



RF MEASUREMENT REPORT

FCC ID: 2ALJ3AP52X
Applicant: HAN Networks Co., Ltd.
Product: HAN Access Point
Model No.: AP521
Brand Name: HAN NETWORKS, HANNETWORKS
FCC Classification: Digital Transmission System (DTS)
FCC Rule Part(s): Part 15 Subpart C (Section 15.247)
Result: Complies
Received Date: 2024-08-12
Test Date: 2024-08-30 ~ 2024-10-09

Reviewed By:

Vincent Yu

Approved By:

Robin Wu



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 and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. 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 (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2412RSU039-U3	V01	Initial Report	2024-12-31	Valid

Note: This report is a copy report based on MRT original report (Report No.: 2408RSU020-U3). Only applicant & manufacture information and product information (name, model and brand name) has changed in this report.

CONTENTS

Description	Page
1. General Information	5
1.1. Applicant	5
1.2. Manufacturer	5
1.3. Testing Facility	5
1.4. Product Information	6
1.5. Radio Specification under Test	7
1.6. Working Frequencies	7
1.7. Antenna Details	8
2. Test Configuration	9
2.1. Test Mode	9
2.2. Test System Connection Diagram	10
2.3. Test Software	10
2.4. Applied Standards	11
2.5. Test Environment Condition	11
3. Antenna Requirements	12
4. Measuring Instrument	13
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. 6dB 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	17
6.3. Output Power Measurement	18
6.3.1. Test Limit	18
6.3.2. Test Procedure	18
6.3.3. Test Setting	18
6.3.4. Test Setup	18
6.3.5. Test Result	18
6.4. Power Spectral Density Measurement	19
6.4.1. Test Limit	19

6.4.2.	Test Procedure	19
6.4.3.	Test Setting	19
6.4.4.	Test Setup	19
6.4.5.	Test Result	20
6.5.	Conducted Band Edge and Out-of-Band Emissions Measurement	21
6.5.1.	Test Limit	21
6.5.2.	Test Procedure	21
6.5.3.	Test Settintg	21
6.5.4.	Test Setup	22
6.5.5.	Test Result	22
6.6.	Radiated Spurious Emission Measurement.....	23
6.6.1.	Test Limit	23
6.6.2.	Test Procedure	23
6.6.3.	Test Setting	23
6.6.4.	Test Setup	25
6.6.5.	Test Result	26
6.7.	Radiated Restricted Band Edge Measurement	27
6.7.1.	Test Limit	27
6.7.2.	Test Procedure	28
6.7.3.	Test Setting	28
6.7.4.	Test Setup	29
6.7.5.	Test Result	29
6.8.	AC Conducted Emissions Measurement	30
6.8.1.	Test Limit	30
6.8.2.	Test Setup	30
6.8.3.	Test Result	30
Appendix A	- Test Result.....	31
A.1	Duty Cycle Test Result	31
A.2	6dB Bandwidth Test Result	33
A.3	Output Power Test Result	38
A.4	Power Spectral Density Test Result.....	39
A.5	Conducted Band Edge and Out-of-Band Emissions Test Result.....	48
A.6	Radiated Spurious Emission Test Result.....	81
A.7	Radiated Restricted Band Edge Test Result.....	91
A.8	AC Conducted Emissions Test Result	155
Appendix B	- Test Setup Photograph	157
Appendix C	- EUT Photograph	158

1. General Information

1.1. Applicant

HAN Networks Co., Ltd.

101-A16, 1st Floor, Building 3, No.9 compound, Yongfeng Road, Haidian District, Beijing, P.R. China

1.2. Manufacturer

HAN Networks Co., Ltd.

101-A16, 1st 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 FCC: CN1166 VCCI: ☐ R-20025 ☐ G-20034 ☐ C-20020 ☐ T-20020 ☐ R-20141 ☐ G-20134 ☐ C-20103 ☐ T-20104 CNAS: L10551 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 CNAS: L10551 ISED: CN0105
☐	Test Site – MRT Taiwan Laboratory
	Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
	Laboratory Accreditations
	TAF: 3261 FCC: 291082, TW3261 ISED: TW3261

1.4. Product Information

Product Name	HAN Access Point
Model No.	AP521
EUT Identification No.	20240929Sample#06 20240819Sample#16
Wi-Fi Specification	802.11a/b/g/n/ac/ax/be
Bluetooth Specification	V5.1 single mode, BLE only
Zigbee Specification	802.15.4
Antenna Information	Refer to section 1.7
Power Type	AC/DC Adapter Input or PoE Input
Operating Environment	Indoor Use
Accessories	
Adapter	Model: ADP-50GR B Input: 100-240V ~ 1.3A 50-60Hz Output: 48.0V, 1.042A 50.1W
PoE Injector	Model: POE60U-1BT-X (ALE P/N: POE60U-1BT-X-R) Input: 100-240V ~ 1.5A, 50/60Hz Output: 56.0V, 0.535A, 30W PIN 3, 6+ PIN 1, 2 Return Output: 56.0V, 0.535A, 30W PIN 4, 5+ PIN 7, 8 Return
Remark:	
- The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer. - AC/DC Power Adapter and PoE Injector are not sold with Product. For this report, we select AC/DC Adapter for testing.	

1.5. Radio Specification under Test

Frequency Range	802.11b/g/n-HT20/ax-HE20/be-EHT20: 2412 ~ 2462MHz 802.11n-HT40/ax-HE40/be-EHT40: 2422 ~ 2452MHz	
Channel Number	802.11b/g/n-HT20/ax-HE20/be-EHT20: 11 802.11n-HT40/ax-HE40/be-EHT40: 7	
Type of Modulation	802.11b: DSSS 802.11g/n: OFDM 802.11ax/be: OFDMA	
Data Rate	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps 802.11ax: up to 573.6Mbps 802.11be: up to 688Mbps	
Channel Puncturing Function	☐ Supported	☒ Unsupported
Support RU	☒ Full RU	☐ Partial RU

1.6. Working Frequencies

802.11b/g/n-HT20/ax-HE20/be-EHT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2412 MHz	02	2417 MHz	03	2422 MHz
04	2427 MHz	05	2432 MHz	06	2437 MHz
07	2442 MHz	08	2447 MHz	09	2452 MHz
10	2457 MHz	11	2462 MHz	--	--

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

Channel	Frequency	Channel	Frequency	Channel	Frequency
03	2422 MHz	04	2427 MHz	05	2432 MHz
06	2437 MHz	07	2442 MHz	08	2447 MHz
09	2452 MHz	--	--	--	--

1.7. Antenna Details

Antenna Type	Frequency (MHz)	TX Paths	Max. Directional Gain (dBi)	
			Correlated	Uncorrelated
Wi-Fi Antenna				
PIFA	2412 ~ 2462	2	5.82	2.83
	5180 ~ 5825	4	9.12	3.18
PIFA & Dipole	5925 ~ 7125	2	4.84	4.84
Notes:				
1. The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.				
2. The EUT also supports Beam Forming mode, and the Beam Forming support 802.11n/ac/ax/be, not include 802.11a/b/g.				
3. For beamforming operation, the software automatically backs power down based on CDD power.				
4. The detail calculation method of directional gain refers to antenna report provided by the applicant.				
5. Uncorrelated Directional Gain is for EIRP calculation, and Correlated Directional Gain is for PSD calculation.				

2. Test Configuration

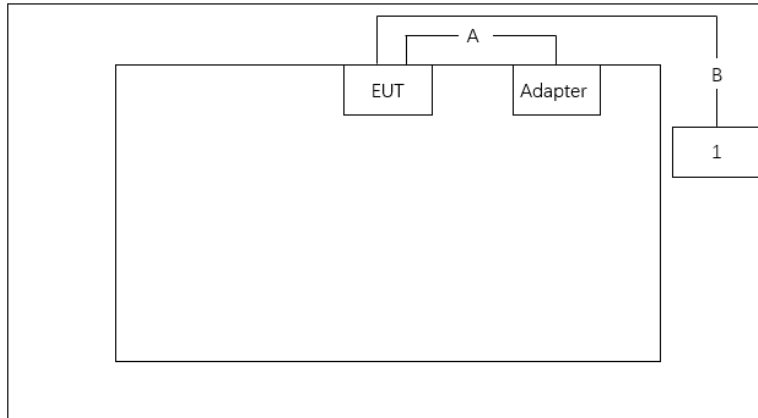
2.1. Test Mode

Mode 1: Transmit by 802.11b _N _{ss} =1 (1Mbps)
Mode 2: Transmit by 802.11g _N _{ss} =1 (6Mbps)
Mode 3: Transmit by 802.11n-HT20 _N _{ss} =1 (MCS0)
Mode 4: Transmit by 802.11n-HT40 _N _{ss} =1 (MCS0)
Mode 5: Transmit by 802.11ax-HE20 _N _{ss} =1 (MCS0)
Mode 6: Transmit by 802.11ax-HE40 _N _{ss} =1 (MCS0)
Mode 7: Transmit by 802.11be-EHT20 _N _{ss} =1 (MCS0)
Mode 8: Transmit by 802.11be-EHT40 _N _{ss} =1 (MCS0)
Notes: 1. The modulation and the data rate picked for testing are determined by the Max. RF conducted power. 2. For CDD mode, this device supports 2 N_{ss} and power level is the same of spatial multiplexing. The worst case is N_{ss}=1. 3. For beamforming operation, the software automatically backs power down based on CDD power. Therefore, only the CDD mode was evaluated in this report. 4. EUT supports one configuration only in 802.11ax/be full RU mode.

2.2. Test System Connection Diagram

The device was tested per the guidance ANSI C63.10: 2013 was used to reference the appropriate EUT setup for radiated emissions testing and AC line conducted testing.

Connection Diagram



Cable Type		Cable Description	Length
A	Power Cable	Non-Shielded	1.5m
B	LAN Cable	Non-Shielded	> 10m
Product		Manufacturer	Model No.
1	Notebook	ThinkPad	E14 Gen 5

2.3. Test Software

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

Final power setting please refer to operational description.

2.4. Applied Standards

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

- FCC Part 15.247
- KDB 558074 D01v05r02
- KDB 662911 D01v02r01
- ANSI C63.10-2013

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.”

- The antenna of the device is **permanently attached**.
- There are no provisions for connection to an external antenna.

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
Signal Analyzer	Keysight	N9010B	MRTSUE07028	1 year	2025-10-13	SIP-TR1
Thermohygrometer	testo	608-H1	MRTSUE11022	1 year	2024-10-28	SIP-TR1
USB Power Sensor	Keysight	U2021XA	MRTSUE06596	1 year	2025-07-23	SIP-TR1
EMI Test Receiver	R&S	ESR3	MRTSUE06612	1 year	2025-05-08	SIP-SR2
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2025-05-08	SIP-SR2
Four-Line V-Network	R&S	ENV432	MRTSUE06614	1 year	2025-10-13	SIP-SR2
Thermohygrometer	testo	608-H1	MRTSUE06621	1 year	2024-11-03	SIP-SR2
Shielding Room	MIX-BEP	SIP-SR2	MRTSUE06949	5 years	2029-10-13	SIP-SR2
Signal Analyzer	Keysight	N9010B	MRTSUE07028	1 year	2025-10-13	SIP-AC2
Preamplifier	EMCI	EMC051845SE	MRTSUE06601	1 year	2024-11-02	SIP-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06648	1 year	2024-10-21	SIP-AC2
Thermohygrometer	testo	608-H1	MRTSUE06622	1 year	2024-11-03	SIP-AC2
Anechoic Chamber	RIKEN	SIP-AC2	MRTSUE06781	1 year	2024-12-21	SIP-AC2
Preamplifier	EMCI	EMC012645SE	MRTSUE06642	1 year	2025-01-11	SIP-AC3
Signal Analyzer	Keysight	N9010B	MRTSUE07028	1 year	2025-10-13	SIP-AC3
Horn Antenna	R&S	HF907	MRTSUE06611	1 year	2025-07-07	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06619	1 year	2024-10-28	SIP-AC3
Anechoic Chamber	RIKEN	SIP-AC3	MRTSUE06782	1 year	2024-12-21	SIP-AC3
Preamplifier	EMCI	EMC118A45SE	MRTSUE07102	1 year	2025-04-11	WJ-AC2
Horn Antenna	EMCI	DRH18-E	MRTSUE07105	1 year	2025-05-12	WJ-AC2
EXA Signal Analyzer	Keysight	N9010B	MRTSUE07147	1 year	2025-04-28	WJ-AC2
Thermohygrometer	testo	608-H1	MRTSUE11315	1 year	2025-06-24	WJ-AC2
Anechoic Chamber	TDK	WJ-AC2	MRTSUE07117	1 year	2025-05-14	WJ-AC2
Broadband Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE07100	1 year	2025-04-24	WJ-AC2
Preamplifier	EMCI	EMC184045SE	MRTSUE07103	1 year	2025-04-14	WJ-AC2
TRILOG Broad Band Antenna	Schwarzbeck	VULB 9163	MRTSUE07096	1 year	2025-04-24	WJ-AC1
EMI Test Receiver	R&S	ESR3	MRTSUE07110	1 year	2025-04-24	WJ-AC1
Anechoic Chamber	TDK	WJ-AC1	MRTSUE07115	1 year	2025-05-17	WJ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11314	1 year	2025-06-24	WJ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11333	1 year	2025-06-24	WJ-AC1
Active Loop Antenna	Schwarzbeck	FMZB 1519-60 D	MRTSUE07076	1 year	2024-12-04	WJ-AC1

Software	Version	Function
e3	230711	EMI Test Software
Controller_MF 7802BS	1.02	RE Antenna & Turntable
CONTROLLER CO3000	v 1.03.02	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: 9kHz~150kHz: 3.58dB 150kHz~30MHz: 3.20dB
Radiated Emission Measurement
The maximum measurement uncertainty is evaluated as: Coaxial: 9kHz~30MHz: 2.61dB Coplanar: 9kHz~30MHz: 2.62dB Horizontal: 30MHz~200MHz: 3.79dB 200MHz~1GHz: 3.91dB 1GHz~40GHz: 4.99dB Vertical: 30MHz~200MHz: 4.06dB 200MHz~1GHz: 5.21dB 1GHz~40GHz: 4.90dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 2.2dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 1.4dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 2.2dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 2.7%

6. Test Result

6.1. Summary

FCC Section(s)	Test Description	Test Condition	Verdict
15.247(a)(2)	6dB Bandwidth	Conducted	Pass
15.247(b)(3)	Output Power		Pass
15.247(e)	Power Spectral Density		Pass
15.247(d)	Band Edge / Out-of-Band Emissions		Pass
15.205 15.209	General Field Strength (Restricted Bands and Radiated Emission)	Radiated	Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	Pass

Notes:

1. 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.
2. For radiated emission tests, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
3. All test data in this report refer to the test data from FCC ID: 2A19TOAW-AP152X.

6.2. 6dB Bandwidth Measurement

6.2.1. Test Limit

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

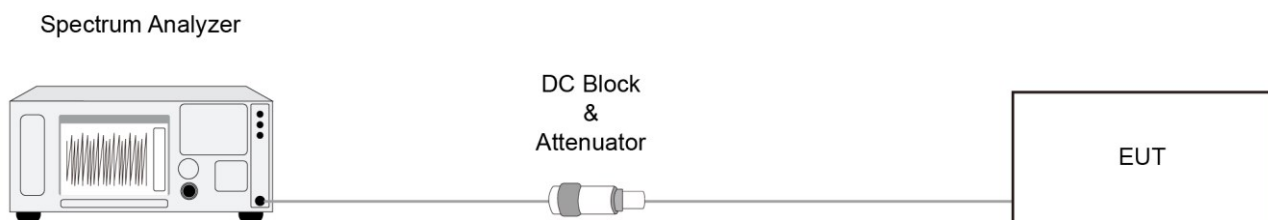
6.2.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.8

6.2.3. Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to $X = 6$. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set RBW = 100 kHz
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize.

6.2.4. Test Setup



6.2.5. Test Result

Refer to Appendix A.2.

6.3. Output Power Measurement

6.3.1. Test Limit

The maximum output power shall be less 1 Watt (30dBm).

The conducted output power limit specified in paragraph FCC Part 15.247(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs FCC Part 15.247(b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.3.2. Test Procedure

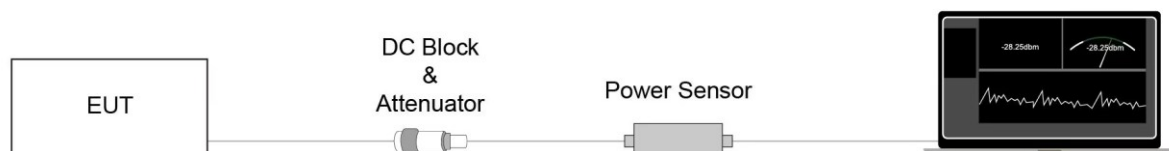
ANSI C63.10 - 2013 - Section 11.9.2.3.2

6.3.3. 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.

6.3.4. Test Setup



6.3.5. Test Result

Refer to Appendix A.3.

6.4. Power Spectral Density Measurement

6.4.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band.

The same method of determining the conducted output power shall be used to determine the power spectral density.

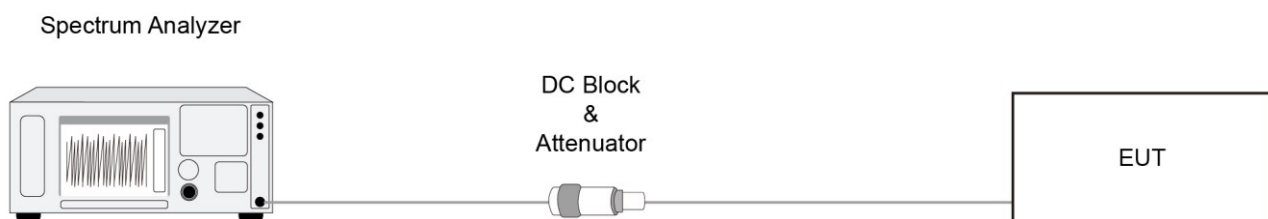
6.4.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.10.5

6.4.3. Test Setting

1. Measure the duty cycle (x) of the transmitter output signal.
2. Set instrument center frequency to DTS channel center frequency.
3. Set span to at least 1.5 times the OBW.
4. RBW = 10 kHz.
5. VBW = 30 kHz.
6. Detector = RMS.
7. Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.
8. Sweep time = auto couple.
9. Don't use sweep triggering. Allow sweep to "free run".
10. Employ trace averaging (RMS) mode over a minimum of 100 traces.
11. Use the peak marker function to determine the maximum amplitude level.
12. Add $10 \log (1/x)$, where x is the duty cycle measured in step (a), to the measured PSD to compute the average PSD during the actual transmission time. If measured value exceeds requirement specified by regulatory agency, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).

6.4.4. Test Setup



6.4.5. Test Result

Refer to Appendix A.4.

6.5. Conducted Band Edge and Out-of-Band Emissions Measurement

6.5.1. Test Limit

The limit for out-of-band spurious emissions at the band edge is 30dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth per the PSD procedure.

6.5.2. Test Procedure

ANSI C63.10-2013 - Section 11.11

6.5.3. Test Settling

Reference level measurement

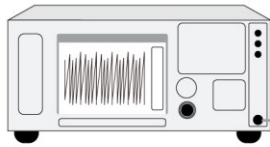
1. Set instrument center frequency to DTS channel center frequency
2. Set the span to ≥ 1.5 times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW $\geq 3 \times$ RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

Emission level measurement

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

6.5.4. Test Setup

Spectrum Analyzer



DC Block
&
Attenuator



EUT



6.5.5. Test Result

Refer to Appendix A.5.

6.6. Radiated Spurious Emission Measurement

6.6.1. 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 [uV/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

6.6.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.11 & 11.12

ANSI C63.10 - 2013 - Section 6.3 (General Requirements)

ANSI C63.10 - 2013 - Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 - 2013 - Section 6.5 (Standard test method above 30MHz to 1GHz)

ANSI C63.10 - 2013 - Section 6.6 (Standard test method above 1GHz)

6.6.3. 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
> 1000MHz	1MHz

Quasi-Peak Measurements below 1GHz

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

Peak Measurements above 1GHz

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

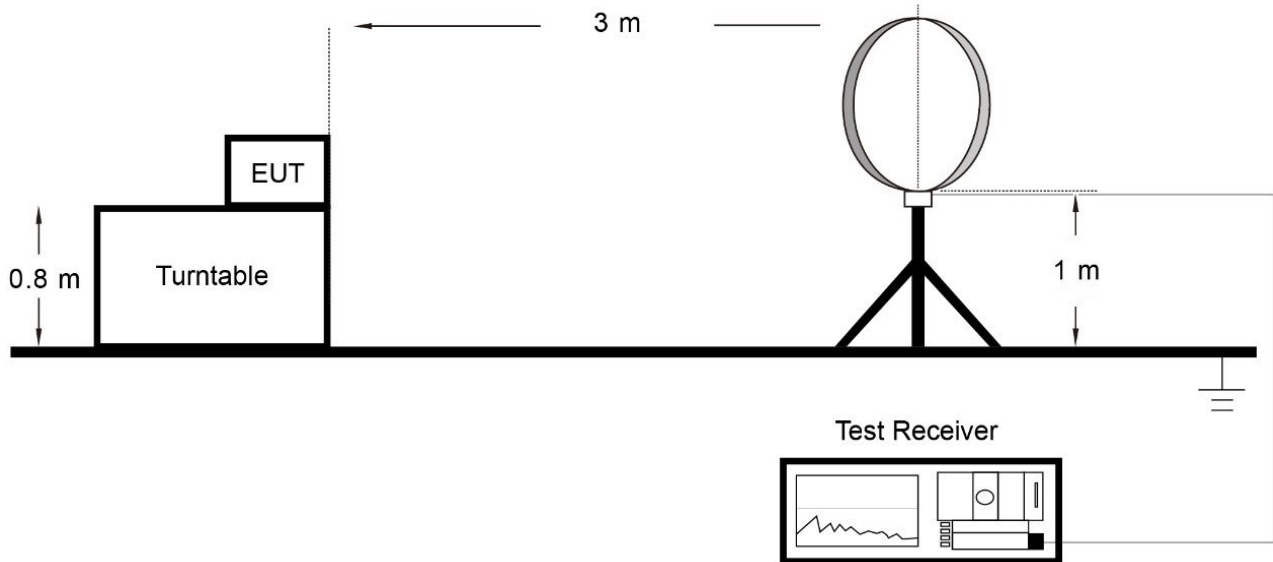
Average Measurements above 1GHz (Method VB)

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

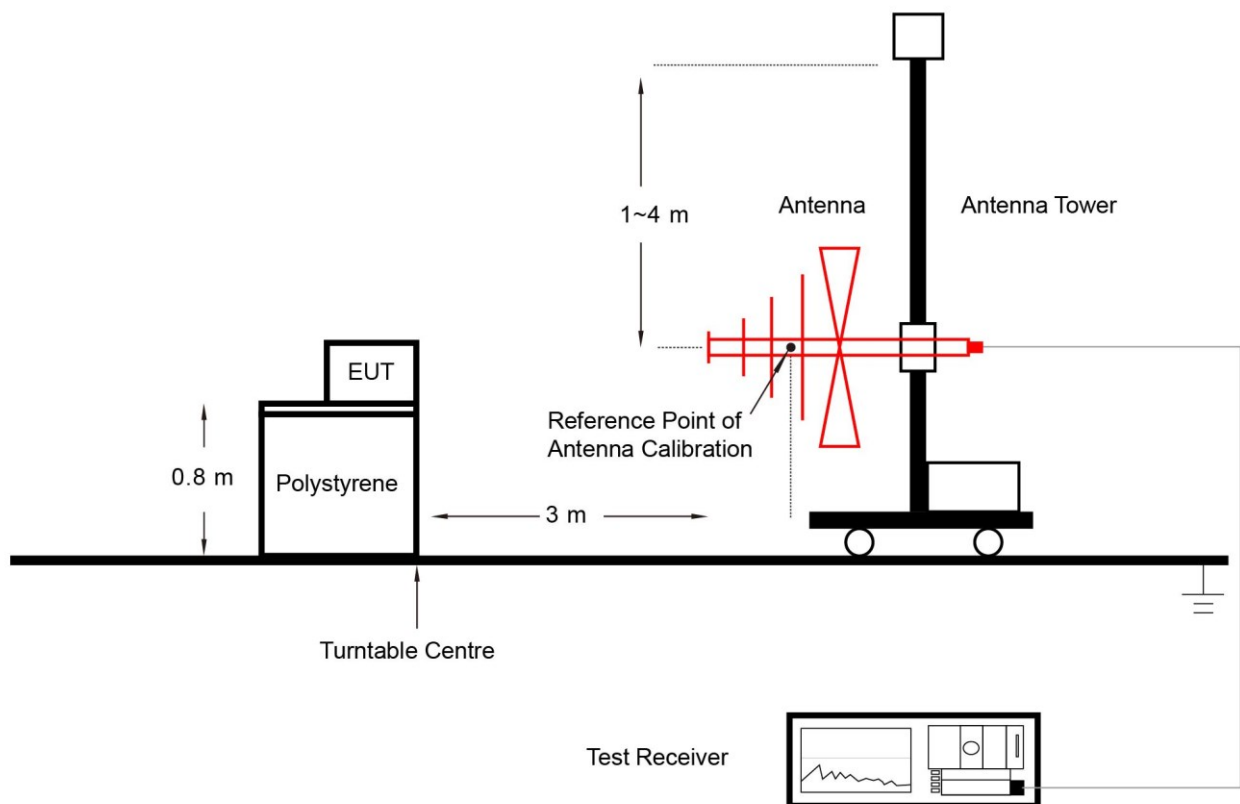
If the EUT duty cycle is $< 98\%$, set $VBW \geq 1/T$. T is the minimum transmission duration.
4. As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear 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

6.6.4. Test Setup

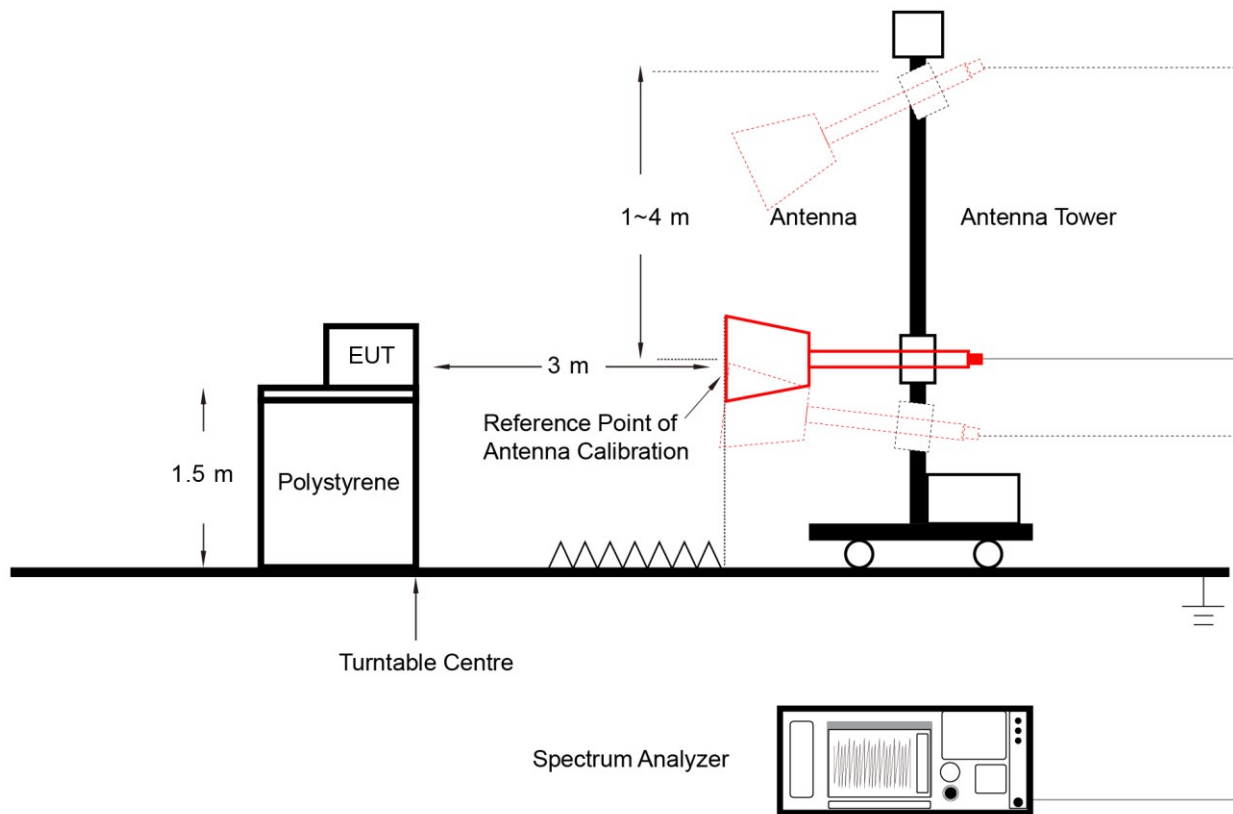
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



6.6.5. Test Result

Refer to Appendix A.6.

6.7. Radiated Restricted Band Edge Measurement

6.7.1. 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	--	--	--

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

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/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

6.7.2. Test Procedure

ANSI C63.10-2013 Section 6.3 & 6.6 & 11.13

6.7.3. Test Setting

Peak Field Strength Measurements

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

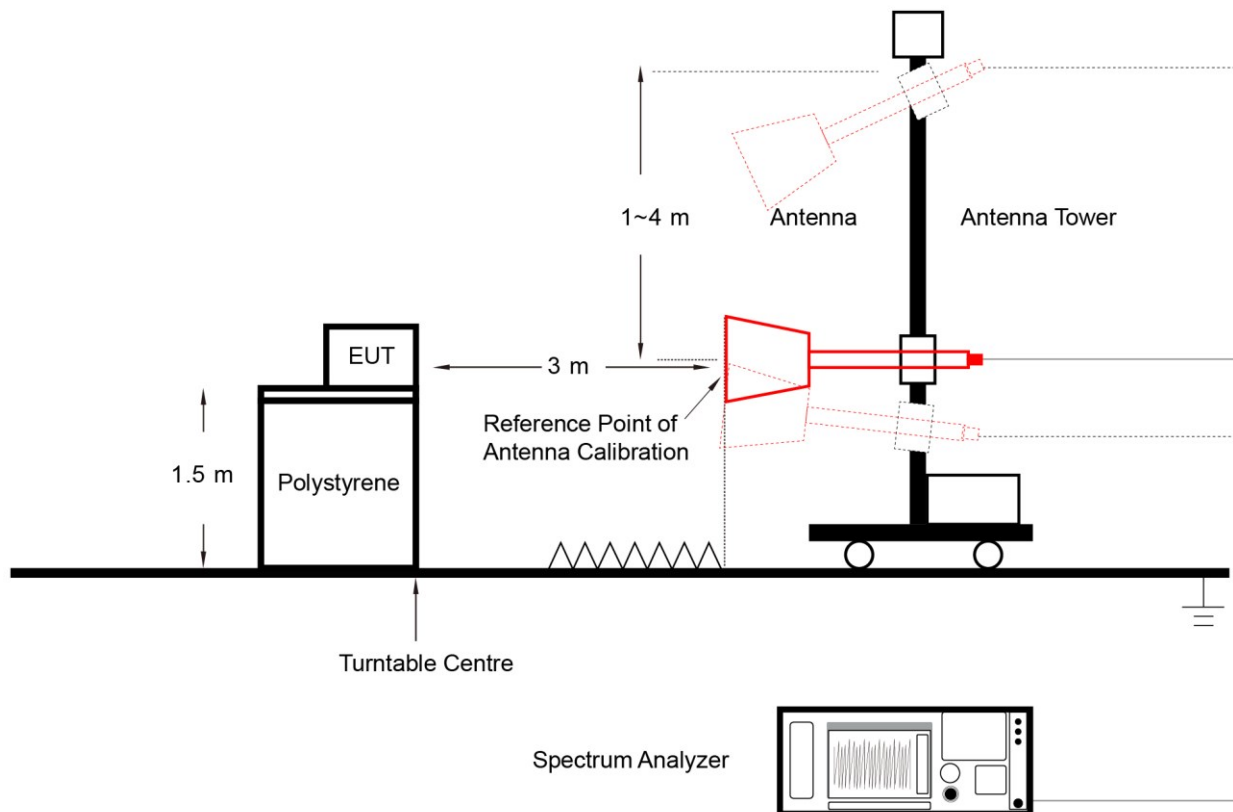
Average Field Strength Measurements

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

If the EUT duty cycle is $< 98\%$, set VBW $\geq 1/T$. 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

6.7.4. Test Setup



6.7.5. Test Result

Refer to Appendix A.7.

6.8. AC Conducted Emissions Measurement

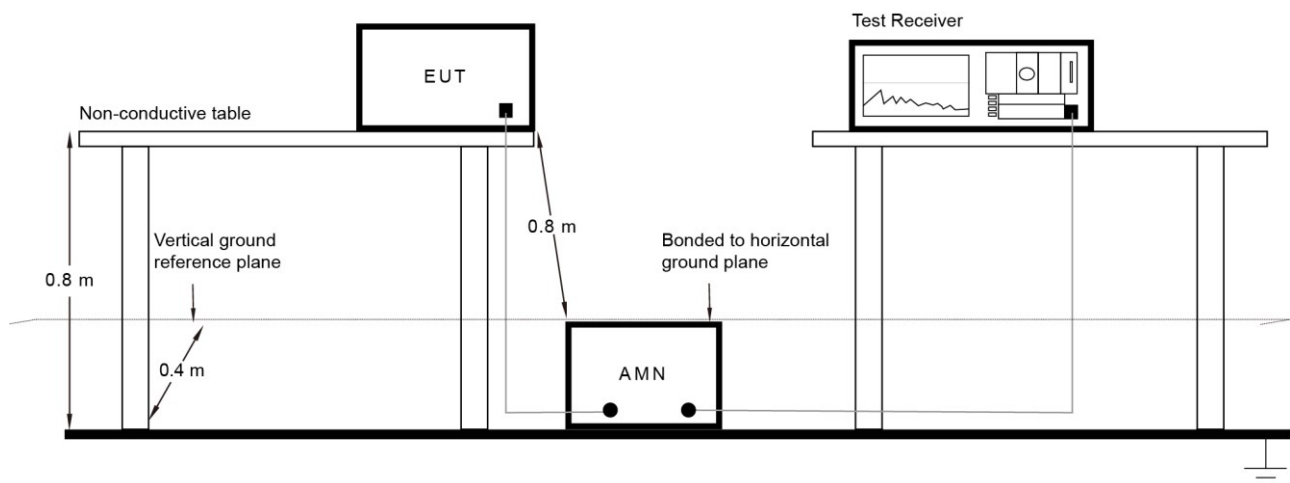
6.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
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 0.15MHz to 0.5MHz.

6.8.2. Test Setup



6.8.3. Test Result

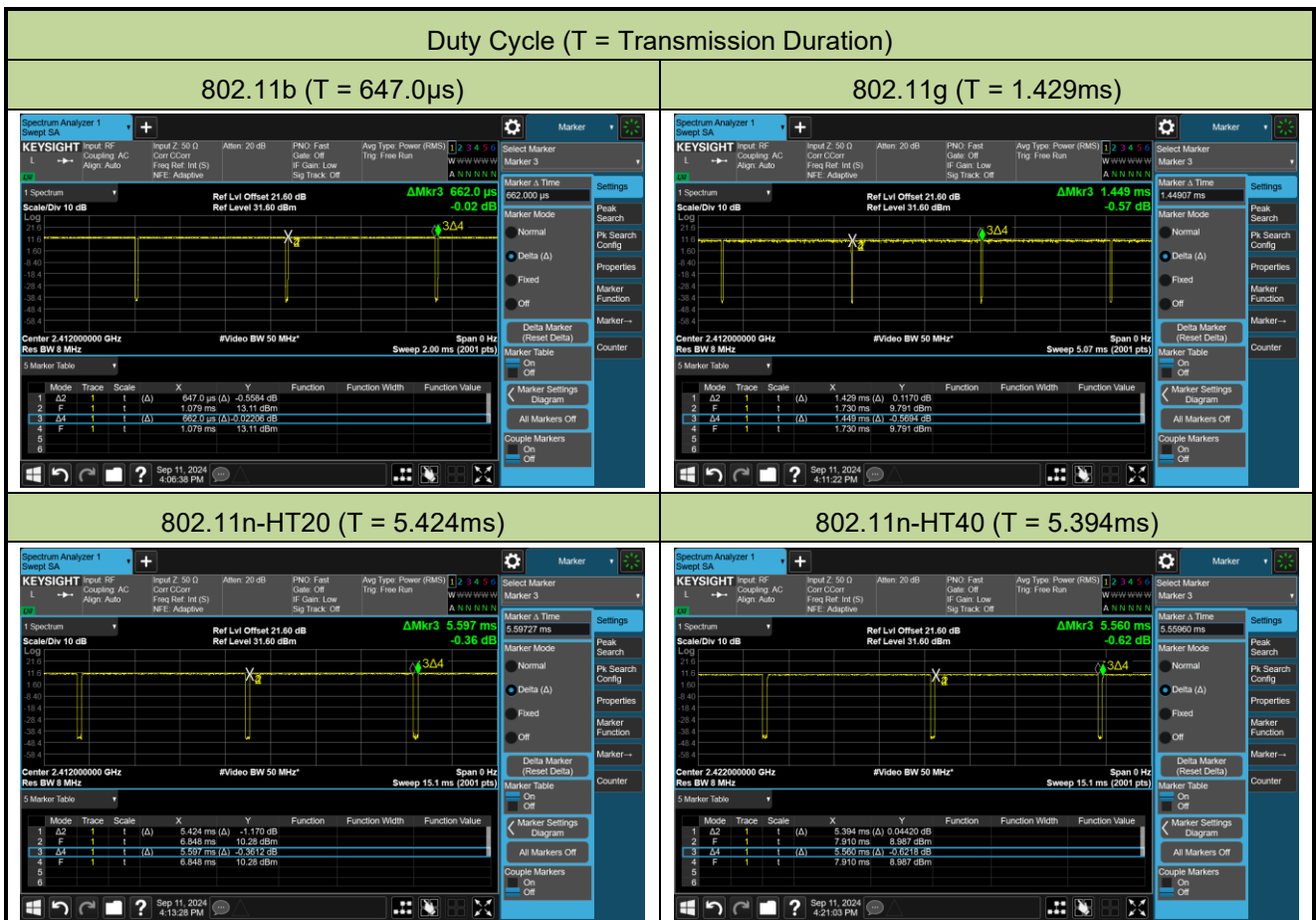
Refer to Appendix A.8.

Appendix A – Test Result

A.1 Duty Cycle Test Result

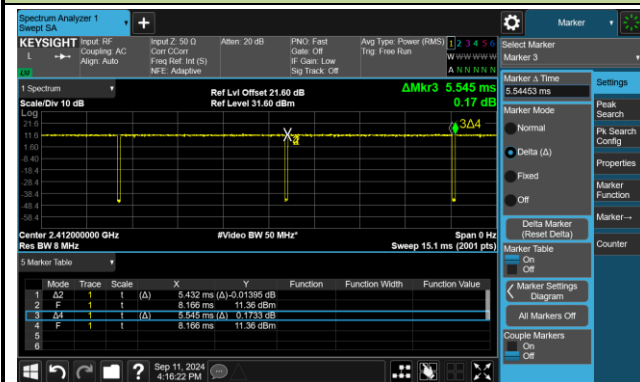
Test Site	SIP-TR1	Test Engineer	Ryan Wang
Test Date	2024-09-11		

Test Mode	Duty Cycle
802.11b	97.73%
802.11g	98.62%
802.11n-HT20	96.91%
802.11n-HT40	97.01%
802.11ax-HE20	97.96%
802.11ax-HE40	98.22%
802.11be-EHT20	96.92%
802.11be-EHT40	97.18%

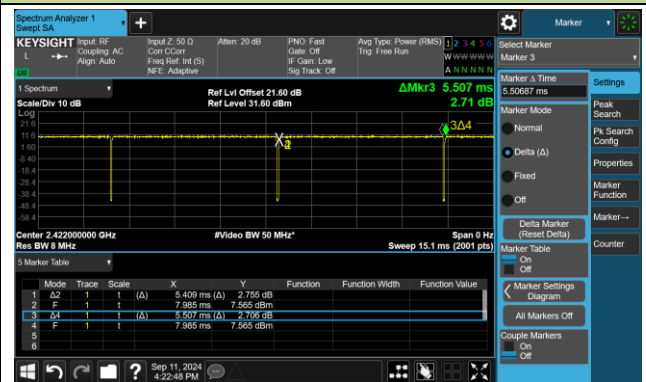


Duty Cycle (T = Transmission Duration)

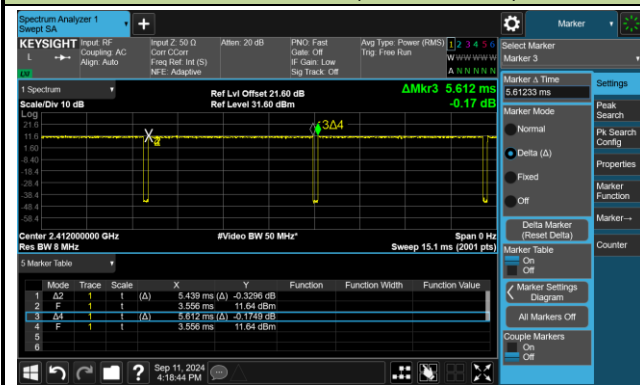
802.11ax-HE20 (T = 5.432ms)



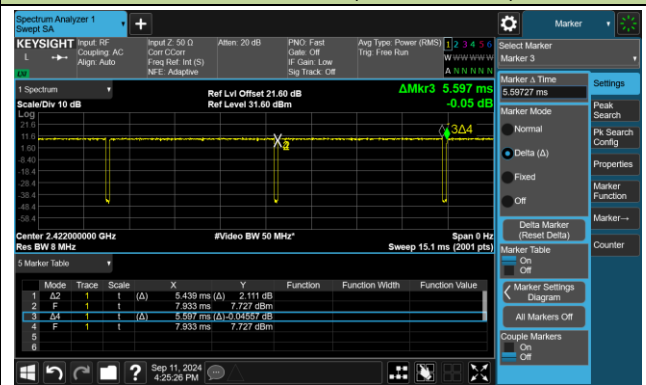
802.11ax-HE40 (T = 5.409ms)



802.11be-EHT20 (T = 5.439ms)



802.11be-EHT40 (T = 5.439ms)



A.2 6dB Bandwidth Test Result

Test Site	SIP-TR1	Test Engineer	Ryan Wang
Test Date	2024-09-24		

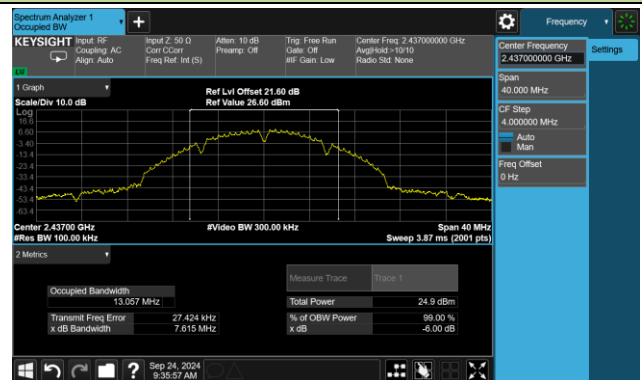
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
11b	1Mbps	01	2412	7.609	≥ 0.5
11b	1Mbps	06	2437	7.615	≥ 0.5
11b	1Mbps	11	2462	7.105	≥ 0.5
11g	6Mbps	01	2412	15.09	≥ 0.5
11g	6Mbps	06	2437	15.05	≥ 0.5
11g	6Mbps	11	2462	15.04	≥ 0.5
11n-HT20	MCS0	01	2412	17.18	≥ 0.5
11n-HT20	MCS0	06	2437	15.72	≥ 0.5
11n-HT20	MCS0	11	2462	13.79	≥ 0.5
11n-HT40	MCS0	03	2422	32.94	≥ 0.5
11n-HT40	MCS0	06	2437	35.07	≥ 0.5
11n-HT40	MCS0	09	2452	33.85	≥ 0.5
11ax-HE20	MCS0	01	2412	18.53	≥ 0.5
11ax-HE20	MCS0	06	2437	15.12	≥ 0.5
11ax-HE20	MCS0	11	2462	15.02	≥ 0.5
11ax-HE40	MCS0	03	2422	35.61	≥ 0.5
11ax-HE40	MCS0	06	2437	33.96	≥ 0.5
11ax-HE40	MCS0	09	2452	34.01	≥ 0.5
11be-EHT20	MCS0	01	2412	15.09	≥ 0.5
11be-EHT20	MCS0	06	2437	14.99	≥ 0.5
11be-EHT20	MCS0	11	2462	15.09	≥ 0.5
11be-EHT40	MCS0	03	2422	35.27	≥ 0.5
11be-EHT40	MCS0	06	2437	32.97	≥ 0.5
11be-EHT40	MCS0	09	2452	30.08	≥ 0.5

802.11b 6dB Bandwidth

Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)

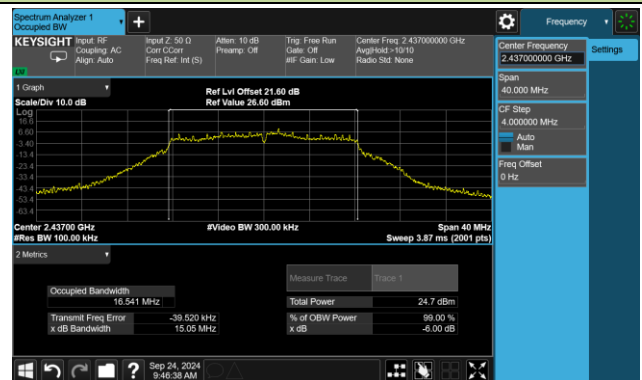


802.11g 6dB Bandwidth

Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)

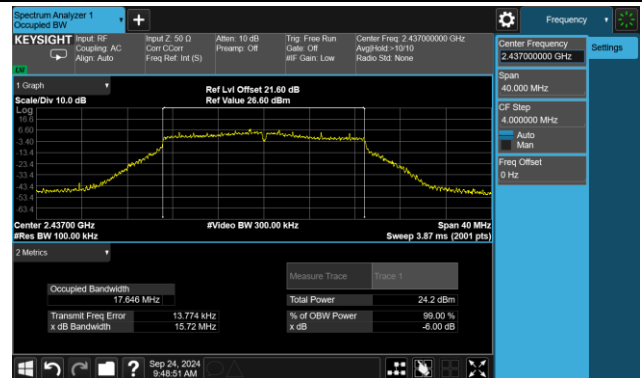


802.11n-HT20 6dB Bandwidth

Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)

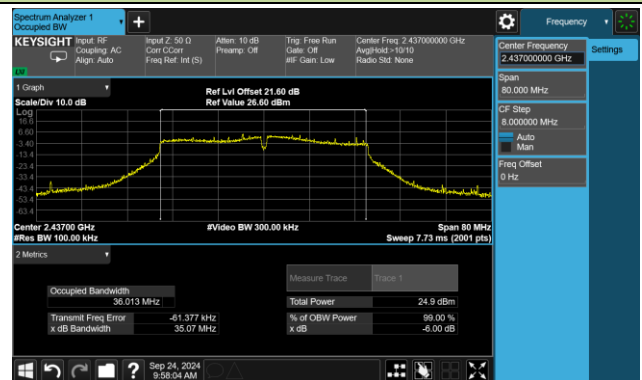


802.11n-HT40 6dB Bandwidth

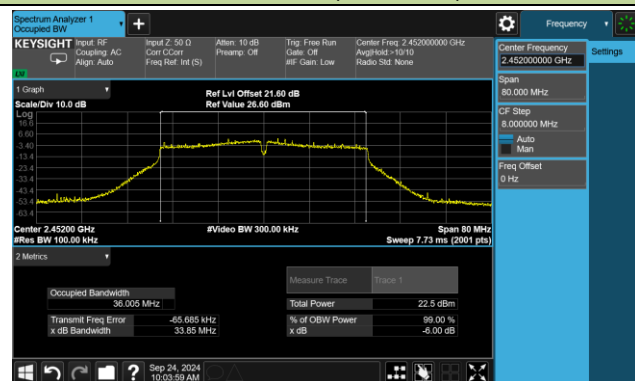
Channel 03 (2422MHz)



Channel 06 (2437MHz)

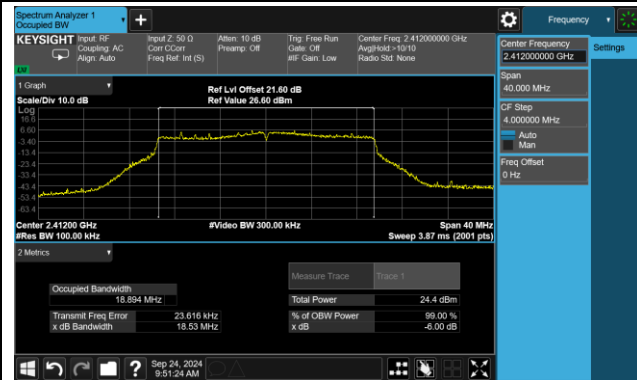


Channel 09 (2452MHz)

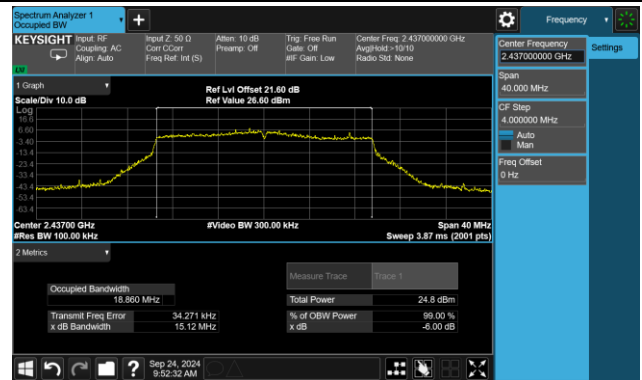


802.11ax-HE20 6dB Bandwidth

Channel 01 (2412MHz)



Channel 06 (2437MHz)

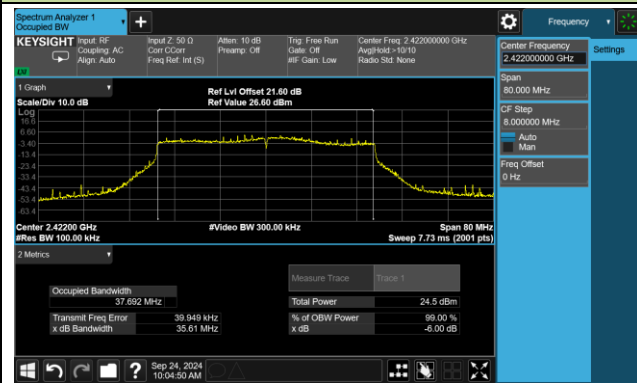


Channel 11 (2462MHz)

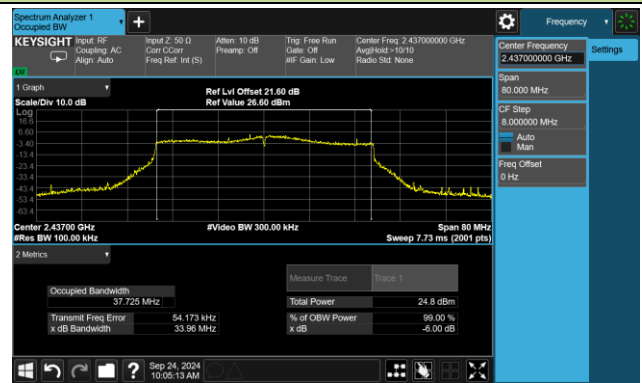


802.11ax-HE40 6dB Bandwidth

Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



802.1be-EHT20 6dB Bandwidth

Channel 01 (2412MHz)



Channel 06 (2437MHz)

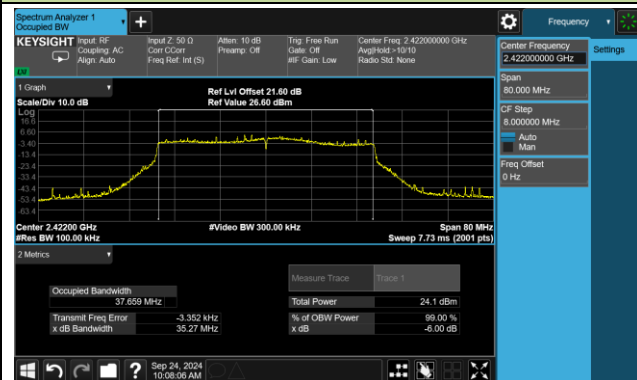


Channel 11 (2462MHz)

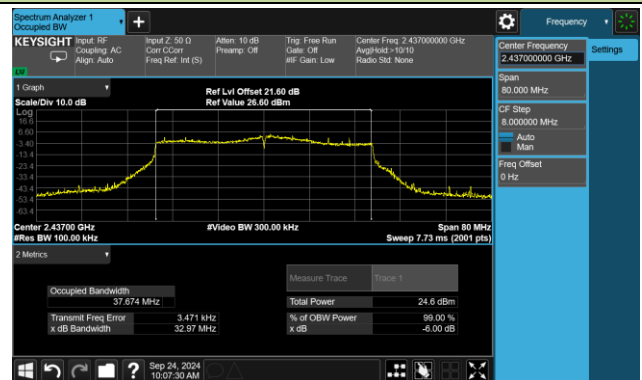


802.11be-EHT40 6dB Bandwidth

Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



A.3 Output Power Test Result

Test Site	SIP-TR1	Test Engineer	Ryan Wang
Test Date	2024-09-11		

Test Mode	Data Rate / MCS	Channel No.	Freq. (MHz)	Average Power (dBm)		Total Average Power (dBm)	Limit (dBm)
				Ant 0	Ant 1		
11b	1Mbps	01	2412	18.21	17.84	21.04	≤ 30.00
11b	1Mbps	06	2437	18.28	17.98	21.14	≤ 30.00
11b	1Mbps	11	2462	18.02	18.14	21.09	≤ 30.00
11g	6Mbps	01	2412	18.04	17.58	20.83	≤ 30.00
11g	6Mbps	06	2437	18.01	17.72	20.88	≤ 30.00
11g	6Mbps	11	2462	17.81	17.83	20.83	≤ 30.00
11n-HT20	MCS0	01	2412	17.78	17.75	20.78	≤ 30.00
11n-HT20	MCS0	06	2437	17.89	18.03	20.97	≤ 30.00
11n-HT20	MCS0	11	2462	17.68	18.15	20.93	≤ 30.00
11n-HT40	MCS0	03	2422	16.75	17.07	19.92	≤ 30.00
11n-HT40	MCS0	06	2437	18.05	17.74	20.91	≤ 30.00
11n-HT40	MCS0	09	2452	15.71	16.23	18.99	≤ 30.00
11ax-HE20	MCS0	01	2412	17.82	17.71	20.78	≤ 30.00
11ax-HE20	MCS0	06	2437	18.06	17.96	21.02	≤ 30.00
11ax-HE20	MCS0	11	2462	17.94	17.82	20.89	≤ 30.00
11ax-HE40	MCS0	03	2422	17.13	16.91	20.03	≤ 30.00
11ax-HE40	MCS0	06	2437	17.92	18.06	21.00	≤ 30.00
11ax-HE40	MCS0	09	2452	15.94	16.57	19.28	≤ 30.00
11be-EHT20	MCS0	01	2412	17.93	17.96	20.96	≤ 30.00
11be-EHT20	MCS0	06	2437	17.87	17.71	20.80	≤ 30.00
11be-EHT20	MCS0	11	2462	17.78	17.28	20.55	≤ 30.00
11be-EHT40	MCS0	03	2422	16.42	16.21	19.33	≤ 30.00
11be-EHT40	MCS0	06	2437	17.56	17.89	20.74	≤ 30.00
11be-EHT40	MCS0	09	2452	16.40	16.91	19.67	≤ 30.00

Note: Total Average Power (dBm) = $10 \cdot \log \{ 10^{(\text{Ant 0 Average Power} / 10)} + 10^{(\text{Ant 1 Average Power} / 10)} \}$ (dBm).

A.4 Power Spectral Density Test Result

Test Site	SIP-TR1	Test Engineer	Ryan Wang
Test Date	2024-09-11		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	PSD (dBm/ 10kHz)		Duty Cycle (%)	10*log (1/x)	Total PSD (dBm/10kHz)	Limit (dBm/3kHz)
				Ant 0	Ant 1				
11b	1Mbps	01	2412	-6.671	-7.289	97.73	0.10	-3.859	≤ 8.00
11b	1Mbps	06	2437	-6.660	-7.064	97.73	0.10	-3.747	≤ 8.00
11b	1Mbps	11	2462	-6.460	-7.179	97.73	0.10	-3.695	≤ 8.00
11g	6Mbps	01	2412	-7.705	-9.044	98.62	0.06	-5.313	≤ 8.00
11g	6Mbps	06	2437	-7.441	-7.301	98.62	0.06	-4.360	≤ 8.00
11g	6Mbps	11	2462	-7.965	-9.056	98.62	0.06	-5.466	≤ 8.00
11n-HT20	MCS0	01	2412	-9.556	-9.157	96.91	0.14	-6.205	≤ 8.00
11n-HT20	MCS0	06	2437	-8.614	-8.373	96.91	0.14	-5.345	≤ 8.00
11n-HT20	MCS0	11	2462	-9.087	-10.406	96.91	0.14	-6.550	≤ 8.00
11n-HT40	MCS0	03	2422	-12.949	-14.135	97.01	0.13	-10.360	≤ 8.00
11n-HT40	MCS0	06	2437	-10.884	-10.522	97.01	0.13	-7.557	≤ 8.00
11n-HT40	MCS0	09	2452	-12.997	-13.373	97.01	0.13	-10.039	≤ 8.00
11ax-HE20	MCS0	01	2412	-9.176	-10.726	97.96	0.09	-6.782	≤ 8.00
11ax-HE20	MCS0	06	2437	-8.773	-8.637	97.96	0.09	-5.605	≤ 8.00
11ax-HE20	MCS0	11	2462	-9.583	-10.133	97.96	0.09	-6.749	≤ 8.00
11ax-HE40	MCS0	03	2422	-12.799	-14.245	98.22	0.08	-10.452	≤ 8.00
11ax-HE40	MCS0	06	2437	-11.695	-11.385	98.22	0.08	-8.527	≤ 8.00
11ax-HE40	MCS0	09	2452	-13.974	-13.160	98.22	0.08	-10.538	≤ 8.00
11be-EHT20	MCS0	01	2412	-9.619	-10.479	96.92	0.14	-6.882	≤ 8.00
11be-EHT20	MCS0	06	2437	-9.701	-10.711	96.92	0.14	-7.031	≤ 8.00
11be-EHT20	MCS0	11	2462	-9.694	-10.544	96.92	0.14	-6.952	≤ 8.00
11be-EHT40	MCS0	03	2422	-13.364	-14.192	97.18	0.12	-10.624	≤ 8.00
11be-EHT40	MCS0	06	2437	-12.194	-14.043	97.18	0.12	-9.886	≤ 8.00
11be-EHT40	MCS0	09	2452	-13.591	-13.649	97.18	0.12	-10.485	≤ 8.00

Note:

When EUT duty cycle ≥ 98%, Total PSD (dBm / 10kHz) = $10 \cdot \log \{10^{(\text{Ant 0 PSD}/10)} + 10^{(\text{Ant 1 PSD}/10)}\}$ (dBm / 10kHz).

When EUT duty cycle < 98%, Total PSD (dBm / 10kHz) = $10 \cdot \log \{10^{(\text{Ant 0 PSD}/10)} + 10^{(\text{Ant 1 PSD}/10)}\}$ (dBm / 10kHz) + $10 \cdot \log (1/\text{Duty Cycle})$.

802.11b - AVGPSD - Ant 0

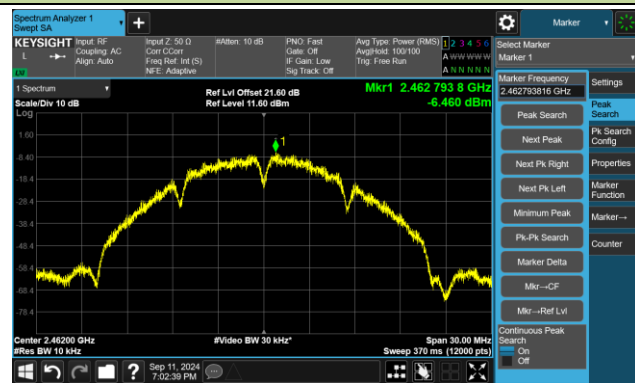
Channel 01 (2412MHz)



Channel 06 (2437MHz)

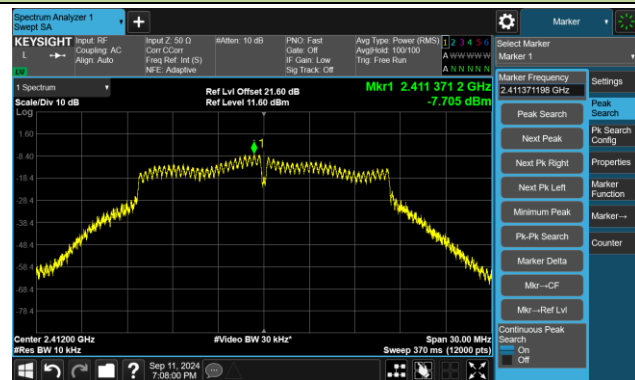


Channel 11 (2462MHz)

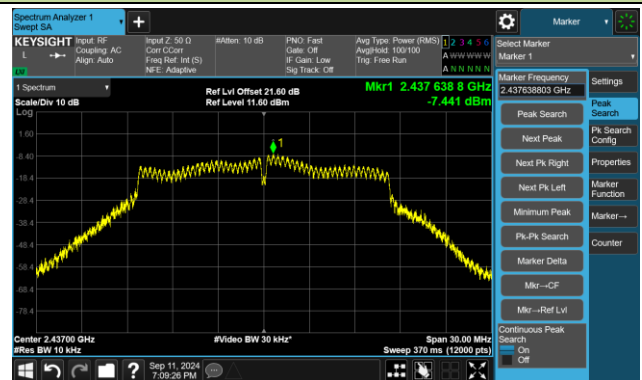


802.11g - AVGPSD - Ant 0

Channel 01 (2412MHz)



Channel 06 (2437MHz)

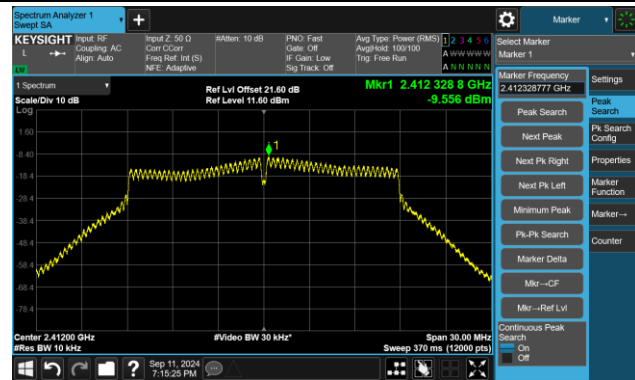


Channel 11 (2462MHz)

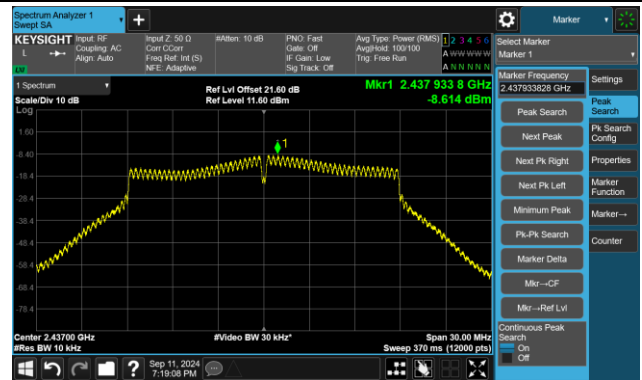


802.11n-HT20 - AVGPDS - Ant 0

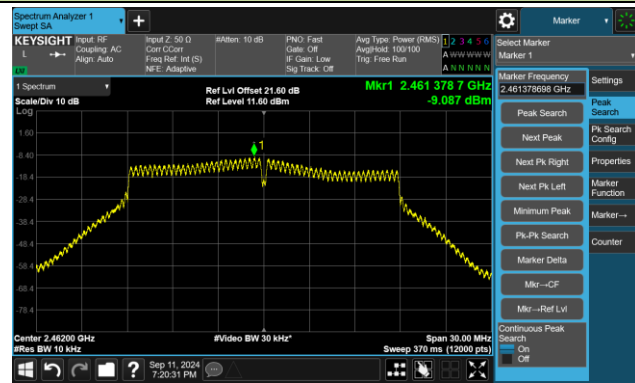
Channel 01 (2412MHz)



Channel 06 (2437MHz)

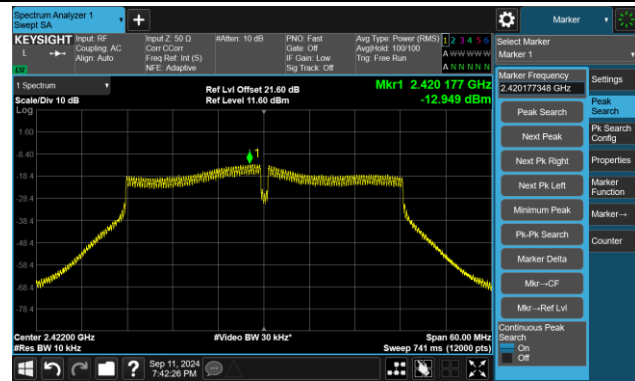


Channel 11 (2462MHz)

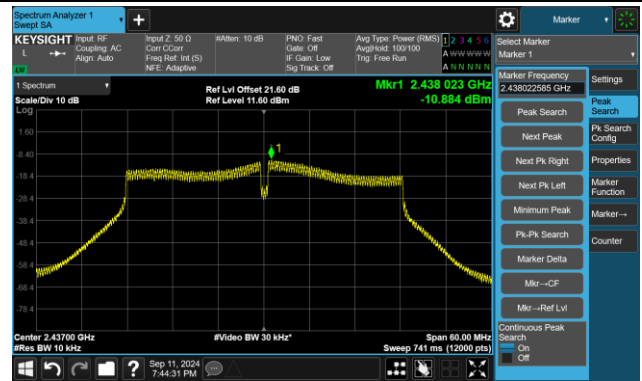


802.11n-HT40 - AVGPDS - Ant 0

Channel 03 (2422MHz)



Channel 06 (2437MHz)

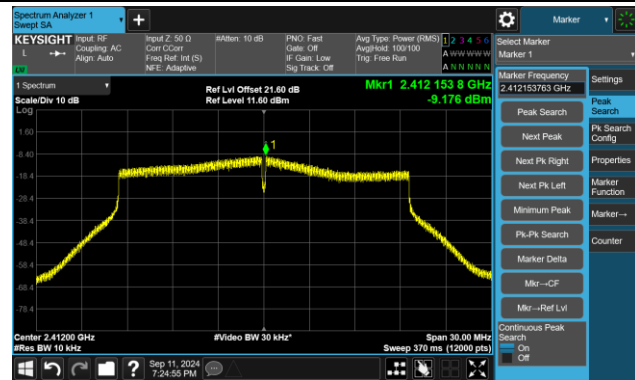


Channel 09 (2452MHz)

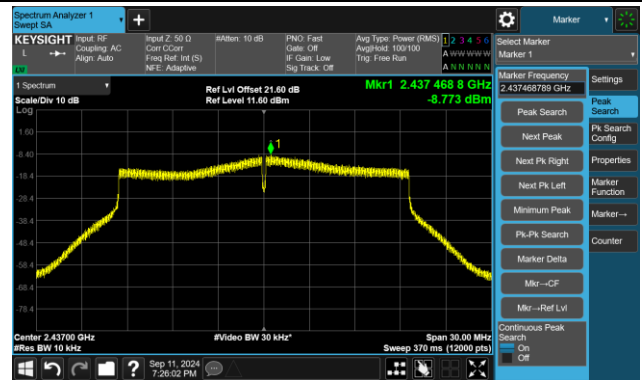


802.11ax-HE20 - AVGPSD - Ant 0

Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)

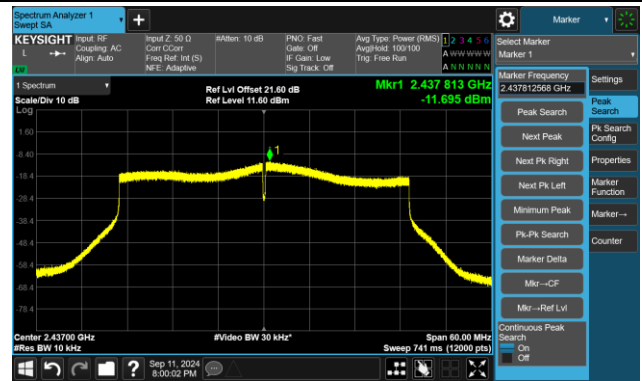


802.11ax-HE40 - AVGPSD - Ant 0

Channel 03 (2422MHz)



Channel 06 (2437MHz)

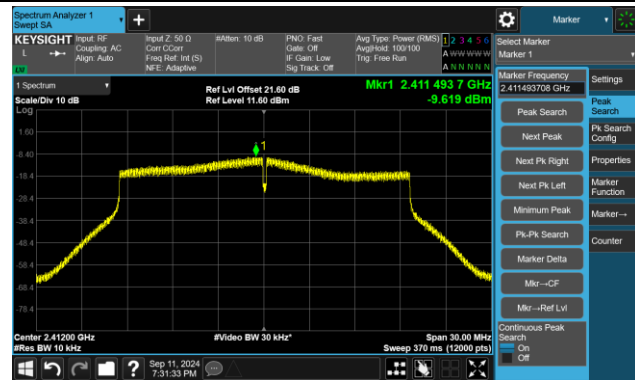


Channel 09 (2452MHz)

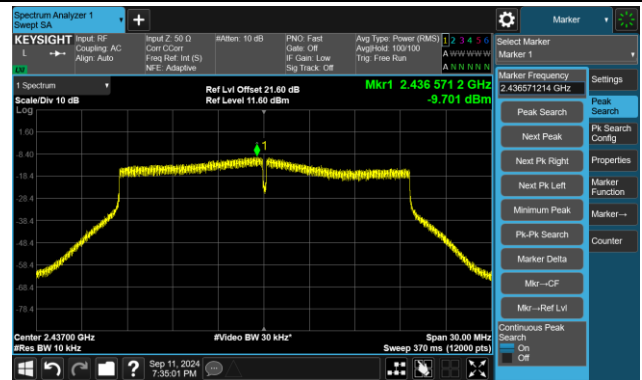


802.11be-EHT20 - AVGPDS - Ant 0

Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)

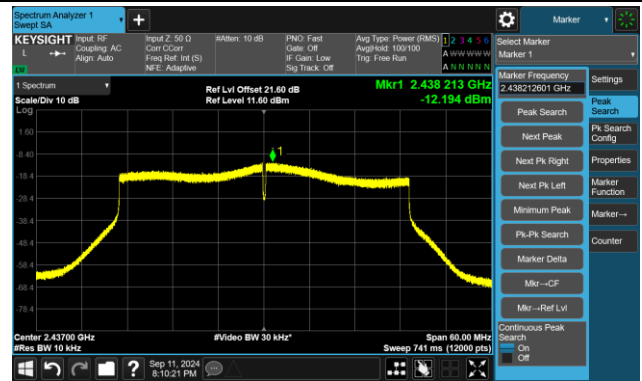


802.11be-EHT40 - AVGPDS - Ant 0

Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



802.11b - AVGPDS - Ant 1

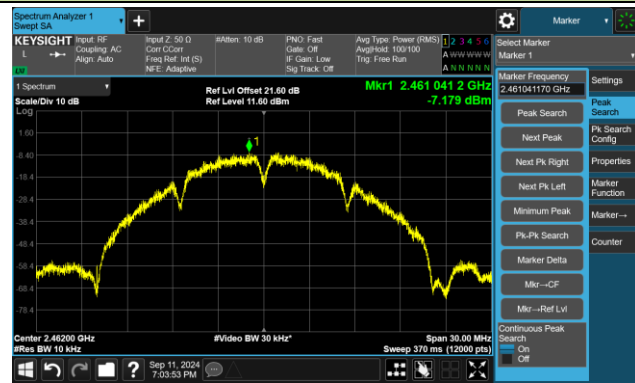
Channel 01 (2412MHz)



Channel 06 (2437MHz)

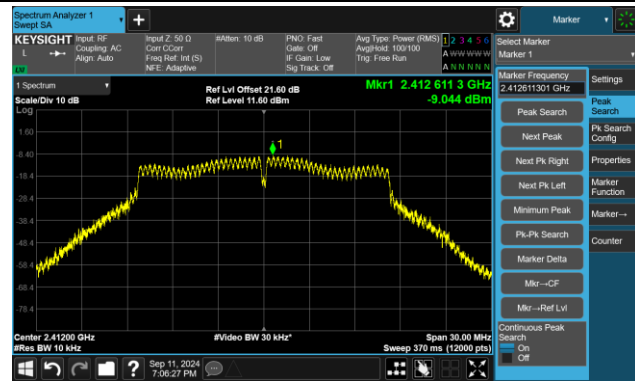


Channel 11 (2462MHz)

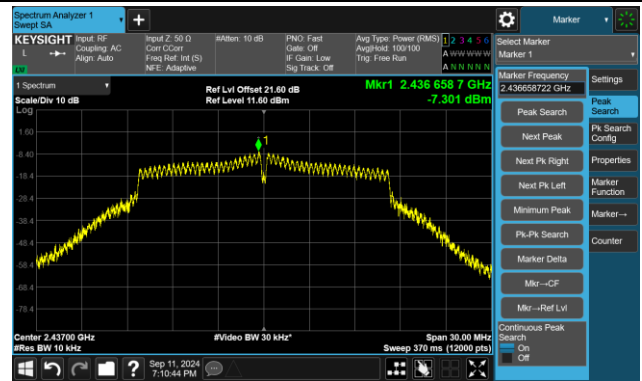


802.11g - AVGPDS - Ant 1

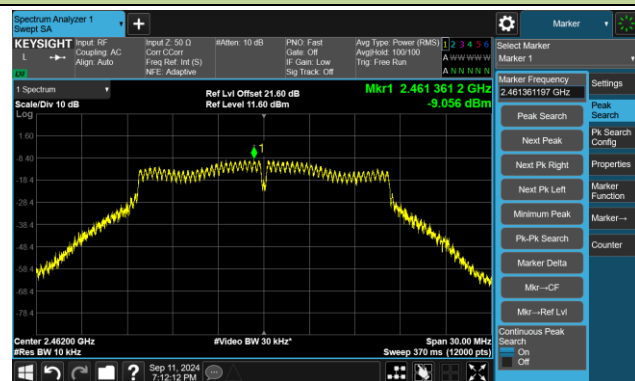
Channel 01 (2412MHz)



Channel 06 (2437MHz)

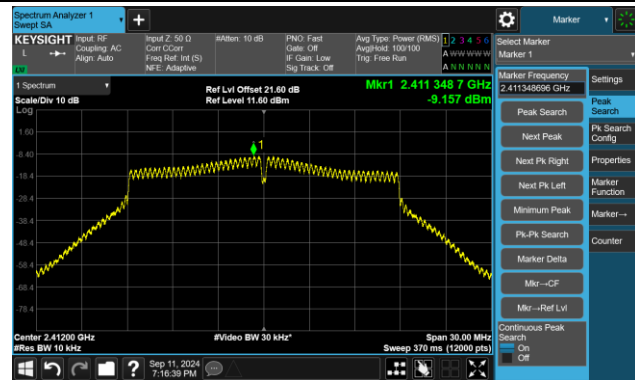


Channel 11 (2462MHz)

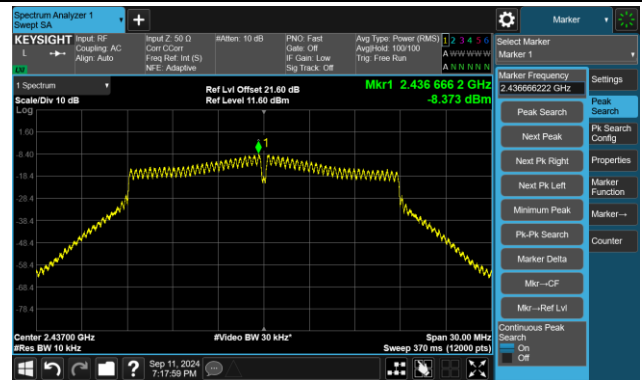


802.11n-HT20 - AVGPDS - Ant 1

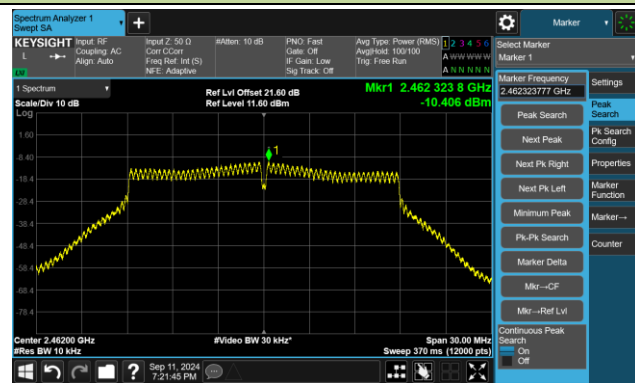
Channel 01 (2412MHz)



Channel 06 (2437MHz)

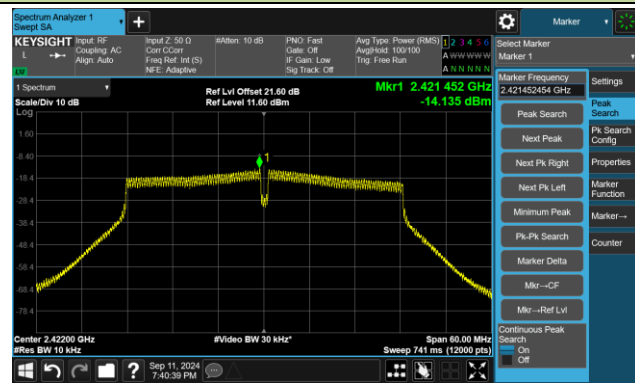


Channel 11 (2462MHz)

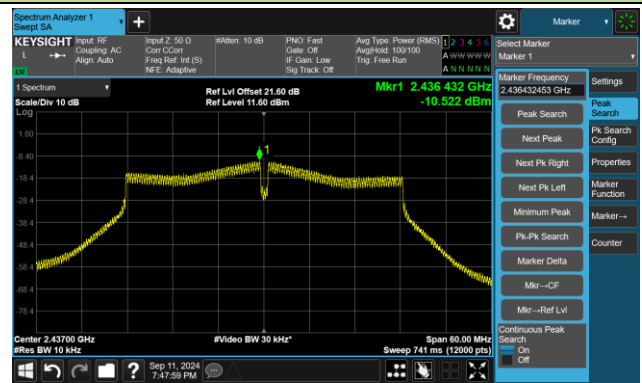


802.11n-HT40 - AVGPDS - Ant 1

Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)

