MEASUREMENT REPORT

FCC PART 15 Subpart C WLAN 802.11b/g/n/ax

FCC ID:	Q9DAPIN0635
APPLICANT:	Hewlett Packard Enterprise Company
Application Type:	Certification
Product:	ACCESS POINT
Model No.:	APIN0635
Trademark:	aruba a Hewlett Packard Enterprise company, Hewlett Packard Enterprise
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part15 Subpart C (Section 15.247)
Test Procedure(s):	ANSI C63.10-2013
Test Date:	January 13 ~ May 10, 2021

Reviewed By: Paddy Chen
(Paddy Chen)

Approved By: Chenz Ker
(Chenz Ker)

Testing Laboratory
3261

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 (Taiwan) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2101TW0003-U3	V1.0	Initial report	05-10-2021	Valid

CONTENTS

Description Page

1. INTRODUCTION 6

1.1. Scope 6
1.2. MRT Test Location 6

2. PRODUCT INFORMATION 7

2.1. Feature of Equipment under Test 7
2.2. Product Specification Subjective to this Report 7
2.3. Working Frequencies for this report 8
2.4. Description of Antenna RF Port 8
2.5. Description of EUT Filter 9
2.6. Description of Available Antennas 10
2.7. Test Mode 10
2.8. Configuration of Test System 11
2.9. Duty Cycle 12
2.10. EMI Suppression Device(s)/Modifications 13
2.11. Labeling Requirements 13

3. DESCRIPTION of TEST 14

3.1. Evaluation Procedure 14
3.2. AC Line Conducted Emissions 14
3.3. Radiated Emissions 15

4. ANTENNA REQUIREMENTS 16

5. TEST EQUIPMENT CALIBRATION DATE 17

6. MEASUREMENT UNCERTAINTY 18

7. TEST RESULT 19

7.1. Summary 19
7.2. 6dB Bandwidth Measurement 20
7.2.1. Test Limit 20
7.2.2. Test Procedure used 20
7.2.3. Test Setting 20
7.2.4. Test Setup 20
7.2.5. Test Result 21
7.3. Output Power Measurement 28
7.3.1. Test Limit 28
7.3.2. Test Procedure Used 28

7.3.3. Test Setting 28
7.3.4. Test Setup 28
7.3.5. Test Result 29
7.4. Power Spectral Density Measurement 32
7.4.1. Test Limit 32
7.4.2. Test Procedure Used 32
7.4.3. Test Setting 32
7.4.4. Test Setup 33
7.4.5. Test Result 34
7.5. Conducted Band Edge and Out-of-Band Emissions 41
7.5.1. Test Limit 41
7.5.2. Test Procedure Used 41
7.5.3. Test Setting 41
7.5.4. Test Setup 42
7.5.5. Test Result 43
7.6. Radiated Spurious Emission Measurement 72
7.6.1. Test Limit 72
7.6.2. Test Procedure Used 72
7.6.3. Test Setting 72
7.6.4. Test Setup 74
7.6.5. Test Result 75
7.7. Radiated Restricted Band Edge Measurement 123
7.7.1. Test Limit 123
7.7.2. Test Procedure Used 124
7.7.3. Test Setting 124
7.7.4. Test Setup 125
7.7.5. Test Result 126
7.8. AC Conducted Emissions Measurement 206
7.8.1. Test Limit 206
7.8.2. Test Setup 206
7.8.3. Test Result 207

8. CONCLUSION 209

Appendix A - Test Setup Photograph 210

Appendix B - EUT Photograph 211

General Information

Applicant	Hewlett Packard Enterprise Company
Applicant Address	3333 Scott Blvd, Santa Clara, CA 95054, USA
Manufacturer	Hewlett Packard Enterprise Company
Manufacturer Address	3333 Scott Blvd, Santa Clara, CA 95054, USA
Test Site	MRT Technology (Taiwan) Co., Ltd
Test Site Address	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)
MRT FCC Registration No.	291082
FCC Rule Part(s)	Part 15.247
Test Device Serial No.	DKS0BS0027 ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

1. MRT facility is a FCC registered (Reg. No. 291082) test facility with the site description report on file and is designated by the FCC as an Accredited Test Firm.
2. MRT facility is an IC registered (MRT Reg. No. 21723) test laboratory with the site description on file at Industry Canada.
3. MRT Lab is accredited to ISO 17025 by the Taiwan Accreditation Foundation (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC (Designation Number: TW3261), Industry Taiwan, EU and TELEC Rules.

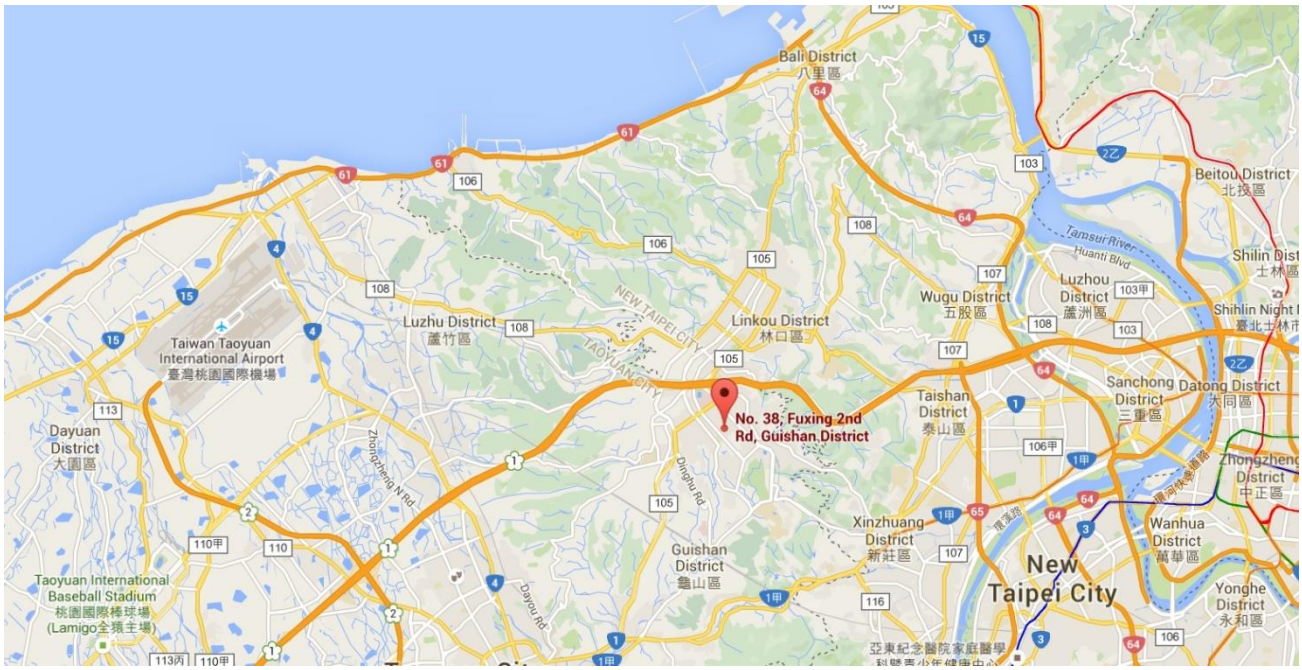
1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada and Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taoyuan City. These measurement tests were conducted at the MRT Technology (Taiwan) Co., Ltd. Facility located at No.38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan (R.O.C).



2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name	ACCESS POINT
Model No.	APIN0635
Software Version	20210105 spf.11.3.css
Wi-Fi Specification	802.11a/b/g/n/ac/ax
Bluetooth Specification	v5.0 single mode, BLE only
Zigbee Specification	802.15.4
Operating Temperature	0 ~ 50 °C
Power Type	AC Adapter or PoE input
Operating Environment	Indoor Use

2.2. Product Specification Subjective to this Report

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

Note: For other features of this EUT, test report will be issued separately.

2.3. Working Frequencies for this report

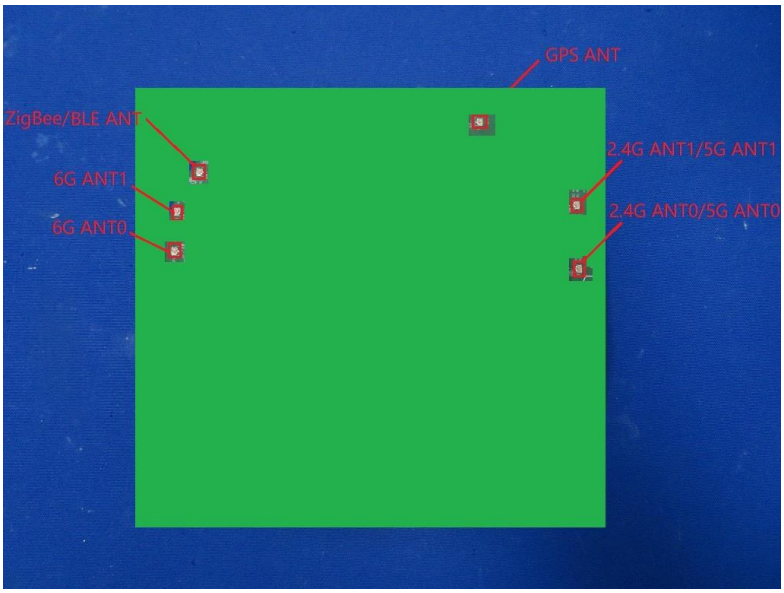
802.11b/g/n-HT20/ax-HE20

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	--	--	--	--

2.4. Description of Antenna RF Port

Antenna RF Port


2.5. Description of EUT Filter

Filter	Specification	Remark
Wi-Fi		
Filter 1#	Band Pass Filter (2412-2472)	Allowing any transmission on all channels
Filter 2#	Band Pass Filter (2402-2447)	Allowing any transmission on 20MHz channels 1 thru 6.
Filter 3#	Band Pass Filter (2452-2472)	Allowing any transmission on 20MHz channel 11
Bluetooth & Zigbee		
Filter 4#	Band Pass Filter (2402-2480)	Allowing any transmission on all channels
Filter 5#	Band Pass Filter (2402-2430)	Allowing transmission on BLE channels 37 (2402MHz) and 38 (2426MHz) and Zigbee channel 11 (2405MHz)
Filter 6#	Band Pass Filter (2478-2482)	Allowing transmission on BLE channel 39 (2480MHz) and Zigbee channel 26 (2480MHz)

Working Mode

Wi-Fi	Bluetooth	Remark
Filter 1#	Filter 4#	Filter 1# or Filter 4# work alone
Filter 2#	Filter 6#	Transmission simultaneously
Filter 3#	Filter 5#	Transmission simultaneously
Note: Filter groups on the 2.4GHz Wi-Fi and BLE/Zigbee outputs to prevent reverse IMD when both 2.4GHz Wi-Fi and BLE/Zigbee are transmitting simultaneously		

2.6. Description of Available Antennas

Antenna Type	Frequency Band (GHz)	Max Peak Gain (dBi)	CDD Directional Gain (dBi)		BF Directional Gain (dBi)
			For Power	For PSD	
Wi-Fi Internal Antenna (2*2 MIMO)					
PIFA	2.4 ~ 2.5	2.90	2.90	5.91	5.91
	5.15 ~ 5.9	4.90	4.90	7.91	7.91
	5.9 ~ 7.2	4.30	4.30	4.30	4.30
Bluetooth / ZigBee Internal Antenna					
PIFA	2.4 ~ 2.5	3.0			

Note:

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

For CDD transmissions, directional gain is calculated as follows, N_{ANT} = 2, N_{SS} = 1.

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

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

  Array Gain = 10 log (N_{ANT}/ N_{SS}) dB = 3.01;

- For power measurements on IEEE 802.11 devices,

  Array Gain = 0 dB for N_{ANT} ≤ 4;

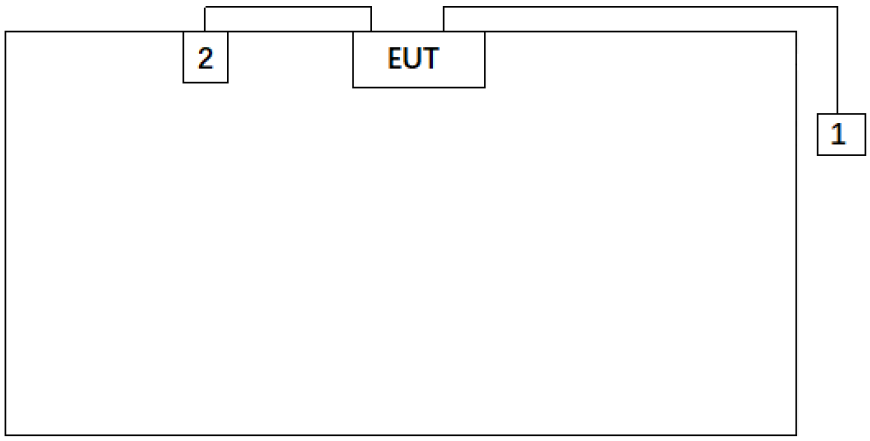
2. The EUT also supports Beam Forming mode, and the Beam Forming support 802.11n/ac/ax, not include 802.11a/b/g. Directional gain = G_{ANT} + BF Gain. BF mode power setting will be less than or equal to CDD power setting.
3. Wi-Fi 6E band antennas are cross polarized, the detail refer to antenna specification.
4. All antenna information is provided by the manufacturer, test laboratory will not be responsible if any error.

2.7. Test Mode

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)
	Mode 5: Transmit by 802.11ax-HE20 (MCS0)
	Mode 6: Transmit by 802.11ax-HE40 (MCS0)

2.8. Configuration of Test System

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.



Product		Manufacturer	Model No.
1	Notebook	DELL	Precision 3510
2	AC Adapter	aruba	DB-48A12

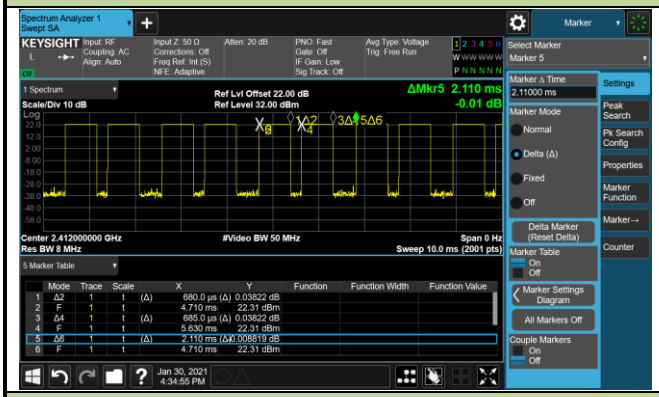
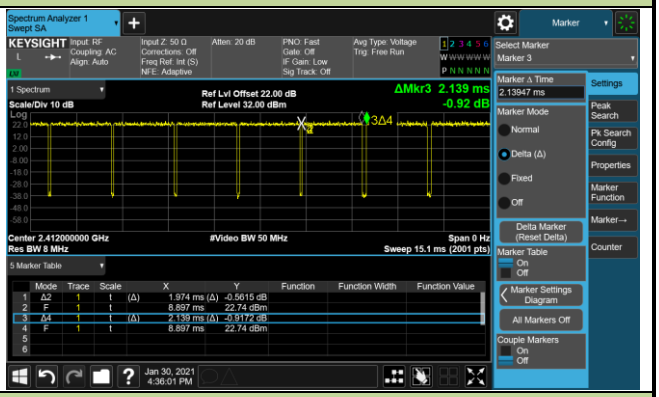
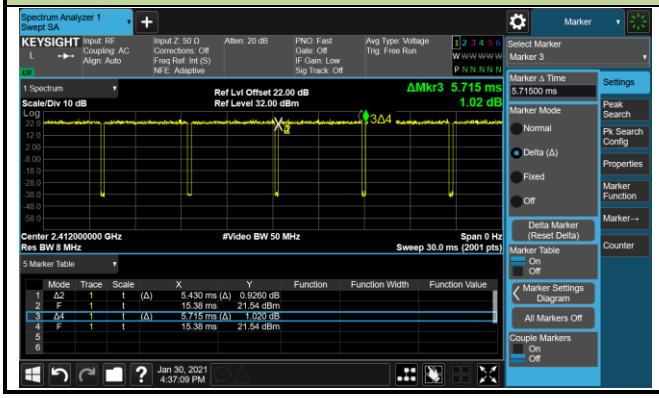
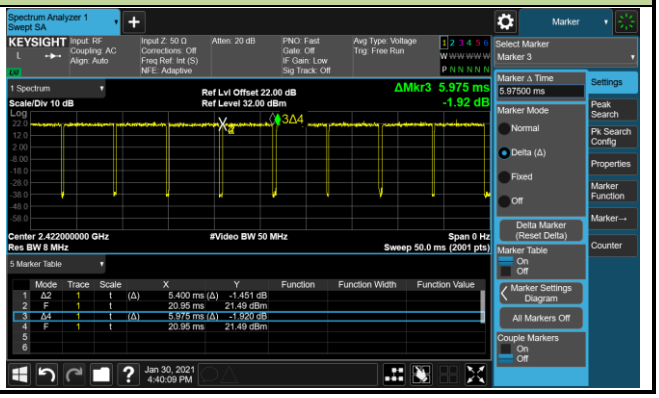
Note 1: The test utility software used during testing was “QSPR”, and the version was “v50-00186”.

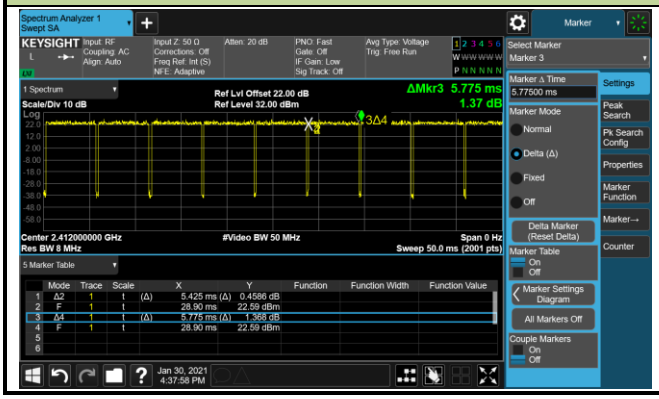
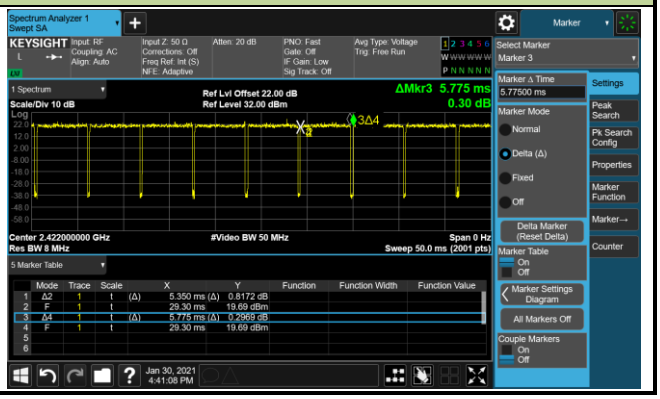
Note 2: Detail power setting refer to operation description.

2.9. Duty Cycle

2.4GHz WLAN (DTS) operation is possible in 20MHz and 40MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Test Mode	Duty Cycle
802.11b	64.69%
802.11g	92.29%
802.11n-HT20	95.01%
802.11n-HT40	90.38%
802.11ax-HE20	93.94%
802.11ax-HE40	92.64%

Duty Cycle	
802.11b (T = 1.365ms)	802.11g (T = 1.974ms)
	
802.11n-HT20 (T = 5.43ms)	802.11n-HT40 (T = 5.40ms)
	

802.11ax-HE20 (T = 5.425ms)	802.11ax-HE40 (T = 5.35ms)
	

2.10. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.11. Labeling Requirements

<u>Per 2.1074 & 15.19; Docket 95-19</u>

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

3. DESCRIPTION of TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance was used in the measurement.

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst-case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

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

Conclusion:

The unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Two-Line V-Network	R&S	ENV 216	MRTTWA00019	1 year	2022/3/23
Two-Line V-Network	R&S	ENV 216	MRTTWA00020	1 year	2022/4/24
8-Wire ISN (T8)	R&S	ENY81	MRTTWA00018	1 year	2021/5/25
EMI Test Receiver	R&S	ESR3	MRTTWA00045	1 year	2021/5/26
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2021/5/28

Radiated Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Acitve Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	1 year	2022/4/27
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2021/10/5
Broadband Horn antenna	SCHWARZBECK	BBHA 9120D	MRTTWA00003	1 year	2022/4/24
Breitband Horn antenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	1 year	2022/4/24
Broadband Preamplifier	SCHWARZBECK	BBV 9718	MRTTWA00005	1 year	2022/4/24
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	1 year	2022/4/24
Signal Analyzer	R&S	FSV40	MRTTWA00007	1 year	2022/3/23
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2022/3/24
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2021/10/14
Antenna Cable	HUBERSUHNER	SF106	MRTTWE00010	1 year	2021/6/16
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00032	1 year	2021/5/29

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
X-Series USB Peak and Average Power Sensor	KEYSIGHT	U2021XA	MRTTWA00014	1 year	2022/4/24
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2021/10/14
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2021/7/11
Attenuator	WTI	218FS-20	MRTTWE00026	1 year	2021/5/30
Attenuator	WTI	218FS-10	MRTTWE00027	1 year	2021/5/30
Attenuator	WTI	218FS-06	MRTTWE00028	1 year	2021/5/30
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2021/5/28

Software	Version	Function
v3	9.160520a	EMI Test Software

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 150kHz~30MHz: 2.53dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: 4.25dB 1GHz ~ 40GHz: 4.45dB
Conducted Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 0.84dB
Conducted Spurious Emission
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 2.65 dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 3.3%
Temp. / Humidity
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ±0.82°C/ ±3%

7. TEST RESULT

7.1. Summary

FCC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	6dB Bandwidth	≥ 500kHz	Conducted	Pass	Section 7.2
15.247(b)(3)	Output Power	≤ 30dBm		Pass	Section 7.3
15.247(e)	Power Spectral Density	≤ 8dBm/3kHz		Pass	Section 7.4
15.247(d)	Band Edge / Out-of-Band Emissions	≥ 30dBc (Average)		Pass	Section 7.5
15.205 15.209	General Field Strength (Restricted Bands and Radiated Emission)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	Pass	Section 7.6 & 7.7
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.8

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 test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
3) Determining compliance is based on the test results met the regulation limits or requirements declared by clients, and the test results don't take into account the value of measurement uncertainty.
4) EUT supports one configuration only in 802.11ax full RU mode.
5) Test Item “6dB Bandwidth” showed the worst test data in this report.

Test Items	Filter 1#	Filter 2#	Filter 3#
6dB Bandwidth	●		
Output Power	●	●	●
Power Spectral Density	●		
Band Edge / Out-of-Band Emissions	●	●	●
Radiated Spurious Emission	●	●	●
Radiated Band Edge	●	●	●
AC Conducted Emissions 150kHz - 30MHz	●		

7.2. 6dB Bandwidth Measurement

7.2.1.Test Limit

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

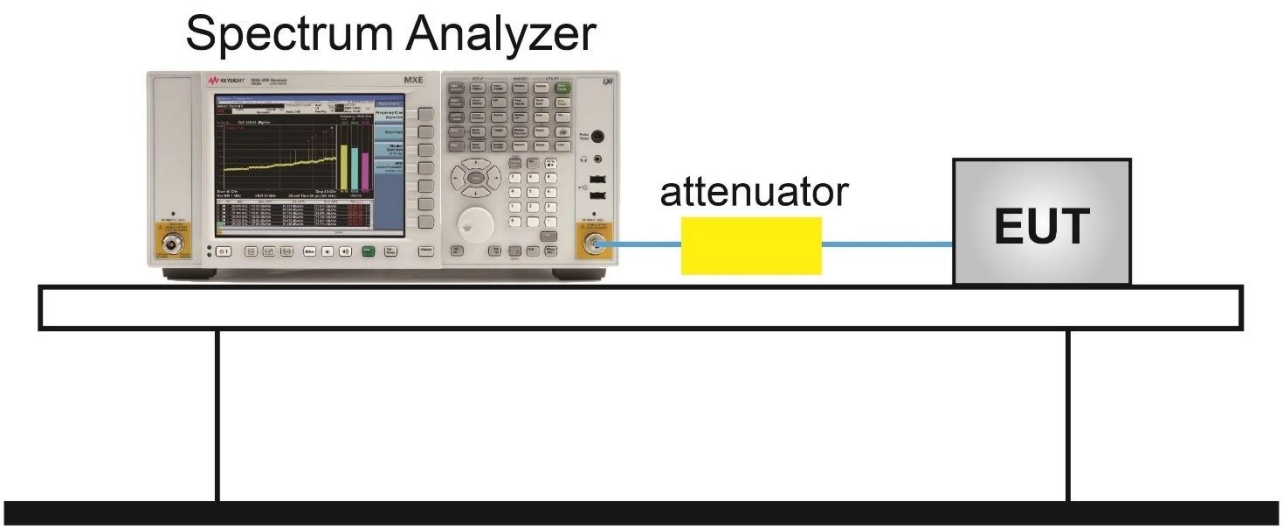
7.2.2.Test Procedure used

ANSI C63.10 Section 11.8

7.2.3.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 ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace was allowed to stabilize

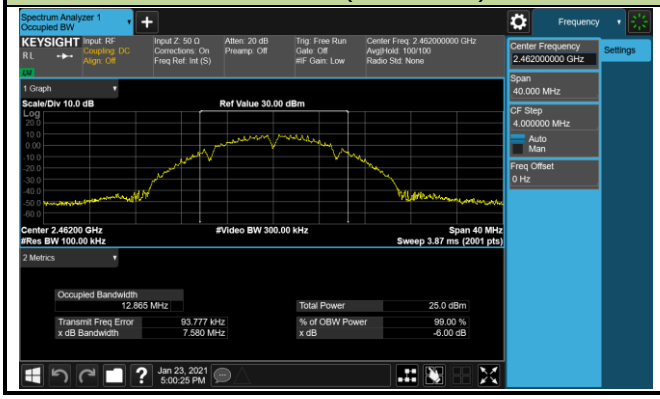
7.2.4.Test Setup

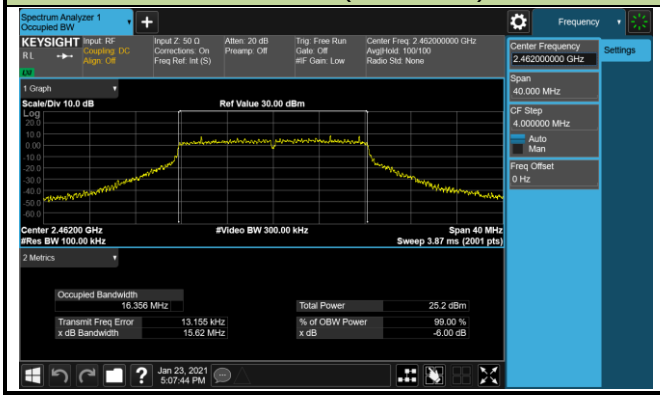


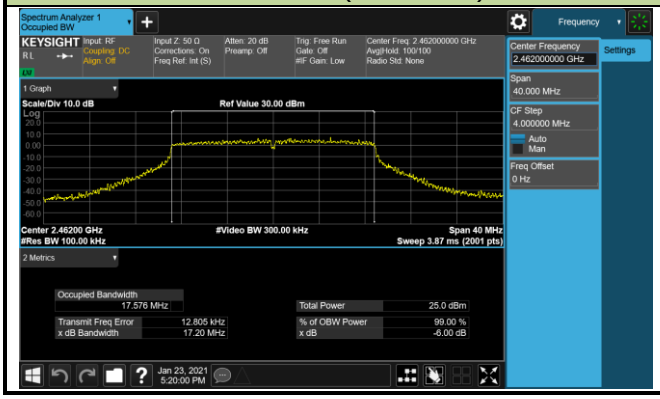
7.2.5.Test Result

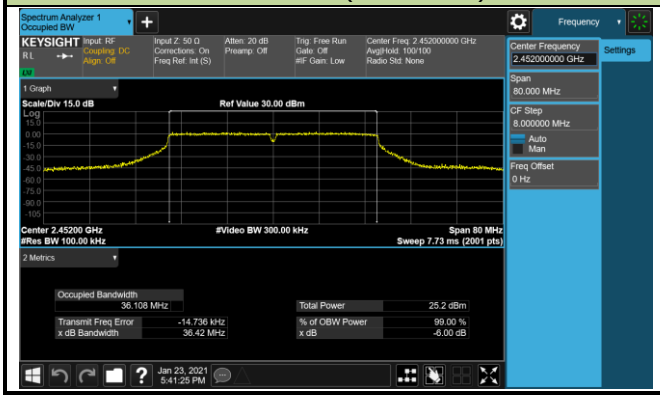
Product	ACCESS POINT	Test Engineer	Eric Lin
Test Site	SR2	Test Date	2021/01/23

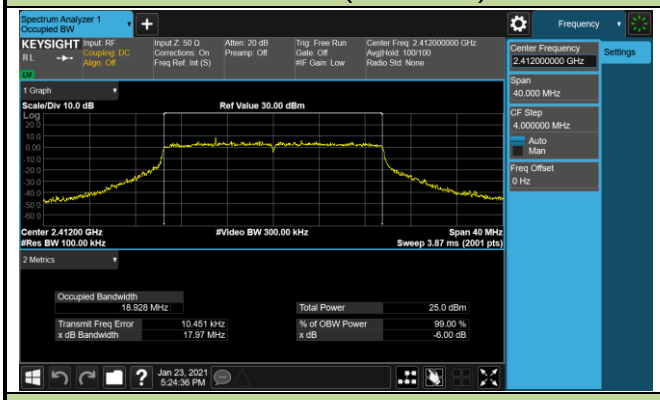
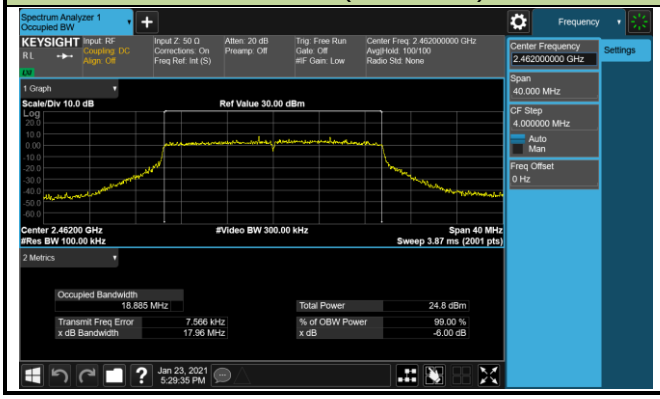
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Ant 1 / Ant 0 + 1						
802.11b	1Mbps	01	2412	8.10	≥ 0.5	Pass
802.11b	1Mbps	06	2437	7.56	≥ 0.5	Pass
802.11b	1Mbps	11	2462	7.58	≥ 0.5	Pass
802.11g	6Mbps	01	2412	16.29	≥ 0.5	Pass
802.11g	6Mbps	06	2437	16.36	≥ 0.5	Pass
802.11g	6Mbps	11	2462	15.62	≥ 0.5	Pass
802.11n-HT20	MCS0	01	2412	16.66	≥ 0.5	Pass
802.11n-HT20	MCS0	06	2437	16.08	≥ 0.5	Pass
802.11n-HT20	MCS0	11	2462	17.20	≥ 0.5	Pass
802.11n-HT40	MCS0	03	2422	33.19	≥ 0.5	Pass
802.11n-HT40	MCS0	06	2437	35.00	≥ 0.5	Pass
802.11n-HT40	MCS0	09	2452	36.42	≥ 0.5	Pass
802.11ax-HE20	MCS0	01	2412	17.97	≥ 0.5	Pass
802.11ax-HE20	MCS0	06	2437	17.52	≥ 0.5	Pass
802.11ax-HE20	MCS0	11	2462	17.96	≥ 0.5	Pass
802.11ax-HE40	MCS0	03	2422	37.80	≥ 0.5	Pass
802.11ax-HE40	MCS0	06	2437	37.72	≥ 0.5	Pass
802.11ax-HE40	MCS0	09	2452	37.07	≥ 0.5	Pass

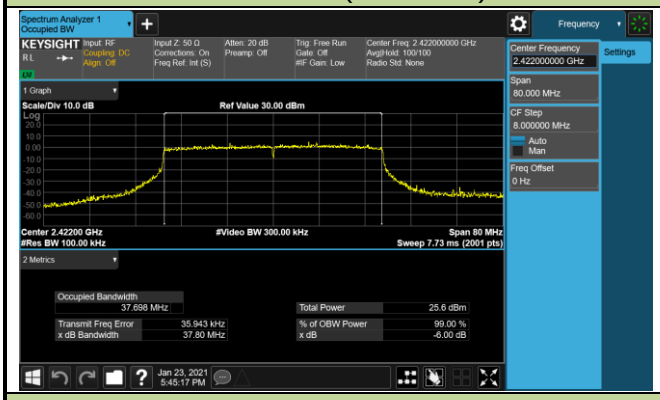
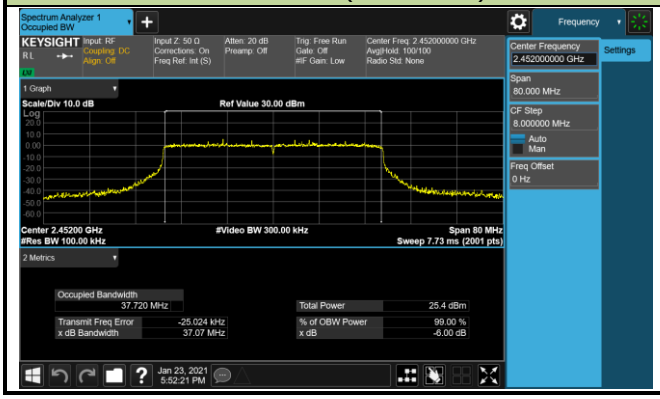
802.11b 6dB Bandwidth - Ant 1 / Ant 0 + 1	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
Channel 11 (2462MHz)	
	

802.11g 6dB Bandwidth - Ant 1 / Ant 0 + 1	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
Channel 11 (2462MHz)	
	

802.11n-HT20 6dB Bandwidth - Ant 1 / Ant 0 + 1	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
Channel 11 (2462MHz)	
	

802.11n-HT40 6dB Bandwidth - Ant 1 / Ant 0 + 1	
Channel 03 (2422MHz)	Channel 06 (2437MHz)
Channel 09 (2452MHz)	
	

802.11ax-HE20 6dB Bandwidth - Ant 1 / Ant 0 + 1	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

802.11ax-HE40 6dB Bandwidth - Ant 1 / Ant 0 + 1	
Channel 03 (2422MHz)	Channel 06 (2437MHz)
	
Channel 09 (2452MHz)	
	

7.3. Output Power Measurement

7.3.1.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.

7.3.2.Test Procedure Used

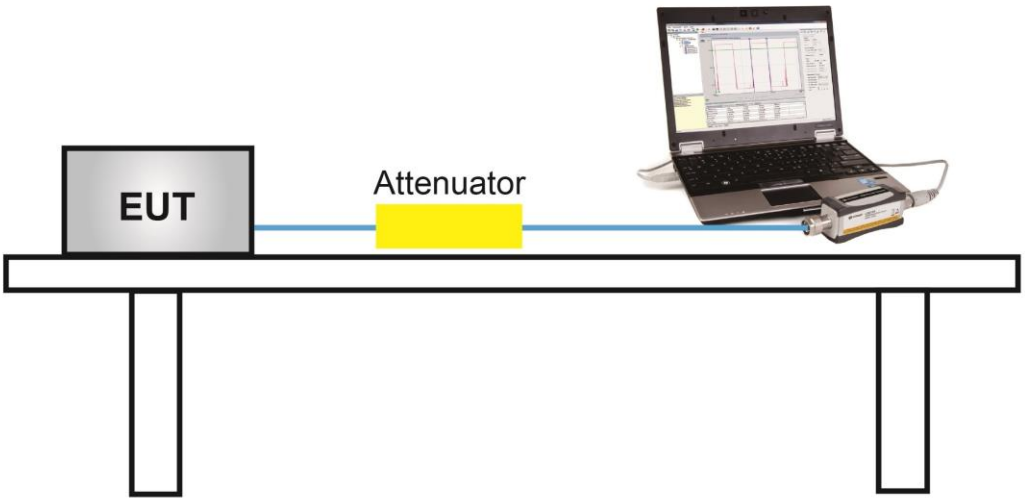
ANSI C63.10 Section 11.9.2.3.2

7.3.3.Test Setting

Average Power Measurement

Average power measurements were perform only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

7.3.4.Test Setup



7.3.5.Test Result

Product	ACCESS POINT	Test Engineer	Eric Lin
Test Site	SR2	Test Date	2021/01/19
Filter Configuration	Filter 1#		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
802.11b	1Mbps	01	2412	18.96	18.85	21.92	≤ 30.00	Pass
802.11b	1Mbps	06	2437	18.83	18.86	21.86	≤ 30.00	Pass
802.11b	1Mbps	11	2462	18.52	18.50	21.52	≤ 30.00	Pass
802.11g	6Mbps	01	2412	18.77	18.93	21.86	≤ 30.00	Pass
802.11g	6Mbps	06	2437	18.72	18.83	21.79	≤ 30.00	Pass
802.11g	6Mbps	11	2462	18.35	18.26	21.32	≤ 30.00	Pass
802.11n-HT20	MCS0	01	2412	18.43	18.90	21.68	≤ 30.00	Pass
802.11n-HT20	MCS0	06	2437	18.75	18.73	21.75	≤ 30.00	Pass
802.11n-HT20	MCS0	11	2462	18.43	18.52	21.49	≤ 30.00	Pass
802.11n-HT40	MCS0	03	2422	17.64	17.84	20.75	≤ 30.00	Pass
802.11n-HT40	MCS0	06	2437	18.86	18.88	21.88	≤ 30.00	Pass
802.11n-HT40	MCS0	09	2452	15.32	15.52	18.43	≤ 30.00	Pass
802.11ax-HE20	MCS0	01	2412	18.72	18.60	21.67	≤ 30.00	Pass
802.11ax-HE20	MCS0	06	2437	18.53	18.58	21.57	≤ 30.00	Pass
802.11ax-HE20	MCS0	11	2462	16.58	16.74	19.67	≤ 30.00	Pass
802.11ax-HE40	MCS0	03	2422	17.63	17.84	20.75	≤ 30.00	Pass
802.11ax-HE40	MCS0	06	2437	18.49	18.56	21.54	≤ 30.00	Pass
802.11ax-HE40	MCS0	09	2452	15.63	15.48	18.57	≤ 30.00	Pass

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

Product	ACCESS POINT	Test Engineer	Eric Lin
Test Site	SR2	Test Date	2021/01/19
Filter Configuration	Filter 2#		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
802.11b	1Mbps	01	2412	18.96	18.87	21.93	≤ 30.00	Pass
802.11b	1Mbps	06	2437	18.68	18.71	21.71	≤ 30.00	Pass
802.11g	6Mbps	01	2412	18.83	18.62	21.74	≤ 30.00	Pass
802.11g	6Mbps	06	2437	18.62	18.51	21.58	≤ 30.00	Pass
802.11n-HT20	MCS0	01	2412	18.41	18.75	21.59	≤ 30.00	Pass
802.11n-HT20	MCS0	06	2437	18.46	18.77	21.63	≤ 30.00	Pass
802.11ax-HE20	MCS0	01	2412	18.53	18.73	21.64	≤ 30.00	Pass
802.11ax-HE20	MCS0	06	2437	18.51	18.55	21.54	≤ 30.00	Pass

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

Product	ACCESS POINT	Test Engineer	Eric Lin
Test Site	SR2	Test Date	2021/01/19
Filter Configuration	Filter 3#		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
802.11b	1Mbps	11	2462	18.39	18.43	21.42	≤ 30.00	Pass
802.11g	6Mbps	11	2462	18.16	18.22	21.20	≤ 30.00	Pass
802.11n-HT20	MCS0	11	2462	18.35	18.53	21.45	≤ 30.00	Pass
802.11ax-HE20	MCS0	11	2462	16.12	16.24	19.19	≤ 30.00	Pass

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

7.4. Power Spectral Density Measurement

7.4.1.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.

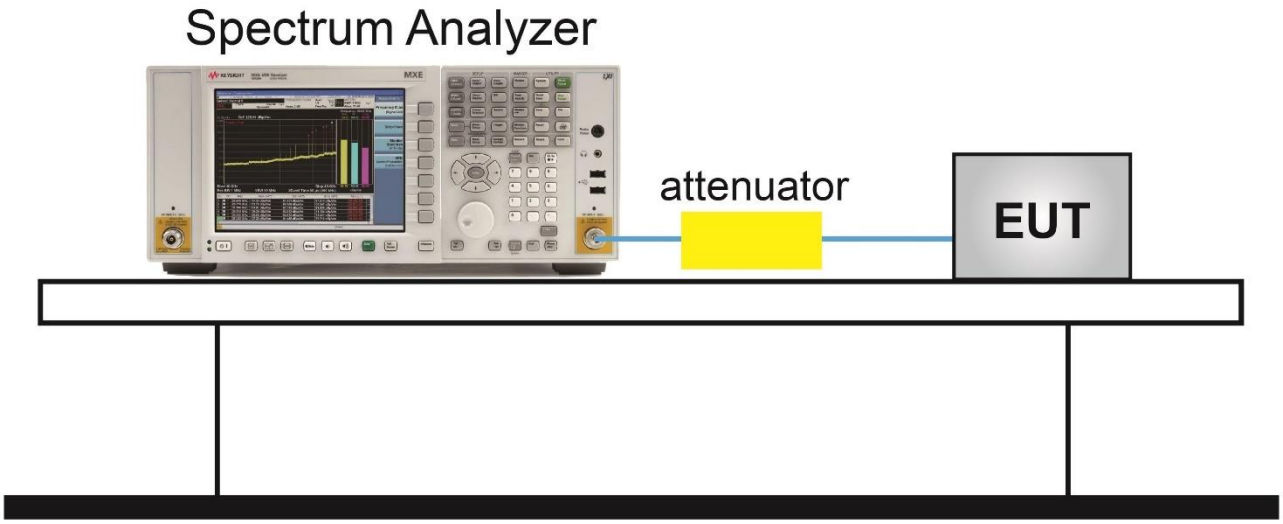
7.4.2.Test Procedure Used

ANSI C63.10 Section 11.10.5

7.4.3.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 ≥ 2 x 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.

7.4.4.Test Setup



7.4.5.Test Result

Product	ACCESS POINT	Test Engineer	Eric Lin
Test Site	SR2	Test Date	2021/01/23

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Ant 0 PSD (dBm/ 10kHz)	Ant 1 PSD (dBm/ 10kHz)	Duty Cycle (%)	10*log (1/x)	Total PSD (dBm/ 10kHz)	Limit (dBm/ 3kHz)	Result
802.11b	1Mbps	01	2412	-7.64	-7.56	64.69	1.89	-2.70	≤ 8.00	Pass
802.11b	1Mbps	06	2437	-7.38	-7.33	64.69	1.89	-2.45	≤ 8.00	Pass
802.11b	1Mbps	11	2462	-7.76	-8.29	64.69	1.89	-3.12	≤ 8.00	Pass
802.11g	6Mbps	01	2412	-9.70	-9.93	92.29	0.35	-6.45	≤ 8.00	Pass
802.11g	6Mbps	06	2437	-9.73	-9.50	92.29	0.35	-6.25	≤ 8.00	Pass
802.11g	6Mbps	11	2462	-9.86	-9.76	92.29	0.35	-6.45	≤ 8.00	Pass
802.11n-HT20	MCS0	01	2412	-11.20	-11.10	95.01	0.22	-7.92	≤ 8.00	Pass
802.11n-HT20	MCS0	06	2437	-10.71	-10.30	95.01	0.22	-7.27	≤ 8.00	Pass
802.11n-HT20	MCS0	11	2462	-10.87	-10.71	95.01	0.22	-7.56	≤ 8.00	Pass
802.11n-HT40	MCS0	03	2422	-14.03	-14.06	90.38	0.44	-10.59	≤ 8.00	Pass
802.11n-HT40	MCS0	06	2437	-13.59	-13.38	90.38	0.44	-10.03	≤ 8.00	Pass
802.11n-HT40	MCS0	09	2452	-16.11	-16.16	90.38	0.44	-12.68	≤ 8.00	Pass
802.11ax-HE20	MCS0	01	2412	-12.17	-12.07	93.94	0.27	-8.84	≤ 8.00	Pass
802.11ax-HE20	MCS0	06	2437	-11.68	-11.78	93.94	0.27	-8.45	≤ 8.00	Pass
802.11ax-HE20	MCS0	11	2462	-11.71	-11.94	93.94	0.27	-8.54	≤ 8.00	Pass
802.11ax-HE40	MCS0	03	2422	-15.28	-14.99	92.64	0.33	-11.79	≤ 8.00	Pass
802.11ax-HE40	MCS0	06	2437	-14.70	-14.67	92.64	0.33	-11.34	≤ 8.00	Pass
802.11ax-HE40	MCS0	09	2452	-17.53	-17.67	92.64	0.33	-14.26	≤ 8.00	Pass

Note: When EUT duty cycle ≤ 98%, Total AVGPSD = 10*log {$10^{(\text{Ant 0 AVGPSD}/10)}$ + $10^{(\text{Ant 1 AVGPSD}/10)}$} + 10*log (1/Duty Cycle).

802.11b AVGPSD - Ant 0 / Ant 0 + 1

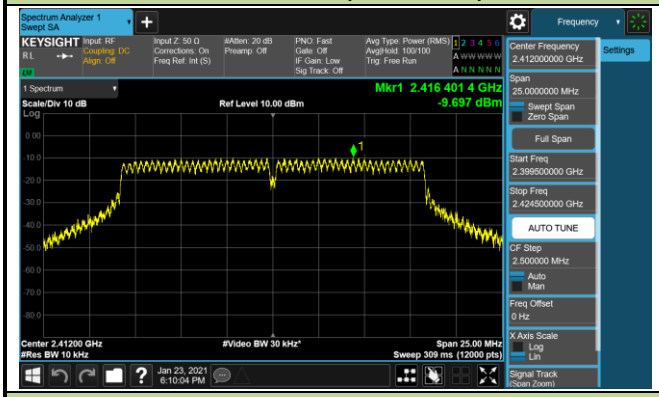
Channel 01 (2412MHz)

Channel 06 (2437MHz)

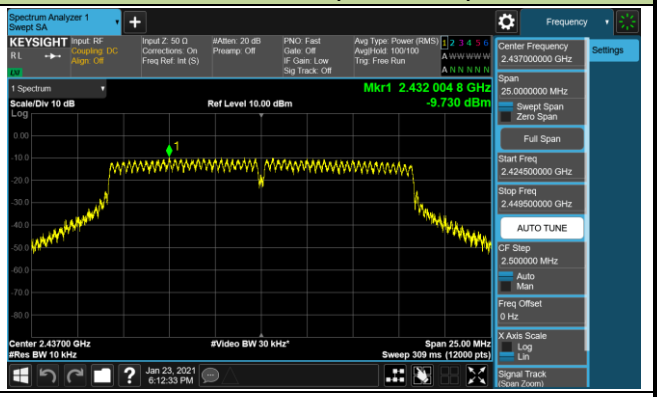
Channel 11 (2462MHz)

802.11g AVGPSD - Ant 0 / Ant 0 + 1

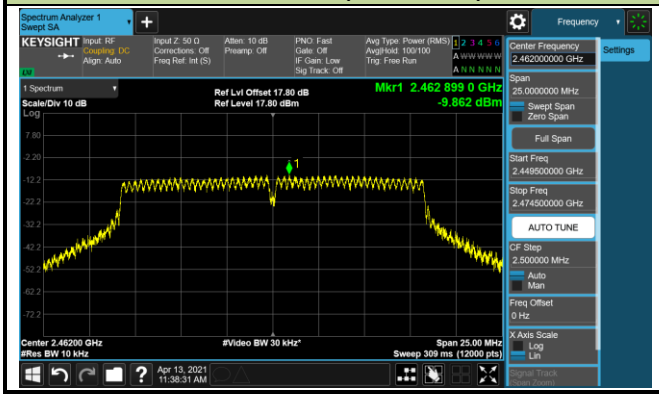
Channel 01 (2412MHz)



Channel 06 (2437MHz)

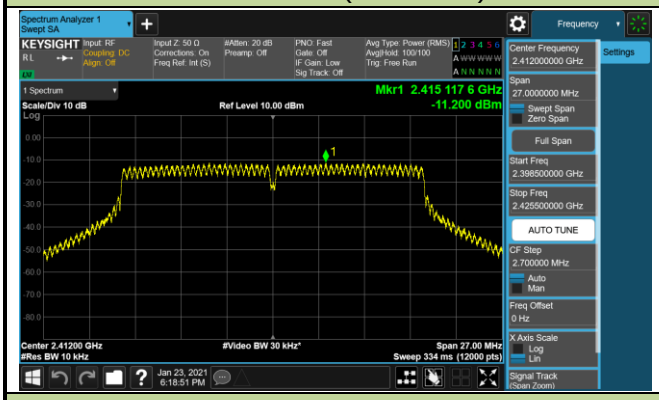


Channel 11 (2462MHz)

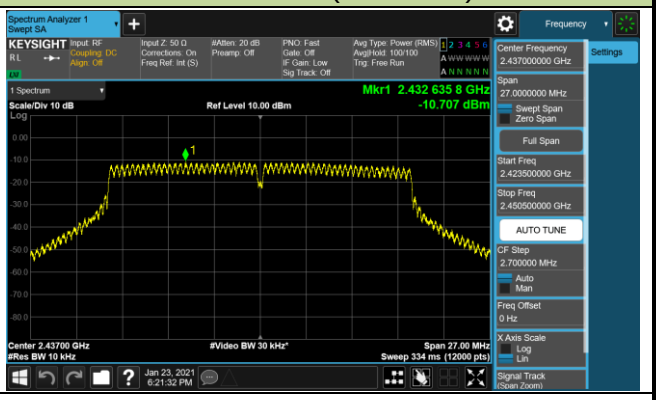


802.11n-HT20 AVGPSD - Ant 0 / Ant 0 + 1

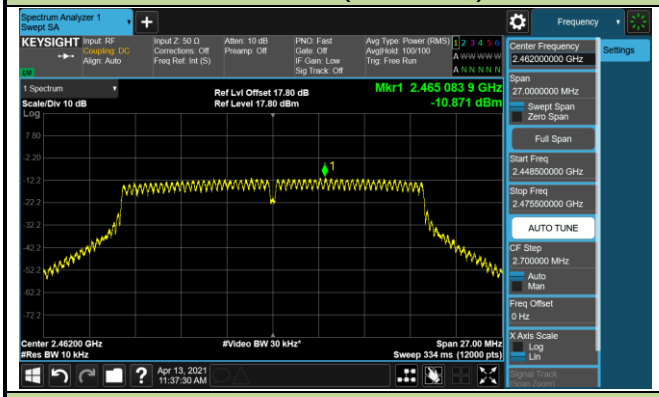
Channel 01 (2412MHz)



Channel 06 (2437MHz)

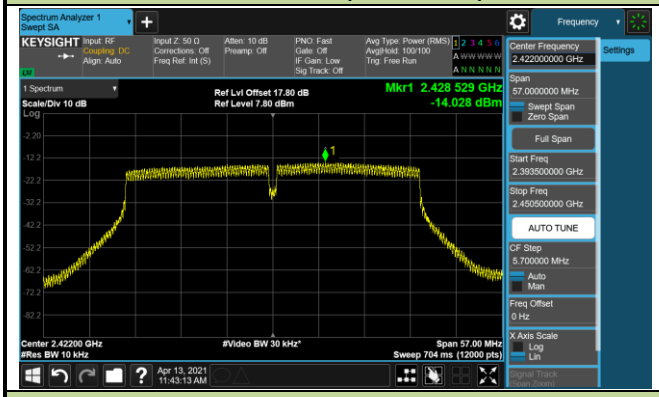


Channel 11 (2462MHz)

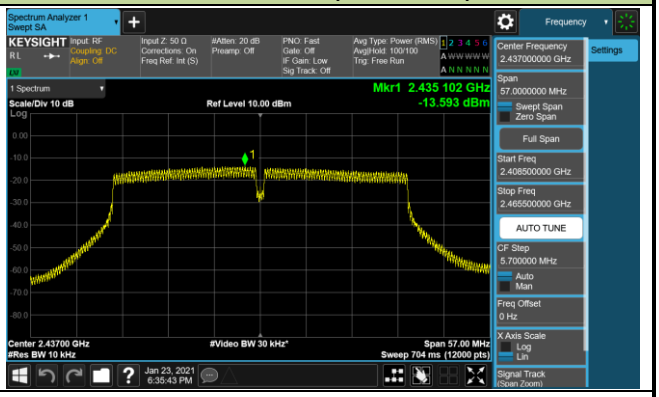


802.11n-HT40 AVGPSD - Ant 0 / Ant 0 + 1

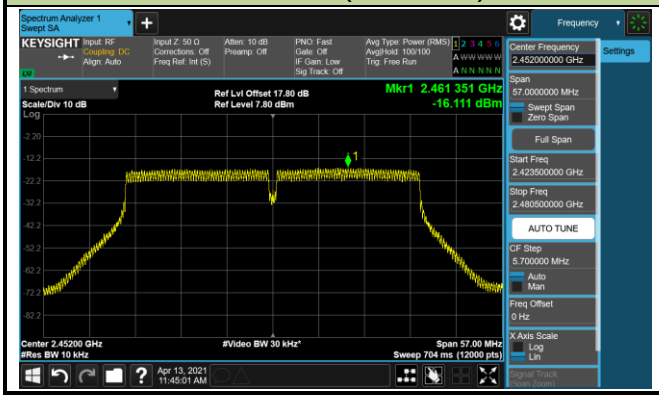
Channel 03 (2422MHz)



Channel 06 (2437MHz)

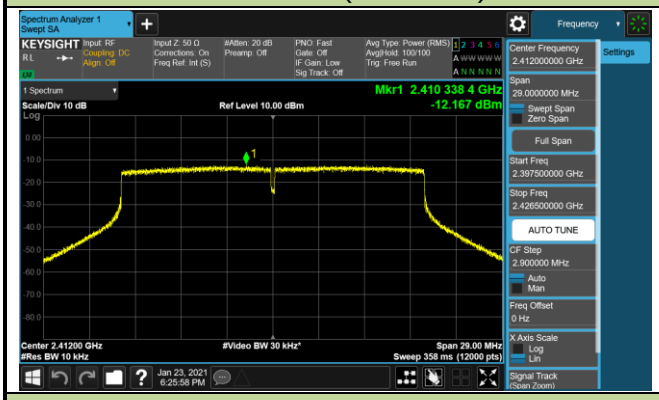


Channel 09 (2452MHz)

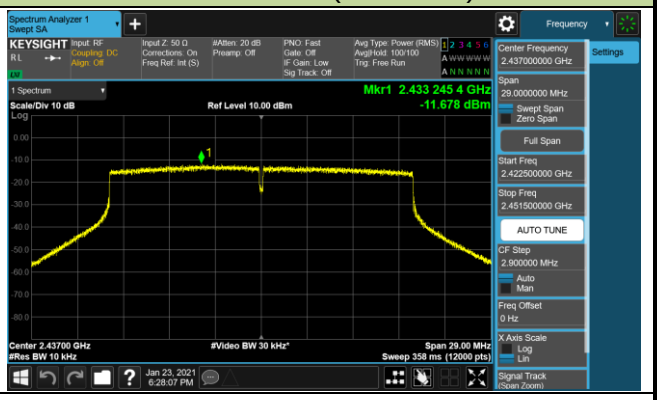


802.11ax-HE20 AVGPSD - Ant 0 / Ant 0 + 1

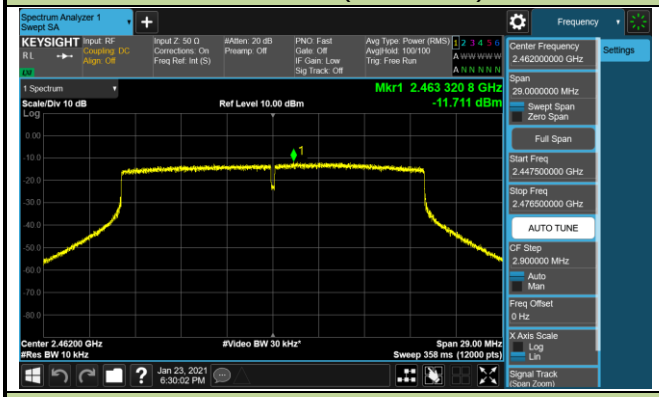
Channel 01 (2412MHz)



Channel 06 (2437MHz)

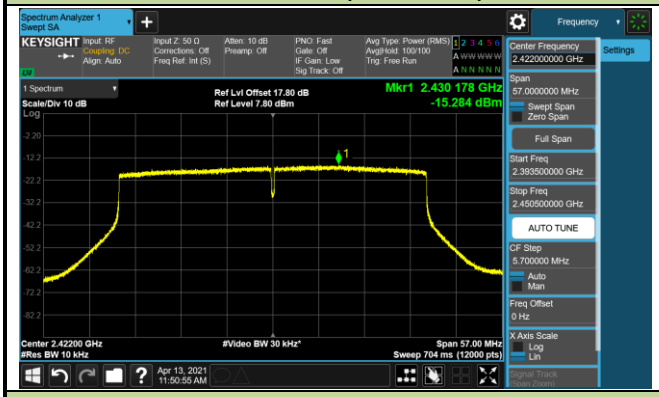


Channel 11 (2462MHz)

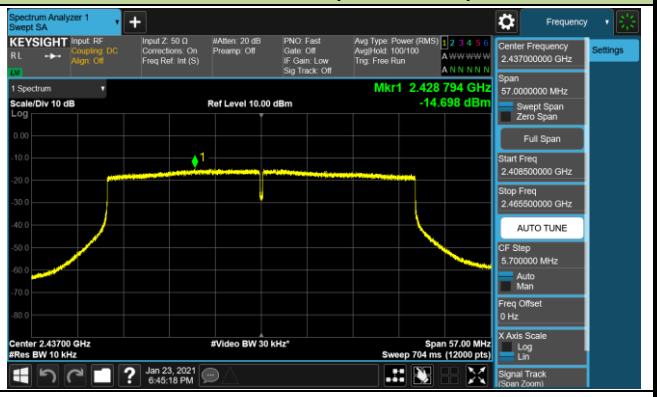


802.11ax-HE40 AVGPSD - Ant 0 / Ant 0 + 1

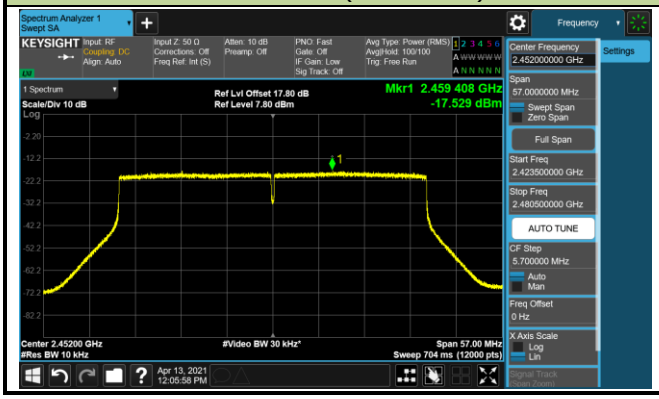
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



802.11b AVGPSD - Ant 1 / Ant 0 + 1

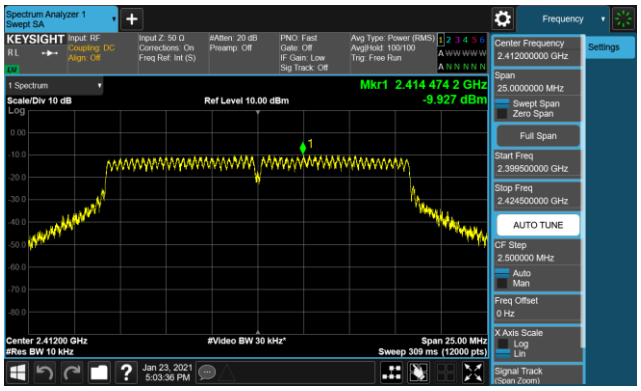
Channel 01 (2412MHz)

Channel 06 (2437MHz)

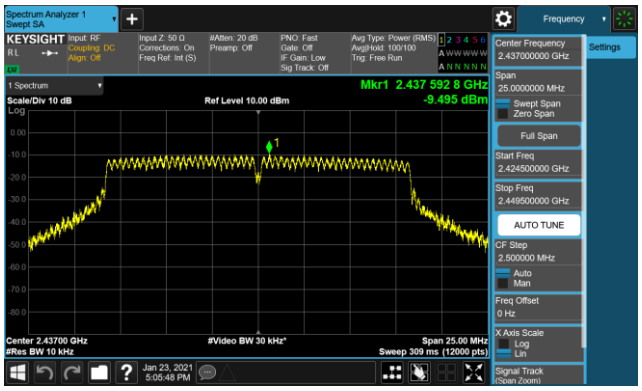
Channel 11 (2462MHz)

802.11g AVGPSD - Ant 1 / Ant 0 + 1

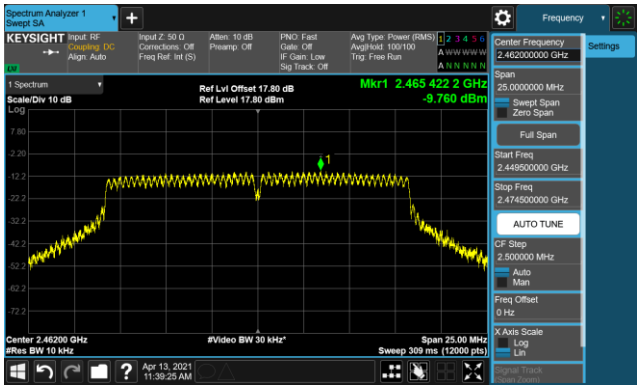
Channel 01 (2412MHz)



Channel 06 (2437MHz)

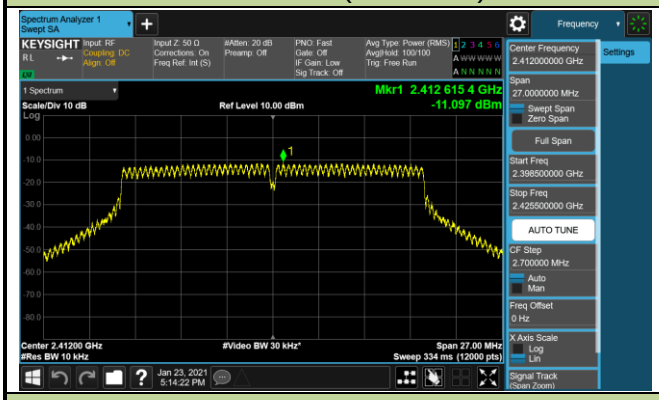


Channel 11 (2462MHz)

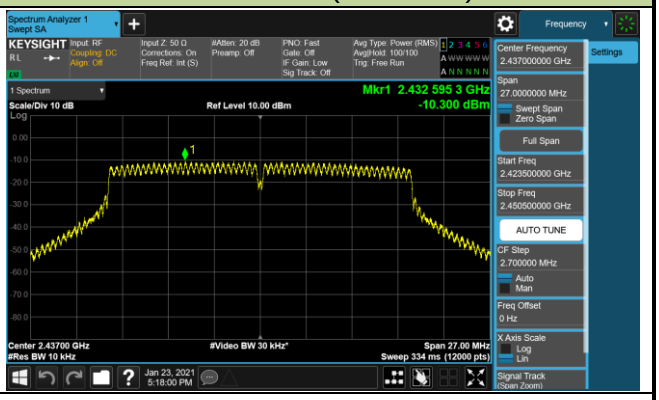


802.11n-HT20 AVGPSD - Ant 1 / Ant 0 + 1

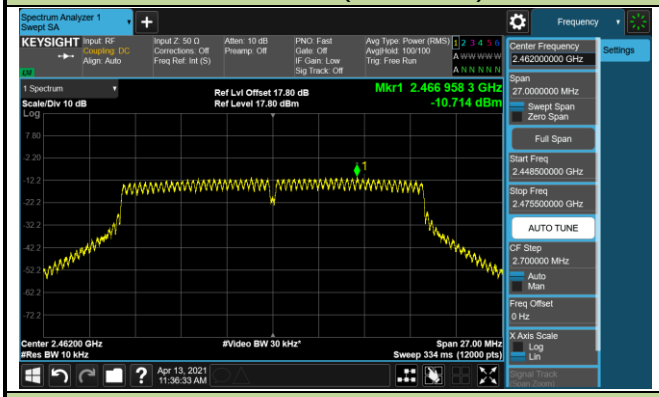
Channel 01 (2412MHz)



Channel 06 (2437MHz)

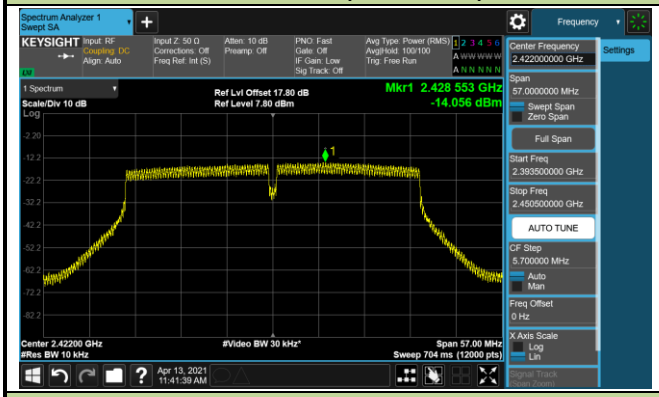


Channel 11 (2462MHz)

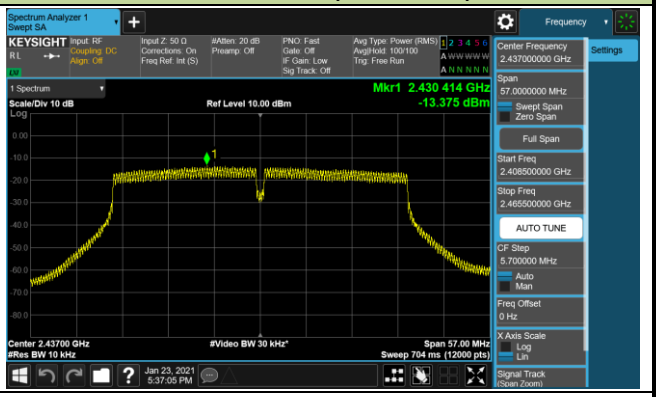


802.11n-HT40 AVGPSD - Ant 1 / Ant 0 + 1

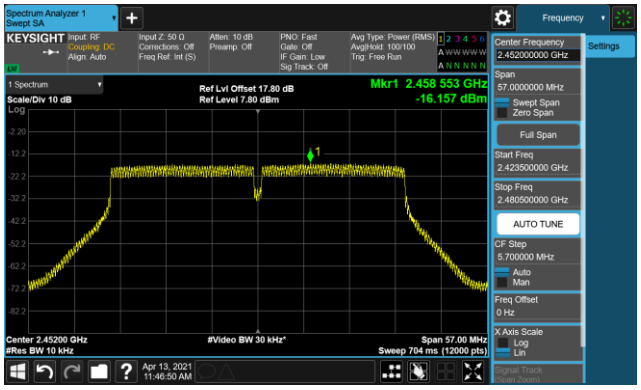
Channel 03 (2422MHz)



Channel 06 (2437MHz)

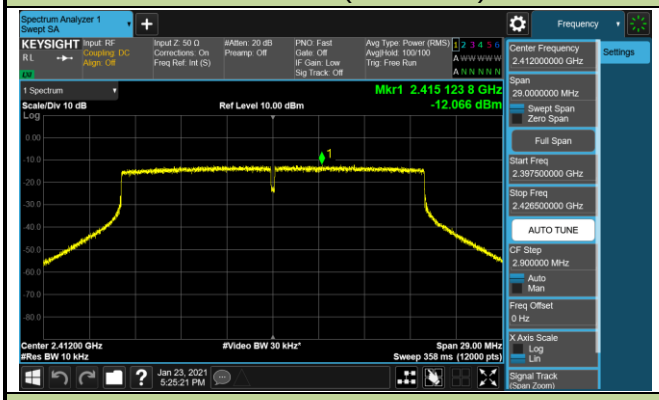


Channel 09 (2452MHz)



802.11ax-HE20 AVGPSD - Ant 1 / Ant 0 + 1

Channel 01 (2412MHz)

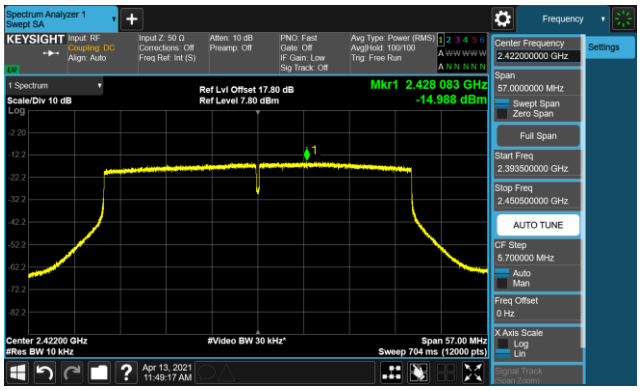


Channel 06 (2437MHz)

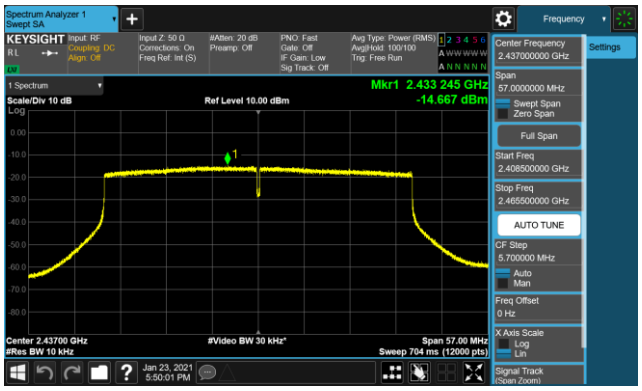
Channel 11 (2462MHz)

802.11ax-HE40 AVGPSD - Ant 1 / Ant 0 + 1

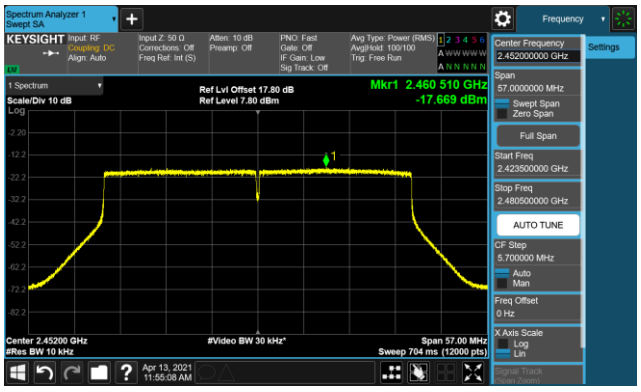
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



7.5. Conducted Band Edge and Out-of-Band Emissions

7.5.1.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.

7.5.2.Test Procedure Used

ANSI C63.10 Section 11.11

7.5.3.Test Setting

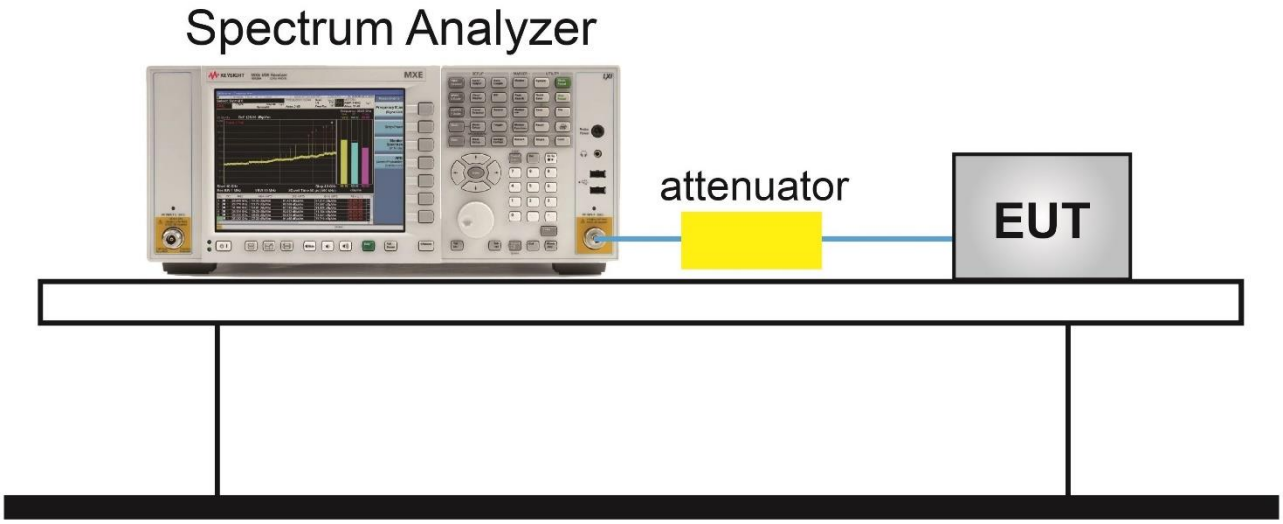
Reference level measurement

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 ≥ 3 x 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 = 100Hz
3. VBW = 300Hz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

7.5.4.Test Setup



7.5.5.Test Result

Product	ACCESS POINT	Test Engineer	Eric Lin
Test Site	SR2	Test Date	2021/01/23
Filter Configuration	Filter 1#		

Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	Limit (dBc)	Result
802.11b	1Mbps	01	2412	30	Pass
802.11b	1Mbps	06	2437	30	Pass
802.11b	1Mbps	11	2462	30	Pass
802.11g	6Mbps	01	2412	30	Pass
802.11g	6Mbps	06	2437	30	Pass
802.11g	6Mbps	11	2462	30	Pass
802.11n-HT20	MCS0	01	2412	30	Pass
802.11n-HT20	MCS0	06	2437	30	Pass
802.11n-HT20	MCS0	11	2462	30	Pass
802.11n-HT40	MCS0	03	2422	30	Pass
802.11n-HT40	MCS0	06	2437	30	Pass
802.11n-HT40	MCS0	09	2452	30	Pass
802.11ax-HE20	MCS0	01	2412	30	Pass
802.11ax-HE20	MCS0	06	2437	30	Pass
802.11ax-HE20	MCS0	11	2462	30	Pass
802.11ax-HE40	MCS0	03	2422	30	Pass
802.11ax-HE40	MCS0	06	2437	30	Pass
802.11ax-HE40	MCS0	09	2452	30	Pass