

RF TEST REPORT

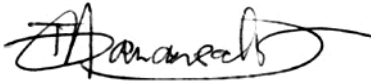


Report No.: FCC_RF_SL15072901-ZBR-024_UNII Rev. 2.0

Supersede Report No.: FCC_RF_SL15072901-ZBR-024_UNII Rev. 1.0

Applicant	:	Zebra Technologies Corporation
Product Name	:	WLAN IEEE 802.11ac/a/b/g/n 1x1 and Bluetooth 4.1 module
Model No.	:	WYSBHVXGXG
Test Standard	:	47 CFR 15.407
Test Method	:	ANSI C63.10: 2013 789033 D02 General UNII Test Procedures New Rules v01
FCC ID	:	I28MD-FXLAN11AC
IC ID	:	3798B-FXLAN11AC
Dates of test	:	09/08/2015
Issue Date	:	11/20/2015
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X]		
Equipment did not comply with the specification []		

This Test Report is Issued Under the Authority of:

	
Teody Manansala	Nima Molaei
Test Engineer	Engineer Reviewer
This test report may be reproduced in full only Test result presented in this test report is applicable to the tested sample only	

Issued By:
SIEMIC Laboratories
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Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.



In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_RF_SL15072901-ZBR-024_UNII	None	Original	10/20/2015
FCC_RF_SL15072901-ZBR-024_UNII Rev. 1.0	1.0	Add Support equipmennt description to PCBA and power supply	11/10/2015
FCC_RF_SL15072901-ZBR-024_UNII Rev. 2.0	2.0	Add remarks on the radio description	11/20/2015

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: Zebra Technologies Corporation
Product: WLAN IEEE 802.11ac/a/b/g/n 1x1 and Bluetooth 4.1 module
Model: WYSBHVXGX

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	:	Zebra Technologies Corporation Error! Bookmark not defined.
Applicant Address	:	333 Corporate Woods, Vernon Hills, IL, 60061, USA
Manufacturer Name	:	Zebra Technologies Corporation
Manufacturer Address	:	333 Corporate Woods, Vernon Hills, IL, 60061, USA

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	881796
IC Test Site No.	4842D-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	:	WLAN IEEE 802.11ac/a/b/g/n 1x1 and Bluetooth 4.1 module
Model No.	:	WYSBHVXG
Trade Name	:	Zebra Technologies Corporation
Serial No.	:	N/A
Host Model No.	:	N/A
Input Power	:	100-240VDC, 50/60Hz
Power Adapter Manu/Model	:	FSP GROPU INC./FSP025-DHAN2
Power Adapter SN	:	H00000048
Product Hardware version	:	Rev E
Product Software version	:	Ver V77.19.xx
Radio Hardware version	:	Rev D
Radio Software version	:	Ver 15.68.07.p36
Test Software version	:	Version 1.71
Date of EUT received	:	September 8, 2015
Equipment Class/ Category	:	UNII
Clock Frequencies	:	N/A
Port/Connectors	:	USB

6.2 Radio Description

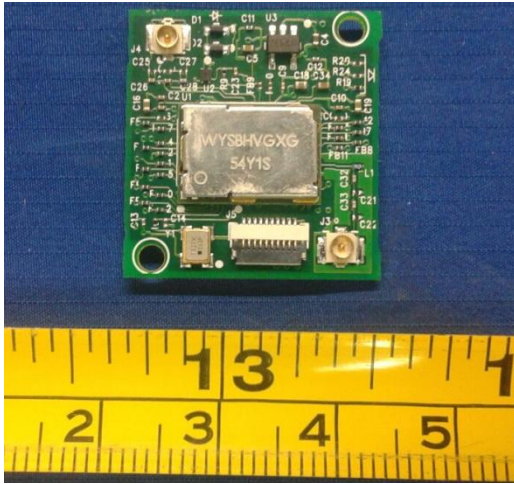
Radio Type	802.11a	802.11n-20M	802.11n-40M	802.11ac-80M
Operating Frequency	5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz	5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz	5190-5230MHz 5270-5310MHz 5510-5670MHz 5755-5795MHz	5210MHz, 5290MHz 5530MHz, 5610MHz, 5690MHz, 5775MHz
Modulation	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Channel Spacing	20MHz	20MHz (5GHz)	40MHz	80MHz
Number of Channels	22	22 (5GHz)	10 (5GHz)	6 (5GHz)
Antenna Type	Omnidirectional Antenna Patch Antenna			
Antenna Gain	Omnidirectional Antenna - 5dBi (5GHz) Patch Antenna - 3.19dBi (5GHz)			
Antenna Connector Type	Reverse SMA U.FL connector			
Remarks	2.4GHz and 5GHz Radio does not transmit simultaneously			

EUT Power Setting (power setting is same for both antenna type)

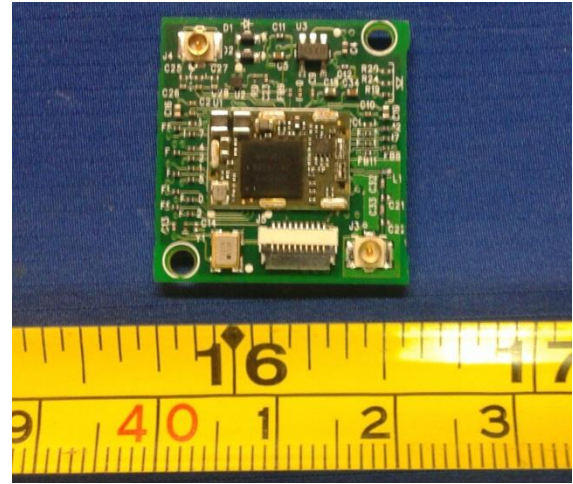
5.2 GHz			
Test mode	Freq(MHz)	CH	Power settings
802.11a	5180	Low	16
	5200	Mid	16
	5240	High	16
802.11n20	5180	Low	16
	5200	Mid	16
	5240	High	16
802.11n40	5190	Low	16
	5230	High	16
802.11ac80	5210	Mid	8
5.3 GHz			
Test mode	Freq(MHz)	CH	Power settings
802.11a	5260	Low	16
	5280	Mid	16
	5320	High	16
802.11n20	5260	Low	16
	5280	Mid	16
	5320	High	16
802.11n40	5270	Low	16
	5310	High	16
802.11ac80	5290	Mid	8
5.5 GHz			
Test mode	Freq(MHz)	CH	Power settings
802.11a	5500	Low	16
	5580	Mid	16
	5700	High	16
802.11n20	5500	Low	16
	5580	Mid	16
	5700	High	16
802.11n40	5510	Low	16
	5550	Mid	16
	5670	High	16
802.11ac80	5530	Low	8
	5610	Mid	8
	5690	High	8

5.8 GHz			
Test mode	Freq(MHz)	CH	Conducted Power (dBm)
802.11a	5745	Low	16
	5785	Mid	16
	5825	High	16
802.11n20	5745	Low	16
	5785	Mid	16
	5825	High	16
802.11n40	5755	Low	16
	5795	High	16
802.11ac80	5775	Mid	8

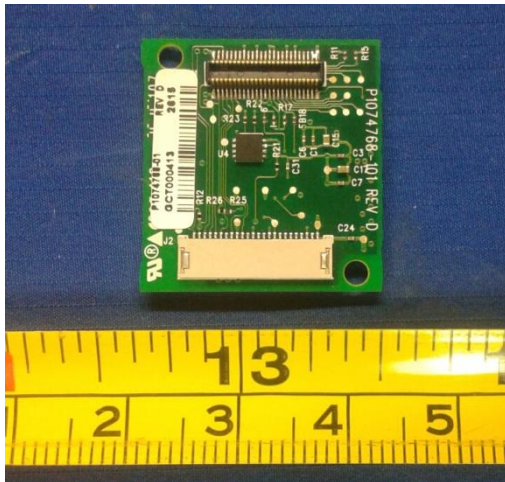
6.3 EUT Photos



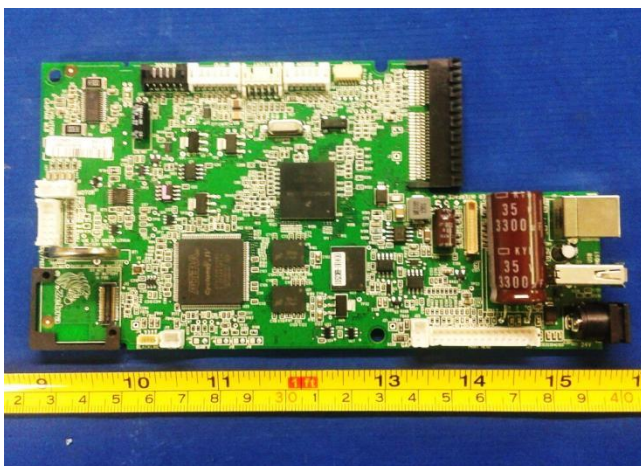
EUT Radio with Shielding Top View



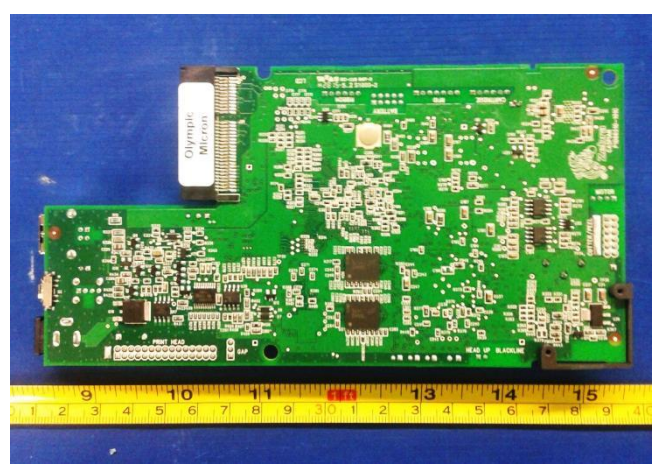
EUT Radio without Shielding Top View



EUT Radio Bottom View



Support Equipment PCBA Top View



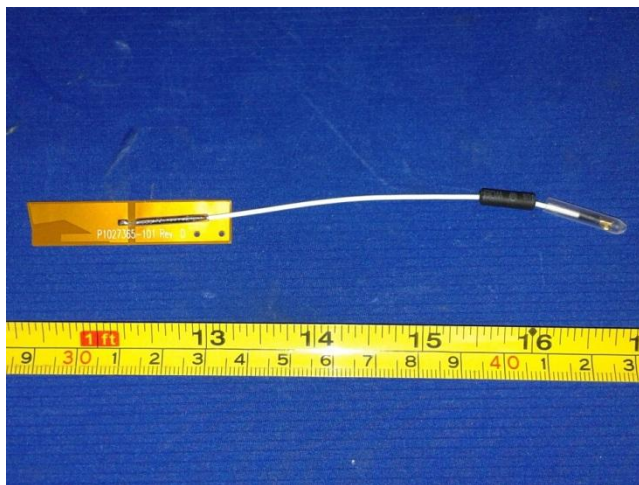
Support Equipment PCBA Bottom View



Omnidirectional Antenna



Omnidirectional Antenna



Patch Antenna Top View



Patch Antenna Bottom



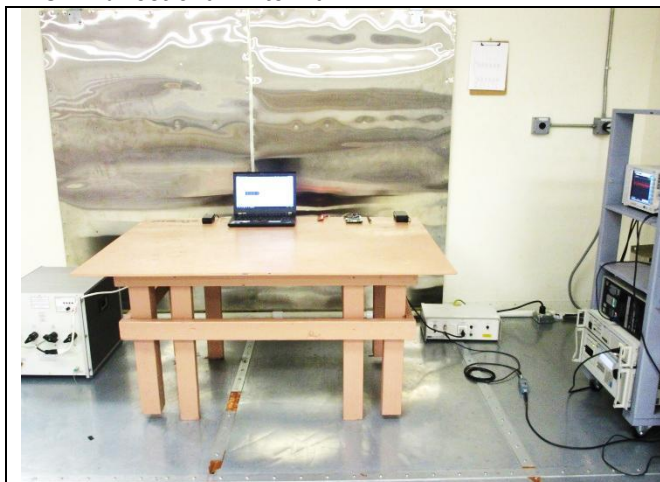
Support Equipment Power Supply Top View



Support Equipment Power Supply Bottom View

6.4 EUT Test Setup Photos

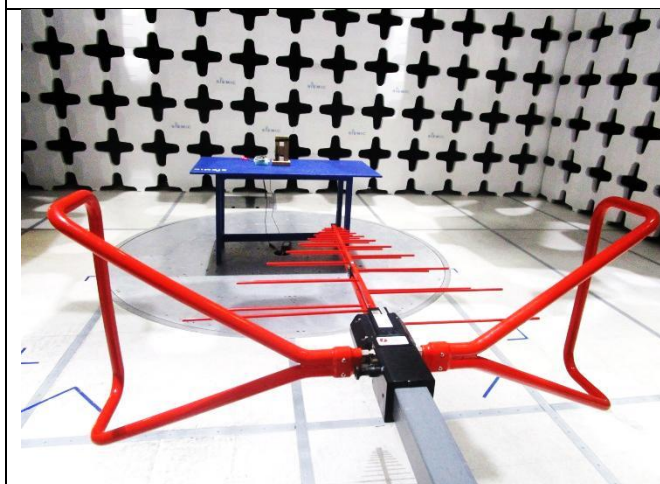
Onmidirectional Antenna



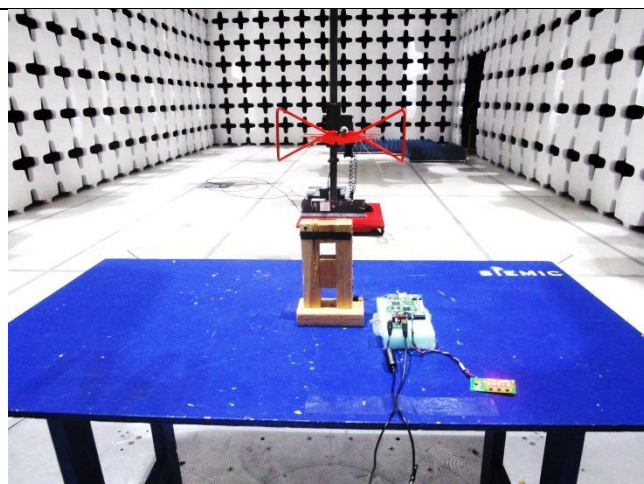
AC Line Conducted Emissions – Front View



AC Line Conducted Emissions – Rear View



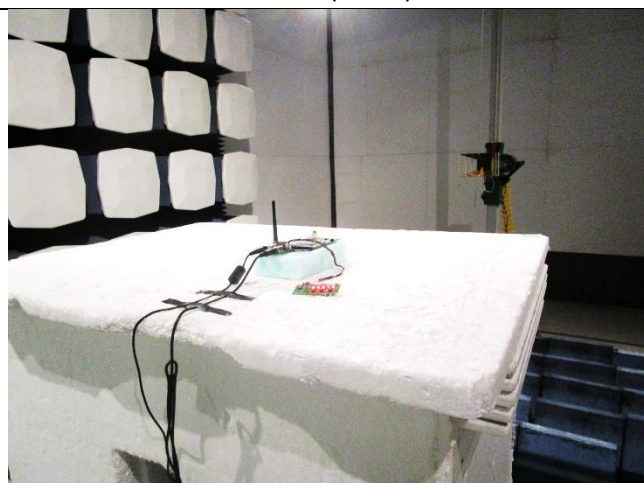
Radiated Emissions (<1GHz) – Front View



Radiated Emissions (<1GHz) – Rear View

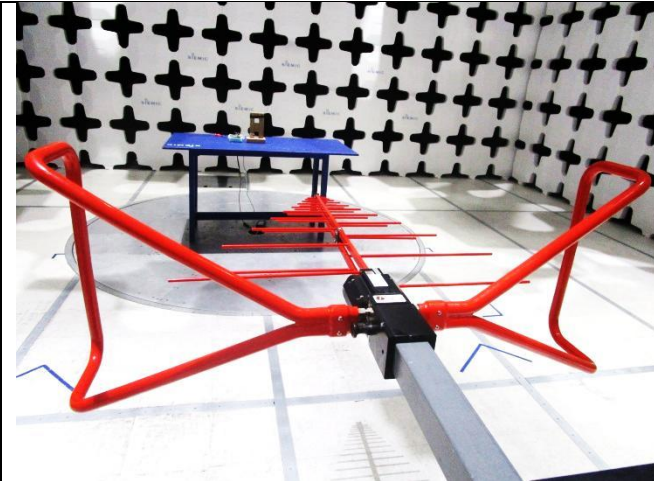


Radiated Emissions (>1GHz) – Front View

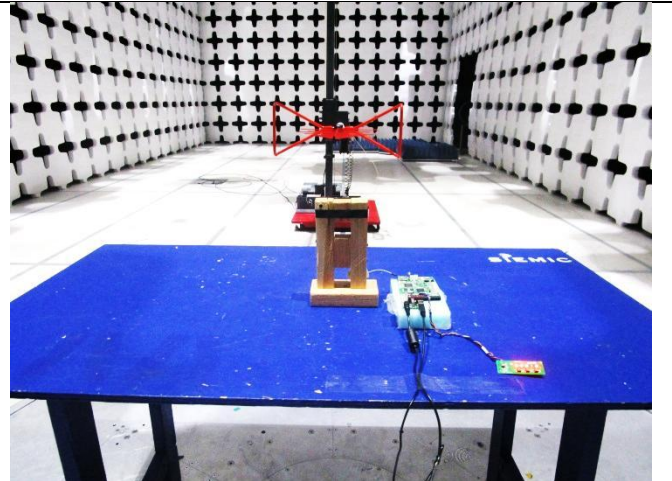


Radiated Emissions (>1GHz) – Rear View

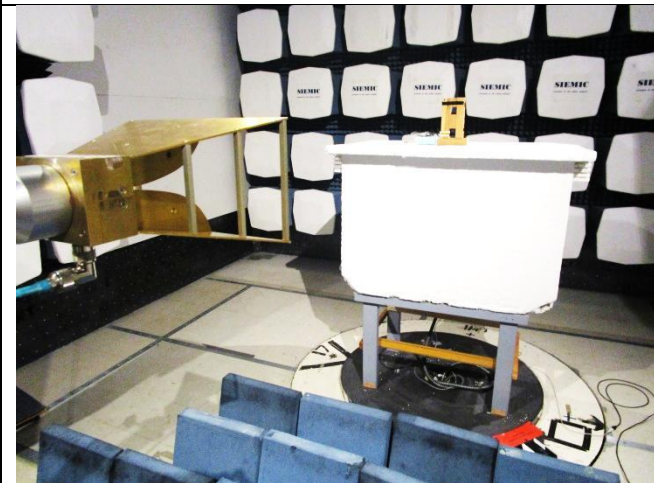
Patch Antenna



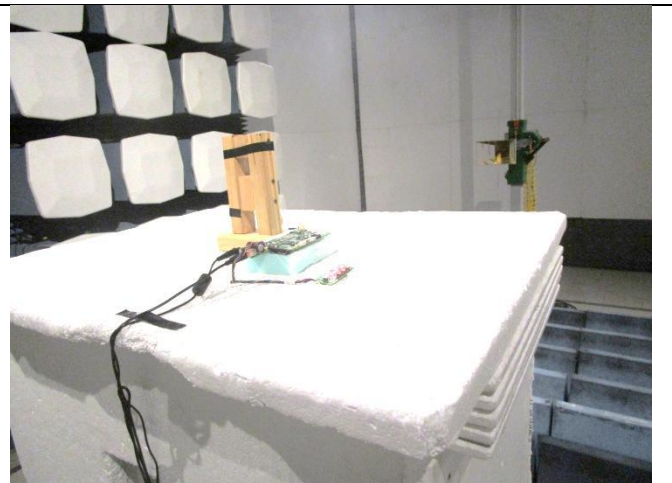
Radiated Emissions (<1GHz) – Front View



Radiated Emissions (<1GHz) – Rear View



Radiated Emissions (>1GHz) – Front View



Radiated Emissions (>1GHz) – Rear View

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	P05F Latitude E5410	N/A	Dell	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
USB	EUT	I/O Port	Laptop	USB	2	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	Toolbox	Set the EUT to transmit continuously in diferent test mode

8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Restricted Band of Operation	FCC	15.205	ANSI C63.10 – 2013 789033 D02 General UNII Test Procedures New Rules v01	☒ Pass ☐ N/A
AC Conducted Emissions Voltage	FCC	15.207(a)	ANSI C63.10 – 2013	☒ Pass ☐ N/A

Test Item	Test standard		Test Method/Procedure	Pass / Fail
26 & 6 dB Emission Bandwidth	FCC	15.407 (a) (2)	789033 D02 General UNII Test Procedures New Rules v01	☒ Pass ☐ N/A
Maximum conducted Output Power	FCC	15.407 (a) (2)	789033 D02 General UNII Test Procedures New Rules v01	☒ Pass ☐ N/A
Power reduction (Antenna Gain > 6 dBi)	FCC	15.407 (a) (2)	-	☒ Pass ☐ N/A
Band Edge and Radiated Spurious Emissions	FCC	15.407(b)(2), 15.407(b)(6)	ANSI C63.10 – 2013 789033 D02 General UNII Test Procedures New Rules v01	☒ Pass ☐ N/A
Power Spectral Density	FCC	15.407 (a) (2)	789033 D02 General UNII Test Procedures New Rules v01	☒ Pass ☐ N/A
User Manual	FCC	-	-	☒ Pass ☐ N/A
Remark	1. All measurement uncertainties are not taken into consideration for all presented test result. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual.			

9 Measurement Uncertainty

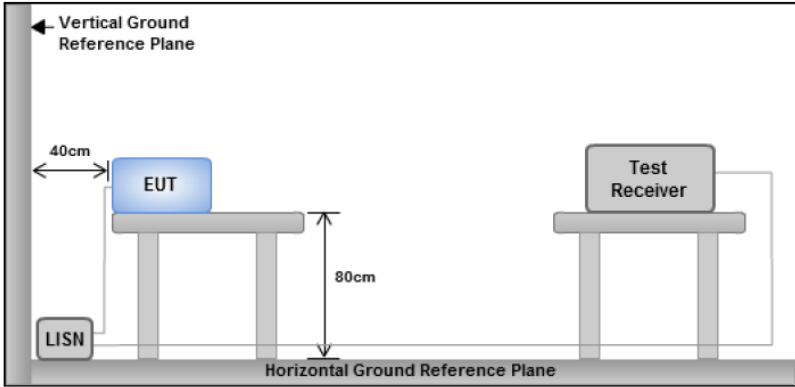
Emissions			
Test Item	Frequency Range	Description	Uncertainty
Band Edge and Radiated Spurious Emissions	30MHz – 1GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
Band Edge and Radiated Spurious Emissions	1GHz – 40GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+4.3dB/-4.1dB

10 Measurements, Examination and Derived Results

10.1 Conducted Emissions

Conducted Emission Limit

Frequency ranges (MHz)	Limit (dBuV)	
	QP	Average
0.15 ~ 0.5	66 – 56	56 – 46
0.5 ~ 5	56	46
5 ~ 30	60	50

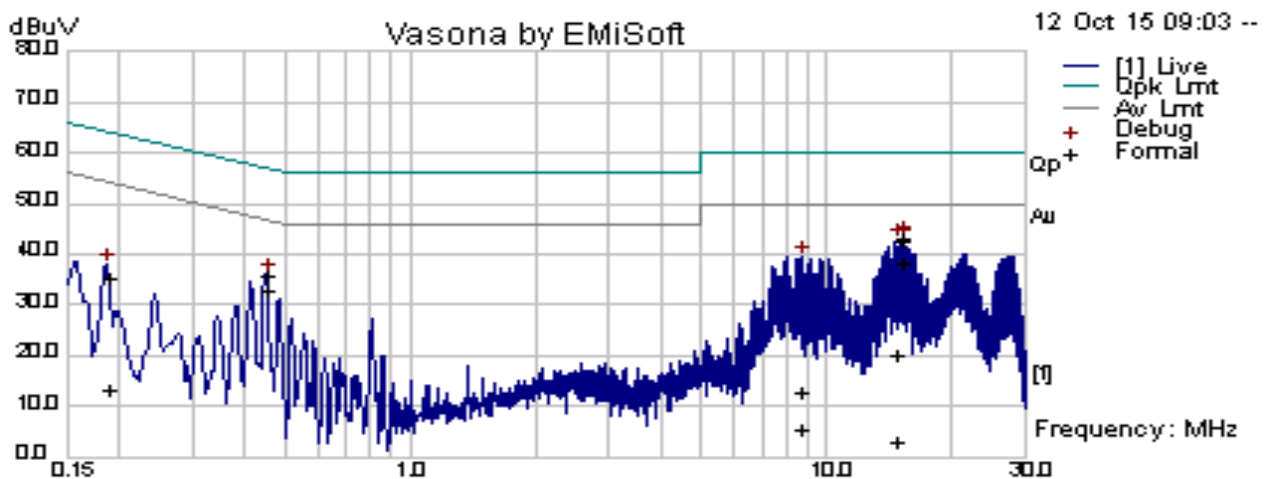
Spec	Item	Requirement	Applicable
47CFR§15.207	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	☒
Test Setup		 Note: 1. Support units were connected to second LISN. 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes	
Procedure		- The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B. - The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains. - The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. - All other supporting equipment was powered separately from another main supply.	
Remark		EUT was tested at 120VAC, 60Hz	
Result		☒ Pass ☐ Fail	

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Teody Manansala			
Test Date:	10/12/2015			
Remarks	AC Line @ Line			

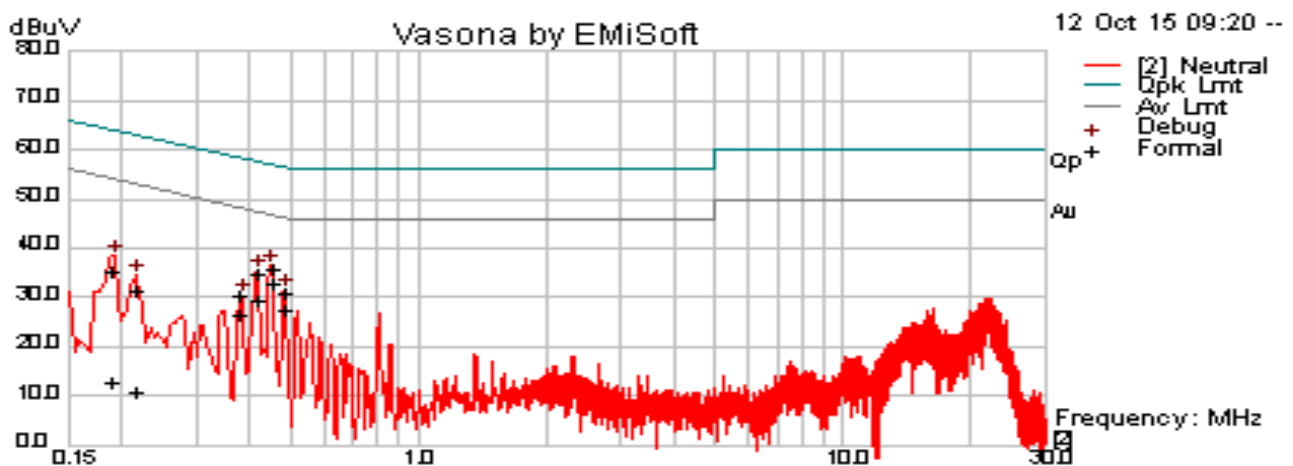


Line Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
15.12	31.83	10.06	0.60	42.49	Quasi Peak	Live	60.00	-17.51	Pass
15.24	32.62	10.06	0.60	43.28	Quasi Peak	Live	60.00	-16.72	Pass
14.65	9.47	10.06	0.60	20.12	Quasi Peak	Live	60.00	-39.88	Pass
8.66	2.09	10.05	0.55	12.69	Quasi Peak	Live	60.00	-47.31	Pass
0.45	25.03	10.01	0.71	35.75	Quasi Peak	Live	56.87	-21.12	Pass
0.19	24.02	10.00	1.39	35.41	Quasi Peak	Live	64.04	-28.63	Pass
15.12	27.64	10.06	0.60	38.31	Average	Live	50.00	-11.69	Pass
15.24	27.44	10.06	0.60	38.10	Average	Live	50.00	-11.90	Pass
14.65	-7.61	10.06	0.60	3.05	Average	Live	50.00	-46.95	Pass
8.66	-5.06	10.05	0.55	5.54	Average	Live	50.00	-44.46	Pass
0.45	21.90	10.01	0.71	32.62	Average	Live	46.87	-14.25	Pass
0.19	1.67	10.00	1.39	13.06	Average	Live	54.04	-40.98	Pass

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Teody Manansala			
Test Date:	10/12/2015			
Remarks	AC Line @ Neutral			



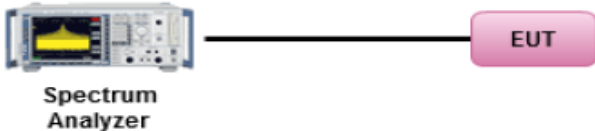
Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
0.45	25.23	10.01	0.71	35.95	Quasi Peak	Neutral	56.87	-20.92	Pass
0.42	24.02	10.01	0.74	34.77	Quasi Peak	Neutral	57.54	-22.77	Pass
0.48	20.45	10.01	0.69	31.15	Quasi Peak	Neutral	56.26	-25.11	Pass
0.19	24.15	10.00	1.39	35.54	Quasi Peak	Neutral	64.08	-28.54	Pass
0.38	19.74	10.01	0.77	30.52	Quasi Peak	Neutral	58.27	-27.75	Pass
0.22	20.05	10.00	1.22	31.27	Quasi Peak	Neutral	62.94	-31.67	Pass
0.45	22.05	10.01	0.71	32.77	Average	Neutral	46.87	-14.10	Pass
0.42	18.79	10.01	0.74	29.54	Average	Neutral	47.54	-18.00	Pass
0.48	16.60	10.01	0.69	27.29	Average	Neutral	46.26	-18.96	Pass
0.19	1.30	10.00	1.39	12.70	Average	Neutral	54.08	-41.38	Pass
0.38	15.92	10.01	0.77	26.70	Average	Neutral	48.27	-21.57	Pass
0.22	-0.43	10.00	1.22	10.79	Average	Neutral	52.94	-42.15	Pass

Note: The results above show only the worst case.

10.2 26 dB Bandwidth & 6 dB Bandwidth

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.407	-	99% BW: Report only for reference.	☒
	a) (2)	26 dB Emission BW: Report only for power limit calculation.	☒
	e)	Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.	☒
Test Setup			
Test Procedure	789033 D02 General UNII Test Procedures New Rules v01 <u>26dB Emission bandwidth measurement procedure (Other than 5.725-5.85 GHz)</u> - Allow the trace to stabilize. - Use the spectrum analyzer built-in measurement function to determine the 26dB BW. - o Set RBW = around 1% of emission bandwidth - o Set VBW > RBW - o Detector = Peak - o Trace mode = max hold - Capture the plot. - Repeat above steps for different test channel and other modulation type. <u>6 dB Minimum emission bandwidth measurement procedure (for 5.725-5.85 GHz)</u> - Allow the trace to stabilize. - Use the spectrum analyzer built-in measurement function to determine the 6dB BW. - o Set RBW = 100 KHz - o Set VBW ≥ 3 x RBW - o Detector = Peak - o Trace mode = max hold - o Sweep = auto couple - Capture the plot. - Repeat above steps for different test channel and other modulation type.		
Test Date	09/10/2015	Environmental condition	Temperature 22°C Relative Humidity 38% Atmospheric Pressure 1020mbar
Remark	None		
Result	☒ Pass ☐ Fail		

Equipment Setting

Test	RBW	VBW	Span	Detector	Sweep	Trace	Notes
26 dB Emission Bandwidth	1% of 26 dB EBW	>RBW	>EBW	PK	Auto	Maxhold	-
6 dB Bandwidth	100 KHz	≥3 x RBW	1.5 - 5 times of OBW	PK	Auto	Maxhold	-

Test Data ☒ Yes ☐ N/A
Test Plot ☒ Yes ☐ N/A

26dB Bandwidth measurement result for 5.2GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit (MHz)
26dB BW	802.11a	5180	Low	19.21	-
26dB BW		5200	Mid	19.19	-
26dB BW		5240	High	19.14	-
26dB BW	802.11n20	5180	Low	19.68	-
26dB BW		5200	Mid	19.86	-
26dB BW		5240	High	19.43	-
26dB BW	802.11n40	5190	Low	39.40	-
26dB BW		5230	High	39.37	-
26dB BW	802.11ac80	5210	Mid	80.96	-

26dB Bandwidth measurement result for 5.3GHz

Type	Test mode	Freq (MHz)	CH	Result(MHz)	Limit (MHz)
26dB BW	802.11a	5260	Low	19.24	-
26dB BW		5280	Mid	19.04	-
26dB BW		5320	High	19.18	-
26dB BW	802.11n20	5260	Low	24.76	-
26dB BW		5280	Mid	19.85	-
26dB BW		5320	High	19.67	-
26dB BW	802.11n40	5270	Low	39.53	-
26dB BW		5310	High	39.25	-
26dB BW	802.11ac80	5290	Mid	80.90	-

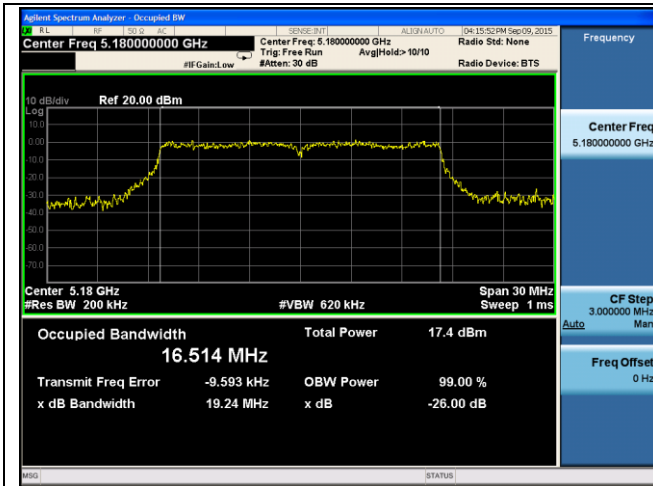
26dB Bandwidth measurement result for 5.5GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit (MHz)
26dB BW	802.11a	5500	Low	21.94	-
26dB BW		5580	Mid	22.33	-
26dB BW		5700	High	18.93	-
26dB BW	802.11n20	5500	Low	23.33	-
26dB BW		5580	Mid	24.90	-
26dB BW		5700	High	19.59	-
26dB BW	802.11n40	5510	Low	39.60	-
26dB BW		5550	Mid	39.61	-
26dB BW		5670	High	36.30	-
26dB BW	802.11ac80	5530	Low	81.27	-
26dB BW		5610	Mid	80.99	-
26dB BW		5690	High	80.72	-

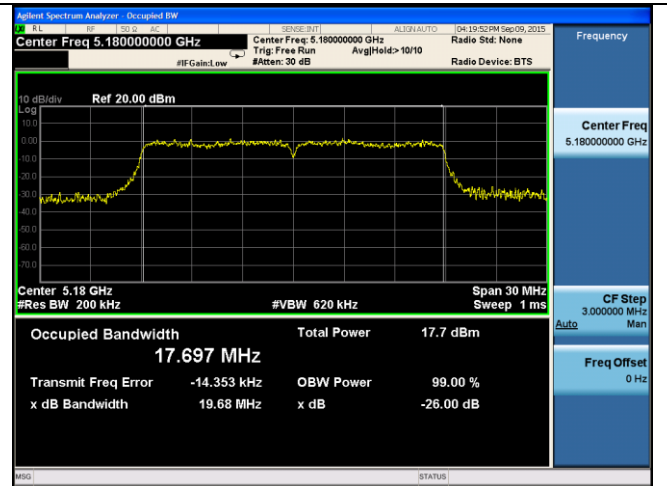
6dB Bandwidth measurement result for 5.8GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit (MHz)	Result
6dB BW	802.11a	5745	Low	16.50	>0.5	pass
6dB BW		5785	Mid	16.50	>0.5	pass
6dB BW		5825	High	16.51	>0.5	pass
6dB BW	802.11n20	5745	Low	17.68	>0.5	pass
6dB BW		5785	Mid	17.67	>0.5	pass
6dB BW		5825	High	17.73	>0.5	pass
6dB BW	802.11n40	5755	Low	36.41	>0.5	pass
6dB BW		5795	High	36.44	>0.5	pass
6dB BW	802.11ac80	5775	Mid	76.52	>0.5	pass

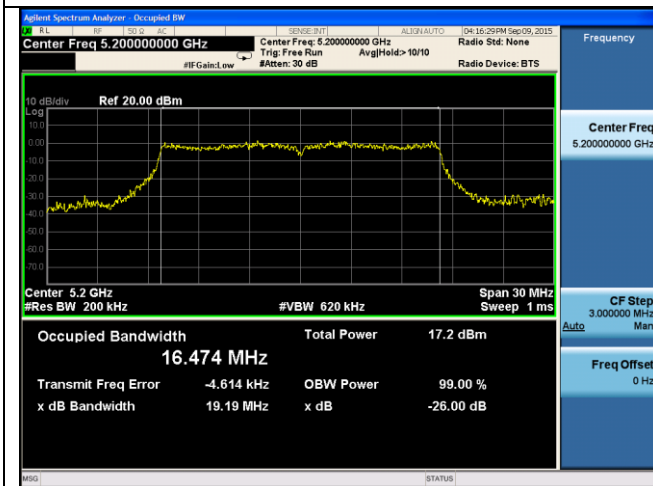
26dB Bandwidth Test Plots



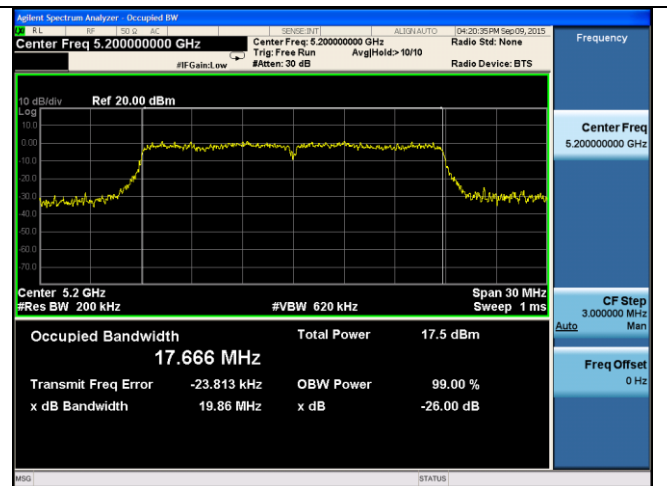
26dB BW - 802.11a 5180MHz



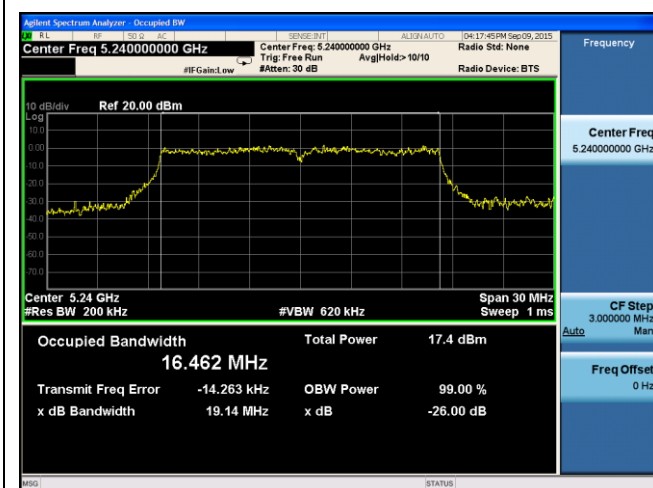
26dB BW - 802.11n-20M 5180MHz



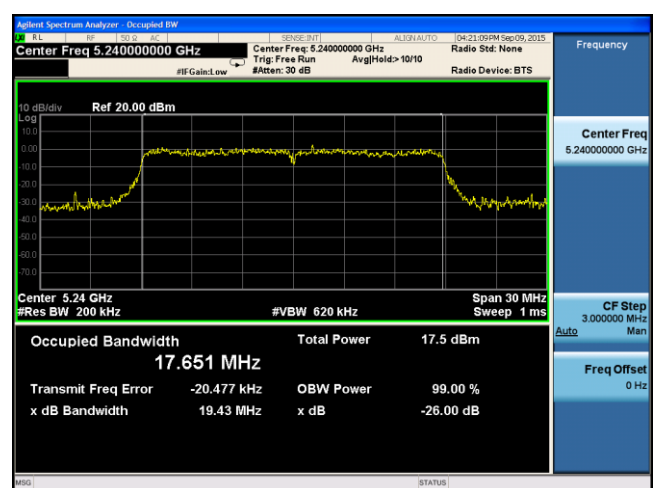
26dB BW - 802.11a 5200MHz



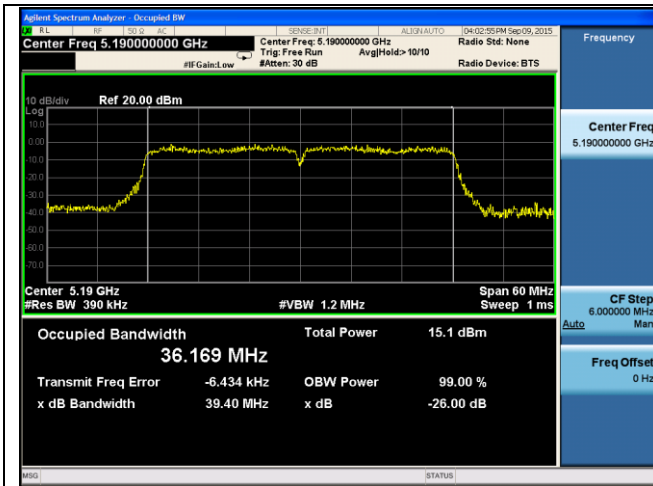
26dB BW - 802.11n-20M 5200MHz



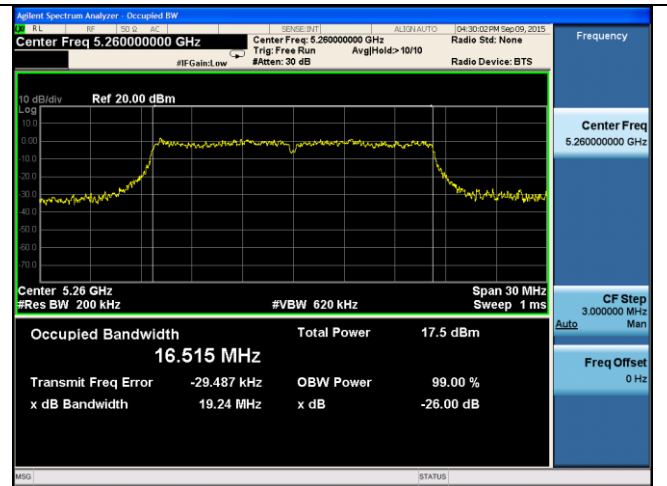
26dB BW - 802.11ac-80M 5210MHz



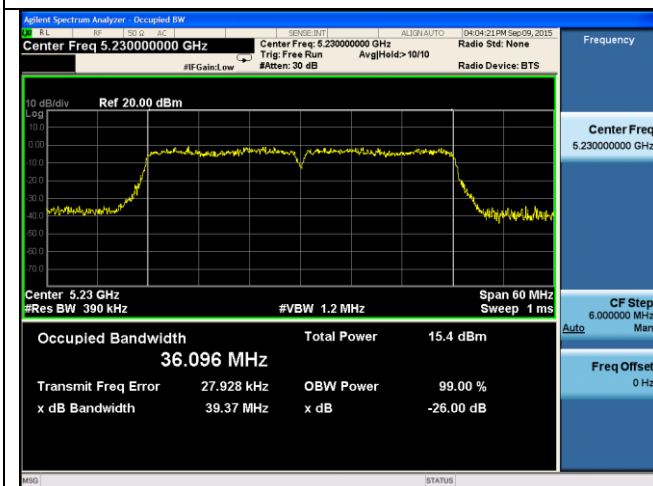
26dB BW - 802.11n-20M 5240MHz



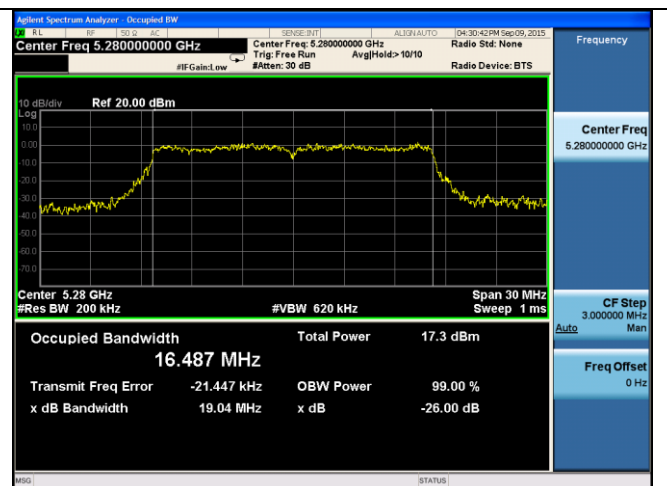
26dB BW - 802.11n40 5190MHz



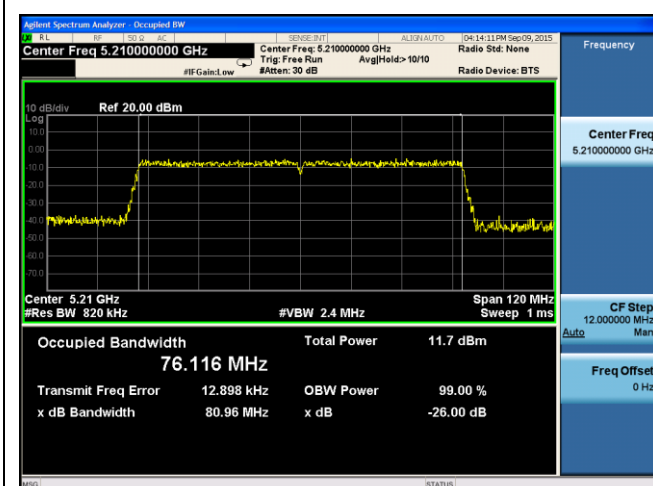
26dB BW - 802.11a 5260MHz



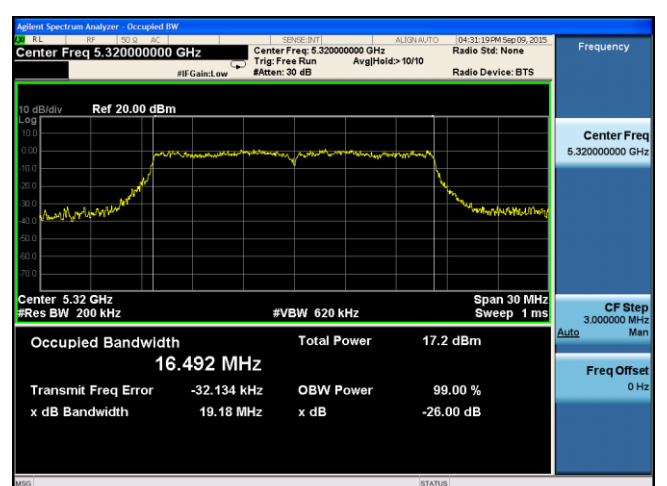
26dB BW - 802.11n-40M 5230MHz



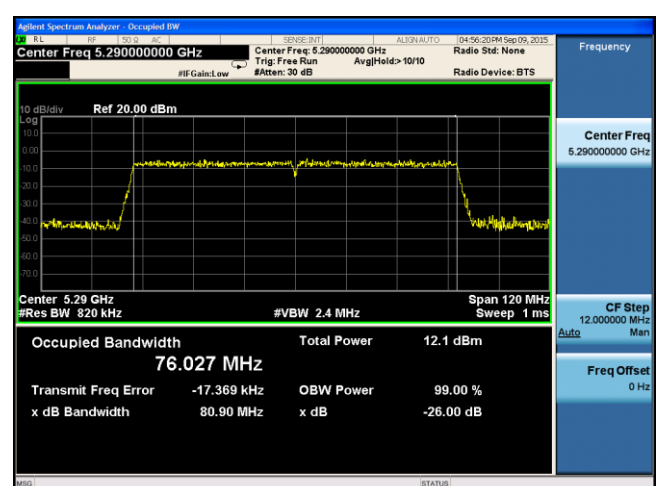
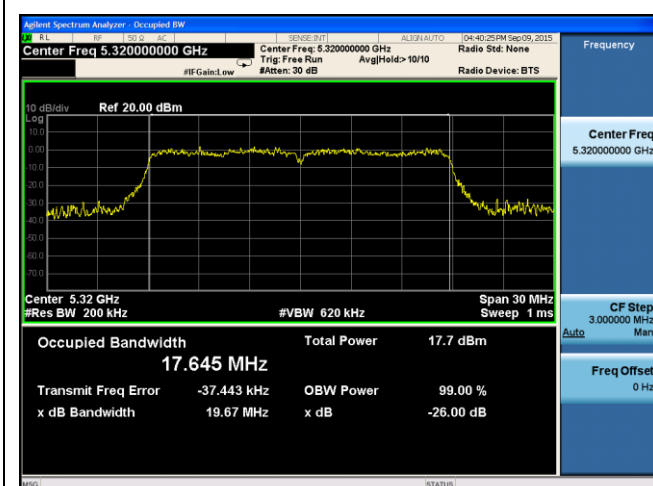
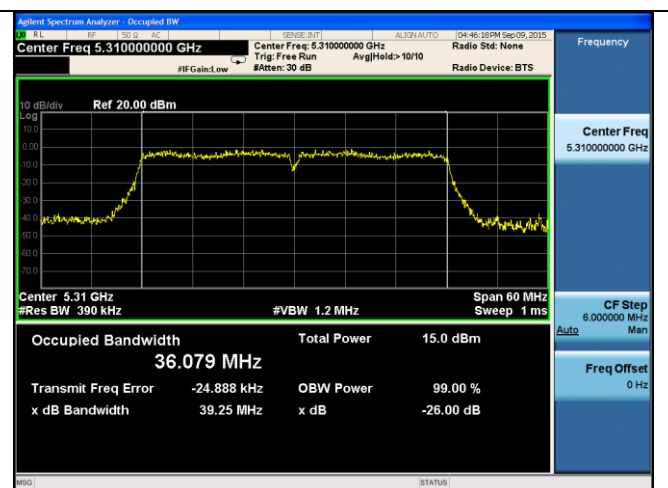
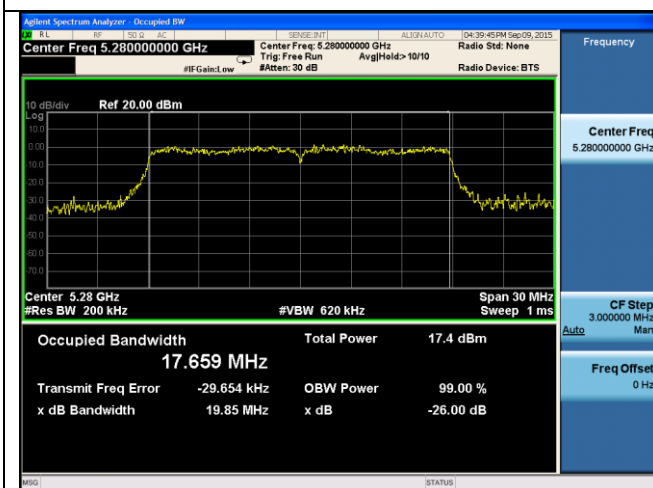
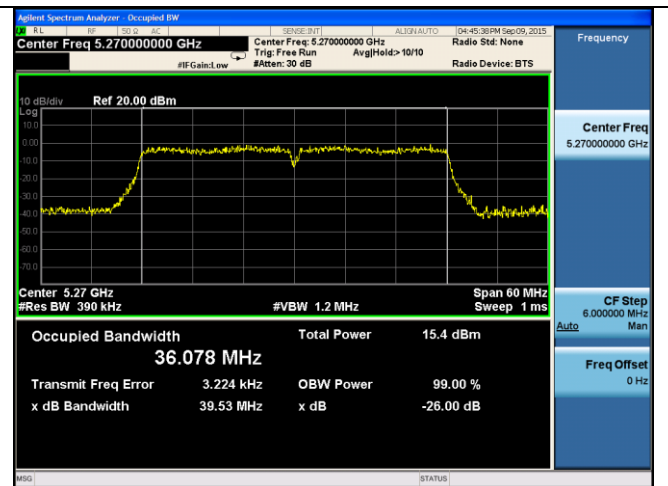
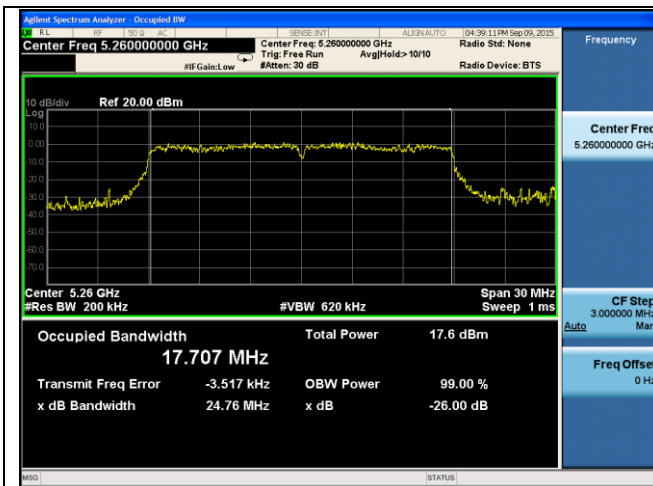
26dB BW - 802.11a 5280MHz

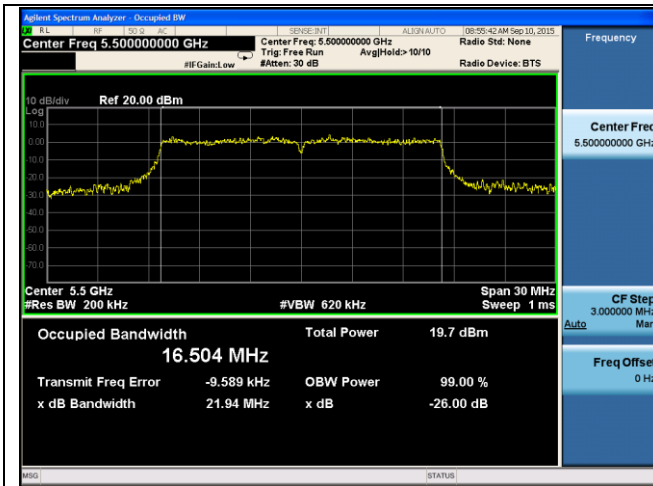


26dB BW - 802.11ac-80M 5210MHz

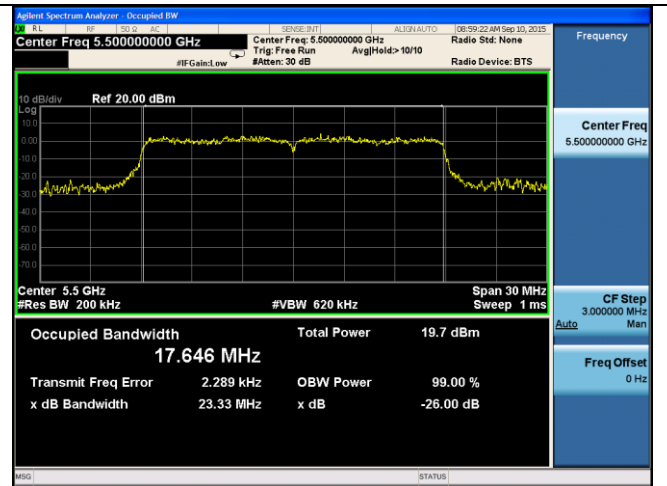


26dB BW - 802.11a 5320MHz

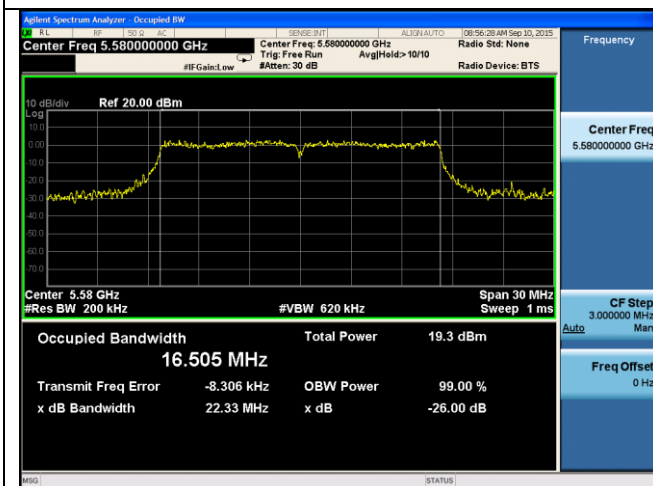




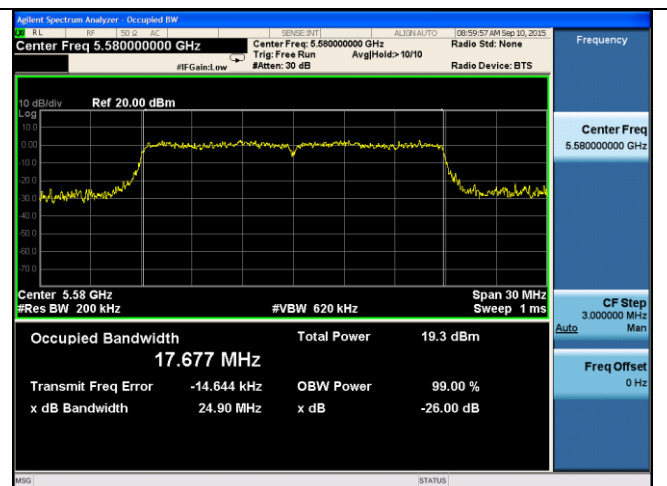
26dB BW - 802.11a 5500MHz



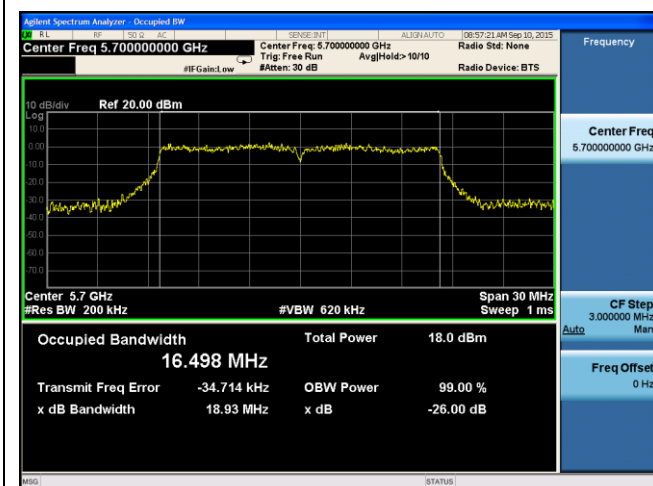
26dB BW - 802.11n-20M 5500MHz



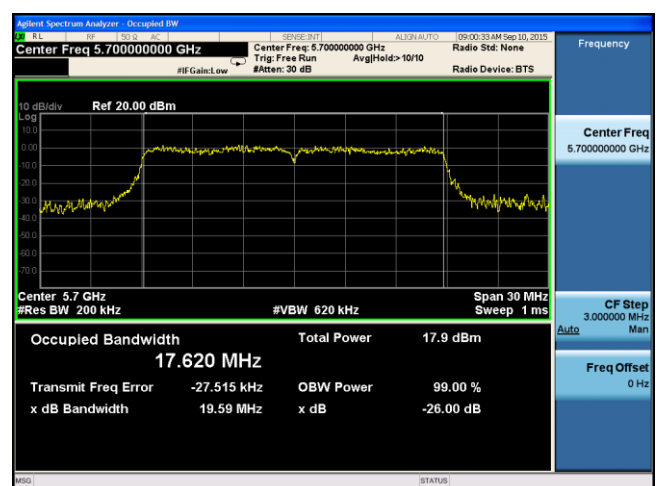
26dB BW - 802.11a 5580MHz



26dB BW - 802.11n-20M 5580MHz



26dB BW - 802.11a 5700MHz



26dB BW - 802.11n-20M 5700MHz