



TEST REPORT

Report Number. : 12934025-E2V2

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

Model : S19

FCC ID : SBVRM019

IC : 5373A-RM019

EUT Description : 802.11 a/b/g/n (HT20) 4x4 master device with BLE and NFC

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

Date Of Issue:
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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	1/10/2020	Initial Issue	
V2	1/16/2020	Updated Section 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: 802.11 a/b/g/n (HT20) 4x4 aster device with BLE and NFC

MODEL: S19

SERIAL NUMBER: A100 1908W 48-A6-B8-00-03-60:B (Conducted Sample)
A100 1908W 48-A6-B8-B0-05-FD:6 (Radiated Sample)

DATE TESTED: October 14 – November 21, 2019

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. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 414788 D01 Radiated Test Site v01r01, and KDB 558074 D01, KDB 62291 D01, KDB 622911 D02 ,15.247 Meas Guidance v05r02 and 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 checked="" type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D	<input checked="" type="checkbox"/> Chamber I
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E	<input type="checkbox"/> Chamber J
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F	<input type="checkbox"/> Chamber K
	<input type="checkbox"/> Chamber G	<input type="checkbox"/> Chamber L
	<input type="checkbox"/> Chamber H	

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

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

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is an 802.11 a/b/g/n (HT20) 4x4 master device with BLE and NFC.

The model S19 is a high performance wireless smart speaker.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
4Tx			
2412 - 2462	802.11b	28.52	711.21
2412 - 2462	802.11g	27.25	530.88
2412 - 2462	802.11n HT20	26.15	412.10

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency (MHz)	Peak Antenna Gain (dBi)			
	Chain 0 (Horizontal Polarization)	Chain 1 (Horizontal Polarization)	Chain 2 (Vertical Polarization)	Chain 3 (Vertical Polarization)
2400 – 2483.5	1.57	2.43	3.88	5.38

NOTE:

Antenna 1 = Chain 0

Antenna 2 = Chain 1

Antenna 3 = Chain 2

Antenna 4 = Chain 3

5.4. SOFTWARE AND FIRMWARE

The EUT software/firmware installed during testing was version 11.0 Build 55070020.

5.5. WORST-CASE CONFIGURATION AND MODE

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

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

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

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	T450s	PC-06YXZP 15/08	PD97265NGU
AC Adapter	Lenovo	ADLX90NLC2A	11S45N0247Z1ZS9B58BA9G	

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	Ethernet to Ethernet Converter
3	Ethernet to USB	1	RJ45 to USB	Unshielded	0.2	USB to Ethernet Adapter
5	DC Power	1	DC	Unshielded	1.2	AC/DC Adapter to Laptop
6	AC Power	1	AC	Unshielded	1	AC Mains to AC/DC Adapter

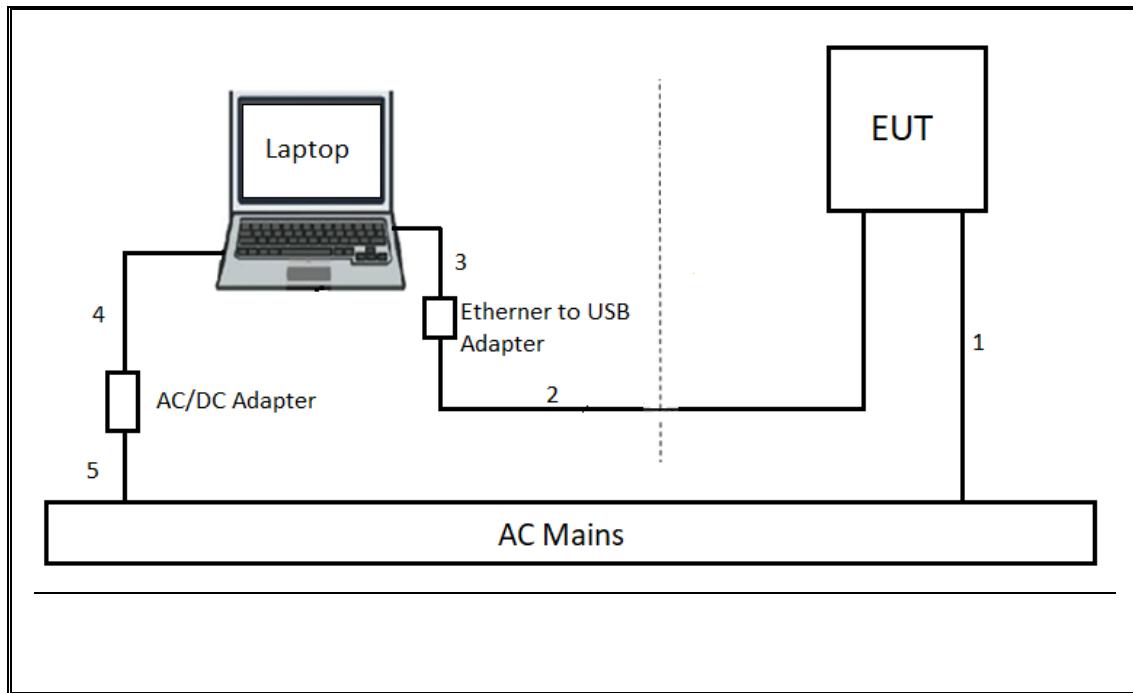
TEST SETUP

The EUT connected to support laptop via the ethernet cable during testing.

The test utility software on support laptop exercised the radio card.

For radiated testing, the support laptop was set up outside the chamber.

SETUP DIAGRAM



6. MEASUREMENT METHOD

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

6 dB BW: ANSI C63.10-2013 Subclause -11.8.1 RBW \geq DTS BW

Output Power: ANSI C63.10-2013 Section 11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter).

Power Spectral Density: ANSI C63.10-2013 Section 11.10.3 Method AVGPSD-1.

Radiated emissions non-restricted frequency bands: ANSI C63.10-2013 Section 11.11.

Radiated emissions restricted frequency bands: ANSI C63.10-2013 Section 11.12.1.

Conducted emissions in restricted frequency bands: ANSI C63.10-2013 Section 11.12.

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

Band-edge: ANSI C63.10-2013 Section -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	Last Cal
Amplifier, 100KHz to 1GHz, 32dB	Keysight Technologies (Formerly Agilent)	8447D	T15	10/20/2019	10/20/2018
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	PRE0181575	09/05/2020	09/05/2019
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	T1165	05/24/2020	06/24/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T346	05/14/2020	05/14/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies (Formerly Agilent)	N9030A	T908	01/23/2020	01/23/2019
Antenna, Passive Loop 30Hz to 1MHz	ELETRO METRICS	EM-6871	PRE0179465	05/31/2020	05/31/2019
Antenna, Passive Loop 100kHz to 30MHz	ELETRO METRICS	EM-6872	PRE0179467	05/31/2020	05/31/2019
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE0180175	05/29/2020	06/29/2019
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179376	02/14/2020	02/14/2019
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	PRE0181078	08/24/2019	08/24/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T862	06/05/2020	06/05/2019
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179376	02/14/2019	02/14/2020
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	08/13/2020	08/13/2019
Rf Amplifier, 18-26.5GHz, 60dB gain	AMPLICAL	Rf Amplifier, 18-26.5GHz, 60dB gain	PRE0181238	05/01/2020	05/01/2019
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1265	01/29/2020	01/29/2019
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1227	02/05/2020	02/05/2019
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies (Formerly Agilent)	E4446A	T146	01/28/2020	01/28/2019
AC Line Conducted					
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/14/2020	02/14/2019
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	01/24/2020	01/24/2019
Test Software List					
Radiated Software	UL	UL EMC	Ver 9.5, September 24, 2019		
Antenna Port Software	UL	UL RF	Ver 10.4, October 10, 2019		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015		

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

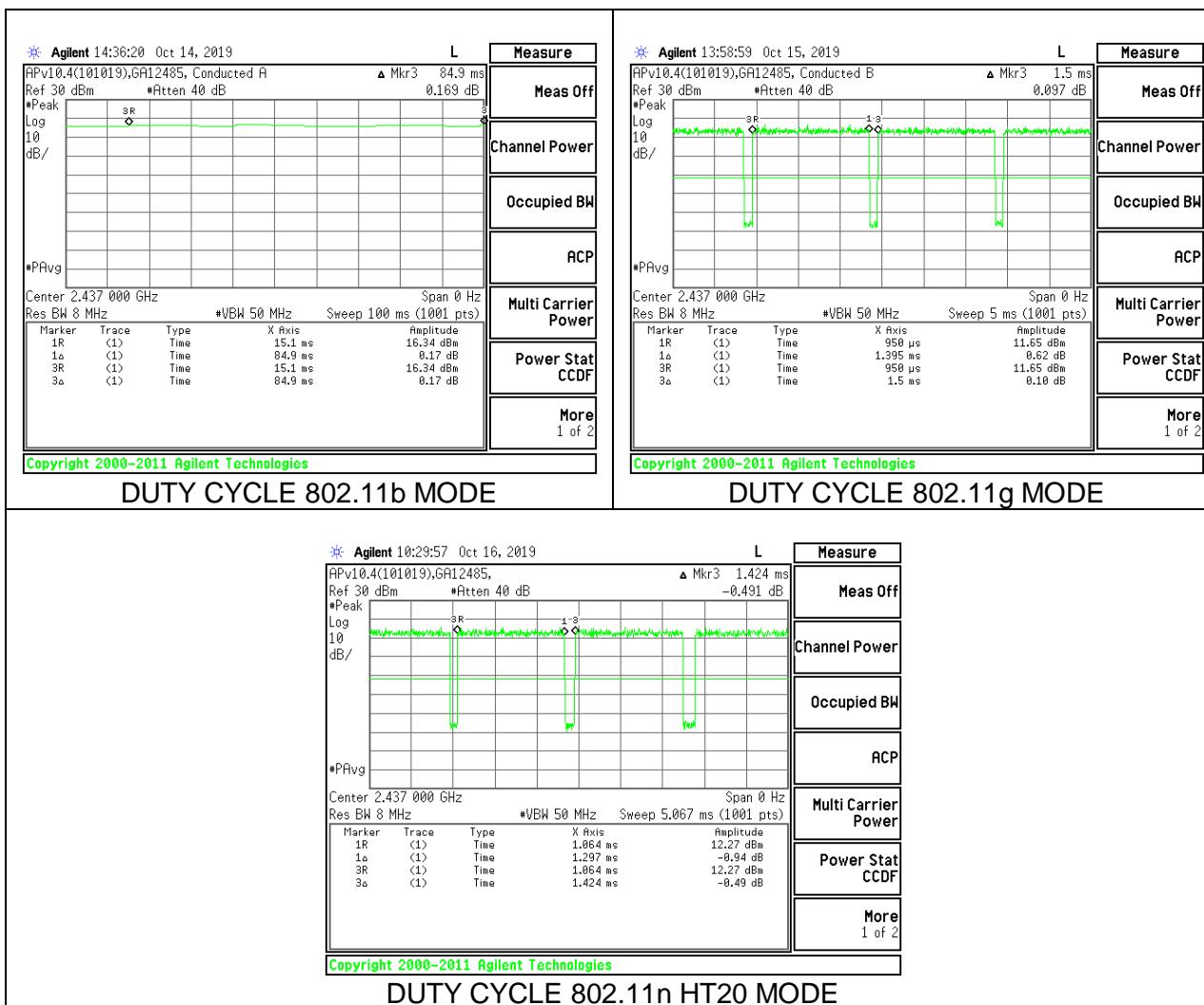
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
802.11b	84.900	84.900	1.000	100.00%	0.00	0.010
802.11g	1.395	1.500	0.930	93.00%	0.32	0.717
802.11n HT20	1.297	1.424	0.911	91.08%	0.41	0.771

DUTY CYCLE PLOTS



8.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

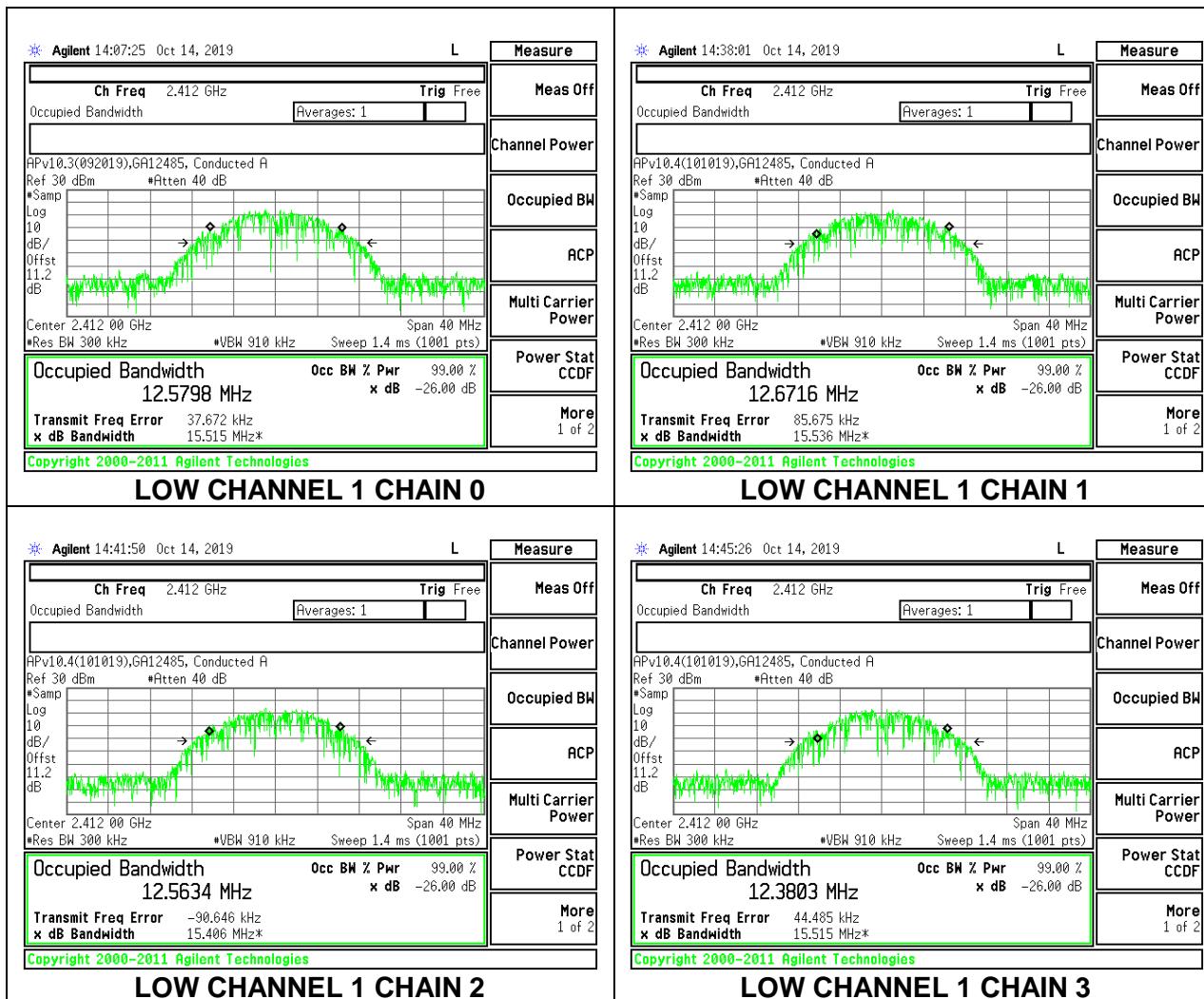
RESULTS

8.2.1. 802.11b MODE

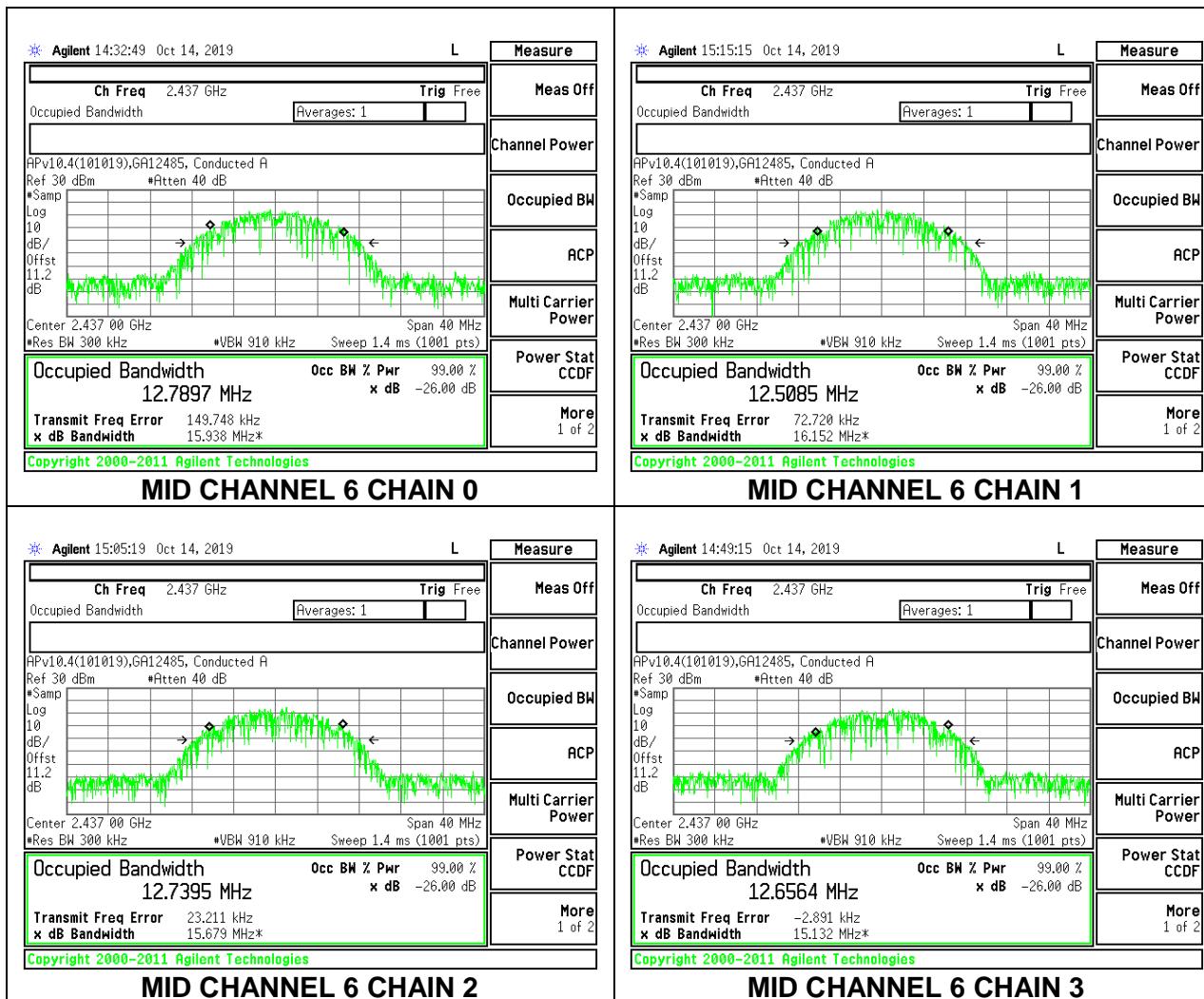
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)	99% Bandwidth Chain 3 (MHz)
Low 1	2412	12.5798	12.6716	12.5634	12.3803
Mid 6	2437	12.7897	12.5085	12.7395	12.6564
High 11	2462	12.7550	12.7721	12.7148	12.3822

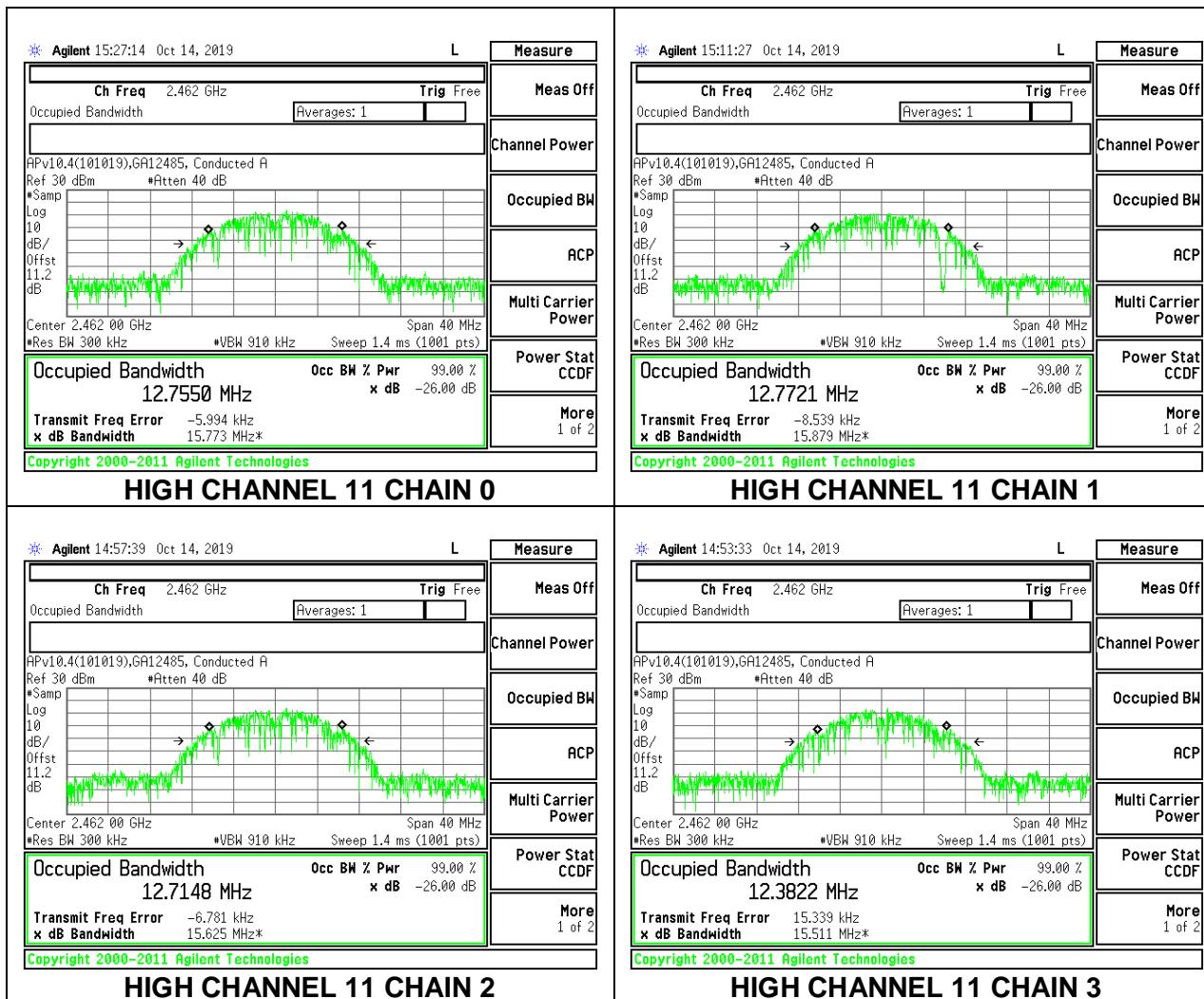
LOW CHANNEL 1



MID CHANNEL 6



HIGH CHANNEL 11

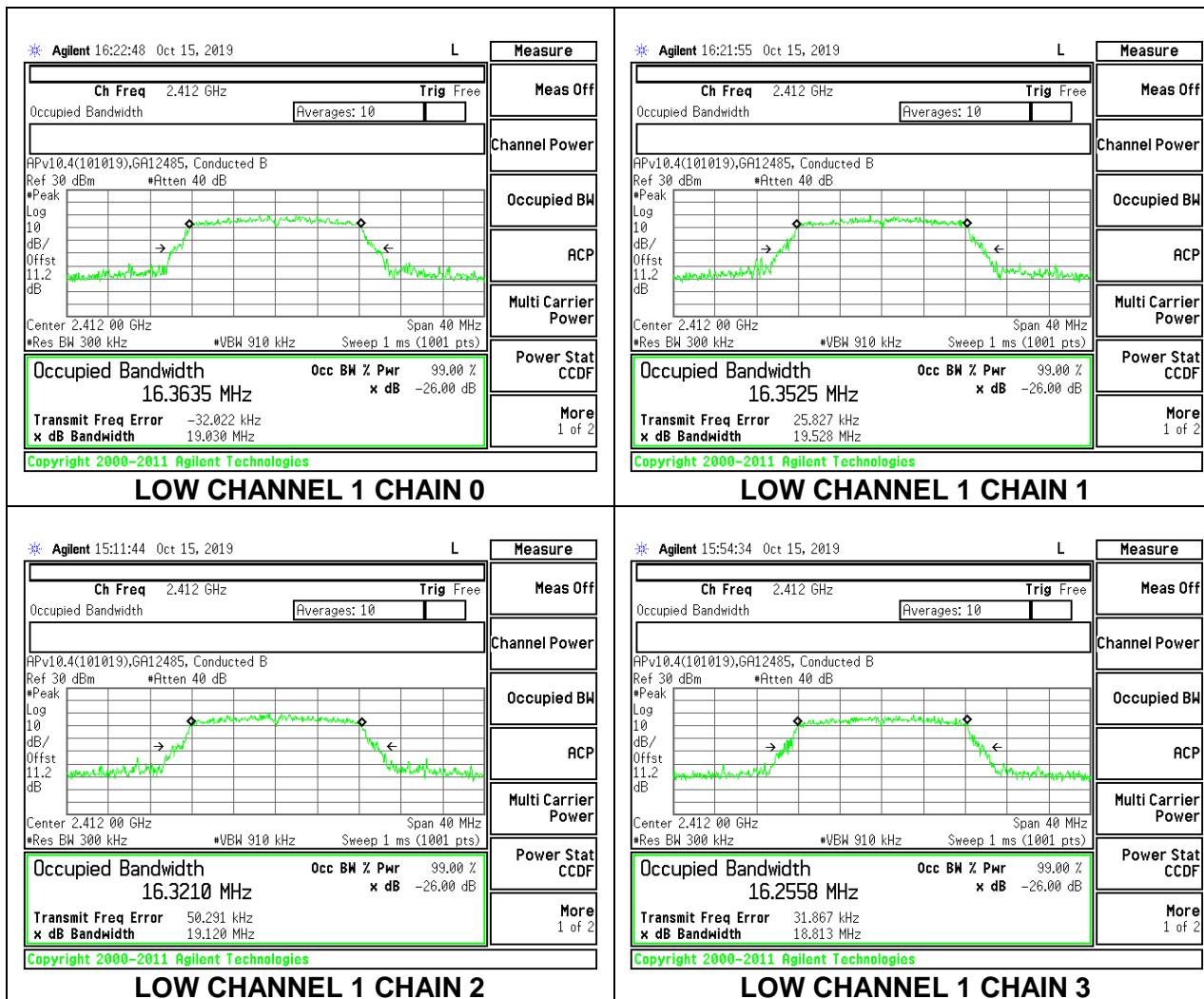


8.2.2. 802.11g MODE

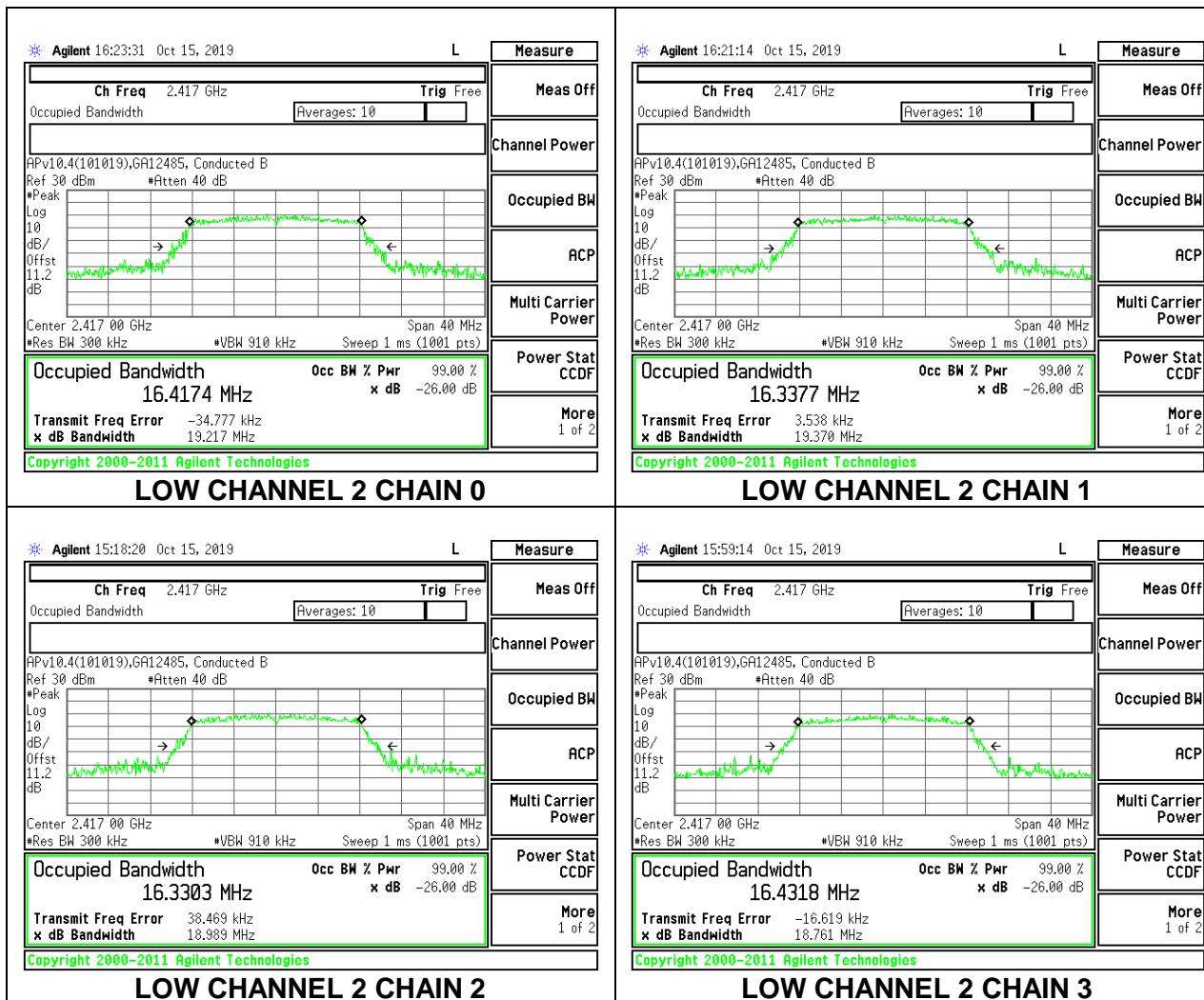
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)	99% Bandwidth Chain 3 (MHz)
Low 1	2412	16.3635	16.3525	16.3210	16.2558
Low 2	2417	16.4174	16.3377	16.3303	16.4318
Mid 6	2437	16.6295	16.6194	16.3546	16.6873
High 10	2457	16.2975	16.2635	16.0069	16.3040
High 11	2462	16.3878	16.3684	16.3913	16.3766

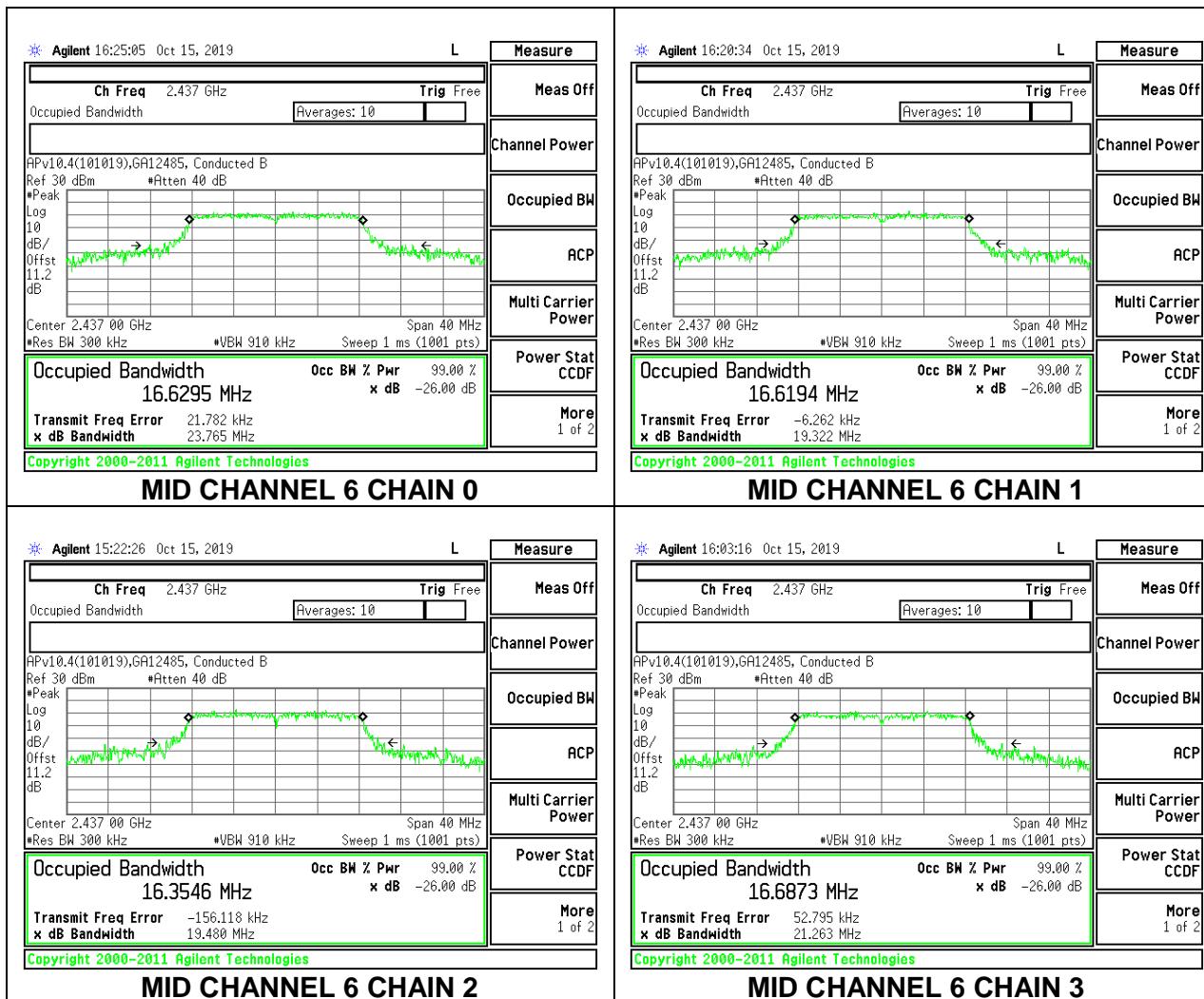
LOW CHANNEL 1



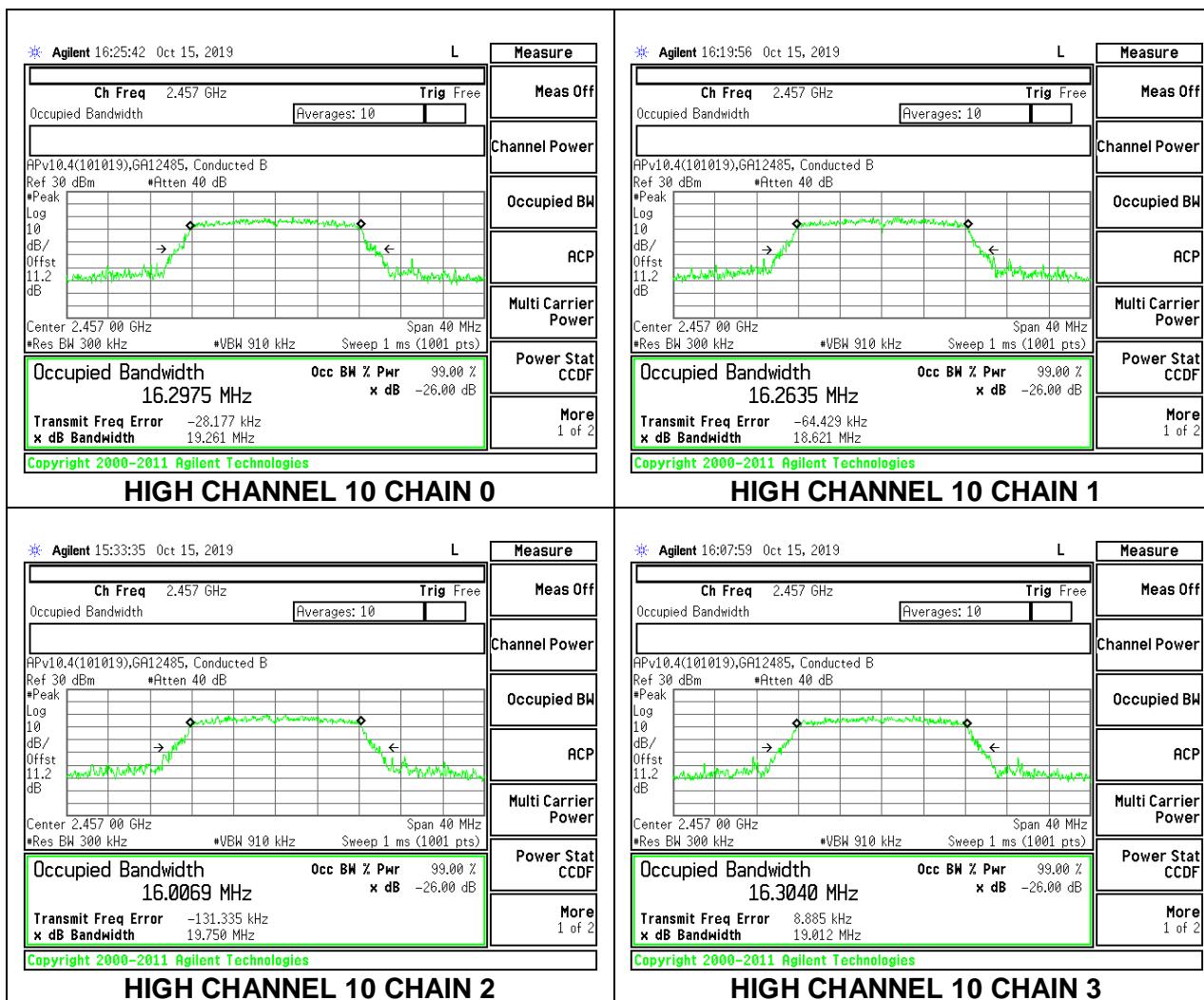
LOW CHANNEL 2



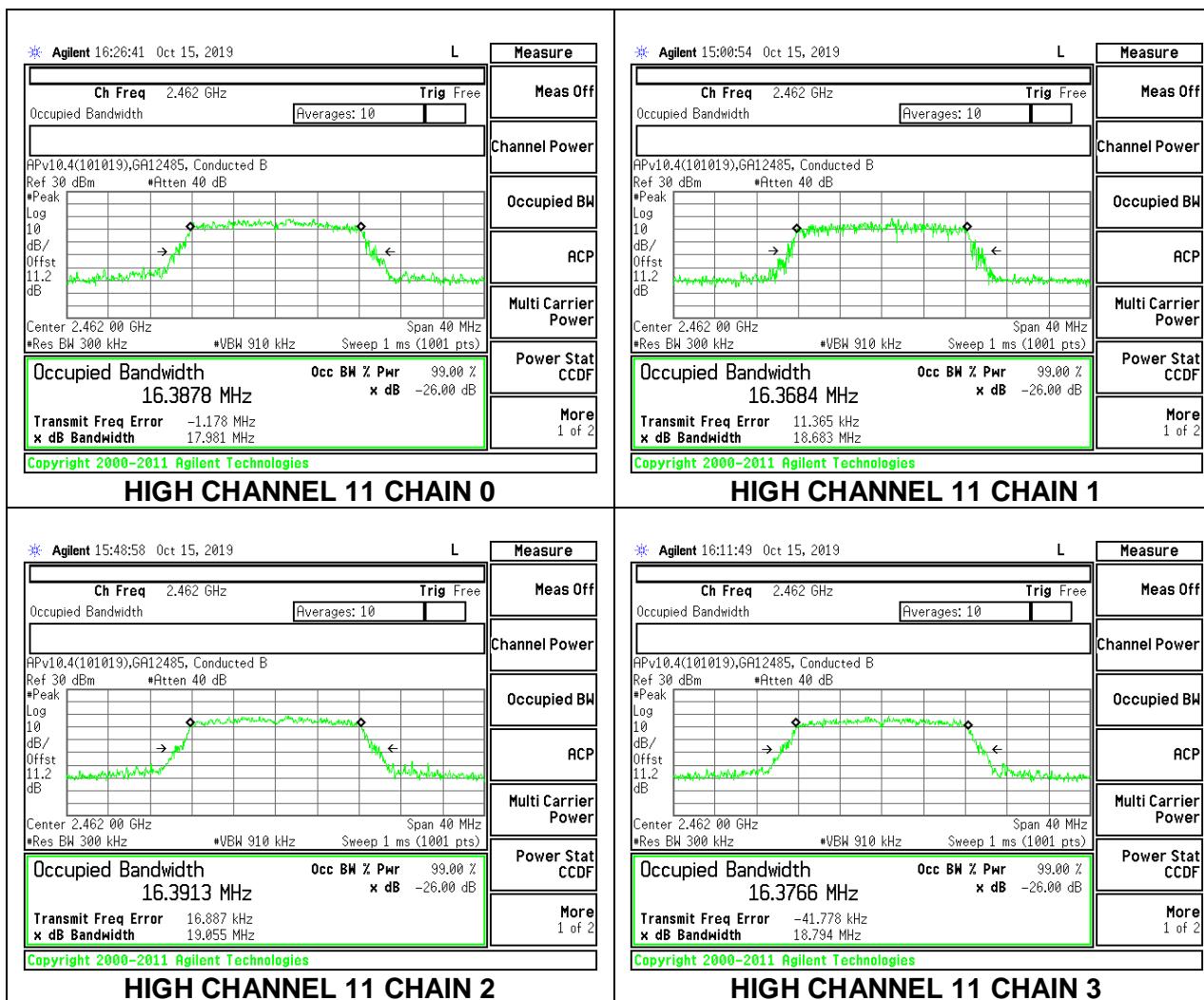
MID CHANNEL 6



HIGH CHANNEL 10



HIGH CHANNEL 11

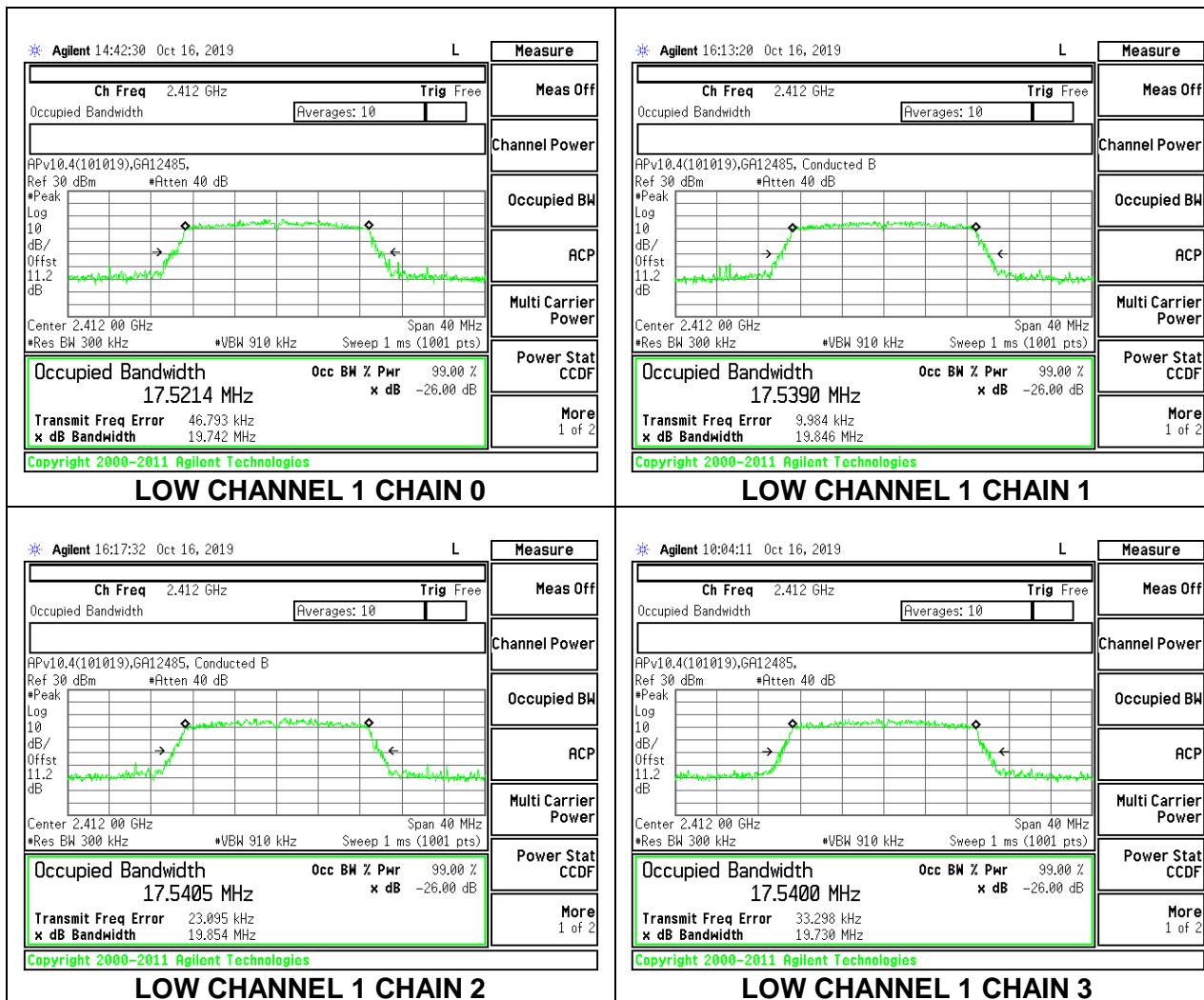


8.2.3. 802.11n HT20 MODE

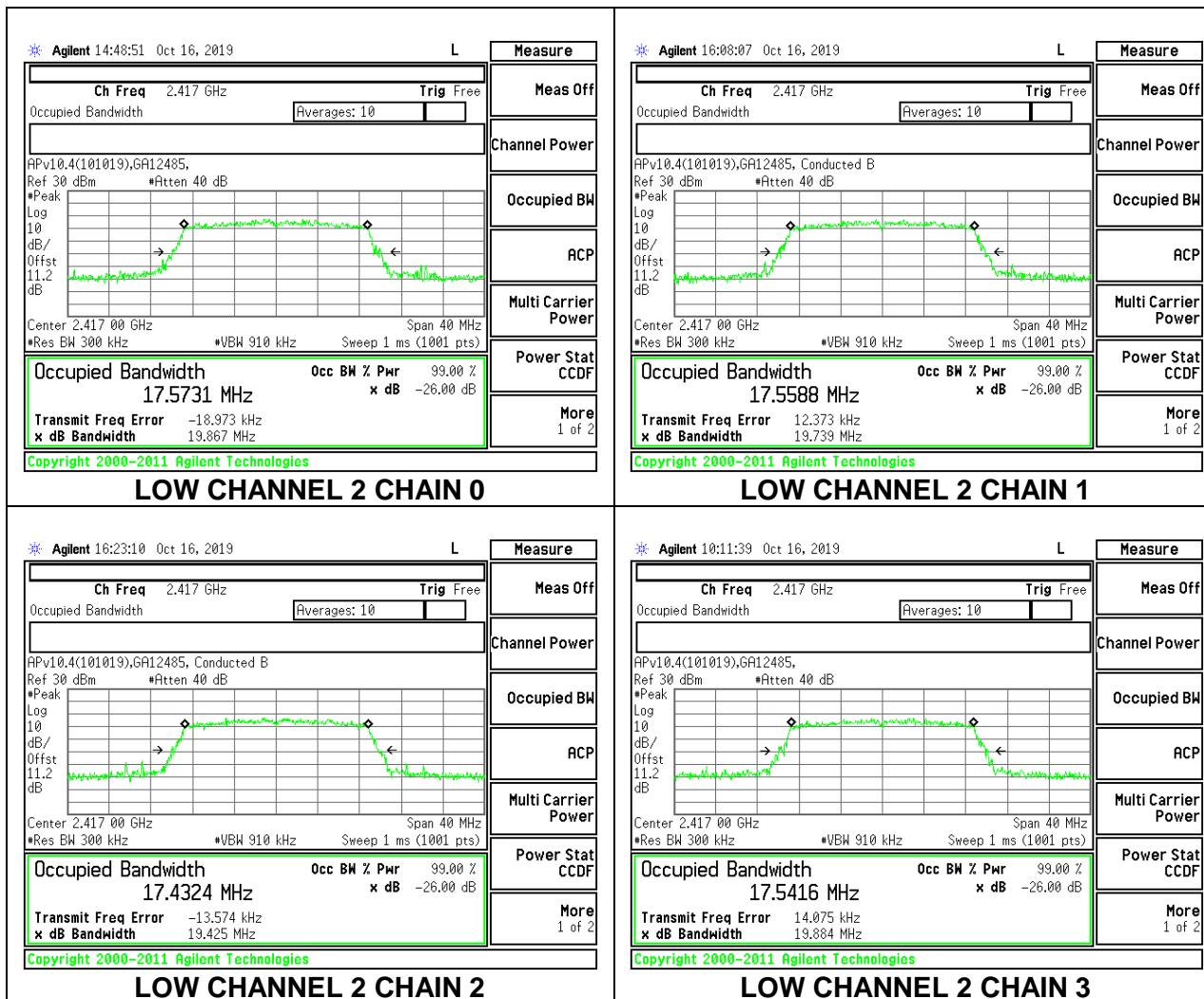
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)	99% Bandwidth Chain 3 (MHz)
Low 1	2412	17.5214	17.5390	17.5405	17.5400
Low 2	2417	17.5731	17.5588	17.4324	17.5416
Low 3	2422	17.3895	17.5140	17.5529	17.5431
Low 4	2427	17.4428	17.5934	17.6549	17.4896
Low 5	2432	17.7246	17.8365	17.7892	17.7739
Mid 6	2437	17.7582	17.7715	17.8187	17.7303
High 8	2447	17.7843	17.7845	17.7488	17.4711
High 9	2452	17.5658	17.5146	17.5369	17.5318
High 10	2457	17.5403	17.4993	17.5045	17.5746
High 11	2462	17.1855	17.5786	17.3717	17.5889

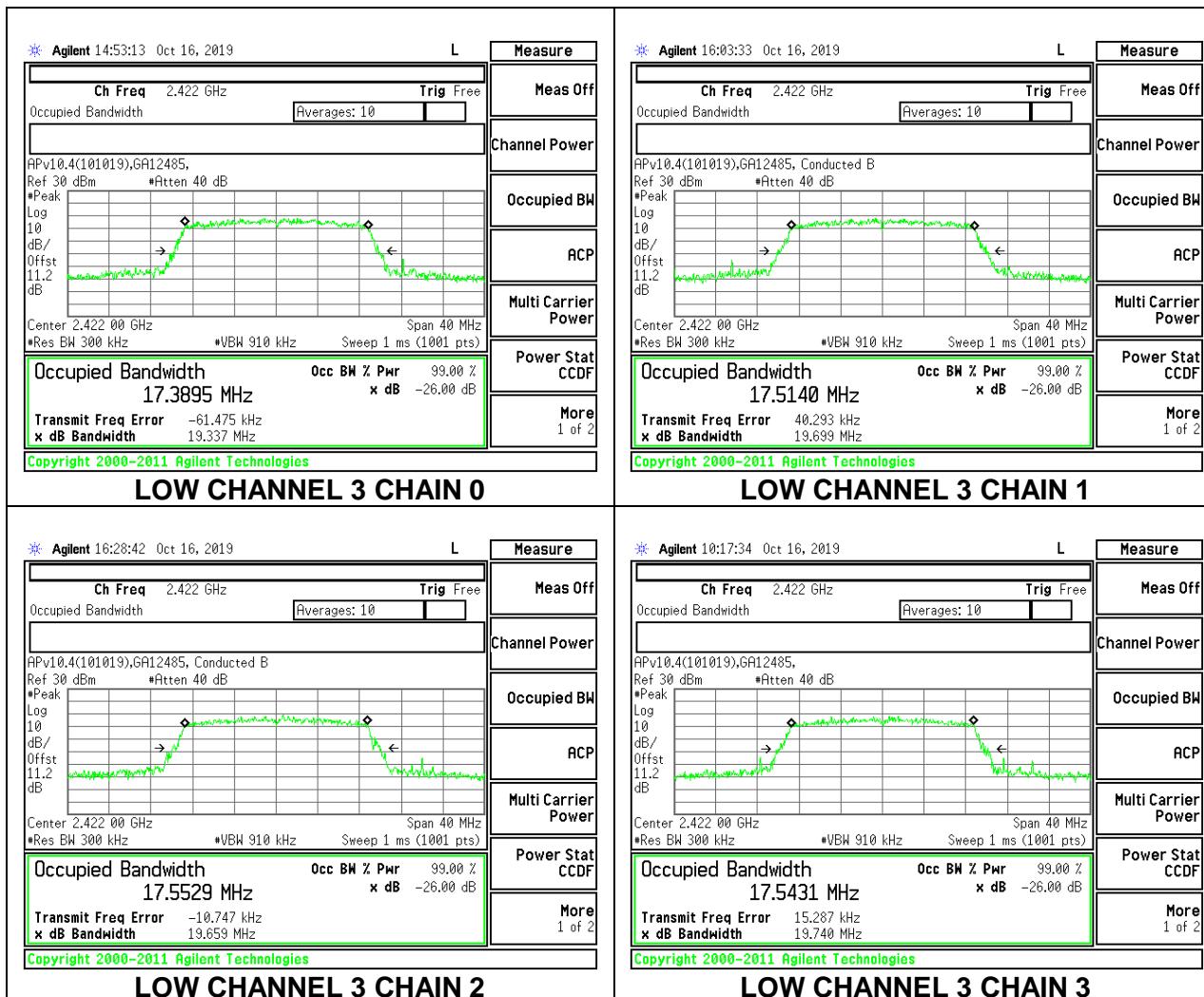
LOW CHANNEL 1



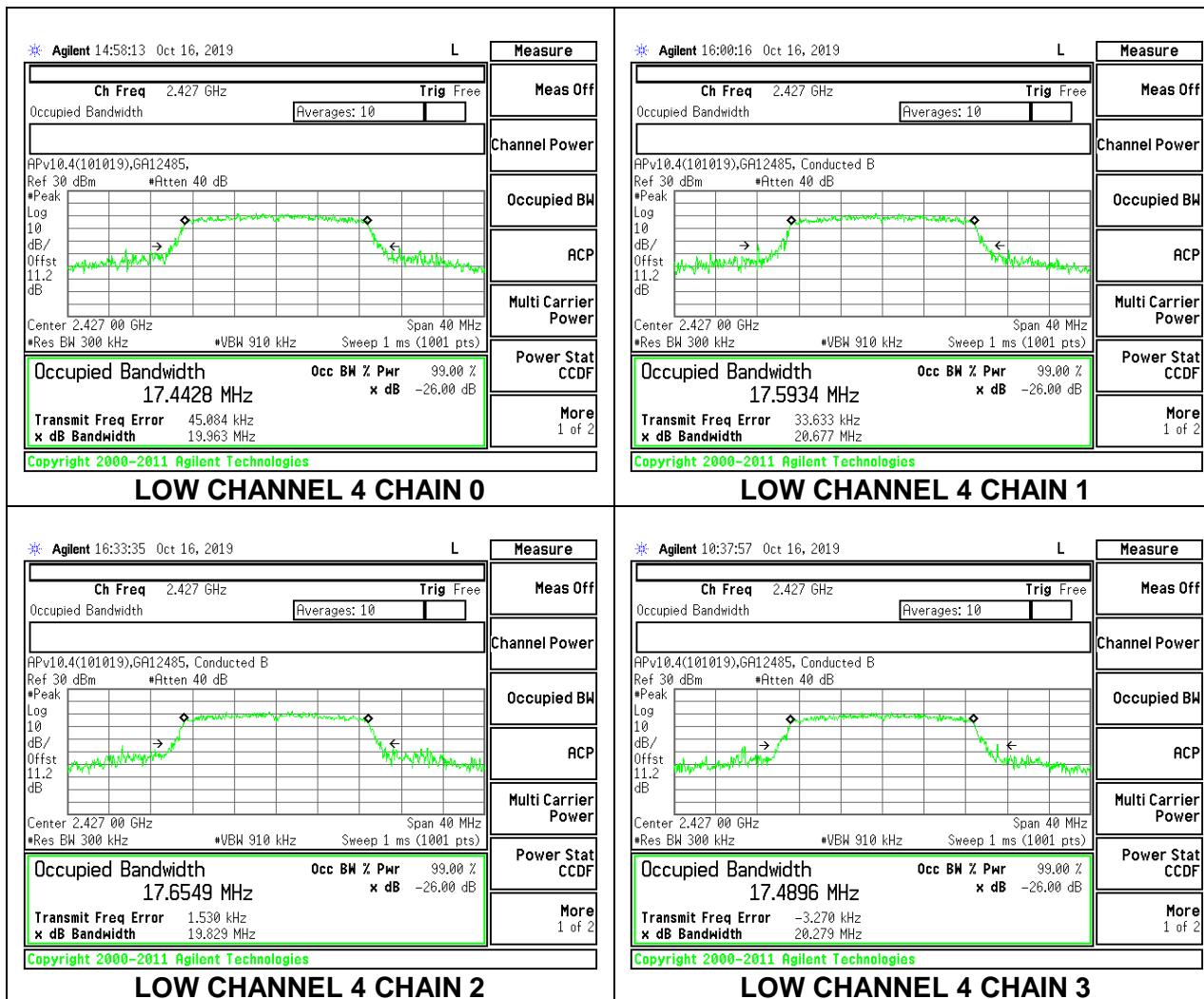
LOW CHANNEL 2



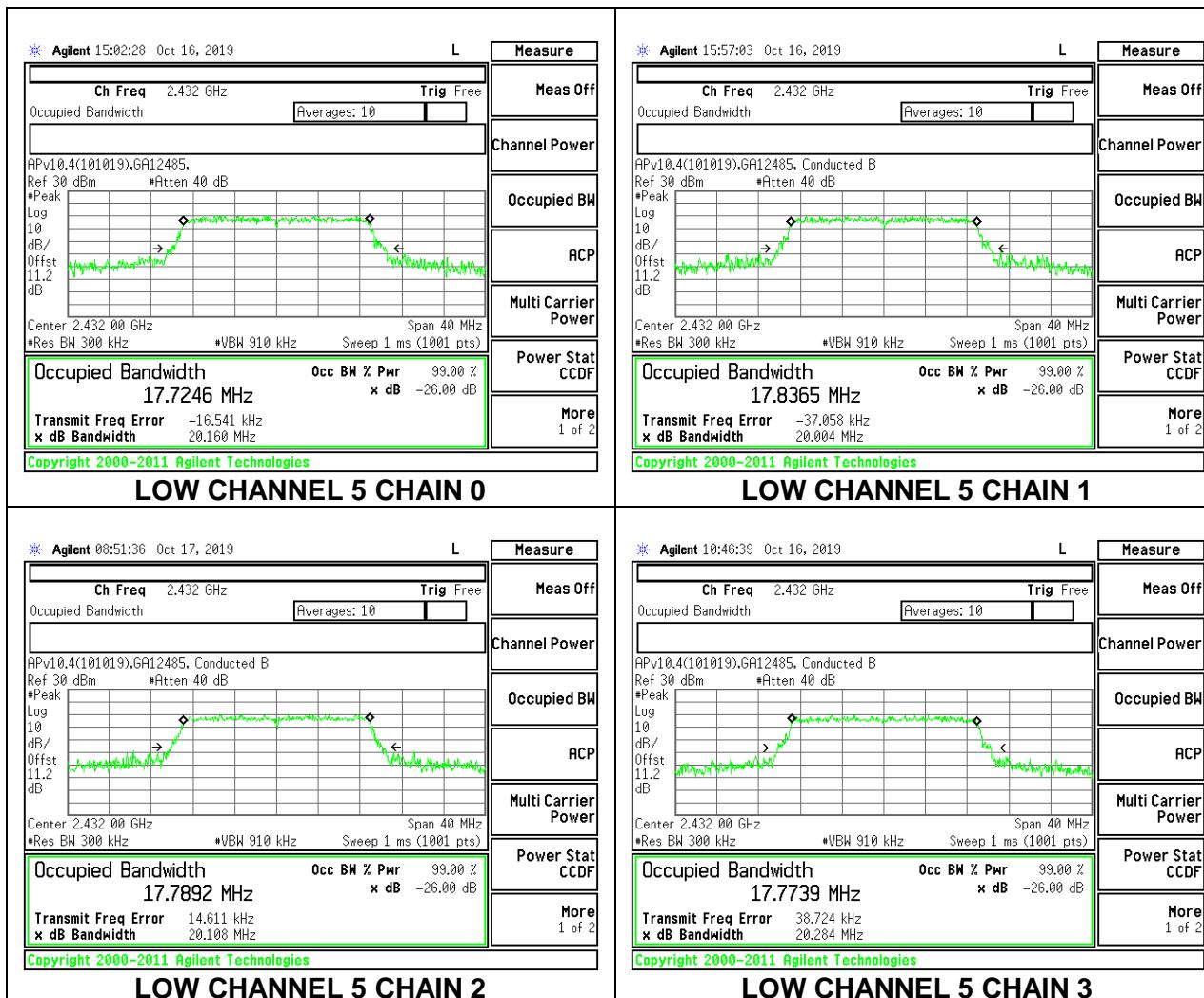
LOW CHANNEL 3



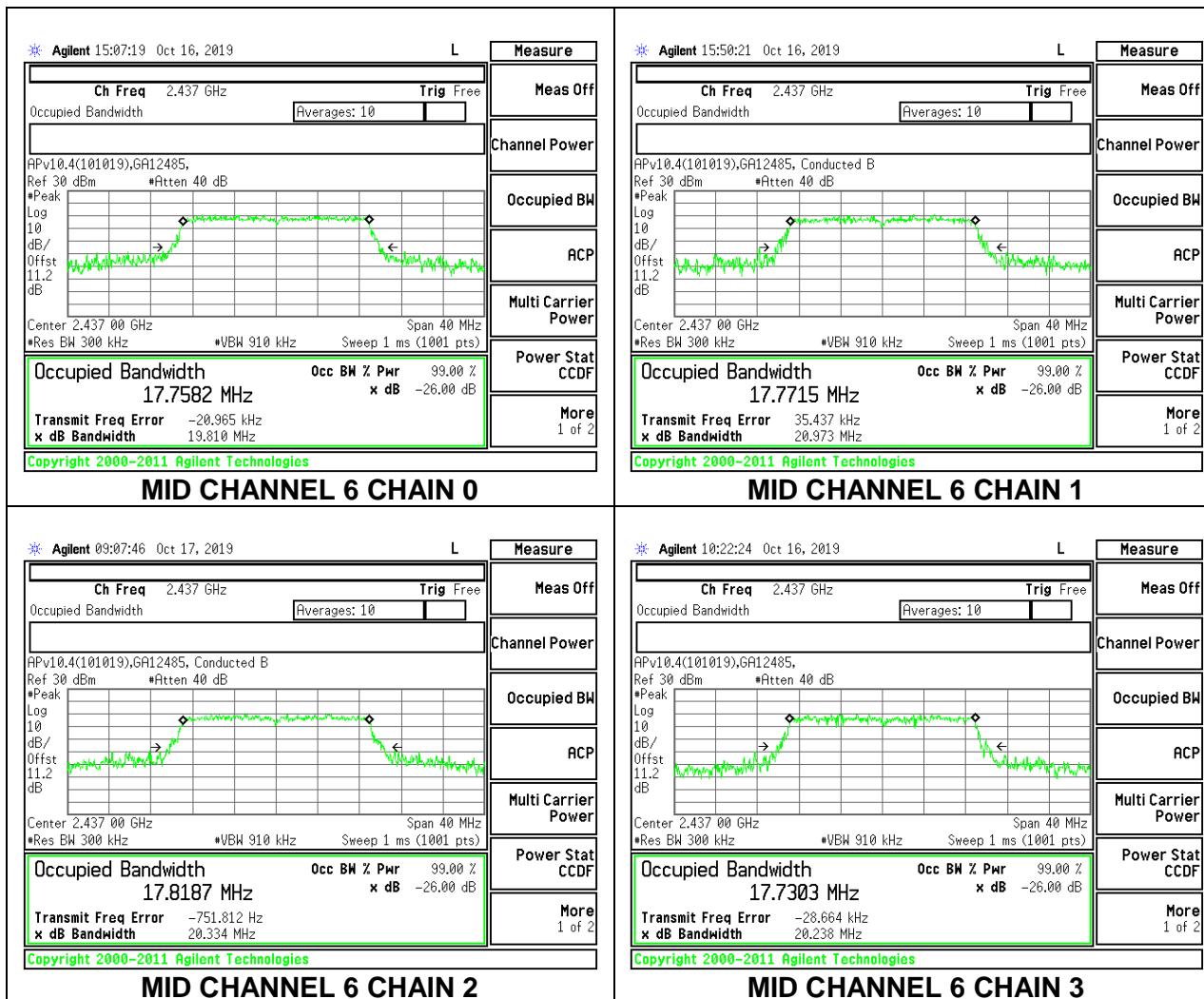
LOW CHANNEL 4



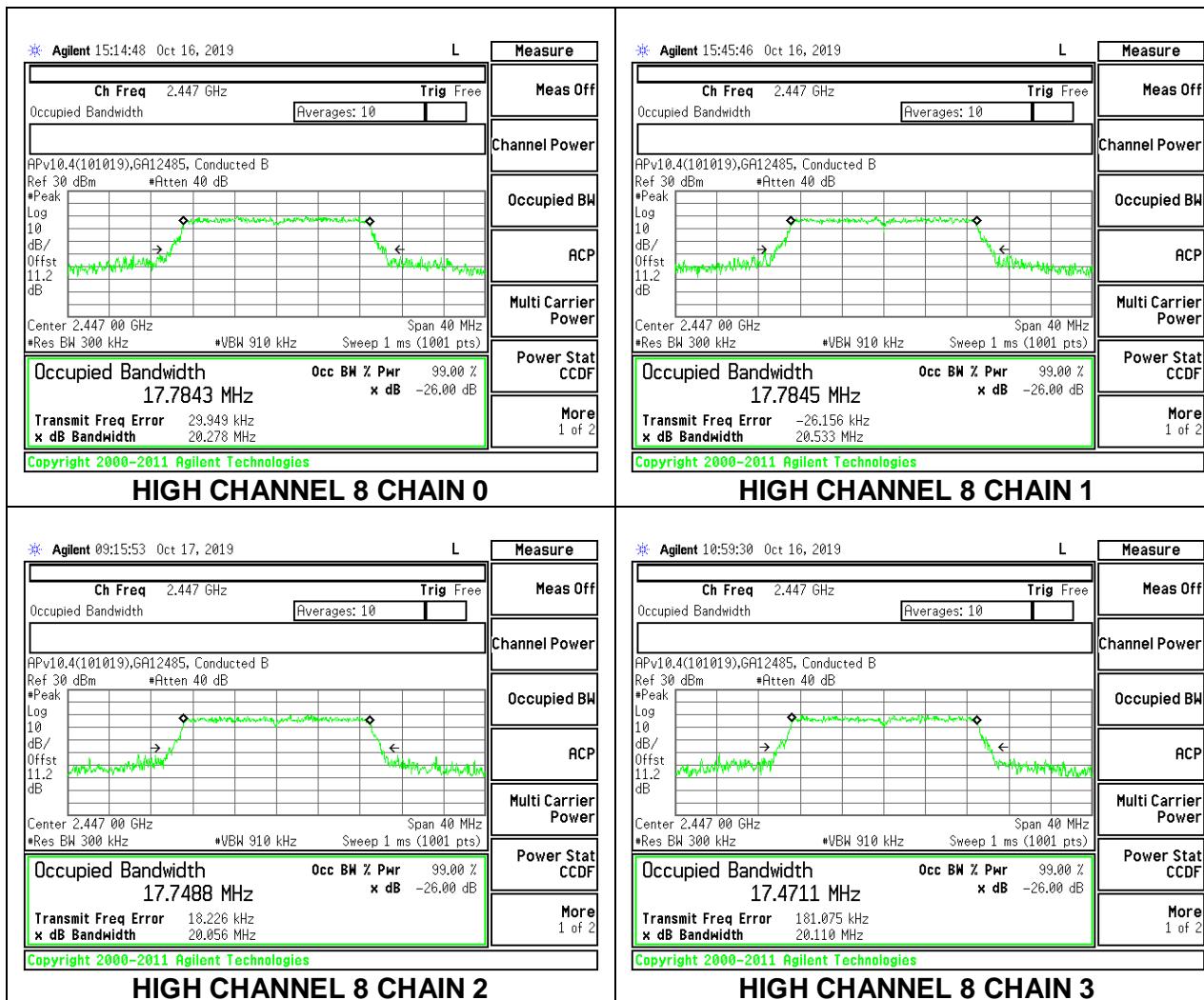
LOW CHANNEL 5



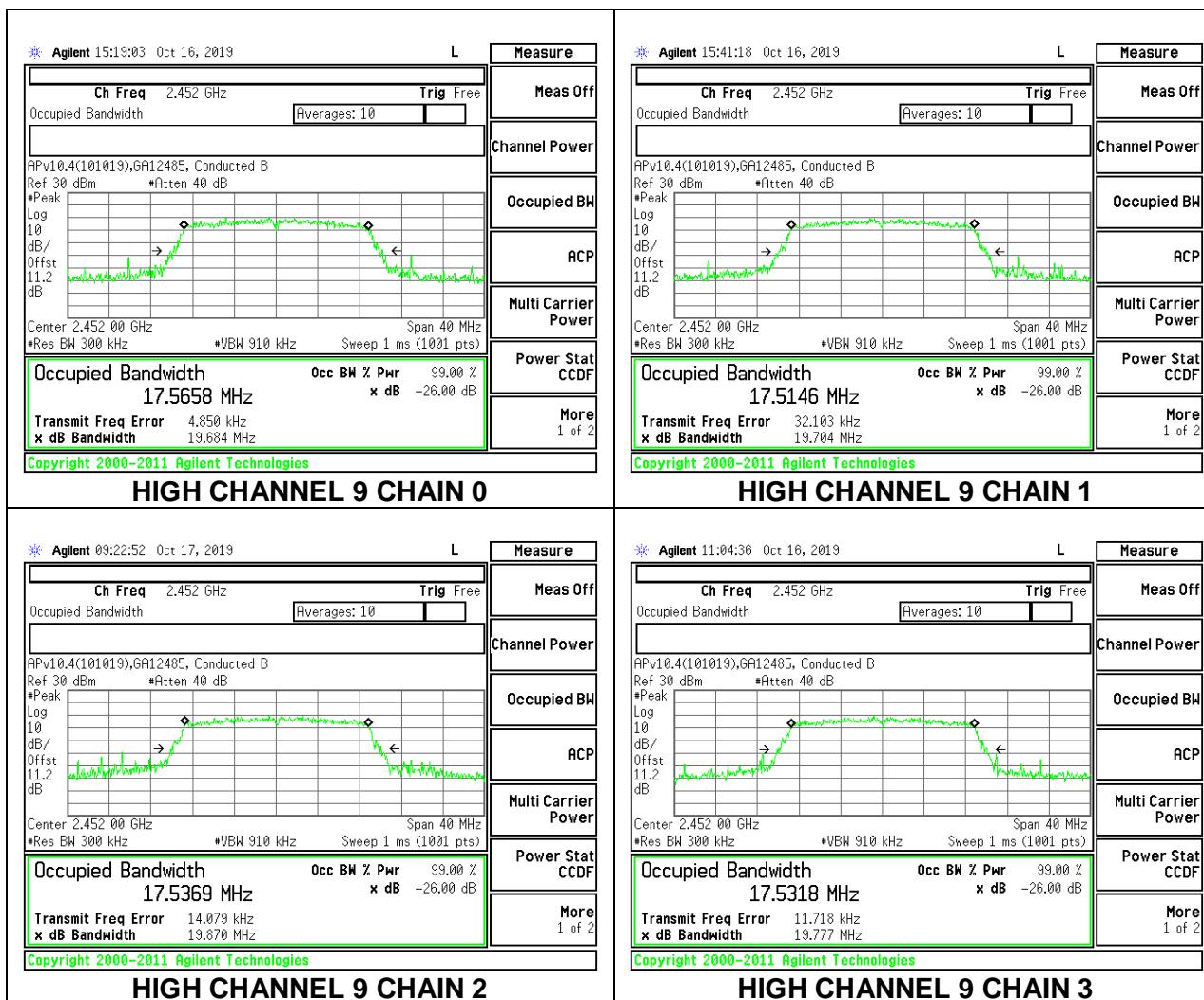
MID CHANNEL 6



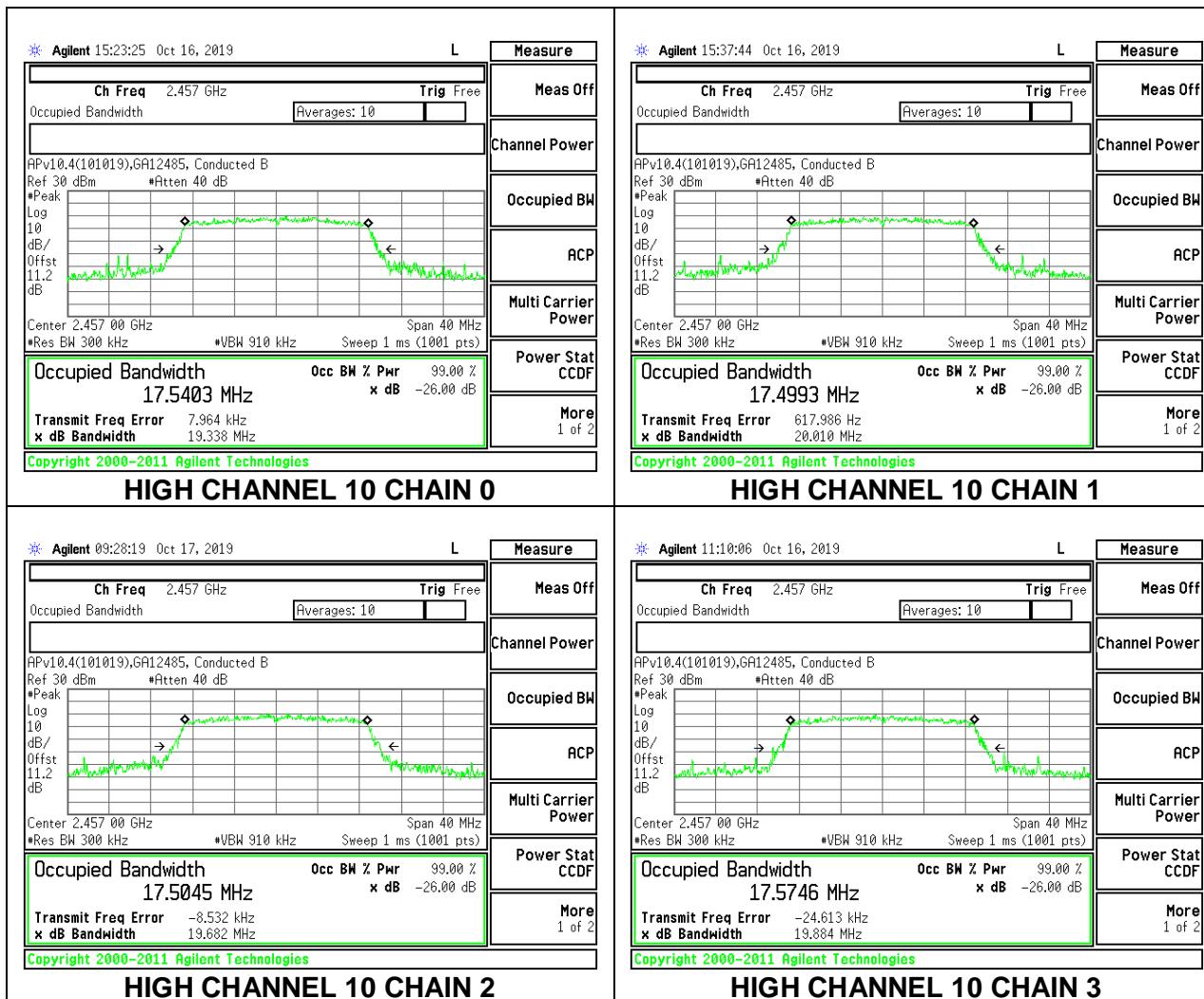
HIGH CHANNEL 8



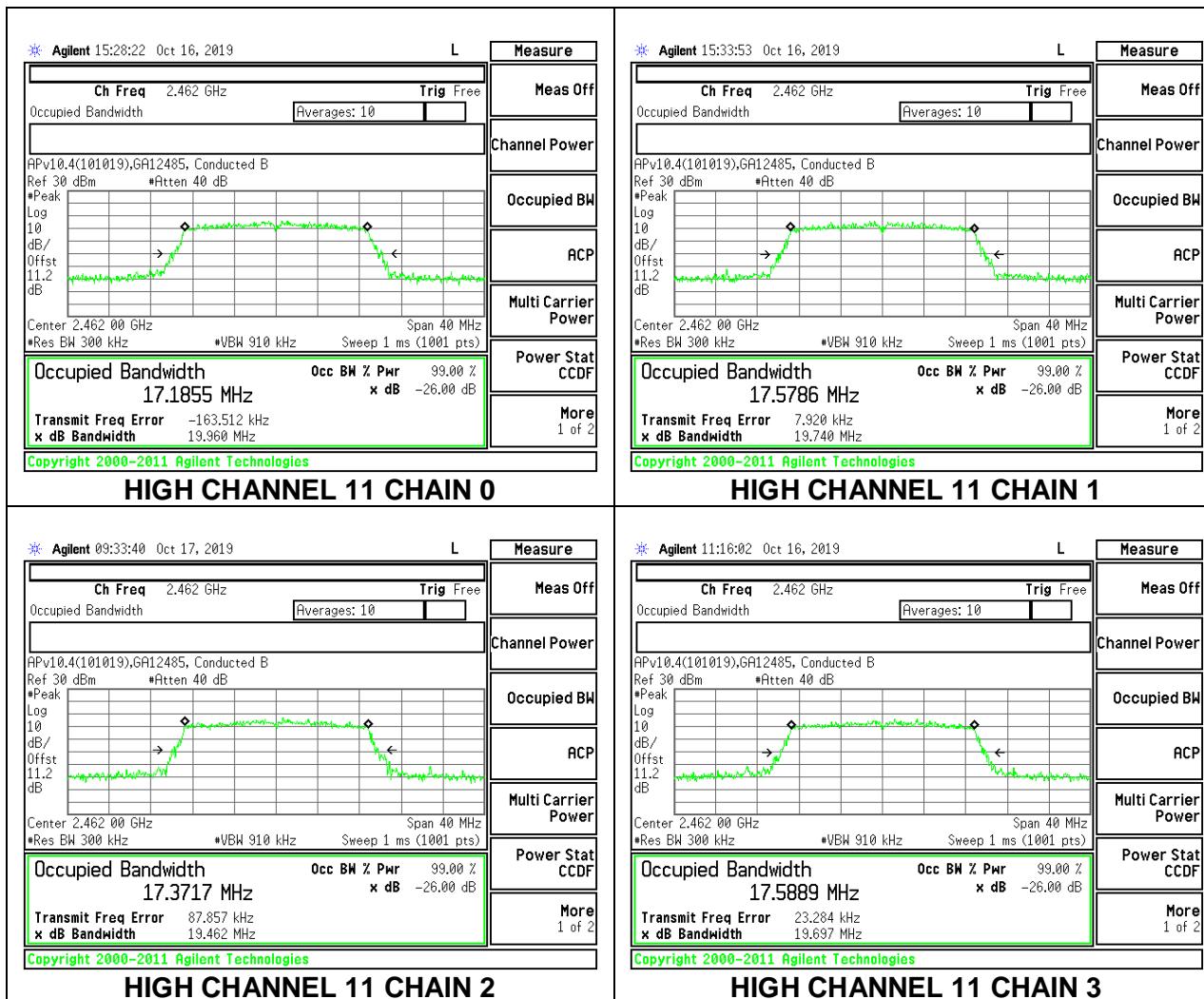
HIGH CHANNEL 9



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.

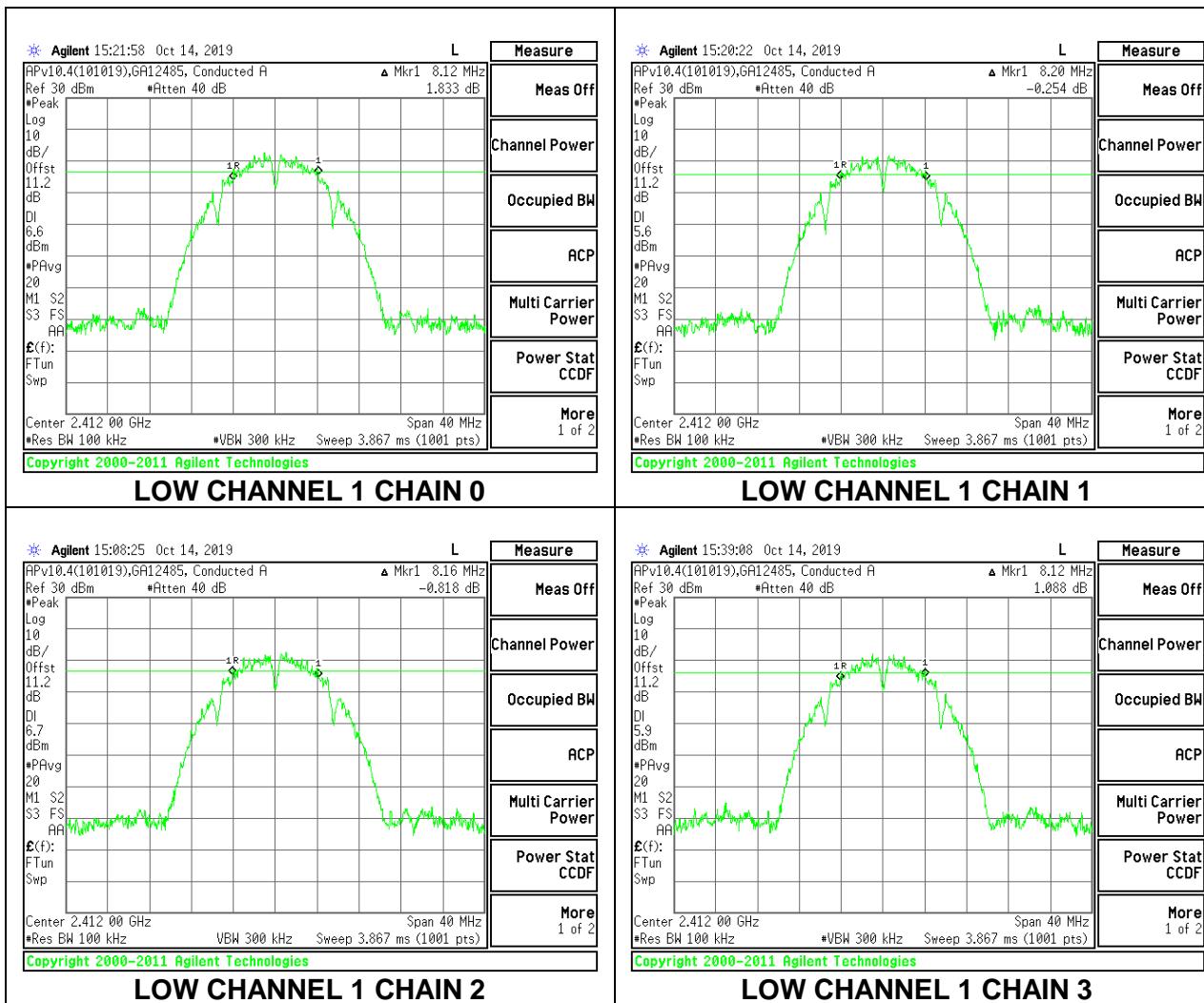
RESULTS

8.3.1. 802.11b MODE

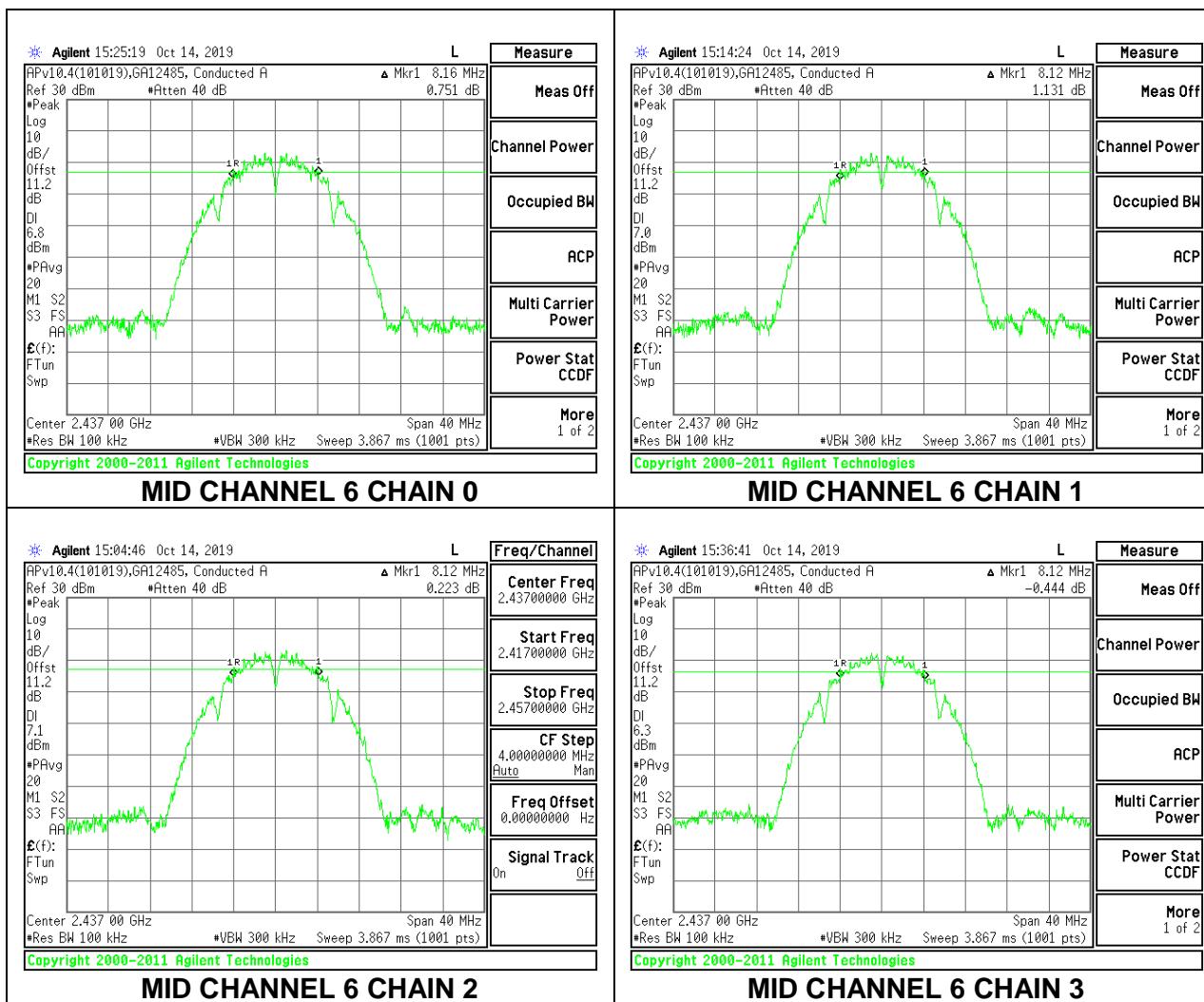
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	6 dB BW Chain 3 (MHz)	Minimum Limit (MHz)
Low 1	2412	8.12	8.20	8.16	8.12	0.5
Mid 6	2437	8.16	8.12	8.12	8.12	0.5
High 11	2462	8.16	8.16	8.12	8.12	0.5

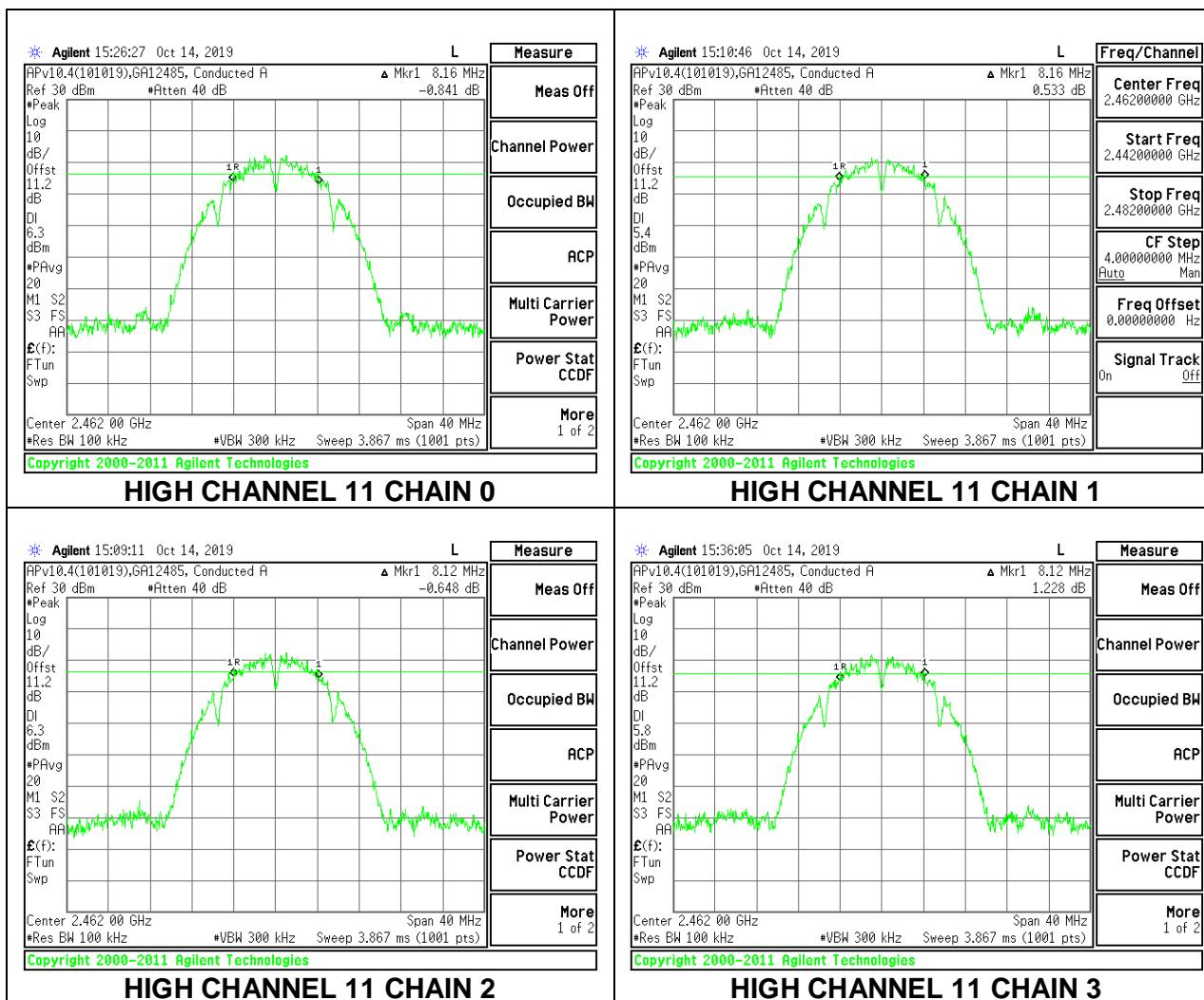
LOW CHANNEL 1



MID CHANNEL 6



HIGH CHANNEL 11

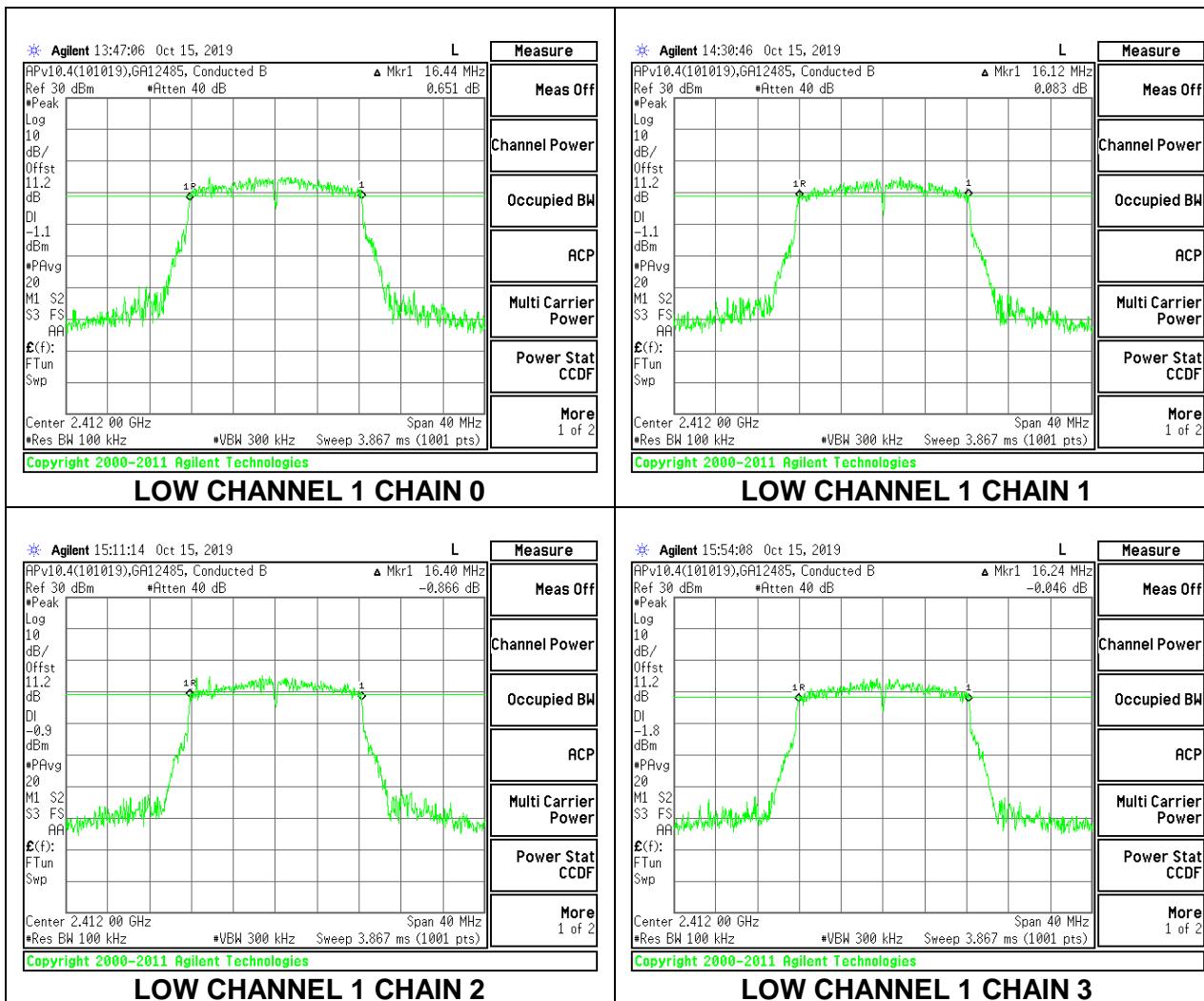


8.3.2. 802.11g MODE

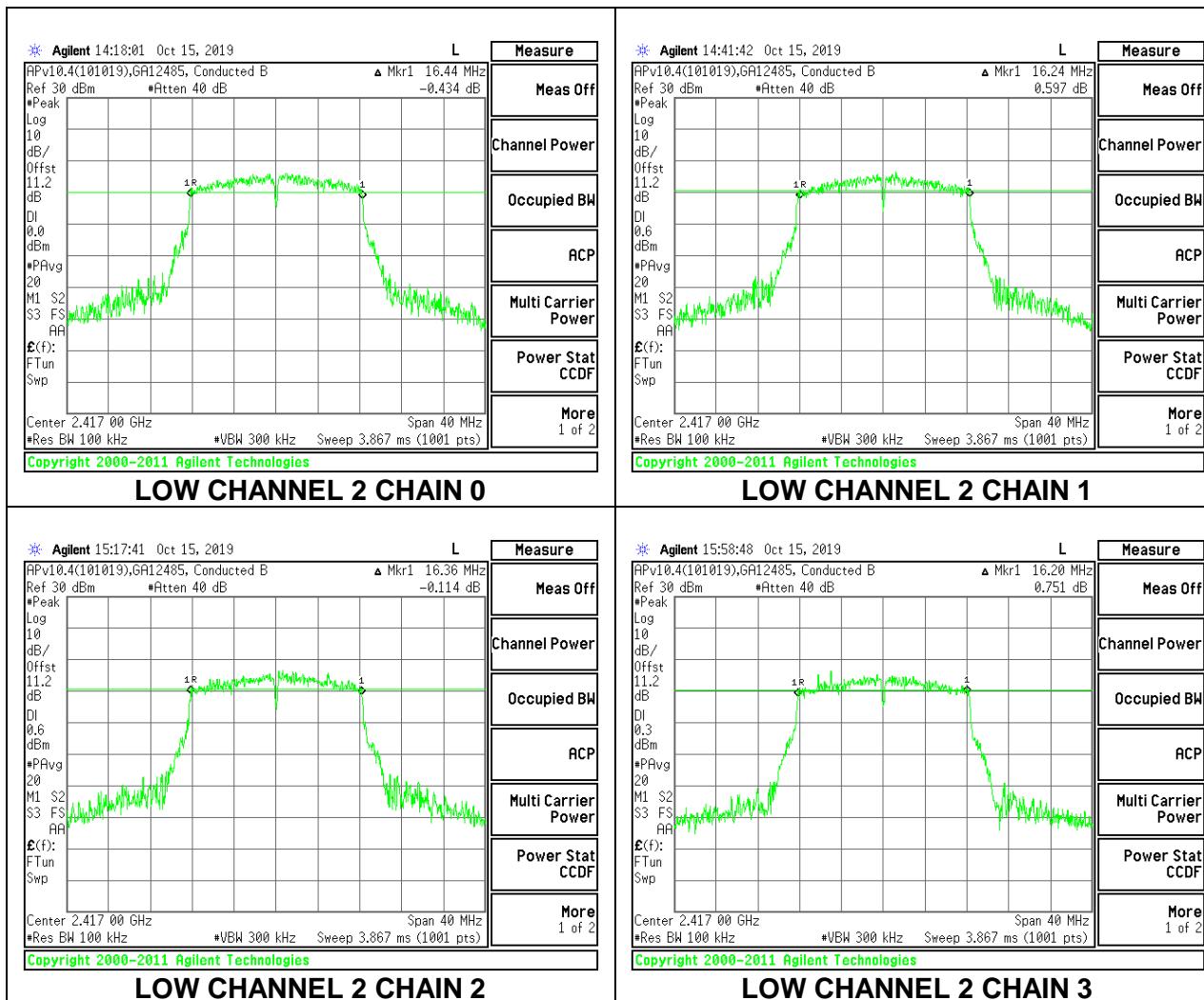
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	6 dB BW Chain 3 (MHz)	Minimum Limit (MHz)
Low 1	2412	16.44	16.12	16.40	16.24	0.5
Low 2	2417	16.44	16.24	16.36	16.20	0.5
Mid 6	2437	16.56	16.44	16.36	16.60	0.5
High 10	2457	16.44	16.40	16.40	16.20	0.5
High 11	2462	16.36	16.36	16.04	16.08	0.5

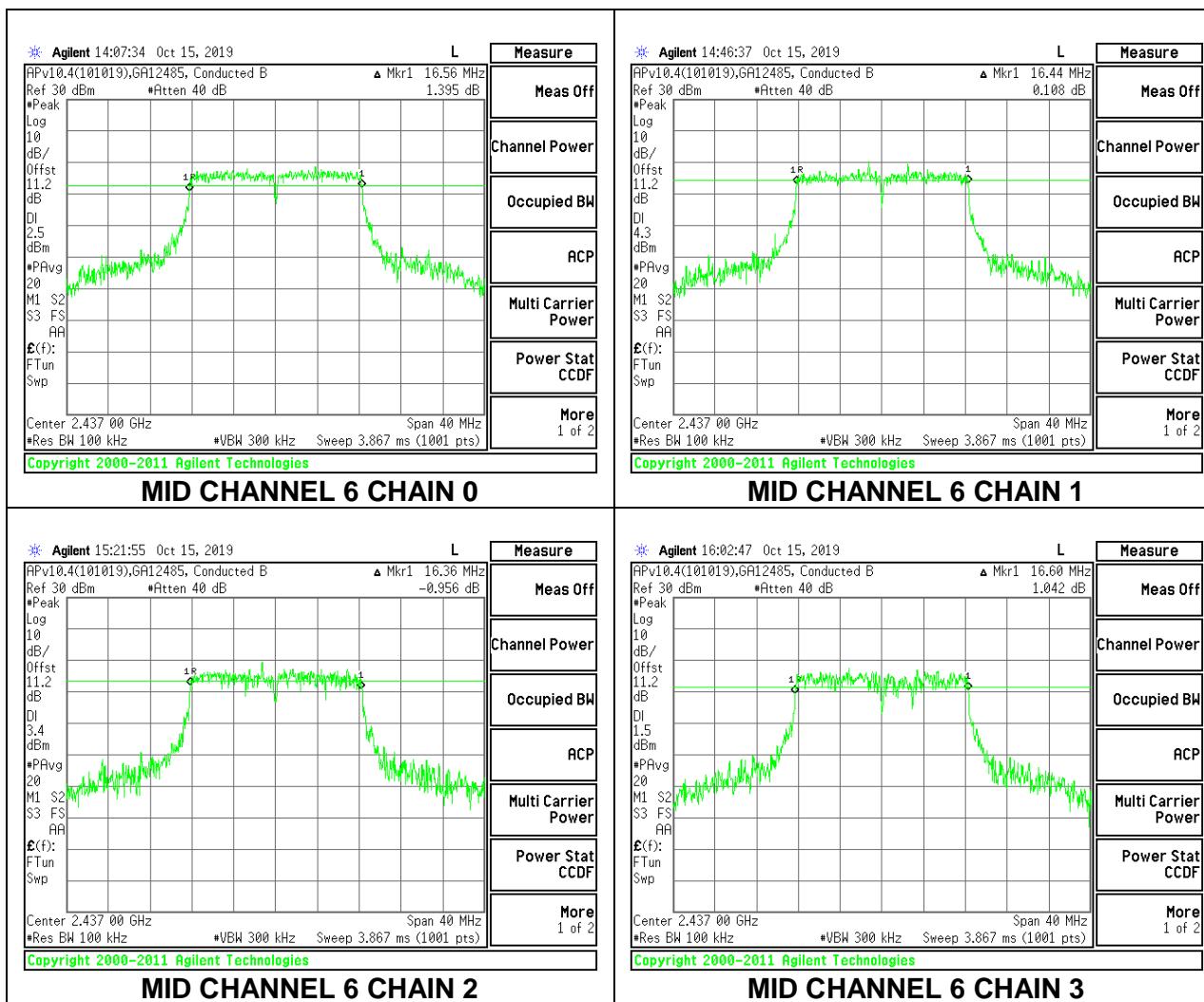
LOW CHANNEL 1



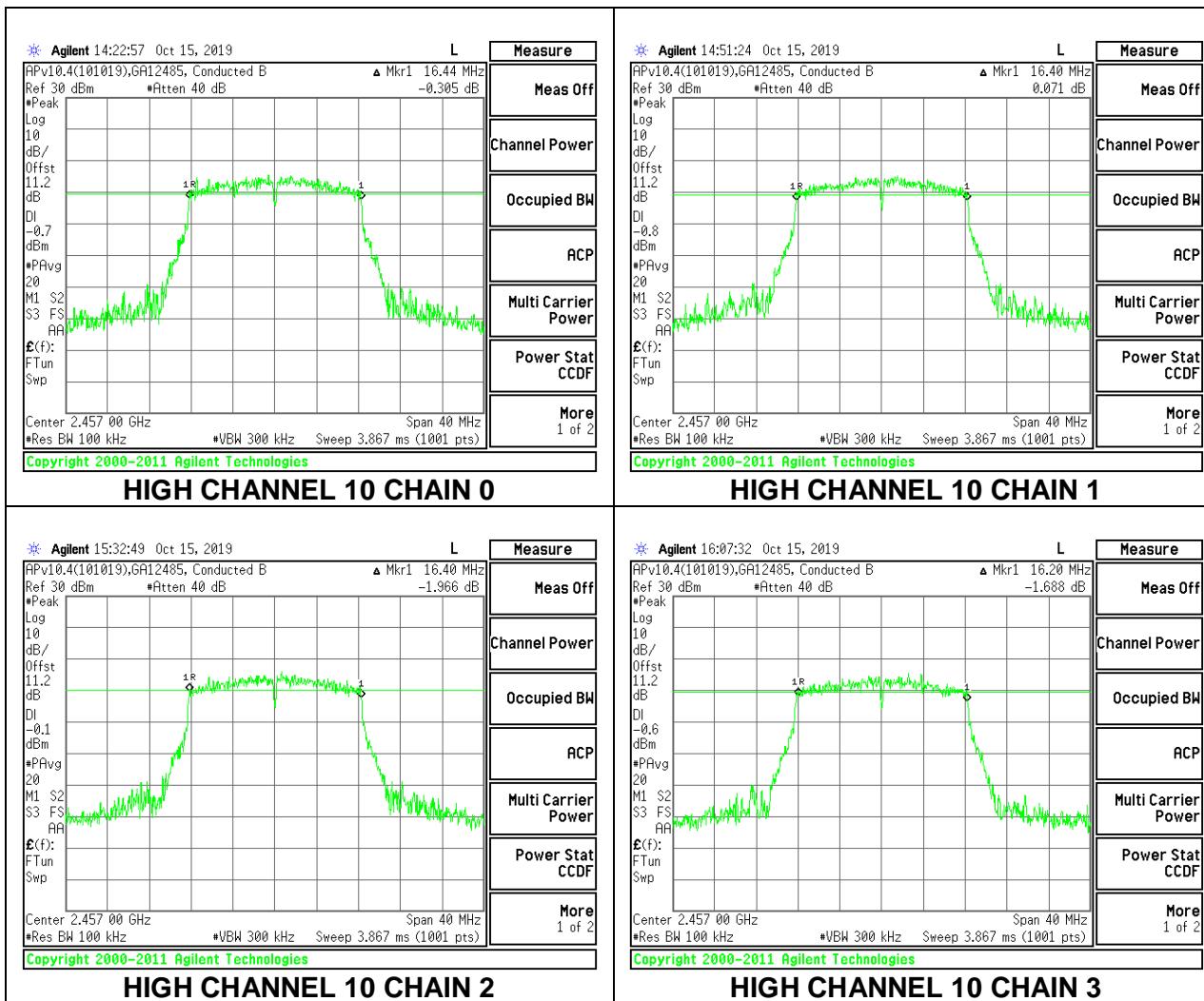
LOW CHANNEL 2



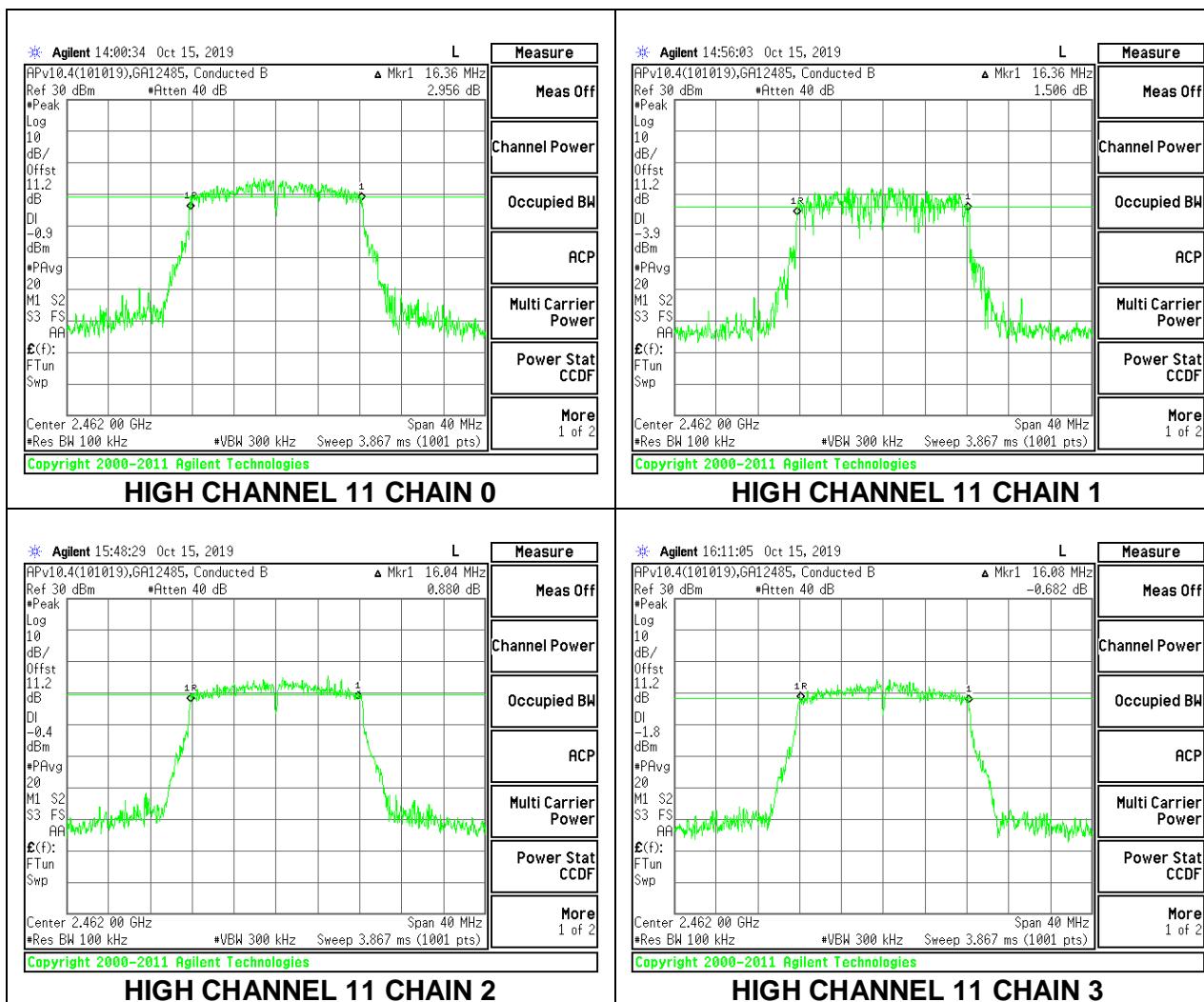
MID CHANNEL 6



HIGH CHANNEL 10



HIGH CHANNEL 11

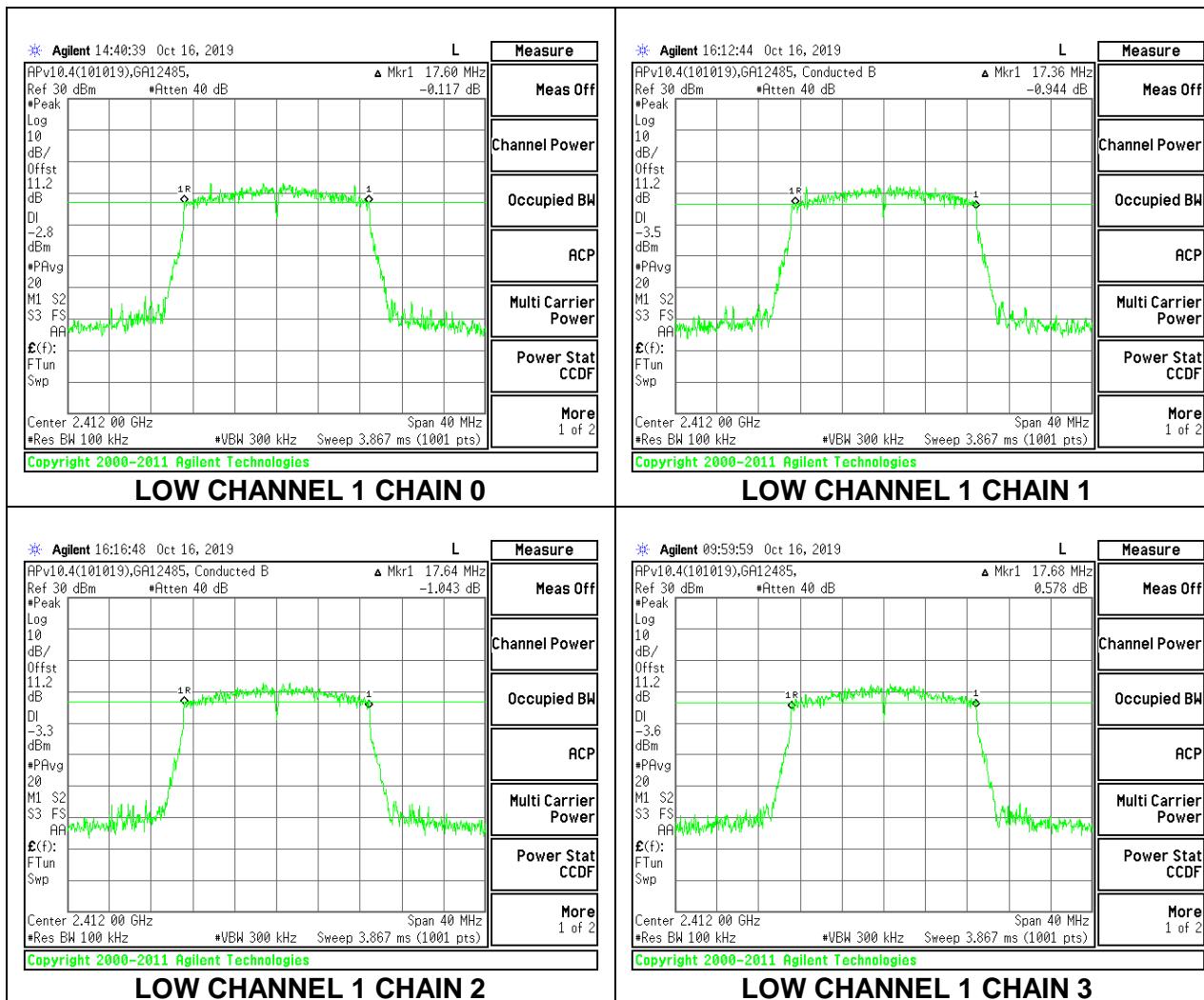


8.3.3. 802.11n HT20 MODE

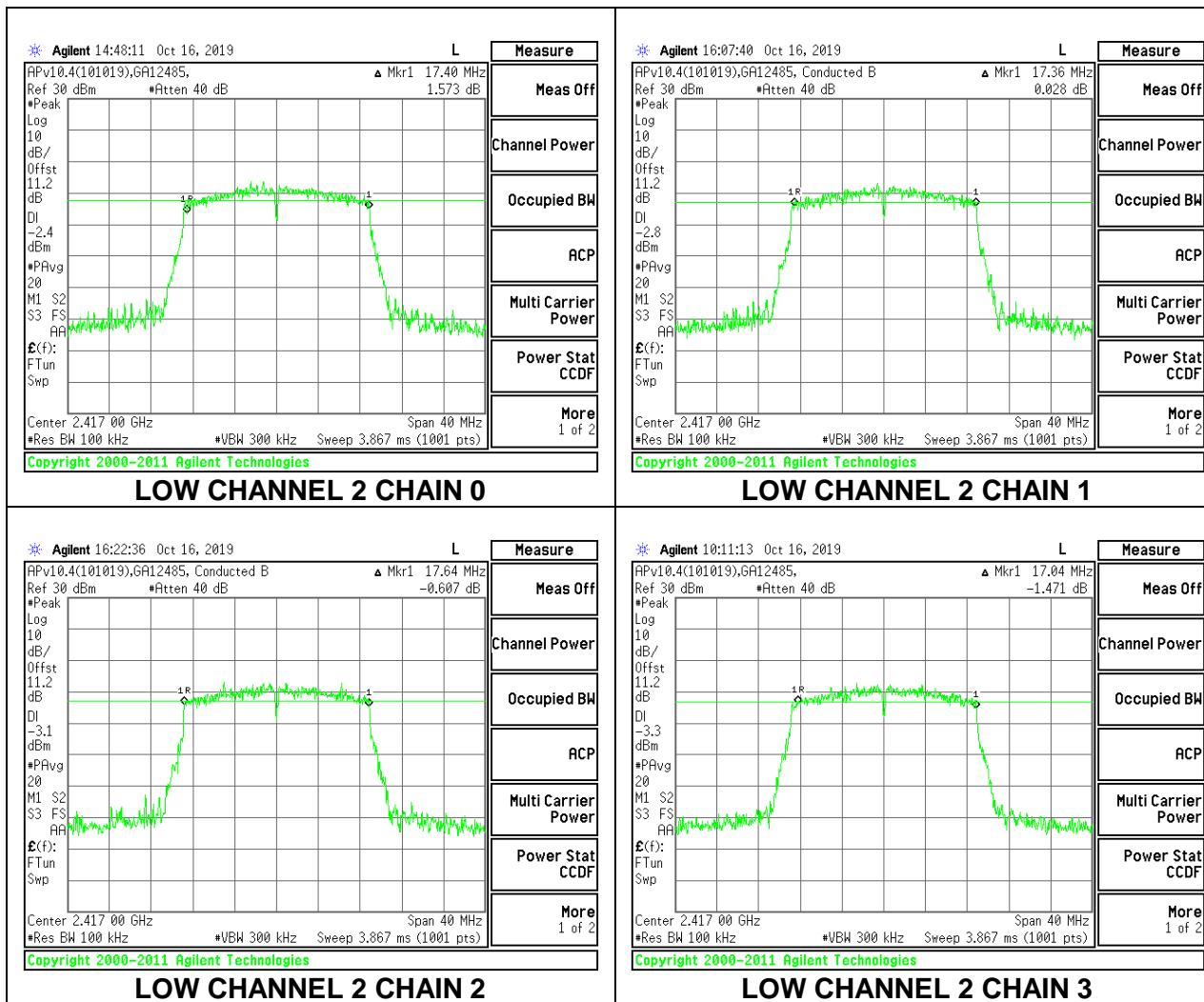
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

	(MHz)	Chain 0 (MHz)	Chain 1 (MHz)	Chain 2 (MHz)	Chain 3 (MHz)	Limit (MHz)
Low 1	2412	17.60	17.36	17.64	17.68	0.5
Low 2	2417	17.40	17.36	17.64	17.04	0.5
Low 3	2422	17.60	17.72	17.08	17.24	0.5
Low 4	2427	17.64	17.64	17.56	17.00	0.5
Low 5	2432	17.84	17.72	17.72	17.84	0.5
Mid 6	2437	17.40	17.76	17.72	17.44	0.5
High 8	2447	17.68	17.68	17.68	17.76	0.5
High 9	2452	17.44	17.16	17.00	17.00	0.5
High 10	2457	17.68	17.68	17.52	17.20	0.5
High 11	2462	17.00	17.60	17.40	17.68	0.5

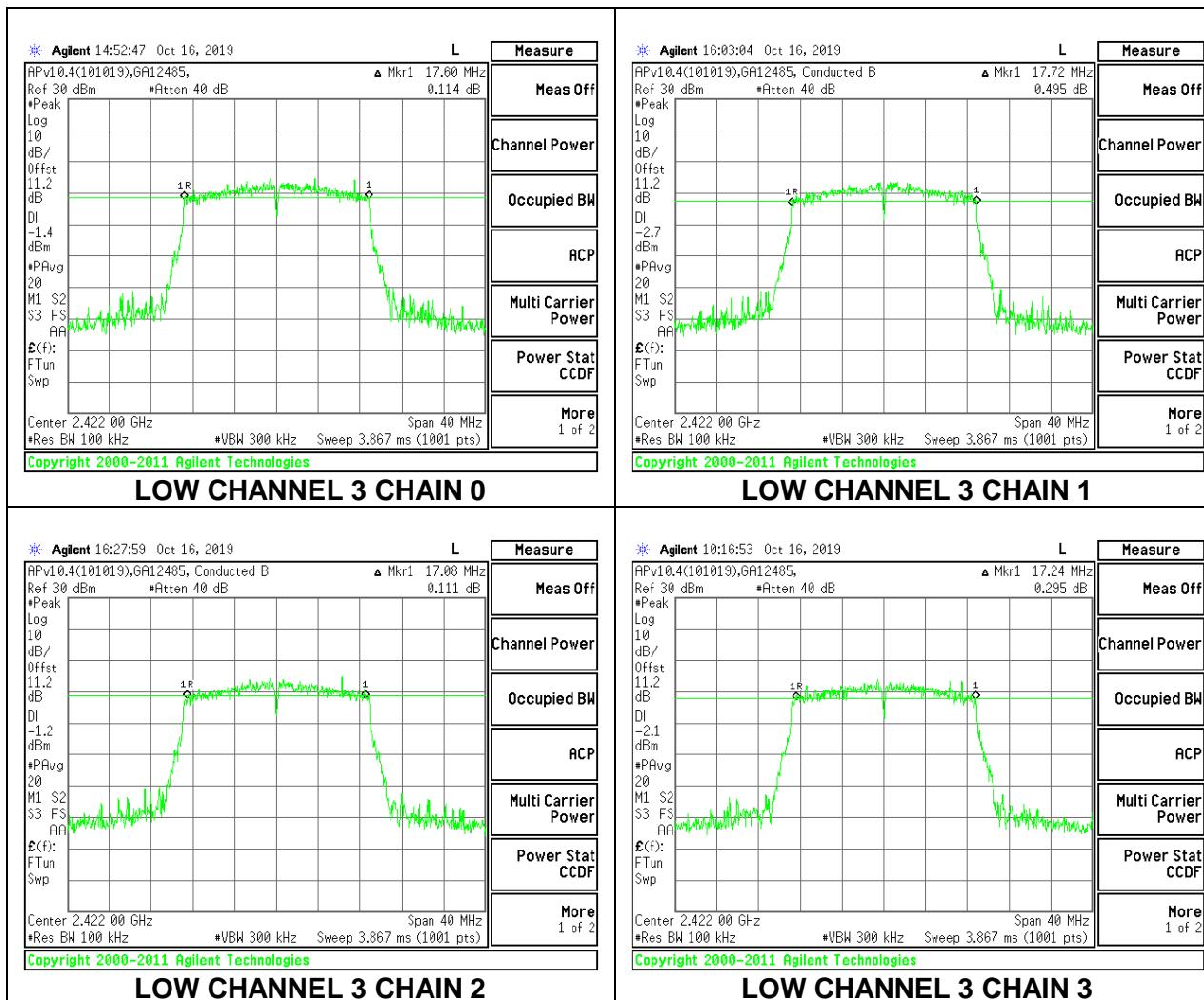
LOW CHANNEL 1



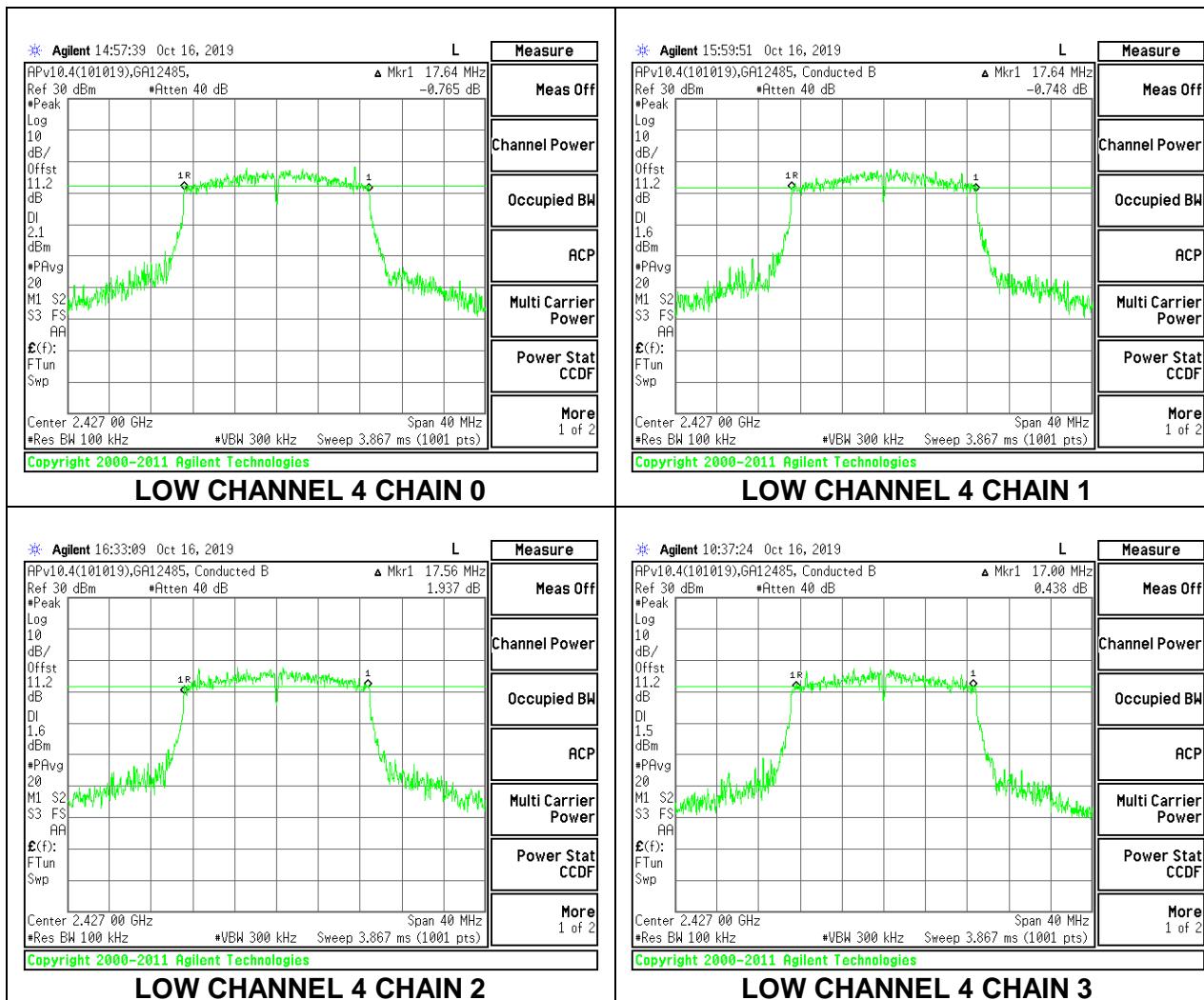
LOW CHANNEL 2



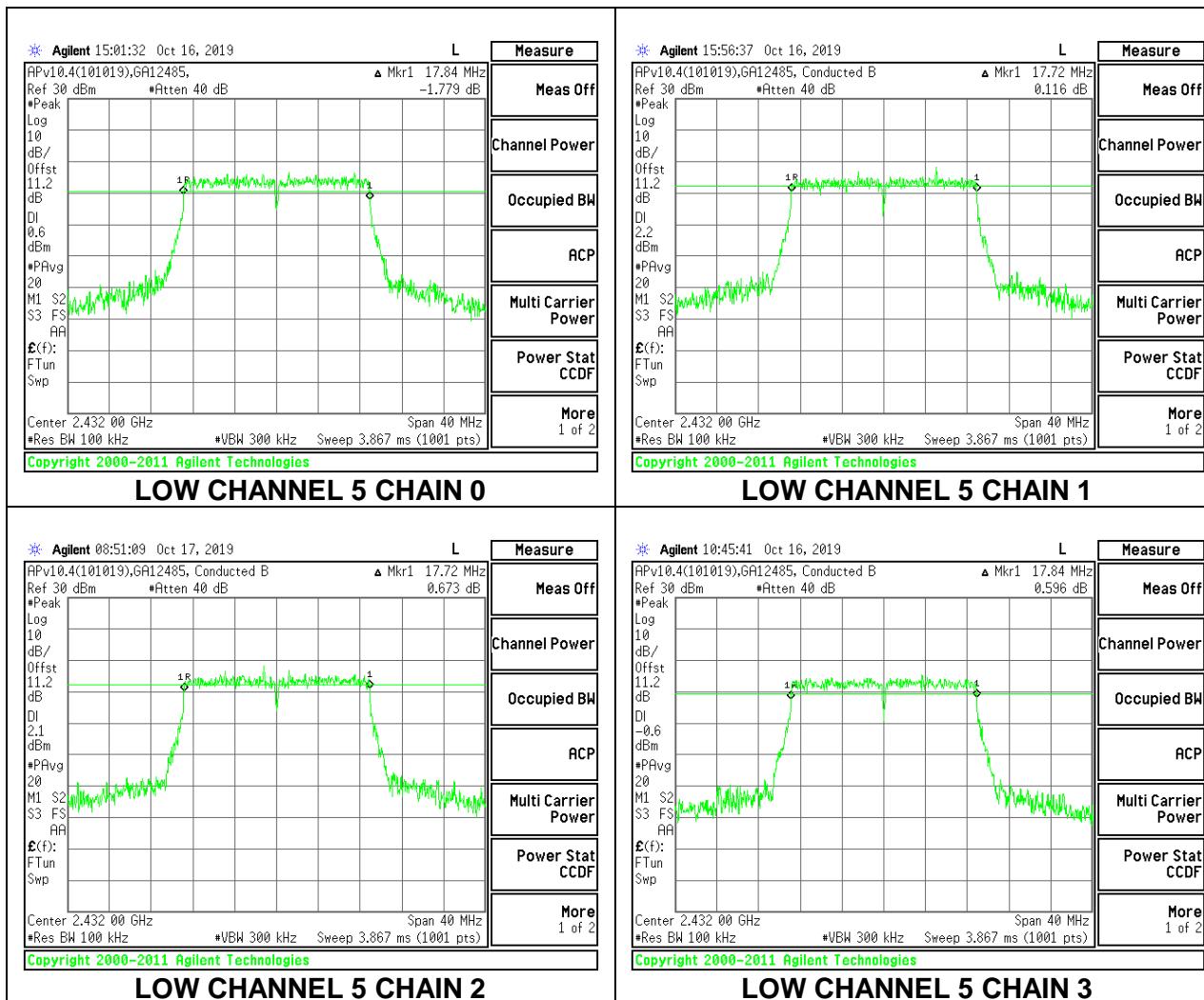
LOW CHANNEL 3



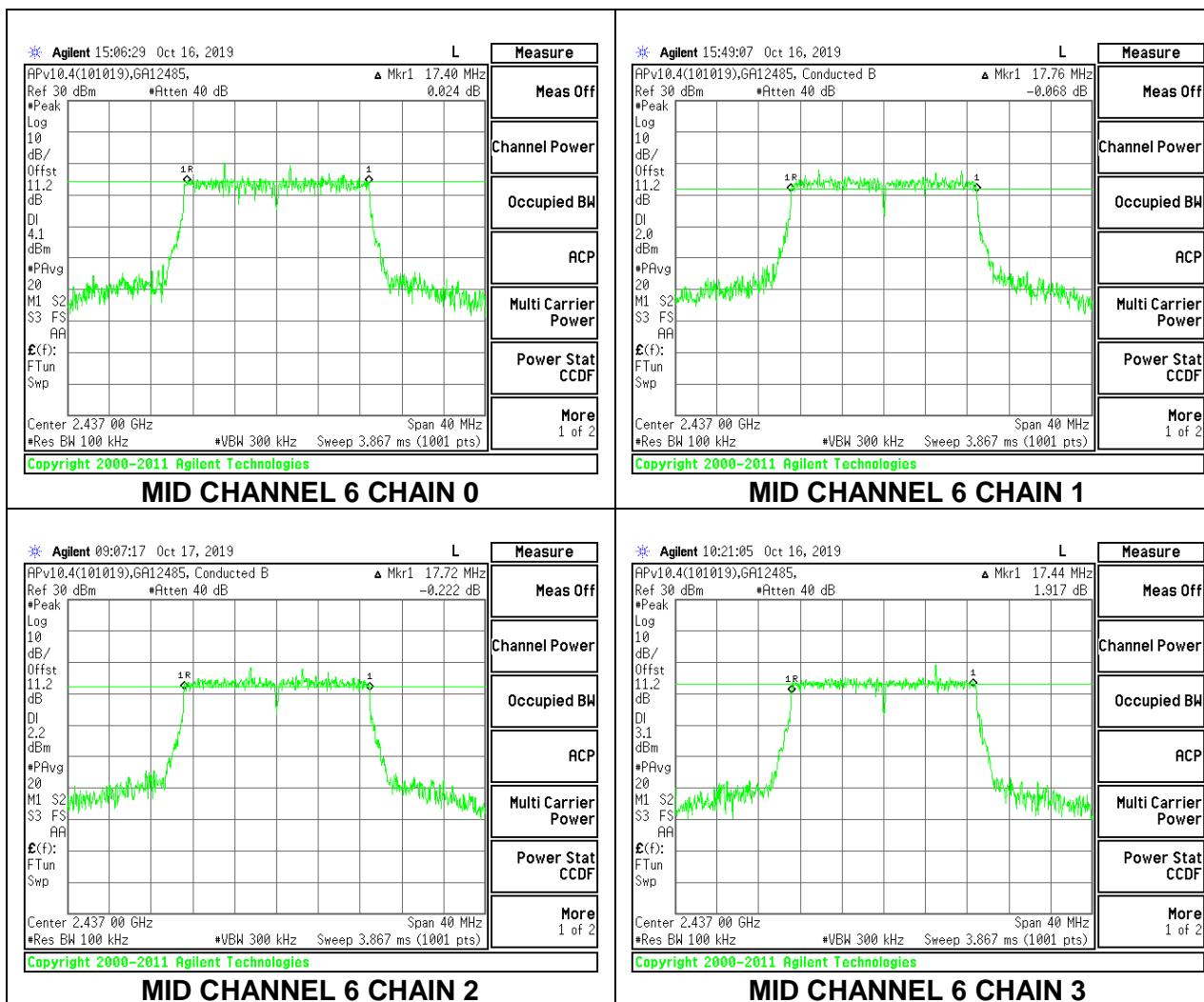
LOW CHANNEL 4



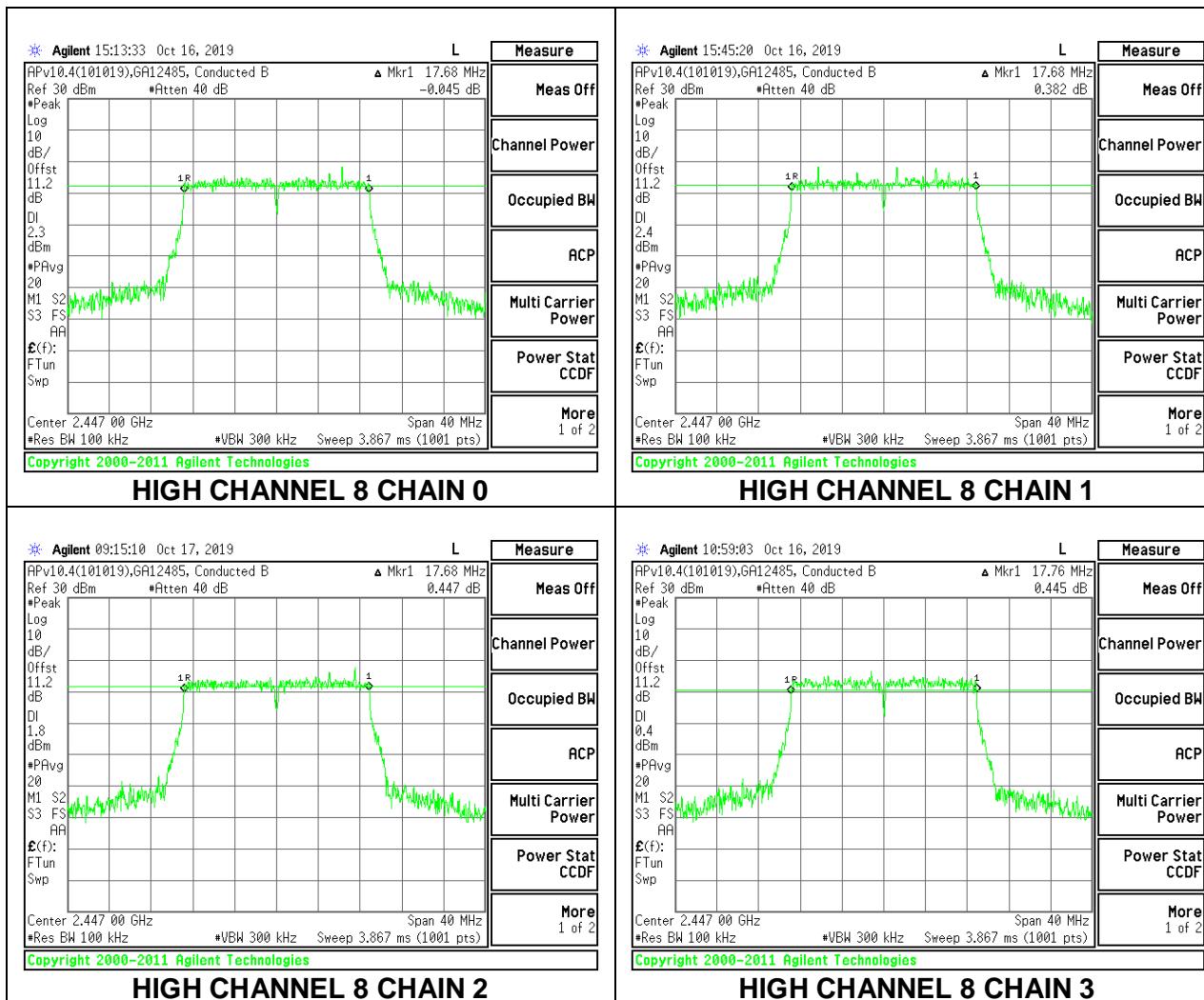
LOW CHANNEL 5



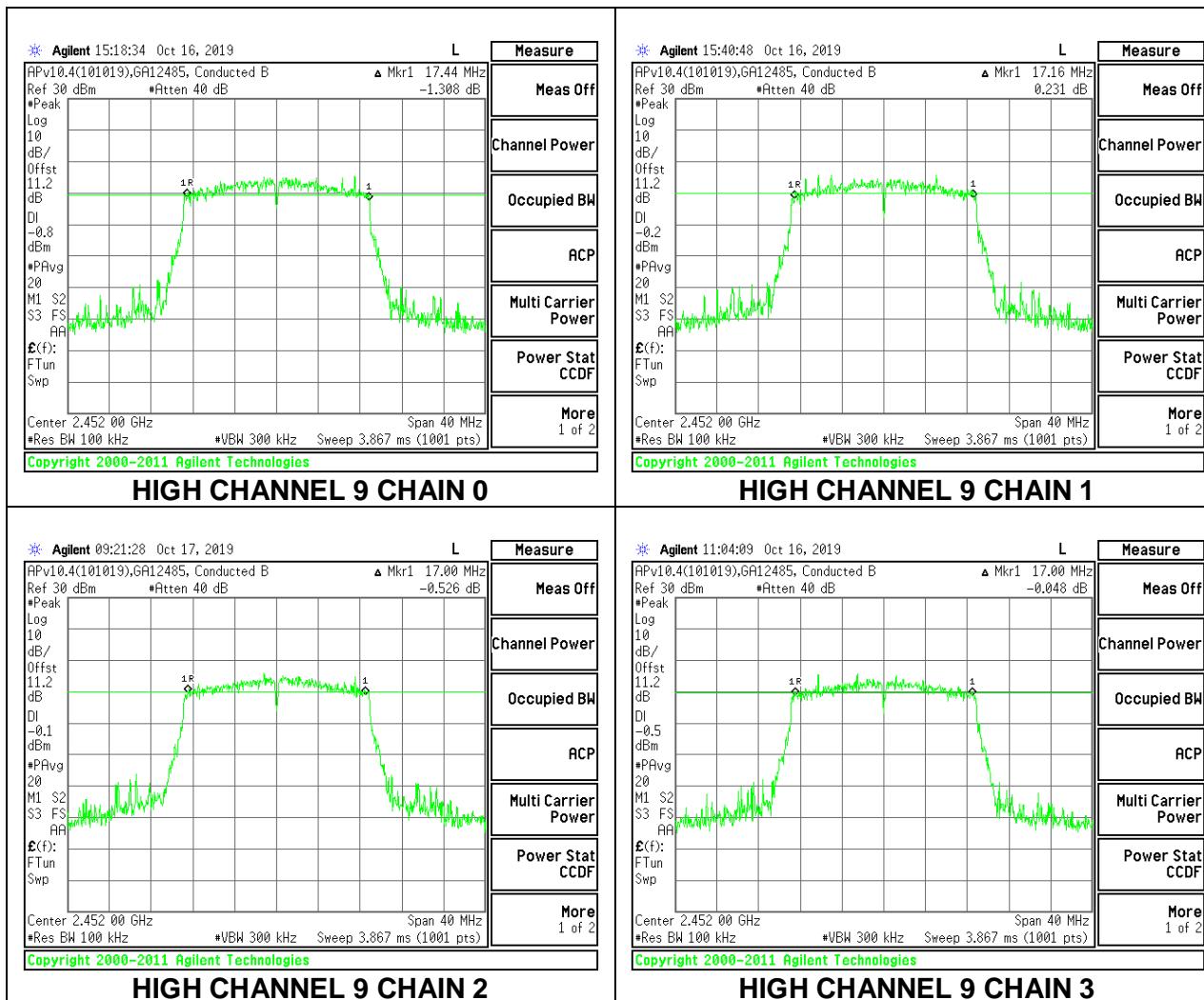
MID CHANNEL 6



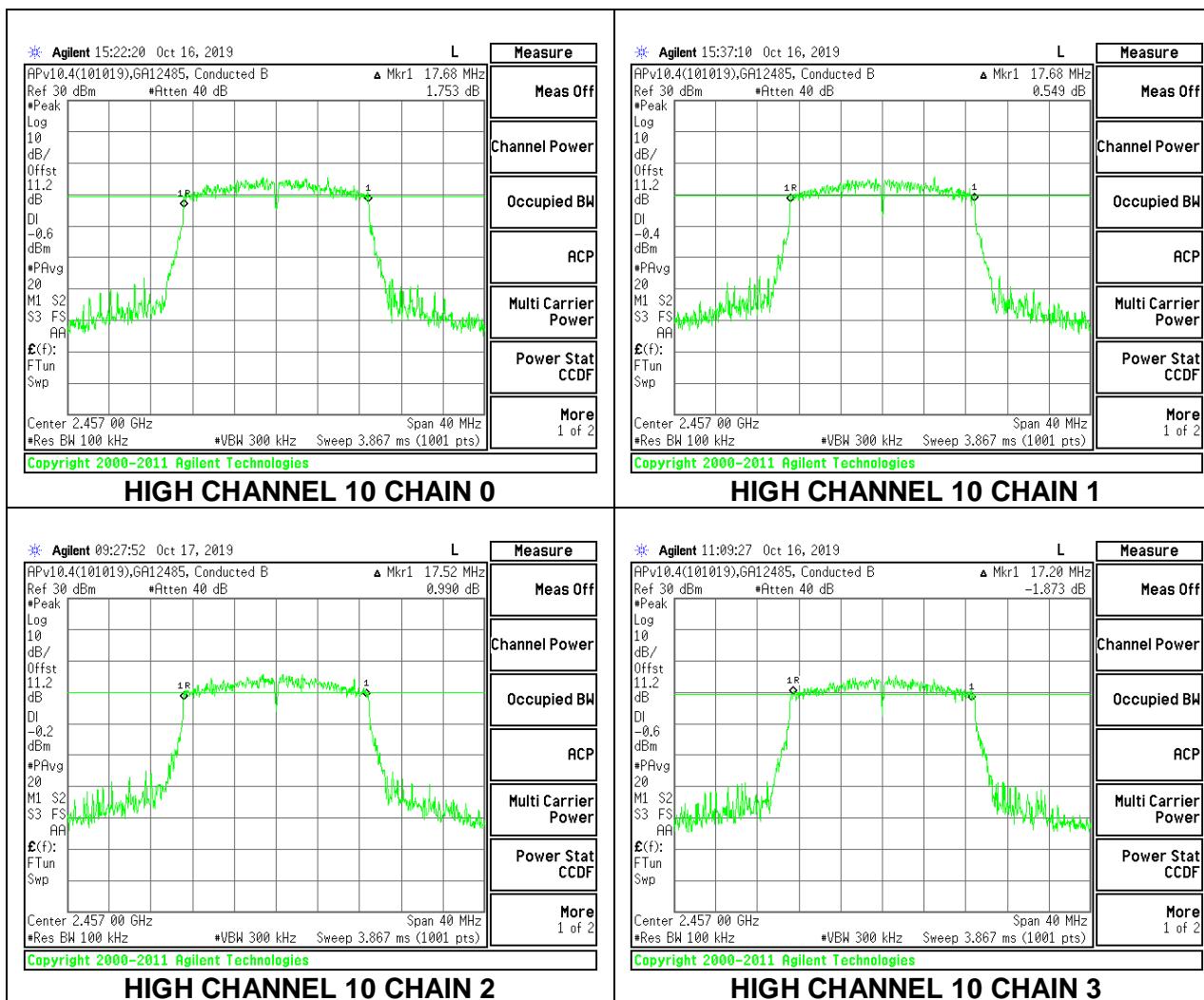
HIGH CHANNEL 8



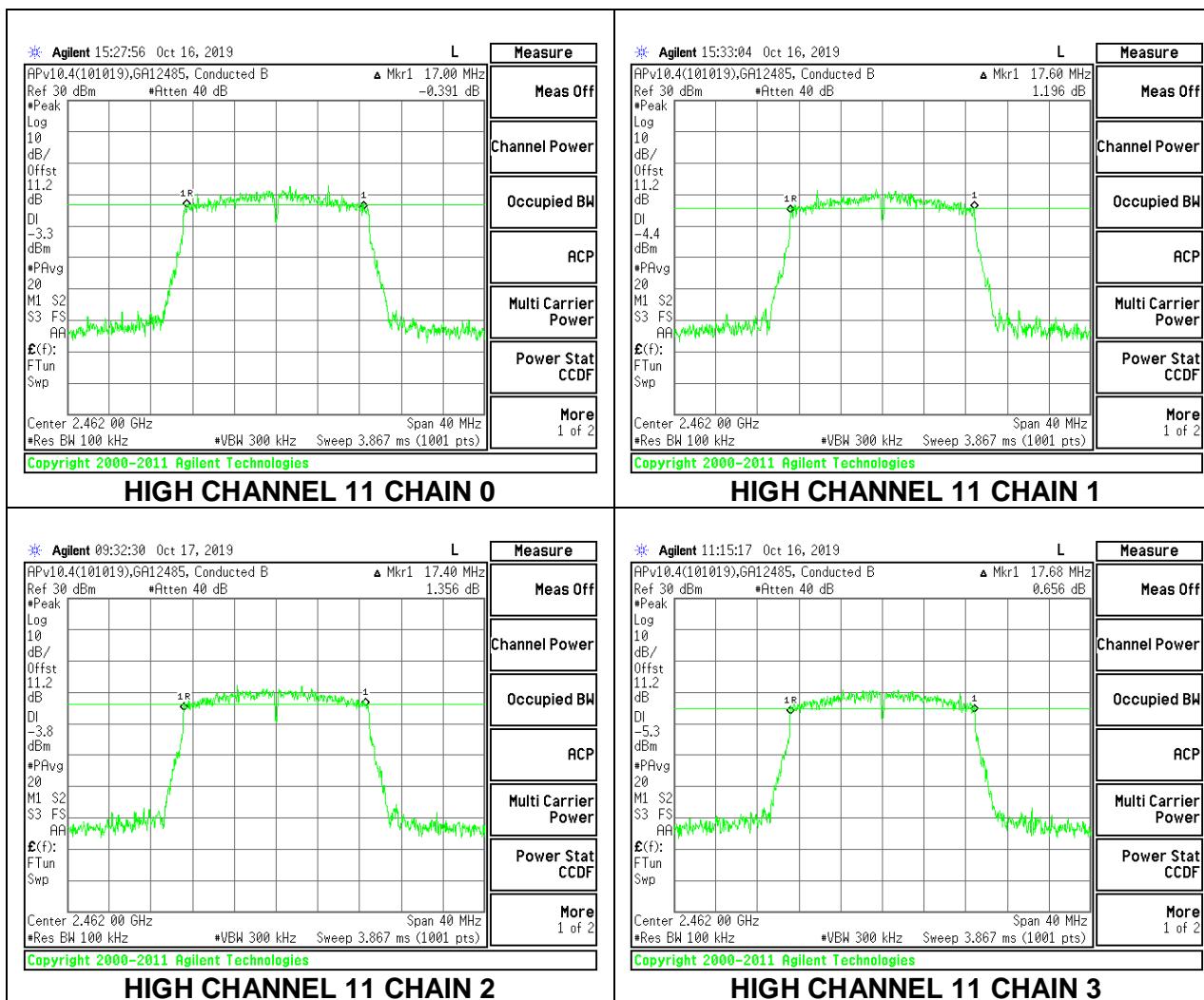
HIGH CHANNEL 9



HIGH CHANNEL 10



HIGH CHANNEL 11



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 4 TX:

Vertical Polarity (Worst Case)

Band (GHz)	Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
2.4	3.88	5.38	4.69

Horizontal Polarity

Band (GHz)	Chain 2 Antenna Gain (dBi)	Chain 3 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
2.4	1.57	2.43	2.02

RESULTS

Tested By:	12485 GA
Date:	10/14/2019

8.4.1. 802.11b MODE

4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC/ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	4.69	30.00	36	30.00
Mid 6	2437	4.69	30.00	36	30.00
High 11	2462	4.69	30.00	36	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	22.04	21.41	21.71	20.99	27.58	30.00	-2.42
Mid 6	2437	22.88	22.73	22.96	21.23	28.52	30.00	-1.48
High 11	2462	22.09	21.74	22.39	20.93	27.84	30.00	-2.16

8.4.2. 802.11g MODE

4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC/ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	4.69	30.00	36	30.00
Low 2	2417	4.69	30.00	36	30.00
Mid 6	2437	4.69	30.00	36	30.00
High 10	2457	4.69	30.00	36	30.00
High 11	2462	4.69	30.00	36	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	17.70	17.29	17.23	16.81	23.29	30.00	-6.71
Low 2	2417	19.06	18.52	18.55	18.04	24.58	30.00	-5.42
Mid 6	2437	21.61	21.42	21.25	20.55	27.25	30.00	-2.75
High 10	2457	17.82	18.02	18.10	17.70	23.93	30.00	-6.07
High 11	2462	16.91	16.88	17.41	16.85	23.04	30.00	-6.96

8.4.3. 802.11n HT20 MODE

4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC/ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	4.69	30.00	36	30.00
Low 2	2417	4.69	30.00	36	30.00
Low 3	2422	4.69	30.00	36	30.00
Low 4	2427	4.69	30.00	36	30.00
Low 5	2432	4.69	30.00	36	30.00
Mid 6	2437	4.69	30.00	36	30.00
High 8	2447	4.69	30.00	36	30.00
High 9	2452	4.69	30.00	36	30.00
High 10	2457	4.69	30.00	36	30.00
High 11	2462	4.69	30.00	36	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	15.42	15.54	15.27	14.68	21.26	30.00	-8.74
Low 2	2417	15.76	15.64	15.44	14.84	21.45	30.00	-8.55
Low 3	2422	16.78	16.53	16.71	15.98	22.53	30.00	-7.47
Low 4	2427	20.43	20.09	20.35	19.60	26.15	30.00	-3.85
Low 5	2432	19.37	19.28	19.43	18.67	25.22	30.00	-4.78
Mid 6	2437	20.57	20.01	20.33	19.41	26.12	30.00	-3.88
High 8	2447	19.44	18.61	19.28	18.85	25.08	30.00	-4.92
High 10	2457	18.65	18.25	18.51	17.89	24.36	30.00	-5.64
High 11	2462	14.78	13.96	14.72	13.94	20.39	30.00	-9.61

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

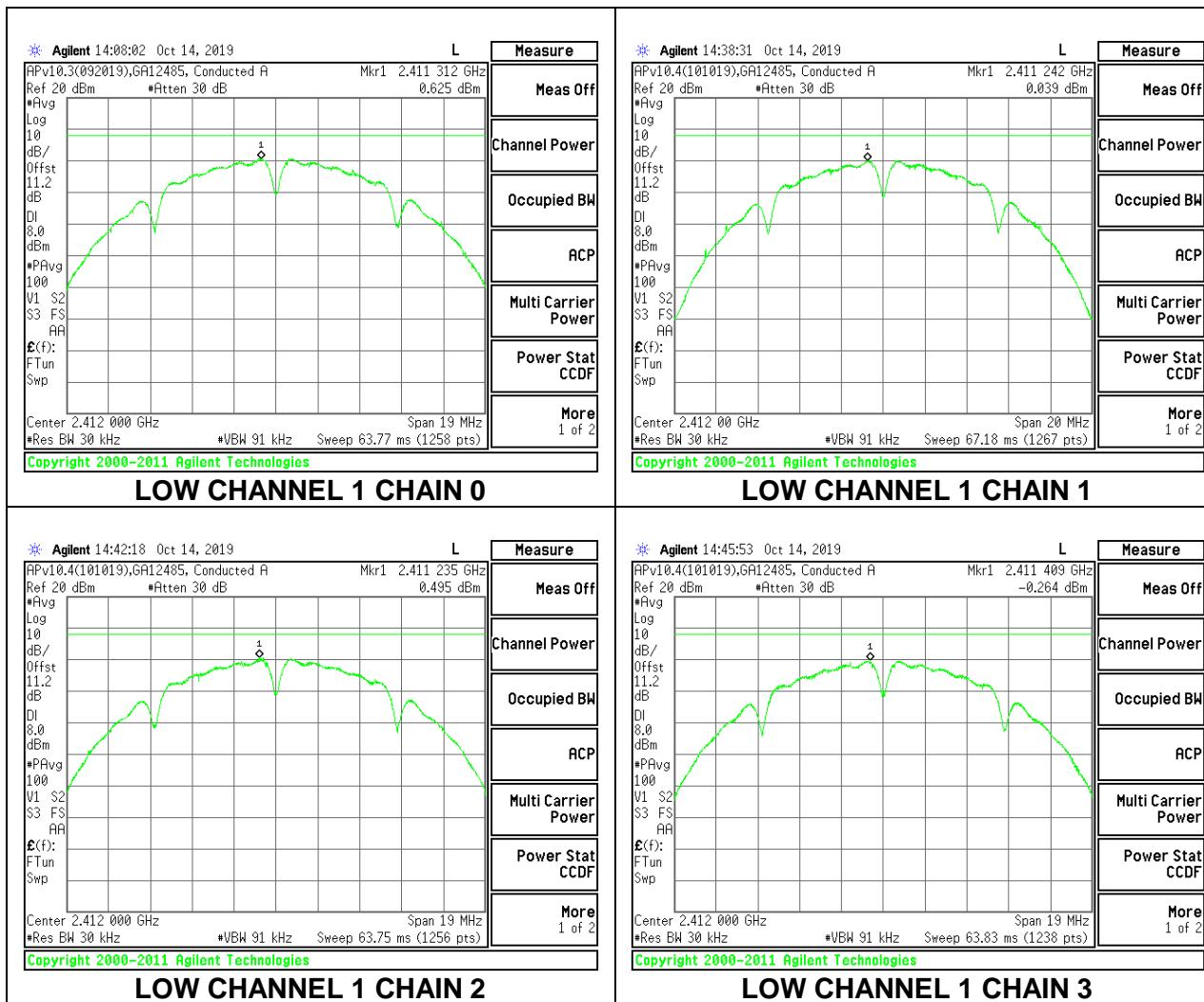
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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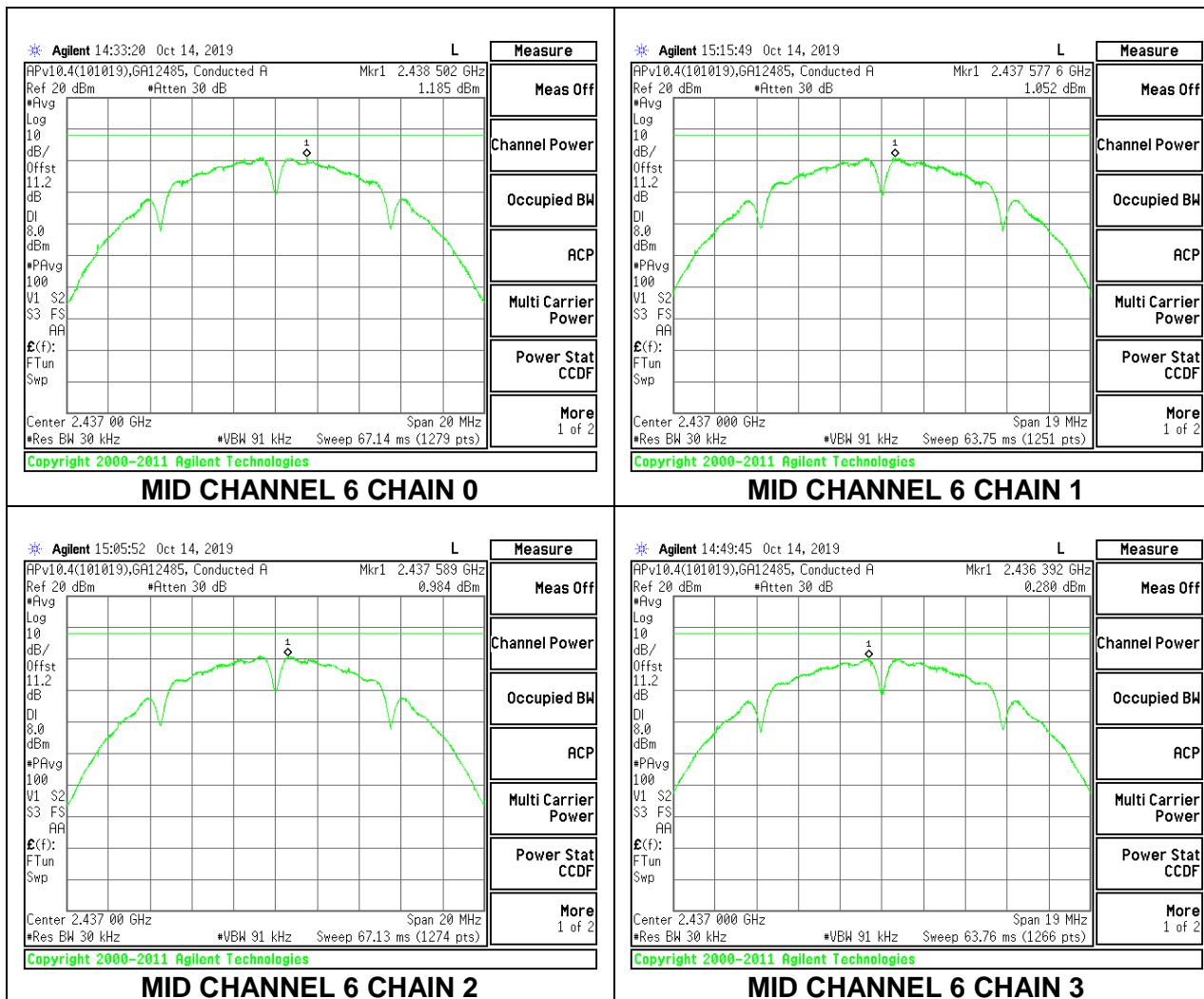
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Chain 1 Meas (dBm/ 3kHz)	Chain 2 Meas (dBm/ 3kHz)	Chain 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	0.625	0.039	0.495	-0.264	6.26	8.0	-1.74
Mid 6	2437	1.185	1.052	0.984	0.280	6.91	8.0	-1.09
High 11	2462	0.958	0.161	0.294	-0.230	6.34	8.0	-1.66

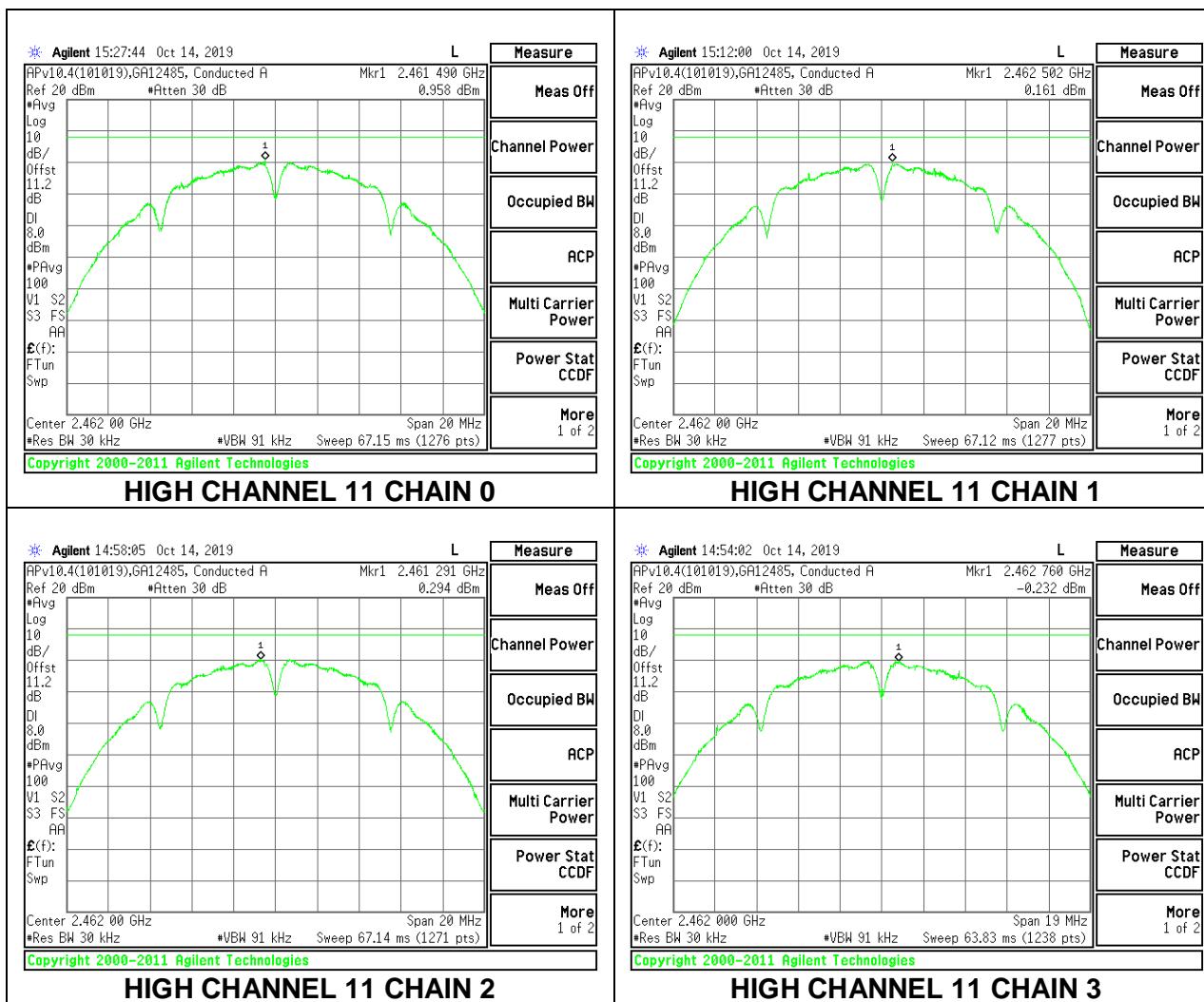
LOW CHANNEL 1



MID CHANNEL 6



HIGH CHANNEL 11



8.5.2. 802.11g MODE

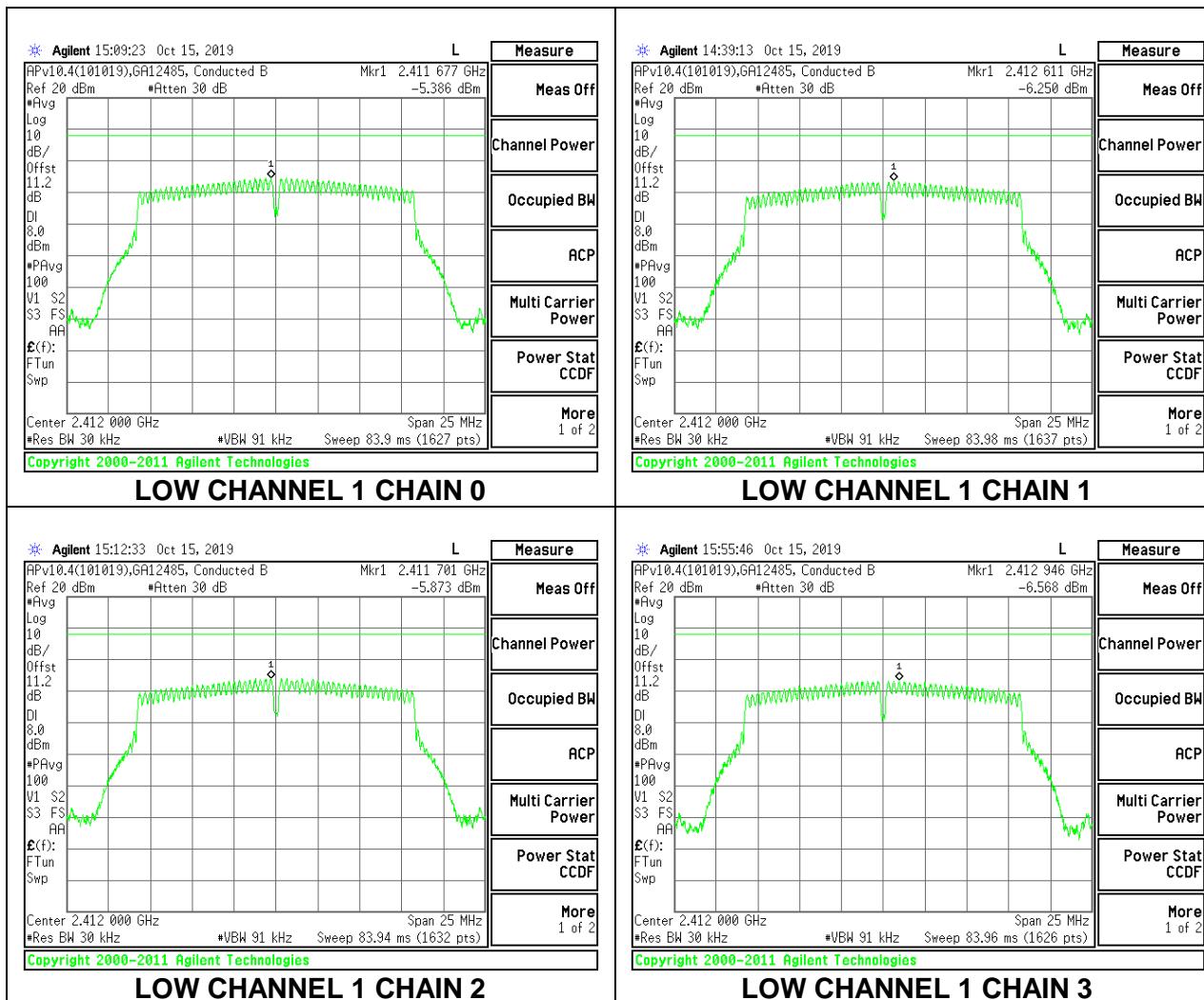
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Duty Cycle CF (dB)	0.32	Included in Calculations of Corr'd PSD
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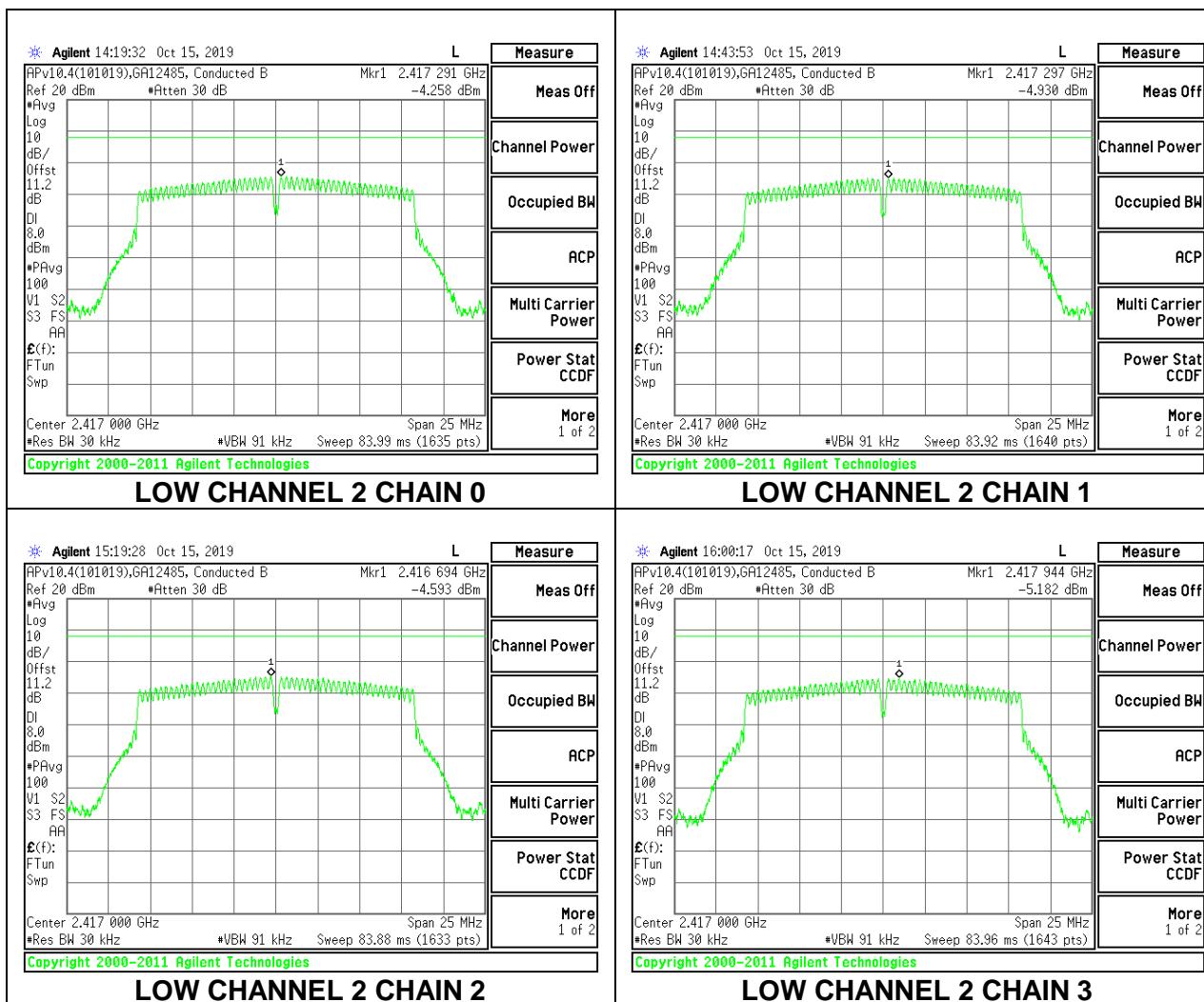
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Chain 1 Meas (dBm/ 3kHz)	Chain 2 Meas (dBm/ 3kHz)	Chain 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-5.386	-6.250	-5.873	-6.568	0.344	8.0	-7.7
Low 2	2417	-4.258	-4.930	-4.593	-5.182	1.614	8.0	-6.4
Mid 6	2437	-2.670	-3.200	-3.204	-4.406	3.015	8.0	-5.0
High 10	2457	-5.475	-5.671	-5.336	-5.964	0.735	8.0	-7.3
High 11	2462	-6.757	-7.776	-6.395	-6.921	-0.593	8.0	-8.6

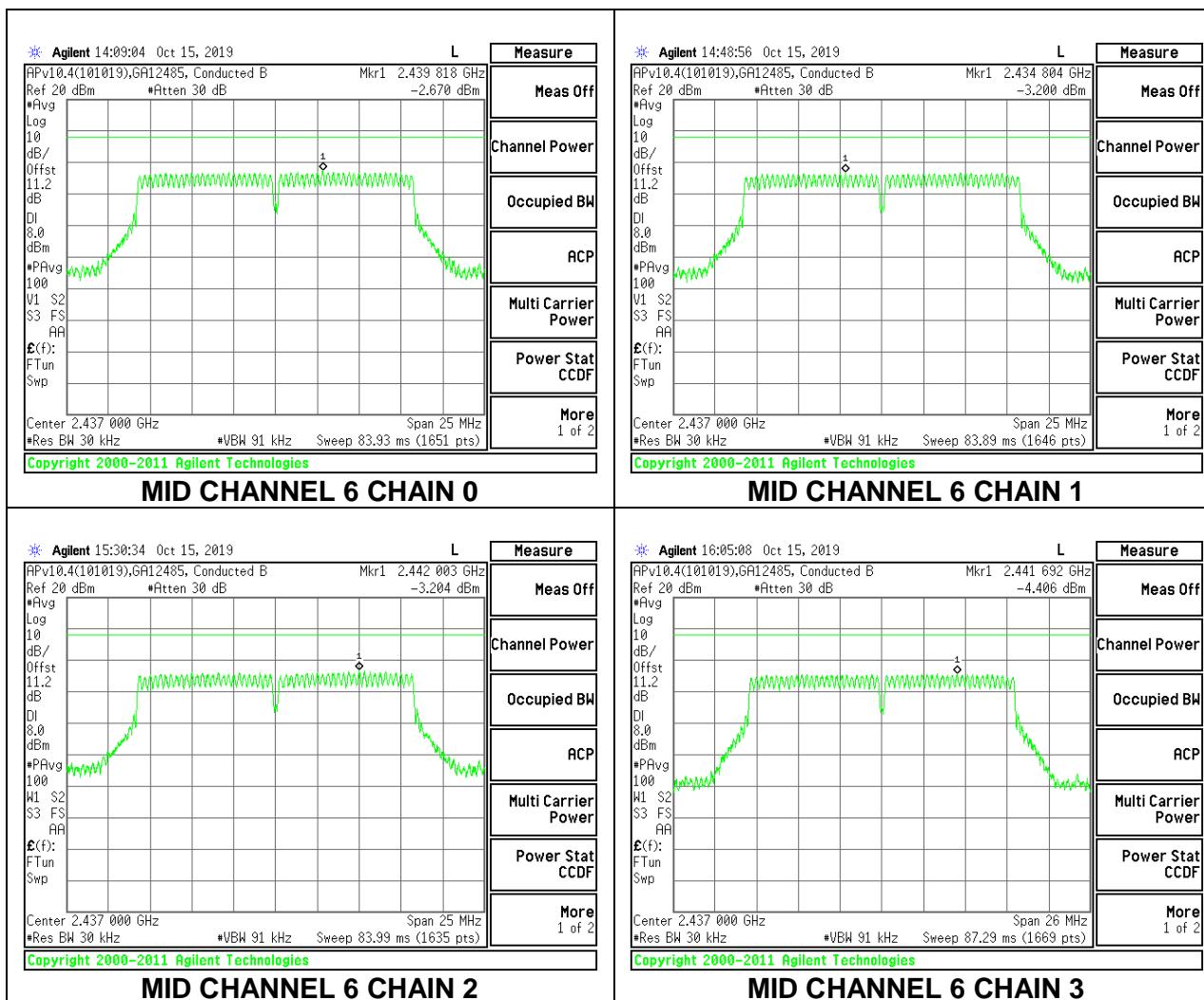
LOW CHANNEL 1



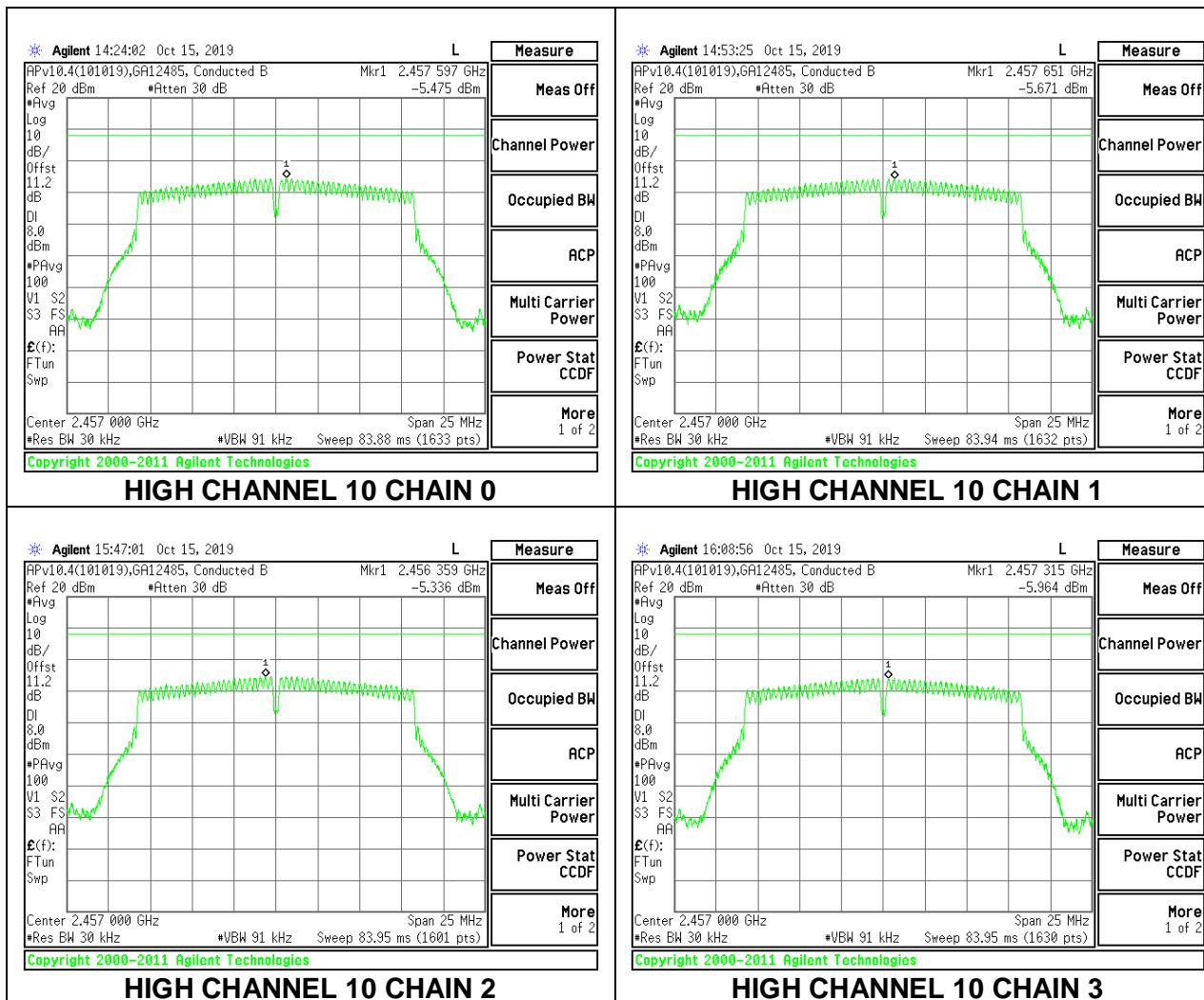
LOW CHANNEL 2



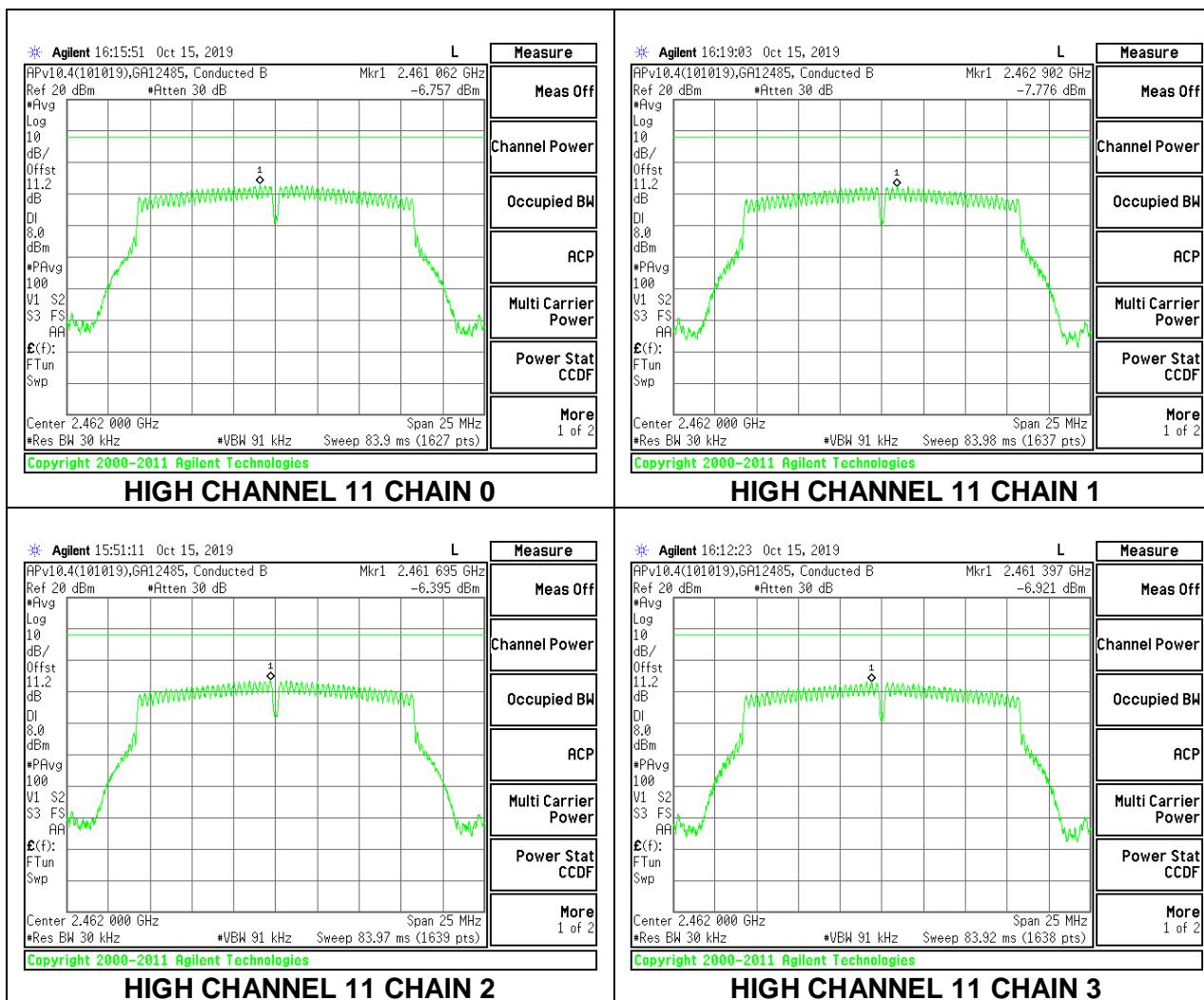
MID CHANNEL 6



HIGH CHANNEL 10



HIGH CHANNEL 11



8.5.3. 802.11n HT20 MODE

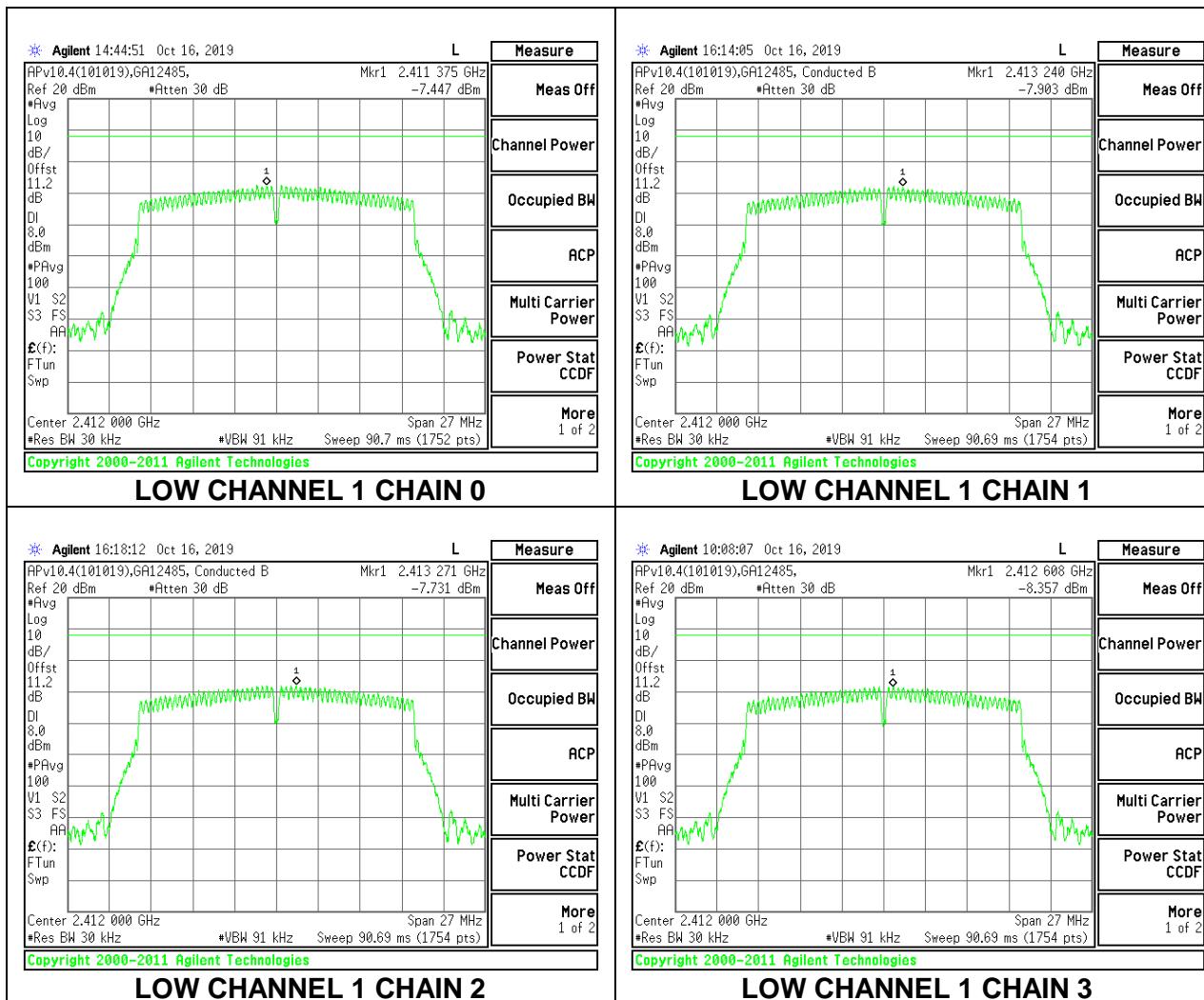
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Duty Cycle CF (dB)	0.41	Included in Calculations of Corr'd PSD
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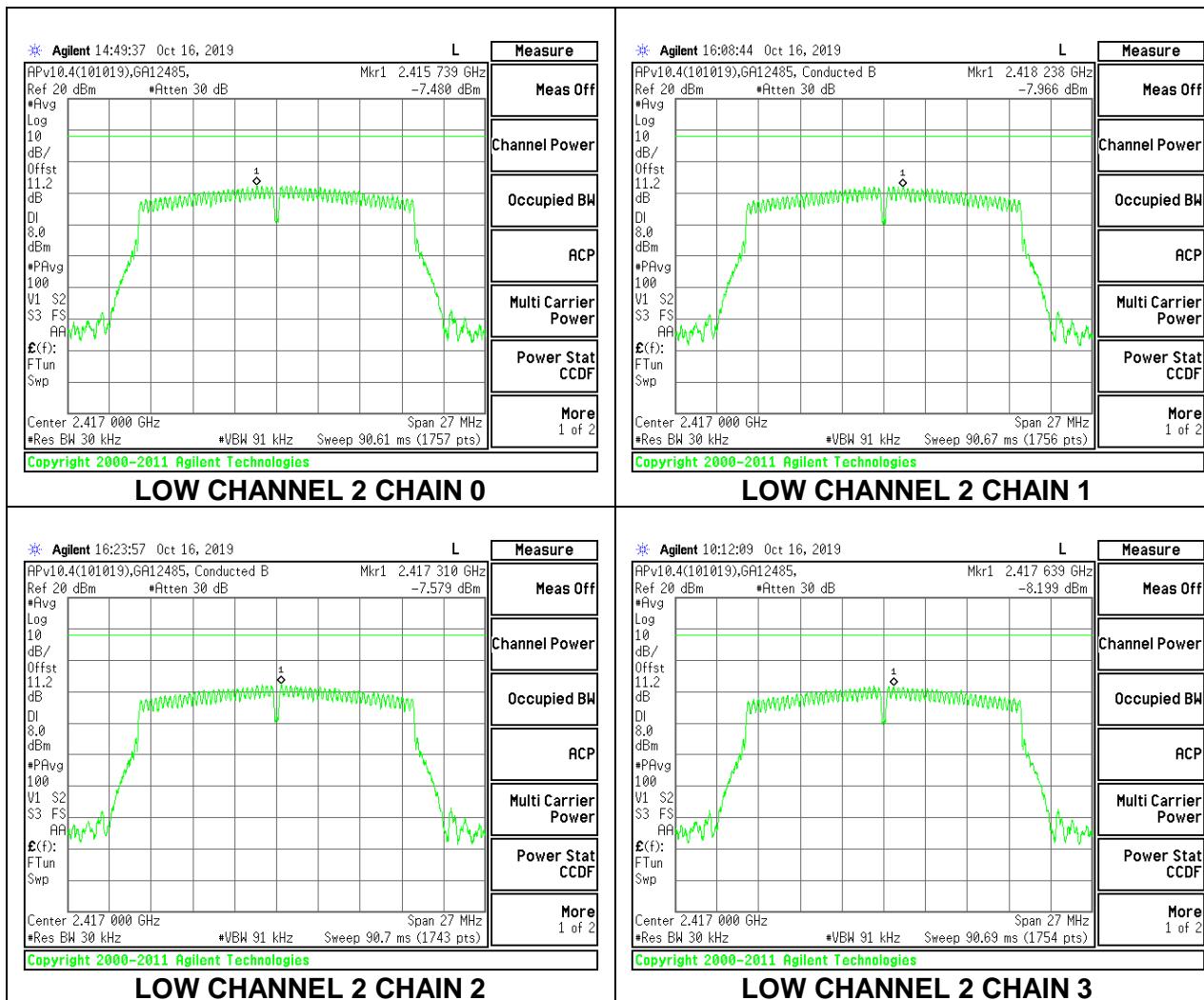
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Chain 1 Meas (dBm/ 3kHz)	Chain 2 Meas (dBm/ 3kHz)	Chain 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-7.447	-7.903	-7.731	-8.357	-1.42	8.0	-9.4
Low 2	2417	-7.480	-7.966	-7.579	-8.119	-1.35	8.0	-9.3
Low 3	2422	-6.450	-6.814	-6.644	-7.011	-0.29	8.0	-8.3
Low 4	2427	-2.939	-3.212	-2.831	-3.613	3.29	8.0	-4.7
Low 5	2432	-4.939	-5.259	-4.985	-5.717	1.22	8.0	-6.8
Mid 6	2437	-5.659	-6.782	-5.672	-6.011	0.42	8.0	-7.6
High 8	2447	-5.473	-5.261	-5.111	-5.542	1.09	8.0	-6.9
High 9	2452	-5.356	-5.289	-5.150	-5.987	1.00	8.0	-7.0
High 10	2457	-4.915	-5.000	-4.814	-5.025	1.49	8.0	-6.5
High 11	2462	-9.036	-9.228	-9.215	-9.603	-2.84	8.0	-10.8

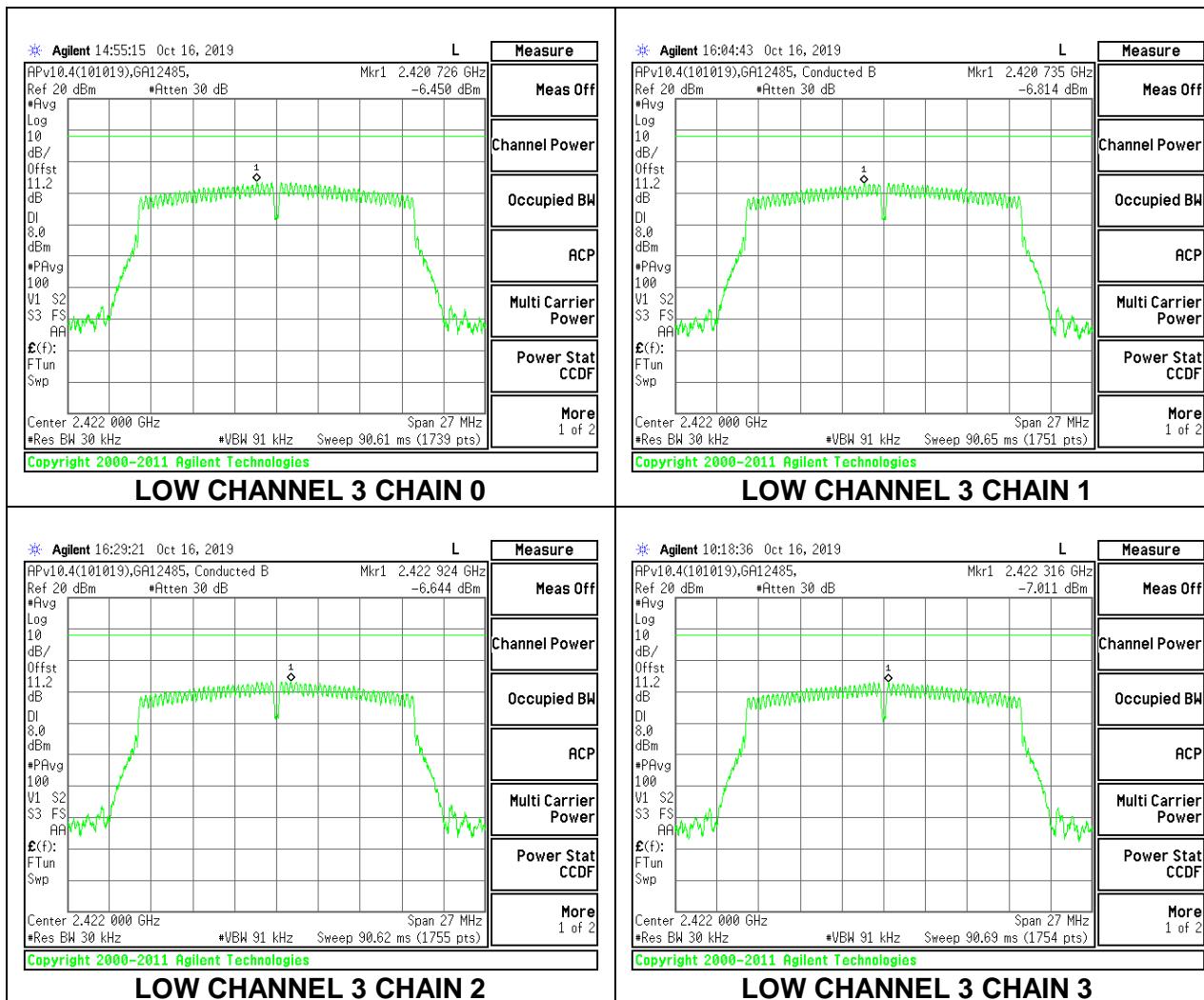
LOW CHANNEL 1



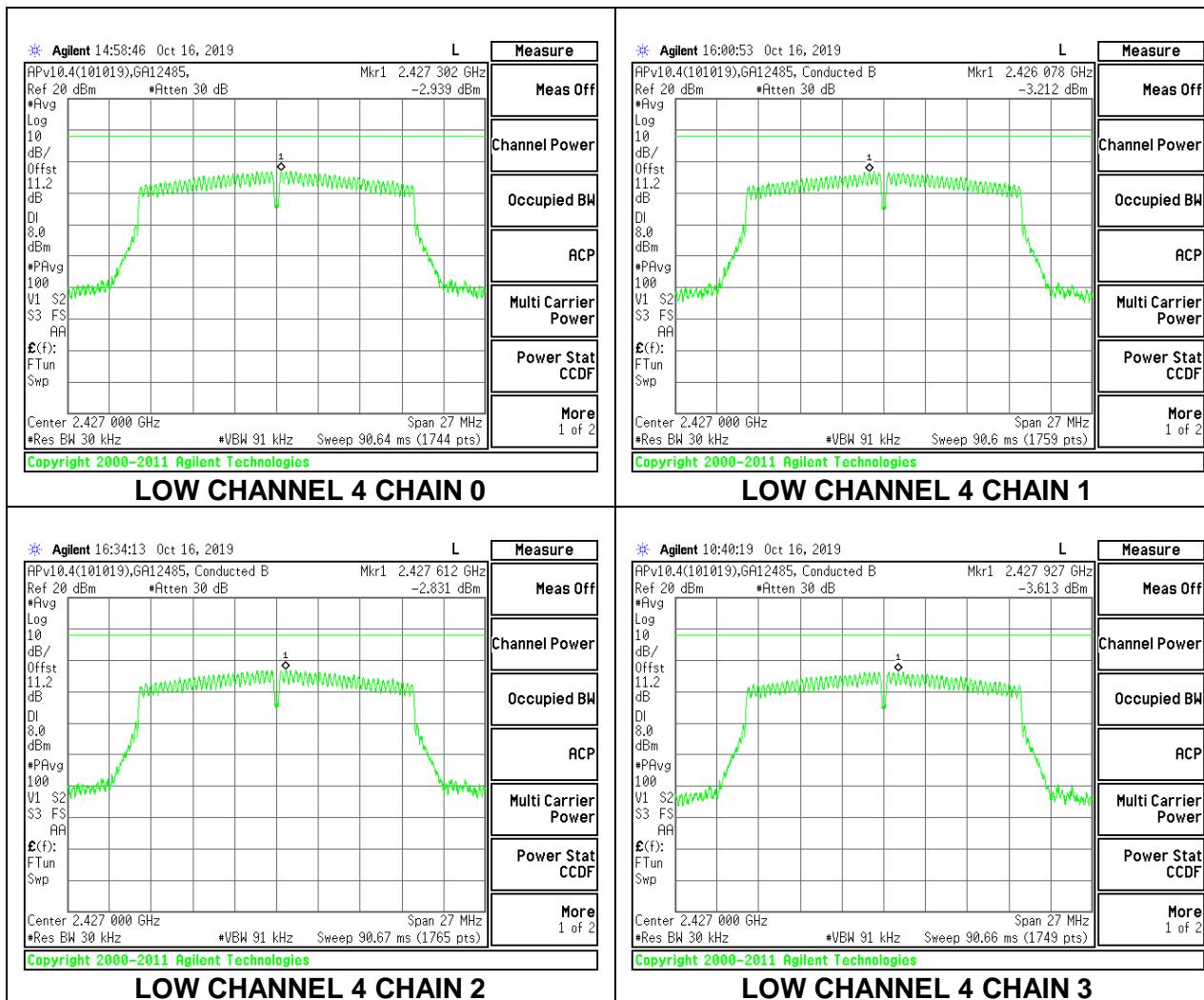
LOW CHANNEL 2



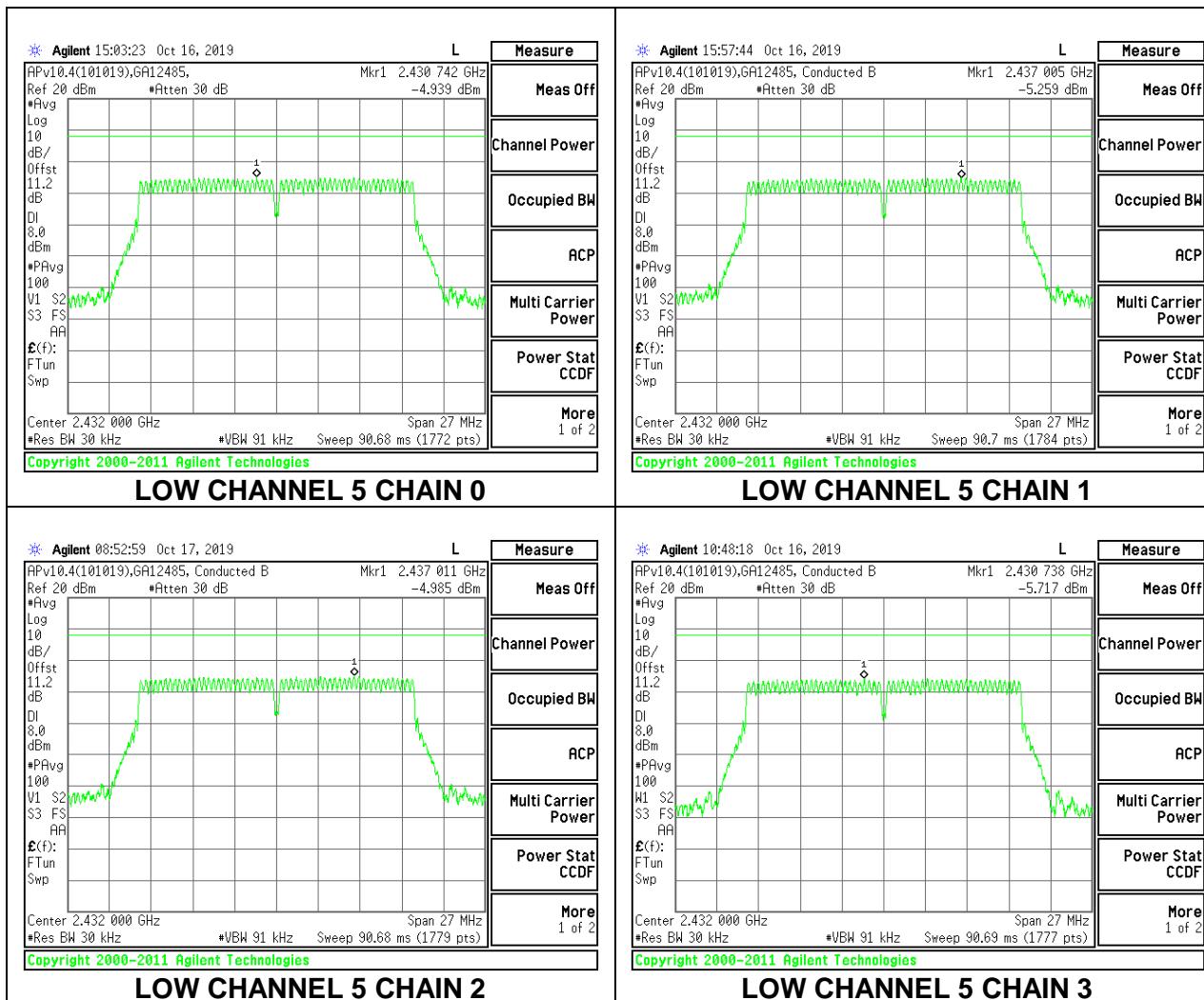
LOW CHANNEL 3



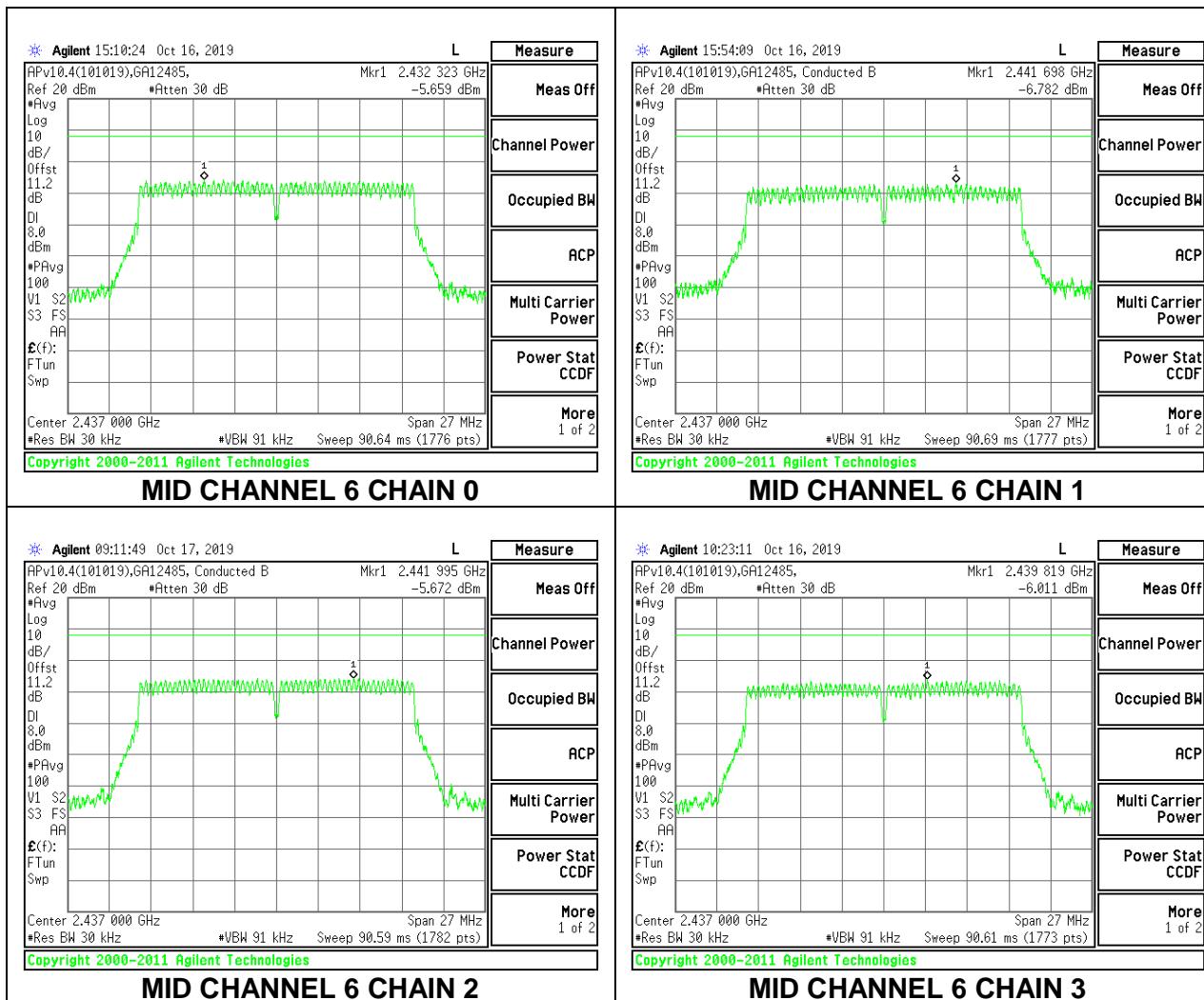
LOW CHANNEL 4



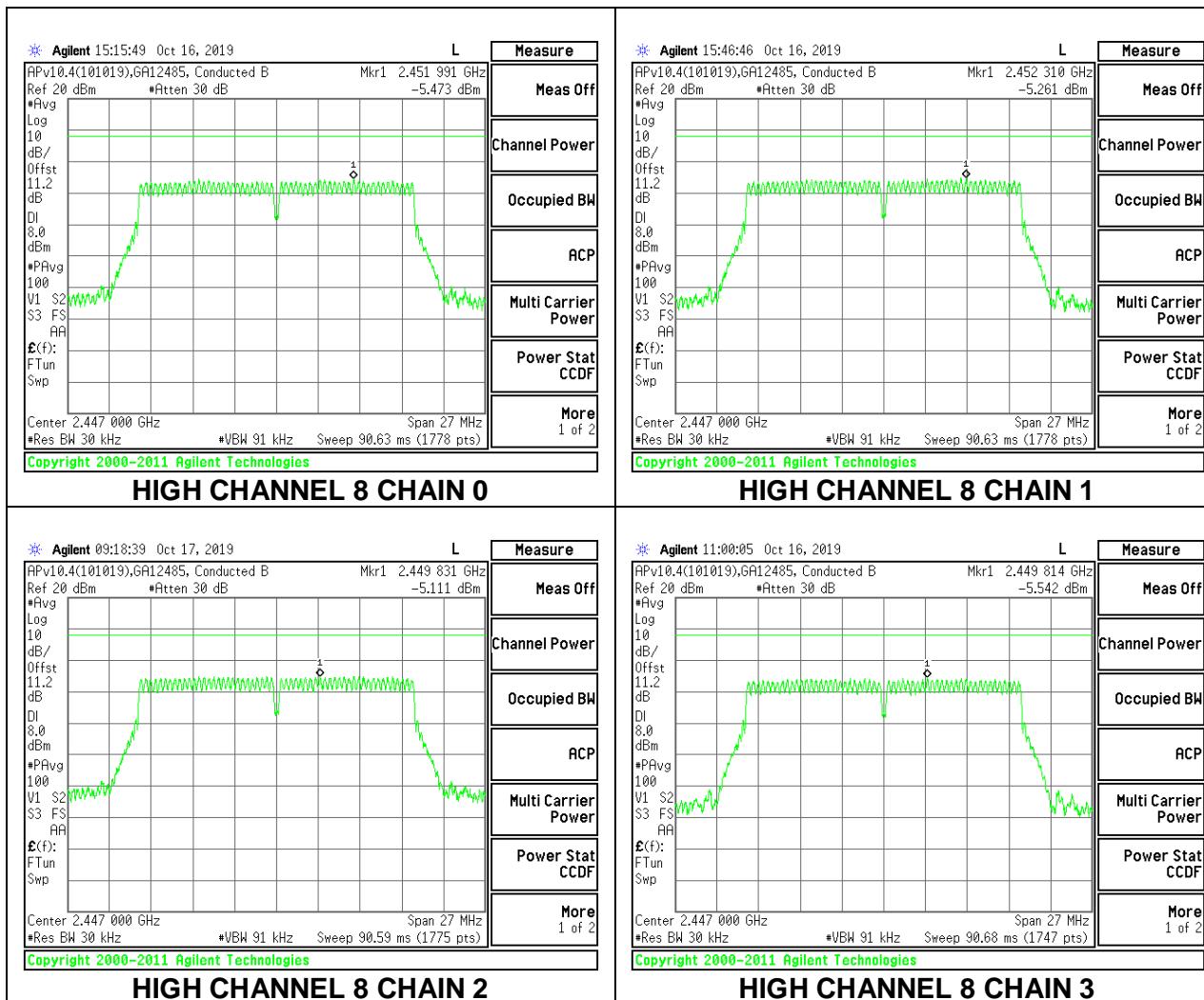
LOW CHANNEL 5



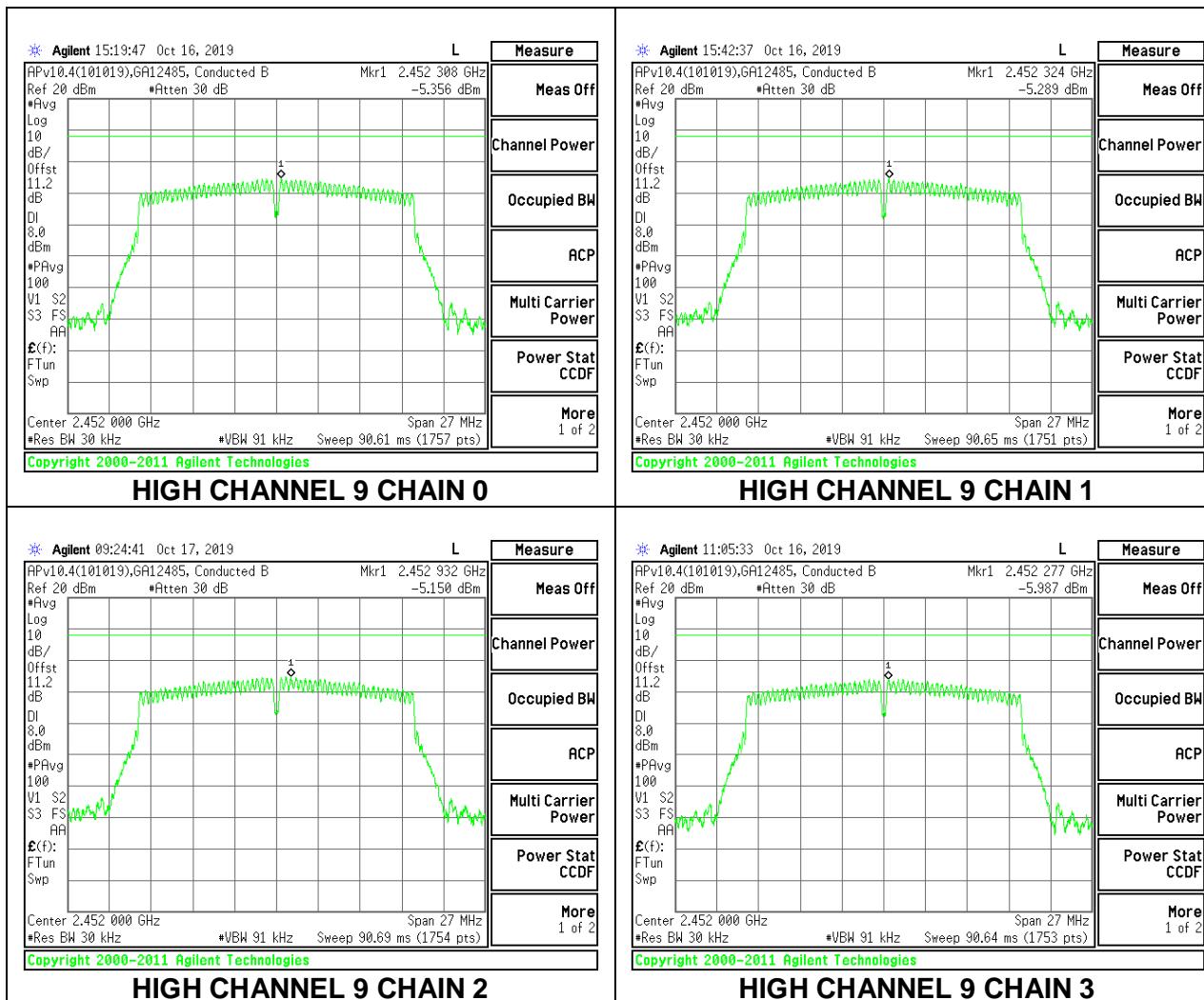
MID CHANNEL 6



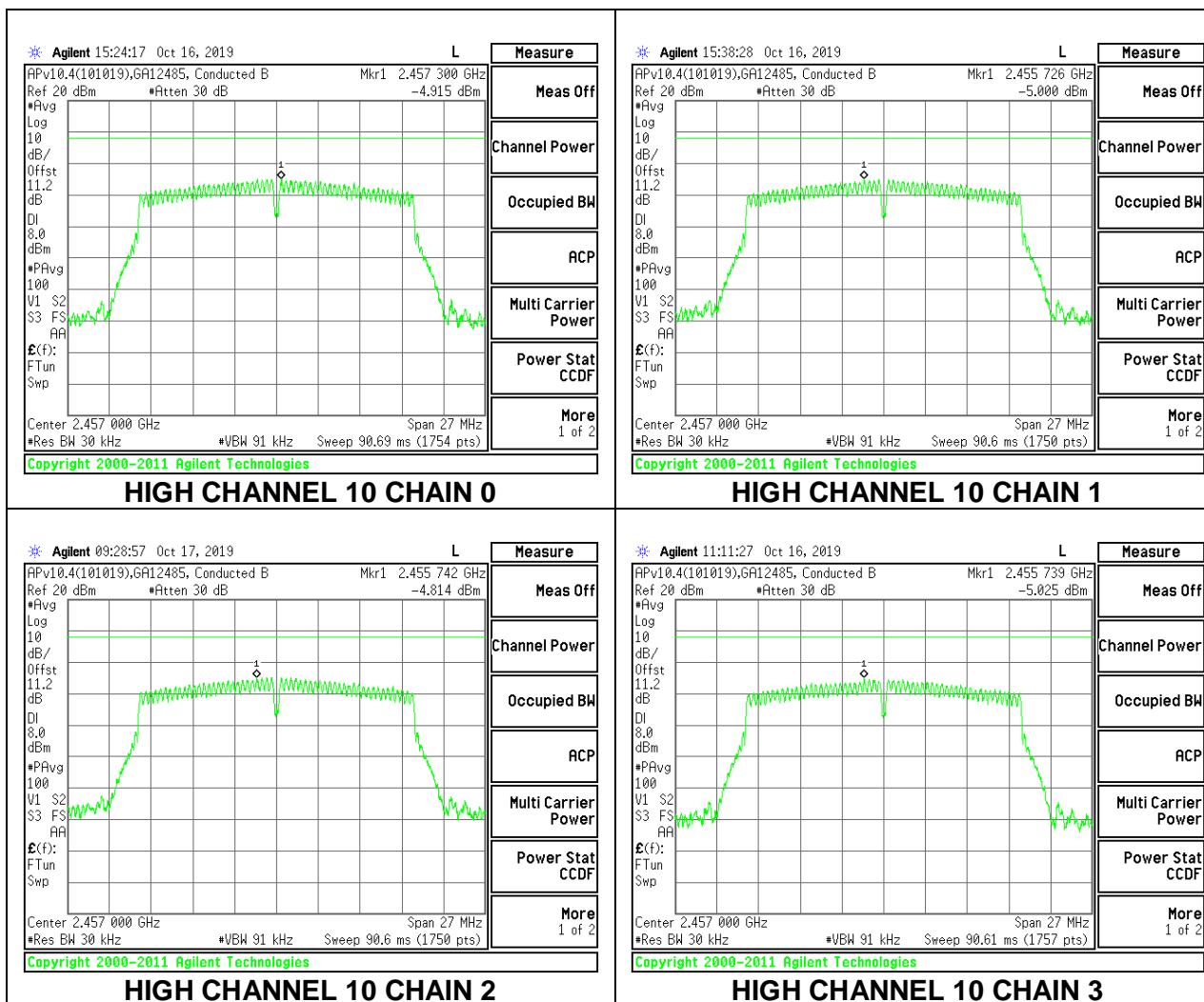
HIGH CHANNEL 8



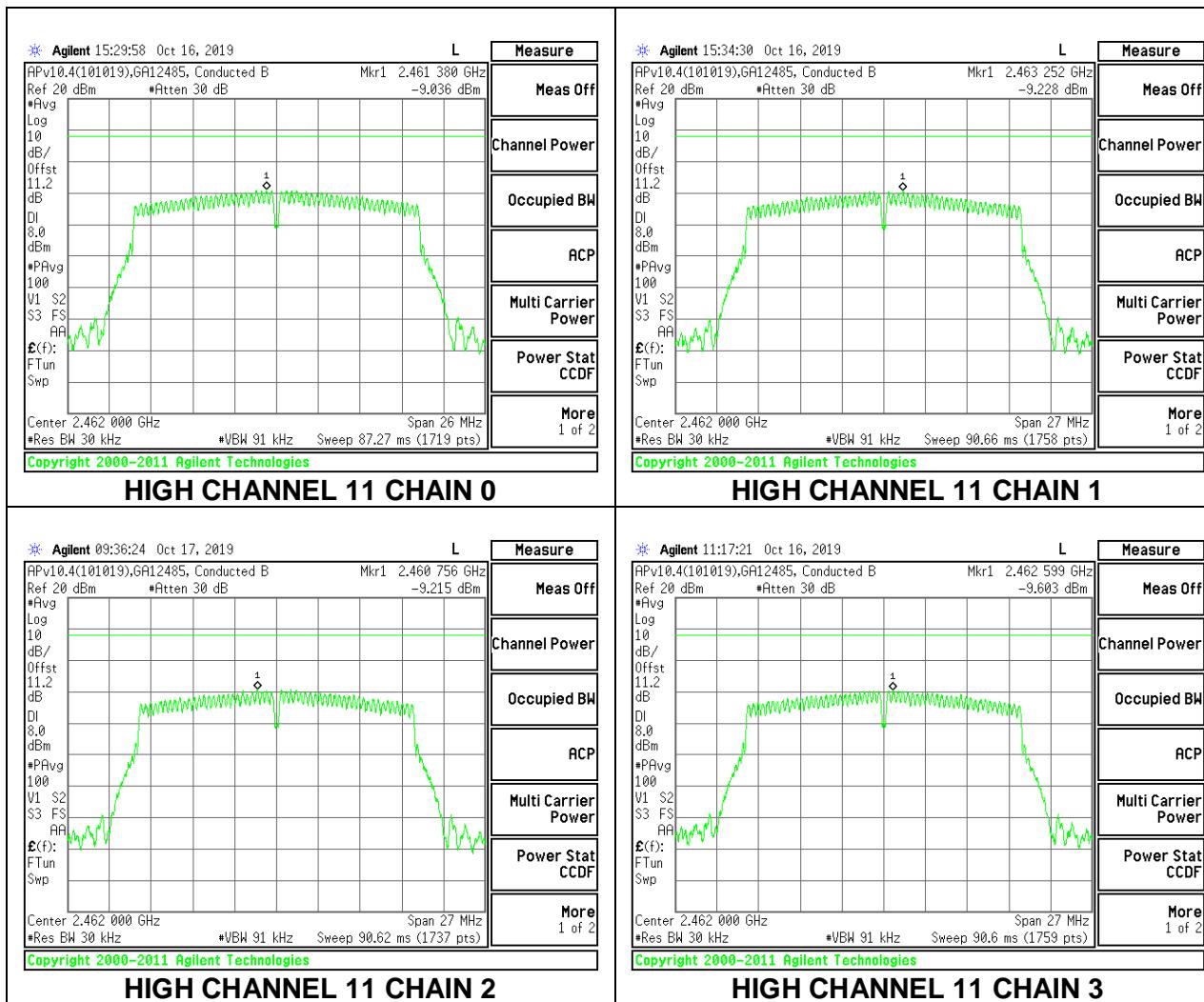
HIGH CHANNEL 9



HIGH CHANNEL 10



HIGH CHANNEL 11



8.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

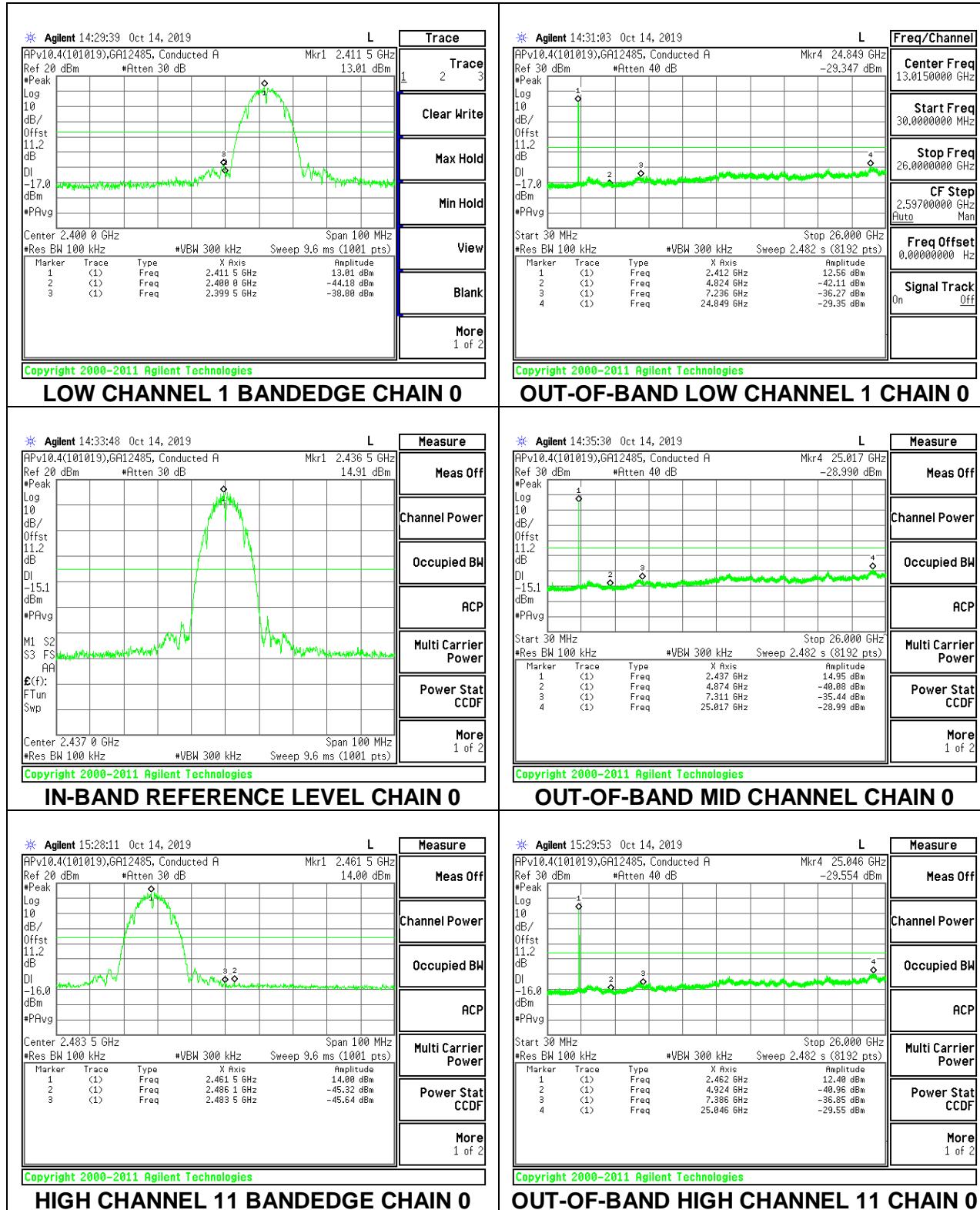
RSS-247 5.5

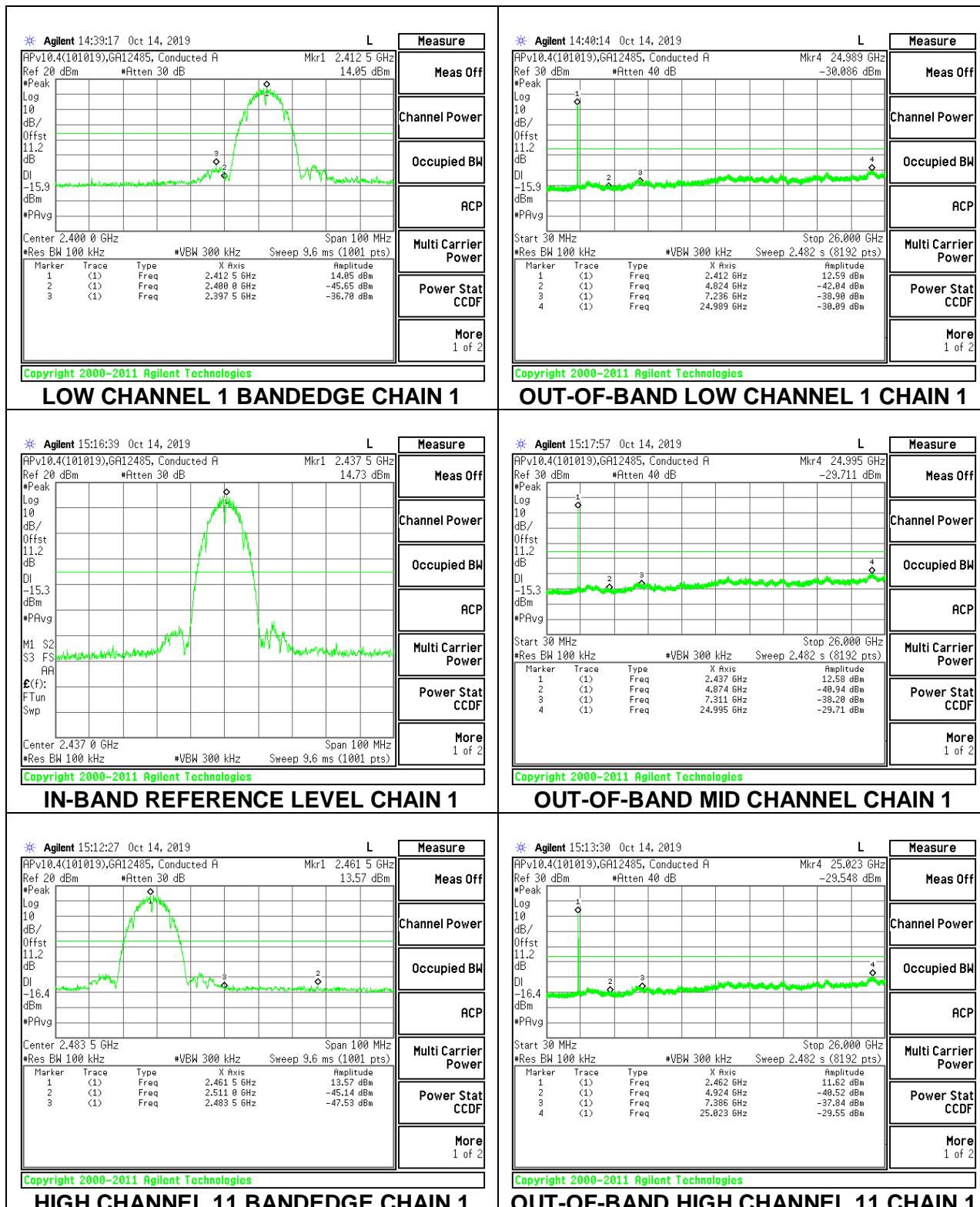
Output power was measured based on the use of average measurement, therefore the required attenuation is 30 dB.

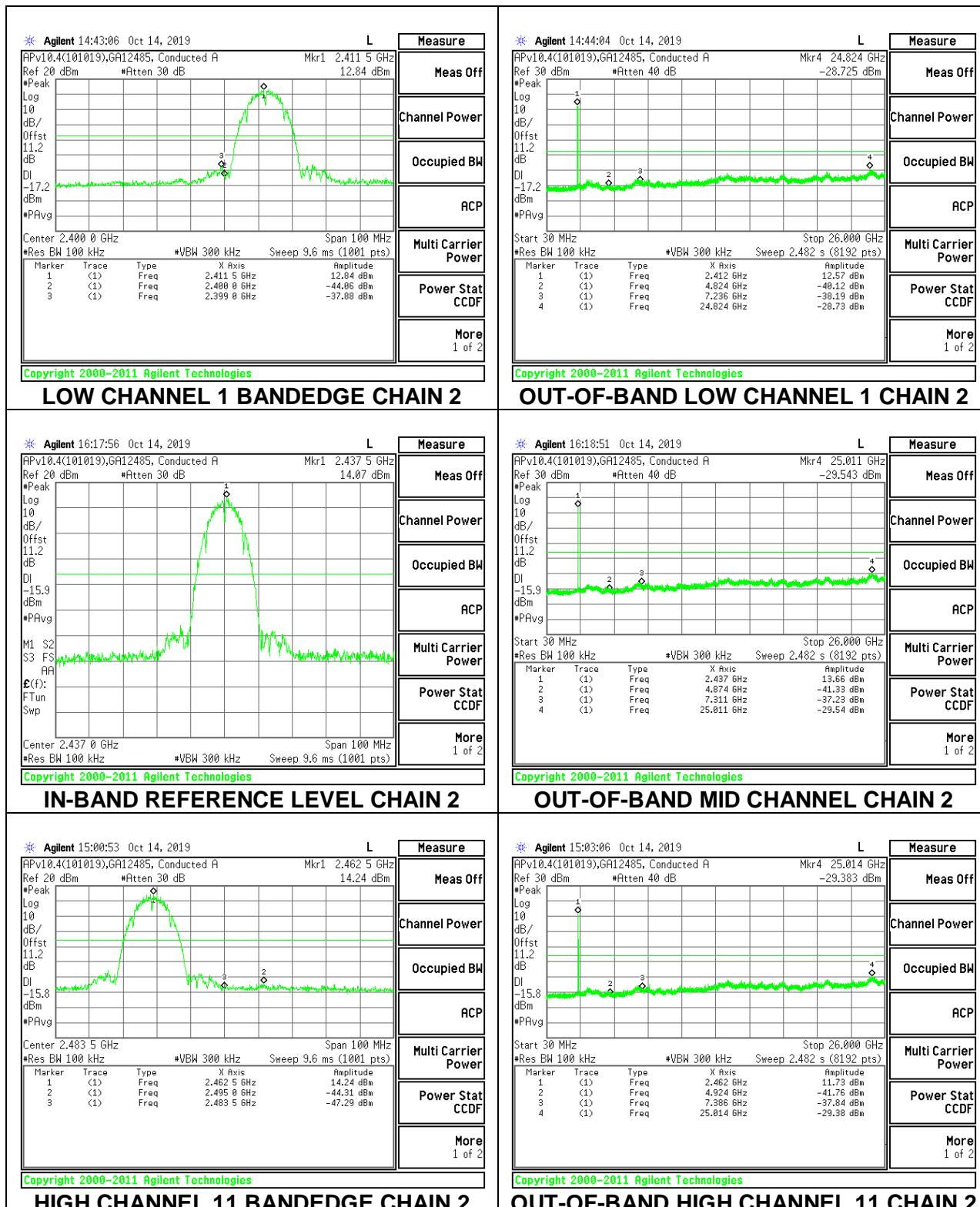
RESULTS

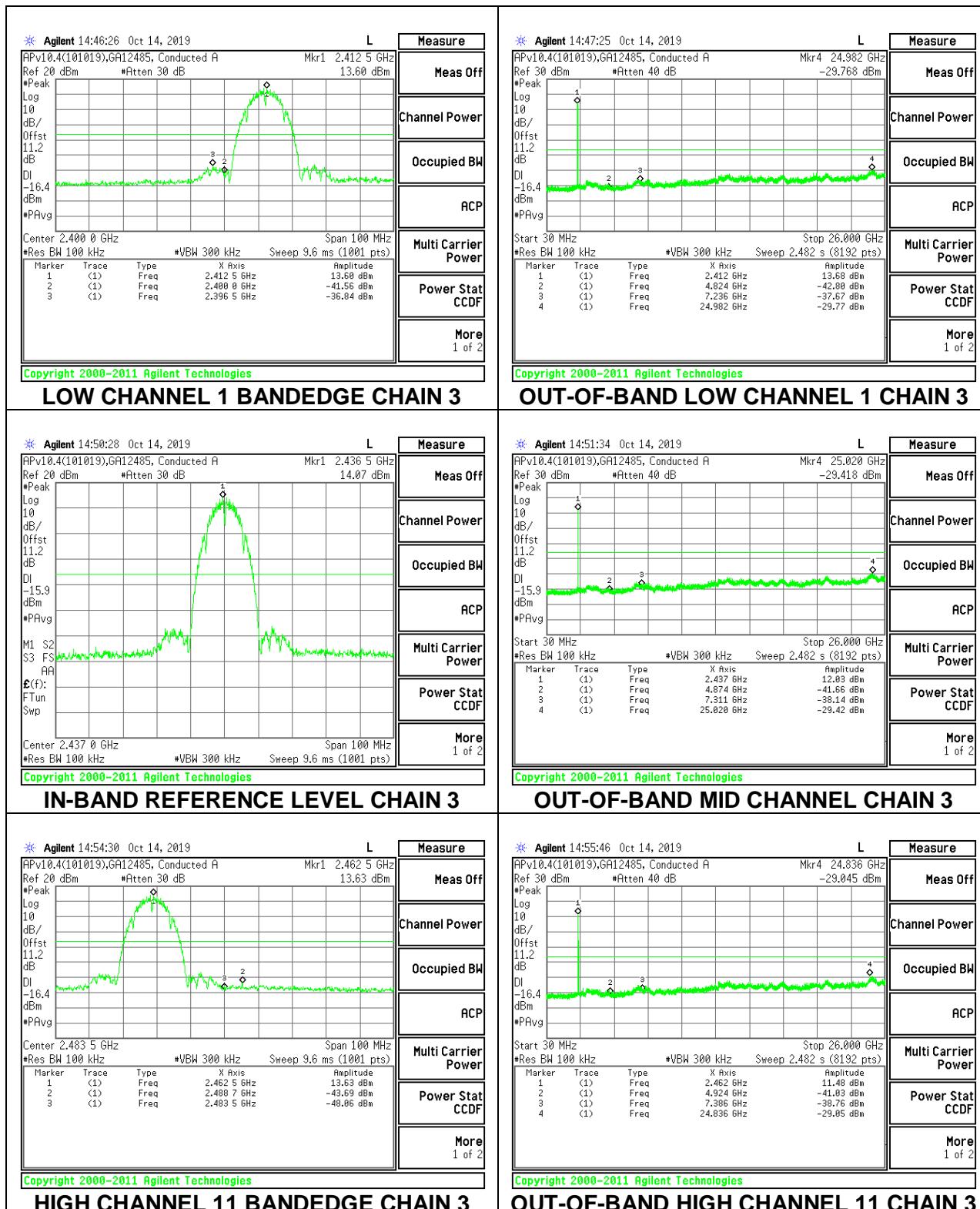
8.6.1. 802.11b MODE

4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE









8.6.2. 802.11g MODE

4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

