



RF MEASUREMENT REPORT

FCC ID: 2BFH8PLUG5LTE
Applicant: UAB "Ruptela"
Product: Plug5
Model No.: Plug5-LTE-NA-BT-WiFi
Brand Name: Ruptela
FCC Classification: Digital Transmission System (DTS)
FCC Rule Part(s): Part 15 Subpart C (Section 15.247)
Result: Complies
Received Date: 2024-03-07
Test Date: 2024-04-02 ~ 2024-04-09

Reviewed By:

Kevin Guo

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
2403RSU012-U2	V01	Initial Report	2024-04-23	Valid

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1. General Information

1.1. Applicant

UAB “Ruptela”

Perkūnkiemio st. 6, LT-12130, Vilnius, Lithuania

1.2. Manufacturer

UAB “Ruptela”

Raudondvario pl. 242c, LT-47158, Kaunas, Lithuania

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 Accreditations
	A2LA: 3628.01 CNAS: L10551 FCC: CN1166 ISED: CN0001 VCCI: ☐ R-20025 ☐ G-20034 ☐ C-20020 ☐ T-20020 ☐ R-20141 ☐ G-20134 ☐ C-20103 ☐ T-20104
☐	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 CNAS: L10551 FCC: CN1284 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	Plug5
Model No.	Plug5-LTE-NA-BT-WiFi
EUT Identification No.	20240307Sample#04
Wi-Fi Specification	802.11b/g/n
Bluetooth Specification	V5.1 Bluetooth LE
3GPP Specification	LTE Band 2/4/5/12/14
Antenna Information	Refer to Section 1.5
Power Type	9 ~ 32Vdc, typically 12Vdc
Operating Environment	In the vehicular environment
Note: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification under Test

Frequency Range	802.11b/g/n-HT20: 2412 ~ 2462MHz 802.11n-HT40: 2422 ~ 2452MHz
Channel Number	802.11b/g/n-HT20: 11 802.11n-HT40: 7
Type of Modulation	802.11b: DSSS 802.11g/n: OFDM
Data Rate	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 150Mbps
Antenna Type	LDS Antenna
Antenna Gain	3.01dBi

1.6. Working Frequencies

802.11b/g/n-HT20

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

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	--	--	--	--

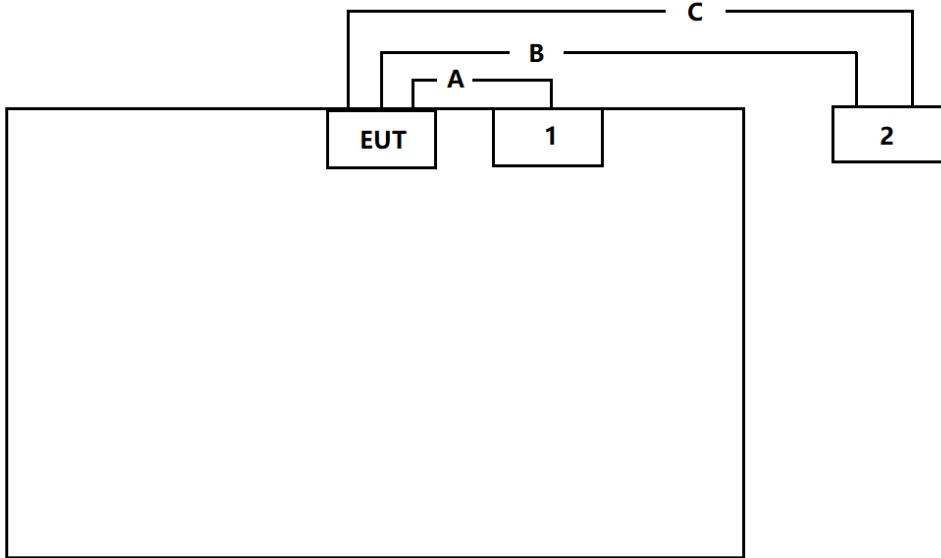
2. Test Configuration

2.1. Test Mode

Mode 1: Transmit by 802.11b (1Mbps)
Mode 2: Transmit by 802.11g (6Mbps)
Mode 3: Transmit by 802.11n-HT20 (MCS0)
Mode 4: Transmit by 802.11n-HT40 (MCS0)
Note: All modes of operation and data rates were investigated, so all RF test requirements shall be executed at the worst data rate.

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.

Connection Diagram			
 <pre> graph TD EUT[EUT] --- A[A] --- 1[1] 1 --- B[B] --- 2[2] 2 --- C[C] --- EUT </pre>			
Cable Type		Cable Description	Length
A	Power Cable	Non-Shielded	1.5m
B	USB Cable	Shielded	> 10m
C	USB Cable	Shielded	> 10m
Product		Manufacturer	Model No.
1	AC Adapter	Mentech	MAES-1201001200
2	Notebook	Lenovo	E430C

2.3. Test Software

The test utility software used during testing were “Terminal” & “platform-tools” and the commands were provided by the manufacturer.

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
- 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
EMI Test Receiver	Agilent	N9038A	MRTSUE06125	1 year	2024-05-23	WZ-AC2
Active Loop Antenna	Schwarzbeck	FMZB 1519-60 D	MRTSUE07076	1 year	2024-12-04	WZ-AC2
TRILOG Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2024-05-15	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06171	1 year	2024-10-11	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2024-11-04	WZ-AC2
Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2024-05-07	WZ-AC2
Preamplifier	EMCI	EMC184045SE	MRTSUE06640	1 year	2025-01-11	WZ-AC2
Thermohygrometer	testo	608-H1	MRTSUE11263	1 year	2024-11-07	WZ-AC2
Anechoic Chamber	RIKEN	WZ-AC2	MRTSUE06213	1 year	2024-04-20	WZ-AC2
USB Power Sensor	Keysight	U2021XA	MRTSUE06446	1 year	2024-05-23	WZ-SR5
Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2024-05-23	WZ-SR5
Attenuator	MVE	MVE2213	MRTSUE11079	1 year	2024-06-08	WZ-SR5
Thermohygrometer	testo	608-H1	MRTSUE06402	1 year	2024-05-31	WZ-SR5
Shielding Room	HUAMING	WZ-SR5	MRTSUE06442	N/A	N/A	WZ-SR5

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802	1.02	RE Antenna & Turntable
BenchVue Power Meter	2018.1	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 $k = 2$.

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	N/A

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. "N/A" means that the test item is not applicable, and the detailed information refers to relevant section.

6.2. 6dB Bandwidth Measurement

6.2.1. Test Limit

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

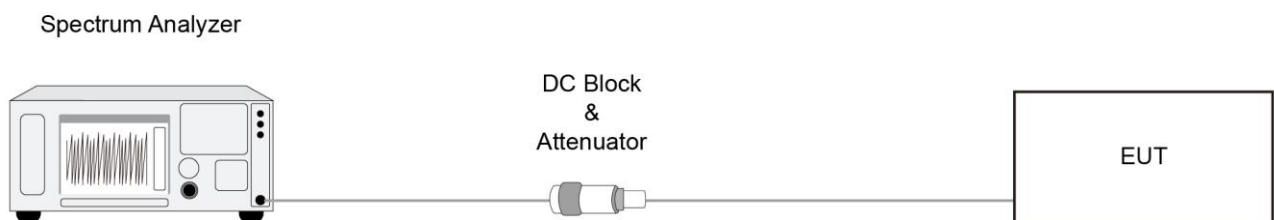
6.2.2. Test Procedure

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

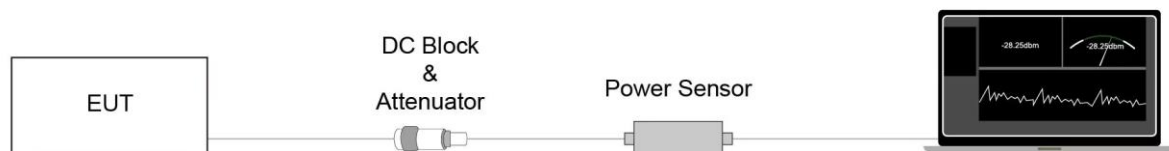
ANSI C63.10 - 2013 - Section 11.9.2.3.2

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.

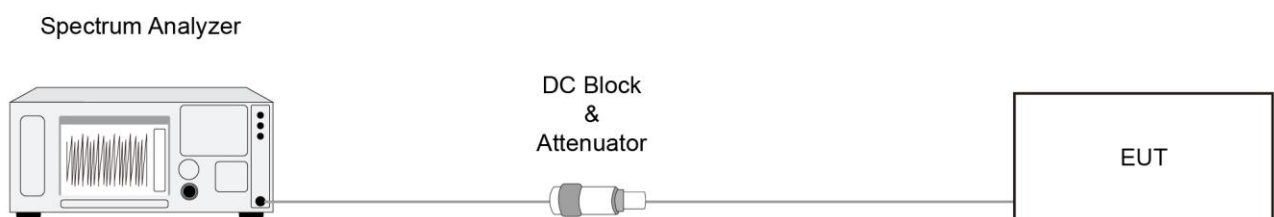
6.4.2. Test Procedure

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 $\geq 2 \times \text{span/RBW}$.
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 Setting

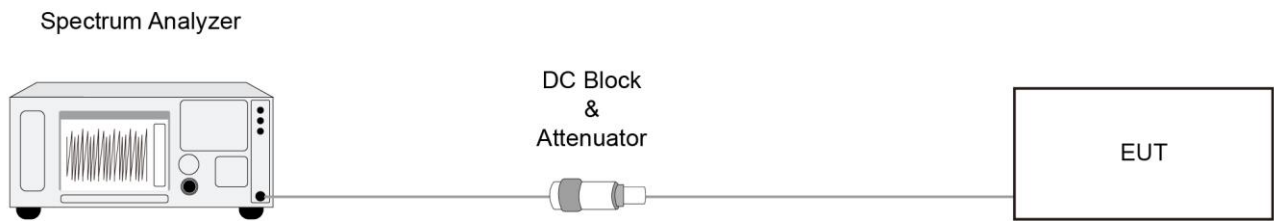
Reference level measurement

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



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 [$\mu\text{V/m}$]	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

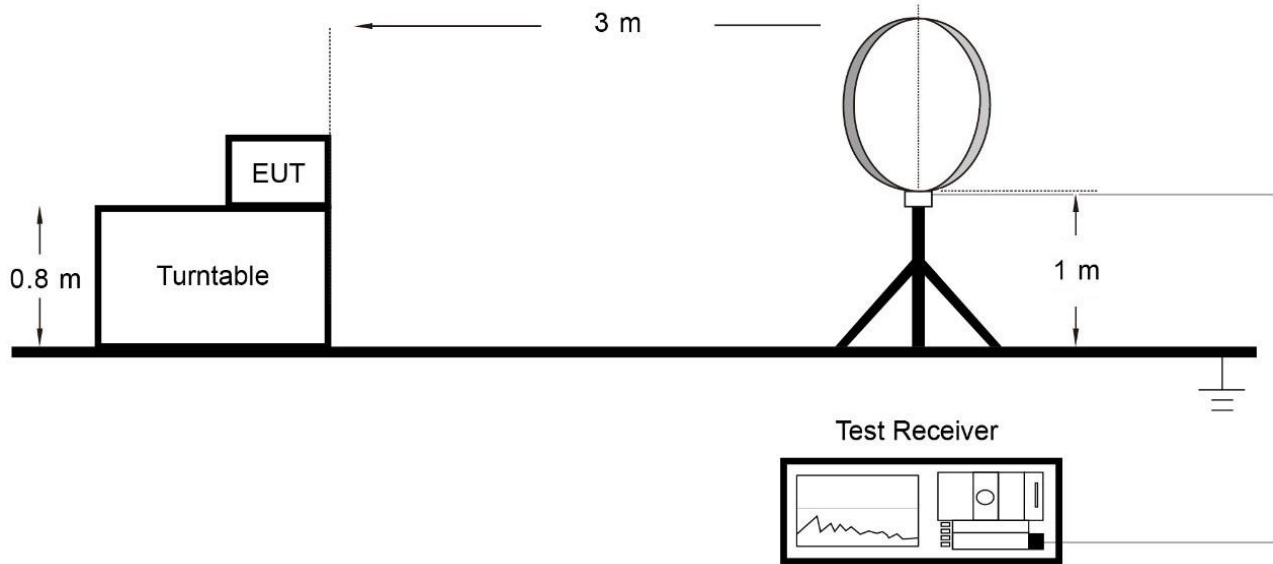
Average Measurements above 1GHz (Method VB)

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

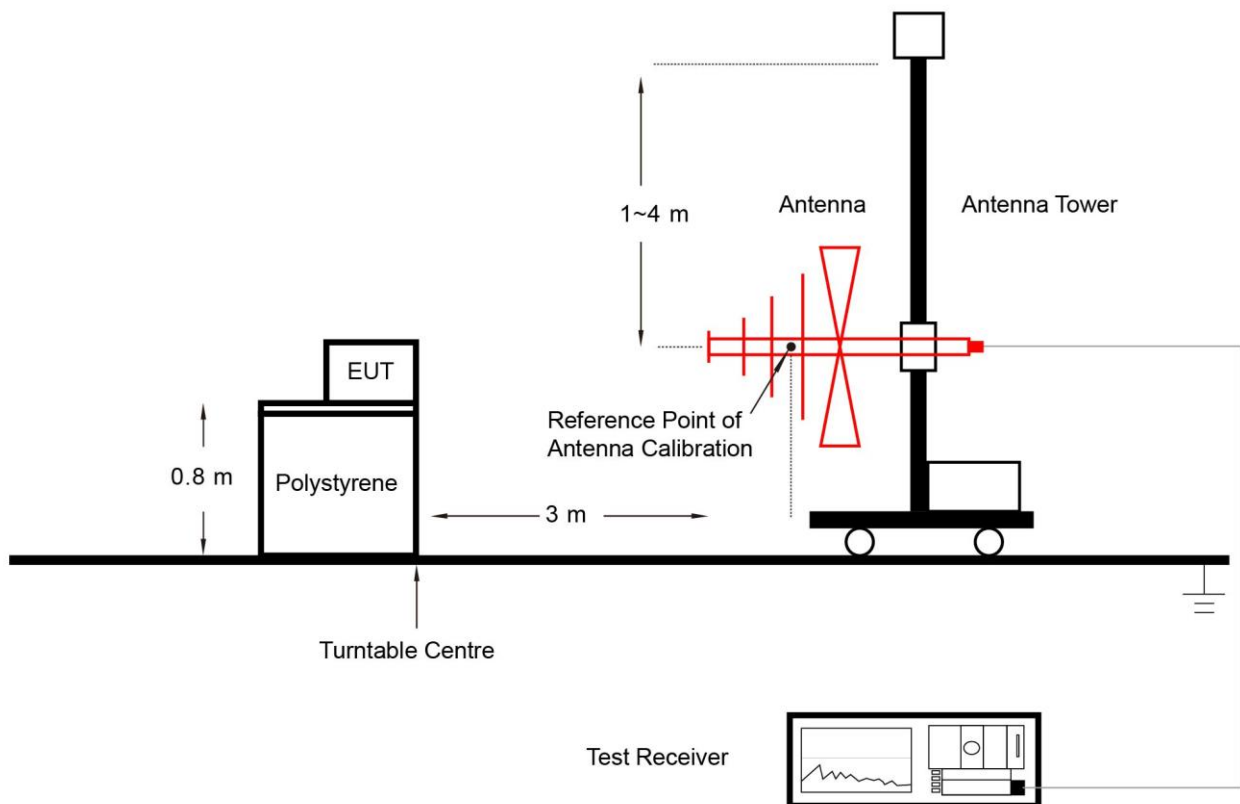
If the EUT duty cycle is $< 98\%$, set $\text{VBW} \geq 1/T$. T is the minimum transmission duration.
4. As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require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

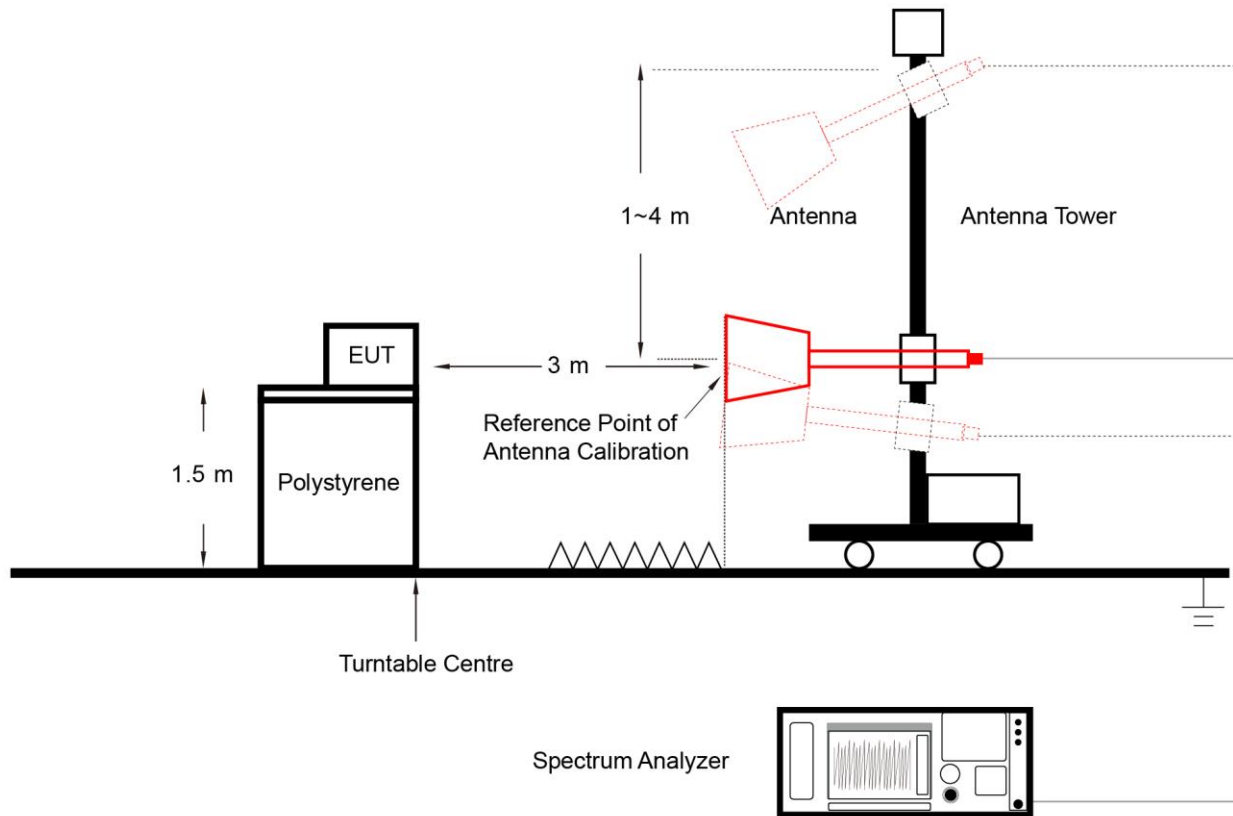
Below 30MHz Test Setup:



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 [μ V/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 & 11.12

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

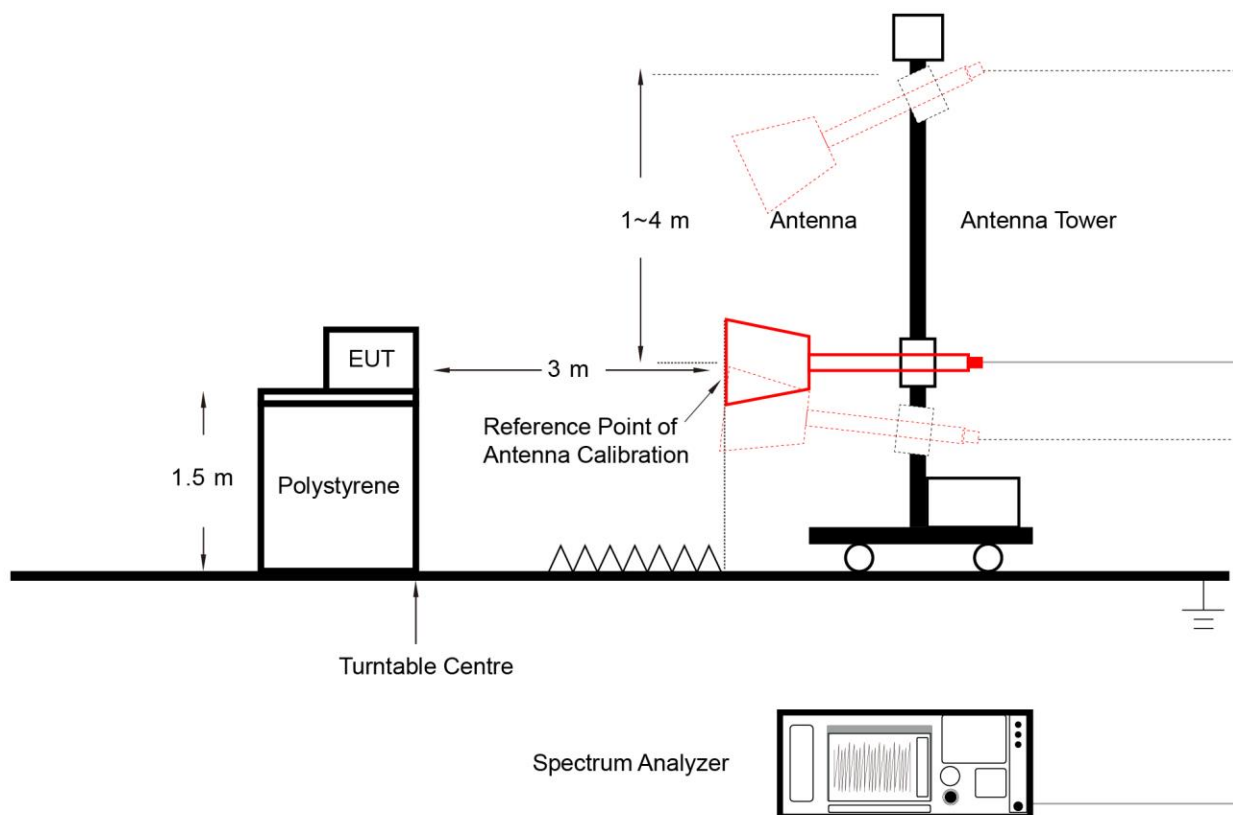
Average Field Strength Measurements

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

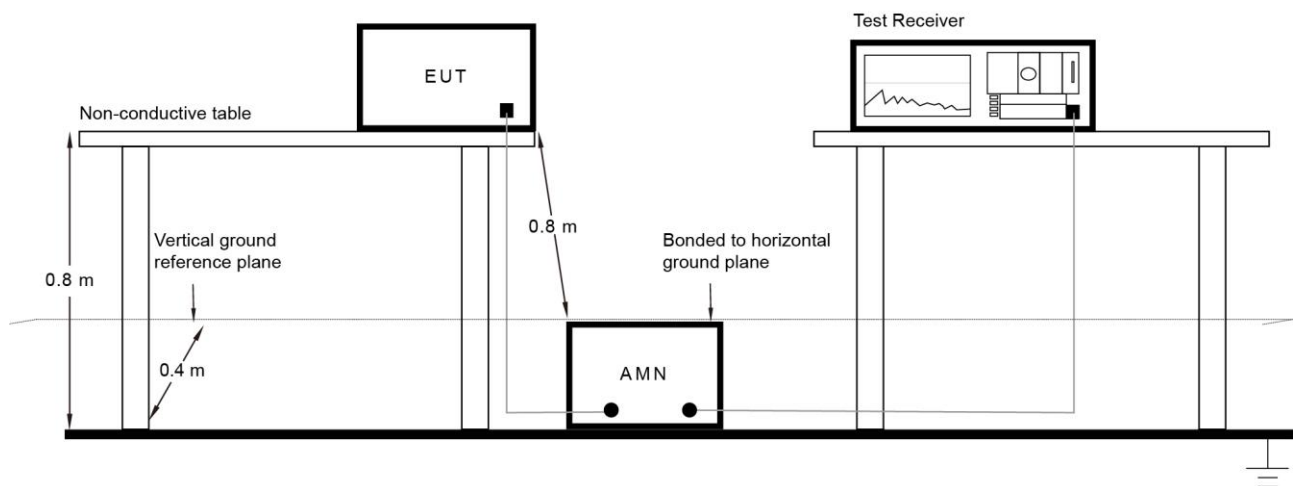
6.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dB μ V)	AV (dB μ V)
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

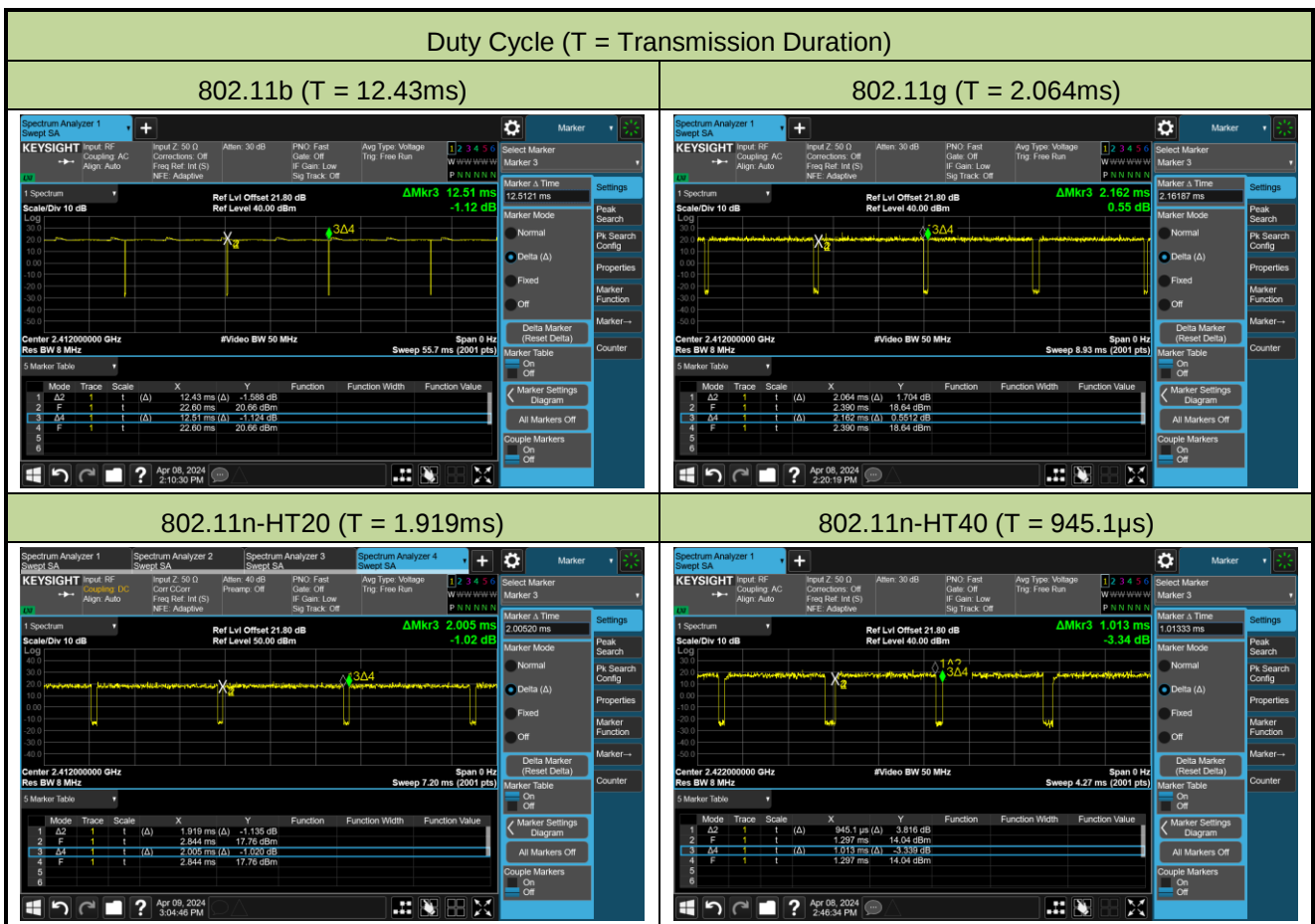
The EUT is powered by DC supply, so this item is not applicable.

Appendix A – Test Result

A.1 Duty Cycle Test Result

Test Site	WZ-SR5	Test Engineer	Jeff Yang
Test Date	2024-04-08 ~ 2024-04-09		

Test Mode	Duty Cycle
802.11b	99.36%
802.11g	95.47%
802.11n-HT20	95.71%
802.11n-HT40	93.30%



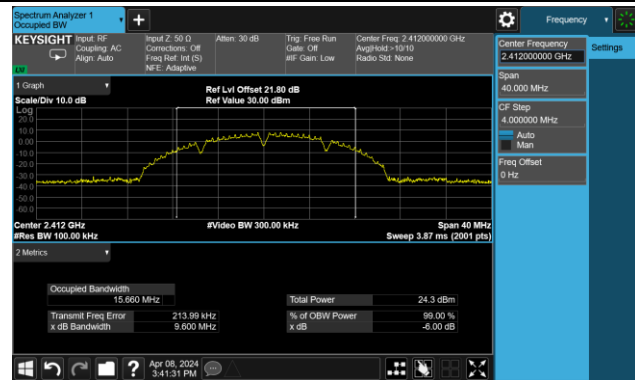
A.2 6dB Bandwidth Test Result

Test Site	WZ-SR5	Test Engineer	Jeff Yang
Test Date	2024-04-08		

Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
11b	1Mbps	01	2412	9.600	≥ 0.5
11b	1Mbps	06	2437	9.609	≥ 0.5
11b	1Mbps	11	2462	9.127	≥ 0.5
11g	6Mbps	01	2412	15.750	≥ 0.5
11g	6Mbps	06	2437	16.340	≥ 0.5
11g	6Mbps	11	2462	16.360	≥ 0.5
11n-HT20	MCS0	01	2412	17.350	≥ 0.5
11n-HT20	MCS0	06	2437	17.310	≥ 0.5
11n-HT20	MCS0	11	2462	17.130	≥ 0.5
11n-HT40	MCS0	03	2422	35.150	≥ 0.5
11n-HT40	MCS0	06	2437	36.090	≥ 0.5
11n-HT40	MCS0	09	2452	35.360	≥ 0.5

802.11b 6dB Bandwidth

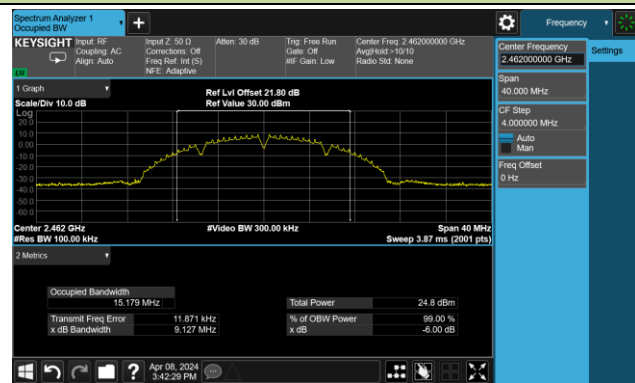
Channel 01 (2412MHz)



Channel 06 (2437MHz)

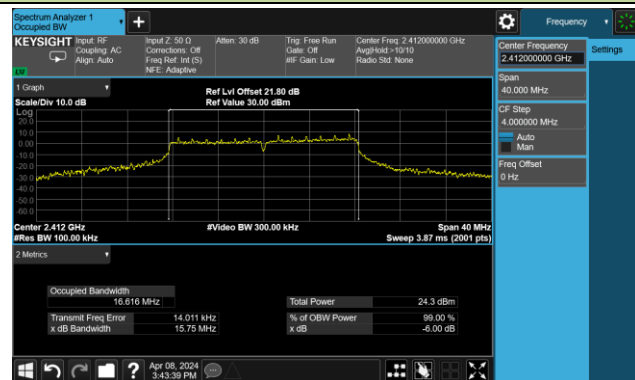


Channel 11 (2462MHz)

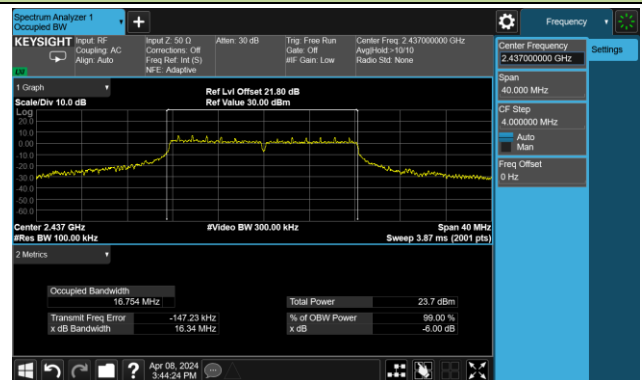


802.11g 6dB Bandwidth

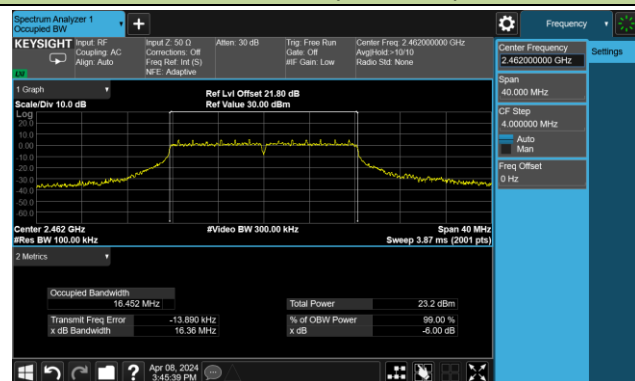
Channel 01 (2412MHz)



Channel 06 (2437MHz)

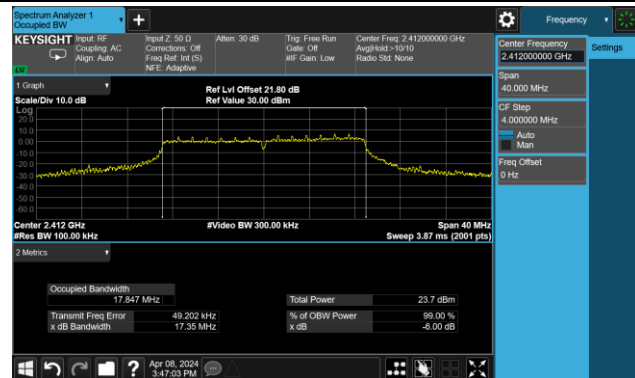


Channel 11 (2462MHz)

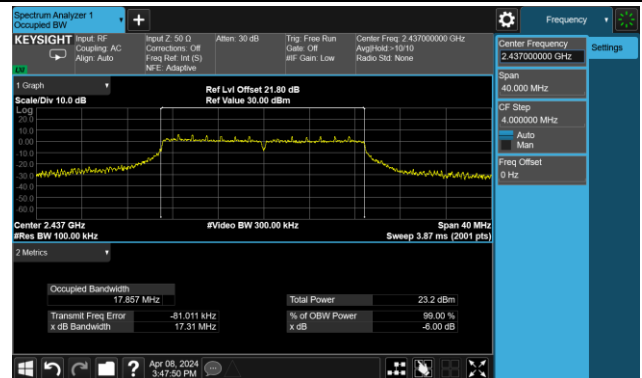


802.11n-HT20 6dB Bandwidth

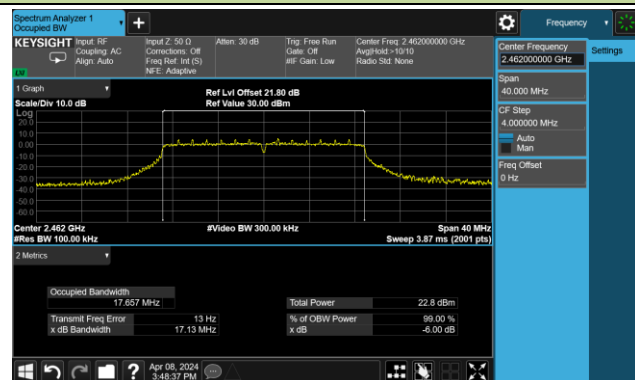
Channel 01 (2412MHz)



Channel 06 (2437MHz)

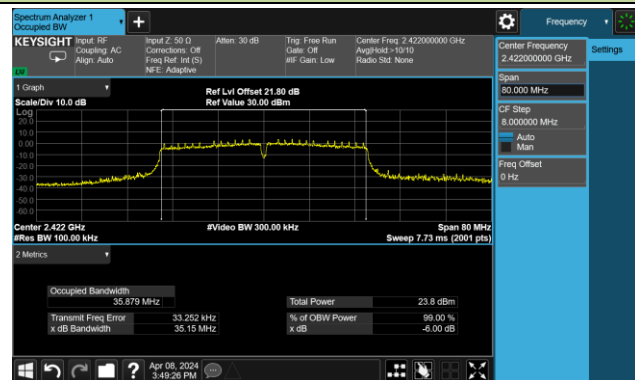


Channel 11 (2462MHz)

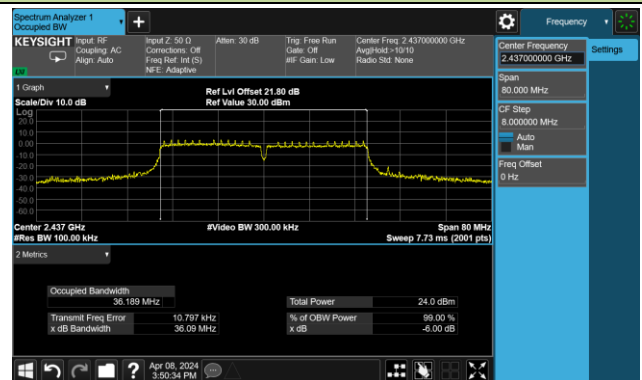


802.11n-HT40 6dB Bandwidth

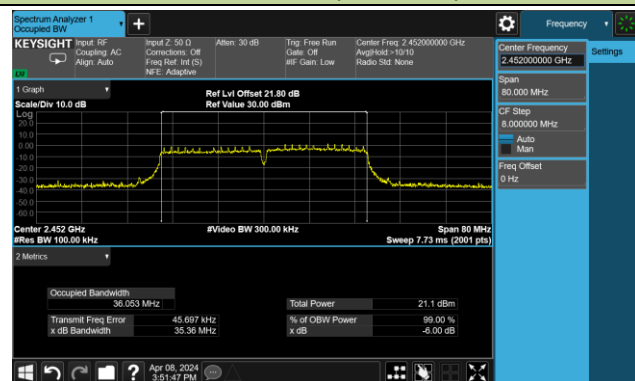
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



A.3 Output Power Test Result

Test Site	WZ-SR5	Test Engineer	Jeff Yang
Test Date	2024-04-02 ~ 2024-04-09		

Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	Average Power (dBm)	Limit (dBm)
11b	1Mbps	01	2412	18.13	≤ 30.00
11b	1Mbps	06	2437	18.21	≤ 30.00
11b	1Mbps	11	2462	18.11	≤ 30.00
11g	6Mbps	01	2412	15.93	≤ 30.00
11g	6Mbps	06	2437	16.98	≤ 30.00
11g	6Mbps	11	2462	16.87	≤ 30.00
11n-HT20	MCS0	01	2412	15.51	≤ 30.00
11n-HT20	MCS0	06	2437	16.37	≤ 30.00
11n-HT20	MCS0	11	2462	16.03	≤ 30.00
11n-HT40	MCS0	03	2422	17.09	≤ 30.00
11n-HT40	MCS0	06	2437	17.11	≤ 30.00
11n-HT40	MCS0	09	2452	14.27	≤ 30.00

A.4 Power Spectral Density Test Result

Test Site	WZ-SR5	Test Engineer	Jeff Yang
Test Date	2024-04-08 ~ 2024-04-09		

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)
11b	1Mbps	01	2412	-10.439	99.36	0.028	-10.439	≤ 8.00
11b	1Mbps	06	2437	-10.252	99.36	0.028	-10.252	≤ 8.00
11b	1Mbps	11	2462	-9.758	99.36	0.028	-9.758	≤ 8.00
11g	6Mbps	01	2412	-13.066	95.47	0.201	-12.865	≤ 8.00
11g	6Mbps	06	2437	-12.200	95.47	0.201	-11.999	≤ 8.00
11g	6Mbps	11	2462	-12.323	95.47	0.201	-12.122	≤ 8.00
11n-HT20	MCS0	01	2412	-13.411	95.71	0.190	-13.221	≤ 8.00
11n-HT20	MCS0	06	2437	-12.258	95.71	0.190	-12.068	≤ 8.00
11n-HT20	MCS0	11	2462	-13.360	95.71	0.190	-13.170	≤ 8.00
11n-HT40	MCS0	03	2422	-13.786	93.30	0.301	-13.485	≤ 8.00
11n-HT40	MCS0	06	2437	-14.013	93.30	0.301	-13.712	≤ 8.00
11n-HT40	MCS0	09	2452	-16.327	93.30	0.301	-16.026	≤ 8.00

Note:

When EUT Duty Cycle ≥ 98%, Total PSD (dBm/10kHz) = PSD (dBm/10kHz).

When EUT Duty Cycle < 98%, Total PSD (dBm/10kHz) = PSD (dBm/10kHz) + 10*log (1/Duty Cycle).

802.11b - AVGPSD

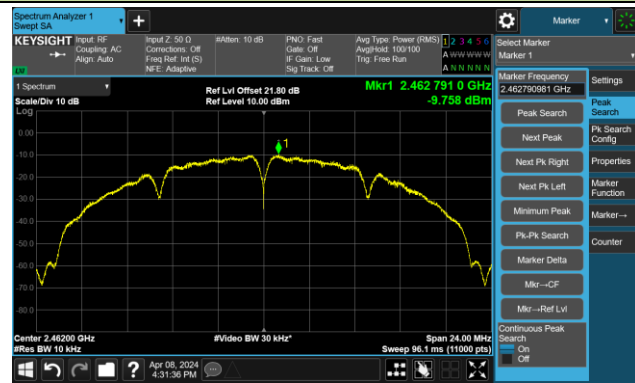
Channel 01 (2412MHz)



Channel 06 (2437MHz)

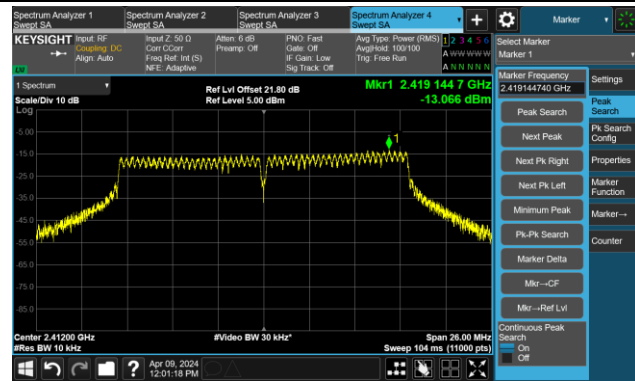


Channel 11 (2462MHz)

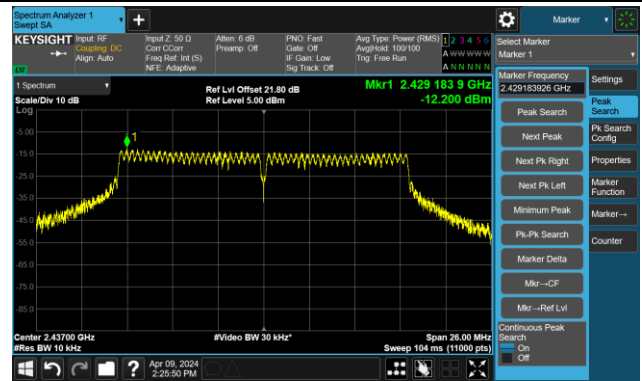


802.11g - AVGPSD

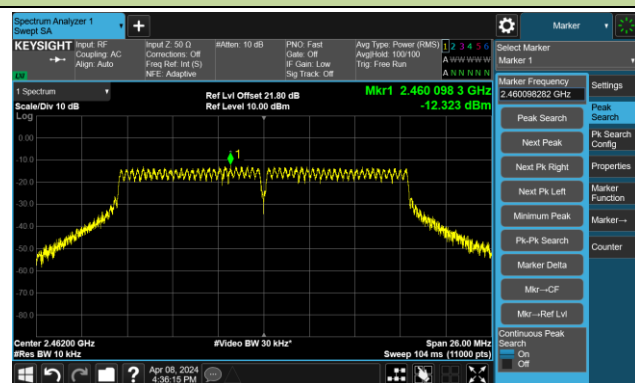
Channel 01 (2412MHz)



Channel 06 (2437MHz)

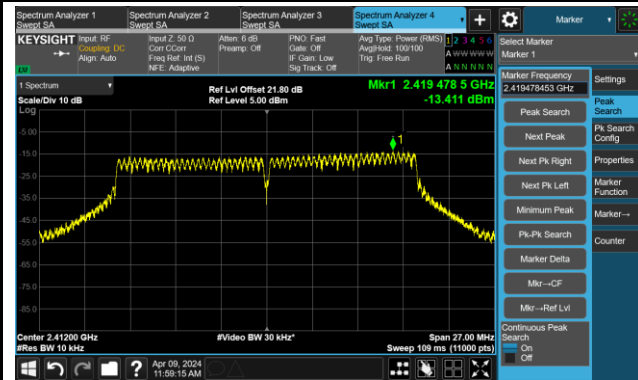


Channel 11 (2462MHz)

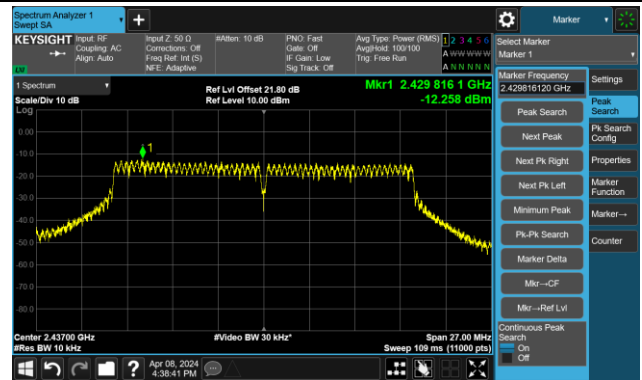


802.11n-HT20 - AVGPSD

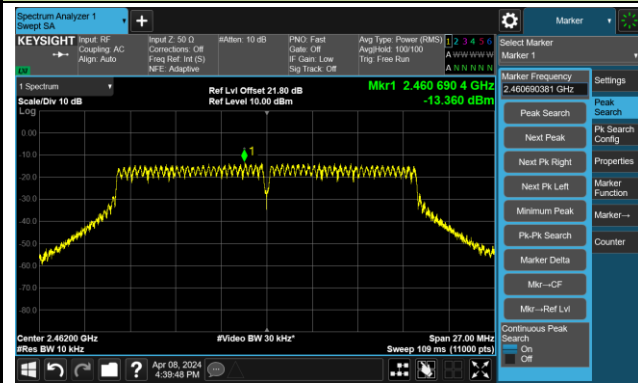
Channel 01 (2412MHz)



Channel 06 (2437MHz)

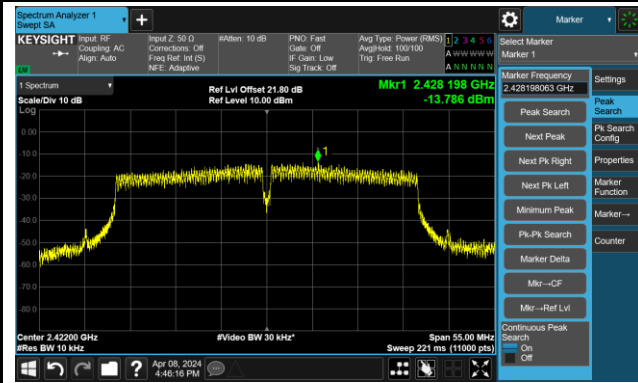


Channel 11 (2462MHz)

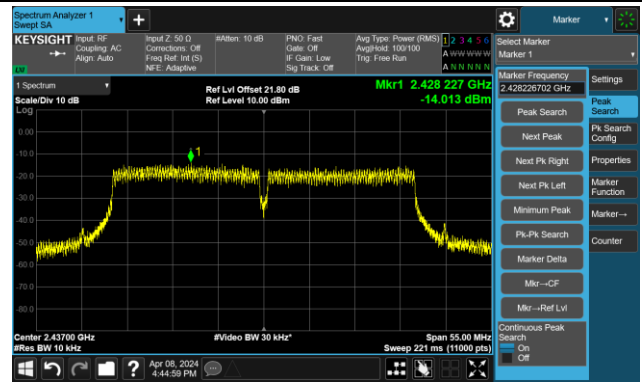


802.11n-HT40 - AVGPSD

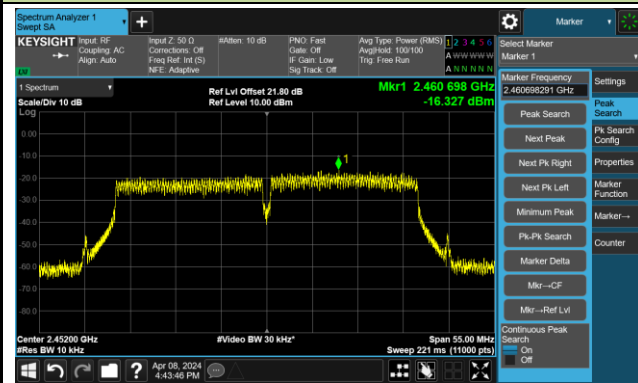
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



A.5 Conducted Band Edge and Out-of-Band Emissions Test Result

Test Site	WZ-SR5	Test Engineer	Jeff Yang
Test Date	2024-04-08 ~ 2024-04-09		

Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	Limit	Result
11b	1Mbps	01	2412	30dBc	Pass
11b	1Mbps	06	2437	30dBc	Pass
11b	1Mbps	11	2462	30dBc	Pass
11g	6Mbps	01	2412	30dBc	Pass
11g	6Mbps	06	2437	30dBc	Pass
11g	6Mbps	11	2462	30dBc	Pass
11n-HT20	MCS0	01	2412	30dBc	Pass
11n-HT20	MCS0	06	2437	30dBc	Pass
11n-HT20	MCS0	11	2462	30dBc	Pass
11n-HT40	MCS0	03	2422	30dBc	Pass
11n-HT40	MCS0	06	2437	30dBc	Pass
11n-HT40	MCS0	09	2452	30dBc	Pass

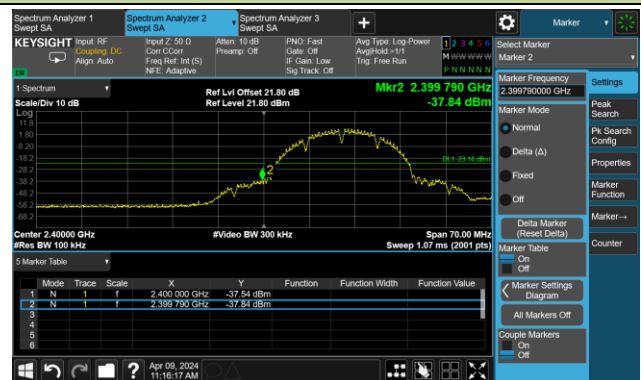
802.11b Out-of-Band Emissions

Channel 01 (2412MHz)

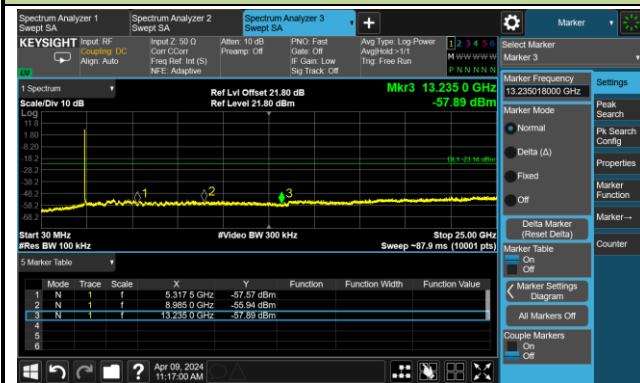
Reference Level



Low Band Edge

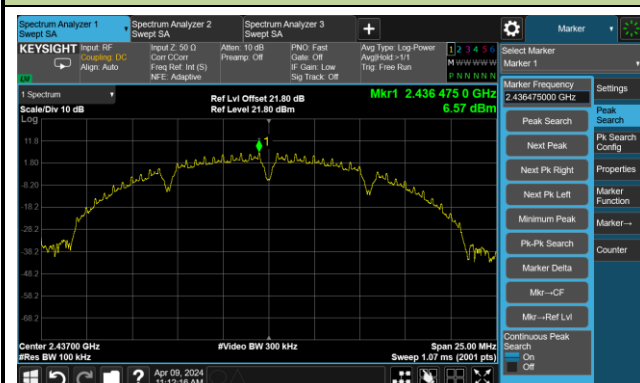


Spurious Emission

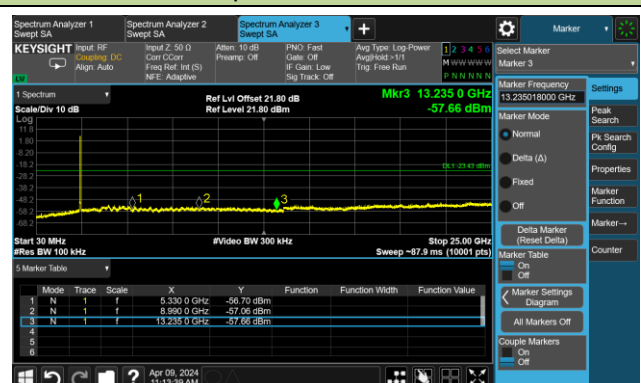


Channel 06 (2437MHz)

Reference Level



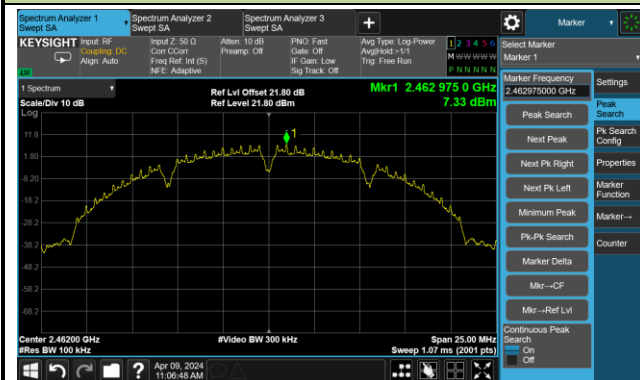
Spurious Emission



802.11b Out-of-Band Emissions

Channel 11 (2462MHz)

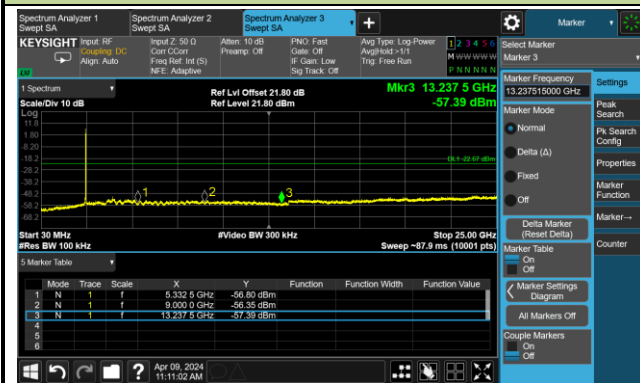
Reference Level



High Band Edge



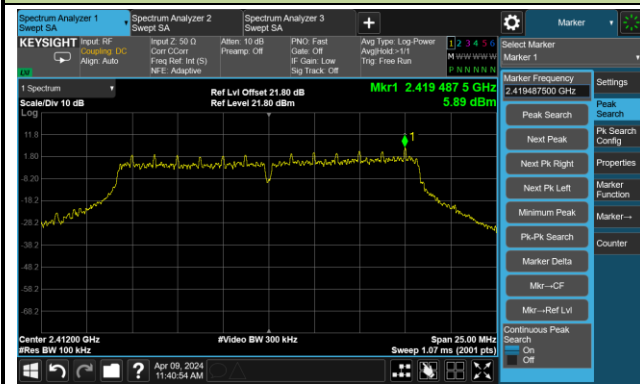
Spurious Emission



802.11g Out-of-Band Emissions

Channel 01 (2412MHz)

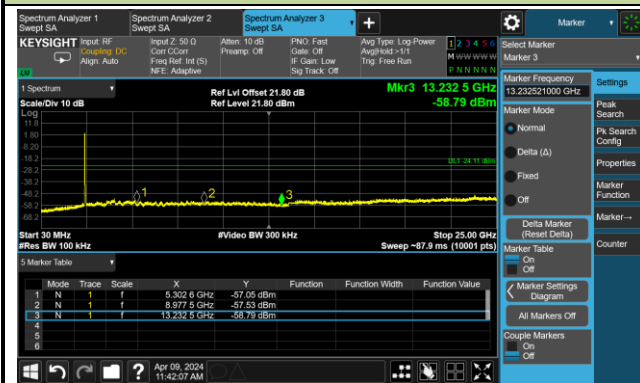
Reference Level



Low Band Edge

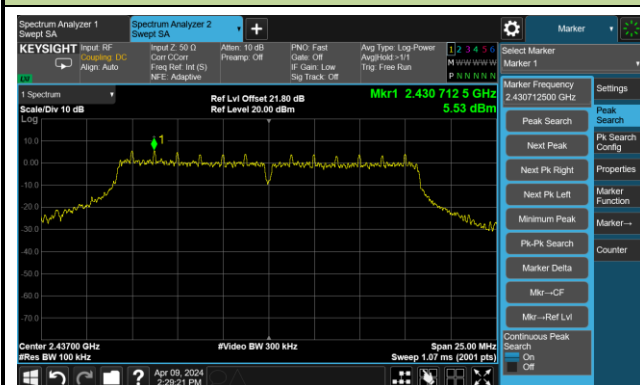


Spurious Emission

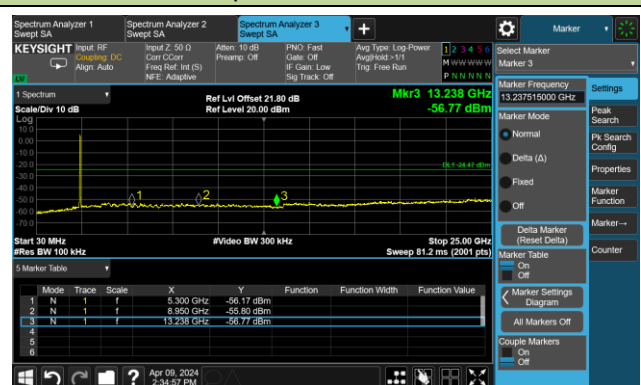


Channel 06 (2437MHz)

Reference Level



Spurious Emission



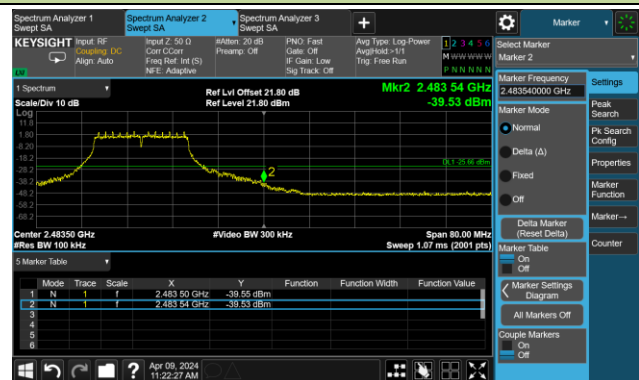
802.11g Out-of-Band Emissions

Channel 11 (2462MHz)

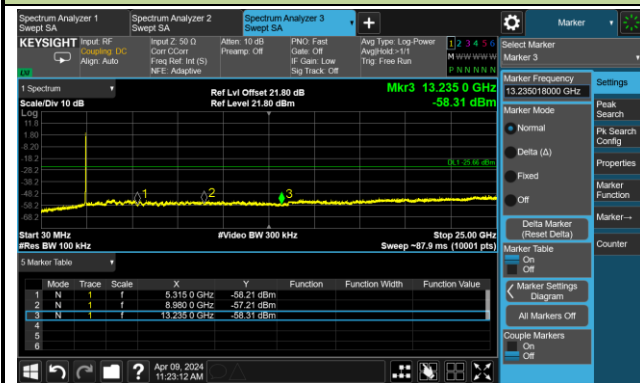
Reference Level



High Band Edge



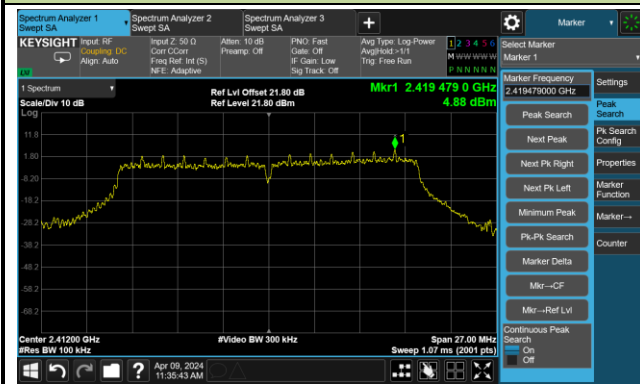
Spurious Emission



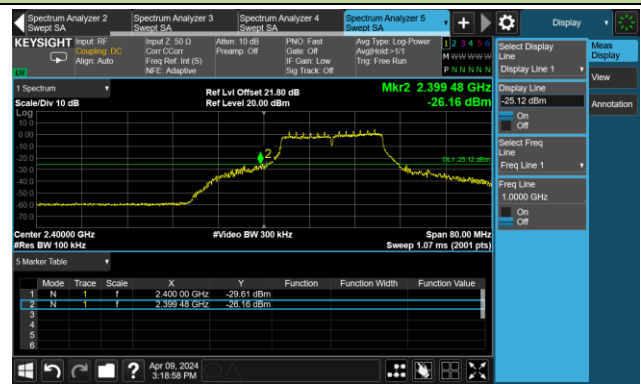
802.11n-HT20 Out-of-Band Emissions

Channel 01 (2412MHz)

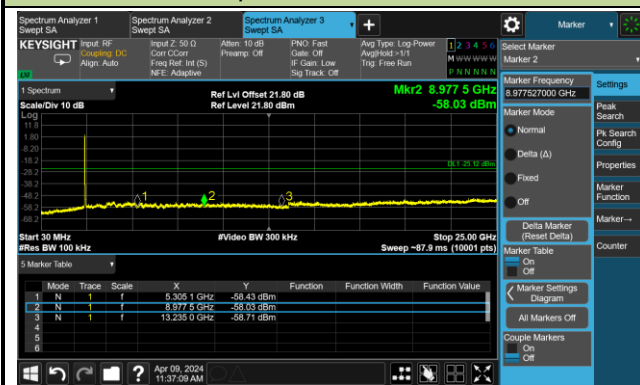
Reference Level



Low Band Edge

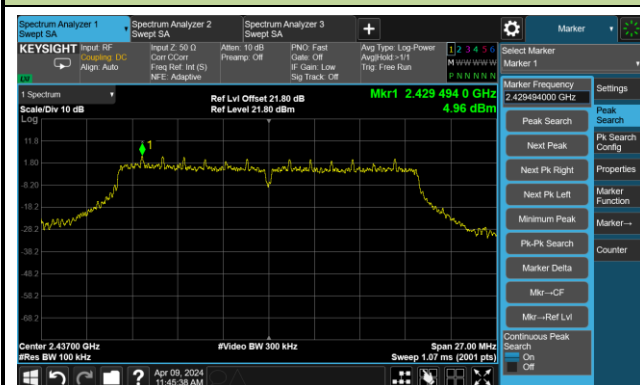


Spurious Emission

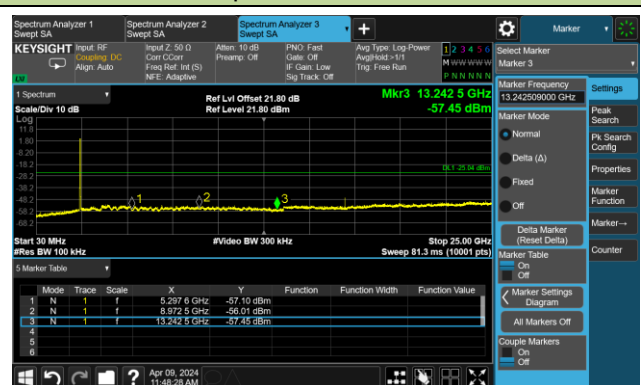


Channel 06 (2437MHz)

Reference Level



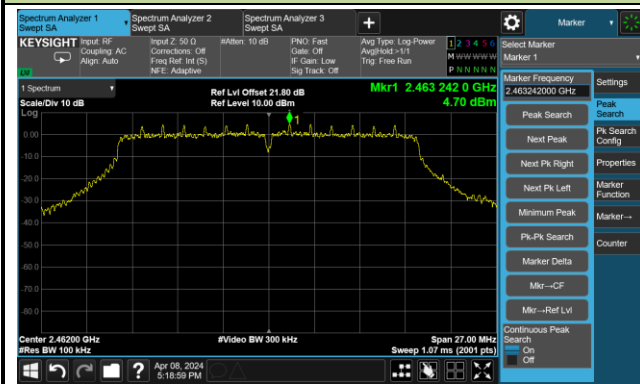
Spurious Emission



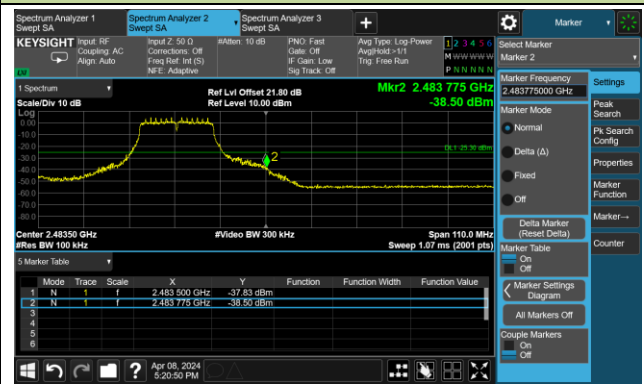
802.11n-HT20 Out-of-Band Emissions

Channel 11 (2462MHz)

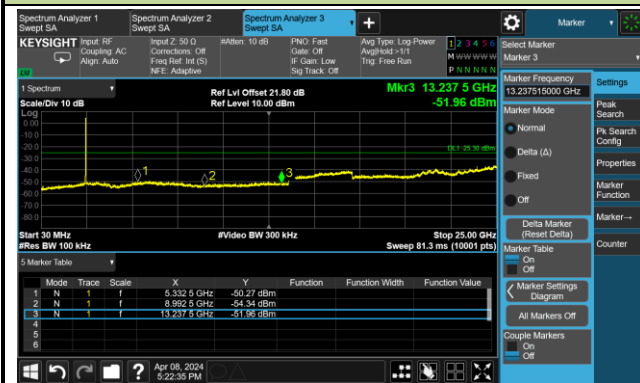
Reference Level



High Band Edge



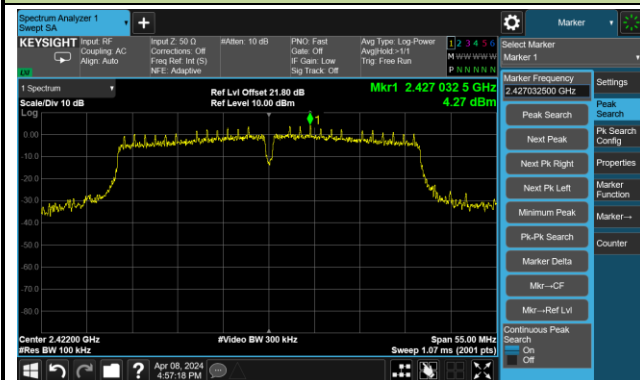
Spurious Emission



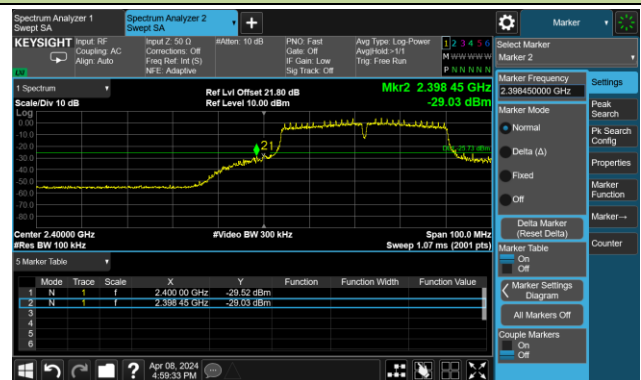
802.11n-HT40 Out-of-Band Emissions

Channel 03 (2422MHz)

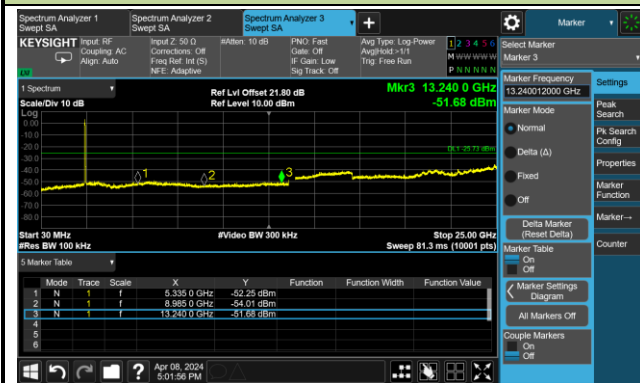
Reference Level



Low Band Edge

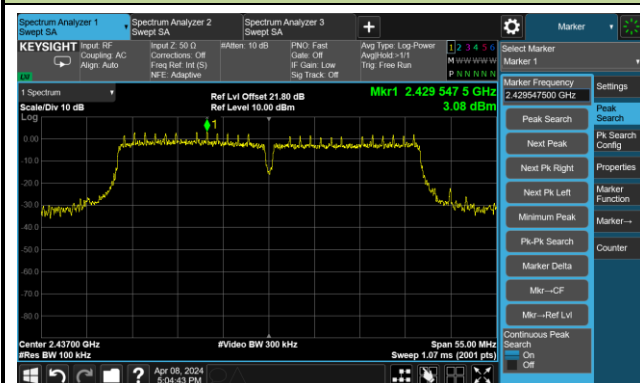


Spurious Emission



Channel 06 (2437MHz)

Reference Level



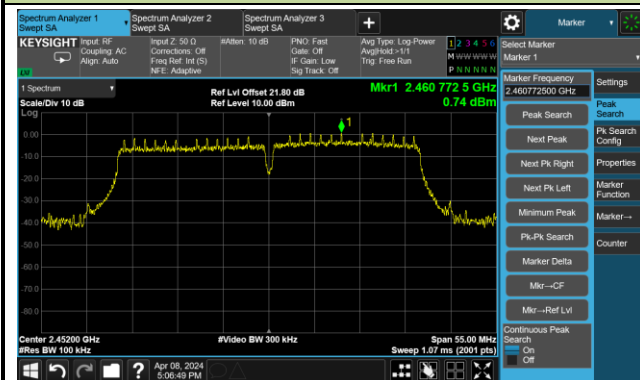
Spurious Emission



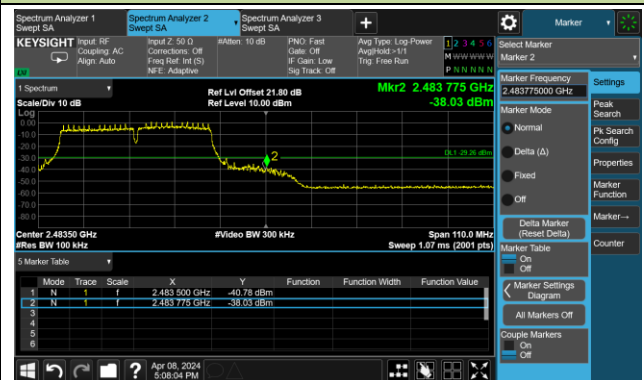
802.11n-HT40 Out-of-Band Emissions

Channel 09 (2452MHz)

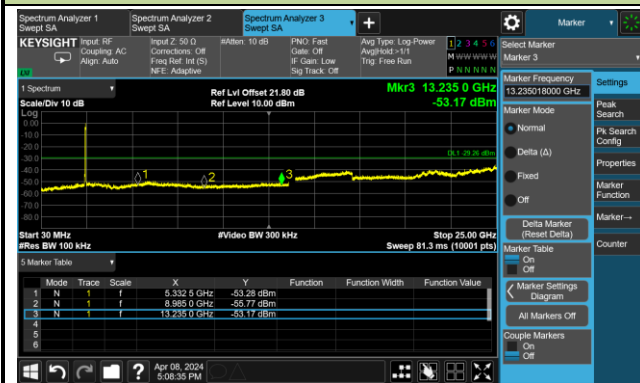
Reference Level



High Band Edge



Spurious Emission



A.6 Radiated Spurious Emission Test Result

Test Site	WZ-AC2	Test Engineer	Dick Shen
Test Date	2024-04-03	Test Mode	802.11b
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Test Channel	Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
01	4816.5	35.0	3.0	38.0	74.0	-36.0	Peak	Horizontal
	11523.0	32.7	17.2	49.9	74.0	-24.1	Peak	Horizontal
	17906.5	30.3	28.0	58.3	74.0	-15.7	Peak	Horizontal
	17906.5	18.6	28.0	46.6	54.0	-7.4	Average	Horizontal
	4825.0	36.8	3.0	39.8	74.0	-34.2	Peak	Vertical
	11540.0	32.1	17.6	49.7	74.0	-24.3	Peak	Vertical
	17983.0	30.3	28.5	58.8	74.0	-15.2	Peak	Vertical
	17983.0	18.5	28.5	47.0	54.0	-7.0	Average	Vertical
06	4825.0	35.2	3.0	38.2	74.0	-35.8	Peak	Horizontal
	11489.0	31.7	17.7	49.4	74.0	-24.6	Peak	Horizontal
	17983.0	30.4	28.5	58.9	74.0	-15.1	Peak	Horizontal
	17983.0	18.1	28.5	46.6	54.0	-7.4	Average	Horizontal
	4825.0	35.4	3.0	38.4	74.0	-35.6	Peak	Vertical
	11446.5	31.9	17.3	49.2	74.0	-24.8	Peak	Vertical
	17966.0	30.4	27.9	58.3	74.0	-15.7	Peak	Vertical
	17966.0	18.2	27.9	46.1	54.0	-7.9	Average	Vertical
11	4102.5	36.3	0.7	37.0	74.0	-37.0	Peak	Horizontal
	11684.5	32.1	17.3	49.4	74.0	-24.6	Peak	Horizontal
	17983.0	31.2	28.5	59.7	74.0	-14.3	Peak	Horizontal
	17983.0	17.9	28.5	46.4	54.0	-7.6	Average	Horizontal
	4255.5	36.2	1.2	37.4	74.0	-36.6	Peak	Vertical
	11319.0	31.9	17.4	49.3	74.0	-24.7	Peak	Vertical
	17974.5	30.7	28.2	58.9	74.0	-15.1	Peak	Vertical
	17974.5	18.3	28.2	46.5	54.0	-7.5	Average	Vertical

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Test Site	WZ-AC2	Test Engineer	Dick Shen
Test Date	2024-04-03	Test Mode	802.11g
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Test Channel	Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
01	3873.0	37.1	0.0	37.1	74.0	-36.9	Peak	Horizontal
	11574.0	31.7	17.7	49.4	74.0	-24.6	Peak	Horizontal
	17881.0	30.9	27.7	58.6	74.0	-15.4	Peak	Horizontal
	17881.0	18.6	27.7	46.3	54.0	-7.7	Average	Horizontal
	4825.0	35.3	3.0	38.3	74.0	-35.7	Peak	Vertical
	11480.5	33.1	17.6	50.7	74.0	-23.3	Peak	Vertical
	17991.5	31.4	28.3	59.7	74.0	-14.3	Peak	Vertical
	17991.5	18.3	28.3	46.6	54.0	-7.4	Average	Vertical
06	4910.0	34.5	3.2	37.7	74.0	-36.3	Peak	Horizontal
	11089.5	31.8	16.8	48.6	74.0	-25.4	Peak	Horizontal
	17991.5	30.5	28.3	58.8	74.0	-15.2	Peak	Horizontal
	17991.5	17.8	28.3	46.1	54.0	-7.9	Average	Horizontal
	3813.5	37.0	-0.2	36.8	74.0	-37.2	Peak	Vertical
	11667.5	32.1	17.5	49.6	74.0	-24.4	Peak	Vertical
	17983.0	30.9	28.5	59.4	74.0	-14.6	Peak	Vertical
	17983.0	17.5	28.5	46.0	54.0	-8.0	Average	Vertical
11	7468.5	31.9	12.1	44.0	74.0	-30.0	Peak	Horizontal
	11540.0	31.5	17.6	49.1	74.0	-24.9	Peak	Horizontal
	17974.5	29.7	28.2	57.9	74.0	-16.1	Peak	Horizontal
	17974.5	18.0	28.2	46.2	54.0	-7.8	Average	Horizontal
	4782.5	35.2	3.1	38.3	74.0	-35.7	Peak	Vertical
	11540.0	31.4	17.6	49.0	74.0	-25.0	Peak	Vertical
	17915.0	30.1	28.0	58.1	74.0	-15.9	Peak	Vertical
	17915.0	18.1	28.0	46.1	54.0	-7.9	Average	Vertical

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Test Site	WZ-AC2	Test Engineer	Dick Shen
Test Date	2024-04-03	Test Mode	802.11n-HT20
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Test Channel	Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
01	4816.5	34.9	3.0	37.9	74.0	-36.1	Peak	Horizontal
	11659.0	31.8	17.7	49.5	74.0	-24.5	Peak	Horizontal
	17974.5	30.5	28.2	58.7	74.0	-15.3	Peak	Horizontal
	17974.5	18.3	28.2	46.5	54.0	-7.5	Average	Horizontal
	7477.0	31.9	12.1	44.0	74.0	-30.0	Peak	Vertical
	11659.0	31.3	17.7	49.0	74.0	-25.0	Peak	Vertical
	17966.0	30.4	27.9	58.3	74.0	-15.7	Peak	Vertical
	17966.0	18.3	27.9	46.2	54.0	-7.8	Average	Vertical
06	4808.0	35.7	2.9	38.6	74.0	-35.4	Peak	Horizontal
	11506.0	31.9	17.4	49.3	74.0	-24.7	Peak	Horizontal
	17983.0	30.3	28.5	58.8	74.0	-15.2	Peak	Horizontal
	17983.0	17.8	28.5	46.3	54.0	-7.7	Average	Horizontal
	8123.0	33.2	12.0	45.2	74.0	-28.8	Peak	Vertical
	11310.5	31.4	17.3	48.7	74.0	-25.3	Peak	Vertical
	17974.5	30.4	28.2	58.6	74.0	-15.4	Peak	Vertical
	17975.5	17.5	28.2	45.7	54.0	-8.3	Average	Vertical
11	4791.0	34.3	3.1	37.4	74.0	-36.6	Peak	Horizontal
	11574.0	31.7	17.7	49.4	74.0	-24.6	Peak	Horizontal
	17983.0	30.5	28.5	59.0	74.0	-15.0	Peak	Horizontal
	17983.0	17.7	28.5	46.2	54.0	-7.8	Average	Horizontal
	7298.5	32.7	11.4	44.1	74.0	-29.9	Peak	Vertical
	11642.0	31.3	17.9	49.2	74.0	-24.8	Peak	Vertical
	17983.0	29.8	28.5	58.3	74.0	-15.7	Peak	Vertical
	17983.0	17.9	28.5	46.4	54.0	-7.6	Average	Vertical

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Test Site	WZ-AC2	Test Engineer	Dick Shen
Test Date	2024-04-03	Test Mode	802.11n-HT40
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

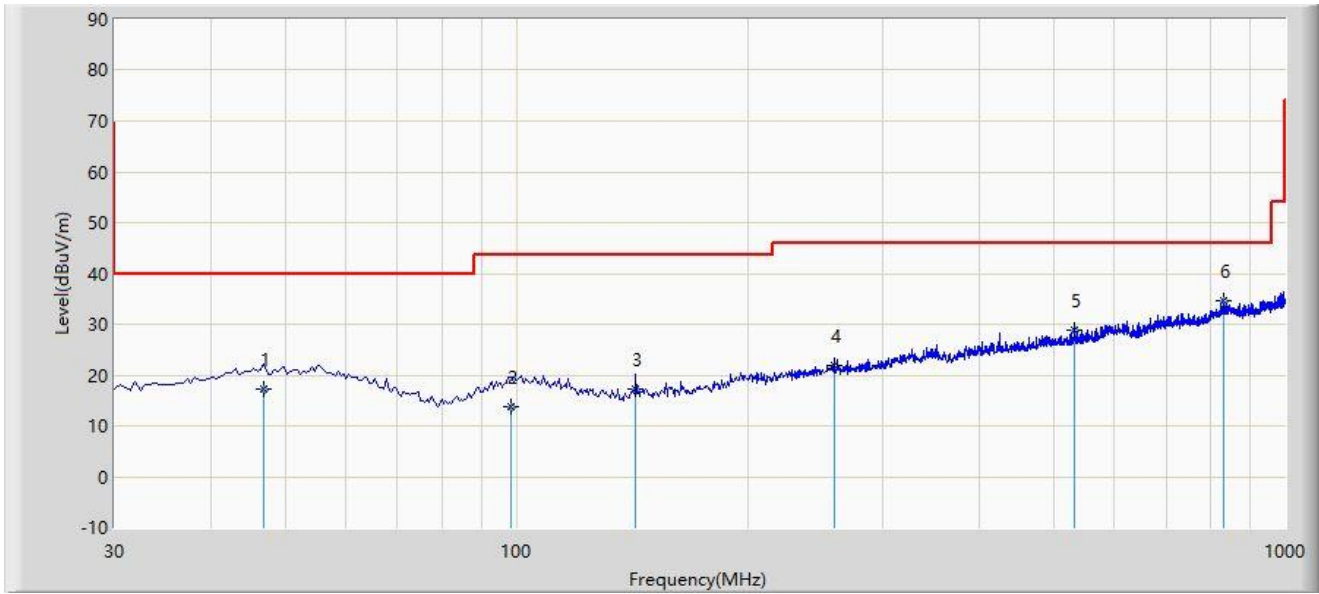
Test Channel	Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
03	4340.5	37.2	1.5	38.7	74.0	-35.3	Peak	Horizontal
	11514.5	31.3	17.3	48.6	74.0	-25.4	Peak	Horizontal
	17957.5	30.4	27.5	57.9	74.0	-16.1	Peak	Horizontal
	17957.5	18.2	27.5	45.7	54.0	-8.3	Average	Horizontal
	5054.5	35.3	3.4	38.7	74.0	-35.3	Peak	Vertical
	11497.5	31.7	17.6	49.3	74.0	-24.7	Peak	Vertical
	17932.0	31.5	27.3	58.8	74.0	-15.2	Peak	Vertical
	17932.0	18.2	27.3	45.5	54.0	-8.5	Average	Vertical
06	4612.5	35.1	2.5	37.6	74.0	-36.4	Peak	Horizontal
	11166.0	31.8	17.0	48.8	74.0	-25.2	Peak	Horizontal
	17923.5	30.2	27.8	58.0	74.0	-16.0	Peak	Horizontal
	17923.5	18.0	27.8	45.8	54.0	-8.2	Average	Horizontal
	4825.0	35.4	3.0	38.4	74.0	-35.6	Peak	Vertical
	11319.0	31.4	17.4	48.8	74.0	-25.2	Peak	Vertical
	17906.5	29.9	28.0	57.9	74.0	-16.1	Peak	Vertical
	17906.5	18.3	28.0	46.3	54.0	-7.7	Average	Vertical
09	3864.5	36.9	0.0	36.9	74.0	-37.1	Peak	Horizontal
	11081.0	31.6	16.7	48.3	74.0	-25.7	Peak	Horizontal
	17983.0	30.8	28.5	59.3	74.0	-14.7	Peak	Horizontal
	17983.0	17.7	28.5	46.2	54.0	-7.8	Average	Horizontal
	4833.5	35.9	3.1	39.0	74.0	-35.0	Peak	Vertical
	11548.5	30.6	17.7	48.3	74.0	-25.7	Peak	Vertical
	17906.5	29.8	28.0	57.8	74.0	-16.2	Peak	Vertical
	17906.5	18.3	28.0	46.3	54.0	-7.7	Average	Vertical

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

The Result of Radiated Emission below 1GHz:

Site: WZ-AC2	Test Date: 2024-04-04
Limit: FCC_Part15.209_RSE(3m)	Engineer: Dick Shen
Probe: VULB9162_30-7000MHz	Polarity: Horizontal
EUT: Plug5	Power: AC 120V/60Hz
Test Mode: Transmit by 802.11b at 2437MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		46.975	17.178	-3.300	-22.822	40.000	20.478	QP
2		98.385	13.692	-4.600	-29.808	43.500	18.292	QP
3		143.005	17.316	2.300	-26.184	43.500	15.015	QP
4		258.920	22.018	1.600	-23.982	46.000	20.418	QP
5		531.490	28.884	3.300	-17.116	46.000	25.584	QP
6	*	830.200	34.499	3.600	-11.501	46.000	30.900	QP

Note 1: " * ", means this data is the worst emission level.

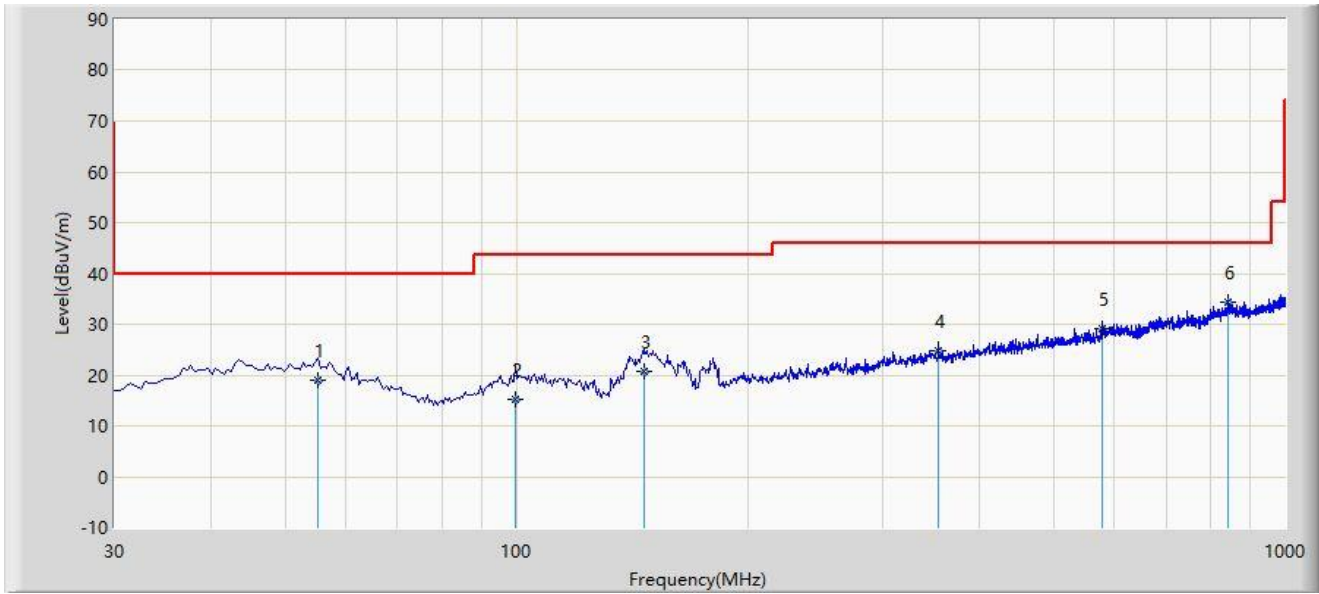
Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz and 18GHz to 25GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value.

Therefore, the data is not presented in the report.

Site: WZ-AC2	Test Date: 2024-04-04
Limit: FCC_Part15.209_RSE(3m)	Engineer: Dick Shen
Probe: VULB9162_30-7000MHz	Polarity: Vertical
EUT: Plug5	Power: AC 120V/60Hz
Test Mode: Transmit by 802.11b at 2437MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		55.220	18.842	-1.300	-21.158	40.000	20.142	QP
2		99.840	15.169	-3.300	-28.331	43.500	18.469	QP
3		146.400	20.679	5.600	-22.821	43.500	15.079	QP
4		353.980	24.645	2.100	-21.355	46.000	22.545	QP
5		579.100	29.227	2.600	-16.773	46.000	26.626	QP
6	*	843.100	34.456	3.200	-11.544	46.000	31.257	QP

Note 1: " * ", means this data is the worst emission level.

Note 2: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB/m).

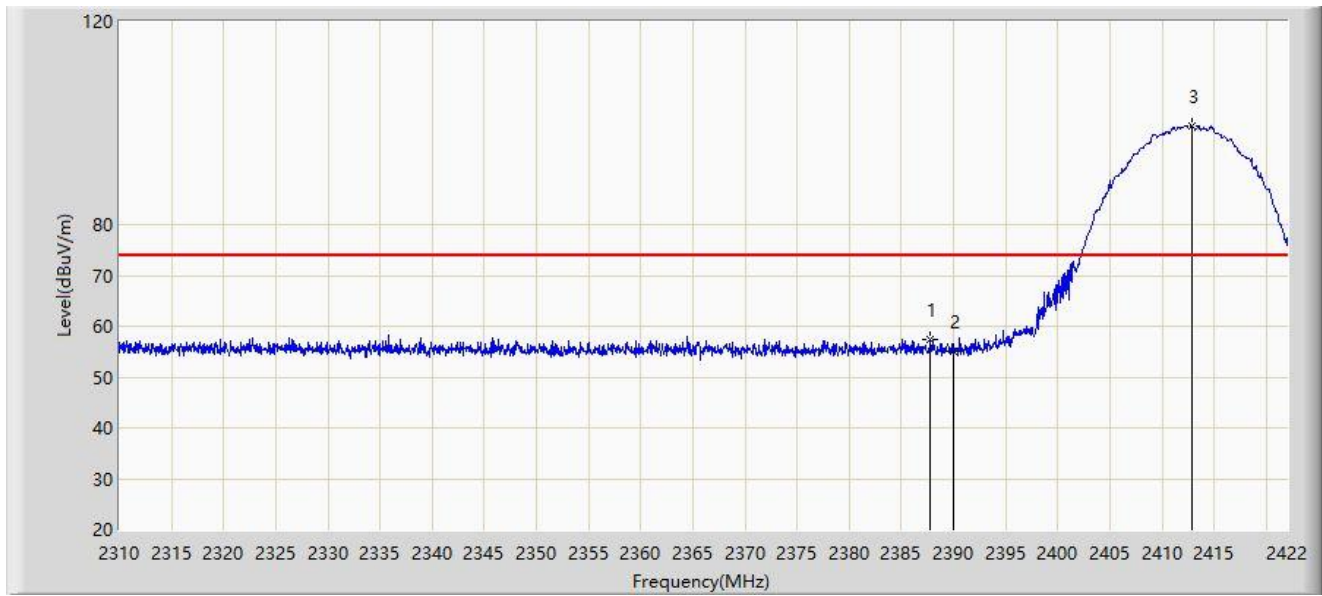
Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz and 18GHz to 25GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value.

Therefore, the data is not presented in the report.

A.7 Radiated Restricted Band Edge Test Result

Site: WZ-AC2	Test Date: 2024-04-03
Limit: FCC_2.4G_RE(3m)	Engineer: Bob Zhang
Probe: BBHA9120D_1457_1-18GHz	Polarity: Horizontal
EUT: Plug5	Power: AC 120V/60Hz
Test Mode: Transmit by 802.11b at 2412MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1	*	2387.784	57.270	25.405	-16.730	74.000	31.865	PK
2		2390.000	55.167	23.314	-18.833	74.000	31.853	PK
3		2412.816	99.450	67.702	N/A	N/A	31.748	PK

Note 1: " * ", means this data is the worst emission level.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).