



# TEST REPORT

**Report Number.:** 13757234-E8V1

**Applicant :** Magic Leap Inc.  
7500 West Sunrise Blvd  
Plantation, FL, 33322, US

**Model :** M1003000, M1004000, M1005000  
M1103000, M1104000, M1105000

**Brand :** Magic Leap Inc.

**FCC ID :** 2AM5N-ML2M1

**IC :** 23045-ML2M1

**EUT Description :** Magic Leap 2 Compute Pack and Headset

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C  
ISED RSS-247 ISSUE 2  
ISED RSS-GEN ISSUE 5 + A1 + A2

**Date of Issue:**

May 18, 2022

**Prepared by:**

UL VERIFICATION SERVICES

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## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	5/18/2022	Initial Issue	--

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Magic Leap Inc  
7500 West Sunrise Blvd  
Plantation, FL, 33322, US

**EUT DESCRIPTION:** Magic Leap 2 Compute Pack and Headset

**BRAND:** Magic Leap Inc.

**MODEL:** M1003000, M1004000, M1005000  
M1103000, M1104000, M1105000

**MODEL TESTED:** M1003000

**SERIAL NUMBER:** P552X8E001Q (Radiated)  
P552X8E0001W (Conducted)

**SAMPLE RECEIPT DATE:** AUGUST 10, 2021

**DATE TESTED:** AUGUST 10, 2021 – SEPTEMBER 20, 2021

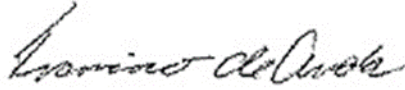
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 + A1 + A2	Complies

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 A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For  
UL Verification Services Inc. By:



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

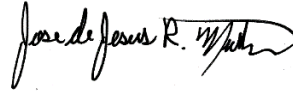
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Vien Tran  
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Consumer Technology Division  
UL Verification Services Inc.

2<sup>nd</sup> Reviewed By:



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Henry Lau  
Project Engineer  
Consumer Technology Division  
UL Verification Services Inc.

## 2. TEST RESULTS 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	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Compliant	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Compliant	None.
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Compliant	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Compliant	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Compliant	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Compliant	None.

For Colocation Test results, please refer to UL Verification Services Inc report number 13757234-E13V1.

### 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A1+ A2, and RSS-247 Issue 2.

The scope of this report covers the 802.11 b/g/n modes in the 2.4GHz band of Models M1003000, M1004000, M1005000, M1103000, M1104000, M1105000.

### 4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by A2LA, Certificate Number #0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input checked="" type="checkbox"/>	Building 1: 47173 Benicia Street Fremont, CA 94538, U.S.A	US0104	2324A	550739
<input type="checkbox"/>	Building 2: 47266 Benicia Street Fremont, CA 94538, U.S.A	US0104	22541	550739
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd Fremont, CA 94538, U.S.A	US0104	2324B	550739



## 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 <sub>Lab</sub>
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

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

### 5.4. SAMPLE CALCULATION

#### **RADIATED EMISSIONS**

Where relevant, the following sample calculation is provided:

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

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

#### **MAINS CONDUCTED EMISSIONS**

Where relevant, the following sample calculation is provided:

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

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

## 6. EQUIPMENT UNDER TEST

### 6.1. EUT DESCRIPTION

EUT is a spatial AR computing device consists of compute pack and headset. The compute pack includes BT, BLE, 802.11 a/b/g/n/ac/ax radio transceivers.

### 6.2. MODEL DIFFERENCES

Models M1003000, M1004000, M1005000, M1103000, M1104000, and M1105000 are electronically identical. The model numbers are to differentiate the markets and regions of sale.

### 6.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
<b>1Tx</b>			
2412 - 2462	802.11b	16.43	43.95
2412 - 2462	802.11g	16.44	44.06
2412 - 2462	802.11n HT20	16.32	42.85

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
<b>2Tx</b>			
2412 - 2462	802.11b CDD	16.46	44.26
2412 - 2462	802.11g CDD	16.74	47.21
2412 - 2462	802.11n HT20 CDD	16.56	45.29

## 6.4. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes two Dual Band PCB Printed antennas, with a maximum gain of:

Frequency (GHz)	Peak Antenna Gain (dBi)	
	Antenna 1	Antenna 2
2412 - 2472	2.0	1.5

## 6.5. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version PEQ3B

The test utility software used during testing was ML Connectivity Test Tool v012 & v005.

## 6.6. WORST-CASE CONFIGURATION AND MODE

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

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

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, Z, it was determined that SISO ANT1 X, SISO ANT2 Y, MIMO Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in its corresponding worst-case orientation. Photos are shown for Z-orientation.

The worst-case data rates were determined to be as follows, based on input from the manufacturer of the radio.

802.11b mode: 1 Mbps  
802.11g mode: 6 Mbps  
802.11n HT20mode: MCS0

## 6.7. DESCRIPTION OF TEST SETUP

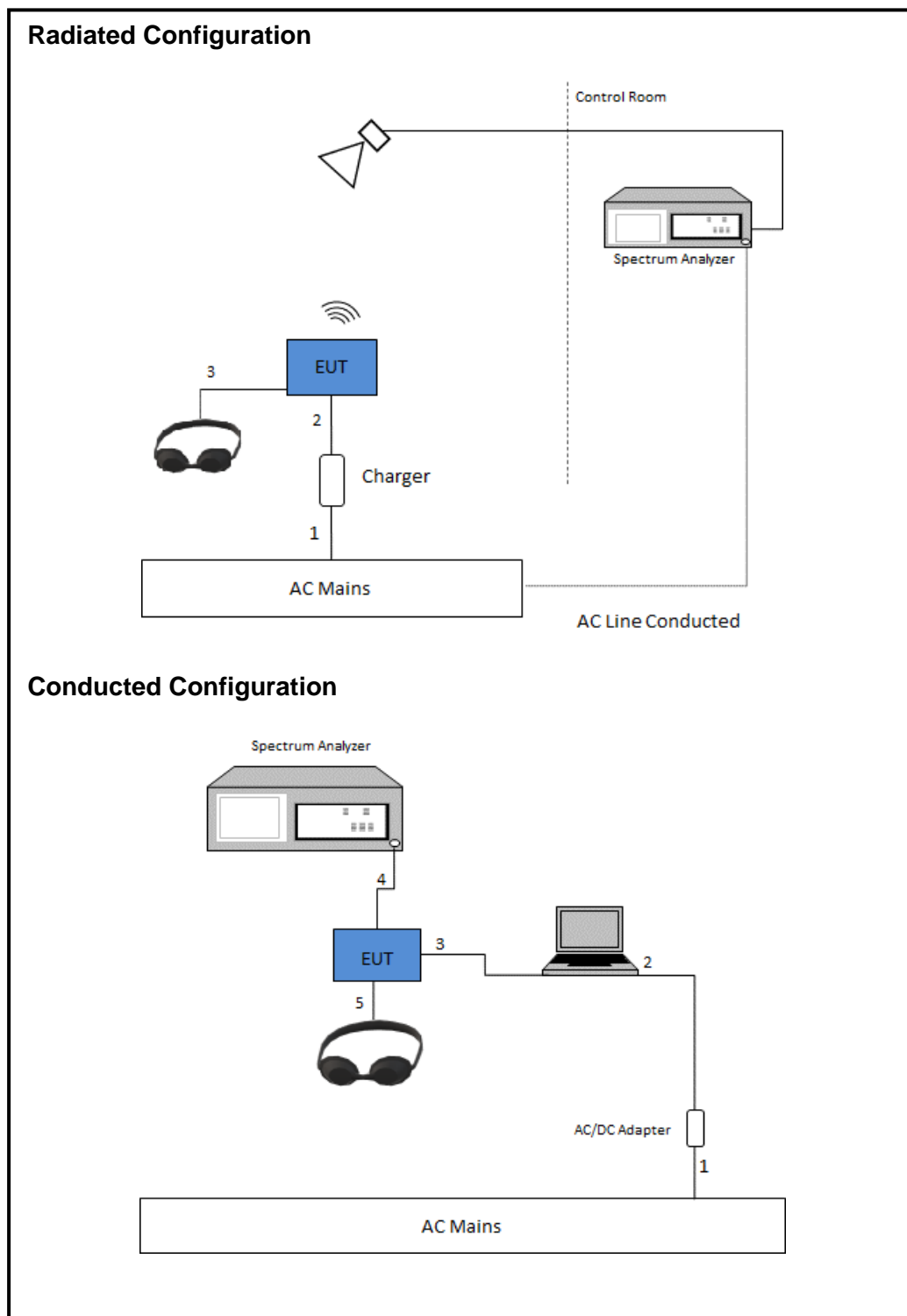
SUPPORT TEST EQUIPMENT						
Description	Manufacturer	Model	Serial Number	FCC ID/ DoC		
Laptop (Radiated)	HP	EliteBook 840 G3	5CG6253DNC	DoC		
Laptop AC Adapter (Radiated)	HP	709986-003	WDHKR0AAR8U467	DoC		
Charger	Magic Leap	M3013	E135498	DoC		
Laptop (Conducted)	HP	EliteBook 840 G3	5CG65235OJ	DoC		
Laptop AC Adapter (Conducted)	HP	854055-002	CTWFTKVOEGC95379	DoC		
I/O CABLES (CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC Power	1	AC (3-prong)	Un-shielded	1.25	AC Mains to DC Power Adapter
2	DC	1	3-pin	Un-shielded	1	Power adapter to laptop
3	USB-C	1	USB Type C	Shielded	0.9	USB-C to EUT USB-C
4	Antenna	1	SMA	Un-shielded	.5	Antenna to Analyzer
5	A/V, Data	1	Permanent	Shielded	1.25	EUT to headset
I/O CABLES (RADIATED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC Power	1	AC (2-prong)	Un-shielded	1.25	AC Mains to Power Adapter
2	USB-C	1	USB Type C	Shielded	0.9	Power Adapter to EUT
3	A/V Data	1	Permanent	Shielded	1.25	EUT to headset

### TEST SETUP

A test laptop is used to program the EUT and then removed during radiated tests. Test software exercised the radio card. For radiated emissions, EUT was powered by AC/DC adapter and for conducted tests the EUT was connected to laptop via USB.

The computer pack and headset are permanently connected.

**SETUP DIAGRAMS**



## 7. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10 Section 11.6.

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW  $\geq$  DTS BW

Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.3 Method AVGPSD-1

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

Band-edge: ANSI C63.10 Section 6.10

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
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	174373	12/02/2021	12/02/2020
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310N	T300	04/09/2022	04/09/2021
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	T119	05/07/2022	05/07/2021
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25-S-42	T1568	04/09/2022	04/09/2021
EMI TEST RECEIVER, with B8 option	Rohde & Schwarz	ESW44	PRE0179377	02/23/2022	02/23/2021
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	05/21/2022	05/21/2021
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	SC-8015	05/24/2022	05/24/2021
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	SC-8014	05/24/2022	05/24/2021
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies Inc	E4446A	T123	01/22/2022	01/22/2021
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1269	01/25/2022	01/25/2021
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T1223	06/17/2022	06/17/2021
AC Line Conducted					
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	PRE0186446	01/20/2022	01/20/2021
EMI TEST RECEIVER	Rohde & Schwarz	ESR	T1436	02/19/2022	02/19/2021
Transient Limiter	TE	TBFL1	207996	06/01/2022	06/01/2021
UL TEST SOFTWARE LIST					
Radiated Software	UL	UL EMC	Rev 9.5, Apr 30, 2020/Jan 3, 2020		
Antenna Port Software	UL	UL RF	Ver 2021.08.11		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, 07 Jul 2020		

## 9. ANTENNA PORT TEST RESULTS

### 9.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

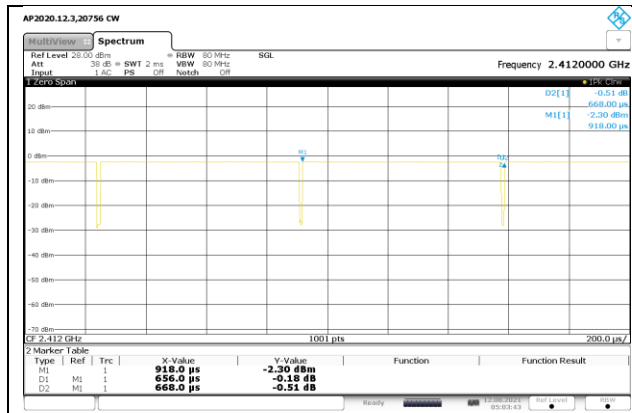
#### PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

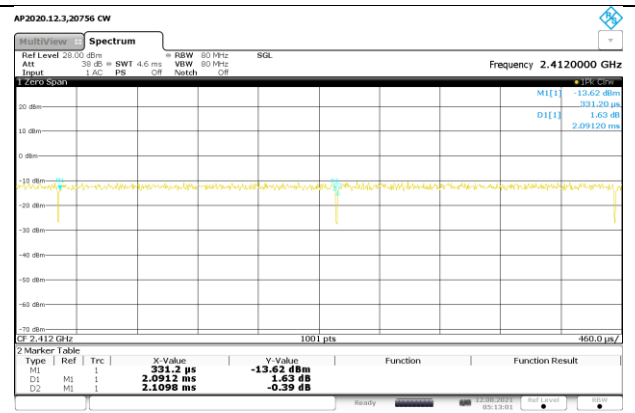
#### ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
<b>2.4GHz Band</b>						
802.11b 1TX	0.656	0.668	0.982	98.20	0.00	0.010
802.11g 1TX	2.091	2.110	0.991	99.12	0.00	0.010
802.11n HT20 1TX	5.410	5.450	0.993	99.27	0.00	0.010

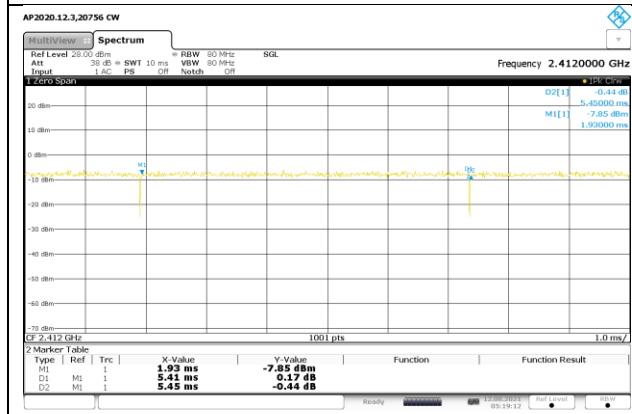
#### DUTY CYCLE PLOTS



DUTY CYCLE 802.11b MODE



DUTY CYCLE 802.11g MODE



DUTY CYCLE 802.11n HT20 MODE

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## 9.2. 99% BANDWIDTH LIMITS

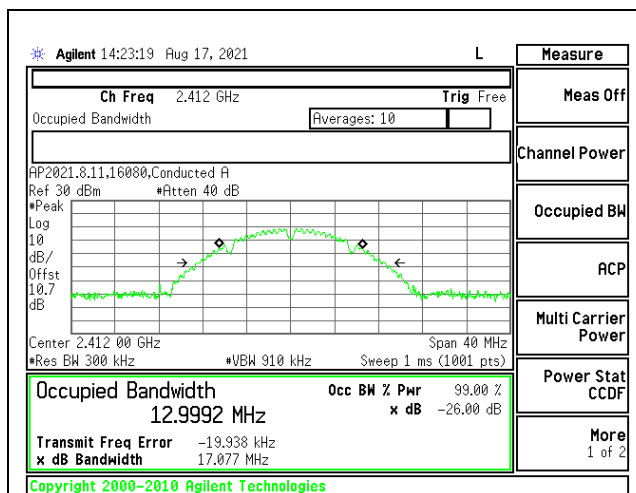
None; for reporting purposes only.

### RESULTS

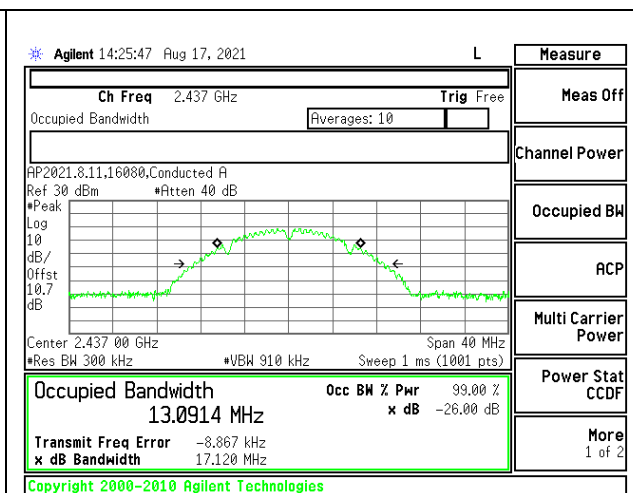
#### 9.2.1. 802.11b MODE

#### 1TX Antenna 1 MODE

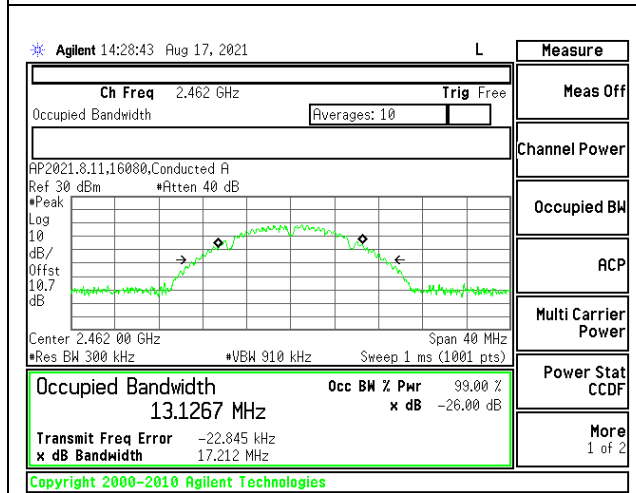
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	12.9992
Mid 6	2437	13.0914
High 11	2462	13.1267



LOW CHANNEL 1



MID CHANNEL 6



HIGH CHANNEL 11

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**1TX Antenna 2 MODE**

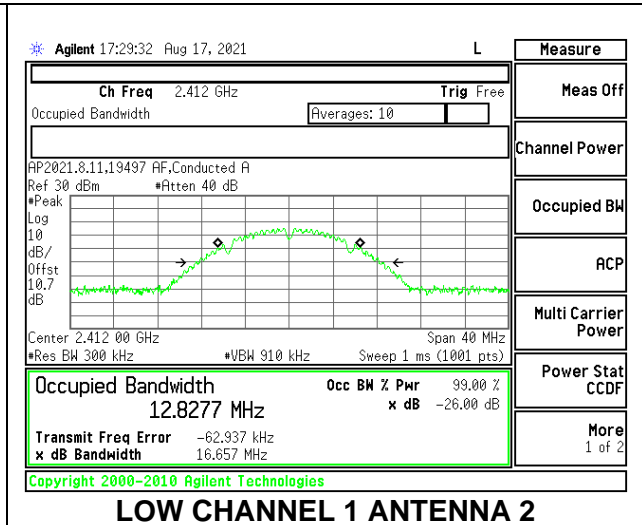
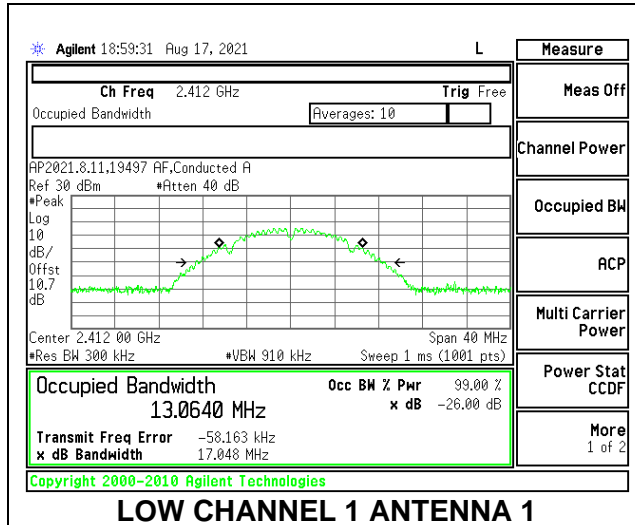
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	13.0320
Mid 6	2437	13.0580
High 11	2462	13.0223

<p>Agilent 14:55:23 Aug 17, 2021</p> <p>Ch Freq 2.412 GHz Trig Free</p> <p>Occupied Bandwidth Averages: 10</p> <p>AP2021.8.11.16000,Conducted A              Ref 30 dBm #Atten 40 dB</p> <p>Occupied Bandwidth 13.0320 MHz Occ BW % Pwr 99.00 %              x dB -26.00 dB</p> <p>Transmit Freq Error -19.530 kHz              x dB Bandwidth 16.951 MHz</p> <p>Copyright 2000-2010 Agilent Technologies</p> <p><b>LOW CHANNEL 1</b></p>	<p>Agilent 14:58:02 Aug 17, 2021</p> <p>Ch Freq 2.437 GHz Trig Free</p> <p>Occupied Bandwidth Averages: 10</p> <p>AP2021.8.11.16000,Conducted A              Ref 30 dBm #Atten 40 dB</p> <p>Occupied Bandwidth 13.0580 MHz Occ BW % Pwr 99.00 %              x dB -26.00 dB</p> <p>Transmit Freq Error -7.566 kHz              x dB Bandwidth 17.031 MHz</p> <p>Copyright 2000-2010 Agilent Technologies</p> <p><b>MID CHANNEL 6</b></p>
<p>Agilent 15:01:05 Aug 17, 2021</p> <p>Ch Freq 2.462 GHz Trig Free</p> <p>Occupied Bandwidth Averages: 10</p> <p>AP2021.8.11.16000,Conducted A              Ref 30 dBm #Atten 40 dB</p> <p>Occupied Bandwidth 13.0223 MHz Occ BW % Pwr 99.00 %              x dB -26.00 dB</p> <p>Transmit Freq Error -66.184 kHz              x dB Bandwidth 17.067 MHz</p> <p>Copyright 2000-2010 Agilent Technologies</p> <p><b>HIGH CHANNEL 11</b></p>	<p style="text-align: center;"><b>Intentionally left blank</b></p>

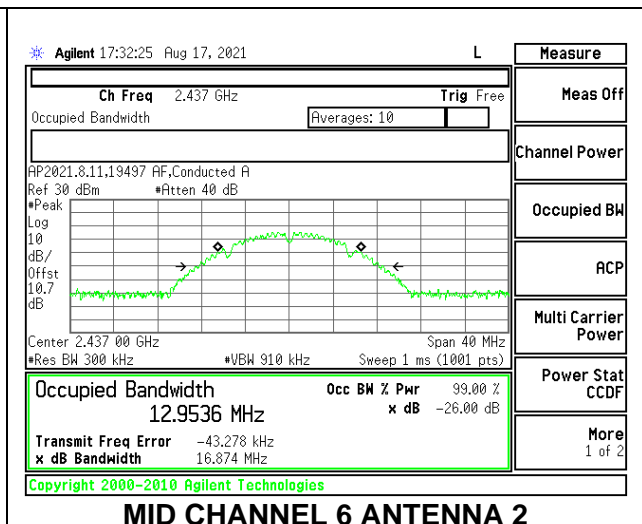
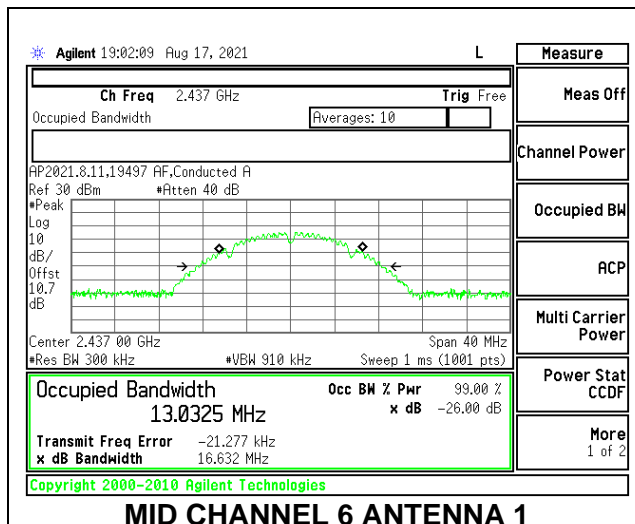
**2TX Antenna 1 + Antenna 2 CDD MODE**

Channel	Frequency (MHz)	99% Bandwidth Antenna 1 (MHz)	99% Bandwidth Antenna 2 (MHz)
Low 1	2412	13.0640	12.8277
Mid 6	2437	13.0325	12.9536
High 11	2462	13.0707	12.9592

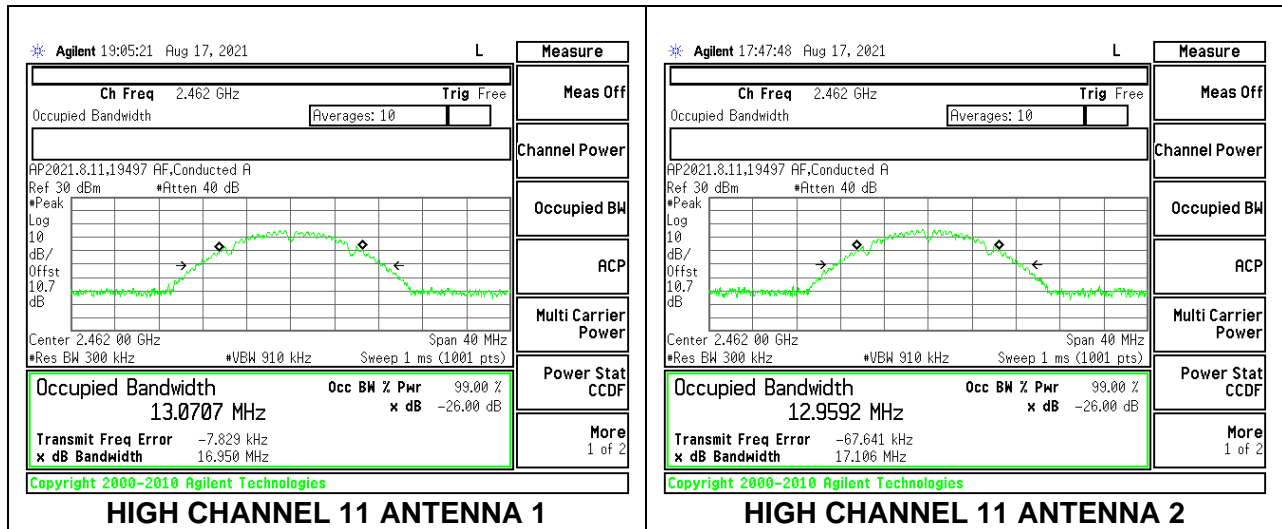
**LOW CHANNEL 1**



**MID CHANNEL 6**



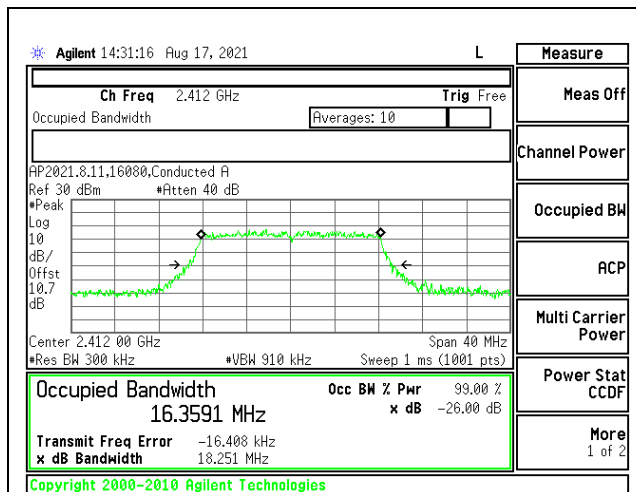
### HIGH CHANNEL 11



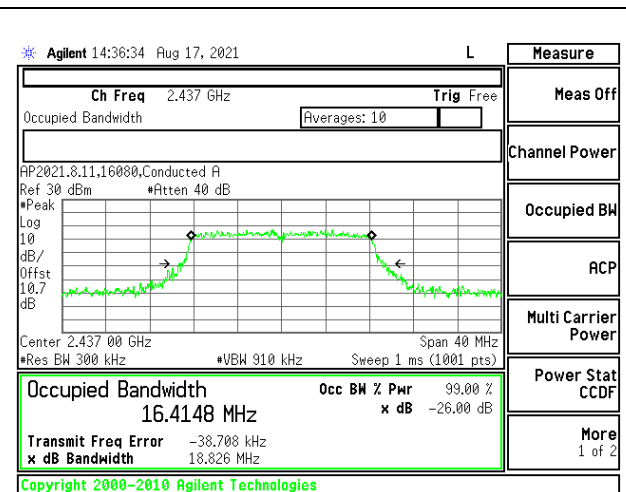
### 9.2.2. 802.11g MODE

#### 1TX Antenna 1 MODE

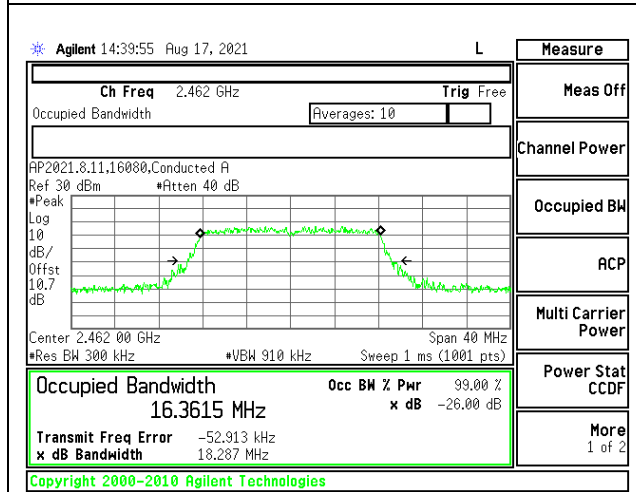
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	16.3591
Mid 6	2437	16.4148
High 11	2462	16.3615



**LOW CHANNEL 1**



**MID CHANNEL 6**



**HIGH CHANNEL 11**

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**1TX Antenna 2 MODE**

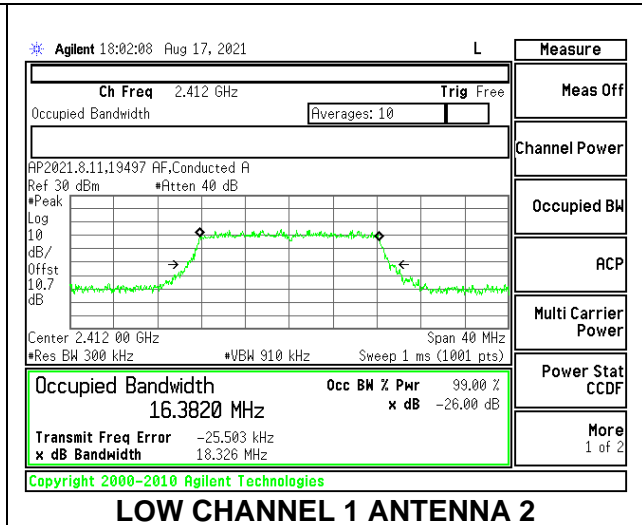
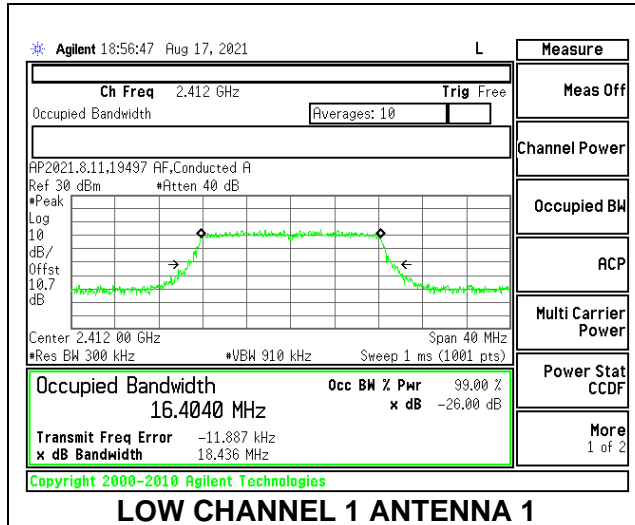
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	16.4471
Mid 6	2437	16.4076
High 11	2462	16.3921

<p>Agilent 15:04:05 Aug 17, 2021</p> <p>Ch Freq 2.412 GHz</p> <p>Occupied Bandwidth</p> <p>Occupied Bandwidth 16.4471 MHz</p> <p>Transmit Freq Error -15.788 kHz</p> <p>x dB Bandwidth 18.888 MHz</p> <p><b>LOW CHANNEL 1</b></p>	<p>Agilent 15:07:12 Aug 17, 2021</p> <p>Ch Freq 2.437 GHz</p> <p>Occupied Bandwidth</p> <p>Occupied Bandwidth 16.4076 MHz</p> <p>Transmit Freq Error 7.519 kHz</p> <p>x dB Bandwidth 18.542 MHz</p> <p><b>MID CHANNEL 6</b></p>
<p>Agilent 15:12:13 Aug 17, 2021</p> <p>Ch Freq 2.462 GHz</p> <p>Occupied Bandwidth</p> <p>Occupied Bandwidth 16.3921 MHz</p> <p>Transmit Freq Error -28.767 kHz</p> <p>x dB Bandwidth 18.418 MHz</p> <p><b>HIGH CHANNEL 11</b></p>	<p style="text-align: center;"><b>Intentionally left blank</b></p>

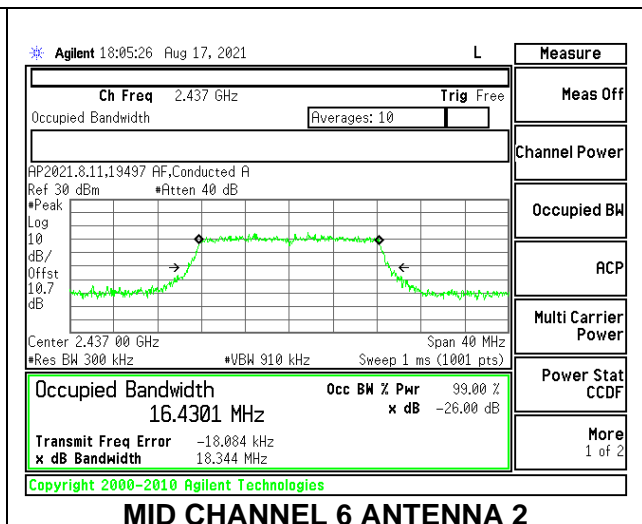
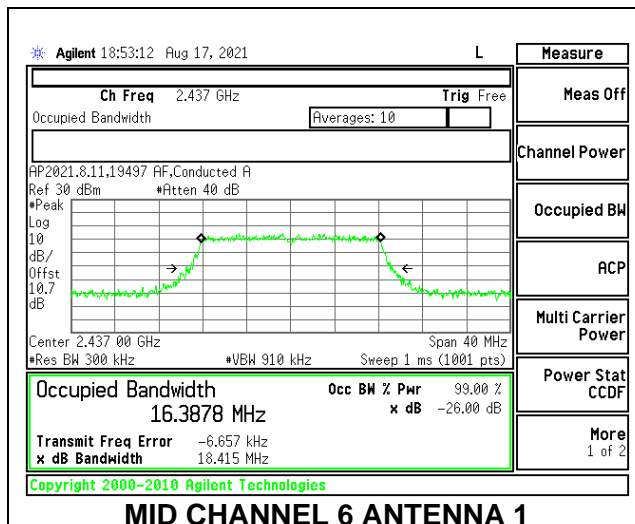
**2TX Antenna 1 + Antenna 2 CDD MODE**

Channel	Frequency (MHz)	99% Bandwidth Antenna 1 (MHz)	99% Bandwidth Antenna 2 (MHz)
Low 1	2412	16.4040	16.3820
Mid 6	2437	16.3878	16.4301
High 11	2462	16.3691	16.3983

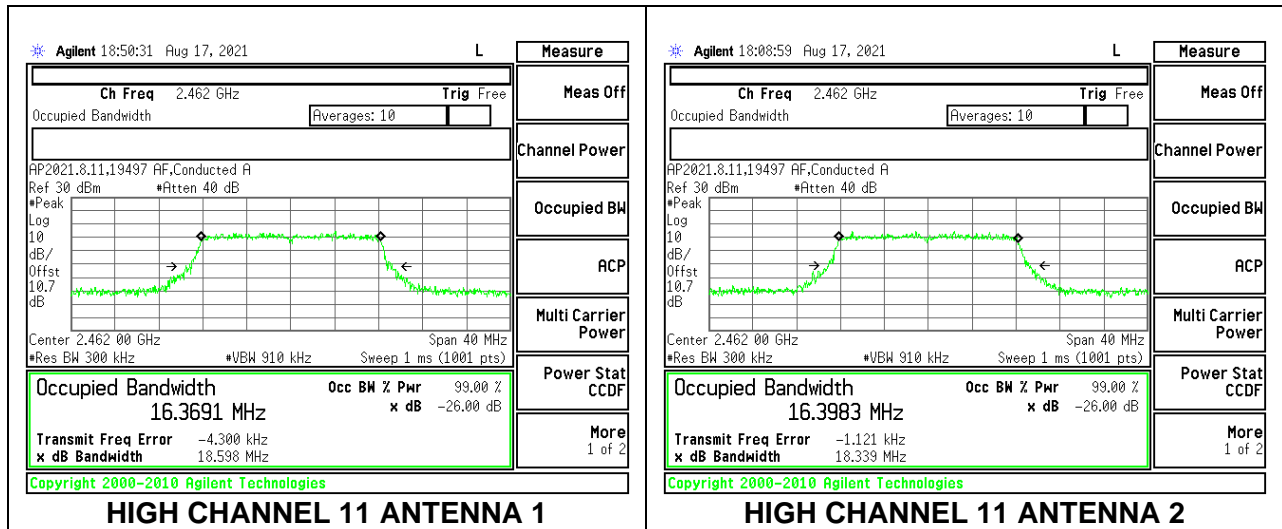
**LOW CHANNEL 1**



**MID CHANNEL 6**



### HIGH CHANNEL 11

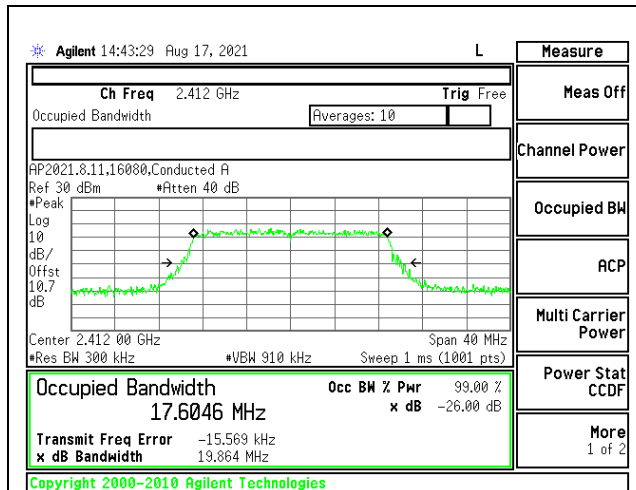




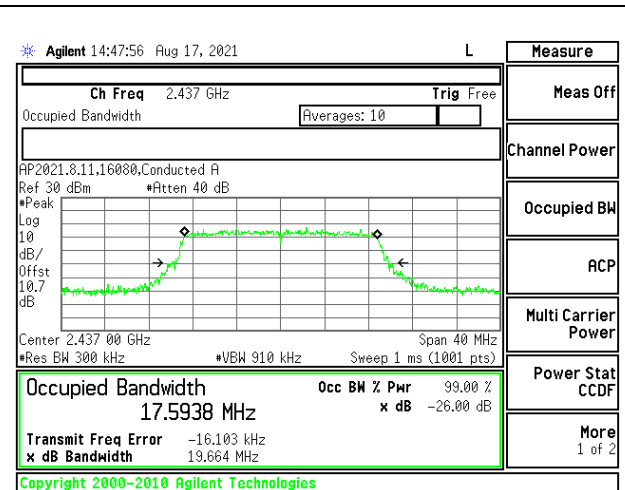
### 9.2.3. 802.11n HT20 MODE

#### 1TX Antenna 1 MODE

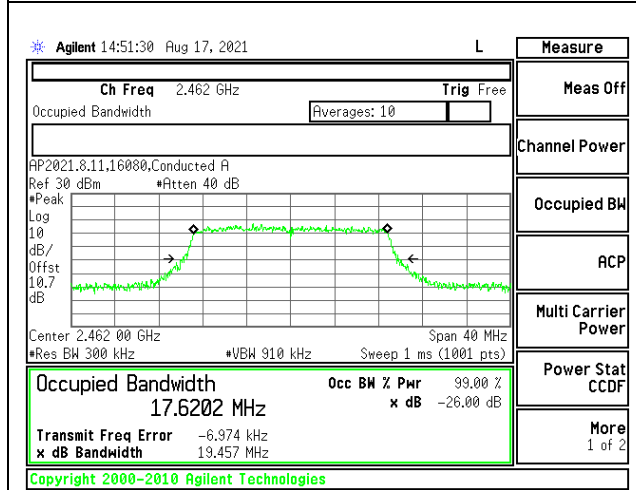
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	17.6046
Mid 6	2437	17.5938
High 11	2462	17.6202



**LOW CHANNEL 1**



**MID CHANNEL 6**



**HIGH CHANNEL 11**

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**1TX Antenna 2 MODE**

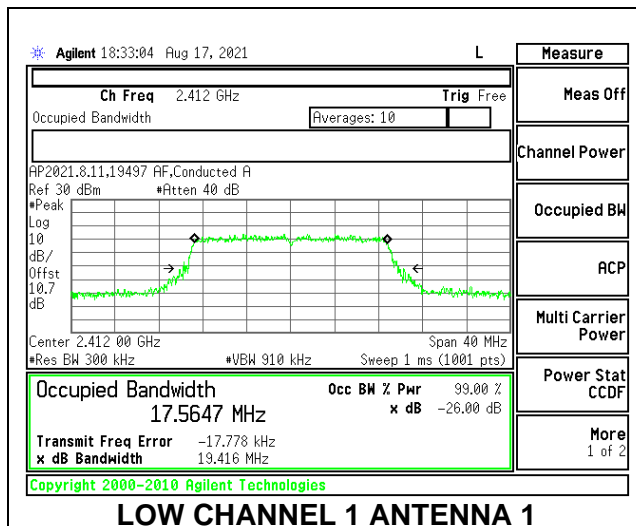
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	17.6701
Mid 6	2437	17.5925
High 11	2462	17.6261

<p>Agilent 15:15:42 Aug 17, 2021</p> <p>Ch Freq 2.412 GHz Trig Free</p> <p>Occupied Bandwidth Averages: 10</p> <p>AP2021.8.11.16080,Conducted A                  Ref 30 dBm #Atten 40 dB</p> <p>Center 2.412 00 GHz Span 40 MHz                  #Res BW 300 kHz #VBW 910 kHz Sweep 1 ms (1001 pts)</p> <p>Occupied Bandwidth 17.6701 MHz Occ BW % Pwr 99.00 %                  x dB -26.00 dB</p> <p>Transmit Freq Error -22.946 kHz                  x dB Bandwidth 19.938 MHz</p> <p>Copyright 2000-2010 Agilent Technologies</p> <p><b>LOW CHANNEL 1</b></p>	<p>Agilent 15:25:32 Aug 17, 2021</p> <p>Ch Freq 2.437 GHz Trig Free</p> <p>Occupied Bandwidth Averages: 10</p> <p>AP2021.8.11.16080,Conducted A                  Ref 30 dBm #Atten 40 dB</p> <p>Center 2.437 00 GHz Span 40 MHz                  #Res BW 300 kHz #VBW 910 kHz Sweep 1 ms (1001 pts)</p> <p>Occupied Bandwidth 17.5925 MHz Occ BW % Pwr 99.00 %                  x dB -26.00 dB</p> <p>Transmit Freq Error -30.735 kHz                  x dB Bandwidth 19.898 MHz</p> <p>Copyright 2000-2010 Agilent Technologies</p> <p><b>MID CHANNEL 6</b></p>
<p>Agilent 15:30:38 Aug 17, 2021</p> <p>Ch Freq 2.462 GHz Trig Free</p> <p>Occupied Bandwidth Averages: 10</p> <p>AP2021.8.11.16080,Conducted A                  Ref 30 dBm #Atten 40 dB</p> <p>Center 2.462 00 GHz Span 40 MHz                  #Res BW 300 kHz #VBW 910 kHz Sweep 1 ms (1001 pts)</p> <p>Occupied Bandwidth 17.6261 MHz Occ BW % Pwr 99.00 %                  x dB -26.00 dB</p> <p>Transmit Freq Error -22.659 kHz                  x dB Bandwidth 19.884 MHz</p> <p>Copyright 2000-2010 Agilent Technologies</p> <p><b>HIGH CHANNEL 11</b></p>	<p style="text-align: center;"><b>Intentionally left blank</b></p>

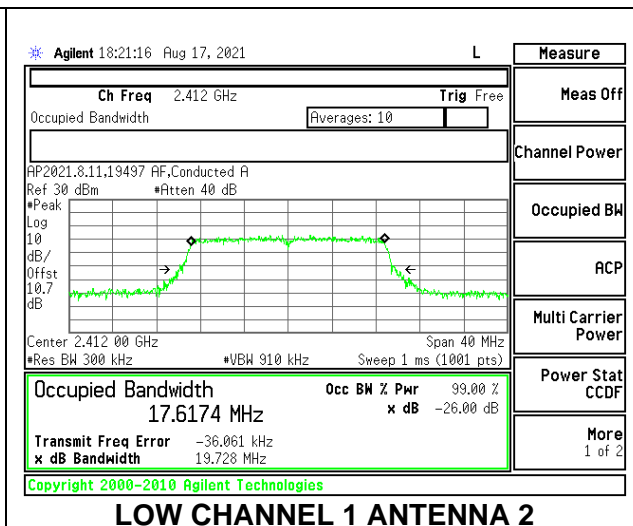
**2TX Antenna 1 + Antenna 2 CDD MODE**

Channel	Frequency (MHz)	99% Bandwidth Antenna 1 (MHz)	99% Bandwidth Antenna 2 (MHz)
Low 1	2412	17.5647	17.6174
Mid 6	2437	17.5757	17.5709
High 11	2462	17.5755	17.5509

**LOW CHANNEL 1**

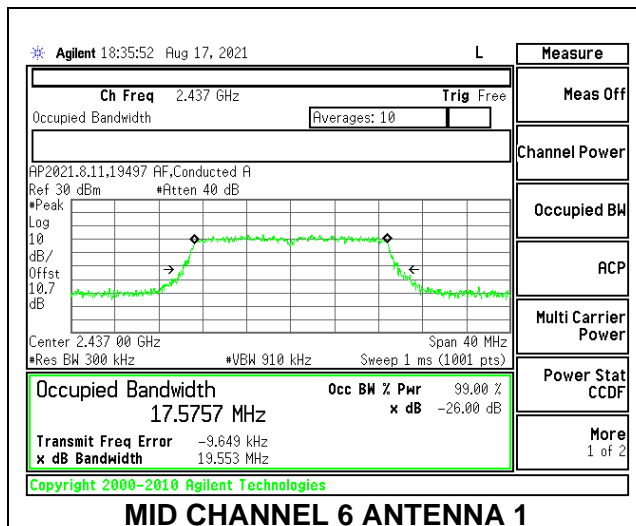


**LOW CHANNEL 1 ANTENNA 1**

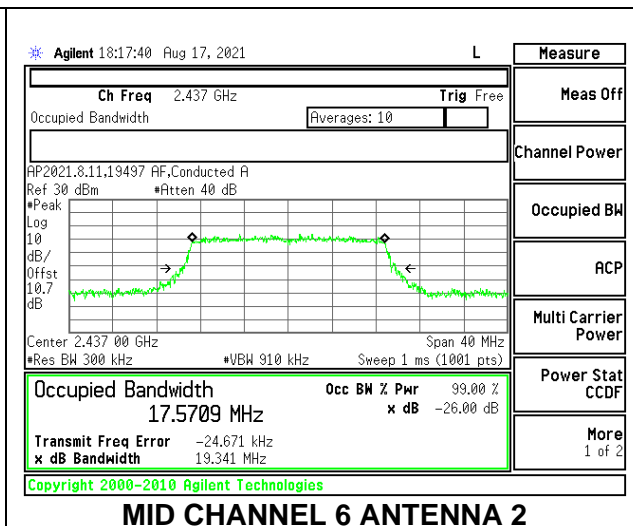


**LOW CHANNEL 1 ANTENNA 2**

**MID CHANNEL 6**

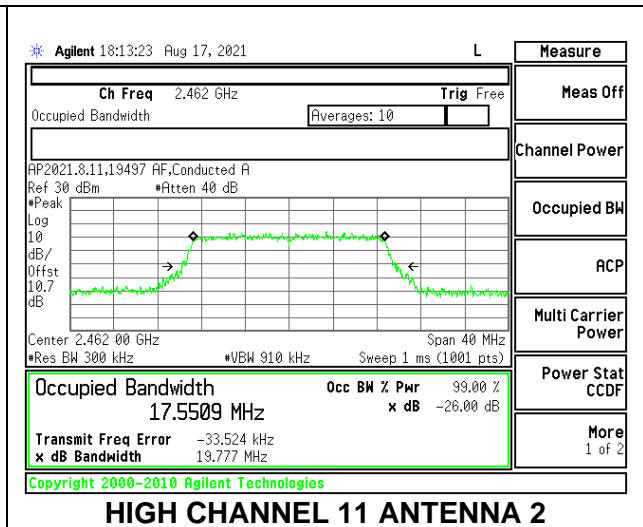
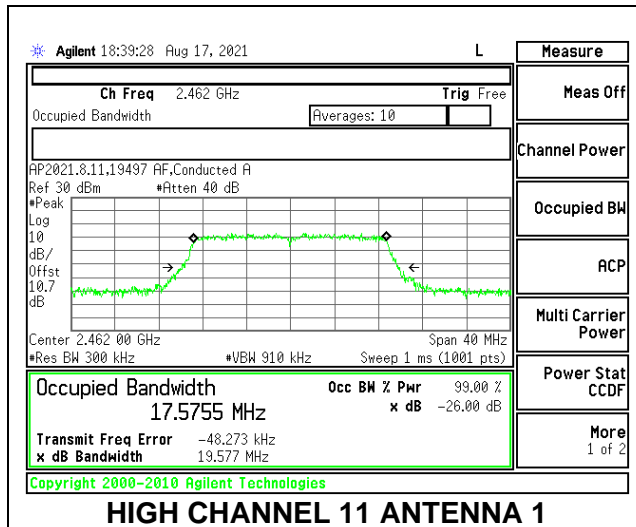


**MID CHANNEL 6 ANTENNA 1**



**MID CHANNEL 6 ANTENNA 2**

### HIGH CHANNEL 11



### **9.3. 6 dB BANDWIDTH**

#### **LIMITS**

FCC §15.247 (a) (2)

RSS-247 5.2 (a)

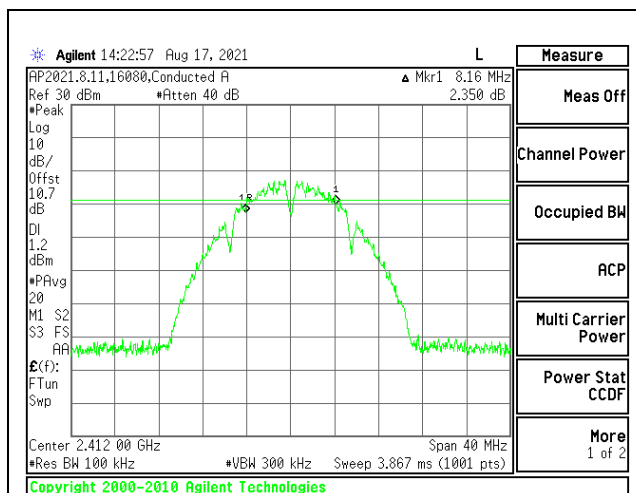
The minimum 6 dB bandwidth shall be at least 500 kHz.

#### **RESULTS**

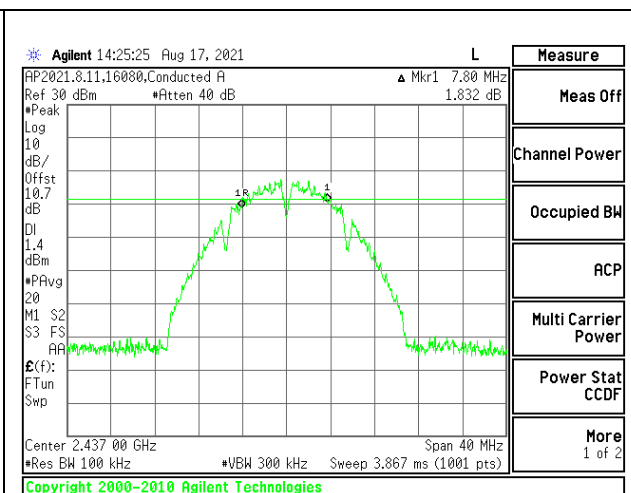
### 9.3.1. 802.11b MODE

#### 1TX Antenna 1 MODE

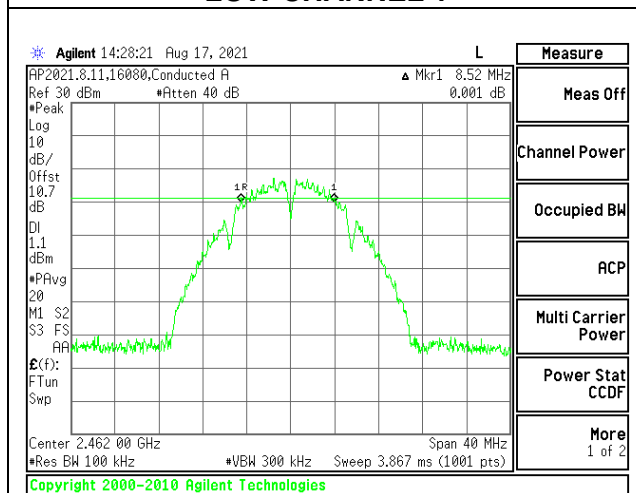
Channel	Frequency	6 dB Bandwidth	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low 1	2412	8.16	0.5
Mid 6	2437	7.80	0.5
High 11	2462	8.52	0.5



**LOW CHANNEL 1**



**MID CHANNEL 6**

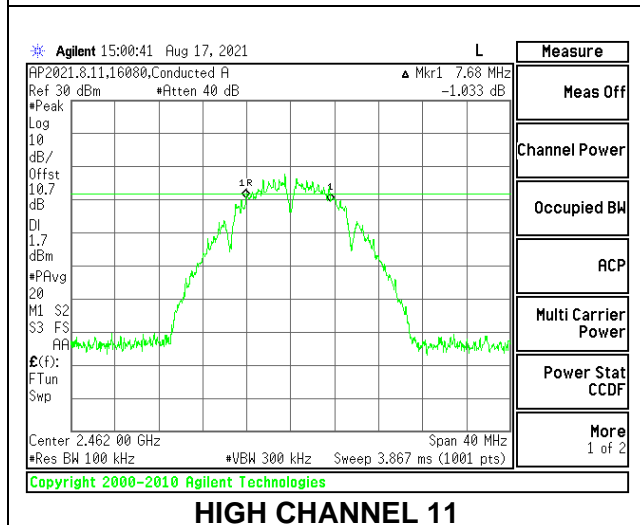
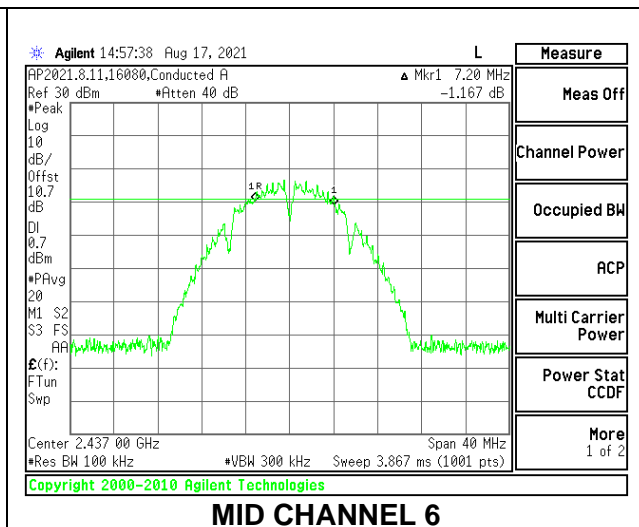
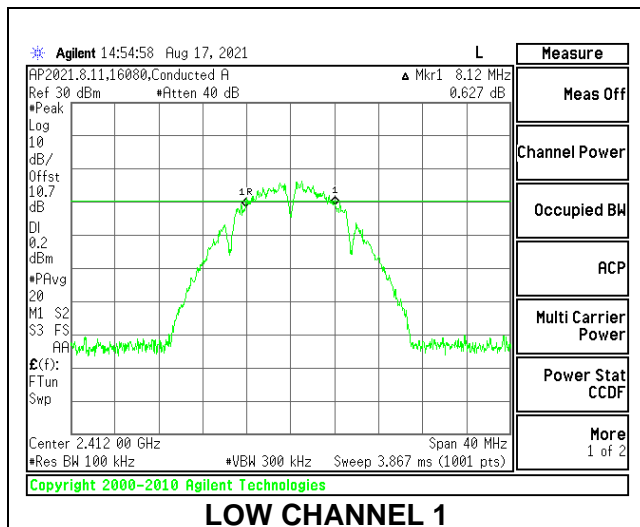


**HIGH CHANNEL 11**

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**1TX Antenna 2 MODE**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	8.12	0.5
Mid 6	2437	7.20	0.5
High 11	2462	7.68	0.5

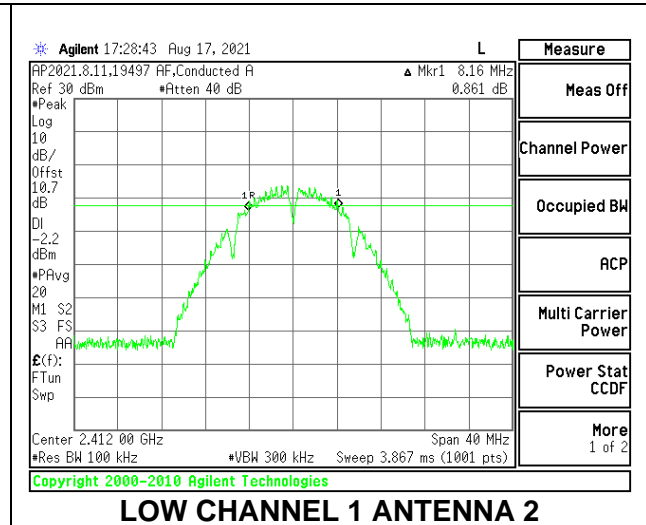
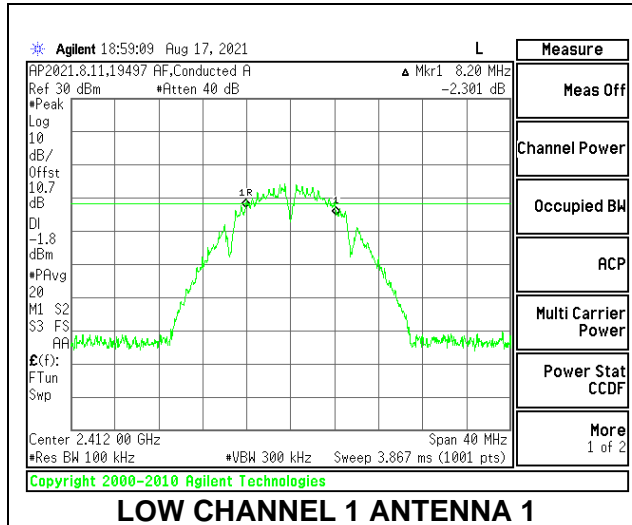


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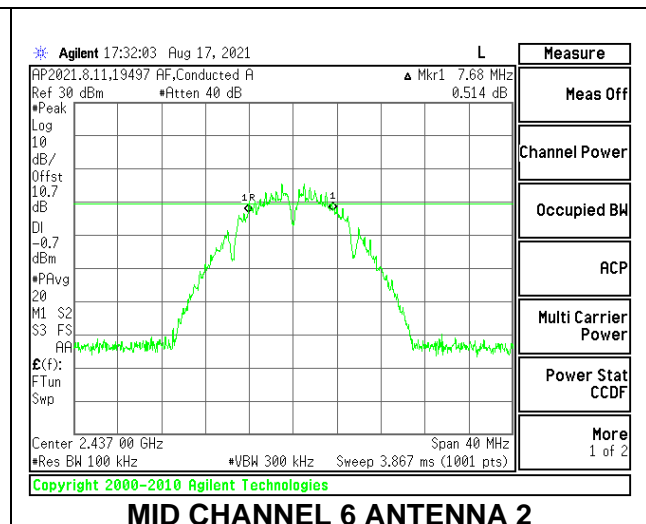
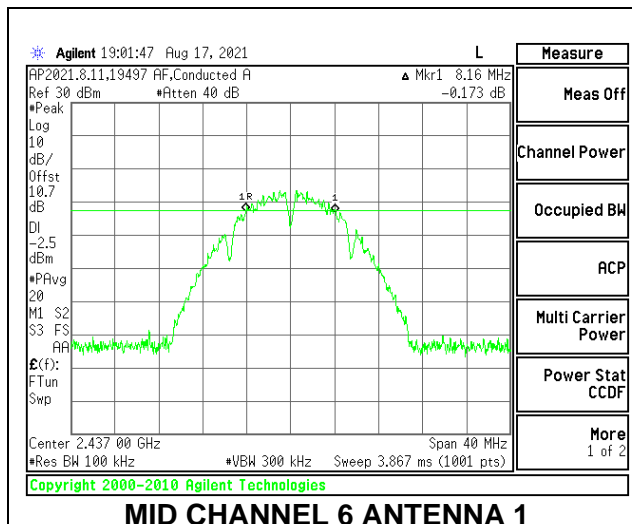
**2TX Antenna 1 + Antenna 2 CDD MODE**

Channel	Frequency (MHz)	6 dB BW Antenna 1 (MHz)	6 dB BW Antenna 2 (MHz)	Minimum Limit (MHz)
Low 1	2412	8.20	8.16	0.5
Mid 6	2437	8.16	7.68	0.5
High 11	2462	7.48	8.00	0.5

**LOW CHANNEL 1**

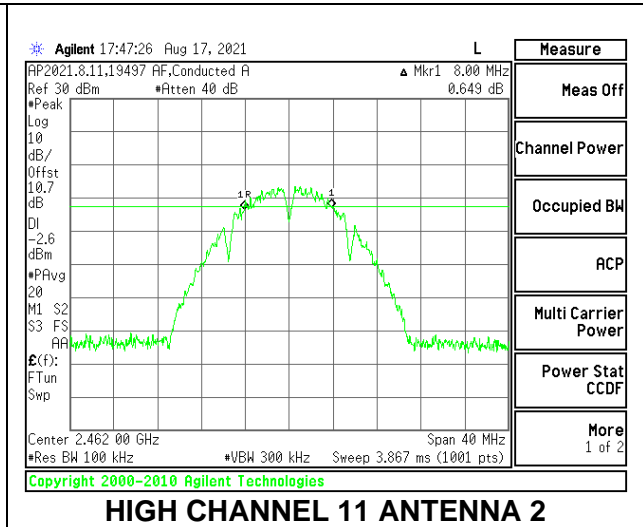
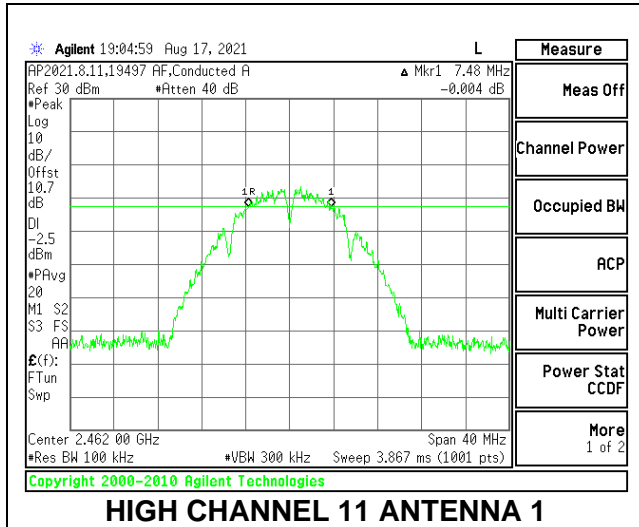


**MID CHANNEL 6**





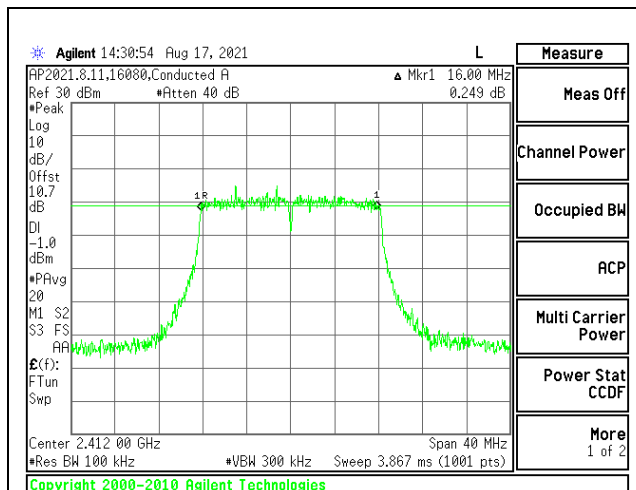
### HIGH CHANNEL 11



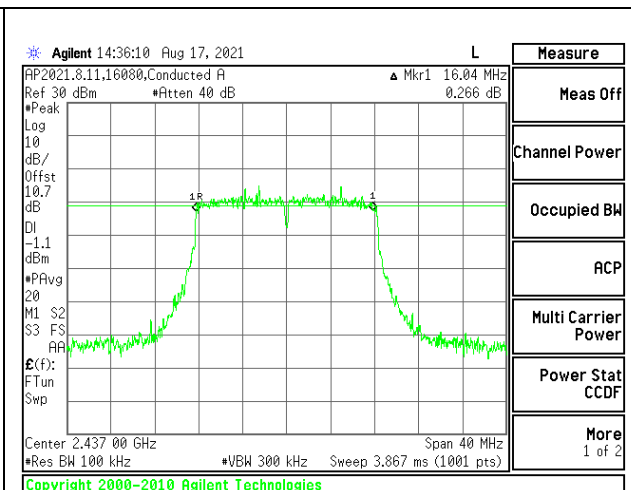
### 9.3.2. 802.11g MODE

#### 1TX Antenna 1 MODE

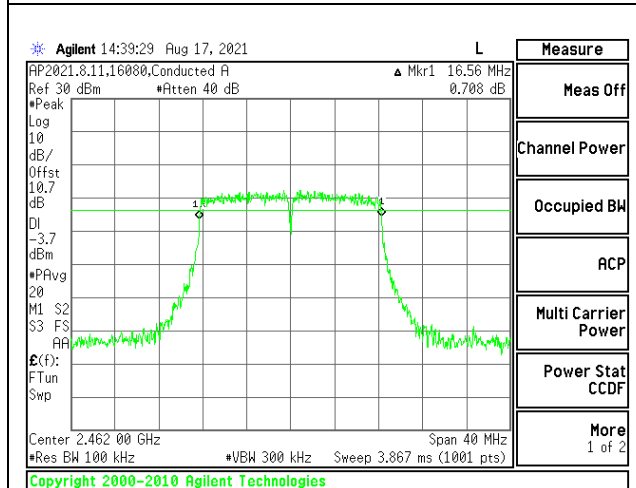
Channel	Frequency	6 dB Bandwidth	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low 1	2412	16.00	0.5
Mid 6	2437	16.04	0.5
High 11	2462	16.56	0.5



**LOW CHANNEL 1**



**MID CHANNEL 6**

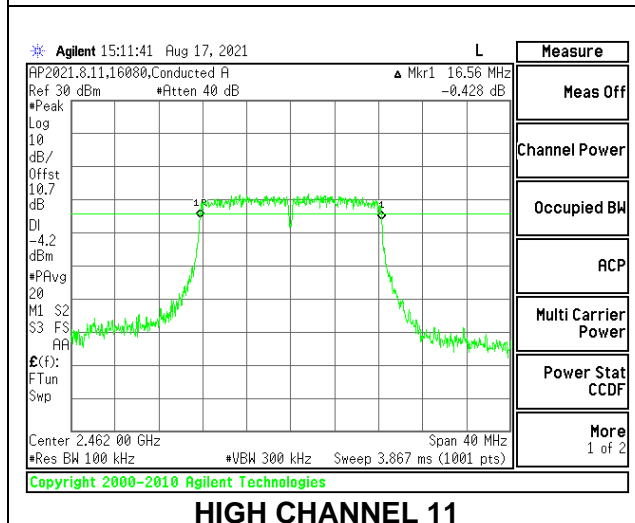
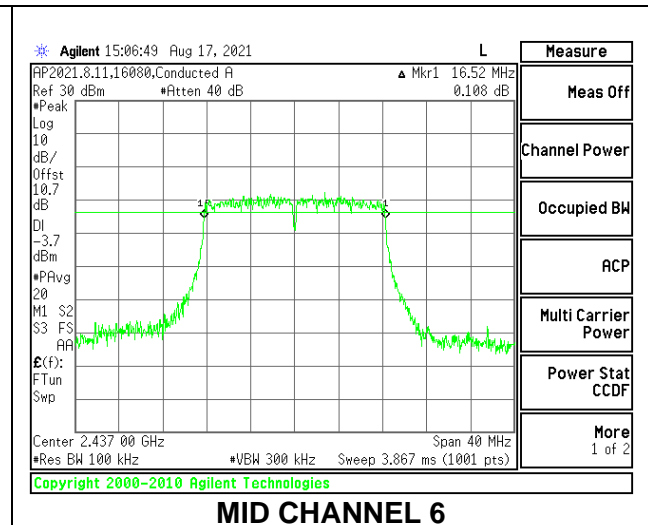
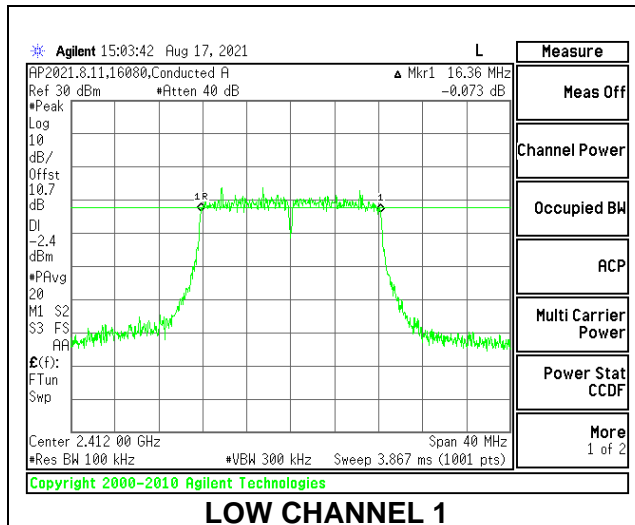


**HIGH CHANNEL 11**

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**1TX Antenna 2 MODE**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	16.36	0.5
Mid 6	2437	16.52	0.5
High 11	2462	16.56	0.5

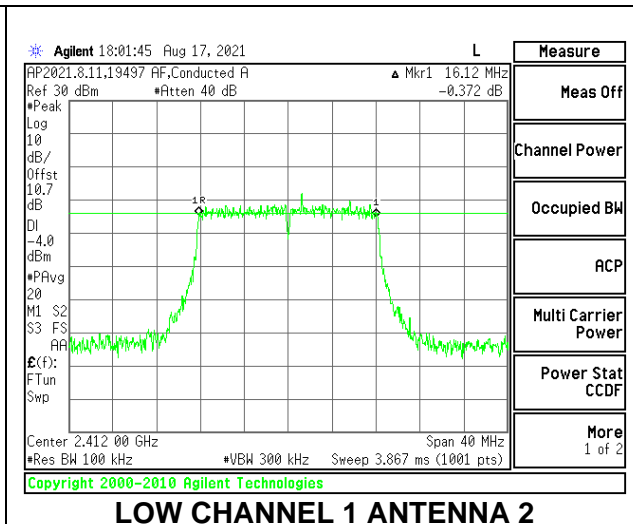
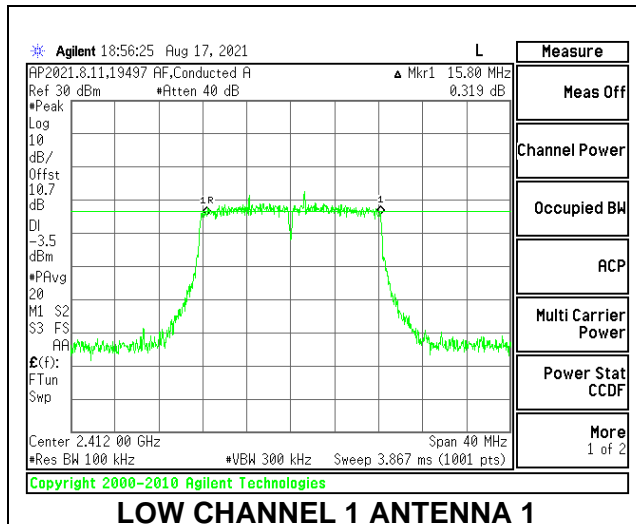


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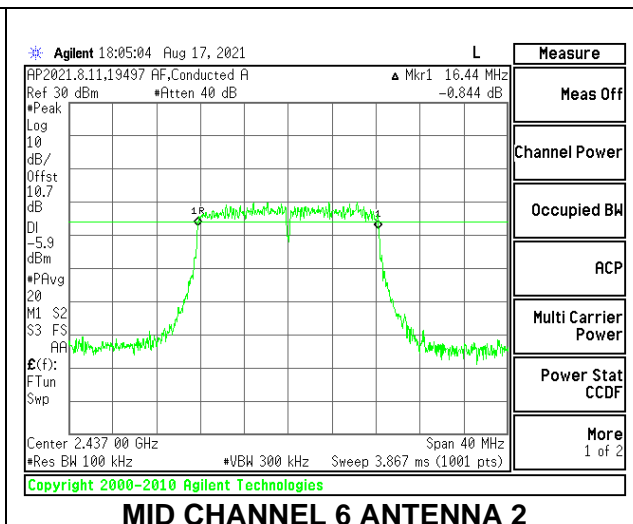
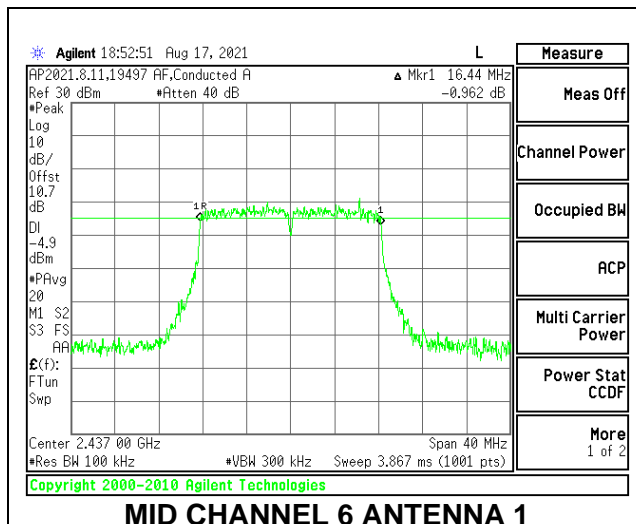
**2TX Antenna 1 + Antenna 2 CDD MODE**

Channel	Frequency (MHz)	6 dB BW Antenna 1 (MHz)	6 dB BW Antenna 2 (MHz)	Minimum Limit (MHz)
Low 1	2412	15.80	16.12	0.5
Mid 6	2437	16.44	16.44	0.5
High 11	2462	16.40	16.44	0.5

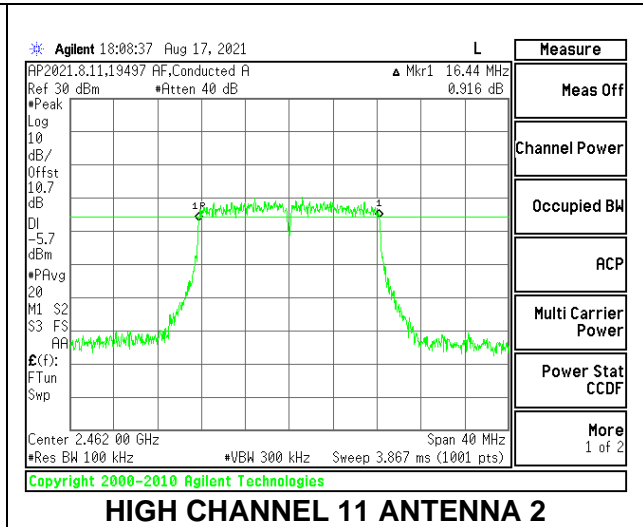
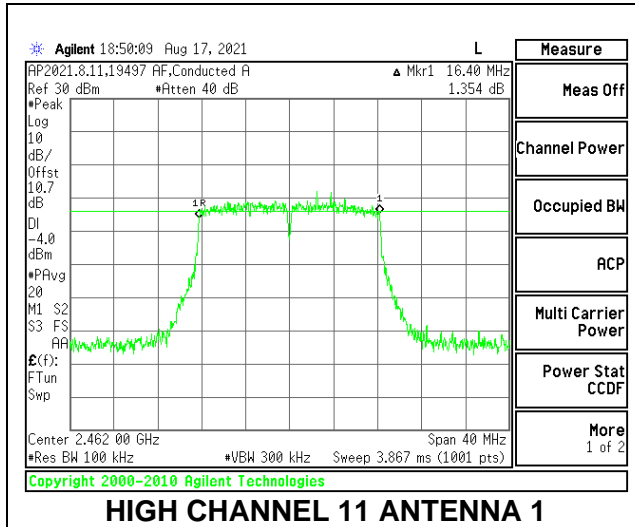
**LOW CHANNEL 1**



**MID CHANNEL 6**



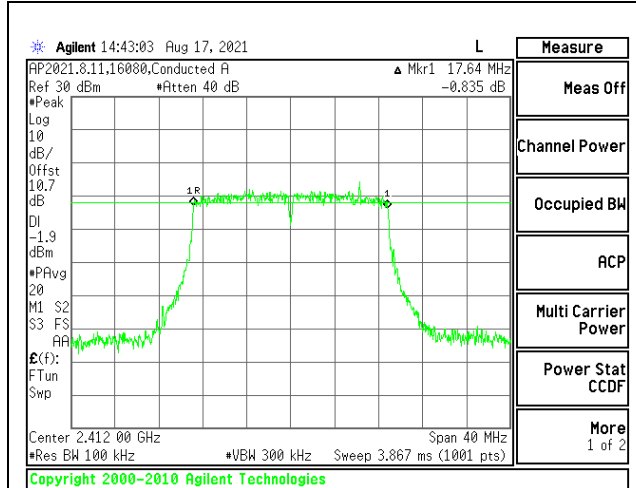
### HIGH CHANNEL 11



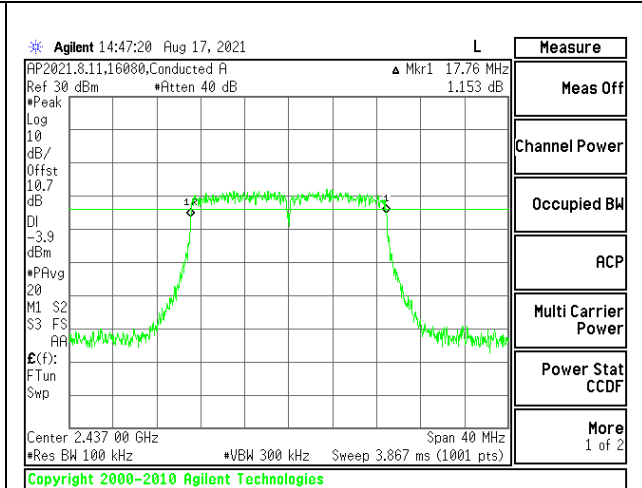
### 9.3.3. 802.11n HT20 MODE

#### 1TX Antenna 1 MODE

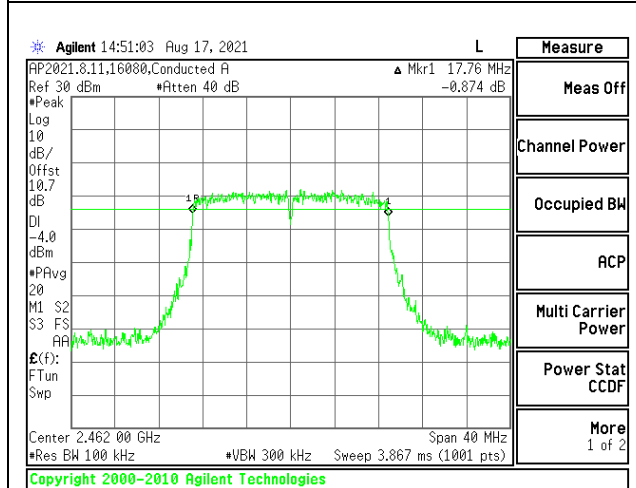
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	17.64	0.5
Mid 6	2437	17.76	0.5
High 11	2462	17.76	0.5



**LOW CHANNEL 1**



**MID CHANNEL 6**

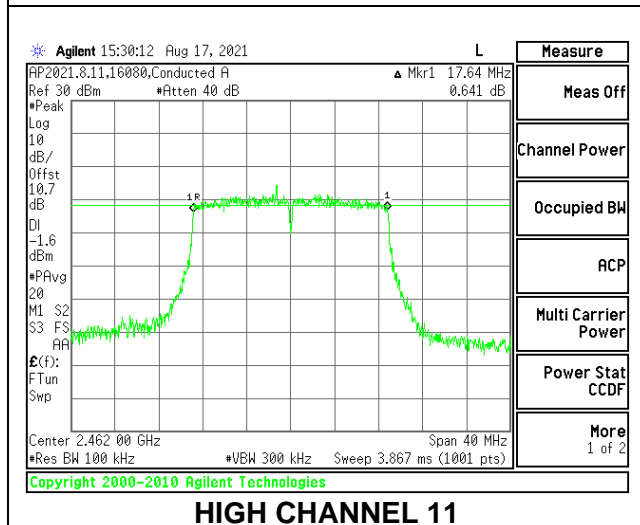
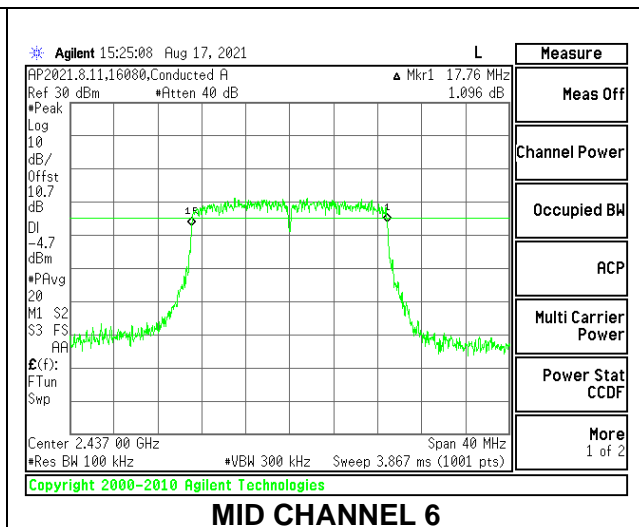
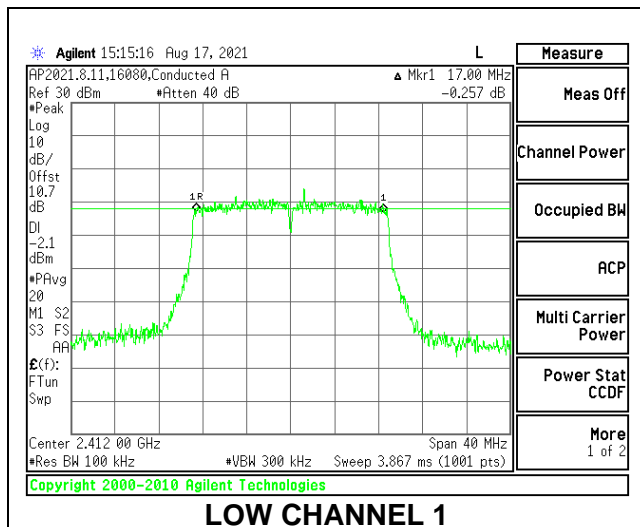


**HIGH CHANNEL 11**

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**1TX Antenna 2 MODE**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	17.00	0.5
Mid 6	2437	17.76	0.5
High 11	2462	17.64	0.5

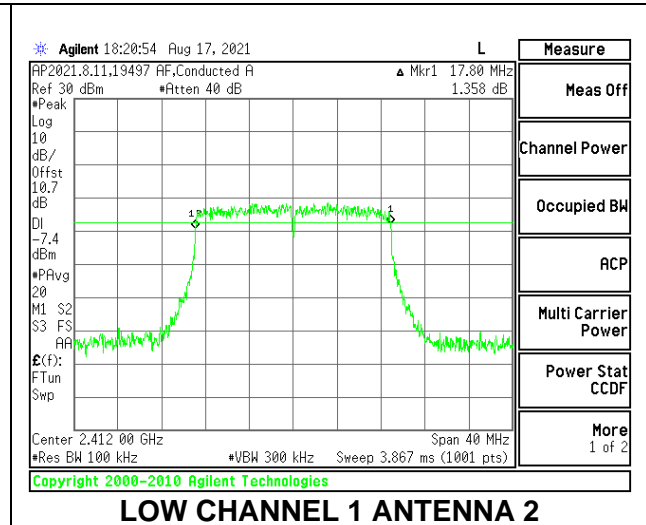
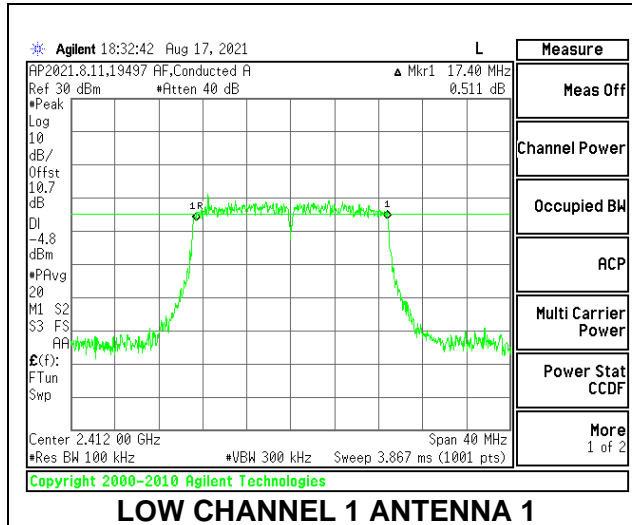


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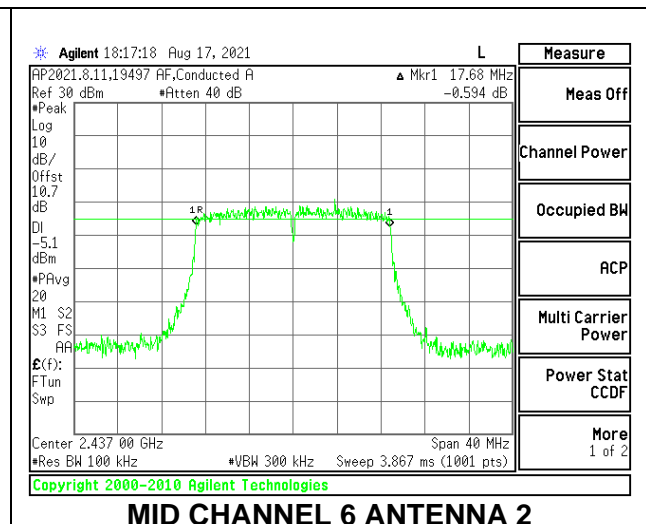
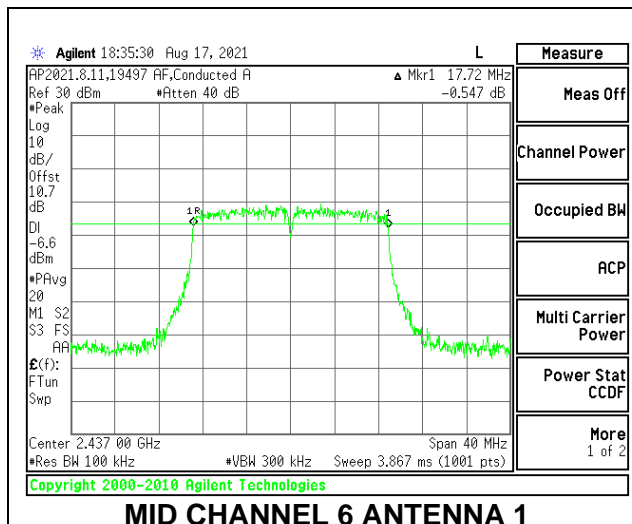
**2TX Antenna 1 + Antenna 2 CDD MODE**

Channel	Frequency (MHz)	6 dB BW Antenna 1 (MHz)	6 dB BW Antenna 2 (MHz)	Minimum Limit (MHz)
Low 1	2412	17.40	17.80	0.5
Mid 6	2437	17.72	17.68	0.5
High 11	2462	17.72	17.72	0.5

**LOW CHANNEL 1**

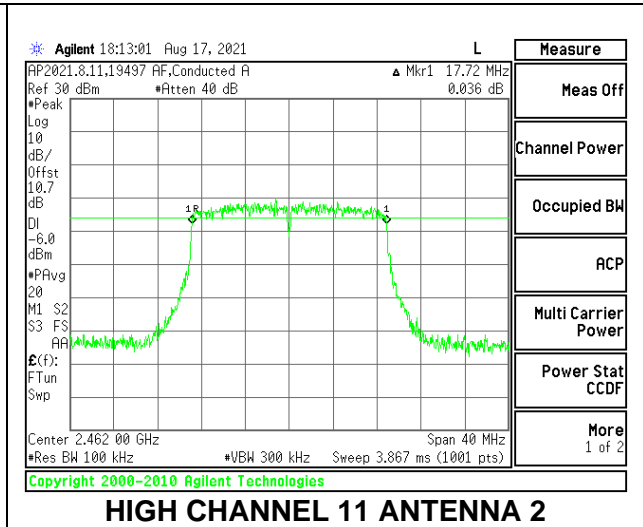
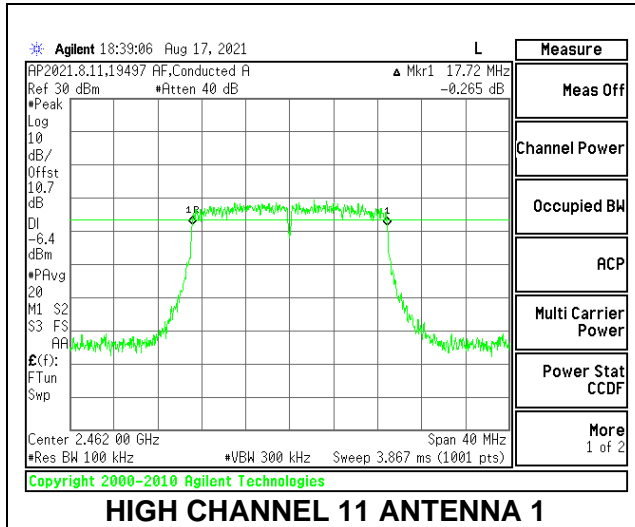


**MID CHANNEL 6**





### HIGH CHANNEL 11



## 9.4. OUTPUT POWER

### LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband average power sensor. Gated average output power was read directly from power meter.

**DIRECTIONAL ANTENNA GAIN**

For 1 TX:

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

For 2 TX:

Tx chains are uncorrelated for power and correlated for PSD due to the device supporting CDD in all MIMO modes. The directional gains are as follows:

<b>Band (GHz)</b>	<b>Antenna 1 Antenna Gain (dBi)</b>	<b>Antenna 2 Antenna Gain (dBi)</b>	<b>Uncorrelated Chains Directional Gain (dBi)</b>	<b>Correlated Chains Directional Gain (dBi)</b>
2.4	2.00	1.50	1.76	4.76

**RESULTS**

**9.4.1. 802.11b MODE**

**1TX Antenna 1 MODE**

<b>Test Engineer:</b>	16080 ZS
<b>Test Date:</b>	8/11/2021

**Limits**

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	2.00	30.00	30	36	30.00
Mid 6	2437	2.00	30.00	30	36	30.00
High 11	2462	2.00	30.00	30	36	30.00

**Results**

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	16.43	16.43	30.00	-13.57
Mid 6	2437	16.34	16.34	30.00	-13.66
High 11	2462	16.14	16.14	30.00	-13.86

**1TX Antenna 2 MODE**

<b>Test Engineer:</b>	16080 ZS
<b>Test Date:</b>	8/11/2021

**Limits**

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	1.50	30.00	30	36	30.00
Mid 6	2437	1.50	30.00	30	36	30.00
High 11	2462	1.50	30.00	30	36	30.00

**Results**

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	15.92	15.92	30.00	-14.08
Mid 6	2437	16.02	16.02	30.00	-13.98
High 11	2462	16.38	16.38	30.00	-13.62

**2TX Antenna 1 + Antenna 2 CDD MODE**

<b>Test Engineer:</b>	16080 ZS
<b>Test Date:</b>	8/11/2021

**Limits**

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC/ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	1.76	30.00	36	30.00
Mid 6	2437	1.76	30.00	36	30.00
High 11	2462	1.76	30.00	36	30.00

**Results**

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	13.16	13.69	16.44	30.00	-13.56
Mid 6	2437	13.08	13.79	16.46	30.00	-13.54
High 11	2462	12.90	13.88	16.43	30.00	-13.57

### 9.4.2. 802.11g MODE

#### 1TX Antenna 1 MODE

<b>Test Engineer:</b>	16080 ZS
<b>Test Date:</b>	8/11/2021

#### Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	2.00	30.00	30	36	30.00
Mid 6	2437	2.00	30.00	30	36	30.00
High 11	2462	2.00	30.00	30	36	30.00

#### Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	16.33	16.33	30.00	-13.67
Mid 6	2437	16.30	16.30	30.00	-13.70
High 11	2462	16.00	16.00	30.00	-14.00

**1TX Antenna 2 MODE**

<b>Test Engineer:</b>	16080 ZS
<b>Test Date:</b>	8/11/2021

**Limits**

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	1.50	30.00	30	36	30.00
Mid 6	2437	1.50	30.00	30	36	30.00
High 11	2462	1.50	30.00	30	36	30.00

**Results**

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	16.00	16.00	30.00	-14.00
Mid 6	2437	16.05	16.05	30.00	-13.95
High 11	2462	16.44	16.44	30.00	-13.56



**2TX Antenna 1 + Antenna 2 CDD MODE**

<b>Test Engineer:</b>	16080 ZS
<b>Test Date:</b>	8/11/2021

**Limits**

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC/ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	1.76	30.00	36	30.00
Mid 6	2437	1.76	30.00	36	30.00
High 11	2462	1.76	30.00	36	30.00

**Results**

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	13.70	13.76	16.74	30.00	-13.26
Mid 6	2437	13.40	13.84	16.64	30.00	-13.36
High 11	2462	13.43	13.88	16.67	30.00	-13.33

### 9.4.3. 802.11n HT20 MODE

#### 1TX Antenna 1 MODE

<b>Test Engineer:</b>	16080 ZS
<b>Test Date:</b>	8/11/2021

#### Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	2.00	30.00	30	36	30.00
Mid 6	2437	2.00	30.00	30	36	30.00
High 11	2462	2.00	30.00	30	36	30.00

#### Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	16.07	16.07	30.00	-13.93
Mid 6	2437	16.04	16.04	30.00	-13.96
High 11	2462	16.03	16.03	30.00	-13.97