



CERTIFICATION TEST REPORT

Report Number. : 12781776-E3V4

Applicant : Microsoft Corp.
One Microsoft Way
Redmond, WA 98052

Model : 1797

FCC ID : C3K1797

IC : 3048A-1797

EUT Description : Wireless Input Device

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

Date Of Issue:

May 31, 2019

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	5/20/2019	Initial Issue	---
V2	5/23/2019	Section 5.5 Headset & Charger as worst case statement added	Henry Lau
V3	5/28/19	Section 7 – Pre amp Description fix Section 9 – Below 30MHz added to statement	Jose Martinez Henry Lau
V4	5/31/2019	Section 8.2 – 26dB Bandwidth updated Section 8.5 – Table updated to reflect 26dB update	Jose Martinez

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Microsoft Corp.
One Microsoft Way
Redmond, WA 98052

EUT DESCRIPTION: Wireless Input Device

MODEL: 1797

SERIAL NUMBER: 02630001482912 (Conducted)
02630001242912 (Radiated)

DATE TESTED: April 16, 2019 – May 31, 2019

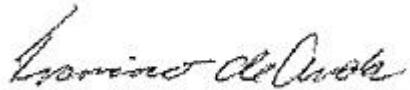
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

UL Verification Services Inc. 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.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 14-30, FCC KDB 662911 D01 v02r01, FCC KDB 905462 D02 v02/D03 v01r02/D06 v02, FCC KDB 789033 D02 v02r01, FCC KDB 644545 D03 v01, ANSI C63.10-2013, FCC 06-96, FCC KDB 905462 D02 and D03, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Rd
<input type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D	<input checked="" type="checkbox"/> Chamber I
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E	<input type="checkbox"/> Chamber J
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F	<input checked="" type="checkbox"/> Chamber K
	<input type="checkbox"/> Chamber G	<input type="checkbox"/> Chamber L
	<input type="checkbox"/> Chamber H	<input type="checkbox"/> Chamber M

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable

Loss (dB) – 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:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a wireless input device.

5.2. 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			
5180-5240	802.11a	8.48	7.05
5180-5240	802.11n HT20	8.42	6.95

5.2 GHz BAND (IC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.2 GHz band, 1TX			
5180-5240	802.11a	8.48	7.05
5180-5240	802.11n HT20	8.42	6.95

5.3 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.3 GHz band, 1TX			
5260 - 5320	802.11a	8.26	6.70
5260 - 5320	802.11n HT20	8.37	6.87

5.3 GHz BAND (IC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.3 GHz band, 1TX			
5260 - 5320	802.11a	8.26	6.70
5260 - 5320	802.11n HT20	8.37	6.87

5.6 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.6 GHz band, 1TX			
5500-5720	802.11a	8.15	6.53
5500-5720	802.11n HT20	8.12	6.49

5.6 GHz BAND (IC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.6 GHz band, 1TX			
5500-5720	802.11a	8.15	6.53
5500-5720	802.11n HT20	8.12	6.49

5.8 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.8 GHz band, 1TX			
5745-5825	802.11a	8.15	6.53
5745-5825	802.11n HT20	7.89	6.15

5.8 GHz BAND (IC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.8 GHz band, 1TX			
5745-5825	802.11a	8.15	6.53
5745-5825	802.11n HT20	7.89	6.15

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a monopole antenna, with a maximum gain of:

Frequency (GHz)	Peak Antenna Gain (dBi)	
	Main (Chain 0)	Aux (Chain 1)
5150-5250	2.48	4.24
5250-5350	2.77	4.02
5500-5700	3.82	4.04
5725-5850	3.75	4.33

Note: Main antenna corresponds to Antenna 1 and Aux(diversity) antenna corresponds to Antenna 2 for data within this report.

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was FW: 4.7.1774.0

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

The EUT was tested with headset and charger as worst case configuration.

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

802.11a mode: 6 Mbps
802.11n HT20mode: MCS0

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter to EUT	SONY	N/A	N/A	N/A
Laptop	Lenovo	X1 Carbon	4973401	PD97265NGU
AC Adapter to Laptop	Lenovo	ADLX45NLC2A	45N0474	N/A
Earphone	SONY	N/A	N/A	N/A
Debug Board*	Microsoft	N/A	X930837-002	N/A

*Note: Debug board only used for programming EUT. Not used during tests.

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-Shielded	0.2	to AC/DC Adaptor
2	DC	1	DC	Shielded	1	to Laptop
3	USB	1	Type C	Un-shielded	2	Laptop to EUT
4	Antenna	1	SMA	Un-Shielded	0.2	to Analyzer

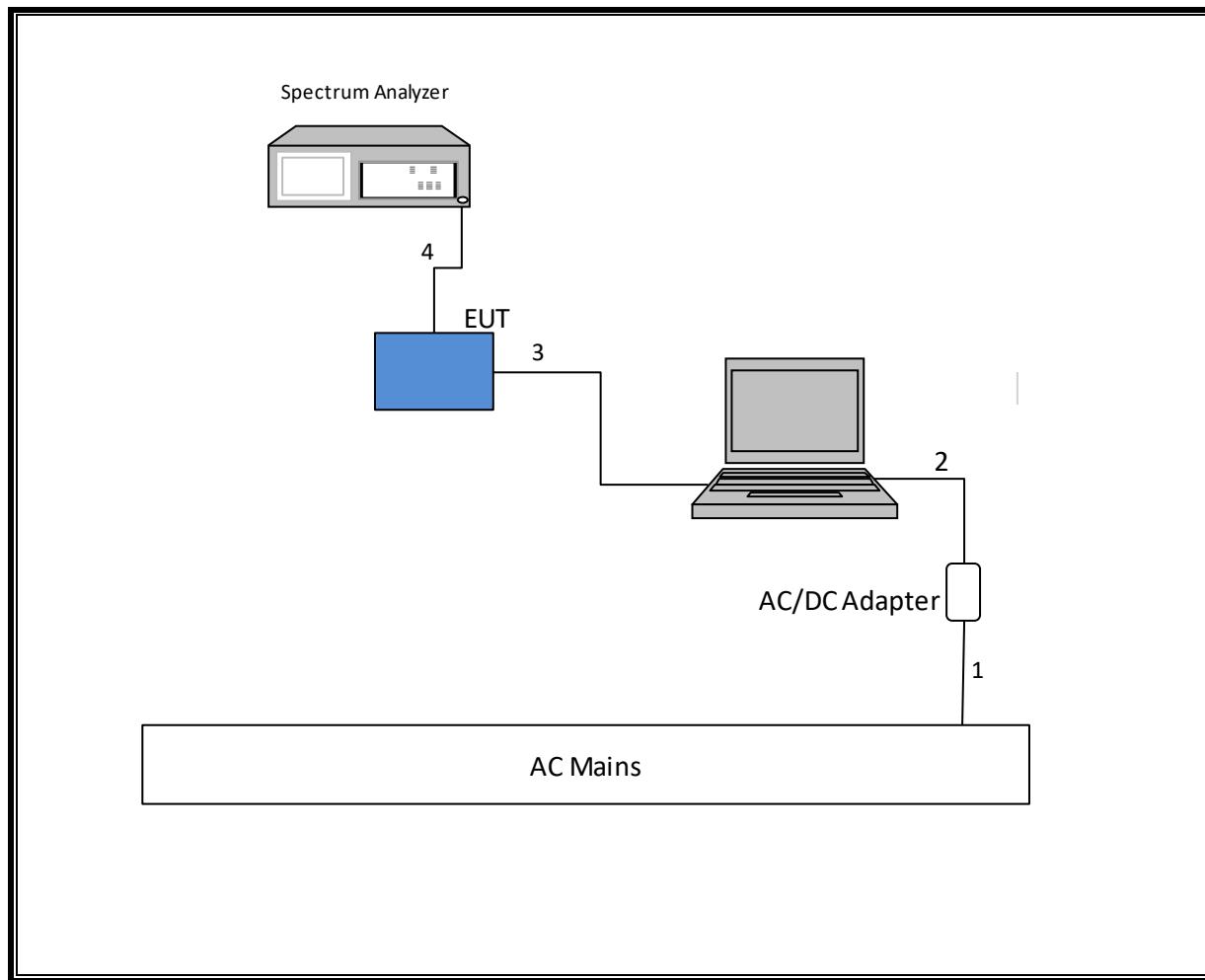
I/O CABLES (RADIATED AND CONDUCTED EMISSIONS)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
3	USB	1	Type C	Un-shielded	2	Laptop to EUT
2	earphone	1	3.5mm	Un-shielded	1	to EUT

TEST SETUP

The EUT is a stand alone unit. Test software exercised the radio card.

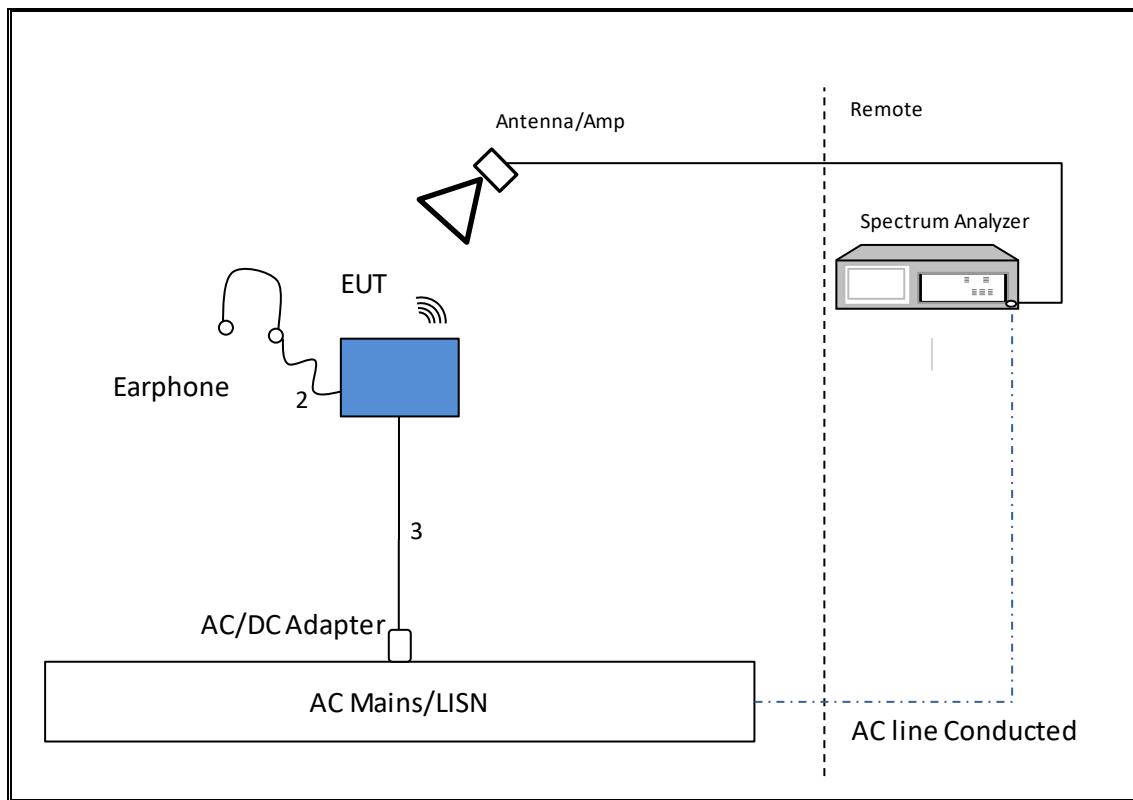
CONDUCTED TEST SETUP DIAGRAM



TEST SETUP

For conducted tests: the EUT was connected to a laptop. The test software exercises the radio.

RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



TEST SETUP

For radiated tests: EUT is connected to a charger. The test software exercises the radio.

6. MEASUREMENT METHOD

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

6 dB Emission BW: KDB 789033 D02 v02r01, Section C.2

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.3, G.4, G.5, and G.6.

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

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

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

7. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1265	01/29/2020	01/29/2019
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1227	02/05/2020	02/05/2019
Antenna, Passive Loop 30Hz to 1MHz	ELETRO METRICS	EM-6871	PRE0179465	05/22/2019	05/22/2018
Antenna, Passive Loop 100kHz to 30MHz	ELETRO METRICS	EM-6872	PRE0179467	05/22/2019	05/22/2018
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T862	05/25/2019	05/25/2018
Amplifier, 1 to 18GHz	MITEQ	AFS42-00101800-25-S-42	PRE018078	08/01/2019	08/01/2018
Hybrid Antenna, 30MHz to 3GHz	SunAR rf motion	JB3	PRE0184052	10/24/2019	10/24/2018
Amplifier, 100kHz to 1GHz, 32 dB	Agilent (Keysight) Technologies	8447D	PRE0186650	12/13/2019	12/13/2018
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	PRE0182188	08/29/2019	08/29/2018
Pre-Amp, 18-26.5GHz	Ampical	AMP18G26.5-60	PRE0181238	05/01/2020	05/01/2019
Antenna, Horn 26 to 40GHz	ARA	MWH-2640	T90	09/11/2019	09/11/2018
Pre-Amp, 26-40GHz	Ampical	AMP26G40-60	PRE0181238	05/01/2020	05/01/2019
EMI Test Receiver	Rohde & Schwarz	ESW44	PRE0179367	02/14/2020	02/14/2019
EMI Test Receiver	Rohde & Schwarz	ESW44	PRE0179372	02/16/2020	02/16/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T908	01/23/2020	01/23/2019
AC Line Conducted					
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/14/2020	02/14/2019
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	01/24/2020	01/24/2019
Test Software List					
Radiated Software	UL	UL EMC	Ver 9.5, June 22, 2018		
Antenna Port Software	UL	UL RF	Ver 9.6, April 18, 2019		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015		

NOTES:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

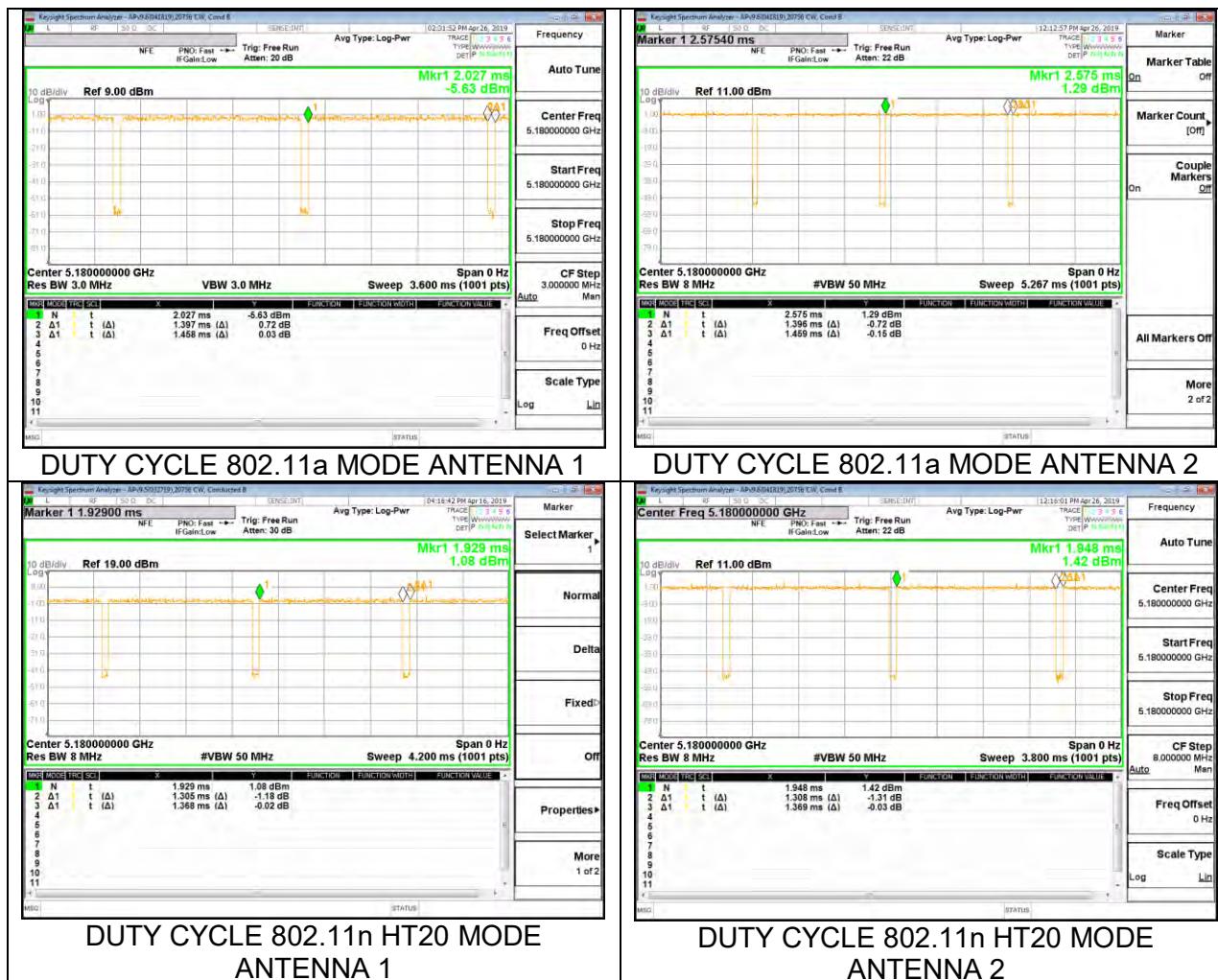
KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11a 1TX Antenna 1	1.397	1.458	0.958	95.82%	0.19	0.716
802.11a 1TX Antenna 2	1.396	1.459	0.957	95.68%	0.19	0.716
802.11n HT20 1TX Antenna 1	1.305	1.368	0.954	95.39%	0.20	0.766
802.11n HT20 1TX Antenna 2	1.308	1.369	0.955	95.54%	0.20	0.765

Results

DUTY CYCLE PLOTS



8.2. 26 dB BANDWIDTH

LIMITS

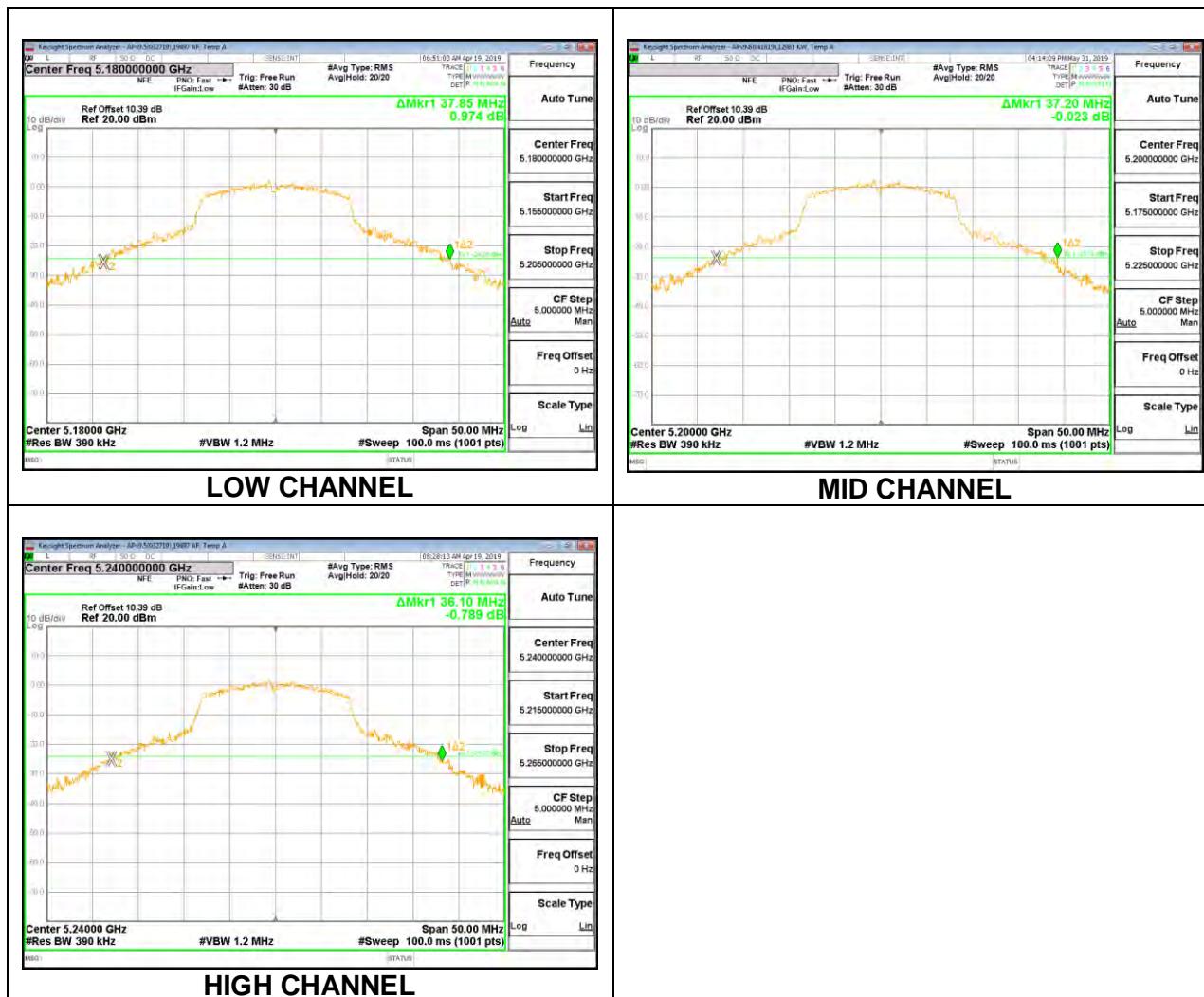
None; for reporting purposes only.

RESULTS

8.2.1. 802.11a MODE IN THE 5.2 GHz BAND

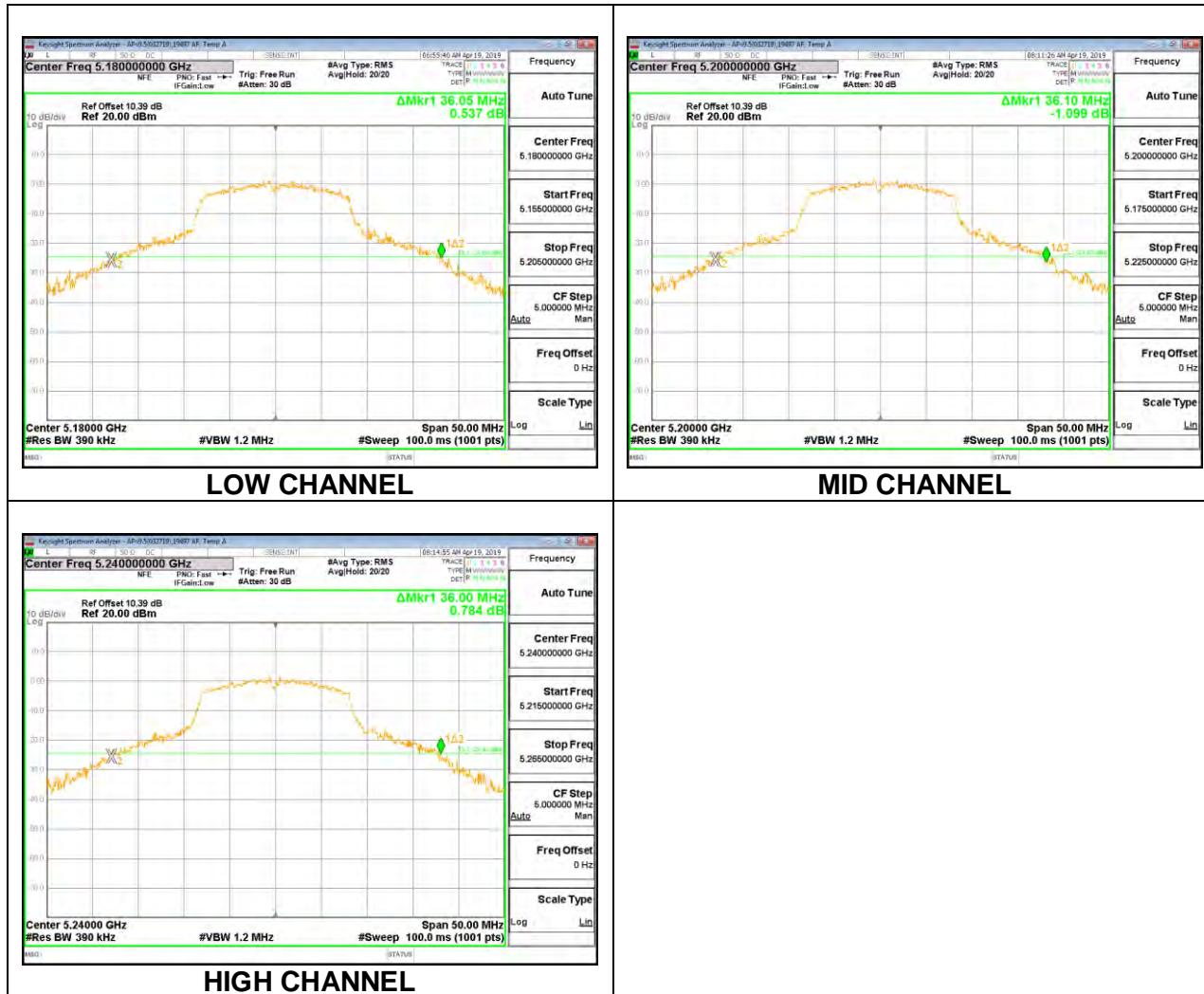
1TX Antenna 1 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	37.85
Mid	5200	37.20
High	5240	36.10



1TX Antenna 2 MODE

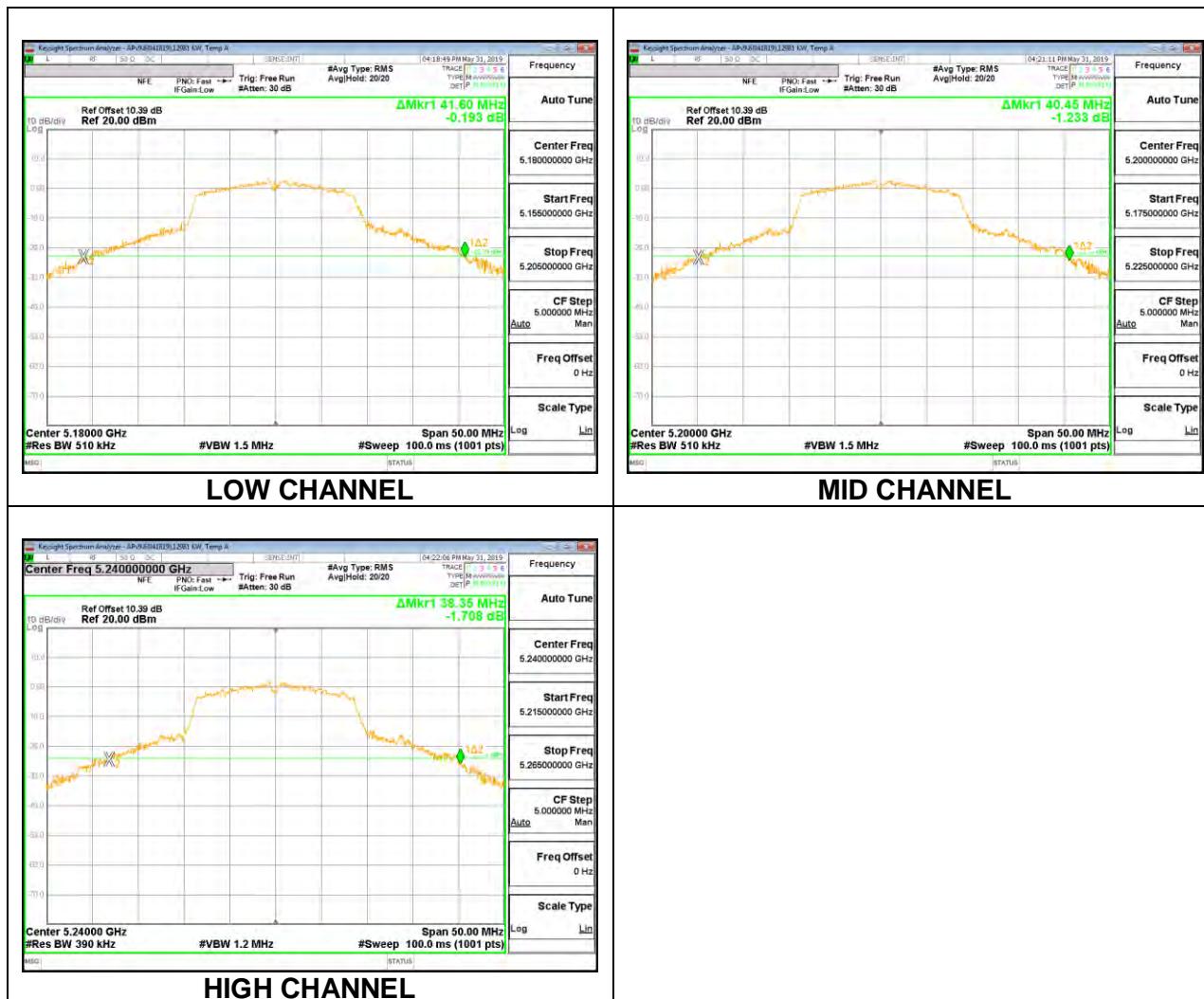
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	36.05
Mid	5200	36.10
High	5240	36.00



8.2.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

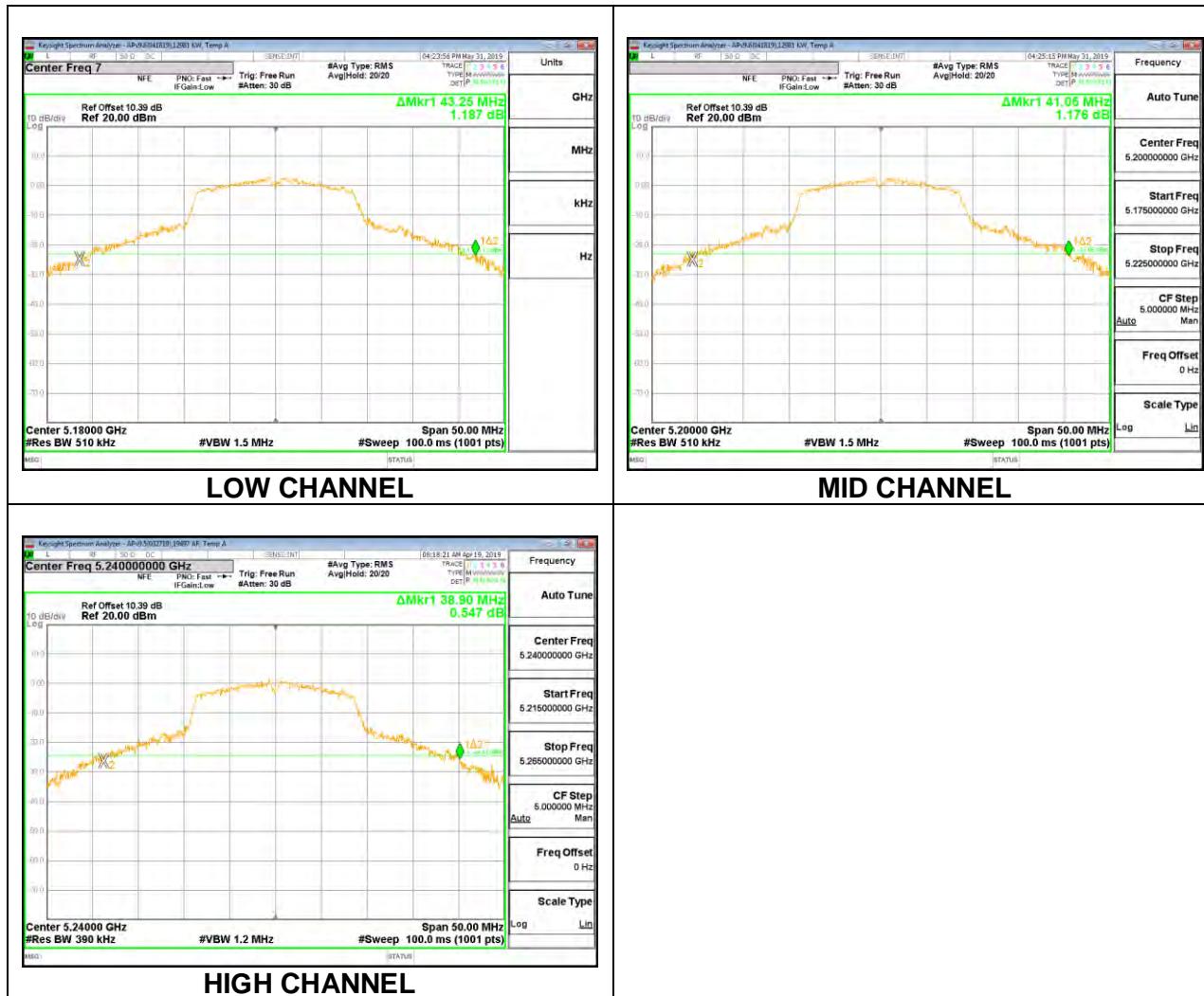
1TX Antenna 1 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	41.60
Mid	5200	40.45
High	5240	38.35



1TX Antenna 2 MODE

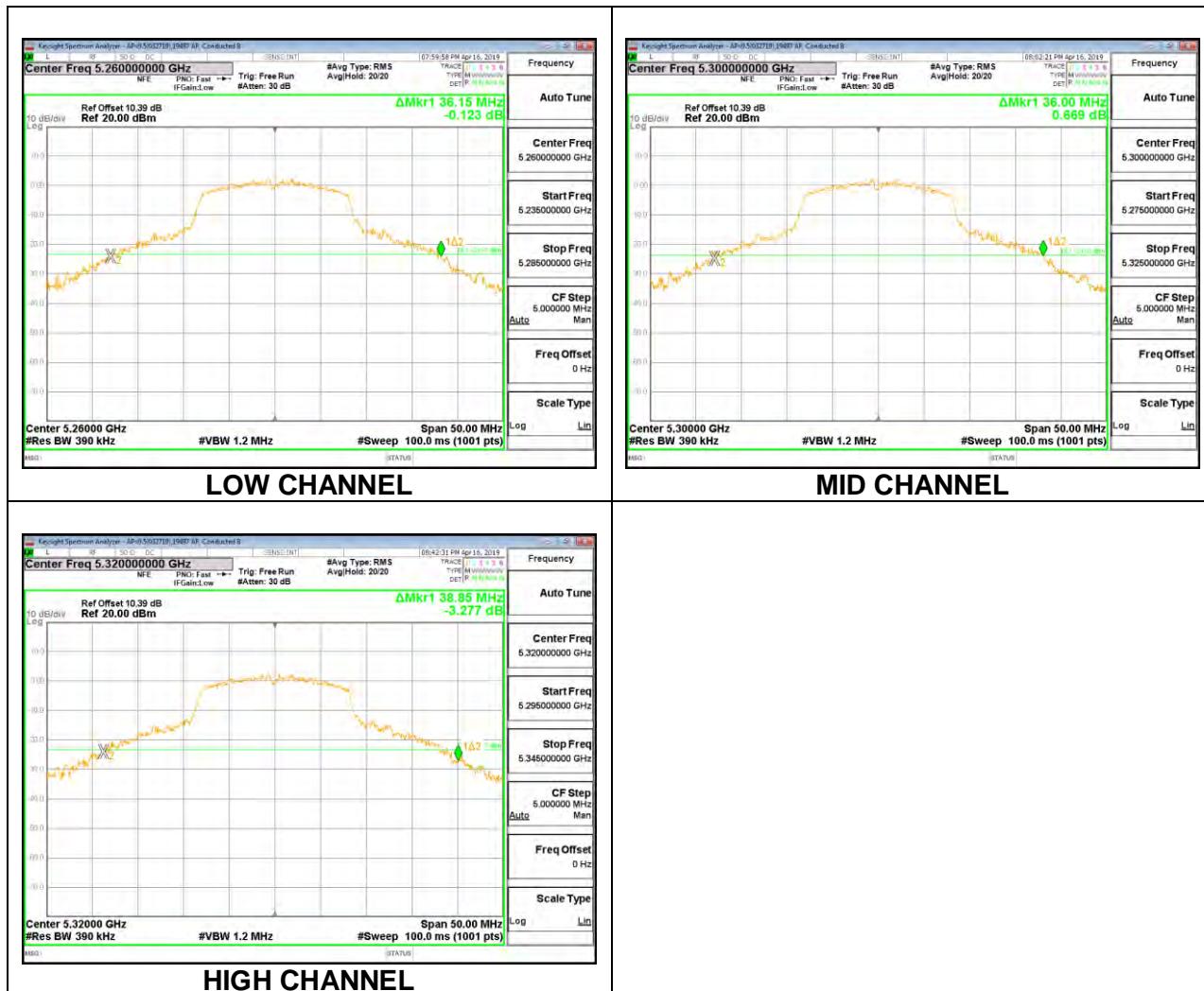
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	43.25
Mid	5200	41.05
High	5240	38.90



8.2.3. 802.11a MODE IN THE 5.3 GHz BAND

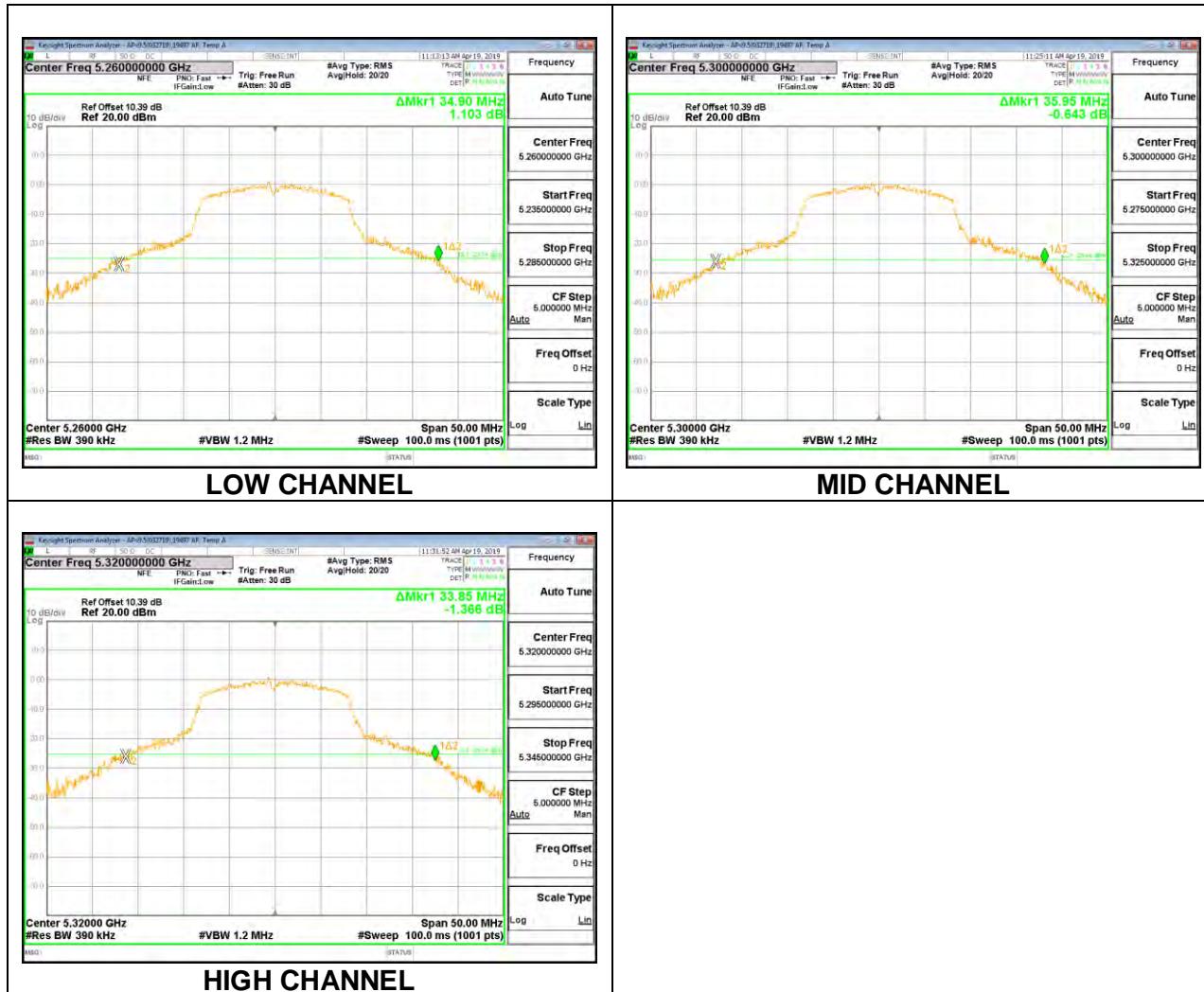
1TX Antenna 1 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	36.15
Mid	5300	36.00
High	5320	38.85



1TX Antenna 2 MODE

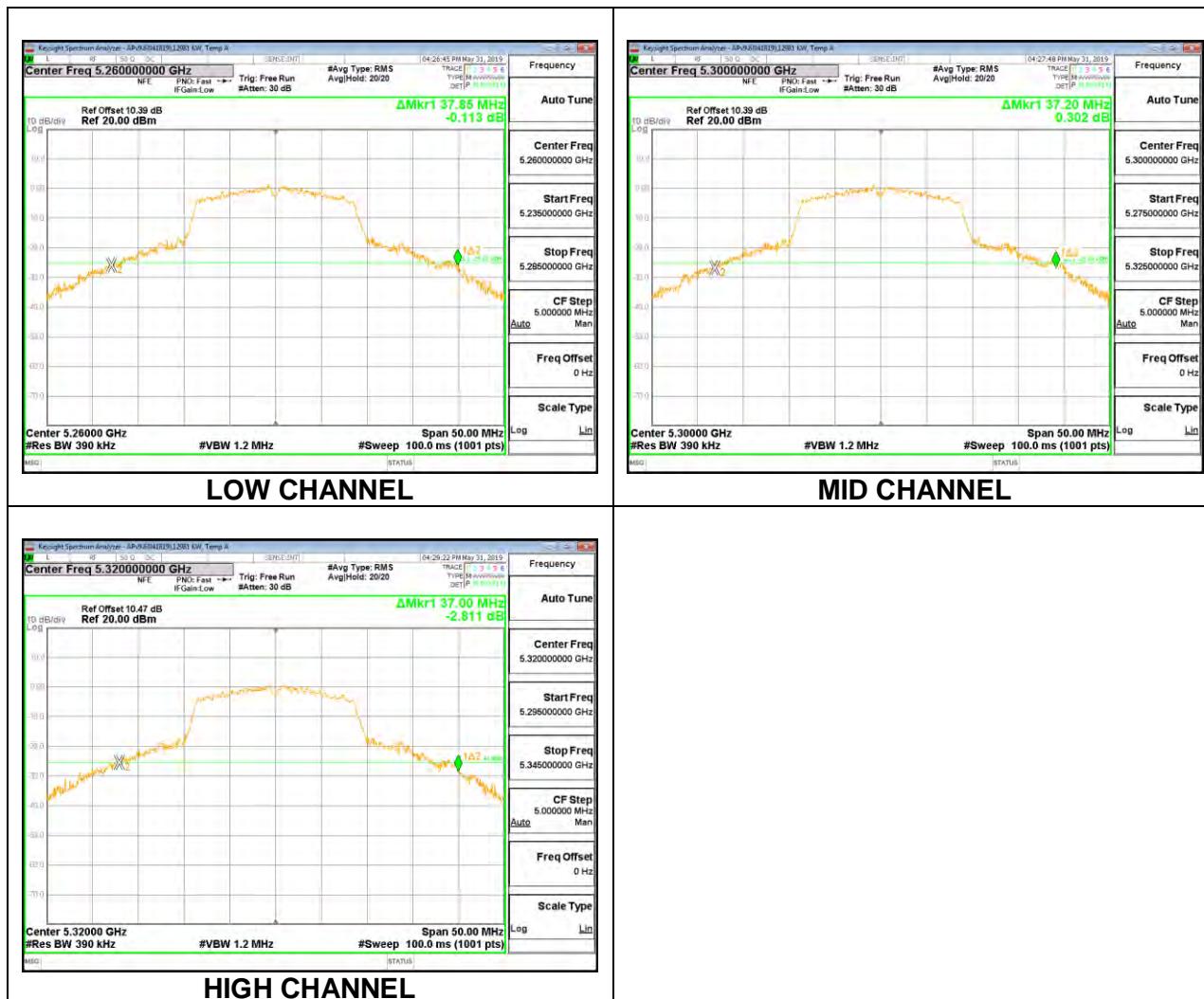
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	34.90
Mid	5300	35.95
High	5320	33.85



8.2.4. 802.11n HT20 MODE IN THE 5.3 GHz BAND

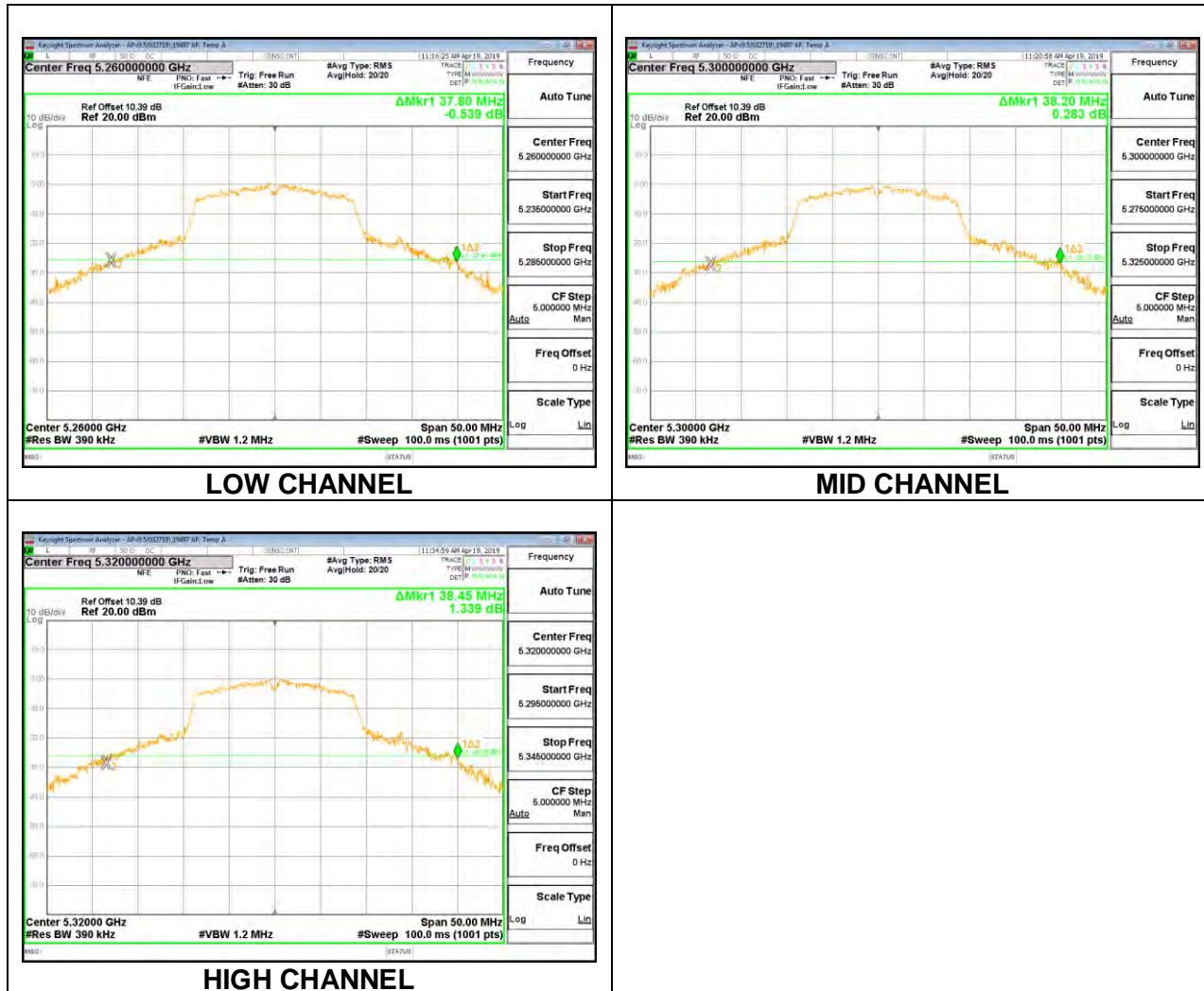
1TX Antenna 1 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	37.85
Mid	5300	37.20
High	5320	37.00



1TX Antenna 2 MODE

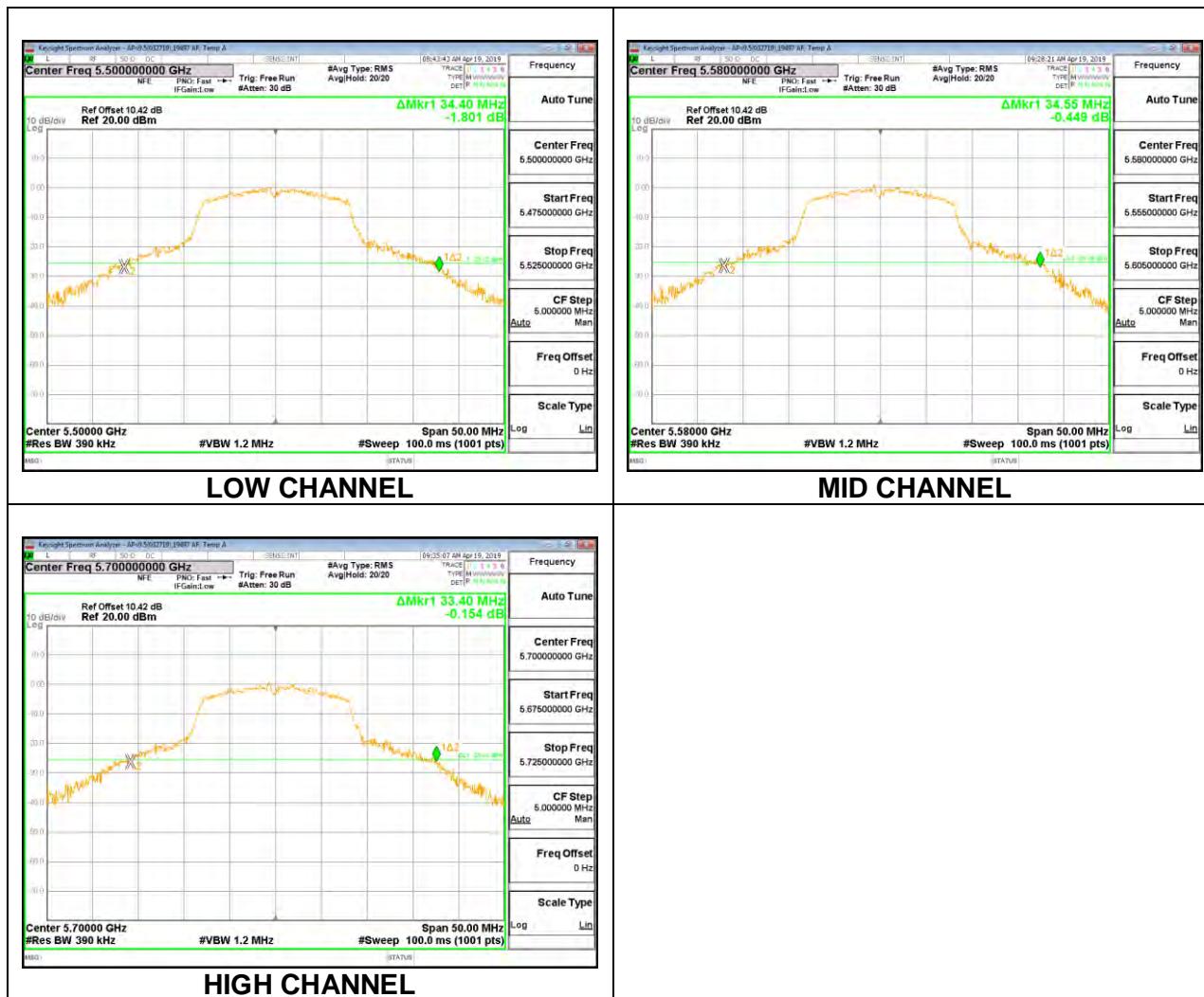
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	37.80
Mid	5300	38.20
High	5320	38.45



8.2.5. 802.11a MODE IN THE 5.6 GHz BAND

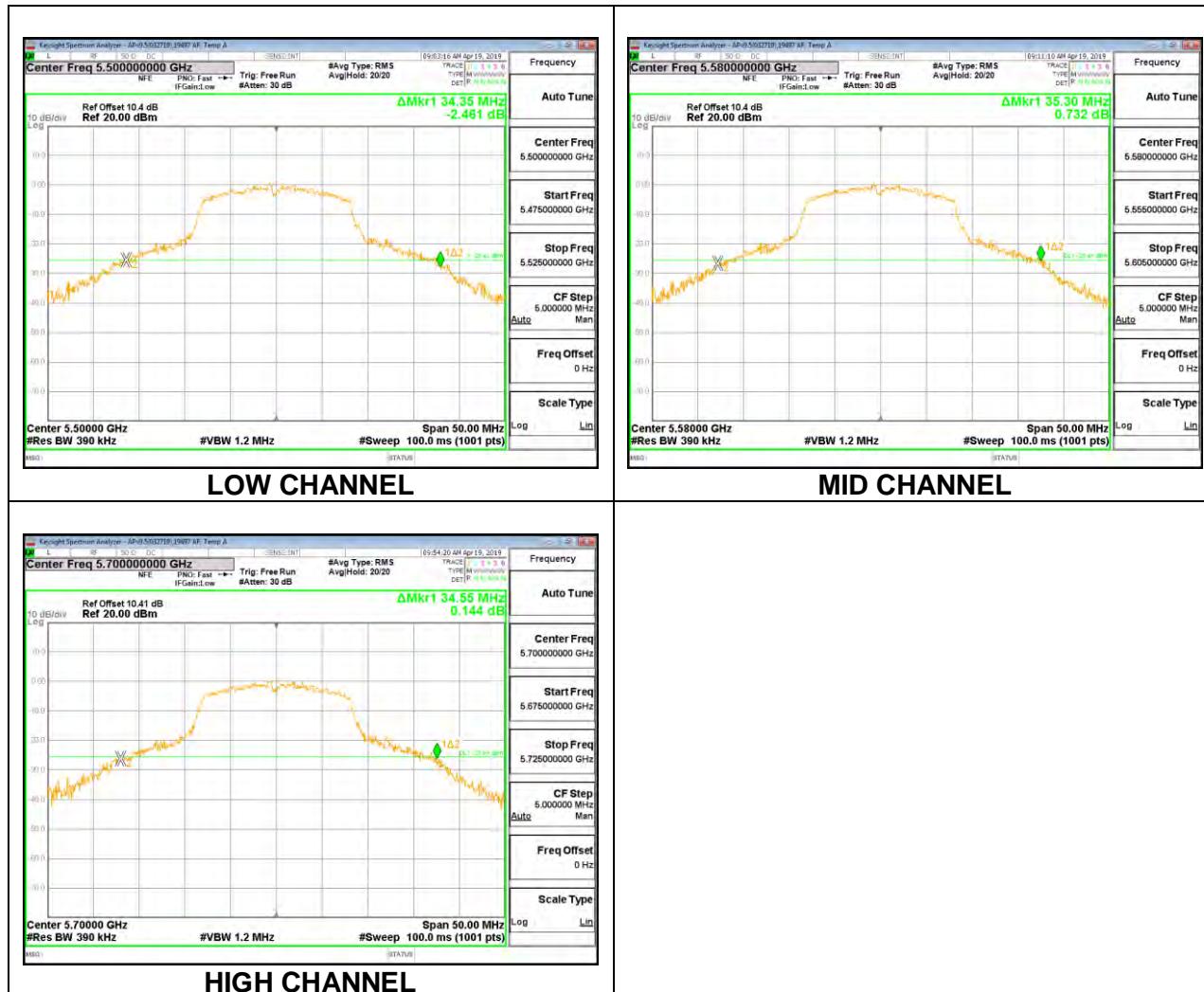
1TX Antenna 1 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5500	34.40
Mid	5580	34.55
High	5700	33.40



1TX Antenna 2 MODE

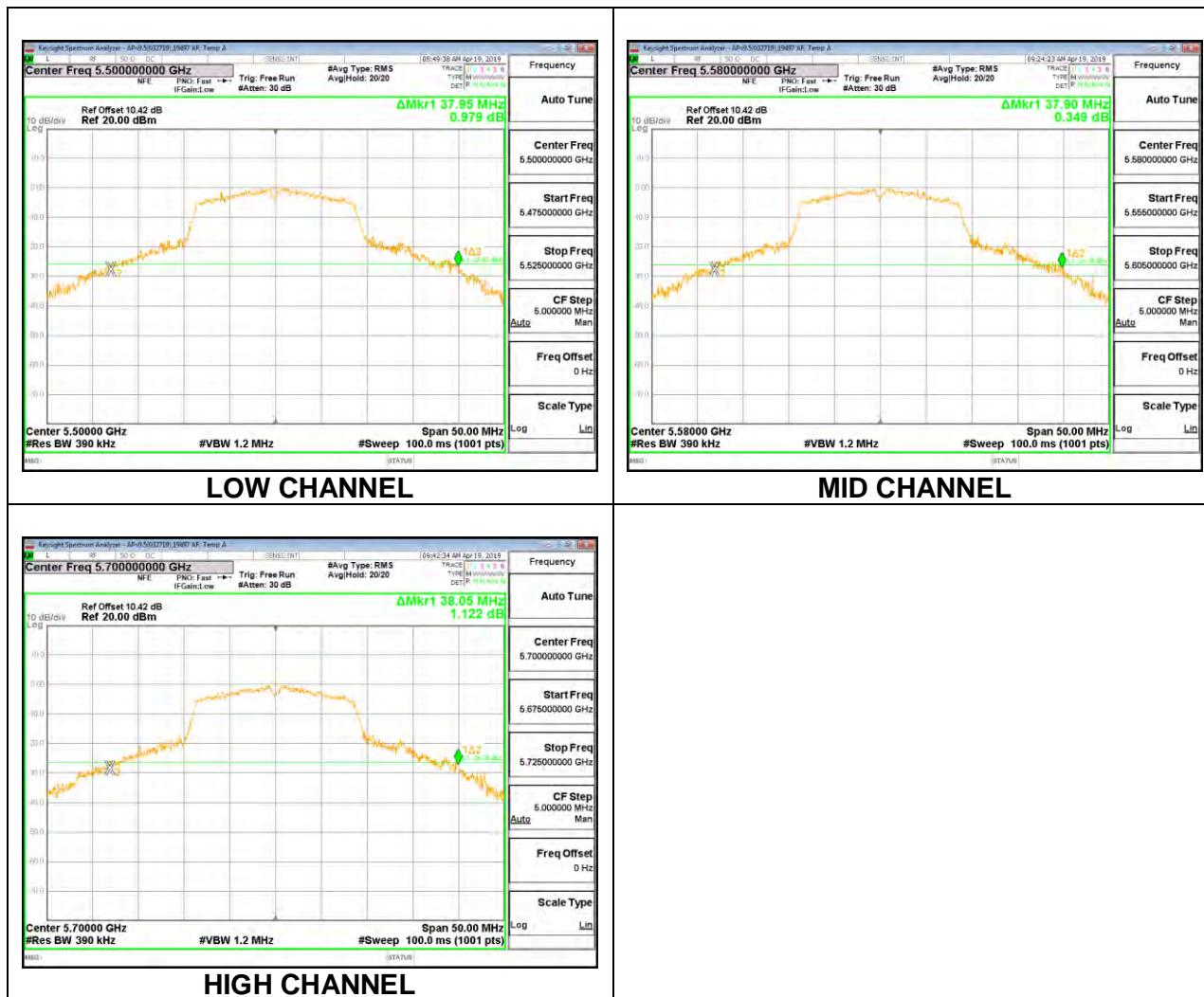
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5500	34.35
Mid	5580	35.30
High	5700	34.55



8.2.6. 802.11n HT20 MODE IN THE 5.6 GHz BAND

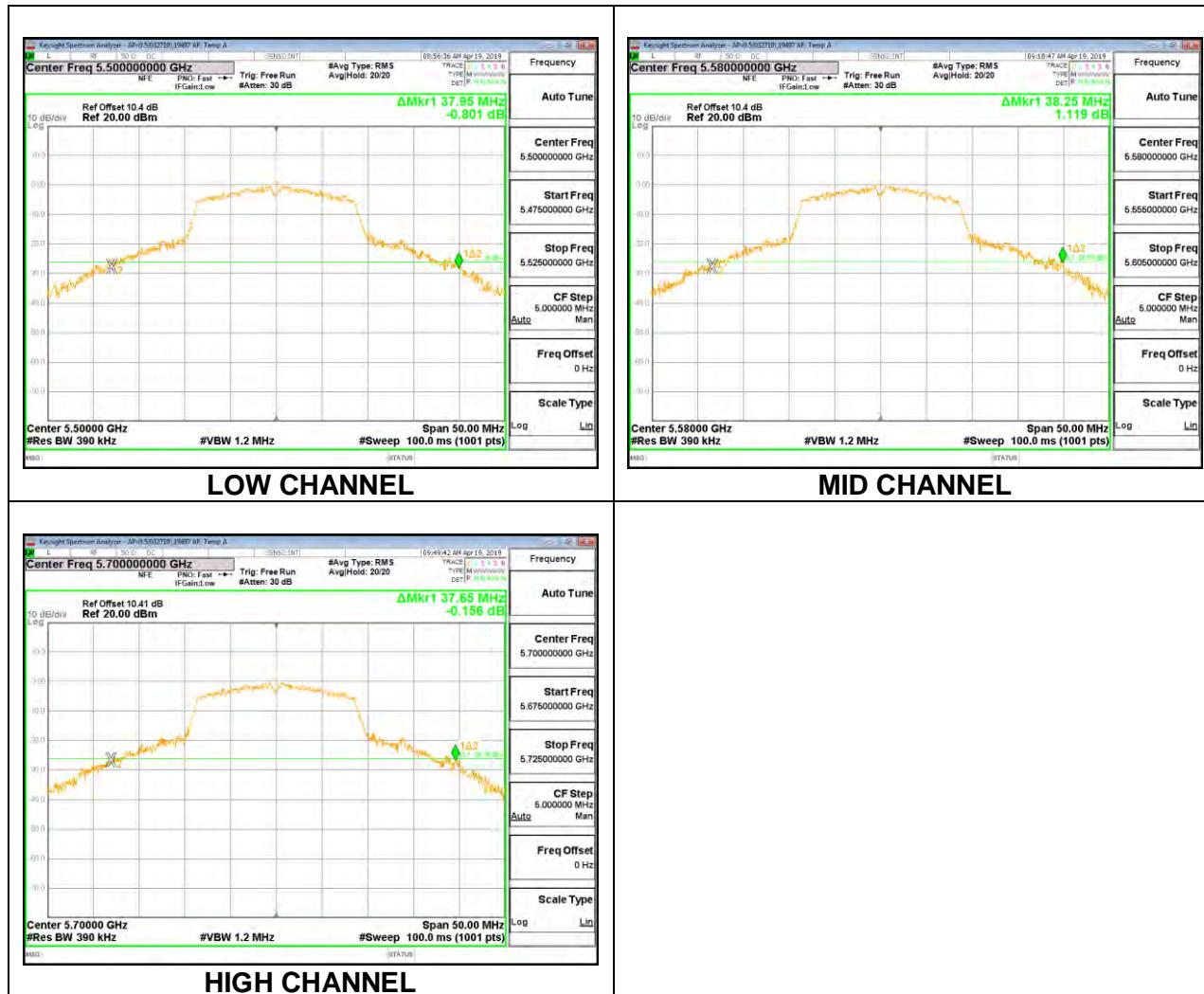
1TX Antenna 1 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5500	37.95
Mid	5580	37.90
High	5700	38.05



1TX Antenna 2 MODE

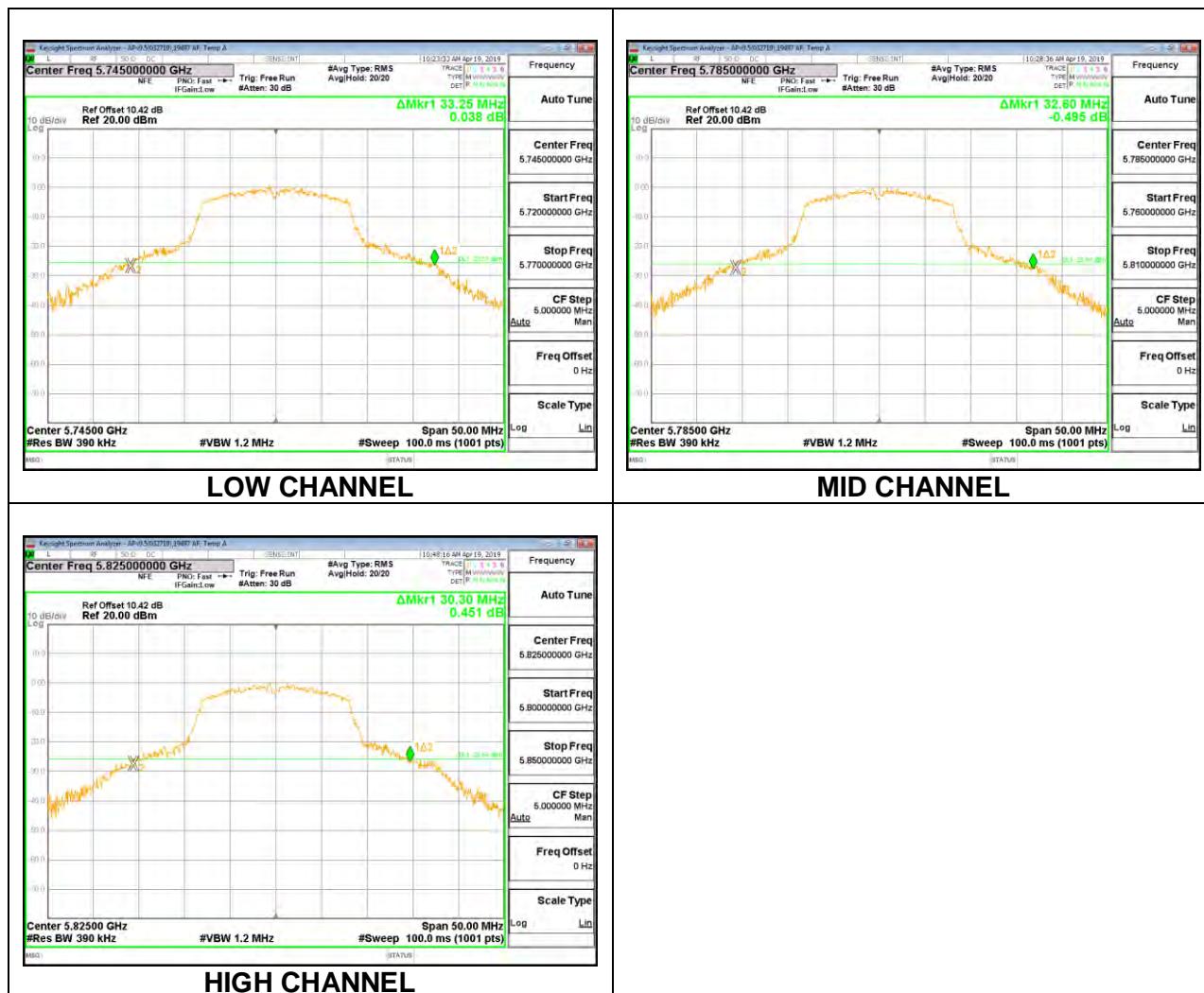
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5500	37.95
Mid	5580	38.25
High	5700	37.65



8.2.7. 802.11a MODE IN THE 5.8 GHz BAND

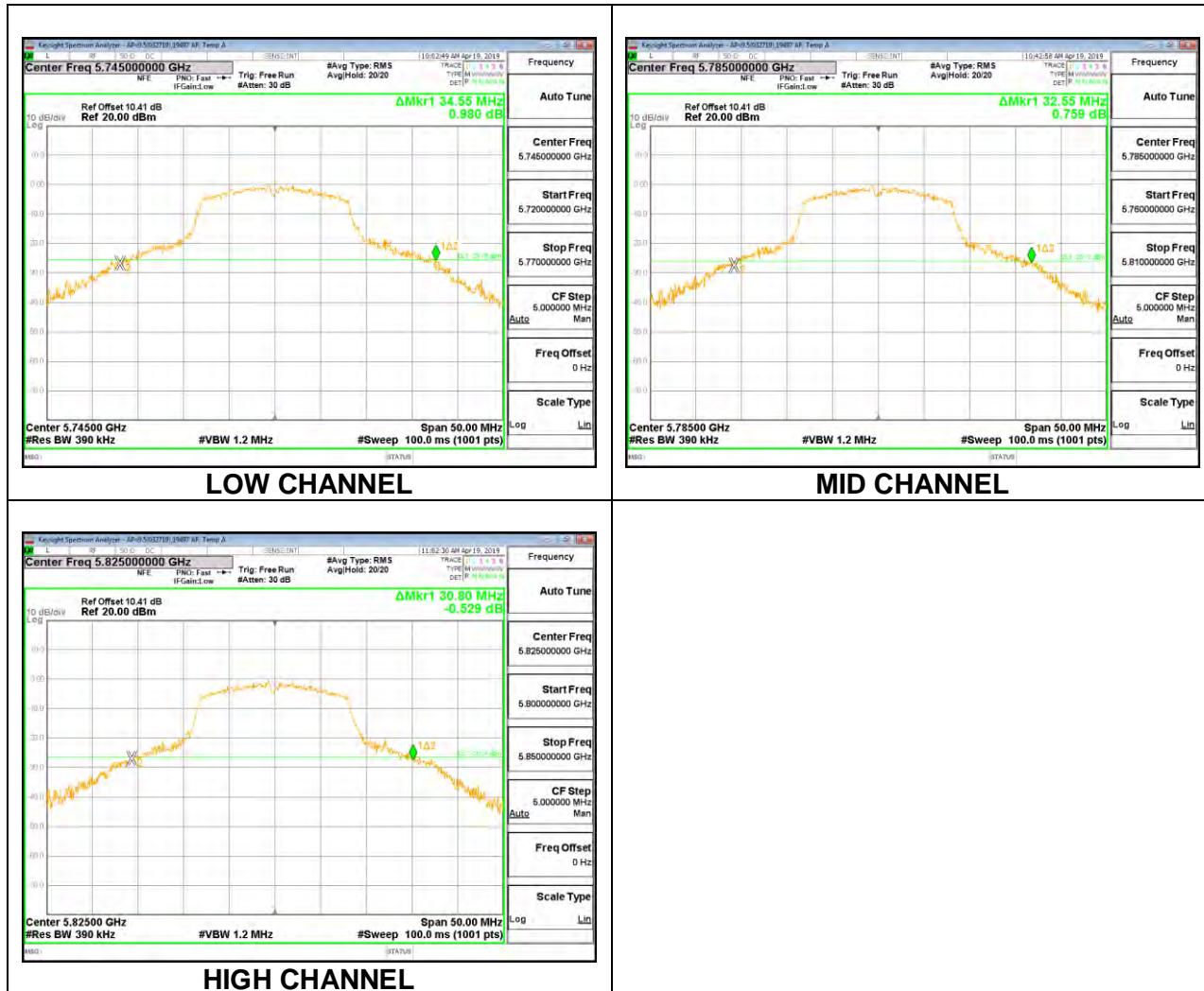
1TX Antenna 1 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5745	33.25
Mid	5785	32.60
High	5825	30.30



1TX Antenna 2 MODE

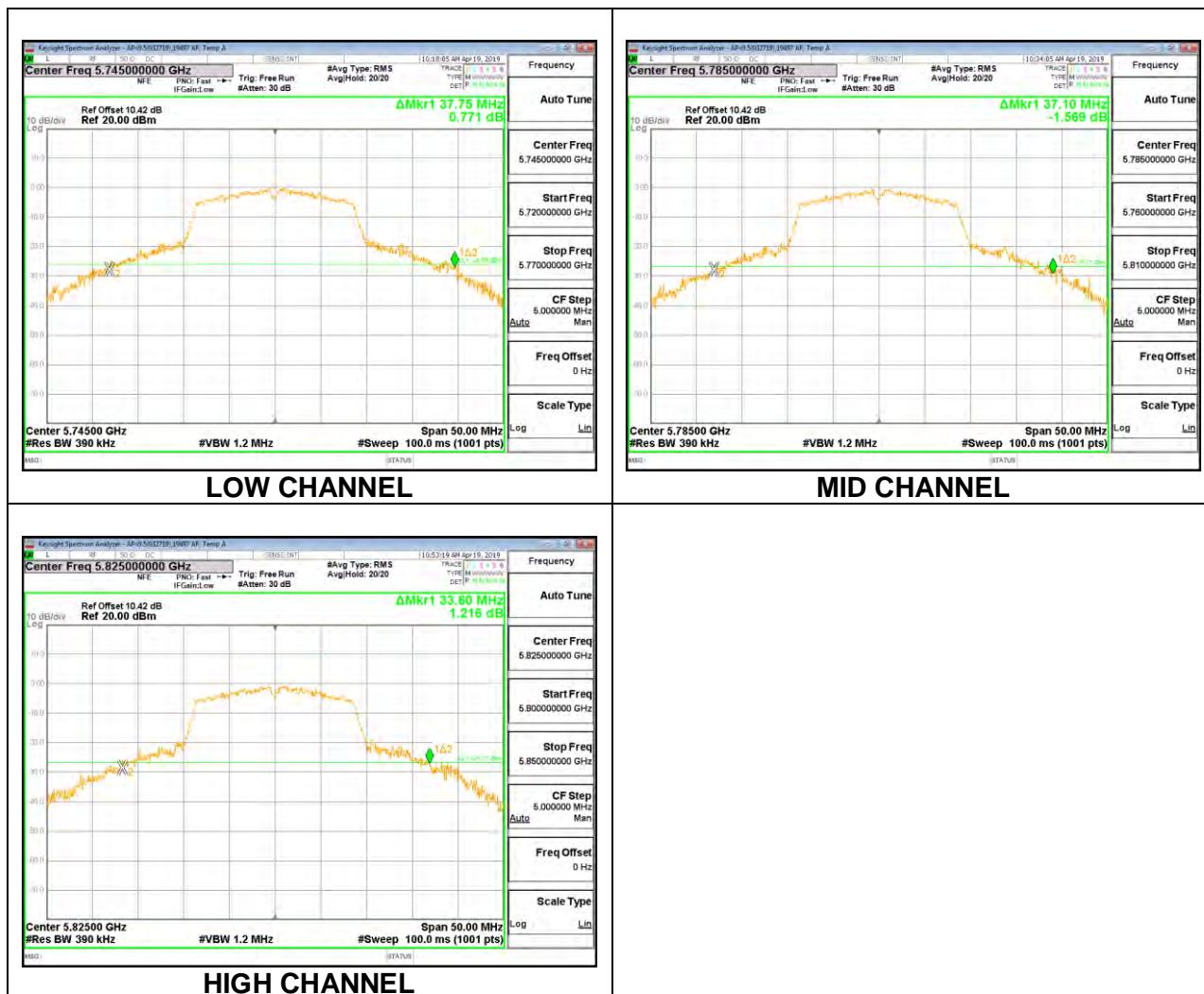
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5745	34.55
Mid	5785	32.55
High	5825	30.80



8.2.8. 802.11n HT20 MODE IN THE 5.8 GHz BAND

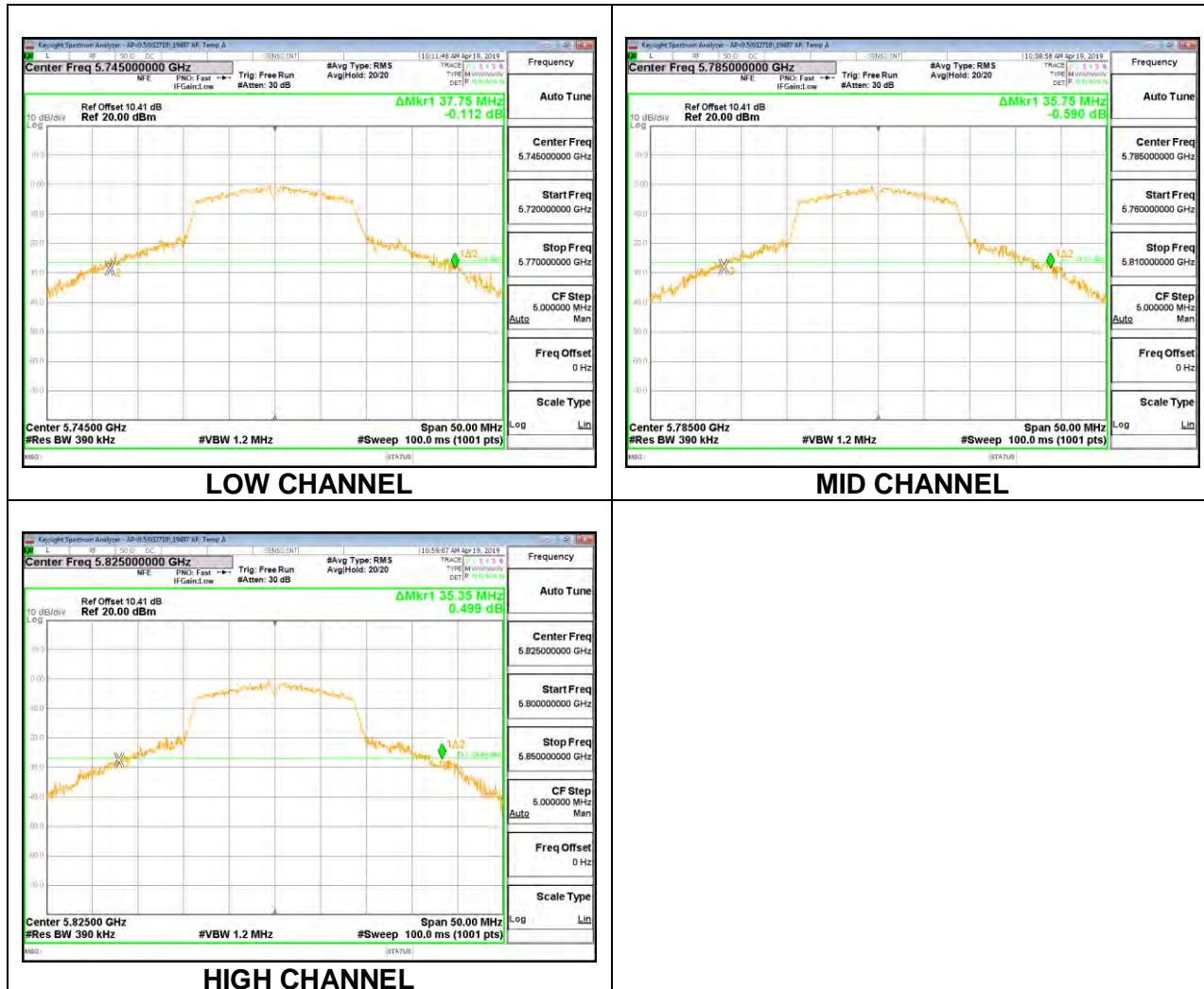
1TX Antenna 1 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5745	37.75
Mid	5785	37.10
High	5825	33.60



1TX Antenna 2 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5745	37.75
Mid	5785	35.75
High	5825	35.35



8.3. 99% BANDWIDTH

LIMITS

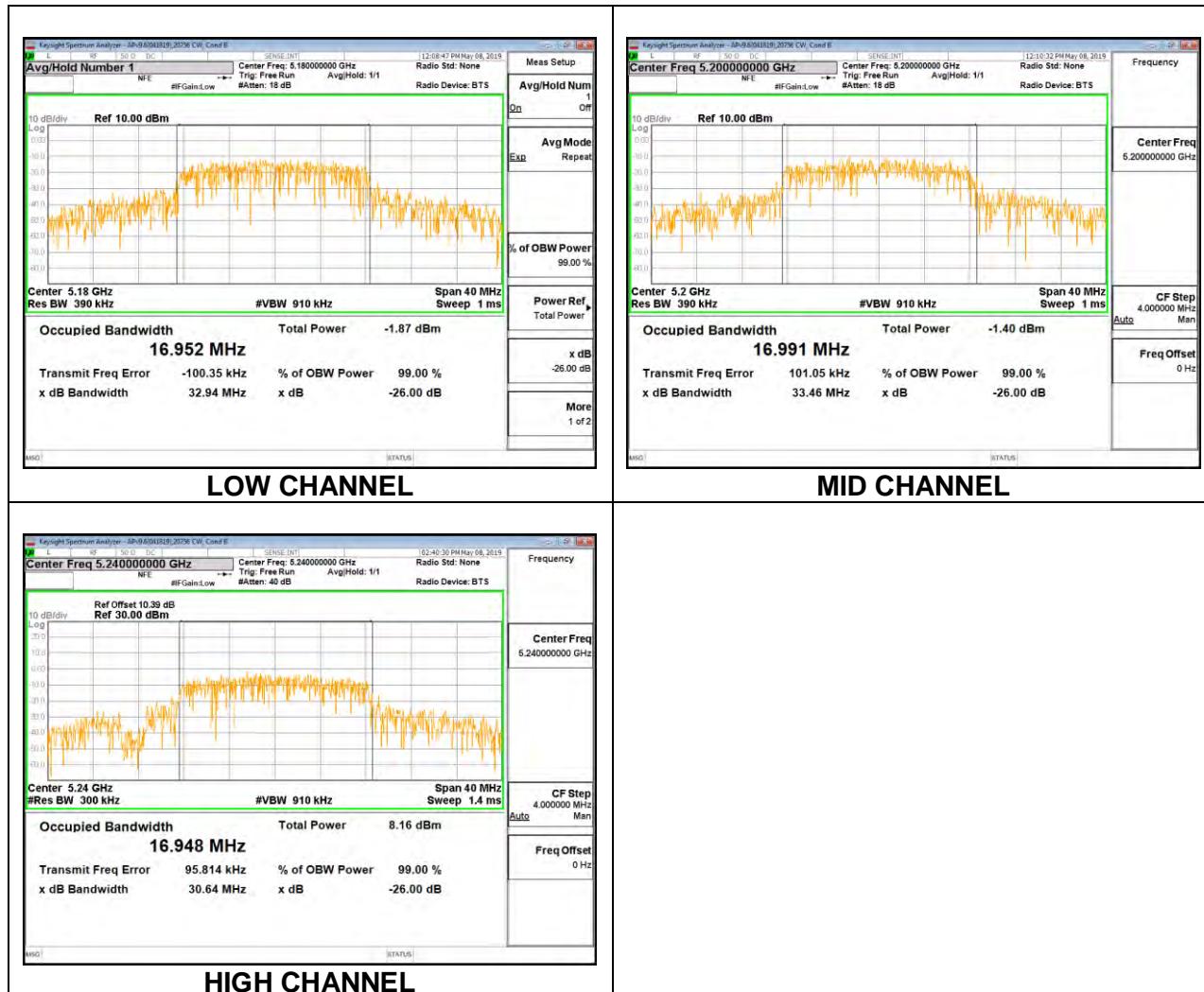
None; for reporting purposes only.

RESULTS

8.3.1. 802.11a MODE IN THE 5.2 GHz BAND

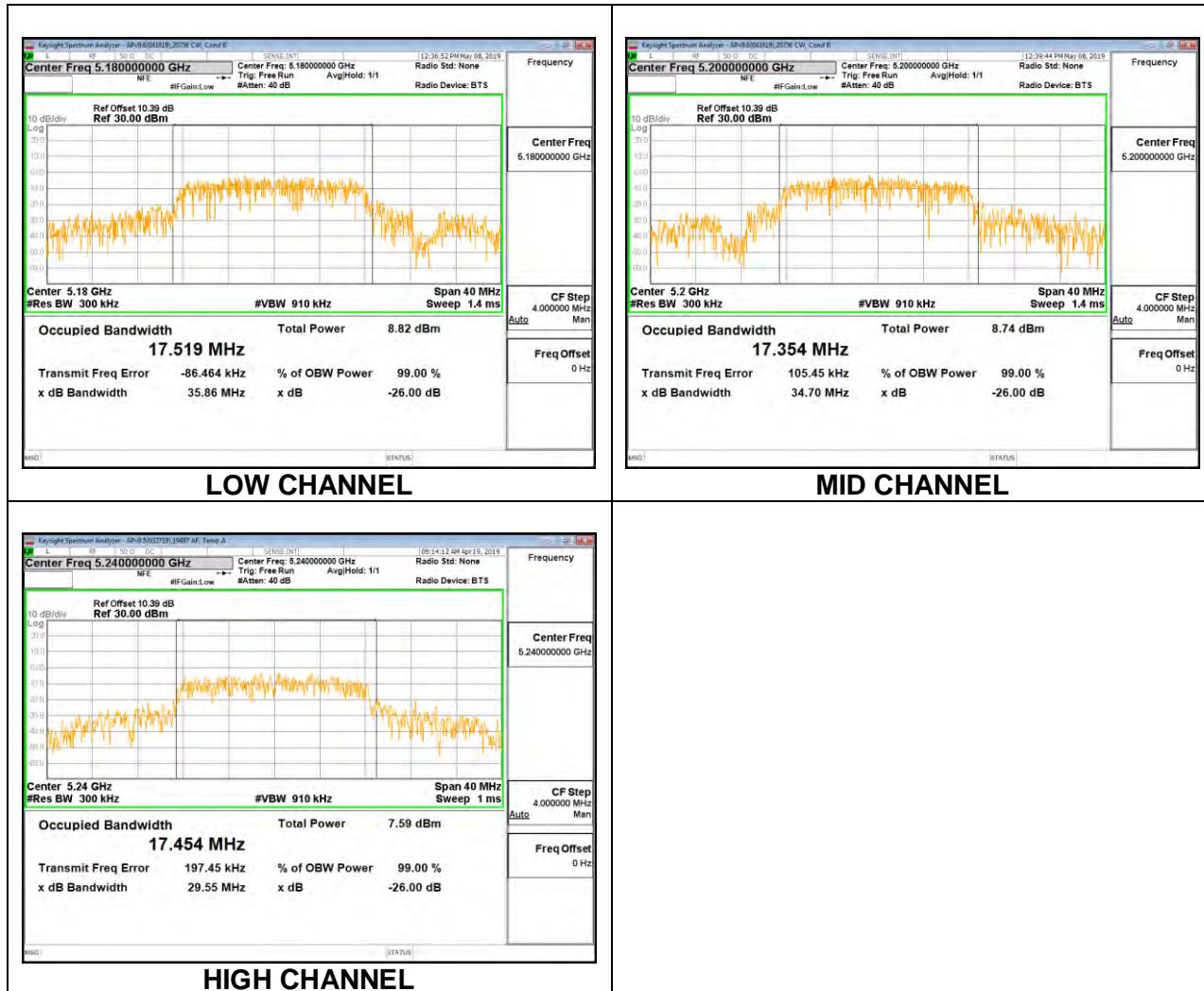
1TX Antenna 1 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	16.9520
Mid	5200	16.9910
High	5240	16.9480



1TX Antenna 2 MODE

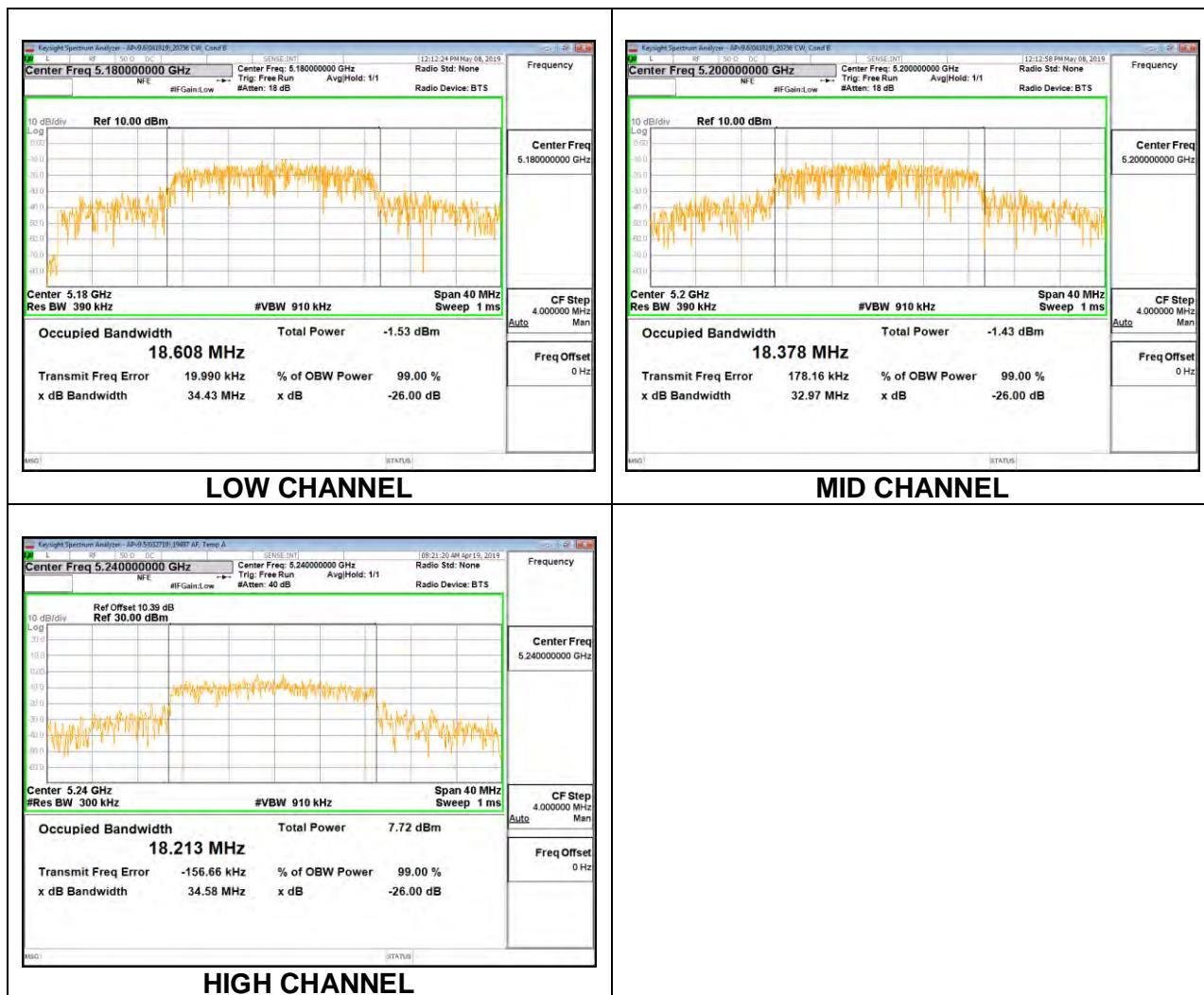
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.5190
Mid	5200	17.3540
High	5240	17.4540



8.3.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

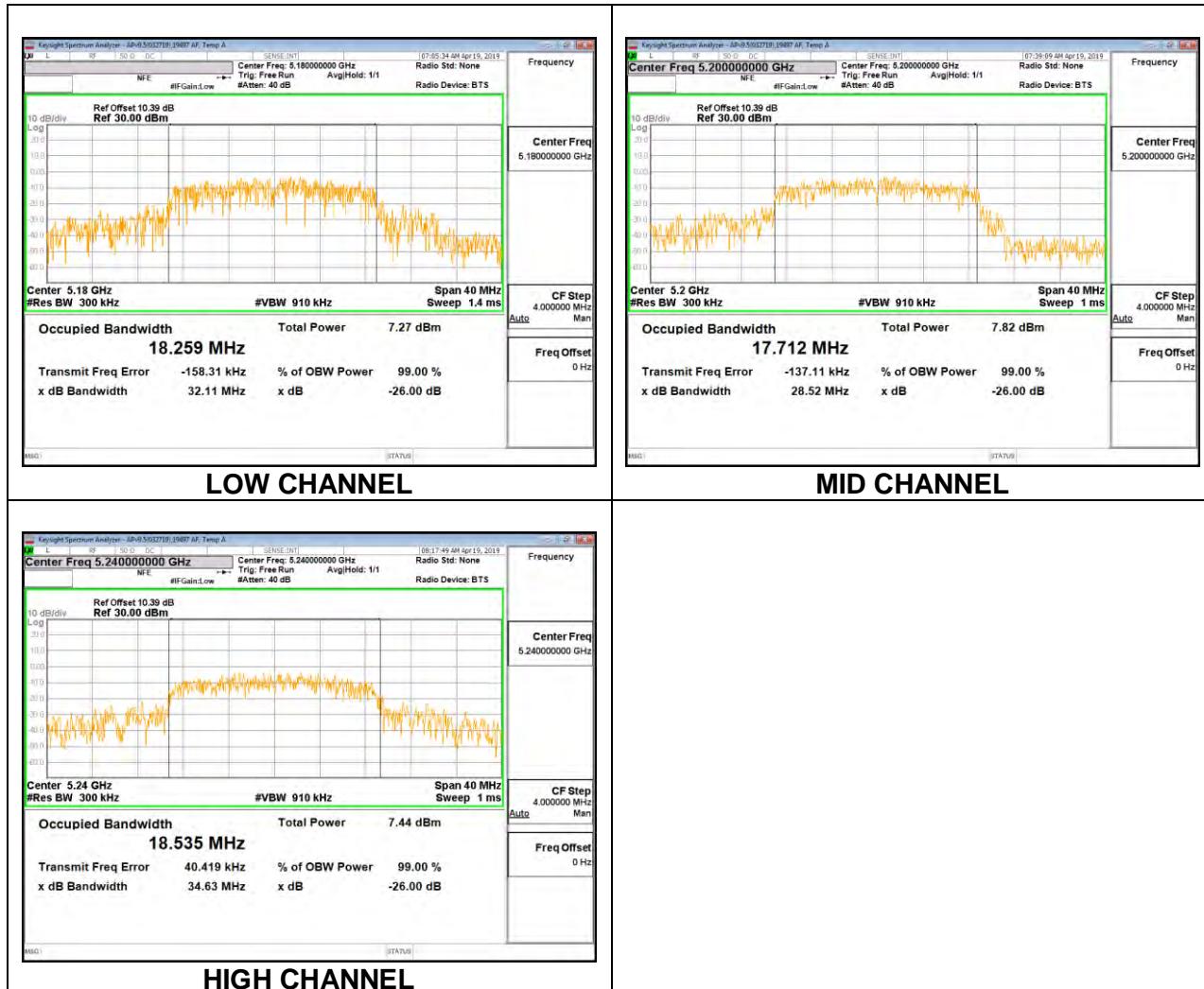
1TX Antenna 1 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	18.6080
Mid	5200	18.3780
High	5240	18.2130



1TX Antenna 2 MODE

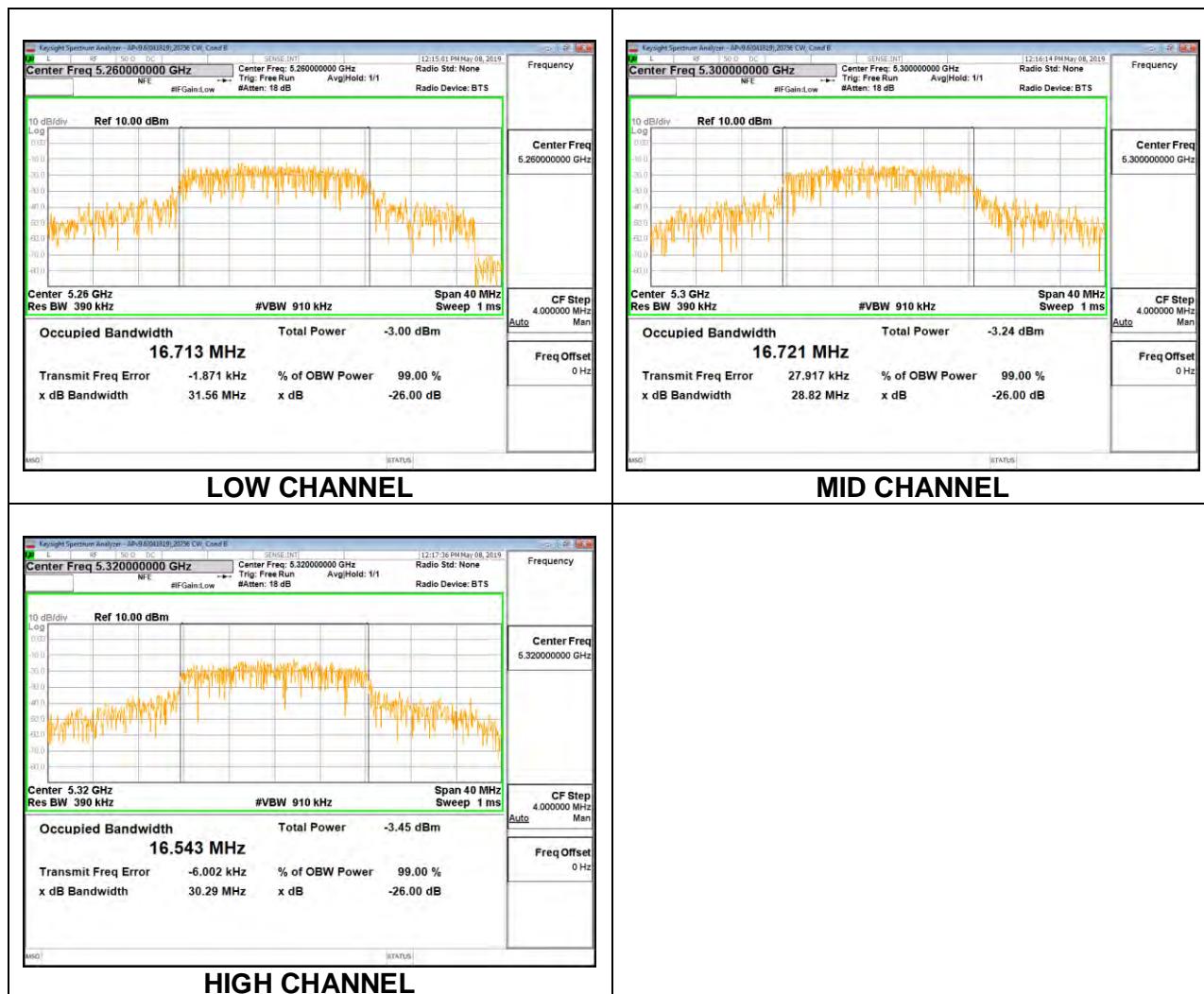
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	18.2590
Mid	5200	17.7120
High	5240	18.5350



8.3.3. 802.11a MODE IN THE 5.3 GHz BAND

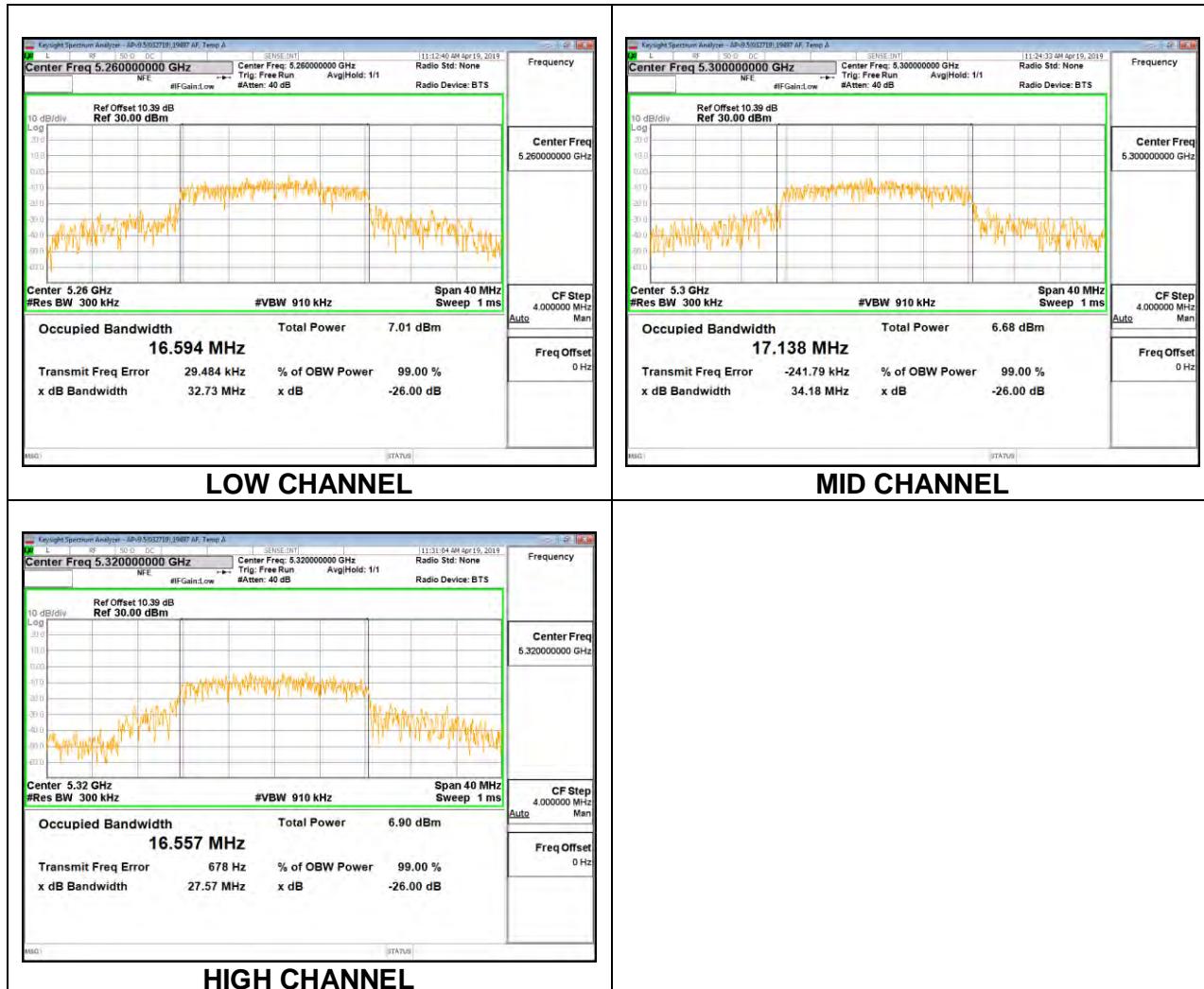
1TX Antenna 1 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5260	16.7130
Mid	5300	16.7210
High	5320	16.5430



1TX Antenna 2 MODE

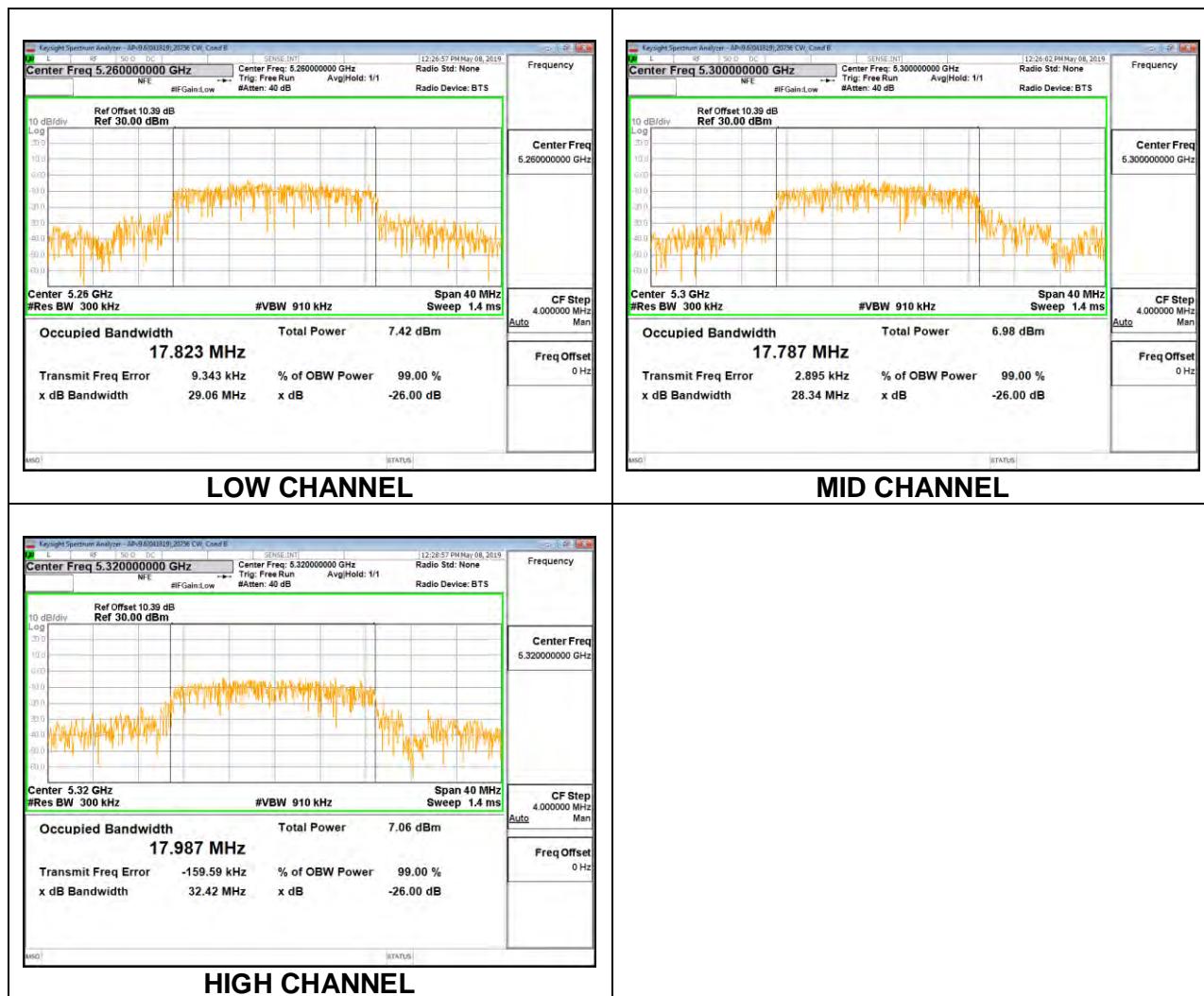
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5260	16.5940
Mid	5300	17.1380
High	5320	16.5570



8.3.4. 802.11n HT20 MODE IN THE 5.3 GHz BAND

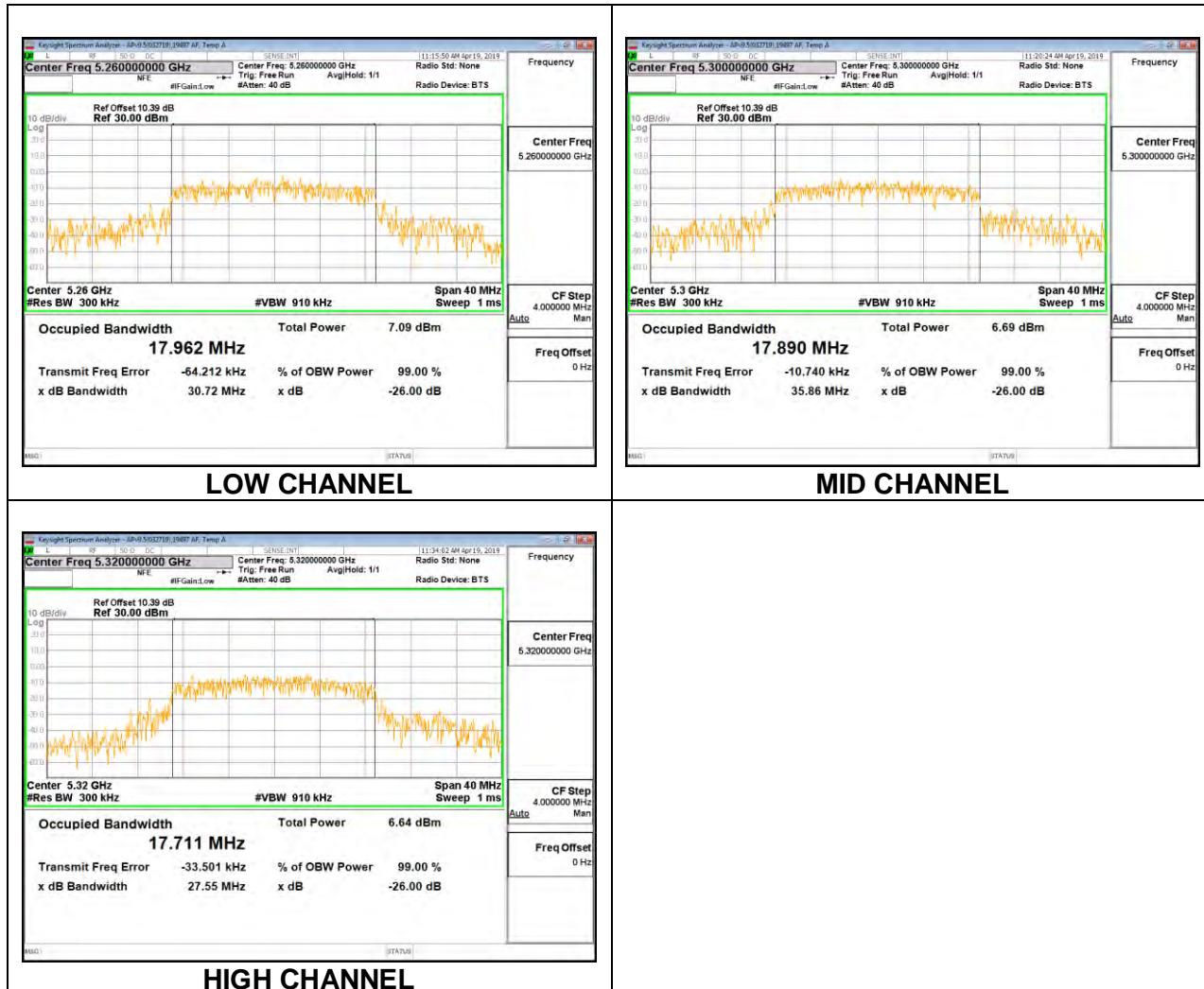
1TX Antenna 1 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5260	17.8230
Mid	5300	17.7870
High	5320	17.9870



1TX Antenna 2 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5260	17.9620
Mid	5300	17.8900
High	5320	17.7110



8.3.5. 802.11a MODE IN THE 5.6 GHz BAND

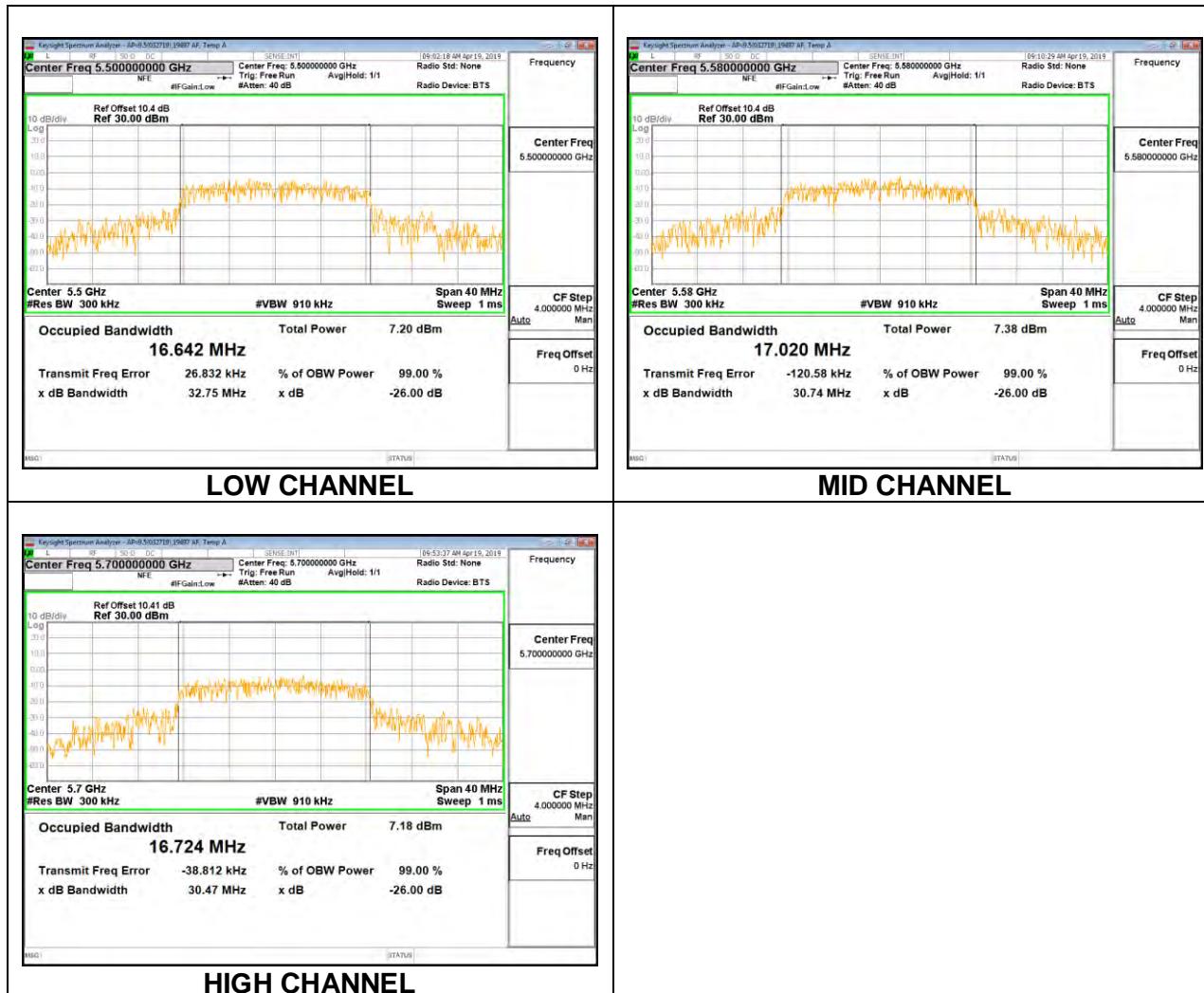
1TX Antenna 1 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5500	16.9980
Mid	5580	16.4220
High	5700	16.7150



1TX Antenna 2 MODE

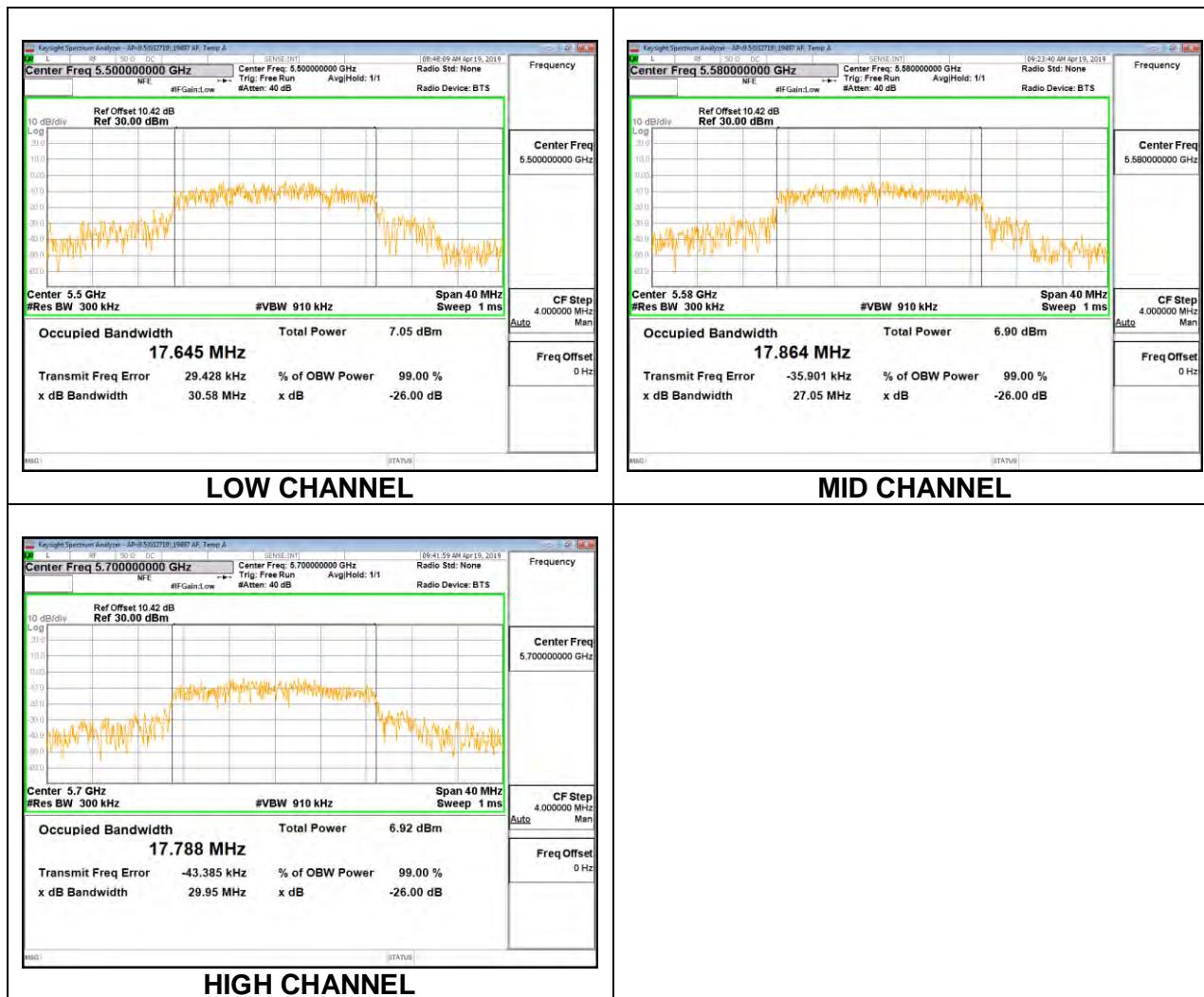
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5500	16.6420
Mid	5580	17.0200
High	5700	16.7240



8.3.6. 802.11n HT20 MODE IN THE 5.6 GHz BAND

1TX Antenna 1 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5500	17.6450
Mid	5580	17.8640
High	5700	17.7880



1TX Antenna 2 MODE

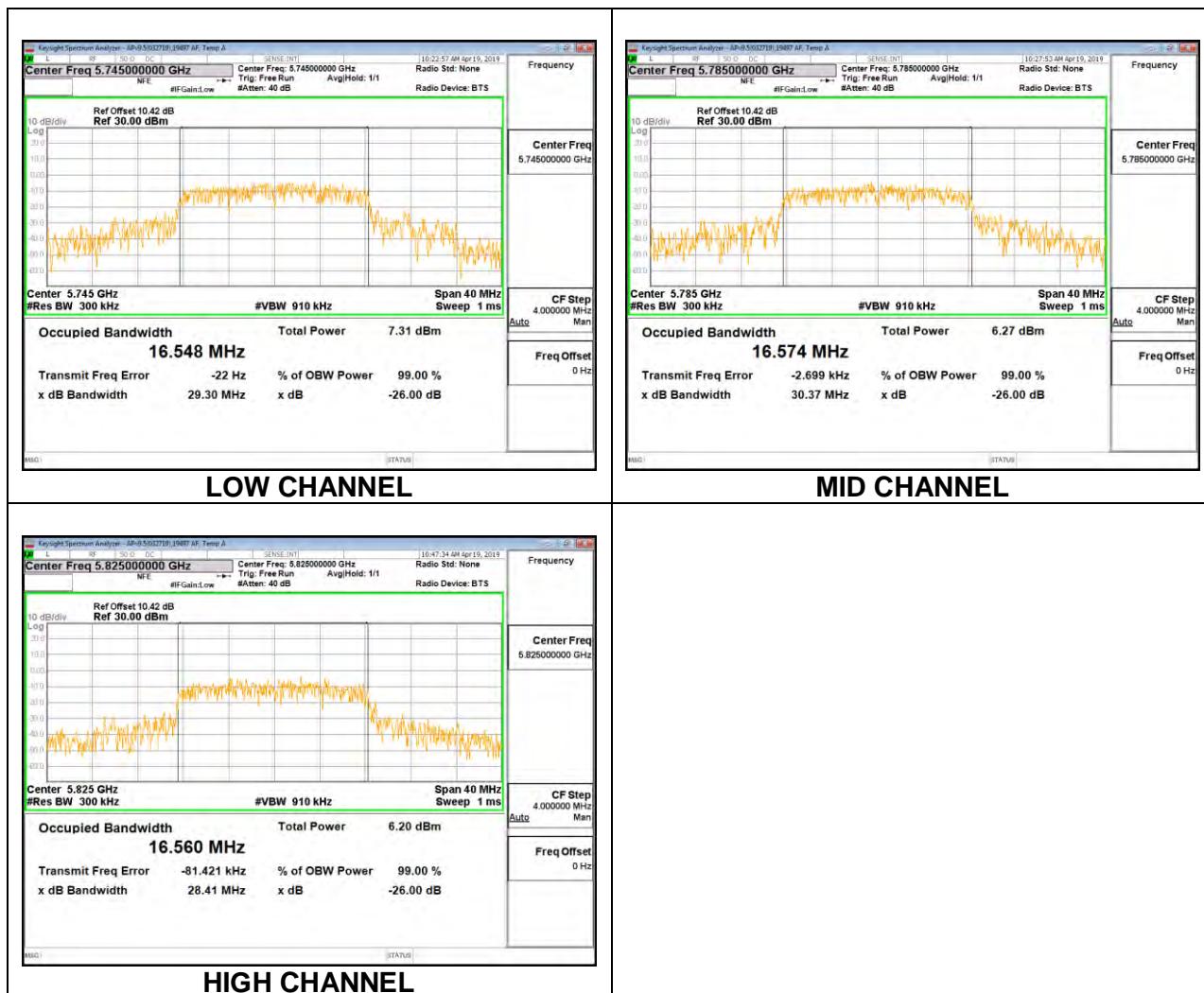
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5500	17.6960
Mid	5580	17.7820
High	5700	17.7600



8.3.7. 802.11a MODE IN THE 5.8 GHz BAND

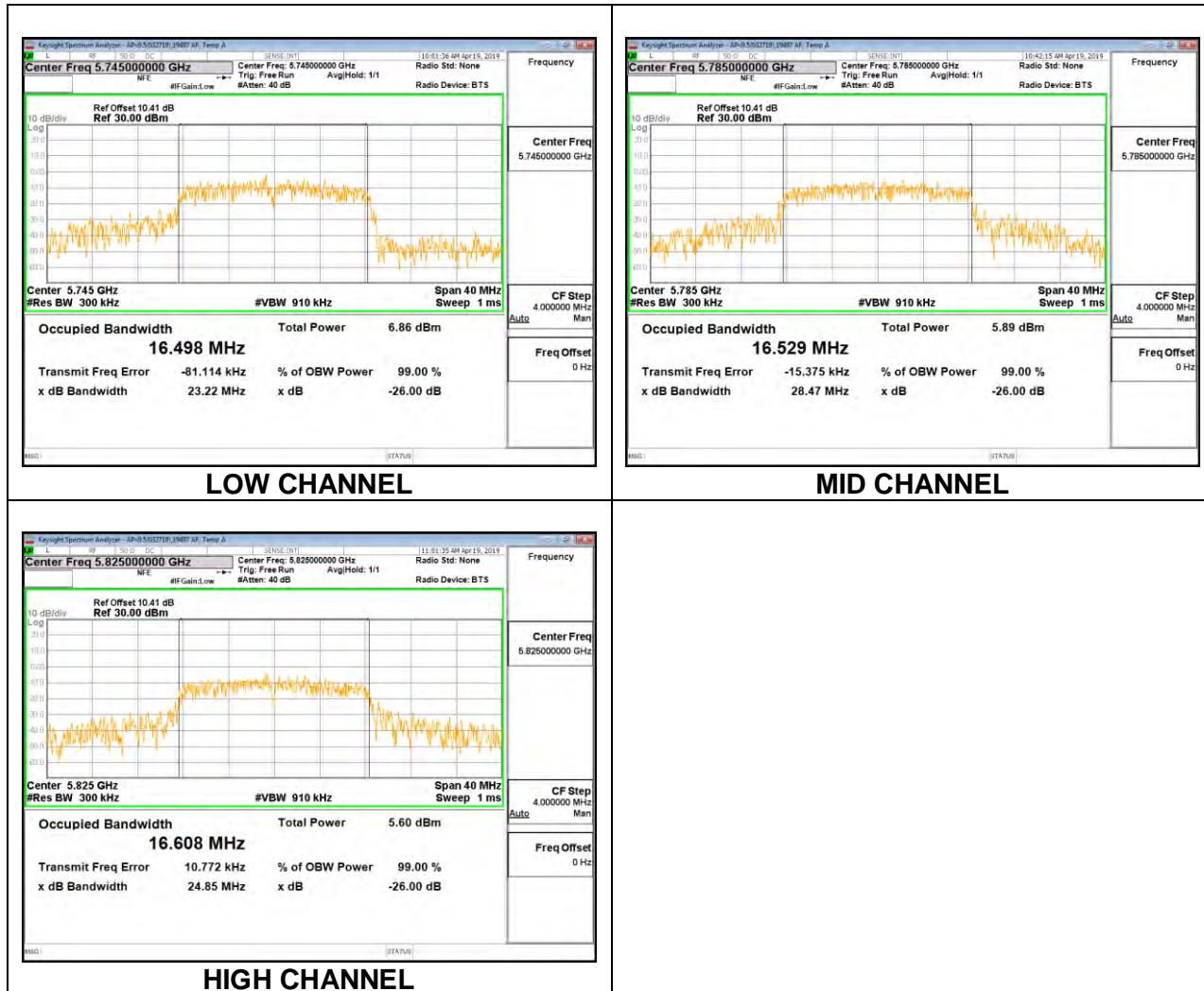
1TX Antenna 1 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	16.5480
Mid	5785	16.5740
High	5825	16.5600



1TX Antenna 2 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	16.4980
Mid	5785	16.5290
High	5825	16.6080



8.3.8. 802.11n HT20 MODE IN THE 5.8 GHz BAND

1TX Antenna 1 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.7370
Mid	5785	17.9440
High	5825	17.6690



1TX Antenna 2 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.9520
Mid	5785	17.7040
High	5825	17.5900

