



TEST REPORT

Report Number. : R13541206-E5

Applicant : Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

Model : 1964

FCC ID : C3K1964

IC : 3048A-1964

EUT Description : Portable Computing Device

Test Standard(s) : FCC 47 CFR PART 15 SUBPART E
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5 + A2

Date Of Issue:
2021-08-13

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
v1	2021-05-25	Initial Issue	Niklas Haydon
V2	2021-06-22	Reformatted 802.11a data. This mode does not support 2Tx CDD.	Brian T. Kiewra
V3	2021-08-13	Updated power for 5.2GHz 11a and 5.3GHz 11a Added note in Radiated section regarding below 30MHz & Above 18GHz emisisions	Cristian Melara

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	5
2. TEST RESULT SUMMARY	7
3. TEST METHODOLOGY	8
4. FACILITIES AND ACCREDITATION	8
5. DECISION RULES AND MEASUREMENT UNCERTAINTY	9
5.1. METROLOGICAL TRACEABILITY	9
5.2. DECISION RULES.....	9
5.3. MEASUREMENT UNCERTAINTY.....	9
5.4. SAMPLE CALCULATION	9
6. EQUIPMENT UNDER TEST	10
6.1. EUT DESCRIPTION	10
6.2. MAXIMUM OUTPUT POWER.....	10
6.3. DESCRIPTION OF AVAILABLE ANTENNAS.....	13
6.4. SOFTWARE AND FIRMWARE.....	13
6.5. WORST-CASE CONFIGURATION AND MODE.....	14
6.6. DESCRIPTION OF TEST SETUP.....	19
7. MEASUREMENT METHOD.....	20
8. TEST AND MEASUREMENT EQUIPMENT	21
9. ANTENNA PORT TEST RESULTS	24
9.1. ON TIME AND DUTY CYCLE.....	24
9.1.1. ON TIME AND DUTY CYCLE RESULTS.....	24
9.2. 26 dB BANDWIDTH.....	27
9.2.1. 802.11a MODE IN THE 5.2 GHz BAND.....	27
9.2.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND	30
9.2.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND	32
9.2.4. 802.11ac VHT80 MODE IN THE 5.2 GHz BAND	33
9.2.5. 802.11ac VHT160 MODE IN THE 5.2/5.3 GHz BAND	34
9.2.6. 802.11a MODE IN THE 5.3 GHz BAND.....	35
9.2.7. 802.11n HT20 MODE IN THE 5.3 GHz BAND	37
9.2.8. 802.11n HT40 MODE IN THE 5.3 GHz BAND	39

9.2.9. 802.11ac VHT80 MODE IN THE 5.3 GHz BAND40

9.3. 99% BANDWIDTH.....41

9.3.1. 802.11a MODE IN THE 5.2 GHz BAND.....41

9.3.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND44

9.3.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND46

9.3.4. 802.11ac VHT80 MODE IN THE 5.2 GHz BAND47

9.3.5. 802.11ac VHT160 MODE IN THE 5.2/5.3 GHz BAND48

9.3.6. 802.11a MODE IN THE 5.3 GHz BAND.....49

9.3.7. 802.11n HT20 MODE IN THE 5.3 GHz BAND51

9.3.8. 802.11n HT40 MODE IN THE 5.3 GHz BAND53

9.3.9. 802.11ac VHT80 MODE IN THE 5.3 GHz BAND54

9.4. OUTPUT POWER AND PSD.....55

9.4.1. 802.11a MODE IN THE 5.2 GHz BAND.....57

9.4.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND67

9.4.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND81

9.4.4. 802.11ac VHT80 MODE IN THE 5.2 GHz BAND93

9.4.5. 802.11ac VHT160 MODE IN THE 5.2 GHz BAND105

9.4.6. 802.11a MODE IN THE 5.3 GHz BAND.....117

9.4.7. 802.11n HT20 MODE IN THE 5.3 GHz BAND125

9.4.8. 802.11n HT40 MODE IN THE 5.3 GHz BAND139

9.4.9. 802.11ac VHT80 MODE IN THE 5.3 GHz BAND151

9.4.10. 802.11ac VHT160 MODE IN THE 5.3 GHz BAND163

10. RADIATED TEST RESULTS.....164

10.1. TRANSMITTER ABOVE 1 GHz.....165

10.1.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND165

10.1.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND.....175

10.1.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND.....187

10.1.4. TX ABOVE 1 GHz 802.11ac VHT80 MODE IN THE 5.2 GHz BAND.....199

10.1.5. TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND205

10.1.6. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND.....219

10.1.7. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND.....239

10.1.8. TX ABOVE 1 GHz 802.11ac VHT80 MODE IN THE 5.3 GHz BAND.....251

10.1.9. TX ABOVE 1 GHz 802.11ac VHT160 MODE IN THE 5.2 & 5.3 GHz BAND257

11. SETUP PHOTOS.....269

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

EUT DESCRIPTION: Portable Computing Device

MODEL: 1964

SERIAL NUMBER: 0F0002Z211200C (radiated)
0F000AN211200C (radiated)
0F0008Z211200C (radiated)
0F0003K211200C (antenna port conducted)
0F0003W211200C (antenna port conducted)
0F0003V211200C (antenna port conducted)

SAMPLE RECEIPT DATE: 2021-04-12

DATE TESTED: 2021-04-13 to 2021-05-04 , 2021-08-10, 2021-08-13

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 + A2	Complies

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

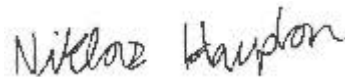
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2. TEST RESULT SUMMARY

This report contains data provided by the applicant which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	Per ANSI C63.10, Section 12.2.
See Comment	RSS-GEN 6.7	26dB BW/99% OBW	Reporting purposes only	Per ANSI C63.10 Sections 6.9.2 and 6.9.3
15.407 (a) (1-4), (h) (1)	RSS-247 6.2	Output Power	Complies	None.
15.407 (a) (1-3, 5)	RSS-247 6.2	PSD	Complies	None.
15.209, 15.205, 15.407 (b)	RSS-GEN 8.9, 8.10, RSS-247 6.2	Radiated Emissions	Complies	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Complies	None.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with;

- FCC CFR 47 Part 2
- FCC CFR 47 Part 15
- FCC KDB 662911 D01 v02r01,
- FCC KDB 905462 D06 v02
- FCC KDB 789033 D02 v02r01,
- KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013
- RSS-GEN Issue 5 + A2
- RSS-247 Issue 2

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification #0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input checked="" type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr Morrisville, NC 27560, U.S.A			

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57%
Humidity	3.39%
DC Supply voltages	1.70%
Time	3.39%

Uncertainty figures are valid to a confidence level of 95%.

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Final Voltage (dBuV)} = \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor (dB)} + \text{LISN Insertion Loss}$$

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a portable computing device. This report covers the 5.2/5.3 WLAN non-ax radio in the device.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

5.2 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.2 GHz band, 1TX, ANT A			
5180-5240	802.11a	18.71	74.30
5180-5240	802.11n HT20	18.89	77.45
5190-5230	802.11n HT40	18.05	63.83
5210	802.11ac VHT80	14.18	26.18
5250	802.11ac VHT160	12.25	16.79
5.2 GHz band, 1TX, ANT B			
5180-5240	802.11a	18.22	66.37
5180-5240	802.11n HT20	18.94	78.34
5190-5230	802.11n HT40	18.06	63.97
5210	802.11ac VHT80	14.30	26.92
5250	802.11ac VHT160	12.69	18.58
5.2 GHz band, 2TX			
5180-5240	802.11n HT20 SDM	21.01	126.18
5190-5230	802.11n HT40 SDM	19.03	79.98
5210	802.11ac VHT80 SDM	16.17	41.40

5.2 GHz BAND (IC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.2 GHz band, 1TX, ANT A			
5180-5240	802.11a	12.73	18.75
5180-5240	802.11n HT20	12.49	17.74
5190-5230	802.11n HT40	16.07	40.46
5210	802.11ac VHT80	14.18	26.18
5250	802.11ac VHT160	12.25	16.79
5.2 GHz band, 1TX, ANT B			
5180-5240	802.11a	13.15	20.65
5180-5240	802.11n HT20	12.32	17.06
5190-5230	802.11n HT40	16.07	40.46
5210	802.11ac VHT80	14.30	26.92
5250	802.11ac VHT160	12.69	18.58
5.2 GHz band, 2TX			
5180-5240	802.11n HT20 SDM	13.29	21.33
5190-5230	802.11n HT40 SDM	15.40	34.67
5210	802.11ac VHT80 SDM	16.17	41.40

5.3 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.3 GHz band, 1TX, ANT A			
5260 - 5320	802.11a	19.28	84.72
5260 - 5320	802.11n HT20	19.03	79.98
5270 - 5310	802.11n HT40	18.13	65.01
5290	802.11ac VHT80	13.04	20.14
5250	802.11ac VHT160 SDM	12.25	16.79
5.3 GHz band, 1TX, ANT B			
5260 - 5320	802.11a	19.47	88.51
5260 - 5320	802.11n HT20	19.01	79.62
5270 - 5310	802.11n HT40	18.21	66.22
5290	802.11ac VHT80	13.39	21.83
5250	802.11ac VHT160	12.69	18.58
5.3 GHz band, 2TX			
5260 - 5320	802.11n HT20	20.54	113.24
5270 - 5310	802.11n HT40 SDM	18.97	78.89
5290	802.11ac VHT80 SDM	13.96	24.89
5250	802.11ac VHT160 SDM	13.49	22.34

5.3 GHz BAND (IC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.3 GHz band, 1TX, ANT A			
5260 - 5320	802.11a	19.28	84.72
5260 - 5320	802.11n HT20	19.03	79.98
5270 - 5310	802.11n HT40	18.13	65.01
5290	802.11ac VHT80	13.04	20.14
5250	802.11ac VHT160 SDM	12.25	16.79
5.3 GHz band, 1TX, ANT B			
5260 - 5320	802.11a	19.47	88.51
5260 - 5320	802.11n HT20	19.01	79.62
5270 - 5310	802.11n HT40	18.21	66.22
5290	802.11ac VHT80	13.39	21.83
5250	802.11ac VHT160	12.69	18.58
5.3 GHz band, 2TX			
5260 - 5320	802.11n HT20	20.54	113.24
5270 - 5310	802.11n HT40 SDM	18.97	78.89
5290	802.11ac VHT80 SDM	13.96	24.89
5250	802.11ac VHT160 SDM	13.49	22.34

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

The radio utilizes two PIFA antennas, with the following gains:

Frequency	Antenna A	Antenna B
5150 to 5250MHz	4.5 dBi	3.4 dBi
5250 to 5350MHz	4.6 dBi	4.6 dBi

6.4. SOFTWARE AND FIRMWARE

OS: Windows Build 19041.vb_release 191206-1406
Test tool version 22.35020.0.0-01924
WLAN driver 22.20.0.5
BT driver 22.30.0.4

6.5. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated in the three available configurations (A, B and C as described in the test setup photos) for Antenna A. Where a configuration can be portable it was also investigated in three orthogonal orientations (X, Y, Z) modes. It was determined that C (portable) configuration in Y orientation was the worst-case configuration orientation; therefore, all final radiated testing was performed with the EUT in C (portable) configuration in Y orientation. for Antenna A.

The fundamental of the EUT was investigated in the three available configurations (A, B and C as described in the test setup photos) for Antenna B. Where a configuration can be portable it was also investigated in three orthogonal orientations (X, Y, Z) modes. It was determined that C (portable) configuration in Z orientation was the worst-case configuration orientation; therefore, all final radiated testing was performed with the EUT in C (portable) configuration in Z orientation. for Antenna B.

The fundamental of the EUT was investigated in the three available configurations (A, B and C as described in the test setup photos) for Antenna A + Antenna B. Where a configuration can be portable it was also investigated in three orthogonal orientations (X, Y, Z) modes. It was determined that A configuration was the worst-case configuration orientation; therefore, all final radiated testing was performed with the EUT in configuration A for Antenna A + Antenna B.

All radios that can transmit simultaneously have been evaluated for radiated for all possible combinations of transmission and found to be in compliance.

Note: 802.11a does not support CDD mode, however for radiated testing this mode was tested as ANT A + ANT B using SISO power as worst-case scenario, except if this was non-compliant. In this case 1 Tx mode was tested.

Worst-case data rates as provided by the client were:

802.11a 1Tx mode: 6 Mbps
802.11n HT20 1Tx mode: MCS0
802.11n HT40 1Tx mode: MCS0
802.11ac VHT80 1Tx mode: MCS0
802.11ac VHT160 1Tx mode: MCS0
802.11n HT20 2Tx, SDM mode: MCS8
802.11n HT40 2Tx, SDM mode: MCS8
802.11ac VHT80 2Tx, SDM mode: MCS0 (NSS=2)
802.11ac VHT160 2Tx, SDM mode: MCS0 (NSS=2)

Radiated band edge emissions (FCC settings), output power, average power, and power spectral density were performed with the EUT set to the max power setting of each modulation/channel/mode the EUT will be set at:

Frequency Band	FCC 2Tx SDM			
	Wi-Fi Channels	802.11n20	Wi-Fi Channels	802.11n40
5150 to 5350 MHz	36	16	38	14
	40	17		
	44	18	46	16
	48	18		
	52	17.5	54	16
	56	17.5		
	60	17.5	62	11
	64	13		

Frequency Band	FCC 2Tx SDM			
	Wi-Fi Channels	802.11ac80	Wi-Fi Channels	802.11ac160
5150 to 5350 MHz	42	13	50	10
	58	11		

Frequency Band	FCC 1Tx Antenna A/B				
	Wi-Fi Channels	802.11a	802.11n20	Wi-Fi Channels	802.11n40
5150 to 5350 MHz	36	18	18	38	16
	40	19	19		
	44	19	-	46	18
	48	19	19		
	52	19	19	54	18
	56	18	18		
	60	17	17	62	15
	64	15	15		

Frequency Band	FCC 1Tx Antenna A/B			
	Wi-Fi Channels	802.11ac80	Wi-Fi Channels	802.11ac160
5150 to 5350 MHz	42	14	50	12
	58	13		

Frequency Band	IC 2Tx SDM			
	Wi-Fi Channels	802.11n20	Wi-Fi Channels	802.11n40
5150 to 5350 MHz	36	11	38	13
	40	11		
	44	11	46	13
	48	11		
	52	17.5	54	16
	56	17.5		
	60	17.5	62	11
	64	13		

Frequency Band	IC 2Tx SDM			
	Wi-Fi Channels	802.11ac80	Wi-Fi Channels	802.11ac160
5150 to 5350 MHz	42	13	50	10
	58	11		

Frequency Band	IC 1Tx Antenna A/B				
	Wi-Fi Channels	802.11a	802.11n20	Wi-Fi Channels	802.11n40
5150 to 5350 MHz	36	13	13	38	16
	40	13	13		
	44	13	13	46	16
	48	13	13		
	52	19	19	54	18
	56	18	18		
	60	17	17	62	15
	64	15	15		

Frequency Band	IC 1Tx Antenna A/B			
	Wi-Fi Channels	802.11ac80	Wi-Fi Channels	802.11ac160
5150 to 5350 MHz	42	14	50	12
	58	13		

26dB and 99% bandwidth were performed with the EUT set in 2Tx modes at 1Tx power levels:

Frequency Band	2Tx CCD/SDM			
	Wi-Fi Channels	802.11n20	Wi-Fi Channels	802.11n40
5150 to 5350 MHz	36	18	38	16
	40	19		
	44	-	46	18
	48	19		
	52	19	54	18
	56	18		
	60	17	62	15
	64	15		

Frequency Band	2Tx CCD/SDM			
	Wi-Fi Channels	802.11ac80	Wi-Fi Channels	802.11ac160
5150 to 5350 MHz	42	14	50	11
	58	13		

Radiated spurious emissions between 1GHz and 18GHz (not including radiated band edge emissions), were performed with the EUT set to transmit on low, middle and high channels on each modulation with the maximum output power settings (note – These are set higher than the final power levels listed above). Testing was performed in 802.11a mode which is considered worst-case power and PSD when set at the max. power settings and yields the worst-case spurious emissions.

Frequency Band	2Tx CCD/SDM				
	Wi-Fi Channels	802.11a	802.11n20	Wi-Fi Channels	802.11n40
5150 to 5350 MHz	36	19	-	38	-
	40	19	-		
	44	-	-	46	-
	48	19	-		
	52	19	-	54	-
	56	-	-		
	60	19	-	62	-
	64	19	-		

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed in UL LLC report R13541206-E7.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
USB Hub	J5create	JCA374	AY2A1904000477	NA
USB Hub	J5create	JCA374	AY3A2010013253	NA
USB Hub	J5create	JCD383	DL3A1903011541	NA
USB Hub	J5create	JCD383	FY5A2010034764	NA
Earbuds	Sony	MDR-EX14AP	NA	NA
Earbuds	Sony	MDR-EX14AP	NA	NA
Earbuds	JVC	HA-FXL	NA	NA
Power Supply	Microsoft	1706	0D130U0HD210C	NA
Power Supply	Microsoft	1706	0D130U0GX310C	N/A
Power Supply	Microsoft	1706	0D130U0HD710C	N/A
Power Supply	Microsoft	1706	0D130U0GU310C	N/A
Power Supply	Microsoft	1706	0D130U0HDL10C	N/A

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Mains	1	12-pin	Mains	<3	Goes to ac/dc adapter
2	USB-C	2	USB-C	USB	<3	None

TEST SETUP

Test software on the EUT exercised the radio card.

SETUP DIAGRAMS

Please refer to R13541206-EP2 for setup diagrams.

7. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 789033 D02 v02r01, Section B.

26 dB Emission BW: KDB 789033 D02 v02r01, Section C.1

99% Occupied BW: KDB 789033 D02 v02r01, Section D.

Conducted Output Power: KDB 789033 D02 v02r01, Section E.3.b (Method PM-G)

Power Spectral Density: KDB 789033 D02 v02r01, Section F

Unwanted emissions in restricted bands: KDB 789033 D02 v02r01, Sections G.1, G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v02r01, Sections G.2, G.3, G.4, and G.5.

General Radiated Spurious Emissions: ANSI C63.10-2013 Section 6.3-6.6

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

8. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Wireless Conducted Measurement Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
Conducted Room 1					
SA0025	Spectrum Analyzer	Agilent	N9030A	2021-04-01	2022-04-01
PWM002 (PRE0137344)	RF Power Meter	Keysight Technologies	N1911A	2020-07-31	2021-07-31
PWS001 (PRE0137347)	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-05-27	2021-05-27
PWS002 (PRE0137348)	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-07-31	2021-07-31
HI0090 (PRE0191271)	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
SOFTEMI	Antenna Port Software	UL	Version 2021.04.28	NA	NA
Conducted Room 2					
SA0027 (PRE0126407)	Spectrum Analyzer	Keysight Technologies	N9030A	2020-06-10	2021-06-10
SA0027 (PRE0126407)	Spectrum Analyzer	Keysight Technologies	N9030A	2021-06-25	2022-06-25
PWM004 (PRE0137346)	RF Power Meter	Keysight Technologies	N1911A	2020-07-31	2021-07-31
PWM004 (PRE0137346)	RF Power Meter	Keysight Technologies	N1911A	2021-07-16	2022-07-16
PWM001	RF Power Meter	Keysight Technologies	N1912A	2021-07-16	2022-07-16
PWS002 (PRE0137348)	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-08-12	2021-08-12
PWS003	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	E9323A	2021-05-27	2022-05-27
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2021-07-12	2022-07-12
SOFTEMI	Antenna Port Software	UL	Version 2021.4.13, 2021.4.28, 2021.4.29 2021.5.28	NA	NA

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-27	2021-04-27
	Gain-Loss Chains				
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-28	2021-07-28
	Receiver & Software				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-30	2022-03-30
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 2021)		
	Additional Equipment used				
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2020-08-06	2021-08-06

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-28	2021-04-28
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-05-26	2021-05-26
	Gain-Loss Chains				
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-06	2021-07-06
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-10	2022-03-10
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 2021)		
	Additional Equipment used				
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

Test Equipment Used - Radiated Disturbance Emissions (E-field) – Chamber C

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0062	HORN Antenna	ETS-Lindgren	3117	2021-02-03	2022-02-03
	Gain-Loss Chains				
C-SAC02	Gain-loss string: 1-18GHz	Various	Various	2021-04-15	2022-04-15
C-SAC02 Path 7	Gain-loss string 1-7GHz	Various	Various	2021-04-15	2022-04-15
	Receiver & Software				
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2020-03-09	2022-03-09
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0085	Temp/Humid/Pressure Meter	EXTECH	SD700	2020-04-20	2021-04-30

NOTES:

1. For equipment listed above that was calibrated during the testing period, please note the equipment was used for testing after calibration.
2. For equipment listed above that has a calibration due date during the testing period, the testing was completed before the equipment expiration date.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

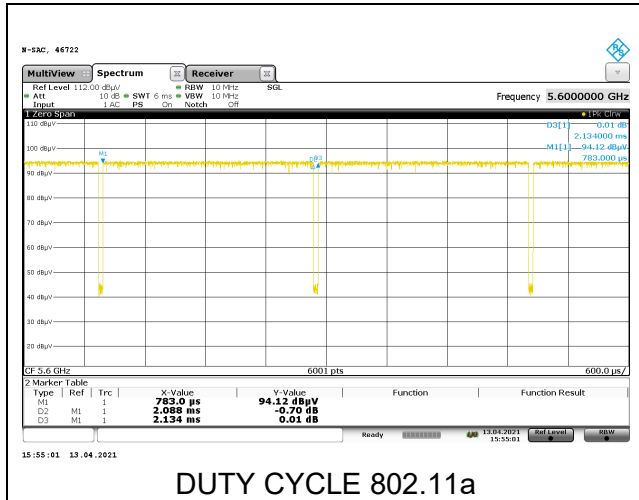
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

9.1.1. ON TIME AND DUTY CYCLE RESULTS

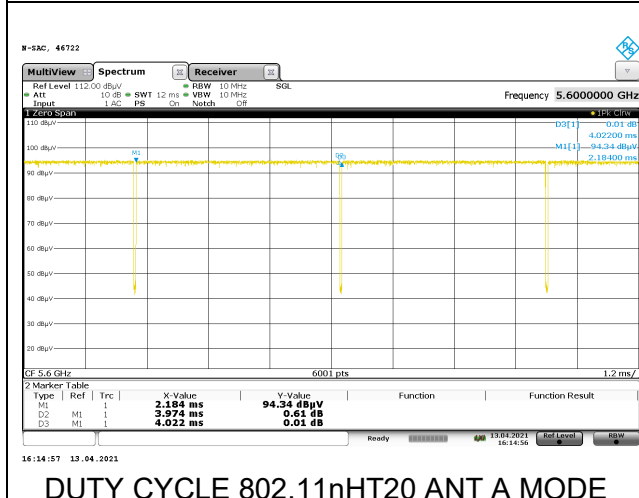
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction - RMS (dB)	Duty Cycle Correction - Voltage (dB)	1/B Minimum VBW (kHz)
802.11a	2.088	2.134	0.978	97.84%	0.09	0.19	0.479
802.11n HT20 Ant A	3.974	4.022	0.988	98.81%	0.00	0.00	0.010
802.11n HT20 Ant B	3.974	4.022	0.988	98.81%	0.00	0.00	0.010
802.11n HT40 Ant A	3.972	4.014	0.990	98.95%	0.00	0.00	0.010
802.11n HT40 Ant B	3.972	4.020	0.988	98.81%	0.00	0.00	0.010
802.11ac VHT80 Ant A	3.972	4.014	0.990	98.95%	0.00	0.00	0.010
802.11ac VHT80 Ant B	3.972	4.014	0.990	98.95%	0.00	0.00	0.010
802.11ac VHT160 Ant A	4.658	4.710	0.989	98.89%	0.00	0.00	0.010
802.11ac VHT160 Ant B	4.658	4.710	0.989	98.89%	0.00	0.00	0.010

DUTY CYCLE PLOTS

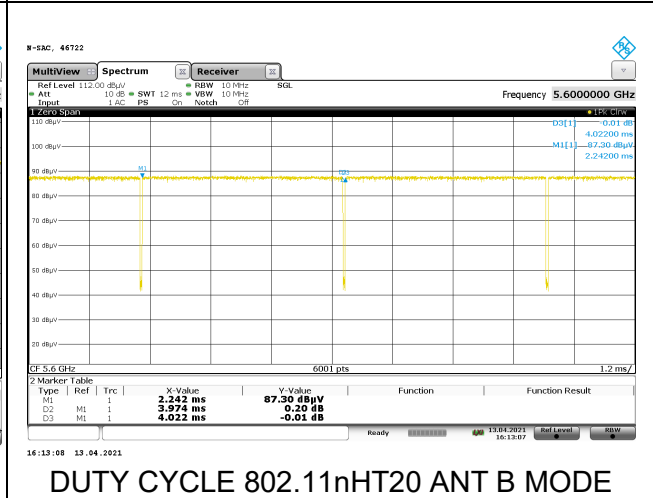


DUTY CYCLE 802.11a

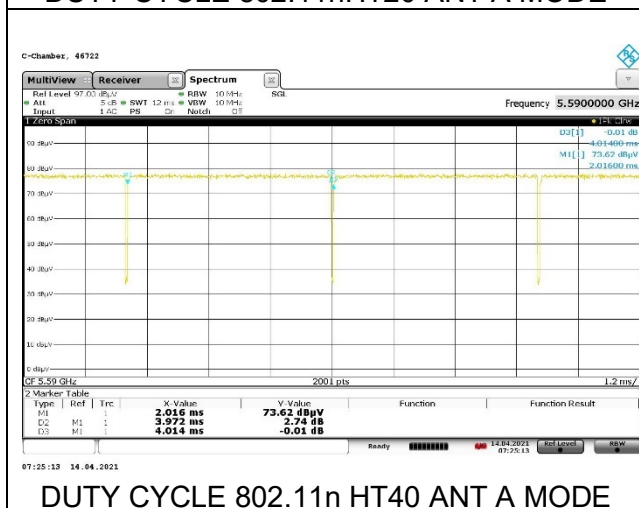
INTENTIONALLY LEFT BLANK



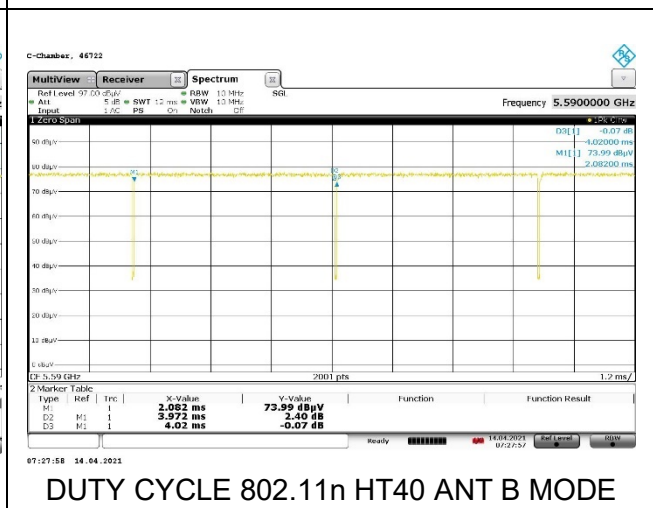
DUTY CYCLE 802.11nHT20 ANT A MODE



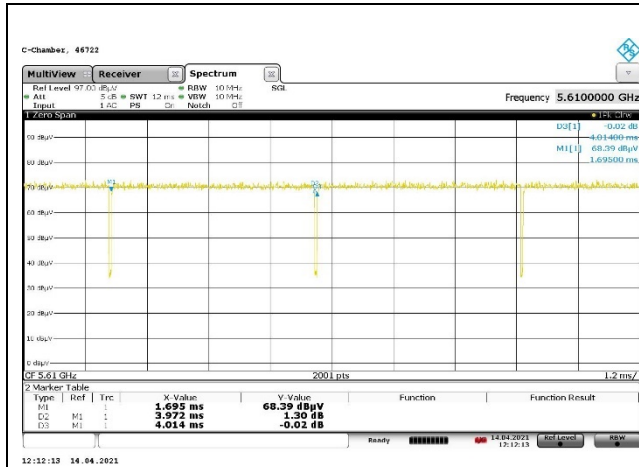
DUTY CYCLE 802.11nHT20 ANT B MODE



DUTY CYCLE 802.11n HT40 ANT A MODE



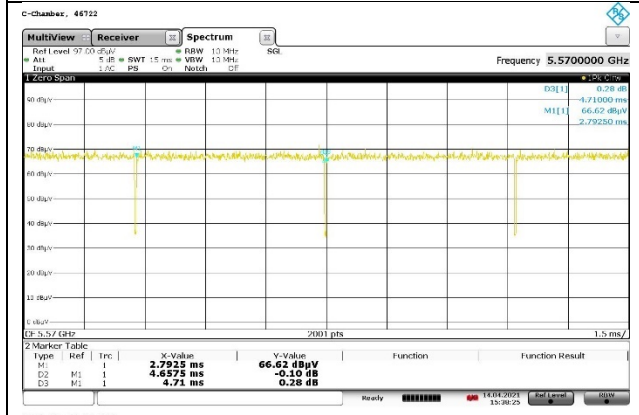
DUTY CYCLE 802.11n HT40 ANT B MODE



DUTY CYCLE 802.11ac VHT80 ANT A MODE



DUTY CYCLE 802.11ac VHT80 ANT B MODE



DUTY CYCLE 802.11ac VHT160 ANT A MODE



DUTY CYCLE 802.11ac VHT160 ANT B MODE

9.2. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

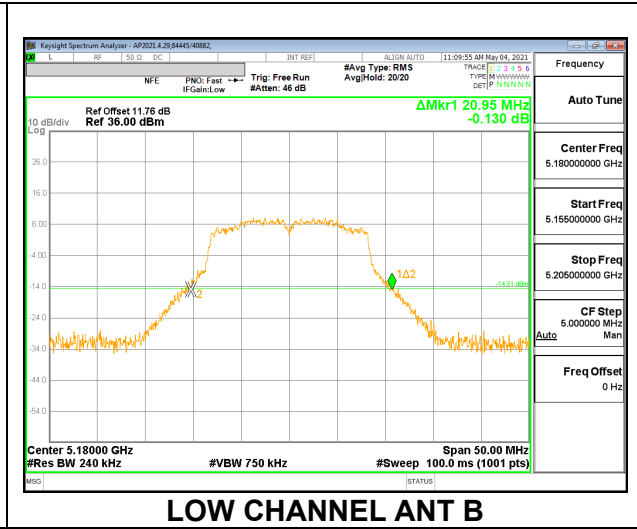
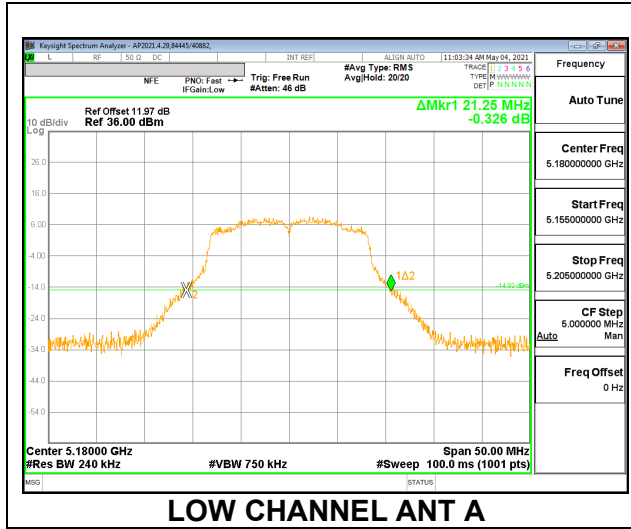
RESULTS

9.2.1. 802.11a MODE IN THE 5.2 GHz BAND

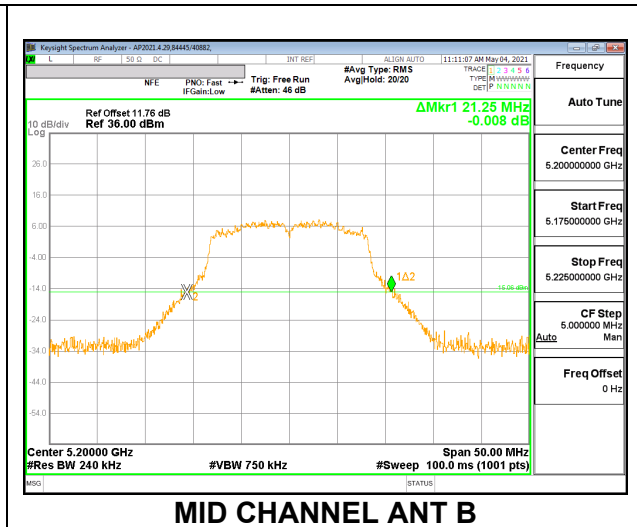
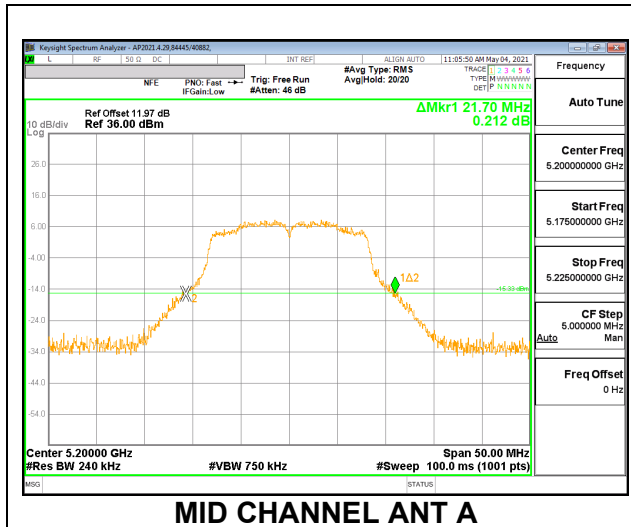
1Tx Antenna A and 1Tx Antenna B Mode

Channel	Frequency (MHz)	26 dB Bandwidth Antenna A (MHz)	26 dB Bandwidth Antenna B (MHz)
Low	5180	21.25	20.95
Mid	5200	21.70	21.25
Mid	5220	21.75	21.15
High	5240	21.90	21.00

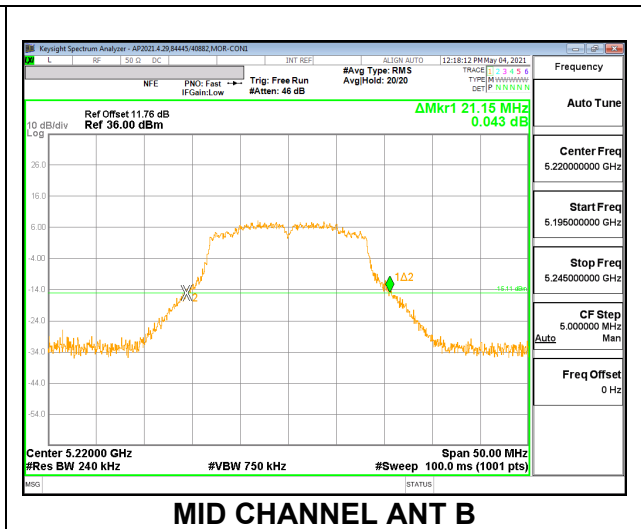
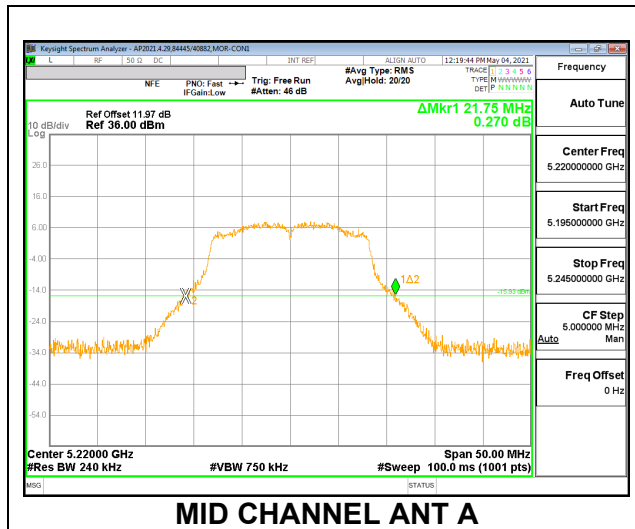
LOW CHANNEL



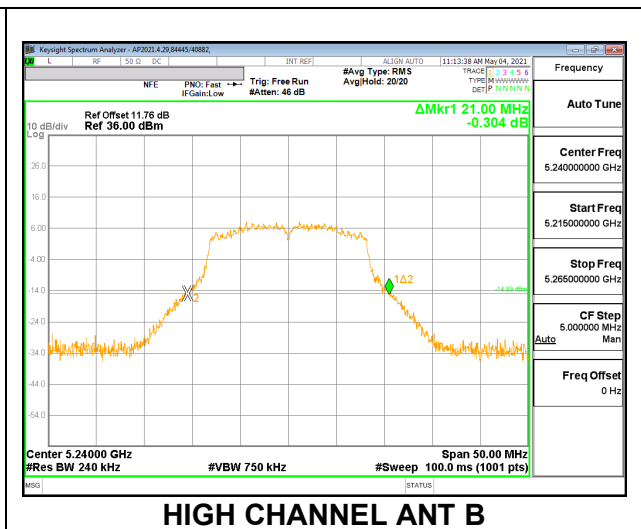
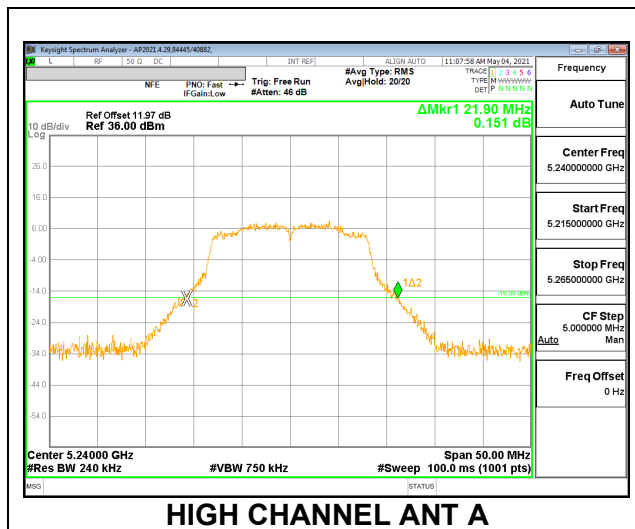
MID CHANNEL



MID CHANNEL



HIGH CHANNEL

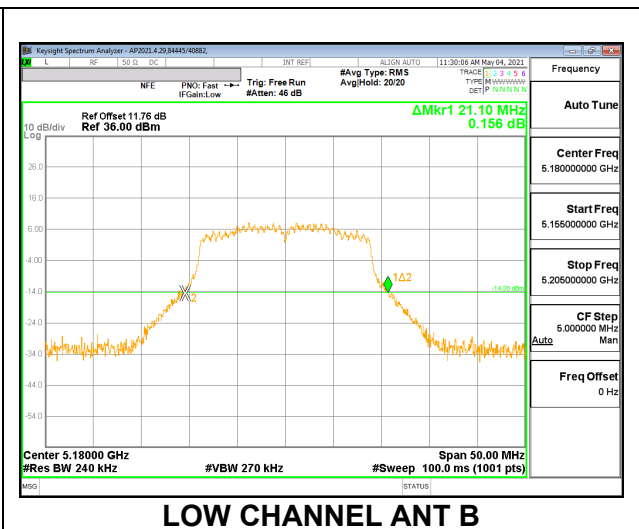
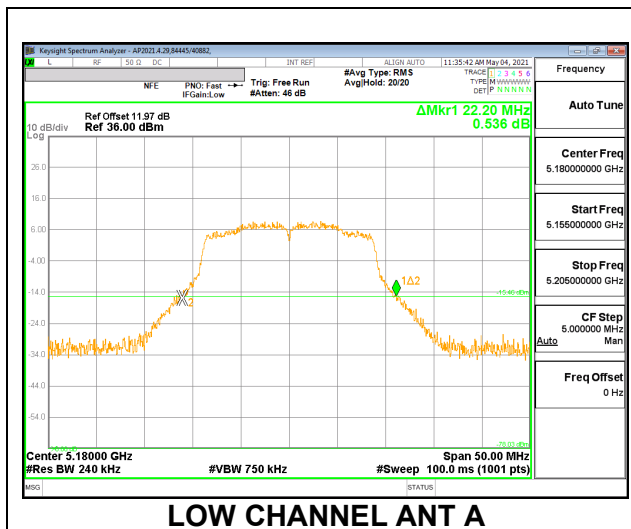


9.2.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

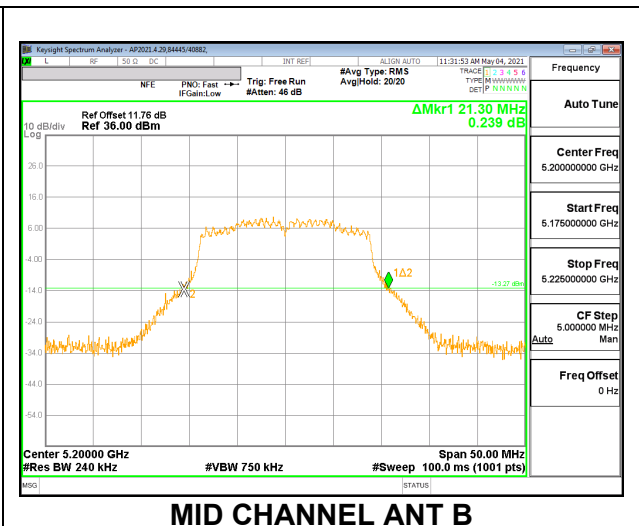
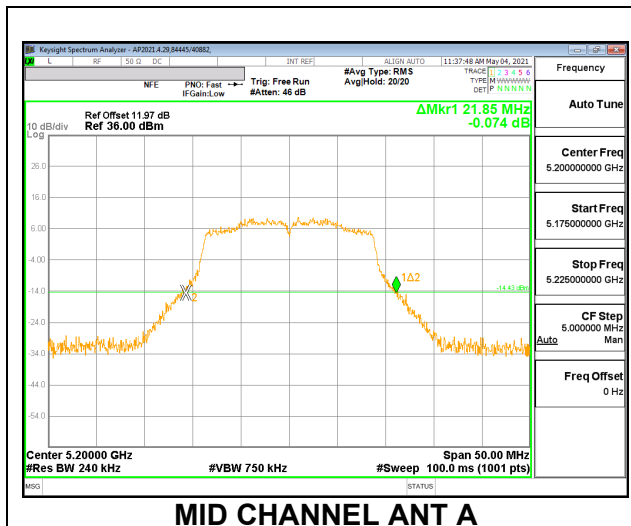
2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna A (MHz)	26 dB Bandwidth Antenna B (MHz)
Low	5180	22.20	21.10
Mid	5200	21.85	21.30
Mid	5220	22.30	21.75
High	5240	21.75	21.75

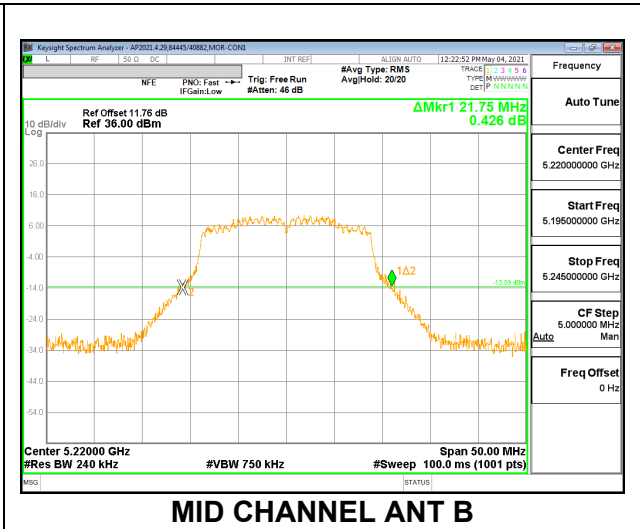
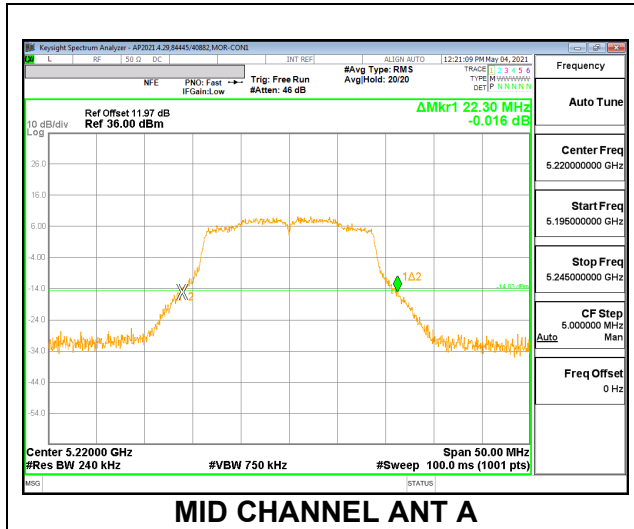
LOW CHANNEL



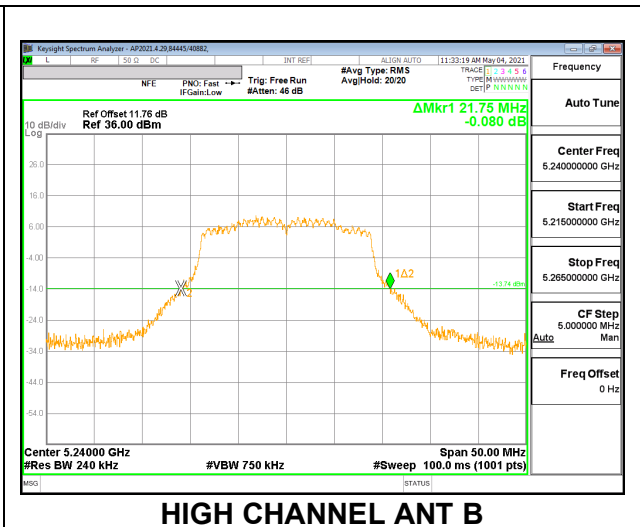
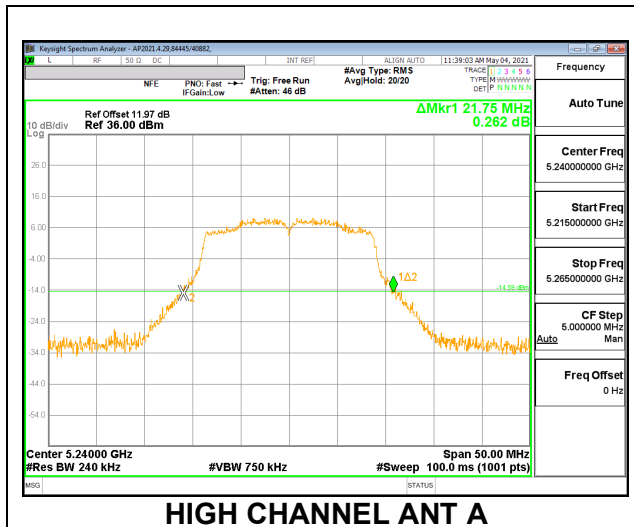
MID CHANNEL



MID CHANNEL



HIGH CHANNEL

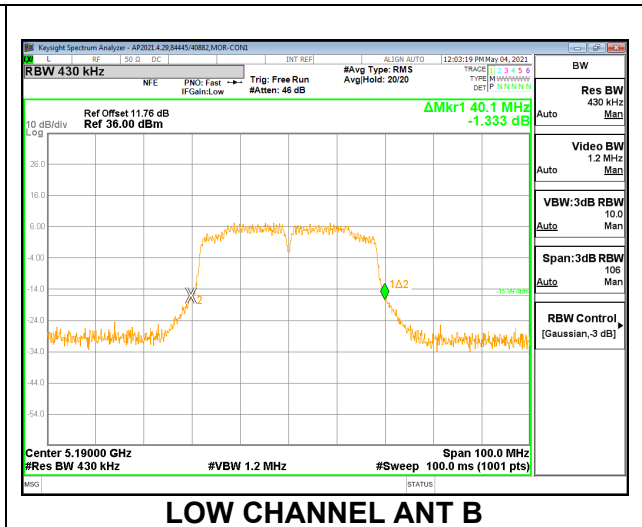
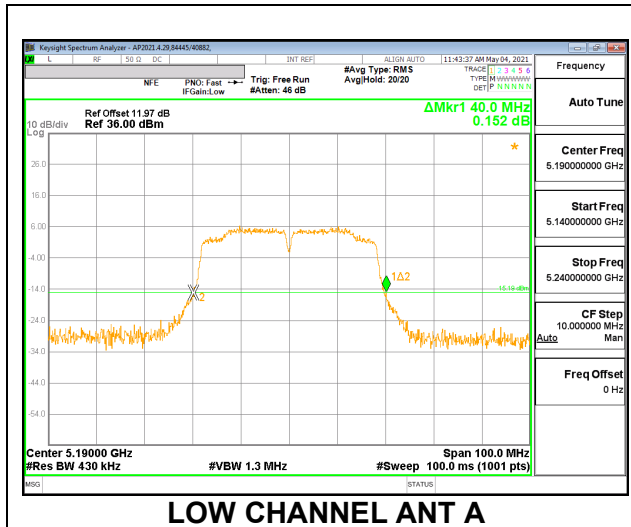


9.2.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

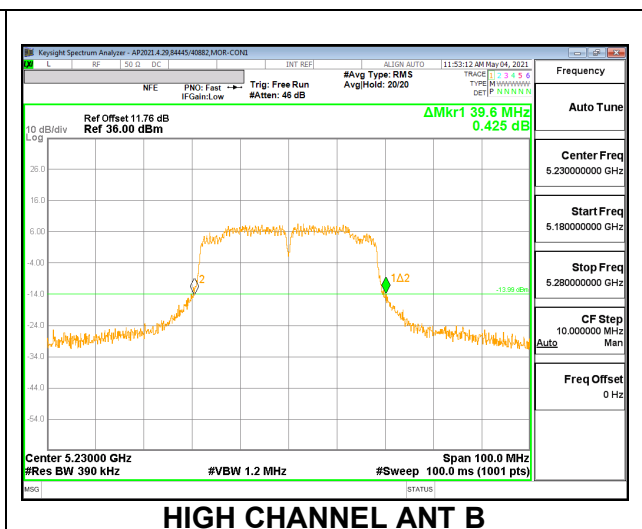
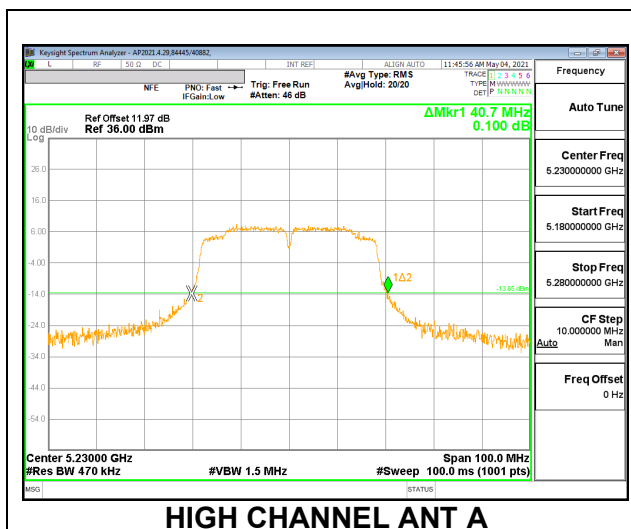
2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna A (MHz)	26 dB Bandwidth Antenna B (MHz)
Low	5190	40.00	40.10
High	5230	40.70	39.60

LOW CHANNEL



HIGH CHANNEL

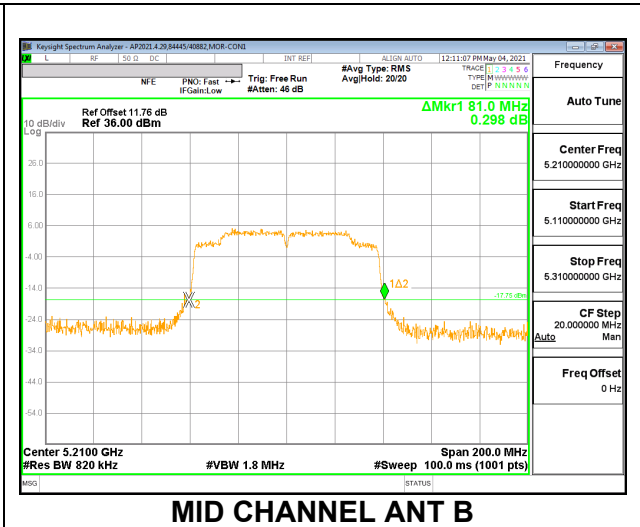
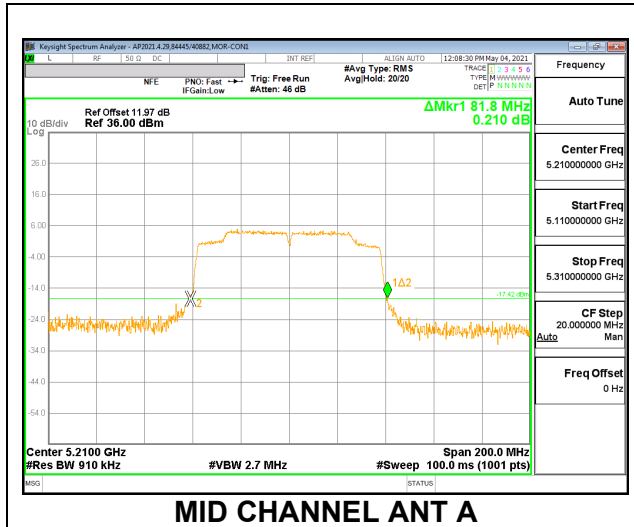


9.2.4. 802.11ac VHT80 MODE IN THE 5.2 GHz BAND

2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna A (MHz)	26 dB Bandwidth Antenna B (MHz)
Mid	5210	81.80	81.00

MID CHANNEL

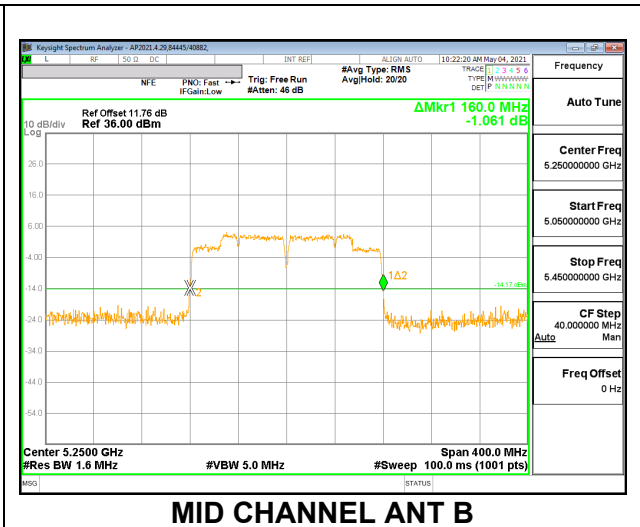
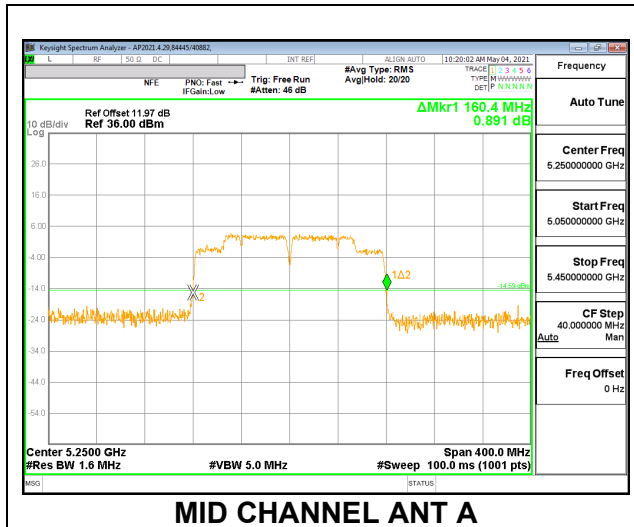


9.2.5. 802.11ac VHT160 MODE IN THE 5.2/5.3 GHz BAND

2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna A (MHz)	26 dB Bandwidth Antenna B (MHz)
Mid	5250	160.40	160.00

MID CHANNEL

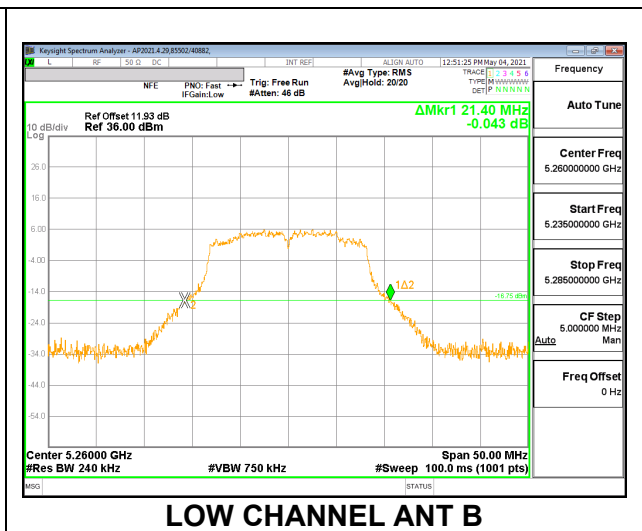
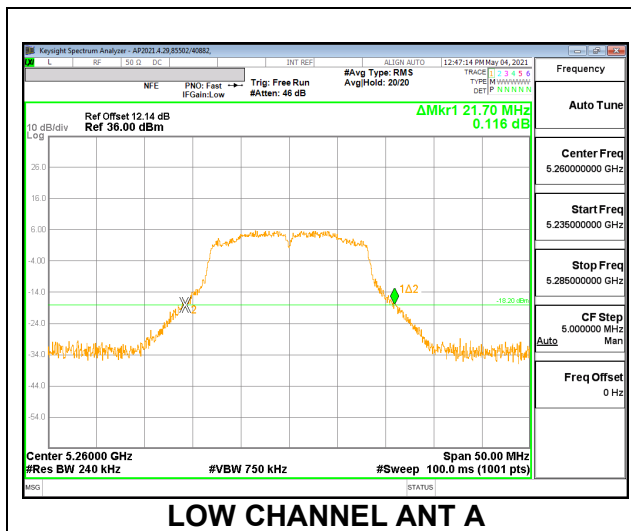


9.2.6. 802.11a MODE IN THE 5.3 GHz BAND

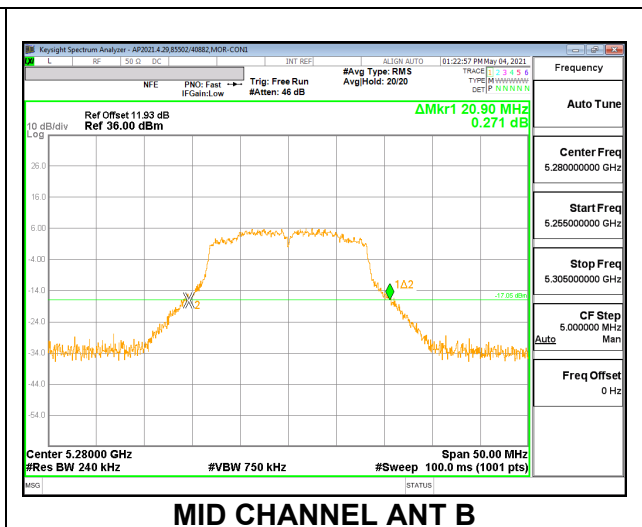
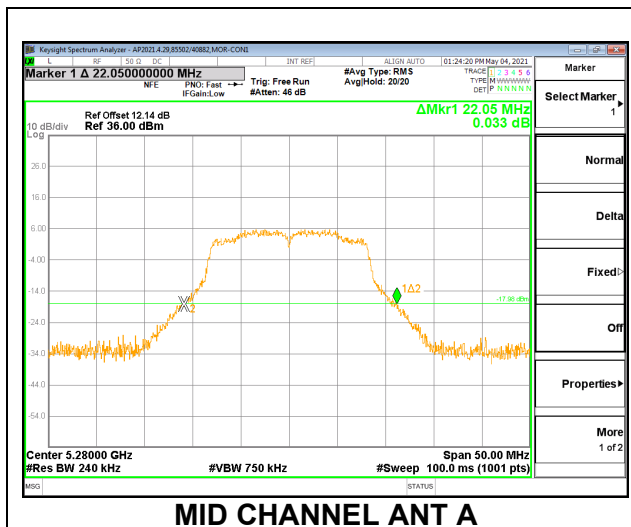
1Tx Antenna A and 1Tx Antenna B Mode

Channel	Frequency (MHz)	26 dB Bandwidth Antenna A (MHz)	26 dB Bandwidth Antenna B (MHz)
Low	5260	21.70	21.40
Mid	5280	22.05	20.90
Mid	5300	21.80	21.65
High	5320	21.40	21.25

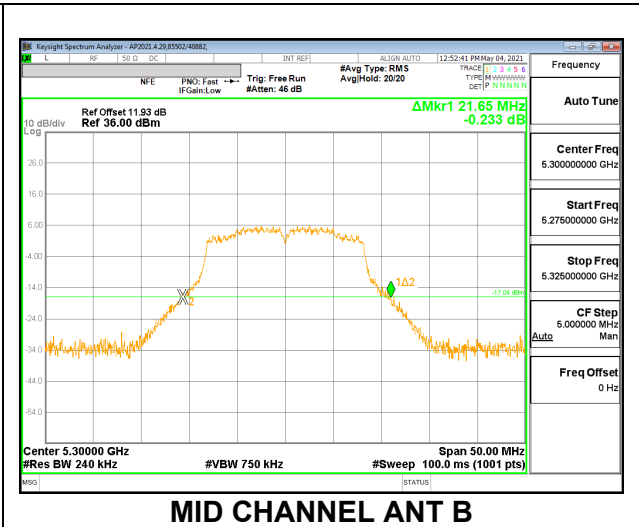
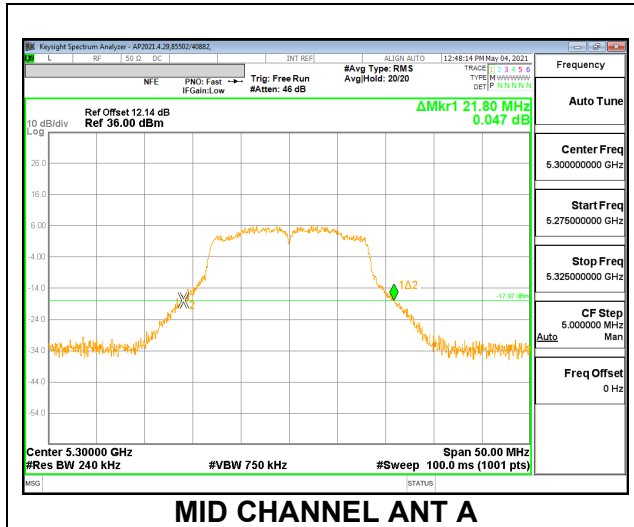
LOW CHANNEL



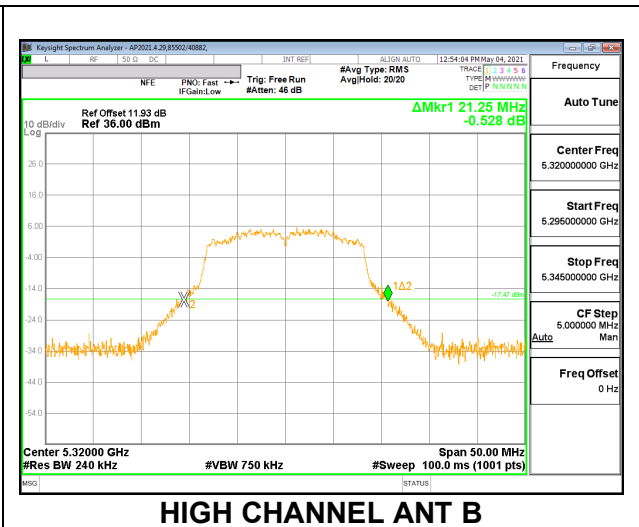
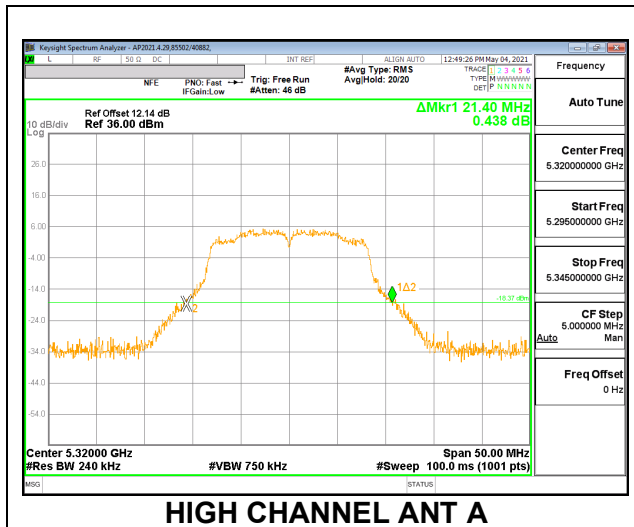
MID CHANNEL



MID CHANNEL



HIGH CHANNEL

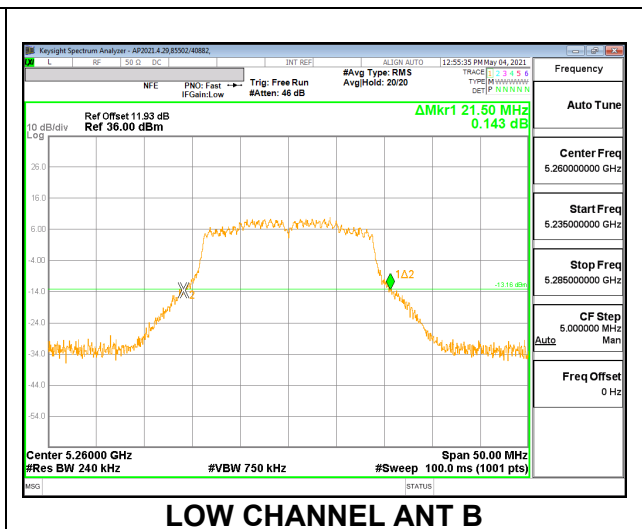
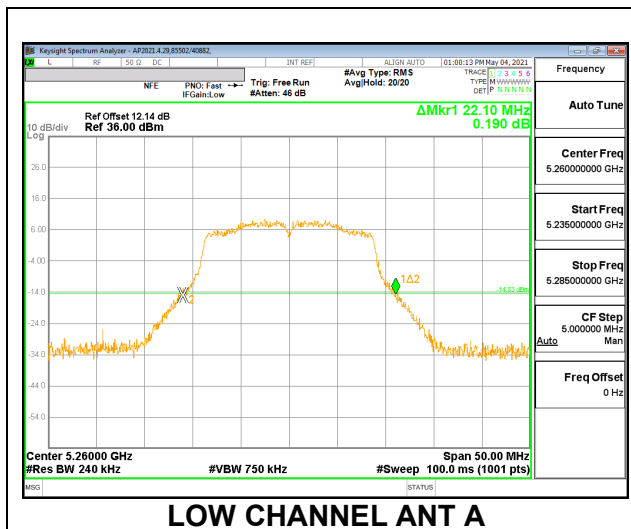


9.2.7. 802.11n HT20 MODE IN THE 5.3 GHz BAND

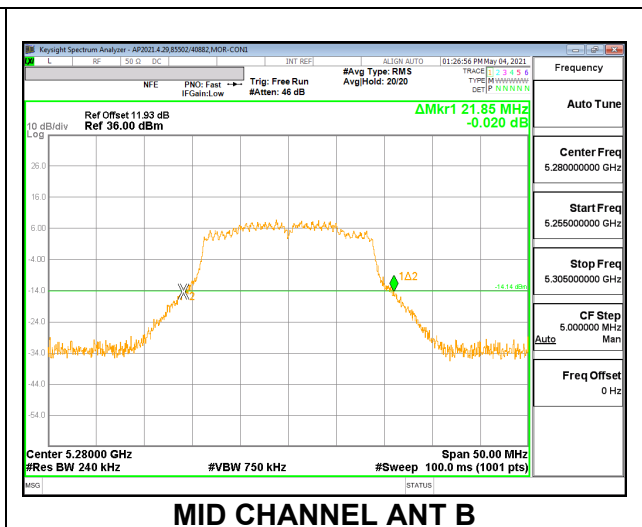
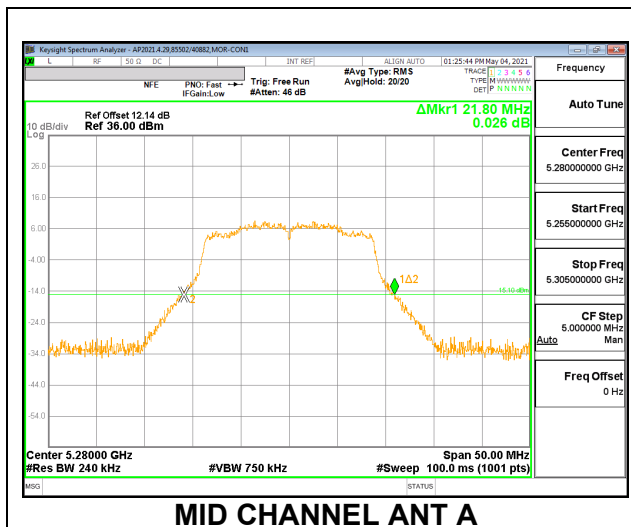
2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna A (MHz)	26 dB Bandwidth Antenna B (MHz)
Low	5260	22.10	21.50
Mid	5280	21.80	21.85
Mid	5300	22.35	21.55
High	5320	22.40	21.55

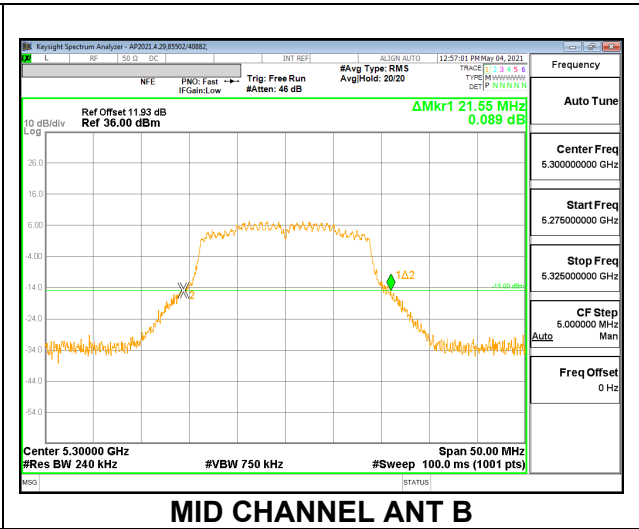
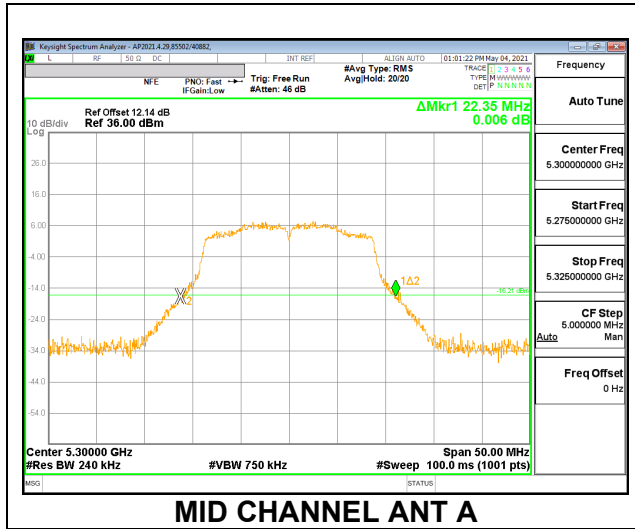
LOW CHANNEL



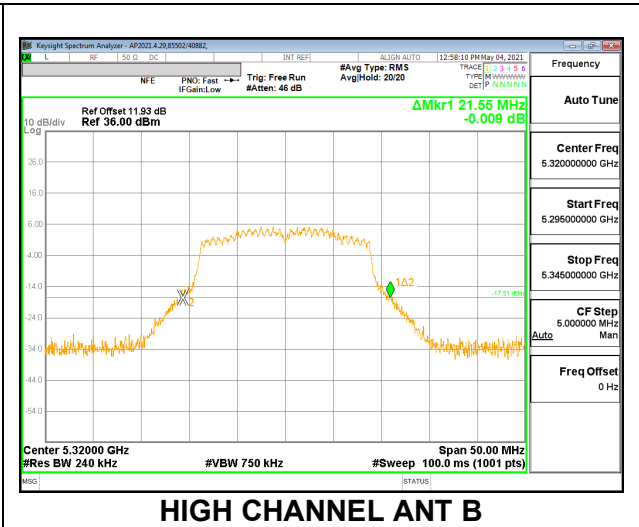
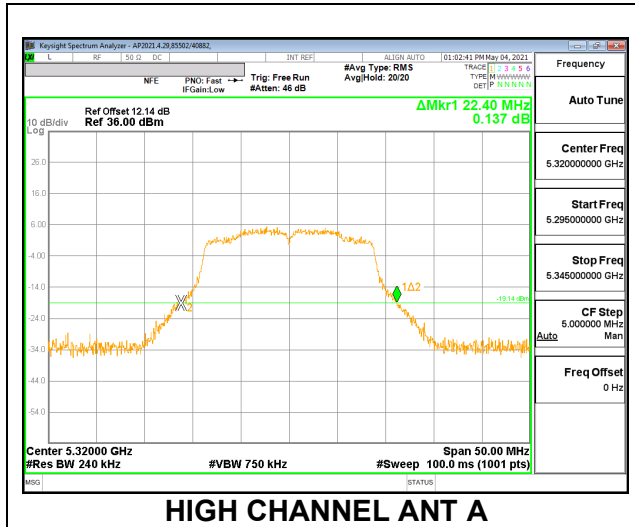
MID CHANNEL



MID CHANNEL



HIGH CHANNEL

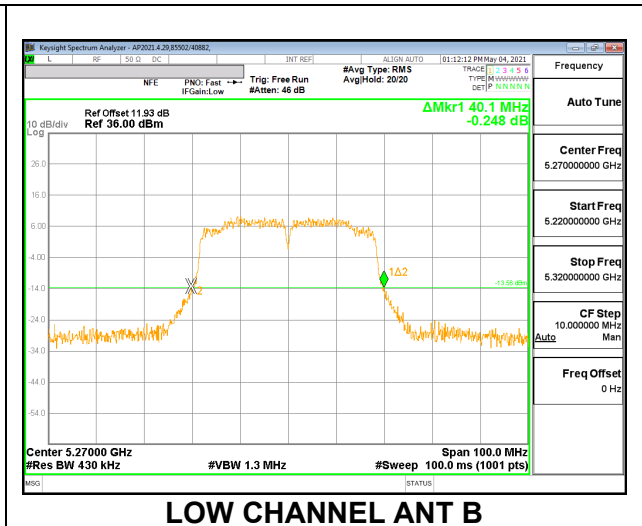
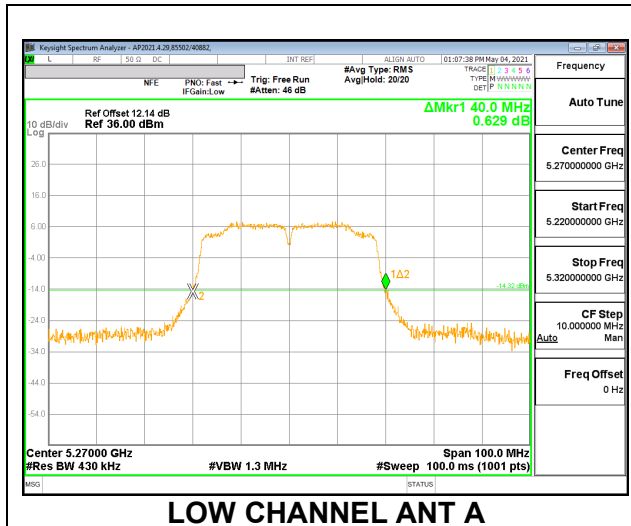


9.2.8. 802.11n HT40 MODE IN THE 5.3 GHz BAND

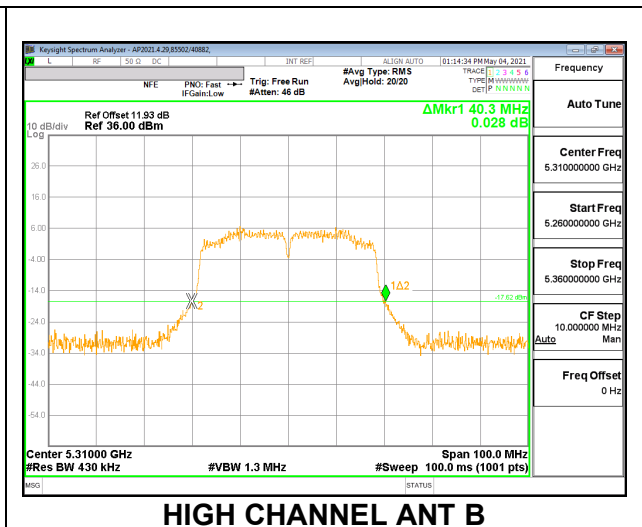
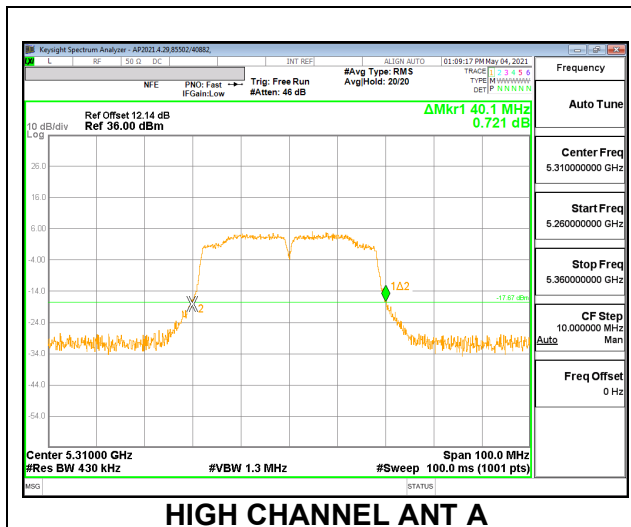
2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna A (MHz)	26 dB Bandwidth Antenna B (MHz)
Low	5270	40.00	40.10
High	5310	40.10	40.30

LOW CHANNEL



HIGH CHANNEL

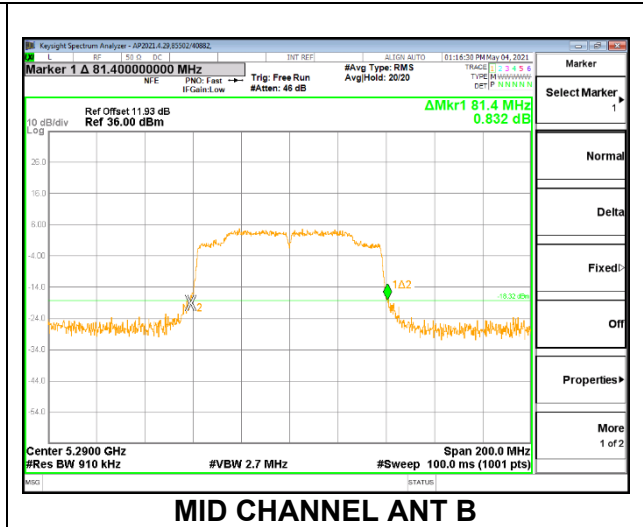
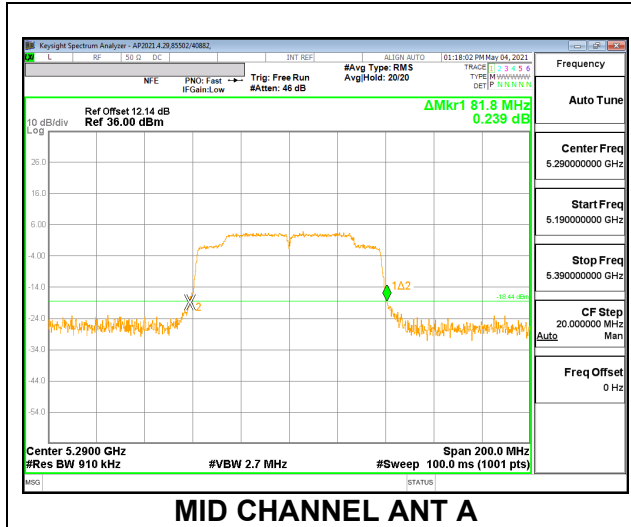


9.2.9. 802.11ac VHT80 MODE IN THE 5.3 GHz BAND

2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna A (MHz)	26 dB Bandwidth Antenna B (MHz)
Mid	5290	81.80	81.40

MID CHANNEL



9.3. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

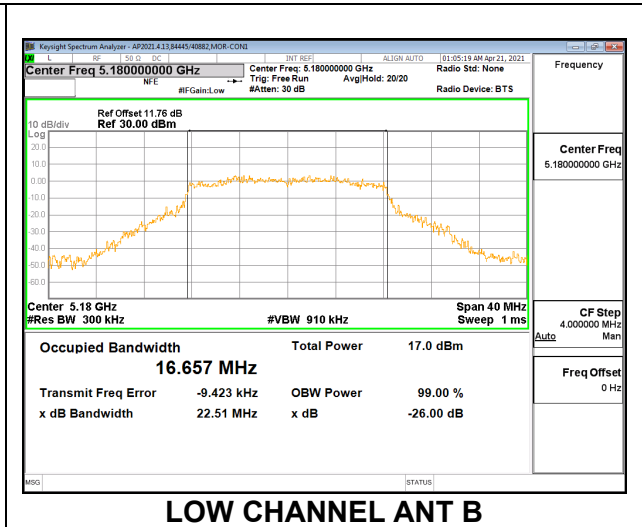
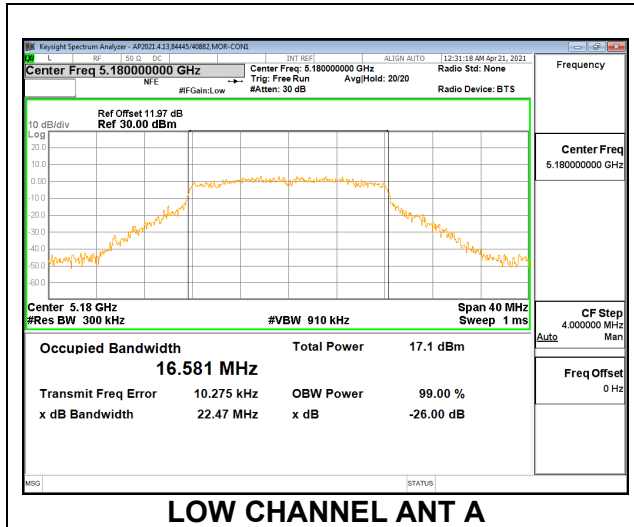
RESULTS

9.3.1. 802.11a MODE IN THE 5.2 GHz BAND

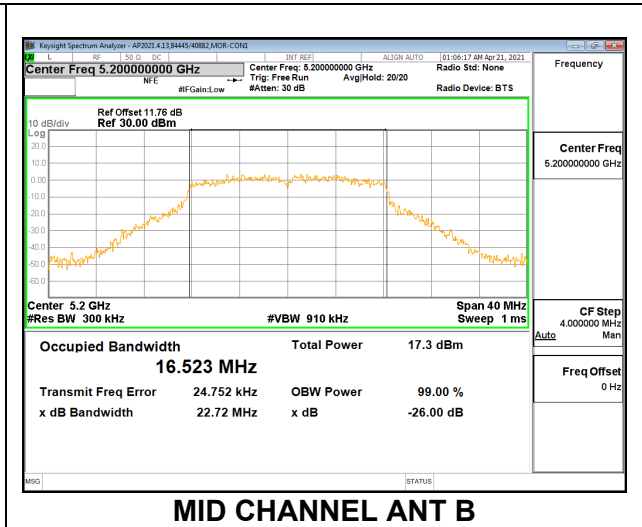
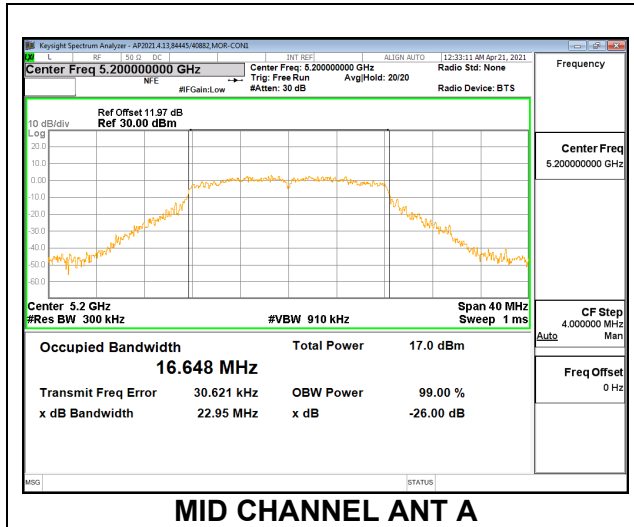
1Tx Antenna A and 1Tx Antenna B Mode

Channel	Frequency (MHz)	99% Bandwidth Antenna A (MHz)	99% Bandwidth Antenna B (MHz)
Low	5180	16.5810	16.6570
Mid	5200	16.6480	16.5230
Mid	5220	16.6880	16.6210
High	5240	16.6030	16.7080

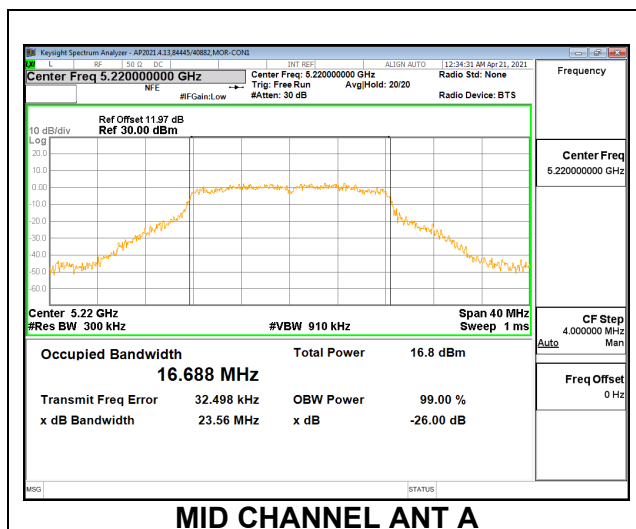
LOW CHANNEL



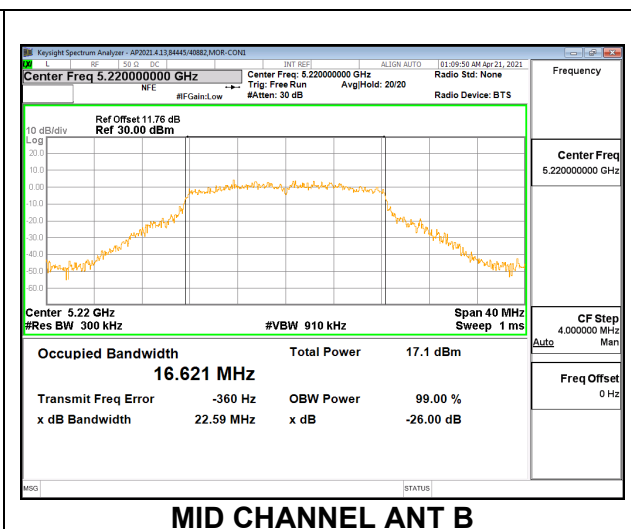
MID CHANNEL



MID CHANNEL

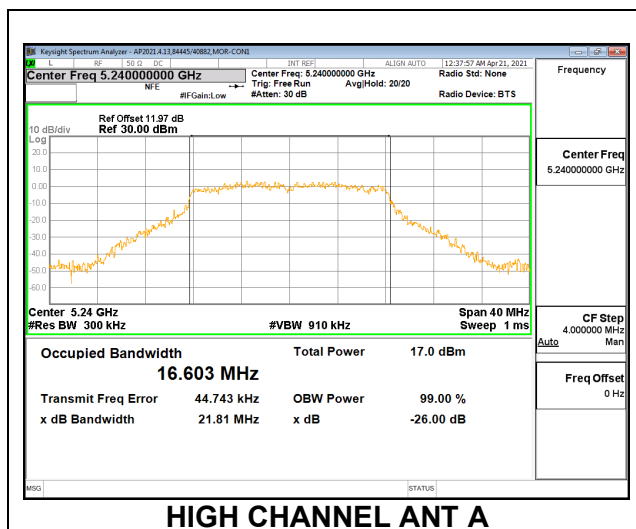


MID CHANNEL ANT A

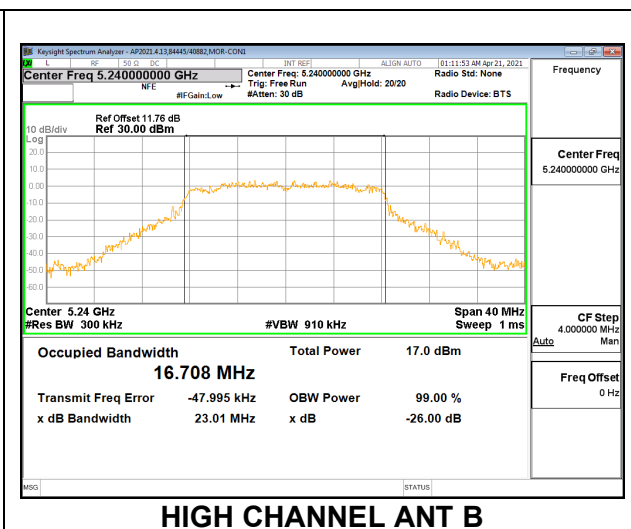


MID CHANNEL ANT B

HIGH CHANNEL



HIGH CHANNEL ANT A



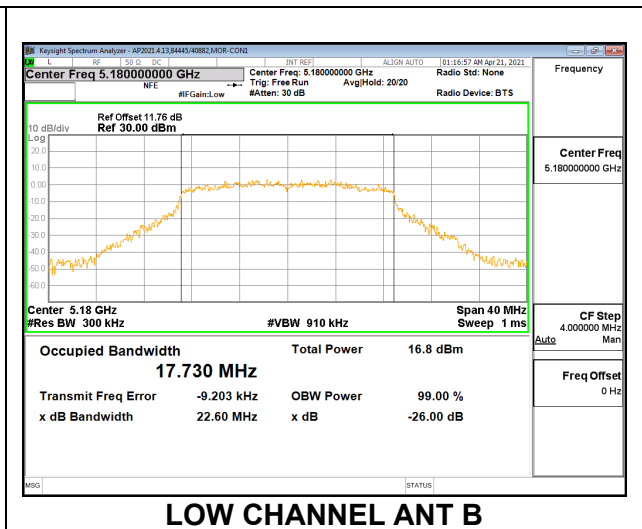
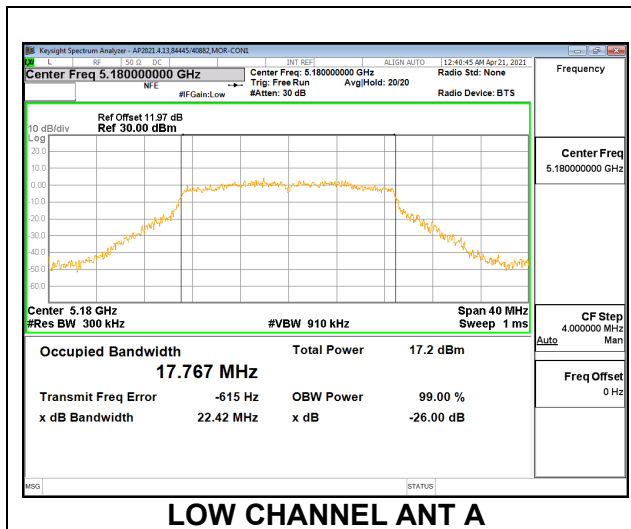
HIGH CHANNEL ANT B

9.3.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

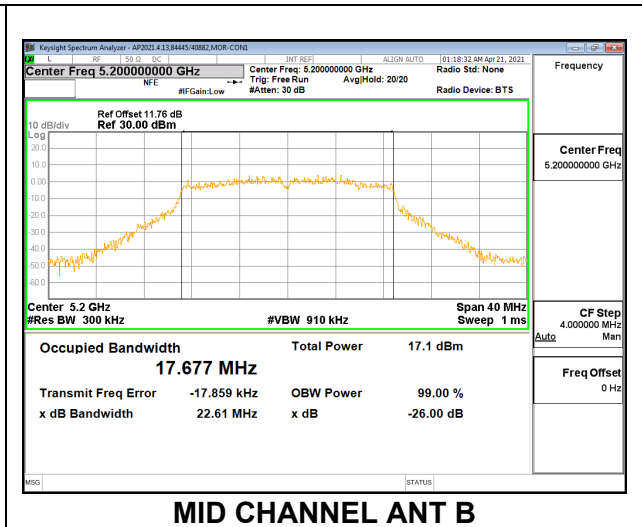
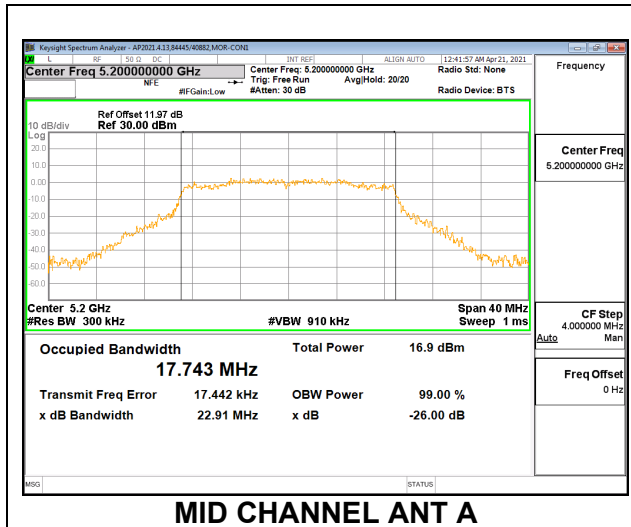
2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna A (MHz)	99% Bandwidth Antenna B (MHz)
Low	5180	17.7670	17.7300
Mid	5200	17.7430	17.6770
Mid	5220	17.6950	17.7370
High	5240	17.7480	17.8060

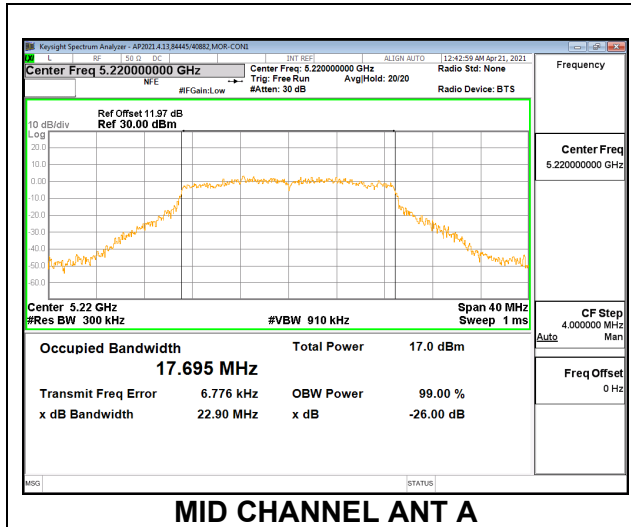
LOW CHANNEL



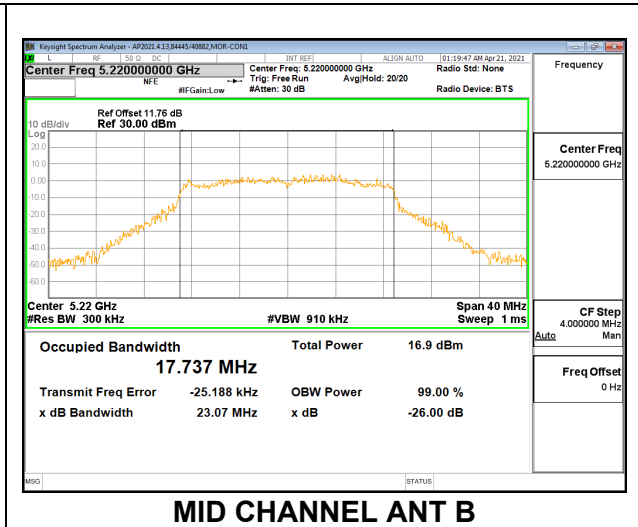
MID CHANNEL



MID CHANNEL

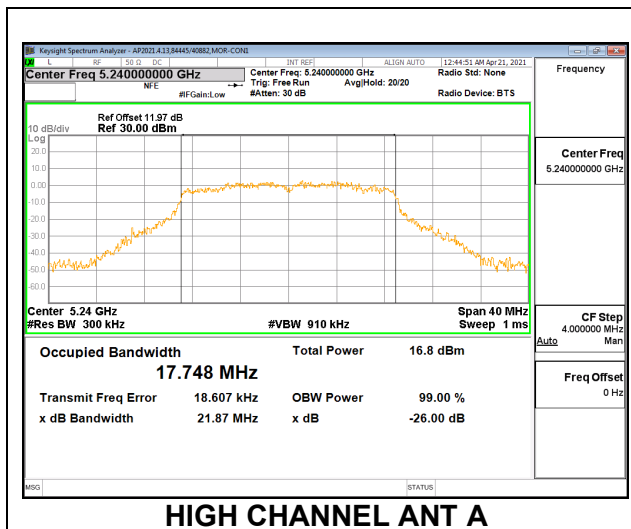


MID CHANNEL ANT A

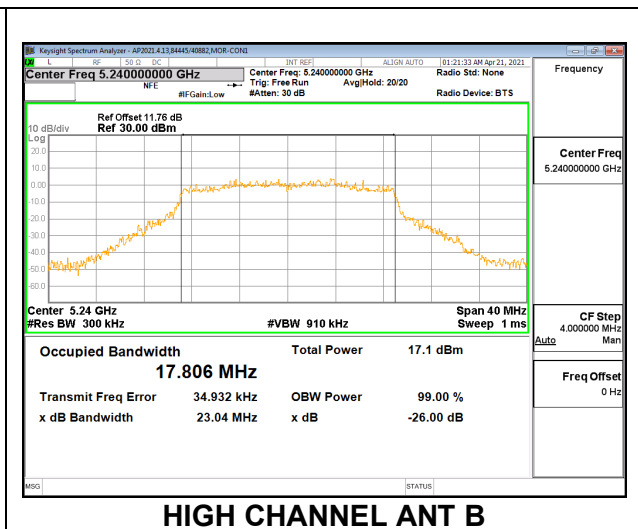


MID CHANNEL ANT B

HIGH CHANNEL



HIGH CHANNEL ANT A



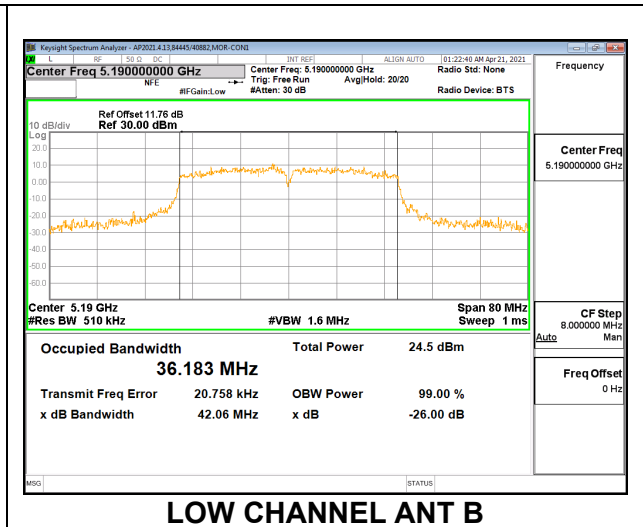
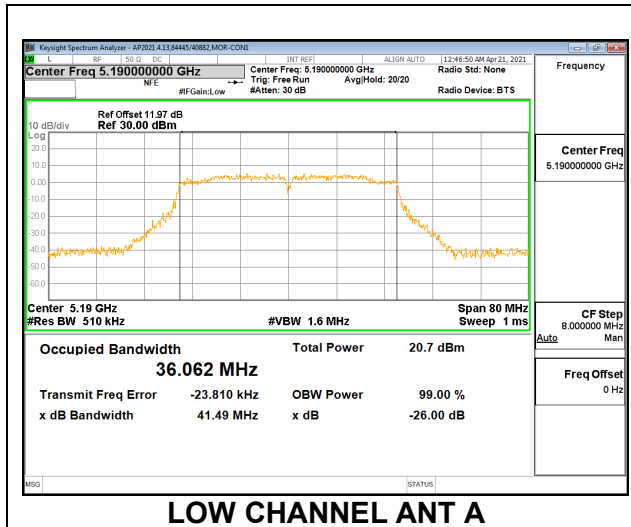
HIGH CHANNEL ANT B

9.3.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

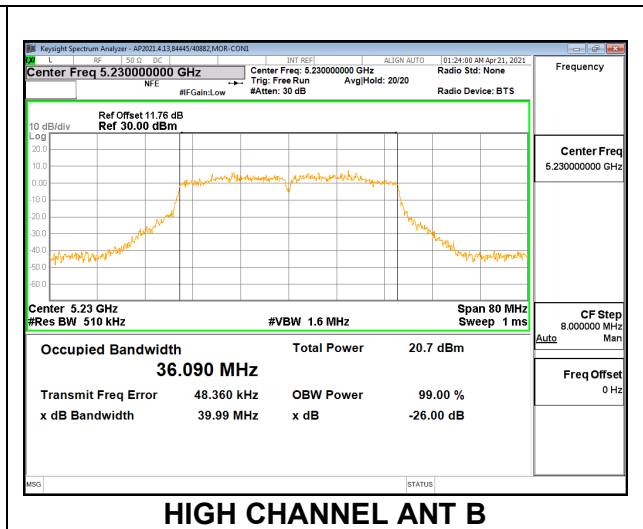
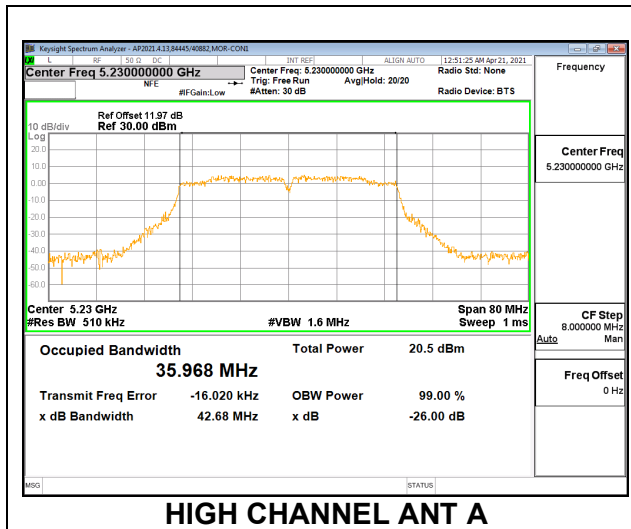
2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna A (MHz)	99% Bandwidth Antenna B (MHz)
Low	5190	36.0620	36.1830
High	5230	35.9680	36.0900

LOW CHANNEL



HIGH CHANNEL

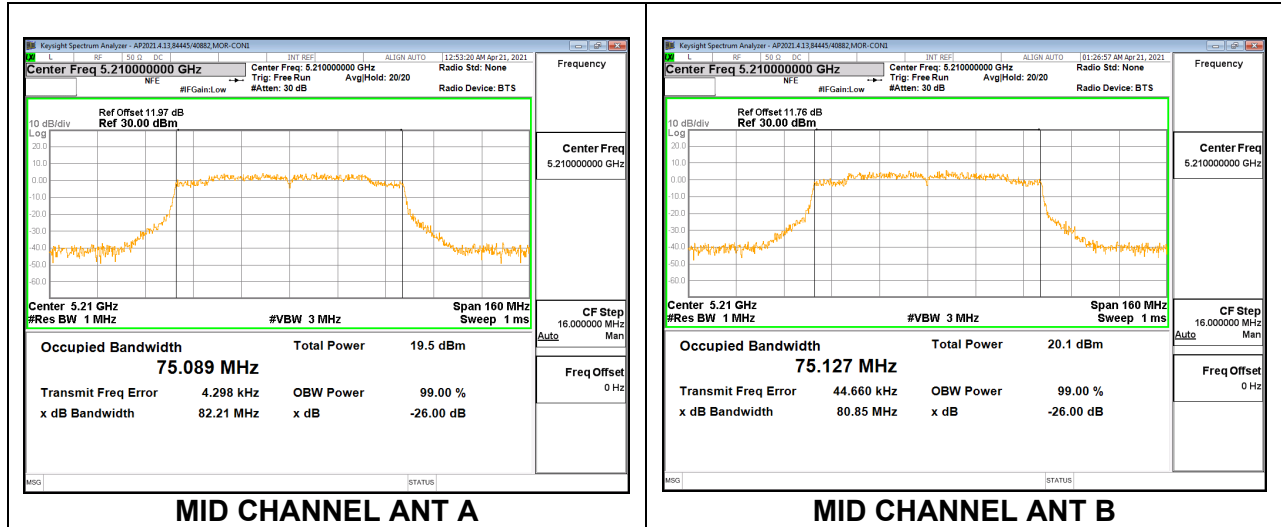


9.3.4. 802.11ac VHT80 MODE IN THE 5.2 GHz BAND

2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna A (MHz)	99% Bandwidth Antenna B (MHz)
Mid	5210	75.0890	75.1270

MID CHANNEL

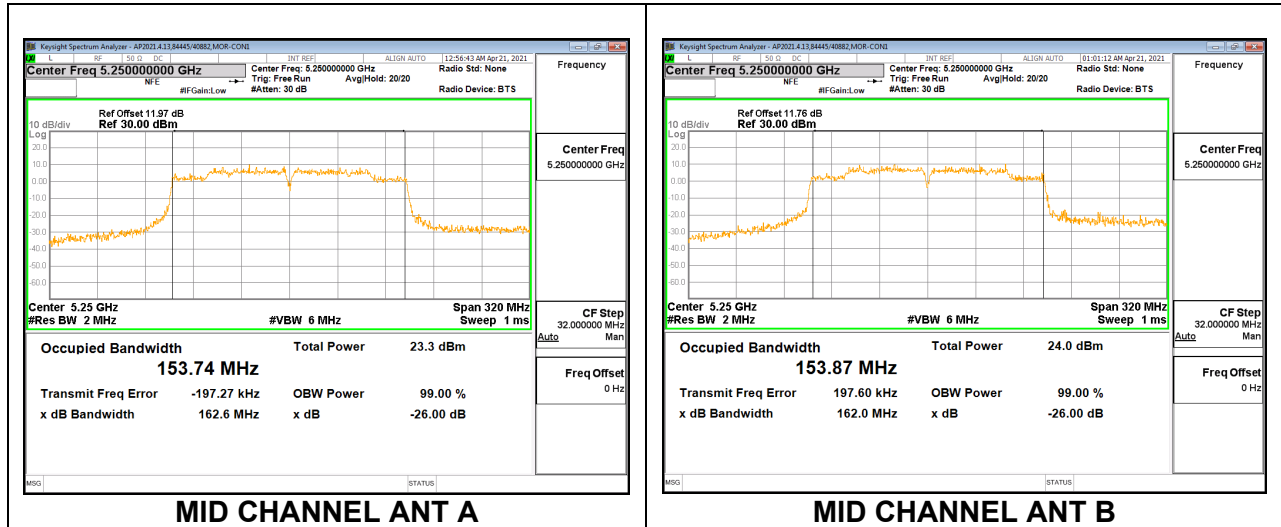


9.3.5. 802.11ac VHT160 MODE IN THE 5.2/5.3 GHz BAND

2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna A (MHz)	99% Bandwidth Antenna B (MHz)
Mid	5250	153.7400	153.8700

MID CHANNEL

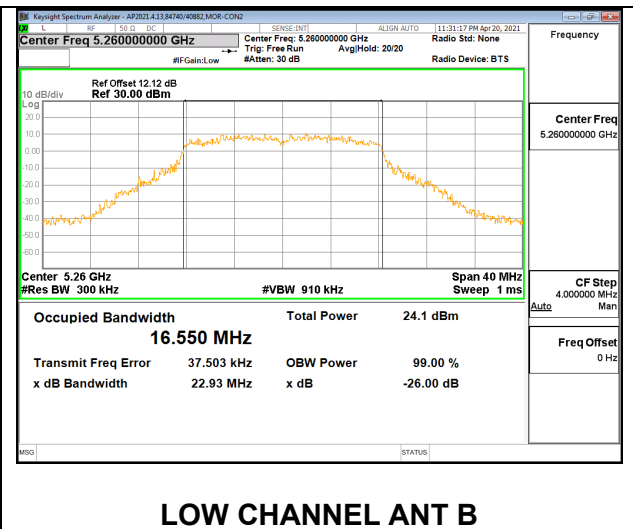
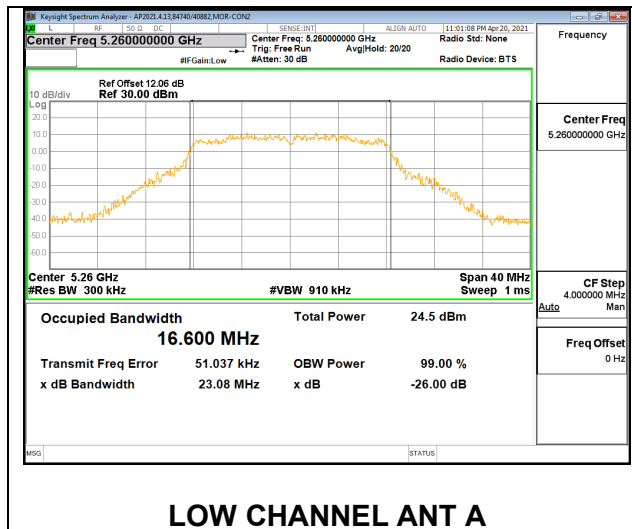


9.3.6. 802.11a MODE IN THE 5.3 GHz BAND

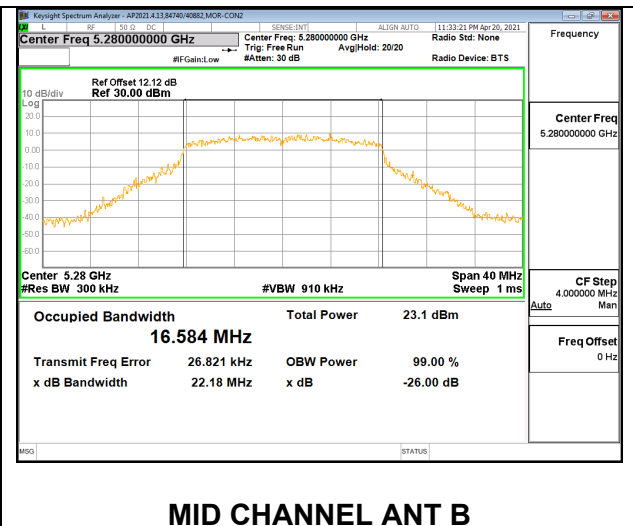
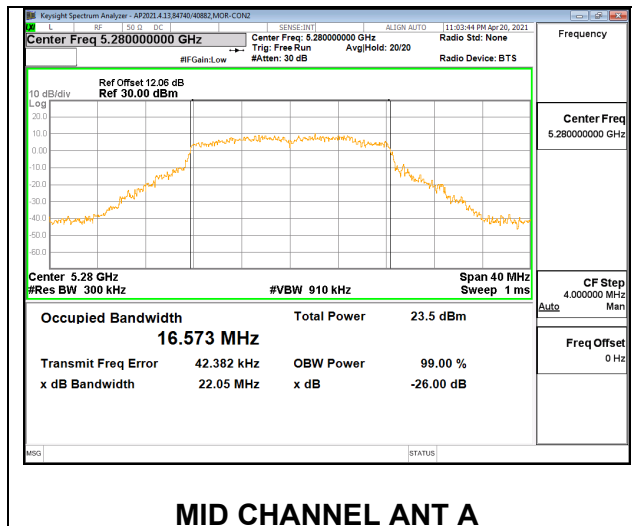
1Tx Antenna A and 1Tx Antenna B Mode

Channel	Frequency (MHz)	99% Bandwidth Antenna A (MHz)	99% Bandwidth Antenna B (MHz)
Low	5260	16.6000	16.5500
Mid	5280	16.5730	16.5840
Mid	5300	16.6370	16.5500
High	5320	16.7110	16.6680

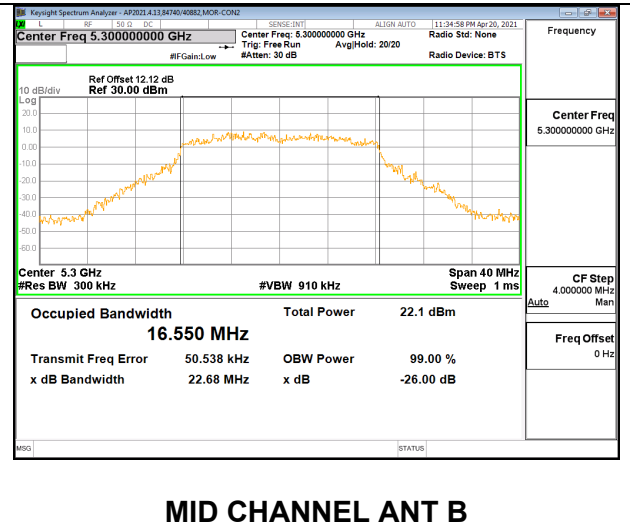
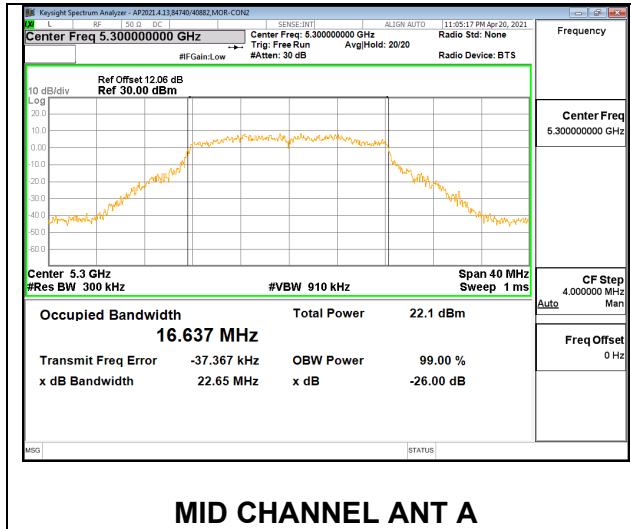
LOW CHANNEL



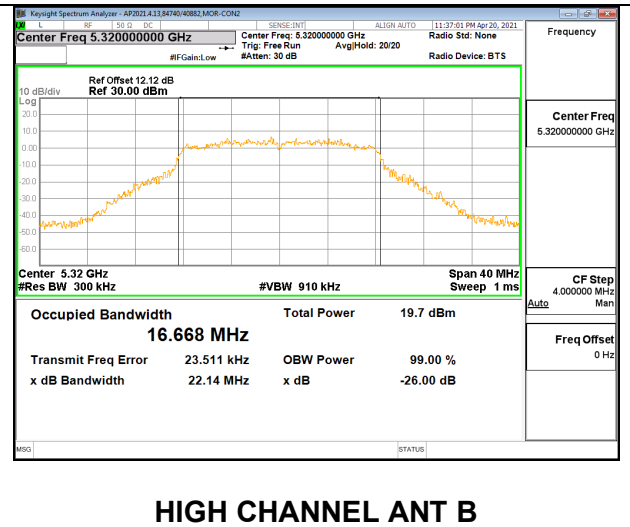
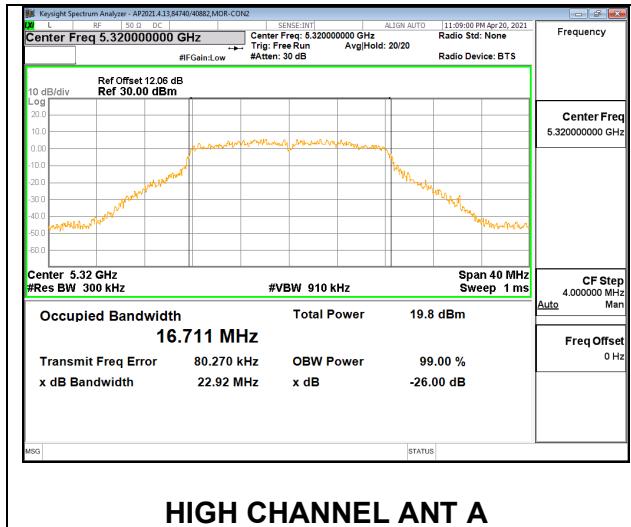
MID CHANNEL



MID CHANNEL



HIGH CHANNEL

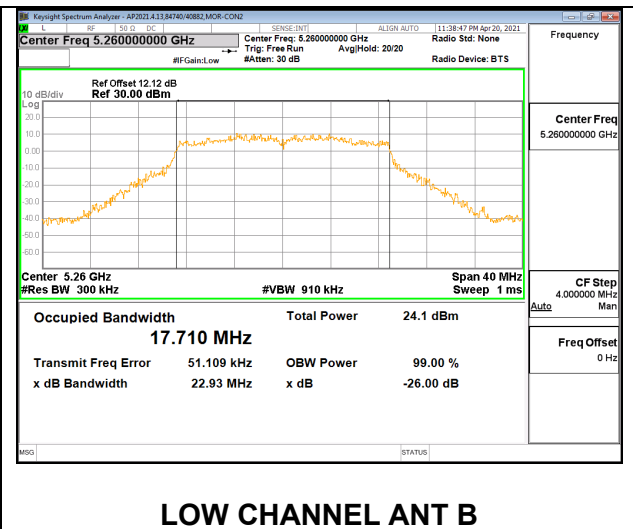
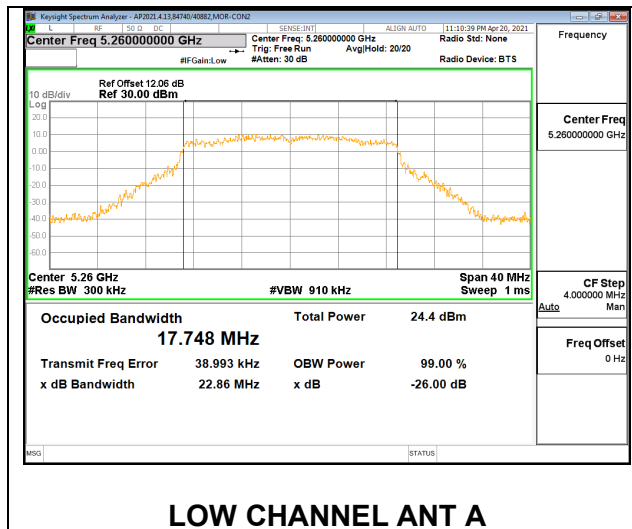


9.3.7. 802.11n HT20 MODE IN THE 5.3 GHz BAND

2TX Antenna A + Antenna B SDM MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna A (MHz)	99% Bandwidth Antenna B (MHz)
Low	5260	17.7480	17.7100
Mid	5280	17.8240	17.6950
Mid	5300	17.7070	17.7310
High	5320	17.7150	17.7550

LOW CHANNEL



MID CHANNEL

