SAR EVALUATION REPORT

IEEE Std 1528-2013

For
PORTABLE COMPUTING DEVICE

FCC ID: C3K1964
Model Name: 1964

Report Number: 13541206-S1V2
Issue Date: 8/26/2021

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ACCREDITED
CERT #0751.05

Revision History

Rev.	Date	Revisions	Revised By
V1	7/21/2021	Initial Issue	
V2	8/26/2021	General – Removed Bystander Information Added Appendix G – Power Reduction Verification Appendix A – Updated photographs Appendix C – Updated plots Section 1 – Updated simultaneous and standalone values Section 10 – Updated SAR tables Section 12 – Added NFC analysis	Dave Weaver

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1. Attestation of Test Results

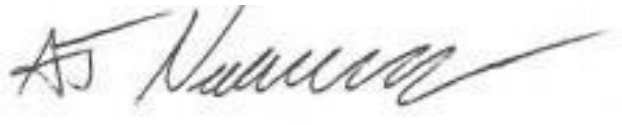
Applicant Name	Microsoft Corporation			
Model Name	1964			
FCC ID	C3K1964			
Applicable Standards	Specific FCC Published RF exposure KDB procedures IEEE Std 1528-2013 IEC 62209-2:2010			
Exposure Category	SAR Limits (W/Kg)			
	Peak spatial-average (1g of tissue)		Extremities (hands, wrists, ankles, etc.) (10g of tissue)	
General population / Uncontrolled exposure	1.6		4	
RF Exposure Conditions	Equipment Class - Highest Reported SAR (W/kg)			
	Licensed	DTS	UNII	DSS
Standalone	N/A	0.353	1.198	0.062
Simultaneous TX		0.694	0.724	0.724
Date Tested	4/12/2021 to 6/4/2021			
Test Results	Pass			

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

This report contains data provided by the customer which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released By:	Prepared By:
	
Devin Chang Senior Test Engineer UL Verification Services Inc.	AJ Newcomer Laboratory Engineer UL Verification Services Inc.

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2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with IEEE STD 1528:2013, the following Specific FCC Published RF exposure KDB procedures:

- KDB 865664 D01 (Section 3.5): SAR Measurement 100 MHz to 6 GHz v01r04
- KDB 248227 D01: 802.11 Wi-Fi SAR v02r02
- KDB 447498 D01: General RF exposure Guidance v06 (see Notice-DRS0001 for exemptions)
- KDB 616217 D04: SAR for Laptops and Tablets v01r02

In addition to the above, the following information was used:

- TCB workshop October 2016; RF Exposure Procedures (DUT Holder Perturbations)
- TCB workshop May 2017; RF Exposure Procedures (Broadband Liquid Above 3 GHz)
- TCB workshop April 2019; RF Exposure Procedures (Tissue Simulating Liquids (TSL))
- TCB workshop October 2016; RF Exposure Procedures (Bluetooth Duty Factor)

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	SAR Lab 6
SAR Lab G	SAR Lab 7
SAR Lab H	SAR Lab 8
	SAR Lab 9
	SAR Lab 10

UL Verification Services Inc. is accredited by A2LA, Certificate Number 0751.05

The Test Lab Conformity Assessment Body Identifier (CABID)

Location	CABID	Company Number
47173 Benicia Street, Fremont, CA, 94538 UNITED STATES	US0104	2324A
47266 Benicia Street, Fremont, CA, 94538 UNITED STATES		22541

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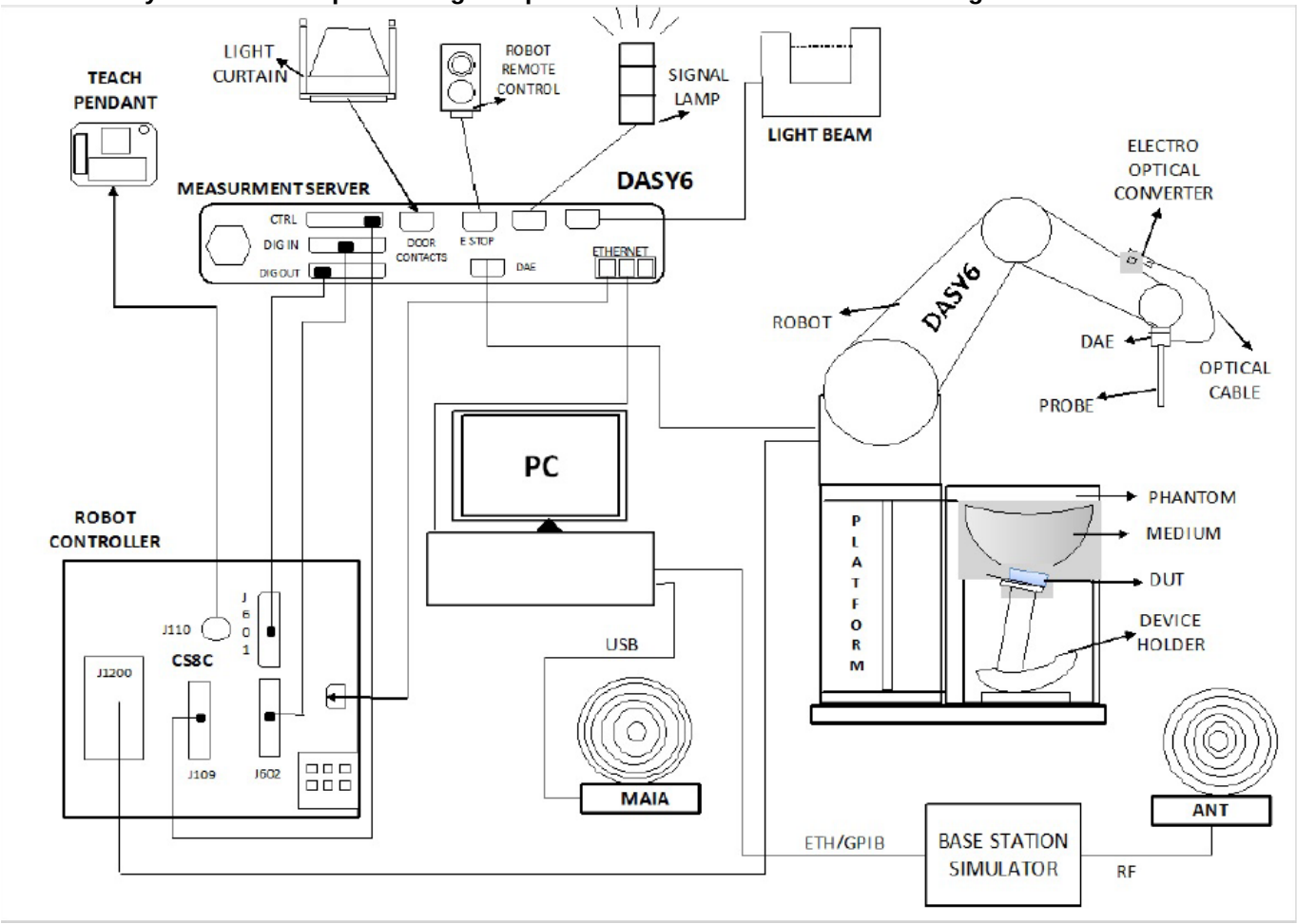
4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7, Win10 and the DASY52[1] and DASY6[2] software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

[1] DASY52 software used: DASY52.10.4 & S 14.6.14 and older generations.

[2] DASY6 software used: DASY6.14 & S 14.6.14 and older generations.

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4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

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Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

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4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations and is traceable to recognized national standards.

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Vector Network Analyzer	Rhode & Schwarz	ZNLE6	101273-VA	2/26/2022
Dielectric Probe kit	SPEAG	DAK-3.5	1087	11/12/2021
Shorting Block	SPEAG	DAK-3.5 Short	SM DAK 200 DA	11/12/2021
Thermometer	Fisher Scientific	Traceable	150378159	8/5/2021

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Signal Generator	Rohde & Schwarz	SMB100A	180968-gX	2/22/2022
Signal Generator	Rohde & Schwarz	SMB100A	180970-zC	2/16/2022
Analog Signal Generator	Agilent	N5181A	MY50140630	1/21/2022
Power Meter	Agilent	N1912A	MY50001018	1/21/2022
Power Meter	HP	437B	3125011347	1/26/2022
Power Sensor	HP	8481A	1926A27048	1/28/2022
Average Power Sensor	Rohde & Schwarz	NRP18A	100995-hS	2/26/2022
Wideband Power Sensor	Agilent	N1921A	MY53260001	1/28/2022
Wideband Power Sensor	Agilent	N1921A	MY52260009	1/28/2022
Bi-directional Coupler	Werlatone	C8060-102	2714	N/A
Bi-directional Coupler	Werlatone	C8060-102	4062	N/A
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795092	N/A
Regulated DC Power Supply	Sorensen Ametek	XT 15-4	1802A01877	N/A

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
E-Field Probe (SAR Lab 1)	SPEAG	EX3DV4	3772	2/25/2022
E-Field Probe (SAR Lab 2)	SPEAG	EX3DV4	7335	2/25/2022
E-Field Probe (SAR Lab 10)	SPEAG	EX3DV4	7448	2/26/2022
Data Acquisition Electronics (SAR Lab 1)	SPEAG	DAE4	1352	11/17/2021
Data Acquisition Electronics (SAR Lab 2)	SPEAG	DAE4	1377	9/10/2021
Data Acquisition Electronics (SAR Lab 10)	SPEAG	DAE4	1545	2/22/2022
System Validation Dipole	SPEAG	D2450V2	748	2/19/2022
System Validation Dipole	SPEAG	D5GHzV2	1168	11/27/2021
System Validation Dipole	SPEAG	D5GHzV2	1003	2/17/2022
System Validation Dipole	SPEAG	D5GHzV2	1138	8/17/2021
Thermometer (SAR Lab 1)	TRACEABLE	6530CC	181163657	3/30/2022
Thermometer (SAR Lab 2)	TRACEABLE	6530CC	181163657	3/30/2022

Other

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Keysight	N1911A	MY55196015	1/20/2022
Wideband Power Sensor	Agilent	N1921A	MY53020038	1/28/2022

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

Therefore, the measurement uncertainty is not required.

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6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	See Appendix A
Battery Options	The rechargeable battery is not user accessible.
Accessory	N/A
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☒ Wi-Fi Direct (Wi-Fi 5 GHz)
Test sample information	**S/N** **IMEI** **Notes** 0F00030211200C D9F1FB670361 SAR UNIT 0F00034211200C DEE45A99055E SAR UNIT 0F0002T211200C F168735858C8 SAR UNIT 0F0003L211200C 97E481BD129D SAR UNIT
HW/SW Version	OS: 19042.541

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20) 802.11n (HT40) 802.11ax (HE20) 802.11ax (HE40)	99.48% (802.11b 20MHz BW)[1]
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT20) 802.11ac (VHT40) 802.11ac (VHT80) 802.11ac (VHT160) 802.11ax (HE20) 802.11ax (HE40) 802.11ax (HE80) 802.11ax (HE160)	98.03% (802.11a 20MHz BW)[2] 97.29% (802.11n 40MHz BW)[2] 97.05% (802.11ac 80MHz BW)[2] 97.00% (802.11axHE80 20MHz Tone)[2] 97.74% (802.11axHE160 20MHz Tone)[2] 96.48% (802.11axHE160 80MHz Tone)[2]
	Bluetooth	BR, EDR, LE	76.9% (GFSK)[3]
NFC	13.56 MHz	CW	100%[4]

Notes:

1. Refer to §9.1 for Wi-Fi 2.4GHz measured Duty cycle.
2. Refer to §9.2 for Wi-Fi 5GHz measured Duty cycle.
3. Refer to §9.3 for Bluetooth measured Duty cycle.
4. Refer to Microsoft test report S-677-FCC-SAR-1

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7. RF Exposure Conditions (Test Configurations)

Refer to Appendix A for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

This device can be operated in two user modes: Tablet configuration and Laptop configuration. The device is in Laptop configuration by default. It will change to Tablet configuration when the lower half of the display detaches from the magnetized back.

7.1. Standalone SAR Test Exclusion Considerations

Since the *Dedicated Host Approach* is applied, the standalone SAR test exclusion procedure in KDB 447498 § 4.3.1 is applied in conjunction with KDB 616217 § 4.3 to determine the minimum test separation distance:

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

SAR Test Exclusion Calculations for Laptop Mode Max Power WLAN

SAR evaluation is required if the separation distance between the user and the device is less than or equal to 20 cm. Therefore, SAR measurements are not required for Max Power.

SAR Test Exclusion Calculations for Tablet Mode Reduced Power WLAN

Antennas < 50mm to adjacent edges for Reduced Output Power Tablet Mode

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Calculated Threshold Value				
		dBm	mW	Folded Rear	Folded Edge 1	Folded Edge 2	Folded Edge 3	Folded Edge 4	Folded Rear	Folded Edge 1	Folded Edge 2	Folded Edge 3	Folded Edge 4
Wi-Fi/BT ANT A													
Wi-Fi 2.4 GHz	2462	17.50	56	20	5	246	210	20	4.4 -MEASURE-	17.6 -MEASURE-	> 50 mm	> 50 mm	4.4 -MEASURE-
Wi-Fi 5.2 GHz	5240	17.50	56	20	5	246	210	20	6.4 -MEASURE-	25.6 -MEASURE-	> 50 mm	> 50 mm	6.4 -MEASURE-
Wi-Fi 5.3 GHz	5320	17.50	56	20	5	246	210	20	6.5 -MEASURE-	25.8 -MEASURE-	> 50 mm	> 50 mm	6.5 -MEASURE-
Wi-Fi 5.5 GHz	5700	15.50	35	20	5	246	210	20	4.2 -MEASURE-	16.7 -MEASURE-	> 50 mm	> 50 mm	4.2 -MEASURE-
Wi-Fi 5.8 GHz	5825	14.50	28	20	5	246	210	20	3.4 -MEASURE-	13.5 -MEASURE-	> 50 mm	> 50 mm	3.4 -MEASURE-
Bluetooth	2480	10.50	11	20	5	246	210	20	0.9 -EXEMPT-	3.5 -MEASURE-	> 50 mm	> 50 mm	0.9 -EXEMPT-
Wi-Fi ANT B													
Wi-Fi 2.4 GHz	2462	17.50	56	20	5	20	210	246	4.4 -MEASURE-	17.6 -MEASURE-	4.4 -MEASURE-	> 50 mm	> 50 mm
Wi-Fi 5.2 GHz	5240	17.50	56	20	5	20	210	246	6.4 -MEASURE-	25.6 -MEASURE-	6.4 -MEASURE-	> 50 mm	> 50 mm
Wi-Fi 5.3 GHz	5320	17.50	56	20	5	20	210	246	6.5 -MEASURE-	25.8 -MEASURE-	6.5 -MEASURE-	> 50 mm	> 50 mm
Wi-Fi 5.5 GHz	5700	15.50	35	20	5	20	210	246	4.2 -MEASURE-	16.7 -MEASURE-	4.2 -MEASURE-	> 50 mm	> 50 mm
Wi-Fi 5.8 GHz	5825	14.50	28	20	5	20	210	246	3.4 -MEASURE-	13.5 -MEASURE-	3.4 -MEASURE-	> 50 mm	> 50 mm

Antennas > 50mm to adjacent edges for Reduced Output Power Tablet Mode

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Calculated Threshold Value				
		dBm	mW	Folded Rear	Folded Edge 1	Folded Edge 2	Folded Edge 3	Folded Edge 4	Folded Rear	Folded Edge 1	Folded Edge 2	Folded Edge 3	Folded Edge 4
Wi-Fi/BT ANT A													
Wi-Fi 2.4 GHz	2462	17.50	56	20	5	246	210	20	< 50 mm	< 50 mm	2055.6 mW -EXEMPT-	1695.6 mW -EXEMPT-	< 50 mm
Wi-Fi 5.2 GHz	5240	17.50	56	20	5	246	210	20	< 50 mm	< 50 mm	2025.5 mW -EXEMPT-	1665.5 mW -EXEMPT-	< 50 mm
Wi-Fi 5.3 GHz	5320	17.50	56	20	5	246	210	20	< 50 mm	< 50 mm	2025 mW -EXEMPT-	1665 mW -EXEMPT-	< 50 mm
Wi-Fi 5.5 GHz	5700	15.50	35	20	5	246	210	20	< 50 mm	< 50 mm	2022.8 mW -EXEMPT-	1662.8 mW -EXEMPT-	< 50 mm
Wi-Fi 5.8 GHz	5825	14.50	28	20	5	246	210	20	< 50 mm	< 50 mm	2022.2 mW -EXEMPT-	1662.2 mW -EXEMPT-	< 50 mm
Bluetooth	2480	10.50	11	20	5	246	210	20	< 50 mm	< 50 mm	2055.3 mW -EXEMPT-	1695.3 mW -EXEMPT-	< 50 mm
Wi-Fi ANT B													
Wi-Fi 2.4 GHz	2462	17.50	56	20	5	20	210	246	< 50 mm	< 50 mm	< 50 mm	1695.6 mW -EXEMPT-	2055.6 mW -EXEMPT-
Wi-Fi 5.2 GHz	5240	17.50	56	20	5	20	210	246	< 50 mm	< 50 mm	< 50 mm	1665.5 mW -EXEMPT-	2025.5 mW -EXEMPT-
Wi-Fi 5.3 GHz	5320	17.50	56	20	5	20	210	246	< 50 mm	< 50 mm	< 50 mm	1665 mW -EXEMPT-	2025 mW -EXEMPT-
Wi-Fi 5.5 GHz	5700	15.50	35	20	5	20	210	246	< 50 mm	< 50 mm	< 50 mm	1662.8 mW -EXEMPT-	2022.8 mW -EXEMPT-
Wi-Fi 5.8 GHz	5825	14.50	28	20	5	20	210	246	< 50 mm	< 50 mm	< 50 mm	1662.2 mW -EXEMPT-	2022.2 mW -EXEMPT-

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7.2. Required Test Configurations

The table below identifies the tablet and laptop test configurations required for this device according to the findings in Section 7.1:

Required SAR Test Configurations for Laptop Mode Max Power WLAN

SAR evaluation is required if the separation distance between the user or bystanders and the device is less than or equal to 20 cm. Therefore, SAR measurements are not required for Max Power.

Required SAR Test Configurations for Tablet Mode Reduced Power WLAN

Test Configurations	Folded Rear	Folded Edge 1 (Top Edge)	Folded Edge 2 (Right Edge)	Folded Edge 3 (Top Edge)	Folded Edge 4 (Left Edge)
Wi-Fi 2.4 GHz SISO (ANT A)	Yes	Yes	N/A	N/A	No
Wi-Fi 2.4 GHz SISO (ANT B)	Yes	Yes	No	N/A	N/A
Wi-Fi 5 GHz SISO (ANT A)	Yes	Yes	N/A	N/A	Yes
Wi-Fi 5 GHz SISO (ANT B)	Yes	Yes	Yes	N/A	N/A
Bluetooth (ANT A)	Yes	No	N/A	N/A	No

Note(s):

Yes = Testing is required.

No = Testing is not required.

N/A = Testing not considered for these Test Positions. Refer to Section 7.3.

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7.3. Test Rationale

The transmit power changes depending upon the posture of the device. In laptop posture the device transmits at maximum power. In the tablet and stage postures the transmit power is reduced. Verification of the power reduction mechanism is provided in Appendix G.

The Antennas are located within the display screen of the device, therefore; testing in laptop mode was not required because the distance between the user and the device is greater than 20 cm.

In Max Power Laptop Mode SAR measurements were not required because the distance between the user and the device is greater than 20 cm.

In Reduced Power Tablet Mode SAR measurements were performed for WLAN on Rear, Folded Rear, Folded Edge 1, Folded Edge 2, and Folded Edge 4.

SAR testing was not performed on any Edge 2 for ANT A, any Edge 4 for ANT B and any Edge 3 for either antenna. The antennas were considered to be too far away from these edges to provide meaningful SAR values. SAR measurements performed at Edge 2 for ANT B, Edge 4 for ANT A, Rear, and Edge 1 were judged to provide the most conservative SAR values.

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8. Dielectric Property Measurements & System Check

8.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.
The dielectric constant (εr) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within ± 5% of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for εr and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head	
	ε_r	σ (S/m)
150	52.3	0.76
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
915	41.5	0.98
1450	40.5	1.20
1610	40.3	1.29
1800 – 2000	40.0	1.40
2450	39.2	1.80
3000	38.5	2.40
5000	36.2	4.45
5100	36.1	4.55
5200	36.0	4.66
5300	35.9	4.76
5400	35.8	4.86
5500	35.6	4.96
5600	35.5	5.07
5700	35.4	5.17
5800	35.3	5.27

IEEE Std 1528-2013
Refer to Table 3 within the IEEE Std 1528-2013

IEC 62209-1
Refer to Table A.3 within the IEC 62209-1

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Dielectric Property Measurements Results:

SAR Lab	Date	Band (MHz)	Tissue Type	Frequency (MHz)	Relative Permittivity (εr)			Conductivity (σ)		
					Measured	Target	Delta	Measured	Target	Delta
1	5/12/2021	5750	Head	5750	35.22	35.36	-0.40	4.97	5.21	-4.62
				5700	35.32	35.42	-0.28	4.91	5.16	-4.81
				5850	35.07	35.30	-0.65	5.08	5.27	-3.62
1	5/13/2021	5600	Head	5600	36.24	35.53	1.99	4.90	5.06	-3.09
				5500	36.42	35.65	2.17	4.79	4.96	-3.47
				5725	36.03	35.39	1.80	5.06	5.19	-2.51
1	5/17/2021	5600	Head	5600	34.46	35.53	-3.02	5.02	5.06	-0.89
				5500	34.64	35.65	-2.83	4.92	4.96	-0.77
				5725	34.27	35.39	-3.17	5.16	5.19	-0.50
2	4/12/2021	2450	Head	2450	38.02	39.20	-3.01	1.81	1.80	0.56
				2400	38.09	39.30	-3.07	1.77	1.75	1.05
				2480	38.00	39.16	-2.97	1.82	1.83	-0.62
2	4/15/2021	2450	Head	2450	37.55	39.20	-4.21	1.83	1.80	1.89
				2400	37.61	39.30	**-4.29**	1.79	1.75	**2.30**
				2480	37.53	39.16	-4.17	1.85	1.83	0.74
2	5/11/2021	5250	Head	5250	37.62	35.93	4.69	4.58	4.70	-2.51
				5150	37.79	36.05	**4.83**	4.47	4.60	-2.80
				5350	37.44	35.82	4.53	4.70	4.80	-2.17
2	5/11/2021	5600	Head	5600	37.03	35.53	4.21	4.96	5.06	-2.06
				5500	37.23	35.65	4.44	4.84	4.96	-2.44
				5725	36.81	35.39	4.01	5.12	5.19	-1.27
2	5/17/2021	5250	Head	5250	34.42	35.93	-4.21	4.66	4.70	-0.98
				5150	34.73	36.05	-3.65	4.53	4.60	-1.60
				5350	34.13	35.82	-4.72	4.75	4.80	-1.09
10	6/3/2021	5250	Head	5250	37.27	35.93	3.72	4.47	4.70	**-4.92**
				5150	37.41	36.05	3.78	4.39	4.60	-4.56
				5350	37.08	35.82	3.52	4.63	4.80	-3.74

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8.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 3 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within ±10% of the manufacturer calibrated dipole SAR target. Refer to Appendix B for the SAR System Check Plots.

SAR Lab	Date	Tissue Type	Dipole Type_Serial #	Dipole Cal. Due Date	Measured Results for 1g SAR				Measured Results for 10g SAR				Plot No.
					Zoom Scan to 100 mW	Normalize to 1W	Target (Ref. Value)	Delta ±10 %	Zoom Scan to 100 mW	Normalize to 1W	Target (Ref. Value)	Delta ±10 %	
1	5/12/2021	Head	D5GHzV2 SN:1168 (5.75 GHz)	11/27/2021	8.480	84.80	78.00	**8.72**	2.440	24.40	22.40	8.93	1,2
1	5/13/2021	Head	D5GHzV2 SN:1138 (5.6 GHz)	8/17/2021	8.200	82.00	82.80	-0.97	2.360	23.60	23.50	0.43	
1	5/17/2021	Head	D5GHzV2 SN:1138 (5.6 GHz)	8/17/2021	8.070	80.70	82.80	**-2.54**	2.330	23.30	23.50	-0.85	3,4
2	4/12/2021	Head	D2450V2 SN:748	2/19/2022	5.150	51.50	52.15	-1.25	2.380	23.80	24.48	-2.78	
2	4/15/2021	Head	D2450V2 SN:748	2/19/2022	5.550	55.50	52.15	**6.42**	2.560	25.60	24.48	4.58	5,6
2	5/11/2021	Head	D5GHzV2 SN:1168 (5.25 GHz)	11/27/2021	8.780	87.80	80.08	**9.64**	2.470	24.70	23.30	6.01	7,8
2	5/11/2021	Head	D5GHzV2 SN:1168 (5.6 GHz)	11/27/2021	8.770	87.70	86.10	**1.86**	2.550	25.50	24.50	4.08	9,10
2	5/17/2021	Head	D5GHzV2 SN:1168 (5.25 GHz)	11/27/2021	8.740	87.40	80.08	9.14	2.500	25.00	23.30	7.30	
10	6/4/2021	Head	D5GHzV2 SN:1003 (5.25 GHz)	2/17/2022	7.760	77.60	77.10	**0.65**	2.230	22.30	22.20	0.45	11,12

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9. Conducted Output Power Measurements

Conducted Output Power was performed using Cable Loss values provided by the customer.

9.1. Wi-Fi 2.4GHz (DTS Band)

Maximum Output Power (Tune-up Limit) for Wi-Fi 2.4 GHz

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

For “Not required”, SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11b/g/n mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.

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Maximum Output Power for Wi-Fi 2.4 GHz Laptop Mode

Channel	Frequency (MHz)	Tune-up Output Power (dBm)												
		ANT A												
		b (SISO)	g (SISO)	11n/11ac HT20 (SISO)	11n/11ac HT40 (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11n/11ac HT20 (MIMO)	11n/11ac HT40 (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	Frequency (MHz)	11ax HE40 RU (242T) (SISO)	11ax HE40 RU (242T) (MIMO)
1	2412	**20.5**	19.5	20.0		19.5	18.5		17.5			Ch3 RU 61	17.5	17.5
2	2417	**20.5**	20.5	20.5		19.5	18.5		18.5			Ch4 RU 61	18.5	18.5
3	2422	**20.5**	20.5	20.5	18.5	19.5	18.5	17.0	18.5	18.5	17.0	Ch5 RU 61	18.5	18.5
4	2427	**20.5**	20.5	20.5	18.5	19.5	18.5	17.5	18.5	18.5	17.5	Ch6 RU 61	18.5	18.5
5	2432	**20.5**	20.5	20.5	18.5	19.5	18.5	17.5	18.5	18.5	17.5	Ch7 RU 61	18.5	18.5
6	2437	**20.5**	20.5	20.5	18.5	19.5	18.5	17.5	18.5	18.5	17.5	Ch8 RU 61	18.5	18.5
7	2442	**20.5**	20.5	20.5	18.5	19.5	18.5	17.5	18.5	18.5	17.5	Ch5 RU 62	18.5	18.5
8	2447	**20.5**	20.5	20.5	18.5	19.5	18.5	17.5	18.5	18.5	17.5	Ch6 RU 62	18.5	18.5
9	2452	**20.5**	20.5	20.5	17.5	19.5	18.5	17.0	18.5	18.5	17.0	CH7 RU 62	18.5	18.5
10	2457	**20.5**	19.0	19.5	14.5	19.5	18.5	14.5	18.5	18.5	14.0	Ch8 RU 62	18.5	18.5
11	2462	**20.5**	18.0	17.5	11.5	18.5	18.0	10.5	17.5	18.5	11.5	Ch 9 RU 62	18.5	17.5
12	2467	**16.5**	16.0	15.5		15.5	15.0		14.5			Ch10 RU 62	16.0	14.5
13	2472	**13.0**	12.0	12.0		11.0	10.5		10.0			Ch11 RU 62	13.5	10.0
Channel	Frequency (MHz)	Tune-up Output Power (dBm)												
		ANT B												
		b (SISO)	g (SISO)	11n/11ac HT20 (SISO)	11n/11ac HT40 (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11n/11ac HT20 (MIMO)	11n/11ac HT40 (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	Frequency (MHz)	11ax HE40 RU (242T) (SISO)	11ax HE40 RU (242T) (MIMO)
1	2412	**20.5**	19.5	19.5		19.5	18.5		17.5			Ch3 RU 61	17.5	17.5
2	2417	**20.5**	20.5	20.5		19.5	18.5		18.5			Ch4 RU 61	18.5	18.5
3	2422	**20.5**	20.5	20.5	18.5	19.5	18.5	17.0	18.5	18.5	17.0	Ch5 RU 61	18.5	18.5
4	2427	**20.5**	20.5	20.5	18.5	19.5	18.5	17.5	18.5	18.5	17.5	Ch6 RU 61	18.5	18.5
5	2432	**20.5**	20.5	20.5	18.5	19.5	18.5	17.5	18.5	18.5	17.5	Ch7 RU 61	18.5	18.5
6	2437	**20.5**	20.5	20.5	18.5	19.5	18.5	17.5	18.5	18.5	17.5	Ch8 RU 61	18.5	18.5
7	2442	**20.5**	20.5	20.5	18.5	19.5	18.5	17.5	18.5	18.5	17.5	Ch5 RU 62	18.5	18.5
8	2447	**20.5**	20.5	20.5	18.5	19.5	18.5	17.5	18.5	18.5	17.5	Ch6 RU 62	18.5	18.5
9	2452	**20.5**	20.5	20.5	17.5	19.5	18.5	17.0	18.5	18.5	17.0	CH7 RU 62	18.5	18.5
10	2457	**20.5**	19.0	19.0	14.5	19.5	18.5	14.5	18.5	18.5	14.0	Ch8 RU 62	18.5	18.5
11	2462	**20.5**	18.0	17.5	11.5	18.5	18.0	10.5	17.5	18.5	11.5	Ch 9 RU 62	18.5	17.5
12	2467	**16.5**	16.0	16.0		15.5	15.0		14.5			Ch10 RU 62	16.0	14.5
13	2472	**13.0**	12.0	12.0		11.0	10.5		10.0			Ch11 RU 62	13.5	10.0

Wi-Fi 2.4GHz Measured Results

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

SAR testing is not required for OFDM mode(s) when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Band	Mode	Ch #	Freq. (MHz)	ANT A Maximum Average Power (dBm)			ANT B Maximum Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
DSSS 2.4 GHz	802.11b	1	2412	19.1	20.5	Yes	19.3	20.5	Yes
		6	2437	19.0	20.5		19.2	20.5	
		11	2462	19.0	20.5		19.1	20.5	
		12	2467	15.1	16.5		15.0	16.5	
		13	2472	11.2	13.0		11.5	13.0	

Note(s):

SAR is not required for channel 12 and 13 because the tune-up limit and the measured output power for these two channels are not greater than those for the default test channels. Refer to KDB 248227 D01 section 3.1

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Maximum Output Power for Wi-Fi 2.4 GHz Tablet Mode Reduced Power

Channel	Frequency (MHz)	Tune-up Output Power (dBm)												
		ANT A												
		b (SISO)	g (SISO)	11n/11ac HT20 (SISO)	11n/11ac HT40 (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11n/11ac HT20 (MIMO)	11n/11ac HT40 (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	Frequency (MHz)	11ax HE40 RU (242T) (SISO)	11ax HE40 RU (242T) (MIMO)
1	2412	**17.5**	17.5	17.5		17.5		17.5		17.5		Ch3 RU 61	17.5	17.5
2	2417	**17.5**	17.5	17.5		17.5		17.5		17.5		Ch4 RU 61	17.5	17.5
3	2422	**17.5**	17.5	17.5	17.5	17.5	15.5	17.5	17.0	17.5	17.0	Ch5 RU 61	17.5	17.5
4	2427	**17.5**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	Ch6 RU 61	17.5	17.5
5	2432	**17.5**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	Ch7 RU 61	17.5	17.5
6	2437	**17.5**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	Ch8 RU 61	17.5	17.5
7	2442	**17.5**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	Ch5 RU 62	17.5	17.5
8	2447	**17.5**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	Ch6 RU 62	17.5	17.5
9	2452	**17.5**	17.5	17.5	17.5	17.5	15.5	17.5	17.0	17.5	17.0	CH7 RU 62	17.5	17.5
10	2457	**17.5**	17.5	17.5	14.5	17.5	14.5	17.5	14.5	17.5	14.0	Ch8 RU 62	17.5	17.5
11	2462	**17.5**	17.5	17.5	13.0	17.5	13.5	18.0	11.5	17.5	11.5	Ch 9 RU 62	17.5	17.5
12	2467	**16.5**	16.0	15.5		15.5		15.0		14.5		Ch10 RU 62	16.0	14.5
13	2472	**13.0**	12.0	12.0		11.0		10.5		10.0		Ch11 RU 62	13.5	10.0

Channel	Frequency (MHz)	Tune-up Output Power (dBm)												
		ANT B												
		b (SISO)	g (SISO)	11n/11ac HT20 (SISO)	11n/11ac HT40 (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11n/11ac HT20 (MIMO)	11n/11ac HT40 (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	Frequency (MHz)	11ax HE40 RU (242T) (SISO)	11ax HE40 RU (242T) (MIMO)
1	2412	**17.5**	17.5	17.5		17.5		17.5		17.5		Ch3 RU 61	17.5	17.5
2	2417	**17.5**	17.5	17.5		17.5		17.5		17.5		Ch4 RU 61	17.5	17.5
3	2422	**17.5**	17.5	17.5	17.5	17.5	15.5	17.5	17.0	17.5	17.0	Ch5 RU 61	17.5	17.5
4	2427	**17.5**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	Ch6 RU 61	17.5	17.5
5	2432	**17.5**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	Ch7 RU 61	17.5	17.5
6	2437	**17.5**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	Ch8 RU 61	17.5	17.5
7	2442	**17.5**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	Ch5 RU 62	17.5	17.5
8	2447	**17.5**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	Ch6 RU 62	17.5	17.5
9	2452	**17.5**	17.5	17.5	17.5	17.5	15.5	17.5	17.0	17.5	17.0	CH7 RU 62	17.5	17.5
10	2457	**17.5**	17.5	17.5	14.5	17.5	14.5	17.5	14.5	17.5	14.0	Ch8 RU 62	17.5	17.5
11	2462	**17.5**	17.5	17.5	13.0	17.5	13.5	18.0	11.5	17.5	11.5	Ch 9 RU 62	17.5	17.5
12	2467	**16.5**	16.0	16.0		15.5		15.0		14.5		Ch10 RU 62	16.0	14.5
13	2472	**13.0**	12.0	12.0		11.0		10.5		10.0		Ch11 RU 62	13.5	10.0

Wi-Fi 2.4GHz Measured Results

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

SAR testing is not required for OFDM mode(s) when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Band	Mode	Ch #	Freq. (MHz)	ANT A Reduced Average Power (dBm)			ANT B Reduced Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
DSSS 2.4 GHz	802.11b	1	2412	17.0	17.5	Yes	17.0	17.5	Yes
		6	2437	17.0	17.5		17.0	17.5	
		11	2462	17.0	17.5		17.0	17.5	
		12	2467	15.1	16.5		15.0	16.5	
		13	2472	11.2	13.0		11.5	13.0	

Note(s):

SAR is not required for channel 12 and 13 because the tune-up limit and the measured output power for these two channels are not greater than those for the default test channels. Refer to KDB 248227 D01 section 3.1

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Duty Factor Measured Results

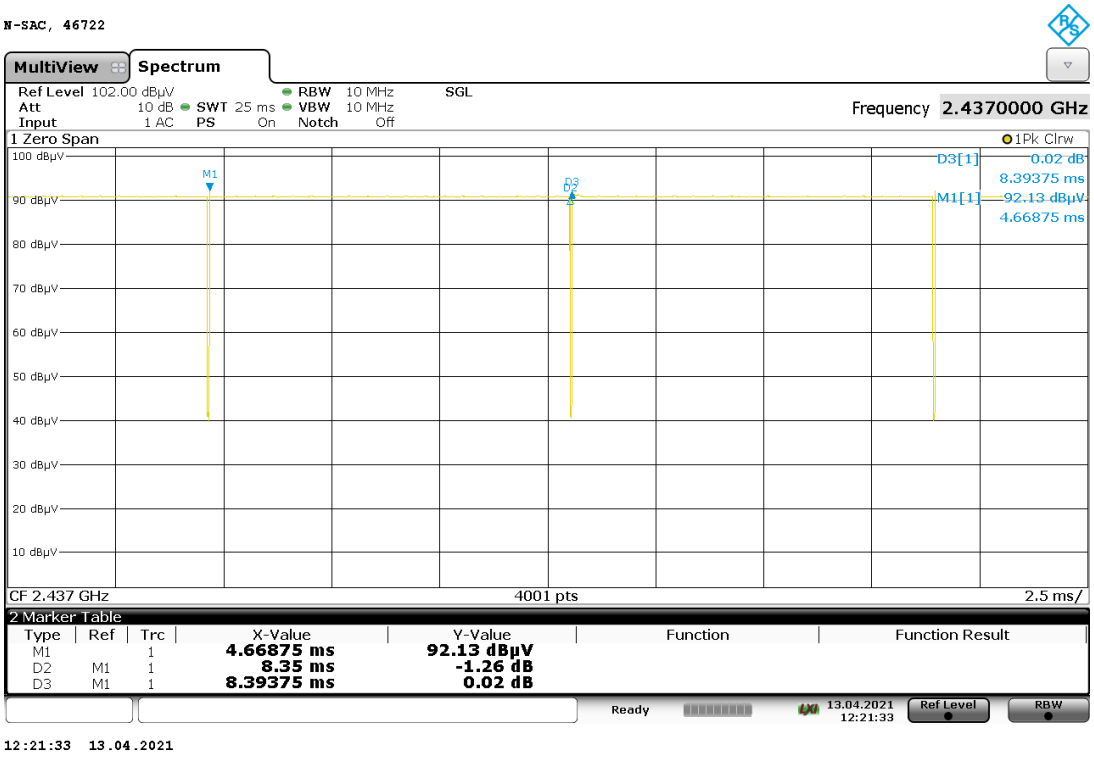
Band	Mode	Data Rate	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
2.4 GHz	802.11b	1 Mbps	8.350	8.394	99.48%	1.01

Note(s):

Duty Cycle = (T on / period) * 100%

Duty Cycle plot

802.11b



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9.2. Wi-Fi 5GHz (U-NII Bands)

Maximum Output Power (Tune-up Limit) for Wi-Fi 5 GHz

When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/n/ac modes, the channel in the lower order/sequence 802.11 transmission mode is selected.

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

For “Not required”, SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac/ax mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.

When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.

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Maximum Output Power for Wi-Fi 5 GHz Laptop Mode

Band	Bandwidth	Channel	Frequency (MHz)	Tune-up Output Power (dBm)										
				ANT A										
				a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-1	20 MHz	36	5180	19.5	19.5	18.5	18.5	18.5	18.5	17.5	16.5	16.5	16.5	16.5
		40	5200	20.5	20.5	20.5	20.5	20.5	20.0	18.5	19.5	19.5	19.5	19.5
		44	5220	20.5	20.5	20.5	20.5	20.5	20.0	19.5	19.5	19.5	19.5	19.5
		48	5240	20.5	20.5	20.5	20.5	20.5	20.0	19.5	19.5	19.5	19.5	19.5
	40 MHz	38	5190		17.5		17.5	17.5	17.5	15.5		15.5	15.5	15.5
		46	5230		19.5		19.5	19.5	19.5	17.5		17.5	17.5	17.5
	80 MHz	42	5210		15.5			15.5	15.5	14.5			14.5	14.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-2A	20 MHz	52	5260	20.5	20.5	20.5	20.5	**20.5**	20.0	19.5	19.5	19.5	19.5	19.5
		56	5280	19.5	19.5	20.5	20.5	**20.5**	20.0	19.5	19.5	19.5	19.5	19.5
		60	5300	18.5	18.5	20.5	20.5	**20.5**	20.0	19.5	19.5	19.5	19.5	19.5
		64	5320	16.5	16.5	16.5	16.5	**16.5**	16.5	14.5	14.5	14.5	14.5	14.5
	40 MHz	54	5270		19.5		19.5	19.5	16.5	17.5		16.5	16.5	16.5
		62	5310		16.5		16.5	16.5	16.5	12.5		13.5	13.5	13.5
	80 MHz	58	5290		14.5			14.5	14.5	12.5			13.5	13.5
	160 MHz	50	5250		13.5				13.5	11.5				13.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-2C	20 MHz	100	5500	17.5	17.5	17.5	17.5	**17.5**	17.5	15.5	15.5	15.5	15.5	15.5
		104	5520	17.5	20.5	20.0	20.0	**20.0**	19.5	16.5	16.5	16.5	16.5	16.5
		108	5540	17.5	20.5	20.0	20.0	**20.0**	19.5	16.5	16.5	16.5	16.5	16.5
		112	5560	17.5	20.5	20.0	20.0	**20.0**	19.5	16.5	16.5	16.5	16.5	16.5
		116	5580	17.5	20.5	20.5	20.5	**20.5**	19.5	16.5	16.5	16.5	16.5	16.5
		120	5600	17.5	20.5	20.5	20.5	**20.5**	19.5	16.5	16.5	16.5	16.5	16.5
		124	5620	17.5	20.5	20.5	20.5	**20.5**	19.5	16.5	16.5	16.5	16.5	16.5
		128	5640	17.5	20.5	20.5	20.5	**20.5**	19.5	16.5	16.5	16.5	16.5	16.5
		132	5660	17.5	20.5	20.5	20.5	**20.5**		16.5	16.5	16.5	16.5	
		136	5680	17.5	20.5	20.5	20.5	**20.5**		16.5	16.5	16.5	16.5	
		140	5700	17.5	18.5	18.5	20.5	**20.5**		15.5	15.5	15.5	15.5	
		144	5720	17.5	20.5	20.5	20.5	**20.5**		16.5	16.5	16.5	16.5	
	40 MHz	102	5510		16.5		15.5	15.5	15.5	14.5		13.5	13.5	13.5
		110	5550		19.5		19.5	19.5	19.5	16.5		16.5	16.5	16.5
		118	5590		19.5		19.5	19.5	19.5	16.5		16.5	16.5	16.5
		126	5630		19.5		19.5	19.5	19.5	16.5		16.5	16.5	16.5
		134	5670		17.5		16.5	16.5		15.5		15.5	15.5	
		142	5710		20.5		19.5	19.5		16.5		16.5	16.5	
	80 MHz	106	5530		15.5			14.5	14.5	14.5			14.5	14.5
		122	5610		17.5			16.5	16.5	15.5			15.5	15.5
		138	5690		17.5			16.5		15.5			15.5	
	160 MHz	114	5570		14.5				14.5	12.5				13.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-3	20 MHz	149	5745	20.5	20.5	20.5	20.5	**20.5**		19.5	19.5	19.5	19.5	
		153	5765	20.5	20.5	20.5	20.5	**20.5**		19.5	19.5	19.5	19.5	
		157	5785	20.5	20.5	20.5	20.5	**20.5**		19.5	19.5	19.5	19.5	
		161	5805	20.5	20.5	20.5	20.5	**20.5**		19.5	19.5	19.5	19.5	
		165	5825	20.5	20.5	20.5				19.5	19.5			
	40 MHz	151	5755		19.5		16.5	16.5		17.5		16.5	16.5	
		159	5795		19.5		17.5	16.5		17.5		16.5	16.5	
	80 MHz	155	5775		15.5			16.5		13.5			16.5	

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Band	Bandwidth	Channel	Frequency (MHz)	Tune-up Output Power (dBm)										
				ANT B										
				a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-1	20 MHz	36	5180	19.5	19.5	18.5	18.5	18.5	18.5	17.5	16.5	16.5	16.5	16.5
		40	5200	20.5	20.5	20.5	20.5	20.5	20.0	18.5	19.5	19.5	19.5	19.5
		44	5220	20.5	20.5	20.5	20.5	20.5	20.0	19.5	19.5	19.5	19.5	19.5
		48	5240	20.5	20.5	20.5	20.5	20.5	20.0	19.5	19.5	19.5	19.5	19.5
	40 MHz	38	5190		17.5		17.5	17.5	17.5	15.5		15.5	15.5	15.5
		46	5230		19.5		19.5	19.5	19.5	17.5		17.5	17.5	17.5
	80 MHz	42	5210		15.5			15.5	15.5	14.5			14.5	14.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-2A	20 MHz	52	5260	**20.5**	20.5	19.5	19.5	19.5	19.0	19.5	19.5	19.5	19.5	19.5
		56	5280	**19.5**	19.5	19.5	19.5	19.5	19.0	19.5	19.5	19.5	19.5	19.5
		60	5300	**18.5**	18.5	19.5	19.5	19.5	19.0	19.5	19.5	19.5	19.5	19.5
		64	5320	**16.5**	16.5	16.5	16.5	16.5	16.5	14.5	14.5	14.5	14.5	14.5
	40 MHz	54	5270		19.5		19.5	19.5	16.5	17.5		16.5	16.5	16.5
		62	5310		16.5		16.5	16.5	16.5	12.5		13.5	13.5	13.5
	80 MHz	58	5290		14.5			14.5	14.5	12.5			13.5	13.5
	160 MHz	50	5250		13.5				13.5	11.5				13.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-2C	20 MHz	100	5500	17.5	17.5	17.5	17.5	17.5	17.0	15.5	15.5	15.5	15.5	15.5
		104	5520	17.5	17.5	17.5	17.5	17.5	17.0	16.5	16.5	16.5	16.5	16.5
		108	5540	17.5	17.5	17.5	17.5	17.5	17.0	16.5	16.5	16.5	16.5	16.5
		112	5560	17.5	17.5	17.5	17.5	17.5	17.0	16.5	16.5	16.5	16.5	16.5
		116	5580	17.5	17.5	17.5	17.5	17.5	17.0	16.5	16.5	16.5	16.5	16.5
		120	5600	17.5	17.5	17.5	17.5	17.5	17.0	16.5	16.5	16.5	16.5	16.5
		124	5620	17.5	17.5	17.5	17.5	17.5	17.0	16.5	16.5	16.5	16.5	16.5
		128	5640	17.5	17.5	17.5	17.5	17.5	17.0	16.5	16.5	16.5	16.5	16.5
		132	5660	17.5	17.5	17.5	17.5	17.5		16.5	16.5	16.5	16.5	
		136	5680	17.5	17.5	17.5	17.5	17.5		16.5	16.5	16.5	16.5	
		140	5700	17.5	17.5	17.5	17.5	17.5		15.5	15.5	15.5	15.5	
		144	5720	17.5	17.5	17.5	17.5	17.5		16.5	16.5	16.5	16.5	
	40 MHz	102	5510		**16.5**		15.5	15.5	15.5	14.5		13.5	13.5	13.5
		110	5550		**19.5**		17.5	17.5	17.5	16.5		16.5	16.5	16.5
		118	5590		**19.5**		17.5	17.5	17.5	16.5		16.5	16.5	16.5
		126	5630		**19.5**		17.5	17.5	17.5	16.5		16.5	16.5	16.5
		134	5670		**17.5**		16.5	16.5		15.5		15.5	15.5	
		142	5710		**20.5**		17.5	17.5		16.5		16.5	16.5	
	80 MHz	106	5530		15.5			14.5	14.5	14.5			14.5	14.5
		122	5610		17.5			16.5	16.5	15.5			15.5	15.5
		138	5690		17.5			16.5		15.5			15.5	
	160 MHz	114	5570		14.5				14.5	12.5				13.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-3	20 MHz	149	5745	20.5	20.5	20.5	20.5	**20.5**		19.5	19.5	19.5	19.5	
		153	5765	20.5	20.5	20.5	20.5	**20.5**		19.5	19.5	19.5	19.5	
		157	5785	20.5	20.5	20.5	20.5	**20.5**		19.5	19.5	19.5	19.5	
		161	5805	20.5	20.5	20.5	20.5	**20.5**		19.5	19.5	19.5	19.5	
		165	5825	20.5	20.5	20.5				19.5	19.5			
	40 MHz	151	5755		19.5		16.5	16.5		17.5		16.5	16.5	
		159	5795		19.5		16.5	16.5		17.5		16.5	16.5	
	80 MHz	155	5775		15.5			16.5		13.5			16.5	

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Wi-Fi 5 GHz Measured Results Laptop Mode Max Power

Band	Mode	Ch #	Freq. (MHz)	ANT A Maximum Average Power (dBm)			Mode	Ch #	Freq. (MHz)	ANT B Maximum Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)				Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-2A 5.3 GHz	802.11ax (HE80) 242T	58 [RU 61]	5290	18.9	20.5	Yes	802.11a	52	5290	20.3	20.5	Yes
		58 [RU 62]	5290	20.1	20.5			56	5290	19.5	19.5	
		58 [RU 63]	5290	19.6	20.5			60	5290	18.5	18.5	
		58 [RU 64]	5290	15.1	16.5			64	5290	16.5	16.5	
Band	Mode	Ch #	Freq. (MHz)	ANT A Maximum Average Power (dBm)			Mode	Ch #	Freq. (MHz)	ANT B Maximum Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)				Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-2C 5.5 GHz	802.11ax (HE80) 242T	106 [RU 61]	5530	17.3	17.5	No	802.11n (HT40)	102	5530	16.3	16.5	Yes
		106 [RU 62]	5530	20.0	20.0			118	5530	19.5	19.5	
		106 [RU 53]	5530	20.0	20.0			126	5530	19.5	19.5	
		106 [RU 64]	5530	20.0	20.0			142	5530	20.5	20.5	
		122 [RU 61]	5610	20.5	20.5							
		122 [RU 62]	5610	20.5	20.5							
		122 [RU 63]	5610	20.5	20.5							
		122 [RU 64]	5610	20.5	20.5							
		138 [RU 61]	5690	20.5	20.5							
		138 [RU 62]	5690	20.5	20.5							
		138 [RU 63]	5690	20.5	20.5							
		138 [RU 64]	5690	20.5	20.5							
Band	Mode	Ch #	Freq. (MHz)	ANT A Maximum Average Power (dBm)			Mode	Ch #	Freq. (MHz)	ANT B Maximum Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)				Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-3 5.8 GHz	802.11ax (HE80) 242T	155 [RU 61]	5775	19.2	20.5	Yes	802.11ax (HE80) 242T	155 [RU 61]	5775	19.4	20.5	Yes
		155 [RU 62]	5775	20.0	20.5			155 [RU 62]	5775	18.8	20.5	
		155 [RU 63]	5775	20.1	20.5			155 [RU 63]	5775	19.9	20.5	
		155 [RU 64]	5775	19.8	20.5			155 [RU 64]	5775	19.5	20.5	

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Maximum Output Power for Wi-Fi 5 GHz Tablet Mode Reduced Power

Band	Bandwidth	Channel	Frequency (MHz)	Tune-up Output Power (dBm)										
				ANT A										
				a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-1	20 MHz	36	5180	17.5	17.5	17.5	17.5	17.5	17.5	17.5	16.5	16.5	16.5	16.5
		40	5200	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
		44	5220	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
		48	5240	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
	40 MHz	38	5190		17.5		17.5	17.5	17.5	15.5		15.5	15.5	15.5
		46	5230		17.5		17.5	17.5	17.5	17.5		17.5	17.5	17.5
	80 MHz	42	5210		15.5			15.5	15.5	14.5			14.5	14.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-2A	20 MHz	52	5260	17.5	17.5	17.5	17.5	17.5	**17.5**	17.5	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5	17.5	**17.5**	17.5	17.5	17.5	17.5	17.5
		60	5300	17.5	17.5	17.5	17.5	17.5	**17.5**	17.5	17.5	17.5	17.5	17.5
		64	5320	16.5	16.5	16.5	16.5	16.5	**17.5**	14.5	14.5	14.5	14.5	14.5
	40 MHz	54	5270		17.5		17.5	17.5	16.5	17.5		16.5	16.5	16.5
		62	5310		16.5		16.5	16.5	16.5	12.5		13.5	13.5	13.5
	80 MHz	58	5290		14.5			14.5	14.5	12.5			13.5	13.5
	160 MHz	50	5250		13.5				13.5	11.5				13.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-2C	20 MHz	100	5500	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		104	5520	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		108	5540	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		112	5560	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		116	5580	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		120	5600	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		124	5620	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		128	5640	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		132	5660	15.5	15.5	15.5	15.5	15.5		15.5	15.5	15.5	15.5	
		136	5680	15.5	15.5	15.5	15.5	15.5		15.5	15.5	15.5	15.5	
		140	5700	15.5	15.5	15.5	15.5	15.5		15.5	15.5	15.5	15.5	
		144	5720	15.5	15.5	15.5	15.5	15.5		15.5	15.5	15.5	15.5	
	40 MHz	102	5510		15.5		15.5	15.5	15.5	14.5		13.5	13.5	13.5
		110	5550		15.5		15.5	15.5	15.5	15.5		15.5	15.5	15.5
		118	5590		15.5		15.5	15.5	15.5	15.5		15.5	15.5	15.5
		126	5630		15.5		15.5	15.5	15.5	15.5		15.5	15.5	15.5
		134	5670		15.5		15.5	15.5		15.5		15.5	15.5	
		142	5710		15.5		15.5	15.5		15.5		15.5	15.5	
	80 MHz	106	5530		15.5			14.5	**14.5**	14.5			14.5	14.5
		122	5610		15.5			15.5	**15.5**	15.5			15.5	15.5
		138	5690		15.5			15.5		15.5			15.5	
	160 MHz	114	5570		14.5				14.5	12.5				13.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-3	20 MHz	149	5745	14.5	14.5	14.5	14.5	14.5		14.5	14.5	14.5	14.5	
		153	5765	14.5	14.5	14.5	14.5	14.5		14.5	14.5	14.5	14.5	
		157	5785	14.5	14.5	14.5	14.5	14.5		14.5	14.5	14.5	14.5	
		161	5805	14.5	14.5	14.5	14.5	14.5		14.5	14.5	14.5	14.5	
		165	5825	14.5	14.5	14.5				14.5	14.5			
	40 MHz	151	5755		14.5		14.5	14.5		14.5		14.5	14.5	
		159	5795		14.5		14.5	14.5		14.5		14.5	14.5	
	80 MHz	155	5775		**14.5**			14.5		13.5			14.5	

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Band	Bandwidth	Channel	Frequency (MHz)	Tune-up Output Power (dBm)										
				ANT B										
				a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-1	20 MHz	36	5180	17.5	17.5	17.5	17.5	17.5	17.5	17.5	16.5	16.5	16.5	16.5
		40	5200	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
		44	5220	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
		48	5240	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
	40 MHz	38	5190		17.5		17.5	17.5	17.5	15.5		15.5	15.5	15.5
		46	5230		17.5		17.5	17.5	17.5	17.5		17.5	17.5	17.5
	80 MHz	42	5210		15.5			15.5	15.5	14.5			14.5	14.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-2A	20 MHz	52	5260	17.5	17.5	17.5	17.5	17.5	**17.5**	17.5	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5	17.5	**17.5**	17.5	17.5	17.5	17.5	17.5
		60	5300	17.5	17.5	17.5	17.5	17.5	**17.5**	17.5	17.5	17.5	17.5	17.5
		64	5320	16.5	16.5	16.5	16.5	16.5	**16.5**	14.5	14.5	14.5	14.5	14.5
	40 MHz	54	5270		17.5		17.5	17.5	16.5	17.5		16.5	16.5	16.5
		62	5310		16.5		16.5	16.5	16.5	12.5		13.5	13.5	13.5
	80 MHz	58	5290		14.5			14.5	14.5	12.5			13.5	13.5
	160 MHz	50	5250		13.5				13.5	11.5				13.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-2C	20 MHz	100	5500	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		104	5520	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		108	5540	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		112	5560	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		116	5580	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		120	5600	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		124	5620	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		128	5640	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
		132	5660	15.5	15.5	15.5	15.5	15.5		15.5	15.5	15.5	15.5	
		136	5680	15.5	15.5	15.5	15.5	15.5		15.5	15.5	15.5	15.5	
		140	5700	15.5	15.5	15.5	15.5	15.5		15.5	15.5	15.5	15.5	
		144	5720	15.5	15.5	15.5	15.5	15.5		15.5	15.5	15.5	15.5	
	40 MHz	102	5510		15.5		15.5	15.5	15.5	14.5		13.5	13.5	13.5
		110	5550		15.5		15.5	15.5	15.5	15.5		15.5	15.5	15.5
		118	5590		15.5		15.5	15.5	15.5	15.5		15.5	15.5	15.5
		126	5630		15.5		15.5	15.5	15.5	15.5		15.5	15.5	15.5
		134	5670		15.5		15.5	15.5		15.5		15.5	15.5	
		142	5710		15.5		15.5	15.5		15.5		15.5	15.5	
	80 MHz	106	5530		15.5			14.5	**14.5**	14.5			14.5	14.5
		122	5610		15.5			15.5	**15.5**	15.5			15.5	15.5
		138	5690		15.5			15.5		15.5			15.5	
	160 MHz	114	5570		14.5				14.5	12.5				13.5
Band	Bandwidth	Channel	Frequency (MHz)	a (SISO)	11n/11ac HT (SISO)	11ax HE20 SU (242T) (SISO)	11ax HE40 SU (484T) (SISO)	11ax HE80 SU (996T) (SISO)	11ax HE160 SU (996T *2) (SISO)	11n/11ac HT (MIMO)	11ax HE20 SU (242T) (MIMO)	11ax HE40 SU (484T) (MIMO)	11ax HE80 SU (996T) (MIMO)	11ax HE160 SU (996T *2) (MIMO)
U-NII-3	20 MHz	149	5745	14.5	14.5	14.5	14.5	14.5		14.5	14.5	14.5	14.5	
		153	5765	14.5	14.5	14.5	14.5	14.5		14.5	14.5	14.5	14.5	
		157	5785	14.5	14.5	14.5	14.5	14.5		14.5	14.5	14.5	14.5	
		161	5805	14.5	14.5	14.5	14.5	14.5		14.5	14.5	14.5	14.5	
		165	5825	14.5	14.5	14.5				14.5	14.5			
	40 MHz	151	5755		14.5		14.5	14.5		14.5		14.5	14.5	
		159	5795		14.5		14.5	14.5		14.5		14.5	14.5	
	80 MHz	155	5775		**14.5**			14.5		13.5			14.5	

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Wi-Fi 5 GHz Measured Results Tablet Mode Reduced Power

Band	Mode	Ch #	Freq. (MHz)	ANT A Reduced Average Power (dBm)			Mode	Ch #	Freq. (MHz)	ANT B Reduced Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)				Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-1 & 2A	802.11ax (HE160) 242T	50 (RU 61)	5250	17.4	17.5	Yes	802.11ax (HE160) 242T	50 (RU 61)	5250	17.5	17.5	Yes
		50 (RU 62)	5250	17.3	17.5			50 (RU 62)	5250	17.5	17.5	
		50 (RU 63)	5250	17.3	17.5			50 (RU 63)	5250	17.3	17.5	
		50 (RU 64)	5250	17.5	17.5			50 (RU 64)	5250	17.4	17.5	
		50 (RU S61)	5250	17.5	17.5			50 (RU S61)	5250	17.5	17.5	
		50 (RU S62)	5250	17.5	17.5			50 (RU S62)	5250	17.5	17.5	
		50 (RU S63)	5250	17.4	17.5			50 (RU S63)	5250	17.4	17.5	
		50 (RU S64)	5250	17.3	17.5			50 (RU S64)	5250	17.3	17.5	
Band	Mode	Ch #	Freq. (MHz)	ANT A Reduced Average Power (dBm)			Mode	Ch #	Freq. (MHz)	ANT B Reduced Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)				Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-2C 5.5 GHz	802.11ax (HE160) 996T	114 [RU 67]	5570	14.4	14.5	Yes	802.11ax (HE160) 996T	114 [RU 67]	5570	14.2	14.5	Yes
		114 [RU S67]	5570	14.4	15.5			114 [RU S67]	5570	14.2	15.5	
Band	Mode	Ch #	Freq. (MHz)	ANT A Reduced Average Power (dBm)			Mode	Ch #	Freq. (MHz)	ANT B Reduced Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)				Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-3 5.8 GHz	802.11ac (VHT80)	155	5775	14.5	14.5	Yes	802.11ac (VHT80)	155	5775	14.3	14.5	Yes

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Duty Factor Measured Results

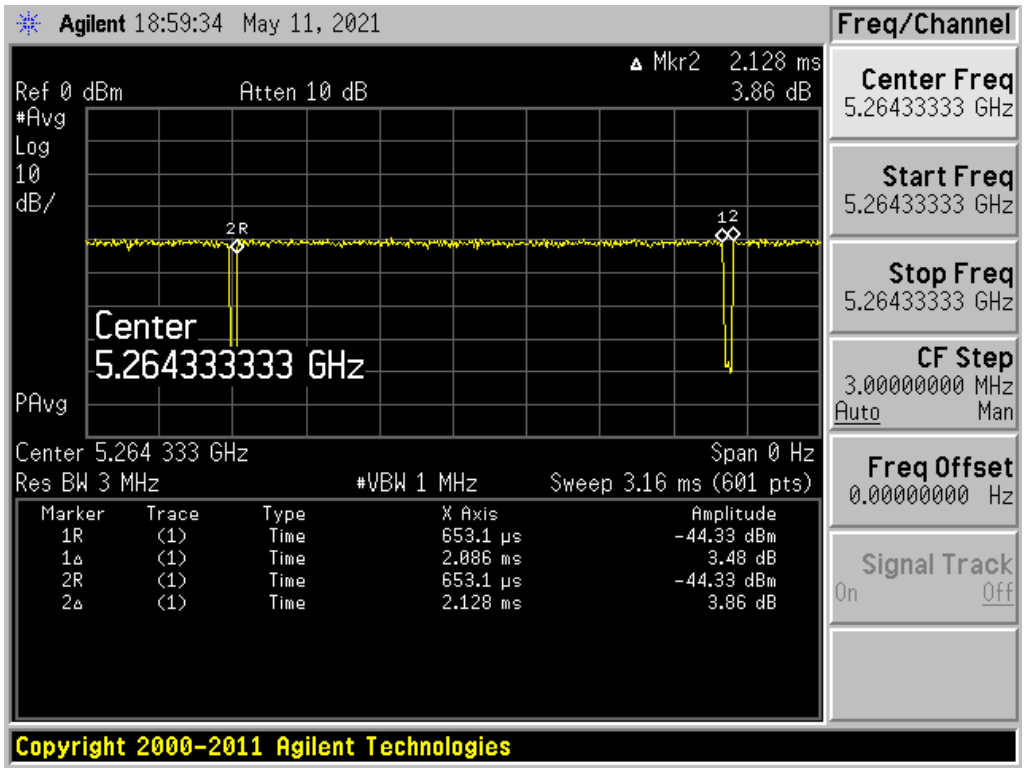
Band	Mode	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
5 GHz	802.11a	2.086	2.128	98.03%	1.02
5 GHz	802.11n HT40	2.547	2.618	97.29%	1.03
5 GHz	802.11ac VHT80	2.537	2.614	97.05%	1.03
5 GHz	802.11ax HE80 242T	2.555	2.634	97.00%	1.03
5 GHz	802.11ax HE160 242T	2.590	2.650	97.74%	1.02
5 GHz	802.11ax HE160 996T	2.523	2.615	96.48%	1.04

Note(s):

Duty Cycle = (T on / period) * 100%

Duty Cycle plot

802.11a



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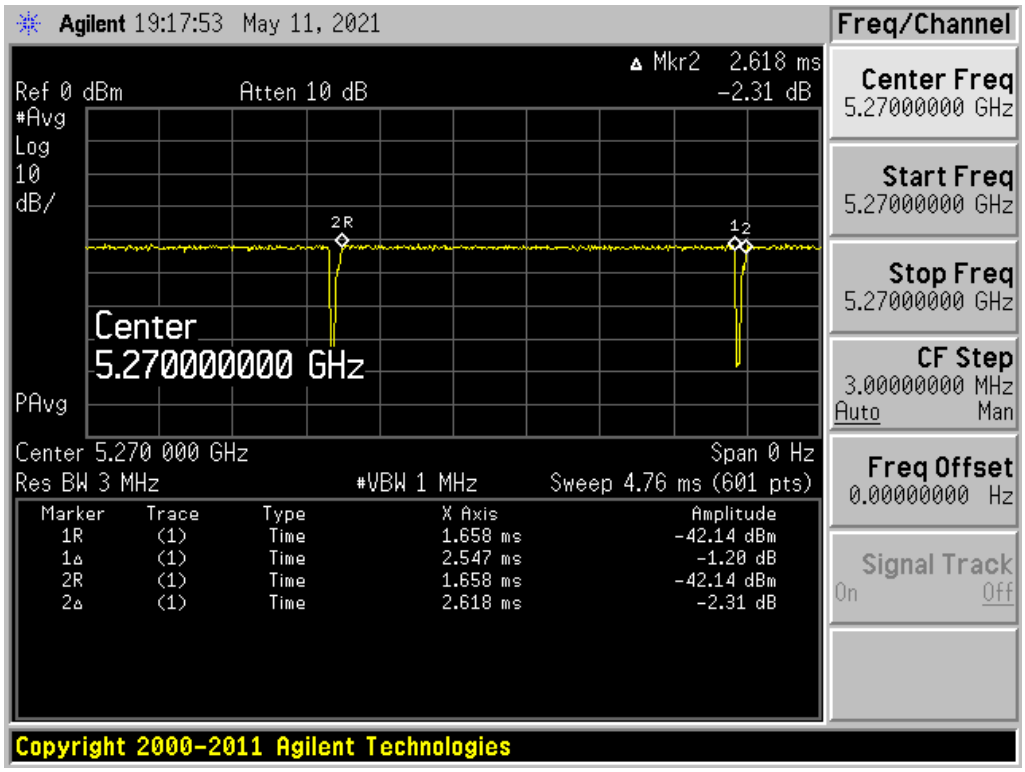
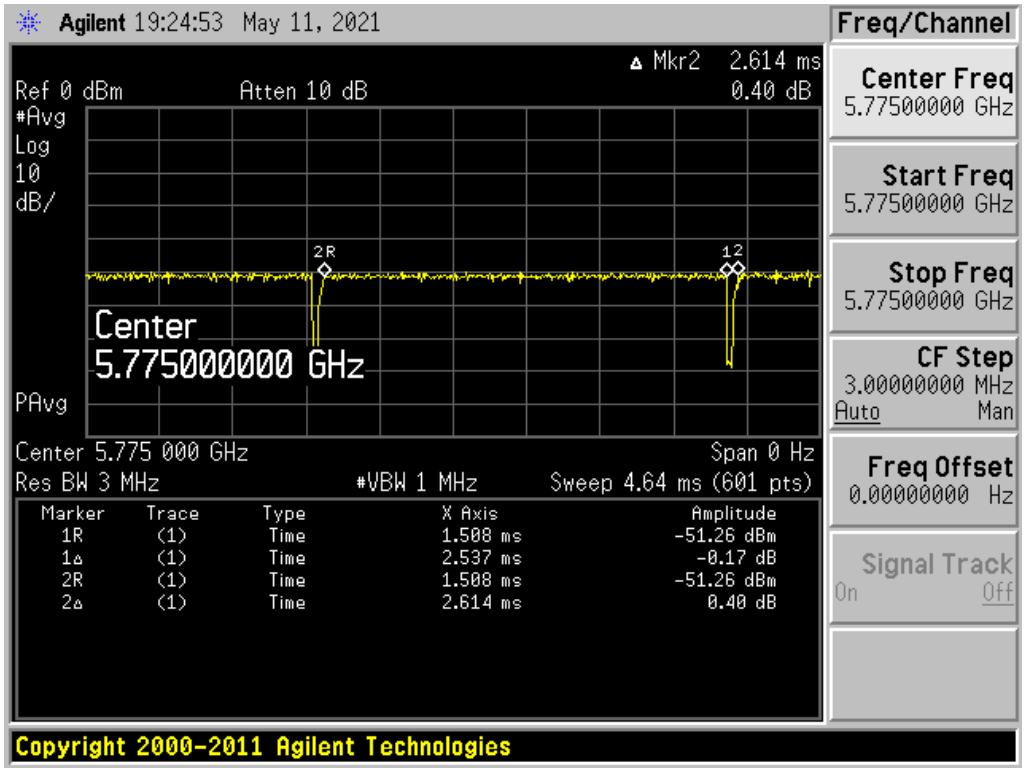
802.11n HT40



802.11ac VHT80



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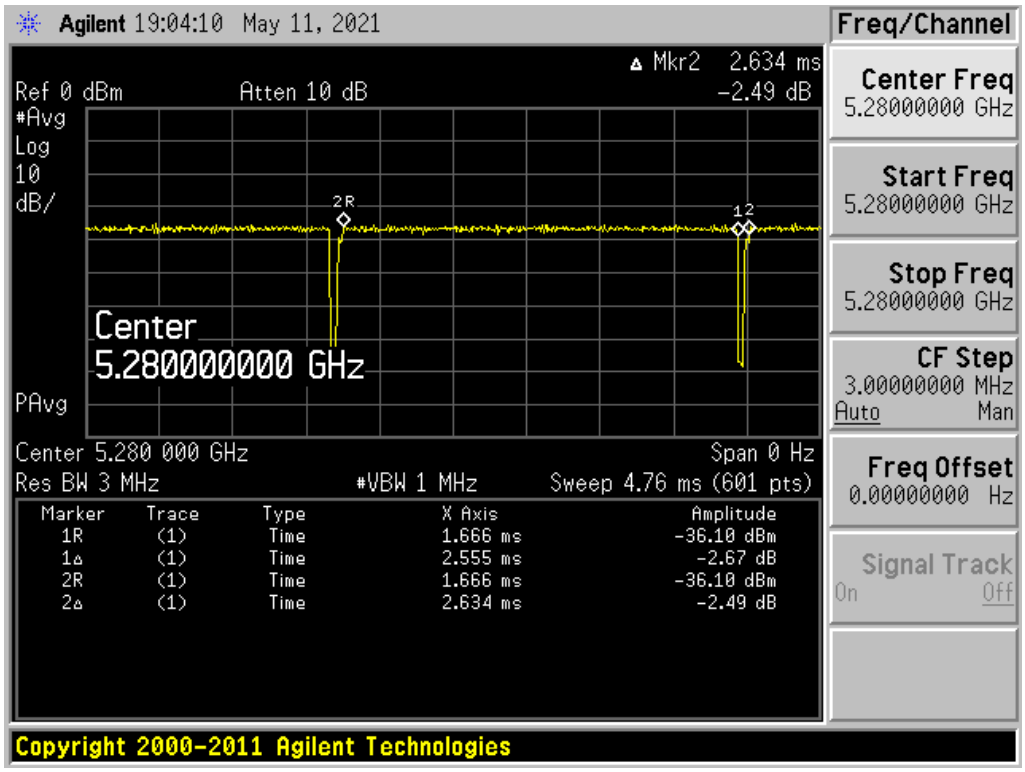
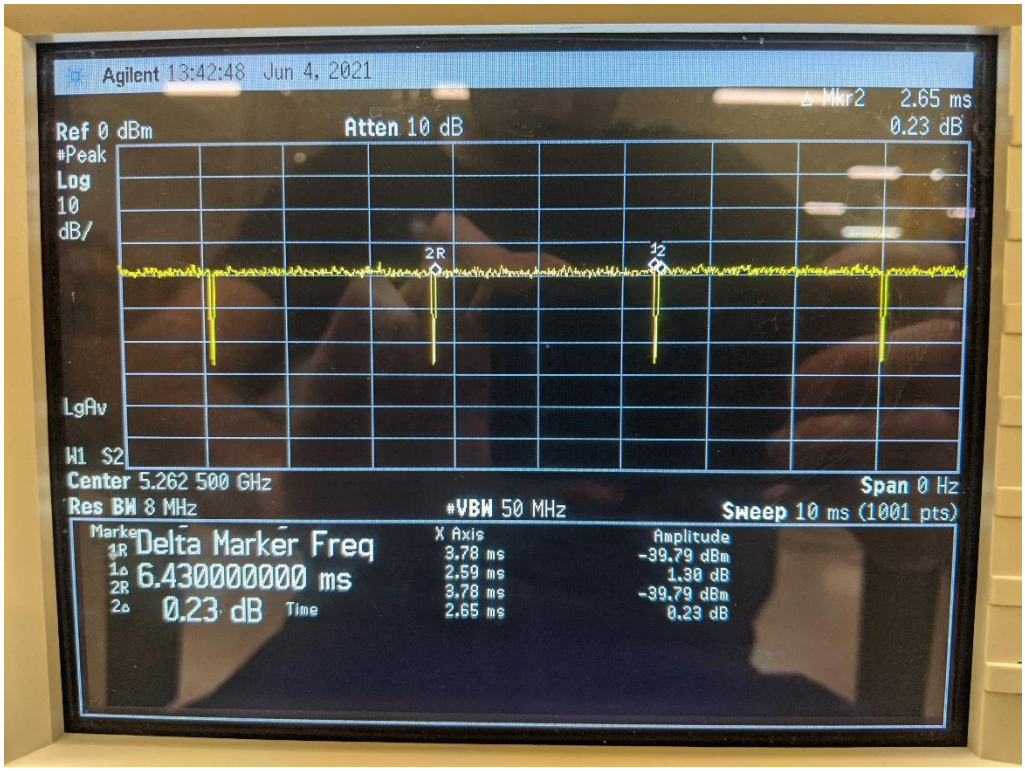
802.11ax HE80 242T



802.11ax HE160 242T



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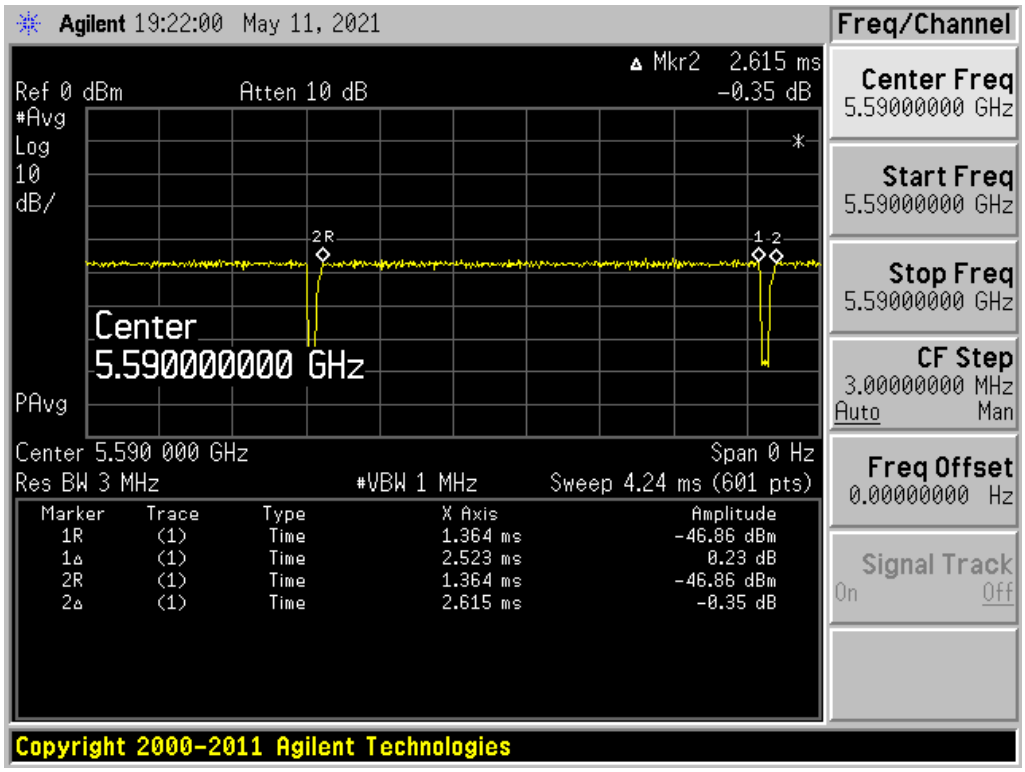
802.11ax HE160 996T



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9.3. Bluetooth

Maximum Output Power (Tune-up Limit) for Bluetooth

SAR measurement is not required for the EDR and LE. When the secondary mode is ≤ ¼ dB higher than the primary mode.

Bluetooth Measured Results

Band	Mode	Ch #	Freq. (MHz)	ANT A Max Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)
2.4 GHz	BR GFSK	0	2402	9.8	10.5	Yes
		39	2441	9.9	10.5	
		78	2480	10.2	10.5	
	EDR, π/4 DQPSK	0	2402		7.5	No
		39	2441		7.5	
		78	2480		7.5	
	EDR, 8-DPSK	0	2402		7.5	No
		39	2441		7.5	
		78	2480		7.5	
	LE, GFSK	0	2402		5.5	No
		19	2440		5.5	
		39	2480		5.5	

Duty Factor Measured Results

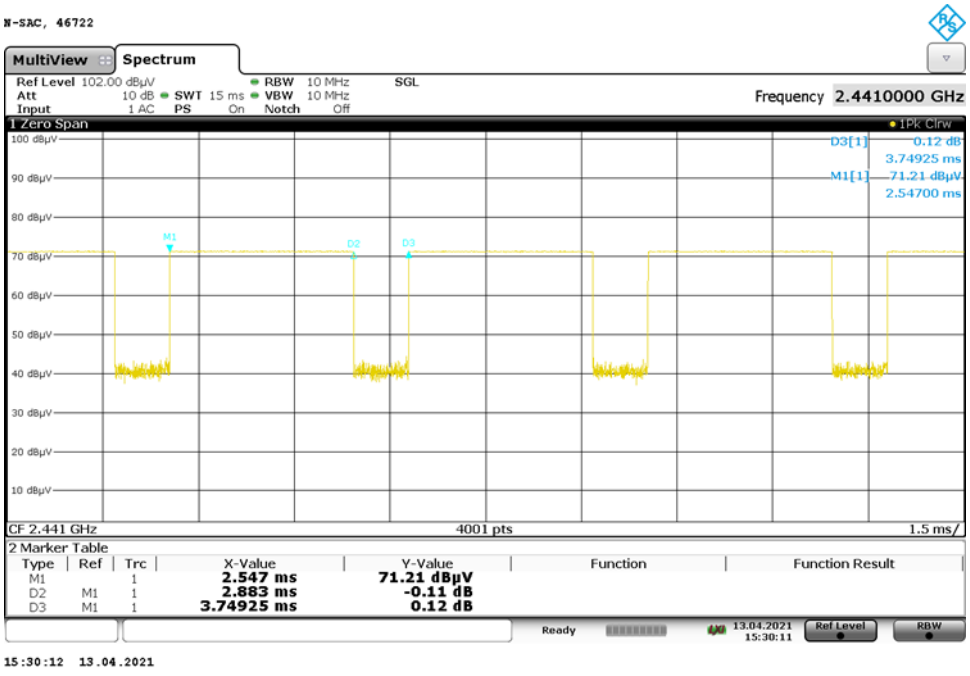
Band	Mode	Data Rate	Antenna	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
BT	GFSK	1-DH5	ANT A	2.88	3.75	76.90%	1.30

Note(s):

Duty Cycle = (T on / period) * 100%

Duty Cycle plot

GFSK



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10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

- Reported SAR(W/kg) for Wi-Fi = Measured SAR * Tune-up scaling factor * Duty Cycle scaling factor
- Duty Cycle scaling factor = 1 / Duty cycle (%)

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 248227 D01 SAR meas for 802.11:

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the *initial test position(s)* by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The *initial test position(s)* is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the *reported* SAR for the *initial test position* is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the *initial test position* to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the *reported* SAR is ≤ 0.8 W/kg or all required test positions are tested.
  - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
  - When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the *initial test position* and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required test channels are considered.
  - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

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10.1. Wi-Fi (DTS Band)

When the 802.11b reported SAR of the highest measured maximum output power channel is ≤ 0.8 W/kg, no further SAR testing is required. If SAR is > 0.8 W/kg and ≤ 1.2 W/kg, SAR is required for the next highest measured output power channel. Finally, if SAR is > 1.2 W/kg, SAR is required for the third channel.

SAR testing is not required for OFDM mode(s) when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

RF Exposure Conditions	Mode	Antenna	Pwr Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up Limit	Meas.	Meas.	Scaled	
Standalone	802.11b	ANT A	ON	0	Folded Rear	6	2437	99.48%	17.5	17.0	0.012	0.014	
					Folded Edge 1	6	2437	99.48%	17.5	17.0	0.302	**0.341**	1
					Folded Edge 4	6	2437	99.48%	17.5	17.0	0.093	0.105	
	802.11b	ANT B	ON	0	Folded Rear	6	2437	99.48%	17.5	17.0	0.013	0.014	
					Folded Edge 1	6	2437	99.48%	17.5	17.0	0.313	**0.353**	2
					Folded Edge 2	6	2437	99.48%	17.5	17.0	0.068	0.077	

10.2. Wi-Fi (U-NII Band)

UNII-1 &2A

When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest *reported* SAR for UNII band 2A is

- ≤ 1.2 W/kg, SAR is not required for UNII band I
- > 1.2 W/kg, both bands should be tested independently for SAR.

RF Exposure Conditions	Mode	Antenna	Pwr Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up Limit	Meas.	Meas.	Scaled	
Standalone	802.11ax (HE160 242T)	ANT A	ON	0	Folded Rear	50 RU S61	5250	97.74%	17.5	17.5	<0.01	<0.01	
					Folded Edge 1	50 RU S61	5250	97.74%	17.5	17.5	0.650	**0.665**	3
					Folded Edge 4	50 RU S61	5250	97.74%	17.5	17.5	<0.01	<0.01	
	802.11ax (HE160 242T)	ANT B	ON	0	Folded Rear	50 RU S61	5250	97.74%	17.5	17.5	<0.01	<0.01	
					Folded Edge 1	50 RU S61	5250	97.74%	17.5	17.5	0.457	**0.468**	4
					Folded Edge 2	50 RU S61	5250	97.74%	17.5	17.5	<0.01	<0.01	

UNII-2C

RF Exposure Conditions	Mode	Antenna	Pwr Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up Limit	Meas.	Meas.	Scaled	
Standalone	802.11ax (HE160) 996T	ANT A	ON	0	Folded Rear	114 [RU S67]	5570	96.48%	15.5	14.4	0.017	0.023	
					Folded Edge 1	114 [RU S67]	5570	96.48%	15.5	14.4	0.897	**1.198**	5
					Folded Edge 4	114 [RU S67]	5570	96.48%	15.5	14.4	0.028	0.037	
	802.11ax (HE160) 996T	ANT B	ON	0	Folded Rear	114 [RU S67]	5570	96.48%	15.5	14.2	0.016	0.023	
					Folded Edge 1	114 [RU S67]	5570	96.48%	15.5	14.2	0.839	**1.173**	6
					Folded Edge 2	114 [RU S67]	5570	96.48%	15.5	14.2	0.043	0.060	

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UNII-3

RF Exposure Conditions	Mode	Antenna	Pwr Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up Limit	Meas.	Meas.	Scaled	
Standalone	802.11ac (VHT80)	ANT A	ON	0	Folded Rear	155	5775	97.05%	14.5	14.5	<0.01	<0.01	
					Folded Edge 1	155	5775	97.05%	14.5	14.5	0.746	**0.769**	7
					Folded Edge 4	155	5775	97.05%	14.5	14.5	0.016	0.016	
	802.11ac (VHT80)	ANT B	ON	0	Folded Rear	155	5775	97.05%	14.5	14.3	<0.01	<0.01	
					Folded Edge 1	155	5775	97.05%	14.5	14.3	0.628	**0.678**	8
					Folded Edge 2	155	5775	97.05%	14.5	14.3	<0.01	<0.01	

10.3. Bluetooth

RF Exposure Conditions	Mode	Antenna	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up Limit	Meas.	Meas.	Scaled	
Standalone	GFSK	ANT A	0	Folded Rear	78	2480	10.5	10.2	<0.01	<0.01	
				Folded Edge 1	78	2480	10.5	10.2	0.060	**0.062**	9

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10.4. Standalone SAR Test Exclusion Considerations & Estimated SAR

Considerations for SAR estimation

1. When standalone SAR test exclusion applies, standalone SAR must also be estimated to determine simultaneous transmission SAR test exclusion.
2. Dedicated Host Approach criteria for SAR test exclusion is likewise applied to SAR estimation, with certain distinctions between test exclusion and SAR estimation:
   - When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied for SAR estimation; this is the same between test exclusion and SAR estimation calculations.
   - When the separation distance from the antenna to an adjacent edge is > 5 mm but ≤ 50 mm, the actual antenna-to-edge separation distance is applied for SAR estimation.
   - When the minimum test separation distance is > 50 mm, the estimated SAR value is 0.4 W/kg
3. Please refer to Estimated SAR Tables to see which test positions are inherently compliant as they consist of only estimated SAR values for all applicable transmitters and consequently will always have sum of SAR values < 1.2 W/kg. Simultaneous transmission SAR analysis was therefore not performed for these test positions.

SAR Test Exclusion Calculations for Laptop Mode Max Power WLAN

SAR evaluation is required if the separation distance between the user or bystanders and the device is less than or equal to 20 cm. Therefore, SAR measurements are not required for Max Power.

SAR Test Exclusion Calculations for Tablet Mode Reduced Power WLAN

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Estimated 1-g SAR Value (W/kg)				
		dBm	mW	Folded Rear	Folded Edge 1	Folded Edge 2	Folded Edge 3	Folded Edge 4	Folded Rear	Folded Edge 1	Folded Edge 2	Folded Edge 3	Folded Edge 4
Wi-Fi/BT ANT A													
Wi-Fi 2.4 GHz	2462	17.50	56	20	5	246	210	20	-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-
Wi-Fi 5.2 GHz	5240	17.50	56	20	5	246	210	20	-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-
Wi-Fi 5.3 GHz	5320	17.50	56	20	5	246	210	20	-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-
Wi-Fi 5.5 GHz	5700	15.50	35	20	5	246	210	20	-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-
Wi-Fi 5.8 GHz	5825	14.50	28	20	5	246	210	20	-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-
Bluetooth	2480	10.50	11	20	5	246	210	20	0.115	-MEASURE-	0.400	0.400	0.115
Wi-Fi ANT B													
Wi-Fi 2.4 GHz	2462	17.50	56	20	5	20	210	246	-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400
Wi-Fi 5.2 GHz	5240	17.50	56	20	5	20	210	246	-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400
Wi-Fi 5.3 GHz	5320	17.50	56	20	5	20	210	246	-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400
Wi-Fi 5.5 GHz	5700	15.50	35	20	5	20	210	246	-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400
Wi-Fi 5.8 GHz	5825	14.50	28	20	5	20	210	246	-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400

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11. SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is < 0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	First Repeated		Second Repeated		Third Repeated
						Measured SAR (W/kg)	Largest to Smallest SAR Ratio	Measured SAR (W/kg)	Largest to Smallest SAR Ratio	Measured SAR (W/kg)
5500	Wi-Fi 802.11a/n/ac	Standalone	Folded Edge 1	Yes	0.897	0.835	1.07	N/A	N/A	N/A

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12. Simultaneous Transmission Conditions

12.1. Simultaneous transmission SAR test exclusion considerations

KDB 447498 D01 General RF Exposure Guidance provides two procedures for determining simultaneous transmission SAR test exclusion: Sum of SAR and SAR to Peak Location Ratio (SPLSR)

12.1.1. Sum of SAR

To qualify for simultaneous transmission SAR test exclusion based upon Sum of SAR the sum of the reported standalone SARs for all simultaneously transmitting antennas shall be below the applicable standalone SAR limit. If the sum of the SARs is above the applicable limit then simultaneous transmission SAR test exclusion may still apply if the requirements of the SAR to Peak Location Ratio (SPLSR) evaluation are met.

12.1.2. SAR to Peak Location Ratio (SPLSR)

KDB 447498 D01 General RF Exposure Guidance explains how to calculate the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / Ri$$

Where:

SAR_1 is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR_2 is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of

$$[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$$

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / Ri \leq 0.04$$

When an individual antenna transmits at on two bands simultaneously, the sum of the highest *reported* SAR for the frequency bands should be used to determine SAR_1.or SAR_2. When SPLSR is necessary, the smallest distance between the peak SAR locations for the antenna pair with respect to the peaks from each antenna should be used.

The antennas in all antenna pairs that do not qualify for simultaneous transmission SAR test exclusion must be tested for SAR compliance, according to the enlarged zoom scan and volume scan post-processing procedures in KDB Publication 865664 D01

The antenna for the unlicensed transmitters (WLAN Ant A and Bluetooth Ant A) are closely situated. As a result, the associated SAR hotspots are also closely situated. Some of the sum of SAR calculations yielded results over 1.6 W/kg. The SPSLR calculations for these situations were performed by treating the unlicensed SAR values as a single transmitter. The most conservative distance between all the unlicensed hotspots to the licensed hotspot was used for the value of *d* in the SPSLR calculation.

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12.2. Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations
Standalone	1	Wi-Fi 5 GHz ANT A + Wi-Fi 5 GHz ANT B + BT ANT A
	2	Wi-Fi 5 GHz ANT A + Wi-Fi 5 GHz ANT B
	3	Wi-Fi 2.4 GHz ANT A + Wi-Fi 2.4 GHz ANT B
	4	Wi-Fi 2.4 GHz ANT B + BT ANT A

Notes:

1. Wi-Fi 2.4 GHz ANT B Radio can transmit simultaneously with Bluetooth Radio ANT A.
2. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Wi-Fi 5 GHz Radio.
3. Wi-Fi 5 GHz Radio can transmit simultaneously with Bluetooth Radio.

12.3. Sum of the SAR for Wi-Fi & BT

RF Exposure conditions	Test Position	Standalone SAR (W/kg)					∑ 1-g SAR (W/kg)			
		2.4 GHz		5 GHz		BT				
		ANT A	ANT B	ANT A	ANT B	ANT A	1+2	2+5	3+4	3+4+5
		1	2	3	4	5				
Standalone	Folded Rear	0.014	0.014	0.023	0.023	0.000	0.028	0.014	0.046	0.046
	Folded Edge 1	0.341	0.353	1.198	1.173	0.062	**0.694**	0.415	2.371	2.433
	Folded Edge 2	0.179	0.077		0.060	0.036	0.256	0.113		
	Folded Edge 4	0.105	0.258	0.037	0.320	0.367	0.363	0.625	0.357	**0.724**

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because either the sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is ≤ 0.04 for all circumstances that require SPLSR calculation.

SAR to Peak Location Separation Ratio (SPLSR)

RF Exposure Conditions	Test Position	Standalone SAR (W/kg)			∑ 1-g SAR (W/kg)		Calculated distance (mm)	SPLSR (≤ 0.04)	Volume Scan (Yes/ No)
		UNII	UNII	BT					
		ANT A 3	ANT B 4	ANT A 5					
Standalone	Folded Edge 1	1.198	1.173	0.062	3 + 4 + 5	2.433	216.5	0.02	No
		1.198	1.173		3 + 4	2.371	216.5	0.02	No
			1.173	0.062	4 + 5	1.235	227.3	0.01	No

RF Exposure Conditions	Test Position	Mode		Peak SAR	X	Y	Z	d: Calculated distance (mm)	
				W/kg	m	m	m		
Standalone	Folded Edge 1	UNII	ANT A	2.190	0.001	-0.109	-0.177	3 + 4	216.5
		UNII	ANT B	2.010	0.015	0.107	-0.178		
		UNII	ANT B	2.010	0.015	0.107	-0.178	4 + 5	227.3
		BT	ANT A	0.112	0.004	-0.120	-0.176		
		UNII	ANT A	2.190	0.001	-0.109	-0.177	3 + 5	11.4
		BT	ANT A	0.112	0.004	-0.120	-0.176		

The Peak Location Separation Distance is computed by using the formula: SQRT((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)

12.4. NFC Simultaneous transmission

The standalone NFC SAR was tested by the applicant and is reported in Microsoft test report S-677-FCC-SAR-1. The highest reported SAR value is 0.0167 W/kg

Simultaneous transmission has not been considered due to the large separation distance between the WLAN and NFC antennas in all postures.

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Appendixes

Refer to separated files for the following appendixes.

Appendix A: SAR Setup Photos

Appendix B: SAR System Check Plots

Appendix C: SAR Highest Test Plots

Appendix D: SAR Tissue Ingredients

Appendix E: SAR Probe Certificates

Appendix F: SAR Dipole Certificates

Appendix G: Power Reduction Verification

END OF REPORT

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