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Report No.: 1503RSU02001
Report Version: V01
Issue Date: 06-01-2015

MEASUREMENT REPORT
FCC PART 15.247 WLAN 802.11b/g/n

FCC ID: O9C-BJNGAFB0008

APPLICANT: Hewlett Packard Company

Application Type: Certification

Product: Wireless LAN Access Point

Model No.:   BJNGA-FB0008, JH306A

Trademark: HP

FCC Classification: Digital Transmission System (DTS)

FCC Rule Part(s):   Part 15.247

Test Procedure(s):   ANSI C63.10-2013, KDB 558074 D01v03r02,
                         KDB 662911 D01v02r01, KDB 662911 D02v01

Test Date: Mar.16 ~ May. 29, 2015

Reviewed By   :   *Robin Wu*
                    (Robin Wu)

Approved By   :   *Marlin Chen*
                    (Marlin Chen)

Revision History

Report No.	Version	Description	Issue Date
1503RSU02001	Rev. 01	Initial report	06-01-2015

CONTENTS

§2.1033 General Information

Applicant:	Hewlett Packard Company
Applicant Address:	153 Taylor Street Littleton Massachusetts, United States 01460-1407
Manufacturer:	Hewlett Packard Company
Manufacturer Address:	153 Taylor Street Littleton Massachusetts, United States 01460-1407
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
MRT Registration No.:	809388
FCC Rule Part(s):	Part 15.247
Model No.:	BJNGA-FB0008, JH306A
FCC ID:	O9C-BJNGAFB0008
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	Digital Transmission System (DTS)

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- **MRT facility is a FCC registered (MRT Reg. No. 809388) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.**

- **MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.**

- **MRT facility is a VCCI registered (R-4179, G-814, C-4664, T-2206) test laboratory with the site description on file at VCCI Council.**

- **MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, 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 Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.

2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name	Wireless LAN Access Point
Model No.	BJNGA-FB0008, JH306A
Power Type	POE input
Frequency Range	802.11b/g/n-HT20: 2412 ~ 2462 MHz
	802.11n-HT40: 2422 ~ 2452 MHz
Maximum Output Power	802.11b: 25.71dBm
	802.11g: 28.93dBm
	802.11n-HT20: 28.23dBm
	802.11n-HT40: 22.89dBm
Type of Modulation	802.11b: DSSS
	802.11g/n: OFDM

2.2. Applicable Standards

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

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02
- ANSI C63.10-2013

Note:

1. All the test items were verified and recorded according to the standards and without any deviation during the test.
2. FCC permits the use of the 1.5 meter table as an alternative in ANSI C63.10-2013 through inquiry tracking number 198796.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B recorded in a separate report.

2.3. Operation Frequency / Channel List
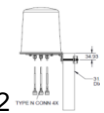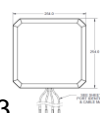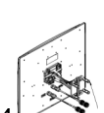
802.11b/g/n-HT20

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

802.11n-HT40

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

2.4. Description of Available Antennas

Antenna No.	Frequency Band (GHz)	Operation Mode	Product Number	Tx Paths	Max Peak Gain (dBi)	> 30 Degree Peak Gain (dBi)	Directional Gain (dBi)	
							For Power	For PSD
1	2.4	Indoor P-T-MP	JG696A	2	3.83	---	3.83	6.84
	5			2	5.69	---	5.69	8.70
2	2.4	Outdoor P-T-MP	JL195A	2	6.70	---	6.70	9.71
	5			2	10.70	-2.0	10.70	13.71
3	2.4	Outdoor P-T-MP	JL193A	2	8.80	---	8.80	8.80
	5			2	8.90	7.0	8.90	8.90
4	2.4	Outdoor P-T-P	JL194A	2	11.50	---	11.50	11.50
	5			2	15.60	---	15.60	15.60

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.

   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) If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream:

   - Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain;

   - $$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

$g_{j,k} = 10^{G_k/20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;
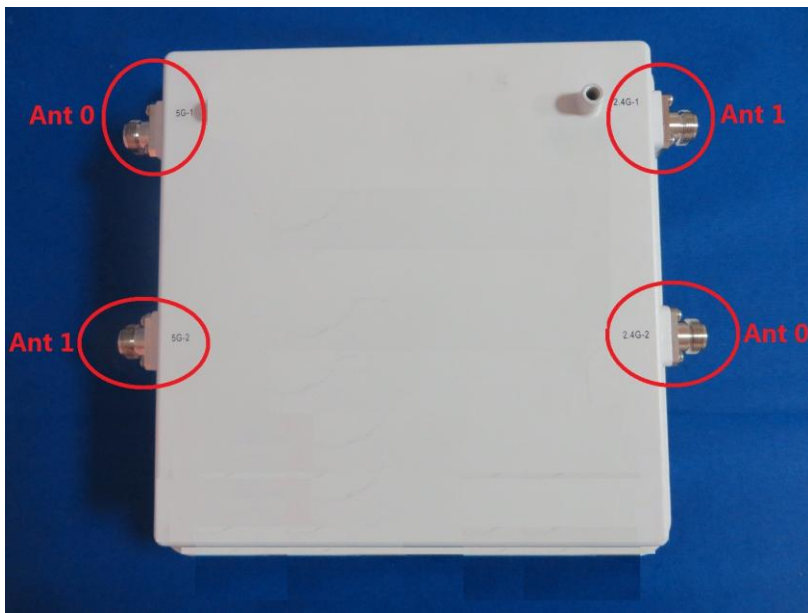
G_k is the gain in dBi of the kth antenna.

2. The antenna 3# and antenna 4# belong to cross-polarized antenna (horizontal and vertical polarizations) refer to antenna specification. According to 662911 D02 MIMO with Cross-Polarized Antennas v01, directional gain is the gain of an individual antenna.

2.5. Description of Antenna RF Port

Antenna RF Port				
--	2.4GHz RF Port		5GHz RF Port	
	2.4G-1	2.4G-2	5G-1	5G-2
Software Control Port	Ant 1	Ant 0	Ant 0	Ant 1

Antenna RF Port Plot

2.6. Test Mode

Test Mode	Mode 1: Transmit by 802.11b
	Mode 2: Transmit by 802.11g
	Mode 3: Transmit by 802.11n-HT20
	Mode 4: Transmit by 802.11n-HT40

2.7. Test Software

The test utility software used during testing were "ART2-GUI Version: 2.3" and "CART Version: 4.9".

Final Power Parameter Value of the test software.

Test Mode	Test Frequency (MHz)	Power Parameter Value	Test Mode	Test Frequency (MHz)	Power Parameter Value
ANTENNA 1#			ANTENNA 2#		
802.11b	2412	21.0	802.11b	2412	20.0
	2417	21.0		2417	21.0
	2437	23.0		2437	21.0
	2457	21.0		2457	19.5
	2462	20.0		2462	18.0
802.11g	2412	19.5	802.11g	2412	19.0
	2417	21.0		2417	21.0
	2437	27.0		2437	24.5
	2457	22.0		2457	17.0
	2462	18.0		2462	13.5
802.11n-HT20	2412	20.0	802.11n-HT20	2412	19.0
	2417	21.0		2417	20.5
	2437	26.0		2437	25.0
	2457	21.0		2457	16.5
	2462	17.0		2462	14.0
802.11n-HT40	2422	17.5	802.11n-HT40	2422	17.0
	2427	18.0		2427	18.0
	2437	20.0		2437	18.0
	2447	17.0		2447	15.0
	2452	16.5		2452	13.0

ANTENNA 3#			ANTENNA 4#		
802.11b	2412	20.5	802.11b	2412	19.0
	2417	21.0		2417	19.0
	2437	21.0		2437	17.0
	2457	19.5		2457	16.0
	2462	18.5		2462	14.5
802.11g	2412	18.0	802.11g	2412	17.5
	2417	20.0		2417	20.0
	2437	24.0		2437	24.0
	2457	19.0		2457	17.0
	2462	15.5		2462	14.0
802.11n-HT20	2412	17.5	802.11n-HT20	2412	17.0
	2417	20.0		2417	19.5
	2437	24.0		2437	24.0
	2457	18.0		2457	16.5
	2462	14.5		2462	14.0
802.11n-HT40	2422	14.0	802.11n-HT40	2422	14.0
	2427	15.0		2427	15.0
	2437	18.0		2437	16.0
	2447	15.0		2447	13.0
	2452	13.5		2452	12.5

2.8. Device Capabilities

This device contains the following capabilities:

2.4GHz WLAN (DTS) and 5GHz WLAN (UNII)

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, and detector = average per the guidance of Section 6.0 b) of KDB 558074 D01v03r02. 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	99.4%
802.11g	97.3%
802.11n-HT20	94.8%
802.11n-HT40	93.0%

802.11 b – Duty Cycle	802.11 g – Duty Cycle
802.11 n-HT20 – Duty Cycle	**802.11 n-HT40 – Duty Cycle**

2.9. Test Configuration

The **Wireless LAN Access Point FCC ID: O9C-BJNGAFB0008** was tested per the guidance of KDB 558074 D01v03r02. 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 trade name and 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 D01v03r02 were used in the measurement of the **Wireless LAN Access Point FCC ID: O9C-BJNGAFB0008. 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.

Line conducted emissions test results are shown in Section 7.8.

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 1-25GHz 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."

Conclusion:

The **Wireless LAN Access Point FCC ID: O9C-BJNGAFB0008** unit belongs to the professional installation of equipment, and doesn't need to comply 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	ESR7	MRTSUE06001	1 year	2015/11/07
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2015/11/07
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2015/11/07
Temperature/ Meter Humidity	Anymetre	TH101B	MRTSUE06045	1 year	2015/11/14

Radiated Emission

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	E4447A	MRTSUE06028	1 year	2015/10/09
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2015/11/07
Preamplifier	MRT	AP18G40	MRTSUE06020	1 year	2015/10/06
Preamplifier	Agilent	83017A	MRTSUE06019	1 year	2015/12/13
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2015/11/08
TRILOG Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2015/11/08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2015/11/08
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2016/01/05
Temperature/Humidity Meter	Anymetre	TH101B	MRTSUE06048	1 year	2015/11/14

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2016/04/23
USB Wideband Power Sensor	Boonton	55006	MRTSUE06109	1 year	2015/10/15
Temperature/Humidity Meter	Anymetre	TH101B	MRTSUE06046	1 year	2015/11/14

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: 3.46dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):   9kHz ~ 1GHz: 4.18dB   1GHz ~ 25GHz: 4.76dB

7. TEST RESULT

7.1. Summary

Company Name:　　　**Hewlett Packard Company**
FCC ID:　　　**O9C-BJNGAFB0008**
FCC Classification:　　　**Digital Transmission System (DTS)**
Data Rate(s) Tested:　**1Mbps ~ 11Mbps (b);**

　　　　　　　　　　6Mbps ~ 54Mbps (g);

　　　　　　　　　　13/14.4Mbps ~ 130/144.4Mbps (n-HT20);

　　　　　　　　　　27/30Mbps ~ 270/300Mbps (n-HT40)

FCC Part 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) All modes of operation and data rates were investigated. 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.

2) 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.

3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

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

KDB 558074 D01v03r02 – Section 8.2 Option 2

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

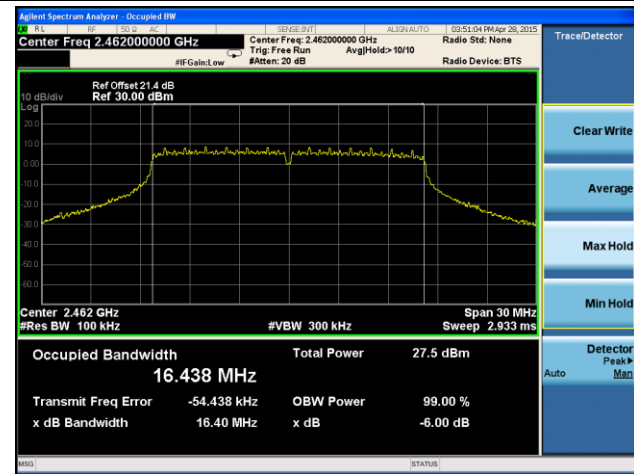7. Allow the trace was allowed to stabilize

7.2.4. Test Setup
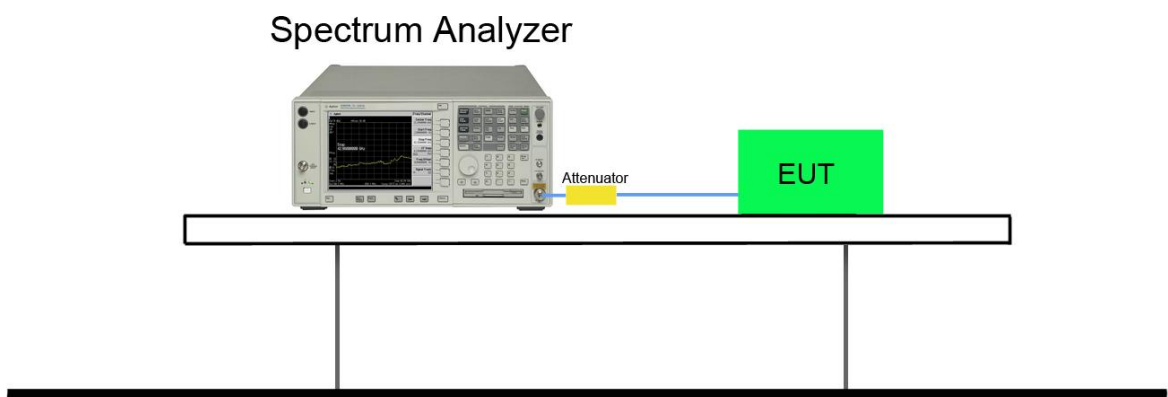
7.2.5. Test Result

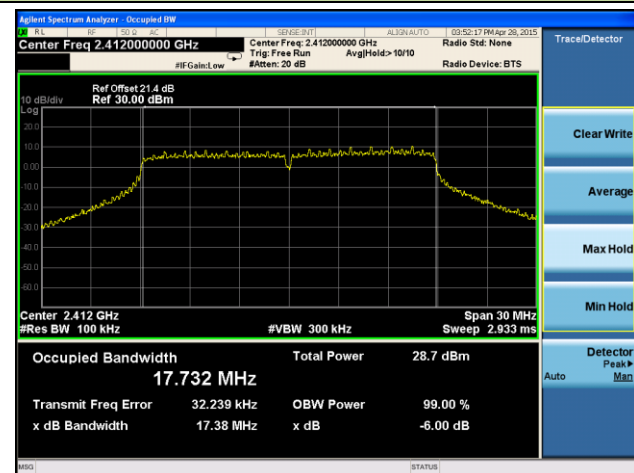| Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Ant 0 / Ant 0 + 1						
802.11b	1	01	2412	7.57	≥ 0.5	Pass
802.11b	1	06	2437	7.10	≥ 0.5	Pass
802.11b	1	11	2462	7.08	≥ 0.5	Pass
802.11g	6	01	2412	16.42	≥ 0.5	Pass
802.11g	6	06	2437	16.40	≥ 0.5	Pass
802.11g	6	11	2462	16.40	≥ 0.5	Pass
802.11n-HT20	13	01	2412	17.38	≥ 0.5	Pass
802.11n-HT20	13	06	2437	17.65	≥ 0.5	Pass
802.11n-HT20	13	11	2462	17.62	≥ 0.5	Pass
802.11n-HT40	27	03	2422	35.76	≥ 0.5	Pass
802.11n-HT40	27	06	2437	36.39	≥ 0.5	Pass
802.11n-HT40	27	09	2452	36.35	≥ 0.5	Pass
Ant 1 / Ant 0 + 1						
802.11b	1	01	2412	7.12	≥ 0.5	Pass
802.11b	1	06	2437	7.54	≥ 0.5	Pass
802.11b	1	11	2462	7.09	≥ 0.5	Pass
802.11g	6	01	2412	16.48	≥ 0.5	Pass
802.11g	6	06	2437	16.18	≥ 0.5	Pass
802.11g	6	11	2462	16.15	≥ 0.5	Pass
802.11n-HT20	13	01	2412	17.66	≥ 0.5	Pass
802.11n-HT20	13	06	2437	17.34	≥ 0.5	Pass
802.11n-HT20	13	11	2462	16.97	≥ 0.5	Pass
802.11n-HT40	27	03	2422	35.51	≥ 0.5	Pass
802.11n-HT40	27	06	2437	35.77	≥ 0.5	Pass
802.11n-HT40	27	09	2452	35.80	≥ 0.5	Pass

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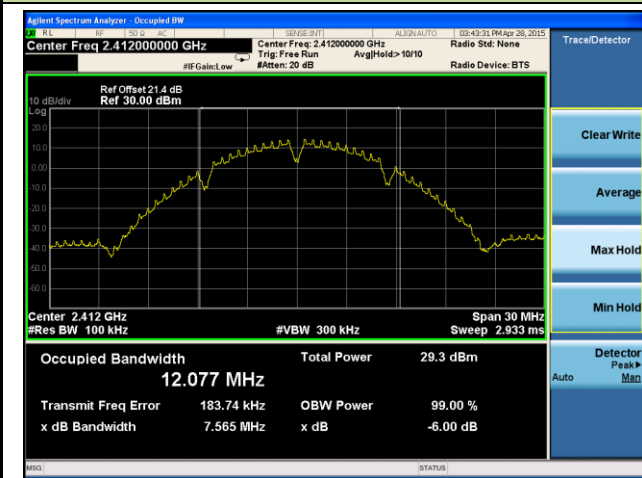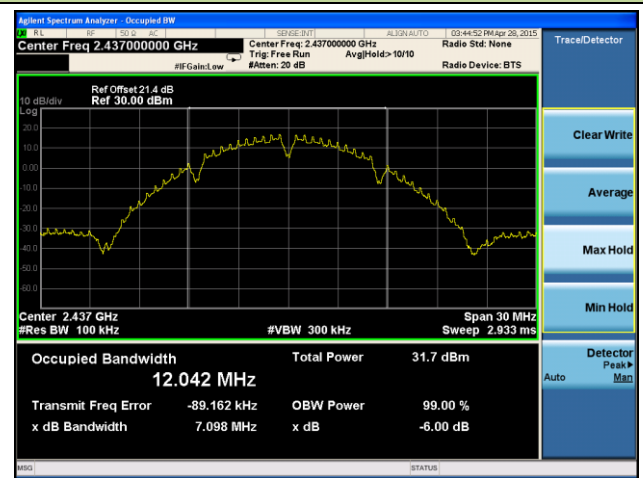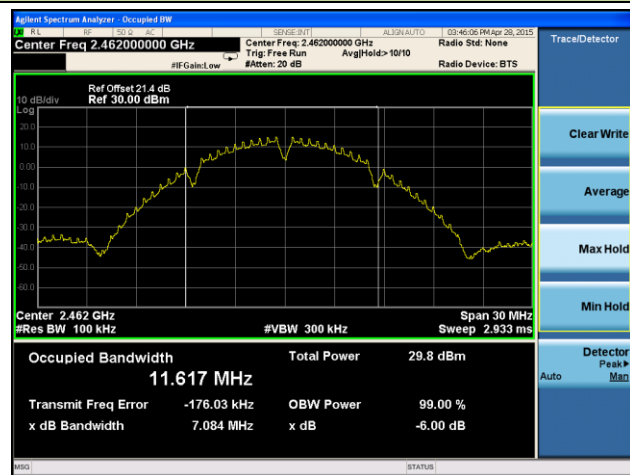
Channel 01 (2412MHz) / Channel 06 (2437MHz)

Channel 11 (2462MHz)

802.11g 6dB Bandwidth - Ant 0 / Ant 0 + 1

Channel 01 (2412MHz) / Channel 06 (2437MHz)
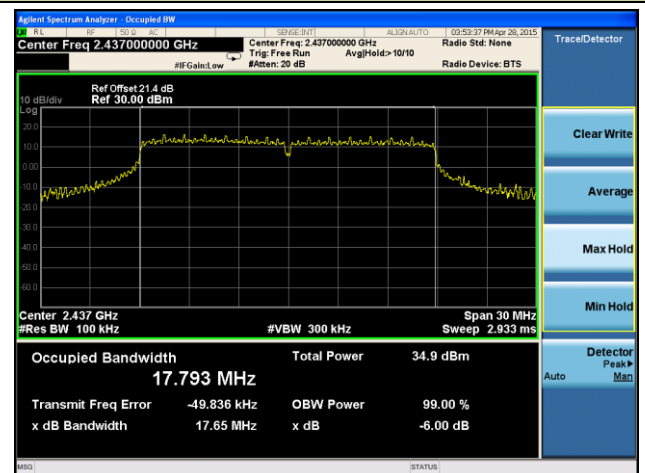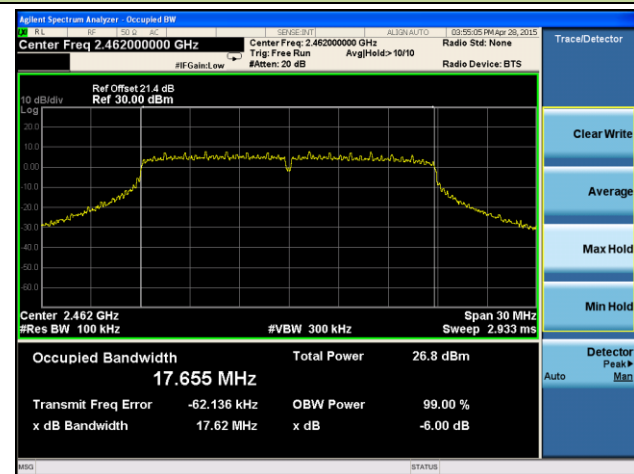
Channel 11 (2462MHz)	
Occupied Bandwidth 16.438 MHz; Total Power 27.5 dBm; Transmit Freq Error -54.438 kHz; OBW Power 99.00 %; x dB Bandwidth 16.40 MHz; x dB -6.00 dB	

802.11n-HT20 6dB Bandwidth - Ant 0 / Ant 0 + 1

Channel 01 (2412MHz)	Channel 06 (2437MHz)
Occupied Bandwidth 17.732 MHz; Total Power 28.7 dBm; Transmit Freq Error 32.239 kHz; OBW Power 99.00 %; x dB Bandwidth 17.38 MHz; x dB -6.00 dB	Occupied Bandwidth 17.793 MHz; Total Power 34.9 dBm; Transmit Freq Error -49.836 kHz; OBW Power 99.00 %; x dB Bandwidth 17.65 MHz; x dB -6.00 dB
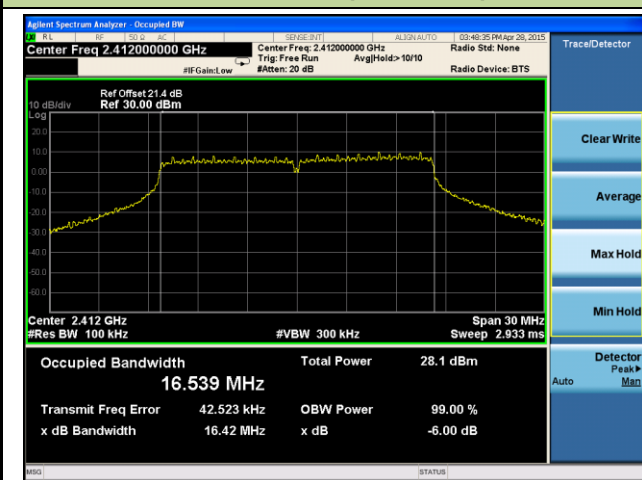
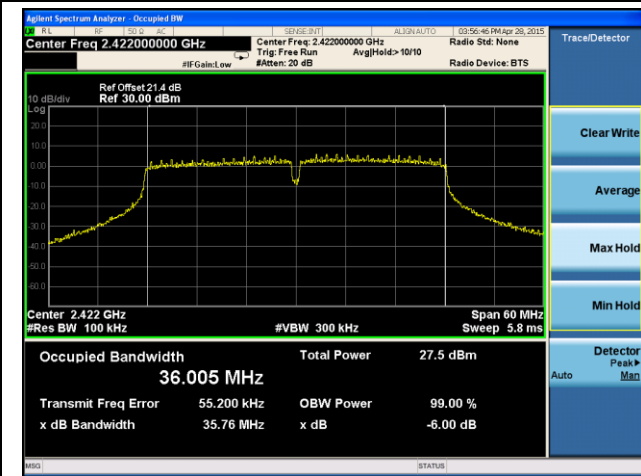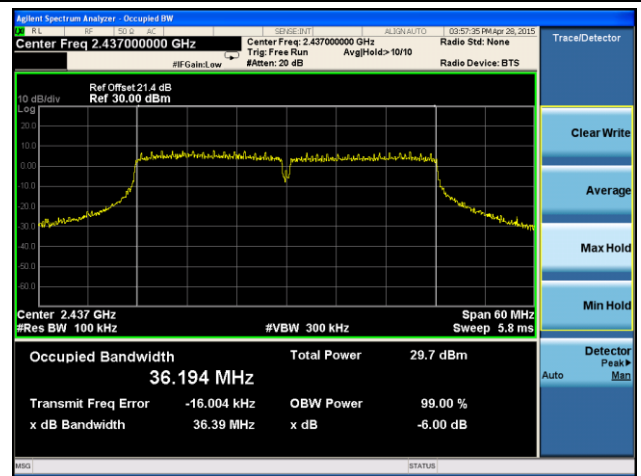| Channel 11 (2462MHz)	
Occupied Bandwidth 17.655 MHz; Total Power 26.8 dBm; Transmit Freq Error -62.136 kHz; OBW Power 99.00 %; x dB Bandwidth 17.62 MHz; x dB -6.00 dB	
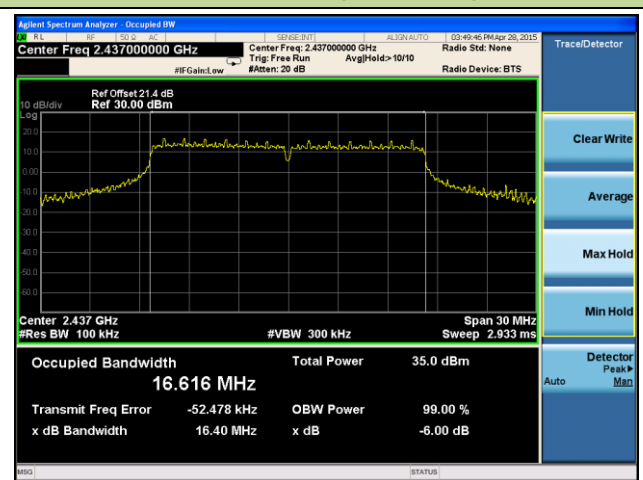
802.11n-HT40 6dB Bandwidth - Ant 0 / Ant 0 + 1

Channel 03 (2422MHz)	Channel 06 (2437MHz)

Channel 09 (2452MHz)	

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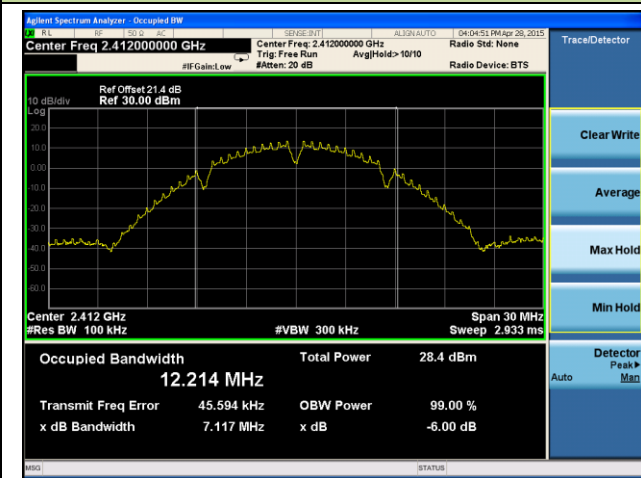
Channel 01 (2412MHz)	Channel 06 (2437MHz)

Channel 11 (2462MHz)	

802.11g 6dB Bandwidth - Ant 1 / Ant 0 + 1

Channel 01 (2412MHz)	Channel 06 (2437MHz)

Channel 11 (2462MHz)	
Occupied Bandwidth 16.506 MHz, Total Power 26.3 dBm, Transmit Freq Error -95.250 kHz, OBW Power 99.00 %, x dB Bandwidth 16.15 MHz, x dB -6.00 dB	

802.11n-HT20 6dB Bandwidth - Ant 1 / Ant 0 + 1

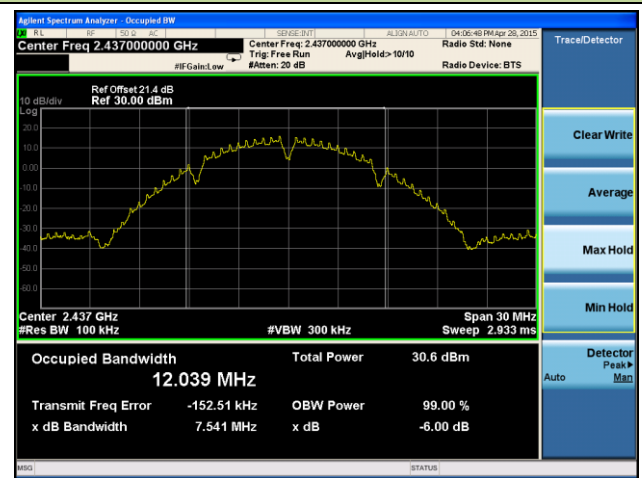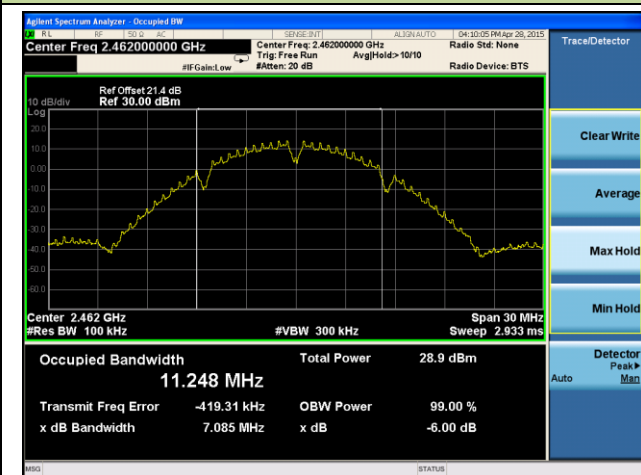| Channel 01 (2412MHz)	Channel 06 (2437MHz)
Occupied Bandwidth 17.780 MHz, Total Power 27.7 dBm, Transmit Freq Error -955 Hz, OBW Power 99.00 %, x dB Bandwidth 17.66 MHz, x dB -6.00 dB	Occupied Bandwidth 17.722 MHz, Total Power 33.1 dBm, Transmit Freq Error -73.240 kHz, OBW Power 99.00 %, x dB Bandwidth 17.34 MHz, x dB -6.00 dB
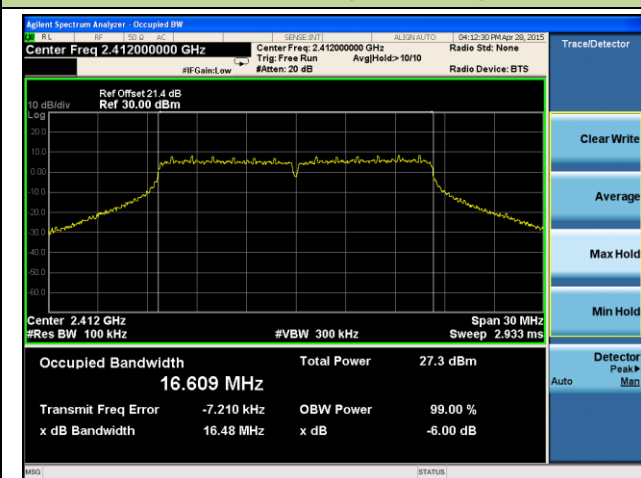
Channel 11 (2462MHz)	
Occupied Bandwidth 17.644 MHz, Total Power 25.3 dBm, Transmit Freq Error -79.478 kHz, OBW Power 99.00 %, x dB Bandwidth 16.97 MHz, x dB -6.00 dB	
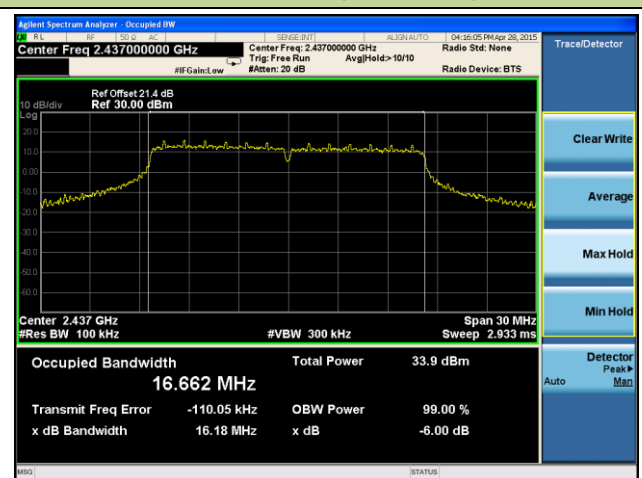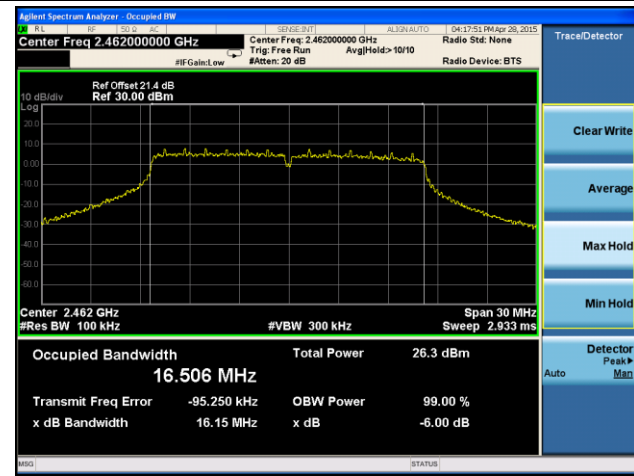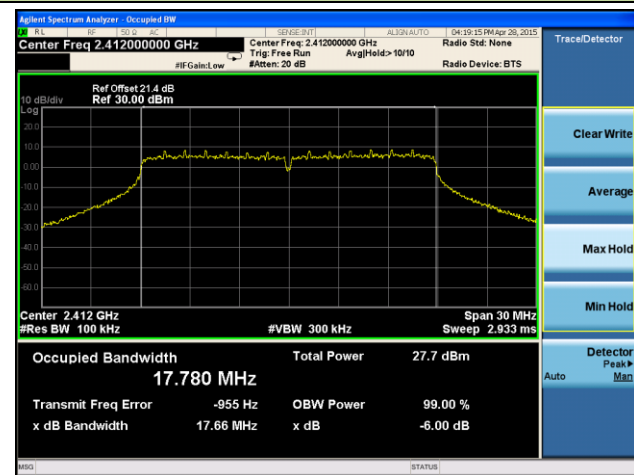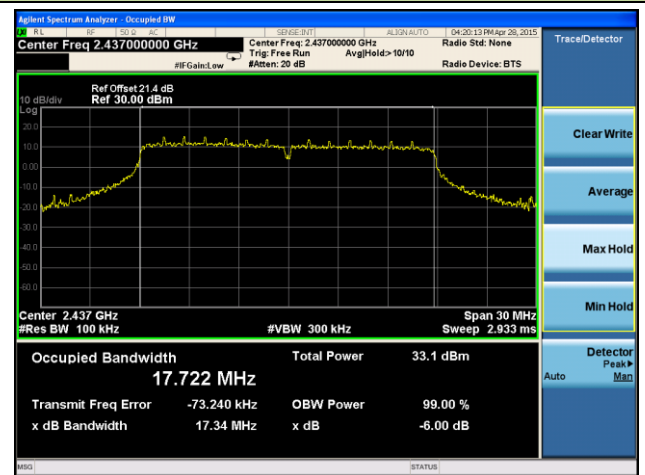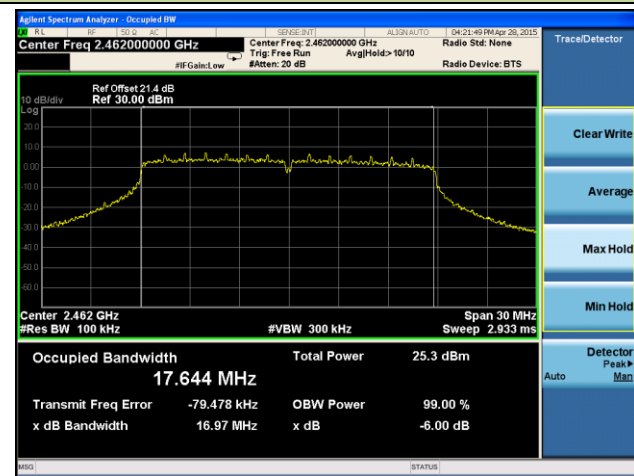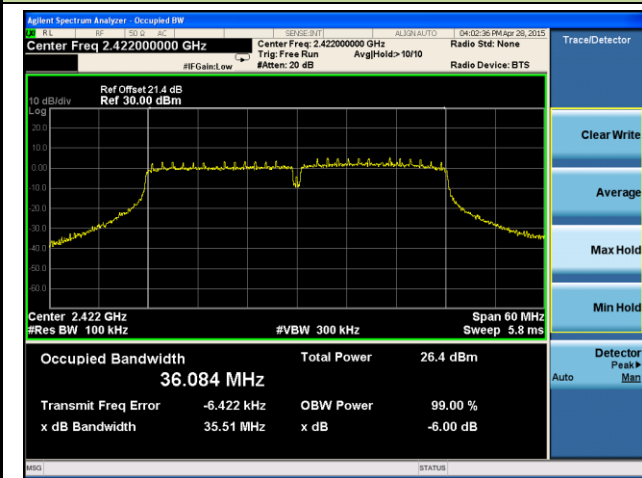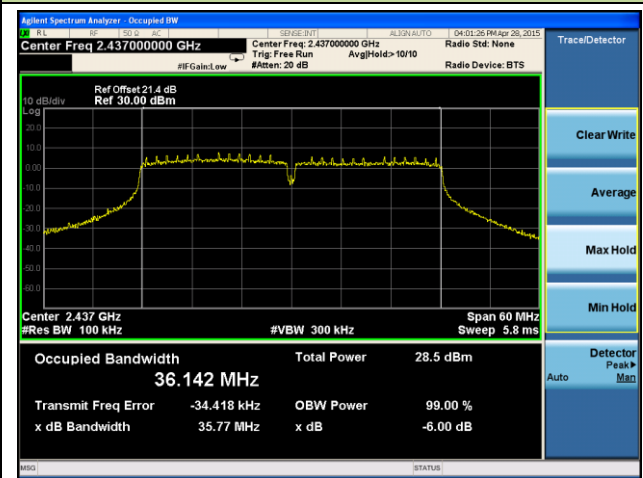
802.11n-HT40 6dB Bandwidth - Ant 1 / Ant 0 + 1	
Channel 03 (2422MHz)	**Channel 06 (2437MHz)**
Channel 09 (2452MHz)	
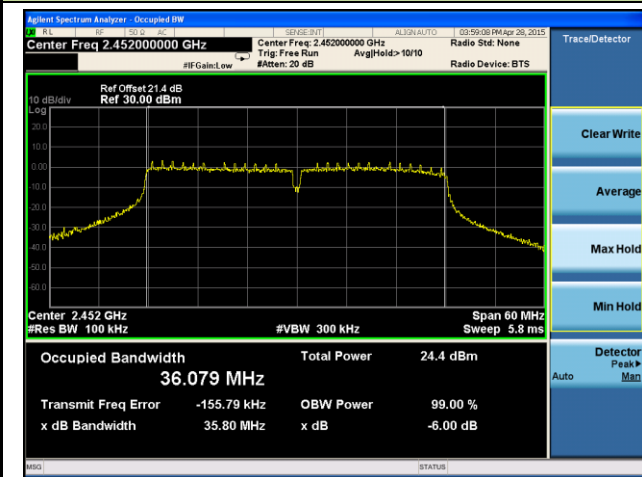
7.3. Output Power Measurement

7.3.1. Test Limit

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

The conducted output power limit 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 by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For fixed point-to-point operation, systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

For 2.412~2.462GHz Band:

ANTENNA 1# Power Limit = 30dBm;

ANTENNA 2# Power Limit = 30dBm – (6.7dBi – 6dBi) = 29.3dBm;

ANTENNA 3# Power Limit = 30dBm – (8.8dBi – 6dBi) = 27.2dBm;

ANTENNA 4# Power Limit = 30dBm – (11.5dBi – 6dBi)/3 = 28.2dBm;

7.3.2. Test Procedure Used

KDB 558074 D01v03r02 - Section 9.2.3.2 AVGPM-G Average Power Method

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. The trace was averaged over 100 traces to obtain the final measured average power.

7.3.4. Test Setup
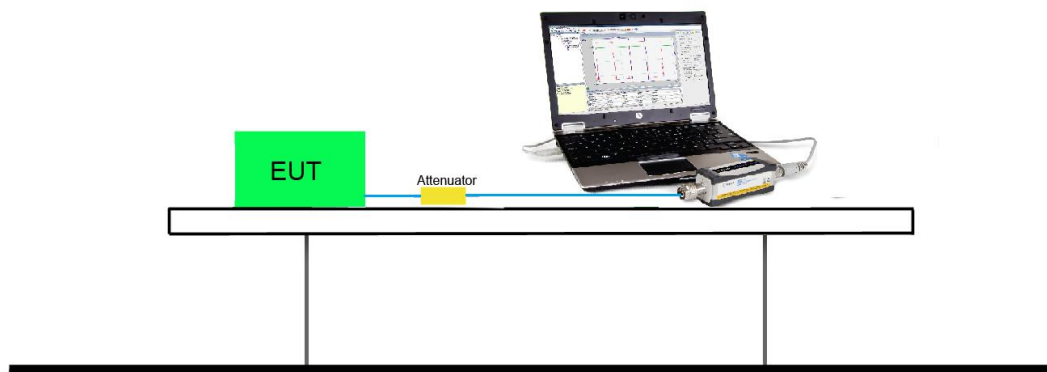
7.3.5. Test Result of Output Power

Output power at various data rates for Ant 0 / Ant 0 + 1:

Test Mode	Bandwidth (MHz)	Channel No.	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)
802.11b	20	6	2437	1	23.02
				5.5	22.85
				11	22.67
802.11g	20	6	2437	6	26.60
				24	26.49
				54	26.33
802.11n	20	6	2437	13	25.86
				14.4	25.73
				52	25.52
				57.8	25.35
				130	25.14
				144	25.02
802.11n	40	6	2437	27	20.36
				30	20.23
				108	20.05
				120	19.86
				270	19.69
				300	19.55

Test Result of Average Output Power

ANTENNA 1#

Test Mode	N_{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
11b	2	1	1	2412	20.37	19.52	22.98	≤ 30	Pass
11b	2	1	6	2437	23.02	22.36	25.71	≤ 30	Pass
11b	2	1	11	2462	20.92	20.08	23.53	≤ 30	Pass
11g	2	6	1	2412	19.48	18.36	21.97	≤ 30	Pass
11g	2	6	6	2437	26.60	25.12	28.93	≤ 30	Pass
11g	2	6	11	2462	18.92	17.67	21.35	≤ 30	Pass
11n-HT20	2	13	1	2412	19.93	19.04	22.52	≤ 30	Pass
11n-HT20	2	13	6	2437	25.86	24.47	28.23	≤ 30	Pass
11n-HT20	2	13	11	2462	17.92	16.86	20.43	≤ 30	Pass
11n-HT40	2	27	3	2422	18.43	17.27	20.90	≤ 30	Pass
11n-HT40	2	27	6	2437	20.36	19.35	22.89	≤ 30	Pass
11n-HT40	2	27	9	2452	16.94	16.55	19.76	≤ 30	Pass

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

ANTENNA 2#

Test Mode	N_{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
11b	2	1	1	2412	19.95	19.16	22.58	≤ 29.3	Pass
11b	2	1	6	2437	21.87	20.66	24.32	≤ 29.3	Pass
11b	2	1	11	2462	19.75	18.37	22.12	≤ 29.3	Pass
11g	2	6	1	2412	19.61	18.37	22.04	≤ 29.3	Pass
11g	2	6	6	2437	24.45	22.91	26.76	≤ 29.3	Pass
11g	2	6	11	2462	15.22	13.92	17.63	≤ 29.3	Pass
11n-HT20	2	13	1	2412	19.63	18.40	22.07	≤ 29.3	Pass
11n-HT20	2	13	6	2437	25.08	23.52	27.38	≤ 29.3	Pass
11n-HT20	2	13	11	2462	15.65	14.40	18.08	≤ 29.3	Pass
11n-HT40	2	27	3	2422	18.15	17.53	20.86	≤ 29.3	Pass
11n-HT40	2	27	6	2437	18.81	17.56	21.24	≤ 29.3	Pass
11n-HT40	2	27	9	2452	14.43	12.54	16.60	≤ 29.3	Pass

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

ANTENNA 3#

Test Mode	N_{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
11b	2	1	1	2412	20.51	19.81	23.18	≤ 27.2	Pass
11b	2	1	6	2437	21.98	20.54	24.33	≤ 27.2	Pass
11b	2	1	11	2462	19.98	19.21	22.62	≤ 27.2	Pass
11g	2	6	1	2412	18.54	17.46	21.04	≤ 27.2	Pass
11g	2	6	6	2437	24.46	23.08	26.83	≤ 27.2	Pass
11g	2	6	11	2462	16.86	16.13	19.52	≤ 27.2	Pass
11n-HT20	2	13	1	2412	17.99	17.16	20.61	≤ 27.2	Pass
11n-HT20	2	13	6	2437	24.48	22.96	26.80	≤ 27.2	Pass
11n-HT20	2	13	11	2462	16.17	14.98	18.63	≤ 27.2	Pass
11n-HT40	2	27	3	2422	15.55	14.29	17.98	≤ 27.2	Pass
11n-HT40	2	27	6	2437	18.81	17.56	21.24	≤ 27.2	Pass
11n-HT40	2	27	9	2452	14.94	13.08	17.12	≤ 27.2	Pass

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

ANTENNA 4#

Test Mode	N_{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
11b	2	1	1	2412	19.01	18.14	21.61	≤ 28.2	Pass
11b	2	1	6	2437	18.31	16.62	20.56	≤ 28.2	Pass
11b	2	1	11	2462	16.32	15.16	18.79	≤ 28.2	Pass
11g	2	6	1	2412	18.07	17.15	20.64	≤ 28.2	Pass
11g	2	6	6	2437	24.64	23.13	26.96	≤ 28.2	Pass
11g	2	6	11	2462	15.71	14.53	18.17	≤ 28.2	Pass
11n-HT20	2	13	1	2412	17.56	16.61	20.12	≤ 28.2	Pass
11n-HT20	2	13	6	2437	24.17	22.68	26.50	≤ 28.2	Pass
11n-HT20	2	13	11	2462	15.65	14.49	18.12	≤ 28.2	Pass
11n-HT40	2	27	3	2422	15.55	14.31	17.98	≤ 28.2	Pass
11n-HT40	2	27	6	2437	16.79	15.65	19.27	≤ 28.2	Pass
11n-HT40	2	27	9	2452	13.98	11.97	16.10	≤ 28.2	Pass

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

7.4. Power Spectral Density Measurement

7.4.1. Test Limit

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

For 2.412~2.462GHz Band:

ANTENNA 1#: Limit (dBm) = 8dBm/3kHz – (6.84dBi – 6dBi) = 7.16dBm/3kHz;

ANTENNA 2#: Limit (dBm) = 8dBm/3kHz – (9.71dBi – 6dBi) = 4.29dBm/3kHz;

ANTENNA 3#: Limit (dBm) = 8dBm/3kHz – (8.80dBi – 6dBi) = 5.20dBm/3kHz;

ANTENNA 4#: Limit (dBm) = 8dBm/3kHz – (11.50dBi – 6dBi)/3 = 6.17dBm/3kHz;

7.4.2. Test Procedure Used

KDB 558074 D01v03r02 - Section 10.5 Method AVGPSD

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 = 10kHz

5. VBW = 30kHz

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

Spectrum Analyzer
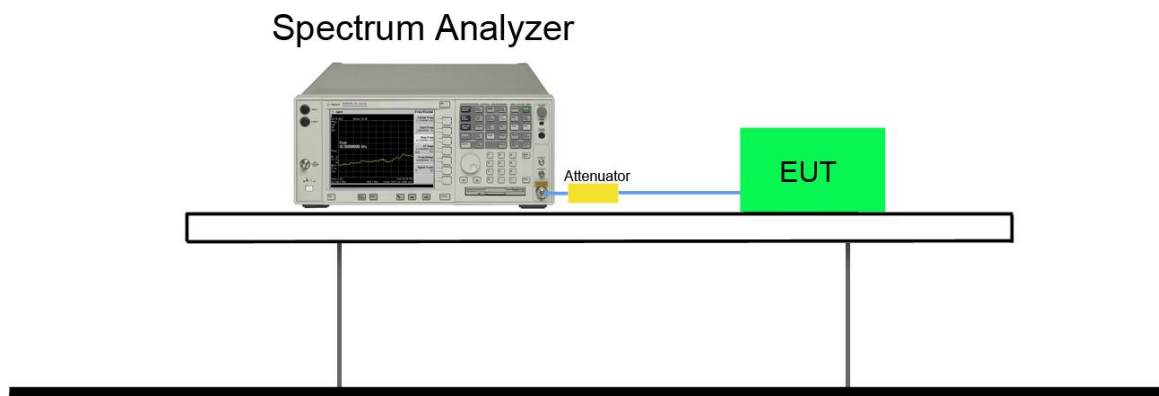
7.4.5. Test Result

ANTENNA 1#

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 AVGPSD (dBm / 10kHz)	Ant 1 AVGPSD (dBm / 10kHz)	Duty Cycle (%)	Constant Factor	Total AVGPSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
11b	1	1	2412	-4.05	-4.93	99.4	-5.23	-6.69	≤ 7.16	Pass
11b	1	6	2437	-1.61	-2.84	99.4	-5.23	-4.40	≤ 7.16	Pass
11b	1	11	2462	-3.29	-4.33	99.4	-5.23	-6.00	≤ 7.16	Pass
11g	6	1	2412	-8.15	-9.75	97.3	-5.23	-10.98	≤ 7.16	Pass
11g	6	6	2437	-1.66	-2.53	97.3	-5.23	-4.17	≤ 7.16	Pass
11g	6	11	2462	-9.20	-6.93	97.3	-5.23	-10.02	≤ 7.16	Pass
11n-HT20	13	1	2412	-6.93	-9.62	94.8	-5.23	-10.06	≤ 7.16	Pass
11n-HT20	13	6	2437	-2.08	-3.77	94.8	-5.23	-4.83	≤ 7.16	Pass
11n-HT20	13	11	2462	-10.55	-11.52	94.8	-5.23	-13.00	≤ 7.16	Pass
11n-HT40	27	3	2422	-12.26	-13.50	93.0	-5.23	-14.74	≤ 7.16	Pass
11n-HT40	27	6	2437	-10.15	-11.44	93.0	-5.23	-12.65	≤ 7.16	Pass
11n-HT40	27	9	2452	-10.57	-15.55	93.0	-5.23	-14.29	≤ 7.16	Pass

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

ANTENNA 2#

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 AVGPSD (dBm / 10kHz)	Ant 1 AVGPSD (dBm / 10kHz)	Duty Cycle (%)	Constant Factor	Total AVGPSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
11b	1	1	2412	-5.60	-7.30	99.4	-5.23	-8.59	≤ 4.29	Pass
11b	1	6	2437	-5.12	-6.28	99.4	-5.23	-7.88	≤ 4.29	Pass
11b	1	11	2462	-6.76	-6.81	99.4	-5.23	-9.00	≤ 4.29	Pass
11g	6	1	2412	-8.71	-11.02	97.3	-5.23	-11.81	≤ 4.29	Pass
11g	6	6	2437	-3.80	-4.87	97.3	-5.23	-6.40	≤ 4.29	Pass
11g	6	11	2462	-15.94	-15.94	97.3	-5.23	-18.04	≤ 4.29	Pass
11n-HT20	13	1	2412	-7.86	-11.01	94.8	-5.23	-11.14	≤ 4.29	Pass
11n-HT20	13	6	2437	-3.22	-4.61	94.8	-5.23	-5.85	≤ 4.29	Pass
11n-HT20	13	11	2462	-14.54	-15.69	94.8	-5.23	-17.06	≤ 4.29	Pass
11n-HT40	27	3	2422	-13.85	-14.35	93.0	-5.23	-16.00	≤ 4.29	Pass
11n-HT40	27	6	2437	-12.20	-12.81	93.0	-5.23	-14.40	≤ 4.29	Pass
11n-HT40	27	9	2452	-18.33	-19.55	93.0	-5.23	-20.80	≤ 4.29	Pass

Note: When EUT duty cycle < 98%, the total AVGPSD = $10*\log\{10^{(Ant\ 0\ AVGPSD/10)}+10^{(Ant\ 1\ AVGPSD/10)}\} + 10*\log(1/duty\ cycle) + Constant\ Factor.$
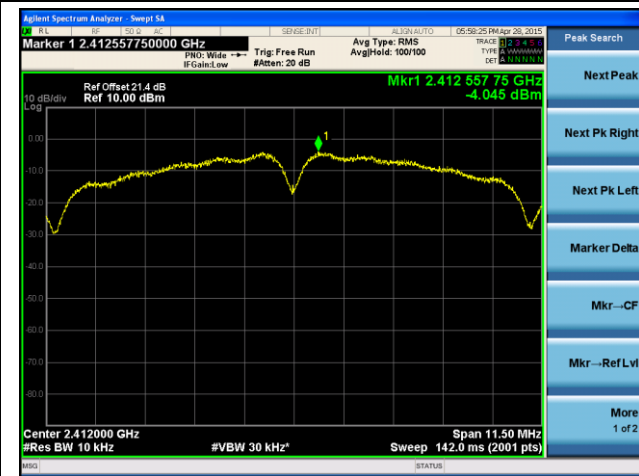
ANTENNA 3#

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 AVGPSD (dBm / 10kHz)	Ant 1 AVGPSD (dBm / 10kHz)	Duty Cycle (%)	Constant Factor	Total AVGPSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
11b	1	1	2412	-5.49	-6.37	99.4	-5.23	-8.13	≤ 5.20	Pass
11b	1	6	2437	-4.43	-5.37	99.4	-5.23	-7.09	≤ 5.20	Pass
11b	1	11	2462	-6.53	-7.39	99.4	-5.23	-9.16	≤ 5.20	Pass
11g	6	1	2412	-9.29	-11.99	97.3	-5.23	-12.53	≤ 5.20	Pass
11g	6	6	2437	-4.73	-5.97	97.3	-5.23	-7.41	≤ 5.20	Pass
11g	6	11	2462	-13.45	-11.72	97.3	-5.23	-14.60	≤ 5.20	Pass
11n-HT20	13	1	2412	-9.68	-12.84	94.8	-5.23	-12.97	≤ 5.20	Pass
11n-HT20	13	6	2437	-4.62	-5.78	94.8	-5.23	-7.15	≤ 5.20	Pass
11n-HT20	13	11	2462	-13.97	-14.98	94.8	-5.23	-16.43	≤ 5.20	Pass
11n-HT40	27	3	2422	-14.72	-17.68	93.0	-5.23	-17.86	≤ 5.20	Pass
11n-HT40	27	6	2437	-12.20	-12.81	93.0	-5.23	-14.40	≤ 5.20	Pass
11n-HT40	27	9	2452	-17.24	-19.58	93.0	-5.23	-20.16	≤ 5.20	Pass

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

ANTENNA 4#

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 AVGPSD (dBm / 10kHz)	Ant 1 AVGPSD (dBm / 10kHz)	Duty Cycle (%)	Constant Factor	Total AVGPSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
11b	1	1	2412	-5.52	-7.73	99.4	-5.23	-8.71	≤ 6.17	Pass
11b	1	6	2437	-7.70	-9.53	99.4	-5.23	-10.74	≤ 6.17	Pass
11b	1	11	2462	-10.33	-10.52	99.4	-5.23	-12.64	≤ 6.17	Pass
11g	6	1	2412	-9.97	-12.82	97.3	-5.23	-13.27	≤ 6.17	Pass
11g	6	6	2437	-4.76	-6.79	97.3	-5.23	-7.76	≤ 6.17	Pass
11g	6	11	2462	-15.06	-14.72	97.3	-5.23	-16.99	≤ 6.17	Pass
11n-HT20	13	1	2412	-10.86	-13.12	94.8	-5.23	-13.83	≤ 6.17	Pass
11n-HT20	13	6	2437	-4.11	-5.35	94.8	-5.23	-6.67	≤ 6.17	Pass
11n-HT20	13	11	2462	-14.80	-15.87	94.8	-5.23	-17.29	≤ 6.17	Pass
11n-HT40	27	3	2422	-15.57	-17.41	93.0	-5.23	-18.30	≤ 6.17	Pass
11n-HT40	27	6	2437	-12.25	-15.21	93.0	-5.23	-15.39	≤ 6.17	Pass
11n-HT40	27	9	2452	-18.81	-19.74	93.0	-5.23	-21.15	≤ 6.17	Pass

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

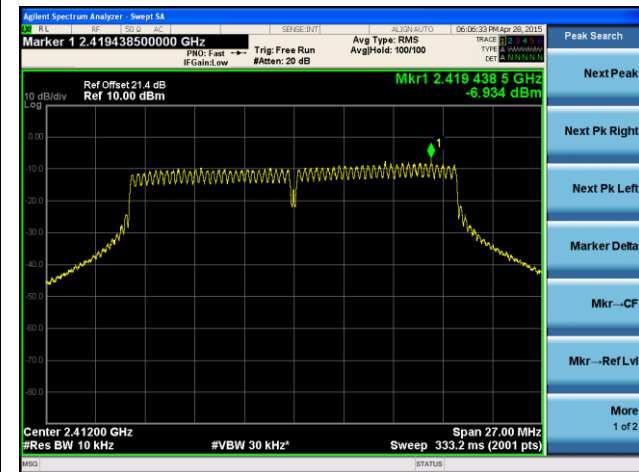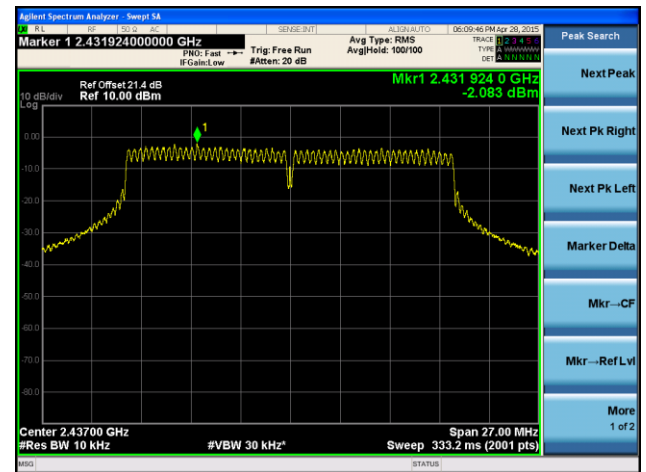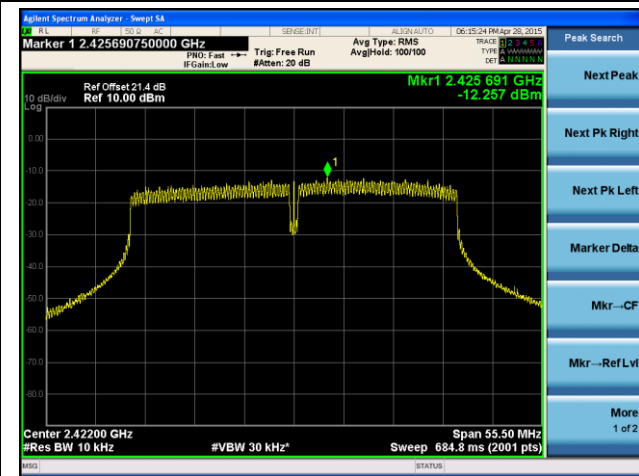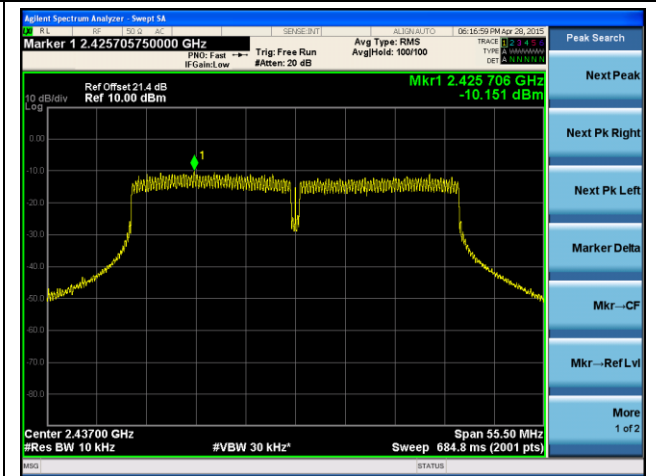| ANTENNA 1# - 802.11b AVGPSD - Ant 0 / Ant 0 + 1	
Channel 01 (2412MHz)	**Channel 06 (2437MHz)**
Channel 11 (2462MHz)	
ANTENNA 1# - 802.11g AVGPSD - Ant 0 / Ant 0 + 1	
Channel 01 (2412MHz)	**Channel 06 (2437MHz)**
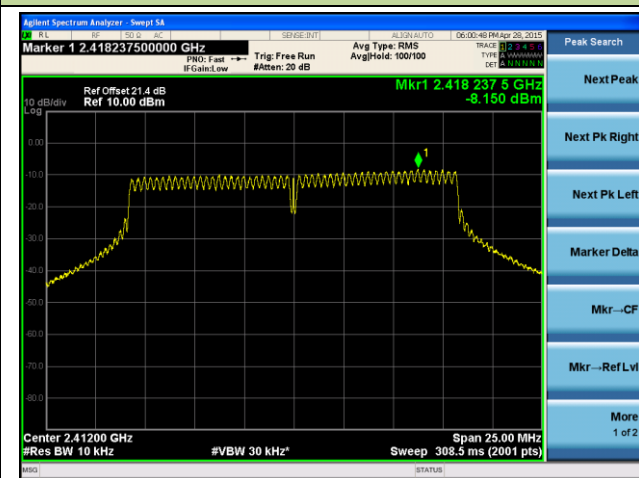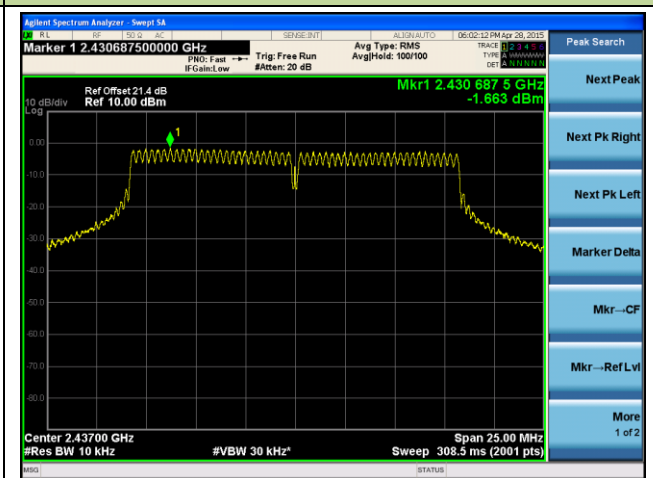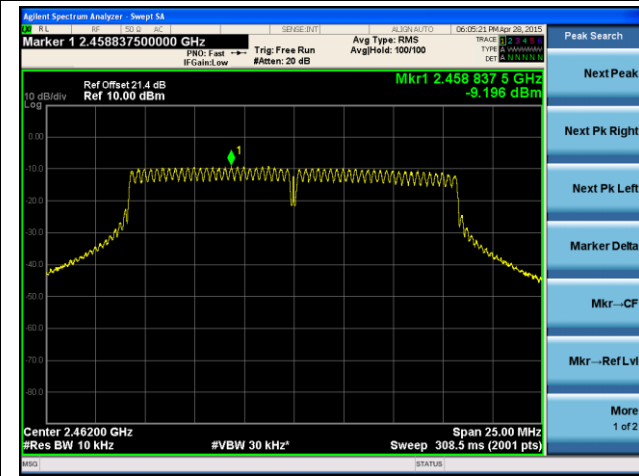
Channel 11 (2462MHz)

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

Channel 01 (2412MHz)

Channel 06 (2437MHz)
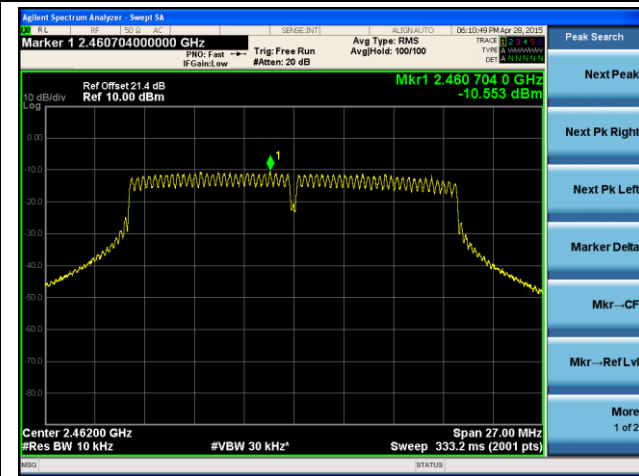
Channel 11 (2462MHz)

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

Channel 03 (2422MHz)

Channel 06 (2437MHz)

Channel 09 (2452MHz)

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

ANTENNA 1# - 802.11g AVGPSD - Ant 1 / Ant 0 + 1	
Channel 01 (2412MHz)	**Channel 06 (2437MHz)**