



CERTIFICATION TEST REPORT

Report Number. : 12943451-E4V2

Applicant : APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A.

Model : A2218

FCC ID : BCG-E3308A

EUT Description : SMARTPHONE

Test Standard(s) : FCC 47 CFR PART 15 SUBPART E

Date Of Issue:
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REPORT REVISION HISTORY

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: SMARTPHONE

MODEL: A2218

SERIAL NUMBER: G6TYW036N39T, G6TYW03BN39T

DATE TESTED: MAY 20, 2019 – AUGUST 24, 2019

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	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, ANSI C63.10-2013, FCC 06-96.

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 ISED Site Code: 2324A	47266 Benicia Street ISED Site Code: XXXXX	47658 Kato Rd ISED Site Code: XXXXX
☒ Chamber A	☒ Chamber D	☐ Chamber I
☒ Chamber B	☐ Chamber E	☐ Chamber J
☐ Chamber C	☒ Chamber F	☒ Chamber K
	☒ Chamber G	☐ Chamber L
	☒ Chamber H	☐ 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

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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable} \\ &\text{Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Final Voltage (dBuV)} &= \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor (dB)} + \\ &\text{LISN Insertion Loss.} \\ 36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} &= 46.6 \text{ dBuV} \end{aligned}$$

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 Apple iPhone is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, TD-SCDMA, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wide band, GPS and NFC. All models support at least one UICC based SIM. The second SIM, if present, is either UICC based pSIM (physical SIM) or e-SIM (electronic SIM). The device has a built-in inductive charging receiver. The rechargeable battery is also not user accessible.

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	Covered by 802.11n HT20 1TX	
5180-5240	802.11n HT20	20.88	122.46
5190-5230	802.11n HT40	21.40	138.04
5180-5240	802.11ac VHT20	Covered by 802.11n HT20 1TX	
5190-5230	802.11ac VHT40	Covered by 802.11n HT40 1TX	
5210	802.11ac VHT80	16.78	47.64
5180-5240	802.11ax HE20	20.89	122.74
5190-5230	802.11ax HE40	21.42	138.68
5210	802.11ax HE80	15.22	33.27
5.2 GHz band, 2TX			
5180-5240	802.11n HT20 CDD	20.93	123.88
5180-5240	802.11n HT20 SDM/STBC	Covered by 802.11n HT20 2TX CDD	
5190-5230	802.11n HT40 CDD	23.00	199.53
5190-5230	802.11n HT40 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5180-5240	802.11ac VHT20 SDM/STBC/CDD	Covered by 802.11n HT20 2TX CDD	
5190-5230	802.11ac VHT40 SDM/STBC/CDD	Covered by 802.11n HT40 2TX CDD	
5210	802.11ac VHT80 CDD	18.84	76.56
5210	802.11ac VHT80 SDM/STBC	Covered by 802.11ac VHT80 2TX CDD	
5180-5240	802.11ax HE20 OFDMA	20.95	124.45
5190-5230	802.11ax HE40 OFDMA	22.91	195.43
5210	802.11ax HE80 OFDMA	17.48	55.98

5.3 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.3 GHz band, 1TX			
5260 - 5320	802.11a	Covered by 802.11n HT20 1TX	
5260 - 5320	802.11n HT20	20.89	122.74
5270 - 5310	802.11n HT40	21.39	137.72
5260 - 5320	802.11ac VHT20	Covered by 802.11n HT20 1TX	
5270 - 5310	802.11ac VHT40	Covered by 802.11n HT40 1TX	
5290	802.11ac VHT80	17.44	55.46
5260 - 5320	802.11ax HE20	20.94	124.17
5270 - 5310	802.11ax HE40	21.40	138.04
5290	802.11ax HE80	15.90	38.90
5.3 GHz band, 2TX			
5260 - 5320	802.11n HT20 CDD	20.91	123.31
5260 - 5320	802.11n HT20 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5270 - 5310	802.11n HT40 CDD	22.93	196.34
5270 - 5310	802.11n HT40 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5260 - 5320	802.11ac VHT20 SDM/STBC/CDD	Covered by 802.11n HT20 2TX CDD	
5270 - 5310	802.11ac VHT40 SDM/STBC/CDD	Covered by 802.11n HT40 2TX CDD	
5290	802.11ac VHT80 CDD	19.48	88.72
5290	802.11ac VHT80 SDM/STBC	Covered by 802.11ac VHT80 2TX CDD	
5260 - 5320	802.11ax HE20 OFDMA	20.99	125.60
5270 - 5310	802.11ax HE40 OFDMA	23.00	199.53
5290	802.11ax HE80 OFDMA	17.88	61.38

5.6 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.6 GHz band, 1TX			
5500-5720	802.11a	Covered by 802.11n HT20 1TX	
5500-5720	802.11n HT20	20.89	122.74
5510-5710	802.11n HT40	21.26	133.66
5500-5720	802.11ac VHT20	Covered by 802.11n HT20 1TX	
5510-5710	802.11ac VHT40	Covered by 802.11n HT40 1TX	
5530-5690	802.11ac VHT80	21.40	138.04
5500-5720	802.11ax HE20	20.87	122.18
5510-5710	802.11ax HE40	21.40	138.04
5530-5690	802.11ax HE80	21.40	138.04
5.6 GHz band, 2TX			
5500-5720	802.11n HT20 CDD	20.92	123.59
5500-5720	802.11n HT20 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5510-5710	802.11n HT40 CDD	22.96	197.70
5510-5710	802.11n HT40 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5500-5720	802.11ac VHT20 SDM/STBC/CDD	Covered by 802.11n HT20 2TX CDD	
5510-5710	802.11ac VHT40 SDM/STBC/CDD	Covered by 802.11n HT40 2TX CDD	
5530-5690	802.11ac VHT80 CDD	22.91	195.43
5530-5690	802.11ac VHT80 SDM/STBC	Covered by 802.11ac VHT80 2TX CDD	
5500-5720	802.11ax HE20 OFDMA	20.91	123.31
5510-5710	802.11ax HE40 OFDMA	22.96	197.70
5530-5690	802.11ax HE80 OFDMA	22.97	198.15

5.8 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.8 GHz band, 1TX			
5745-5825	802.11a	Covered by 802.11n HT20 1TX	
5745-5825	802.11n HT20	21.45	139.64
5755-5795	802.11n HT40	21.39	137.72
5745-5825	802.11ac VHT20	Covered by 802.11n HT20 1TX	
5755-5795	802.11ac VHT40	Covered by 802.11n HT40 1TX	
5775	802.11ac VHT80	21.40	138.04
5745-5825	802.11ax HE20	21.43	139.00
5755-5795	802.11ax HE40	21.45	139.64
5775	802.11ax HE80	21.43	139.00
5.8 GHz band, 2TX			
5745-5825	802.11n HT20 CDD	24.43	277.33
5745-5825	802.11n HT20 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5755-5795	802.11n HT40 CDD	24.33	271.02
5755-5795	802.11n HT40 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5745-5825	802.11ac VHT20 STM/STBC/CDD	Covered by 802.11n HT20 2TX CDD	
5755-5795	802.11ac VHT40 STM/STBC/CDD	Covered by 802.11n HT40 2TX CDD	
5775	802.11ac VHT80 CDD	24.36	272.90
5775	802.11ac VHT80 SDM/STBC	Covered by 802.11ac VHT80 2TX CDD	
5745-5825	802.11ax HE20 OFDMA	24.43	277.33
5755-5795	802.11ax HE40 OFDMA	24.49	281.19
5775	802.11ax HE80 OFDMA	22.97	198.15

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range	Antenna 6 (Core 0)	Antenna 5 (Core 1)
5180 - 5240	-1.3	-5.8
5260 - 5320	-2.3	-7.1
5500 - 5720	-3.1	-5.6
5745 - 5825	-5.2	-9.4

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was WiFi FW Version: 18_20_56_1

5.5. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z on Ant 6 (Core 0) and Ant 5 (Core 1). It was determined that X (Flatbed) orientation was the worst-case orientation for Ant 6, X (Flatbed) orientation was the worst case for Ant 5, and X (Flatbed) for 2TX.

For radiated harmonics spurious below 1GHz, 1-18GHz L/M/H channels, 18-40GHz, and power line conducted emissions were performed with the EUT set at the 2TX CDD mode among the CDD/SDM modes with power setting equal or higher than SISO modes as worst-case scenario.

Radiated band edge, harmonic, and spurious emissions from 1GHz to 18GHz were performed with the EUT was set to transmit at highest power on Low/Middle/High channels.

Below 1GHz tests were performed with EUT connected to AC power adapter as the worst case; and for above 1GHz, the worst-case configuration reported was tested with EUT only. For AC line conducted emission, test was investigated with AC power adapter and with laptop.

There were no emissions found below 30MHz within 20dB of the limit.

The output power and psd for the 802.11 ax mode were investigated between all different tones, and we found that the highest tone had the highest output power and lowest tone had the highest PSD readings. Therefore, full testing was performed on both the highest and lowest tones.

For simultaneous transmission with the Bluetooth was investigated, no noticeable emission was found.

Investigated worst-case data rates as listed below were:

802.11n HT20mode: MCS0
802.11n HT40mode: MCS0
802.11ac VHT80 mode: MCS0
802.11ax HE20/HE40/HE80 FULL RU & RU26

There are two vendors of the WiFi/Bluetooth radio modules: variant 1 and variant 2. The Wi-Fi/Bluetooth radio modules have the same mechanical outline (e.g., the same package dimension and pin-out layout), use the same on-board antenna matching circuit, have an identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances.

Baseline testing was performed on the two variants to determine the worst case on all conducted power and radiated emissions.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
laptop	Apple	Macbook Pro	C02P41RZG086	FCC DoC
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC Adapter	Apple	A1385	D292365CDYADHLHC3	NA

I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Shielded	1	N/A
3	AC	1	AC	Un-shielded	2	N/A

I/O CABLES (RADIATED ABOVE 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
NA						

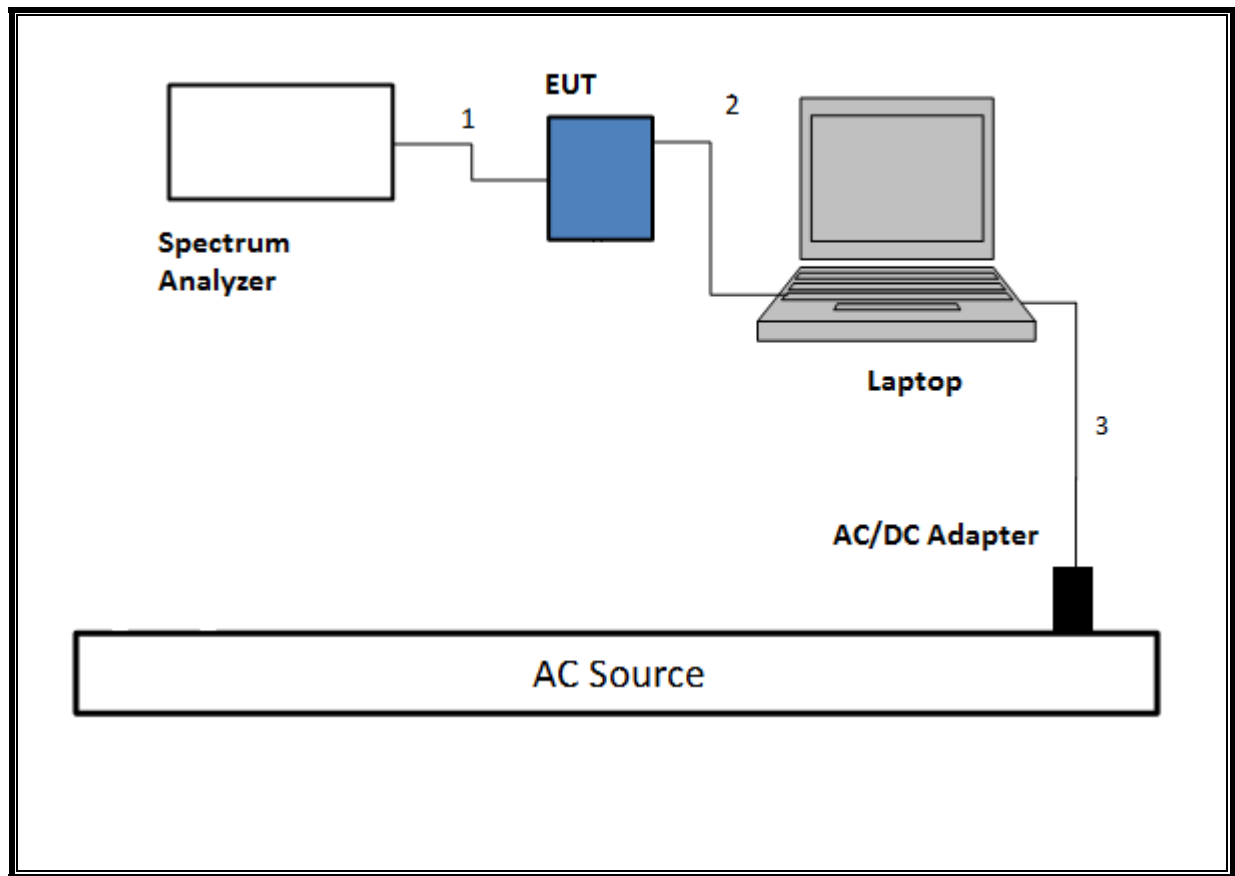
I/O CABLES (BELOW 1GHz AND AC POWER LINE TEST WITH ADAPTER AND LAPTOP)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-shielded	2	N/A
2	USB	1	USB	Shielded	1	N/A

TEST SETUP

The EUT is installed in a host laptop computer during the tests. Test software exercised the radio card.

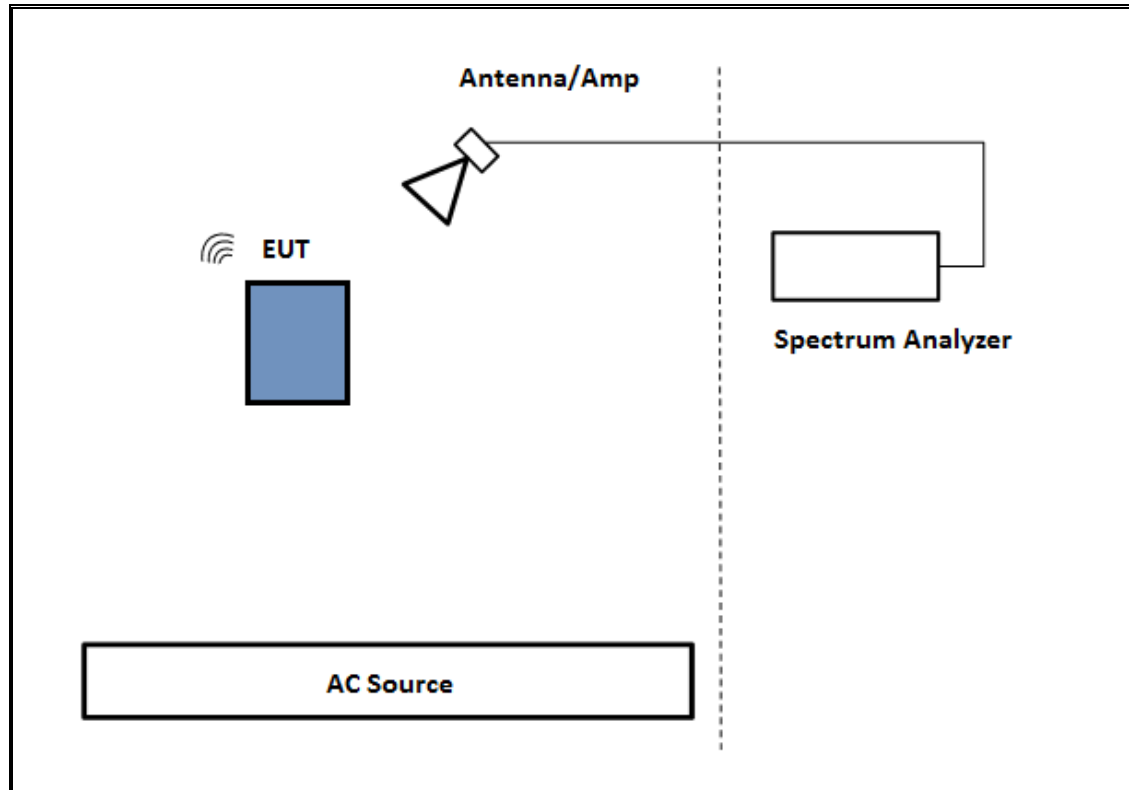
SETUP DIAGRAM FOR CONDUCTED TESTS



TEST SETUP- RADIATED-ABOVE 1 GHZ

The EUT was powered by Battery. Test software exercised the EUT.

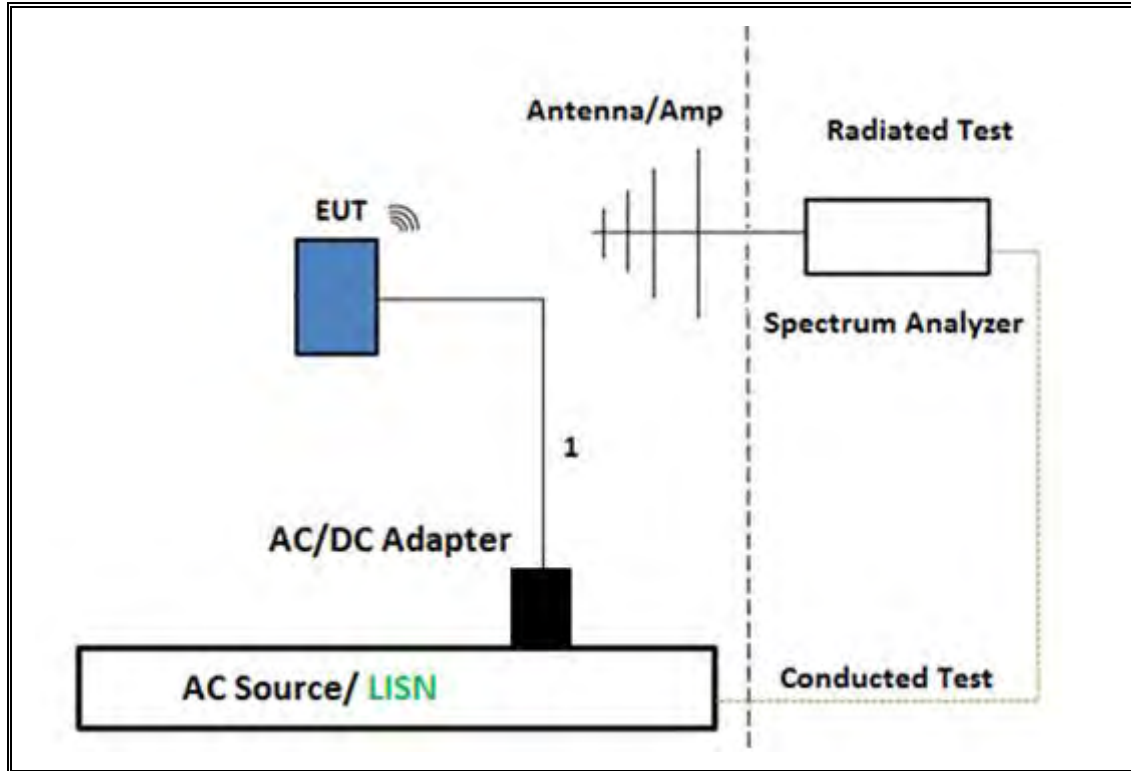
SETUP DIAGRAM



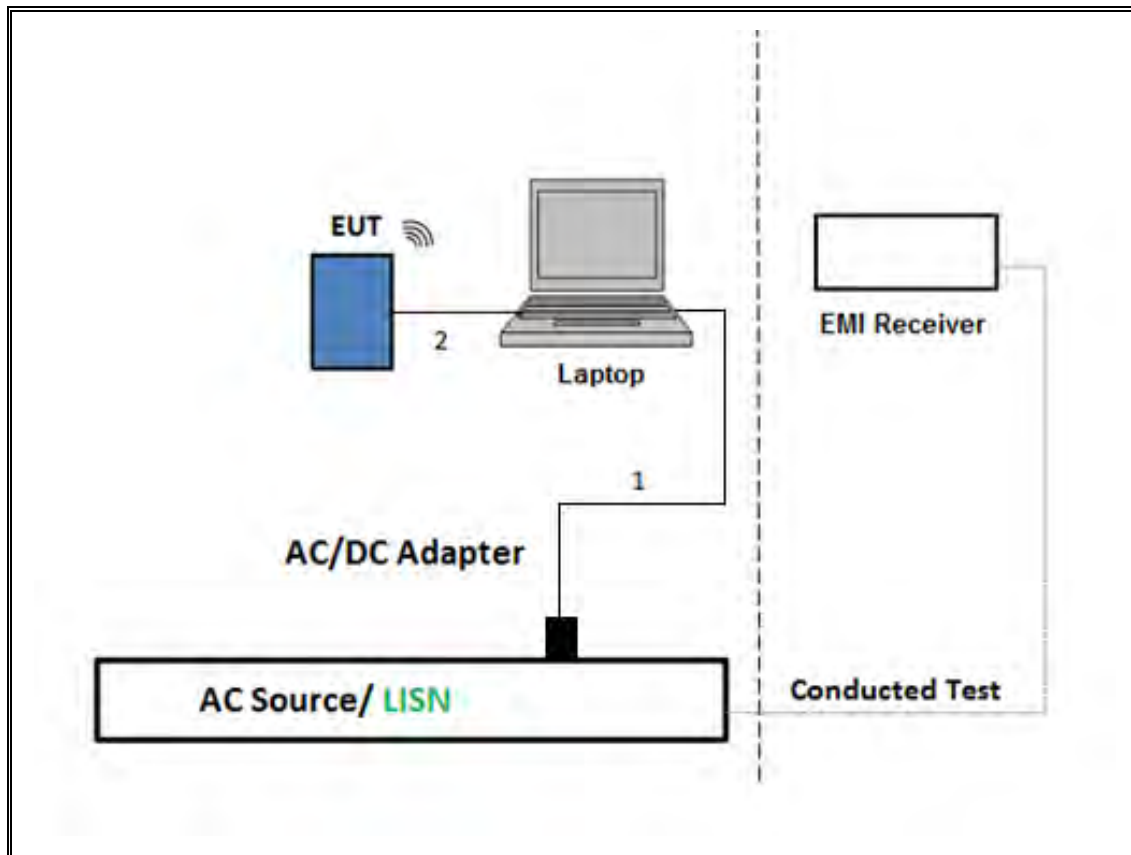
TEST SETUP- BELOW 1GHZ & AC LINE CONDUCTED TESTS

The EUT was powered by AC cord. Test software exercised the EUT.

SETUP DIAGRAM



TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION



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) and Section E.2.d (Method SA-2)

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
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T119	03/22/2020	03/22/2019
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T346	05/14/2020	05/14/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	05/30/2020	05/30/2019
*Antenna, Horn 1-18GHz	ETS Lindgren	3117	T136	07/02/2019	07/02/2018
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T712	02/26/2020	02/26/2019
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T344	05/17/2020	05/17/2019
*Antenna Horn, 18 to 26GHz	ARA	MWH-1826	T447	06/16/2019	06/16/2018
Antenna Horn 26-40GHz	ARA	MWH-2640	T90	09/11/2019	09/11/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	T122	03/21/2020	03/21/2019
Amplifier, 1 to 18GHz, 35dB	Ampical	AMP1G18-35	138301	09/15/2019	09/15/2018
Amplifier, 1 to 18GHz, 35dB	Ampical	AFS42-00101800-25-S-42	T1567	01/26/2020	01/26/2019
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T931	05/11/2020	05/11/2019
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T493	08/30/2019	08/30/2018
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T491	05/30/2020	05/30/2019
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T740	10/06/2019	10/06/2018
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	03/23/2020	03/23/2019
Amplifier, 26GHz to 40GHz	Miteq	TTA2640-35-HG	T1864	03/23/2020	03/23/2019
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T286	06/04/2019	06/04/2018
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T905	01/24/2020	01/24/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T342	01/23/2020	01/23/2019
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T1454	01/23/2020	01/23/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T340	01/22/2020	01/22/2019
Spectrum Analyzer, PXA 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T908	01/23/2020	01/23/2019
Spectrum Analyzer, PXA 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A-544	T1113	01/22/2020	01/22/2019
3GHz HPF	Micro-Tronic	HPM17543	T1014	04/28/2020	04/28/2019
*Power Sensor	Keysight	N1921A	T1228	07/10/2019	07/10/2018
Power Meter, P-series single channel	Keysight	N1912A	T1272	01/29/2020	01/29/2019
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T757	09/25/2019	09/25/2018

AC Line Conducted					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESC17	T1436	02/14/2020	02/14/2019
Power Cable, Line Conducted Emissions	UL	PG1	T861	08/31/2019	08/31/2018
*LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/19/2019	06/19/2018
UL AUTOMATION SOFTWARE					
Radiated Software	UL	UL EMC	Ver 9.5, April 26, 2016		
Conducted Software	UL	UL EMC	Ver 9.9, June 4, 2019		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015		

*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.

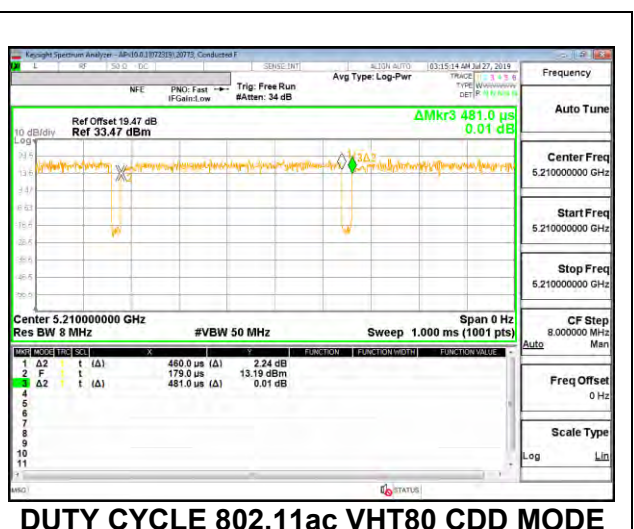
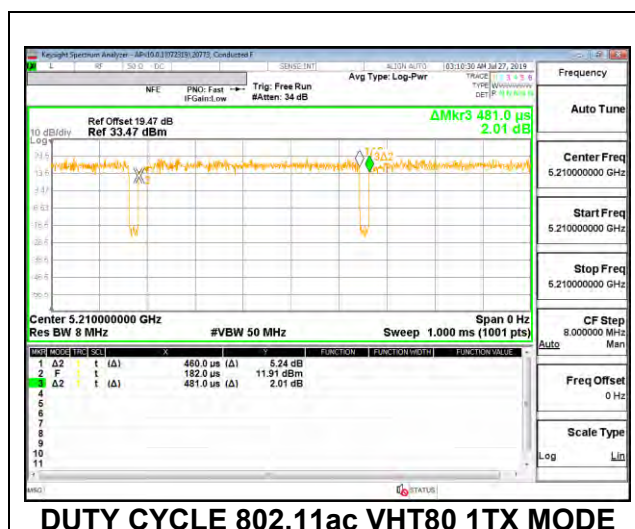
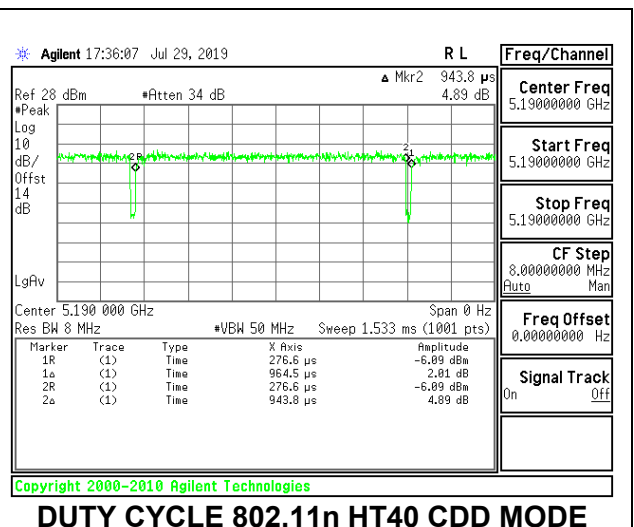
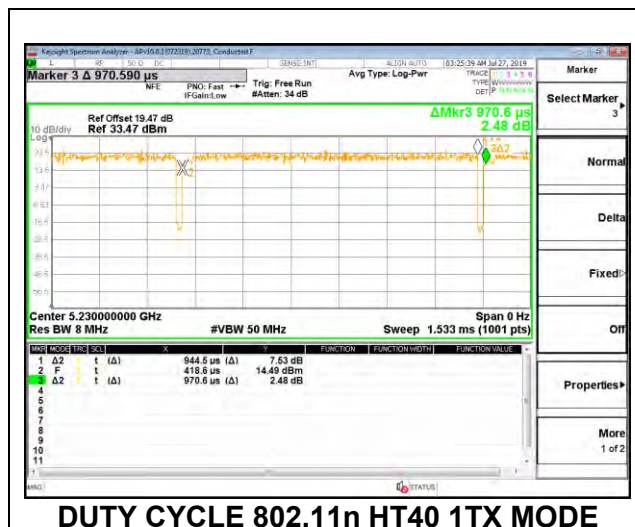
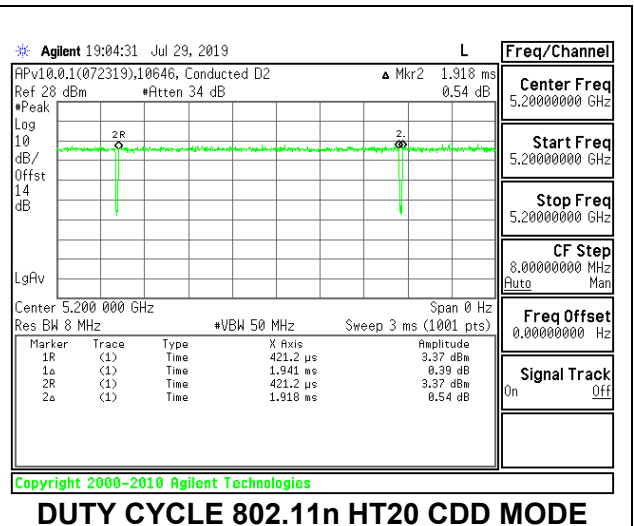
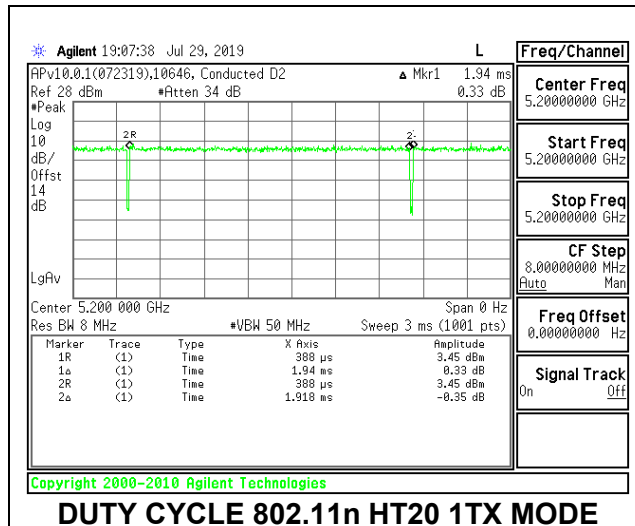
PROCEDURE

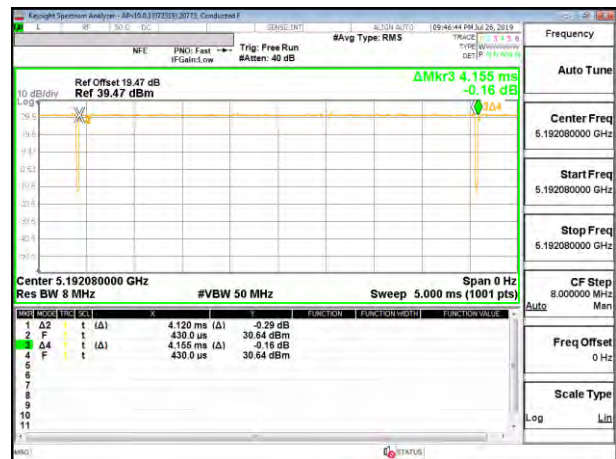
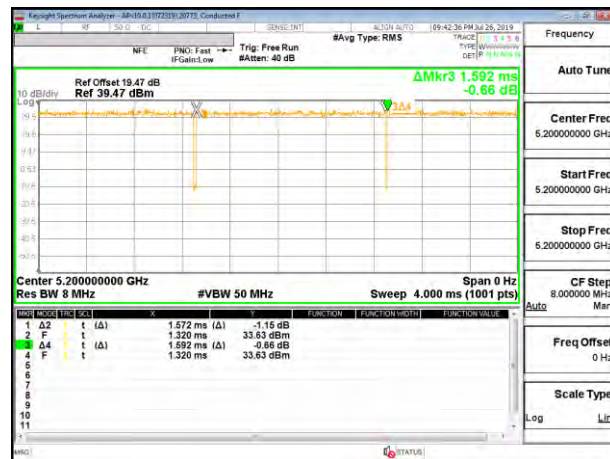
KDB 558074 Zero-Span Spectrum Analyzer Method.

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)
5GHz Band						
802.11n HT20 1Tx	1.918	1.940	0.989	98.87%	0.00	0.010
802.11n HT20 CDD	1.918	1.941	0.988	98.82%	0.00	0.010
802.11n HT40 1Tx	0.945	0.971	0.973	97.31%	0.12	1.059
802.11n HT40 CDD	0.944	0.965	0.979	97.85%	0.09	1.060
802.11ac VHT80 1Tx	0.460	0.481	0.956	95.63%	0.19	2.174
802.11ac VHT80 CDD	0.460	0.481	0.956	95.63%	0.19	2.174
802.11ax HE20 1Tx, 242-Tones	1.572	1.592	0.987	98.74%	0.00	0.010
802.11ax HE20 1Tx, 26-Tones	4.125	4.155	0.993	99.28%	0.00	0.010
802.11ax HE20 OFDMA, 242-Tones	1.572	1.592	0.987	98.74%	0.00	0.010
802.11ax HE20 OFDMA, 26-Tones	4.120	4.155	0.992	99.16%	0.00	0.010
802.11ax HE40 1Tx, 484-Tones	1.539	1.560	0.987	98.65%	0.00	0.010
802.11ax HE40 1Tx, 26-Tones	4.103	4.154	0.988	98.77%	0.00	0.010
802.11ax HE40 OFDMA, 484-Tones	1.557	1.578	0.987	98.67%	0.00	0.010
802.11ax HE40 OFDMA, 26-Tones	4.103	4.147	0.989	98.94%	0.00	0.010
802.11ax HE80 1Tx, 996-Tones	1.461	1.503	0.972	97.21%	0.12	0.684
802.11ax HE80 1Tx, 26-Tones	4.095	4.155	0.986	98.56%	0.00	0.010
802.11ax HE80 OFDMA, 996-Tones	1.464	1.497	0.978	97.80%	0.10	0.683
802.11ax HE80 OFDMA, 26-Tones	4.087	4.155	0.984	98.36%	0.00	0.010

DUTY CYCLE PLOTS







802.11ax HE40 OFDMA, 484-Tones



802.11ax HE40 OFDMA, 26-Tones



802.11ax HE80 1Tx, 996-Tones



802.11ax HE80 1Tx, 26-Tones



802.11ax HE80 OFDMA, 996-Tones



802.11ax HE80 OFDMA, 26-Tones

8.2. 26 dB BANDWIDTH

LIMITS

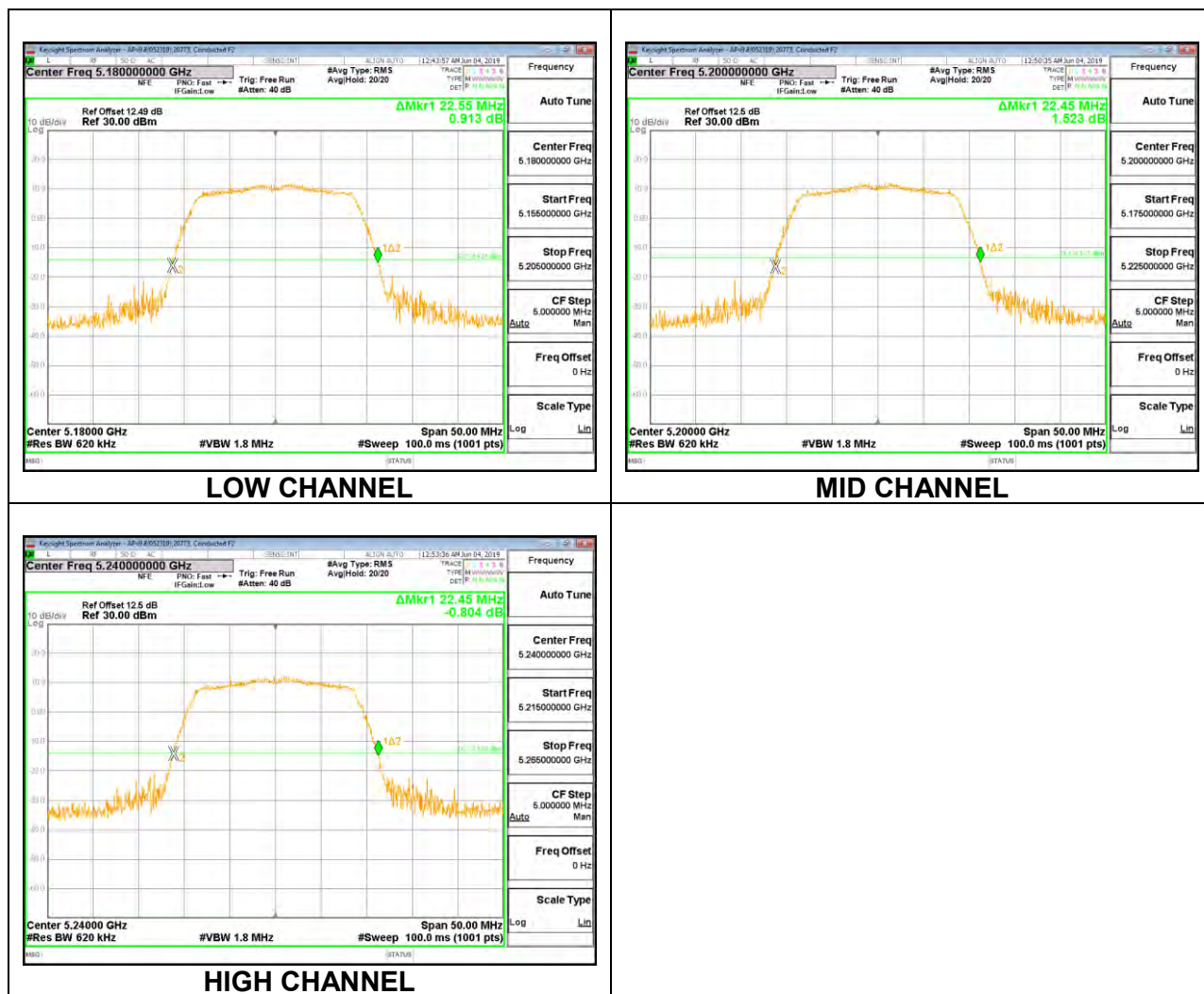
None; for reporting purposes only.

RESULTS

8.2.1. 802.11n HT20 MODE IN THE 5.2 GHz BAND

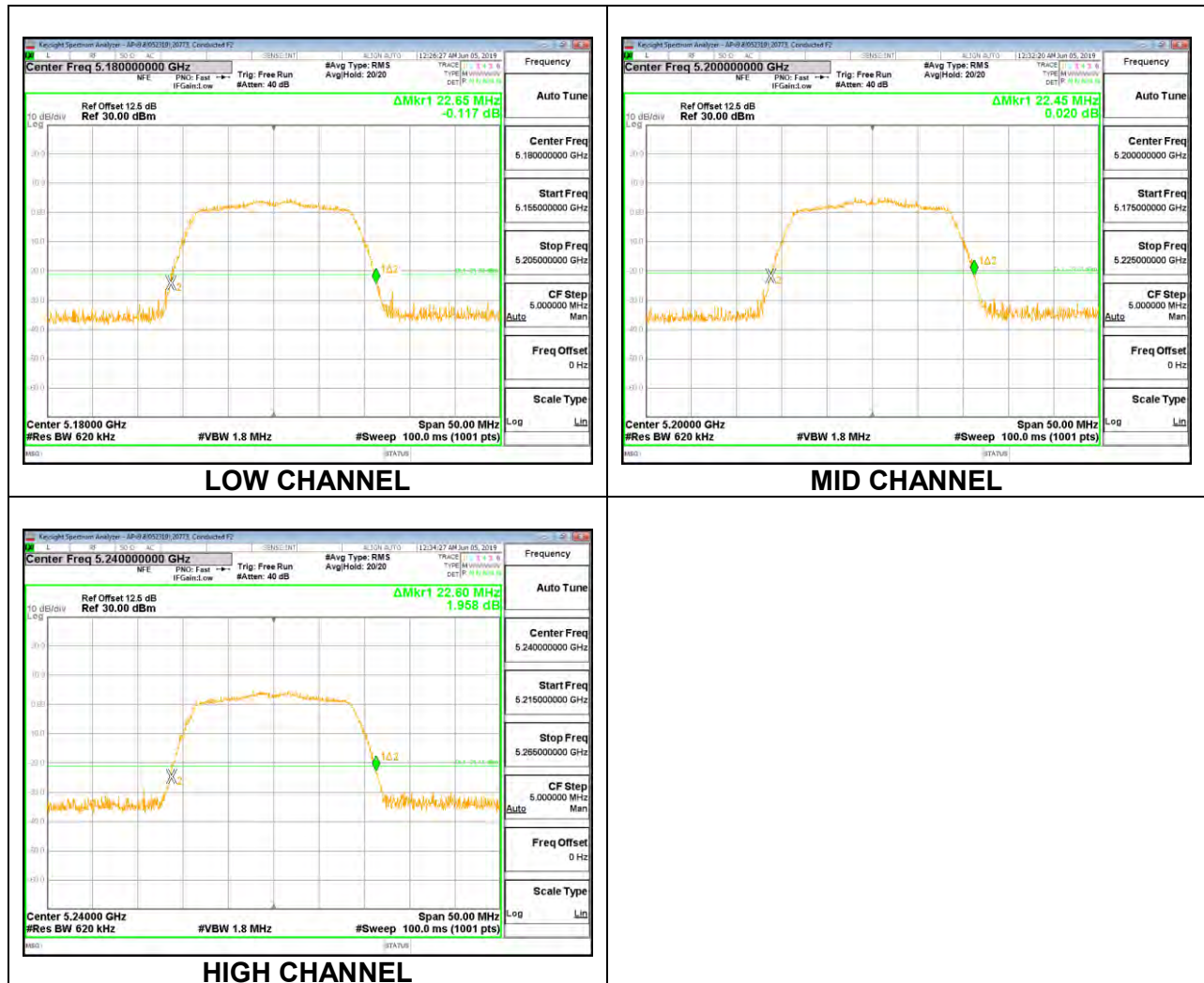
1TX Antenna 6 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	22.55
Mid	5200	22.45
High	5240	22.45



1TX Antenna 5 MODE

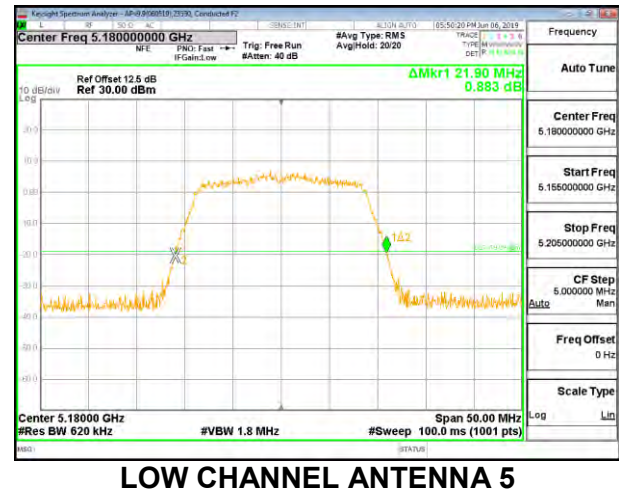
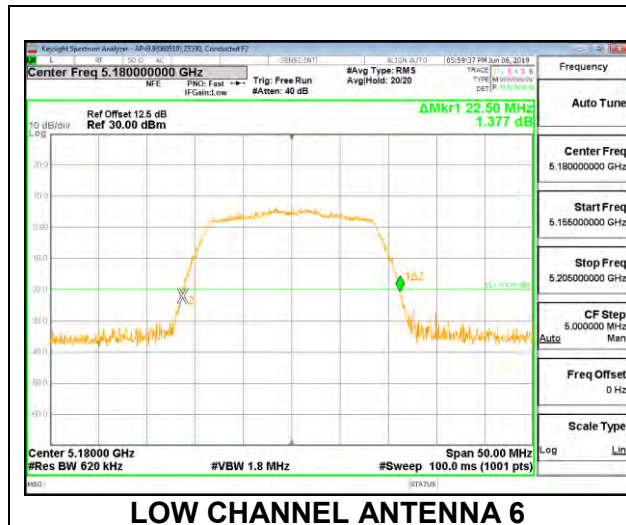
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5180	22.65
Mid	5200	22.45
High	5240	22.60



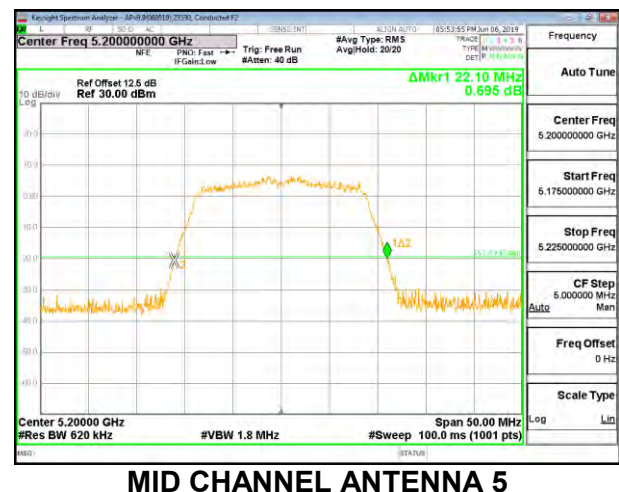
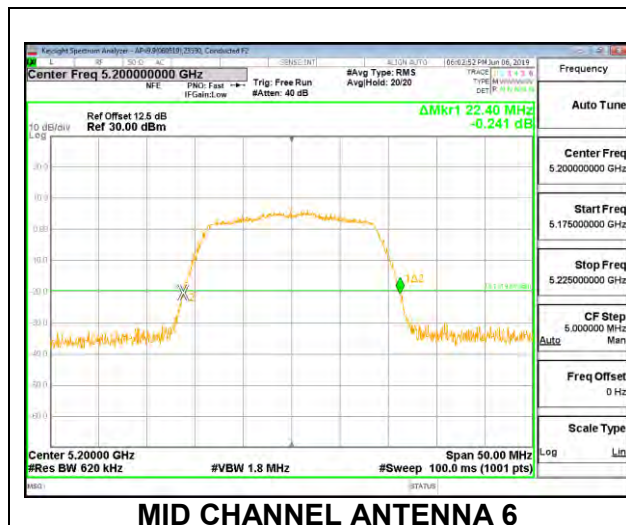
2TX Antenna 6 + Antenna 5 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5180	22.50	21.90
Mid	5200	22.40	22.10
High	5240	22.60	22.15

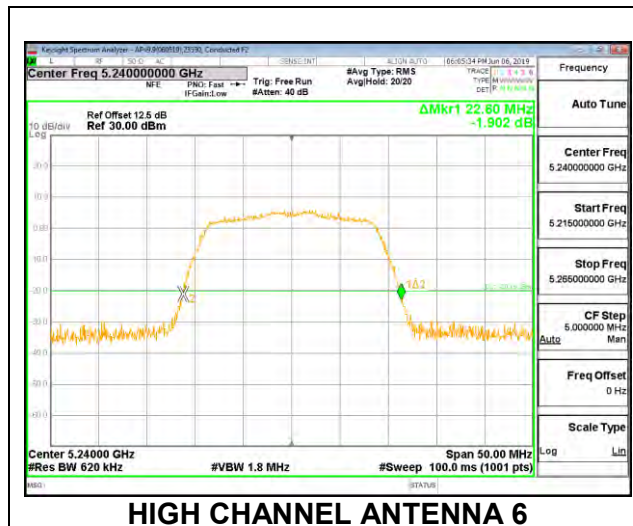
LOW CHANNEL



MID CHANNEL



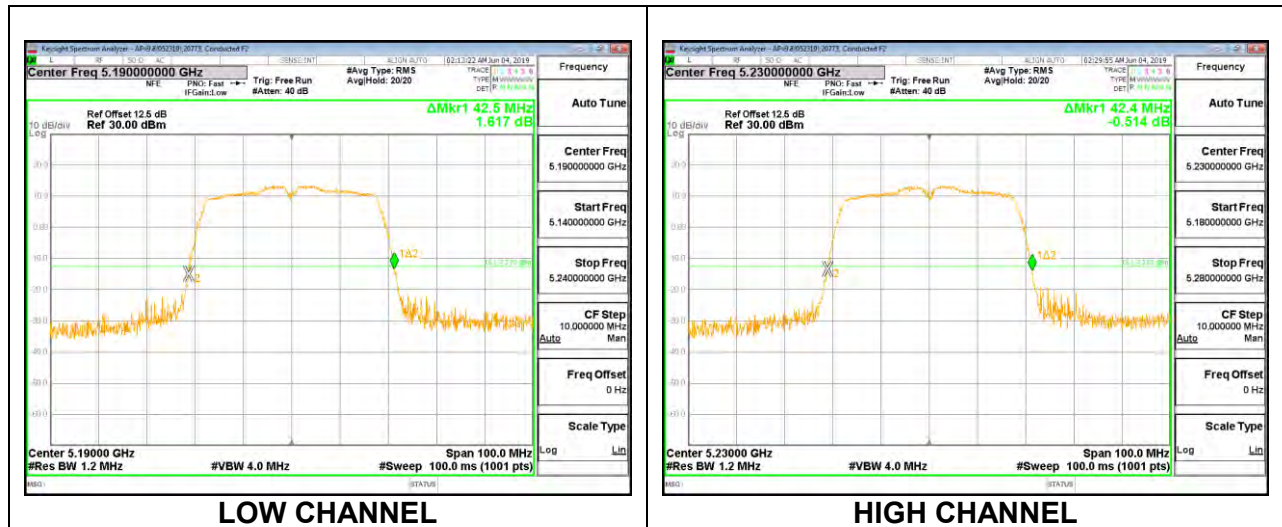
HIGH CHANNEL



8.2.2. 802.11n HT40 MODE IN THE 5.2 GHz BAND

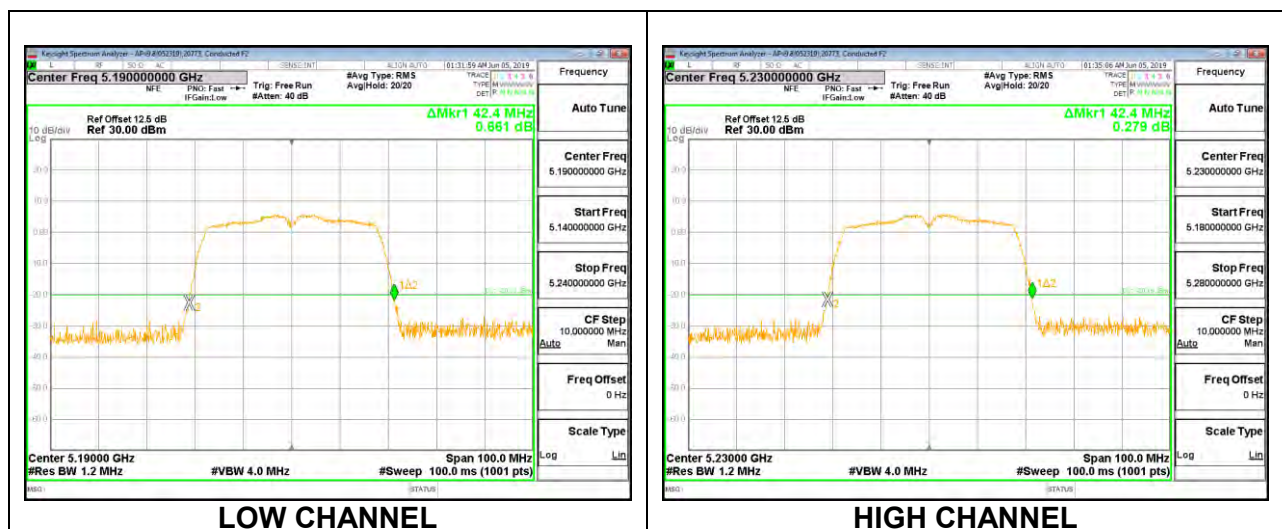
1TX Antenna 6 MODE

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
Low	5190	42.50
High	5230	42.40



1TX Antenna 5 MODE

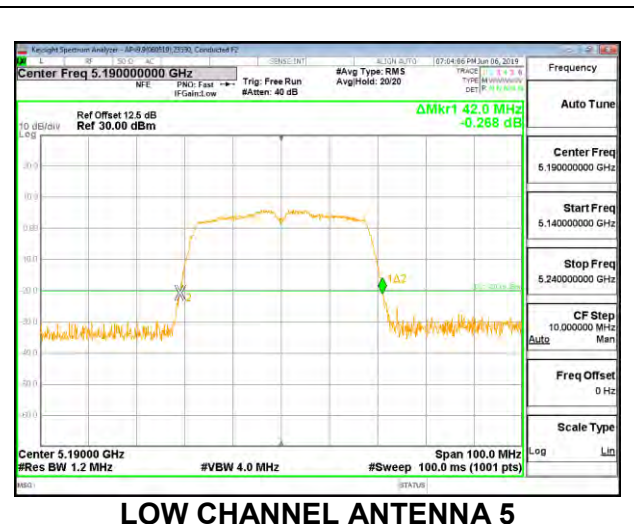
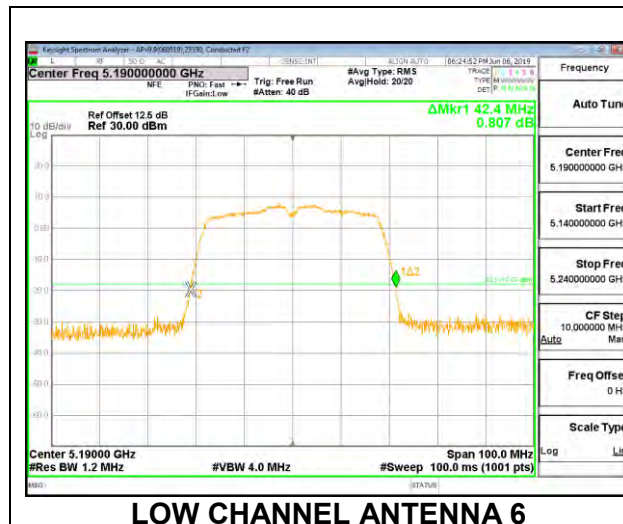
Channel	Frequency (MHz)	26dB Bandwidth (MHz)
Low	5190	42.40
High	5230	42.40



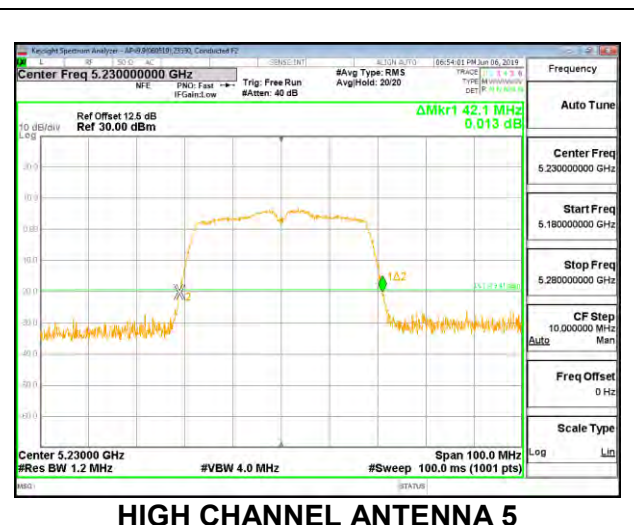
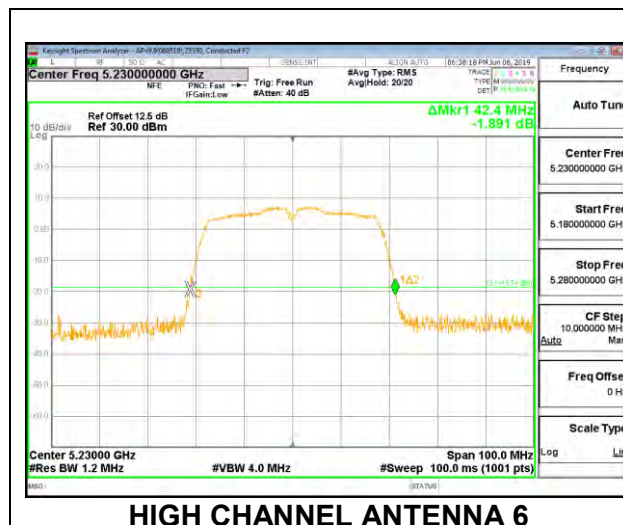
2TX Antenna 6 + Antenna 5 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5190	42.40	42.00
High	5230	42.40	42.10

LOW CHANNEL



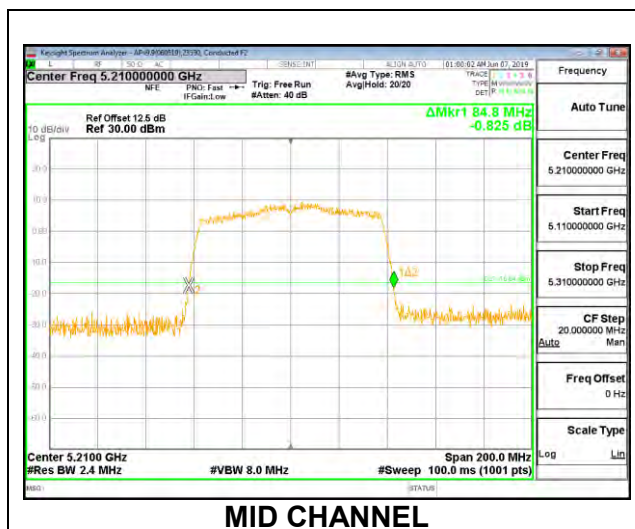
HIGH CHANNEL



8.2.3. 802.11ac VHT80 MODE IN THE 5.2 GHz BAND

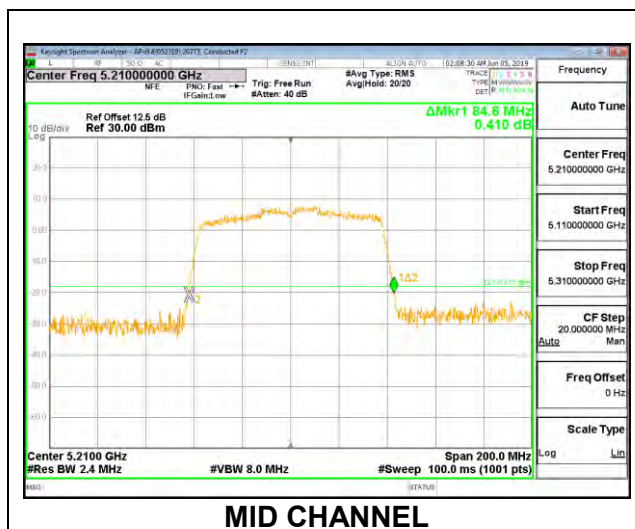
1TX Antenna 6 MODE

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5210	84.80



1TX Antenna 5 MODE

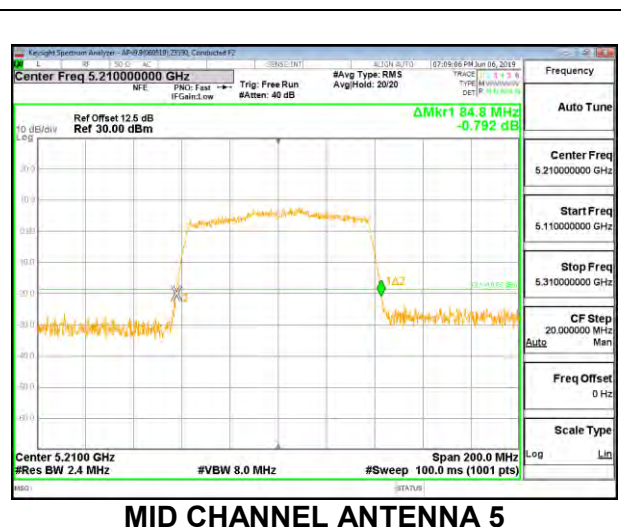
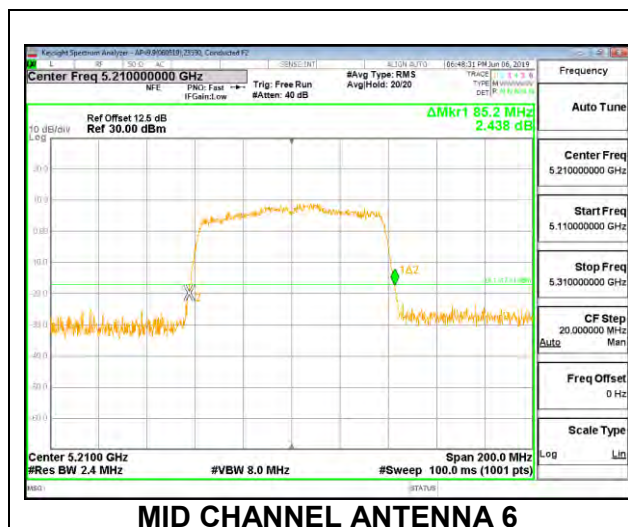
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5210	84.60



2TX Antenna 6 + Antenna 5 CDD MODE

Channel	Frequency	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Mid	5210	85.20	84.80

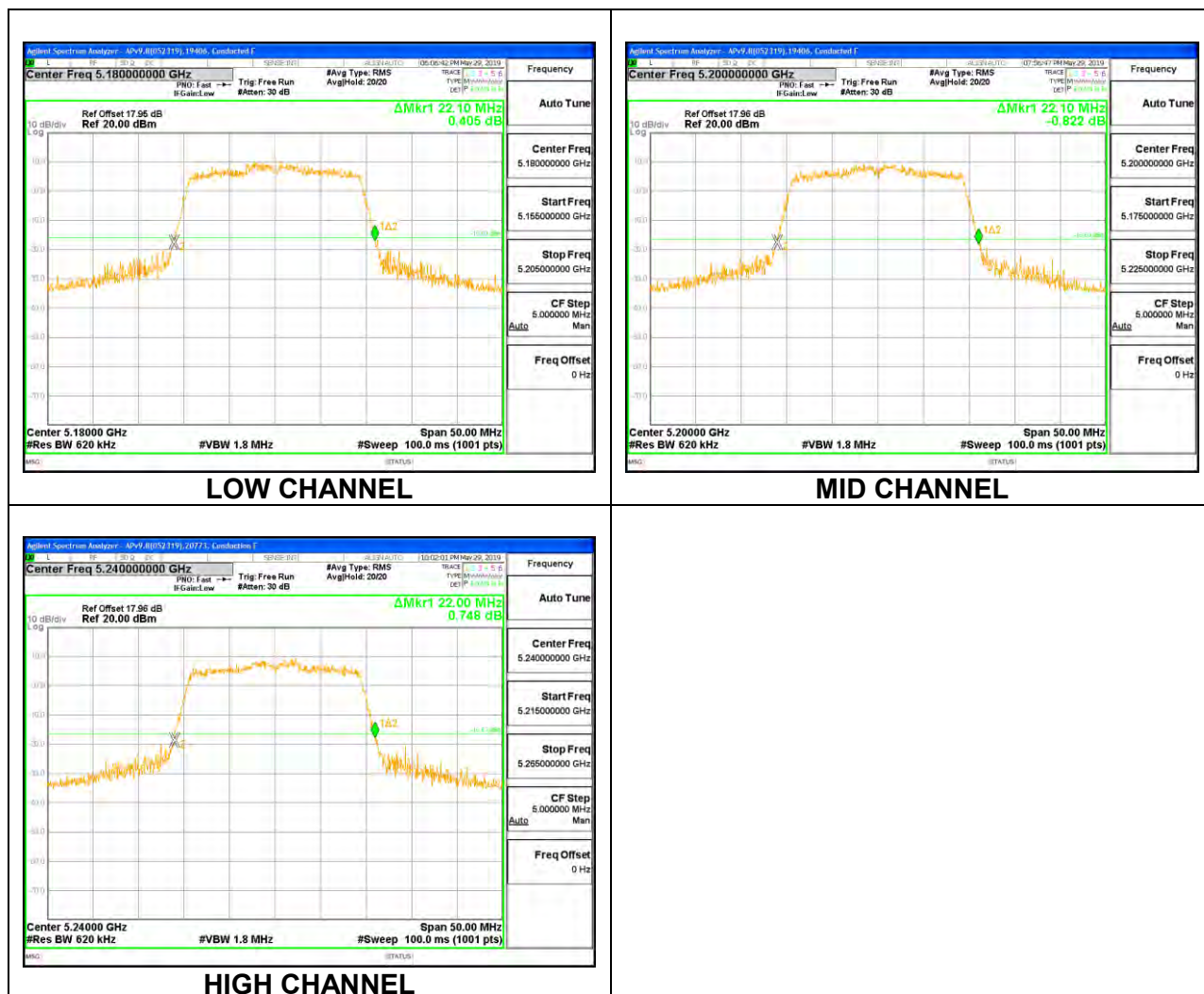
MID CHANNEL



8.2.4. 802.11ax HE20 MODE IN THE 5.2 GHz BAND

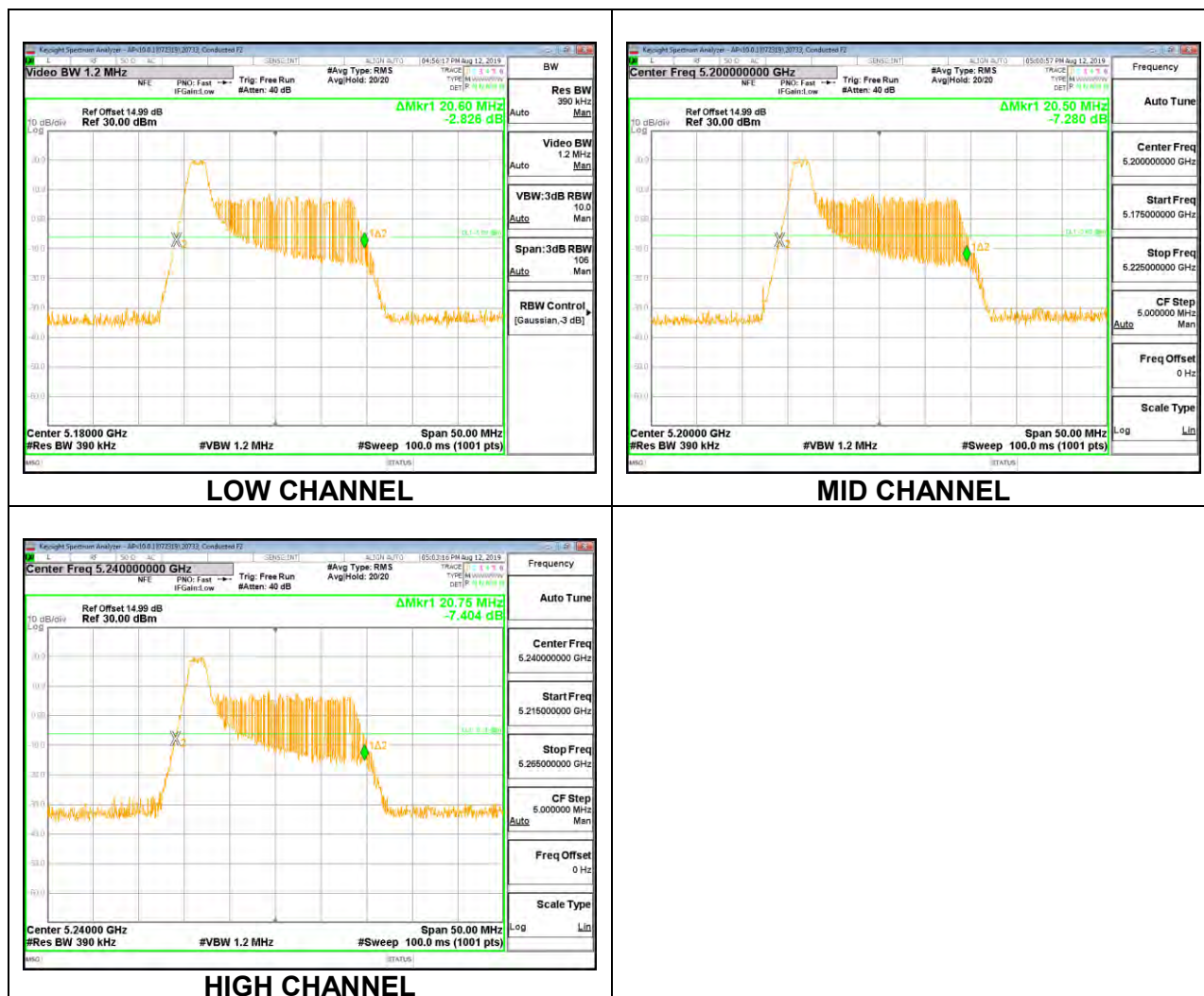
1TX Antenna 6 MODE – 242-Tones, RU Index 61

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	22.10
Mid	5200	22.10
High	5240	22.00



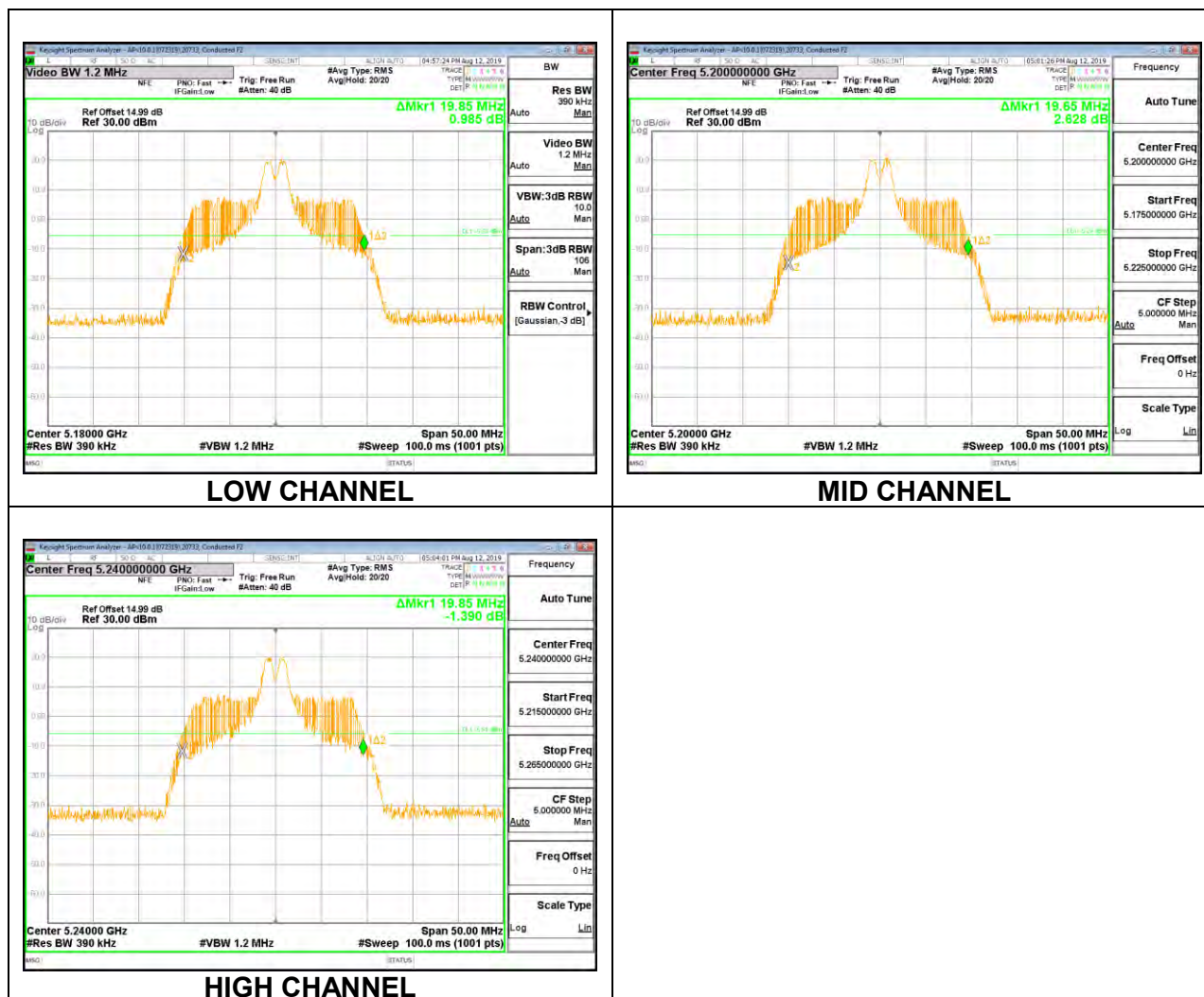
1TX Antenna 6 MODE – 26-Tones, RU Index 0

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5180	20.60
Mid	5200	20.50
High	5240	20.75



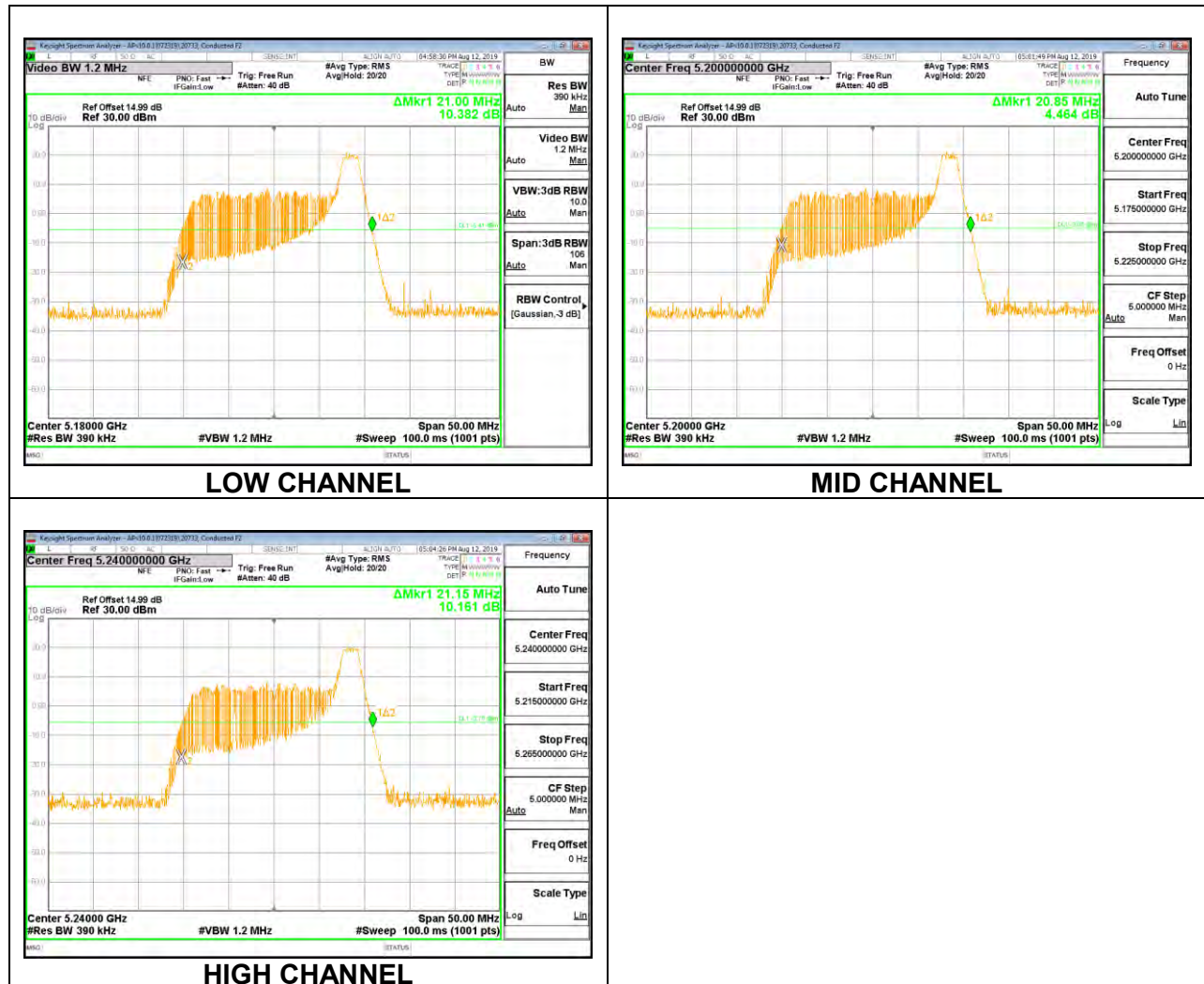
1TX Antenna 6 MODE – 26-Tones, RU Index 4

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5180	19.85
Mid	5200	19.65
High	5240	19.85



1TX Antenna 6 MODE – 26-Tones, RU Index 8

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	21.00
Mid	5200	20.85
High	5240	21.15



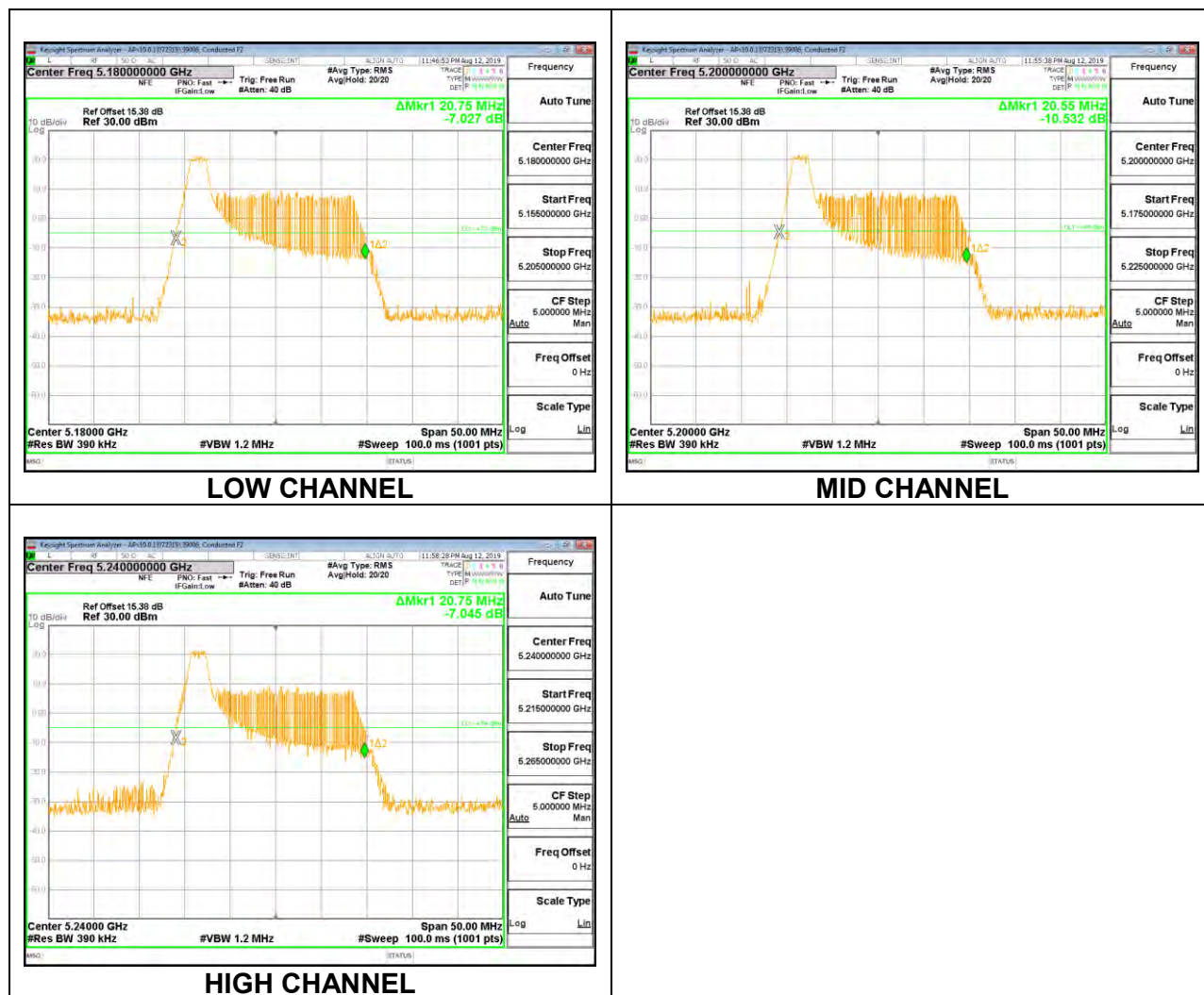
1TX Antenna 5 MODE – 242-Tones, RU Index 61

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	22.20
Mid	5200	22.15
High	5240	22.10



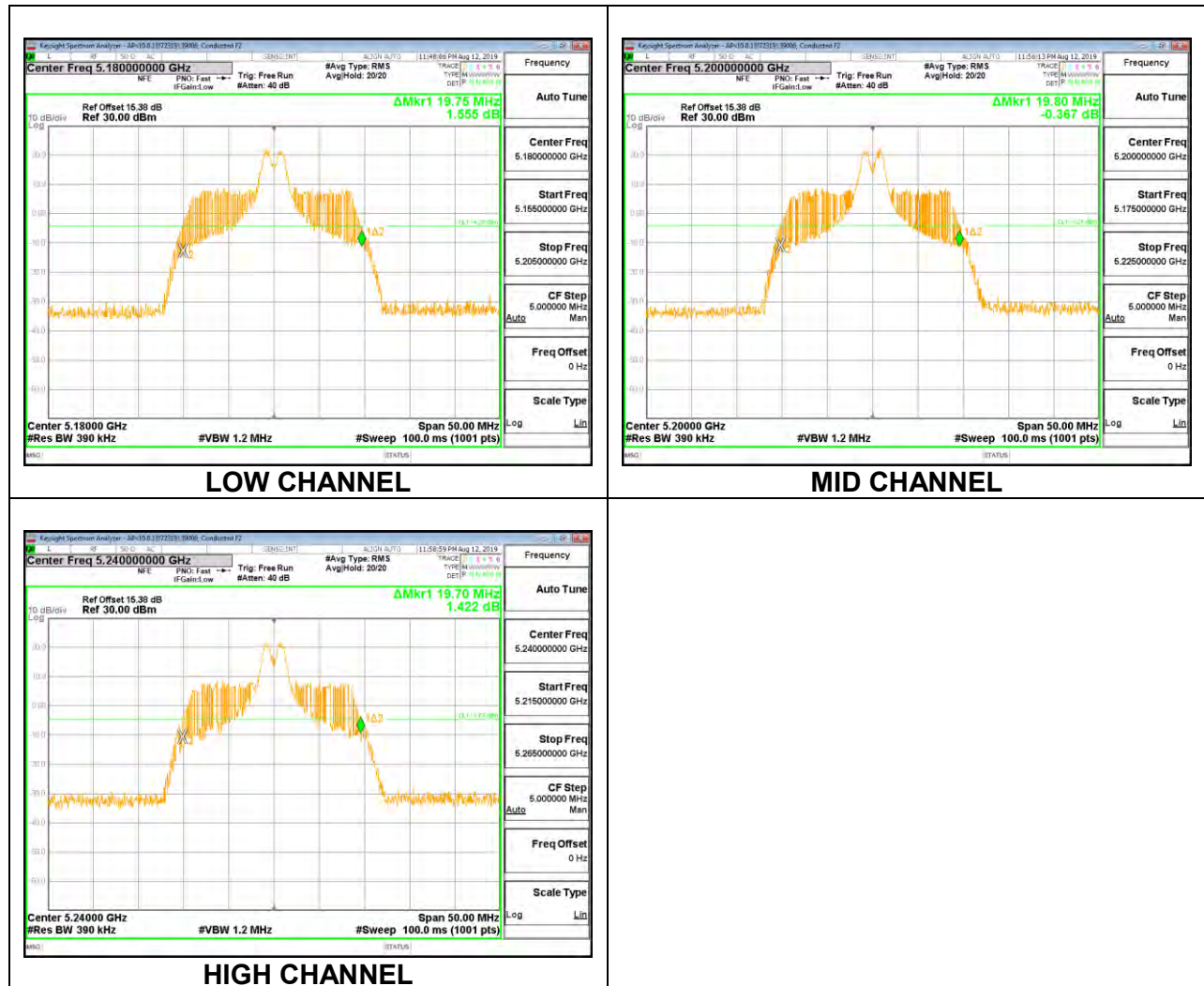
1TX Antenna 5 MODE – 26-Tones, RU Index 0

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5180	20.75
Mid	5200	20.55
High	5240	20.75



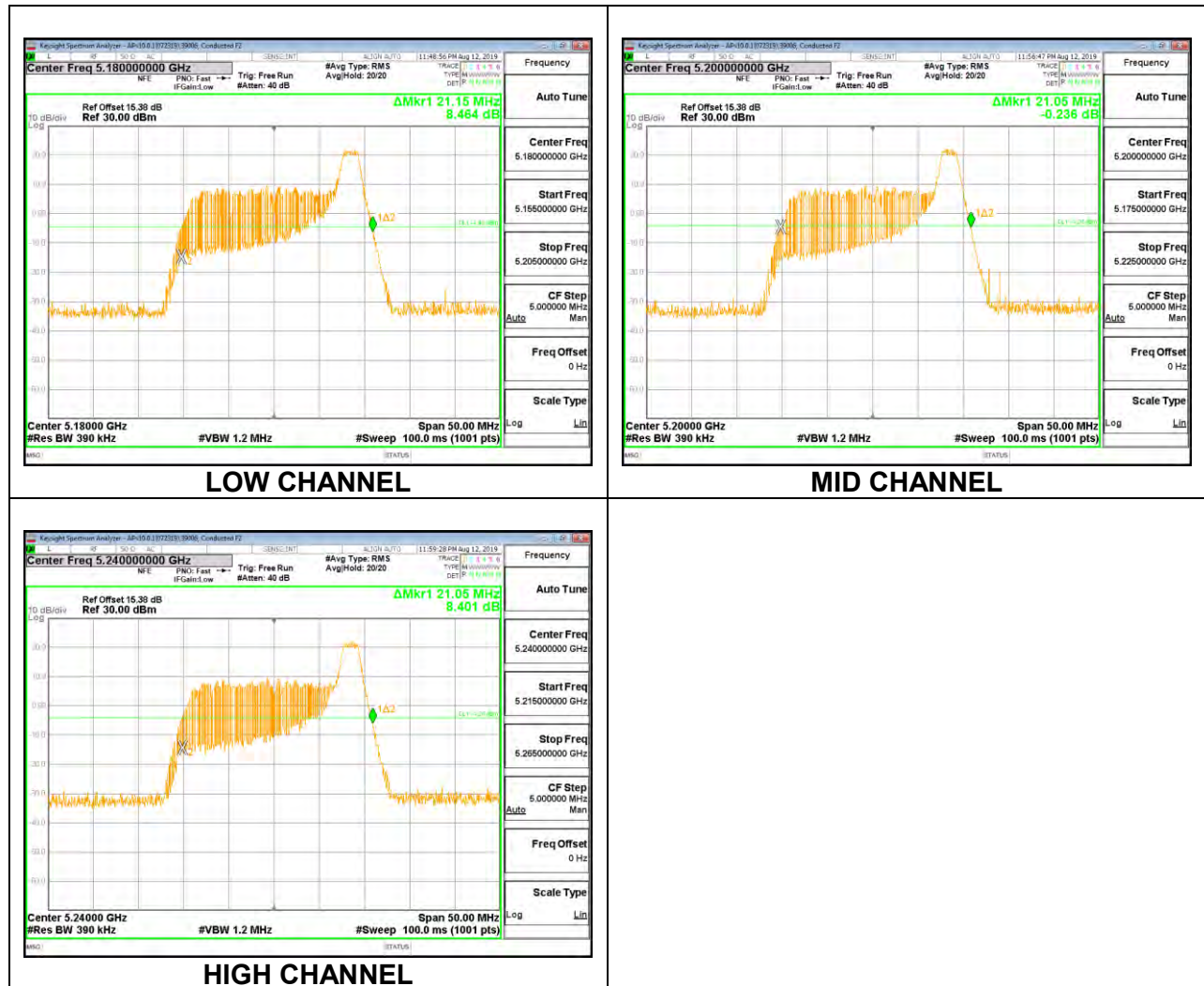
1TX Antenna 5 MODE – 26-Tones, RU Index 4

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5180	19.75
Mid	5200	19.80
High	5240	19.70



1TX Antenna 5 MODE – 26-Tones, RU Index 8

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5180	21.15
Mid	5200	21.05
High	5240	21.05



2TX Antenna 6 + Antenna 5 OFDMA MODE – 242-Tones, RU Index 61

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5180	22.00	22.05
Mid	5200	22.20	22.05
High	5240	22.05	21.80

LOW CHANNEL

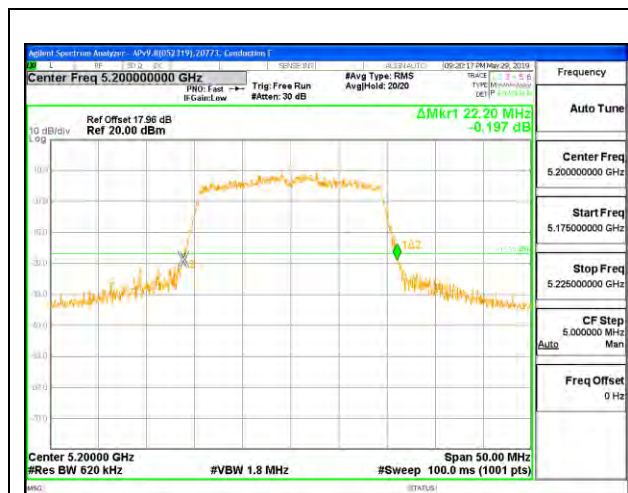


LOW CHANNEL ANTENNA 6



LOW CHANNEL ANTENNA 5

MID CHANNEL



MID CHANNEL ANTENNA 6



MID CHANNEL ANTENNA 5

The figure displays two side-by-side screenshots of a Spectrum Analyzer, showing the frequency response of two different antennas: High Channel Antenna 6 (left) and High Channel Antenna 5 (right).

Left Screenshot (High Channel Antenna 6):

- Center Freq: 5.240000000 GHz
- Ref Offset: 17.96 dB
- Ref: 20.00 dBm
- Auto Tune
- Center Freq: 5.240000000 GHz
- Start Freq: 5.215000000 GHz
- Stop Freq: 5.265000000 GHz
- CF Step: 5.000000 MHz
- Freq Offset: 0 Hz
- Center 5.24000 GHz
- #Res BW 620 kHz
- #VBW 1.8 MHz
- #Sweep 100.0 ms (1001 pts)
- Span 50.00 MHz
- Peak deviation: $\Delta Mkrt$ 22.05 MHz, -1.678 dB

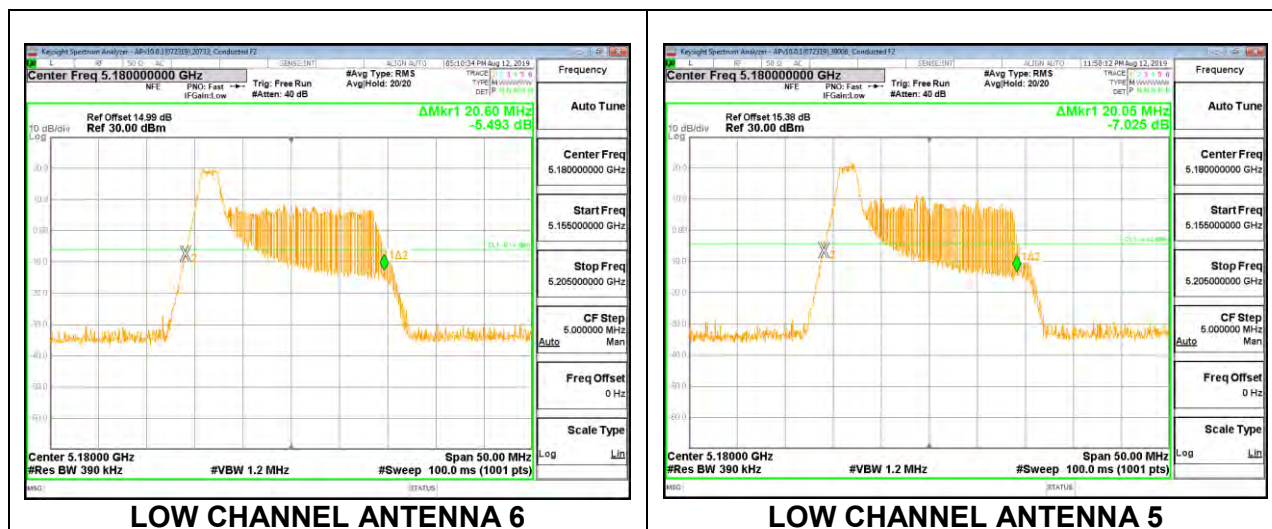
Right Screenshot (High Channel Antenna 5):

- Center Freq: 5.240000000 GHz
- Ref Offset: 17.96 dB
- Ref: 20.00 dBm
- Auto Tune
- Center Freq: 5.240000000 GHz
- Start Freq: 5.215000000 GHz
- Stop Freq: 5.265000000 GHz
- CF Step: 5.000000 MHz
- Freq Offset: 0 Hz
- Center 5.24000 GHz
- #Res BW 620 kHz
- #VBW 1.8 MHz
- #Sweep 100.0 ms (1001 pts)
- Span 50.00 MHz
- Peak deviation: $\Delta Mkrt$ 21.80 MHz, -0.394 dB

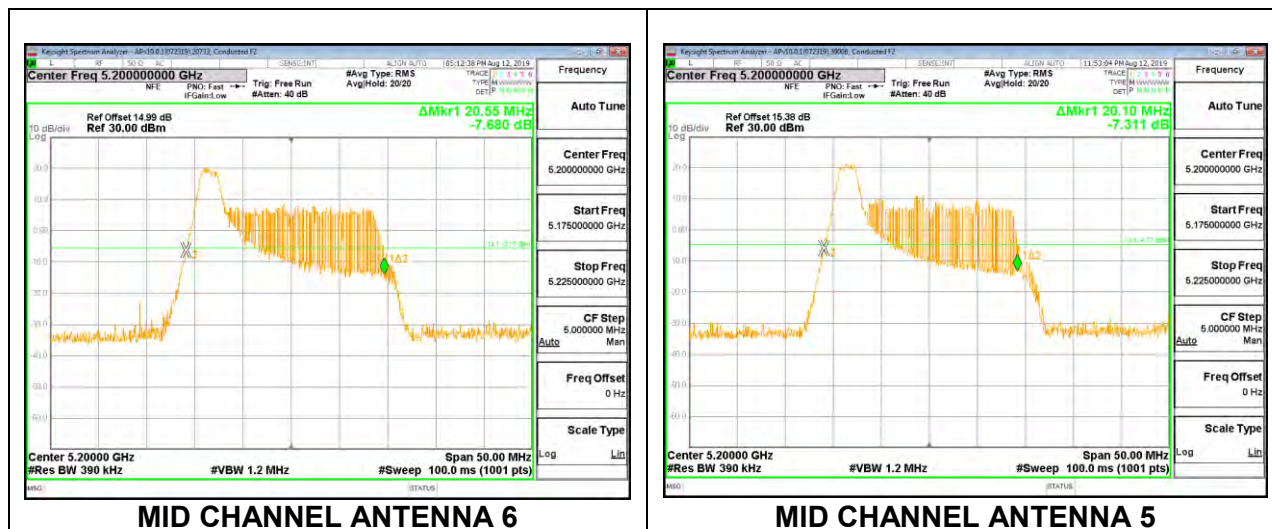
2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 0

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5180	20.60	20.05
Mid	5200	20.55	20.10
High	5240	20.55	20.20

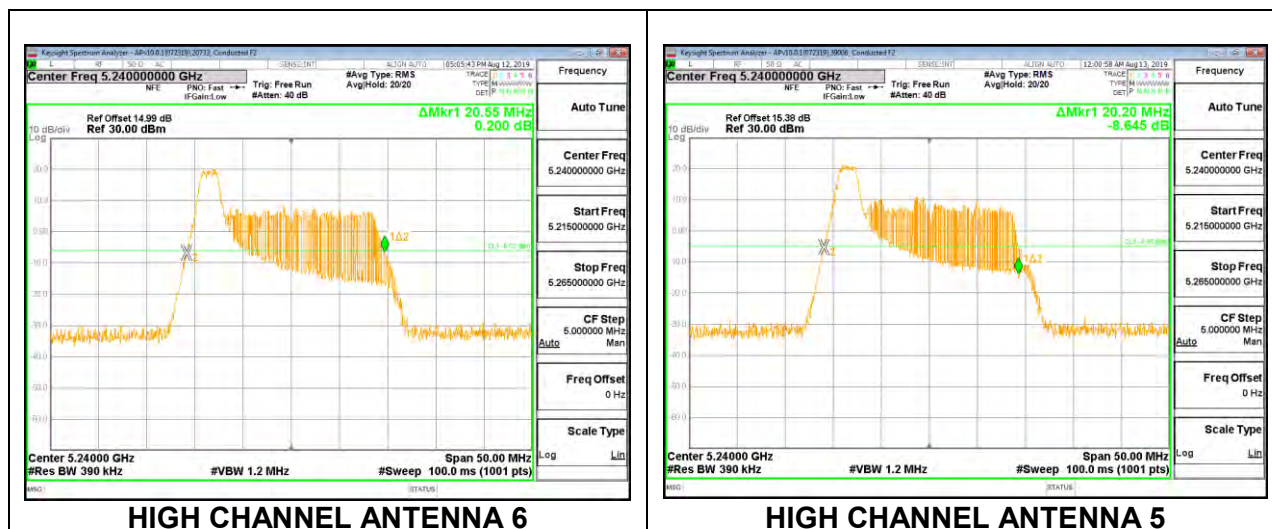
LOW CHANNEL



MID CHANNEL



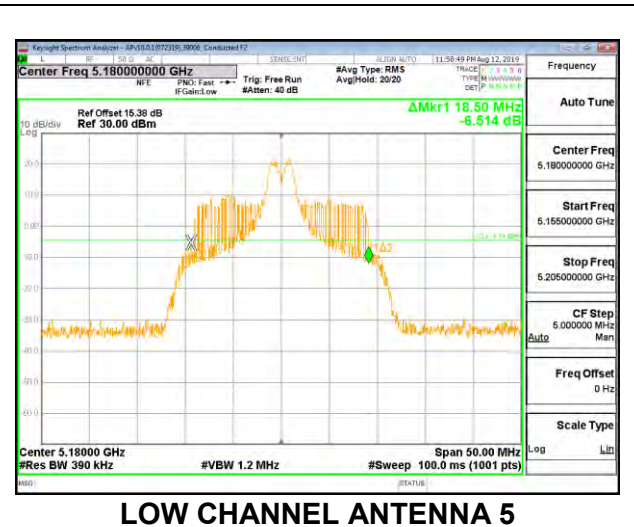
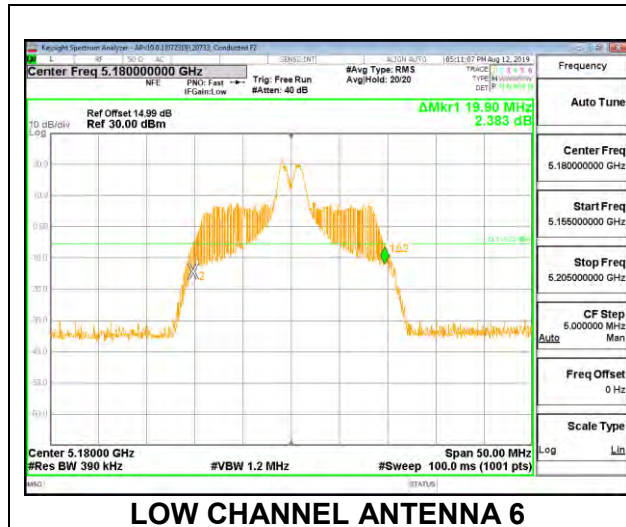
HIGH CHANNEL



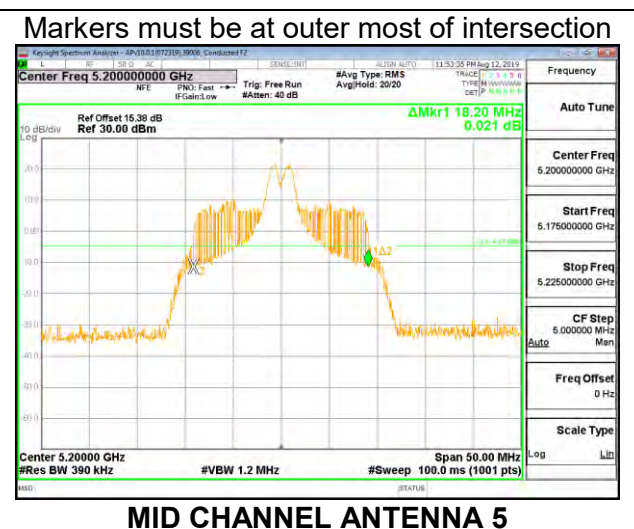
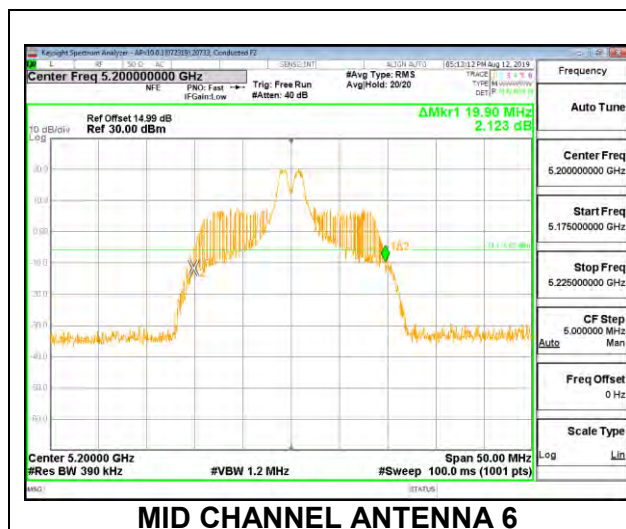
2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 4

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5180	19.90	18.50
Mid	5200	19.90	18.20
High	5240	19.70	18.55

LOW CHANNEL

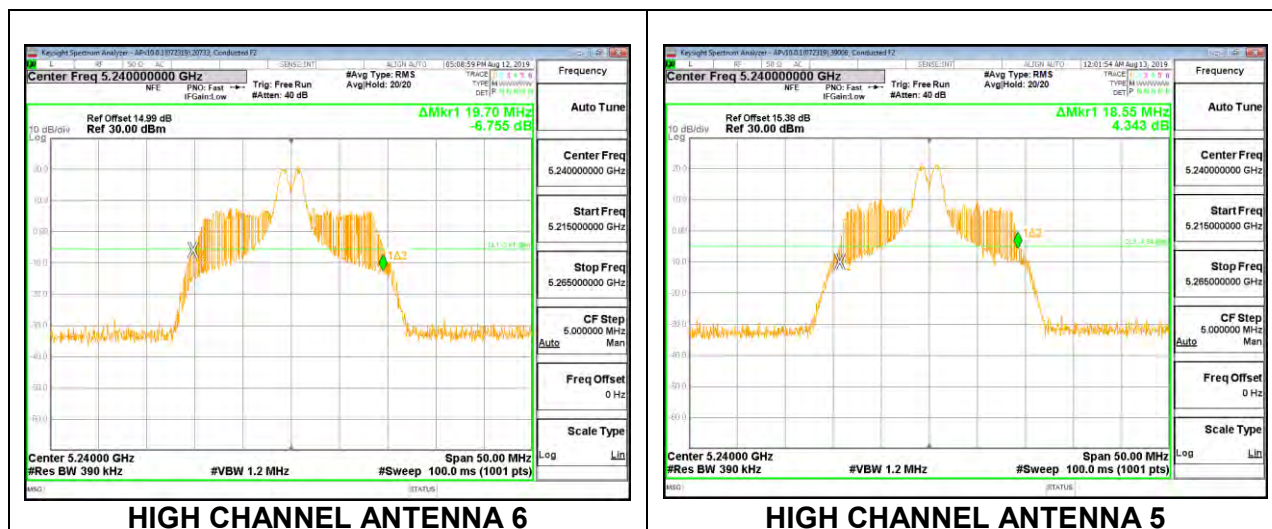


MID CHANNEL



Markers must be at outer most of intersection

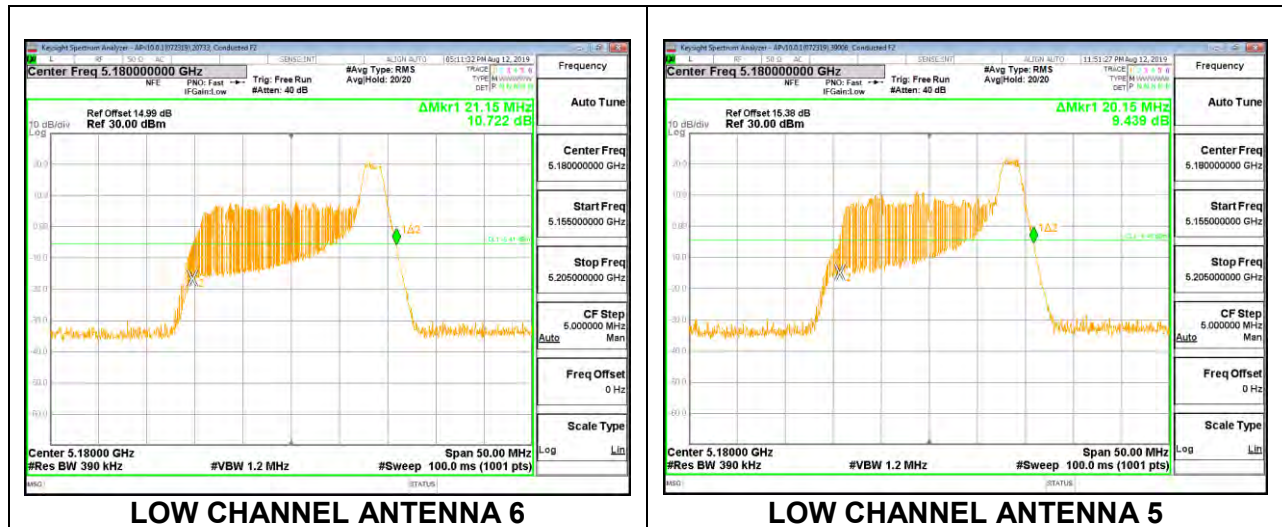
HIGH CHANNEL



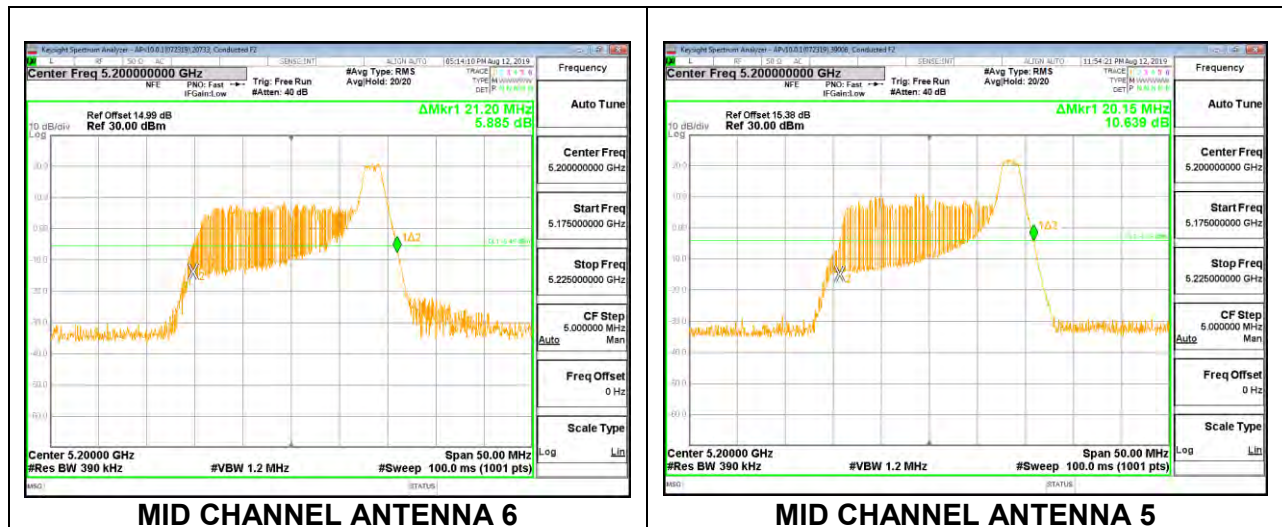
2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 8

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5180	21.15	20.15
Mid	5200	21.20	20.15
High	5240	21.10	20.15

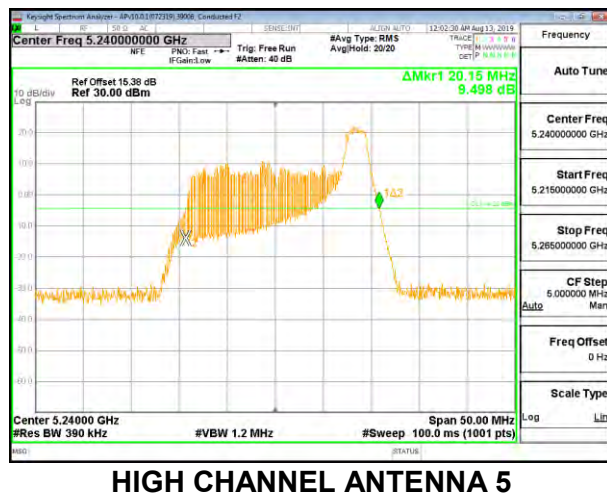
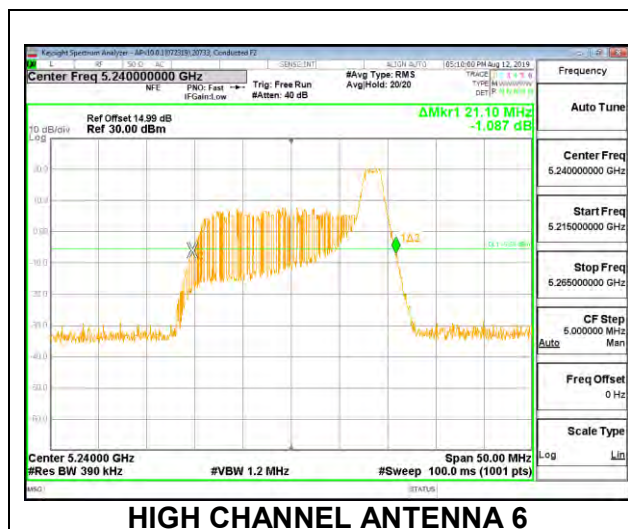
LOW CHANNEL



MID CHANNEL



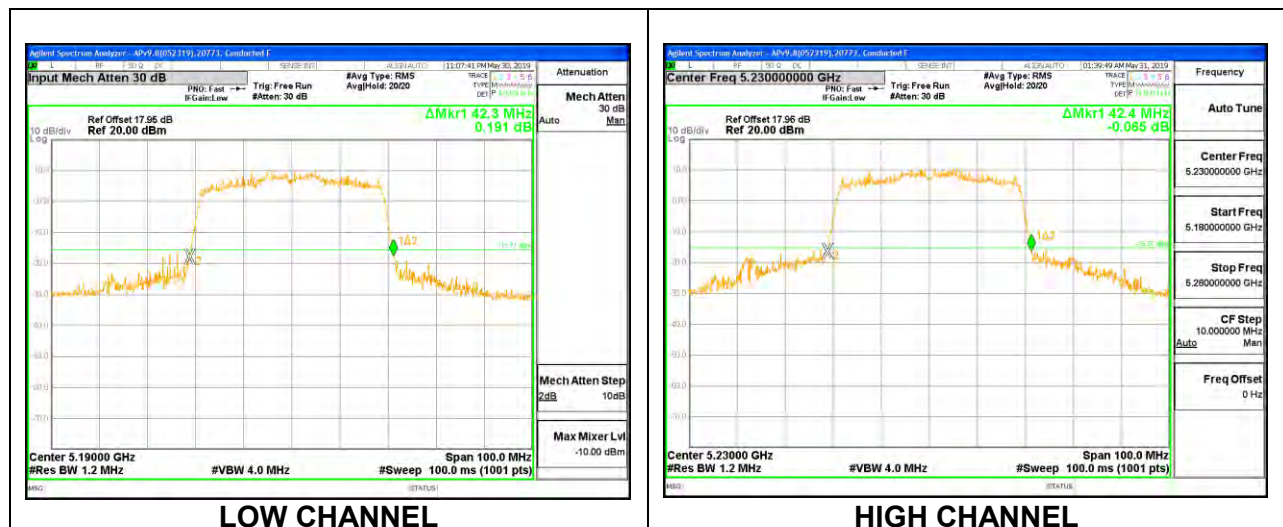
HIGH CHANNEL



8.2.5. 802.11ax HE40 MODE IN THE 5.2 GHz BAND

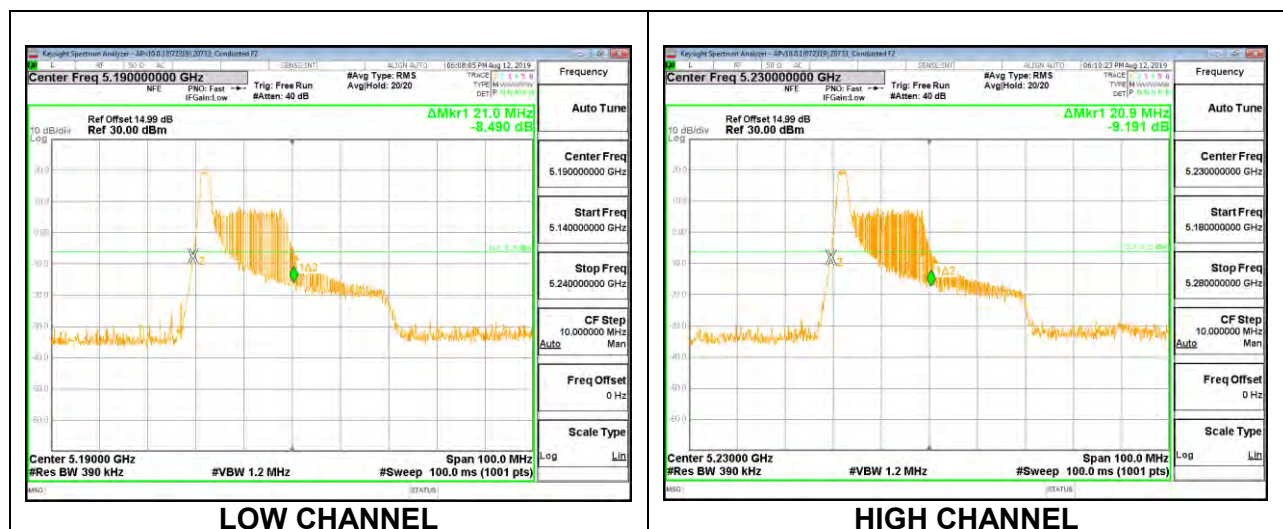
1TX Antenna 6 MODE – 484-Tones, RU Index 65

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
Low	5190	42.30
High	5230	42.40



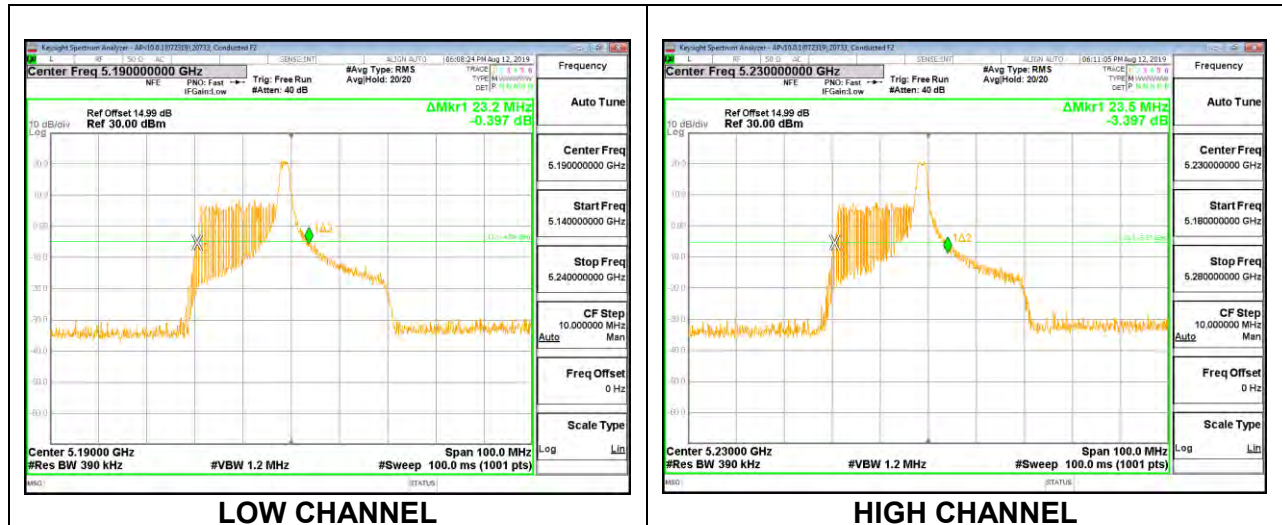
1TX Antenna 6 MODE – 26-Tones, RU Index 0

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
Low	5190	21.00
High	5230	20.90



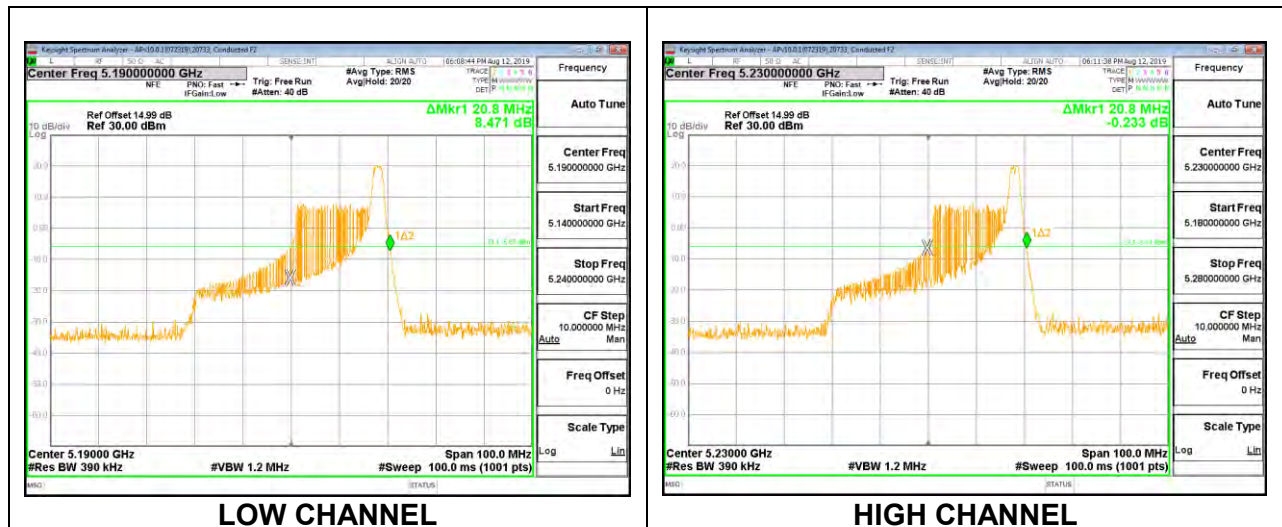
1TX Antenna 6 MODE – 26-Tones, RU Index 8

Channel	Frequency	26dB Bandwidth
	(MHz)	(MHz)
Low	5190	23.20
High	5230	23.50



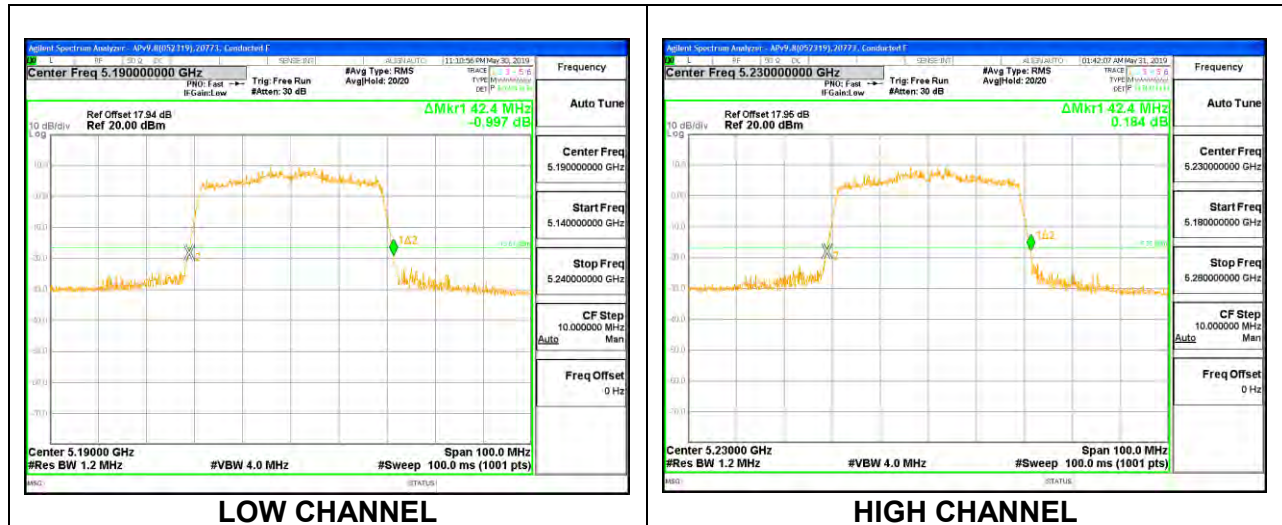
1TX Antenna 6 MODE – 26-Tones, RU Index 17

Channel	Frequency	26dB Bandwidth
	(MHz)	(MHz)
Low	5190	20.80
High	5230	20.80



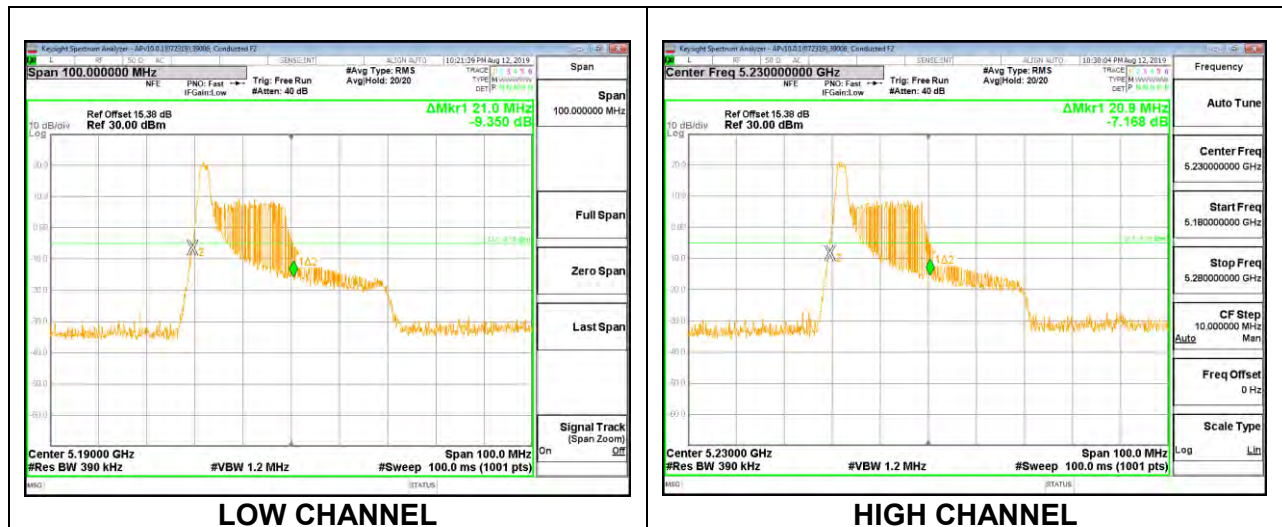
1TX Antenna 5 MODE – 484-Tones, RU Index 65

Channel	Frequency	26dB Bandwidth
	(MHz)	(MHz)
Low	5190	42.40
High	5230	42.40



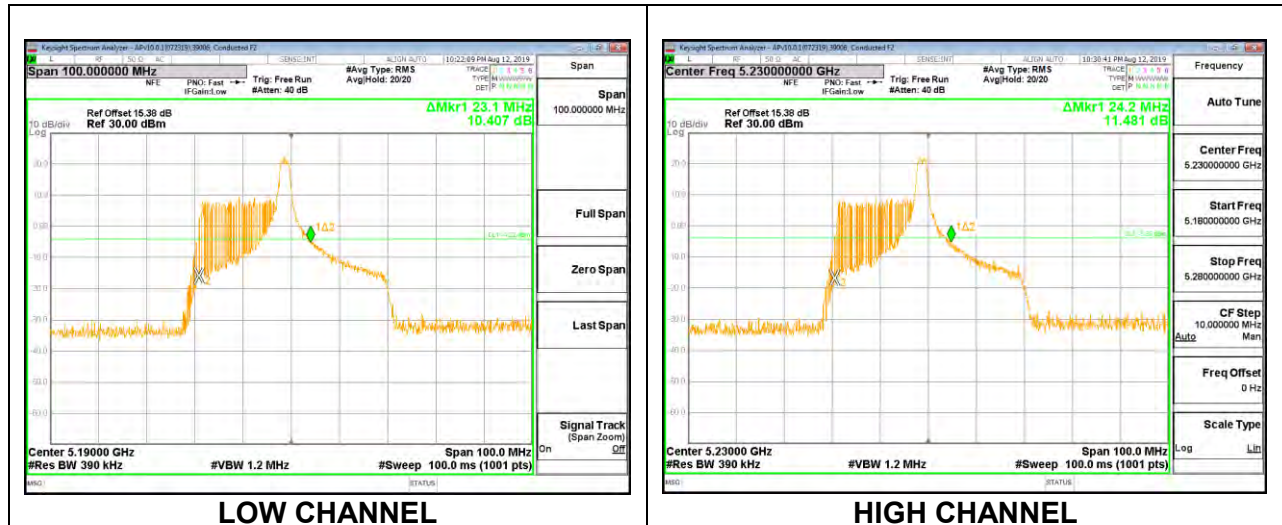
1TX Antenna 5 MODE – 26-Tones, RU Index 0

Channel	Frequency	26dB Bandwidth
	(MHz)	(MHz)
Low	5190	21.00
High	5230	20.90



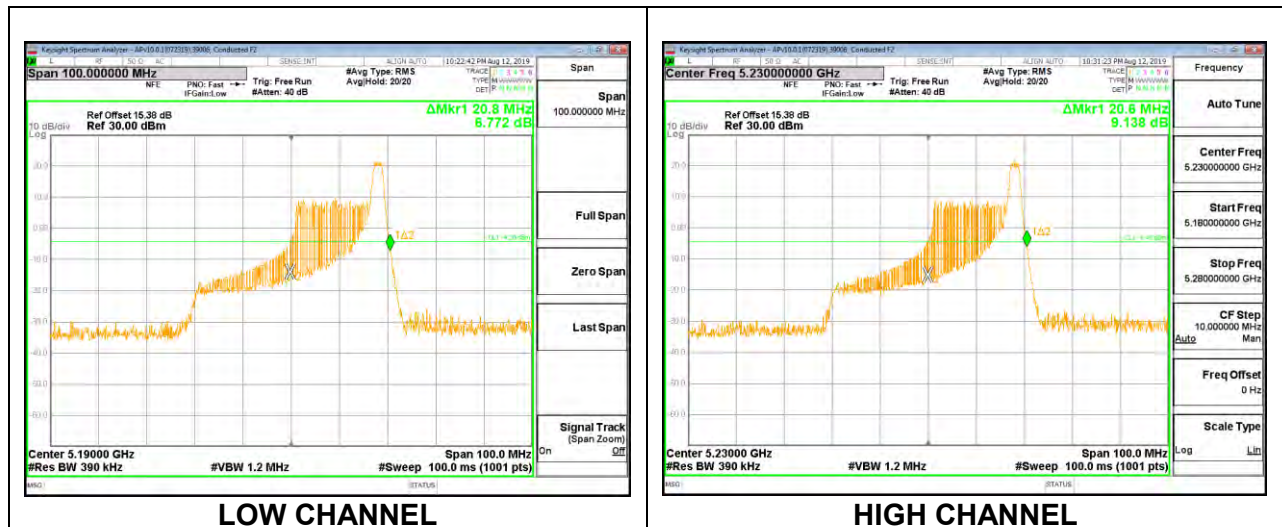
1TX Antenna 5 MODE – 26-Tones, RU Index 8

Channel	Frequency	26dB Bandwidth
	(MHz)	(MHz)
Low	5190	23.10
High	5230	24.20



1TX Antenna 5 MODE – 26-Tones, RU Index 17

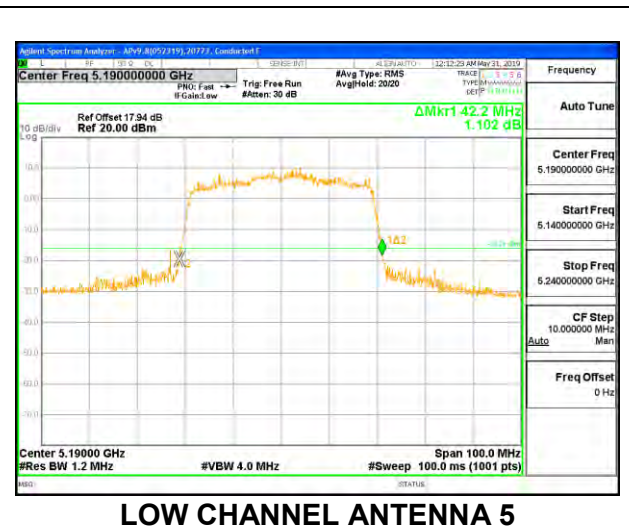
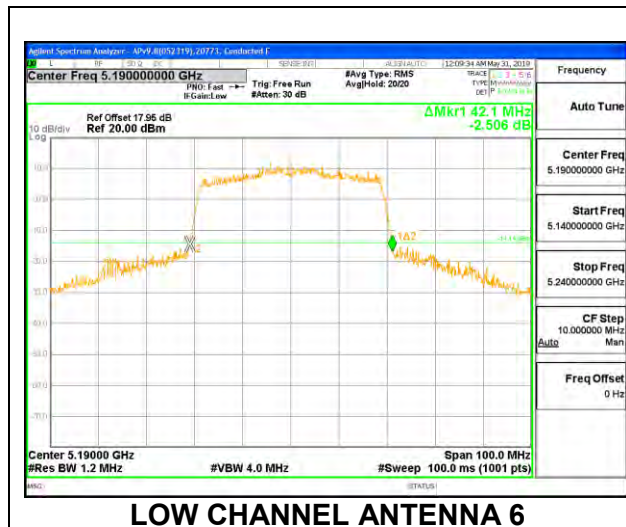
Channel	Frequency	26dB Bandwidth
	(MHz)	(MHz)
Low	5190	20.80
High	5230	20.60



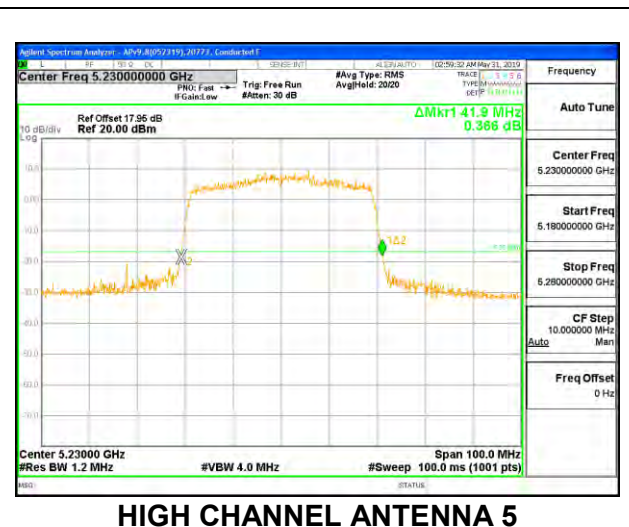
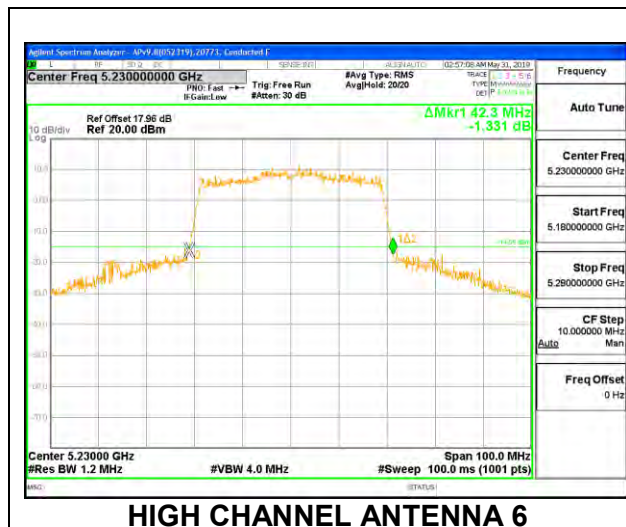
2TX Antenna 6 + Antenna 5 OFDMA MODE – 484-Tones, RU Index 65

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5190	42.10	42.20
High	5230	42.30	41.90

LOW CHANNEL



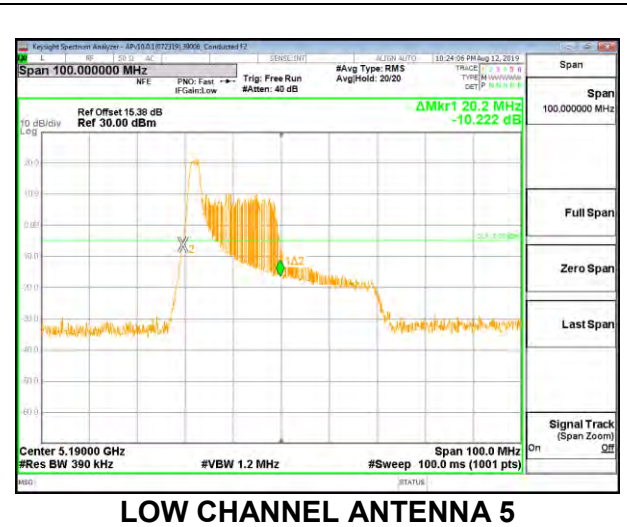
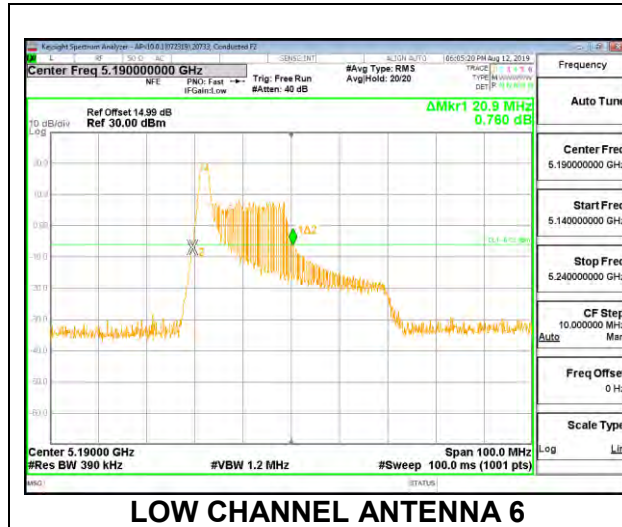
HIGH CHANNEL



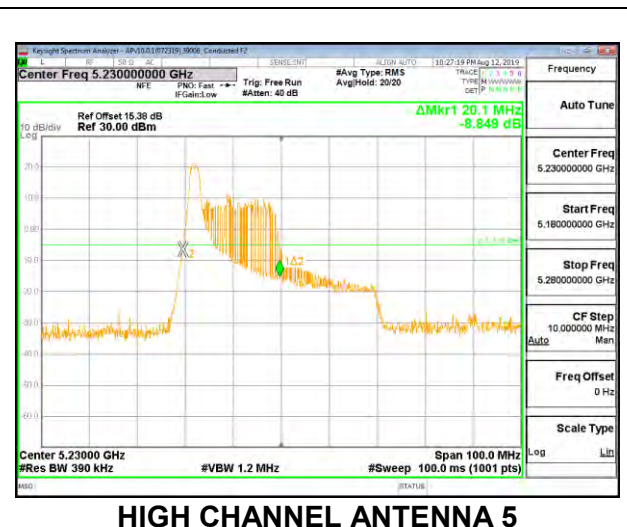
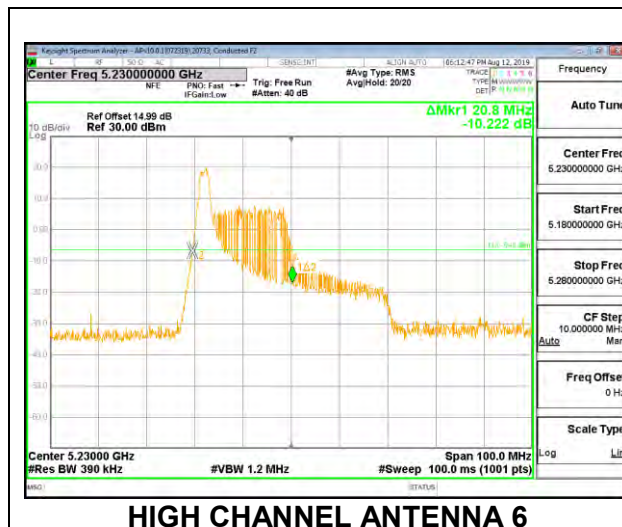
2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 0

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5190	20.90	20.20
High	5230	20.80	20.10

LOW CHANNEL



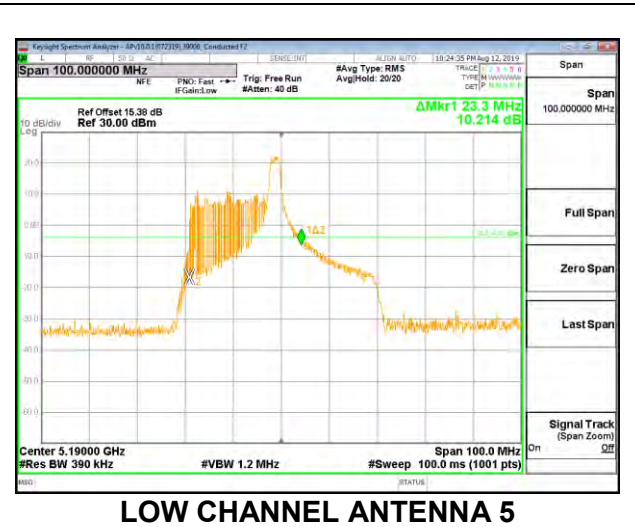
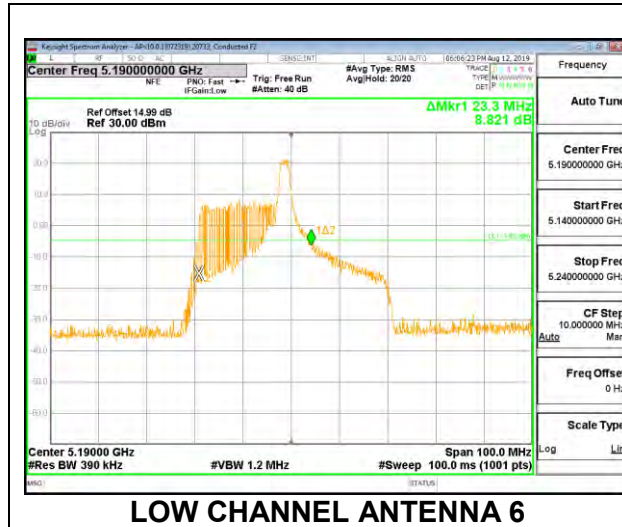
HIGH CHANNEL



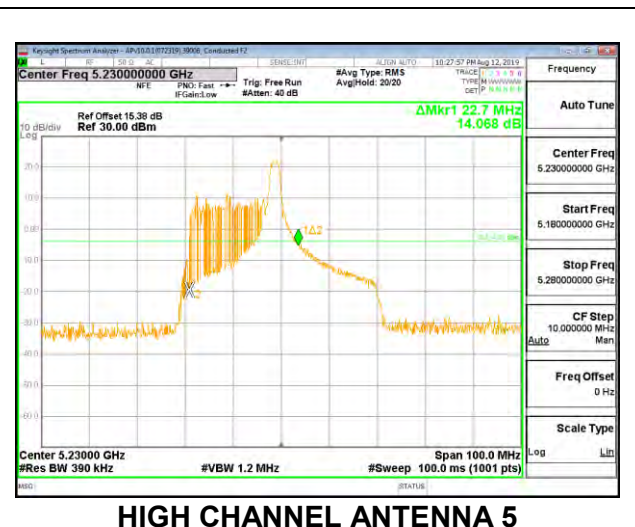
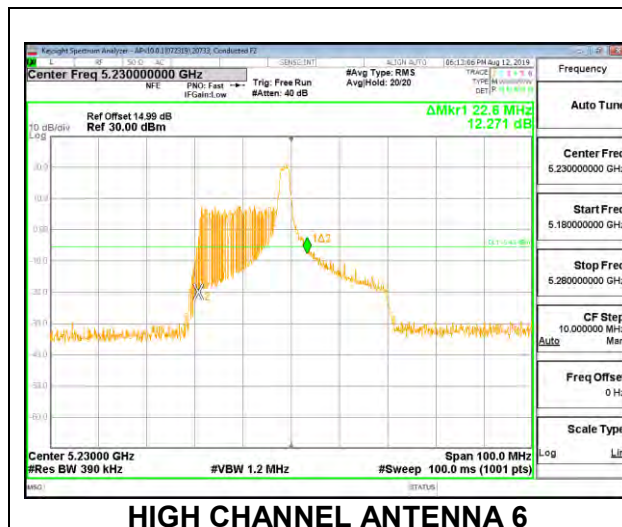
2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 8

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5190	23.30	23.30
High	5230	22.60	22.70

LOW CHANNEL



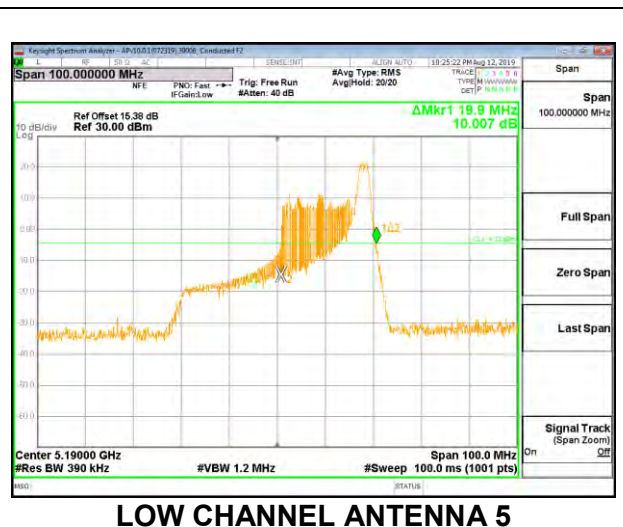
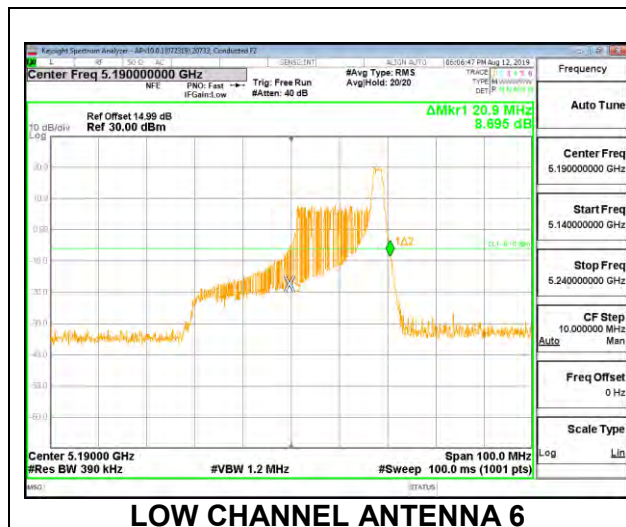
HIGH CHANNEL



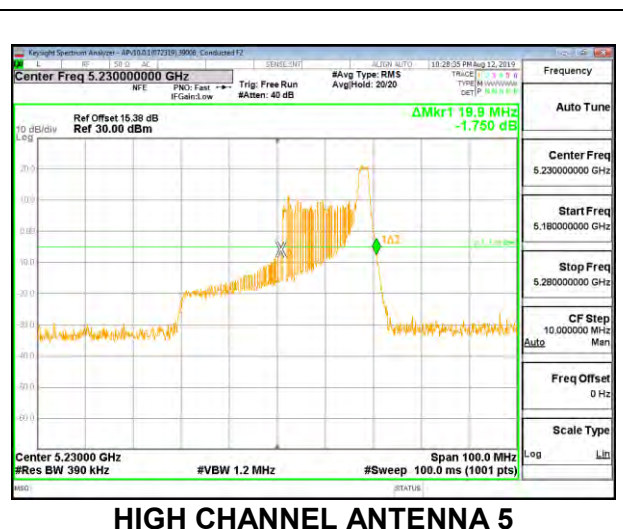
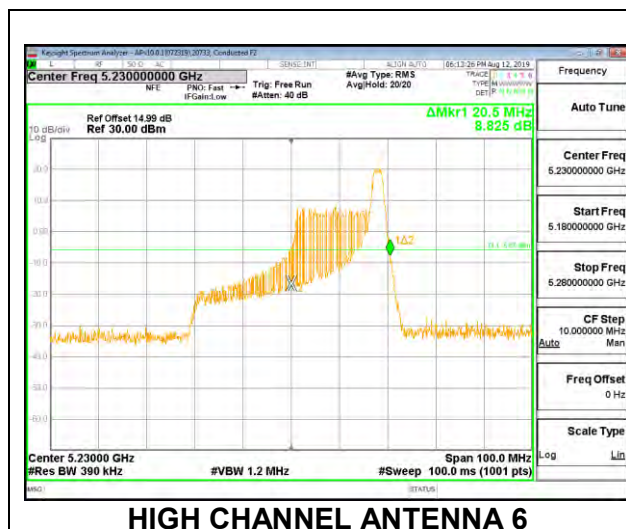
2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 17

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5190	20.90	19.90
High	5230	20.50	19.90

LOW CHANNEL



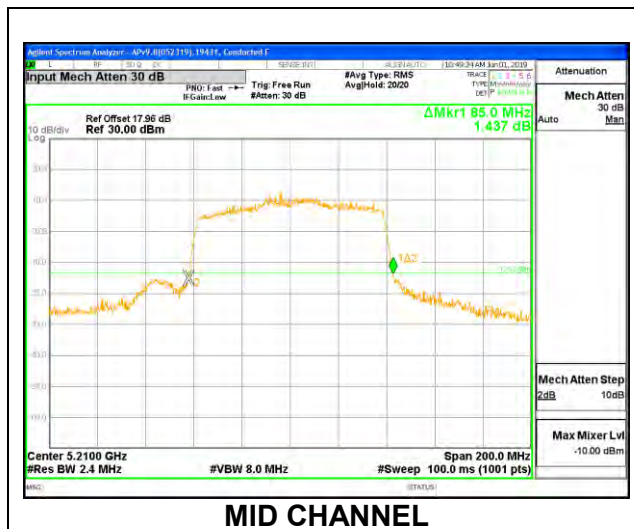
HIGH CHANNEL



8.2.6. 802.11ax HE80 MODE IN THE 5.2 GHz BAND

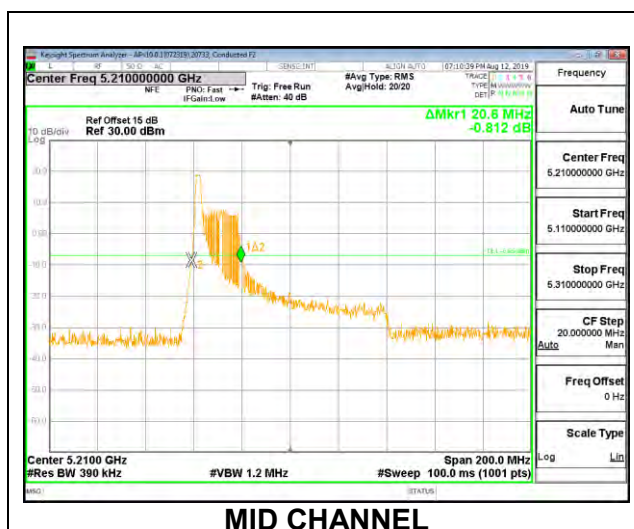
1TX Antenna 6 MODE – 996-Tones, RU Index 67

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5210	85.00



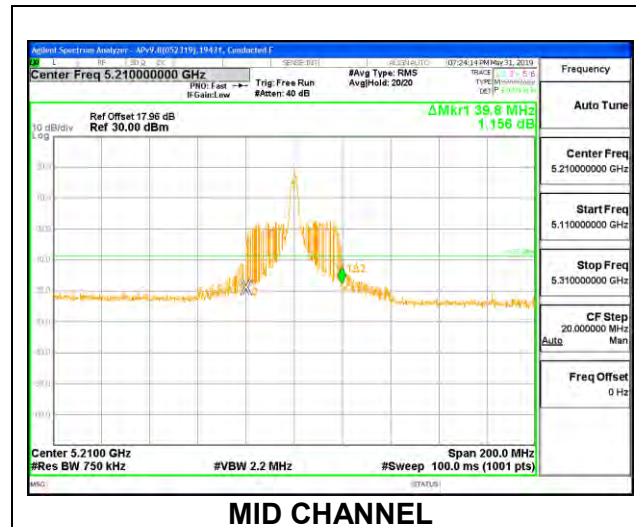
1TX Antenna 6 MODE – 26-Tones, RU Index 0

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5210	20.60



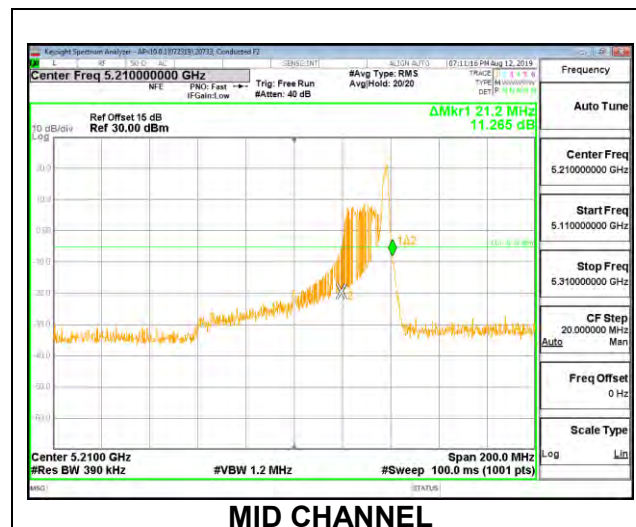
1TX Antenna 6 MODE – 26-Tones, RU Index 18

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5210	39.80



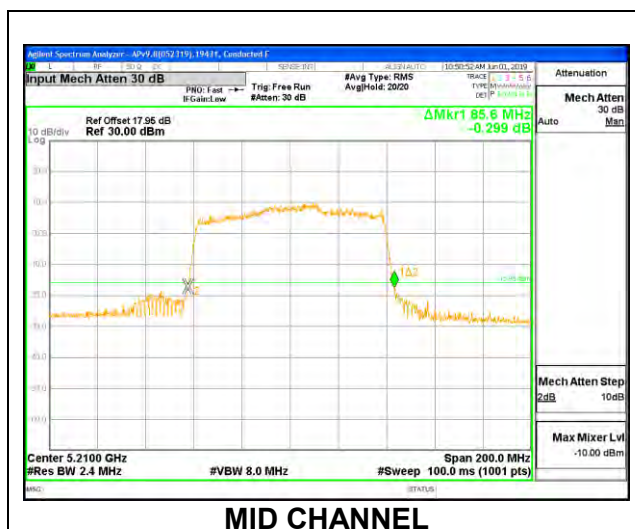
1TX Antenna 6 MODE – 26-Tones, RU Index 36

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5210	21.20



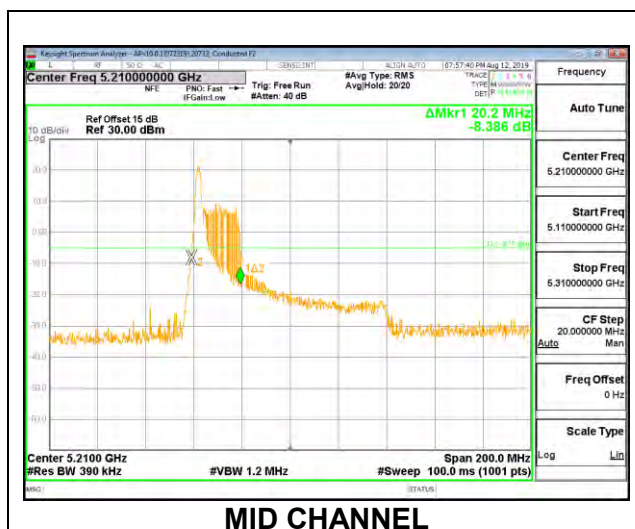
1TX Antenna 5 MODE – 996-Tones, RU Index 67

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5210	85.60



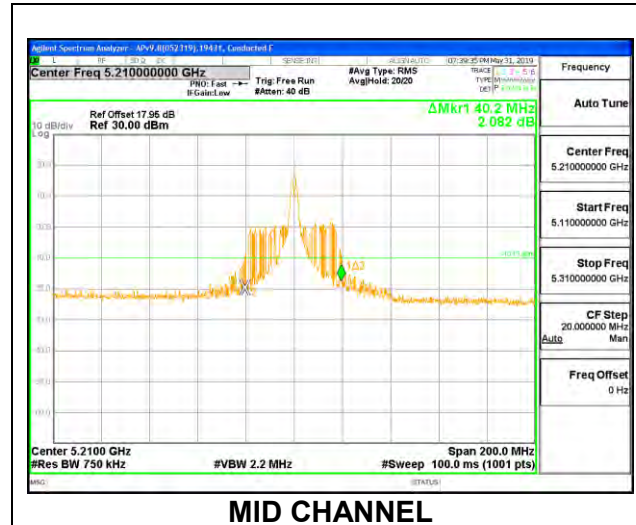
1TX Antenna 5 MODE – 26-Tones, RU Index 0

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5210	20.20



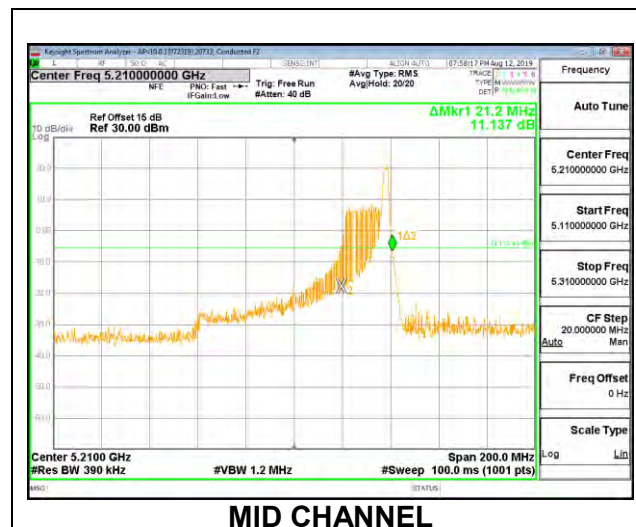
1TX Antenna 5 MODE – 26-Tones, RU Index 18

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5210	40.20



1TX Antenna 5 MODE – 26-Tones, RU Index 36

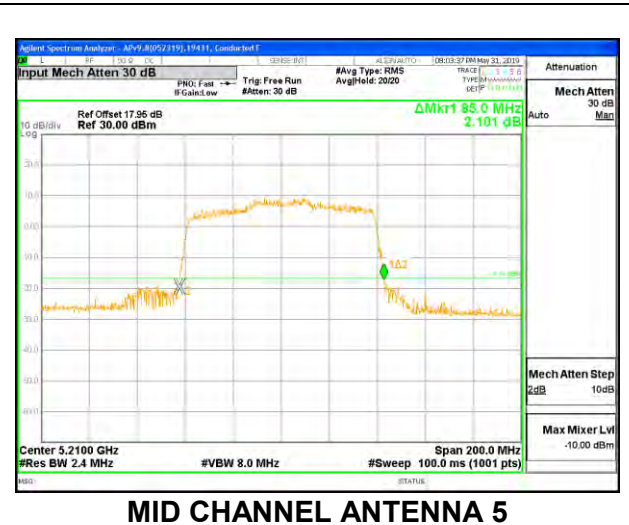
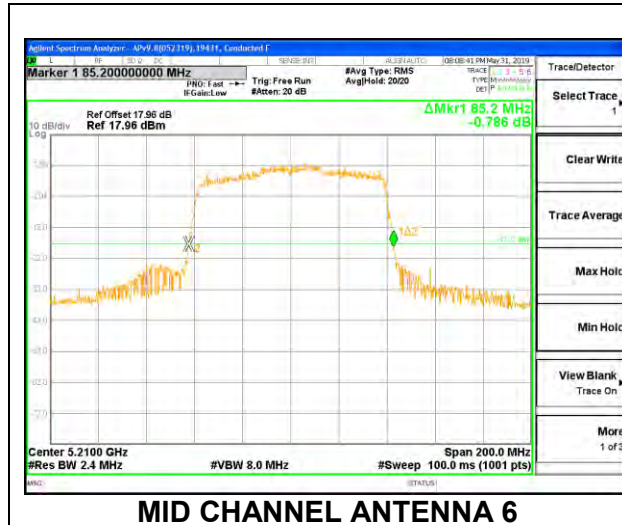
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5210	21.20



2TX Antenna 6 + Antenna 5 OFDMA MODE – 996-Tones, RU Index 67

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Mid	5210	85.20	85.00

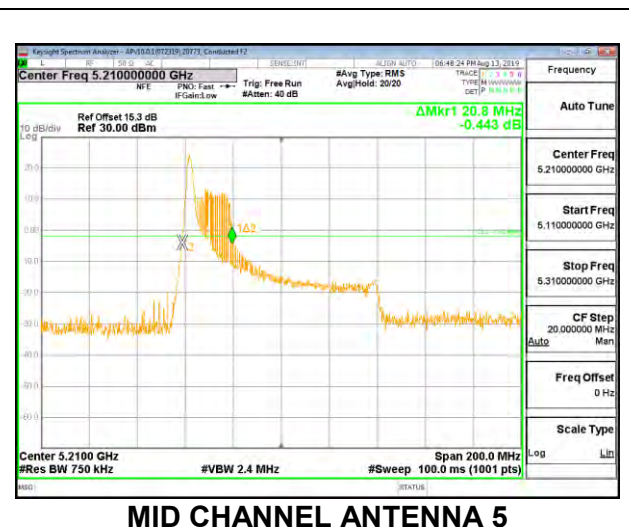
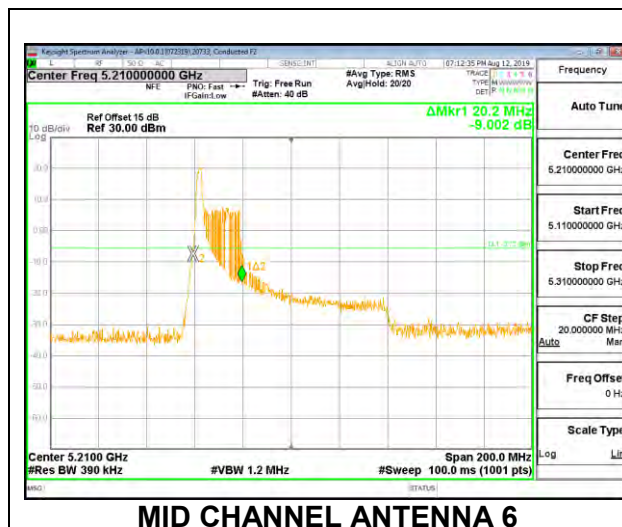
MID CHANNEL



2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 0

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Mid	5210	20.20	20.80

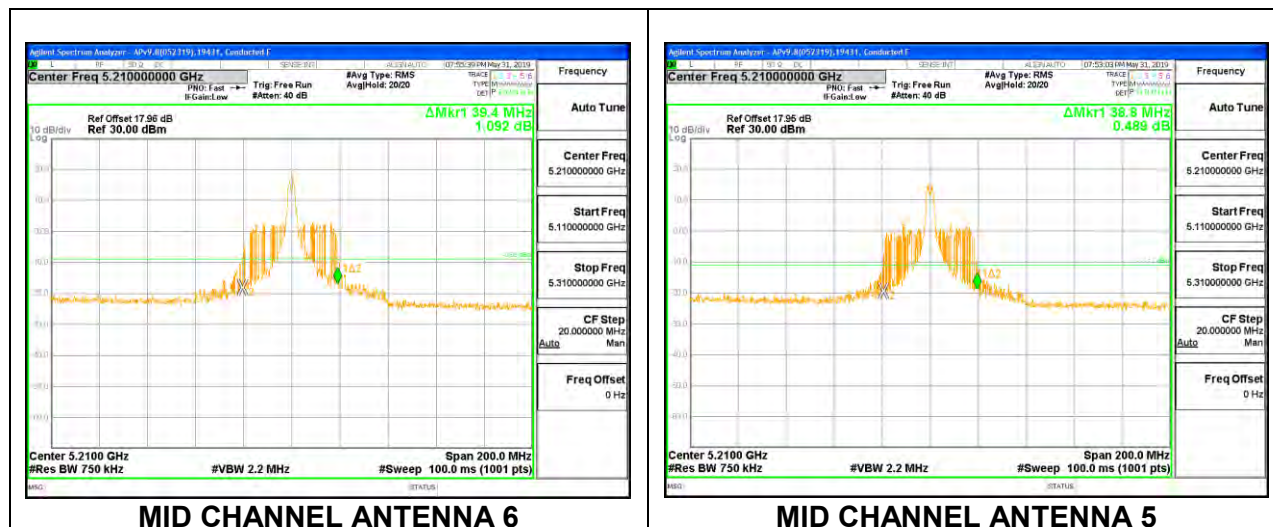
MID CHANNEL



2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 18

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Mid	5210	39.40	38.80

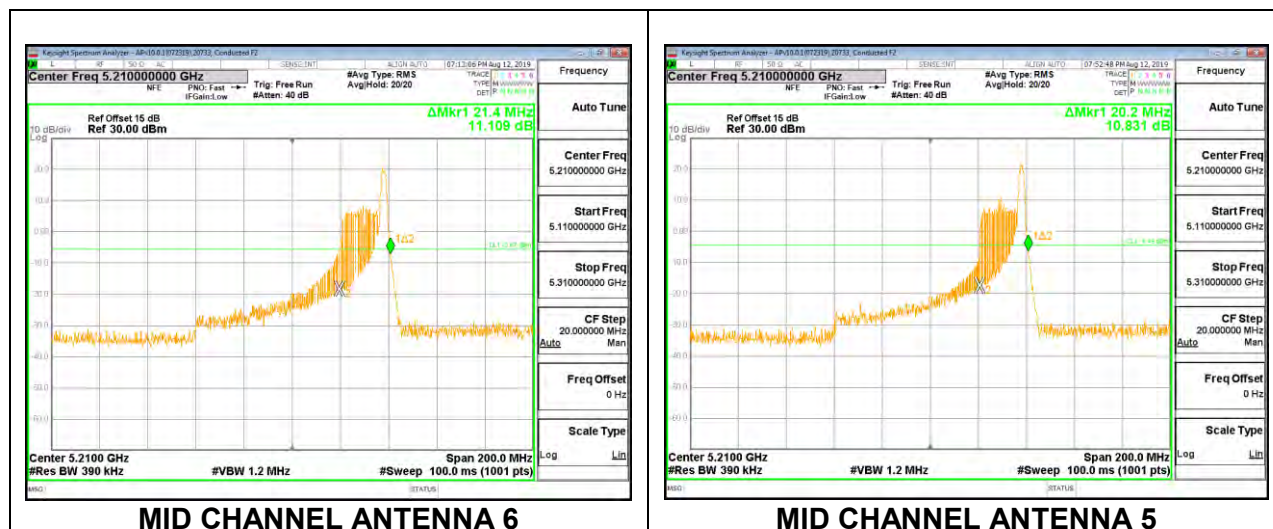
MID CHANNEL



2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 36

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Mid	5210	21.40	20.20

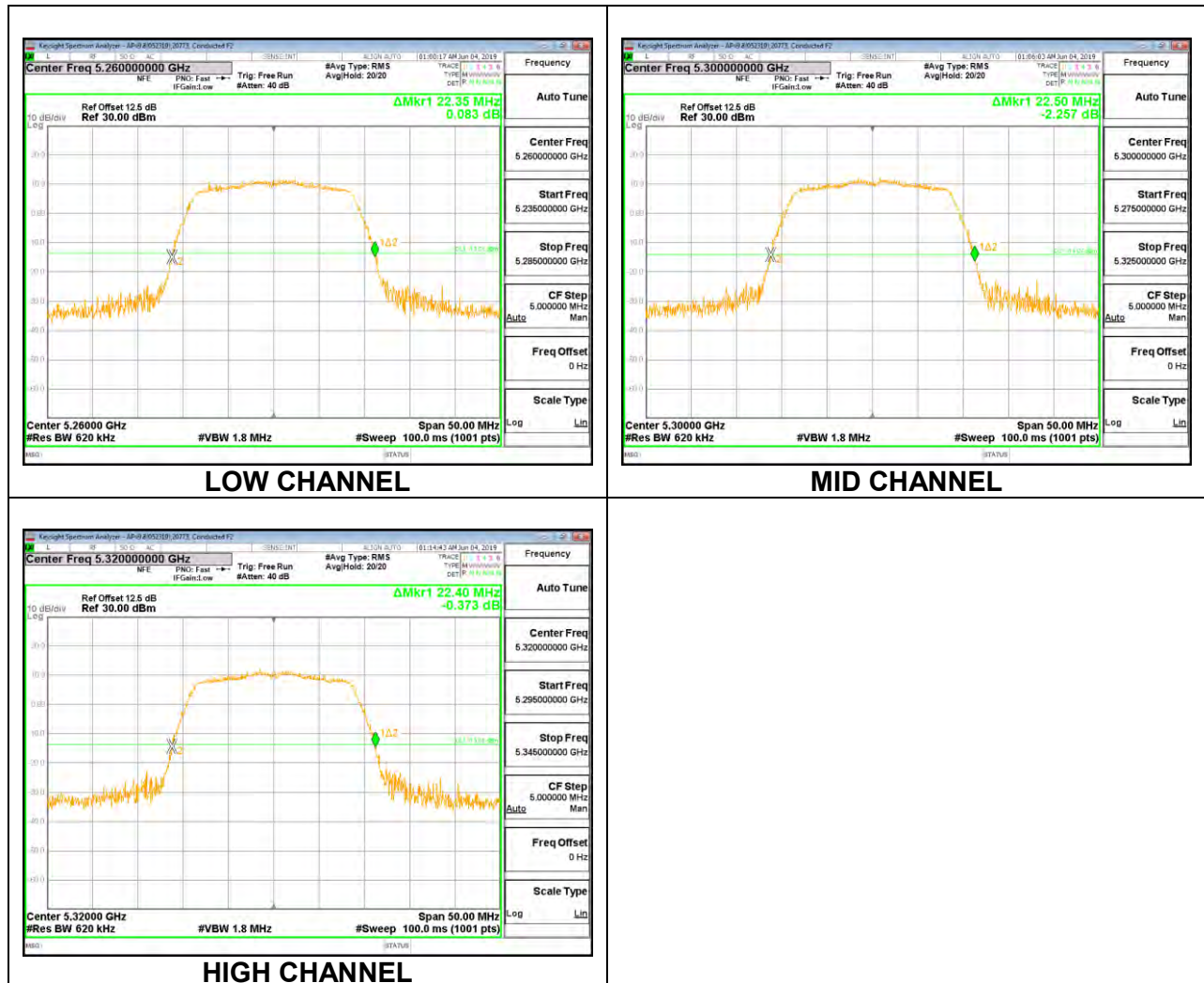
MID CHANNEL



8.2.7. 802.11n HT20 MODE IN THE 5.3 GHz BAND

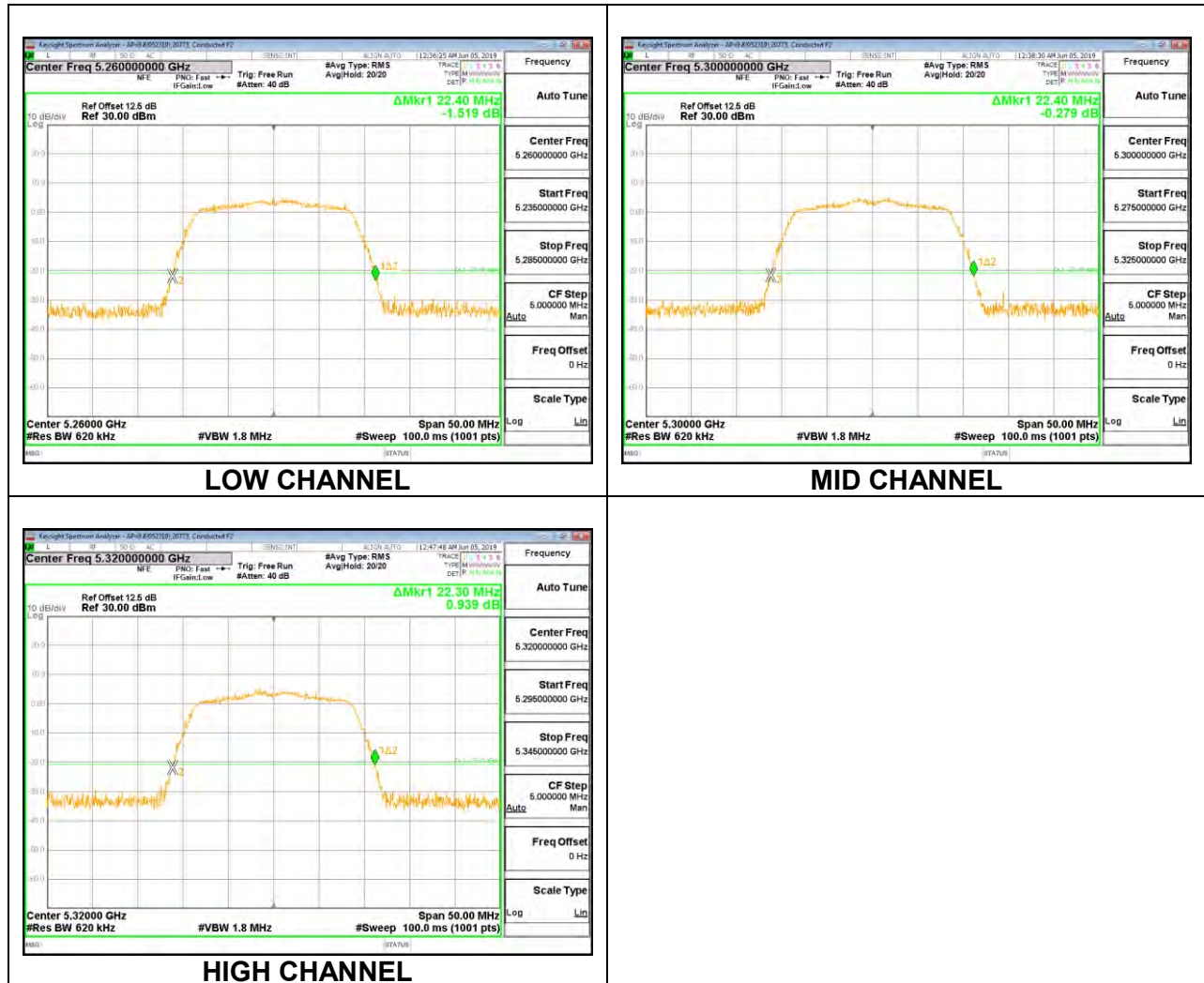
1TX Antenna 6 MODE

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	22.35
Mid	5300	22.50
High	5320	22.40



1TX Antenna 5 MODE

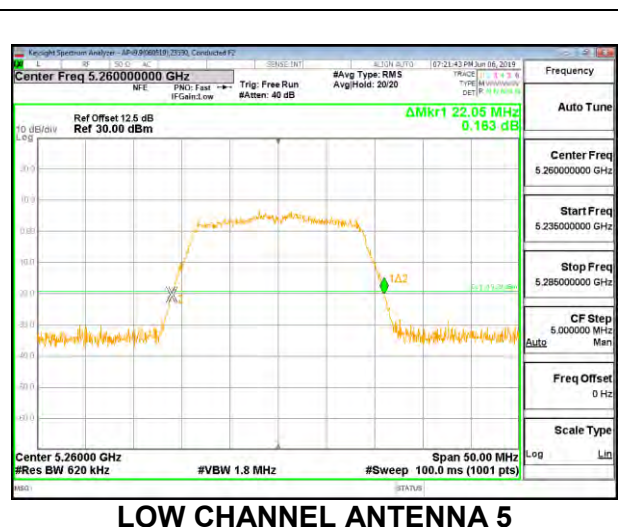
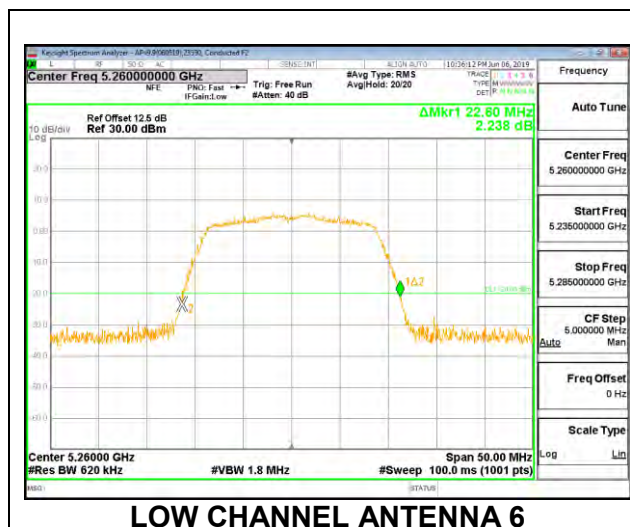
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	22.40
Mid	5300	22.40
High	5320	22.30



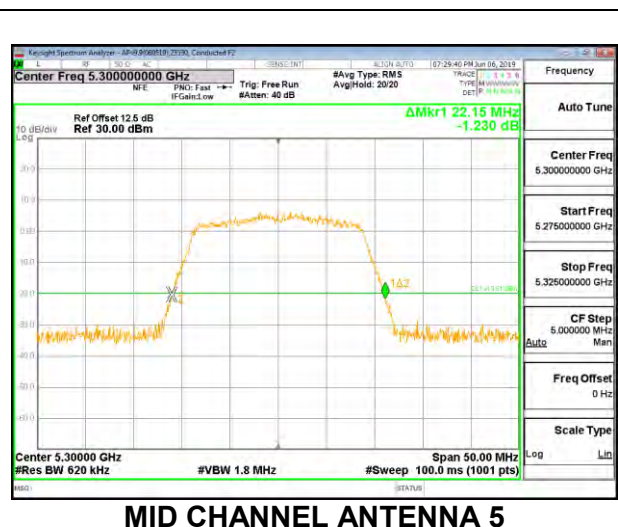
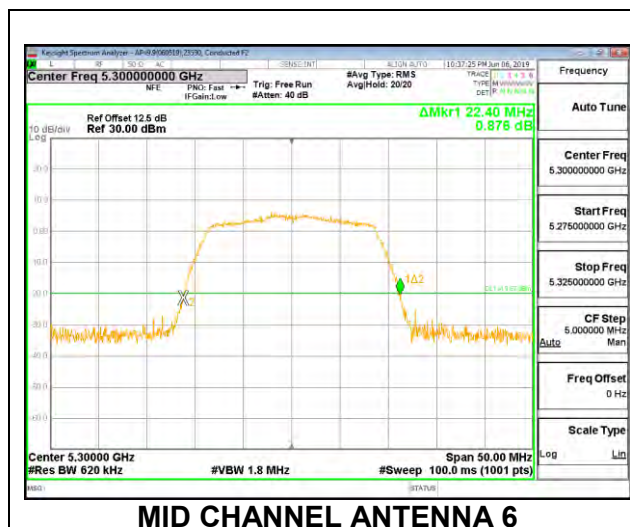
2TX Antenna 6 + Antenna 5 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5260	22.60	22.05
Mid	5300	22.40	22.15
High	5320	22.50	21.90

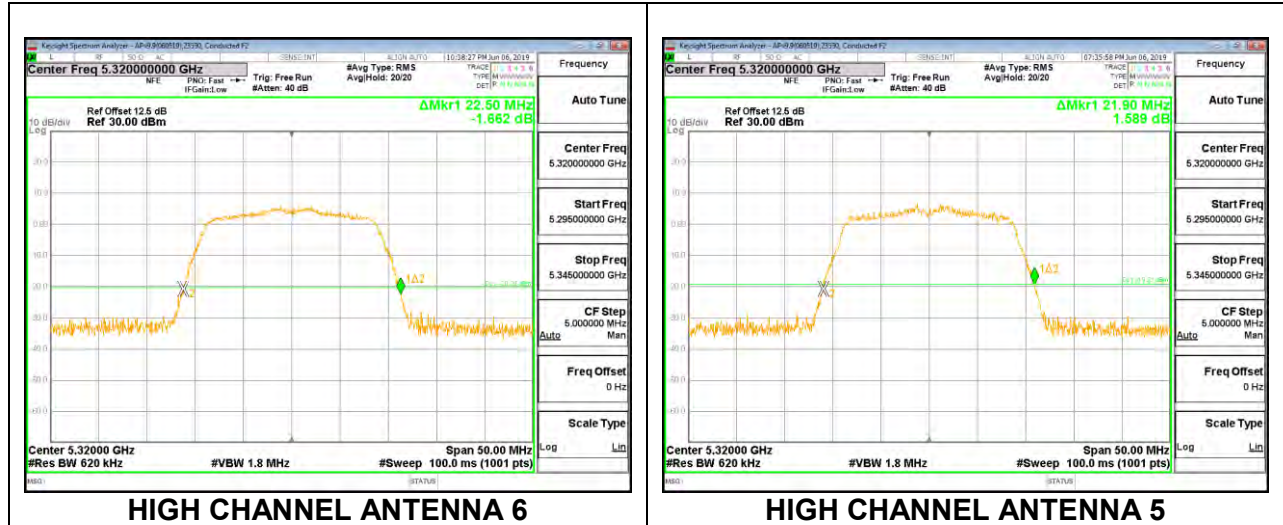
LOW CHANNEL



MID CHANNEL



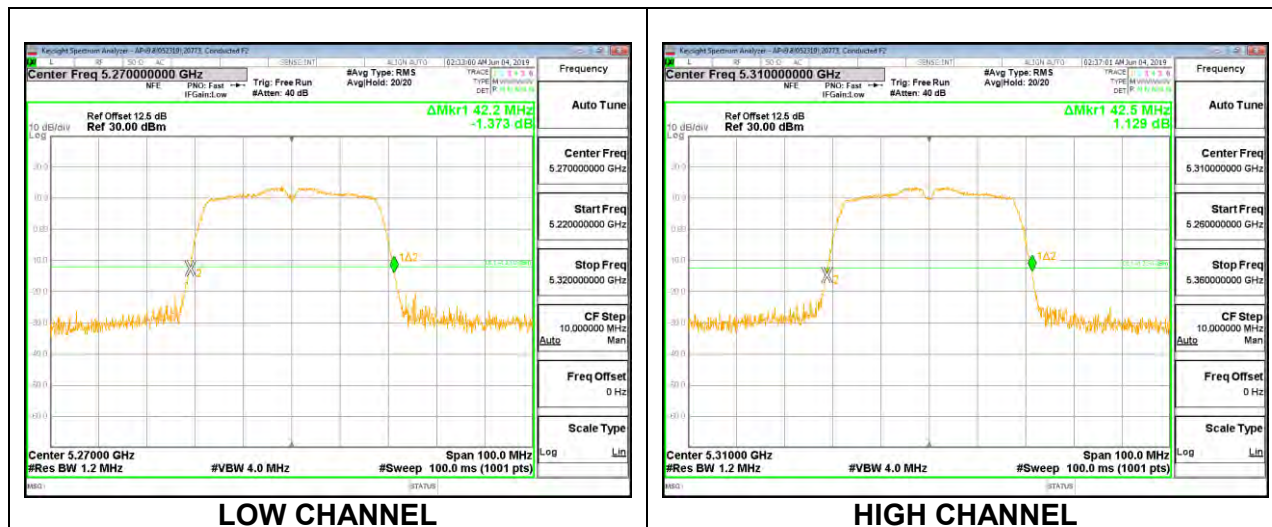
HIGH CHANNEL



8.2.8. 802.11n HT40 MODE IN THE 5.3 GHz BAND

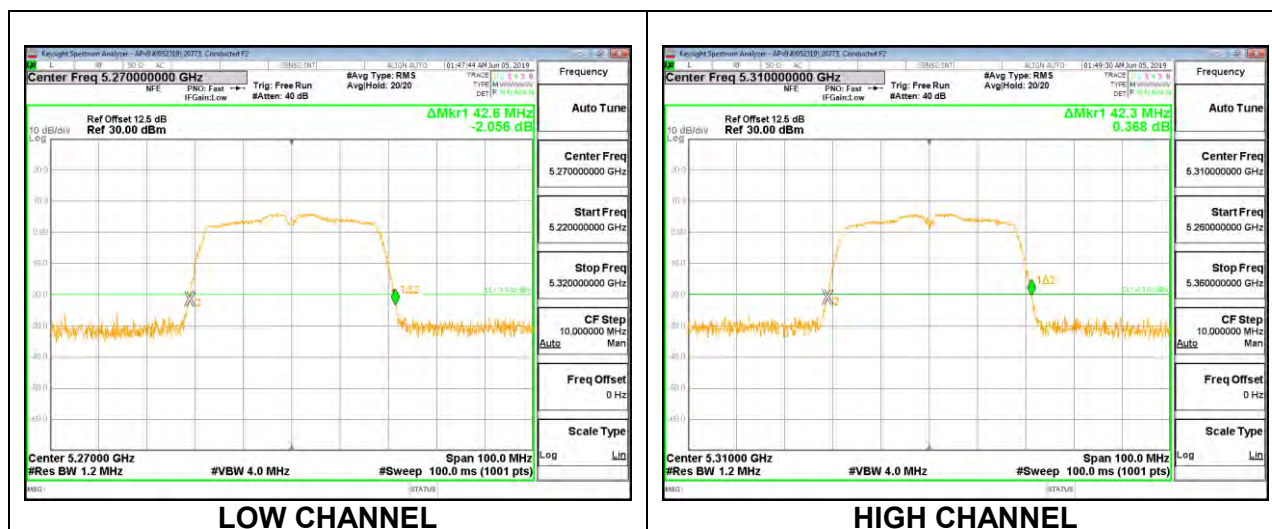
1TX Antenna 6 MODE

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
Low	5270	42.20
High	5310	42.50



1TX Antenna 5 MODE

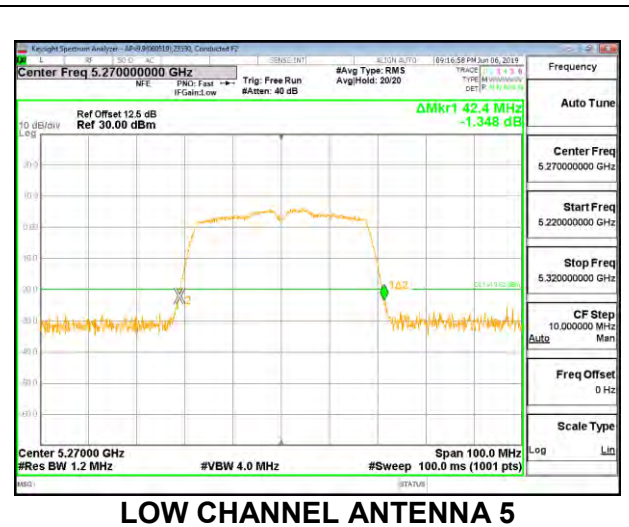
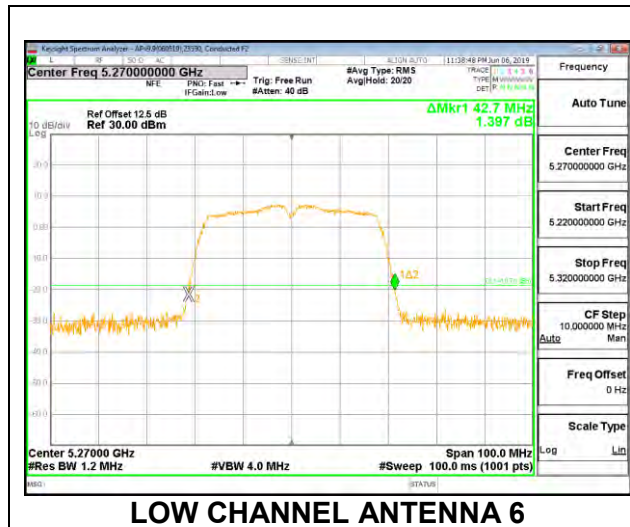
Channel	Frequency (MHz)	26dB Bandwidth (MHz)
Low	5270	42.60
High	5310	42.30



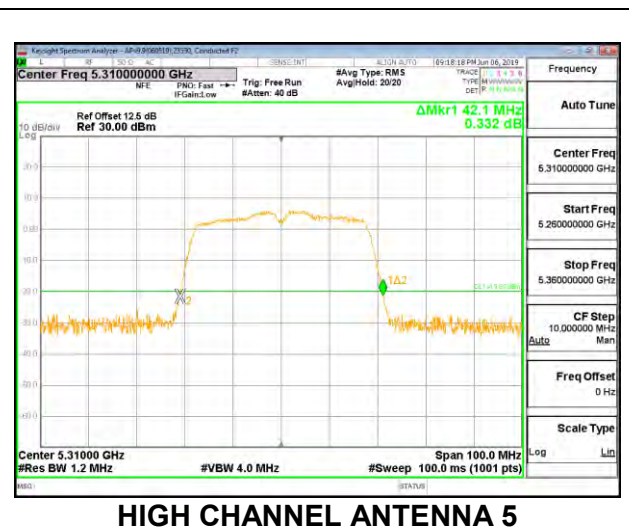
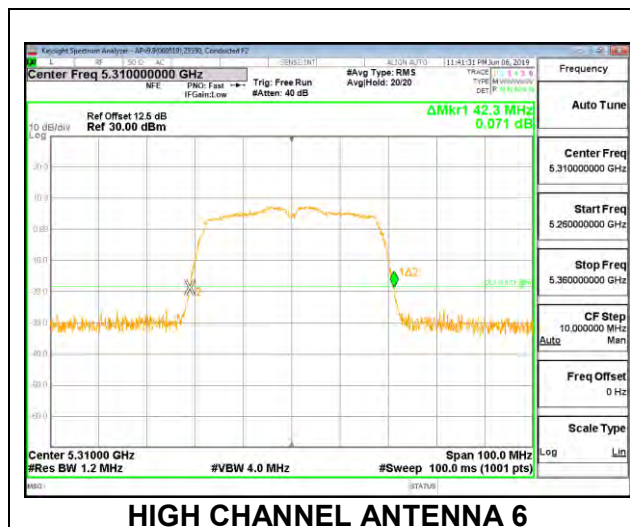
2TX Antenna 6 + Antenna 5 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5270	42.70	42.40
High	5310	42.30	42.10

LOW CHANNEL



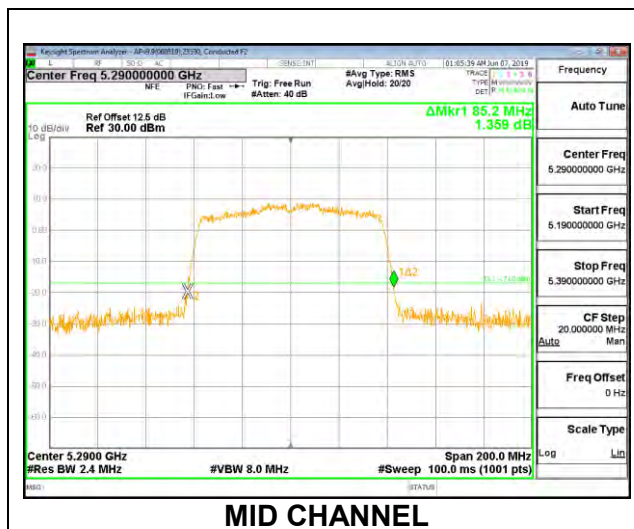
HIGH CHANNEL



8.2.9. 802.11ac VHT80 MODE IN THE 5.3 GHz BAND

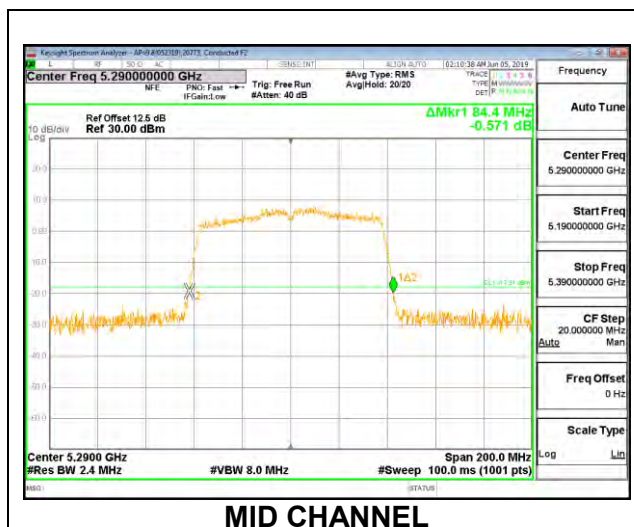
1TX Antenna 6 MODE

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5290	85.20



1TX Antenna 5 MODE

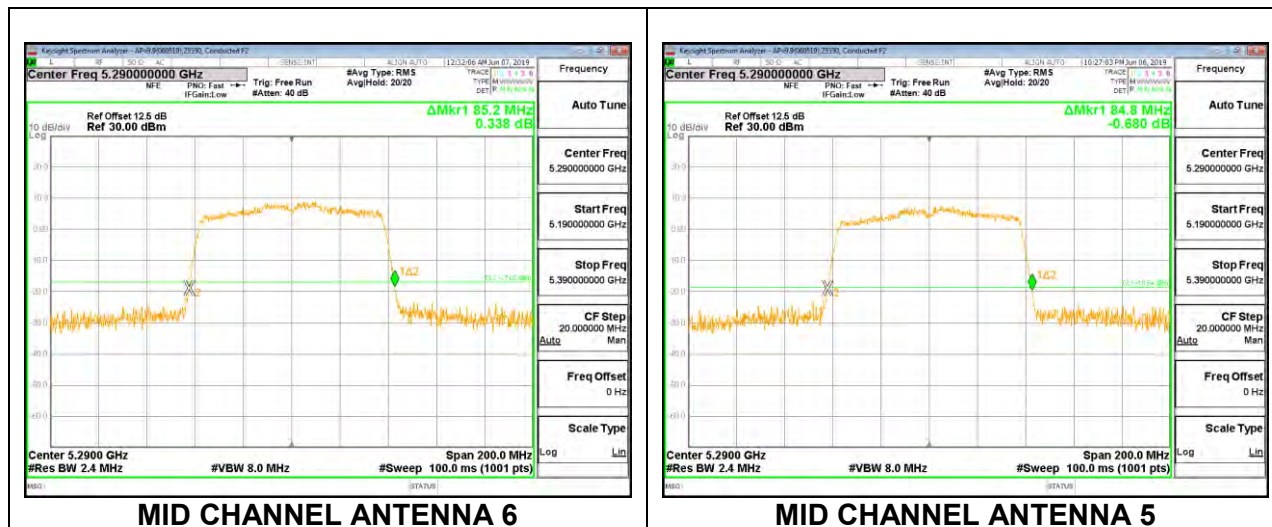
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Mid	5290	84.40



2TX Antenna 6 + Antenna 5 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Mid	5290	85.20	84.80

MID CHANNEL



8.2.10. 802.11ax HE20 MODE IN THE 5.3 GHz BAND

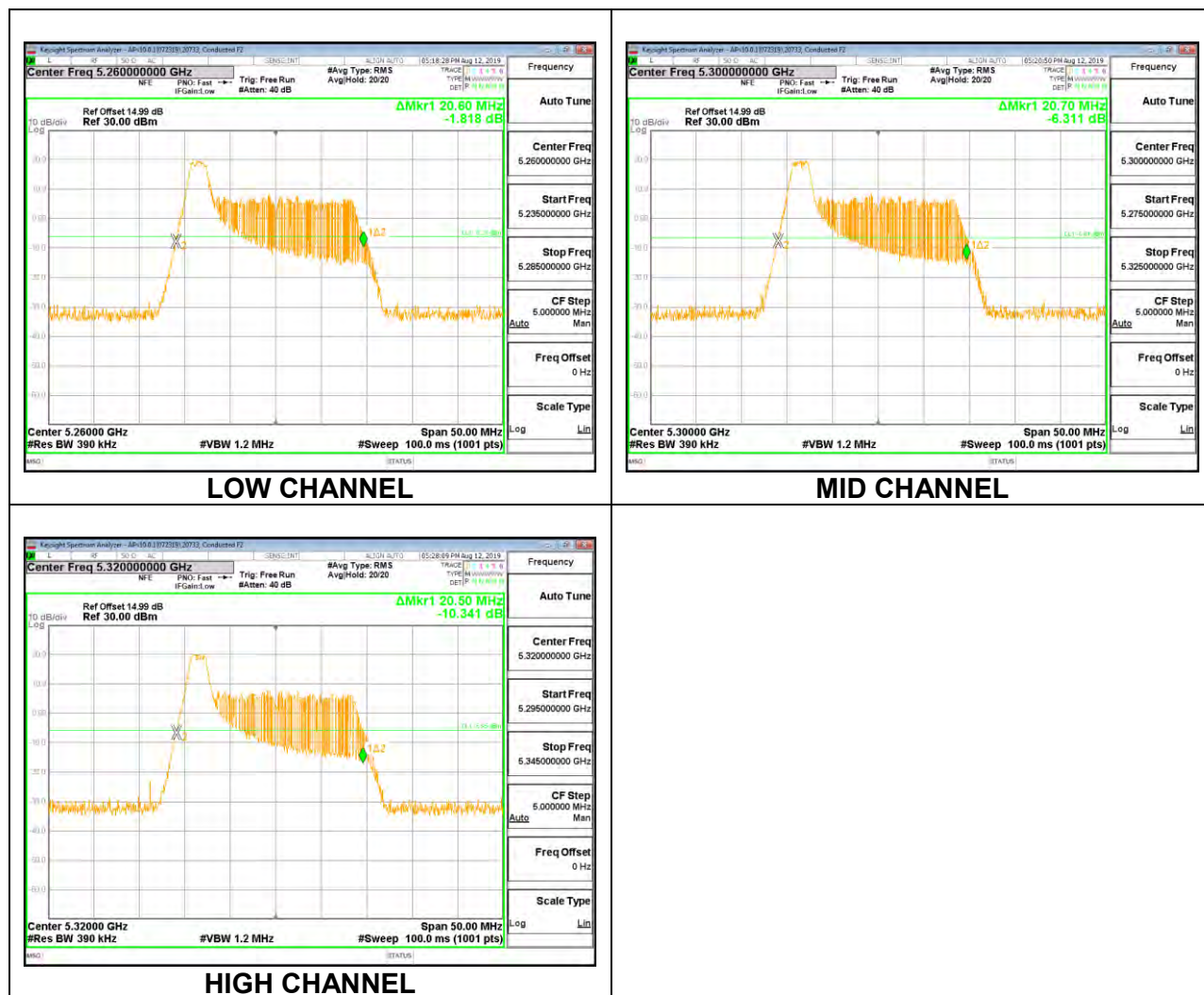
1TX Antenna 6 MODE – 242-Tones, RU Index 61

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	22.10
Mid	5300	22.20
High	5320	22.25



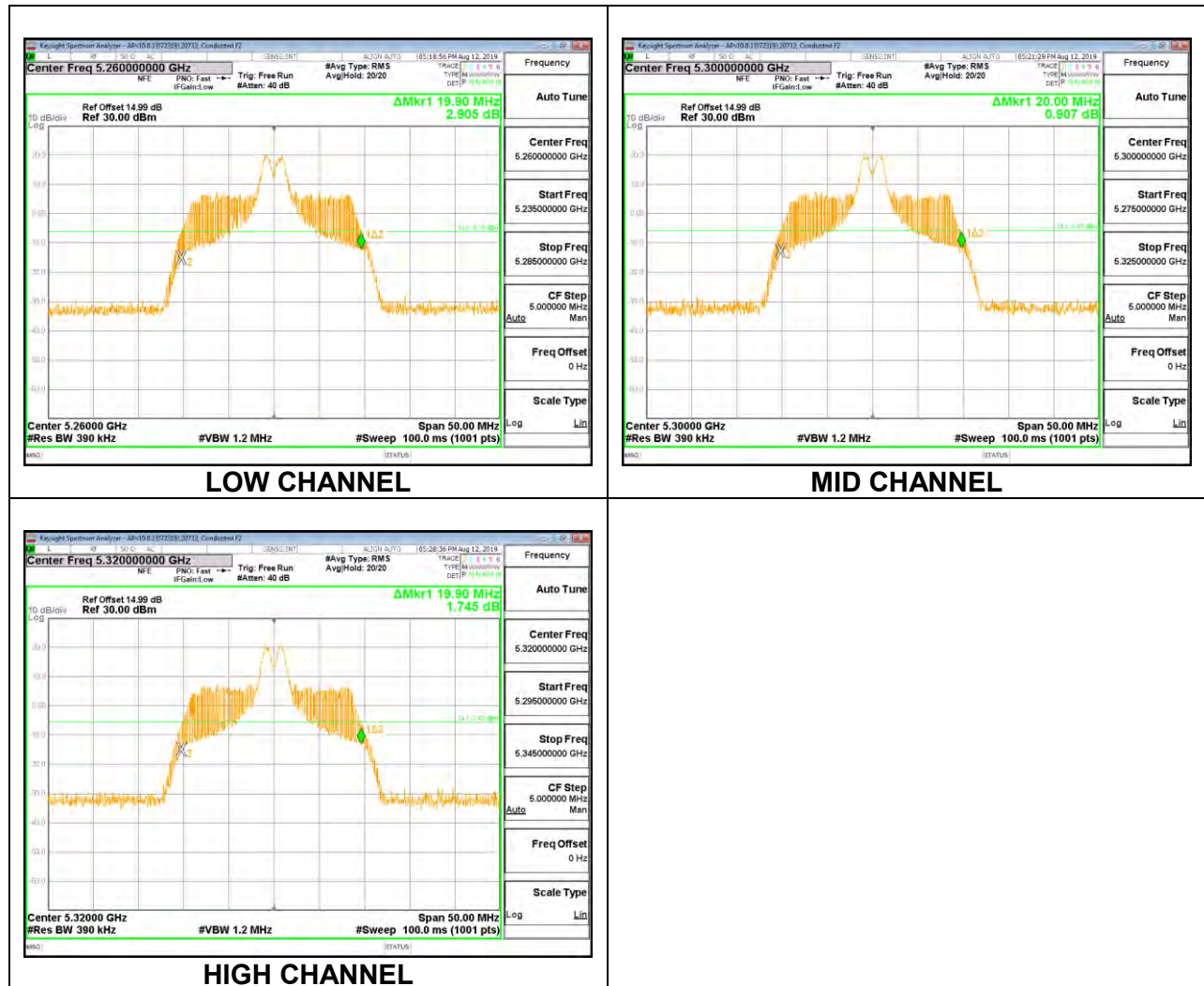
1TX Antenna 6 MODE – 26-Tones, RU Index 0

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	20.60
Mid	5300	20.70
High	5320	20.50



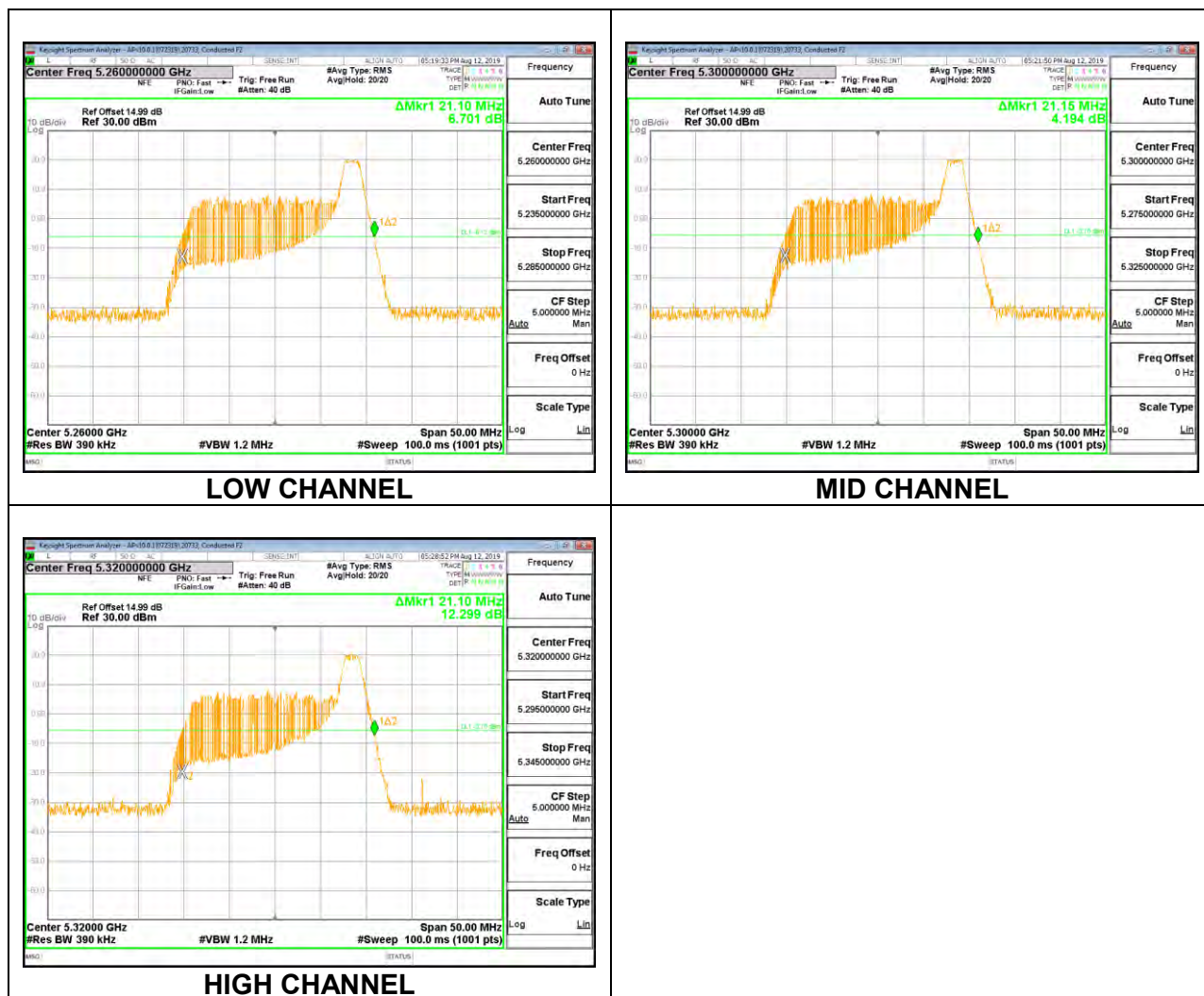
1TX Antenna 6 MODE – 26-Tones, RU Index 4

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	19.90
Mid	5300	20.00
High	5320	19.90



1TX Antenna 6 MODE – 26-Tones, RU Index 8

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	21.10
Mid	5300	21.15
High	5320	21.10



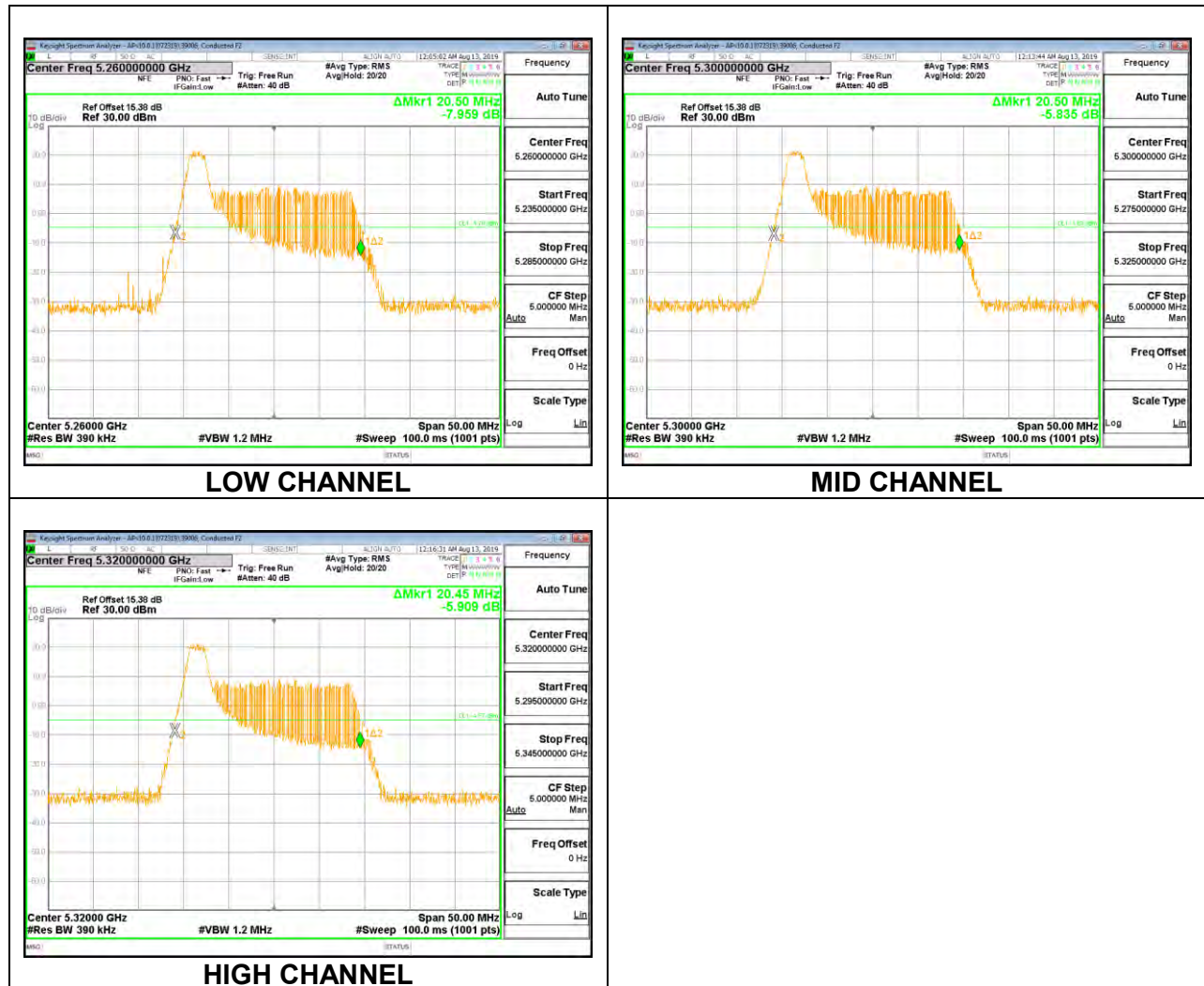
1TX Antenna 5 MODE – 242-Tones, RU Index 61

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	22.00
Mid	5300	22.05
High	5320	22.05



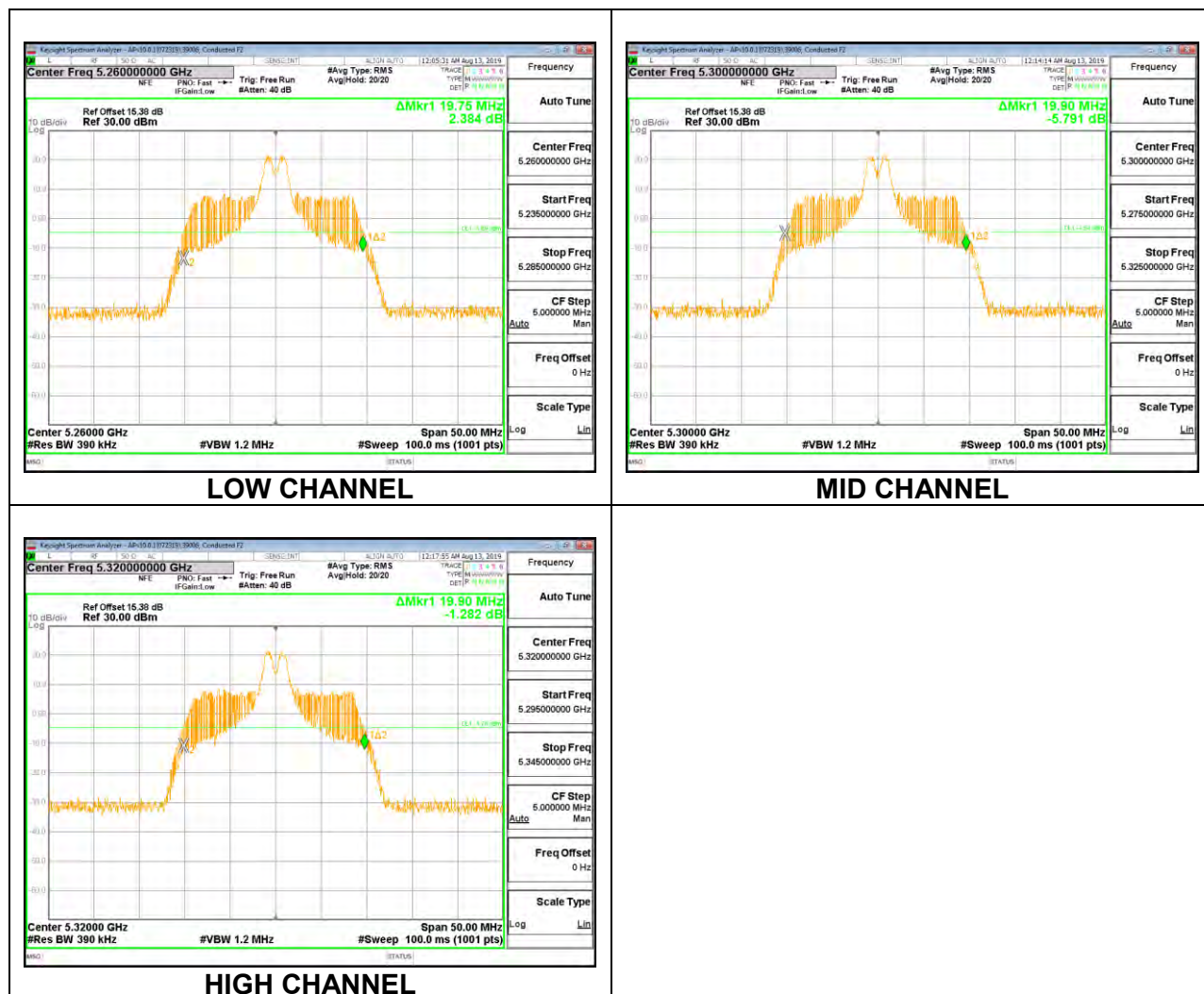
1TX Antenna 5 MODE – 26-Tones, RU Index 0

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	20.50
Mid	5300	20.50
High	5320	20.45



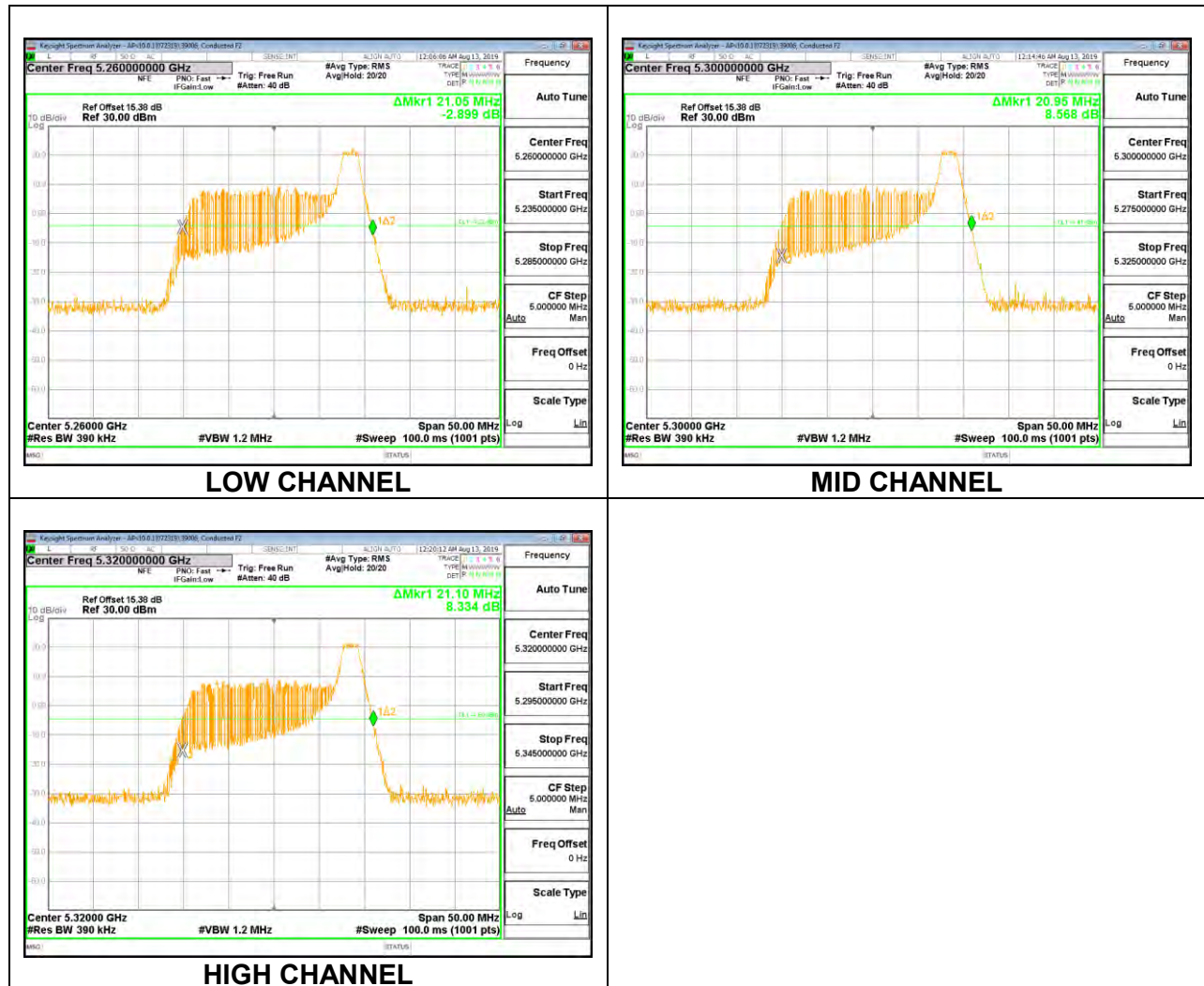
1TX Antenna 5 MODE – 26-Tones, RU Index 4

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	19.75
Mid	5300	19.90
High	5320	19.90



1TX Antenna 5 MODE – 26-Tones, RU Index 8

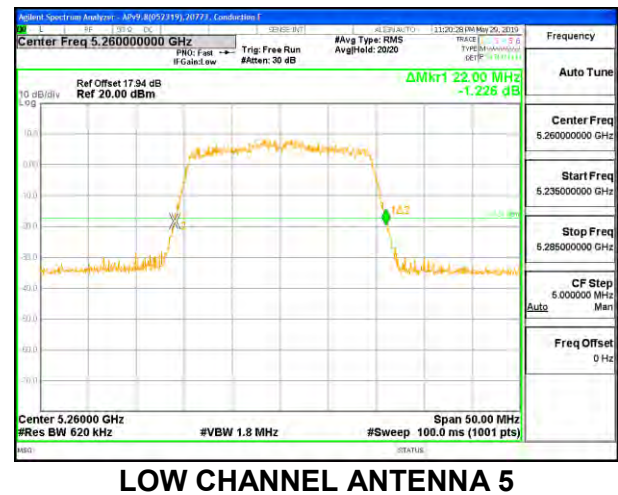
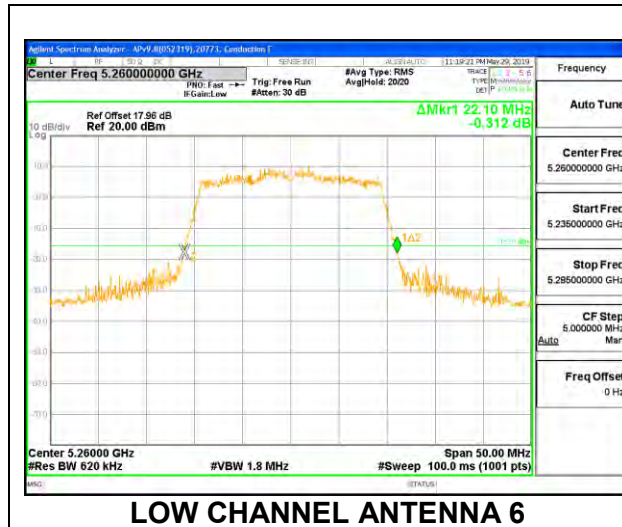
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	21.05
Mid	5300	20.95
High	5320	21.10



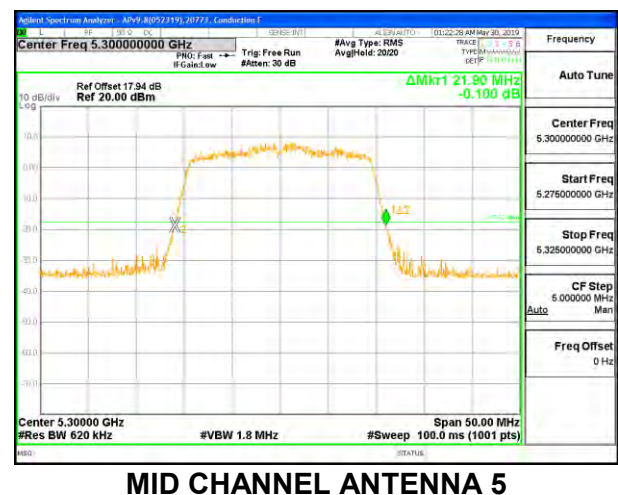
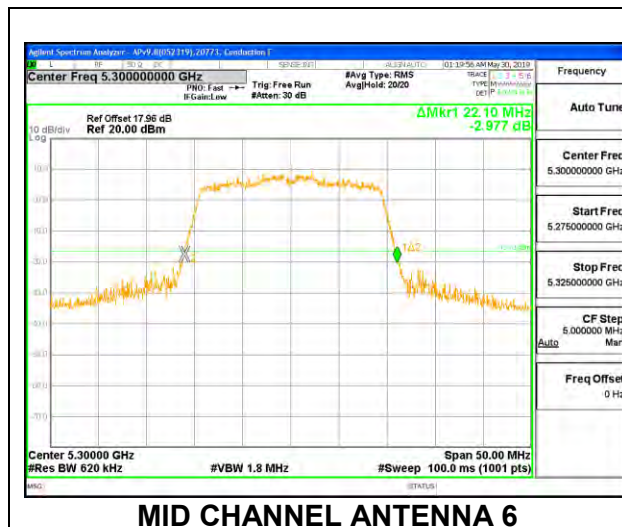
2TX Antenna 6 + Antenna 5 OFDMA MODE – 242-Tones, RU Index 61

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5260	22.10	22.00
Mid	5300	22.10	21.90
High	5320	22.25	22.10

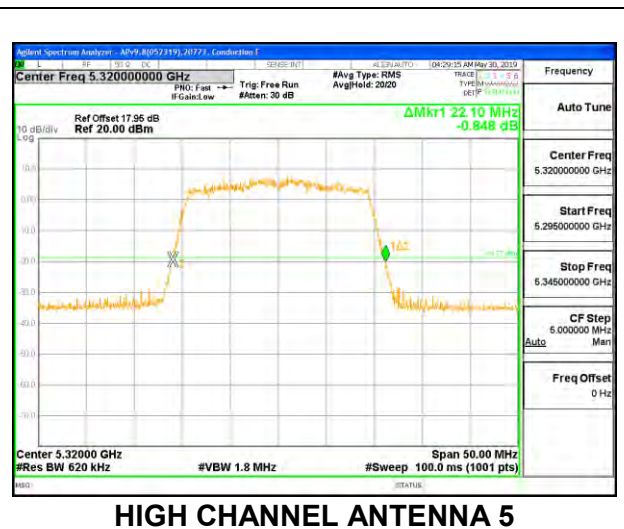
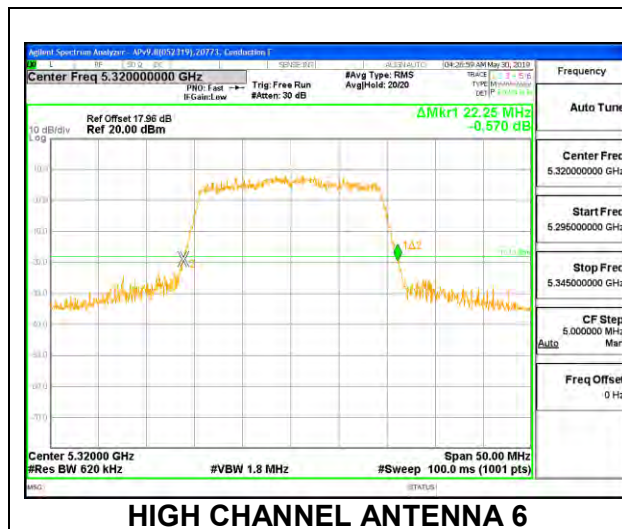
LOW CHANNEL



MID CHANNEL



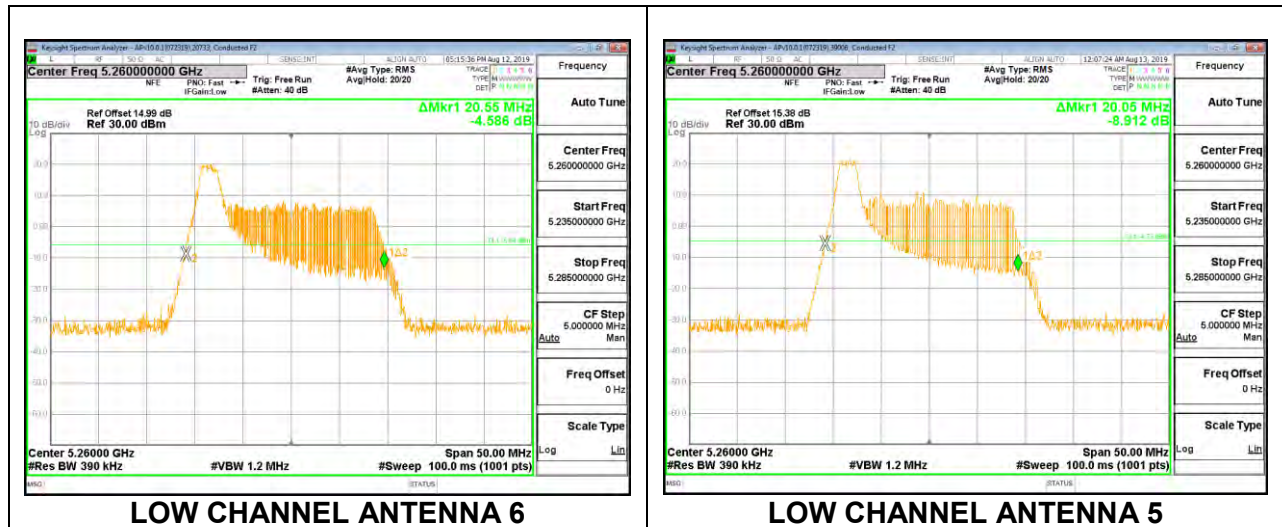
HIGH CHANNEL



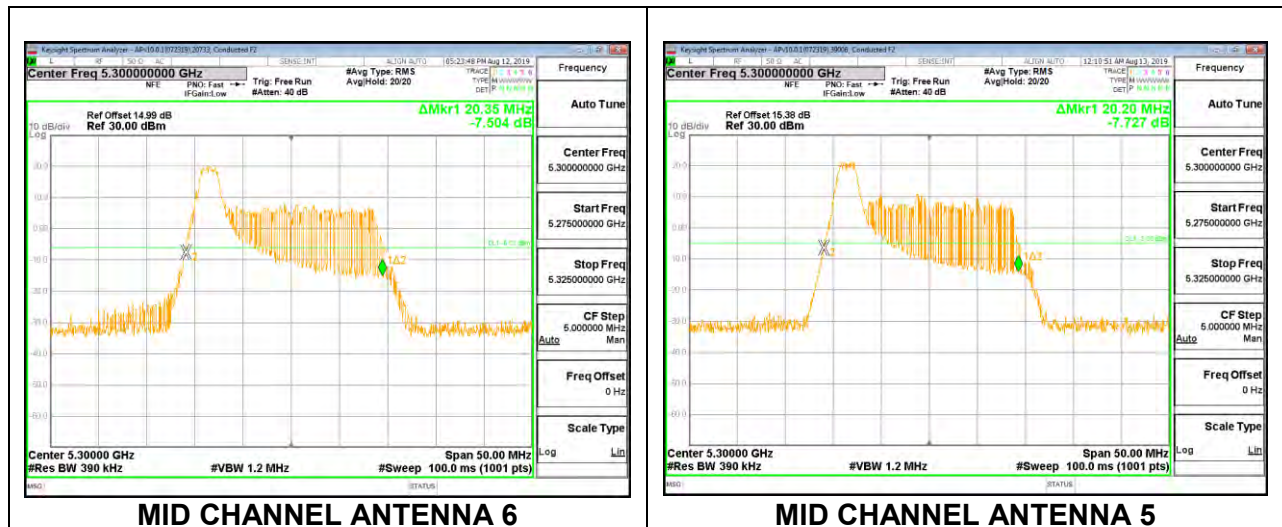
2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 0

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5260	20.55	20.05
Mid	5300	20.35	20.20
High	5320	20.50	20.10

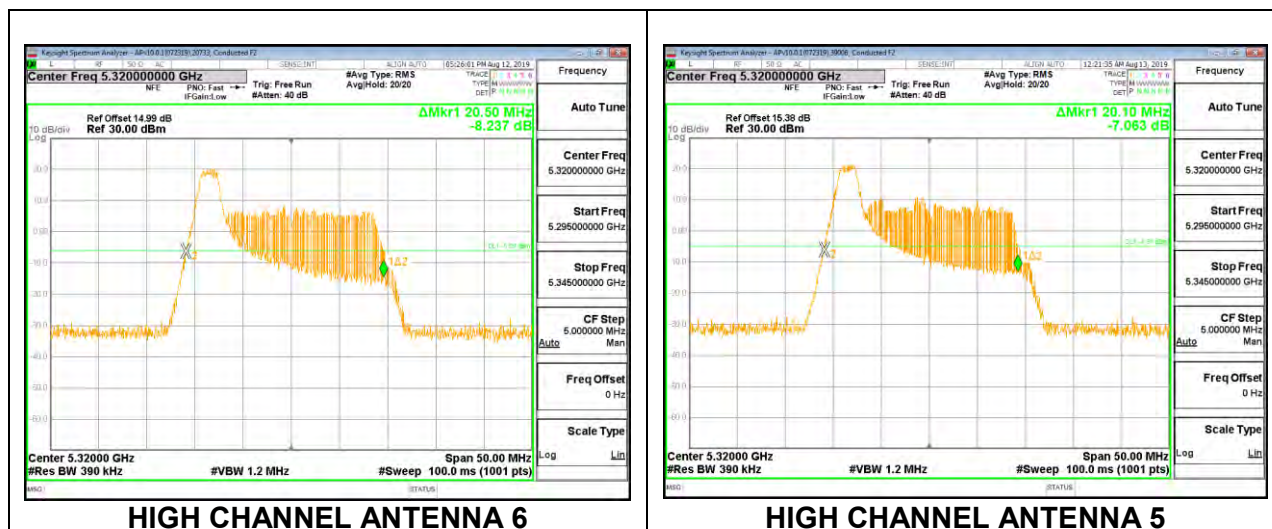
LOW CHANNEL



MID CHANNEL



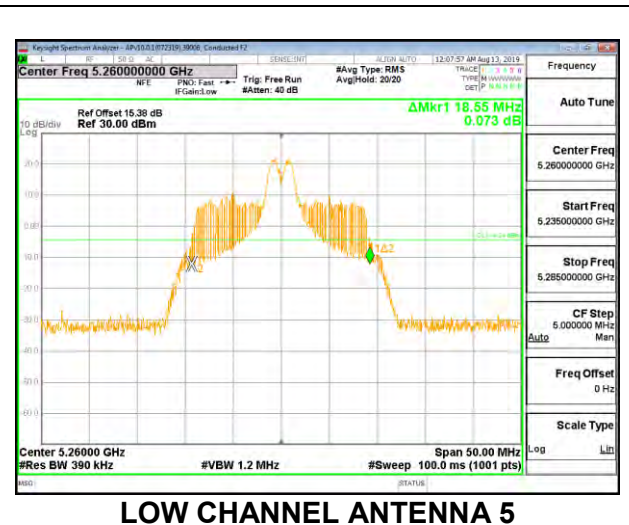
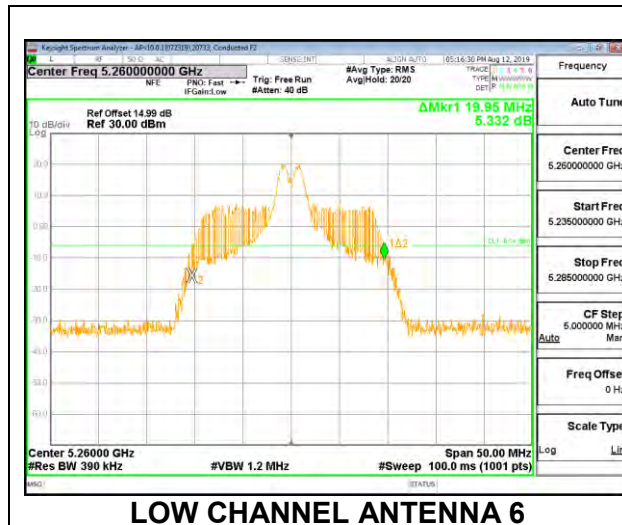
HIGH CHANNEL



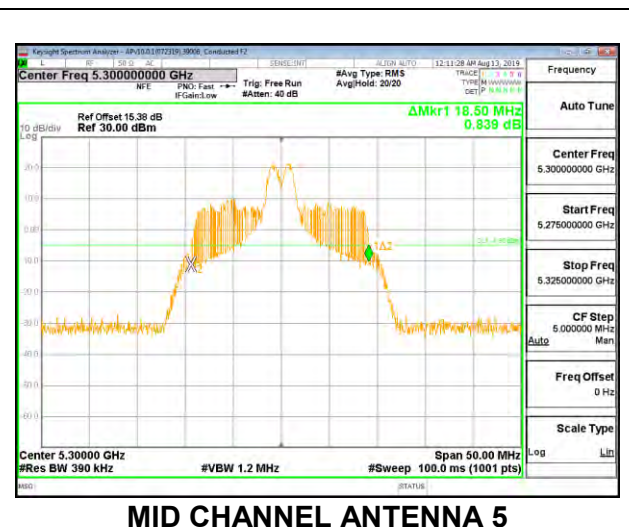
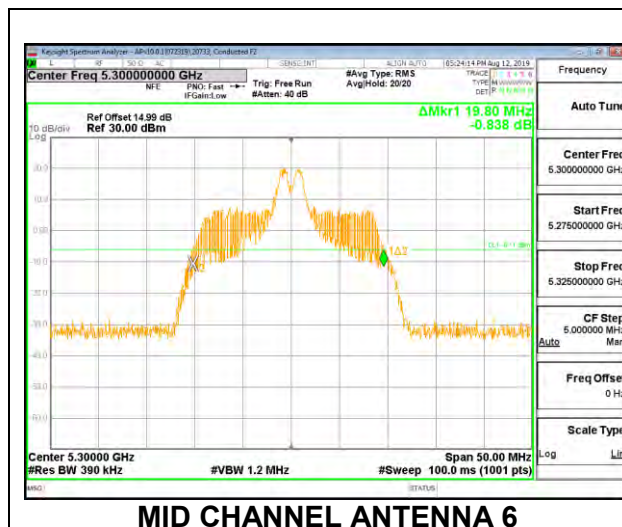
2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 4

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5260	19.95	18.55
Mid	5300	19.80	18.50
High	5320	20.00	18.65

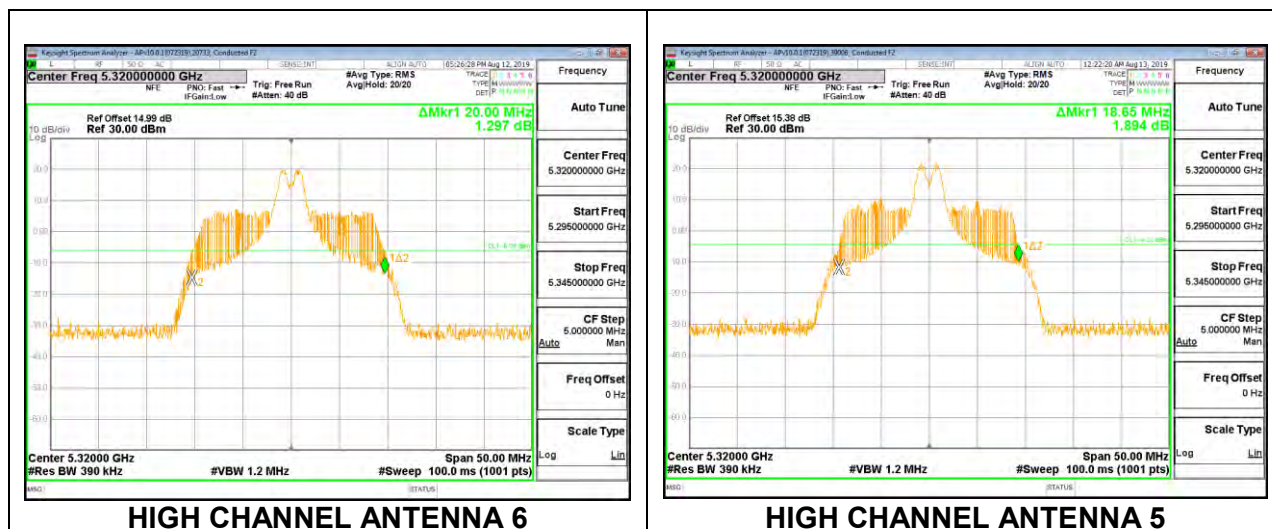
LOW CHANNEL



MID CHANNEL



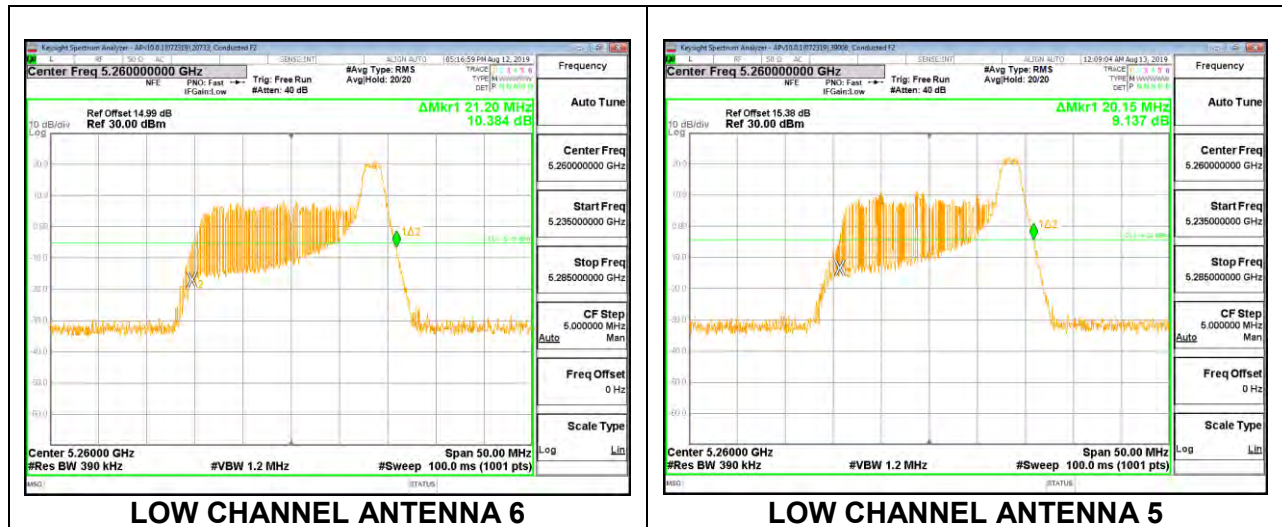
HIGH CHANNEL



2TX Antenna 6 + Antenna 5 OFDMA MODE – 26-Tones, RU Index 8

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 6 (MHz)	26 dB Bandwidth Antenna 5 (MHz)
Low	5260	21.20	20.15
Mid	5300	21.20	20.30
High	5320	21.20	20.25

LOW CHANNEL



MID CHANNEL

