
		138			14.00	12.50	14.00	12.50
		155			13.75	12.25	13.75	12.25

Note: In MIMO operations, each antenna transmits at maximum allowed powers as indicated above.

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1.3.2

Bluetooth Maximum Output Power

Mode / Band		Modulated Average (EPA) - Single Tx Chain (dBm) - Antenna WF8
Bluetooth BDR/LE	Maximum	18.00
	Nominal	16.50
Bluetooth EDR	Maximum	15.00
	Nominal	13.50
Bluetooth HDR	Maximum	14.00
	Nominal	12.50

Mode / Band		Modulated Average (EPA) - TxBF (dBm) - Antenna WF8
Bluetooth BDR/LE	Maximum	17.00
	Nominal	15.50
Bluetooth EDR	Maximum	13.50
	Nominal	12.00
Bluetooth HDR	Maximum	14.00
	Nominal	12.50

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Mode / Band		Modulated Average (EPA) - Single Tx Chain (dBm) - Antenna WF7B
Bluetooth BDR/LE	Maximum	19.50
	Nominal	18.00
Bluetooth EDR	Maximum	15.00
	Nominal	13.50
Bluetooth HDR	Maximum	14.00
	Nominal	12.50

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Mode / Band		Modulated Average (EPA) -TxBF (dBm) - Antenna WF7B
Bluetooth BDR/LE	Maximum	17.00
	Nominal	15.50
Bluetooth EDR	Maximum	13.50
	Nominal	12.00
Bluetooth HDR	Maximum	14.00
	Nominal	12.50

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Mode / Band		Modulated Average (IPA) - Single Tx Chain (dBm) - Antenna WF8
Bluetooth BDR/LE	Maximum	12.00
	Nominal	10.50
Bluetooth EDR	Maximum	9.50
	Nominal	8.00
Bluetooth HDR	Maximum	7.00
	Nominal	5.50

Mode / Band		Modulated Average (IPA) - TxBF (dBm) - Antenna WF8
Bluetooth BDR/LE	Maximum	12.00
	Nominal	10.50
Bluetooth EDR	Maximum	9.50
	Nominal	8.00
Bluetooth HDR	Maximum	7.00
	Nominal	5.50

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

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Mode / Band		Modulated Average (IPA) - Single Tx Chain (dBm) - Antenna WF7B
Bluetooth BDR/LE	Maximum	12.50
	Nominal	11.00
Bluetooth EDR	Maximum	9.50
	Nominal	8.00
Bluetooth HDR	Maximum	8.00
	Nominal	6.50

Mode / Band		Modulated Average (IPA) -TxBF (dBm) - Antenna WF7B
Bluetooth BDR/LE	Maximum	12.50
	Nominal	11.00
Bluetooth EDR	Maximum	9.50
	Nominal	8.00
Bluetooth HDR	Maximum	8.00
	Nominal	6.50

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

1.3.3 Bluetooth Reduced Output Power

Note: Below table is applicable in the following conditions:
-Simultaneous conditions with 5 GHz WLAN active

Mode / Band		Modulated Average (EPA) - Single Tx Chain (dBm) - Antenna WF8
Bluetooth BDR/LE Reduced	Maximum	14.00
	Nominal	12.50
Bluetooth EDR Reduced	Maximum	14.00
	Nominal	12.50
Bluetooth HDR Reduced	Maximum	14.00
	Nominal	12.50

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Note: Below table is applicable in the following conditions:
-Simultaneous conditions with 5 GHz WLAN active

Mode / Band		Modulated Average (EPA) - TxBF (dBm) - Antenna WF8
Bluetooth BDR/LE Reduced	Maximum	14.00
	Nominal	12.50
Bluetooth EDR Reduced	Maximum	13.50
	Nominal	12.00
Bluetooth HDR Reduced	Maximum	14.00
	Nominal	12.50

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Note: Below table is applicable in the following conditions:
-Simultaneous conditions with 5 GHz WLAN active

Mode / Band		Modulated Average (EPA) - Single Tx Chain (dBm) - Antenna WF7B
Bluetooth BDR/LE Reduced	Maximum	14.00
	Nominal	12.50
Bluetooth EDR Reduced	Maximum	14.00
	Nominal	12.50
Bluetooth HDR Reduced	Maximum	14.00
	Nominal	12.50

Note: Below table is applicable in the following conditions:
-Simultaneous conditions with 5 GHz WLAN active

Mode / Band		Modulated Average (EPA) - TxBF (dBm) - Antenna WF7B
Bluetooth BDR/LE Reduced	Maximum	14.00
	Nominal	12.50
Bluetooth EDR Reduced	Maximum	13.50
	Nominal	12.00
Bluetooth HDR Reduced	Maximum	14.00
	Nominal	12.50

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

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Mode / Band		Modulated Average (IPA) - Single Tx Chain (dBm) - Antenna WF8
Bluetooth BDR/LE Reduced	Maximum	12.00
	Nominal	10.50
Bluetooth EDR Reduced	Maximum	9.50
	Nominal	8.00
Bluetooth HDR Reduced	Maximum	7.00
	Nominal	5.50

Mode / Band		Modulated Average (IPA) - TxBF (dBm) - Antenna WF8
Bluetooth BDR/LE Reduced	Maximum	12.00
	Nominal	10.50
Bluetooth EDR Reduced	Maximum	9.50
	Nominal	8.00
Bluetooth HDR Reduced	Maximum	7.00
	Nominal	5.50

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Mode / Band		Modulated Average (IPA) - Single Tx Chain (dBm) - Antenna WF7B
Bluetooth BDR/LE Reduced	Maximum	12.50
	Nominal	11.00
Bluetooth EDR Reduced	Maximum	9.50
	Nominal	8.00
Bluetooth HDR Reduced	Maximum	8.00
	Nominal	6.50

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Mode / Band		Modulated Average (IPA) - TxBF (dBm) - Antenna WF7B
Bluetooth BDR/LE Reduced	Maximum	12.50
	Nominal	11.00
Bluetooth EDR Reduced	Maximum	9.50
	Nominal	8.00
Bluetooth HDR Reduced	Maximum	8.00
	Nominal	6.50

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

1.4 DUT Antenna Locations

The overall dimensions of this device are > 200mm. A diagram showing the location of the device antennas can be found in Appendix E. Exact antenna dimensions and separation are shown in the Technical Descriptions in the FCC filings.

Table 1-1
Device Edges/Sides for SAR Testing

Device Sides/Edges for SAR Testing						
Mode	Back	Front	Top	Bottom	Right	Left
2.4 GHz WLAN Antenna WF8	Yes	No	Yes	No	No	No
2.4 GHz WLAN Antenna WF7B	Yes	No	Yes	No	No	Yes
5 GHz WLAN Antenna WF8	Yes	No	Yes	No	No	No
5 GHz WLAN Antenna WF7A	Yes	No	Yes	No	No	No
Bluetooth Antenna WF8	Yes	No	Yes	No	No	No
Bluetooth Antenna WF7B	Yes	No	Yes	No	No	Yes

Note: Per FCC KDB Publication 616217 D04v01r01, particular edges were not required to be evaluated for SAR based on the SAR exclusion threshold in KDB 447498 D01V06. Additional edges may have been evaluated for simultaneous transmission analysis.

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1.5 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 4.3.2 procedures.

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Body
1	2.4 GHz Wi-Fi MIMO	Yes
2	2.4 GHz Bluetooth TxBF	Yes
3	5GHz Wi-Fi MIMO	Yes
4	2.4 GHz Bluetooth Antenna WF7b + 2.4 GHz Wi-Fi Antenna WF8	Yes
5	2.4 GHz Bluetooth + 5 GHz Wi-Fi	Yes
6	2.4 GHz Bluetooth + 5 GHz Wi-Fi MIMO	Yes
7	2.4 GHz Bluetooth TxBF + 5 GHz Wi-Fi	Yes
8	2.4 GHz Bluetooth TxBF + 5 GHz Wi-Fi MIMO	Yes

Note: In disconnected mode for this scenario, BT will be using iPA only. Since targets for BT ePA was higher than BT iPA, BT ePA was evaluated as the most conservative SAR summation scenario

1. 2.4GHz WIFI and 2.4 GHz Bluetooth can transmit simultaneously on separate antennas. Specific 2.4 GHz WIFI Antenna that can only transmit simultaneously with 2.4 GHz Bluetooth is listed in the above table. In this scenario, Wi-Fi max power will not exceed minimum of (13.5dBm, SAR max cap, Reg max cap) power. Additionally, in disconnected mode, BT will be using iPA only.
2. 2.4GHz WLAN and 5 GHz WLAN cannot transmit simultaneously.
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. This device supports VOWIFI.

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1.6 Miscellaneous SAR Test Considerations

(A) WIFI/BT

Based on the maximum allowed power for the respective antennas, U-NII-2A was evaluated for Antenna WF8 and UNII-1 was evaluated Antenna WF7a SAR. Additional testing for U-NII-1/ Antenna WF8 and UNII-2a Antenna WF7a SAR was not required since all reported SAR was less than 1.2 W/kg per FCC KDB Publication 248227 D01v02r02.

The WLAN/Bluetooth chipset in this device is produced by two different suppliers. The electrically identical modules are manufactured with the identical mechanical structure to meet the same specifications and functions. Two device variants are referenced as Variant 1 and Variant 2 in this report. WLAN/Bluetooth SAR worst case configuration was spot-checked on Variant 1 and Variant 2.

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, default channels for SAR testing are determined per FCC KDB 248227 D01V02r02.

This device supports IEEE 802.11ac with the following features:

- a) Up to 80 MHz Bandwidth only
- b) No aggregate channel configurations
- c) 2 Tx antenna output
- d) 256 QAM is supported
- e) TDWR and Band gap channels are supported

This device supports IEEE 802.11ax with the following features:

- a) Up to 80 MHz Bandwidth only for 5 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 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.

1.7 Guidance Applied

- IEEE 1528-2013
- 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)
- FCC KDB Publication 616217 D04v01r02 (Tablet)
- April 2019 TCB Workshop Notes (IEEE 802.11ax)

1.8 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units. The serial numbers used for each test are indicated alongside the results in Section 9.

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2 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.

2.1 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 2-1).

Equation 2-1
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/m³)
- 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]

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3 DOSIMETRIC ASSESSMENT

3.1 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 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 3-1) 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 3-1) 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 3-1. 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.

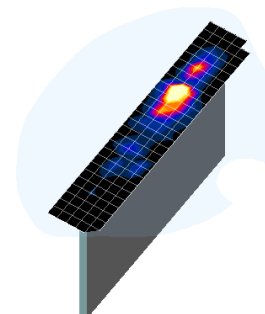


Figure 3-1
Sample SAR Area
Scan

Table 3-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

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

*Also compliant to IEEE 1528-2013 Table 6

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4 TEST CONFIGURATION POSITIONS

4.1 Device Holder

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

4.2 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 configurations. 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.

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5 RF EXPOSURE LIMITS

5.1 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.

5.2 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 5-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT <i>General Population</i> (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT <i>Occupational</i> (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.

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6 FCC MEASUREMENT PROCEDURES

6.1 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.

6.2 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.

6.2.1 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 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.

6.2.2 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.

6.2.3 U-NII-2C and U-NII-3

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

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6.2.4 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.

6.2.5 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.

6.2.6 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 6.2.5).

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6.2.7 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.

6.2.8 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.

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7 RF CONDUCTED POWERS

7.1 WLAN Conducted Powers

Table 7-1
2.4 GHz WLAN Maximum Average RF Power – Ant WF8, Variant 1

2.4GHz Conducted Power [dBm]					
Freq [MHz]	Channel	IEEE Transmission Mode			
		802.11b	802.11g	802.11n	802.11ax (SU)
		Average	Average	Average	Average
2412	1	19.59	14.58	14.61	13.47
2437	6	19.62	19.43	19.48	19.61
2462	11	19.56	16.63	16.59	14.18

Table 7-2
2.4 GHz WLAN Maximum Average RF Power – Ant WF8, Variant 2

2.4GHz Conducted Power [dBm]					
Freq [MHz]	Channel	IEEE Transmission Mode			
		802.11b	802.11g	802.11n	802.11ax (SU)
		Average	Average	Average	Average
2412	1	19.29	14.60	14.58	13.74
2437	6	19.14	19.41	19.54	19.77
2462	11	19.10	16.56	16.52	14.08

Table 7-3
2.4 GHz WLAN Maximum Average RF Power – Ant WF7b, Variant 1

2.4GHz Conducted Power [dBm]					
Freq [MHz]	Channel	IEEE Transmission Mode			
		802.11b	802.11g	802.11n	802.11ax (SU)
		Average	Average	Average	Average
2412	1	19.10	14.65	14.57	13.57
2437	6	19.21	19.24	19.27	19.45
2462	11	19.25	16.55	16.53	14.14

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Table 7-4
2.4 GHz WLAN Maximum Average RF Power – Ant WF7b, Variant 2

2.4GHz Conducted Power [dBm]					
Freq [MHz]	Channel	IEEE Transmission Mode			
		802.11b	802.11g	802.11n	802.11ax (SU)
		Average	Average	Average	Average
2412	1	19.29	14.39	14.44	13.39
2437	6	19.14	19.01	18.99	19.23
2462	11	19.15	16.41	16.34	14.12

Table 7-5
5 GHz WLAN Maximum Average RF Power – Ant WF8, Variant 1

5GHz (40MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11n	802.11ac	802.11ax (SU)
		Average	Average	Average
5190	38	11.47	11.43	10.89
5230	46	15.72	15.63	15.56
5270	54	16.63	16.49	16.63
5310	62	11.07	11.01	10.80

5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11ac	802.11ax (SU)
		Average	Average
5530	106	10.03	10.01
5610	122	16.30	16.15
5690	138	16.23	16.33
5775	155	16.85	16.41

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Table 7-6
5 GHz WLAN Maximum Average RF Power – Ant WF8, Variant 2

5GHz (40MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11n	802.11ac	802.11ax (SU)
		Average	Average	Average
5190	38	11.44	11.37	10.58
5230	46	15.75	15.59	15.70
5270	54	16.54	16.63	16.78
5310	62	11.06	11.03	10.78

5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11ac	802.11ax (SU)
		Average	Average
5530	106	10.09	10.12
5610	122	16.77	16.03
5690	138	16.76	16.31
5775	155	16.60	16.33

Table 7-7
5 GHz WLAN Maximum Average RF Power – Ant WF7a, Variant 1

5GHz (40MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11n	802.11ac	802.11ax (SU)
		Average	Average	Average
5190	38	11.57	11.46	10.72
5230	46	15.07	15.03	15.19
5270	54	14.55	14.27	14.52
5310	62	10.98	10.95	10.77

5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11ac	802.11ax (SU)
		Average	Average
5530	106	10.12	10.17
5610	122	13.22	13.15
5690	138	13.20	12.96
5775	155	13.25	13.00

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Table 7-8
5 GHz WLAN Maximum Average RF Power – Ant WF7a, Variant 2

5GHz (40MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11n	802.11ac	802.11ax (SU)
		Average	Average	Average
5190	38	11.53	11.36	10.31
5230	46	15.07	14.98	15.17
5270	54	14.10	14.27	14.18
5310	62	11.08	10.91	10.56

5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11ac	802.11ax (SU)
		Average	Average
5530	106	10.05	9.98
5610	122	13.15	13.04
5690	138	13.12	13.19
5775	155	13.30	12.90

Table 7-9
5 GHz WLAN Maximum Average RF Power – Ant WF8 and Ant WF7a MIMO, Variant 1

5GHz (40MHz) 802.11n Conducted Power [dBm]				
Freq [MHz]	Channel	ANT WF8	ANT WF7a	MIMO
5190	38	11.22	10.13	13.72
5230	46	11.10	10.98	14.05
5270	54	16.63	14.55	18.72
5310	62	10.42	10.64	13.54
5755	151	16.25	12.44	17.76
5795	159	16.31	12.42	17.80

5GHz (80MHz) 802.11ac Conducted Power [dBm]				
Freq [MHz]	Channel	ANT WF8	ANT WF7a	MIMO
5530	106	9.49	9.57	12.54
5610	122	16.30	13.22	18.04
5690	138	16.23	12.98	17.91

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Table 7-10
5 GHz WLAN Maximum Average RF Power – Ant WF8 and Ant WF7a MIMO, Variant 2

5GHz (40MHz) 802.11n Conducted Power [dBm]				
Freq [MHz]	Channel	ANT WF8	ANT WF7a	MIMO
5190	38	10.33	10.10	13.23
5230	46	11.08	11.14	14.12
5270	54	16.54	14.10	18.50
5310	62	10.55	10.52	13.55
5755	151	16.26	12.72	17.85
5795	159	16.27	12.73	17.86
5GHz (80MHz) 802.11ac Conducted Power [dBm]				
Freq [MHz]	Channel	ANT WF8	ANT WF7a	MIMO
5530	106	9.48	9.55	12.53
5610	122	16.77	13.15	18.34
5690	138	16.17	12.90	17.85

7.1.1 Notes for WLAN

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.
- The WLAN chipset in this device is produced by two different suppliers. The electrically identical modules are manufactured with the identical mechanical structure to meet the same specifications and functions. Two device variants are referenced as Variant 1 and Variant 2 in this report.
- The worst case configurations were evaluated for both variant 1 and variant 2.

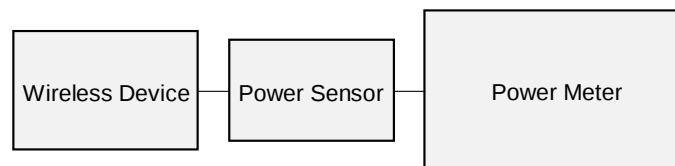


Figure 7-1
Power Measurement Setup

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7.2 Bluetooth Conducted Powers

Table 7-11
Maximum Bluetooth Average RF Power – Antenna WF8, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	16.92	49.204
2441	GFSK	1.0	39	16.61	45.814
2480	GFSK	1.0	78	16.91	49.091

Table 7-12
Maximum Bluetooth Average RF Power – Antenna WF8, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	17.26	53.211
2441	GFSK	1.0	39	17.12	51.523
2480	GFSK	1.0	78	17.59	57.412

Table 7-13
Maximum Bluetooth Average RF Power – Antenna WF7b, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	18.57	71.945
2441	GFSK	1.0	39	18.84	76.560
2480	GFSK	1.0	78	18.86	76.913

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Table 7-14
Maximum Bluetooth Average RF Power – Antenna WF7b, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	18.76	75.162
2441	GFSK	1.0	39	18.58	72.111
2480	GFSK	1.0	78	18.67	73.621

Table 7-15
Reduced 2.5 dB Bluetooth Average RF Power – Antenna WF8, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	14.95	31.261
2441	GFSK	1.0	39	14.40	27.542
2480	GFSK	1.0	78	15.18	32.961

Table 7-16
Reduced 2.5 dB Bluetooth Average RF Power – Antenna WF8, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	14.98	31.477
2441	GFSK	1.0	39	14.79	30.130
2480	GFSK	1.0	78	14.61	28.907

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Table 7-17
Reduced 1 dB Bluetooth Average RF Power – Antenna WF7b, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	16.55	45.186
2441	GFSK	1.0	39	16.51	44.771
2480	GFSK	1.0	78	16.75	47.315

Table 7-18
Reduced 1dB Bluetooth Average RF Power – Antenna WF7b, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	17.53	56.624
2441	GFSK	1.0	39	17.12	51.523
2480	GFSK	1.0	78	17.01	50.234

Table 7-19
Reduced 4 dB Bluetooth Average RF Power – Antenna WF8, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	12.19	16.558
2441	GFSK	1.0	39	12.11	16.255
2480	GFSK	1.0	78	12.14	16.368

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Table 7-20
Reduced 4 dB Bluetooth Average RF Power – Antenna WF8, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	12.12	16.293
2441	GFSK	1.0	39	12.01	15.885
2480	GFSK	1.0	78	12.14	16.368

Table 7-21
Reduced 5.5 dB Bluetooth Average RF Power – Antenna WF7B, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	12.36	17.219
2441	GFSK	1.0	39	12.40	17.378
2480	GFSK	1.0	78	12.12	16.293

Table 7-22
Reduced 5.5 dB Bluetooth Average RF Power – Antenna WF7B, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	12.34	17.140
2441	GFSK	1.0	39	12.76	18.880
2480	GFSK	1.0	78	12.95	19.724

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7.3 Bluetooth Duty Cycle

7.3.1 Maximum Bluetooth Transmission Antenna WF8 Variant 1

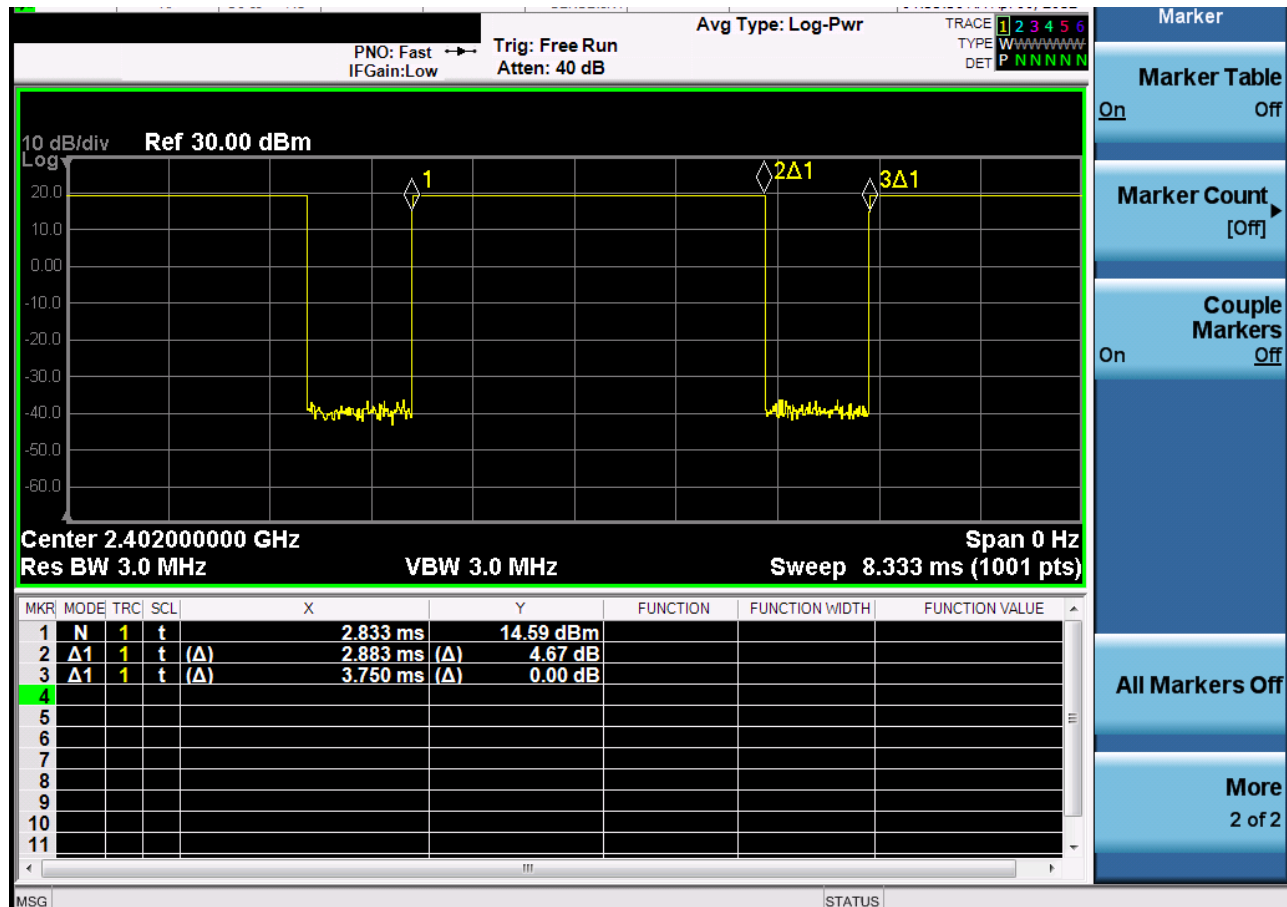


Figure 7-2
Bluetooth Transmission Plot – Antenna WF8, Variant 1

Equation 7-1 Bluetooth Duty Cycle Calculation – Antenna WF8, Variant 1

$$\text{Duty Cycle} = \frac{\text{Pulse Width}}{\text{Period}} * 100\% = \frac{2.883 \text{ ms}}{3.750 \text{ ms}} * 100\% = 76.9\%$$

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7.3.2 Maximum Bluetooth Transmission Antenna WF8 Variant 2

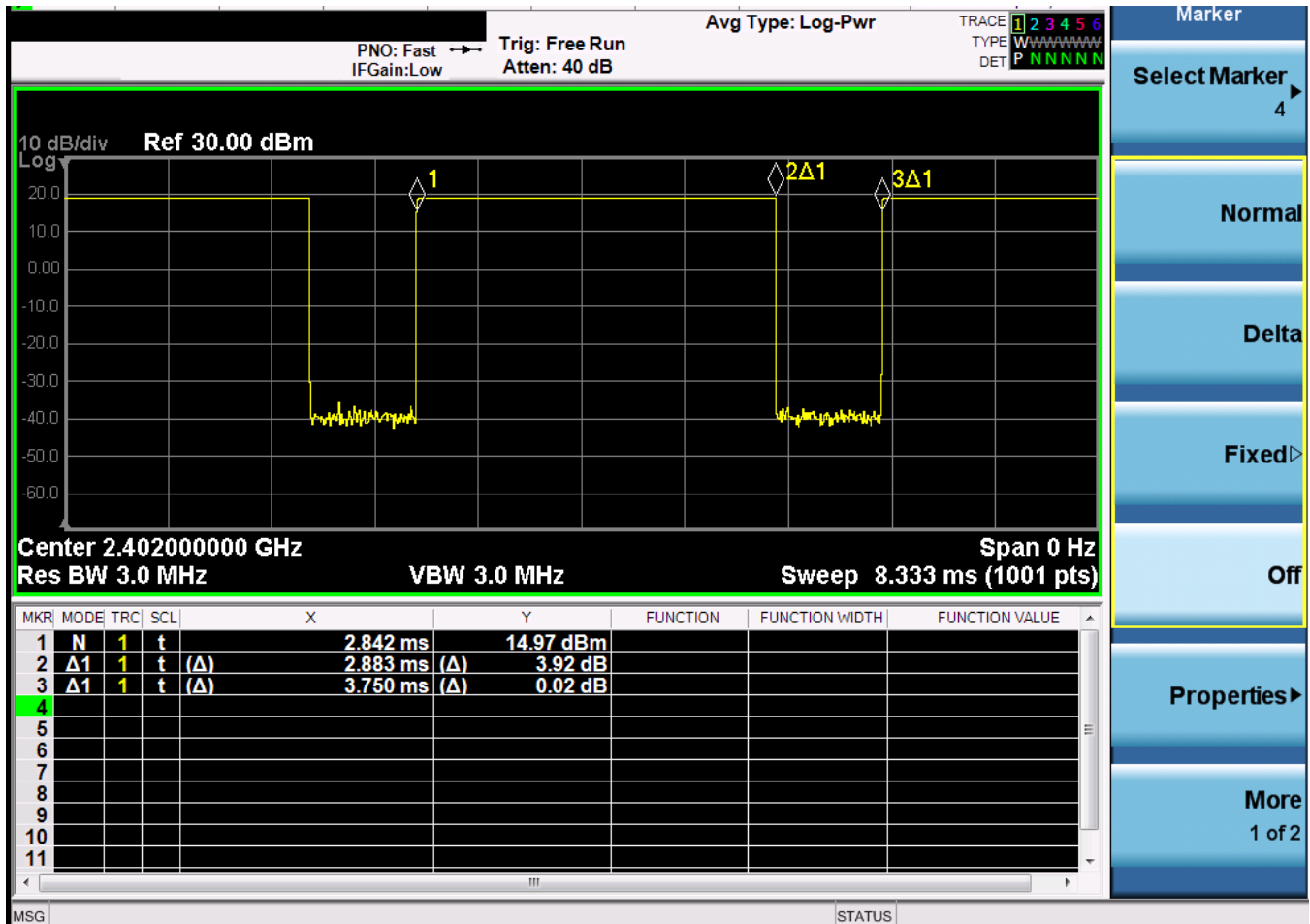


Figure 7-3
Bluetooth Transmission Plot – Antenna WF8, Variant 2

Equation 7-2
Bluetooth Duty Cycle Calculation – Antenna WF8, Variant 2

$$\text{Duty Cycle} = \frac{\text{Pulse Width}}{\text{Period}} * 100\% = \frac{2.883 \text{ ms}}{3.750 \text{ ms}} * 100\% = 76.9\%$$

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7.3.3 Maximum Bluetooth Transmission Antenna WF7b Variant 1

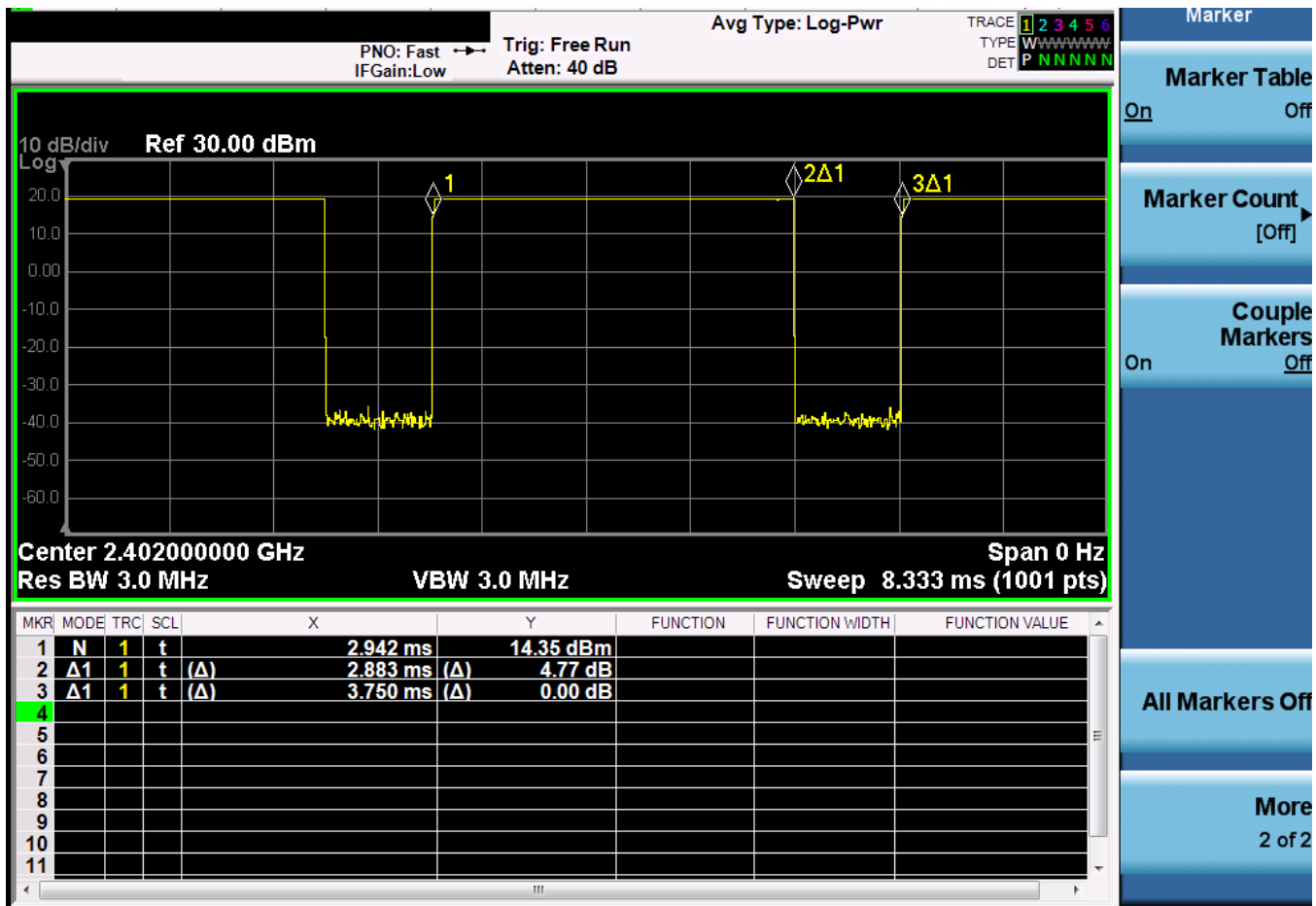


Figure 7-4
Bluetooth Transmission Plot – Antenna WF7b, Variant 1

Equation 7-3 Bluetooth Duty Cycle Calculation – Antenna WF7b, Variant 1

$$\text{Duty Cycle} = \frac{\text{Pulse Width}}{\text{Period}} * 100\% = \frac{2.880 \text{ ms}}{3.750 \text{ ms}} * 100\% = 76.9\%$$

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7.3.4 Maximum Bluetooth Transmission Antenna WF7b Variant 2

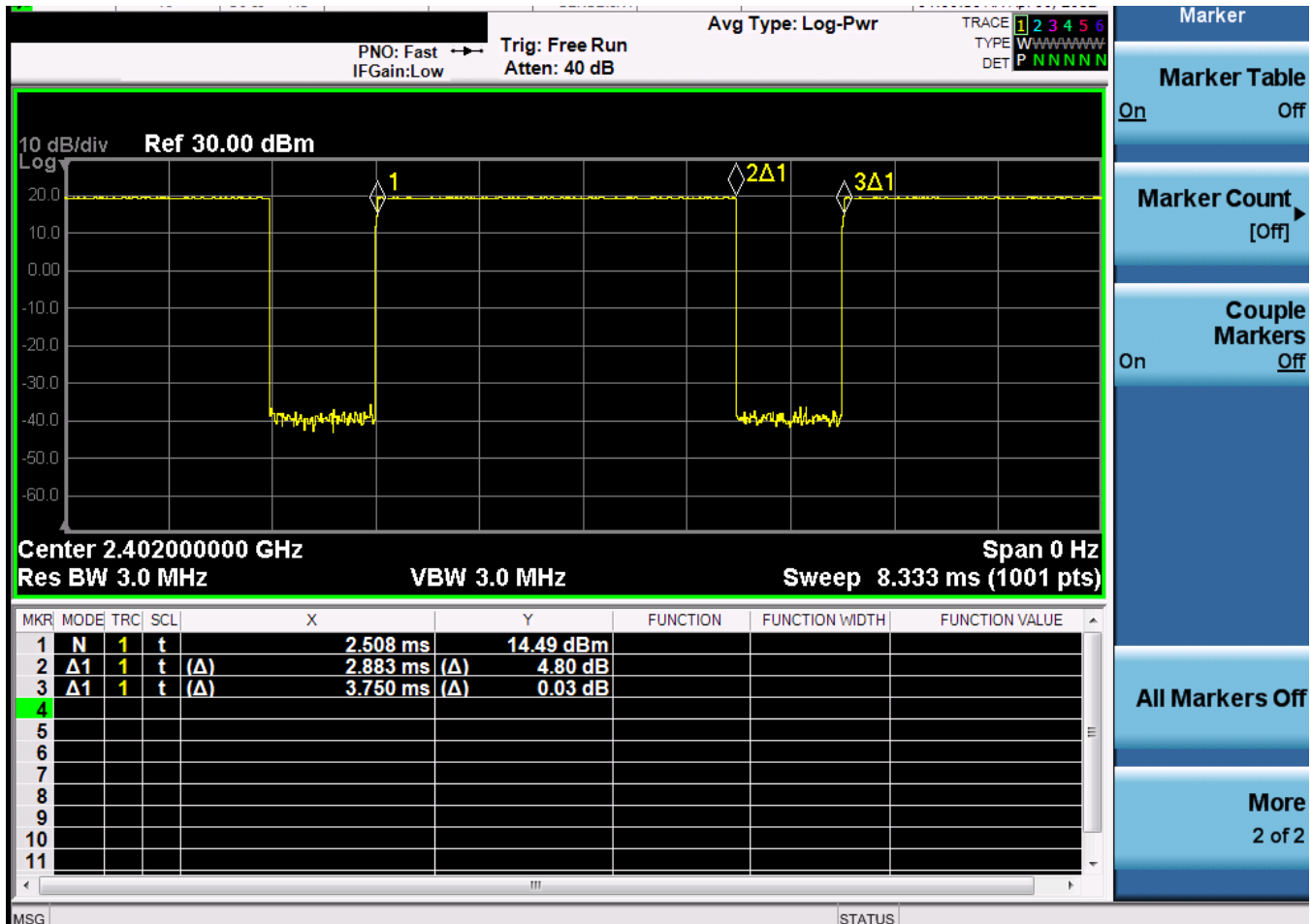


Figure 7-5
Bluetooth Transmission Plot – Antenna WF7b, Variant 2

Equation 7-4
Bluetooth Duty Cycle Calculation – Antenna WF7b, Variant 2

$$\text{Duty Cycle} = \frac{\text{Pulse Width}}{\text{Period}} * 100\% = \frac{2.880 \text{ ms}}{3.750 \text{ ms}} * 100\% = 76.9\%$$

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7.4 Bluetooth Power Reduction Verification Summary

Antenna	Mode/Band	Condition (s)	Maximum Target Power [dBm]	Reduced Target Power [dBm]	Maximum Measured Power	Reduced Measured Power	Verdict
			(Tolerance [dB])	(Tolerance [dB])	[dBm]	[dBm]	
WF7b	2.4 GHz Bluetooth	5 GHz WLAN ON ANT WF8	18 (+/-1.5)	12.5 (+/-1.5)	17.99	12.48	PASS
	2.4 GHz Bluetooth	5 GHz WLAN ON ANT WF7a	18 (+/-1.5)	12.5 (+/-1.5)	17.99	12.44	PASS
	2.4 GHz Bluetooth	5 GHz WLAN ON ANT WF8 + WF7a	18 (+/-1.5)	12.5 (+/-1.5)	17.99	11.52	PASS
WF8	2.4 GHz Bluetooth	5 GHz WLAN ON ANT WF8	16.5 (+/-1.5)	12.5 (+/-1.5)	16.20	12.16	PASS
	2.4 GHz Bluetooth	5 GHz WLAN ON ANT WF7a	16.5 (+/-1.5)	12.5 (+/-1.5)	16.20	12.08	PASS
	2.4 GHz Bluetooth	5 GHz WLAN ON ANT WF8 + WF7a	16.5 (+/-1.5)	12.5 (+/-1.5)	16.20	11.97	PASS

Conducted powers were measured for each Mode/Band and applied condition. All conducted power measurements were verified to be within tolerance.

7.5 Notes for Bluetooth

- The Bluetooth chipset in this device is produced by two different suppliers. The electrically identical modules are manufactured with the identical mechanical structure to meet the same specifications and functions. Two device variants are referenced as Variant 1 and Variant 2 in this report.
- Bluetooth SAR worst case configuration was spot checked on Variant 1 and Variant 2.
- Full power measurements were performed for Variant 1 and Variant 2 per FCC KDB Procedures 248227.

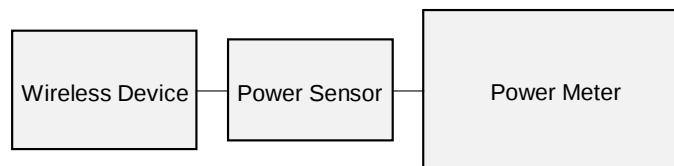


Figure 7-6
Power Measurement Setup

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8 SYSTEM VERIFICATION

8.1 Tissue Verification

Table 8-1
Measured 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
06/22/2022	2450 Head	24.7	2400	1.795	38.443	1.756	39.289	2.22%	-2.15%
			2450	1.854	38.236	1.800	39.200	3.00%	-2.46%
			2480	1.887	38.114	1.833	39.162	2.95%	-2.68%
			2400	1.780	37.613	1.756	39.289	1.37%	-4.27%
07/25/2022	2450 Head	20.8	2450	1.821	37.564	1.800	39.200	1.17%	-4.17%
			2480	1.844	37.513	1.833	39.162	0.60%	-4.21%
			5180	4.472	35.152	4.635	36.009	-3.52%	-2.38%
			5190	4.485	35.130	4.645	35.998	-3.44%	-2.41%
06/30/2022	5200-5800 Head	20.9	5200	4.496	35.110	4.655	35.986	-3.42%	-2.43%
			5210	4.508	35.100	4.666	35.975	-3.39%	-2.43%
			5220	4.519	35.091	4.676	35.963	-3.36%	-2.42%
			5240	4.540	35.055	4.696	35.940	-3.32%	-2.46%
			5250	4.550	35.036	4.706	35.929	-3.31%	-2.49%
			5260	4.561	35.018	4.717	35.917	-3.31%	-2.50%
			5270	4.573	35.001	4.727	35.906	-3.26%	-2.52%
			5280	4.588	34.985	4.737	35.894	-3.15%	-2.53%
			5290	4.600	34.971	4.748	35.883	-3.12%	-2.54%
			5300	4.611	34.955	4.758	35.871	-3.09%	-2.55%
			5310	4.619	34.942	4.768	35.860	-3.13%	-2.56%
			5320	4.628	34.925	4.778	35.849	-3.14%	-2.58%
			5500	4.820	34.610	4.963	35.643	-2.88%	-2.90%
			5510	4.831	34.585	4.973	35.632	-2.86%	-2.94%
			5520	4.843	34.565	4.983	35.620	-2.81%	-2.96%
			5530	4.856	34.550	4.994	35.609	-2.76%	-2.97%
			5540	4.869	34.531	5.004	35.597	-2.70%	-2.99%
			5550	4.880	34.511	5.014	35.586	-2.67%	-3.02%
			5560	4.890	34.489	5.024	35.574	-2.67%	-3.05%
			5580	4.913	34.447	5.045	35.551	-2.62%	-3.11%
			5600	4.938	34.413	5.065	35.529	-2.51%	-3.14%
			5610	4.949	34.405	5.076	35.518	-2.50%	-3.13%
			5620	4.960	34.394	5.086	35.506	-2.48%	-3.13%
			5640	4.981	34.344	5.106	35.483	-2.45%	-3.21%
			5660	5.006	34.310	5.127	35.460	-2.36%	-3.24%
			5670	5.018	34.293	5.137	35.449	-2.32%	-3.26%
			5680	5.027	34.277	5.147	35.437	-2.33%	-3.27%
			5690	5.037	34.258	5.158	35.426	-2.35%	-3.30%
			5700	5.048	34.237	5.168	35.414	-2.32%	-3.32%
			5710	5.062	34.217	5.178	35.403	-2.24%	-3.35%
			5720	5.076	34.203	5.188	35.391	-2.16%	-3.36%
			5745	5.105	34.181	5.214	35.363	-2.09%	-3.34%
			5750	5.110	34.176	5.219	35.357	-2.09%	-3.34%
			5755	5.116	34.171	5.224	35.351	-2.07%	-3.34%
			5765	5.128	34.151	5.234	35.340	-2.03%	-3.36%
			5775	5.137	34.130	5.245	35.329	-2.06%	-3.39%
			5785	5.149	34.118	5.255	35.317	-2.02%	-3.39%
			5795	5.159	34.104	5.265	35.305	-2.01%	-3.40%
			5800	5.165	34.096	5.270	35.300	-1.99%	-3.41%
			5800	5.165	34.096	5.270	35.300	-1.99%	-3.41%
			5805	5.172	34.091	5.275	35.294	-1.95%	-3.41%
			5825	5.196	34.049	5.296	35.271	-1.89%	-3.46%
			5835	5.208	34.041	5.305	35.230	-1.83%	-3.37%
			5845	5.219	34.027	5.315	35.210	-1.81%	-3.36%
			5855	5.231	34.011	5.325	35.197	-1.77%	-3.37%
			5865	5.240	33.996	5.336	35.190	-1.80%	-3.39%
			5865	5.240	33.996	5.336	35.190	-1.80%	-3.39%
			5865	5.240	33.996	5.336	35.190	-1.80%	-3.39%
			5875	5.249	33.980	5.347	35.183	-1.83%	-3.42%
			5885	5.261	33.967	5.357	35.177	-1.79%	-3.44%
			5905	5.282	33.920	5.379	35.163	-1.80%	-3.53%

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.

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8.2 Test System Verification

Prior to SAR assessment, the system is verified to $\pm 10\%$ 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 Appendix D.

Table 8-2
System Verification Results – 1g

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Source SN	Probe SN	Measured SAR _{1g} (W/kg)	1 W Target SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation _{1g} (%)
AM3	2450	HEAD	06/22/2022	23.4	23.0	0.100	921	7427	5.380	54.200	53.800	-0.74%
AM10	2450	HEAD	07/25/2022	22.5	20.8	0.100	750	7308	5.110	52.600	51.100	-2.85%
AM9	5250	HEAD	06/30/2022	24.0	21.0	0.050	1123	7638	3.710	80.500	74.200	-7.83%
AM9	5600	HEAD	06/30/2022	24.0	21.0	0.050	1123	7638	4.160	83.700	83.200	-0.60%
AM9	5750	HEAD	06/30/2022	24.0	21.0	0.050	1123	7638	3.830	80.500	76.600	-4.84%

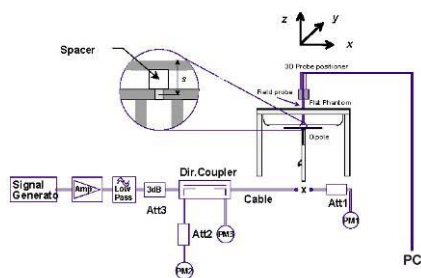


Figure 8-1
System Verification Setup Diagram



Figure 8-2
System Verification Setup Photo

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9 SAR DATA SUMMARY

9.1 Standalone Body SAR Data

Table 9-1
2.4 GHz WLAN Body SAR Data – Antenna WF8

MEASUREMENT RESULTS																					
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.														(W/kg)			(W/kg)		(W/kg)	
2437	6	802.11b	DSSS	22	20.50	19.62	0.01	0 mm	Ant WF8	V1	KKGJYGGJ9V	1	back	99.7	0.117	1.225	1.003	0.144	0.058	0.071	
2412	1	802.11b	DSSS	22	20.50	19.59	0.00	0 mm	Ant WF8	V1	KKGJYGGJ9V	1	top	99.7	0.851	1.233	1.003	1.052	0.360	0.445	
2437	6	802.11b	DSSS	22	20.50	19.62	0.00	0 mm	Ant WF8	V1	KKGJYGGJ9V	1	top	99.7	0.886	1.225	1.003	1.089	0.385	0.473	
2462	11	802.11b	DSSS	22	20.50	19.56	-0.02	0 mm	Ant WF8	V1	KKGJYGGJ9V	1	top	99.7	0.913	1.242	1.003	1.137	0.388	0.483	A1
2462	11	802.11b	DSSS	22	20.50	19.10	-0.03	0 mm	Ant WF8	V2	T6G7H27MJ7	1	top	99.7	0.810	1.380	1.003	1.121	0.347	0.480	
2437	6	802.11b	DSSS	22	20.50	19.62	-0.02	0 mm	Ant WF8	V1	KKGJYGGJ9V	1	bottom	99.7	0.012	1.225	1.003	0.015	0.005	0.006	
2437	6	802.11b	DSSS	22	20.50	19.62	-0.04	0 mm	Ant WF8	V1	KKGJYGGJ9V	1	right	99.7	0.020	1.225	1.003	0.025	0.010	0.012	
2437	6	802.11b	DSSS	22	20.50	19.62	0.04	0 mm	Ant WF8	V1	KKGJYGGJ9V	1	left	99.7	0.003	1.225	1.003	0.004	0.001	0.001	
2462	11	802.11b	DSSS	22	20.50	19.56	0.02	0 mm	Ant WF8	V1	KKGJYGGJ9V	1	top	99.7	0.891	1.242	1.003	1.110	0.381	0.475	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT									Body												
Spatial Peak									1.6 W/kg (mW/g)												
Uncontrolled Exposure/General Population									averaged over 1 gram												

Note: Blue entry indicates variability measurement.

Table 9-2
2.4 GHz WLAN Body SAR Data – Antenna WF7B

MEASUREMENT RESULTS																					
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.														(W/kg)			(W/kg)		(W/kg)	
2412	1	802.11b	DSSS	22	20.25	19.29	-0.02	0 mm	Ant WF7B	V2	R76DF4H6D6	1	back	99.7	0.159	1.247	1.003	0.199	0.077	0.096	
2412	1	802.11b	DSSS	22	20.25	19.29	-0.01	0 mm	Ant WF7B	V2	R76DF4H6D6	1	top	99.7	0.824	1.247	1.003	1.031	0.362	0.453	
2437	6	802.11b	DSSS	22	20.25	19.14	-0.21	0 mm	Ant WF7B	V2	R76DF4H6D6	1	top	99.7	0.793	1.291	1.003	1.027	0.354	0.458	
2462	11	802.11b	DSSS	22	20.25	19.15	0.03	0 mm	Ant WF7B	V2	R76DF4H6D6	1	top	99.7	0.845	1.288	1.003	1.092	0.368	0.475	
2462	11	802.11b	DSSS	22	20.25	19.25	0.02	0 mm	Ant WF7B	V1	KKGJYGGJ9V	1	top	99.7	0.859	1.259	1.003	1.085	0.380	0.480	
2412	1	802.11b	DSSS	22	20.25	19.29	0.19	0 mm	Ant WF7B	V2	R76DF4H6D6	1	bottom	99.7	0.018	1.247	1.003	0.023	0.007	0.009	
2412	1	802.11b	DSSS	22	20.25	19.29	0.04	0 mm	Ant WF7B	V2	R76DF4H6D6	1	right	99.7	0.028	1.247	1.003	0.035	0.011	0.014	
2412	1	802.11b	DSSS	22	20.25	19.29	0.00	0 mm	Ant WF7B	V2	R76DF4H6D6	1	left	99.7	0.800	1.247	1.003	1.001	0.347	0.434	
2437	6	802.11b	DSSS	22	20.25	19.14	0.01	0 mm	Ant WF7B	V2	R76DF4H6D6	1	left	99.7	0.810	1.291	1.003	1.049	0.356	0.461	
2462	11	802.11b	DSSS	22	20.25	19.15	0.01	0 mm	Ant WF7B	V2	R76DF4H6D6	1	left	99.7	0.765	1.288	1.003	0.988	0.337	0.435	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT									Body												
Spatial Peak									1.6 W/kg (mW/g)												
Uncontrolled Exposure/General Population									averaged over 1 gram												

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Table 9-3
5 GHz WLAN Body SAR Data – Antenna WF8

MEASUREMENT RESULTS																					
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.														(W/kg)			(W/kg)	(W/kg)		
5270	54	802.11n	OFDM	40	17.50	16.54	-0.06	0 mm	Ant WF8	V2	L9NW9QKVCW	13.5	back	97.7	0.087	1.247	1.024	0.111	0.032	0.041	
5270	54	802.11n	OFDM	40	17.50	16.63	0.00	0 mm	Ant WF8	V1	N797HWOCJD	13.5	top	97.7	0.898	1.222	1.024	1.124	0.288	0.360	
5270	54	802.11n	OFDM	40	17.50	16.54	0.07	0 mm	Ant WF8	V2	L9NW9QKVCW	13.5	top	97.7	0.926	1.247	1.024	1.182	0.294	0.375	
5310	62	802.11n	OFDM	40	12.00	11.06	0.07	0 mm	Ant WF8	V2	L9NW9QKVCW	13.5	top	97.7	0.241	1.242	1.024	0.307	0.070	0.089	
5270	54	802.11n	OFDM	40	17.50	16.54	-0.05	0 mm	Ant WF8	V2	L9NW9QKVCW	13.5	bottom	97.7	0.021	1.247	1.024	0.027	0.004	0.005	
5270	54	802.11n	OFDM	40	17.50	16.54	-0.07	0 mm	Ant WF8	V2	L9NW9QKVCW	13.5	right	97.7	0.013	1.247	1.024	0.017	0.001	0.001	
5270	54	802.11n	OFDM	40	17.50	16.54	0.02	0 mm	Ant WF8	V2	L9NW9QKVCW	13.5	left	97.7	0.000	1.247	1.024	0.000	0.000	0.000	
5610	122	802.11ac	OFDM	80	17.25	16.30	0.06	0 mm	Ant WF8	V1	N797HWOCJD	29.3	back	95.4	0.065	1.245	1.048	0.085	0.023	0.030	
5530	106	802.11ac	OFDM	80	11.00	10.09	-0.04	0 mm	Ant WF8	V2	L9NW9QKVCW	29.3	top	95.4	0.181	1.233	1.048	0.234	0.051	0.066	
5610	122	802.11ac	OFDM	80	17.25	16.77	-0.11	0 mm	Ant WF8	V2	L9NW9QKVCW	29.3	top	95.4	0.924	1.117	1.048	1.082	0.286	0.335	
5690	138	802.11ac	OFDM	80	17.25	16.76	0.03	0 mm	Ant WF8	V2	L9NW9QKVCW	29.3	top	95.4	0.891	1.119	1.048	1.045	0.267	0.313	
5610	122	802.11ac	OFDM	80	17.25	16.30	-0.01	0 mm	Ant WF8	V1	N797HWOCJD	29.3	top	95.4	0.829	1.245	1.048	1.082	0.256	0.334	
5610	122	802.11ac	OFDM	80	17.25	16.30	-0.02	0 mm	Ant WF8	V1	N797HWOCJD	29.3	bottom	95.4	0.014	1.245	1.048	0.018	0.000	0.000	
5610	122	802.11ac	OFDM	80	17.25	16.30	0.04	0 mm	Ant WF8	V1	N797HWOCJD	29.3	right	95.4	0.011	1.245	1.048	0.014	0.000	0.000	
5610	122	802.11ac	OFDM	80	17.25	16.30	-0.06	0 mm	Ant WF8	V1	N797HWOCJD	29.3	left	95.4	0.000	1.245	1.048	0.000	0.000	0.000	
5775	155	802.11ac	OFDM	80	17.25	16.85	-0.05	0 mm	Ant WF8	V1	GJN7M49FV0	29.3	back	95.4	0.068	1.096	1.048	0.078	0.026	0.030	
5775	155	802.11ac	OFDM	80	17.25	16.85	0.02	0 mm	Ant WF8	V1	GJN7M49FV0	29.3	top	95.4	1.030	1.096	1.048	1.183	0.303	0.348	A2
5775	155	802.11ac	OFDM	80	17.25	16.60	0.05	0 mm	Ant WF8	V2	L9NW9QKVCW	29.3	top	95.4	0.825	1.161	1.048	1.004	0.242	0.294	
5775	155	802.11ac	OFDM	80	17.25	16.85	-0.02	0 mm	Ant WF8	V1	GJN7M49FV0	29.3	bottom	95.4	0.038	1.096	1.048	0.044	0.010	0.011	
5775	155	802.11ac	OFDM	80	17.25	16.85	-0.04	0 mm	Ant WF8	V1	GJN7M49FV0	29.3	right	95.4	0.018	1.096	1.048	0.021	0.004	0.005	
5775	155	802.11ac	OFDM	80	17.25	16.85	-0.14	0 mm	Ant WF8	V1	GJN7M49FV0	29.3	left	95.4	0.000	1.096	1.048	0.000	0.000	0.000	
5610	122	802.11ac	OFDM	80	17.25	16.77	0.00	0 mm	Ant WF8	V2	L9NW9QKVCW	29.3	top	95.4	0.943	1.117	1.048	1.104	0.298	0.349	
5775	155	802.11ac	OFDM	80	17.25	16.85	0.03	0 mm	Ant WF8	V1	GJN7M49FV0	29.3	top	95.4	1.000	1.096	1.048	1.149	0.301	0.346	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body													
Spatial Peak								1.6 W/kg (mW/g)													
Uncontrolled Exposure/General Population								averaged over 1 gram													

Note: Blue entry indicates variability measurement.

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Table 9-4
5 GHz WLAN Body SAR Data – Antenna WF7A

MEASUREMENT RESULTS																					
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.														(W/kg)	(W/kg)	(W/kg)	(W/kg)			
5230	46	802.11n	OFDM	40	16.00	15.07	0.07	0 mm	Ant WF7A	V1	RM0HCJ6C3P	13.5	back	97.7	0.131	1.239	1.024	0.166	0.050	0.063	
5190	38	802.11n	OFDM	40	12.50	11.57	-0.01	0 mm	Ant WF7A	V1	RM0HCJ6C3P	13.5	top	97.7	0.346	1.239	1.024	0.439	0.109	0.138	
5230	46	802.11n	OFDM	40	16.00	15.07	0.02	0 mm	Ant WF7A	V1	RM0HCJ6C3P	13.5	top	97.7	0.897	1.239	1.024	1.138	0.287	0.364	
5230	46	802.11n	OFDM	40	16.00	15.07	-0.18	0 mm	Ant WF7A	V2	L9NW9QKVCW	13.5	top	97.7	0.794	1.239	1.024	1.007	0.264	0.335	
5230	46	802.11n	OFDM	40	16.00	15.07	0.21	0 mm	Ant WF7A	V1	RM0HCJ6C3P	13.5	bottom	97.7	0.013	1.239	1.024	0.016	0.004	0.005	
5230	46	802.11n	OFDM	40	16.00	15.07	0.21	0 mm	Ant WF7A	V1	RM0HCJ6C3P	13.5	right	97.7	0.004	1.239	1.024	0.005	0.000	0.000	
5230	46	802.11n	OFDM	40	16.00	15.07	0.00	0 mm	Ant WF7A	V1	RM0HCJ6C3P	13.5	left	97.7	0.014	1.239	1.024	0.018	0.002	0.003	
5610	122	802.11ac	OFDM	80	14.00	13.22	0.04	0 mm	Ant WF7a	V1	N797HW0CJD	29.3	back	95.4	0.083	1.197	1.048	0.104	0.029	0.036	
5530	106	802.11ac	OFDM	80	11.00	10.12	0.21	0 mm	Ant WF7a	V1	N797HW0CJD	29.3	top	95.4	0.456	1.225	1.048	0.585	0.139	0.178	
5610	122	802.11ac	OFDM	80	14.00	13.22	0.00	0 mm	Ant WF7a	V1	N797HW0CJD	29.3	top	95.4	0.783	1.197	1.048	0.982	0.241	0.302	
5690	138	802.11ac	OFDM	80	14.00	13.20	0.04	0 mm	Ant WF7a	V1	N797HW0CJD	29.3	top	95.4	0.892	1.202	1.048	1.124	0.274	0.345	
5690	138	802.11ac	OFDM	80	14.00	13.12	0.07	0 mm	Ant WF7a	V2	L9NW9QKVCW	29.3	top	95.4	0.789	1.225	1.048	1.013	0.243	0.312	
5610	122	802.11ac	OFDM	80	14.00	13.22	0.03	0 mm	Ant WF7a	V1	N797HW0CJD	29.3	bottom	95.4	0.000	1.197	1.048	0.000	0.000	0.000	
5610	122	802.11ac	OFDM	80	14.00	13.22	-0.19	0 mm	Ant WF7a	V1	N797HW0CJD	29.3	right	95.4	0.000	1.197	1.048	0.000	0.000	0.000	
5610	122	802.11ac	OFDM	80	14.00	13.22	-0.05	0 mm	Ant WF7a	V1	N797HW0CJD	29.3	left	95.4	0.007	1.197	1.048	0.009	0.000	0.000	
5775	155	802.11ac	OFDM	80	13.75	13.25	0.08	0 mm	Ant WF7a	V1	WJG6Q6269H	29.3	back	95.4	0.119	1.122	1.048	0.140	0.042	0.049	
5775	155	802.11ac	OFDM	80	13.75	13.25	0.06	0 mm	Ant WF7a	V1	WJG6Q6269H	29.3	top	95.4	0.988	1.122	1.048	1.162	0.304	0.357	
5775	155	802.11ac	OFDM	80	13.75	13.30	-0.06	0 mm	Ant WF7a	V2	CQ2FJFV4	29.3	top	95.4	0.971	1.109	1.048	1.129	0.301	0.350	
5775	155	802.11ac	OFDM	80	13.75	13.25	-0.07	0 mm	Ant WF7a	V1	WJG6Q6269H	29.3	bottom	95.4	0.003	1.122	1.048	0.004	0.000	0.000	
5775	155	802.11ac	OFDM	80	13.75	13.25	0.02	0 mm	Ant WF7a	V1	WJG6Q6269H	29.3	right	95.4	0.000	1.122	1.048	0.000	0.000	0.000	
5775	155	802.11ac	OFDM	80	13.75	13.25	-0.06	0 mm	Ant WF7a	V1	WJG6Q6269H	29.3	left	95.4	0.000	1.122	1.048	0.000	0.000	0.000	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body													
Spatial Peak								1.6 W/kg (mW/g)													
Uncontrolled Exposure/General Population								averaged over 1 gram													

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Table 9-5
5 GHz WLAN Body SAR Data – MIMO

MEASUREMENT RESULTS																						
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Cube	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate [Mbps]	Side	Duty Cycle (%)	SAR [1g] (W/kg)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR [1g] (W/kg)	SAR [10g] (W/kg)	Reported SAR [10g] (W/kg)	Plot #
	Ch.																					
5270	54	802.11n	OFDM	40	17.50	16.63	1	0.05	0 mm	MIMO	V1	WJG6Q6269H	13.5	top	97.7	0.871	1.222	1.024	1.092	0.277	0.347	
					15.25	14.55	2	-0.17							97.7	0.983	1.175	1.024	1.185	0.323	0.389	
5270	54	802.11n	OFDM	40	17.50	16.54	1	0.01	0 mm	MIMO	V2	CQ2FJFVFV4	13.5	top	97.7	0.825	1.247	1.024	1.056	0.264	0.338	
					15.25	14.10	2	0.01							97.7	0.841	1.303	1.024	1.124	0.271	0.362	
5310	62	802.11n	OFDM	40	11.50	10.42	1	0.06	0 mm	MIMO	V1	WJG6Q6269H	13.5	top	97.7	0.187	1.282	1.024	0.245	0.056	0.074	
					11.50	10.64	2	-0.15							97.7	0.426	1.219	1.024	0.532	0.133	0.166	
5530	106	802.11ac	OFDM	80	10.25	9.49	1	-0.18	0 mm	MIMO	V1	N797HWOCJD	29.3	top	95.4	0.159	1.191	1.048	0.198	0.048	0.060	
					10.25	9.57	2	0.03							95.4	0.384	1.169	1.048	0.479	0.118	0.147	
5610	122	802.11ac	OFDM	80	17.25	16.30	1	0.07	0 mm	MIMO	V1	N797HWOCJD	29.3	top	95.4	0.823	1.245	1.048	1.074	0.257	0.335	
					14.00	13.22	2	-0.05							95.4	0.863	1.197	1.048	1.083	0.272	0.341	
5610	122	802.11ac	OFDM	80	17.25	16.77	1	0.03	0 mm	MIMO	V2	CQ2FJFVFV4	29.3	top	95.4	0.878	1.117	1.048	1.028	0.268	0.314	
					14.00	13.15	2	0.13							95.4	0.810	1.216	1.048	1.032	0.259	0.330	
5690	138	802.11ac	OFDM	80	17.25	16.23	1	0.07	0 mm	MIMO	V1	N797HWOCJD	29.3	top	95.4	0.757	1.265	1.048	1.000	0.229	0.304	
					14.00	12.98	2	0.03							95.4	0.800	1.265	1.048	1.061	0.254	0.337	
5755	151	802.11n	OFDM	40	17.25	16.25	1	0.04	0 mm	MIMO	V1	N797HWOCJD	13.5	top	97.7	0.817	1.259	1.048	1.053	0.240	0.309	
					13.75	12.44	2	0.06							97.7	0.785	1.352	1.024	1.087	0.242	0.335	
5795	159	802.11n	OFDM	40	17.25	16.31	1	0.00	0 mm	MIMO	V1	N797HWOCJD	13.5	top	97.7	0.847	1.242	1.024	1.077	0.250	0.318	
					13.75	12.42	2	0.05							97.7	0.782	1.358	1.024	1.087	0.241	0.335	
5795	159	802.11n	OFDM	40	17.25	16.27	1	0.05	0 mm	MIMO	V2	CQ2FJFVFV4	13.5	top	97.7	0.825	1.253	1.024	1.059	0.241	0.309	
					13.75	12.73	2	0.07							97.7	0.789	1.265	1.024	1.022	0.246	0.319	
5270	54	802.11n	OFDM	40	17.50	16.63	1	-0.05	0 mm	MIMO	V1	WJG6Q6269H	13.5	top	97.7	0.897	1.222	1.024	1.122	0.286	0.358	
					15.25	14.55	2	0.04					13.5		97.7	0.946	1.175	1.024	1.138	0.302	0.363	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT									Body													
Spatial Peak									1.6 W/kg (mW/g)													
Uncontrolled Exposure/General Population									averaged over 1 gram													

Due to the spatial separation of Antenna WF7a and Antenna WF8, two measurement cubes were evaluated during MIMO SAR testing. Cubes 1 and 2 are located over the SAR distributions produced by Antenna WF8 and WF7A, respectively. Due to the spatial separation of the distributions, the conducted power of each antenna was individually considered for each measurement cube to determine the reported SAR.

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Table 9-6
Bluetooth Body SAR Data – Antenna WF8

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.													(W/kg)			(W/kg)		(W/kg)	
2480	78	Bluetooth	FHSS	18.00	17.59	-0.14	0 mm	Ant WF8	V2	R76DF4H6D6	1	back	76.9	0.043	1.099	1.008	0.048	0.021	0.023	
2480	78	Bluetooth	FHSS	18.00	17.59	0.05	0 mm	Ant WF8	V2	R76DF4H6D6	1	Top	76.9	0.404	1.099	1.008	0.448	0.178	0.197	
2480	78	Bluetooth	FHSS	18.00	16.91	-0.03	0 mm	Ant WF8	V1	DJ5RH2FYVR	1	Top	76.9	0.325	1.285	1.008	0.421	0.146	0.189	
2480	78	Bluetooth	FHSS	18.00	17.59	0.11	0 mm	Ant WF8	V2	R76DF4H6D6	1	bottom	76.9	0.000	1.099	1.008	0.000	0.000	0.000	
2480	78	Bluetooth	FHSS	18.00	17.59	-0.15	0 mm	Ant WF8	V2	R76DF4H6D6	1	right	76.9	0.005	1.099	1.008	0.006	0.002	0.002	
2480	78	Bluetooth	FHSS	18.00	17.59	0.16	0 mm	Ant WF8	V2	R76DF4H6D6	1	left	76.9	0.000	1.099	1.008	0.000	0.000	0.000	
2480	78	Bluetooth	FHSS	14.00	12.14	-0.03	0 mm	Ant WF8	V2	R76DF4H6D6	1	back	76.9	0.013	1.535	1.008	0.020	0.005	0.008	
2480	78	Bluetooth	FHSS	14.00	12.14	0.01	0 mm	Ant WF8	V2	R76DF4H6D6	1	Top	76.9	0.111	1.535	1.008	0.172	0.048	0.074	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram													

Note: The reported SAR was scaled to the 77.5% transmission duty factor to determine compliance since the duty factor of the device is permanently limited to 77.5% per manufacturer.

Table 9-7
Bluetooth Body SAR Data – Antenna WF7B

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.													(W/kg)			(W/kg)		(W/kg)	
2480	78	Bluetooth	FHSS	19.50	18.86	0.09	0 mm	Ant WF7B	V1	DJ5RH2FYVR	1	back	76.9	0.092	1.159	1.008	0.107	0.045	0.053	
2480	78	Bluetooth	FHSS	19.50	18.86	0.01	0 mm	Ant WF7B	V1	DJ5RH2FYVR	1	Top	76.9	0.498	1.159	1.008	0.582	0.215	0.251	
2480	78	Bluetooth	FHSS	19.50	18.86	-0.16	0 mm	Ant WF7B	V1	DJ5RH2FYVR	1	bottom	76.9	0.003	1.159	1.008	0.004	0.000	0.000	
2480	78	Bluetooth	FHSS	19.50	18.86	-0.03	0 mm	Ant WF7B	V1	DJ5RH2FYVR	1	right	76.9	0.009	1.159	1.008	0.011	0.003	0.004	
2402	0	Bluetooth	FHSS	19.50	18.57	0.05	0 mm	Ant WF7B	V1	DJ5RH2FYVR	1	left	76.9	0.377	1.239	1.008	0.471	0.165	0.206	
2441	39	Bluetooth	FHSS	19.50	18.84	-0.02	0 mm	Ant WF7B	V1	DJ5RH2FYVR	1	left	76.9	0.553	1.164	1.008	0.649	0.242	0.284	A3
2480	78	Bluetooth	FHSS	19.50	18.86	-0.02	0 mm	Ant WF7B	V1	DJ5RH2FYVR	1	left	76.9	0.518	1.159	1.008	0.605	0.230	0.269	
2441	39	Bluetooth	FHSS	19.50	18.58	0.06	0 mm	Ant WF7B	V2	R76DF4H6D6	1	left	76.9	0.488	1.236	1.008	0.608	0.213	0.265	
2441	39	Bluetooth	FHSS	14.00	12.40	-0.02	0 mm	Ant WF7B	V1	DJ5RH2FYVR	1	back	76.9	0.023	1.445	1.008	0.034	0.011	0.016	
2441	39	Bluetooth	FHSS	14.00	12.40	-0.02	0 mm	Ant WF7B	V1	DJ5RH2FYVR	1	Top	76.9	0.114	1.445	1.008	0.166	0.052	0.076	
2441	39	Bluetooth	FHSS	14.00	12.40	0.03	0 mm	Ant WF7B	V1	DJ5RH2FYVR	1	left	76.9	0.126	1.445	1.008	0.184	0.056	0.082	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram													

Note: The reported SAR was scaled to the 77.5% transmission duty factor to determine compliance since the duty factor of the device is permanently limited to 77.5% per manufacturer.

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9.2 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 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 performed when the measured SAR results for a frequency band were greater than or equal to 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 11 for variability analysis.
7. 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.
8. This device utilizes power reduction for some wireless modes and technologies, as outlined in Section 1.2. The maximum output power allowed for each transmitter and exposure condition was evaluated for SAR compliance based on expected use conditions and simultaneous transmission scenarios.
9. The orange highlights throughout the report represent the highest scaled SAR per equipment class.

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 6.2.4 for more information.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 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 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 6.2.5 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 Section 10 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. The time-averaged mechanism for WLAN operations was disabled for the above SAR measurements. The SAR was scaled to the maximum time-averaged output power.

Bluetooth Notes

1. Bluetooth SAR was evaluated with a test mode with hopping disabled with DH5 operation. The reported SAR was scaled to the 77.5% transmission duty factor to determine compliance since the duty factor of the device is limited to 77.5% per manufacturer. See Section 7.3 for the time domain plot and calculation for the duty factor of the device.

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10 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

10.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to devices with built-in unlicensed transmitters such as 802.11 and Bluetooth devices which may simultaneously transmit together.

10.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore, simultaneous transmission analysis is required. Per FCC KDB Publication 447498 D01v06 4.3.2 and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1g SAR for all the simultaneous transmitting antennas in a specific physical test configuration is ≤ 1.6 W/kg. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1g or 10g SAR.

Note:

*The SAR distributions for at least one of the antennas are spatially separated from the other antennas per FCC KDB Publication 248227 Section 6.1 procedures. Therefore, the simultaneous transmission was treated independently for this configuration. See section 10.4 for more information about the Spatial Separation Analysis.

10.3 Body SAR Simultaneous Transmission Analysis

Table 10-1
Simultaneous Transmission Scenario with 2.4 GHz WLAN

Simult Tx	Configuration	2.4 GHz WLAN Ant WF7B SAR (W/kg)	2.4 GHz WLAN Ant WF8 SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body SAR	Back	0.199	0.144	0.343
	Top	1.092	1.137	1.137*
	Bottom	0.023	0.015	0.038
	Right	0.035	0.025	0.060
	Left	1.049	0.004	1.053

Table 10-2
Simultaneous Transmission Scenario with 2.4 GHz Bluetooth

Simult Tx	Configuration	Bluetooth Ant WF7B SAR (W/kg)	Bluetooth Ant WF8 SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body SAR	Back	0.107	0.048	0.155
	Top	0.582	0.448	1.030
	Bottom	0.004	0.000	0.004
	Right	0.011	0.006	0.017
	Left	0.649	0.000	0.649

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Table 10-3
Simultaneous Transmission Scenario with 2.4 GHz WLAN and Bluetooth

Simult Tx	Configuration	Bluetooth Ant WF7B SAR (W/kg)	2.4 GHz WLAN Ant WF8 SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body SAR	Back	0.107	0.144	0.251
	Top	0.582	1.137	1.137*
	Bottom	0.004	0.015	0.019
	Right	0.011	0.025	0.036
	Left	0.649	0.004	0.653

Table 10-4
Simultaneous Transmission Scenario with Bluetooth (TxBF) and 5 GHz MIMO

Simult Tx	Configuration	Bluetooth Ant WF7B at 14 dBm SAR (W/kg)	Bluetooth Ant WF8 at 14 dBm SAR (W/kg)	5 GHz WLAN Ant WF7A SAR (W/kg)	5 GHz WLAN Ant WF8 SAR (W/kg)	Σ SAR (W/kg)
		1	2	3	4	1+2+3+4
Body SAR	Back	0.034	0.020	0.166	0.111	0.331
	Top	0.166	0.172	1.162	1.183	see table Below
	Bottom	0.004	0.000	0.016	0.044	0.064
	Right	0.011	0.006	0.005	0.021	0.043
	Left	0.184	0.000	0.018	0.000	0.202

Simult Tx	Configuration	Bluetooth Reduced Ant WF7B at 14 dBm SAR (W/kg)	Bluetooth Reduced Ant WF8 at 14 dBm SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
		1	2	3	1+2+3
Body	Top	0.166	0.172	1.185	1.523

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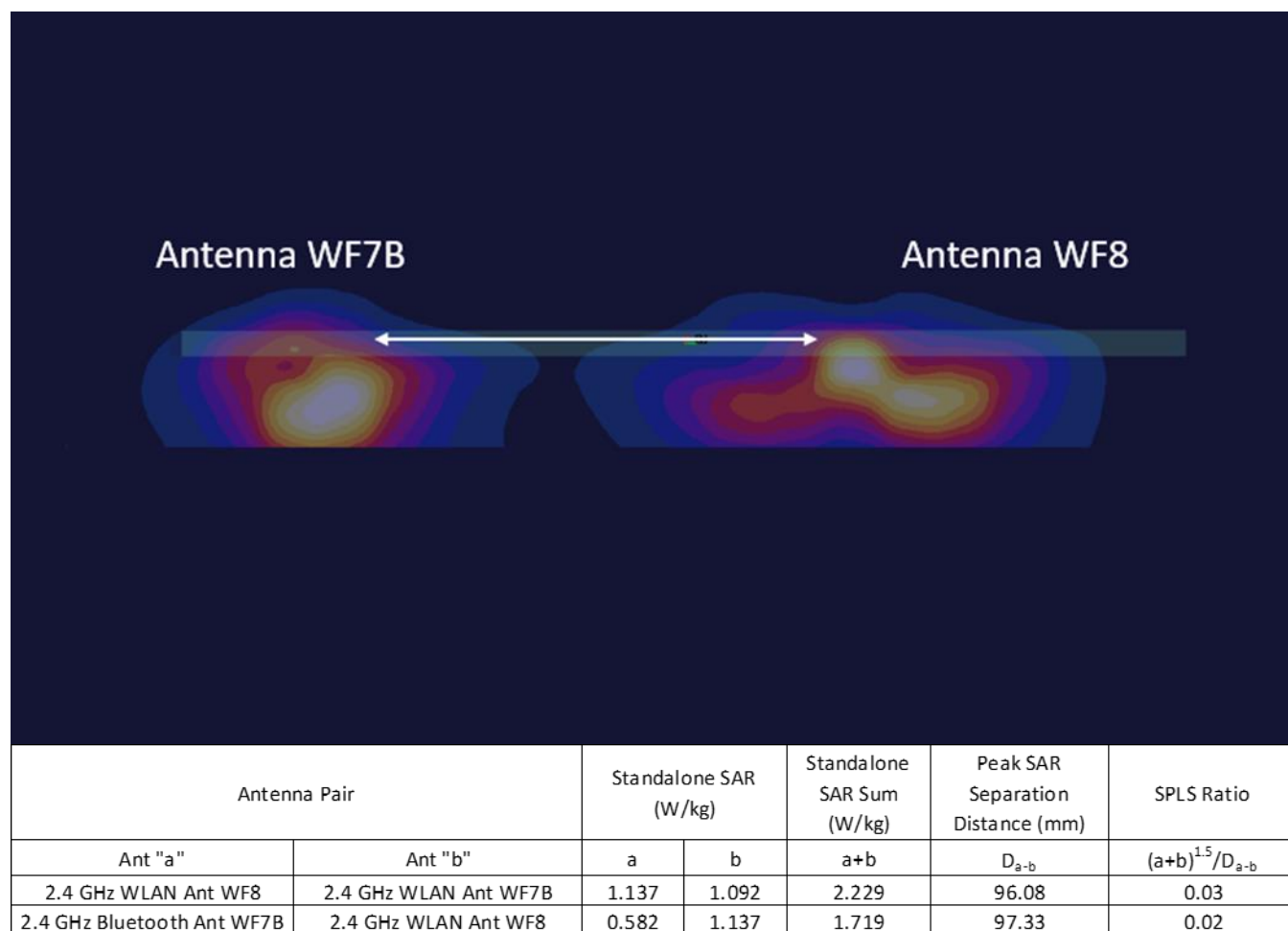
10.4 Spatial Separation Analysis

Per FCC KDB Publication 248227, antennas may be considered spatially separated when the aggregate SAR from multiple antennas at any location in the combined SAR distribution is either ≤ 1.2 W/kg where at least 90% of the SAR is attributed to a single SAR distribution or ≤ 0.4 W/kg where no more than one SAR distribution is contributing > 0.1 W/kg.

Spatial separation was determined by inspection of the area scan SAR distributions to confirm that at all locations, SAR was < 1.2 W/kg, where at least 90% of the SAR is attributed to a single SAR distribution. See below for illustrations of the spatial separated antennas considered.

10.4.1 Top Edge Spatial Separation Analysis

Figure 10-1
Top Edge Spatial Separation for Antenna WF8 and Antenna WF7b



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10.5 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is 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 IEEE 1528-2013 Section 6.3.4.1.2.

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11 SAR MEASUREMENT VARIABILITY

11.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was 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) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
- 2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1g SAR limit).
- 3) A third repeated measurement was performed only if the original, first, or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .
- 4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

Table 11-1
Body SAR Measurement Variability Results

BODY VARIABILITY RESULTS														
Band	FREQUENCY		Mode	Ant	Data Rate (Mbps)	Side	Spacing	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.						(W/kg)	(W/kg)		(W/kg)		(W/kg)	
2450	2462.00	11	802.11b, 22 MHz Bandwidth	WF8	1.0	top	0 mm	0.913	0.891	1.02	N/A	N/A	N/A	N/A
5270	5270.00	54	802.11n, 40 MHz Bandwidth	MIMO	13.5	top	0 mm	0.871	0.897	1.02	N/A	N/A	N/A	N/A
								0.983	0.946	1.02	N/A	N/A	N/A	N/A
5600	5610.00	122	802.11ac, 80 MHz Bandwidth	WF8	29.3	top	0 mm	0.924	0.943	1.02	N/A	N/A	N/A	N/A
5750	5775.00	155	802.11ac, 80 MHz Bandwidth	WF8	29.3	top	0 mm	1.030	1.000	1.03	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT							Body							
Spatial Peak							1.6 W/kg (mW/g)							
Uncontrolled Exposure/General Population							averaged over 1 gram							

11.2 Measurement Uncertainty

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

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12 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Vector Network Analyzer	2/11/2022	Annual	2/11/2023	MY40003841
Agilent	E4438C	ESG Vector Signal Generator	3/22/2022	Annual	3/22/2023	US41460739
Agilent	E5515C	Wireless Communications Test Set	5/4/2021	Biennial	5/4/2023	GB41450275
Agilent	N5182A	MXG Vector Signal Generator	11/17/2021	Annual	11/17/2022	US46240505
Agilent	N5182A	MXG Vector Signal Generator	1/12/2022	Annual	1/12/2023	MY47420837
Agilent	N9020A	MXA Signal Analyzer	5/6/2022	Annual	5/6/2023	MY51240479
Agilent	E4404A	PSA Series Spectrum Analyzer	3/22/2022	Annual	3/22/2023	MY46186272
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343971
Anritsu	MA24106A	USB Power Sensor	9/21/2021	Annual	9/21/2022	2018527
Anritsu	MA24106A	USB Power Sensor	9/21/2021	Annual	9/21/2022	1827527
Anritsu	MA24106A	USB Power Sensor	9/21/2021	Annual	9/21/2022	1244515
Anritsu	MA24106A	USB Power Sensor	9/21/2021	Annual	9/21/2022	2018534
Anritsu	MA2411B	Pulse Power Sensor	3/2/2022	Annual	3/2/2023	1126066
Anritsu	MT8821C	Radio Communication Analyzer	5/2/2022	Annual	5/2/2023	6200901190
Anritsu	MT8821C	Radio Communication Analyzer	5/24/2022	Annual	5/24/2023	6201144418
Control Company	4040	Therm./Clock/Humidity Monitor	1/21/2022	Annual	1/21/2023	160574418
Control Company	4040	Therm./Clock/Humidity Monitor	3/12/2021	Biennial	3/12/2023	210202100
Control Company	4353	Long Stem Thermometer	10/28/2020	Biennial	10/28/2022	C01065
Control Company	4353	Long Stem Thermometer	10/28/2020	Biennial	10/28/2022	C01064
Insize	1108-150	Digital Caliper	4/5/2022	Biennial	4/5/2023	409193536
MCL	BW-N10W5+	10dB Attenuator	CBT	N/A	CBT	1611
MCL	BW-N3W5+	3dB Attenuator	CBT	N/A	CBT	1812
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1311
Mini-Circuits	NLP-2950+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	ZHDC-16-63-S+	50-6000MHz Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	NRX	Power Meter	11/22/2021	Annual	11/22/2022	102583
Huber + Suhner	74Z-0-0-21	Torque Wrench	4/6/2022	Biennial	4/6/2024	N/A
SPEAG	DAKS-3.5	Portable DAK	10/7/2021	Annual	10/7/2022	1045
SPEAG	D2450V2	2450 MHz SAR Dipole	11/9/2021	Annual	11/9/2022	921
SPEAG	D2450V2	2450 MHz SAR Dipole	5/11/2022	Annual	5/11/2023	750
SPEAG	D5GHzV2	5 GHz SAR Dipole	3/22/2022	Annual	3/22/2023	1123
SPEAG	EX3DV4	SAR Probe	2/22/2022	Annual	2/22/2023	7427
SPEAG	EX3DV4	SAR Probe	2/21/2022	Annual	2/21/2023	7308
SPEAG	EX3DV4	SAR Probe	3/22/2022	Annual	3/22/2023	7638
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/21/2022	Annual	3/21/2023	1408
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/22/2022	Annual	2/22/2023	1403
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/24/2022	Annual	2/24/2023	467

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.

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13 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 Uncertainty	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
Expanded Uncertainty							k=2	24.4	24.0
(95% CONFIDENCE LEVEL)									

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

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14 CONCLUSION

14.1 Measurement Conclusion

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

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

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