

MEASUREMENT REPORT

FCC PART 15.407 WLAN 802.11a/n/ac

FCC ID: 2AD8UFZCWMBOM2

APPLICANT: Nokia Solutions and Networks, OY

Application Type: Certification

Product: AC220m Wi-Fi module OD US

Model No.: FZCWMBOM2

Brand Name: NOKIA

FCC Classification: Unlicensed National Information Infrastructure (UNII)

FCC Rule Part(s): Part15 Subpart E (Section 15.407)

Test Procedure(s): ANSI C63.10-2013, KDB 789033 D02v02r01,
KDB 662911 D01v02r01

Test Procedure(s): ANSI C63.10-2013

Test Date: November 12, 2017 ~ April 10, 2018

Reviewed By : Paddy Chen
(Paddy Chen)

Approved By : Chenz Ker
(Chenz Ker)



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 (Taiwan) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
1712TW0104-U6	Rev. 01	Initial Report	05-17-2018	Valid

Note: This report is prepared for FCC Class II permissive change and supplement to MRT Original “1712TW0104-U2” Report adding “Wi-Fi Directional Antenna” & DFS bands and related data

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§2.1033 General Information

Applicant:	Nokia Solutions and Networks, OY
Applicant Address:	2000 W. Lucent Lane, Naperville, Illinois, United States, 60563
Manufacturer:	Nokia Solutions and Networks, OY
Manufacturer Address:	2000 W. Lucent Lane, Naperville, Illinois, United States, 60563
Test Site:	MRT Technology (Taiwan) Co., Ltd
Test Site Address:	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)
FCC Registration No.:	153292
FCC Rule Part(s):	Part15 Subpart E (Section 15.407)
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 (Reg. No. 153292) test facility with the site description report on file and is designated by the FCC as an Accredited Test Film.
- MRT facility is an IC registered (MRT Reg. No. 21723-1) test laboratory with the site description on file at Industry Canada.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (TAF) under the American Association for Laboratory Accreditation Program (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC, Industry Taiwan, EU and TELEC Rules.

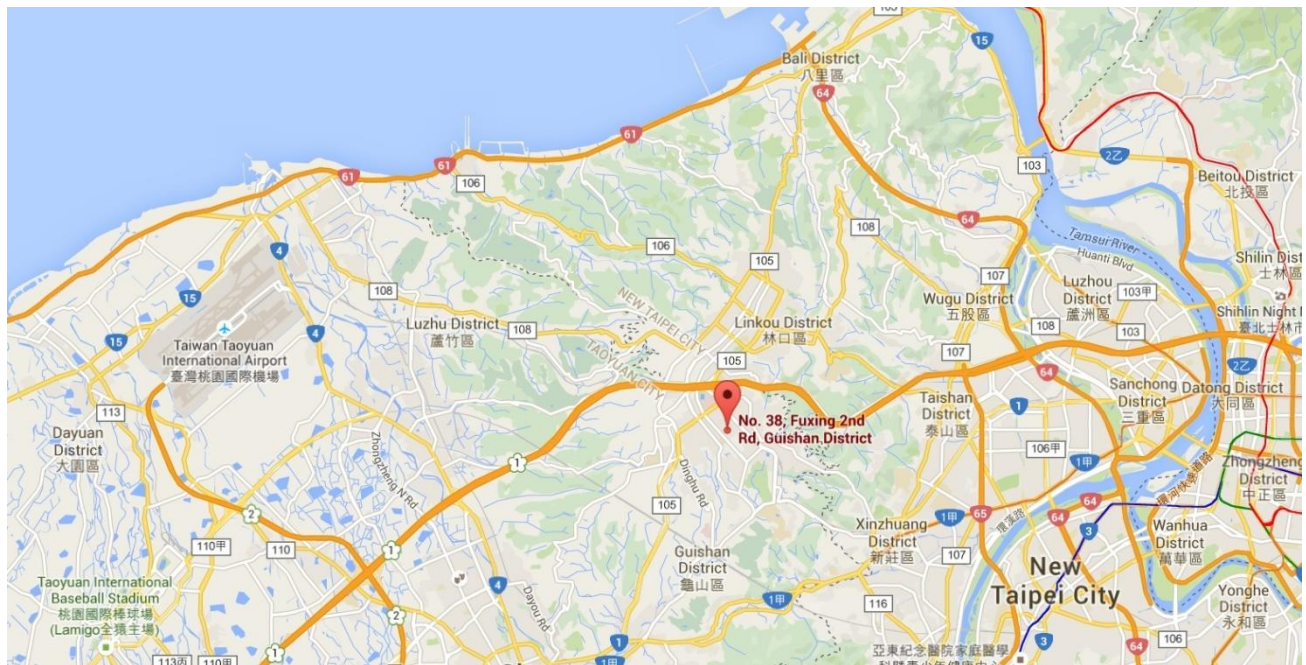
1. INTRODUCTION

1.1. Scope

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

1.2. MRT Test Location

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



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	AC220m Wi-Fi module OD US
Model No.:	FZCWMBOM2
Brand Name:	NOKIA
Wi-Fi Specification:	802.11a/b/g/n/ac
Frequency Range:	<u>2.4GHz:</u> For 802.11b/g/n-HT20: 2412 ~ 2462 MHz For 802.11n-HT40: 2422 ~ 2452 MHz <u>5GHz:</u> For 802.11a/n-HT20/ac-VHT20: 5180~5320MHz, 5500~5720MHz, 5745~5825MHz For 802.11n-HT40/ac-VHT40: 5190~5310MHz, 5510~5710MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5290MHz, 5530MHz, 5610MHz, 5690MHz, 5775MHz
Maximum Output Power:	<u>CDD Mode:</u> 802.11a: 25.29dBm, 802.11n-HT20: 25.32dBm, 802.11n-HT40: 25.56dBm, 802.11ac-VHT20: 25.27dBm, 802.11ac-VHT40: 25.60dBm, 802.11ac-VHT80: 20.49dBm <u>Beam-Forming Mode:</u> 802.11n-HT20: 23.77dBm, 802.11n-HT40: 23.87dBm, 802.11ac-VHT20: 23.71dBm, 802.11ac-VHT40: 23.82dBm, 802.11ac-VHT80: 22.02dBm
Type of Modulation:	802.11b: DSSS, 802.11a/g/n/ac: OFDM
Modulation Type:	CCK, DQPSK, DBPSK for DSSS 16QAM, 64QAM, 256QAM, QPSK, BPSK for OFDM

2.2. Operation Frequency and Channel List

802.11a/n-HT20/ac-VHT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz	44	5220 MHz
48	5240 MHz	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	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	54	5270 MHz
62	5310 MHz	102	5510 MHz	110	5550 MHz
118	5590 MHz	126	5630 MHz	134	5670 MHz
142	5710 MHz	151	5755 MHz	159	5795 MHz

802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	58	5290 MHz	106	5530 MHz
122	5610 MHz	138	5690 MHz	155	5775 MHz

2.3. Description of Available Antenna

Antenna	Manufacturer	Frequency Band (GHz)	Antenna Name	Tx Paths
	Nokia	2.4	473171A / FAWH (WiFi Omni Antenna)	2
		5		2
	Nokia	2.4	474073A / FA2NB (WiFi Directional Antenna)	2
		5		2

Note: The manufacture has provided an antenna cable to connect WiFi Omni Antenna with EUT, and the cable loss is: 0.45dB Max @ 0~3 GHz; 0.75dB Max @ 0~6 GHz

Frequency Band (MHz)	TX Paths	Per Chain Max Antenna Gain (dBi)		Beam Forming Directional Gain (dBi)	CDD Directional Gain(dBi)	
		Ant 0	Ant 1		For Power	For PSD
WiFi Omni Antenna						
2412 ~ 2462	2	4.0	4.0	7.01	4.00	7.01
5150 ~ 5250	2	7.0	7.0	10.01	7.00	10.01
5150 ~ 5250 (30 Degree)	2	7.0	7.0	10.01	N/A	N/A
5250 ~ 5350	2	7.0	7.0	10.01	7.00	10.01
5470 ~ 5725	2	7.0	7.0	10.01	7.00	10.01
5725 ~ 5850	2	7.0	7.0	10.01	7.00	10.01
WiFi Directional Antenna						
2412 ~2462	2	7.7	8.5	11.12	8.5	11.51
5150 ~ 5250	2	8.3	9.5	11.93	9.5	12.51
5150 ~ 5250 (30 Degree)	2	-2.7	-3.6	-0.13	N/A	N/A
5250 ~ 5350	2	8.1	9.5	11.84	9.5	12.51
5470 ~ 5725	2	9.9	9.6	12.76	9.9	12.91
5725 ~ 5850	2	9.0	8.8	11.91	9.0	12.01

Note1: The EUT supports Cyclic Delay Diversity (CDD) technology for 802.11a/b/g mode, and CDD signals are correlated.

Note 2: The EUT supports Beam Forming technology for 802.11n/ac mode.

Note 3: For CDD transmissions, directional gain is calculated as follows, $N_{ANT} = 2$, $N_{SS} = 1$.

Two antennas have the same gain, G_{ANT} , Directional gain = $G_{ANT} + \text{Array Gain}$, 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 $N_{ANT} \leq 4$;

Note 4: For Beam Forming transmissions, directional gain = $10 \cdot \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}]$ dBi.

2.4. Description of Antenna RF Port

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

2.5. Test Mode

Test Mode	Mode 1: Transmit by 802.11a (6Mbps)
	Mode 2: Transmit by 802.11n-HT20 (MSC0)
	Mode 3: Transmit by 802.11n-HT40 (MSC0)
	Mode 4: Transmit by 802.11ac-VHT20 (MSC0)
	Mode 5: Transmit by 802.11ac-VHT40 (MSC0)
	Mode 6: Transmit by 802.11ac-VHT80 (MSC0)

5GHz Test Mode	Ant 0 + 1	
	CDD	Beam-Forming
802.11a	√	×
802.11n-HT20	√	√
802.11n-HT40	√	√
802.11ac-VHT20	√	√
802.11ac-VHT40	√	√
802.11ac-VHT80	√	√

2.6. Description of Test Software

The test utility software used during testing was“QCARCT”, and the version was “v3.0.174.0”.

2.7. Device Capabilities

This device contains the following capabilities:

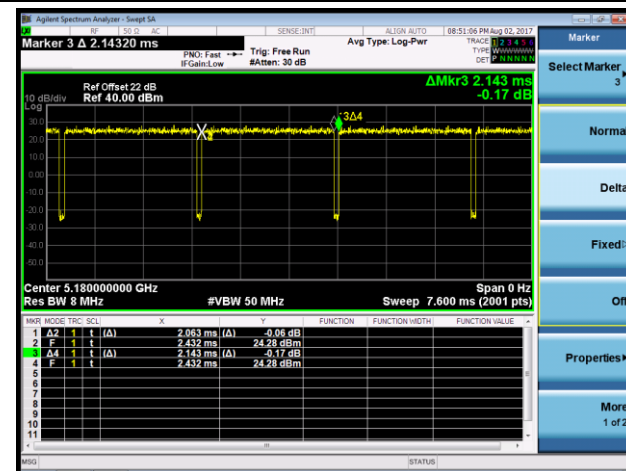
2.4GHz WLAN (DTS) and 5GHz WLAN (NII)

Note: 5GHz (NII) operation is possible in 20MHz, 40MHzand 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 ANSI C63.10-2013. 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:

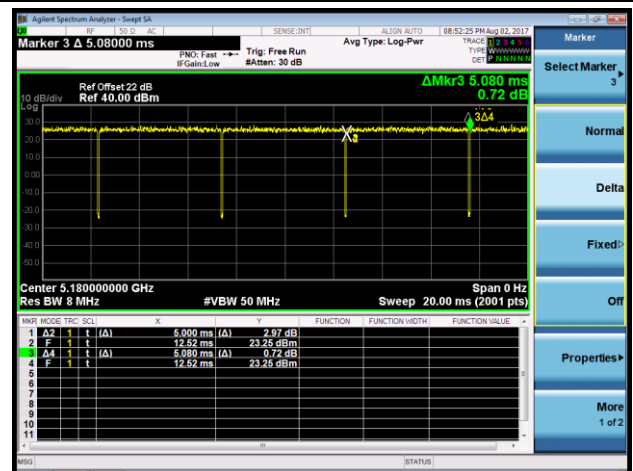
Test Mode	Duty Cycle
802.11a	96.27 %
802.11n-HT20	98.43 %
802.11n-HT40	95.40 %
802.11ac-VHT20	98.43 %
802.11ac-VHT40	94.84 %
802.11ac-VHT80	92.51 %

Duty Cycle (T = Transmission Duration)

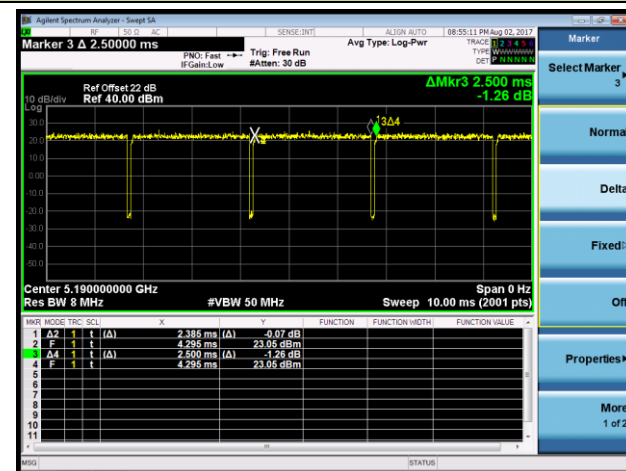
802.11a (T = 2.063ms)



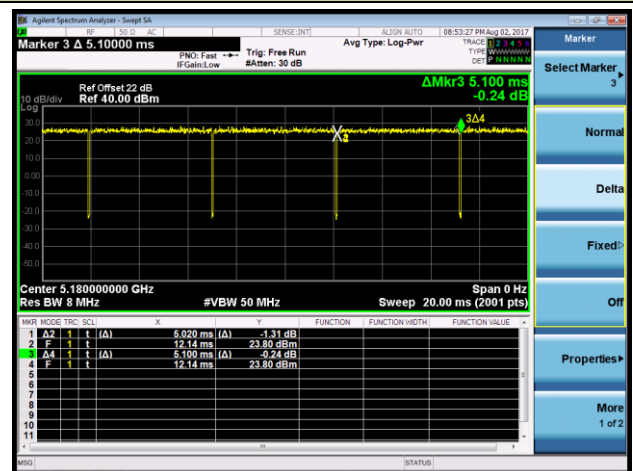
802.11n-HT20 (T = 5.000ms)



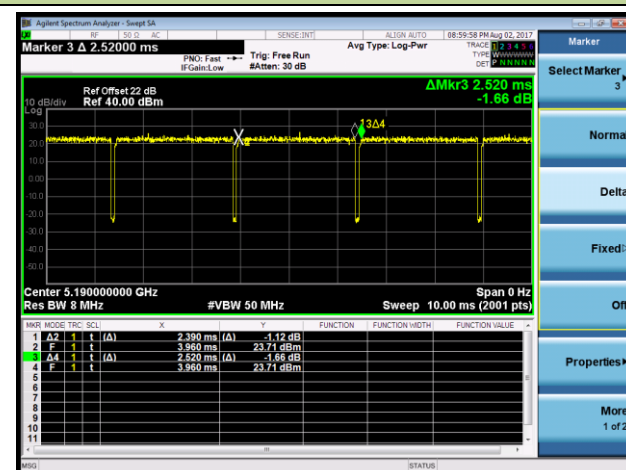
802.11n-HT40 (T = 2.385ms)



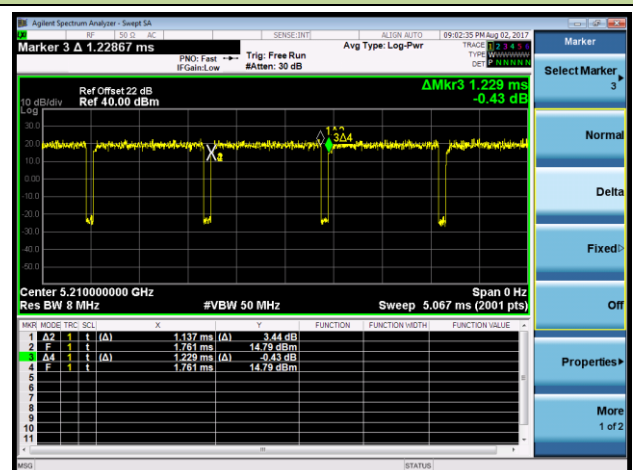
802.11ac-VHT20 (T = 5.020ms)



802.11ac-VHT40 (T = 2.390ms)



802.11ac-VHT80 (T = 1.137ms)



2.8. Test Configuration

The device 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.

2.9. EMI Suppression Device(s)/Modifications

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

2.10. 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, remotecontrolled, 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.”

- There are provisions for special connector (4.3_10 connector) to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTTWA00045	1 year	2019/03/16
Two-Line V-Network	R&S	ENV216	MRTTWA00019	1 year	2019/03/22
Two-Line V-Network	R&S	ENV216	MRTTWA00020	1 year	2019/03/22
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2018/06/08

Radiated Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Signal Analyzer	R&S	FSV40	MRTTWA00007	1 year	2019/03/01
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2019/03/15
Broadband Preamplifier	SCHWARZBECK	BBV 9718	MRTTWA00005	1 year	2019/04/05
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	1 year	2019/04/05
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	1 year	2019/04/05
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2019/04/05
Broadband Hornantenna	SCHWARZBECK	BBHA 9120D	MRTTWA00003	1 year	2019/04/05
Breitband Hornantenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	1 year	2019/04/05
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2018/06/08

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2018/07/10
X-Series USB Peak and Average Power Sensor	KEYSIGHT	U2021XA	MRTTWA00014	1 year	2019/03/17
X-Series USB Peak and Average Power Sensor	KEYSIGHT	U2021XA	MRTTWA00015	1 year	2019/03/17
Programmable Temperature & Humidity Chamber	TEN BILLION	TTH-B3UP	MRTTWA00036	1 year	2018/05/11
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2018/06/08

Software	Version	Function
EMI Software	V3	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: AC220m Wi-Fi module OD US
FCC ID: 2AD8UFZCWMBOM2
Data Rate / MCS 6Mbps ~ 54Mbps (a); MCS0 for 802.11n-HT20MHz;
Tested: 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)(i), (2), (3)	Maximum Conducted Output Power	Refer to Section 7.4		Pass	Section 7.4
15.407(h)(1)	Transmit Power Control	≤ 24 dBm		N/A	Section 7.5
15.407(a)(1)(i), (2), (3), (5)	Peak Power Spectral Density	Refer to Section 7.6		Pass	Section 7.6
15.407(g)	Frequency Stability	N/A		Pass	Section 7.7
15.407(b)(1), (2), (3), (4)	Undesirable Emissions	Refer to Section 7.8 & 7.9	Radiated	Pass	Section 7.8 & 7.9
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 7.10

Notes:

- 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.
- Test Items “26dB Bandwidth”, “99% Bandwidth”, “6dB Bandwidth” have been assessed single and MIMO transmission, and showed the worst test data in this report.
- For Omni antenna, the NII-band 1 & NII-band 3 had been assessed in the original FCC application, so we show the NII-band 2A & NII-band 2C test data in this report.

7.2. 26dB Bandwidth & 99% Bandwidth Measurement

7.2.1. Test Limit

N/A

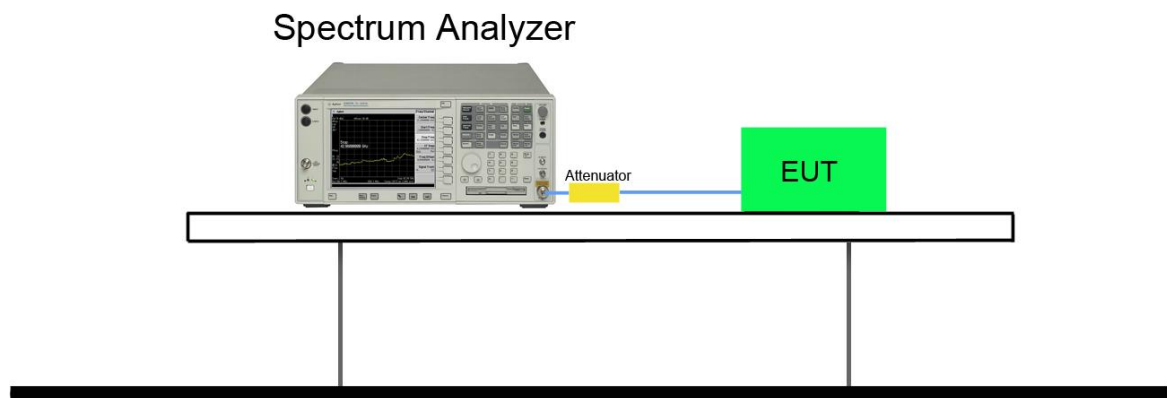
7.2.2. Test Procedure used

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	AC220m Wi-Fi module OD US	Temperature	24°C
Test Engineer	Peter Xu	Relative Humidity	59%
Test Site	SR2	Test Date	2017/12/13
Antenna Type	WiFi Omni Antenna		
Test Item	26dB & 99% Bandwidth (NII-band 2A & NII-band 2C)		

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 0					
802.11a	6Mbps	52	5260	33.86	16.97
802.11a	6Mbps	60	5300	29.20	16.74
802.11a	6Mbps	64	5320	20.84	16.50
802.11a	6Mbps	100	5500	20.69	16.44
802.11a	6Mbps	120	5600	19.13	16.39
802.11a	6Mbps	140	5700	19.46	16.42
802.11a	6Mbps	144	5720	33.62	16.98
802.11n-HT20	MCS0	52	5260	25.18	17.75
802.11n-HT20	MCS0	60	5300	22.21	17.67
802.11n-HT20	MCS0	64	5320	20.48	17.64
802.11n-HT20	MCS0	100	5500	20.39	17.62
802.11n-HT20	MCS0	120	5600	19.80	17.58
802.11n-HT20	MCS0	140	5700	20.51	17.64
802.11n-HT20	MCS0	144	5720	29.29	17.80
802.11n-HT40	MCS0	54	5270	66.05	36.51
802.11n-HT40	MCS0	62	5310	39.29	35.93
802.11n-HT40	MCS0	102	5510	39.45	35.93
802.11n-HT40	MCS0	118	5590	39.07	35.88
802.11n-HT40	MCS0	134	5670	39.54	35.99
802.11n-HT40	MCS0	142	5710	76.97	36.92
802.11ac-VHT20	MCS0	52	5260	30.07	17.79
802.11ac-VHT20	MCS0	60	5300	28.14	17.78
802.11ac-VHT20	MCS0	64	5320	20.92	17.64
802.11ac-VHT20	MCS0	100	5500	20.06	17.62
802.11ac-VHT20	MCS0	120	5600	19.80	17.58
802.11ac-VHT20	MCS0	140	5700	20.38	17.61
802.11ac-VHT20	MCS0	144	5720	29.87	17.82

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 0					
802.11ac-VHT40	MCS0	54	5270	67.33	36.47
802.11ac-VHT40	MCS0	62	5310	39.10	35.94
802.11ac-VHT40	MCS0	102	5510	39.39	35.91
802.11ac-VHT40	MCS0	118	5590	38.96	35.87
802.11ac-VHT40	MCS0	134	5670	39.24	35.98
802.11ac-VHT40	MCS0	142	5710	78.98	39.65
802.11ac-VHT80	MCS0	58	5290	82.96	75.75
802.11ac-VHT80	MCS0	106	5530	82.66	75.68
802.11ac-VHT80	MCS0	122	5610	82.62	75.75
802.11ac-VHT80	MCS0	138	5690	159.90	77.37

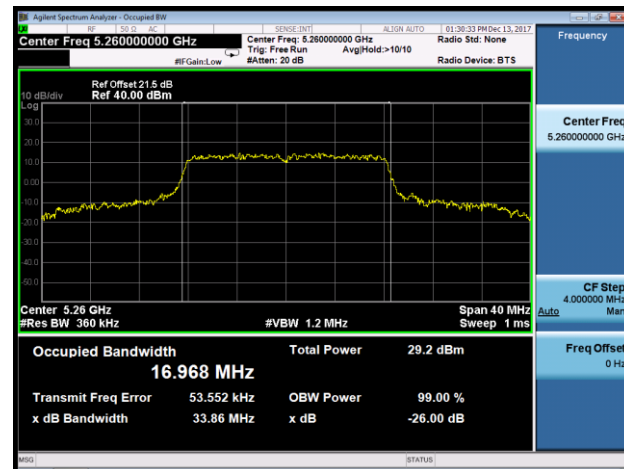
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 1					
802.11a	6Mbps	52	5260	20.27	16.45
802.11a	6Mbps	60	5300	20.75	16.52
802.11a	6Mbps	64	5320	20.97	16.49
802.11a	6Mbps	100	5500	20.71	16.50
802.11a	6Mbps	120	5600	19.04	16.41
802.11a	6Mbps	140	5700	19.04	16.42
802.11a	6Mbps	144	5720	20.48	16.47
802.11n-HT20	MCS0	52	5260	22.31	17.68
802.11n-HT20	MCS0	60	5300	22.40	17.68
802.11n-HT20	MCS0	64	5320	20.22	17.61
802.11n-HT20	MCS0	100	5500	20.45	17.64
802.11n-HT20	MCS0	120	5600	19.88	17.59
802.11n-HT20	MCS0	140	5700	20.04	17.60
802.11n-HT20	MCS0	144	5720	21.51	17.67
802.11n-HT40	MCS0	54	5270	66.01	36.37
802.11n-HT40	MCS0	62	5310	38.98	35.88
802.11n-HT40	MCS0	102	5510	39.05	35.86
802.11n-HT40	MCS0	118	5590	39.11	35.85
802.11n-HT40	MCS0	134	5670	39.33	35.92
802.11n-HT40	MCS0	142	5710	71.93	36.45
802.11ac-VHT20	MCS0	52	5260	22.92	17.68
802.11ac-VHT20	MCS0	60	5300	23.07	17.69
802.11ac-VHT20	MCS0	64	5320	20.19	17.61
802.11ac-VHT20	MCS0	100	5500	20.37	17.63
802.11ac-VHT20	MCS0	120	5600	19.91	17.59
802.11ac-VHT20	MCS0	140	5700	20.07	17.62
802.11ac-VHT20	MCS0	144	5720	20.47	17.66
802.11ac-VHT40	MCS0	54	5270	67.09	36.48
802.11ac-VHT40	MCS0	62	5310	39.12	35.87
802.11ac-VHT40	MCS0	102	5510	39.22	35.89
802.11ac-VHT40	MCS0	118	5590	39.09	35.87
802.11ac-VHT40	MCS0	134	5670	39.48	35.96
802.11ac-VHT40	MCS0	142	5710	67.20	36.39



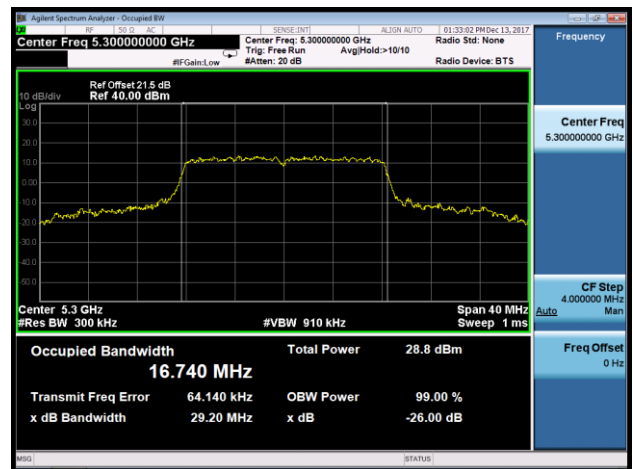
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 1					
802.11ac-VHT80	MCS0	58	5290	82.77	75.66
802.11ac-VHT80	MCS0	106	5530	82.85	75.66
802.11ac-VHT80	MCS0	122	5610	82.86	75.66
802.11ac-VHT80	MCS0	138	5690	110.70	76.19

802.11a 26dB Bandwidth & 99% Bandwidth - Ant 0

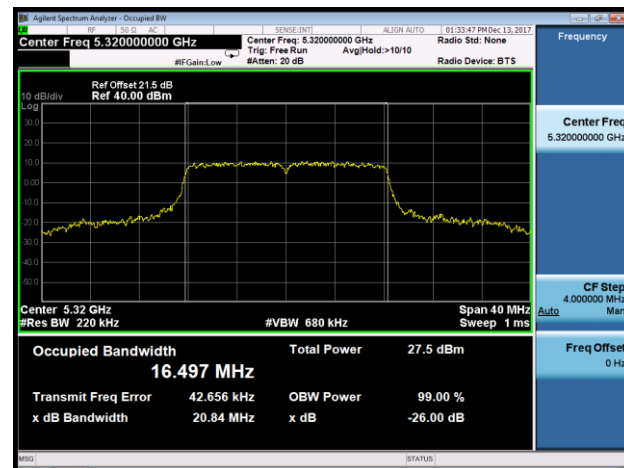
Channel 52 (5260MHz)



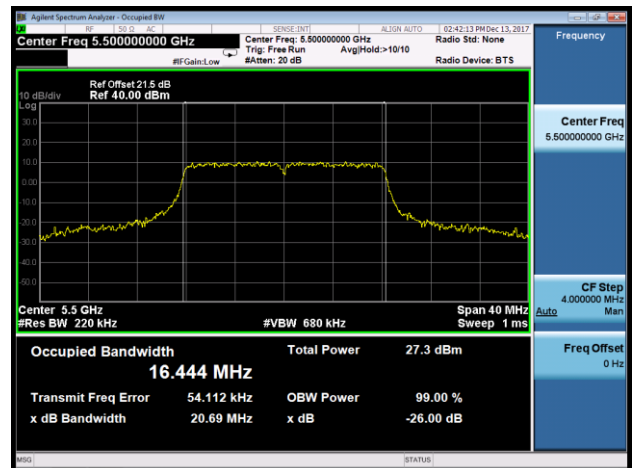
Channel 60 (5300MHz)



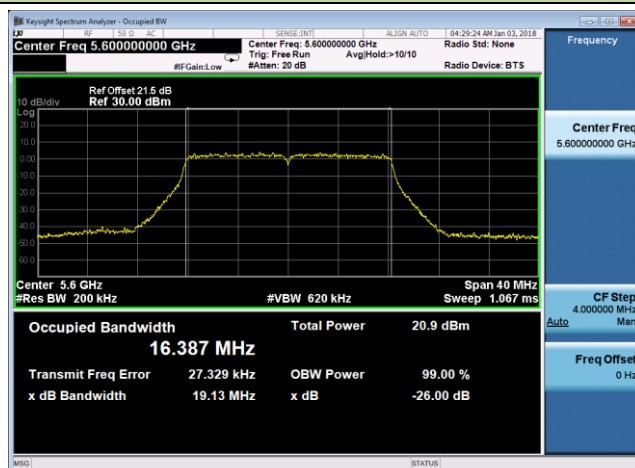
Channel 64 (5320MHz)



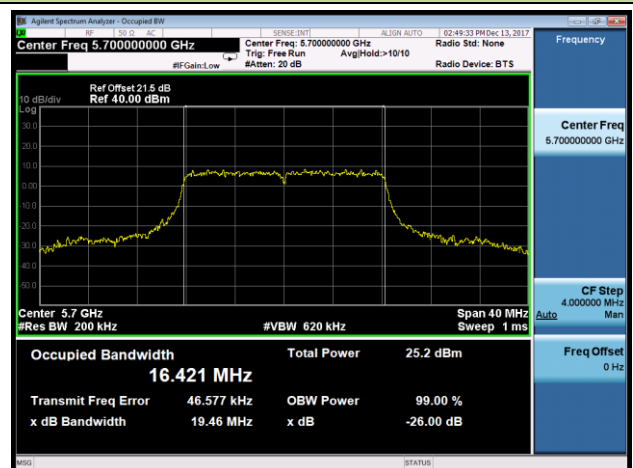
Channel 100 (5500MHz)

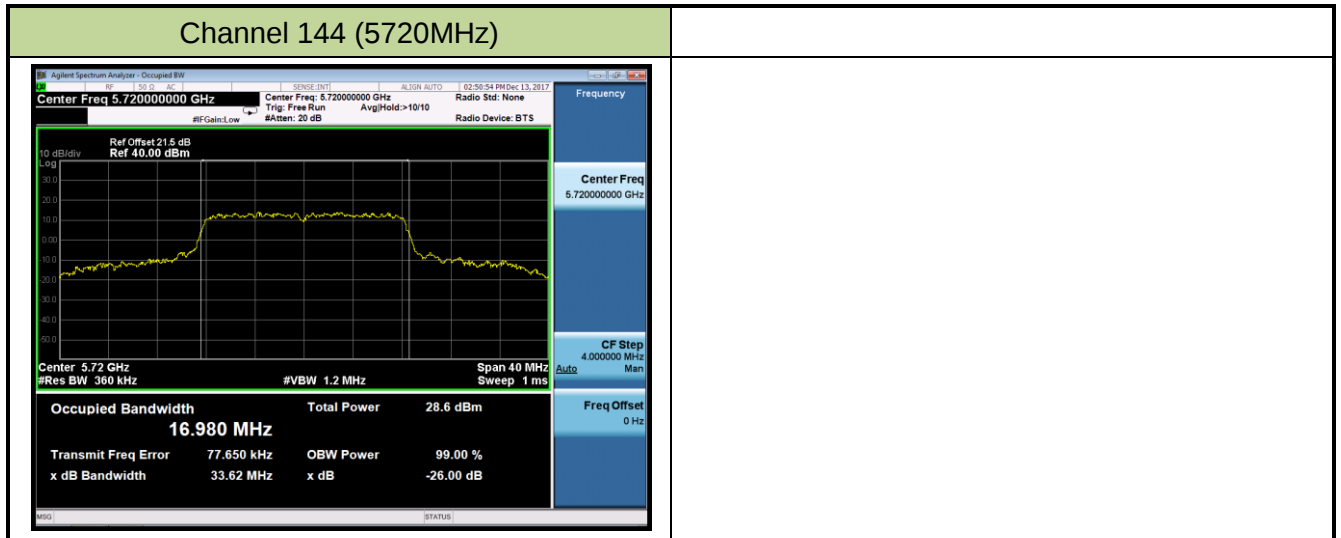


Channel 120 (5600MHz)



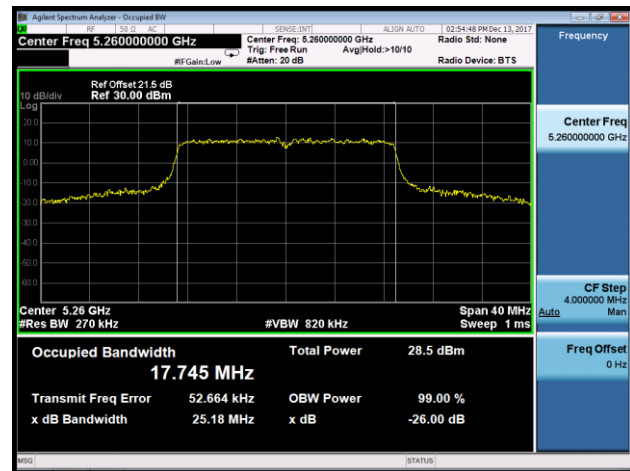
Channel 140 (5700MHz)



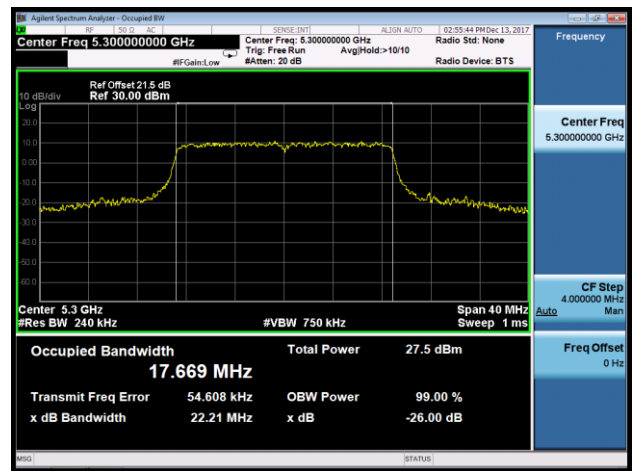


802.11n-HT20 26dB Bandwidth & 99% Bandwidth - Ant 0

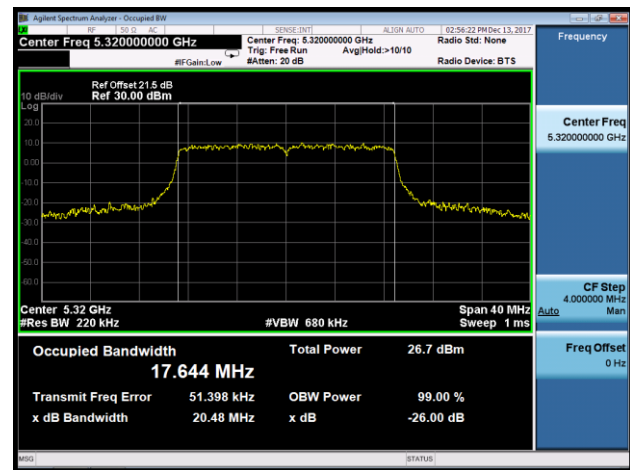
Channel 52 (5260MHz)



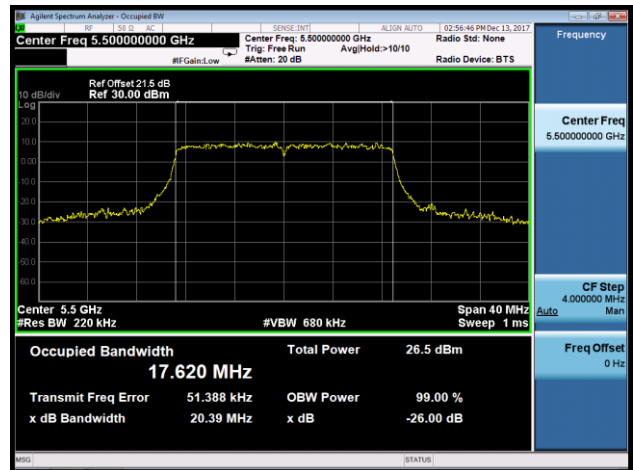
Channel 60 (5300MHz)



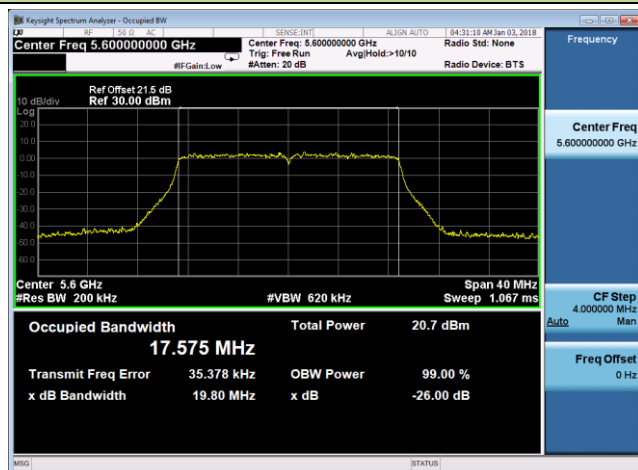
Channel 64 (5320MHz)



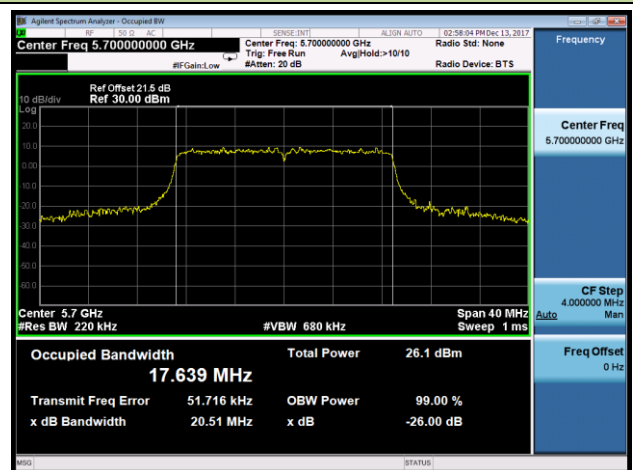
Channel 100 (5500MHz)

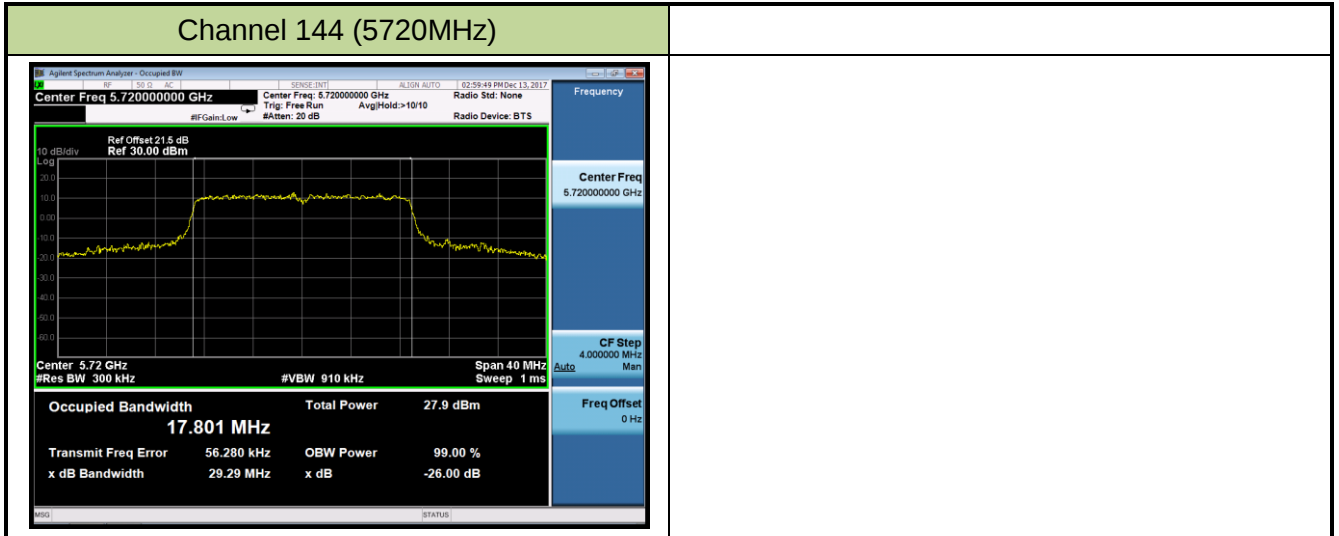


Channel 120 (5600MHz)



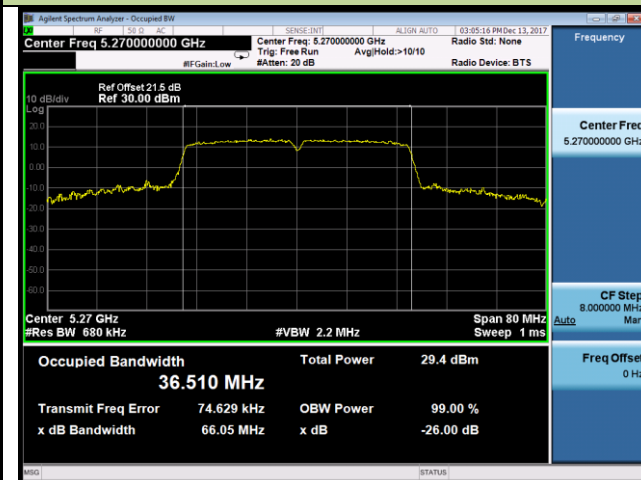
Channel 140 (5700MHz)



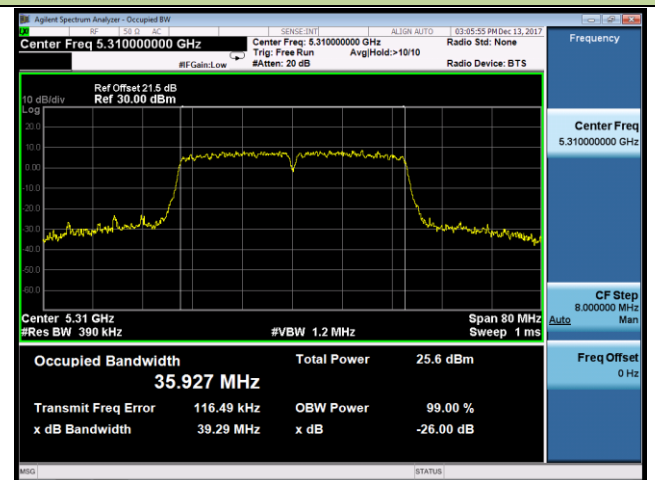


802.11n-HT40 26dB Bandwidth & 99% Bandwidth - Ant 0

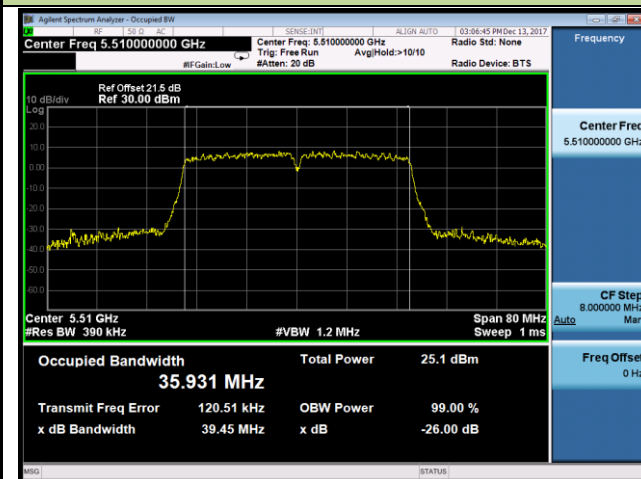
Channel 54 (5270MHz)



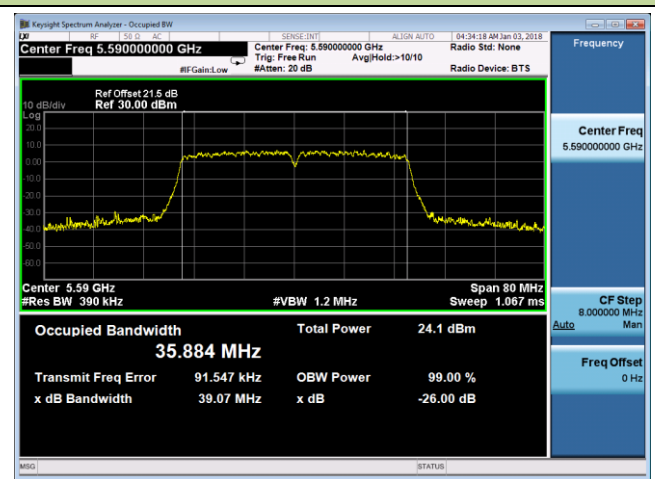
Channel 62 (5310MHz)



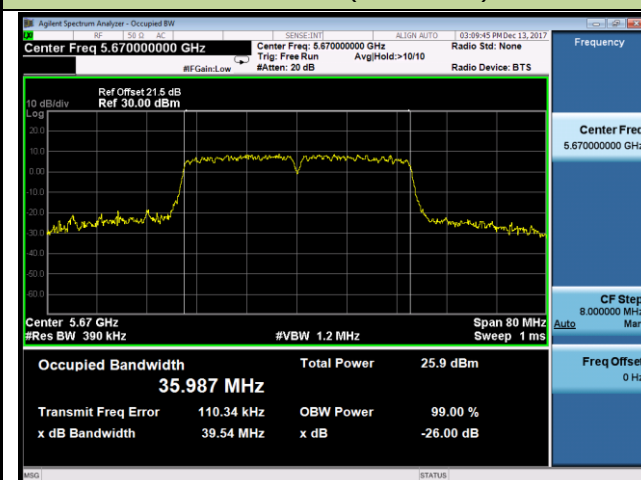
Channel 102 (5510MHz)



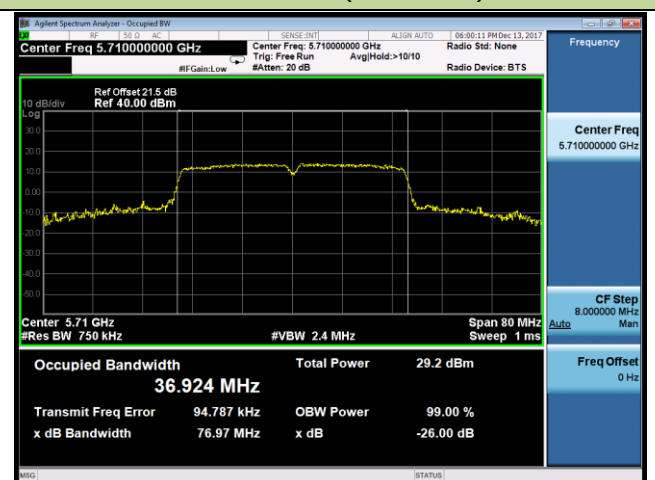
Channel 118 (5590MHz)



Channel 134 (5670MHz)

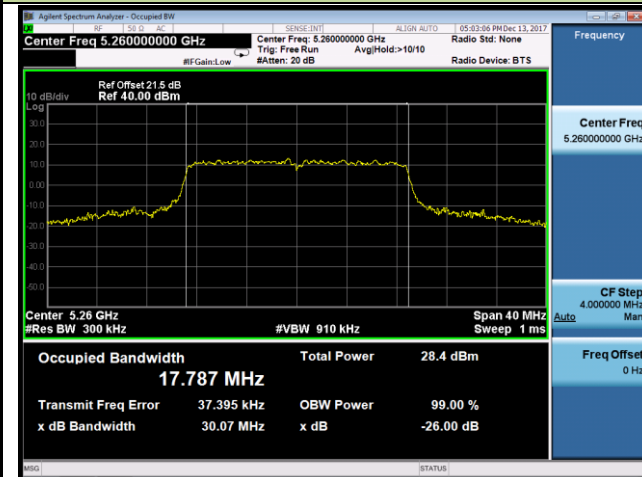


Channel 142 (5710MHz)

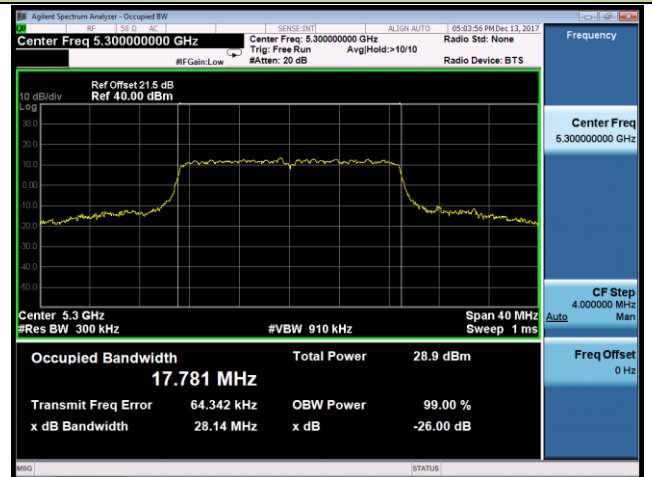


802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth - Ant 0

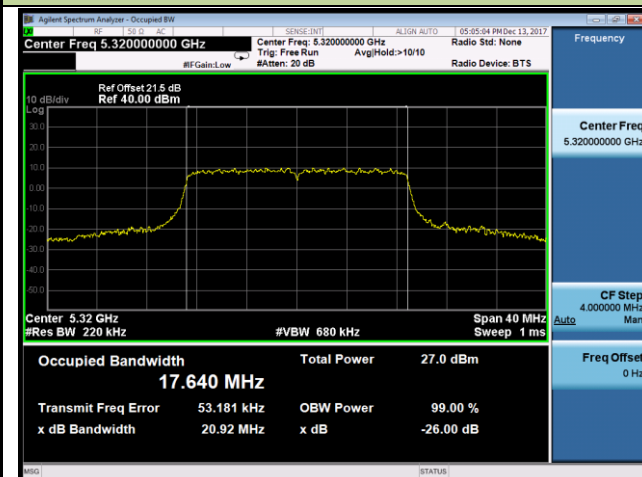
Channel 52 (5260MHz)



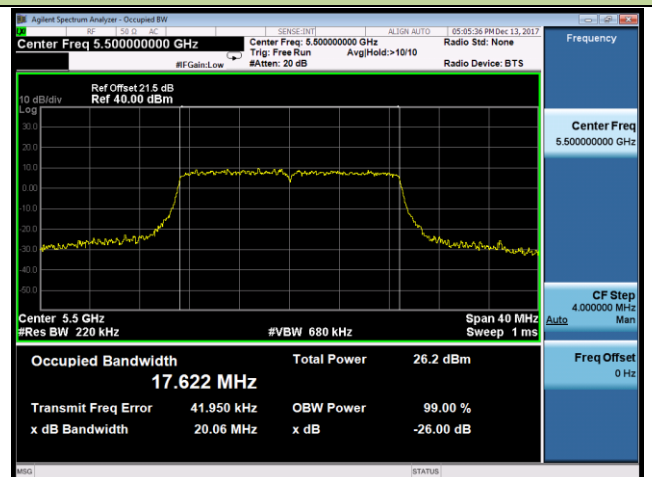
Channel 60 (5300MHz)



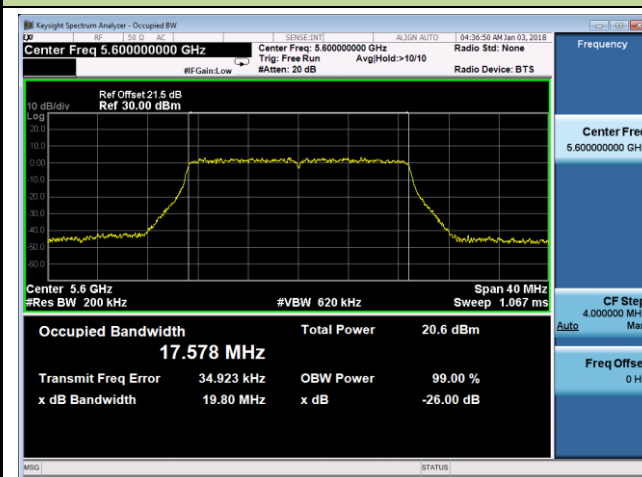
Channel 64 (5320MHz)



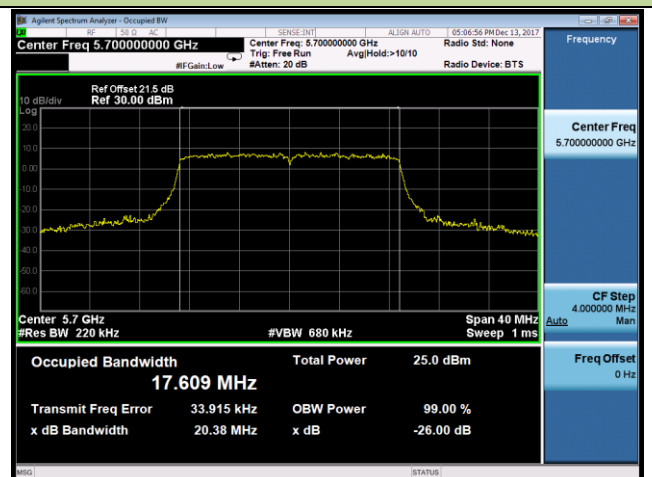
Channel 100 (5500MHz)

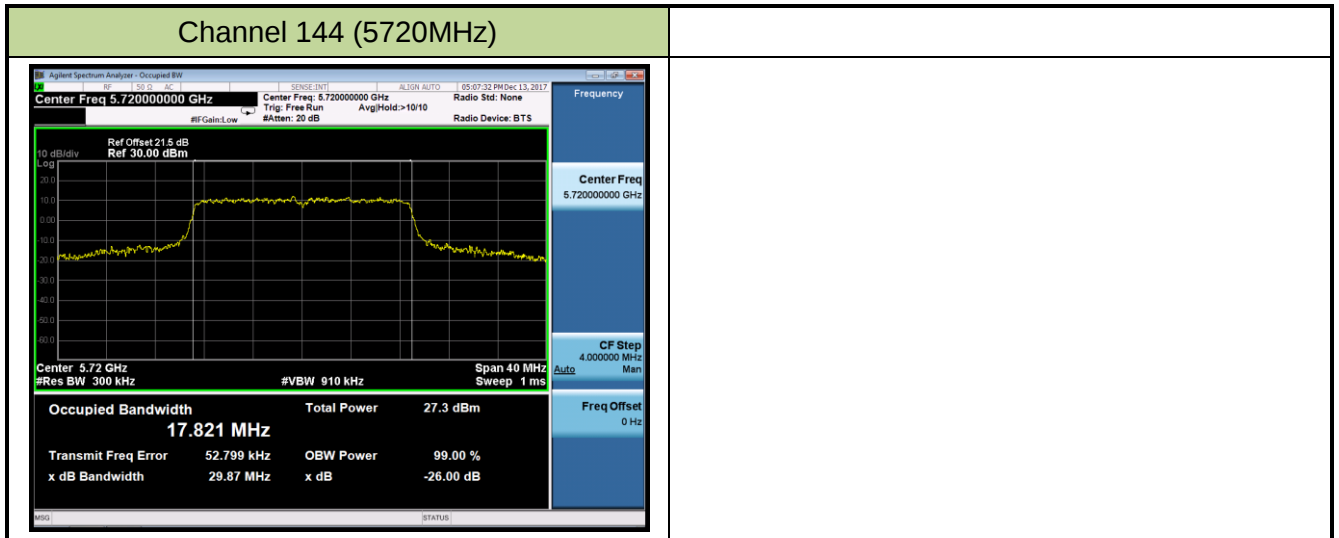


Channel 120 (5600MHz)



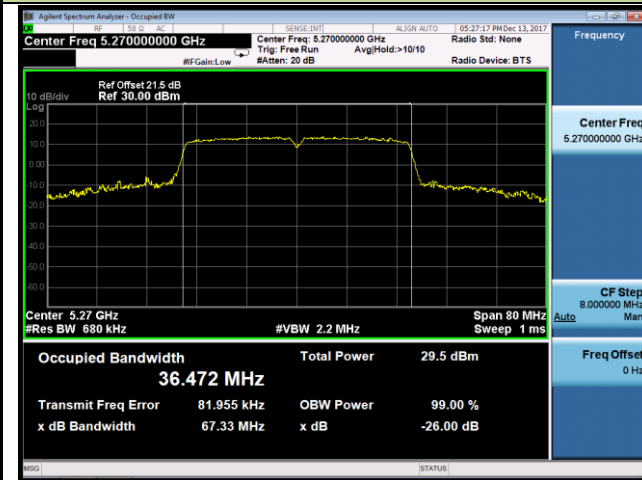
Channel 140 (5700MHz)



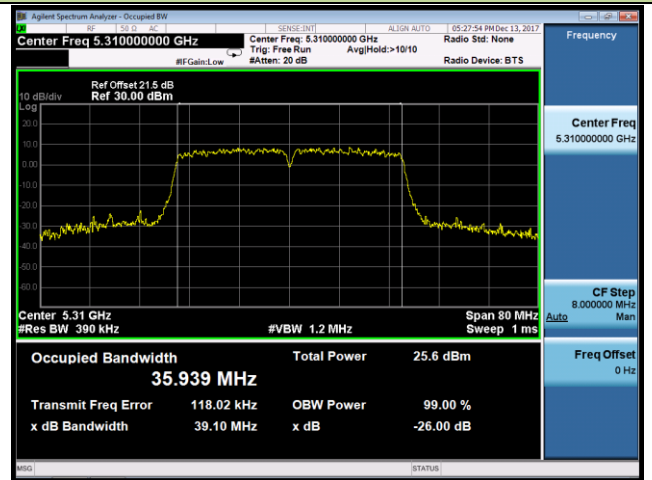


802.11ac-VHT40 26dB Bandwidth & 99% Bandwidth - Ant 0

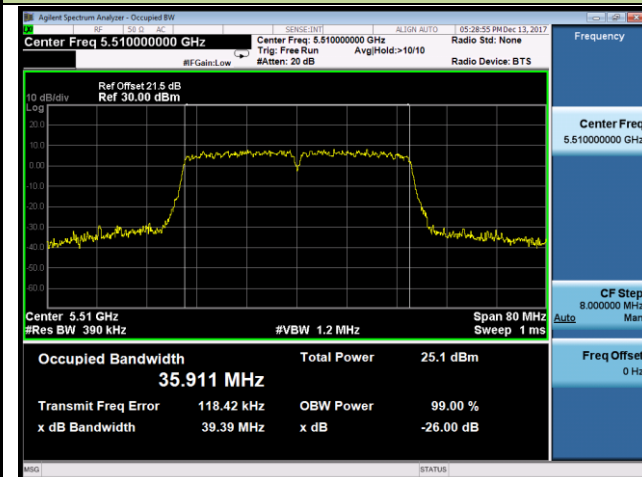
Channel 54 (5270MHz)



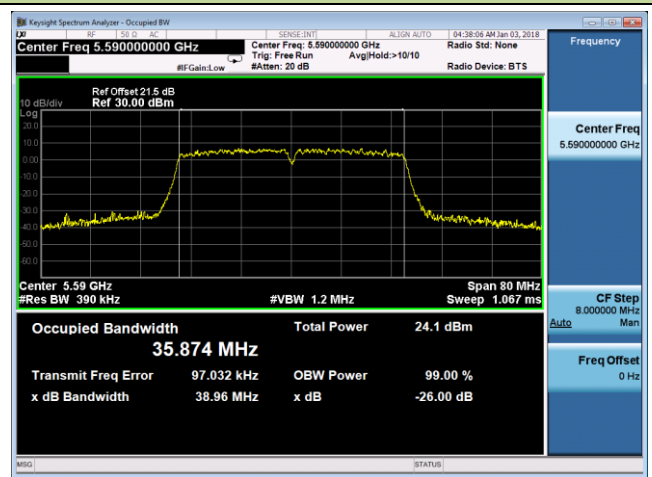
Channel 62 (5310MHz)



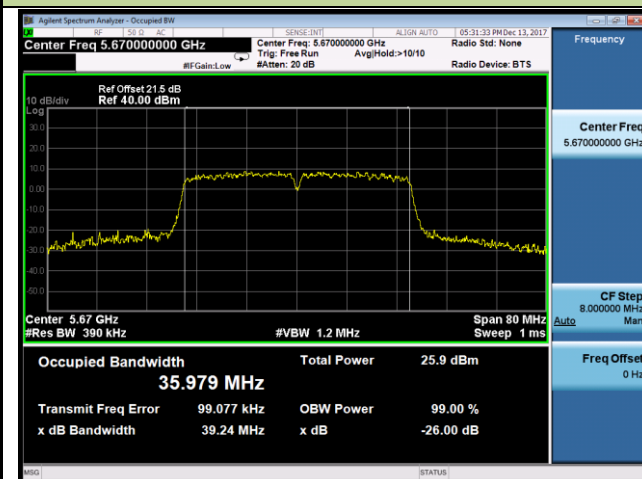
Channel 102 (5510MHz)



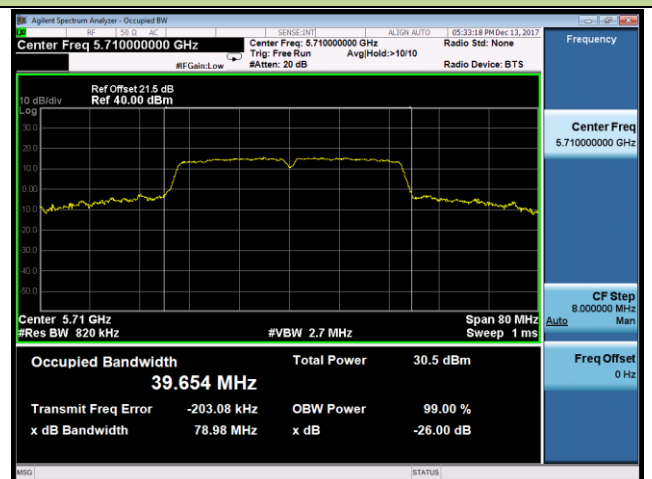
Channel 118 (5590MHz)



Channel 134 (5670MHz)

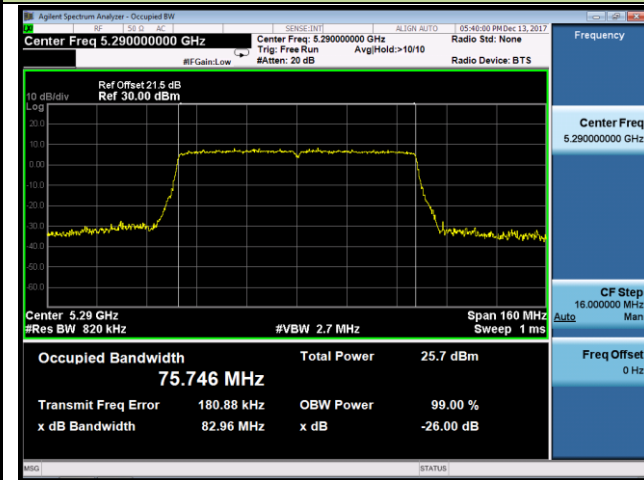


Channel 142 (5710MHz)

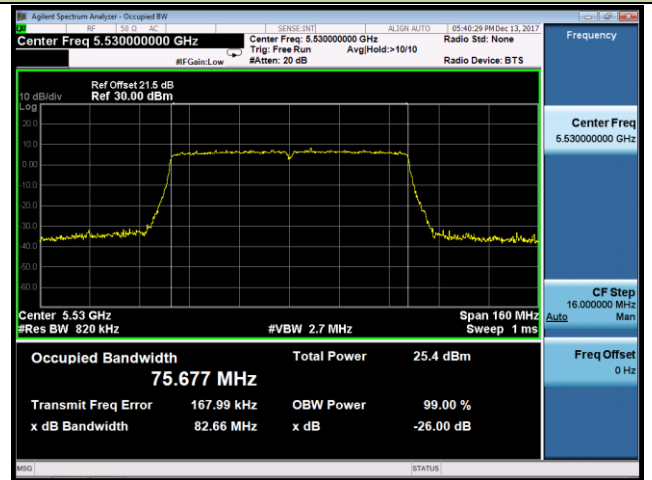


802.11ac-VHT80 26dB Bandwidth & 99% Bandwidth - Ant 0

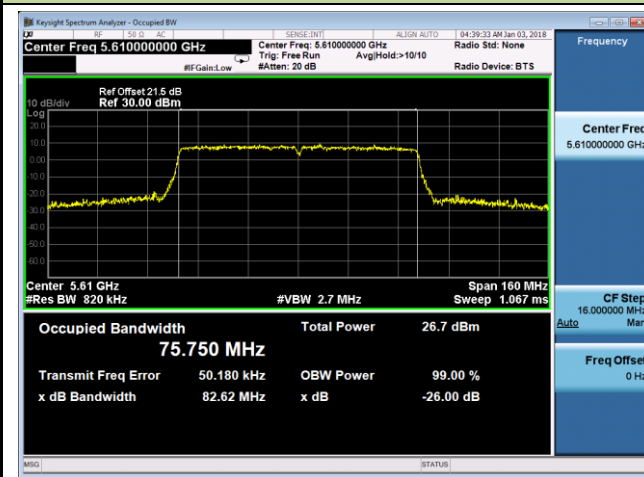
Channel 58 (5290MHz)



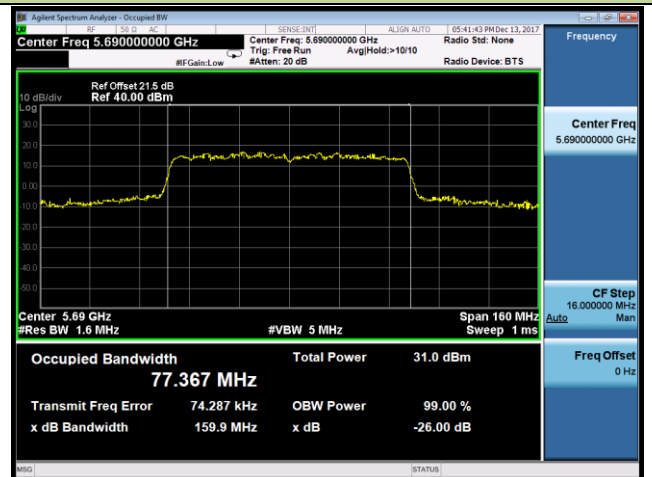
Channel 106 (5530MHz)



Channel 122 (5610MHz)

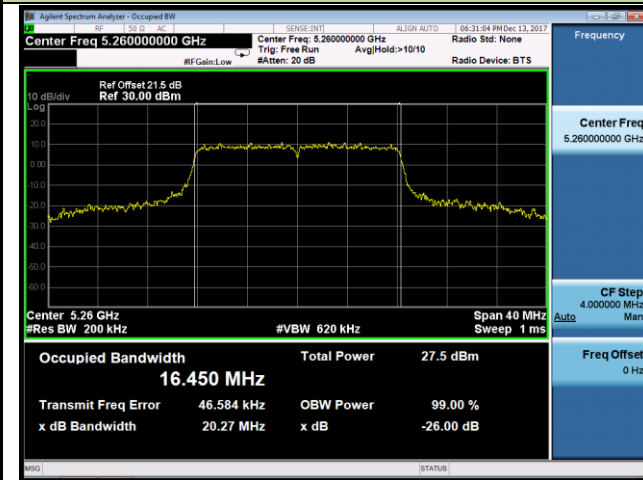


Channel 138 (5690MHz)

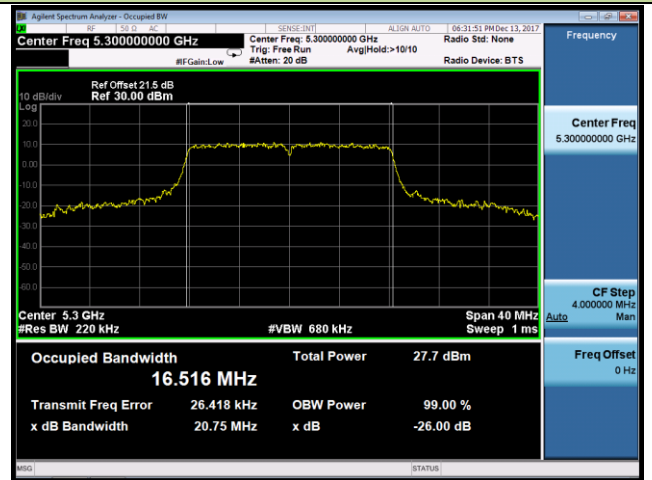


802.11a 26dB Bandwidth & 99% Bandwidth - Ant 1

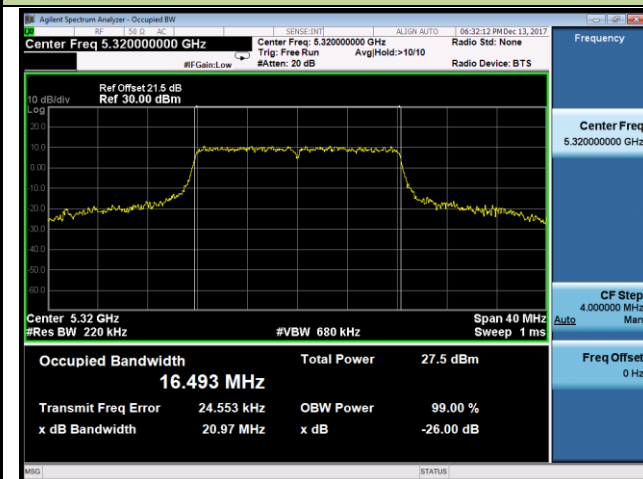
Channel 52 (5260MHz)



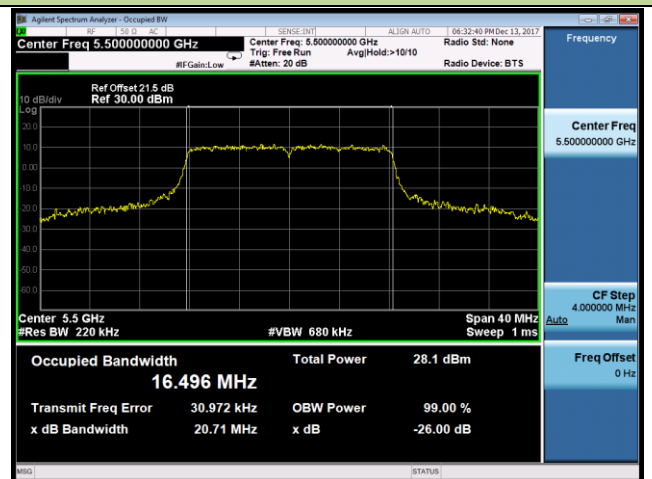
Channel 60 (5300MHz)



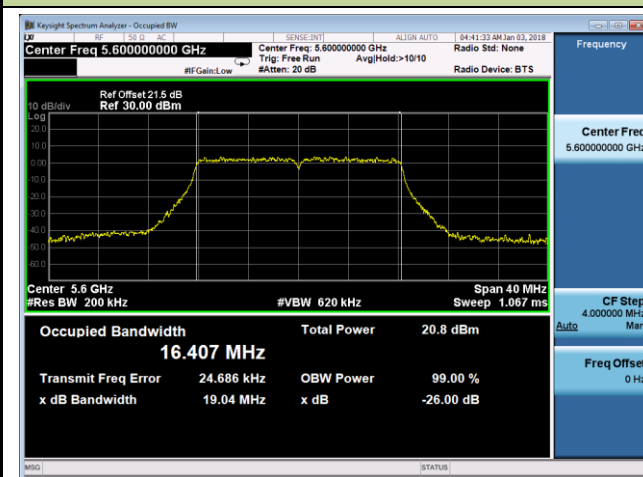
Channel 64 (5320MHz)



Channel 100 (5500MHz)



Channel 120 (5600MHz)



Channel 140 (5700MHz)

