MEASUREMENT REPORT

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

FCC ID:	Q9DAPIN0514515
APPLICANT:	Hewlett Packard Enterprise Company
Application Type:	Certification
Product:	ACCESS POINT
Model No.:	APIN0514, APIN0515
Brand Name:	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, KDB 558074 D01v05 KDB 662911 D01v02r01
Test Date:	June 19 ~ August 10, 2018

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.

Revision History

Report No.	Version	Description	Issue Date	Note
1807TW0111-U1	Rev. 01	Initial report	08-30-2018	Valid

CONTENTS

§2.1033 General Information

Applicant:	Hewlett Packard Enterprise Company
Applicant Address:	6280 America Center Drive, San Jose, CA 95002
Manufacturer:	Hewlett Packard Enterprise Company
Manufacturer Address:	6280 America Center Drive, San Jose, CA 95002
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.:	153292
Test Device Serial No.:	APIN0514: Conducted Sample S/N: CS18640017 Radiated Sample S/N: CS1864005
	APIN0515: Conducted Sample S/N: CQK85T001C Radiated Sample S/N: CQK85T0003

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Fuxing Rd., Taoyuan, Taiwan (R.O.C)

- **MRT facility is a FCC registered (Reg. No. 153292) test facility with the site description report on file and is designated by the FCC as an Accredited Test Film.**
- **MRT facility is an IC registered (MRT Reg. No. 21723-1) test laboratory with the site description on file at Industry Canada.**
- **MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (TAF) under the American Association for Laboratory Accreditation Program (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC, Industry Taiwan, EU and TELEC Rules.**

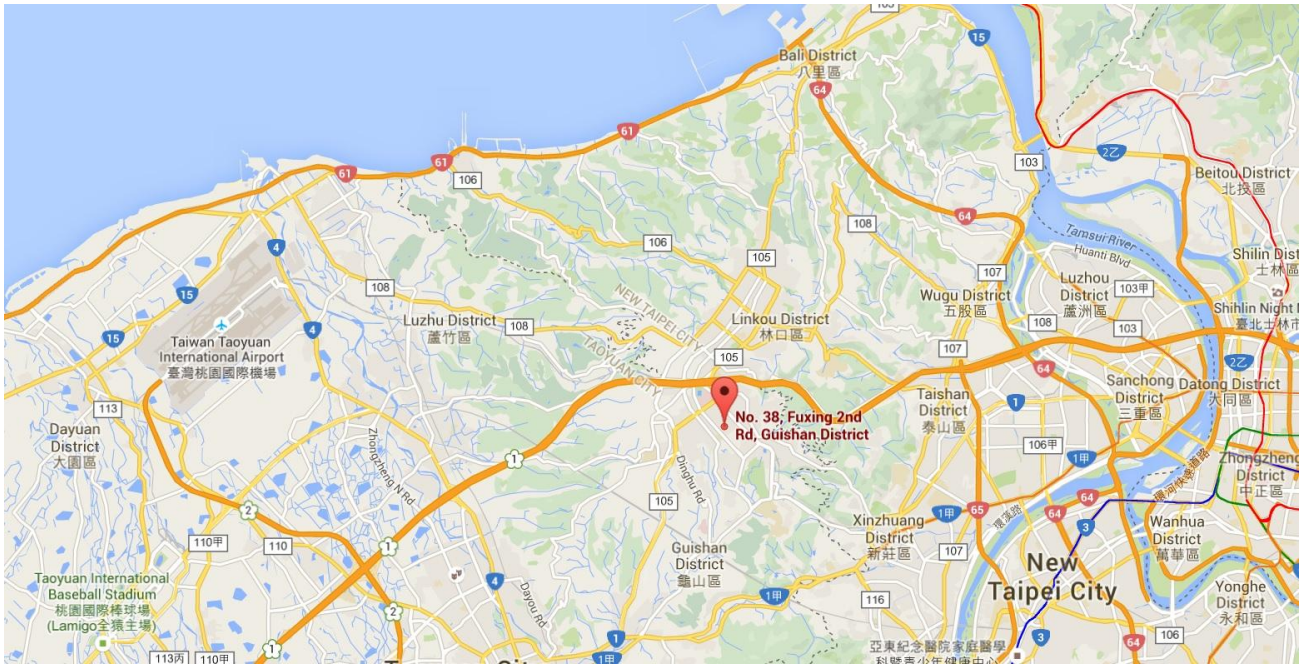
1. INTRODUCTION

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 Industry Canada 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.:	APIN0514, APIN0515
Brand Name:	aruba a Hewlett Packard Enterprise company , Hewlett Packard Enterprise
Wi-Fi Specification:	802.11a/b/g/n/ac/ax
Bluetooth Specification:	v4.2 single mode
Zigbee Specification:	802.15.4
Software Version:	F.0.8
Operating Temperature:	0 ~ 50 °C
Power Type:	AC Adapter or POE input
Operating Environment:	Indoor Use

Note: The difference between models is that EUT use different antenna and appearance, APIN0514 use some external antennas, but APIN0515 use internal antenna, other hardware and software are the same. Besides, each model has its own power parameter value.

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 Available Antennas

Model No.: APIN0514

Antenna No.	Directionality	Frequency Band (GHz)	Model No.	Max Peak Gain (dBi)	BF Gain (dBi)	CDD Directional Gain (dBi)	
						For Power	For PSD
Wi-Fi External Antenna List (2.4GHz 2*2 MIMO, 5GHz 4*4 MIMO)							
1	Omni	2.4	AP-ANT-40	**4.0**	3.01	4.0	7.01
		5		5.0	6.02	5.0	11.02
2	Omni	2.4	AP-ANT-19	3.0	3.01	3.0	6.01
		5		**6.0**	6.02	6.0	12.02
3	Omni	2.4	AP-ANT-1W	3.8	3.01	3.8	6.81
		5		5.8	6.02	5.8	11.82
4	Omni	2.4	AP-ANT-13B	2.3	3.01	2.3	5.31
		5		4.0	6.02	4.0	10.02
5	Omni	2.4	AP-ANT-20W	**2.0**	3.01	2.0	5.01
		5		**2.0**	6.02	2.0	8.02
6 (Note 3)	Directional	2.4	AP-ANT-45	4.5	0.00	4.5	4.50
		5		5.5	3.01	5.5	8.51
7 (Note 3)	Directional	2.4	AP-ANT-48	**8.5**	0.00	8.5	8.5
		5		**8.5**	3.01	8.5	11.51
Bluetooth & ZigBee Internal Antenna							
PCB		2.4		4.9			

Model No.: APIN0515

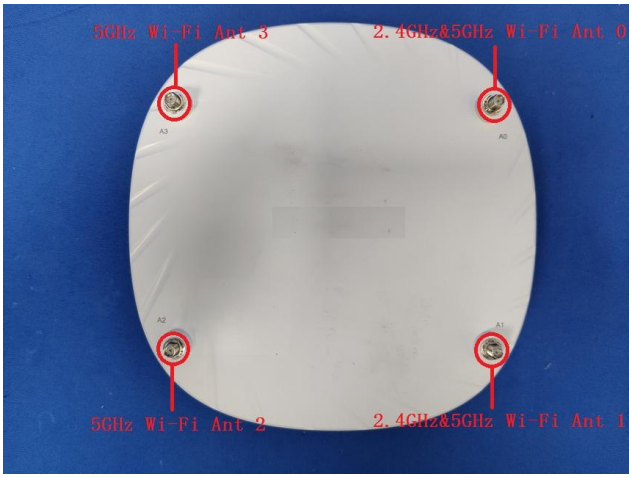
Directionality	Frequency Band (GHz)	Max Peak Gain (dBi)	BF Gain (dBi)	CDD Directional Gain (dBi)	
				For Power	For PSD
Wi-Fi Internal Antenna List (2.4GHz 2*2 MIMO, 5GHz 4*4 MIMO)					
Omni	2.4	3.77	3.01	3.77	6.78
Omni	5	4.55	5.97	4.55	10.52
Bluetooth & ZigBee Internal Antenna					
PCB	2.4	3.5			

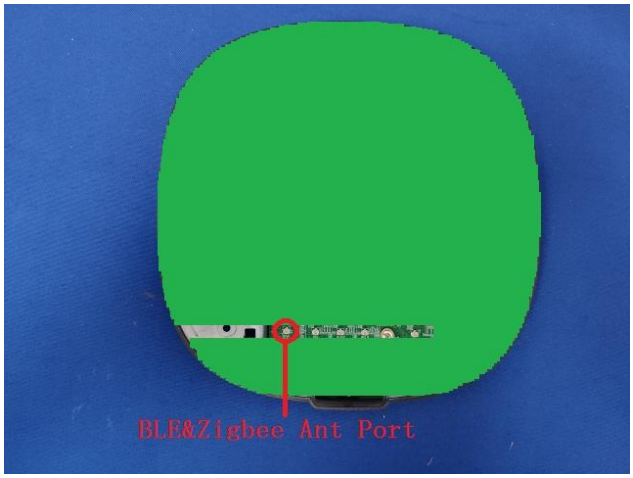
Note:

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 Gain was declared by the applicant.
3. Two antennas have Cross-Polarized design, the detail see the antenna specification.
4. For model APIN0514, the final test antenna list was shown as below table.

Antenna	Conducted Testing	Radiated Testing
Omni Antenna 1# (Max 2.4GHz Omni ANT)	N/A	Yes
Omni Antenna 2# (Max 5GHz Omni ANT)	N/A	Yes
Omni Antenna 5# (Min 2.4&5GHz Omni ANT)	Yes (High Power Setting)	Yes
Directional Antenna 7# (Max 2.4&5GHz Directional ANT)	N/A	Yes

2.5. Description of Antenna RF Port

<table>
<tr><td colspan="7">Antenna RF Port</td></tr>
<tr><td>--</td><td colspan="2">2.4GHz RF Port</td><td colspan="4">5GHz RF Port</td></tr>
<tr><td>Software Control Port</td><td>Ant 0</td><td>Ant 1</td><td>Ant 0</td><td>Ant 1</td><td>Ant 2</td><td>Ant 3</td></tr>
<tr><td colspan="7">APIN0514</td></tr>
<tr><td colspan="7"> 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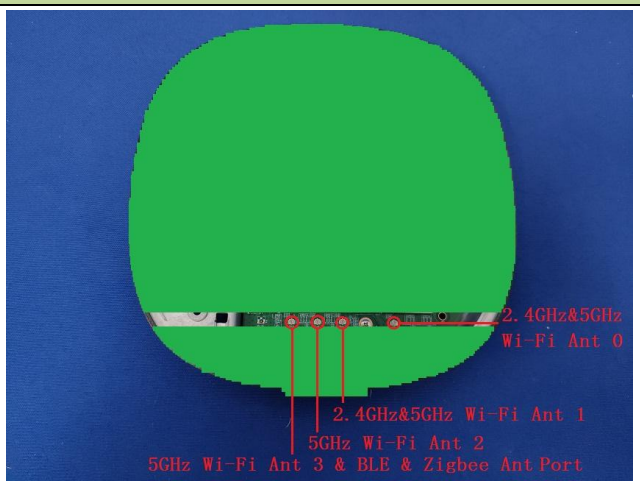
<tr><td colspan="7">APIN0515</td></tr>
<tr><td colspan="7"> 
</td></tr>
</table>

2.6. 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)

2.7. Description of Test Software

The test utility software used during testing was “accessMTool”, and the version was “v3.0.0.7”.

Power Parameter Value for APIN0514 - Omni Antenna (AP-ANT-20W)

Test Mode	Test Frequency (MHz)	Power Parameter Value Ant 0 + 1	Test Mode	Test Frequency (MHz)	Power Parameter Value Ant 0 + 1
802.11b	2412	76	802.11g	2412	76
	2437	75		2437	76
	2462	76		2462	66
802.11n-HT20	2412	77	802.11n-HT40	2422	70
	2437	77		2437	76
	2462	71		2452	67
802.11ax-HE20	2412	70	802.11ax-HE40	2422	70
	2437	75		2437	76
	2457	70			
	2462	61		2452	67

Power Parameter Value for APIN0514 - Omni Antenna (AP-ANT-40):

Test Mode	Test Frequency (MHz)	Power Parameter Value Ant 0 + 1	Test Mode	Test Frequency (MHz)	Power Parameter Value Ant 0 + 1
802.11b	2412	76	802.11g	2412	69
	2437	75		2437	76
	2462	76		2462	66
802.11n-HT20	2412	69	802.11n-HT40	2422	66
	2437	77		2437	76
	2457	77			
	2462	64		2452	67
802.11ax-HE20	2412	70	802.11ax-HE40	2422	70
	2437	75		2437	73
	2457	70			
	2462	61		2452	65

Power Parameter Value for APIN0514 - Directional Antenna (AP-ANT-48):

Test Mode	Test Frequency (MHz)	Power Parameter Value Ant 0 + 1	Test Mode	Test Frequency (MHz)	Power Parameter Value Ant 0 + 1
802.11b	2412	71	802.11g	2412	69
	2437	75		2437	76
	2462	66		2462	66
802.11n-HT20	2412	72	802.11n-HT40	2422	70
	2437	77		2437	76
	2462	67		2452	65
802.11ax-HE20	2412	70	802.11ax-HE40	2422	66
	2437	75		2437	76
	2457	70			
	2462	60		2452	65

Power Parameter Value for APIN0515:

Test Mode	Test Frequency (MHz)	Power Parameter Value Ant 0 + 1	Test Mode	Test Frequency (MHz)	Power Parameter Value Ant 0 + 1
802.11b	2412	76	802.11g	2412	68
	2437	76		2437	70
	2462	76		2462	64
802.11n-HT20	2412	69	802.11n-HT40	2422	64
	2437	70		2437	72
				2447	65
	2462	63		2452	60
802.11ax-HE20	2412	66	802.11ax-HE40	2422	64
	2437	69		2437	72
	2462	59		2452	62

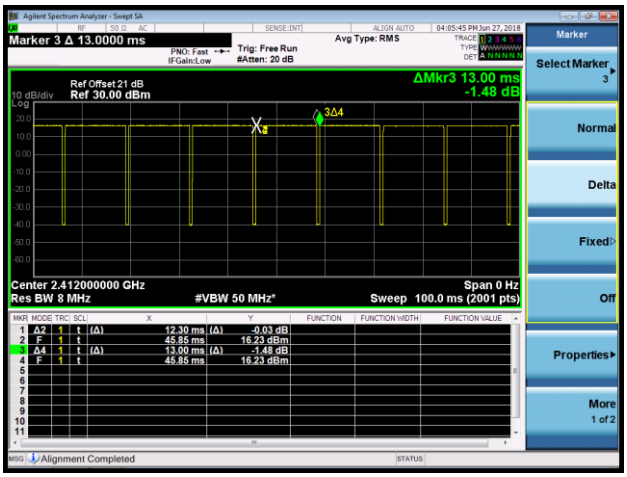
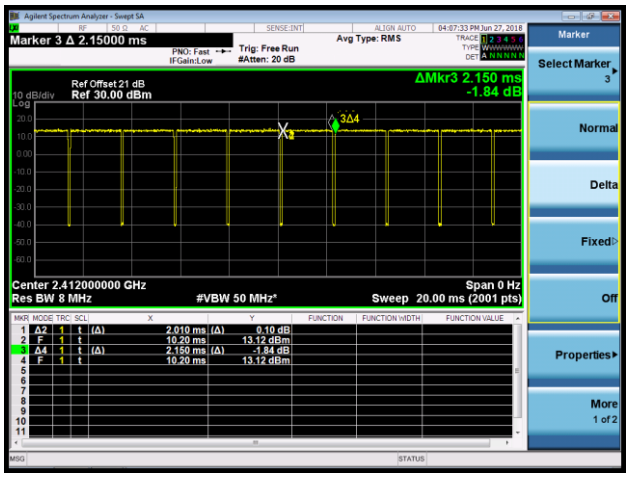
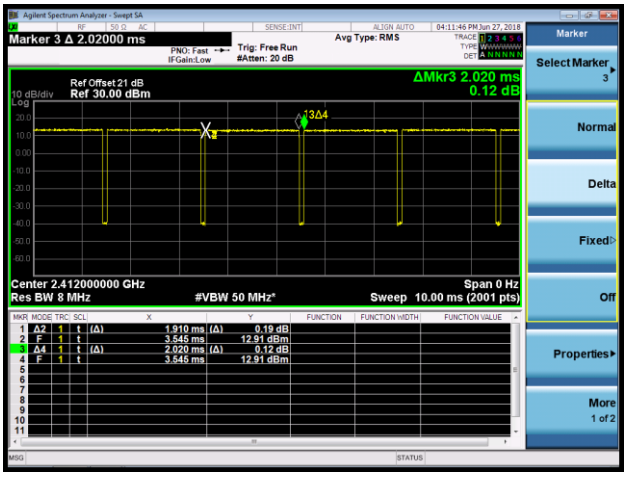
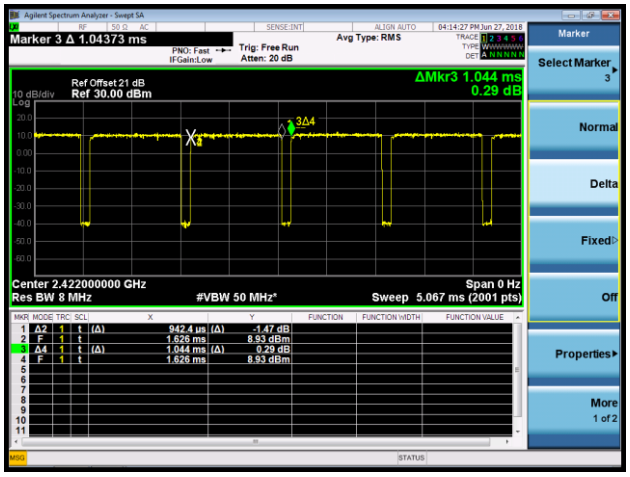
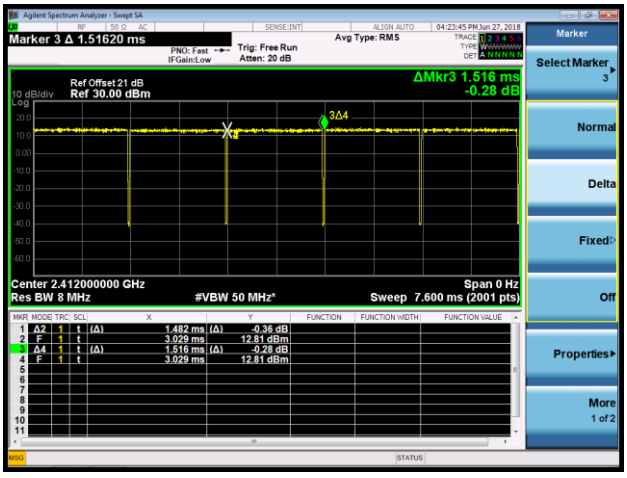
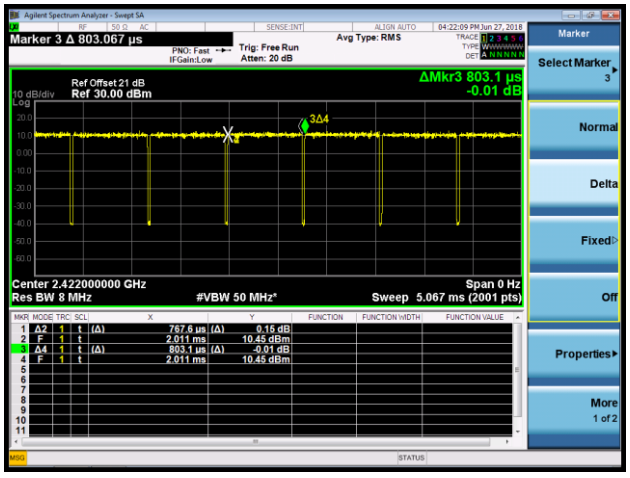
2.8. Device Capabilities

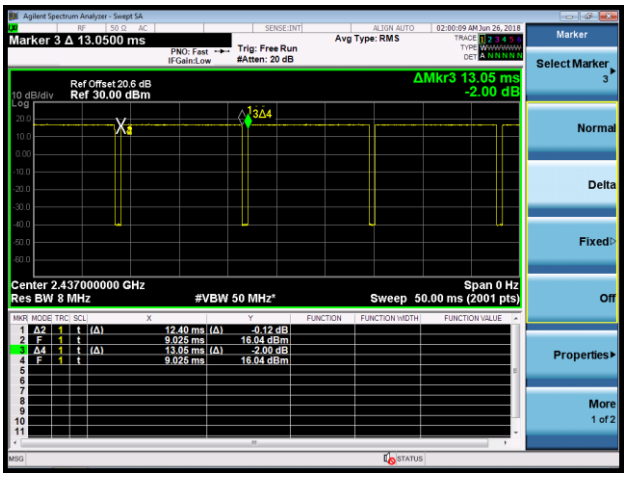
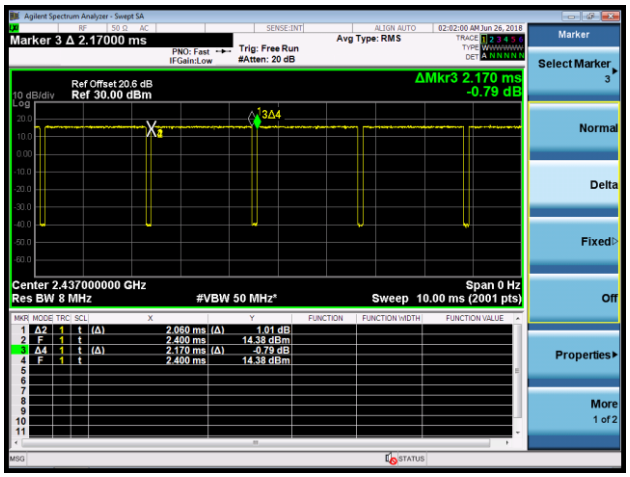
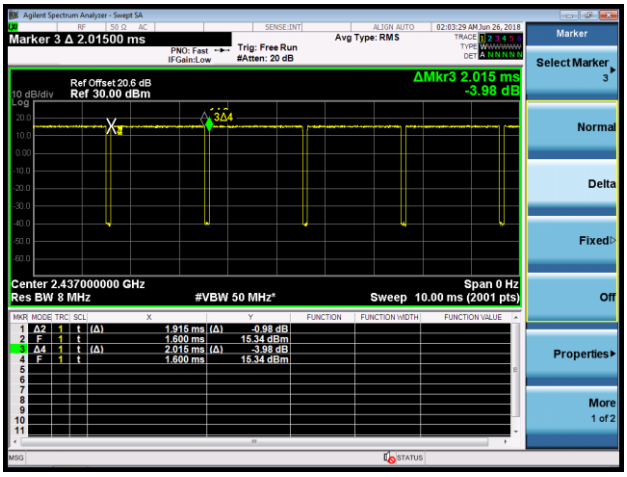
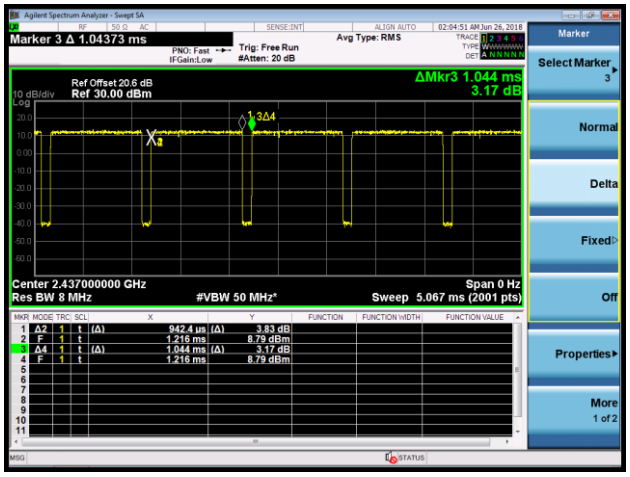
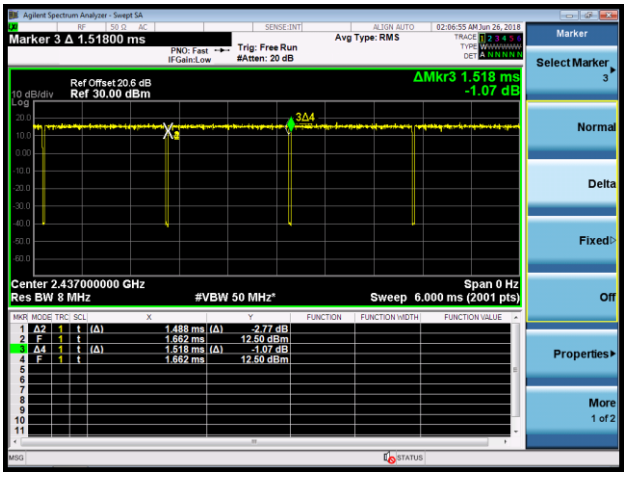
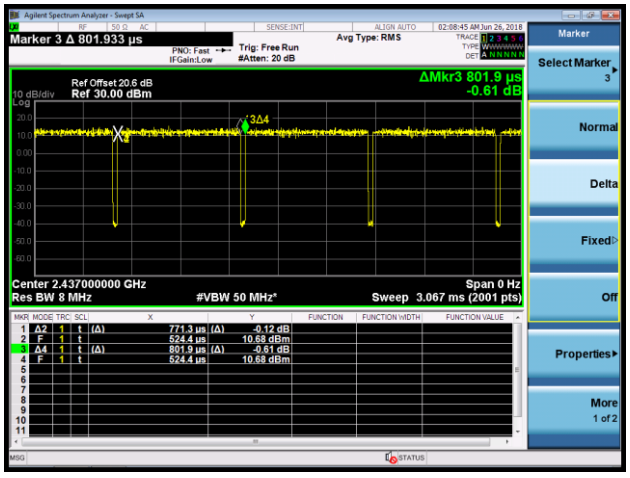
This device contains the following capabilities:

802.11a/b/g/n/ac/ax Wi-Fi, Bluetooth v4.2 single mode and Zigbee devices.

Note: 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:

Model No.	Test Mode	Duty Cycle
APIN0514	802.11b	94.62%
	802.11g	93.49%
	802.11n-HT20	94.55%
	802.11n-HT40	90.27%
	802.11ax-HE20	97.76%
	802.11ax-HE40	95.58%
APIN0515	802.11b	95.02%
	802.11g	94.93%
	802.11n-HT20	95.04%
	802.11n-HT40	90.27%
	802.11ax-HE20	98.02%
	802.11ax-HE40	96.18%

Duty Cycle (T = Transmission Duration) - APIN0514	
802.11b (T = 12.30ms)	802.11g (T = 2.010ms)
	
802.11n-HT20 (T = 1.910ms)	802.11n-HT40 (T = 942.4us)
	
802.11ax-HE20 (T = 1.482ms)	802.11ax-HE40 (T = 767.6us)
	

Duty Cycle (T = Transmission Duration) - APIN0515	
802.11b (T = 12.40ms)	802.11g (T = 2.060ms)
	
802.11n-HT20 (T = 1.915ms)	802.11n-HT40 (T = 942.4us)
	
802.11ax-HE20 (T = 1.488ms)	802.11ax-HE40 (T = 771.3us)
	

2.9. Test Configuration

The **ACCESS POINT** was tested per the guidance of ANSI C63.10-2013. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

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

Per 2.1074 & 15.19; Docket 95-19

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 for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 558074 D01v05 were used in the measurement of the **ACCESS POINT.**

Deviation from measurement procedure…….....None

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."

For APIN0515

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

For APIN0514

- The antenna of the ACCESS POINT uses a reversed SMA connector.

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
EMI Test Receiver	R&S	ESR3	MRTTWA00045	1 year	2019/03/17
Two-Line V-Network	R&S	ENV216	MRTTWA00019	1 year	2019/03/23
Two-Line V-Network	R&S	ENV216	MRTTWA00020	1 year	2019/03/23
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2019/06/08

Radiated Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Signal Analyzer	R&S	FSV40	MRTTWA00007	1 year	2019/03/02
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2019/03/16
Broadband Preamplifier	SCHWARZBECK	BBV 9718	MRTTWA00005	1 year	2019/04/06
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	1 year	2019/04/06
Acitve Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	1 year	2019/04/06
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2019/04/06
Broadband Hornantenna	SCHWARZBECK	BBHA 9120D	MRTTWA00003	1 year	2019/04/06
Breitband Hornantenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	1 year	2019/04/06
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2019/06/08

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2018/07/10
				1 year	2019/07/10
PSA Series Spectrum Analyzer	Agilent	E4447A	MRTTWA00060	1 year	2018/12/11
X-Series USB Peak and Average Power Sensor	KEYSIGHT	U2021XA	MRTTWA00014	1 year	2019/03/18
X-Series USB Peak and Average Power Sensor	KEYSIGHT	U2021XA	MRTTWA00015	1 year	2019/03/18
Programmable Temperature & Humidity Chamber	TEN BILLION	TTH-B3UP	MRTTWA00036	1 year	2019/05/10
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2019/06/08

Software	Version	Function
e3	V 8.3.5	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 - SR2
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 150kHz~30MHz: 3.46dB
Radiated Emission Measurement - AC1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: 4.18dB 1GHz ~ 25GHz: 4.76dB
Spurious Emissions, Conducted - SR1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.78dB
Output Power - SR1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.13dB
Power Spectrum Density - SR1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.15dB
Occupied Bandwidth - SR1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.28%

7. TEST RESULT

7.1. Summary

Product Name: **ACCESS POINT**

FCC ID: **Q9DAPIN0514515**

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 Limits (Restricted Bands and Radiated Emission Limits)	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) Test Items “6dB Bandwidth” & “Band Edge / Out-of-Band Emissions” have been assessed MIMO transmission, and showed the worst test data in this report.

7.2. 6dB Bandwidth Measurement

7.2.1.Test Limit

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

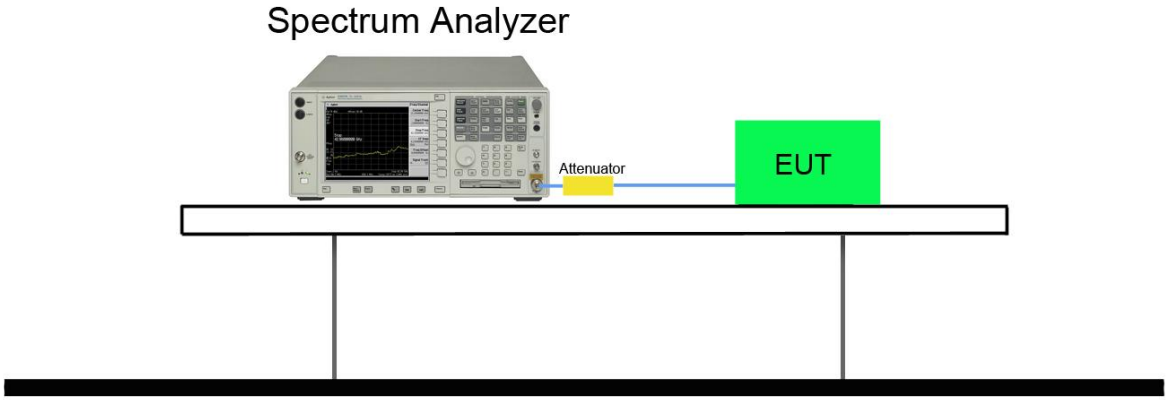
7.2.2.Test Procedure used

ANSI C63.10-2013 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

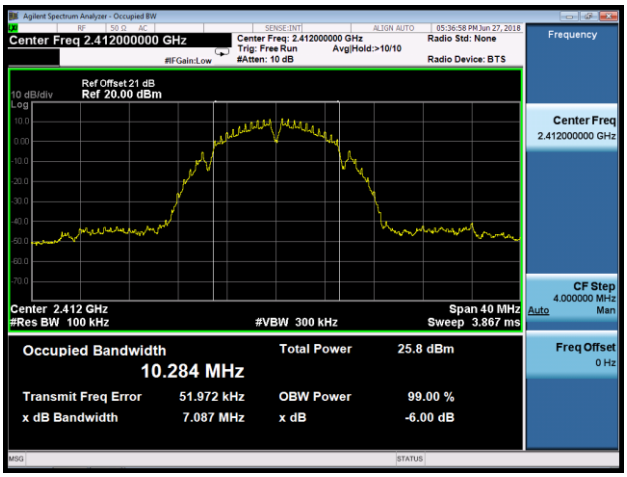
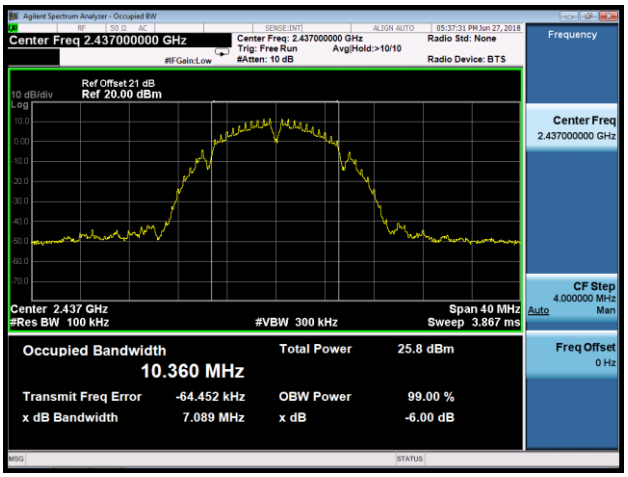
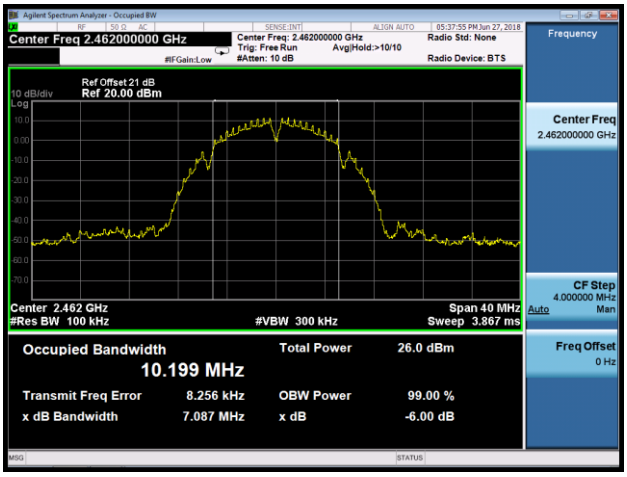
7.2.4.Test Setup

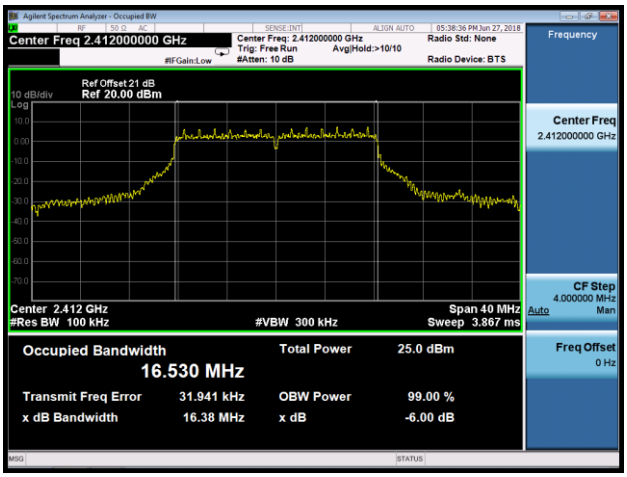
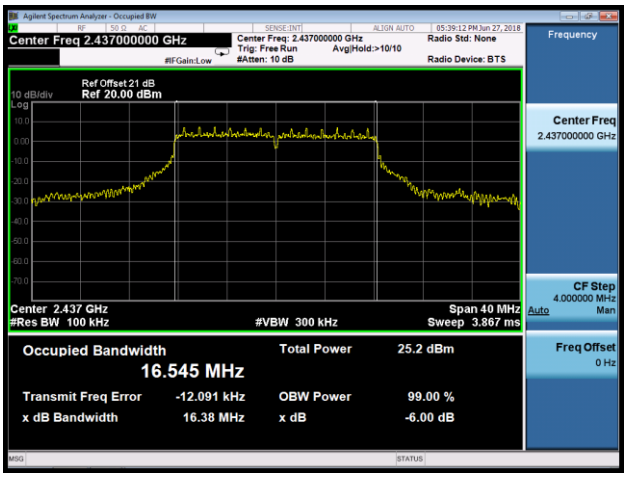
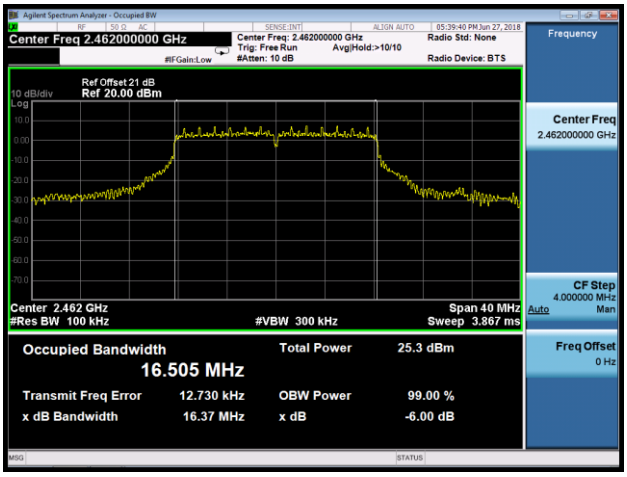


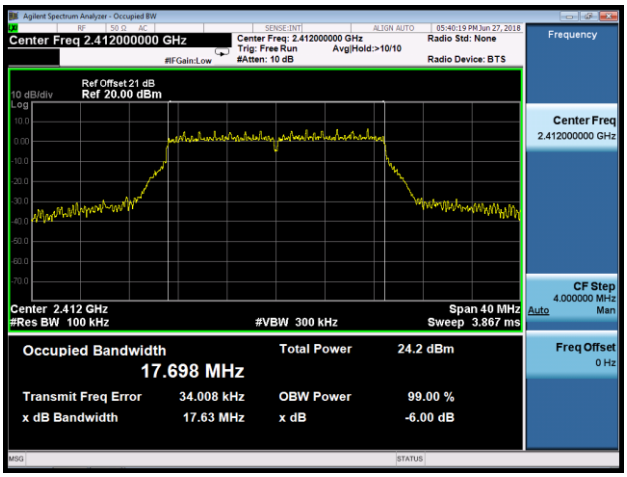
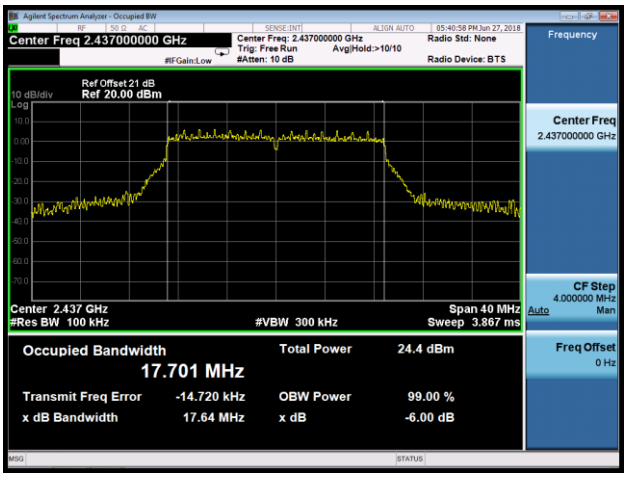
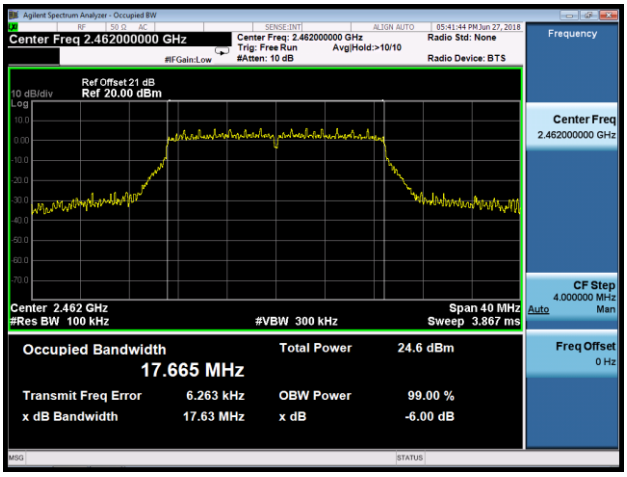
7.2.5.Test Result

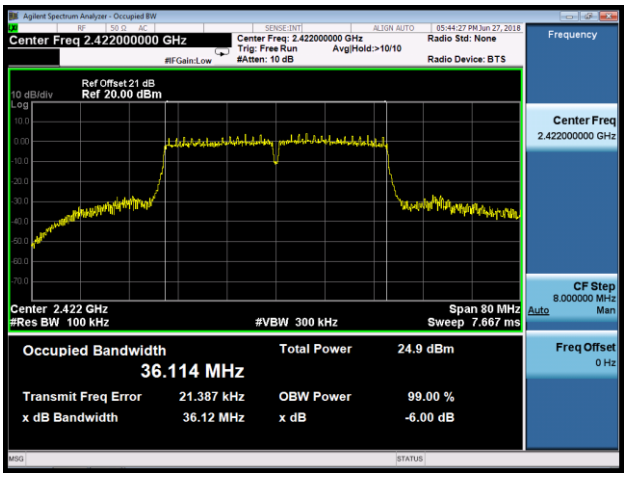
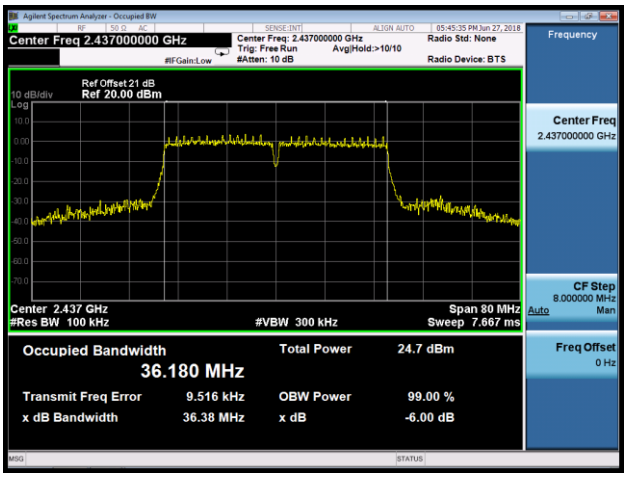
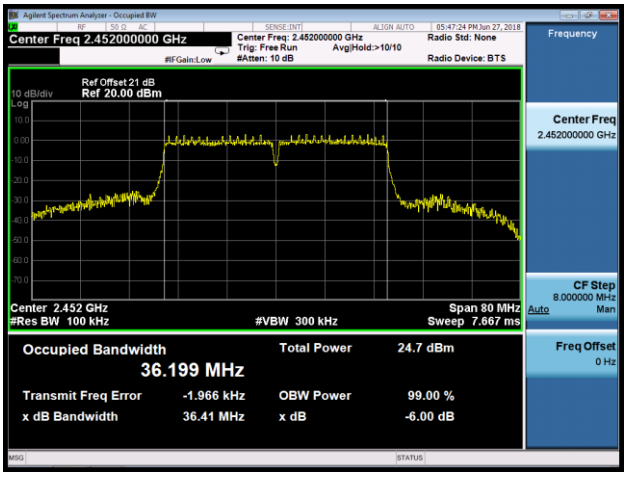
Product	ACCESS POINT	Temperature	25°C
Test Engineer	Kevin Ker	Relative Humidity	54%
Test Site	SR2	Test Date	2018/06/27
Model No.	APIN0514	Test Item	6dB Bandwidth

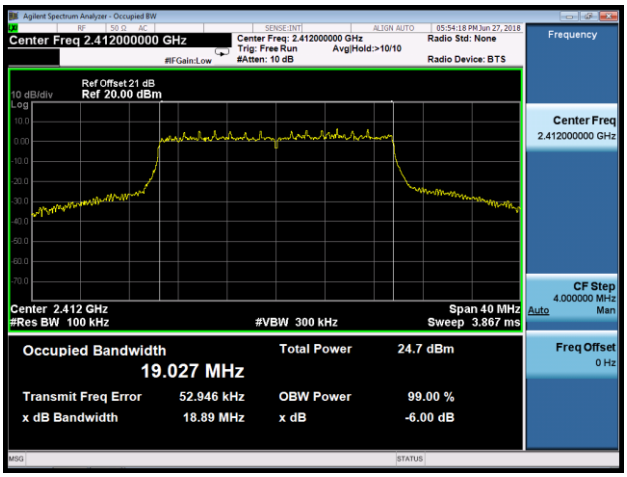
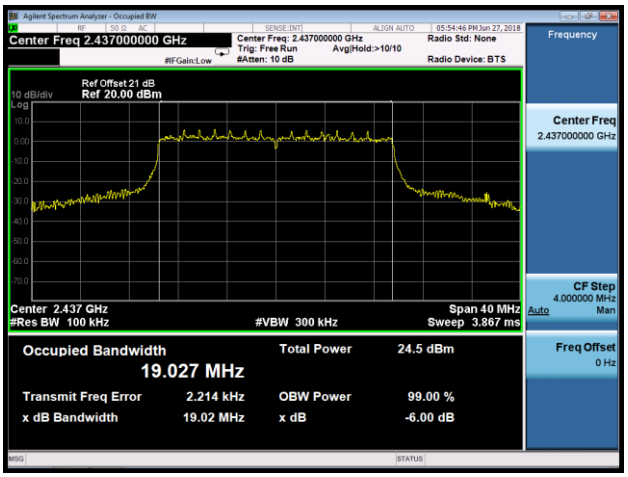
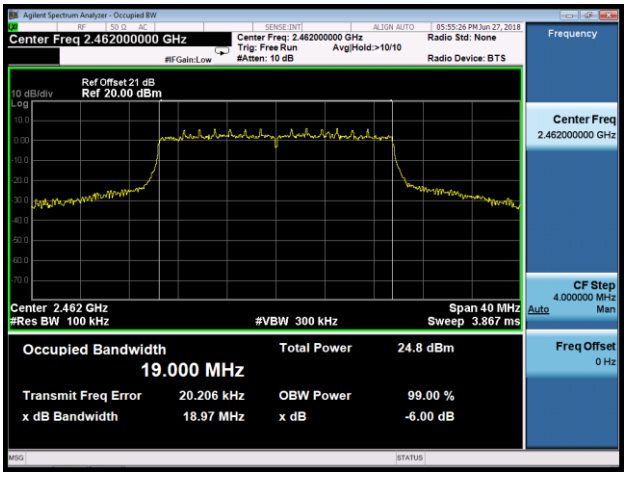
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Ant 1 / Ant 0 + 1						
802.11b	1Mbps	01	2412	7.09	≥ 0.5	Pass
802.11b	1Mbps	06	2437	7.09	≥ 0.5	Pass
802.11b	1Mbps	11	2462	7.09	≥ 0.5	Pass
802.11g	6Mbps	01	2412	16.38	≥ 0.5	Pass
802.11g	6Mbps	06	2437	16.38	≥ 0.5	Pass
802.11g	6Mbps	11	2462	16.37	≥ 0.5	Pass
802.11n-HT20	MCS0	01	2412	17.63	≥ 0.5	Pass
802.11n-HT20	MCS0	06	2437	17.64	≥ 0.5	Pass
802.11n-HT20	MCS0	11	2462	17.63	≥ 0.5	Pass
802.11n-HT40	MCS0	03	2422	36.12	≥ 0.5	Pass
802.11n-HT40	MCS0	06	2437	36.38	≥ 0.5	Pass
802.11n-HT40	MCS0	09	2452	36.41	≥ 0.5	Pass
802.11ax-HE20	MCS0	01	2412	18.89	≥ 0.5	Pass
802.11ax-HE20	MCS0	06	2437	19.02	≥ 0.5	Pass
802.11ax-HE20	MCS0	11	2462	18.97	≥ 0.5	Pass
802.11ax-HE40	MCS0	03	2422	36.41	≥ 0.5	Pass
802.11ax-HE40	MCS0	06	2437	36.49	≥ 0.5	Pass
802.11ax-HE40	MCS0	09	2452	37.35	≥ 0.5	Pass

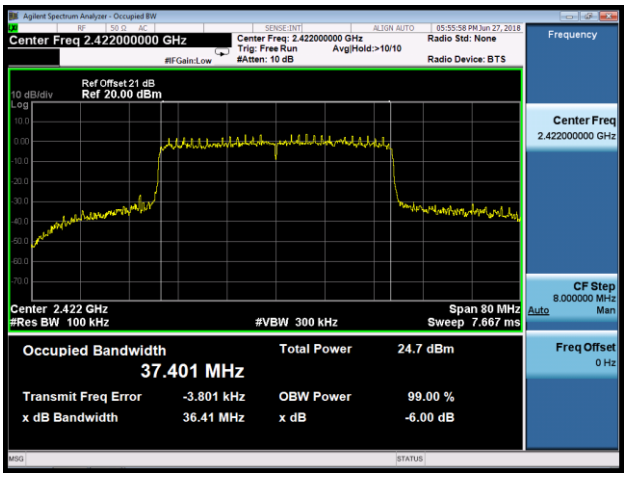
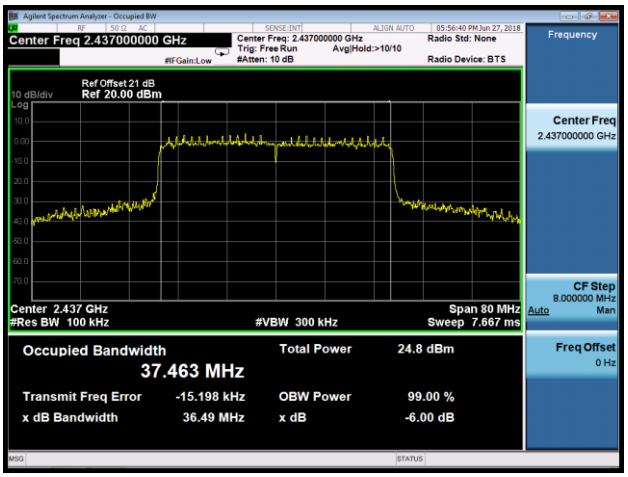
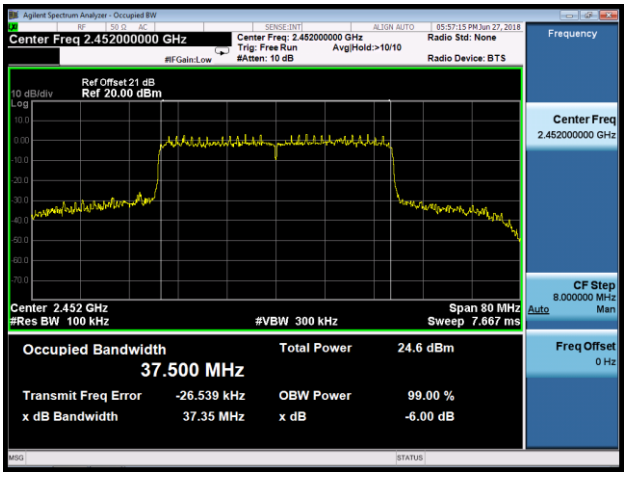
802.11b 6dB Bandwidth - Ant 1 / Ant 0 + 1	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

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

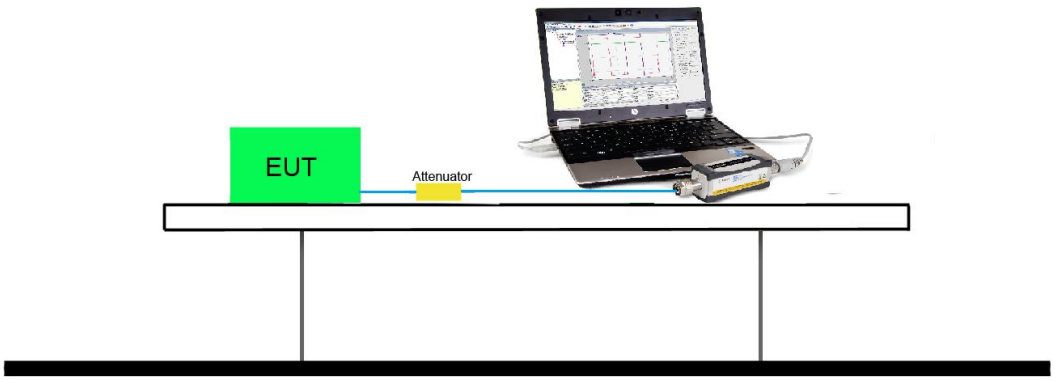
ANSI C63.10 Section 11.9.2.3

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 of Output Power

Power output test was verified over all data rates of each mode shown as below table, and then choose the maximum power output (gray marker) for final test of each channel.

For Ant 1 / Ant 0 + 1 port of APIN0514 (Antenna Mode No.: AP-ANT-20W):

Test Mode	Bandwidth (MHz)	Channel No.	Frequency (MHz)	Data Rate/ MCS	Average Power (dBm)
802.11b	20	6	2437	1Mbps	18.29
				5.5Mbps	18.01
				11Mbps	17.76
802.11g	20	6	2437	6Mbps	18.04
				24Mbps	17.78
				54Mbps	17.54
802.11n	20	6	2437	MCS0	18.24
				MCS3	17.95
				MCS7	17.65
802.11n	40	6	2437	MCS0	18.24
				MCS3	18.01
				MCS7	17.78
802.11ax	20	6	2437	MCS0	18.29
				MCS5	18.03
				MCS11	17.78
802.11ax	40	6	2437	MCS0	18.30
				MCS5	18.01
				MCS11	17.81

Product	ACCESS POINT	Temperature	25°C
Test Engineer	Kevin Ker	Relative Humidity	54%
Test Site	SR2	Test Date	2018/06/30
Model No.	APIN0514	Test Item	Output Power
Antenna Model No.	AP-ANT-20W		

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)	Max E.I.R.P (dBm)	Result
11b	1Mbps	01	2412	18.03	18.33	21.19	≤ 30.00	23.19	Pass
11b	1Mbps	06	2437	17.82	18.29	21.07	≤ 30.00		Pass
11b	1Mbps	11	2462	17.83	18.11	20.98	≤ 30.00		Pass
11g	6Mbps	01	2412	17.45	18.05	20.77	≤ 30.00	22.79	Pass
11g	6Mbps	06	2437	17.50	18.04	20.79	≤ 30.00		Pass
11g	6Mbps	11	2462	14.93	15.59	18.28	≤ 30.00		Pass
11n-HT20	MCS0	01	2412	17.73	18.07	20.91	≤ 30.00	23.06	Pass
11n-HT20	MCS0	06	2437	17.85	18.24	21.06	≤ 30.00		Pass
11n-HT20	MCS0	11	2462	16.30	16.74	19.54	≤ 30.00		Pass
11n-HT40	MCS0	03	2422	16.07	16.65	19.38	≤ 30.00	23.04	Pass
11n-HT40	MCS0	06	2437	17.81	18.24	21.04	≤ 30.00		Pass
11n-HT40	MCS0	09	2452	15.33	15.73	18.54	≤ 30.00		Pass
11ax-HE20	MCS0	01	2412	16.34	16.72	19.54	≤ 30.00	23.10	Pass
11ax-HE20	MCS0	06	2437	17.89	18.29	21.10	≤ 30.00		Pass
11ax-HE20	MCS0	10	2457	16.82	17.60	20.24	≤ 30.00		Pass
11ax-HE20	MCS0	11	2462	14.11	14.64	17.39	≤ 30.00		Pass
11ax-HE40	MCS0	03	2422	16.22	16.73	19.49	≤ 30.00	23.09	Pass
11ax-HE40	MCS0	06	2437	17.84	18.30	21.09	≤ 30.00		Pass
11ax-HE40	MCS0	09	2452	15.33	15.77	18.57	≤ 30.00		Pass

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

Note 2: Max E.I.R.P (dBm) = The Max Total Average Power (dBm) + Antenna Gain (dBi), Antenna Gain = 2 dBi.

Product	ACCESS POINT	Temperature	25°C
Test Engineer	Kevin Ker	Relative Humidity	54%
Test Site	SR2	Test Date	2018/06/26
Model No.	APIN0515	Test Item	Output Power

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)	Max E.I.R.P (dBm)	Result
11b	1Mbps	01	2412	18.06	18.22	21.15	≤ 30.00	25.04	Pass
11b	1Mbps	06	2437	18.16	18.36	21.27	≤ 30.00		Pass
11b	1Mbps	11	2462	18.02	18.28	21.16	≤ 30.00		Pass
11g	6Mbps	01	2412	17.52	17.33	20.44	≤ 30.00	24.83	Pass
11g	6Mbps	06	2437	17.99	18.11	21.06	≤ 30.00		Pass
11g	6Mbps	11	2462	16.35	16.40	19.39	≤ 30.00		Pass
11n-HT20	MCS0	01	2412	17.56	17.68	20.63	≤ 30.00	24.82	Pass
11n-HT20	MCS0	06	2437	18.03	18.05	21.05	≤ 30.00		Pass
11n-HT20	MCS0	11	2462	16.28	16.25	19.28	≤ 30.00		Pass
11n-HT40	MCS0	03	2422	16.29	15.11	18.75	≤ 30.00	24.94	Pass
11n-HT40	MCS0	06	2437	18.34	17.97	21.17	≤ 30.00		Pass
11n-HT40	MCS0	08	2447	16.41	15.82	19.14	≤ 30.00		Pass
11n-HT40	MCS0	09	2452	15.40	14.79	18.12	≤ 30.00		Pass
11ax-HE20	MCS0	01	2412	17.23	17.01	20.13	≤ 30.00	24.99	Pass
11ax-HE20	MCS0	06	2437	18.34	18.07	21.22	≤ 30.00		Pass
11ax-HE20	MCS0	11	2462	15.32	15.55	18.45	≤ 30.00		Pass
11ax-HE40	MCS0	03	2422	16.33	16.22	19.29	≤ 30.00	25.03	Pass
11ax-HE40	MCS0	06	2437	18.39	18.10	21.26	≤ 30.00		Pass
11ax-HE40	MCS0	09	2452	15.48	15.30	18.40	≤ 30.00		Pass

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

Note 2: Max E.I.R.P (dBm) = The Max Total Average Power (dBm) + Antenna Gain (dBi), Antenna Gain = 3.77 dBi.

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.

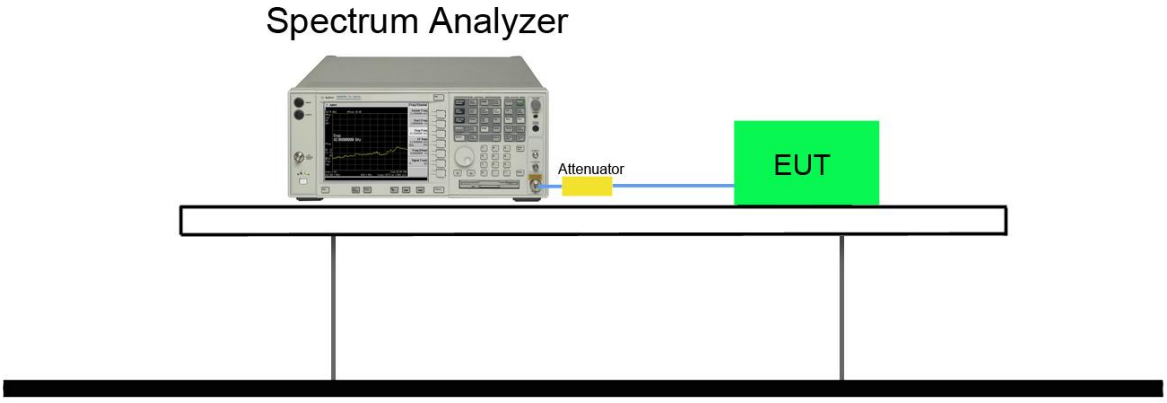
7.4.2.Test Procedure Used

ANSI C63.10 Section 11.10.6

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.
13. Add Constant Factor = 10*log(3kHz / 10kHz) = -5.23.

7.4.4.Test Setup



7.4.5.Test Result

Product	ACCESS POINT	Temperature	25°C
Test Engineer	Kevin Ker	Relative Humidity	54%
Test Site	SR2	Test Date	2018/07/07
Model No.	APIN0514	Test Item	Power Spectral Density
Antenna Model No.	AP-ANT-20W		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Ant 0 AVGPSD (dBm / 10kHz)	Ant 1 AVGPSD (dBm / 10kHz)	Duty Cycle (%)	Constant Factor (dB)	Total AVGPSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
11b	1Mbps	01	2412	-7.89	-7.46	94.62	-5.23	-9.65	≤ 8.0	Pass
11b	1Mbps	06	2437	-7.47	-7.86	94.62	-5.23	-9.64	≤ 8.0	Pass
11b	1Mbps	11	2462	-7.22	-7.14	94.62	-5.23	-9.16	≤ 8.0	Pass
11g	6Mbps	01	2412	-10.48	-9.37	93.49	-5.23	-11.82	≤ 8.0	Pass
11g	6Mbps	06	2437	-9.49	-9.09	93.49	-5.23	-11.21	≤ 8.0	Pass
11g	6Mbps	11	2462	-13.09	-11.69	93.49	-5.23	-14.26	≤ 8.0	Pass
11n-HT20	MCS0	01	2412	-10.24	-9.55	94.55	-5.23	-11.86	≤ 8.0	Pass
11n-HT20	MCS0	06	2437	-10.08	-9.62	94.55	-5.23	-11.82	≤ 8.0	Pass
11n-HT20	MCS0	11	2462	-11.75	-10.63	94.55	-5.23	-13.13	≤ 8.0	Pass
11n-HT40	MCS0	03	2422	-13.25	-12.35	90.27	-5.23	-14.55	≤ 8.0	Pass
11n-HT40	MCS0	06	2437	-12.14	-11.01	90.27	-5.23	-13.31	≤ 8.0	Pass
11n-HT40	MCS0	09	2452	-14.48	-13.98	90.27	-5.23	-16.00	≤ 8.0	Pass
11ax-HE20	MCS0	01	2412	-12.33	-11.26	97.76	-5.23	-13.88	≤ 8.0	Pass
11ax-HE20	MCS0	06	2437	-10.94	-9.10	97.76	-5.23	-12.04	≤ 8.0	Pass
11ax-HE20	MCS0	11	2462	-14.32	-13.63	97.76	-5.23	-16.08	≤ 8.0	Pass
11ax-HE40	MCS0	03	2422	-14.03	-12.76	95.58	-5.23	-15.37	≤ 8.0	Pass
11ax-HE40	MCS0	06	2437	-12.87	-11.41	95.58	-5.23	-14.10	≤ 8.0	Pass
11ax-HE40	MCS0	09	2452	-15.68	-14.53	95.58	-5.23	-17.09	≤ 8.0	Pass

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

Note 2: 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) + Constant Factor.

Product	ACCESS POINT	Temperature	25°C
Test Engineer	Kevin Ker	Relative Humidity	54%
Test Site	SR2	Test Date	2018/06/26
Model No.	APIN0515	Test Item	Power Spectral Density

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Ant 0 AVGPSD (dBm / 10kHz)	Ant 1 AVGPSD (dBm / 10kHz)	Duty Cycle (%)	Constant Factor (dB)	Total AVGPSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
11b	1Mbps	01	2412	-8.37	-8.25	95.02	-5.23	-10.31	≤ 7.22	Pass
11b	1Mbps	06	2437	-8.03	-7.77	95.02	-5.23	-9.90	≤ 7.22	Pass
11b	1Mbps	11	2462	-8.27	-7.96	95.02	-5.23	-10.11	≤ 7.22	Pass
11g	6Mbps	01	2412	-10.69	-10.39	94.93	-5.23	-12.53	≤ 7.22	Pass
11g	6Mbps	06	2437	-9.62	-9.36	94.93	-5.23	-11.48	≤ 7.22	Pass
11g	6Mbps	11	2462	-11.50	-10.72	94.93	-5.23	-13.09	≤ 7.22	Pass
11n-HT20	MCS0	01	2412	-10.51	-10.18	95.04	-5.23	-12.34	≤ 7.22	Pass
11n-HT20	MCS0	06	2437	-10.10	-10.29	95.04	-5.23	-12.19	≤ 7.22	Pass
11n-HT20	MCS0	11	2462	-12.21	-11.45	95.04	-5.23	-13.81	≤ 7.22	Pass
11n-HT40	MCS0	03	2422	-13.71	-13.84	90.27	-5.23	-15.55	≤ 7.22	Pass
11n-HT40	MCS0	06	2437	-11.94	-12.75	90.27	-5.23	-14.10	≤ 7.22	Pass
11n-HT40	MCS0	09	2452	-15.34	-16.29	90.27	-5.23	-17.56	≤ 7.22	Pass
11ax-HE20	MCS0	01	2412	-12.00	-11.70	98.02	-5.23	-14.07	≤ 7.22	Pass
11ax-HE20	MCS0	06	2437	-10.81	-10.75	98.02	-5.23	-13.00	≤ 7.22	Pass
11ax-HE20	MCS0	11	2462	-14.29	-13.82	98.02	-5.23	-16.27	≤ 7.22	Pass
11ax-HE40	MCS0	03	2422	-14.28	-15.25	96.18	-5.23	-16.79	≤ 7.22	Pass
11ax-HE40	MCS0	06	2437	-13.15	-12.89	96.18	-5.23	-15.07	≤ 7.22	Pass
11ax-HE40	MCS0	09	2452	-15.43	-16.39	96.18	-5.23	-17.93	≤ 7.22	Pass

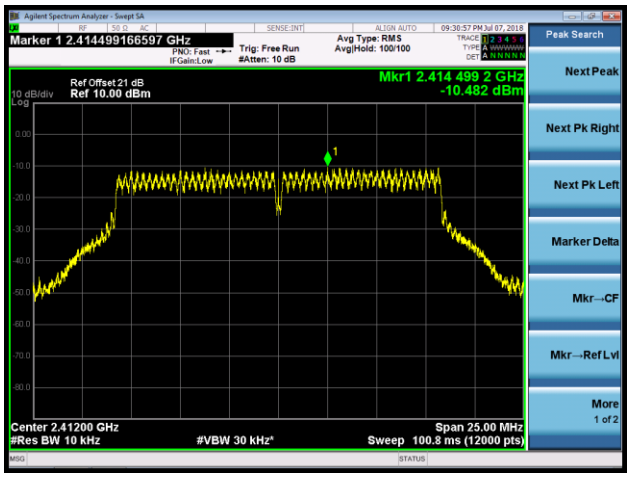
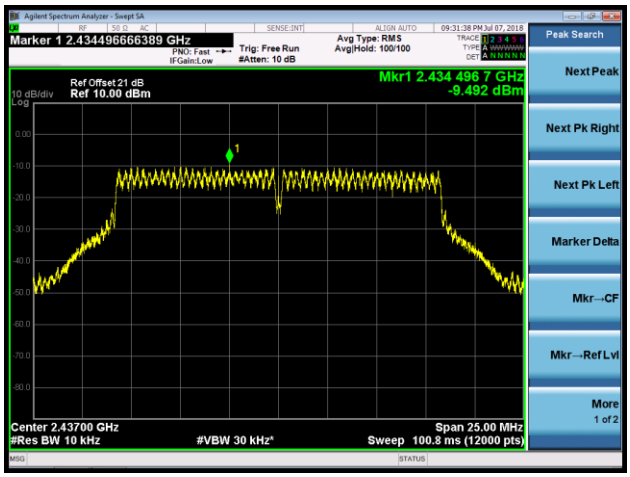
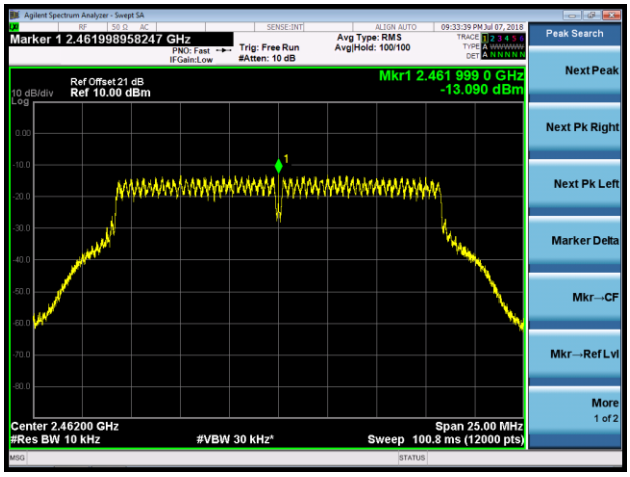
Note 1: When EUT duty cycle ≥ 98%, Total AVGPSD = 10*log $\{10^{(\text{Ant 0 AVGPSD}/10)} + 10^{(\text{Ant 1 AVGPSD}/10)}\}$ + Constant Factor.

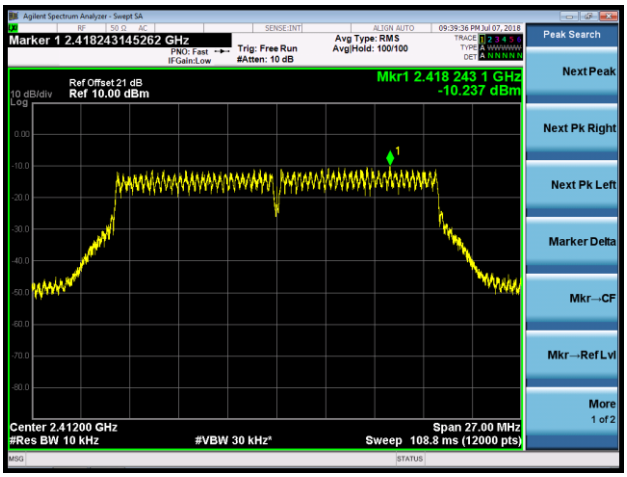
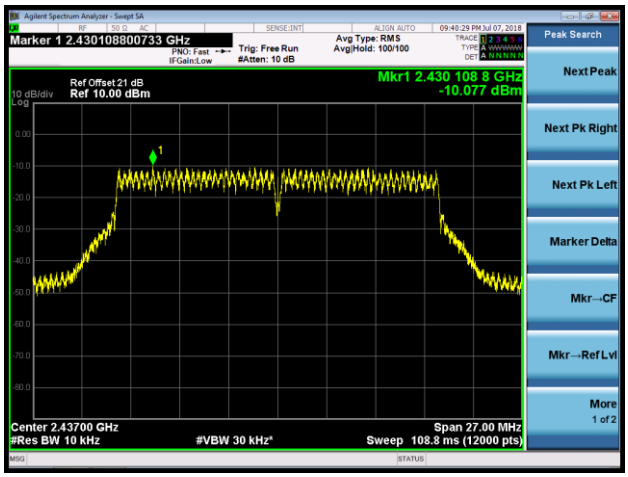
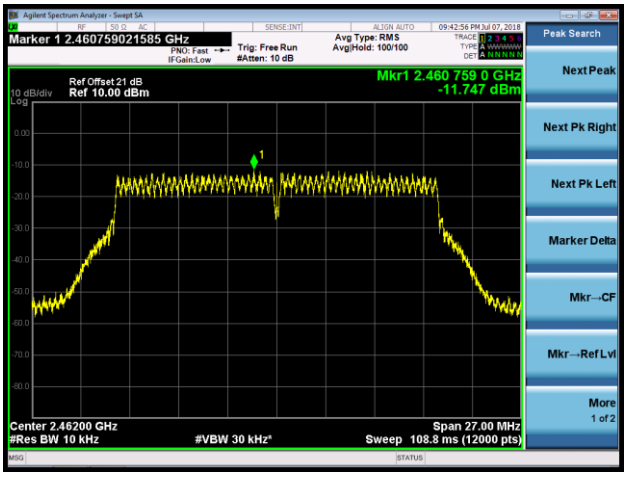
Note 2: When EUT duty cycle < 98%, Total AVGPSD = 10*log $\{10^{(\text{Ant 0 AVGPSD}/10)} + 10^{(\text{Ant 1 AVGPSD}/10)}\}$ + 10*log (1/duty cycle) + Constant Factor.

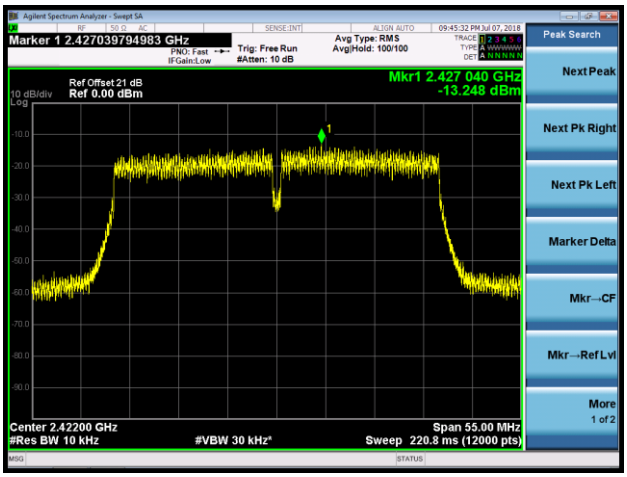
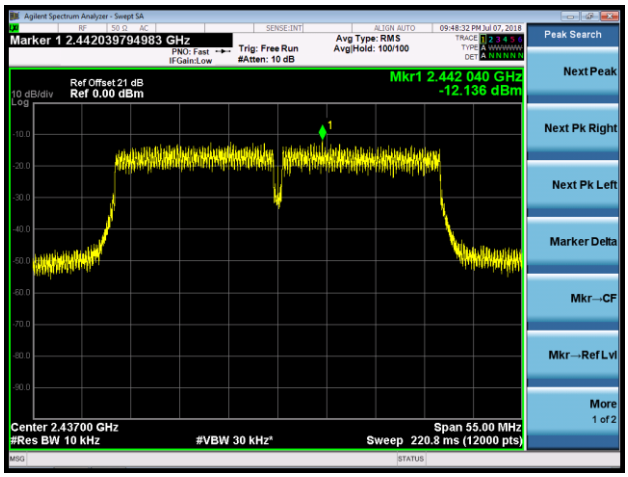
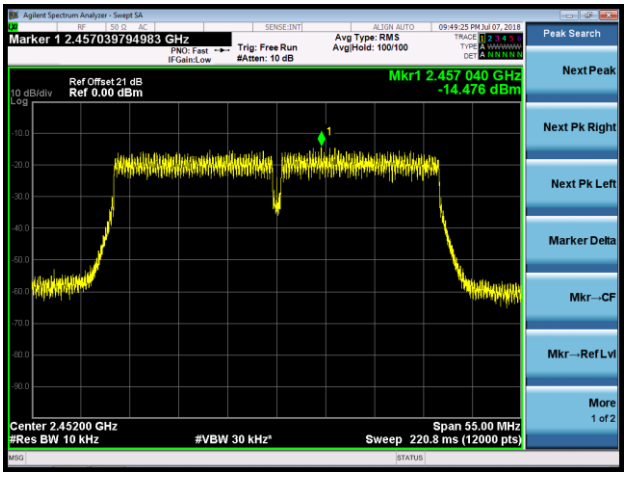
Note 3: PSD Limit = 8 dBm/3kHz - (6.78 dBi – 6.00 dBi) = 7.22 dBm/3kHz.

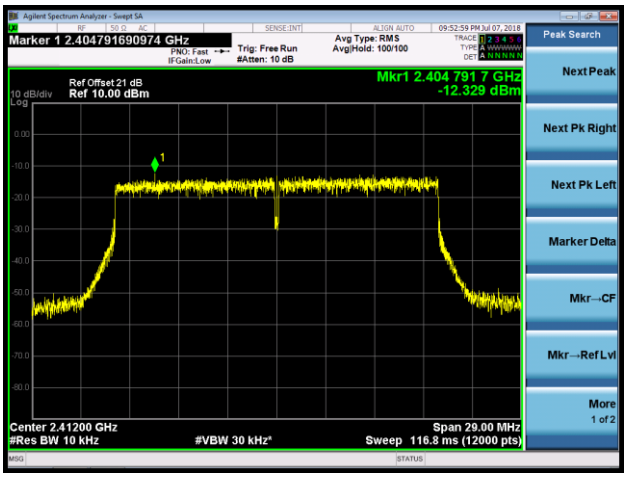
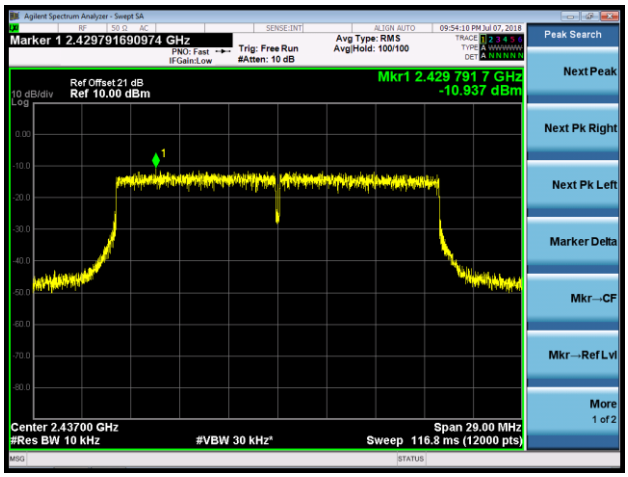
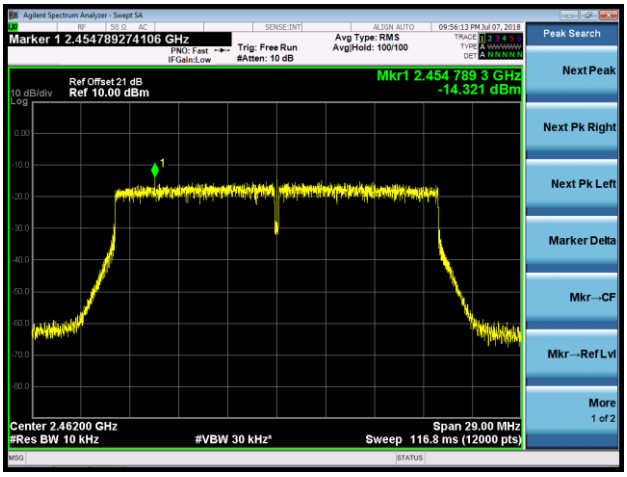
Product	ACCESS POINT	Temperature	25°C
Test Engineer	Kevin Ker	Relative Humidity	54%
Model No.	APIN0514	Antenna Model No.	AP-ANT-20W

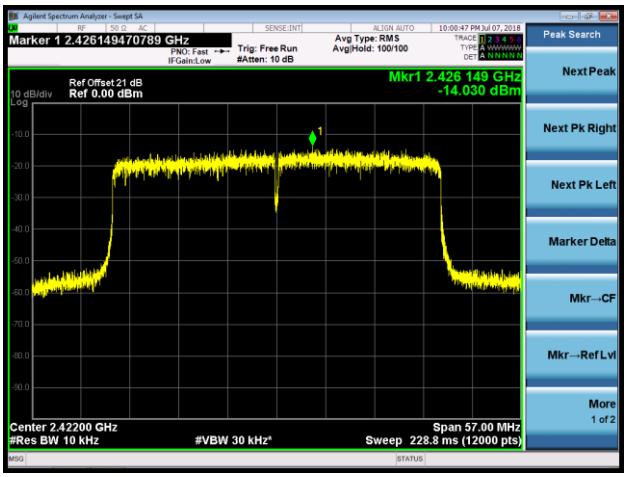
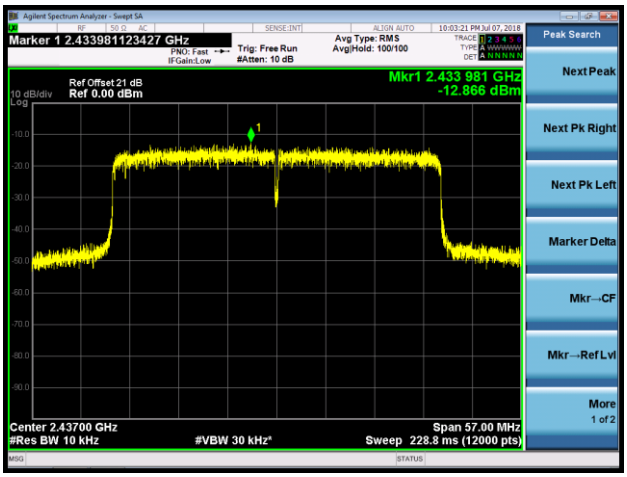
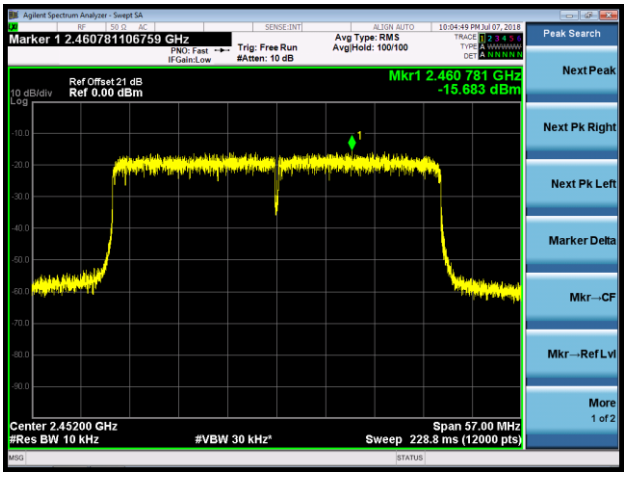
802.11b AVGPSD - Ant 0 / Ant 0 + 1	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

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)