FCC 47 CFR PART 15 SUBPART E AND ANSI C63.10:2013 TEST REPORT

For

DOCSIS 3.1 wifi Gateway

Model: CODA-4782

Data Applies To : CODA-4682, CODA-4580, CODA-4582

Trade Name: Hitron

Issued for

Hitron Technologies,Inc.

No. 1-8,Lihsin 1st Rd.,HsinChu Science Park,HisnChu,Taiwan 300,R.O.C.

Issued by

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	10/21/2016	Initial Issue	All Page 303	Michelle Chiu
01	11/03/2016	Add 26dB bandwidth	All Page 331 (P.18 ~ 68)	Michelle Chiu

TABLE OF CONTENTS

1. TEST REPORT CERTIFICATION

Applicant	：	Hitron Technologies,Inc.
Address	：	No. 1-8,Lihsin 1st Rd.,HsinChu Science Park,HisnChu,Taiwan 300,R.O.C.
Equipment Under Test	：	DOCSIS 3.1 wifi Gateway
Model	：	CODA-4782
Data Applies To	：	CODA-4682, CODA-4580, CODA-4582
Trade Name	：	Hitron
Tested Date	：	September 02 ~ October 03, 2016 ; November 03, 2016

APPLICABLE STANDARD	
Standard	**Test Result**
FCC Part 15 Subpart E AND ANSI C63.10:2013	PASS

WE HEREBY CERTIFY THAT: The above equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Sb. Lu
Sr. Engineer

Reviewed by:

Gundam Lin
Sr. Engineer

2. EUT DESCRIPTION

Product Name	DOCSIS 3.1 wifi Gateway
Model Number	CODA-4782
Data Applies To	CODA-4682, CODA-4580, CODA-4582
Identify Number	T160919S01
Received Date	September 02, 2016
Frequency Range	UNII Band 1 : IEEE 802.11a, 802.11ac VHT20 Mode : 5180 MHz ~ 5240 MHz IEEE 802.11ac VHT40 Mode : 5190 MHz ~ 5230 MHz IEEE 802.11ac VHT80 Mode : 5210 MHz UNII Band 3 : IEEE 802.11a, 802.11ac VHT20 Mode : 5745 MHz ~ 5825 MHz IEEE 802.11ac VHT40 Mode : 5755 MHz ~ 5795 MHz IEEE 802.11ac VHT80 Mode : 5775 MHz UNII Band 1 + Band 3 : IEEE 802.11ac VHT160 : 5210 MHz + 5775 MHz
Transmit Power	For Non-beamforming : UNII Band 1 : IEEE 802.11a Mode : 22.71 dBm (0.1866W) IEEE 802.11ac VHT20 Mode : 22.76 dBm (0.1888 W) IEEE 802.11ac VHT40 Mode : 26.38 dBm (0.4345 W) IEEE 802.11ac VHT80 Mode : 20.67 dBm (0.1167 W) UNII Band 3 : IEEE 802.11a Mode : 25.27 dBm (0.3365 W) IEEE 802.11ac VHT20 Mode : 25.33 dBm (0.3412 W) IEEE 802.11ac VHT40 Mode : 26.04 dBm (0.4018 W) IEEE 802.11ac VHT80 Mode : 25.66 dBm (0.3681 W) UNII Band 1 + Band 3 IEEE 802.11ac VHT160 : 18.17 dBm (0.0656 W) / 18.40 dBm (0.0692 W)

	For Beamforming : UNII Band 1 : IEEE 802.11a Mode : 22.07 dBm (0.1611 W) IEEE 802.11ac VHT20 Mode : 22.63 dBm (0.1832 W) IEEE 802.11ac VHT40 Mode : 23.61 dBm (0.2296 W) IEEE 802.11ac VHT80 Mode : 18.97 dBm (0.0789 W) UNII Band 3 : IEEE 802.11a Mode : 24.11 dBm (0.2576 W) IEEE 802.11ac VHT20 Mode : 24.45 dBm (0.2786 W) IEEE 802.11ac VHT40 Mode : 24.41 dBm (0.2761 W) IEEE 802.11ac VHT80 Mode : 24.21 dBm (0.2636 W) UNII Band 1 + Band 3 IEEE 802.11ac VHT160 : 15.54 dBm (0.0358 W) / 22.46dBm (0.1762 W)
Channel Spacing	IEEE 802.11a, 802.11ac VHT20 Mode : 20MHz IEEE 802.11ac VHT40 Mode : 40MHz IEEE 802.11ac VHT80 Mode : 80MHz IEEE 802.11ac VHT160 : N/A
Channel Number	IEEE 802.11a, 802.11ac VHT20 Mode : 5150MHz ~ 5250MHz : 4 Channels 5725MHz ~ 5825MHz : 5 Channels IEEE 802.11ac VHT40 Mode : 5150MHz ~ 5250MHz : 2 Channels 5725MHz ~ 5825MHz : 2 Channels IEEE 802.11ac VHT80 Mode : 5150MHz ~ 5250MHz : 1 Channels 5725MHz ~ 5825MHz : 1 Channels IEEE 802.11ac VHT160 : 5210 MHz + 5775 MHz : 1 Channels
Transmit Data Rate	IEEE 802.11a Mode: up to 54 Mbps IEEE 802.11ac VHT20 Mode (800ns GI) : up to 312.00 Mbps IEEE 802.11ac VHT20 Mode (400ns GI) : up to 346.80 Mbps IEEE 802.11ac VHT40 Mode (800ns GI) : up to 720.00 Mbps IEEE 802.11ac VHT40 Mode (400ns GI) : up to 800.00 Mbps IEEE 802.11ac VHT80 Mode (800ns GI) : up to 1560.00 Mbps IEEE 802.11ac VHT80 Mode (400ns GI) : up to 1733.20 Mbps IEEE 802.11ac VHT160 Mode (800ns GI) : up to 1560.00 Mbps IEEE 802.11ac VHT160 Mode (400ns GI) : up to 1733.20 Mbps

Type of Modulation	IEEE 802.11a Mode : OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac VHT20/40/80/160 Mode : OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Type	Dipole Antenna × 4, Ant. 4 (Chain 2), Antenna Gain : 4.51 dBi Ant. 5 (Chain 1), Antenna Gain : 6.10 dBi Ant. 6 (Chain 0), Antenna Gain : 4.94 dBi Ant. 7 (Chain 3), Antenna Gain : 4.83 dBi
Power Rating	100-120Vac, 0.5A, 50-60Hz
Test Voltage	120Vac, 60Hz
AC Power Cord Type	Non-shielded cable, 1.8m × 1 (Detachable)
I/O Port	RJ-45 Port × 4, USB Port × 1, Coaxial Port × 1, Power Port × 1
Signal Cable	Non-shielded RJ-45 cable, 1.5m × 1 (Detachable)

The difference of the series model

Model Number	Difference				
	Cable Upstream Freq	Downstream Freq	MOCA	Diplexer	Color
CODA-4580	5-85MHz	108-1002MHz	Without	1	Black
CODA-4582	5-85MHz	108-1002MHz	With	1	White
CODA-4682	5-42MHz 5-85MHz	108-1002MHz 258-1002MHz	With	2	Black
CODA-4782	5-85MHz 5-204MHz	108-1002MHz 258-1002MHz	With	2	Black

Remark:

1. *The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*
2. *For more details, please refer to the User's manual of the EUT.*
3. *This submittal(s) (test report) is intended for FCC ID: 2AHKM-CODA4782 filing to comply with Section 15.207, 15.209 and 15.407 of the FCC Part 15, Subpart E Rules.*
4. *The model CODA-4782 was considered the main model for testing.*
5. *FCC 15.407(c) states: The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signalling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.*

3. DESCRIPTION OF TEST MODES

The EUT (DOCSIS 3.1 wifi Gateway) had been tested under operating condition.
For IEEE 802.11a, 802.11ac VHT20/VHT40/VHT80/VHT160 Mode (4TX / 4RX):
Ant. 4 / Chain 2 & Ant. 5 / Chain 1 & Ant. 6 / Chain 0 & Ant. 7 / Chain 3 transmit/receive.

Conducted Emission / Radiated Emission Test (Below 1 GHz)

1. The following test modes were scanned during the preliminary test:

No.	Pre-Test Mode
1	Normal Operating Mode (Full Function)

2. After the preliminary scan, the following test mode was found to produce the highest emission level.

Final Test Mode		
Emission	Radiated Emission	Mode 1
	Radiated Emission	Mode 1

Remark: *Then, the above highest emission mode of the configuration of the EUT and cable was chosen for all final test items.*

Conducted / Radiated Emission Test (Above 1 GHz)

IEEE 802.11a, 802.11ac VHT20 Mode

The EUT had been tested under operating condition.

Following channel(s) was (were) selected for the final test as listed below:

UNII Band	Channel	Frequency (MHz)
Band 1	Low	5180
	Middle	5200
	High	5240
Band 3	Low	5745
	Middle	5785
	High	5825

IEEE 802.11a Mode: 6Mbps data rate (worst case) was chosen for full testing.
IEEE 802.11ac VHT20 Mode: 6.5Mbps data rate (worst case) was chosen for full testing.

IEEE 802.11ac VHT40 Mode:

The EUT had been tested under operating condition.

Following channel(s) was (were) selected for the final test as listed below:

UNII Band	Channel	Frequency (MHz)
Band 1	Low	5190
	High	5230
Band 3	Low	5755
	High	5795

IEEE 802.11ac VHT40 Mode: 13.5Mbps data rate (worst case) was chosen for full testing.

IEEE 802.11ac VHT80 Mode

The EUT had been tested under operating condition.

Following channel(s) was (were) selected for the final test as listed below:

UNII Band	Channel	Frequency (MHz)
Band 1	Low	5210
Band 3	Low	5775

IEEE 802.11ac VHT80 Mode: 29.3 Mbps data rate (worst case) was chosen for full testing.

IEEE 802.11ac VHT160 Mode (Band 1 + Band 3)

The EUT had been tested under operating condition.

Following channel(s) was (were) selected for the final test as listed below.

UNII Band	Channel	Frequency (MHz)
Band 1	Low	5210
Band 3	Low	5775

IEEE 802.11ac VHT160 mode: 58.5 Mbps data rate (worst case) were chosen for full testing.

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10:2013 and FCC CFR 47, 15.207, 15.209 and 15. 407.

5. FACILITIES AND ACCREDITATION

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No.989-1, Wenshan Rd., Shangshan Village,
Qionglin Township, Hsinchu County 30741, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.10:2013 and CISPR 22. All receiving equipment conforms to CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-3, CISPR 16-1-4, CISPR 16-1-5.

5.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Taiwan	TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	INDUSTRY CANADA
Japan	VCCI
Taiwan	BSMI
USA	FCC MRA

Copies of granted accreditation certificates are available for downloading from our web site, http:///www.ccsrf.com

Remark: *FCC Designation Number TW1027.*

5.3 MEASUREMENT UNCERTAINTY

The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4-2.

PARAMETER	UNCERTAINTY
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 30 to 1000 MHz	+/- 3.97
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 1 to 18GHz	+/- 3.58
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 18 to 26 GHz	+/- 3.59
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 26 to 40 GHz	+/- 3.81
Conducted Emission (Mains Terminals), 9kHz to 30MHz	+/- 2.48

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
Consistent with industry standard (e.g. CISPR 22, clause 11, Measurement Uncertainty) determining compliance with the limits shall be base on the results of the compliance measurement. Consequently the measure emissions being less than the maximum allowed emission result in this be a compliant test or passing test.
The acceptable measurement uncertainty value without requiring revision of the compliance statement is base on conducted and radiated emissions being less than U_{CISPR} which is 3.6dB and 5.2dB respectively. CCS values (called U_{Lab} in CISPR 16-4-2) is less than U_{CISPR} as shown in the table above. Therefore, MU need not be considered for compliance.

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

No.	Product	Manufacturer	Model No.	Serial No.
1	Notebook PC	Lenovo	TP00018A	R9LMB1Z
2	Notebook PC	TOSHIBA	PORTEGE R30-A	7F097011H
3	Notebook PC	TOSHIBA	PORTEGE R30-A	7F097001H
4	USB Flash Drive	Kingston	DTSE9 8G	---
5	CMTS	Hitron	RAC-500	S15070901-X0601
6	Client AP	Qualcomm	AP161	---

No.	Signal Cable Description
1	Non-shielded RJ-45 cable, 12m × 1
2	Non-shielded RJ-45 cable, 1.2m × 3

SETUP DIAGRAM FOR TESTS

EUT & peripherals setup diagram is shown in appendix setup photos.

EUT OPERATING CONDITION

RF Mode :

1. EUT & peripherals setup diagram is shown in appendix setup photos.
2. USE HyperTerminal Link to EUT by Console →Transfer mode：115200
   Login: root
   KeyIn Command Load Firmware (line by line keyin) ->
   apdown
   mount /dev/mmcblk0p17 /lib/firmware/QCA9984/hw.1/
   mkdir -p /nvram/etc/ath
   cp /lib/firmware/QCA9984/hw.1/boardData_QCA9984_CUS239_5G_v1_001.bin
   /nvram/etc/ath/boarddata_1.bin
   /etc/ath/qdart start 1
3. Link EUT by LAN and Run RF Control software [QRCT]
4. In QRCT,
   User Defind Transport: connect
   FTM Command -> WLAN
   Select Chipset : QX9984
   Select RFCal Data : DataEeprom
   [Load DUT] ->

5. TX Mode:

⇨ **TX Data Rate:** 6Mbps Bandwidth 20 (IEEE 802.11a Mode)
6.5Mbps Bandwidth 20 (IEEE 802.11ac VHT20 Mode)
13.5Mbps Bandwidth 40 (IEEE 802.11ac VHT40 Mode)
29.3 Mbps Bandwidth 80 (IEEE 802.11ac VHT80 Mode)
58.5 Mbps Bandwidth 80 (IEEE 802.11ac VHT160 mode)

Beamforming mode:

1. EUT & peripherals setup diagram is shown in appendix setup photos.
2. USE HyperTerminal Link to EUT by Console →Transfer mode：115200

Login: root
KeyIn Command Load Firmware (line by line keyin) ->
#beamforming on, 1 (line by line keyin)
iwpriv ath4 vhtsubfer 1
iwpriv ath4 vhtsubfee 1
iwpriv ath4 vhtmubfer 1
iwpriv ath4 implicitbf 1
iwpriv ath4 nss 1

3. Beamforming Client Link EUT by WIFI

KeyIn Command Load Firmware (line by line keyin) ->
iwpriv ath4 mode 11ACVHT20 //set mode=11ACVHT20
802.11a=11A
802.11ac_20MHz=11ACVHT20
802.11ac_40MHz=11ACVHT40
802.11ac_80MHz=11ACVHT80
80+80=11ACVHT80_80
ifconfig ath4 down up
iwconfig ath4 channel 36 //set channel =ch36
iwconfig ath4 rate 6M //fix rate=6M (by 11A)
iwpriv ath4 vhtmcs 0 //fix rate=MCS0 (by AN/AC)
iwconfig ath4 txpower 22 //set txpower=22

wlanconfig ath4 list // Look now
connected state

5. TX Mode:

⇨ **Tx Data Rate:**
6 Mbps Bandwidth 20 (IEEE 802.11a mode)
6.5 Mbps Bandwidth 20 (IEEE 802.11ac VHT20 mode)

13.5 Mbps Bandwidth 40 (IEEE 802.11ac VHT40 mode)
29.3 Mbps Bandwidth 80 (IEEE 802.11ac VHT80 mode)
58.5 Mbps Bandwidth 80 (IEEE 802.11ac VHT160 mode)

⇨ **Power control (Non-Beamforming)**

IEEE 802.11a Mode

UNII Band	Channel	Frequency (MHz)	Chain	Power Set
Band 1	Low	5180	0/1/2/3	16.5
	Middle	5200	0/1/2/3	16.5
	High	5240	0/1/2/3	16.5
Band 3	Low	5745	0/1/2/3	19
	Middle	5785	0/1/2/3	19
	High	5825	0/1/2/3	19

IEEE 802.11ac VHT20 Mode

UNII Band	Channel	Frequency (MHz)	Chain	Power Set
Band 1	Low	5180	0/1/2/3	17
	Middle	5200	0/1/2/3	17
	High	5240	0/1/2/3	17
Band 3	Low	5745	0/1/2/3	19
	Middle	5785	0/1/2/3	19
	High	5825	0/1/2/3	20

IEEE 802.11ac VHT40 Mode

UNII Band	Channel	Frequency (MHz)	Chain	Power Set
Band 1	Low	5190	0/1/2/3	17
	High	5230	0/1/2/3	20
Band 3	Low	5755	0/1/2/3	20
	High	5795	0/1/2/3	20

IEEE 802.11ac VHT80 Mode

UNII Band	Channel	Frequency (MHz)	Chain	Power Set
Band 1	Low	5210	0/1/2/3	15
Band 3	Low	5775	0/1/2/3	20

IEEE 802.11ac VHT160 Mode

UNII Band	Channel	Frequency (MHz)	Chain	Power Set
Band 1	Low	5210	0/1/2/3	16
Band 3	Low	5775	0/1/2/3	16

⇨ **Power control (Beamforming)**

IEEE 802.11a Mode

UNII Band	Channel	Frequency (MHz)	Chain	Power Set
Band 1	Low	5180	0/1/2/3	21
	Middle	5200	0/1/2/3	21
	High	5240	0/1/2/3	21
Band 3	Low	5745	0/1/2/3	22
	Middle	5785	0/1/2/3	22
	High	5825	0/1/2/3	22

IEEE 802.11ac VHT20 Mode

UNII Band	Channel	Frequency (MHz)	Chain	Power Set
Band 1	Low	5180	0/1/2/3	21
	Middle	5200	0/1/2/3	21
	High	5240	0/1/2/3	21.5
Band 3	Low	5745	0/1/2/3	22
	Middle	5785	0/1/2/3	22
	High	5825	0/1/2/3	22

IEEE 802.11ac VHT40 Mode

UNII Band	Channel	Frequency (MHz)	Chain	Power Set
Band 1	Low	5190	0/1/2/3	20
	High	5230	0/1/2/3	24
Band 3	Low	5755	0/1/2/3	23
	High	5795	0/1/2/3	23

IEEE 802.11ac VHT80 Mode

UNII Band	Channel	Frequency (MHz)	Chain	Power Set
Band 1	Low	5210	0/1/2/3	20
Band 3	Low	5775	0/1/2/3	22

IEEE 802.11ac VHT160 Mode

UNII Band	Channel	Frequency (MHz)	Chain	Power Set
Band 1	Low	5210	0/1/2/3	24
Band 3	Low	5775	0/1/2/3	24

6. All of the functions are under run.
7. Start test.

Normal Mode :

1. EUT & peripherals setup diagram is shown in appendix setup photos.
2. Turn on the power of all equipment.
3. Coaxial cable link Headend-CMTS.
4. Notebook PC 1 Link EUT by LAN and ping to EUT and CMTS.
5. Notebook PC 2 Link EUT by 2.4G WiFi and ping to EUT and CMTS.
6. Notebook PC 3 Link EUT by 5G WiFi and ping to EUT and CMTS.
7. USB flash drive with load.
8. All of the functions are under run
9. Start test.

7. FCC PART 15.407 REQUIREMENTS

7.1 DUTY CYCLE MEASUREMENT

Product Name	DOCSIS 3.1 wifi Gateway	Test By	Waternil Guan
Test Model	CODA-4782	Test Date	2016/09/02
Test Mode	TX Mode	Temp. & Humidity	28°C, 54%

Mode	TX on (ms)	TX on + off (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
IEEE 802.11a	2.066	2.143	96.41	0.16	0.484
IEEE 802.11ac VHT20	4.520	5.040	89.68	0.47	0.221
IEEE 802.11ac VHT40	2.190	2.710	80.81	0.93	0.457
IEEE 802.11ac VHT80	3.007	3.553	84.63	0.72	0.333
IEEE 802.11ac VHT160	3.960	4.520	87.61	0.57	0.253

7.2 26dB BANDWIDTH

LIMITS

None: For reporting purposes only.

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Signal Analyzer	Agilent	N9010A	MY52220817	03/15/2017
Test S/W	N/A			

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

TEST PROCEDURE

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

TEST RESULTS

Product Name	DOCSIS 3.1 wifi Gateway	Test By	Waternil Guan
Test Model	CODA-4782	Test Date	2016/11/03
Test Mode	TX Mode / Non-Beamforming	Temp. & Humidity	25°C, 56%

IEEE 802.11a Mode (4TX)

U-NII Band	Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
Band 1	Low	5180	19.65	19.68	19.30	19.51
	Middle	5200	19.67	19.35	19.27	19.28
	High	5240	19.54	19.37	19.12	19.57

IEEE 802.11ac VHT20 Mode (4TX)

U-NII Band	Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
Band 1	Low	5180	20.41	20.26	20.42	20.44
	Middle	5200	20.38	20.23	20.47	20.49
	High	5240	20.44	20.20	20.28	20.50

IEEE 802.11ac VHT40 Mode (4TX)

U-NII Band	Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
Band 1	Low	5190	39.40	39.55	39.42	39.32
	High	5230	39.46	39.68	39.33	39.32

IEEE 802.11ac VHT80 Mode (4TX)

U-NII Band	Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
Band 1	Low	5210	83.42	83.95	84.08	84.66

IEEE 802.11ac VHT160 Mode (4TX)

U-NII Band	Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
Band 1	Low	5210	85.06	85.25	86.06	99.64

Product Name	DOCSIS 3.1 wifi Gateway	Test By	Waternil Guan
Test Model	CODA-4782	Test Date	2016/11/03
Test Mode	TX Mode / Beamforming	Temp. & Humidity	25°C, 56%

IEEE 802.11a Mode (4TX)

U-NII Band	Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
Band 1	Low	5180	19.46	19.58	19.29	19.32
	Middle	5200	19.75	19.52	19.31	19.55
	High	5240	19.61	19.26	19.09	19.43

IEEE 802.11ac VHT20 Mode (4TX)

U-NII Band	Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
Band 1	Low	5180	20.29	20.14	20.34	20.47
	Middle	5200	20.43	20.34	20.39	20.47
	High	5240	20.36	20.23	20.41	20.27

IEEE 802.11ac VHT40 Mode (4TX)

U-NII Band	Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
Band 1	Low	5190	39.14	39.46	39.27	39.28
	High	5230	39.33	39.11	39.24	39.05

IEEE 802.11ac VHT80 Mode (4TX)

U-NII Band	Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
Band 1	Low	5210	83.37	84.09	84.30	84.52

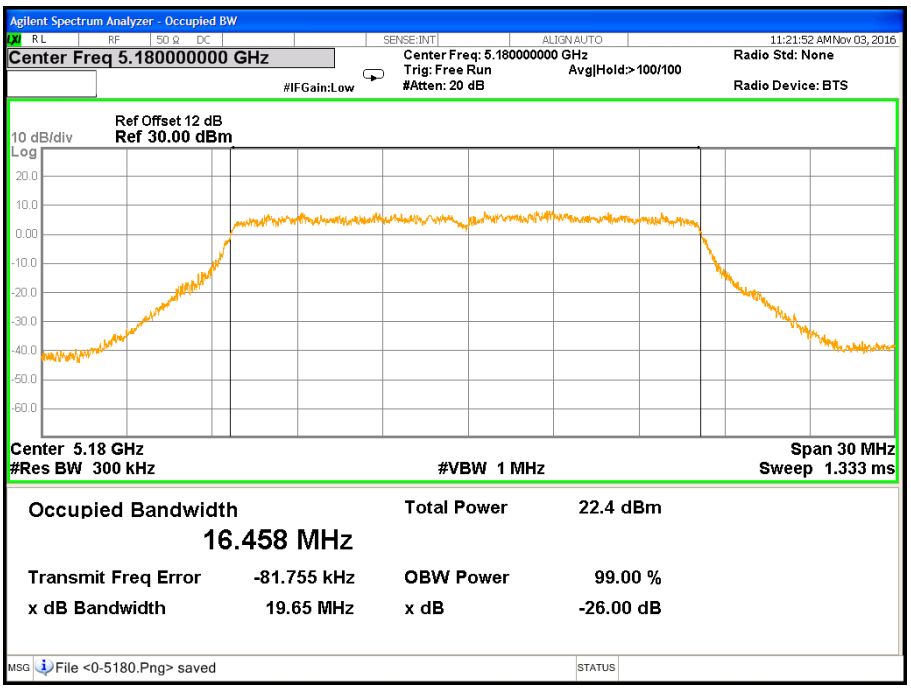
IEEE 802.11ac VHT160 Mode (4TX)

U-NII Band	Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
Band 1	Low	5210	85.31	85.16	85.65	99.96

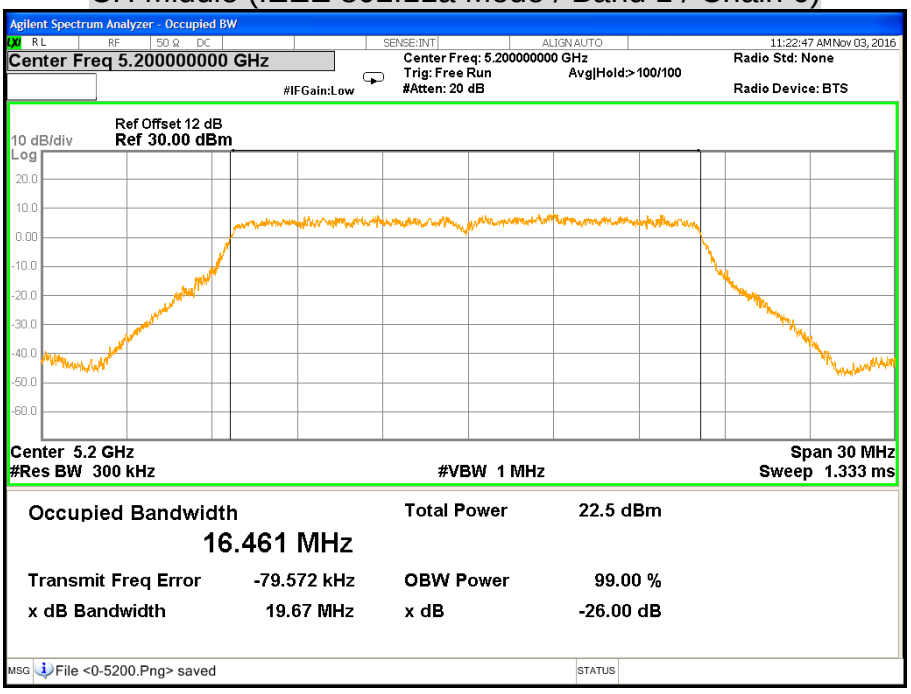
26dB BANDWIDTH

Non-beamforming

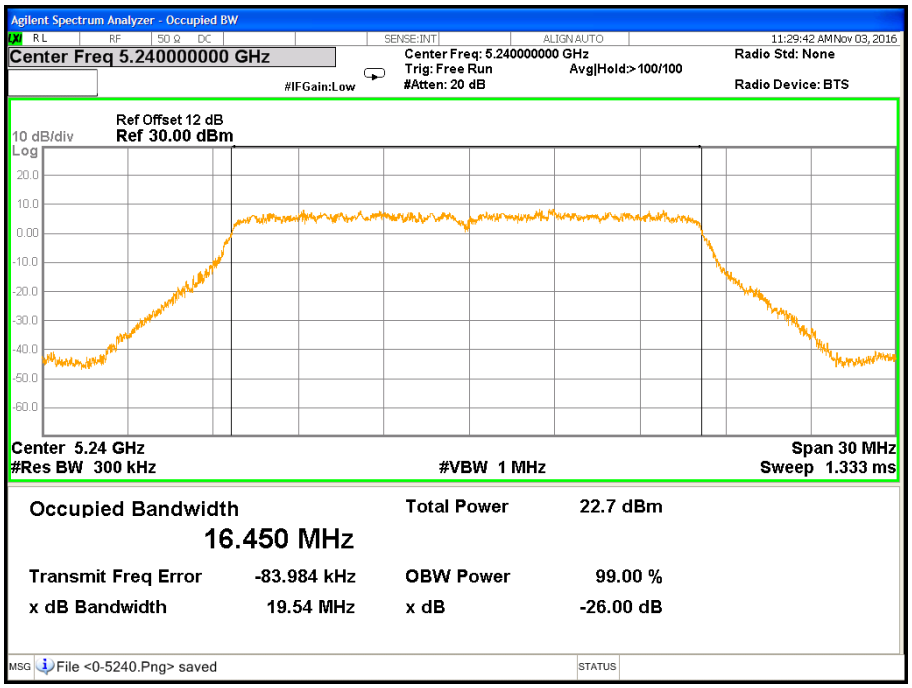
CH Low (IEEE 802.11a Mode / Band 1 / Chain 0)



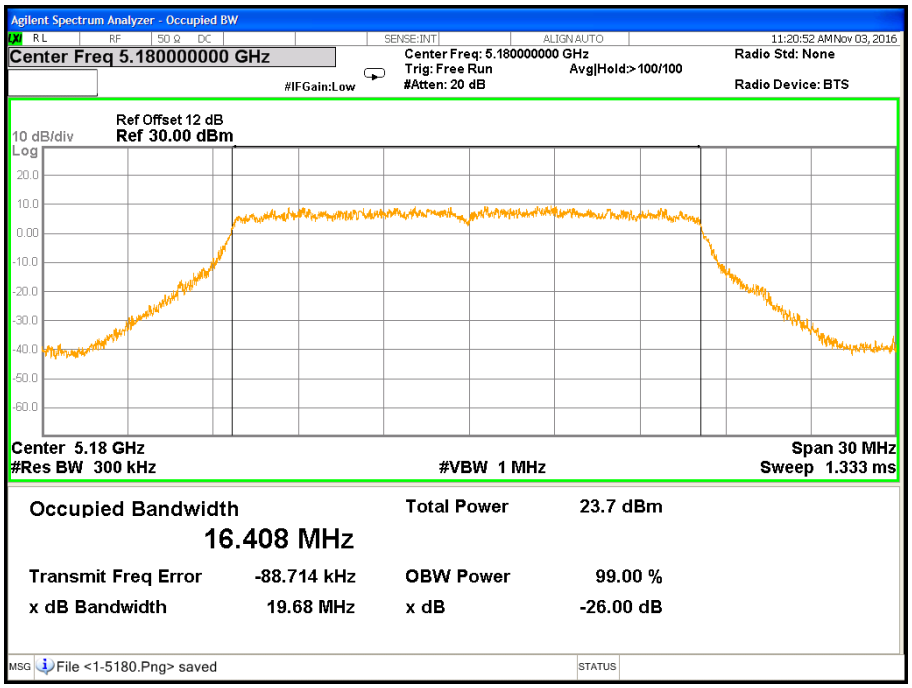
CH Middle (IEEE 802.11a Mode / Band 1 / Chain 0)



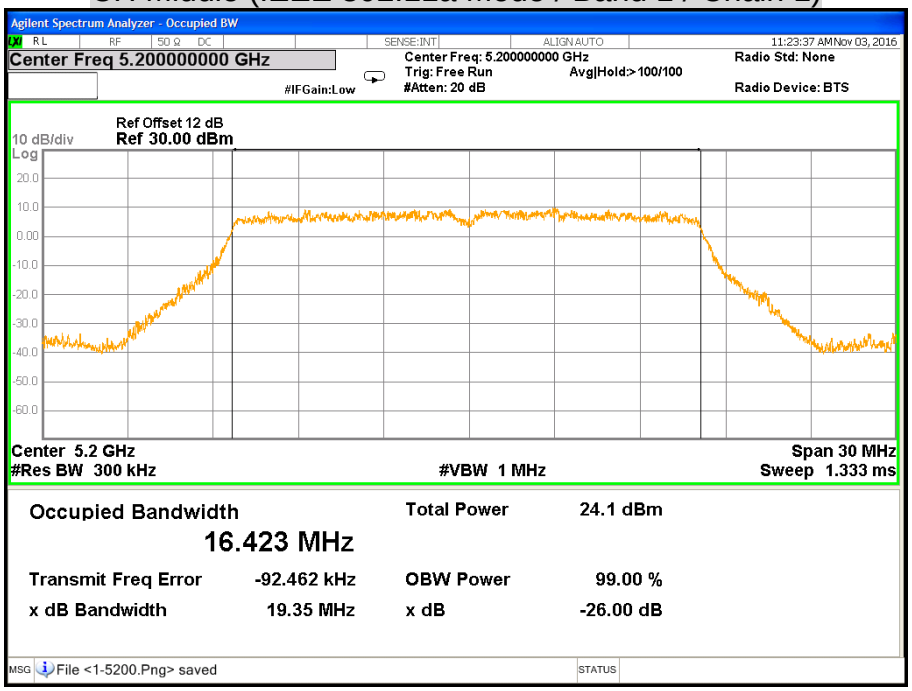
CH High (IEEE 802.11a Mode / Band 1 / Chain 0)



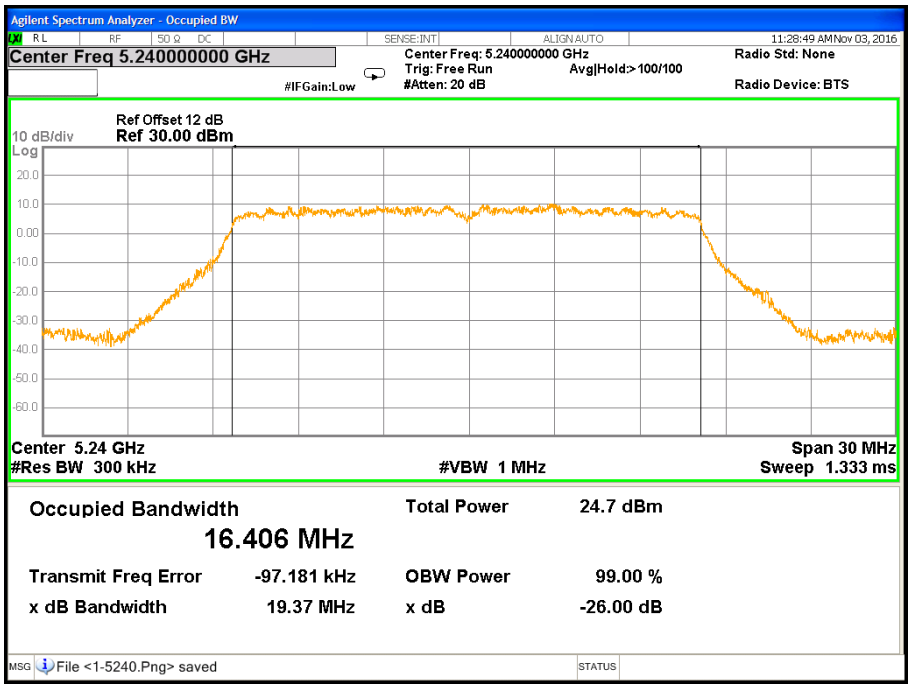
CH Low (IEEE 802.11a Mode / Band 1 / Chain 1)



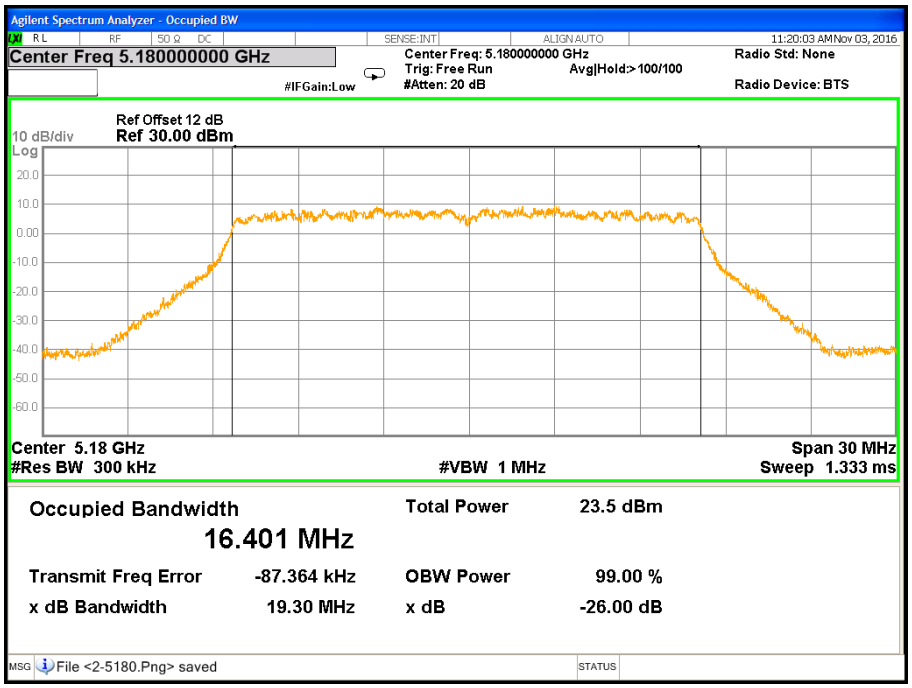
CH Middle (IEEE 802.11a Mode / Band 1 / Chain 1)



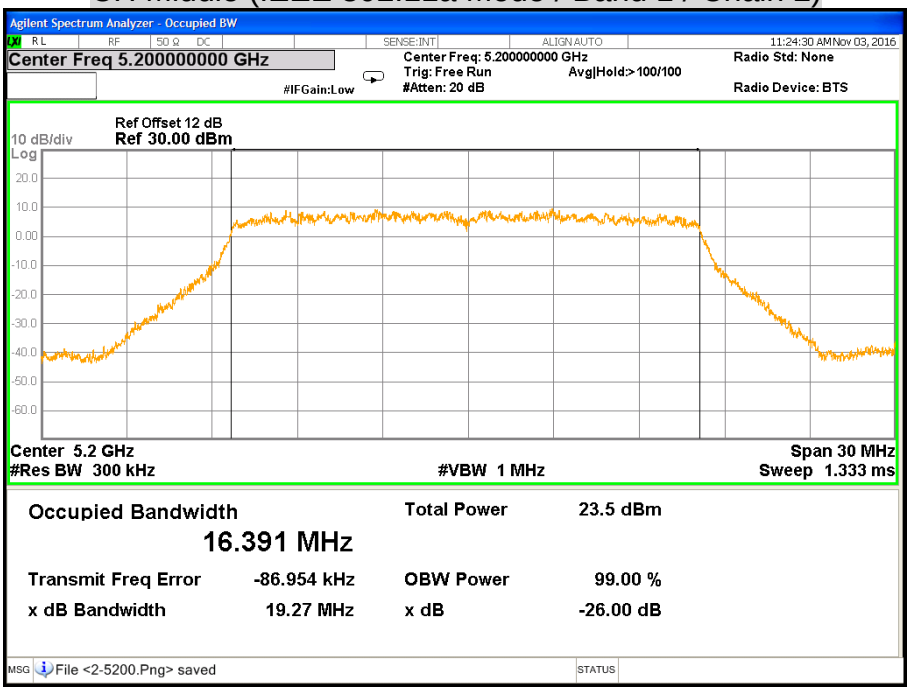
CH High (IEEE 802.11a Mode / Band 1 / Chain 1)



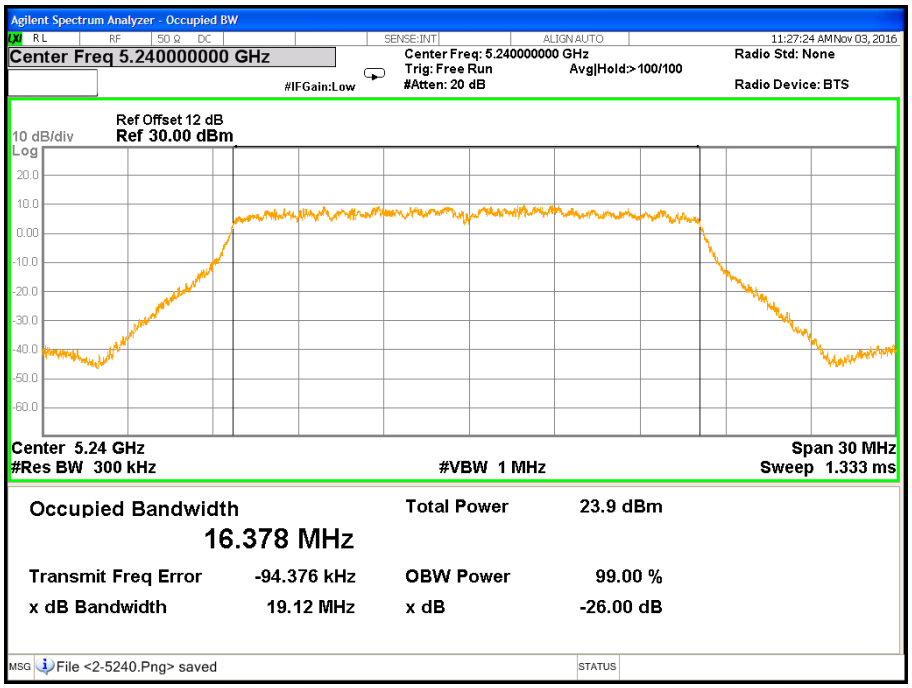
CH Low (IEEE 802.11a Mode / Band 1 / Chain 2)



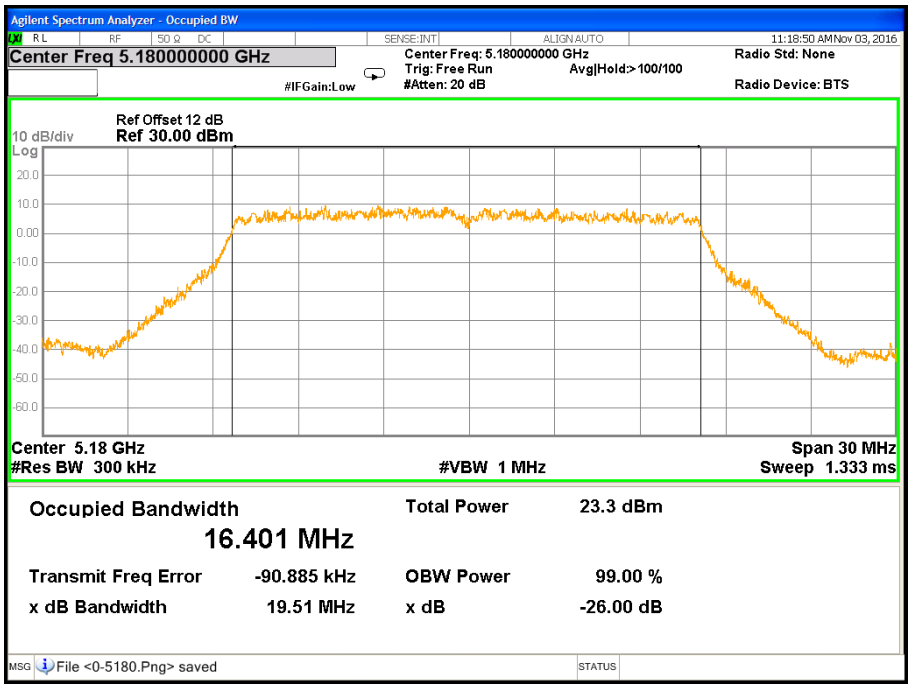
CH Middle (IEEE 802.11a Mode / Band 1 / Chain 2)



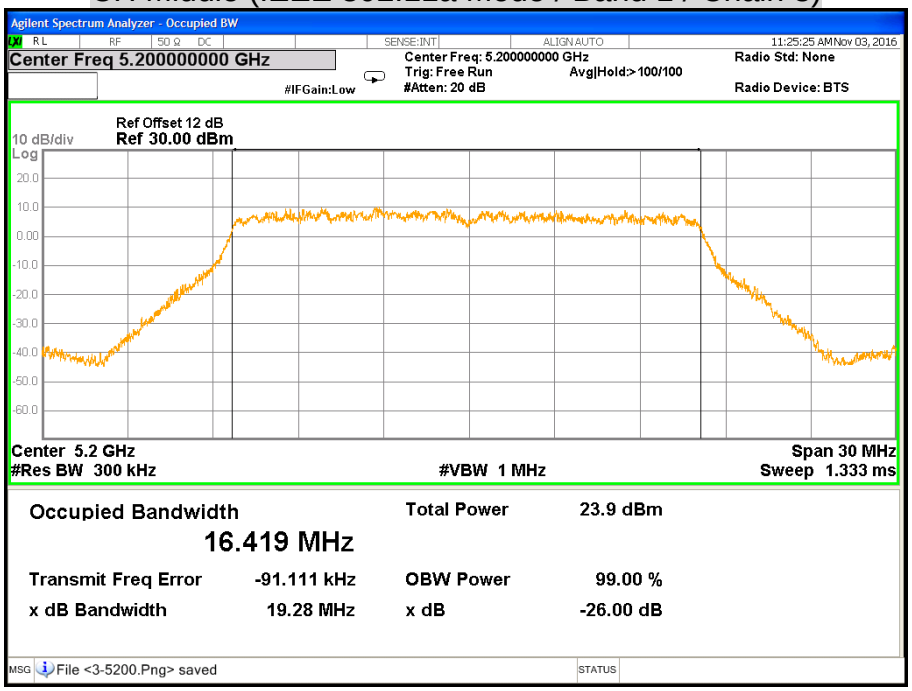
CH High (IEEE 802.11a Mode / Band 1 / Chain 2)



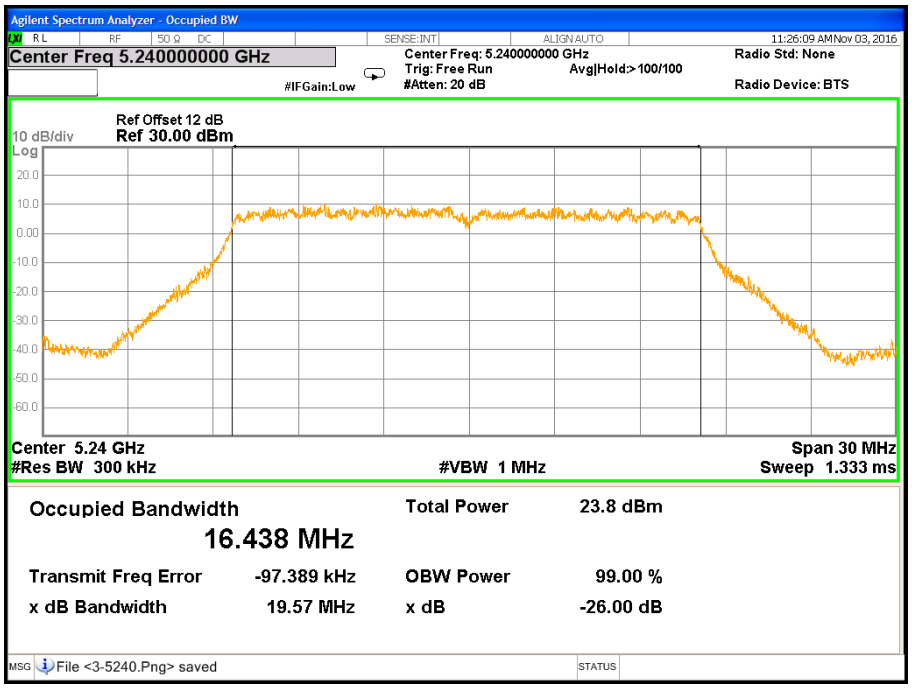
CH Low (IEEE 802.11a Mode / Band 1 / Chain 3)



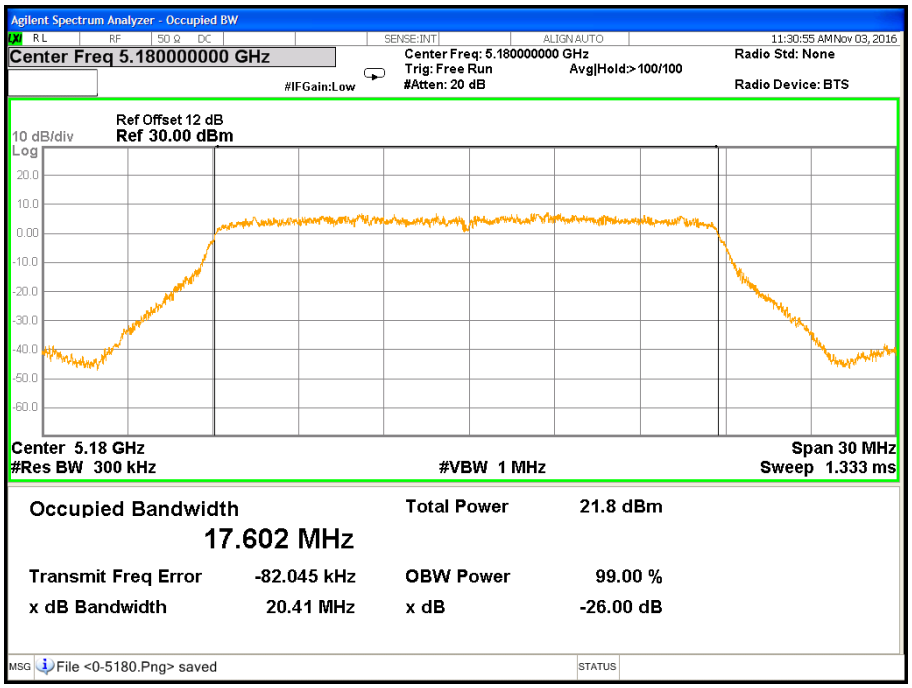
CH Middle (IEEE 802.11a Mode / Band 1 / Chain 3)



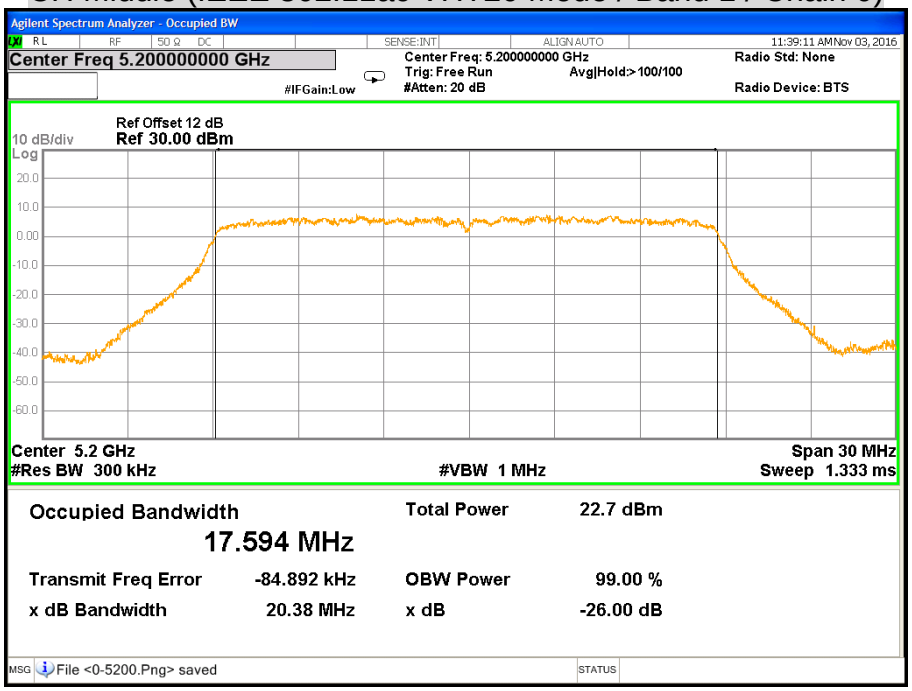
CH High (IEEE 802.11a Mode / Band 1 / Chain 3)



CH Low (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 0)



CH Middle (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 0)



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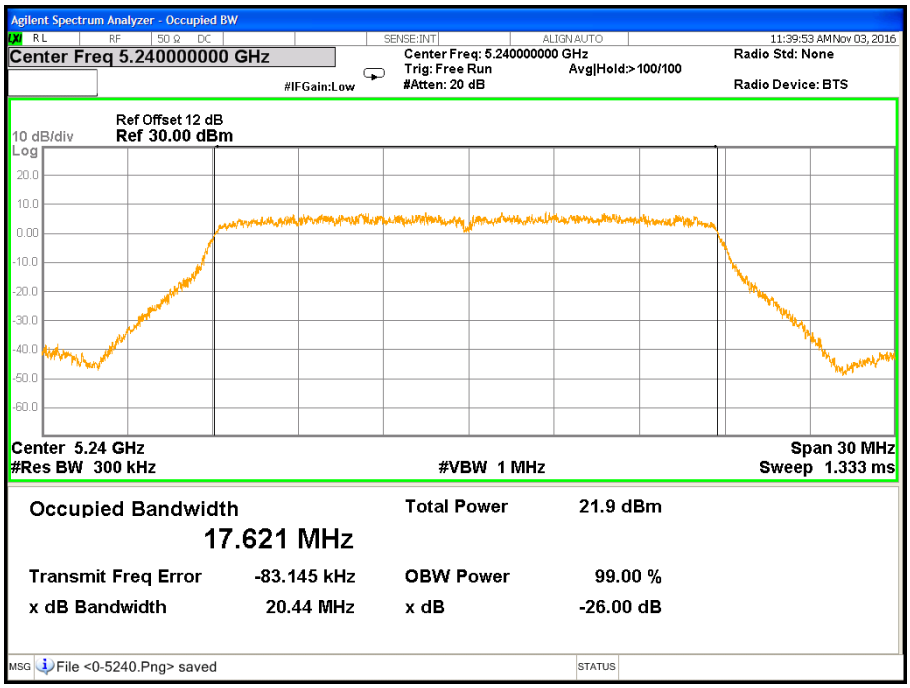
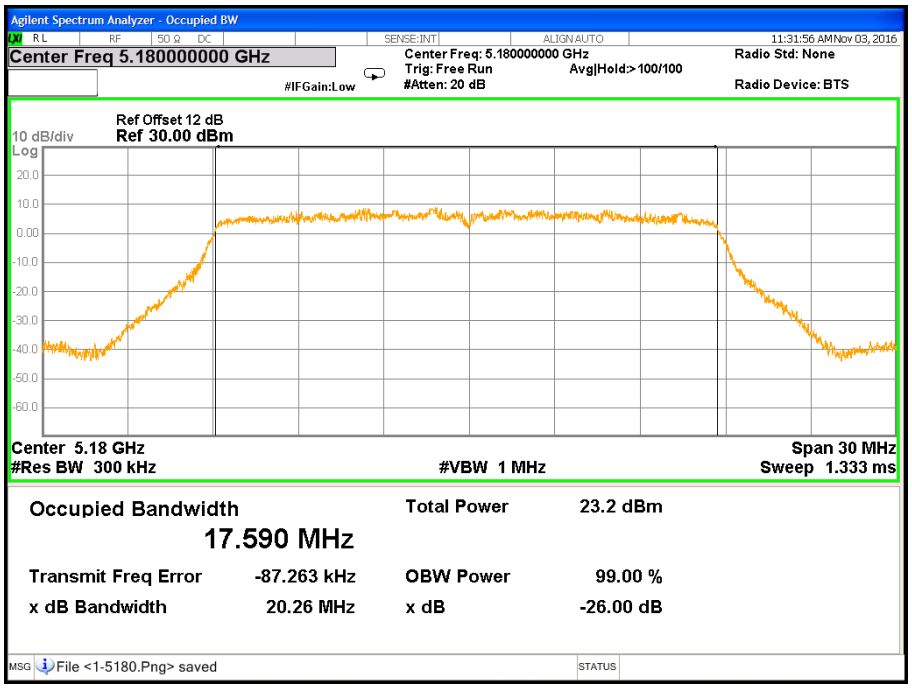


CH Low (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 1)



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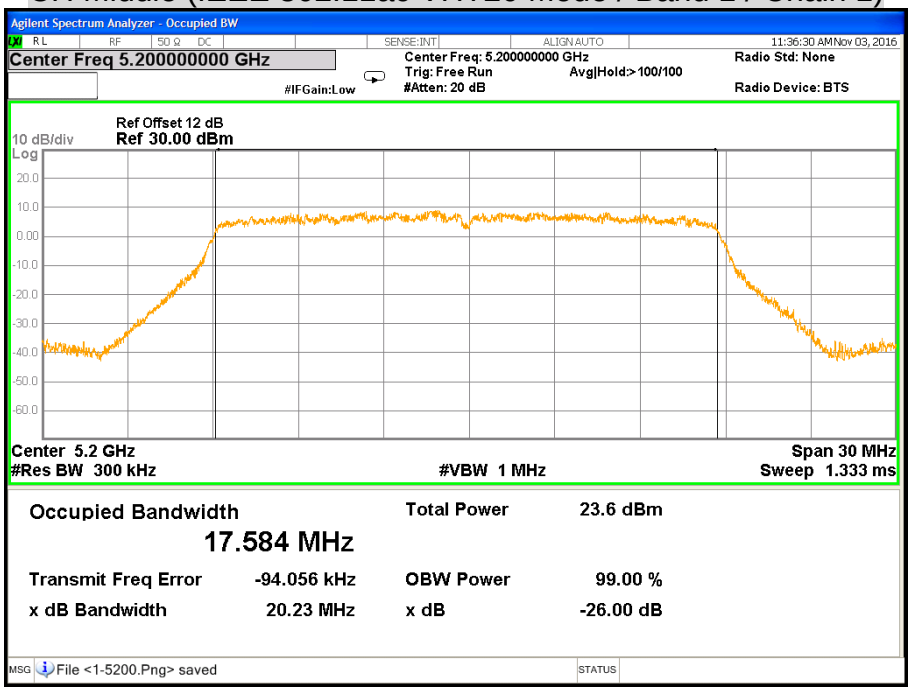
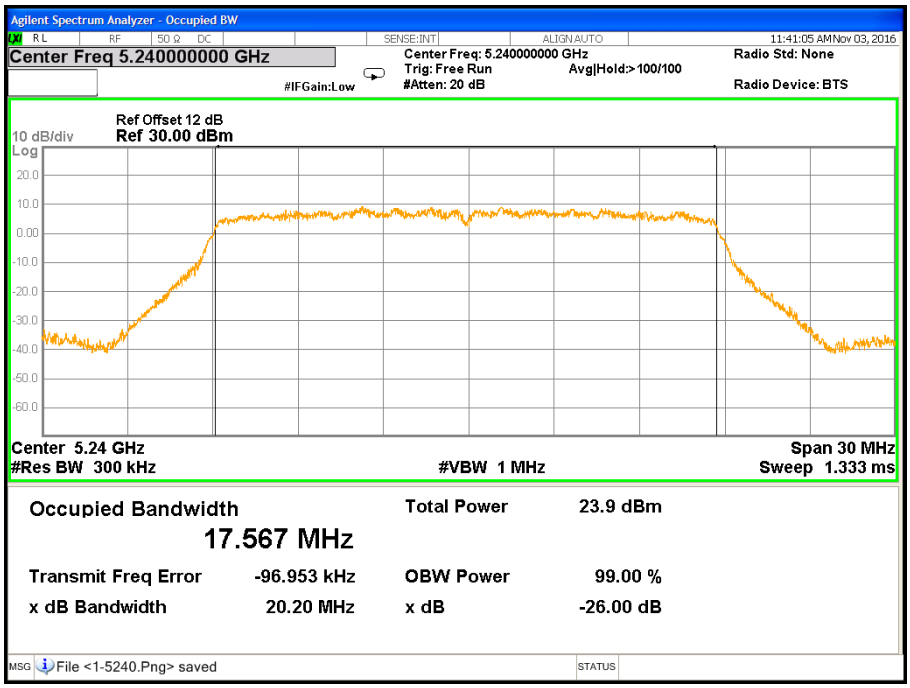
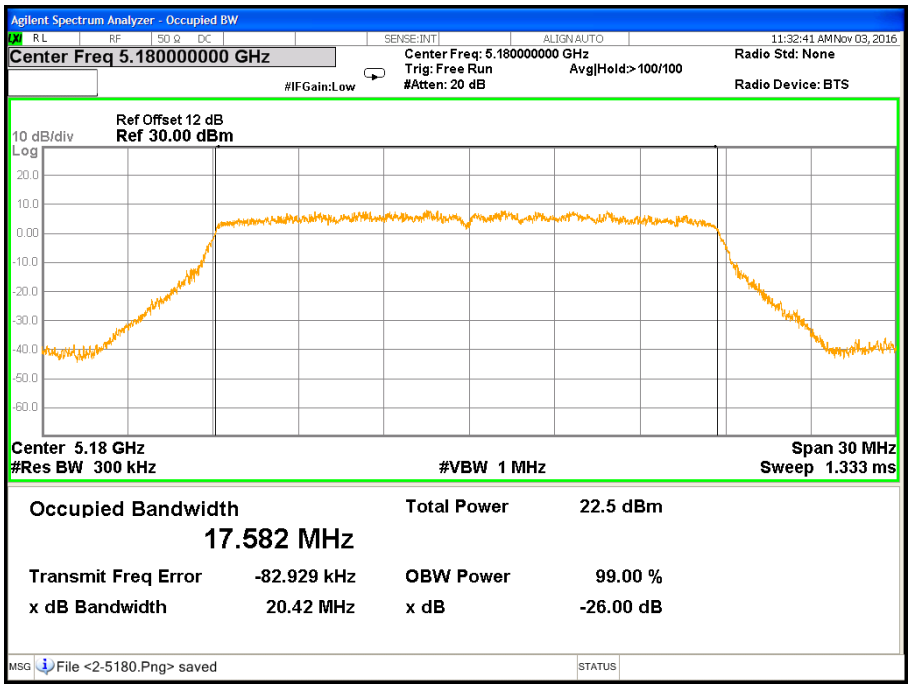


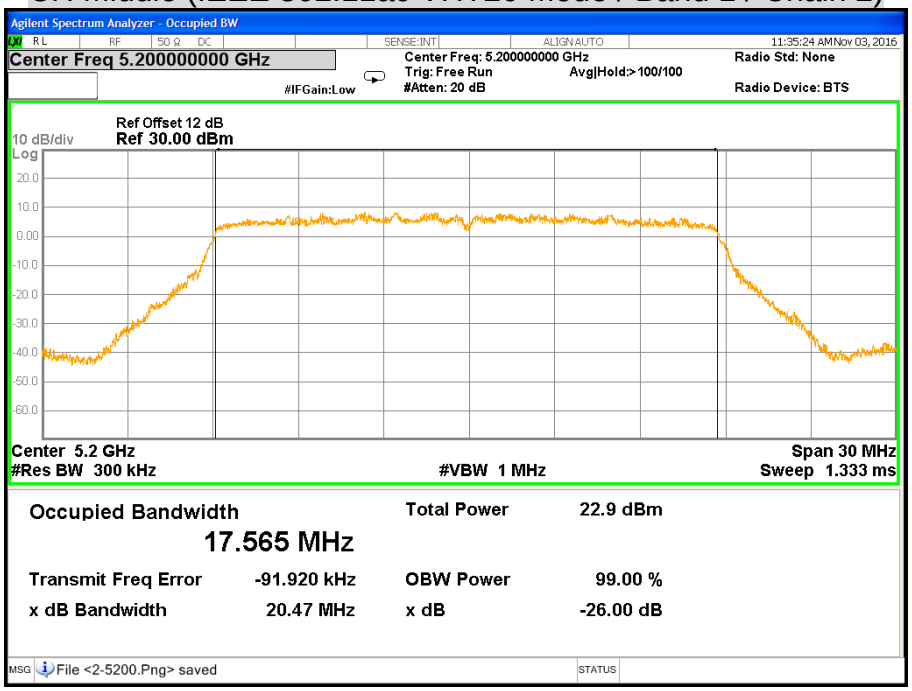
CH High (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 1)



CH Low (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 2)



CH Middle (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 2)



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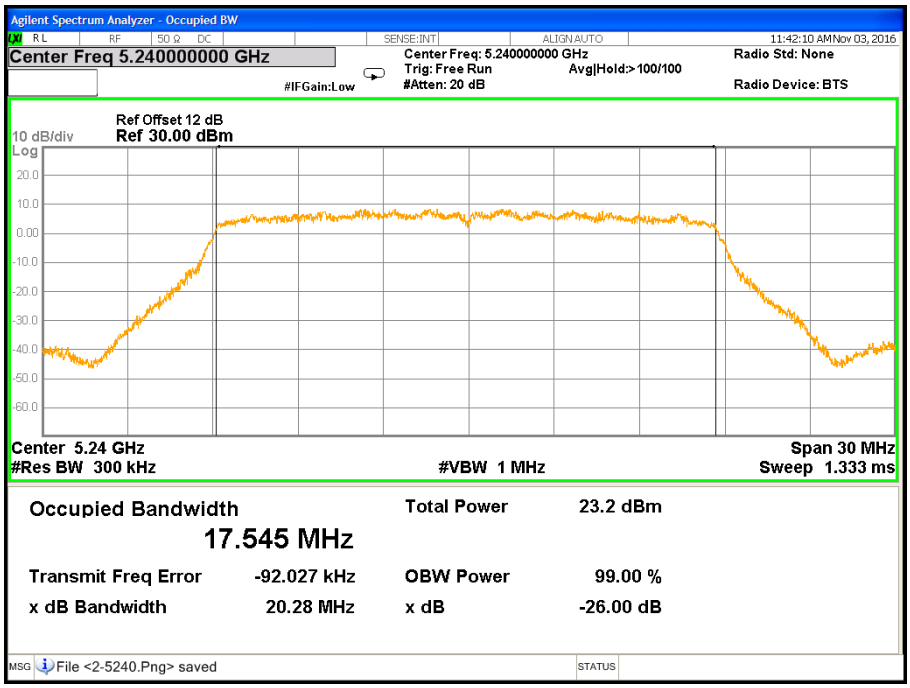
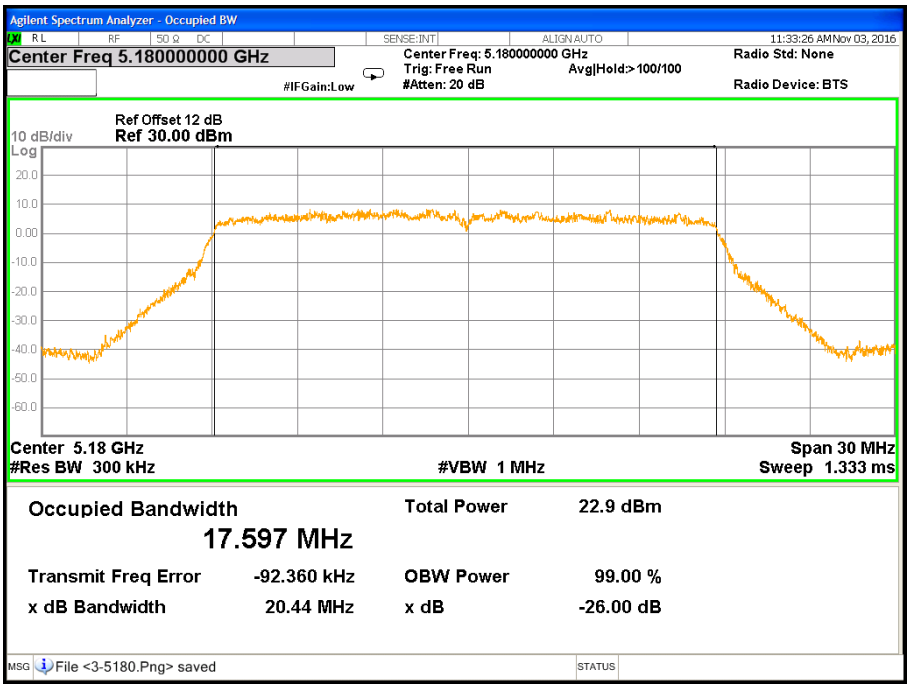


CH Low (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 3)



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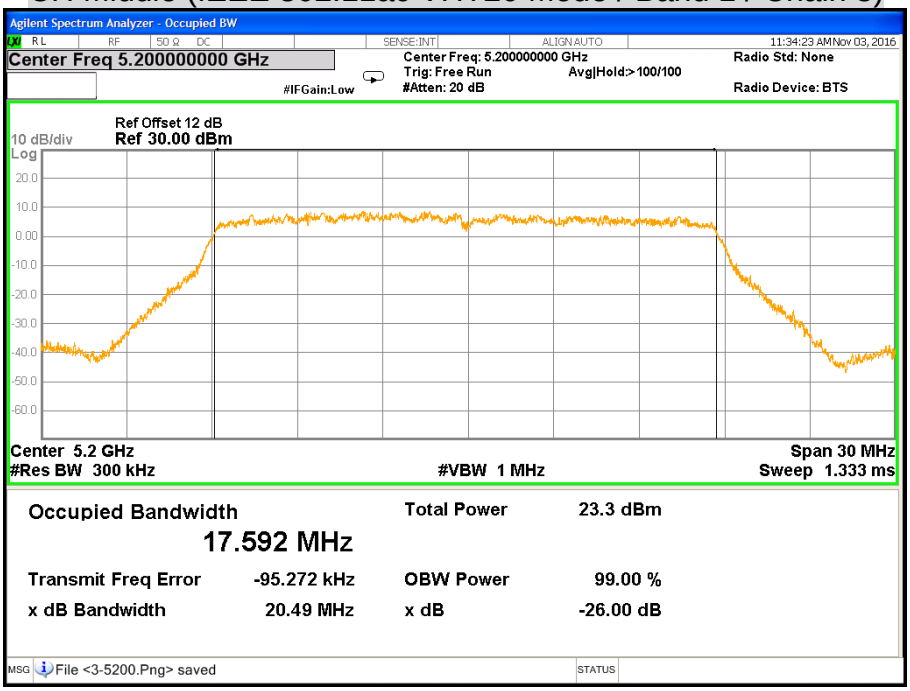
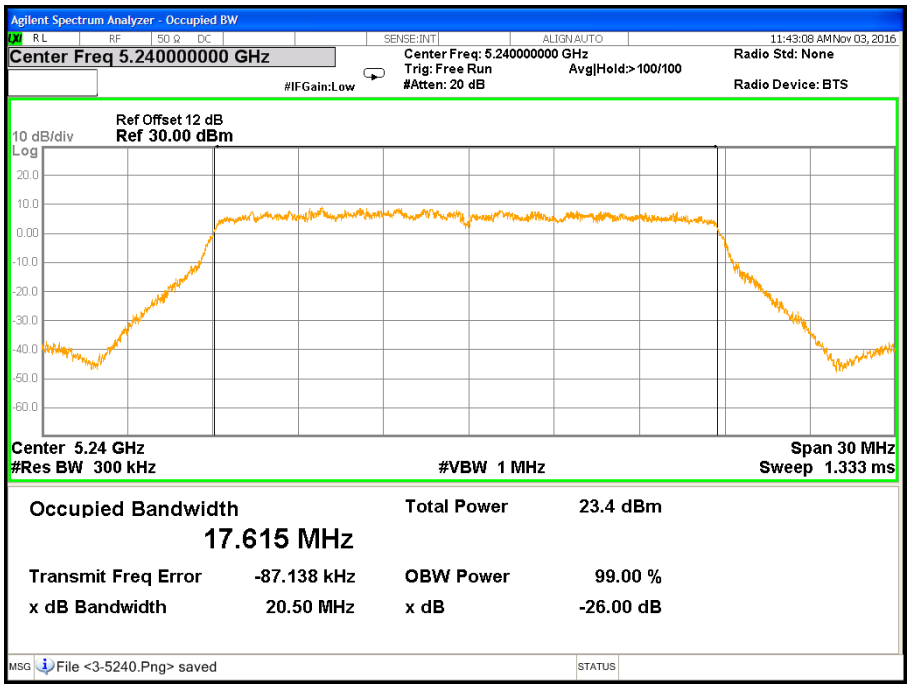
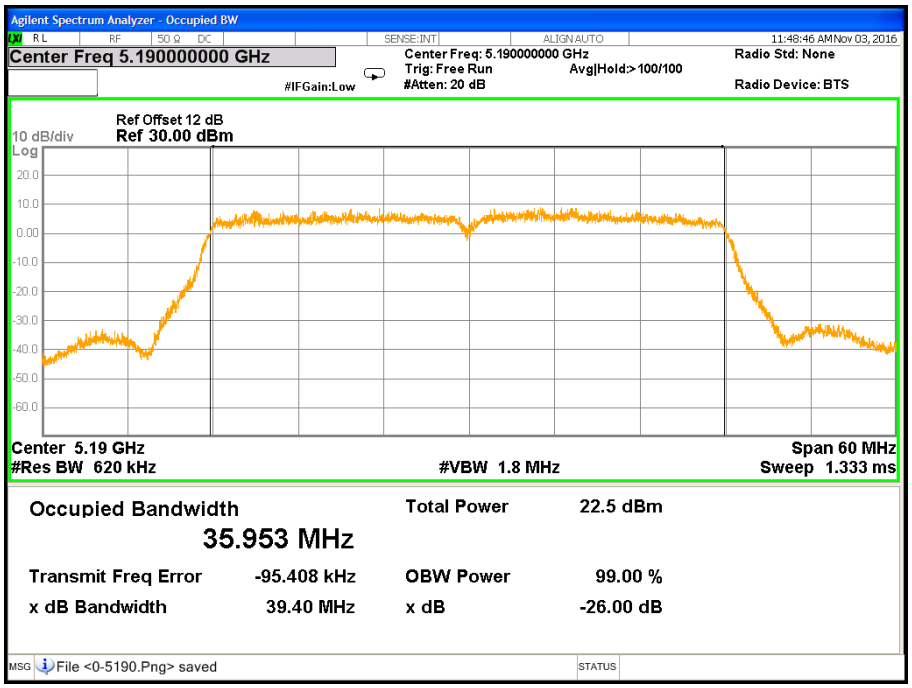


CH High (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 3)



CH Low (IEEE 802.11ac VHT40 Mode / Band 1 / Chain 0)



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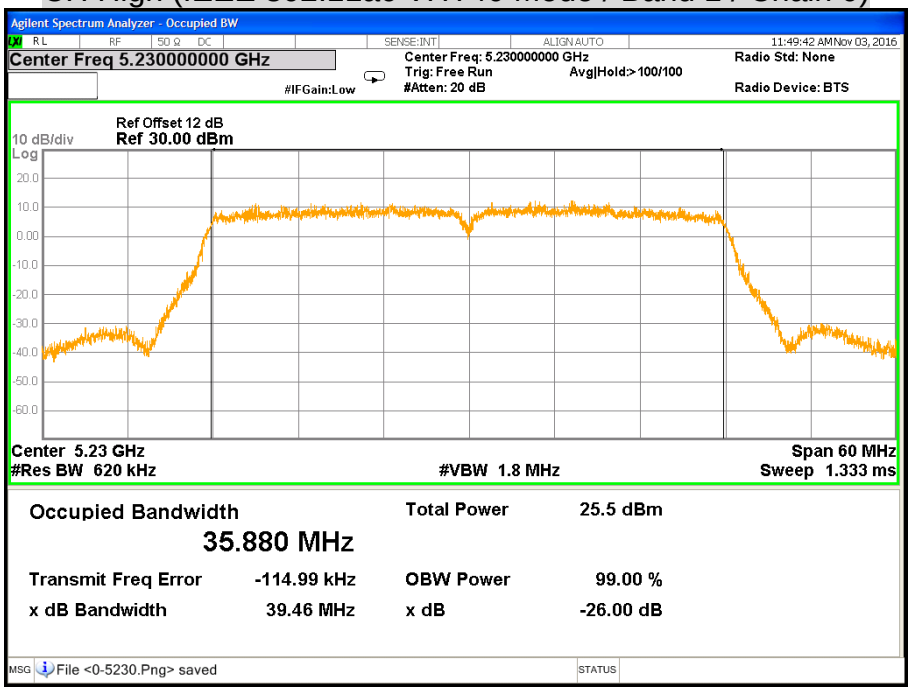

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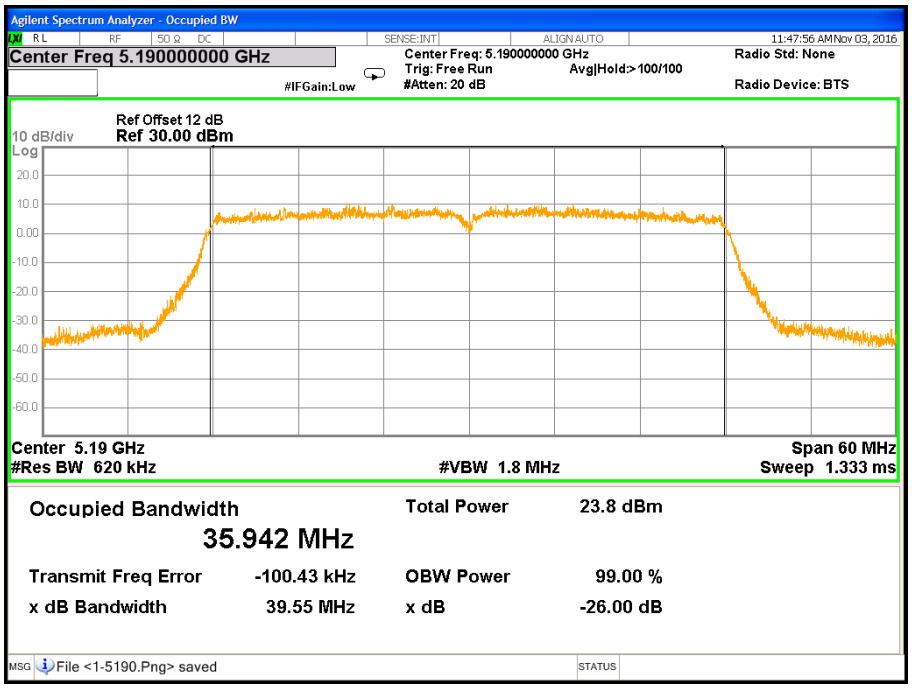

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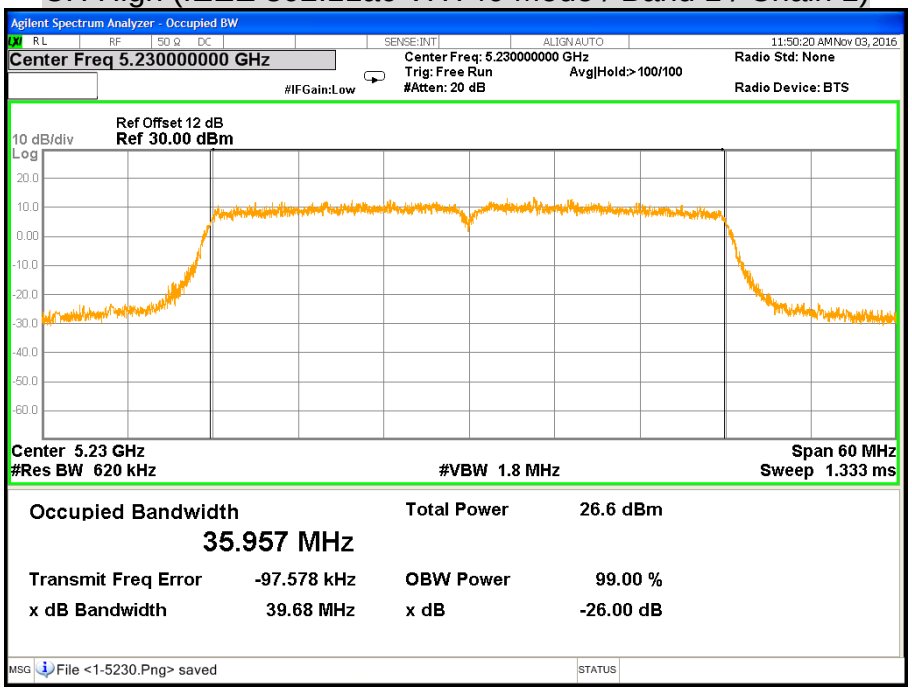

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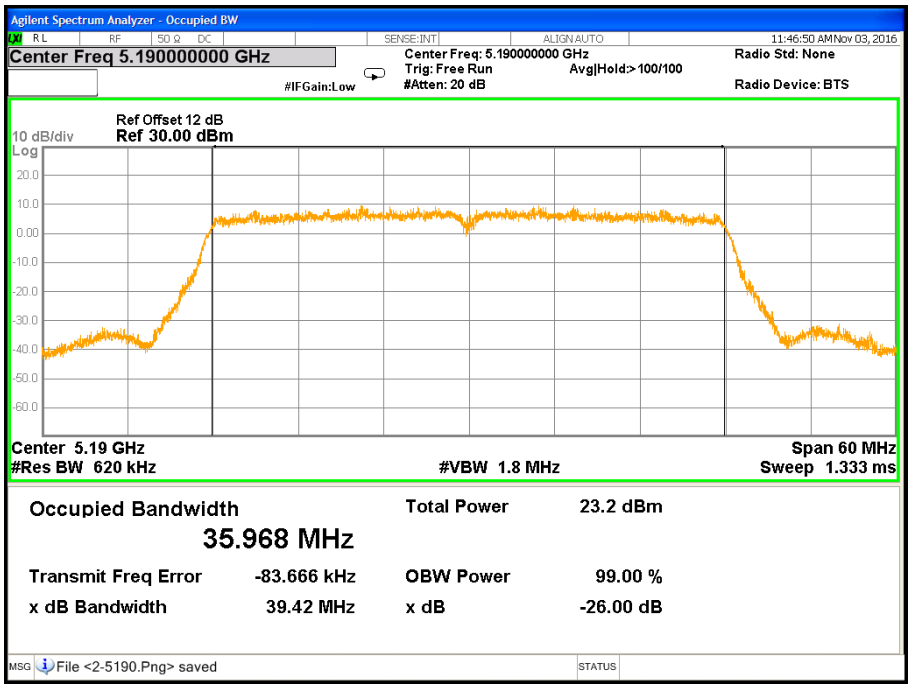
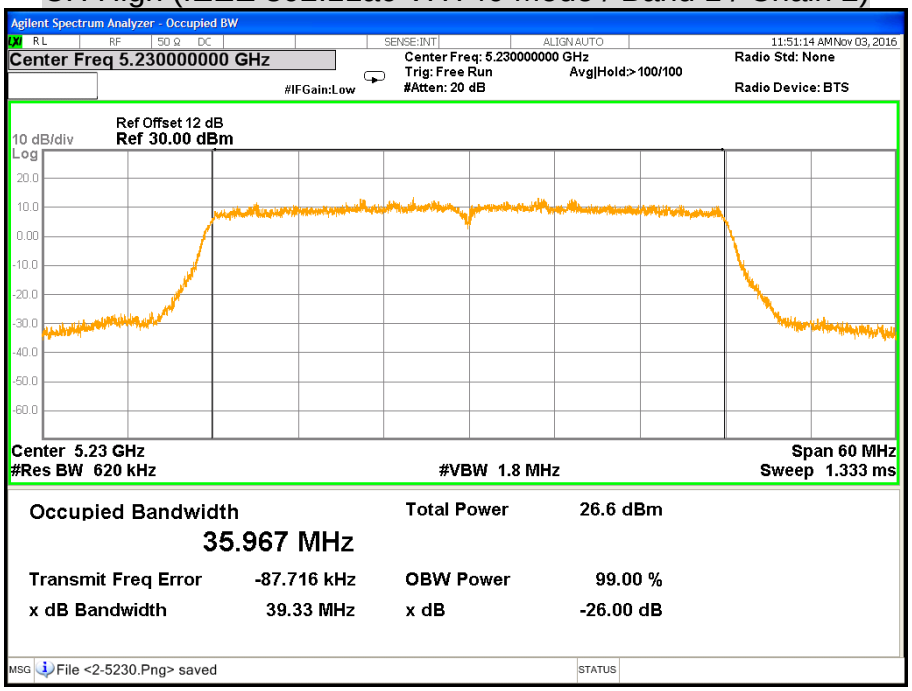


CH High (IEEE 802.11ac VHT40 Mode / Band 1 / Chain 2)



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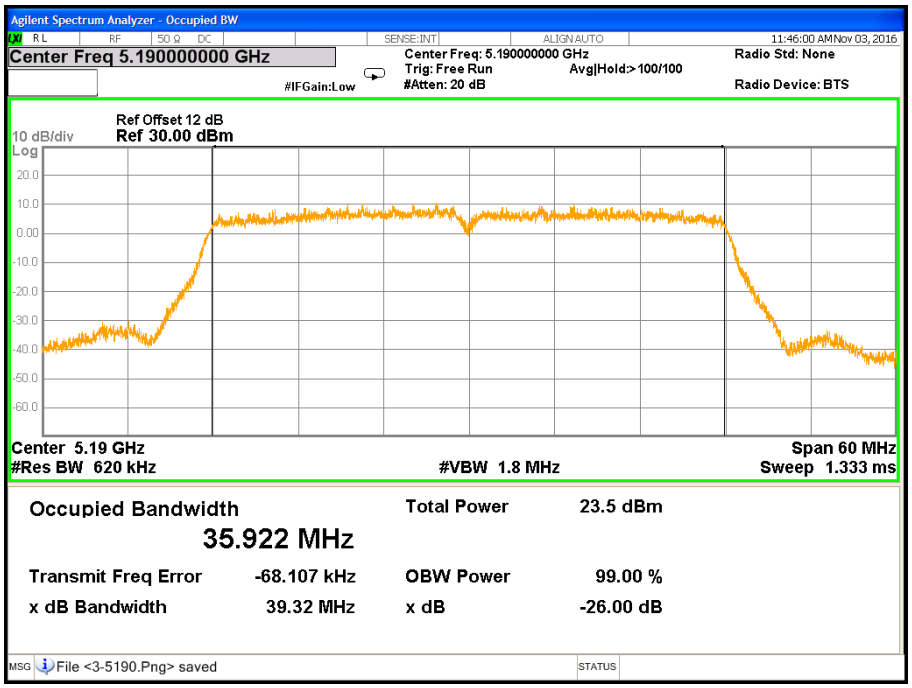
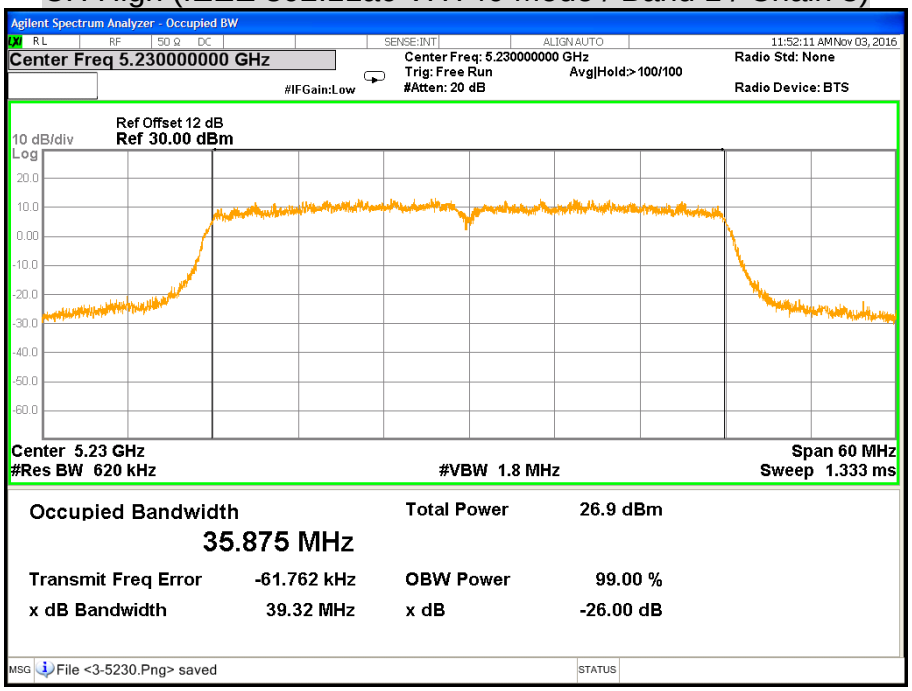
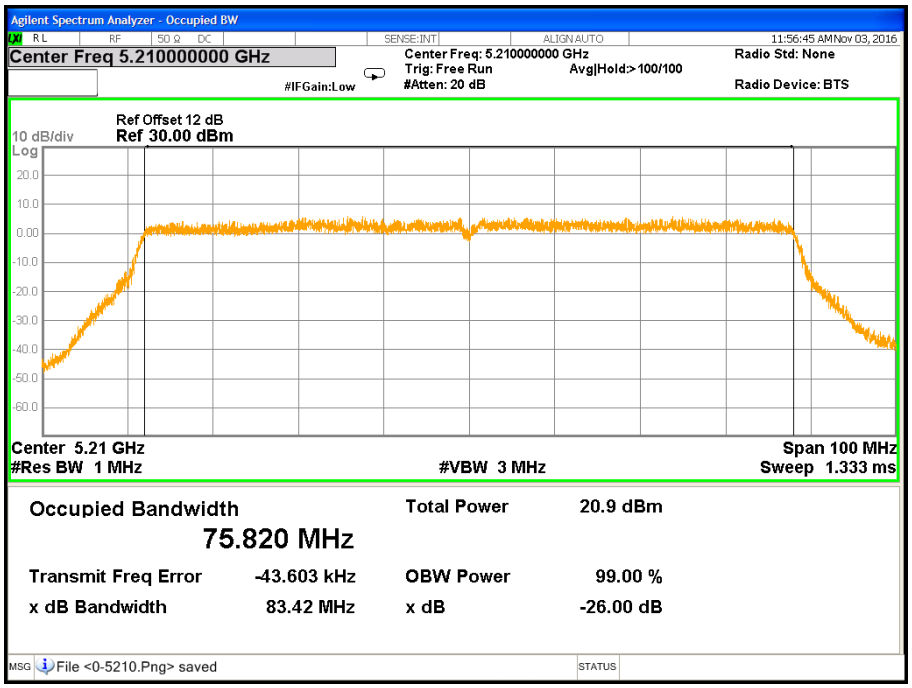


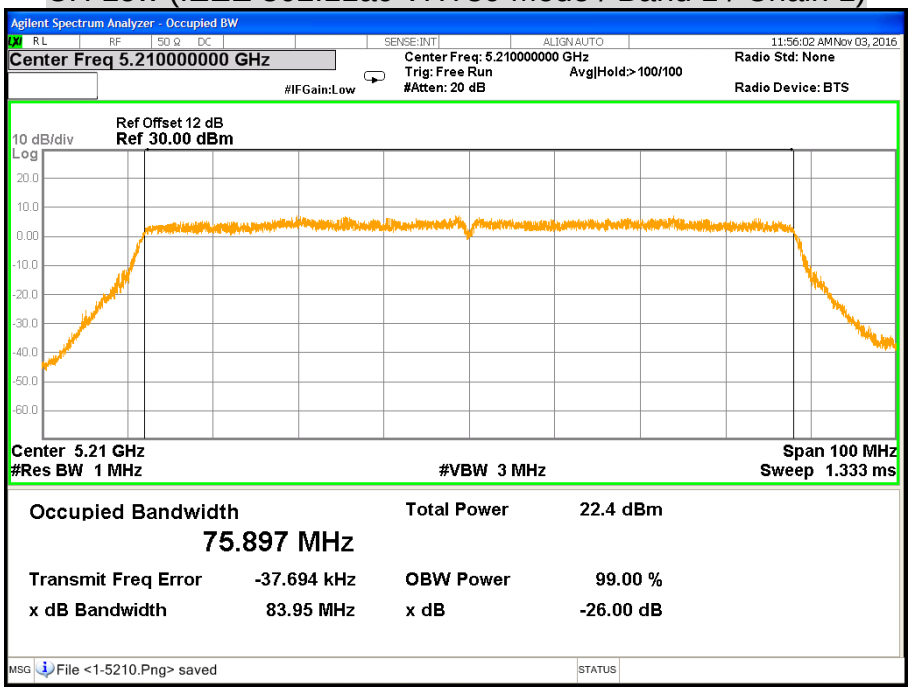
CH High (IEEE 802.11ac VHT40 Mode / Band 1 / Chain 3)



CH Low (IEEE 802.11ac VHT80 Mode / Band 1 / Chain 0)



CH Low (IEEE 802.11ac VHT80 Mode / Band 1 / Chain 1)



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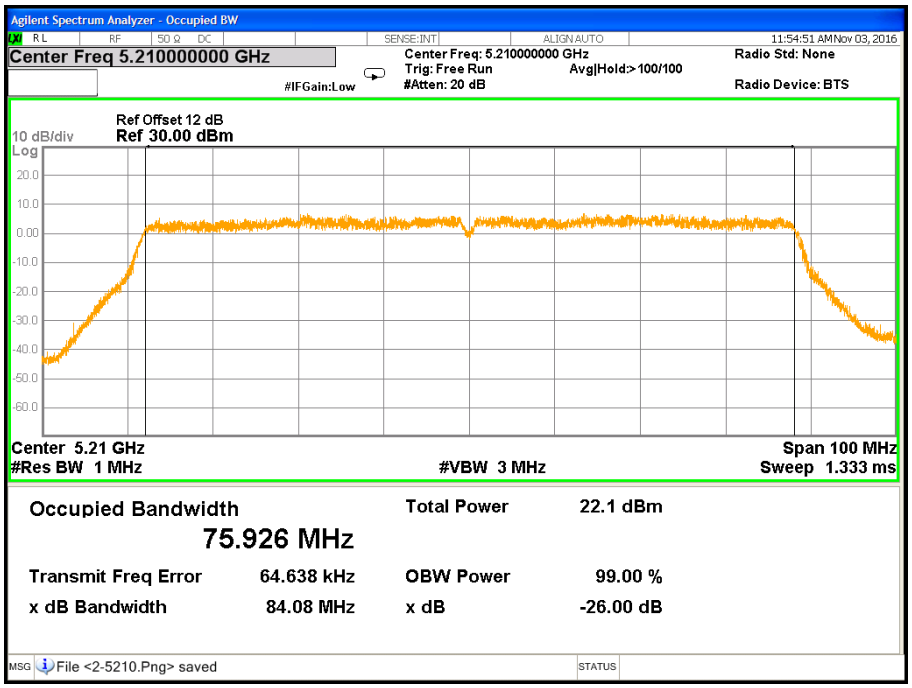
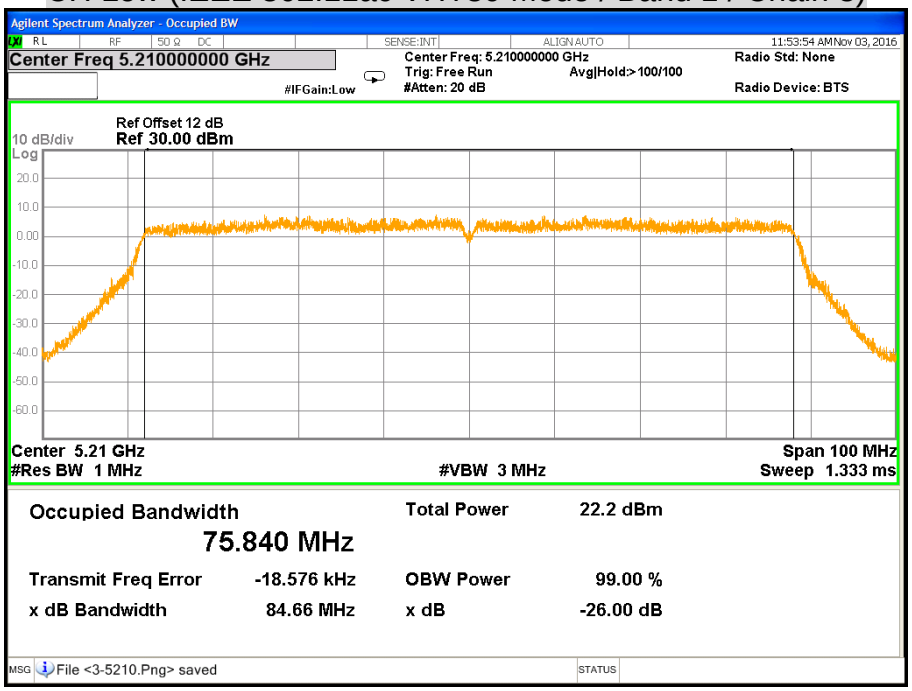
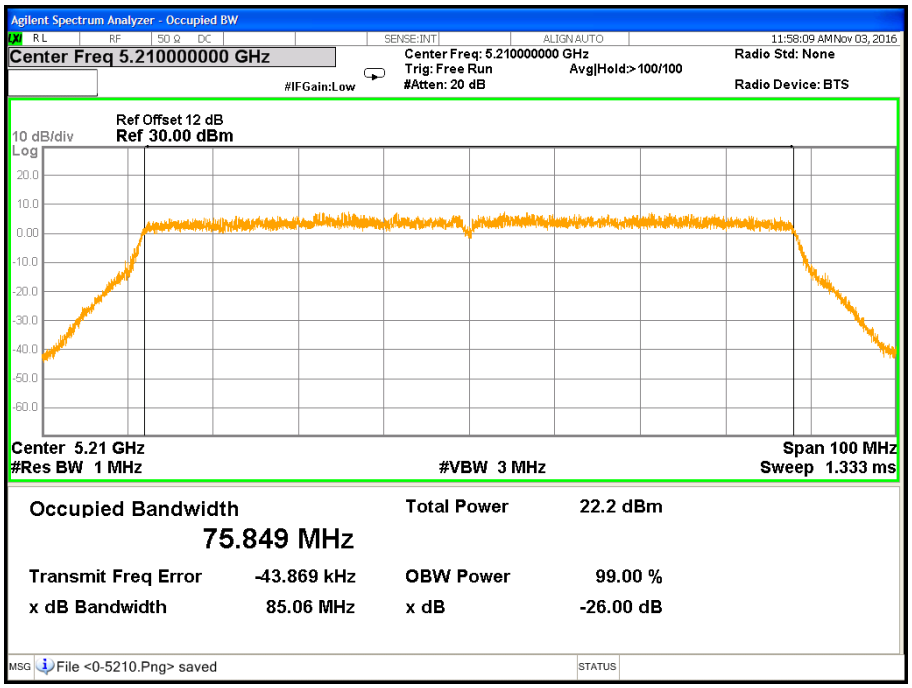


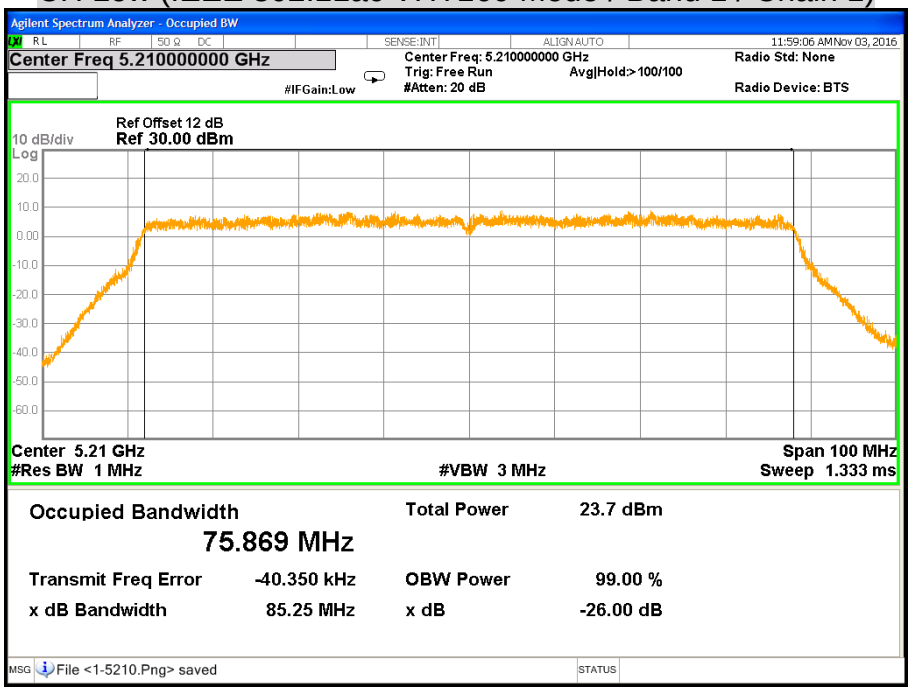
CH Low (IEEE 802.11ac VHT80 Mode / Band 1 / Chain 3)



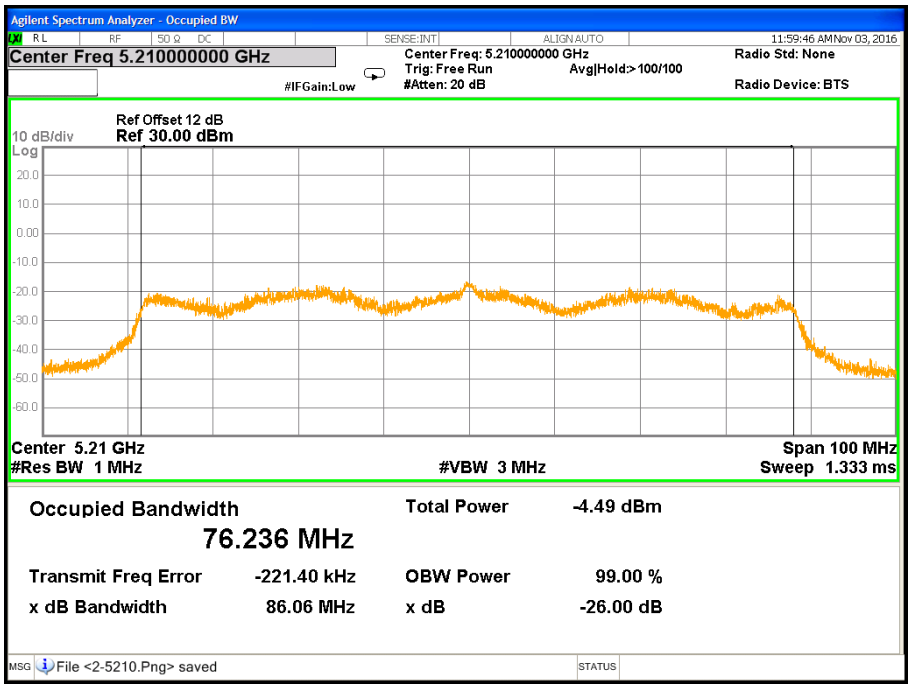
CH Low (IEEE 802.11ac VHT160 Mode / Band 1 / Chain 0)



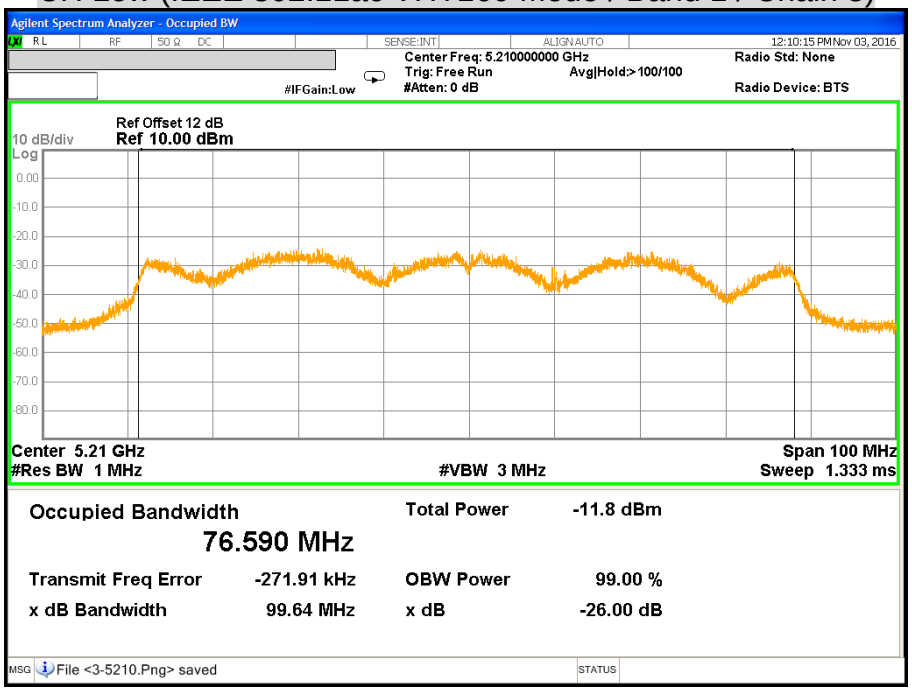
CH Low (IEEE 802.11ac VHT160 Mode / Band 1 / Chain 1)



CH Low (IEEE 802.11ac VHT160 Mode / Band 1 / Chain 2)

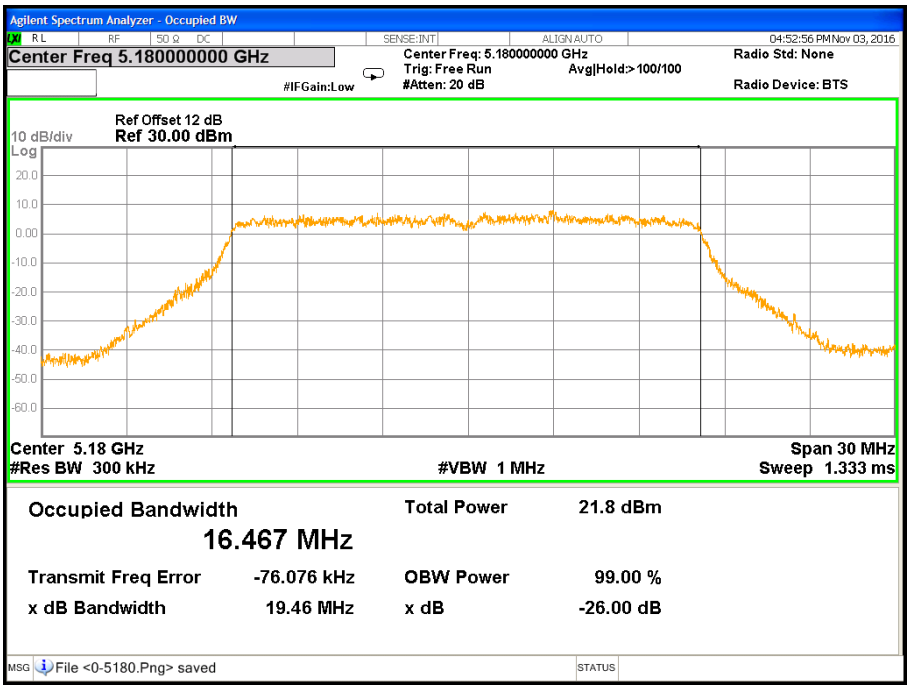


CH Low (IEEE 802.11ac VHT160 Mode / Band 1 / Chain 3)

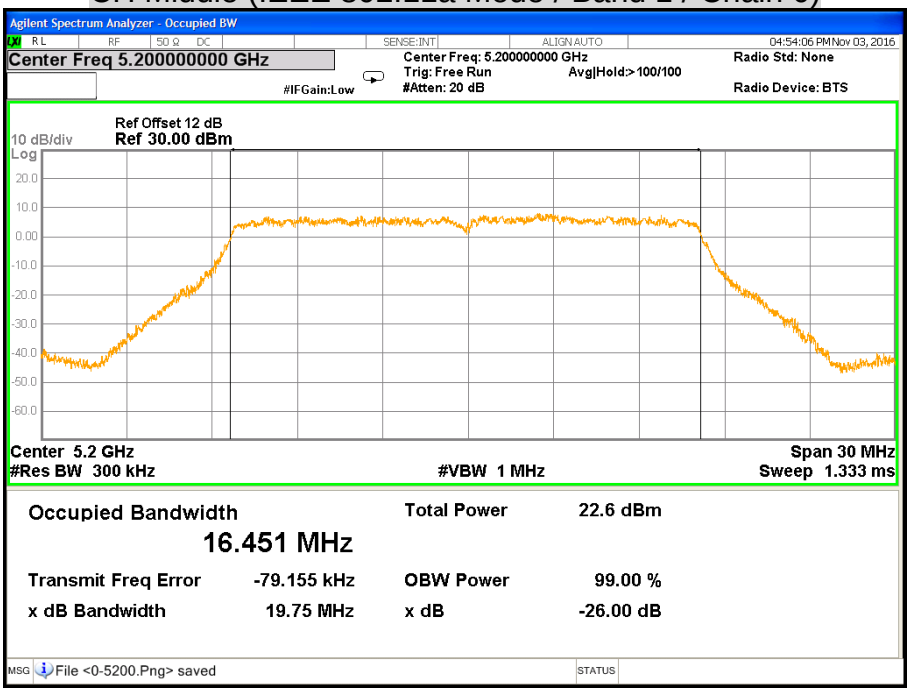


Beamforming

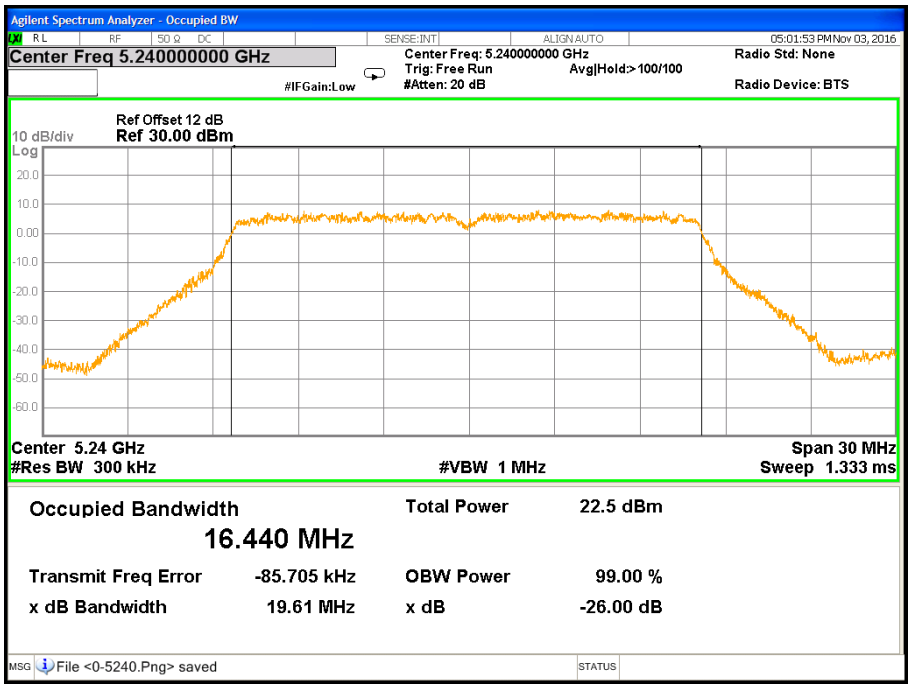
CH Low (IEEE 802.11a Mode / Band 1 / Chain 0)



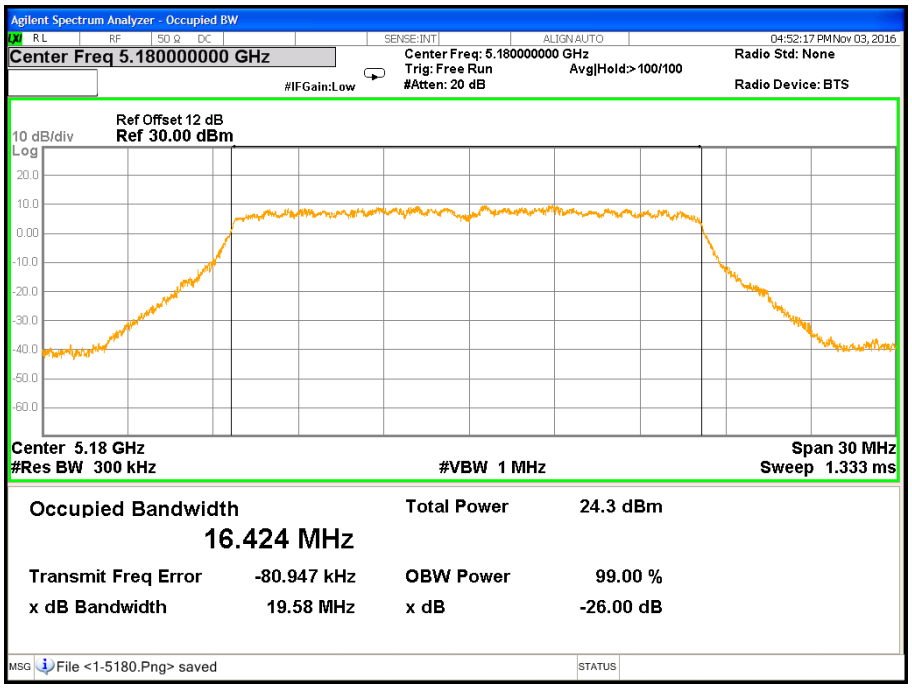
CH Middle (IEEE 802.11a Mode / Band 1 / Chain 0)



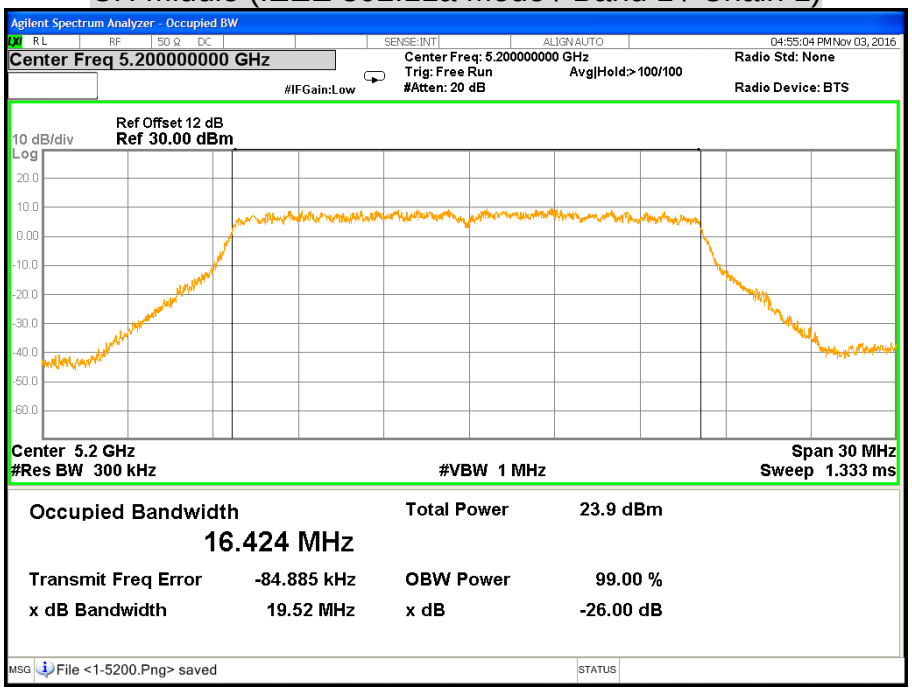
CH High (IEEE 802.11a Mode / Band 1 / Chain 0)



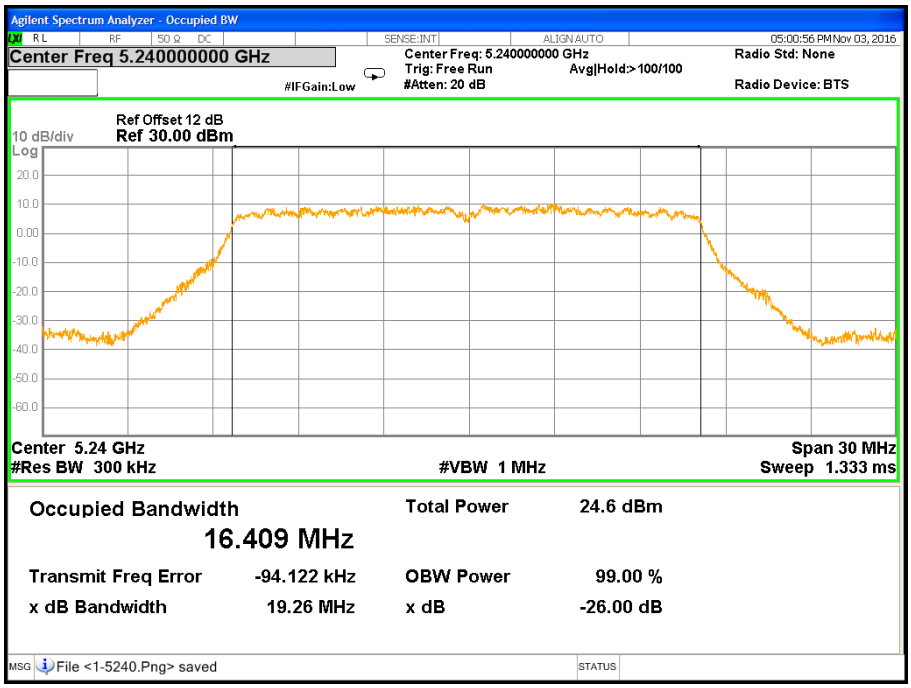
CH Low (IEEE 802.11a Mode / Band 1 / Chain 1)



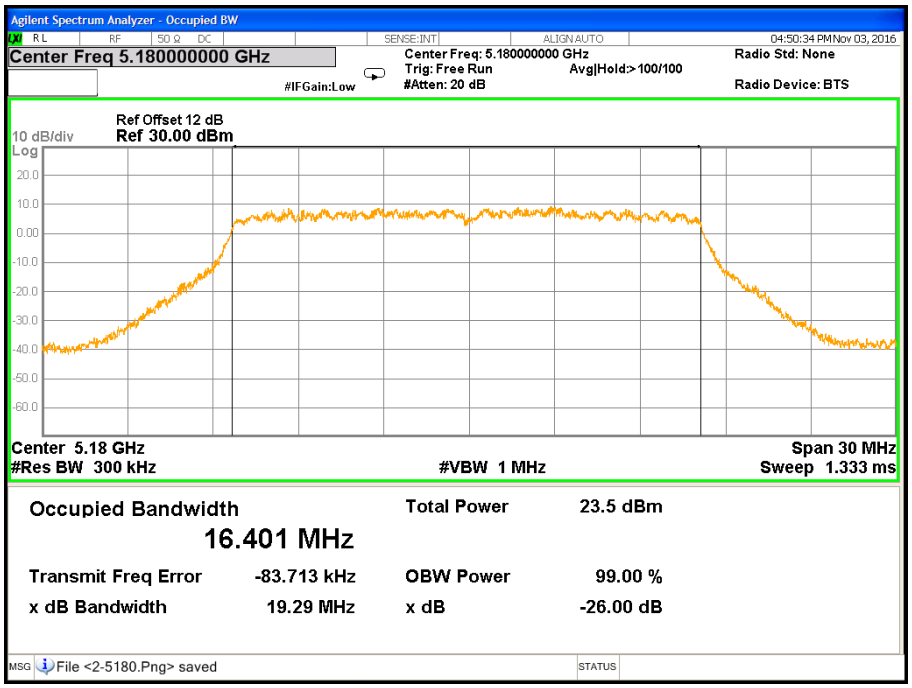
CH Middle (IEEE 802.11a Mode / Band 1 / Chain 1)



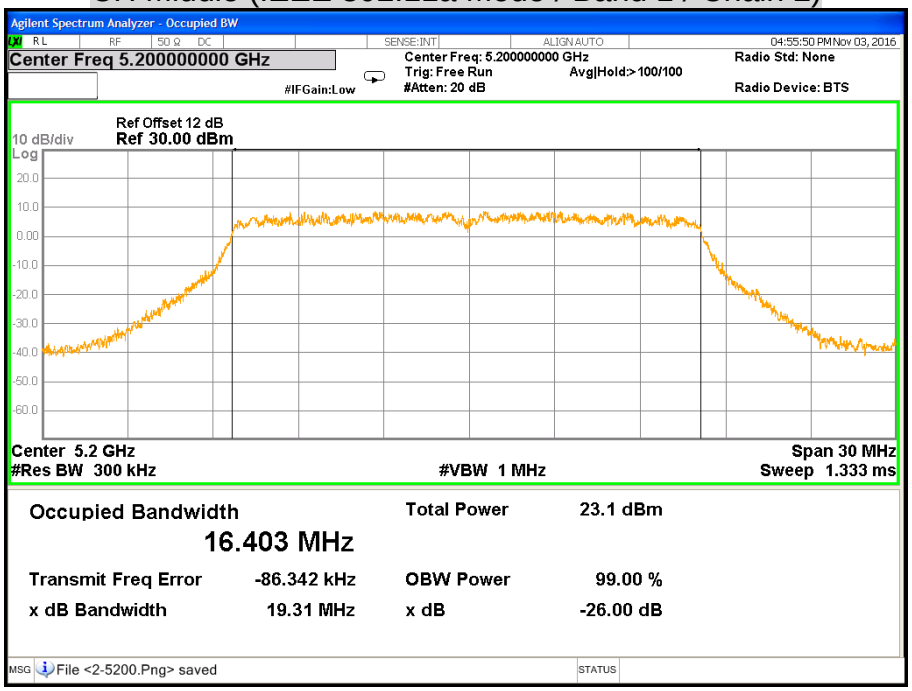
CH High (IEEE 802.11a Mode / Band 1 / Chain 1)



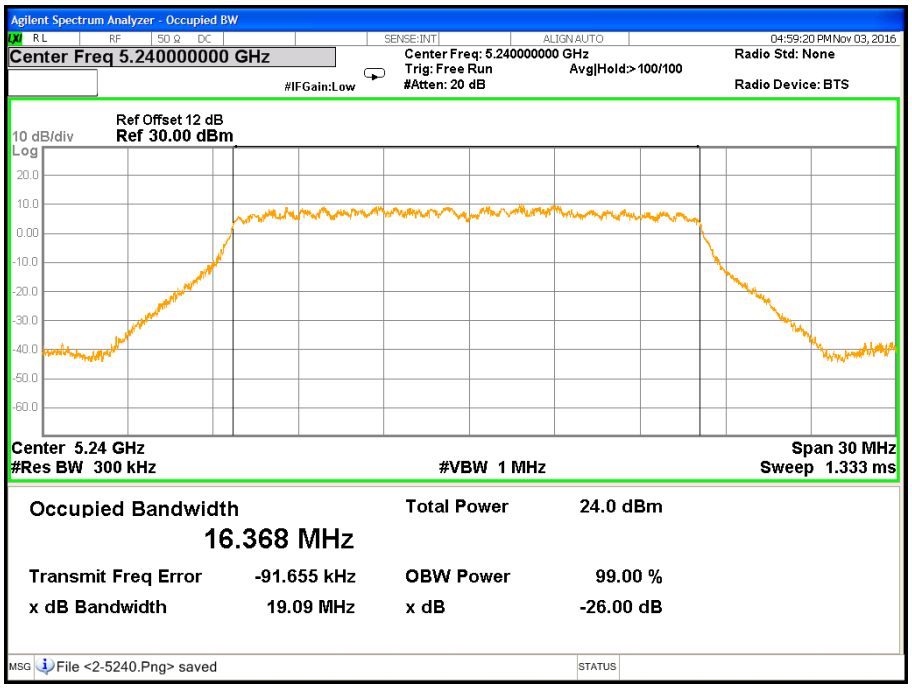
CH Low (IEEE 802.11a Mode / Band 1 / Chain 2)



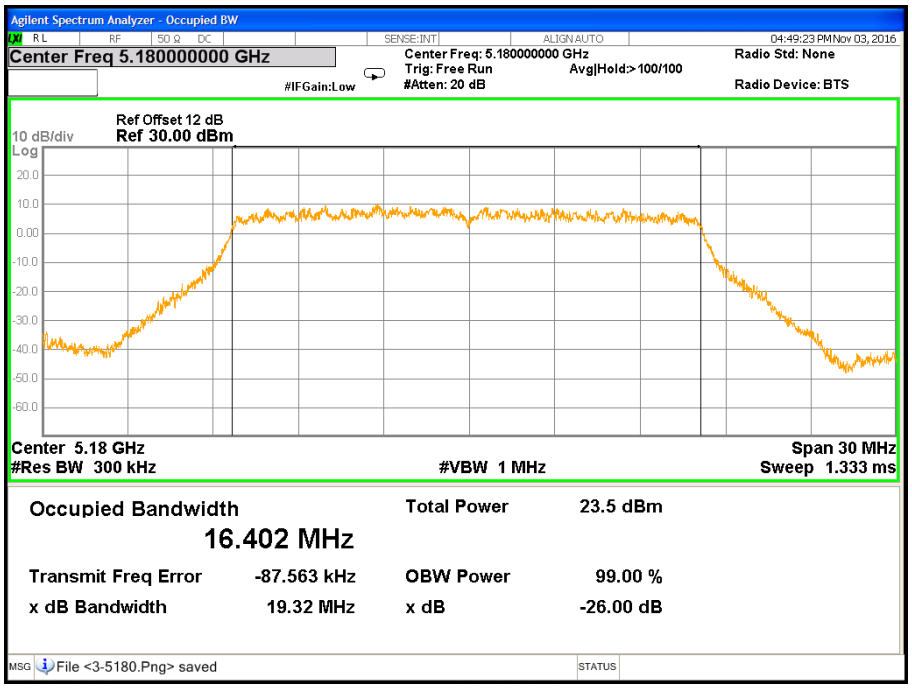
CH Middle (IEEE 802.11a Mode / Band 1 / Chain 2)



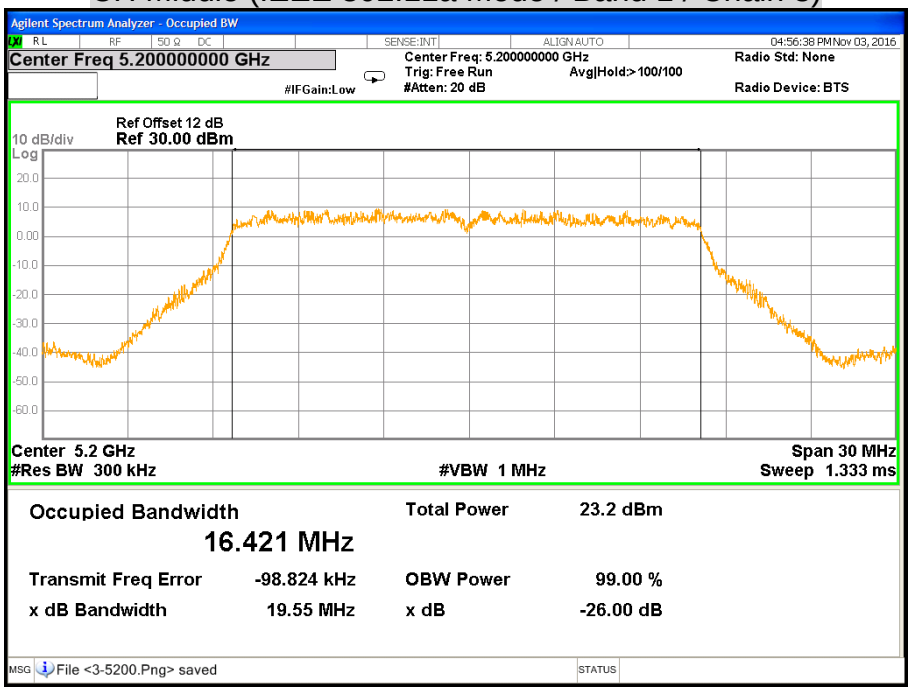
CH High (IEEE 802.11a Mode / Band 1 / Chain 2)



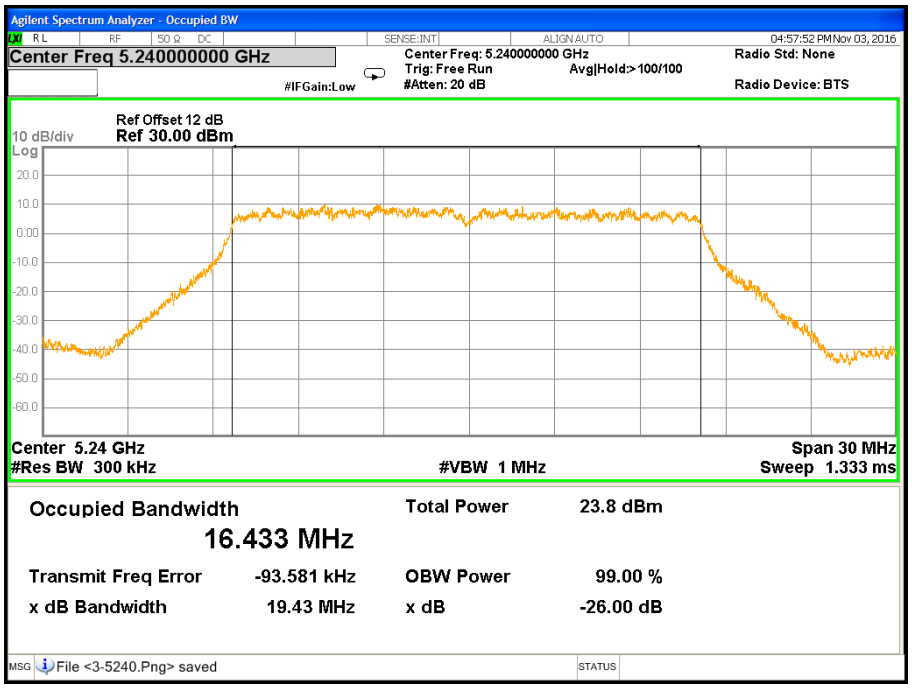
CH Low (IEEE 802.11a Mode / Band 1 / Chain 3)



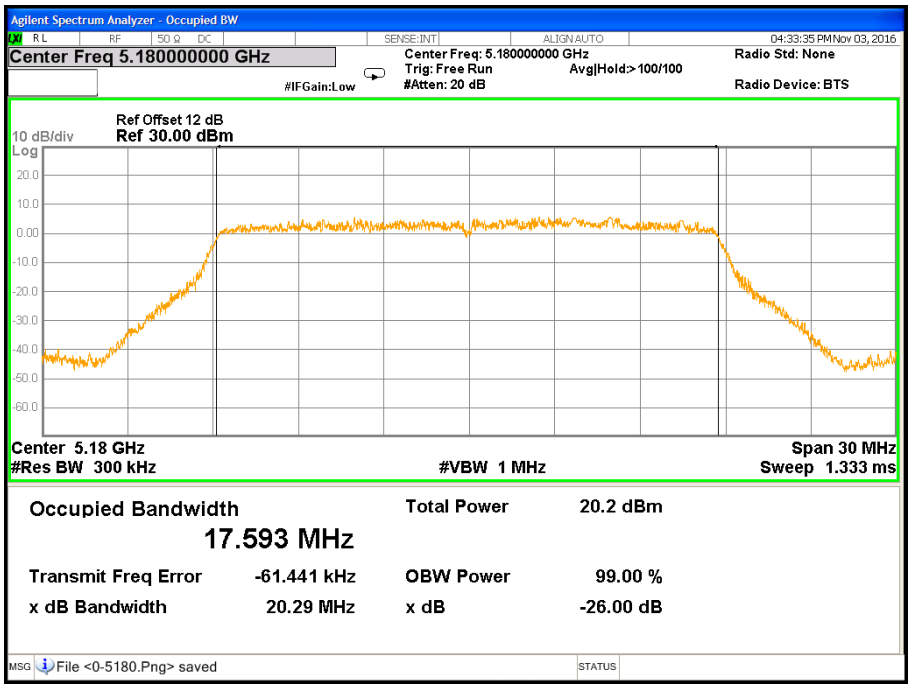
CH Middle (IEEE 802.11a Mode / Band 1 / Chain 3)



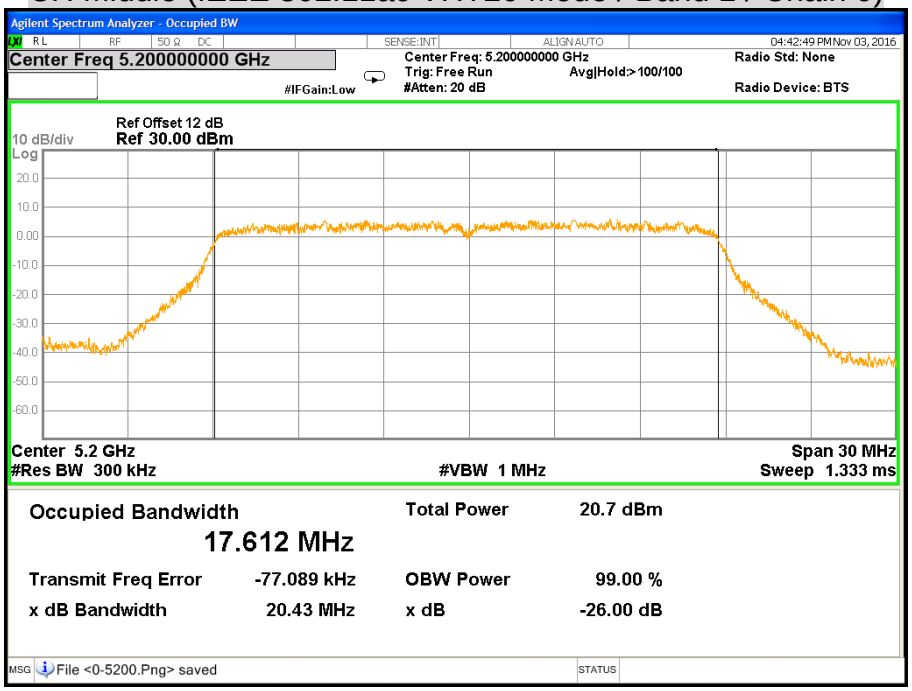
CH High (IEEE 802.11a Mode / Band 1 / Chain 3)



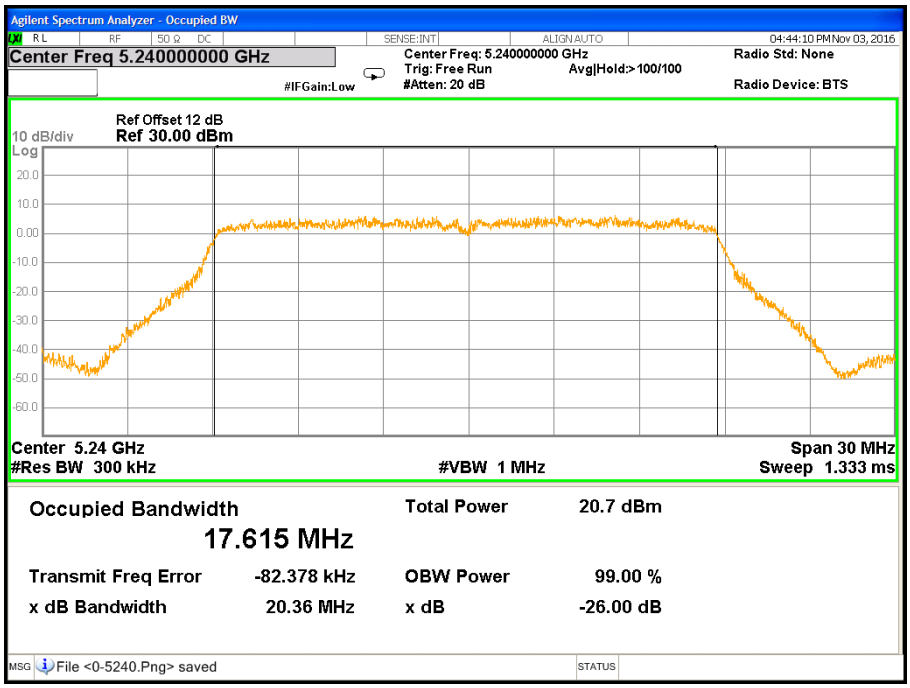
CH Low (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 0)



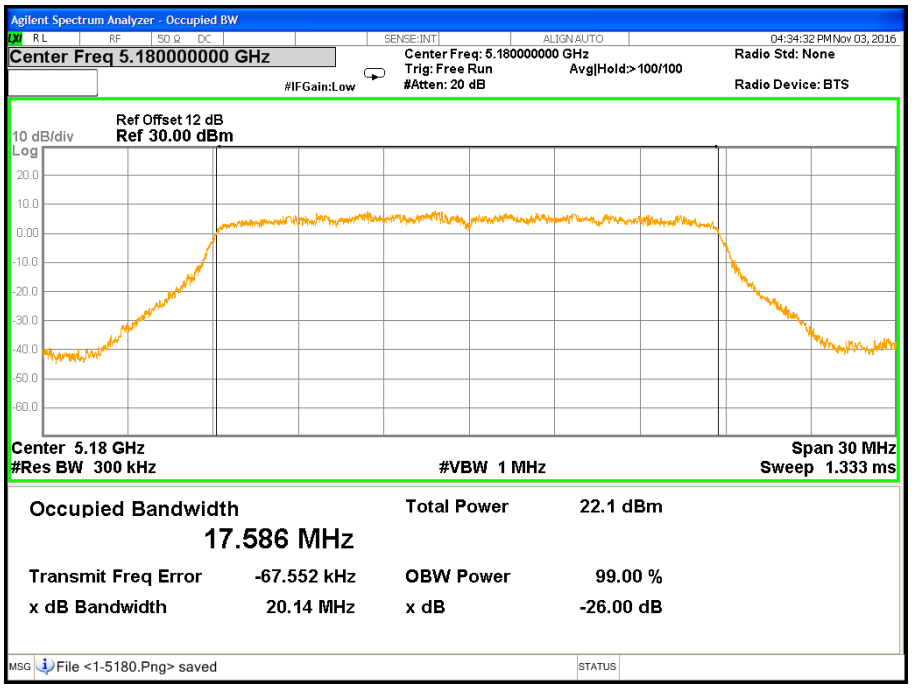
CH Middle (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 0)



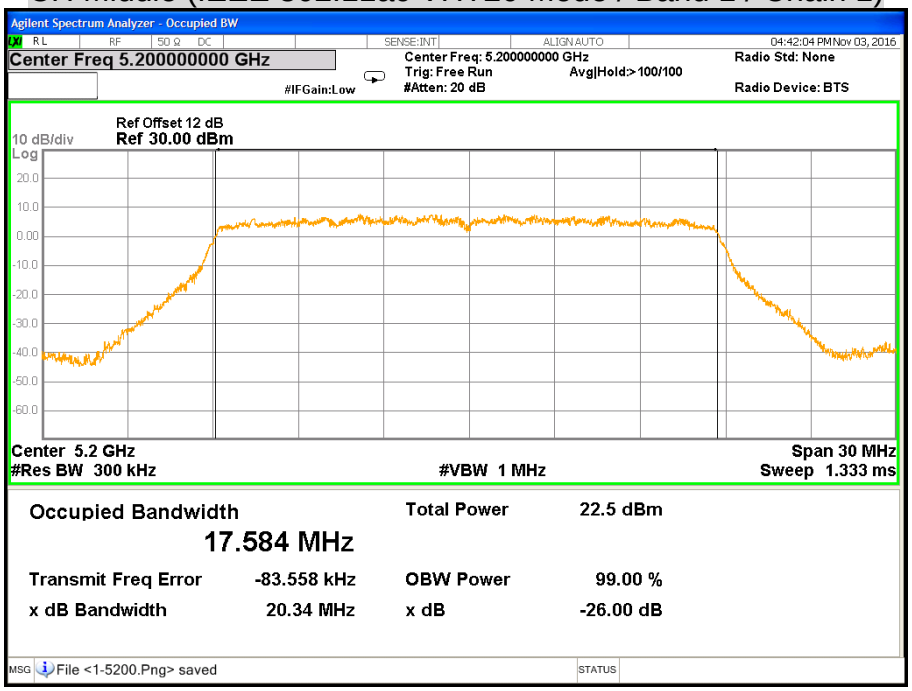
CH High (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 0)



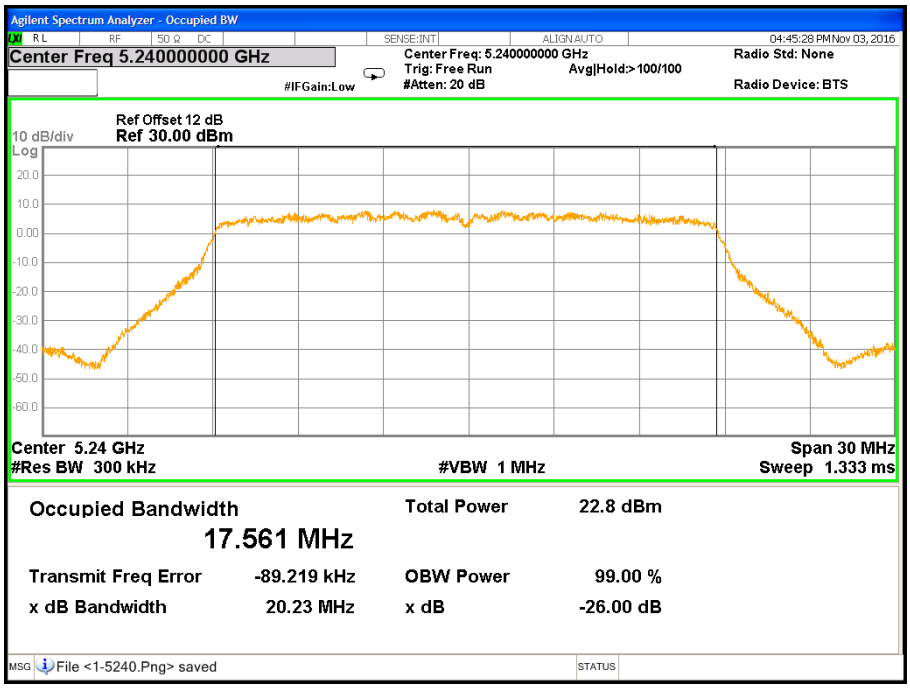
CH Low (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 1)



CH Middle (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 1)



CH High (IEEE 802.11ac VHT20 Mode / Band 1 / Chain 1)



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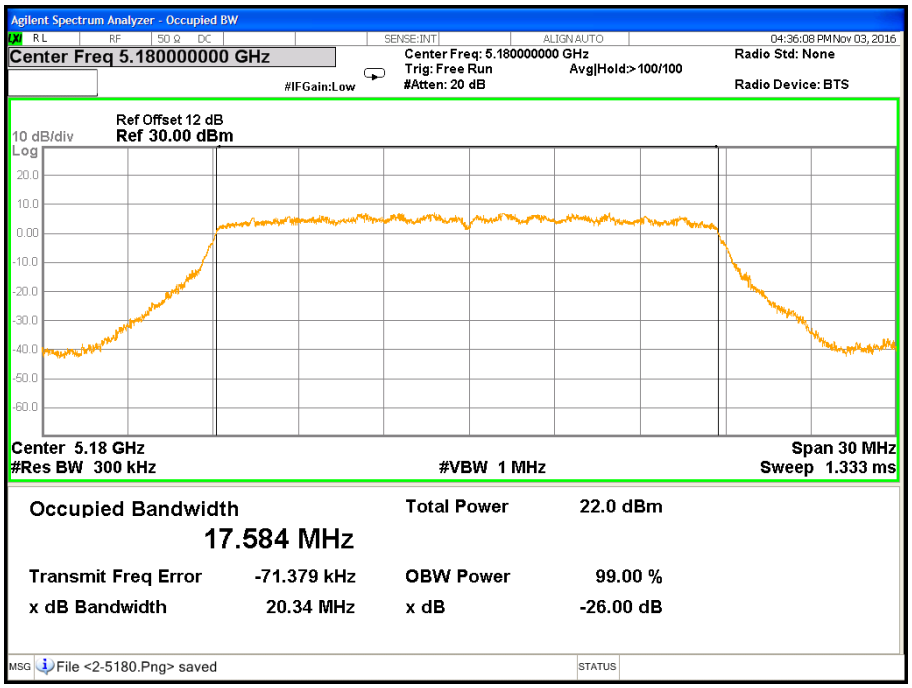

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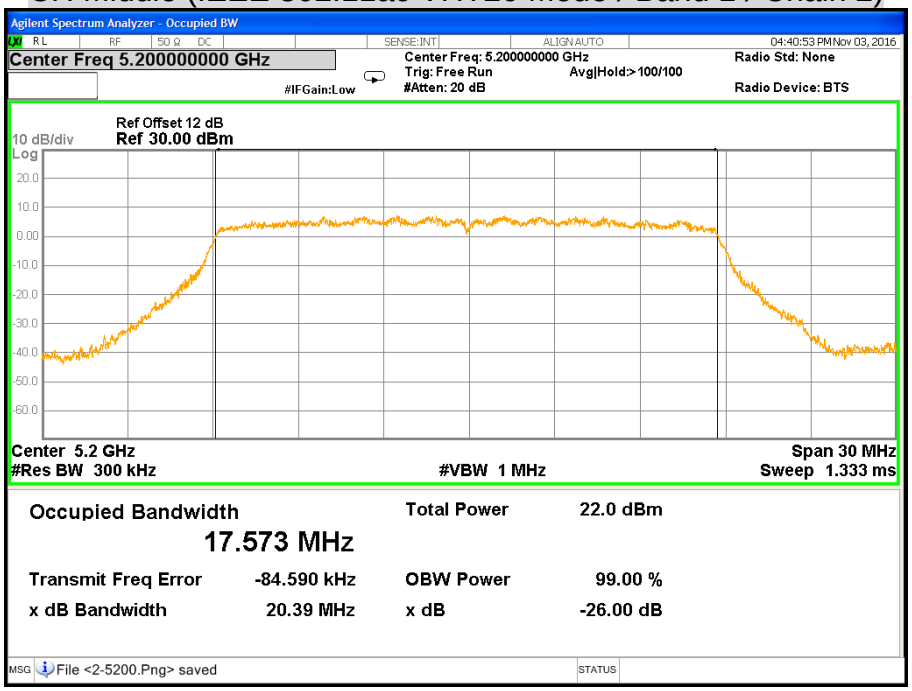

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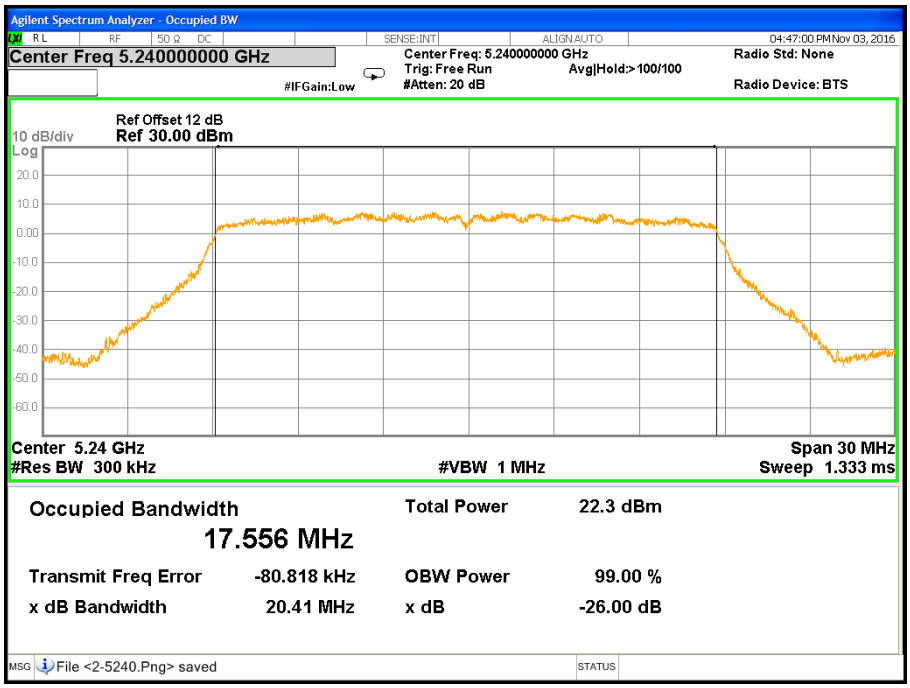

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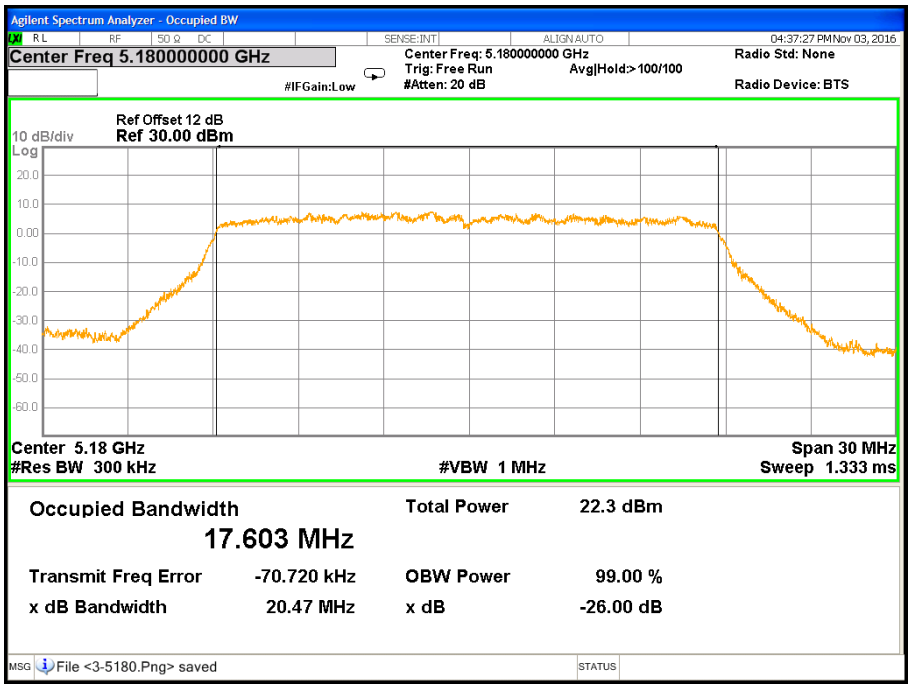

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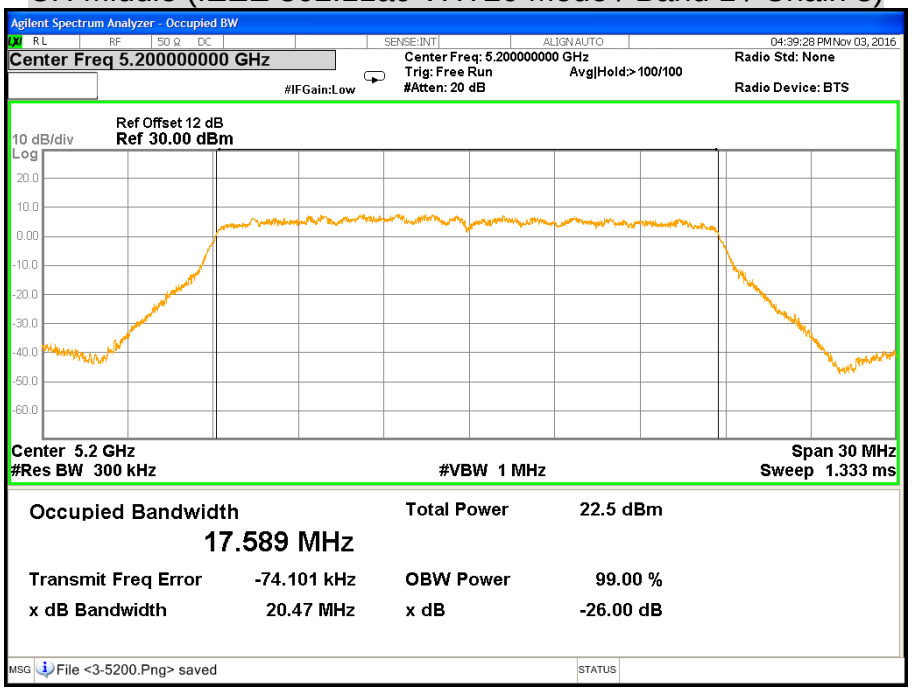

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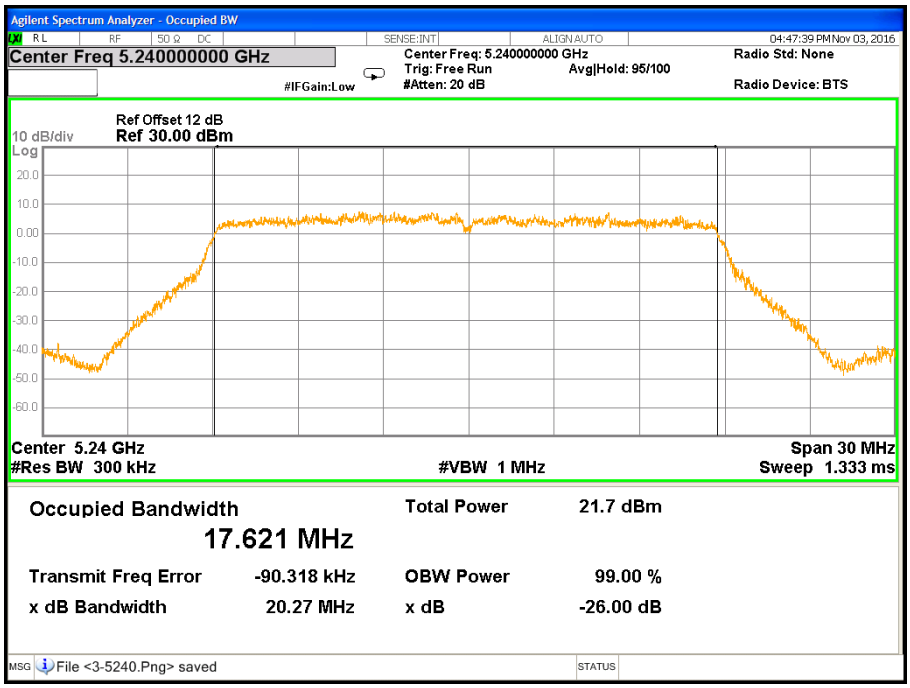
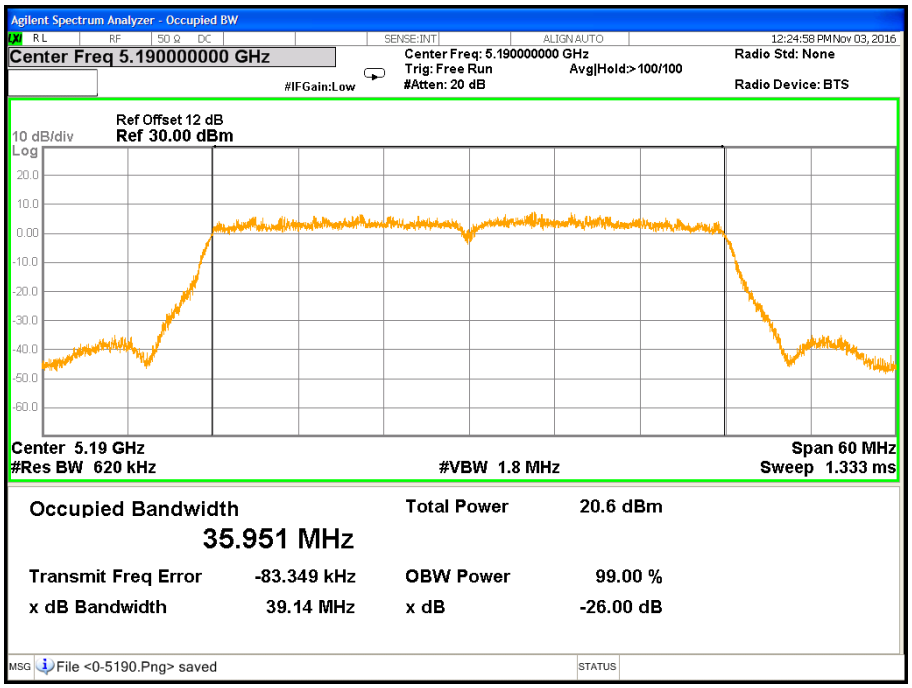


CH Low (IEEE 802.11ac VHT40 Mode / Band 1 / Chain 0)



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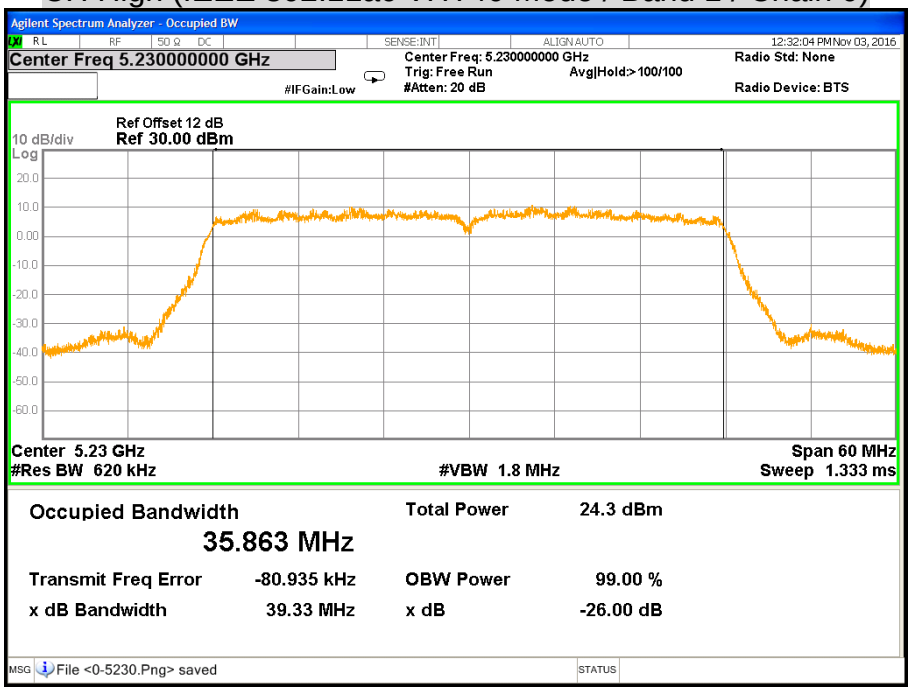
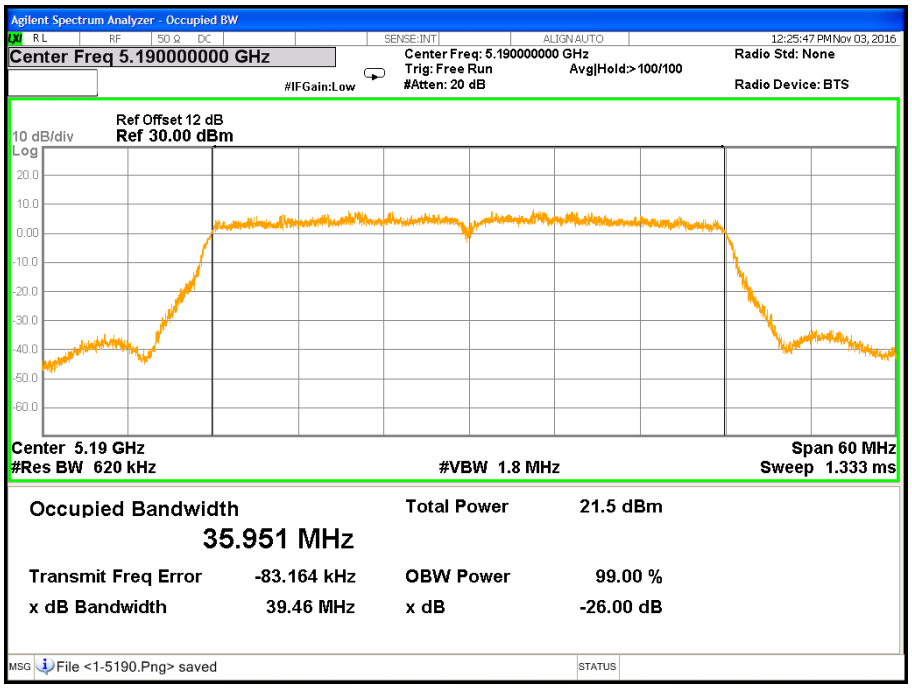


CH Low (IEEE 802.11ac VHT40 Mode / Band 1 / Chain 1)



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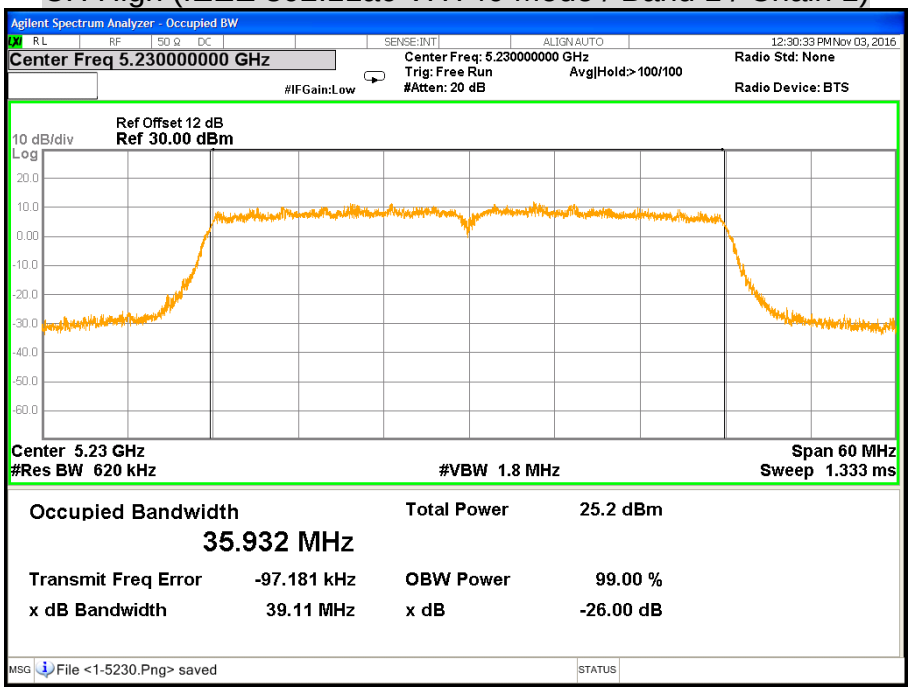

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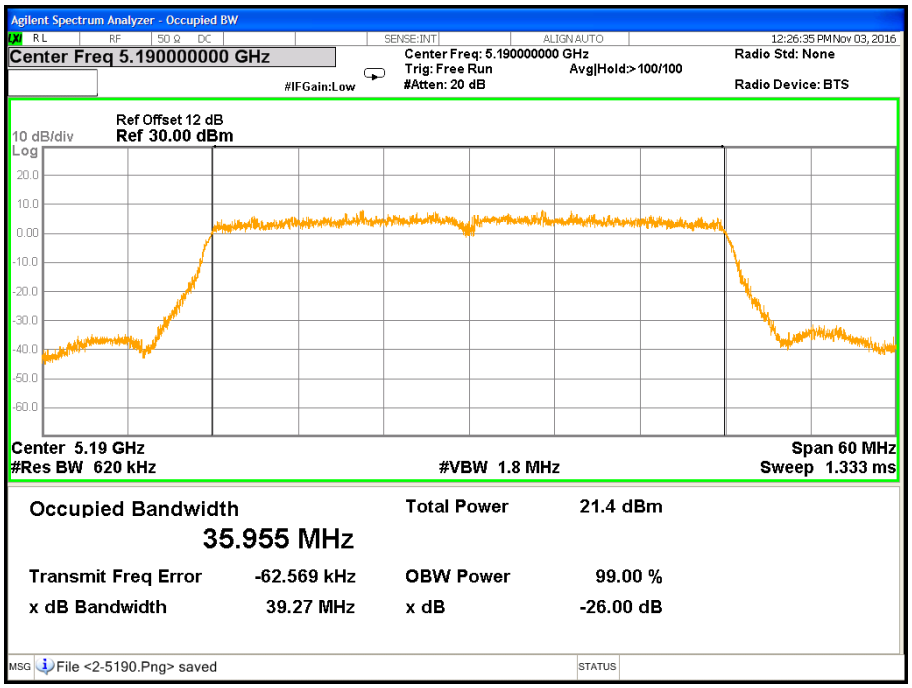
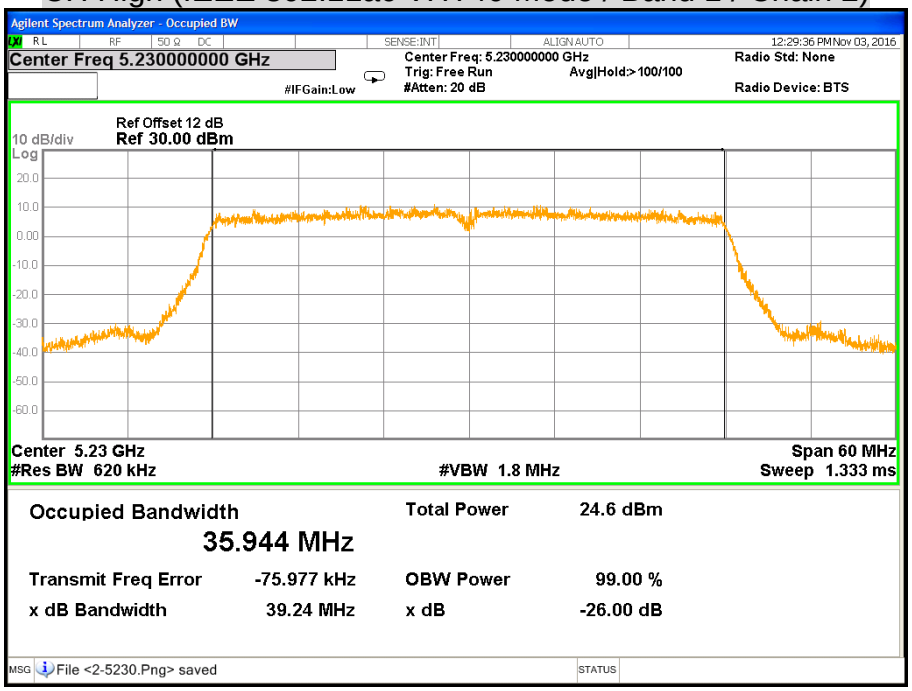
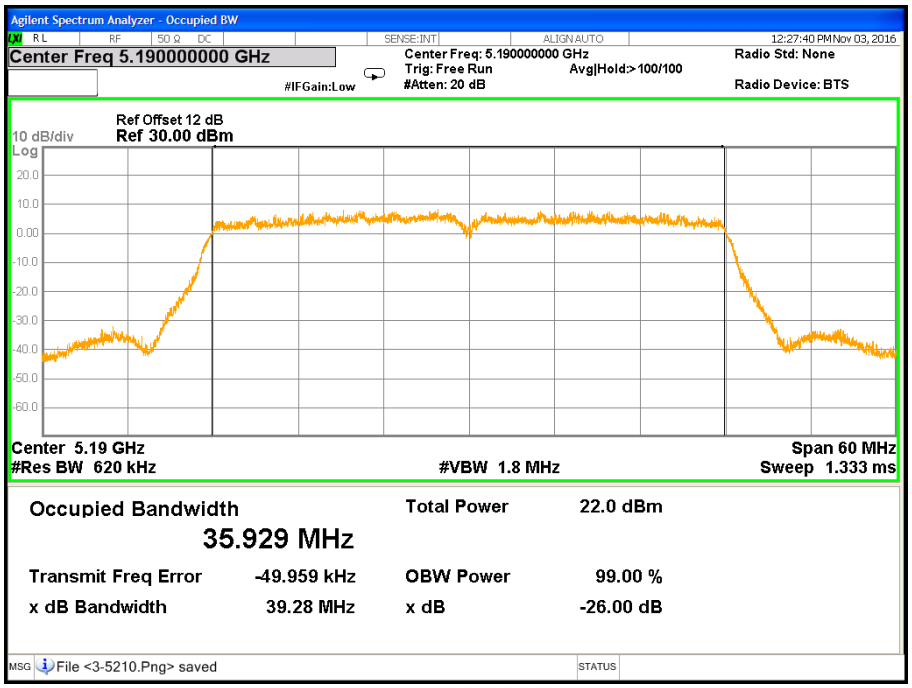


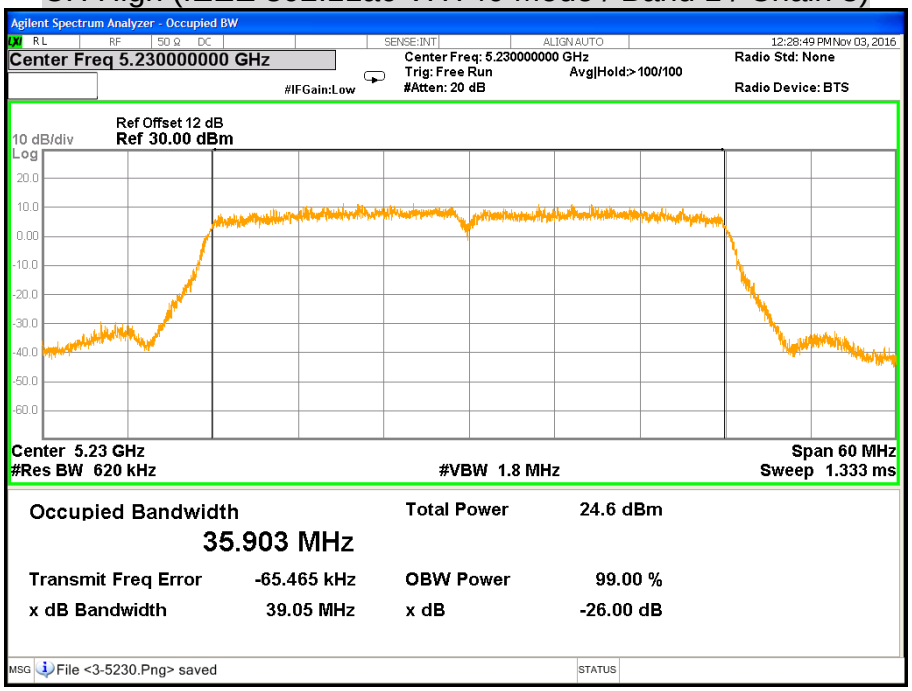
CH High (IEEE 802.11ac VHT40 Mode / Band 1 / Chain 2)



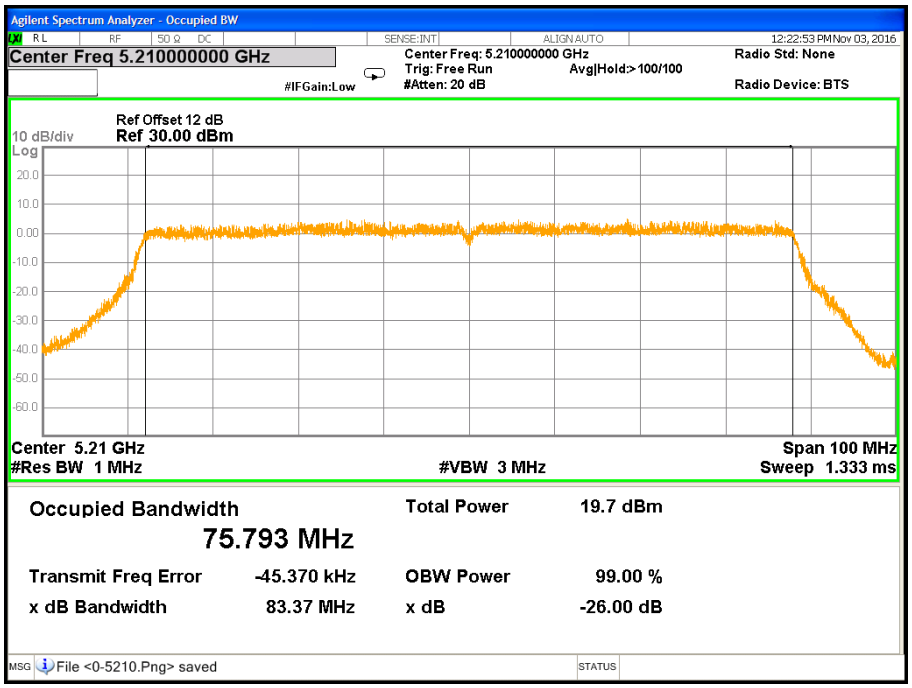
CH Low (IEEE 802.11ac VHT40 Mode / Band 1 / Chain 3)



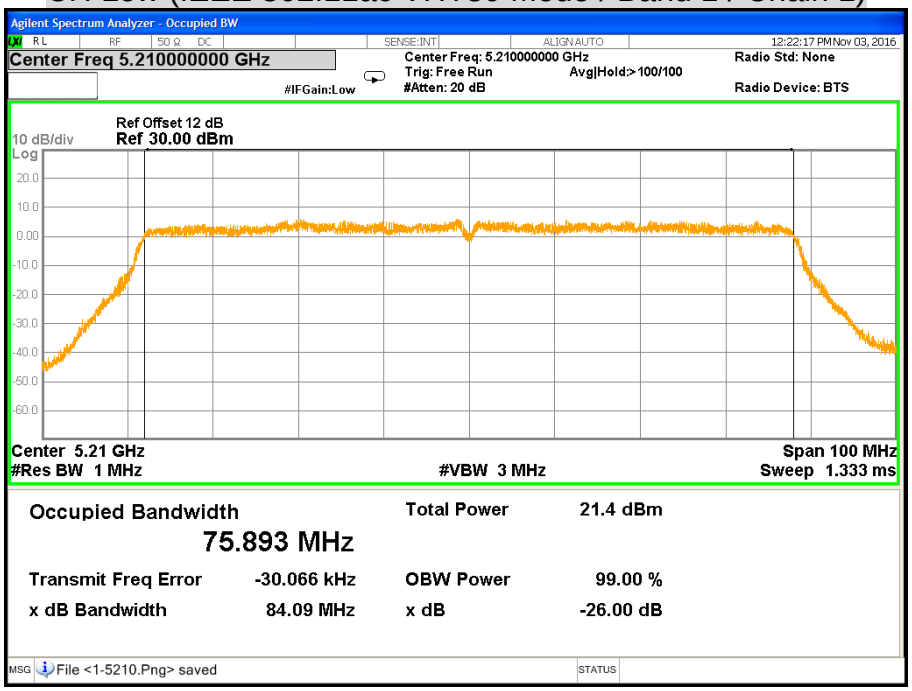
CH High (IEEE 802.11ac VHT40 Mode / Band 1 / Chain 3)



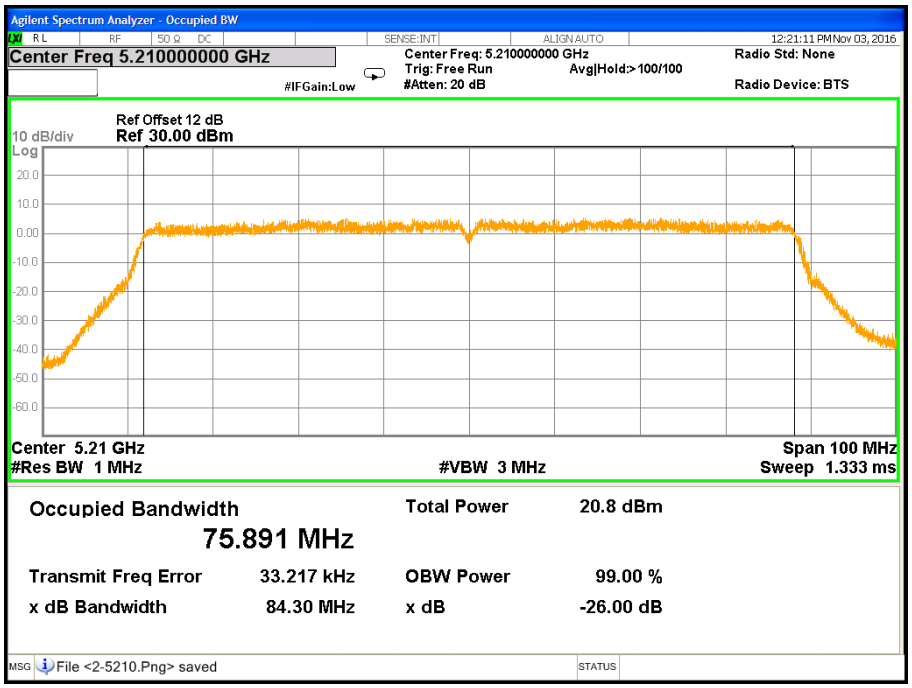
CH Low (IEEE 802.11ac VHT80 Mode / Band 1 / Chain 0)



CH Low (IEEE 802.11ac VHT80 Mode / Band 1 / Chain 1)



CH Low (IEEE 802.11ac VHT80 Mode / Band 1 / Chain 2)



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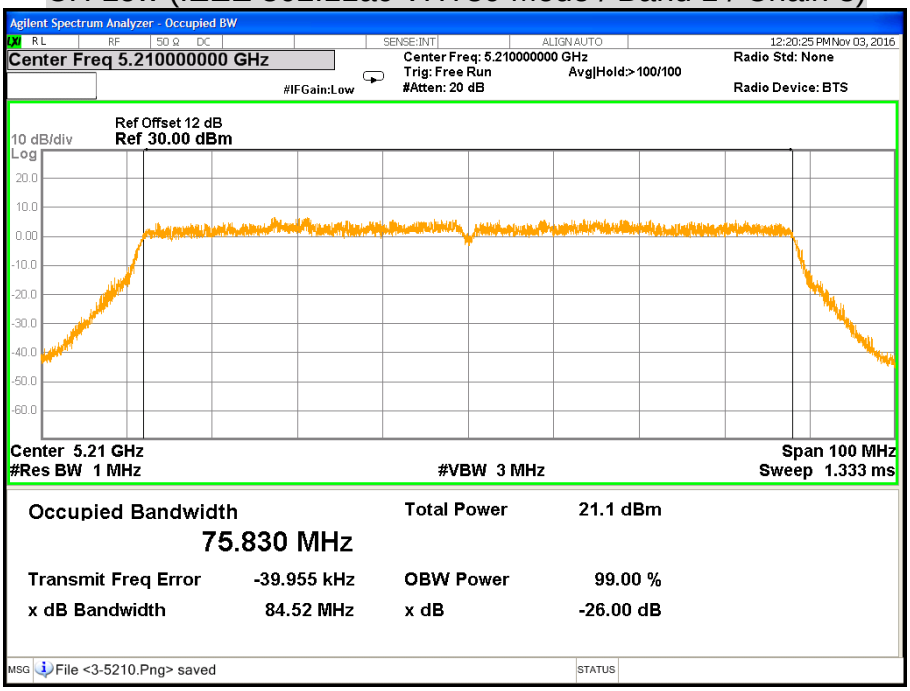
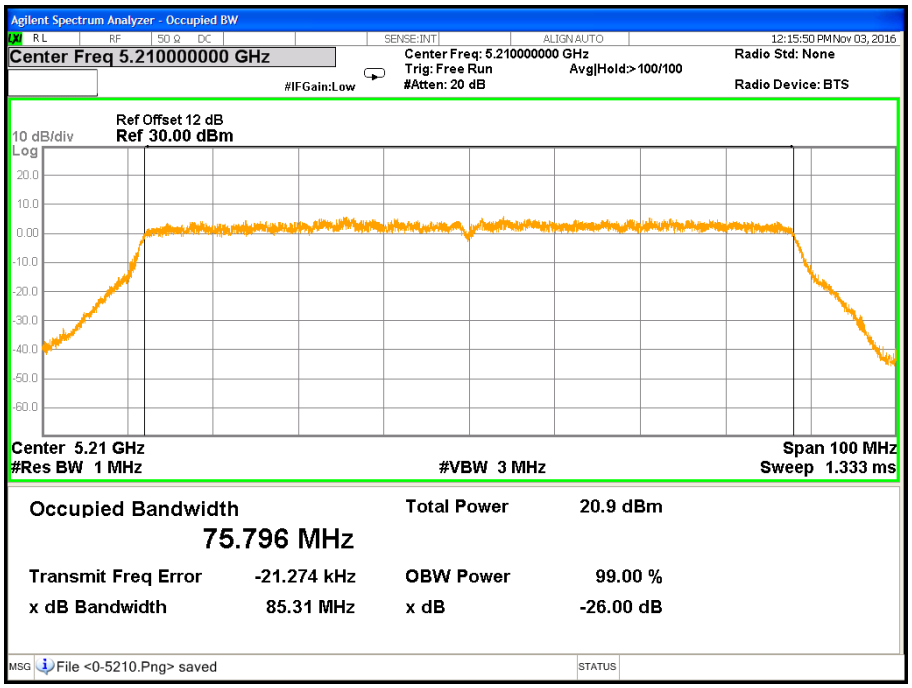


CH Low (IEEE 802.11ac VHT160 Mode / Band 1 / Chain 0)



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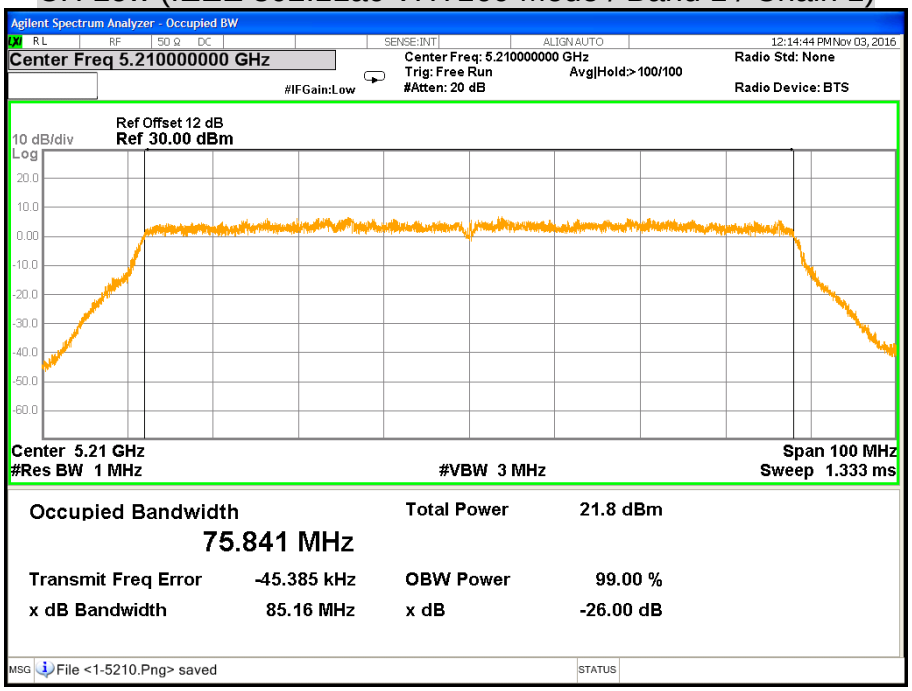
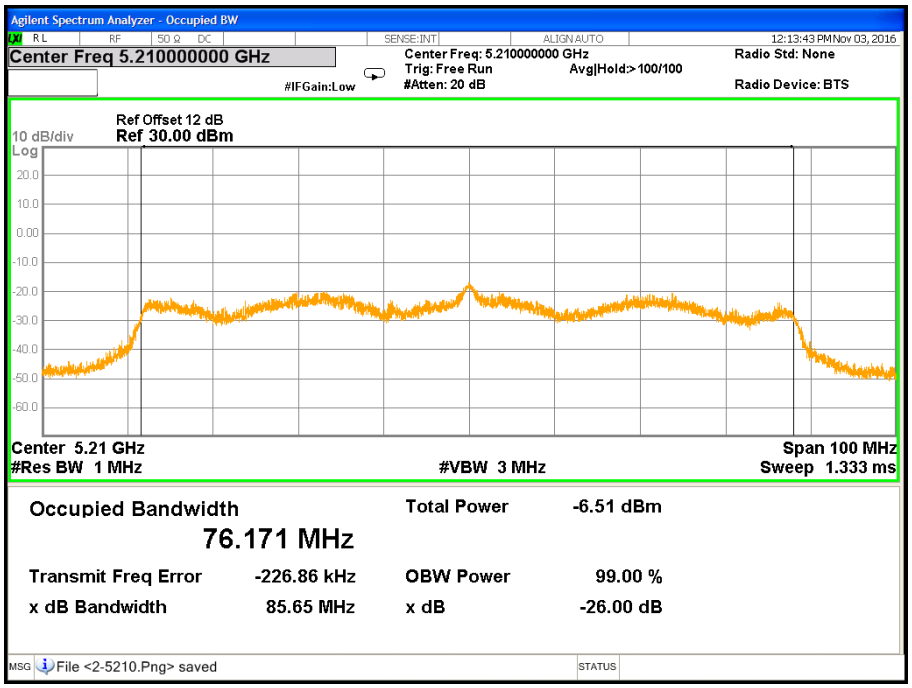
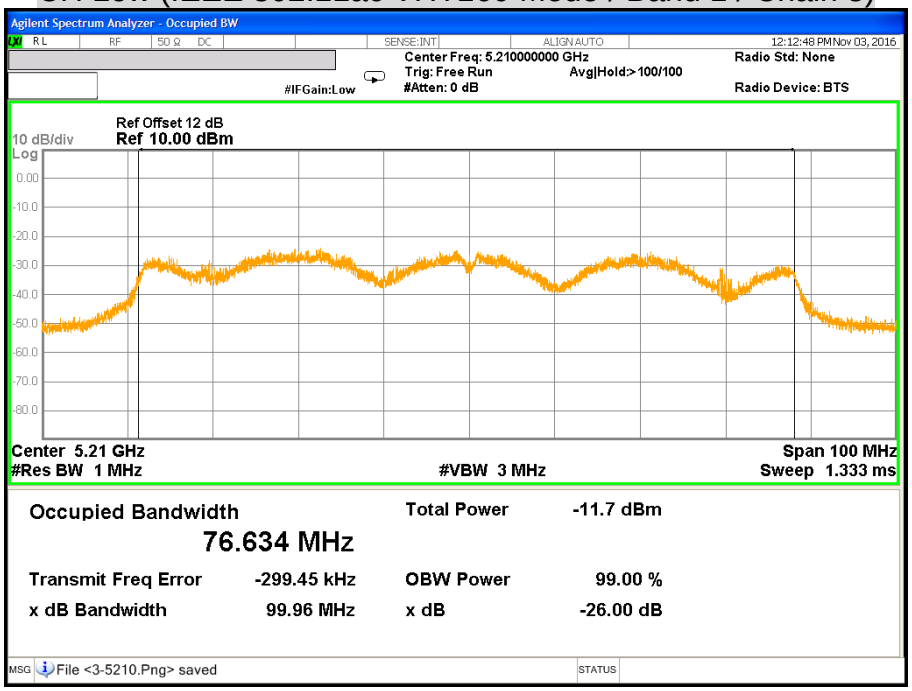


CH Low (IEEE 802.11ac VHT160 Mode / Band 1 / Chain 2)



CH Low (IEEE 802.11ac VHT160 Mode / Band 1 / Chain 3)



7.3 6dB BANDWIDTH

LIMITS

According to§ 15.407 (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 EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Signal Analyzer	Agilent	N9010A	MY52220817	03/15/2017
Test S/W	N/A			

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100kHz, VBW = 300kHz, Sweep = auto.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

Product Name	DOCSIS 3.1 wifi Gateway	Test By	Davis Tseng
Test Model	CODA-4782	Test Date	2016/09/22
Test Mode	TX Mode / Non-beamforming	Temp. & Humidity	20°C, 63%

IEEE 802.11a Mode (4TX)

UNII Band	Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
Band 3	Low	5745	16.360	16.340	16.320	16.300	500
	Middle	5785	16.330	16.290	16.320	16.280	500
	High	5825	16.360	16.310	16.270	16.340	500

IEEE 802.11ac VHT20 Mode (4TX)

UNII Band	Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
Band 3	Low	5745	17.080	17.570	17.400	17.540	500
	Middle	5785	16.860	17.100	17.080	17.550	500
	High	5825	17.390	17.550	17.570	17.580	500

IEEE 802.11ac VHT40 Mode (4TX)

UNII Band	Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
Band 3	Low	5755	35.440	32.140	34.590	34.880	500
	High	5795	35.470	30.860	34.040	34.960	500

IEEE 802.11ac VHT80 Mode (4TX)

UNII Band	Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
Band 3	Low	5775	75.180	71.690	75.740	72.980	500

IEEE 802.11ac VHT160 Mode (4TX)

UNII Band	Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
Band 3	Low	5775	73.180	73.510	75.590	72.400	500

Product Name	DOCSIS 3.1 wifi Gateway	Test By	Davis Tseng
Test Model	CODA-4782	Test Date	2016/09/22
Test Mode	TX Mode / Beamforming	Temp. & Humidity	20°C, 63%

IEEE 802.11a Mode (4TX)

UNII Band	Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
Band 3	Low	5745	16.290	16.350	16.310	16.320	500
	Middle	5785	16.300	16.320	16.280	16.340	500
	High	5825	16.320	16.320	16.310	16.300	500

IEEE 802.11ac VHT20 Mode (4TX)

UNII Band	Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
Band 3	Low	5745	17.590	17.700	17.590	17.550	500
	Middle	5785	17.640	17.600	17.800	17.600	500
	High	5825	17.590	17.660	17.630	17.650	500

IEEE 802.11ac VHT40 Mode (4TX)

UNII Band	Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
Band 3	Low	5755	35.650	36.130	35.960	36.340	500
	High	5795	35.510	35.390	36.040	36.290	500

IEEE 802.11ac VHT80 Mode (4TX)

UNII Band	Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
Band 3	Low	5745	76.410	72.960	76.130	74.150	500

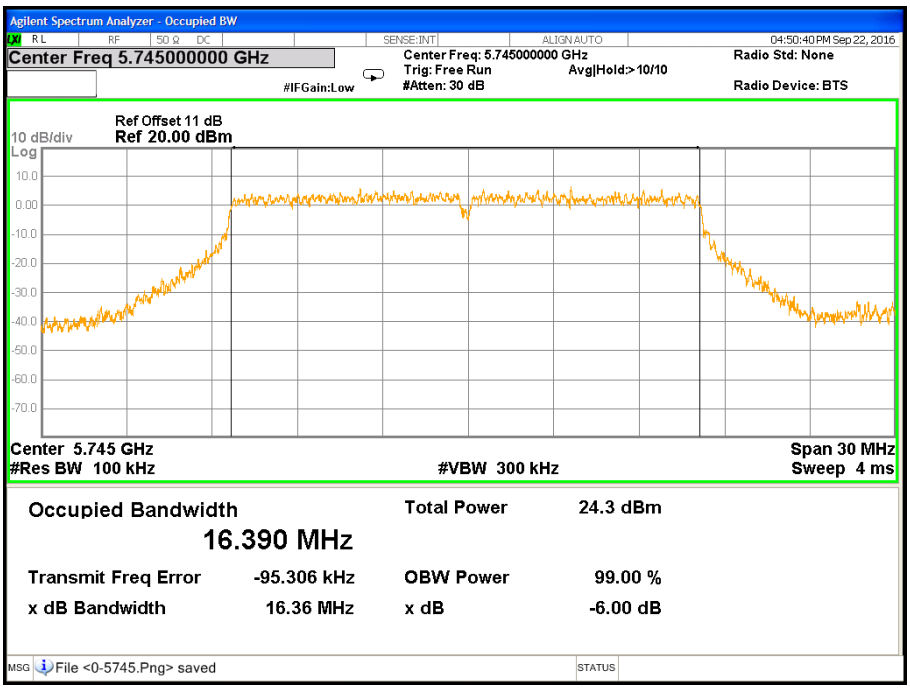
IEEE 802.11ac VHT160 Mode (4TX)

UNII Band	Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
Band 3	Low	5775	72.570	74.980	76.470	75.070	500

6dB BANDWIDTH

Non-beamforming

CH Low (IEEE 802.11a Mode / Band 3 / Chain 0)



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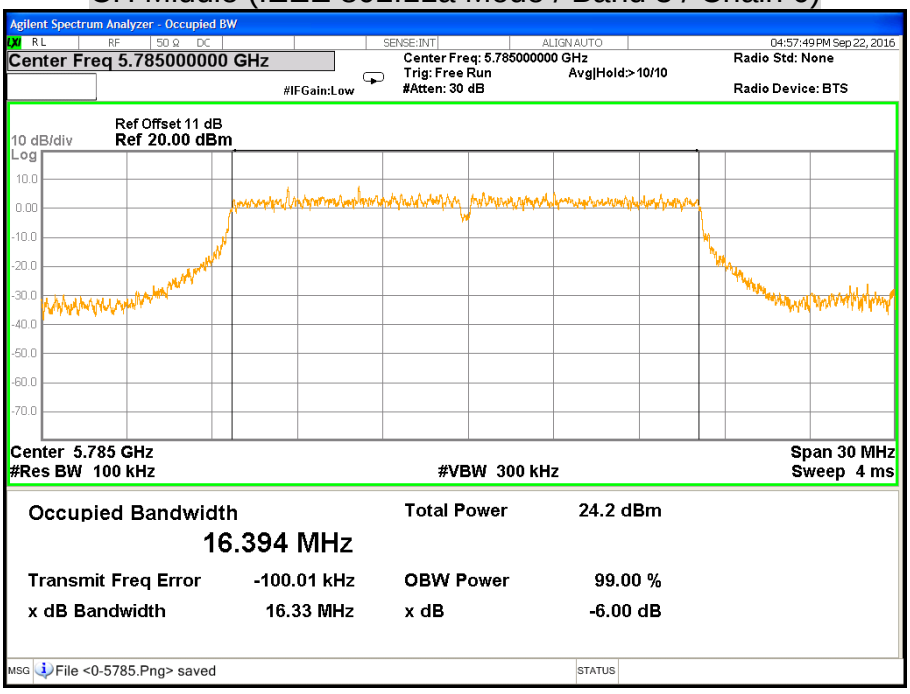
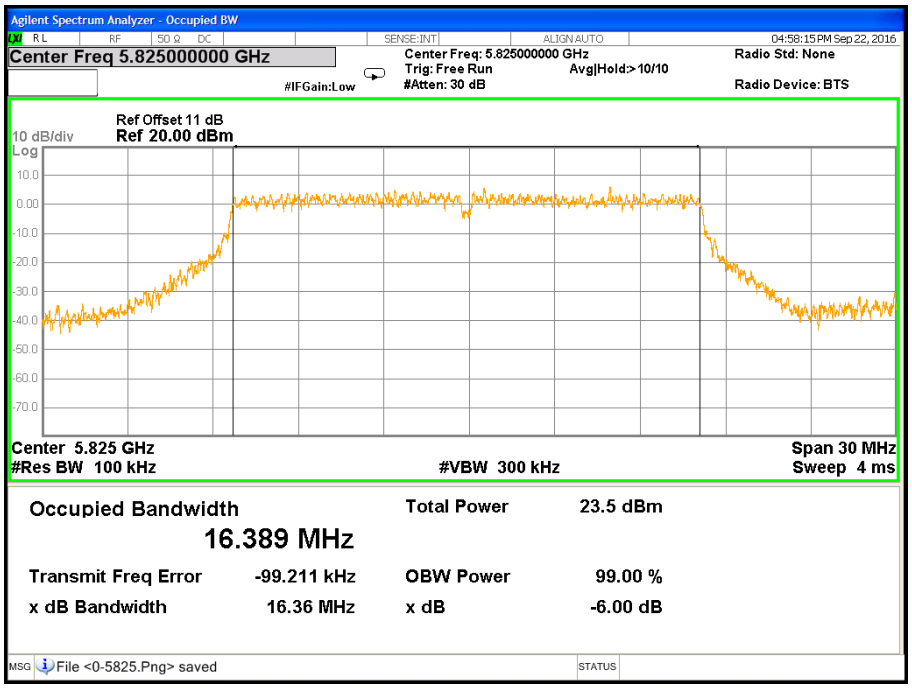
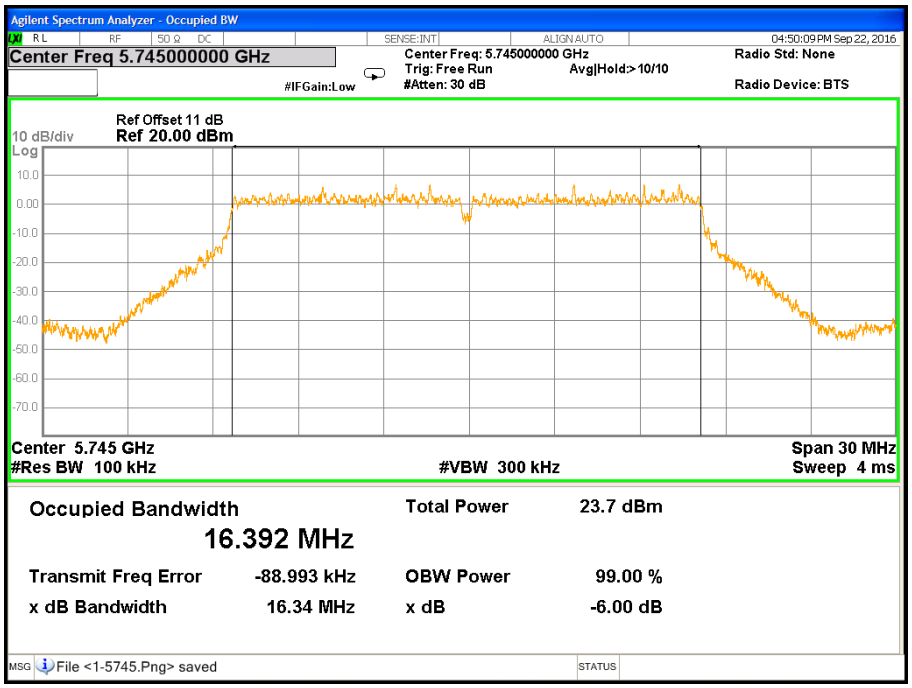


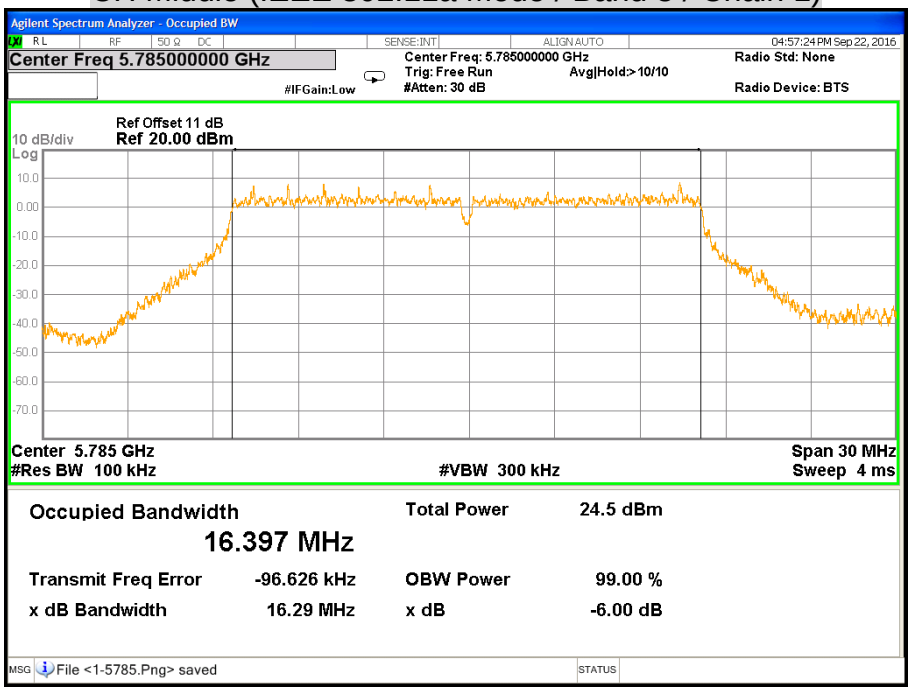
CH High (IEEE 802.11a Mode / Band 3 / Chain 0)



CH Low (IEEE 802.11a Mode / Band 3 / Chain 1)



CH Middle (IEEE 802.11a Mode / Band 3 / Chain 1)



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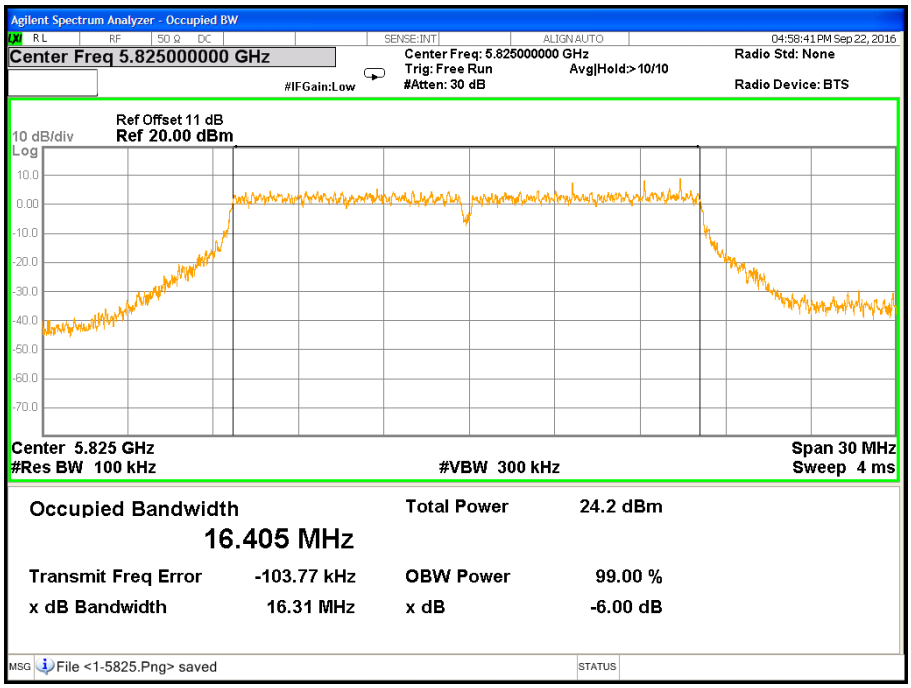

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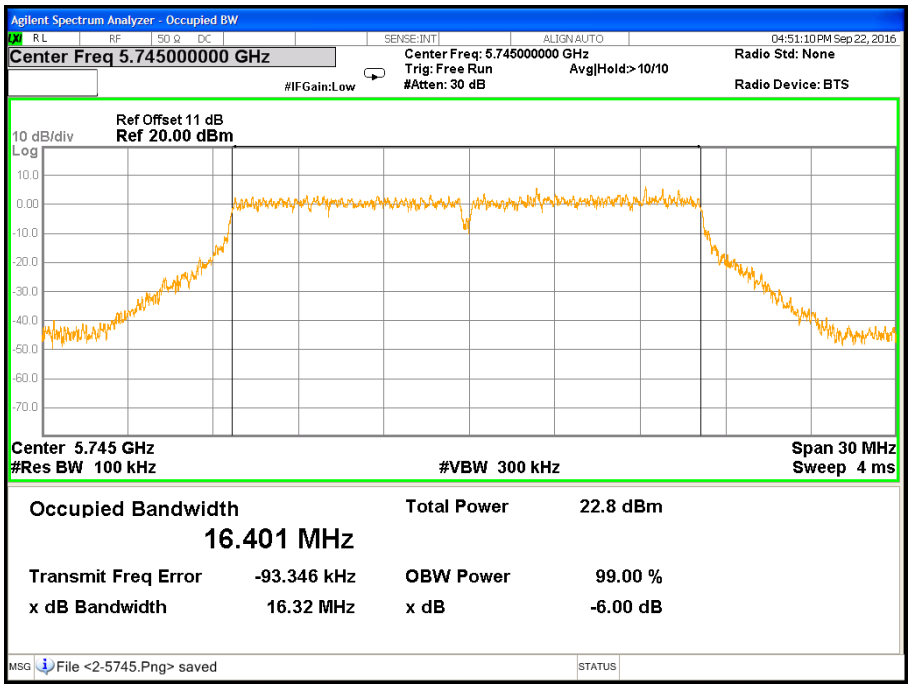

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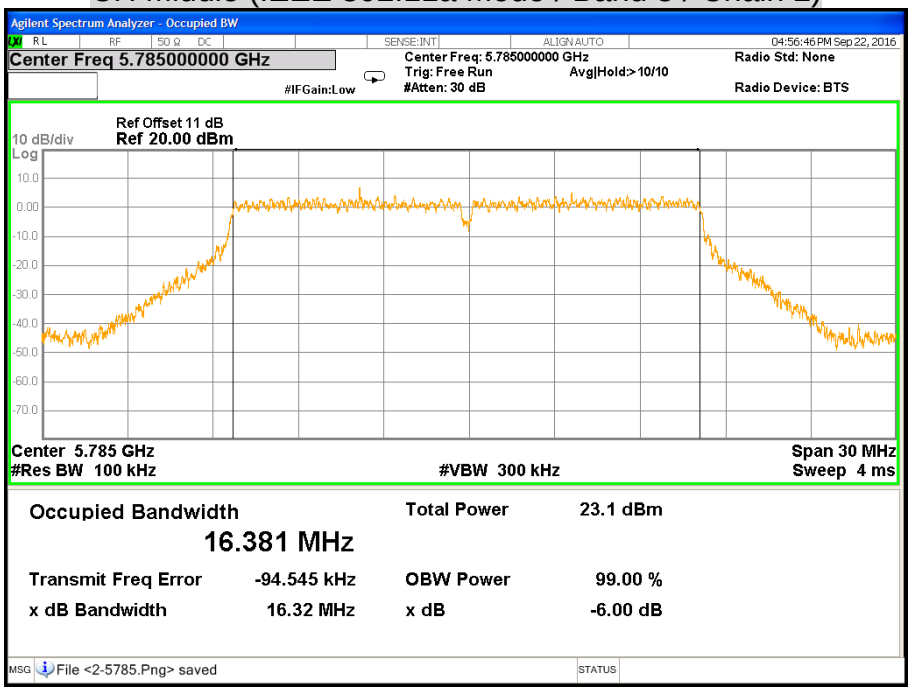

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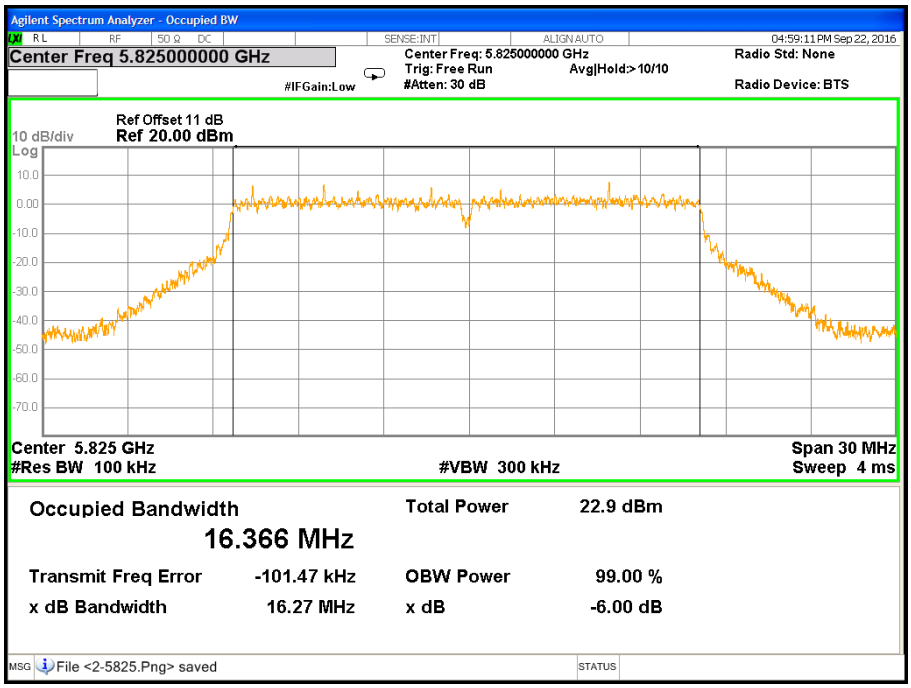

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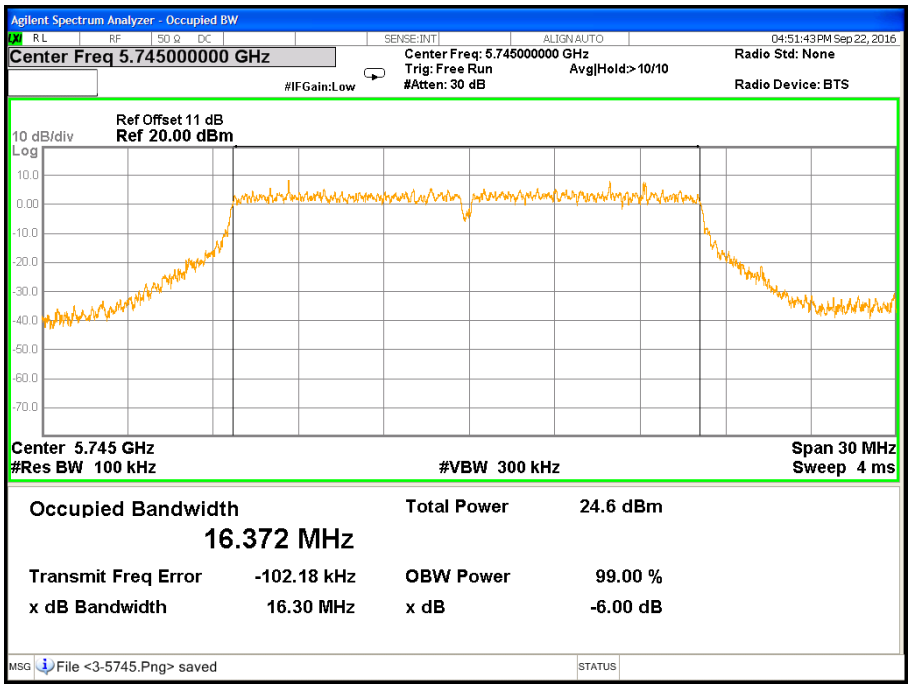

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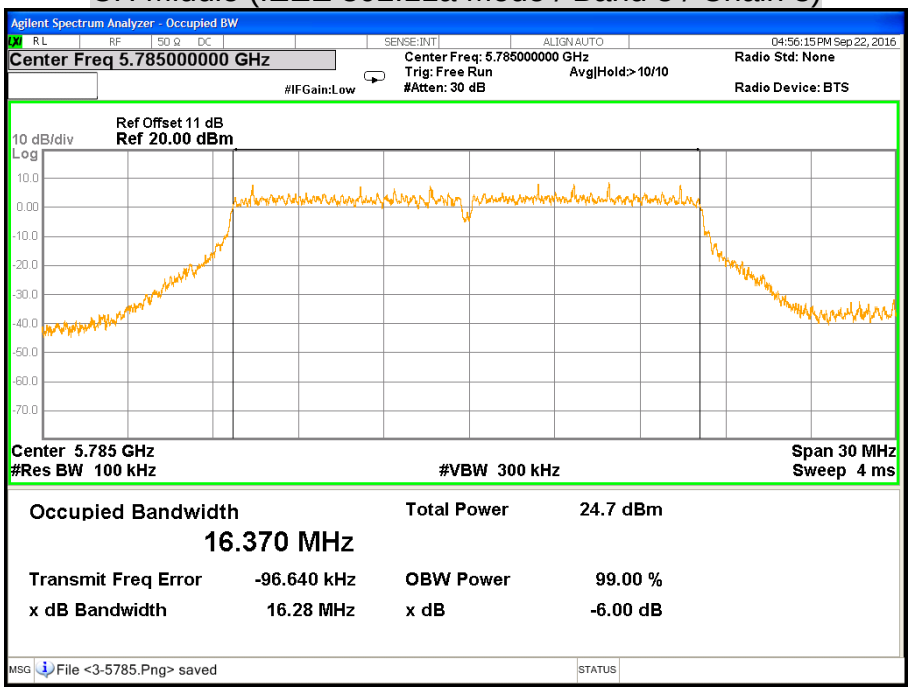
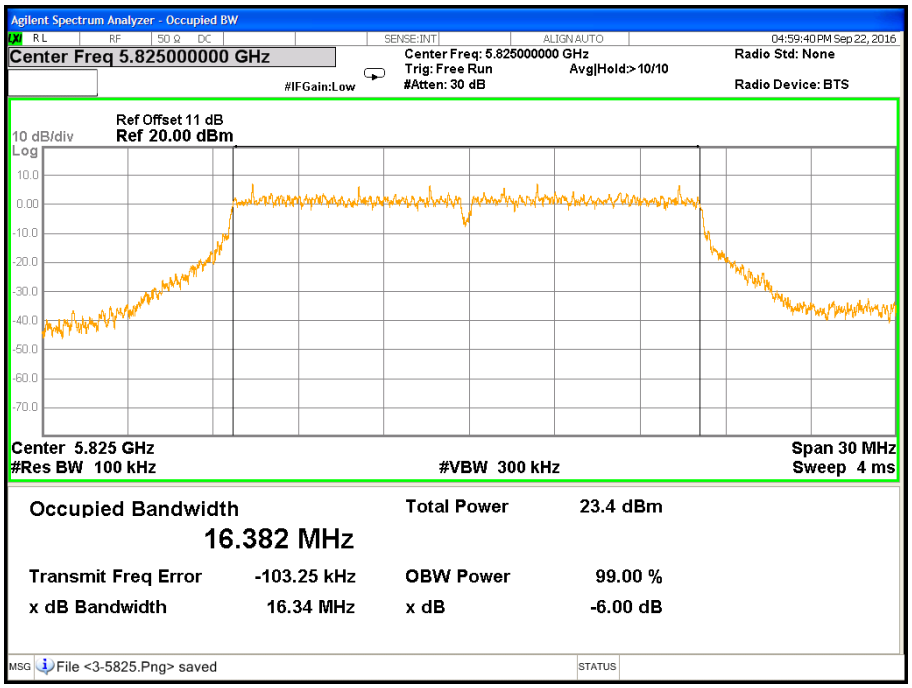
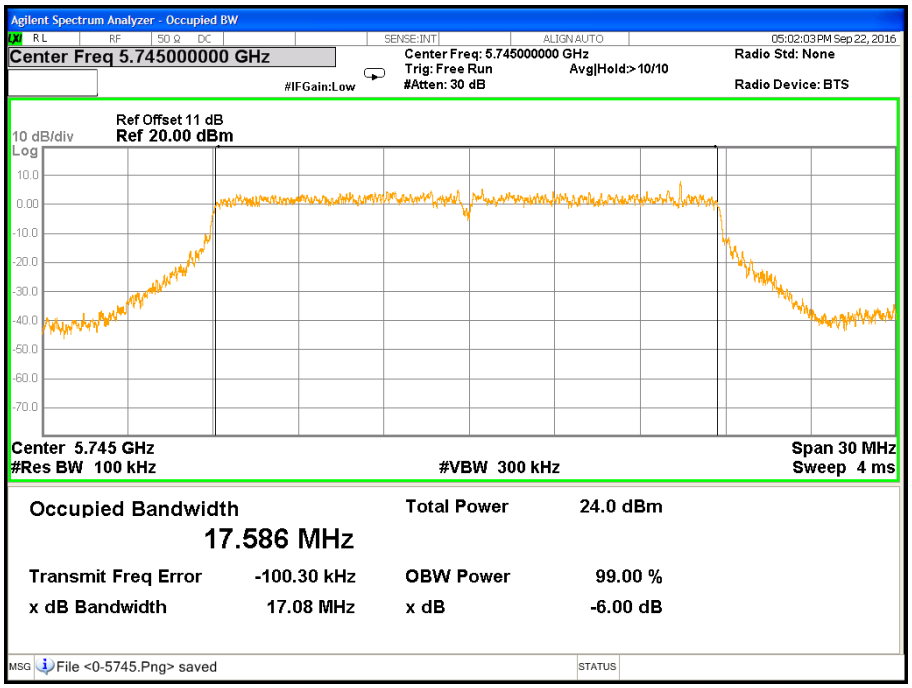


CH High (IEEE 802.11a Mode / Band 3 / Chain 3)



CH Low (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 0)



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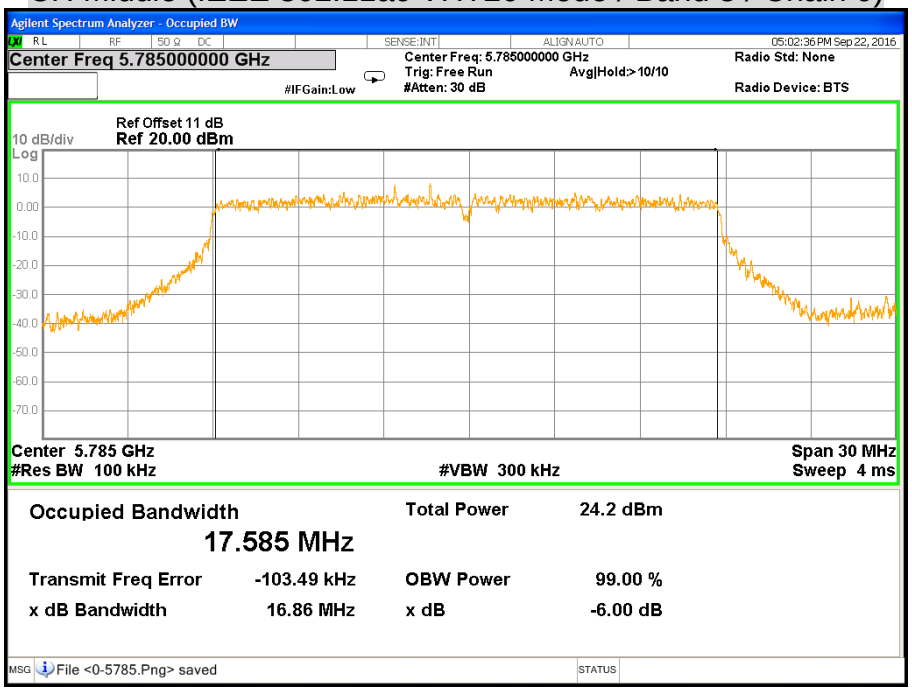

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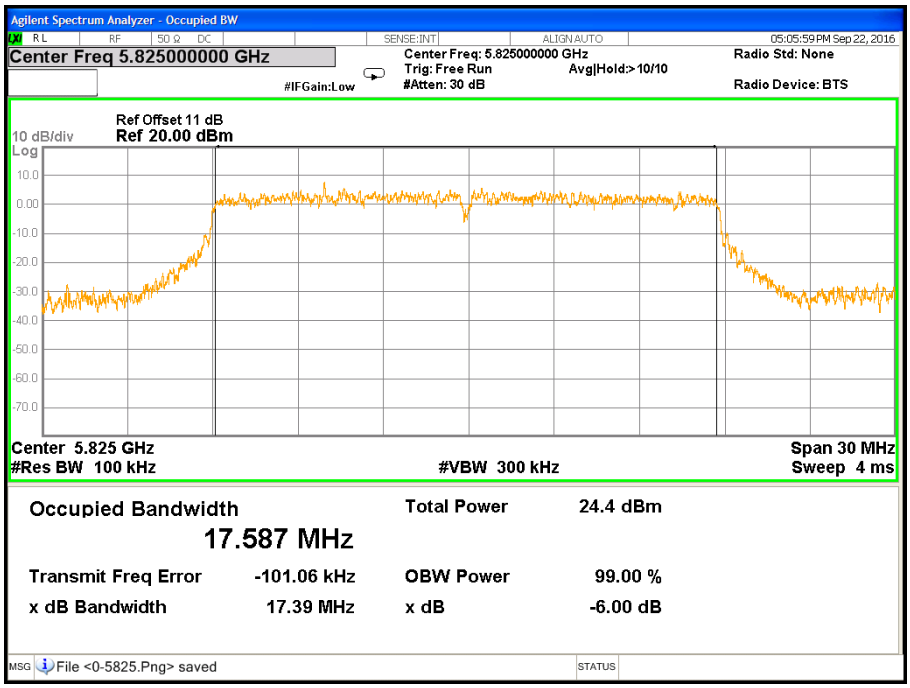
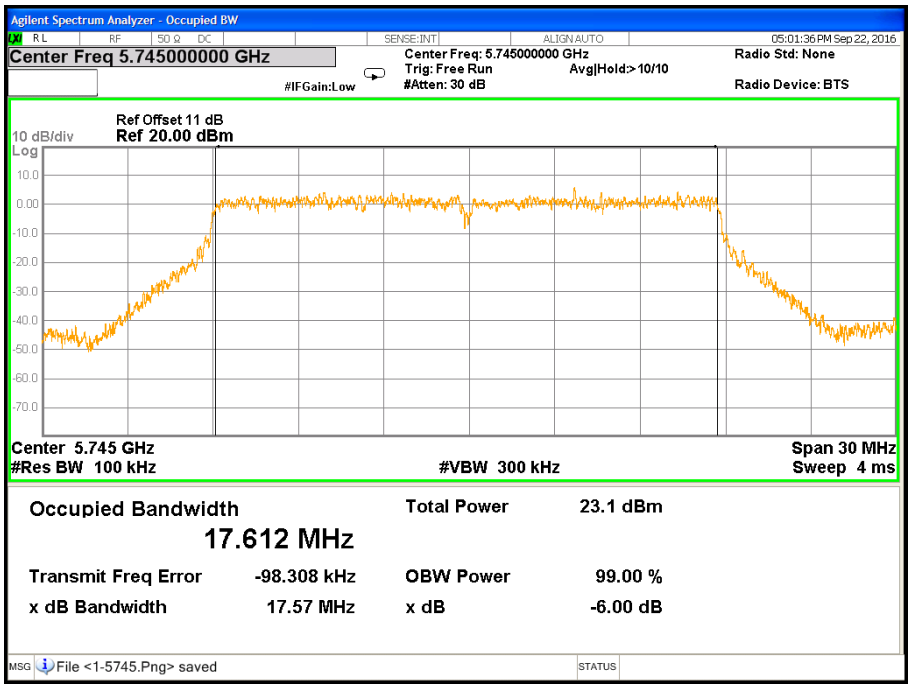


CH Low (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 1)



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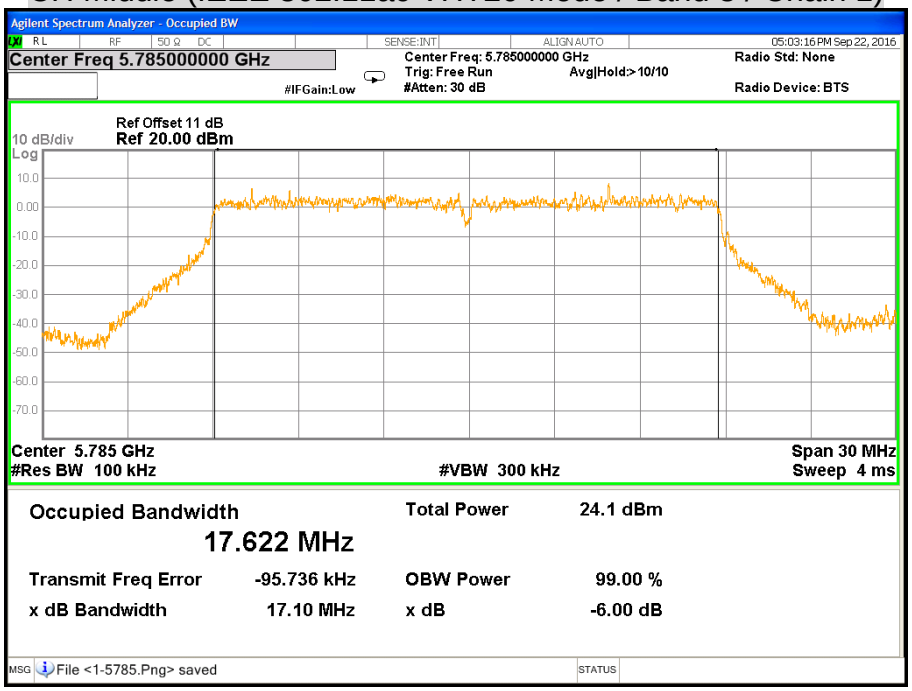

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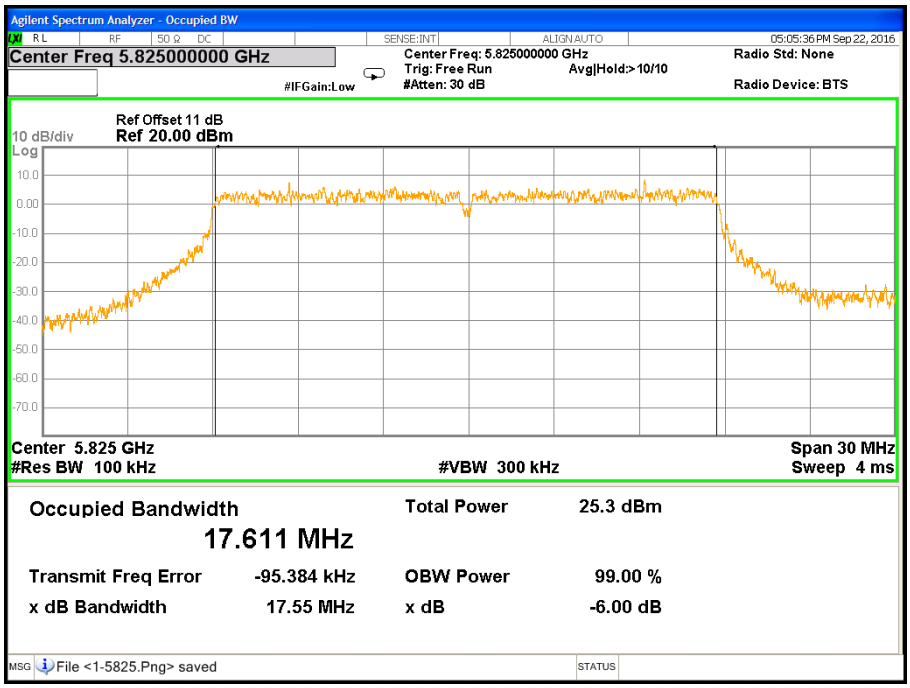

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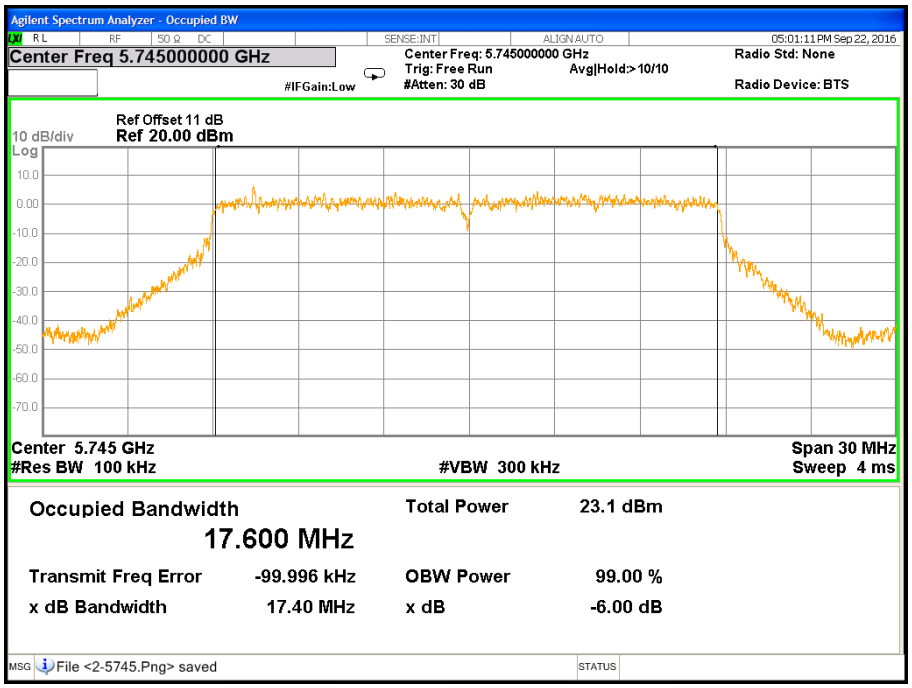

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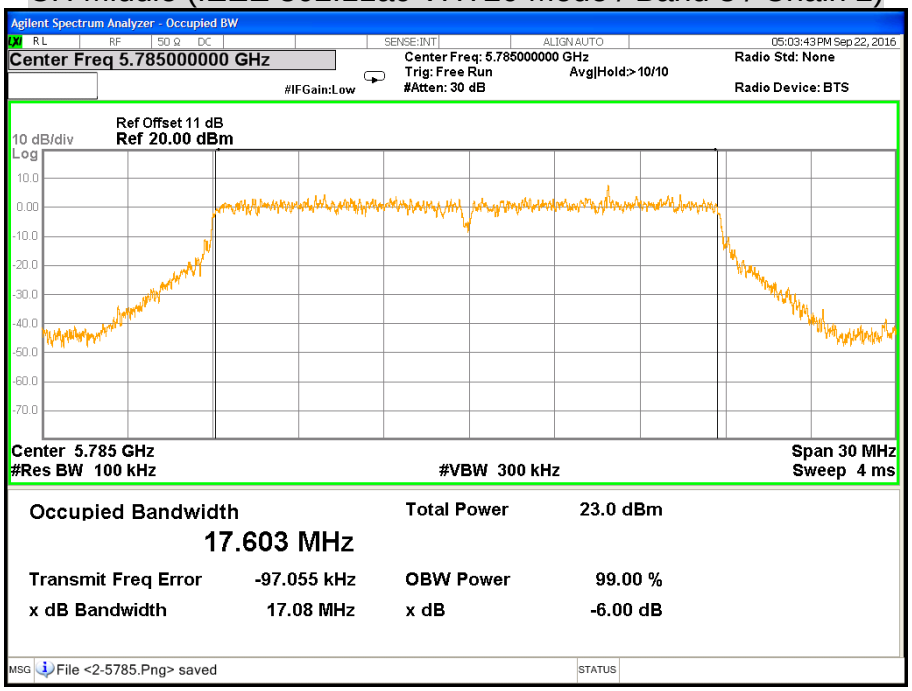
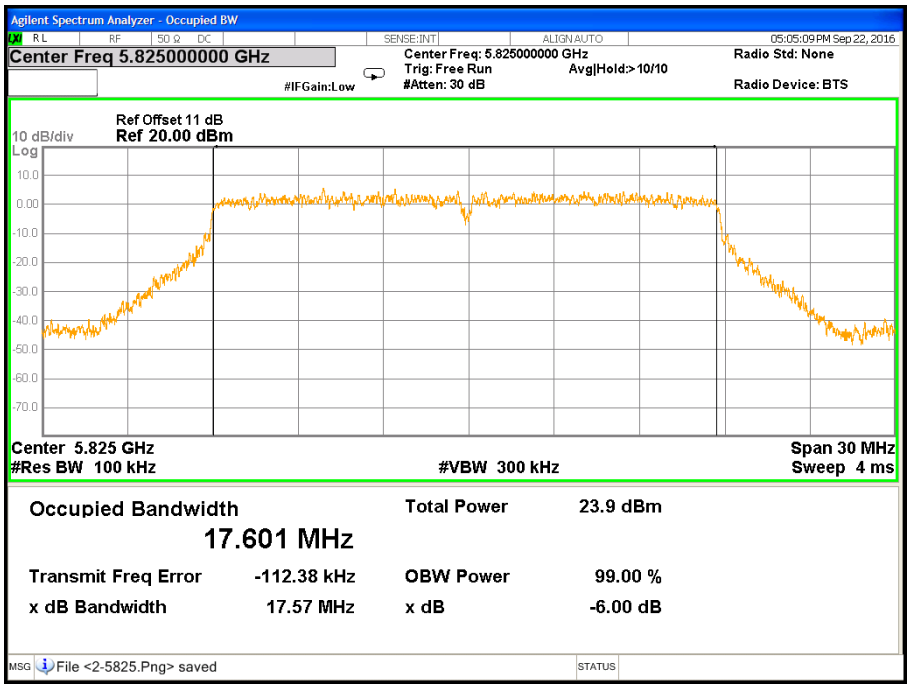
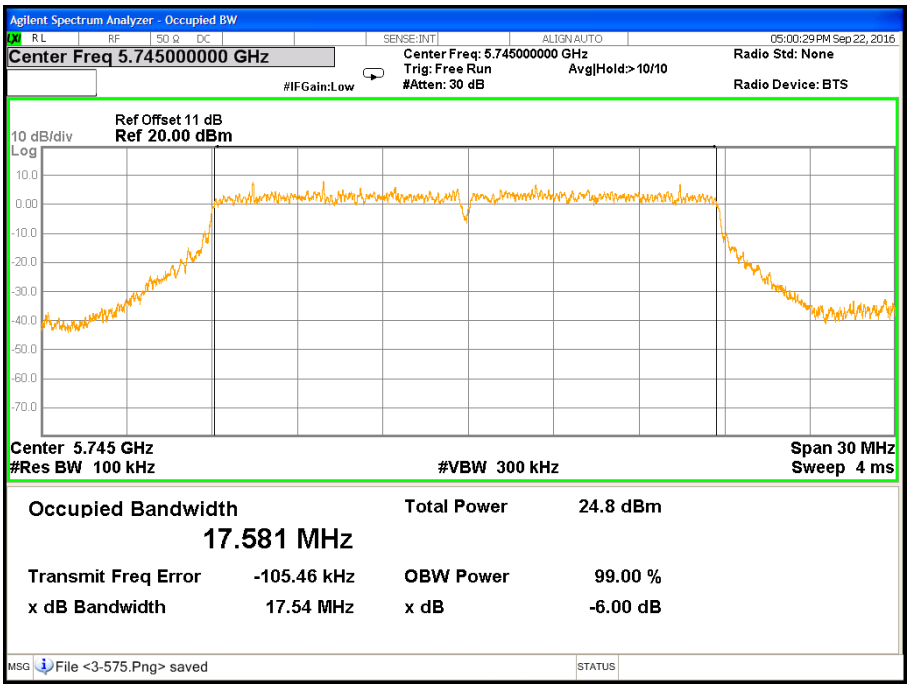


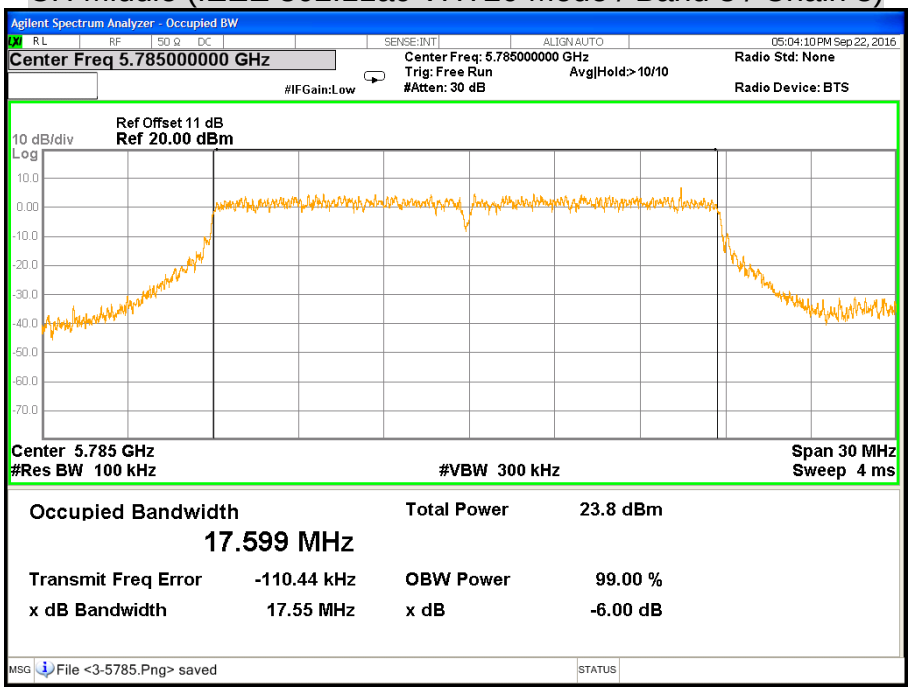
CH High (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 2)



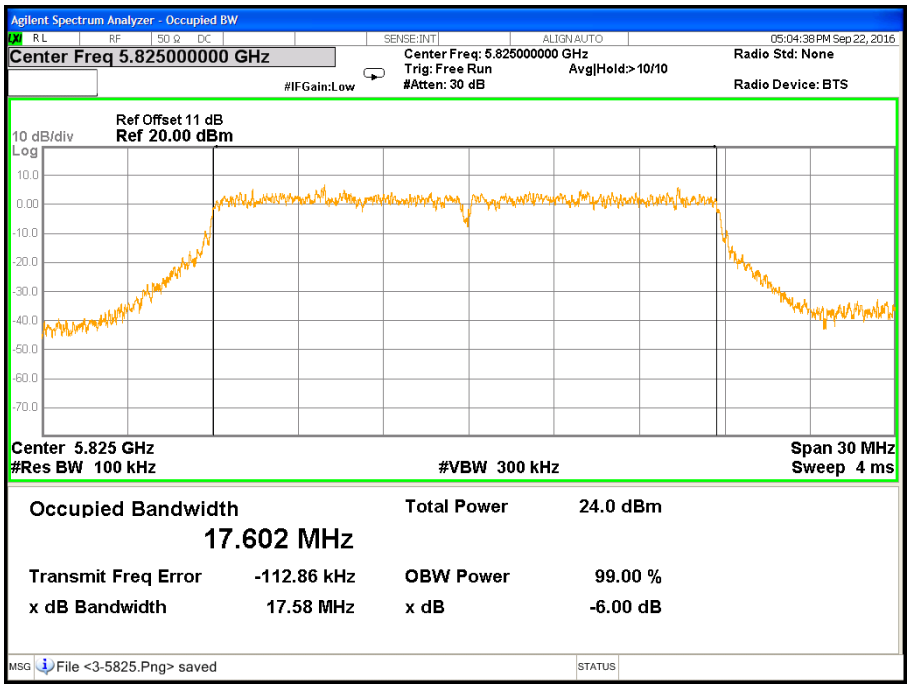
CH Low (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 3)



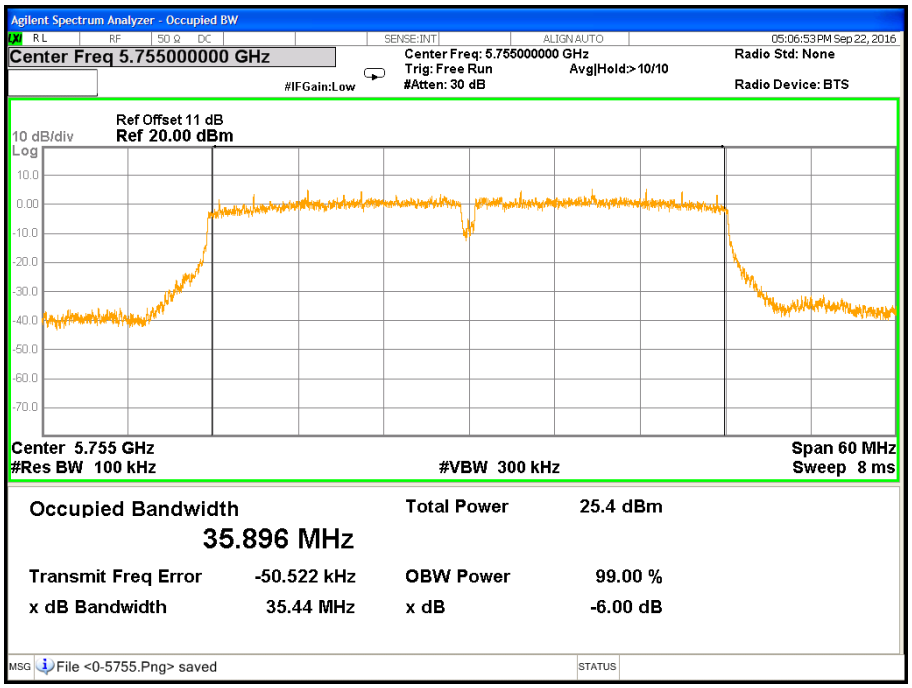
CH Middle (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 3)



CH High (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 3)



CH Low (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 0)



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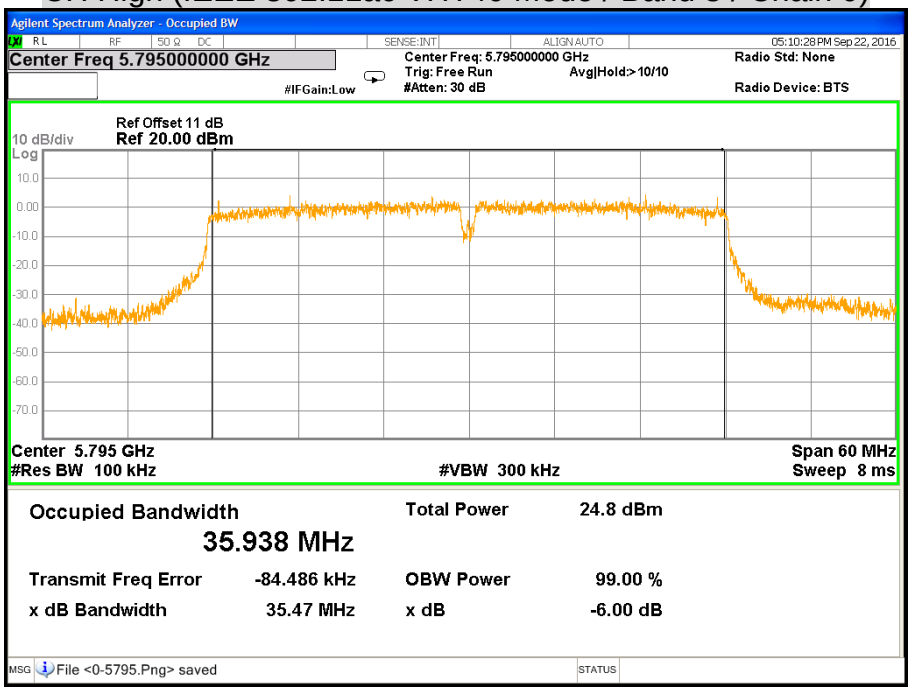

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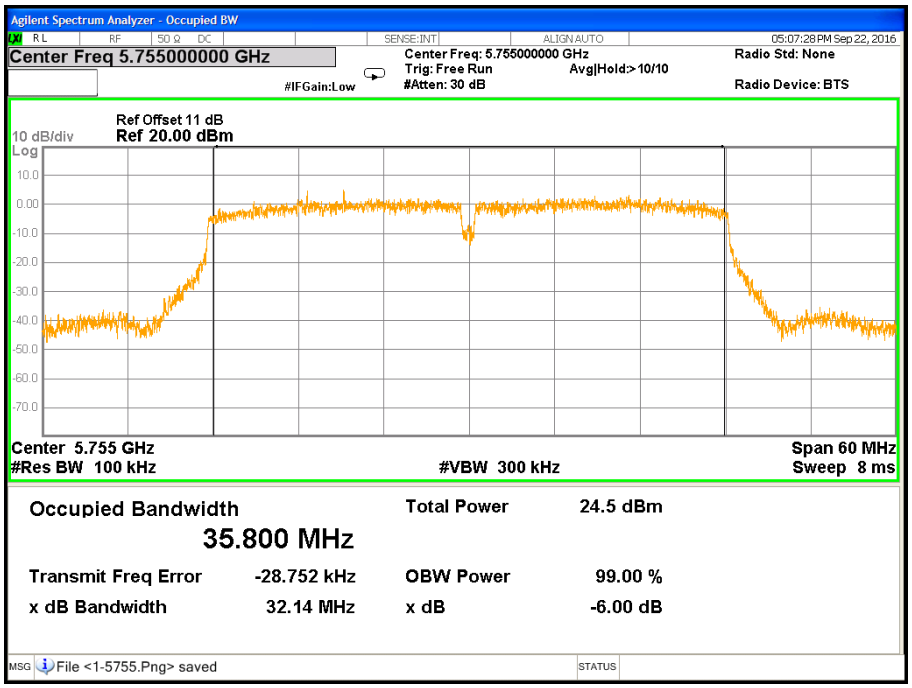

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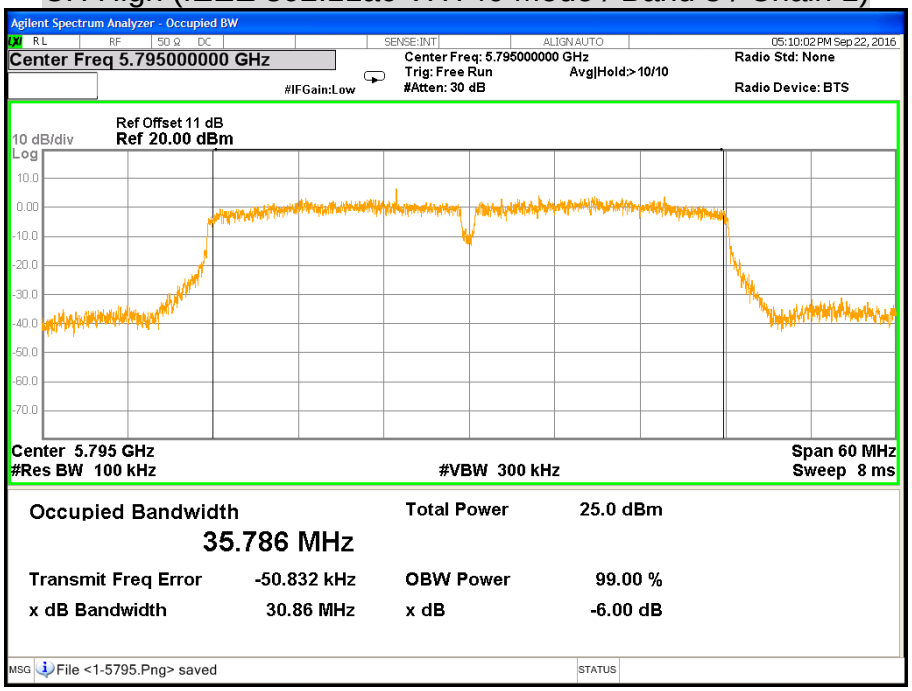

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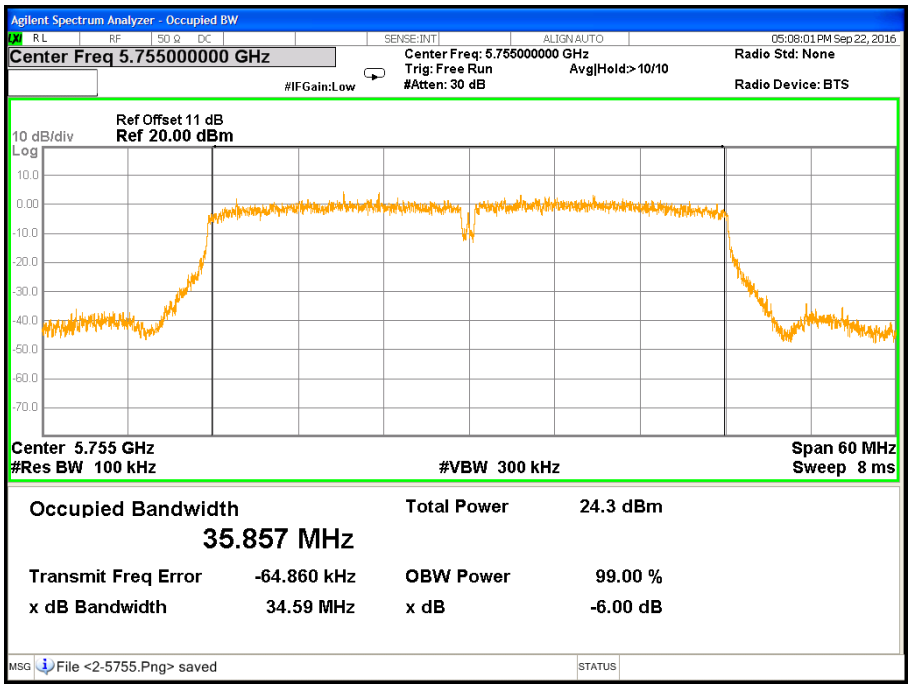

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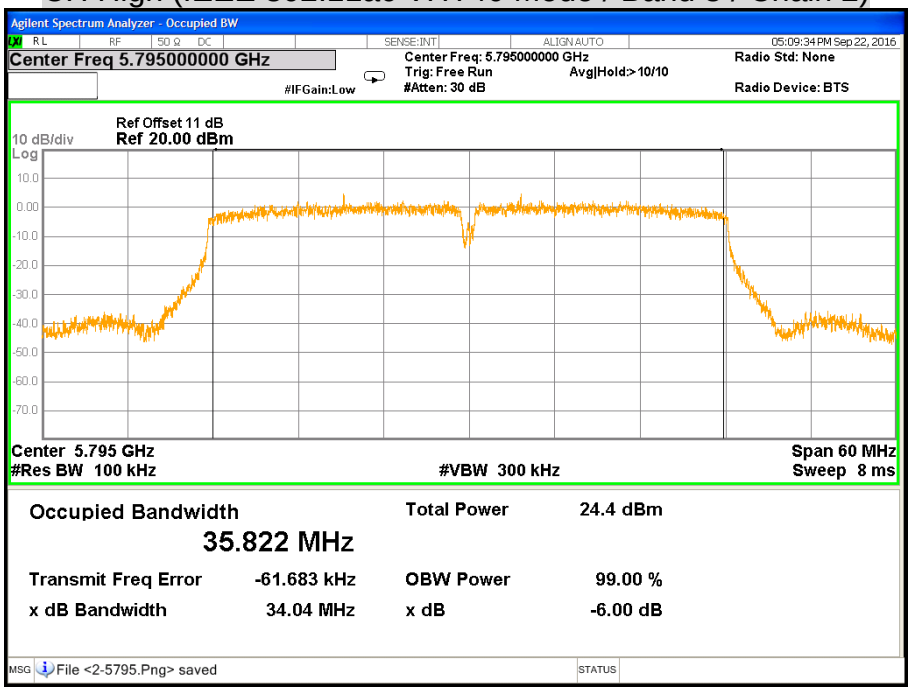
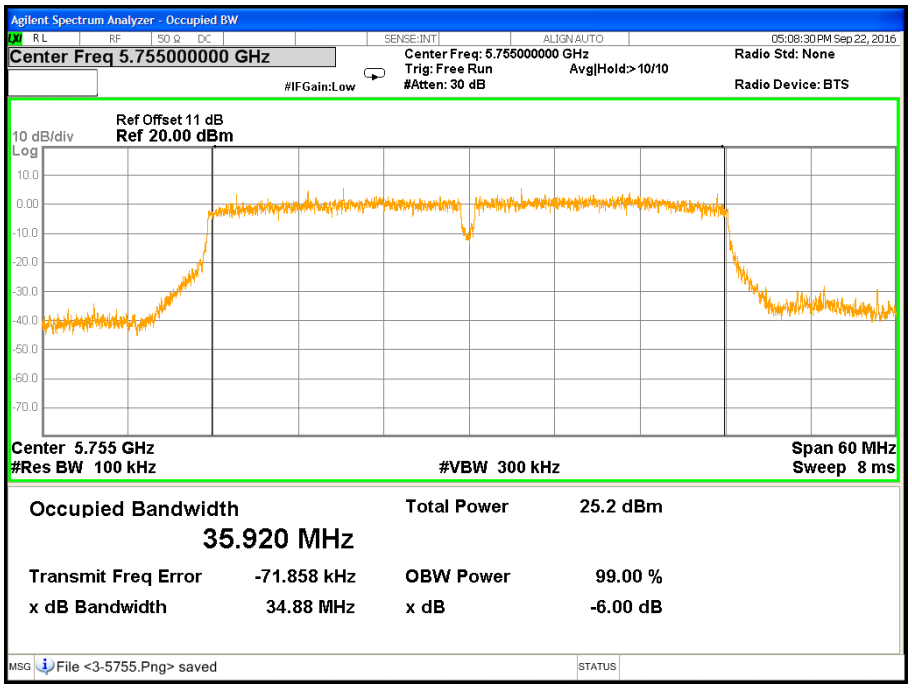
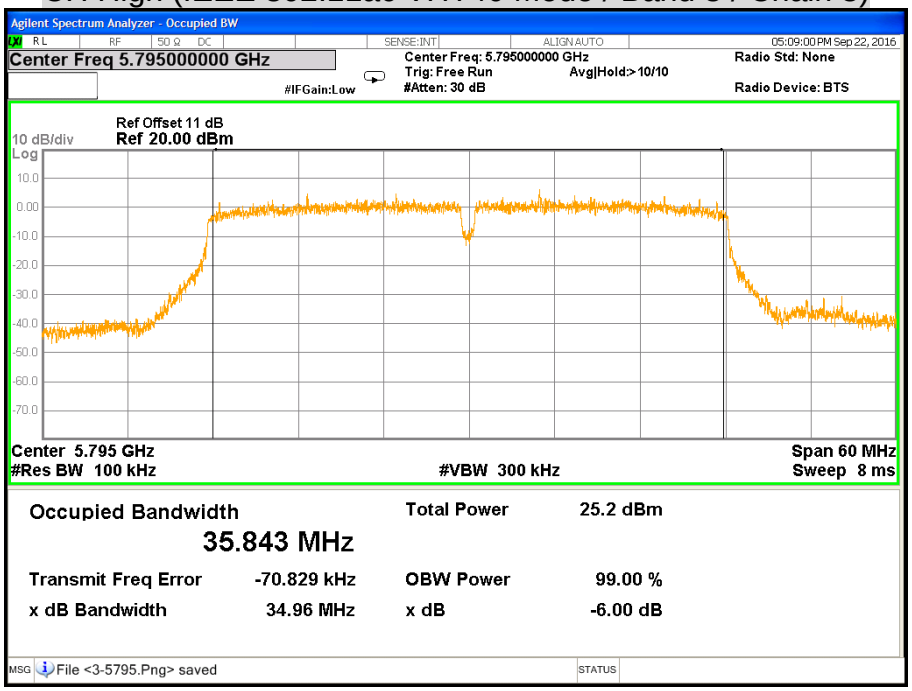


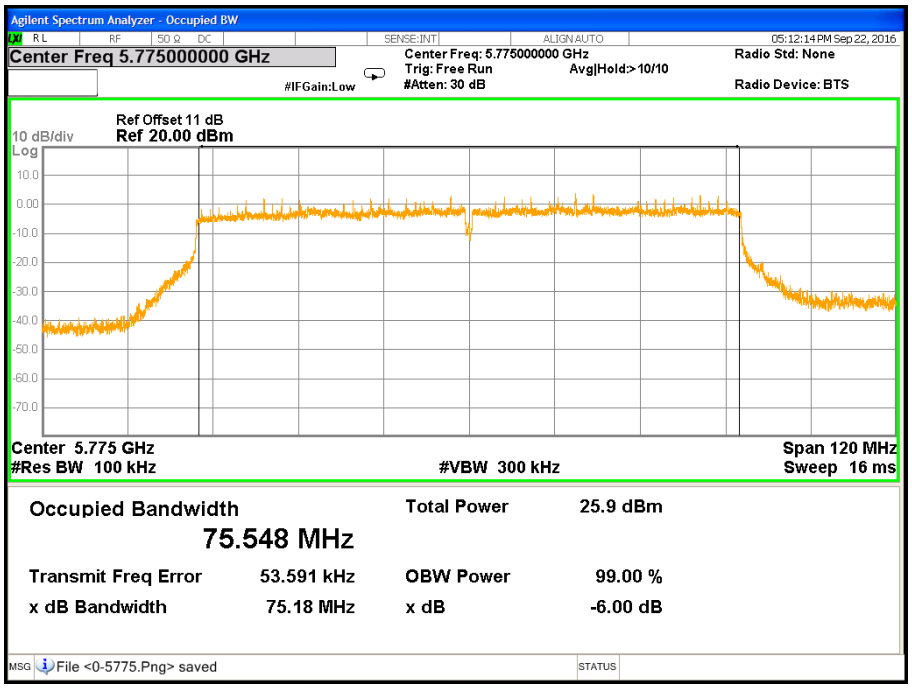
CH Low (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 3)



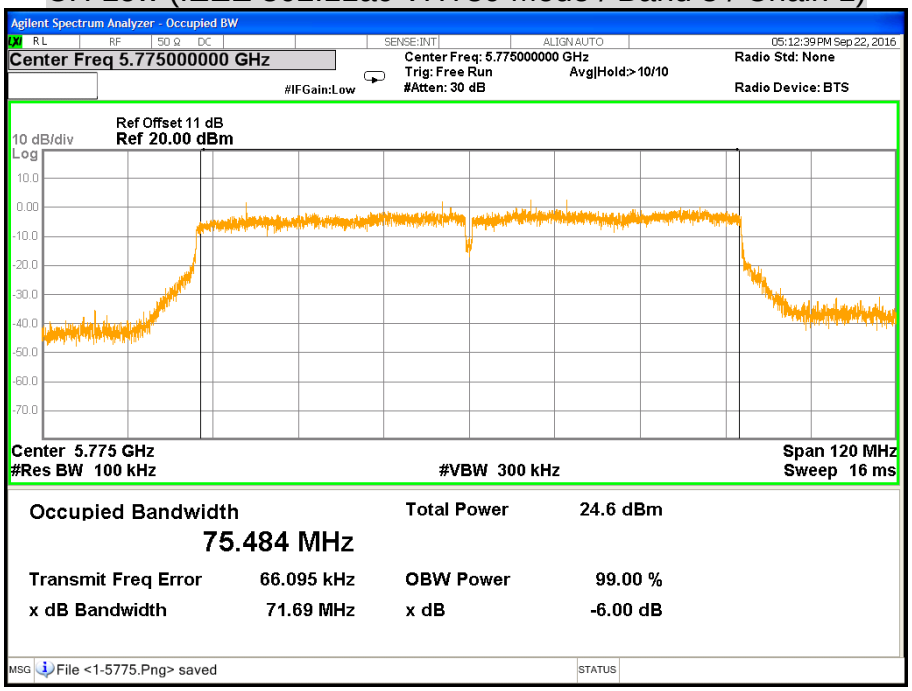
CH High (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 3)



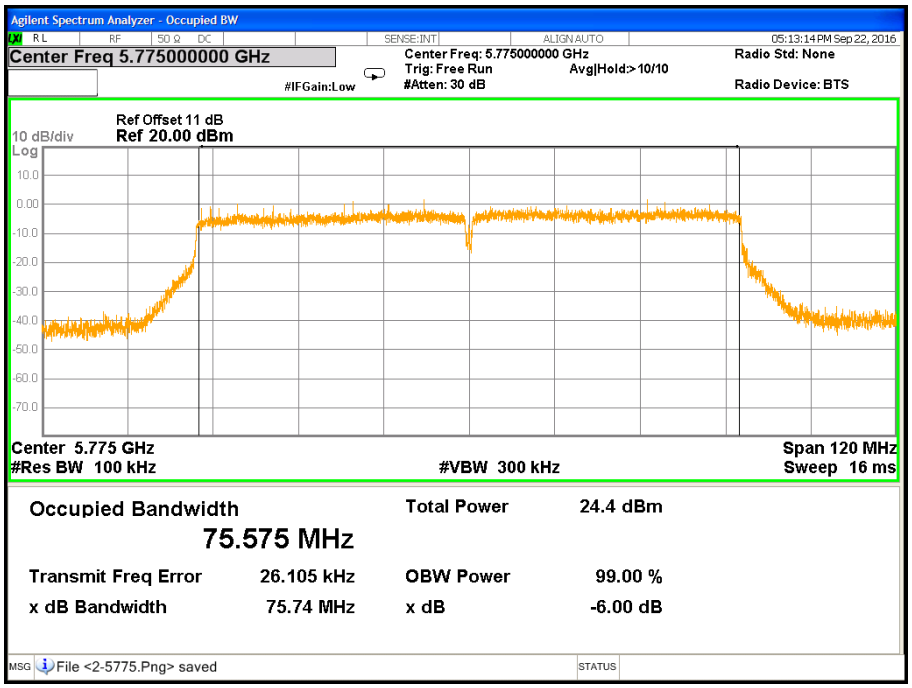
CH Low (IEEE 802.11ac VHT80 Mode / Band 3 / Chain 0)



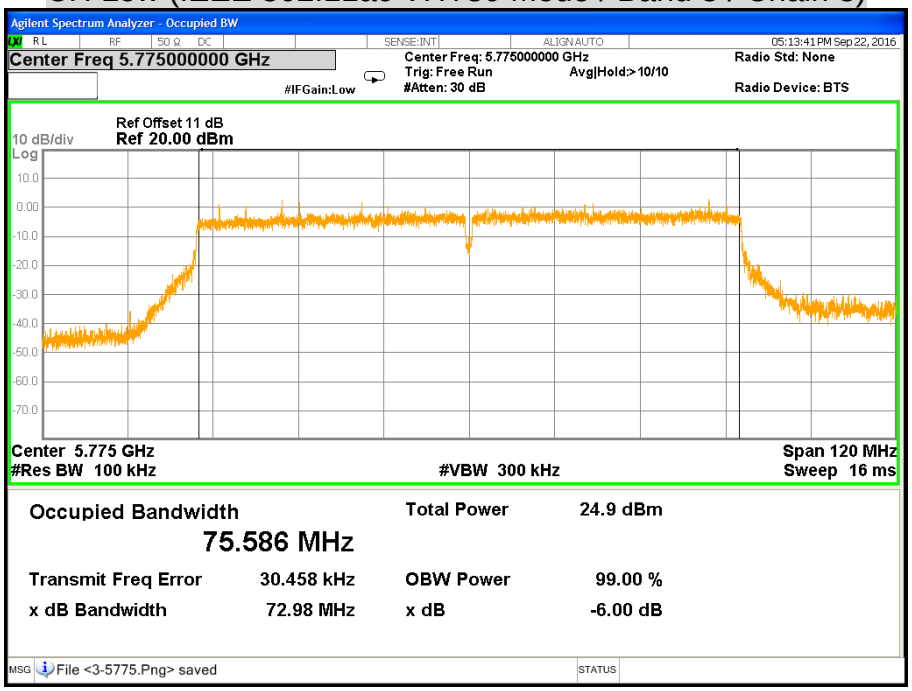
CH Low (IEEE 802.11ac VHT80 Mode / Band 3 / Chain 1)



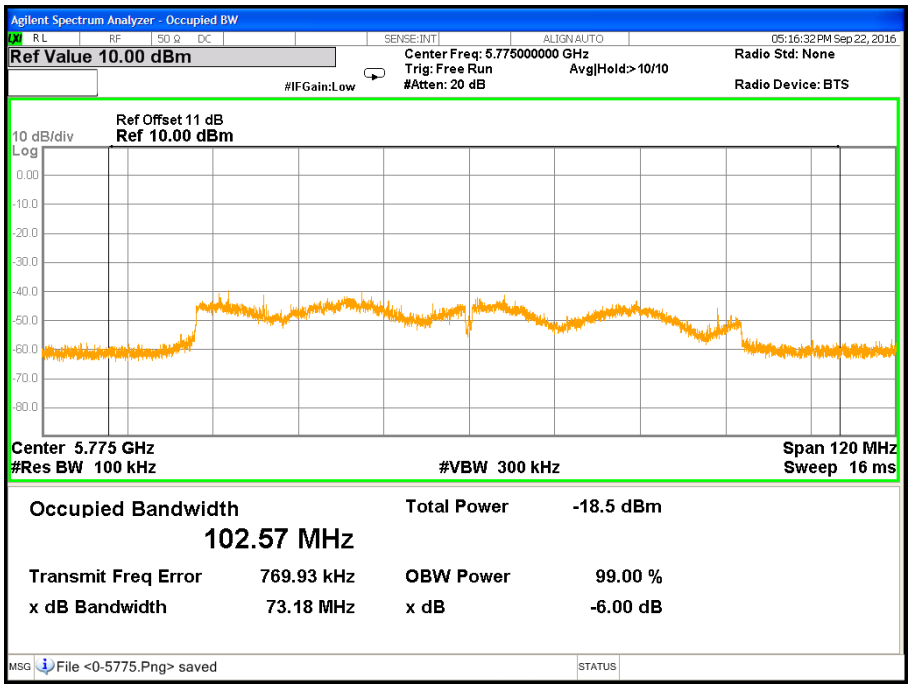
CH Low (IEEE 802.11ac VHT80 Mode / Band 3 / Chain 2)



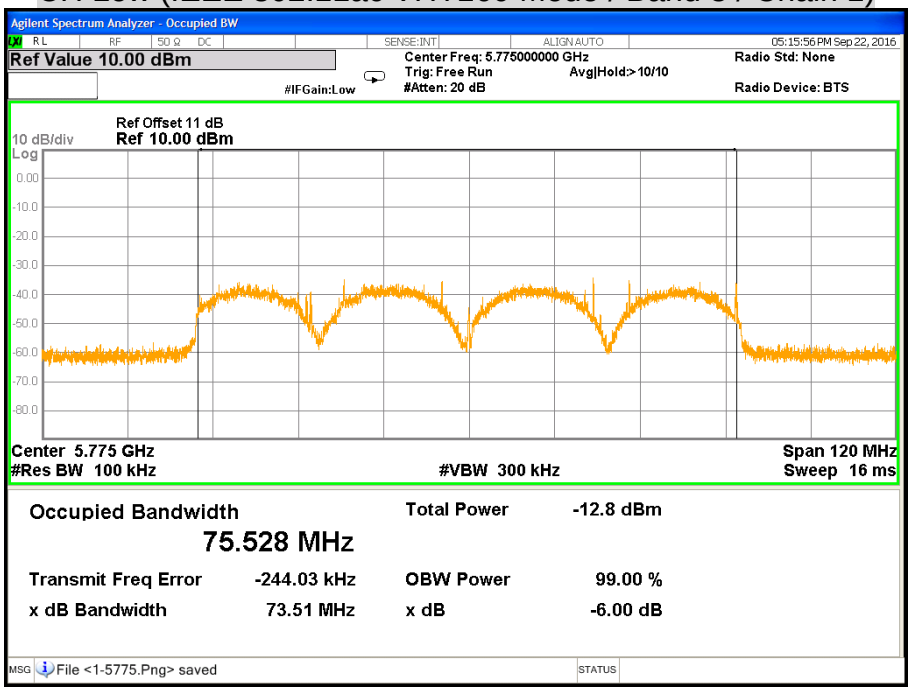
CH Low (IEEE 802.11ac VHT80 Mode / Band 3 / Chain 3)



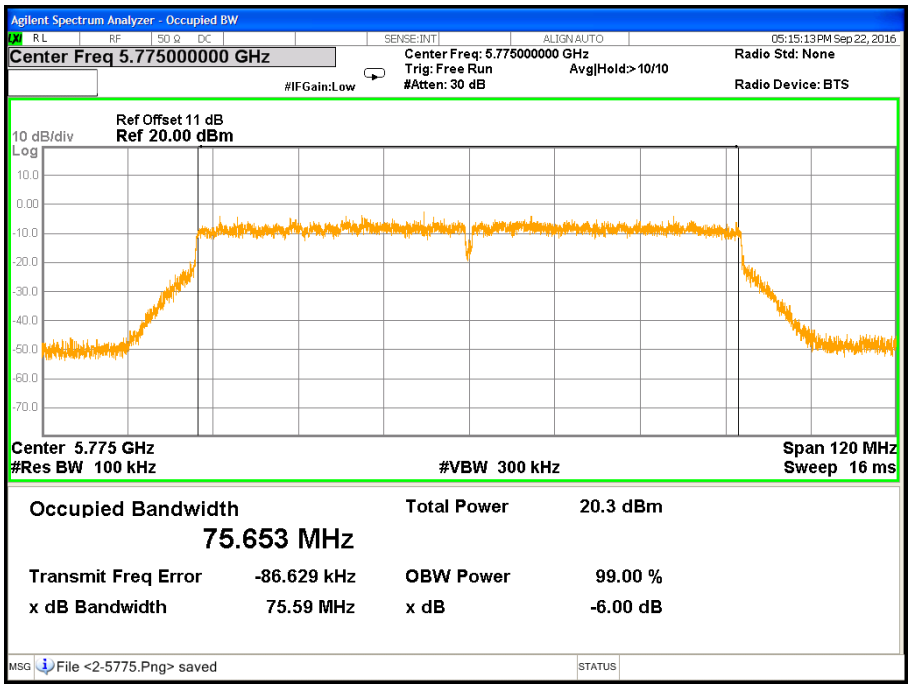
CH Low (IEEE 802.11ac VHT160 Mode / Band 3 / Chain 0)



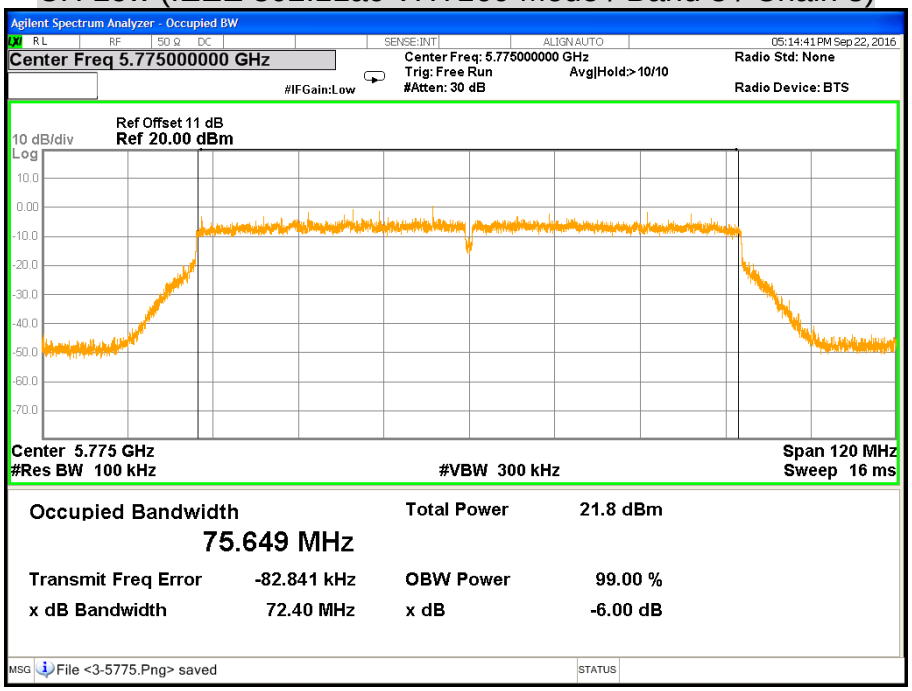
CH Low (IEEE 802.11ac VHT160 Mode / Band 3 / Chain 1)



CH Low (IEEE 802.11ac VHT160 Mode / Band 3 / Chain 2)

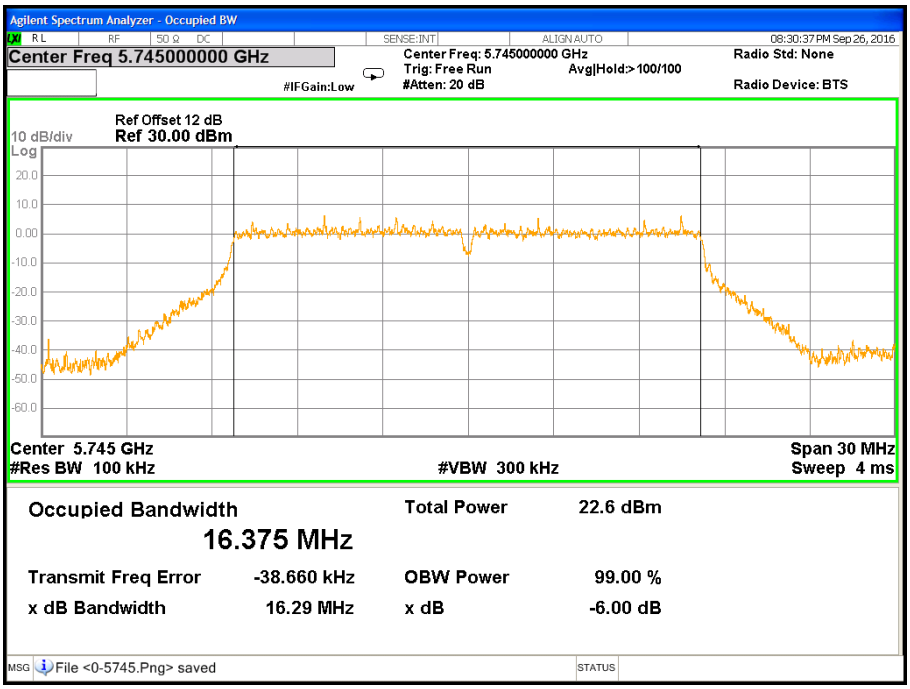


CH Low (IEEE 802.11ac VHT160 Mode / Band 3 / Chain 3)

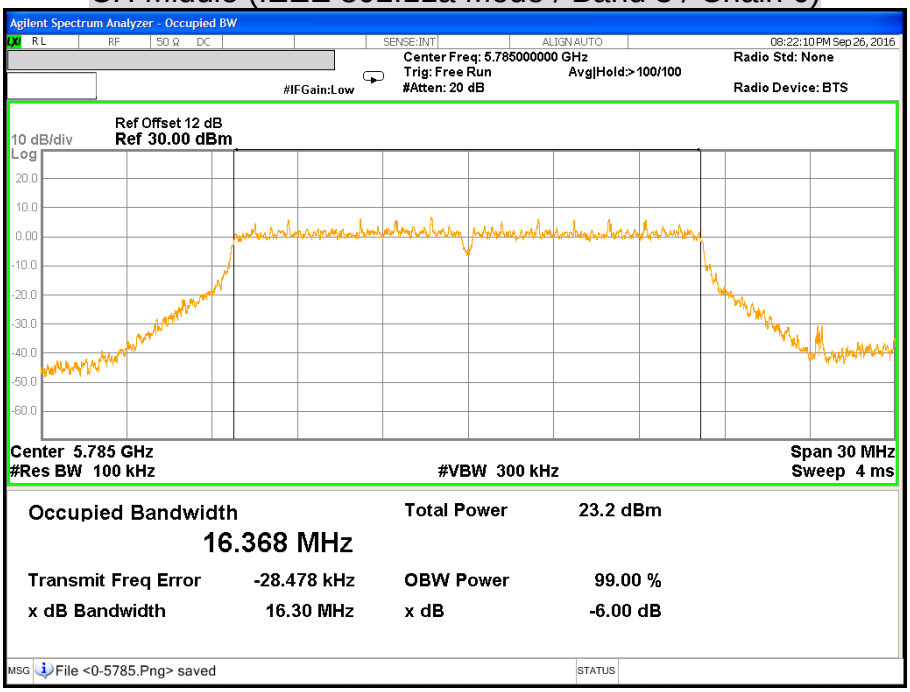


Beamforming

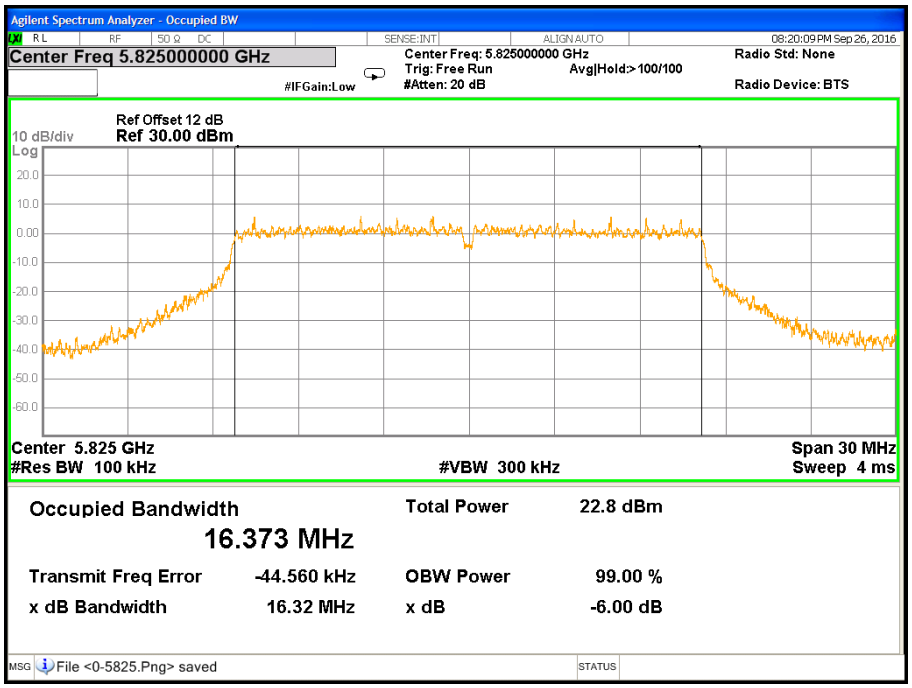
CH Low (IEEE 802.11a Mode / Band 3 / Chain 0)



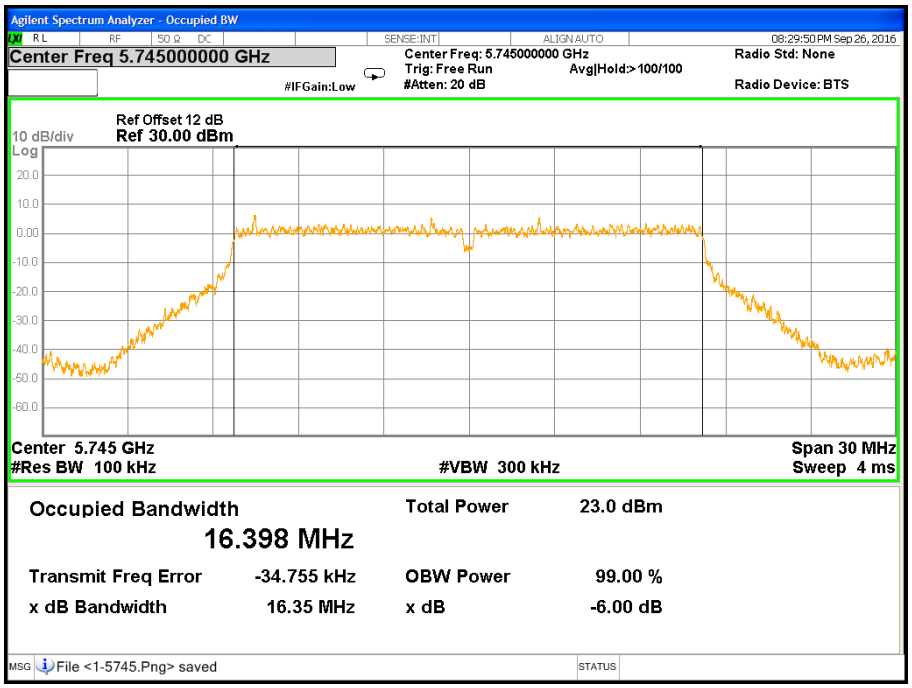
CH Middle (IEEE 802.11a Mode / Band 3 / Chain 0)



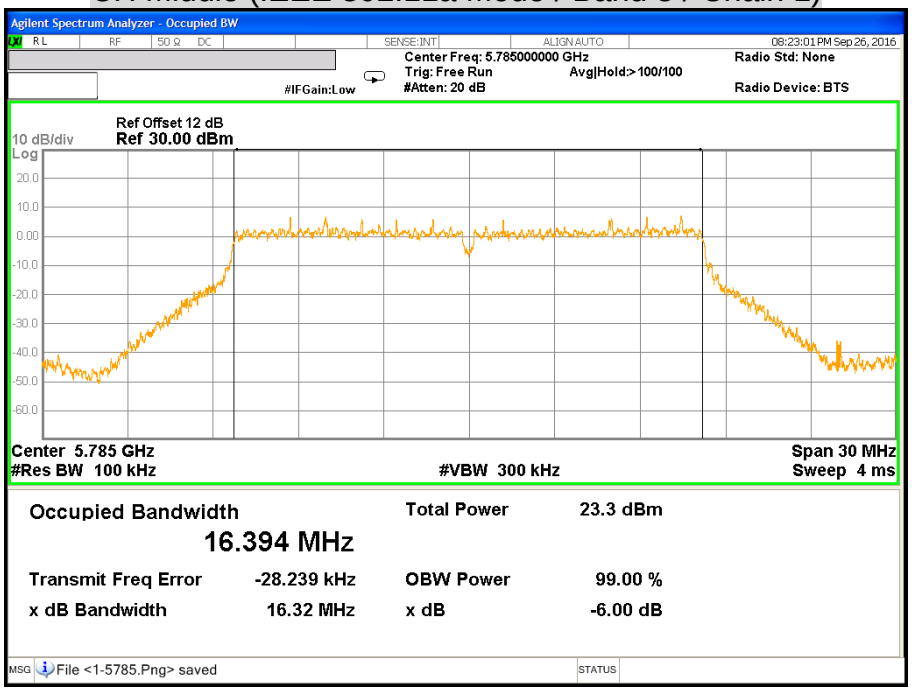
CH High (IEEE 802.11a Mode / Band 3 / Chain 0)



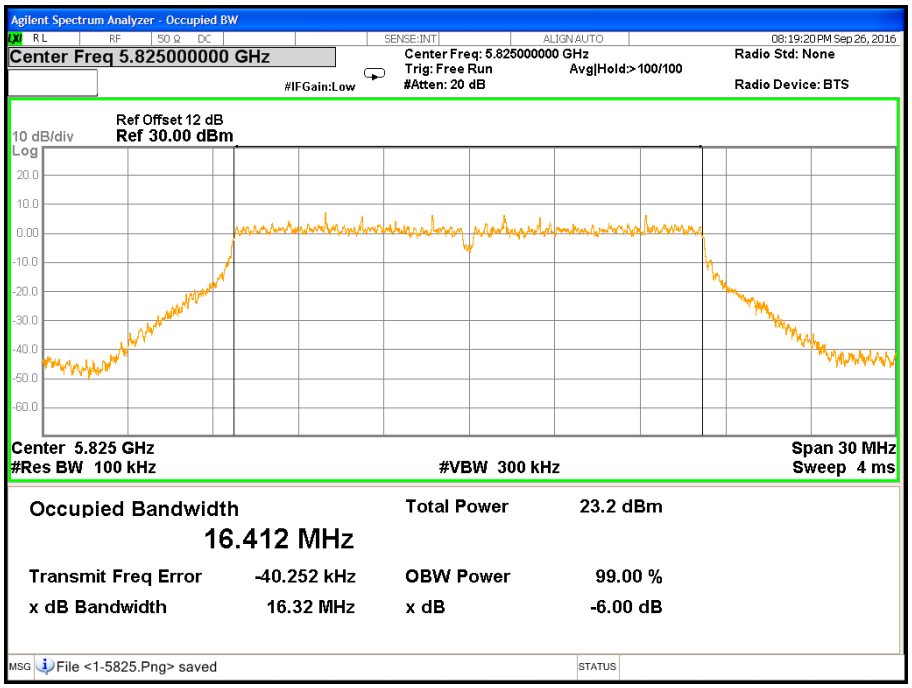
CH Low (IEEE 802.11a Mode / Band 3 / Chain 1)



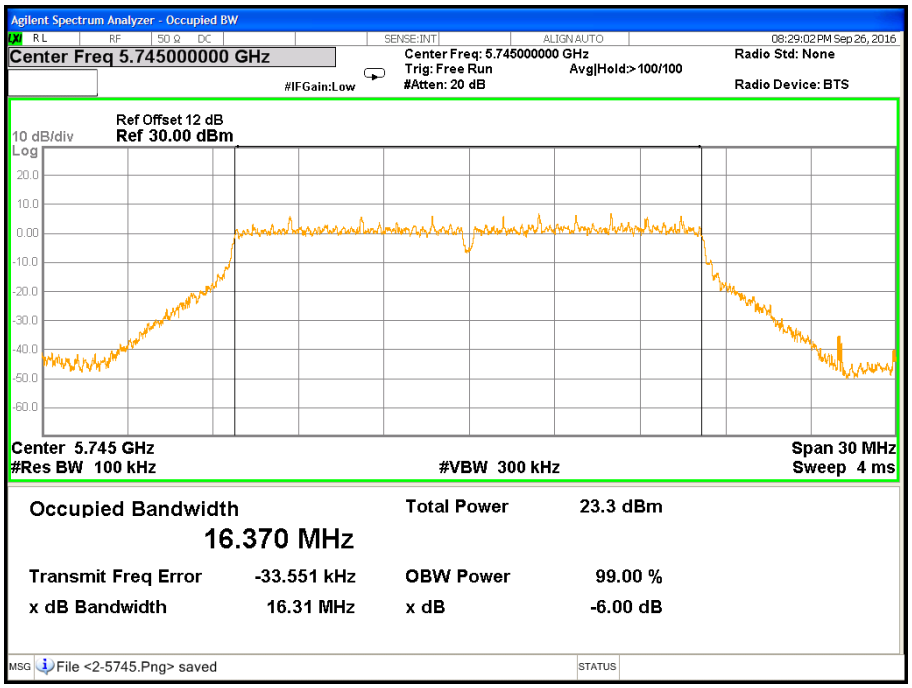
CH Middle (IEEE 802.11a Mode / Band 3 / Chain 1)



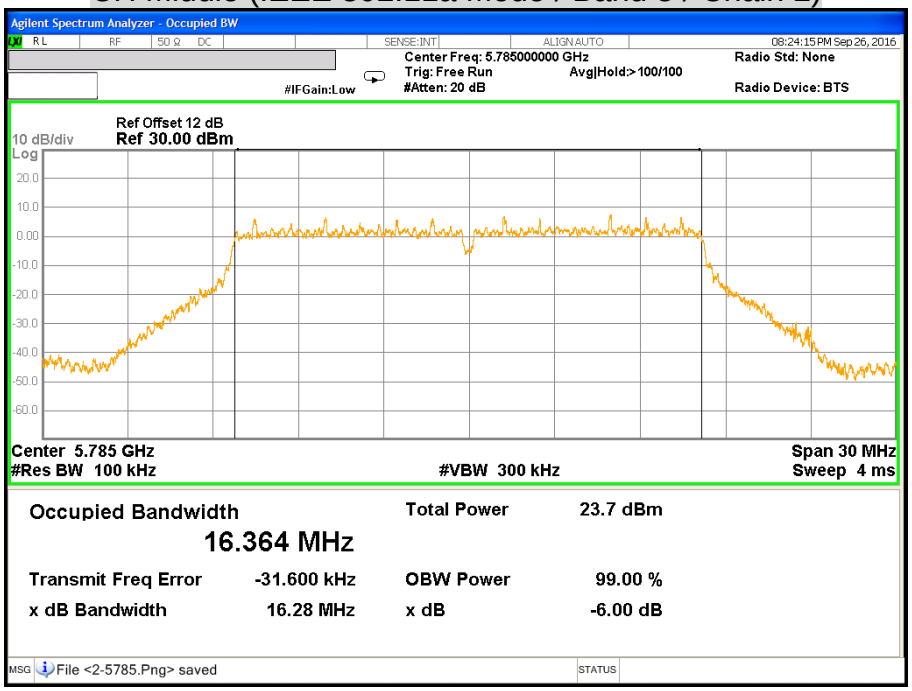
CH High (IEEE 802.11a Mode / Band 3 / Chain 1)



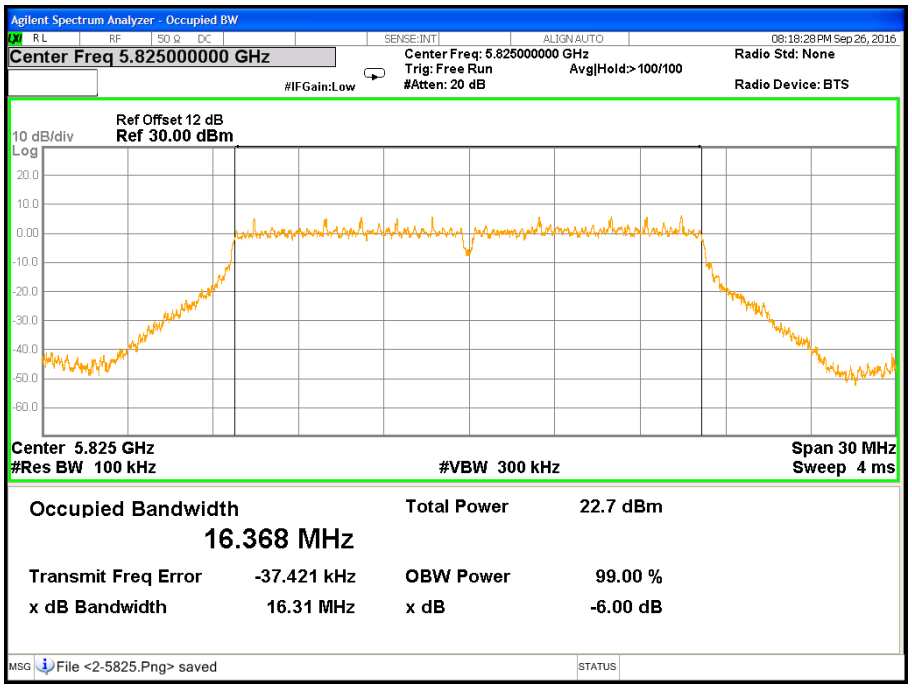
CH Low (IEEE 802.11a Mode / Band 3 / Chain 2)



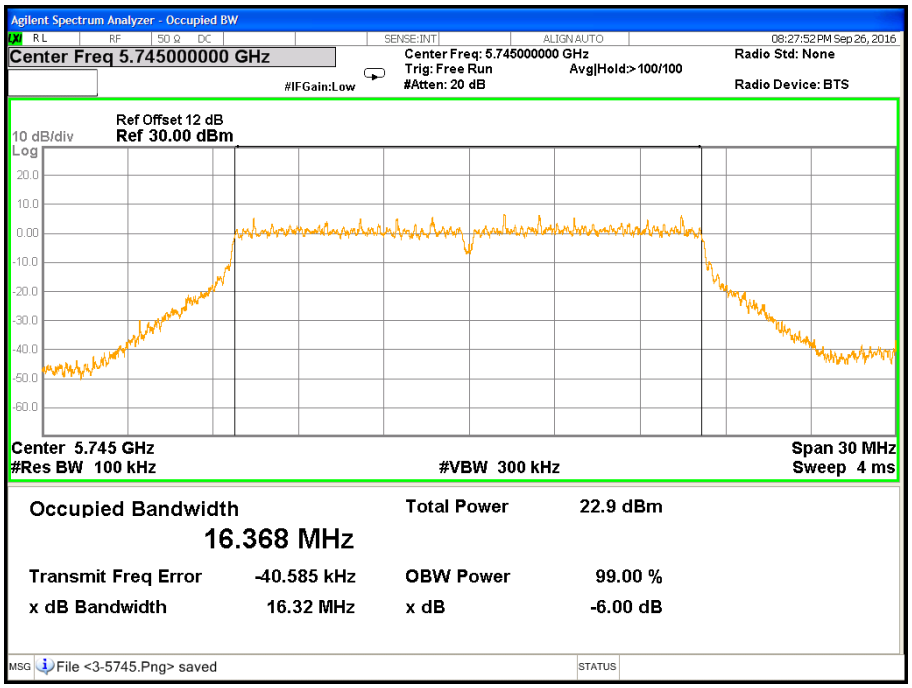
CH Middle (IEEE 802.11a Mode / Band 3 / Chain 2)



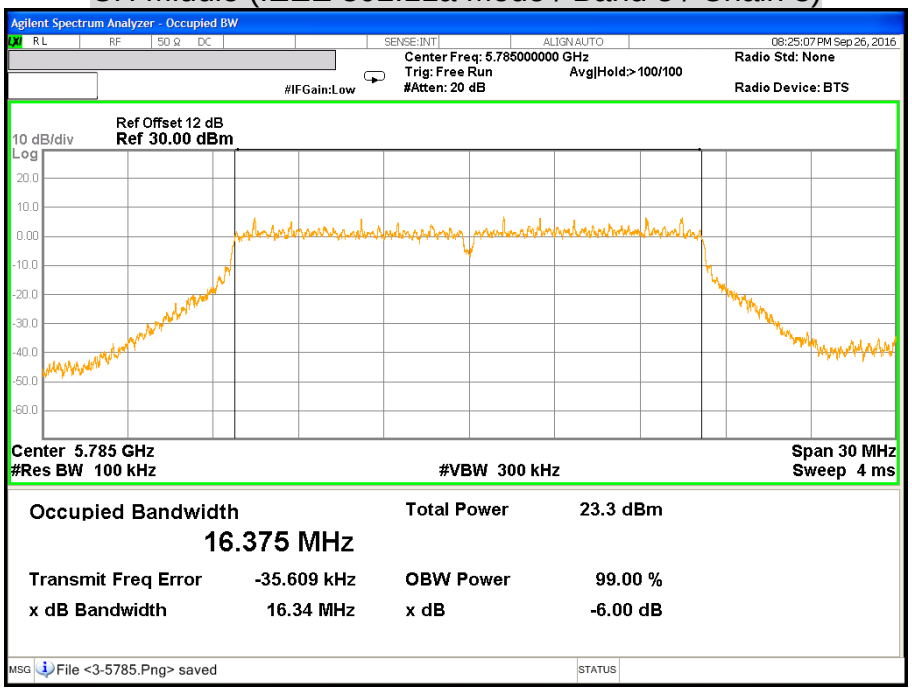
CH High (IEEE 802.11a Mode / Band 3 / Chain 2)



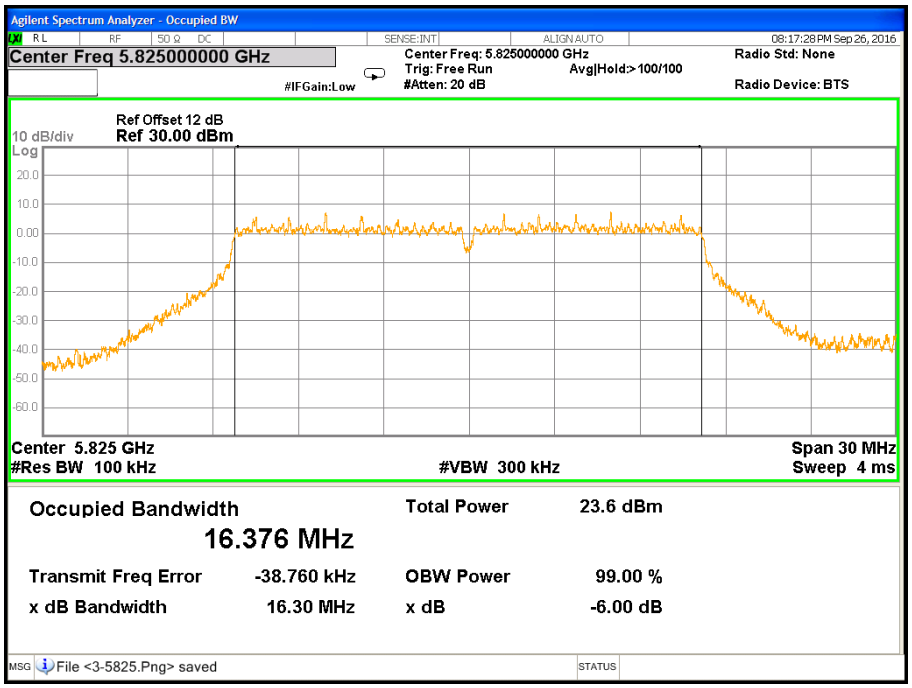
CH Low (IEEE 802.11a Mode / Band 3 / Chain 3)



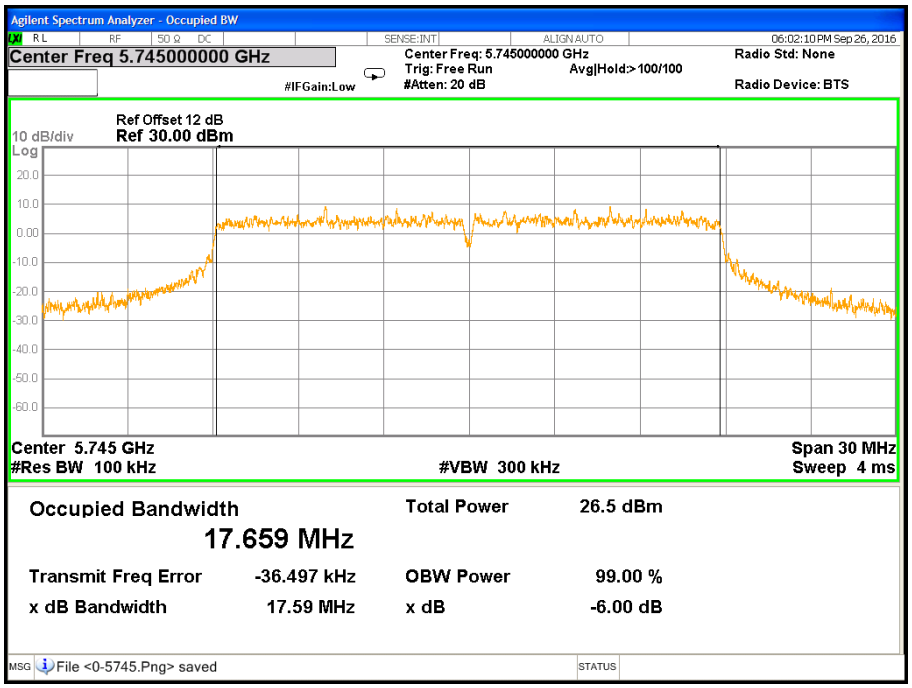
CH Middle (IEEE 802.11a Mode / Band 3 / Chain 3)



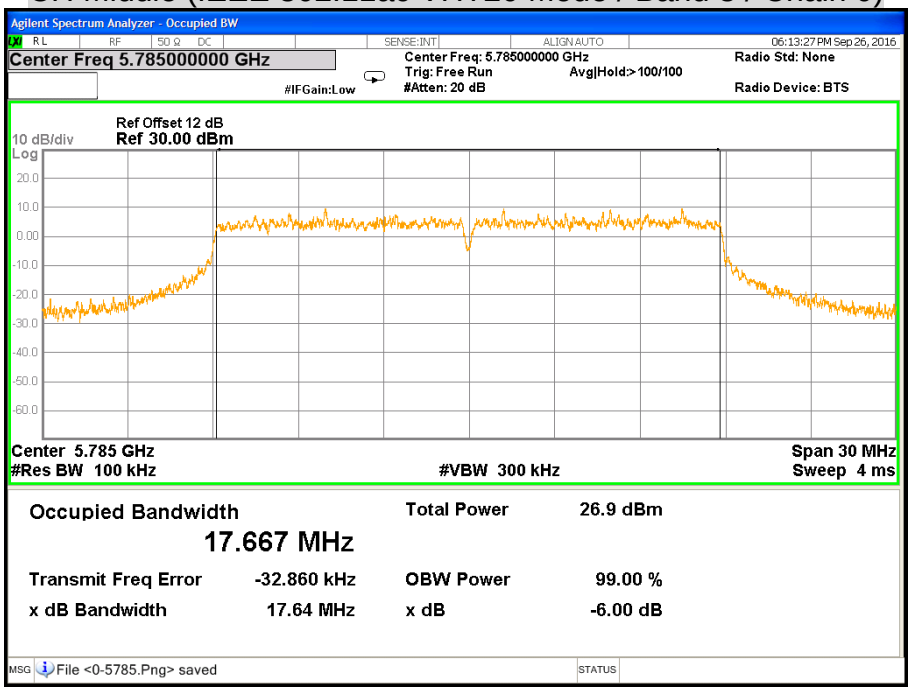
CH High (IEEE 802.11a Mode / Band 3 / Chain 3)



CH Low (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 0)



CH Middle (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 0)



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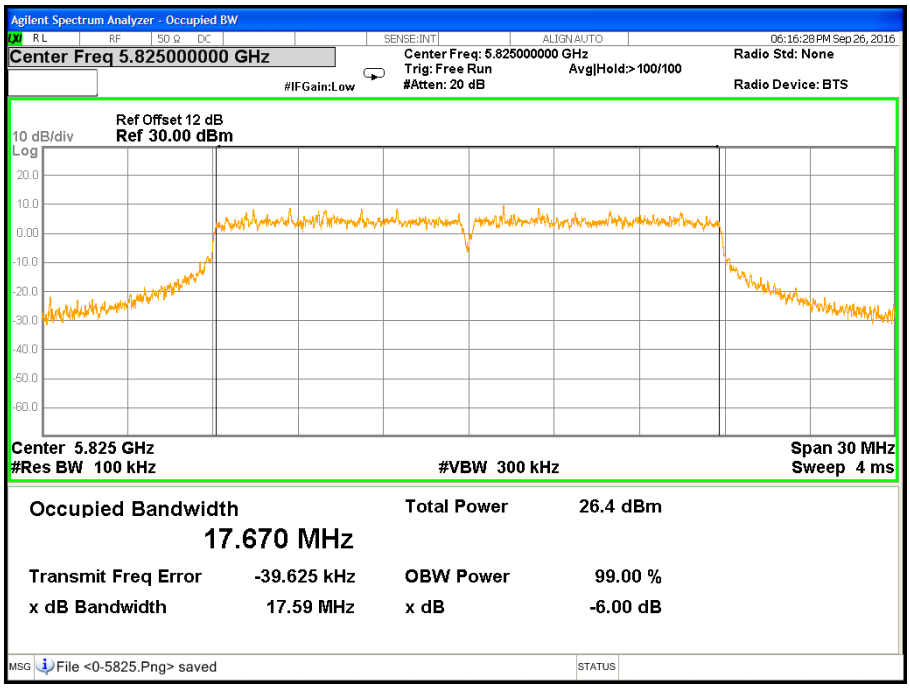
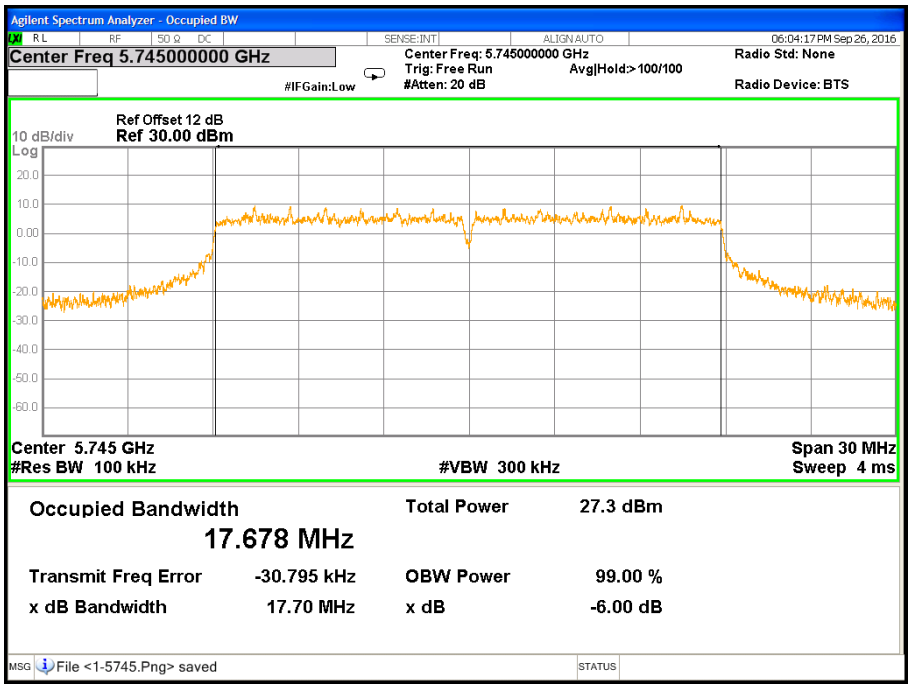
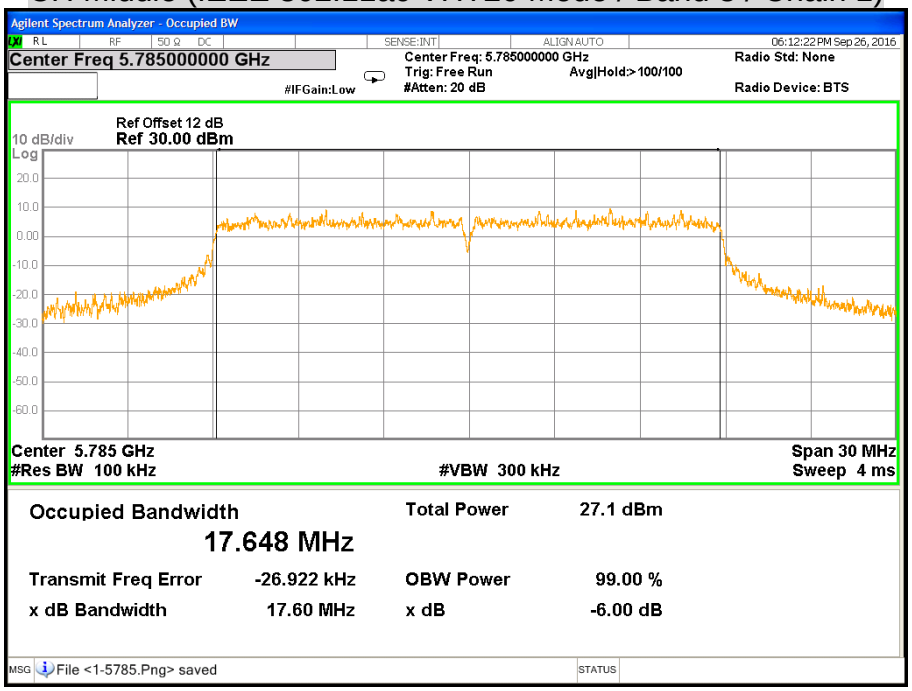


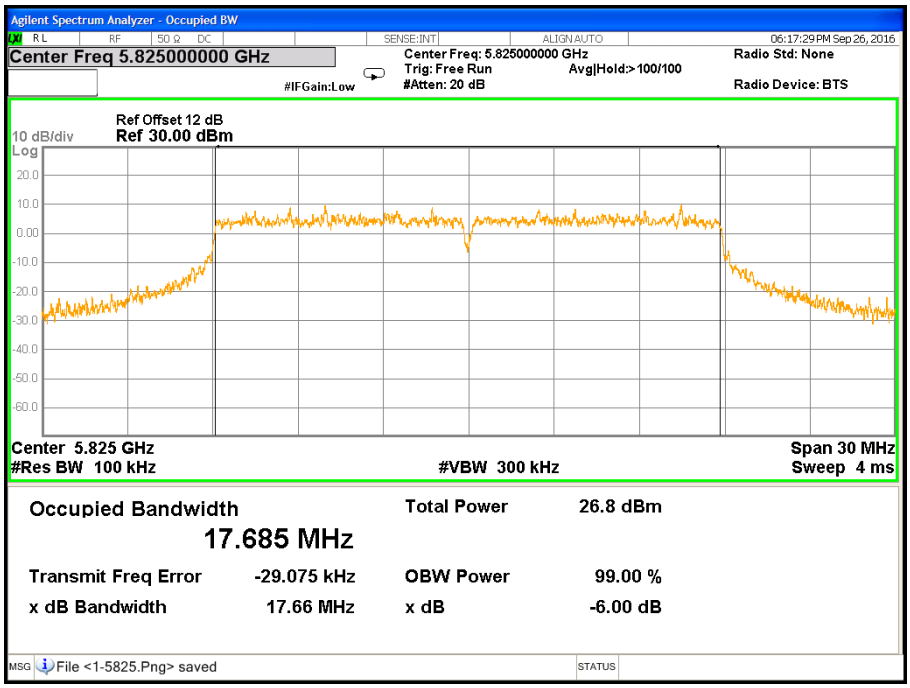
CH Low (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 1)



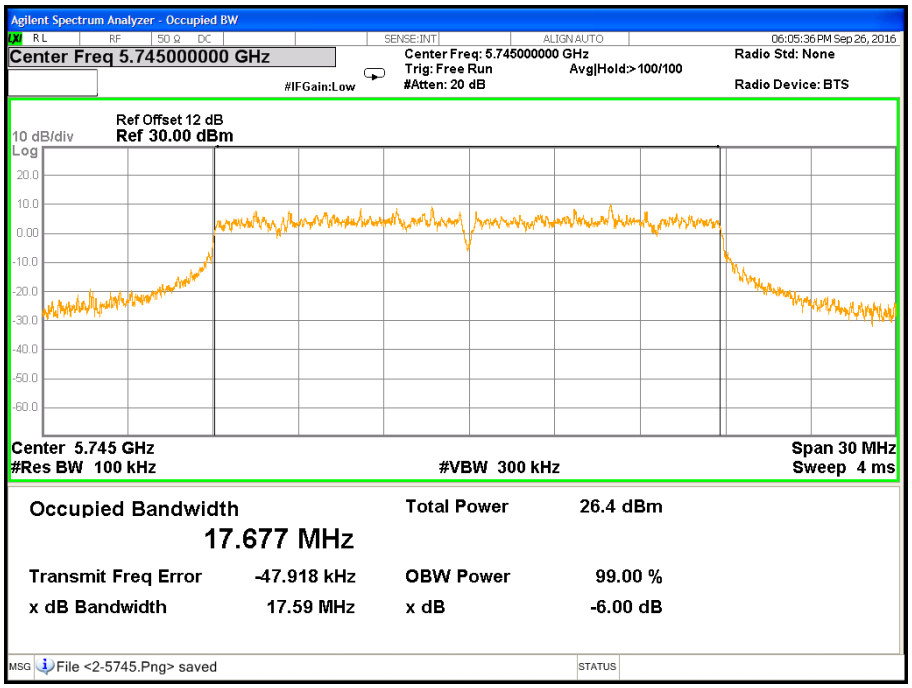
CH Middle (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 1)



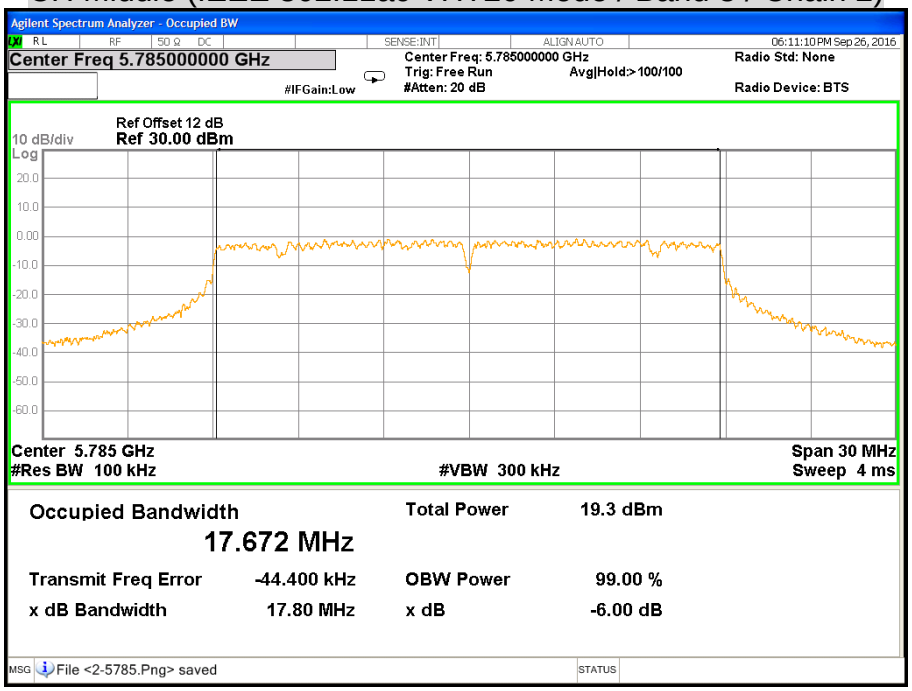
CH High (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 1)



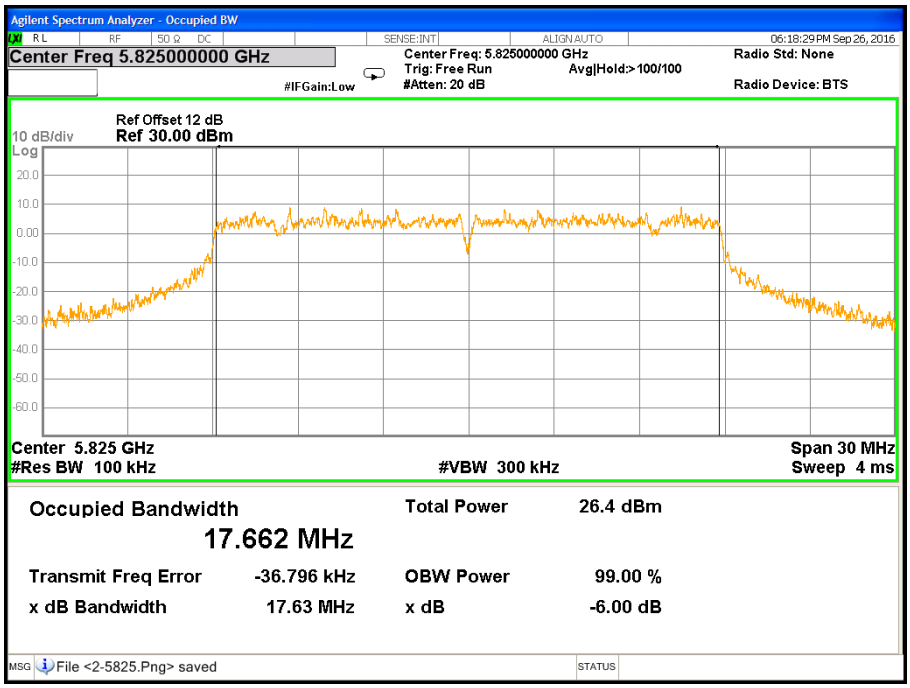
CH Low (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 2)



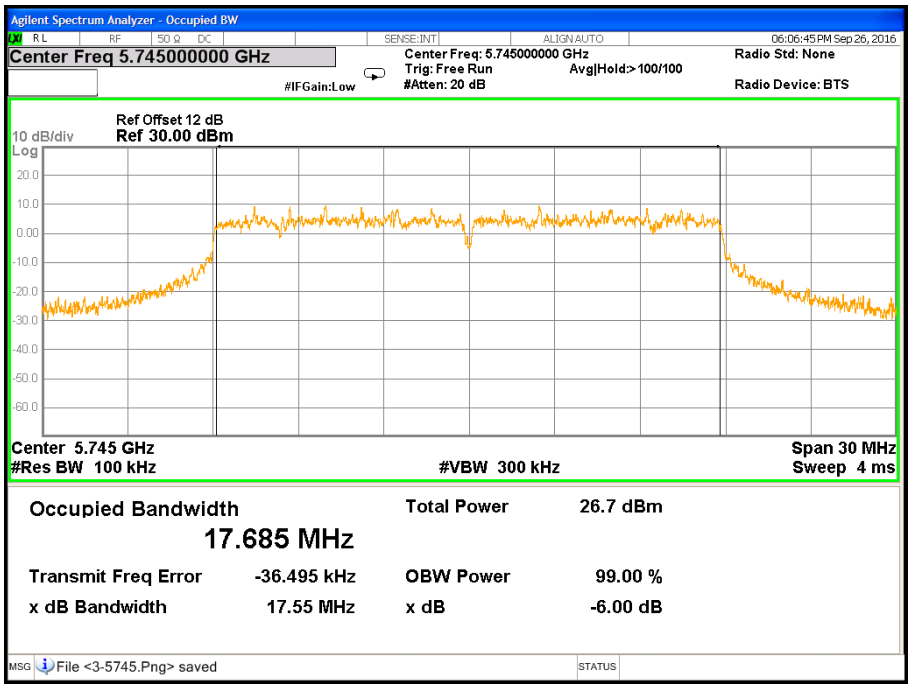
CH Middle (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 2)



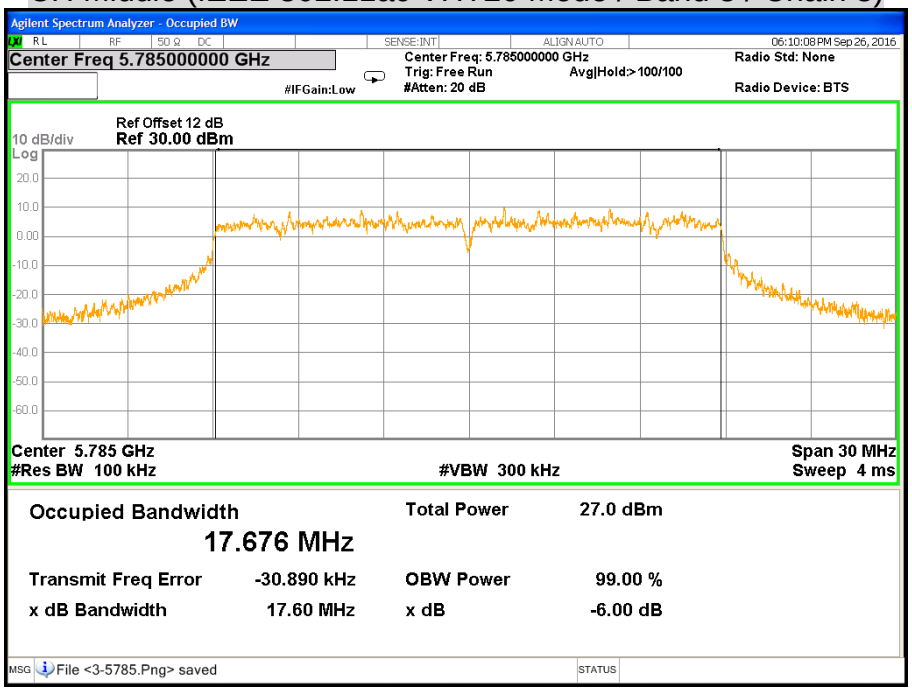
CH High (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 2)



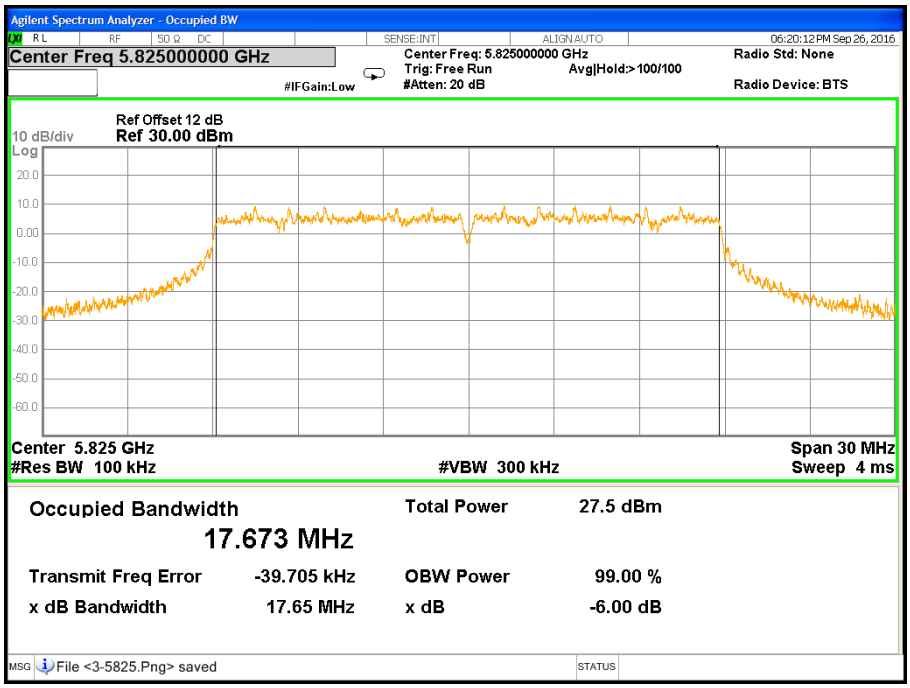
CH Low (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 3)



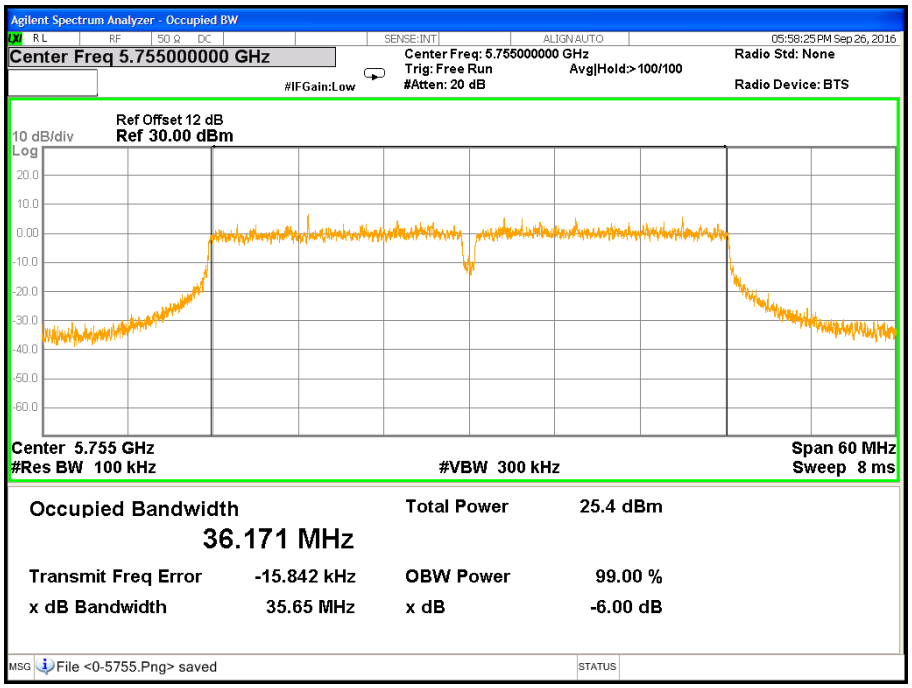
CH Middle (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 3)



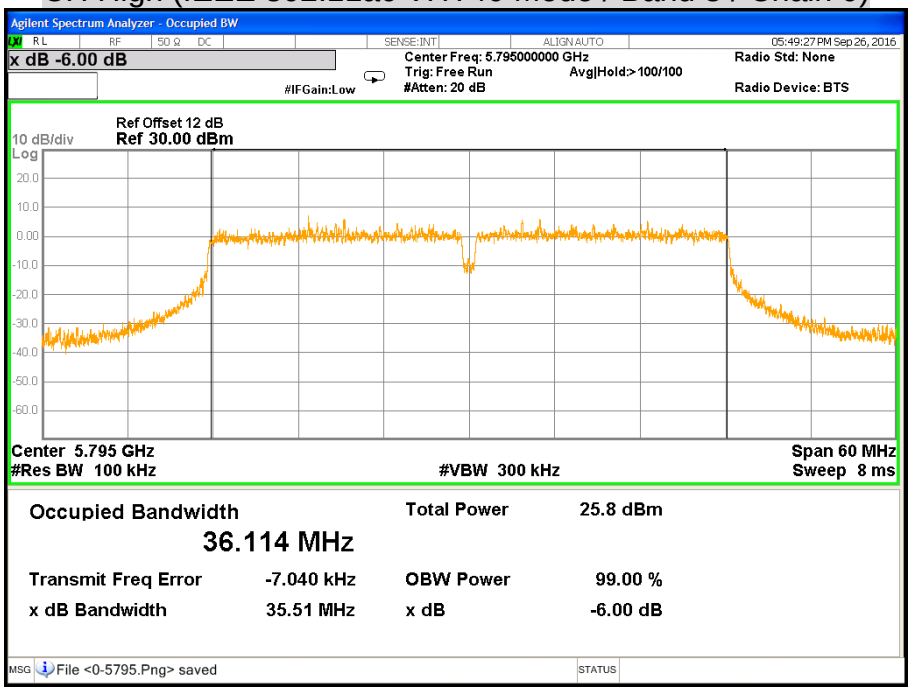
CH High (IEEE 802.11ac VHT20 Mode / Band 3 / Chain 3)



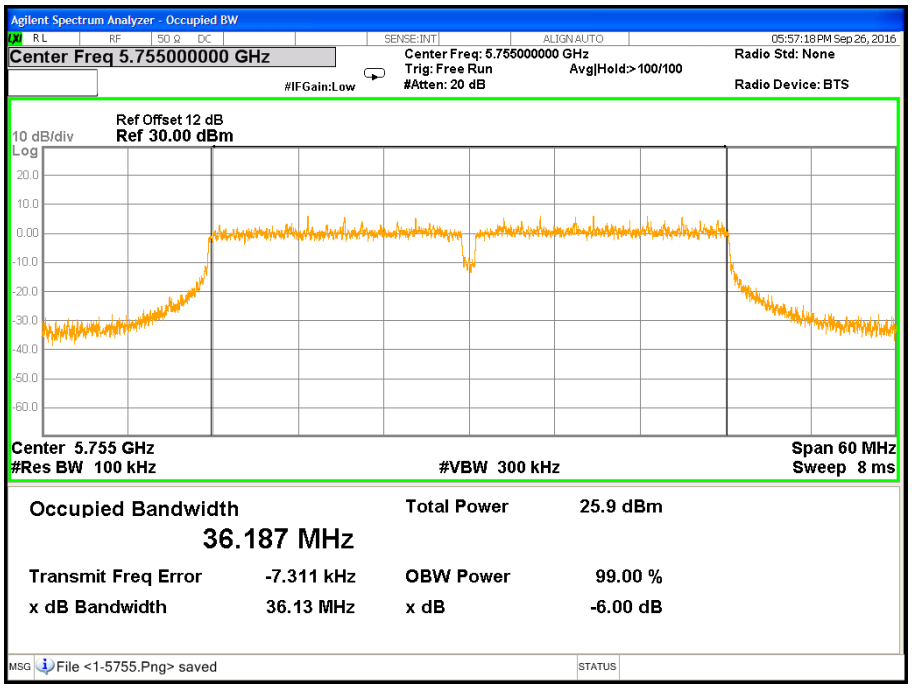
CH Low (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 0)



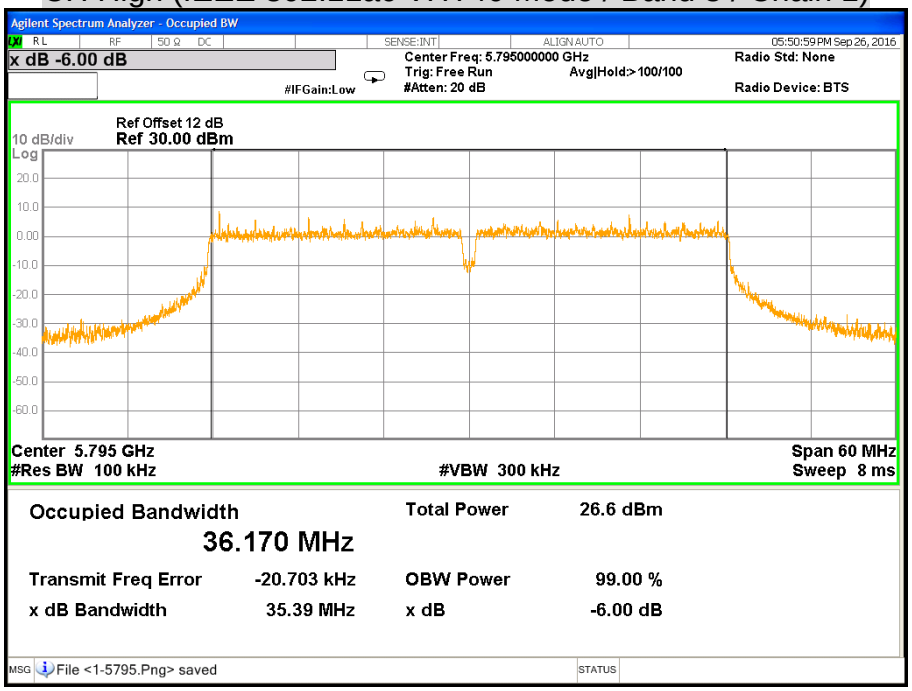
CH High (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 0)



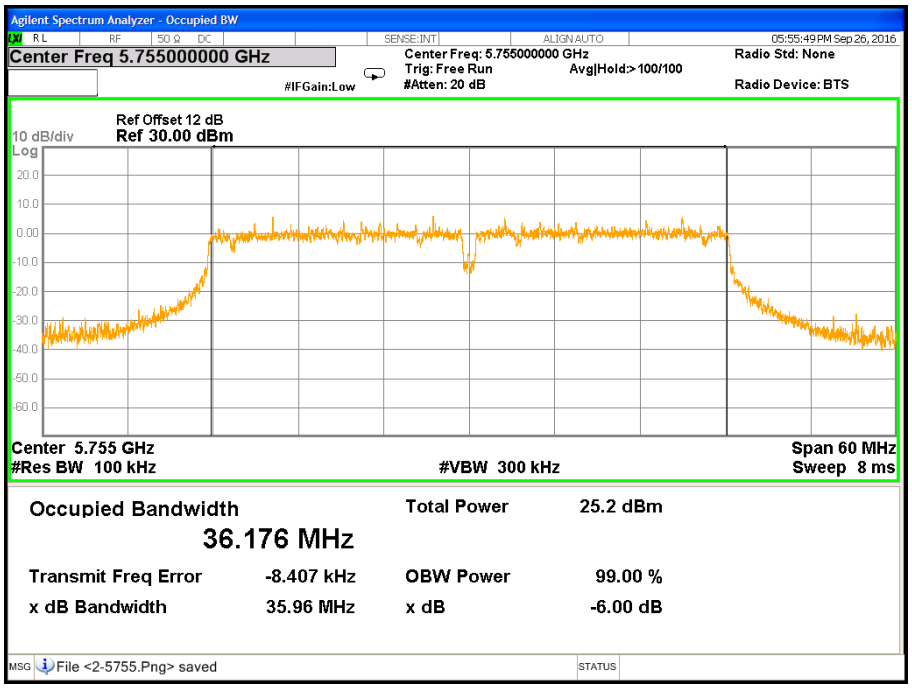
CH Low (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 1)



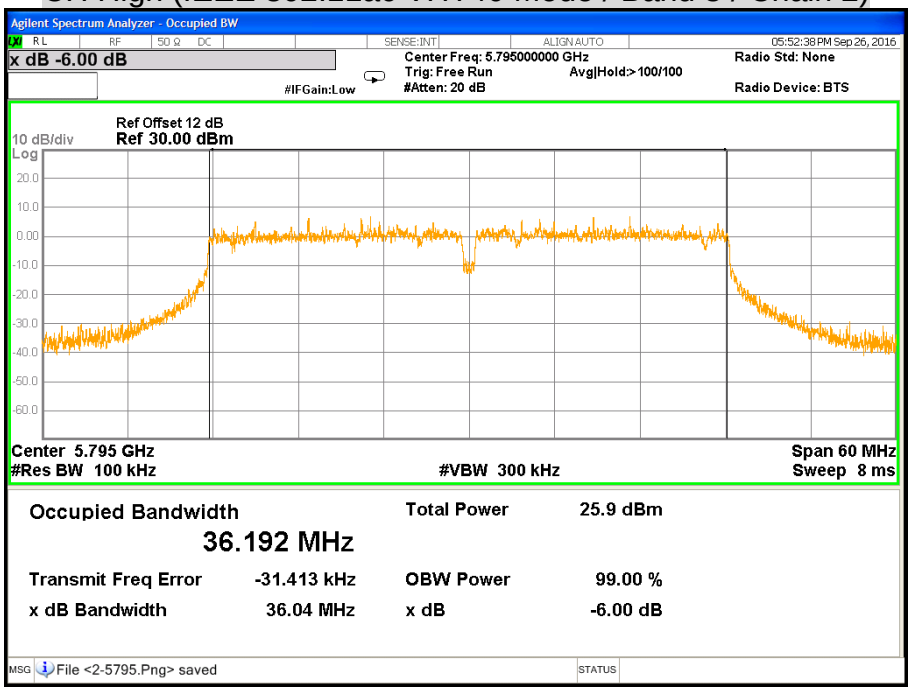
CH High (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 1)



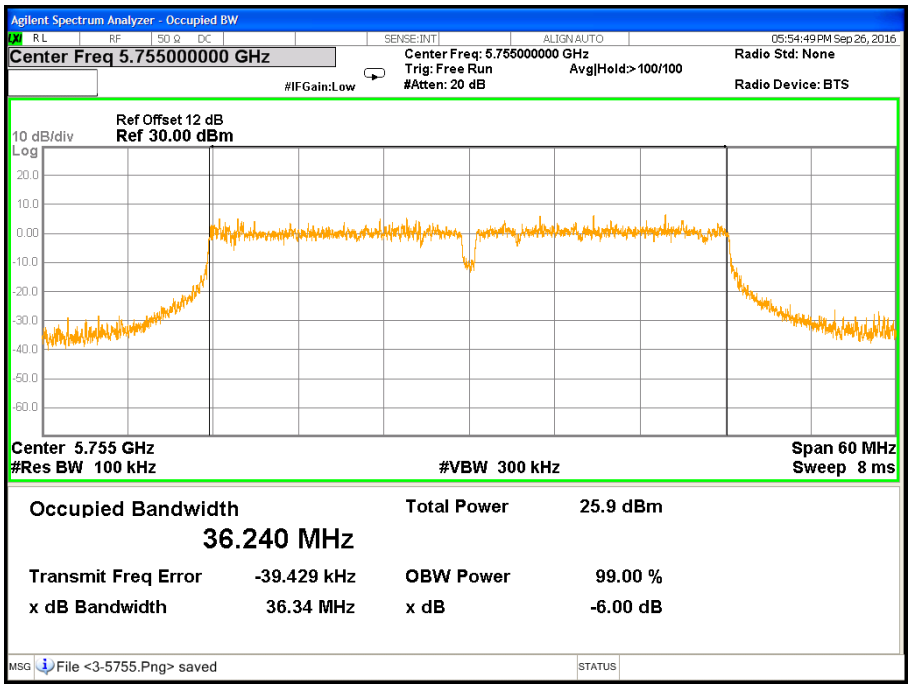
CH Low (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 2)



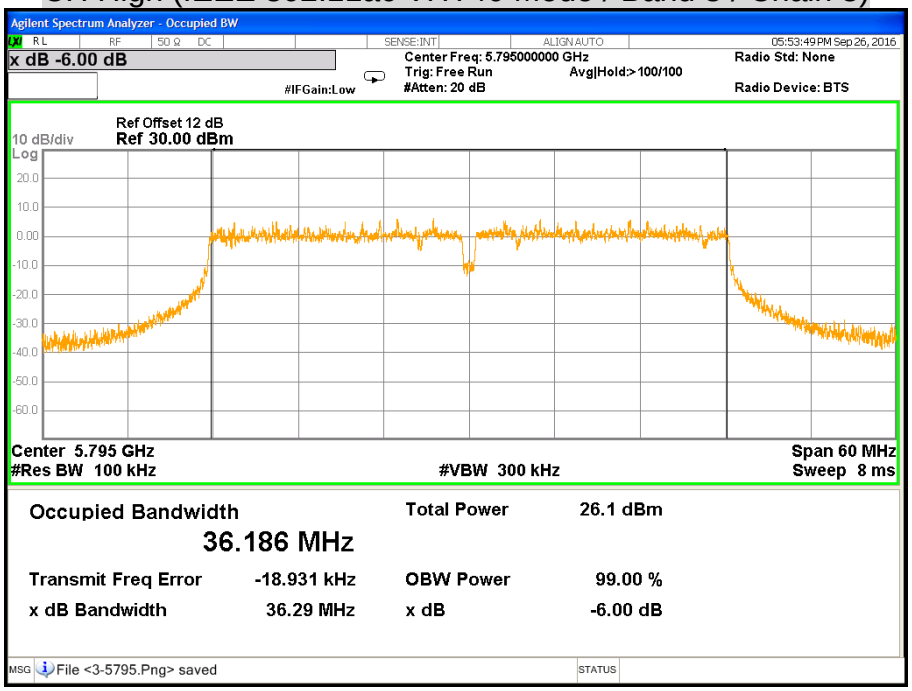
CH High (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 2)



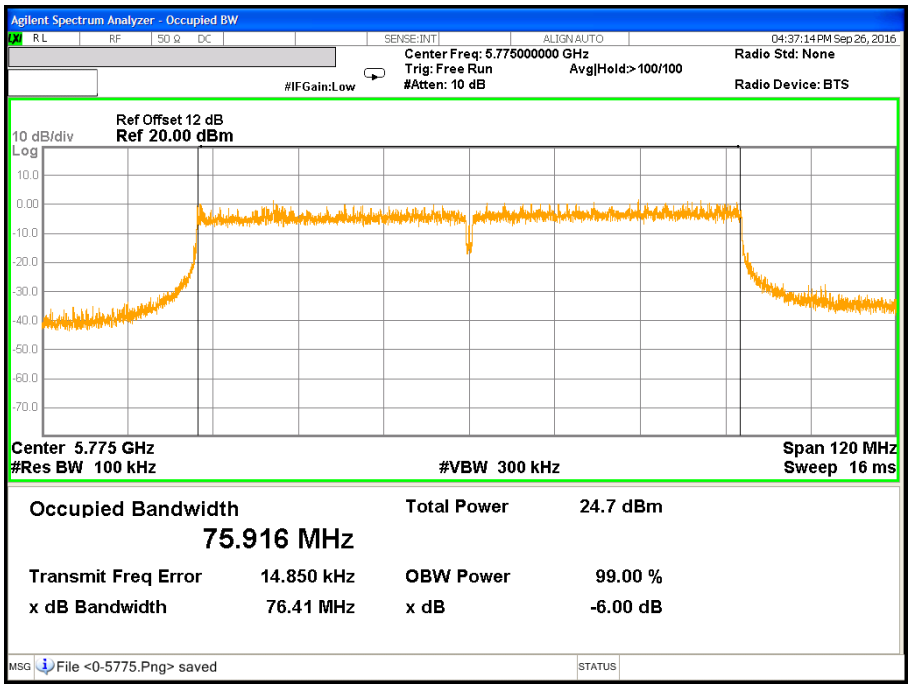
CH Low (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 3)



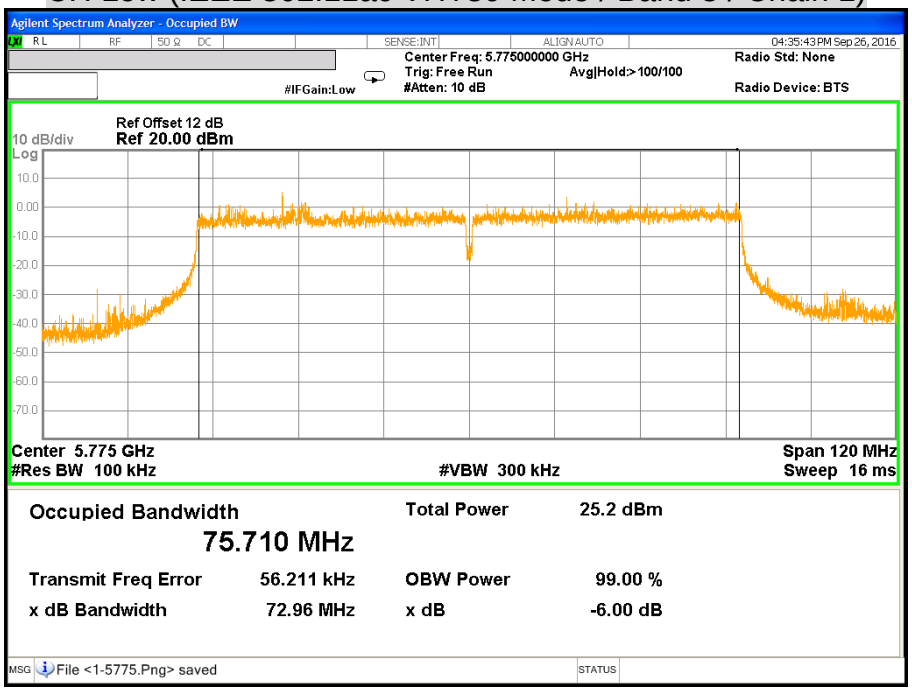
CH High (IEEE 802.11ac VHT40 Mode / Band 3 / Chain 3)



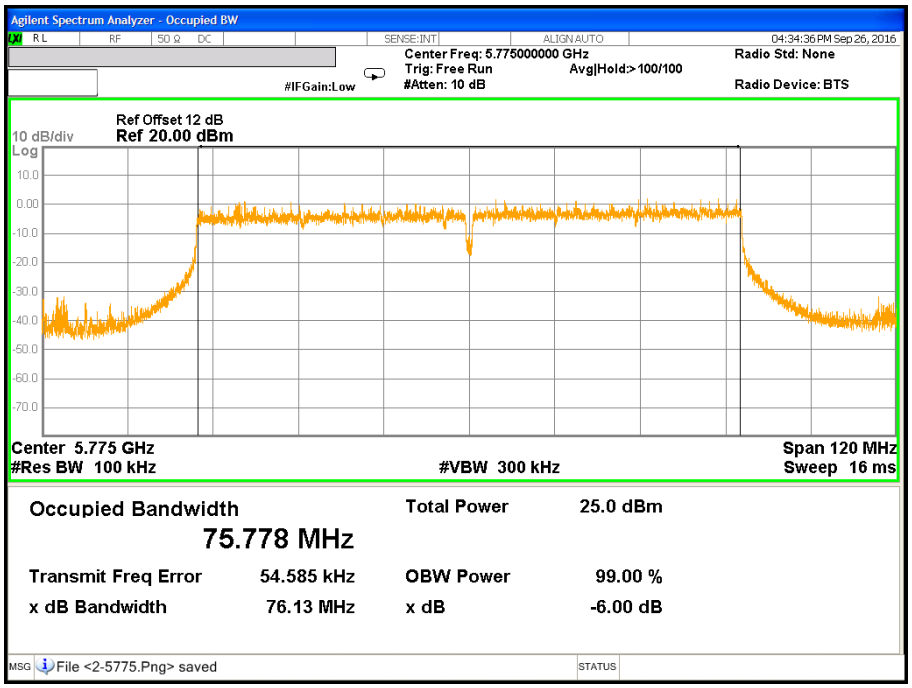
CH Low (IEEE 802.11ac VHT80 Mode / Band 3 / Chain 0)



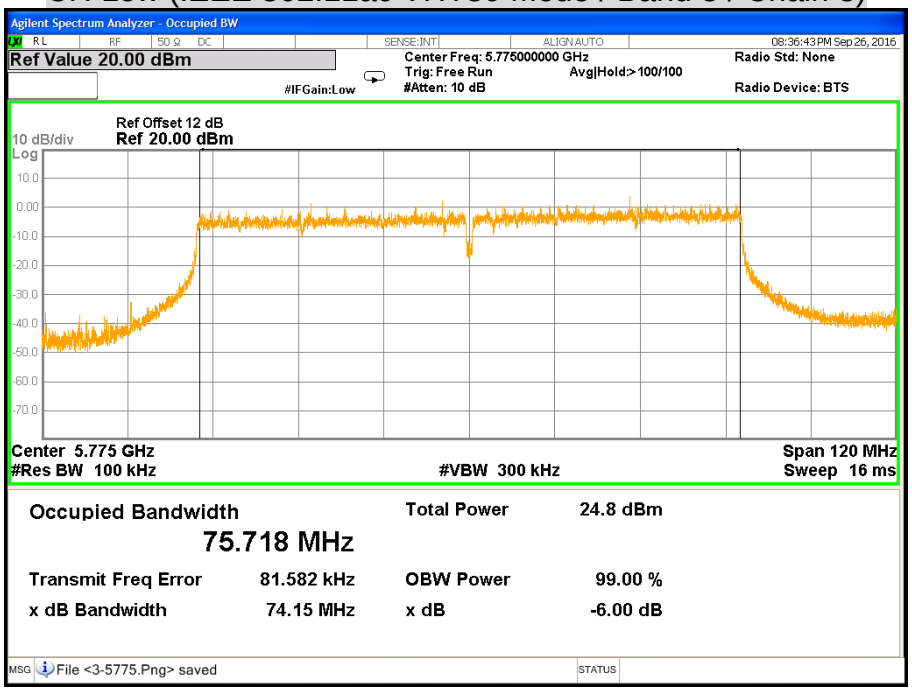
CH Low (IEEE 802.11ac VHT80 Mode / Band 3 / Chain 1)



CH Low (IEEE 802.11ac VHT80 Mode / Band 3 / Chain 2)



CH Low (IEEE 802.11ac VHT80 Mode / Band 3 / Chain 3)



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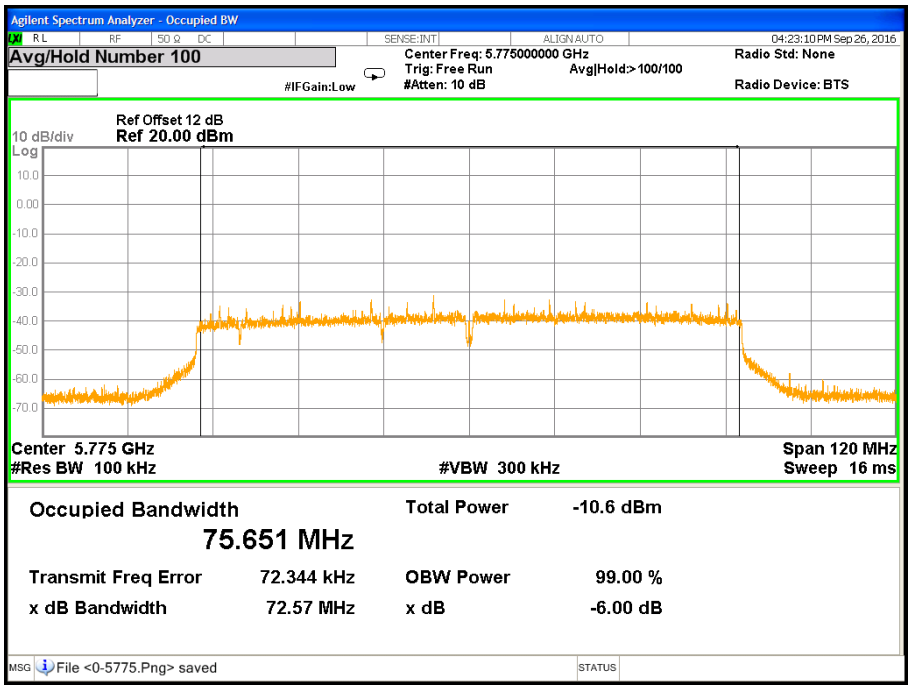
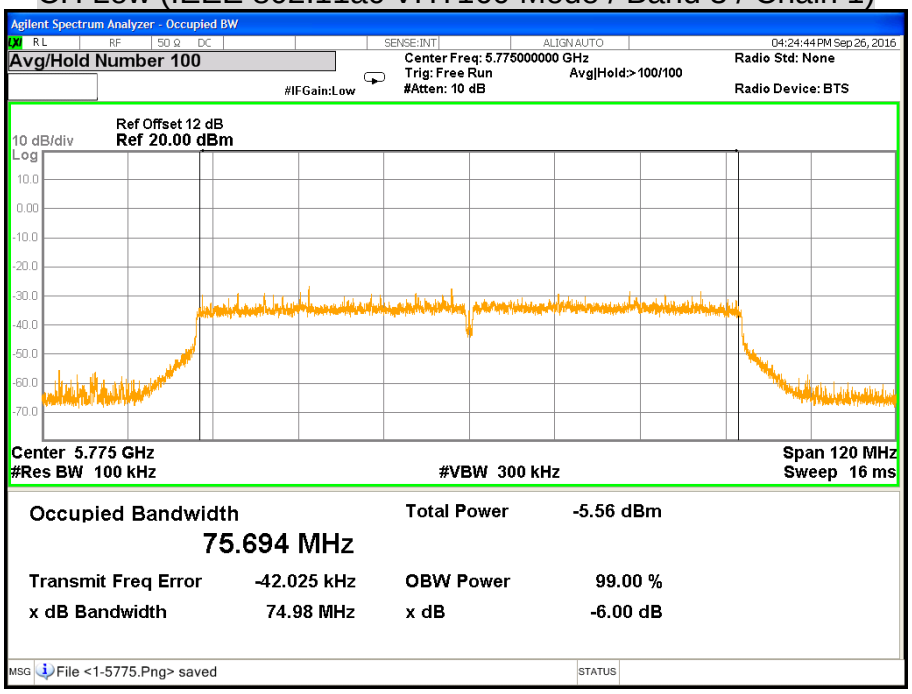
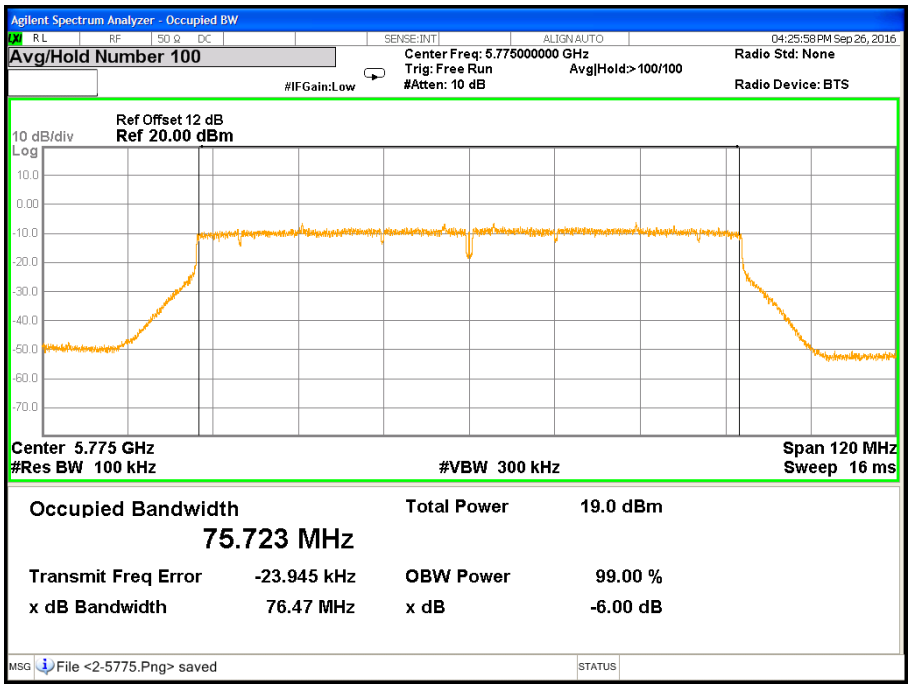


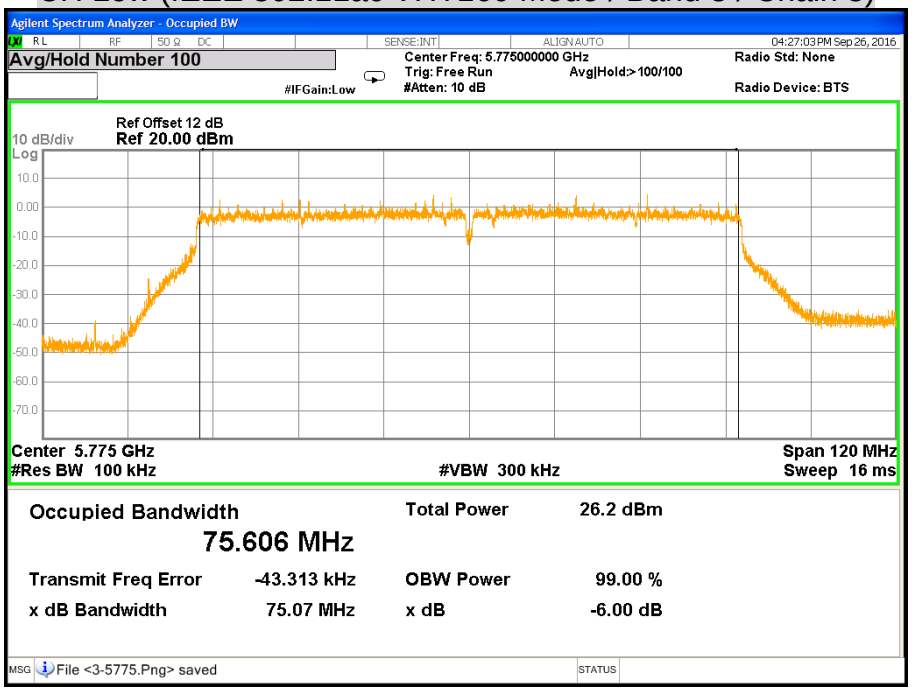
CH Low (IEEE 802.11ac VHT160 Mode / Band 3 / Chain 1)



CH Low (IEEE 802.11ac VHT160 Mode / Band 3 / Chain 2)



CH Low (IEEE 802.11ac VHT160 Mode / Band 3 / Chain 3)



7.4 MAXIMUM CONDUCTED OUTPUT POWER

LIMITS

§ 15.407(a)

(1) For the band 5.15-5.25 GHz,

(I) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(II) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

(III) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(IV) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) 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 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

§ KDB 662911:

If all antennas have the same gain, GANT, Directional gain = GANT + Array Gain, where Array Gain is as follows.

For power measurements on IEEE 802.11 devices

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

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

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

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Power Meter	Anritsu	ML2495A	1149001	12/08/2016
Power Sensor	Anritsu	MA2411B	1126148	12/08/2016
Test S/W	N/A			

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

TEST PROCEDURE

The transmitter output is connected to the power meter. The power meter is set to the power detection.

TEST RESULTS

Product Name	DOCSIS 3.1 wifi Gateway	Test By	Davis Tseng
Test Model	CODA-4782	Test Date	2016/09/22
Test Mode	TX Mode / Non-beamforming	Temp. & Humidity	20°C, 63%

IEEE 802.11a Mode

UNII Band	CH.	Channel Frequency (MHz)	Maximum Conducted Output Power								Result
			(dBm)				(dBm)	(W)	(dBm)	(W)	
			Chain 0	Chain 1	Chain 2	Chain 3	Total		Limit		
Band 1	Low	5180	15.20	17.01	16.16	17.04	22.44	0.1754	29.90	0.9772	PASS
	Middle	5200	15.28	17.04	16.32	17.02	22.49	0.1774	29.90	0.9772	PASS
	High	5240	15.51	17.39	16.49	17.13	22.71	0.1866	29.90	0.9772	PASS
Band 3	Low	5745	19.63	18.85	18.44	19.93	25.27	0.3365	29.90	0.9772	PASS
	Middle	5785	19.56	19.15	18.33	19.29	25.13	0.3258	29.90	0.9772	PASS
	High	5825	19.02	19.55	17.93	18.14	24.73	0.2972	29.90	0.9772	PASS

Remark:

1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The maximum antenna gain is 6.1dBi which is less than 6dBi, the limit should be 0.9772W.*
4. *Total power = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT20 Mode

UNII Band	CH.	Channel Frequency (MHz)	Maximum Conducted Output Power								Result
			(dBm)				(dBm)	(W)	(dBm)	(W)	
			Chain 0	Chain 1	Chain 2	Chain 3	Total		Limit		
Band 1	Low	5180	15.32	17.17	16.31	17.09	22.55	0.1799	29.90	0.9772	PASS
	Middle	5200	15.58	17.34	16.31	17.18	22.68	0.1854	29.90	0.9772	PASS
	High	5240	15.75	17.43	16.53	17.05	22.76	0.1888	29.90	0.9772	PASS
Band 3	Low	5745	19.33	18.68	18.21	19.58	25.00	0.3162	29.90	0.9772	PASS
	Middle	5785	19.23	19.02	18.16	18.96	24.88	0.3076	29.90	0.9772	PASS
	High	5825	19.42	20.04	18.59	19.04	25.33	0.3412	29.90	0.9772	PASS

Remark:

1. *At finial test to get the worst-case emission at 6.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The maximum antenna gain is 6.1dBi which is less than 6dBi, the limit should be 0.9772W.*
4. *Total power = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT40 Mode

UNII Band	CH.	Channel Frequency (MHz)	Maximum Conducted Output Power								Result
			(dBm)				(dBm)	(W)	(dBm)	(W)	
			Chain 0	Chain 1	Chain 2	Chain 3	Total		Limit		
Band 1	Low	5190	15.67	17.02	16.54	17.27	22.69	0.1858	29.90	0.9772	PASS
	High	5230	19.68	21.02	20.49	20.15	26.38	0.4345	29.90	0.9772	PASS
Band 3	Low	5755	20.20	19.88	19.44	20.49	26.04	0.4018	29.90	0.9772	PASS
	High	5795	19.83	20.04	19.28	19.74	25.75	0.3758	29.90	0.9772	PASS

Remark:

1. *At finial test to get the worst-case emission at 13.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The maximum antenna gain is 6.1dBi which is less than 6dBi, the limit should be 0.9772W.*
4. *Total power = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT80 Mode

UNII Band	CH.	Channel Frequency (MHz)	Maximum Conducted Output Power								Result
			(dBm)				(dBm)	(W)	(dBm)	(W)	
			Chain 0	Chain 1	Chain 2	Chain 3	Total		Limit		
Band 1	Low	5210	13.68	15.07	14.61	15.10	20.67	0.1167	29.90	0.9772	PASS
Band 3	Low	5775	19.78	19.45	19.05	20.21	25.66	0.3681	29.90	0.9772	PASS

Remark:

1. *At finial test to get the worst-case emission at 29.3 Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The maximum antenna gain is 6.1dBi which is less than 6dBi, the limit should be 0.98W.*
4. *Total power = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT160 Mode

UNII Band	CH.	Channel Frequency (MHz)	Maximum Conducted Output Power								Result
			(dBm)				(dBm)	(W)	(dBm)	(W)	
			Chain 0	Chain 1	Chain 2	Chain 3	Total		Limit		
Band 1	Low	5210	14.33	15.85	-12.09	-20.66	18.17	0.0656	29.90	0.9772	PASS
Band 3	Low	5775	-25.32	-18.84	15.09	15.66	18.40	0.0692	29.90	0.9772	PASS

Remark:

1. *At finial test to get the worst-case emission at 58.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The maximum antenna gain is 6.1dBi which is less than 6dBi, the limit should be 0.9772W.*
4. *Total power = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

Product Name	DOCSIS 3.1 wifi Gateway	Test By	Davis Tseng
Test Model	CODA-4782	Test Date	2016/09/22
Test Mode	TX Mode / Beamforming	Temp. & Humidity	20°C, 63%

IEEE 802.11a Mode

UNII Band	CH.	Channel Frequency (MHz)	Maximum Conducted Output Power								Result
			(dBm)				(dBm)	(W)	(dBm)	(W)	
			Chain 0	Chain 1	Chain 2	Chain 3	Total		Limit		
Band 1	Low	5180	15.63	16.06	16.01	16.47	22.07	0.1611	24.86	0.3062	PASS
	Middle	5200	15.61	16.12	15.94	16.44	22.06	0.1607	24.86	0.3062	PASS
	High	5240	15.16	15.76	15.27	15.85	21.54	0.1426	24.86	0.3062	PASS
Band 3	Low	5745	17.88	18.14	18.11	18.12	24.08	0.2559	24.86	0.3062	PASS
	Middle	5785	18.01	18.09	18.03	18.23	24.11	0.2576	24.86	0.3062	PASS
	High	5825	17.49	17.80	17.68	18.05	23.78	0.2388	24.86	0.3062	PASS

Remark:

1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 0.3062W.*
4. *Total power = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT20 Mode

UNII Band	CH.	Channel Frequency (MHz)	Maximum Conducted Output Power								Result
			(dBm)				(dBm)	(W)	(dBm)	(W)	
			Chain 0	Chain 1	Chain 2	Chain 3	Total		Limit		
Band 1	Low	5180	16.31	17.05	16.53	16.36	22.59	0.1816	24.86	0.3062	PASS
	Middle	5200	16.33	16.80	16.31	16.95	22.63	0.1832	24.86	0.3062	PASS
	High	5240	16.01	16.27	15.68	16.24	22.08	0.1614	24.86	0.3062	PASS
Band 3	Low	5745	18.12	18.59	18.39	18.41	24.40	0.2754	24.86	0.3062	PASS
	Middle	5785	18.29	18.62	18.23	18.56	24.45	0.2786	24.86	0.3062	PASS
	High	5825	18.21	18.61	18.17	18.29	24.34	0.2716	24.86	0.3062	PASS

Remark:

1. *At finial test to get the worst-case emission at 6.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 0.3062W.*
4. *Total power = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT40 Mode

UNII Band	CH.	Channel Frequency (MHz)	Maximum Conducted Output Power								Result
			(dBm)				(dBm)	(W)	(dBm)	(W)	
			Chain 0	Chain 1	Chain 2	Chain 3	Total		Limit		
Band 1	Low	5190	14.19	14.39	14.11	14.70	20.37	0.1089	24.86	0.3062	PASS
	High	5230	17.46	17.77	17.16	17.92	23.61	0.2296	24.86	0.3062	PASS
Band 3	Low	5755	18.44	18.51	18.31	18.31	24.41	0.2761	24.86	0.3062	PASS
	High	5795	18.21	18.44	18.26	18.42	24.35	0.2723	24.86	0.3062	PASS

Remark:
1. *At finial test to get the worst-case emission at 13.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 0.3062W.*
4. *Total power = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT80 Mode

UNII Band	CH.	Channel Frequency (MHz)	Maximum Conducted Output Power								Result
			(dBm)				(dBm)	(W)	(dBm)	(W)	
			Chain 0	Chain 1	Chain 2	Chain 3	Total		Limit		
Band 1	Low	5210	12.76	13.07	12.60	13.34	18.97	0.0789	24.86	0.3062	PASS
Band 3	Low	5775	17.94	18.36	18.23	18.20	24.21	0.2636	24.86	0.3062	PASS

Remark:
1. *At finial test to get the worst-case emission at 29.3 Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 0.3062W.*
4. *Total power = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT160 Mode

UNII Band	CH.	Channel Frequency (MHz)	Maximum Conducted Output Power								Result
			(dBm)				(dBm)	(W)	(dBm)	(W)	
			Chain 0	Chain 1	Chain 2	Chain 3	Total		Limit		
Band 1	Low	5210	12.47	12.58	-14.48	-20.13	15.54	0.0358	24.86	0.3062	PASS
Band 3	Low	5775	-17.34	-14.40	19.67	19.21	22.46	0.1762	24.86	0.3062	PASS

Remark:
1. *At finial test to get the worst-case emission at 58.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 0.3062W.*
4. *Total power = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

7.5 PEAK POWER SPECTRAL DENSITY

LIMITS

§ 15.407 (a)

(1) For the band 5.15-5.25 GHz

(I) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(II) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

(III) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

(2) 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 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Signal Analyzer	Agilent	N9010A	MY52220817	03/15/2017
Test S/W	N/A			

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 1MHz, VBW = 3MHz, Span = Sweep= AUTO
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

Product Name	DOCSIS 3.1 wifi Gateway	Test By	Davis Tseng
Test Model	CODA-4782	Test Date	2016/09/22
Test Mode	TX Mode / Non-beamforming	Temp. & Humidity	20°C, 63%

IEEE 802.11a Mode

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 1	Low	5180	4.244	5.987	5.162	6.084	11.45	11.86	PASS
	Middle	5200	4.361	6.046	5.060	6.045	11.46	11.86	PASS
	High	5240	4.409	6.238	5.453	6.107	11.63	11.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 11.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3*

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/500kHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 3	Low	5745	5.260	4.370	3.988	5.521	10.85	24.86	PASS
	Middle	5785	5.266	4.820	4.377	5.121	10.93	24.86	PASS
	High	5825	4.868	5.547	4.024	4.009	10.68	24.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 24.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT20 Mode

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 1	Low	5180	4.015	5.845	5.125	6.131	11.37	11.86	PASS
	Middle	5200	4.257	6.003	5.156	6.124	11.47	11.86	PASS
	High	5240	4.242	6.403	5.453	5.974	11.61	11.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 6.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 11.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/500kHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 3	Low	5745	4.931	4.039	3.781	5.129	10.53	24.86	PASS
	Middle	5785	4.885	4.812	3.775	4.668	10.58	24.86	PASS
	High	5825	5.428	6.064	4.801	5.053	11.38	24.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 6.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 24.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT40 Mode

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 1	Low	5190	1.630	2.822	2.331	3.131	8.54	11.86	PASS
	High	5230	4.601	6.035	5.699	6.204	11.70	11.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 13.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 11.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3..*

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/500kHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 3	Low	5755	2.500	2.554	2.172	3.199	8.64	24.86	PASS
	High	5795	2.670	3.341	2.223	2.485	8.72	24.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 13.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 24.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT80 Mode

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 1	Low	5210	-3.483	-2.477	-2.643	-1.864	3.44	11.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 29.3 Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 11.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/500kHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 3	Low	5775	-0.503	0.013	-1.082	0.226	5.71	24.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 29.3 Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 24.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT160 Mode

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 1	Low	5210	-2.296	-0.911	-21.542	-35.097	1.48	11.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 58.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 11.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/500kHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 3	Low	5775	-41.372	-36.615	-5.114	-3.763	-1.37	24.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 58.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 24.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

Product Name	DOCSIS 3.1 wifi Gateway	Test By	Davis Tseng
Test Model	CODA-4782	Test Date	2016/09/22
Test Mode	TX Mode / Beamforming	Temp. & Humidity	20°C, 63%

IEEE 802.11a Mode

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 1	Low	5180	4.406	5.234	5.050	5.880	11.19	11.86	PASS
	Middle	5200	4.259	4.235	3.534	7.188	11.07	11.86	PASS
	High	5240	4.002	2.962	3.141	9.372	11.82	11.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 11.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3*

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/500kHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 3	Low	5745	1.181	1.110	1.423	6.568	9.31	24.86	PASS
	Middle	5785	2.201	2.315	1.301	1.744	7.93	24.86	PASS
	High	5825	3.504	3.473	3.519	3.468	9.51	24.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 24.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT20 Mode

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 1	Low	5180	5.140	5.636	4.698	5.661	11.32	11.86	PASS
	Middle	5200	4.841	5.522	4.450	5.772	11.20	11.86	PASS
	High	5240	4.938	5.302	4.350	5.656	11.11	11.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 6.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 11.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/500kHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 3	Low	5745	5.722	6.036	4.880	5.088	11.48	24.86	PASS
	Middle	5785	5.930	6.377	5.750	5.591	11.94	24.86	PASS
	High	5825	5.964	5.378	5.249	5.470	11.54	24.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 6.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 24.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT40 Mode

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 1	Low	5190	1.419	1.022	0.822	1.708	7.28	11.86	PASS
	High	5230	3.299	3.716	3.155	3.581	9.46	11.86	PASS

Remark:
1. *At finial test to get the worst-case emission at 13.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 11.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3..*

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/500kHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 3	Low	5755	1.754	2.493	1.463	1.887	7.94	24.86	PASS
	High	5795	2.076	2.937	1.819	2.989	8.51	24.86	PASS

Remark:
1. *At finial test to get the worst-case emission at 13.5Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 24.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT80 Mode

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 1	Low	5210	-4.774	-4.773	-5.099	-3.769	1.45	11.86	PASS

Remark:
1. *At finial test to get the worst-case emission at 29.3 Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 11.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/500kHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 3	Low	5775	-1.619	-1.673	-2.506	-1.500	4.21	24.86	PASS

Remark:
1. *At finial test to get the worst-case emission at 29.3 Mbps.*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 24.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

IEEE 802.11ac VHT 160 Mode

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 1	Low	5210	-4.322	-4.061	-23.841	-40.096	-1.16	11.86	PASS

Remark:

1. *At finial test to get the worst-case emission at 58.5Mbps..*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 11.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

UNII Band	CH.	Channel Frequency (MHz)	Peak Power Spectral Density (dBm/500kHz)						Result
			Chain 0	Chain 1	Chain 2	Chain 3	Total	Limit	
Band 3	Low	5775	-39.780	-33.350	-0.425	-0.113	2.75	24.86	PASS

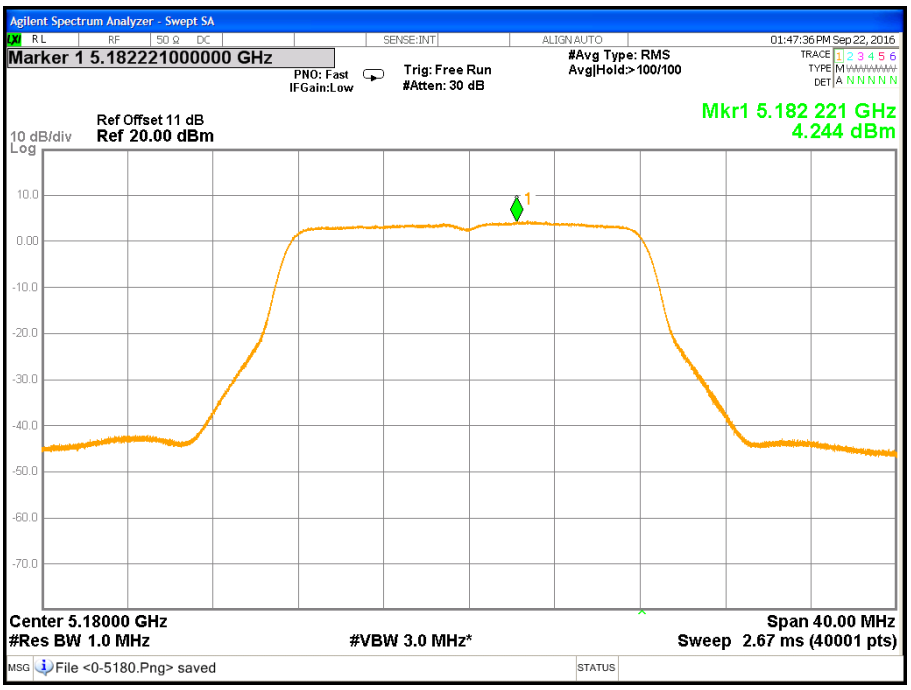
Remark:

1. *At finial test to get the worst-case emission at 58.5Mbps..*
2. *The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 11.14dBi which is more than 6dBi, the limit should be 24.86dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2 + Chain 3.*

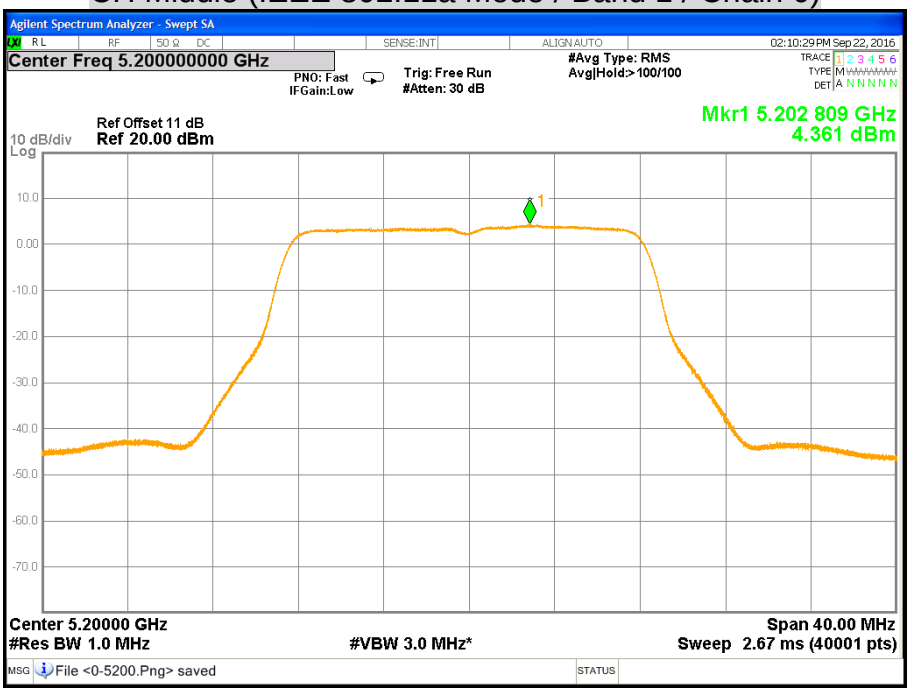
POWER SPECTRAL DENSITY

Non-beamforming

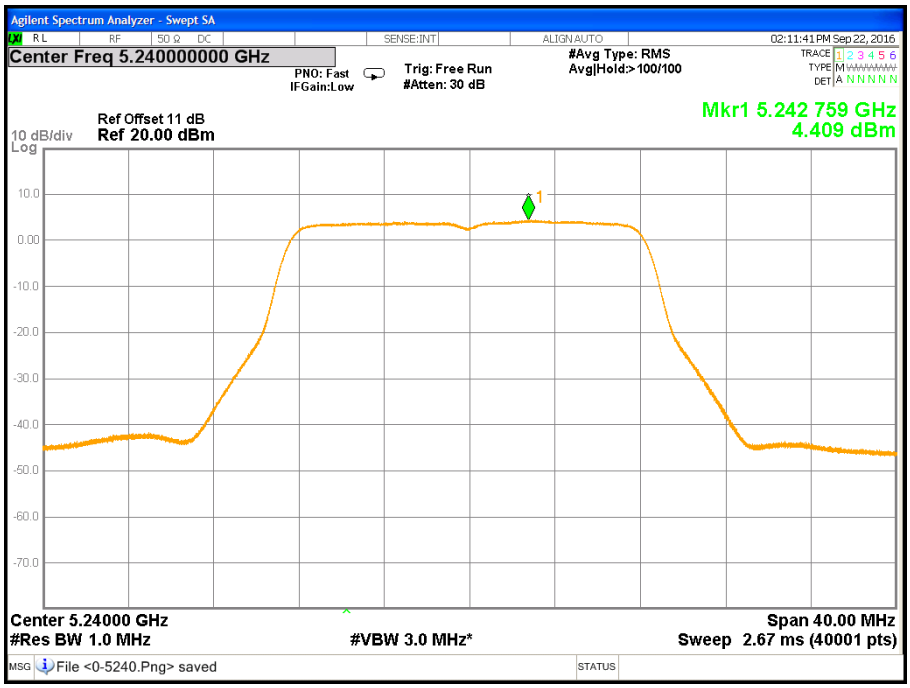
CH Low (IEEE 802.11a Mode / Band 1 / Chain 0)



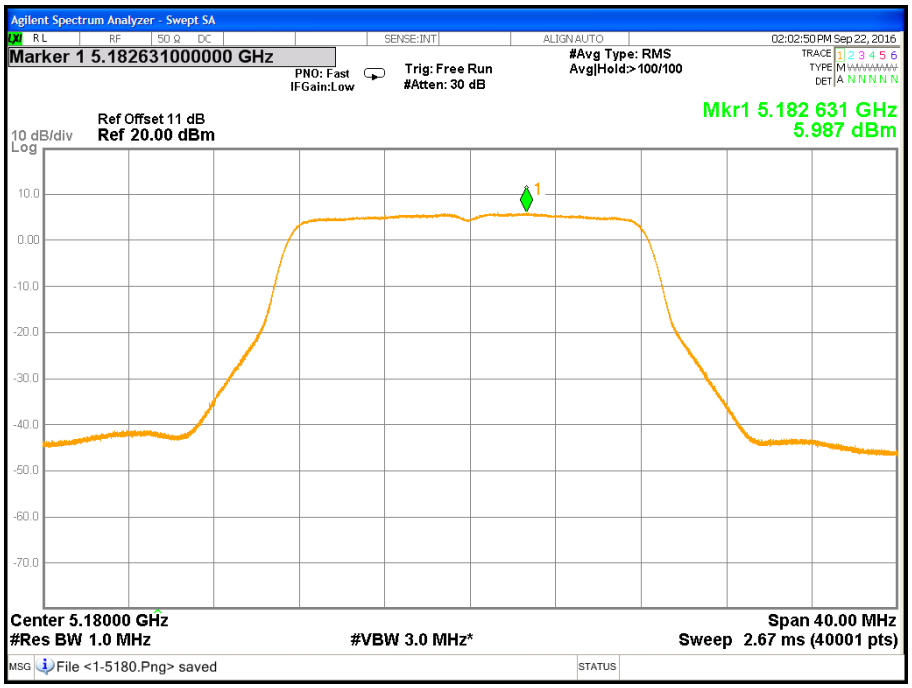
CH Middle (IEEE 802.11a Mode / Band 1 / Chain 0)



CH High (IEEE 802.11a Mode / Band 1 / Chain 0)



CH Low (IEEE 802.11a Mode / Band 1 / Chain 1)



CH Middle (IEEE 802.11a Mode / Band 1 / Chain 1)