



# **CERTIFICATION TEST REPORT**

**Report Number. :** 12166253-E2V3

**Applicant :** SONOS INC.  
614 CHAPALA STREET  
SANTA BARBARA, CA 93101, U.S.A

**Model :** S18

**FCC ID :** SBVRM016

**IC :** 5373A-RM016

**EUT Description :** 802.11a/b/g/n HT20 CLIENT DEVICE

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

**Date Of Issue:**

October 10, 2018

**Prepared by:**

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NVLAP Lab code: 200065-0

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## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	9/21/2018	Initial Issue	-
V2	10/1/2018	Updated Section 2, 6 & 8.	K.Kedida
V3	10/10/2018	Updated Section 8.5 & 9.2	K.Kedida

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SONOS INC.  
614 CHAPALA STREET  
SANTA BARBARA, CA 93101, U.S.A.

**EUT DESCRIPTION:** 802.11a/b/g/n HT20 CLIENT DEVICE

**MODEL:** S18

**SERIAL NUMBER:** 78-28-CA-F0-00-2E-C (Radiated Sample)  
78-28-CA-F0-00-14 (Conducted Sample)

**DATE TESTED:** July 23 to August 02, 2018

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

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

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Reviewed By:



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UL Verification Services Inc.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB 558074 D01 v05, KDB 662911 D01 v02r01, 662911 D02 MIMO v01, ANSI C63.10-2013, RSS-GEN Issue 5, and RSS-247 Issue 2.

## 3. FACILITIES AND ACCREDITATION

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

47173 Benicia Street	47266 Benicia Street	47658 Kato Rd.
<input type="checkbox"/> Chamber A (ISED:2324B-1)	<input type="checkbox"/> Chamber D (ISED:22541-1)	<input type="checkbox"/> Chamber K (ISED: 2324A-1)
<input checked="" type="checkbox"/> Chamber B (ISED:2324B-2)	<input type="checkbox"/> Chamber E (ISED:22541-2)	<input type="checkbox"/> Chamber L (ISED: 2324A-3)
<input type="checkbox"/> Chamber C (ISED:2324B-3)	<input type="checkbox"/> Chamber F (ISED:22541-3)	
	<input type="checkbox"/> Chamber G (ISED:22541-4)	
	<input type="checkbox"/> Chamber H (ISED:22541-5)	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through C are covered under ISED company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under ISED company address code 22541 with site numbers 22541 -1 through 22541-5, respectively. Chambers K and L are covered under ISED company address code 2324A with site numbers 2324A-1 and 2324A-3, respectively.

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

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

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

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

### 4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. EUT DESCRIPTION

The EUT is 802.11a/b/g/n HT20 CLIENT DEVICE.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

#### 2.4GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b 3TX	23.74	236.59
2412 - 2462	802.11g 3TX	22.65	184.08
2412 - 2462	802.11n HT20 3TX	22.39	173.38

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes the antennas with maximums gain per chain as follows:

Frequency (MHz)	Peak Antenna Gain (dBi)		
	Chain 0 (Horizontal Polarization)	Chain 1 (Horizontal Polarization)	Chain 2 (Vertical Polarization)
2400 – 2483.5	2.1	1.4	1.17

### 5.4. SOFTWARE AND FIRMWARE

The EUT software ware installed during testing was 44.2-53220-RF-Complianc\_20180523.

The test utility software used during testing was Sonos Compliance GUI V2.2.

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## 5.5. WORST-CASE CONFIGURATION AND MODE

Radiated bandage, harmonics, and spurious emissions from 1 GHz to 18GHz were performed. The EUT was set to transmit at the Low/Middle/High channels with designed (target) output powers.

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

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

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

802.11b mode: 11 Mbps

802.11g mode: 24 Mbps

802.11n HT20mode: MCS9

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	X201	SON-00000964	N/A
AC Adapter	Lenovo	ADLX65NLT2A	11S36200291ZZ200315AJU	N/A
Charging Base	Lenovo	X200	1S43R8781R934HPB	N/A

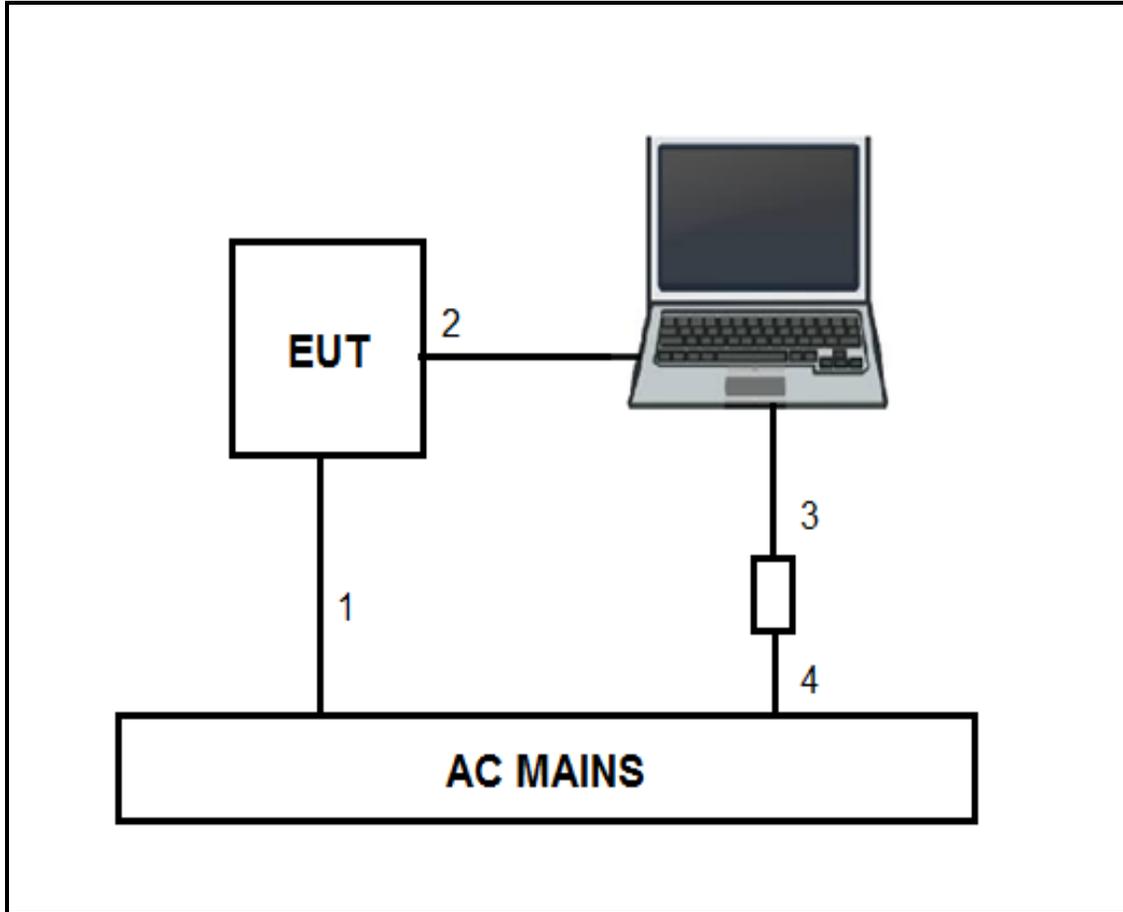
### I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC Power	1	AC	Unshielded	2	AC Mains to EUT
2	Ethernet	1	RJ45	Unshielded	10	EUT to Laptop
3	DC Power	1	DC	Shielded	1.2	AC/DC Adapter to Laptop
4	AC Power	1	AC	Unshielded	1	AC Mains to AC/DC Adapter

**TEST SETUP**

The EUT is a stand-alone unit, and the radio is exercised by Sonos Compliance GUI V2.2 test utility software via Ethernet.

**SETUP DIAGRAM**



## **6. MEASUREMENT METHOD**

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6.

6 dB BW: ANSI C63.10 Section 11.8.1. Option 1

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

Power Spectral Density: ANSI C63.10 Section 11.10.3 Method AVGPSD-1.

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

Radiated emissions restricted frequency bands: ANSI C63.10 Section 11.12.1.

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

Band-edge: ANSI C63.10 Subclause -11.13.3.4 Integration method -Trace averaging across ON and OFF times DC correction

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

## 7. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	ID Num	Cal Due
Amplifier, 100kHz to 1GHz, 32dB	Hewlet Packard	8447D	T15	08/14/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	T407	05/10/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	06/21/2019
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	T1165	04/23/2019
Amplifier, 1 to 8GHz, 35dB	Miteq Inc.	AMF-4D-01000800-30-29P	T1573	04/03/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1450	02/05/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1113	12/21/2018
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1466	04/16/2019
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1271	07/17/2019
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1225	04/10/2019
Antenna, Active Loop 9kHz-30MHz	Com-Power Corp.	AL-130R	T1866	10/10/2018
18 - 26.5 GHz Horn Antenna	Seavey Division	MWH-1826/B	T89	01/18/2019
Pre-Amp 1-26.5 GHz	Agilent	8449B	T404	03/09/2019
EMI Reciever	Rohde & Schwarz	ESR	T1436	02/21/2019
L.I.S.N.	FCC INC.	FCC LISN 50/250	T1310	06/15/2019

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, June 22, 2018
Antenna Port Software	UL	UL RF	Ver 8.4, June 12, 2018

## 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

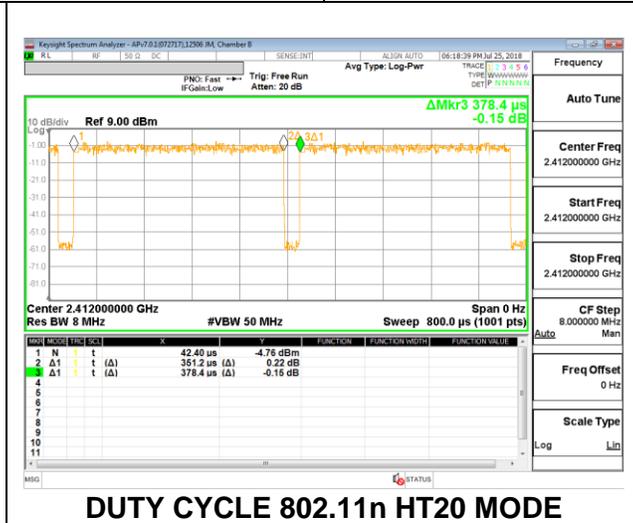
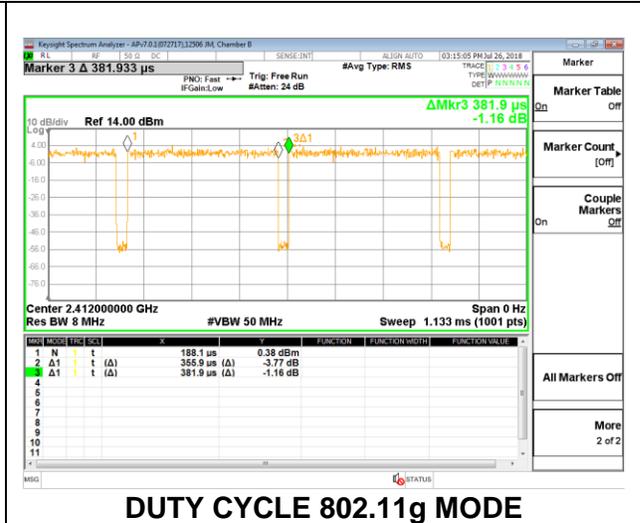
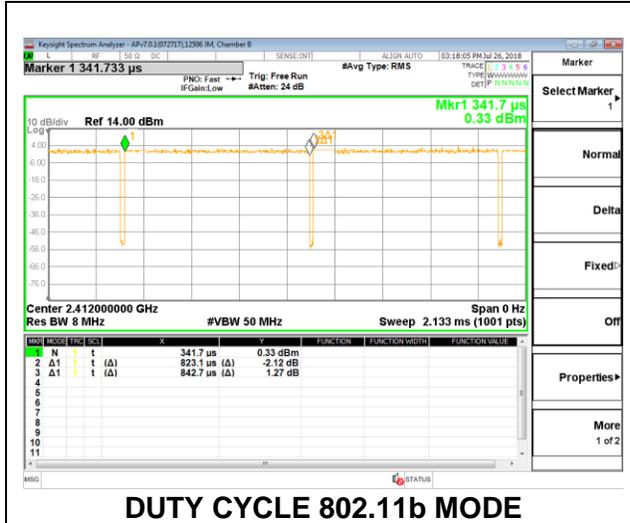
#### PROCEDURE

KDB 789033 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	0.823	0.843	0.977	97.67%	0.10	1.215
802.11g	0.356	0.382	0.932	93.19%	0.31	2.810
802.11n HT20	0.351	0.378	0.928	92.81%	0.32	2.847

**DUTY CYCLE PLOTS**



## 8.2. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

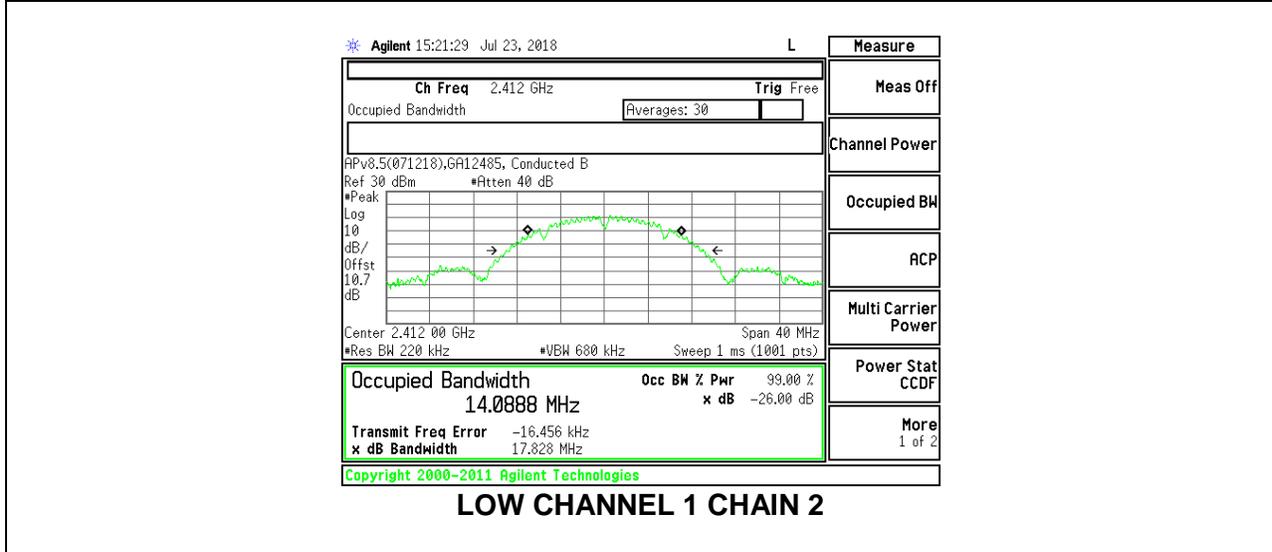
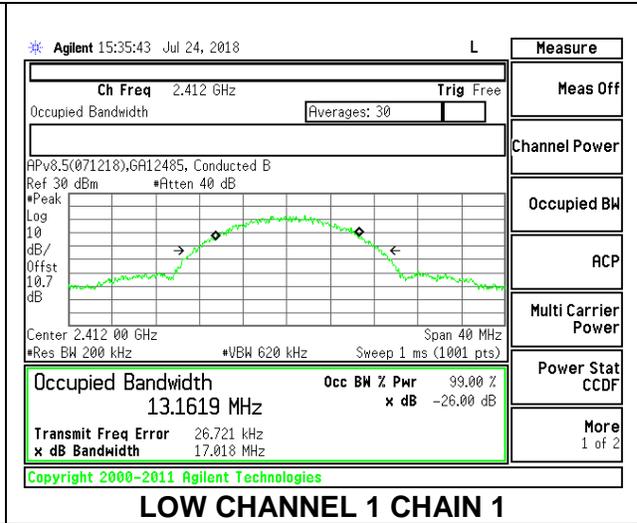
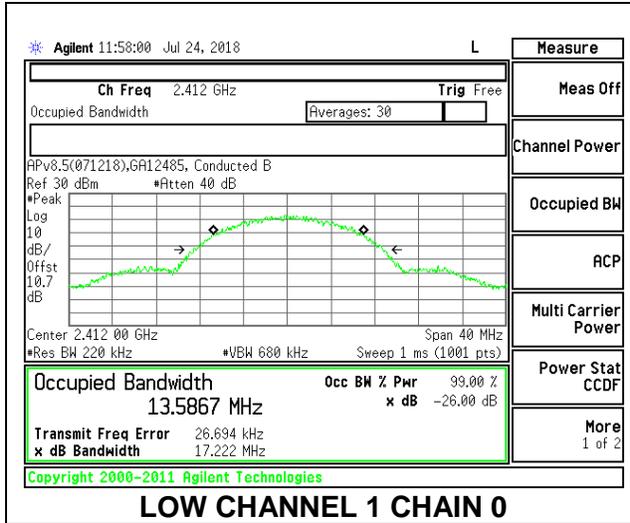
### RESULTS

#### 8.2.1. 802.11b MODE

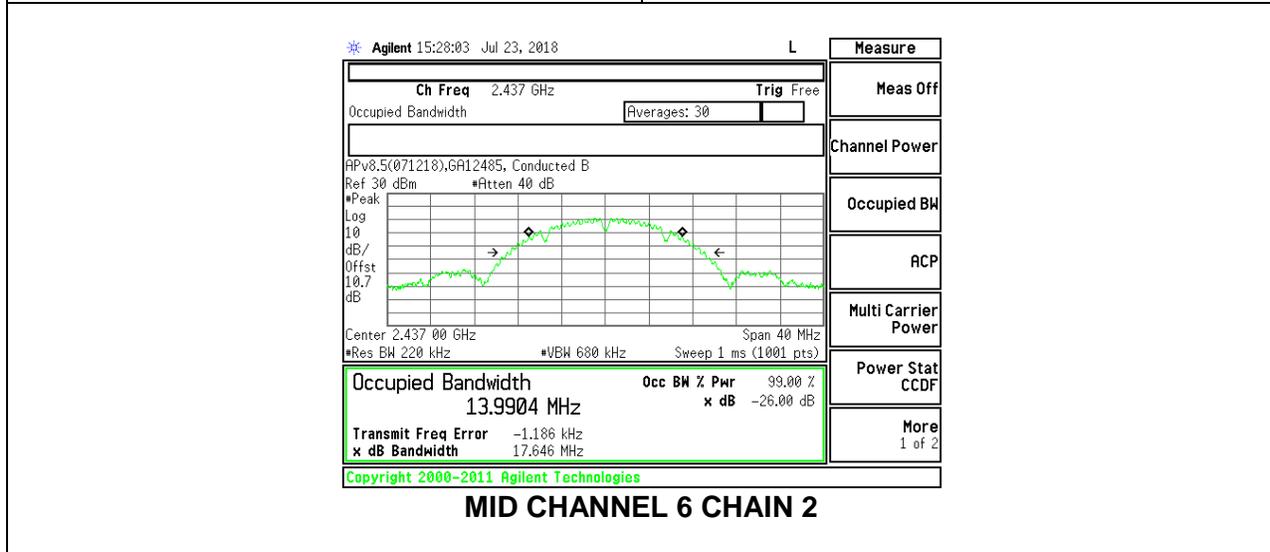
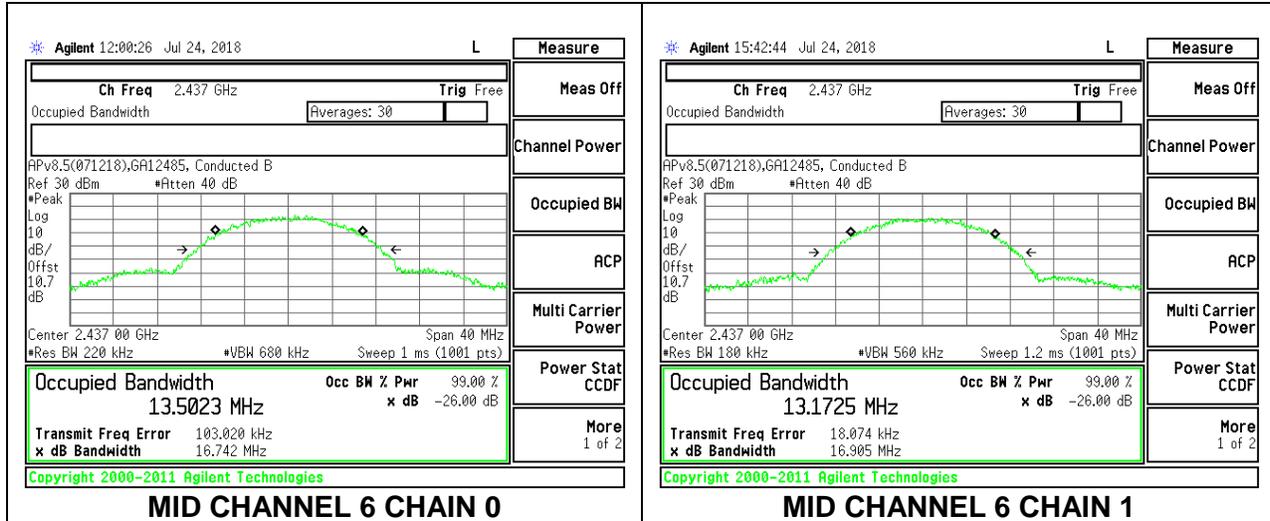
##### 3TX CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)
Low 1	2412	13.5867	13.1619	14.0888
Mid 6	2437	13.5023	13.1725	13.9904
High 11	2462	13.3372	13.4541	13.9765

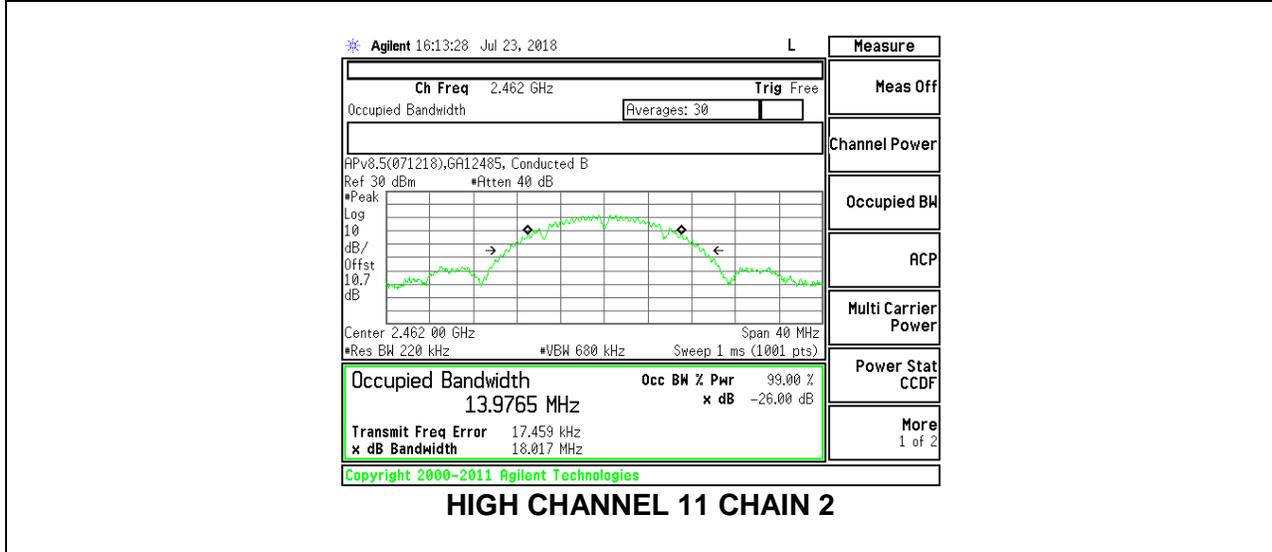
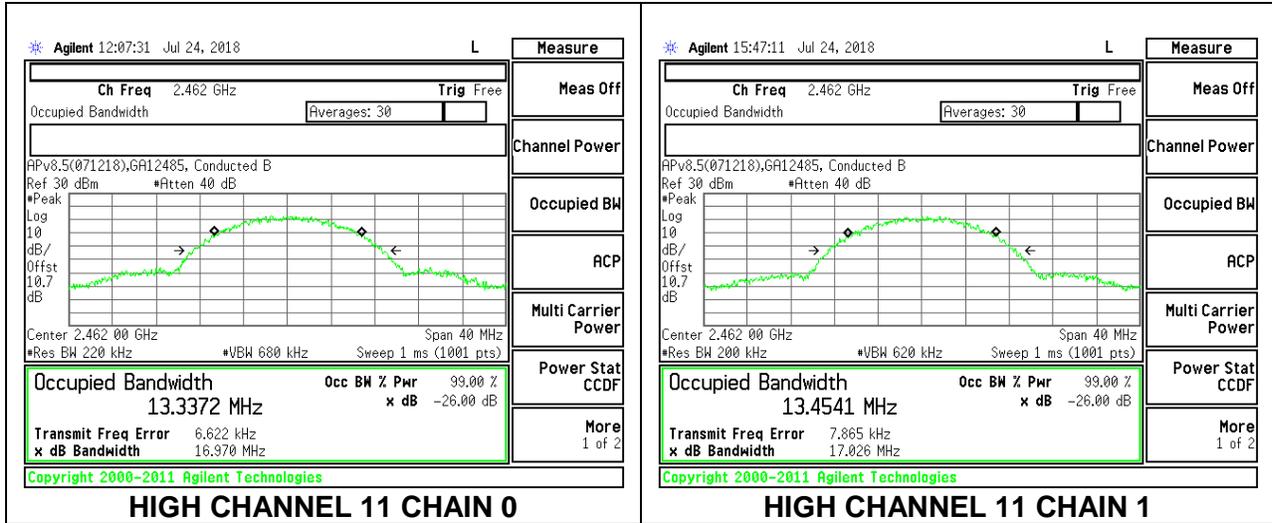
### LOW CHANNEL 1



**MID CHANNEL 6**



### HIGH CHANNEL 11

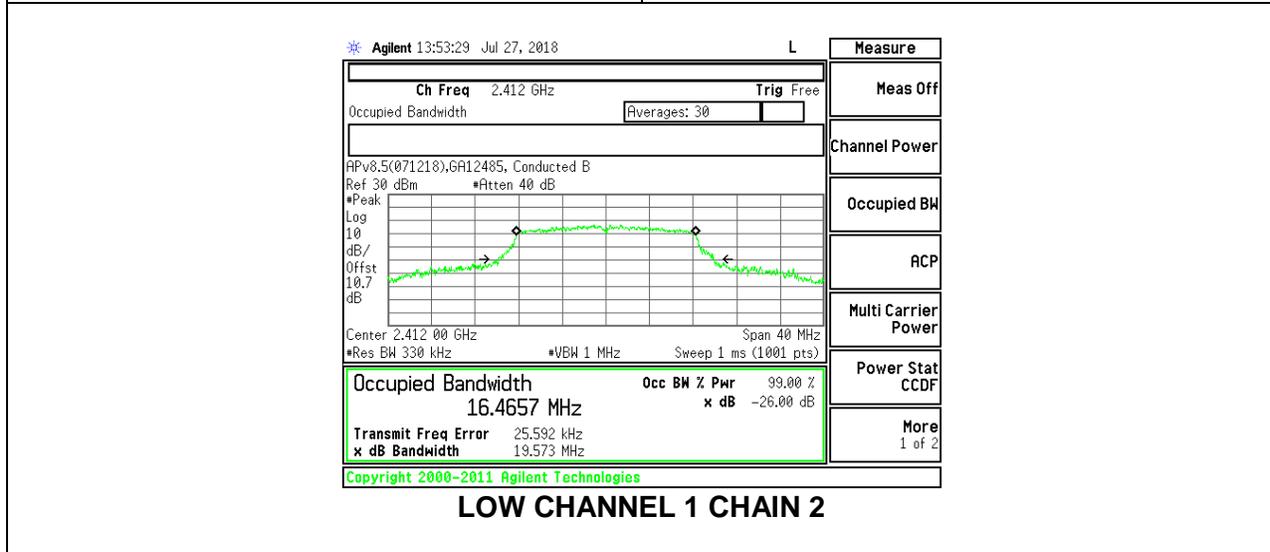
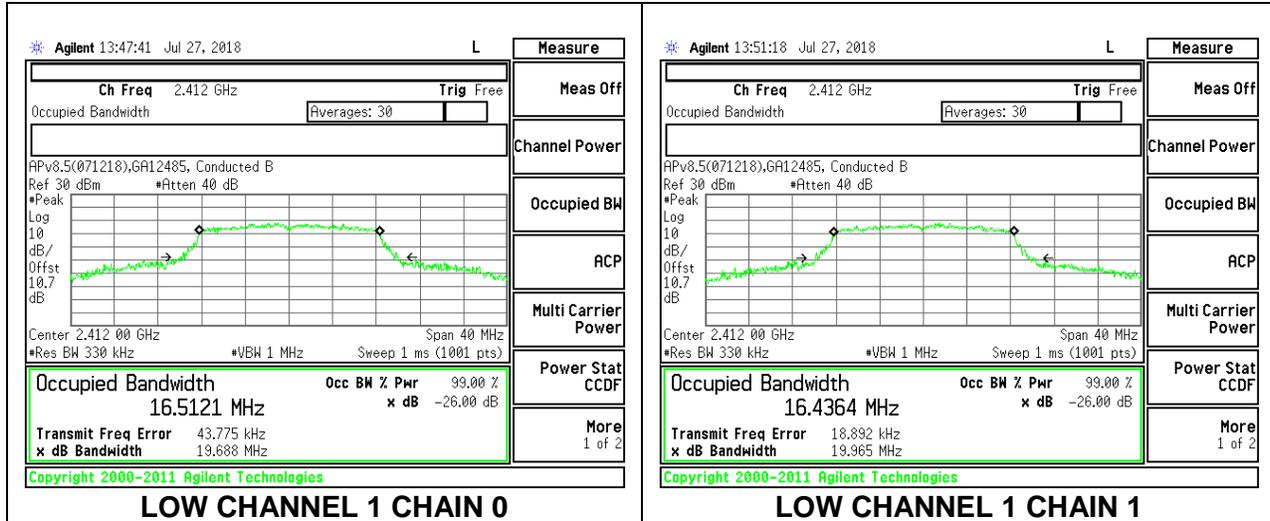


**8.2.2. 802.11g MODE**

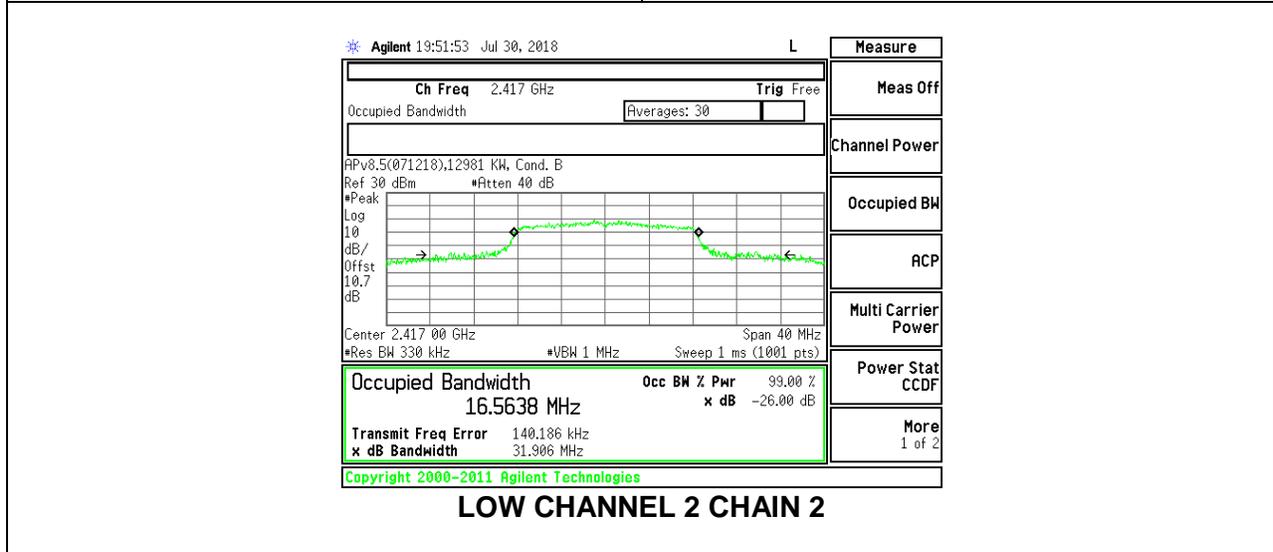
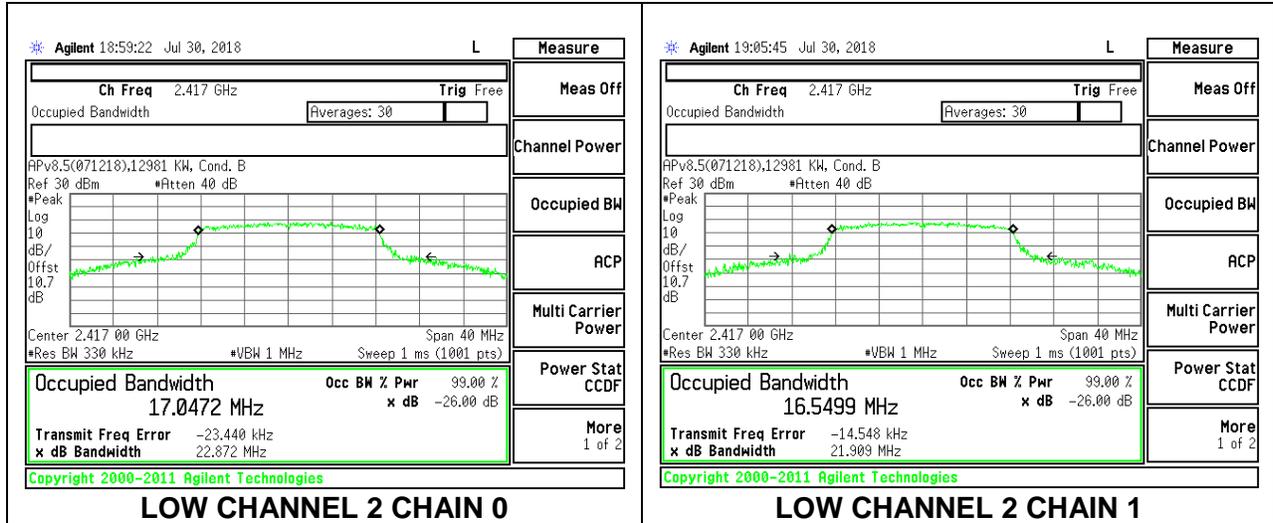
**3TX CDD MODE**

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)
Low 1	2412	16.5121	16.4364	16.4657
Low 2	2417	17.0472	16.5499	16.5638
Mid 6	2437	16.6175	16.5567	16.5967
High 10	2457	16.7812	16.7316	16.6097
High 11	2462	16.5309	16.4984	16.5411

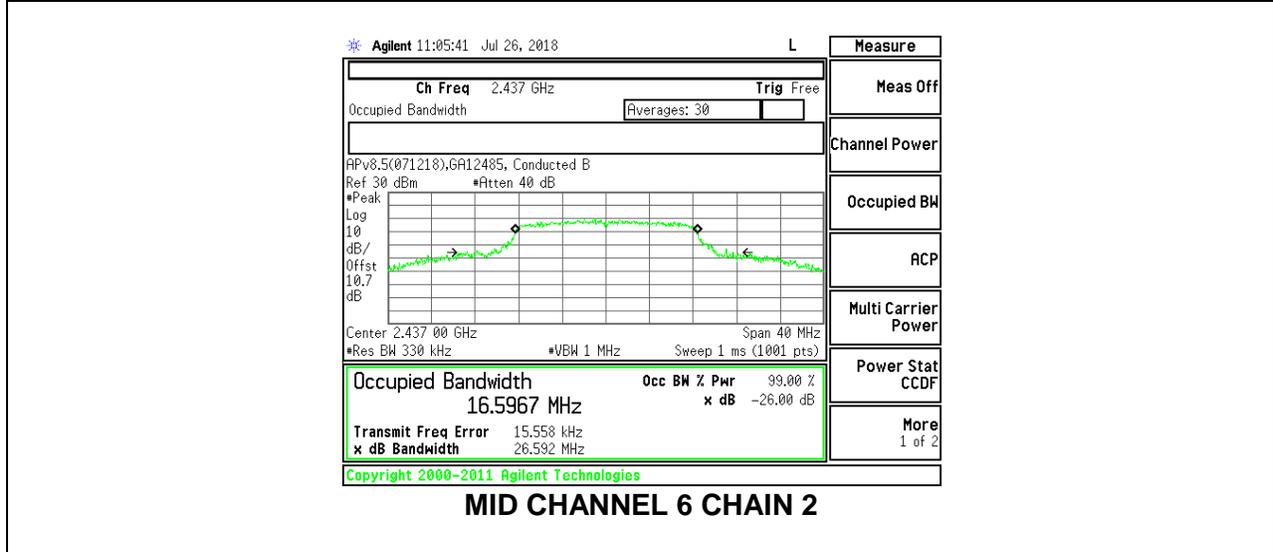
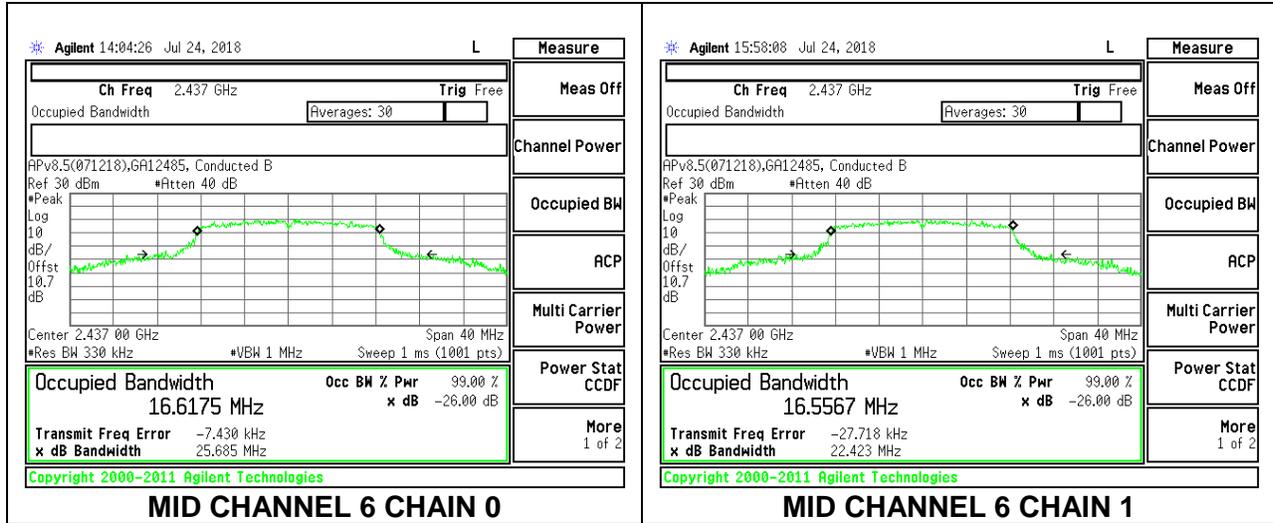
### LOW CHANNEL 1



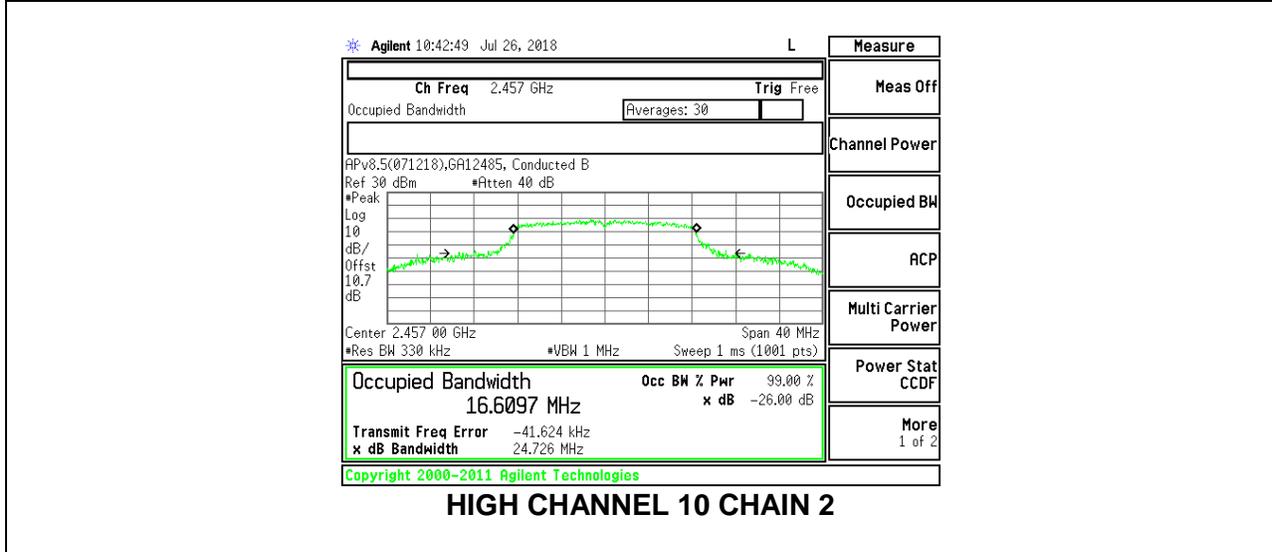
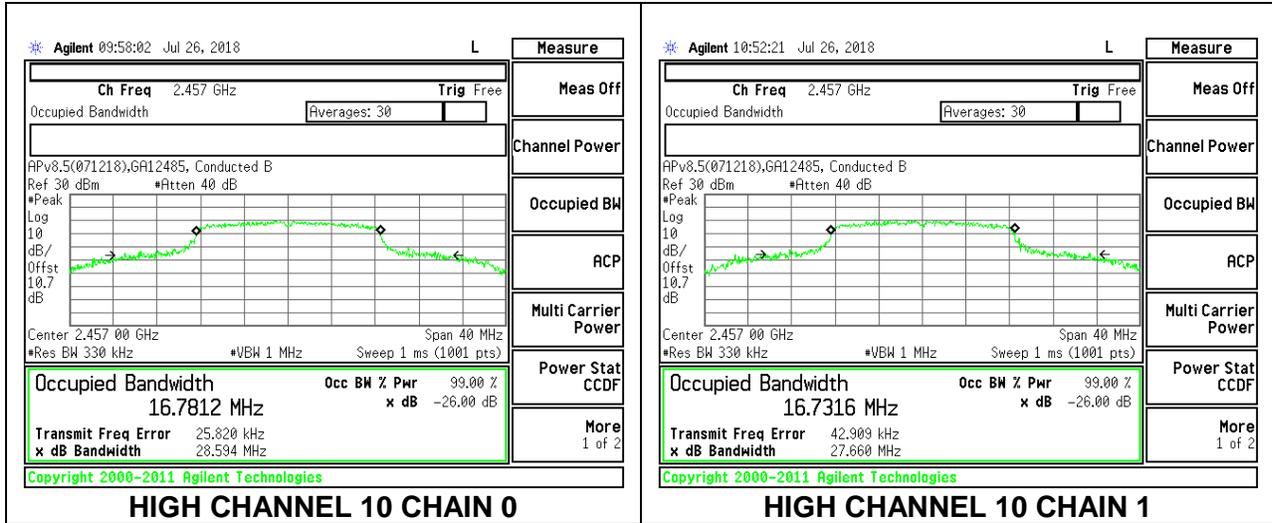
### LOW CHANNEL 2



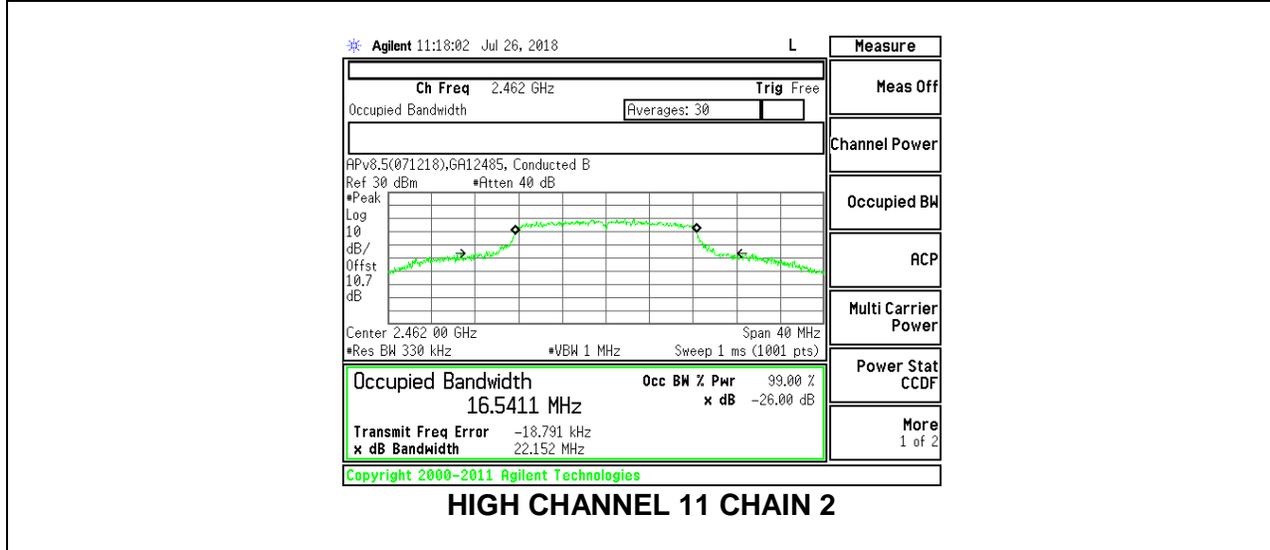
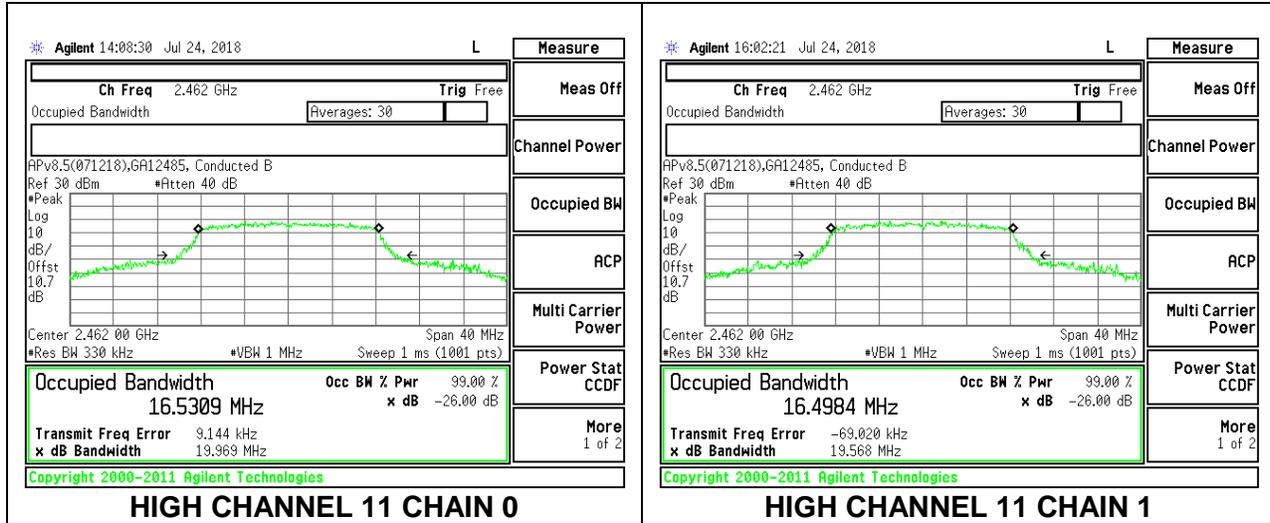
**MID CHANNEL 6**



### HIGH CHANNEL 10



### HIGH CHANNEL 11

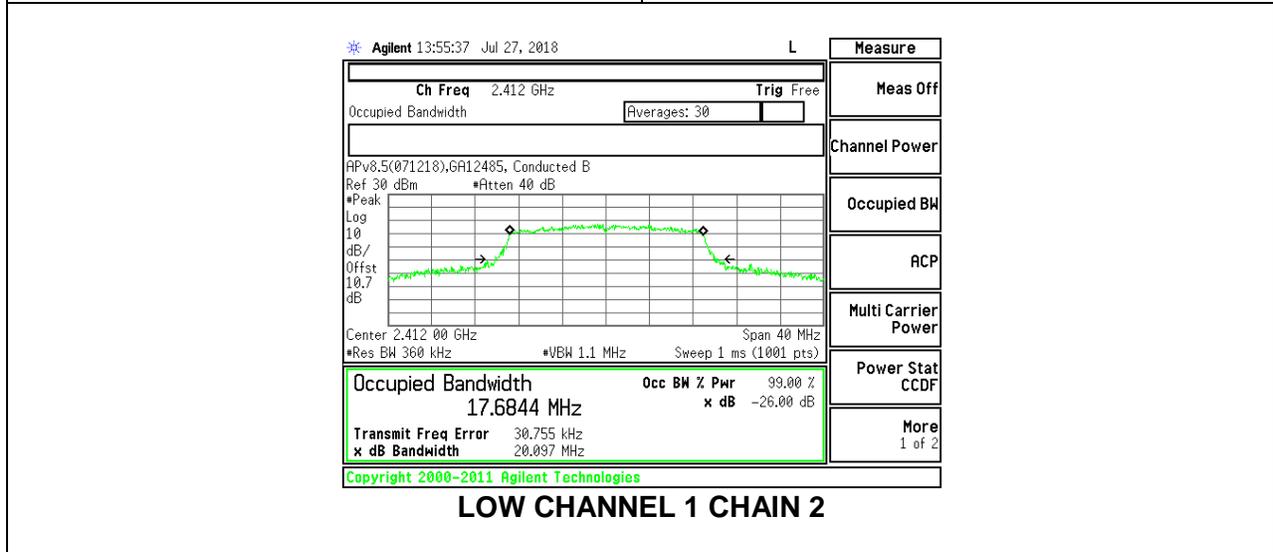
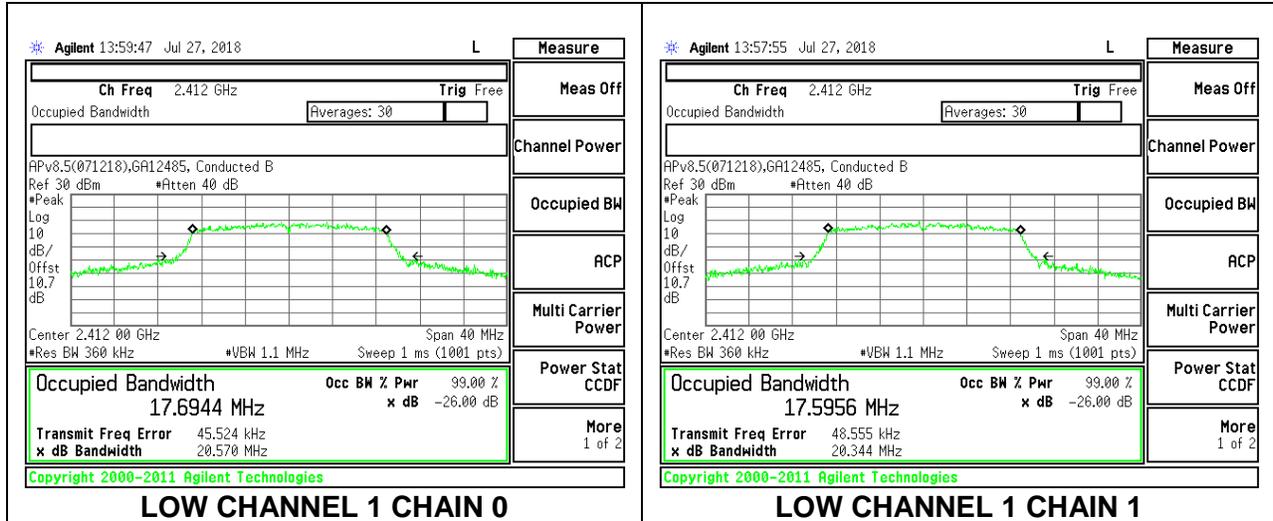


**8.2.3. 802.11n HT20 MODE**

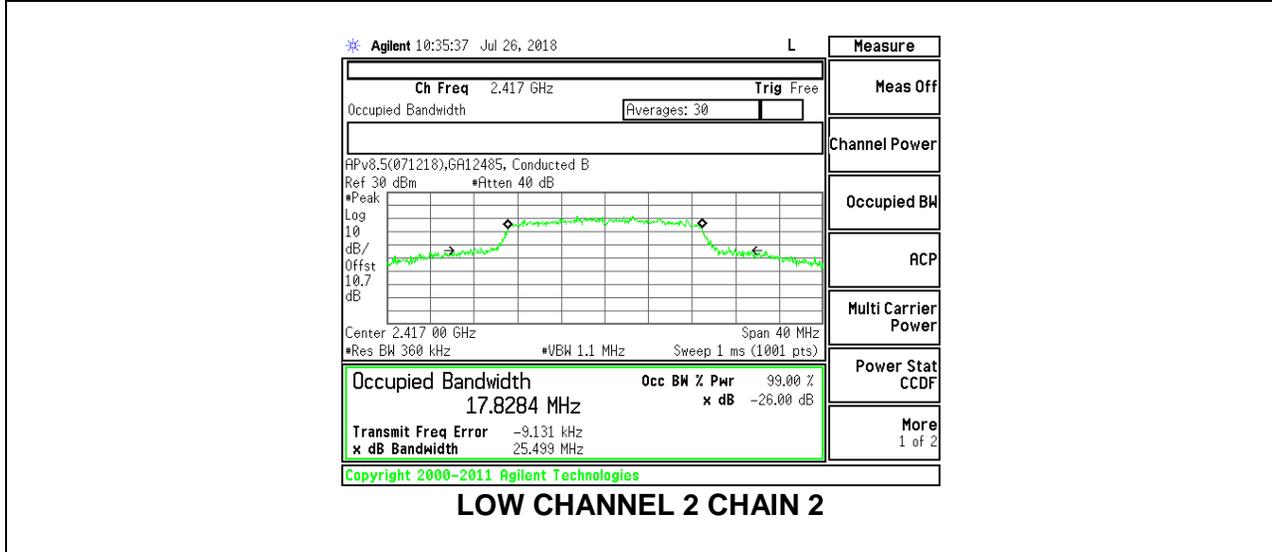
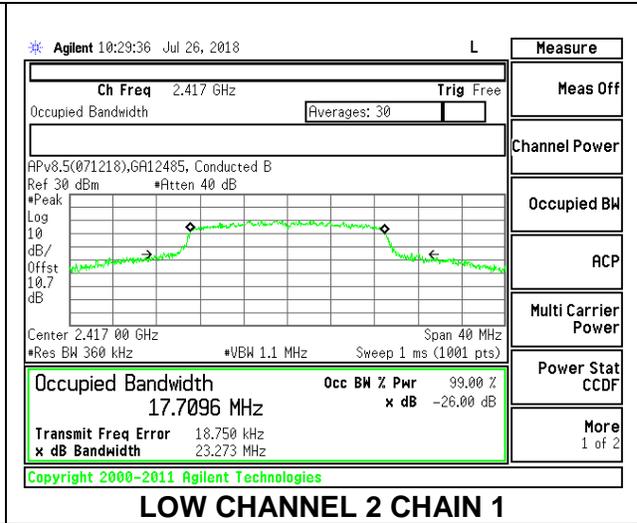
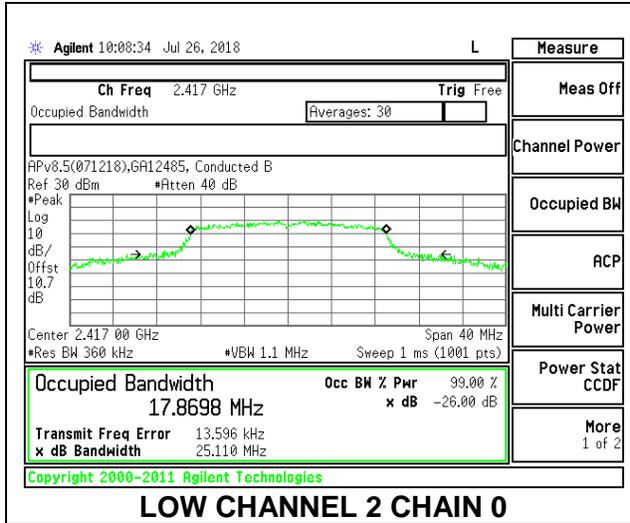
**3TX CDD MODE**

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)
Low 1	2412	17.6944	17.5956	17.6844
Low 2	2417	17.8698	17.7096	17.8284
Mid 6	2437	17.7037	17.6537	17.6785
High 10	2457	17.6832	17.7402	17.6512
High 11	2462	17.7527	17.6438	17.6508

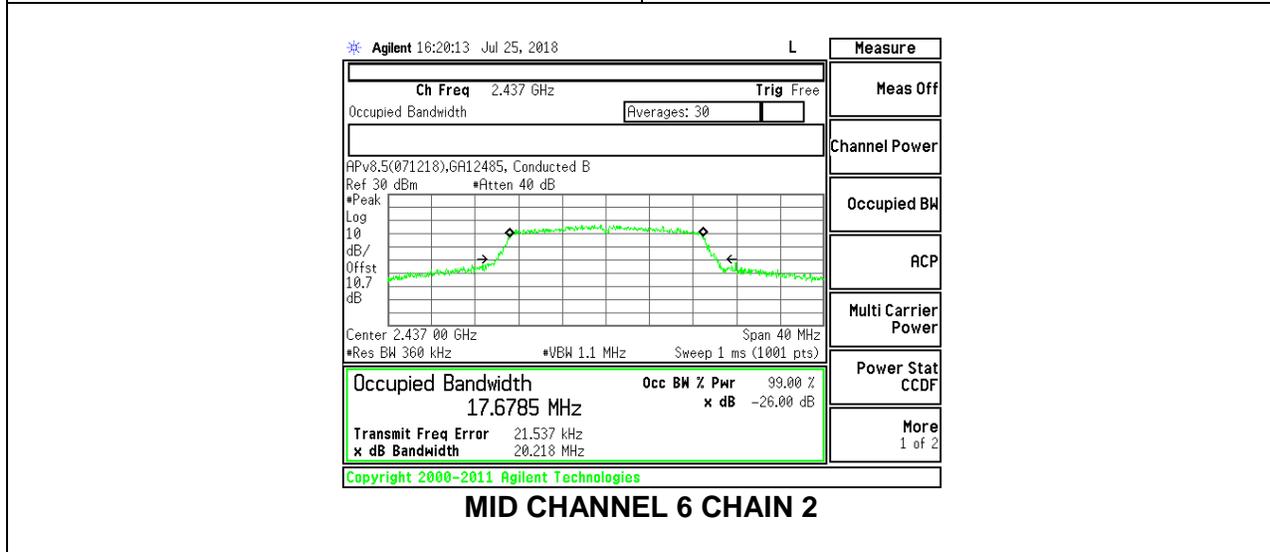
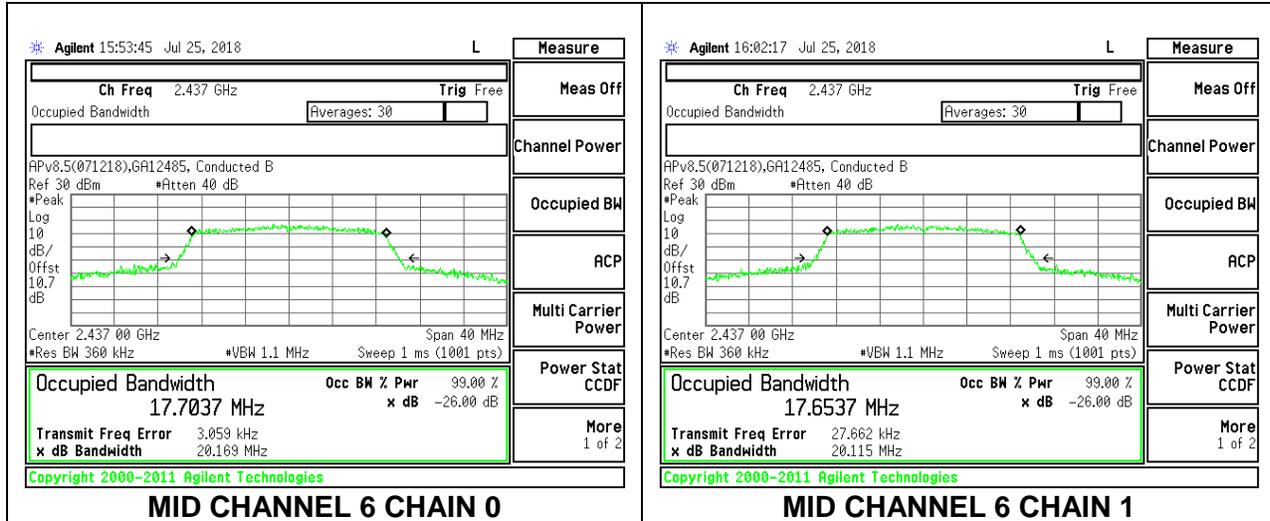
### LOW CHANNEL 1



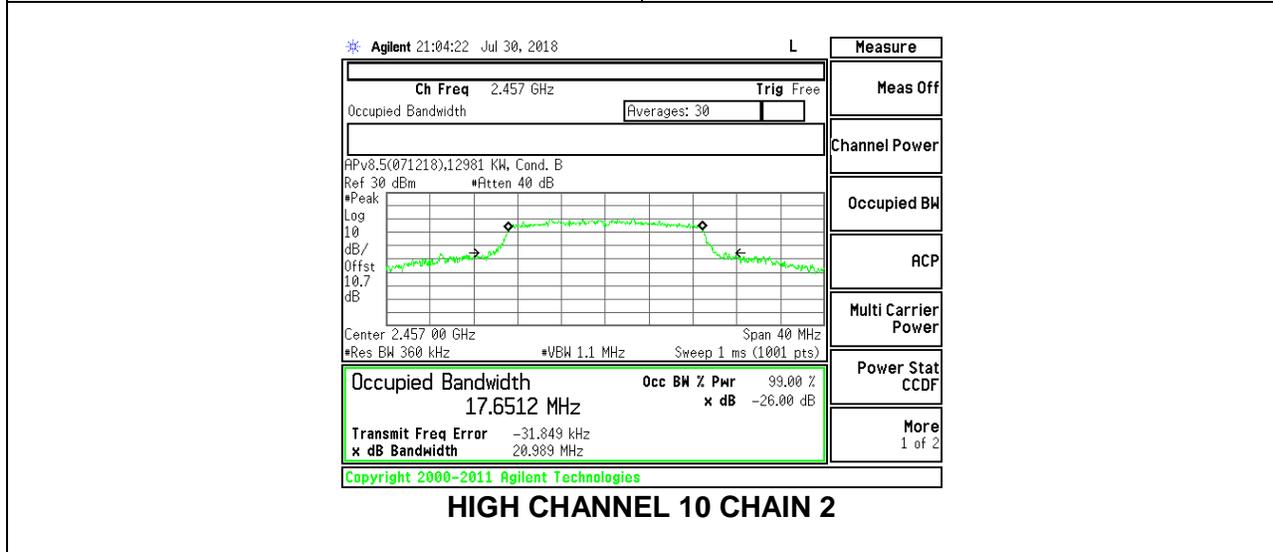
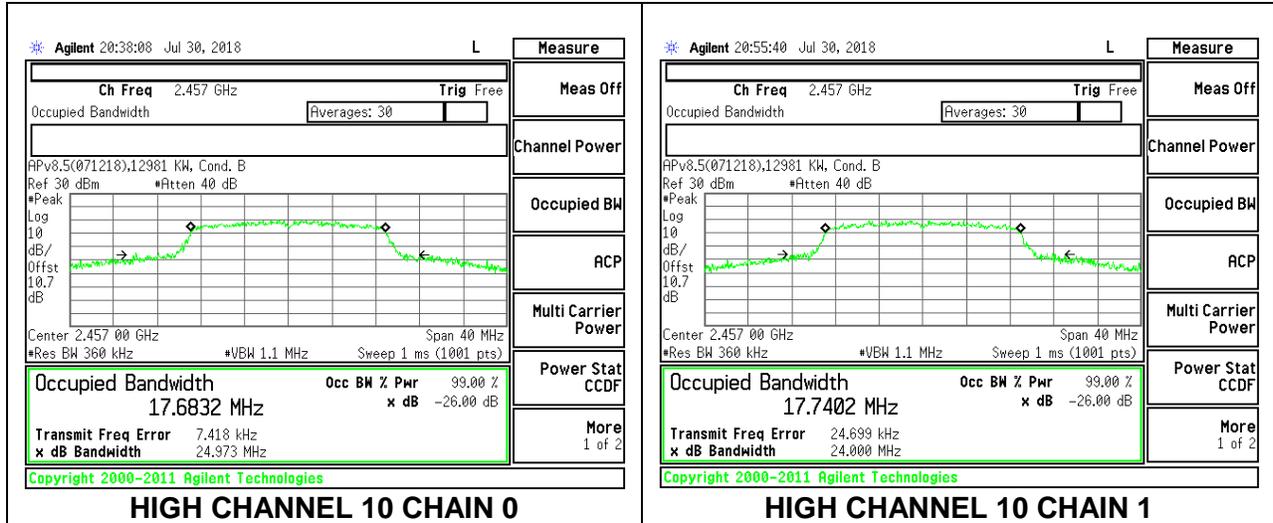
**LOW CHANNEL 2**



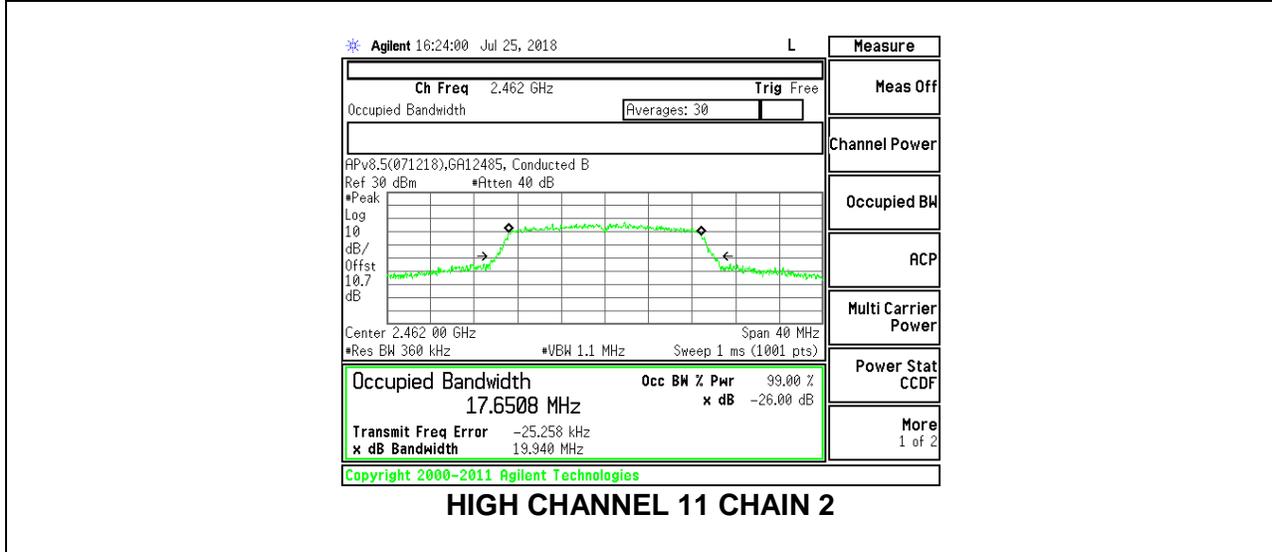
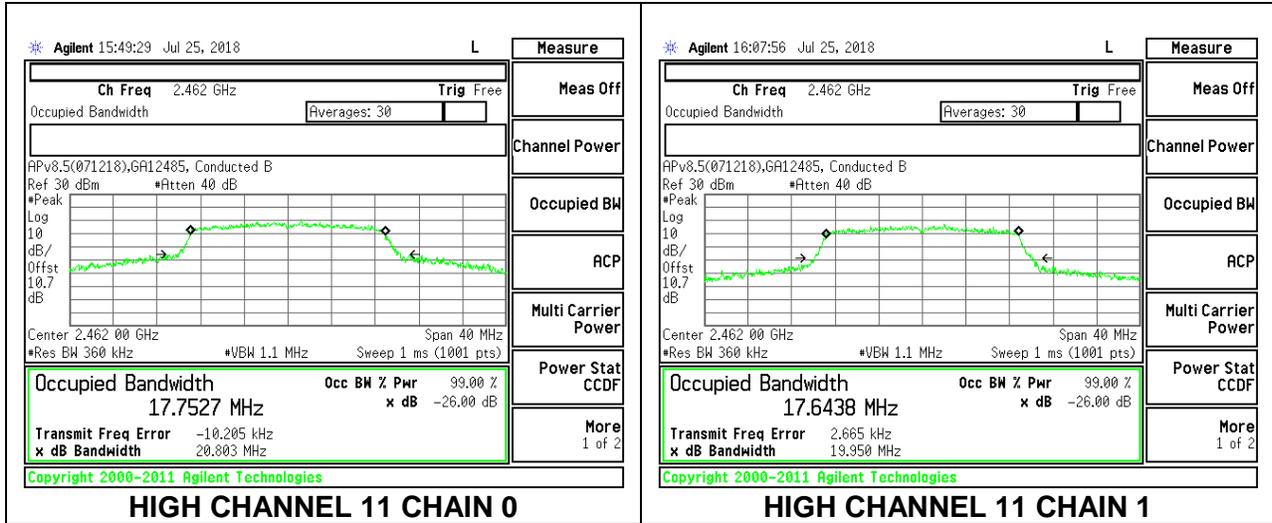
**MID CHANNEL 6**



### HIGH CHANNEL 10



### HIGH CHANNEL 11



### **8.3. 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.

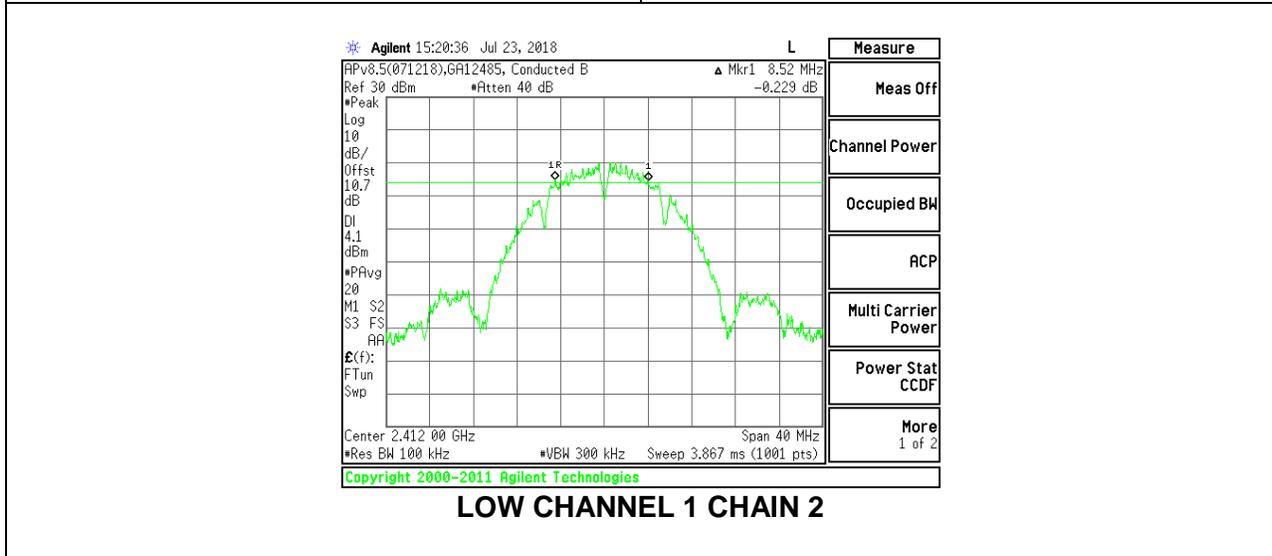
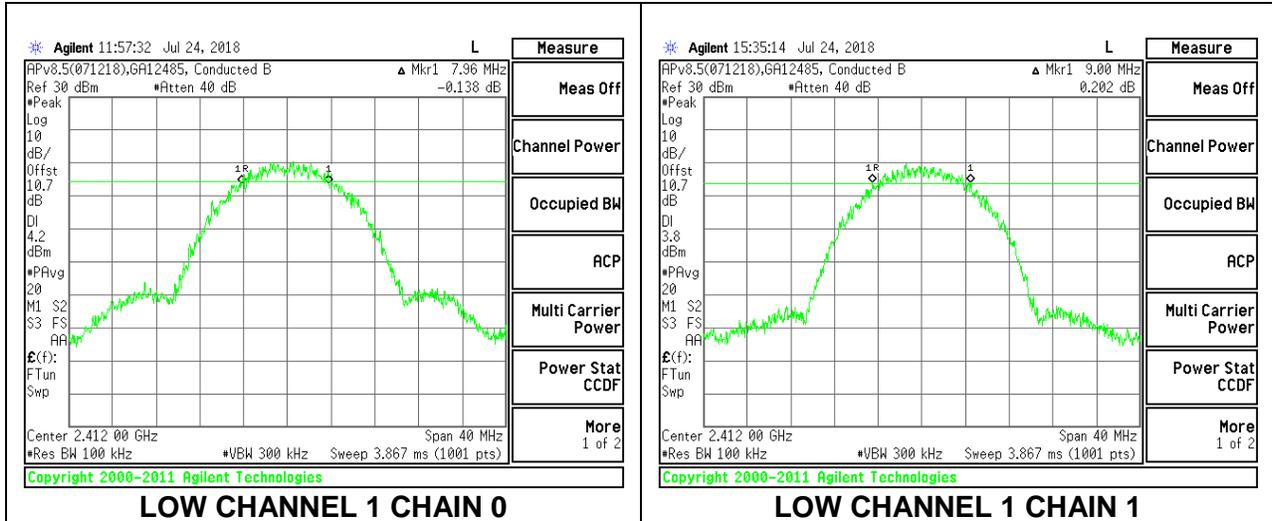
#### **RESULTS**

**8.3.1. 802.11b MODE**

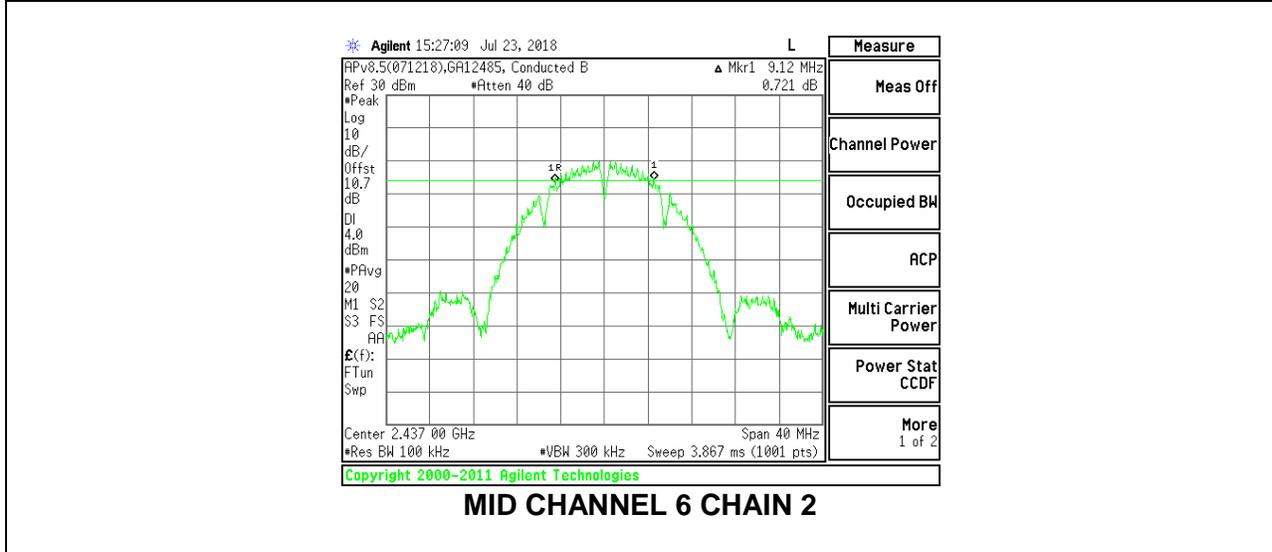
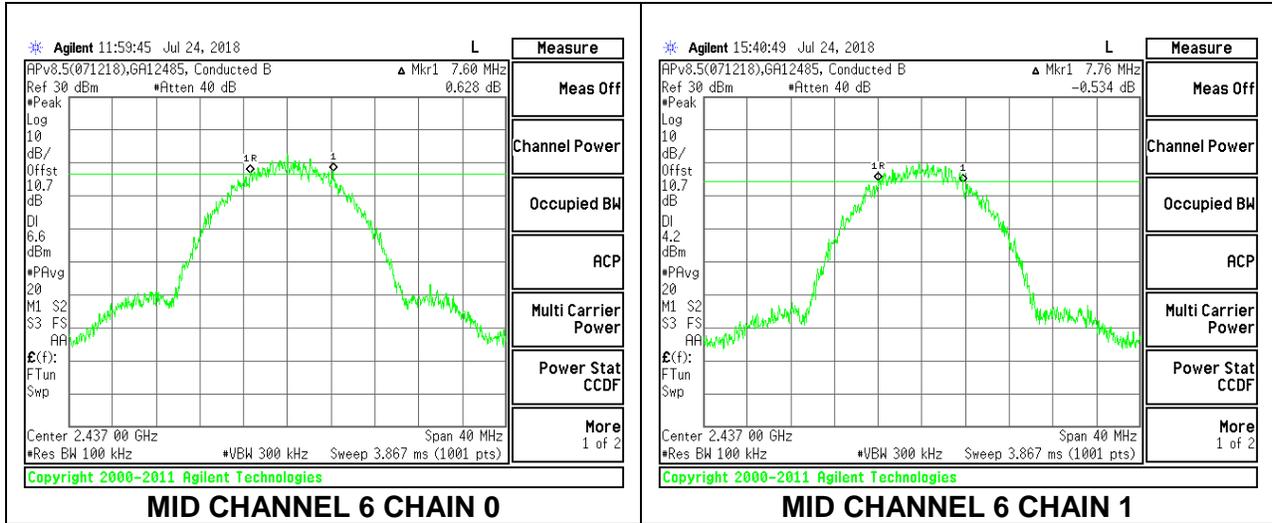
**3TX CDD MODE**

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	Minimum Limit (MHz)
Low 1	2412	7.9600	9.0000	8.5200	0.5
Mid 6	2437	7.6000	7.7600	9.1200	0.5
High 11	2462	8.4000	8.4000	9.0000	0.5

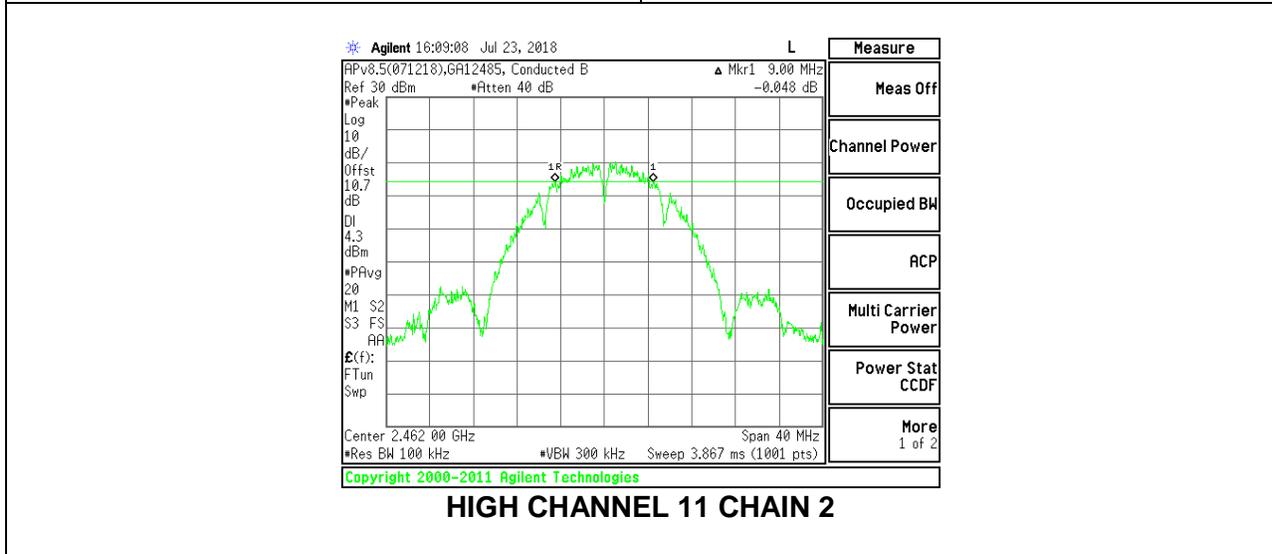
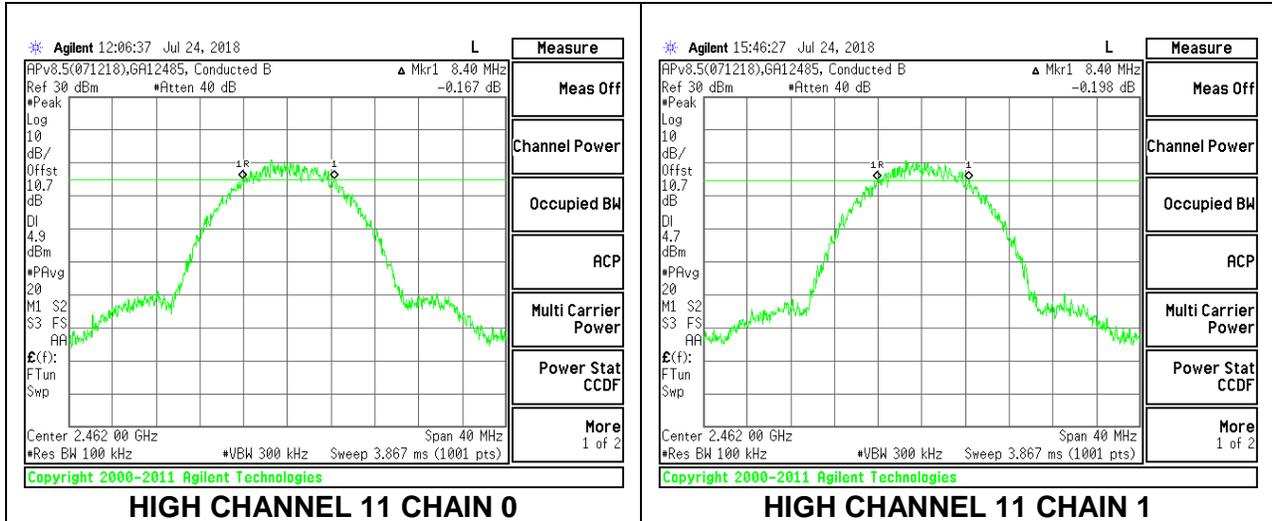
### LOW CHANNEL 1



**MID CHANNEL 6**



### HIGH CHANNEL 11

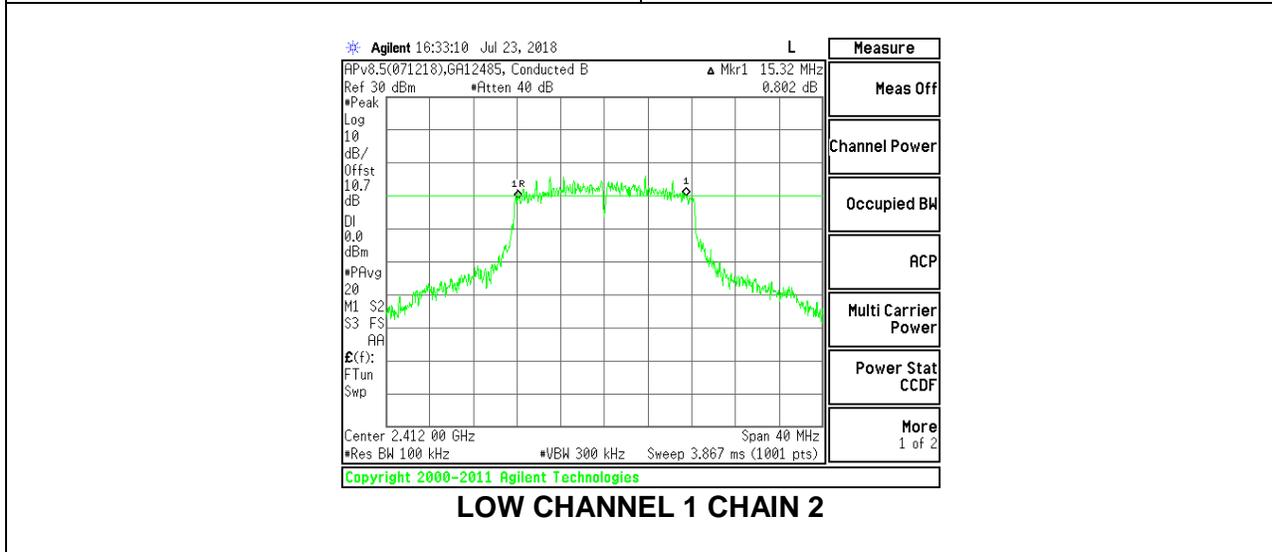
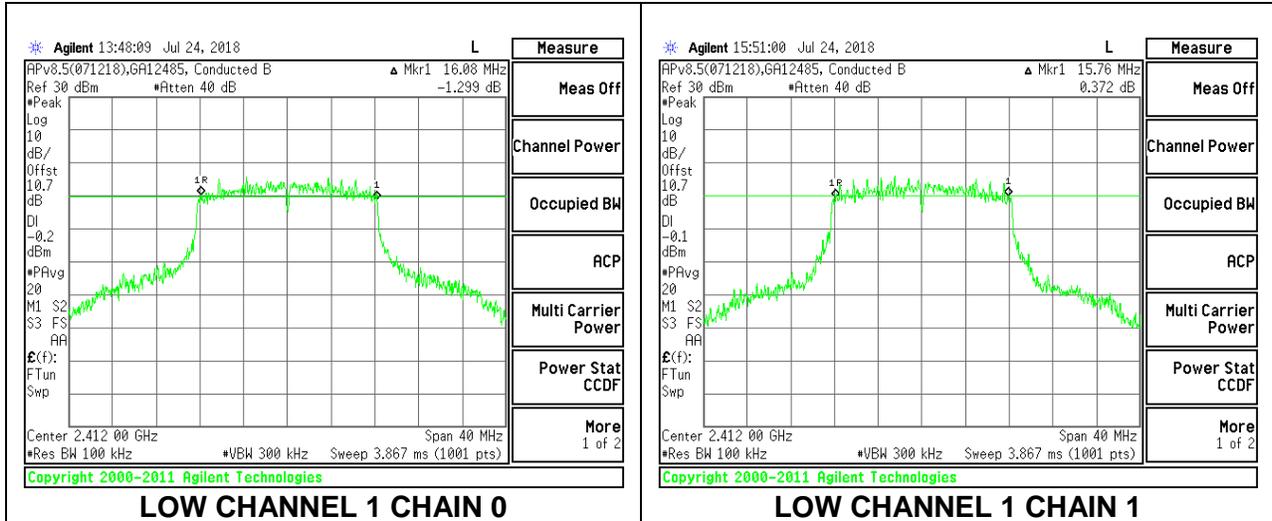


**8.3.2. 802.11g MODE**

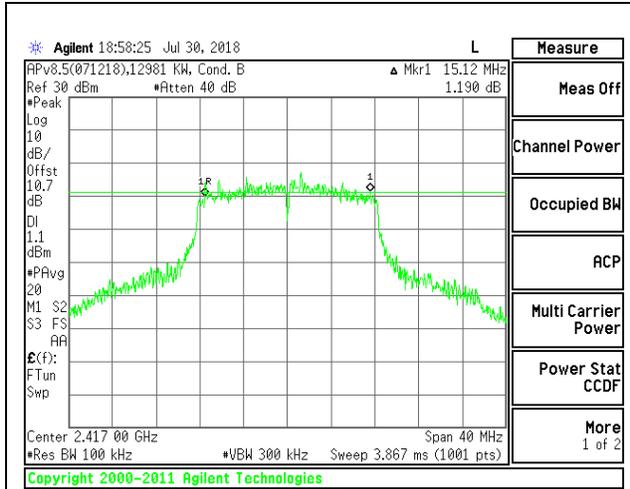
**3TX CDD MODE**

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	Minimum Limit (MHz)
Low 1	2412	16.0800	15.7600	15.3200	0.5
Low 2	2417	15.1200	15.1200	15.4400	0.5
Mid 6	2437	16.0400	15.0000	15.1600	0.5
High 10	2457	15.7200	15.0400	15.1600	0.5
High 11	2462	15.6800	16.0400	15.4800	0.5

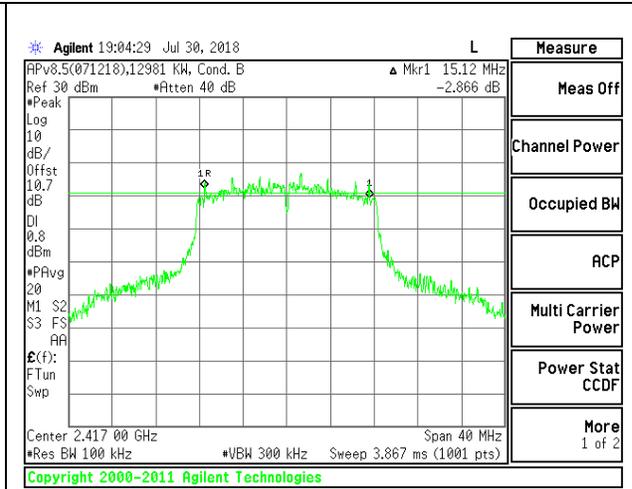
### LOW CHANNEL 1



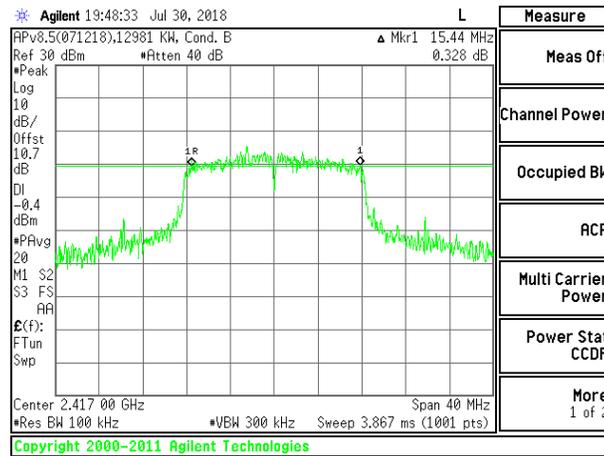
**LOW CHANNEL 2**



**LOW CHANNEL 2 CHAIN 0**

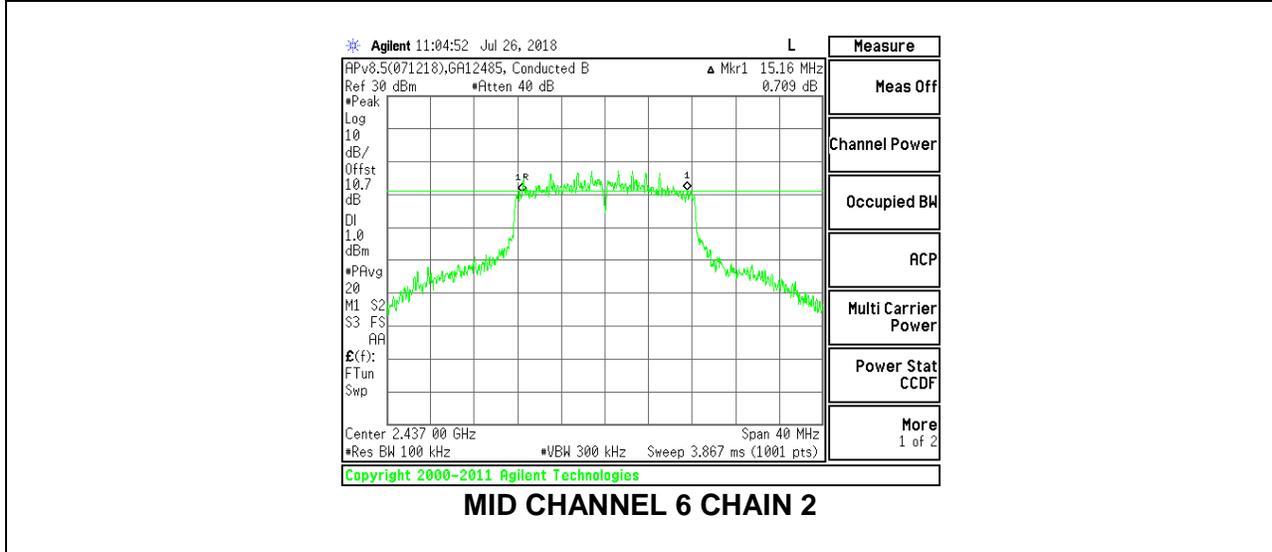
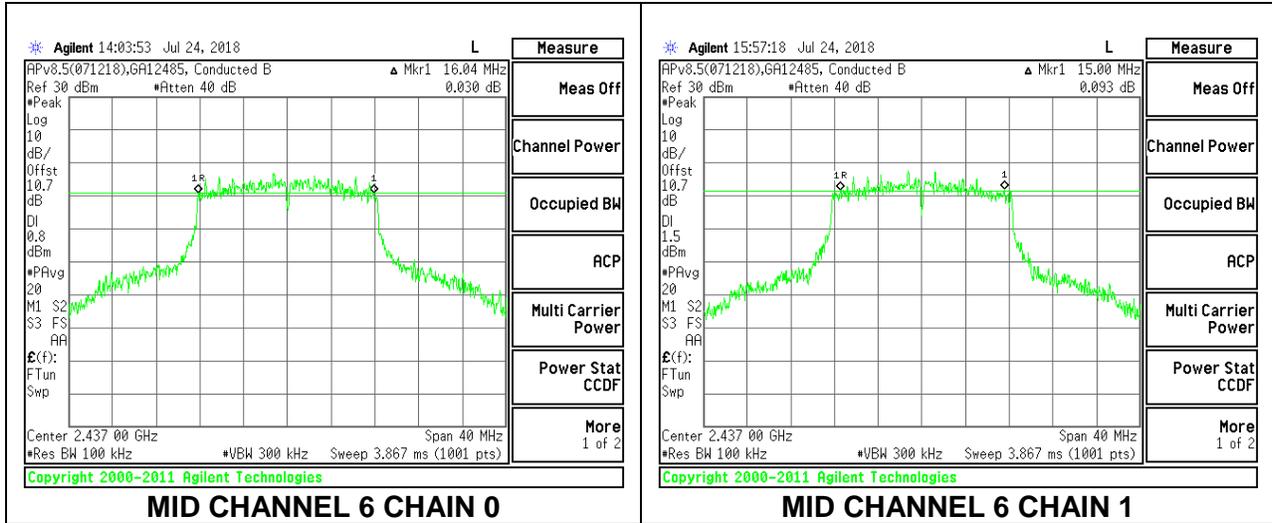


**LOW CHANNEL 2 CHAIN 1**

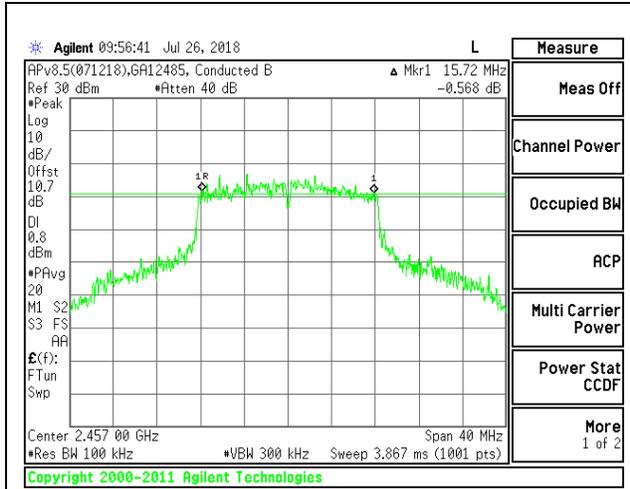


**LOW CHANNEL 2 CHAIN 2**

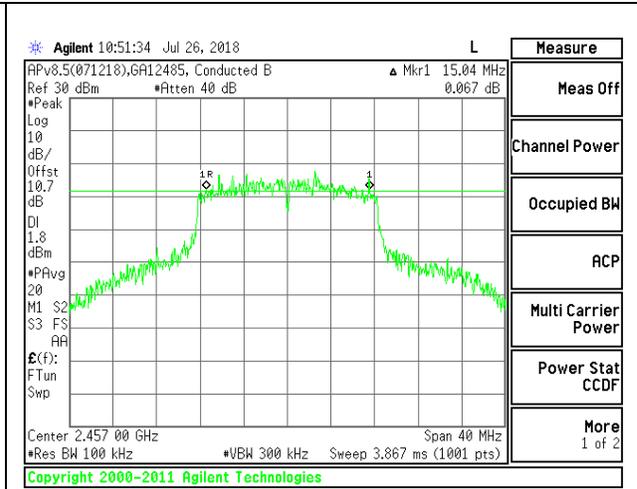
**MID CHANNEL 6**



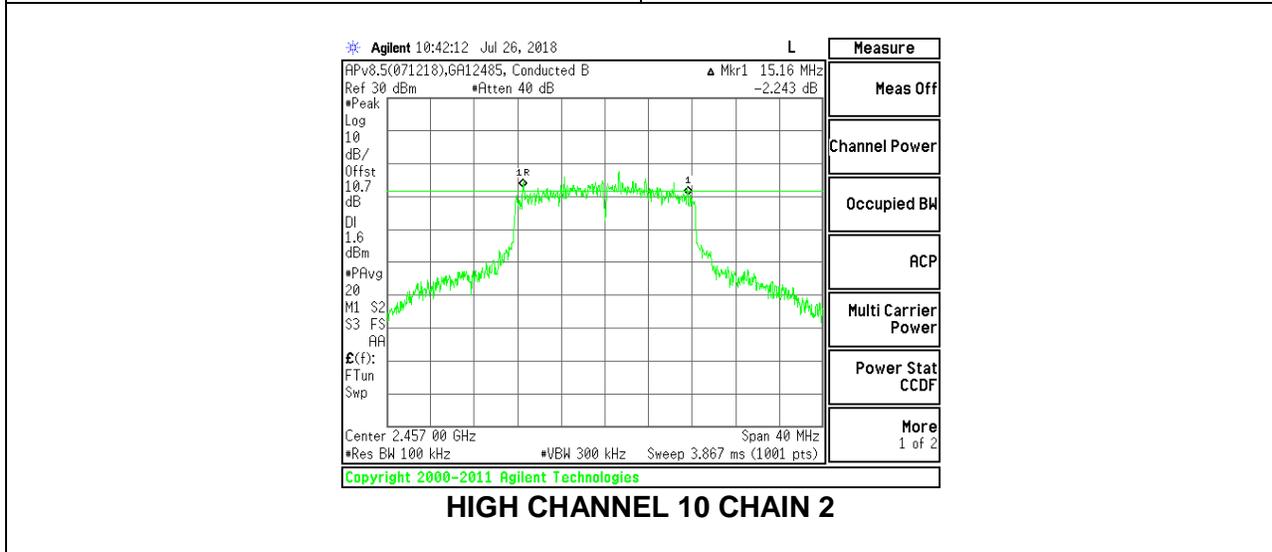
### HIGH CHANNEL 10



**HIGH CHANNEL 10 CHAIN 0**

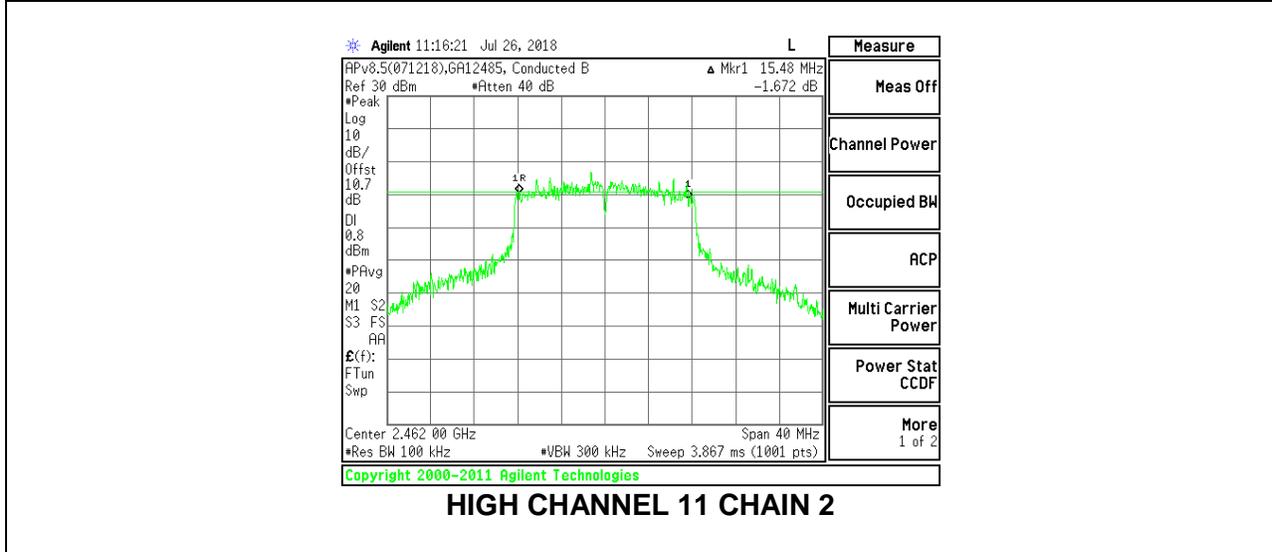
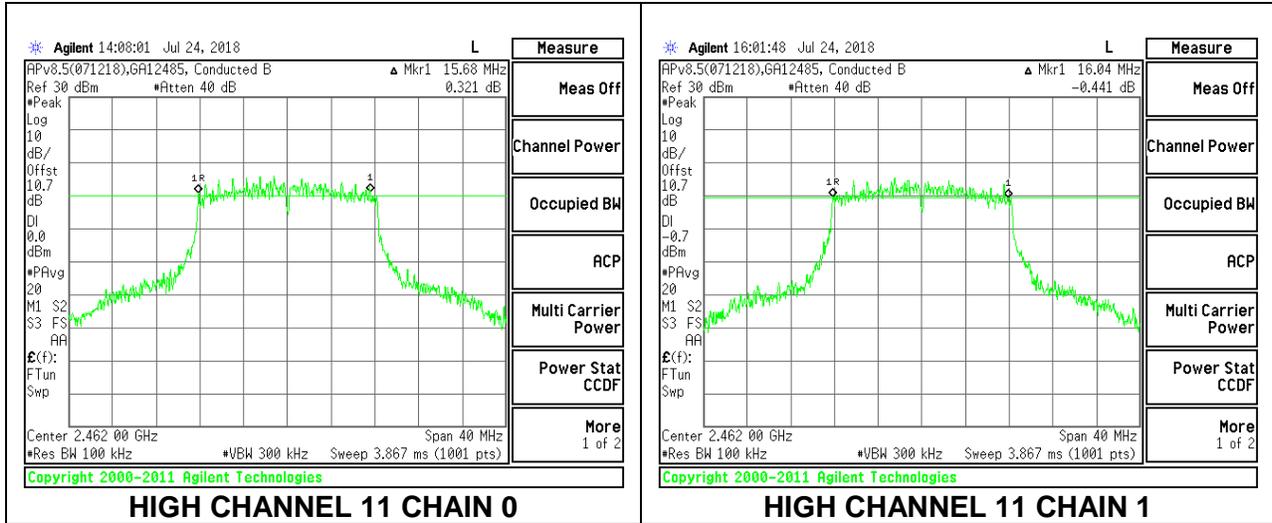


**HIGH CHANNEL 10 CHAIN 1**



**HIGH CHANNEL 10 CHAIN 2**

### HIGH CHANNEL 11

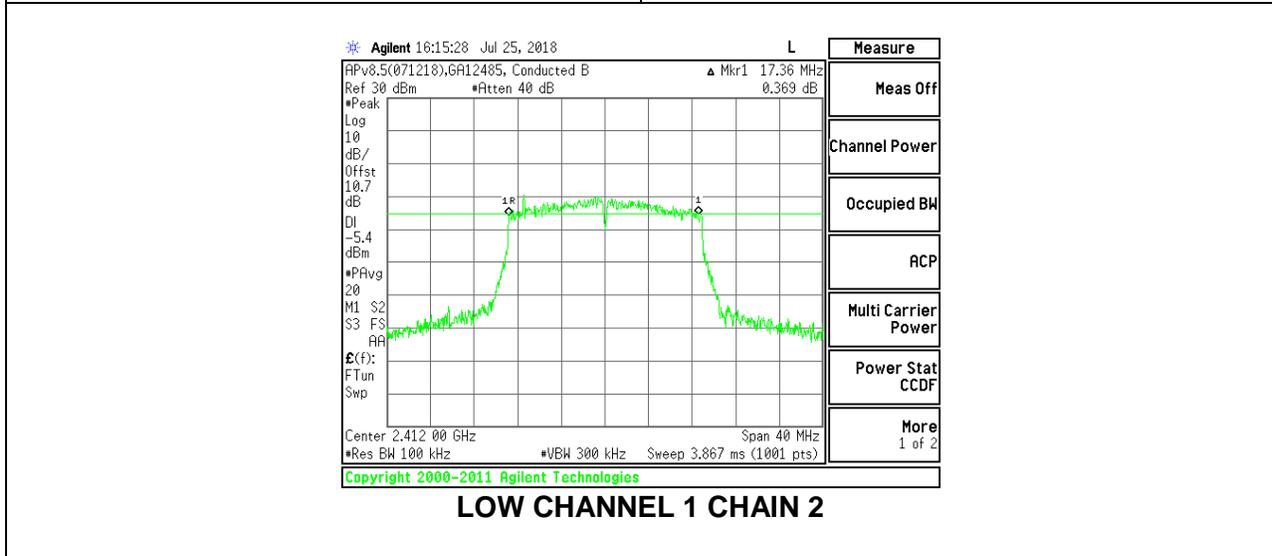
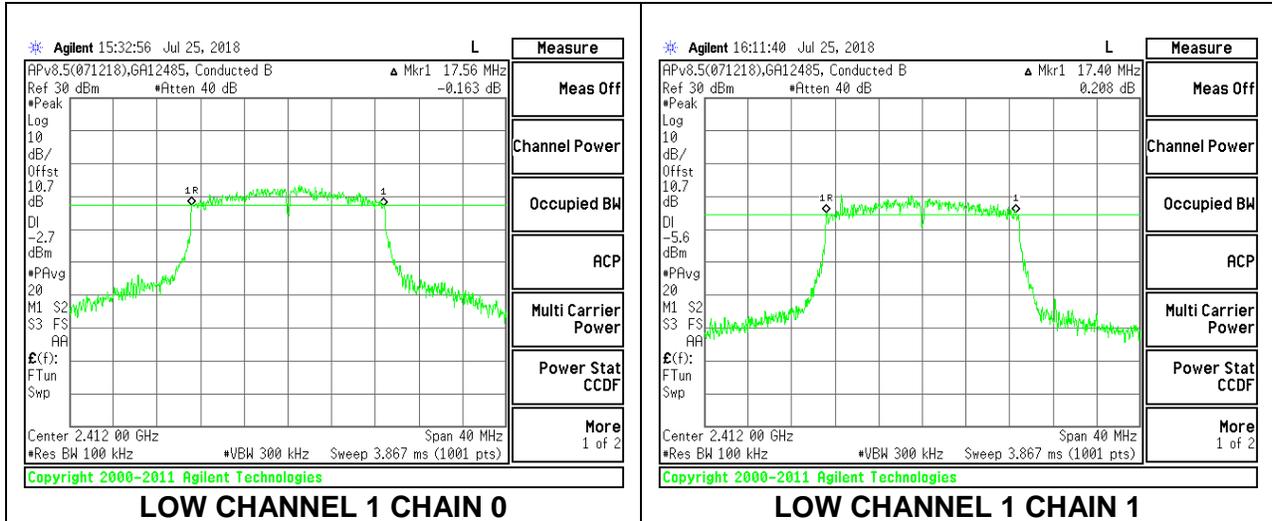


**8.3.3. 802.11n HT20 MODE**

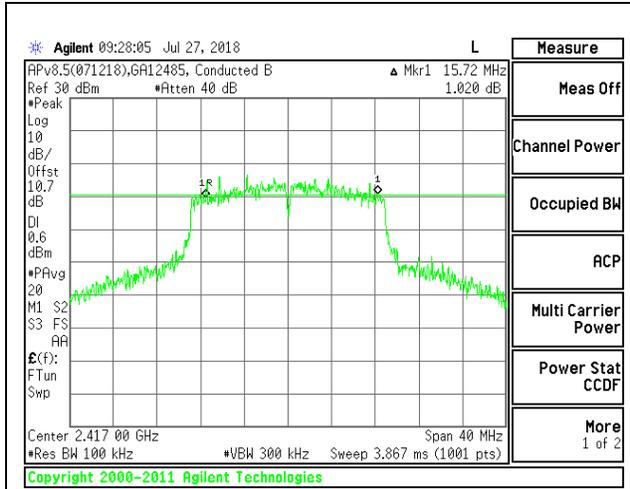
**3TX CDD MODE**

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	Minimum Limit (MHz)
Low 1	2412	17.5600	17.4000	17.3600	0.5
Low 2	2417	15.7200	15.9600	15.8400	0.5
Mid 6	2437	17.6000	17.6800	17.5600	0.5
High 10	2457	17.0400	16.3600	17.5600	0.5
High 11	2462	17.3600	17.6800	17.6000	0.5

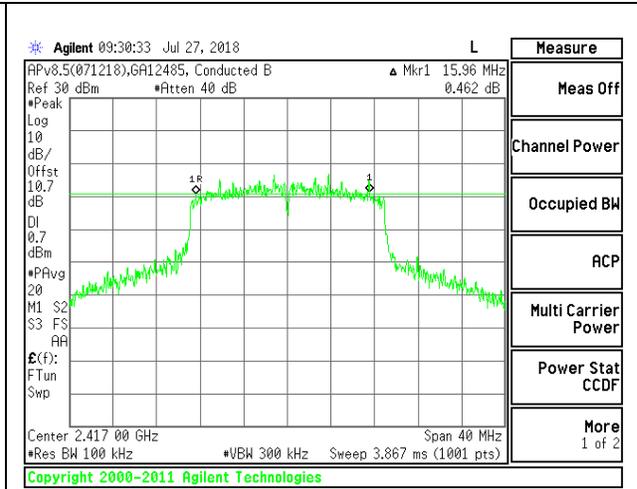
### LOW CHANNEL 1



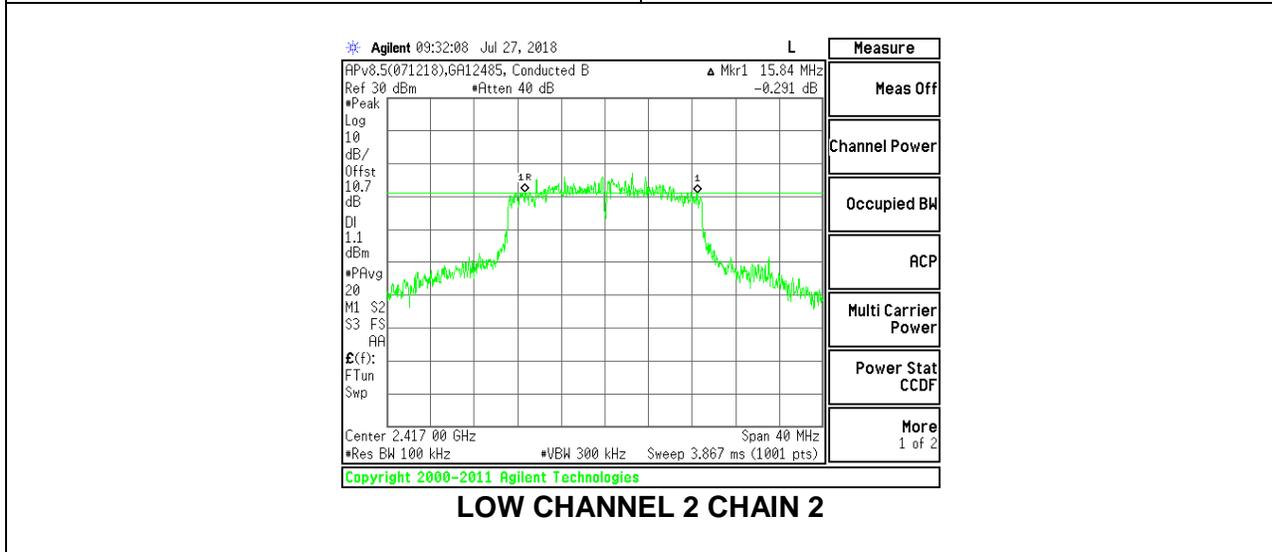
**LOW CHANNEL 2**



**LOW CHANNEL 2 CHAIN 0**

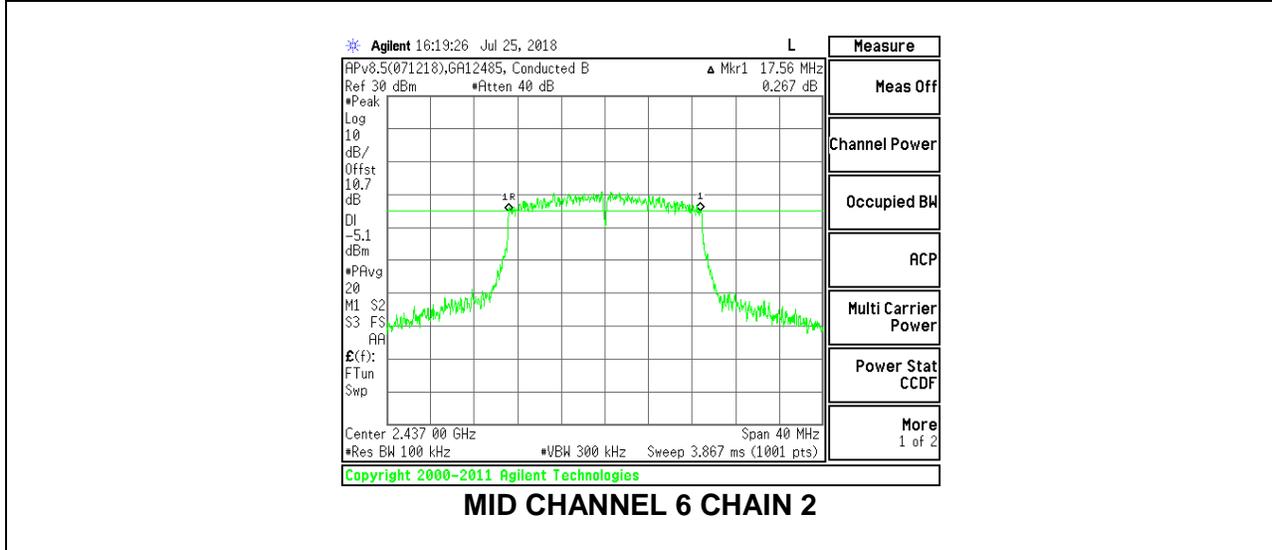
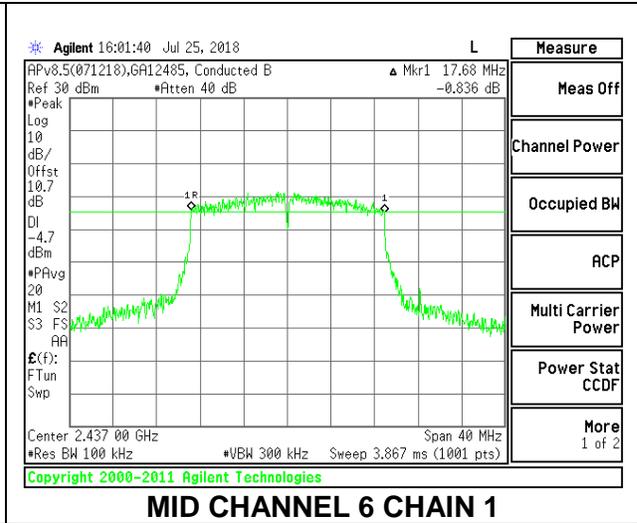
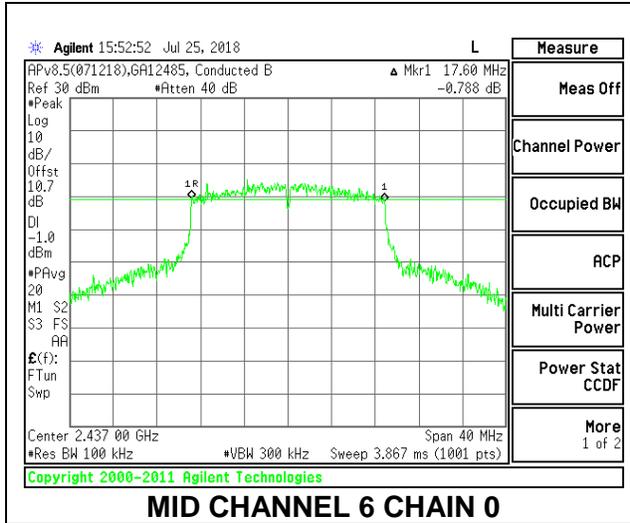


**LOW CHANNEL 2 CHAIN 1**

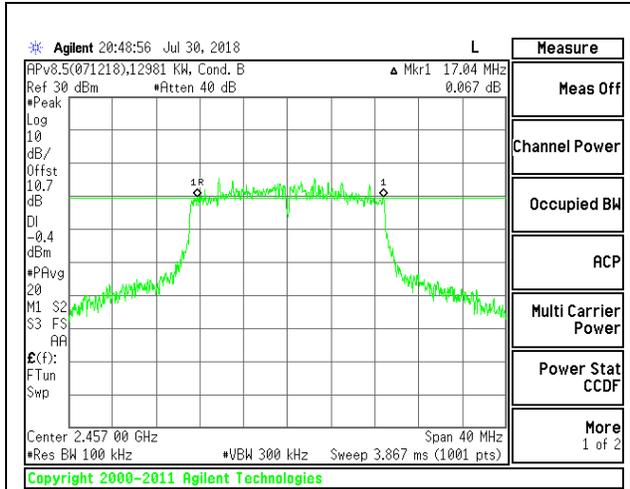


**LOW CHANNEL 2 CHAIN 2**

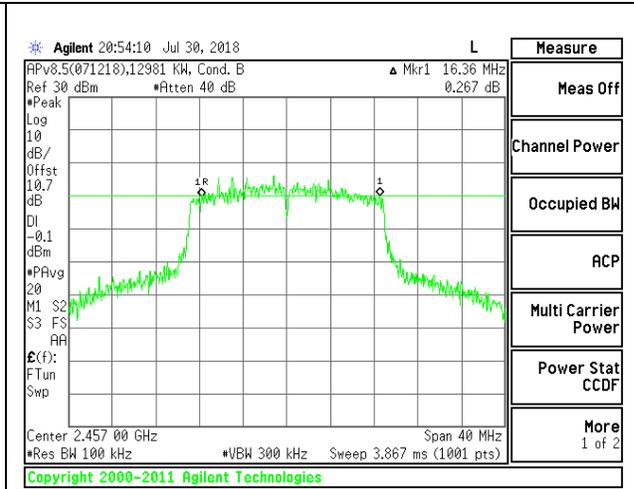
**MID CHANNEL 6**



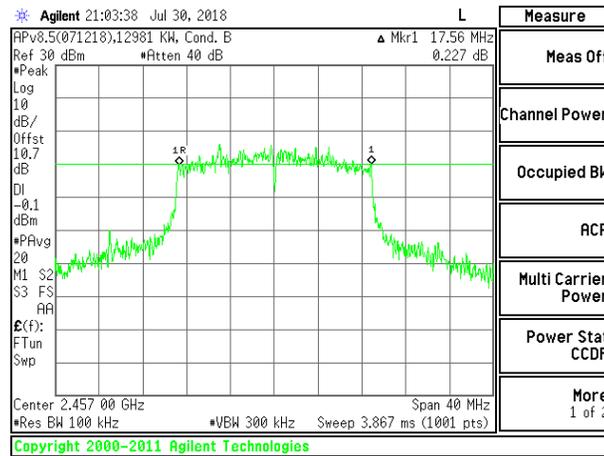
### HIGH CHANNEL 10



**HIGH CHANNEL 10 CHAIN 0**

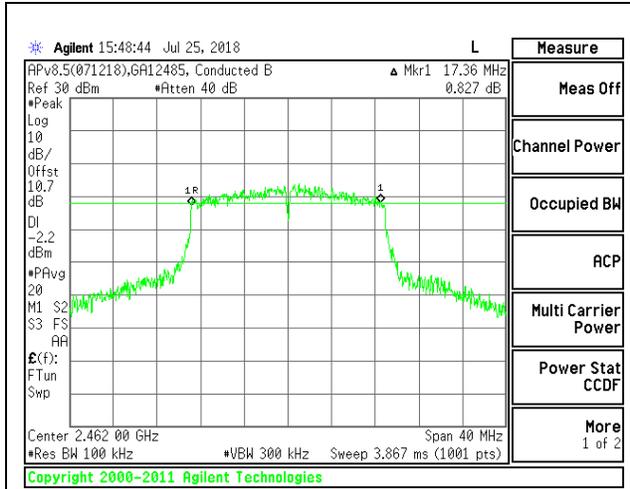


**HIGH CHANNEL 10 CHAIN 1**

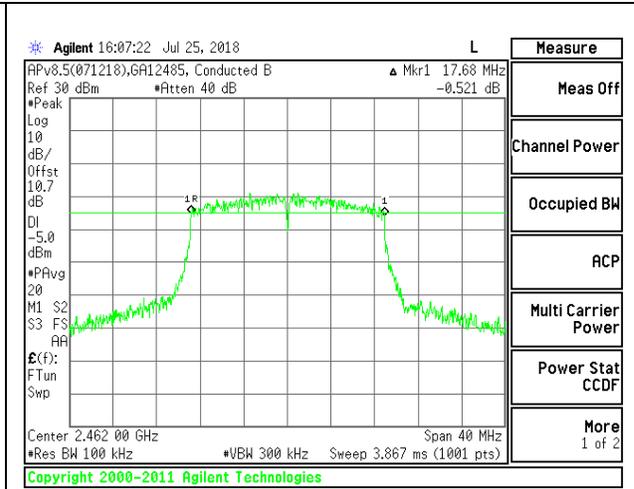


**HIGH CHANNEL 10 CHAIN 2**

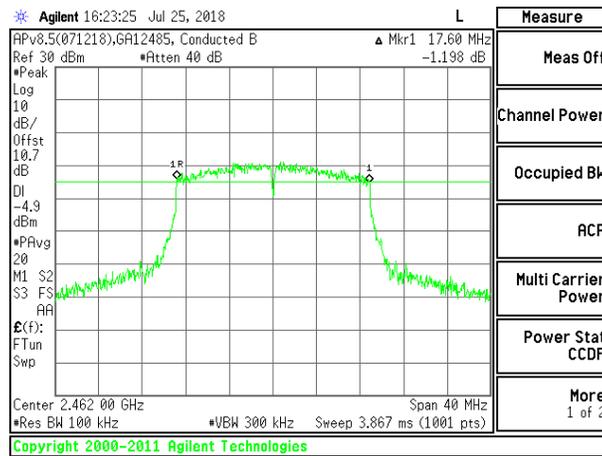
### HIGH CHANNEL 11



**HIGH CHANNEL 11 CHAIN 0**



**HIGH CHANNEL 11 CHAIN 1**



**HIGH CHANNEL 11 CHAIN 2**

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## **8.4. 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 transmitter output is connected to a power meter. The cable assembly insertion loss was entered as an offset in the power meter to allow for a gated Average reading of power.

**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. The directional gains are as follows:

Horizontal Polarization (Worst Case)

<b>Band (GHz)</b>	<b>Chain 0 Antenna Gain (dBi)</b>	<b>Chain 1 Antenna Gain (dBi)</b>	<b>Uncorrelated Chains Directional Gain (dBi)</b>	<b>Correlated Chains Directional Gain (dBi)</b>
2.4	2.10	1.40	1.76	4.77

Vertical Polarization

<b>Band (GHz)</b>	<b>Chain 2 Antenna Gain (dBi)</b>	<b>Uncorrelated Chains Directional Gain (dBi)</b>	<b>Correlated Chains Directional Gain (dBi)</b>
2.4	1.17	1.17	1.17

**RESULTS**

**8.4.1. 802.11b MODE**

**3TX CDD MODE**

**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)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	19.35	18.85	18.69	23.74	30.00	-6.26
Mid 6	2437	19.24	18.67	18.55	23.60	30.00	-6.40
High 11	2462	19.19	18.79	18.65	23.65	30.00	-6.35

**8.4.2. 802.11g MODE**

**3TX CDD MODE**

**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
Low 2	2417	1.76	30.00	36	30.00
Mid 6	2437	1.76	30.00	36	30.00
High 10	2457	1.76	30.00	36	30.00
High 11	2462	1.76	30.00	36	30.00

**Results**

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	15.74	15.56	15.39	20.34	30.00	-9.66
Low 2	2417	17.38	17.15	17.06	21.97	30.00	-8.03
Mid 6	2437	17.85	17.59	17.45	22.40	30.00	-7.60
High 10	2457	18.12	17.84	17.67	22.65	30.00	-7.35
High 11	2462	16.90	16.77	16.66	21.55	30.00	-8.45

**8.4.3. 802.11n HT20 MODE**

**3TX CDD MODE**

**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
Low 2	2417	1.76	30.00	36	30.00
Mid 6	2437	1.76	30.00	36	30.00
High 10	2457	1.76	30.00	36	30.00
High 11	2462	1.76	30.00	36	30.00

**Results**

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	14.00	14.00	14.00	18.77	30.00	-11.23
Low 2	2417	17.48	17.20	17.01	22.01	30.00	-7.99
Mid 6	2437	17.92	17.28	17.64	22.39	30.00	-7.61
High 10	2457	17.33	17.20	17.00	21.95	30.00	-8.05
High 11	2462	14.11	13.94	14.20	18.86	30.00	-11.14

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## **8.5. POWER SPECTRAL DENSITY**

### **LIMITS**

FCC §15.247 (e)

RSS-247 (5.2) (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

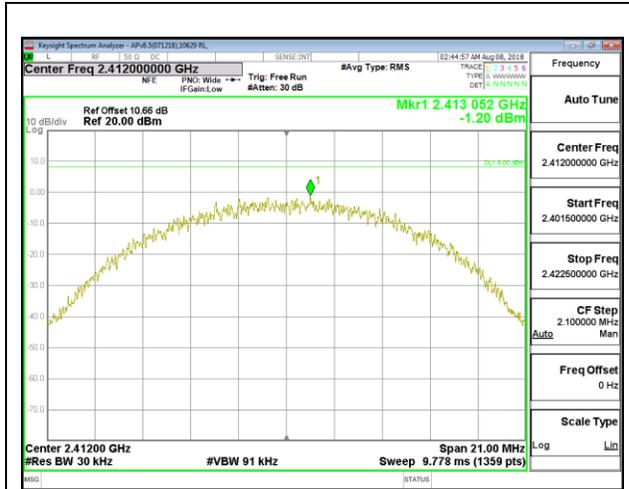
### **RESULTS**

**8.5.1. 802.11b MODE**

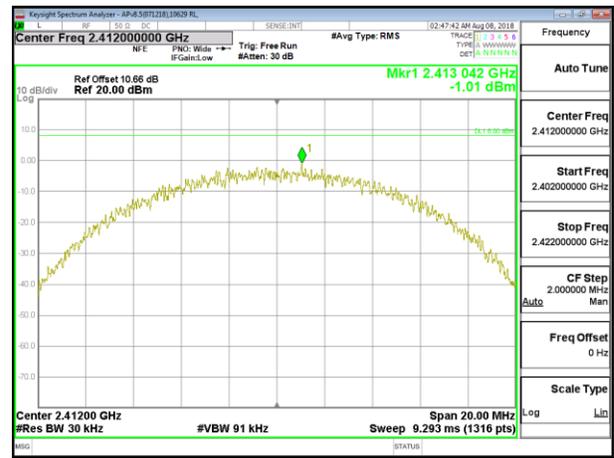
**3TX CDD MODE**

Duty Cycle CF (dB)		0.10	Included in Calculations of Corr'd PSD				
PSD Results							
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Chain 2 Meas (dBm)	Total Corr'd PSD (dBm)	Limit (dBm)	Margin (dB)
Low 1	2412	-1.20	-1.01	-2.46	3.36	8.0	-4.6
Mid 6	2437	-1.69	-2.43	-2.63	2.64	8.0	-5.4
High 11	2462	-1.41	-1.59	-1.70	3.31	8.0	-4.7

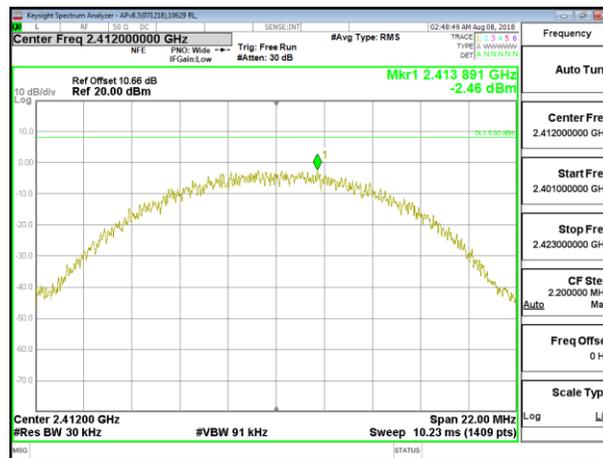
### LOW CHANNEL 1



LOW CHANNEL 1 CHAIN 0

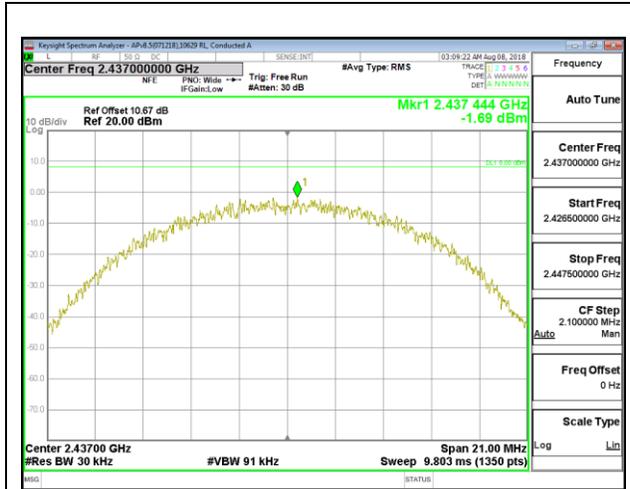


LOW CHANNEL 1 CHAIN 1

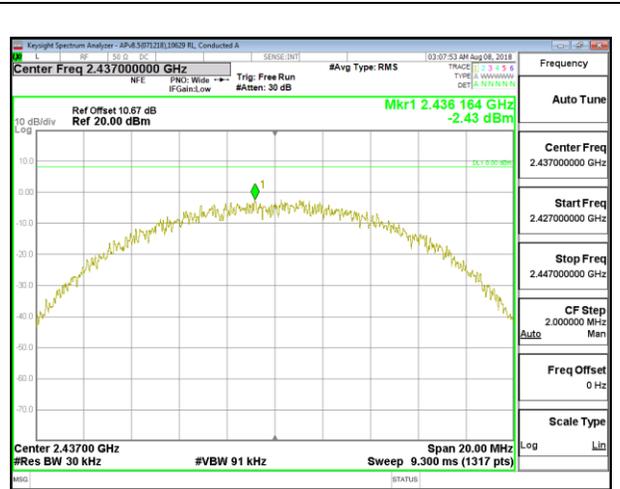


LOW CHANNEL 1 CHAIN 2

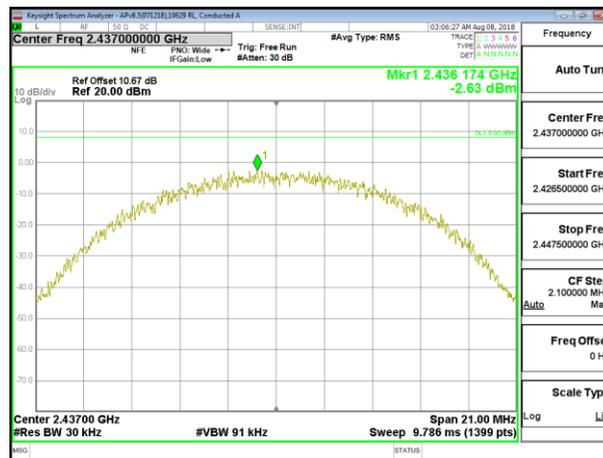
### MID CHANNEL 6



MID CHANNEL 6 CHAIN 0

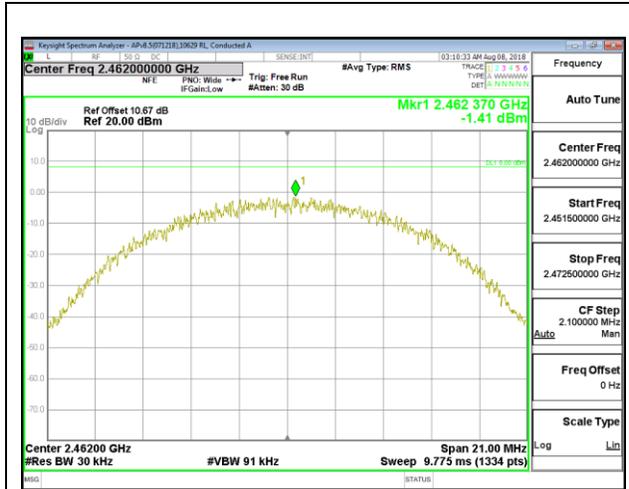


MID CHANNEL 6 CHAIN 1

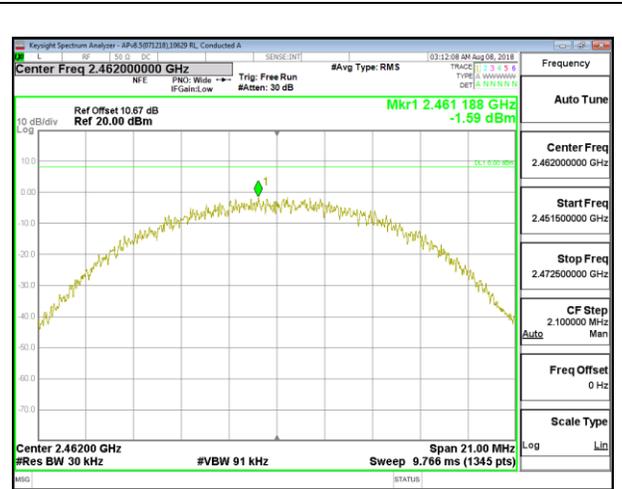


MID CHANNEL 6 CHAIN 2

### HIGH CHANNEL 11



HIGH CHANNEL 11 CHAIN 0



HIGH CHANNEL 11 CHAIN 1



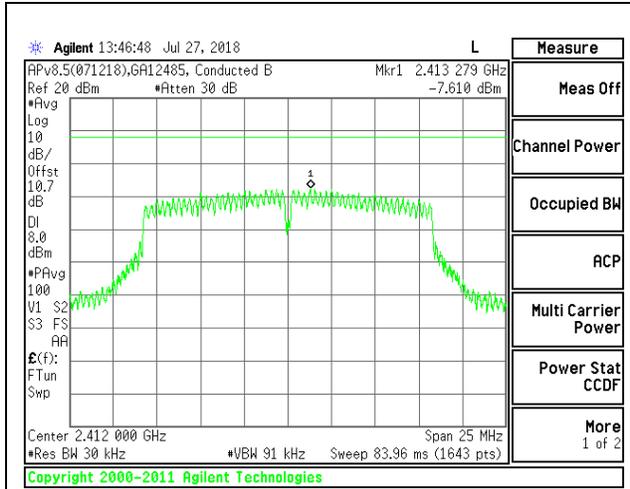
HIGH CHANNEL 11 CHAIN 2

**8.5.2. 802.11g MODE**

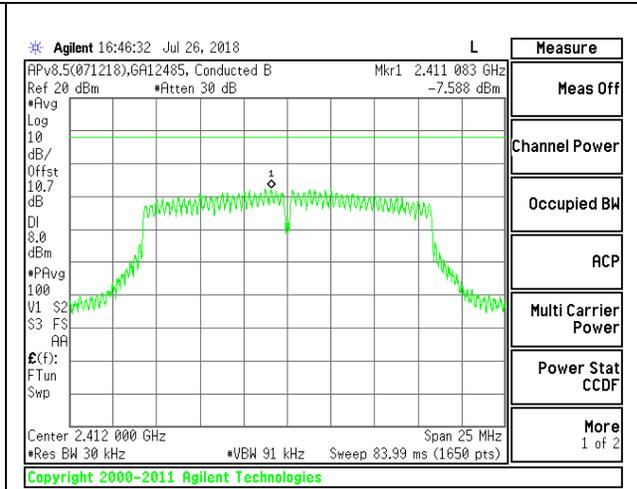
**3TX CDD MODE**

Duty Cycle CF (dB)		0.31	Included in Calculations of Corr'd PSD				
PSD Results							
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Chain 2 Meas (dBm)	Total Corr'd PSD (dBm)	Limit (dBm)	Margin (dB)
Low 1	2412	-7.61	-7.59	-8.67	-2.85	8.0	-10.8
Low 2	2417	-7.19	-7.26	-7.45	-2.22	8.0	-10.2
Mid 6	2437	-4.78	-5.72	-5.66	-0.28	8.0	-8.3
High 10	2457	-5.36	-4.64	-6.15	-0.26	8.0	-8.3
High 11	2462	-6.53	-6.74	-6.36	-1.46	8.0	-9.5

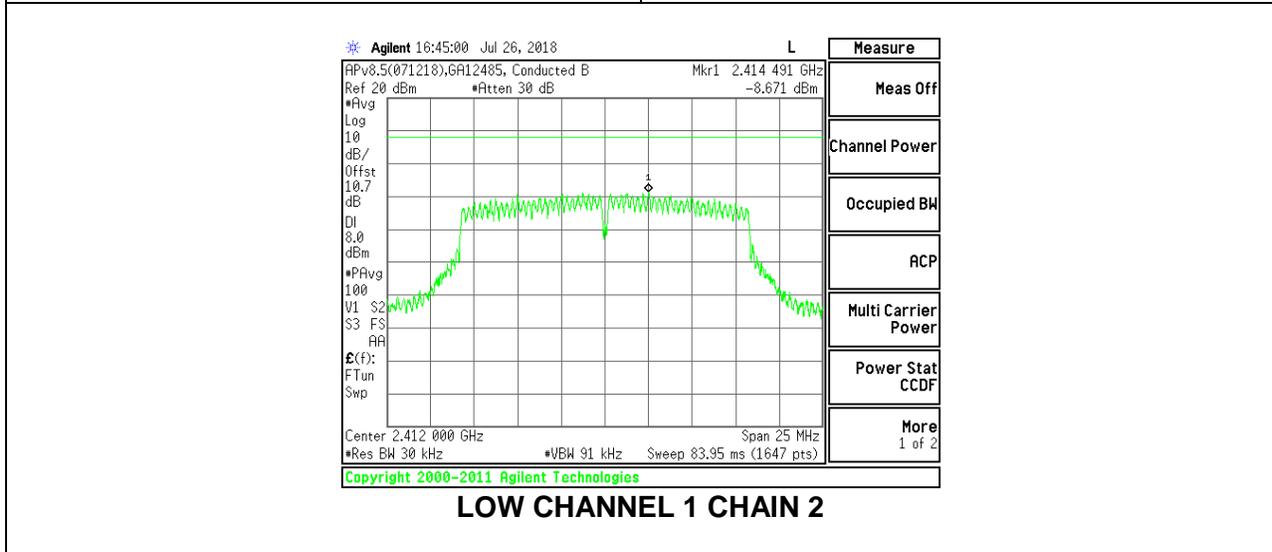
**LOW CHANNEL 1**



**LOW CHANNEL 1 CHAIN 0**

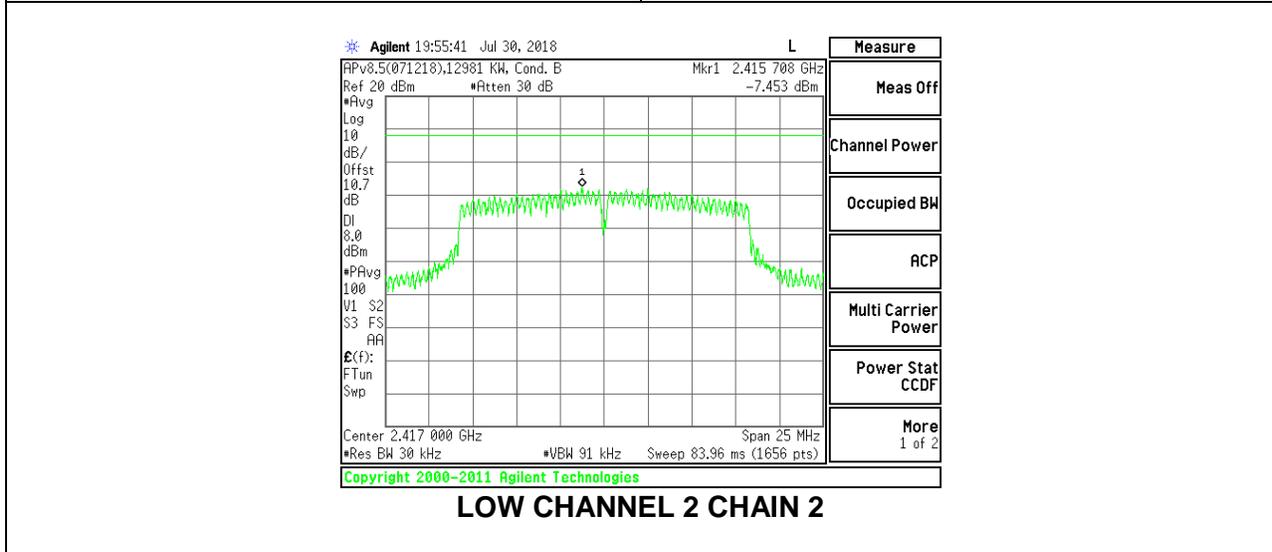
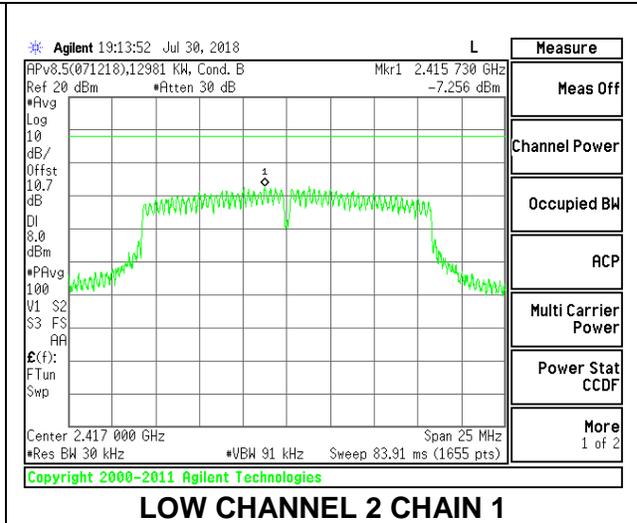
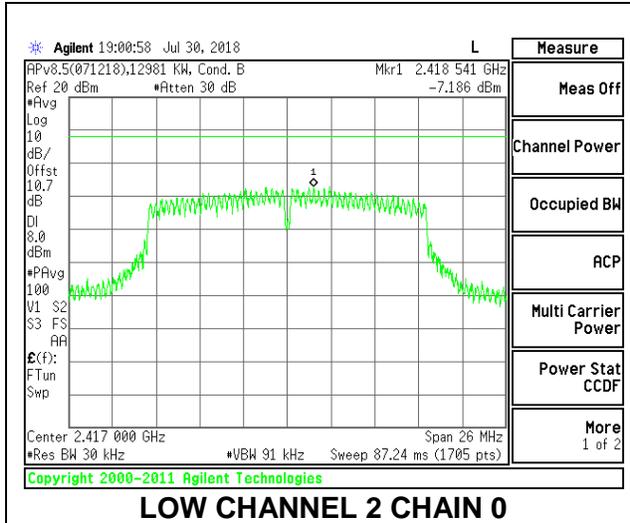


**LOW CHANNEL 1 CHAIN 1**

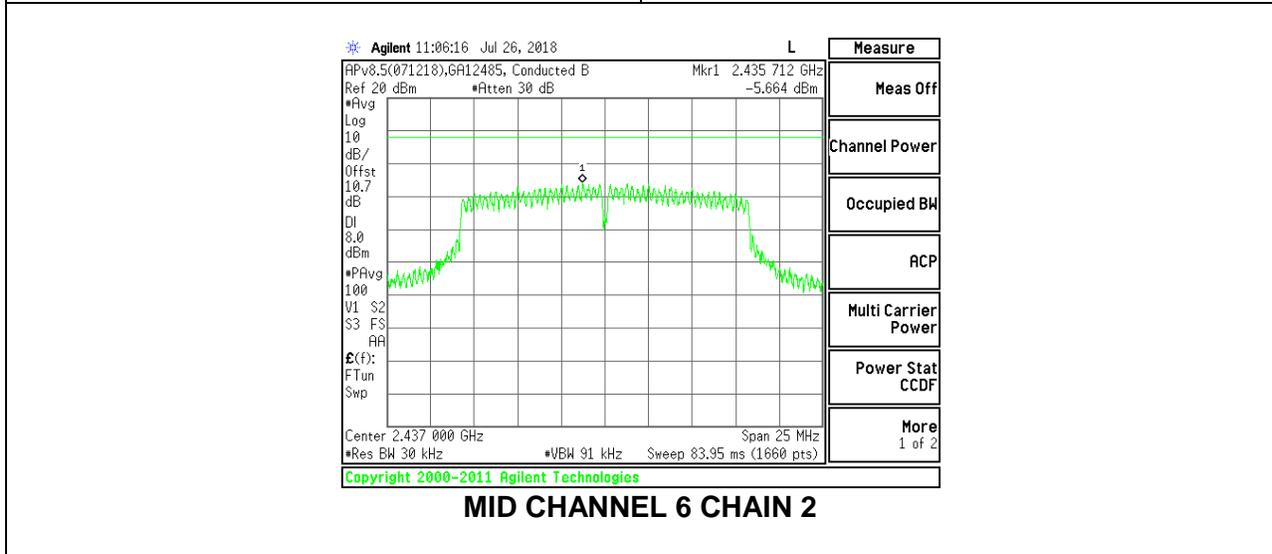
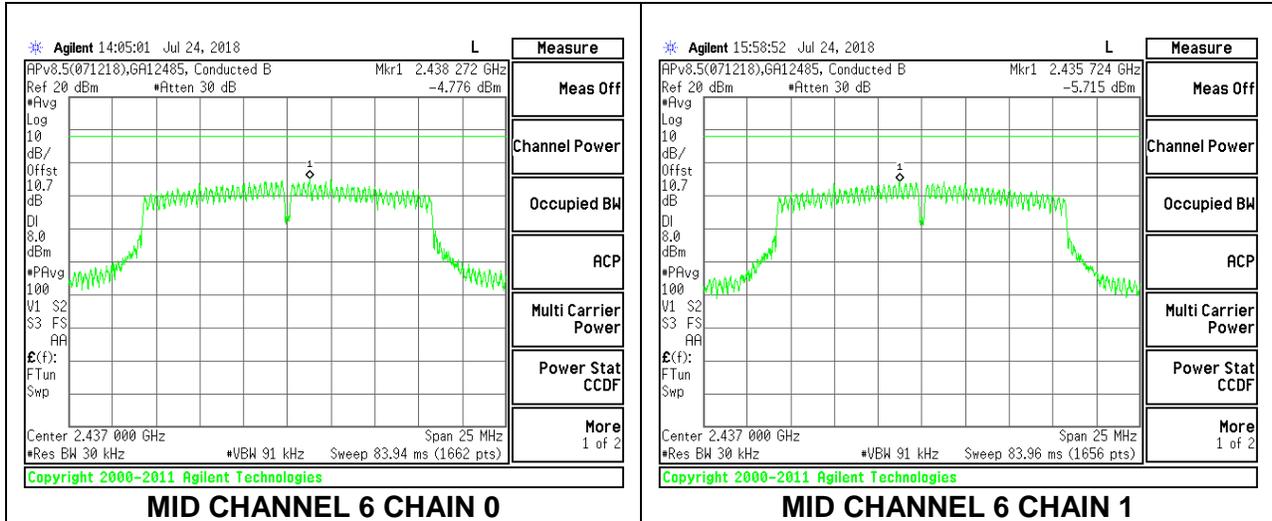


**LOW CHANNEL 1 CHAIN 2**

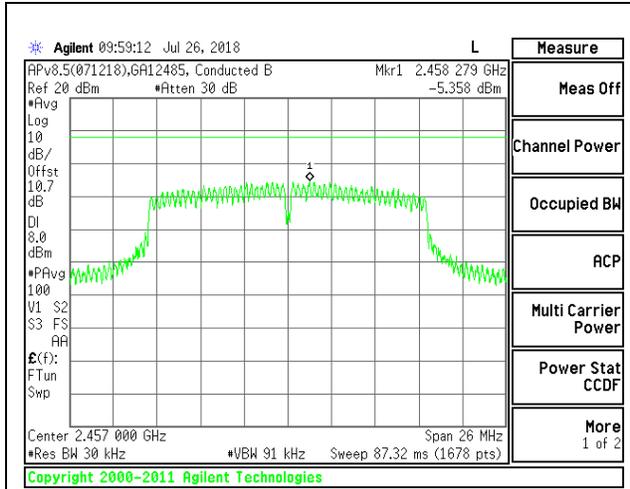
**LOW CHANNEL 2**



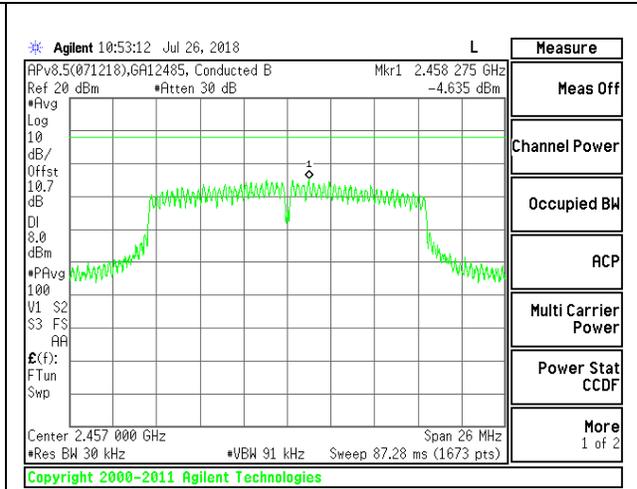
**MID CHANNEL 6**



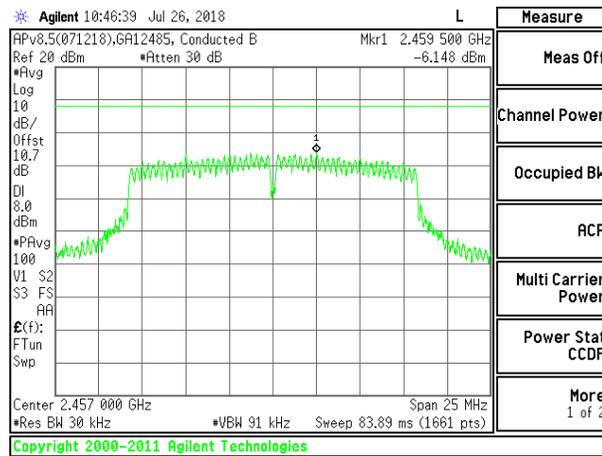
### HIGH CHANNEL 10



**HIGH CHANNEL 10 CHAIN 0**

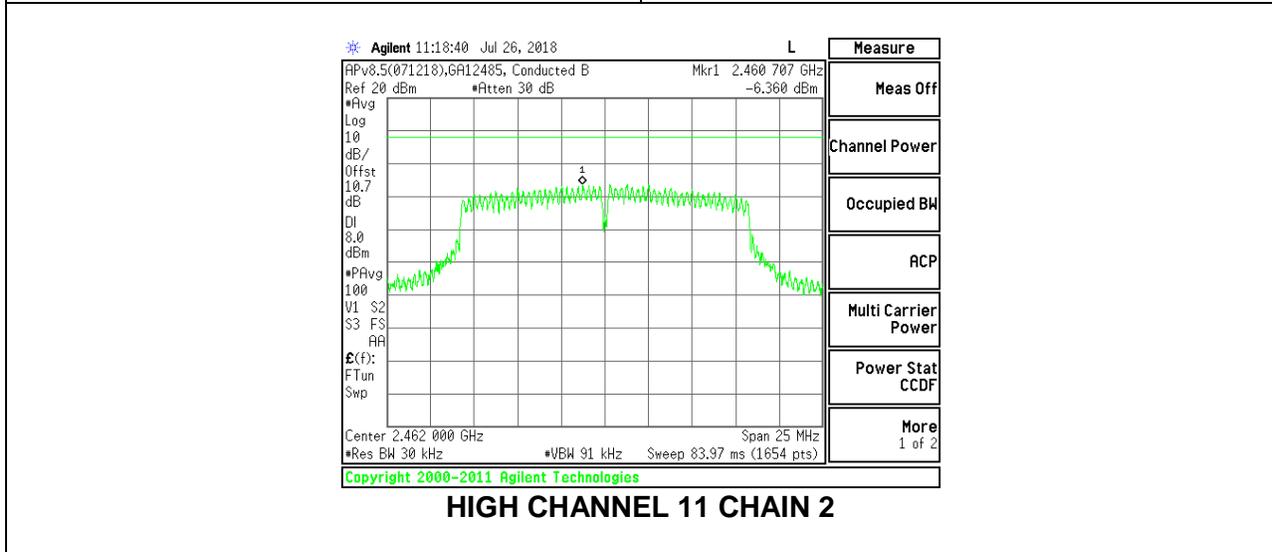
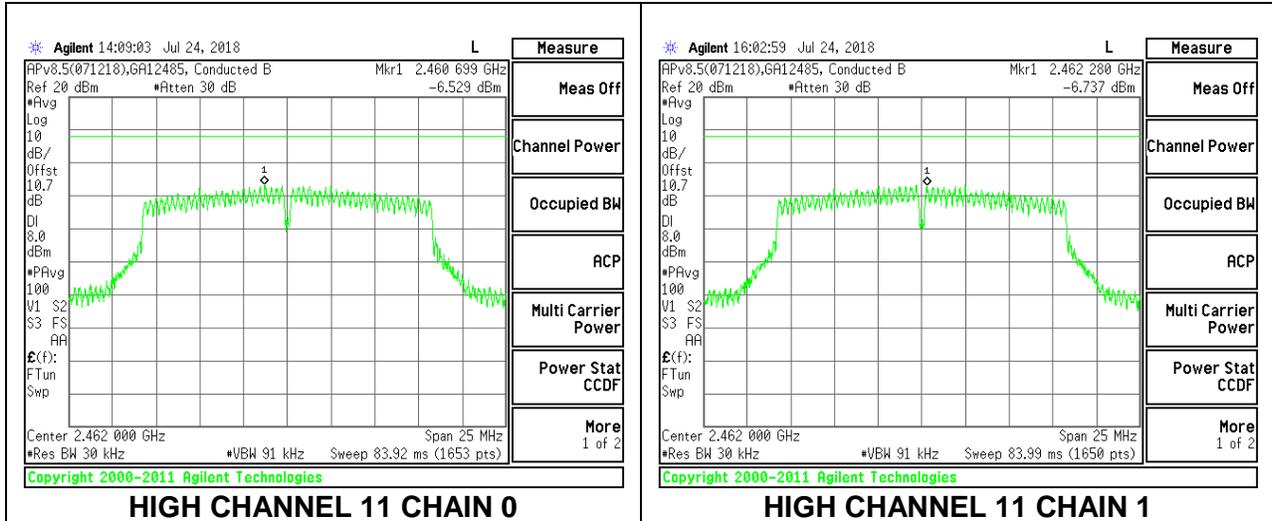


**HIGH CHANNEL 10 CHAIN 1**



**HIGH CHANNEL 10 CHAIN 2**

### HIGH CHANNEL 11

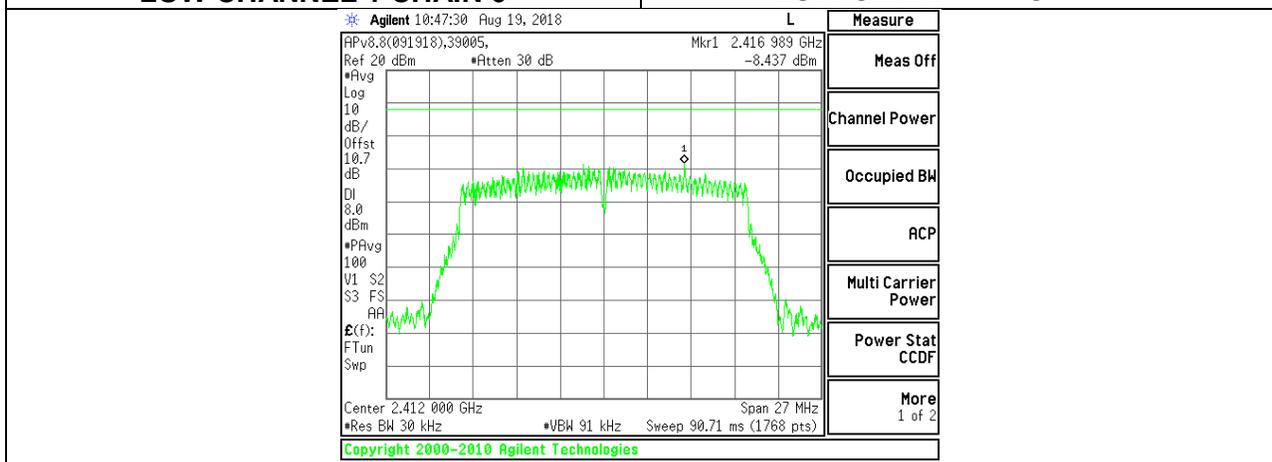
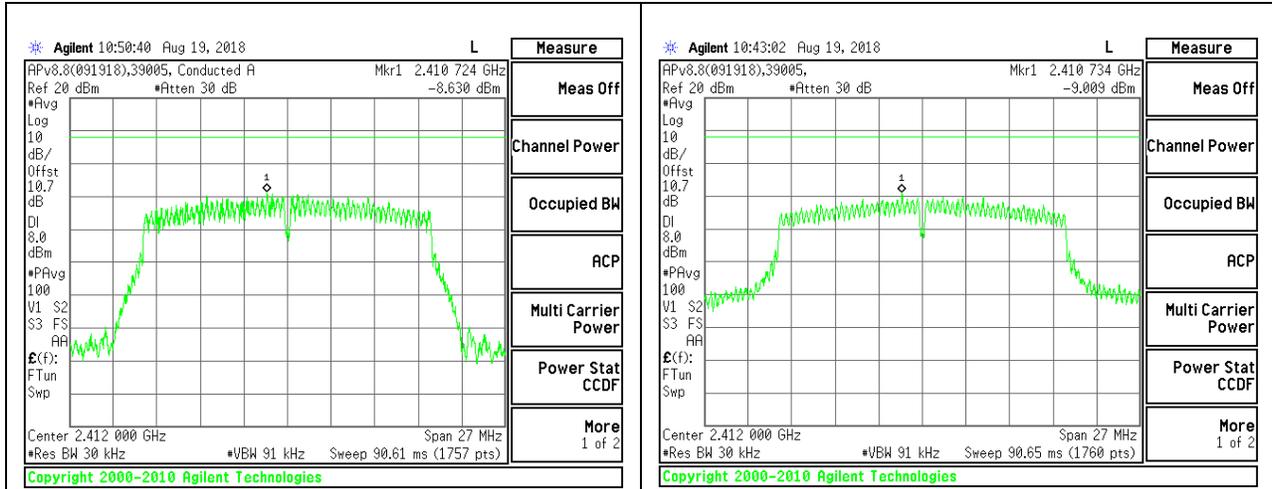


**8.5.3. 802.11n HT20 MODE**

**3TX CDD MODE**

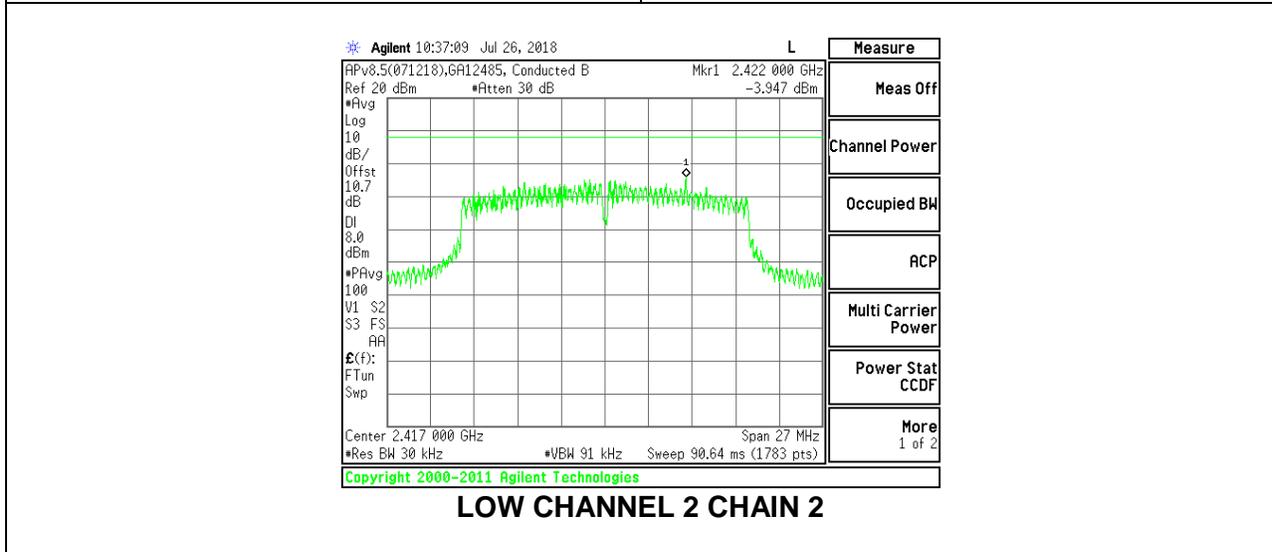
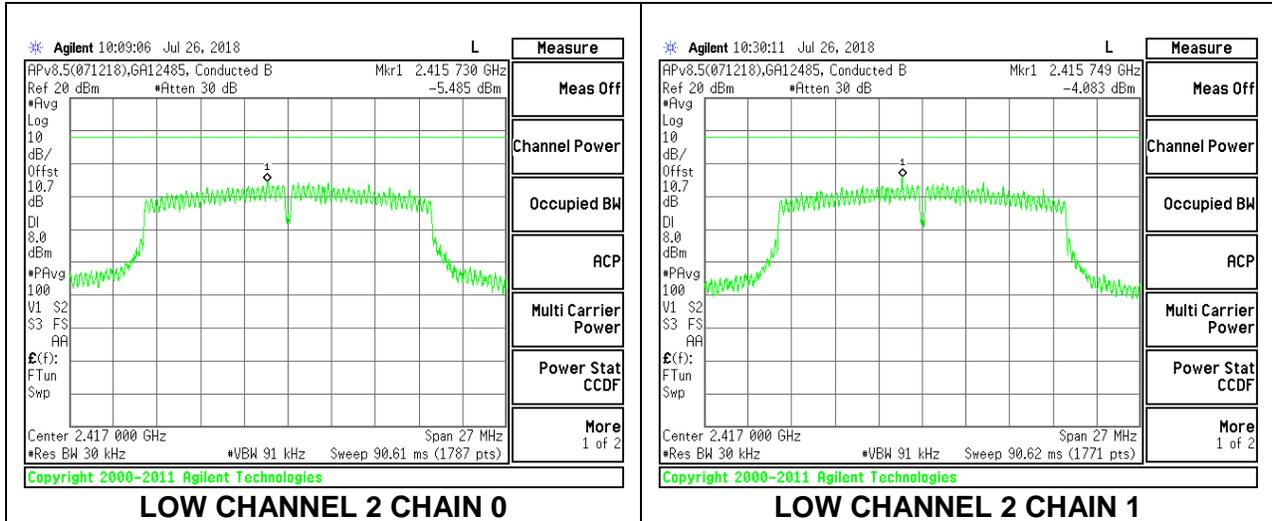
Duty Cycle CF (dB)		0.32	Included in Calculations of Corr'd PSD				
PSD Results							
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Chain 2 Meas (dBm)	Total Corr'd PSD (dBm)	Limit (dBm)	Margin (dB)
Low 1	2412	-8.63	-9.01	-8.44	-3.59	8.0	-11.6
Low 2	2417	-5.49	-4.08	-3.95	0.64	8.0	-7.4
Mid 6	2437	-8.99	-9.33	-9.40	-4.15	8.0	-12.1
High 10	2457	-5.25	-4.16	-5.26	0.23	8.0	-7.8
High 11	2462	-8.93	-8.10	-8.12	-3.27	8.0	-11.3

### LOW CHANNEL 1

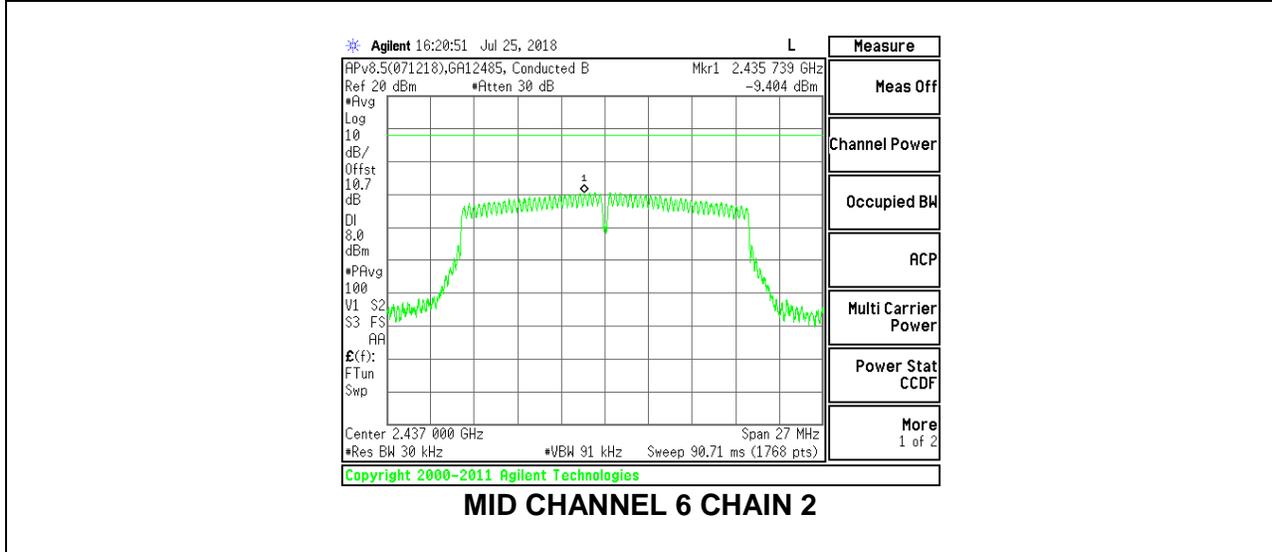
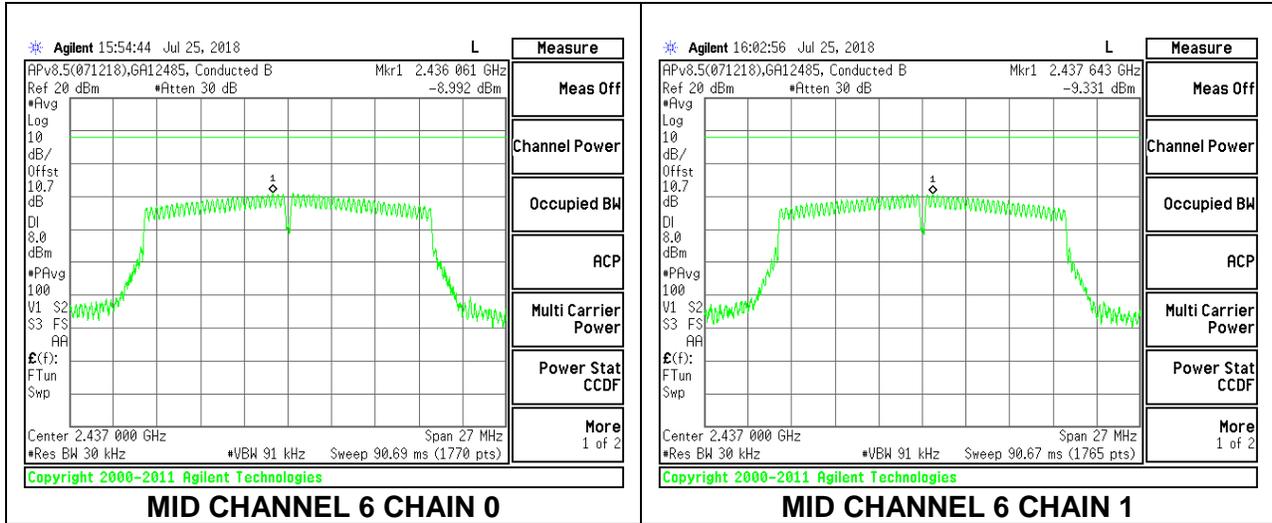


### LOW CHANNEL 1 CHAIN 2

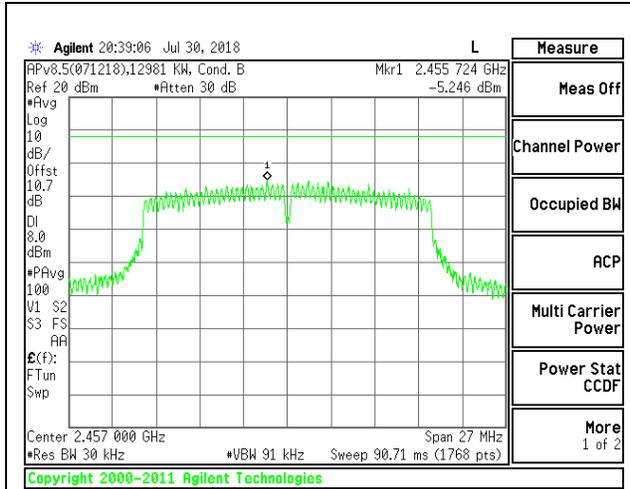
**LOW CHANNEL 2**



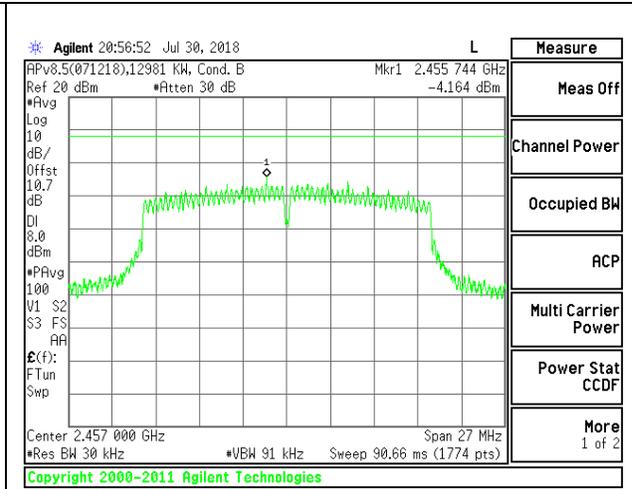
**MID CHANNEL 6**



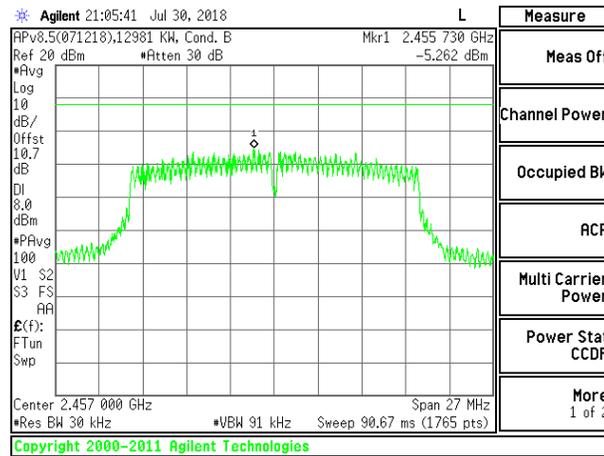
### HIGH CHANNEL 10



**HIGH CHANNEL 10 CHAIN 0**

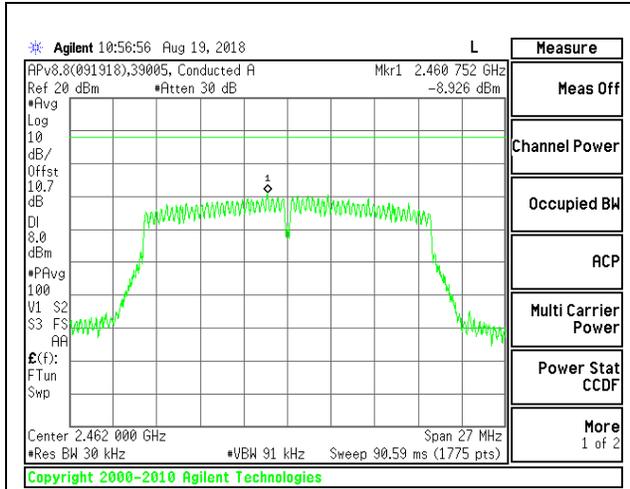


**HIGH CHANNEL 10 CHAIN 1**

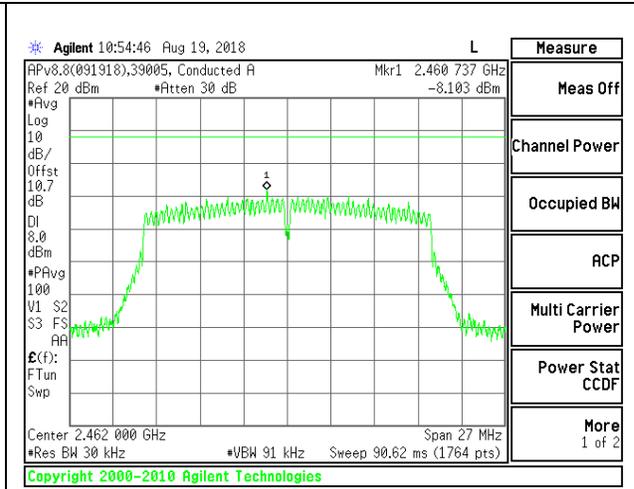


**HIGH CHANNEL 10 CHAIN 2**

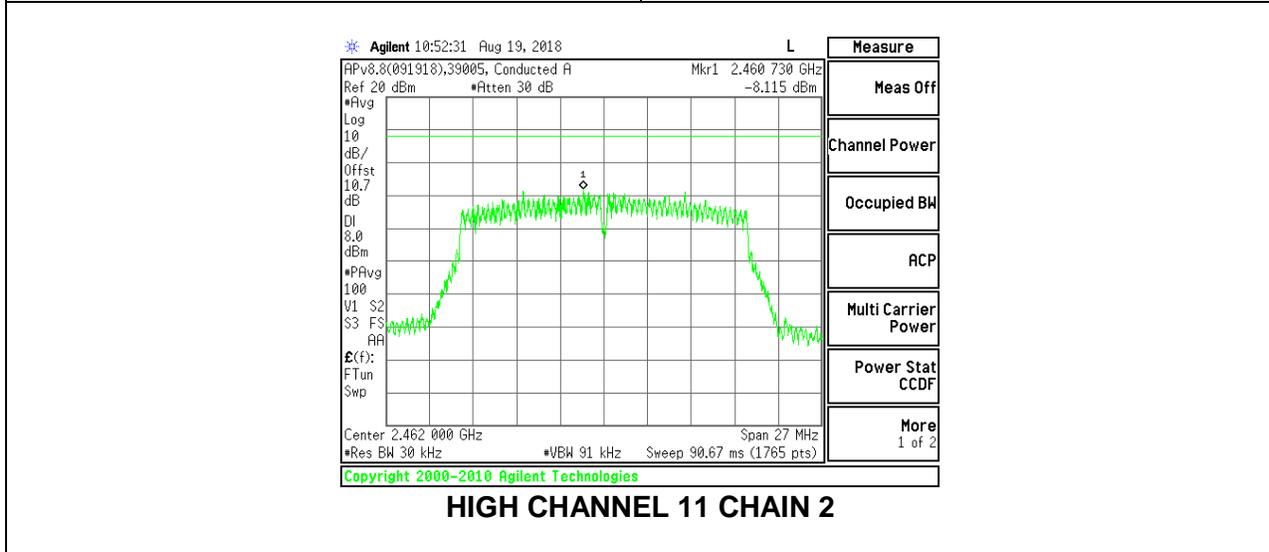
### HIGH CHANNEL 11



**HIGH CHANNEL 11 CHAIN 0**



**HIGH CHANNEL 11 CHAIN 1**



**HIGH CHANNEL 11 CHAIN 2**

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## 8.6. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.247 (d)

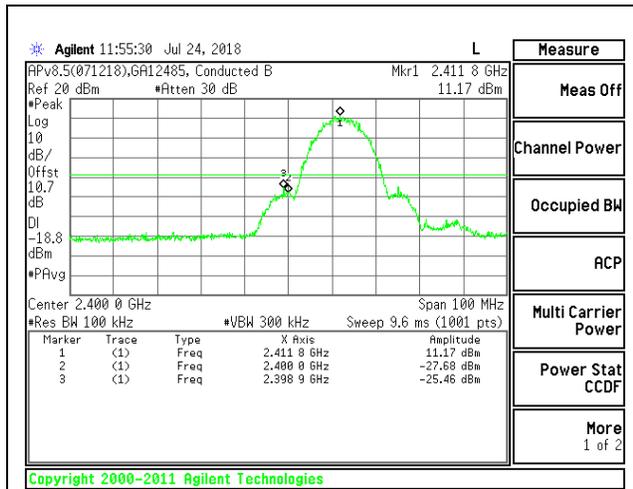
RSS-247 5.5

Output power was measured based on the use of Average measurement, therefore the required attenuation is 30 dB.

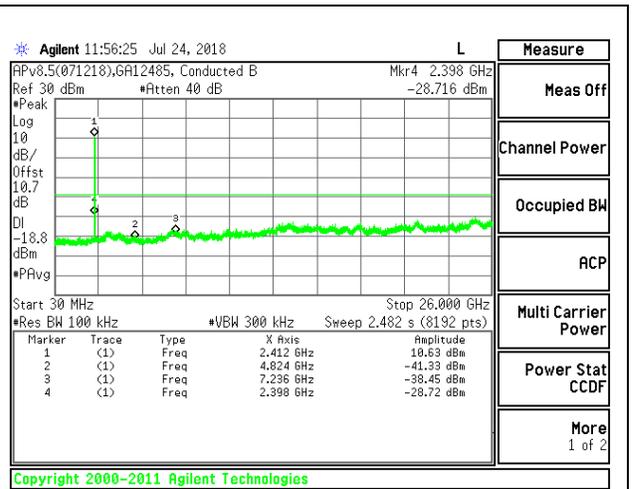
### RESULTS

8.6.1. 802.11b MODE

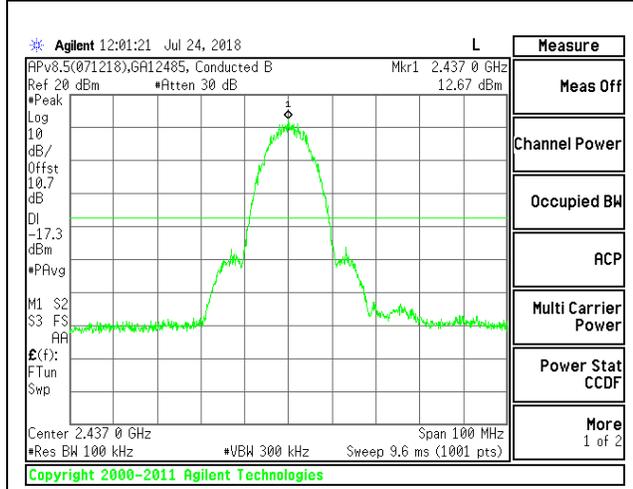
3TX CDD MODE



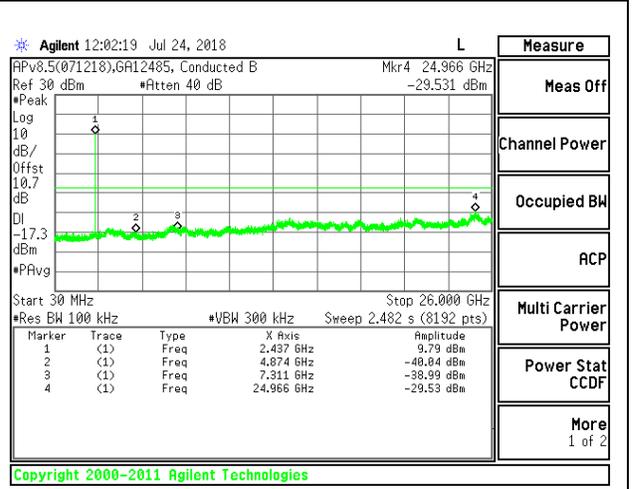
LOW CHANNEL 1 BANDEDGE CHAIN 0



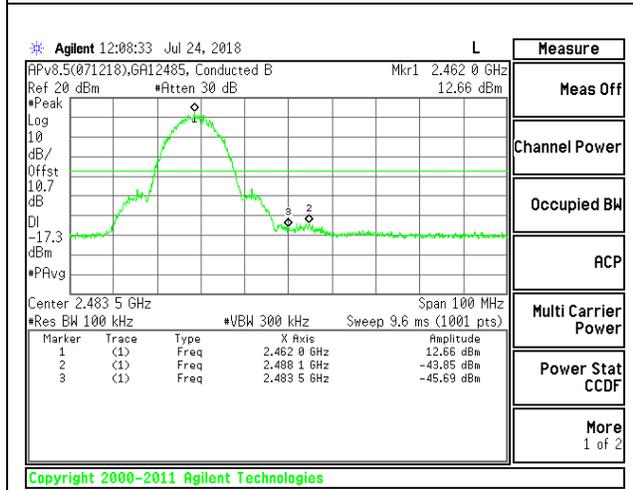
OUT-OF-BAND LOW CHANNEL 1 CHAIN 0



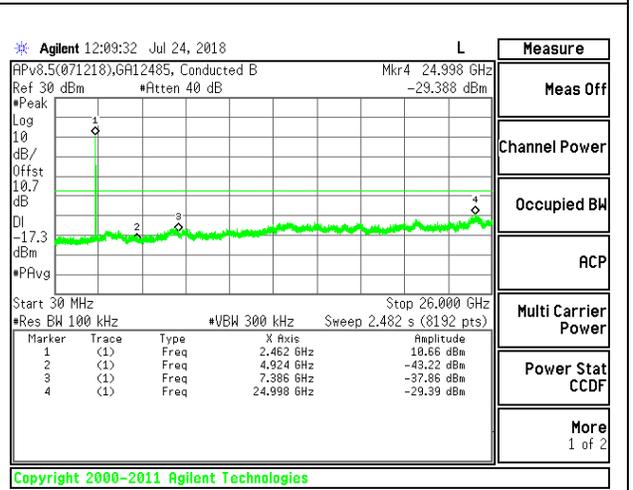
IN-BAND REFERENCE LEVEL CHAIN 0



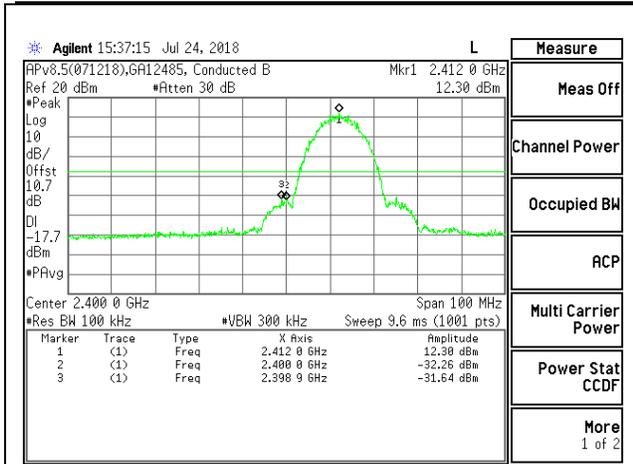
OUT-OF-BAND MID CHANNEL CHAIN 0



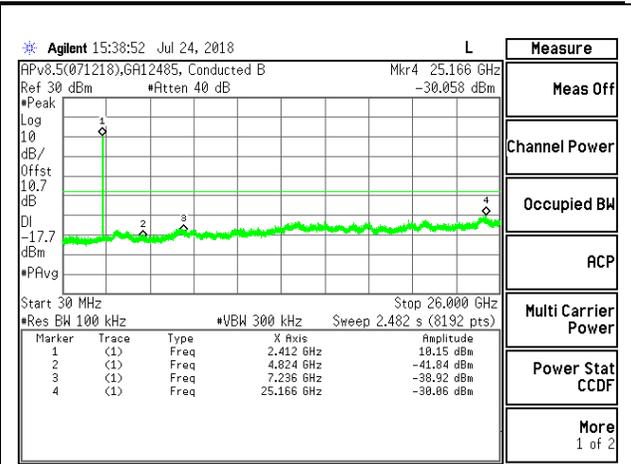
HIGH CHANNEL 11 BANDEDGE CHAIN 0



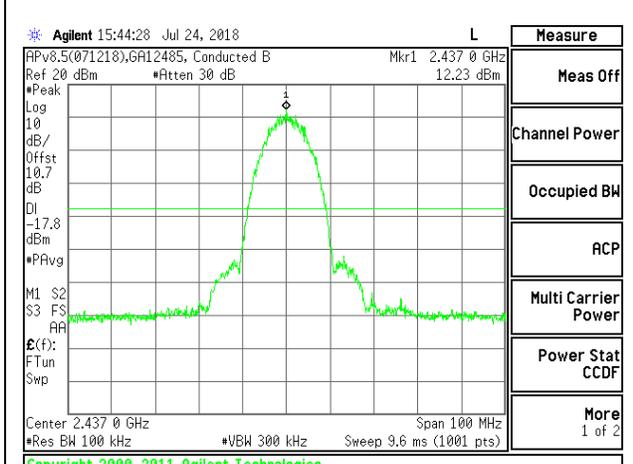
OUT-OF-BAND HIGH CHANNEL 11 CHAIN 0



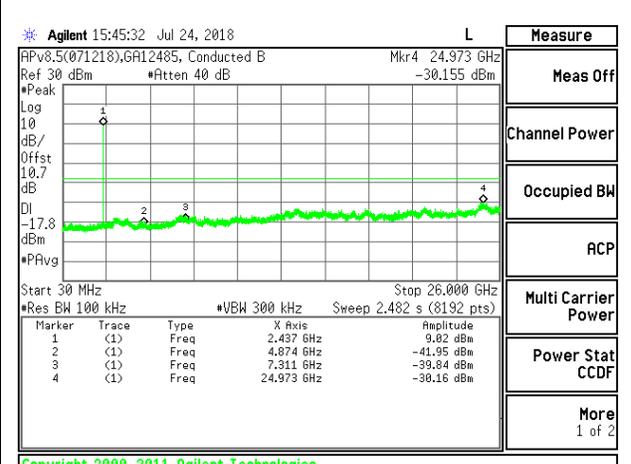
LOW CHANNEL 1 BANDEDGE CHAIN 1



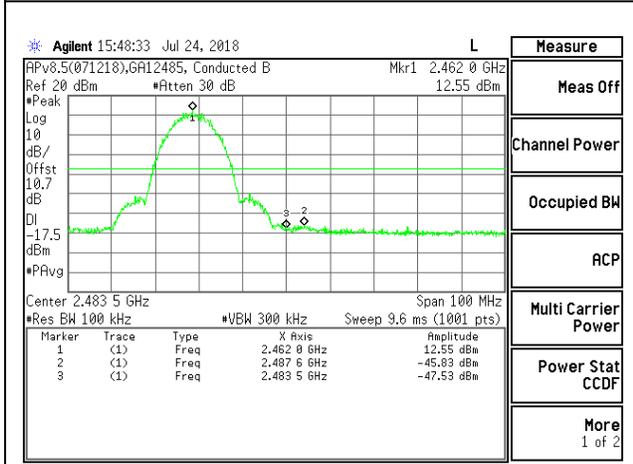
OUT-OF-BAND LOW CHANNEL 1 CHAIN 1



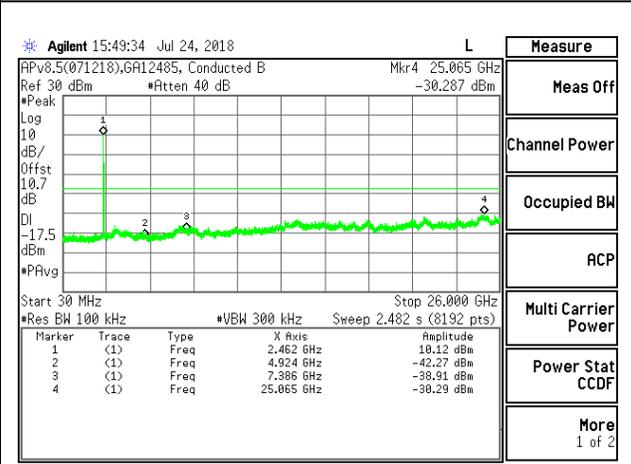
IN-BAND REFERENCE LEVEL CHAIN 1



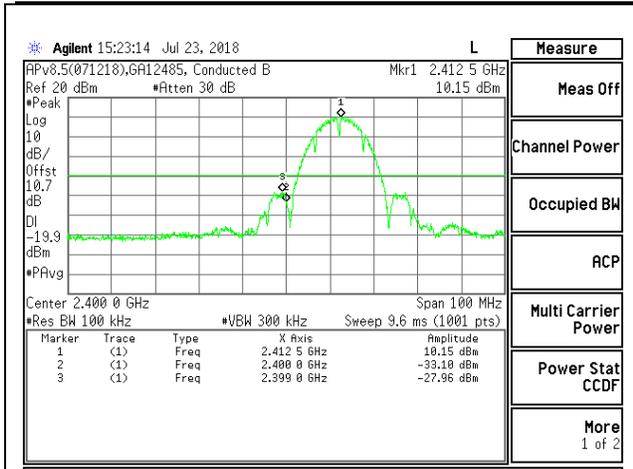
OUT-OF-BAND MID CHANNEL CHAIN 1



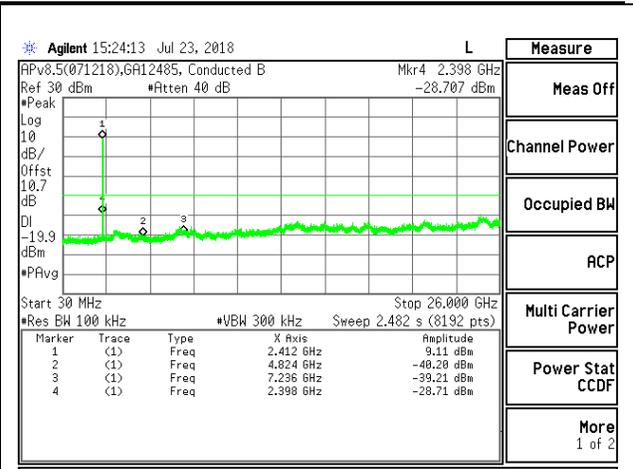
HIGH CHANNEL 11 BANDEDGE CHAIN 1



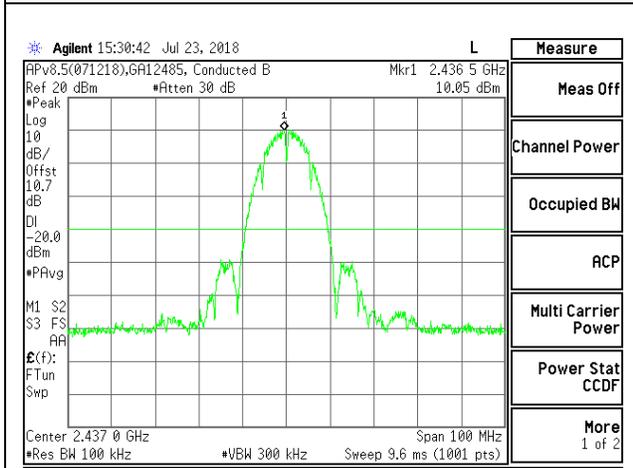
OUT-OF-BAND HIGH CHANNEL 11 CHAIN 1



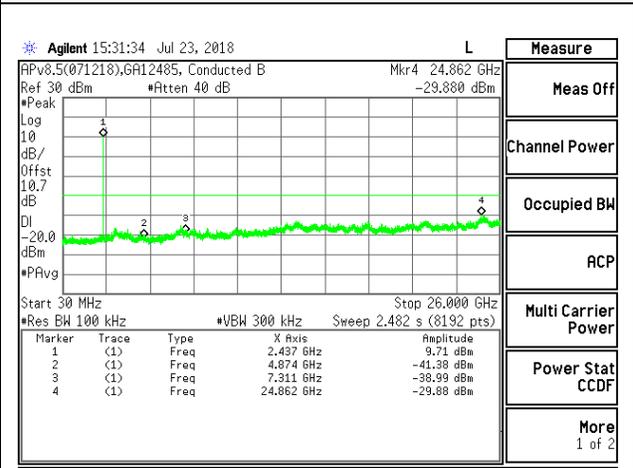
LOW CHANNEL 1 BANDEDGE CHAIN 2



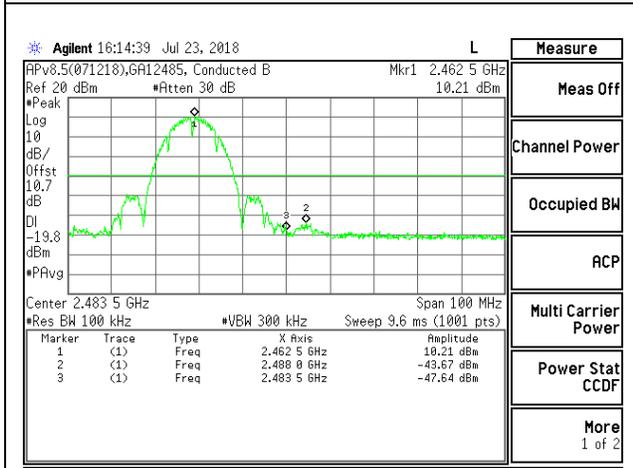
OUT-OF-BAND LOW CHANNEL 1 CHAIN 2



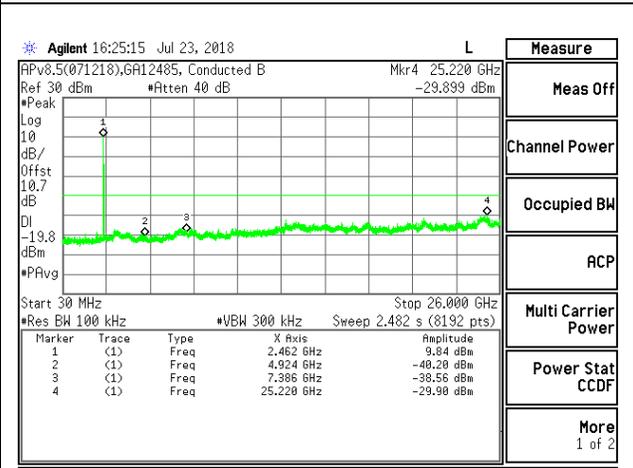
IN-BAND REFERENCE LEVEL CHAIN 2



OUT-OF-BAND MID CHANNEL CHAIN 2



HIGH CHANNEL 11 BANDEDGE CHAIN 2



OUT-OF-BAND HIGH CHANNEL 11 CHAIN 2

8.6.2. 802.11g MODE

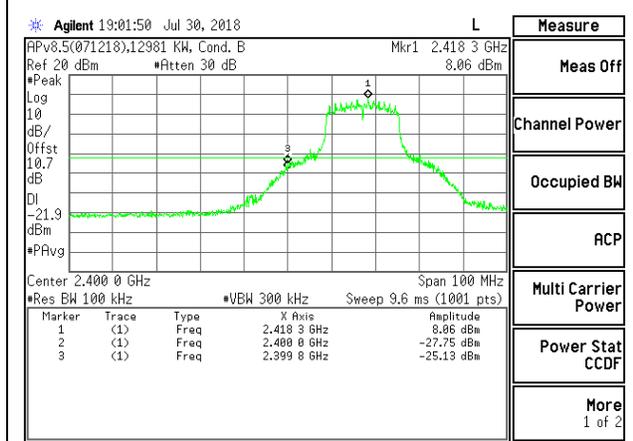
3TX CDD MODE



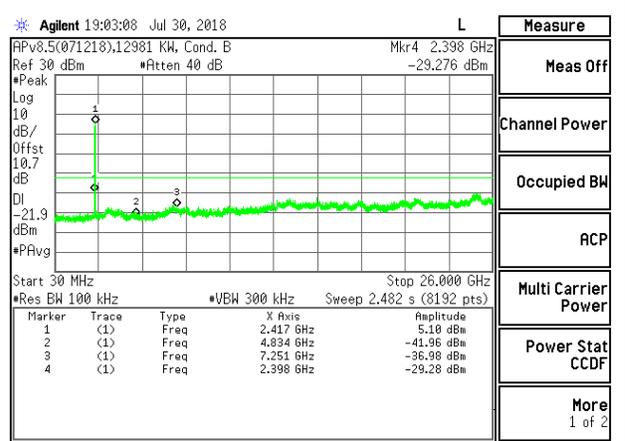
LOW CHANNEL 1 BANDEDGE CHAIN 0



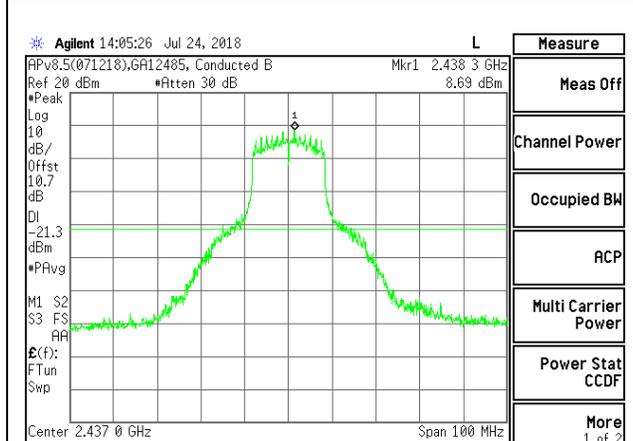
OUT-OF-BAND LOW CHANNEL 1 CHAIN 0



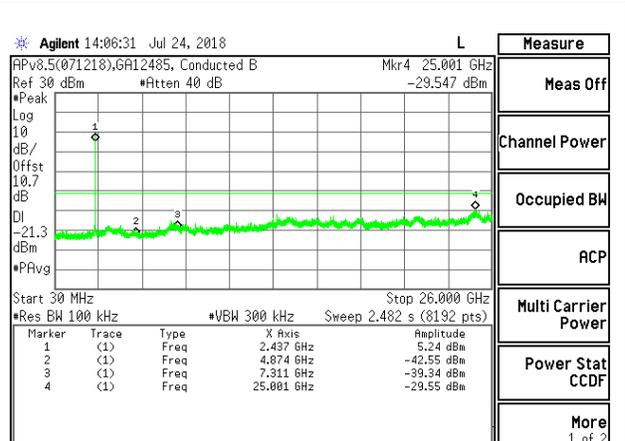
LOW CHANNEL 2 BANDEDGE CHAIN 0



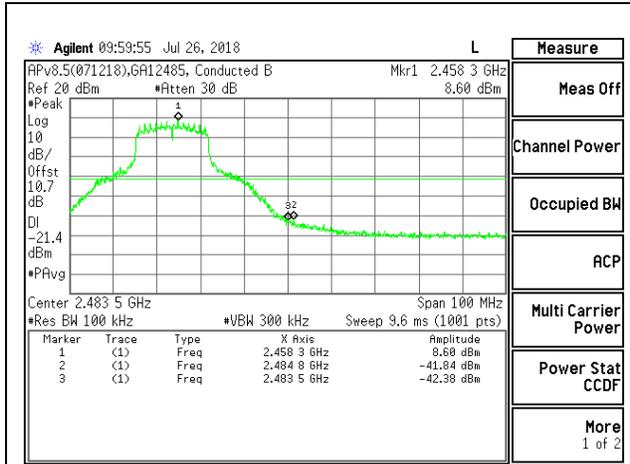
OUT-OF-BAND LOW CHANNEL 2 CHAIN 0



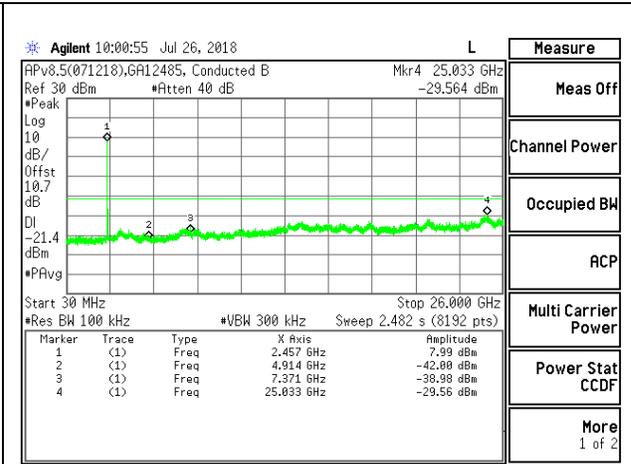
IN-BAND REFERENCE LEVEL CHAIN 0



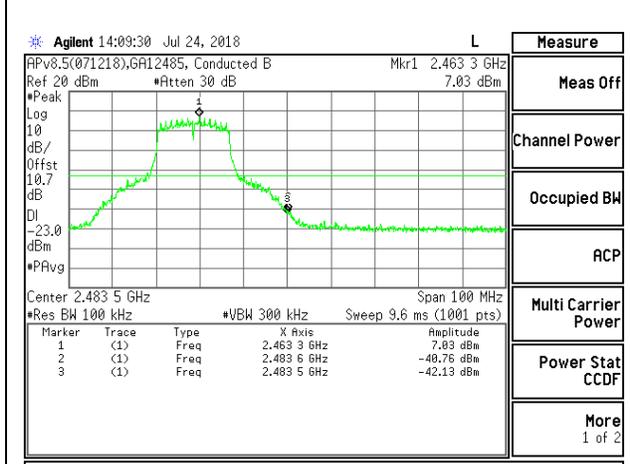
OUT-OF-BAND MID CHANNEL CHAIN 0



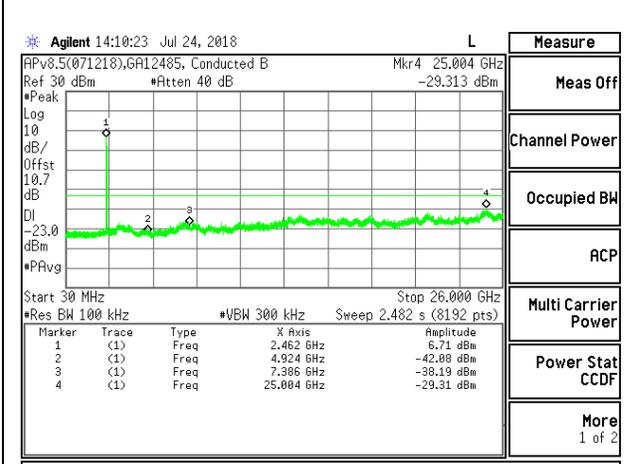
**HIGH CHANNEL 10 BANDEDGE CHAIN 0**



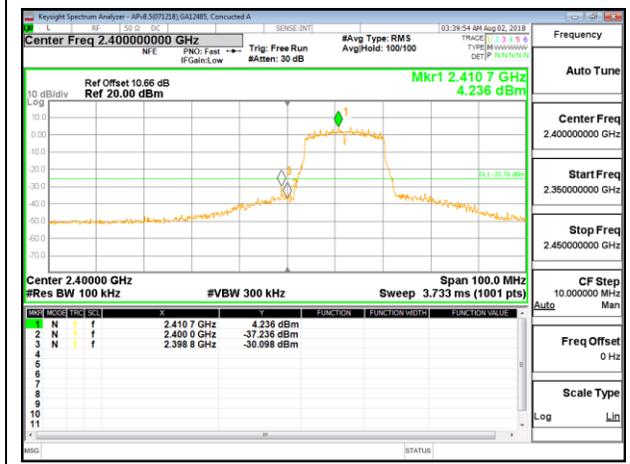
**OUT-OF-BAND HIGH CHANNEL 10 CHAIN 0**



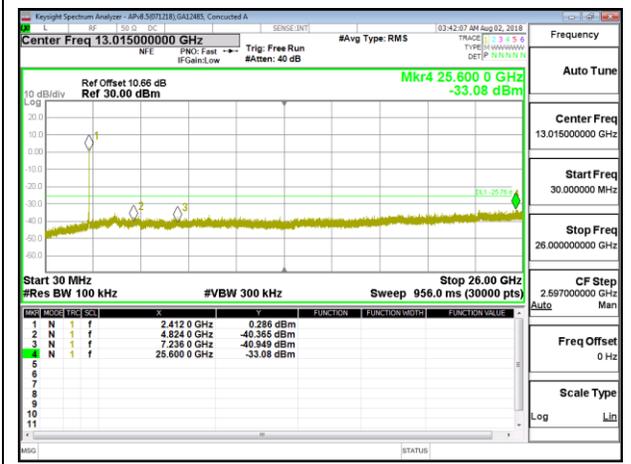
**HIGH CHANNEL 11 BANDEDGE CHAIN 0**



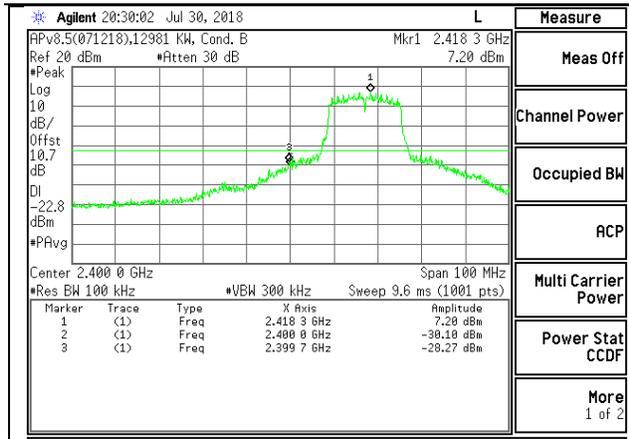
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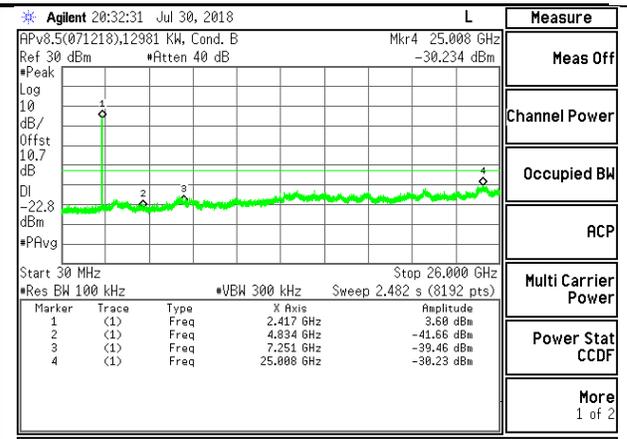
**LOW CHANNEL 1 BANDEDGE CHAIN 1**



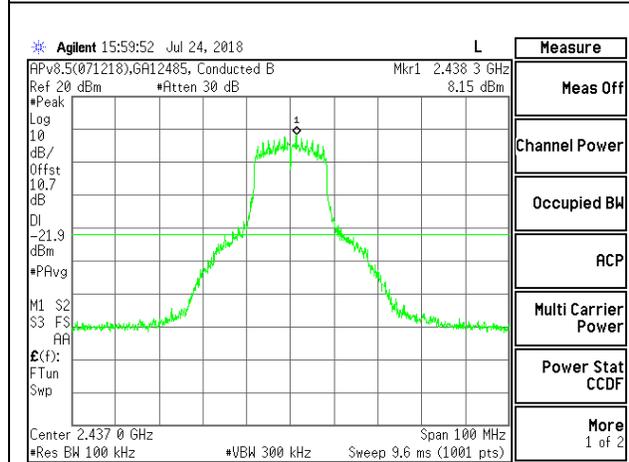
**OUT-OF-BAND LOW CHANNEL 1 CHAIN 1**



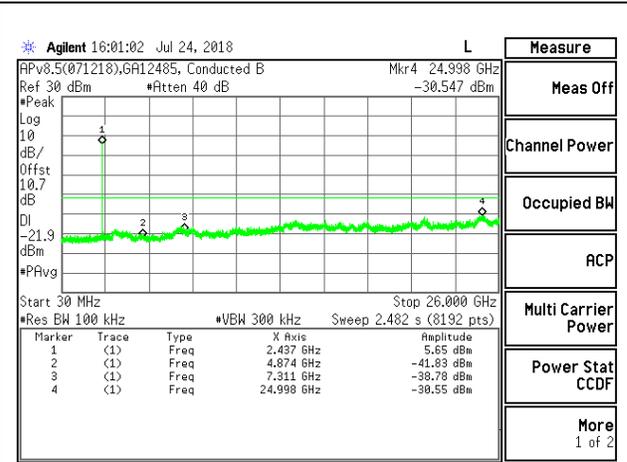
**LOW CHANNEL 2 BANDEDGE CHAIN 1**



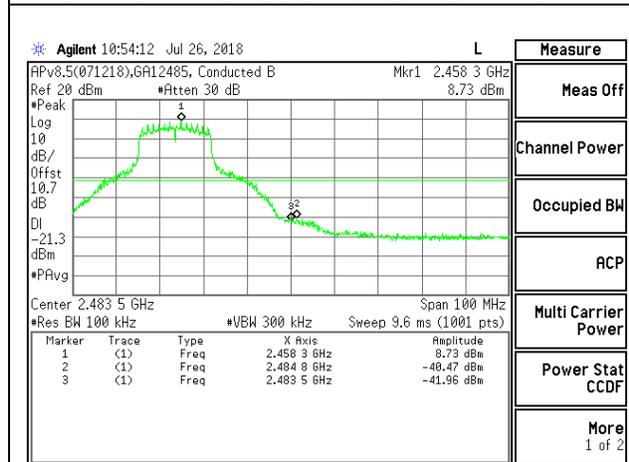
**OUT-OF-BAND LOW CHANNEL 2 CHAIN 1**



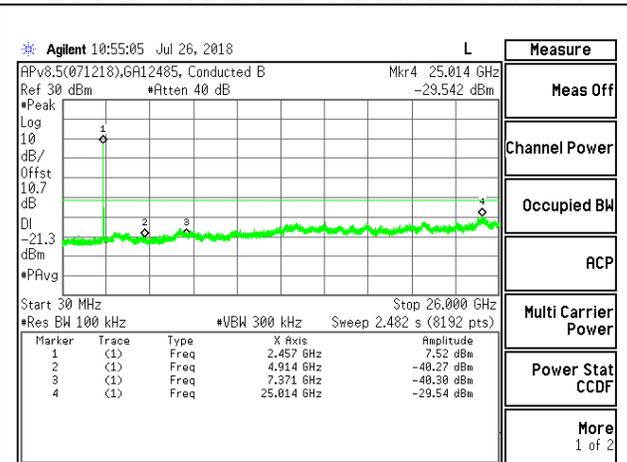
**IN-BAND REFERENCE LEVEL CHAIN 1**



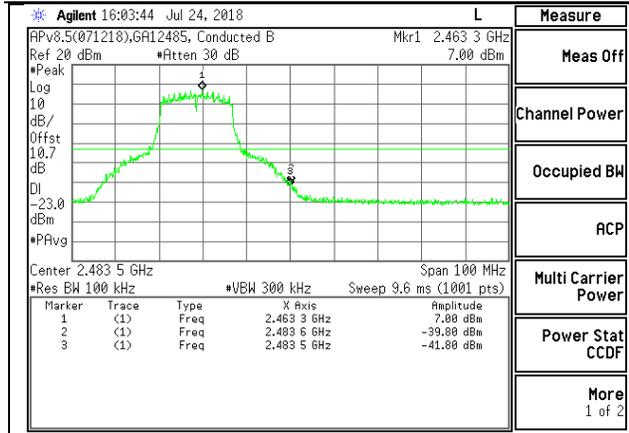
**OUT-OF-BAND MID CHANNEL CHAIN 1**



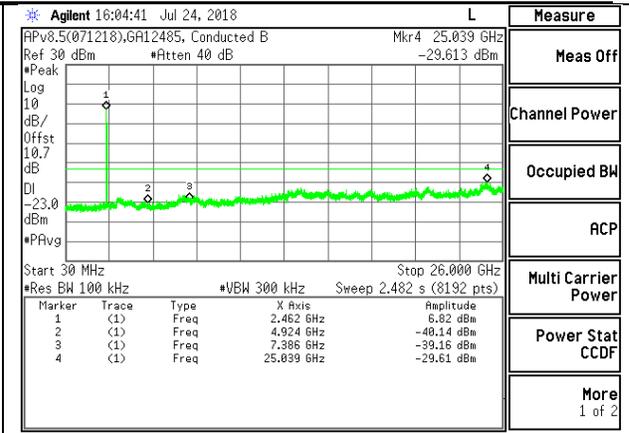
**HIGH CHANNEL 10 BANDEDGE CHAIN 1**



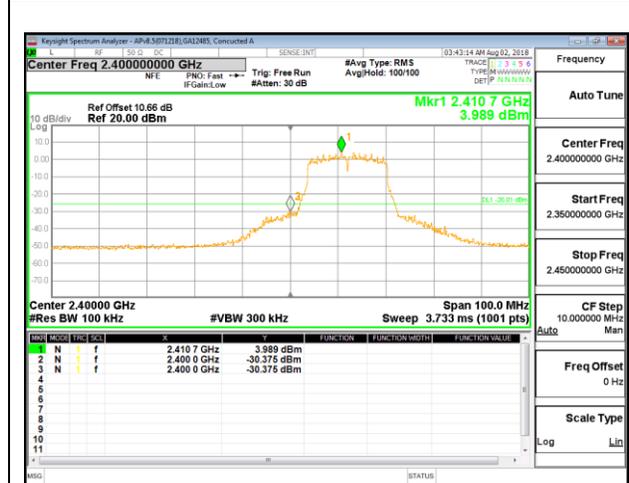
**OUT-OF-BAND HIGH CHANNEL 10 CHAIN 1**



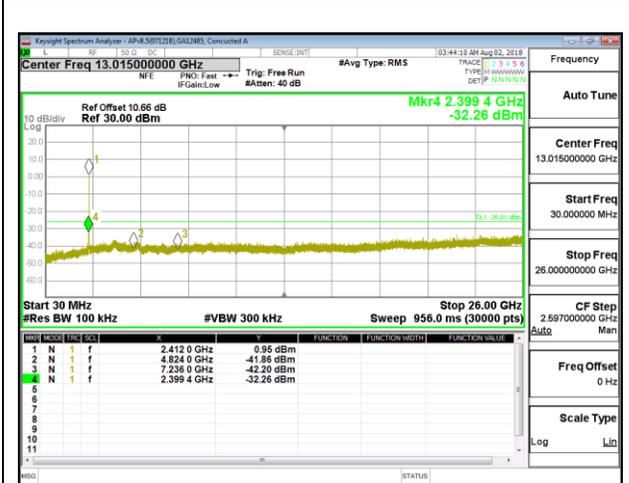
Copyright 2000-2011 Agilent Technologies  
**HIGH CHANNEL 11 BANDEDGE CHAIN 1**



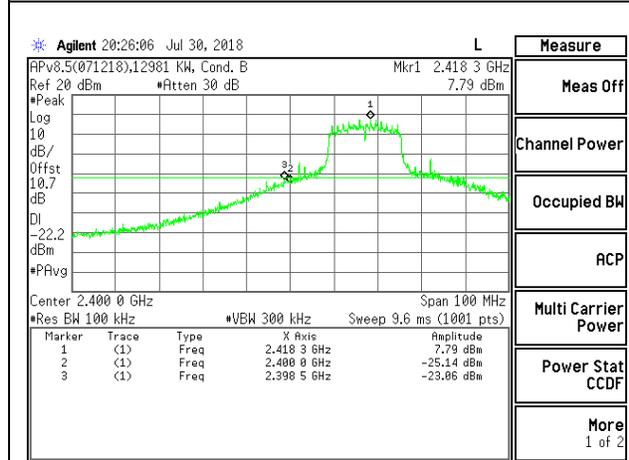
Copyright 2000-2011 Agilent Technologies  
**OUT-OF-BAND HIGH CHANNEL 11 CHAIN 1**



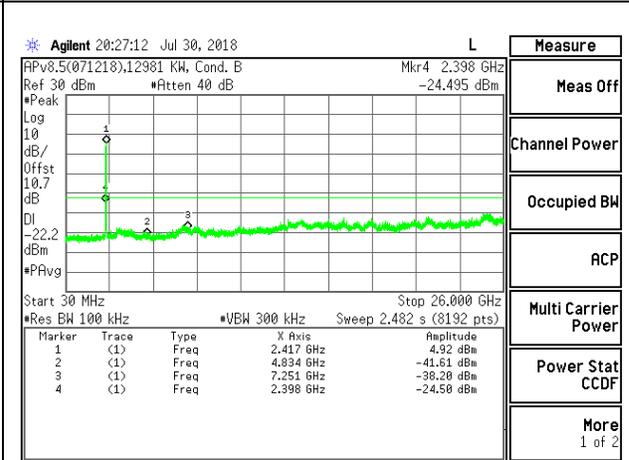
**LOW CHANNEL 1 BANDEDGE CHAIN 2**



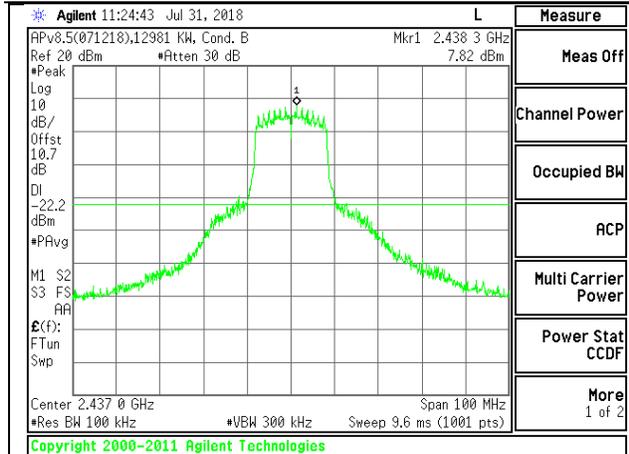
**OUT-OF-BAND LOW CHANNEL 1 CHAIN 2**



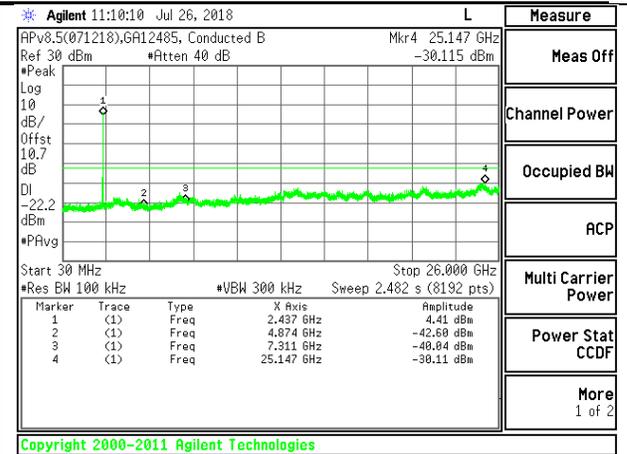
Copyright 2000-2011 Agilent Technologies  
**LOW CHANNEL 2 BANDEDGE CHAIN 2**



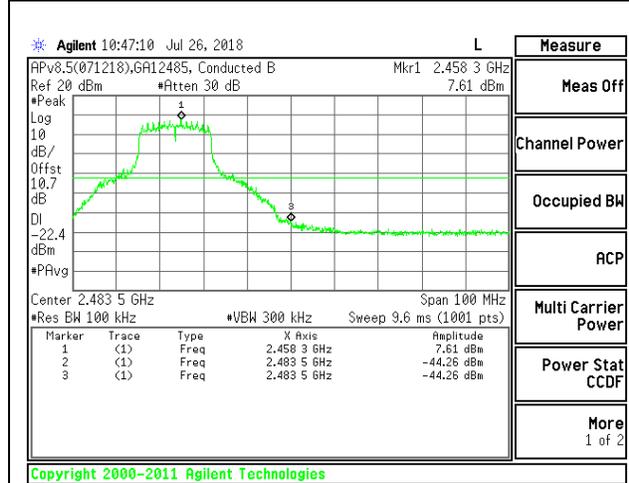
Copyright 2000-2011 Agilent Technologies  
**OUT-OF-BAND LOW CHANNEL 2 CHAIN 2**



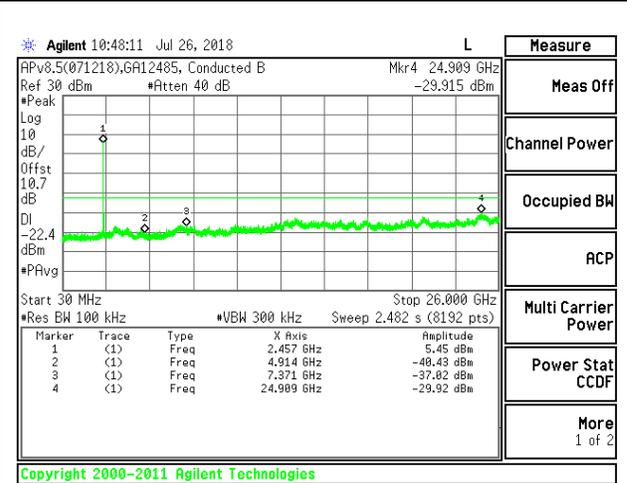
**IN-BAND REFERENCE LEVEL CHAIN 2**



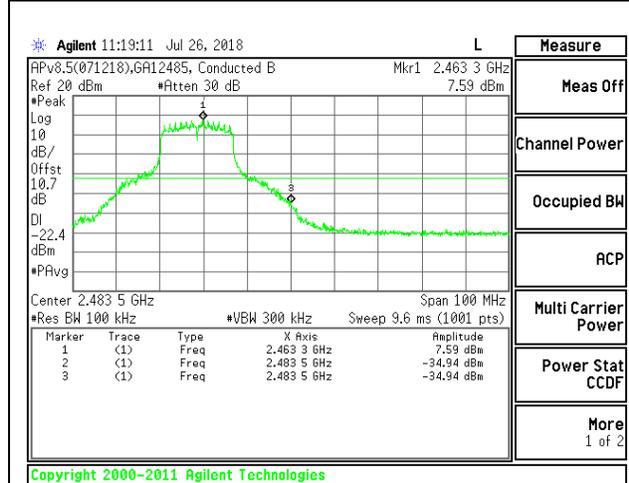
**OUT-OF-BAND MID CHANNEL CHAIN 2**



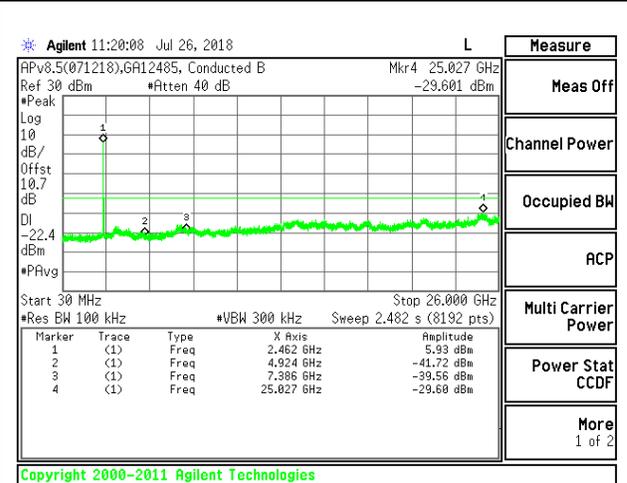
**HIGH CHANNEL 10 BANDEDGE CHAIN 2**



**OUT-OF-BAND HIGH CHANNEL 10 CHAIN 2**



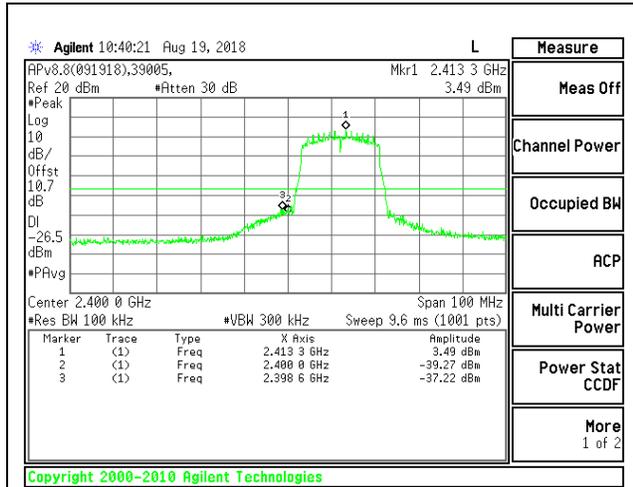
**HIGH CHANNEL 11 BANDEDGE CHAIN 2**



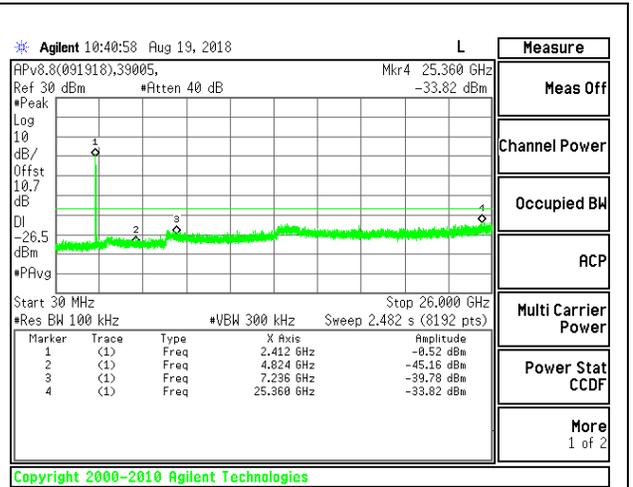
**OUT-OF-BAND HIGH CHANNEL 11 CHAIN 2**

**8.6.3. 802.11n HT20 MODE**

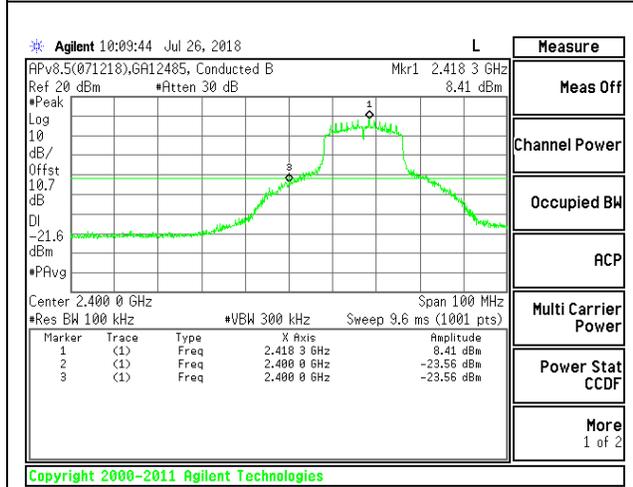
**3TX CDD MODE**



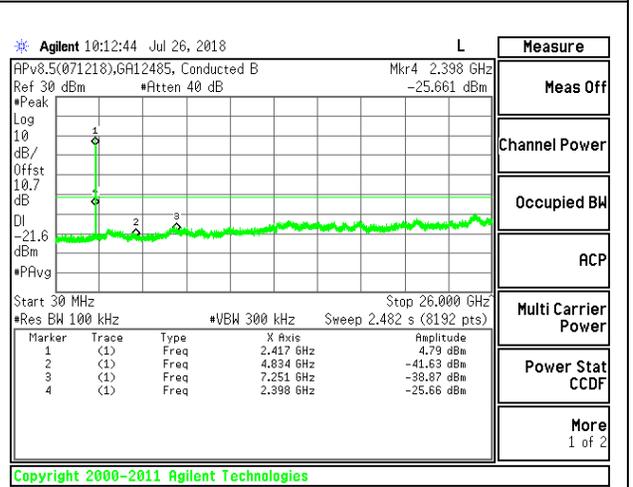
**LOW CHANNEL 1 BANDEDGE CHAIN 0**



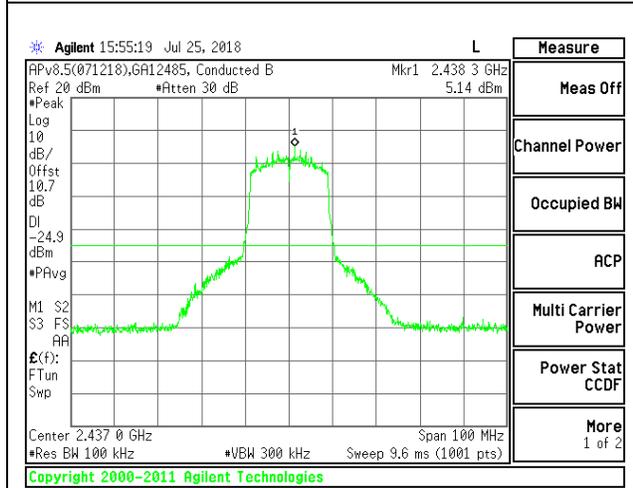
**OUT-OF-BAND LOW CHANNEL 1 CHAIN 0**



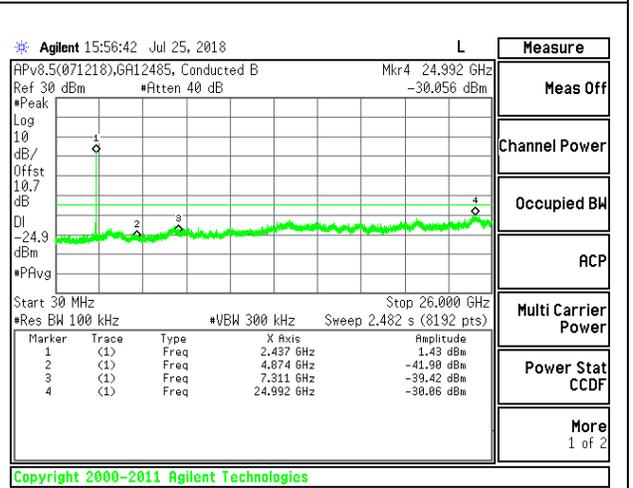
**LOW CHANNEL 2 BANDEDGE CHAIN 0**



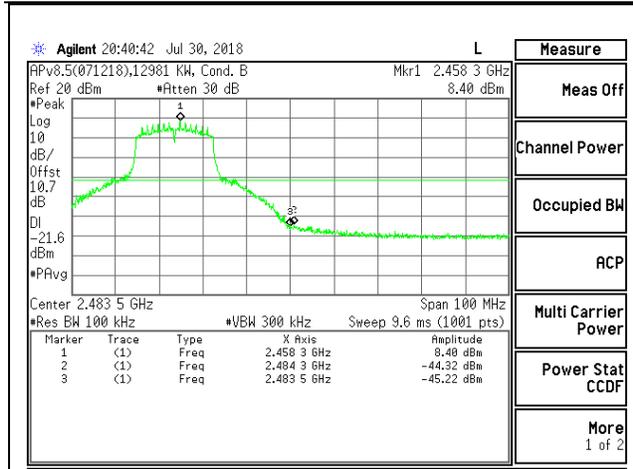
**OUT-OF-BAND LOW CHANNEL 2 CHAIN 0**



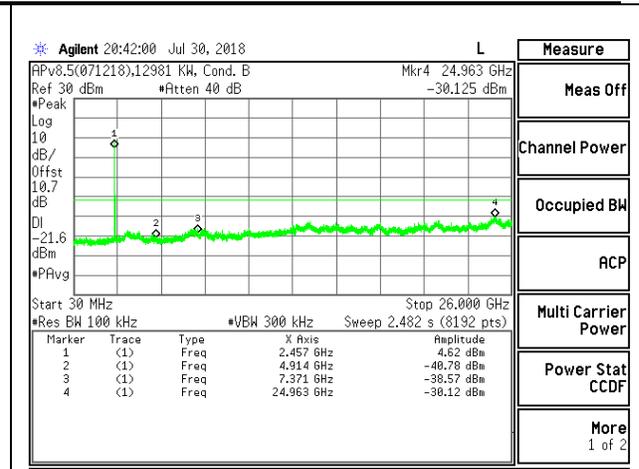
**IN-BAND REFERENCE LEVEL CHAIN 0**



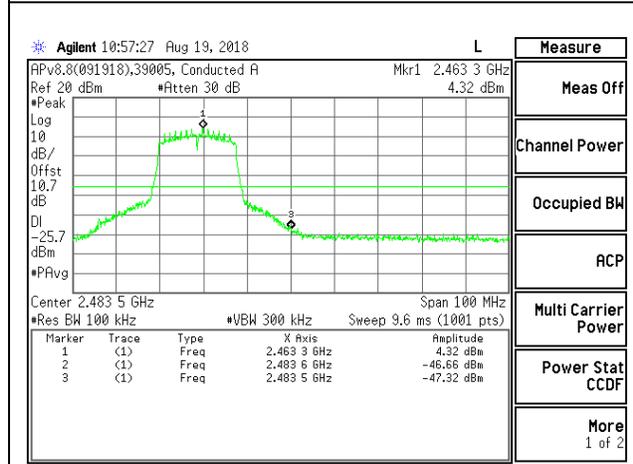
**OUT-OF-BAND MID CHANNEL CHAIN 0**



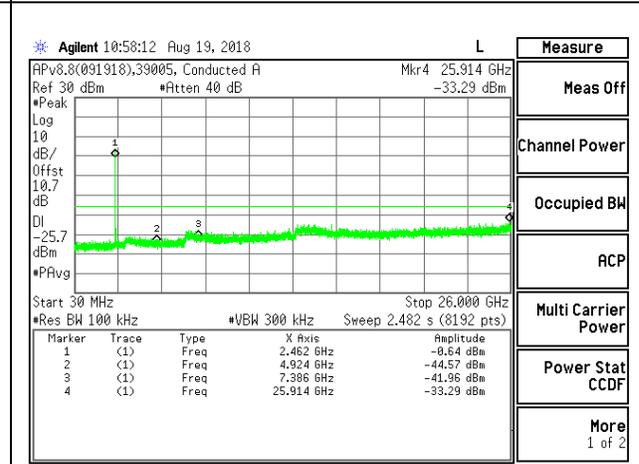
**HIGH CHANNEL 10 BANDEDGE CHAIN 0**



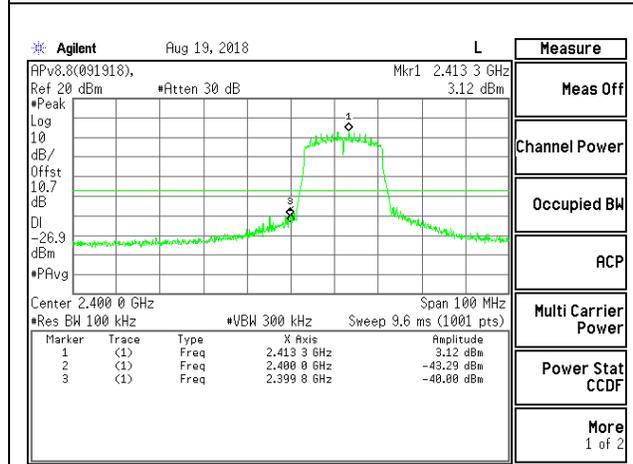
**OUT-OF-BAND HIGH CHANNEL 10 CHAIN 0**



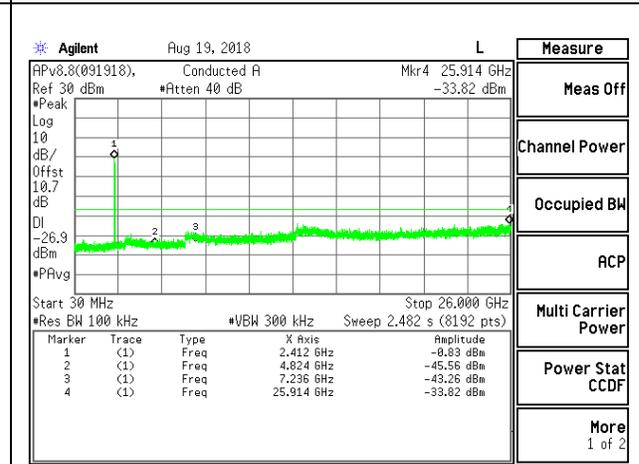
**HIGH CHANNEL 11 BANDEDGE CHAIN 0**



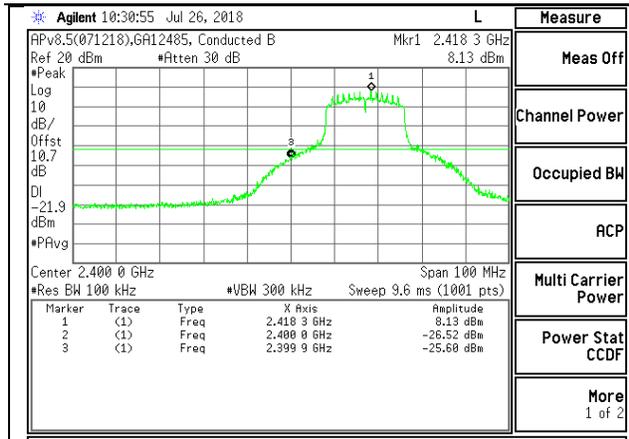
**OUT-OF-BAND HIGH CHANNEL 11 CHAIN 0**



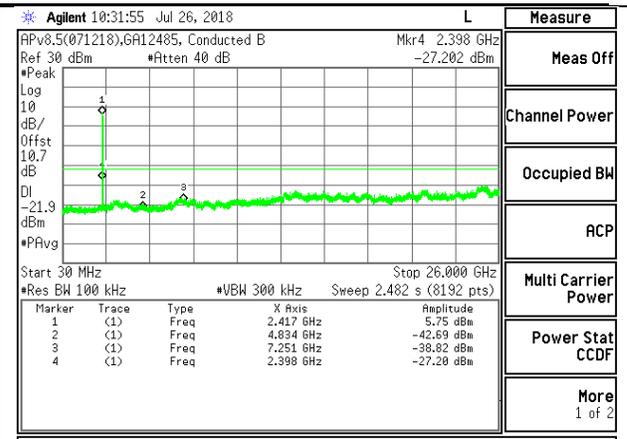
**LOW CHANNEL 1 BANDEDGE CHAIN 1**



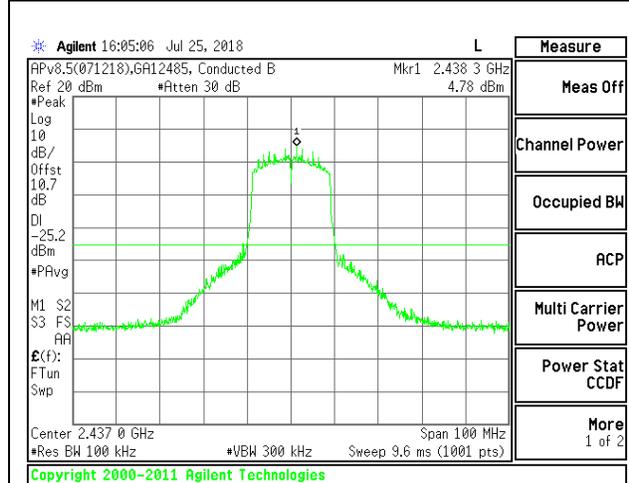
**OUT-OF-BAND LOW CHANNEL 1 CHAIN 1**



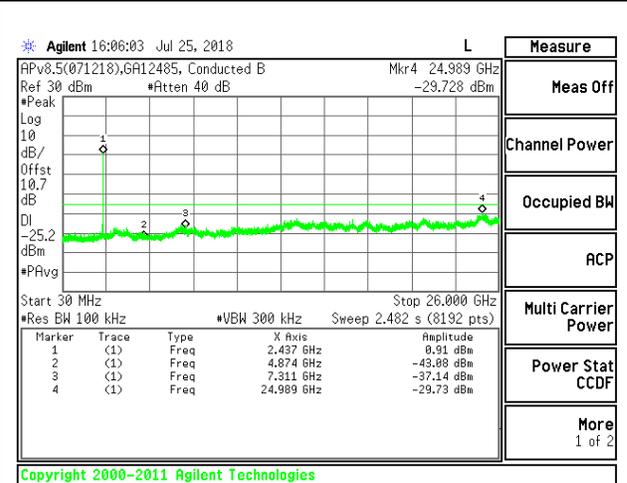
**LOW CHANNEL 2 BANDEDGE CHAIN 1**



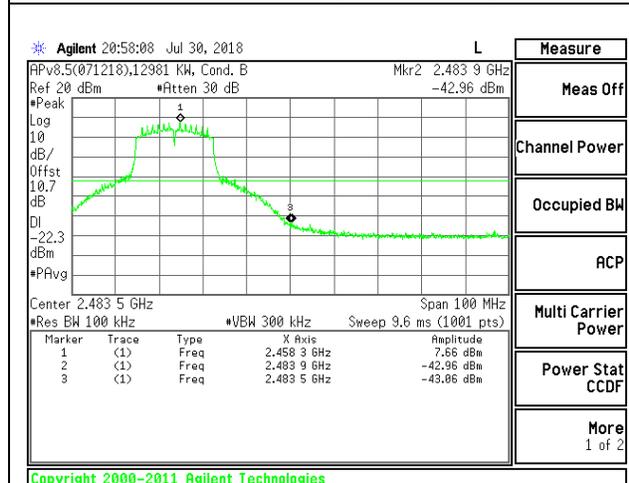
**OUT-OF-BAND LOW CHANNEL 2 CHAIN 1**



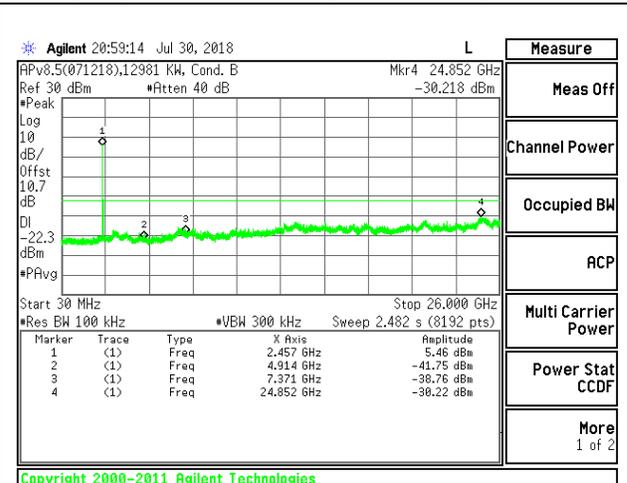
**IN-BAND REFERENCE LEVEL CHAIN 1**



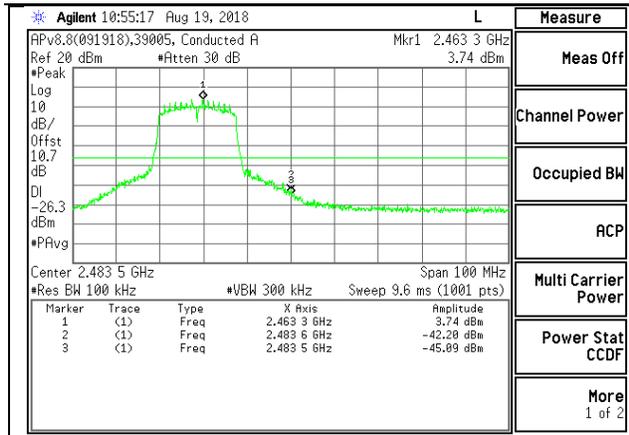
**OUT-OF-BAND MID CHANNEL CHAIN 1**



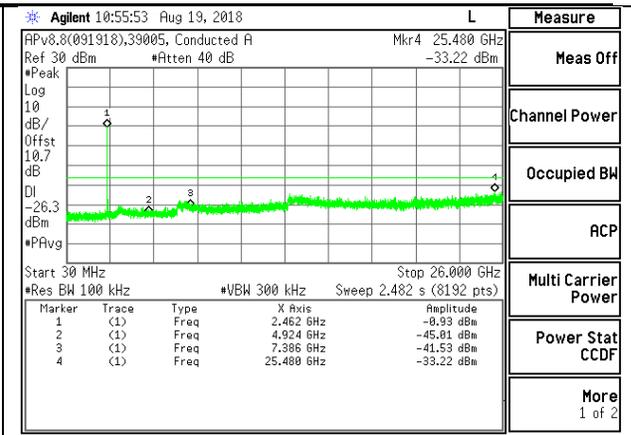
**HIGH CHANNEL 10 BANDEDGE CHAIN 1**



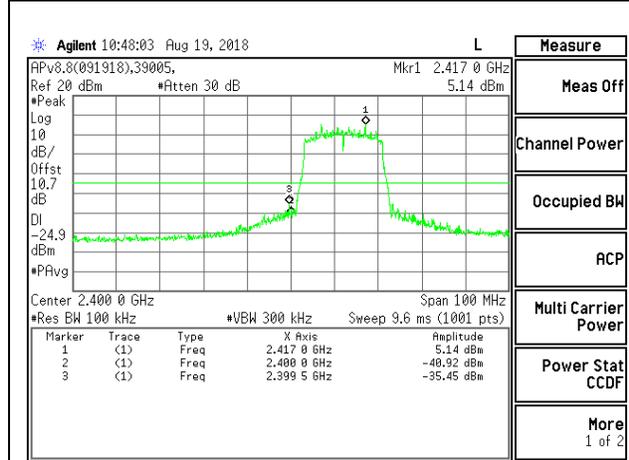
**OUT-OF-BAND HIGH CHANNEL 10 CHAIN 1**



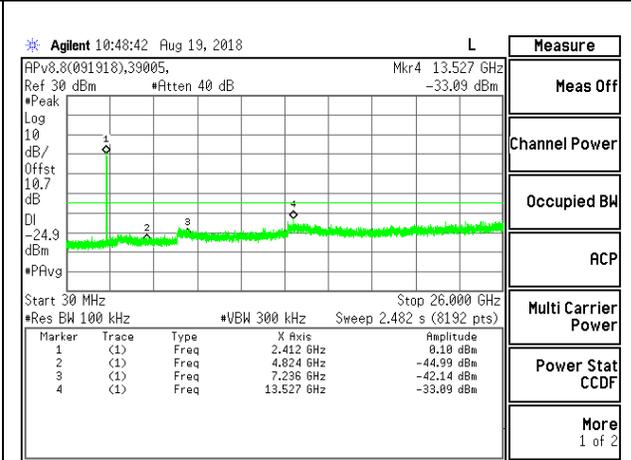
**HIGH CHANNEL 11 BANDEDGE CHAIN 1**



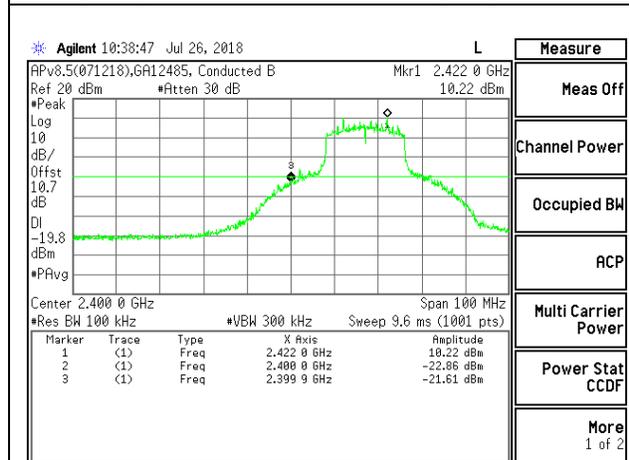
**OUT-OF-BAND HIGH CHANNEL 11 CHAIN 1**



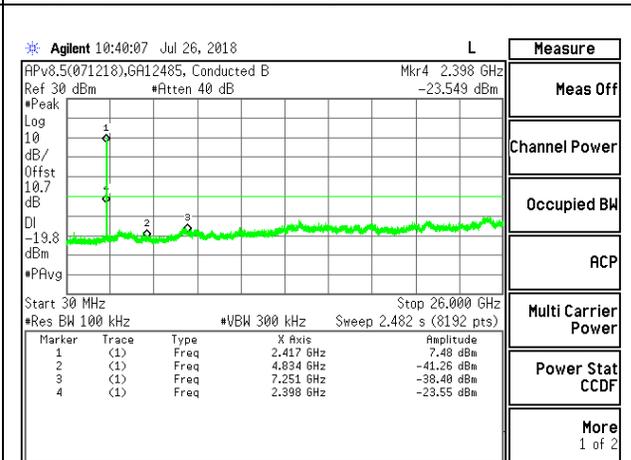
**LOW CHANNEL 1 BANDEDGE CHAIN 2**



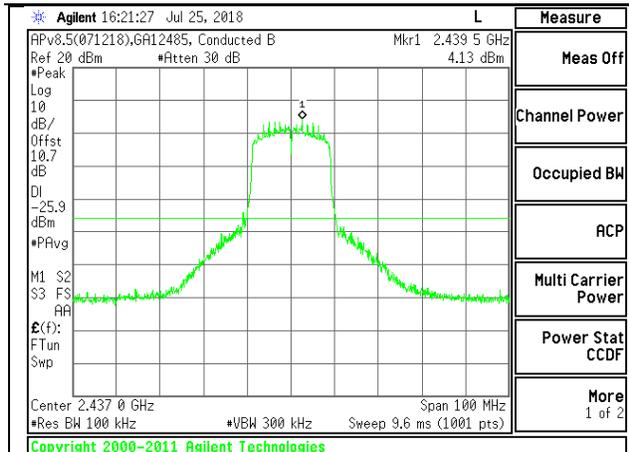
**OUT-OF-BAND LOW CHANNEL 1 CHAIN 2**



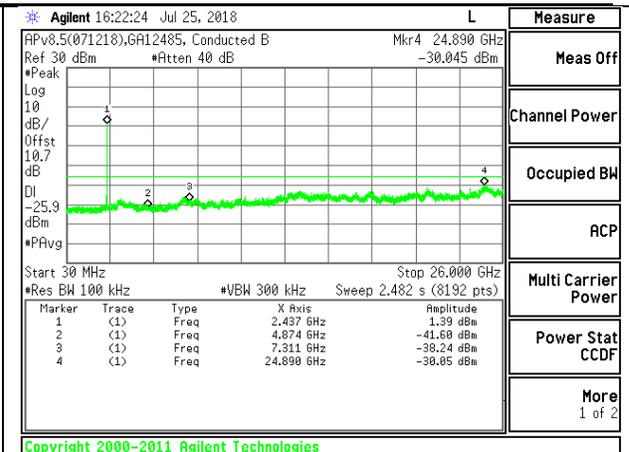
**LOW CHANNEL 2 BANDEDGE CHAIN 2**



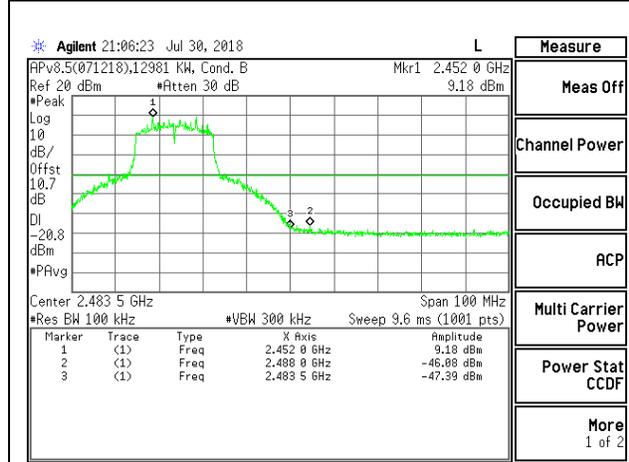
**OUT-OF-BAND LOW CHANNEL 2 CHAIN 2**



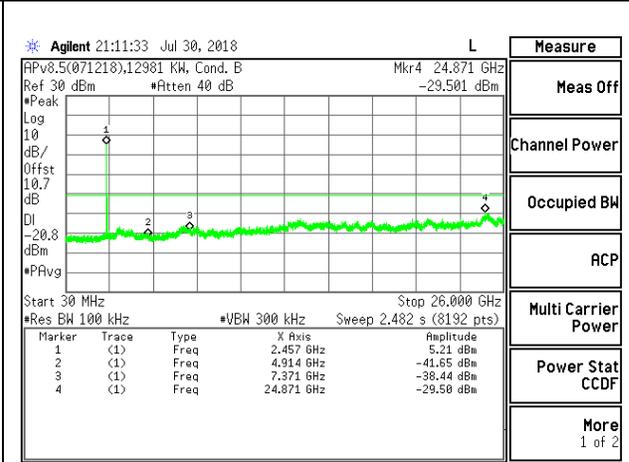
**IN-BAND REFERENCE LEVEL CHAIN 2**



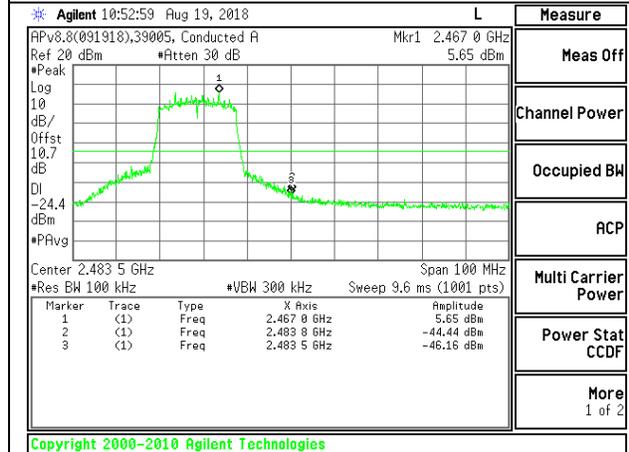
**OUT-OF-BAND MID CHANNEL CHAIN 2**



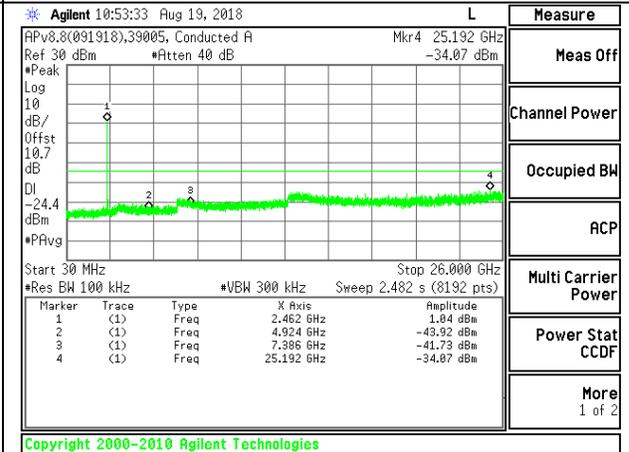
**HIGH CHANNEL 10 BANDEDGE CHAIN 2**



**OUT-OF-BAND HIGH CHANNEL 10 CHAIN 2**



**HIGH CHANNEL 11 BANDEDGE CHAIN 2**



**OUT-OF-BAND HIGH CHANNEL 11 CHAIN 2**

## 9. RADIATED TEST RESULTS

### LIMITS

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
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. Peak detection is used unless otherwise noted as quasi-peak.

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 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

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.