MEASUREMENT REPORT

FCC ID	:	**XBG-VNS-10WR2**
APPLICANT	:	**AVALUE TECHNOLOGY INCORPORATION**
Application Type	:	**Certification**
Product	:	**Panel PC**
Model No.	:	**VNS-10WR2**
Series Model No.	:	**VNS-10WR2XXXXXXXXXX(where "X" may be any alphanumeric character, blank or "-")**
Brand Name	:	**AVALUE**
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	:	**May 6, 2024**
Test Date	:	**June 17, 2024~ July 3, 2024**

Test By : Owen Tsai
(Owen Tsai)

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
2405TW3102-U4	1.0	Original Report	2024-09-19	

CONTENTS

Description Page

General Information

Applicant	AVALUE TECHNOLOGY INCORPORATION
Applicant Address	7F, 228, Lian-cheng Road, Zhonghe Dist., New Taipei City 235, Taiwan
Manufacturer	AVALUE TECHNOLOGY INCORPORATION
Manufacturer Address	7F, 228, Lian-cheng Road, Zhonghe Dist., New Taipei City 235, Taiwan
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)
Model No.	VNS-10WR2
Test Device Serial No.	#1-1 ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification	Unlicensed National Information Infrastructure (UNII)

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 Canada, EU and TELEC Rules.**

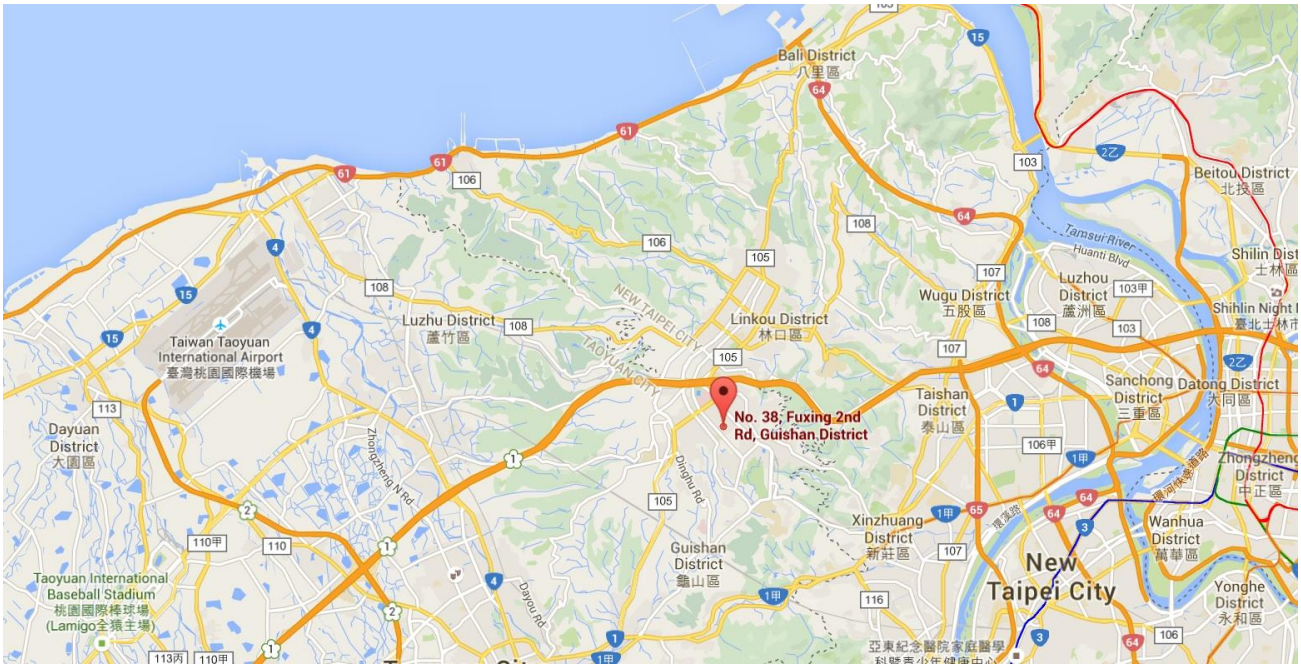
1. INTRODUCTION

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	Panel PC
Model No.	VNS-10WR2
Series Model No.	VNS-10WR2XXXXXXXXXX(where "X" may be any alphanumeric character, blank or "-")
Test Sample Number	#1
Supports Radios Spec.	**WPAN:** Bluetooth V5.1 **WLAN:** 2.4G: 802.11b/g/n-20/n-40 5G: 802.11a/n-20/ac-20/n-40/ac-40/ac-80, Band 1,4
Frequency Range	**2.4GHz:** For 802.11b/g/n-HT20: 2412 ~ 2462 MHz For 802.11n-HT40: 2422 ~ 2452 MHz **5GHz:** For 802.11a/n-HT20/ac-VHT-20: 5180~5320MHz, 5745~5825MHz For 802.11n-HT40/ ac-VHT40: 5190~5310MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5775MHz
Modulation Type	802.11a/n-20/ac-20/n-40/ac-40/ac-80: OFDM (BPSK, QPSK, 16QAM, 64QAM,256QAM)
Accessory	
Power Adapter	Brand: FSP Model No: FSP060-DHAN3 Input: AC 100-240V~1.8A, 50-60Hz Output: DC 12.0V, 5.0A 60.0W Cable Out: Non-shielding, 1.5m with Core*1

Note:

1. Model Difference: The difference of models only for marketing different, the other hardware was the same. (declared by the manufacturer)
2. The test was performed base on VNS-10WR2.

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	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	151	5755 MHz
159	5795 MHz	--	--	--	--

802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	155	5775 MHz	--	--

2.3. Test Mode

Test Mode	Mode 1: Transmit by 802.11a
	Mode 2: Transmit by 802.11n-HT20
	Mode 3: Transmit by 802.11n-HT40
	Mode 4: Transmit by 802.11ac-VHT80
	Mode 5: Transmit by 802.11a (By PoE)

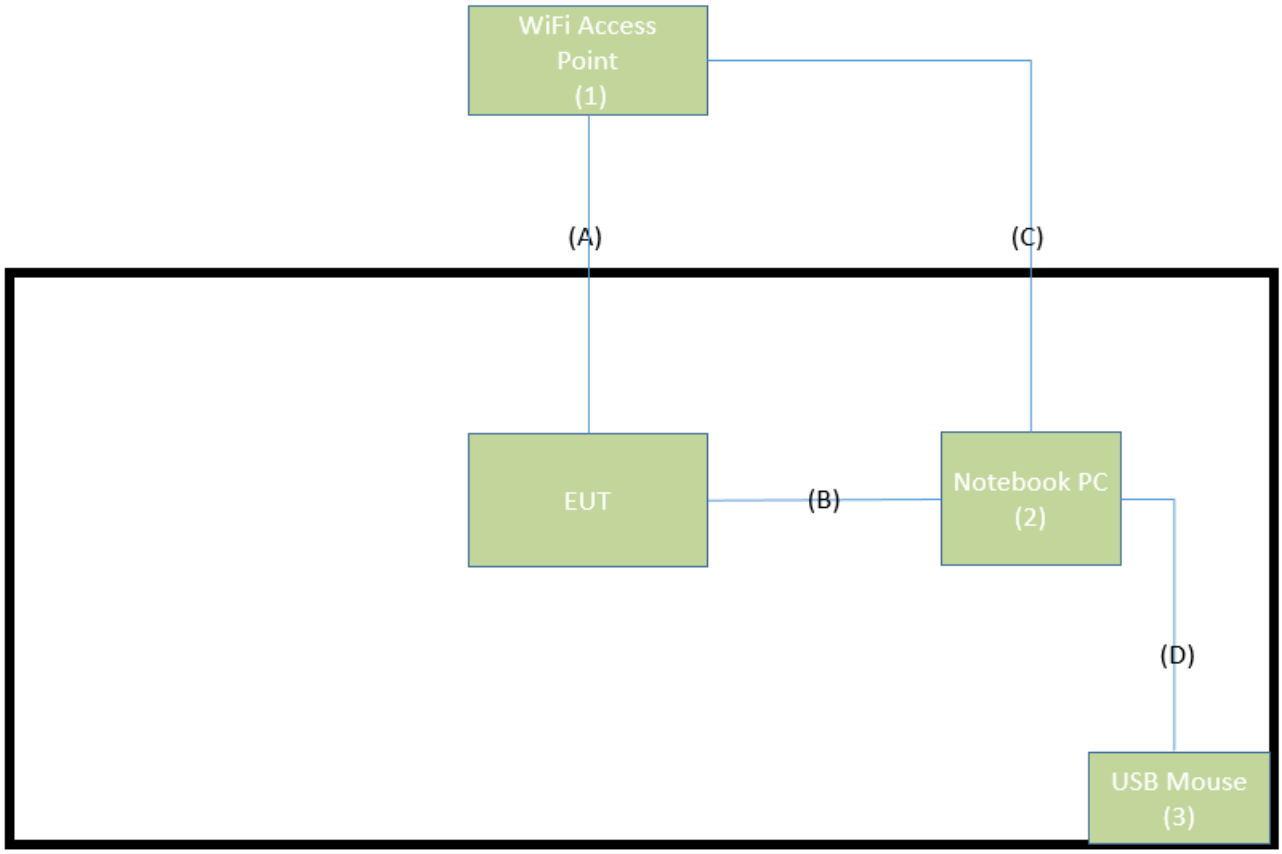
2.4. Test Software

The test utility software used during testing was “adb.exe”.

2.5. Test Configuration

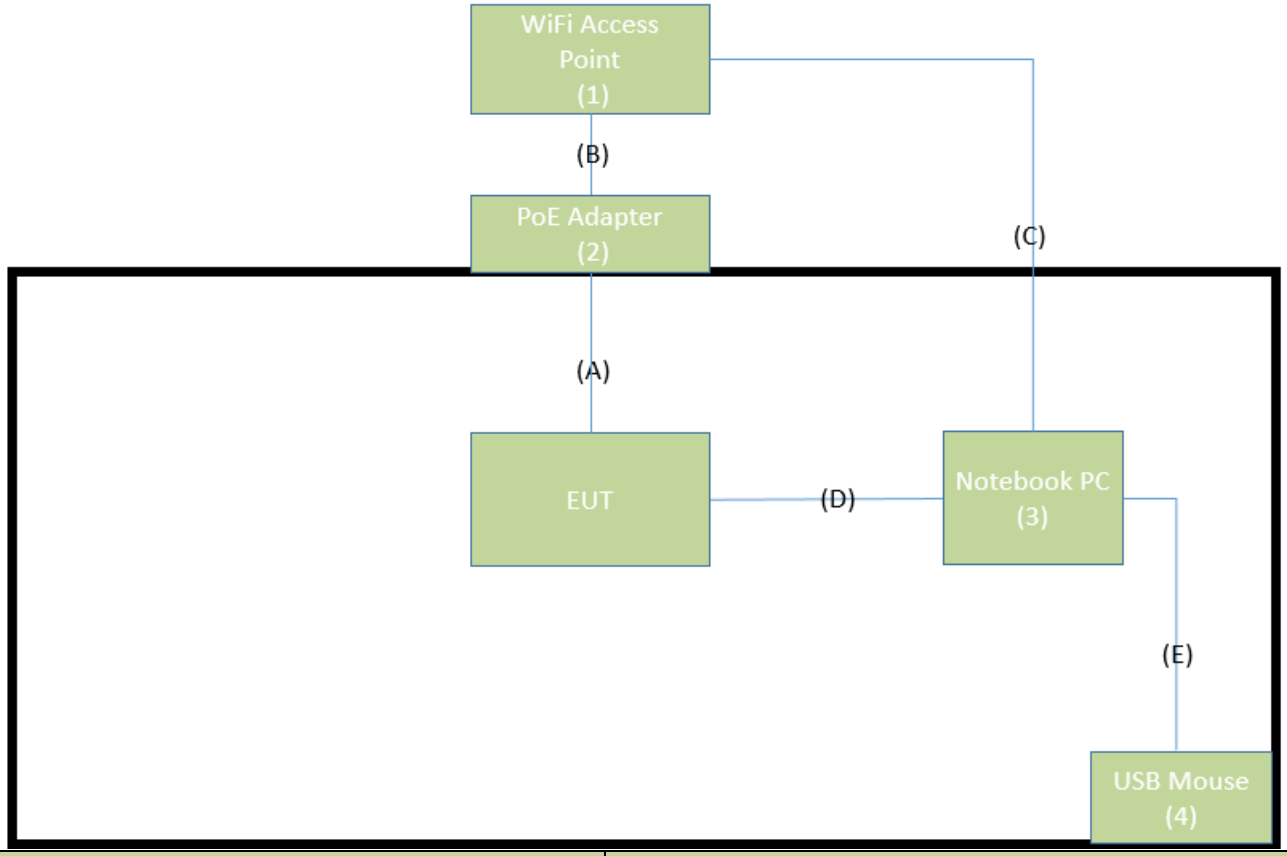
This device was tested per the guidance of KDB 789033 D02v02r01. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

Connection Diagram (Adapter Mode)



Signal Cable Type		Signal Cable Description
A	LAN Cable	Non-Shielded 2.4m
B	USB Cable	Shielded, 1.6m
C	LAN Cable	Non-Shielded 3.0m
D	USB Mouse Cable	Shielded, 1.8m

Connection Diagram (PoE Mode)



Signal Cable Type		Signal Cable Description
A	LAN Cable	Non-Shielded 2.4m
B	LAN Cable	Non-Shielded 3.0m
C	LAN Cable	Non-Shielded 3.0m
D	USB Cable	Shielded, 1.6m
E	USB Mouse Cable	Shielded, 1.8m

2.6. Test System Details

The types for all equipment, and descriptions of all cables used in the tested system (including inserted cards) are:

Adapter Mode:

No.	Product	Manufacturer	Model No.	Serial No.	Power Cord
1	WiFi Access Point	D-Link	DIR-612	N/A	Non-shielded, 1.5m
2	Notebook PC	Lenovo	21DH00A3TW	N/A	Non-shielded, 0.8m
3	USB Mouse	Logitech	M90	N/A	N/A

PoE Mode:

No.	Product	Manufacturer	Model No.	Serial No.	Power Cord
1	WiFi Access Point	D-LINK	DIR-612	N/A	Non-shielded, 1.5m
2	PoE Adapter	EUSSO	UPE5600-IHGE	N/A	Non-shielded, 1.8m
3	Notebook PC	Lenovo	21DH00A3TW	N/A	Non-shielded, 0.8m
4	USB Mouse	Logitech	M90	N/A	N/A

2.7. Device Capabilities

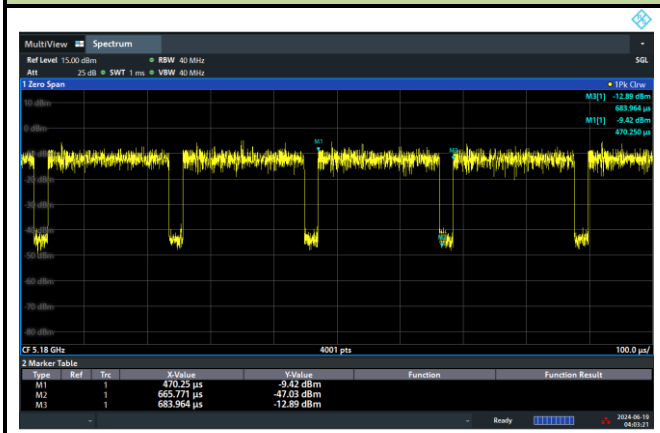
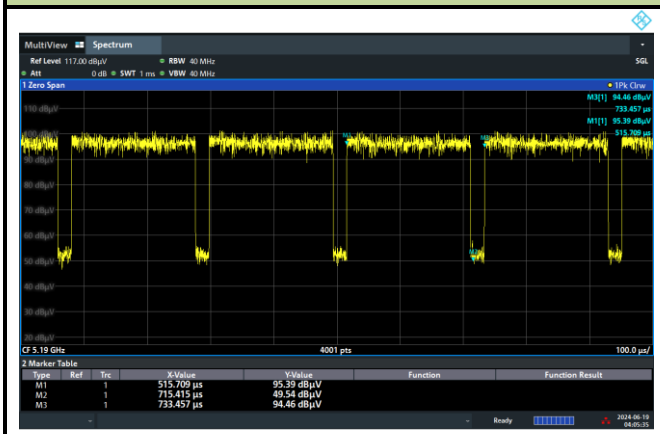
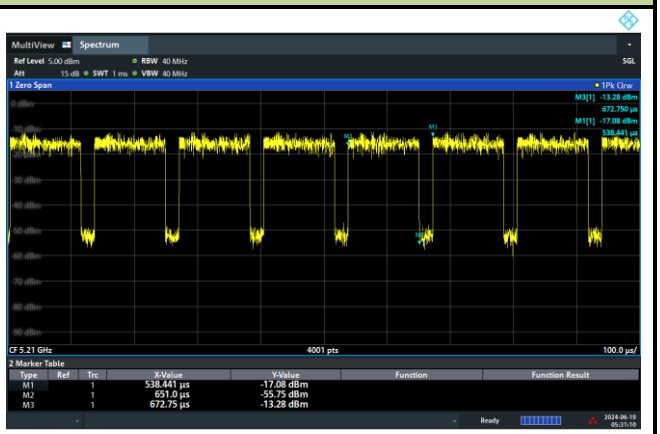
This device contains the following capabilities:

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. The duty cycles are as follows:

Duty Cycle

Test Mode	Duty Cycle
802.11a	95.38%
802.11n-HT20	94.43%
802.11ac-VHT20	94.56%
802.11n-HT40	92.86%
802.11ac-VHT40	91.74%
802.11ac-VHT80	84.33%

802.11 a	802.11 n20
	
802.11 n40	**802.11 ac20**
	
802.11 ac40	**802.11 ac80**
	

2.8. 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.

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 **Panel PC,** 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)	BF Directional Gain (dBi)	CDD Directional Gain (dBi)	
					For Power	For PSD
Wi-Fi External Antenna						
Antenna	2412 ~ 2462					
	5150 ~ 5850					

Note 1: The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.

If all antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

- For power spectral density (PSD) measurements on all devices,

  Array Gain = 10 log (N_{ANT}/ N_{SS}) dB;
- For power measurements on IEEE 802.11 devices,

  Array Gain = 0 dB for $N_{ANT} \leq 4$;

Note 2: The EUT also supports Beam Forming mode, and the Beam Forming support 802.11n/ac, not include 802.11a/b/g. BF Directional gain = G_{ANT} + 10 log (N_{ANT}).

Note 3: 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	2025/3/5
Cable	Rosnol	N1C50-RG400-B 1C50-500CM	MRTTWE00013	1 year	2025/6/14
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2025/3/5

Radiated Emissions – AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Acitve Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	1 year	2025/5/7
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2024/10/31
Broadband Hornantenna	RFSPIN	DRH18-E	MRTTWA00087	1 year	2025/5/20
Broadband Preamplifier	EMC Instruments corporation	EMC118A45SE	MRTTWA00088	1 year	2025/5/14
Breitband Hornantenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	1 year	2025/3/26
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	1 year	2025/3/21
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2025/3/5
Signal Analyzer	R&S	FSVA3044	MRTTWA00092	1 year	2024/6/29
Antenna Cable	HUBERSUHNER	SF106	MRTTWE00034	1 year	2025/6/25
Cable	HUBERSUHNER	EMC105-NM-NM -3000	MRTTWE00035	1 year	2025/6/25
Temperature/Humidity Meter	TFA	35.1083	MRTTWA00050	1 year	2025/6/2

Conducted Test Equipment –SR5

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2024/10/17
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2024/8/12
USB Wideband Power Sensor	KEYSIGHT	U2021XA	MRTTWA00015	1 year	2025/3/12

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: **Panel PC**

Model No.: **VNS-10WR2**

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 7.4
15.407(h)(1)	Transmit Power Control	≤ 24 dBm		N/A	Section 7.5
15.407(a)(1)(i), (2), (3), (5)	Power Spectral Density	Refer to Section 7.7		Pass	Section 7.6
15.407(g)	Frequency Stability	N/A		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)(8), (9), (10)	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

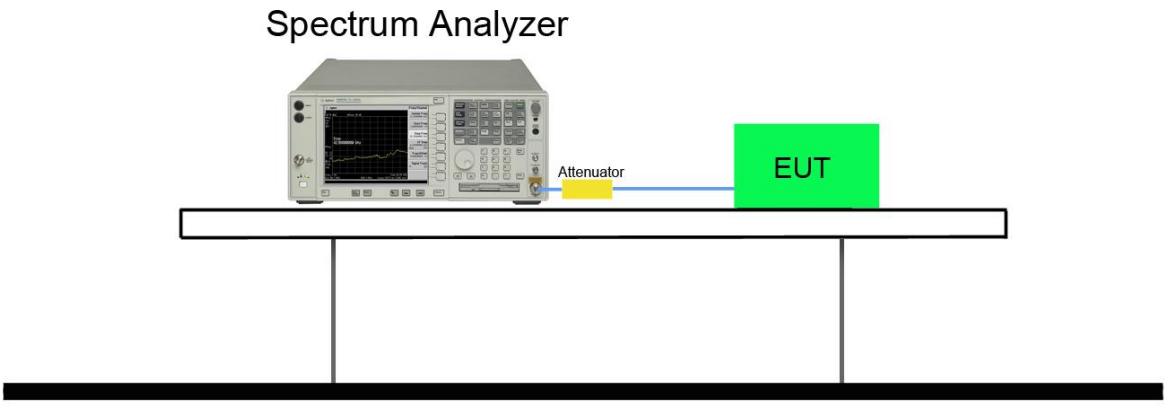
7.2.2. Test Procedure used

KDB 789033 D02v02r01 - Section C.1

7.2.3. Test Setting

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediated power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth.
3. VBW ≥ 3 × RBW.
4. Detector = Peak.
5. Trace mode = max hold.

7.2.4. Test Setup



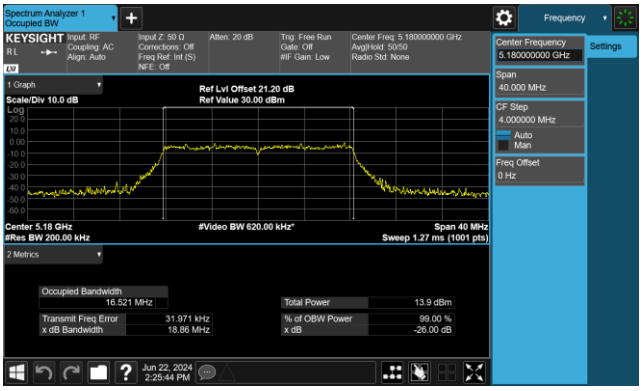
7.2.5. Test Result

Product	Panel PC	Test Engineer	Owen
Test Site	SR2	Test Date	2024/6/22
Test Item	26dB Bandwidth		

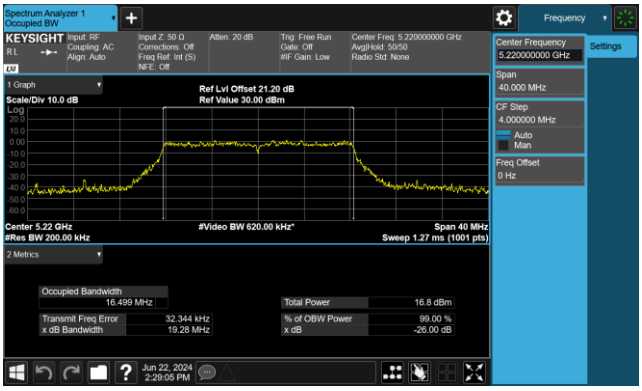
Test Mode	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 1				
802.11a	36	5180	18.86	16.521
802.11a	44	5220	19.28	16.499
802.11a	48	5240	19.11	16.516
802.11a	149	5745	18.98	16.497
802.11a	157	5785	19.14	16.506
802.11a	165	5825	19.12	16.542
802.11n-HT20	36	5180	19.51	17.623
802.11n-HT20	44	5220	19.50	17.618
802.11n-HT20	48	5240	19.55	17.625
802.11n-HT20	149	5745	19.64	17.620
802.11n-HT20	157	5785	19.42	17.603
802.11n-HT20	165	5825	19.69	17.613
802.11n-HT40	38	5190	39.47	36.081
802.11n-HT40	46	5230	39.05	36.159
802.11n-HT40	151	5755	39.89	36.117
802.11n-HT40	159	5795	39.55	36.166
802.11ac-VHT80	42	5210	80.31	75.932
802.11ac-VHT80	155	5775	80.80	75.858

802.11a 26dB Bandwidth & 99% Bandwidth - Ant 1

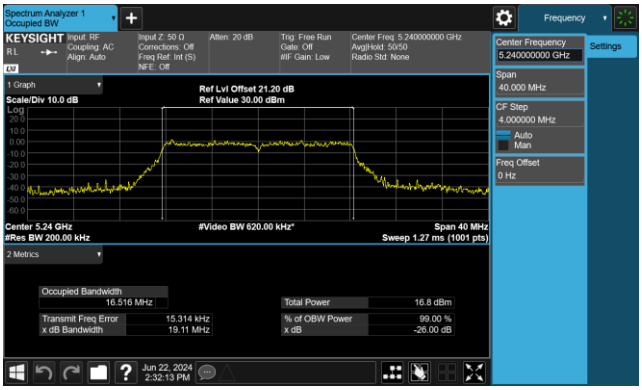
Channel 36 (5180MHz)



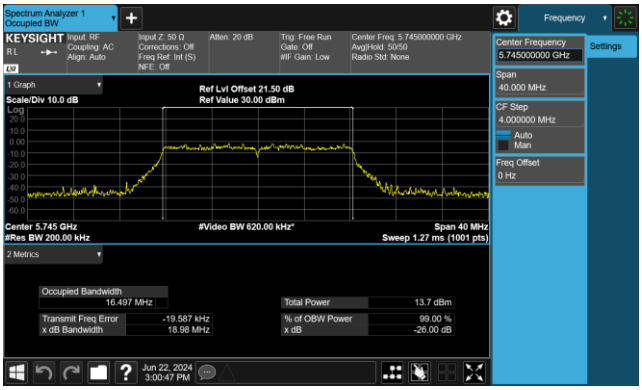
Channel 44 (5220MHz)



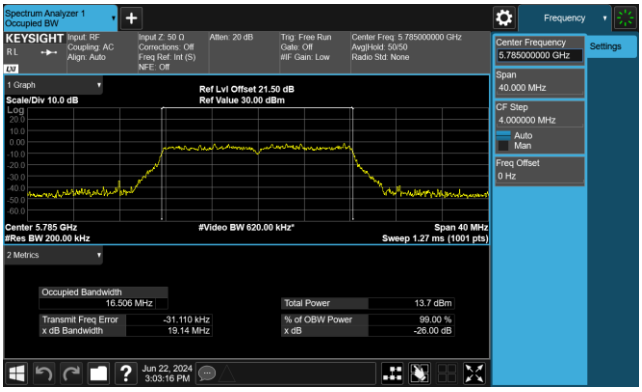
Channel 48 (5240MHz)



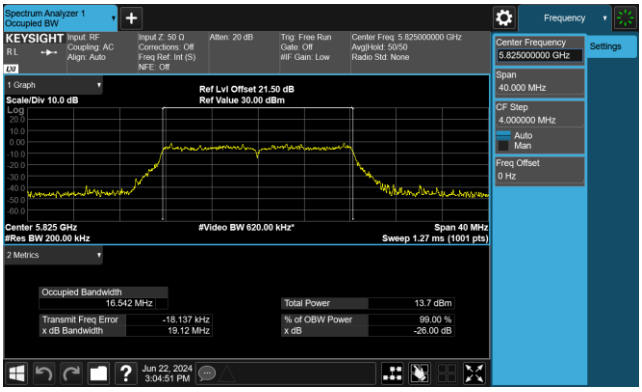
Channel 149 (5745MHz)



Channel 157 (5785MHz)

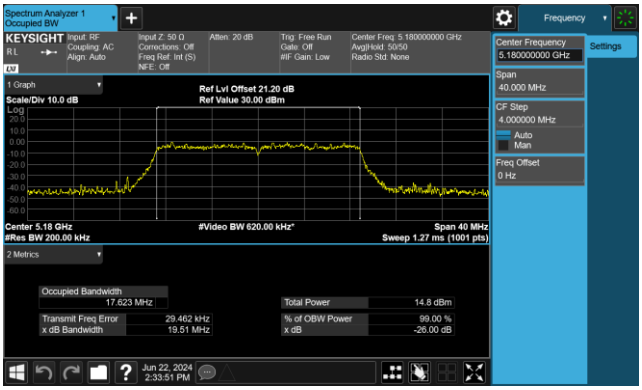


Channel 165 (5825MHz)

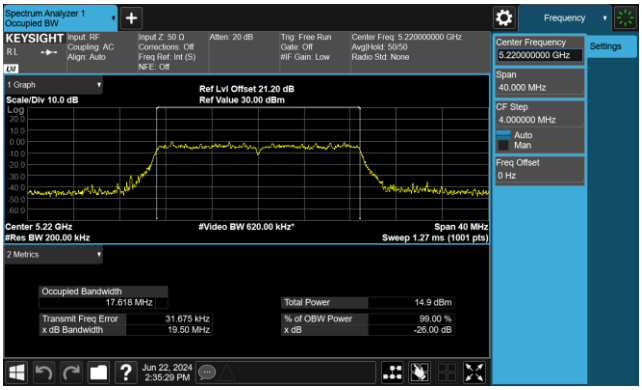


802.11n-HT20 26dB Bandwidth & 99% Bandwidth - Ant 0

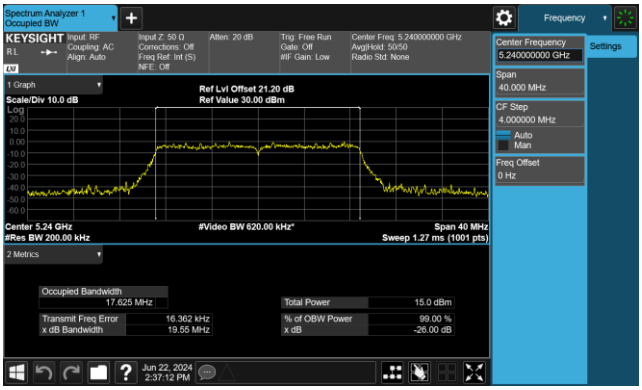
Channel 36 (5180MHz)



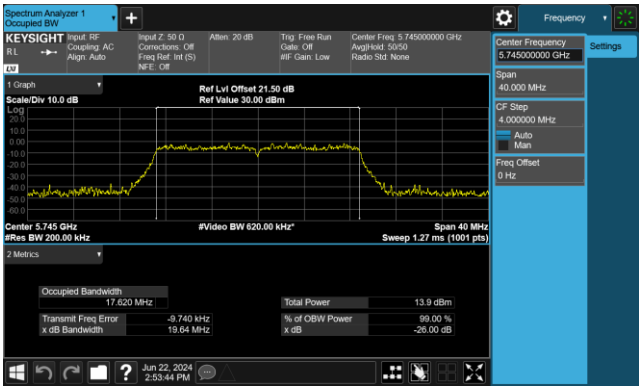
Channel 44 (5220MHz)



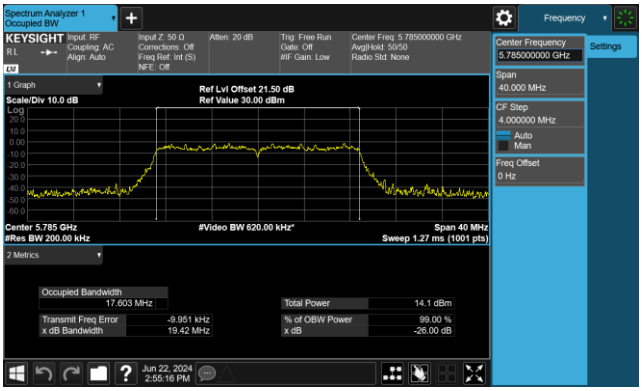
Channel 48 (5240MHz)



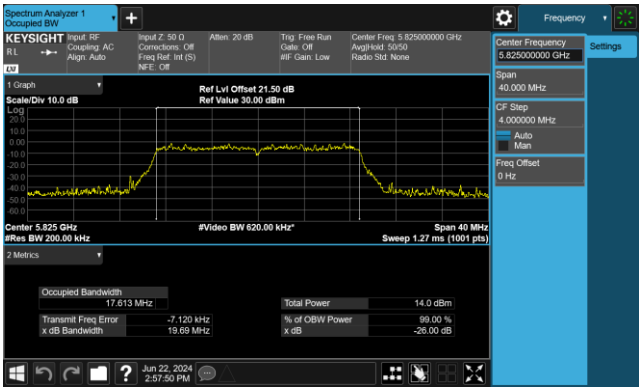
Channel 149 (5745MHz)



Channel 157 (5785MHz)

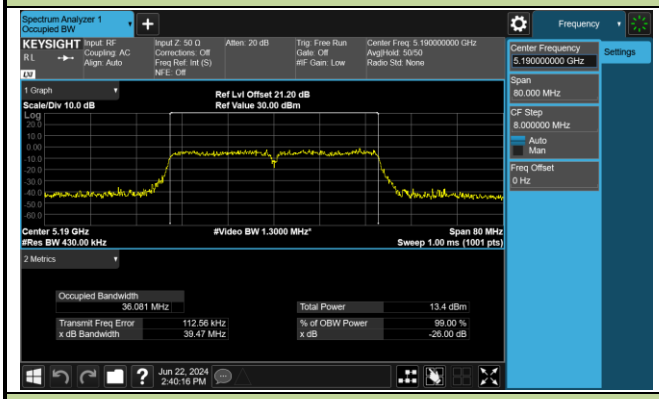


Channel 165 (5825MHz)

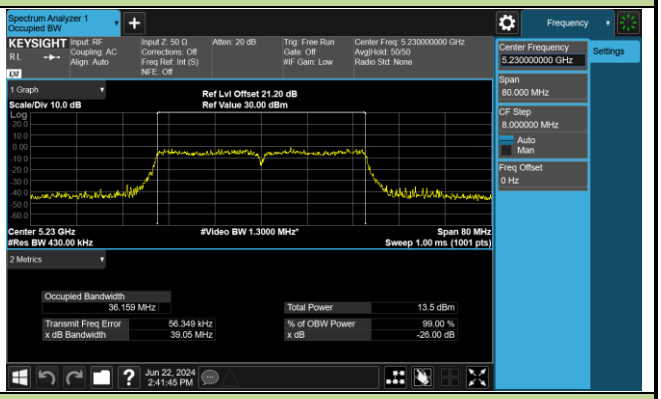


802.11n-HT40 26dB Bandwidth & 99% Bandwidth - Ant 0

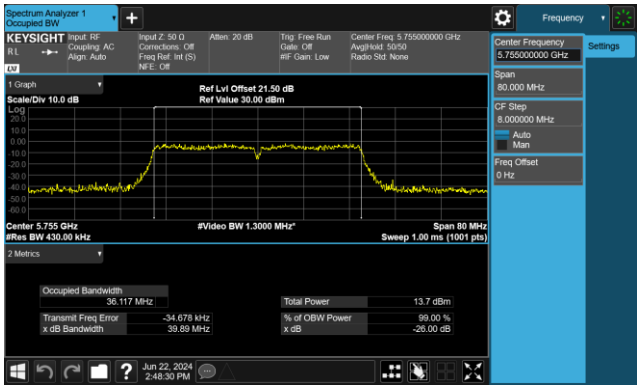
Channel 38 (5190MHz)



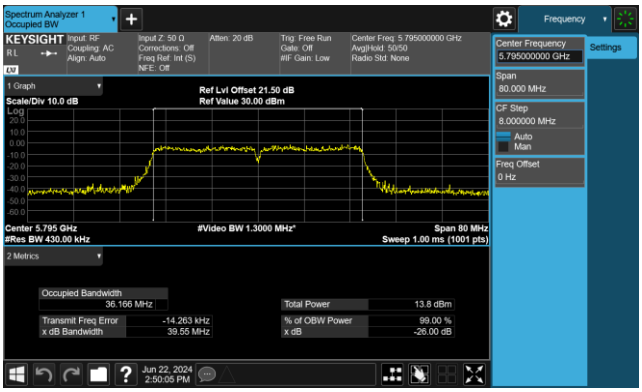
Channel 46 (5230MHz)

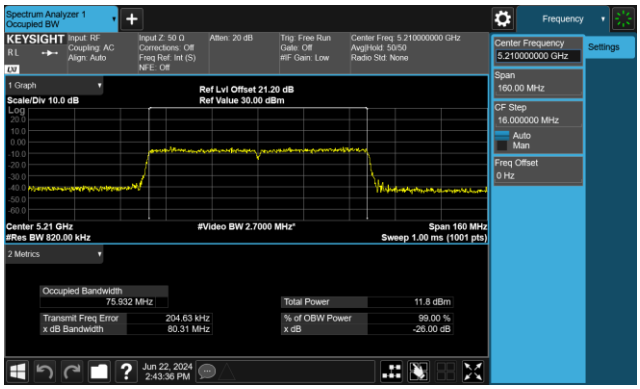
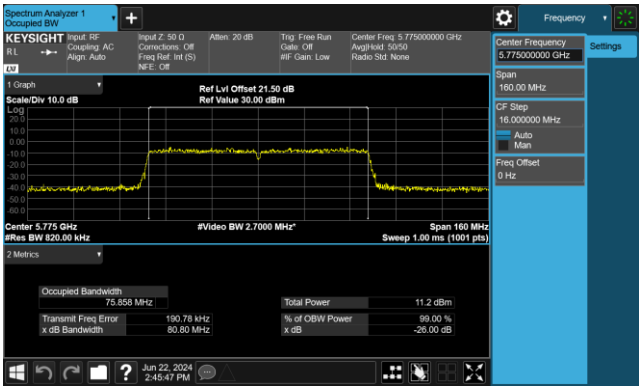


Channel 151 (5755MHz)



Channel 159 (5795MHz)



802.11ac-VHT80 26dB Bandwidth & 99% Bandwidth - Ant 0	
Channel 42 (5210MHz)	**Channel 155 (5775MHz)**
	

7.3. 6dB Bandwidth Measurement

7.3.1. Test Limit

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

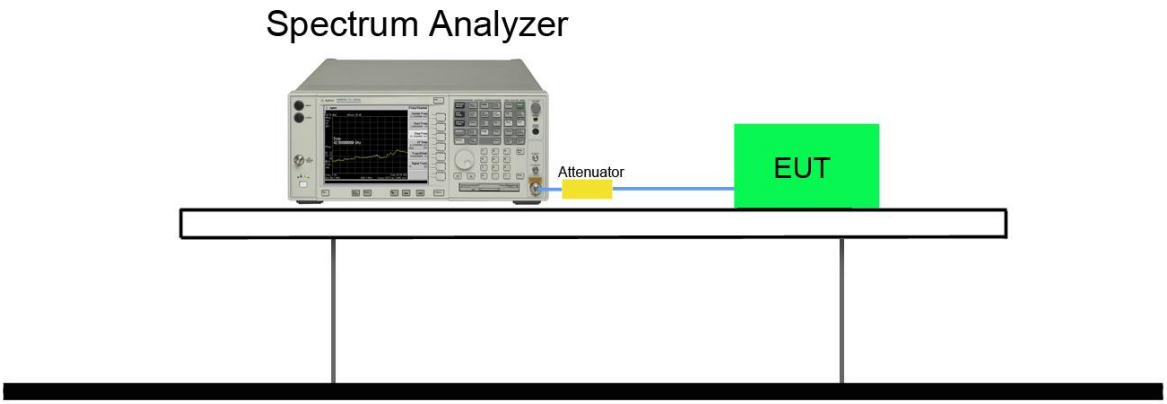
7.3.2. Test Procedure used

KDB 789033 D02v02r01 - Section 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.

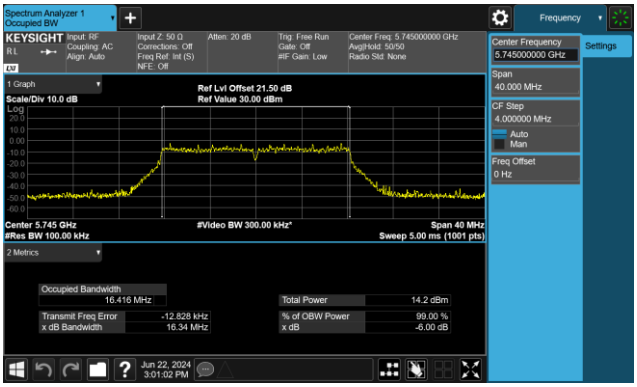
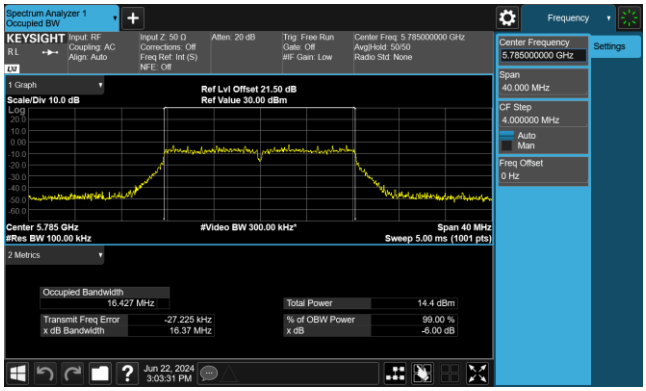
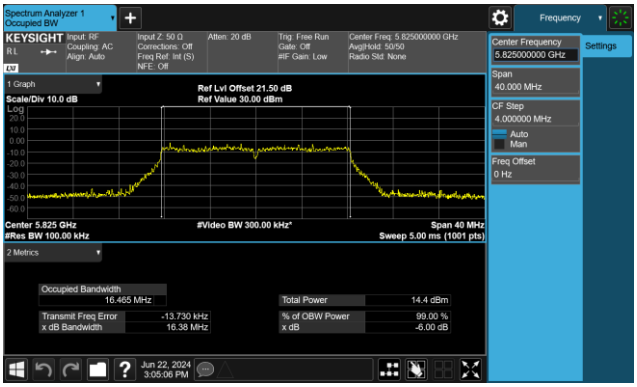
7.3.4. Test Setup

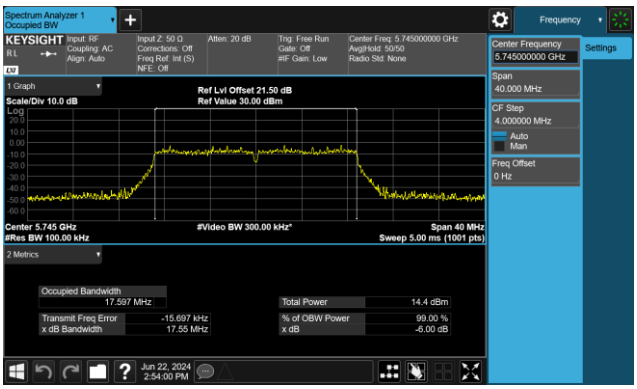
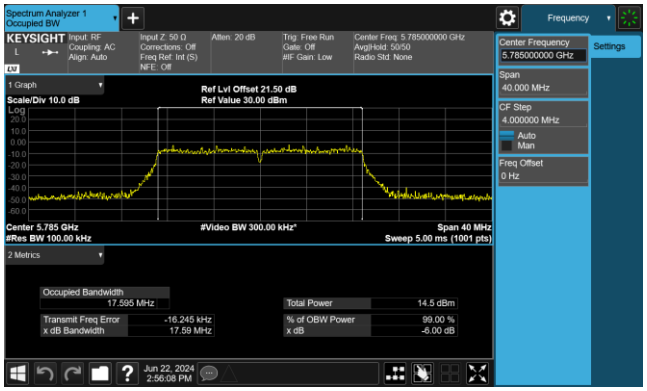
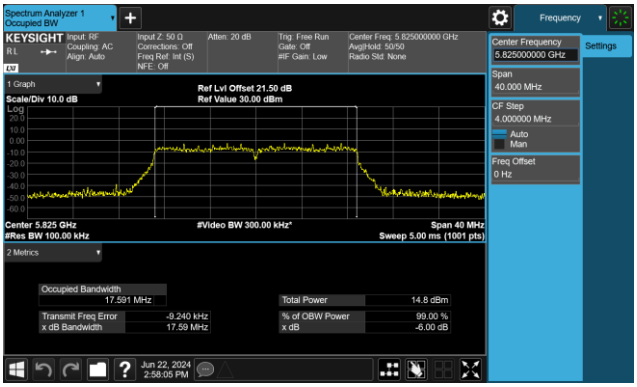
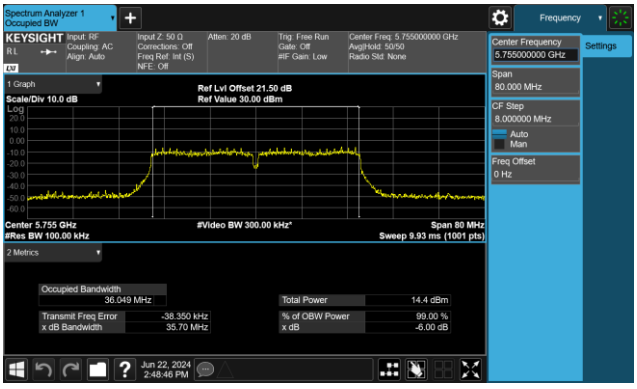
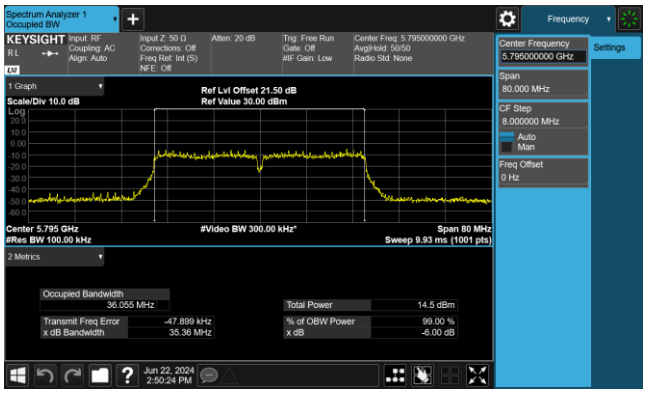


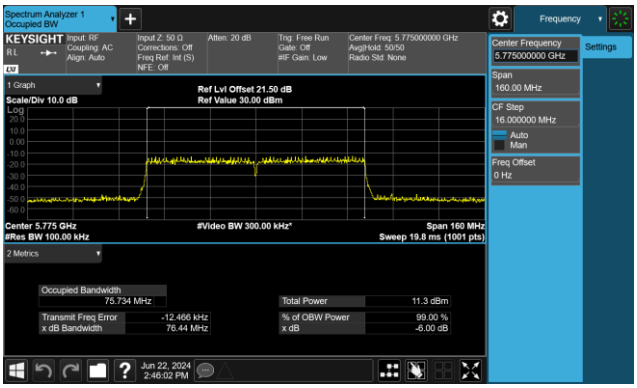
7.3.5. Test Result

Product	Panel PC	Test Engineer	Owen
Test Site	SR2	Test Date	2024/6/22
Test Item	6dB Bandwidth		

Test Mode	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Ant 1					
802.11a	149	5745	16.34	≥ 0.5	Pass
802.11a	157	5785	16.37	≥ 0.5	Pass
802.11a	165	5825	16.38	≥ 0.5	Pass
802.11n-HT20	149	5745	17.55	≥ 0.5	Pass
802.11n-HT20	157	5785	17.59	≥ 0.5	Pass
802.11n-HT20	165	5825	17.59	≥ 0.5	Pass
802.11n-HT40	151	5755	35.70	≥ 0.5	Pass
802.11n-HT40	159	5795	35.36	≥ 0.5	Pass
802.11ac-VHT80	155	5775	76.44	≥ 0.5	Pass

802.11a 6dB Bandwidth - Ant 1	
Channel 149 (5745MHz)	**Channel 157 (5785MHz)**
	
Channel 165 (5825MHz)	
	

802.11n-HT20 6dB Bandwidth - Ant 1	
Channel 149 (5745MHz)	**Channel 157 (5785MHz)**
	
Channel 165 (5825MHz)	
	
802.11n-HT40 6dB Bandwidth - Ant 1	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

802.11ac-VHT80 6dB Bandwidth - Ant 1	
Channel 155 (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.

For IC Power Measurement Limit

For the band 5.15-5.25 GHz, the maximum e.i.r.p. shall not exceed 200 mW (23.01dBm) or 10 + 10*log10 B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power shall not exceed 250 mW (23.98dBm) or 11 + 10 log10 B, dBm, whichever power is less. The maximum e.i.r.p. shall not exceed 1.0 W (30dBm) or 17 + 10 log10 B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.
For the 5.725-5.85 GHz band, the maximum conducted output power shall not exceed 1 W.
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.

Max Conducted Output Power Limit Calculation as below:

For U-NII-1 (5150-5250MHz)

24dBm for Client Device

For U-NII-2A (5250-5350MHz), U-NII-2C (5470-5725MHz)

802.11a: 11 + 10 log10 (24.95MHz) = 25dBm > 24dBm;

802.11n-HT20/ac-VHT20: 11 + 10 log10 (23.95MHz) = 25dBm > 24dBm;

802.11n-HT40/ac-VHT40: 11 + 10 log10 (42.87MHz) = 27dBm > 24dBm;

802.11n-HT80/ac-VHT80: 11 + 10 log10 (83.55MHz) = 30dBm > 24dBm;

802.11ac-VHT160: 11 + 10 log10 (162.8MHz) = 33dBm > 24dBm;

For U-NII-3 (5725-5850MHz)

30dBm for Client Device

EIRP Limit Calculation as below:

For U-NII-1 (5150-5250MHz)

36dBm with 6dBi Antenna Gain

For U-NII-2A (5250-5350MHz), U-NII-2C (5470-5725MHz)

30dBm with 6dBi Antenna Gain

For U-NII-3 (5725-5850MHz)

36dBm with 6dBi Antenna Gain

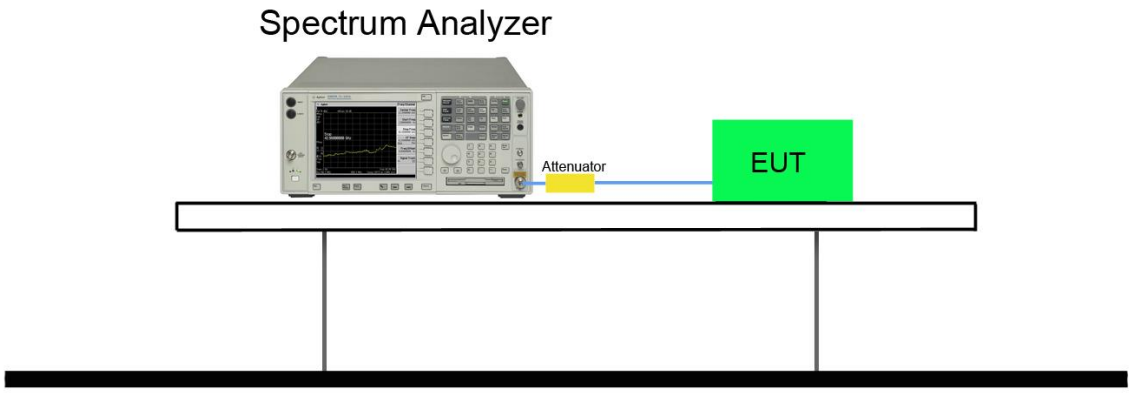
7.4.2. Test Procedure Used

KDB 789033 D02v02r01 - Section 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	Panel PC	Test Engineer	Owen
Test Site	SR2	Test Date	2024/6/22
Test Item	Output Power		

Max Conducted 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	11.37	11.71	14.55	23.98
	6M	44	5220	11.22	11.55	14.40	23.98
	6M	48	5240	11.45	11.69	14.58	23.98
802.11a Band4	6M	149	5745	11.68	11.75	14.73	30.00
	6M	157	5785	11.74	11.83	14.80	30.00
	6M	165	5825	11.76	11.45	14.62	30.00
n-HT20 Band1	MCS0	36	5180	11.37	11.70	14.55	23.98
	MCS0	44	5220	11.55	11.60	14.59	23.98
	MCS0	48	5240	11.66	11.73	14.71	23.98
n-HT20 Band4	MCS0	149	5745	12.01	11.25	14.66	30.00
	MCS0	157	5785	11.10	11.30	14.21	30.00
	MCS0	165	5825	11.03	11.32	14.19	30.00
ac-VHT20 Band1	MCS0	36	5180	11.36	11.68	14.53	23.98
	MCS0	44	5220	11.56	11.57	14.58	23.98
	MCS0	48	5240	11.64	11.71	14.69	23.98
ac-VHT20 Band4	MCS0	149	5745	11.00	11.14	14.08	30.00
	MCS0	157	5785	11.01	11.26	14.15	30.00
	MCS0	165	5825	10.93	11.20	14.08	30.00
n-HT40 Band1	MCS0	38	5190	10.09	10.28	13.20	23.98
	MCS0	46	5230	10.34	10.35	13.36	23.98
n-HT40 Band4	MCS0	151	5755	10.67	10.94	13.82	30.00
	MCS0	159	5795	10.69	10.91	13.81	30.00

Model	Rate	Ch.	Freq. (MHz)	Ant 0 Power (dBm)	Ant 1 Power (dBm)	Ant 0+1 Power (dBm)	Power Limit (dBm)
ac-VHT40 Band1	MCS0	38	5190	9.66	10.12	12.91	23.98
	MCS0	46	5230	9.69	10.15	12.94	23.98
ac-VHT40 Band4	MCS0	151	5755	10.55	10.90	13.74	30.00
	MCS0	159	5795	10.63	10.89	13.77	30.00
ac-VHT80 Band1	MCS0	42	5210	8.42	8.62	11.53	23.98
ac-VHT80 Band4	MCS0	155	5775	8.02	8.29	11.17	30.00

Note: Output power =Reading value on power meter + duty cycle factor + cable loss。

7.5. Transmit Power Control

7.5.1. Test Limit

The U-NII-2A & U-NII-2C device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm.

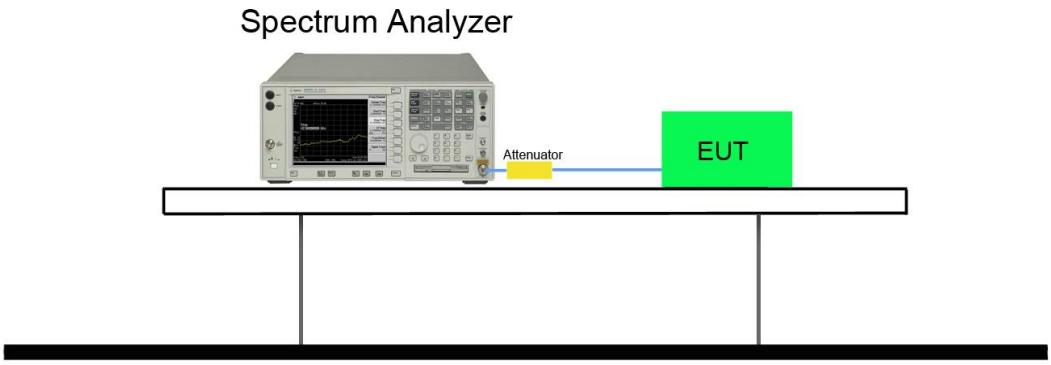
7.5.2. Test Procedure Used

KDB 789033 D02v02r01 - Section 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 17 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.

For IC Power Spectral Density Limit

For the band 5.15-5.25 GHz, the e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

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

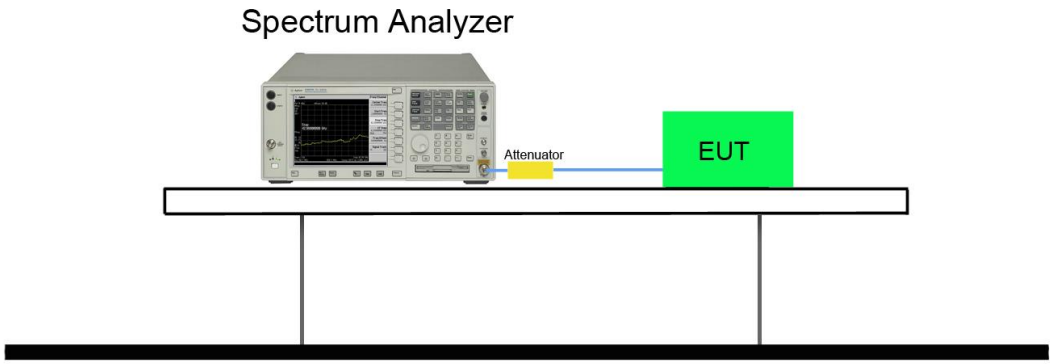
7.6.2. Test Procedure Used

KDB 789033 D02v02r01 - Section 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, if measurement bandwidth of Maximum PSD is specified in 500 kHz,
4. RBW = 100 kHz
5. VBW = 3MHz
6. Number of sweep points ≥ 2 × (span / RBW)
7. Detector = power averaging (Average)
8. Sweep time = auto
9. Trigger = free run
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.
12. When the measurement bandwidth of Maximum PSD is specified in 500 kHz, add a constant factor 10*log(500kHz/100kHz) = 7 dB to the measured result

7.6.4. Test Setup



7.6.5. Test Result

Product	Panel PC	Test Engineer	Owen
Test Site	SR2	Test Date	2024/6/22
Test Item	Power Spectral Density		

For FCC bands (UNII-1)

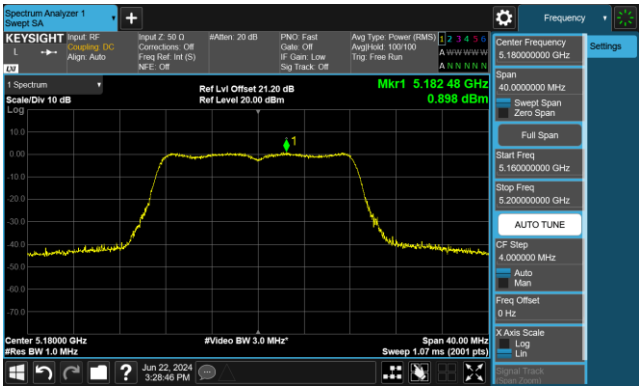
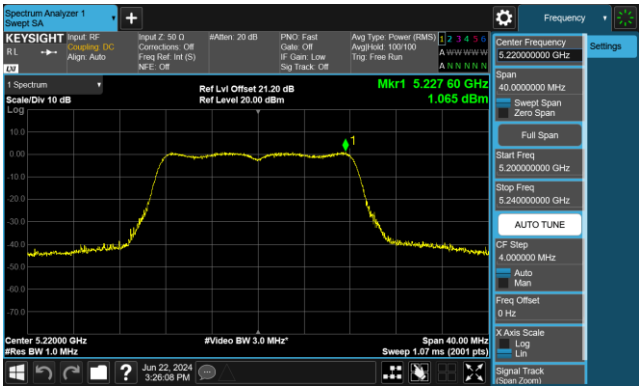
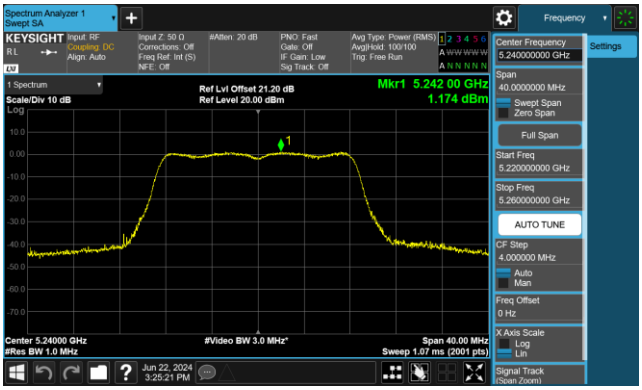
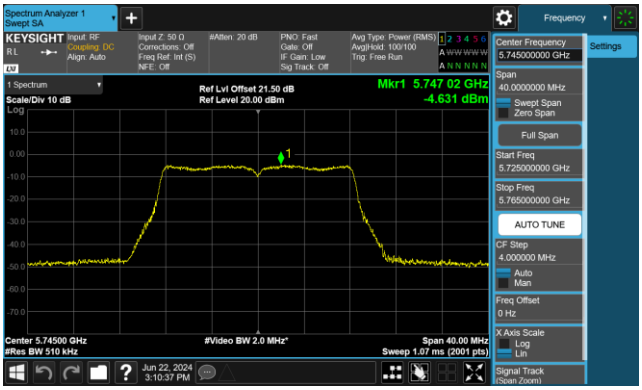
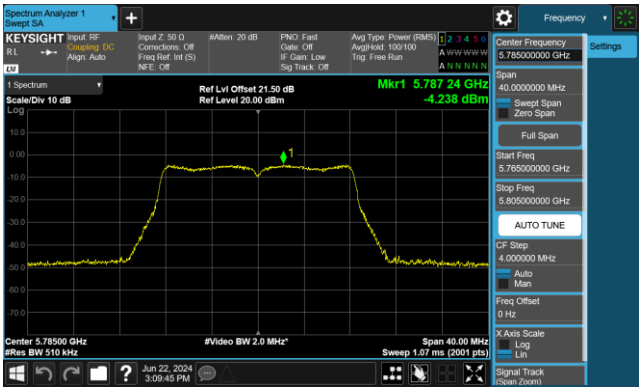
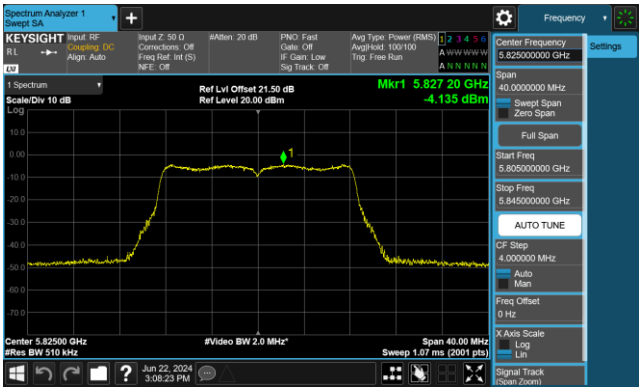
Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	PSD (dBm/ MHz)	Duty Cycle (%)	Total PSD (dBm/ MHz)	PSD Limit (dBm/ MHz)	Result
Ant 0								
11a	6	36	5180	0.898	95.38%	4.117	≤ 11	Pass
11a	6	44	5220	1.065	95.38%	4.443	≤ 11	Pass
11a	6	48	5240	1.174	95.38%	4.520	≤ 11	Pass
11n-HT20	6.5	36	5180	-0.955	94.43%	2.136	≤ 11	Pass
11n-HT20	6.5	44	5220	-0.762	94.43%	2.422	≤ 11	Pass
11n-HT20	6.5	48	5240	-0.808	94.43%	2.580	≤ 11	Pass
11n-HT40	13.5	38	5190	-5.333	92.86%	-1.836	≤ 11	Pass
11n-HT40	13.5	46	5230	-4.817	92.86%	-1.393	≤ 11	Pass
11ac-VHT80	29.3	42	5210	-10.078	84.33%	-6.271	≤ 11	Pass
Ant 1								
11a	6	36	5180	0.905	95.38%	4.117	≤ 11	Pass
11a	6	44	5220	1.383	95.38%	4.443	≤ 11	Pass
11a	6	48	5240	1.430	95.38%	4.520	≤ 11	Pass
11n-HT20	6.5	36	5180	-1.299	94.43%	2.136	≤ 11	Pass
11n-HT20	6.5	44	5220	-0.913	94.43%	2.422	≤ 11	Pass
11n-HT20	6.5	48	5240	-0.554	94.43%	2.580	≤ 11	Pass
11n-HT40	13.5	38	5190	-5.009	92.86%	-1.836	≤ 11	Pass
11n-HT40	13.5	46	5230	-4.634	92.86%	-1.393	≤ 11	Pass
11ac-VHT80	29.3	42	5210	-9.965	84.33%	-6.271	≤ 11	Pass

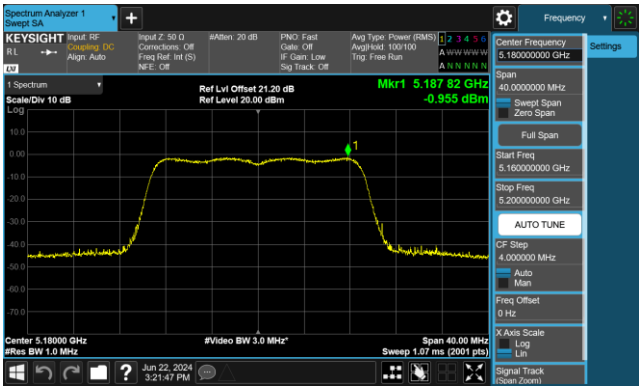
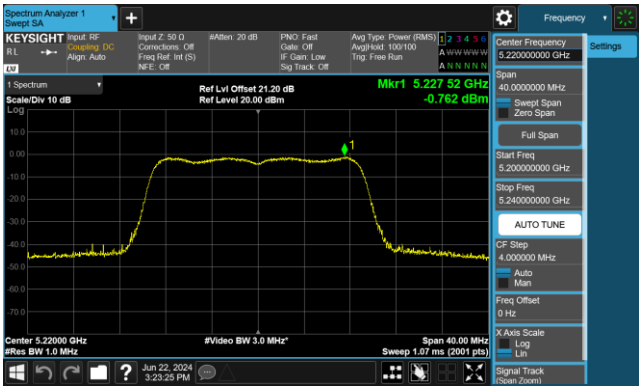
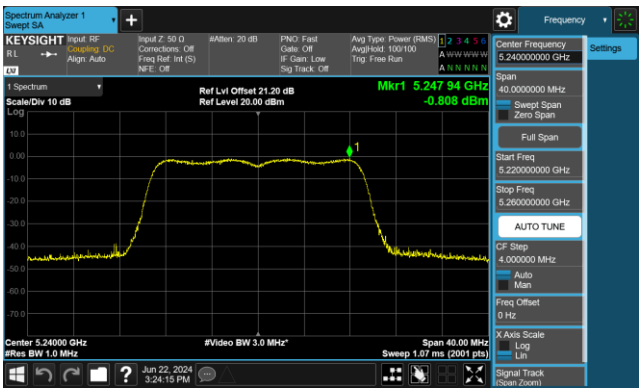
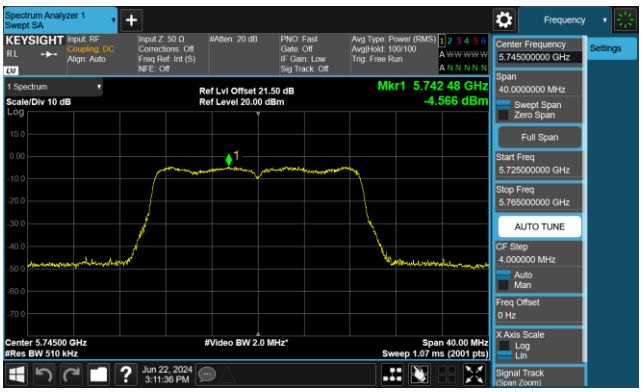
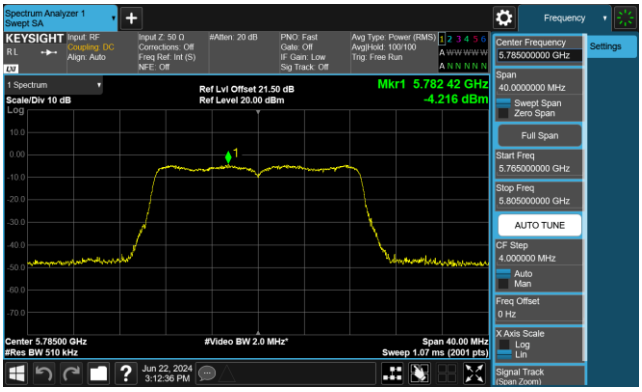
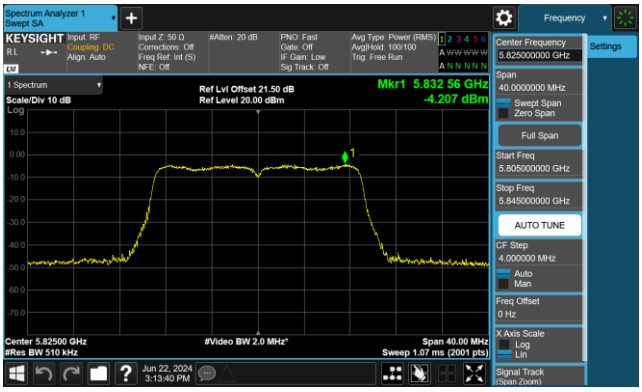
Note: Total PSD (dBm/MHz) = Ant PSD (dBm/MHz) + 10*log(1/duty cycle)

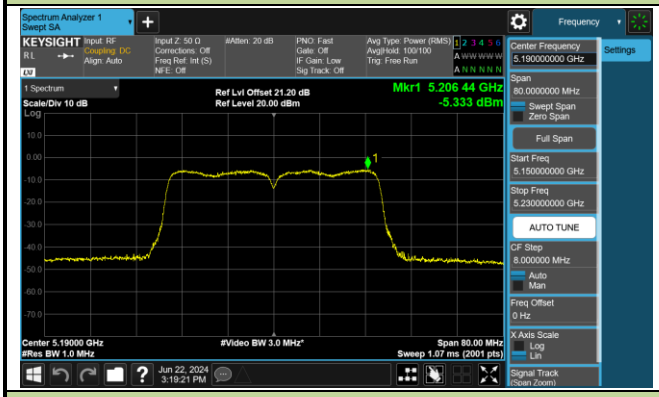
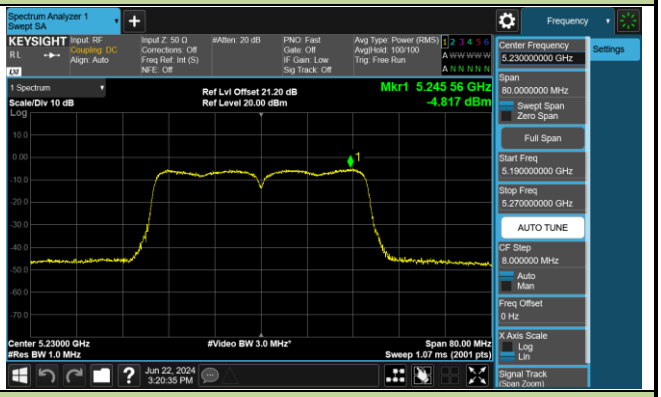
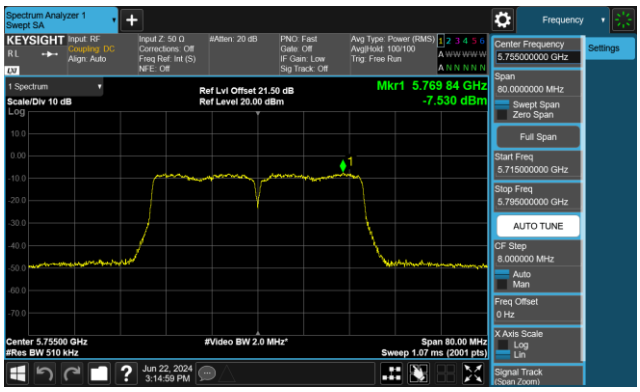
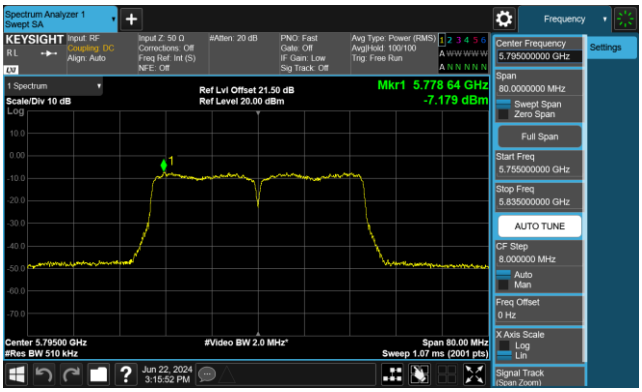
For FCC bands (UNII-4)

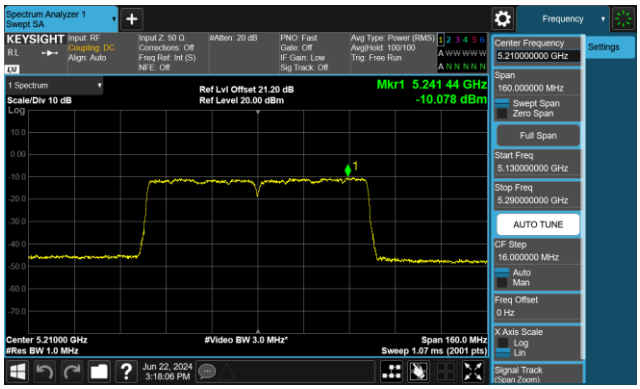
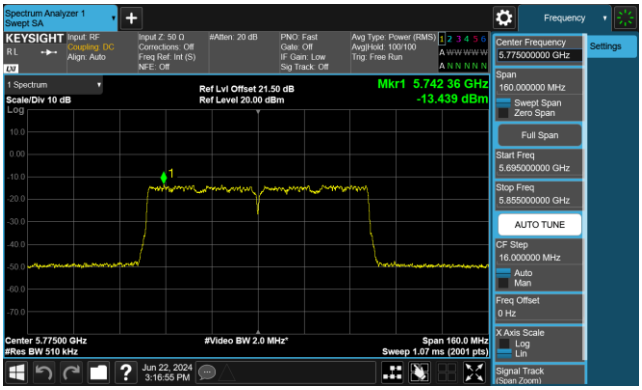
Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	PSD (dBm/ 100kHz)	Duty Cycle (%)	Total PSD (dBm/ 500kHz)	Limit (dBm/ 500kHz)	Result
11a	6	149	5745	-4.631	95.38%	-1.409	≤ 30	Pass
11a	6	157	5785	-4.238	95.38%	-1.153	≤ 30	Pass
11a	6	165	5825	-4.135	95.38%	-1.070	≤ 30	Pass
11n-HT20	6.5	149	5745	-4.566	94.43%	-1.333	≤ 30	Pass
11n-HT20	6.5	157	5785	-4.216	94.43%	-1.111	≤ 30	Pass
11n-HT20	6.5	165	5825	-4.207	94.43%	-1.154	≤ 30	Pass
11n-HT40	13.5	151	5755	-7.530	92.86%	-4.099	≤ 30	Pass
11n-HT40	13.5	159	5795	-7.179	92.86%	-3.973	≤ 30	Pass
11ac-VHT80	29.3	155	5775	-13.439	84.33%	-9.683	≤ 30	Pass
11a	6	149	5745	-4.618	95.38%	-1.409	≤ 30	Pass
11a	6	157	5785	-4.503	95.38%	-1.153	≤ 30	Pass
11a	6	165	5825	-4.441	95.38%	-1.070	≤ 30	Pass
11n-HT20	6.5	149	5745	-4.618	94.43%	-1.333	≤ 30	Pass
11n-HT20	6.5	157	5785	-4.530	94.43%	-1.111	≤ 30	Pass
11n-HT20	6.5	165	5825	-4.630	94.43%	-1.154	≤ 30	Pass
11n-HT40	13.5	151	5755	-7.335	92.86%	-4.099	≤ 30	Pass
11n-HT40	13.5	159	5795	-7.434	92.86%	-3.973	≤ 30	Pass
11ac-VHT80	29.3	155	5775	-13.428	84.33%	-9.683	≤ 30	Pass

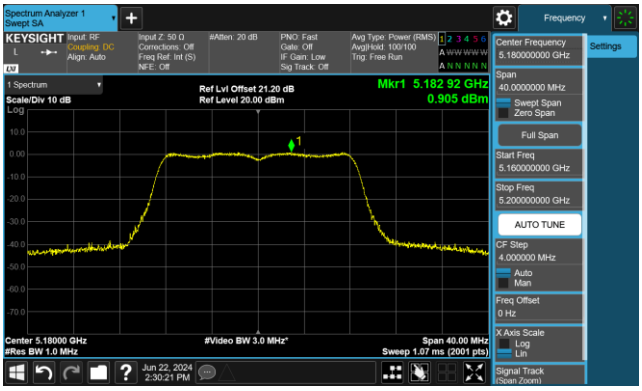
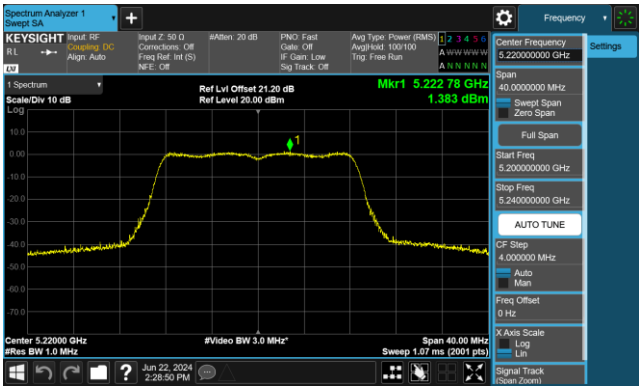
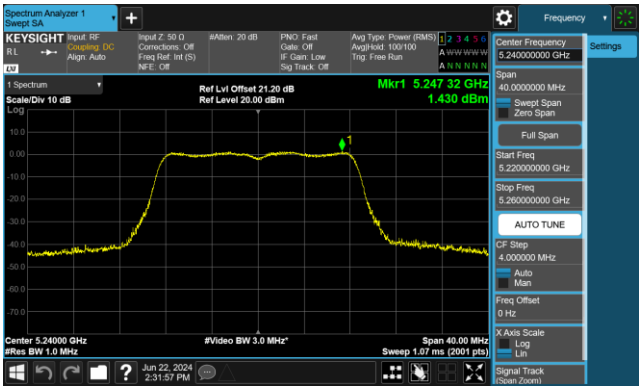
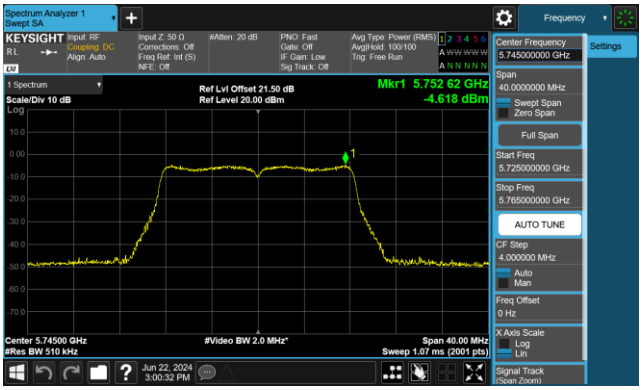
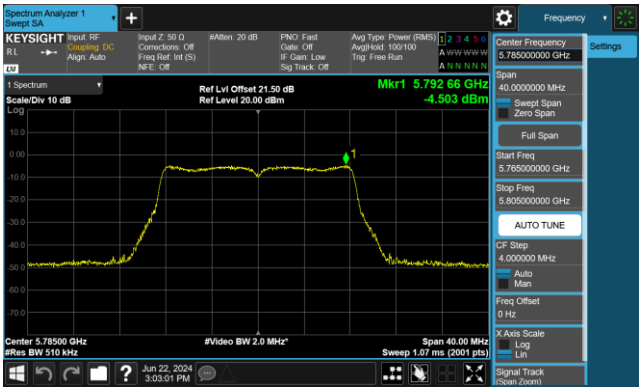
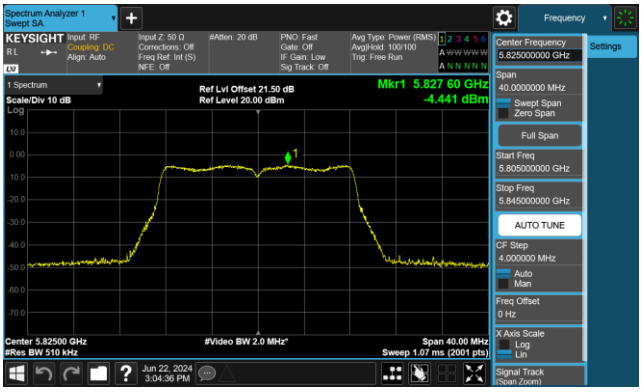
Note: Total PSD (dBm/500kHz) = Ant PSD (dBm/100kHz) + 10*log(1/duty cycle) + Constant Factor.

802.11a Power Spectral Density - Ant 0	
Channel 36 (5180MHz)	**Channel 44 (5220MHz)**
	
Channel 48 (5240MHz)	**Channel 149 (5745MHz)**
	
Channel 157 (5785MHz)	**Channel 165 (5825MHz)**
	

802.11n-HT20 Power Spectral Density - Ant 0	
Channel 36 (5180MHz)	**Channel 44 (5220MHz)**
	
Channel 48 (5240MHz)	**Channel 149 (5745MHz)**
	
Channel 157 (5785MHz)	**Channel 165 (5825MHz)**
	

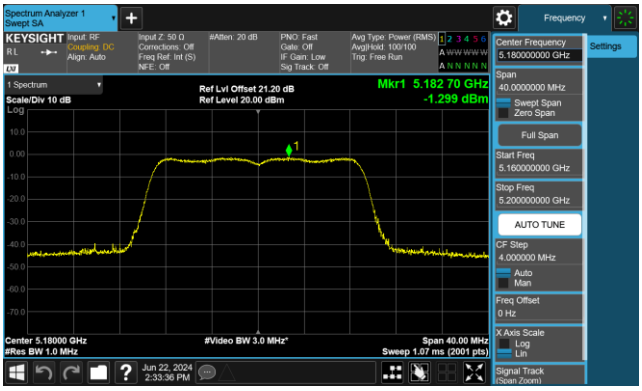
802.11n-HT40 Power Spectral Density - Ant 0	
Channel 38 (5190MHz)	**Channel 46 (5230MHz)**
	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

802.11ac-VHT80 Power Spectral Density - Ant 0	
Channel 42 (5210MHz)	**Channel 155 (5775MHz)**
	

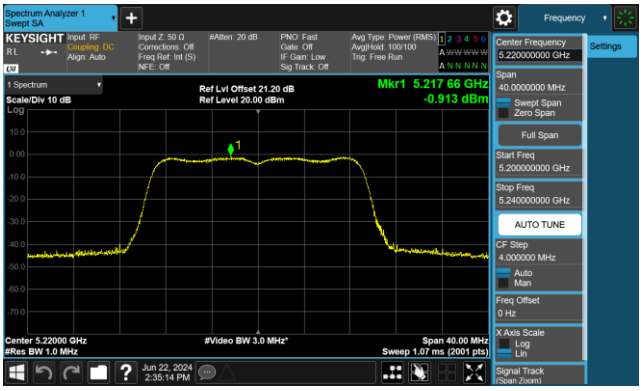
802.11a Power Spectral Density - Ant 1	
Channel 36 (5180MHz)	**Channel 44 (5220MHz)**
	
Channel 48 (5240MHz)	**Channel 149 (5745MHz)**
	
Channel 157 (5785MHz)	**Channel 165 (5825MHz)**
	

802.11n-HT20 Power Spectral Density - Ant 1

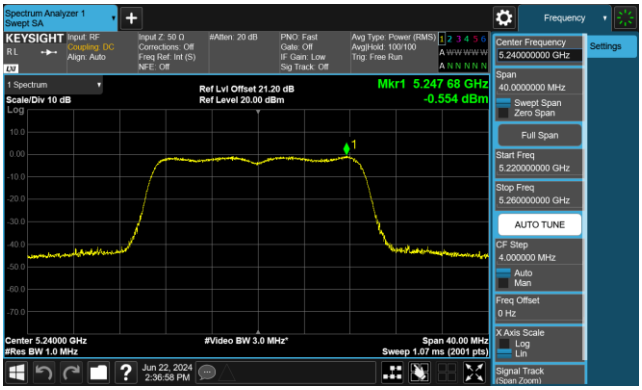
Channel 36 (5180MHz)



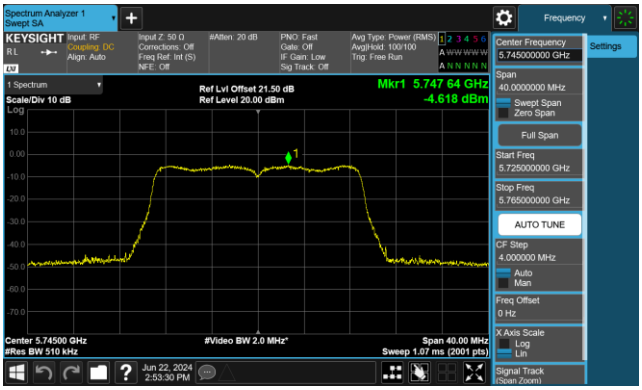
Channel 44 (5220MHz)



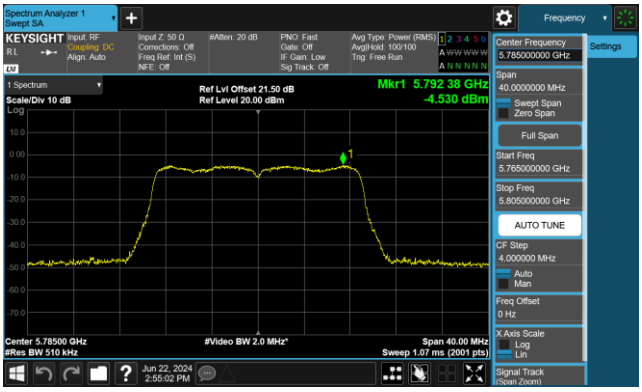
Channel 48 (5240MHz)



Channel 149 (5745MHz)



Channel 157 (5785MHz)



Channel 165 (5825MHz)