RF MEASUREMENT REPORT

FCC ID:	2ALJ3AP541E
Applicant:	HAN Networks Co., Ltd.
Product:	HAN Access Point
Model No.:	AP541e
Brand Name:	HAN NETWORKS, HANNETWORKS
FCC Classification:	Unlicensed National Information Infrastructure (NII)
FCC Rule Part(s):	Part 15 Subpart E (Section 15.407)
Result:	Complies
Received Date:	2025-12-01
Test Date:	2025-12-09 ~ 2026-04-24

Reviewed By: Vincent Yu

Approved By: Robin Wu

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

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

Revision History

Report No.	Version	Description	Issue Date	Note
R26S1033075-U202	V01	Initial Report	2026-09-30	Valid

Note: This report is based on the original MRT report (No.: R25S1061112-U202). Only the applicant, manufacturer, and product information (including product name, model number, and brand name) have been updated. All other contents remain unchanged, and all test results are directly copied from the original report.

CONTENTS

Description Page

1. General Information 6

1.1. Applicant 6
1.2. Manufacturer 6
1.3. Testing Facility 6
1.4. Product Information 7
1.5. Radio Specification under Test 8
1.6. Working Frequencies 8
1.7. Antenna Details 9
1.8. WLAN Configuration 9

2. Test Configuration 10

2.1. Test Mode 10
2.2. Test System Connection Diagram 11
2.3. Test Software 11
2.4. Applied Standards 12
2.5. Test Environment Condition 12

3. Antenna Requirements 13

4. Measuring Instrument 14

5. Decision Rules and Measurement Uncertainty 15

5.1. Decision Rules 15
5.2. Measurement Uncertainty 15

6. Test Result 16

6.1. Summary 16
6.2. 26 dB & 99% Bandwidth Measurement 17
6.2.1. Test Limit 17
6.2.2. Test Procedure 17
6.2.3. Test Setting 17
6.2.4. Test Setup 17
6.2.5. Test Result 18
6.3. 6 dB Bandwidth Measurement 19
6.3.1. Test Limit 19
6.3.2. Test Procedure 19
6.3.3. Test Setting 19
6.3.4. Test Setup 19
6.3.5. Test Result 19
6.4. Output Power Measurement 20

6.4.1. Test Limit 20
6.4.2. Test Procedure 20
6.4.3. Test Setting 20
6.4.4. Test Setup 20
6.4.5. Test Result 20
6.5. Transmit Power Control Measurement 21
6.5.1. Test Limit 21
6.5.2. Test Procedure 21
6.5.3. Test Setting 21
6.5.4. Test Setup 21
6.5.5. Test Result 21
6.6. Power Spectral Density Measurement 22
6.6.1. Test Limit 22
6.6.2. Test Procedure 22
6.6.3. Test Setting 22
6.6.4. Test Setup 23
6.6.5. Test Result 23
6.7. Frequency Stability Measurement 24
6.7.1. Test Limit 24
6.7.2. Test Procedure 24
6.7.3. Test Setup 24
6.7.4. Test Result 25
6.8. Radiated Spurious Emissions Measurement 26
6.8.1. Test Limit 26
6.8.2. Test Procedure 26
6.8.3. Test Setting 26
6.8.4. Test Setup 28
6.8.5. Test Result 29
6.9. Radiated Restricted Band Edge Measurement 30
6.9.1. Test Limit 30
6.9.2. Test Procedure 32
6.9.3. Test Setting 32
6.9.4. Test Setup 33
6.9.5. Test Result 33
6.10. AC Conducted Emissions Measurement 34
6.10.1. Test Limit 34
6.10.2. Test Setup 34
6.10.3. Test Result 34
Appendix A - Test Result 35

A.1 Duty Cycle Test Result 35
A.2 26 dB Bandwidth Test Result 39
A.3 6 dB Bandwidth Test Result 65
A.4 Output Power Test Result 77
A.5 Power Spectral Density Test Result 84
A.6 Frequency Stability Test Result 175
A.7 Radiated Spurious Emissions Test Result 176
A.8 Radiated Restricted Band Edge Test Result 314
A.9 AC Conducted Emissions Test Result 526

Appendix B - Test Setup Photograph 528

Appendix C - EUT Photograph 529

1. General Information

1.1. Applicant

HAN Networks Co., Ltd.

101, 3rd Floor, Building 3, No.9 Compound, Yongfeng Road, Haidian District, Beijing, P.R. China

1.2. Manufacturer

HAN Networks Co., Ltd.

101, 3rd Floor, Building 3, No.9 Compound, Yongfeng Road, Haidian District, Beijing, P.R. China

1.3. Testing Facility

☒	**Test Site - MRT Suzhou Laboratory**
	☐ **Laboratory Location (Suzhou - Wuzhong)** D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China ☒ **Laboratory Location (Suzhou - SIP)** 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China ☐ **Laboratory Location (Suzhou - Wujiang)** Building 1, No.1 Xingdong Road, Wujiang, Suzhou, Jiangsu, People's Republic of China
	Laboratory Accreditations
	A2LA: 3628.01 CNAS: L10551 FCC: CN1166 ISED: CN0001
☐	**Test Site - MRT Shenzhen Laboratory**
	Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China
	Laboratory Accreditations
	A2LA: 3628.02 FCC: CN1284 ISED: CN0105

1.4. Product Information

Product	HAN Access Point
Model No.	AP541e
Brand Name	HAN NETWORKS, HANNETWORKS
EUT Identification No.	20251201Sample#04 (Conducted) Y-260126-R061-01 (Radiated)
Bluetooth Specification	Bluetooth_LE
ZigBee Specification	802.15.4
Wi-Fi Specification	802.11a/b/g/n/ac/ax/be
Operating Temperature	0 ~ 50 °C
Antenna Information	Refer to section 1.7
Operating Environment	Indoor Use
Power Type	AC/DC Adapter or PoE Injector
Accessory (ies)	
Adapter	Model No.: AA65U-540A Input Power: 100 – 240 V ~ 50/60 Hz, 1.6 A Output Power: 54 V ⎓ 1.2 A, 64.8 W
PoE Injector	Model: POE60U-1BT-X Input: 100-240 V ~ 1.5 A, 50-60 Hz,98-104 VA Output: 56 V⎓0.535 A, 30 W PIN 3, 6+ PIN 1, 2 Return Output: 56 V⎓0.535 A, 30 W PIN 4, 5+ PIN 7, 8 Return

Notes:

1. The information of the EUT (Equipment Under Test) was provided by the manufacturer. The accuracy, completeness, and validity of the information are solely the responsibility of the manufacturer.
2. AC/DC Adapter and PoE Injector are not marketed in conjunction with the device.

1.5. Radio Specification under Test

Frequency Range	UNII-1: 5150 ~ 5250 MHz UNII-2A: 5250 ~ 5350 MHz UNII-2C: 5470 ~ 5725 MHz UNII-3: 5725 ~ 5850 MHz	
Modulation Technology	802.11a/n/ac: OFDM 802.11ax/be: OFDMA	
Data Rate	802.11a: 6/9/12/18/24/36/48/54 Mbps 802.11n: up to 600 Mbps 802.11ac: up to 3466.7 Mbps 802.11ax: up to 4804 Mbps 802.11be: up to 5764 Mbps	
Channel Puncturing Function	☐ Supported	☒ Unsupported
Support RU	☒ Full RU	☐ Partial RU

1.6. Working Frequencies

802.11a/n-HT20/ac-VHT20/ax-HE20/be-EHT20

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
116	5580 MHz	120	5600 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	--	--	--	--

802.11n-HT40/ac-VHT40/ax-HE40/be-EHT40

Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz	54	5270 MHz
62	5310 MHz	102	5510 MHz	110	5550 MHz
118	5590 MHz	126	5630 MHz	134	5670 MHz
142	5710 MHz	151	5755 MHz	159	5795 MHz

802.11ac-VHT80/ax-HE80/be-EHT80

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

802.11ac-VHT160/ax-HE160/be-EHT160

Channel	Frequency	Channel	Frequency	Channel	Frequency
50	5250 MHz	114	5570 MHz	--	--

1.7. Antenna Details

Antenna Type	Frequency Band (MHz)	Antenna Gain (dBi)				Directional Gain (dBi)	
		Ant 0	Ant 1	Ant 2	Ant 3	For Power	For PSD
Wi-Fi Antenna (2.4 GHz / 5 GHz / 6 GHz)							
Omni-directional	2400 ~ 2483.5	3.30	3.30	3.30	3.30	3.30	9.32
	5150 ~ 5850	3.30	3.30	3.30	3.30	3.30	9.32
	5925 ~ 6425	4.40	4.40	4.40	4.40	4.40	10.42
	6525 ~ 6875	4.40	4.40	4.40	4.40	4.40	10.42

Notes:

1. The EUT supports Cyclic Delay Diversity (CDD) mode for 802.11a/b/g/n/ac/ax/be.
2. The EUT also supports Beamforming mode for 802.11n/ac/ax/be, not include 802.11a/b/g.
3. All antenna information is provided by the manufacturer.

1.8. WLAN Configuration

Model No.	WLAN Antenna Port	WLAN Config 1 - Supporting Band	WLAN Config 2 - Supporting Band
AP541e	5GHz 4TX Port	5GHz Full Band: U-NII-1 (5150-5250 MHz) U-NII-2A (5250-5350 MHz) U-NII-2C (5470-5725 MHz) U-NII-3 (5725-5850 MHz)	5GHz Low Band: U-NII-1 (5150-5250 MHz) U-NII-2A (5250-5350 MHz)
	2GHz 4TX Port	2412 to 2462 MHz	2412 to 2462 MHz
	6GHz 4TX Port	U-NII-5 (5925-6425 MHz) U-NII-7 (6525-6875 MHz)	5GHz High Band: U-NII-2C (5470-5725 MHz) U-NII-3 (5725-5850 MHz)

Note 1: WLAN Config 1 and WLAN Config 2 only differ in the software settings and there are no changes in the hardware.

Note 2: For WLAN Config 2, only the 5GHz High Band was tested; the data for the 5GHz Low Band is referenced from WLAN Config 1.

2. Test Configuration

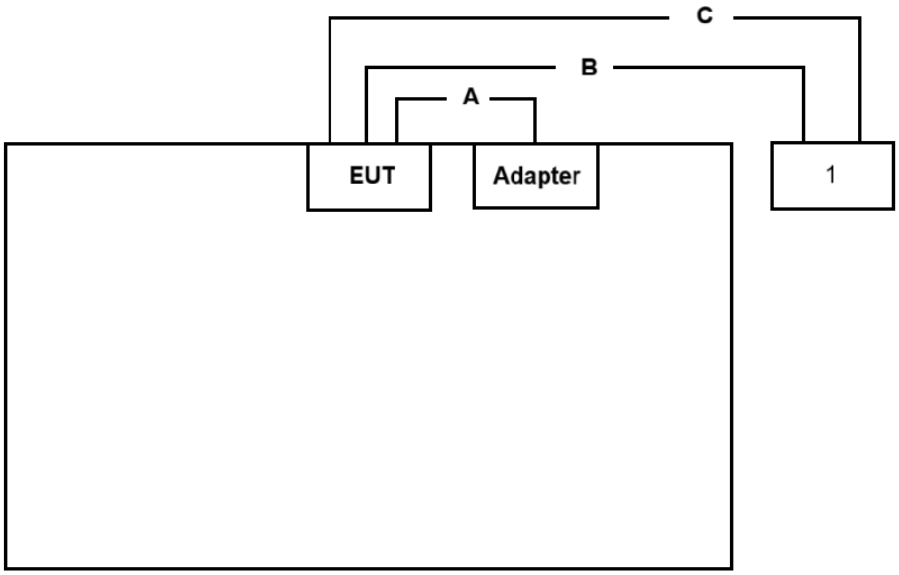
2.1. Test Mode

Mode 1: Transmit by 802.11a (6 Mbps)
Mode 2: Transmit by 802.11ac-VHT20 (MCS0)
Mode 3: Transmit by 802.11ac-VHT40 (MCS0)
Mode 4: Transmit by 802.11ac-VHT80 (MCS0)
Mode 5: Transmit by 802.11ac-VHT160 (MCS0)
Mode 6: Transmit by 802.11ax-HE20 (MCS0)
Mode 7: Transmit by 802.11ax-HE40 (MCS0)
Mode 8: Transmit by 802.11ax-HE80 (MCS0)
Mode 9: Transmit by 802.11ax-HE160 (MCS0)
Mode 10: Transmit by 802.11be-EHT20 (MCS0)
Mode 11: Transmit by 802.11be-EHT40 (MCS0)
Mode 12: Transmit by 802.11be-EHT80 (MCS0)
Mode 13: Transmit by 802.11be-EHT160 (MCS0)
Note 1: 802.11n (HT) and 802.11ac (VHT) modes are both OFDM-based technologies and are configured with the same output power settings as declared by the manufacturer. Based on this technical rationale, 802.11ac was selected as the representative mode for RF testing. Therefore, only the 802.11ac test data are presented in this report. Note 2: 802.11ax (HE) and 802.11be (EHT) are both OFDMA-based modes. Considering the similarity of the modulation technology and the output power verification results, 802.11be were selected as representative worst-case modes for RF testing. Therefore, only the 802.11be test data are presented in this report. Note 3: All applicable modes of operation and data rates were investigated. The RF test requirements were performed on the selected representative worst-case configurations with the highest measured output power. Note 4: For beamforming operation, manufacturer automatically backs power down based on a 10log(N_{ANT}) factor based on CDD power. Therefore, only the CDD mode was evaluated in this report.

2.2. Test System Connection Diagram

The device was tested per the guidance ANSI C63.10-2020 was used to reference the appropriate EUT setup for radiated emissions testing and AC conducted emissions testing.

Connection Diagram - Radiated Emission testing & AC Conducted Emissions



Cable Type		Cable Description	Length
A	Power Cable	Non shielded	1.5 m
B	USB Cable	Shielded	> 10 m
C	LAN Cable	Non shielded, Cat.5e	> 10 m
Product		Manufacturer	Model No.
1	Notebook	ThinkPad	Gen 5 E14

2.3. Test Software

The test utility software used during testing was “QSPR” and the version was “5.0-00202”.

2.4. 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 D02 v02r01
- KDB 662911 D01 v02r01
- ANSI C63.10-2020
- ANSI C63.10-2020/Cor1-2023
- ANSI C63.10a-2024

2.5. Test Environment Condition

Ambient Temperature	15 ~ 35 °C
Relative Humidity	20 ~ 75%RH

3. 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."

Conclusion:

The unit complies with the requirement of §15.203.

4. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2026-12-03	SIP-AC3
Signal Analyzer	Keysight	N9010B	MRTSUE06559	1 year	2026-04-26	SIP-AC3
Preamplifier	EMCI	EMC184045SE	MRTSUE06602	1 year	2026-09-29	SIP-AC3
Horn Antenna	R&S	HF907	MRTSUE06611	1 year	2026-06-20	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06619	1 year	2026-10-16	SIP-AC3
Preamplifier	EMCI	EMC012645SE	MRTSUE06642	1 year	2026-01-04 2027-01-03	SIP-AC3
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06646	1 year	2026-07-03	SIP-AC3
Anechoic Chamber	RIKEN	SIP-AC3	MRTSUE06782	1 year	2026-12-15	SIP-AC3
Signal Analyzer	Keysight	N9010B	MRTSUE07028	1 year	2026-09-28	SIP-AC3
Active Loop Antenna	Schwarzbeck	FMZB 1519-60 D	MRTSUE07075	1 year	2026-11-18	SIP-AC3
USB Power Sensor	Keysight	U2021XA	MRTSUE06596	1 year	2026-07-14	SIP-TR2
Temperature Chamber	BAOYT	BYG-408CS	MRTSUE06847	1 year	2026-01-18 2027-01-17	SIP-TR1
Signal Analyzer	Keysight	N9010B	MRTSUE07036	1 year	2026-01-18 2027-01-17	SIP-TR1/SIP-TR2
Thermohygrometer	testo	608-H1	MRTSUE11022	1 year	2026-10-16	SIP-TR1
Thermohygrometer	testo	608-H1	MRTSUE11563	1 year	2026-03-03 2027-03-02	SIP-TR2
Attenuator	MVE	MVE2213	MRTSUE11100	1 year	2026-06-04	SIP-TR1/SIP-TR2
Attenuator	MVE	MVE2213	MRTSUE11057	1 year	2026-06-04	SIP-TR1/SIP-TR2
EMI Test Receiver	R&S	ESR3	MRTSUE06612	1 year	2026-04-29	SIP-SR2
Four-Line V-Network	R&S	ENV432	MRTSUE06614	1 year	2026-09-28	SIP-SR2
Thermohygrometer	testo	608-H1	MRTSUE06621	1 year	2026-10-08	SIP-SR2
Shielding Room	MIX-BEP	SIP-SR2	MRTSUE06949	5 years	2029-10-13	SIP-SR2

Note: The loss of the Attenuator & Cable will be measured before testing.

Software	Version	Function
e3	230711	RE & CE
Controller_MF 7802BS	1.02	RE Antenna & Turntable
Agilent Power Analyzer/Agilent Power Panel	V R03.09.00	Power

5. Decision Rules and Measurement Uncertainty

5.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.2. 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.

AC Conducted Emission Measurement
The maximum measurement uncertainty is evaluated as: 9 kHz ~ 150 kHz: 3.59 dB 150 kHz ~ 30 MHz: 3.20 dB
Radiated Emission Measurement
The maximum measurement uncertainty is evaluated as: Coaxial: 9 kHz ~ 30 MHz: 2.56 dB Coplanar: 9 kHz ~ 30 MHz: 2.55 dB Horizontal: 30 MHz ~ 200 MHz: 3.48 dB 200 MHz ~ 1 GHz: 4.17 dB 1 GHz ~ 40 GHz: 5.01 dB Vertical: 30 MHz ~ 200 MHz: 4.09 dB 200 MHz ~ 1 GHz: 5.30 dB 1 GHz ~ 40 GHz: 4.85 dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2 Uc(y)): 2.9 dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2 Uc(y)): 1.4 dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2 Uc(y)): 2.9 dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2 Uc(y)): 2.6%

6. Test Result

6.1. Summary

FCC Section(s)	Test Description	Test Condition	Verdict
15.407(a)	26 dB Bandwidth	Conducted	Pass
15.407(e)	6 dB Bandwidth		Pass
15.407(a)(1)(ii), (2), (3)(i)	Maximum Conducted Output Power		Pass
15.407(h)(1)	Transmit Power Control		Pass
15.407(g)	Frequency Stability		Pass
15.407(a)(1)(ii), (2), (3)(i), (13)	Peak Power Spectral Density		Pass
15.407(h)(2)	Dynamic Frequency Selection (DFS)		Pass Note 3
15.407(b)(1), (2), (3), (4)(i)	Undesirable Emissions	Radiated	Pass
15.205, 15.209 15.407(b)(8), (9), (10)	General Field Strength (Restricted Bands and Radiated Emissions)		Pass
15.207	AC Conducted Emissions 150 kHz - 30 MHz	Line Conducted	Pass

Notes:

1. The analyzer plots shown in this section were captured using a correction table to account for cable and attenuator losses in the system connecting the EUT to the analyzer across relevant frequencies.
2. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
3. DFS report refer to R26S1033075-U205.

6.2. 26 dB & 99% Bandwidth Measurement

6.2.1. Test Limit

N/A

6.2.2. Test Procedure

KDB 789033 D02 v02r01 - Section II - C.1 (26 dB Bandwidth)

KDB 789033 D02 v02r01 - Section II - D (99% Bandwidth)

6.2.3. Test Setting

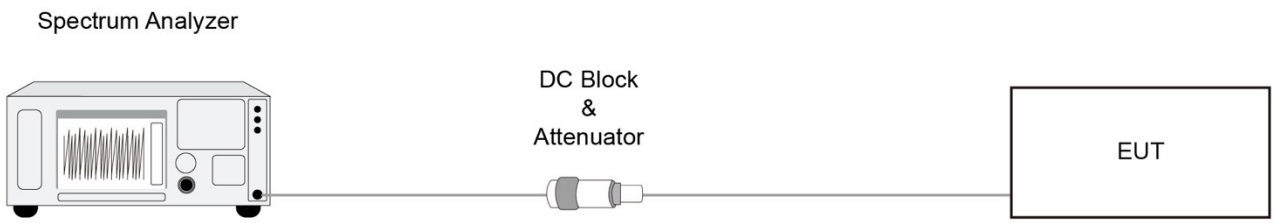
26 dB Bandwidth

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26 dB bandwidth
2. RBW = Approximately 1% of the emission bandwidth
3. VBW ≥ 3 × 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. Span = 1.5 times to 5.0 times the OBW
3. RBW = 1% to 5% of the OBW
4. VBW ≥ 3 × RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99% power bandwidth function of the instrument

6.2.4. Test Setup



6.2.5. Test Result

Refer to Appendix A.2.

6.3. 6 dB Bandwidth Measurement

6.3.1. Test Limit

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

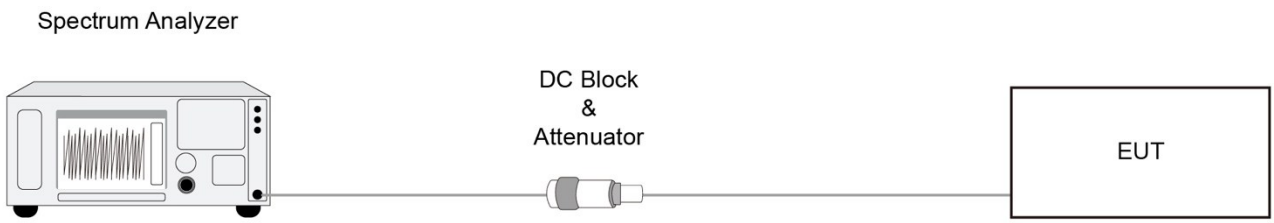
6.3.2. Test Procedure

KDB 789033 D02 v02r01 - Section II - C.2

6.3.3. 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

6.3.4. Test Setup



6.3.5. Test Result

Refer to Appendix A.3.

6.4. Output Power Measurement

6.4.1. Test Limit

For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

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 or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30 dBm).

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

6.4.2. Test Procedure

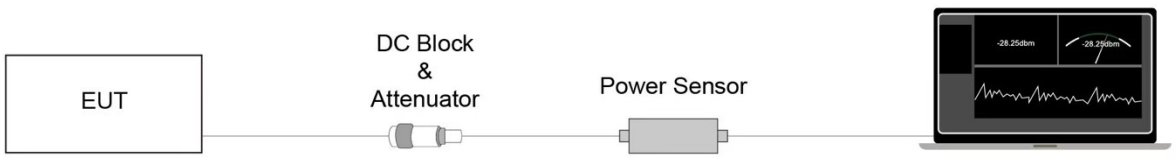
KDB 789033 D02 v02r01 - Section II - E.3.b (Method PM-G)

6.4.3. Test Setting

Average Power Measurement

Average power measurements were performed 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.

6.4.4. Test Setup



6.4.5. Test Result

Refer to Appendix A.4.

6.5. Transmit Power Control Measurement

6.5.1. 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.

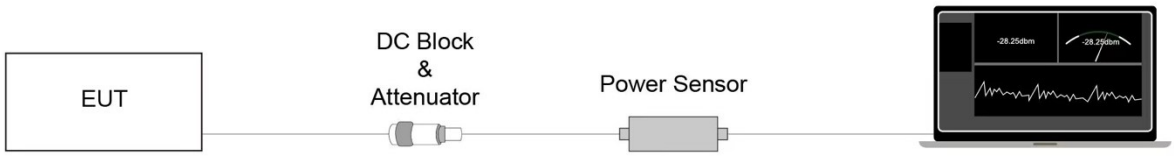
6.5.2. Test Procedure

KDB 789033 D02 v02r01 - Section II - E.3.b (Method PM-G)

6.5.3. Test Setting

Average power measurements were performed 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.

6.5.4. Test Setup



6.5.5. Test Result

Device supports TPC mechanism, details refer to the operational description.

6.6. Power Spectral Density Measurement

6.6.1. Test Limit

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

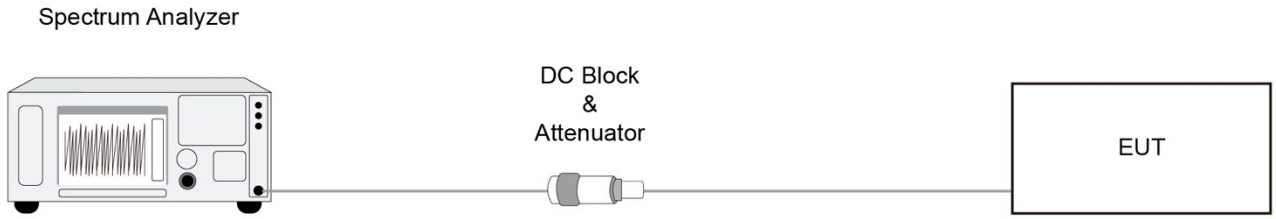
6.6.2. Test Procedure

KDB 789033 D02 v02r01 - Section II - F

6.6.3. Test Setting

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire 26 dB EBW of the signal.
3. RBW = 1 MHz (510 kHz, if measurement bandwidth of Maximum PSD is specified in 500 kHz)
4. VBW ≥ 3 × RBW
5. Number of sweep points ≥ 2 × (Span / RBW)
6. Detector = Power averaging (RMS)
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. If duty cycle < 98%, 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; If duty cycle ≥ 98%, no need to add 10×log(1/x).

6.6.4. Test Setup



6.6.5. Test Result

Refer to Appendix A.5.

6.7. Frequency Stability Measurement

6.7.1. Test Limit

Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

6.7.2. Test Procedure

Frequency Stability Under Temperature Variations:

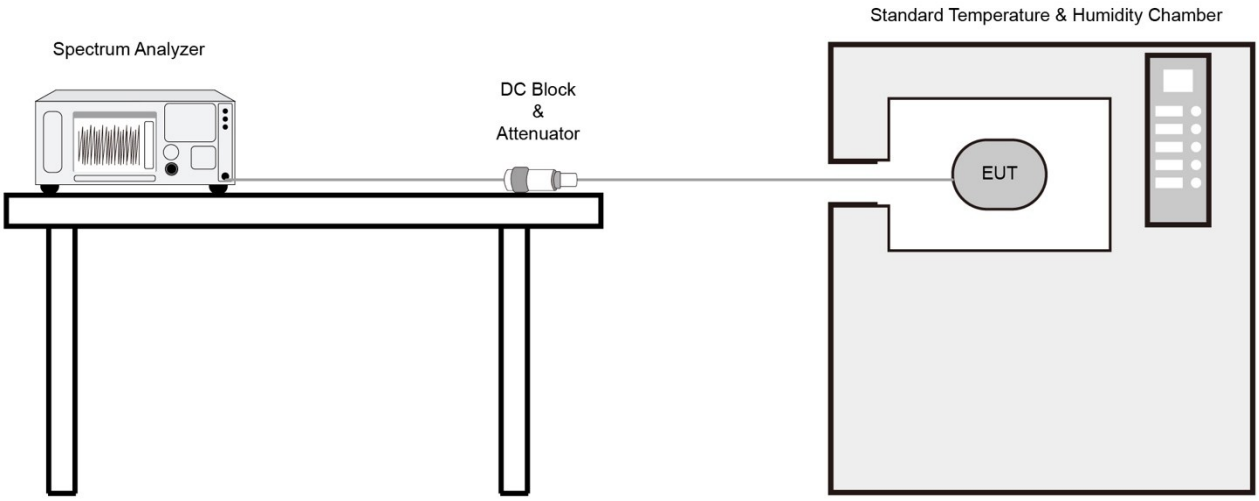
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, record the maximum frequency change.

6.7.3. Test Setup



6.7.4. Test Result

Refer to Appendix A.6.

6.8. Radiated Spurious Emissions Measurement

6.8.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [μV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.8.2. Test Procedure

KDB 789033 D02 v02r01 - Section II - G

6.8.3. Test Setting

Table 1 - RBW as a function of frequency

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Quasi-Peak Measurements below 1 GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1 MHz
3. RBW = as specified in Table 1
4. VBW ≥ 3 × RBW
5. Detector = CISPR quasi-peak
6. Sweep time = Auto couple
7. Trace was allowed to stabilize

Peak Measurements above 1 GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1 MHz
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max hold
7. Trace was allowed to stabilize

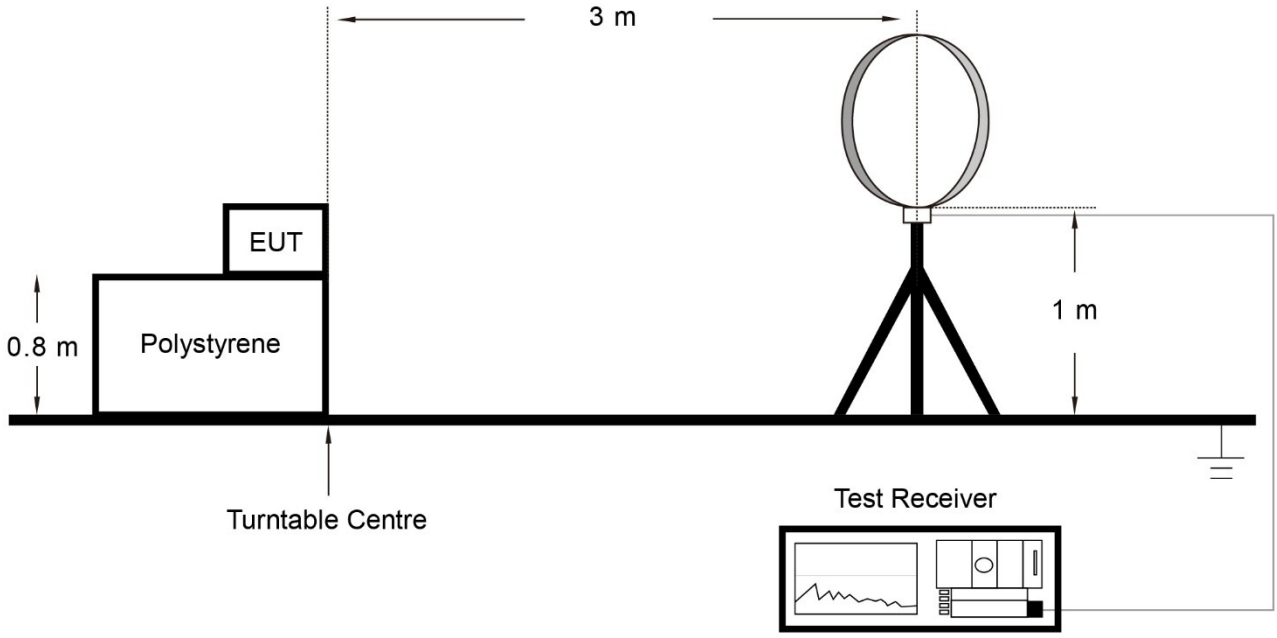
Average Measurements above 1 GHz (Method VB)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1 MHz
3. VBW; if the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz

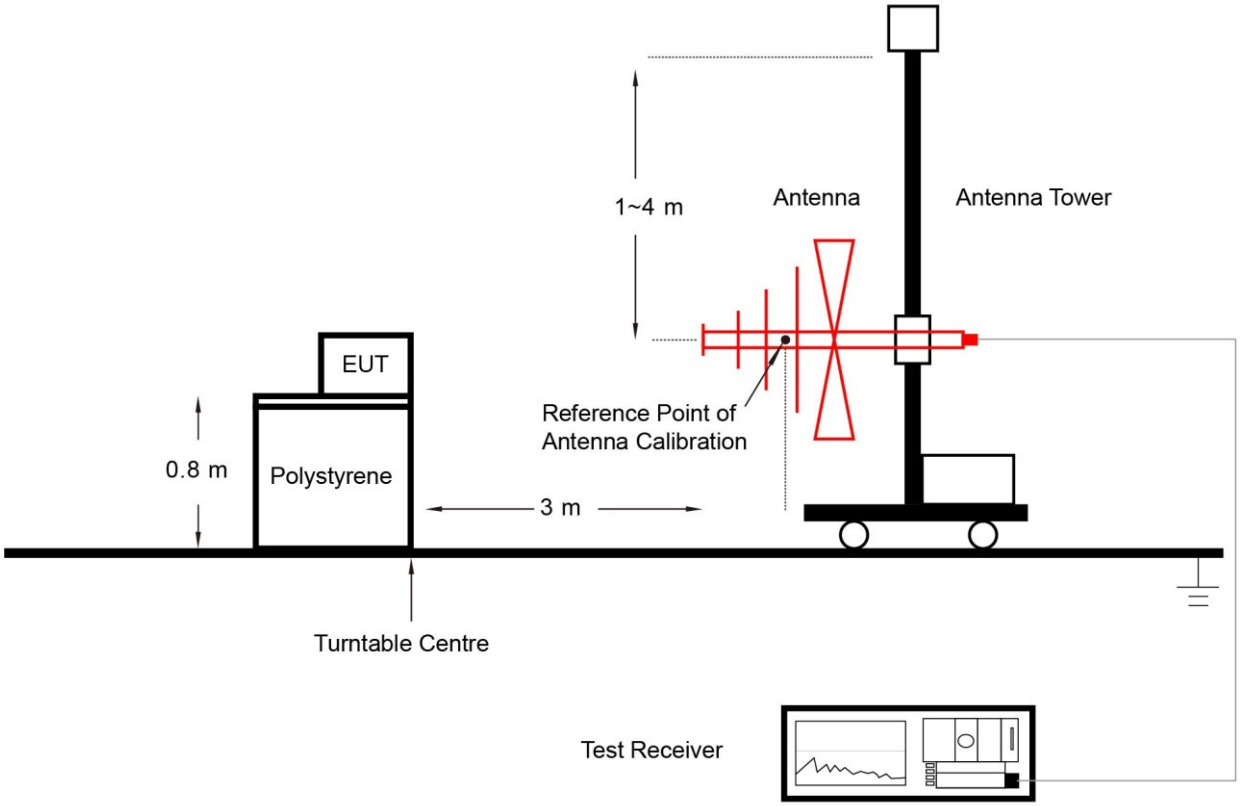
   If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.
4. As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
5. Detector = Peak
6. Sweep time = Auto
7. Trace mode = Max hold
8. Trace was allowed to stabilize

6.8.4. Test Setup

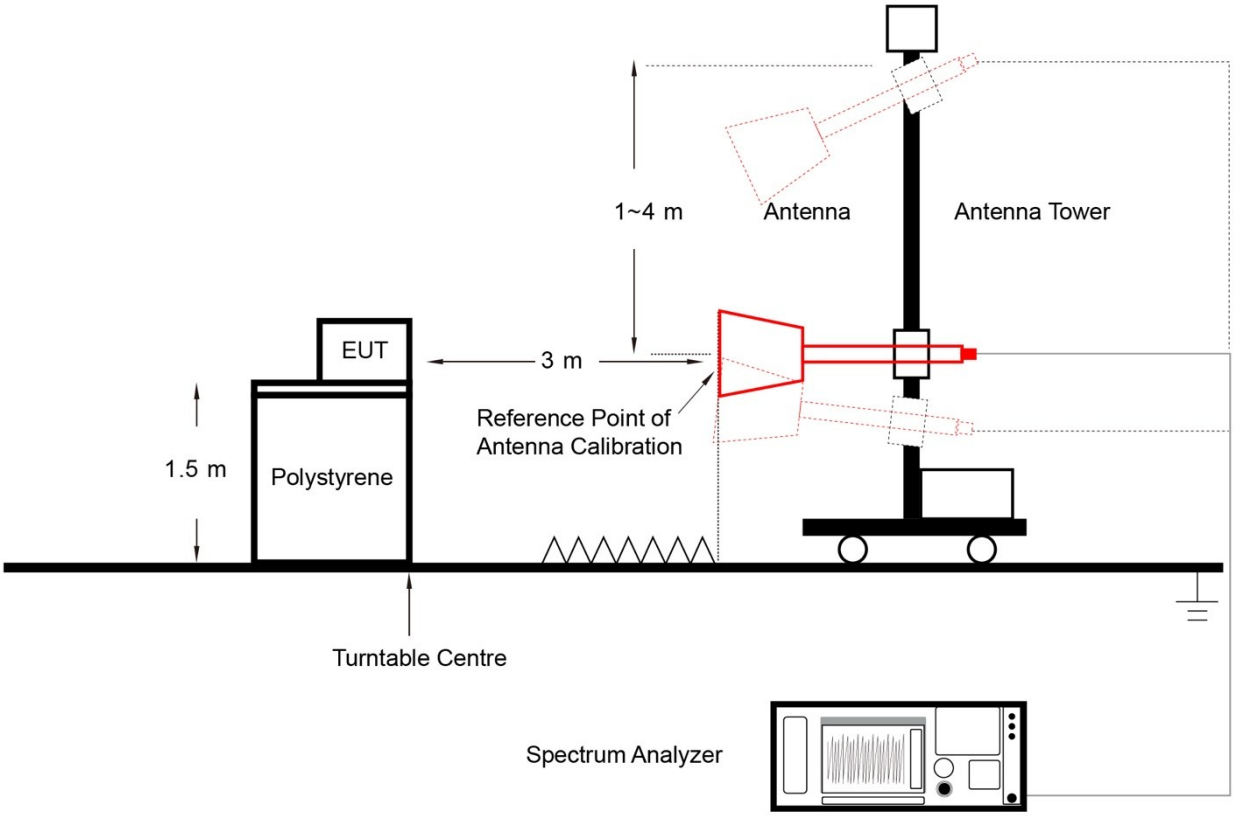
Below 30 MHz Test Setup:



Below 1 GHz Test Setup:



Above 1 GHz Test Setup:



6.8.5. Test Result

Refer to Appendix A.7.

6.9. Radiated Restricted Band Edge Measurement

6.9.1. Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1] 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41	--	--	--

For 15.407(b) requirement:

For transmitters operating in the band 5150-5250 MHz:

All emissions outside of the band 5150-5350 MHz shall not exceed an EIRP of -27 dBm/MHz.

For transmitters operating in the band 5250-5350 MHz:

All emissions outside of the band 5150-5350 MHz shall not exceed an EIRP of -27 dBm/MHz.

For transmitters operating in the band 5470-5725 MHz:

All emissions outside of the band 5470-5725 MHz shall not exceed an EIRP of -27 dBm/MHz.

For transmitters operating in the band 5725-5850 MHz:

All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Refer to KDB 789033 D02 v02r01 - Section II - G.2.c, as specified in § 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a maximum emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in § 15.407(b)(4)). However, an out-of-band emission that complies with both the peak and average limits of § 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz maximum emission limit.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [μV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.9.2. Test Procedure

KDB 789033 D02 v02r01 - Section II - G

6.9.3. Test Setting

Peak Field Strength Measurements

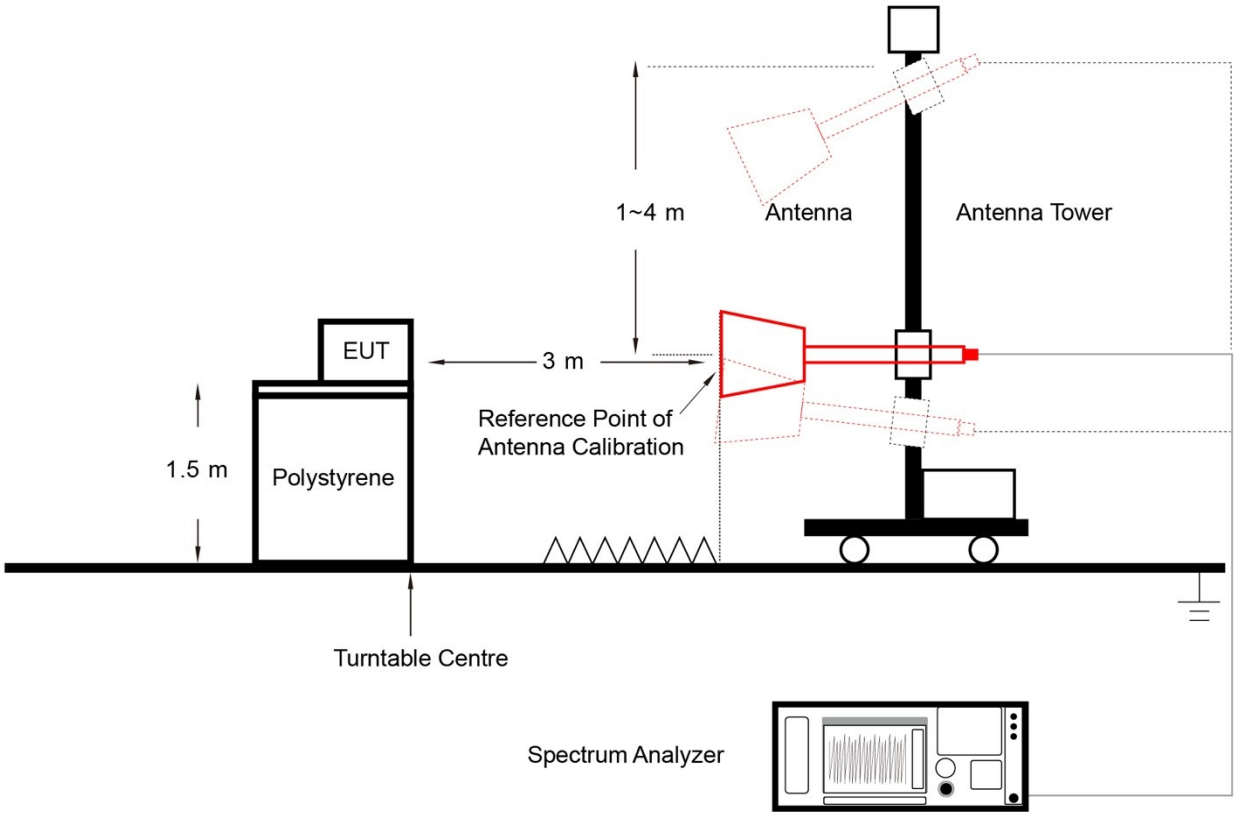
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1 MHz
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max hold
7. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1 MHz
3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.

   If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.
4. As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to “Voltage” regardless of the display mode
5. Detector = Peak
6. Sweep time = Auto
7. Trace mode = Max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

6.9.4. Test Setup



6.9.5. Test Result

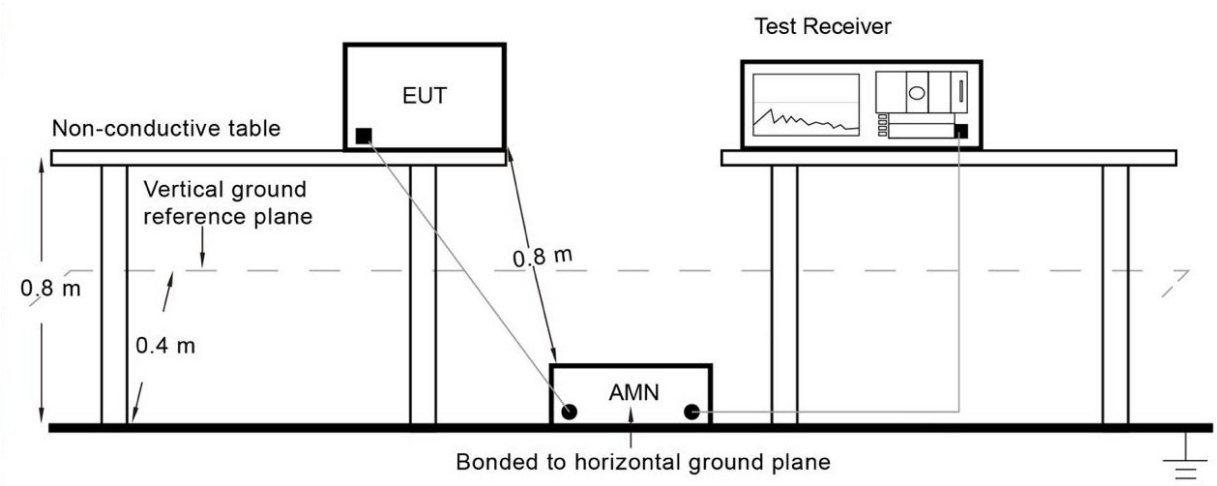
Refer to Appendix A.8.

6.10. AC Conducted Emissions Measurement

6.10.1. Test Limit

FCC Part 15.207 Limits		
Frequency (MHz)	QP (dBμV)	AV (dBμV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50
Note 1: The lower limit shall apply at the transition frequencies. Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.		

6.10.2. Test Setup



6.10.3. Test Result

Refer to Appendix A.9.

Appendix A - Test Result

A.1 Duty Cycle Test Result

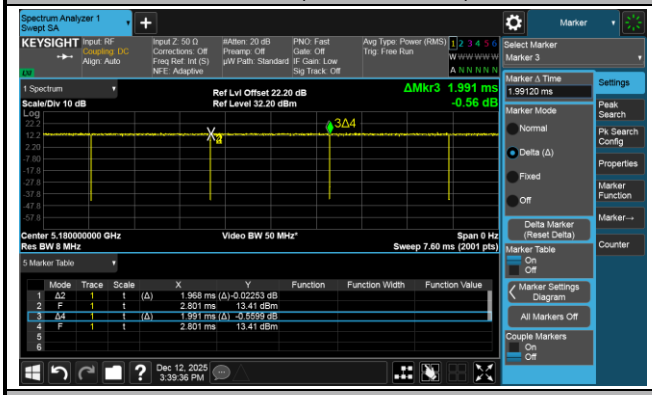
AP541e - WLAN Config 1

Test Site	SIP-TR2	Test Engineer	Nolan Chen
Test Date	2025-12-12		

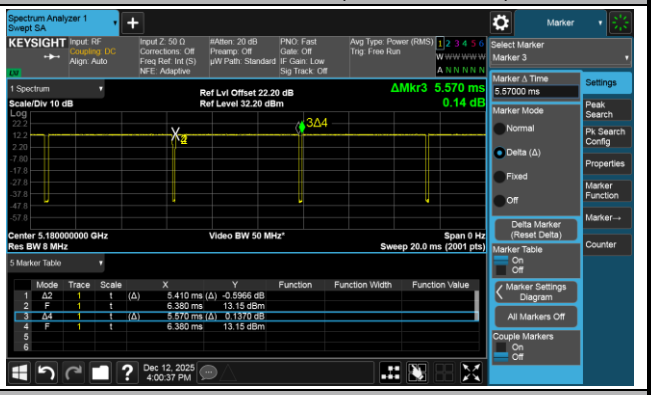
Test Mode	Duty Cycle	Test Mode	Duty Cycle
11a	98.84%	11be-EHT20	97.84%
11ac-VHT20	97.13%	11be-EHT40	96.96%
11ac-VHT40	98.35%	11be-EHT80	96.27%
11ac-VHT80	96.95%	11be-EHT160	96.62%
11ac-VHT160	96.95%	--	--

Duty Cycle (T = Transmission Duration)

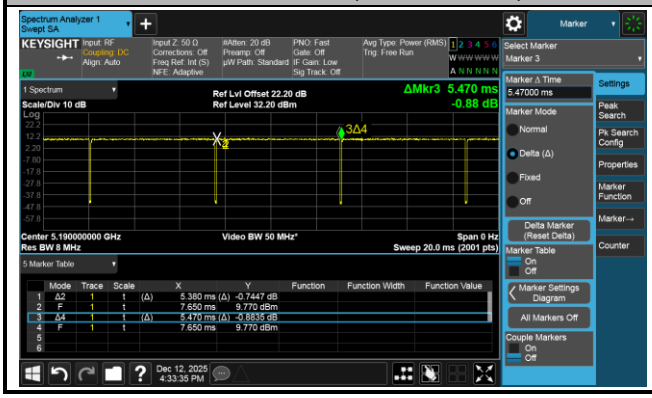
802.11a (T = 1.968 ms)



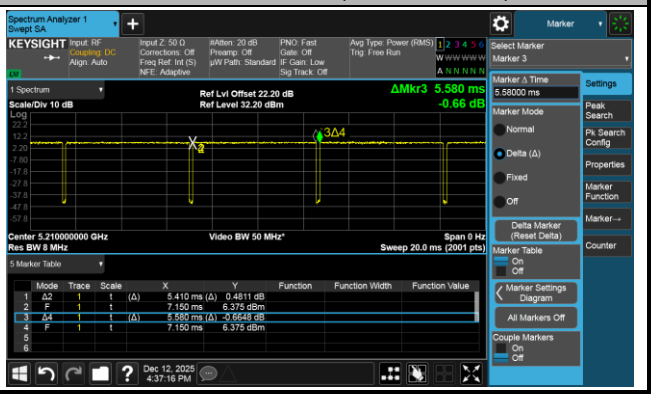
802.11ac-VHT20 (T = 5.410 ms)

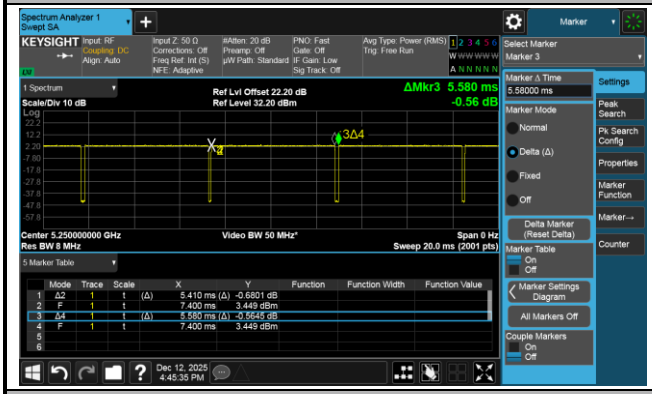
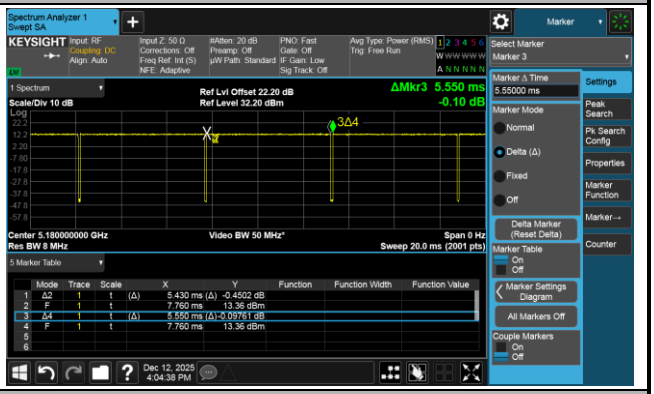
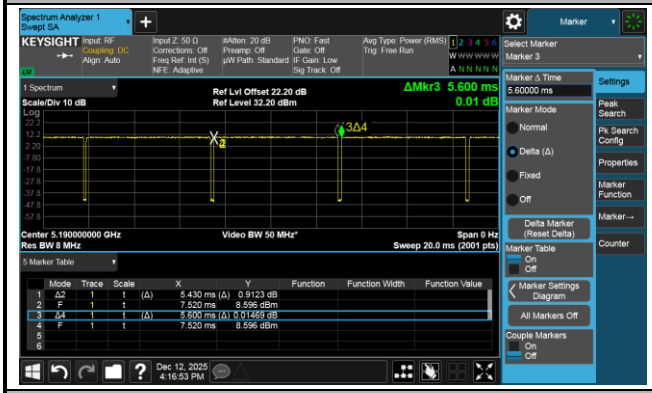
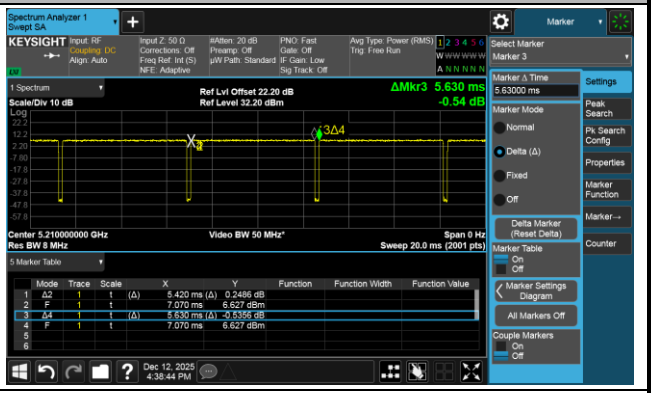
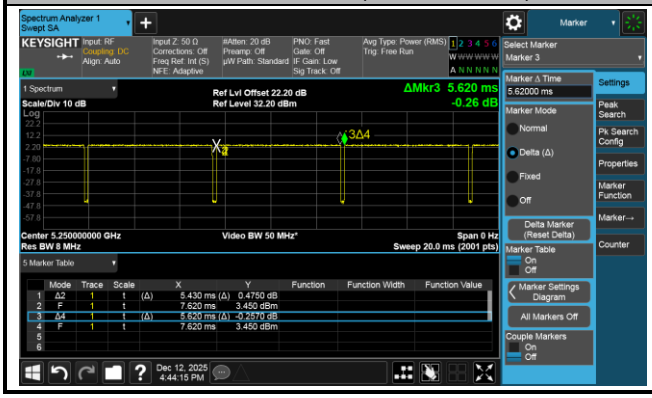


802.11ac-VHT40 (T = 5.380 ms)



802.11ac-VHT80 (T = 5.410 ms)



Duty Cycle (T = Transmission Duration)	
802.11ac-VHT160 (T = 5.410 ms)	802.11be-EHT20 (T = 5.430 ms)
	
802.11be-EHT40 (T = 5.430 ms)	802.11be-EHT80 (T = 5.420 ms)
	
802.11be-EHT160 (T = 5.430 ms)	
	

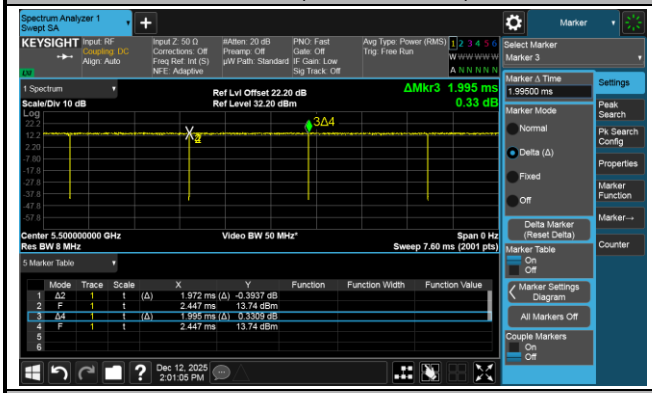
AP541e - WLAN Config 2

Test Site	SIP-TR2	Test Engineer	Nolan Chen
Test Date	2025-12-12		

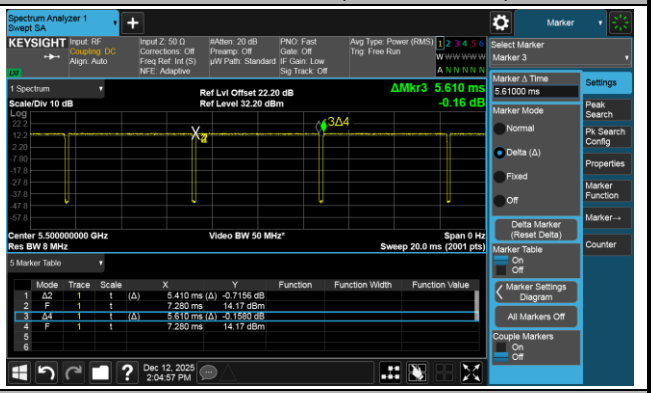
Test Mode	Duty Cycle	Test Mode	Duty Cycle
11a	98.85%	11be-EHT20	96.45%
11ac-VHT20	96.43%	11be-EHT40	98.19%
11ac-VHT40	96.79%	11be-EHT80	97.67%
11ac-VHT80	96.43%	11be-EHT160	97.67%
11ac-VHT160	98.54%	--	--

Duty Cycle (T = Transmission Duration)

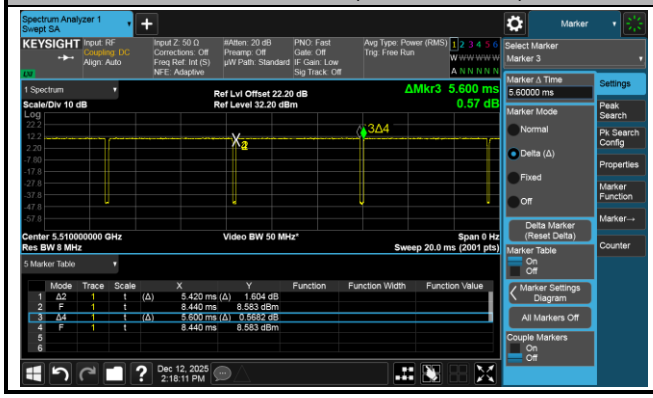
802.11a (T = 1.972 ms)



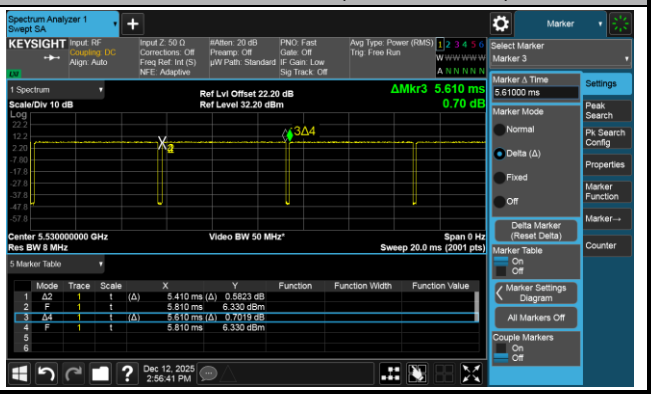
802.11ac-VHT20 (T = 5.410 ms)

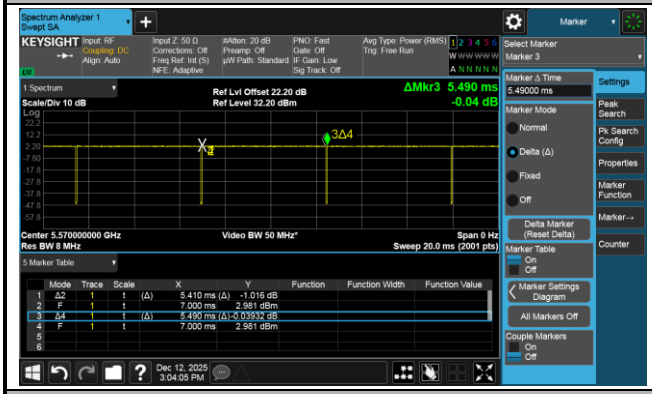
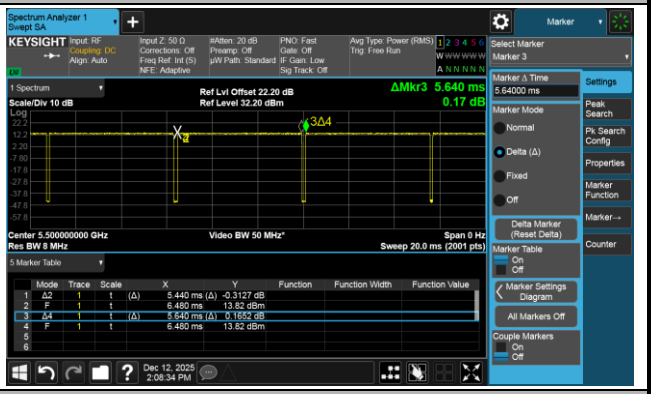
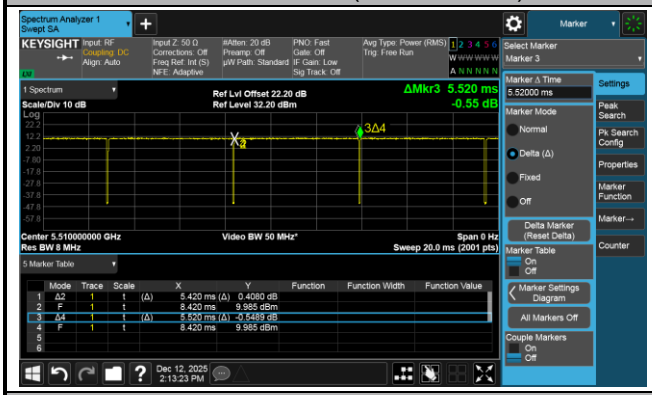
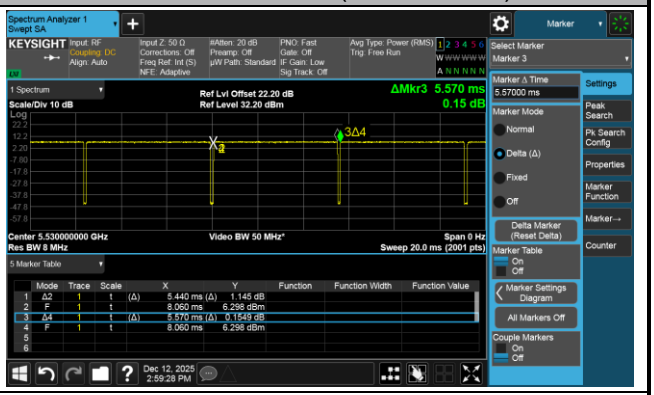
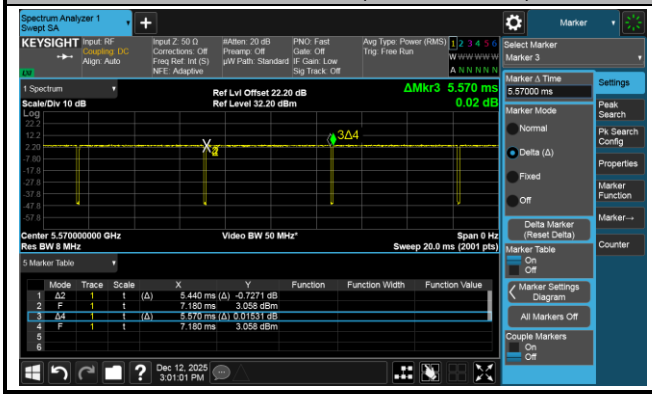


802.11ac-VHT40 (T = 5.420 ms)



802.11ac-VHT80 (T = 5.410 ms)



Duty Cycle (T = Transmission Duration)	
802.11ac-VHT160 (T = 5.410 ms)	802.11be-EHT20 (T = 5.440 ms)
	
802.11be-EHT40 (T = 5.420 ms)	802.11be-EHT80 (T = 5.440 ms)
	
802.11be-EHT160 (T = 5.440 ms)	
	

A.2 26 dB Bandwidth Test Result

AP541e - WLAN Config 1

Test Site	SIP-TR2	Test Engineer	Nolan Chen
Test Date	2025-12-09 ~ 2026-03-03		

Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	6 Mbps	36	5180	22.39	16.876
11a	6 Mbps	44	5220	22.09	16.800
11a	6 Mbps	48	5240	22.10	16.806
11a	6 Mbps	52	5260	22.40	16.885
11a	6 Mbps	60	5300	22.15	16.860
11a	6 Mbps	64	5320	22.98	16.877
11a	6 Mbps	100	5500	22.70	16.825
11a	6 Mbps	116	5580	22.40	16.890
11a	6 Mbps	140	5700	22.57	16.983
11a	6 Mbps	144	5720	22.59	16.898
11a	6 Mbps	149	5745	22.72	16.870
11a	6 Mbps	157	5785	22.34	16.872
11a	6 Mbps	165	5825	22.58	16.890
11ac-VHT20	MCS0	36	5180	22.46	17.936
11ac-VHT20	MCS0	44	5220	22.67	17.901
11ac-VHT20	MCS0	48	5240	23.02	17.941
11ac-VHT20	MCS0	52	5260	23.00	17.908
11ac-VHT20	MCS0	60	5300	22.92	17.906
11ac-VHT20	MCS0	64	5320	22.75	17.910
11ac-VHT20	MCS0	100	5500	23.17	17.939
11ac-VHT20	MCS0	116	5580	23.42	17.983
11ac-VHT20	MCS0	140	5700	22.44	17.910
11ac-VHT20	MCS0	144	5720	22.85	17.868
11ac-VHT20	MCS0	149	5745	23.40	17.934
11ac-VHT20	MCS0	157	5785	22.72	17.926
11ac-VHT20	MCS0	165	5825	22.74	17.937

Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11ac-VHT40	MCS0	38	5190	45.46	36.671
11ac-VHT40	MCS0	46	5230	44.43	36.488
11ac-VHT40	MCS0	54	5270	45.47	36.571
11ac-VHT40	MCS0	62	5310	45.09	36.685
11ac-VHT40	MCS0	102	5510	43.98	36.504
11ac-VHT40	MCS0	110	5550	44.77	36.592
11ac-VHT40	MCS0	134	5670	44.28	36.499
11ac-VHT40	MCS0	142	5710	44.96	36.646
11ac-VHT40	MCS0	151	5755	44.81	36.635
11ac-VHT40	MCS0	159	5795	45.89	36.771
11ac-VHT80	MCS0	42	5210	90.92	76.140
11ac-VHT80	MCS0	58	5290	92.76	76.185
11ac-VHT80	MCS0	106	5530	89.41	76.277
11ac-VHT80	MCS0	122	5610	91.61	76.195
11ac-VHT80	MCS0	138	5690	94.74	76.360
11ac-VHT80	MCS0	155	5775	89.52	76.154
11ac-VHT160	MCS0	50	5250	173.20	155.52
11ac-VHT160	MCS0	114	5570	173.50	155.69
11be-EHT20	MCS0	36	5180	22.66	19.046
11be-EHT20	MCS0	44	5220	23.98	19.058
11be-EHT20	MCS0	48	5240	22.75	19.048
11be-EHT20	MCS0	52	5260	23.31	19.078
11be-EHT20	MCS0	60	5300	22.60	19.123
11be-EHT20	MCS0	64	5320	22.92	19.073
11be-EHT20	MCS0	100	5500	23.47	19.106
11be-EHT20	MCS0	116	5580	22.87	19.102
11be-EHT20	MCS0	140	5700	22.93	19.049
11be-EHT20	MCS0	144	5720	22.89	19.059
11be-EHT20	MCS0	149	5745	23.86	19.090
11be-EHT20	MCS0	157	5785	23.37	19.073
11be-EHT20	MCS0	165	5825	23.15	19.043

Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11be-EHT40	MCS0	38	5190	43.96	38.063
11be-EHT40	MCS0	46	5230	43.33	37.956
11be-EHT40	MCS0	54	5270	42.81	37.952
11be-EHT40	MCS0	62	5310	44.19	38.044
11be-EHT40	MCS0	102	5510	43.58	38.054
11be-EHT40	MCS0	110	5550	44.36	38.044
11be-EHT40	MCS0	134	5670	43.55	38.036
11be-EHT40	MCS0	142	5710	43.80	37.996
11be-EHT40	MCS0	151	5755	44.46	37.970
11be-EHT40	MCS0	159	5795	43.22	38.028
11be-EHT80	MCS0	42	5210	88.67	77.705
11be-EHT80	MCS0	58	5290	87.34	77.603
11be-EHT80	MCS0	106	5530	86.78	77.492
11be-EHT80	MCS0	122	5610	87.40	77.671
11be-EHT80	MCS0	138	5690	89.90	77.588
11be-EHT80	MCS0	155	5775	88.89	77.703
11be-EHT160	MCS0	50	5250	168.70	156.86
11be-EHT160	MCS0	114	5570	169.40	156.73

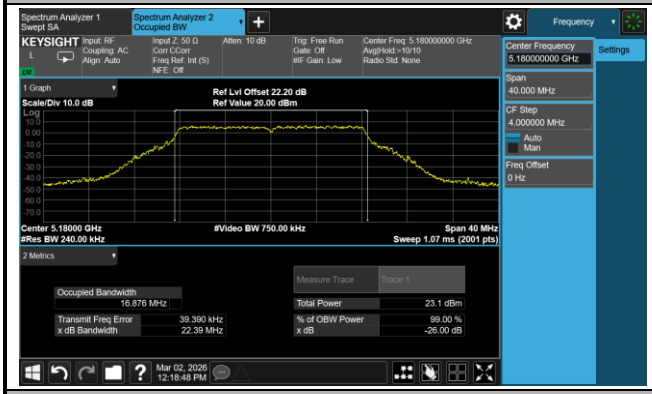
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	F_H (MHz)	Limit (MHz)
802.11a	6 Mbps	48	5240	5248.403	< 5250
802.11ac-VHT20	MCS0	48	5240	5248.971	< 5250
802.11ac-VHT40	MCS0	46	5230	5248.244	< 5250
802.11ac-VHT80	MCS0	42	5210	5248.070	< 5250
802.11be-EHT20	MCS0	48	5240	5249.524	< 5250
802.11be-EHT40	MCS0	46	5230	5248.978	< 5250
802.11be-EHT80	MCS0	42	5210	5248.853	< 5250

Note: F_H = Centre frequency + 99% OBW / 2.

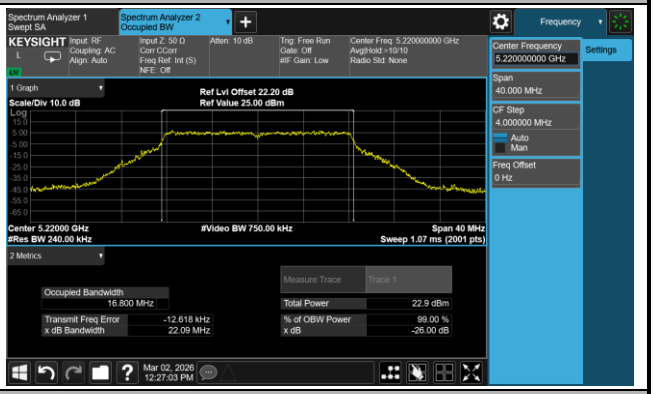
For example, 802.11a 5240 MHz, F_H = 5240 MHz + 16.806 MHz / 2 = 5248.403 MHz.

802.11a 26 dB Bandwidth & 99% Bandwidth

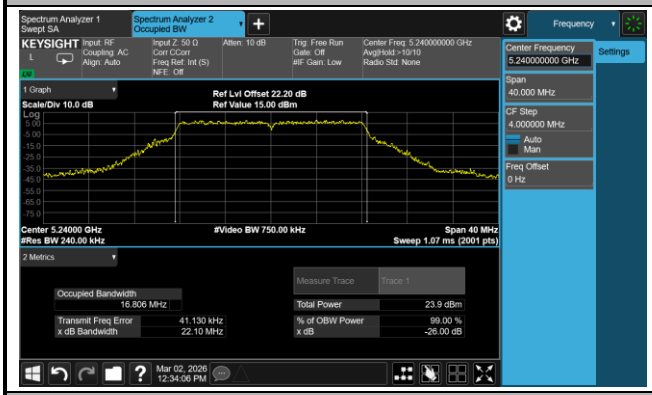
Channel 36 (5180 MHz)



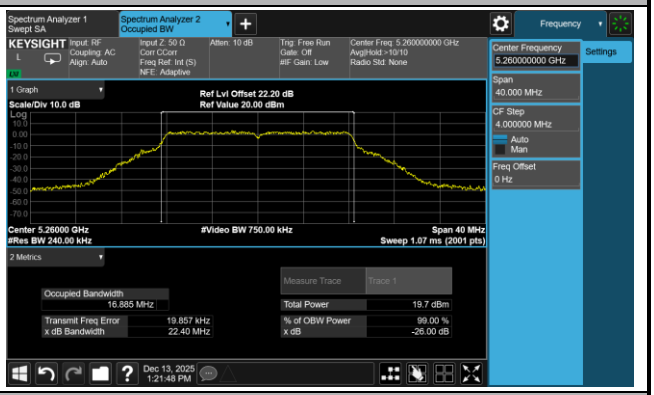
Channel 44 (5220 MHz)



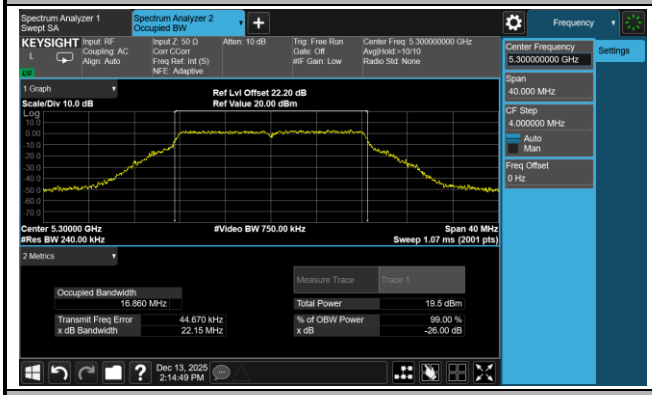
Channel 48 (5240 MHz)



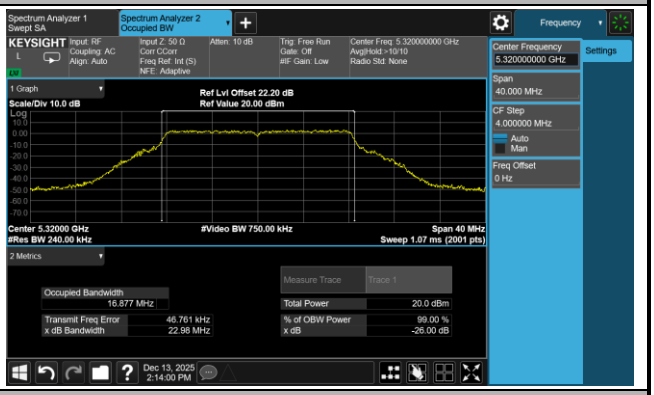
Channel 52 (5260 MHz)



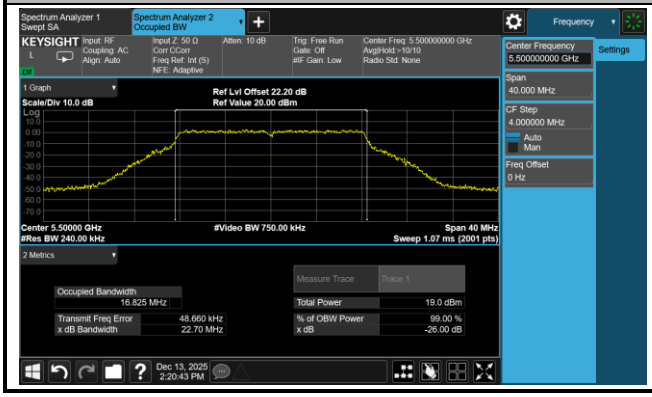
Channel 60 (5300 MHz)



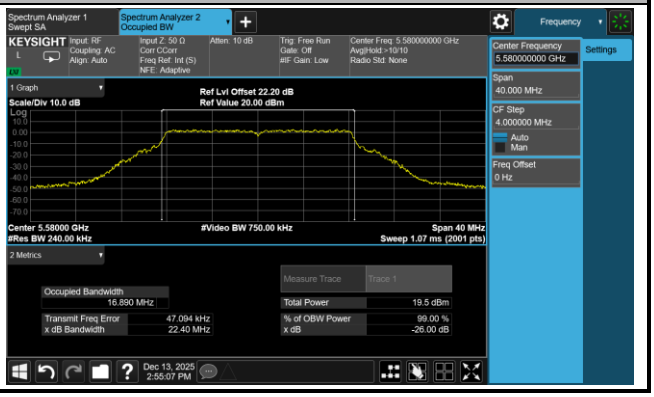
Channel 64 (5320 MHz)

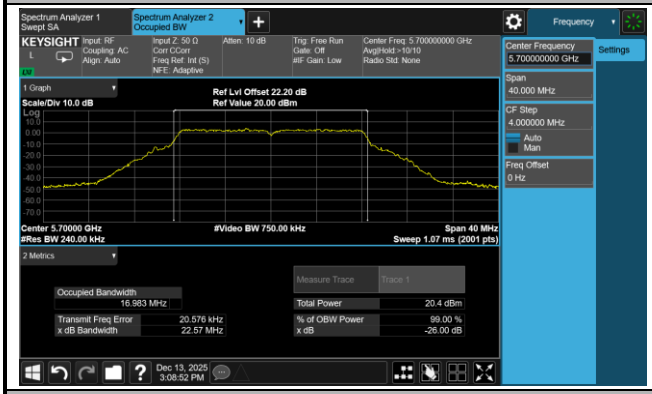
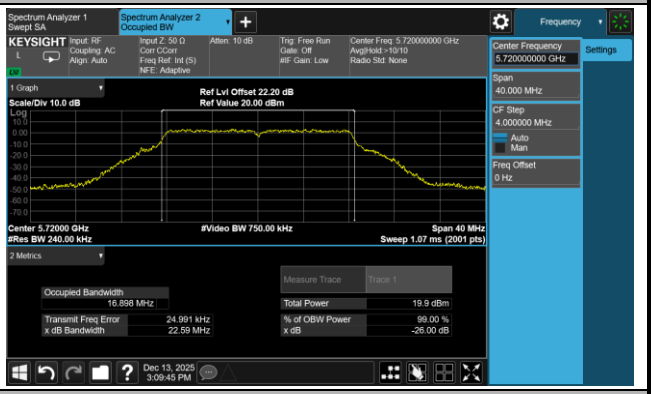
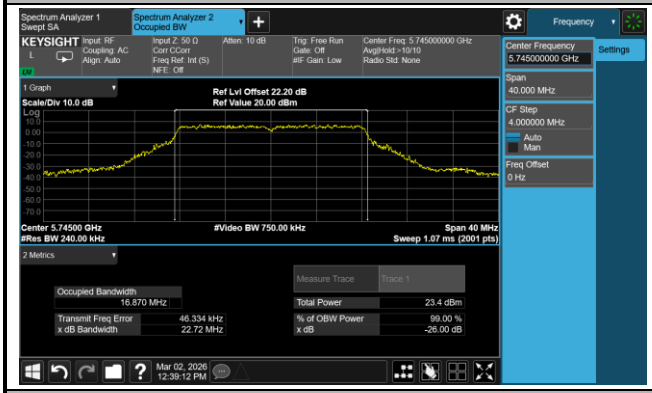
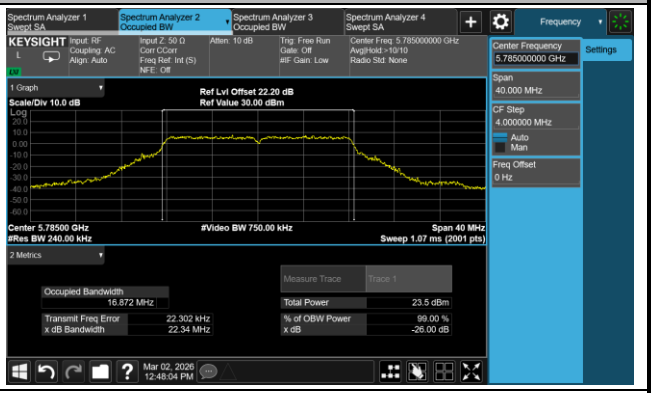
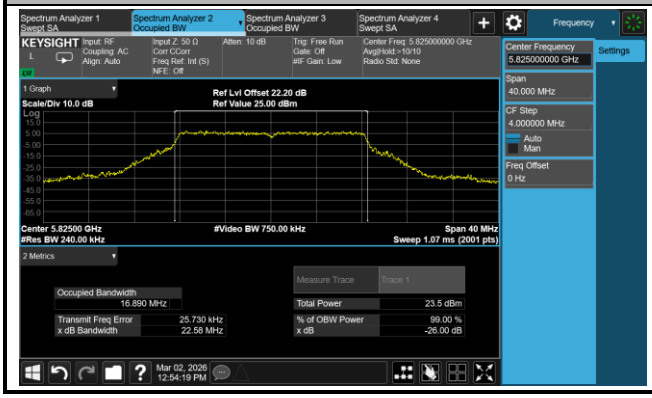


Channel 100 (5500 MHz)



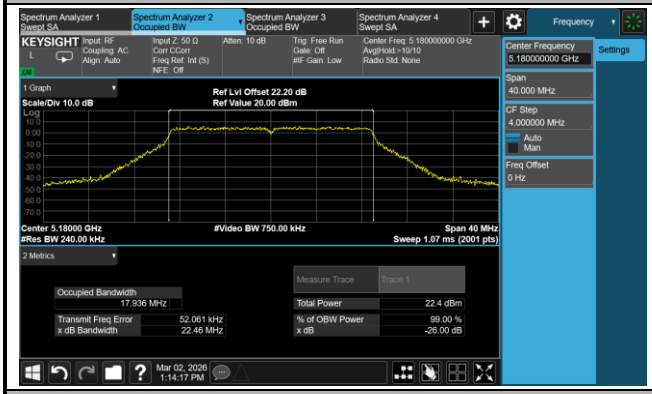
Channel 116 (5580 MHz)



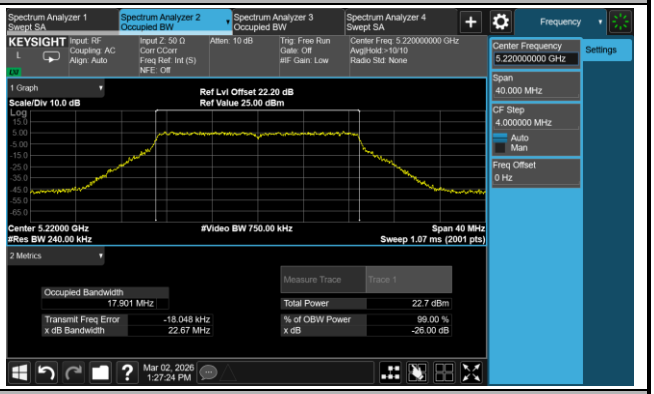
802.11a 26 dB Bandwidth & 99% Bandwidth	
Channel 140 (5700 MHz)	Channel 144 (5720 MHz)
	
Channel 149 (5745 MHz)	Channel 157 (5785 MHz)
	
Channel 165 (5825 MHz)	
	

802.11ac-VHT20 26 dB Bandwidth & 99% Bandwidth

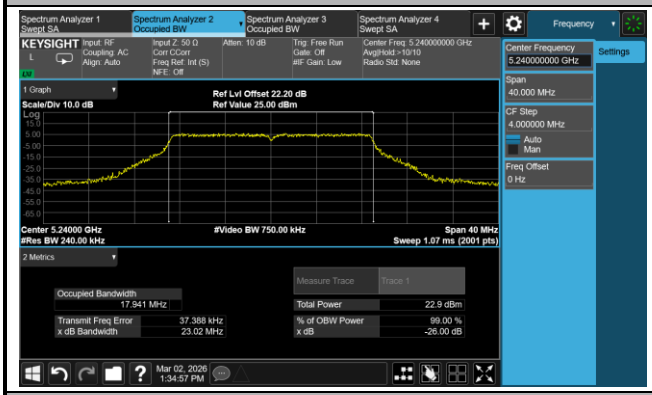
Channel 36 (5180 MHz)



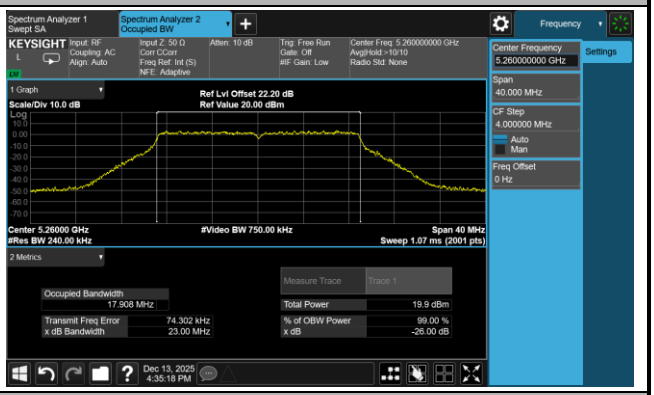
Channel 44 (5220 MHz)



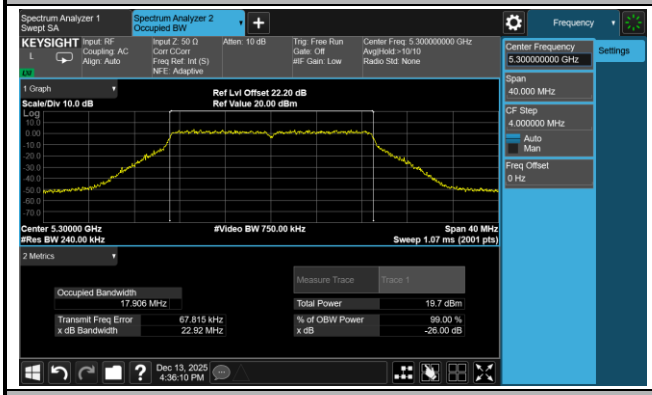
Channel 48 (5240 MHz)



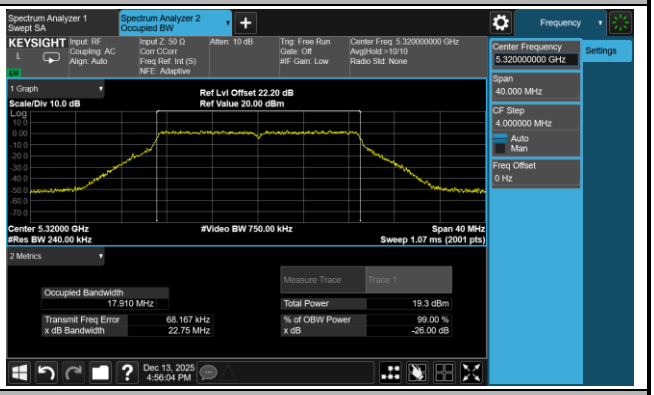
Channel 52 (5260 MHz)



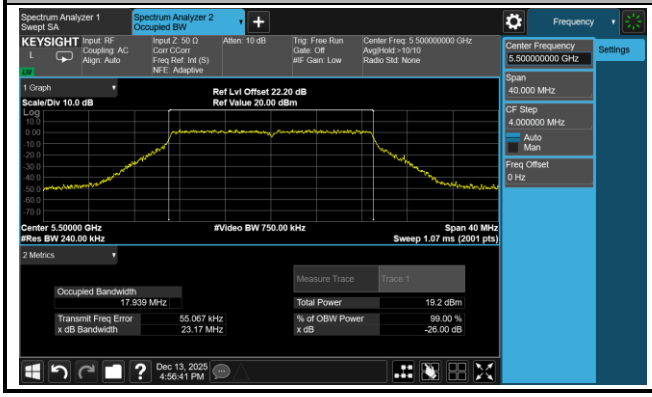
Channel 60 (5300 MHz)



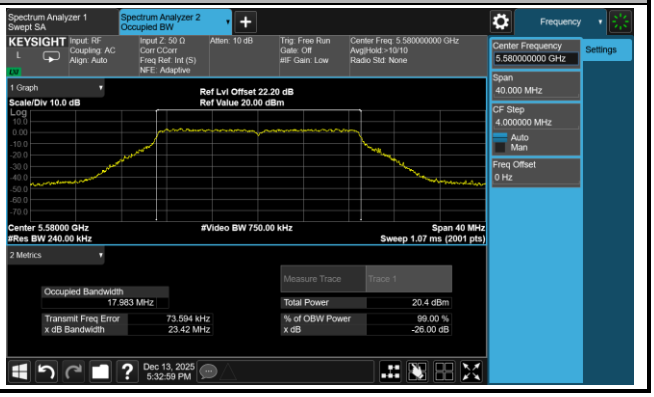
Channel 64 (5320 MHz)

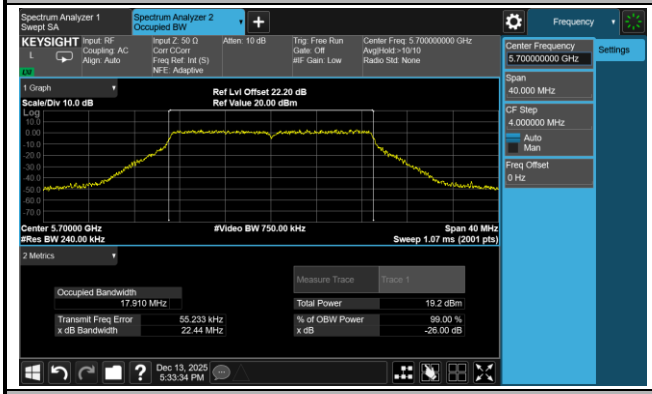
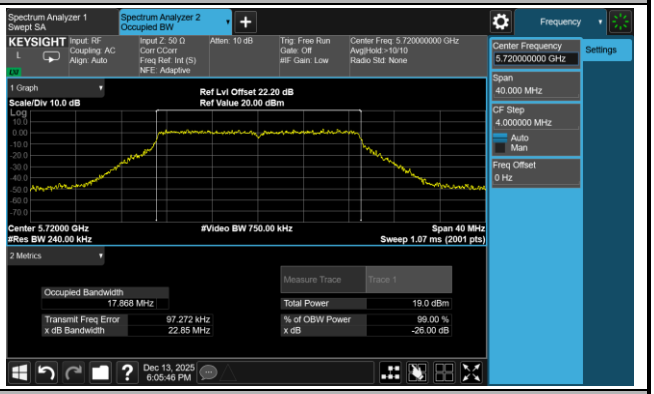
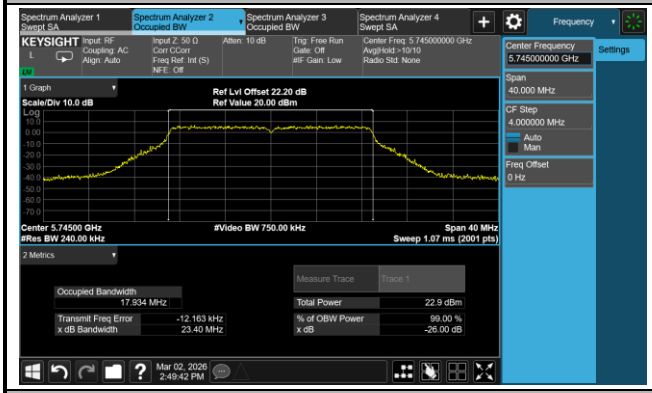
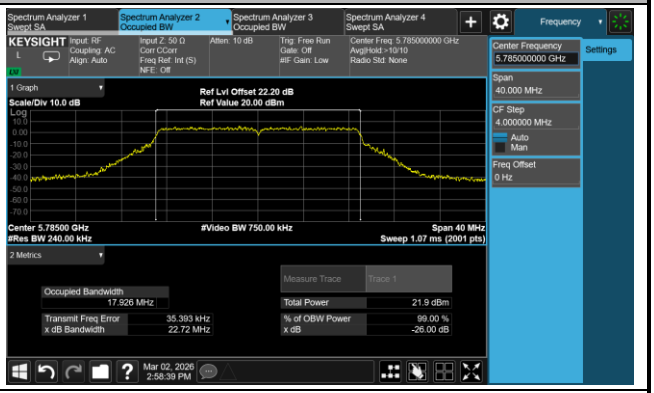
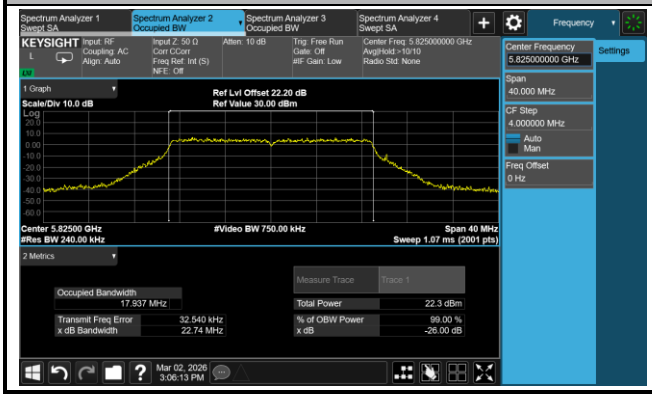


Channel 100 (5500 MHz)



Channel 116 (5580 MHz)



802.11ac-VHT20 26 dB Bandwidth & 99% Bandwidth	
Channel 140 (5700 MHz)	Channel 144 (5720 MHz)
	
Channel 149 (5745 MHz)	Channel 157 (5785 MHz)
	
Channel 165 (5825 MHz)