



RF MEASUREMENT REPORT

FCC ID: LNQWF660AG
Applicant: Actiontec Electronics Inc.
Product: Wi-Fi 6 Outdoor AP
Model No.: WF-660AG, WF-660A
Brand Name: Actiontec
FCC Classification: Digital Transmission System (DTS)
FCC Rule Part(s): Part 15 Subpart C (Section 15.247)
Result: Complies
Received Date: 2023-06-12
Test Date: 2023-06-16 ~ 2023-07-13

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
2305RSU058-U1	V01	Initial Report	2023-08-12	Valid

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	6
1.6. Working Frequencies	7
1.7. Antenna Details.....	7
2. Test Configuration	9
2.1. Test Mode.....	9
2.2. Test System Connection Diagram.....	9
2.3. Test Software	10
2.4. Applied Standards.....	10
2.5. Test Environment Condition	10
3. Antenna Requirements	11
4. Measuring Instrument	12
5. Decision Rules and Measurement Uncertainty	13
5.1. Decision Rules	13
5.2. Measurement Uncertainty	13
6. Test Result.....	14
6.1. Summary	14
6.2. 6dB Bandwidth Measurement.....	15
6.2.1. Test Limit	15
6.2.2. Test Procedure	15
6.2.3. Test Setting	15
6.2.4. Test Setup	15
6.2.5. Test Result	15
6.3. Output Power Measurement	16
6.3.1. Test Limit	16
6.3.2. Test Procedure	16
6.3.3. Test Setting	16
6.3.4. Test Setup	16
6.3.5. Test Result	16
6.4. Power Spectral Density Measurement	17
6.4.1. Test Limit	17

6.4.2.	Test Procedure	17
6.4.3.	Test Setting	17
6.4.4.	Test Setup	17
6.4.5.	Test Result	18
6.5.	Conducted Band Edge and Out-of-Band Emissions Measurement	19
6.5.1.	Test Limit	19
6.5.2.	Test Procedure	19
6.5.3.	Test Setting	19
6.5.4.	Test Setup	19
6.5.5.	Test Result	20
6.6.	Radiated Spurious Emission Measurement.....	21
6.6.1.	Test Limit	21
6.6.2.	Test Procedure	21
6.6.3.	Test Setting	21
6.6.4.	Test Setup	23
6.6.5.	Test Result	24
6.7.	Radiated Restricted Band Edge Measurement	25
6.7.1.	Test Limit	25
6.7.2.	Test Procedure	26
6.7.3.	Test Setting	26
6.7.4.	Test Setup	27
6.7.5.	Test Result	27
6.8.	AC Conducted Emissions Measurement	28
6.8.1.	Test Limit	28
6.8.2.	Test Setup	28
6.8.3.	Test Result	28
Appendix A – Test Result.....		29
A.1	Duty Cycle Test Result	29
A.2	6dB Bandwidth Test Result	31
A.3	Output Power Test Result	35
A.4	Power Spectral Density Test Result.....	36
A.5	Conducted Band Edge and Out-of-Band Emissions Test Result.....	43
A.6	Radiated Spurious Emission Test Result.....	68
A.7	Radiated Restricted Band Edge Test Result.....	76
A.8	AC Conducted Emissions Test Result	164
Appendix B – Test Setup Photograph		166
Appendix C – EUT Photograph		167

1. General Information

1.1. Applicant

Actiontec Electronics Inc.

2445 Augustine Drive Suite 501, Santa Clara, California 95054, United States

1.2. Manufacturer

Actiontec Electronics Inc.

2445 Augustine Drive Suite 501, Santa Clara, California 95054, United States

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: L3261-190725 FCC: 291082, TW3261 ISED: TW3261

1.4. Product Information

Product Name	Wi-Fi 6 Outdoor AP
Model No.	WF-660AG, WF-660A
EUT Identification No.	20230524Sample#07 for conducted testing 20230524Sample#01 for radiated testing
Wi-Fi Specification	802.11b/g/n/ac/ax
Bluetooth Specification	V5.0 single mode, BLE only
Antenna Information	Refer to section 1.7
Working Voltage	By PoE
Note: - The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer. - The model difference is the WF-660A removes the GPS circuit from the WF-660AG, others are exactly the same. WF-660AG is selected for the test in this report.	

1.5. Radio Specification under Test

Frequency Range	802.11b/g/n-HT20/ax-HE20: 2412 ~ 2462MHz 802.11n-HT40/ax-HE40: 2422 ~ 2452MHz	
Channel Number	802.11b/g/n-HT20/ax-HE20: 11 802.11n-HT40/ax-HE40: 7	
Type of Modulation	802.11b: DSSS 802.11g/n: OFDM 802.11ax: 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 574Mbps	
Channel Puncturing Function	☐ Supported	☒ Unsupported
Support RU	☒ Full RU	☐ Partial RU

1.6. Working Frequencies

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

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

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	Antenna Gain (dBi)		Directional Gain (Elevation angle above 30 degrees) (dBi)		Directional Gain (dBi)	
			Ant 0	Ant 1	Correlated	Uncorrelated	Correlated	Uncorrelated
PIFA	2400 ~ 2500	2	4.47	5.80	--	--	7.92	4.95
	5150 ~ 5350	2	5.45	5.28	7.04	4.07	8.31	5.30
	5470 ~ 5725	2	6.56	6.45	--	--	9.49	6.48
	5725 ~ 5850	2	7.03	6.95	--	--	10.00	6.99

Note:

- The antenna gain and directional gain refer to manufacturer's antenna specification.
- The device supports CDD Mode and STBC mode, details refer to the table as below.
- CDD signals are correlated, the directional gain as follows,
the max directional gain (each angle) = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}]$
- STBC signals are uncorrelated, the directional gain as follows,
the max directional gain (each angle) = $10 \log[(10^{G1/10} + 10^{G2/10} + \dots + 10^{GN/10}) / N_{ANT}]$

Test Mode	Tx Paths	CDD Mode	STBC Mode
Wi-Fi 2.4G			
802.11b/g	2	√	X
802.11n/ax	2	X	√
Wi-Fi 5G			
802.11a	2	√	X
802.11n/ac/ax	2	X	√
Note: "√" means "Support", "X" means "Not support".			

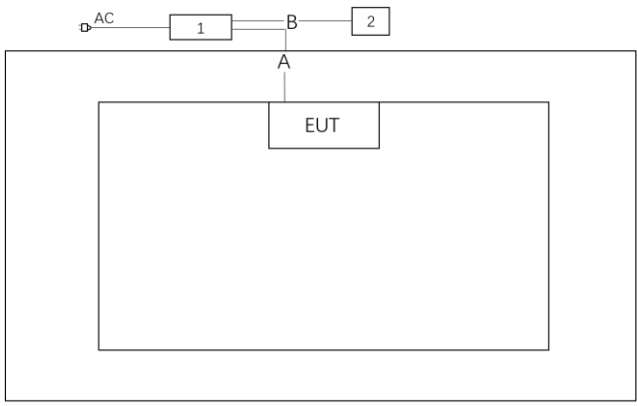
2. Test Configuration

2.1. Test Mode

Mode 1: Transmit by 802.11b (1Mbps) _ Nss=1 (CDD Mode)
Mode 2: Transmit by 802.11g (6Mbps) _ Nss=1 (CDD Mode)
Mode 3: Transmit by 802.11n-HT20 (MCS0) _ Nss=2 (STBC Mode)
Mode 4: Transmit by 802.11n-HT40 (MCS0) _ Nss=2 (STBC Mode)
Mode 5: Transmit by 802.11ax-HE20 (MCS0) _ Nss=2 (STBC Mode)
Mode 6: Transmit by 802.11ax-HE40 (MCS0) _ Nss=2 (STBC Mode)
Note: - For Radiated emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power. - For CDD mode, this device supports 2 Nss and power level is the same of spatial multiplexing. The worst case is Nss=1. - EUT supports one configuration only in 802.11ax full RU mode. - All modes of operation and data rates were investigated, so all RF test requirements shall be executed at the worse data rate which power is the greatest.

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			
			
No.	Cable Type	Cable Spec.	Length
A	LAN Cable	Non-Shielding	> 10m
B	LAN Cable	Non-Shielding	1.0m
No.	Product	Manufacturer	Model No.
1	PoE	tp-link	T480050-2-PoE
2	Notebook	Lenovo	E431

2.3. Test Software

The test utility software used during testing was “QRCT”, and the version was 4.0.00175.0.

Note: 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
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2023-12-28	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2023-08-22	WZ-AC1
Preamplifier	Agilent	83017A	MRTSUE06076	1 year	2024-05-07	WZ-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2024-06-09	WZ-AC1
Anechoic Chamber	TDK	WZ-AC1	MRTSUE06212	1 year	2024-04-20	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE06403	1 year	2024-05-31	WZ-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06607	1 year	2023-12-28	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11039	1 year	2023-11-01	WZ-AC1
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2023-09-29	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2023-11-05	WZ-AC2
Preamplifier	EMCI	EMC184045SE	MRTSUE06640	1 year	2024-01-12	WZ-AC2
TRILOG Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2024-05-15	WZ-AC2
EMI Test Receiver	Agilent	N9038A	MRTSUE06125	1 year	2024-05-23	WZ-AC2
Thermohygrometer	Mingle	ETH529	MRTSUE06170	1 year	2023-11-27	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06171	1 year	2023-10-13	WZ-AC2
Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2024-05-07	WZ-AC2
Anechoic Chamber	RIKEN	WZ-AC2	MRTSUE06213	1 year	2024-04-20	WZ-AC2
Thermohygrometer	testo	608-H1	MRTSUE11038	1 year	2023-11-01	WZ-AC2
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2024-05-23	WZ-SR2
Shielding Room	MIX-BEP	WZ-SR2	MRTSUE06215	5 years	2026-12-20	WZ-SR2
Thermohygrometer	testo	608-H1	MRTSUE06404	1 year	2024-05-31	WZ-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06909	1 year	2023-10-27	WZ-SR2
Thermohygrometer	testo	608-H1	MRTSUE06402	1 year	2024-05-31	WZ-SR5
Shielding Room	HUAMING	WZ-SR5	MRTSUE06442	N/A	N/A	WZ-SR5
Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2024-05-23	WZ-SR5
Attenuator	MVE	MVE2213	MRTSUE11083	1 year	2024-06-08	WZ-SR5
Attenuator	MVE	MVE2213	MRTSUE11097	1 year	2024-06-08	WZ-SR5

Software	Version	Function
EMI V3	V 3.0.0	EMI Test Software
Controller_MF 7802BS	2.03C	RE Antenna & Turntable
Controller_MF 7802BS	1.02	RE Antenna & Turntable
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
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 9kHz~150kHz: 3.58dB 150kHz~30MHz: 3.20dB
Radiated Disturbance
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 9kHz~30MHz: 2.60dB 30MHz~200MHz: 4.06dB 200MHz~1GHz: 5.28dB 1GHz~40GHz: 4.98dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 2.3dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 1.5dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 2.3dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 3.2%

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.

6.2. 6dB Bandwidth Measurement

6.2.1. Test Limit

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

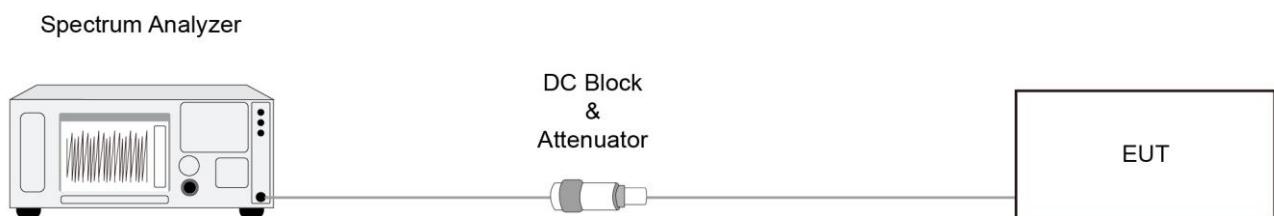
6.2.2. Test Procedure

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

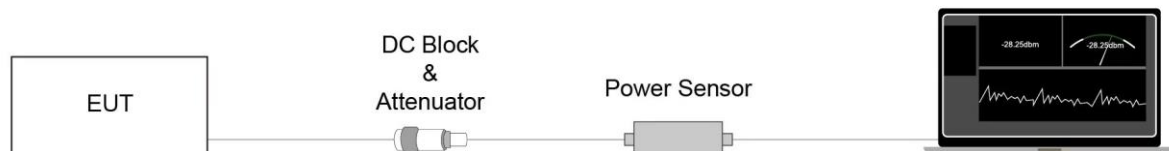
ANSI C63.10 - 2013 - Section 11.9.2.3.2

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.

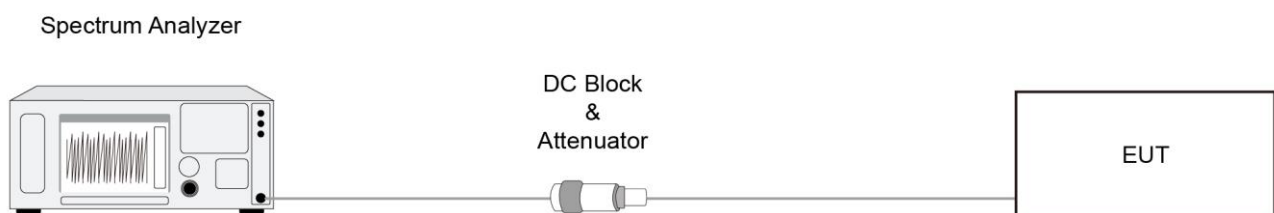
6.4.2. Test Procedure

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 20dB 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

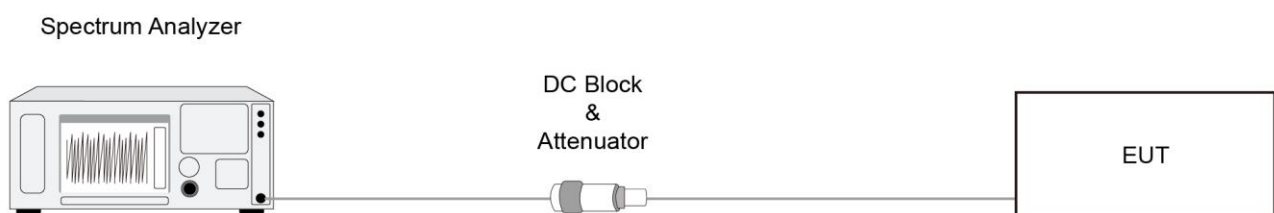
Reference level measurement

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 [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

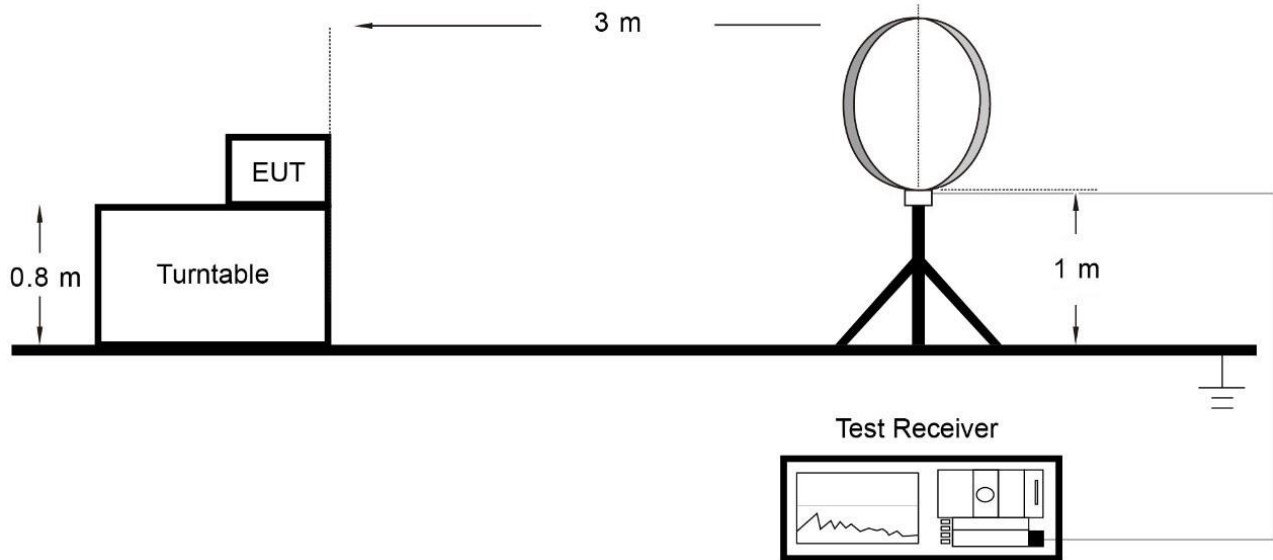
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

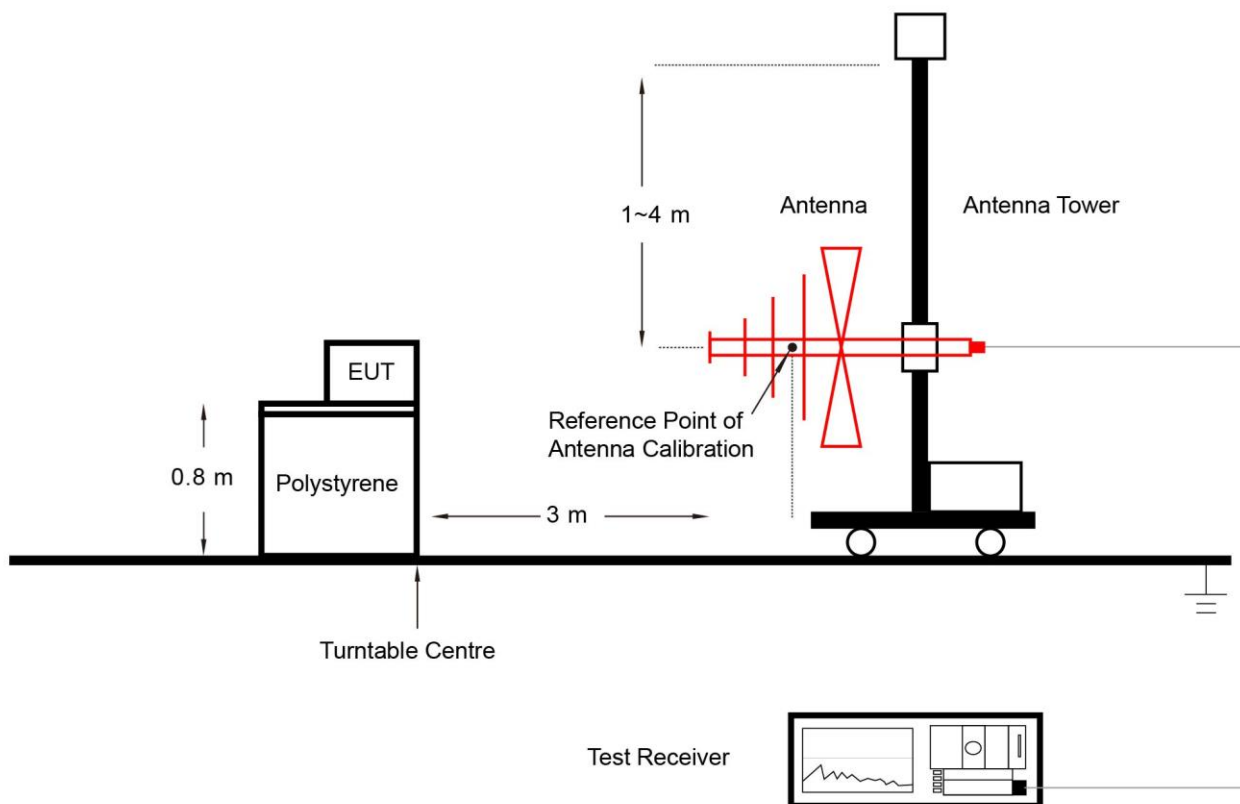
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW = 10 Hz.
If the EUT duty cycle is $< 98\%$, set $\text{VBW} \geq 1/T$. T is the minimum transmission duration.
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

6.6.4. Test Setup

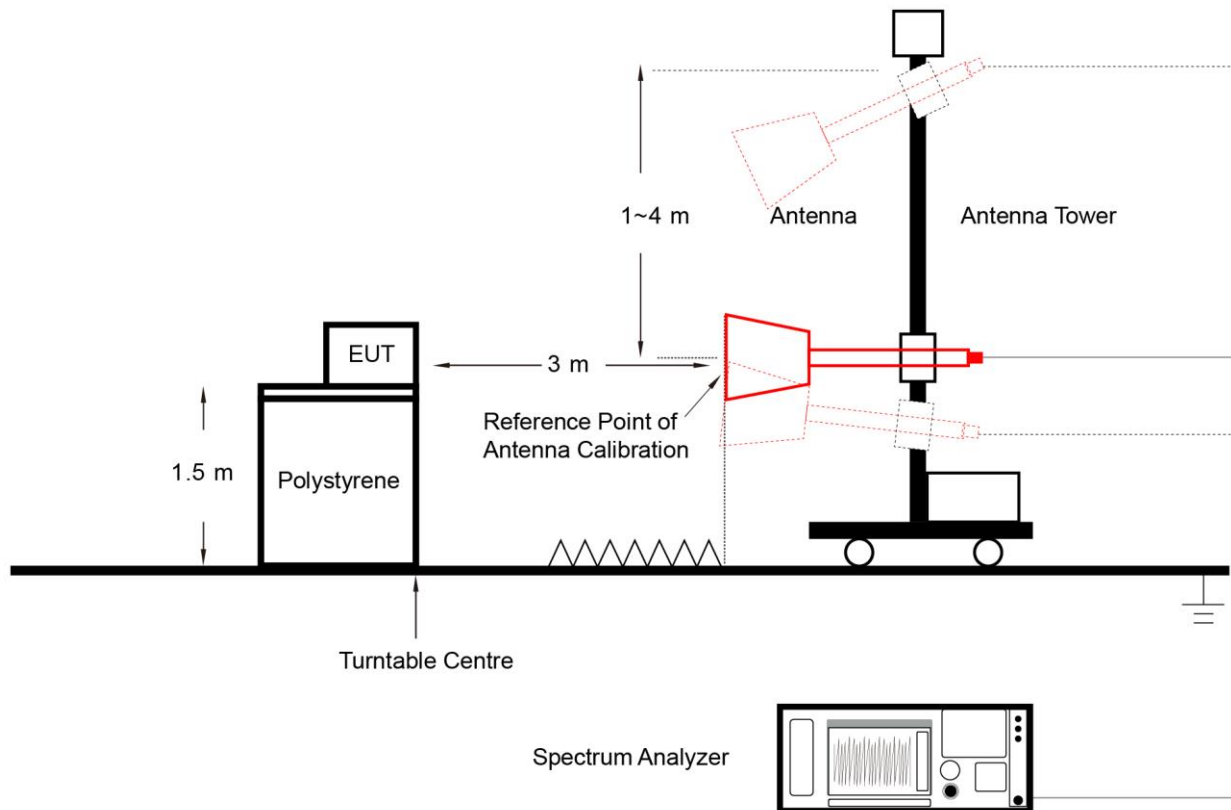
Below 30MHz Test Setup:



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

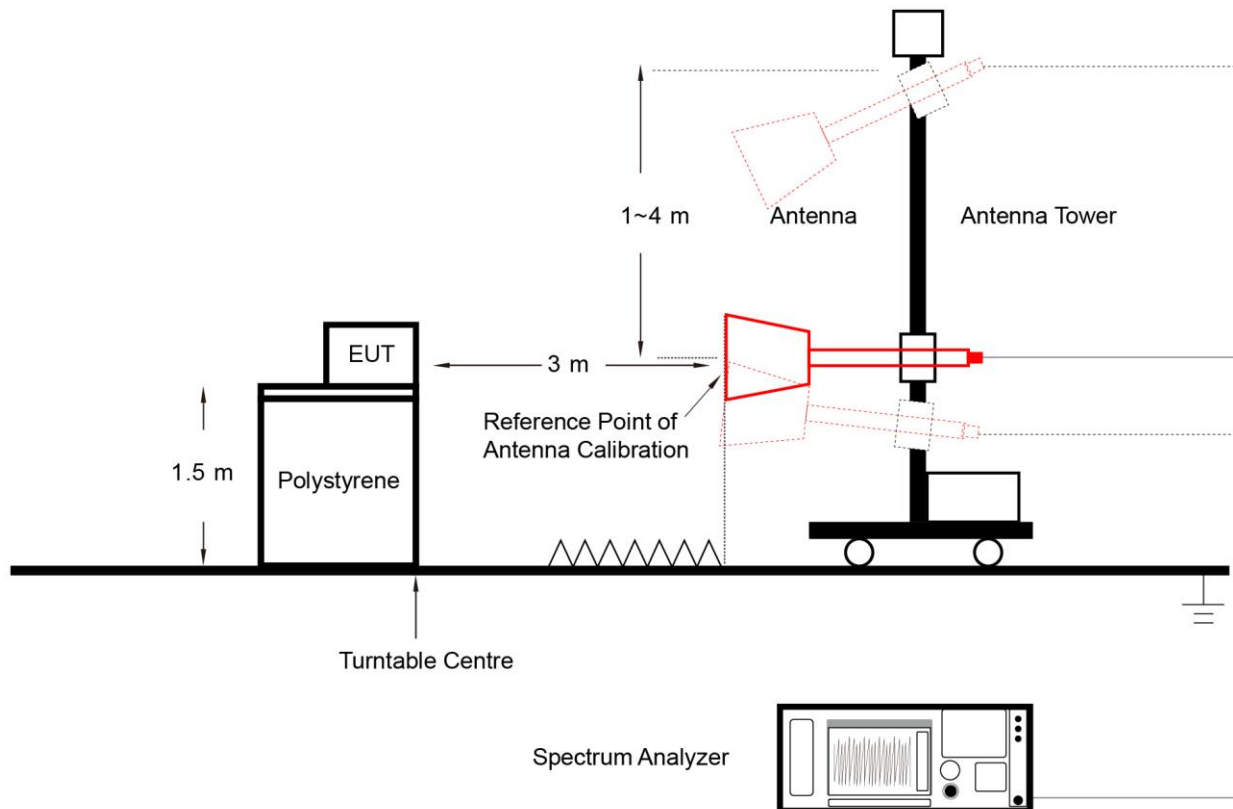
Peak Field Strength Measurements

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 $\geq 1/T$
4. Average Type = Voltage
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

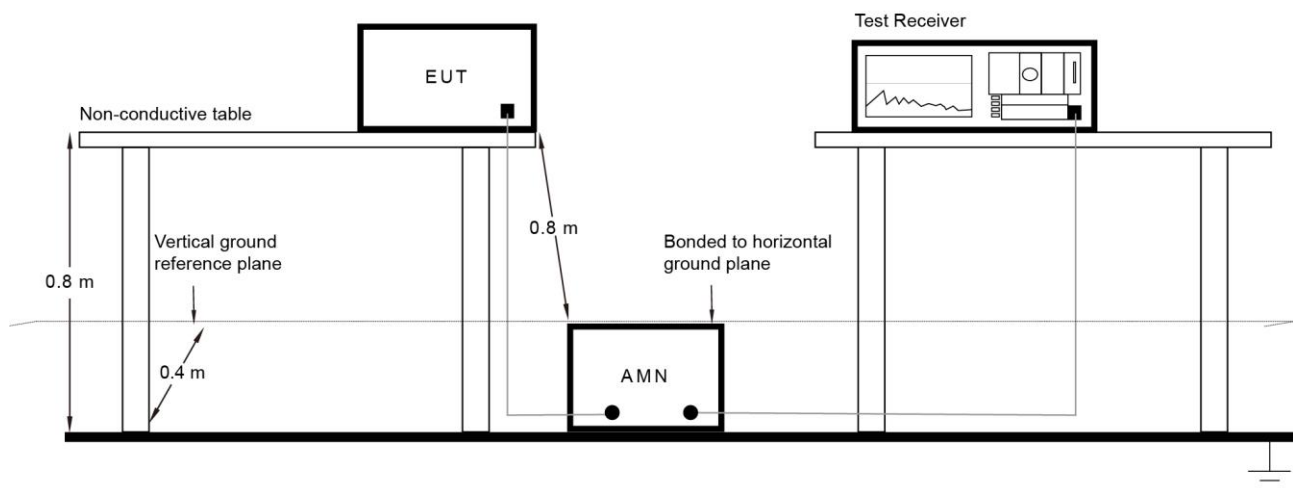
6.8.1. Test Limit

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

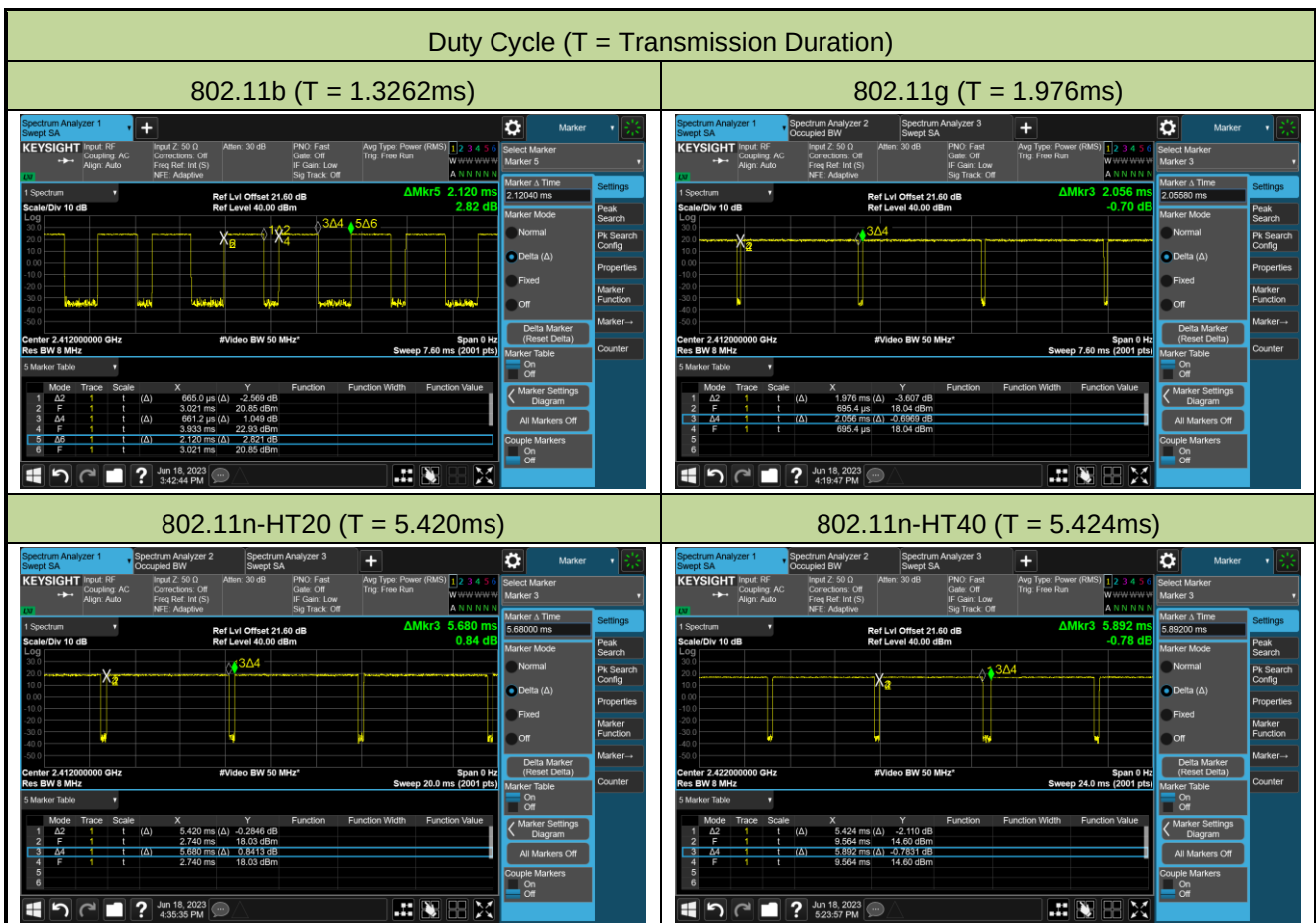
Refer to Appendix A.8.

Appendix A – Test Result

A.1 Duty Cycle Test Result

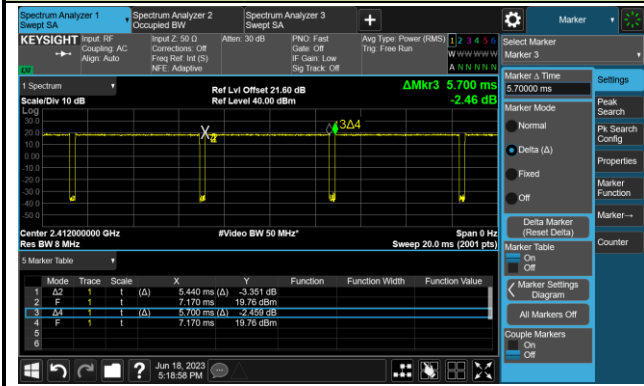
Test Site	WZ-SR5	Test Engineer	Jeff Yang
Test Date	2023-06-18		

Test Mode	Duty Cycle
802.11b	62.56%
802.11g	96.11%
802.11n-HT20	95.42%
802.11n-HT40	92.06%
802.11ax-HE20	95.44%
802.11ax-HE40	94.04%

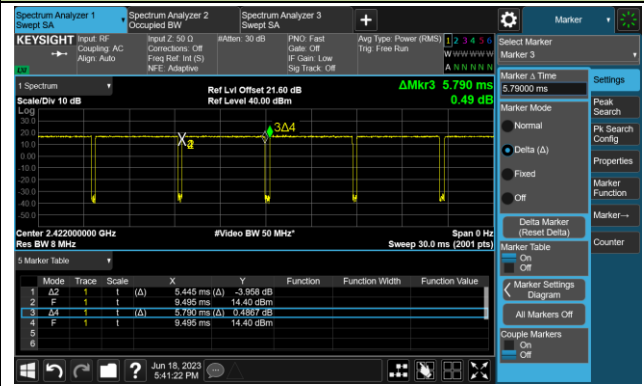


Duty Cycle (T = Transmission Duration)

802.11ax-HE20 (T = 5.440ms)



802.11ax-HE40 (T = 5.445ms)



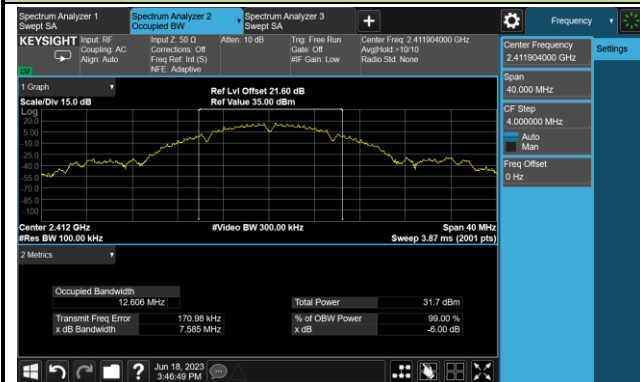
A.2 6dB Bandwidth Test Result

Test Site	WZ-SR5	Test Engineer	Jeff Yang
Test Date	2023-06-18		

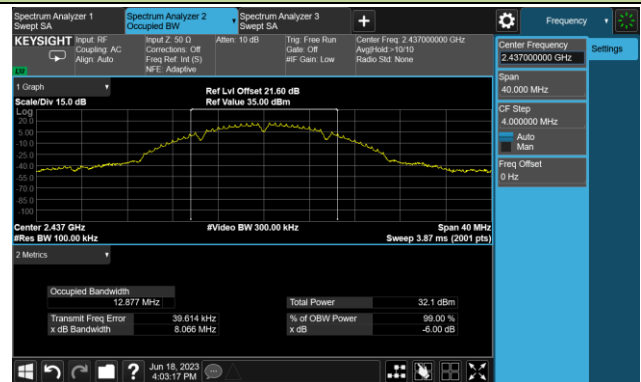
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
11b	1Mbps	01	2412	7.585	≥ 0.5
11b	1Mbps	06	2437	8.066	≥ 0.5
11b	1Mbps	11	2462	8.063	≥ 0.5
11g	6Mbps	01	2412	15.92	≥ 0.5
11g	6Mbps	06	2437	15.36	≥ 0.5
11g	6Mbps	11	2462	16.29	≥ 0.5
11n-HT20	MCS0	01	2412	17.30	≥ 0.5
11n-HT20	MCS0	06	2437	16.15	≥ 0.5
11n-HT20	MCS0	11	2462	17.52	≥ 0.5
11n-HT40	MCS0	03	2422	33.30	≥ 0.5
11n-HT40	MCS0	06	2437	35.73	≥ 0.5
11n-HT40	MCS0	09	2452	36.34	≥ 0.5
11ax-HE20	MCS0	01	2412	17.77	≥ 0.5
11ax-HE20	MCS0	06	2437	17.53	≥ 0.5
11ax-HE20	MCS0	11	2462	16.63	≥ 0.5
11ax-HE40	MCS0	03	2422	36.62	≥ 0.5
11ax-HE40	MCS0	06	2437	37.78	≥ 0.5
11ax-HE40	MCS0	09	2452	37.47	≥ 0.5

802.11b 6dB Bandwidth

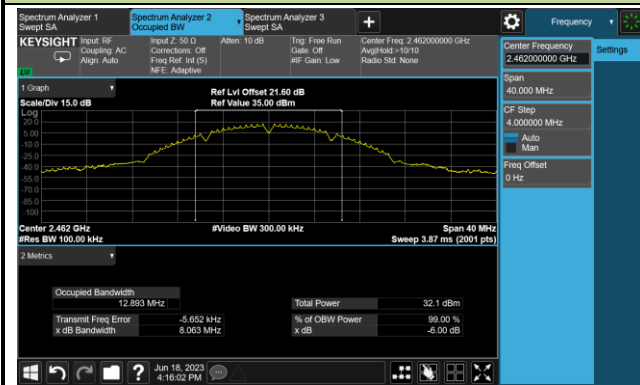
Channel 01 (2412MHz)



Channel 06 (2437MHz)

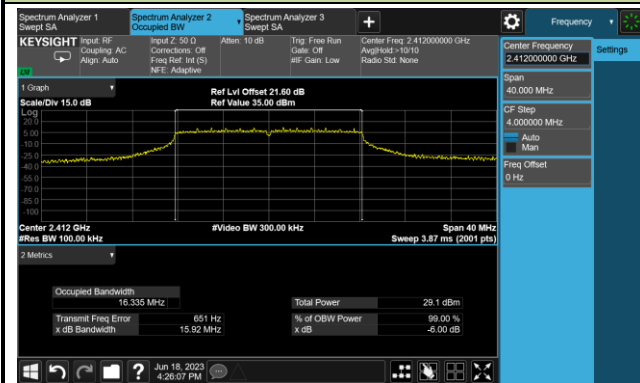


Channel 11 (2462MHz)

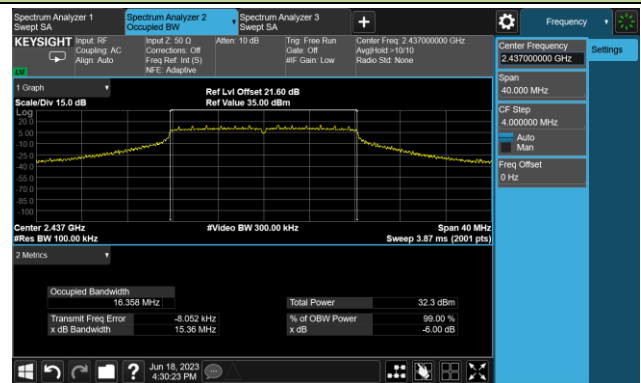


802.11g 6dB Bandwidth

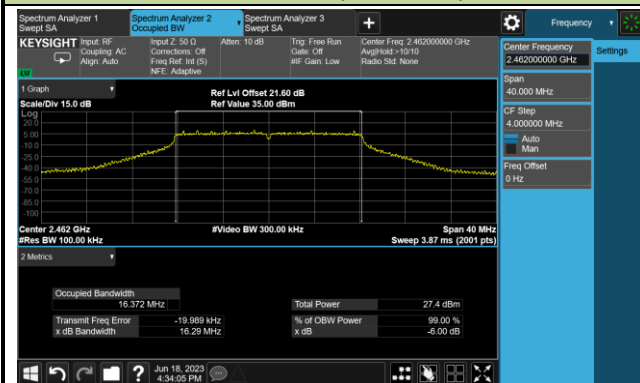
Channel 01 (2412MHz)



Channel 06 (2437MHz)

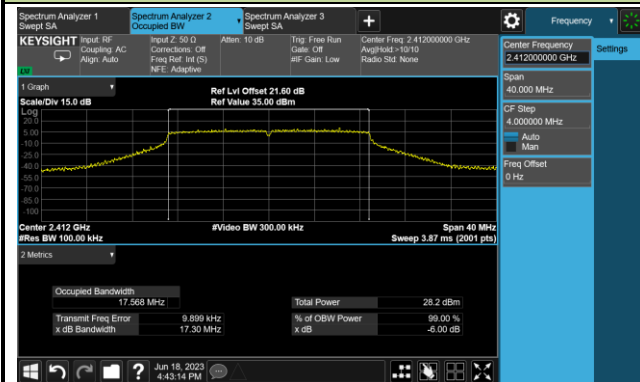


Channel 11 (2462MHz)

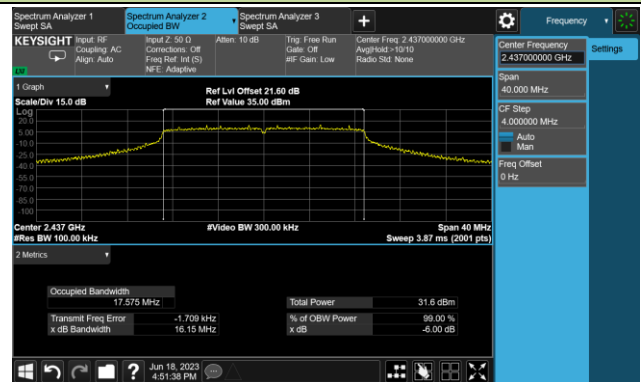


802.11n-HT20 6dB Bandwidth

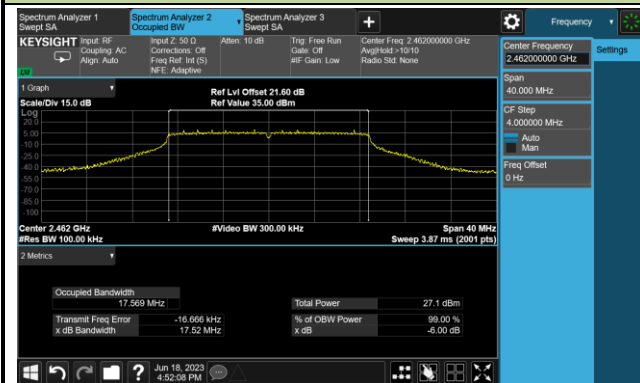
Channel 01 (2412MHz)



Channel 06 (2437MHz)

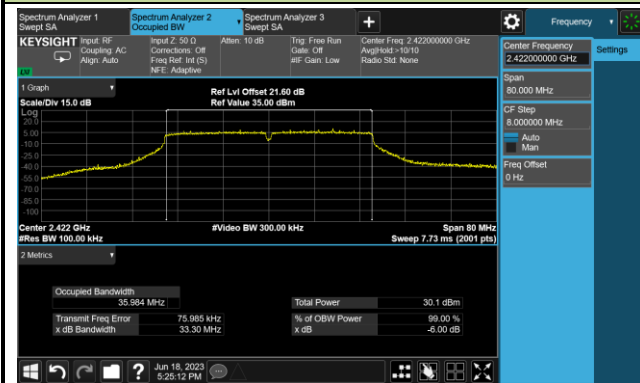


Channel 11 (2462MHz)

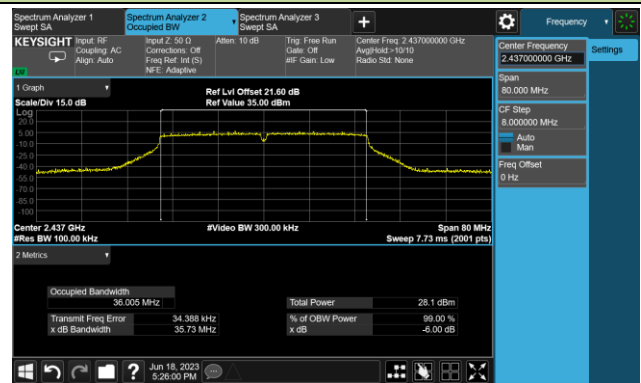


802.11n-HT40 6dB Bandwidth

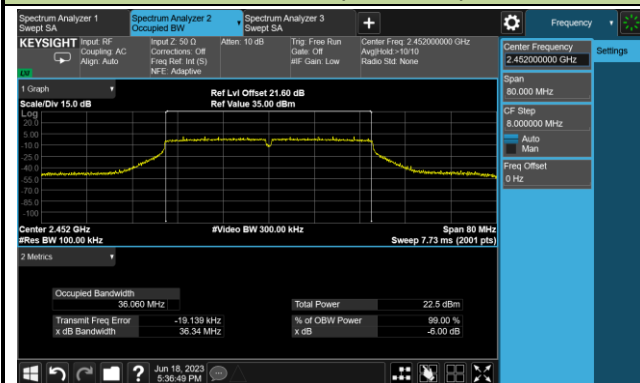
Channel 03 (2422MHz)



Channel 06 (2437MHz)

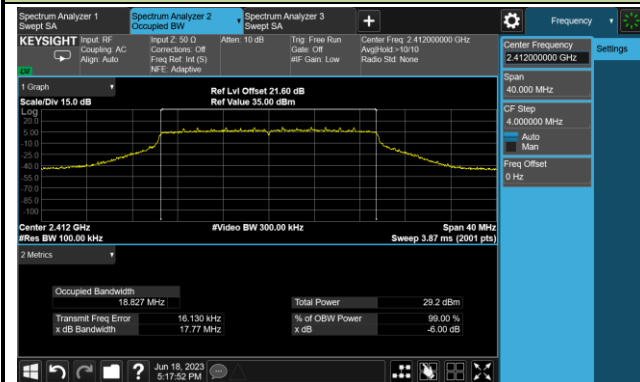


Channel 09 (2452MHz)

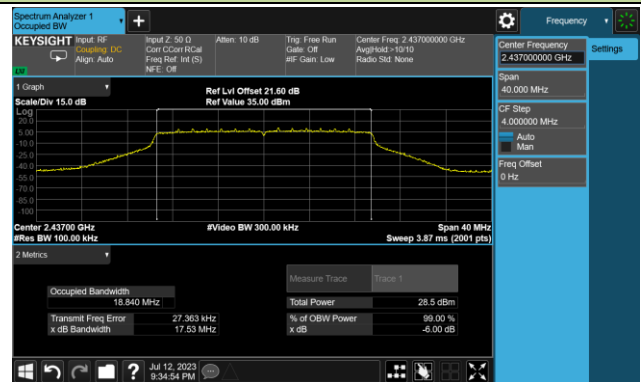


802.11ax-HE20 6dB Bandwidth

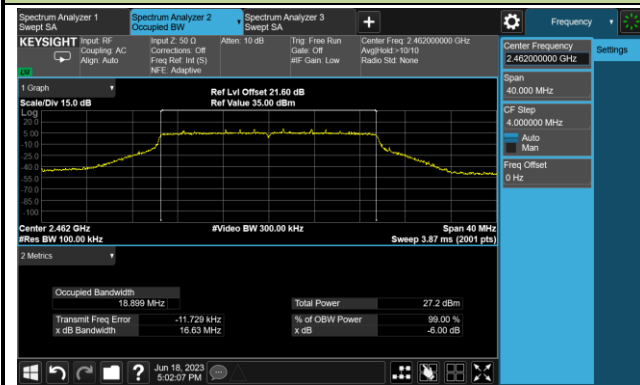
Channel 01 (2412MHz)



Channel 06 (2437MHz)

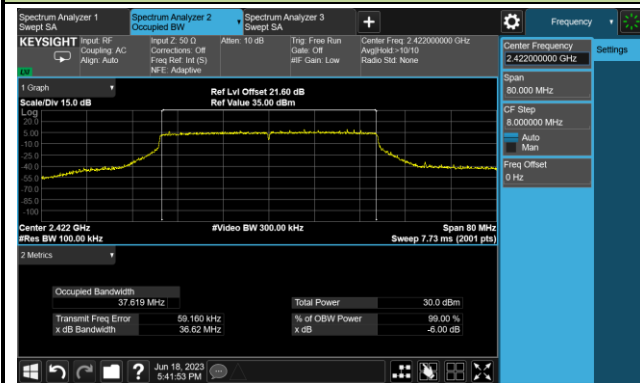


Channel 11 (2462MHz)

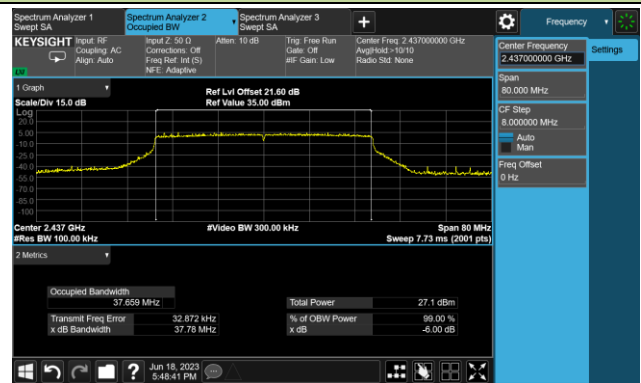


802.11ax-HE40 6dB Bandwidth

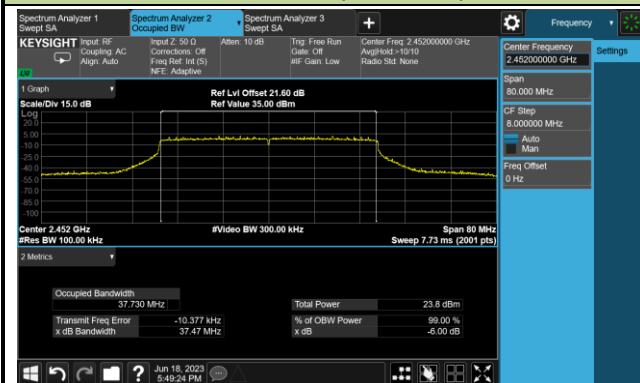
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



A.3 Output Power Test Result

Test Site	WZ-SR5	Test Engineer	Jeff Yang
Test Date	2023-06-26 ~ 2023-07-05		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Average Power (dBm)		Total AV Power (dBm)	Limit (dBm)
				Ant 0	Ant 1		
11b	1Mbps	01	2412	24.61	24.54	27.59	≤ 28.08
11b	1Mbps	06	2437	24.62	24.46	27.55	≤ 28.08
11b	1Mbps	11	2462	24.03	24.06	27.06	≤ 28.08
11g	6Mbps	01	2412	21.23	20.73	24.00	≤ 28.08
11g	6Mbps	02	2417	24.55	24.30	27.44	≤ 28.08
11g	6Mbps	06	2437	24.64	24.59	27.63	≤ 28.08
11g	6Mbps	10	2457	23.42	23.12	26.28	≤ 28.08
11g	6Mbps	11	2462	20.04	20.25	23.16	≤ 28.08
11n-HT20	MCS0	01	2412	21.18	21.15	24.18	≤ 30.00
11n-HT20	MCS0	02	2417	24.23	24.08	27.17	≤ 30.00
11n-HT20	MCS0	06	2437	24.27	24.24	27.27	≤ 30.00
11n-HT20	MCS0	10	2457	24.18	23.91	27.06	≤ 30.00
11n-HT20	MCS0	11	2462	20.02	20.16	23.10	≤ 30.00
11n-HT40	MCS0	03	2422	22.21	21.92	25.08	≤ 30.00
11n-HT40	MCS0	06	2437	20.32	20.21	23.28	≤ 30.00
11n-HT40	MCS0	08	2447	18.66	18.43	21.56	≤ 30.00
11n-HT40	MCS0	09	2452	14.95	14.56	17.77	≤ 30.00
11ax-HE20	MCS0	01	2412	21.02	20.87	23.96	≤ 30.00
11ax-HE20	MCS0	02	2417	24.23	23.99	27.12	≤ 30.00
11ax-HE20	MCS0	06	2437	24.45	24.02	27.25	≤ 30.00
11ax-HE20	MCS0	10	2457	22.89	22.78	25.85	≤ 30.00
11ax-HE20	MCS0	11	2462	19.70	19.55	22.64	≤ 30.00
11ax-HE40	MCS0	03	2422	22.05	21.87	24.97	≤ 30.00
11ax-HE40	MCS0	06	2437	20.29	20.11	23.21	≤ 30.00
11ax-HE40	MCS0	08	2447	19.12	18.92	22.03	≤ 30.00
11ax-HE40	MCS0	09	2452	15.71	15.68	18.71	≤ 30.00

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

A.4 Power Spectral Density Test Result

Test Site	WZ-SR5	Test Engineer	Jeff Yang
Test Date	2023-06-18		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	PSD (dBm/10kHz)		Duty Cycle (%)	Total PSD (dBm/10kHz)	Limit (dBm/3kHz)	Result
				Ant 0	Ant 1				
11b	1Mbps	01	2412	-1.194	-1.243	62.56	3.83	≤ 6.08	Pass
11b	1Mbps	06	2437	-1.004	-1.292	62.56	3.90	≤ 6.08	Pass
11b	1Mbps	11	2462	-2.133	-1.794	62.56	3.09	≤ 6.08	Pass
11g	24Mbps	01	2412	-7.392	-7.277	96.11	-4.15	≤ 6.08	Pass
11g	24Mbps	06	2437	-4.348	-4.085	96.11	-1.03	≤ 6.08	Pass
11g	24Mbps	11	2462	-8.772	-8.731	96.11	-5.57	≤ 6.08	Pass
11n-HT20	MCS2	01	2412	-7.887	-7.926	95.42	-4.69	≤ 8.00	Pass
11n-HT20	MCS2	06	2437	-5.034	-4.848	95.42	-1.73	≤ 8.00	Pass
11n-HT20	MCS2	11	2462	-9.373	-9.581	95.42	-6.26	≤ 8.00	Pass
11n-HT40	MCS2	03	2422	-9.681	-8.870	92.06	-5.89	≤ 8.00	Pass
11n-HT40	MCS2	06	2437	-11.485	-11.529	92.06	-8.14	≤ 8.00	Pass
11n-HT40	MCS2	09	2452	-17.107	-17.157	92.06	-13.76	≤ 8.00	Pass
11ax-HT20	MCS2	01	2412	-9.465	-9.664	95.44	-6.35	≤ 8.00	Pass
11ax-HT20	MCS2	06	2437	-6.285	-6.230	95.44	-3.04	≤ 8.00	Pass
11ax-HT20	MCS2	11	2462	-10.967	-10.988	95.44	-7.76	≤ 8.00	Pass
11ax-HT40	MCS2	03	2422	-10.917	-10.516	94.04	-7.43	≤ 8.00	Pass
11ax-HT40	MCS2	06	2437	-13.242	-13.192	94.04	-9.94	≤ 8.00	Pass
11ax-HT40	MCS2	09	2452	-17.891	-17.783	94.04	-14.56	≤ 8.00	Pass

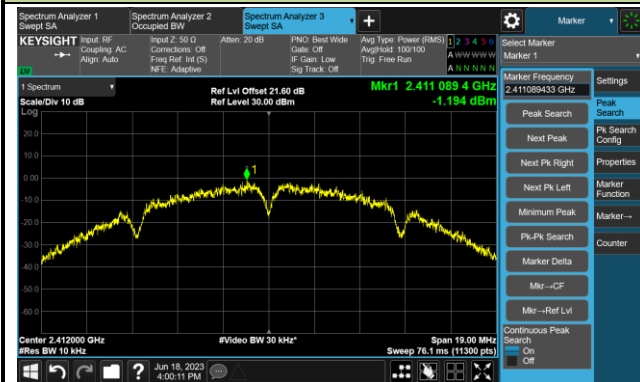
Note:

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 - PSD – Ant 0

Channel 01 (2412MHz)



Channel 06 (2437MHz)

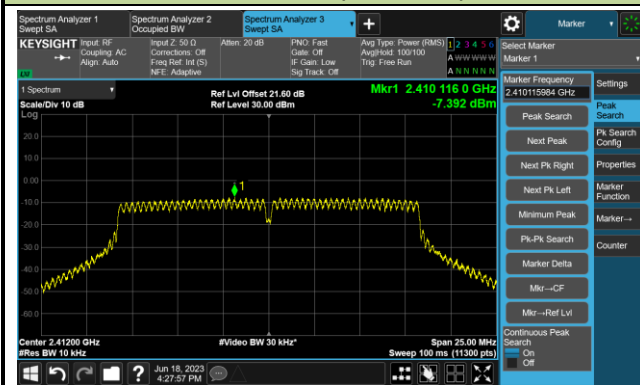


Channel 11 (2462MHz)

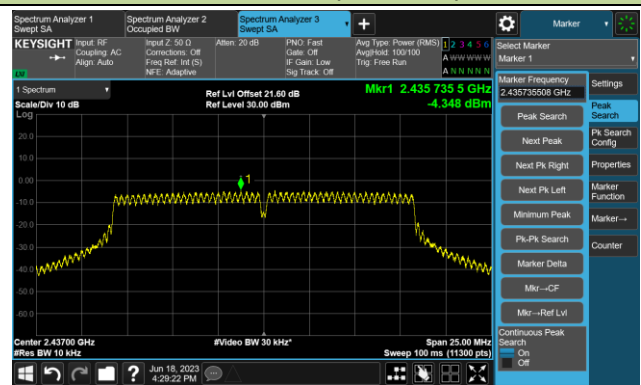


802.11g - PSD – Ant 0

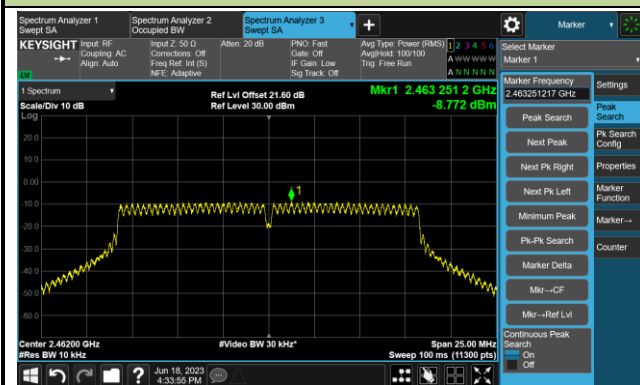
Channel 01 (2412MHz)



Channel 06 (2437MHz)

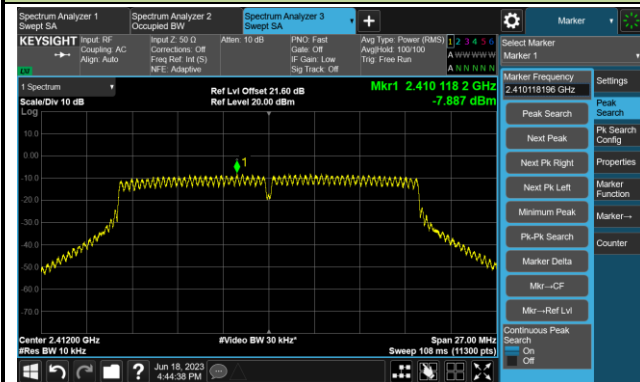


Channel 11 (2462MHz)

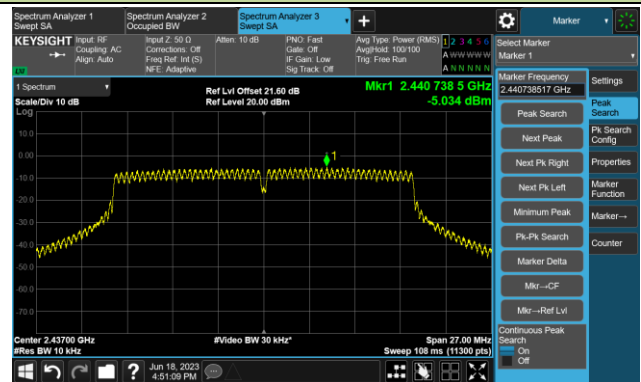


802.11n-HT20 - PSD – Ant 0

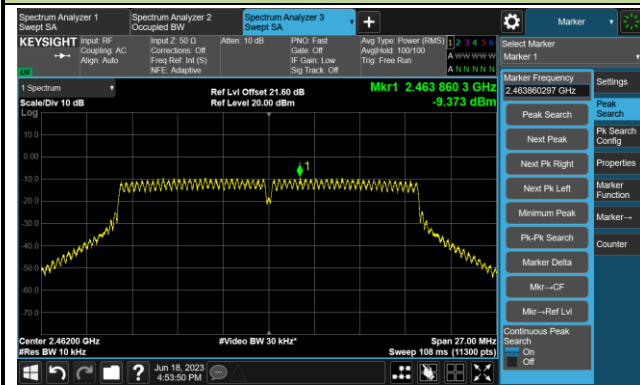
Channel 01 (2412MHz)



Channel 06 (2437MHz)

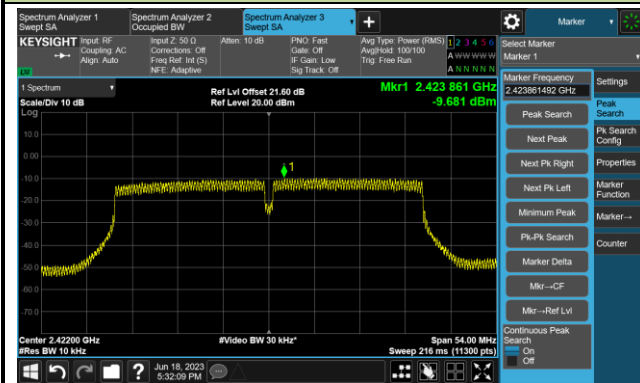


Channel 11 (2462MHz)

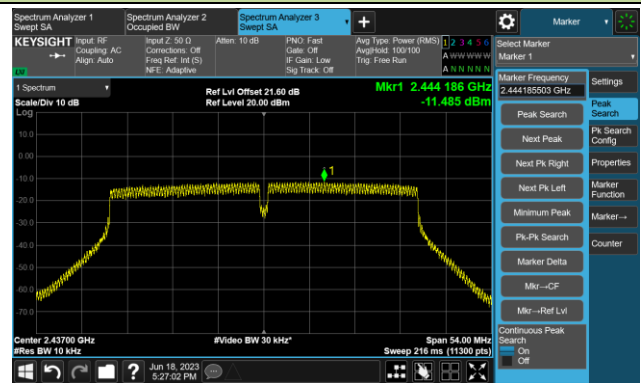


802.11n-HT40 - PSD – Ant 0

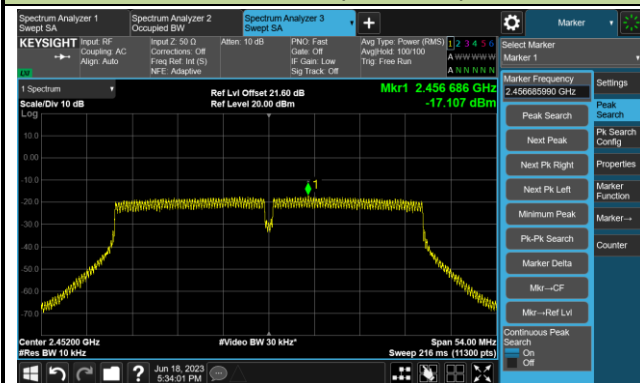
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



802.11ax-HE20 - PSD – Ant 0

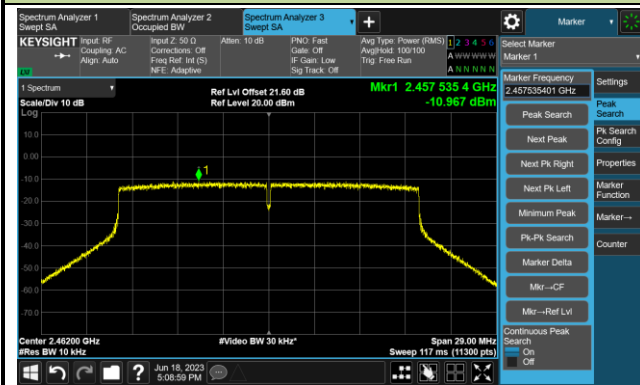
Channel 01 (2412MHz)



Channel 06 (2437MHz)

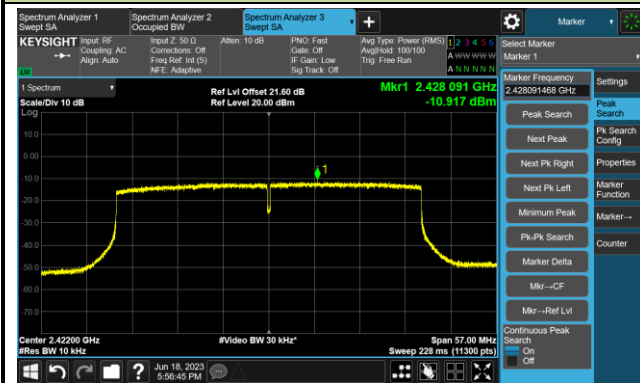


Channel 11 (2462MHz)

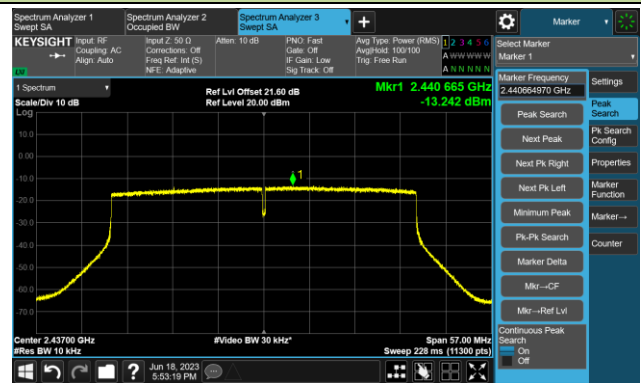


802.11ax-HE40 - PSD – Ant 0

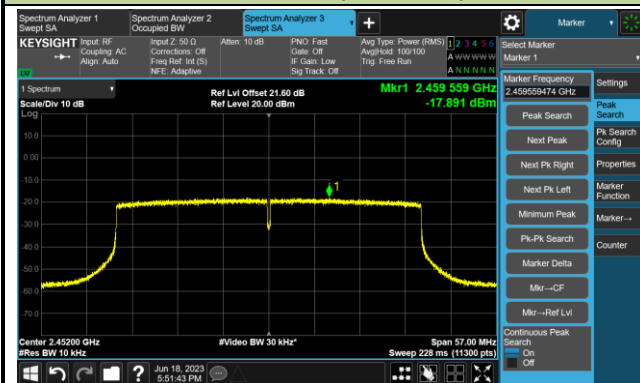
Channel 03 (2422MHz)



Channel 06 (2437MHz)

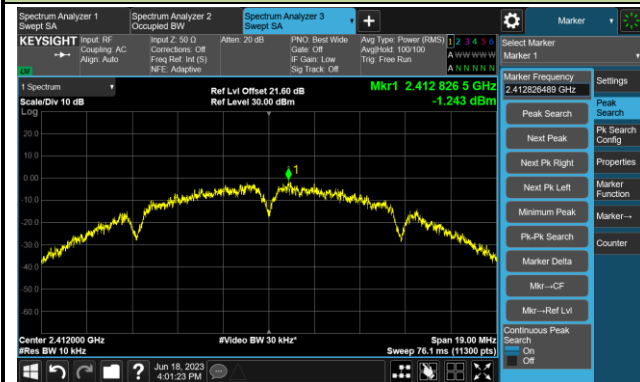


Channel 09 (2452MHz)



802.11b - PSD – Ant 1

Channel 01 (2412MHz)



Channel 06 (2437MHz)

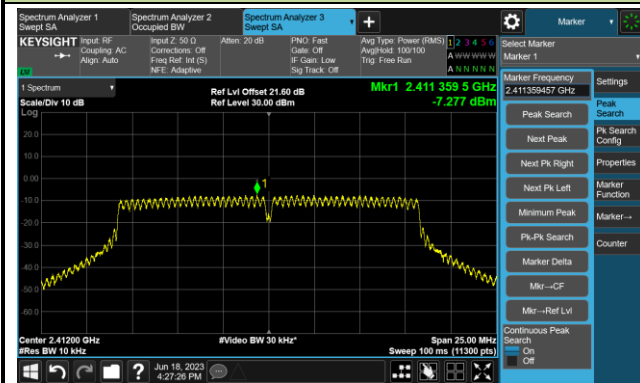


Channel 11 (2462MHz)

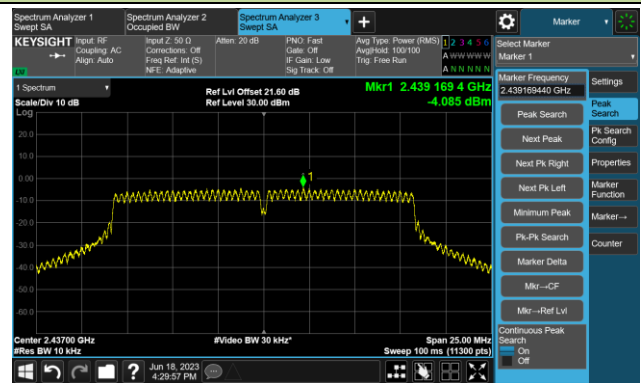


802.11g - PSD – Ant 1

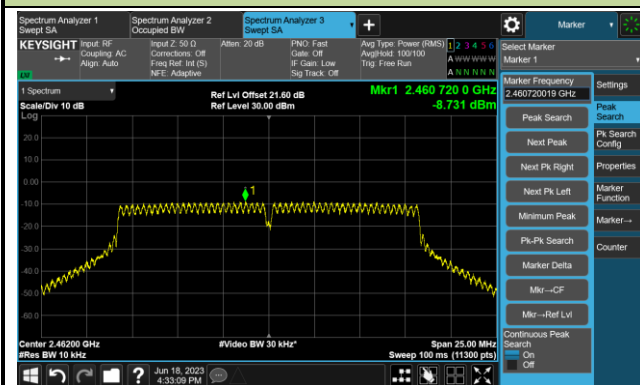
Channel 01 (2412MHz)



Channel 06 (2437MHz)

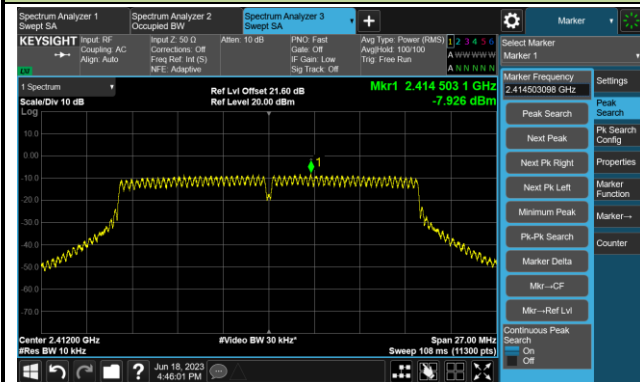


Channel 11 (2462MHz)

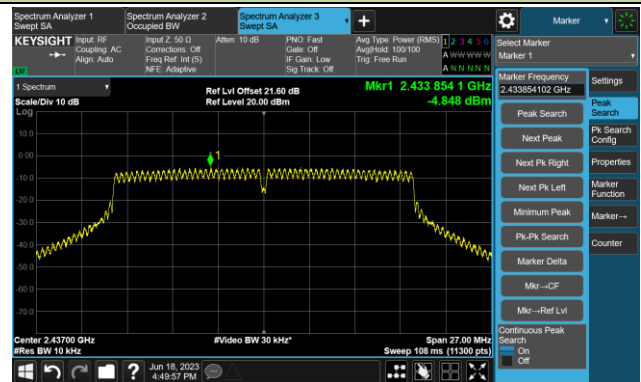


802.11n-HT20 - PSD – Ant 1

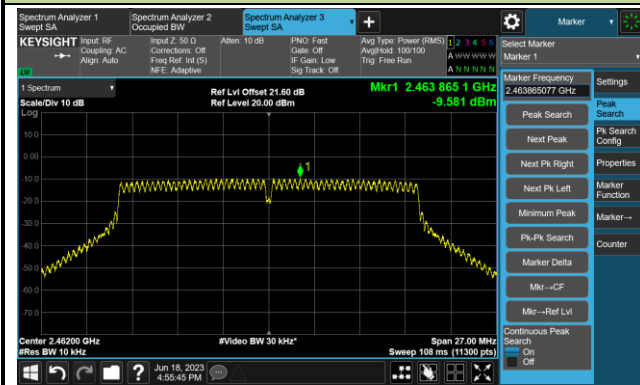
Channel 01 (2412MHz)



Channel 06 (2437MHz)

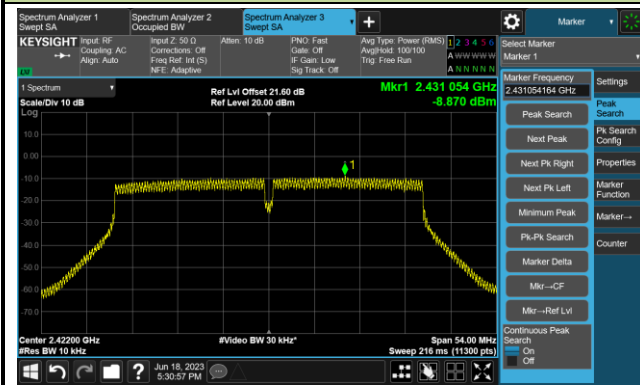


Channel 11 (2462MHz)

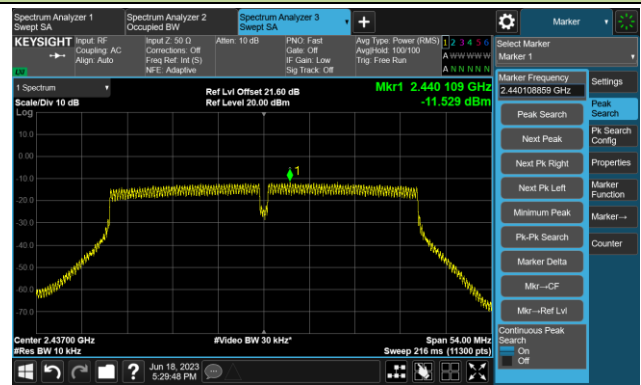


802.11n-HT40 - PSD – Ant 1

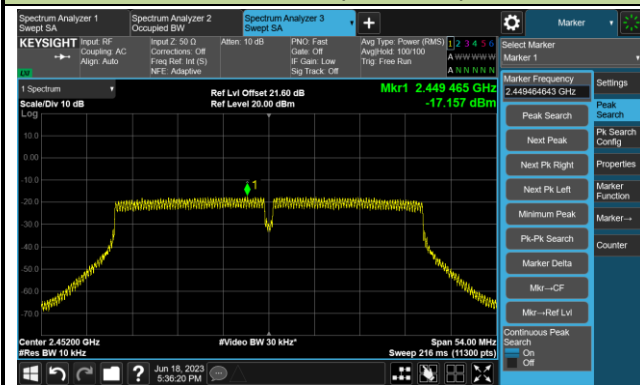
Channel 03 (2422MHz)



Channel 06 (2437MHz)

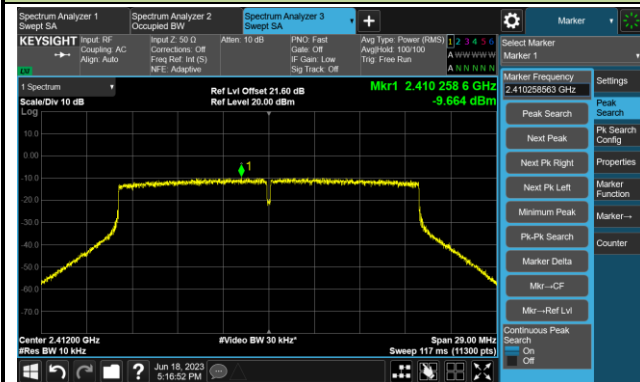


Channel 09 (2452MHz)



802.11ax-HE20 - PSD – Ant 1

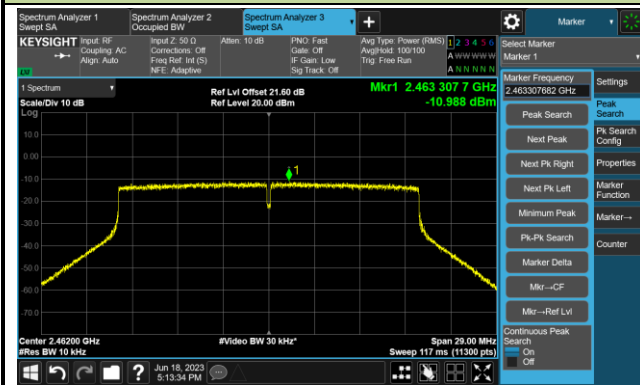
Channel 01 (2412MHz)



Channel 06 (2437MHz)

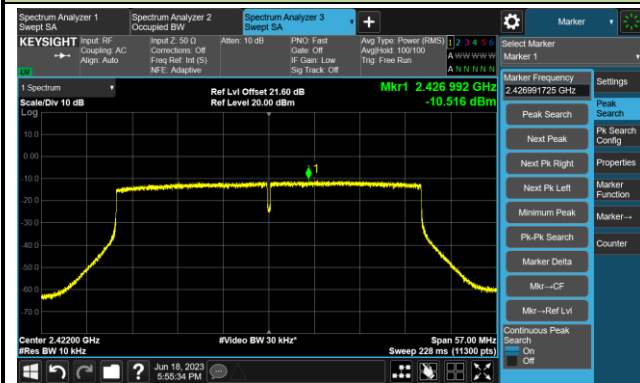


Channel 11 (2462MHz)

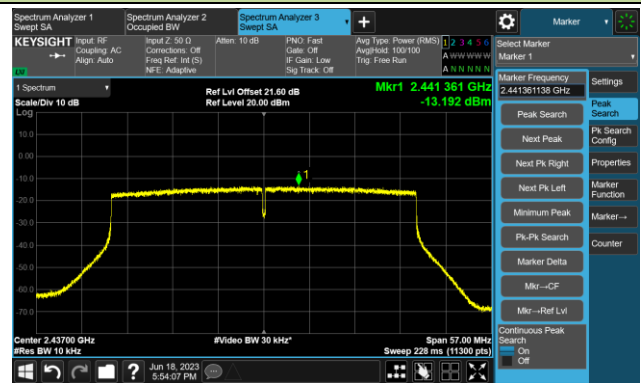


802.11ax-HE40 - PSD – Ant 1

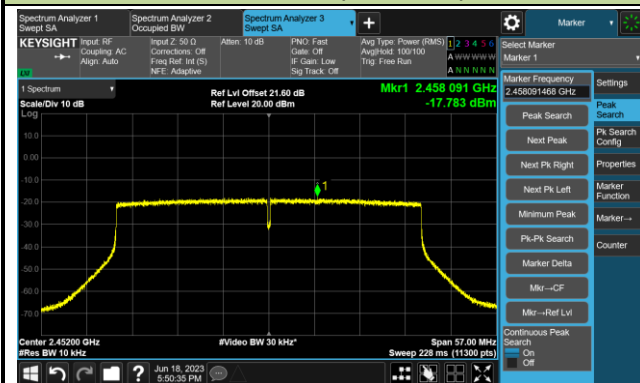
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



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

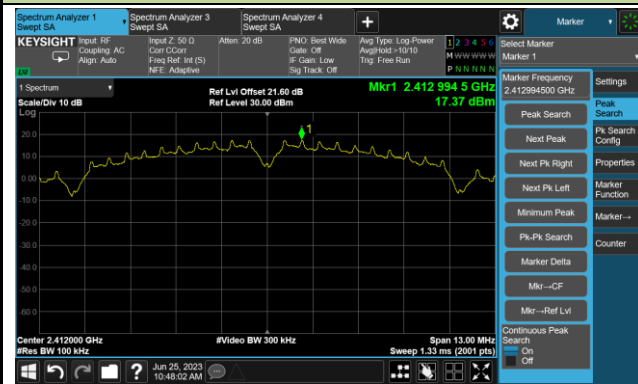
Test Site	WZ-SR5	Test Engineer	Jeff Yang
Test Date	2023-06-25		

Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	Limit
11b	1Mbps	01	2412	30dBc
11b	1Mbps	06	2437	30dBc
11b	1Mbps	11	2462	30dBc
11g	6Mbps	01	2412	30dBc
11g	6Mbps	06	2437	30dBc
11g	6Mbps	11	2462	30dBc
11n-HT20	MCS0	01	2412	30dBc
11n-HT20	MCS0	06	2437	30dBc
11n-HT20	MCS0	11	2462	30dBc
11n-HT40	MCS0	03	2422	30dBc
11n-HT40	MCS0	06	2437	30dBc
11n-HT40	MCS0	09	2452	30dBc
11ax-HE20	MCS0	01	2412	30dBc
11ax-HE20	MCS0	06	2437	30dBc
11ax-HE20	MCS0	11	2462	30dBc
11ax-HE40	MCS0	03	2422	30dBc
11ax-HE40	MCS0	06	2437	30dBc
11ax-HE40	MCS0	09	2452	30dBc

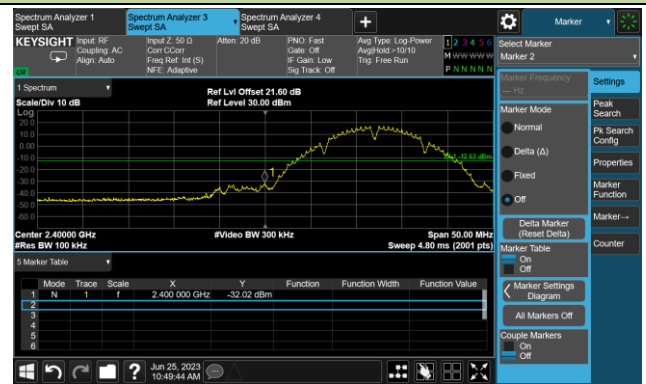
802.11b Out-of-Band Emissions – Ant 0

Channel 01 (2412MHz)

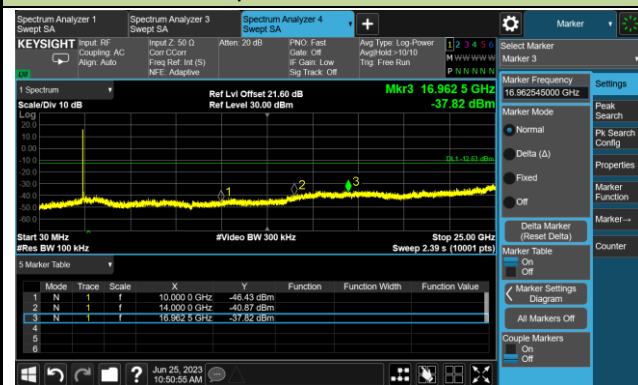
100kHz PSD Reference Level



Low Band Edge

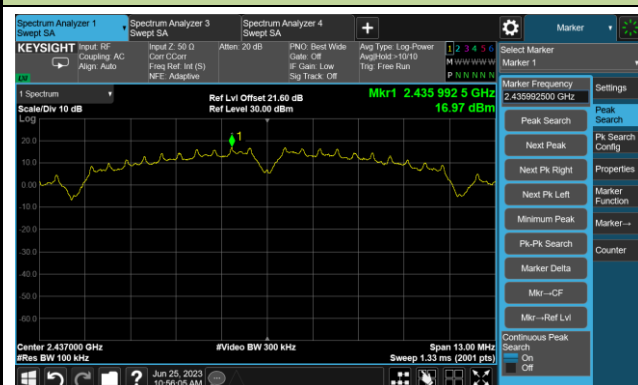


Spurious Emission



Channel 06 (2437MHz)

100kHz PSD Reference Level



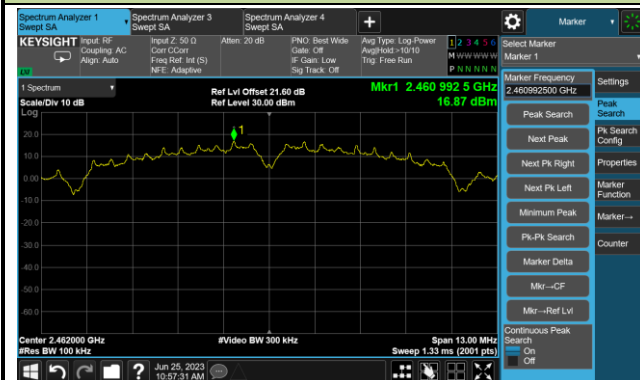
Spurious Emission



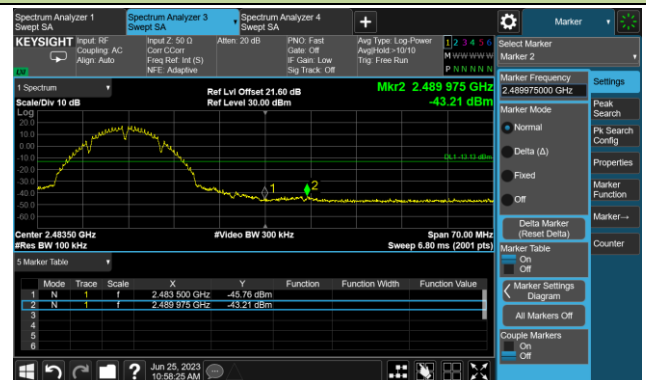
802.11b Out-of-Band Emissions – Ant 0

Channel 11 (2462MHz)

100kHz PSD Reference Level



High Band Edge



Spurious Emission

