



TEST REPORT

Report Number. : 13619076-E4V3

Applicant : DISH TECHNOLOGIES LLC
90 INVERNESS CIRCLE EAST
ENGLEWOOD, CO 80112, UNITED STATES

Model : D45

Brand : DISH

FCC ID : DKNRW33

EUT Description : TV SET TOP BOX

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

Date Of Issue:

June 07, 2021

Prepared by:

UL VERIFICATION SERVICES

47173 Benicia Street

Fremont, CA 94538 U.S.A.

TEL: (510) 319-4000

FAX: (510) 661-0888



NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	4/26/2021	Initial Issue	---
V2	5/17/2021	Switched above 1G front and back photos to address TCB's questions. Updated Section 9.4 wordings on the result tables. Updated Section 9.4.11 and 9.4.12 antenna gain.	Tina Chu
V3	6/7/2021	Updated Section 6.3 to address TCB's question	Tina Chu

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	11
6.4. SOFTWARE AND FIRMWARE.....	11
6.5. WORST-CASE CONFIGURATION AND MODE.....	12
6.6. DESCRIPTION OF TEST SETUP.....	13
7. MEASUREMENT METHOD.....	17
8. TEST AND MEASUREMENT EQUIPMENT	18
9. ANTENNA PORT TEST RESULTS	19
9.1. ON TIME AND DUTY CYCLE.....	19
9.2. 26 dB BANDWIDTH.....	21
9.2.1. 802.11n HT20 MODE IN THE 5.2 GHz BAND	22
9.2.2. 802.11n HT40 MODE IN THE 5.2 GHz BAND	25
9.2.3. 802.11ac VHT80 MODE IN THE 5.2 GHz BAND	27
9.2.4. 802.11n HT20 MODE IN THE 5.3 GHz BAND	28
9.2.5. 802.11n HT40 MODE IN THE 5.3 GHz BAND	31
9.2.6. 802.11ac VHT80 MODE IN THE 5.3 GHz BAND	33
9.2.7. 802.11n HT20 MODE IN THE 5.6 GHz BAND	34
9.2.8. 802.11n HT40 MODE IN THE 5.6 GHz BAND	38
9.2.9. 802.11ac VHT80 MODE IN THE 5.6 GHz BAND	42

9.2.10.	802.11n HT20 MODE IN THE 5.8 GHz BAND	45
9.2.11.	802.11n HT40 MODE IN THE 5.8 GHz BAND	48
9.2.12.	802.11ac VHT80 MODE IN THE 5.8 GHz BAND	50
9.3.	6 dB BANDWIDTH.....	51
9.3.1.	802.11n HT20 MODE IN THE 5.8 GHz BAND	52
9.3.2.	802.11n HT40 MODE IN THE 5.8 GHz BAND	56
9.3.3.	802.11ac VHT80 MODE IN THE 5.8 GHz BAND	59
9.4.	OUTPUT POWER AND PSD.....	61
9.4.1.	802.11n HT20 MODE IN THE 5.2 GHz BAND	63
9.4.2.	802.11n HT40 MODE IN THE 5.2 GHz BAND	67
9.4.3.	802.11ac VHT80 MODE IN THE 5.2 GHz BAND	70
9.4.4.	802.11n HT20 MODE IN THE 5.3 GHz BAND	72
9.4.5.	802.11n HT40 MODE IN THE 5.3 GHz BAND	76
9.4.6.	802.11ac VHT80 MODE IN THE 5.3 GHz BAND	79
9.4.7.	802.11n HT20 MODE IN THE 5.6 GHz BAND	81
9.4.8.	802.11n HT40 MODE IN THE 5.6 GHz BAND	86
9.4.9.	802.11ac VHT80 MODE IN THE 5.6 GHz BAND	91
9.4.10.	802.11n HT20 MODE IN THE 5.8 GHz BAND	95
9.4.11.	802.11n HT40 MODE IN THE 5.8 GHz BAND	99
9.4.12.	802.11ac VHT80 MODE IN THE 5.8 GHz BAND	102
10.	RADIATED TEST RESULTS.....	104
10.1.	TRANSMITTER ABOVE 1 GHz.....	106
10.1.1.	TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND.....	106
10.1.2.	TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND.....	114
10.1.3.	TX ABOVE 1 GHz 802.11ac VHT80 MODE IN THE 5.2 GHz BAND	120
10.1.4.	TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND.....	124
10.1.5.	TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND.....	132
10.1.6.	TX ABOVE 1 GHz 802.11ac VHT80 MODE IN THE 5.3 GHz BAND	138
10.1.7.	TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.6 GHz BAND.....	142
10.1.8.	TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.6 GHz BAND.....	154
10.1.9.	TX ABOVE 1 GHz 802.11ac VHT80 MODE IN THE 5.6 GHz BAND	166
10.1.10.	TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.8 GHz BAND.....	176
10.1.11.	TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.8 GHz BAND.....	186
10.1.12.	TX ABOVE 1 GHz 802.11ac VHT80 MODE IN THE 5.8 GHz BAND	194
10.2.	WORST CASE BELOW 30MHZ.....	200
10.3.	WORST CASE BELOW 1 GHZ.....	202
10.4.	WORST CASE 18-26 GHZ.....	204
10.5.	WORST CASE 26-40 GHZ.....	206
10.6.	SPURIOUS EMISSIONS FOR CO-LOCATION.....	208
11.	AC POWER LINE CONDUCTED EMISSIONS.....	211
12.	SETUP PHOTOS.....	214

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: DISH TECHNOLOGIES LLC
90 INVERNESS CIRCLE EAST
ENGLEWOOD, CO 80112, UNITED STATES

EUT DESCRIPTION: TV SET TOP BOX

MODEL: D45

BRAND: DISH

SERIAL NUMBER: CONDUCTED: E4EXUH00015A
RADIATED: E4EXUH00018A

SAMPLE RECEIPT DATE: FEBRUARY 12, 2021

DATE TESTED: MARCH 04, 2021 to APRIL 22, 2021

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.

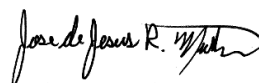
This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This 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.

Approved & Released For
UL Verification Services Inc. By:



Francisco deAnda
Staff Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Jose Martinez
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:



Tina Chu
Senior Project Engineer
Consumer Technology Division
UL Verification Services Inc.

2. TEST RESULT SUMMARY

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

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Reporting purposes only	Per ANSI C63.10, Section 12.2.
See Comment	26dB BW/99% OBW	Reporting purposes only	Per ANSI C63.10 Sections 6.9.2 and 6.9.3
15.407 (e)	6 dB BW	Complies	None.
15.407 (a) (1-3), (h) (1)	Output Power	Complies	None.
15.407 (a) (1-3)	PSD	Complies	None.
15.209, 15.205, 15.407 (b)	Radiated Emissions	Complies	None.
15.207	AC Mains Conducted Emissions	Complies	None.

Note: This report covers non-ax modes only

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,D03 v01
- FCC KDB 905462 D02 v02/D03 v01r02/D06 v02
- FCC KDB 789033 D02 v02r01,
- KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013

4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0, 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 type="checkbox"/>	Building 1: 47173 Benicia Street Fremont, CA 94538, U.S.A	US0104	2324A	208313
<input type="checkbox"/>	Building 2: 47266 Benicia Street Fremont, CA 94538, U.S.A	US0104	22541	208313
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd Fremont, CA 94538, U.S.A	US0104	2324B	208313

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	U _{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.84 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB

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

5.4. 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.

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

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a TV Set Top Box with RF4CE Zigbee, BLE (2Mbps), BT and 5GHz 802.11a/n/ac/ax radios.

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, 3TX			
5180-5240	802.11n HT20 CDD	19.86	96.83
5190-5230	802.11n HT40 CDD	20.40	109.65
5210	802.11ac VHT80 CDD	19.06	80.54

5.3 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.3 GHz band, 3TX			
5260 - 5320	802.11n HT20 CDD	18.51	70.96
5270 - 5310	802.11n HT40 CDD	18.93	78.16
5290	802.11ac VHT80 CDD	19.31	85.31

5.6 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.6 GHz band, 3TX			
5500-5720	802.11n HT20 CDD	19.58	90.78
5510-5710	802.11n HT40 CDD	21.99	158.12
5530-5690	802.11ac VHT80 CDD	19.24	83.95

5.8 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.8 GHz band, 3TX			
5745-5825	802.11n HT20 CDD	24.79	301.30
5755-5795	802.11n HT40 CDD	23.97	249.46
5775	802.11ac VHT80 CDD	26.53	449.78

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

According to FCC KDB 662911 D03 v01, a measurement of directional gain of multi-antenna systems is allowed for compliance verification. Antenna gains are approved through manufacturers KDB. KDB reference can be found as part of the operational description.

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

EUT uses three antennas for 3TX MIMO operation. The radio utilizes PCB Inverted F antennas.

Frequency Band	Uncorrelated Total Gain	Correlated Total Gain
5.15 to 5.25 GHz	2.5	6.9
5.25 to 5.35 GHz	3.2	7.7
5.47 to 5.725 GHz	3.2	7.8
5.725 to 5.85 GHz	2.9	7.6

Note: Antenna 1 ↔ Chain 0, Antenna 2 ↔ Chain 1, Antenna 3 ↔ Chain 2

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was Linux with MFG Driver

The test utility software used during testing was Mtool version 3.2.1.0

6.5. 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.

For all modes, tests were performed with the EUT set at the 3Tx MIMO mode with power setting equal to SISO modes as the worst case scenario thus MIMO is representative of SISO.

The EUT can only be setup in desktop orientation; therefore, all radiated testing was performed with the EUT in desktop orientation.

802.11a mode is covered by 802.11n HT20 mode since it has the same power as HT20.

The worst-case data rate is determined to be as follows, based on input from the manufacturer of the radio;

802.11a mode: 6 Mbps
802.11n HT20mode: MCS0
802.11n HT40mode: MCS0
802.11ac VHT80 mode: MCS0

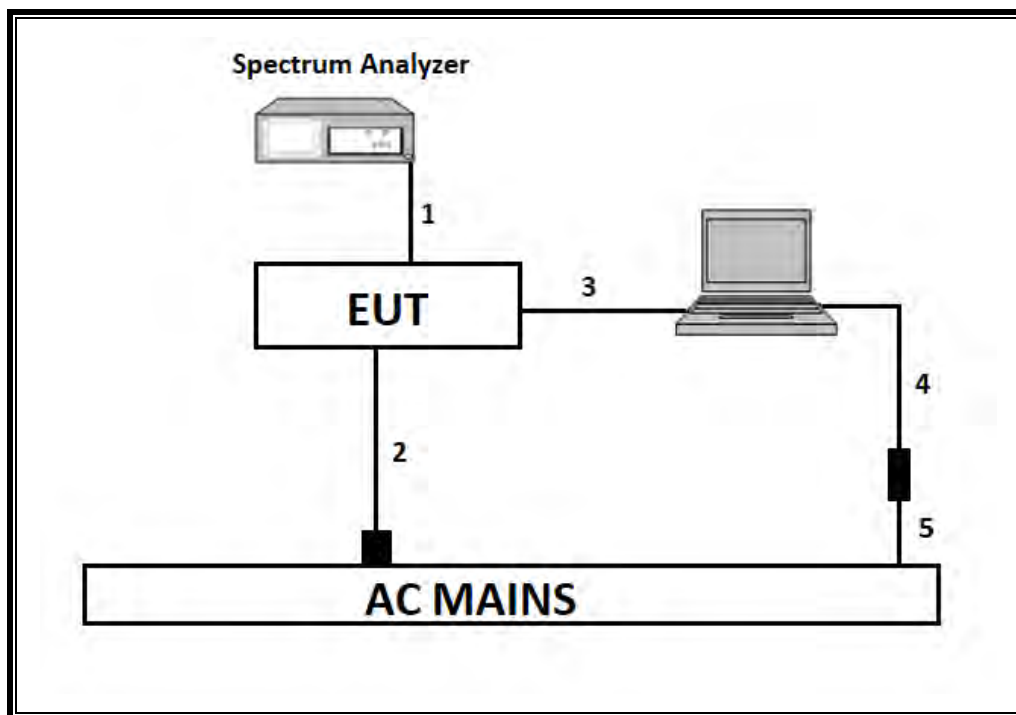
802.11ac VHT20 and VHT40 mode are different from 802.11n HT20 and HT40 only in control signals and have the same power settings.

This EUT supports BLE/BT + Zigbee + WLAN 5GHz simultaneous transmission, radiated emission test was performed, please refer to section 10.6 for results.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description	Manufacturer	Model	Serial Number	FCC ID/ DoC		
AC/DC Adapter (EUT)	NetBit	NBC25A120210VU	-	Doc		
Laptop(radiated test)	HP	EliteBook 740 G1	5CG4382SLC	DoC		
AC/DC Adapte(radiated test, laptop)	DELTA ELECTRONICS	HSTNN-DA40	WDWRT0AAR7AANI	DoC		
Router -1(radiated test)	D-Link	EBR-2310	F311388010596	Doc		
AC/DC Adapter (Router, radiated test)	D-Link	AF0605-B	-	Doc		
Laptop (conducted test)	HP	Elitebook 740	5CG43730V2	DoC		
AC/DC Adapter (Laptop, conducted test)	CHICONY Power Technology	HSTNN-CA40	A045R00DH	DoC		
Router-2(conducted test)	Netgear	R6250	3DK1337V0253E	PY312400219		
AC/DC Adapter (Router, conducted test)	Netgear	AD2025F10	3321074001	Doc		
TV Emulator	Dish Technologies	-	D25-41	Doc		
Monitor	SCEPTRE	E248W-1920R	J07F248CCD8002	Doc		
AC/DC Adapter (Monitor)	BSY	BSYF120250U W	-	Doc		
USB Flash Drive	SanDisk	SDCZ60-016G	-	Doc		
I/O CABLES (CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	RF	Un-shielded	0.2	To spectrum analyzer
2	AC	1	Two Prong	Un-shielded	1	EUT to AC Mains
3	UART	1	USB	Shielded	1.5	EUT to Laptop
4	DC	1	DC	Un-shielded	1	AC Adapter to Laptop
5	AC	1	Two Prong	Un-shielded	1	AC Adapter to AC Mains
I/O CABLES (RADIATED TEST AND AC POWER LINE CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	Two Prong	Un-shielded	1	EUT to AC Mains
2	HDMI	1	HDMI	Shielded	2	EUT to Monitor/emulator
3	AC	1	Two Prong	Un-shielded	2.5	Monitor to AC Mains
4	RJ45	1	RJ45	Un-shielded	More than 3	EUT to Router
5	DC	1	AC-Two Prong	Un-shielded	2	Router adapter to AC Mains

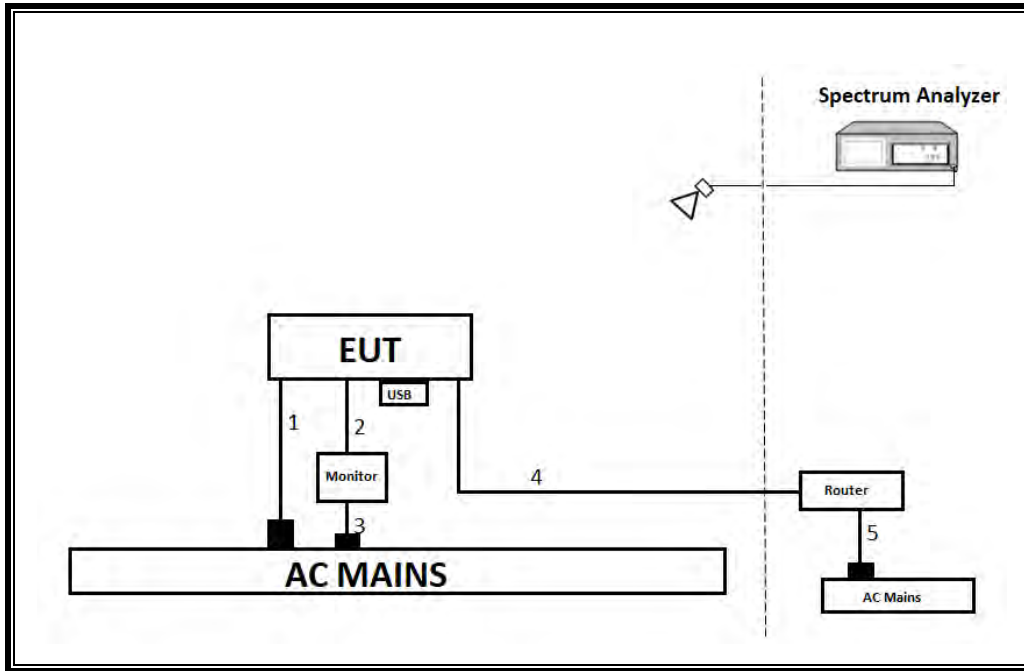
CONDUCTED TEST SETUP DIAGRAM



TEST SETUP

The EUT is connected to a test laptop by USB to UART cable adapter during the tests. Test software exercised the radio card.

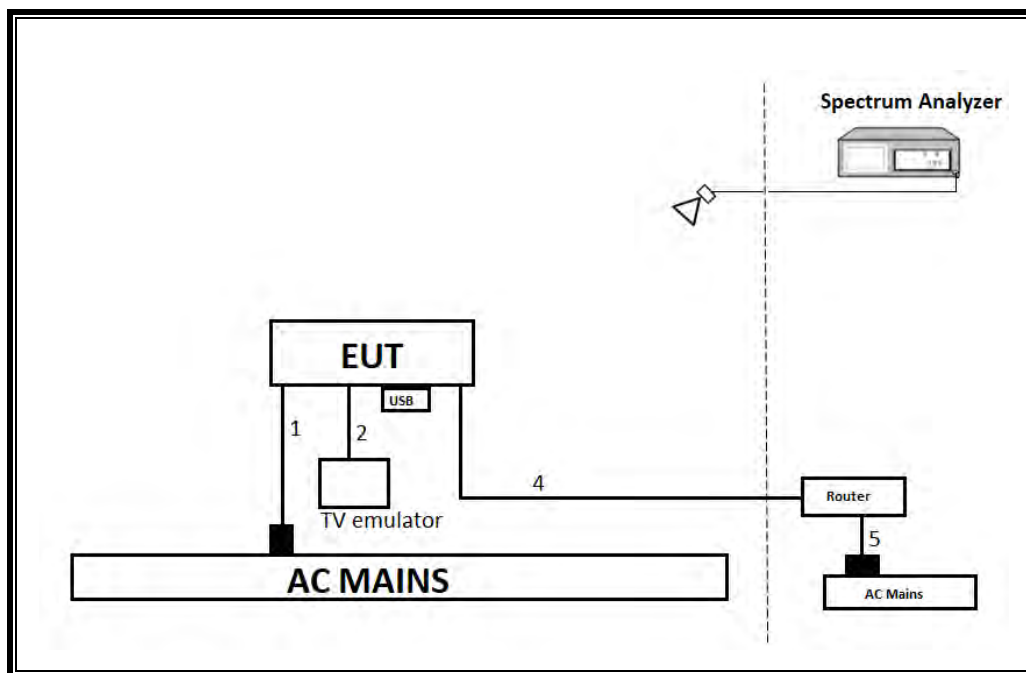
RADIATED TEST SETUP DIAGRAM- 1GHz-18GHz



TEST SETUP

The EUT is connected to a test laptop by USB to UART cable adapter during the tests. Test software exercised the radio card.

RADIATED & AC LINE TEST SETUP DIAGRAM- 30MHz to 1GHz,18GHz-40GHz



TEST SETUP

The EUT is connected to support equipment and AC powered. Test software exercised the radio card.

7. 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

Conducted Output Power: KDB 789033 D02 v02r01, Section E.3.b (Method PM-G) and KDB 789033 D02 v02r01, Section E.2.b (Method SA-1)

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

8. 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
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179522	02/19/2022	02/19/2021
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1571	08/20/2021	08/20/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	PRE0100034	09/15/2021	09/15/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179376	02/21/2022	02/21/2021
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25-S-42	T1568	04/14/2021	04/14/2020
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	T344	05/26/2021	05/26/2020
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310N	T300	03/02/2022	03/02/2021
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	PRE0184970 (174373)	12/02/2021	12/02/2020
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	PRE0179466	05/27/2021	05/27/2020
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	PRE0179468	05/27/2021	05/27/2020
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	09/24/2021	09/24/2020
Rf Amplifier, 18-26.5GHz, 60dB gain	AMPLICAL	AMP18G26.5-60	171590	01/20/2022	01/20/2021
Antenna, Horn 26.5 to 40GHz	ARA	MWH-2640/B	T446	09/24/2021	09/24/2020
Rf Amplifier, 26-40GHz, 60dB gain	AMPLICAL	AMP26G40-60	PRE0181239	06/07/2021	06/07/2020
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	T863	08/31/2021	08/31/2020
Amplifier, 100MHz-18GHz	AMPLICAL	AMP0.1G18-47-20	PRE0197319	04/08/2022	04/08/2021
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	02/21/2022	02/21/2021
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies Inc	E4446A	T123	01/22/2022	01/22/2021
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T1227	03/16/2022	03/16/2021
Power Sensor	Keysight Technologies Inc	N1911A	T1225	01/28/2022	01/28/2021
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1272	01/21/2022	01/21/2021
AC Line Conducted					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	PRE0186446	01/20/2022	01/20/2021
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2	T24	01/20/2022	10/20/2021
EMI TEST RECEIVER	Rohde & Schwarz	ESR	T1436	02/19/2022	02/19/2021
Transient Limiter	COM-POWER	LIT-930A	T1457	01/20/2022	01/20/2021
Test Software List					
Description	Manufacturer	Model	Version		
Radiated Software	UL	UL EMC	Rev 9.5, April 30, 2020, Oct 21, 2019		
Antenna Port Software	UL	UL RF	AP 2021.1.19/4.1/4.9, AP 2021.3.16		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, July 07, 2020		

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

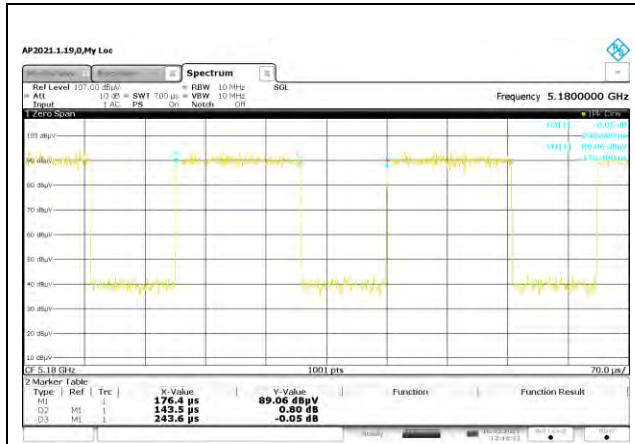
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

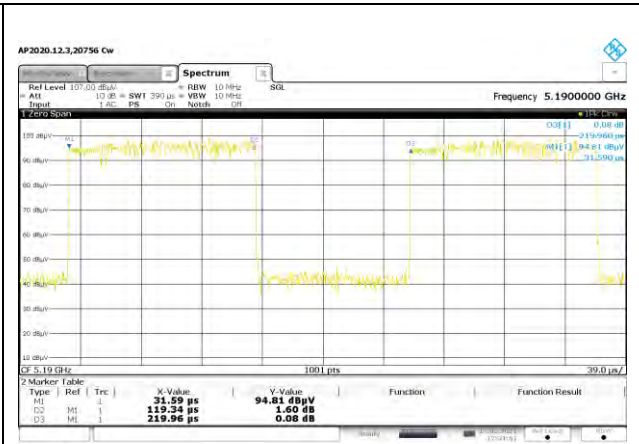
ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11n HT20 CDD	0.144	0.244	0.589	58.91	2.30	6.969
802.11n HT40 CDD	0.1193	0.2200	0.543	54.26	2.66	8.379
802.11ac VHT80 1TX	0.120	0.150	0.801	80.11	0.96	8.335

DUTY CYCLE PLOTS



13:44:44 16.03.2021
 DUTY CYCLE 802.11n HT20 CDD MODE



17:31:51 17.03.2021
 DUTY CYCLE 802.11n HT40 CDD MODE



21:22:38 17.03.2021
 DUTY CYCLE 802.11ac VHT80 CDD MODE

9.2. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

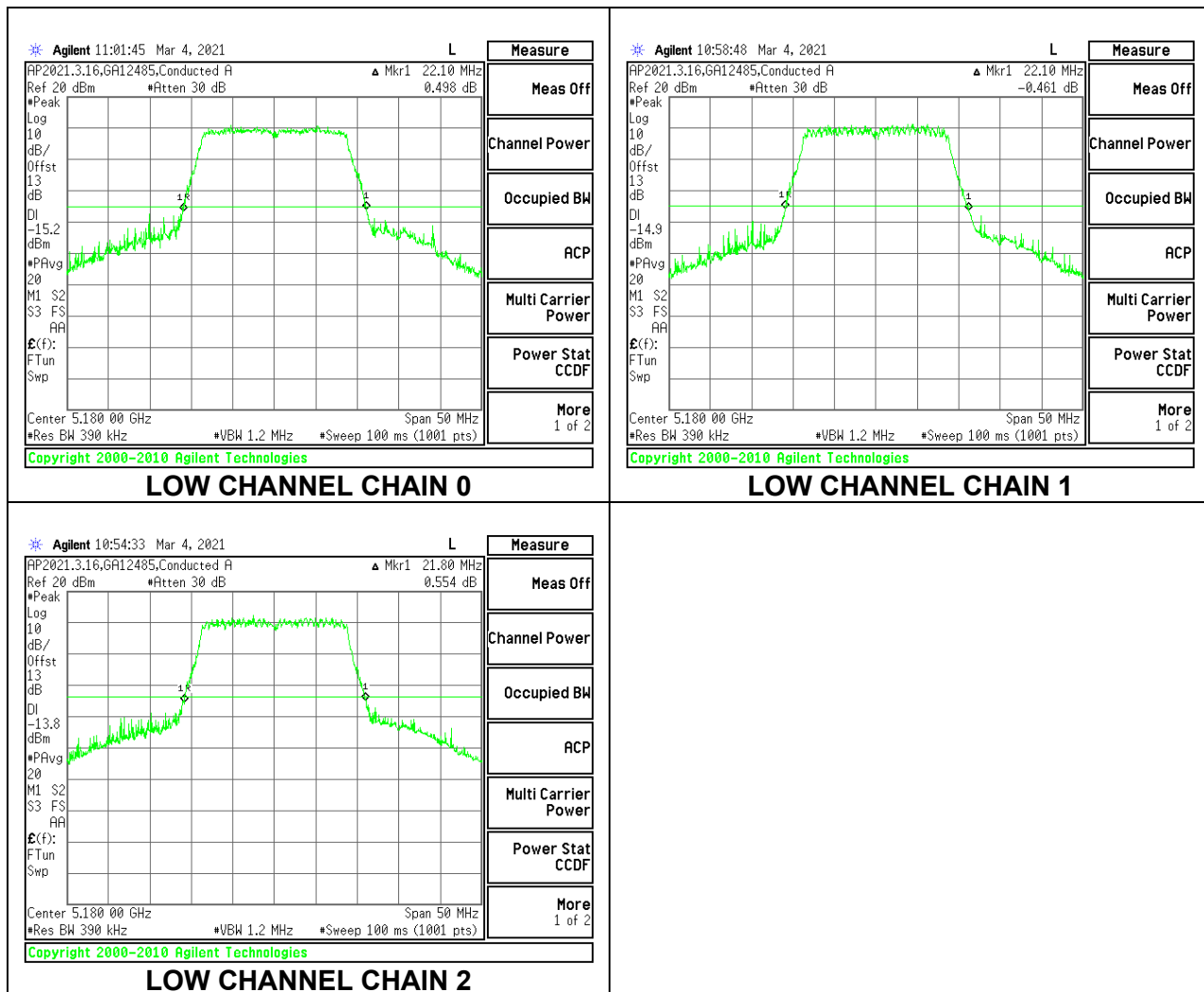
RESULTS

9.2.1. 802.11n HT20 MODE IN THE 5.2 GHz BAND

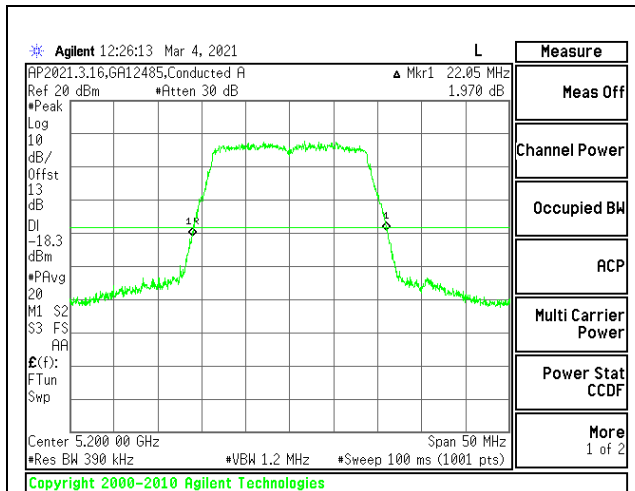
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Low	5180	22.10	22.10	21.80
Mid	5200	22.05	22.00	22.00
High	5240	22.10	21.80	21.75

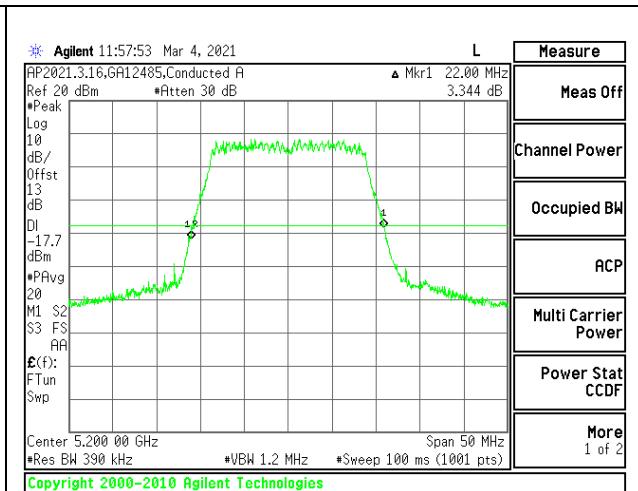
LOW CHANNEL



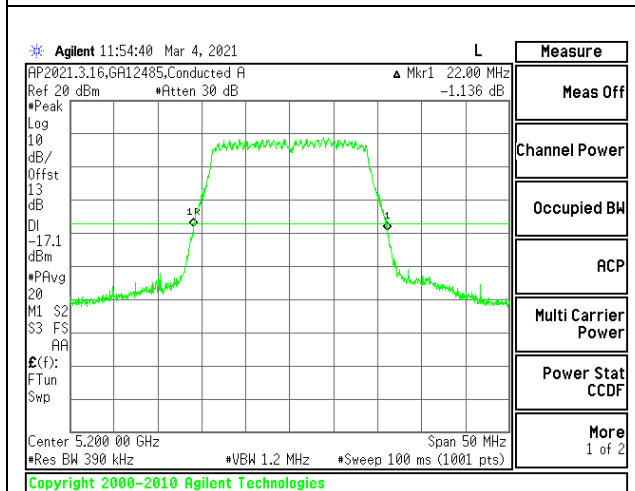
MID CHANNEL



MID CHANNEL CHAIN 0

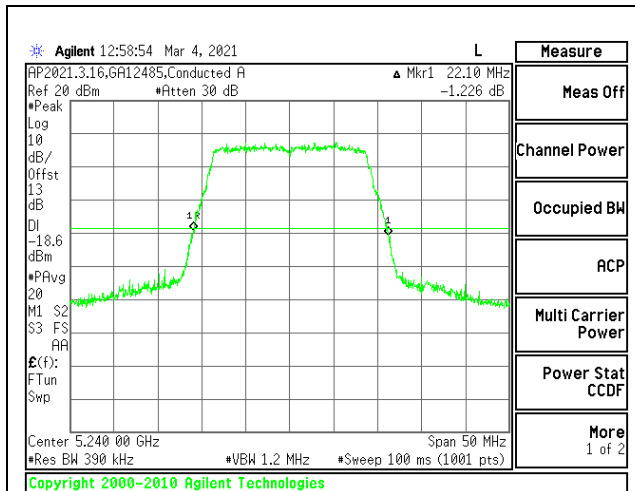


MID CHANNEL CHAIN 1

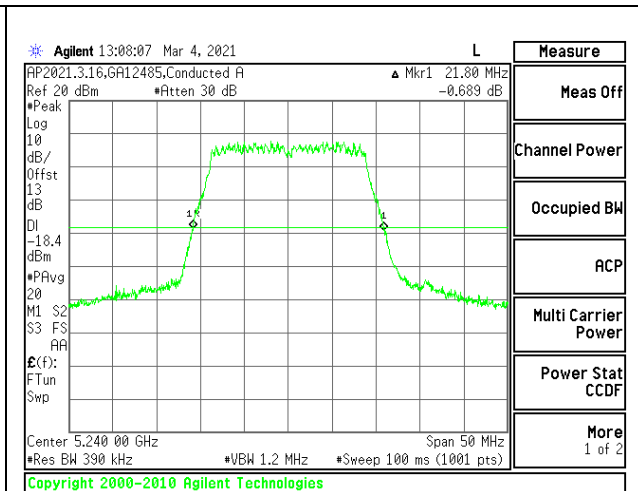


MID CHANNEL CHAIN 2

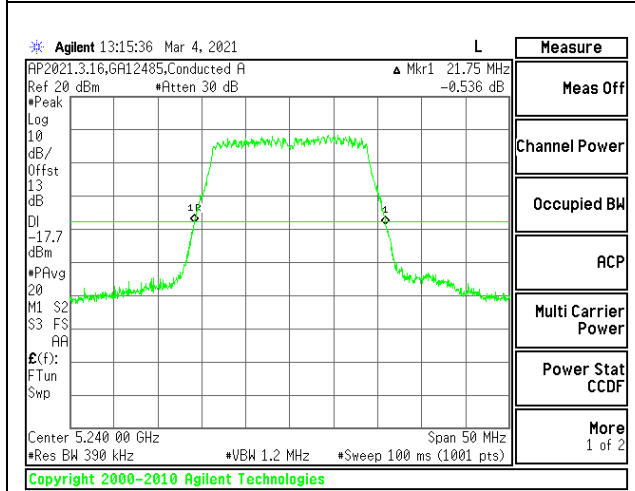
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



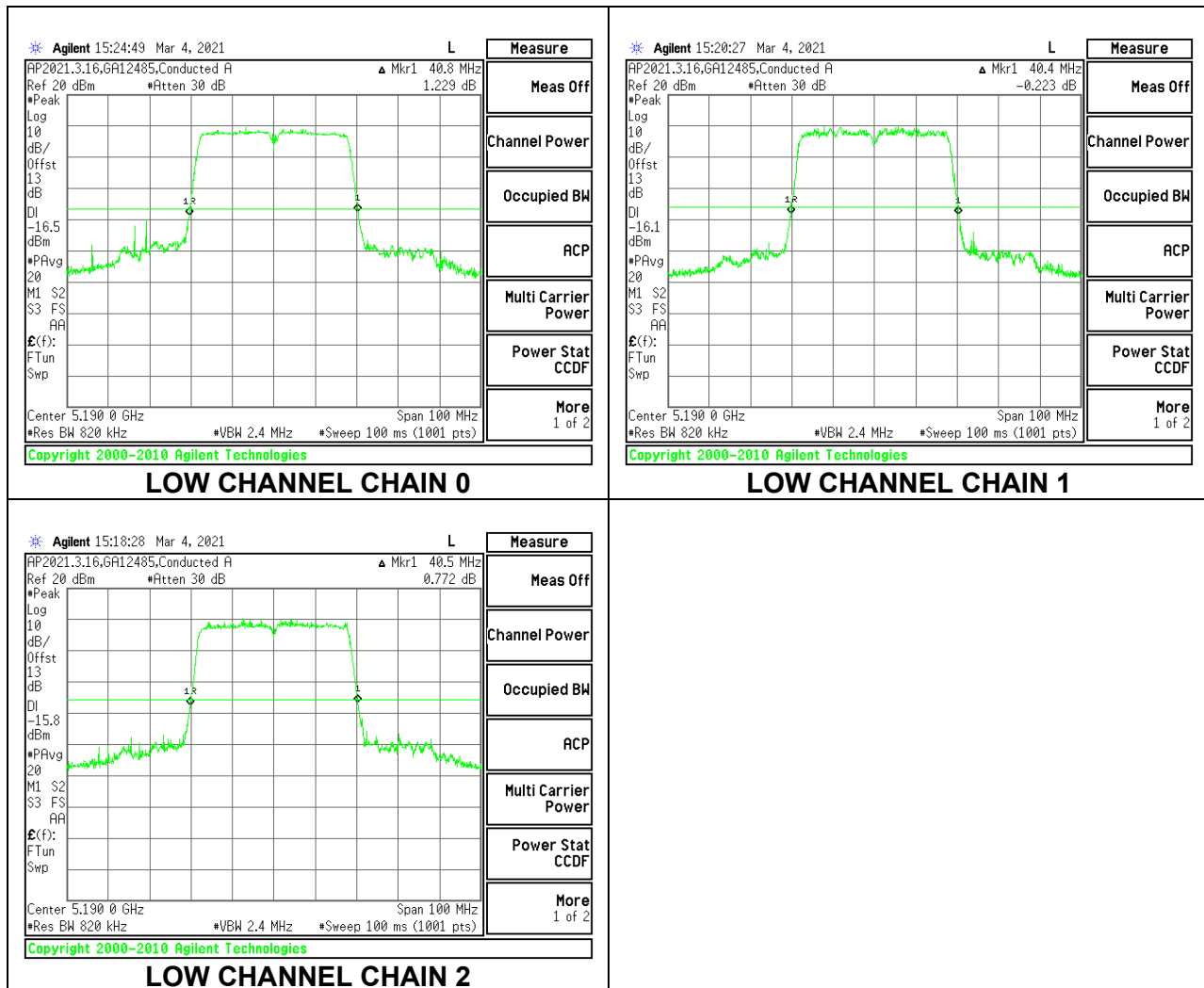
HIGH CHANNEL CHAIN 2

9.2.2. 802.11n HT40 MODE IN THE 5.2 GHz BAND

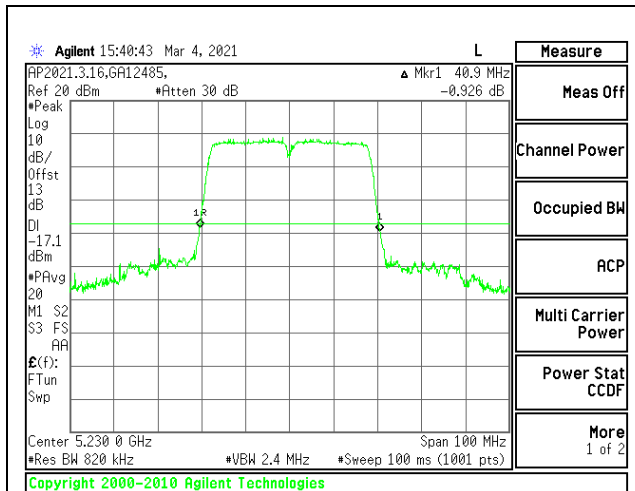
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Low	5190	40.80	40.40	40.50
High	5230	40.90	40.50	40.50

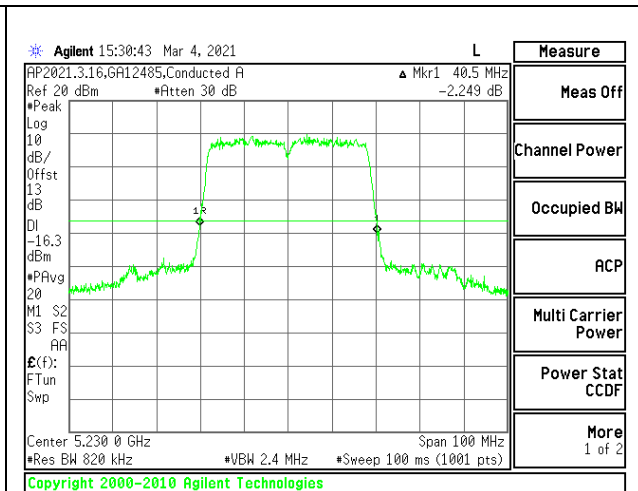
LOW CHANNEL



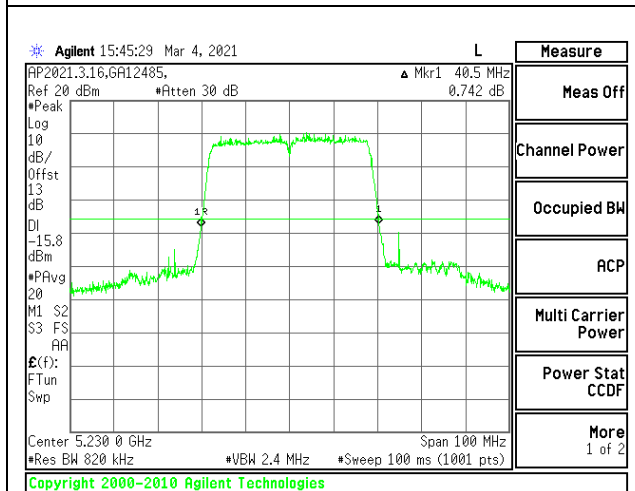
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



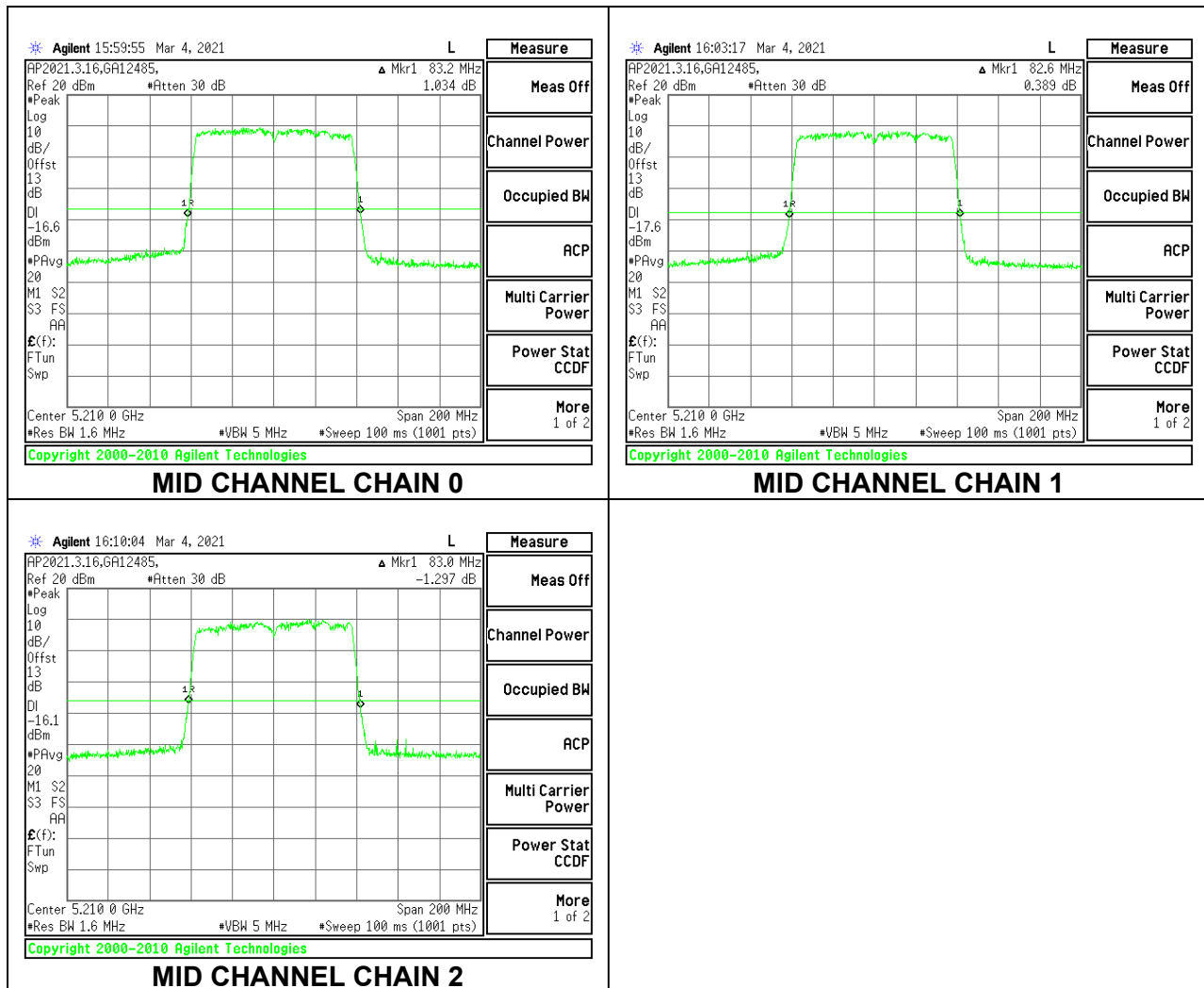
HIGH CHANNEL CHAIN 2

9.2.3. 802.11ac VHT80 MODE IN THE 5.2 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Mid	5210	83.20	82.60	83.00

MID CHANNEL

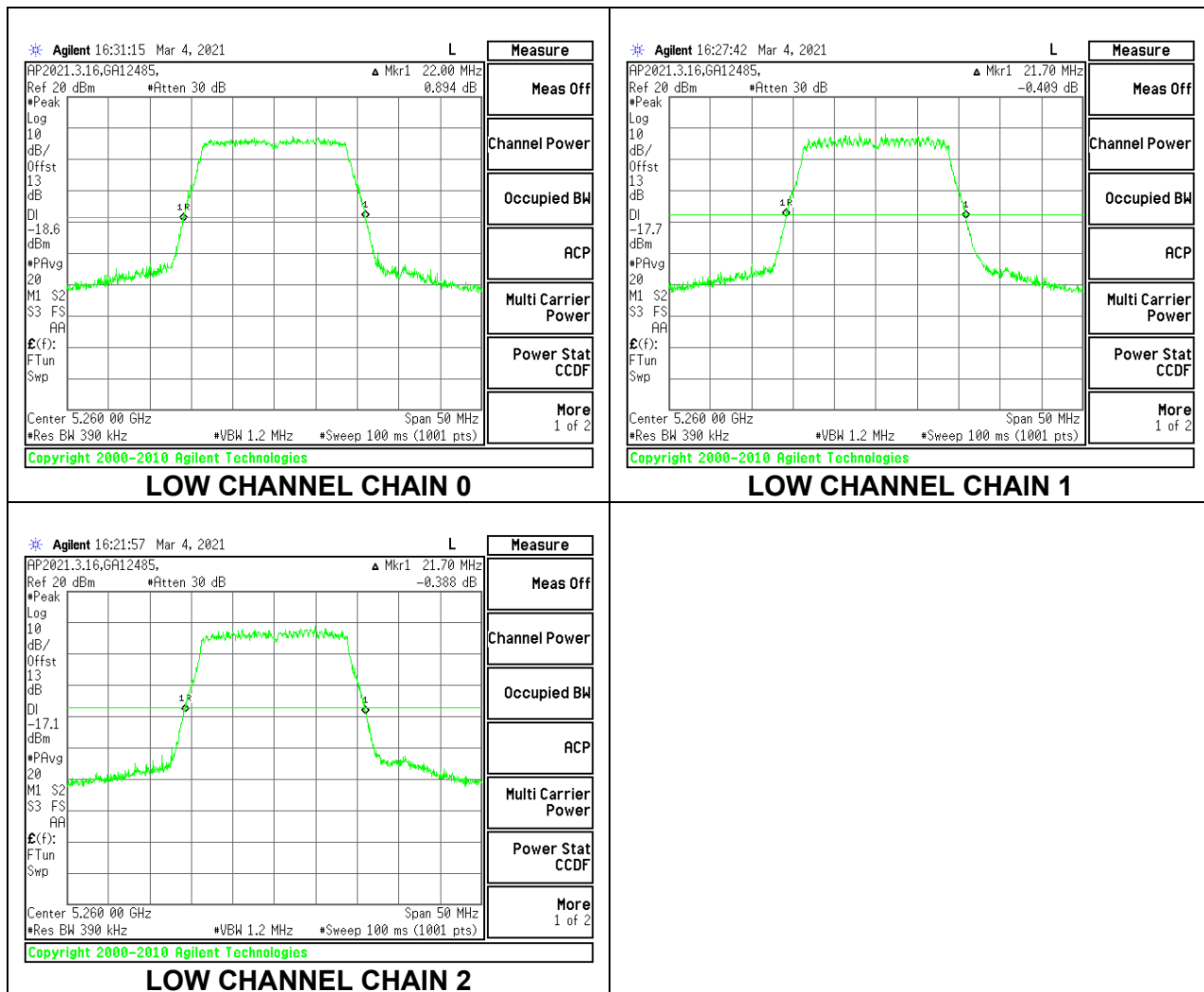


9.2.4. 802.11n HT20 MODE IN THE 5.3 GHz BAND

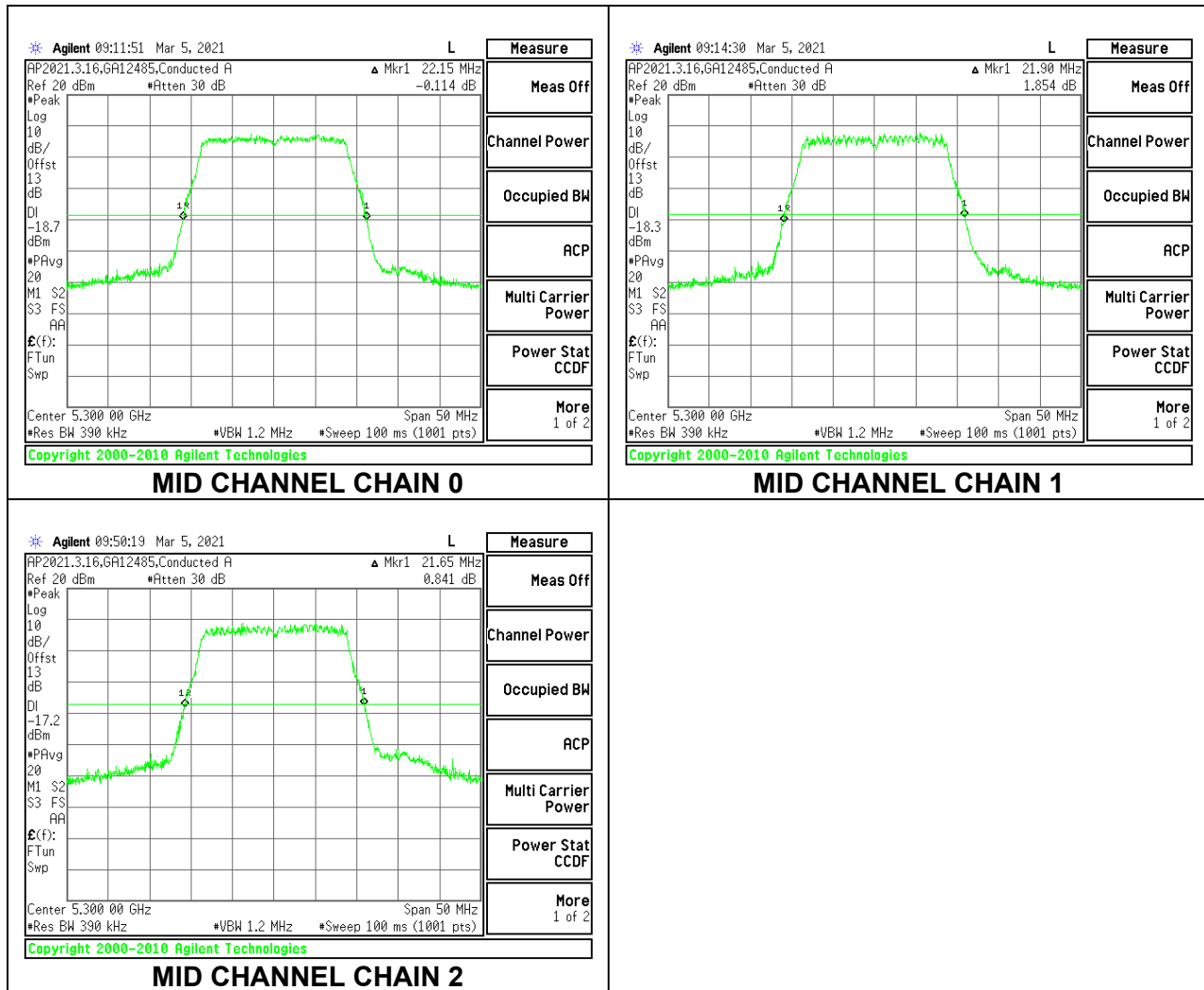
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Low	5260	22.00	21.70	21.70
Mid	5300	22.15	21.90	21.65
High	5320	22.10	21.70	21.95

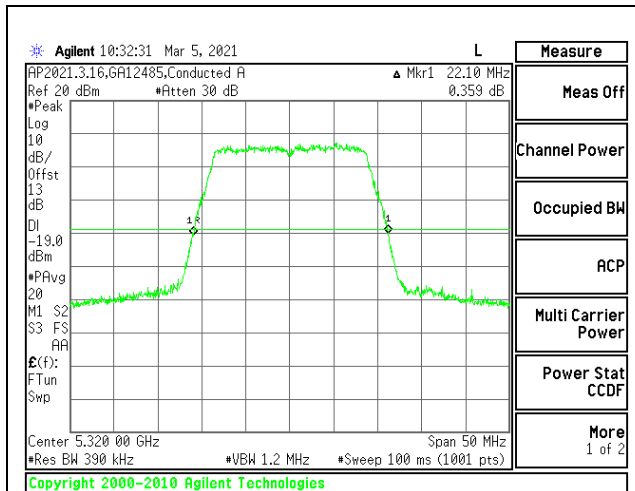
LOW CHANNEL



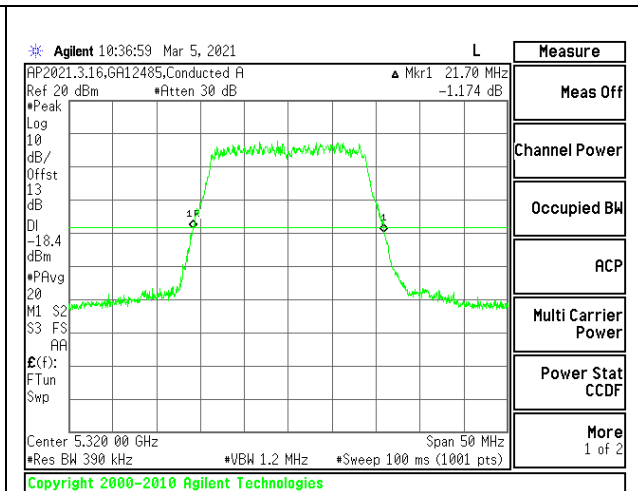
MID CHANNEL



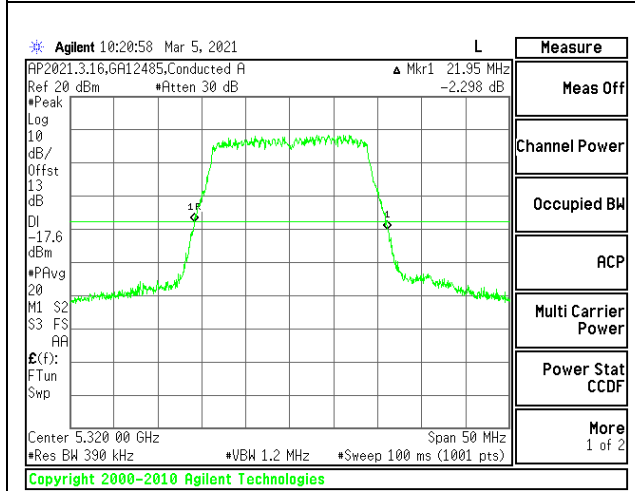
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



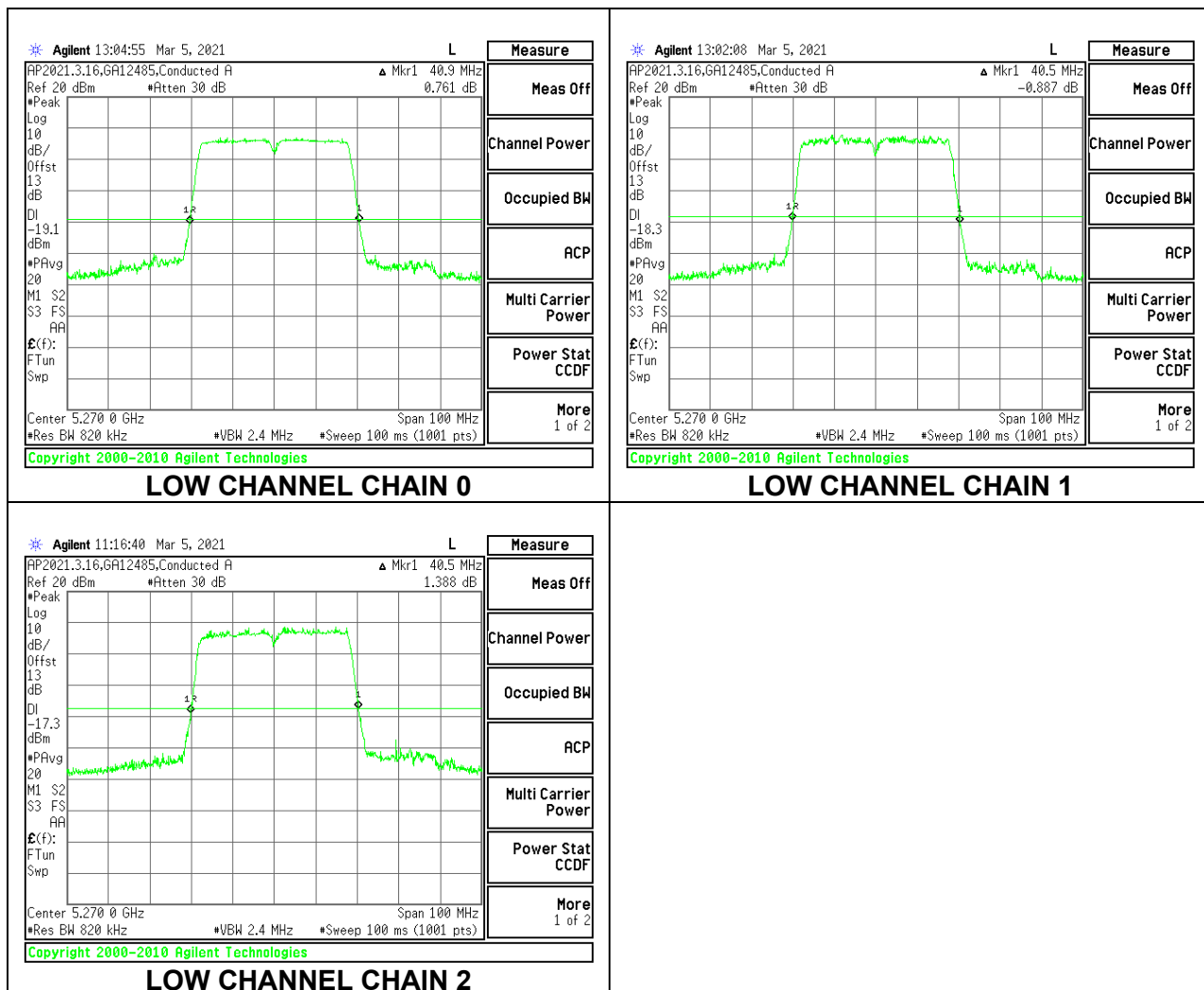
HIGH CHANNEL CHAIN 2

9.2.5. 802.11n HT40 MODE IN THE 5.3 GHz BAND

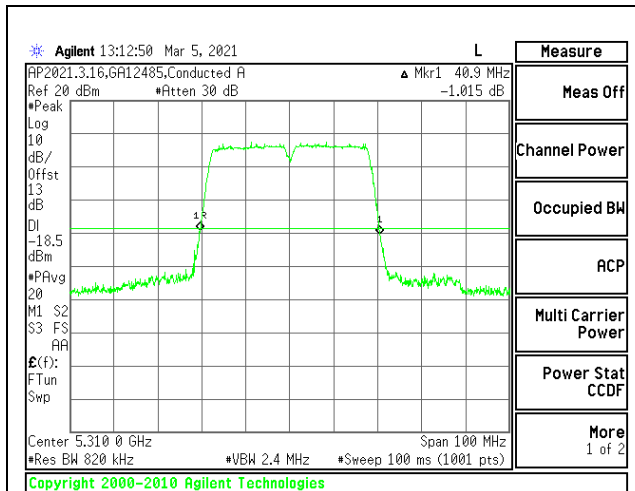
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Low	5270	40.90	40.50	40.50
High	5310	40.90	40.60	40.40

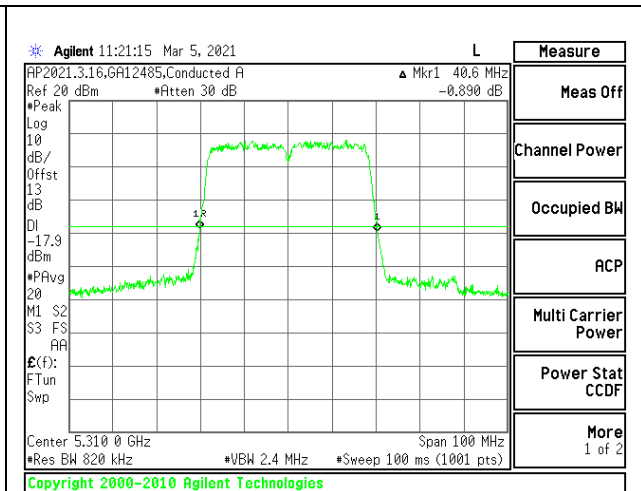
LOW CHANNEL



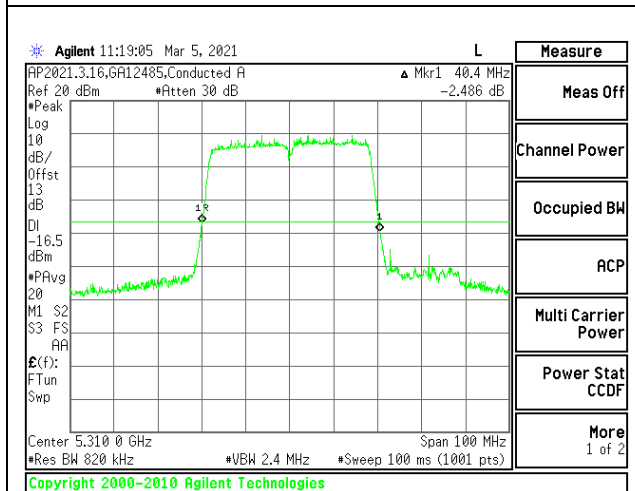
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



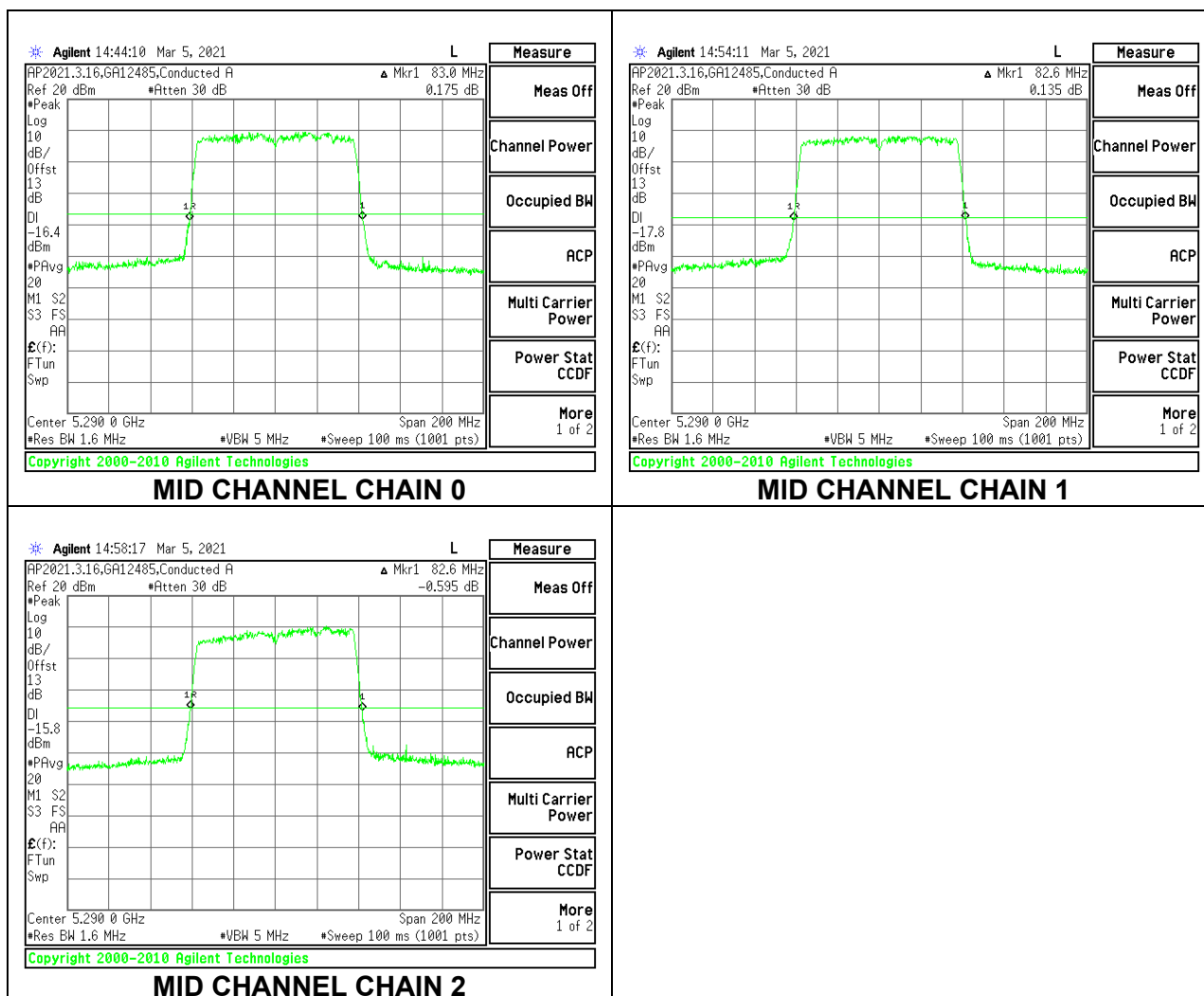
HIGH CHANNEL CHAIN 2

9.2.6. 802.11ac VHT80 MODE IN THE 5.3 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Mid	5290	83.00	82.60	82.60

MID CHANNEL

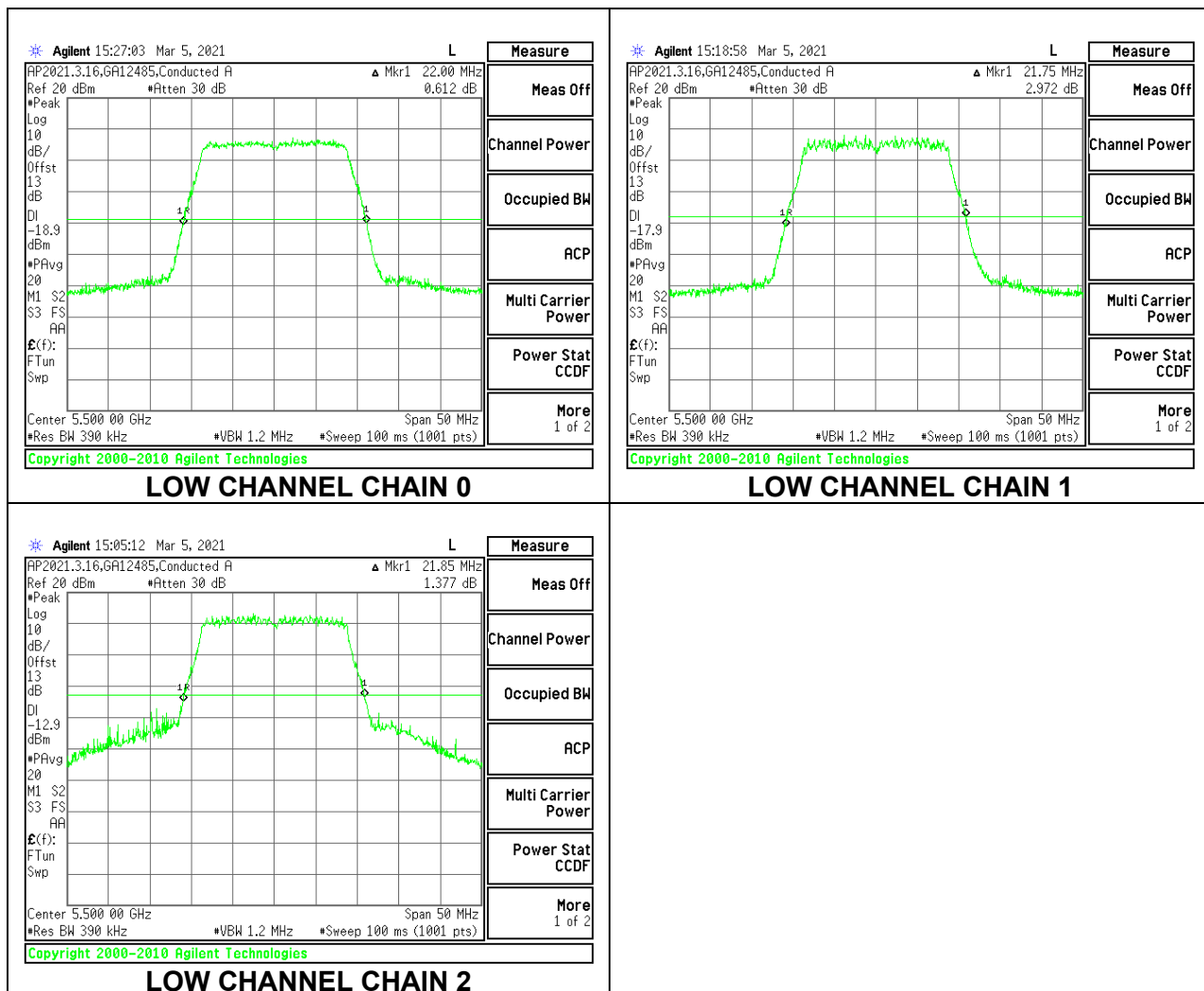


9.2.7. 802.11n HT20 MODE IN THE 5.6 GHz BAND

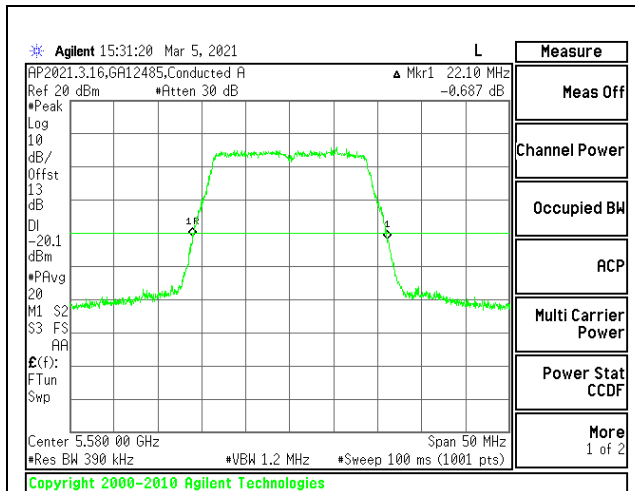
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Low	5500	22.00	21.75	21.85
Mid	5580	22.10	21.85	21.90
High	5700	22.10	21.85	21.85
144	5720	22.00	21.85	21.95

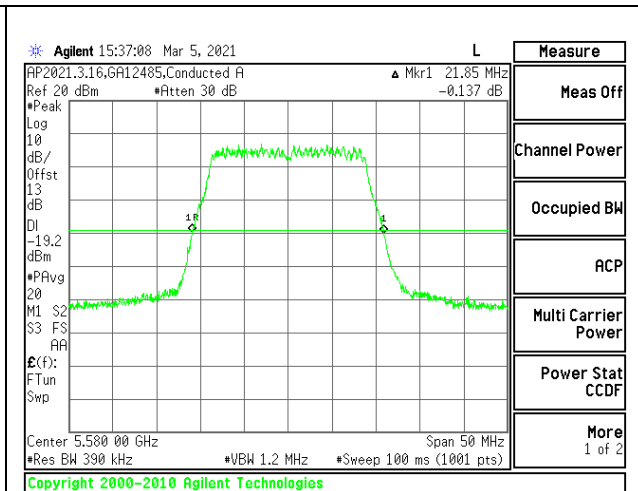
LOW CHANNEL



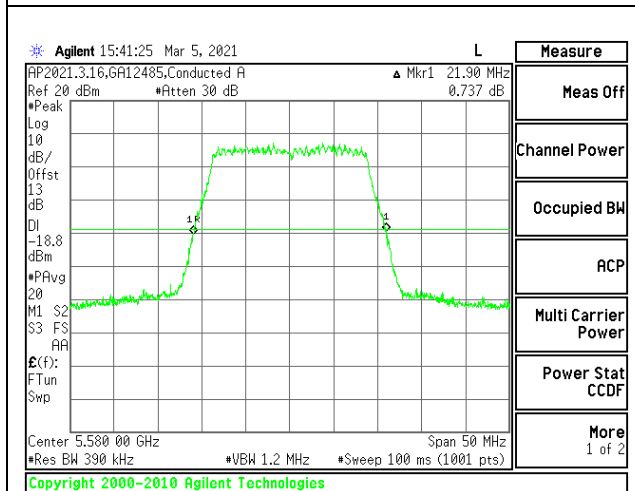
MID CHANNEL



MID CHANNEL CHAIN 0

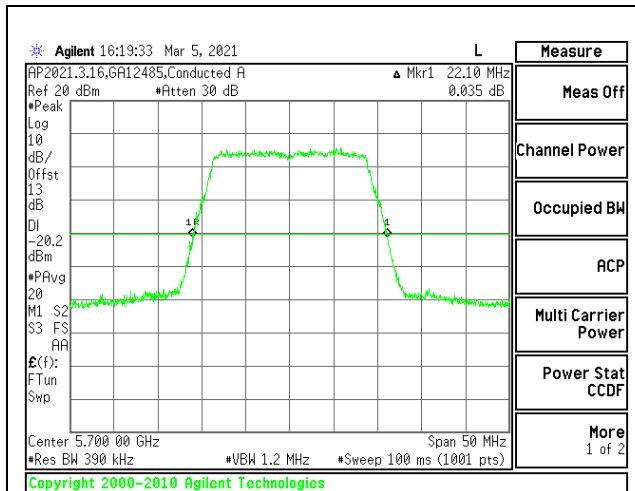


MID CHANNEL CHAIN 1

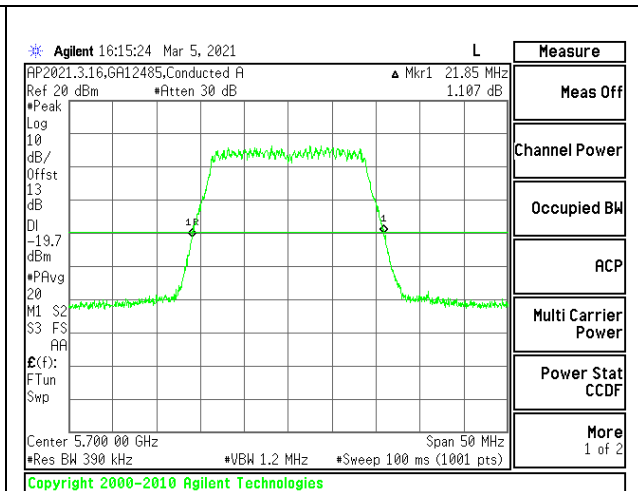


MID CHANNEL CHAIN 2

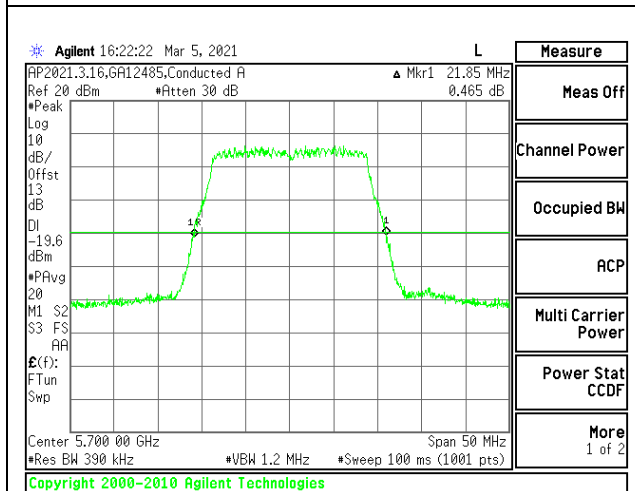
HIGH CHANNEL



HIGH CHANNEL CHAIN 0

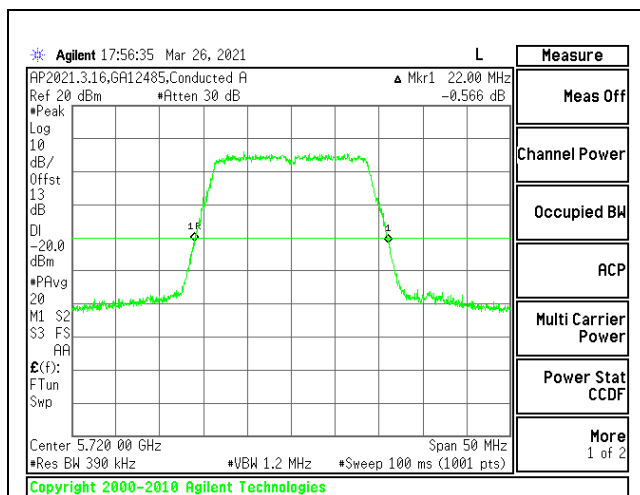


HIGH CHANNEL CHAIN 1

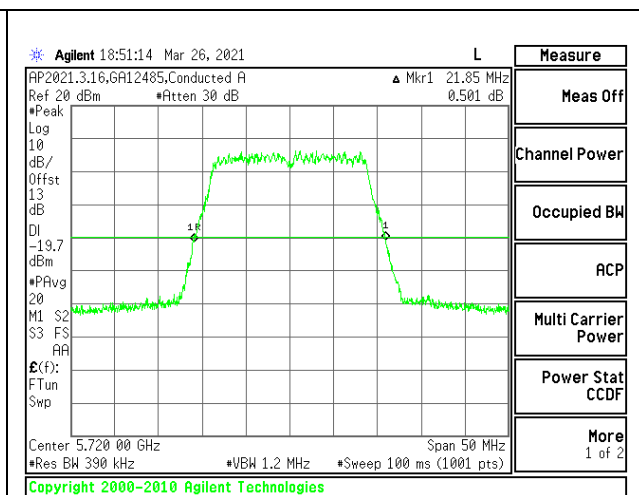


HIGH CHANNEL CHAIN 2

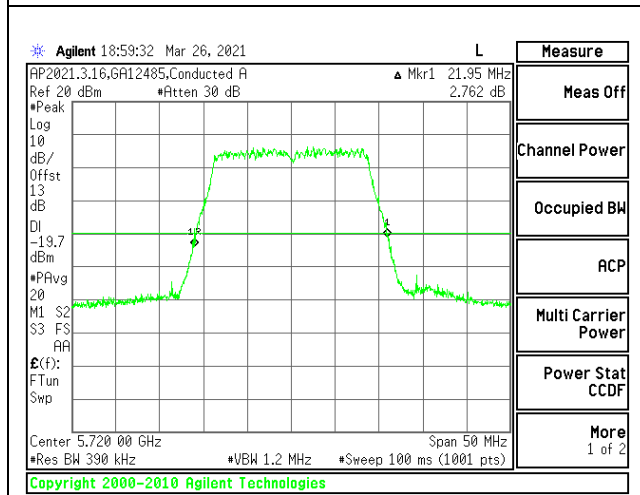
CHANNEL 144



CHANNEL 144 CHAIN 0



CHANNEL 144 CHAIN 1



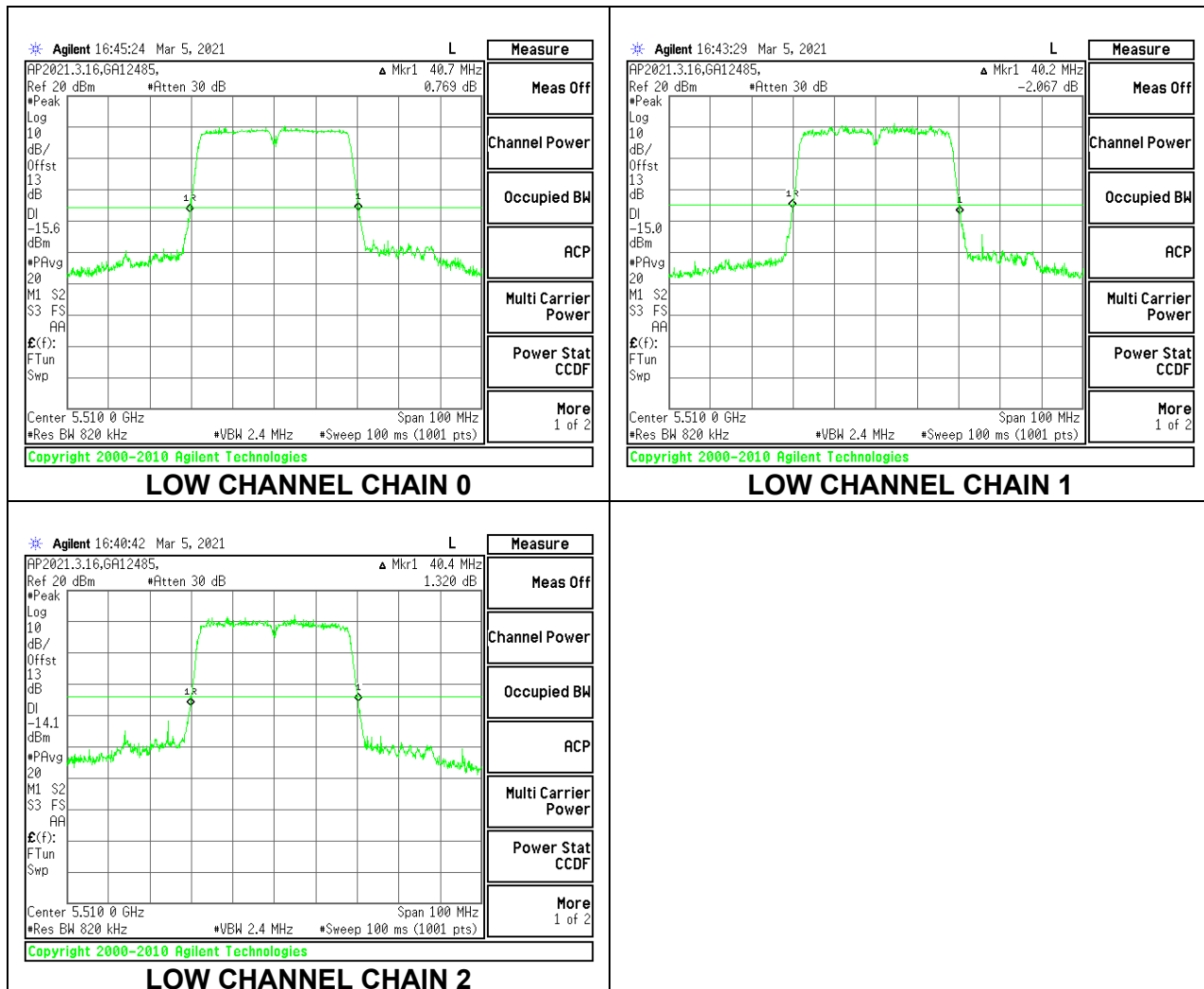
CHANNEL 144 CHAIN 2

9.2.8. 802.11n HT40 MODE IN THE 5.6 GHz BAND

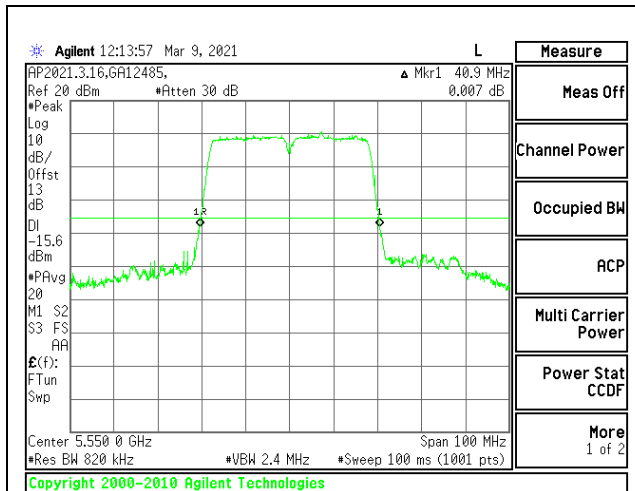
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Low	5510	40.70	40.20	40.40
Mid	5550	40.90	40.50	40.30
High	5670	40.60	40.30	40.40
142	5710	40.70	40.20	40.50

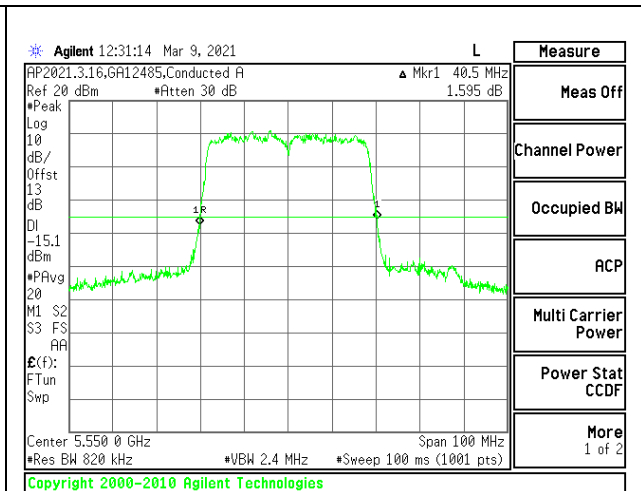
LOW CHANNEL



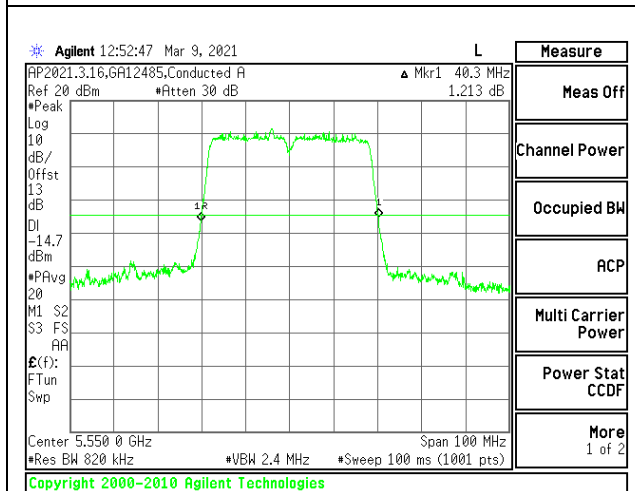
MID CHANNEL



MID CHANNEL CHAIN 0

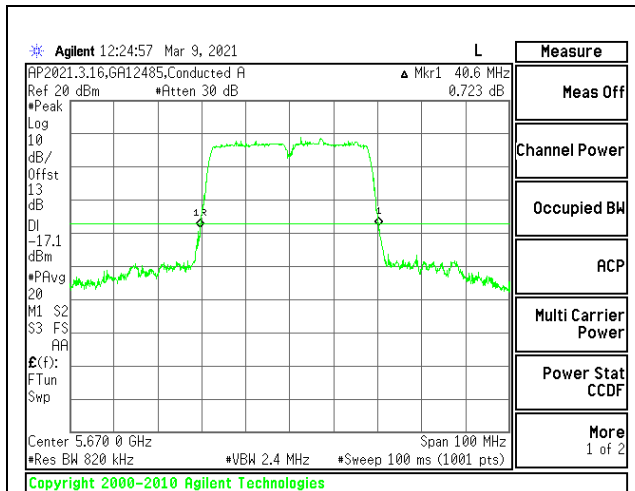


MID CHANNEL CHAIN 1

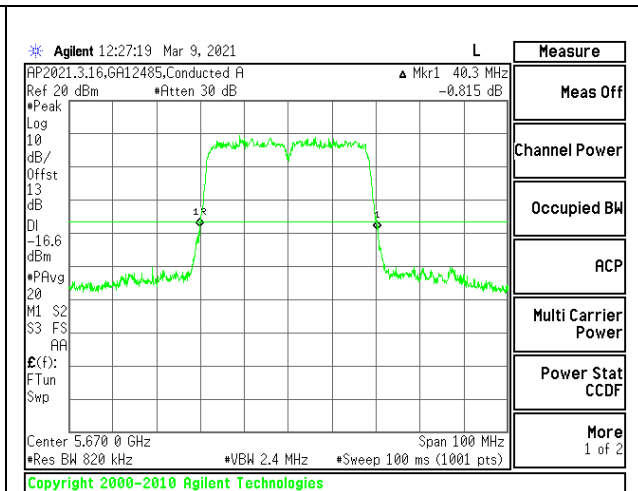


MID CHANNEL CHAIN 2

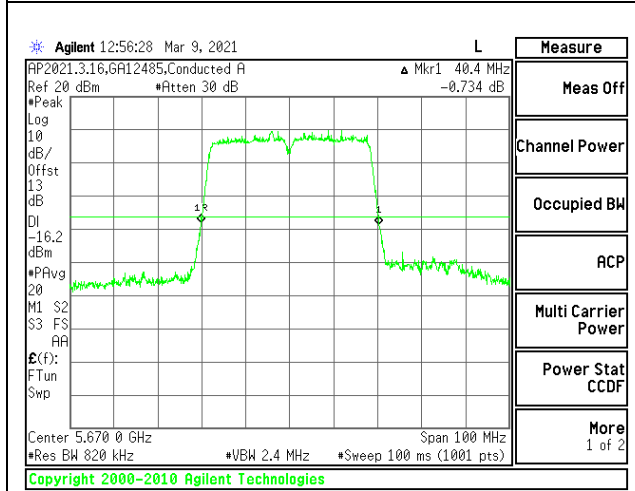
HIGH CHANNEL



HIGH CHANNEL CHAIN 0

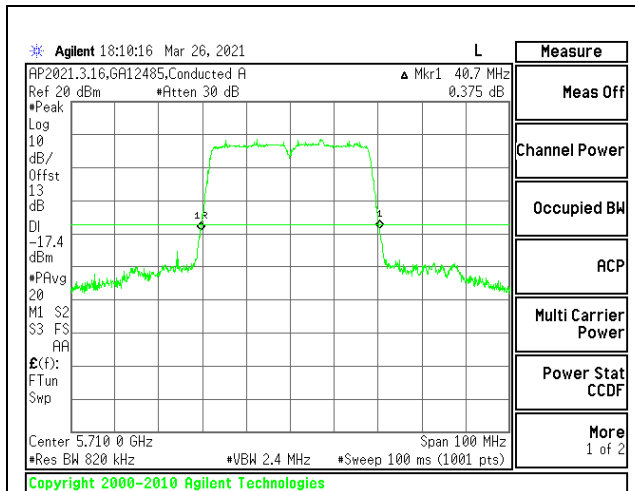


HIGH CHANNEL CHAIN 1

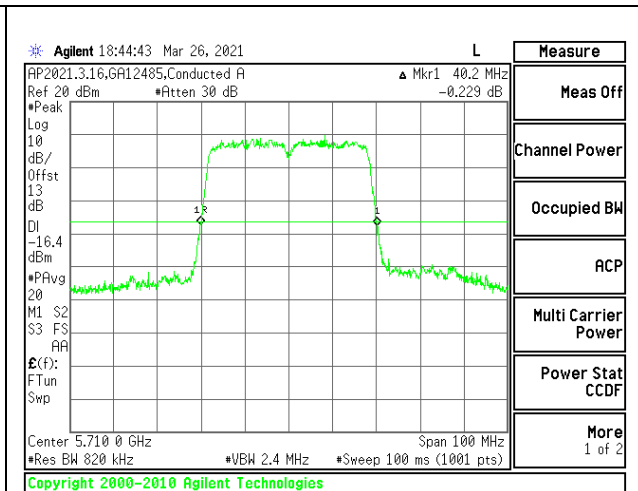


HIGH CHANNEL CHAIN 2

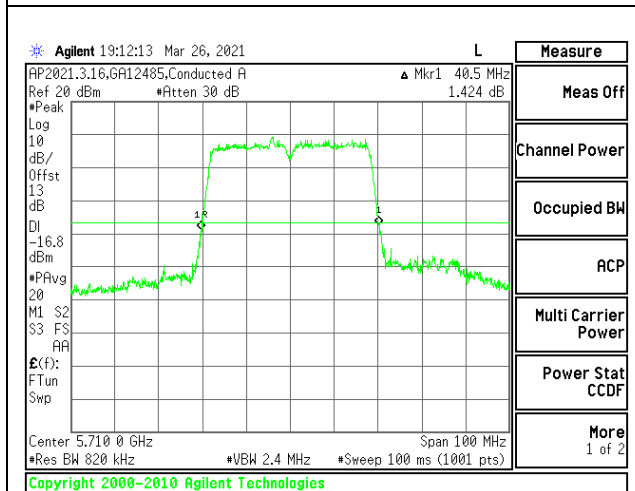
CHANNEL 142



CHANNEL 142 CHAIN 0



CHANNEL 142 CHAIN 1



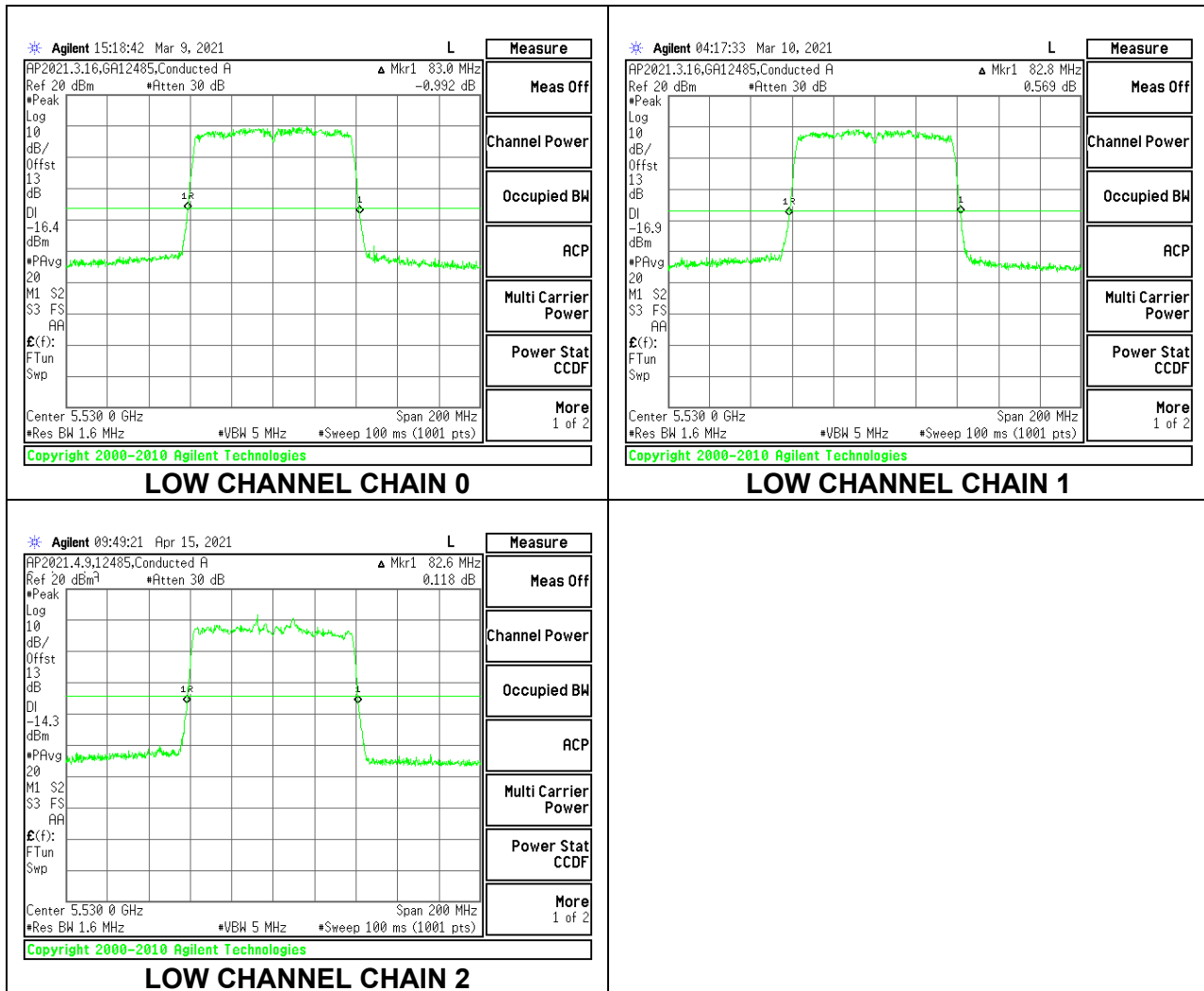
CHANNEL 142 CHAIN 2

9.2.9. 802.11ac VHT80 MODE IN THE 5.6 GHz BAND

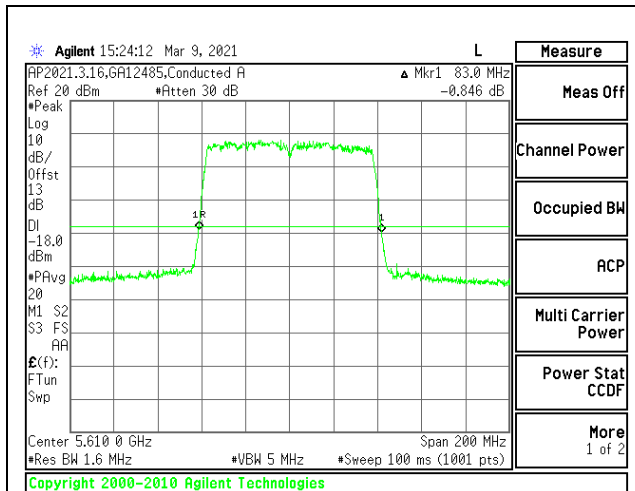
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Low	5530	83.00	82.80	82.60
High	5610	83.00	82.80	82.80
138	5690	83.00	83.00	82.80

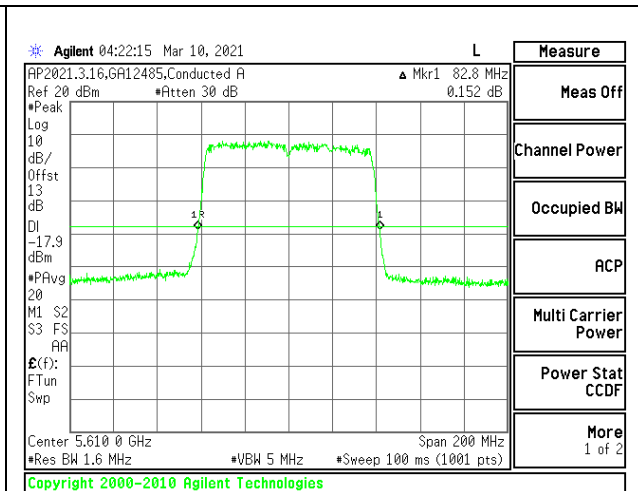
LOW CHANNEL



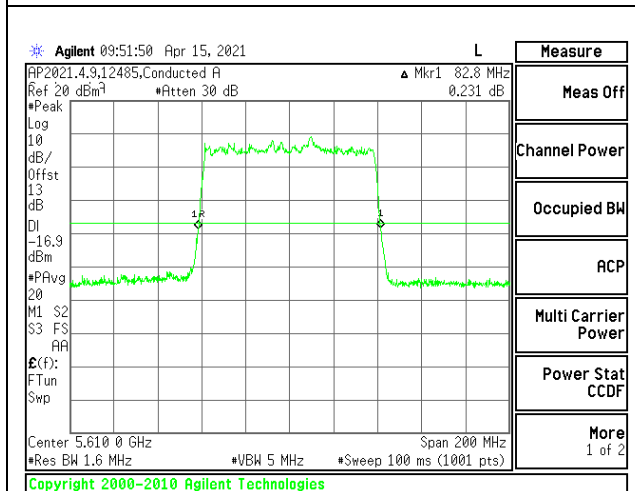
HIGH CHANNEL



HIGH CHANNEL CHAIN 0

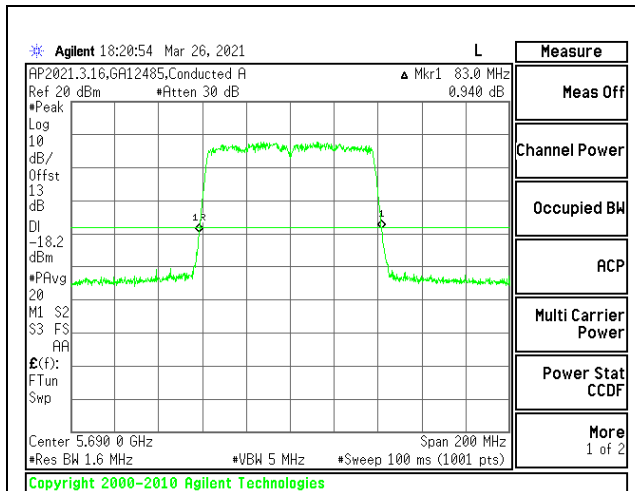


HIGH CHANNEL CHAIN 1

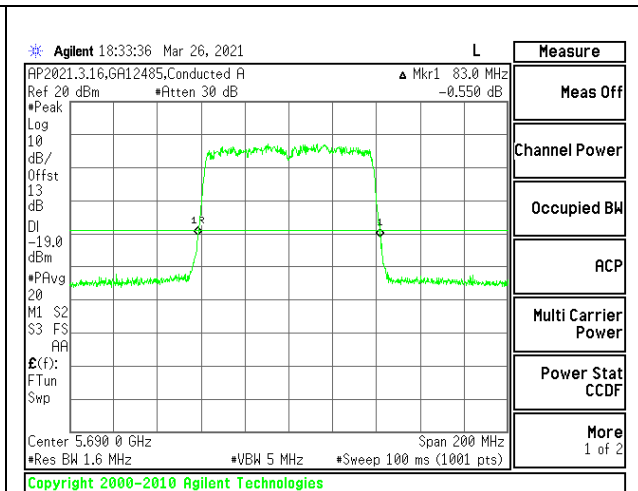


HIGH CHANNEL CHAIN 2

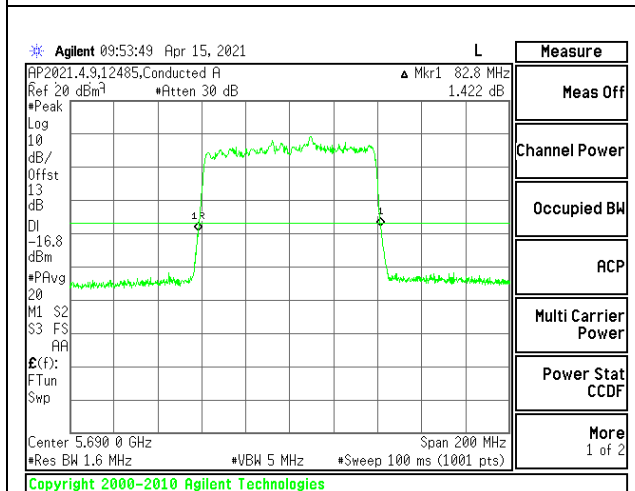
CHANNEL 138



CHANNEL 138 CHAIN 0



CHANNEL 138 CHAIN 1



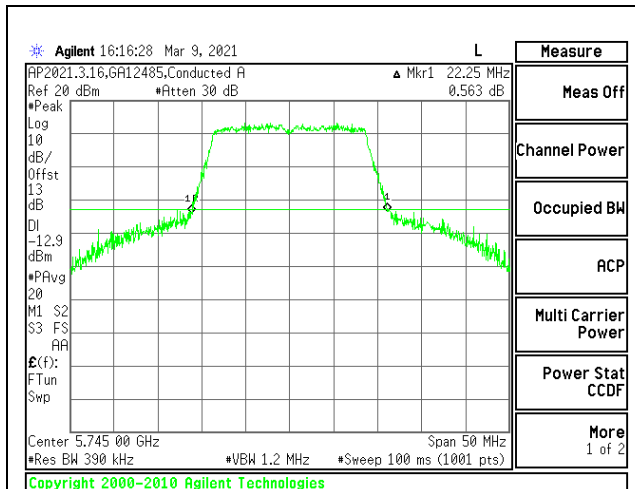
CHANNEL 138 CHAIN 2

9.2.10. 802.11n HT20 MODE IN THE 5.8 GHz BAND

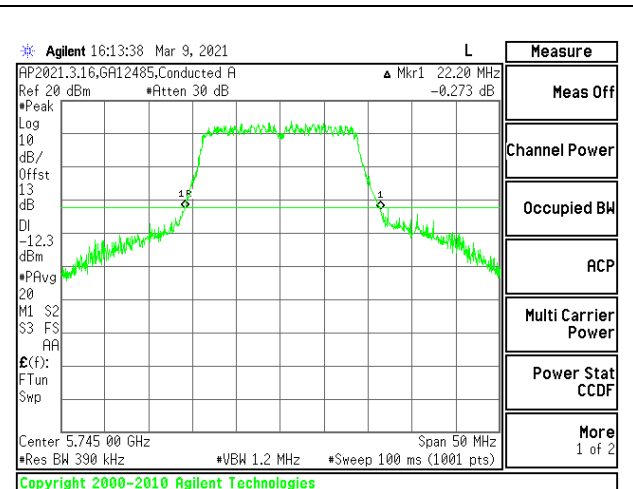
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Low	5745	22.25	22.20	23.85
Mid	5785	23.30	22.60	23.35
High	5825	25.75	23.00	24.45

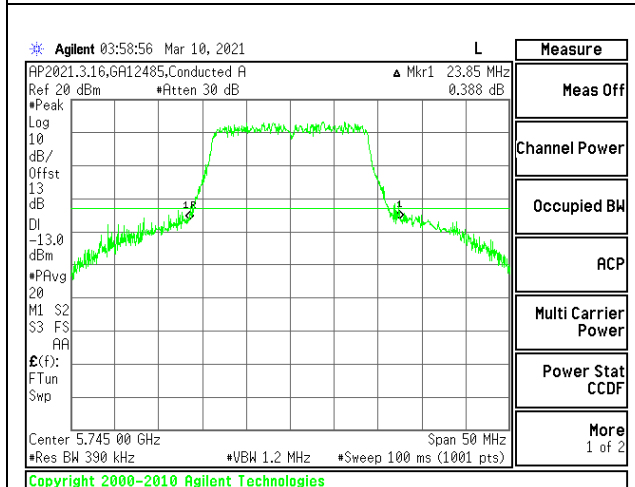
LOW CHANNEL



LOW CHANNEL CHAIN 0

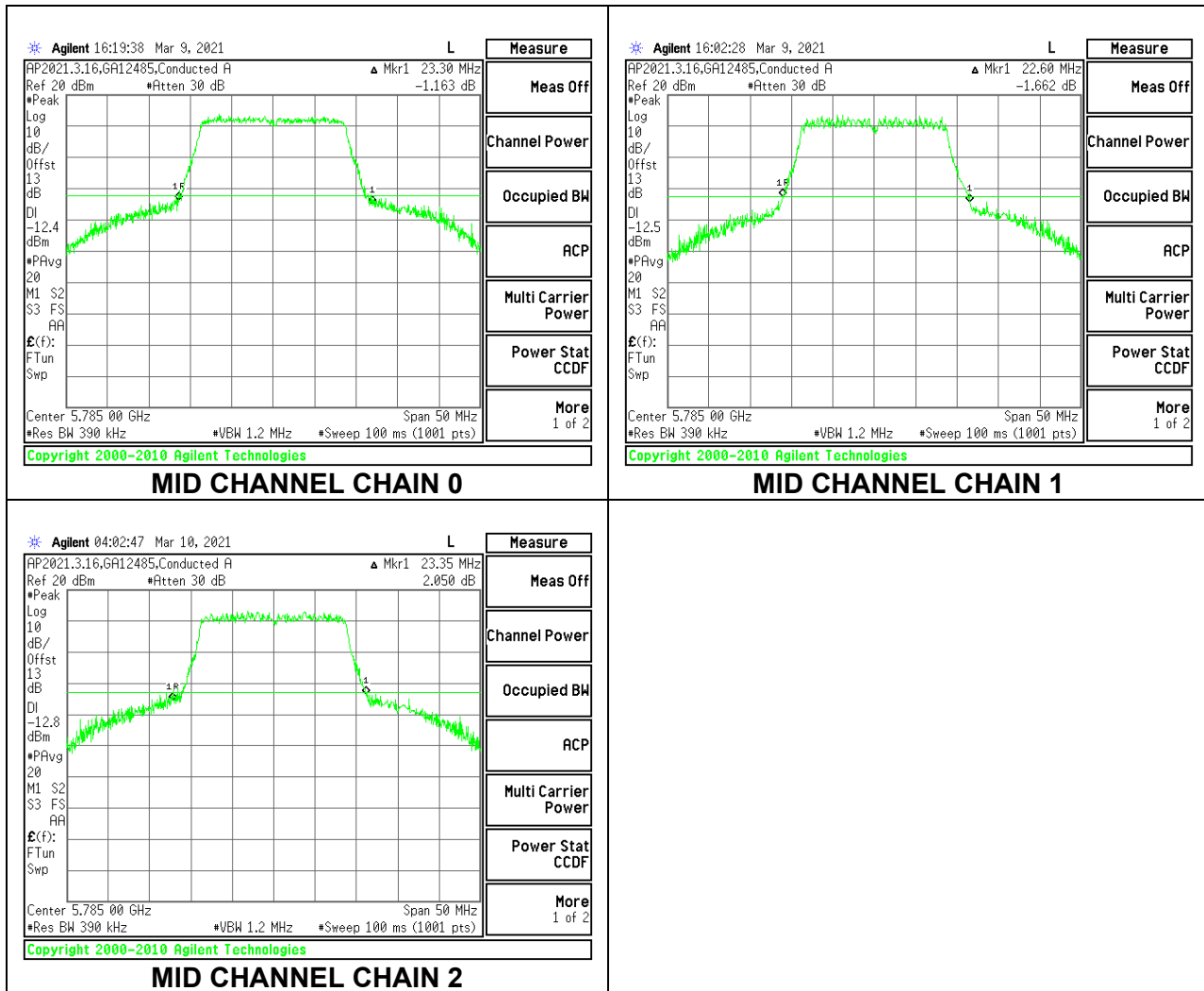


LOW CHANNEL CHAIN 1

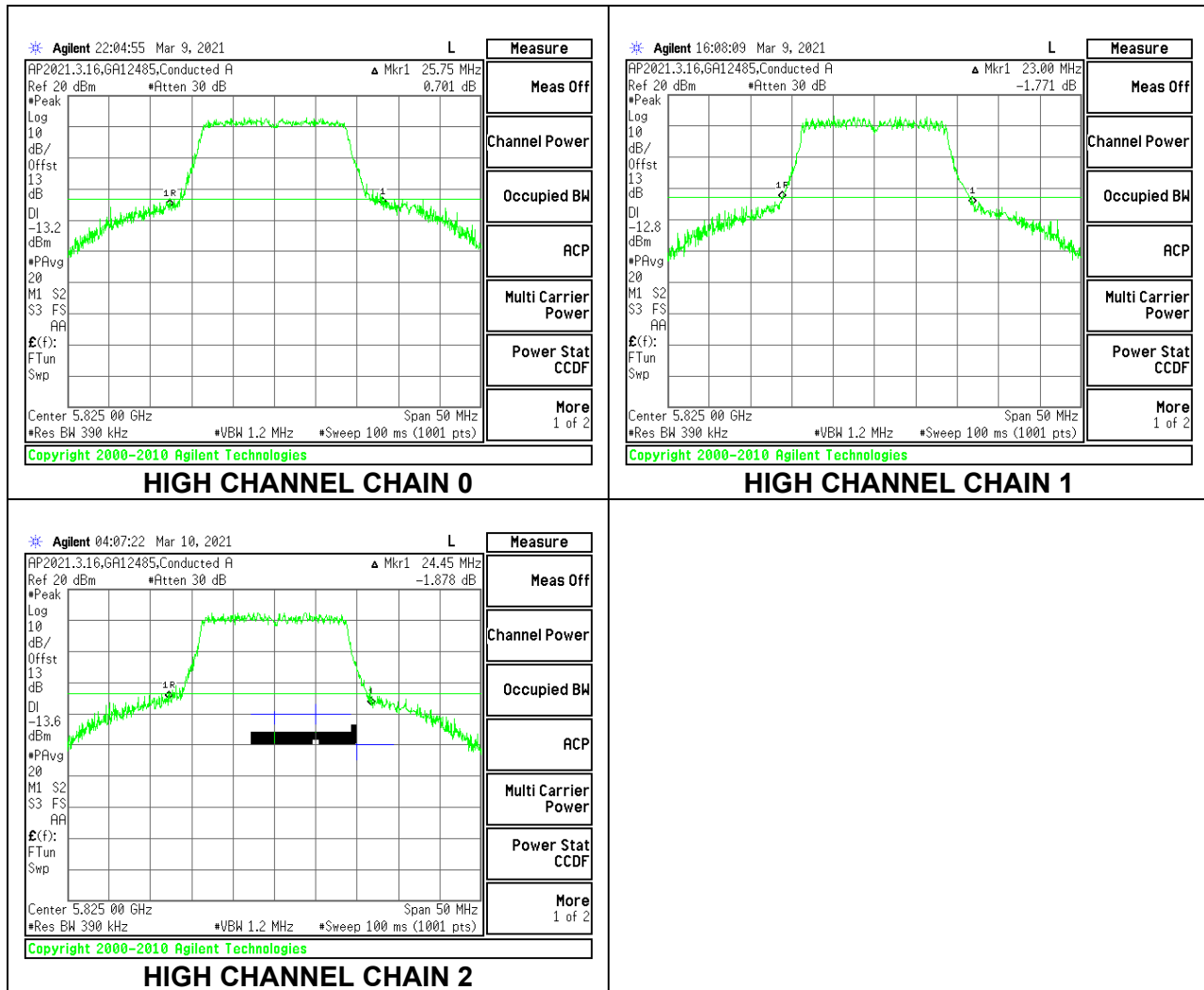


LOW CHANNEL CHAIN 2

MID CHANNEL



HIGH CHANNEL

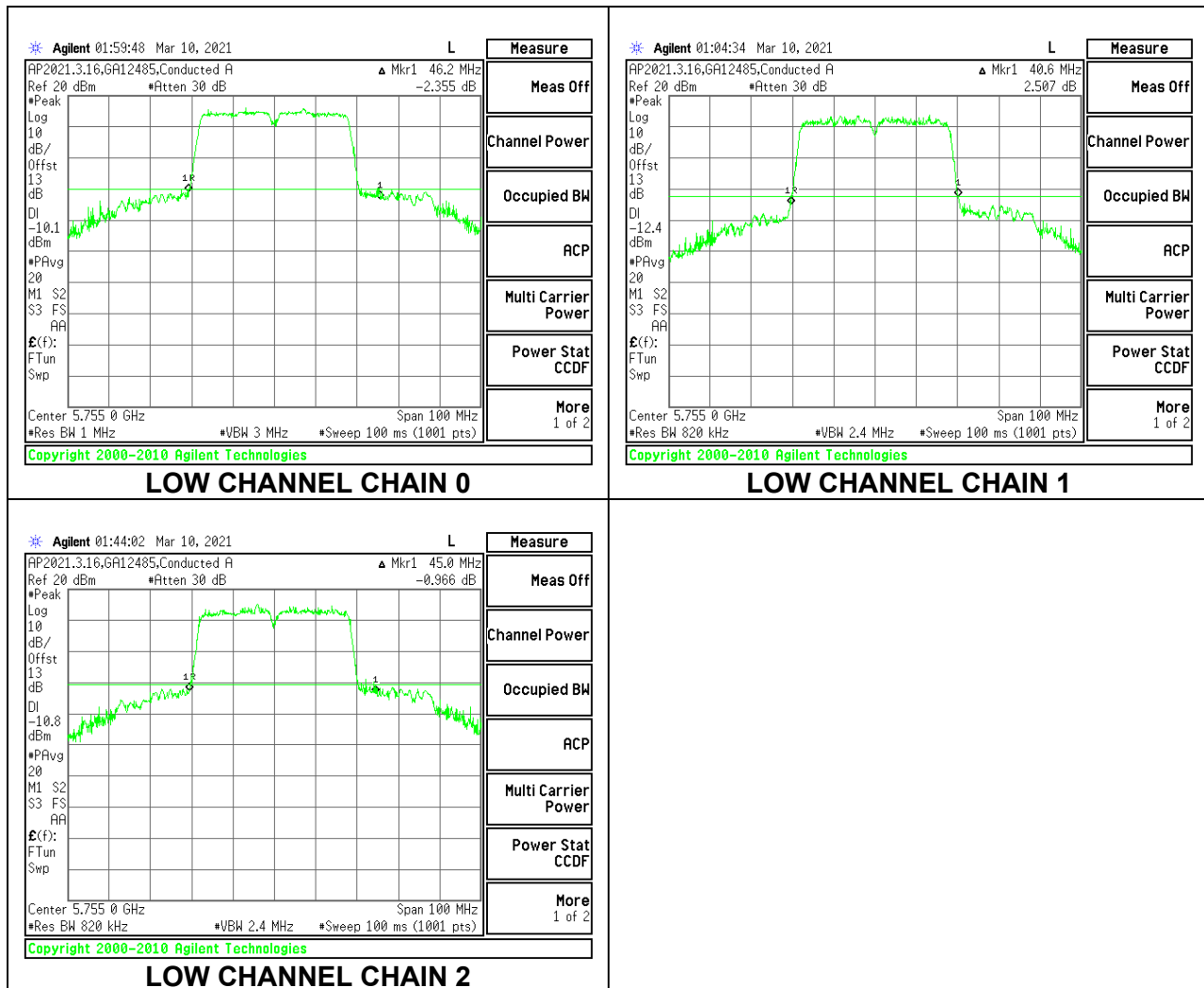


9.2.11. 802.11n HT40 MODE IN THE 5.8 GHz BAND

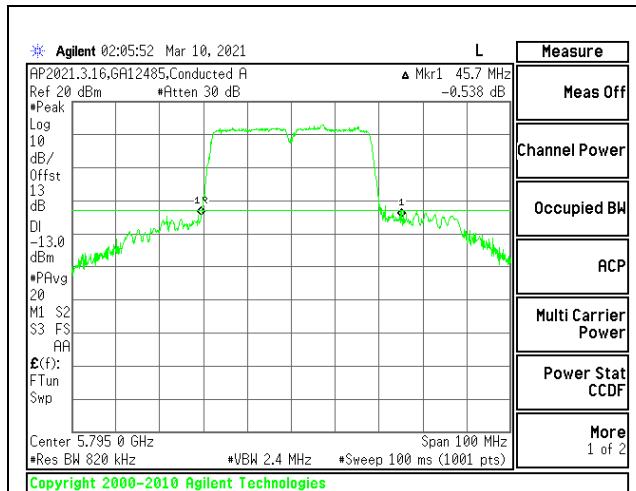
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Low	5755	46.20	40.60	45.00
High	5795	45.70	41.40	44.80

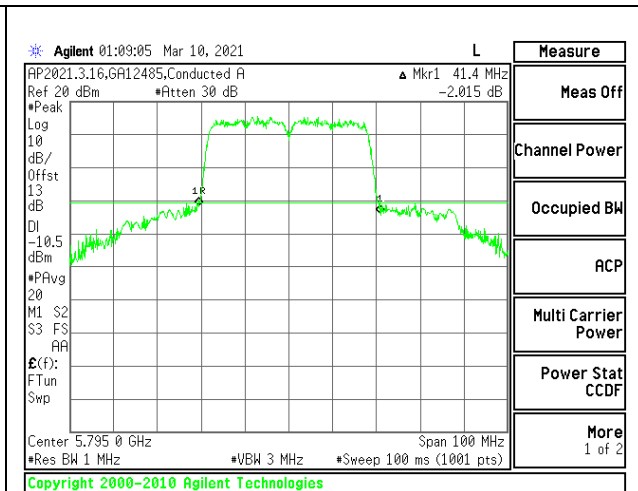
LOW CHANNEL



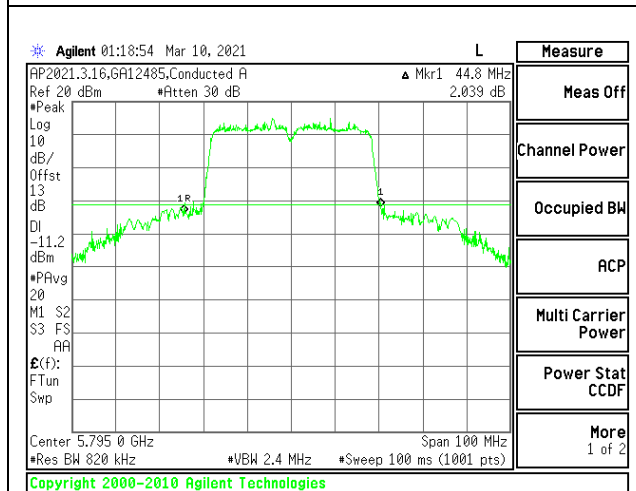
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



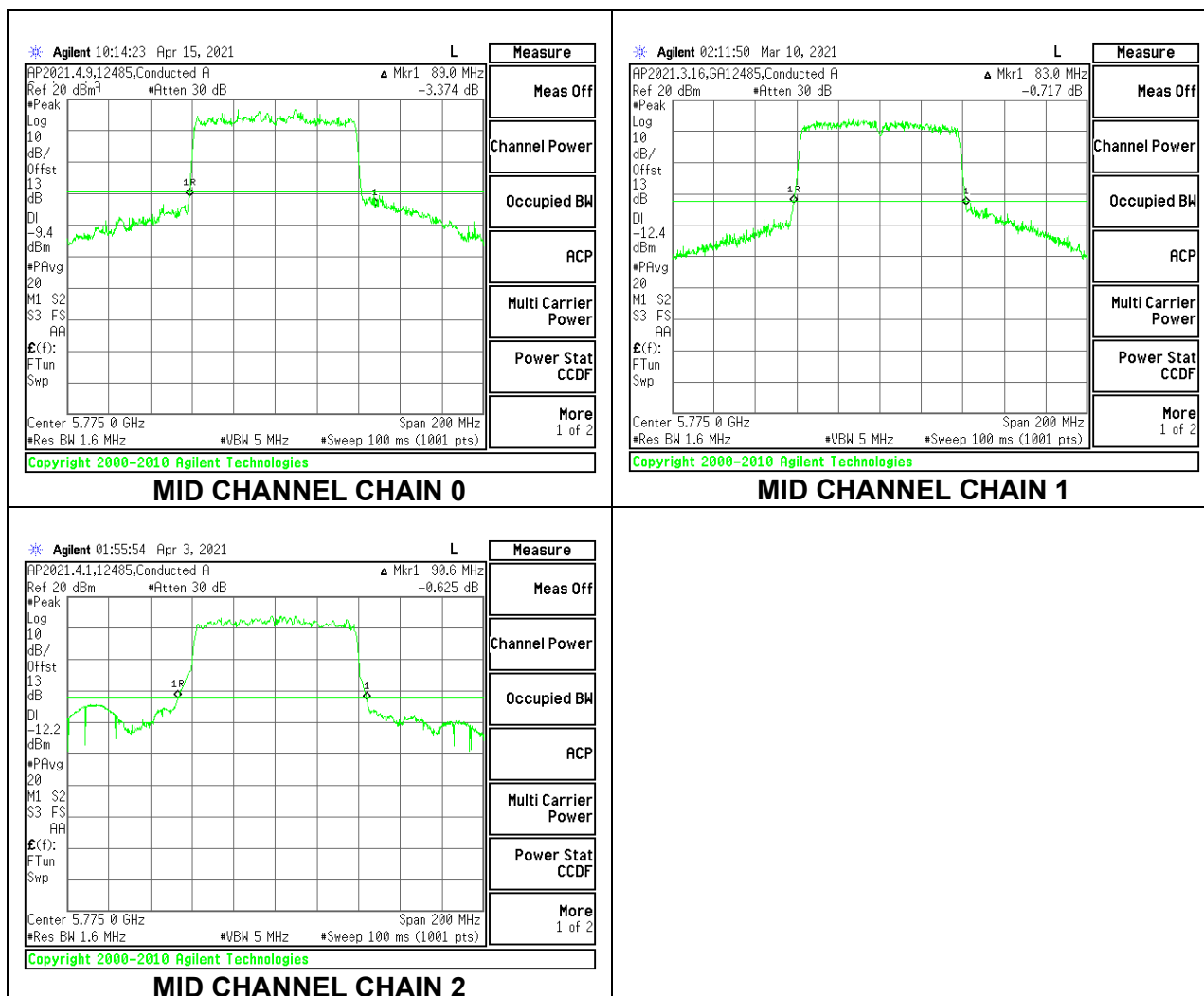
HIGH CHANNEL CHAIN 2

9.2.12. 802.11ac VHT80 MODE IN THE 5.8 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)
Mid	5775	89.00	83.00	90.60

MID CHANNEL



9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.407 (e)

The minimum 6 dB bandwidth shall be at least 500 kHz.

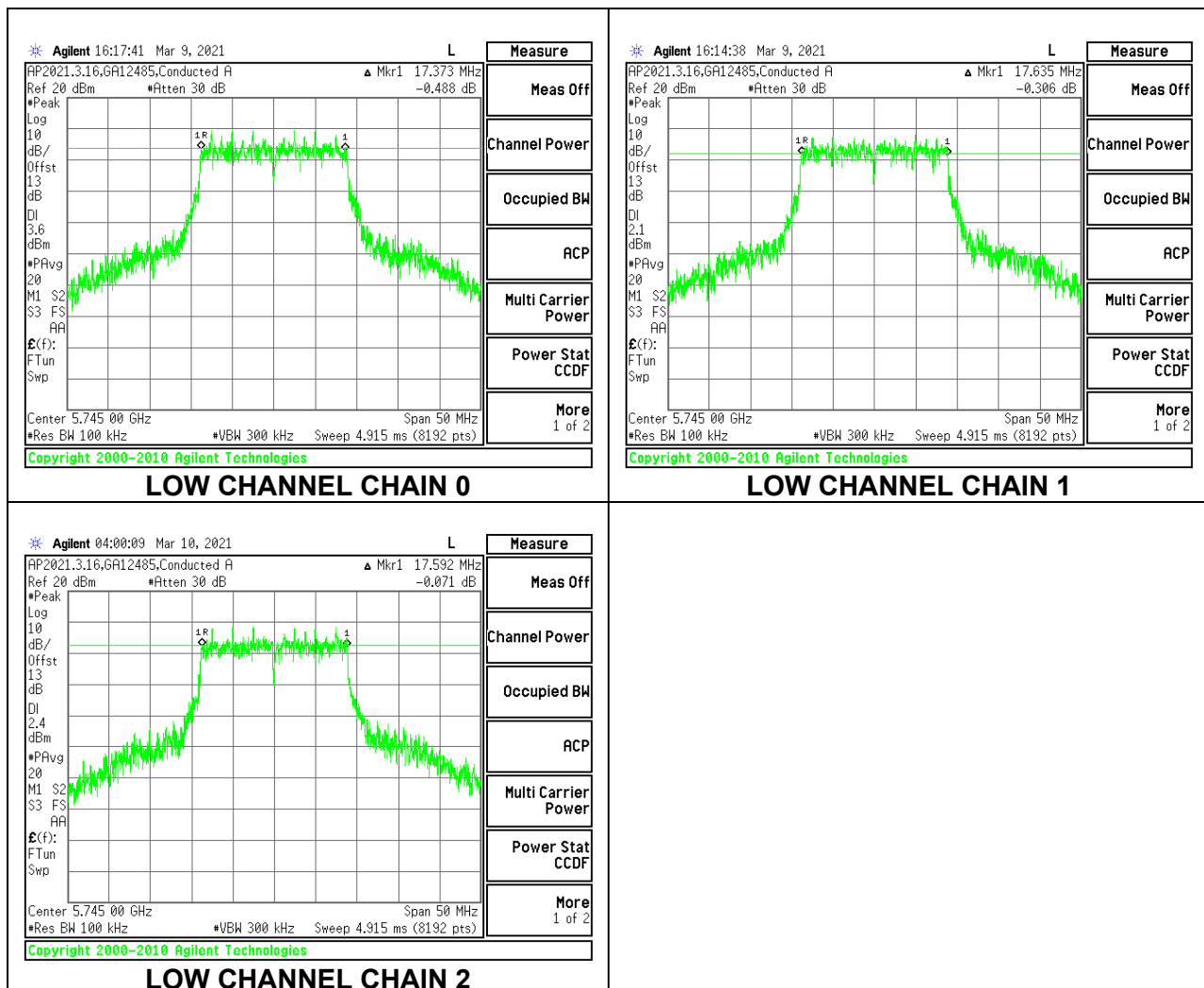
RESULTS

9.3.1. 802.11n HT20 MODE IN THE 5.8 GHz BAND

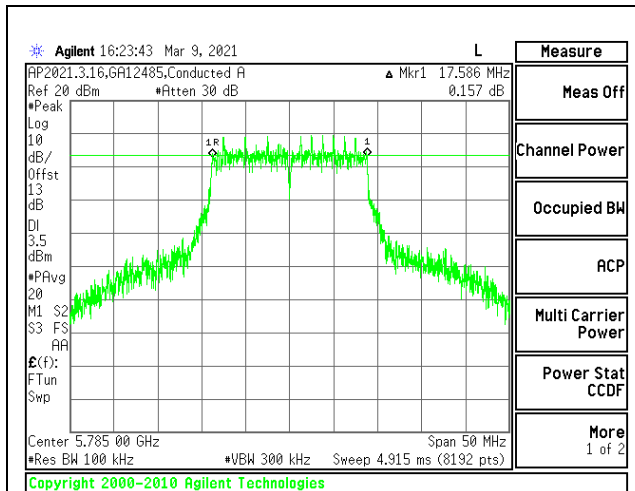
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	6 dB BW Antenna 1 (MHz)	6 dB BW Antenna 2 (MHz)	6 dB BW Antenna 3 (MHz)	Minimum Limit (MHz)
Low	5745	17.373	17.635	17.592	0.5
Mid	5785	17.586	17.592	17.538	0.5
High	5825	17.171	17.299	17.318	0.5
144	5720	3.763	3.763	3.757	0.5

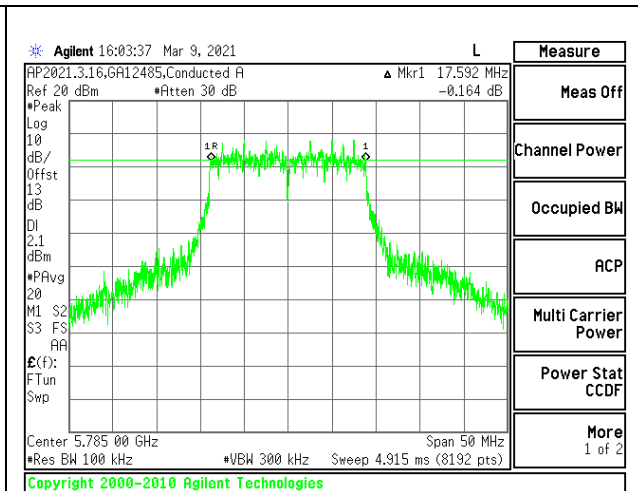
LOW CHANNEL



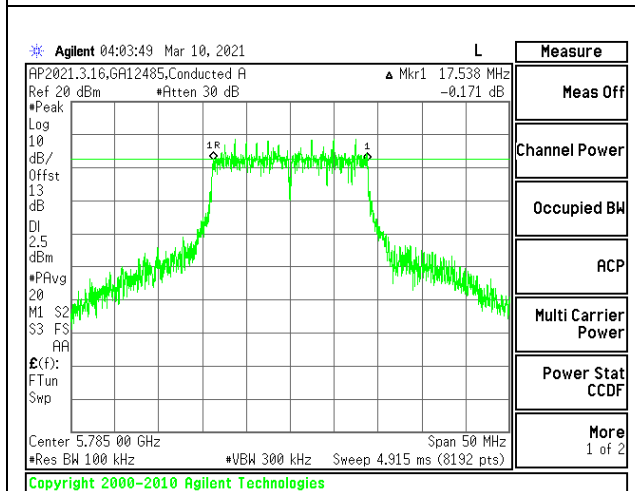
MID CHANNEL



MID CHANNEL CHAIN 0

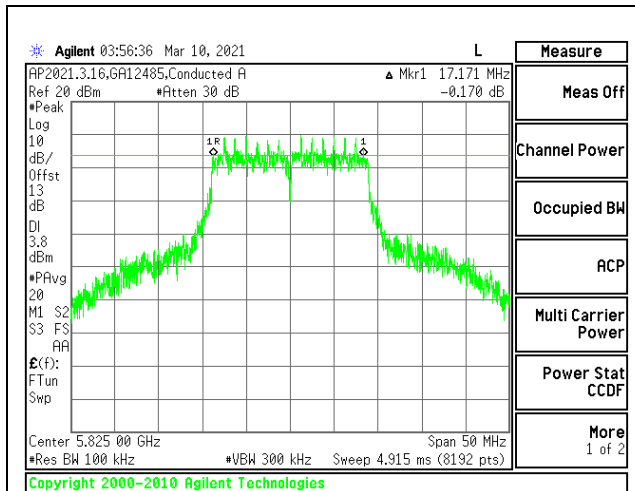


MID CHANNEL CHAIN 1

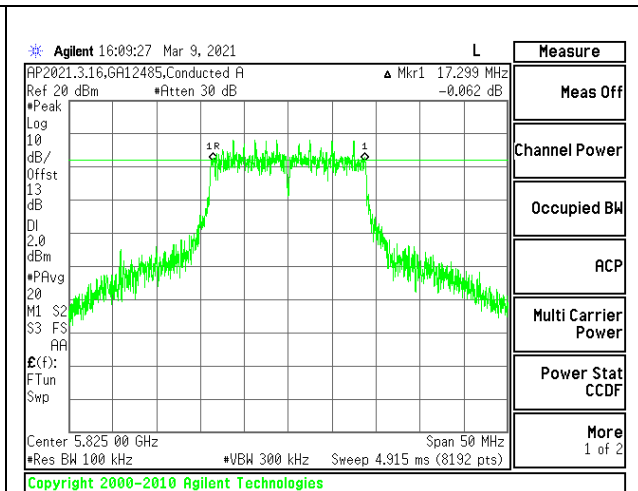


MID CHANNEL CHAIN 2

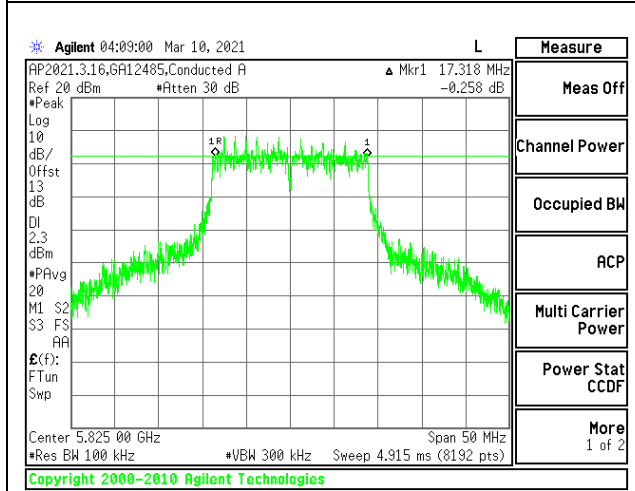
HIGH CHANNEL



HIGH CHANNEL CHAIN 0

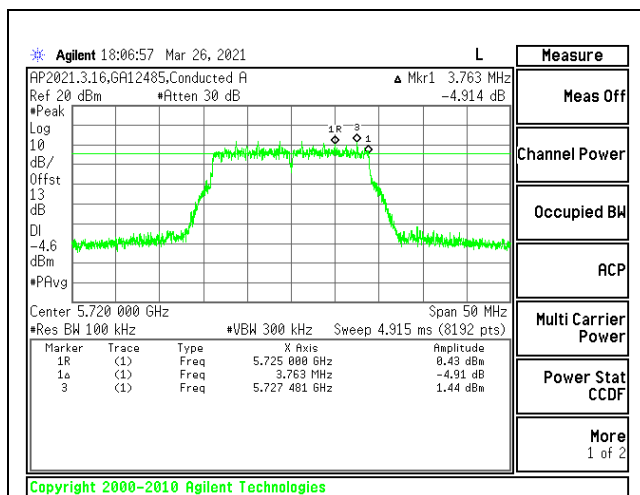


HIGH CHANNEL CHAIN 1

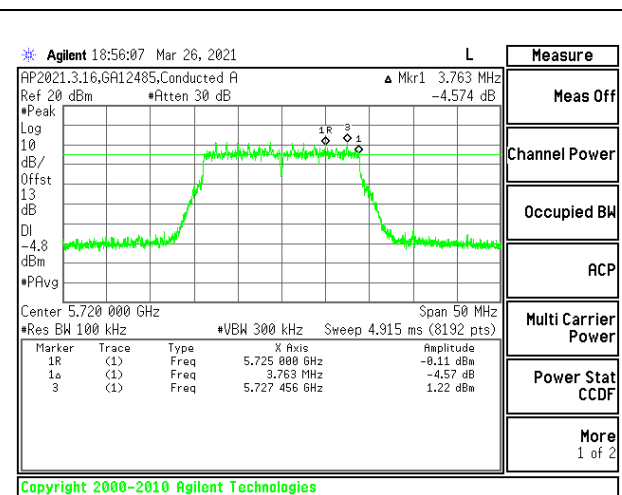


HIGH CHANNEL CHAIN 2

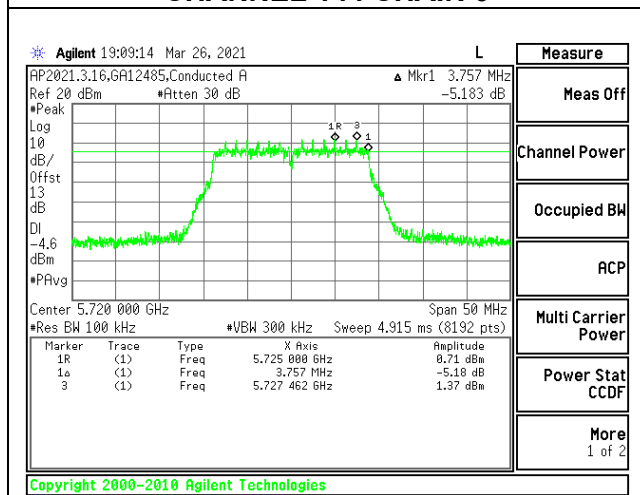
CHANNEL 144



CHANNEL 144 CHAIN 0



CHANNEL 144 CHAIN 1



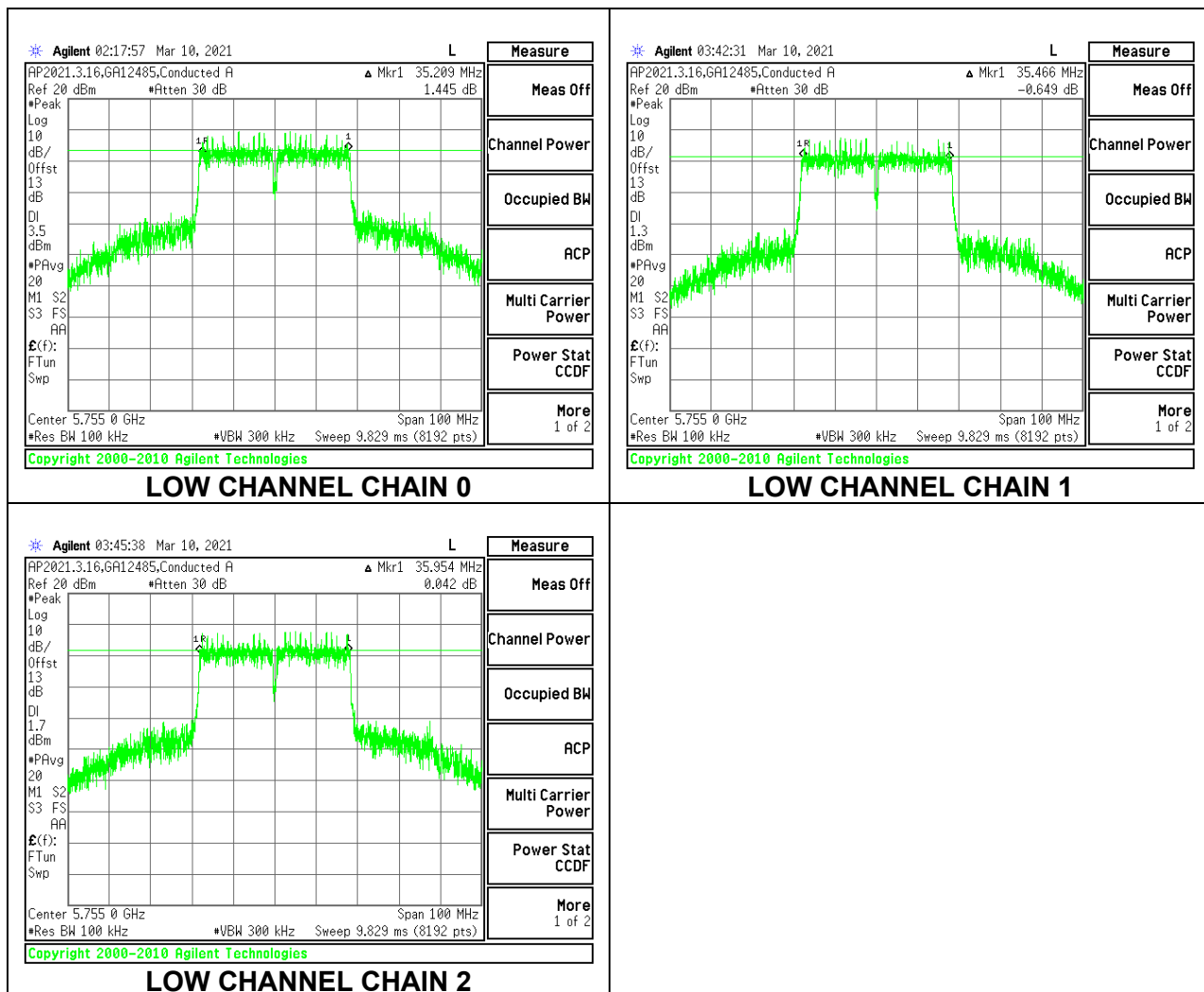
CHANNEL 144 CHAIN 2

9.3.2. 802.11n HT40 MODE IN THE 5.8 GHz BAND

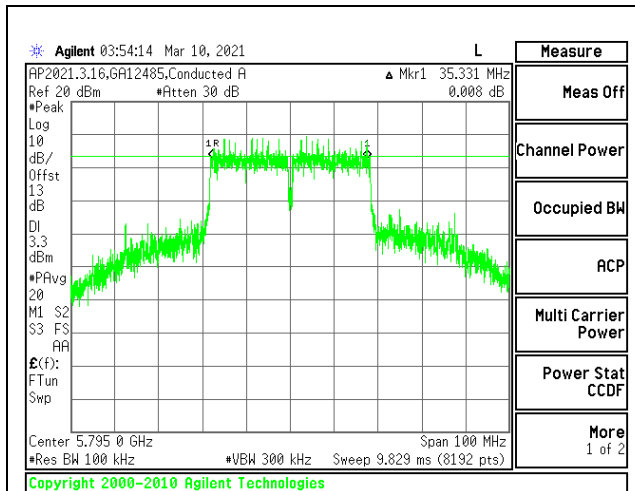
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	6 dB BW Antenna 1 (MHz)	6 dB BW Antenna 2 (MHz)	6 dB BW Antenna 3 (MHz)	Minimum Limit (MHz)
Low	5755	35.209	35.466	35.954	0.5
High	5795	35.331	36.333	36.113	0.5
142	5710	3.124	3.136	3.172	0.5

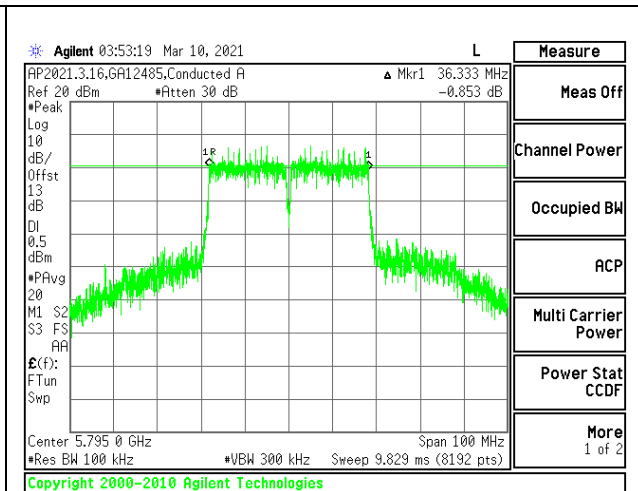
LOW CHANNEL



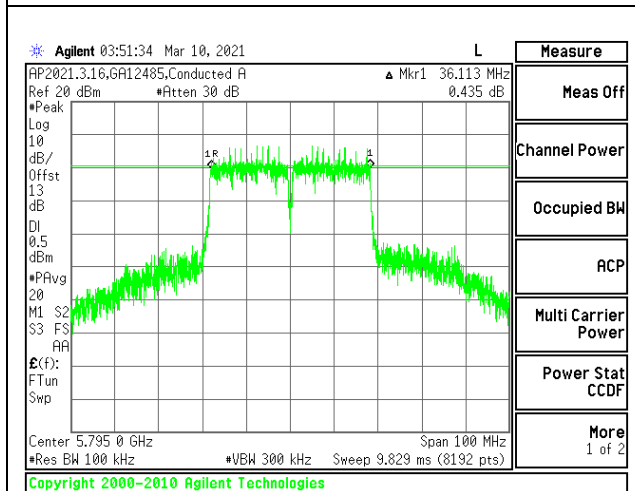
HIGH CHANNEL



HIGH CHANNEL CHAIN 0

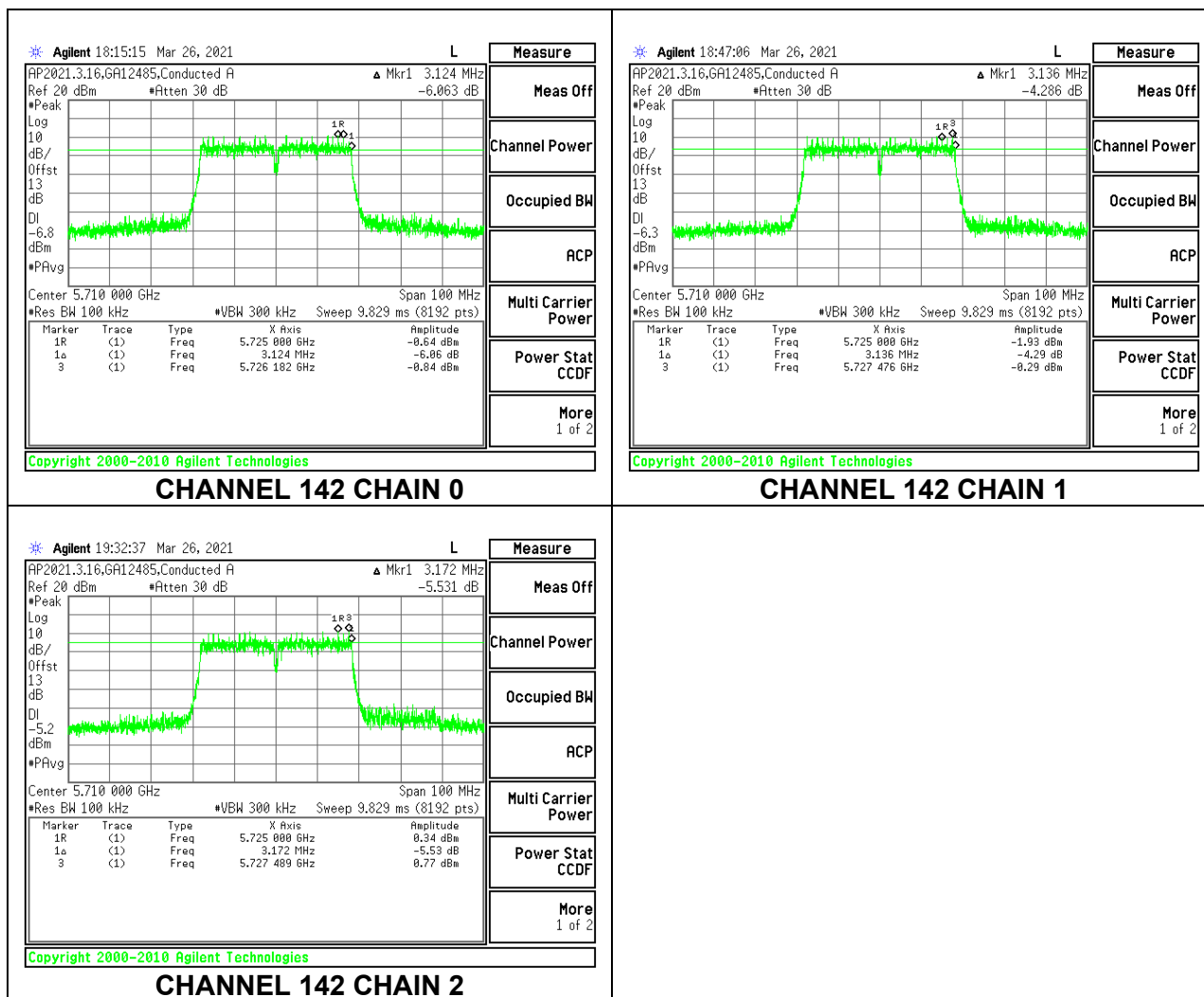


HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2

CHANNEL 142

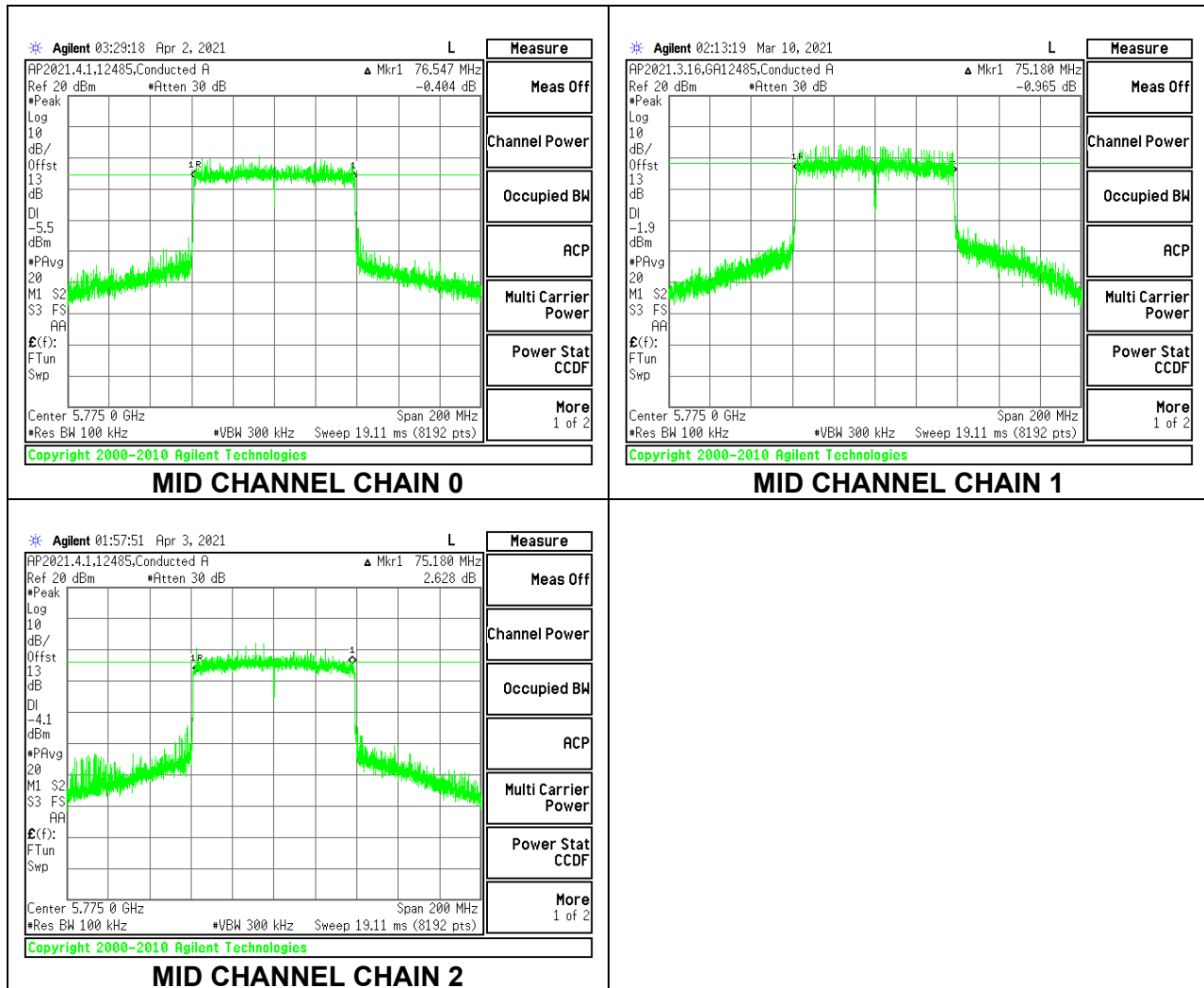


9.3.3. 802.11ac VHT80 MODE IN THE 5.8 GHz BAND

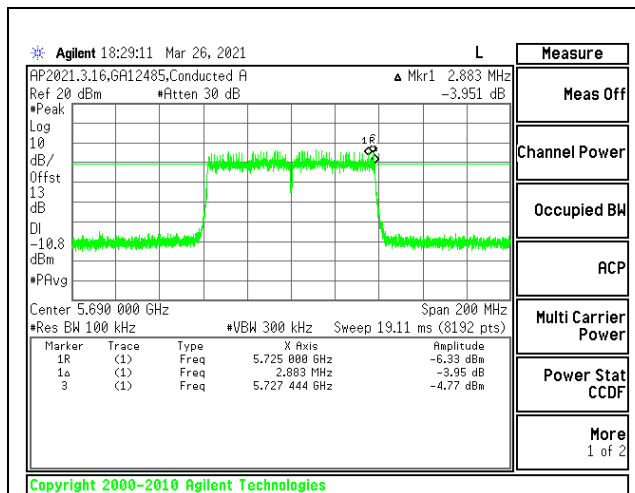
3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	6 dB BW Antenna 1 (MHz)	6 dB BW Antenna 2 (MHz)	6 dB BW Antenna 3 (MHz)	Minimum Limit (MHz)
Mid	5775	76.547	75.180	75.180	0.5
138	5690	2.883	3.127	3.103	0.5

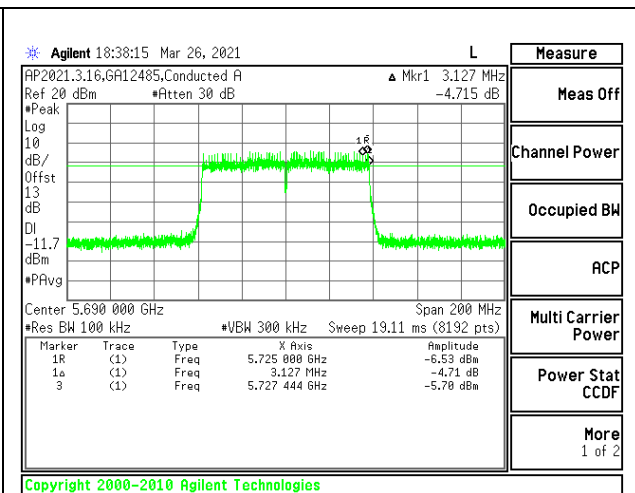
MID CHANNEL



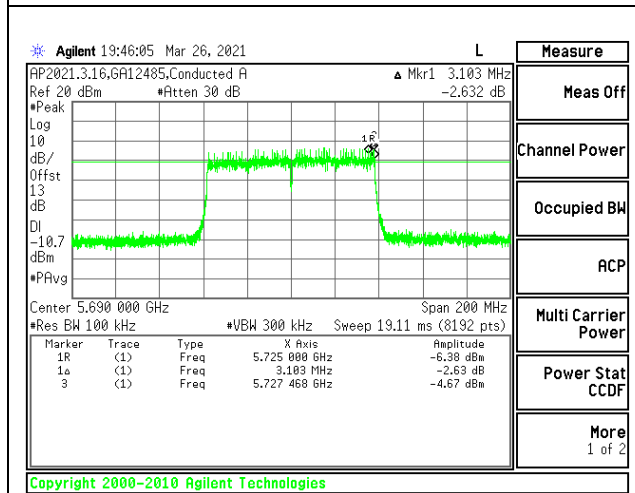
CHANNEL 138



CHANNEL 138 CHAIN 0



CHANNEL 138 CHAIN 1



CHANNEL 138 CHAIN 2

9.4. OUTPUT POWER AND PSD

LIMITS

FCC §15.407

Band 5.15–5.25 GHz (pick the section that applies to your product)

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

Bands 5.25-5.35 GHz and 5.47-5.725 GHz

The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Band 5.725-5.85 GHz

The maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

TEST PROCEDURE

The measurement method used for output power is KDB 789033 D02 v02r01, Section E.3.b (Method PM-G) and for straddles channels KDB 789033 D02 v02r01, Section E.2.b (Method SA-1) was used.

The measurement method used for power spectral density is KDB 789033 D02 v02r01, Section F

DIRECTIONAL ANTENNA GAIN

For 3 TX:

Tx chains are uncorrelated for power and correlated for PSD due to the device supporting CDD in all MIMO modes.

According to FCC KDB 662911 D03 v01, a measurement of directional gain of multi-antenna systems is allowed for compliance verification. Antenna gains are approved through manufacturers KDB. KDB reference can be found as part of the operational description. Please see the maximum directional gains as below:

Frequency Band	Uncorrelated Total Gain	Correlated Total Gain
5.15 to 5.25 GHz	2.5	6.9
5.25 to 5.35 GHz	3.2	7.7
5.47 to 5.725 GHz	3.2	7.8
5.725 to 5.85 GHz	2.9	7.6

RESULTS

9.4.1. 802.11n HT20 MODE IN THE 5.2 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC) MOBILE

Test Engineer:	12485 GA
Test Date:	03/04/2021

Antenna Gain and Limits

Channel	Frequency (MHz)	Uncorrelated Gain for Power (dBi)	Correlated Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/1MHz)
Low	5180	2.50	6.90	24.00	10.10
Mid	5200	2.50	6.90	24.00	10.10
High	5240	2.50	6.90	24.00	10.10

Duty Cycle CF (dB)	2.30	Included in Calculations of Corr'd PSD
---------------------------	------	---

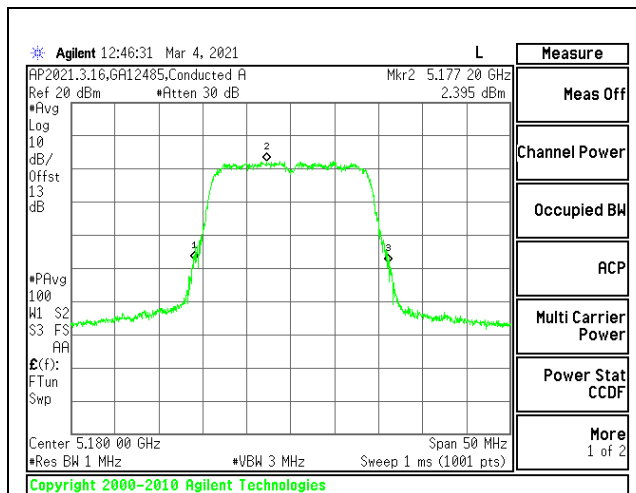
Output Power Results

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	15.09	14.58	15.55	19.86	24.00	-4.14
Mid	5200	14.57	14.48	15.17	19.52	24.00	-4.48
High	5240	14.22	14.11	14.84	19.17	24.00	-4.83

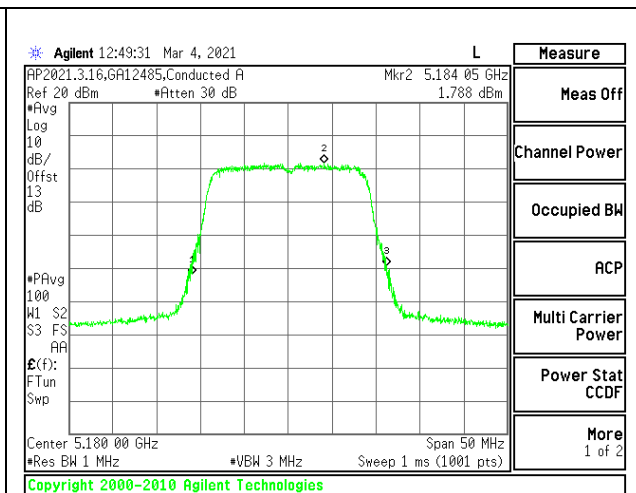
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/1MHz)	Antenna 2 Meas PSD (dBm/1MHz)	Antenna 3 Meas PSD (dBm/1MHz)	Total Corr'd PSD (dBm/1MHz)	PSD Limit (dBm/ 1MHz)	PSD Margin (dB)
Low	5180	2.40	1.79	2.84	9.43	10.10	-0.67
Mid	5200	2.31	1.76	2.70	9.34	10.10	-0.76
High	5240	1.98	1.49	2.39	9.04	10.10	-1.06

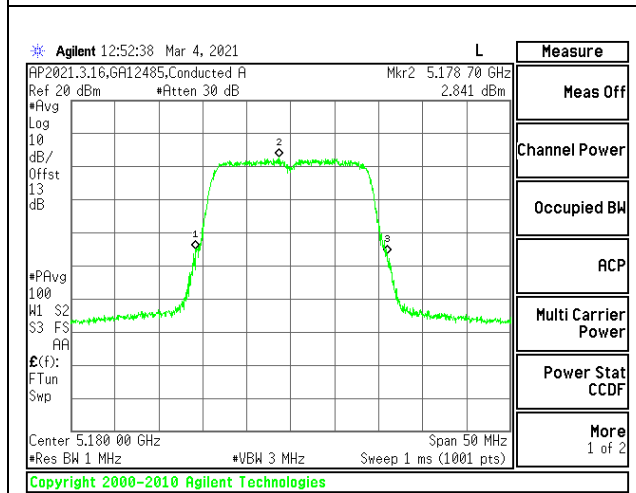
LOW CHANNEL



LOW CHANNEL CHAIN 0

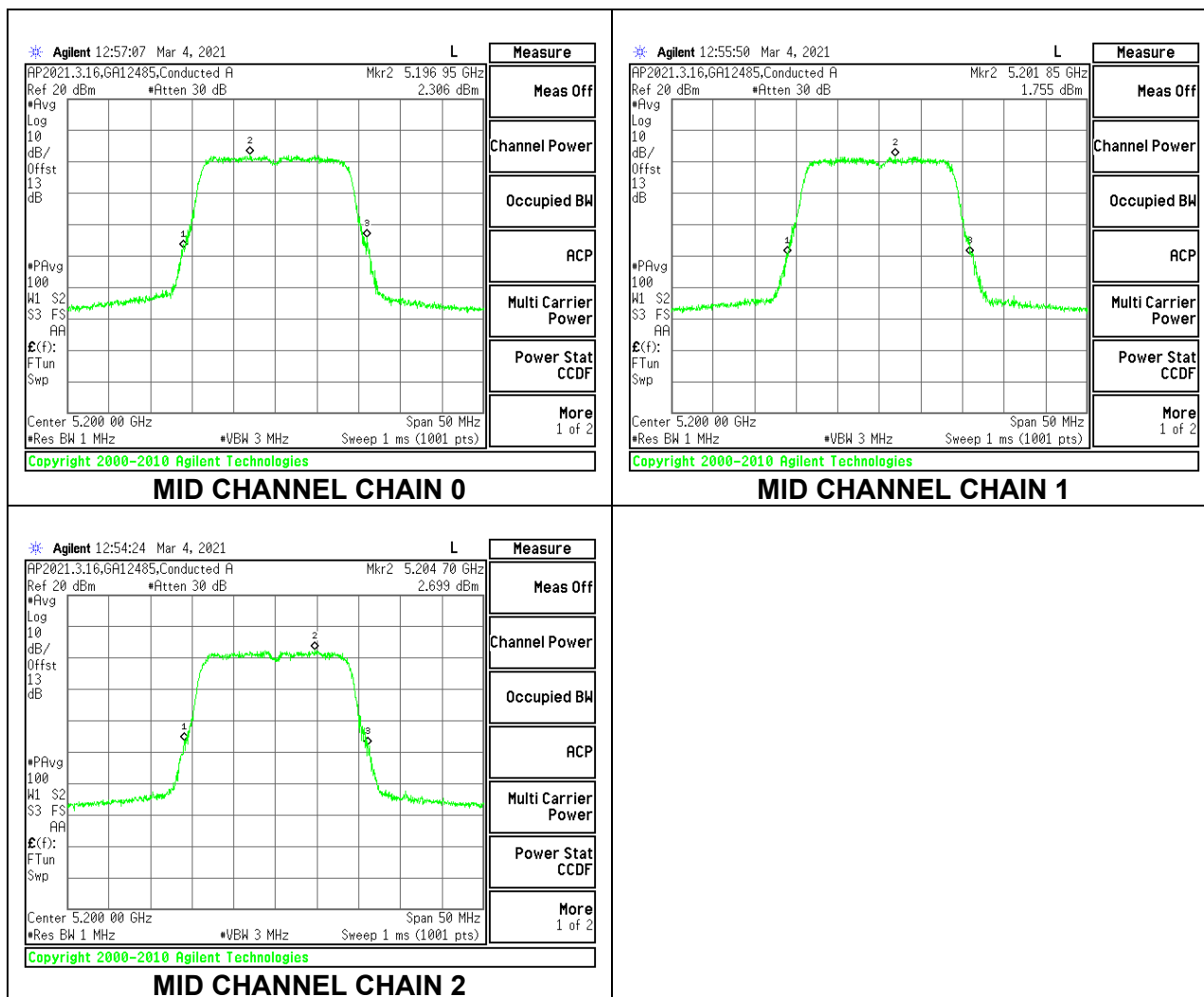


LOW CHANNEL CHAIN 1

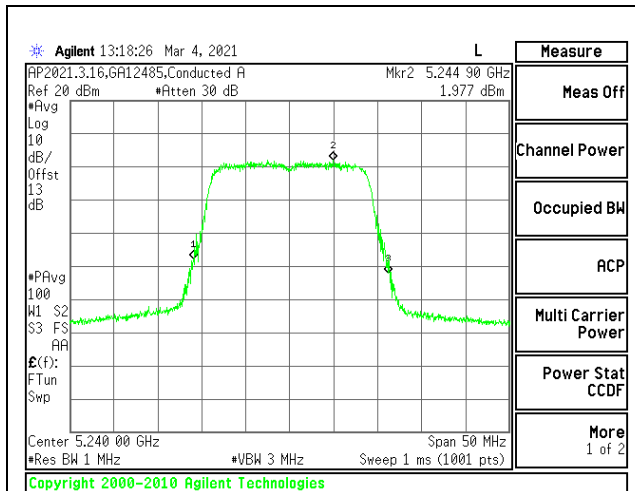


LOW CHANNEL CHAIN 2

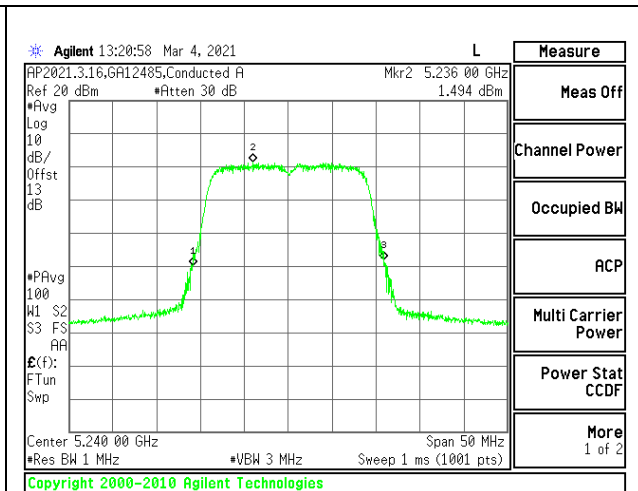
MID CHANNEL



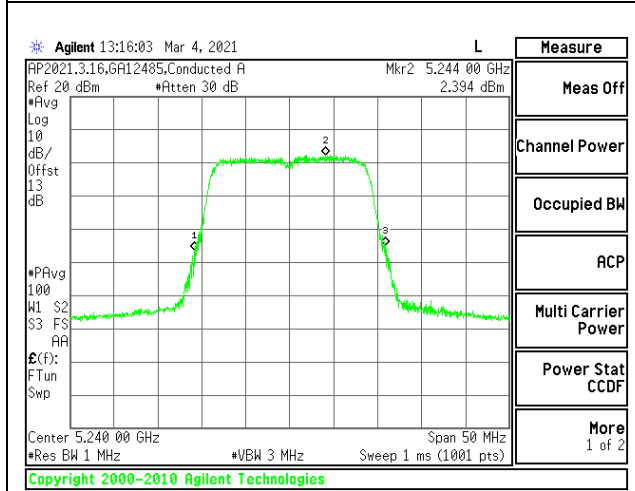
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2

9.4.2. 802.11n HT40 MODE IN THE 5.2 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC) MOBILE

Test Engineer:	12485 GA
Test Date:	03/04/2021

Antenna Gain and Limits

Channel	Frequency (MHz)	Uncorrelate Gain for Power (dBi)	Correlated Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5190	2.50	6.90	24.00	10.10
High	5230	2.50	6.90	24.00	10.10

Duty Cycle CF (dB)	2.66	Included in Calculations of Corr'd PSD
---------------------------	------	---

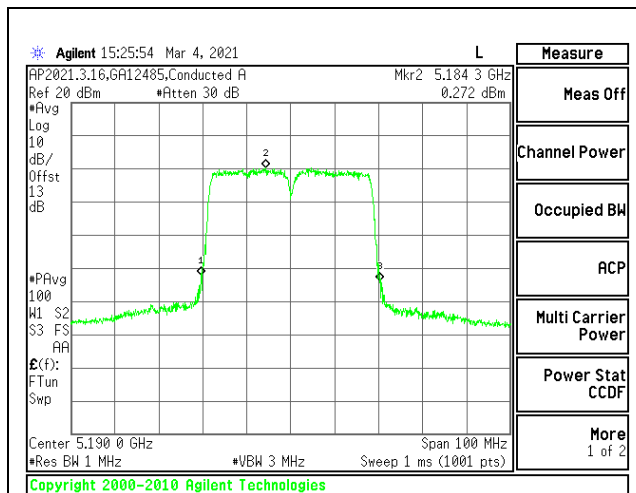
Output Power Results

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	15.67	15.46	15.74	20.40	24.00	-3.60
High	5230	15.63	15.19	15.88	20.35	24.00	-3.65

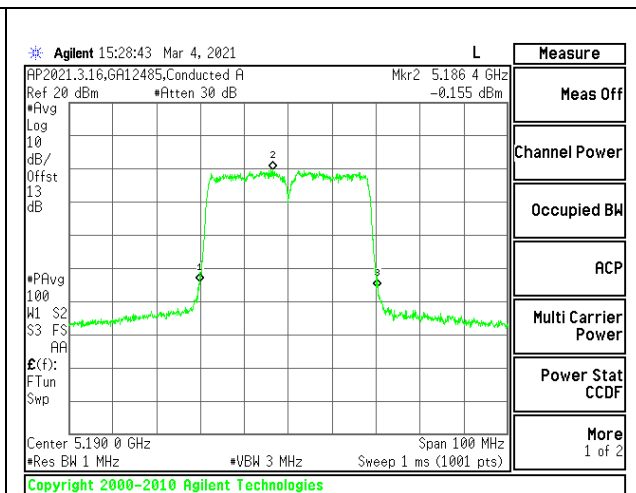
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/ 1MHz)	Antenna 2 Meas PSD (dBm/ 1MHz)	Antenna 3 Meas PSD (dBm/ 1MHz)	Total Corr'd PSD (dBm/ 1MHz)	PSD Limit (dBm/ 1MHz)	PSD Margin (dB)
Low	5190	0.27	-0.16	0.32	7.58	10.10	-2.52
High	5230	-0.25	-0.54	0.40	7.32	10.10	-2.78

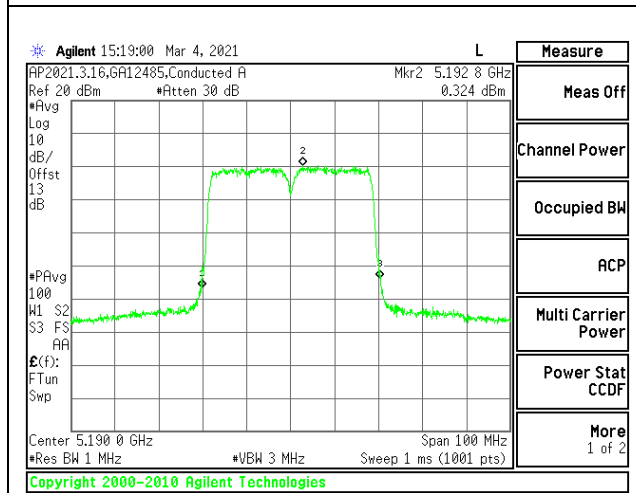
LOW CHANNEL



LOW CHANNEL CHAIN 0

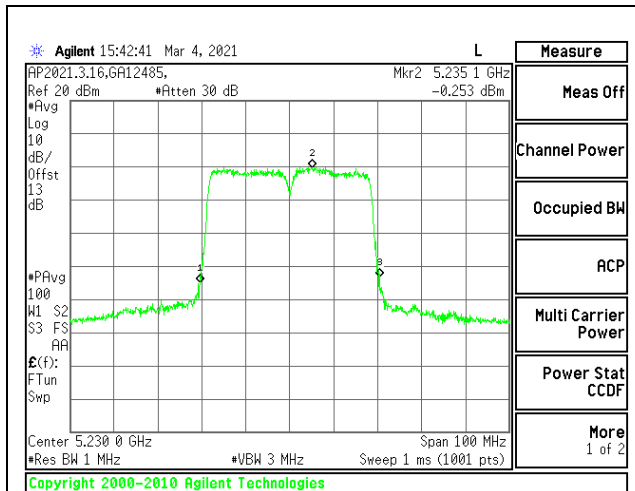


LOW CHANNEL CHAIN 1

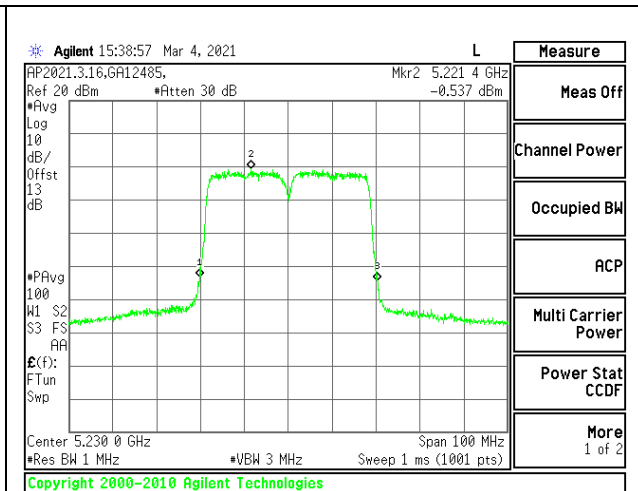


LOW CHANNEL CHAIN 2

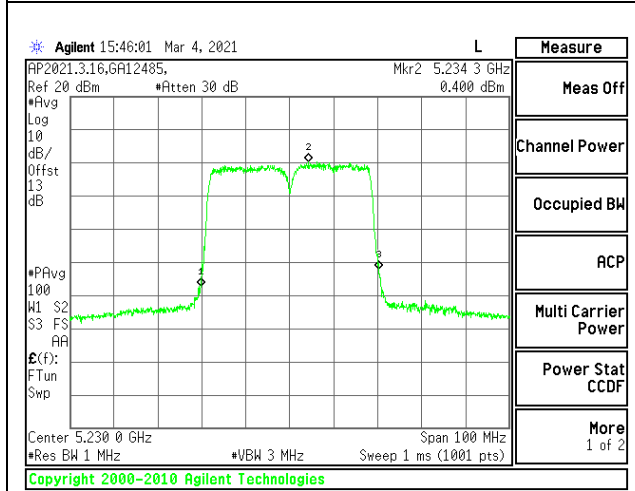
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2

9.4.3. 802.11ac VHT80 MODE IN THE 5.2 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC) MOBILE

Test Engineer:	12485 GA
Test Date:	03/04/2021

Antenna Gain and Limits

Channel	Frequency (MHz)	Uncorrelated Gain for Power (dBi)	Correlated Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Mid	5210	2.50	6.90	24.00	10.10

Duty Cycle CF (dB)	0.96	Included in Calculations of Corr'd PSD
---------------------------	------	---

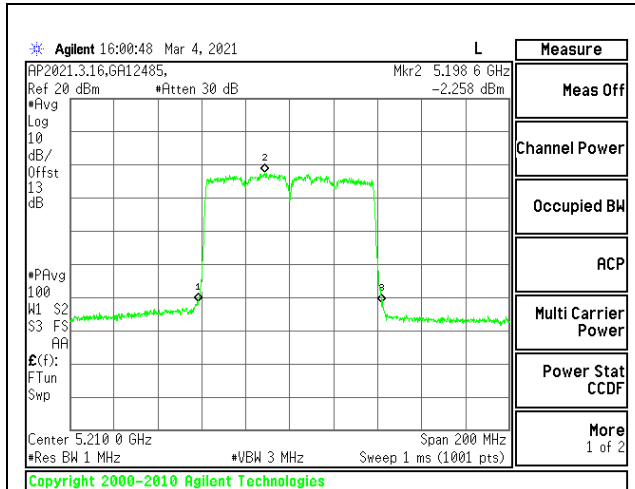
Output Power Results

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Mid	5210	14.21	13.88	14.74	19.06	24.00	-4.94

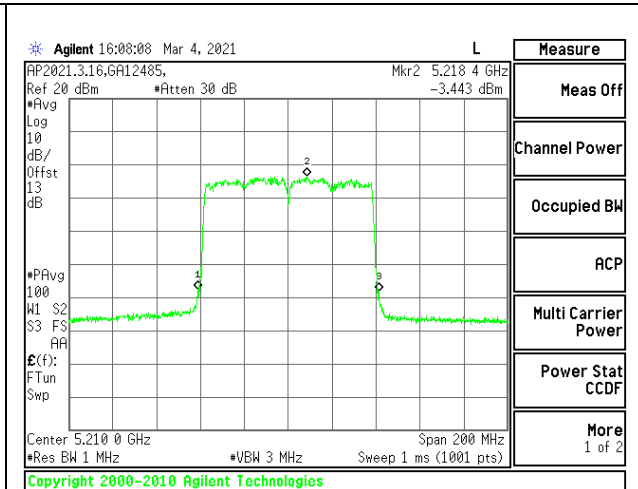
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/ 1MHz)	Antenna 2 Meas PSD (dBm/ 1MHz)	Antenna 3 Meas PSD (dBm/ 1MHz)	Total Corr'd PSD (dBm/ 1MHz)	PSD Limit (dBm/ 1MHz)	PSD Margin (dB)
Mid	5210	-2.26	-3.44	-2.21	3.13	10.10	-6.97

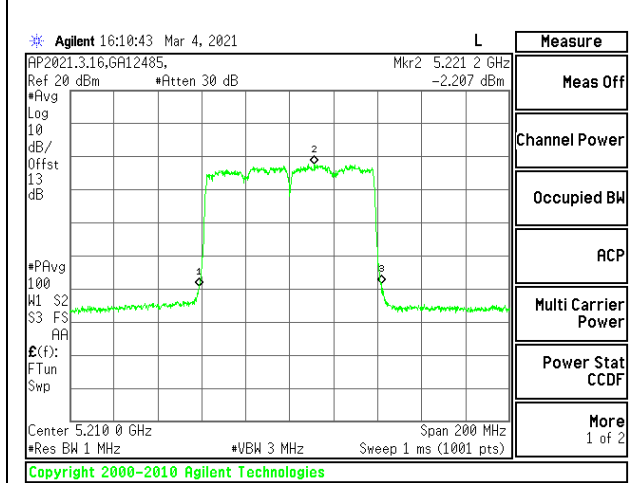
MID CHANNEL



MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1



MID CHANNEL CHAIN 2

9.4.4. 802.11n HT20 MODE IN THE 5.3 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC)

Test Engineer:	12485 GA
Test Date:	03/05/2021

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Uncorrelated Gain for Power (dBi)	Correlated Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/1MHz)
Low	5260	21.70	3.20	7.70	24.00	9.30
Mid	5300	21.65	3.20	7.70	24.00	9.30
High	5320	21.70	3.20	7.70	24.00	9.30

Duty Cycle CF (dB)	2.30	Included in Calculations of Corr'd PSD
---------------------------	------	---

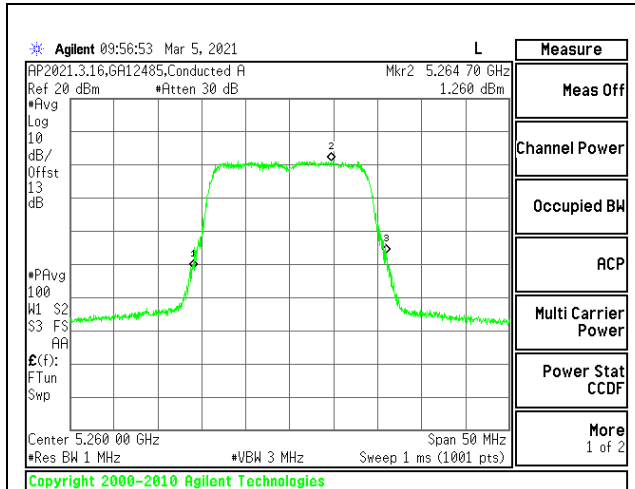
Output Power Results

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	13.55	12.98	14.14	18.35	24.00	-5.65
Mid	5300	13.63	12.78	14.15	18.33	24.00	-5.67
High	5320	13.77	13.12	14.24	18.51	24.00	-5.49

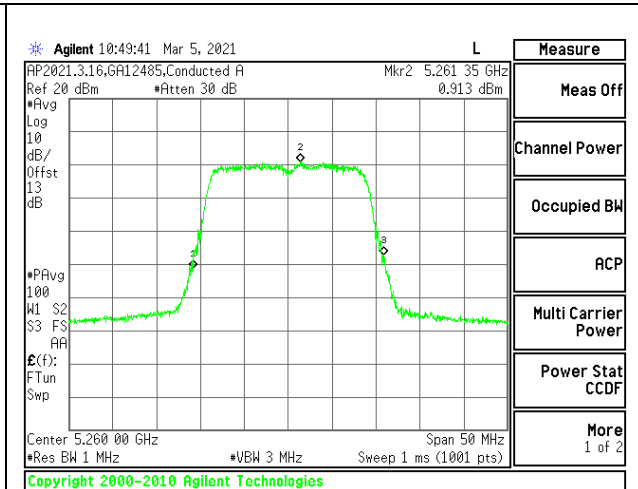
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/1MHz)	Antenna 2 Meas PSD (dBm/1MHz)	Antenna 3 Meas PSD (dBm/1MHz)	Total Corr'd PSD (dBm/1MHz)	PSD Limit (dBm/1MHz)	PSD Margin (dB)
Low	5260	1.26	0.91	2.15	8.54	9.30	-0.76
Mid	5300	1.44	0.91	2.16	8.61	9.30	-0.69
High	5320	1.57	0.97	2.21	8.68	9.30	-0.62

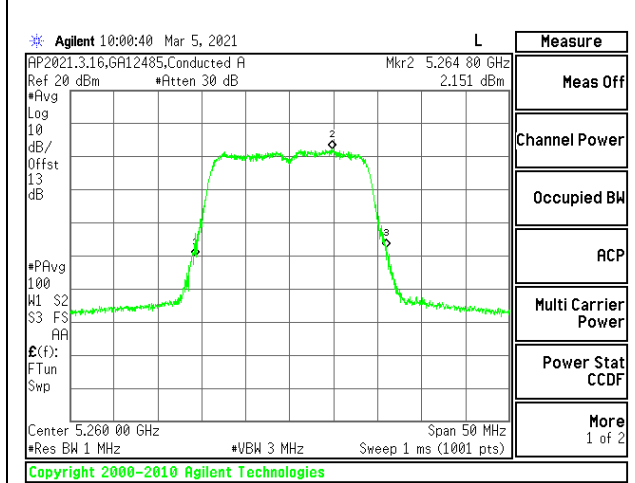
LOW CHANNEL



LOW CHANNEL CHAIN 0

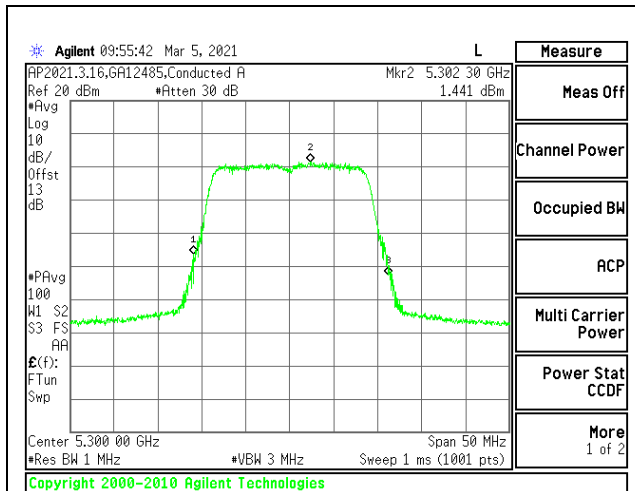


LOW CHANNEL CHAIN 1

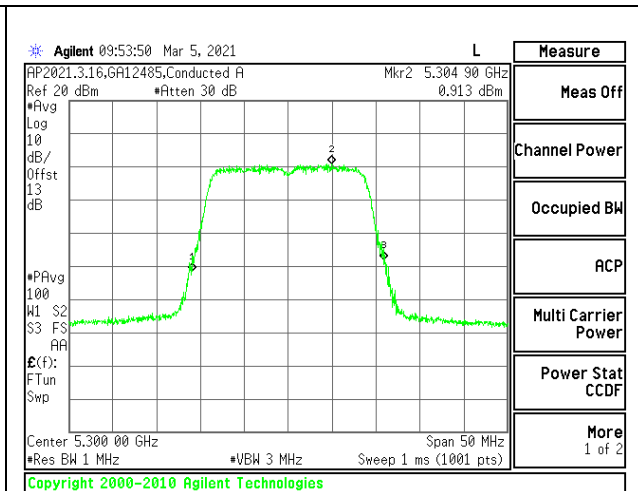


LOW CHANNEL CHAIN 2

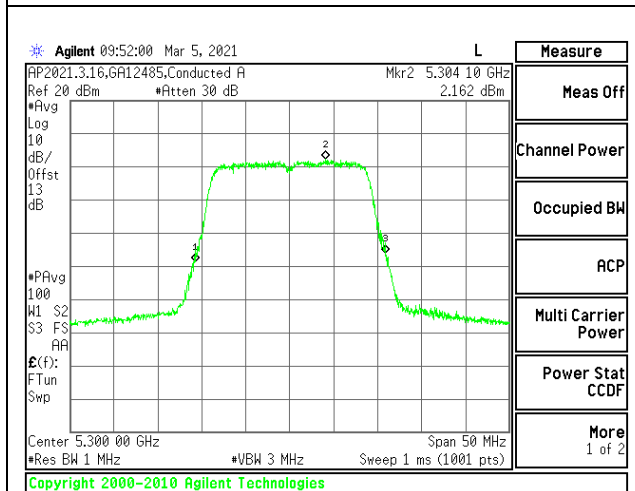
MID CHANNEL



MID CHANNEL CHAIN 0

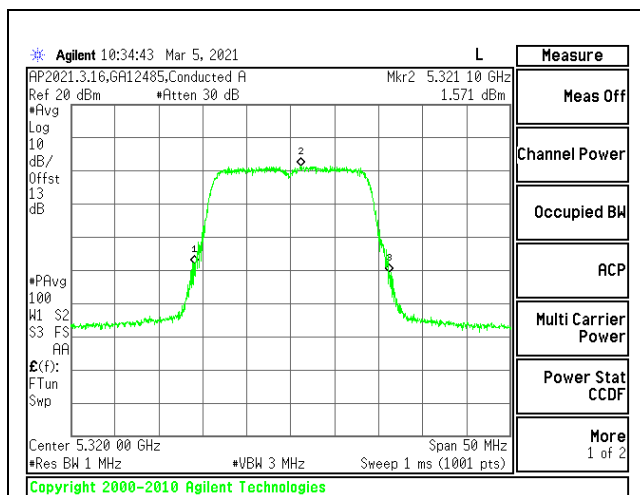


MID CHANNEL CHAIN 1

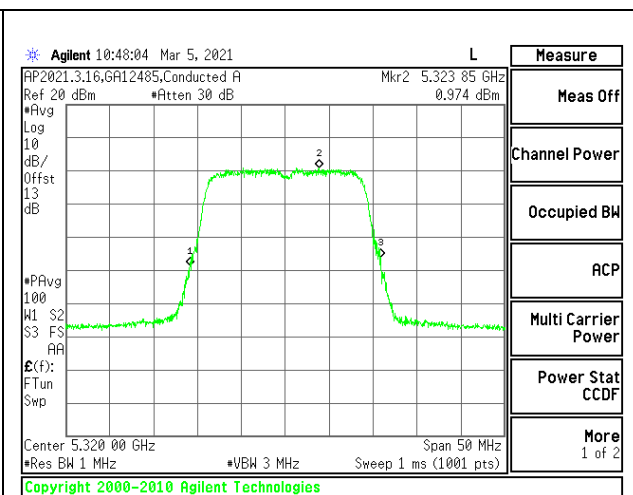


MID CHANNEL CHAIN 2

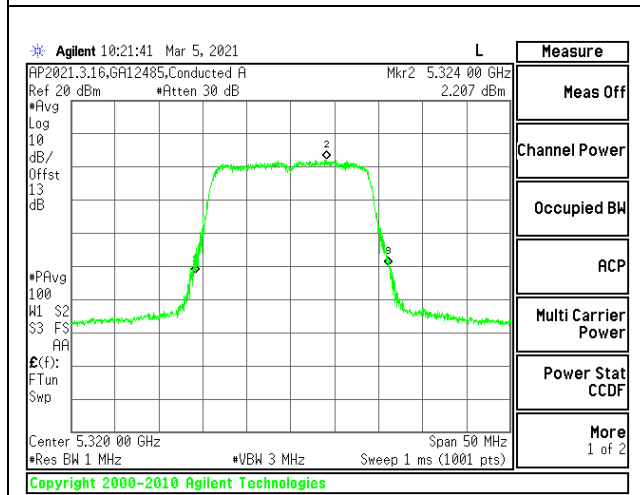
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2

9.4.5. 802.11n HT40 MODE IN THE 5.3 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC)

Test Engineer:	12485 GA
Test Date:	03/05/2021

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Uncorrelated Gain for Power (dBi)	Correlated Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/1MHz)
Low	5270	40.50	3.20	7.70	24.00	9.30
High	5310	40.40	3.20	7.70	24.00	9.30

Duty Cycle CF (dB)	2.66	Included in Calculations of Corr'd PSD
---------------------------	------	---

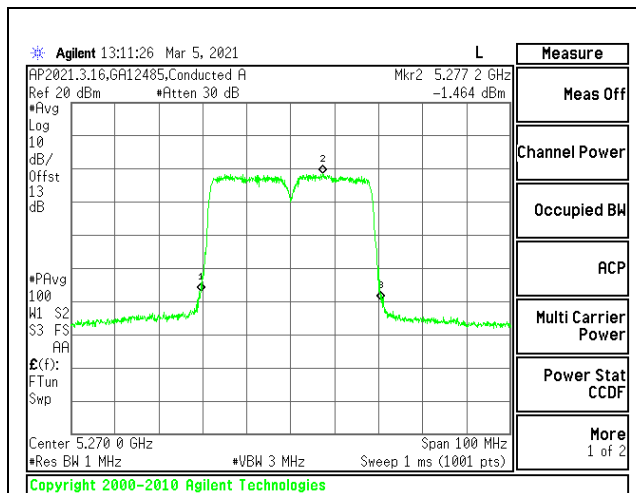
Output Power Results

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5270	14.02	13.33	14.16	18.62	24.00	-5.38
High	5310	14.32	13.61	14.50	18.93	24.00	-5.07

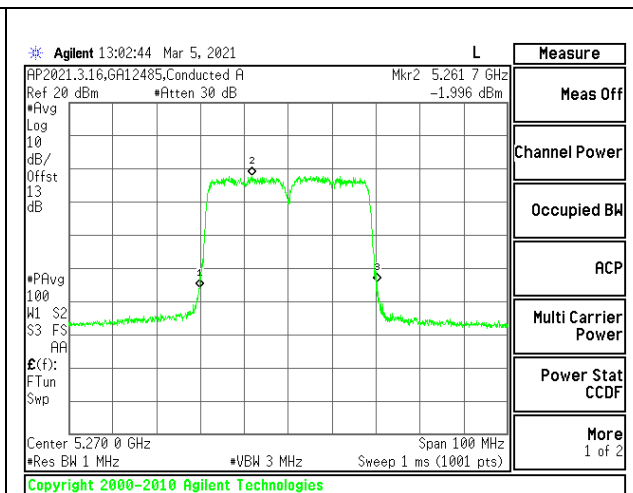
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/1MHz)	Antenna 2 Meas PSD (dBm/1MHz)	Antenna 3 Meas PSD (dBm/1MHz)	Total Corr'd PSD (dBm/1MHz)	PSD Limit (dBm/1MHz)	PSD Margin (dB)
Low	5270	-1.46	-2.00	-0.64	6.10	9.30	-3.20
High	5310	-1.53	-1.97	-0.76	6.04	9.30	-3.26

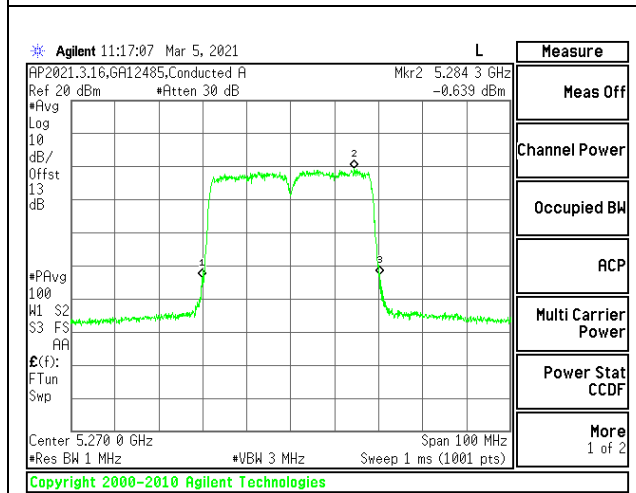
LOW CHANNEL



LOW CHANNEL CHAIN 0

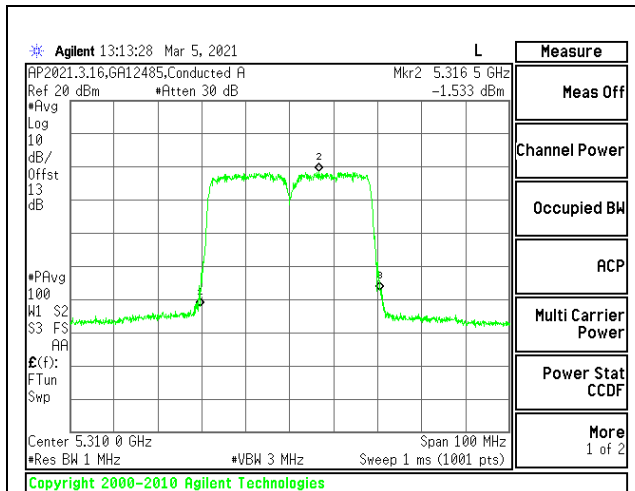


LOW CHANNEL CHAIN 1

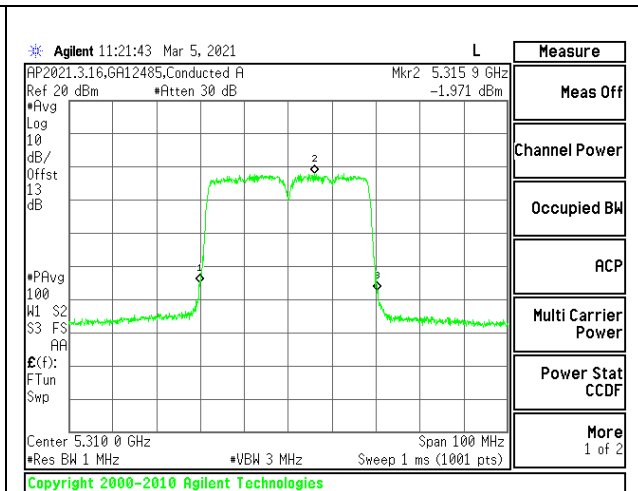


LOW CHANNEL CHAIN 2

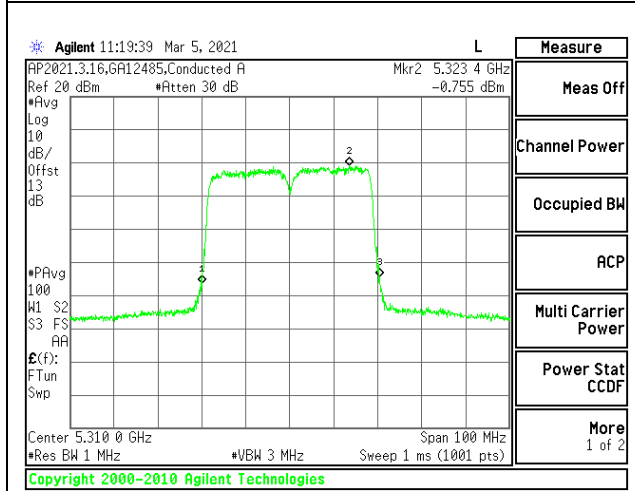
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2

9.4.6. 802.11ac VHT80 MODE IN THE 5.3 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC)

Test Engineer:	12485 GA
Test Date:	03/05/2021

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Uncorrelated Gain for Power (dBi)	Correlated Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/1MHz)
Mid	5290	82.60	3.20	7.70	24.00	9.30

Duty Cycle CF (dB)	0.96	Included in Calculations of Corr'd PSD
---------------------------	------	---

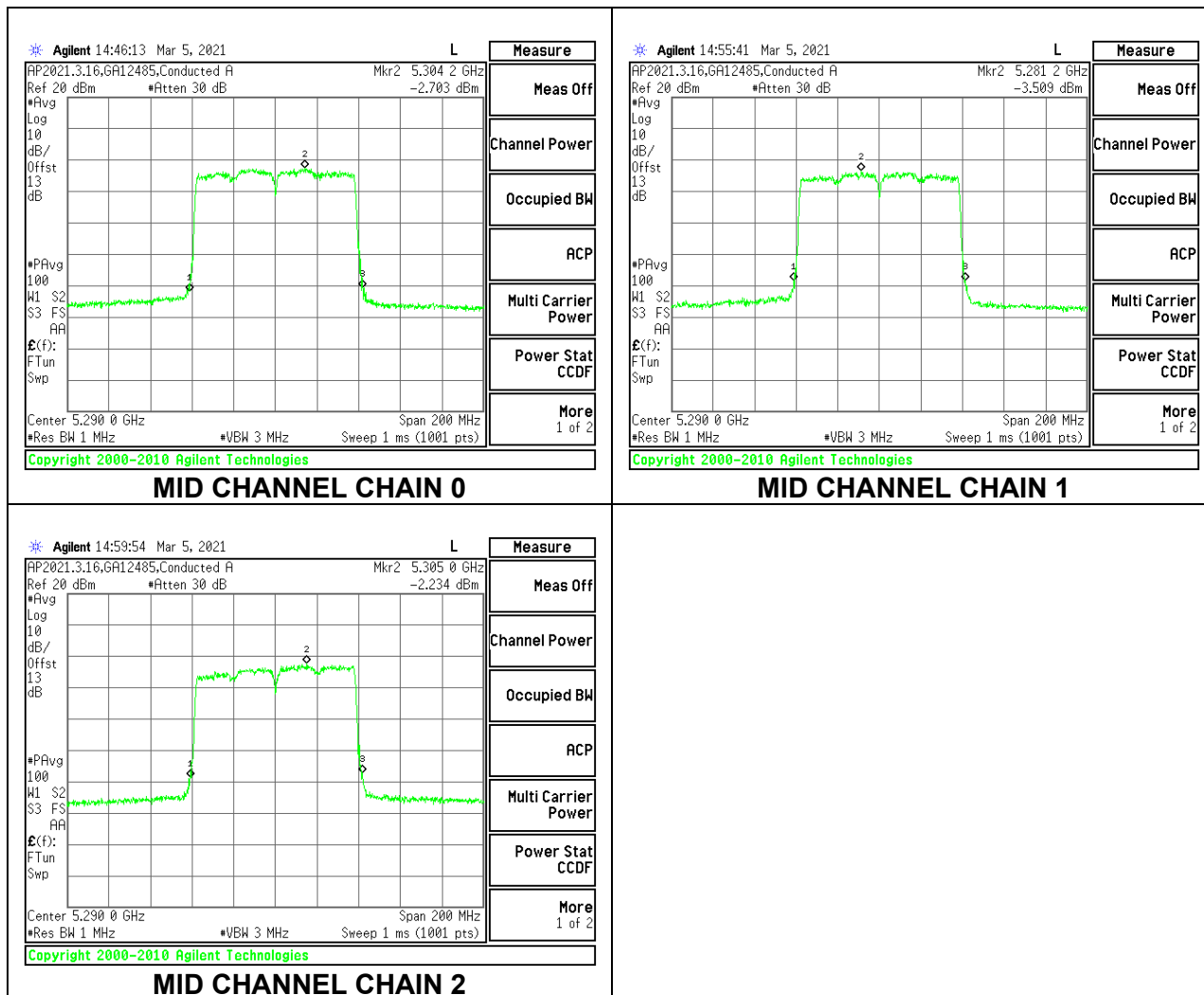
Output Power Results

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Mid	5290	14.71	13.85	14.98	19.31	24.00	-4.69

PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/1MHz)	Antenna 2 Meas PSD (dBm/1MHz)	Antenna 3 Meas PSD (dBm/1MHz)	Total Corr'd PSD (dBm/1MHz)	PSD Limit (dBm/1MHz)	PSD Margin (dB)
Mid	5290	-2.70	-3.51	-2.23	2.95	9.30	-6.35

MID CHANNEL



9.4.7. 802.11n HT20 MODE IN THE 5.6 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC)

Test Engineer:	12485 GA
Test Date:	03/5/2021 & 03/26/2021

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Uncorrelated Gain for Power (dBi)	Correlated Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/1MHz)
Low	5500	21.75	3.20	7.80	24.00	9.20
Mid	5580	21.85	3.20	7.80	24.00	9.20
High	5700	21.85	3.20	7.80	24.00	9.20
*144	5720	21.85	3.20	7.80	24.00	9.20

Duty Cycle CF (dB)	2.30	Included in Calculations of Corr'd PSD
---------------------------	------	---

Output Power Results

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	14.14	14.79	15.40	19.58	24.00	-4.42
Mid	5580	13.48	13.92	14.63	18.81	24.00	-5.19
High	5700	13.14	12.09	13.22	17.62	24.00	-6.38
*144	5720	13.65	12.17	13.42	17.90	24.00	-6.10

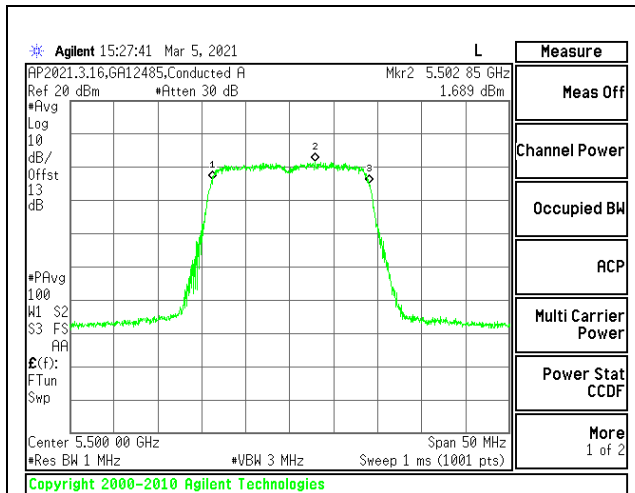
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/1MHz)	Antenna 2 Meas PSD (dBm/1MHz)	Antenna 3 Meas PSD (dBm/1MHz)	Total Corr'd PSD (dBm/1MHz)	PSD Limit (dBm/1MHz)	PSD Margin (dB)
Low	5500	1.69	1.09	1.95	8.66	9.20	-0.54
Mid	5580	-0.11	-0.11	0.91	7.33	9.20	-1.87
High	5700	-0.21	-0.57	0.41	6.97	9.20	-2.23
*144	5720	0.35	-0.25	0.64	7.33	9.20	-1.87

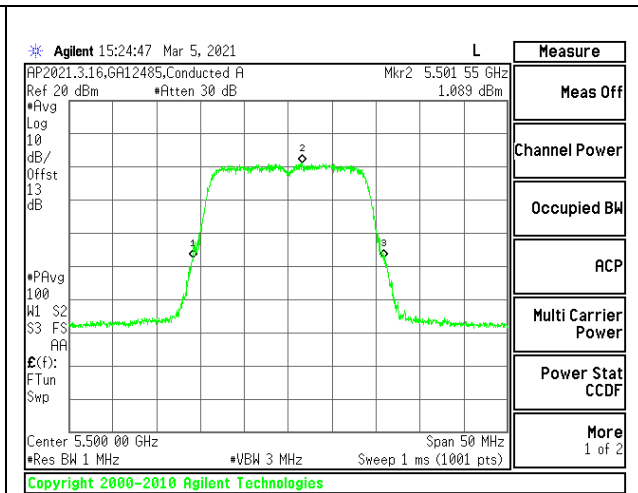
* As per the calculated formula, measured total bandwidth (21.85MHz) /2 +5MHz, the worst bandwidth is 15.925MHz.

Based on the 15.925MHz bandwidth for the portion that the straddle channel occupied in the UNII-2C band, the calculated power limit is $11+10*\log(15.925) = 23.02$ dBm. The total signal power is 17.90dBm which is less than the limit of 23.02dBm.

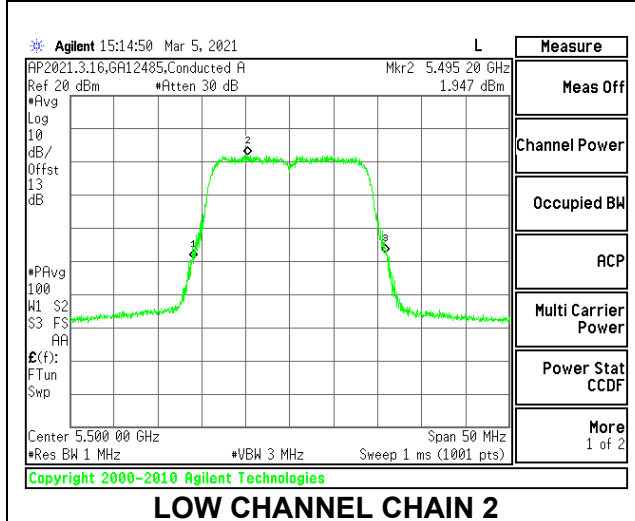
LOW CHANNEL



LOW CHANNEL CHAIN 0

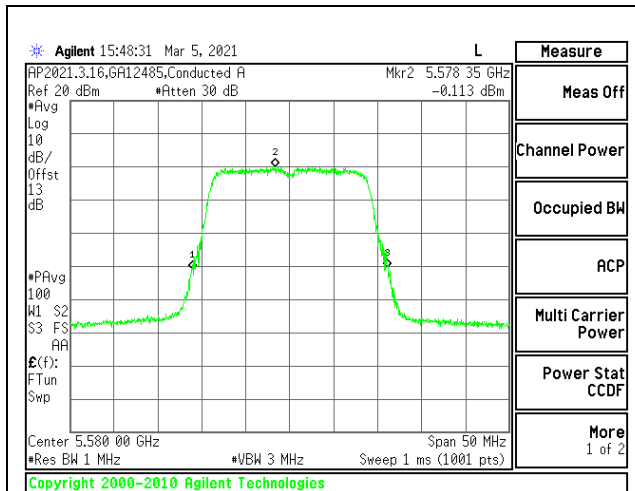


LOW CHANNEL CHAIN 1

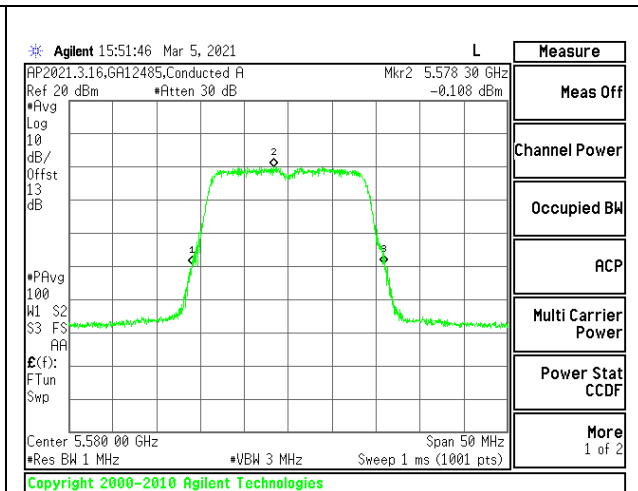


LOW CHANNEL CHAIN 2

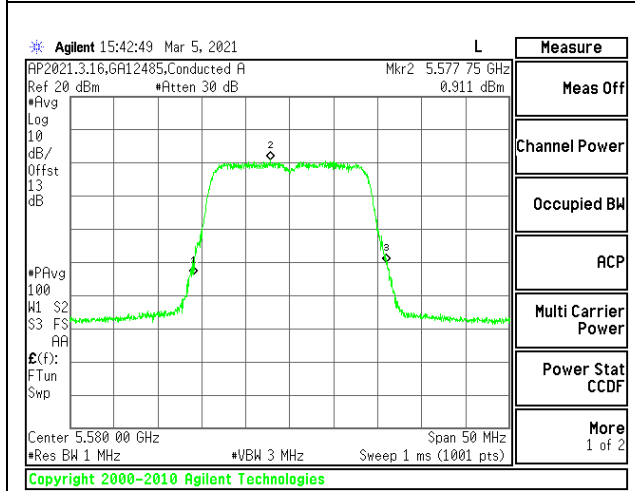
MID CHANNEL



MID CHANNEL CHAIN 0

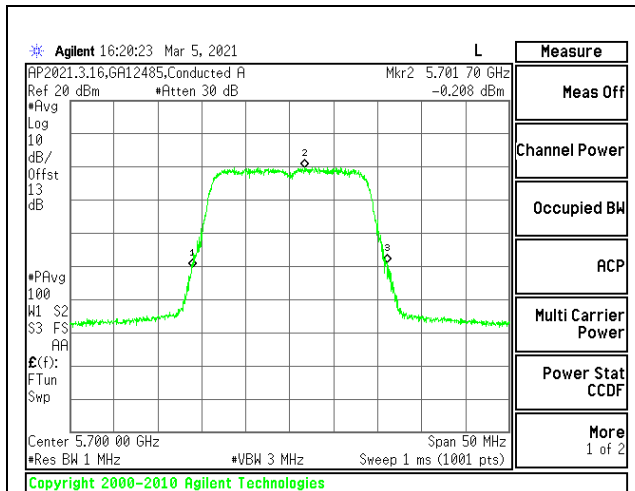


MID CHANNEL CHAIN 1

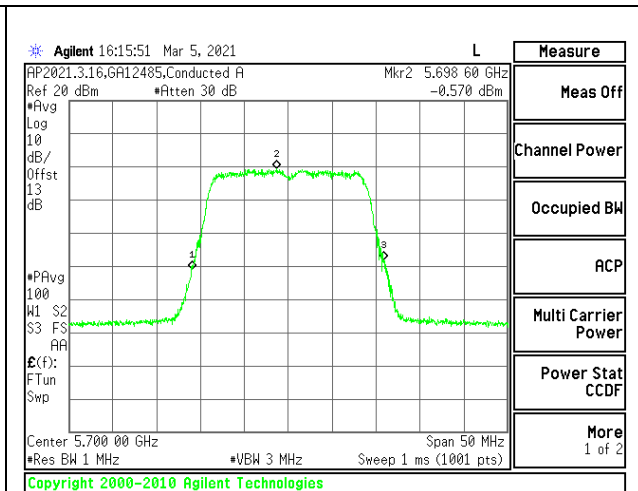


MID CHANNEL CHAIN 2

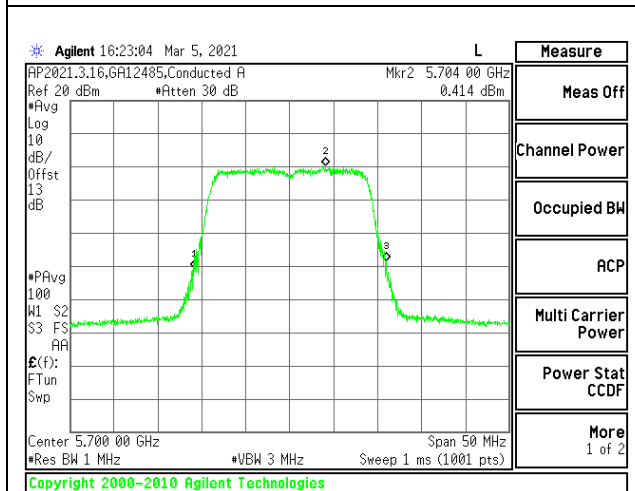
HIGH CHANNEL



HIGH CHANNEL CHAIN 0

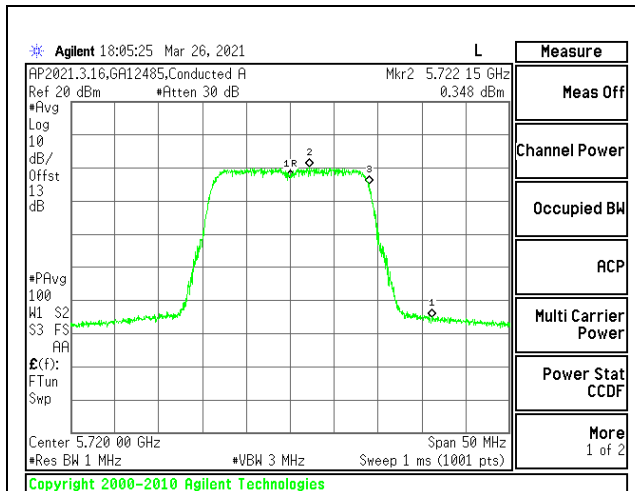


HIGH CHANNEL CHAIN 1

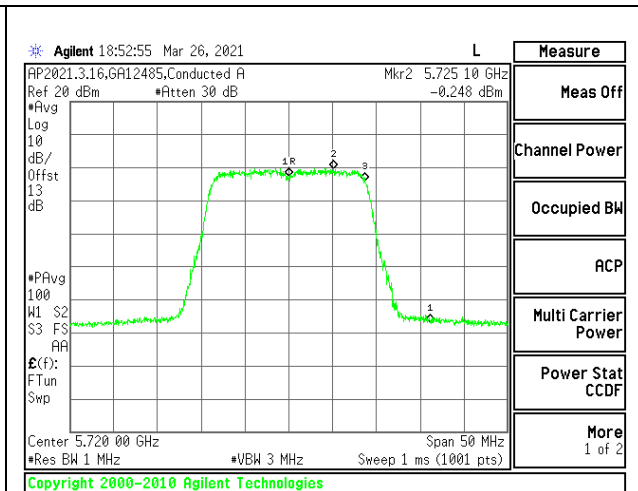


HIGH CHANNEL CHAIN 2

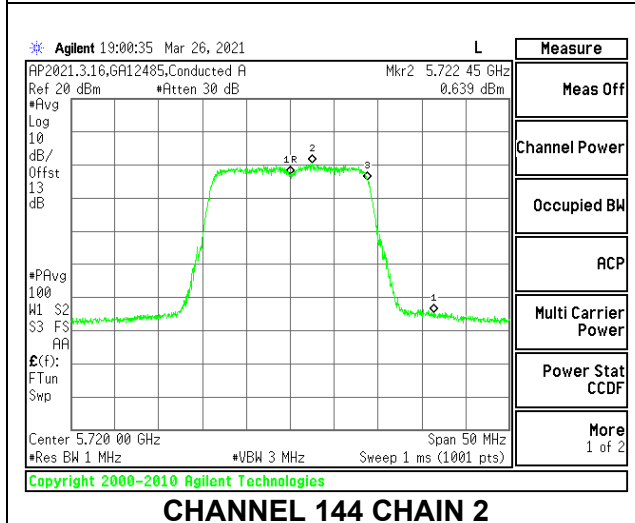
CHANNEL 144



CHANNEL 144 CHAIN 0



CHANNEL 144 CHAIN 1



CHANNEL 144 CHAIN 2

9.4.8. 802.11n HT40 MODE IN THE 5.6 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC)

Test Engineer:	12485 GA
Test Date:	03/09/2021 & 03/26/2021

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Uncorrelated Gain for Power (dBi)	Correlated Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5510	40.20	3.20	7.80	24.00	9.20
Mid	5550	40.30	3.20	7.80	24.00	9.20
High	5670	40.30	3.20	7.80	24.00	9.20
*142	5710	40.20	3.20	7.80	24.00	9.20

Duty Cycle CF (dB)	2.66	Included in Calculations of Corr'd PSD
---------------------------	------	---

Output Power Results

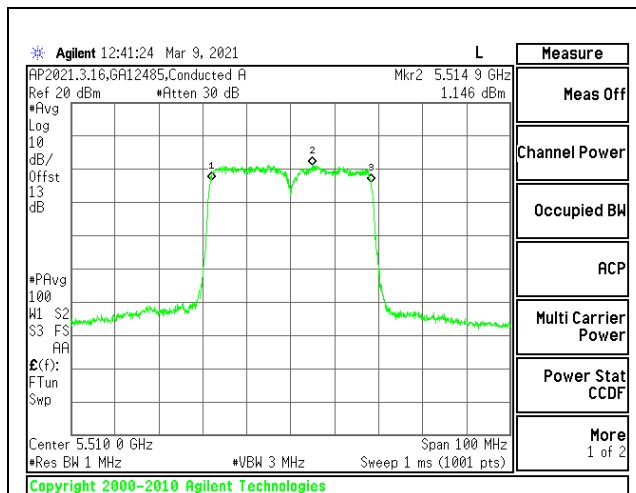
Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5510	17.50	16.68	17.44	21.99	24.00	-2.01
Mid	5550	15.29	16.40	16.77	20.97	24.00	-3.03
High	5670	15.28	14.45	15.15	19.75	24.00	-4.25
*142	5710	16.12	14.77	15.45	20.25	24.00	-3.75

PSD Results

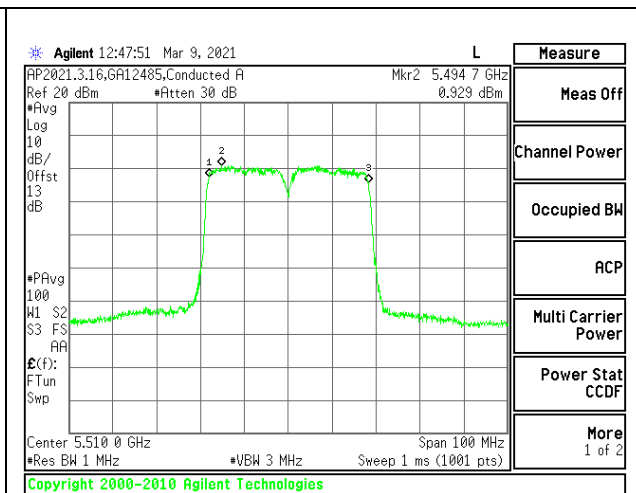
Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/ 1MHz)	Antenna 2 Meas PSD (dBm/ 1MHz)	Antenna 3 Meas PSD (dBm/ 1MHz)	Total Corr'd PSD (dBm/ 1MHz)	PSD Limit (dBm/ 1MHz)	PSD Margin (dB)
Low	5510	1.15	0.93	1.48	8.62	9.20	-0.58
Mid	5550	1.23	0.12	0.84	8.19	9.20	-1.01
High	5670	-0.77	-1.49	-0.55	6.51	9.20	-2.69
*142	5710	-1.11	-1.22	-0.81	6.39	9.20	-2.81

*The 26dB signal bandwidth within the 5470 -5725 MHz band clearly exceed 20MHz and so the limit for the power within the 5470-5725MHz band is 24.00dBm.

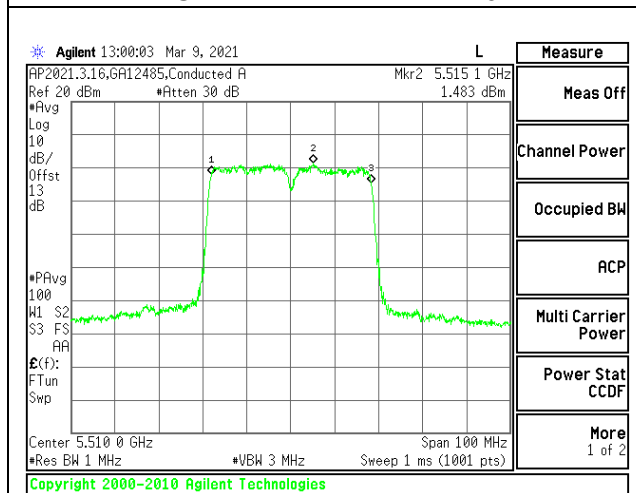
LOW CHANNEL



LOW CHANNEL CHAIN 0

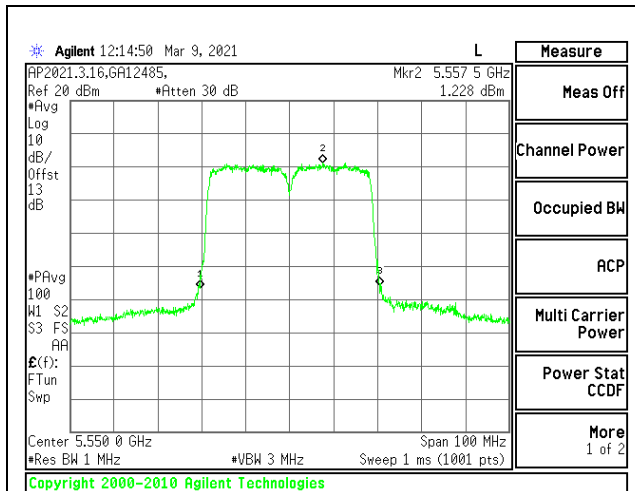


LOW CHANNEL CHAIN 1

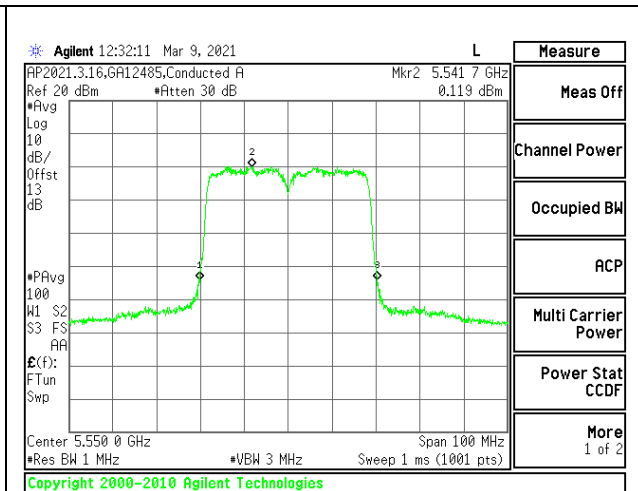


LOW CHANNEL CHAIN 2

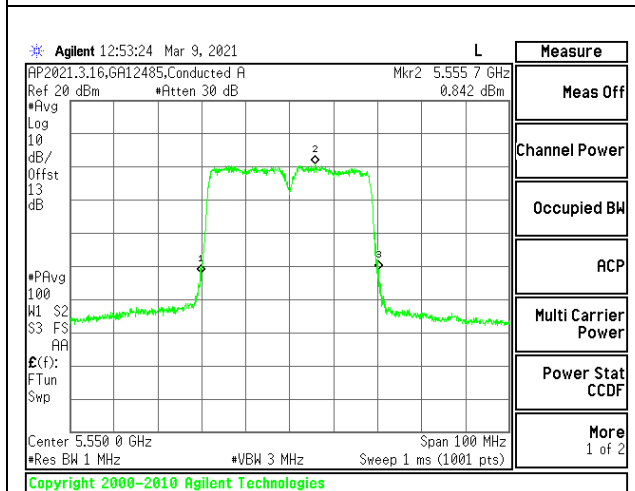
MID CHANNEL



MID CHANNEL CHAIN 0

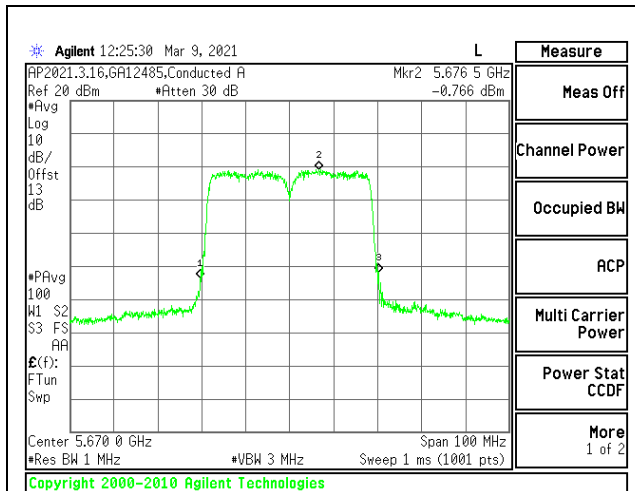


MID CHANNEL CHAIN 1

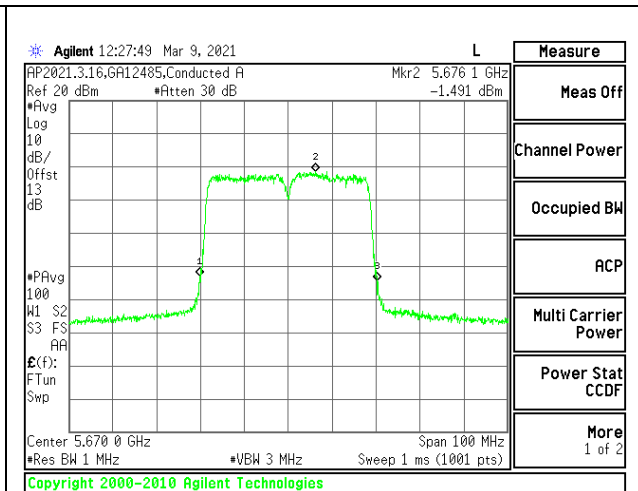


MID CHANNEL CHAIN 2

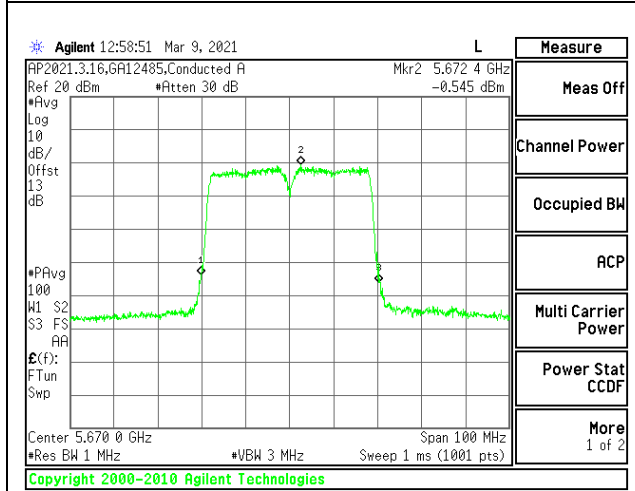
HIGH CHANNEL



HIGH CHANNEL CHAIN 0

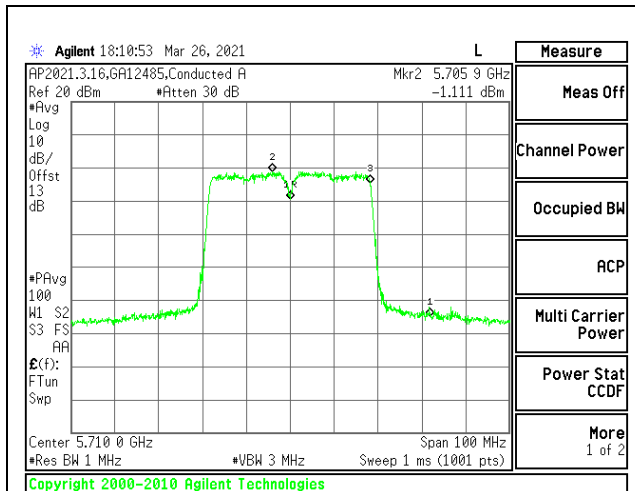


HIGH CHANNEL CHAIN 1

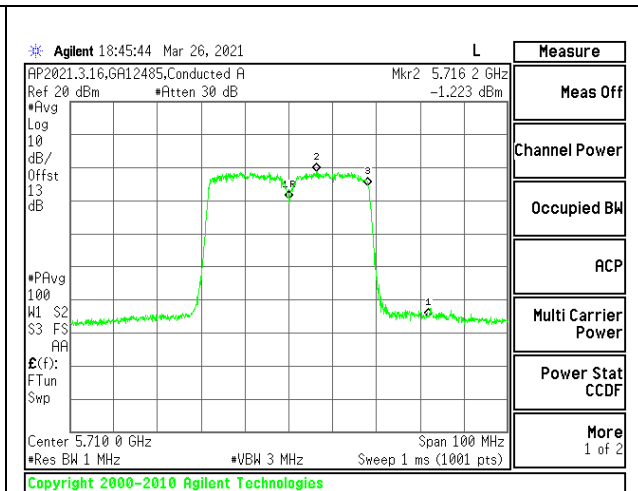


HIGH CHANNEL CHAIN 2

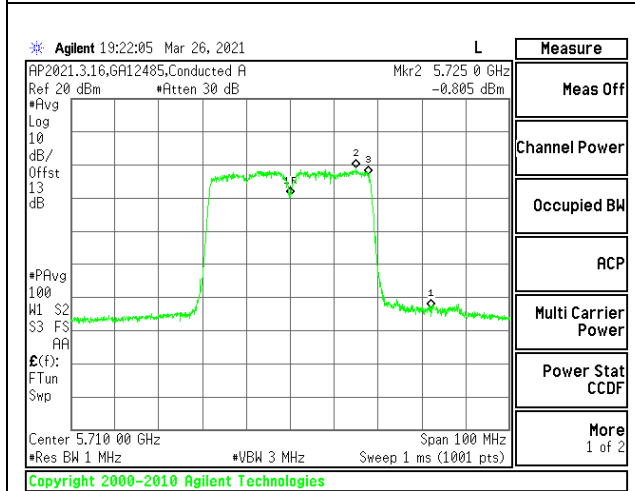
CHANNEL 142



CHANNEL 142 CHAIN 0



CHANNEL 142 CHAIN 1



CHANNEL 142 CHAIN 2

9.4.9. 802.11ac VHT80 MODE IN THE 5.6 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC)

Test Engineer:	12485 GA
Test Date:	03/09-10/2021 & 03/26/2021

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Uncorrelated Gain for Power (dBi)	Correlated Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5530	82.60	3.20	7.80	24.00	9.20
High	5610	82.80	3.20	7.80	24.00	9.20
*138	5690	82.80	3.20	7.80	24.00	9.20

Duty Cycle CF (dB)	0.96	Included in Calculations of Corr'd PSD
---------------------------	------	---

Output Power Results

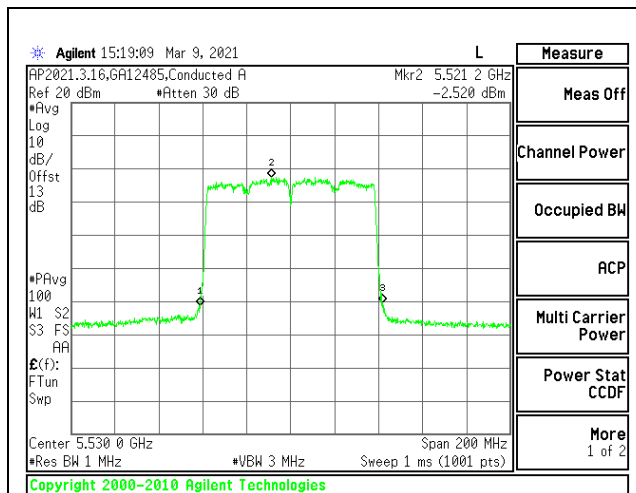
Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5530	14.02	14.63	14.72	19.24	24.00	-4.76
High	5610	14.04	13.16	13.26	18.28	24.00	-5.72
*138	5690	13.85	12.24	13.24	17.93	24.00	-6.07

PSD Results

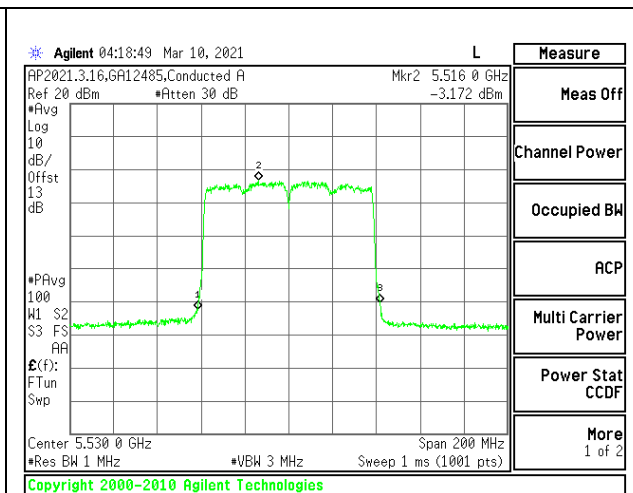
Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/ 1MHz)	Antenna 2 Meas PSD (dBm/ 1MHz)	Antenna 3 Meas PSD (dBm/ 1MHz)	Total Corr'd PSD (dBm/ 1MHz)	PSD Limit (dBm/ 1MHz)	PSD Margin (dB)
Low	5530	-2.52	-3.17	-2.75	2.93	9.20	-6.27
High	5610	-4.33	-4.30	-4.70	1.29	9.20	-7.91
*138	5690	-4.41	-5.26	-4.50	1.03	9.20	-8.17

*The 26dB signal bandwidth within the 5470 -5725 MHz band clearly exceed 20MHz and so the limit for the power within the 5470-5725MHz band is 24.00dBm

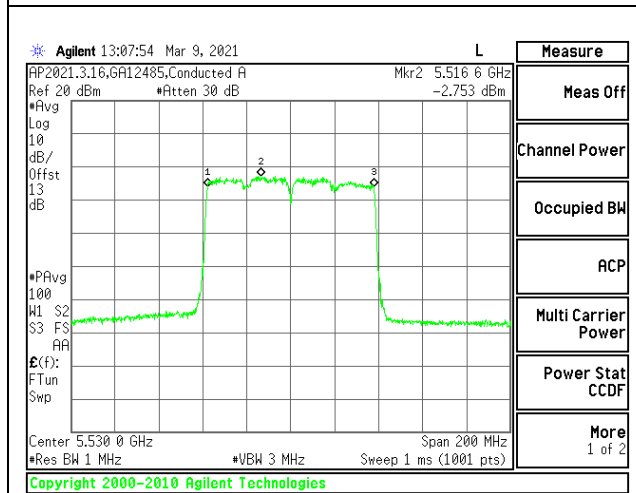
LOW CHANNEL



LOW CHANNEL CHAIN 0

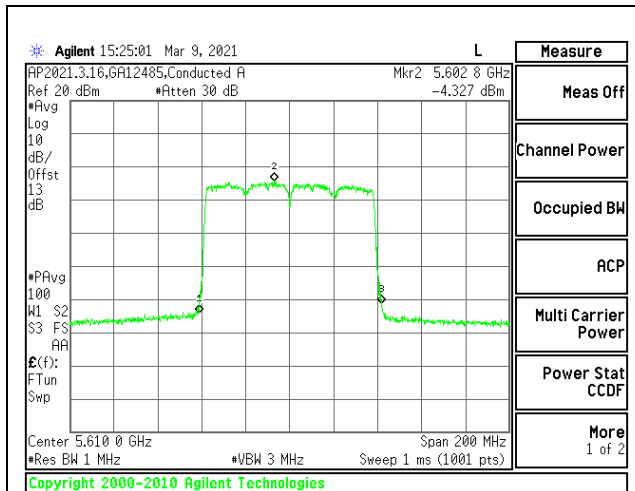


LOW CHANNEL CHAIN 1

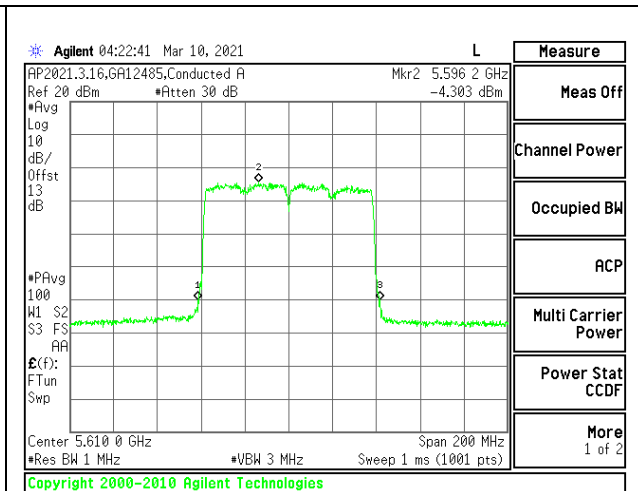


LOW CHANNEL CHAIN 2

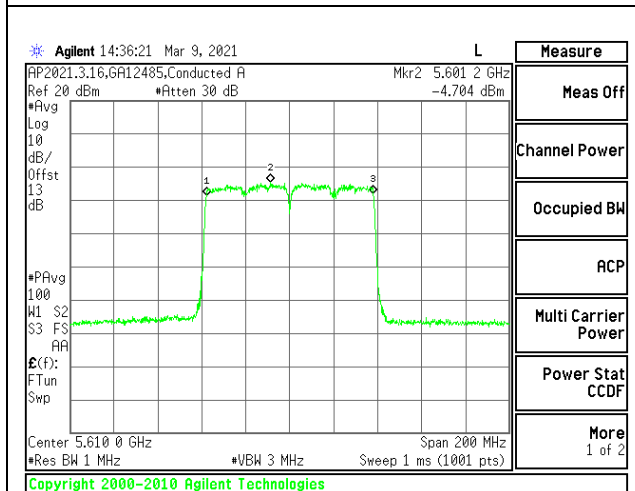
HIGH CHANNEL



HIGH CHANNEL CHAIN 0

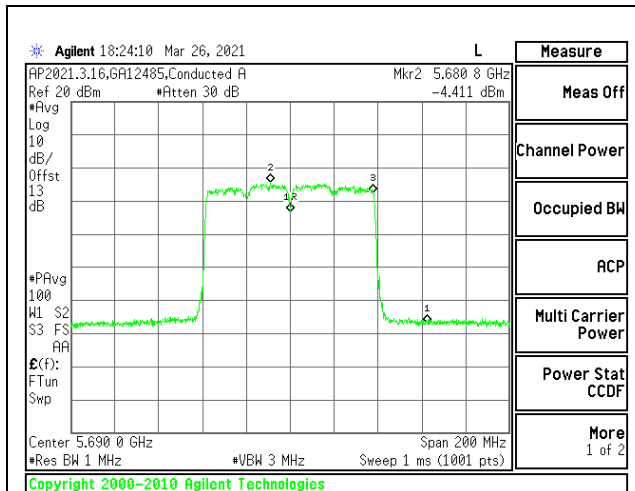


HIGH CHANNEL CHAIN 1

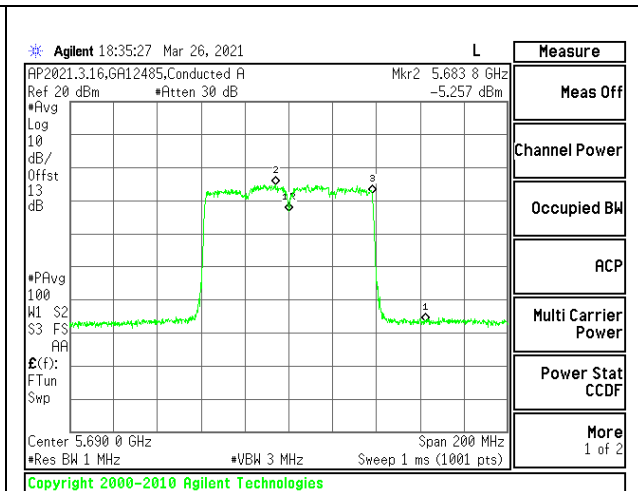


HIGH CHANNEL CHAIN 2

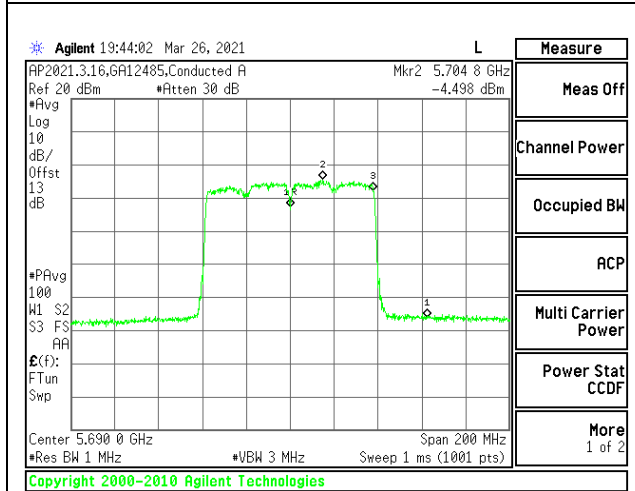
CHANNEL 138



CHANNEL 138 CHAIN 0



CHANNEL 138 CHAIN 1



CHANNEL 138 CHAIN 2

9.4.10. 802.11n HT20 MODE IN THE 5.8 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC)

Test Engineer:	12485 GA
Test Date:	03/09/2021 & 03/10/2021

Antenna Gain and Limit

Channel	Frequency (MHz)	Uncorrelated Gain For Power (dBi)	Correlated Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 500KHz)
Low	5745	2.90	7.60	30.00	28.40
Mid	5785	2.90	7.60	30.00	28.40
High	5825	2.90	7.60	30.00	28.40

Duty Cycle CF (dB)	2.30	Included in Calculations of Corr'd PSD
---------------------------	------	---

Output Power Results

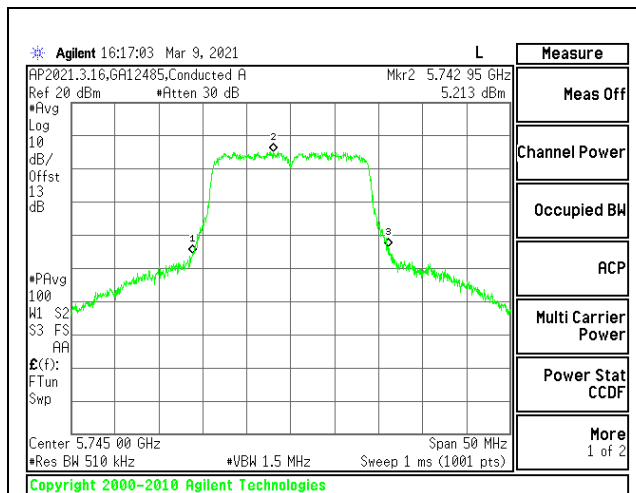
Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	19.52	19.12	19.75	24.24	30.00	-5.76
Mid	5785	20.13	19.89	20.02	24.79	30.00	-5.21
High	5825	20.41	19.16	19.54	24.51	30.00	-5.49

PSD Results

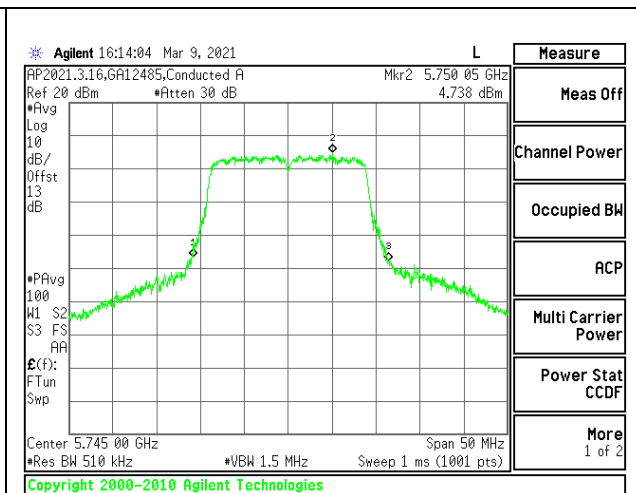
Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/ 500KHz)	Antenna 2 Meas PSD (dBm/ 500KHz)	Antenna 3 Meas PSD (dBm/ 500KHz)	Total Corr'd PSD (dBm/ 500KHz)	PSD Limit (dBm/ 500KHz)	PSD Margin (dB)
Low	5745	5.21	4.74	4.92	12.03	28.40	-16.37
Mid	5785	4.95	4.17	4.51	11.63	28.40	-16.77
High	5825	5.04	4.04	3.83	11.41	28.40	-16.99

Note for Straddle Channel: Total power and Highest PSD across the entire channel meets the UNII-2C limits thus UNII-3 limits and therefore compliant

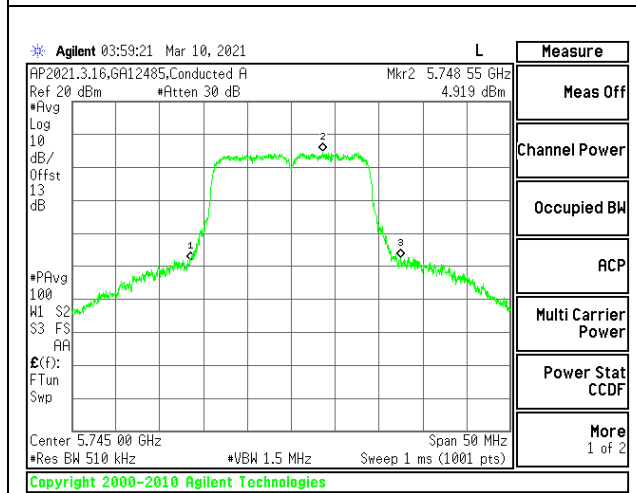
LOW CHANNEL



LOW CHANNEL CHAIN 0

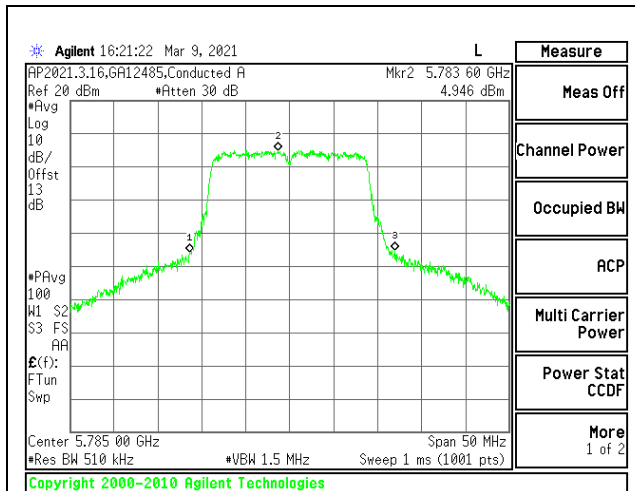


LOW CHANNEL CHAIN 1

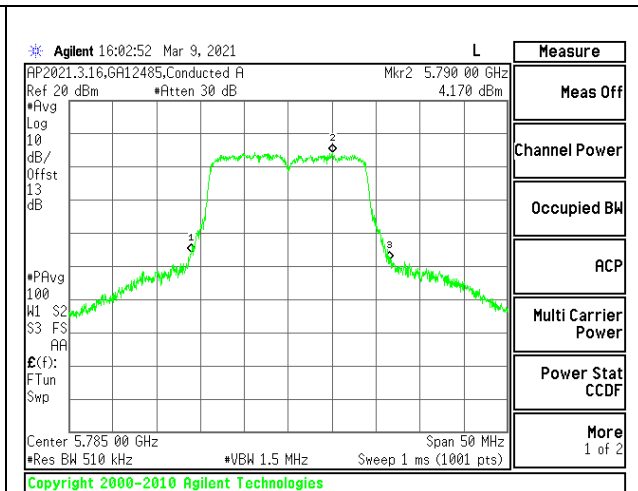


LOW CHANNEL CHAIN 2

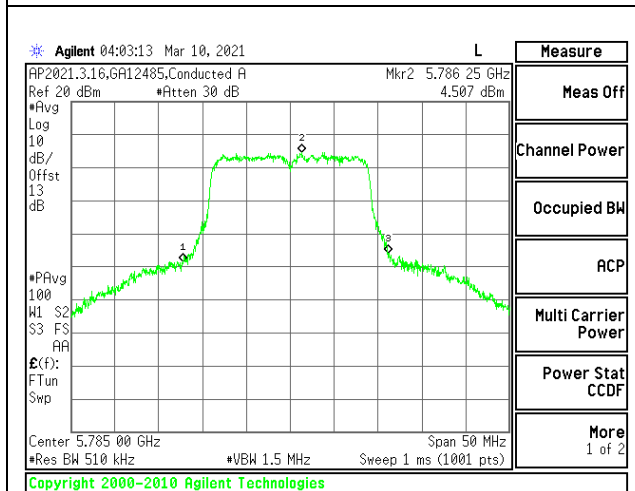
MID CHANNEL



MID CHANNEL CHAIN 0

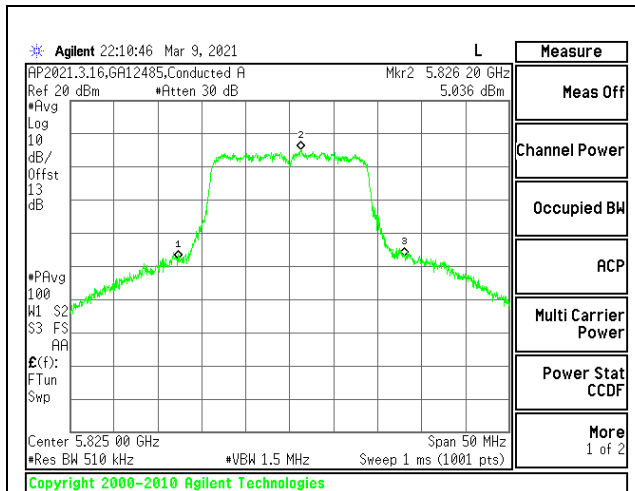


MID CHANNEL CHAIN 1

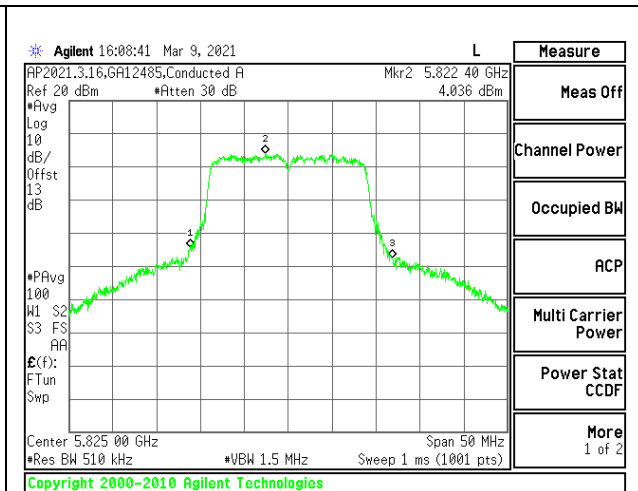


MID CHANNEL CHAIN 2

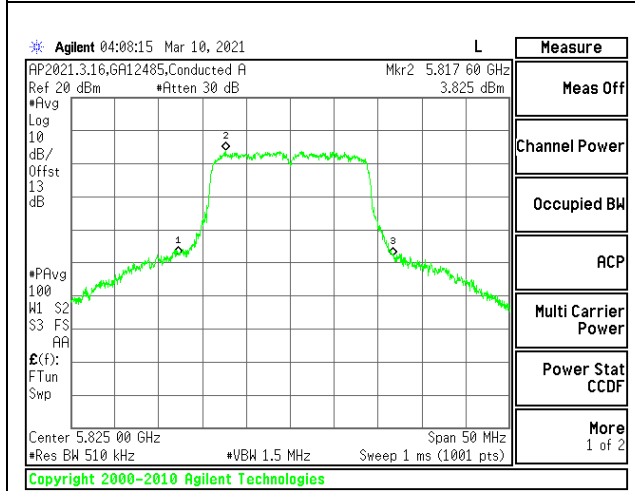
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2

9.4.11. 802.11n HT40 MODE IN THE 5.8 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC)

Test Engineer:	12485 GA
Test Date:	04/22/2021

Antenna Gain and Limit

Channel	Frequency (MHz)	Uncorrelated Gain For Power (dBi)	Correlated Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 500KHz)
Low	5755	2.90	7.60	30.00	28.40
High	5795	2.90	7.60	30.00	28.40

Duty Cycle CF (dB)	2.66	Included in Calculations of Corr'd PSD
---------------------------	------	---

Output Power Results

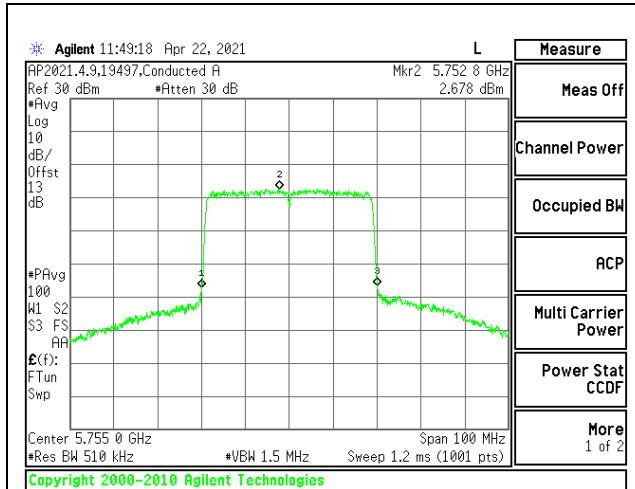
Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5755	19.92	18.85	18.71	23.97	30.00	-6.03
High	5795	19.44	18.45	18.32	23.54	30.00	-6.46

PSD Results

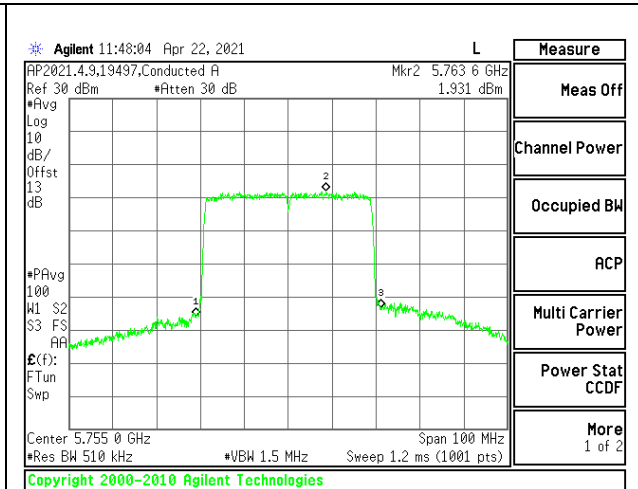
Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm/ 500KHz)	Antenna 2 Meas PSD (dBm/ 500KHz)	Antenna 3 Meas PSD (dBm/ 500KHz)	Total Corr'd PSD (dBm/ 500KHz)	PSD Limit (dBm/ 500KHz)	PSD Margin (dB)
Low	5755	2.68	1.93	2.19	9.71	28.40	-18.69
High	5795	2.46	1.26	1.50	9.20	28.40	-19.20

Note for Straddle Channel: Total power and Highest PSD across the entire channel meets the UNII-2C limits thus UNII-3 limits and therefore compliant

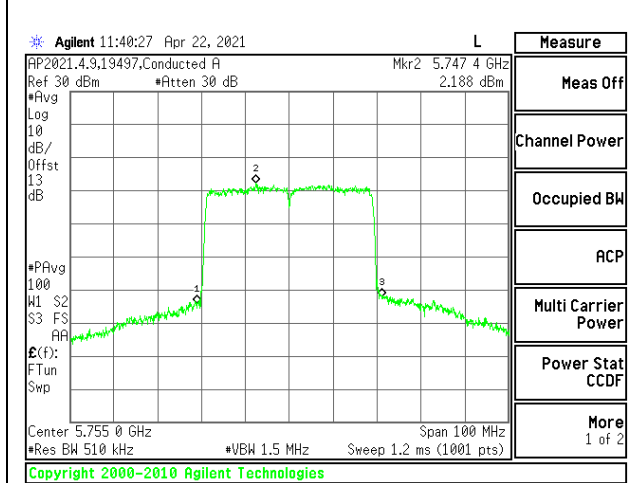
LOW CHANNEL



LOW CHANNEL CHAIN 0

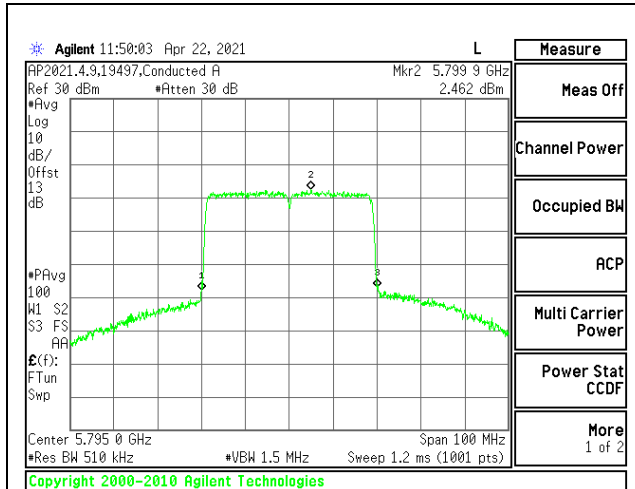


LOW CHANNEL CHAIN 1

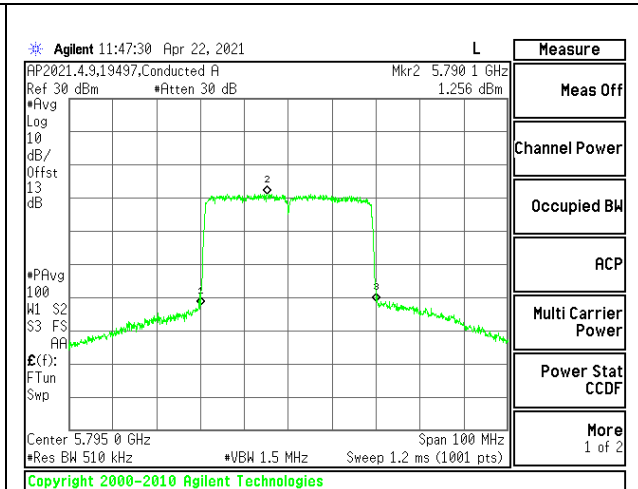


LOW CHANNEL CHAIN 2

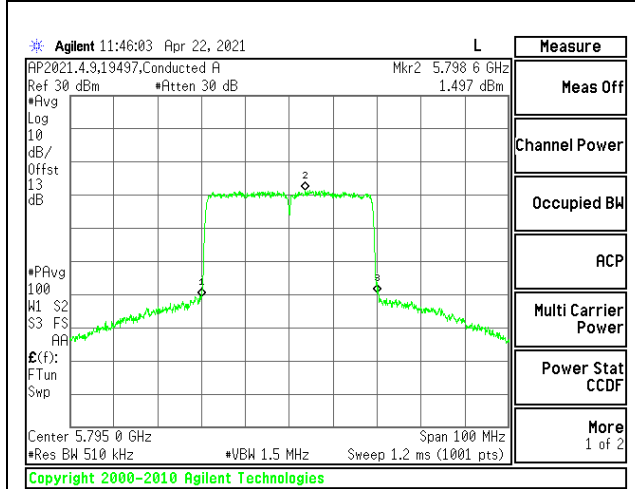
HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2

9.4.12. 802.11ac VHT80 MODE IN THE 5.8 GHz BAND

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE (FCC)

Test Engineer:	12485 GA
Test Date:	03/10/2021

Antenna Gain and Limit

Channel	Frequency (MHz)	Uncorrelated Gain For Power (dBi)	Correlated Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 500KHz)
Mid	5755	2.90	7.60	30.00	28.40

Duty Cycle CF (dB)	0.96	Included in Calculations of Corr'd PSD
---------------------------	------	---

Output Power Results

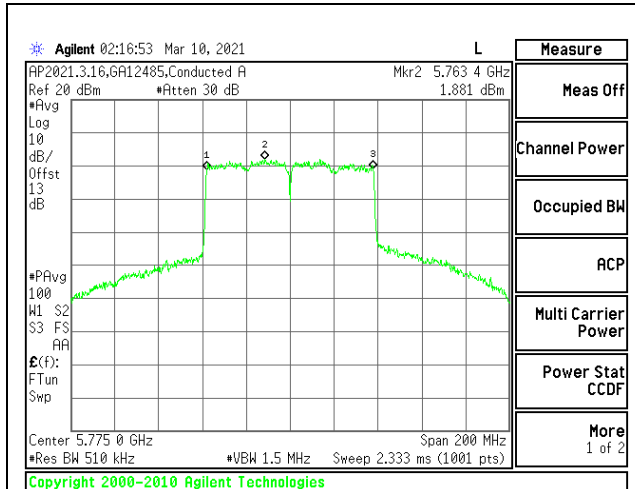
Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Antenna 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Mid	5755	22.68	21.06	21.37	26.53	30.00	-3.47

PSD Results

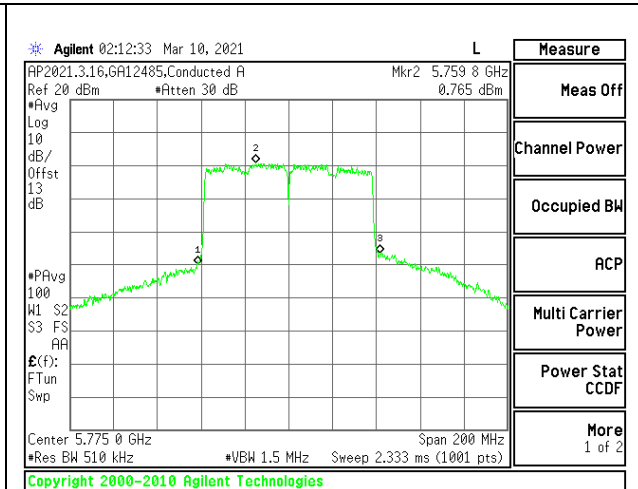
Channel	Frequency (MHz)	Antenna 1 Meas PSD (dBm)	Antenna 2 Meas PSD (dBm)	Antenna 3 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Mid	5755	1.88	0.77	0.95	6.96	28.40	-21.44

Note for Straddle Channel: Total power and Highest PSD across the entire channel meets the UNII-2C limits thus UNII-3 limits and therefore compliant

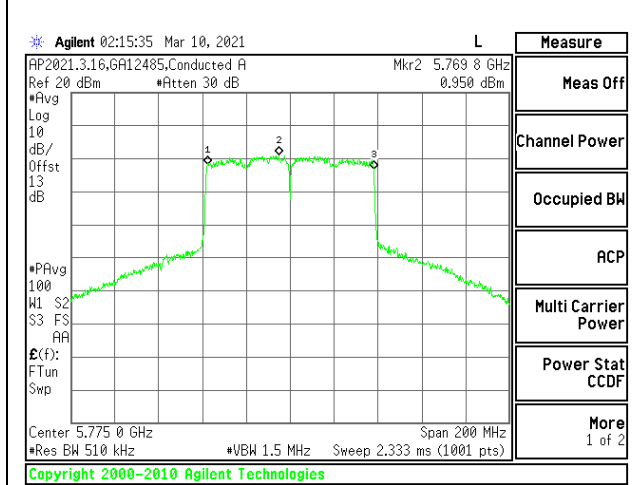
MID CHANNEL



MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1



MID CHANNEL CHAIN 2

10. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209 -Restricted bands

FCC §15.407(b)(1-3) -Un-Restricted bands

After January 01, 2019 for Outside of the Restricted Bands Emissions

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 30 MHz to 1GHz and 18GHz to 40 GHz is investigated with the transmitter set to transmit at the channel with highest output power as worst-case scenario. 1GHz to 18GHz was set to the lowest, middle, and highest channels in the 5 GHz bands.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

2D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only. Blue color trace on plots: Parallel orientation. Green color trace on plots: Perpendicular orientation.

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

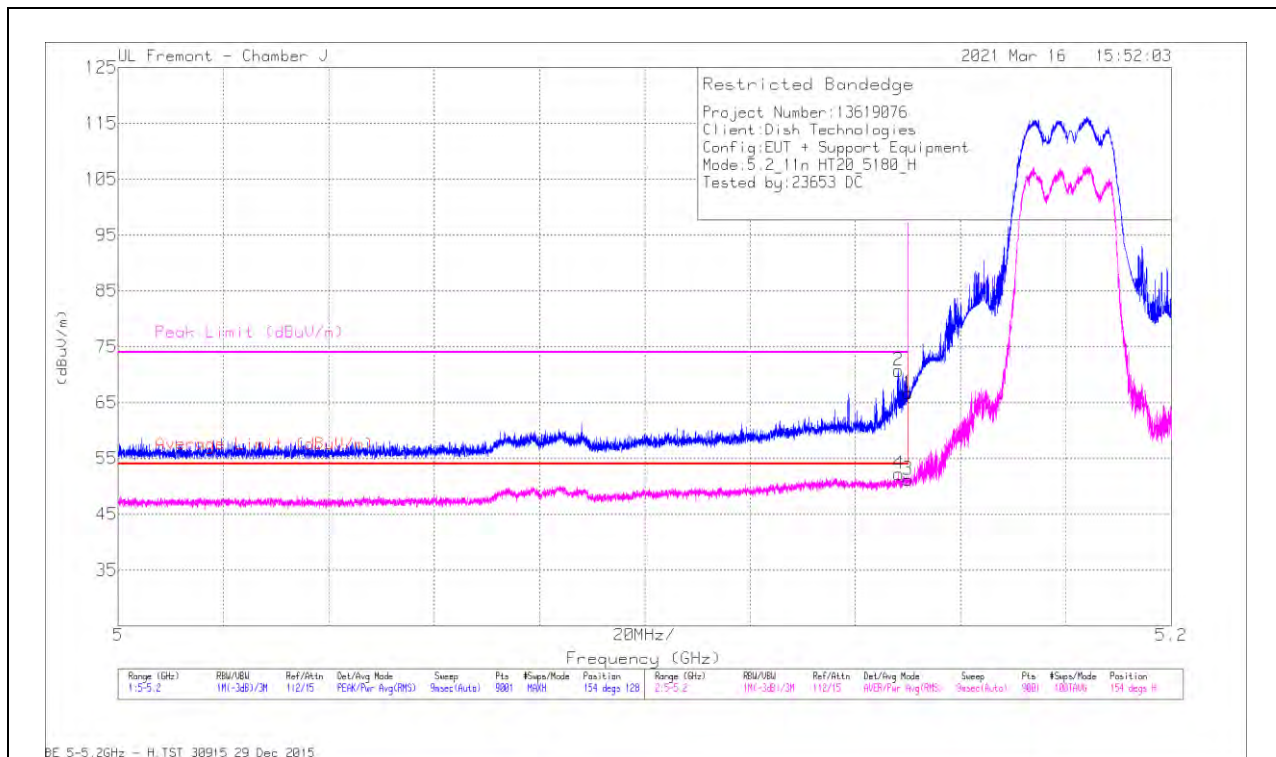
10.1. TRANSMITTER ABOVE 1 GHz

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

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



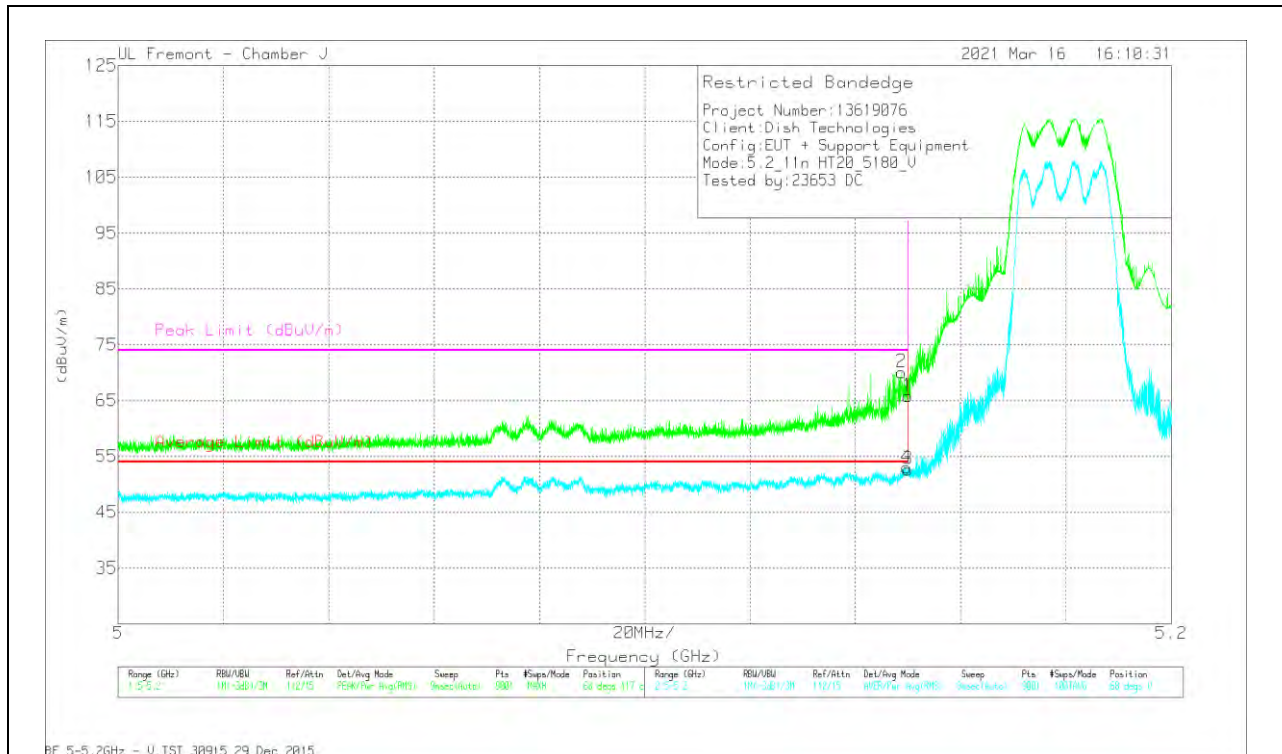
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AP PRE0100034 (dBm)	Amp/Cbl/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 5.15	53.04	Pk	34.4	-20.8	0	66.64	-	-	74	-7.36	154	128	H
2	* 5.14815	57.14	Pk	34.4	-20.8	0	70.74	-	-	74	-3.26	154	128	H
3	* 5.15	35.3	RMS	34.4	-20.8	2.3	51.2	54	-2.8	-	-	154	128	H
4	* 5.14822	36.33	RMS	34.4	-20.8	2.3	52.23	54	-1.77	-	-	154	128	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AP PRE0100034 (dBm)	Amp/Cal/Pln/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 5.15	52.23	Pk	34.4	-20.8	0	65.83	-	-	74	-8.17	68	117	V
2	* 5.14873	56.48	Pk	34.4	-20.8	0	70.08	-	-	74	-3.92	68	117	V
3	* 5.15	36.79	RMS	34.4	-20.8	2.3	52.69	54	-1.31	-	-	68	117	V
4	* 5.14971	37.08	RMS	34.4	-20.8	2.3	52.98	54	-1.02	-	-	68	117	V

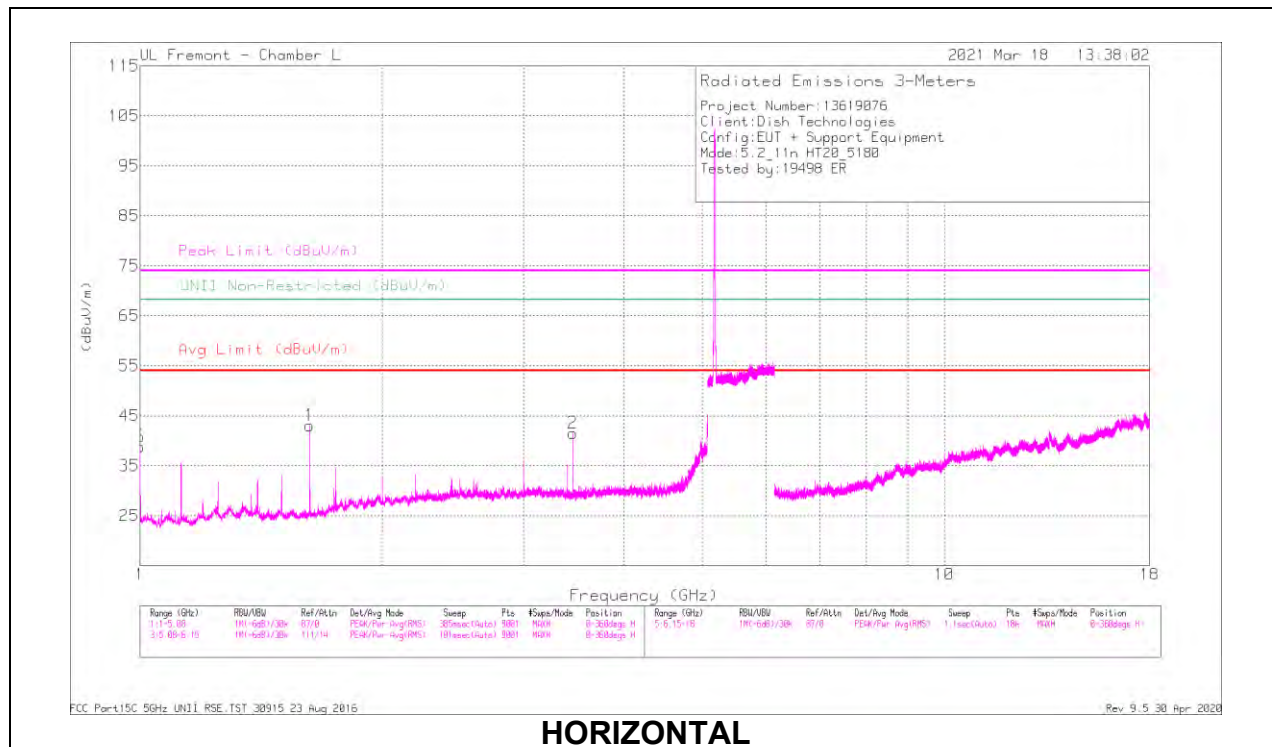
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

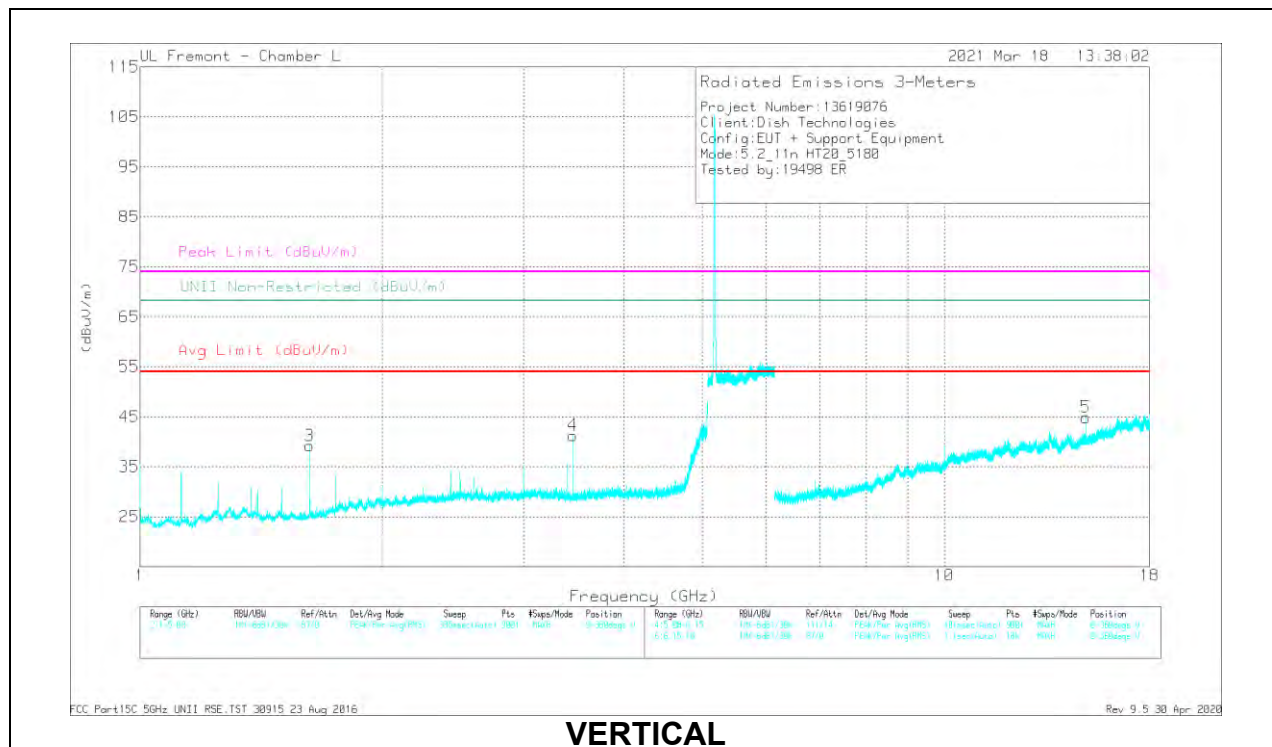
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

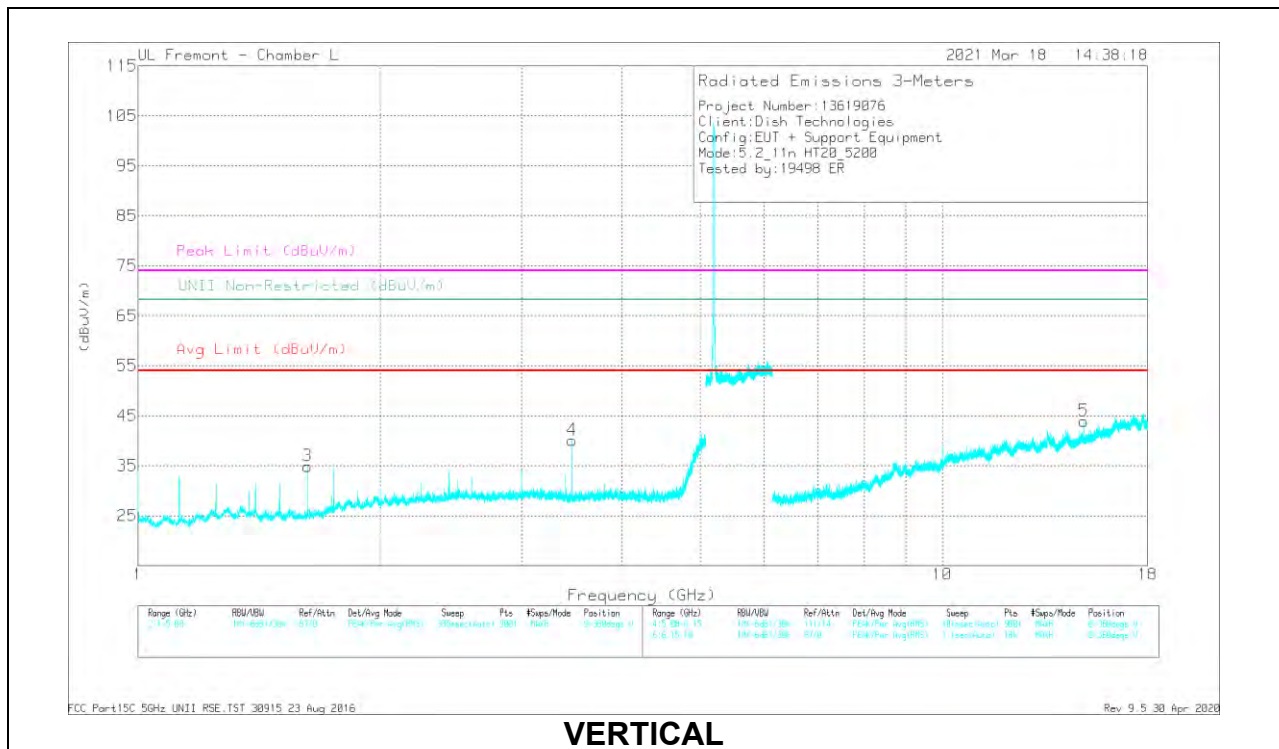
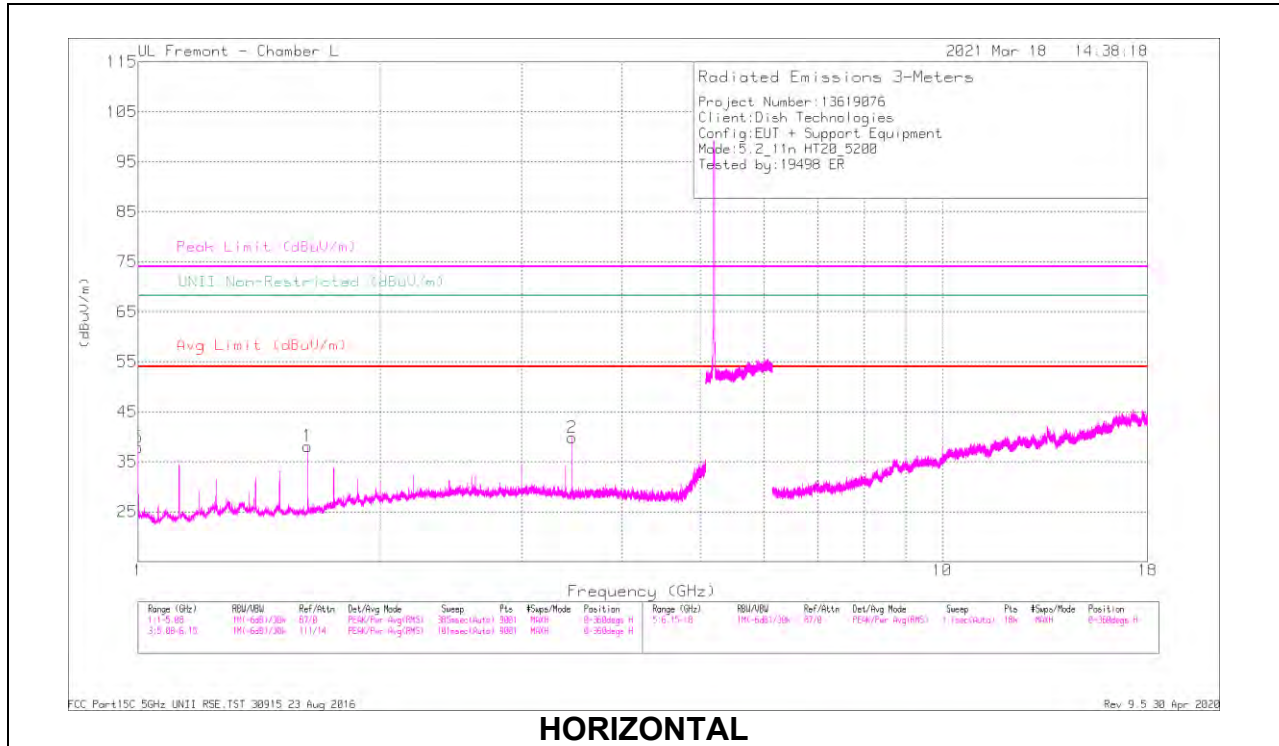
Marker	Frequency (MHz)	Meas Reading (dBm)	Det	AF 344 (dBm)	Amp/Corr/Freq/Psd (dB)	DC Corr (dB)	Corrected Reading (dBm)	Avg Limit (dBm/1m)	Margin (dB)	Peak Limit (dBm/1m)	PK Margin (dB)	URI Non-Restricted (dBm/1m)	PK Margin (dB)	Azimuth (Deg)	Height (m)	Polarity
1	* 1.62478	48.21	PK-U	28.3	-32.0	0	43.61	-	-	74	-30.39	-	-	187	155	H
	* 1.62478	43.72	ADR	28.3	-32.9	2.3	41.42	54	-12.58	-	-	-	-	187	155	H
6	* 1	47.28	PK-U	28.1	-34.3	0	41.08	-	-	74	-32.92	-	-	162	199	H
	* 1	43.16	ADR	28.1	-34.3	2.3	39.26	54	-14.74	-	-	-	-	162	199	H
2	3.45337	40.52	PK-U	32.6	-29	0	44.12	-	-	74	-	88.2	-	187	101	H
	* 1.62478	45.8	PK-U	28.3	-32.9	0	41.2	-	-	74	-32.8	-	-	197	250	V
	* 1.62478	39.75	ADR	28.3	-32.9	2.3	37.45	54	-16.55	-	-	-	-	197	250	V
4	3.45326	41.58	PK-U	32.6	-29	0	45.18	-	-	-	-	88.2	-25.02	190	114	V
5	14.99952	30.5	PK-U	39.9	-19.1	0	51.3	-	-	-	-	88.2	-18.9	0	109	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

MID CHANNEL RESULTS

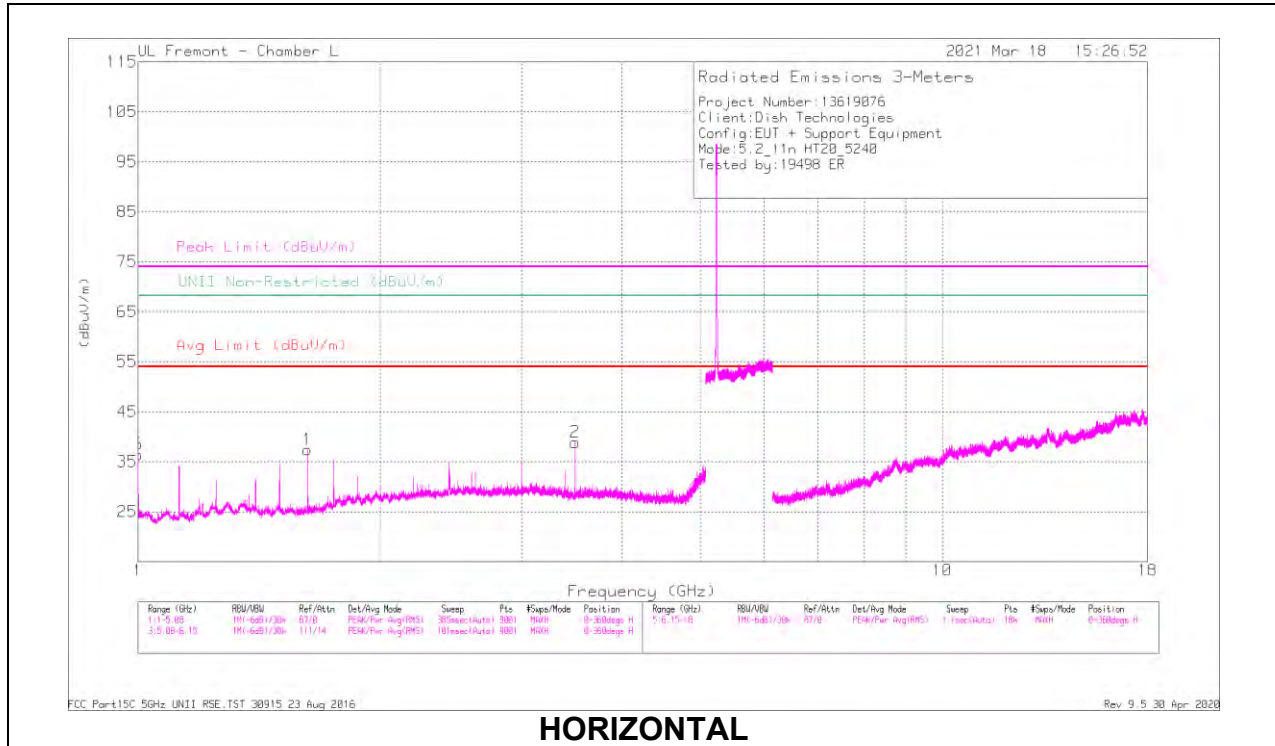


RADIATED EMISSIONS

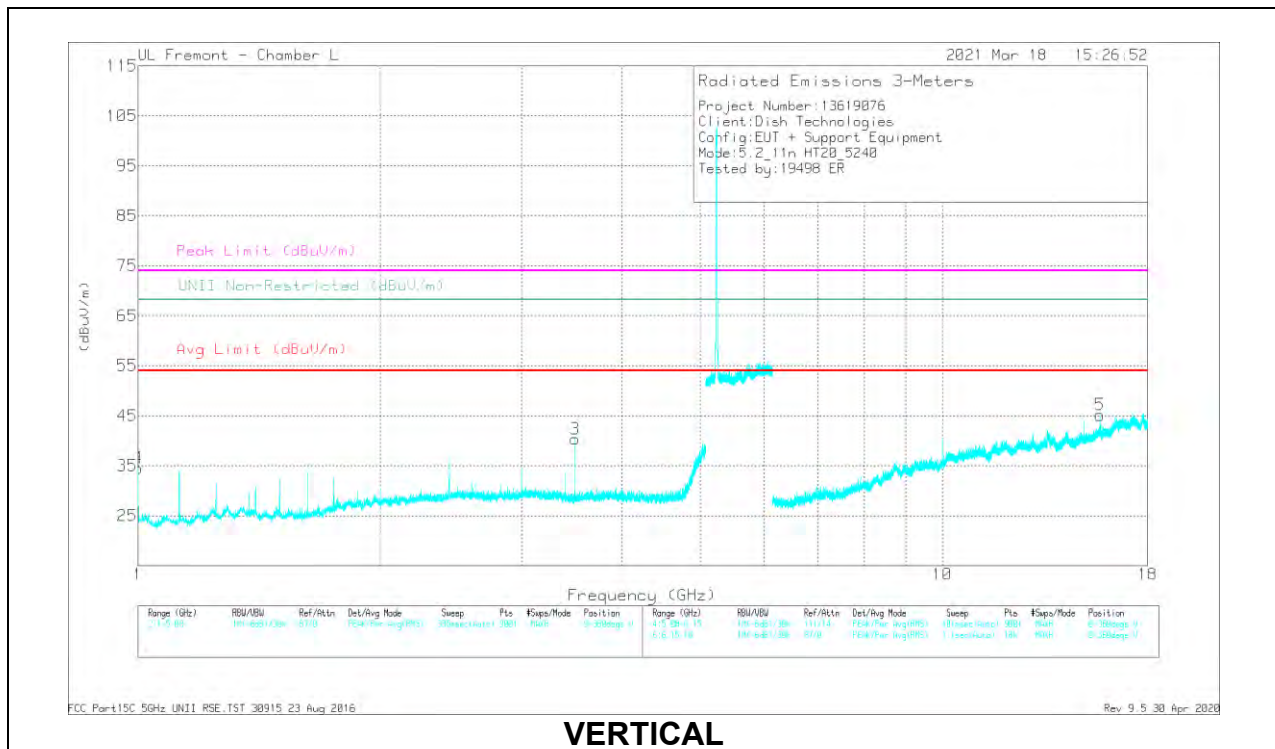
Marker	Frequency (MHz)	Meas Reading (dBm)	Det	AF 344 (dBm)	Amp/Corr/Freq/Psd (dB)	DC Corr (dB)	Corrected Reading (dBm)	Avg Limit (dBm/100)	Margin (dB)	Peak Limit (dBm/100)	PK Margin (dB)	URI Non-Restricted (dBm/100)	PK Margin (dB)	Azimuth (Deg)	Height (m)	Polarity
1	* 1.62478	45.98	PK-U	28.3	-32.0	0	41.36	-	-	74	-32.64	-	-	181	191	H
	* 1.62478	40.6	ADR	28.3	-32.9	2.3	38.3	54	-15.7	-	-	-	-	181	191	H
	* 1.00003	46.98	PK-U	28.1	-34.3	0	40.78	-	-	74	-33.22	-	-	159	206	H
2	* 1	42.71	ADR	28.1	-34.3	2.3	38.81	54	-15.19	-	-	-	-	159	206	H
	3.46687	40.37	PK-U	32.6	-29	0	43.07	-	-	74	-34.67	88.2	-24.23	190	107	H
3	* 1.62478	43.93	PK-U	28.3	-32.9	0	39.33	-	-	74	-34.67	-	-	194	245	V
	* 1.62478	37.48	ADR	28.3	-32.9	2.3	35.18	54	-18.82	-	-	-	-	194	245	V
4	3.46689	34.87	PK-U	32.6	-29	0	38.47	-	-	-	-	88.2	-29.73	231	107	V
	14.99956	29.88	PK-U	39.9	-19.1	0	50.68	-	-	-	-	88.2	-17.52	349	104	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK-U - U-NII: Maximum Peak
 ADR - U-NII AD primary method, RMS average

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meas Reading (dBm)	Det	AF 344 (dBm)	AmpCofFiltPad (dB)	DC Corr (dB)	Corrected Reading (dBm)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNI Non-Restricted (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (m)	Polarity
1	* 1.62498	46.59	PK-U	28.3	-32.9	0	41.99	-	-	74	-32.01	-	-	186	161	H
	* 1.62498	41.28	ADR	28.3	-32.9	2.3	38.98	54	-15.02	-	-	-	-	186	161	H
6	* 1.00005	46.88	PK-U	28.1	-34.3	0	40.68	-	-	74	-33.32	-	-	184	199	H
	* 1	42.86	ADR	28.1	-34.3	2.3	38.96	54	-15.04	-	-	-	-	184	199	H
2	3.49336	40.03	PK-U	32.7	-29	0	43.73	-	-	-	-	68.2	-24.47	190	103	H
4	* 1.00001	47.33	PK-U	28.1	-34.3	0	41.13	-	-	74	-32.67	-	-	182	152	V
	* 1.00001	41.41	ADR	28.1	-34.3	2.3	37.51	54	-16.49	-	-	-	-	182	152	V
3	3.49339	40.69	PK-U	32.7	-29	0	44.39	-	-	-	-	68.2	-23.81	188	111	V
5	* 15.71912	29.25	PK-U	40.9	-19.7	0	30.45	-	-	74	-23.55	-	-	56	239	V
	* 15.7197	17.93	ADR	40.9	-19.7	2.3	41.43	54	-12.57	-	-	-	-	56	239	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK-U - U-NII: Maximum Peak

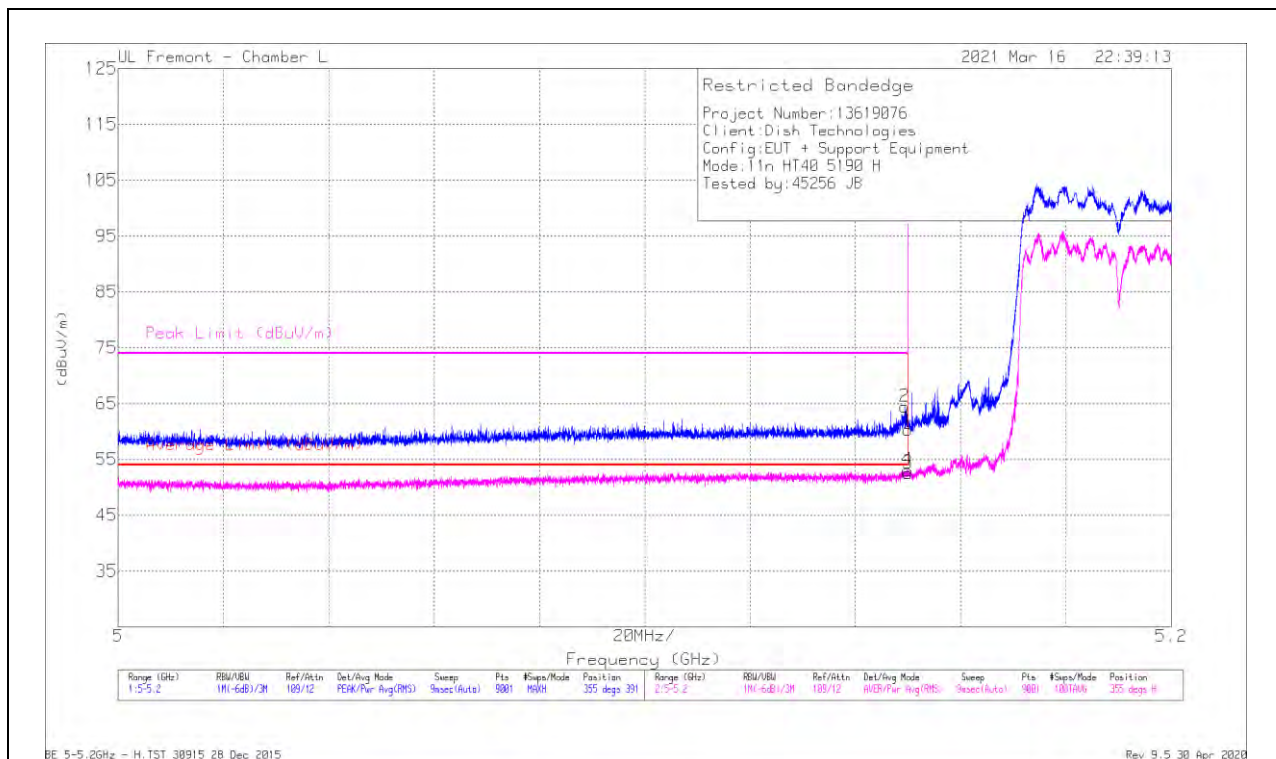
ADR - U-NII AD primary method, RMS average

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

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



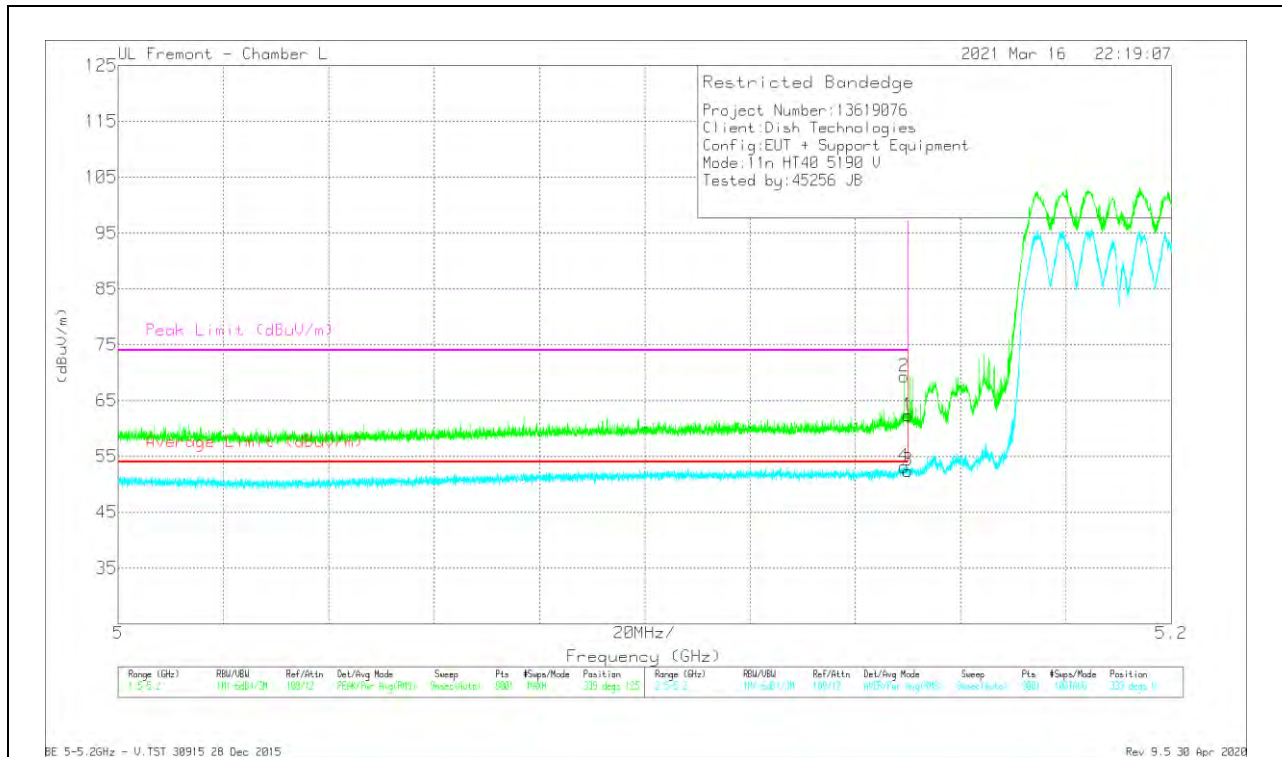
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dBm)	Amp/CbI/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 5.15	33.52	Pk	34.3	-7.5	0	60.32	-	-	74	-13.68	355	391	H
2	* 5.14935	37.62	Pk	34.3	-7.5	0	64.42	-	-	74	-9.58	355	391	H
3	* 5.15	23.08	RMS	34.3	-7.5	2.66	52.54	54	-1.46	-	-	355	391	H
4	* 5.14989	23.58	RMS	34.3	-7.5	2.66	53.04	54	-0.96	-	-	355	391	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dBm)	Amp/Cal/Pln/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 5.15	35.56	Pk	34.3	-7.5	0	62.36	-	-	74	-11.64	339	125	V
2	* 5.14924	42.5	Pk	34.3	-7.5	0	69.3	-	-	74	-4.7	339	125	V
3	* 5.15	22.98	RMS	34.3	-7.5	2.66	52.44	54	-1.56	-	-	339	125	V
4	* 5.14922	23.73	RMS	34.3	-7.5	2.66	53.19	54	-81	-	-	339	125	V

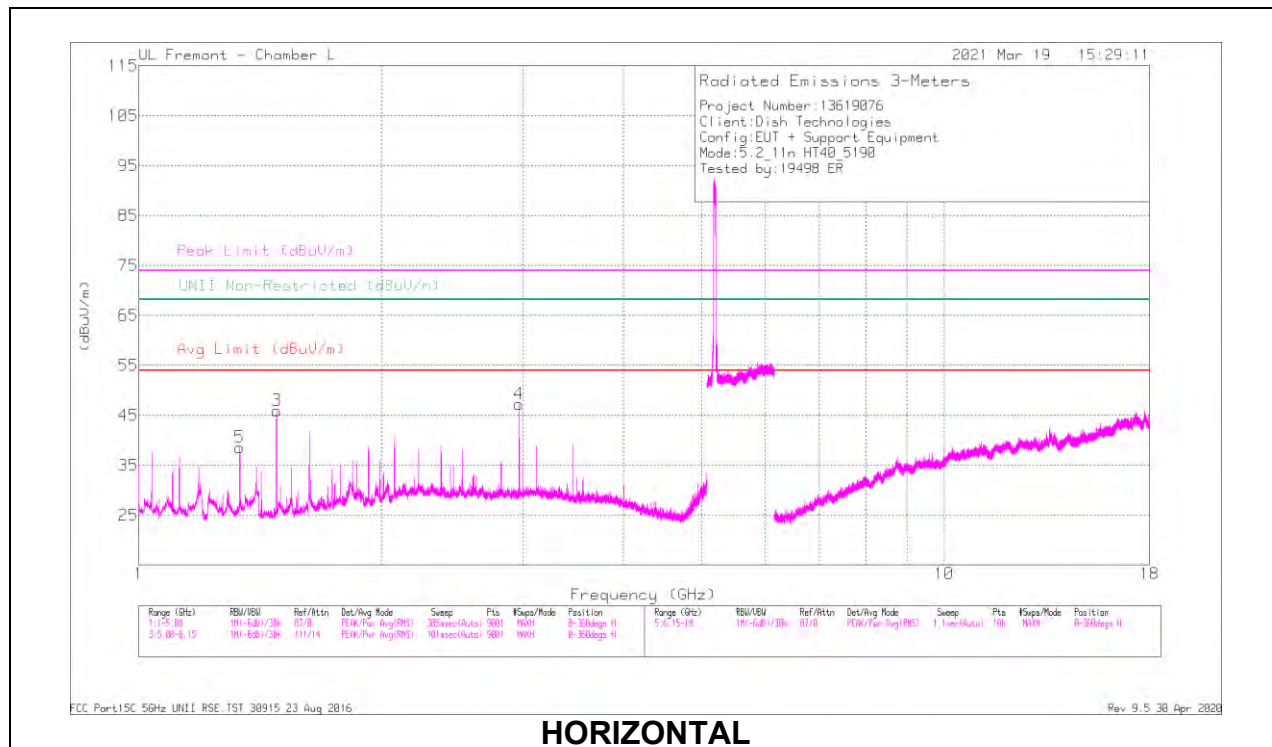
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

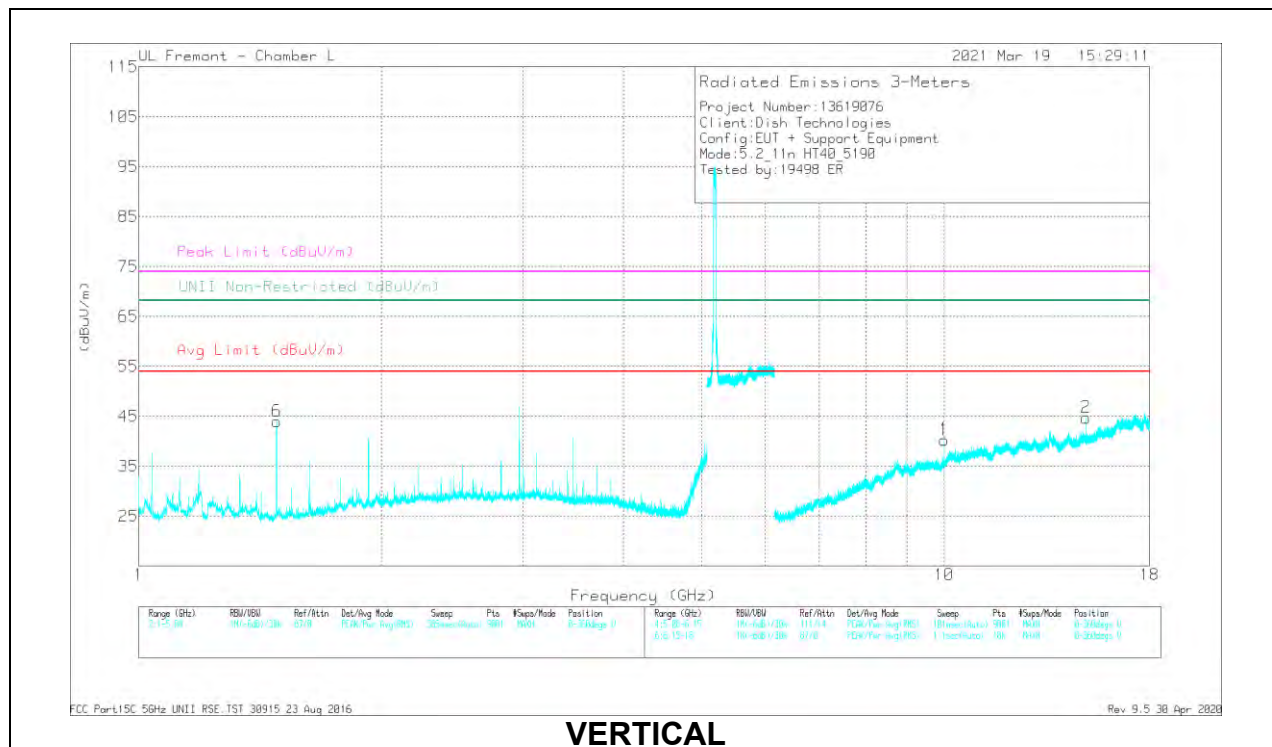
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



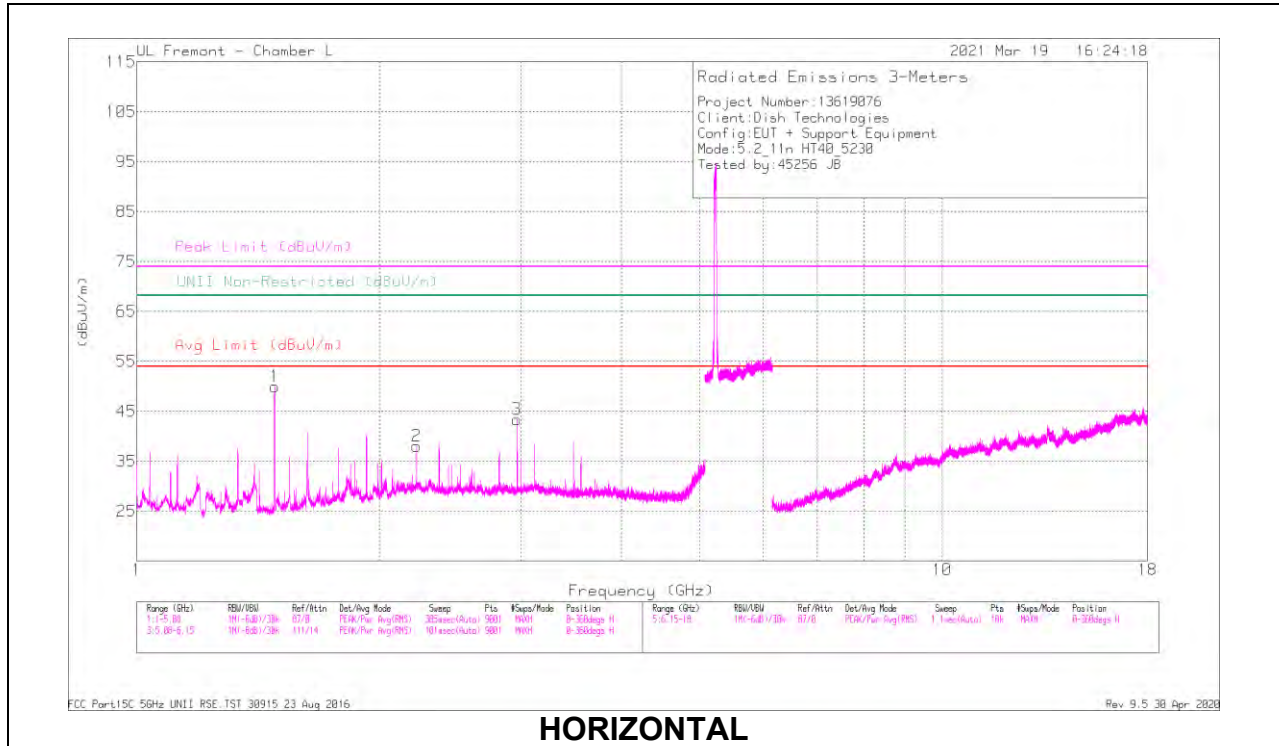
VERTICAL

RADIATED EMISSIONS

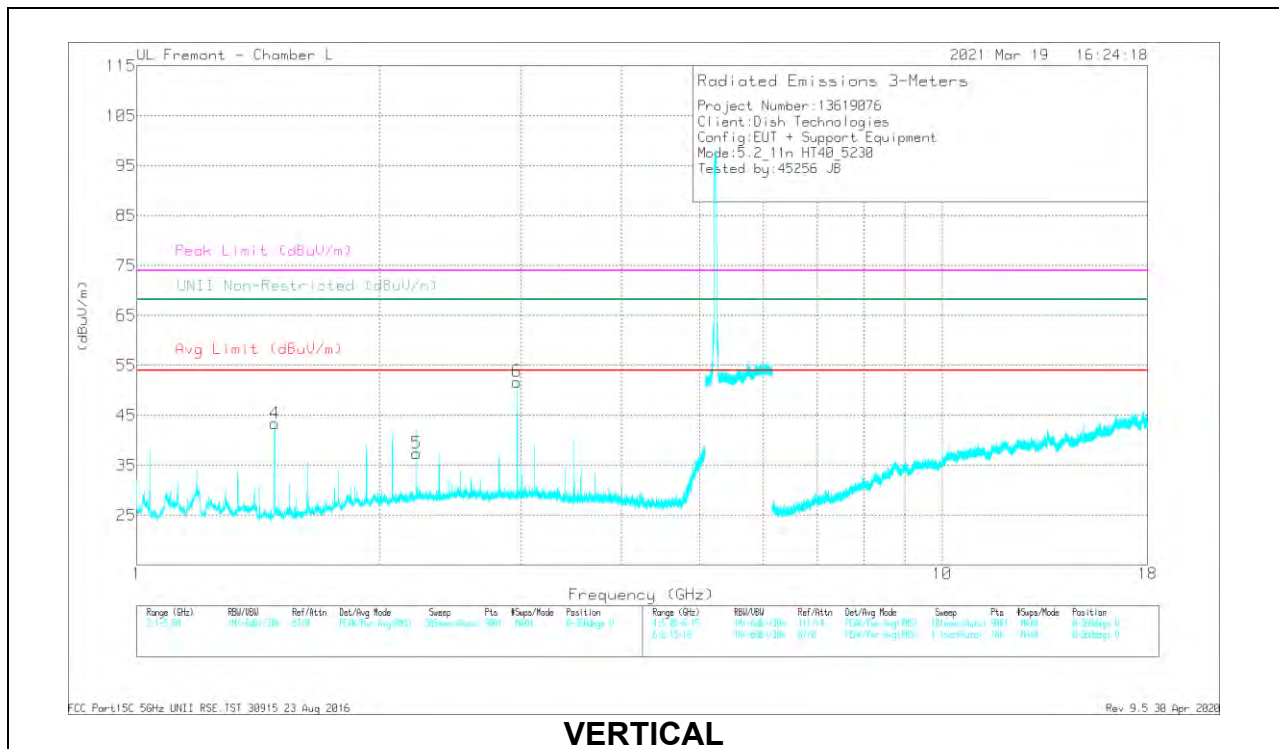
Marker	Frequency (MHz)	Meas Reading (dBuV)	Det	AF 344 (dBm)	Amp/Corr/Freq/Psd (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	URI Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Deg)	Height (m)	Polarity
5	* 1.4835	55.9	PK-U	28.2	-32.8	0	51.3	-	-	74	-22.7	-	-	244	143	H
	* 1.48351	46.8	ADR	28.2	-32.8	2.66	44.96	54	-9.14	-	-	-	-	244	143	H
3	* 1.33515	46.05	PK-U	28.8	-33.3	0	41.55	-	-	74	-32.45	-	-	179	114	H
	* 1.33516	40.13	ADR	28.8	-33.3	2.66	38.29	54	-15.71	-	-	-	-	179	114	H
4	2.98702	59.51	PK-U	32.6	-39.1	0	53.01	-	-	-	-	88.2	-	15.19	236	H
6	* 1.48353	50.95	PK-U	28.2	-32.8	0	46.35	-	-	74	-27.65	-	-	240	293	V
	* 1.48351	41.74	ADR	28.2	-32.8	2.66	39.8	54	-14.2	-	-	-	-	240	293	V
1	9.9999	28.43	PK-U	37	-19.0	0	45.53	-	-	-	-	88.2	-22.67	189	138	V
2	14.99997	30.22	PK-U	39.9	-19.1	0	51.02	-	-	-	-	88.2	-17.16	0	106	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK-U - U-NII: Maximum Peak
 ADR - U-NII AD primary method, RMS average

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meas Reading (dBuV)	Det	AF 344 (dBm)	Amp/Corr/Freq/Psd (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	URI Non-Restricted (dBuV/m)	PK Margin (dB)	Altitude (Feet)	Height (m)	Polarity
1	* 1.48351	56.74	PK-U	28.2	-32.8	0	52.14	-	-	74	-21.86	-	-	261	197	H
	* 1.48351	47.91	ADR	28.2	-32.8	2.66	45.97	54	-8.03	-	-	-	-	261	197	H
	* 2.22526	48.76	PK-U	31.7	-31.3	0	49.16	-	-	74	-24.84	-	-	12	101	H
2	* 2.22527	35.28	ADR	31.7	-31.3	2.66	38.34	54	-15.66	-	-	-	-	12	101	H
	2.96702	49.28	PK-U	32.6	-30.1	0	52.79	-	-	-	-	68.2	-	204	144	H
	* 1.48351	51.96	PK-U	28.2	-32.8	0	46.96	-	-	74	-27.04	-	-	231	231	V
3	* 1.48351	42.97	ADR	28.2	-32.8	2.66	41.03	54	-12.97	-	-	-	-	231	231	V
	* 2.22531	45.45	PK-U	31.7	-31.3	0	45.85	-	-	74	-28.15	-	-	9	193	V
	* 2.22526	32.48	ADR	31.7	-31.3	2.66	35.54	54	-18.46	-	-	-	-	9	193	V
4	* 1.48351	56.74	PK-U	28.2	-32.8	0	52.14	-	-	74	-21.86	-	-	261	197	H
	* 1.48351	47.91	ADR	28.2	-32.8	2.66	45.97	54	-8.03	-	-	-	-	261	197	H
	* 2.22526	48.76	PK-U	31.7	-31.3	0	49.16	-	-	74	-24.84	-	-	12	101	H
5	* 2.22527	35.28	ADR	31.7	-31.3	2.66	38.34	54	-15.66	-	-	-	-	12	101	H
	2.96702	49.28	PK-U	32.6	-30.1	0	52.79	-	-	-	-	68.2	-	204	144	H
	* 1.48351	51.96	PK-U	28.2	-32.8	0	46.96	-	-	74	-27.04	-	-	231	231	V
6	* 1.48351	42.97	ADR	28.2	-32.8	2.66	41.03	54	-12.97	-	-	-	-	231	231	V
	* 2.22531	45.45	PK-U	31.7	-31.3	0	45.85	-	-	74	-28.15	-	-	9	193	V
	* 2.22526	32.48	ADR	31.7	-31.3	2.66	35.54	54	-18.46	-	-	-	-	9	193	V
7	2.96703	50.45	PK-U	32.6	-30.1	0	52.95	-	-	-	-	68.2	-15.25	211	101	V

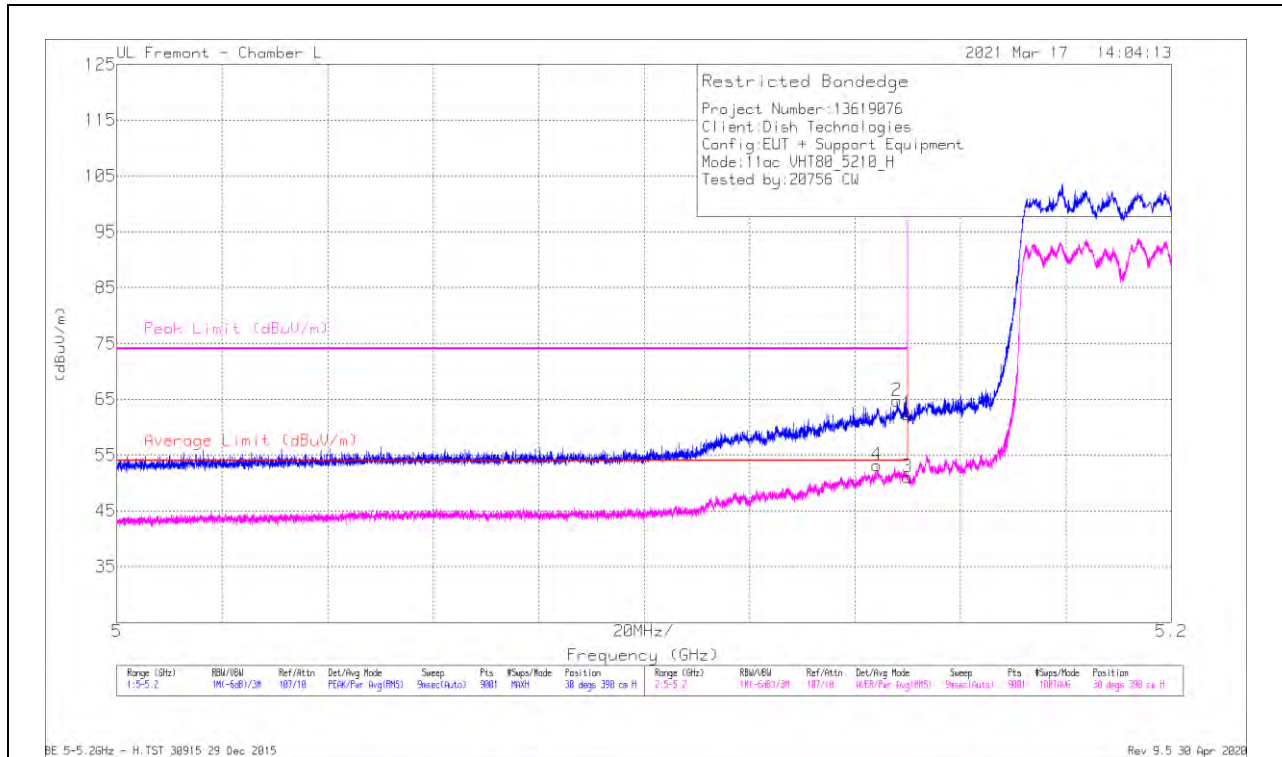
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK-U - U-NII: Maximum Peak
 ADR - U-NII AD primary method, RMS average

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

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

BANDEDGE (MID CHANNEL)

HORIZONTAL RESULT



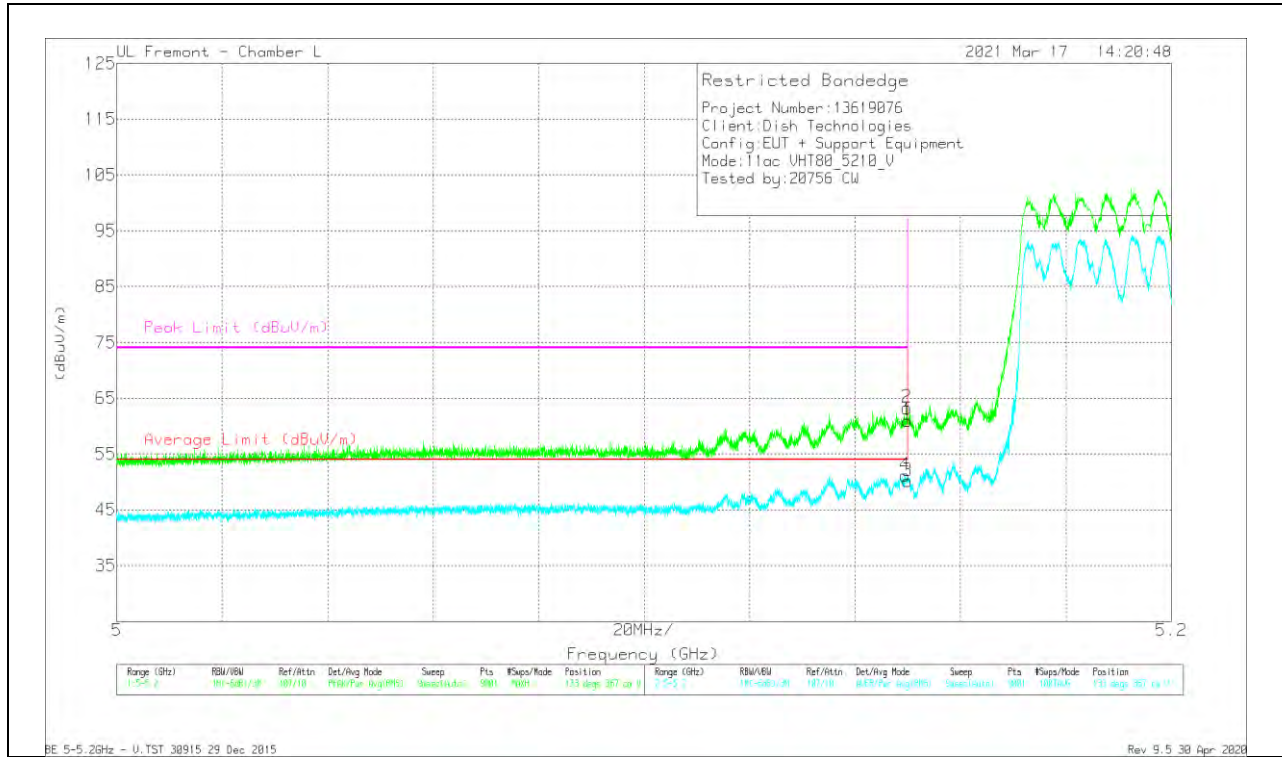
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dBm)	Amp/Cbl/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 5.15	45.5	Pk	34.3	-17.5	0	62.3	-	-	74	-11.7	30	390	H
2	* 5.14793	47.92	Pk	34.3	-17.5	0	64.72	-	-	74	-9.28	30	390	H
3	* 5.15	33.22	RMS	34.3	-17.5	.96	50.98	54	-3.02	-	-	30	390	H
4	* 5.14418	35.4	RMS	34.3	-17.5	.96	53.16	54	-84	-	-	30	390	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dBm)	Amp/Cal/Pwr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 5.15	44.2	Pk	34.3	-17.5	0	61	-	-	74	-13	133	367	V
2	* 5.14984	46.47	Pk	34.3	-17.5	0	63.27	-	-	74	-10.73	133	367	V
3	* 5.15	32.43	RMS	34.3	-17.5	.96	50.19	54	-3.81	-	-	133	367	V
4	* 5.14947	33.35	RMS	34.3	-17.5	.96	51.11	54	-2.89	-	-	133	367	V

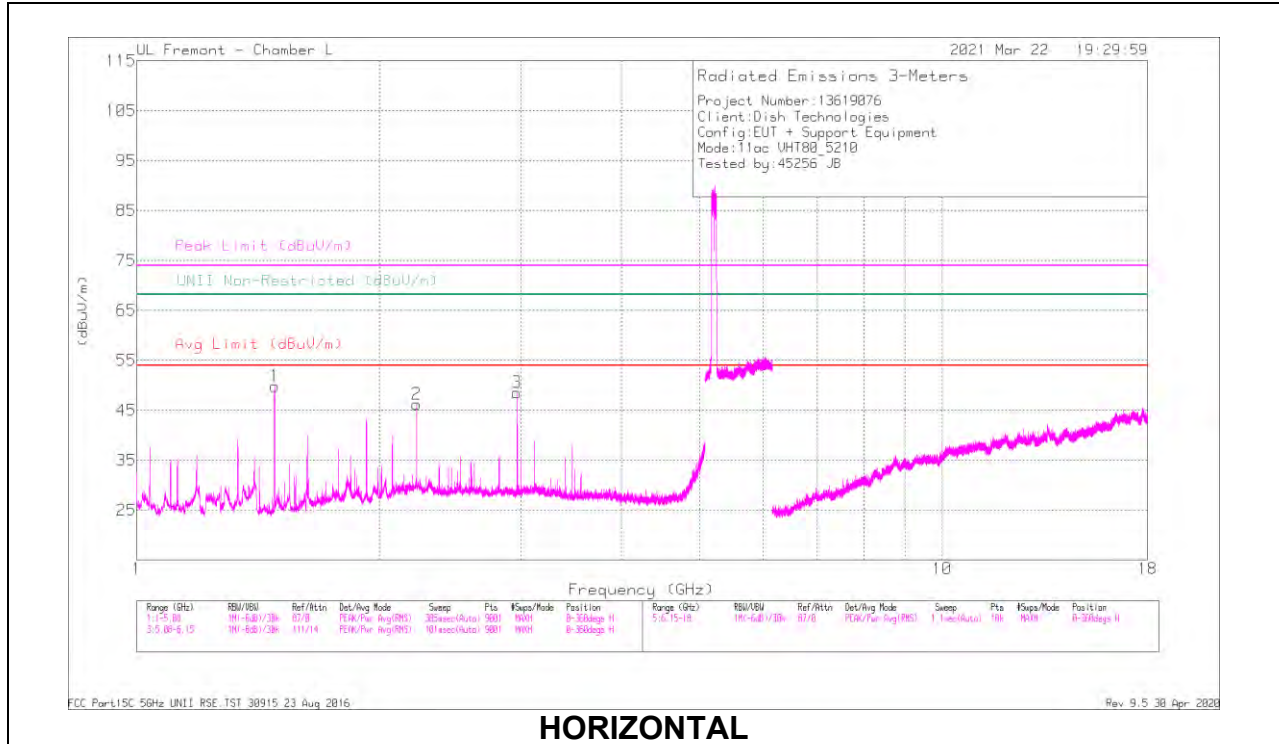
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

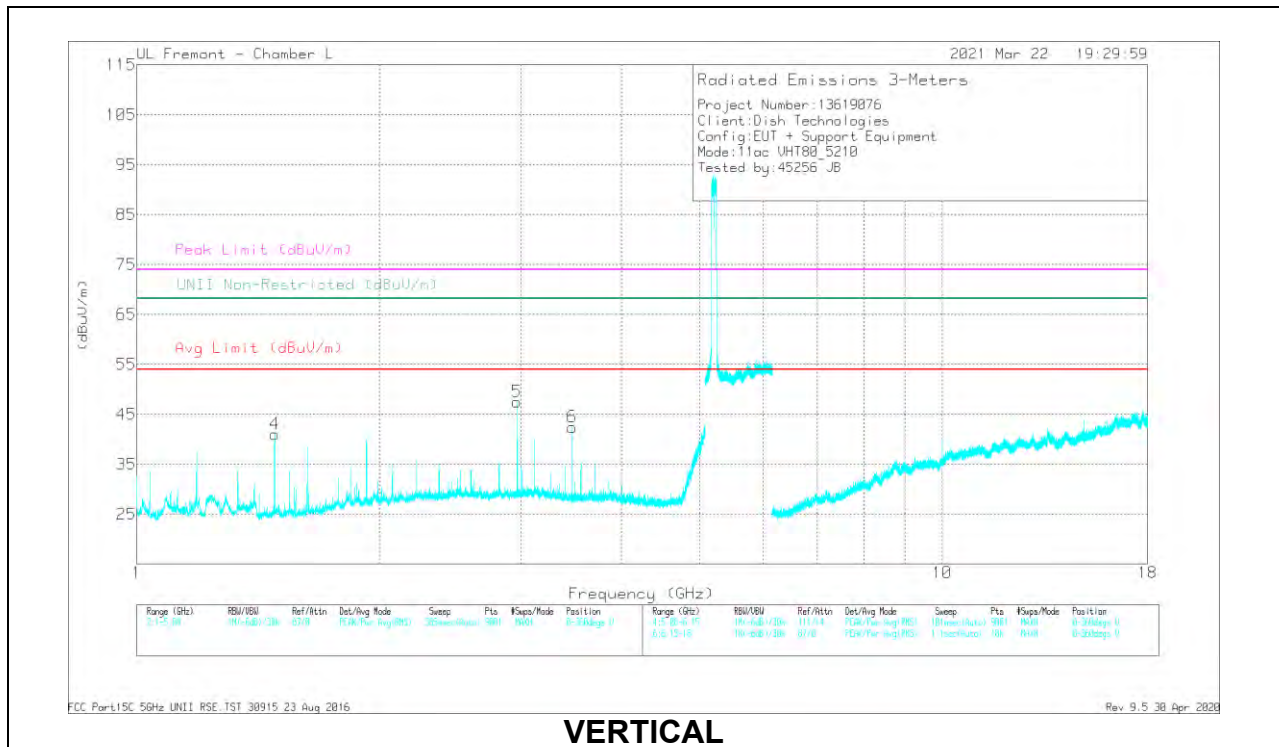
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meas Reading (dBuV)	Det	AF 344 (dBm)	Amp/Corr/Freq/Psd (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	URI Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Deg)	Height (m)	Polarity
1	* 1.4835	57.37	PK-U	28.2	-32.8	0	52.77	-	-	74	-21.23	-	-	248	286	H
	* 1.48351	49.13	ADR	28.2	-32.8	.96	45.49	54	-8.51	-	-	-	-	248	286	H
2	* 2.22518	48.42	PK-U	31.7	-31.3	0	48.82	-	-	74	-25.18	-	-	19	101	H
	* 2.22527	35.69	ADR	31.7	-31.3	.96	37.05	54	-16.95	-	-	-	-	19	101	H
3	2.96701	49.76	PK-U	32.6	-30.1	0	52.36	-	-	74	-	68.2	-15.94	263	105	H
	* 1.48351	48.76	PK-U	28.2	-32.8	0	44.16	-	-	-	-29.84	-	-	192	315	V
4	* 1.4835	39.46	ADR	28.2	-32.8	.96	35.82	54	-18.18	-	-	-	-	192	315	V
	2.96703	50.97	PK-U	32.6	-30.1	0	53.47	-	-	-	-	68.2	-14.73	202	101	V
6	3.47329	39.46	PK-U	32.6	-29	0	43.08	-	-	-	-	68.2	-25.12	187	101	V

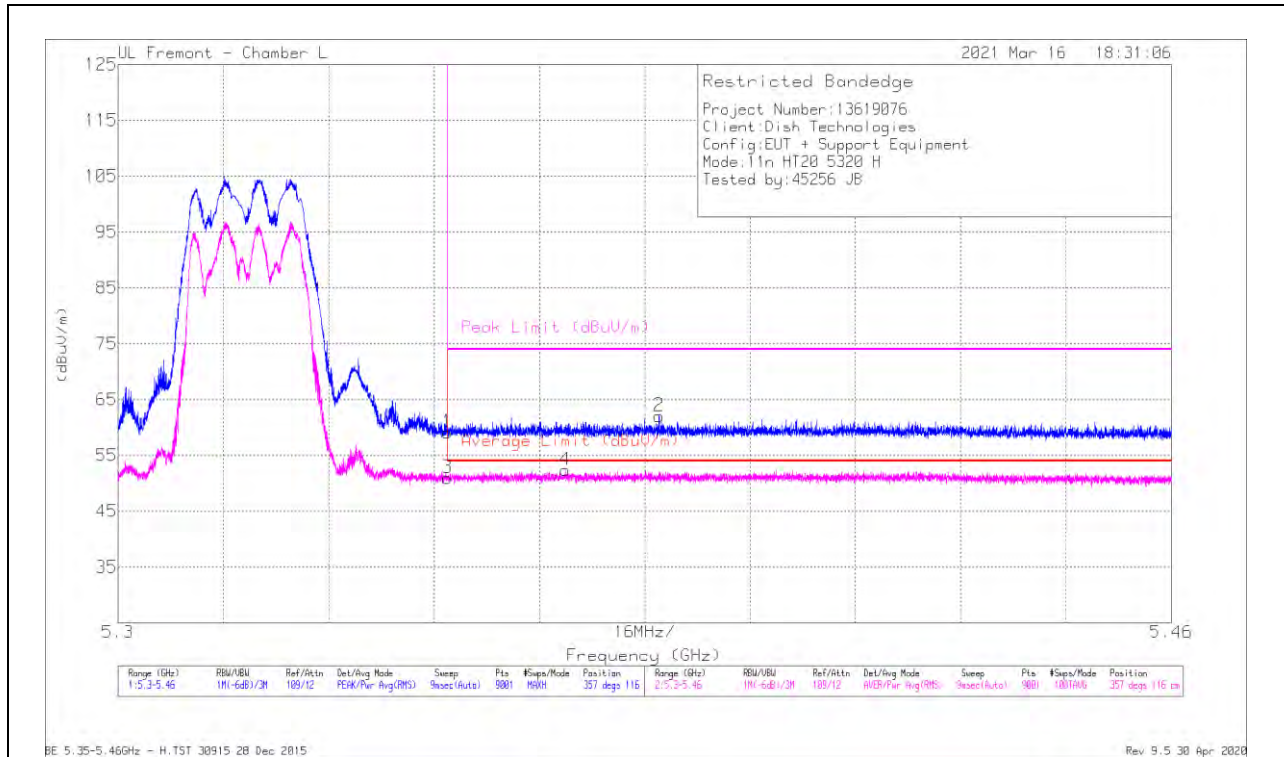
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK-U - U-NII: Maximum Peak
 ADR - U-NII AD primary method, RMS average

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

3TX Antenna 1 + Antenna 2 + Antenna 3 CDD MODE

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



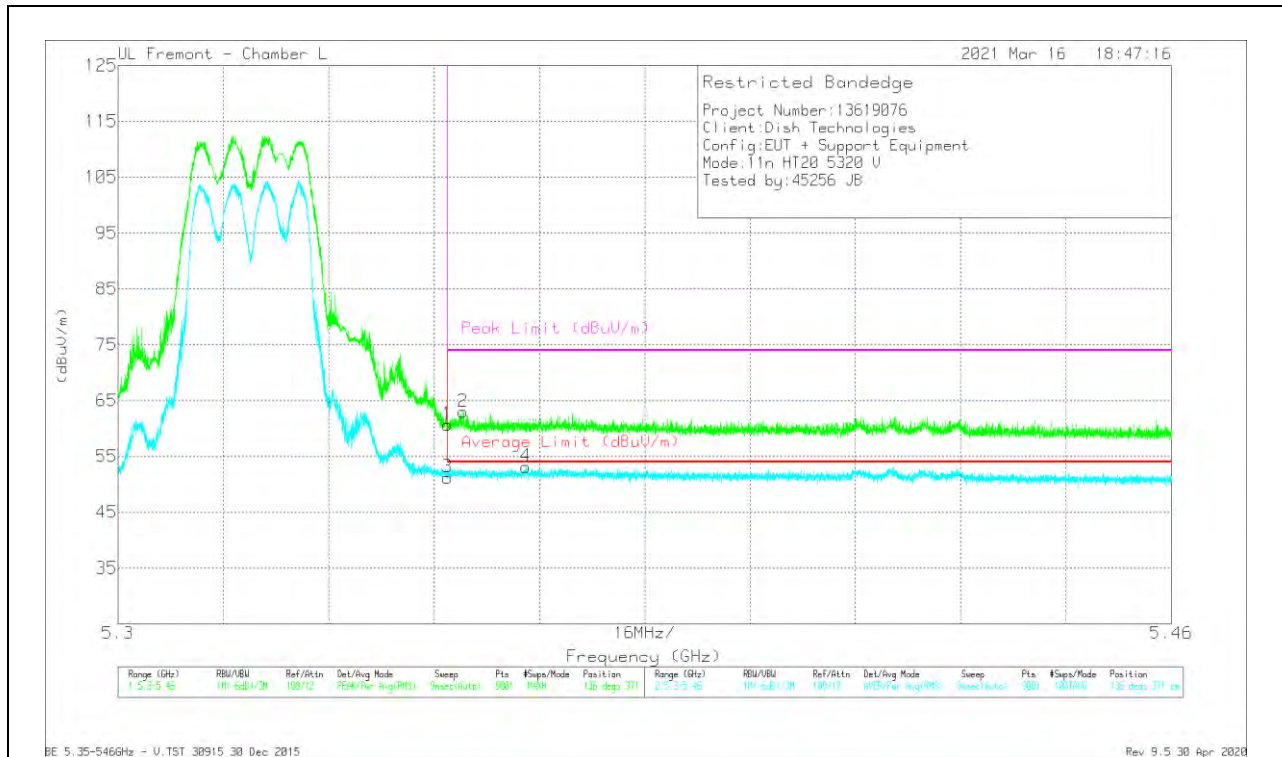
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dBm)	Amp/Cbl/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 5.35001	31.84	Pk	34.5	-7.2	0	59.14	-	-	74	-14.86	357	116	H
2	* 5.38217	34.74	Pk	34.5	-7.2	0	62.04	-	-	74	-11.96	357	116	H
3	* 5.35001	21.37	RMS	34.5	-7.2	2.3	50.97	54	-3.03	-	-	357	116	H
4	* 5.36791	22.76	RMS	34.5	-7.2	2.3	52.36	54	-1.64	-	-	357	116	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 344 (dBm)	Amp/Cou/Pln/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 5.35001	33.39	PK	34.5	-7.2	0	60.69	-	-	74	-13.31	136	371	V
2	* 5.35239	35.66	PK	34.5	-7.2	0	62.96	-	-	74	-11.04	136	371	V
3	* 5.35001	21.63	RMS	34.5	-7.2	2.3	51.23	54	-2.77	-	-	136	371	V
4	* 5.36194	23.63	RMS	34.5	-7.2	2.3	53.13	54	-87	-	-	136	371	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK - Peak detector

RMS - RMS detection