



## MEASUREMENT REPORT

### FCC PART 15.407 / RSS-247 WLAN 802.11a/n/ac

**FCC ID:** T2C-WF50  
**IC:** 10741A-WF50  
**APPLICANT:** YEALINK(XIAMEN) NETWORK TECHNOLOGY CO.,LTD  
**Application Type:** Certification  
**Product:** Wi-Fi USB Dongle  
**Model No.:** WF50  
**Brand Name:** YEALINK  
**FCC Classification:** Unlicensed National Information Infrastructure (UNII)  
**FCC Rule Part(s):** Part 15.407  
**IC Rule(s):** RSS-247 Issue 2, RSS-GEN Issue 5  
**Test Procedure(s):** ANSI C63.10-2013, KDB 789033 D02v02r01  
**Test Date:** December 26, 2017 ~ March 11, 2018

Reviewed By : Sunny Sun  
( Sunny Sun )

Approved By : Robin Wu  
( Robin Wu )



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 789033 D02v02r01. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

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## Revision History

Report No.	Version	Description	Issue Date	Note
1807RSU018-U1	Rev. 01	Initial Report	08-21-2018	Valid

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## §2.1033 General Information

<b>Applicant:</b>	YEALINK(XIAMEN) NETWORK TECHNOLOGY CO.,LTD
<b>Applicant Address:</b>	309, 3th Floor, No.16, Yun Ding North Road, Huli District, Xiamen City, Fujian, P.R. China
<b>Manufacturer:</b>	YEALINK(XIAMEN) NETWORK TECHNOLOGY CO.,LTD
<b>Manufacturer Address:</b>	309, 3th Floor, No.16, Yun Ding North Road, Huli District, Xiamen City, Fujian, P.R. China
<b>Test Site:</b>	MRT Technology (Suzhou) Co., Ltd
<b>Test Site Address:</b>	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
<b>FCC Registration No.:</b>	893164
<b>IC Registration No.:</b>	11384A
<b>Test Device Serial No.:</b>	N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering

### 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. 893164) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.
- 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-20025, G-20034, C-20020, T-20020) 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, Radio and SAR testing.



## 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, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



## 2. PRODUCT INFORMATION

### 2.1. Equipment Description

Product Name	Wi-Fi USB Dongle
Model No.	WF50
Wi-Fi Specification	802.11a/b/g/n/ac
Antenna Delivery	1*Tx + 1*Rx

### 2.2. Product Specification Subjective to this Report

Frequency Range	For 802.11a/n-HT20/ac-VHT20: 5260~5320MHz, 5500~5720MHz For 802.11n-HT40/ac-VHT40: 5270~5310MHz, 5510~5710MHz For 802.11ac-VHT80: 5290MHz, 5530MHz, 5610MHz, 5690MHz, 5775MHz
Type of Modulation	802.11a/n/ac: OFDM
Data Rate:	802.11a: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 150Mbps 802.11ac: up to 433.3Mbps

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

### 2.3. Operation Frequency / Channel list

802.11a/n-HT20/ac-VHT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
52	5260 MHz	56	5280 MHz	60	5300 MHz
64	5320 MHz	100	5500 MHz	104	5520 MHz
108	5540 MHz	112	5560 MHz	116	5580 MHz
120	5600 MHz	124	5620 MHz	128	5640 MHz
132	5660 MHz	136	5680 MHz	140	5700 MHz
144	5720 MHz	---	---	---	---

802.11n-HT40/ac-VHT40

Channel	Frequency	Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz	102	5510 MHz
110	5550 MHz	118	5590 MHz	126	5630 MHz
134	5670 MHz	142	5710 MHz	---	---

802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
58	5290 MHz	106	5530 MHz	122	5610 MHz
138	5690 MHz	---	---	---	---

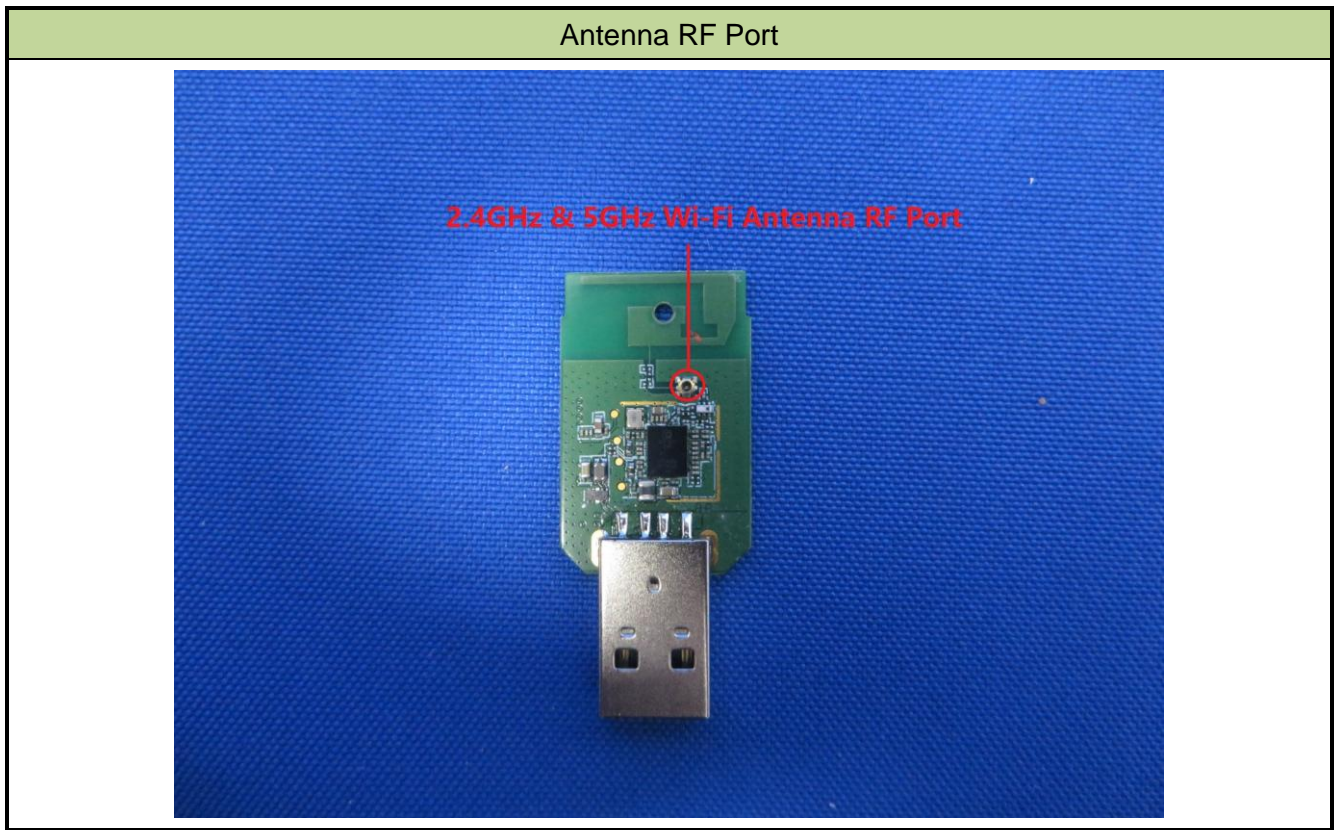
Note: The device can't operate in 5600~5650 MHz band in Canada (The frequency of blue font).

### 2.4. Description of Available Antennas

Antenna Type	Frequency Band (MHz)	TX Paths	Max Peak Gain (dBi)
Built-in	2400 ~ 2483.5	1	3
	5150 ~ 5850	1	3



## 2.5. Description of Antenna RF Port



## 2.6. Test Mode

Test Mode	Mode 1: Transmit by 802.11a (6Mbps)
	Mode 2: Transmit by 802.11n-HT20 (MCS0)
	Mode 3: Transmit by 802.11n-HT40 (MCS0)
	Mode 4: Transmit by 802.11ac-VHT20 (MCS0)
	Mode 5: Transmit by 802.11ac-VHT40 (MCS0)
	Mode 6: Transmit by 802.11ac-VHT80 (MCS0)

## 2.7. Description of Test Software

The test utility software used during testing was "QCARCT", and the version was "3.0.250.0".

## 2.8. Device Capabilities

This device contains the following capabilities:

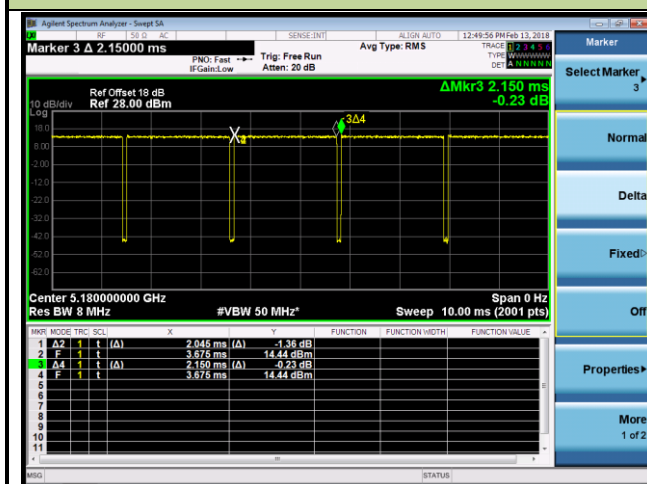
802.11a/b/g/n/ac Wi-Fi Device.

**Note:** 5GHz (UNII) 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.

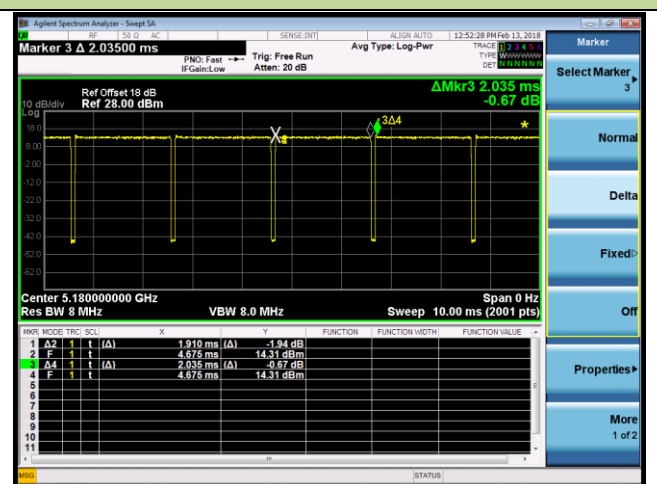
The duty cycles are as follows:

Test Mode	Duty Cycle
802.11a	95.12 %
802.11n-HT20	93.86 %
802.11n-HT40	89.01 %
802.11ac-VHT20	95.08 %
802.11ac-VHT40	89.67 %
802.11ac-VHT80	84.26 %

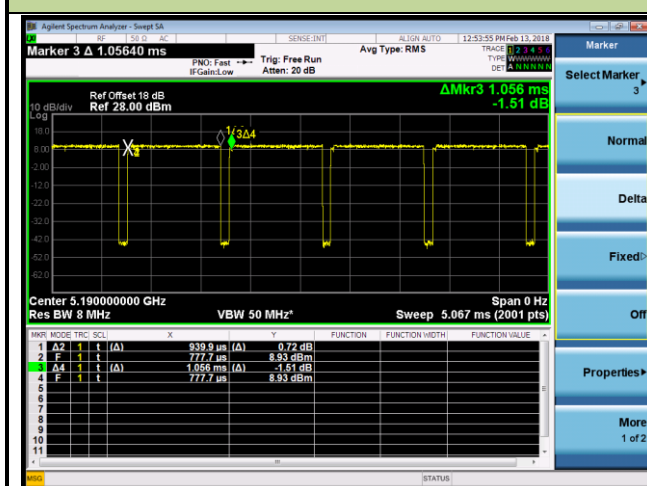
802.11a - T = 2.045 ms



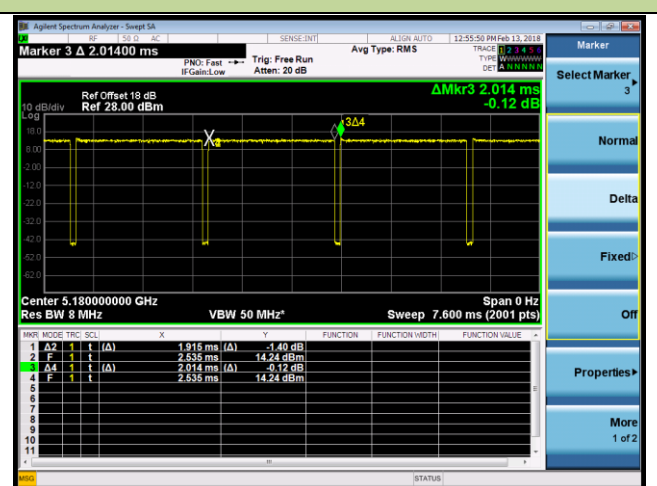
802.11n-HT20 - T = 1.910 ms

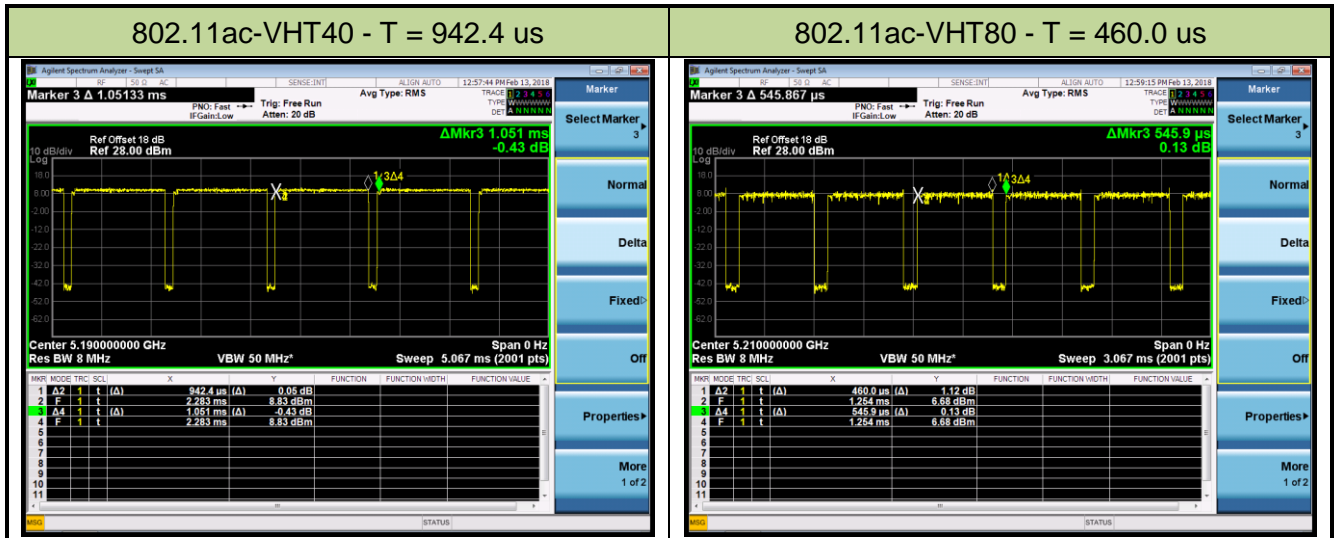


802.11n-HT40 - T = 939.9 us



802.11ac-VHT20 - T = 1.915 ms





## 2.9. Test Configuration

The **Wi-Fi USB Dongle** was tested per the guidance of KDB 789033 D02v02r01. 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 D02v02r01 were used in the measurement.

**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.”

- The antenna of the **Wi-Fi USB Dongle** is **permanently attached**.
- There are no provisions for connection to an external antenna.

### Conclusion:

The **Wi-Fi USB Dongle** unit complies with the requirement of §15.203.



## 5. TEST EQUIPMENT CALIBRATION DATE

### Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2018/08/18
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2019/06/21
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2019/06/21
Thermohygrometer	Testo	608-H1	MRTSUE06404	1 year	2018/08/14
Shielding Anechoic Chamber	Mikebang	Chamber-SR2	MRTSUE06215	1 year	2019/05/10

### Radiated Disturbance - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2018/09/13
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2018/08/18
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2018/11/20
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2019/04/25
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2018/11/17
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2018/11/18
Broad Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2018/10/21
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2018/12/14
Amplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2019/06/14
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2019/08/14
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2019/05/10

### Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2019/04/25
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2018/12/06
Thermohygrometer	Testo	608-H1	MRTSUE06401	1 year	2018/08/14

Software	Version	Function
e3	V8.3.5	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  $k = 2$ .

<b>AC Conducted Emission Measurement - SR2</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 150kHz~30MHz: 3.46dB
<b>Radiated Emission Measurement - AC1</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 9kHz ~ 1GHz: 4.18dB 1GHz ~ 25GHz: 4.76dB
<b>Spurious Emissions, Conducted - TR3</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 0.78dB
<b>Output Power - TR3</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 1.13dB
<b>Power Spectrum Density - TR3</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 1.15dB
<b>Occupied Bandwidth - TR3</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 0.28%



## 7. TEST RESULT

### 7.1. Summary

**Company Name:** YEALINK(XIAMEN) NETWORK TECHNOLOGY CO.,LTD  
**FCC ID:** T2C-WF50  
**IC:** 10741A-WF50

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	$\geq 500\text{kHz}$		Pass	Section 7.3
15.407(a) (2) (4)	Maximum Conducted Output Power	Refer to section 7.4		Pass	Section 7.4
15.407(a) (2), (5)	Peak Power Spectral Density	Refer to Section 7.5		Pass	Section 7.5
15.407(g)	Frequency Stability	N/A		Pass	Section 7.6
15.407(b)(2), (3)	Undesirable Emissions	Refer to 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

RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
RSS-247 §6.2	99% Bandwidth	N/A	Conducted	Pass	Section 7.2
RSS-247 §6.2.4	6dB Bandwidth	>500kHz		Pass	Section 7.3
RSS-247 §6.2.2, §6.2.3	Max Conducted Output Power	Refer to section 7.4		Pass	Section 7.4
RSS-247 §6.2.2, §6.2.3	Peak Power Spectral Density	Refer to section 7.5		Pass	Section 7.5
RSS-Gen [8.11]	Frequency Stability	N/A		Pass	Section 7.6
RSS-247 §6.2.2, §6.2.3	Out-of-Band Emissions	Refer to section 7.8	Radiated	Pass	Section 7.7 & 7.8
RSS-247 §6.2.2, §6.2.3	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in RSS-Gen [8.9]		Pass	
RSS-Gen [8.8]	AC Conducted Emissions 150kHz - 30MHz	≤ RSS-Gen [8.8] Limit	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.

## 7.2. 26dB Bandwidth Measurement

### 7.2.1. Test Limit

N/A

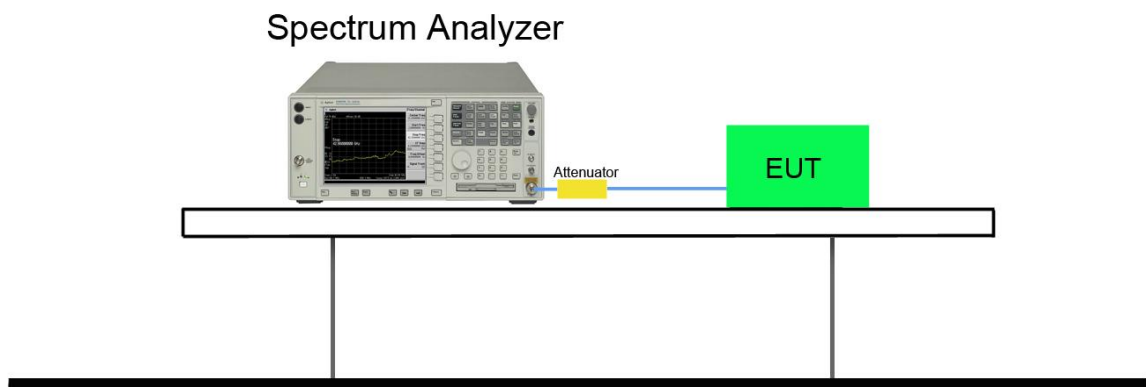
### 7.2.2. Test Procedure used

KDB 789033 D02v02r01 – 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.  $VBW \geq 3 \times RBW$ .
4. Detector = Peak.
5. Trace mode = max hold.

### 7.2.4. Test Setup



### 7.2.5. Test Result

Product	Wi-Fi USB Dongle	Temperature	22°C
Test Engineer	Hunk Li	Relative Humidity	54%
Test Site	TR3	Test Date	2018/02/13 ~ 2018/03/11

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
802.11a	6	52	5260	35.63	20.73	Pass
802.11a	6	60	5300	35.35	20.55	Pass
802.11a	6	64	5320	21.41	16.36	Pass
802.11a	6	100	5500	20.74	16.32	Pass
802.11a	6	116	5580	34.03	18.84	Pass
802.11a	6	120	5600	33.06	17.40	Pass
802.11a	6	140	5700	20.92	16.35	Pass
802.11a	6	144	5720	33.84	18.28	Pass
802.11n-HT20	MCS0	52	5260	34.68	18.48	Pass
802.11n-HT20	MCS0	60	5300	39.09	22.52	Pass
802.11n-HT20	MCS0	64	5320	35.07	18.13	Pass
802.11n-HT20	MCS0	100	5500	20.92	17.40	Pass
802.11n-HT20	MCS0	116	5580	35.04	19.00	Pass
802.11n-HT20	MCS0	120	5600	36.17	19.17	Pass
802.11n-HT20	MCS0	140	5700	21.11	17.42	Pass
802.11n-HT20	MCS0	144	5720	36.07	18.88	Pass
802.11n-HT40	MCS0	54	5270	79.92	47.47	Pass
802.11n-HT40	MCS0	62	5310	42.78	35.95	Pass
802.11n-HT40	MCS0	102	5510	40.69	35.84	Pass
802.11n-HT40	MCS0	110	5550	75.03	37.30	Pass
802.11n-HT40	MCS0	118	5590	78.18	40.06	Pass
802.11n-HT40	MCS0	134	5670	58.97	36.28	Pass
802.11n-HT40	MCS0	142	5710	76.72	38.99	Pass

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
802.11ac-VHT20	MCS0	52	5260	38.35	20.90	Pass
802.11ac-VHT20	MCS0	60	5300	39.00	21.47	Pass
802.11ac-VHT20	MCS0	64	5320	20.41	17.44	Pass
802.11ac-VHT20	MCS0	100	5500	21.16	17.45	Pass
802.11ac-VHT20	MCS0	116	5580	31.74	18.55	Pass
802.11ac-VHT20	MCS0	120	5600	31.09	18.56	Pass
802.11ac-VHT20	MCS0	140	5700	20.94	17.43	Pass
802.11ac-VHT20	MCS0	144	5720	32.36	18.21	Pass
802.11ac-VHT40	MCS0	54	5270	79.13	41.76	Pass
802.11ac-VHT40	MCS0	62	5310	41.34	35.84	Pass
802.11ac-VHT40	MCS0	102	5510	40.52	35.81	Pass
802.11ac-VHT40	MCS0	110	5550	77.09	37.65	Pass
802.11ac-VHT40	MCS0	118	5590	76.07	37.82	Pass
802.11ac-VHT40	MCS0	134	5670	53.62	36.01	Pass
802.11ac-VHT40	MCS0	142	5710	79.33	37.42	Pass
802.11ac-VHT80	MCS0	58	5290	82.17	75.09	Pass
802.11ac-VHT80	MCS0	106	5530	82.32	75.05	Pass
802.11ac-VHT80	MCS0	122	5610	146.4	77.59	Pass
802.11ac-VHT80	MCS0	138	5690	145.2	77.89	Pass

## 802.11a 26dB Bandwidth &amp; 99% Bandwidth

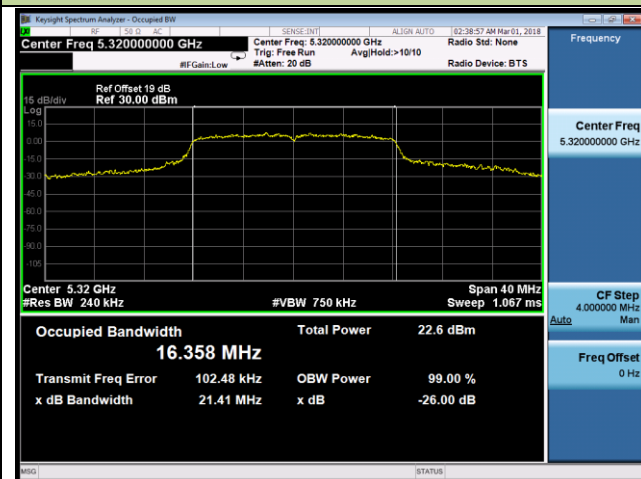
## Channel 52 (5260MHz)



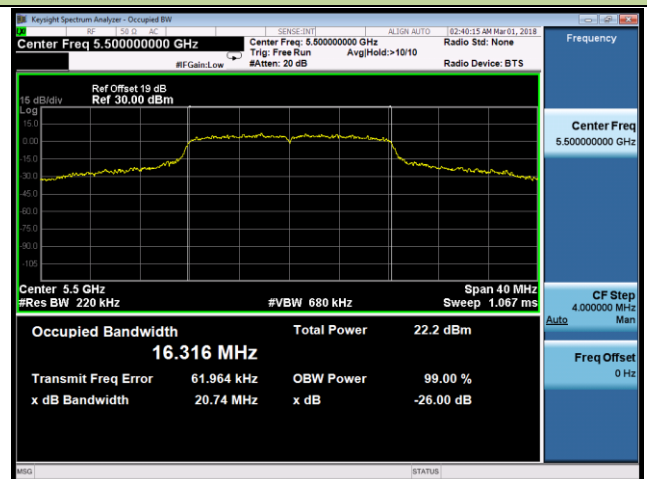
## Channel 60 (5300MHz)



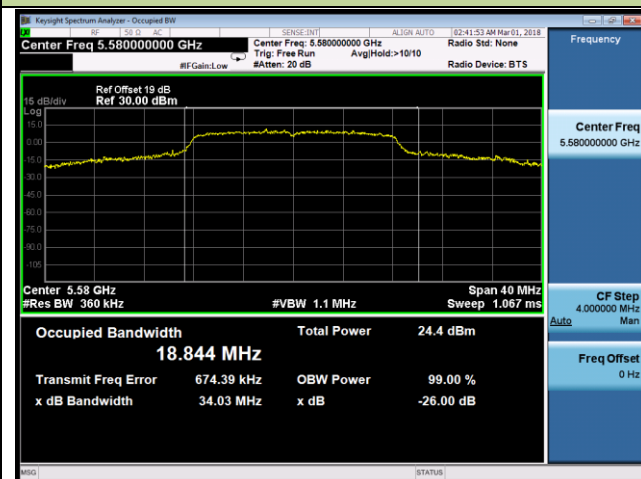
## Channel 64 (5320MHz)



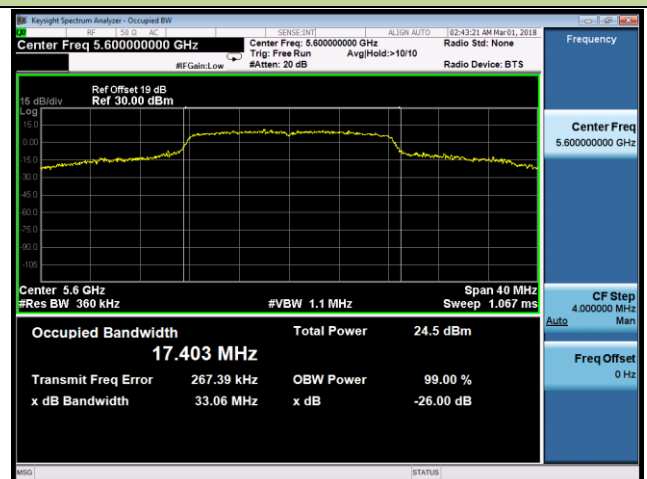
## Channel 100 (5500MHz)

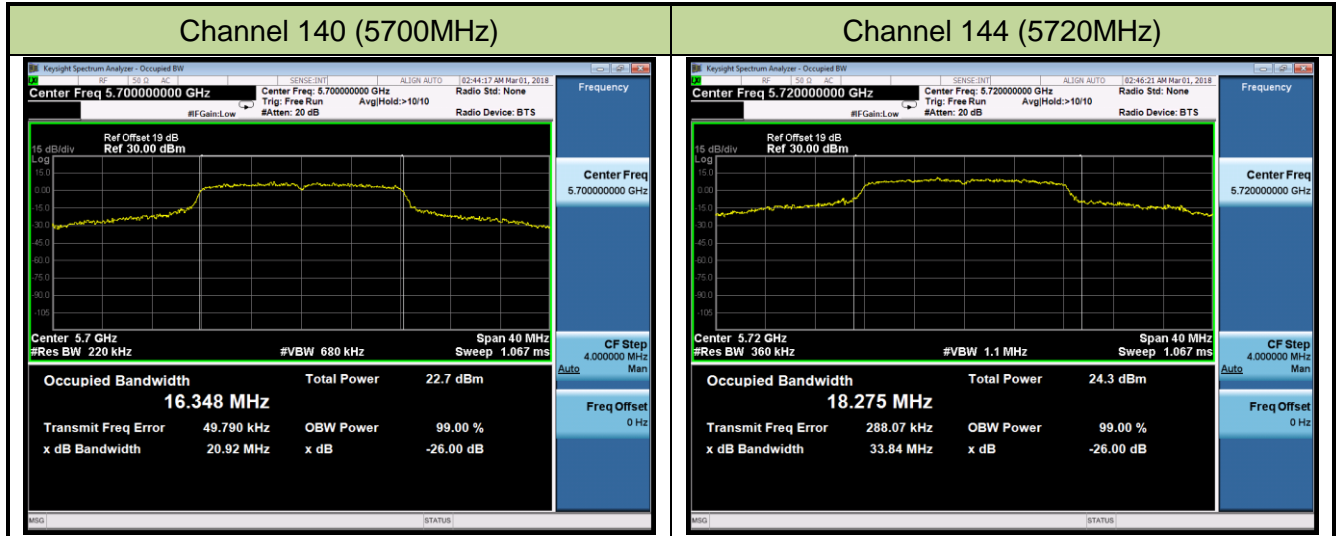


## Channel 116 (5580MHz)



## Channel 120 (5600MHz)



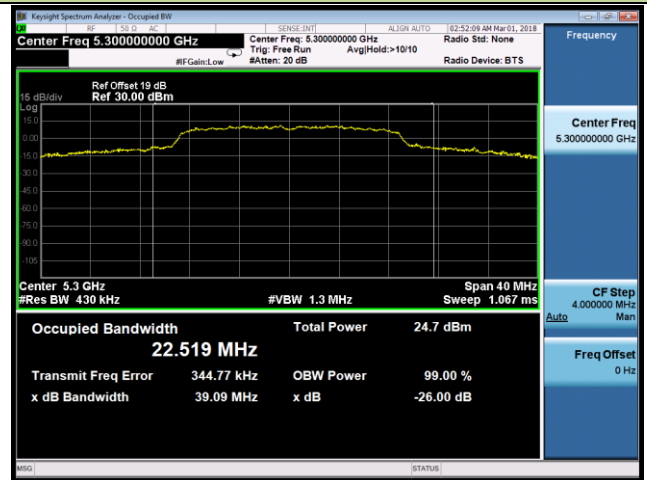


## 802.11n-HT20 26dB Bandwidth &amp; 99% Bandwidth

## Channel 52 (5260MHz)



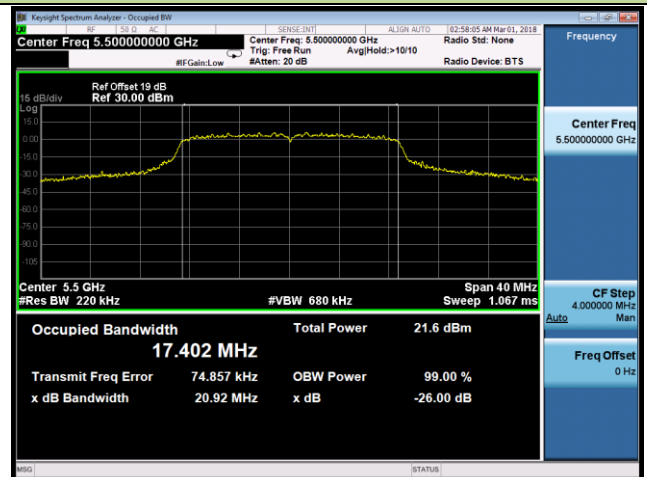
## Channel 60 (5300MHz)



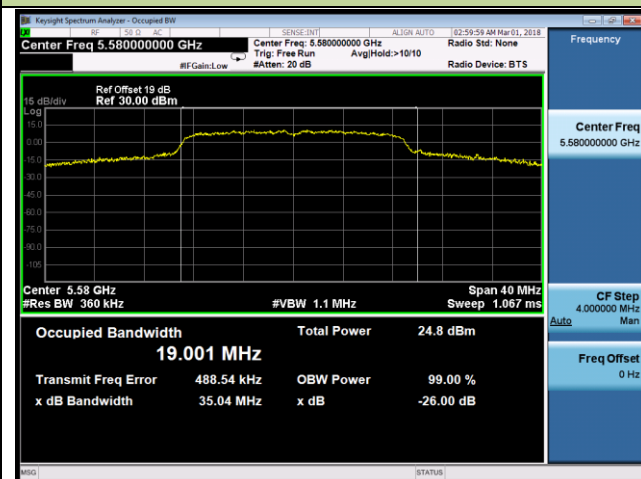
## Channel 64 (5320MHz)



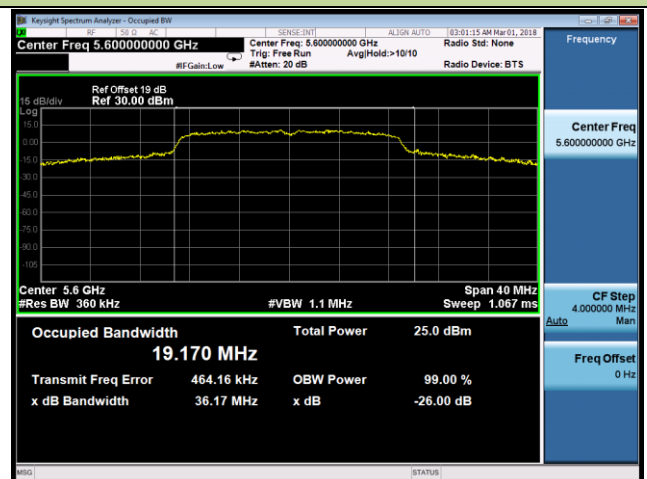
## Channel 100 (5500MHz)



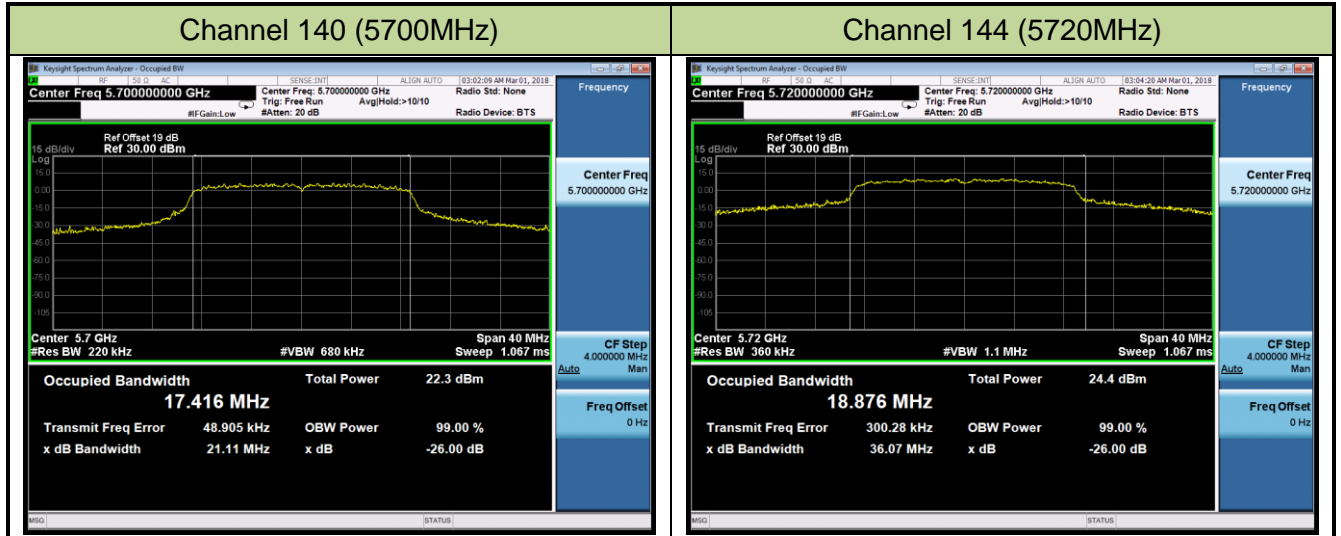
## Channel 116 (5580MHz)



## Channel 120 (5600MHz)





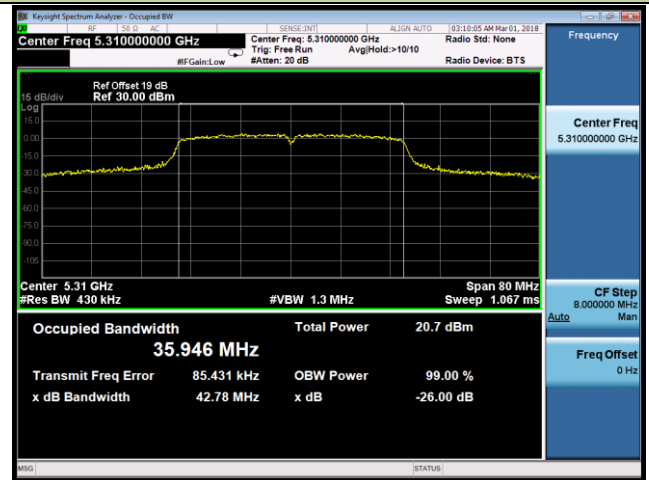


## 802.11n-HT40 26dB Bandwidth &amp; 99% Bandwidth

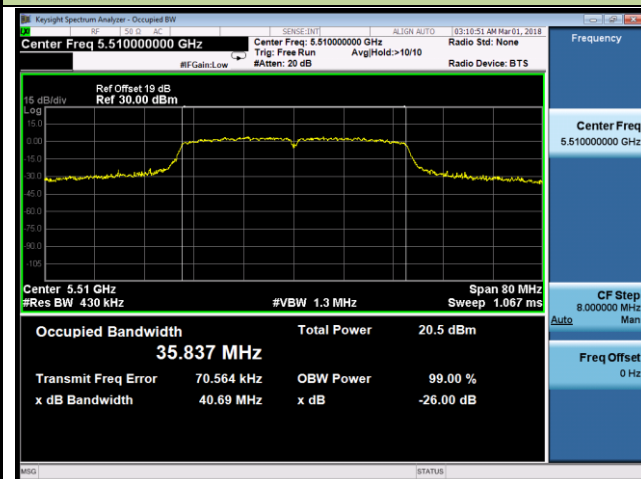
## Channel 54 (5270MHz)



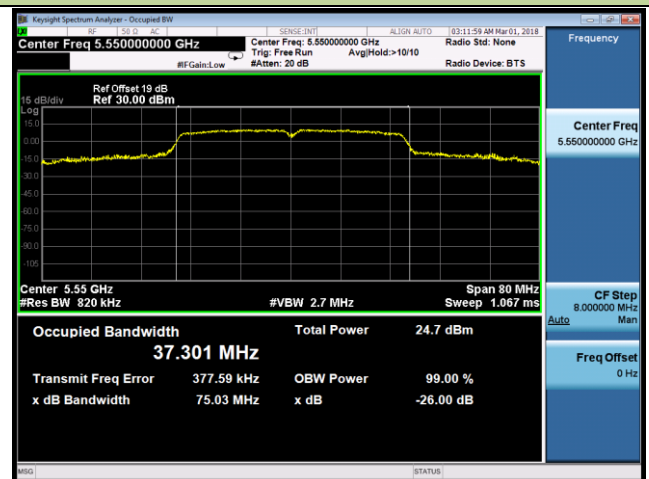
## Channel 62 (5310MHz)



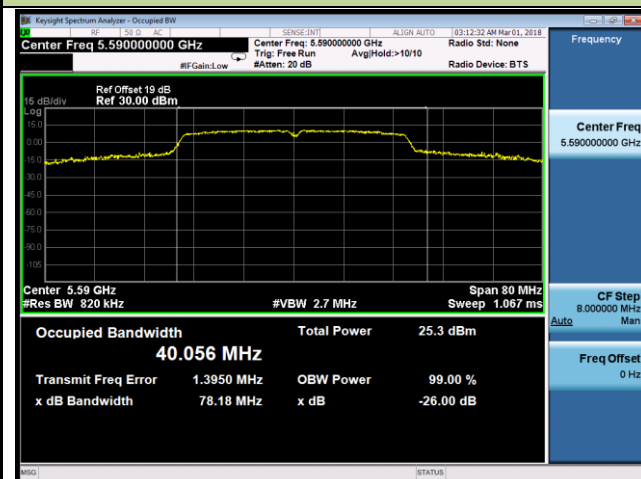
## Channel 102 (5510MHz)



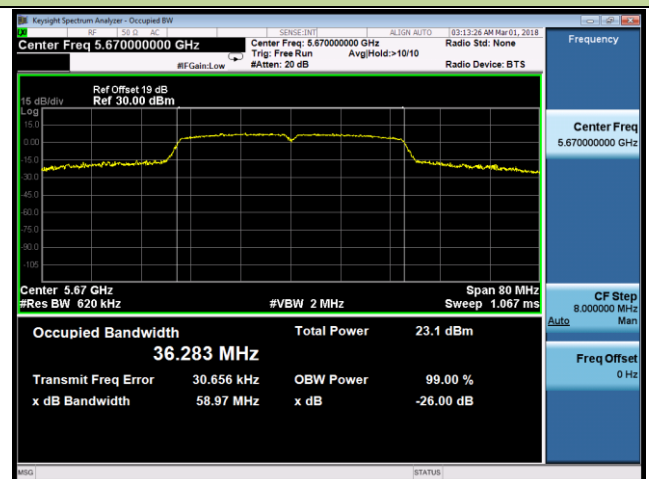
## Channel 110 (5550MHz)

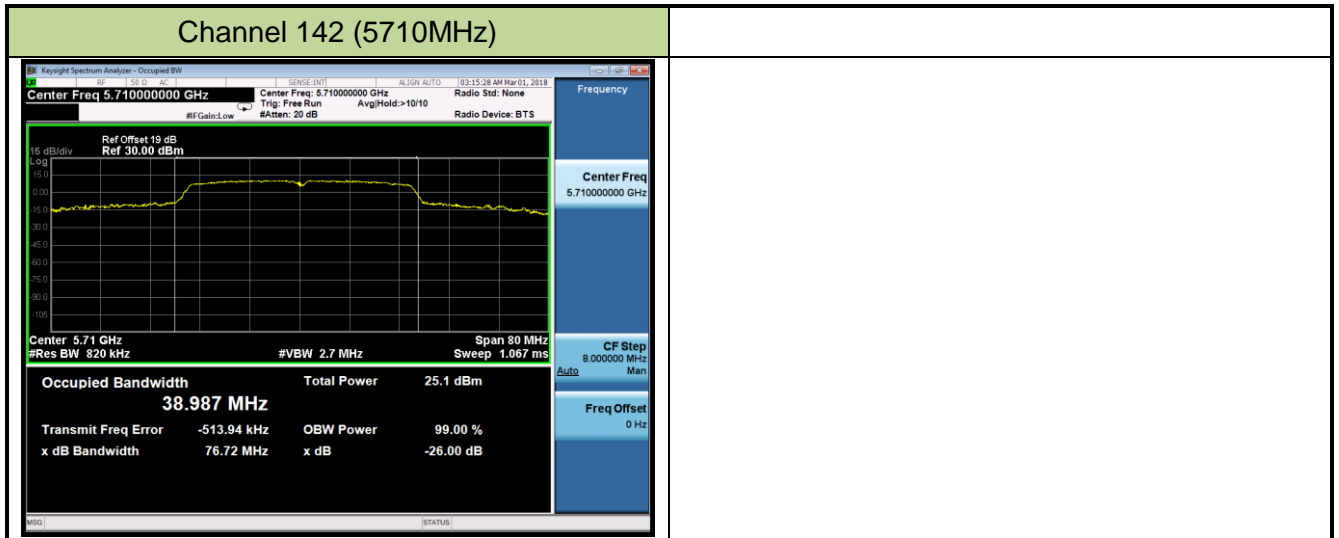


## Channel 118 (5590MHz)



## Channel 134 (5670MHz)





## 802.11ac-VHT20 26dB Bandwidth &amp; 99% Bandwidth

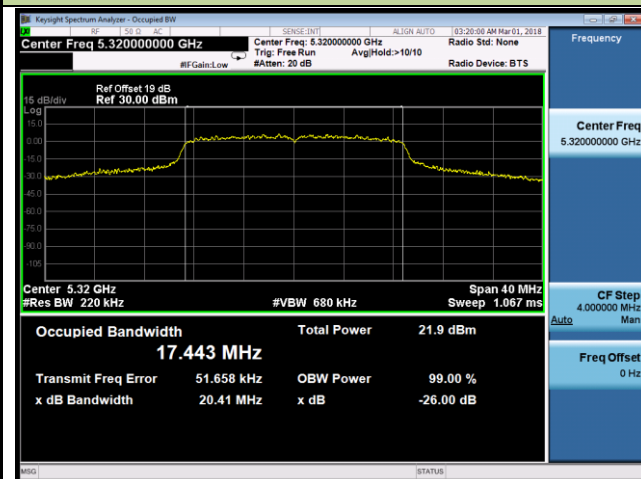
## Channel 52 (5260MHz)



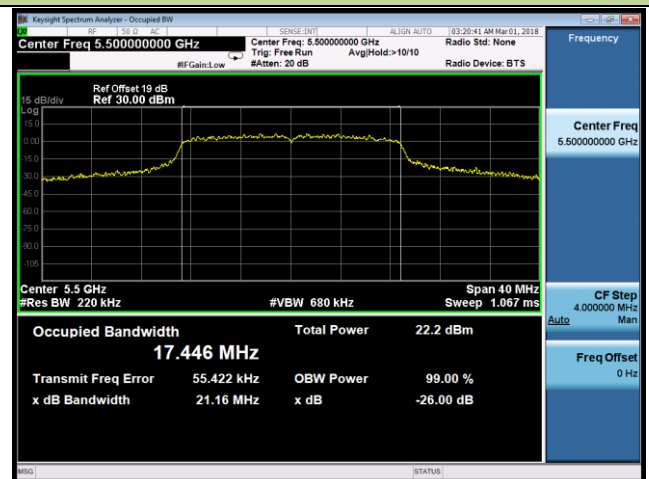
## Channel 60 (5300MHz)



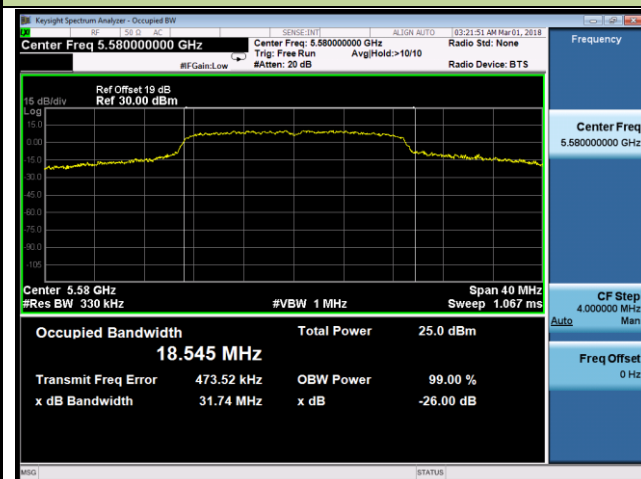
## Channel 64 (5320MHz)



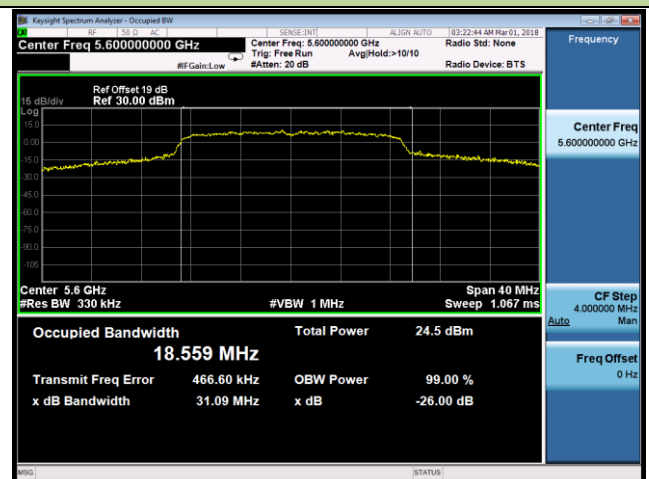
## Channel 100 (5500MHz)

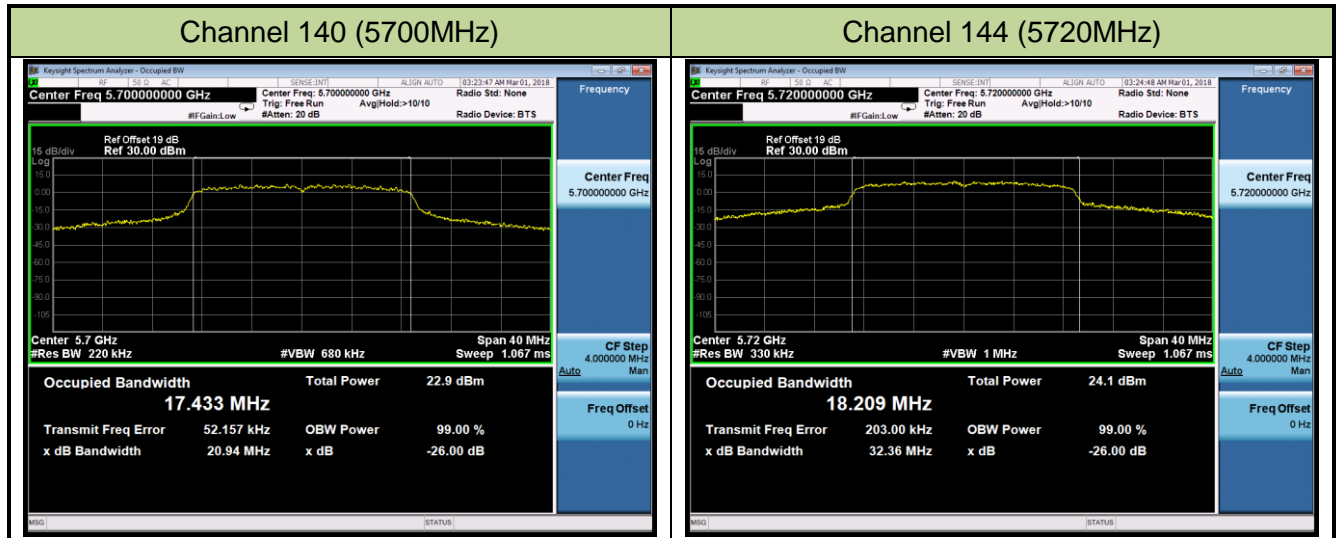


## Channel 116 (5580MHz)



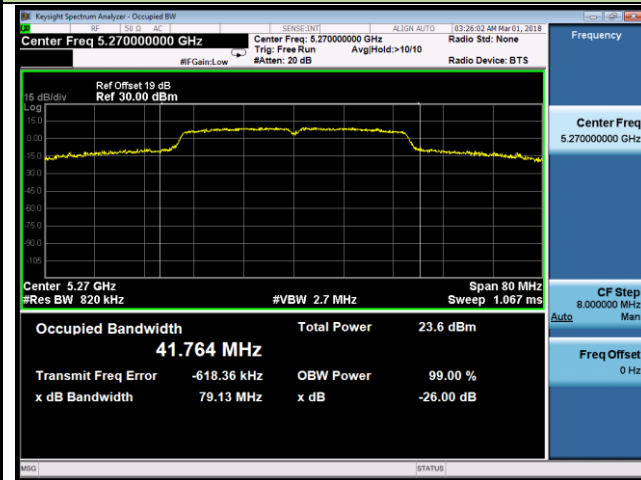
## Channel 120 (5600MHz)



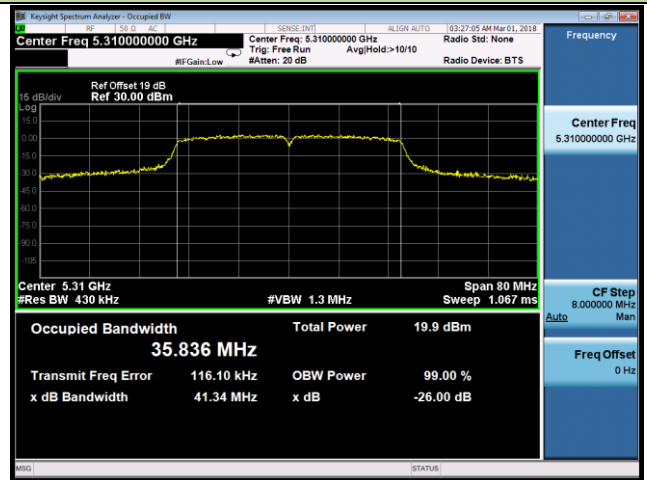


## 802.11ac-VHT40 26dB Bandwidth &amp; 99% Bandwidth

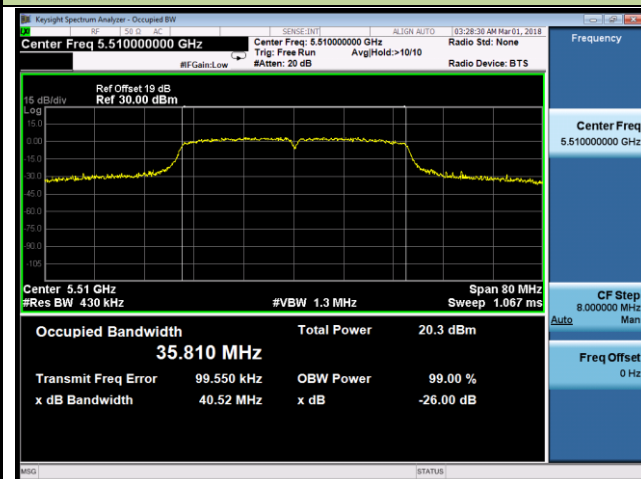
## Channel 54 (5270MHz)



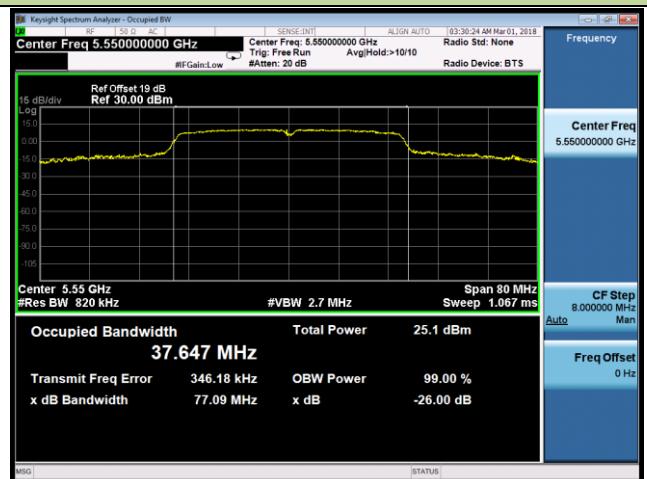
## Channel 62 (5310MHz)



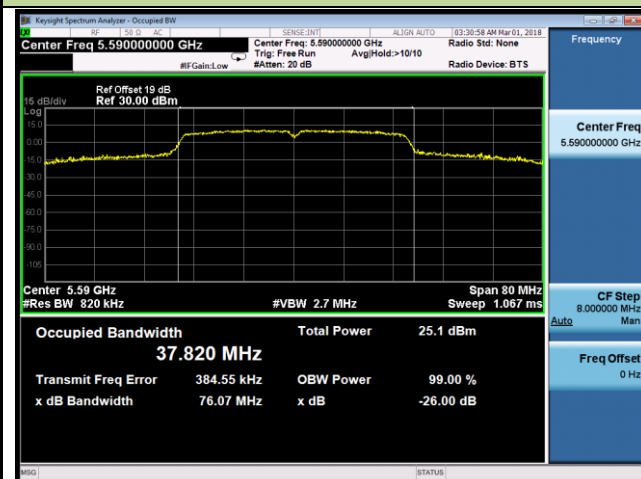
## Channel 102 (5510MHz)



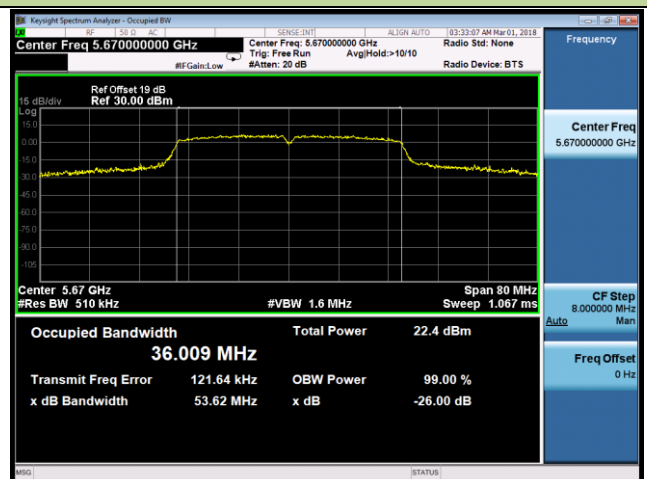
## Channel 110 (5550MHz)

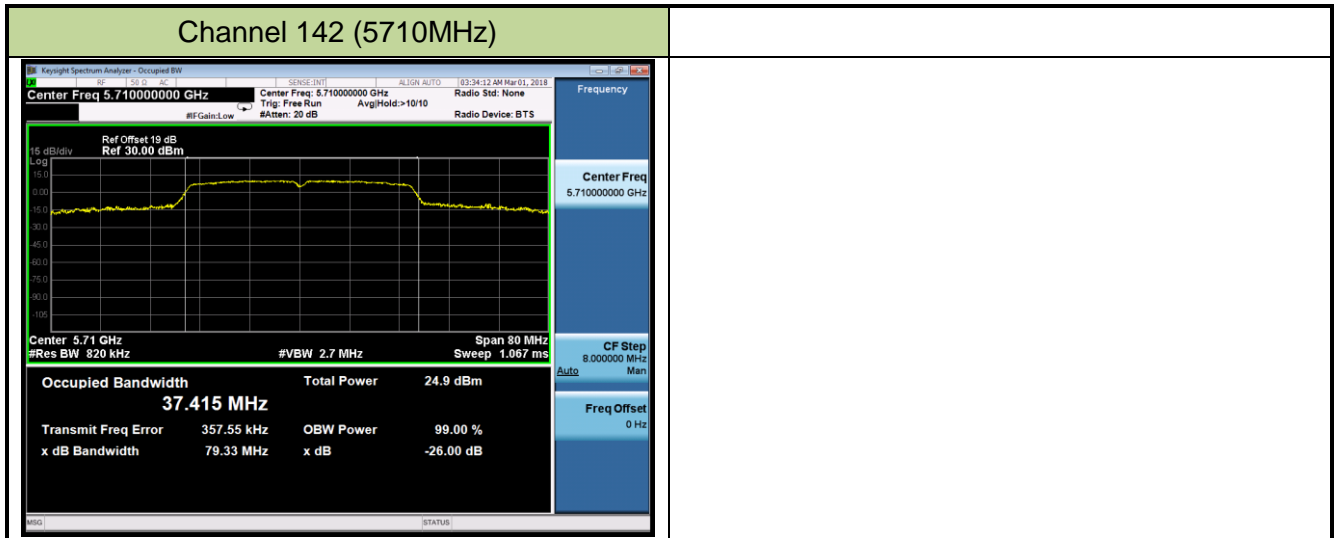


## Channel 118 (5590MHz)



## Channel 134 (5670MHz)



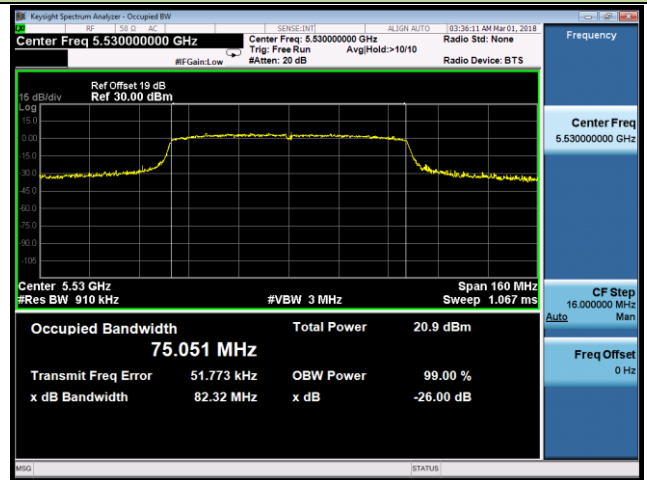


## 802.11ac-VHT80 26dB Bandwidth &amp; 99% Bandwidth

## Channel 58 (5290MHz)



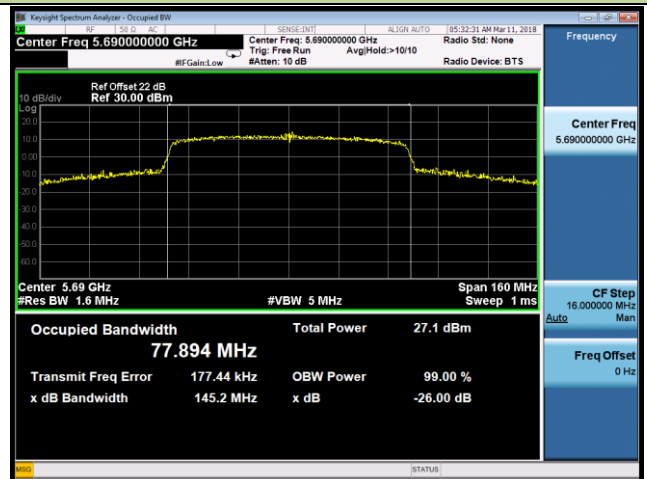
## Channel 106 (5530MHz)



## Channel 122 (5610MHz)



## Channel 138 (5690MHz)





### 7.3. 6dB Bandwidth Measurement

#### 7.3.1. Test Limit

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

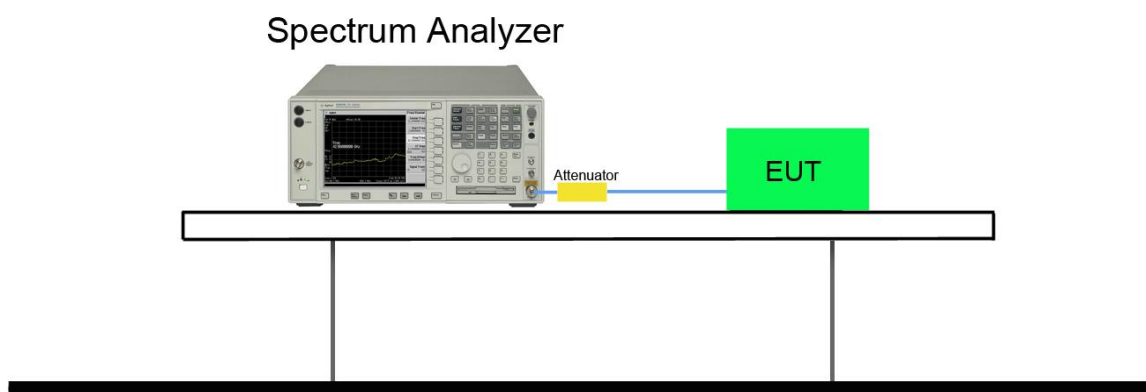
#### 7.3.2. Test Procedure used

KDB 789033 D02v02r01 – 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  $\geq 3 \times$  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

Not Applicable.

## 7.4. Output Power Measurement

### 7.4.1. Test Limit

#### For FCC

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz.

#### For IC

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power shall not exceed 250 mW (23.98dBm) or  $11 + 10 \log_{10} B$ , dBm, whichever is less. The maximum e.i.r.p. shall not exceed 1.0 W (30dBm) or  $17 + 10 \log_{10} B$ , dBm, whichever is less. B is the 99% emission bandwidth in MHz.

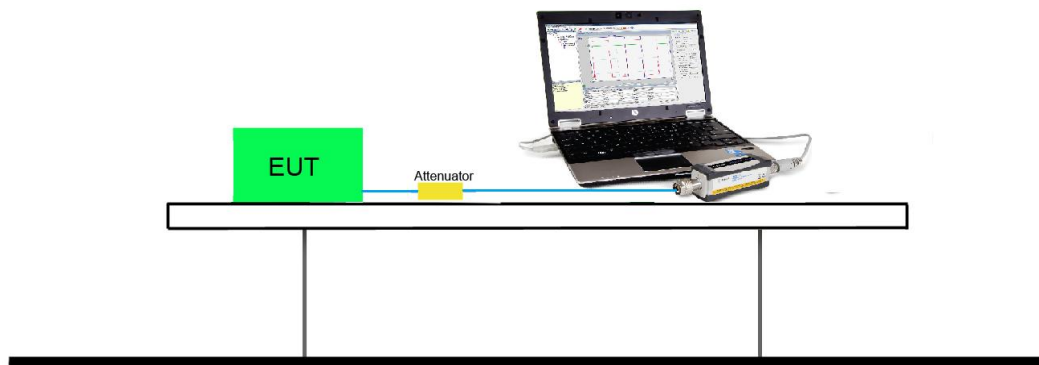
### 7.4.2. Test Procedure Used

KDB 789033 D02v02r01 - Section E) 3) b) Method PM-G

### 7.4.3. Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. 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, and then choose the maximum power output (Gray Marker) for final test of each channel.

##### Output power at various data rates:

Test Mode	Bandwidth	Channel	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)
802.11a	20	36	5180	6	16.38
				24	16.01
				54	15.72
802.11n	20	36	5180	MCS0	16.35
				MCS3	16.03
				MCS7	15.68
802.11n	40	38	5190	MCS0	14.12
				MCS3	13.79
				MCS7	13.44
802.11ac	20	36	5180	MCS0	16.14
				MCS4	15.77
				MCS8	15.37
802.11ac	40	38	5190	MCS0	13.72
				MCS4	13.34
				MCS9	13.03
802.11ac	80	42	5210	MCS0	13.24
				MCS4	12.86
				MCS9	12.47

Product	Wi-Fi USB Dongle	Temperature	22°C
Test Engineer	Hunk Li	Relative Humidity	54%
Test Site	TR3	Test Date	2018/02/08

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Average Power (dBm)	Average Power Limit (dBm)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Result
11a	6	52	5260	17.20	≤ 23.13	20.20	≤ 29.13	Pass
11a	6	60	5300	17.75	≤ 23.13	20.75	≤ 29.13	Pass
11a	6	64	5320	15.83	≤ 23.13	18.83	≤ 29.13	Pass
11a	6	100	5500	15.86	≤ 23.13	18.86	≤ 29.13	Pass
11a	6	116	5580	18.21	≤ 23.13	21.21	≤ 29.13	Pass
11a	6	120	5600	17.71	≤ 23.13	20.71	≤ 29.13	Pass
11a	6	140	5700	16.11	≤ 23.13	19.11	≤ 29.13	Pass
11a	6	144	5720	17.37	≤ 23.13	20.37	≤ 29.13	Pass
11n-HT20	MCS0	52	5260	17.36	≤ 23.41	20.36	≤ 29.41	Pass
11n-HT20	MCS0	60	5300	17.55	≤ 23.41	20.55	≤ 29.41	Pass
11n-HT20	MCS0	64	5320	16.67	≤ 23.41	19.67	≤ 29.41	Pass
11n-HT20	MCS0	100	5500	15.35	≤ 23.41	18.35	≤ 29.41	Pass
11n-HT20	MCS0	116	5580	18.05	≤ 23.41	21.05	≤ 29.41	Pass
11n-HT20	MCS0	120	5600	17.56	≤ 23.41	20.56	≤ 29.41	Pass
11n-HT20	MCS0	140	5700	15.53	≤ 23.41	18.53	≤ 29.41	Pass
11n-HT20	MCS0	144	5720	17.28	≤ 23.41	20.28	≤ 29.41	Pass
11n-HT40	MCS0	54	5270	16.46	≤ 23.98	19.46	≤ 30.00	Pass
11n-HT40	MCS0	62	5310	13.98	≤ 23.98	16.98	≤ 30.00	Pass
11n-HT40	MCS0	102	5510	13.95	≤ 23.98	16.95	≤ 30.00	Pass
11n-HT40	MCS0	110	5550	17.71	≤ 23.98	20.71	≤ 30.00	Pass
11n-HT40	MCS0	118	5590	17.74	≤ 23.98	20.74	≤ 30.00	Pass
11n-HT40	MCS0	134	5670	16.40	≤ 23.98	19.40	≤ 30.00	Pass
11n-HT40	MCS0	142	5710	17.55	≤ 23.98	20.55	≤ 30.00	Pass

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Average Power (dBm)	Limit (dBm)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Result
11ac-VHT20	MCS0	52	5260	16.87	≤ 23.41	19.87	≤ 29.41	Pass
11ac-VHT20	MCS0	60	5300	17.46	≤ 23.41	20.46	≤ 29.41	Pass
11ac-VHT20	MCS0	64	5320	15.41	≤ 23.41	18.41	≤ 29.41	Pass
11ac-VHT20	MCS0	100	5500	16.14	≤ 23.41	19.14	≤ 29.41	Pass
11ac-VHT20	MCS0	116	5580	17.75	≤ 23.41	20.75	≤ 29.41	Pass
11ac-VHT20	MCS0	120	5600	17.55	≤ 23.41	20.55	≤ 29.41	Pass
11ac-VHT20	MCS0	140	5700	16.13	≤ 23.41	19.13	≤ 29.41	Pass
11ac-VHT20	MCS0	144	5720	17.64	≤ 23.41	20.64	≤ 29.41	Pass
11ac-VHT40	MCS0	54	5270	16.79	≤ 23.98	19.79	≤ 30.00	Pass
11ac-VHT40	MCS0	62	5310	13.70	≤ 23.98	16.70	≤ 30.00	Pass
11ac-VHT40	MCS0	102	5510	14.01	≤ 23.98	17.01	≤ 30.00	Pass
11ac-VHT40	MCS0	110	5550	17.57	≤ 23.98	20.57	≤ 30.00	Pass
11ac-VHT40	MCS0	118	5590	17.67	≤ 23.98	20.67	≤ 30.00	Pass
11ac-VHT40	MCS0	134	5670	16.18	≤ 23.98	19.18	≤ 30.00	Pass
11ac-VHT40	MCS0	142	5710	17.70	≤ 23.98	20.70	≤ 30.00	Pass
11ac-VHT80	MCS0	58	5290	13.03	≤ 23.98	16.03	≤ 30.00	Pass
11ac-VHT80	MCS0	106	5530	13.54	≤ 23.98	16.54	≤ 30.00	Pass
11ac-VHT80	MCS0	122	5610	17.68	≤ 23.98	20.68	≤ 30.00	Pass
11ac-VHT80	MCS0	138	5690	17.96	≤ 23.98	20.96	≤ 30.00	Pass

Note 1: Max Conducted Output Power Limit Calculation as below:

For 5250-5350MHz, 5470-5725MHz

802.11a:  $11 + 10 \log_{10} (16.32\text{MHz}) = 23.13\text{dBm} < 23.98\text{dBm}$ ;

802.11n-HT20:  $11 + 10 \log_{10} (17.40\text{MHz}) = 23.41\text{dBm} < 23.98\text{dBm}$ ;

802.11n-HT40/ac-VHT40/ac-VHT80:  $11 + 10 \log_{10} B > 23.98\text{dBm}$ ;

802.11ac-VHT20:  $11 + 10 \log_{10} (17.43\text{MHz}) = 23.41\text{dBm} < 23.98\text{dBm}$ ;

Note 2: EIRP Power Limit Calculation as below:

For 5250-5350MHz, 5470-5725MHz

802.11a:  $17 + 10 \log_{10} (16.32\text{MHz}) = 29.13\text{dBm} < 30.00\text{dBm}$ ;

802.11n-HT20:  $17 + 10 \log_{10} (17.40\text{MHz}) = 29.41\text{dBm} < 30.00\text{dBm}$ ;

802.11ac-VHT20:  $17 + 10 \log_{10} (17.43\text{MHz}) = 29.41\text{dBm} < 30.00\text{dBm}$ ;

802.11n-HT40/ac-VHT40/ac-VHT80:  $17 + 10 \log_{10} B > 30.00\text{dBm}$ ;

## **7.5. Power Spectral Density Measurement**

### **7.5.1. Test Limit**

#### **For FCC**

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz 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.

#### **For IC**

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

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

### **7.5.2. Test Procedure Used**

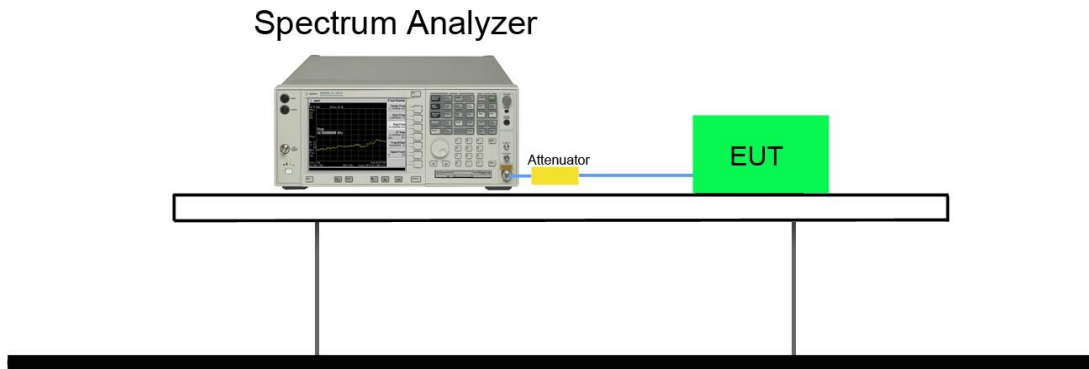
KDB 789033 D02v02r01 - Section F

### **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 OBW of the signal.
3. RBW = 1MHz, if measurement bandwidth of Maximum PSD is specified in 500 kHz,
4. RBW = 100 kHz
5. VBW = 3MHz
6. Number of sweep points  $\geq 2 \times (\text{span} / \text{RBW})$
7. Detector = power averaging (RMS)
8. Sweep time = auto
9. Trigger = free run
10. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
11. Add  $10 \cdot \log(1/x)$ , 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  $10 \cdot \log(1/0.25) = 6$  dB if the duty cycle is 25 percent.

12. When the measurement bandwidth of Maximum PSD is specified in 500 kHz, add a constant factor  $10 \cdot \log(500\text{kHz}/100\text{kHz}) = 6.99 \text{ dB}$  to the measured result

#### 7.5.4. Test Setup



### 7.5.5. Test Result

Product	Wi-Fi USB Dongle	Temperature	22°C
Test Engineer	Hunk Li	Relative Humidity	54%
Test Site	TR3	Test Date	2018/02/13 ~ 2018/03/01

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	PSD (dBm / MHz)	Duty Cycle (%)	Final PSD (dBm / MHz)	Limit (dBm / MHz)	Result
11a	6	52	5260	6.19	95.12	6.41	≤ 11.00	Pass
11a	6	60	5300	6.30	95.12	6.52	≤ 11.00	Pass
11a	6	64	5320	5.10	95.12	5.32	≤ 11.00	Pass
11a	6	100	5500	4.90	95.12	5.12	≤ 11.00	Pass
11a	6	116	5580	7.17	95.12	7.39	≤ 11.00	Pass
11a	6	120	5600	7.33	95.12	7.55	≤ 11.00	Pass
11a	6	140	5700	5.71	95.12	5.93	≤ 11.00	Pass
11a	6	144	5720	6.77	95.12	6.99	≤ 11.00	Pass
11n-HT20	MCS0	52	5260	5.54	93.86	5.82	≤ 11.00	Pass
11n-HT20	MCS0	60	5300	6.27	93.86	6.55	≤ 11.00	Pass
11n-HT20	MCS0	64	5320	5.25	93.86	5.53	≤ 11.00	Pass
11n-HT20	MCS0	100	5500	4.14	93.86	4.42	≤ 11.00	Pass
11n-HT20	MCS0	116	5580	6.76	93.86	7.04	≤ 11.00	Pass
11n-HT20	MCS0	120	5600	6.69	93.86	6.97	≤ 11.00	Pass
11n-HT20	MCS0	140	5700	4.50	93.86	4.78	≤ 11.00	Pass
11n-HT20	MCS0	144	5720	6.56	93.86	6.84	≤ 11.00	Pass
11n-HT40	MCS0	54	5270	1.94	89.01	2.45	≤ 11.00	Pass
11n-HT40	MCS0	62	5310	-0.38	89.01	0.13	≤ 11.00	Pass
11n-HT40	MCS0	102	5510	-0.55	89.01	-0.04	≤ 11.00	Pass
11n-HT40	MCS0	110	5550	3.26	89.01	3.77	≤ 11.00	Pass
11n-HT40	MCS0	118	5590	3.41	89.01	3.92	≤ 11.00	Pass
11n-HT40	MCS0	134	5670	2.70	89.01	3.21	≤ 11.00	Pass
11n-HT40	MCS0	142	5710	3.44	89.01	3.95	≤ 11.00	Pass



Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	PSD (dBm / MHz)	Duty Cycle (%)	Final PSD (dBm / MHz)	Limit (dBm / MHz)	Result
11ac-VHT20	MCS0	52	5260	5.31	95.08	5.53	≤ 11.00	Pass
11ac-VHT20	MCS0	60	5300	6.14	95.08	6.36	≤ 11.00	Pass
11ac-VHT20	MCS0	64	5320	3.99	95.08	4.21	≤ 11.00	Pass
11ac-VHT20	MCS0	100	5500	4.53	95.08	4.75	≤ 11.00	Pass
11ac-VHT20	MCS0	116	5580	6.91	95.08	7.13	≤ 11.00	Pass
11ac-VHT20	MCS0	120	5600	6.52	95.08	6.74	≤ 11.00	Pass
11ac-VHT20	MCS0	140	5700	4.95	95.08	5.17	≤ 11.00	Pass
11ac-VHT20	MCS0	144	5720	6.26	95.08	6.48	≤ 11.00	Pass
11ac-VHT40	MCS0	54	5270	1.75	89.67	2.22	≤ 11.00	Pass
11ac-VHT40	MCS0	62	5310	-0.84	89.67	-0.37	≤ 11.00	Pass
11ac-VHT40	MCS0	102	5510	-0.60	89.67	-0.13	≤ 11.00	Pass
11ac-VHT40	MCS0	110	5550	3.33	89.67	3.80	≤ 11.00	Pass
11ac-VHT40	MCS0	118	5590	3.66	89.67	4.13	≤ 11.00	Pass
11ac-VHT40	MCS0	134	5670	1.95	89.67	2.42	≤ 11.00	Pass
11ac-VHT40	MCS0	142	5710	3.55	89.67	4.02	≤ 11.00	Pass
11ac-VHT80	MCS0	58	5290	-4.91	84.26	-4.17	≤ 11.00	Pass
11ac-VHT80	MCS0	106	5530	-4.59	84.26	-3.85	≤ 11.00	Pass
11ac-VHT80	MCS0	122	5610	0.22	84.26	0.96	≤ 11.00	Pass
11ac-VHT80	MCS0	138	5690	0.75	84.26	1.49	≤ 11.00	Pass

Note 1: When EUT duty cycle < 98%, Final PSD (dBm/MHz) = PSD (dBm/MHz) + 10\*log (1/Duty Cycle).

Note 2: EIRP PSD (dBm/MHz) = Final PSD (dBm/MHz) + Antenna Gain (dBi).