MEASUREMENT REPORT
FCC PART 15.407 WLAN 802.11a/n/ac

FCC ID:	TE7C9V4
APPLICANT:	TP-Link Technologies Co., Ltd.

Application Type:	Certification
Product:	AC1900 Wireless Dual Band Gigabit Router
Model No.:	Archer C9
Brand Name:	TP-Link
FCC Classification:	Unlicensed National Information Infrastructure (UNII)
FCC Rule Part(s):	Part 15.407
Test Procedure(s):	ANSI C63.10-2013, KDB 789033 D02v01r03, KDB 662911 D01v02r01, KDB 644545 D03v01
Test Date:	November 28 ~ December 20, 2016

Reviewed By Manager : Robin Wu
(Robin Wu)

Approved By CEO : Marlin Chen
(Marlin Chen)

Revision History

Report No.	Version	Description	Issue Date	Note
1611RSU03602	Rev. 01	Initial report	12-21-2016	Invalid
1611RSU03602	Rev. 02	Add some test description	01-23-2017	Valid

CONTENTS

§2.1033 General Information

Applicant:	TP-Link Technologies Co., Ltd.
Applicant Address:	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park, Shennan Rd, Nanshan, Shenzhen, China
Manufacturer:	TP-Link Technologies Co., Ltd.
Manufacturer Address:	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park, Shennan Rd, Nanshan, Shenzhen, China
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 Registration No.:	153292
FCC Rule Part(s):	Part 15.407
Model No.:	Archer C9
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

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

- **MRT facility is a FCC registered (MRT 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 Canada, Taiwan, EU and TELEC Rules.**

TAF certificate here

Testing Laboratory
3261

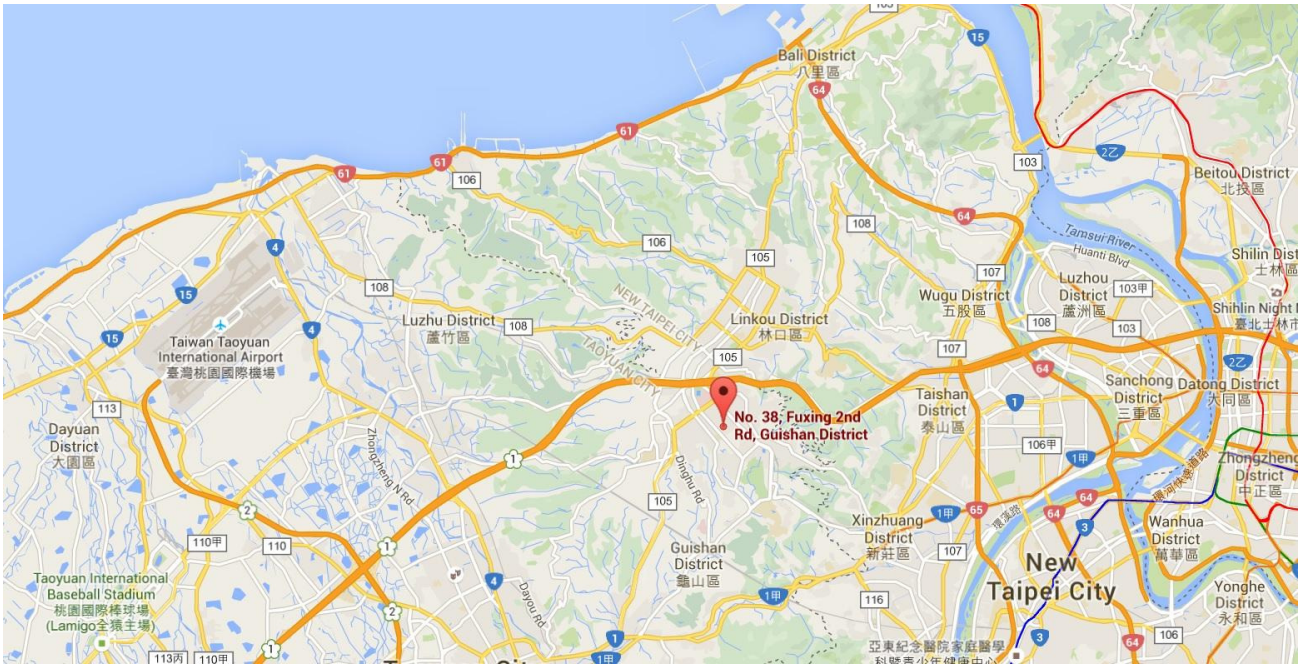
1. INTRODUCTION

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

sThe 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. Equipment Description

Product Name:	AC1900 Wireless Dual Band Gigabit Router
Model No.:	Archer C9
Brand Name:	TP-Link
Wi-Fi Specification:	802.11a/b/g/n/ac
Components	
Adapter	Model No.: S048CU1200330 Input Power: 100 - 240V ~ 50/60Hz 1.5A Max Output Power: 12VDC 3300mA

2.2. Product Specification Subjective to this Report

Frequency Range:	802.11a/n-HT20/ac-VHT20: 5180~5240MHz, 5745~5825MHz 802.11n-HT40/ac-VHT40: 5190~5230MHz, 5755~5795MHz 802.11ac-VHT80: 5210MHz, 5775MHz
Channel Number:	802.11a/ n-HT20/ac-VHT20: 9 802.11a/ n-HT20/ac-VHT40: 4 802.11ac-VHT80: 2
Type of Modulation:	802.11a/n/ac: OFDM
Data Rate:	802.11a: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 600Mbps 802.11ac: up to 1299.9Mbps
Maximum Average Output Power:	802.11a: 29.54dBm 802.11n-HT20: 29.59dBm 802.11n-HT40: 29.43dBm 802.11ac-VHT20: 29.41dBm 802.11ac-VHT40: 29.61dBm 802.11ac-VHT80: 28.23dBm

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

2.3. Working Frequencies for this report

802.11a/n-HT20/ ac-VHT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz	44	5220 MHz
48	5240 MHz	149	5745 MHz	153	5765 MHz
157	5785 MHz	161	5805 MHz	165	5825 MHz

802.11n-HT40/ ac-VHT40

Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz	151	5755 MHz
159	5795 MHz	--	--	--	--

802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	155	5775 MHz	--	--

2.4. Description of Available Antennas

Antenna Type	Frequency Band (MHz)	Tx Paths	Per Chain Max Antenna Gain (dBi)	Beam-forming Gain (dBi)	CDD Directional Gain (dBi)	
					For Power	For PSD
Dipole Antenna	2412 ~ 2462	3	2.09	N/A	2.07	6.86
	5150 ~ 5250	3	1.68	6.45	1.68	6.45
	5725 ~ 5850	3	1.62	6.39	1.62	6.39

Note 1: The EUT supports Cyclic Delay Diversity (CDD) technology for 802.11a/b/g/n/ac mode, and the transmitter output signal is correlated.

For CDD transmissions, directional gain is calculated as follows, N_{ANT} = 3, N_{SS} = 1.

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

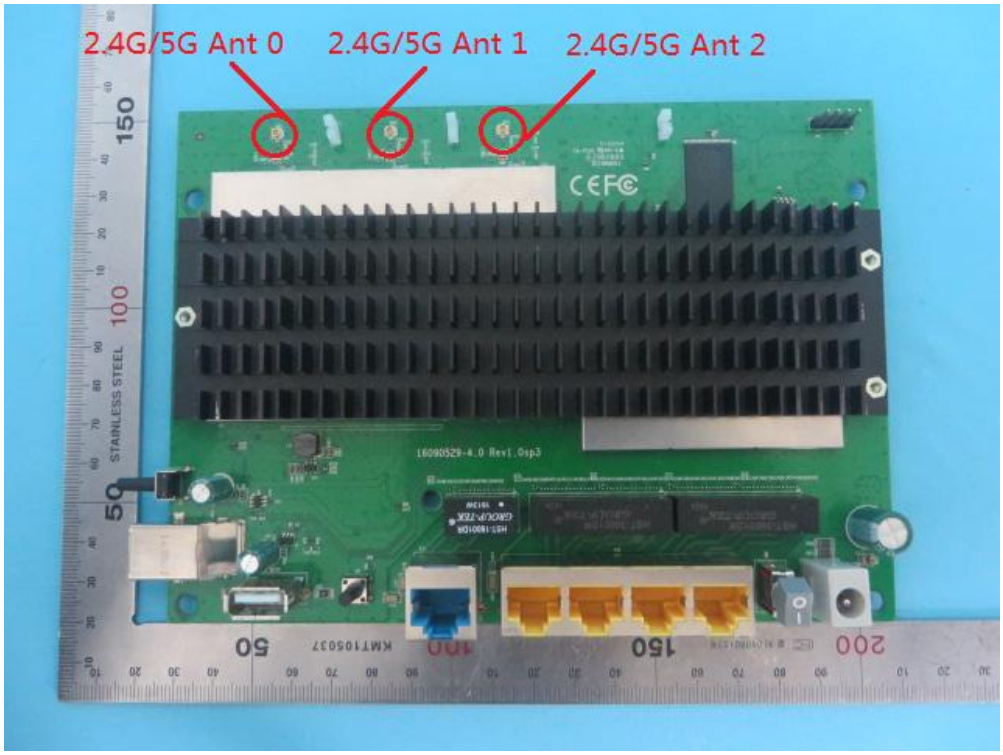
- For power spectral density (PSD) measurements on all devices,
  Array Gain = 10 log (N_{ANT}/ N_{SS}) dB = 4.77;
- For power measurements on IEEE 802.11 devices,
  Array Gain = 0 dB for $N_{ANT} \leq 4$;

Note 2: The EUT also supports Beam Forming technology, and the Beam Forming only support 802.11ac mode. Three antennas have the same gain, G_{ANT}:

Directional gain = G_{ANT} + 10 log (N_{ANT}/N_{SS}) dBi, where N_{SS} = the number of independent spatial streams of data and G_{ANT} is the antenna gain in dBi.

2.5. Description of Antenna RF Port

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



2.6. Test Mode

Test Mode	Mode 1: Transmit by 802.11a
	Mode 2: Transmit by 802.11n-HT20
	Mode 3: Transmit by 802.11n-HT40
	Mode 4: Transmit by 802.11ac-VHT20
	Mode 5: Transmit by 802.11ac-VHT40
	Mode 6: Transmit by 802.11ac-VHT80

2.7. Description of Test Software

The test utility software used during testing was “MTool_2.0.1.1”.

Power Parameter Value for CDD Mode

Test Mode	Test Channel No.	Test Frequency (MHz)	Power Parameter Value
802.11a	36	5180	80.0
	44	5220	88.0
	48	5240	88.0
	149	5745	96.0
	157	5785	100.0
	165	5825	95.0
802.11 n-HT20	36	5180	78.0
	44	5220	88.0
	48	5240	88.0
	149	5745	96.0
	157	5785	96.0
	165	5825	98.0
802.11ac-VHT20	36	5180	80.0
	44	5220	88.0
	48	5240	88.0
	149	5745	96.0
	157	5785	96.0
	165	5825	96.0
802.11n-HT40	38	5190	59.0
	46	5230	88.0
	151	5755	96.0
	159	5795	98.0
802.11ac-VHT40	38	5190	59.0
	46	5230	88.0
	151	5755	96.0
	159	5795	98.0
802.11ac-VHT80	42	5210	56.0
	155	5775	93.0

Power Parameter Value for Beam-forming Mode

Test Mode	Test Channel No.	Test Frequency (MHz)	Power Parameter Value
802.11ac-VHT20	36	5180	71.0
	44	5220	88.0
	48	5240	88.0
	149	5745	96.0
	157	5785	96.0
	165	5825	92.0
802.11ac-VHT40	38	5190	47.0
	46	5230	88.0
	151	5755	96.0
	159	5795	98.0
802.11ac-VHT80	42	5210	42.0
	155	5775	90.0

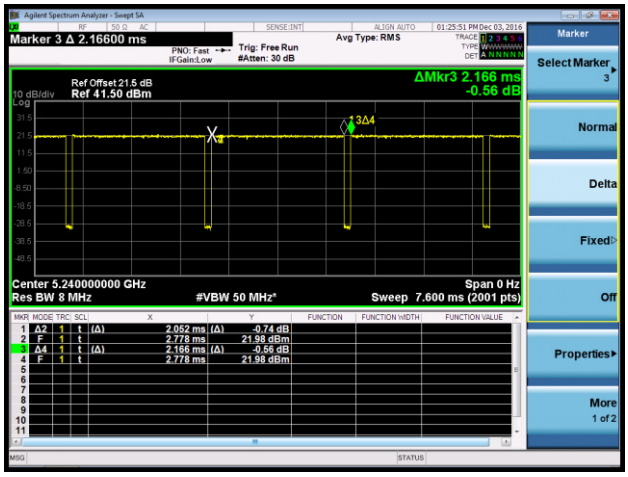
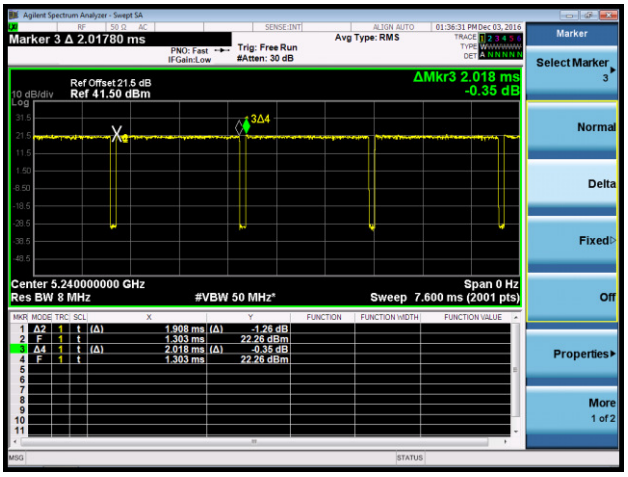
2.8. Device Capabilities

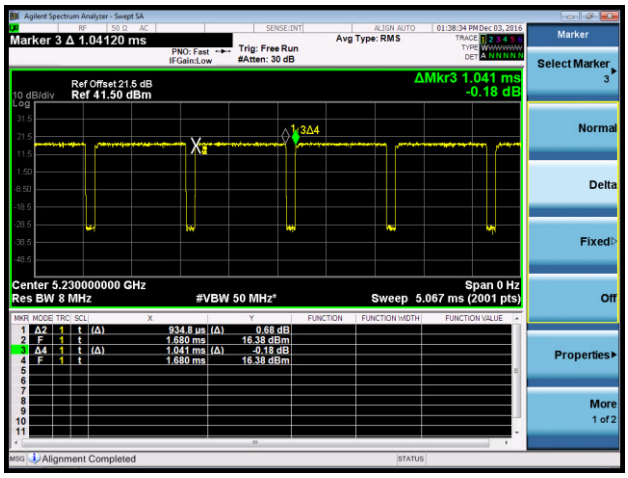
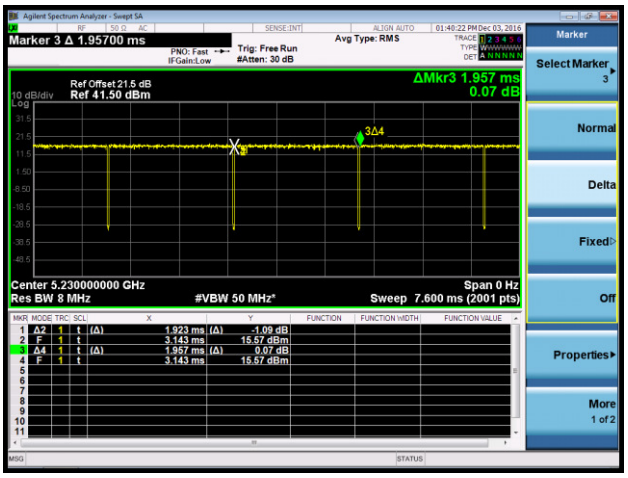
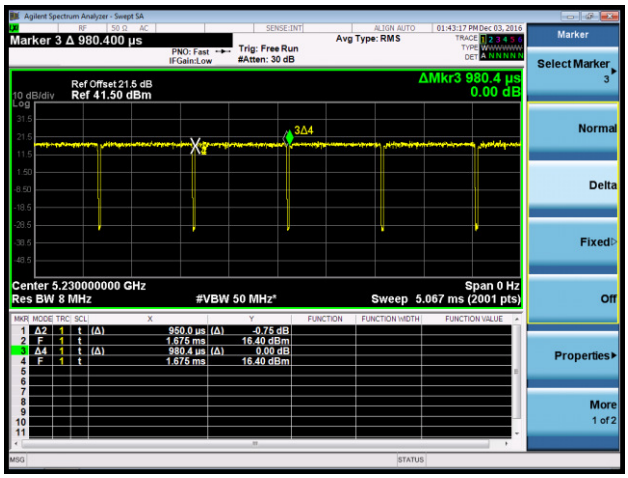
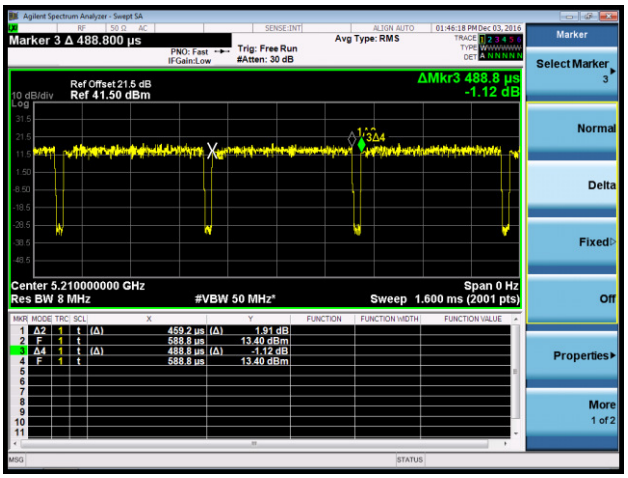
This device contains the following capabilities:

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

Note: 5GHz (NII) operation is possible in 20MHz, 40MHz and 80MHz 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 B)2)b) of KDB 789033 D02v01r03. 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
802.11a	94.74 %
802.11n-HT20	94.55 %
802.11n-HT40	89.80 %
802.11ac-VHT20	98.26 %
802.11ac-VHT40	96.90 %
802.11ac-VHT80	93.94 %

802.11a	802.11n-HT20
	

802.11n-HT40	802.11ac-VHT20
	
802.11ac-VHT40	802.11ac-VHT80
	

2.9. Test Configuration

The **AC1900 Wireless Dual Band Gigabit Router** was tested per the guidance of KDB 789033 D02v01r03. 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 789033 D02v01r03 were used in the measurement of the **AC1900 Wireless Dual Band Gigabit Router.**

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 7.10.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.
For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.
Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

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

- The antennas of **AC1900 Wireless Dual Band Gigabit Router** use a unique reversed SMA connector.

Conclusion:

The **AC1900 Wireless Dual Band Gigabit Router** unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Due Date
Two-Line V-Network	R&S	ENV216	MRTTWA00019	2017.03.23
Two-Line V-Network	R&S	ENV216	MRTTWA00020	2017.03.23
Absorbing Clamp	R&S	MDS21	MRTTWA00016	2017.03.02
EMI Test Receiver	R&S	ESR3	MRTTWA00009	2017.03.16
Conducted Cable	Rosnol	N1C50-RG400-B1 C50-500CM	MRTTWE00013	2017.05.20
TFA	DIVA PLUS Funk-Wetterstation	35.1078.10.IT	MRTTWA00033	2017.06.09

Radiated Spurious Emission and Radiated Restricted Band Edge - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Due Date
Acitve Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	2017.04.06
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	2017.04.06
Broadband Hornantenna	SCHWARZBECK	BBHA 9120D	MRTTWA00003	2017.04.06
BreitbandHornantenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	2017.04.06
Broadband Preamplifier	SCHWARZBECK	BBV 9718	MRTTWA00005	2017.04.06
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	2017.04.06
Signal Analyzer	R&S	FSV40	MRTTWA00007	2017.03.02
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	2017.05.08
Antenna Cable	HUBERSUHNER	SF106	MRTTWE00010	2017.05.20

Conducted Test Equipment - SR1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Due Date
Signal Analyzer	R&S	FSV40	MRTTWA00007	2017.03.02
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	2017.05.08
USB wideband power sensor	Boonton	55006	MRTTWA00050	2017/05/08
X-Series USB Peak and Average Power Sensor	KEYSIGHT	U2021XA	MRTTWA00014	2017.03.18

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 ~ 40GHz: 4.76dB
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: **AC1900 Wireless Dual Band Gigabit Router**

FCC ID: **TE7C9V4**

FCC Classification: **Unlicensed National Information Infrastructure (UNII)**

Data Rate / MCS Tested: **6Mbps for 802.11a;**
MCS0 for 802.11n-HT20MHz;
MCS0 for 802.11n-HT40MHz;
MCS0 for 802.11ac-VHT20MHz;
MCS0 for 802.11ac-VHT40MHz;
MCS0 for 802.11ac-VHT80MHz

FCC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.407(a)	26dB Bandwidth	N/A	Conducted	Pass	Section 7.2
15.407(e)	6dB Bandwidth	≥ 500kHz		Pass	Section 7.3
15.407(a)(1)(ii), (3)	Maximum Conducted Output Power	≤ 30 dBm U-NII-1 ≤ 30 dBm U-NII-3		Pass	Section 7.4
15.407(a)(1)(ii), (3), (5)	Peak Power Spectral Density	≤ 17 dBm/MHz U-NII-1 ≤ 30 dBm/500kHz U-NII-3		Pass	Section 7.5
15.407(g)	Frequency Stability	N/A		Pass	Section 7.6
15.407(b)(1), (4)(i)	Undesirable Emissions	≤ -27dBm/MHz EIRP Detail see section 7.8	Radiated	Pass	Section 7.7 & 7.8
15.205, 15.209 15.407(b)(5), (6), (7)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		Pass	
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.9

Notes:

1) All channels, modes, and modulations/data rates were investigated among all UNII bands. 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.
4) Test Items “26dB Bandwidth” & “99% Bandwidth” & “6dB Bandwidth” & “Frequency Stability” have been assessed MIMO transmission, and showed the worst test data in this report.

7.2. 26dB Bandwidth Measurement

7.2.1. Test Limit

N/A

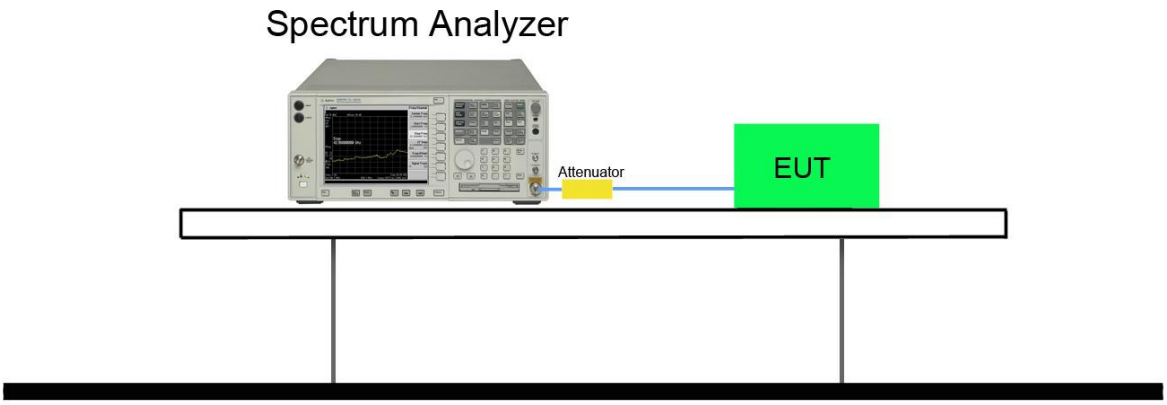
7.2.2. Test Procedure used

KDB 789033 D02v01r03 - Section C.1

7.2.3. Test Setting

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediated power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth.
3. VBW ≥ 3 × RBW.
4. Detector = Peak.
5. Trace mode = max hold.

7.2.4. Test Setup

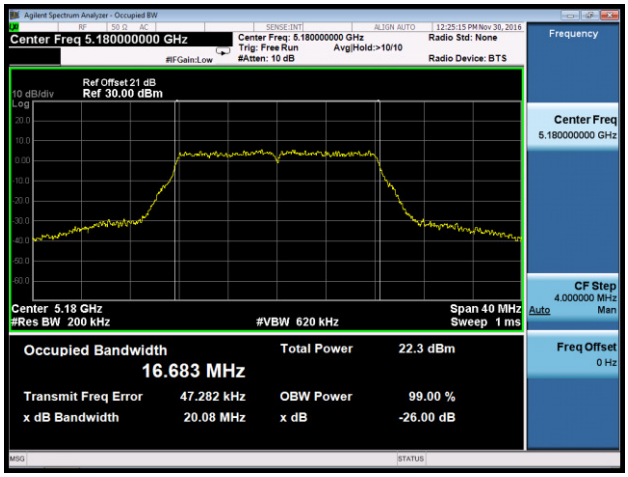


7.2.5. Test Result

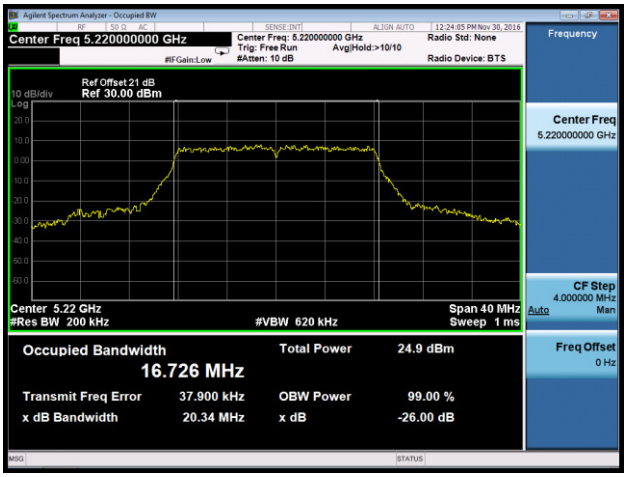
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 0 / Ant 0 + 1 + 2					
802.11a	6Mbps	36	5180	20.08	16.68
802.11a	6Mbps	44	5220	20.34	16.73
802.11a	6Mbps	48	5240	20.39	16.73
802.11a	6Mbps	149	5745	20.23	16.70
802.11a	6Mbps	157	5785	20.14	16.70
802.11a	6Mbps	165	5825	20.20	16.70
802.11n-HT20	MCS0	36	5180	20.58	17.78
802.11n-HT20	MCS0	44	5220	21.31	17.85
802.11n-HT20	MCS0	48	5240	20.40	17.78
802.11n-HT20	MCS0	149	5745	20.90	17.79
802.11n-HT20	MCS0	157	5785	20.99	17.83
802.11n-HT20	MCS0	165	5825	20.61	17.81
802.11n-HT40	MCS0	38	5190	39.75	36.34
802.11n-HT40	MCS0	46	5230	39.69	36.32
802.11n-HT40	MCS0	151	5755	39.69	36.35
802.11n-HT40	MCS0	159	5795	40.15	36.37
802.11ac-VHT20	MCS0	36	5180	20.47	17.79
802.11ac-VHT20	MCS0	44	5220	20.74	17.80
802.11ac-VHT20	MCS0	48	5240	20.81	17.85
802.11ac-VHT20	MCS0	149	5745	20.56	17.83
802.11ac-VHT20	MCS0	157	5785	20.42	17.81
802.11ac-VHT20	MCS0	165	5825	20.57	17.81
802.11ac-VHT40	MCS0	38	5190	39.84	36.28
802.11ac-VHT40	MCS0	46	5230	42.59	36.38
802.11ac-VHT40	MCS0	151	5755	42.04	36.37
802.11ac-VHT40	MCS0	159	5795	40.02	36.35
802.11ac-VHT80	MCS0	42	5210	82.35	75.68
802.11ac-VHT80	MCS0	155	5775	82.62	75.75

802.11a 26dB Bandwidth & 99% Bandwidth - Ant 0 / Ant 0 +1 + 2

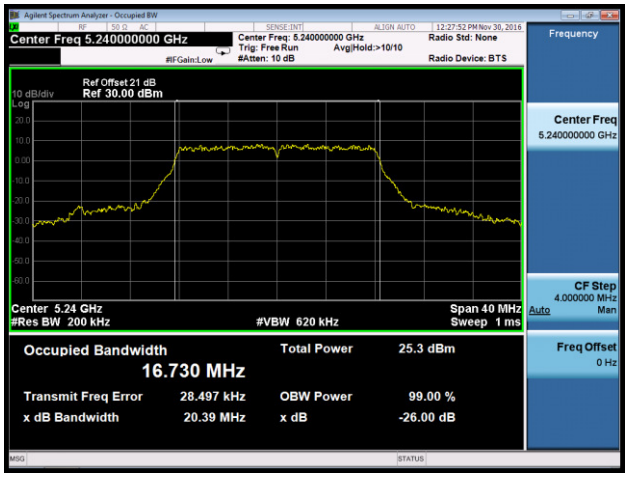
Channel 36 (5180MHz)



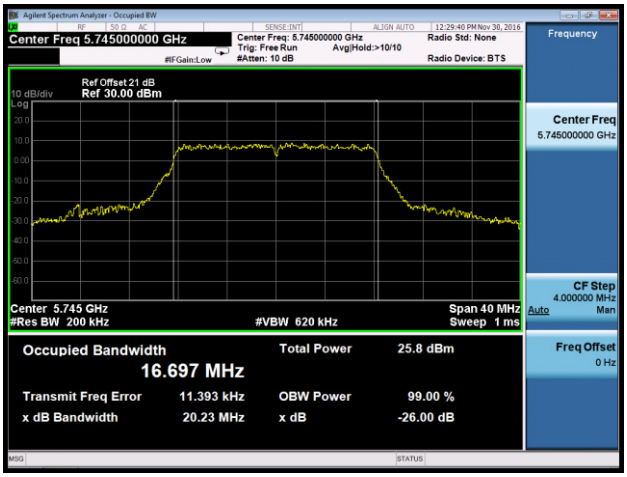
Channel 44 (5220MHz)



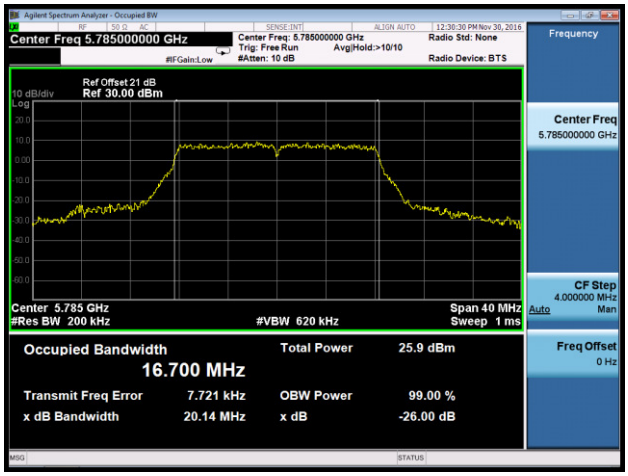
Channel 48 (5240MHz)



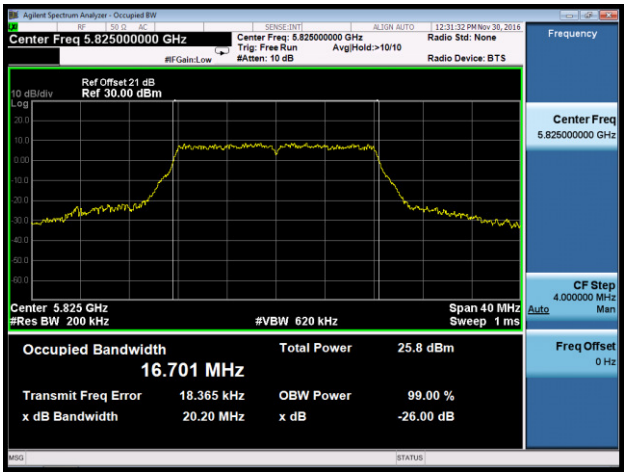
Channel 149 (5745MHz)

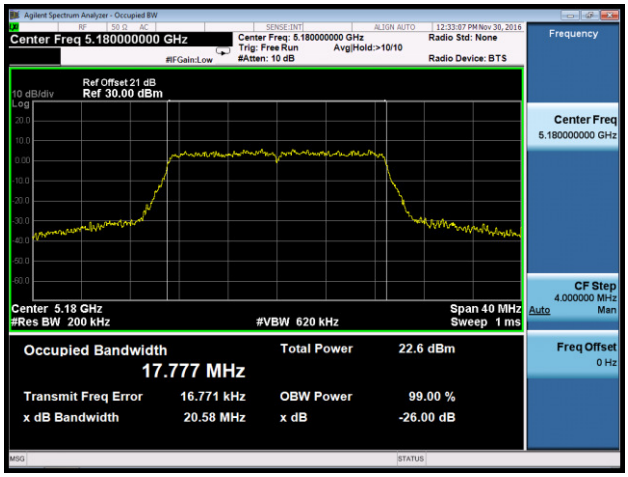
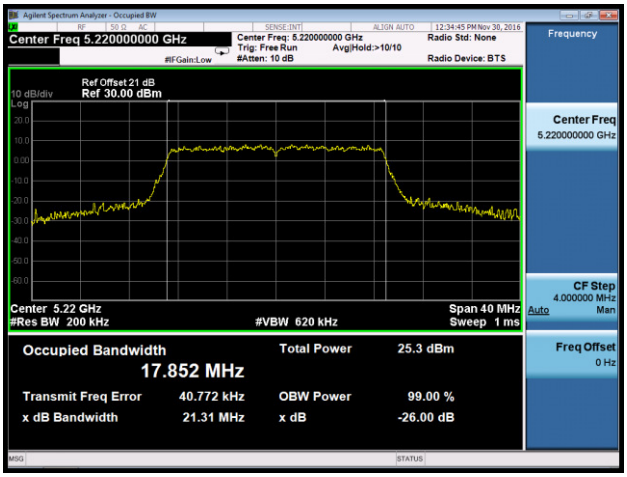
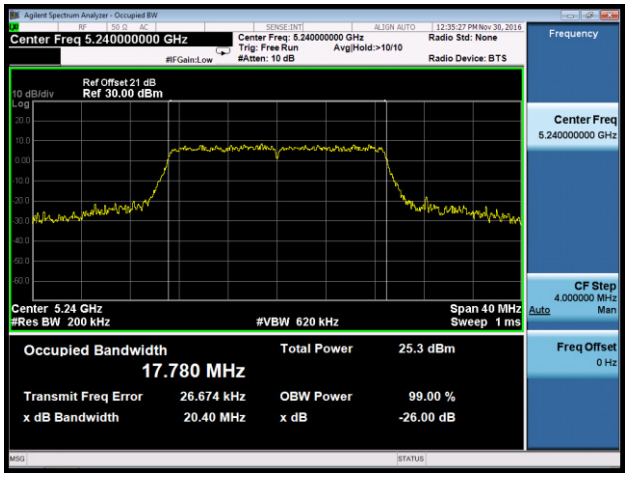
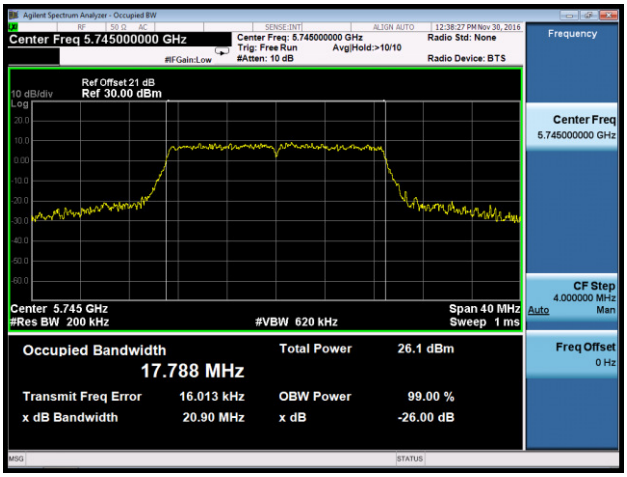
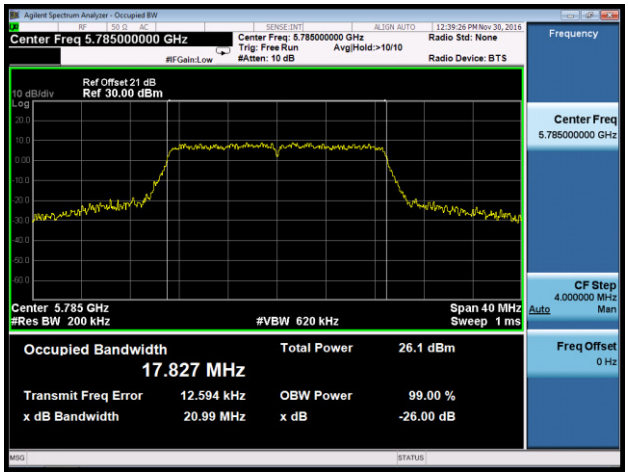
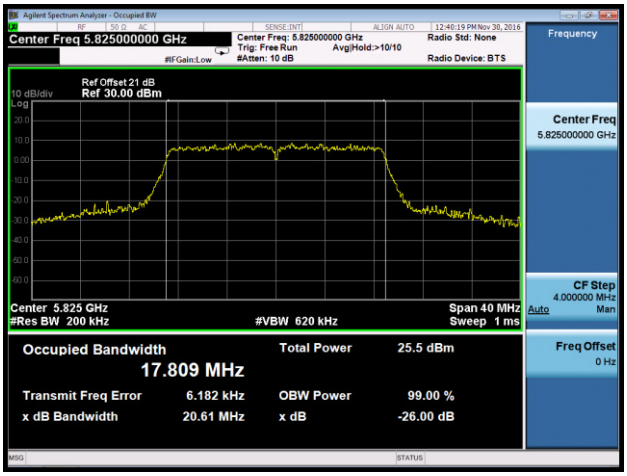


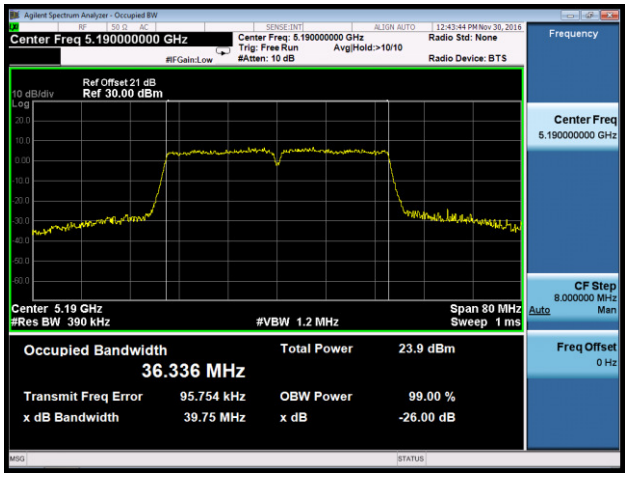
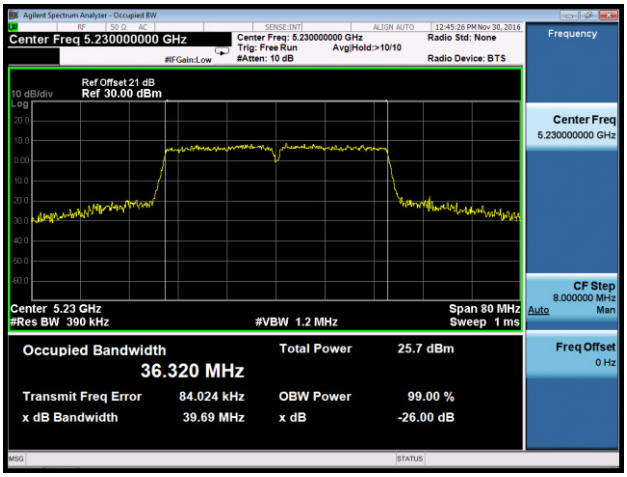
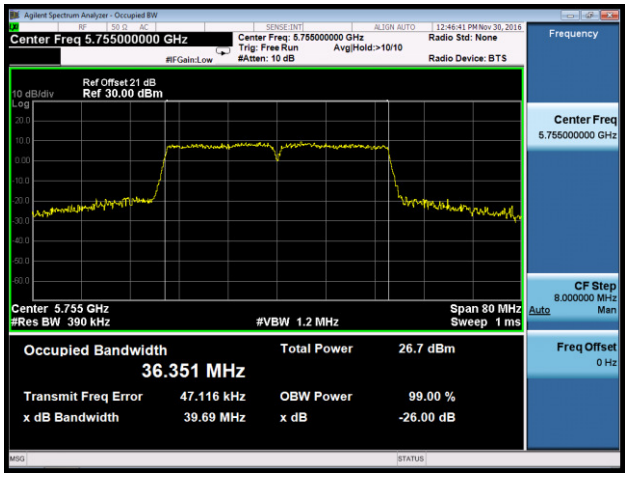
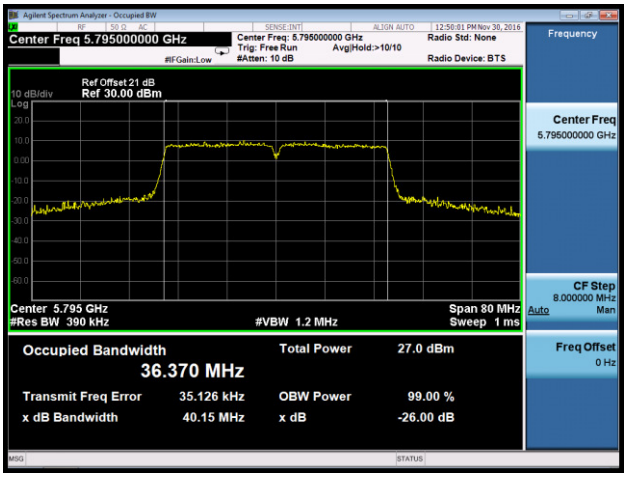
Channel 157 (5785MHz)



Channel 165 (5825MHz)

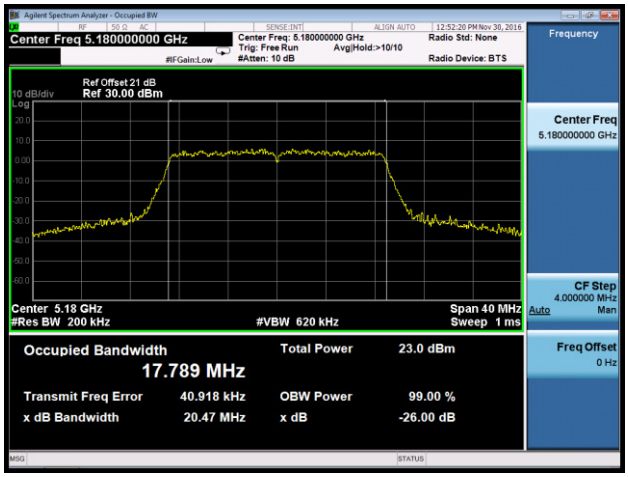


802.11n-HT20 26dB Bandwidth & 99% Bandwidth - Ant 0 / Ant 0 +1 + 2	
Channel 36 (5180MHz)	**Channel 44 (5220MHz)**
	
Channel 48 (5240MHz)	**Channel 149 (5745MHz)**
	
Channel 157 (5785MHz)	**Channel 165 (5825MHz)**
	

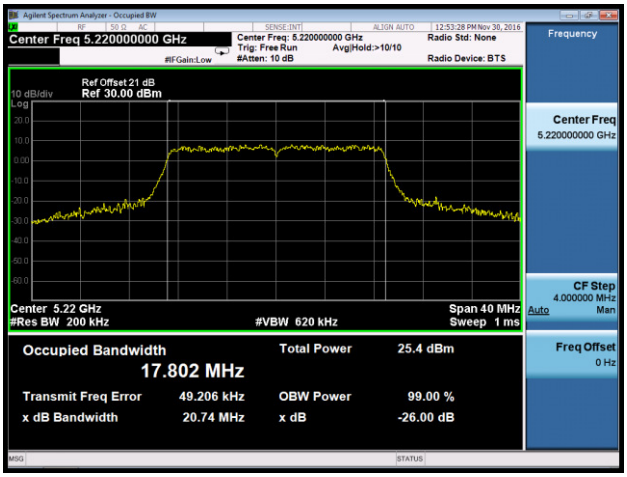
802.11n-HT40 26dB Bandwidth & 99% Bandwidth - Ant 0 / Ant 0 +1 + 2	
Channel 38 (5190MHz)	**Channel 46 (5230MHz)**
	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth - Ant 0 / Ant 0 +1 + 2

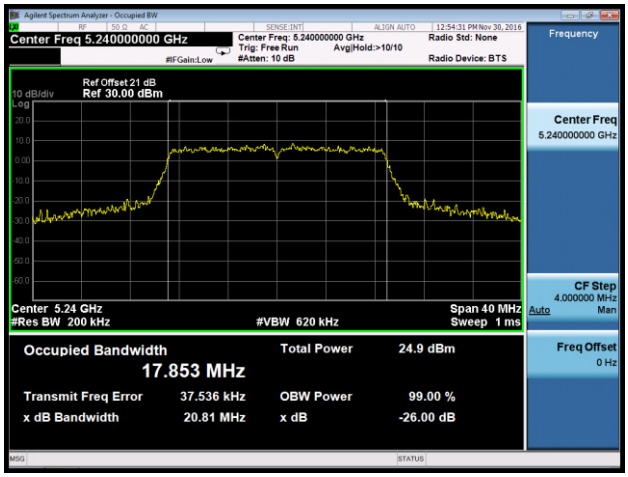
Channel 36 (5180MHz)



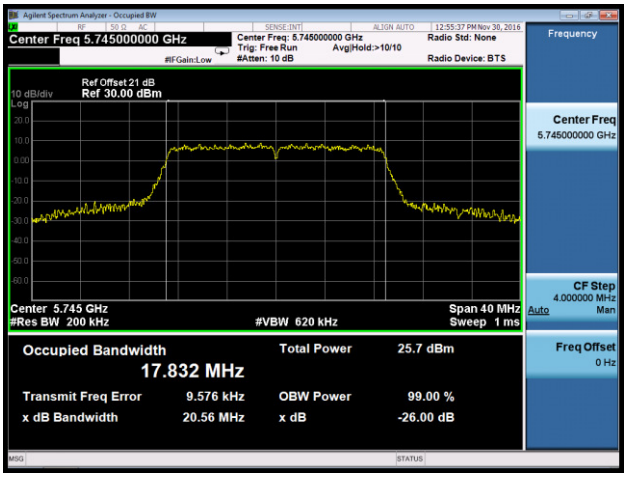
Channel 44 (5220MHz)



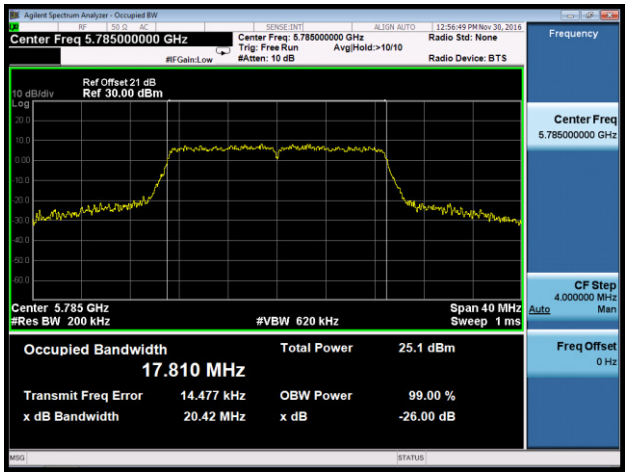
Channel 48 (5240MHz)



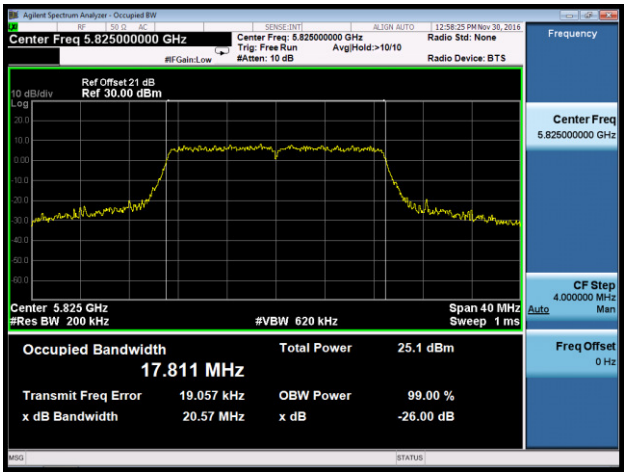
Channel 149 (5745MHz)

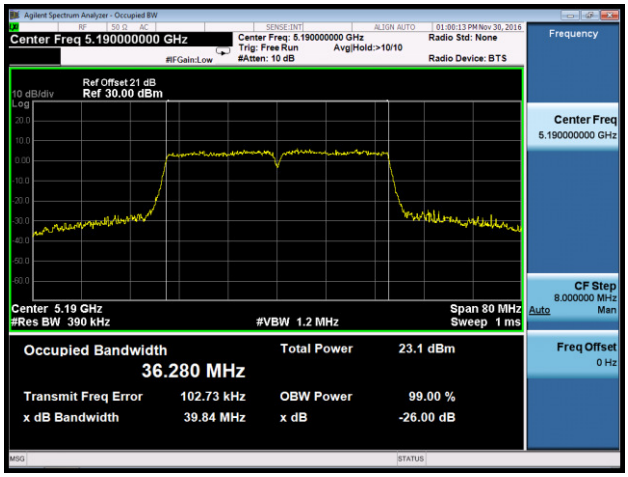
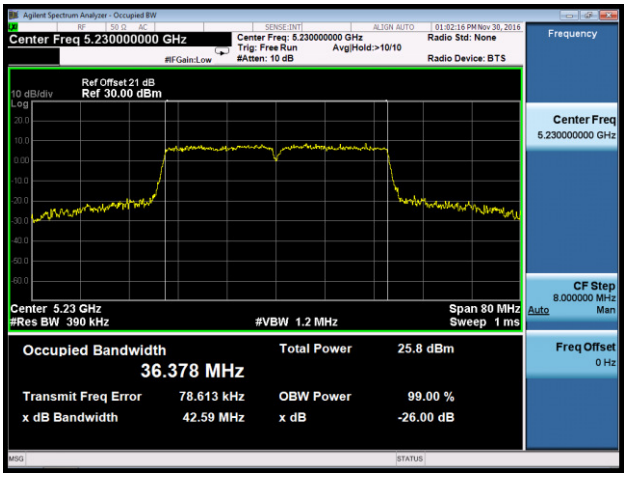
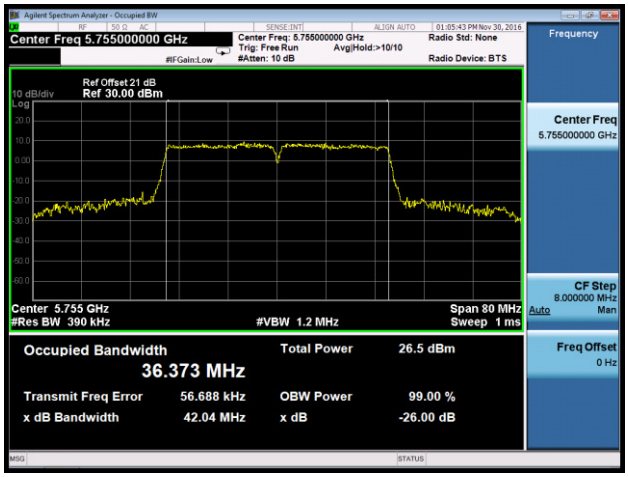
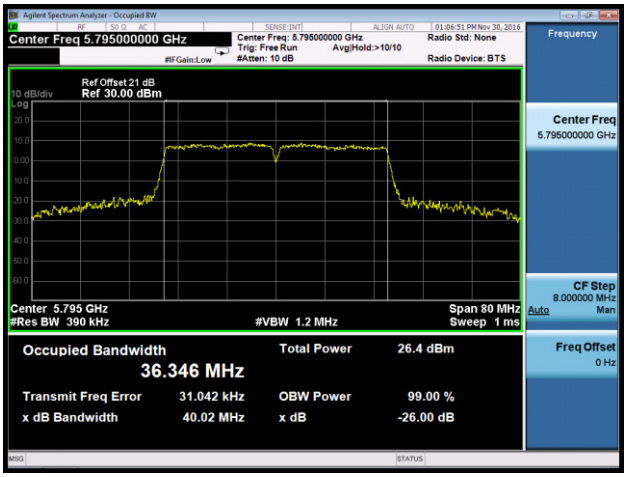


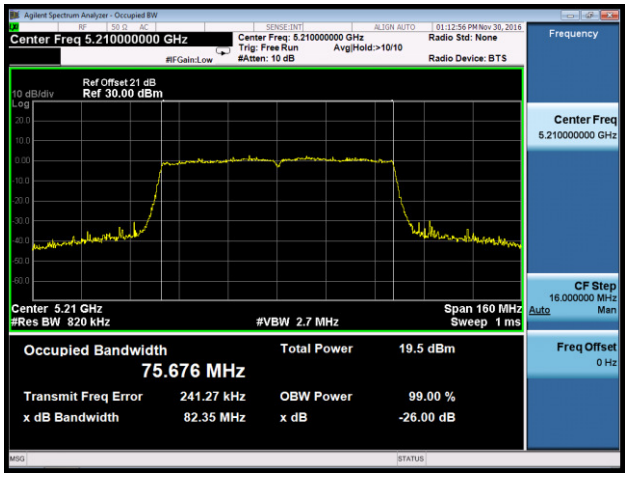
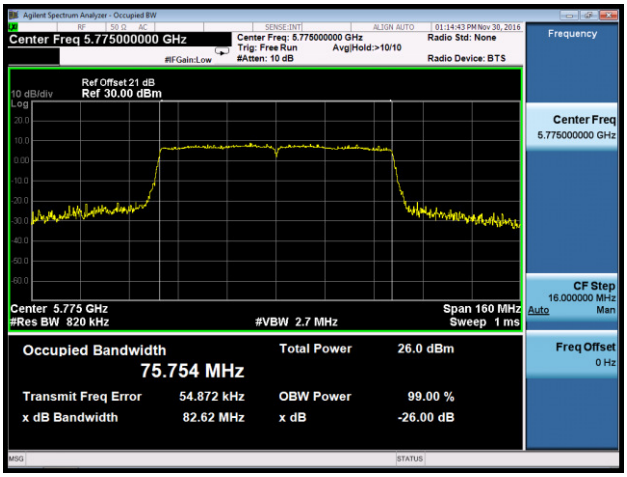
Channel 157 (5785MHz)



Channel 165 (5825MHz)



802.11ac-VHT40 26dB Bandwidth & 99% Bandwidth - Ant 0 / Ant 0 +1 + 2	
Channel 38 (5190MHz)	**Channel 46 (5230MHz)**
	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

802.11ac-VHT80 26dB Bandwidth & 99% Bandwidth - Ant 0 / Ant 0 +1 + 2	
Channel 42 (5210MHz)	Channel 155 (5775MHz)
	

7.3. 6dB Bandwidth Measurement

7.3.1. Test Limit

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

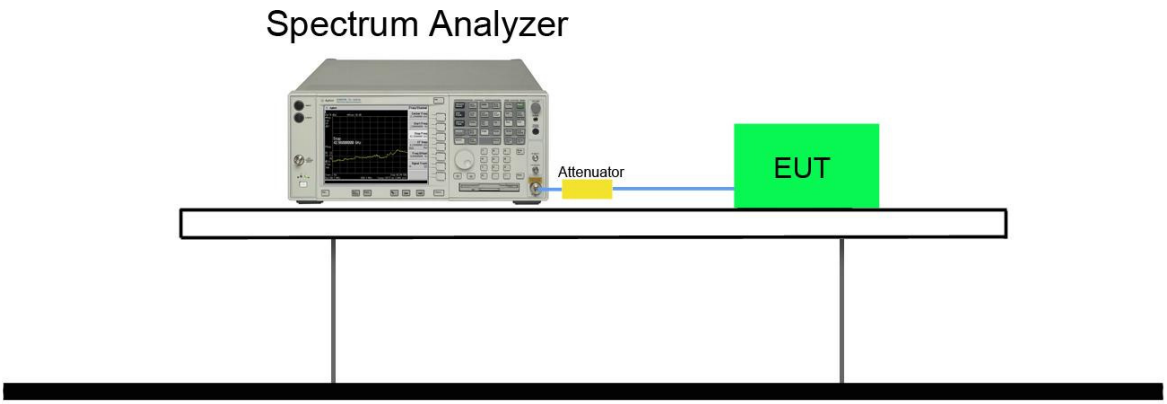
7.3.2. Test Procedure used

KDB 789033 D02v01r03 – Section C.2

7.3.3. Test Setting

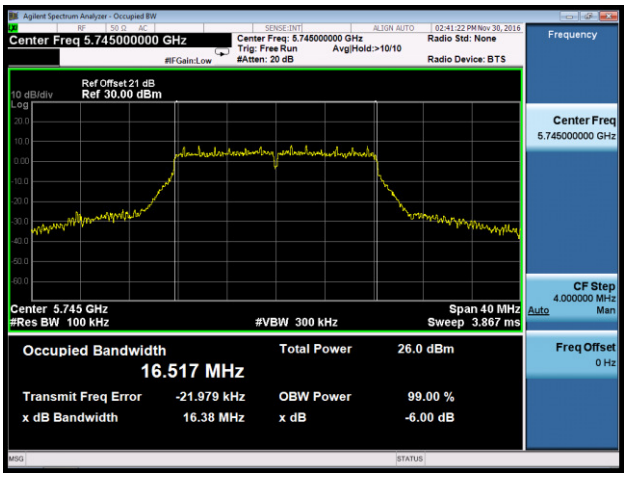
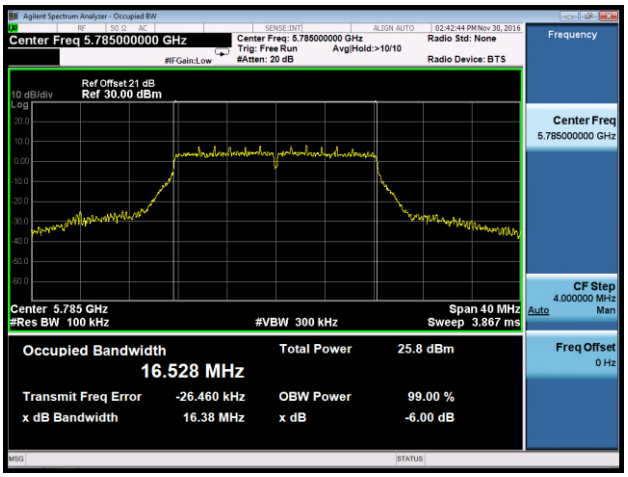
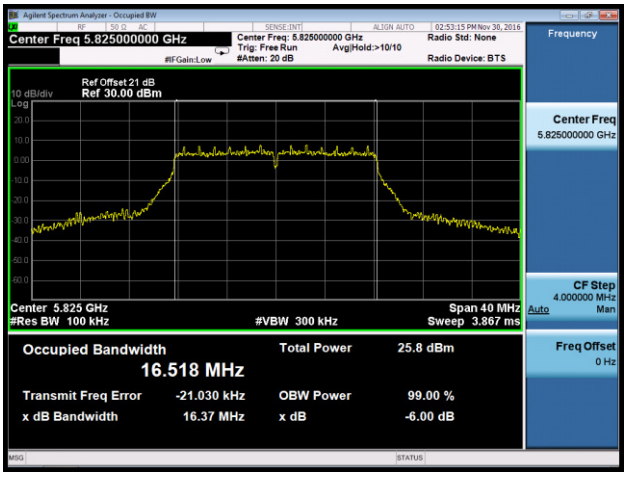
1. Set center frequency to the nominal EUT channel center frequency.
2. RBW = 100 kHz.
3. VBW ≧ 3 × RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.3.4. Test Setup



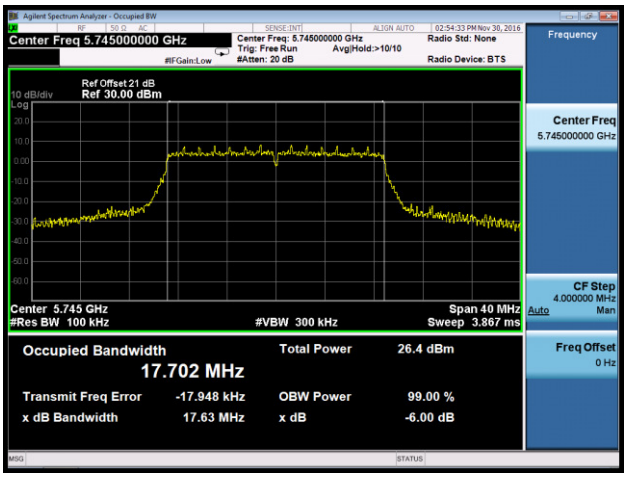
7.3.5. Test Result

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Ant 0 / Ant 0 + 1 + 2						
802.11a	6Mbps	149	5745	16.38	≥ 0.5	Pass
802.11a	6Mbps	157	5785	16.38	≥ 0.5	Pass
802.11a	6Mbps	165	5825	16.37	≥ 0.5	Pass
802.11n-HT20	MCS0	149	5745	17.63	≥ 0.5	Pass
802.11n-HT20	MCS0	157	5785	17.62	≥ 0.5	Pass
802.11n-HT20	MCS0	165	5825	17.61	≥ 0.5	Pass
802.11n-HT40	MCS0	151	5755	36.36	≥ 0.5	Pass
802.11n-HT40	MCS0	159	5795	36.37	≥ 0.5	Pass
802.11ac-VHT20	MCS0	149	5745	17.61	≥ 0.5	Pass
802.11ac-VHT20	MCS0	157	5785	17.62	≥ 0.5	Pass
802.11ac-VHT20	MCS0	165	5825	17.62	≥ 0.5	Pass
802.11ac-VHT40	MCS0	151	5755	36.37	≥ 0.5	Pass
802.11ac-VHT40	MCS0	159	5795	36.36	≥ 0.5	Pass
802.11ac-VHT80	MCS0	155	5775	75.82	≥ 0.5	Pass

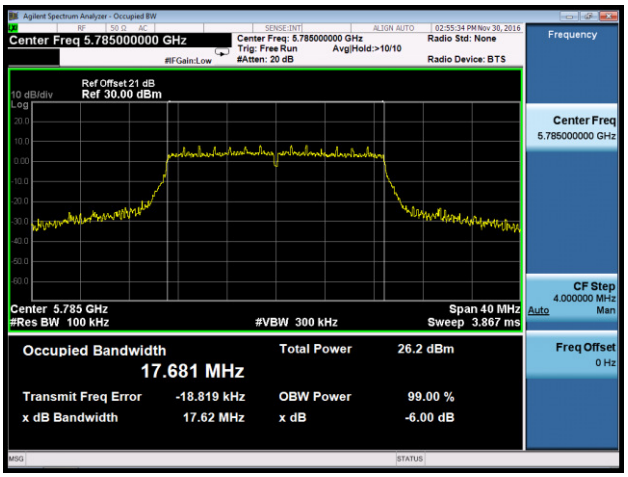
802.11a 6dB Bandwidth - Ant 0 / Ant 0 +1 + 2	
Channel 149 (5745MHz)	**Channel 157 (5785MHz)**
	
Channel 165 (5825MHz)	
	

802.11n-HT20 6dB Bandwidth - Ant 0 / Ant 0 +1 + 2

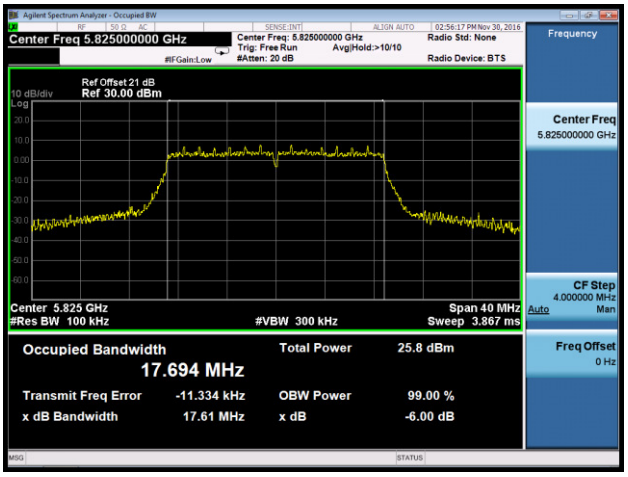
Channel 149 (5745MHz)



Channel 157 (5785MHz)

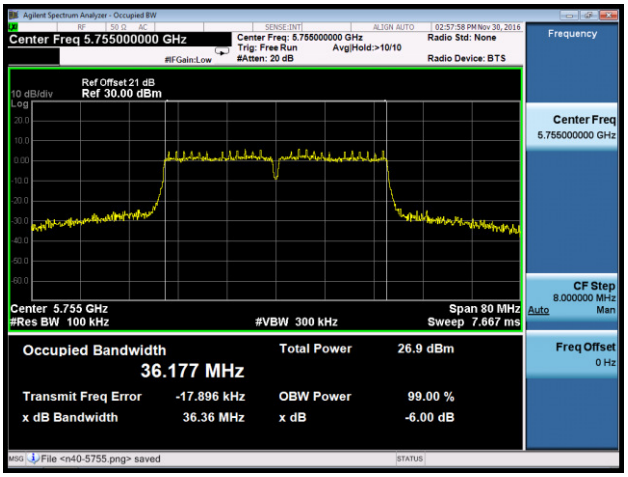


Channel 165 (5825MHz)

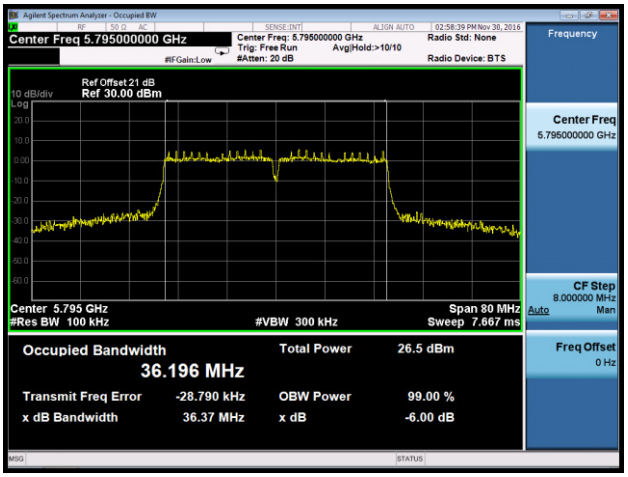


802.11n-HT40 6dB Bandwidth - Ant 0 / Ant 0 +1 + 2

Channel 151 (5755MHz)

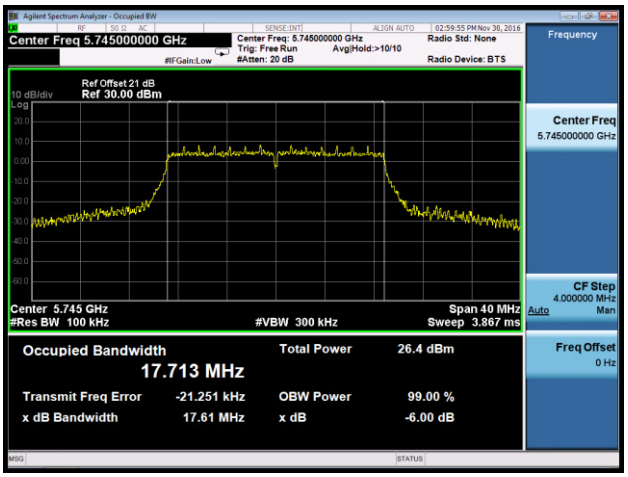


Channel 159 (5795MHz)

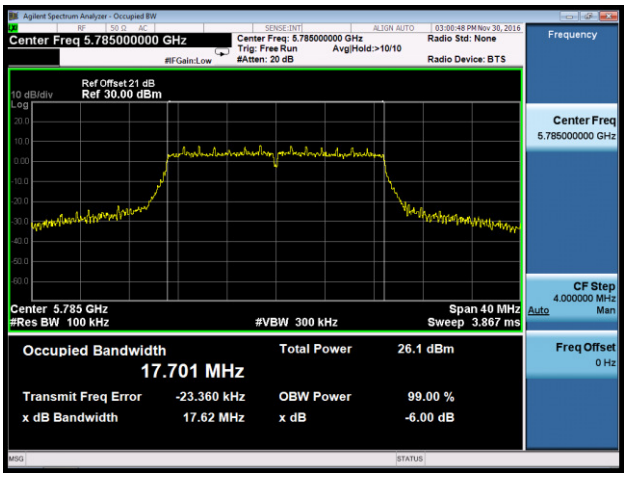


802.11ac-VHT20 6dB Bandwidth - Ant 0 / Ant 0 +1 + 2

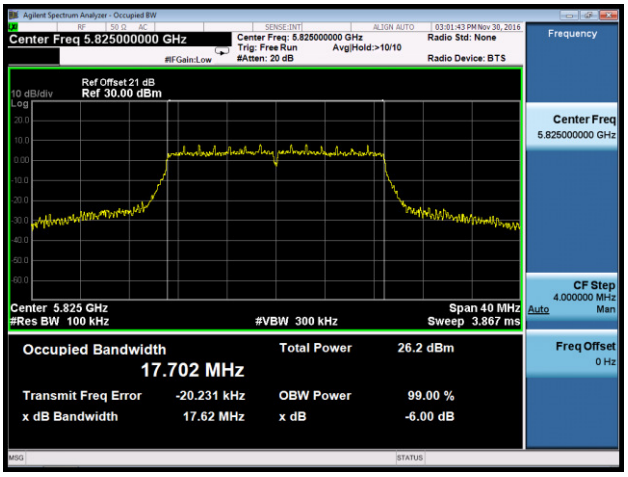
Channel 149 (5745MHz)



Channel 157 (5785MHz)

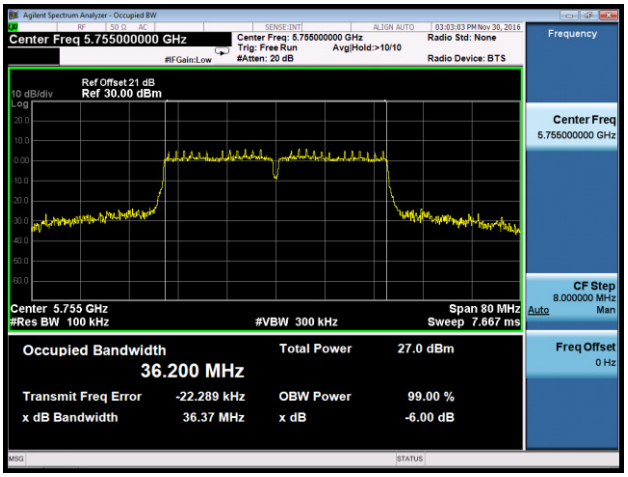


Channel 165 (5825MHz)

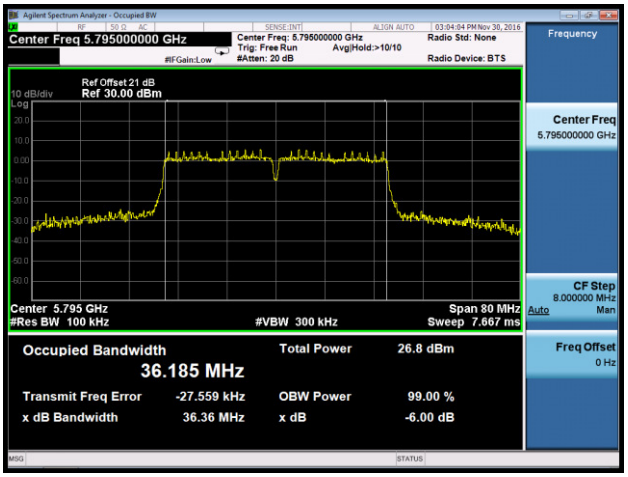


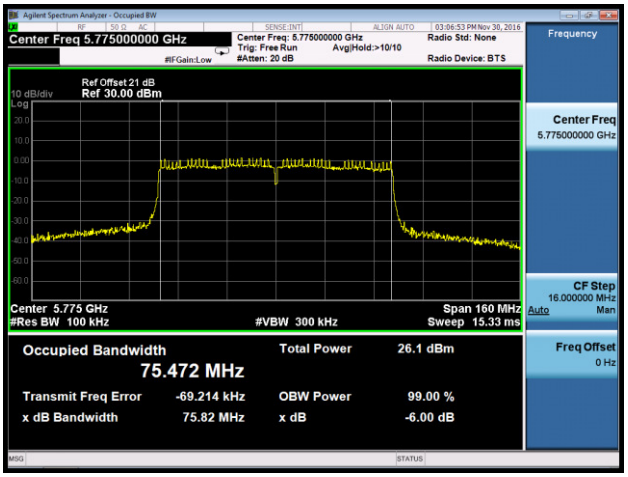
802.11ac-VHT40 6dB Bandwidth - Ant 0 / Ant 0 +1 + 2

Channel 151 (5755MHz)



Channel 159 (5795MHz)



802.11ac-VHT80 6dB Bandwidth - Ant 0 / Ant 0 +1 + 2	
Channel 155 (5775MHz)	
	

7.4. Output Power Measurement

7.4.1. Test Limit

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm).

If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

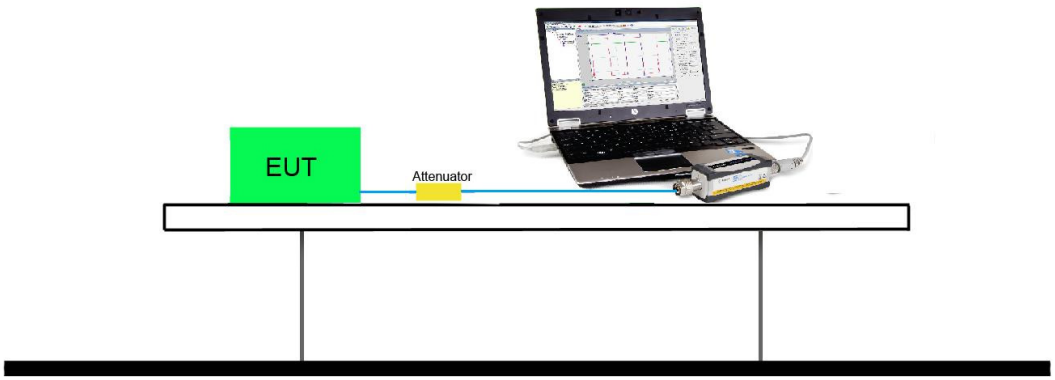
7.4.2. Test Procedure Used

KDB 789033 D02v01r03 - Section E) 3) b) Method PM-G

7.4.3. Test Setting

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.

7.4.4. Test Setup



7.4.5. Test Result

Power output test was verified over all data rates of each mode shown as below table.

For Ant 0 / Ant 0 + 1 + 2 port:

Test Mode	Bandwidth	Channel	Frequency (MHz)	Data Rate/ MCS	Average Power (dBm)
802.11a	20	36	5180	6Mbps	22.02
				24Mbps	21.89
				54Mbps	21.76
802.11n	20	36	5180	MCS0	21.31
				MCS3	21.09
				MCS7	20.92
802.11n	40	38	5190	MCS0	17.78
				MCS3	17.54
				MCS7	17.36
802.11ac	20	36	5180	MCS0	21.83
				MCS4	21.59
				MCS8	21.25
802.11ac	40	38	5190	MCS0	17.24
				MCS4	17.09
				MCS9	16.95
802.11ac	80	42	5210	MCS0	15.95
				MCS4	15.87
				MCS9	15.67

CDD Mode

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Ant 2 Average Power (dBm)	Total Average Power (dBm)	Power Limit (dBm)	Result
11a	6Mbps	36	5180	22.02	22.53	22.34	27.07	≤ 30.00	Pass
11a	6Mbps	44	5220	24.17	24.63	24.43	29.19	≤ 30.00	Pass
11a	6Mbps	48	5240	24.22	24.49	24.31	29.11	≤ 30.00	Pass
11a	6Mbps	149	5745	25.53	23.99	23.29	29.14	≤ 30.00	Pass
11a	6Mbps	157	5785	25.23	24.88	24.14	29.54	≤ 30.00	Pass
11a	6Mbps	165	5825	24.77	23.24	22.92	28.49	≤ 30.00	Pass
11n-HT20	MCS0	36	5180	21.31	21.72	21.27	26.21	≤ 30.00	Pass
11n-HT20	MCS0	44	5220	24.15	24.55	24.32	29.11	≤ 30.00	Pass
11n-HT20	MCS0	48	5240	24.03	24.63	24.44	29.15	≤ 30.00	Pass
11n-HT20	MCS0	149	5745	25.56	24.06	23.89	29.34	≤ 30.00	Pass
11n-HT20	MCS0	157	5785	25.44	23.84	25.01	29.59	≤ 30.00	Pass
11n-HT20	MCS0	165	5825	25.79	24.06	23.41	29.31	≤ 30.00	Pass
11n-HT40	MCS0	38	5190	17.78	17.72	17.76	22.52	≤ 30.00	Pass
11n-HT40	MCS0	46	5230	23.99	24.58	24.41	29.10	≤ 30.00	Pass
11n-HT40	MCS0	151	5755	25.31	23.82	23.81	29.14	≤ 30.00	Pass
11n-HT40	MCS0	159	5795	25.71	24.09	23.94	29.43	≤ 30.00	Pass
11ac-VHT20	MCS0	36	5180	21.83	22.52	22.13	26.94	≤ 30.00	Pass
11ac-VHT20	MCS0	44	5220	24.13	24.78	24.41	29.22	≤ 30.00	Pass
11ac-VHT20	MCS0	48	5240	24.19	24.71	24.57	29.27	≤ 30.00	Pass
11ac-VHT20	MCS0	149	5745	25.57	24.26	23.92	29.41	≤ 30.00	Pass
11ac-VHT20	MCS0	157	5785	25.48	24.11	23.95	29.34	≤ 30.00	Pass
11ac-VHT20	MCS0	165	5825	25.21	23.75	23.78	29.07	≤ 30.00	Pass
11ac-VHT40	MCS0	38	5190	17.24	17.75	17.86	22.40	≤ 30.00	Pass
11ac-VHT40	MCS0	46	5230	24.24	24.65	24.58	29.26	≤ 30.00	Pass
11ac-VHT40	MCS0	151	5755	25.37	23.84	24.05	29.25	≤ 30.00	Pass
11ac-VHT40	MCS0	159	5795	25.83	24.18	24.31	29.61	≤ 30.00	Pass
11ac-VHT80	MCS0	42	5210	15.95	16.65	16.81	21.26	≤ 30.00	Pass
11ac-VHT80	MCS0	155	5775	24.31	22.87	23.04	28.23	≤ 30.00	Pass

Note: Total Average Power (dBm) = $10*\log\{10^{(\text{Ant 0 Average Power }/10)} + 10^{(\text{Ant 1 Average Power }/10)} + 10^{(\text{Ant 2 Average Power }/10)}\}$.

Beamforming Mode

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Ant 2 Average Power (dBm)	Total Average Power (dBm)	Power Limit (dBm)	Result
11ac-VHT20	MCS0	36	5180	19.68	19.72	19.71	24.47	≤ 29.55	Pass
11ac-VHT20	MCS0	44	5220	24.15	24.81	24.39	29.23	≤ 29.55	Pass
11ac-VHT20	MCS0	48	5240	24.22	24.83	24.59	29.33	≤ 29.55	Pass
11ac-VHT20	MCS0	149	5745	25.59	24.33	23.89	29.44	≤ 29.61	Pass
11ac-VHT20	MCS0	157	5785	25.47	24.18	23.96	29.36	≤ 29.61	Pass
11ac-VHT20	MCS0	165	5825	22.51	22.36	22.45	27.21	≤ 29.61	Pass
11ac-VHT40	MCS0	38	5190	14.12	14.33	13.14	18.66	≤ 29.55	Pass
11ac-VHT40	MCS0	46	5230	24.33	24.71	24.59	29.32	≤ 29.55	Pass
11ac-VHT40	MCS0	151	5755	25.41	23.91	24.16	29.32	≤ 29.61	Pass
11ac-VHT40	MCS0	159	5795	25.93	24.21	24.36	29.68	≤ 29.61	Pass
11ac-VHT80	MCS0	42	5210	12.67	12.81	13.06	17.62	≤ 29.55	Pass
11ac-VHT80	MCS0	155	5775	22.51	21.82	21.71	26.80	≤ 29.61	Pass

Note 1: Total Average Power (dBm) = $10*\log\{10^{(\text{Ant 0 Average Power }/10)}+10^{(\text{Ant 1 Average Power }/10)}+10^{(\text{Ant 2 Average Power }/10)}\}$.

Note 2: Power Limit = 30dBm – [Directional Gain (dBi) – 6 (dBi)].

7.5. Power Spectral Density Measurement

7.5.1. Test Limit

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

7.5.2. Test Procedure Used

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7.5.3. Test Setting

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire 26dB EBW of the signal.
3. RBW = 1MHz, if measurement bandwidth of Maximum PSD is specified in 500 kHz, RBW = 100 kHz
4. VBW = 3MHz
5. Number of sweep points ≥ 2 × (span / RBW)
6. Detector = power averaging (Average)
7. Sweep time = auto
8. Trigger = free run
9. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
10. Add 10*log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10*log(1/0.25) = 6 dB if the duty cycle is 25 percent.
11. When the measurement bandwidth of Maximum PSD is specified in 500 kHz, add a constant factor 10*log(500kHz/100kHz) = 7 dB to the measured result

7.5.4. Test Setup