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SAR EVALUATION REPORT

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

Date of Testing:
07/28/2021-07/29/2021
Test Site/Location:
PCTEST Lab, Morgan Hill, CA, USA
Document Serial No.:
1C2106080050-06.BCG (Rev 1)

FCC ID:	**BCGA2602**
APPLICANT:	**APPLE, INC.**

DUT Type:	Tablet Device
Application Type:	Certification
FCC Rule Part(s):	CFR §2.1093
Model:	A2602

Equipment Class	Band & Mode	Tx Frequency	SAR
			1g Body (W/kg)
DTS	2.4 GHz WLAN	2412 - 2472 MHz	1.08
NII	U-NII-1	5180 - 5240 MHz	N/A
NII	U-NII-2A	5260 - 5320 MHz	1.04
NII	U-NII-2C	5500 - 5720 MHz	1.10
NII	U-NII-3	5745 - 5825 MHz	1.02
DSS/DTS	Bluetooth	2402 - 2480 MHz	0.95
Simultaneous SAR per KDB 690783 D01v01r03:			1.27

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.

Randy Ortanez
President

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

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1 DEVICE UNDER TEST

1.1 Device Overview

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

Detailed description of the mechanism and the verification procedures are included in the operational description document. Section 7.5 contain a summary of the verification results.

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 Output Power

Mode/ Band			IEEE 802.11b (2.4 GHz)		IEEE 802.11g (2.4 GHz)		IEEE 802.11n (2.4 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - Single Tx Chain (dBm) - Antenna A	20 MHz Bandwidth	1	16.00	14.50	15.00	13.50	15.00	13.50
		2	16.00	14.50	16.00	14.50	16.00	14.50
		3	16.00	14.50	16.00	14.50	16.00	14.50
		4	16.00	14.50	16.00	14.50	16.00	14.50
		5	16.00	14.50	16.00	14.50	16.00	14.50
		6	16.00	14.50	16.00	14.50	16.00	14.50
		7	16.00	14.50	16.00	14.50	16.00	14.50
		8	16.00	14.50	16.00	14.50	16.00	14.50
		9	16.00	14.50	16.00	14.50	16.00	14.50
		10	16.00	14.50	16.00	14.50	16.00	14.50
		11	16.00	14.50	14.00	12.50	14.00	12.50
		12	16.00	14.50	11.50	10.00	11.50	10.00
		13	14.00	12.50	1.00	-0.50	1.00	-0.50

Mode/ Band			IEEE 802.11g (2.4 GHz)		IEEE 802.11n (2.4 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) - Antenna A	20 MHz Bandwidth	1	13.50	12.00	13.50	12.00
		2	16.00	14.50	16.00	14.50
		3	16.00	14.50	16.00	14.50
		4	16.00	14.50	16.00	14.50
		5	16.00	14.50	16.00	14.50
		6	16.00	14.50	16.00	14.50
		7	16.00	14.50	16.00	14.50
		8	16.00	14.50	16.00	14.50
		9	16.00	14.50	16.00	14.50
		10	16.00	14.50	16.00	14.50
		11	13.00	11.50	13.00	11.50
		12	10.50	9.00	10.50	9.00
		13	0.00	-1.50	0.00	-1.50

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)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - Single Tx Chain (dBm) - Antenna B	20 MHz Bandwidth	1	16.00	14.50	15.00	13.50	15.00	13.50
		2	16.00	14.50	16.00	14.50	16.00	14.50
		3	16.00	14.50	16.00	14.50	16.00	14.50
		4	16.00	14.50	16.00	14.50	16.00	14.50
		5	16.00	14.50	16.00	14.50	16.00	14.50
		6	16.00	14.50	16.00	14.50	16.00	14.50
		7	16.00	14.50	16.00	14.50	16.00	14.50
		8	16.00	14.50	16.00	14.50	16.00	14.50
		9	16.00	14.50	16.00	14.50	16.00	14.50
		10	16.00	14.50	16.00	14.50	16.00	14.50
		11	16.00	14.50	14.00	12.50	14.00	12.50
		12	16.00	14.50	11.50	10.00	11.50	10.00
		13	14.00	12.50	1.00	-0.50	1.00	-0.50

Mode/ Band			IEEE 802.11g (2.4 GHz)		IEEE 802.11n (2.4 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) - Antenna B	20 MHz Bandwidth	1	13.50	12.00	13.50	12.00
		2	16.00	14.50	16.00	14.50
		3	16.00	14.50	16.00	14.50
		4	16.00	14.50	16.00	14.50
		5	16.00	14.50	16.00	14.50
		6	16.00	14.50	16.00	14.50
		7	16.00	14.50	16.00	14.50
		8	16.00	14.50	16.00	14.50
		9	16.00	14.50	16.00	14.50
		10	16.00	14.50	16.00	14.50
		11	13.00	11.50	13.00	11.50
		12	10.50	9.00	10.50	9.00
		13	0.00	-1.50	0.00	-1.50

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

Mode/ Band			IEEE 802.11a (5 GHz)		IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - Single Tx Chain (dBm) - Antenna A	20 MHz Bandwidth	36	16.00	14.50	16.00	14.50	16.00	14.50
		40	16.50	15.00	16.50	15.00	16.50	15.00
		44	16.50	15.00	16.50	15.00	16.50	15.00
		48	16.50	15.00	16.50	15.00	16.50	15.00
		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	15.50	14.00	15.50	14.00	15.50	14.00
		100	14.50	13.00	14.50	13.00	14.50	13.00
		104	17.50	16.00	17.50	16.00	17.50	16.00
		108	17.50	16.00	17.50	16.00	17.50	16.00
		112	17.50	16.00	17.50	16.00	17.50	16.00
		116	17.50	16.00	17.50	16.00	17.50	16.00
		120	17.50	16.00	17.50	16.00	17.50	16.00
		124	17.50	16.00	17.50	16.00	17.50	16.00
		128	17.50	16.00	17.50	16.00	17.50	16.00
		132	17.50	16.00	17.50	16.00	17.50	16.00
		136	16.50	15.00	16.50	15.00	16.50	15.00
		140	13.50	12.00	13.50	12.00	13.50	12.00
		144	17.50	16.00	17.50	16.00	17.50	16.00
		149	16.25	14.75	16.25	14.75	16.25	14.75
		153	16.25	14.75	16.25	14.75	16.25	14.75
		157	16.25	14.75	16.25	14.75	16.25	14.75
		161	16.25	14.75	16.25	14.75	16.25	14.75
		165	16.25	14.75	16.25	14.75	16.25	14.75
	40 MHz Bandwidth	38			13.50	12.00	13.50	12.00
		46			16.50	15.00	16.50	15.00
		54			17.00	15.50	17.00	15.50
		62			14.00	12.50	14.00	12.50
		102			13.00	11.50	13.00	11.50
		110			17.50	16.00	17.50	16.00
		118			17.50	16.00	17.50	16.00
		126			17.50	16.00	17.50	16.00
		134			14.50	13.00	14.50	13.00
		142			17.50	16.00	17.50	16.00
		151			16.25	14.75	16.25	14.75
		159			16.25	14.75	16.25	14.75
	80 MHz Bandwidth	42					12.00	10.50
		58					12.50	11.00
		106					12.50	11.00
		122					15.00	13.50
		138					17.50	16.00
		155					15.00	13.50

Mode/ Band			IEEE 802.11a (5 GHz)		IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) CDD - Antenna A	20 MHz Bandwidth	36	15.00	13.50	15.00	13.50	15.00	13.50
		40	16.50	15.00	16.50	15.00	16.50	15.00
		44	16.50	15.00	16.50	15.00	16.50	15.00
		48	16.50	15.00	16.50	15.00	16.50	15.00
		52	16.50	15.00	16.50	15.00	16.50	15.00
		56	16.50	15.00	16.50	15.00	16.50	15.00
		60	16.50	15.00	16.50	15.00	16.50	15.00
		64	14.00	12.50	14.00	12.50	14.00	12.50
		100	14.50	13.00	14.50	13.00	14.50	13.00
		104	15.50	14.00	15.50	14.00	15.50	14.00
		108	15.50	14.00	15.50	14.00	15.50	14.00
		112	15.50	14.00	15.50	14.00	15.50	14.00
		116	15.50	14.00	15.50	14.00	15.50	14.00
		120	15.50	14.00	15.50	14.00	15.50	14.00
		124	15.50	14.00	15.50	14.00	15.50	14.00
		128	15.50	14.00	15.50	14.00	15.50	14.00
		132	15.50	14.00	15.50	14.00	15.50	14.00
		136	15.50	14.00	15.50	14.00	15.50	14.00
		140	13.00	11.50	13.00	11.50	13.00	11.50
		144	15.50	14.00	15.50	14.00	15.50	14.00
		149	16.25	14.75	16.25	14.75	16.25	14.75
		153	16.25	14.75	16.25	14.75	16.25	14.75
		157	16.25	14.75	16.25	14.75	16.25	14.75
		161	16.25	14.75	16.25	14.75	16.25	14.75
		165	16.25	14.75	16.25	14.75	16.25	14.75
	40 MHz Bandwidth	38	[redacted]		12.00	10.50	12.00	10.50
		46			16.50	15.00	16.50	15.00
		54			17.00	15.50	17.00	15.50
		62			12.50	11.00	12.50	11.00
		102			12.00	10.50	12.00	10.50
		110			17.00	15.50	17.00	15.50
		118			17.50	16.00	17.50	16.00
		126			17.50	16.00	17.50	16.00
		134			13.00	11.50	13.00	11.50
		142			17.50	16.00	17.50	16.00
		151			16.25	14.75	16.25	14.75
		159			16.25	14.75	16.25	14.75
	80 MHz Bandwidth	42	[redacted]				11.00	9.50
		58					11.50	10.00
		106					11.00	9.50
		122					13.50	12.00
		138					17.50	16.00
		155					14.50	13.00

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

Mode/ Band			IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) SDM - Antenna A	20 MHz Bandwidth	36	15.00	13.50	15.00	13.50
		40	16.50	15.00	16.50	15.00
		44	16.50	15.00	16.50	15.00
		48	16.50	15.00	16.50	15.00
		52	17.00	15.50	17.00	15.50
		56	17.00	15.50	17.00	15.50
		60	17.00	15.50	17.00	15.50
		64	14.00	12.50	14.00	12.50
		100	14.50	13.00	14.50	13.00
		104	17.50	16.00	17.50	16.00
		108	17.50	16.00	17.50	16.00
		112	17.50	16.00	17.50	16.00
		116	17.50	16.00	17.50	16.00
		120	17.50	16.00	17.50	16.00
		124	17.50	16.00	17.50	16.00
		128	17.50	16.00	17.50	16.00
		132	17.50	16.00	17.50	16.00
		136	16.50	15.00	16.50	15.00
		140	13.00	11.50	13.00	11.50
		144	17.50	16.00	17.50	16.00
		149	16.25	14.75	16.25	14.75
		153	16.25	14.75	16.25	14.75
		157	16.25	14.75	16.25	14.75
		161	16.25	14.75	16.25	14.75
		165	16.25	14.75	16.25	14.75
	40 MHz Bandwidth	38	12.00	10.50	12.00	10.50
		46	16.50	15.00	16.50	15.00
		54	17.00	15.50	17.00	15.50
		62	12.50	11.00	12.50	11.00
		102	12.00	10.50	12.00	10.50
		110	17.00	15.50	17.00	15.50
		118	17.50	16.00	17.50	16.00
		126	17.50	16.00	17.50	16.00
		134	13.00	11.50	13.00	11.50
		142	17.50	16.00	17.50	16.00
		151	16.25	14.75	16.25	14.75
		159	16.25	14.75	16.25	14.75
	80 MHz Bandwidth	42	[redacted]		11.00	9.50
		58			11.50	10.00
		106			11.00	9.50
		122			13.50	12.00
		138			17.50	16.00
		155			14.50	13.00

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

Mode/ Band			IEEE 802.11a (5 GHz)		IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - Single Tx Chain (dBm) - Antenna B	20 MHz Bandwidth	36	16.00	14.50	16.00	14.50	16.00	14.50
		40	16.25	14.75	16.25	14.75	16.25	14.75
		44	16.25	14.75	16.25	14.75	16.25	14.75
		48	16.25	14.75	16.25	14.75	16.25	14.75
		52	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
		60	16.75	15.25	16.75	15.25	16.75	15.25
		64	15.50	14.00	15.50	14.00	15.50	14.00
		100	14.50	13.00	14.50	13.00	14.50	13.00
		104	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
		112	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
		120	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
		128	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
		136	16.50	15.00	16.50	15.00	16.50	15.00
		140	13.50	12.00	13.50	12.00	13.50	12.00
		144	17.25	15.75	17.25	15.75	17.25	15.75
		149	16.50	15.00	16.50	15.00	16.50	15.00
		153	16.50	15.00	16.50	15.00	16.50	15.00
		157	16.50	15.00	16.50	15.00	16.50	15.00
		161	16.50	15.00	16.50	15.00	16.50	15.00
		165	16.50	15.00	16.50	15.00	16.50	15.00
	40 MHz Bandwidth	38	[redacted]		13.50	12.00	13.50	12.00
		46			16.25	14.75	16.25	14.75
		54			16.75	15.25	16.75	15.25
		62			14.00	12.50	14.00	12.50
		102			13.00	11.50	13.00	11.50
		110			17.25	15.75	17.25	15.75
		118			17.25	15.75	17.25	15.75
		126			17.25	15.75	17.25	15.75
		134			14.50	13.00	14.50	13.00
		142			17.25	15.75	17.25	15.75
		151			16.50	15.00	16.50	15.00
		159			16.50	15.00	16.50	15.00
	80 MHz Bandwidth	42	[redacted]				12.00	10.50
		58					12.50	11.00
		106					12.50	11.00
		122					15.00	13.50
		138					17.25	15.75
		155					15.00	13.50

Mode/ Band			IEEE 802.11a (5 GHz)		IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) CDD - Antenna B	20 MHz Bandwidth	36	15.00	13.50	15.00	13.50	15.00	13.50
		40	16.25	14.75	16.25	14.75	16.25	14.75
		44	16.25	14.75	16.25	14.75	16.25	14.75
		48	16.25	14.75	16.25	14.75	16.25	14.75
		52	16.50	15.00	16.50	15.00	16.50	15.00
		56	16.50	15.00	16.50	15.00	16.50	15.00
		60	16.50	15.00	16.50	15.00	16.50	15.00
		64	14.00	12.50	14.00	12.50	14.00	12.50
		100	14.50	13.00	14.50	13.00	14.50	13.00
		104	15.50	14.00	15.50	14.00	15.50	14.00
		108	15.50	14.00	15.50	14.00	15.50	14.00
		112	15.50	14.00	15.50	14.00	15.50	14.00
		116	15.50	14.00	15.50	14.00	15.50	14.00
		120	15.50	14.00	15.50	14.00	15.50	14.00
		124	15.50	14.00	15.50	14.00	15.50	14.00
		128	15.50	14.00	15.50	14.00	15.50	14.00
		132	15.50	14.00	15.50	14.00	15.50	14.00
		136	15.50	14.00	15.50	14.00	15.50	14.00
		140	13.00	11.50	13.00	11.50	13.00	11.50
		144	15.50	14.00	15.50	14.00	15.50	14.00
		149	16.50	15.00	16.50	15.00	16.50	15.00
		153	16.50	15.00	16.50	15.00	16.50	15.00
		157	16.50	15.00	16.50	15.00	16.50	15.00
		161	16.50	15.00	16.50	15.00	16.50	15.00
		165	16.50	15.00	16.50	15.00	16.50	15.00
	40 MHz Bandwidth	38	[redacted]		12.00	10.50	12.00	10.50
		46			16.25	14.75	16.25	14.75
		54			16.75	15.25	16.75	15.25
		62			12.50	11.00	12.50	11.00
		102			12.00	10.50	12.00	10.50
		110			17.00	15.50	17.00	15.50
		118			17.25	15.75	17.25	15.75
		126			17.25	15.75	17.25	15.75
		134			13.00	11.50	13.00	11.50
		142			17.25	15.75	17.25	15.75
		151			16.50	15.00	16.50	15.00
		159			16.50	15.00	16.50	15.00
	80 MHz Bandwidth	42	[redacted]				11.00	9.50
		58					11.50	10.00
		106					11.00	9.50
		122					13.50	12.00
		138					17.25	15.75
		155					14.50	13.00

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

Mode/ Band			IEEE 802.11n (5 GHz)		IEEE 802.11ac (5 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal
Modulated Average - 2 Tx Chain (dBm) SDM - Antenna B	20 MHz Bandwidth	36	15.00	13.50	15.00	13.50
		40	16.25	14.75	16.25	14.75
		44	16.25	14.75	16.25	14.75
		48	16.25	14.75	16.25	14.75
		52	16.75	15.25	16.75	15.25
		56	16.75	15.25	16.75	15.25
		60	16.75	15.25	16.75	15.25
		64	14.00	12.50	14.00	12.50
		100	14.50	13.00	14.50	13.00
		104	17.25	15.75	17.25	15.75
		108	17.25	15.75	17.25	15.75
		112	17.25	15.75	17.25	15.75
		116	17.25	15.75	17.25	15.75
		120	17.25	15.75	17.25	15.75
		124	17.25	15.75	17.25	15.75
		128	17.25	15.75	17.25	15.75
		132	17.25	15.75	17.25	15.75
		136	16.50	15.00	16.50	15.00
		140	13.00	11.50	13.00	11.50
		144	17.25	15.75	17.25	15.75
		149	16.50	15.00	16.50	15.00
		153	16.50	15.00	16.50	15.00
		157	16.50	15.00	16.50	15.00
		161	16.50	15.00	16.50	15.00
		165	16.50	15.00	16.50	15.00
	40 MHz Bandwidth	38	12.00	10.50	12.00	10.50
		46	16.25	14.75	16.25	14.75
		54	16.75	15.25	16.75	15.25
		62	12.50	11.00	12.50	11.00
		102	12.00	10.50	12.00	10.50
		110	17.00	15.50	17.00	15.50
		118	17.25	15.75	17.25	15.75
		126	17.25	15.75	17.25	15.75
		134	13.00	11.50	13.00	11.50
		142	17.25	15.75	17.25	15.75
		151	16.50	15.00	16.50	15.00
		159	16.50	15.00	16.50	15.00
	80 MHz Bandwidth	42	[redacted]		11.00	9.50
		58			11.50	10.00
		106			11.00	9.50
		122			13.50	12.00
		138			17.25	15.75
		155			14.50	13.00

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

1.3.2 Bluetooth Maximum Output Power

Mode / Band		Modulated Average - Single Tx Chain (dBm)
Bluetooth BDR/LE	Maximum	**17.00**
	Nominal	**15.50**
Bluetooth EDR	Maximum	**14.50**
	Nominal	**13.00**

1.3.3 Bluetooth Reduced Output Power

Mode / Band		Modulated Average - Single Tx Chain (dBm)
Bluetooth BDR/LE Reduced	Maximum	**10.00**
	Nominal	**8.50**
Bluetooth EDR Reduced	Maximum	**10.00**
	Nominal	**8.50**

Note: Bluetooth operations on Antenna A are reduced in output power when it is operating simultaneously with 5 GHz WLAN. Detailed description of the power reduction mechanism is included in the operational description.

1.4 DUT Antenna Locations

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

Table 1-1
Device Edges/Sides for SAR Testing

Mode	Back	Front	Top	Bottom	Right	Left
2.4 GHz WLAN Antenna A	Yes	No	No	Yes	No	Yes
2.4 GHz WLAN Antenna B	Yes	No	No	Yes	Yes	No
5 GHz WLAN Antenna A	Yes	No	No	Yes	No	Yes
5 GHz WLAN Antenna B	Yes	No	No	Yes	Yes	No
Bluetooth Antenna A	Yes	No	No	Yes	No	Yes

Note: Per FCC KDB Publication 616217 D04v01r01, particular DUT 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.

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	5 GHz Wi-Fi MIMO	Yes
3	2.4 GHz Bluetooth + 5 GHz Wi-Fi	Yes
4	2.4 GHz Bluetooth + 5 GHz Wi-Fi MIMO	Yes

1. 2.4 GHz WLAN, 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
2. 2.4 GHz WLAN and 5 GHz WLAN cannot transmit simultaneously.
3. This device supports 2x2 MIMO Tx for WLAN. 802.11a/g/n/ac supports CDD and 802.11n/ac additionally supports SDM. Each WLAN antenna can transmit independently or together when operating with MIMO.
4. This device supports VOWIFI.

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 A and Antenna B SAR. Additional testing for U-NII-1 Antenna A and Antenna B 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 spotchecked on Variant 1 and Variant 2. The Variant with the highest reported SAR value was evaluated for the remaining WLAN/Bluetooth configurations.

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

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

1.7 Guidance Applied

- 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)

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.

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/m^3)
E = Total RMS electric field strength (V/m)

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

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:

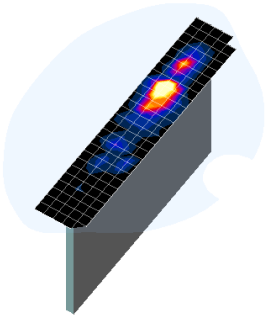


Figure 3-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 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.

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

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

*Also compliant to IEEE 1528-2013 Table 6

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 ε = 3 and loss tangent δ = 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.

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

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

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.

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 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. 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).

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

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.

7 RF CONDUCTED POWERS

7.1 WLAN Conducted Powers

Table 7-1
2.4 GHz WLAN Maximum Average RF Power – Antenna A, Variant 1

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	15.03	14.01	14.17
2417	2		15.23	15.05
2437	6	15.04	15.22	15.15
2457	10		15.02	15.02
2462	11	14.90	13.08	13.10

Table 7-2
2.4 GHz WLAN Maximum Average RF Power – Antenna A, Variant 2

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	15.02	13.97	14.02
2417	2		15.12	15.14
2437	6	15.07	15.03	15.08
2457	10		15.07	15.03
2462	11	14.91	13.02	13.00

Table 7-3
2.4 GHz WLAN Maximum Average RF Power – Antenna B, Variant 1

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	15.04	14.05	14.00
2417	2		14.95	14.97
2437	6	14.96	15.03	15.01
2457	10		14.94	15.03
2462	11	15.00	12.98	13.00

Table 7-4
2.4 GHz WLAN Maximum Average RF Power – Antenna B, Variant 2

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	15.05	14.16	14.01
2417	2		15.11	15.06
2437	6	14.90	15.05	15.02
2457	10		15.03	15.10
2462	11	14.77	13.01	12.95

Table 7-5
5 GHz WLAN Maximum Average RF Power – Antenna A, Variant 1

5GHz (40MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11n	802.11ac
		Average	Average
5190	38	12.44	12.60
5230	46	15.45	15.45
5270	54	15.90	15.98
5310	62	12.42	12.49
5755	151	15.30	15.30
5795	159	15.31	15.35

5GHz (80MHz) Conducted Power [dBm]		
Freq [MHz]	Channel	IEEE Transmission Mode
		802.11ac
		Average
5530	106	11.41
5610	122	14.47
5690	138	16.50

Table 7-6
5 GHz WLAN Maximum Average RF Power – Antenna A, Variant 2

5GHz (40MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11n	802.11ac
		Average	Average
5190	38	12.60	12.62
5230	46	15.55	15.40
5270	54	16.10	16.15
5310	62	12.57	12.59
5755	151	15.26	15.30
5795	159	15.40	15.33

5GHz (80MHz) Conducted Power [dBm]		
Freq [MHz]	Channel	IEEE Transmission Mode
		802.11ac
		Average
5530	106	11.49
5610	122	14.63
5690	138	16.52

Table 7-7
5 GHz WLAN Maximum Average RF Power – Antenna B, Variant 1

5GHz (40MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11n	802.11ac
		Average	Average
5190	38	12.58	12.53
5230	46	15.30	15.35
5270	54	15.65	15.68
5310	62	12.46	12.46
5755	151	15.58	15.60
5795	159	15.56	15.49

5GHz (80MHz) Conducted Power [dBm]		
Freq [MHz]	Channel	IEEE Transmission Mode
		802.11ac
		Average
5530	106	11.32
5610	122	14.36
5690	138	16.17

Table 7-8
5 GHz WLAN Maximum Average RF Power – Antenna B, Variant 2

5GHz (40MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11n	802.11ac
		Average	Average
5190	38	12.61	12.55
5230	46	15.35	15.30
5270	54	15.72	15.79
5310	62	12.55	12.60
5755	151	15.65	15.50
5795	159	15.62	15.47

5GHz (80MHz) Conducted Power [dBm]		
Freq [MHz]	Channel	IEEE Transmission Mode
		802.11ac
		Average
5530	106	11.57
5610	122	14.51
5690	138	16.13

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.
- WLAN SAR worst case configuration was spotchecked on Variant 1 and Variant 2. The Variant with the highest reported SAR value was evaluated for the remaining WLAN configurations.
- Full power measurements were performed for Variant 1 and Variant 2 per FCC KDB Procedures 248227.

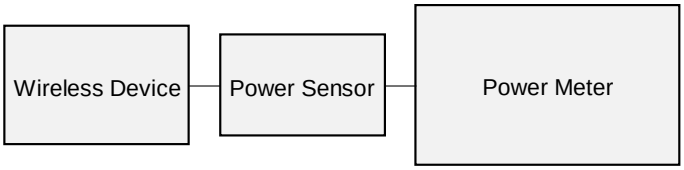


Figure 7-1
Power Measurement Setup

7.2 Bluetooth Maximum Conducted Powers

Table 7-9
Bluetooth Maximum Average RF Power – Antenna A, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	15.55	35.892
2441	GFSK	1.0	39	16.38	43.451
2480	GFSK	1.0	78	15.12	32.509

Table 7-10
Bluetooth Maximum Average RF Power – Antenna A, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	15.94	39.264
2441	GFSK	1.0	39	16.15	41.210
2480	GFSK	1.0	78	16.03	40.087

7.3 Bluetooth Reduced Conducted Powers

Table 7-11
Bluetooth 7 dB Reduced Average RF Power – Antenna A, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	9.43	8.770
2441	GFSK	1.0	39	9.20	8.318
2480	GFSK	1.0	78	8.99	7.925

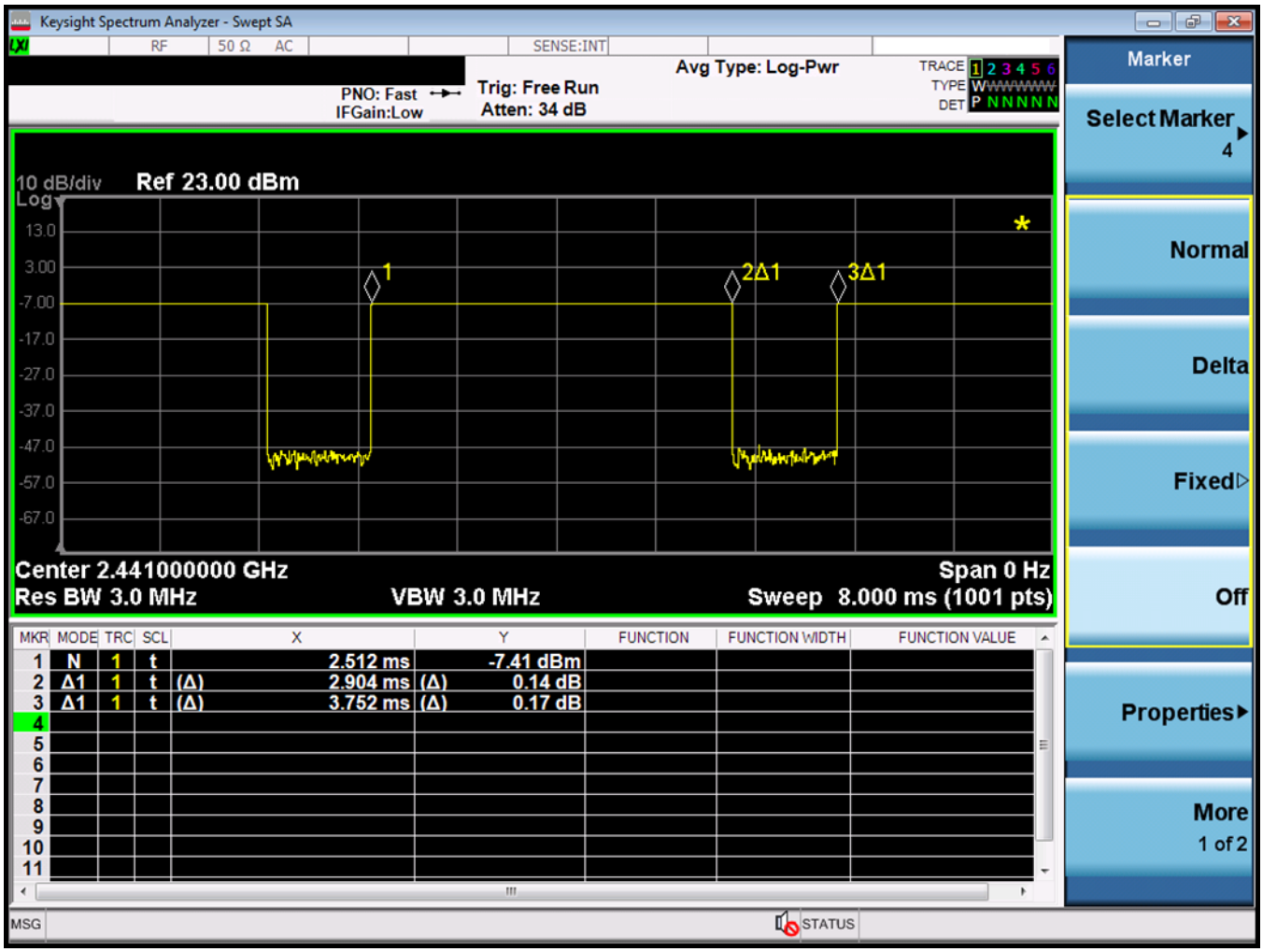
Table 7-12
Bluetooth 7 dB Reduced Average RF Power – Antenna A, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	9.30	8.511
2441	GFSK	1.0	39	9.36	8.630
2480	GFSK	1.0	78	9.42	8.750

7.4 Bluetooth Duty Cycle

7.4.1 Maximum Bluetooth Transmission Antenna A Variant 1

Figure 7-2
Bluetooth Transmission Plot

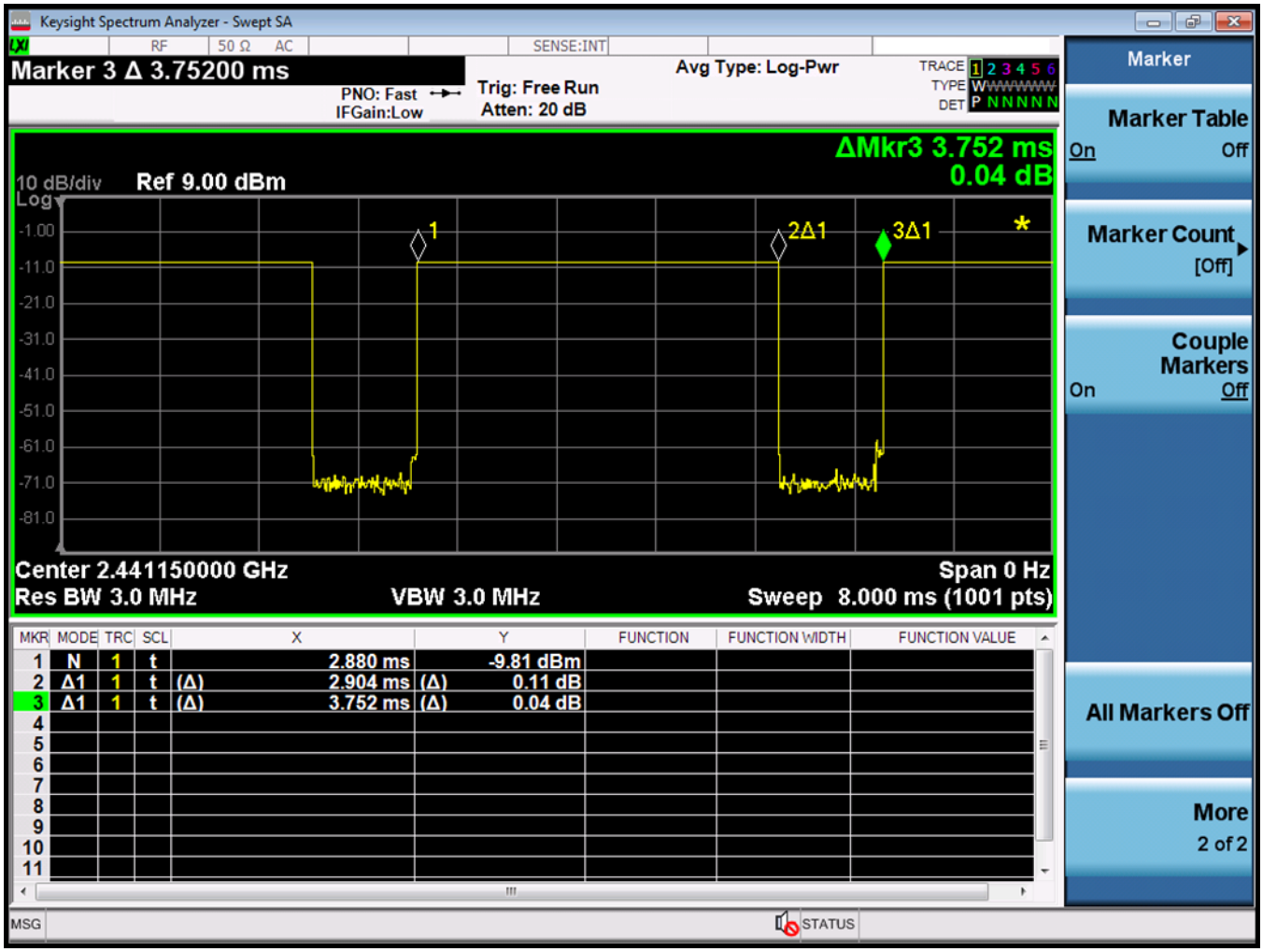


Equation 7-1
Bluetooth Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.904ms}{3.752ms} * 100\% = 77.4\%$$

7.4.2 Maximum Bluetooth Transmission Antenna A Variant 2

Figure 7-3
Bluetooth Transmission Plot



Equation 7-2
Bluetooth Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.904ms}{3.752ms} * 100\% = 77.4\%$$

7.5 Bluetooth Power Reduction Verification Summary

Table 7-13
Bluetooth Power Reduction Verification

Antenna	Mode/Band	Condition (s)	Maximum Target Power [dBm] (Tolerance [dB])	Reduced Target Power [dBm] (Tolerance [dB])	Maximum Measured Power [dBm]	Reduced Measured Power [dBm]	Verdict
A	2.4 GHz Bluetooth	5 GHz WLAN ON Antenna A	15.50 (+1.5/-2.0)	8.50 (+1.5/-2.0)	14.95	7.94	Pass
	2.4 GHz Bluetooth	5 GHz WLAN ON Antenna B	15.50 (+1.5/-2.0)	8.50 (+1.5/-2.0)	14.95	7.85	Pass
	2.4 GHz Bluetooth	5 GHz WLAN ON Antenna A & Antenna B	15.50 (+1.5/-2.0)	8.50 (+1.5/-2.0)	14.95	8.01	Pass

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

7.6 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 spotchecked on Variant 1 and Variant 2. The Variant with the highest reported SAR value was evaluated for the remaining Bluetooth configurations.
- Full power measurements were performed for Variant 1 and Variant 2 per FCC KDB Procedures 248227.
- Bluetooth operations are reduced in output power when it is operating simultaneously with 5 GHz WLAN. Detailed description of the power reduction mechanism is included in the operational description.

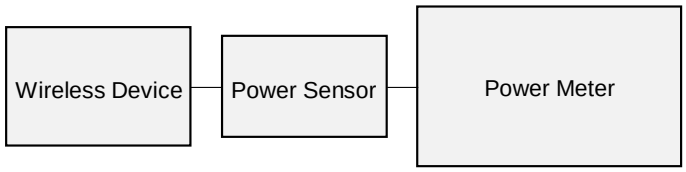


Figure 7-4
Power Measurement Setup

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
7/29/2021	2450 Body	21	2400	1.946	51.447	1.902	52.767	2.31%	-2.50%
			2450	1.992	51.397	1.950	52.700	2.15%	-2.47%
			2480	2.017	51.353	1.993	52.662	1.20%	-2.49%
			2500	2.035	51.327	2.021	52.636	0.69%	-2.49%
7/28/2021	5200-5800 Body	21.2	5180	5.319	47.672	5.276	49.041	0.82%	-2.79%
			5190	5.334	47.662	5.288	49.028	0.87%	-2.79%
			5200	5.349	47.649	5.299	49.014	0.94%	-2.78%
			5210	5.362	47.631	5.311	49.001	0.96%	-2.80%
			5220	5.373	47.605	5.323	48.987	0.94%	-2.82%
			5240	5.403	47.544	5.346	48.960	1.07%	-2.89%
			5250	5.415	47.511	5.358	48.947	1.06%	-2.93%
			5260	5.429	47.493	5.369	48.933	1.12%	-2.94%
			5270	5.445	47.475	5.381	48.919	1.19%	-2.95%
			5280	5.460	47.454	5.393	48.906	1.24%	-2.97%
			5290	5.472	47.433	5.404	48.892	1.26%	-2.98%
			5300	5.482	47.421	5.416	48.879	1.22%	-2.98%
			5310	5.497	47.402	5.428	48.865	1.27%	-2.99%
			5320	5.514	47.381	5.439	48.851	1.38%	-3.01%
			5500	5.773	47.038	5.650	48.607	2.18%	-3.23%
			5510	5.788	47.018	5.661	48.594	2.24%	-3.24%
			5520	5.805	47.004	5.673	48.580	2.33%	-3.24%
			5530	5.822	46.998	5.685	48.566	2.41%	-3.23%
			5540	5.837	46.983	5.696	48.553	2.48%	-3.23%
			5550	5.849	46.953	5.708	48.539	2.47%	-3.27%
			5560	5.864	46.928	5.720	48.526	2.52%	-3.29%
			5580	5.898	46.904	5.743	48.499	2.70%	-3.29%
			5600	5.923	46.873	5.766	48.471	2.72%	-3.30%
			5610	5.937	46.847	5.778	48.458	2.75%	-3.32%
			5620	5.952	46.820	5.790	48.444	2.80%	-3.35%
			5640	5.980	46.780	5.813	48.417	2.87%	-3.38%
			5660	6.009	46.750	5.837	48.390	2.95%	-3.39%
			5670	6.024	46.727	5.848	48.376	3.01%	-3.41%
			5680	6.037	46.697	5.860	48.363	3.02%	-3.44%
			5690	6.049	46.673	5.872	48.349	3.01%	-3.47%
			5700	6.064	46.660	5.883	48.336	3.08%	-3.47%
			5710	6.078	46.653	5.895	48.322	3.10%	-3.45%
			5720	6.095	46.631	5.907	48.309	3.18%	-3.47%
			5745	6.124	46.565	5.936	48.275	3.17%	-3.54%
			5750	6.131	46.555	5.942	48.268	3.18%	-3.55%
			5755	6.140	46.545	5.947	48.261	3.25%	-3.56%
			5765	6.158	46.531	5.959	48.248	3.34%	-3.56%
			5775	6.175	46.510	5.971	48.234	3.42%	-3.57%
			5785	6.188	46.477	5.982	48.220	3.44%	-3.61%
			5795	6.201	46.449	5.994	48.207	3.45%	-3.65%
			5800	6.209	46.434	6.000	48.200	3.48%	-3.66%
			5805	6.215	46.422	6.006	48.193	3.48%	-3.67%
			5825	6.244	46.388	6.029	48.166	3.57%	-3.69%

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.

8.2 Test System Verification

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in 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)	$Deviation_{1g}$ (%)
AM2	2450	BODY	07/29/2021	21.8	21.2	0.100	921	7532	5.230	50.800	52.300	2.95%
AM9	5250	BODY	07/28/2021	24.1	21.4	0.050	1123	7638	3.790	73.500	75.800	3.13%
AM9	5600	BODY	07/28/2021	24.1	21.4	0.050	1123	7638	4.030	77.400	80.600	4.13%
AM9	5750	BODY	07/28/2021	24.1	21.4	0.050	1123	7638	3.840	73.100	76.800	5.06%

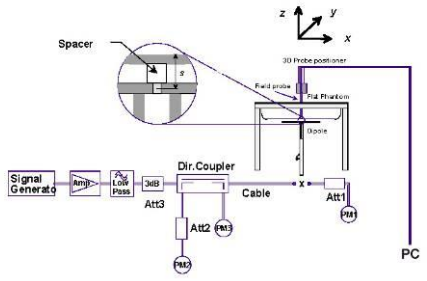


Figure 8-1
System Verification Setup Diagram

Figure 8-2
System Verification Setup Photo

9 SAR DATA SUMMARY

9.1 Standalone Body SAR Data

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

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)	
2437	6	802.11b	DSSS	22	16.00	15.04	-0.13	0 mm	Antenna A	V1	M4W4P4336R	1	back	99.6	0.041	1.247	1.004	0.051	0.020	0.025	
2437	6	802.11b	DSSS	22	16.00	15.04	0.14	0 mm	Antenna A	V1	M4W4P4336R	1	top	99.6	0.008	1.247	1.004	0.010	0.004	0.005	
2412	1	802.11b	DSSS	22	16.00	15.03	-0.03	0 mm	Antenna A	V1	M4W4P4336R	1	bottom	99.6	0.482	1.250	1.004	0.605	0.155	0.195	
2437	6	802.11b	DSSS	22	16.00	15.04	-0.11	0 mm	Antenna A	V1	M4W4P4336R	1	bottom	99.6	0.638	1.247	1.004	0.799	0.205	0.257	
2437	6	802.11b	DSSS	22	16.00	15.07	-0.02	0 mm	Antenna A	V2	RL6L2TDCJR	1	bottom	100.0	0.631	1.239	1.000	0.782	0.202	0.250	
2462	11	802.11b	DSSS	22	16.00	14.90	-0.05	0 mm	Antenna A	V1	M4W4P4336R	1	bottom	99.6	0.554	1.288	1.004	0.716	0.178	0.230	
2437	6	802.11b	DSSS	22	16.00	15.04	-0.14	0 mm	Antenna A	V1	M4W4P4336R	1	right	99.6	0.004	1.247	1.004	0.005	0.002	0.003	
2437	6	802.11b	DSSS	22	16.00	15.04	-0.11	0 mm	Antenna A	V1	M4W4P4336R	1	left	99.6	0.095	1.247	1.004	0.119	0.043	0.054	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Body 1.6 W/kg (mW/g) averaged over 1 gram						

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

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)	
2412	1	802.11b	DSSS	22	16.00	15.04	-0.05	0 mm	Antenna B	V1	M4W4P4336R	1	back	99.6	0.054	1.247	1.004	0.068	0.025	0.031	
2412	1	802.11b	DSSS	22	16.00	15.04	-0.13	0 mm	Antenna B	V1	M4W4P4336R	1	top	99.6	0.009	1.247	1.004	0.011	0.004	0.005	
2412	1	802.11b	DSSS	22	16.00	15.04	0.00	0 mm	Antenna B	V1	M4W4P4336R	1	bottom	99.6	0.635	1.247	1.004	0.795	0.205	0.257	
2437	6	802.11b	DSSS	22	16.00	14.96	-0.13	0 mm	Antenna B	V1	M4W4P4336R	1	bottom	99.6	0.827	1.271	1.004	1.055	0.267	0.341	
2462	11	802.11b	DSSS	22	16.00	15.00	0.04	0 mm	Antenna B	V1	M4W4P4336R	1	bottom	99.6	0.856	1.259	1.004	1.082	0.286	0.362	A1
2462	11	802.11b	DSSS	22	16.00	14.77	-0.06	0 mm	Antenna B	V2	RL6L2TDCJR	1	bottom	100.0	0.671	1.327	1.000	0.890	0.222	0.295	
2412	1	802.11b	DSSS	22	16.00	15.04	-0.05	0 mm	Antenna B	V1	M4W4P4336R	1	right	99.6	0.105	1.247	1.004	0.131	0.045	0.056	
2412	1	802.11b	DSSS	22	16.00	15.04	-0.15	0 mm	Antenna B	V1	M4W4P4336R	1	left	99.6	0.004	1.247	1.004	0.005	0.003	0.004	
2462	11	802.11b	DSSS	22	16.00	15.00	0.02	0 mm	Antenna B	V1	M4W4P4336R	1	bottom	99.6	0.728	1.259	1.004	0.920	0.243	0.307	
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: Blue entry indicates variability measurement.

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

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)	
5270	54	802.11n	OFDM	40	17.00	15.90	0.13	0 mm	Antenna A	V1	M4W4P4336R	13.5	back	97.7	0.048	1.288	1.024	0.063	0.017	0.022	
5270	54	802.11n	OFDM	40	17.00	15.90	-0.12	0 mm	Antenna A	V1	M4W4P4336R	13.5	top	97.7	0.013	1.288	1.024	0.017	0.003	0.004	
5270	54	802.11n	OFDM	40	17.00	15.90	-0.03	0 mm	Antenna A	V1	M4W4P4336R	13.5	bottom	97.7	0.782	1.288	1.024	1.031	0.259	0.342	
5270	54	802.11n	OFDM	40	17.00	16.10	0.05	0 mm	Antenna A	V2	RL6L2TDCJR	13.5	bottom	97.7	0.764	1.230	1.024	0.962	0.248	0.312	
5310	62	802.11n	OFDM	40	14.00	12.42	-0.01	0 mm	Antenna A	V1	M4W4P4336R	13.5	bottom	97.7	0.343	1.439	1.024	0.505	0.109	0.161	
5270	54	802.11n	OFDM	40	17.00	15.90	-0.14	0 mm	Antenna A	V1	M4W4P4336R	13.5	right	97.7	0.000	1.288	1.024	0.000	0.000	0.000	
5270	54	802.11n	OFDM	40	17.00	15.90	0.12	0 mm	Antenna A	V1	M4W4P4336R	13.5	left	97.7	0.072	1.288	1.024	0.095	0.028	0.037	
5690	138	802.11ac	OFDM	80	17.50	16.50	-0.16	0 mm	Antenna A	V1	M4W4P4336R	29.3	back	95.4	0.066	1.259	1.048	0.087	0.015	0.020	
5690	138	802.11ac	OFDM	80	17.50	16.50	-0.15	0 mm	Antenna A	V1	M4W4P4336R	29.3	top	95.4	0.023	1.259	1.048	0.030	0.000	0.000	
5530	106	802.11ac	OFDM	80	12.50	11.41	-0.10	0 mm	Antenna A	V1	M4W4P4336R	29.3	bottom	95.4	0.219	1.285	1.048	0.295	0.071	0.096	
5610	122	802.11ac	OFDM	80	15.00	14.47	-0.03	0 mm	Antenna A	V1	M4W4P4336R	29.3	bottom	95.4	0.482	1.130	1.048	0.571	0.173	0.205	
5690	138	802.11ac	OFDM	80	17.50	16.50	-0.13	0 mm	Antenna A	V1	M4W4P4336R	29.3	bottom	95.4	0.834	1.259	1.048	1.100	0.289	0.381	A2
5690	138	802.11ac	OFDM	80	17.50	16.52	-0.01	0 mm	Antenna A	V2	RL6L2TDCJR	29.3	bottom	95.4	0.815	1.253	1.048	1.070	0.284	0.373	
5690	138	802.11ac	OFDM	80	17.50	16.50	0.00	0 mm	Antenna A	V1	M4W4P4336R	29.3	right	95.4	0.005	1.259	1.048	0.007	0.001	0.001	
5690	138	802.11ac	OFDM	80	17.50	16.50	-0.13	0 mm	Antenna A	V1	M4W4P4336R	29.3	left	95.4	0.115	1.259	1.048	0.152	0.034	0.045	
5795	159	802.11n	OFDM	40	16.25	15.31	-0.08	0 mm	Antenna A	V1	M4W4P4336R	13.5	back	97.7	0.086	1.242	1.024	0.109	0.023	0.029	
5795	159	802.11n	OFDM	40	16.25	15.31	-0.13	0 mm	Antenna A	V1	M4W4P4336R	13.5	top	97.7	0.026	1.242	1.024	0.033	0.003	0.004	
5755	151	802.11n	OFDM	40	16.25	15.30	-0.01	0 mm	Antenna A	V1	M4W4P4336R	13.5	bottom	97.7	0.725	1.245	1.024	0.924	0.245	0.312	
5795	159	802.11n	OFDM	40	16.25	15.31	0.02	0 mm	Antenna A	V1	M4W4P4336R	13.5	bottom	97.7	0.805	1.242	1.024	1.024	0.271	0.345	
5795	159	802.11n	OFDM	40	16.25	15.40	0.04	0 mm	Antenna A	V2	RL6L2TDCJR	13.5	bottom	97.7	0.804	1.216	1.024	1.001	0.273	0.340	
5795	159	802.11n	OFDM	40	16.25	15.31	-0.13	0 mm	Antenna A	V1	M4W4P4336R	13.5	right	97.7	0.004	1.242	1.024	0.005	0.000	0.000	
5795	159	802.11n	OFDM	40	16.25	15.31	-0.20	0 mm	Antenna A	V1	M4W4P4336R	13.5	left	97.7	0.105	1.242	1.024	0.134	0.035	0.045	
5690	138	802.11ac	OFDM	80	17.50	16.50	-0.10	0 mm	Antenna A	V1	M4W4P4336R	29.3	bottom	95.4	0.793	1.259	1.048	1.046	0.271	0.358	
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: Blue entry indicates variability measurement.

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

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)	
5270	54	802.11n	OFDM	40	16.75	15.72	0.07	0 mm	Antenna B	V2	LPJ97XCJ9K	13.5	back	97.8	0.071	1.268	1.022	0.092	0.027	0.035	
5270	54	802.11n	OFDM	40	16.75	15.72	0.13	0 mm	Antenna B	V2	LPJ97XCJ9K	13.5	top	97.8	0.025	1.268	1.022	0.032	0.007	0.009	
5270	54	802.11n	OFDM	40	16.75	15.65	-0.05	0 mm	Antenna B	V1	FH9VXT954G	13.5	bottom	97.7	0.669	1.288	1.024	0.882	0.220	0.290	
5270	54	802.11n	OFDM	40	16.75	15.72	0.13	0 mm	Antenna B	V2	LPJ97XCJ9K	13.5	bottom	97.8	0.805	1.268	1.022	1.043	0.272	0.352	
5310	62	802.11n	OFDM	40	14.00	12.55	-0.13	0 mm	Antenna B	V2	LPJ97XCJ9K	13.5	bottom	97.8	0.325	1.396	1.022	0.464	0.106	0.151	
5270	54	802.11n	OFDM	40	16.75	15.72	-0.12	0 mm	Antenna B	V2	LPJ97XCJ9K	13.5	right	97.8	0.097	1.268	1.022	0.126	0.038	0.049	
5270	54	802.11n	OFDM	40	16.75	15.72	-0.14	0 mm	Antenna B	V2	LPJ97XCJ9K	13.5	left	97.8	0.000	1.268	1.022	0.000	0.000	0.000	
5690	138	802.11ac	OFDM	80	17.25	16.17	-0.12	0 mm	Antenna B	V1	FH9VXT954G	29.3	back	95.6	0.063	1.282	1.046	0.084	0.022	0.030	
5690	138	802.11ac	OFDM	80	17.25	16.17	0.18	0 mm	Antenna B	V1	FH9VXT954G	29.3	top	95.6	0.025	1.282	1.046	0.034	0.007	0.009	
5530	106	802.11ac	OFDM	80	12.50	11.32	-0.19	0 mm	Antenna B	V1	FH9VXT954G	29.3	bottom	95.6	0.243	1.312	1.046	0.333	0.082	0.113	
5610	122	802.11ac	OFDM	80	15.00	14.36	0.02	0 mm	Antenna B	V1	FH9VXT954G	29.3	bottom	95.6	0.649	1.159	1.046	0.787	0.227	0.275	
5690	138	802.11ac	OFDM	80	17.25	16.17	-0.09	0 mm	Antenna B	V1	FH9VXT954G	29.3	bottom	95.6	0.797	1.282	1.046	1.069	0.285	0.382	
5690	138	802.11ac	OFDM	80	17.25	16.13	-0.16	0 mm	Antenna B	V2	7LPJ97XCJ9K	29.3	bottom	95.6	0.734	1.294	1.046	0.993	0.264	0.357	
5690	138	802.11ac	OFDM	80	17.25	16.17	-0.17	0 mm	Antenna B	V1	FH9VXT954G	29.3	right	95.6	0.104	1.282	1.046	0.139	0.037	0.050	
5690	138	802.11ac	OFDM	80	17.25	16.17	0.00	0 mm	Antenna B	V1	FH9VXT954G	29.3	left	95.6	0.000	1.282	1.046	0.000	0.000	0.000	
5755	151	802.11n	OFDM	40	16.50	15.58	0.13	0 mm	Antenna B	V1	FH9VXT954G	13.5	back	97.7	0.036	1.236	1.024	0.046	0.015	0.019	
5755	151	802.11n	OFDM	40	16.50	15.58	0.15	0 mm	Antenna B	V1	FH9VXT954G	13.5	top	97.7	0.019	1.236	1.024	0.024	0.005	0.006	
5755	151	802.11n	OFDM	40	16.50	15.58	-0.12	0 mm	Antenna B	V1	FH9VXT954G	13.5	bottom	97.7	0.728	1.236	1.024	0.921	0.264	0.334	
5755	151	802.11n	OFDM	40	16.50	15.65	0.15	0 mm	Antenna B	V2	7LPJ97XCJ9K	13.5	bottom	97.8	0.727	1.216	1.022	0.903	0.260	0.323	
5795	159	802.11n	OFDM	40	16.50	15.56	0.12	0 mm	Antenna B	V1	FH9VXT954G	13.5	bottom	97.7	0.621	1.242	1.024	0.790	0.223	0.284	
5755	151	802.11n	OFDM	40	16.50	15.58	0.15	0 mm	Antenna B	V1	FH9VXT954G	13.5	right	97.7	0.120	1.236	1.024	0.152	0.041	0.052	
5755	151	802.11n	OFDM	40	16.50	15.58	0.00	0 mm	Antenna B	V1	FH9VXT954G	13.5	left	97.7	0.001	1.236	1.024	0.001	0.000	0.000	
5270	54	802.11n	OFDM	40	16.75	15.72	0.00	0 mm	Antenna B	V2	LPJ97XCJ9K	13.5	bottom	97.8	0.791	1.268	1.022	1.025	0.262	0.340	
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: Blue entry indicates variability measurement.

Table 9-5
Bluetooth Body SAR Data – Antenna A

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)	(W/kg)	
2441	39	Bluetooth	FHSS	17.00	16.15	0.04	0 mm	Antenna A	V2	LPJ97XCJ9K	1	back	77.4	0.052	1.216	1.001	0.063	0.023	0.028	
2441	39	Bluetooth	FHSS	17.00	16.15	0.12	0 mm	Antenna A	V2	LPJ97XCJ9K	1	top	77.4	0.003	1.216	1.001	0.004	0.000	0.000	
2402	0	Bluetooth	FHSS	17.00	15.94	0.01	0 mm	Antenna A	V2	LPJ97XCJ9K	1	bottom	77.4	0.523	1.276	1.001	0.668	0.167	0.213	
2441	39	Bluetooth	FHSS	17.00	16.38	0.06	0 mm	Antenna A	V1	FH9VXT954G	1	bottom	77.4	0.723	1.153	1.001	0.834	0.238	0.275	
2441	39	Bluetooth	FHSS	17.00	16.15	0.05	0 mm	Antenna A	V2	LPJ97XCJ9K	1	bottom	77.4	0.783	1.216	1.001	0.953	0.258	0.314	A3
2480	78	Bluetooth	FHSS	17.00	16.03	0.06	0 mm	Antenna A	V2	LPJ97XCJ9K	1	bottom	77.4	0.672	1.250	1.001	0.841	0.224	0.280	
2441	39	Bluetooth	FHSS	17.00	16.15	0.18	0 mm	Antenna A	V2	LPJ97XCJ9K	1	right	77.4	0.001	1.216	1.001	0.001	0.000	0.000	
2441	39	Bluetooth	FHSS	17.00	16.15	-0.03	0 mm	Antenna A	V2	LPJ97XCJ9K	1	left	77.4	0.111	1.216	1.001	0.135	0.047	0.057	
2480	78	Bluetooth	FHSS	10.00	9.42	0.03	0 mm	Antenna A	V2	LPJ97XCJ9K	1	bottom	77.4	0.148	1.143	1.001	0.169	0.045	0.051	
2480	78	Bluetooth	FHSS	10.00	9.42	-0.12	0 mm	Antenna A	V2	LPJ97XCJ9K	1	left	77.4	0.017	1.143	1.001	0.019	0.005	0.006	
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 the manufacturer.

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 11.1 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. The orange highlights throughout the report represents the highest scaled SAR per Equipment Class.
9. 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.

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) 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. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8 MHz, VBW = 50 MHz, and detector = peak per guidance of Section 6.0 b) of ANSI C63. 10-2013 and KDB 558074 D01v04. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100.

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 the manufacturer. See Section 7.4 for the time domain plot and calculation for the duty factor of the device.

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 a 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 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 were 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 Antenna A SAR (W/kg)	2.4 GHz WLAN Antenna B SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body SAR	Back	0.051	0.068	0.119
	Top	0.010	0.011	0.021
	Bottom	0.799	1.082	**1.082***
	Right	0.005	0.131	0.136
	Left	0.119	0.005	0.124

Table 10-2
Simultaneous Transmission Scenario with 5 GHz WLAN

Simult Tx	Configuration	5 GHz WLAN Antenna A SAR (W/kg)	5 GHz WLAN Antenna B SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body SAR	Back	0.109	0.092	0.201
	Top	0.033	0.034	0.067
	Bottom	1.100	1.069	**1.100***
	Right	0.007	0.152	0.159
	Left	0.152	0.001	0.153

Table 10-3
Simultaneous Transmission Scenario Bluetooth and 5 GHz WLAN MIMO

Simult Tx	Configuration	Bluetooth Antenna A at 10 dBm SAR (W/kg)	5 GHz WLAN Antenna A SAR (W/kg)	5 GHz WLAN Antenna B SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Body SAR	Back	0.063	0.109	0.092	0.172	0.155	0.264
	Top	0.004	0.033	0.034	0.037	0.038	0.071
	Bottom	0.169	1.100	1.069	**1.269**	1.238	1.269*
	Right	0.001	0.007	0.152	0.008	0.153	0.160
	Left	0.019	0.152	0.001	0.171	0.020	0.172

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 $\leq$ 1.2 W/kg where at least 90% of the SAR is attributed to a single SAR distribution or $\leq$ 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 Bottom Edge Spatial Separation Analysis

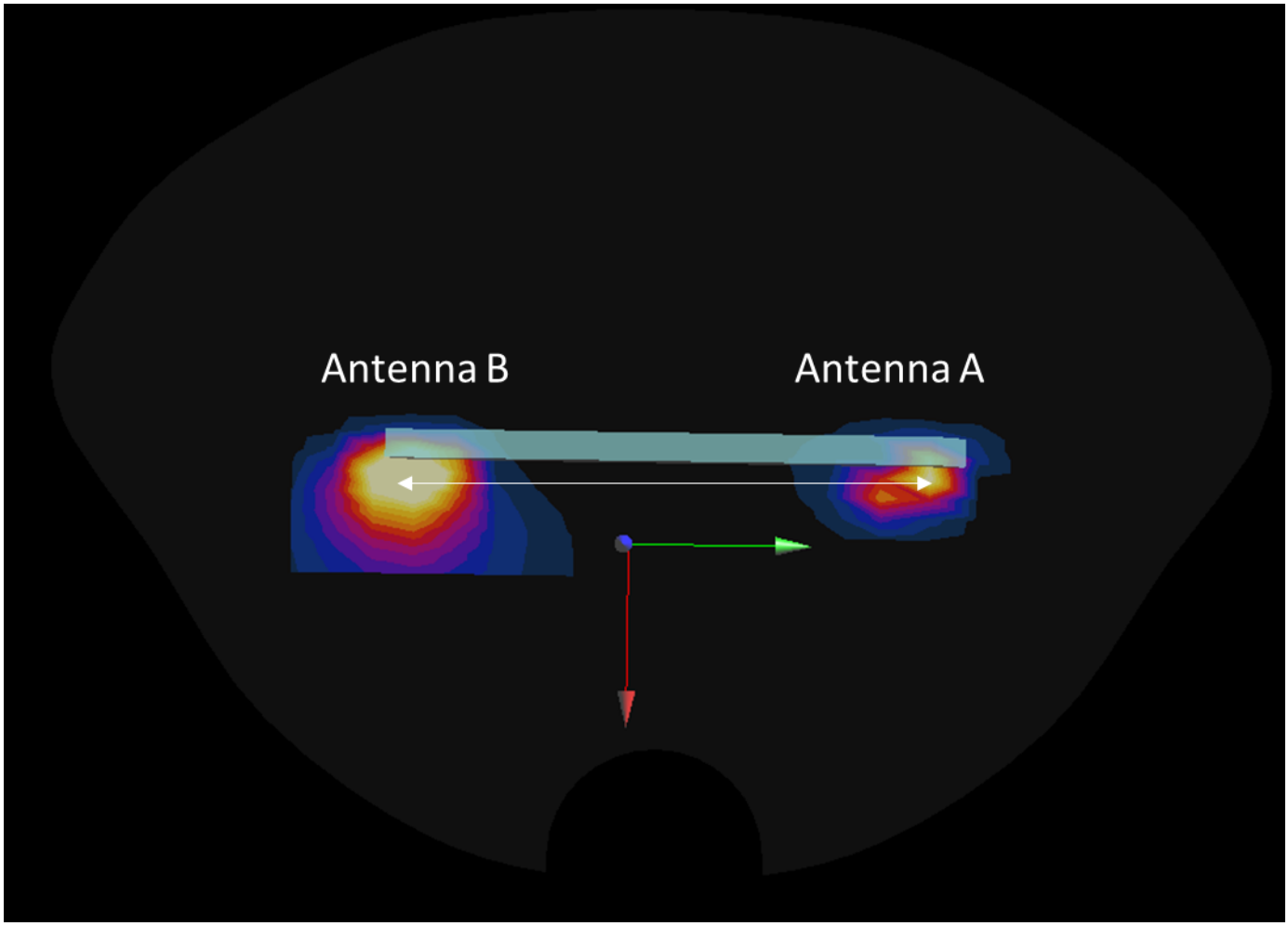


Figure 10-1
Bottom Edge Spatial Separation for Antenna A and Antenna B

10.5 Simultaneous Transmission Conclusion

The above numerical summed SAR results and spatial separation analysis 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.

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

Table 11-1
Body SAR Measurement Variability Results

BODY VARIABILITY RESULTS														
Band	FREQUENCY		Mode	Service	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	DSSS , Antenna B	1	Bottom	0 mm	0.856	0.728	1.18	N/A	N/A	N/A	N/A
5250	5270.00	54	802.11n, 40 MHz Bandwidth	OFDM , Antenna B	13.5	Bottom	0 mm	0.805	0.791	1.02	N/A	N/A	N/A	N/A
5750	5690.00	138	802.11ac, 80 MHz Bandwidth	OFDM , Antenna A	29.3	Bottom	0 mm	0.834	0.793	1.05	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram						

11.2 Measurement Uncertainty

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

12 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	9/16/2020	Annual	9/16/2021	MY40000670
Agilent	E4438C	ESG Vector Signal Generator	12/2/2020	Annual	12/2/2021	MY42081752
Agilent	E5515C	Wireless Communications Test Set	12/15/2020	Annual	12/15/2021	GB42361078
Agilent	N5182A	MXG Vector Signal Generator	9/25/2020	Annual	9/25/2021	US46240505
Agilent	N5182A	MXG Vector Signal Generator	12/1/2020	Annual	12/1/2021	MY47420837
Agilent	N9020A	MXA Signal Analyzer	12/21/2020	Annual	12/21/2021	MY50200571
Amplifier Research	150A100C	Amplifier	CBT	N/A	CBT	350132
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343971
Anritsu	MA24106A	USB Power Sensor	9/15/2020	Annual	9/15/2021	1244515
Anritsu	MA24106A	USB Power Sensor	9/15/2020	Annual	9/15/2021	1248508
Anritsu	MA2411B	Pulse Power Sensor	12/18/2020	Annual	12/18/2021	1126066
Anritsu	ML2495A	Power Meter	11/3/2020	Annual	11/3/2021	1039008
Control Company	4040	Therm./ Clock/ Humidity Monitor	3/12/2021	Biennial	3/12/2023	210201956
Control Company	4040	Therm./ Clock/ Humidity Monitor	3/12/2021	Biennial	3/12/2023	210202053
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	200670646
Control Company	4353	Long Stem Thermometer	10/28/2020	Biennial	10/28/2022	200670653
Insize	1108-150	Digital Caliper	1/17/2020	Biennial	1/17/2022	409193536
Agilent	E4438C	Signal Generator	1/16/2020	Triennial	1/16/2023	MY49070496
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
Rohde & Schwarz	FSP-7	Spectrum Analyzer	1/9/2020	Biennial	1/9/2022	100990
Rosenberger	32W1006-016	Torque Wrench	12/1/2020	Annual	12/1/2021	N/A
SPEAG	DAKS-3.5	Portable DAK	9/9/2020	Annual	9/9/2021	1045
SPEAG	D2450V2	2450 MHz SAR Dipole	11/12/2018	Triennial	11/12/2021	921
SPEAG	D5GHzV2	5 GHz SAR Dipole	3/10/2021	Annual	3/10/2022	1123
SPEAG	EX3DV4	SAR Probe	4/19/2021	Annual	4/19/2022	7532
SPEAG	EX3DV4	SAR Probe	3/3/2021	Annual	3/3/2022	7638
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/13/2021	Annual	4/13/2022	501
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/11/2021	Annual	1/11/2022	1644

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.

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 Unceritainty	E.3.4	0.6	R	1.732	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)			RSS				12.2	12.0	191
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.4	24.0	

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

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]

15 REFERENCES

[1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.

[2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, 2006.

[3] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, Sept. 1992.

[4] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.

[5] IEEE Standards Coordinating Committee 39 –Standards Coordinating Committee 34 – IEEE Std. 1528-2013, IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

[6] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.

[7] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.

[8] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. 1 -124.

[9] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.

[10] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.

[11] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.

[12] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[13] G. Hartsgrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.

[14] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.

[15] W. Gander, Computermathematick, Birkhaeuser, Basel, 1992.

[16] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.

[17] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[18] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.

[19] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hoschschule Zürich, Dosimetric Evaluation of the Cellular Phone.

[20] IEC 62209-1, Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1: Devices used next to the ear (Frequency range of 300 MHz to 6 GHz), July 2016.

[21] Innovation, Science, Economic Development Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 5, March 2015.

[22] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2015

[23] FCC SAR Test Procedures for 2G-3G Devices, Mobile Hotspot and UMPC Devices KDB Publications 941225, D01-D07

[24] SAR Measurement Guidance for IEEE 802.11 Transmitters, KDB Publication 248227 D01

[25] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publications 648474 D03-D04

[26] FCC SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers, FCC KDB Publication 616217 D04

[27] FCC SAR Measurement and Reporting Requirements for 100MHz – 6 GHz, KDB Publications 865664 D01-D02

[28] FCC General RF Exposure Guidance and SAR Procedures for Dongles, KDB Publication 447498, D01-D02

[29] Anexo à Resolução No. 533, de 10 de Septembro de 2009.

[30] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), Mar. 2010.