MEASUREMENT REPORT

FCC ID	:	2AR82-SKOWB822CU3
APPLICANT	:	Guangzhou Shikun Electronics Co., Ltd
Application Type	:	Certification
Product	:	IEEE 802.11 a/b/g/n/ac 2T2R USB Wi-Fi Module Integrated Bluetooth 2.1/3.0/4.2/5.0
Model No.	:	SKO.WB822CU.3
FCC Classification	:	Unlicensed National Information Infrastructure (UNII)
FCC Rule Part(s)	:	Part 15 Subpart E (Section 15.407)
Test Procedure(s)	:	ANSI C63.10-2013
Received Date	:	November 17, 2022
Test Date	:	November 25~December 1, 2022

Tested By : Peter Syu
(Peter Syu)

Reviewed By : Paddy Chen
(Paddy Chen)

Approved By : Chenz Ker
(Chenz Ker)

Testing Laboratory
3261

The test results only relate to the tested samples.
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10. Test results reported herein relate only to the item(s) tested.
The test report shall not be reproduced except in full without the written approval of MRT Technology (Taiwan) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2211TW0105-U5	1.0	Original Report	2022-12-05	

CONTENTS

§2.1033 General Information

Applicant	Guangzhou Shikun Electronics Co., Ltd
Applicant Address	NO.6 Liankun Road, Huangpu District, Guangzhou, China
Manufacturer	Guangzhou Shikun Electronics Co., Ltd
Manufacturer Address	NO.6 Liankun Road, Huangpu District, Guangzhou, China
Test Site	MRT Technology (Taiwan) Co., Ltd
Test Site Address	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)
MRT FCC Registration No.	291082
FCC Rule Part(s)	Part 15 Subpart E (Section 15.407)
Test Device Serial No.	#1-2 ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Fuxing Rd., Taoyuan, Taiwan (R.O.C)

- **MRT facility is a FCC registered (Reg. No. 291082) test facility with the site description report on file and is designated by the FCC as an Accredited Test Firm.**
- **MRT facility is an IC registered (MRT Reg. No. 21723) test laboratory with the site description on file at Industry Canada.**
- **MRT Lab is accredited to ISO 17025 by the Taiwan Accreditation Foundation (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC (Designation Number: TW3261), Industry Taiwan, EU and TELEC Rules.**

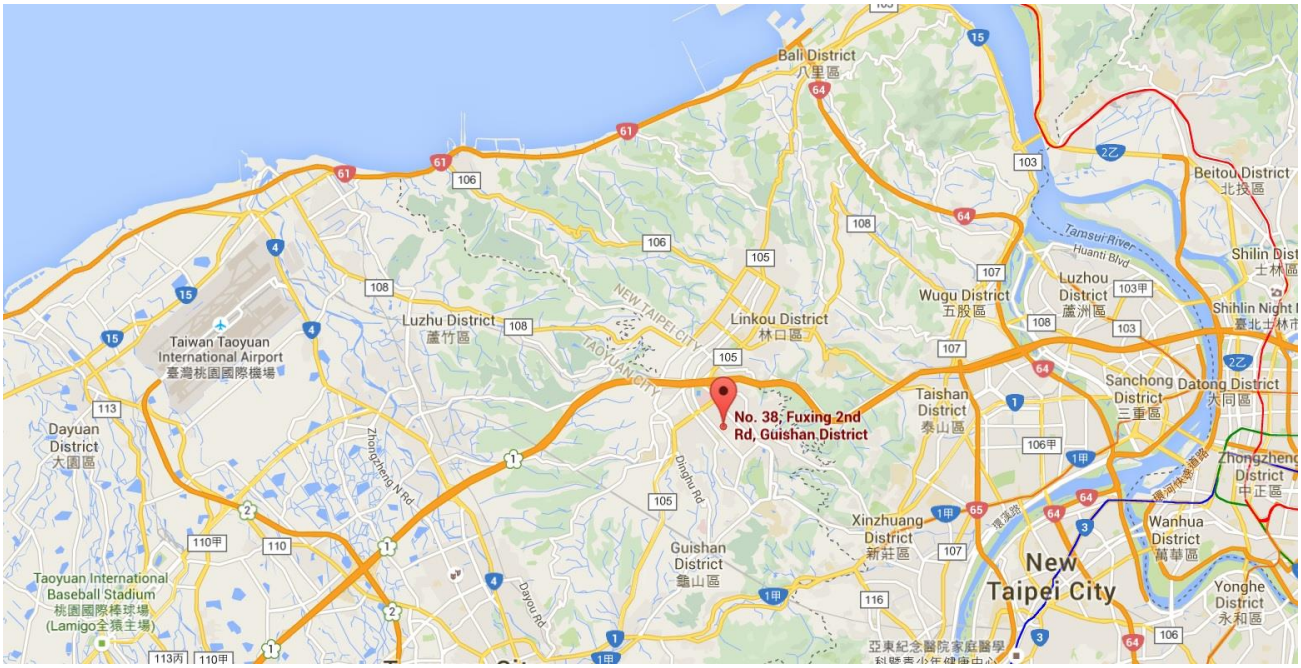
1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taoyuan City. These measurement tests were conducted at the MRT Technology (Taiwan) Co., Ltd. Facility located at No.38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan (R.O.C).



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name	IEEE 802.11 a/b/g/n/ac 2T2R USB Wi-Fi Module Integrated Bluetooth 2.1/3.0/4.2/5.0
Model No.	SKO.WB822CU.3
Supports Radios Spec.	**WLAN:** 2.4G: 802.11b/g/n-20/n-40 5G: 802.11a/n-20/ac-20/n-40/ac-40/ac-80, Band 1,2,3,4 **WPAN:** Bluetooth Dual Mode: V5.0
Wi-Fi Specification	802.11a/n/ac (2TX / 2RX)
Frequency Range	5GHz: For 802.11a/n-HT20/ac-VHT-20: 5180~5320MHz, 5500~5720MHz, 5745~5825MHz For 802.11n-HT40/ ac-VHT40: 5190~5310MHz, 5510~5710MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5290MHz, 5530MHz, 5610MHz, 5690MHz, 5775MHz
Maximum Output Power	802.11a_Ant 0: 15.57dBm 802.11a_Ant 1: 14.92dBm 802.11n-HT20_Ant 0+1: 16.05dBm, 802.11n-HT40_Ant 0+1: 16.86dBm, 802.11ac-VHT20_Ant 0+1: 15.15dBm, 802.11ac-VHT40_Ant 0+1: 16.04dBm, 802.11ac-VHT80_Ant 0+1: 15.89dBm
Modulation Type	802.11a/n-20/ac-20/n-40/ac-40/ac-80: OFDM (BPSK, QPSK, 16QAM, 64QAM,256QAM)

2.2. Operation Frequencies and Channel List

802.11 n-HT20/ ac-VHT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz	44	5220 MHz
48	5240 MHz	52	5260 MHz	56	5280 MHz
60	5300 MHz	64	5320 MHz	100	5500 MHz
104	5520 MHz	108	5540 MHz	112	5560 MHz
118	5580 MHz	124	5620 MHz	128	5640 MHz
132	5660 MHz	136	5680 MHz	140	5700 MHz
144	5720 MHz	149	5745 MHz	153	5765 MHz
157	5785 MHz	161	5805 MHz	165	5825 MHz

802.11 n-HT40/ ac-VHT40

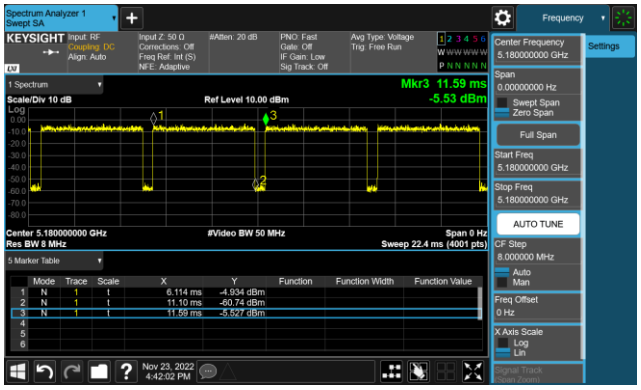
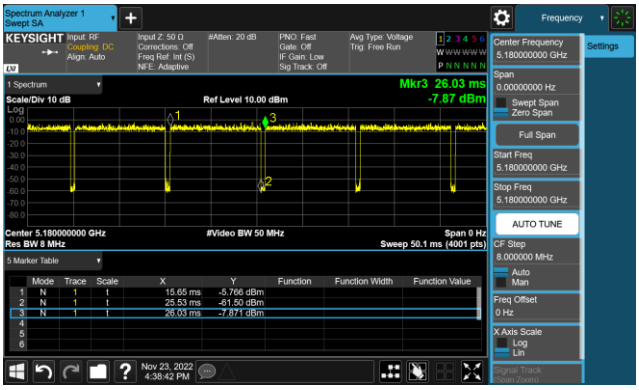
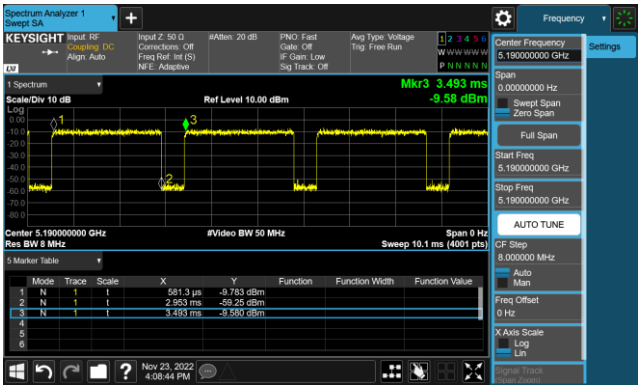
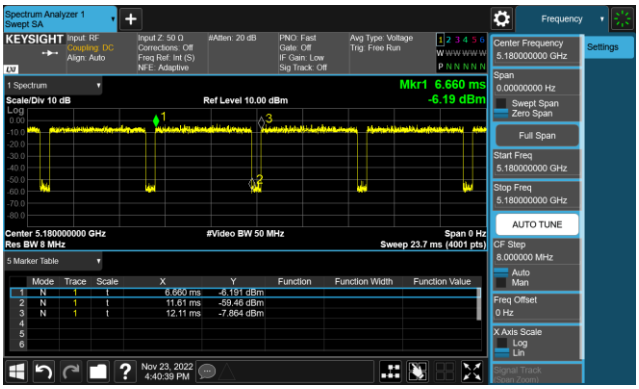
Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz	54	5270 MHz
62	5310 MHz	102	5510 MHz	110	5550 MHz
126	5630 MHz	134	5670 MHz	151	5755 MHz
159	5795 MHz	--	--	--	--

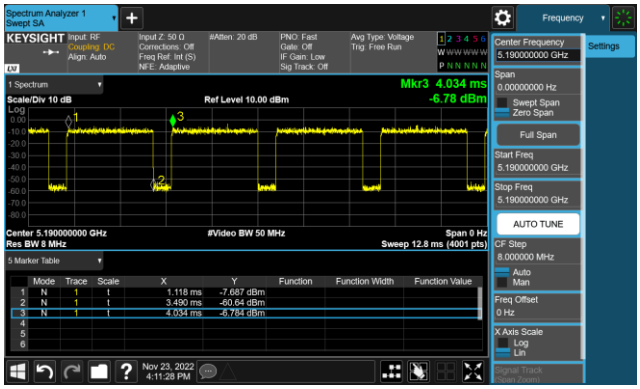
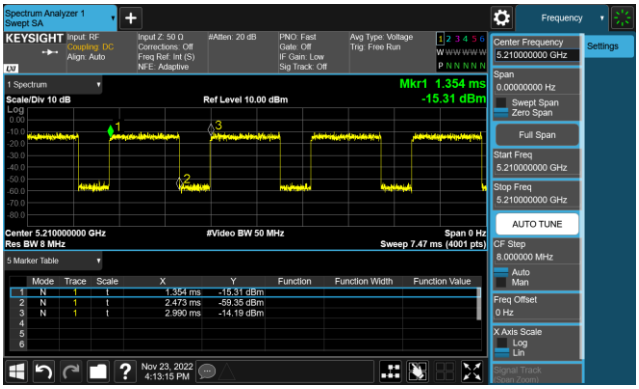
802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	58	5290 MHz	106	5530 MHz
122	5610 MHz	138	5690 MHz	155	5775 MHz

Duty Cycle

Test Mode	Duty Cycle
802.11a	91.05%
802.11 n-HT20	95.18%
802.11 n-HT40	81.45%
802.11ac-VHT20	90.83%
802.11ac-VHT40	81.34%
802.11ac-VHT80	68.40%

802.11 a	802.11 n20
	
802.11 n40	**802.11 ac20**
	

802.11 ac40	802.11 ac80
	

2.3. Test Mode

Test Mode	Mode 1: Transmit by 802.11a_Ant 0
	Mode 2: Transmit by 802.11a_Ant 1
	Mode 2: Transmit by 802.11n-HT20_Ant 0+1
	Mode 3: Transmit by 802.11n-HT40_Ant 0+1
	Mode 4: Transmit by 802.11ac-VHT20_Ant 0+1
	Mode 5: Transmit by 802.11ac-VHT40_Ant 0+1
	Mode 6: Transmit by 802.11ac-VHT80_Ant 0+1

2.4. Test Software

The test utility software used during testing was “MP-tool v10.01”.

2.5. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15.407
- KDB 789033 D02v02r01
- ANSI C63.10-2013

2.6. Device Capabilities

This device contains the following capabilities:

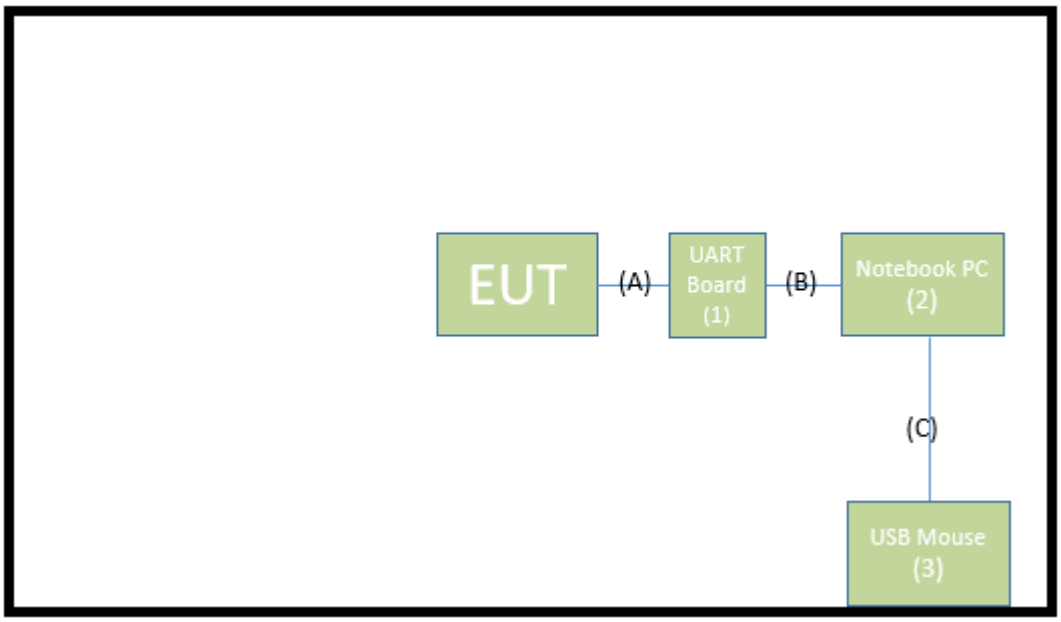
2.4GHz WLAN (DTS) and 5GHz WLAN (NII).

Note: 5GHz (NII) operation is possible in 20MHz, 40MHz and 80MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = average per the guidance of Section B)2)b) of KDB 789033 D02v02r01. 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.

2.7. Test Configuration

This device was tested per the guidance of KDB 789033 D02v02r01. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

Connection Diagram – Radiated Emission testing & AC Conducted Emissions



	Cable Type	Cable Description
A	Signal Cable	Non-Shielded, 0.3m
B	USB Cable	Shielded, 1.0m
C	USB Mouse Cable	Shielded, 1.8m

2.8. Test System Details

No.	Product	Manufacturer	Model No.	S/N	Cable Description
1	UART Board	shikun	Power board	N/A	Non-shielded, 1.5m
2	Notebook PC	Lenovo	T450	N/A	Non-shielded, 0.8m
3	USB Mouse	Logitech	M90	N/A	N/A

2.9. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.10. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 789033 were used in the measurement of the device**.**

Deviation from measurement procedure…….....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 9'x4'x3' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

Line conducted emissions test results are shown in Section 7.10.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antenna of the **IEEE 802.11 a/b/g/n/ac 2T2R USB Wi-Fi Module Integrated Bluetooth 2.1/3.0/4.2/5.0,** is permanently attached.
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT unit complies with the requirement of §15.203.

Antenna List

Antenna Type	Frequency Band (MHz)	TX Paths	Max Antenna Gain (dBi)
PCB Antenna	2412 ~ 2462	2	1.61
	5150 ~ 5850	2	2.70

Note : All information declared by manufacturer.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions – SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Two-Line V-Network	R&S	ENV216	MRTTWA00019	1 year	2023/3/7
Cable	Rosnol	N1C50-RG400-B 1C50-500CM	MRTTWE00013	1 year	2023/6/19
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2023/3/9

Radiated Emissions – AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2022/12/4
Acitve Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	1 year	2023/5/24
Broadband Hornantenna	RFSPIN	DRH18-E	MRTTWA00087	1 year	2023/5/10
Breitband Hornantenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	1 year	2023/3/29
Broadband Preamplifier	EMC Instruments corporation	EMC118A45SE	MRTTWA00088	1 year	2023/5/9
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	1 year	2023/3/30
Signal Analyzer	R&S	FSV40	MRTTWA00007	1 year	2023/3/16
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2023/3/9
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2023/10/5
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2023/7/19
Antenna Cable	HUBERSUHNER	SF106	MRTTWE00034	1 year	2023/6/27
Cable	HUBERSUHNER	EMC105-NM-NM -3000	MRTTWE00035	1 year	2023/6/27

Conducted Test Equipment – SR5

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2023/10/5
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2023/7/19
USB Wideband Power Sensor	KEYSIGHT	U2021XA	MRTTWA00015	1 year	2023/3/16
20dB attenuator	Warison	WATT-218FS-20	MRTTWE00027	1 year	2023/6/15

Test Software

Software	Version	Function
e3	9.160520a	EMI Test Software
EMI	V3	EMI Test Software

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Conducted Emission- Power Line
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.15MHz~30MHz: ± 2.53dB
Radiated Spurious Emission
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz~30MHz: ± 3.92dB 30MHz~1GHz: ± 4.25dB 1GHz~18GHz: ± 4.40dB 18GHz~40GHz: ± 4.45dB
Frequency Error
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ±78.4Hz
Conducted Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 0.84dB
Conducted Spurious Emission
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):± 2.65 dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 3.3%
Temp. / Humidity
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ±0.82°C/ ±3%
DC Voltage
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ±0.3%

7. TEST RESULT

7.1. Summary

Company Name:	**IEEE 802.11 a/b/g/n/ac 2T2R USB Wi-Fi Module Integrated Bluetooth 2.1/3.0/4.2/5.0**
FCC Classification:	**Unlicensed National Information Infrastructure (UNII)**
Data Rate(s) Tested:	**6Mbps ~ 54Mbps (a);** **6.5/7.2Mbps ~ 130/144.4Mbps (n-HT20);** **13.5/15.0Mbps ~ 270/300Mbps (n-HT40);** **6.5/7.2Mbps ~ 156/173.4Mbps (ac-VHT20);** **13.5/15.0Mbps ~ 360/400Mbps (ac-VHT40);** **29.3/32.5Mbps ~ 780/866.6Mbps (ac-VHT80)**

FCC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.407(a)	26dB Bandwidth	N/A	Conducted	Pass	Section 7.2
15.407(e)	6dB Bandwidth	≥ 500kHz		Pass	Section 7.3
15.407(a)(1)(i), (2), (3)	Maximum Conducted Output Power	Refer to Section 7.5		Pass	Section 7.5
15.407(h)(1)	Transmit Power Control	≤ 24 dBm		N/A	Section 7.6
15.407(a)(1)(i), (2), (3), (5)	Power Spectral Density	Refer to Section 7.7		Pass	Section 7.7
15.407(b)(1), (4)	Undesirable Emissions	≤ -27dBm/MHz EIRP ≤ -17dBm/MHz EIRP	Radiated	Pass	Section 7.8 & 7.9
15.205, 15.209 15.407(b)(5), (6), (7)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		Pass	
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.10

Notes:

1) Determining compliance is based on the test results met the regulation limits or requirements declared by clients, and the test results don't take into account the value of measurement uncertainty.
2) All channels, modes, and modulations/data rates were investigated among all UNII bands. The test results

shown in the following sections represent the worst case emissions.

3) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.

7.2. 26dB Bandwidth Measurement

7.2.1. Test Limit

N/A

7.2.2. Test Procedure used

KDB 789033 D02v02r01 - Section II)C)1) (26dB Bandwidth) & Section II)D) (99% Bandwidth) /
ANSI C63.10 6.9.3

7.2.3. Test Setting

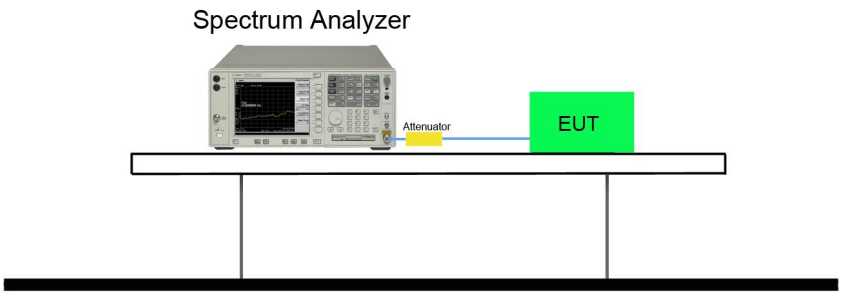
26dB Bandwidth

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth
2. RBW = approximately 1% of the emission bandwidth.
3. VBW > RBW
4. Detector = Peak.
5. Trace mode = max hold.
6. Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

99% Bandwidth

1. Set center frequency to the nominal EUT channel center frequency.
2. RBW = 1% to 5% of the OBW
3. VBW ≥ 3 × RBW
4. Span = 1.5 times to 5 times the OBW
5. Detector = peak
6. Trace mode = max hold
7. Allow the trace to stabilize
8. Use the 99% power bandwidth function of the instrumentTest Setup

7.2.4. Test Setup



7.2.5. Test Result

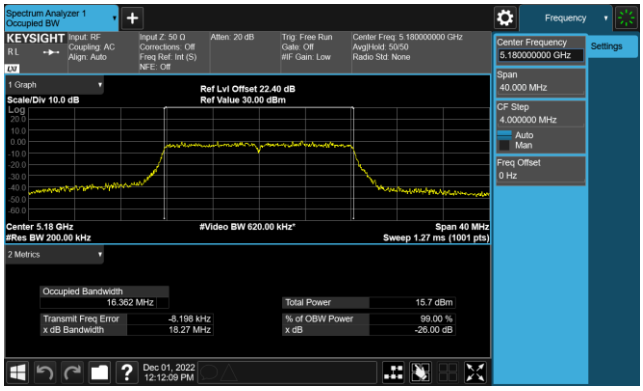
Product	IEEE 802.11 a/b/g/n/ac 2T2R USB Wi-Fi Module Integrated Bluetooth 2.1/3.0/4.2/5.0	Test Engineer	Marvin
Test Site	SR2	Test Date	2022/12/1
Test Item	26dB Bandwidth & 99% Bandwidth		

Test Mode	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 0				
802.11a	36	5180	18.270	16.362
802.11a	44	5220	18.220	16.375
802.11a	48	5240	18.290	16.374
802.11a	52	5260	18.260	16.357
802.11a	60	5300	18.200	16.362
802.11a	64	5320	18.100	16.347
802.11a	100	5500	18.110	16.370
802.11a	118	5580	18.540	16.369
802.11a	140	5700	18.100	16.371
802.11a	144	5720	17.980	16.359
802.11a	149	5745	18.370	16.369
802.11a	157	5785	18.300	16.368
802.11a	165	5825	18.110	16.346
802.11n-HT20	36	5180	19.090	17.556
802.11n-HT20	44	5220	19.250	17.568
802.11n-HT20	48	5240	19.250	17.555
802.11n-HT20	52	5260	19.120	17.567
802.11n-HT20	60	5300	19.250	17.557
802.11n-HT20	64	5320	19.080	17.568
802.11n-HT20	100	5500	19.170	17.554
802.11n-HT20	118	5580	19.180	17.553
802.11n-HT20	140	5700	19.270	17.563
802.11n-HT20	144	5720	19.220	17.559
802.11n-HT20	149	5745	19.270	17.573
802.11n-HT20	157	5785	19.240	17.542
802.11n-HT20	165	5825	18.970	17.548

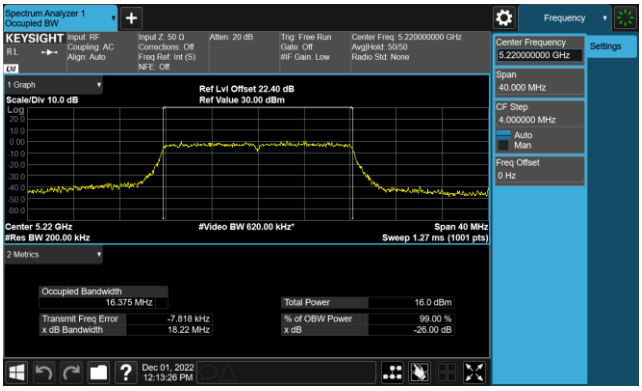
Test Mode	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11n-HT40	38	5190	40.040	36.073
802.11n-HT40	46	5230	39.640	36.098
802.11n-HT40	54	5270	39.470	36.036
802.11n-HT40	62	5310	39.920	36.122
802.11n-HT40	102	5510	39.480	36.031
802.11n-HT40	110	5550	40.620	36.023
802.11n-HT40	134	5670	40.360	36.052
802.11n-HT40	142	5710	39.490	36.069
802.11n-HT40	151	5755	40.090	36.093
802.11n-HT40	159	5795	40.020	36.043
802.11ac-VHT80	42	5210	80.060	74.646
802.11ac-VHT80	58	5290	79.500	74.602
802.11ac-VHT80	106	5530	79.670	74.709
802.11ac-VHT80	122	5610	79.340	74.708
802.11ac-VHT80	138	5690	79.350	74.708
802.11ac-VHT80	155	5775	80.000	74.727

802.11a 26dB Bandwidth & 99% Bandwidth

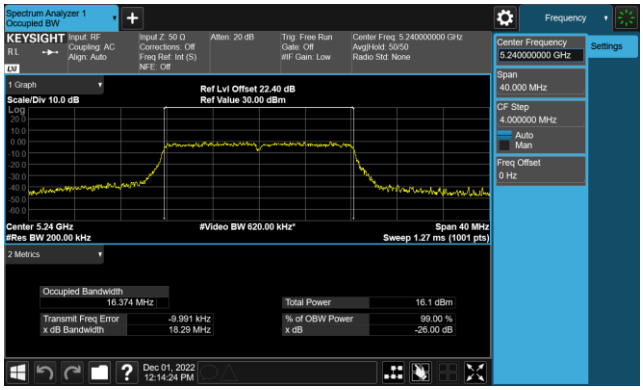
Channel 36 (5180MHz)



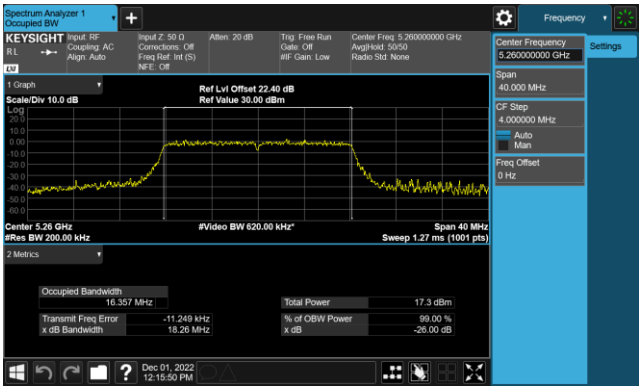
Channel 44 (5220MHz)



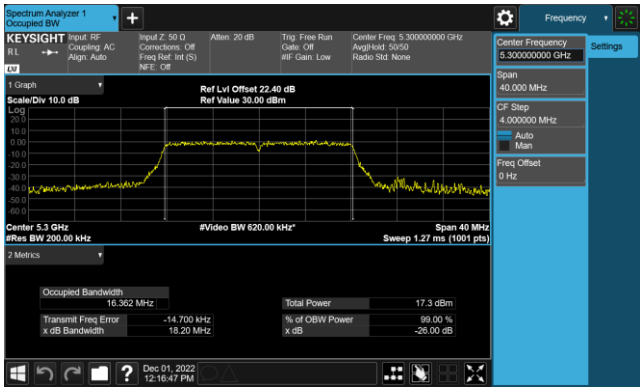
Channel 48 (5240MHz)



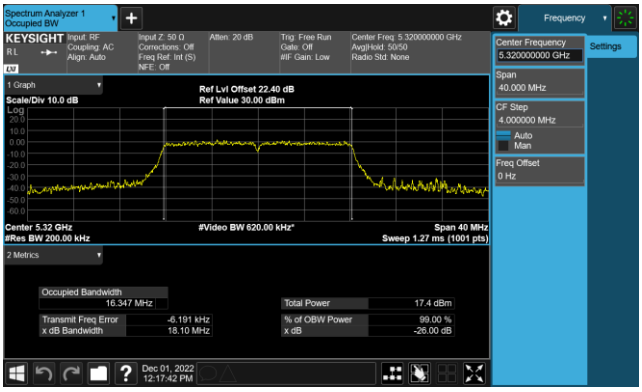
Channel 52 (5260MHz)

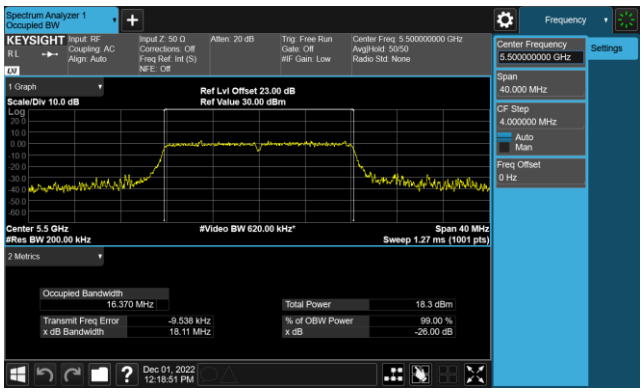
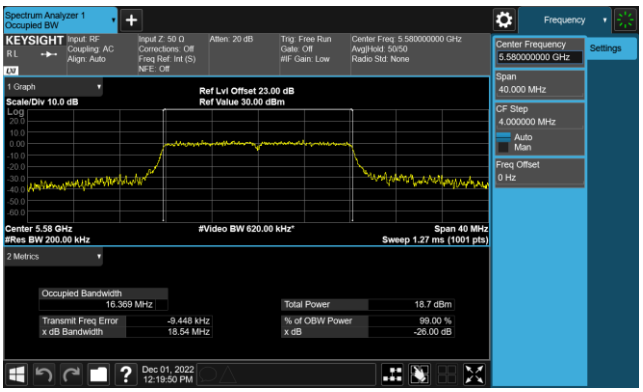
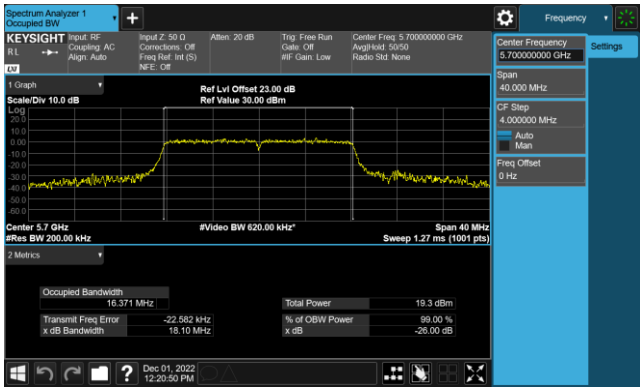
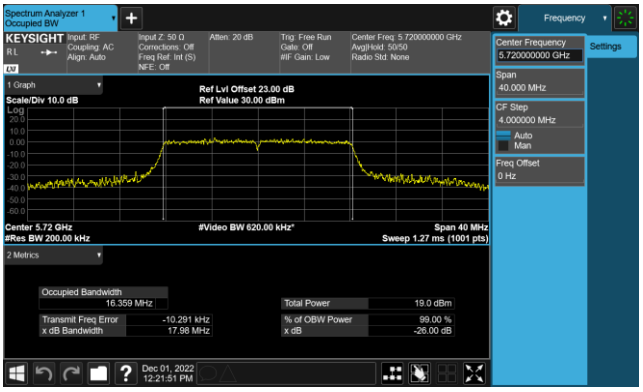
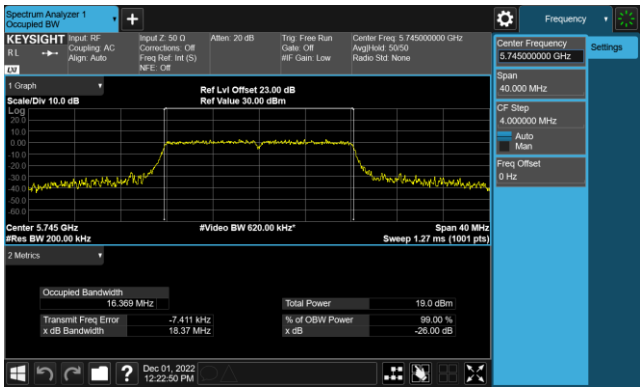
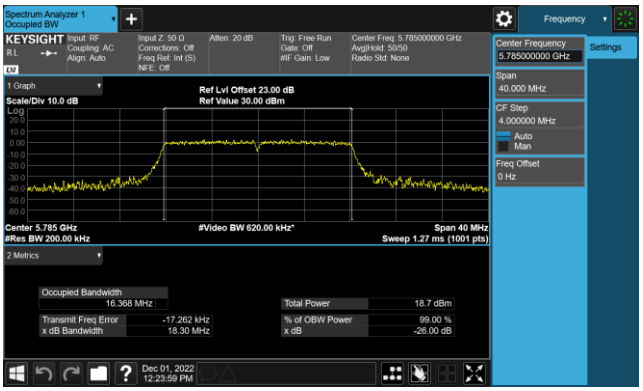


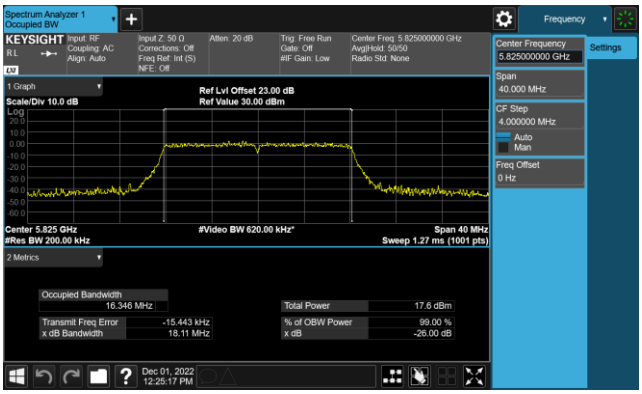
Channel 60 (5300MHz)



Channel 64 (5320MHz)

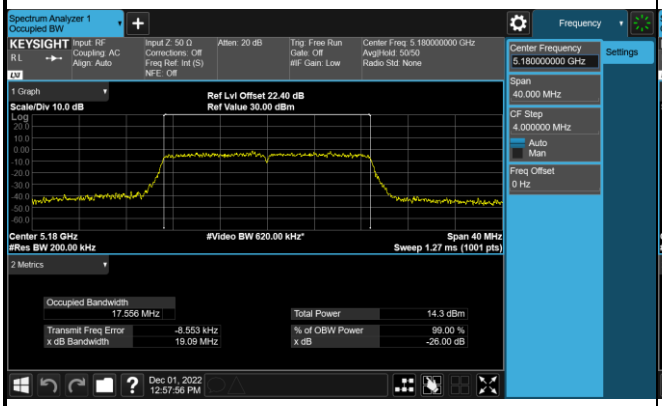


Channel 100 (5500MHz)	Channel 118 (5580MHz)
	
Channel 140 (5700MHz)	**Channel 144 (5720MHz)**
	
Channel 149 (5745MHz)	**Channel 157 (5785MHz)**
	

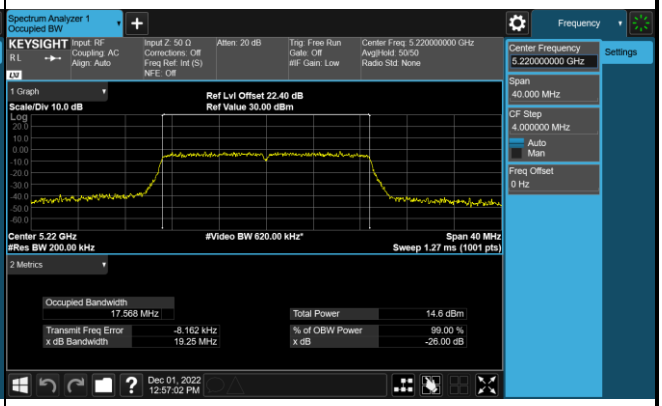
Channel 165 (5825MHz)	
	

802.11n-HT20 26dB Bandwidth & 99% Bandwidth

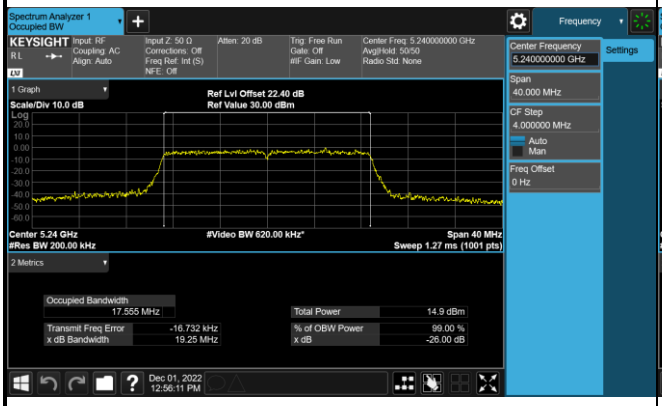
Channel 36 (5180MHz)



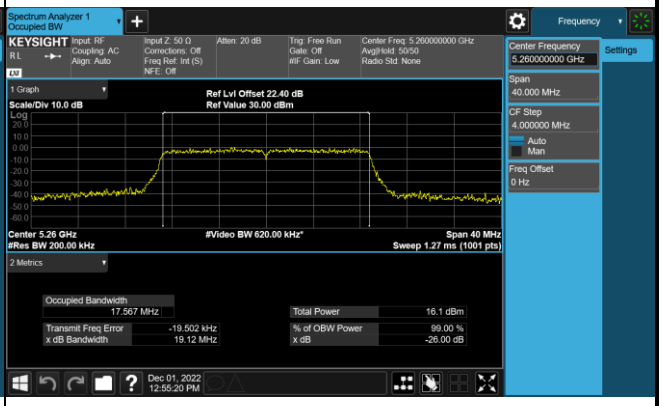
Channel 44 (5220MHz)



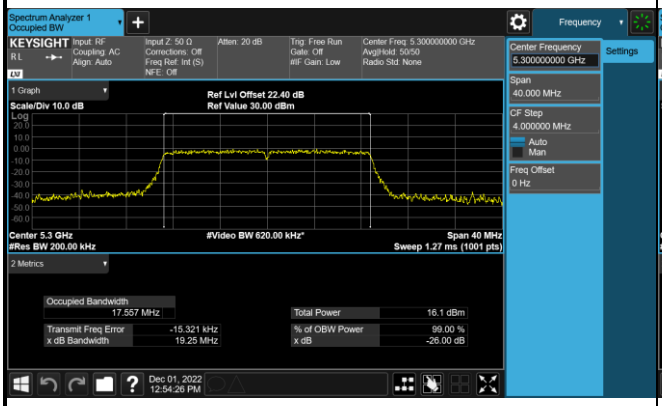
Channel 48 (5240MHz)



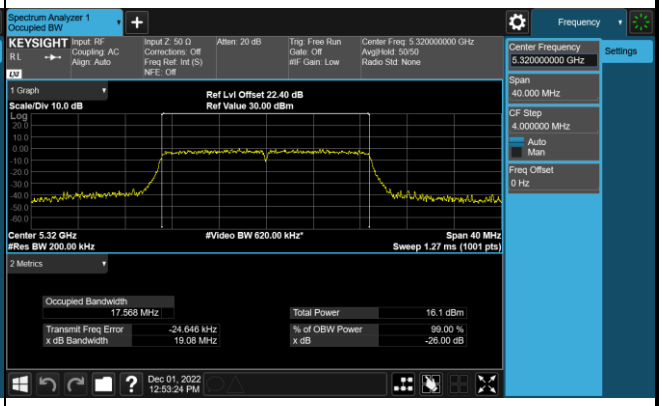
Channel 52 (5260MHz)



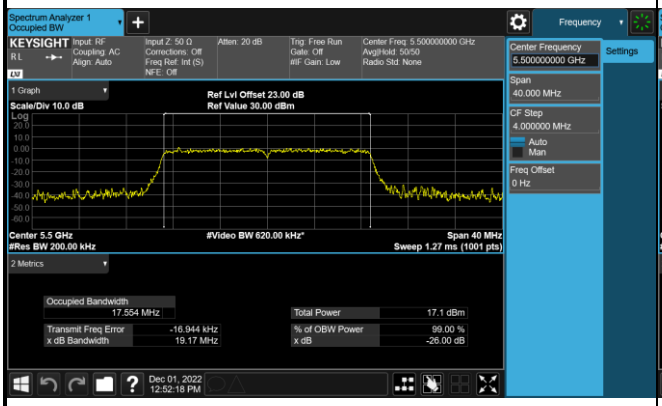
Channel 60 (5300MHz)



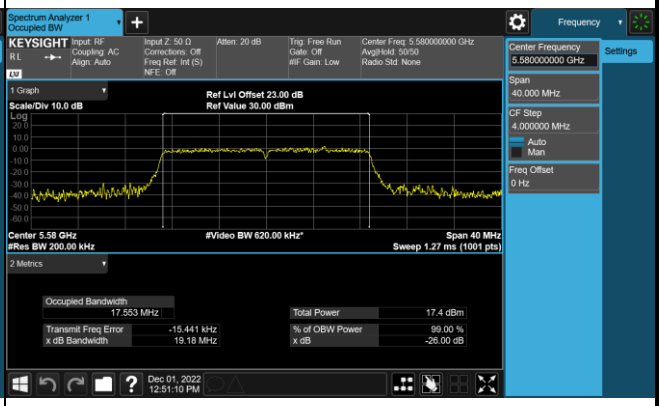
Channel 64 (5320MHz)



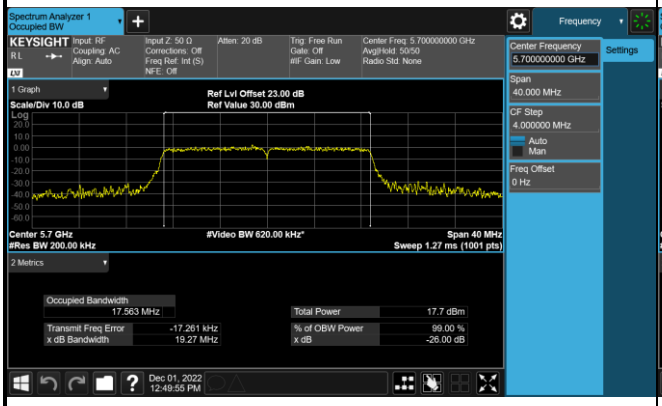
Channel 100 (5500MHz)



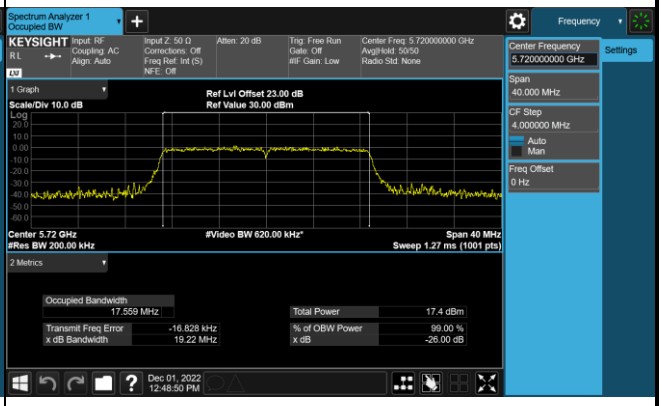
Channel 118 (5580MHz)



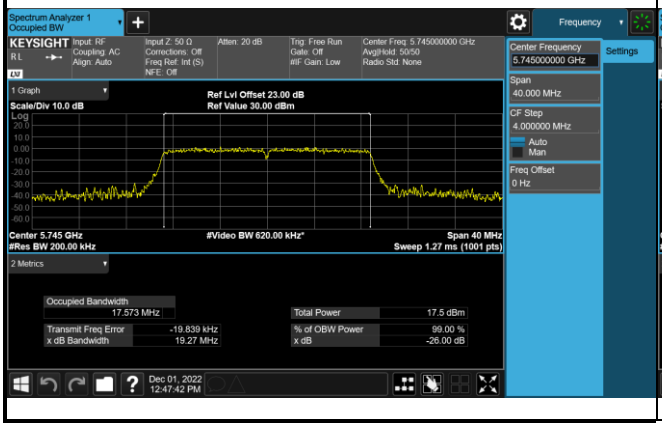
Channel 140 (5700MHz)



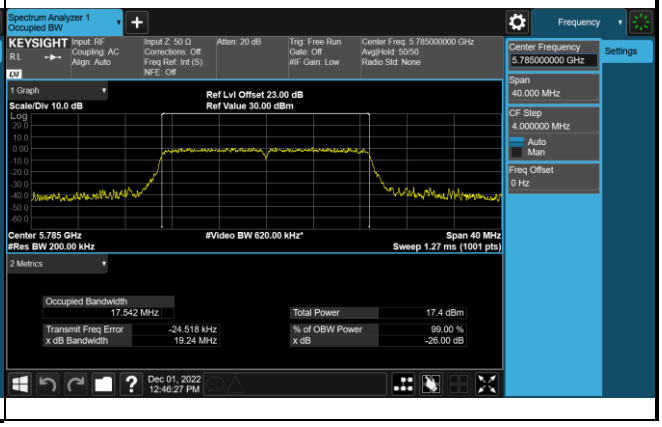
Channel 144 (5720MHz)

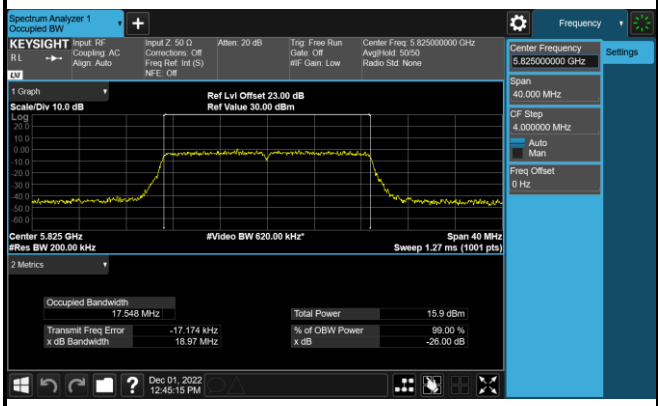


Channel 149 (5745MHz)



Channel 157 (5785MHz)

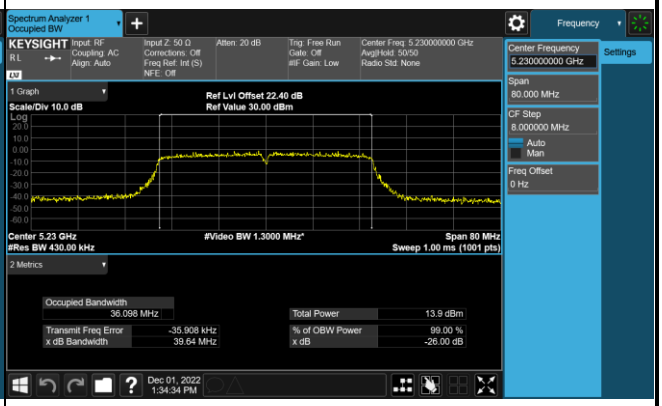


Channel 165 (5825MHz)	
	

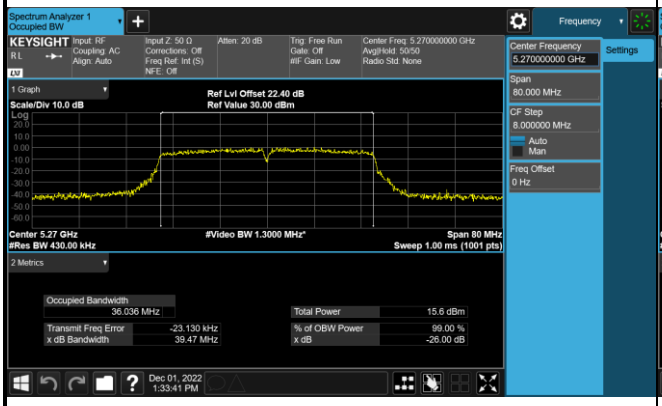
802.11n-HT40 26dB Bandwidth & 99% Bandwidth

Channel 38 (5190MHz)

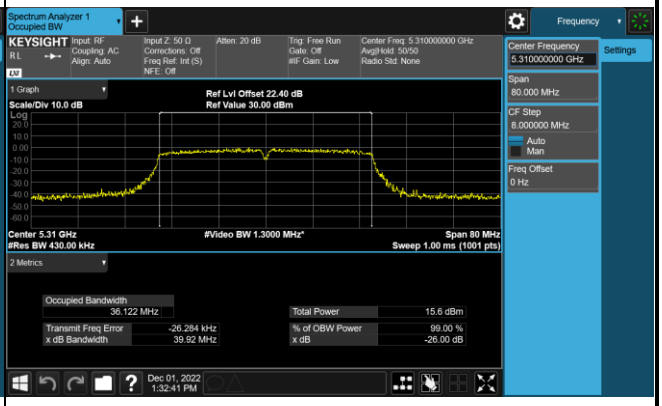
Channel 46 (5230MHz)



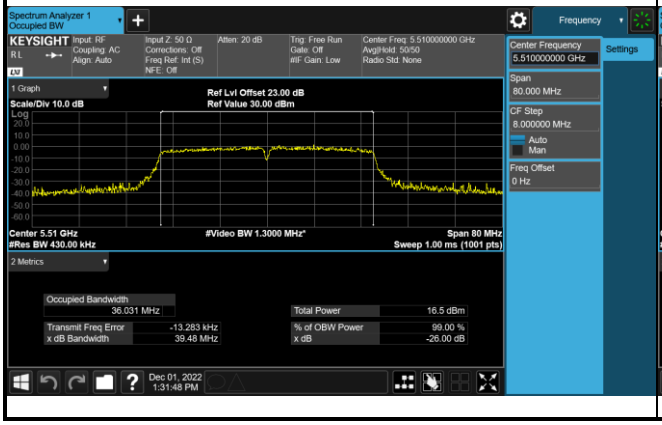
Channel 54 (5270MHz)



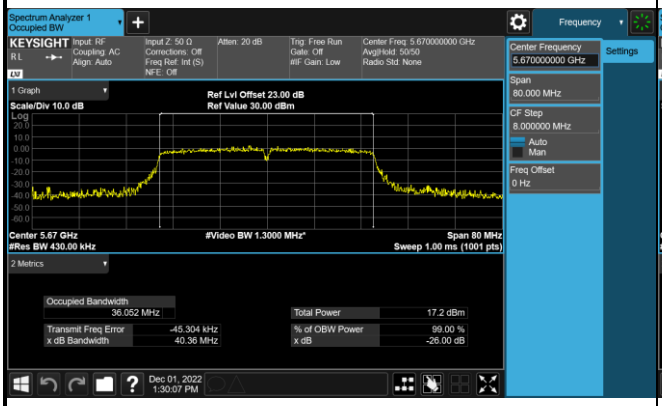
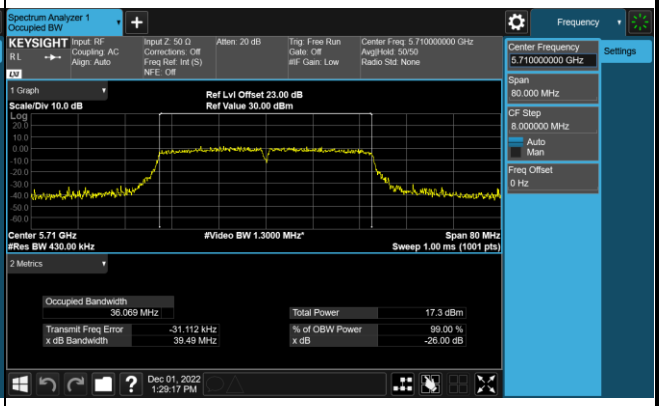
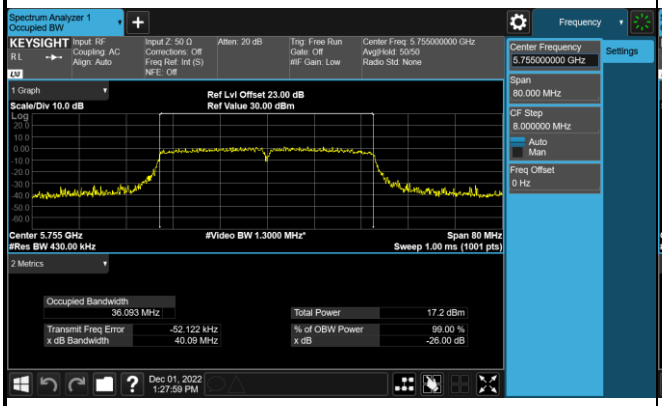
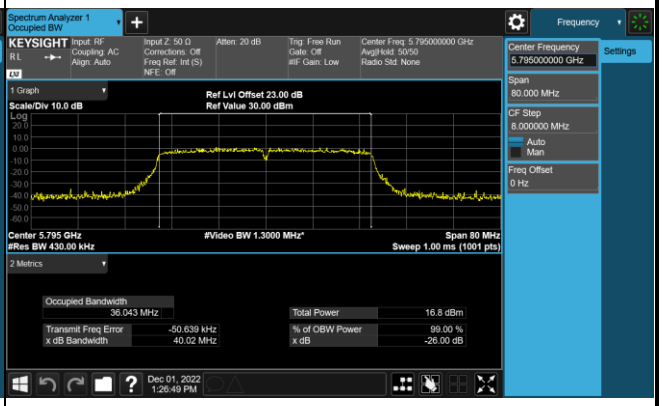
Channel 62 (5310MHz)



Channel 102 (5510MHz)



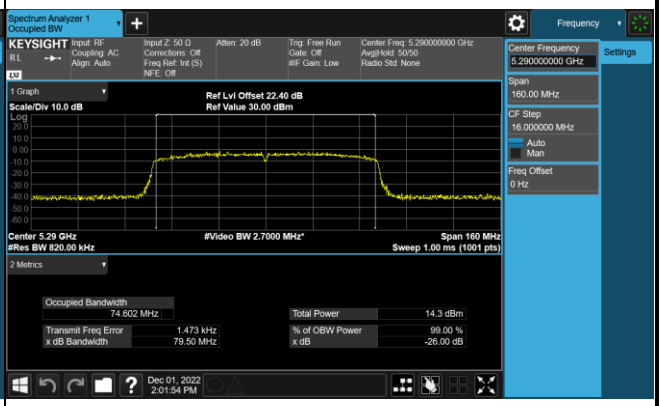
Channel 110 (5550MHz)

Channel 134 (5670MHz)	Channel 142 (5710MHz)
	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

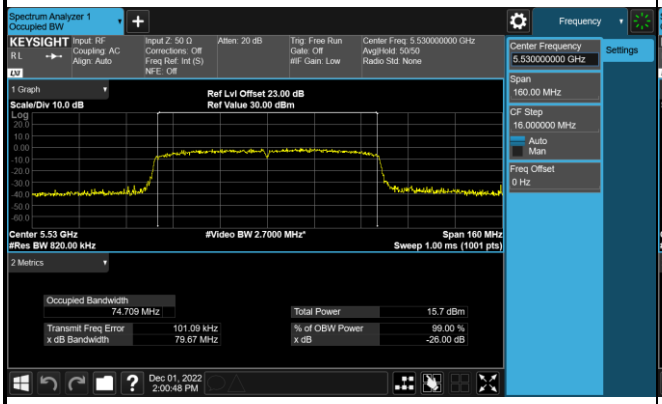
802.11ac-VHT80 26dB Bandwidth & 99% Bandwidth

Channel 42 (5210MHz)

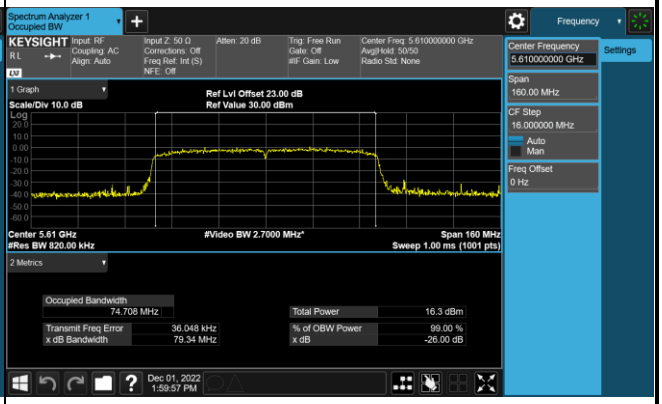
Channel 58 (5290MHz)



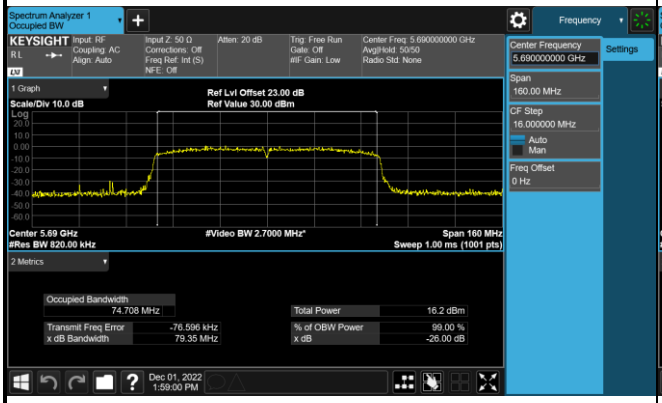
Channel 106 (5530MHz)



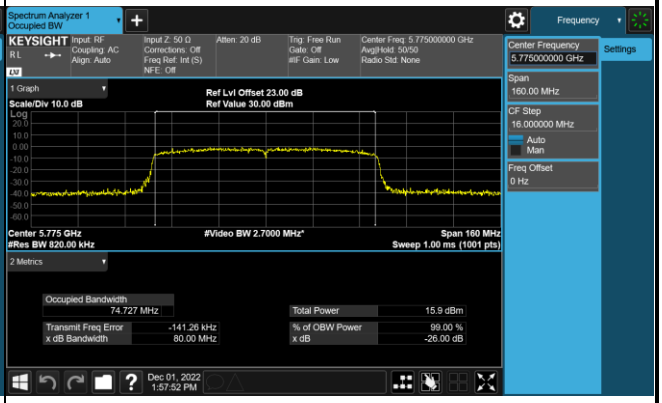
Channel 122 (5610MHz)



Channel 138 (5690MHz)



Channel 155 (5775MHz)



7.3. 6dB Bandwidth Measurement

7.3.1. Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

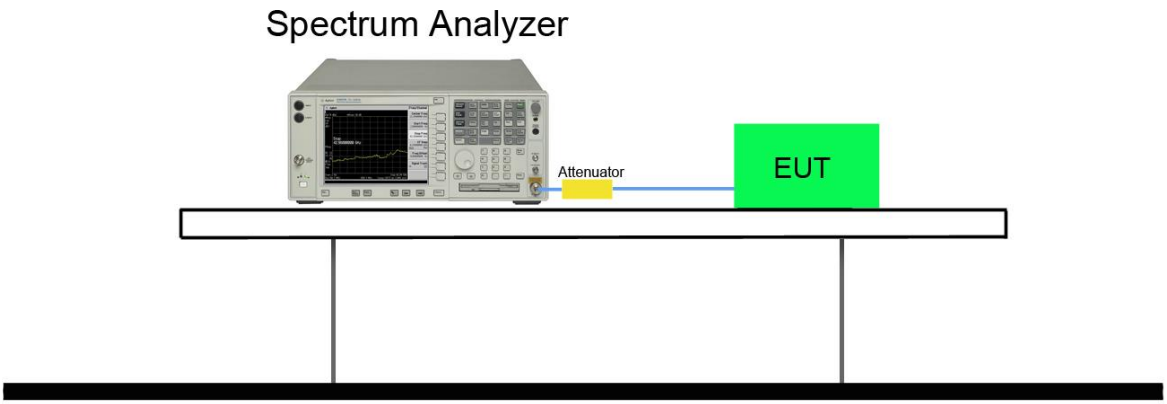
7.3.2. Test Procedure used

KDB 789033 D02v02r01- Section II)C)2)

7.3.3. Test Setting

1. Set center frequency to the nominal EUT channel center frequency.
2. RBW = 100 kHz.
3. VBW ≧ 3 × RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

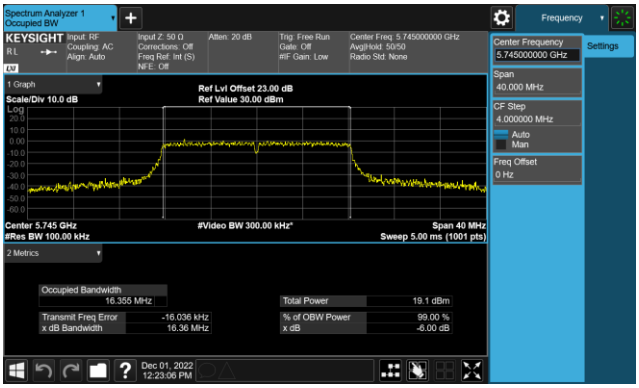
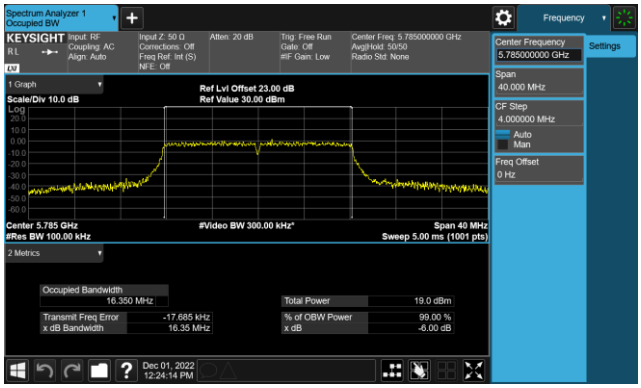
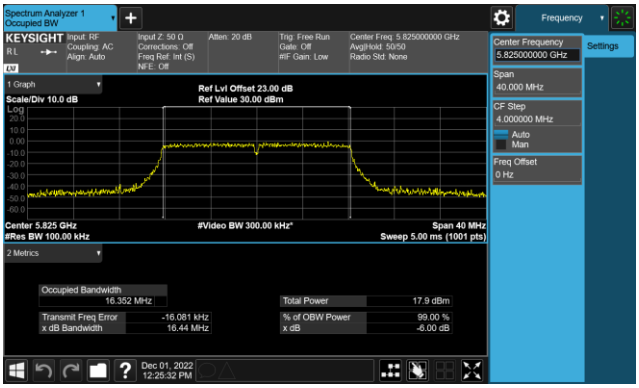
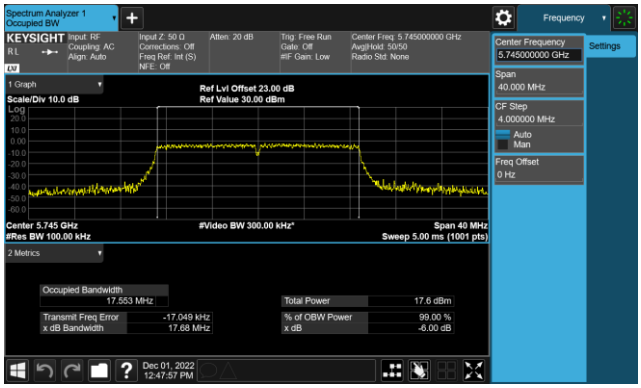
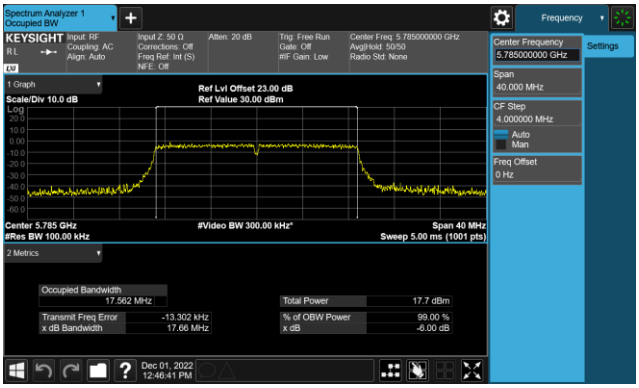
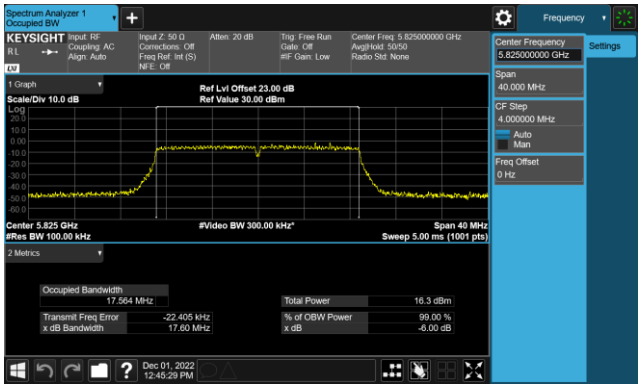
7.3.4. Test Setup

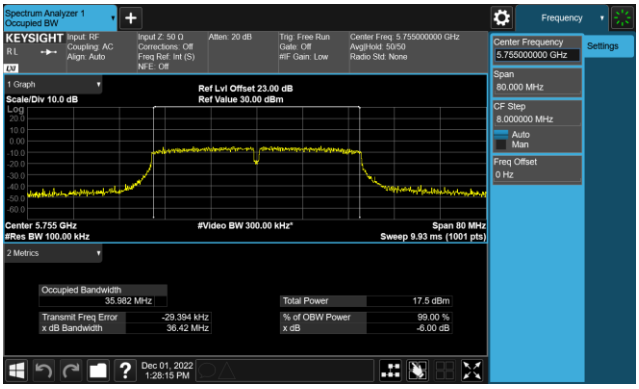
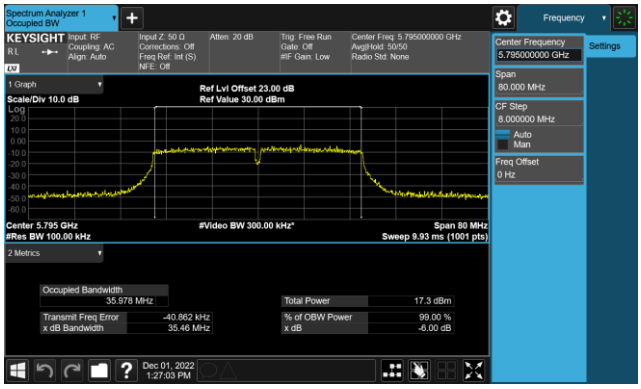
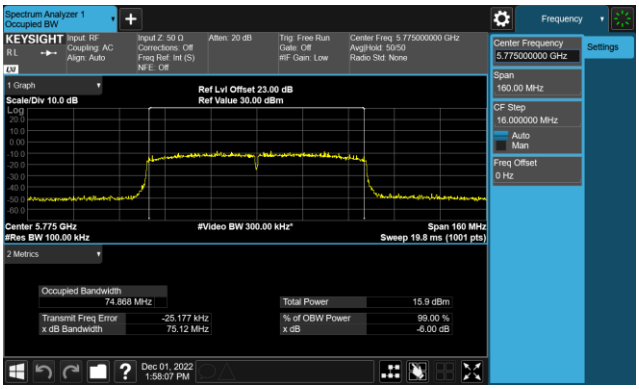


7.3.5. Test Result

Product	IEEE 802.11 a/b/g/n/ac 2T2R USB Wi-Fi Module Integrated Bluetooth 2.1/3.0/4.2/5.0	Test Engineer	Marvin
Test Site	SR2	Test Date	2022/12/1
Test Item	6dB Bandwidth		

Test Mode	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Ant 0					
802.11a	149	5745	16.360	≥ 0.5	Pass
802.11a	157	5785	16.350	≥ 0.5	Pass
802.11a	165	5825	16.440	≥ 0.5	Pass
802.11n-HT20	149	5745	17.680	≥ 0.5	Pass
802.11n-HT20	157	5785	17.660	≥ 0.5	Pass
802.11n-HT20	165	5825	17.600	≥ 0.5	Pass
802.11n-HT40	151	5755	36.420	≥ 0.5	Pass
802.11n-HT40	159	5795	35.460	≥ 0.5	Pass
802.11ac-VHT80	155	5775	75.120	≥ 0.5	Pass

802.11 a CH149 (5745MHz)	802.11 a CH157 (5785MHz)
	
802.11 a CH165 (5825MHz)	**802.11 n-HT20 CH149 (5745MHz)**
	
802.11 n-HT20 CH157 (5785MHz)	**802.11 n-HT20 CH165 (5825MHz)**
	

802.11 n-HT40 CH151 (5755MHz)	802.11 n-HT40 CH159 (5795MHz)
	
802.11 ac-VHT80 CH155 (5775MHz)	
	

7.4. Output Power Measurement

7.4.1. Test Limit

For FCC Power Measurement Limit

For client operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 250mW.
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW (23.98dBm) or 11dBm +10 log (26dB BW).
For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm).

If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

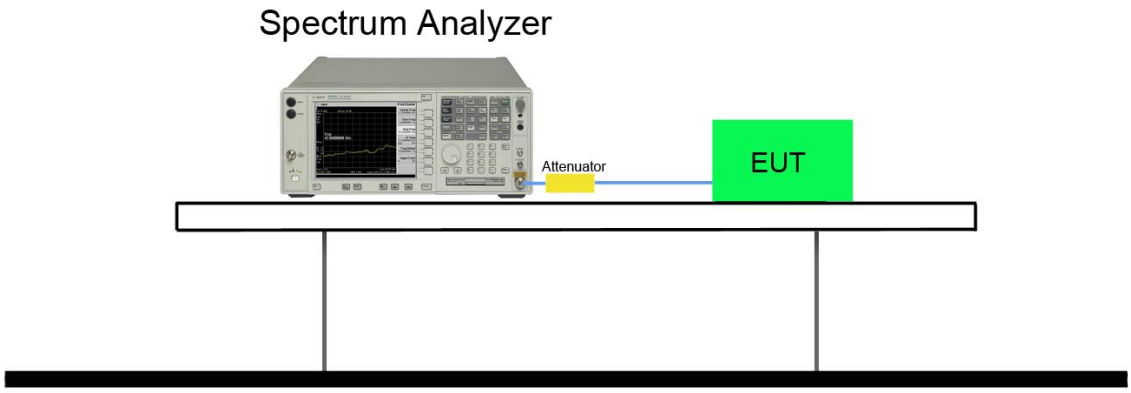
7.4.2. Test Procedure Used

KDB 789033 D02v02r01 - Section II)E) 3) b) Method PM-G

7.4.3. Test Setting

Average power measurements were perform only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

7.4.4. Test Setup



7.4.5. Test Result

Product	IEEE 802.11 a/b/g/n/ac 2T2R USB Wi-Fi Module Integrated Bluetooth 2.1/3.0/4.2/5.0	Test Engineer	Marvin
Test Site	SR5	Test Date	2022/12/1
Test Item	Output Power		

Model	Rate	Ch.	Freq. (MHz)	Ant 0 Power (dBm)	Ant 1 Power (dBm)	Ant 0+1 Power (dBm)	Power Limit (dBm)
802.11a Band1	6M	36	5180	12.52	14.92	N/A	23.98
	6M	44	5220	12.76	14.60	N/A	23.98
	6M	48	5240	13.07	14.83	N/A	23.98
802.11a Band2	6M	52	5260	14.37	14.05	N/A	23.98
	6M	60	5300	14.12	13.72	N/A	23.98
	6M	64	5320	13.96	13.78	N/A	23.98
802.11a Band3	6M	100	5500	15.20	13.96	N/A	23.98
	6M	116	5580	15.57	13.67	N/A	23.98
	6M	140	5700	15.47	14.51	N/A	23.98
	6M	144	5720	15.45	14.35	N/A	22.46
802.11a Band4	6M	149	5745	15.41	13.38	N/A	30.00
	6M	157	5785	15.26	13.83	N/A	30.00
	6M	165	5825	14.18	13.33	N/A	30.00
n-HT20 Band1	MCS8	36	5180	10.75	12.82	14.92	23.98
	MCS8	44	5220	10.93	12.40	14.74	23.98
	MCS8	48	5240	11.02	12.49	14.83	23.98
n-HT20 Band2	MCS8	52	5260	12.12	11.73	14.94	23.98
	MCS8	60	5300	11.86	11.45	14.67	23.98
	MCS8	64	5320	11.84	11.47	14.67	23.98
n-HT20 Band3	MCS8	100	5500	13.02	11.41	15.30	23.98
	MCS8	116	5580	13.37	11.26	15.45	23.98
	MCS8	140	5700	13.67	12.30	16.05	23.98
	MCS8	144	5720	13.40	12.12	15.82	22.65
n-HT20 Band4	MCS8	149	5745	12.37	11.08	14.78	30.00
	MCS8	157	5785	13.48	11.48	15.60	30.00
	MCS8	165	5825	12.35	11.18	14.81	30.00

ac-VHT20 Band1	Nss2 MCS0	36	5180	10.35	12.59	14.62	23.98
	Nss2 MCS0	44	5220	10.68	12.22	14.53	23.98
	Nss2 MCS0	48	5240	10.81	12.28	14.62	23.98
ac-VHT20 Band2	Nss2 MCS0	52	5260	11.82	11.62	14.73	23.98
	Nss2 MCS0	60	5300	11.64	11.32	14.49	23.98
	Nss2 MCS0	64	5320	11.46	11.33	14.41	23.98
ac-VHT20 Band3	Nss2 MCS0	100	5500	11.29	11.31	14.31	23.98
	Nss2 MCS0	116	5580	12.38	11.52	14.98	23.98
	Nss2 MCS0	140	5700	12.12	12.16	15.15	23.98
	Nss2 MCS0	144	5720	11.89	12.05	14.98	22.65
ac-VHT20 Band4	Nss2 MCS0	149	5745	11.89	11.14	14.54	30.00
	Nss2 MCS0	157	5785	12.24	11.59	14.94	30.00
	Nss2 MCS0	165	5825	12.36	11.21	14.83	30.00
n-HT40 Band1	MCS9	38	5190	10.89	13.05	15.11	23.98
	MCS9	46	5230	11.54	13.01	15.35	23.98
n-HT40 Band2	MCS9	54	5270	12.74	12.38	15.57	23.98
	MCS9	62	5310	12.84	12.56	15.71	23.98
n-HT40 Band3	MCS9	102	5510	14.24	12.54	16.48	23.98
	MCS9	110	5550	14.54	12.01	16.47	23.98
	MCS9	134	5670	14.59	12.82	16.80	23.98
	MCS9	142	5710	14.51	13.08	16.86	23.98
n-HT40 Band4	MCS9	151	5755	14.86	12.03	16.68	30.00
	MCS9	159	5795	14.40	12.28	16.48	30.00
ac-VHT40 Band1	Nss2 MCS0	38	5190	11.03	12.81	15.02	23.98
	Nss2 MCS0	46	5230	11.27	12.54	14.96	23.98
ac-VHT40 Band2	Nss2 MCS0	54	5270	12.21	11.67	14.96	23.98
	Nss2 MCS0	62	5310	12.29	11.98	15.15	23.98
ac-VHT40 Band3	Nss2 MCS0	102	5510	13.44	11.69	15.66	23.98
	Nss2 MCS0	110	5550	13.83	11.18	15.71	23.98
	Nss2 MCS0	134	5670	13.78	11.98	15.98	23.98
	Nss2 MCS0	142	5710	13.74	12.19	16.04	23.98
ac-VHT40 Band4	Nss2 MCS0	151	5755	14.23	11.21	15.99	30.00
	Nss2 MCS0	159	5795	13.89	11.68	15.93	30.00

ac-VHT80 Band1	Nss2 MCS1	42	5210	7.62	12.90	14.03	23.98
ac-VHT80 Band2	Nss2 MCS1	58	5290	11.64	11.98	14.82	23.98
ac-VHT80 Band3	Nss2 MCS1	106	5530	13.16	11.72	15.51	23.98
	Nss2 MCS1	122	5610	13.79	11.55	15.82	23.98
	Nss2 MCS1	138	5690	13.13	12.62	15.89	23.98
ac-VHT80 Band4	Nss2 MCS1	155	5775	13.24	11.94	15.65	30.00

Note: Output power =10*log{$10^{\text{Ant 0 RF Output Power /10}}$ +$10^{\text{Ant 1 RF Output Power /10}}$} (dBm).

7.5. Transmit Power Control

7.5.1. Test Limit

The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm.

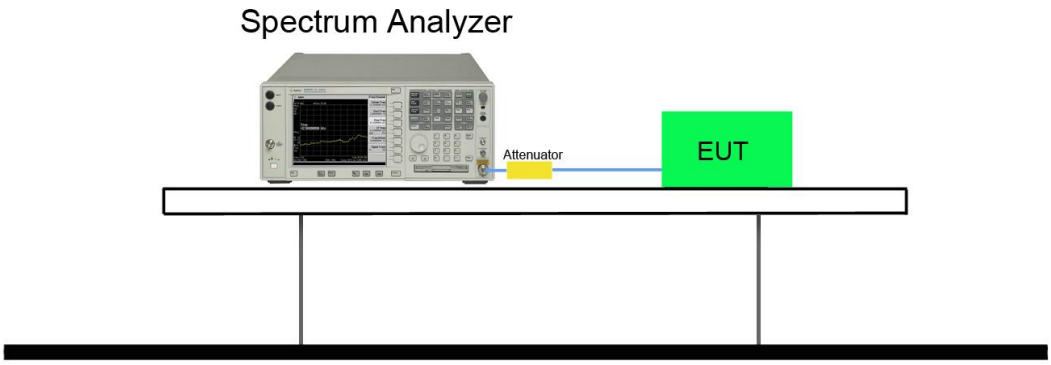
7.5.2. Test Procedure Used

KDB 789033 D02v02r01 - Section II) E) 3) b) Method PM-G

7.5.3. Test Setting

Average power measurements were perform only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

7.5.4. Test Setup



7.5.5. Test Result

Note: TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

7.6. Power Spectral Density Measurement

7.6.1. Test Limit

For FCC Power Spectral Density Limit

For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

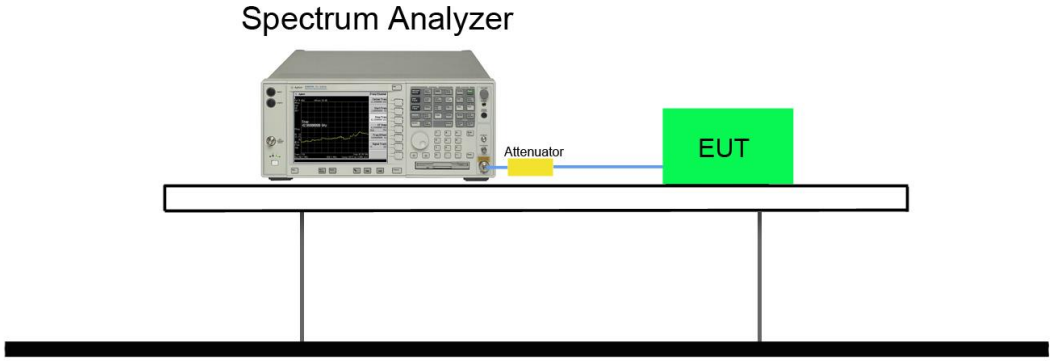
7.6.2. Test Procedure Used

KDB 789033 D02v02r01 - Section II)F)

7.6.3. Test Setting

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire 26dB EBW of the signal
3. RBW = 1MHz (510kHz, if measurement bandwidth of Maximum PSD is specified in 500 kHz)
4. VBW = 3MHz
5. Number of sweep points ≥ 2 × (span / RBW)
6. Detector = power averaging (Average)
7. Sweep time = auto
8. Trigger = free run
9. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.
10. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
11. Add 10*log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10*log(1/0.25) = 6 dB if the duty cycle is 25 percent.

7.6.4. Test Setup



7.6.5. Test Result

Product	IEEE 802.11 a/b/g/n/ac 2T2R USB Wi-Fi Module Integrated Bluetooth 2.1/3.0/4.2/5.0	Test Engineer	Marvin
Test Site	SR2	Test Date	2022/12/1
Test Item	Power Spectral Density		

U-NII-1 & U-NII-2A & U-NII-2C

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	PSD (dBm/ MHz) Ant0	PSD (dBm/ MHz) Ant1	Duty Cycle (%)	Total PSD (dBm/ MHz) Ant0	Total PSD (dBm/ MHz) Ant1	PSD Limit (dBm/MHz)	Result
11a	6	36	5180	-0.382	2.638	91.05%	0.025	3.045	≤ 11	Pass
11a	6	44	5220	0.085	2.158	91.05%	0.492	2.565	≤ 11	Pass
11a	6	48	5240	0.613	2.457	91.05%	1.020	2.864	≤ 11	Pass
11a	6	52	5260	1.781	2.148	91.05%	2.188	2.555	≤ 11	Pass
11a	6	60	5300	1.911	2.092	91.05%	2.318	2.499	≤ 11	Pass
11a	6	64	5320	1.689	2.107	91.05%	2.096	2.514	≤ 11	Pass
11a	6	100	5500	2.711	1.572	91.05%	3.118	1.979	≤ 11	Pass
11a	6	118	5580	3.356	1.195	91.05%	3.763	1.602	≤ 11	Pass
11a	6	140	5700	3.997	1.823	91.05%	4.404	2.230	≤ 11	Pass
11a	6	144	5720	3.236	1.574	91.05%	3.643	1.981	≤ 11	Pass

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	PSD (dBm/ MHz) Ant0	PSD (dBm/ MHz) Ant1	Duty Cycle (%)	Total PSD (dBm/ MHz)	PSD Limit (dBm/MHz)	Result
11n-HT20	6.5	36	5180	-1.286	0.903	95.18%	3.170	≤ 11	Pass
11n-HT20	6.5	44	5220	-1.334	1.130	95.18%	3.295	≤ 11	Pass
11n-HT20	6.5	48	5240	-1.051	1.367	95.18%	3.549	≤ 11	Pass
11n-HT20	6.5	52	5260	0.294	0.667	95.18%	3.709	≤ 11	Pass
11n-HT20	6.5	60	5300	0.176	0.437	95.18%	3.533	≤ 11	Pass
11n-HT20	6.5	64	5320	0.499	0.599	95.18%	3.774	≤ 11	Pass
11n-HT20	6.5	100	5500	1.028	0.368	95.18%	3.935	≤ 11	Pass
11n-HT20	6.5	118	5580	1.120	0.148	95.18%	3.886	≤ 11	Pass
11n-HT20	6.5	140	5700	1.925	0.562	95.18%	4.522	≤ 11	Pass
11n-HT20	6.5	144	5720	1.393	0.333	95.18%	4.120	≤ 11	Pass
11n-HT40	13.5	38	5190	-4.884	-2.145	81.45%	0.599	≤ 11	Pass
11n-HT40	13.5	46	5230	-4.572	-2.511	81.45%	0.481	≤ 11	Pass
11n-HT40	13.5	54	5270	-2.790	-3.262	81.45%	0.882	≤ 11	Pass
11n-HT40	13.5	62	5310	-3.022	-3.069	81.45%	0.856	≤ 11	Pass
11n-HT40	13.5	102	5510	-2.547	-2.971	81.45%	1.148	≤ 11	Pass
11n-HT40	13.5	110	5550	-2.031	-3.968	81.45%	1.009	≤ 11	Pass
11n-HT40	13.5	134	5670	-1.383	-3.319	81.45%	1.657	≤ 11	Pass
11n-HT40	13.5	142	5710	-2.031	-2.983	81.45%	1.420	≤ 11	Pass
11ac-VHT80	29.3	42	5210	-9.509	-6.393	68.40%	-3.018	≤ 11	Pass
11ac-VHT80	29.3	58	5290	-7.565	-6.949	68.40%	-2.586	≤ 11	Pass
11ac-VHT80	29.3	106	5530	-6.394	-7.497	68.40%	-2.251	≤ 11	Pass
11ac-VHT80	29.3	122	5610	-5.846	-7.843	68.40%	-2.071	≤ 11	Pass
11ac-VHT80	29.3	138	5690	-6.664	-7.582	68.40%	-2.439	≤ 11	Pass

Note: Total PSD (dBm/MHz) = $10*\log\{10^{\text{Ant 0 PSD }/10} + 10^{\text{Ant 1 PSD }/10}\}$ (dBm/MHz) + 10*log(1/duty cycle).

U-NII-3

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	PSD (dBm/ 510kHz) Ant0	PSD (dBm/ 510kHz) Ant1	Duty Cycle (%)	Total PSD (dBm/ 510kHz) Ant0	Total PSD (dBm/ 510kHz) Ant1	PSD Limit (dBm/500kHz)	Result
11a	6	149	5745	0.519	-2.423	91.05%	0.926	-2.016	≤ 30	Pass
11a	6	157	5785	0.183	-1.472	91.05%	0.590	-1.065	≤ 30	Pass
11a	6	165	5825	-0.848	-1.758	91.05%	-0.441	-1.351	≤ 30	Pass

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	PSD (dBm/ 510kHz) Ant0	PSD (dBm/ 510kHz) Ant1	Duty Cycle (%)	Total PSD (dBm/ 510kHz)	PSD Limit (dBm/500kHz)	Result
11n-HT20	6.5	149	5745	-1.230	-3.637	95.18%	0.956	≤ 30	Pass
11n-HT20	6.5	157	5785	-1.960	-2.736	95.18%	0.894	≤ 30	Pass
11n-HT20	6.5	165	5825	-2.521	-3.256	95.18%	0.352	≤ 30	Pass
11n-HT40	13.5	151	5755	-4.482	-7.098	81.45%	-1.695	≤ 30	Pass
11n-HT40	13.5	159	5795	-4.926	-6.192	81.45%	-1.612	≤ 30	Pass
11ac-VHT80	29.3	155	5775	-9.494	-10.654	68.40%	-5.376	≤ 30	Pass

Note: Total PSD (dBm/510kHz) = $10*\log\{10^{\text{Ant 0 PSD }/10} + 10^{\text{Ant 1 PSD }/10}\}$ (dBm/510kHz) + 10*log(1/duty cycle).