FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

GROUND BASED UNIT

MODEL NUMBER: RRH

FCC ID: 2AJN8-GS1

REPORT NUMBER: R11150849-E1V3

ISSUE DATE: 2016-09-28

Prepared for
HARRIS CORP.
2400 PALM BAY ROAD NE
PALM BAY
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Prepared by
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Revision History

Ver.	Issue Date	Revisions	Revised By
1	2016-09-08	Initial Issue	M. Heckrotte
2	2016-09-23	Removed photo from section 5.7, Revised citation for power limit.	M. Heckrotte
3	2016-09-28		

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: HARRIS
2400 PALM BAY ROAD NE
PALM BAY, FLORIDA, 32905, USA

EUT DESCRIPTION: GROUND BASED UNIT

MODEL: RRH, P/N 1523K0007

SERIAL NUMBER: Non-serialized

DATE TESTED: 2016-02-02 – 2016-03-03

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass

UL LLC 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 LLC 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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 any government.

Approved & Released For
UL Verification Services Inc. By:

MICHAEL HECKROTTE
PRINCIPAL ENGINEER
UL Verification Services Inc.

Prepared By:

JEFF MOSER
EMC PROGRAM MANAGER
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, ANSI C63.10-2013, KDB 558074 D01 v03r05.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA and 2800 Suite B, Perimeter Park Drive, Morrisville, NC 27560.

12 Laboratory Dr., RTP, NC 27709
☐ Chamber A
☐ Chamber C

2800 Suite B Perimeter Park Dr., Morrisville, NC 27560
☐ Chamber NORTH
☒ Chamber SOUTH

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://www.nist.gov/nvlap/

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:

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

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER		UNCERTAINTY
Total RF power, conducted	+/-	0.45
RF power density, conducted	+/-	1.50
Spurious emissions, conducted	+/-	2.94
All emissions, radiated up to 18 GHz	+/-	5.36
Temperature	+/-	0.07
Humidity	+/-	2.26
DC and low frequency voltages	+/-	1.27
Conducted Disturbance, 0.15 to 30 MHz	+/-	2.37

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a ground-based 2.4 GHz transceiver intended to communicate with airborne stations.

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)
2446.46-2474.56	540 kHz	21.94	156.31
2446.46-2474.74	900 kHz	21.75	149.62
2448.35-2472.85	4.5 MHz	22.19	165.58
2450.70-2470.70	9 MHz	21.22	132.43

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The Ground Station antenna consists of eight columns of elements with individual feeds forming a phased array antenna system. The system has a maximum gain of 28.98 dBi. By applying different phases and amplitudes to the inputs, a beam may be steered in azimuth over a 30 degree range. Control channel information is sent over a 30 degree wide beam.

5.4. SOFTWARE AND FIRMWARE

The software/firmware is as follows:

Version: 0.0.3
Revision: 6002
Build ID: 203
Package ID: 2

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The manufacturer configured the system to provide the maximum throughput based on the highest output power. The manufacturer deemed that QPSK modulation yields highest power and yields worst-case results. Therefore, QPSK modulation was used for all testing.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Power Supply	Newmar	D/C 1639	N/A	N/A

I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC	1	-	-	4.5	
2	CPRI	1	Fiber	Fiber	23	
3	Ethernet	1	RJ45	CAT5e	7.5	
4	Craft	1	RJ45	CAT5e	7.5	
5	Antenna Port	8	SMA	Coax	4.5	

TEST SETUP

Conducted and Restricted Band Spurious Emissions Test Setup

The Ground system was setup to emulate the installed system in the field. The BBU was connected to the RRH and an internet connection (EPC). A GPS antenna was connected to the BBU chassis (SCM). A PC was connected to the RRH and the BBU to enable system testing. The RRH was connected to the Spectrum Analyzer to enable FCC required measurements. The RRH was tested at each of the 8 staves.

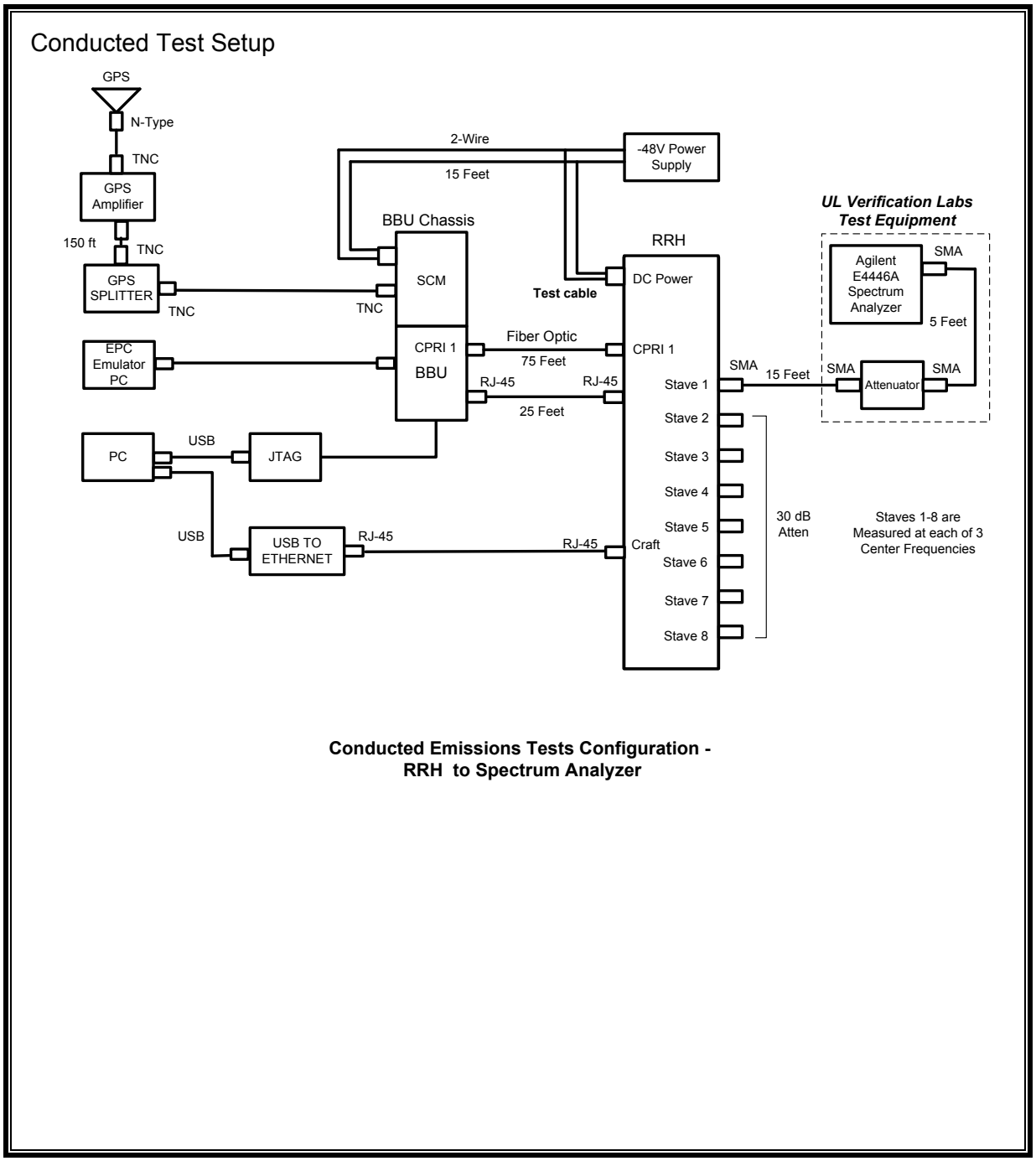
Radiated Test Setup

The Ground system was setup to emulate the installed system in the field. The BBU was connected to the RRH and an internet connection (EPC). A GPS antenna was connected to the BBU chassis (SCM). A PC was connected to the RRH and the BBU to enable system testing. The RRH was located in the EMI chamber, and the SCM and BBU were located outside the chamber.

Line Conducted Emissions Test Setup

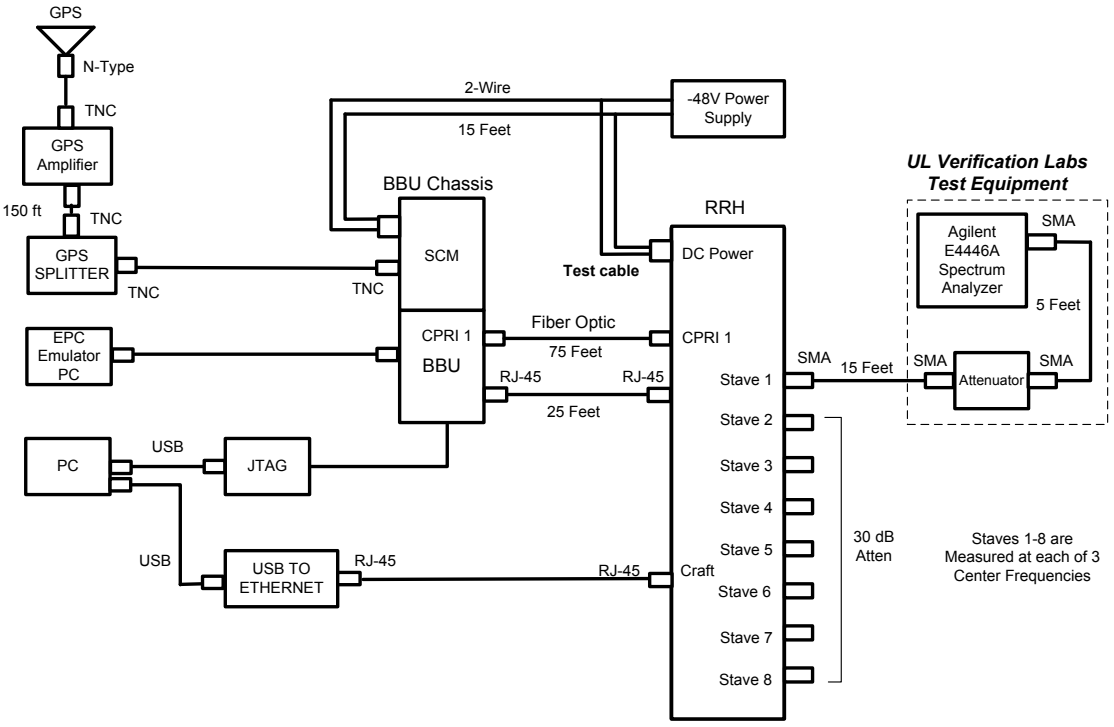
The Ground system was setup to emulate the installed system in the field. The BBU was connected to the RRH and an internet connection (EPC). A GPS antenna was connected to the BBU chassis (SCM). The line conducted emissions were tested on the power lines that fed the Ground system.

SETUP DIAGRAM FOR TESTS

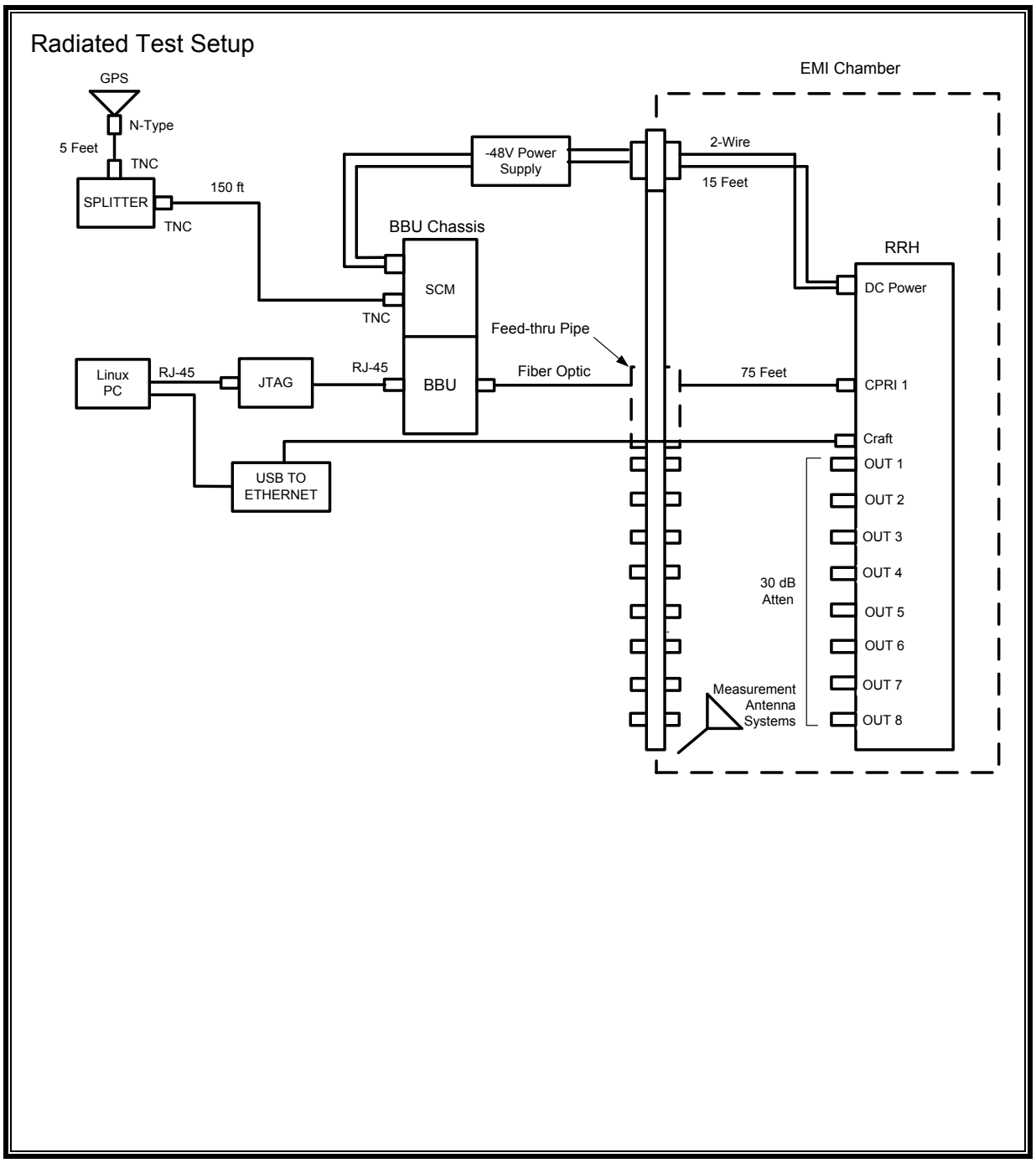


Conducted Emissions Tests Configuration - RRH to Spectrum Analyzer

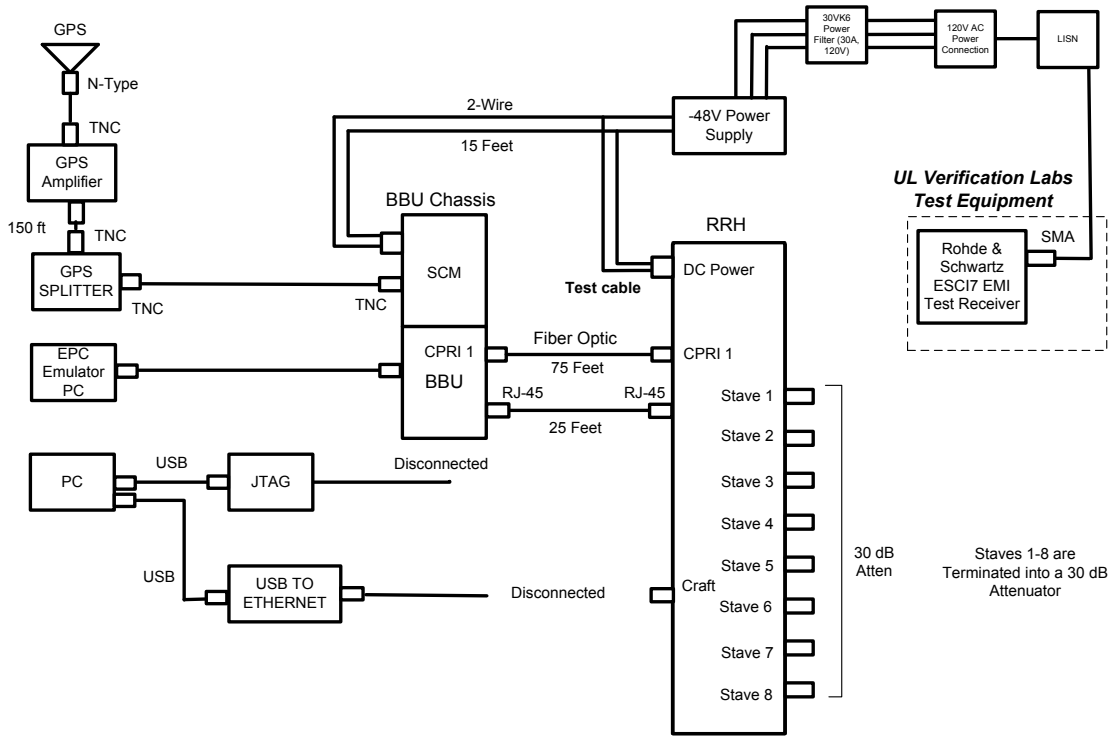
Restricted Band Spurious Emissions (Measured Conducted)



Conducted Emissions Tests Configuration - RRH to Spectrum Analyzer



Line Conducted Emissions



Power Line Conducted Emissions Tests Configuration - Power Connection to Spectrum Analyzer

5.7. MODIFICATIONS REQUIRED FOR COMPLIANCE

MODIFICATION FOR LINE CONDUCTED REQUIREMENTS

As shown in the Line Conducted Emissions Setup drawing above, a CORCOM 30VK6 power-line filter was installed at the AC Mains input of the -48 VDC power supply to meet the FCC 15.207 power-line conducted limits.

6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Room 1				
SA0019	Spectrum Analyzer	Agilent Technologies	E4446A	2015-09-02	2016-09-30
SA0026	Spectrum Analyzer	Agilent	N9030A	2015-03-27	2016-03-31
PWM004	RF Power Meter	Keysight Technologies	N1911A	2015-06-08	2016-06-30
PWS004	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2015-06-05	2016-06-30
HI0079	Temp/Humid/Pressure Meter	Springfield	PreciseTemp	2015-07-1	2016-07-31
MM0167	True RMS Multimeter	Agilent	U1232A	2015-08-17	2016-08-31
76022	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	NA	NA
T1023	EMPower USB RF Power Sensor, 10MHz to 6GHz	ETS Lindgren	7002-006	2015-10-01	2016-10-01

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0074	Hybrid Broadband Antenna, 30-1000MHz	Sunol Sciences Corp.	JB3	2015-06-10	2016-06-30
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2015-02-17	2016-02-29
AT0067 (02/28-03/17/2016)	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2015-03-12	2016-03-31
AT0069 (As of 03/18/2016)	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2016-03-07	2017-03-31
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2015-08-27	2016-08-31
S-SAC02	Gain-loss string: 30-1000MHz	Various	Various	2015-06-09	2016-06-30
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2015-08-22	2016-08-31
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2016-02-29	2017-02-28
SA0018	Spectrum Analyzer	Agilent	N9030A	2015-11-07	2016-11-30
SA0027	Spectrum Analyzer	Agilent	N9030A	2016-01-21	2017-01-31
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
HI0050	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2015-07-01	2016-07-31

Test Equipment Used - Conducted Disturbance Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL076	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3476-240	2015-10-29	2016-10-31
HI0079	Temp/Humid/Pressure Meter	Springfield Precision	PreciseTemp	2015-07-01	2016-07-31
LISN002	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2015-08-24	2016-08-31
LISN008	LISN, 50-ohm/50-uH, 2-conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	2015-09-03	2016-09-30
MM0167	Multi-meter	Agilent	U1232A	2015-08-17	2016-08-31
PRE0101521 (75141)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2015-08-26	2016-08-31
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2015-05-22	2016-05-31
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA

7. MEASUREMENT METHODS

Duty Cycle: KDB 558074 D01 v03r05 Section 6.0

6 dB BW: KDB 558074 D01 v03r05, Section 8.1.

Output Power: KDB 558074 D01 v03r05, Section 9.2.3.1.

Power Spectral Density: KDB 558074 D01 v03r05, Section 10.2.
Power Spectral Density: KDB 558074 D01 v03r05, Section 10.3 & 10.5.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r05, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r05, Section 12.1.
Out-of-band emissions in restricted bands: KDB 558074 D01 v03r05, Section 12.2.

General Radiated Emissions – ANSI C63.10 Sections 6.3-6.6

Line Conducted Emissions – ANSI C63.10 Section 6.2

8. ANTENNA PORT TEST RESULTS – AUTHORIZED BAND

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

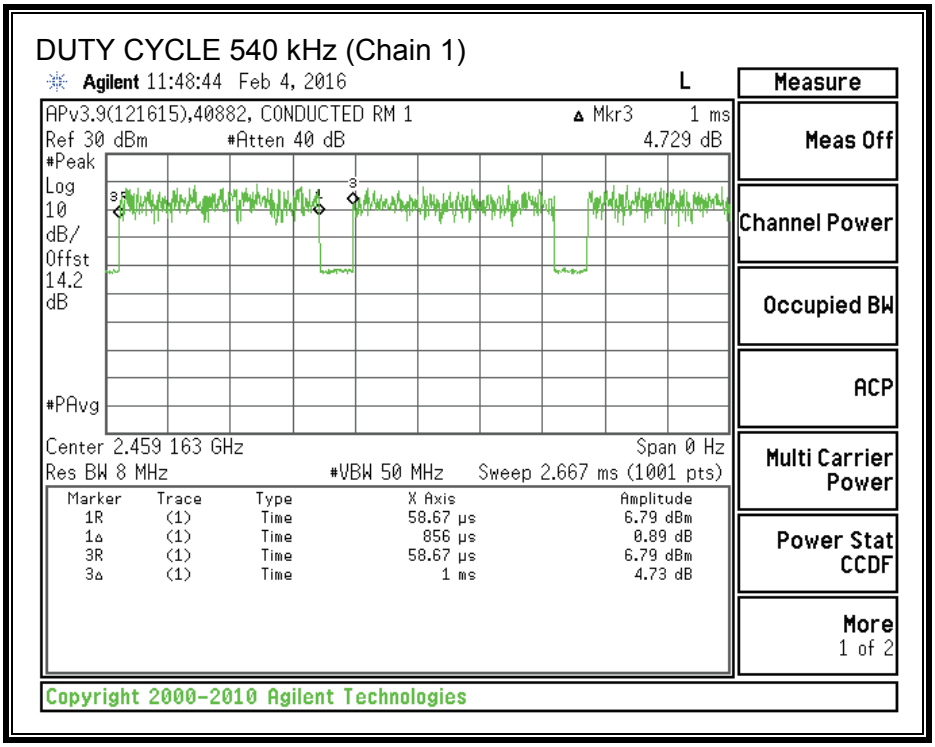
KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

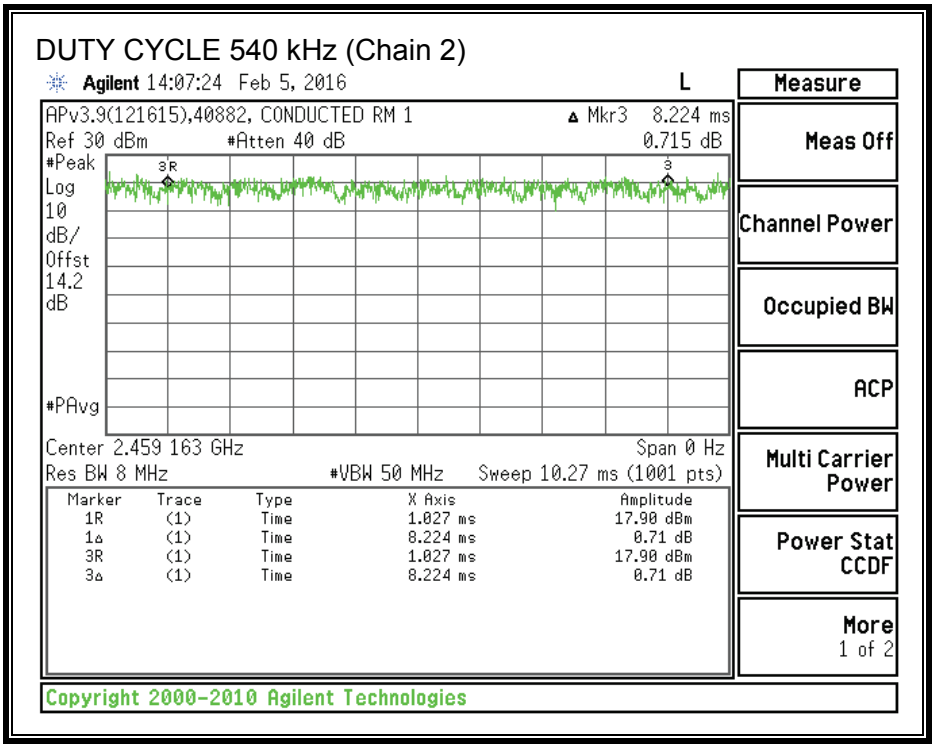
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band (540 kHz) - Covers 900 kHz and 4.5 MHz						
Chain 1	0.856	1.000	0.856	85.60%	0.68	1.168
Chain 2	8.224	8.224	1.000	100.00%	0.00	0.010
Chain 3	8.224	8.224	1.000	100.00%	0.00	0.010
Chain 4	8.224	8.224	1.000	100.00%	0.00	0.010
Chain 5	0.856	1.000	0.856	85.60%	0.68	1.168
Chain 6	0.858	1.001	0.857	85.71%	0.67	1.166
Chain 7	0.845	1.005	0.841	84.08%	0.75	1.183
Chain 8	0.853	1.009	0.845	84.54%	0.73	1.172
2.4GHz Band (9 MHz)						
Chain 1	0.855	1.001	0.854	85.41%	0.68	1.170
Chain 2	32.890	32.890	1.000	100.00%	0.00	0.010
Chain 3	32.890	32.890	1.000	100.00%	0.00	0.010
Chain 4	4.112	4.112	1.000	100.00%	0.00	0.010
Chain 5	0.855	0.998	0.857	85.67%	0.67	1.170
Chain 6	0.858	1.001	0.857	85.71%	0.67	1.166
Chain 7	0.856	1.000	0.856	85.60%	0.68	1.168
Chain 8	0.855	1.001	0.854	85.41%	0.68	1.170

DUTY CYCLE PLOTS

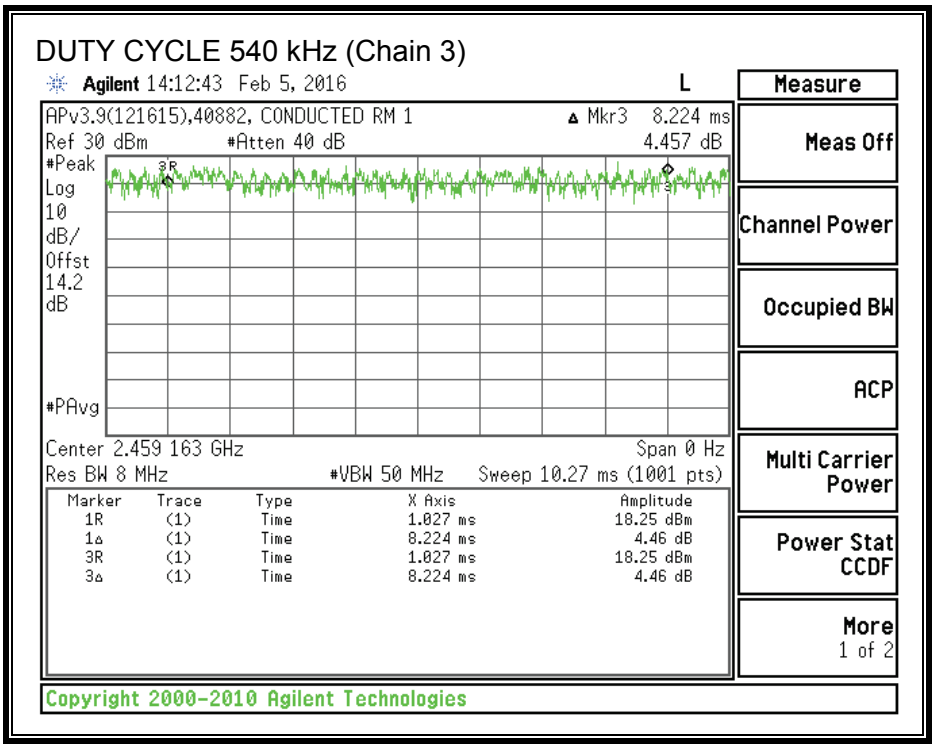
2.4 GHz BAND (540 kHz)



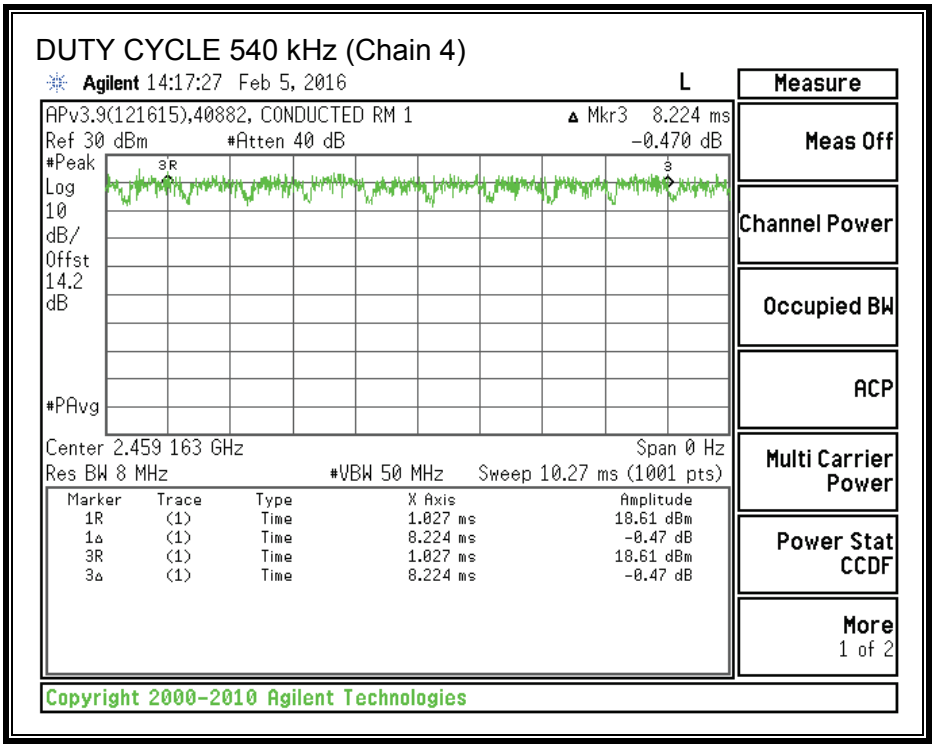
DUTY CYCLE 540 kHz (Chain 2)



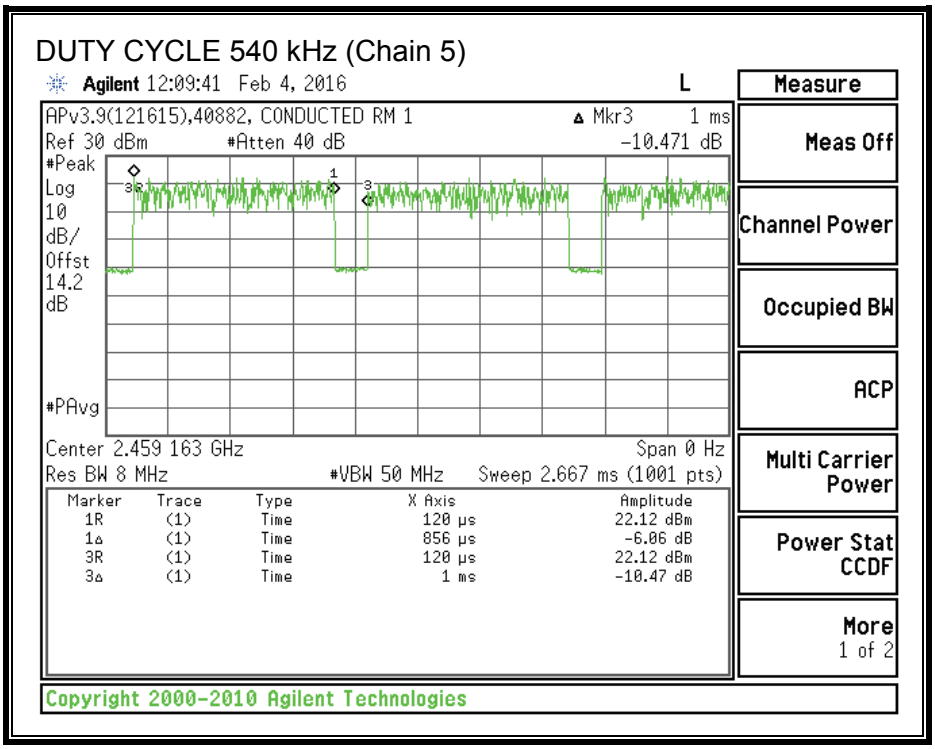
DUTY CYCLE 540 kHz (Chain 3)



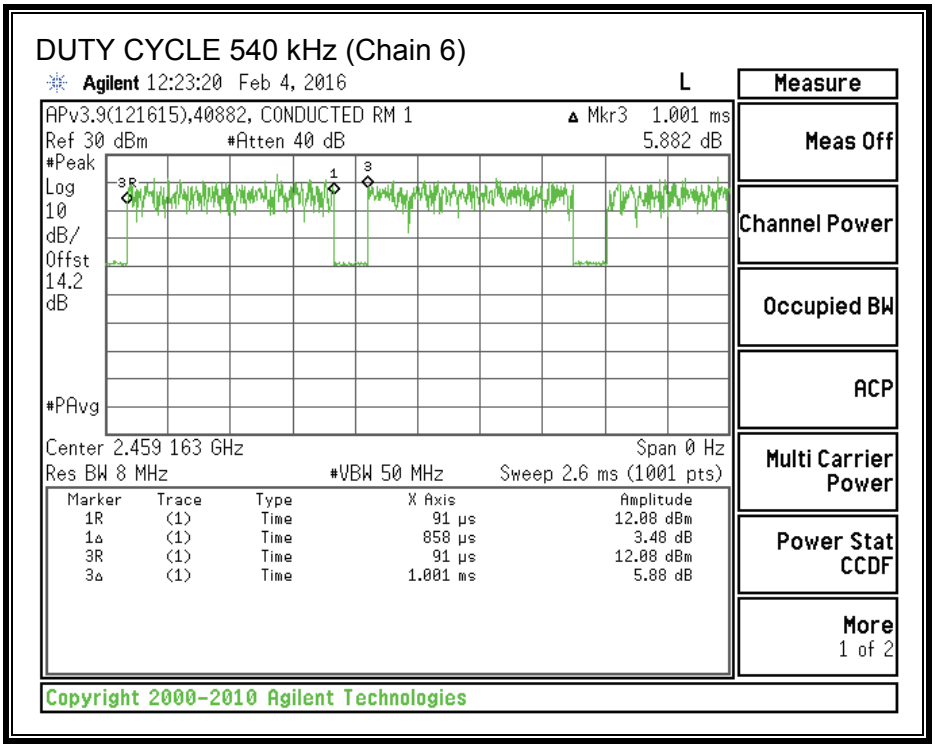
DUTY CYCLE 540 kHz (Chain 4)



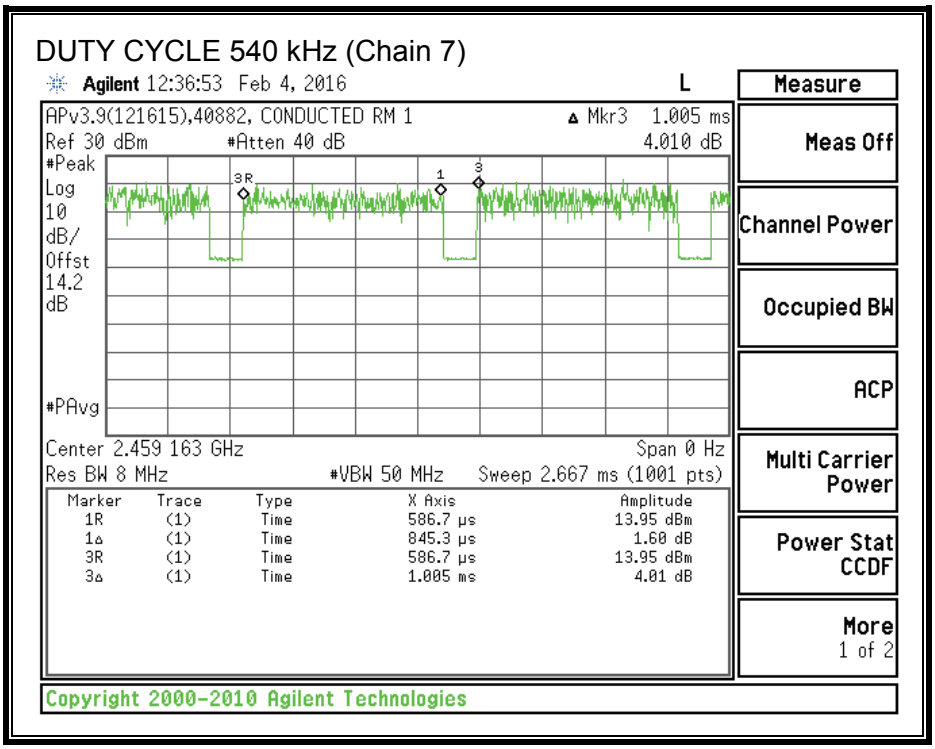
DUTY CYCLE 540 kHz (Chain 5)



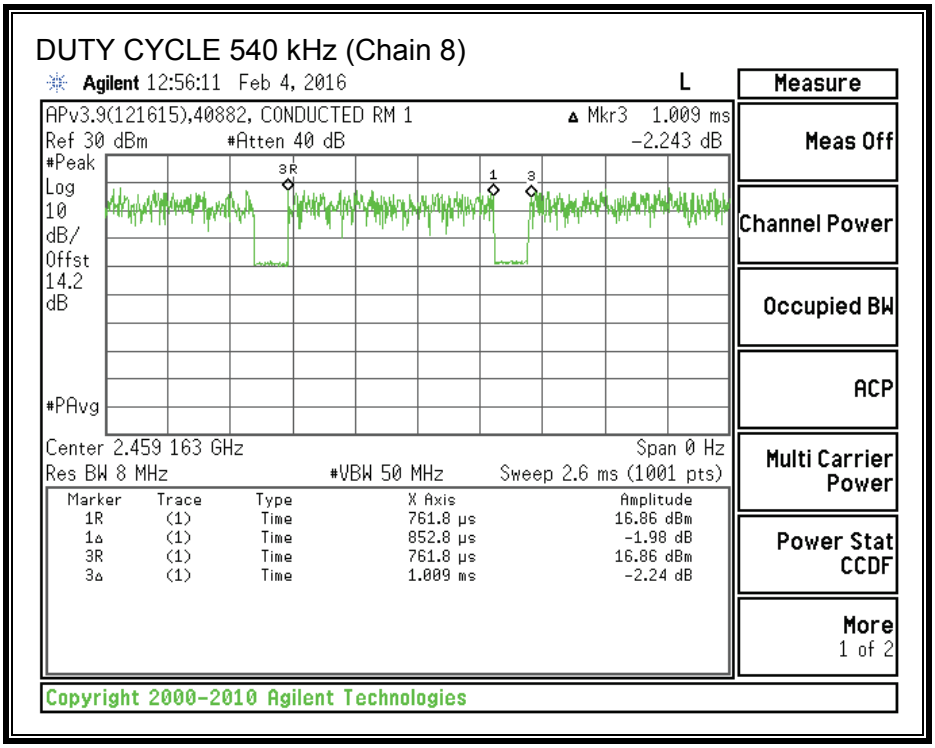
DUTY CYCLE 540 kHz (Chain 6)



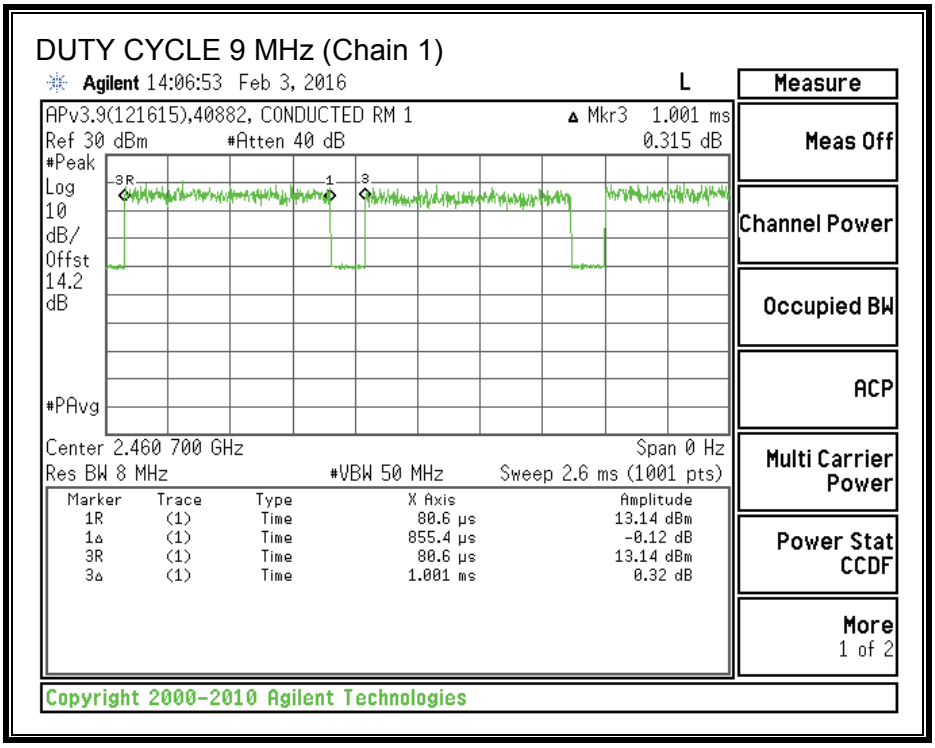
DUTY CYCLE 540 kHz (Chain 7)

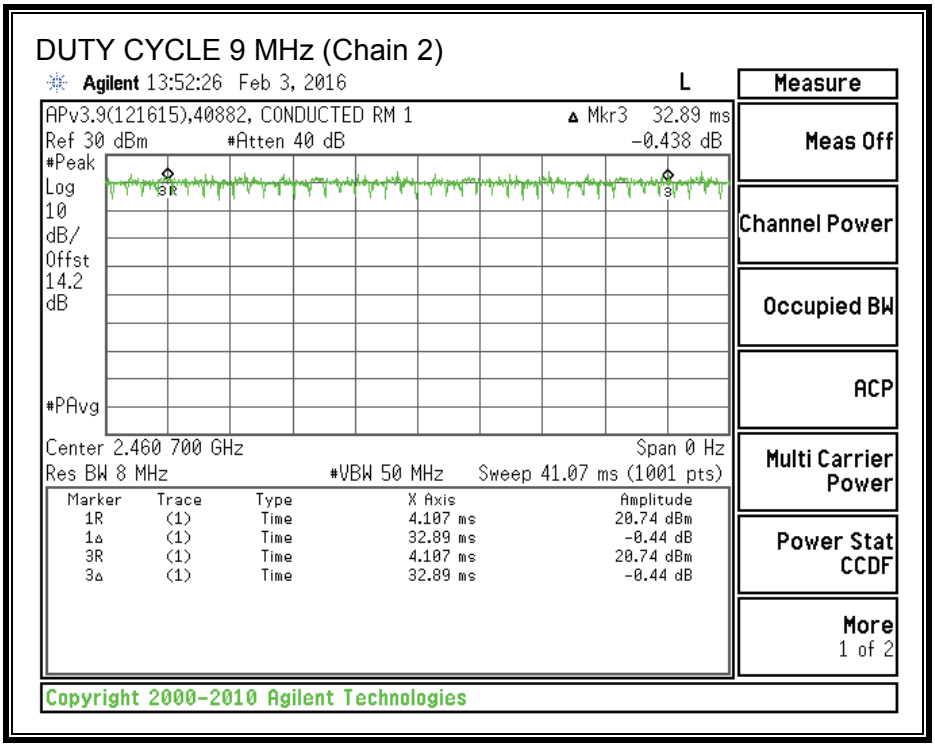


DUTY CYCLE 540 kHz (Chain 8)

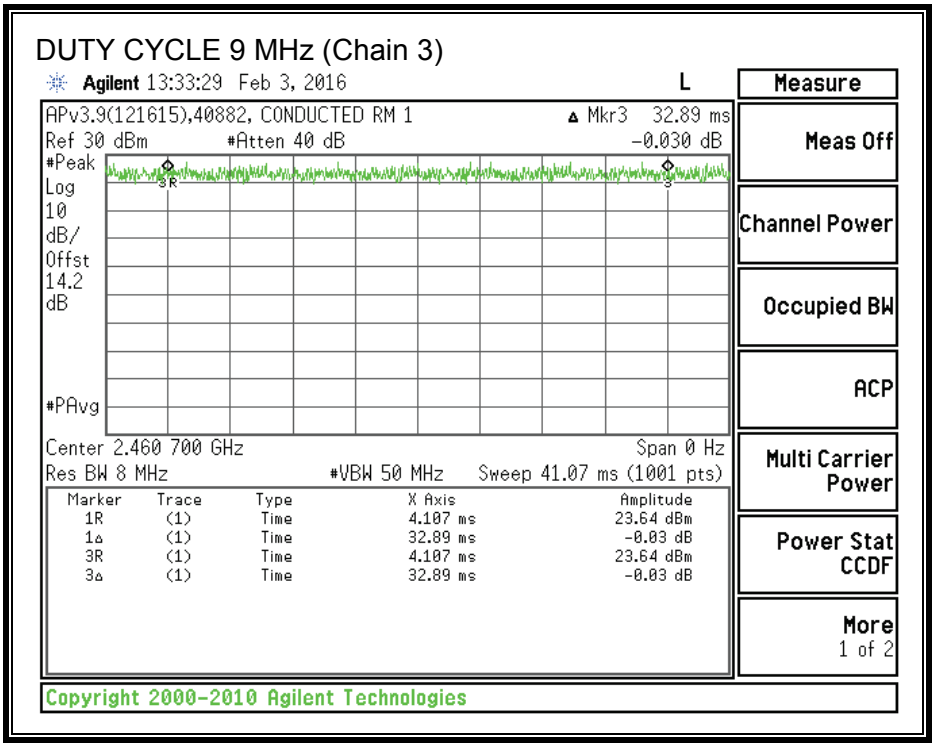


2.4 GHz BAND (9 MHz)

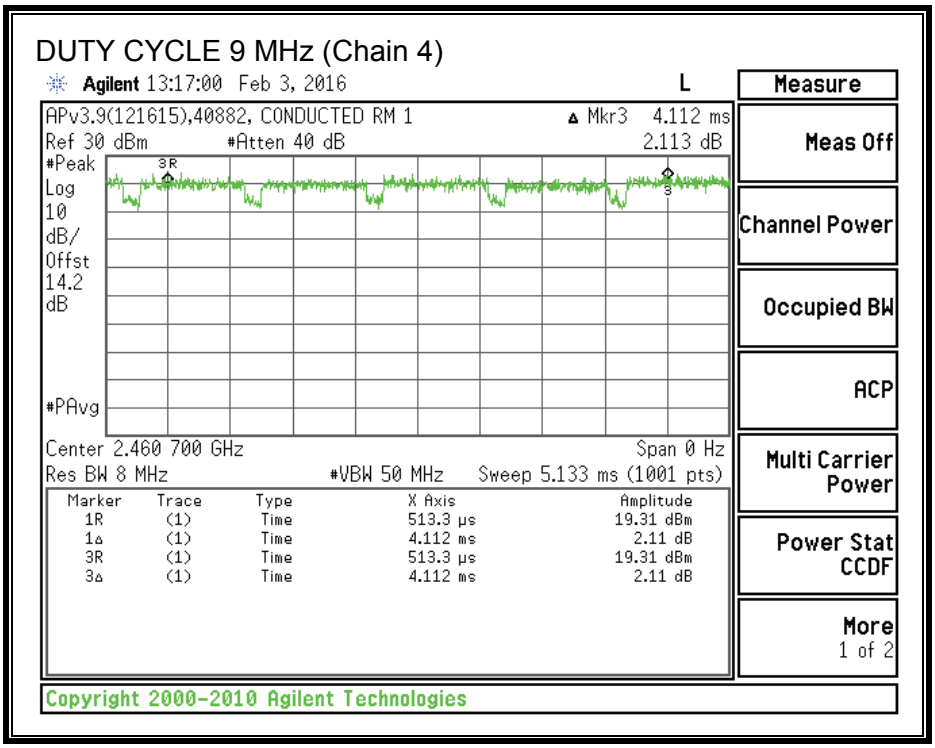




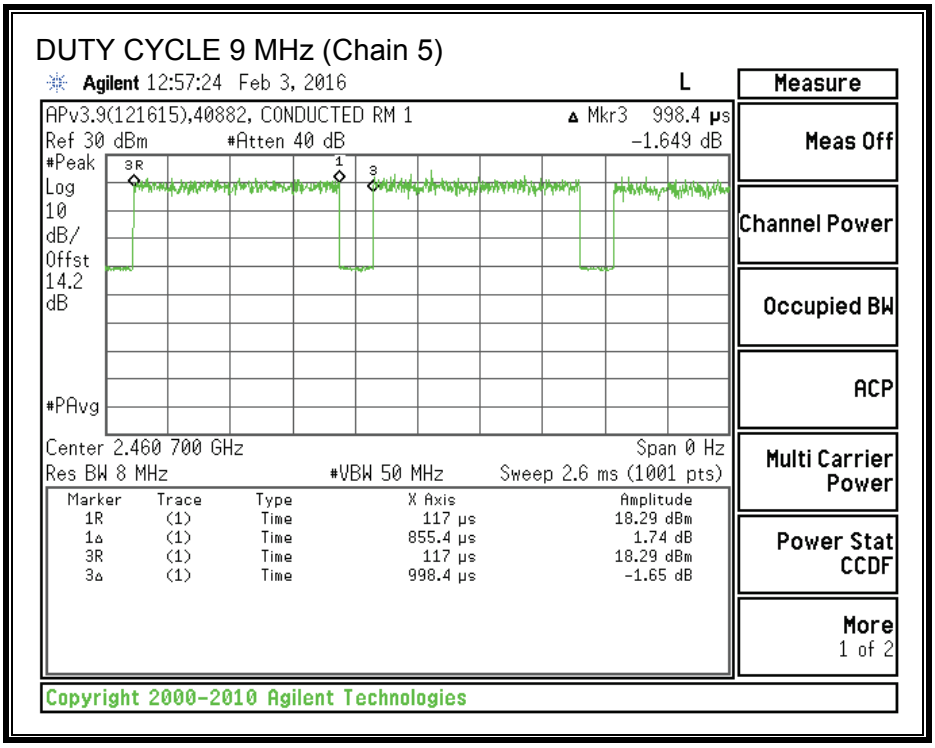
DUTY CYCLE 9 MHz (Chain 3)



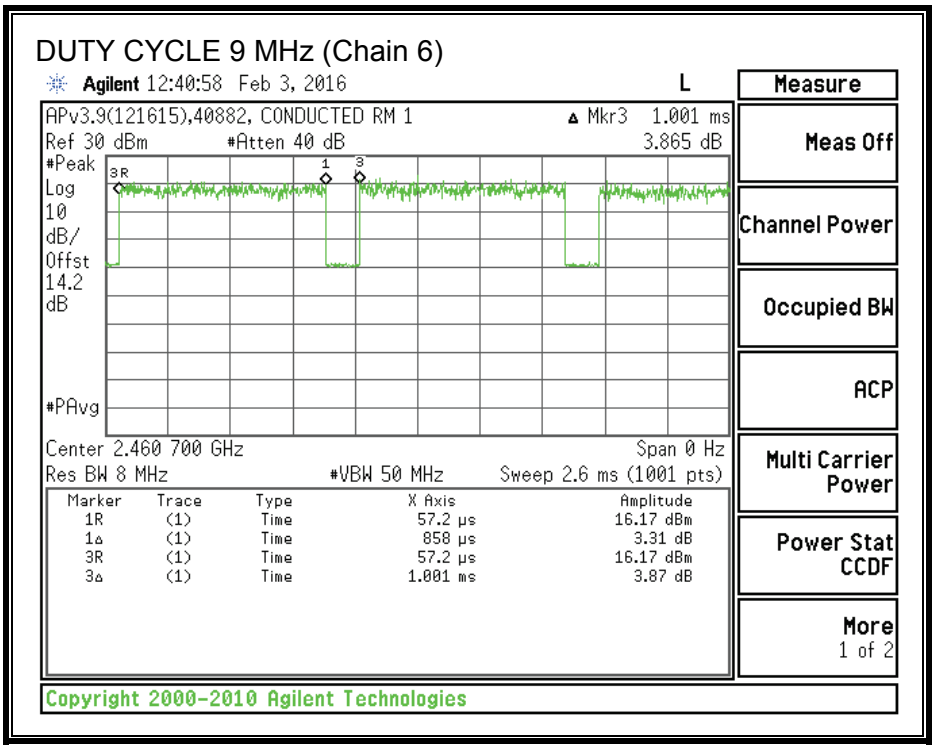
DUTY CYCLE 9 MHz (Chain 4)



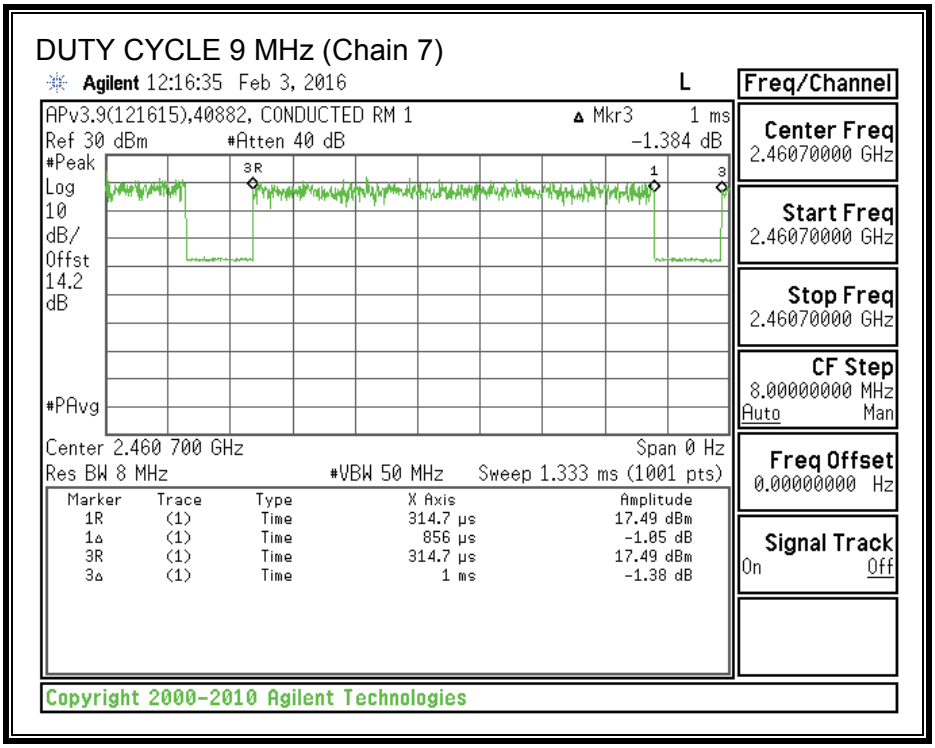
DUTY CYCLE 9 MHz (Chain 5)



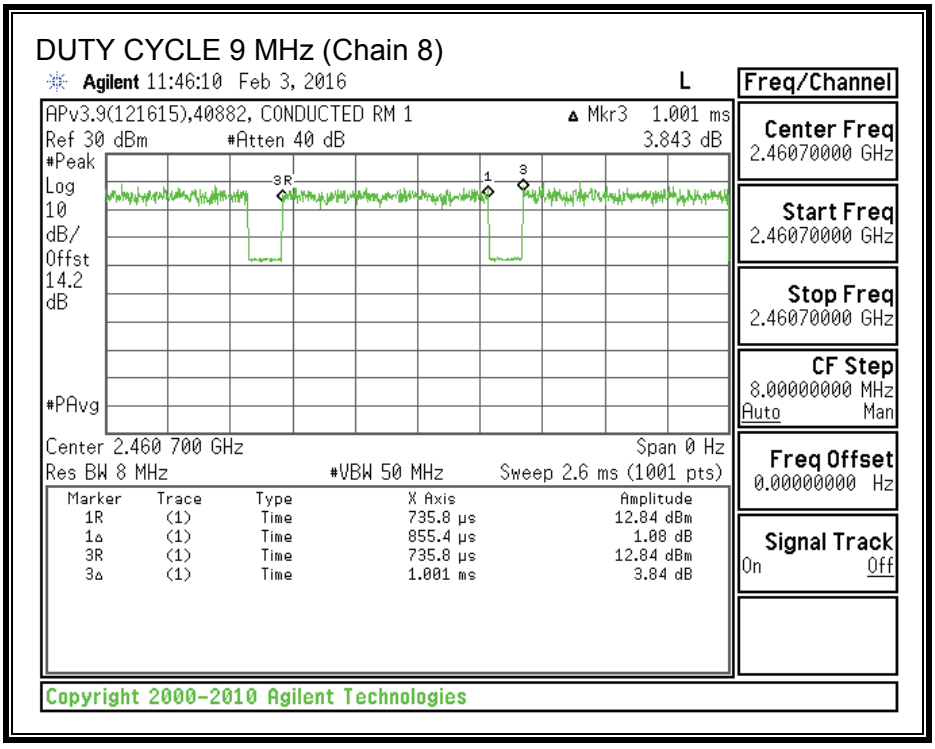
DUTY CYCLE 9 MHz (Chain 6)



DUTY CYCLE 9 MHz (Chain 7)



DUTY CYCLE 9 MHz (Chain 8)



8.2. 540 kHz MODE IN THE 2.4 GHz AUTHORIZED BAND

8.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

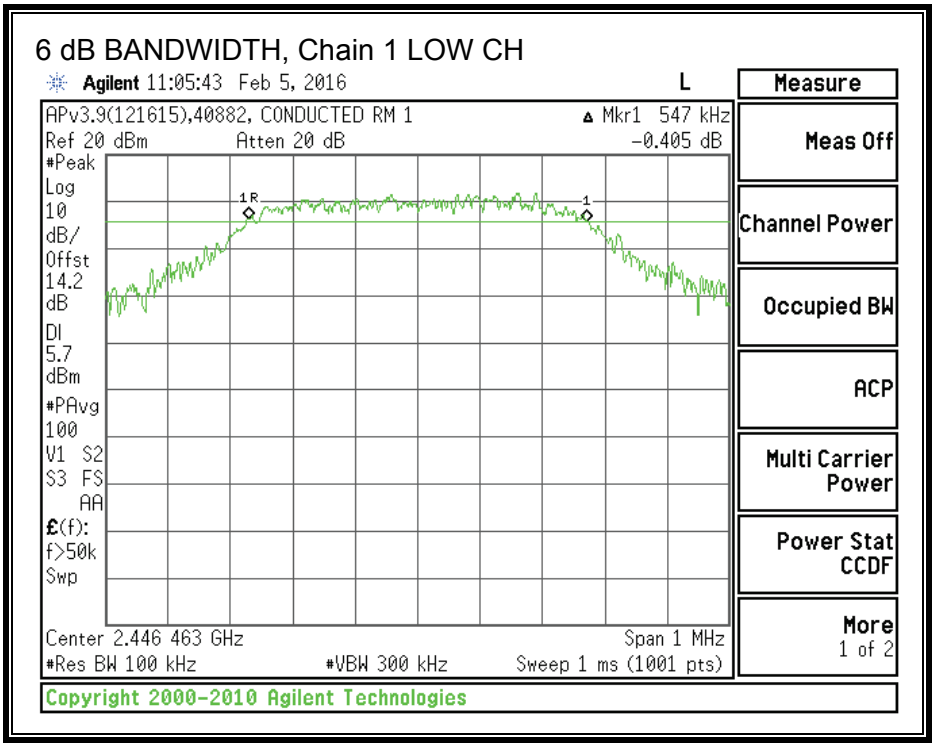
The minimum 6 dB bandwidth shall be at least 500 kHz.

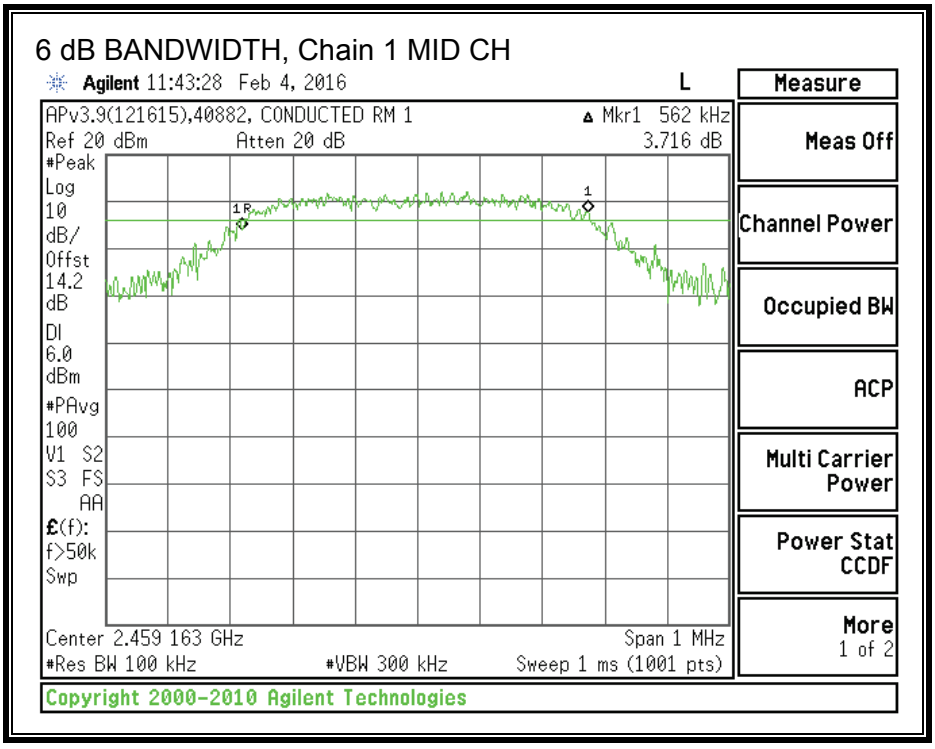
RESULTS

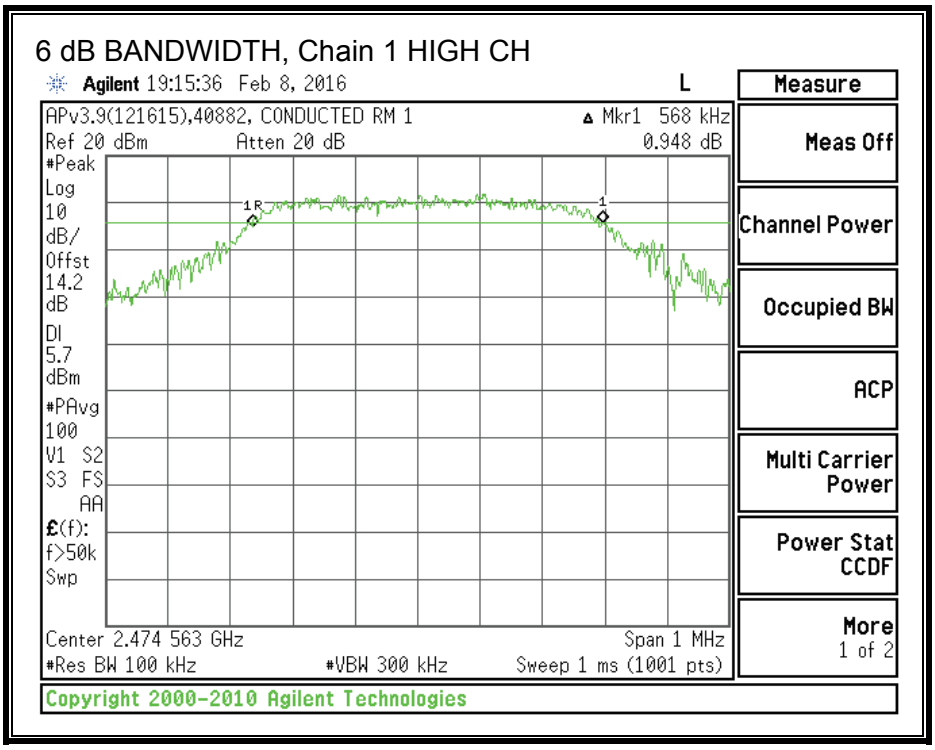
Channel	Frequency (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	6 dB BW Chain 3 (MHz)	6 dB BW Chain 4 (MHz)	Minimum Limit (MHz)
Low	2446.463	0.547	0.549	0.546	0.555	0.5
Mid	2459.163	0.562	0.556	0.570	0.572	0.5
High	2474.563	0.568	0.554	0.565	0.555	0.5

Channel	Frequency (MHz)	6 dB BW Chain 5 (MHz)	6 dB BW Chain 6 (MHz)	6 dB BW Chain 7 (MHz)	6 dB BW Chain 8 (MHz)	Minimum Limit (MHz)
Low	2446.463	0.544	0.559	0.553	0.556	0.5
Mid	2459.163	0.559	0.563	0.547	0.553	0.5
High	2474.563	0.551	0.557	0.550	0.562	0.5

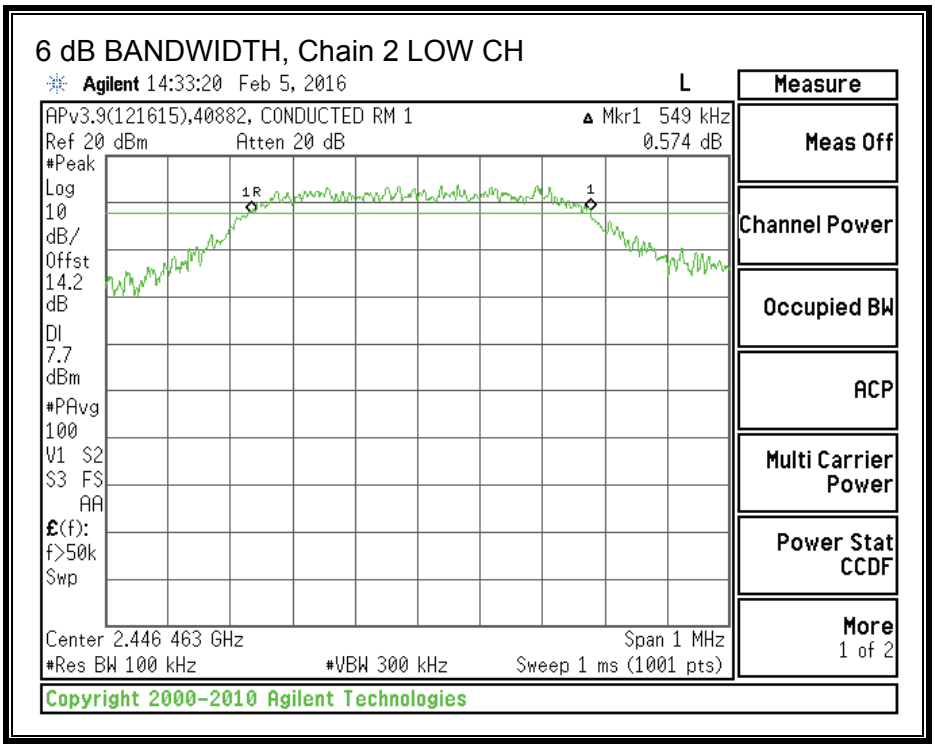
6 dB BANDWIDTH, Chain 1



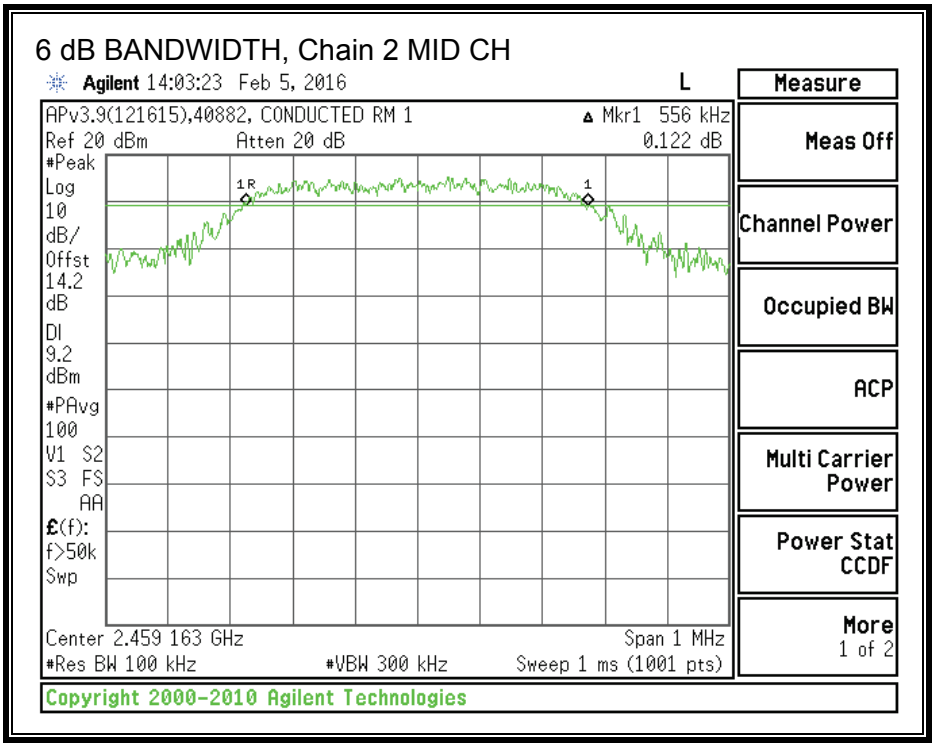




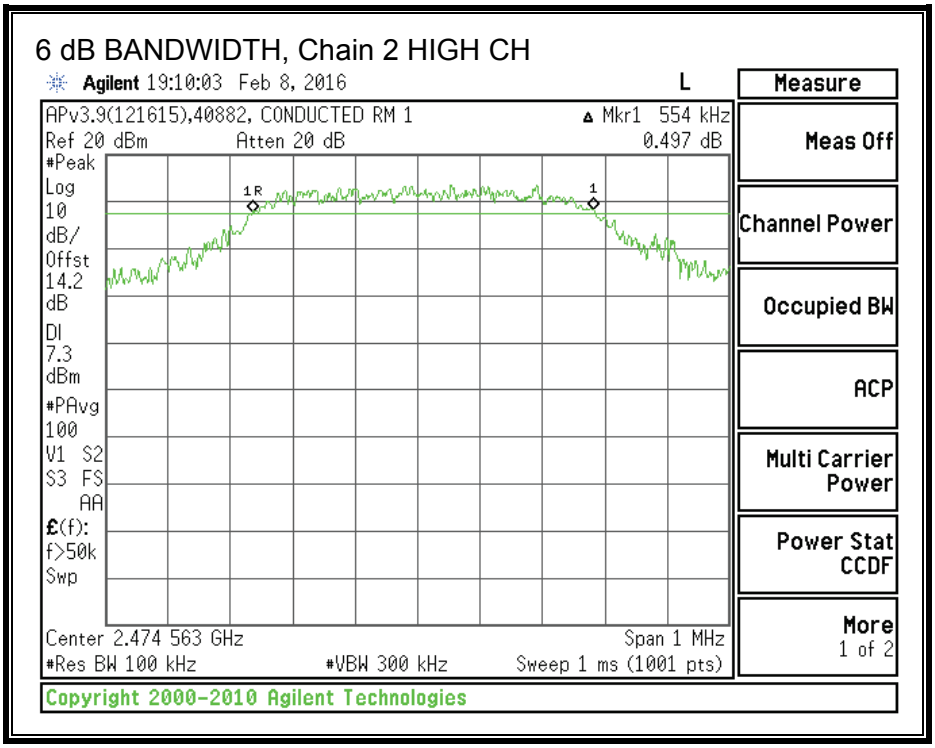
6 dB BANDWIDTH, Chain 2



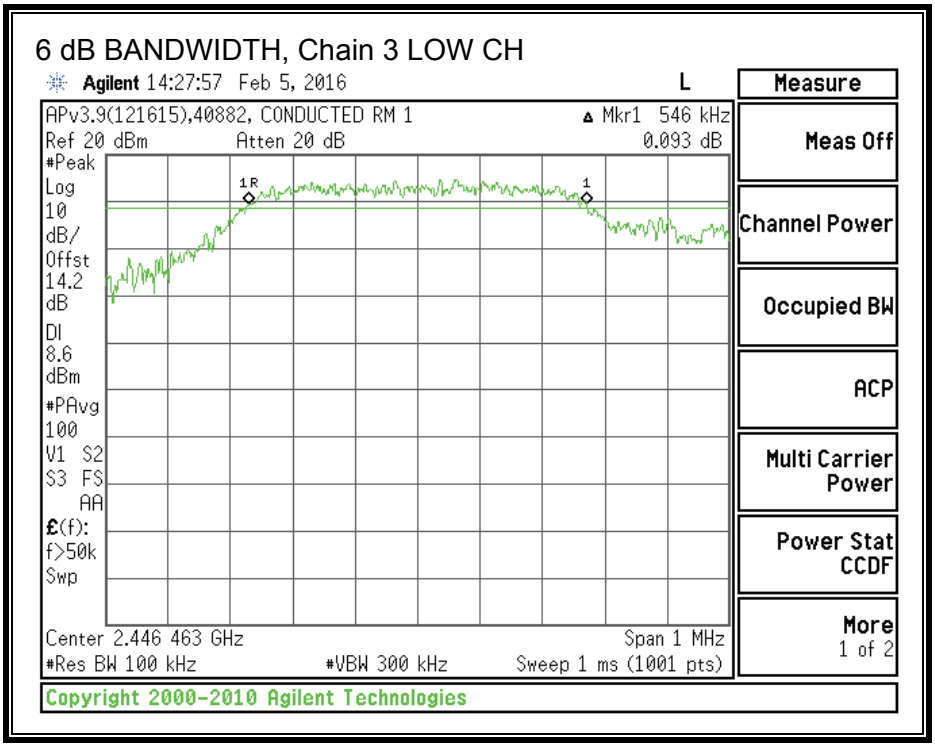
6 dB BANDWIDTH, Chain 2 MID CH

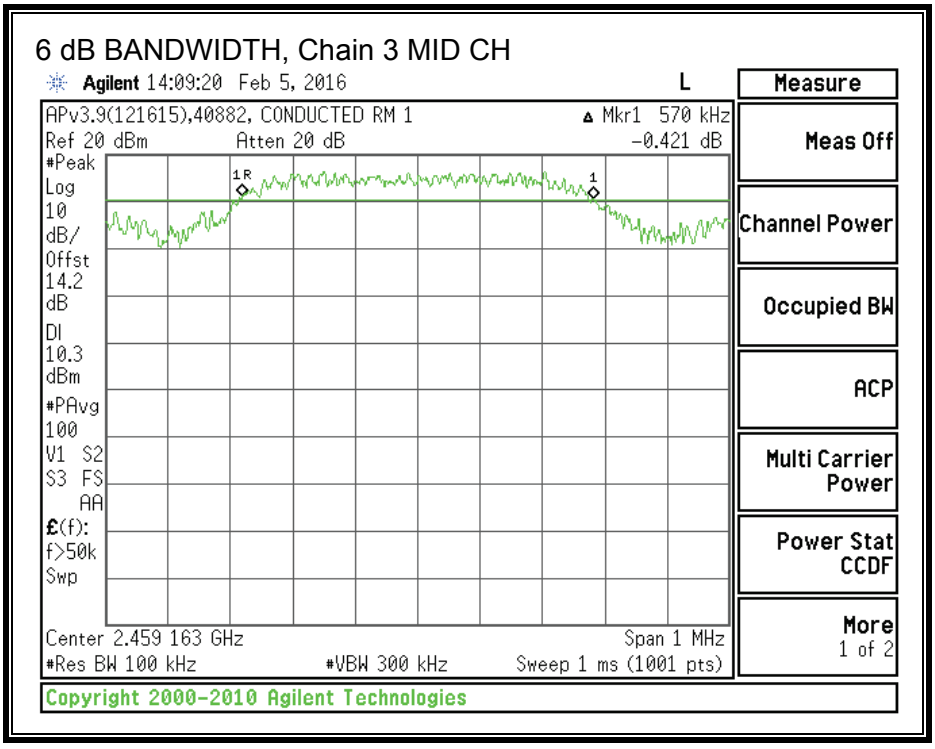


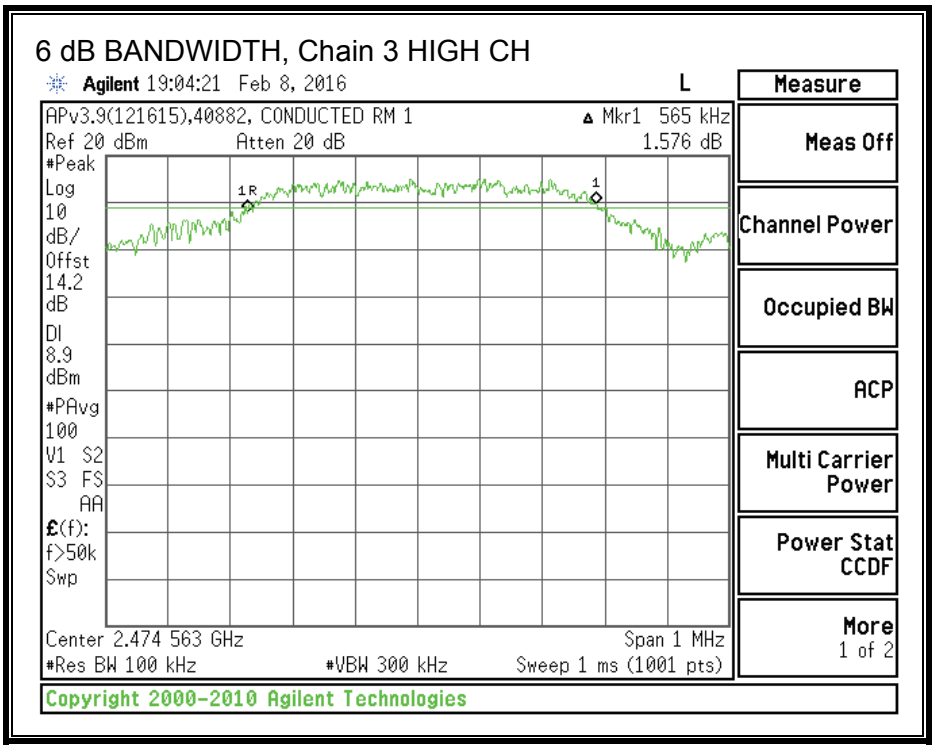
6 dB BANDWIDTH, Chain 2 HIGH CH



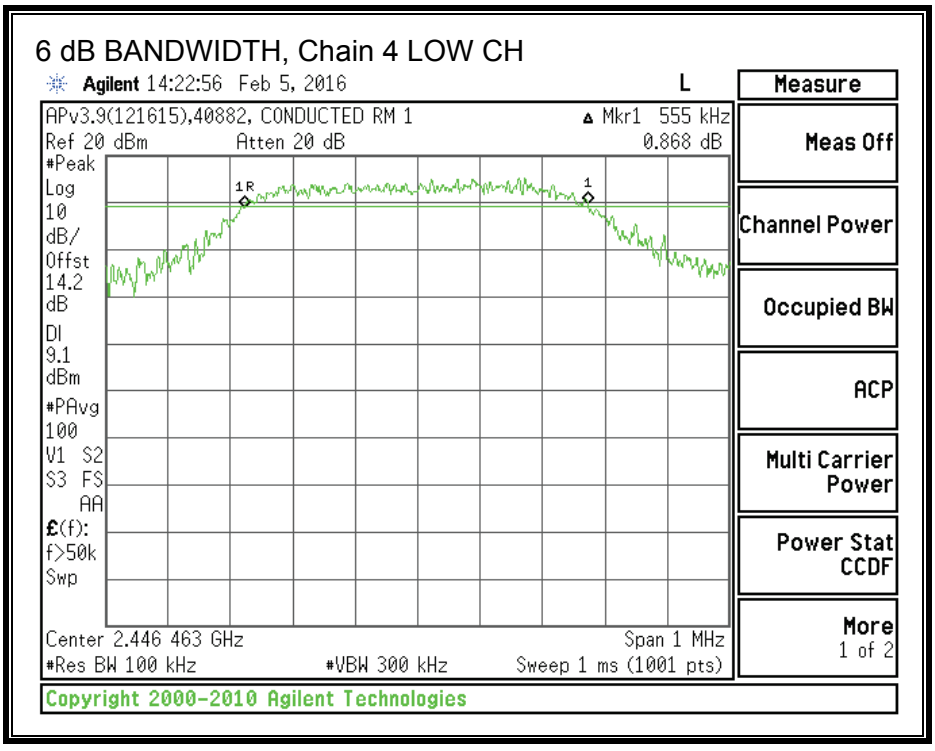
6 dB BANDWIDTH, Chain 3



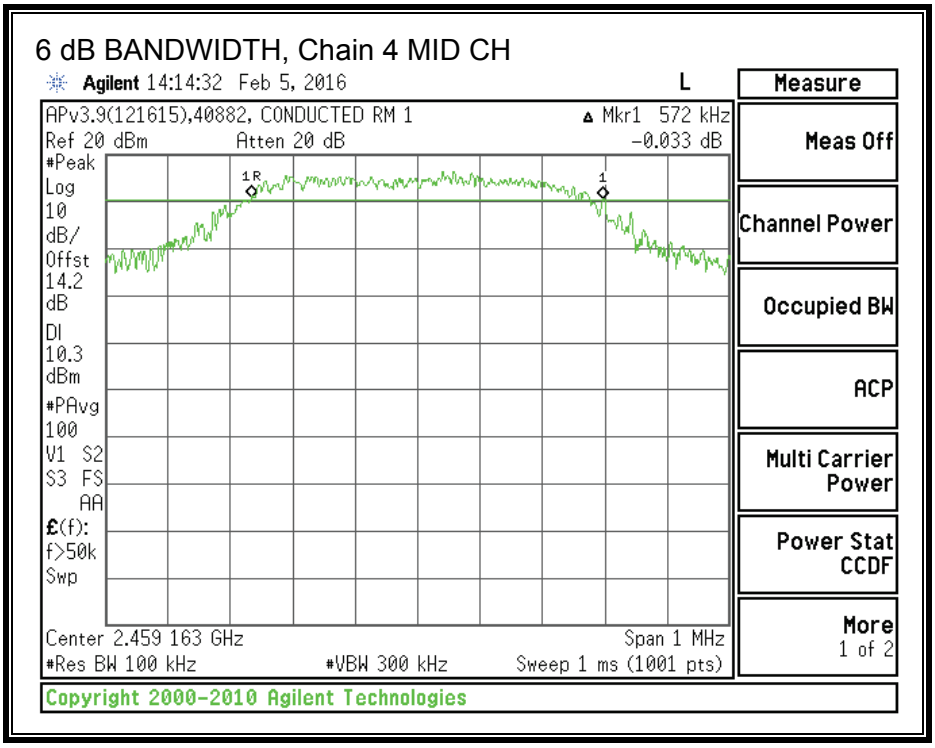




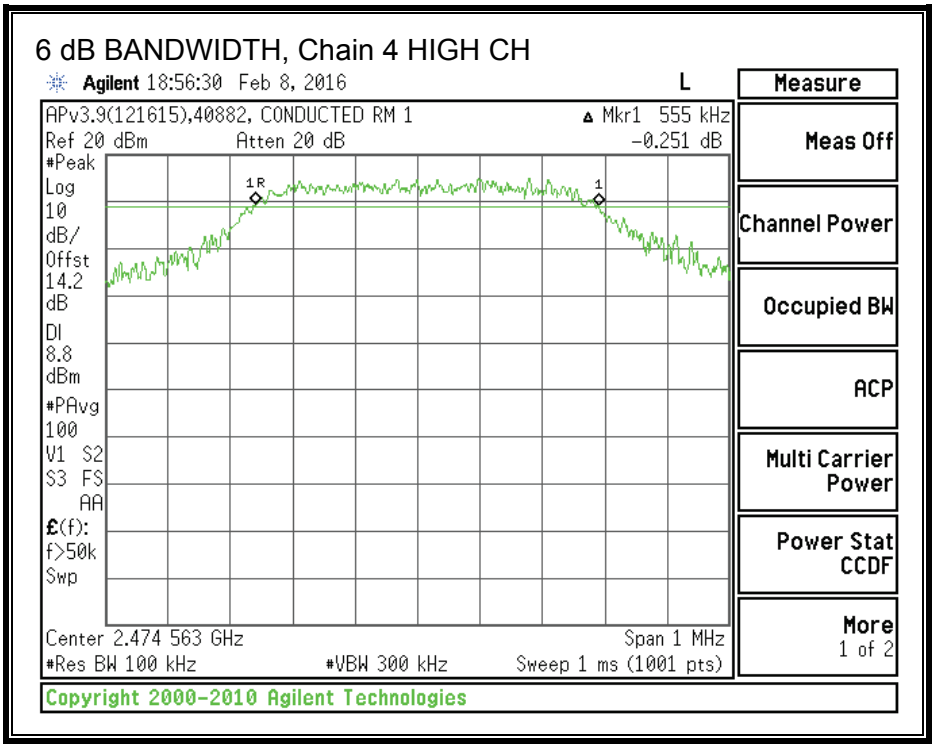
6 dB BANDWIDTH, Chain 4



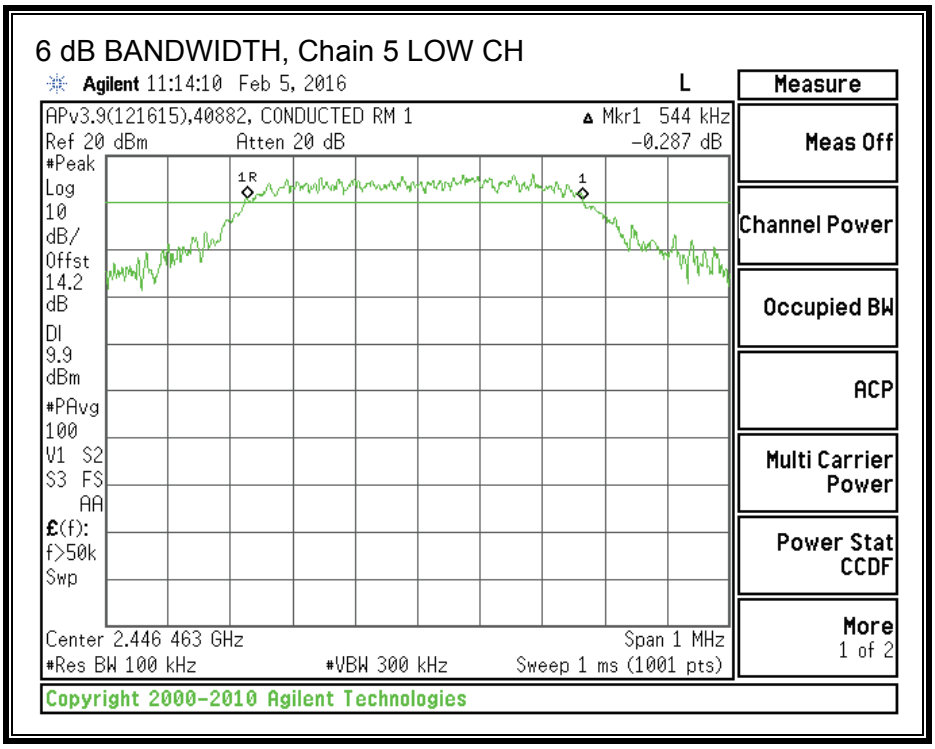
6 dB BANDWIDTH, Chain 4 MID CH

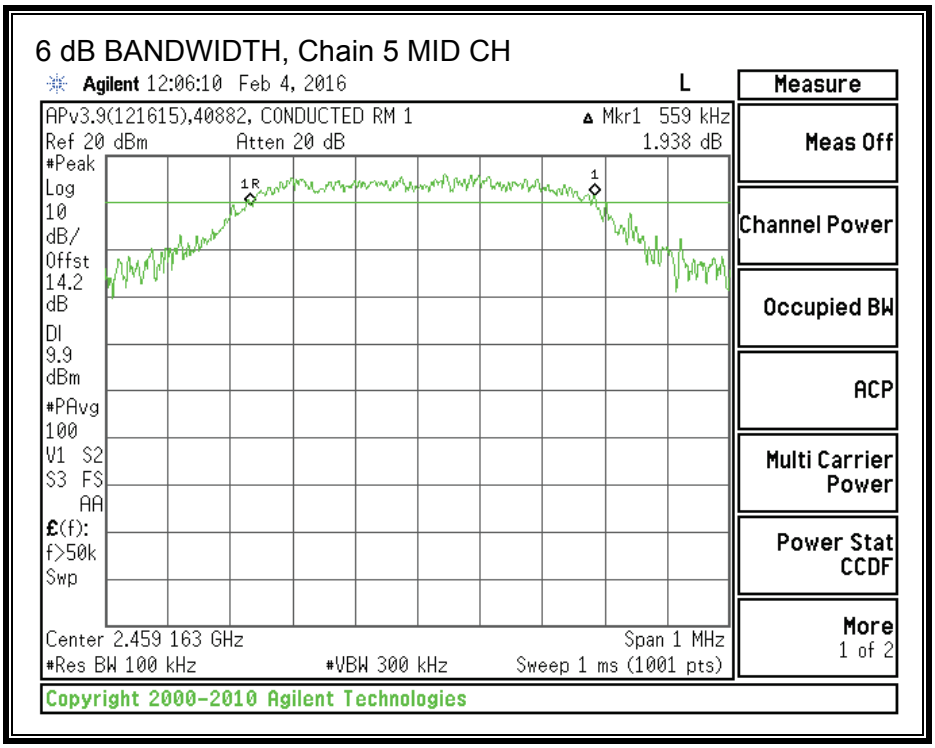


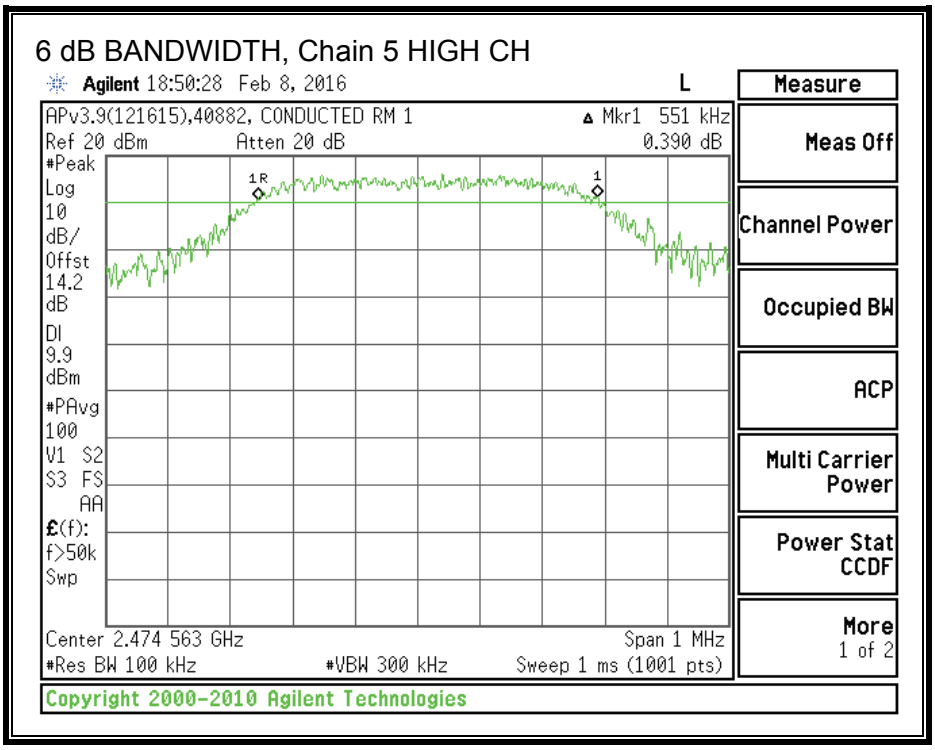
6 dB BANDWIDTH, Chain 4 HIGH CH



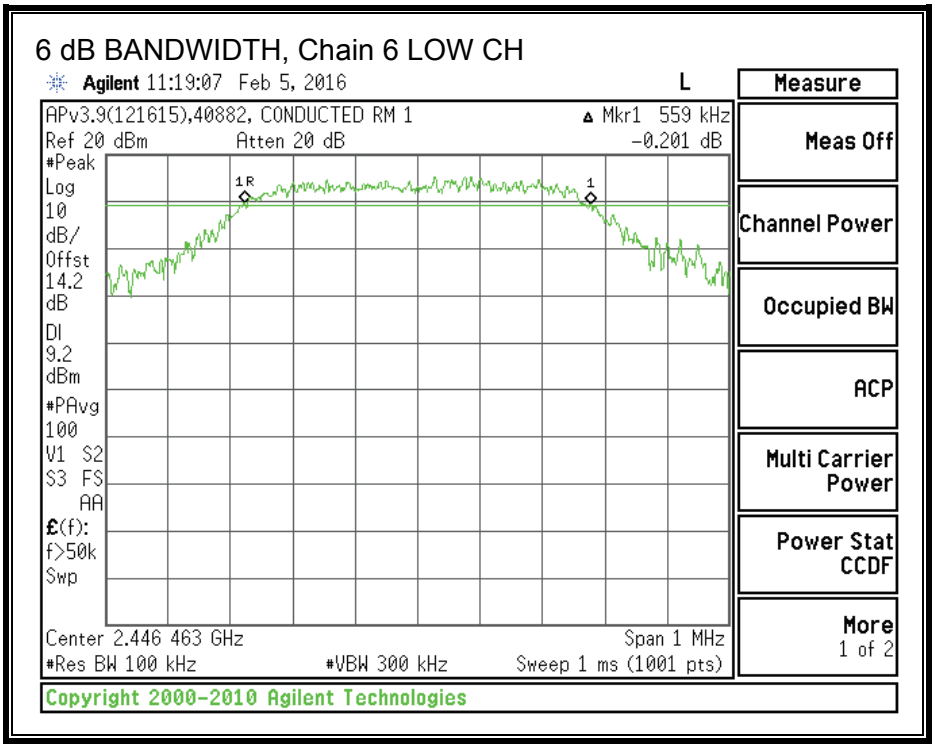
6 dB BANDWIDTH, Chain 5



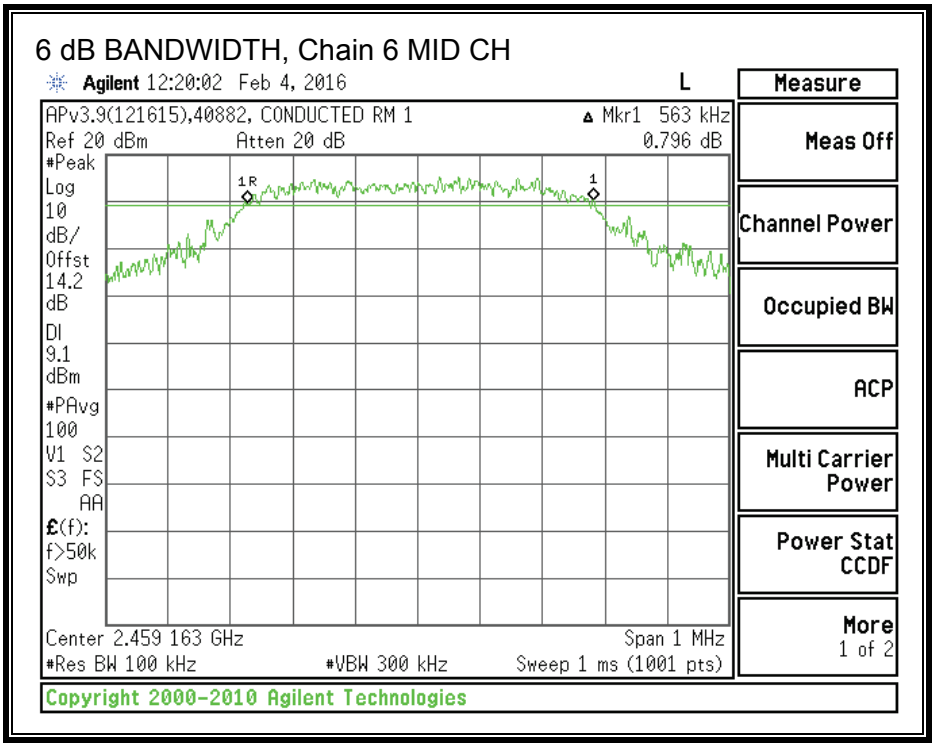




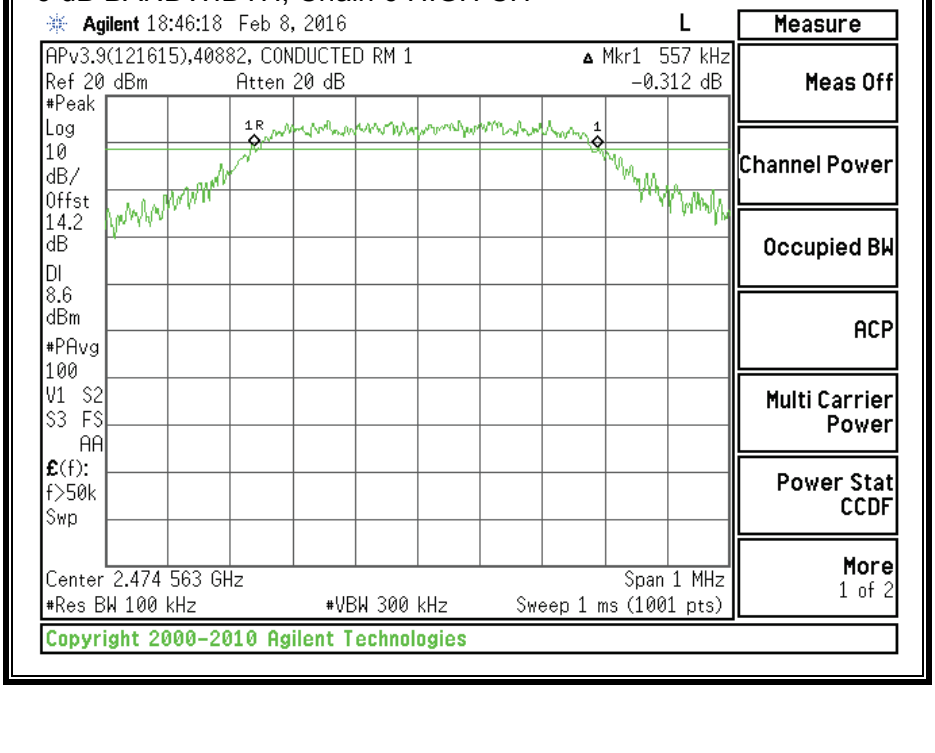
6 dB BANDWIDTH, Chain 6



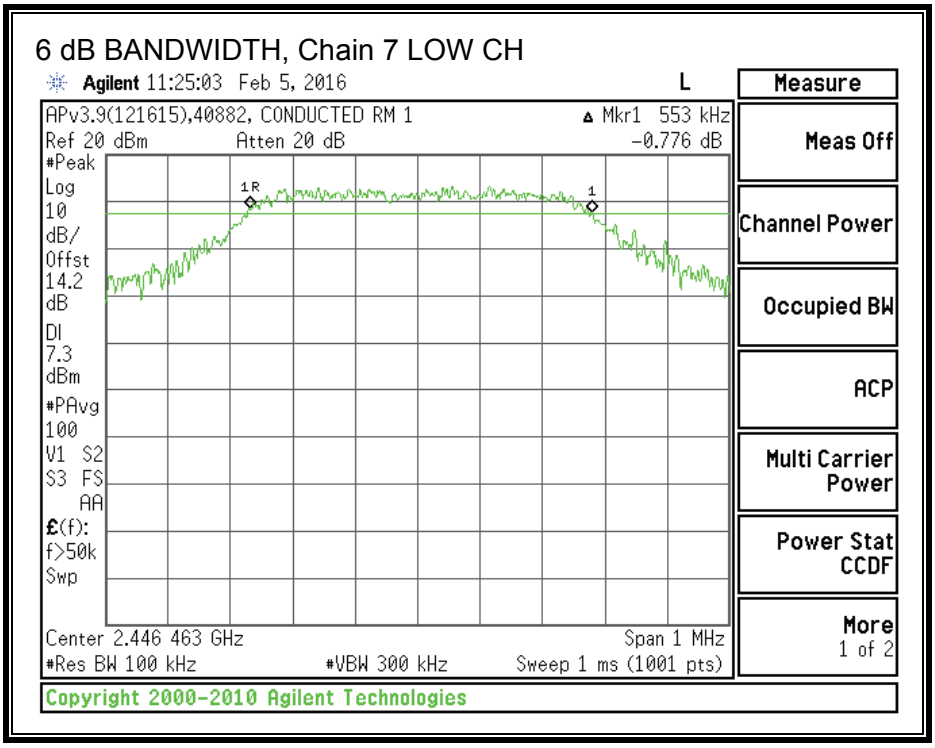
6 dB BANDWIDTH, Chain 6 MID CH

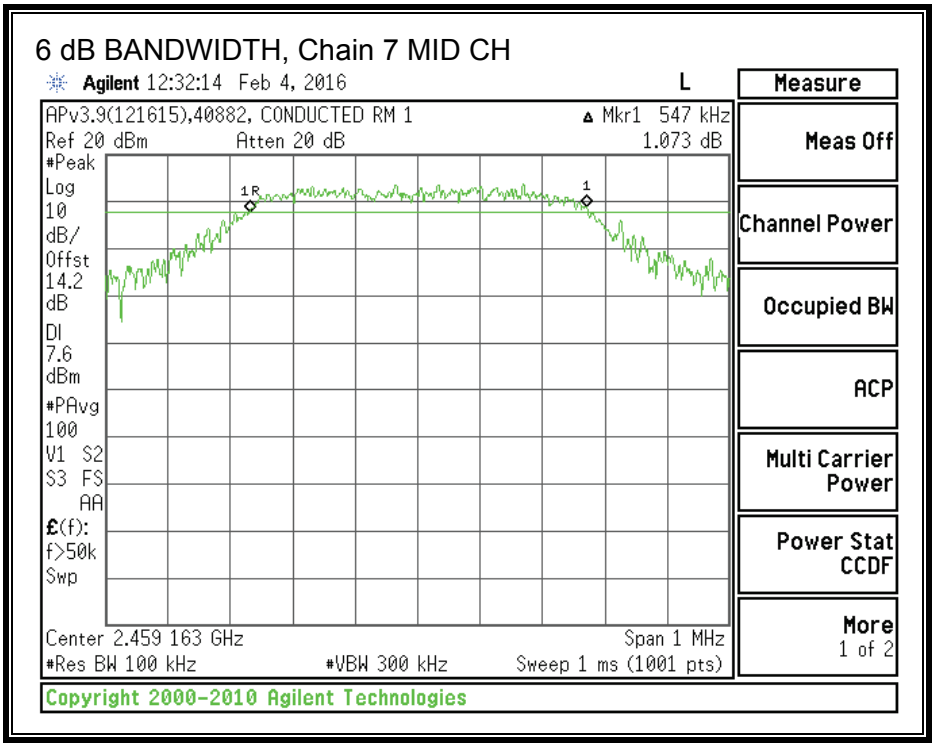


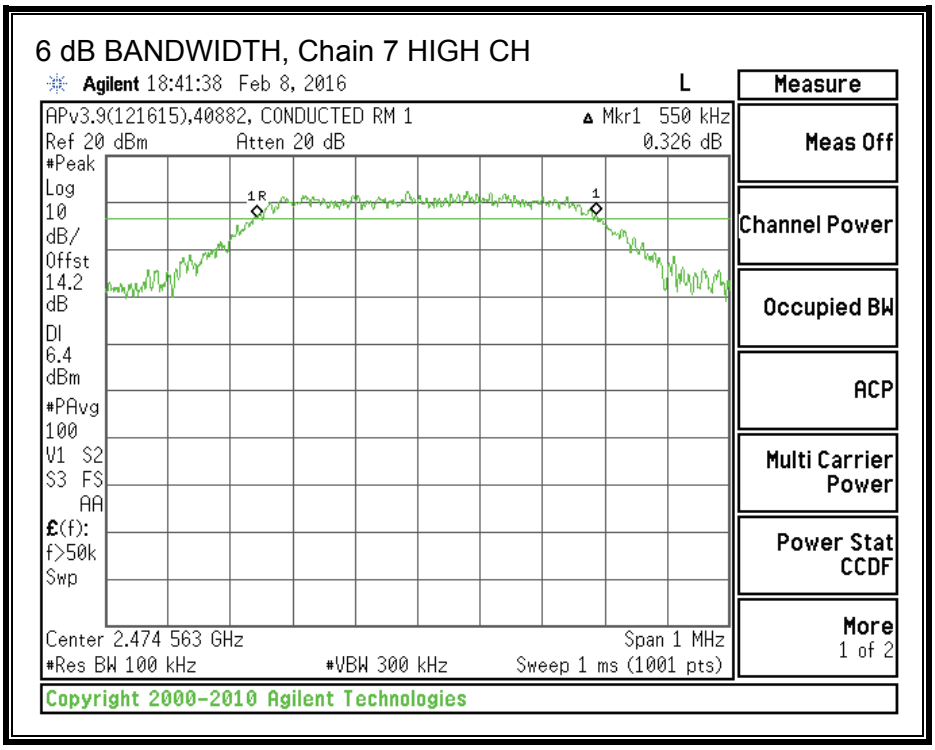
6 dB BANDWIDTH, Chain 6 HIGH CH



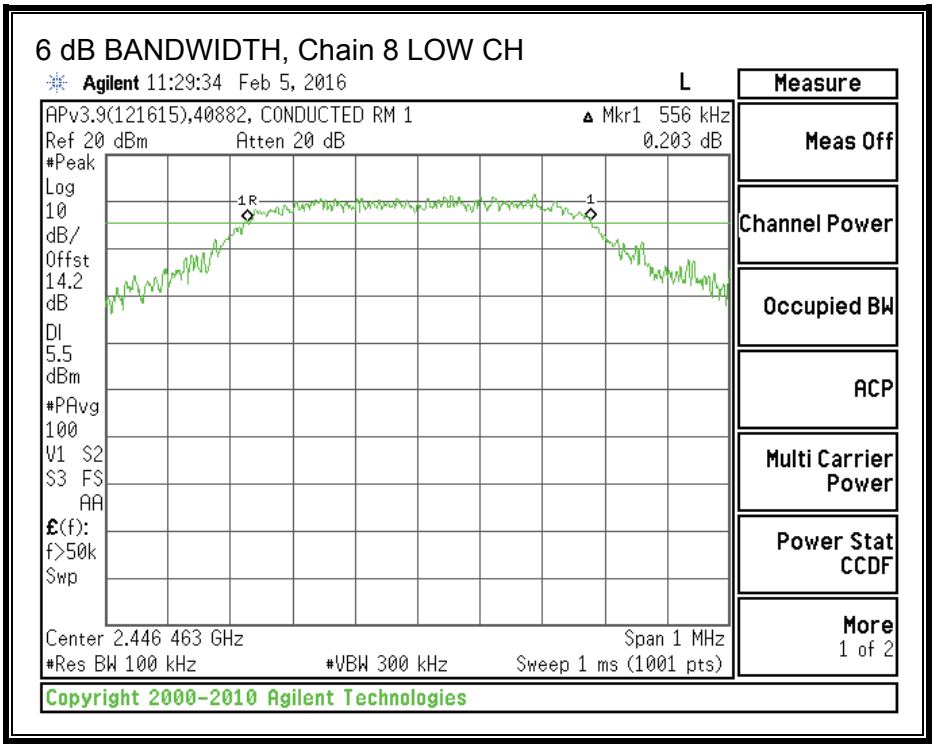
6 dB BANDWIDTH, Chain 7



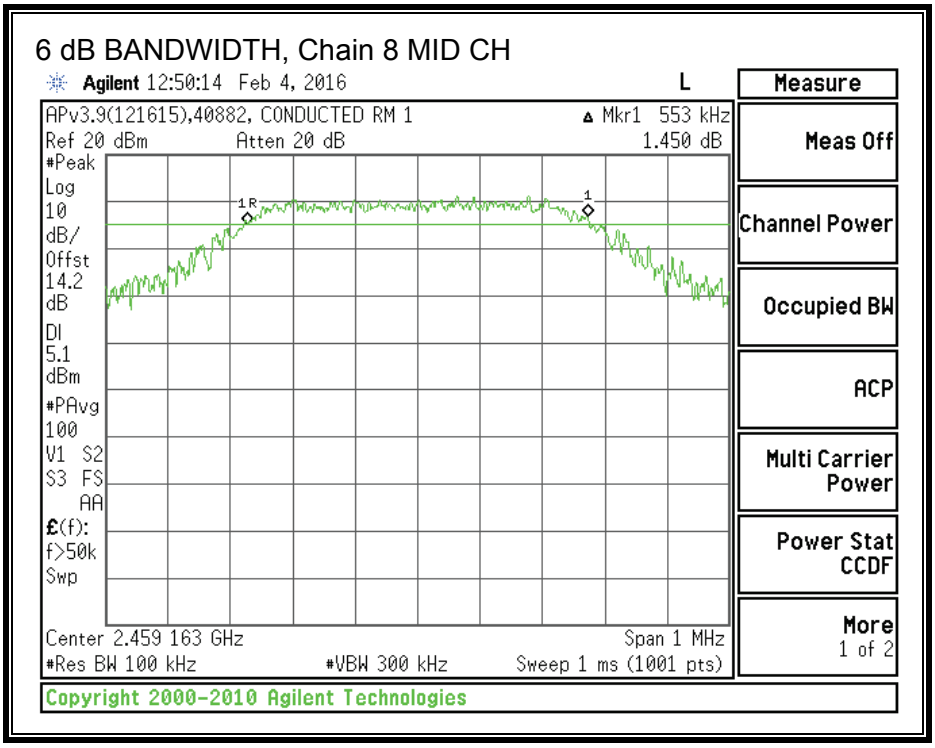




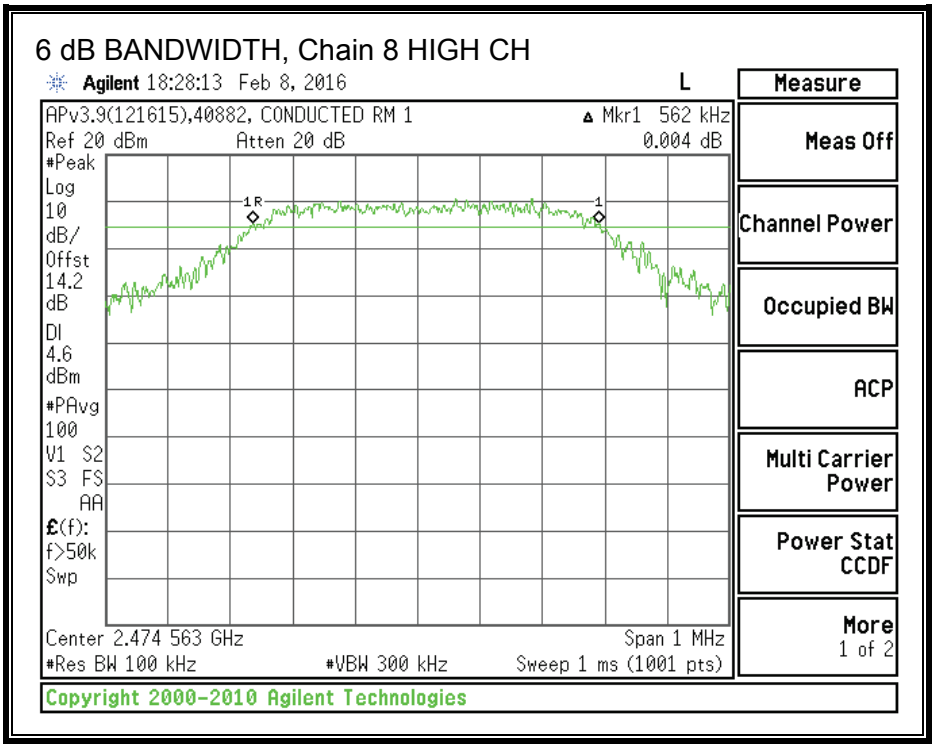
6 dB BANDWIDTH, Chain 8



6 dB BANDWIDTH, Chain 8 MID CH



6 dB BANDWIDTH, Chain 8 HIGH CH



8.2.2. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

	Included in Calculations of Corr'd Power							
Duty Cycle CF (dB)	0.68	0	0	0	0.68	0.67	0.75	0.73

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Chain 4 Power (dBm)	Chain 5 Power (dBm)	Chain 6 Power (dBm)	Chain 7 Power (dBm)	Chain 8 Power (dBm)	Total Power (dBm)
Low	2446.463	9.74	12.81	13.92	12.96	13.97	13.07	10.75	8.99	21.79
Mid	2459.163	9.99	12.85	15.23	13.64	13.03	12.76	10.87	8.73	21.94
High	2474.563	10.12	12.32	14.01	12.64	14.03	12.27	10.91	8.69	21.62

8.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

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.

§15.247 (c) (2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Chain 3 Antenna Gain (dBi)	Chain 4 Antenna Gain (dBi)	Chain 5 Antenna Gain (dBi)	Chain 6 Antenna Gain (dBi)	Chain 7 Antenna Gain (dBi)	Correlated Directional Gain (dBi)
19.7	19.9	20	20.2	20.2	20.1	19.9	19.6	28.98

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)
Low	2446.463	28.98	23.00
Mid	2459.163	28.98	23.00
High	2474.563	28.98	23.00

	Included in Calculations of Corr'd Power			
Duty Cycle CF (dB)	0.68	0	0	0
	0.68	0.67	0.75	0.73

Results

Channel	Frequency (MHz)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Chain 4 Meas Power (dBm)
Low	2446.463	9.74	12.81	13.92	12.96
Mid	2459.163	9.99	12.85	15.23	13.64
High	2474.563	10.12	12.32	14.01	12.64

Channel	Frequency (MHz)	Chain 5 Meas Power (dBm)	Chain 6 Meas Power (dBm)	Chain 7 Meas Power (dBm)	Chain 8 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2446.463	13.97	13.07	10.75	8.99	21.79	23.00	-1.21
Mid	2459.163	13.03	12.76	10.87	8.73	21.94	23.00	-1.06
High	2474.563	14.03	12.27	10.91	8.69	21.62	23.00	-1.38

8.2.4. POWER SPECTRUM DENSITY

LIMITS

FCC §15.247 (e)

RESULTS

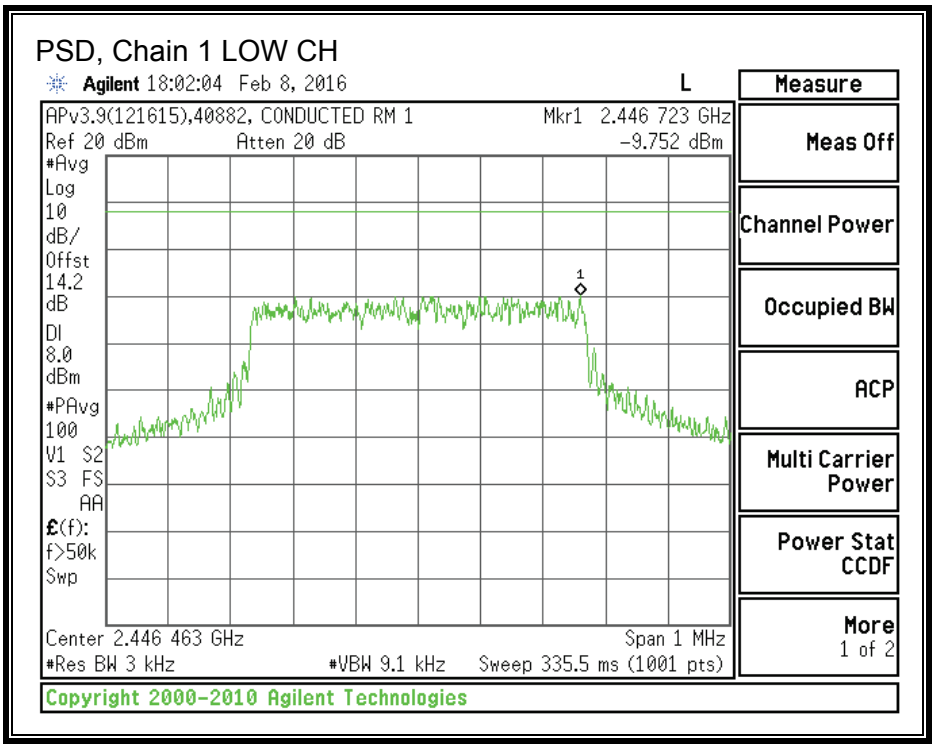
	Included in Calculations of Corr'd PSD			
Duty Cycle CF (dB)	0.68	0	0	0
	0.68	0.67	0.75	0.73

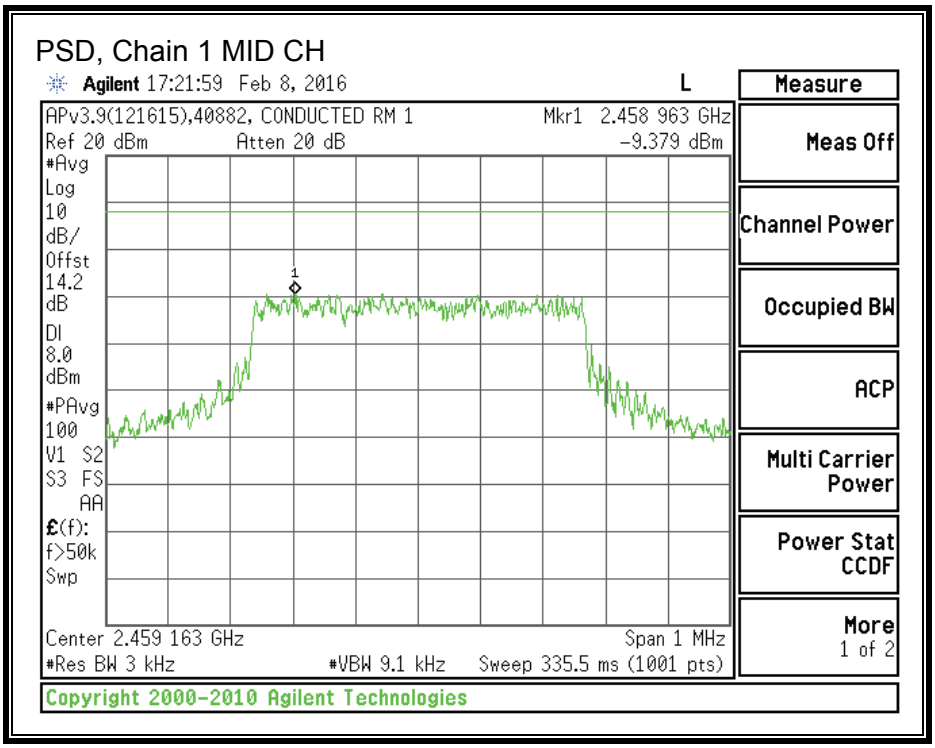
PSD Results

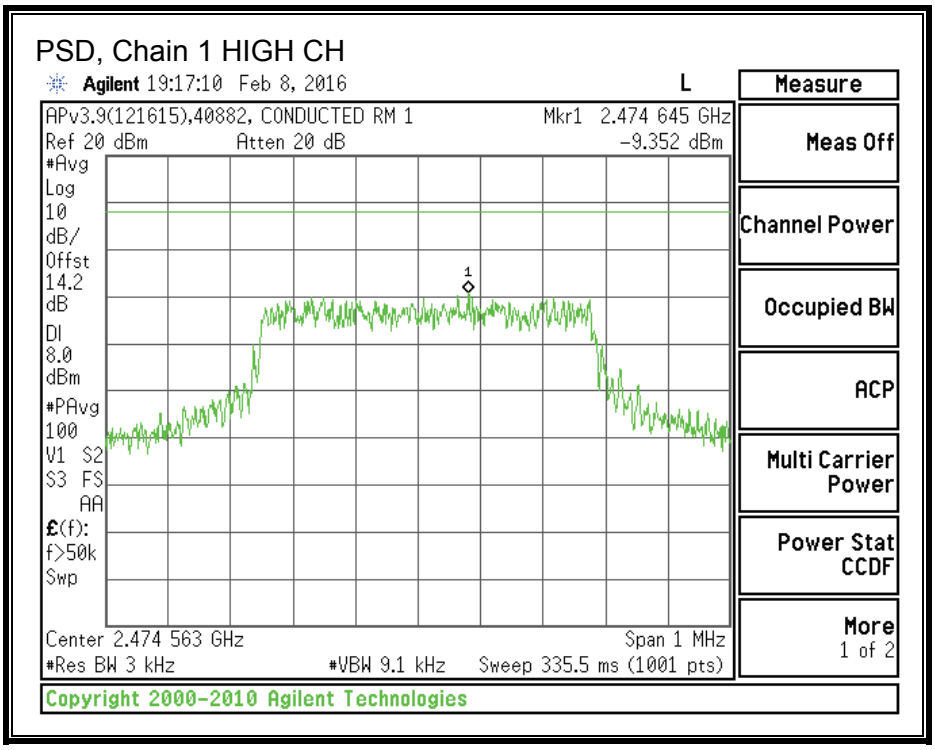
Channel	Frequency (MHz)	Chain 1 Meas (dBm)	Chain 2 Meas (dBm)	Chain 3 Meas (dBm)	Chain 4 Meas (dBm)
Low	2446.463	-9.75	-7.73	-6.87	-6.39
Mid	2459.163	-9.38	-7.16	-4.91	-5.54
High	2474.563	-9.35	-7.77	-6.24	-6.13

Channel	Frequency (MHz)	Chain 5 Meas (dBm)	Chain 6 Meas (dBm)	Chain 7 Meas (dBm)	Chain 8 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2446.463	-5.25	-6.19	-7.68	-10.33	2.23	8.0	-5.8
Mid	2459.163	-4.88	-6.04	-7.16	-10.03	2.89	8.0	-5.1
High	2474.563	-5.23	-6.73	-9.11	-10.93	2.11	8.0	-5.9

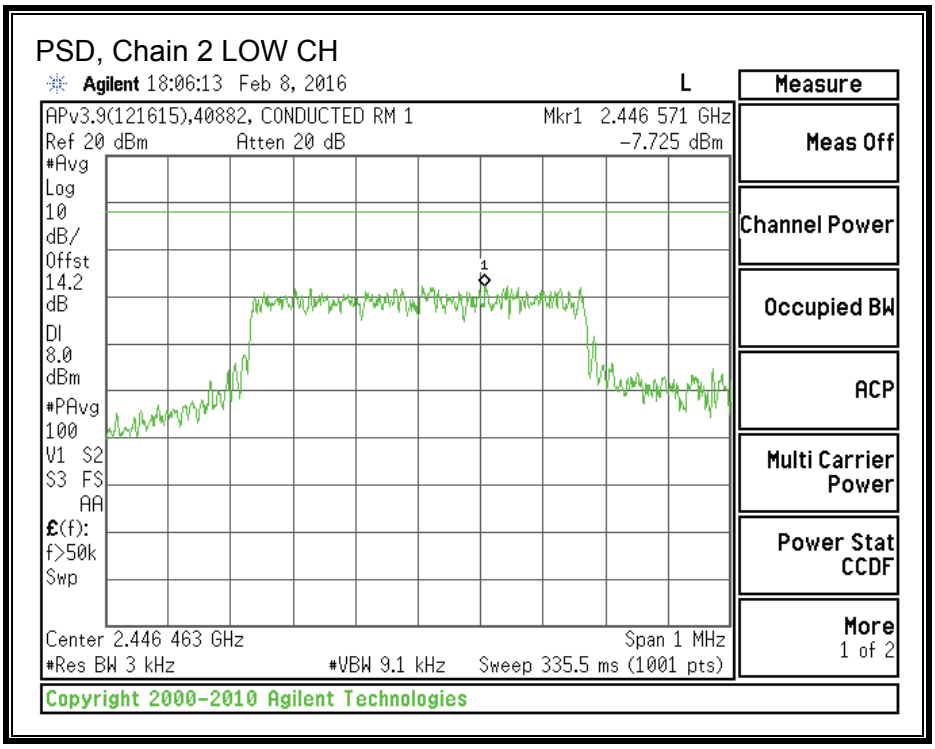
PSD, Chain 1



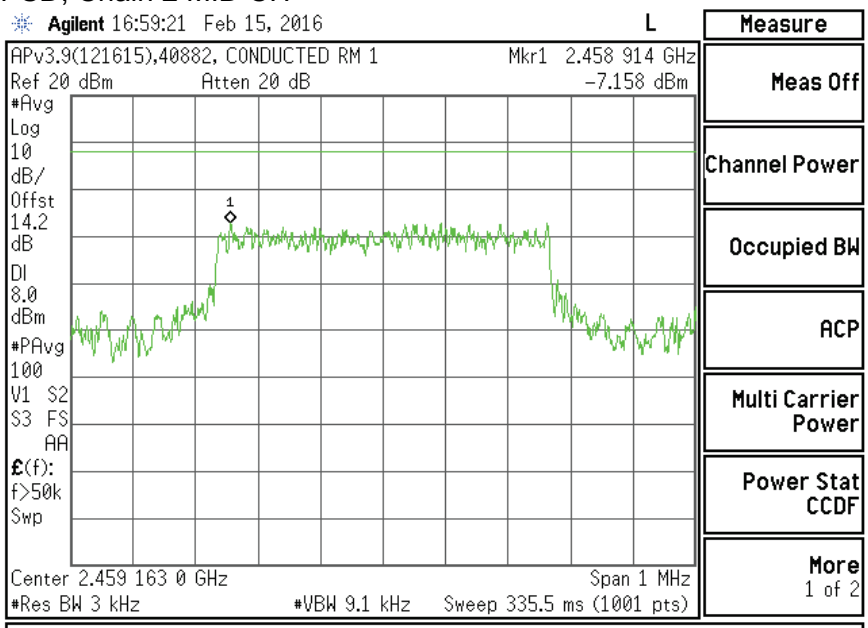




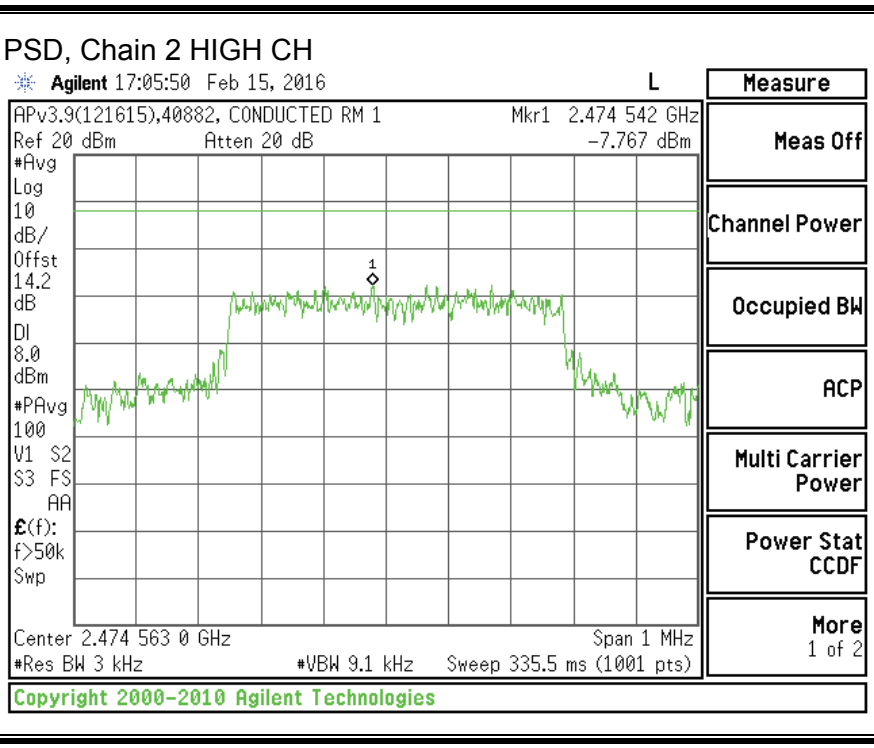
PSD, Chain 2



PSD, Chain 2 MID CH

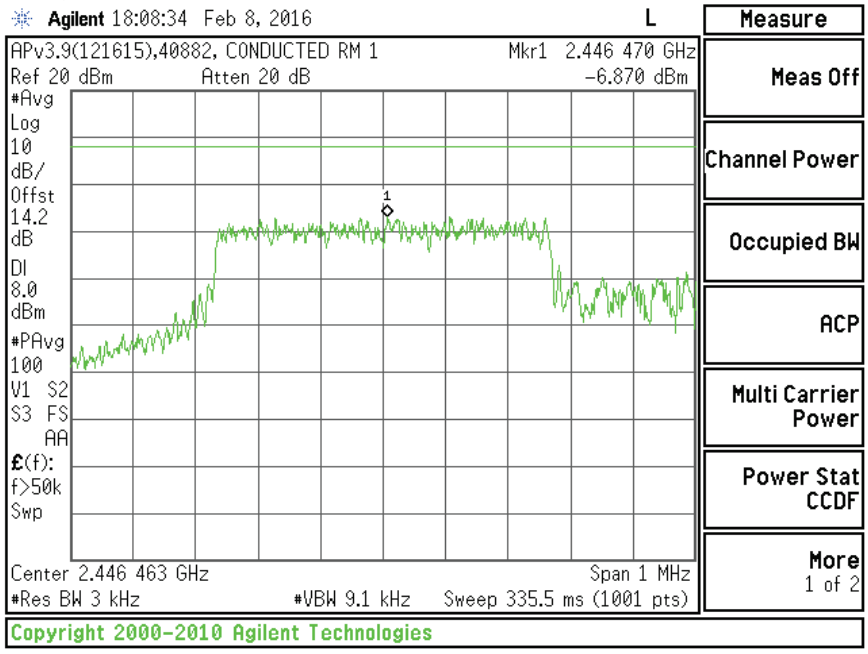


PSD, Chain 2 HIGH CH

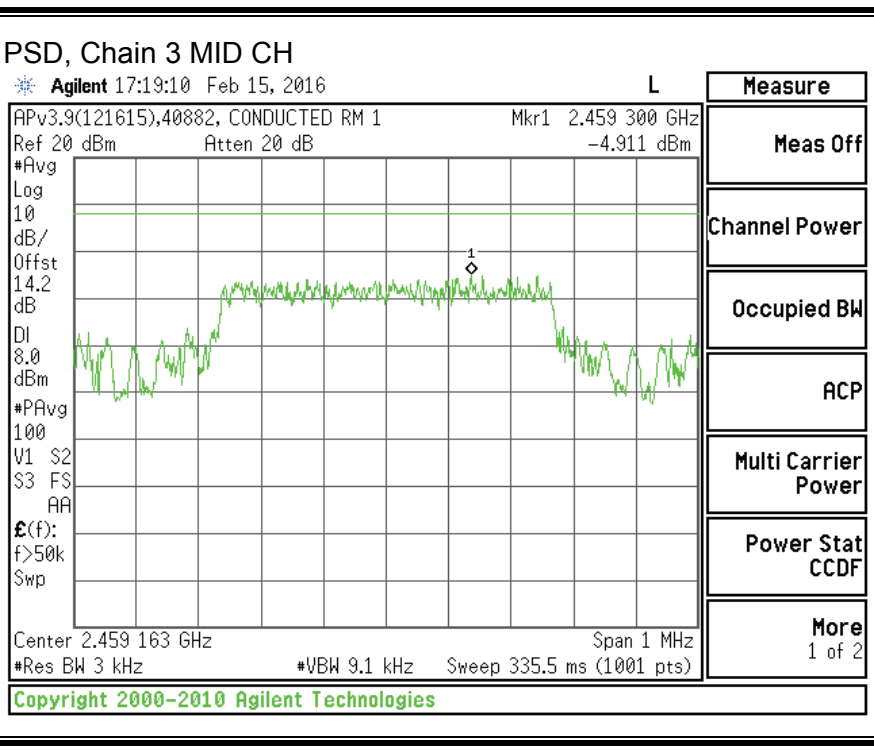


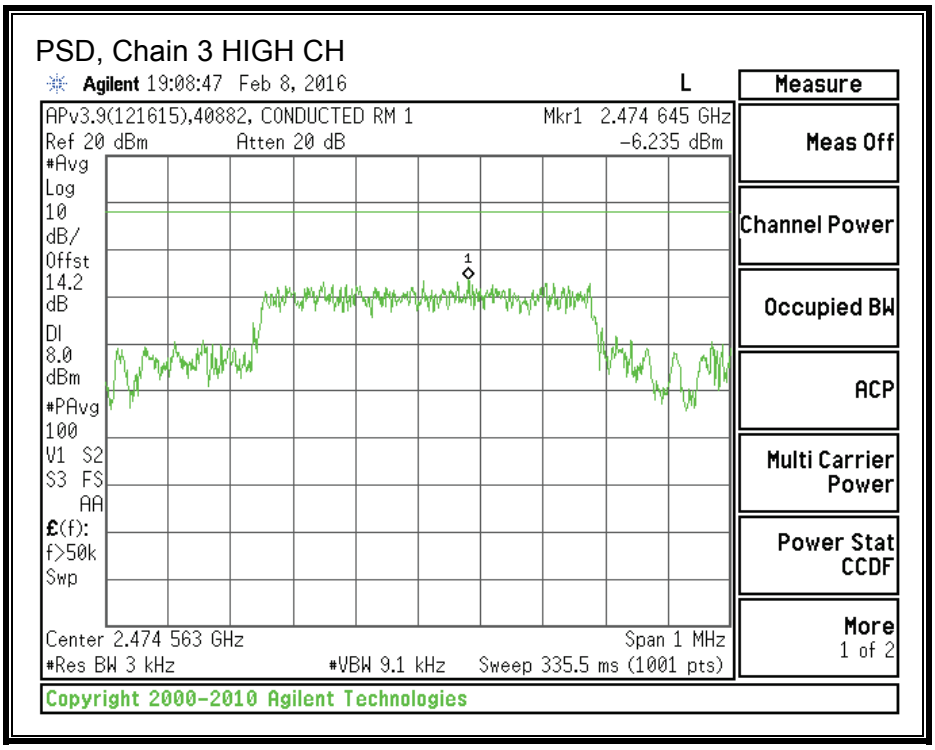
PSD, Chain 3

PSD, Chain 3 LOW CH

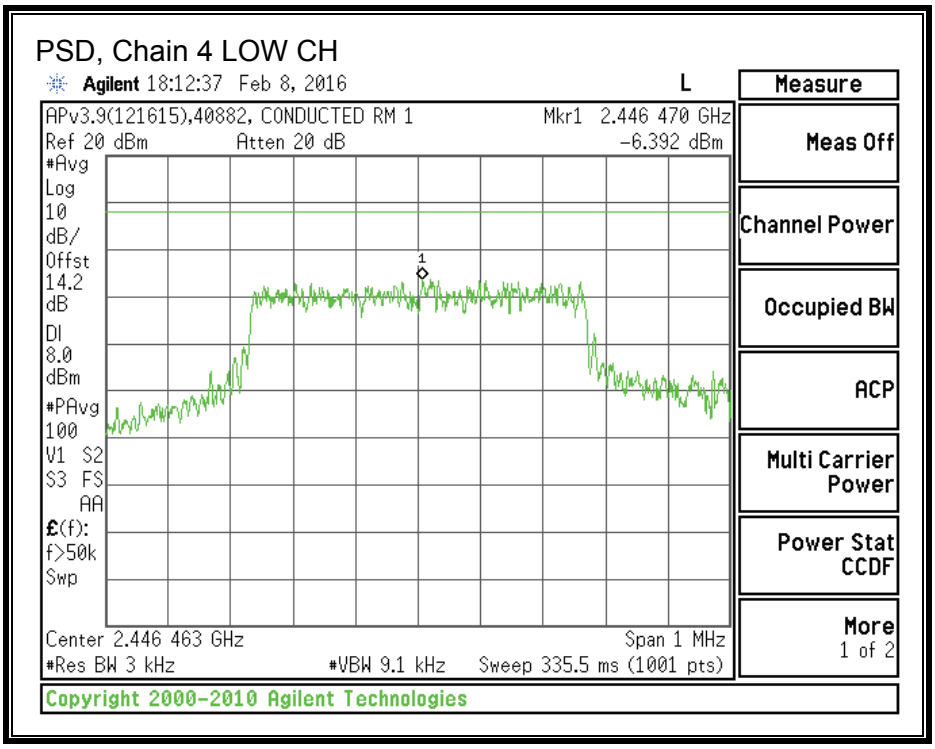


PSD, Chain 3 MID CH

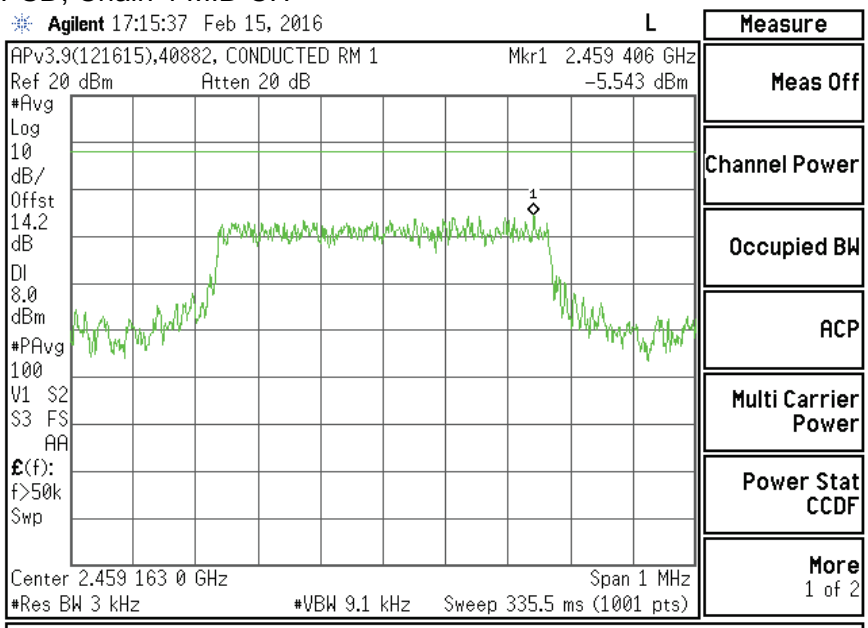




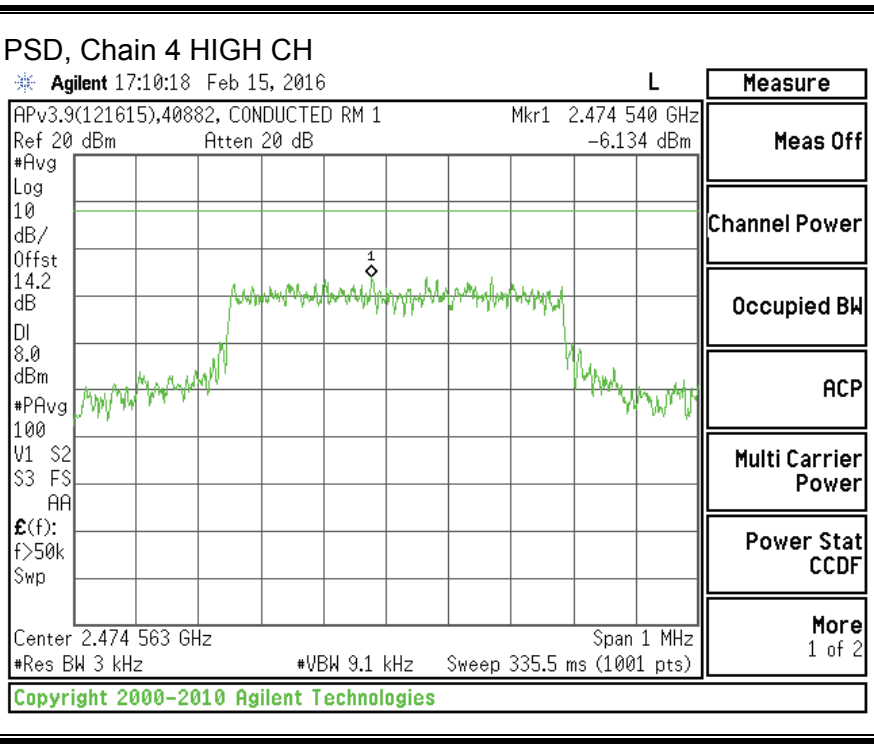
PSD, Chain 4



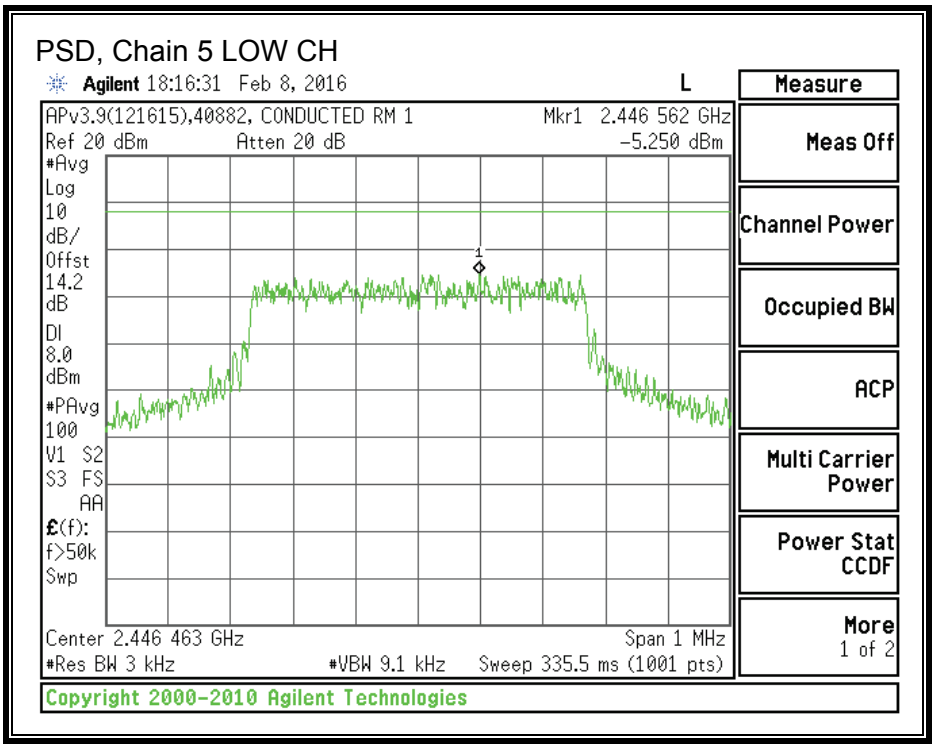
PSD, Chain 4 MID CH

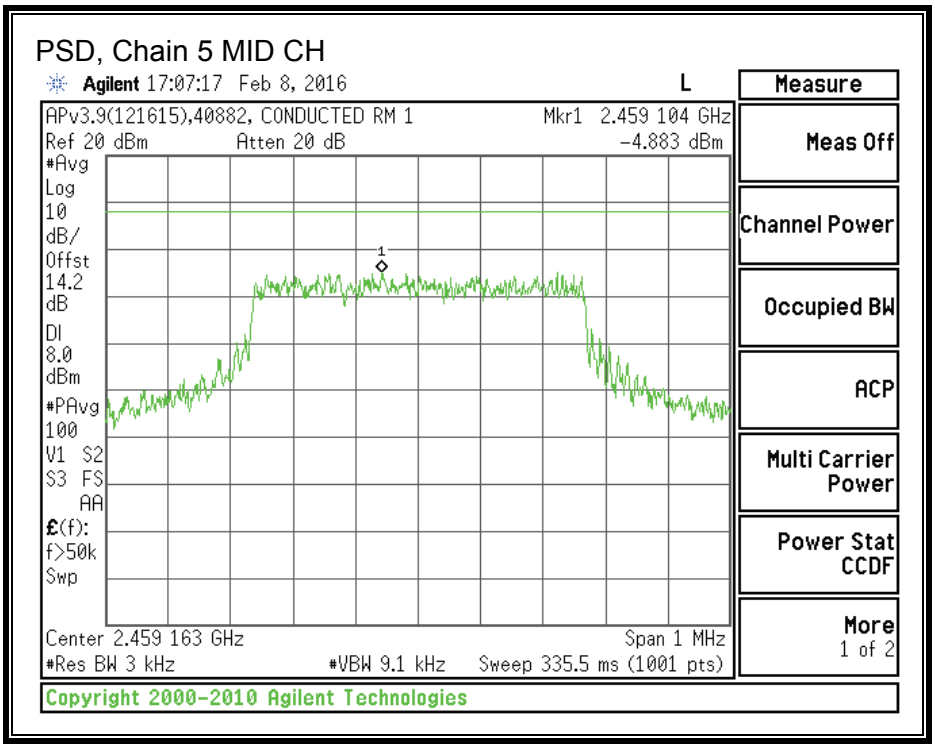


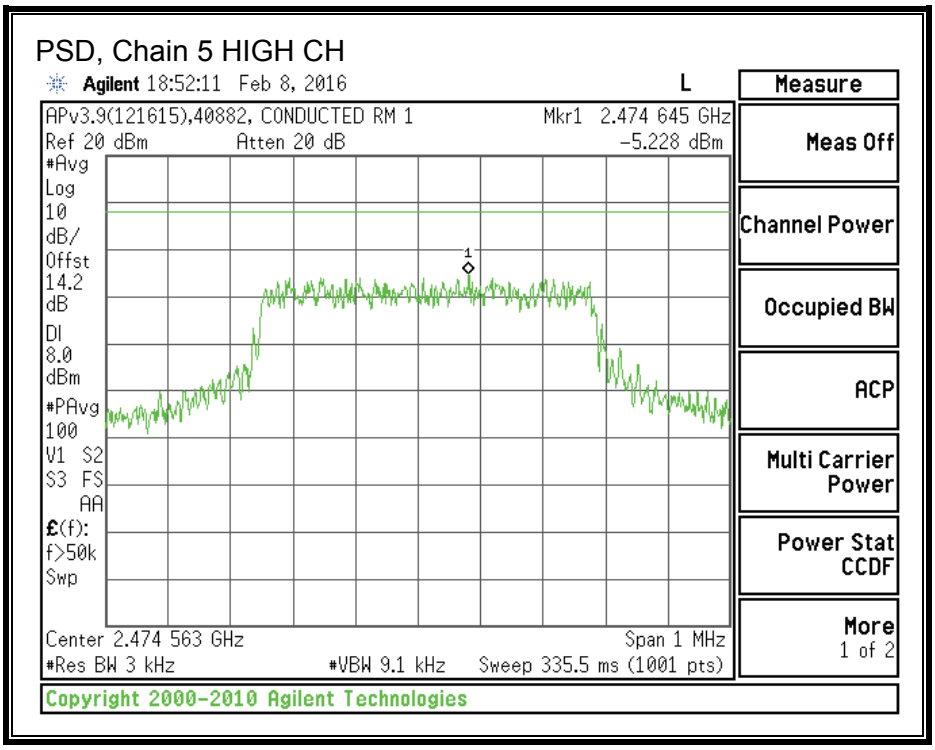
PSD, Chain 4 HIGH CH



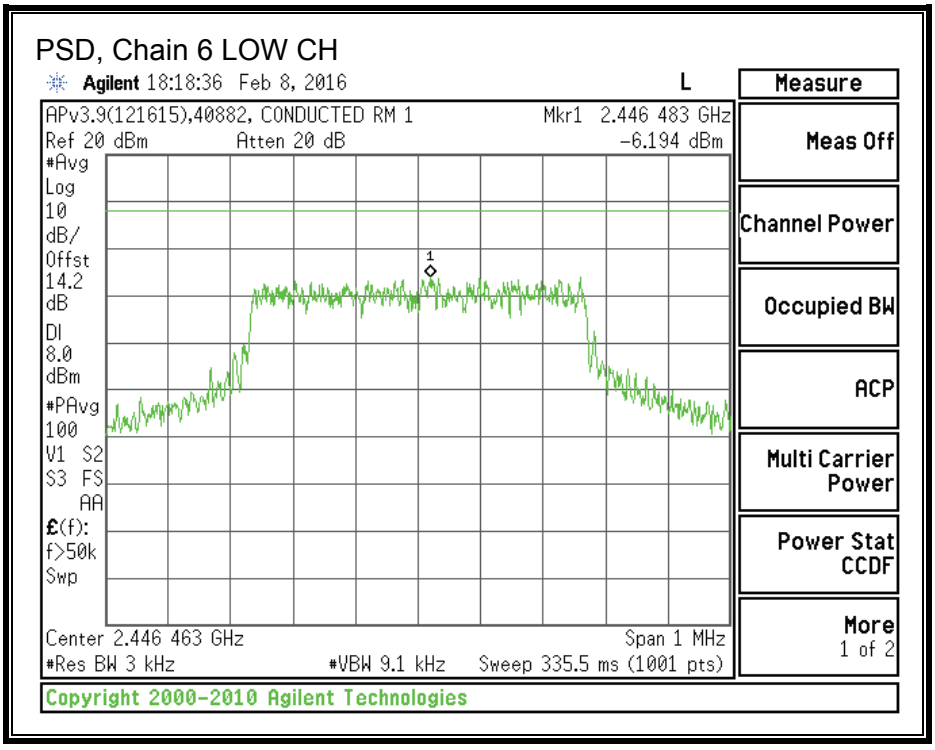
PSD, Chain 5



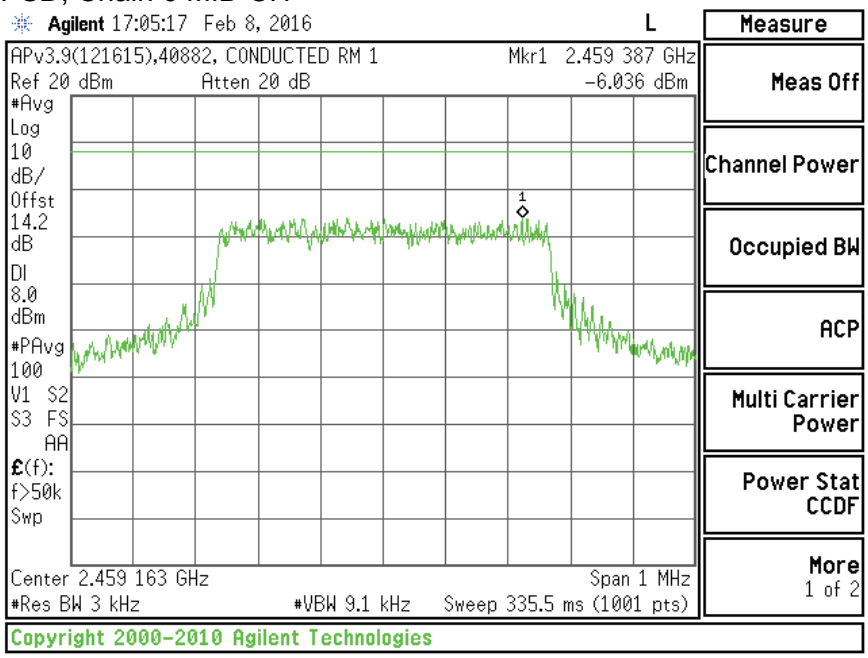




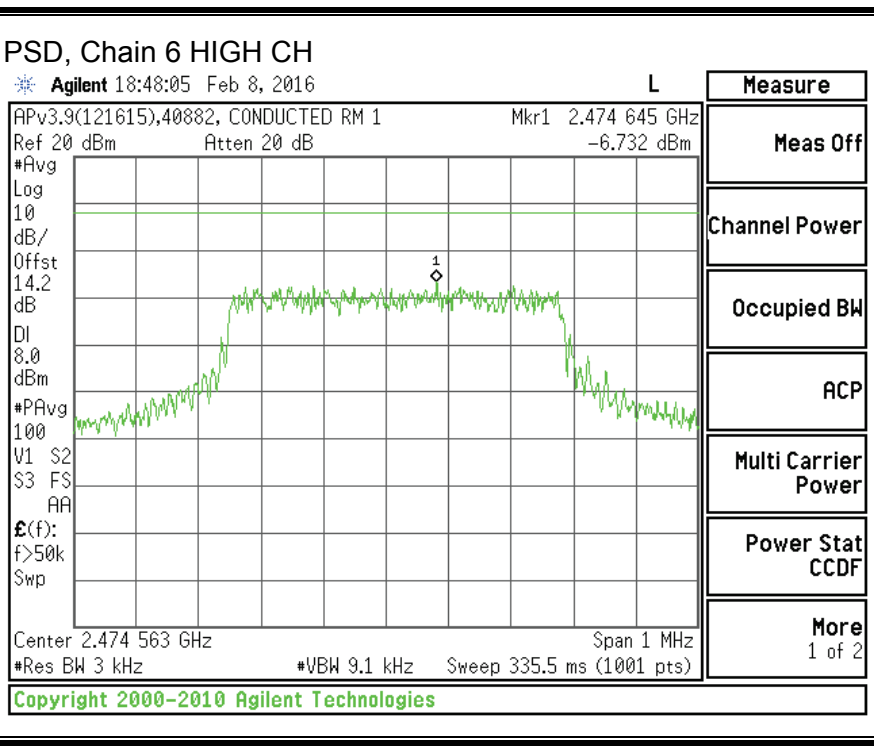
PSD, Chain 6



PSD, Chain 6 MID CH

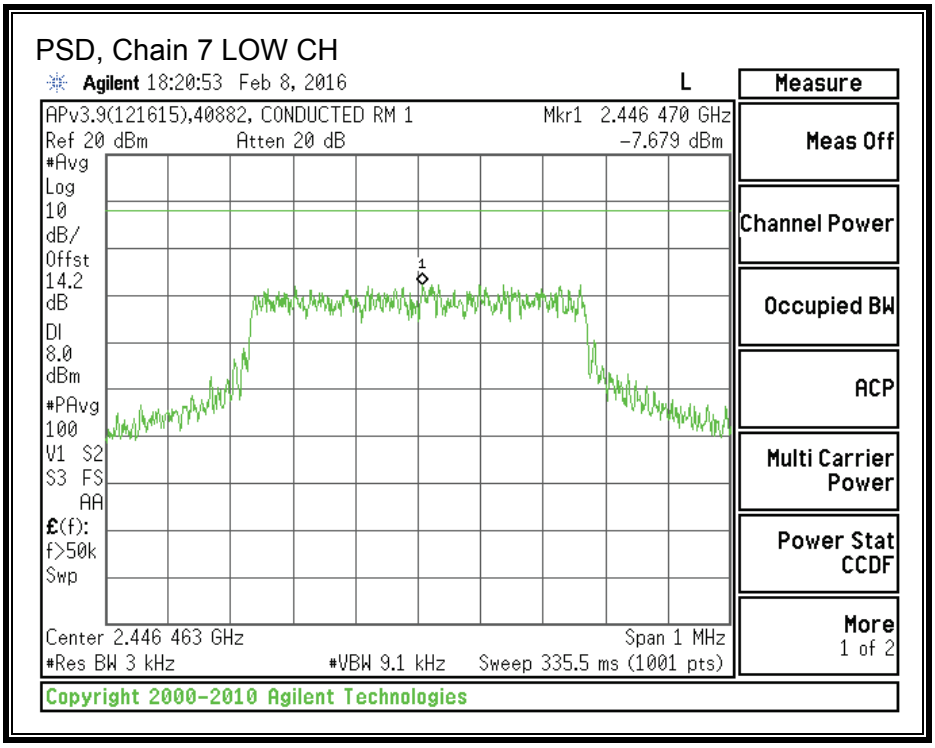


PSD, Chain 6 HIGH CH

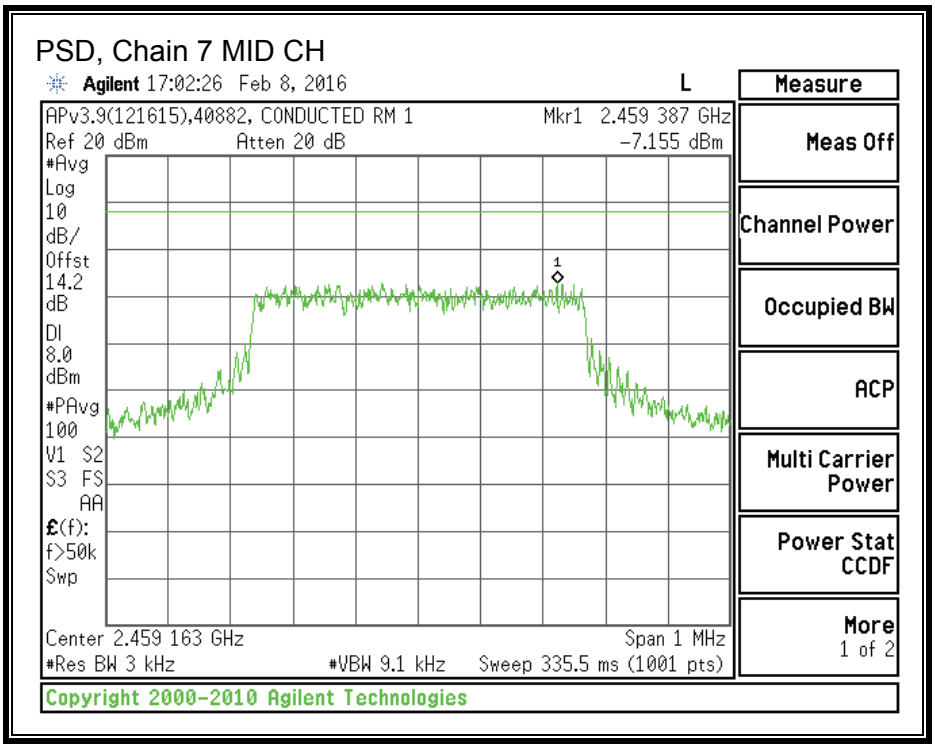


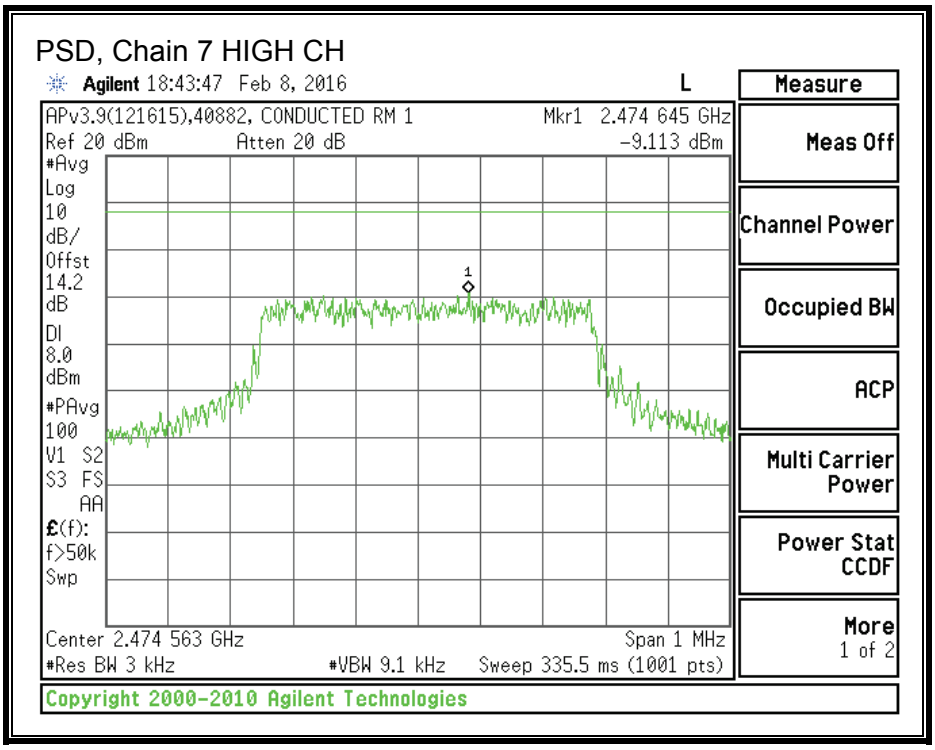
PSD, Chain 7

PSD, Chain 7 LOW CH

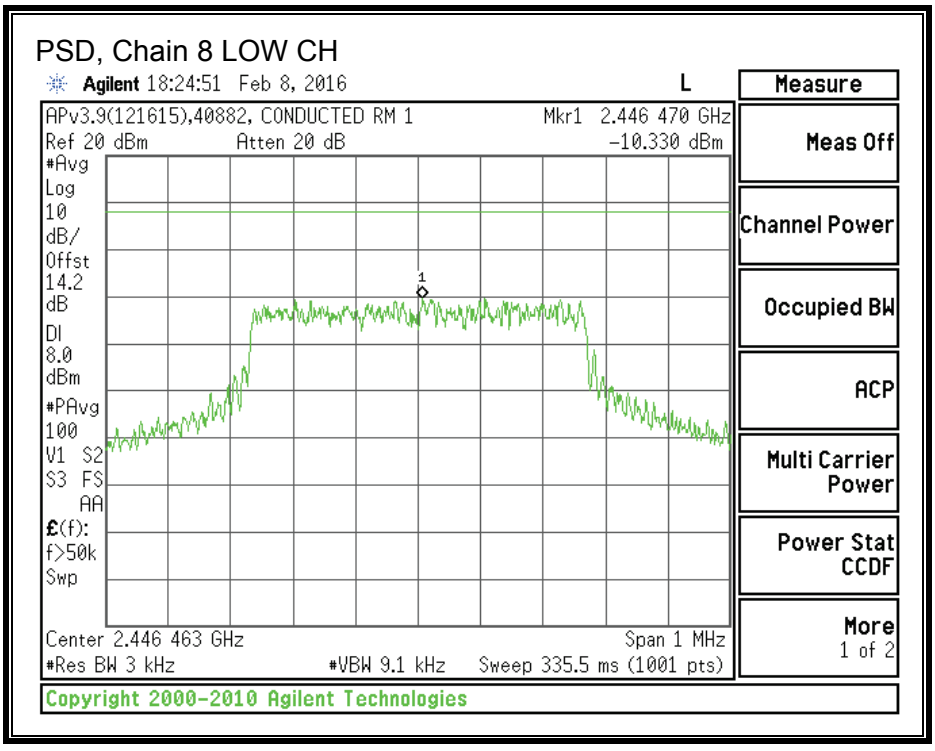


PSD, Chain 7 MID CH

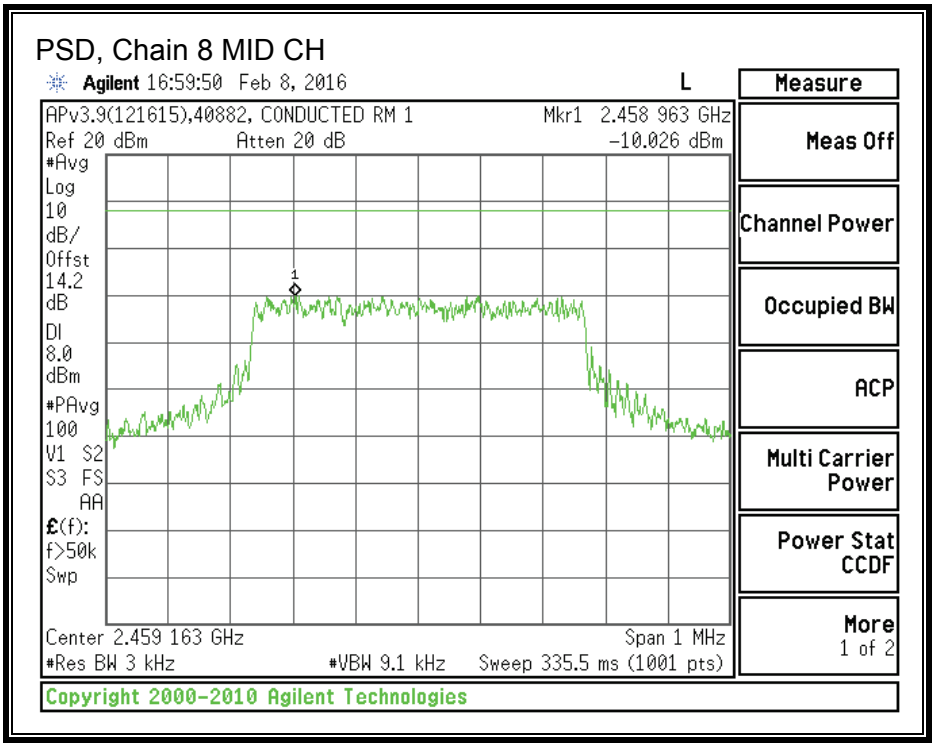




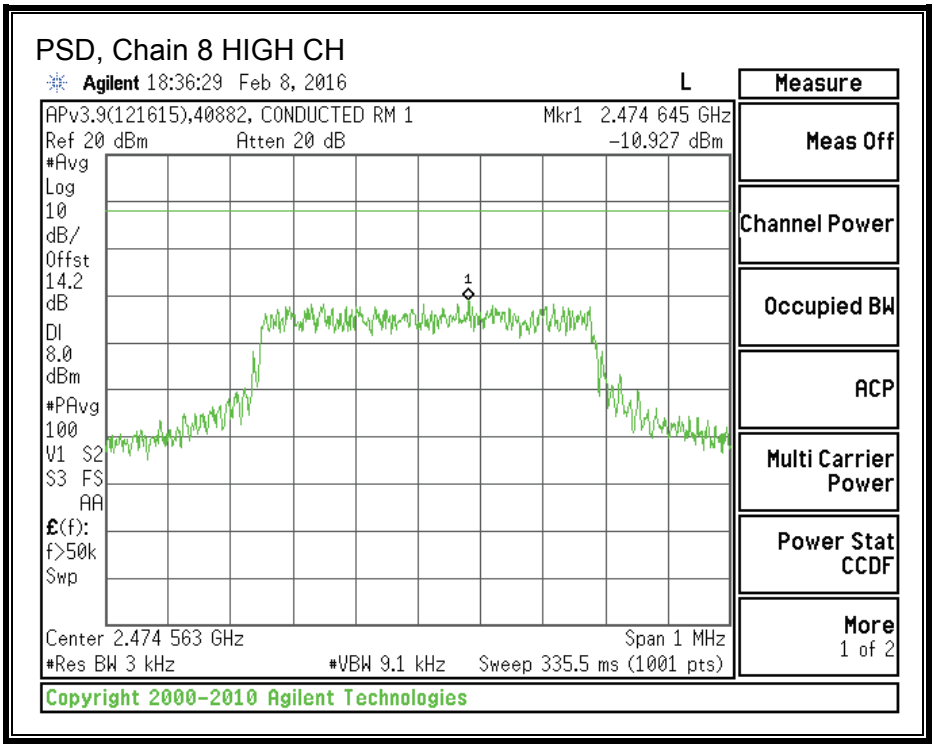
PSD, Chain 8



PSD, Chain 8 MID CH



PSD, Chain 8 HIGH CH



8.2.5. OUT-OF-BAND EMISSIONS

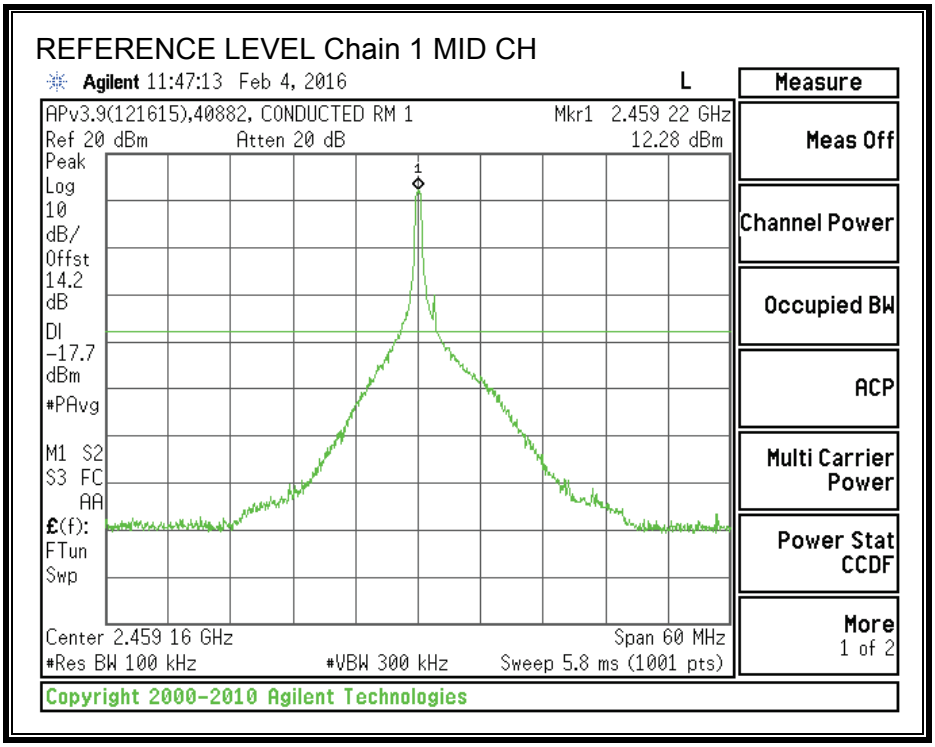
LIMITS

FCC §15.247 (d)

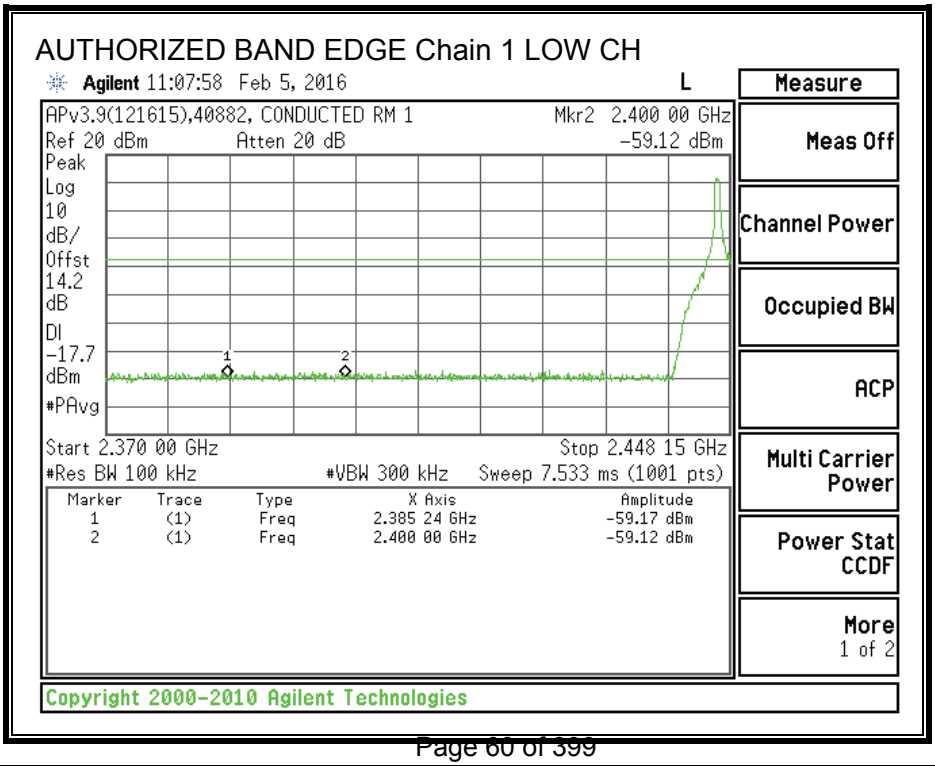
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

RESULTS

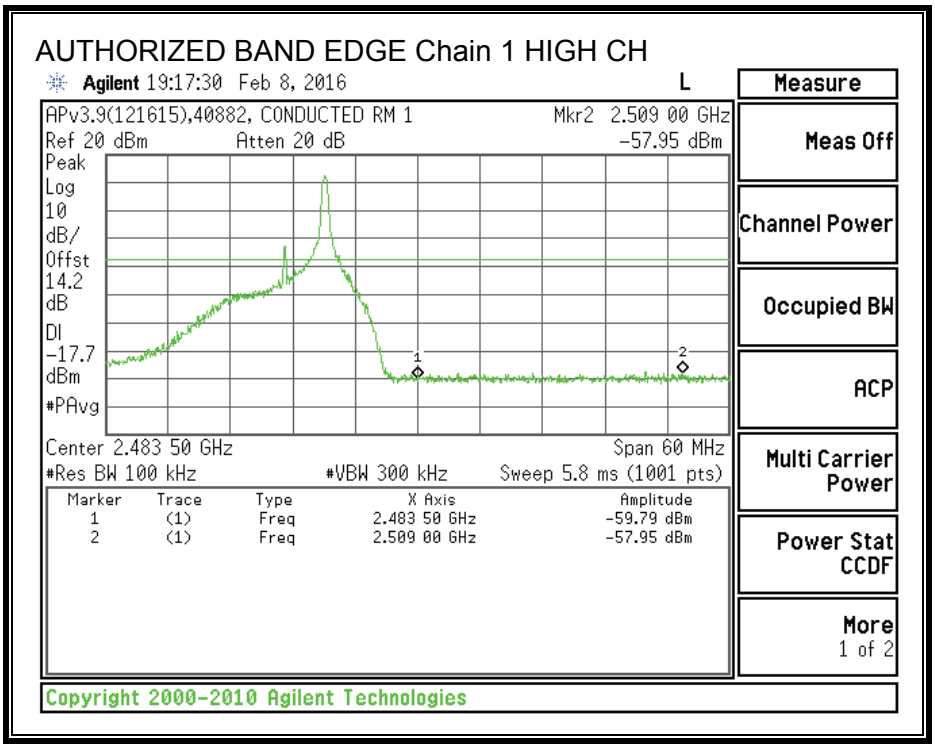
IN-BAND REFERENCE LEVEL, Chain 1



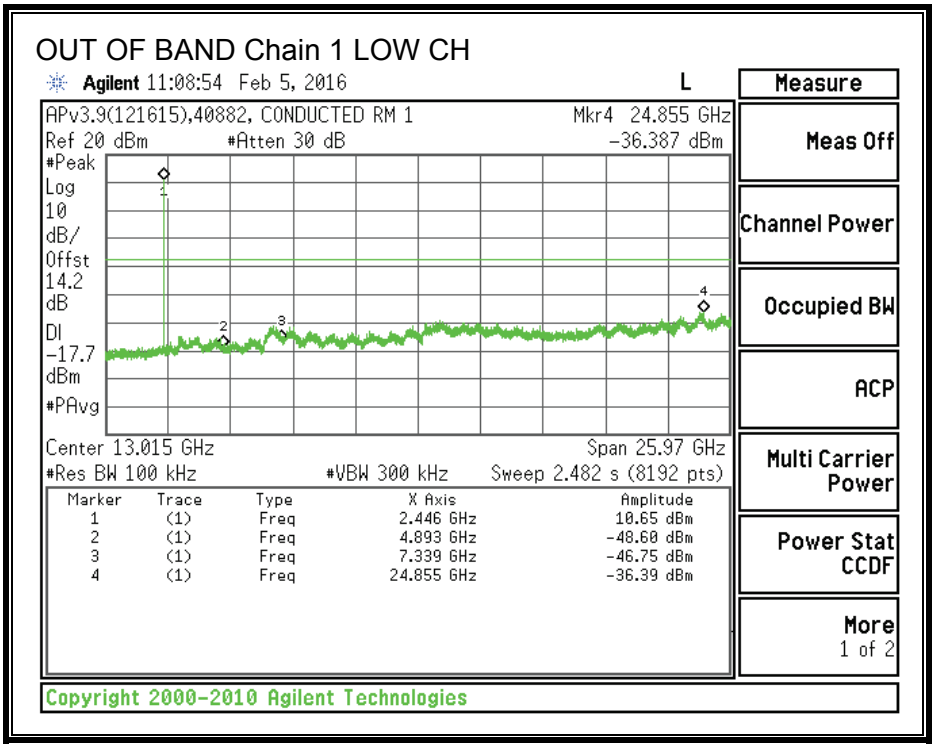
LOW CHANNEL BANDEDGE, Chain 1



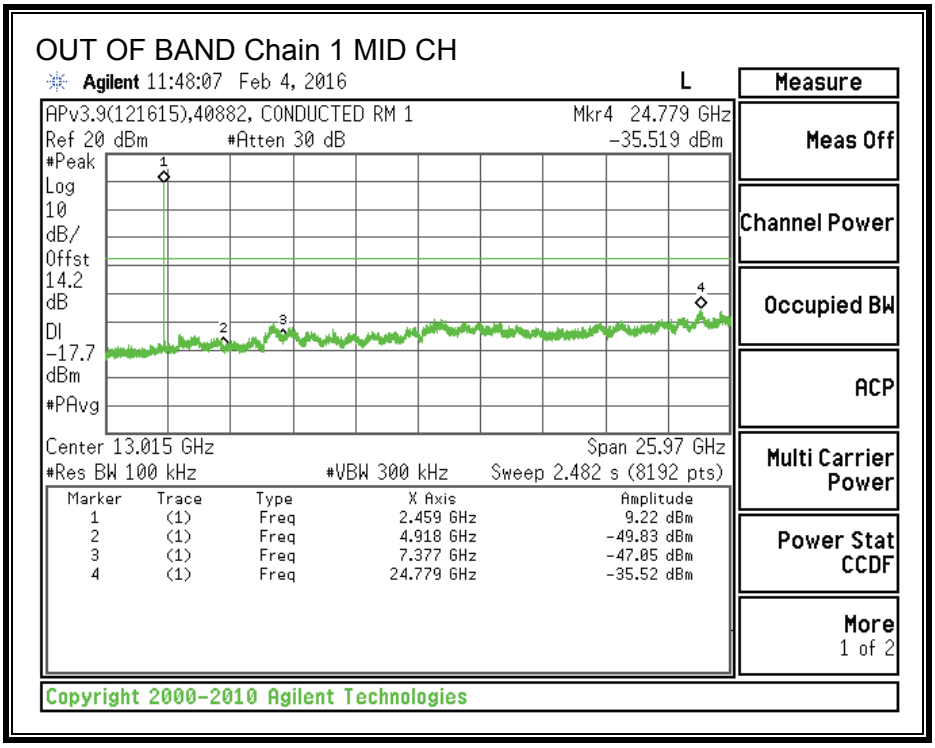
HIGH CHANNEL BANDEDGE, Chain 1



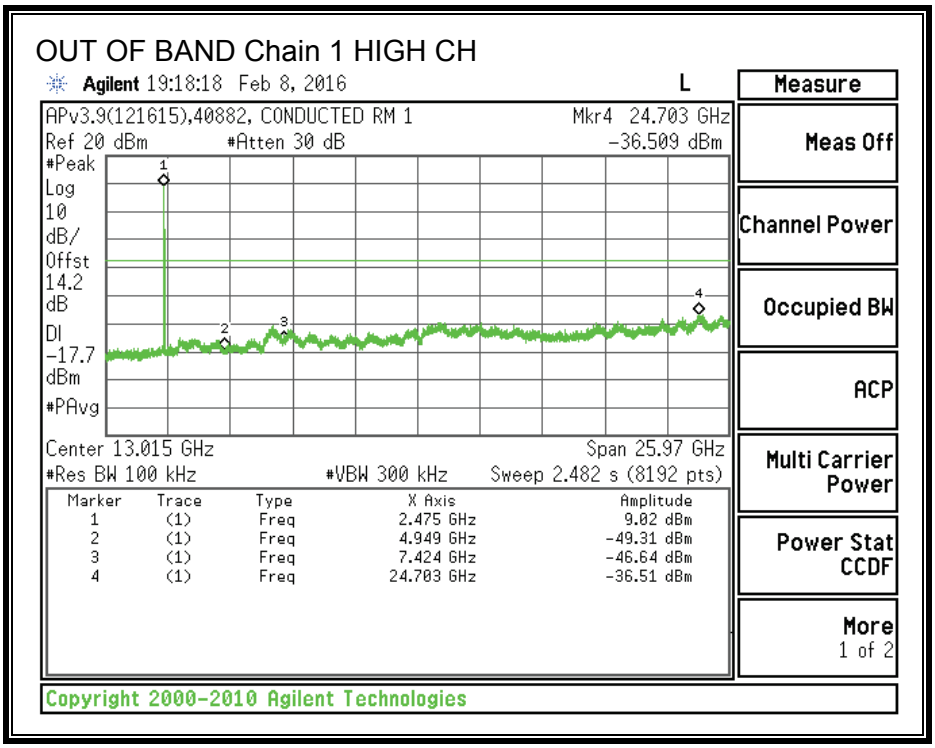
OUT-OF-BAND EMISSIONS, Chain 1



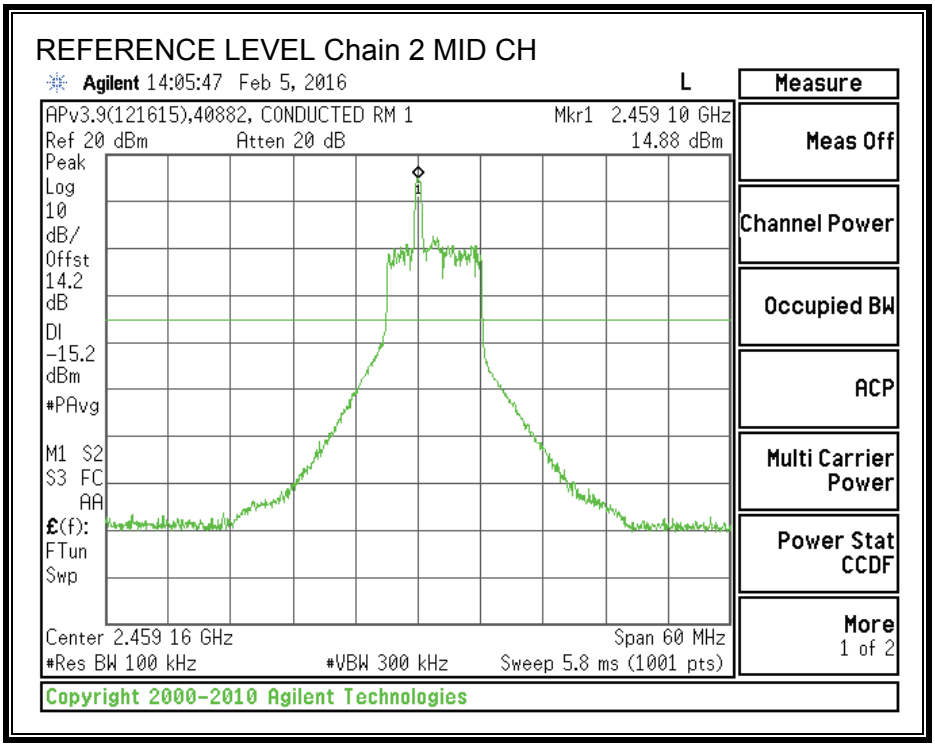
OUT OF BAND Chain 1 MID CH



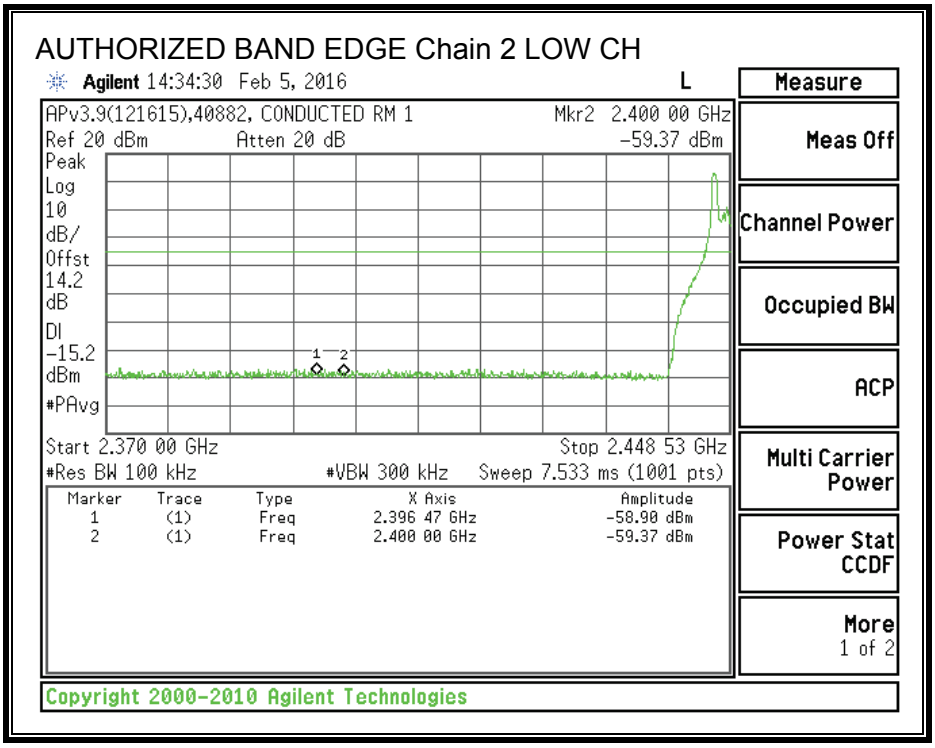
OUT OF BAND Chain 1 HIGH CH



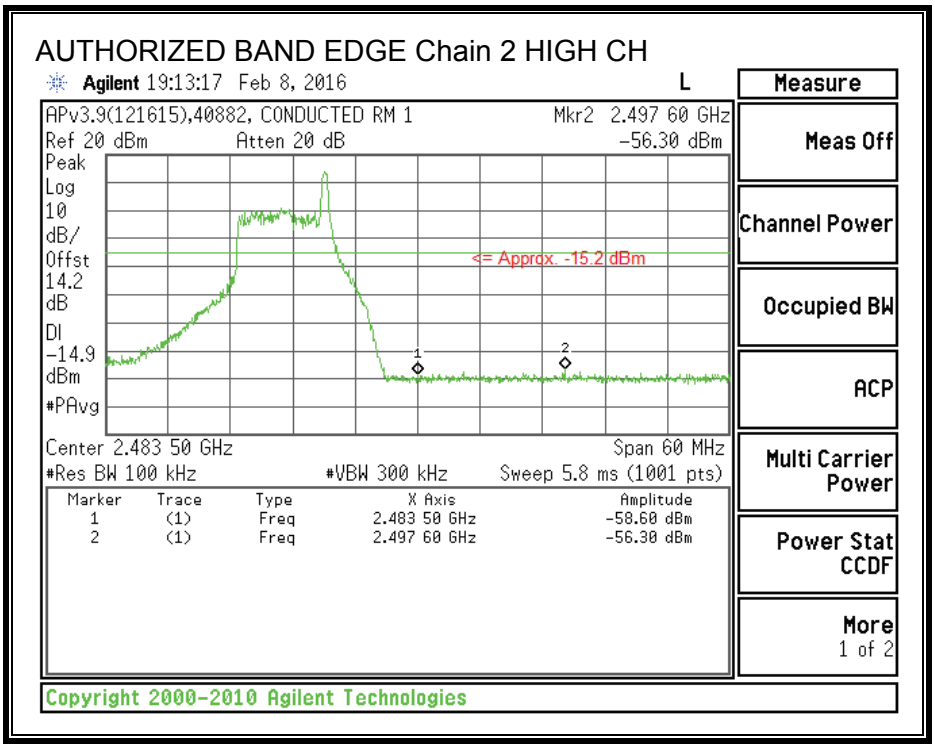
IN-BAND REFERENCE LEVEL, Chain 2



LOW CHANNEL BANDEDGE, Chain 2

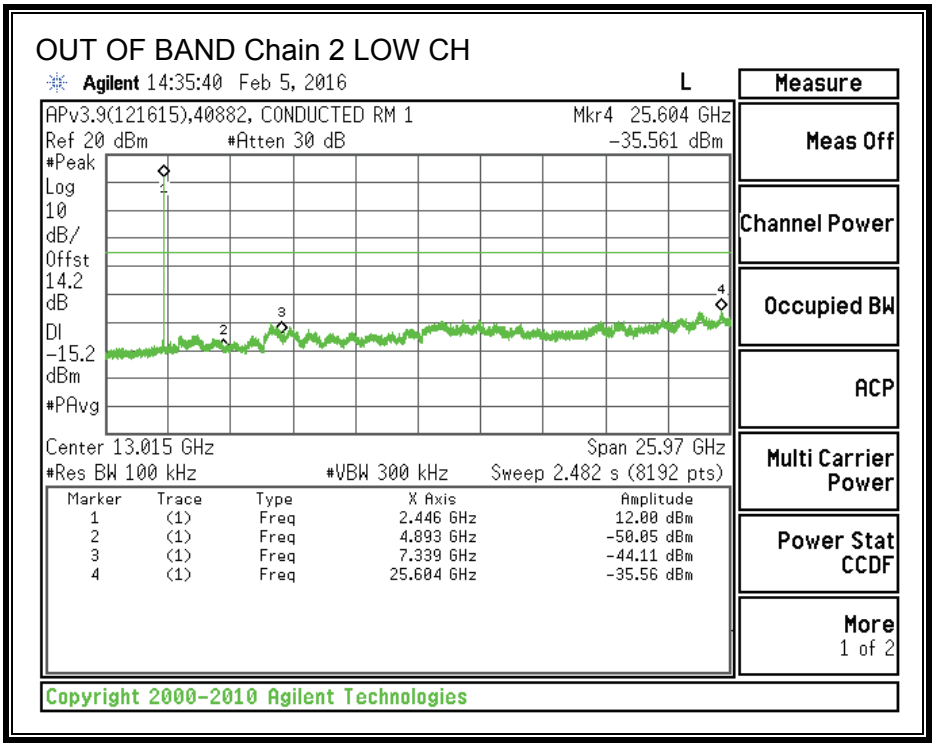


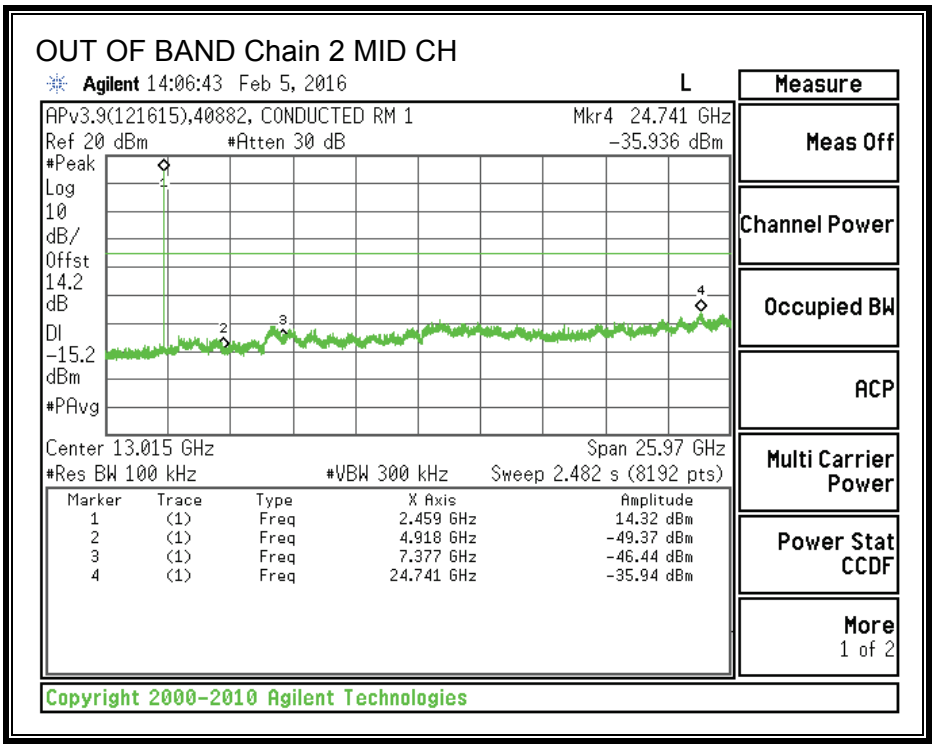
HIGH CHANNEL BANDEDGE, Chain 2

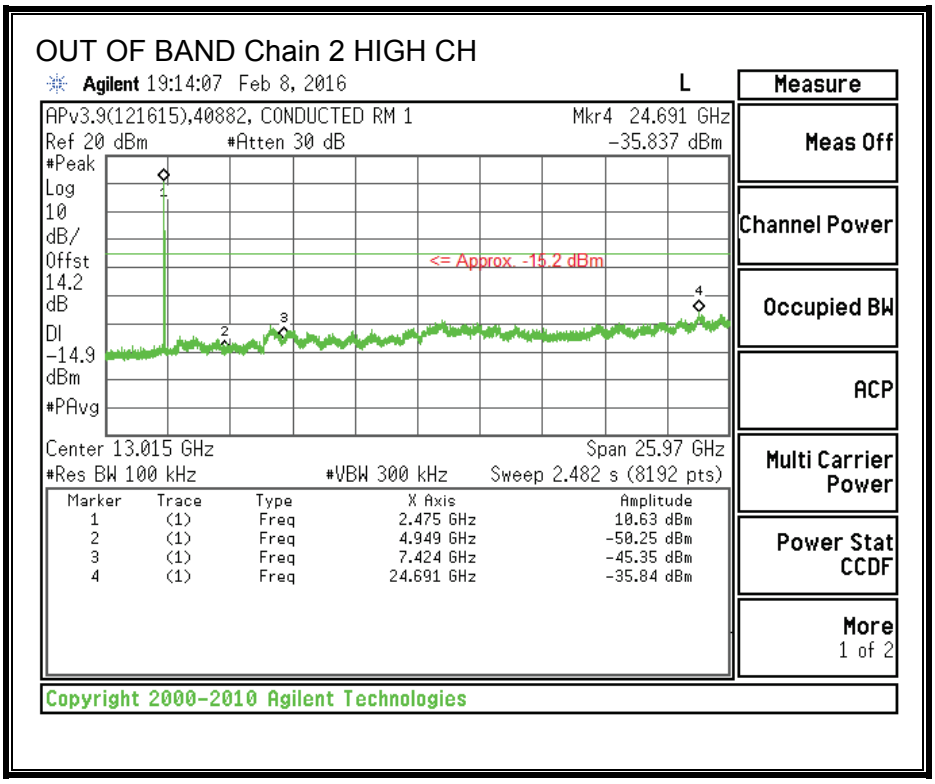


Note – The worst-case limit line is -15.2 dBm. The mid channel reference was remeasured the day this plot was taken and set at -14.9 dBm. The emissions measurements meet both -15.2 and -14.9 dBm.

OUT-OF-BAND EMISSIONS, Chain 2

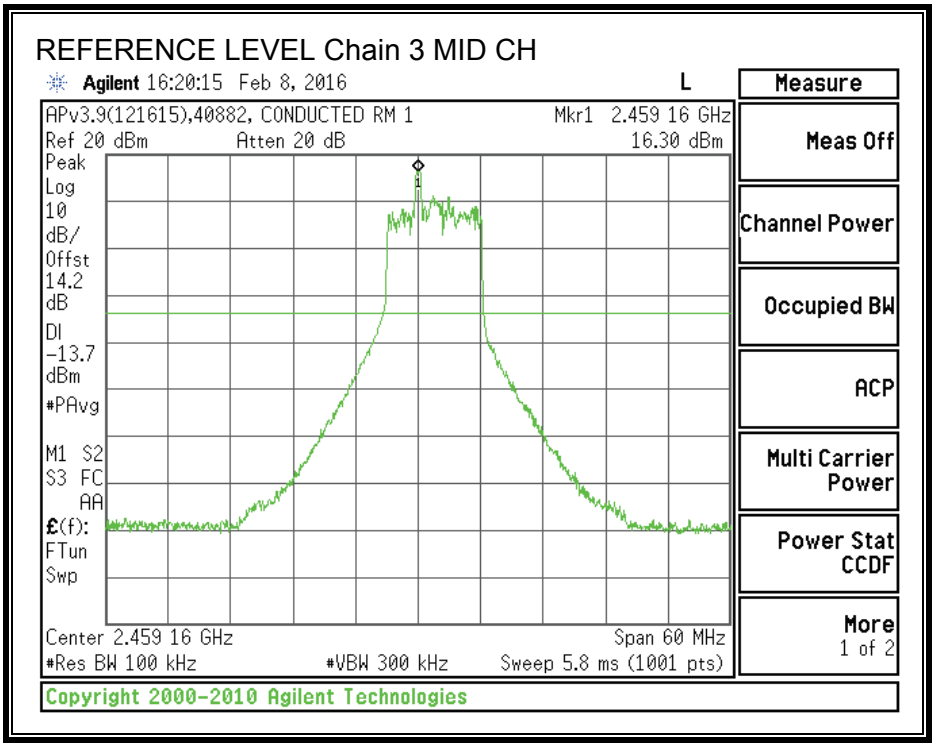




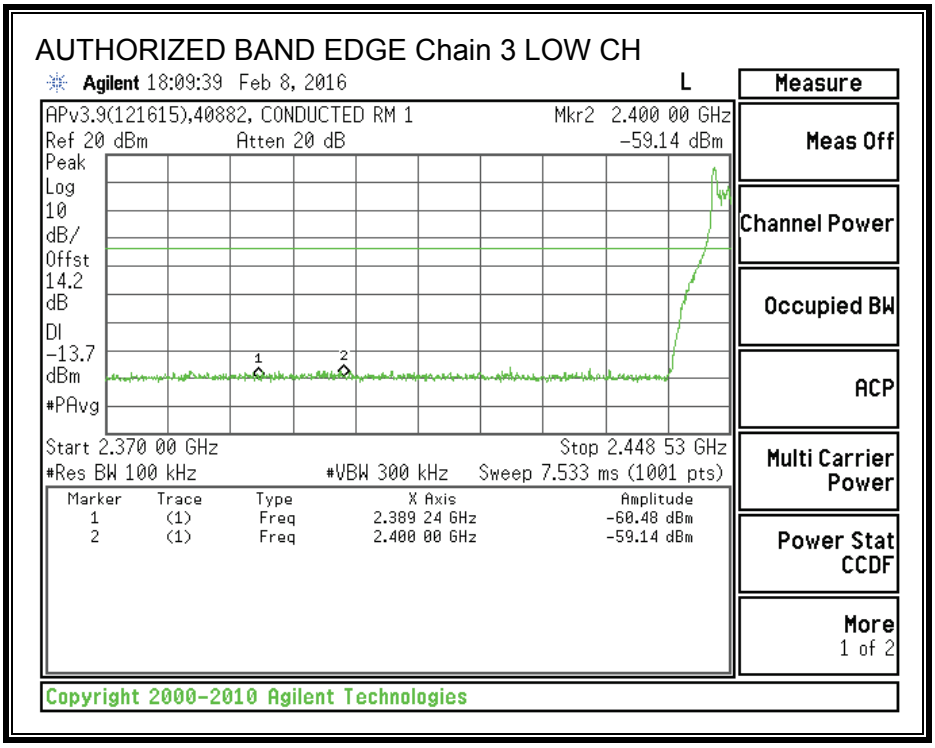


Note – The worst-case limit line is -15.2 dBm. The mid channel reference was remeasured the day this plot was taken and set at -14.9 dBm. The emissions measurements meet both -15.2 and -14.9 dBm.

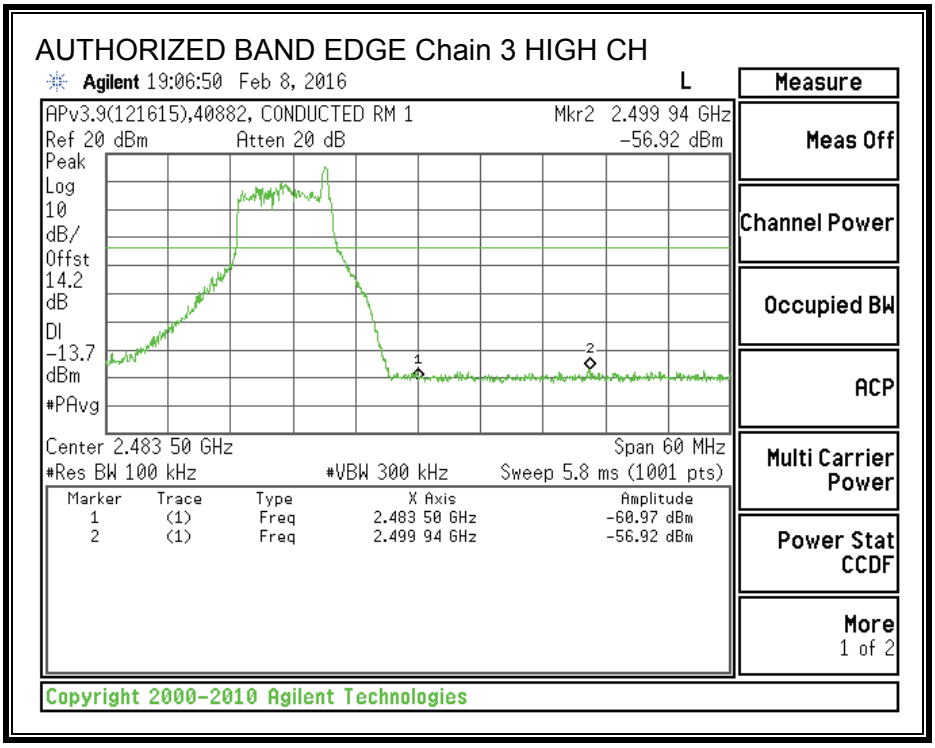
IN-BAND REFERENCE LEVEL, Chain 3



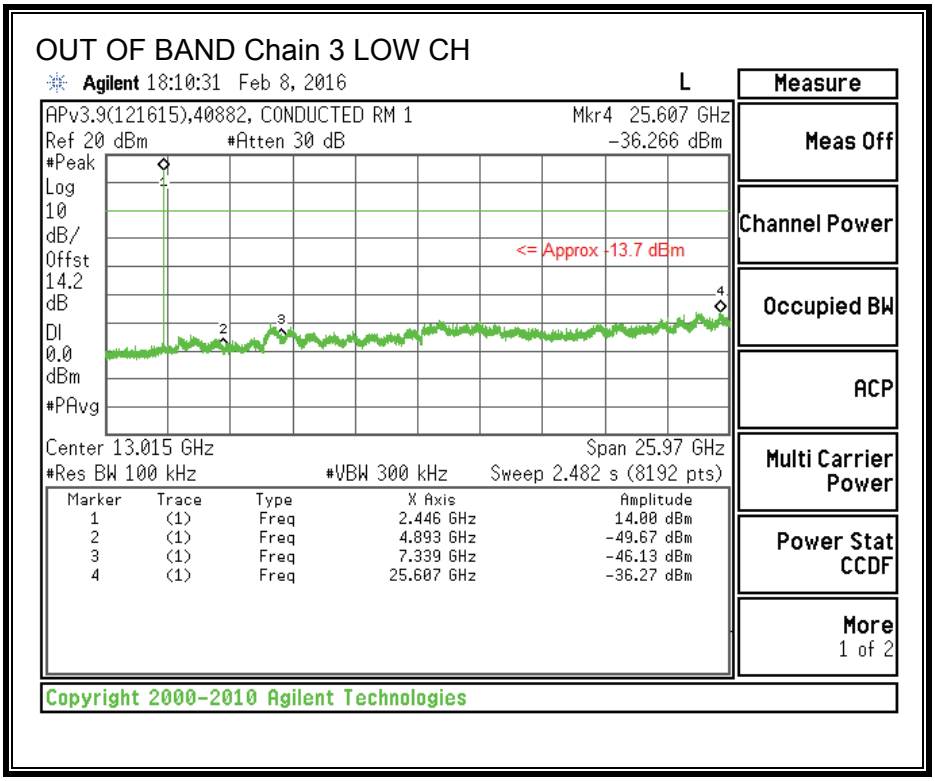
LOW CHANNEL BANDEDGE, Chain 3



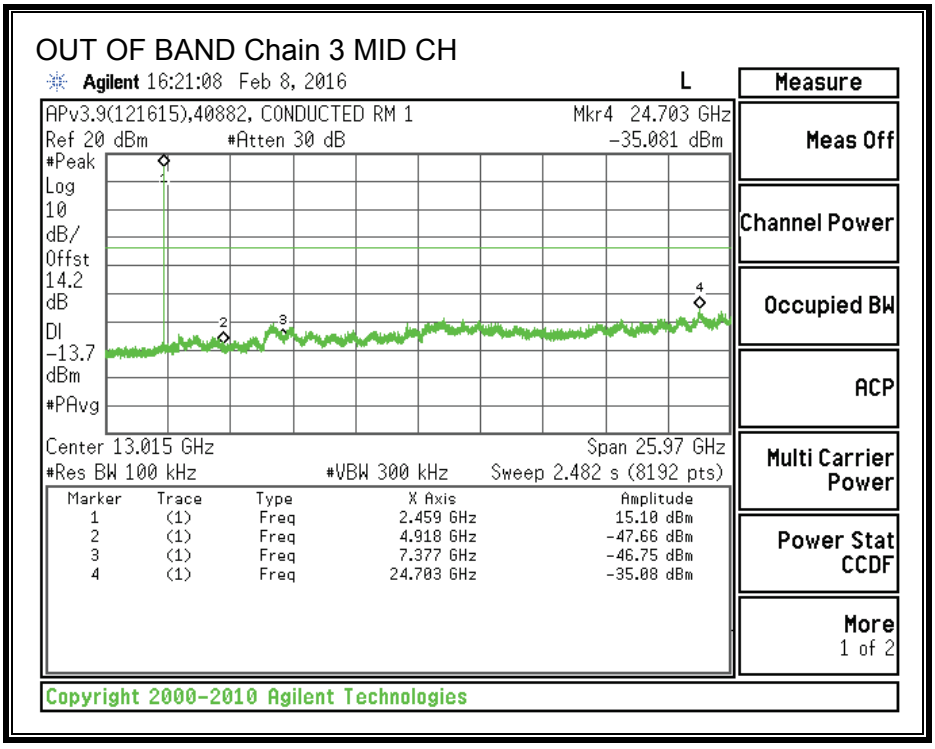
HIGH CHANNEL BANDEDGE, Chain 3



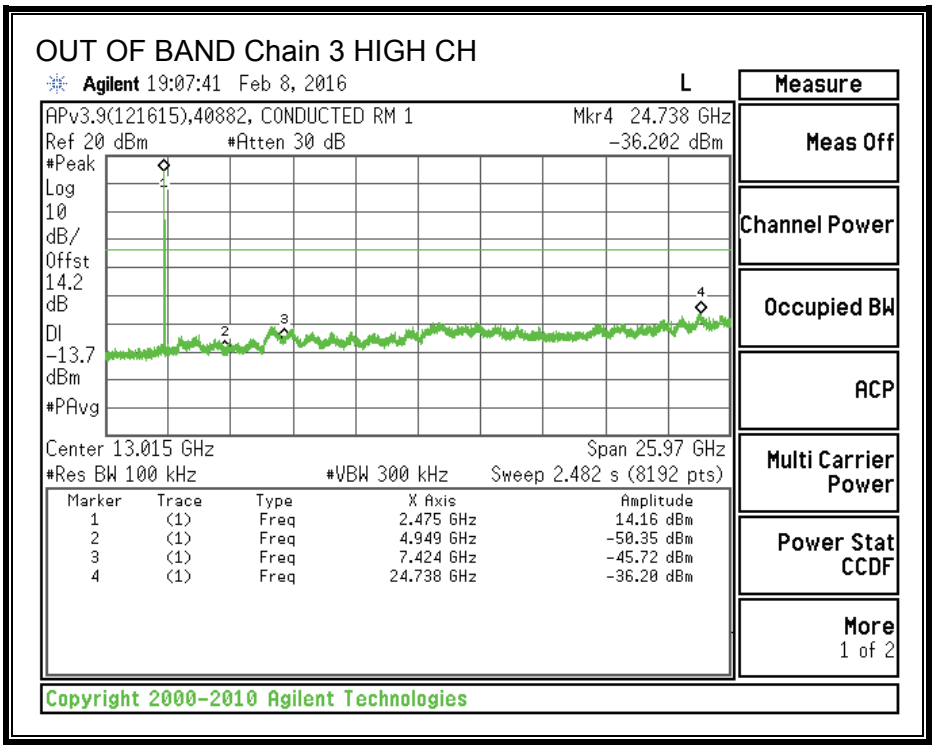
OUT-OF-BAND EMISSIONS, Chain 3



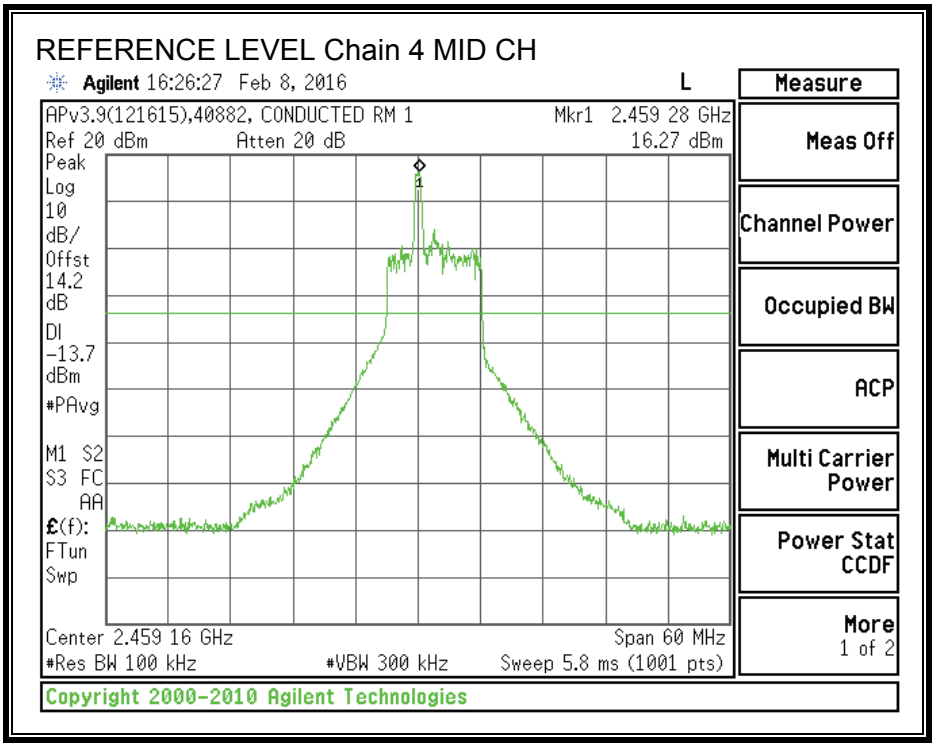
Note – The limit line was incorrectly set for 0 dBm. The limit line should be -13.7 dBm. This plot demonstrates that the emissions measured were below -13.7 dBm.



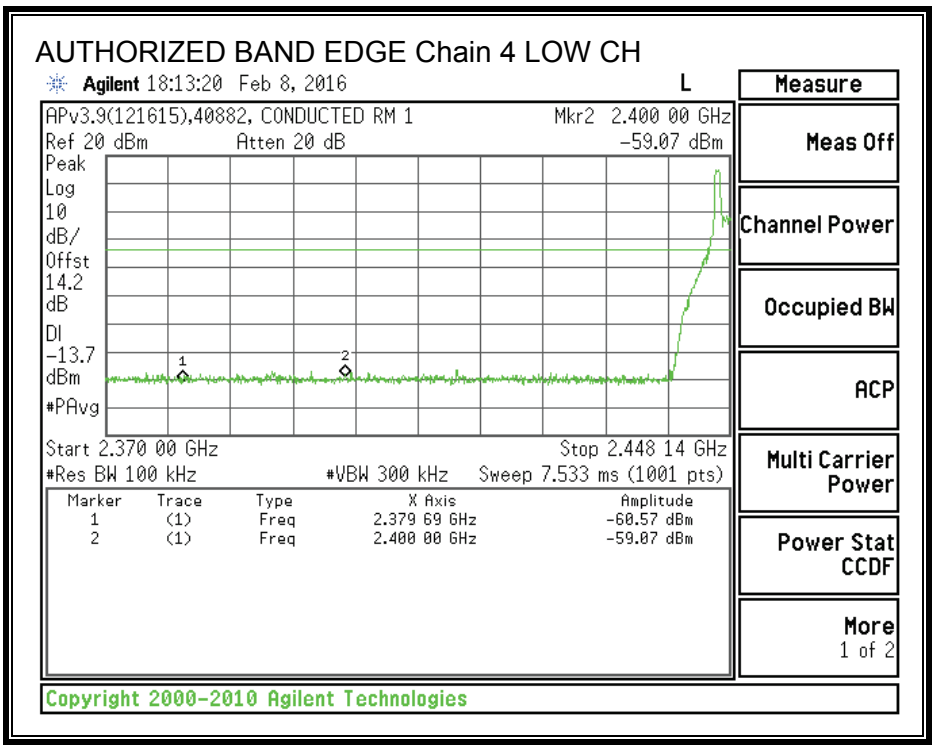
OUT OF BAND Chain 3 HIGH CH



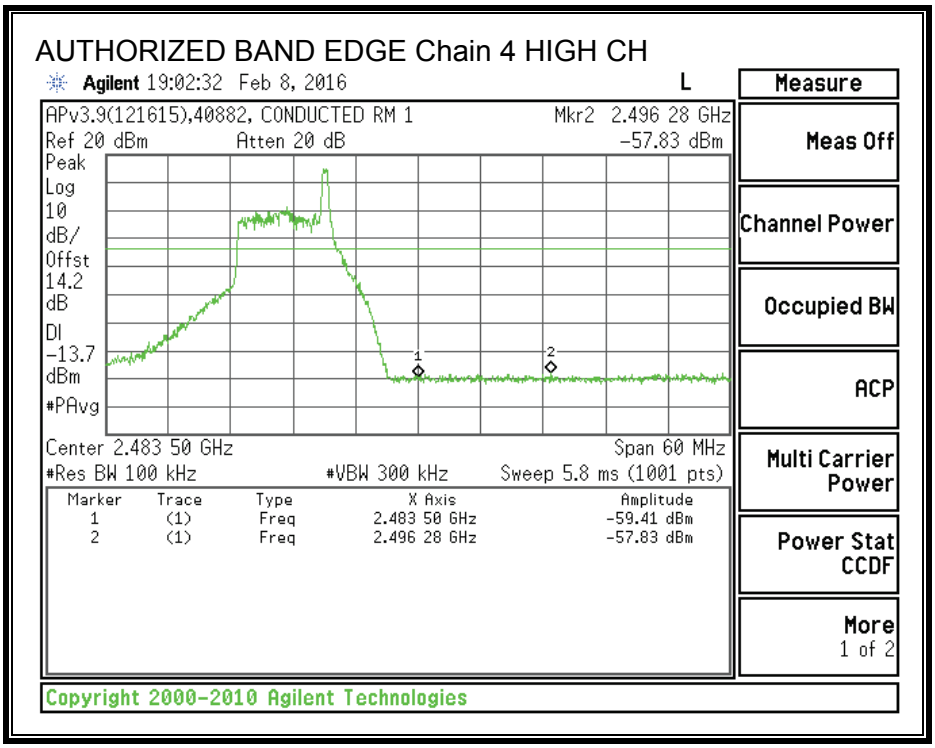
IN-BAND REFERENCE LEVEL, Chain 4



LOW CHANNEL BANDEDGE, Chain 4

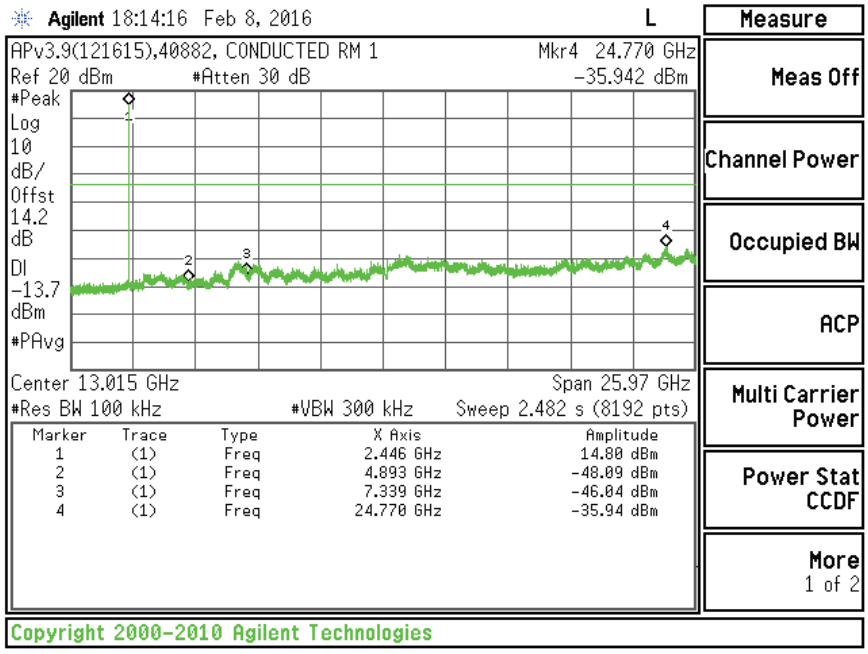


HIGH CHANNEL BANDEDGE, Chain 4

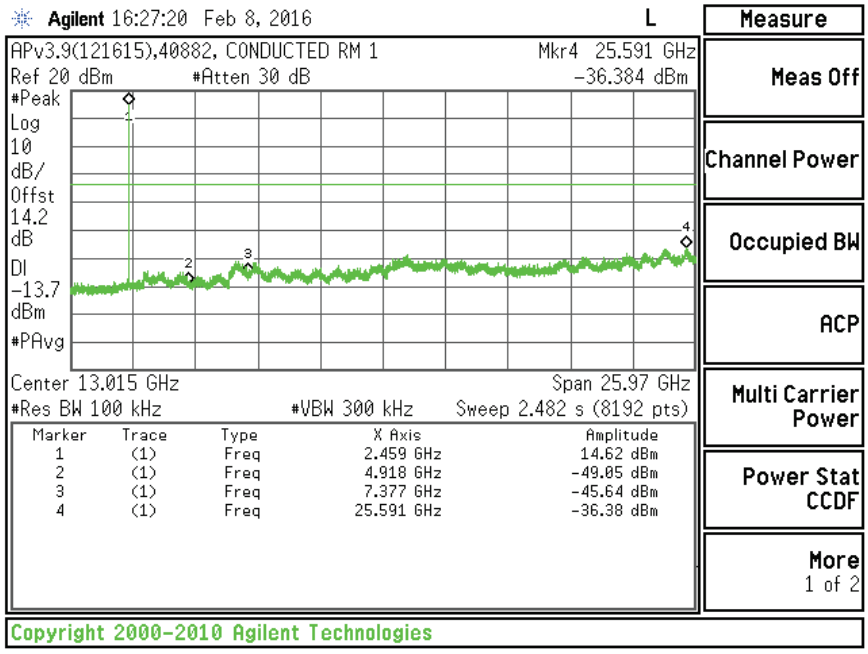


OUT-OF-BAND EMISSIONS, Chain 4

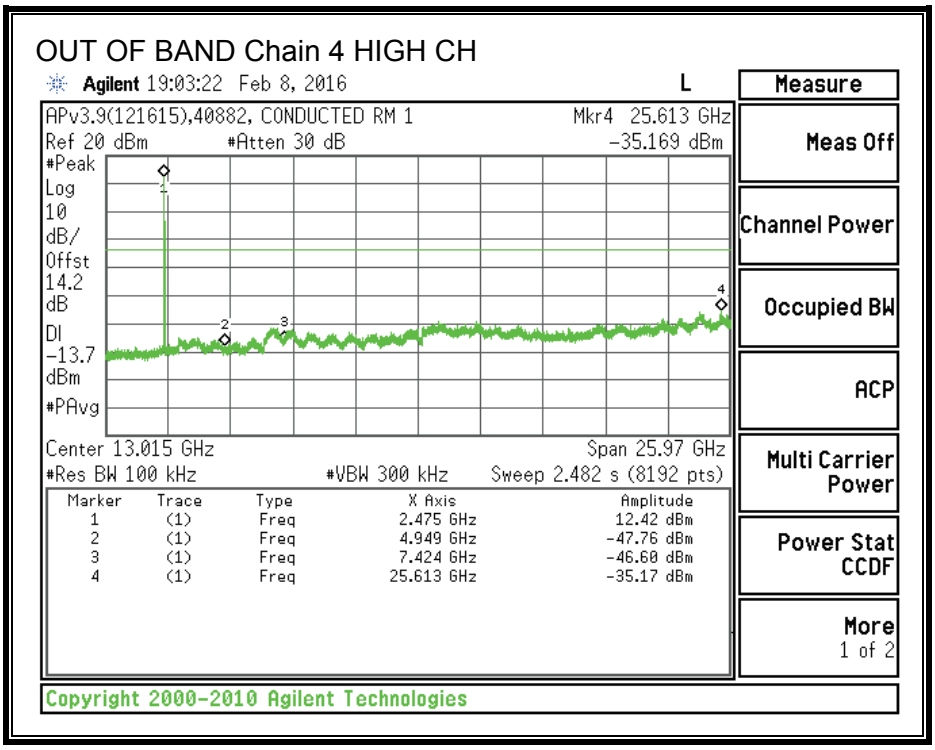
OUT OF BAND Chain 4 LOW CH



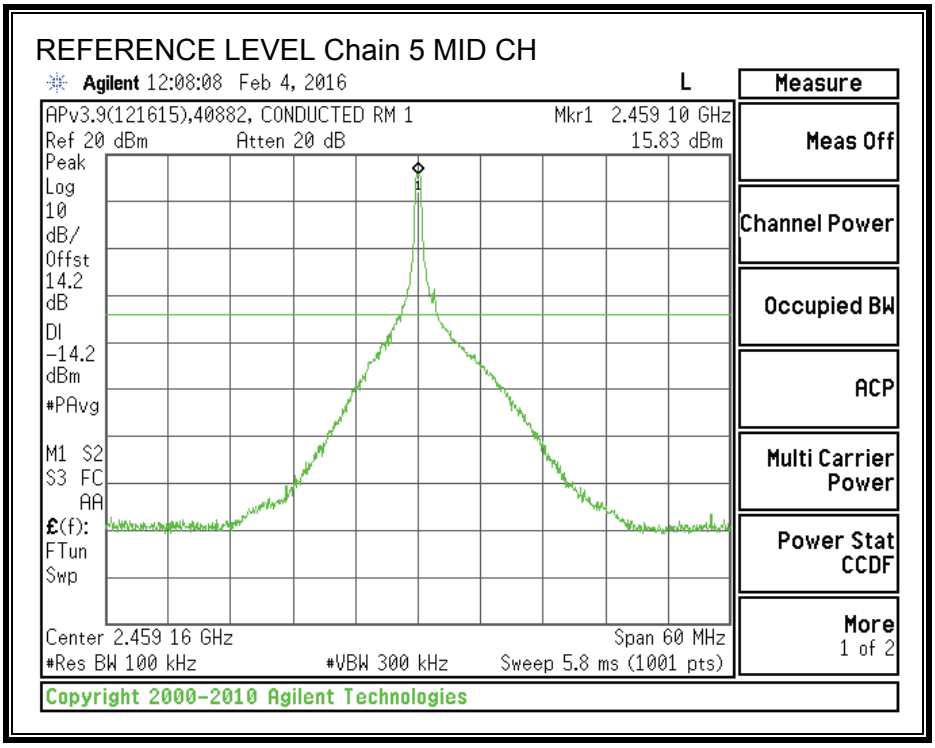
OUT OF BAND Chain 4 MID CH



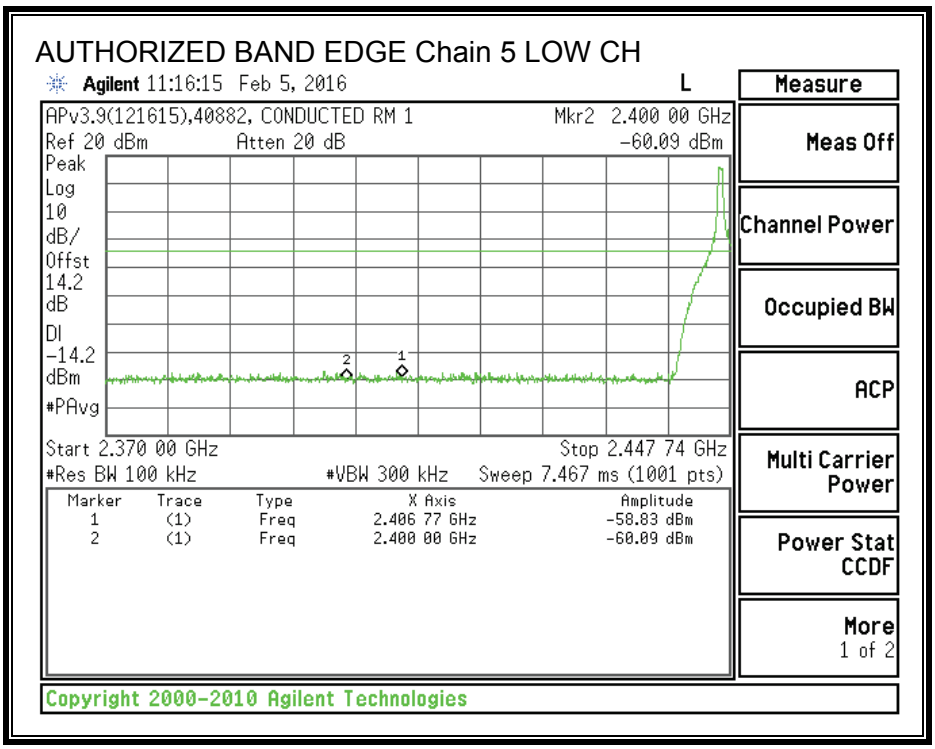
OUT OF BAND Chain 4 HIGH CH



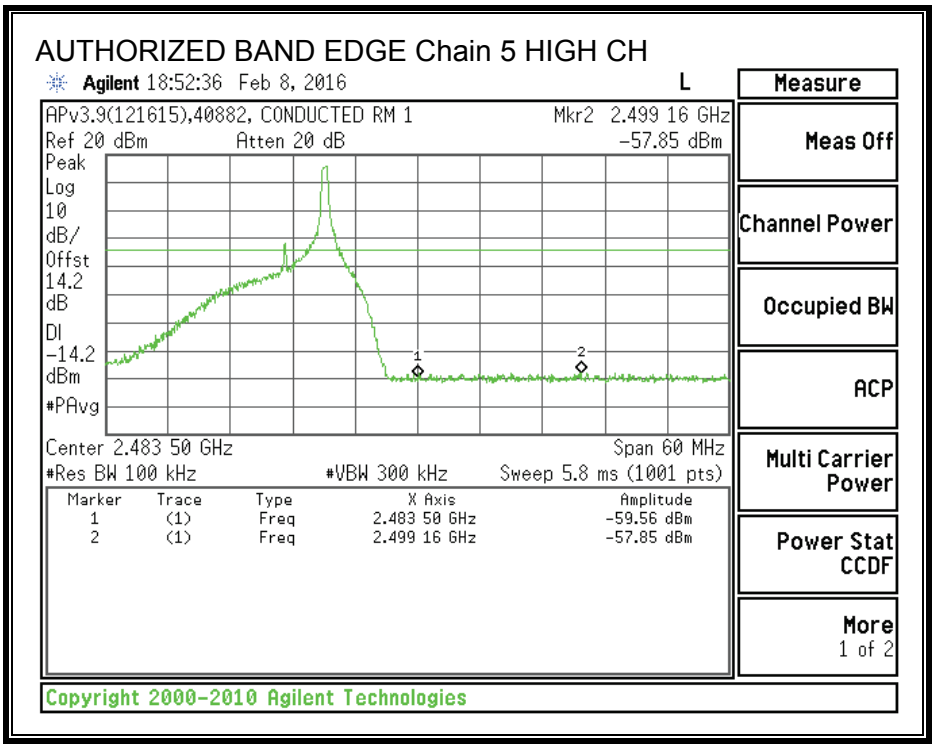
IN-BAND REFERENCE LEVEL, Chain 5



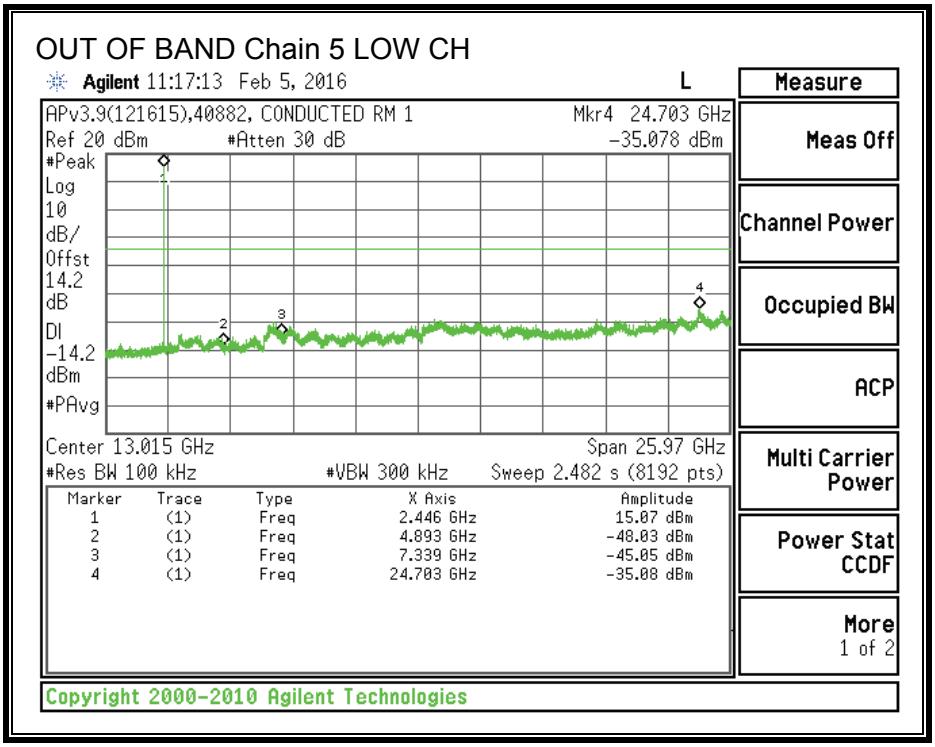
LOW CHANNEL BANDEDGE, Chain 5



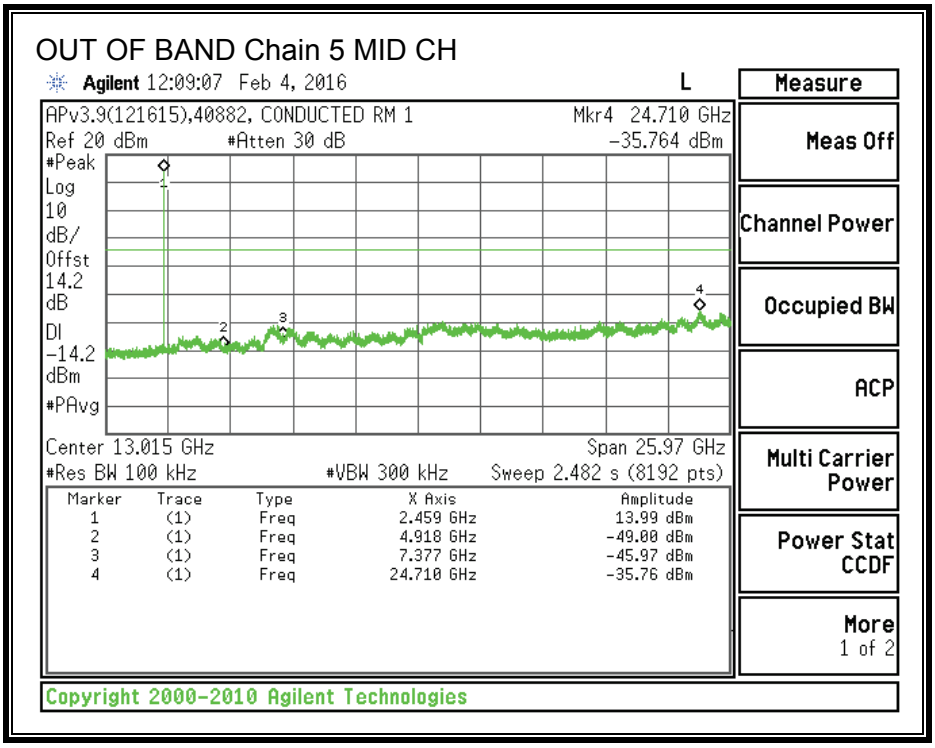
HIGH CHANNEL BANDEDGE, Chain 5



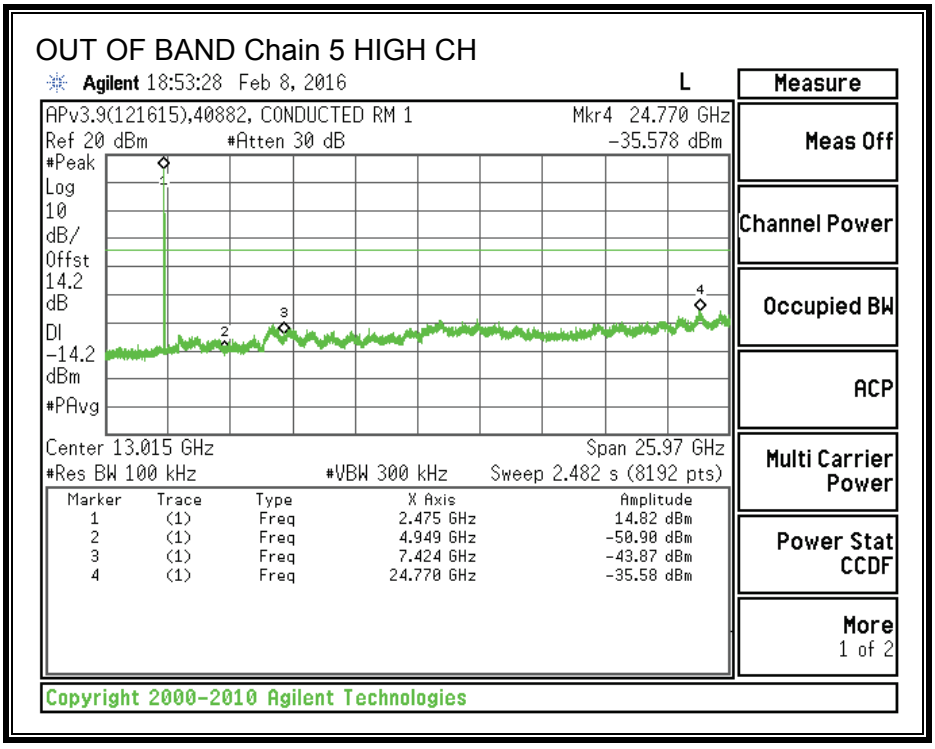
OUT-OF-BAND EMISSIONS, Chain 5



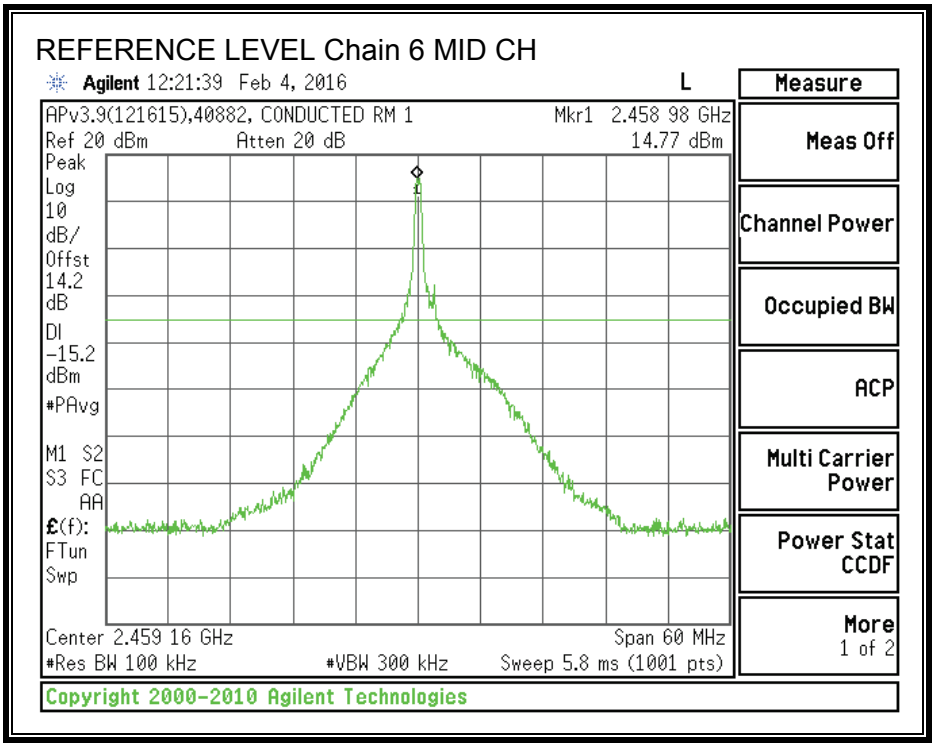
OUT OF BAND Chain 5 MID CH



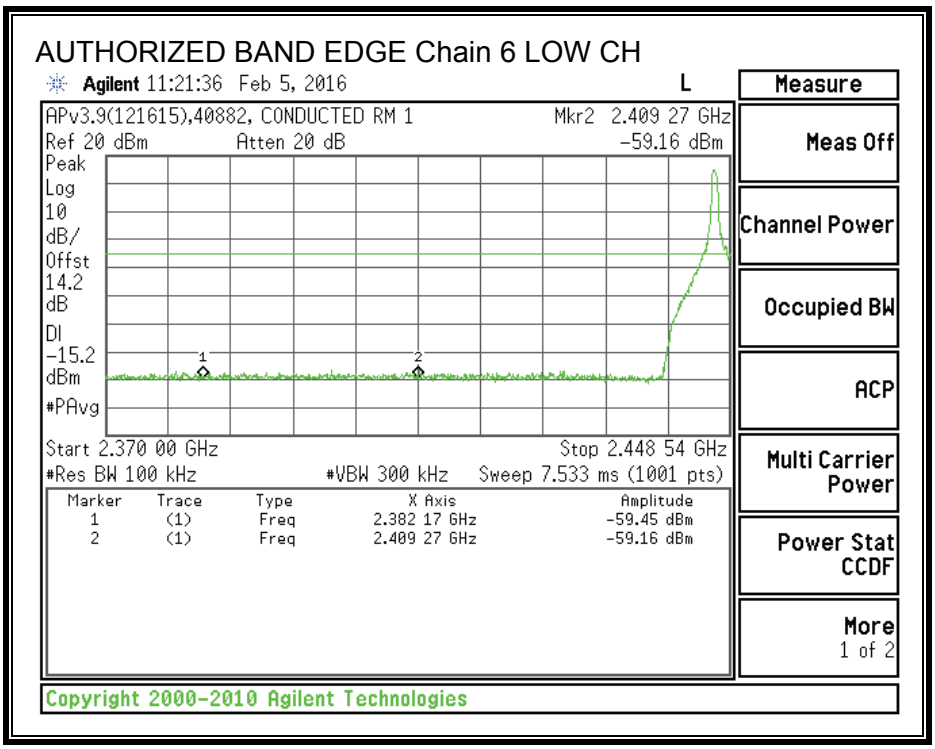
OUT OF BAND Chain 5 HIGH CH



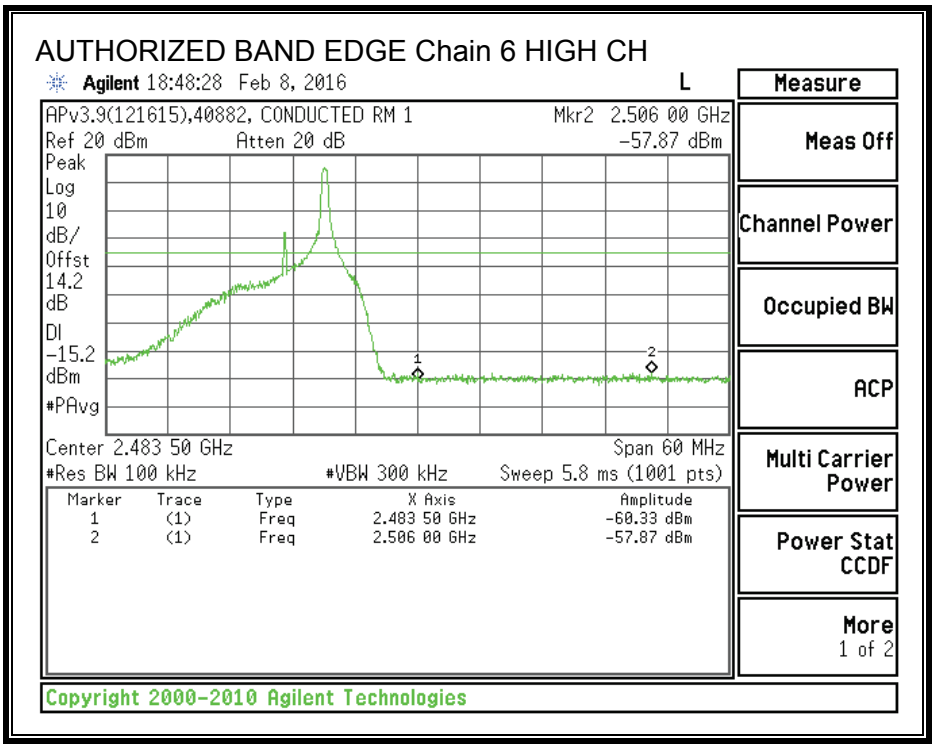
IN-BAND REFERENCE LEVEL, Chain 6



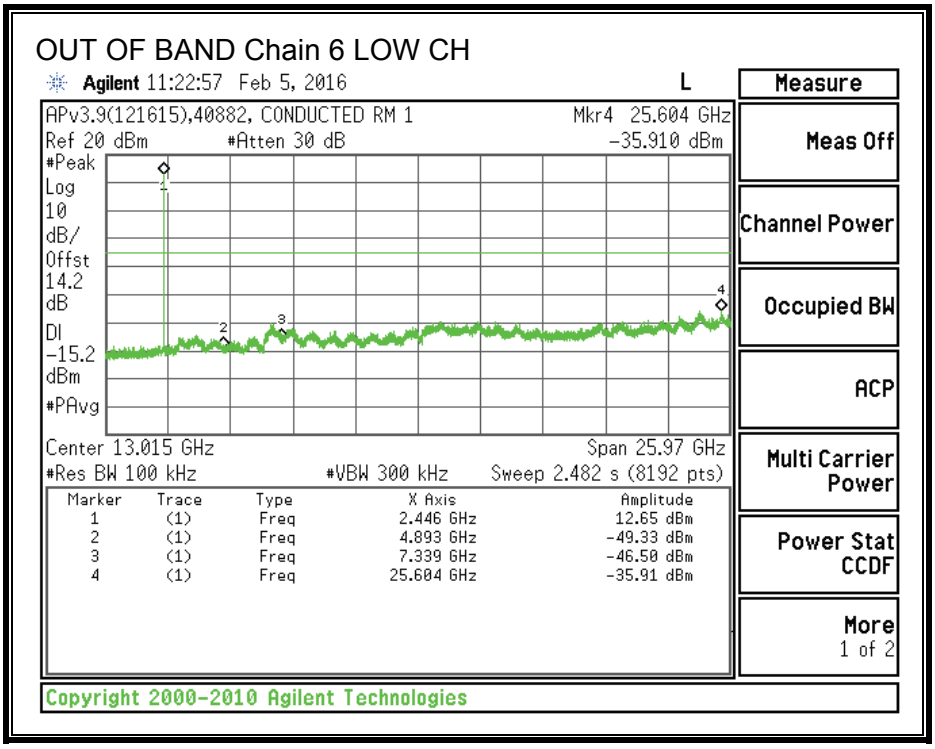
LOW CHANNEL BANDEDGE, Chain 6



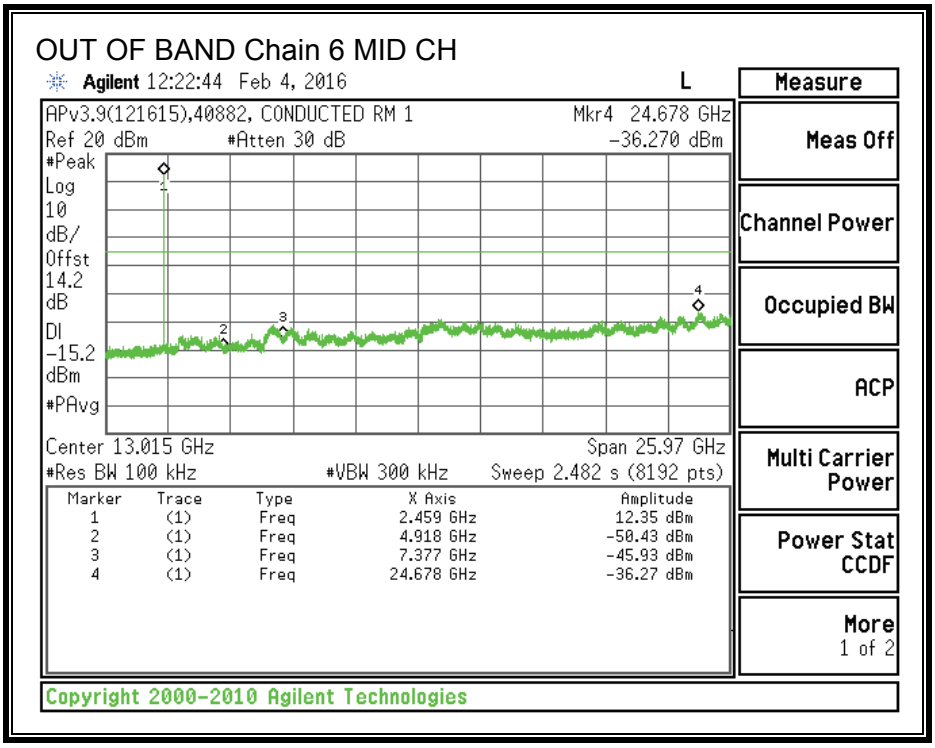
HIGH CHANNEL BANDEDGE, Chain 6



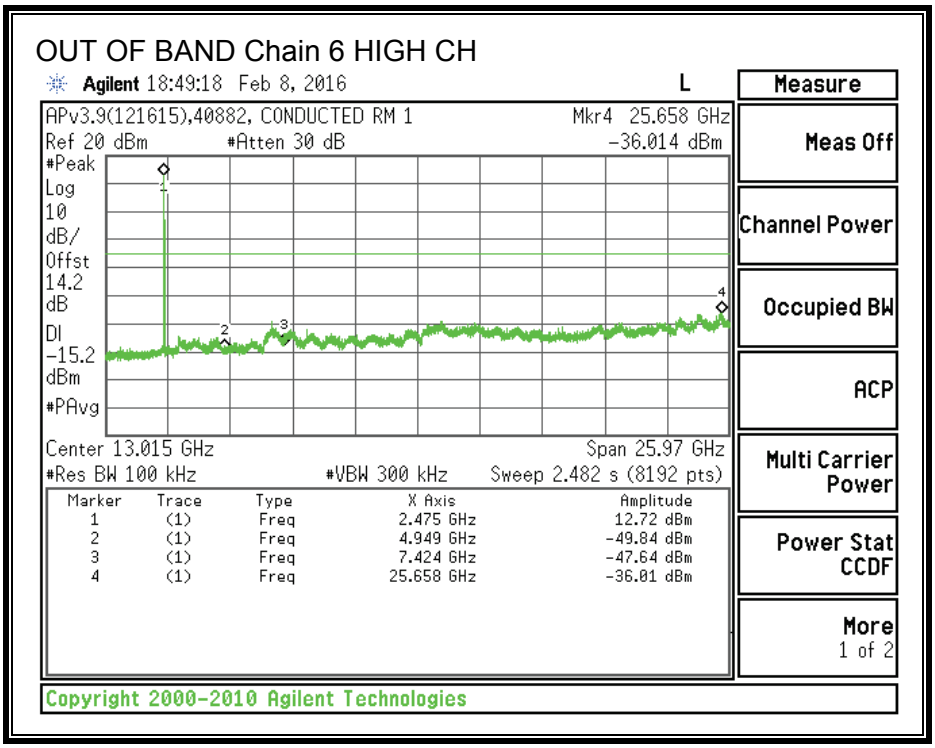
OUT-OF-BAND EMISSIONS, Chain 6



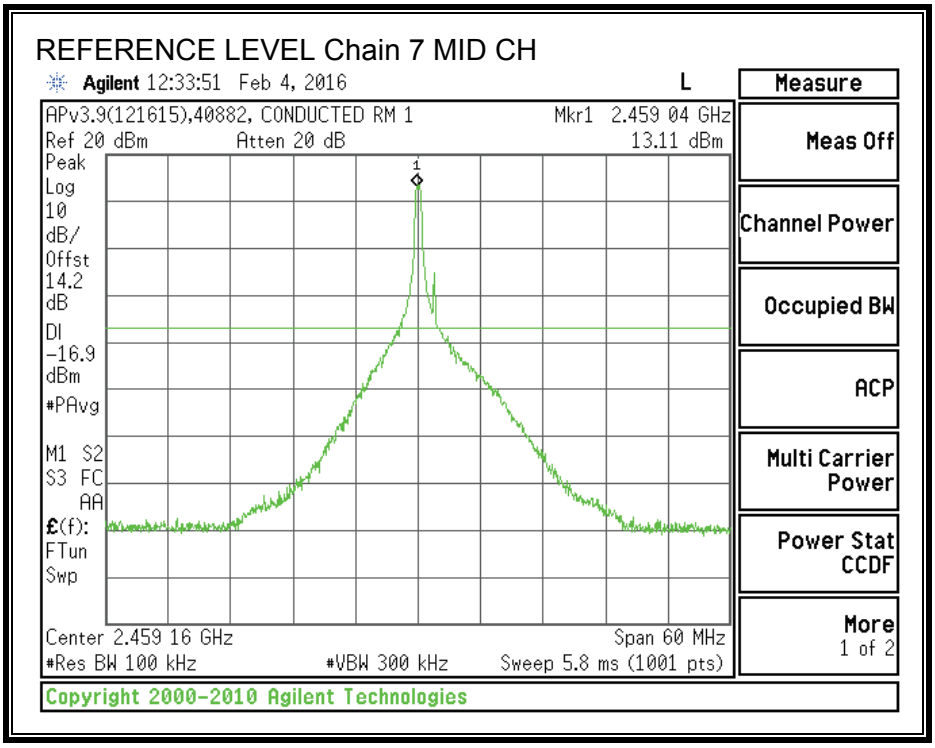
OUT OF BAND Chain 6 MID CH



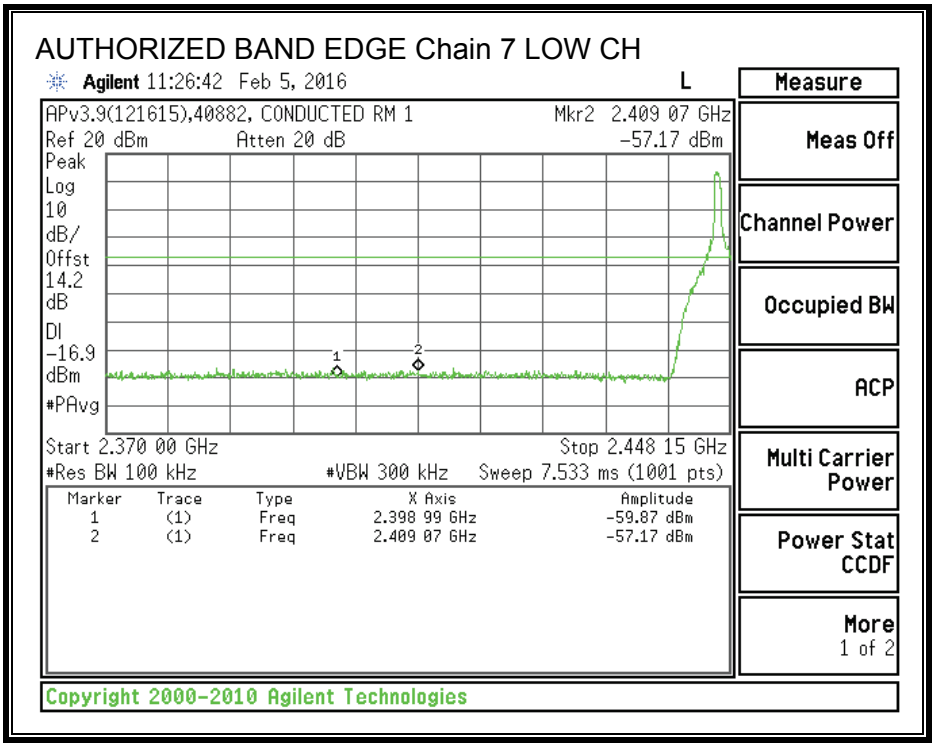
OUT OF BAND Chain 6 HIGH CH



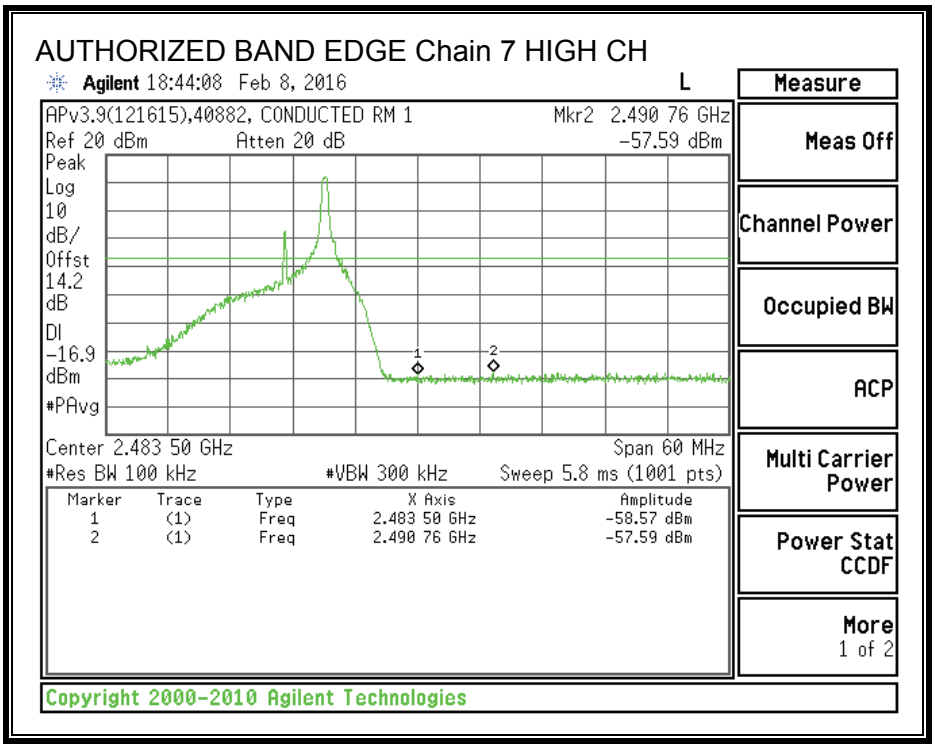
IN-BAND REFERENCE LEVEL, Chain 7



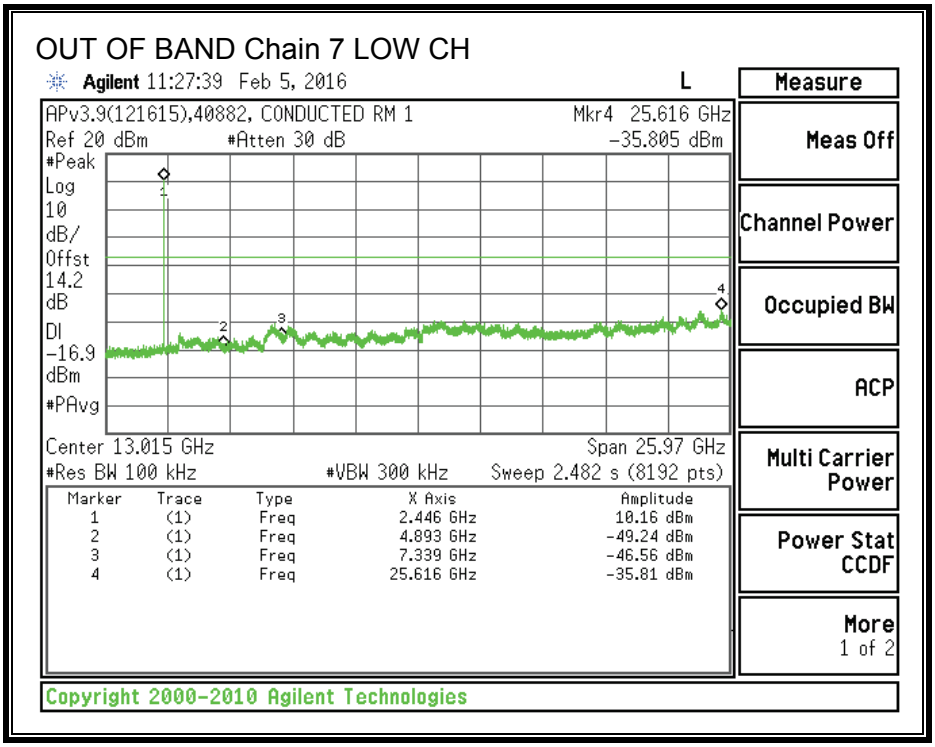
LOW CHANNEL BANDEDGE, Chain 7



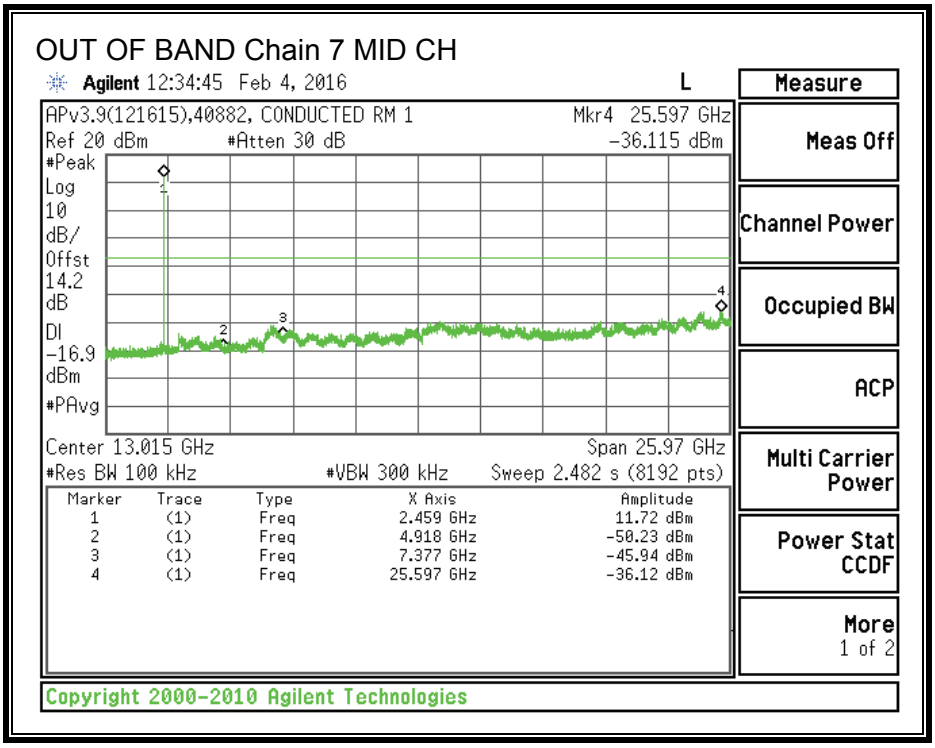
HIGH CHANNEL BANDEDGE, Chain 7



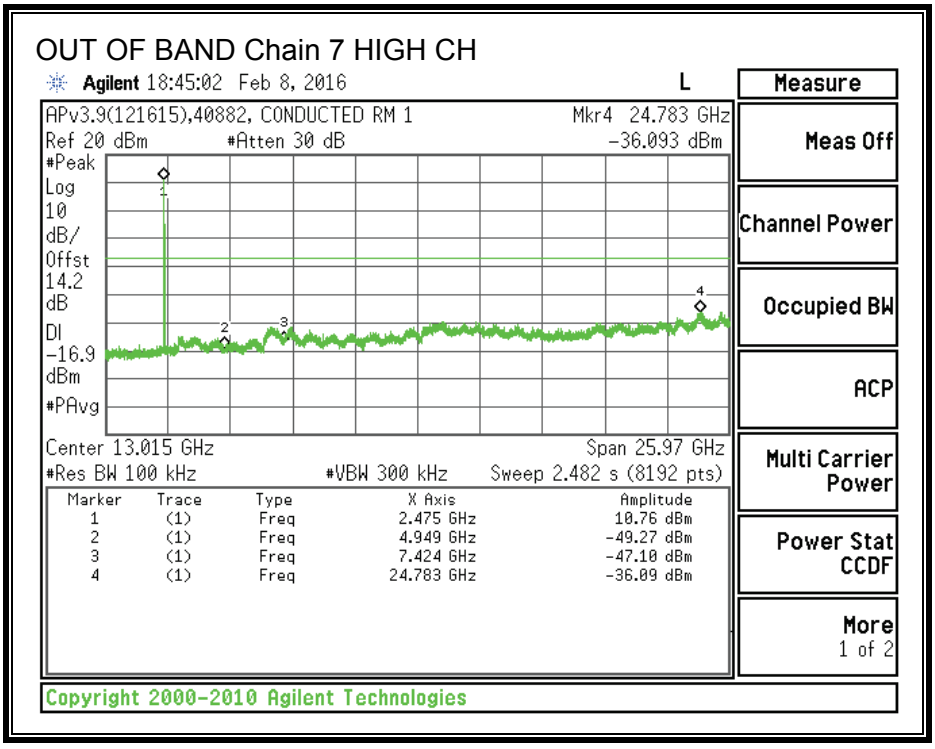
OUT-OF-BAND EMISSIONS, Chain 7



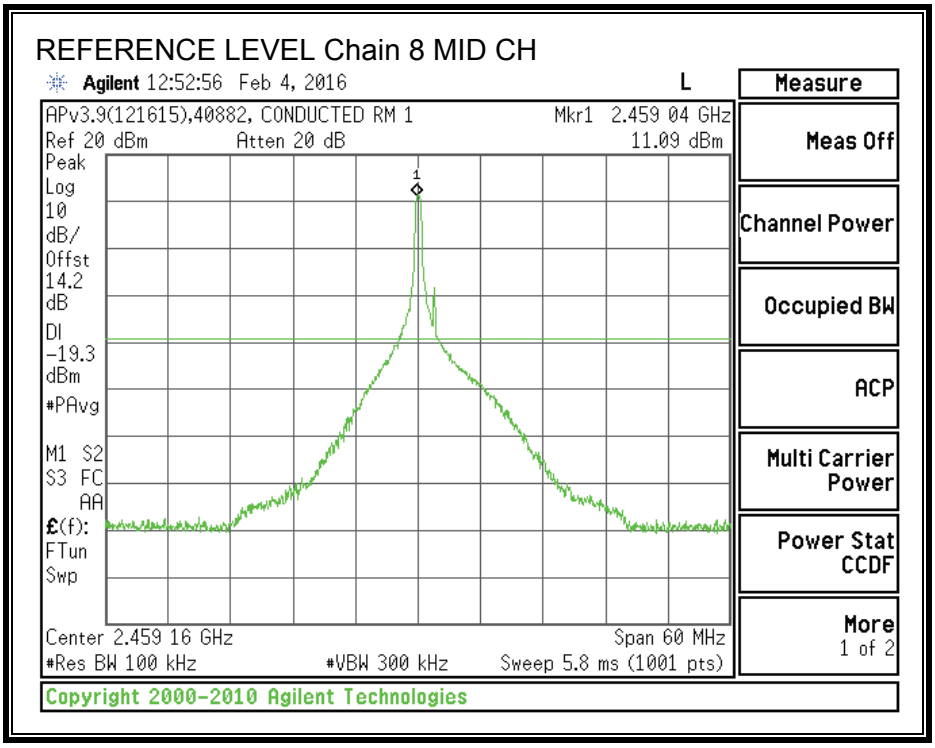
OUT OF BAND Chain 7 MID CH



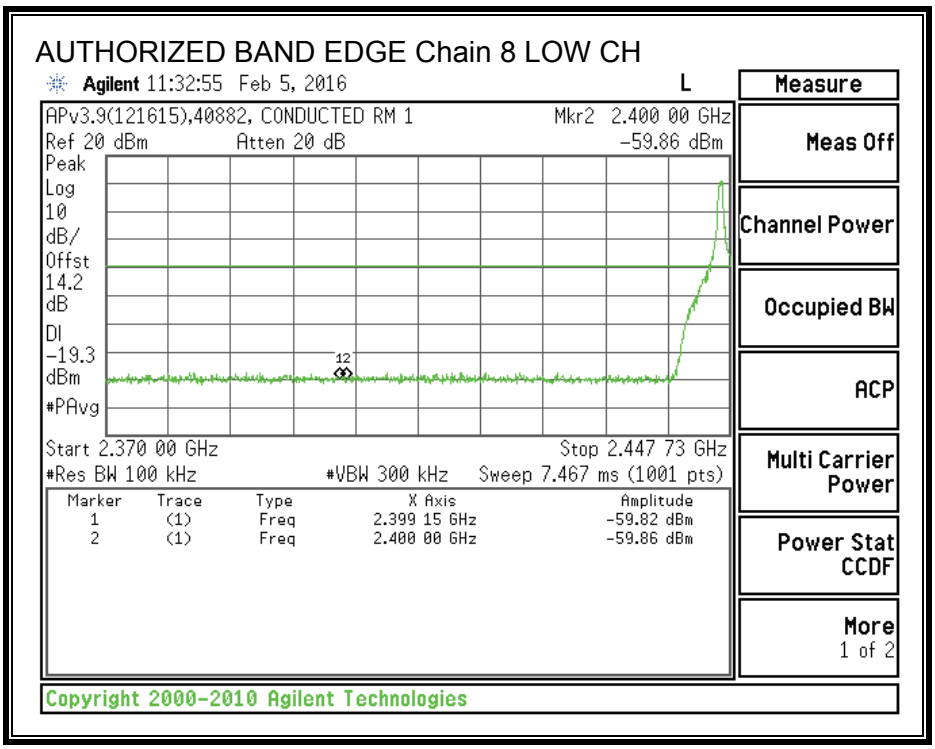
OUT OF BAND Chain 7 HIGH CH



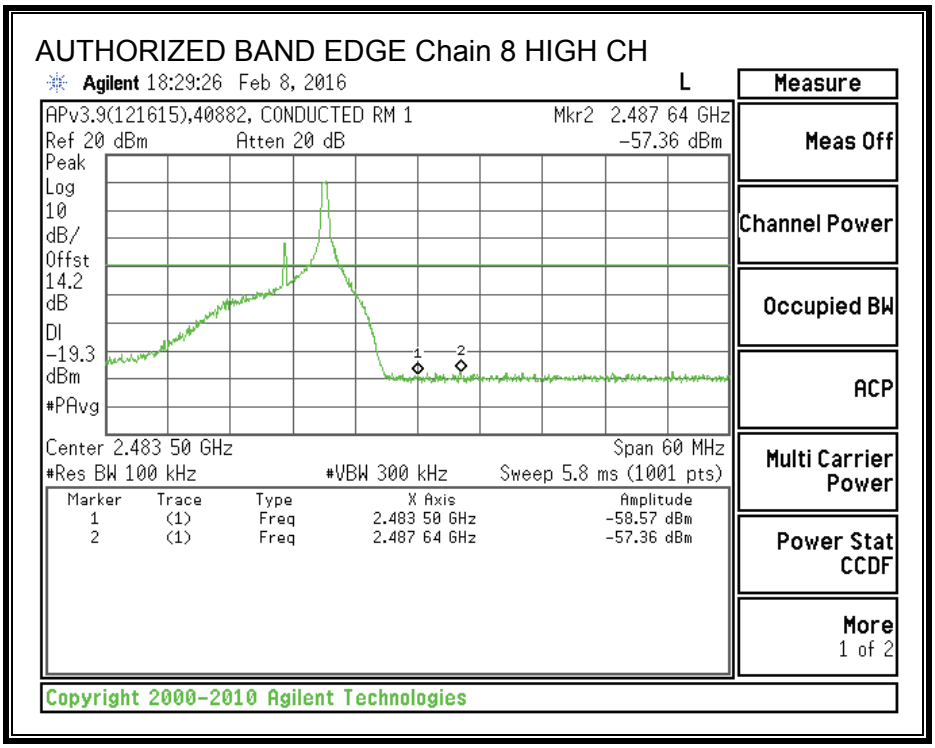
IN-BAND REFERENCE LEVEL, Chain 8



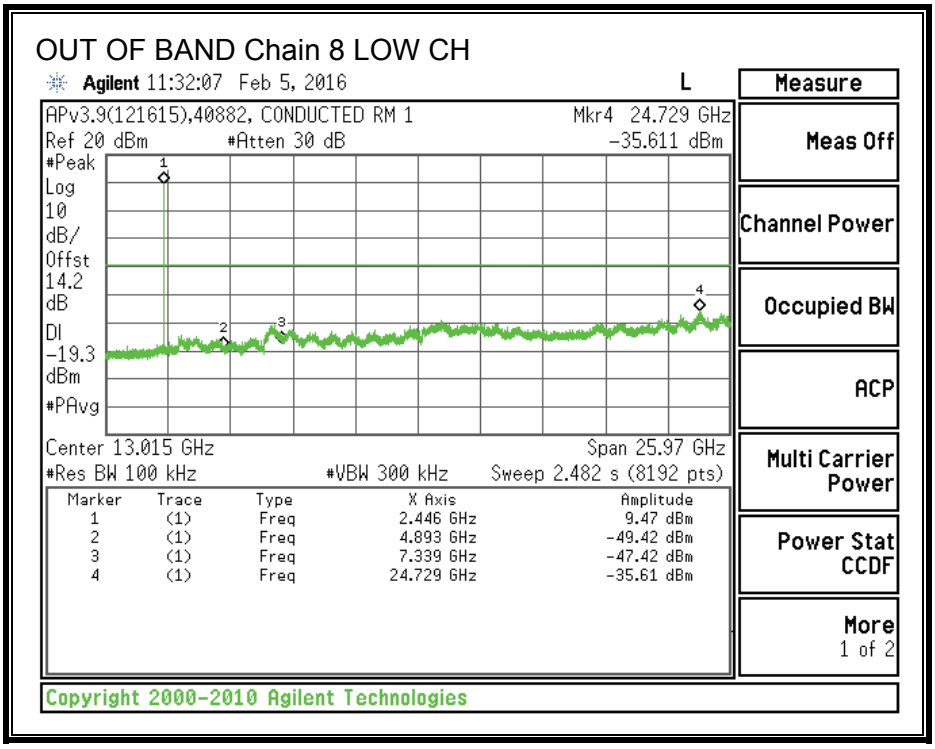
LOW CHANNEL BANDEDGE, Chain 8



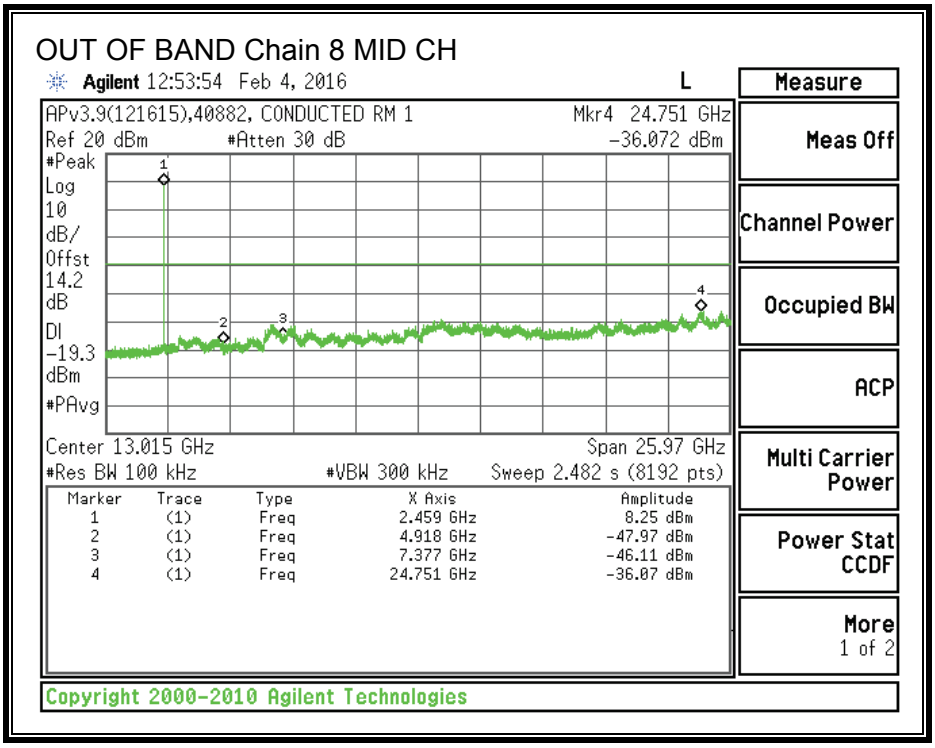
HIGH CHANNEL BANDEDGE, Chain 8



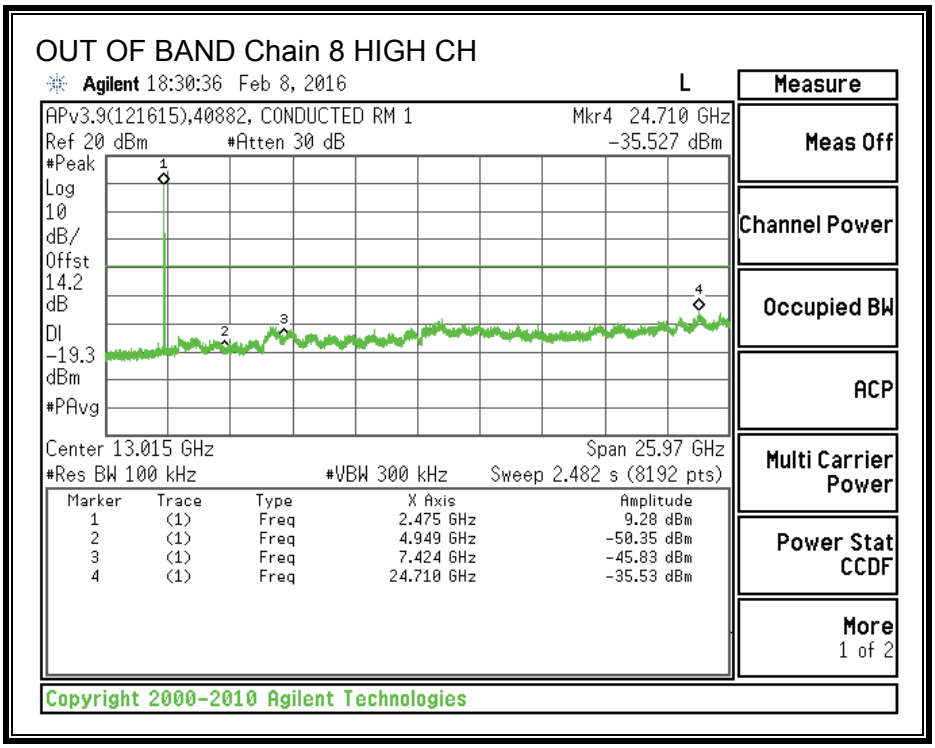
OUT-OF-BAND EMISSIONS, Chain 8



OUT OF BAND Chain 8 MID CH



OUT OF BAND Chain 8 HIGH CH



8.3. 900 kHz MODE IN THE 2.4 GHz AUTHORIZED BAND

Note – 540 kHz data represents 900 kHz data for low and middle channels. The 900 kHz high channel was tested in addition to 540 kHz because the 900 kHz high channel is closer to the high band edge. The 540 kHz low and mid channels are considered worst-case when compared to the 900 kHz bandwidths.

8.3.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

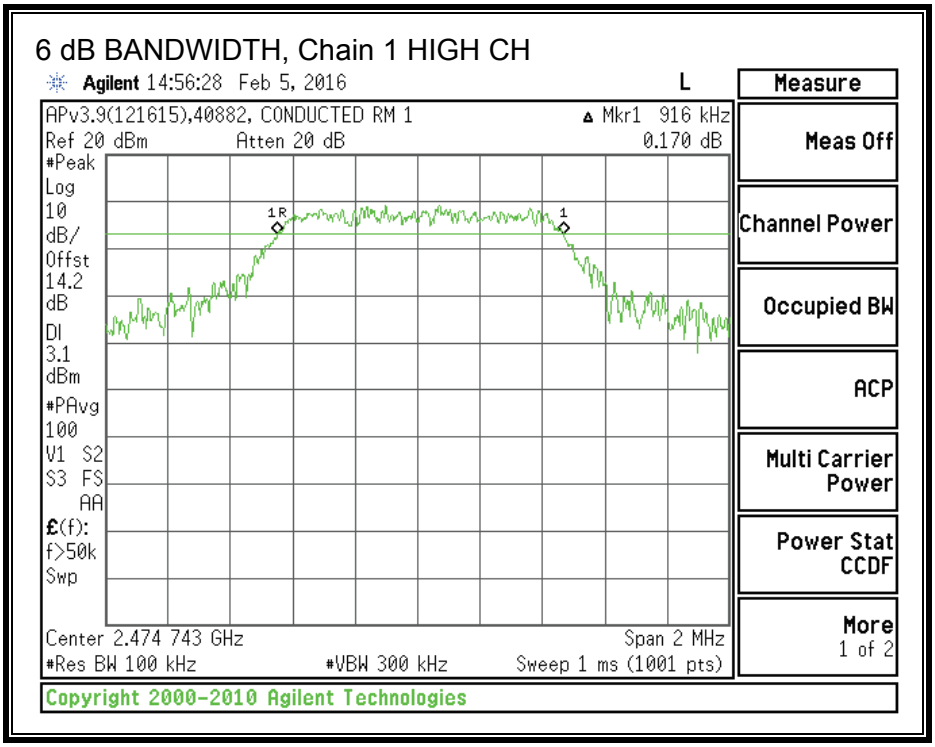
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

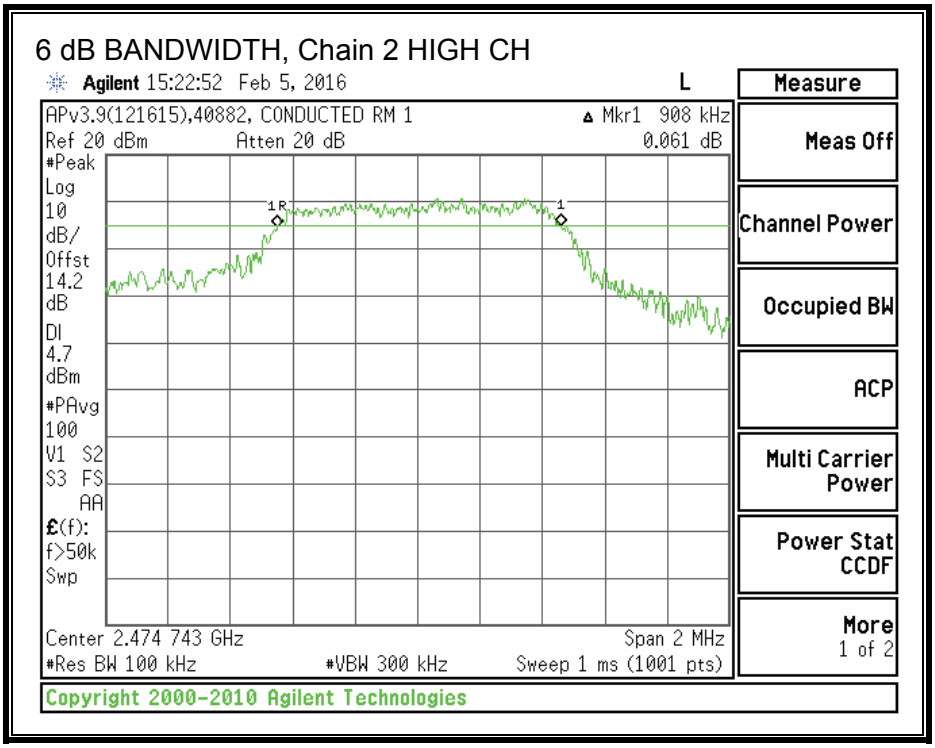
Channel	Frequency (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	6 dB BW Chain 3 (MHz)	6 dB BW Chain 4 (MHz)	Minimum Limit (MHz)
High	2474.743	0.916	0.908	1.072	0.932	0.5

Channel	Frequency (MHz)	6 dB BW Chain 5 (MHz)	6 dB BW Chain 6 (MHz)	6 dB BW Chain 7 (MHz)	6 dB BW Chain 8 (MHz)	Minimum Limit (MHz)
High	2474.743	0.924	0.934	0.908	0.934	0.5

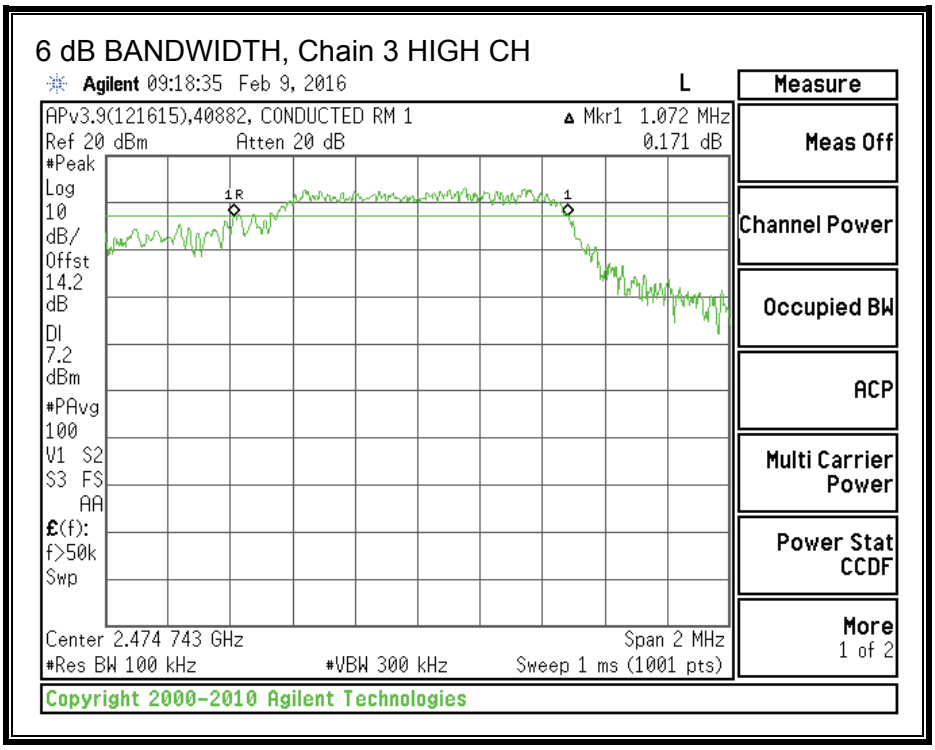
6 dB BANDWIDTH, Chain 1 HIGH CH



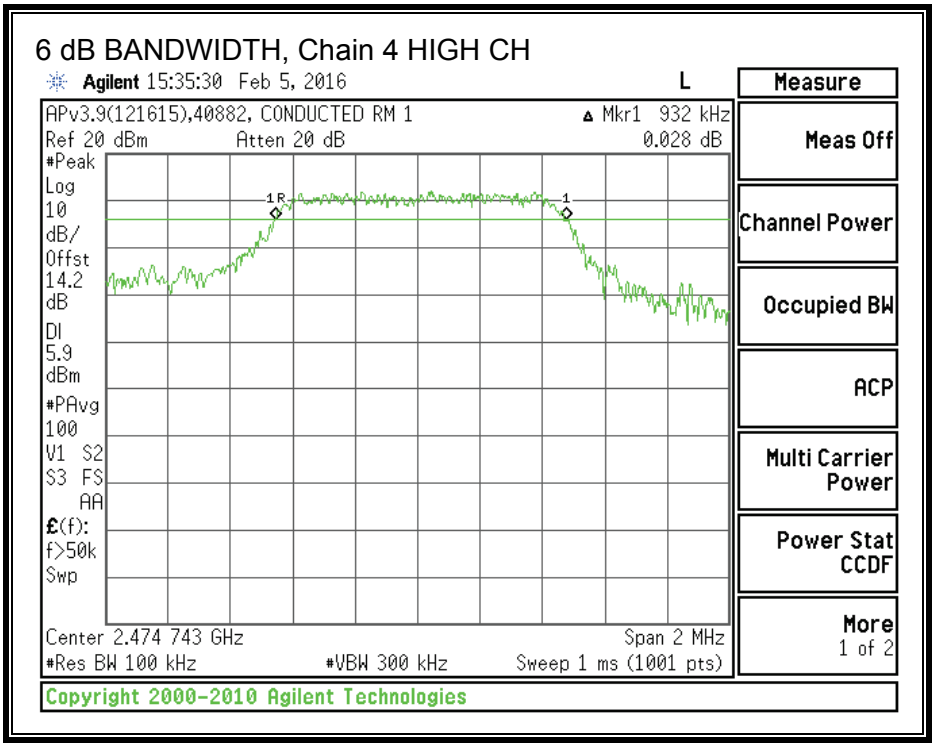
6 dB BANDWIDTH, Chain 2 HIGH CH



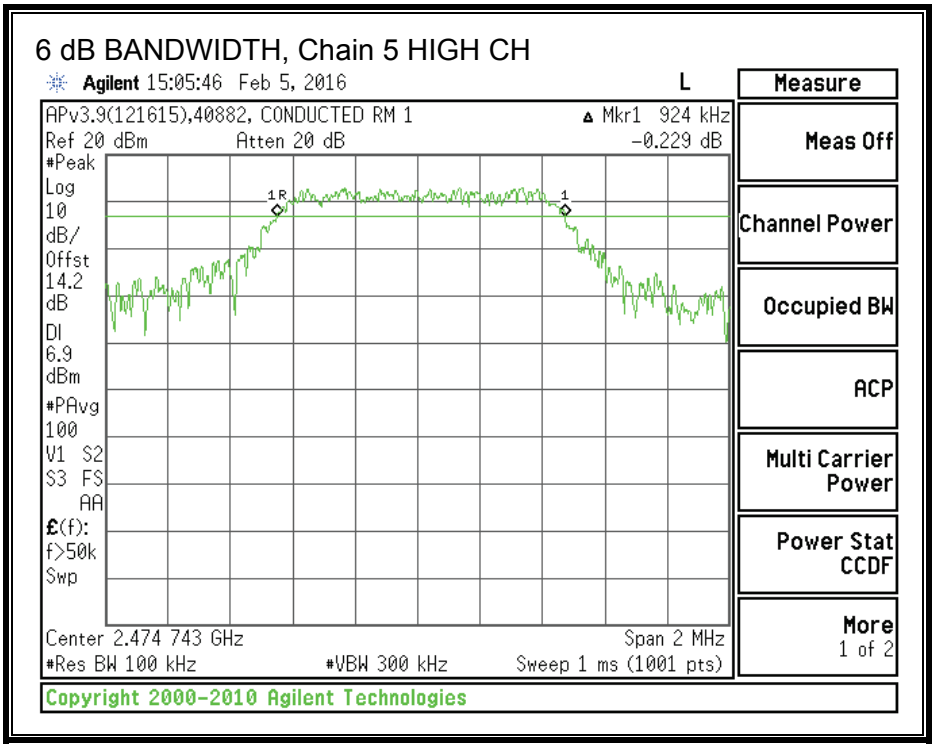
6 dB BANDWIDTH, Chain 3 HIGH CH



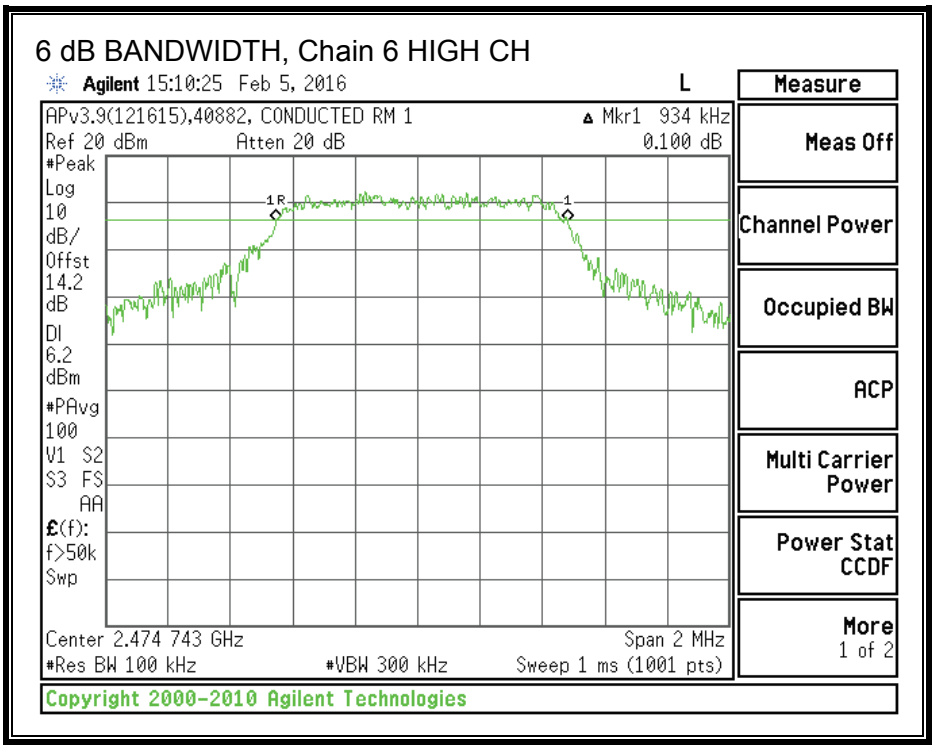
6 dB BANDWIDTH, Chain 4 HIGH CH



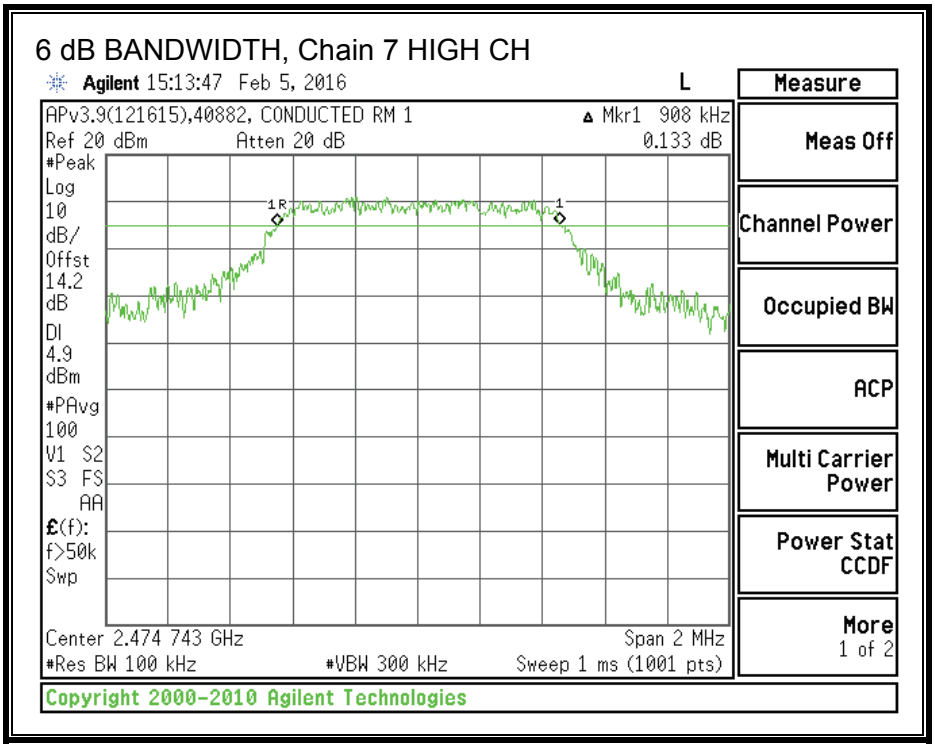
6 dB BANDWIDTH, Chain 5 HIGH CH



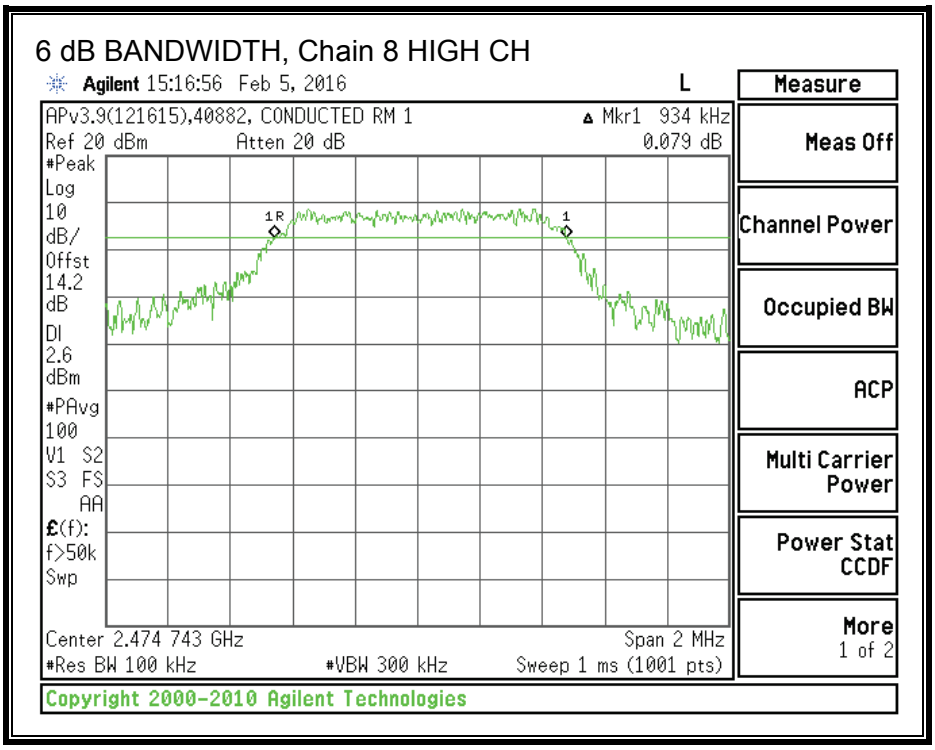
6 dB BANDWIDTH, Chain 6 HIGH CH



6 dB BANDWIDTH, Chain 7 HIGH CH



6 dB BANDWIDTH, Chain 8 HIGH CH



8.3.2. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

	Included in Calculations of Corr'd Power							
Duty Cycle CF (dB)	0.68	0	0	0	0.68	0.67	0.75	0.73

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Chain 4 Power (dBm)	Chain 5 Power (dBm)	Chain 6 Power (dBm)	Chain 7 Power (dBm)	Chain 8 Power (dBm)	Total Power (dBm)
High	2474.743	9.58	11.83	14.76	12.95	13.76	12.54	11.16	9.14	21.67

8.3.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

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.

§15.247 (c) (2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Chain 3 Antenna Gain (dBi)	Chain 4 Antenna Gain (dBi)	Chain 5 Antenna Gain (dBi)	Chain 6 Antenna Gain (dBi)	Chain 7 Antenna Gain (dBi)	Correlated Directional Gain (dBi)
19.70	19.90	20.00	20.20	20.20	20.10	19.90	19.60	28.98

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)
High	2474.743	28.98	23.00

	Included in Calculations of Corr'd Power			
Duty Cycle CF (dB)	0.68	0	0	0
	0.68	0.67	0.75	0.73

Results

Channel	Frequency (MHz)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Chain 4 Meas Power (dBm)
High	2474.743	9.58	11.83	14.76	12.95

Channel	Frequency (MHz)	Chain 5 Meas Power (dBm)	Chain 6 Meas Power (dBm)	Chain 7 Meas Power (dBm)	Chain 8 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
High	2474.743	13.76	12.54	11.16	9.14	21.75	23.00	-1.25

8.3.4. POWER SPECTRUM DENSITY

LIMITS

FCC §15.247 (e)

RESULTS

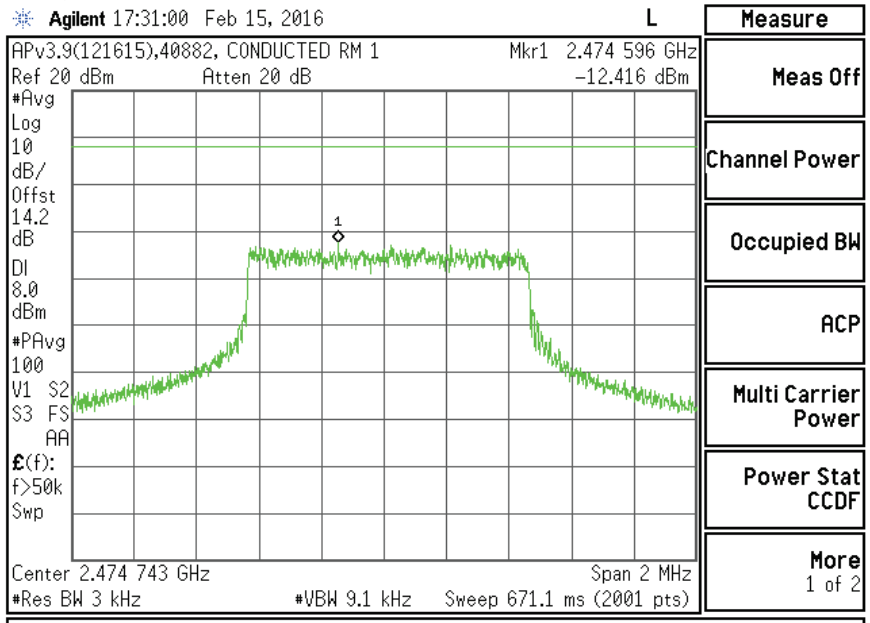
	Included in Calculations of Corr'd PSD			
Duty Cycle CF (dB)	0.68	0	0	0
	0.68	0.67	0.75	0.73

PSD Results

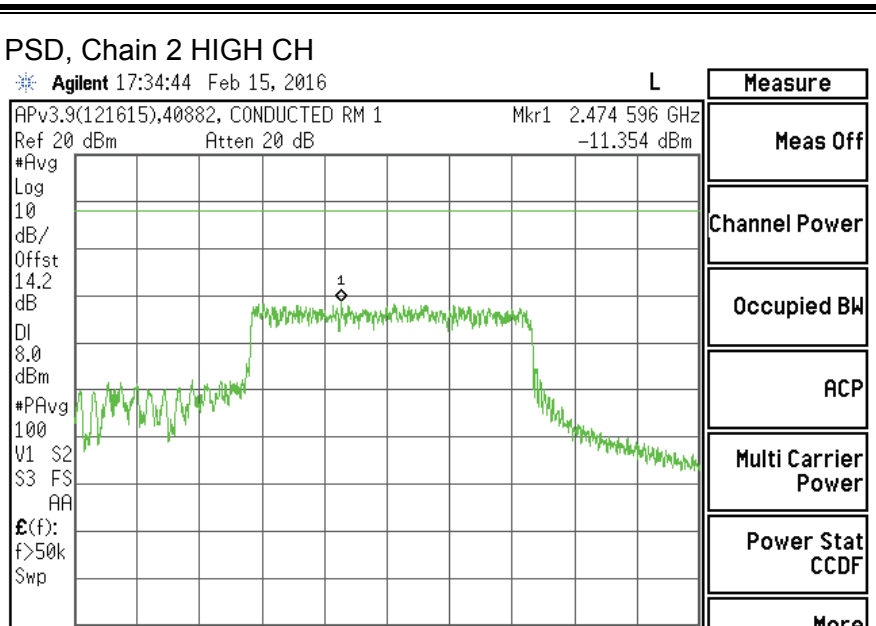
Channel	Frequency (MHz)	Chain 1 Meas (dBm)	Chain 2 Meas (dBm)	Chain 3 Meas (dBm)	Chain 4 Meas (dBm)
High	2474.743	-12.42	-11.35	-9.74	-9.65

Channel	Frequency (MHz)	Chain 5 Meas (dBm)	Chain 6 Meas (dBm)	Chain 7 Meas (dBm)	Chain 8 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
High	2474.743	-8.75	-9.60	-10.55	-12.01	-0.87	8.0	-8.9

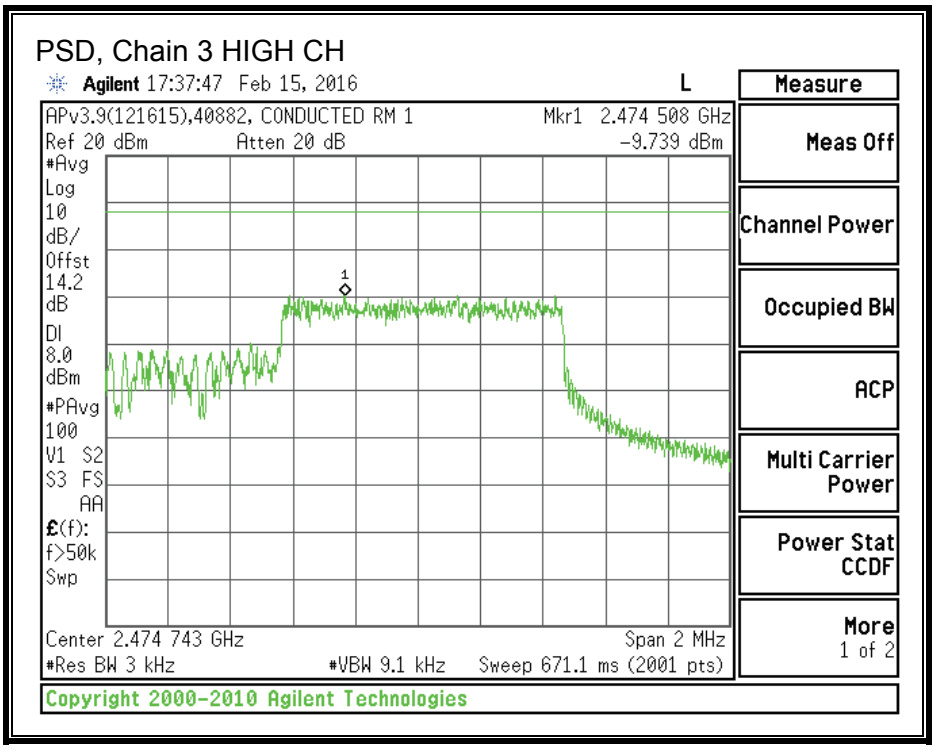
PSD, Chain 1 HIGH CH



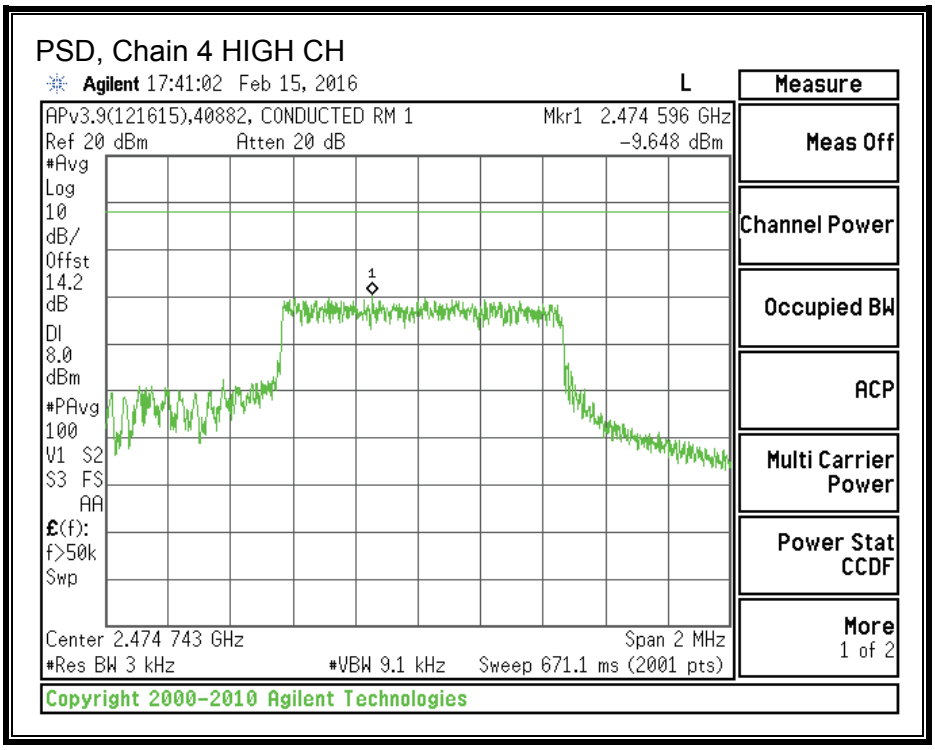
PSD, Chain 2 HIGH CH



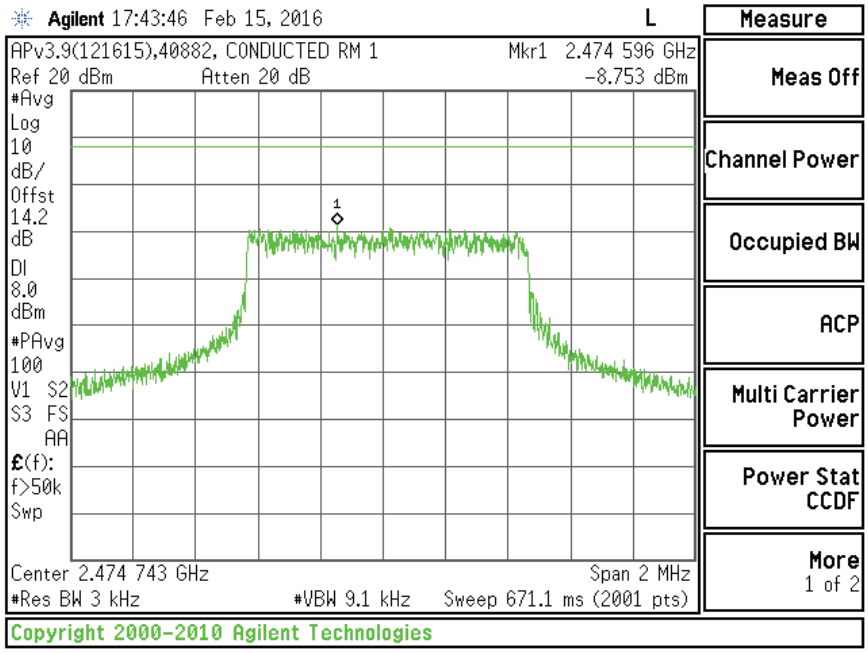
PSD, Chain 3 HIGH CH



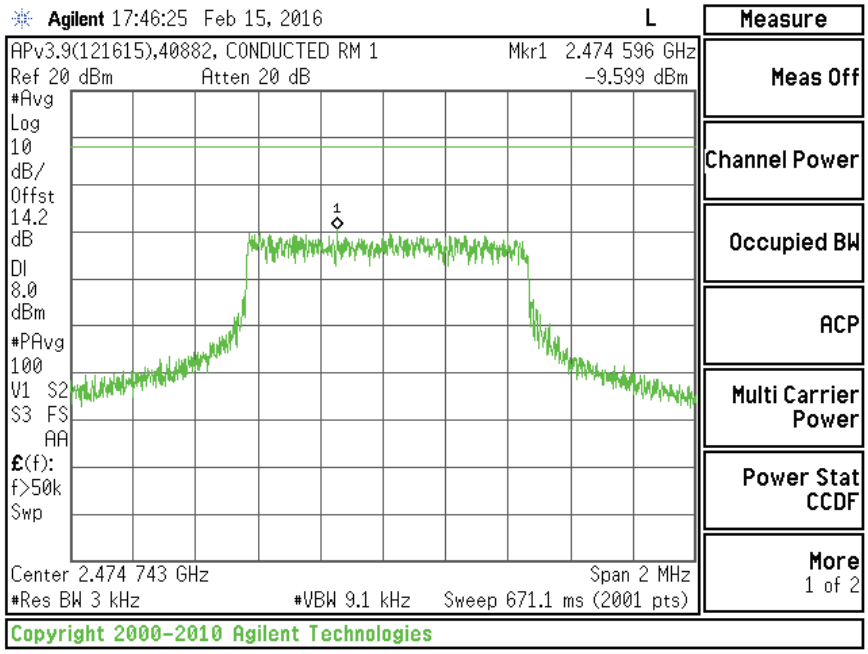
PSD, Chain 4 HIGH CH



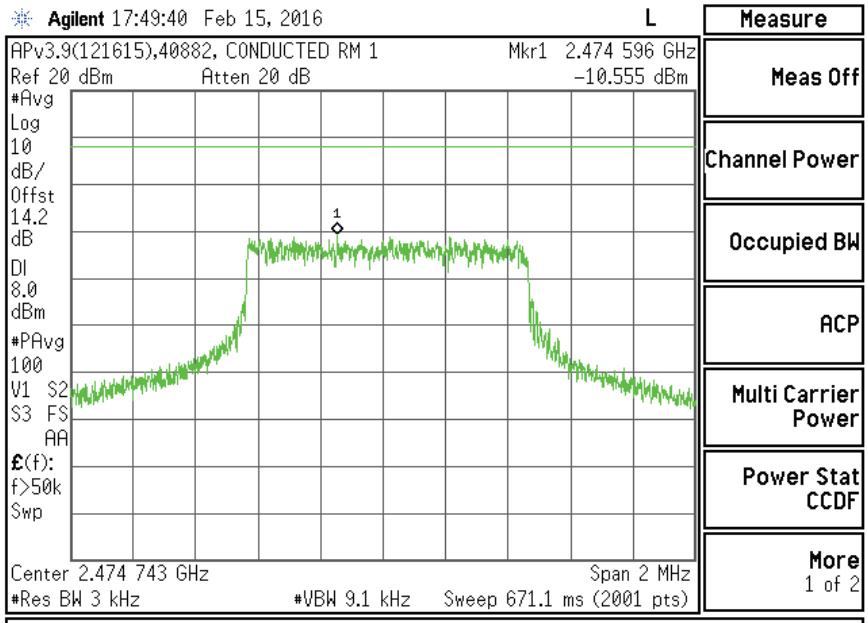
PSD, Chain 5 HIGH CH



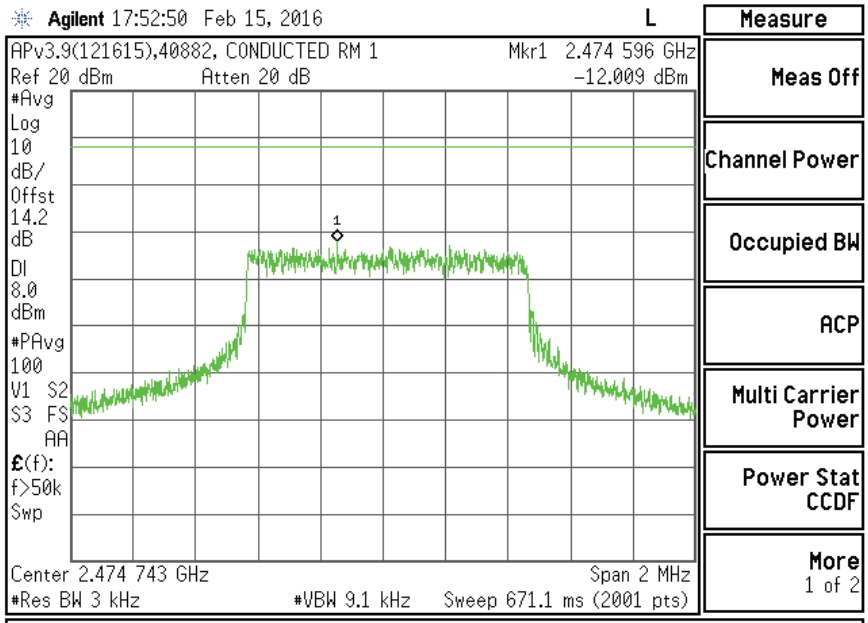
PSD, Chain 6 HIGH CH



PSD, Chain 7 HIGH CH



PSD, Chain 8 HIGH CH



8.3.5. OUT-OF-BAND EMISSIONS

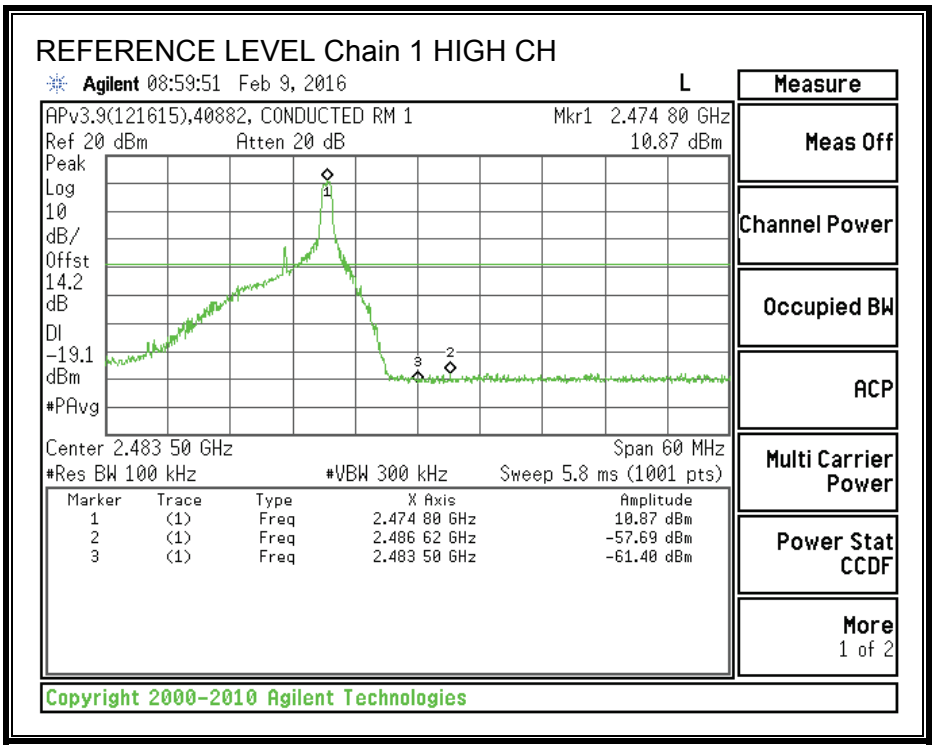
LIMITS

FCC §15.247 (d)

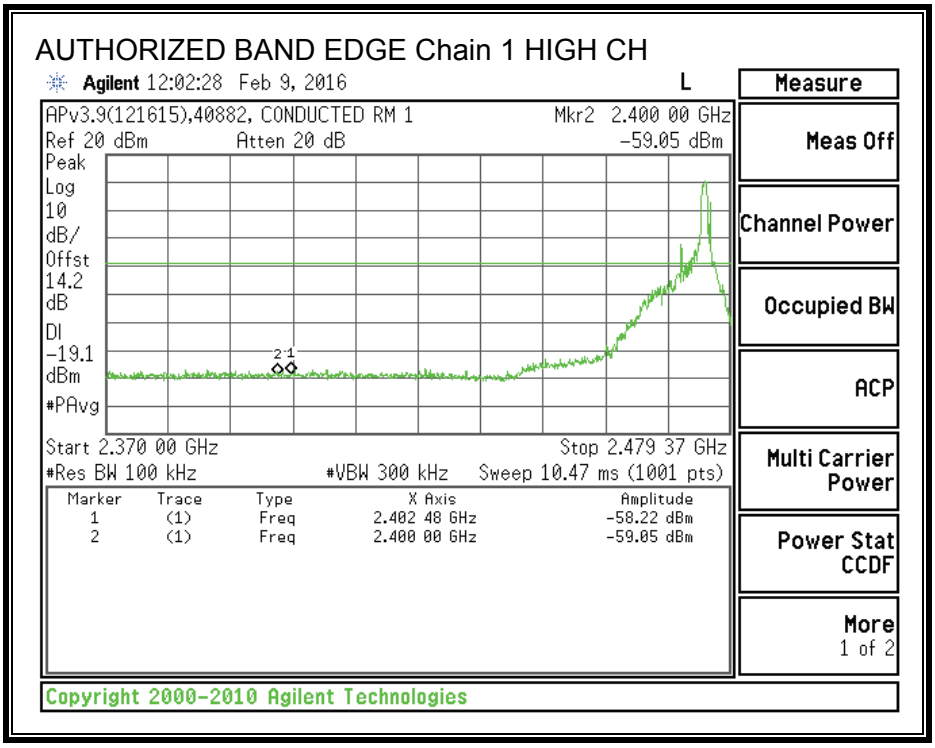
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

RESULTS

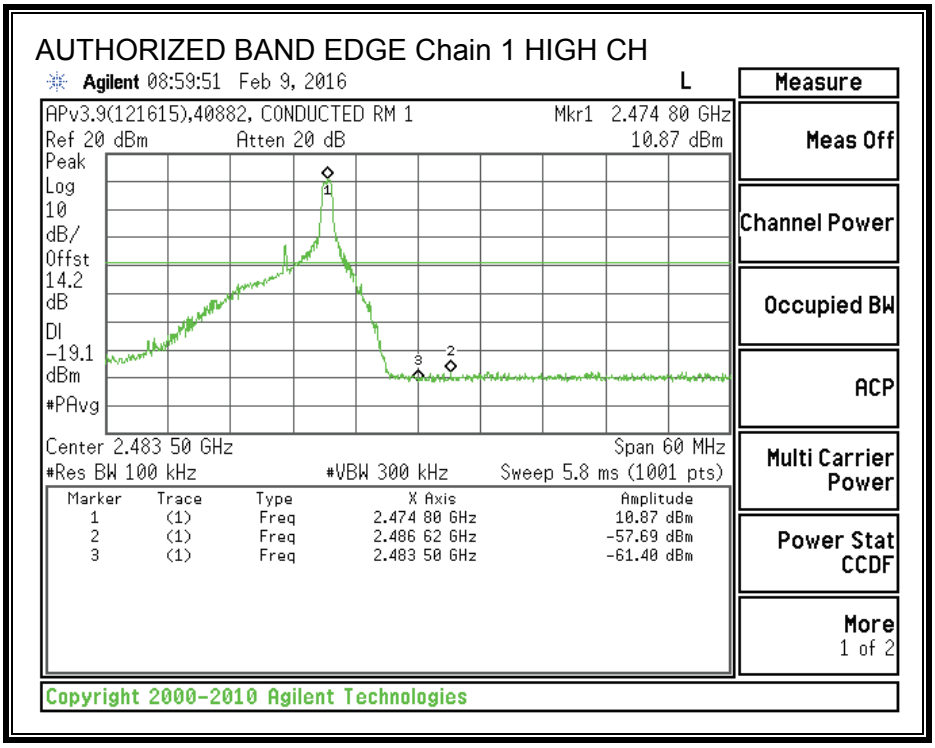
IN-BAND REFERENCE LEVEL, Chain 1



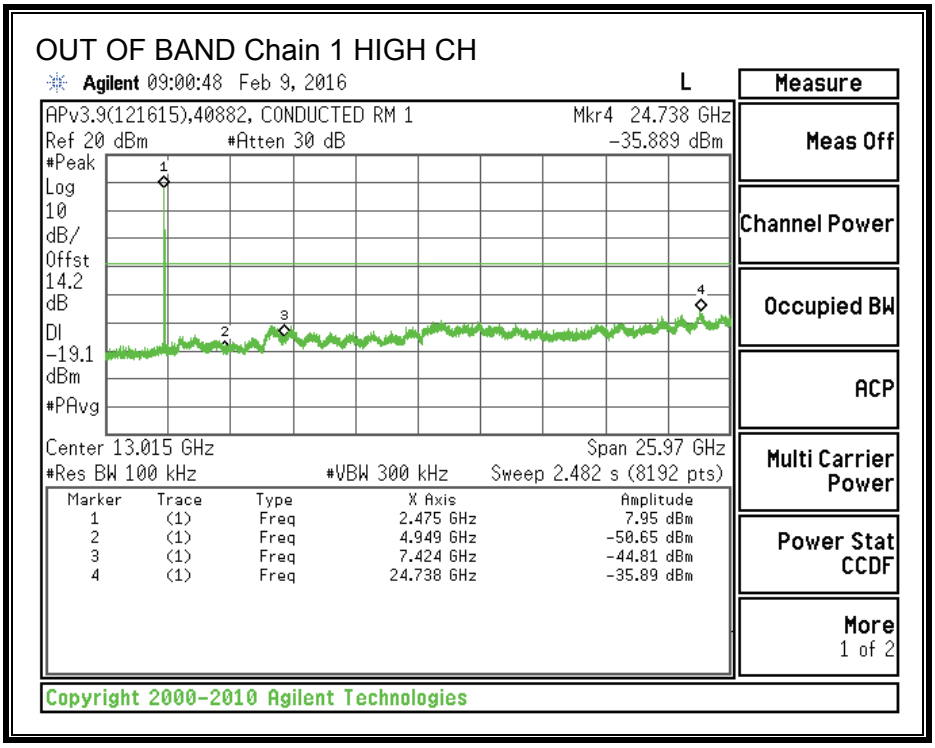
LOW CHANNEL BANDEDGE, Chain 1



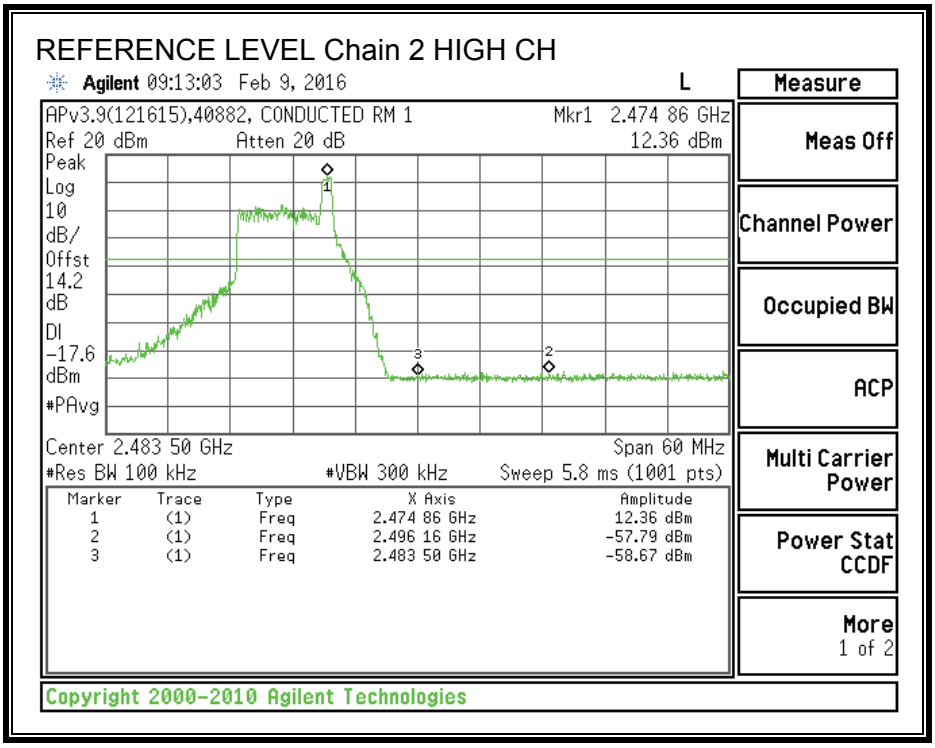
HIGH CHANNEL BANDEDGE, Chain 1



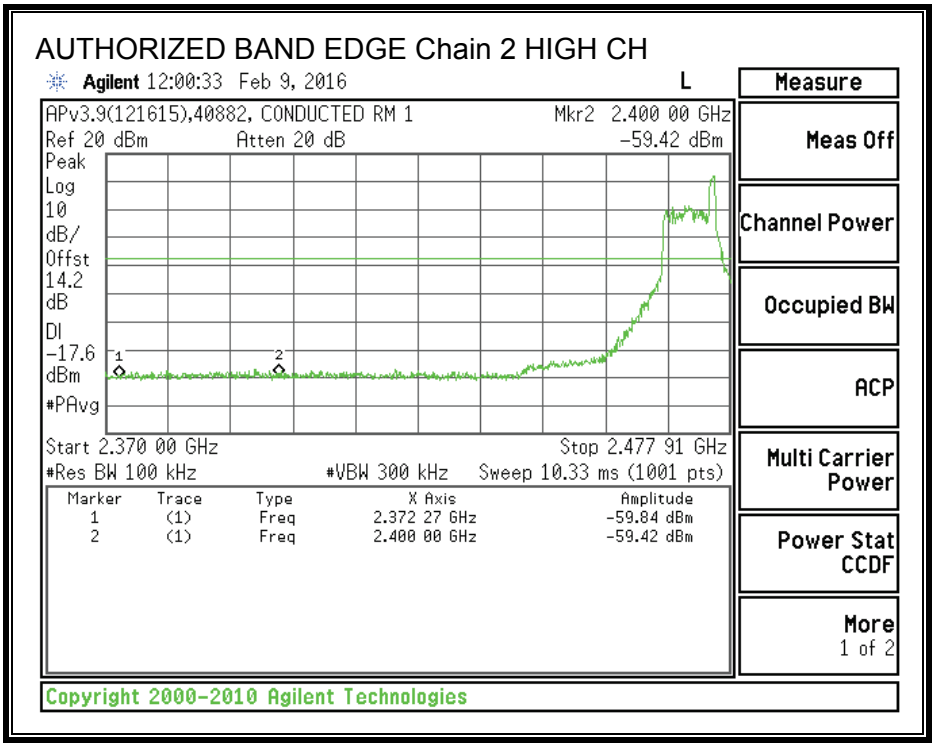
OUT-OF-BAND EMISSIONS, Chain 1



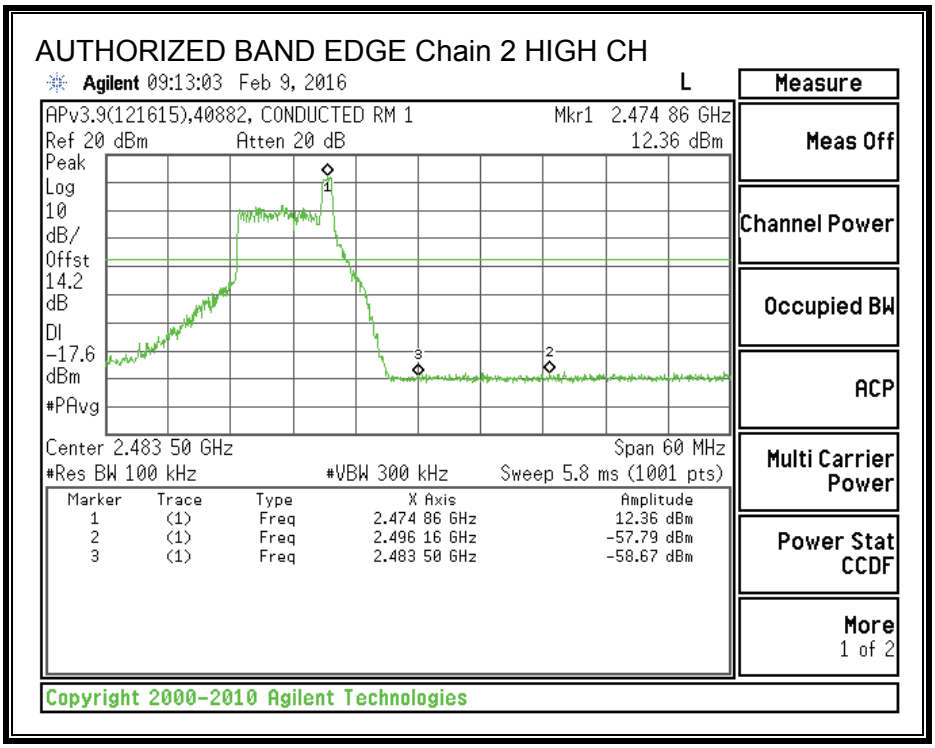
IN-BAND REFERENCE LEVEL, Chain 2



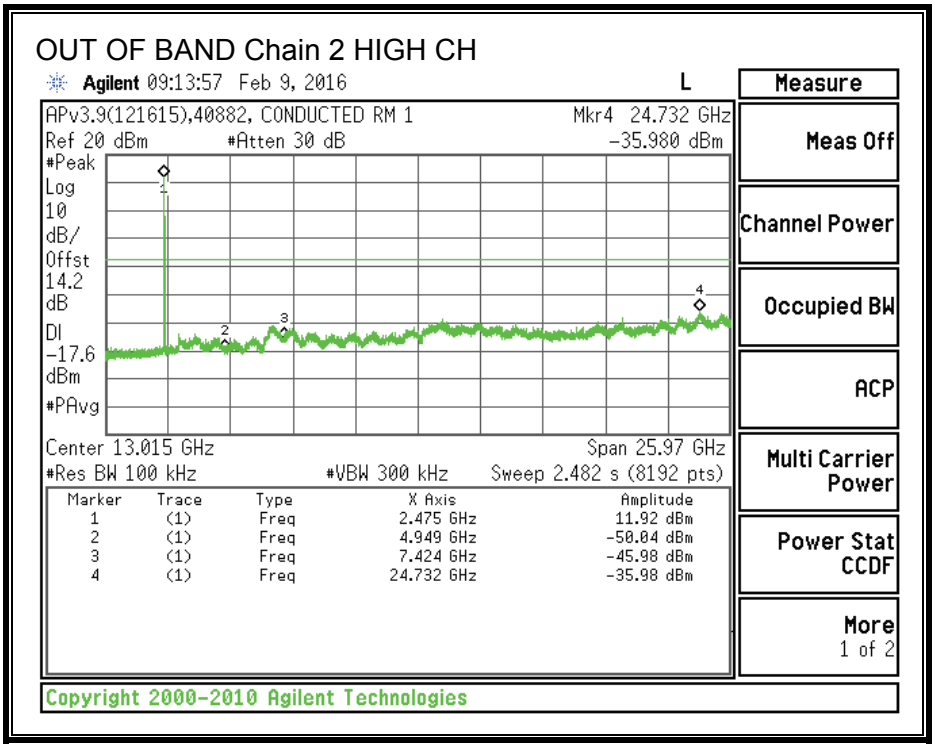
LOW CHANNEL BANDEDGE, Chain 2



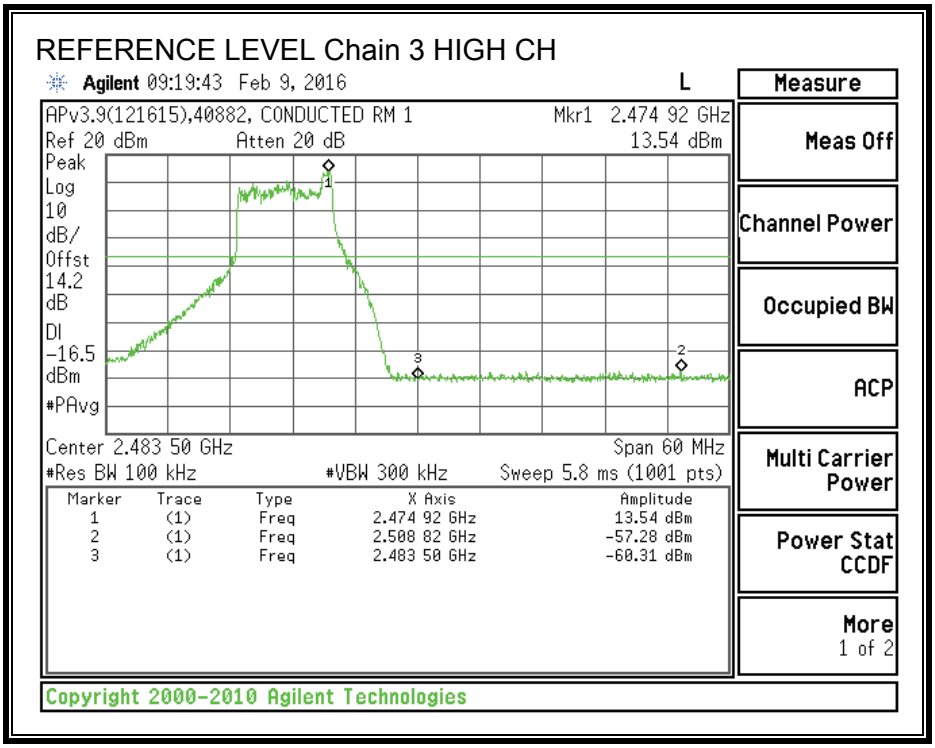
HIGH CHANNEL BANDEDGE, Chain 2



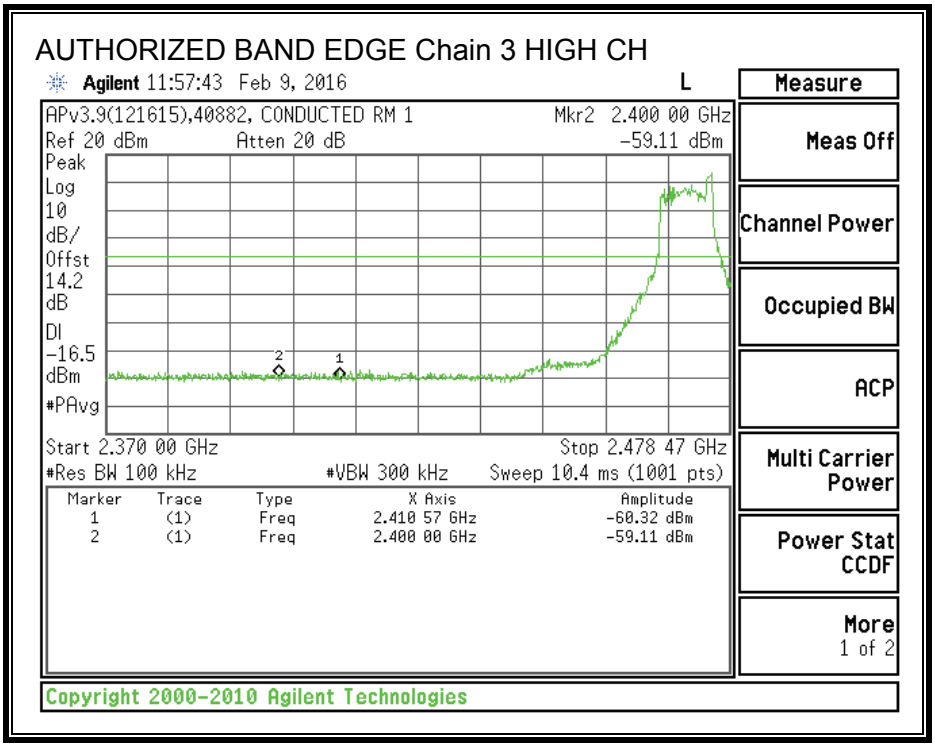
OUT-OF-BAND EMISSIONS, Chain 2



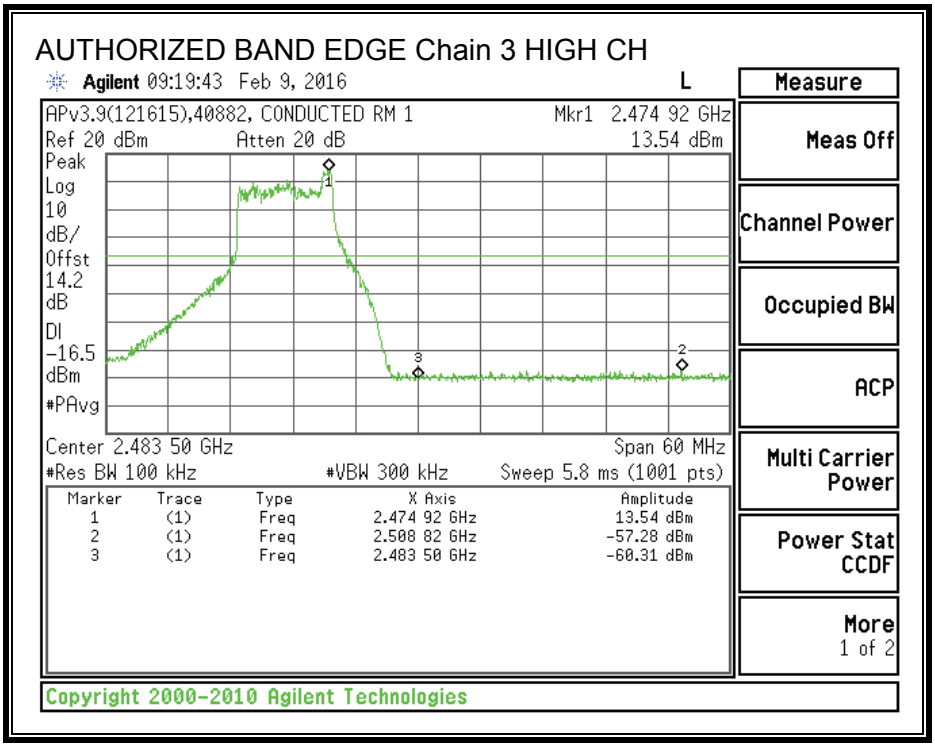
IN-BAND REFERENCE LEVEL, Chain 3



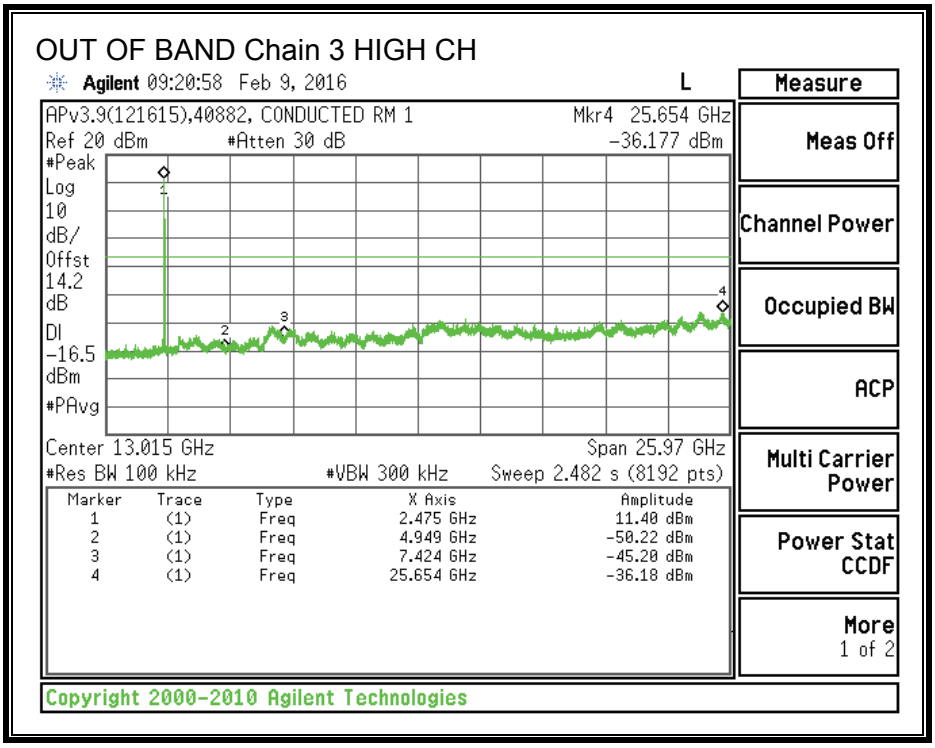
LOW CHANNEL BANDEDGE, Chain 3



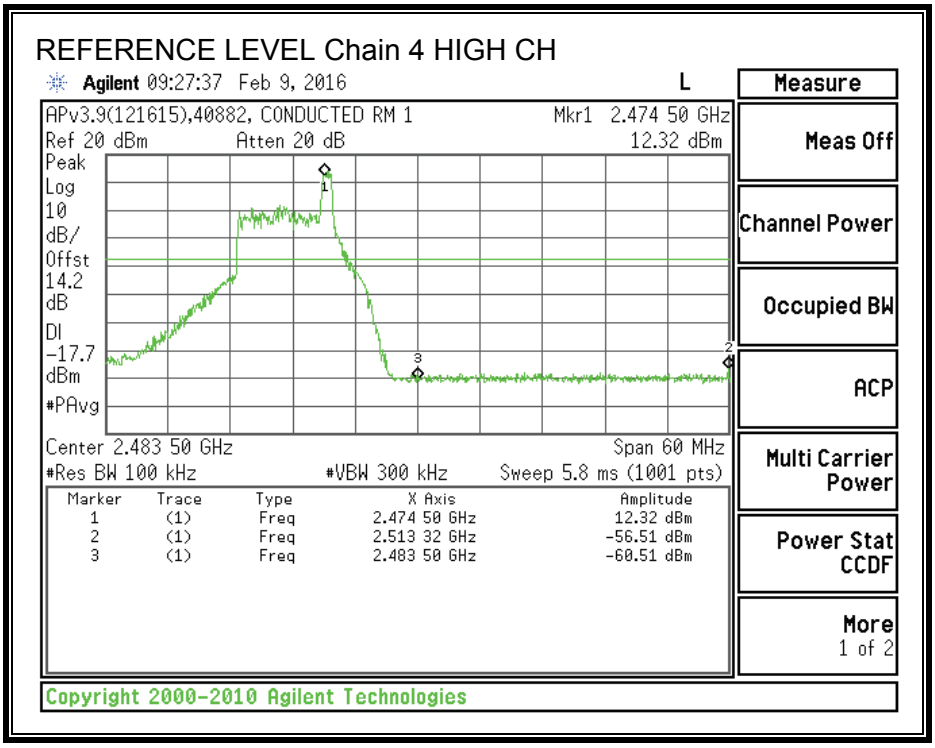
HIGH CHANNEL BANDEDGE, Chain 3



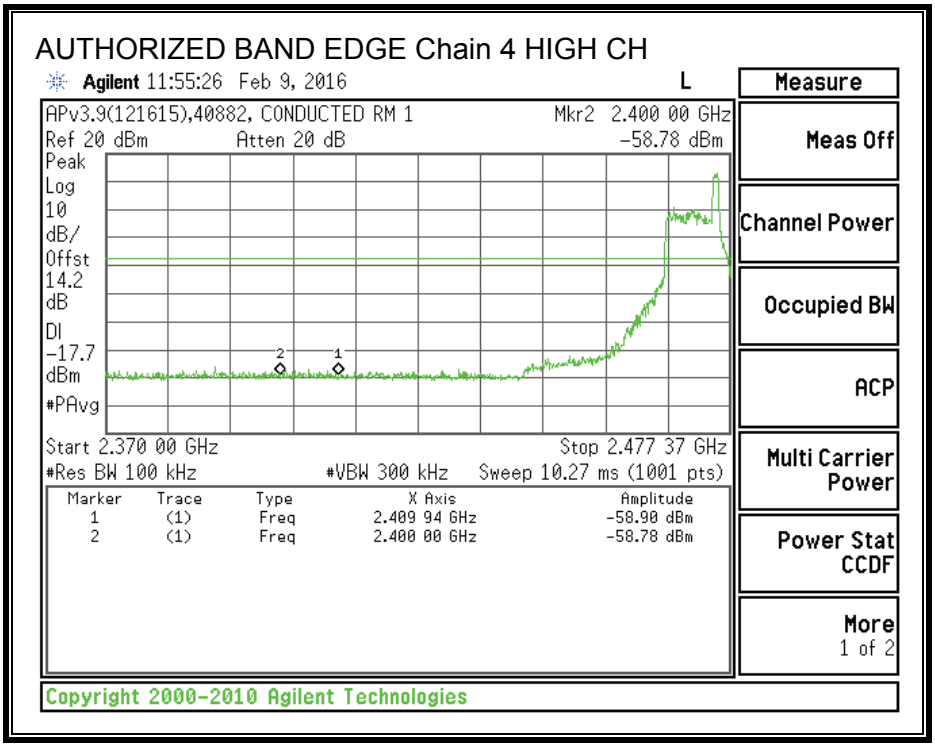
OUT-OF-BAND EMISSIONS, Chain 3



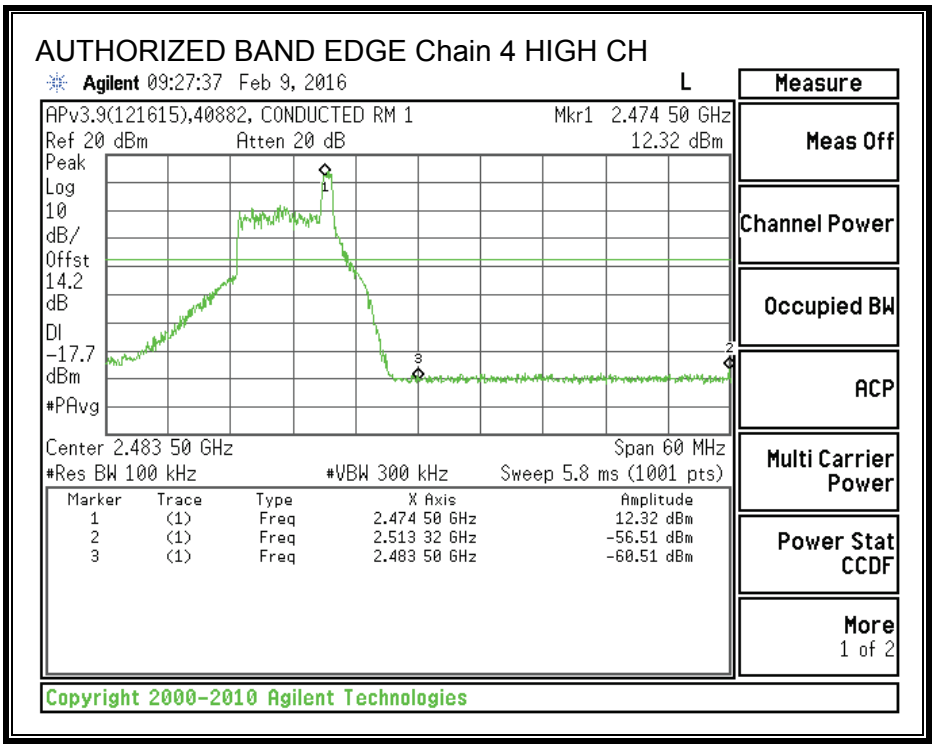
IN-BAND REFERENCE LEVEL, Chain 4



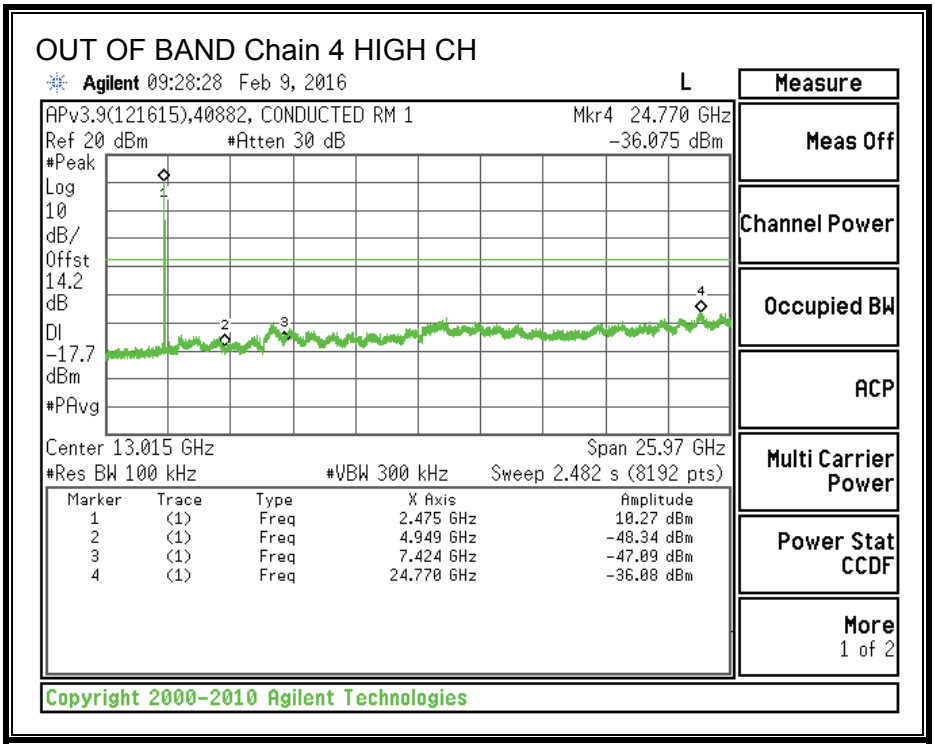
LOW CHANNEL BANDEDGE, Chain 4



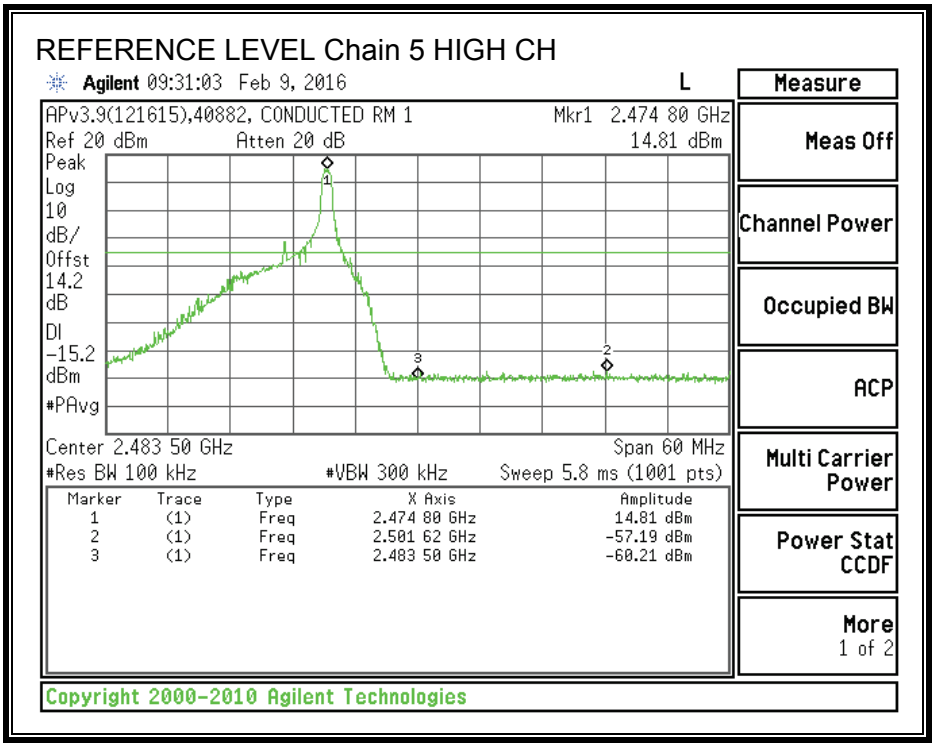
HIGH CHANNEL BANDEDGE, Chain 4



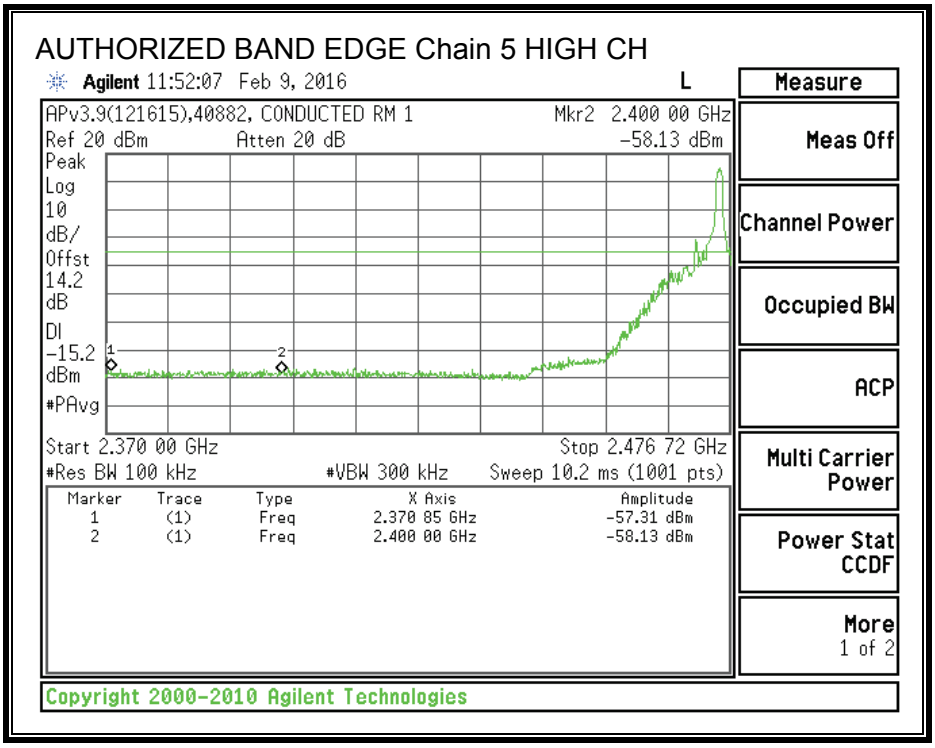
OUT-OF-BAND EMISSIONS, Chain 4



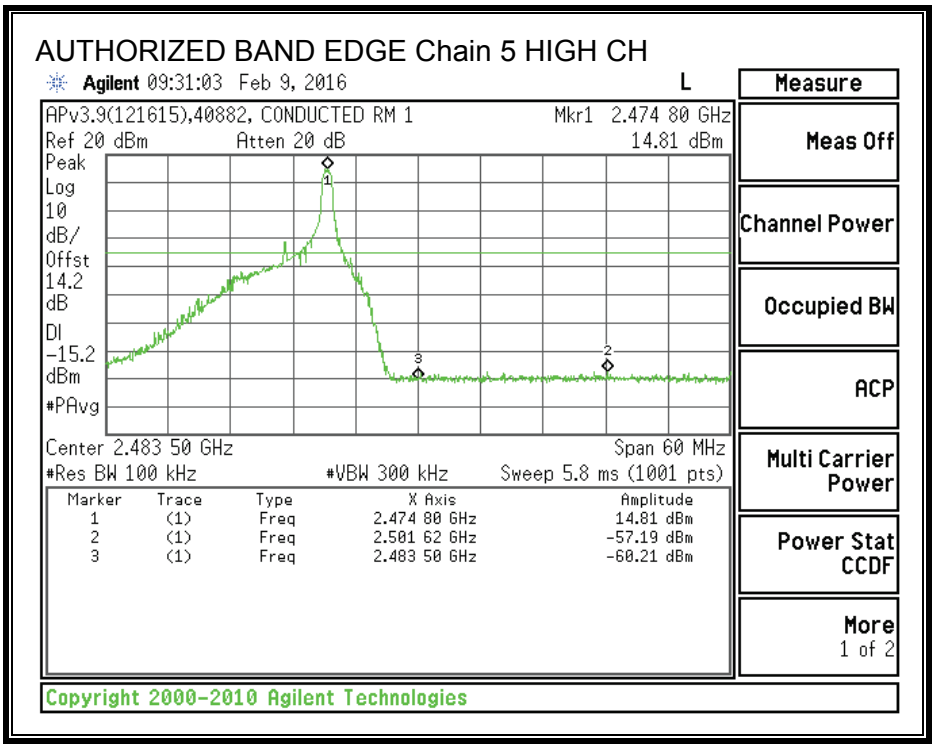
IN-BAND REFERENCE LEVEL, Chain 5



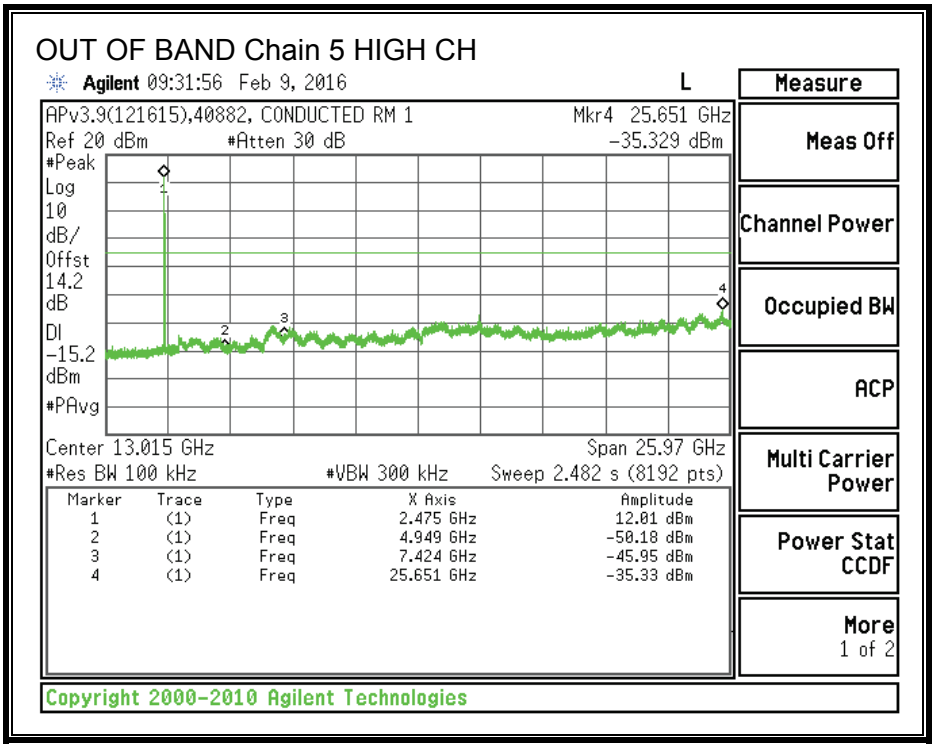
LOW CHANNEL BANDEDGE, Chain 5



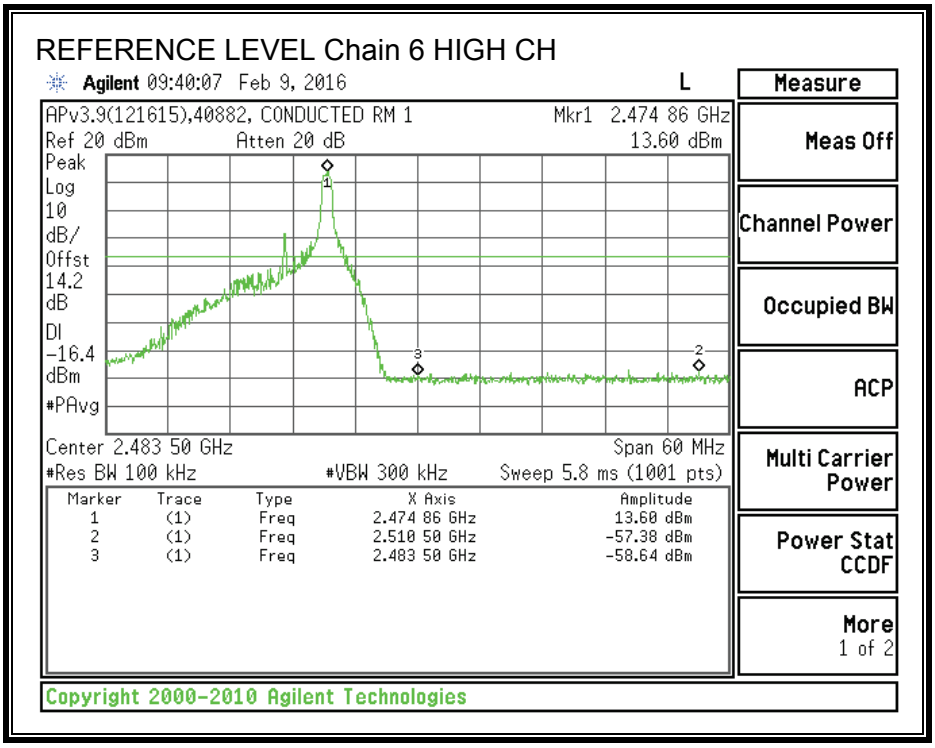
HIGH CHANNEL BANDEDGE, Chain 5



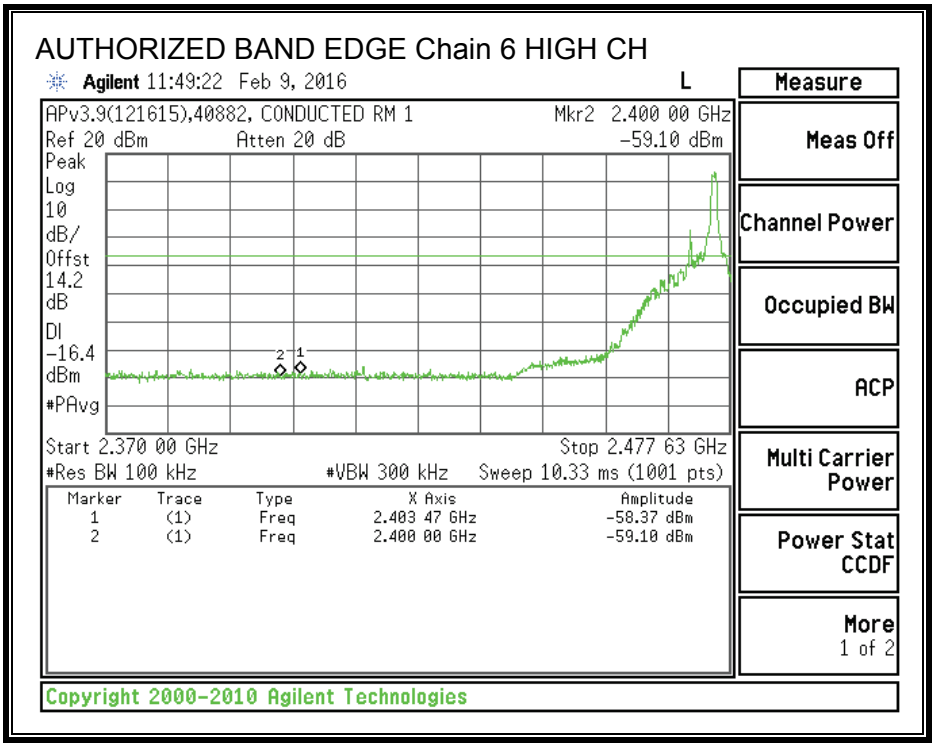
OUT-OF-BAND EMISSIONS, Chain 5



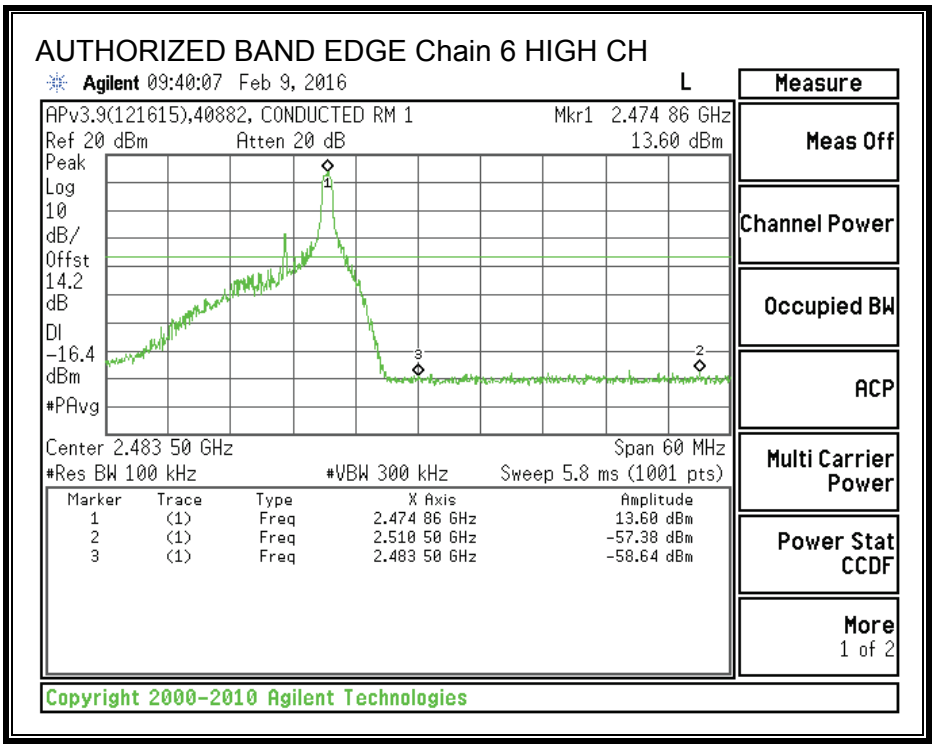
IN-BAND REFERENCE LEVEL, Chain 6



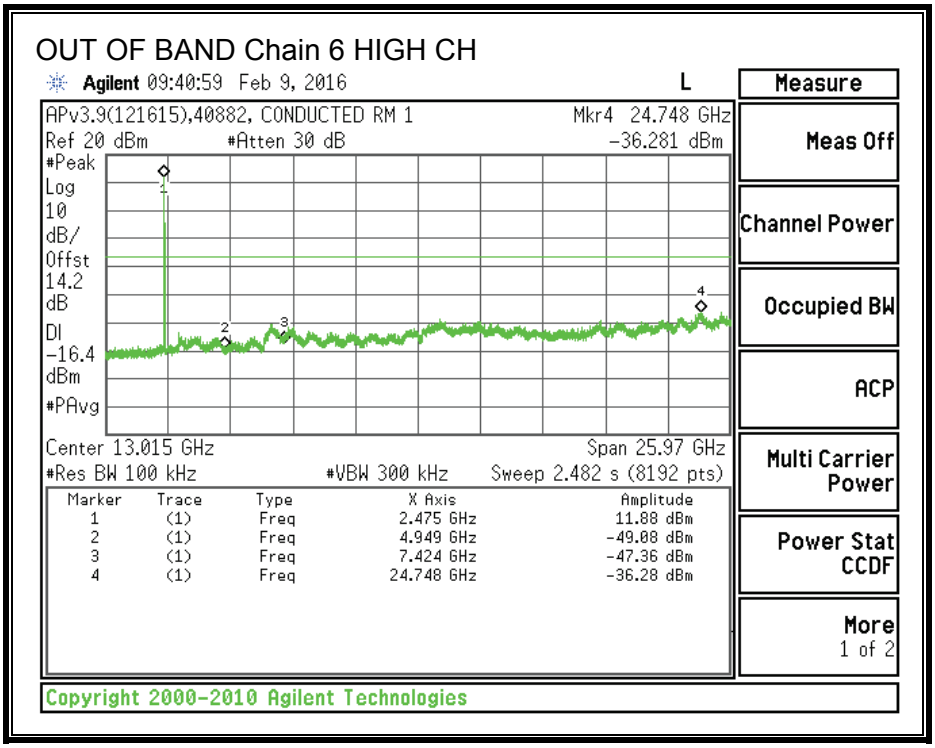
LOW CHANNEL BANDEDGE, Chain 6



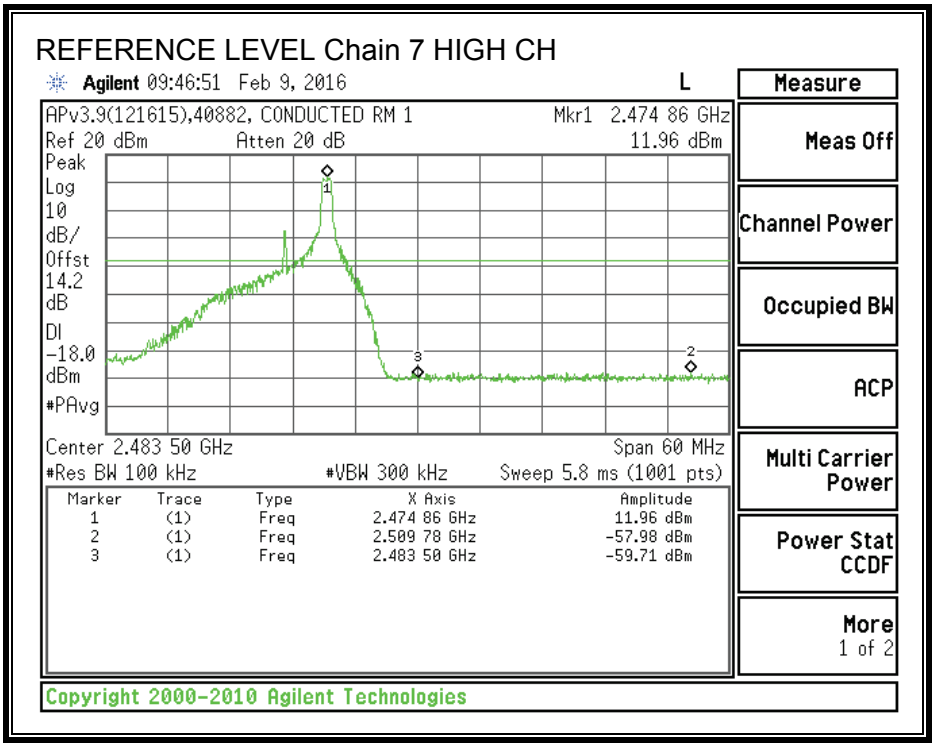
HIGH CHANNEL BANDEDGE, Chain 6



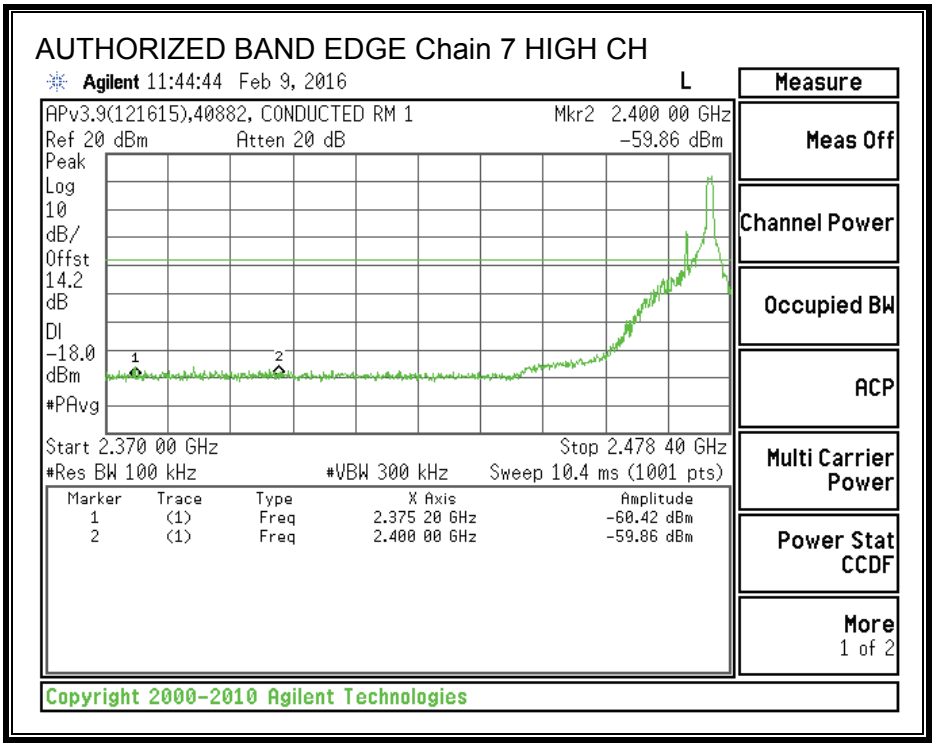
OUT-OF-BAND EMISSIONS, Chain 6



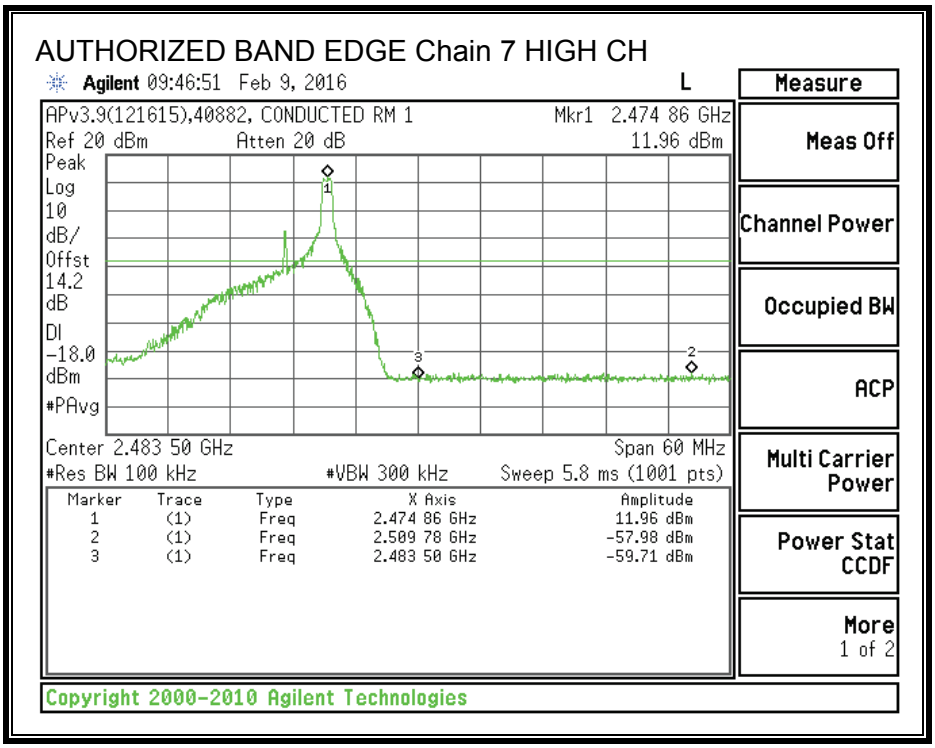
IN-BAND REFERENCE LEVEL, Chain 7



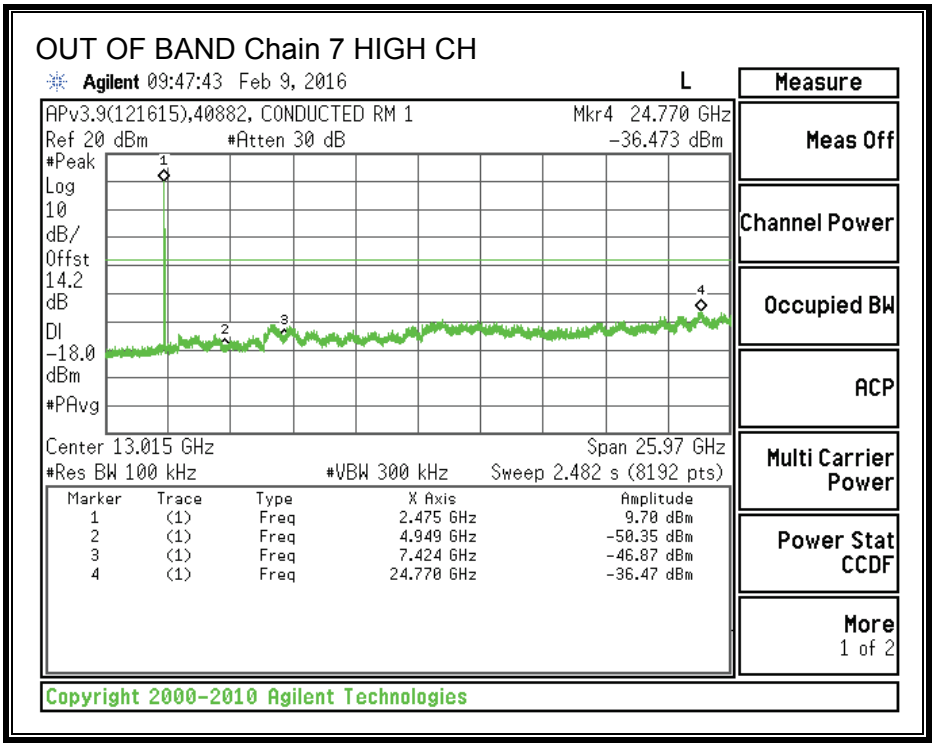
LOW CHANNEL BANDEDGE, Chain 7



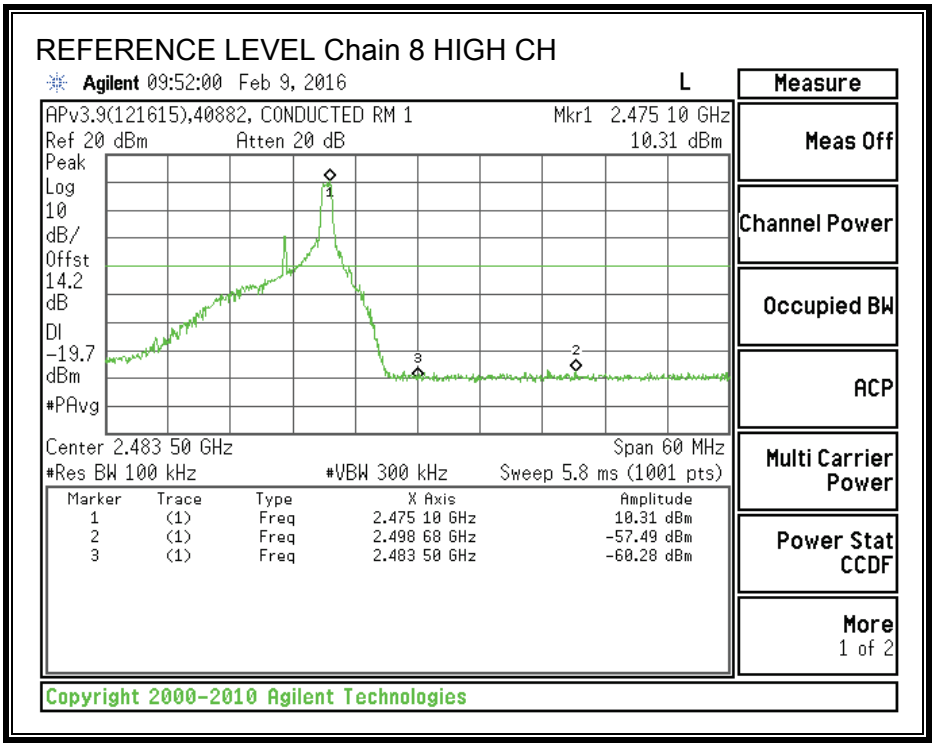
HIGH CHANNEL BANDEDGE, Chain 7



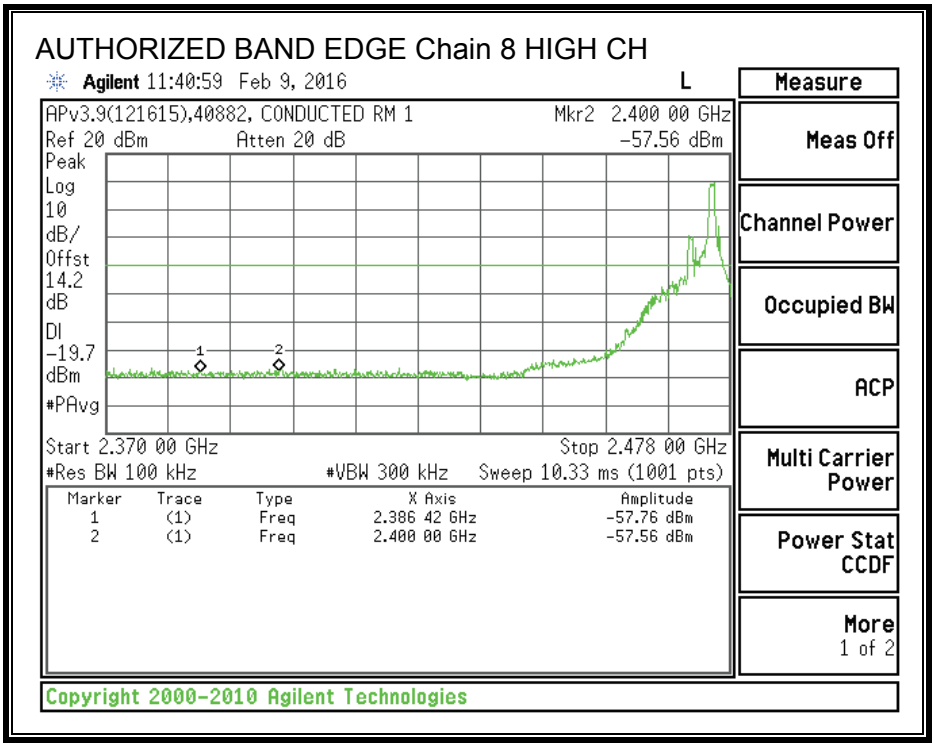
OUT-OF-BAND EMISSIONS, Chain 7



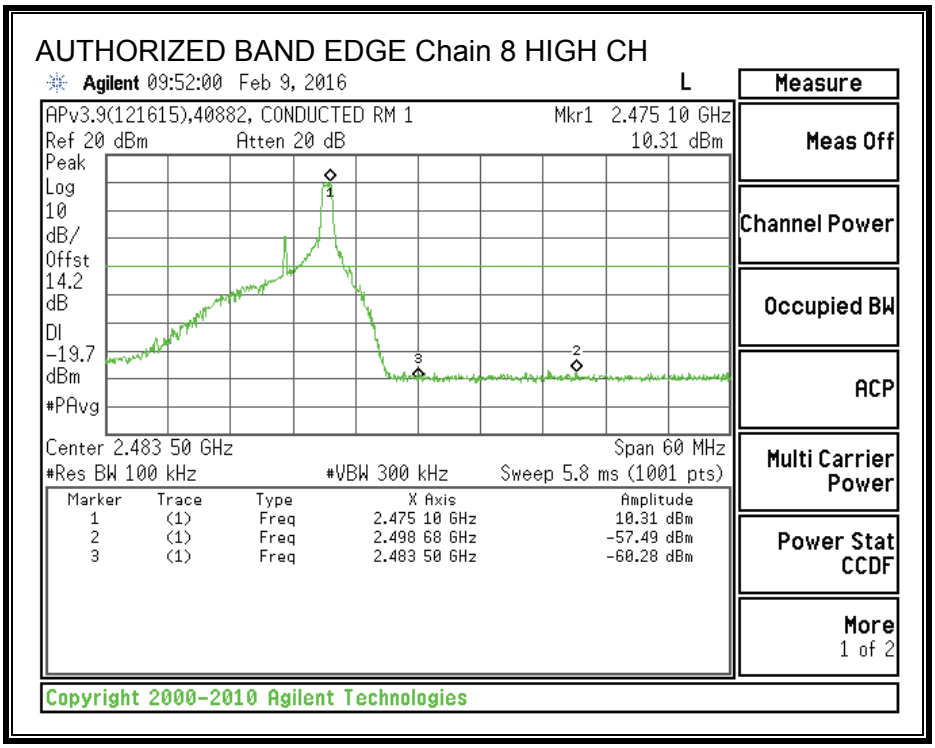
IN-BAND REFERENCE LEVEL, Chain 8



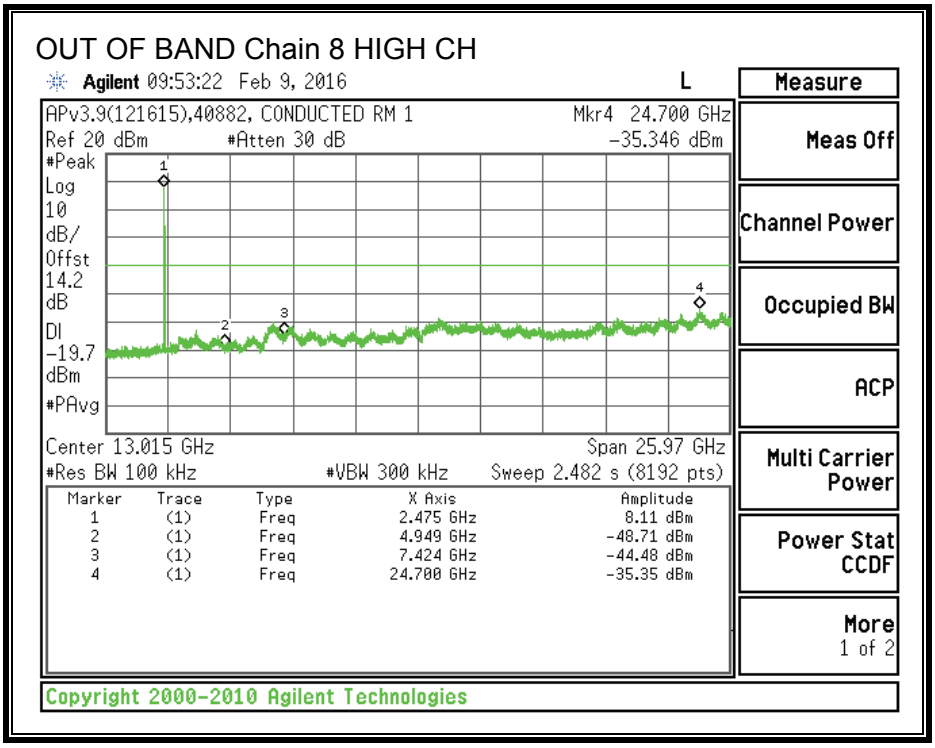
LOW CHANNEL BANDEDGE, Chain 8



HIGH CHANNEL BANDEDGE, Chain 8



OUT-OF-BAND EMISSIONS, Chain 8



8.4. 4.5 MHz MODE IN THE 2.4 GHz AUTHORIZED BAND

8.4.1. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

	Included in Calculations of Corr'd Power							
Duty Cycle CF (dB)	0.68	0	0	0	0.68	0.67	0.75	0.73

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Chain 4 Power (dBm)	Chain 5 Power (dBm)	Chain 6 Power (dBm)	Chain 7 Power (dBm)	Chain 8 Power (dBm)	Total Power (dBm)
Low	2448.353	10.68	12.40	13.80	12.20	13.70	12.80	11.30	8.90	21.65
Mid	2460.700	9.90	12.60	15.70	13.80	13.90	13.00	10.90	8.40	22.18
High	2472.853	8.87	11.97	13.58	12.13	13.10	12.08	10.41	8.40	21.06

8.4.2. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

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.

§15.247 (c) (2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Chain 3 Antenna Gain (dBi)	Chain 4 Antenna Gain (dBi)	Chain 5 Antenna Gain (dBi)	Chain 6 Antenna Gain (dBi)	Chain 7 Antenna Gain (dBi)	Correlated Directional Gain (dBi)
19.70	19.90	20.00	20.20	20.20	20.10	19.90	19.60	28.98

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)
Low	2448.352	28.98	23.00
Mid	2460.513	28.98	23.00
High	2472.853	28.98	23.00

	Included in Calculations of Corr'd Power			
Duty Cycle CF (dB)	0.68	0	0	0
	0.68	0.67	0.75	0.73

Results

Channel	Frequency (MHz)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Chain 4 Meas Power (dBm)
Low	2448.352	10.68	12.40	13.80	12.20
Mid	2460.513	9.90	12.60	15.70	13.80
High	2472.853	8.87	11.97	13.58	12.13

Channel	Frequency (MHz)	Chain 5 Meas Power (dBm)	Chain 6 Meas Power (dBm)	Chain 7 Meas Power (dBm)	Chain 8 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2448.352	13.70	12.80	11.30	8.90	21.66	23.00	-1.34
Mid	2460.513	13.90	13.00	10.90	8.40	22.19	23.00	-0.81
High	2472.853	13.10	12.08	10.41	8.40	21.07	23.00	-1.93

8.4.3. POWER SPECTRUM DENSITY

LIMITS

FCC §15.247 (e)

RESULTS

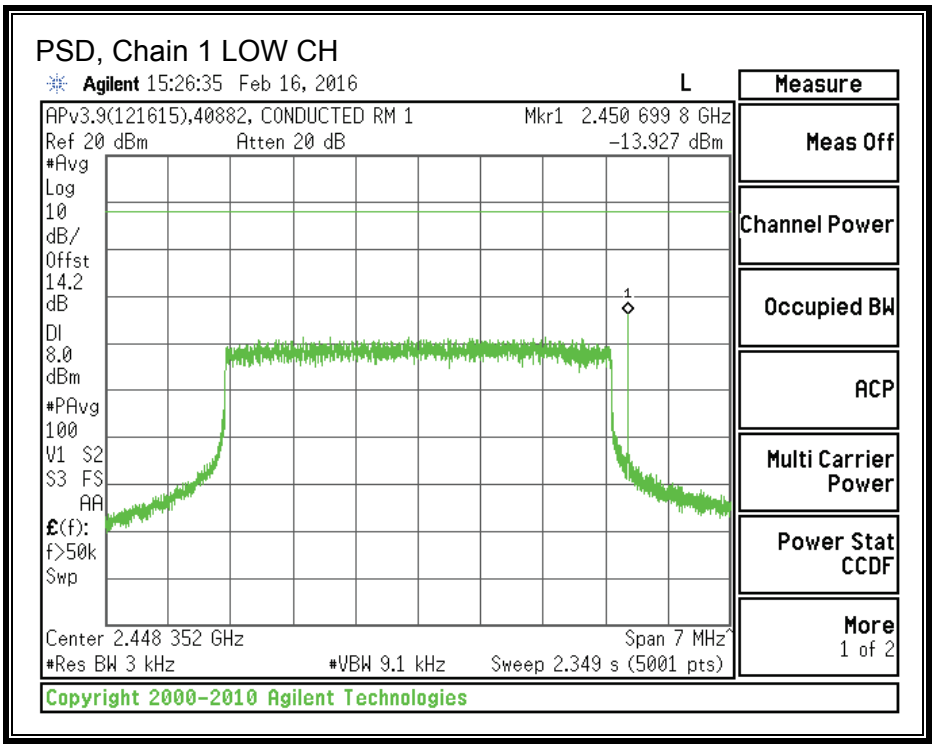
	Included in Calculations of Corr'd PSD			
Duty Cycle CF (dB)	0.68	0	0	0
	0.68	0.67	0.75	0.73

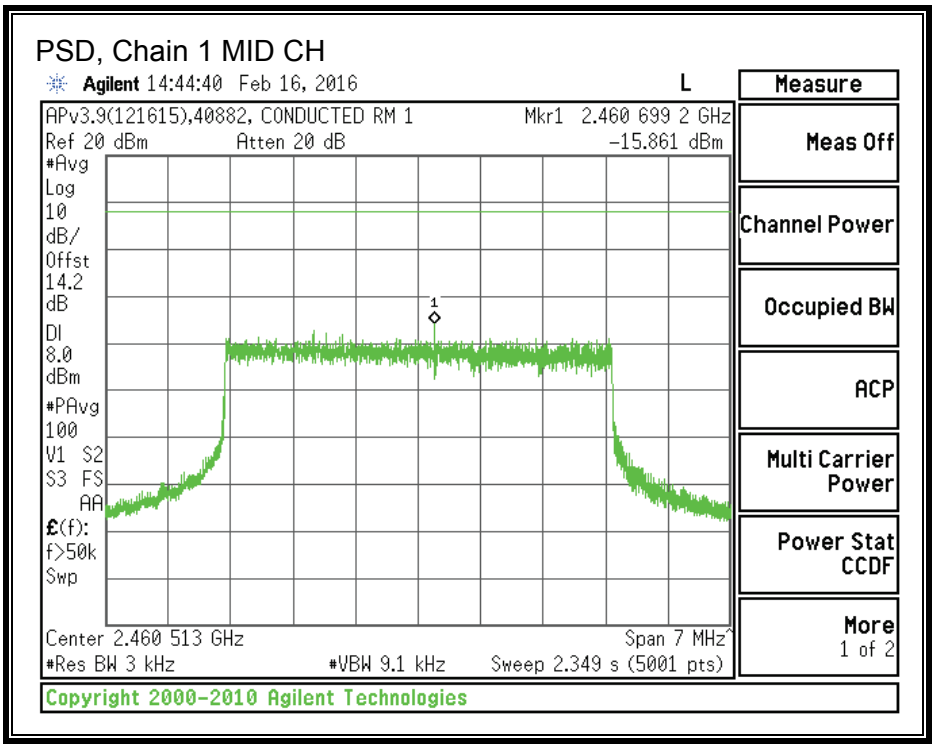
PSD Results

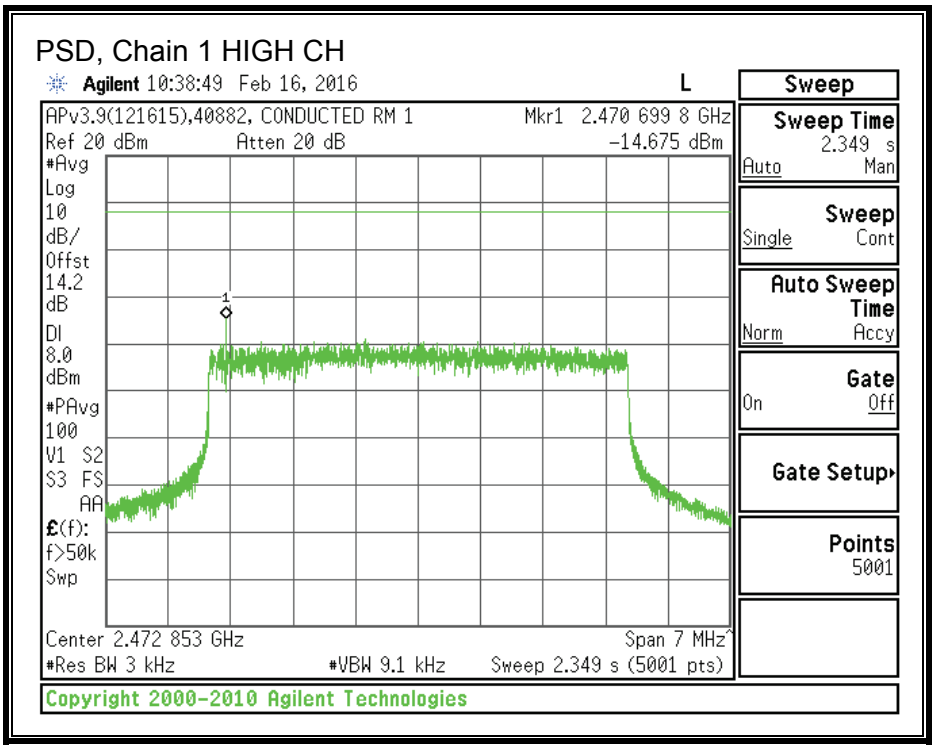
Channel	Frequency (MHz)	Chain 1 Meas (dBm)	Chain 2 Meas (dBm)	Chain 3 Meas (dBm)	Chain 4 Meas (dBm)
Low	2448.352	-13.93	-15.67	-15.09	-11.87
Mid	2460.513	-15.86	-15.73	-13.10	-11.63
High	2472.853	-14.68	-16.12	-14.96	-11.57

Channel	Frequency (MHz)	Chain 5 Meas (dBm)	Chain 6 Meas (dBm)	Chain 7 Meas (dBm)	Chain 8 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2448.352	-13.80	-10.82	-8.98	-11.07	-2.53	8.0	-10.5
Mid	2460.513	-12.92	-11.10	-9.46	-13.23	-2.87	8.0	-10.9
High	2472.853	-14.98	-11.38	-10.00	-13.02	-3.32	8.0	-11.3

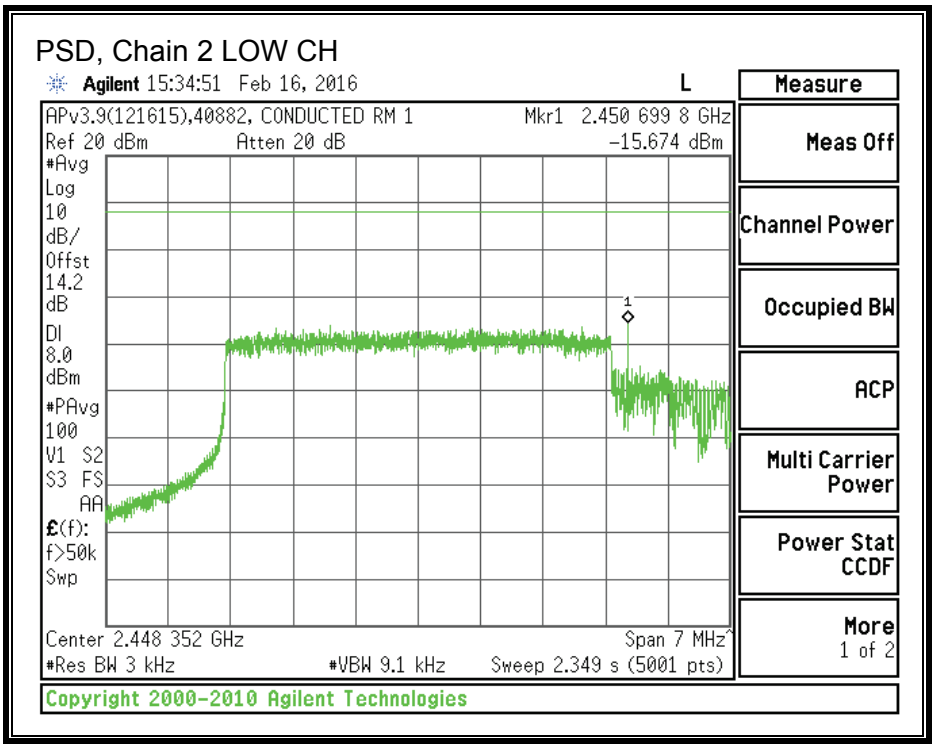
PSD, Chain 1



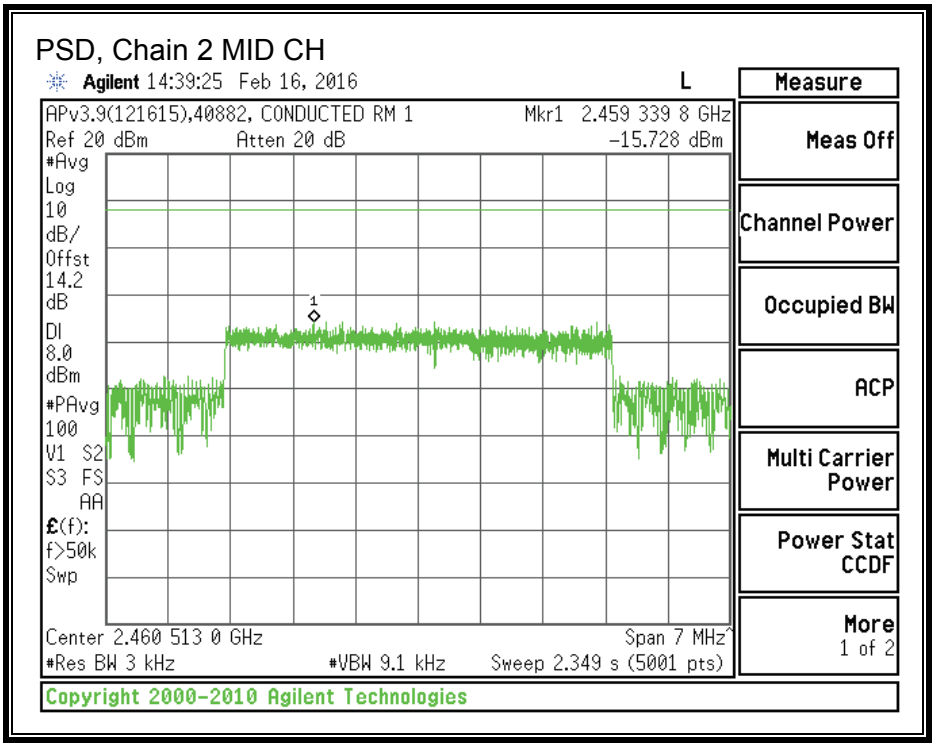




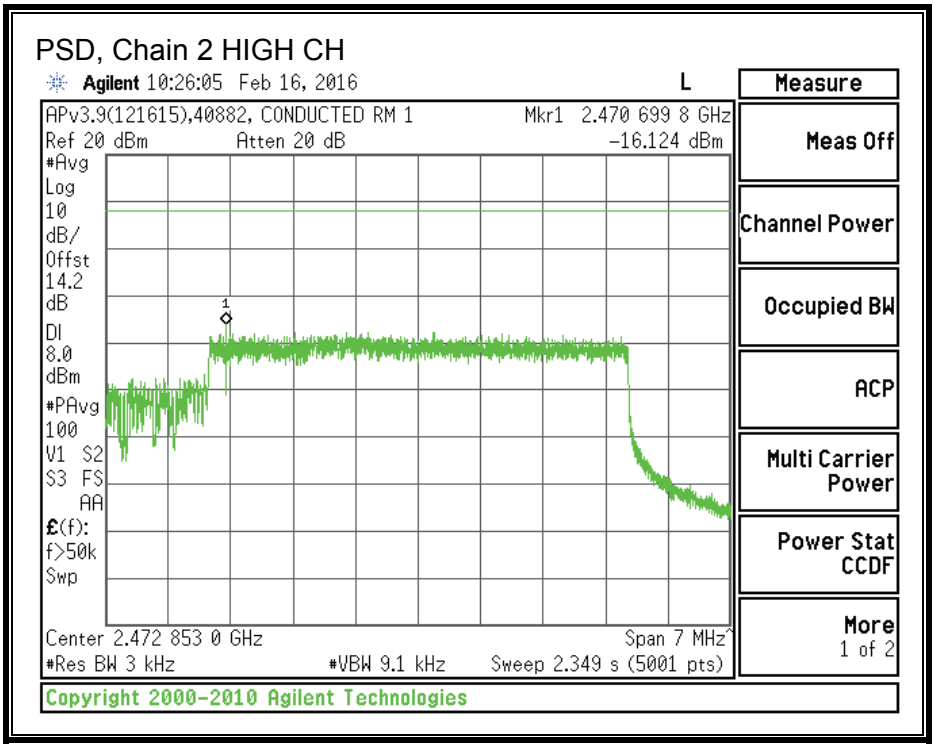
PSD, Chain 2



PSD, Chain 2 MID CH

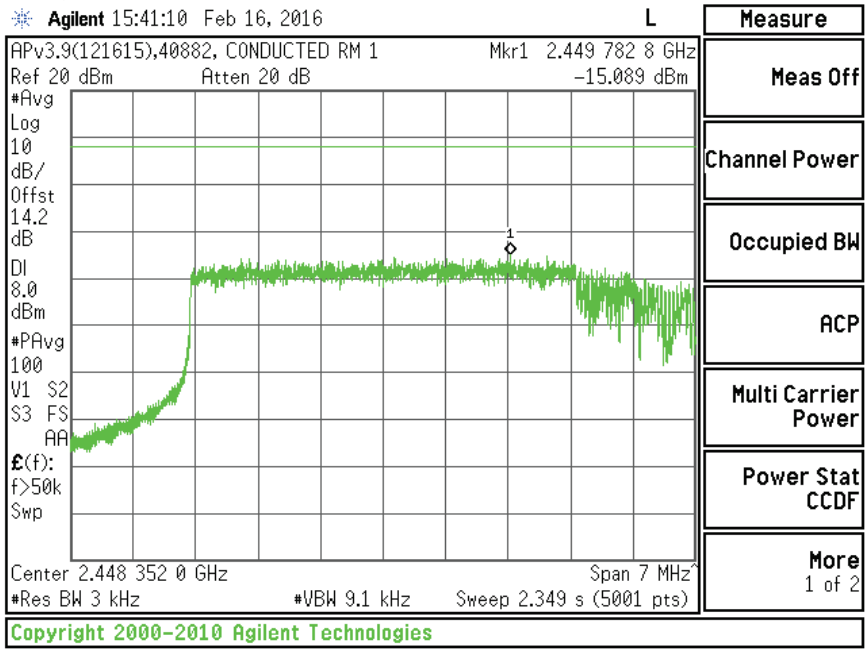


PSD, Chain 2 HIGH CH

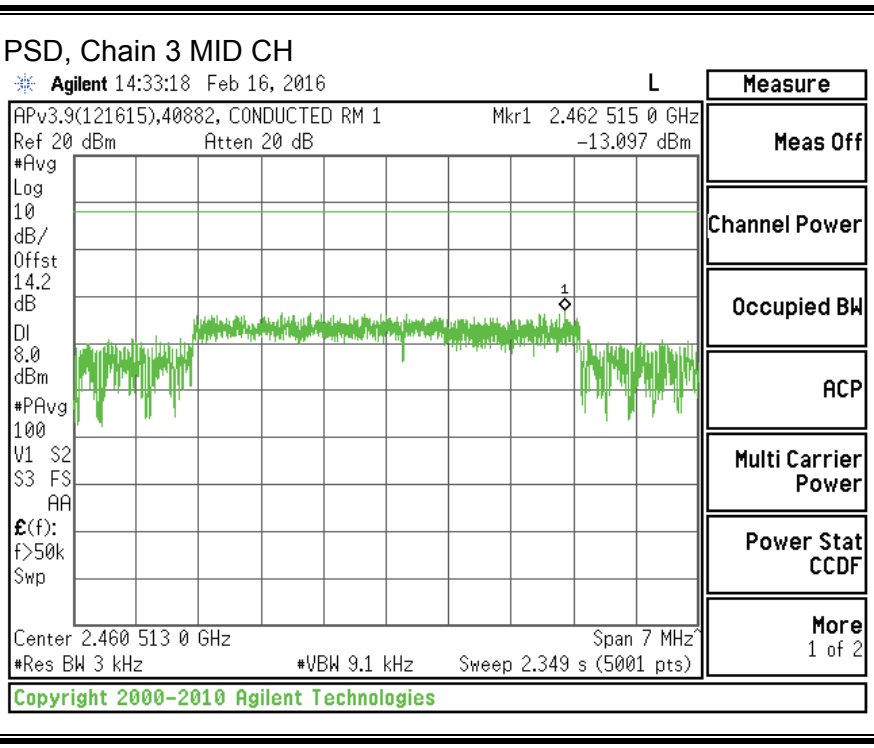


PSD, Chain 3

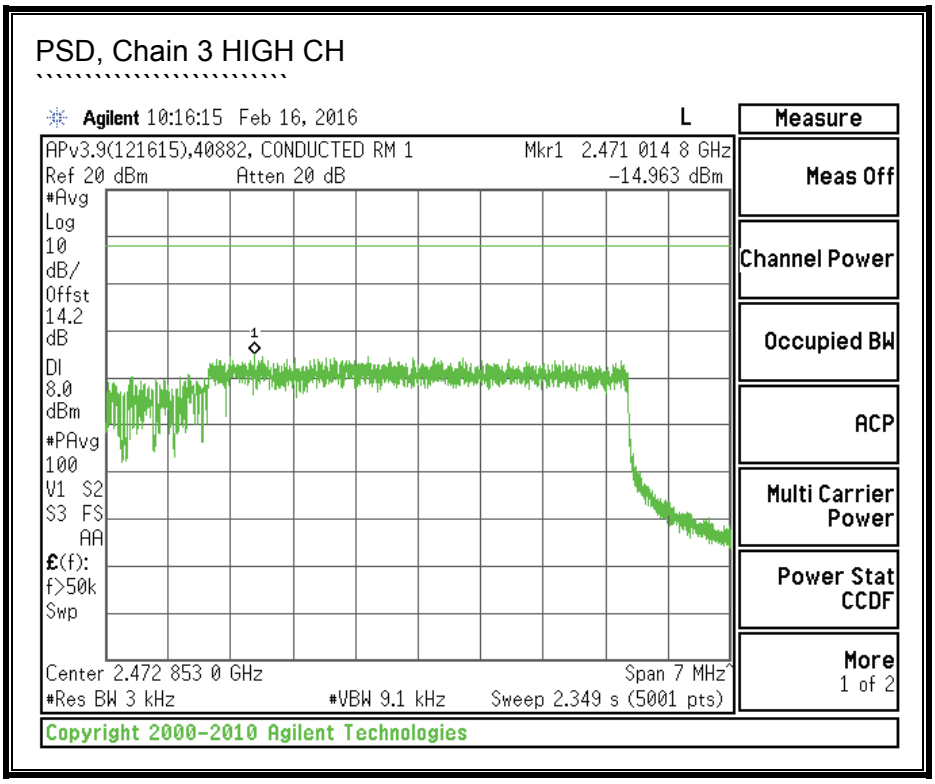
PSD, Chain 3 LOW CH



PSD, Chain 3 MID CH

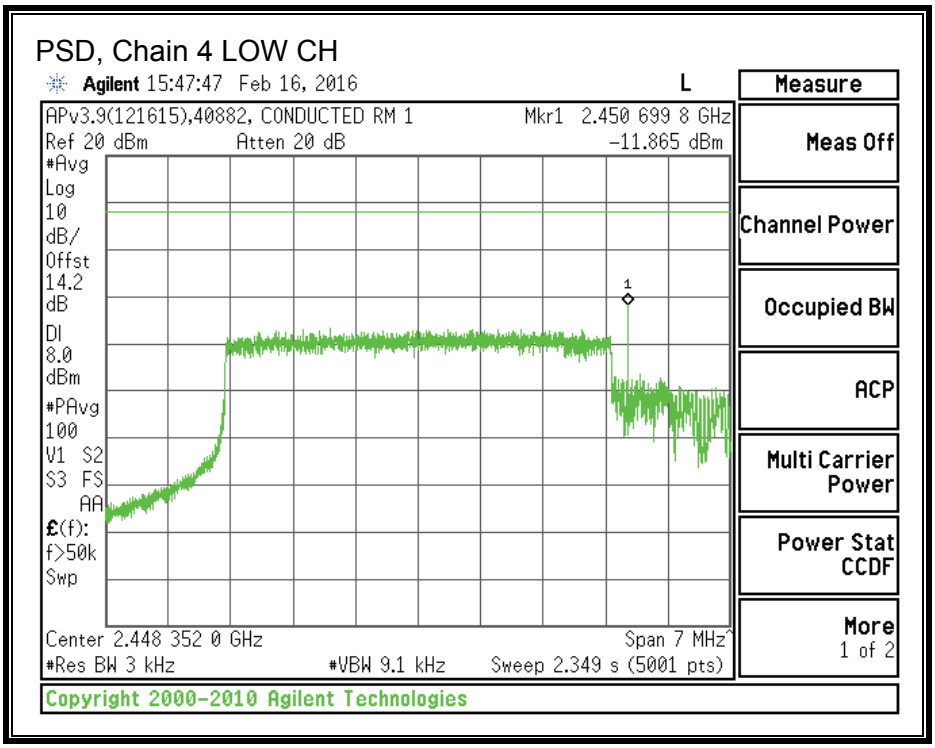


PSD, Chain 3 HIGH CH

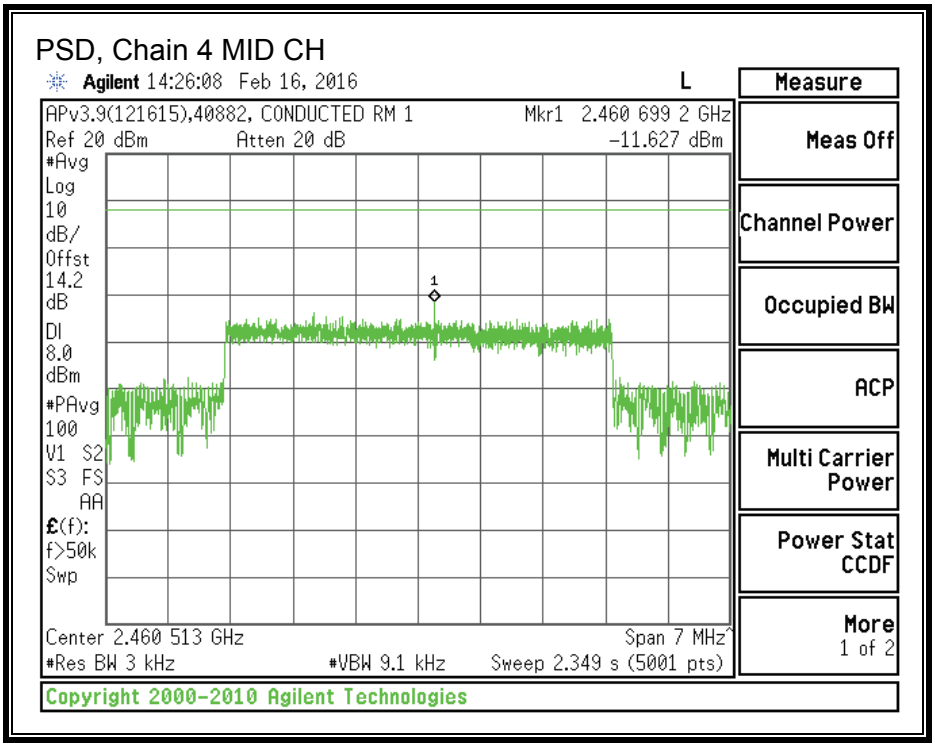


PSD, Chain 4

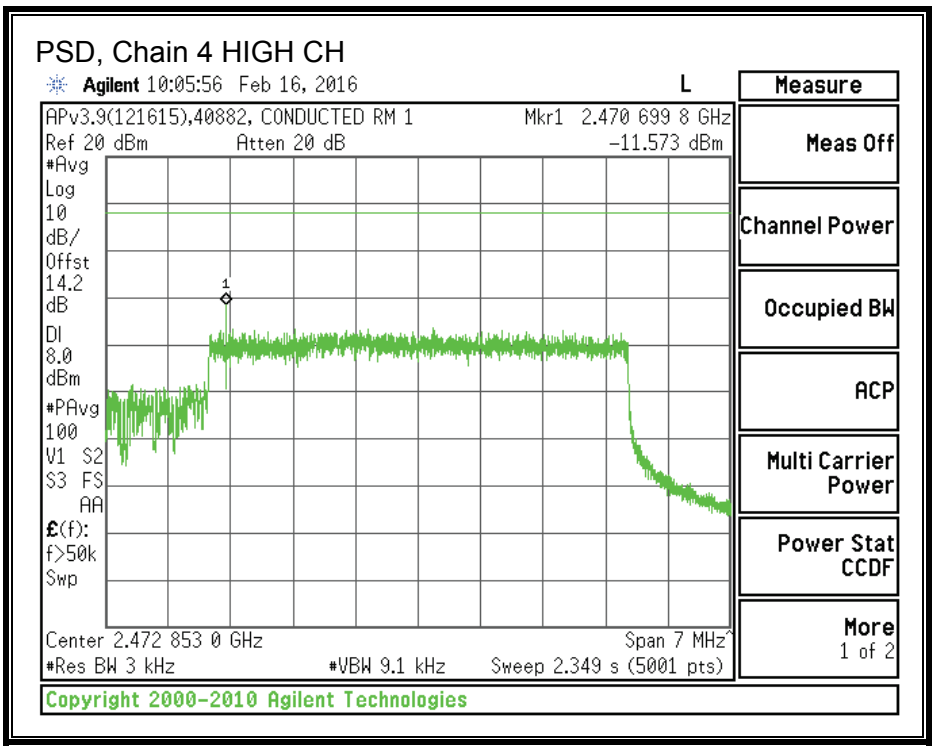
PSD, Chain 4 LOW CH



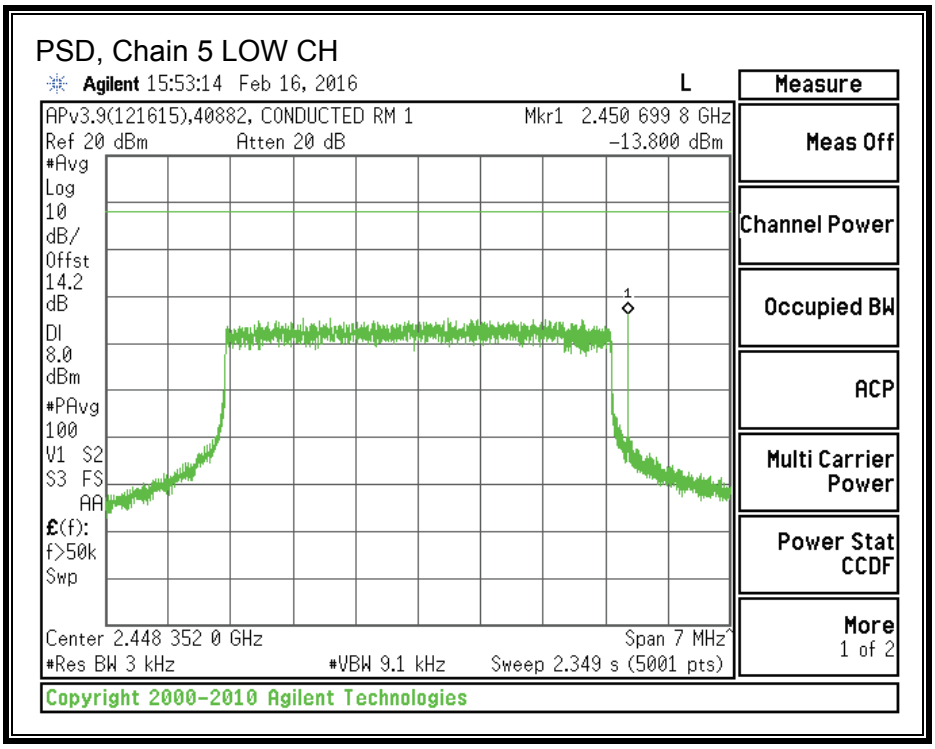
PSD, Chain 4 MID CH

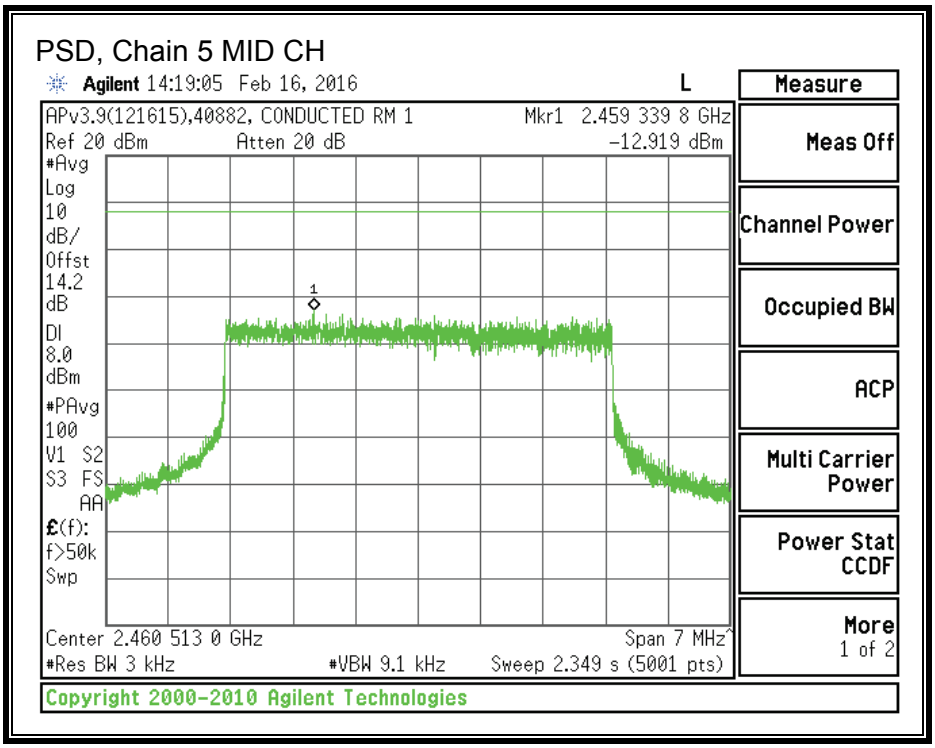


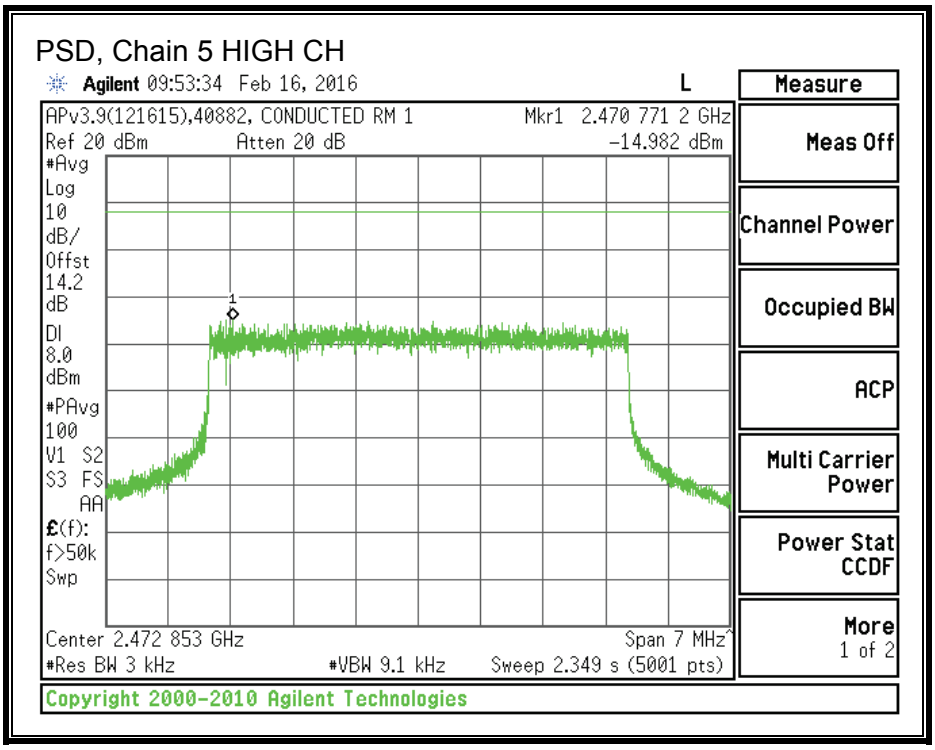
PSD, Chain 4 HIGH CH



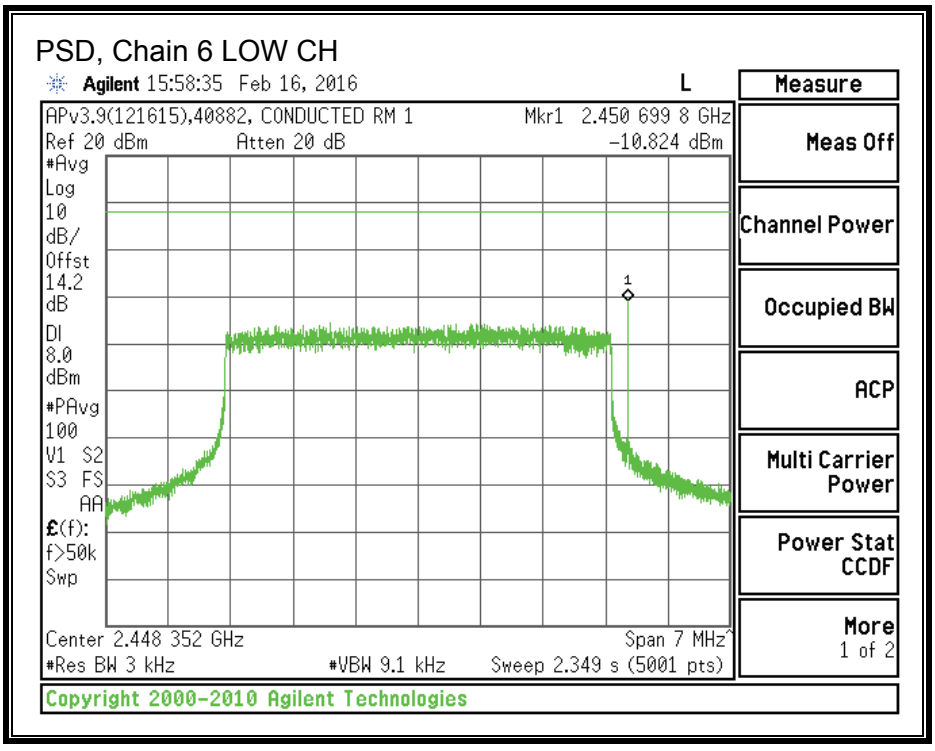
PSD, Chain 5



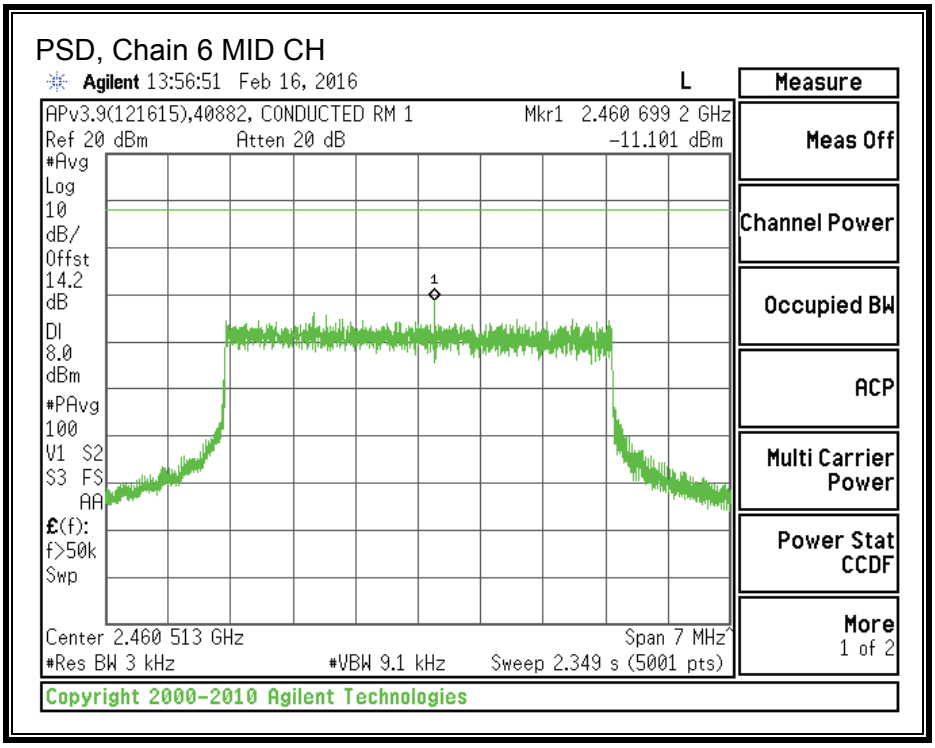




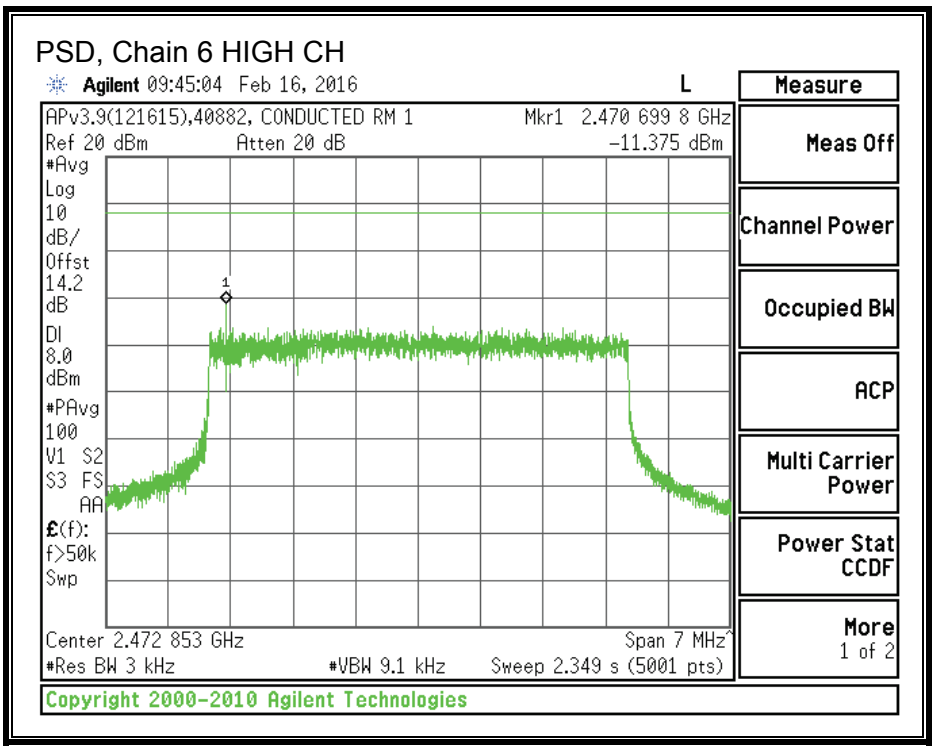
PSD, Chain 6



PSD, Chain 6 MID CH

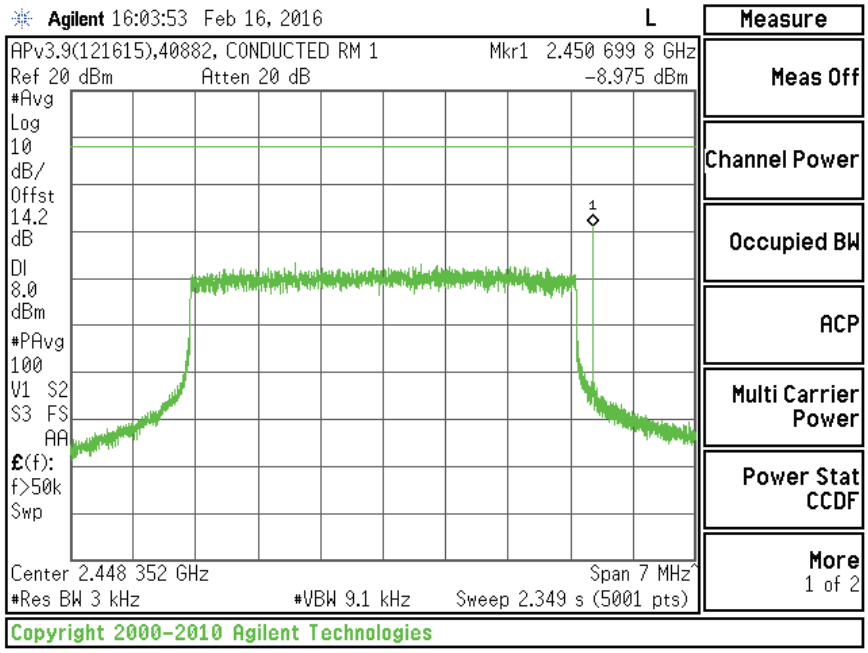


PSD, Chain 6 HIGH CH

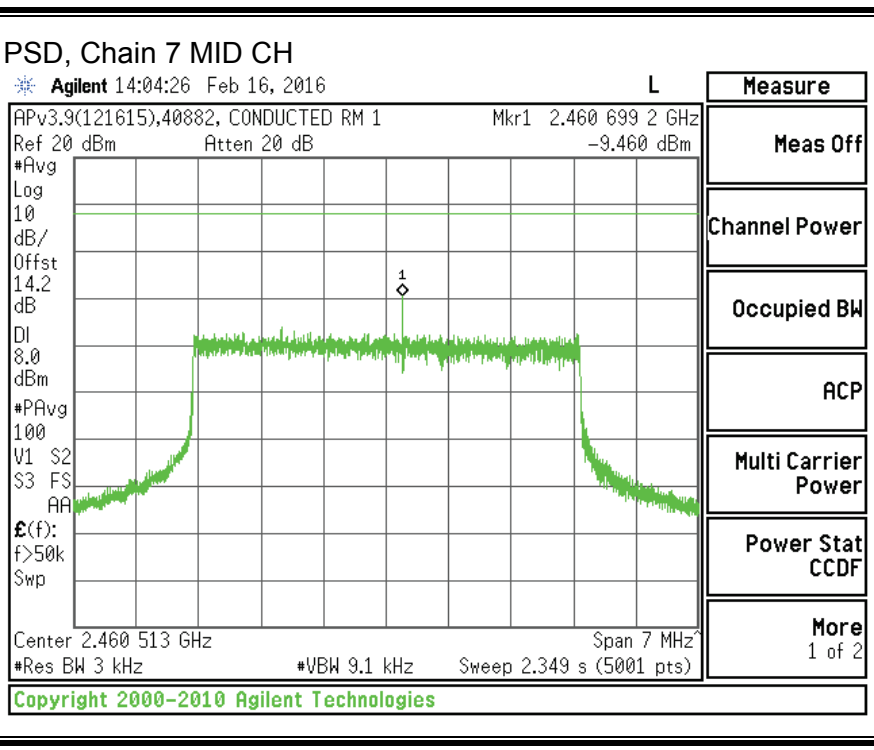


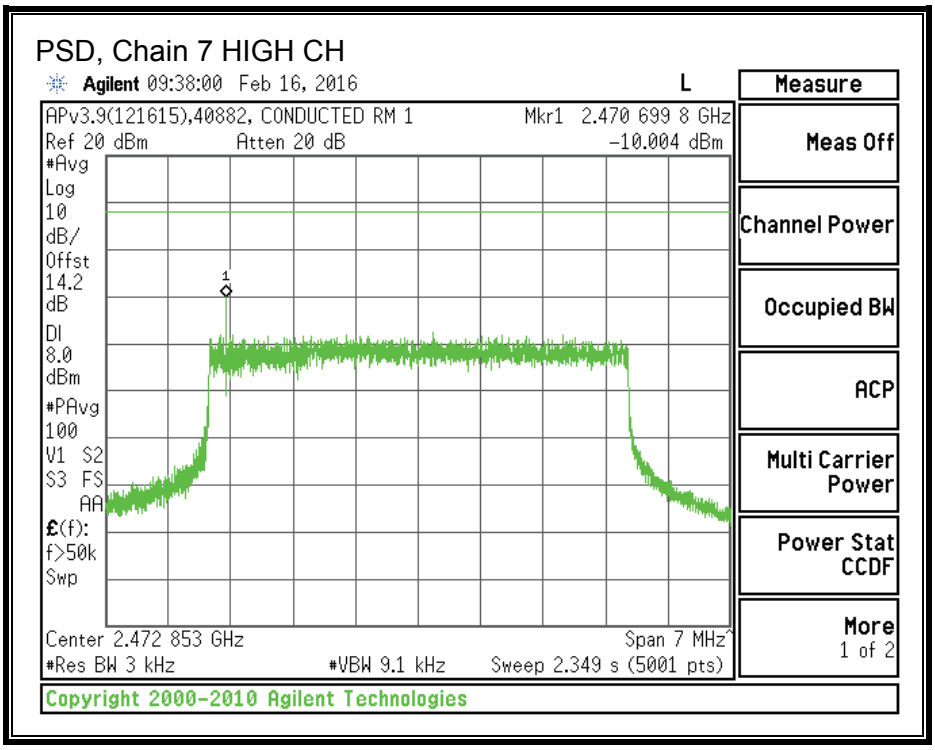
PSD, Chain 7

PSD, Chain 7 LOW CH

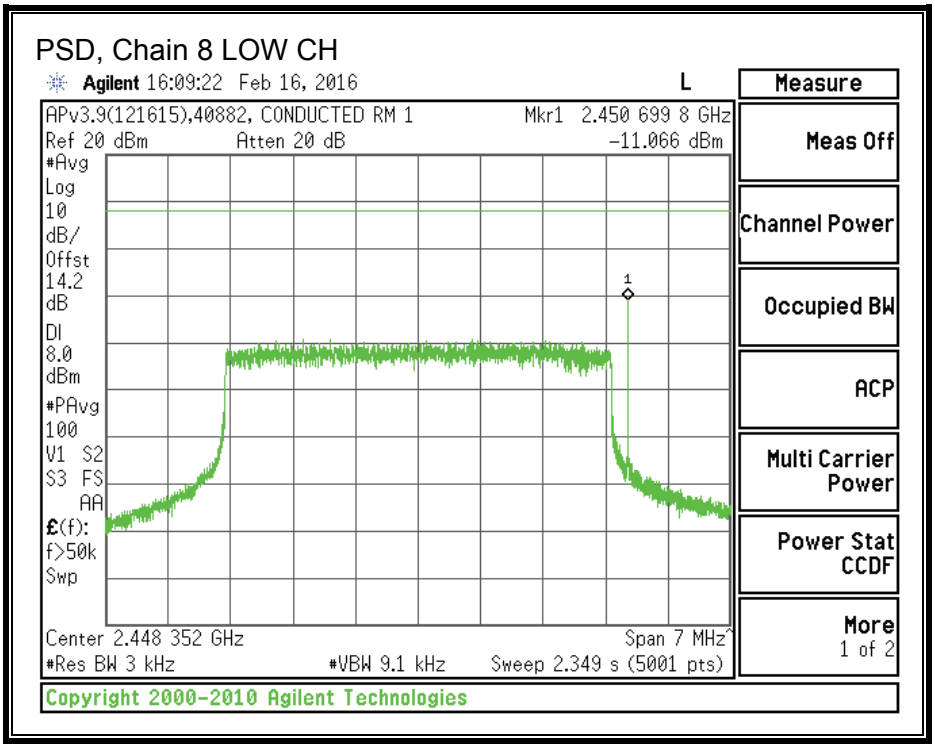


PSD, Chain 7 MID CH

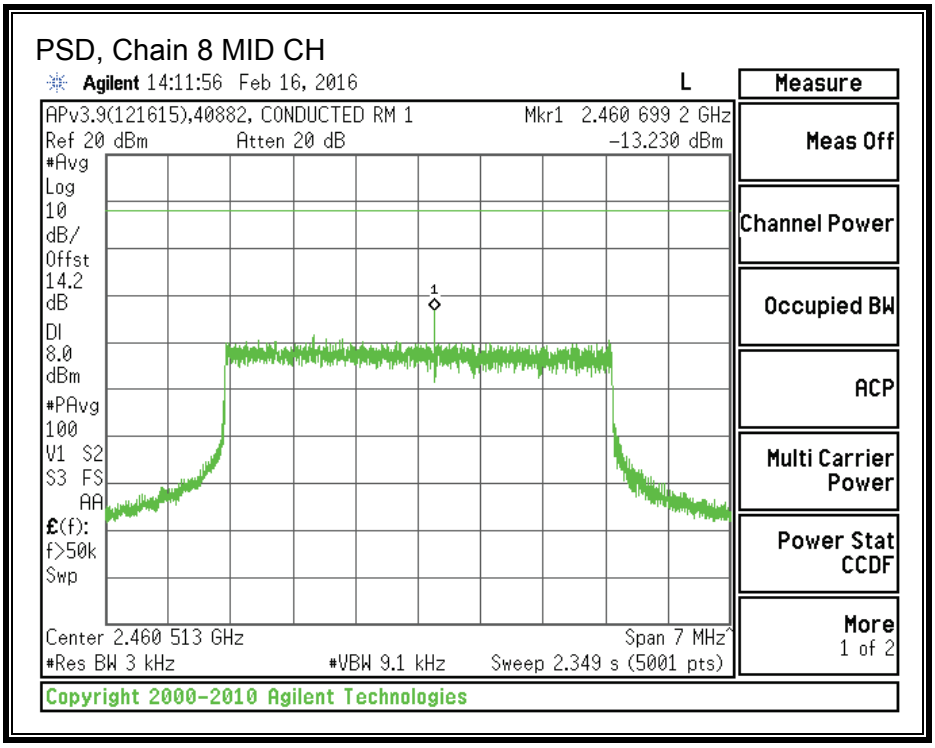




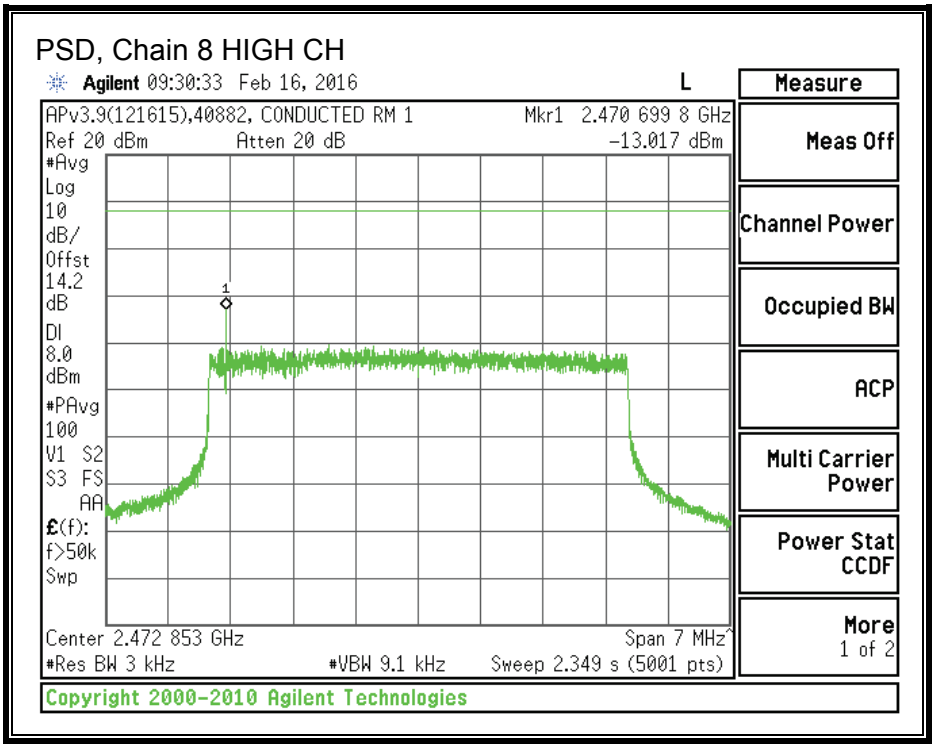
PSD, Chain 8



PSD, Chain 8 MID CH



PSD, Chain 8 HIGH CH



8.5. 9 MHz MODE IN THE 2.4 GHz AUTHORIZED BAND

8.5.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

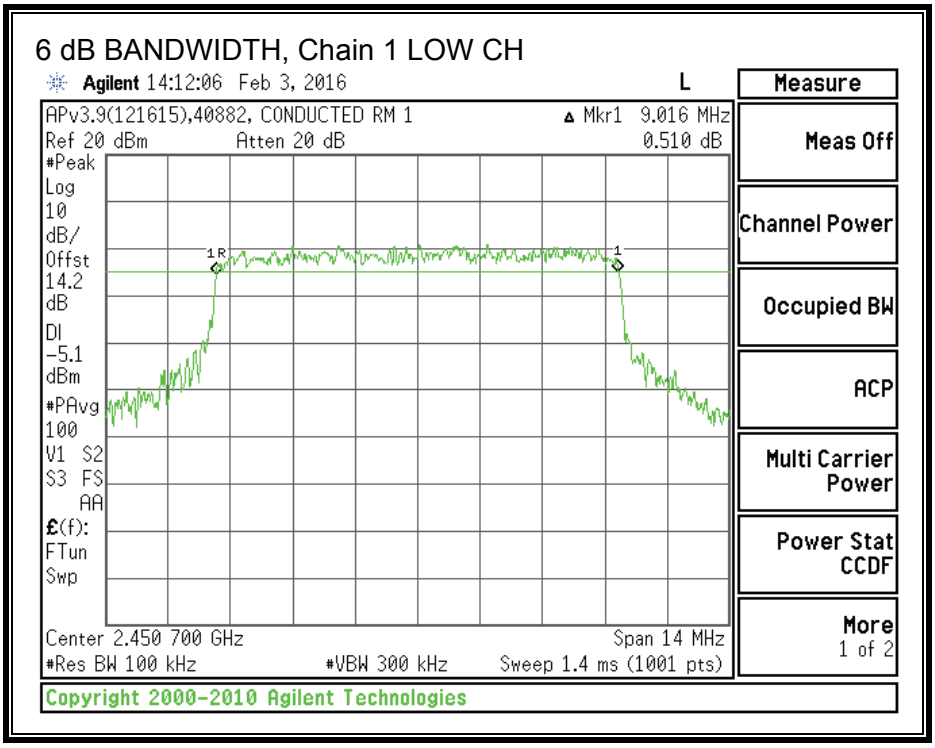
The minimum 6 dB bandwidth shall be at least 500 kHz.

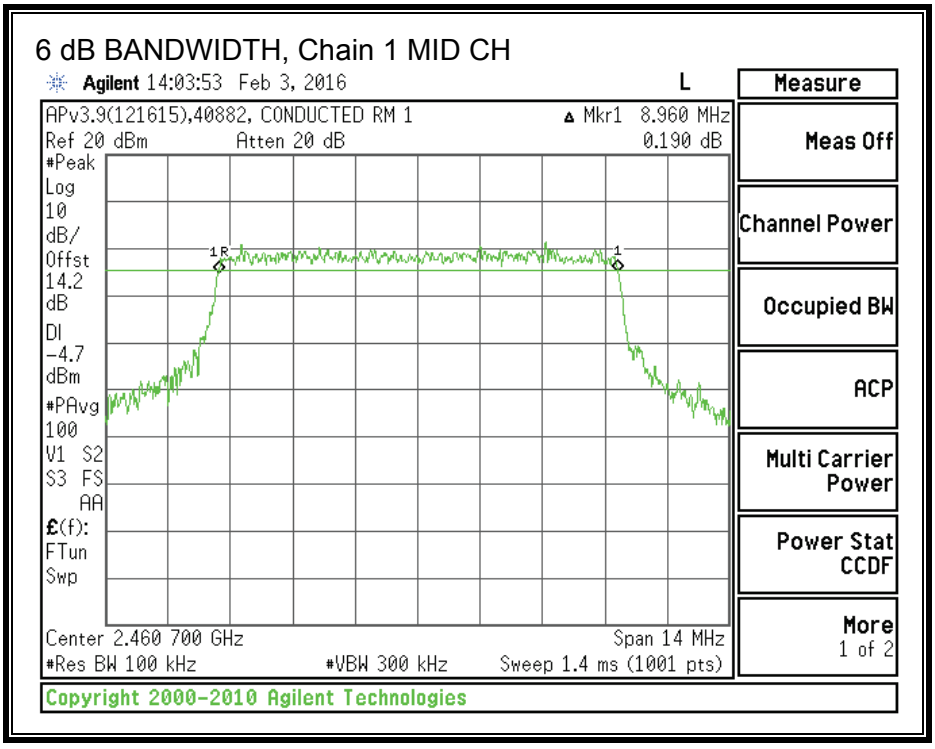
RESULTS

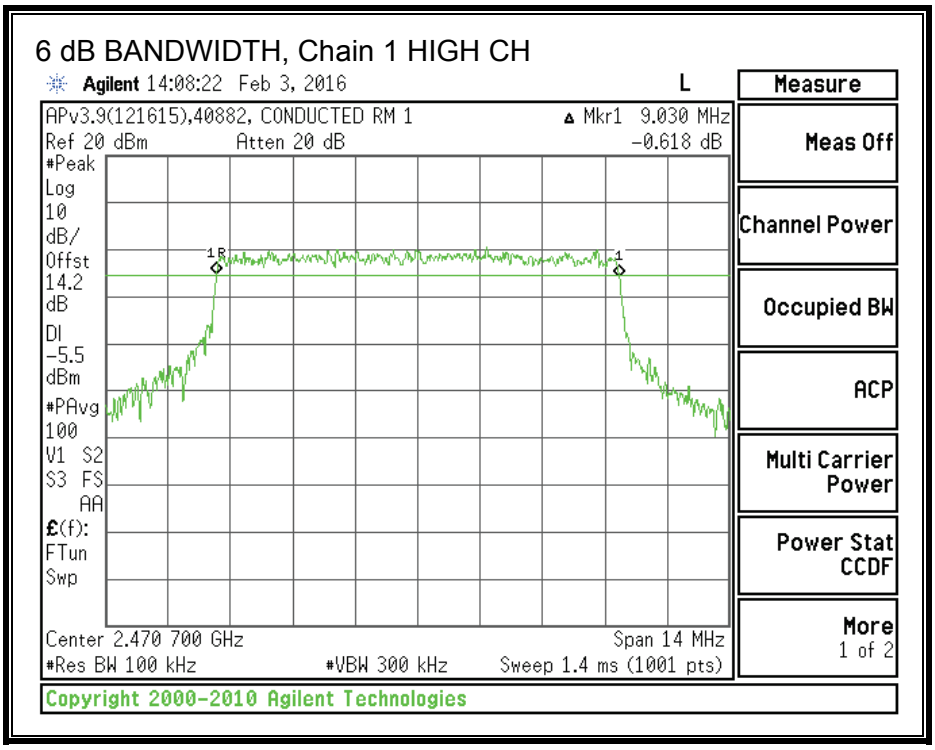
Channel	Frequency (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	6 dB BW Chain 3 (MHz)	6 dB BW Chain 4 (MHz)	Minimum Limit (MHz)
Low	2450.7	9.016	8.988	8.946	9.016	0.5
Mid	2460.7	8.960	9.044	8.722	8.988	0.5
High	2470.7	9.030	8.988	8.806	9.030	0.5

Channel	Frequency (MHz)	6 dB BW Chain 5 (MHz)	6 dB BW Chain 6 (MHz)	6 dB BW Chain 7 (MHz)	6 dB BW Chain 8 (MHz)	Minimum Limit (MHz)
Low	2450.7	9.044	8.932	8.974	9.044	0.5
Mid	2460.7	8.946	9.030	9.016	8.960	0.5
High	2470.7	9.044	8.904	9.016	8.960	0.5

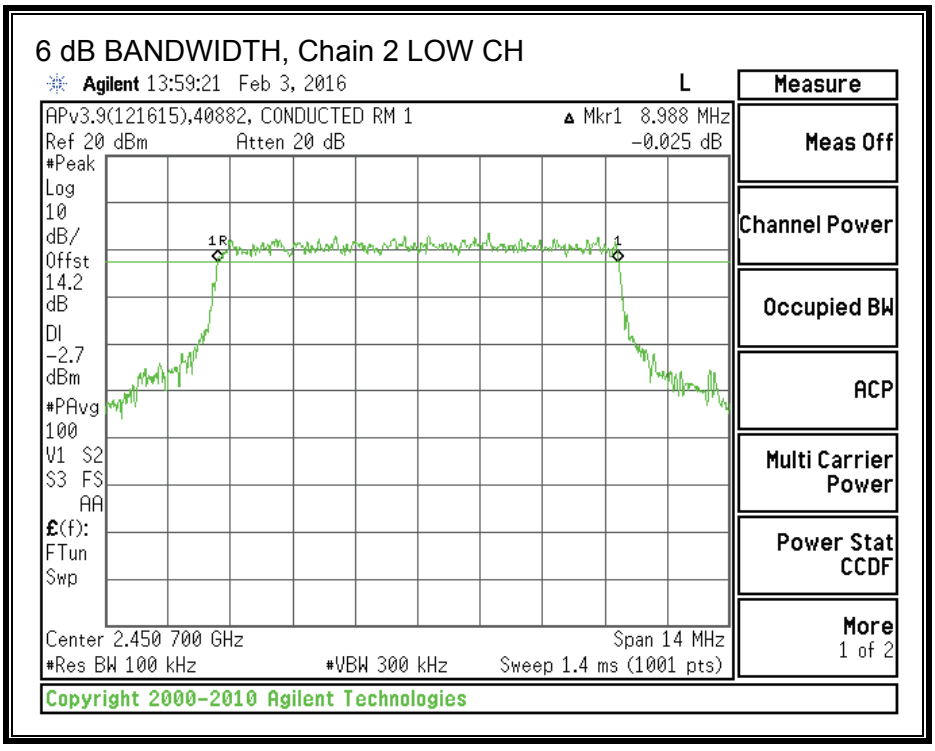
6 dB BANDWIDTH, Chain 1



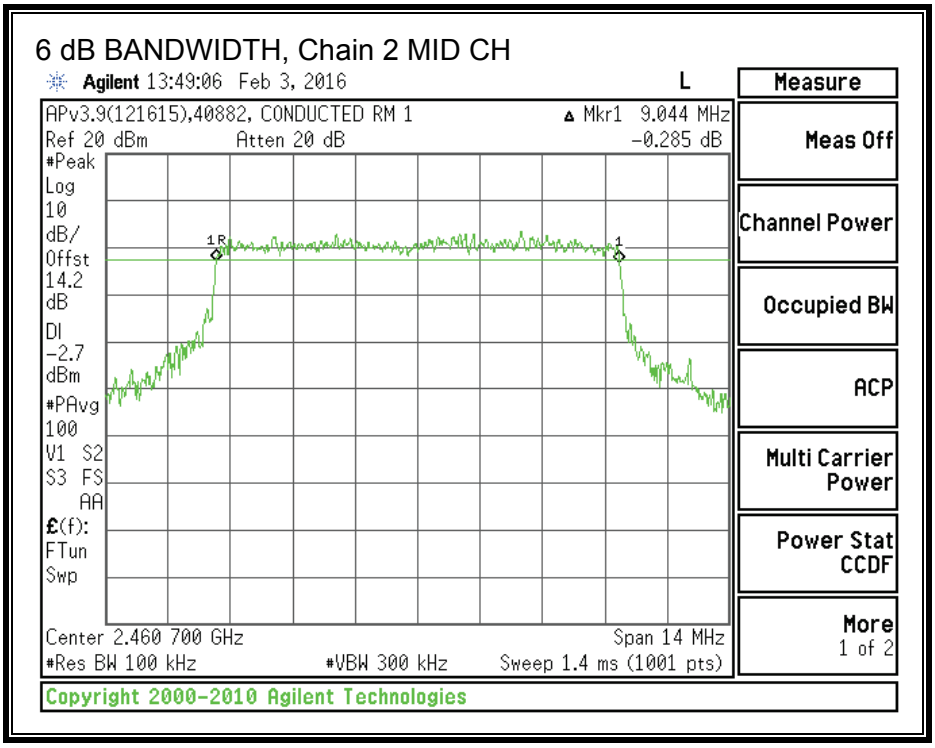




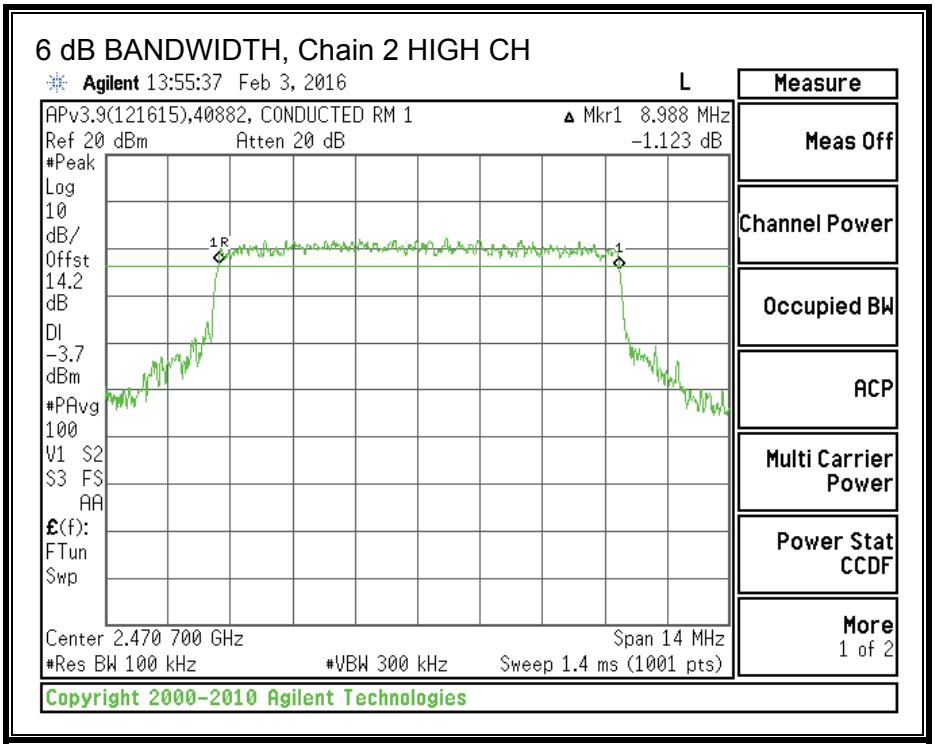
6 dB BANDWIDTH, Chain 2



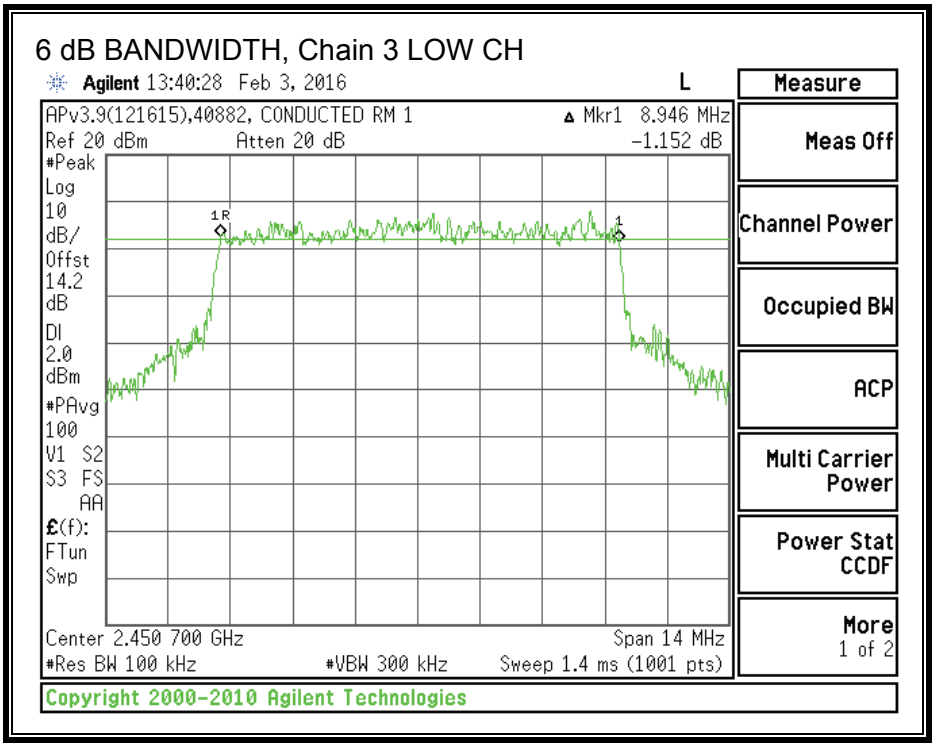
6 dB BANDWIDTH, Chain 2 MID CH

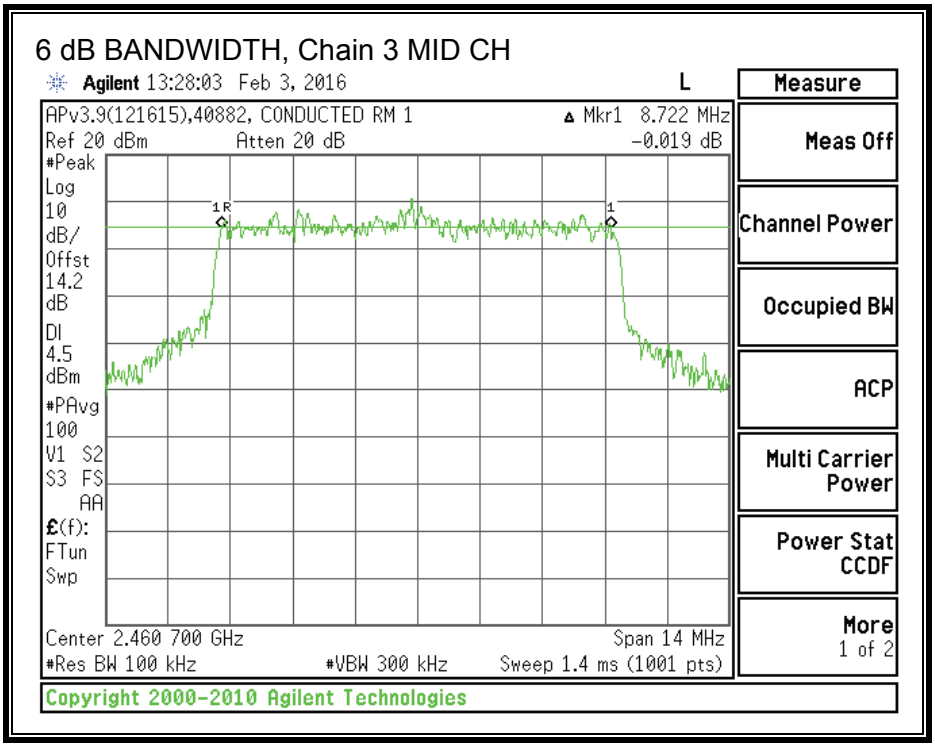


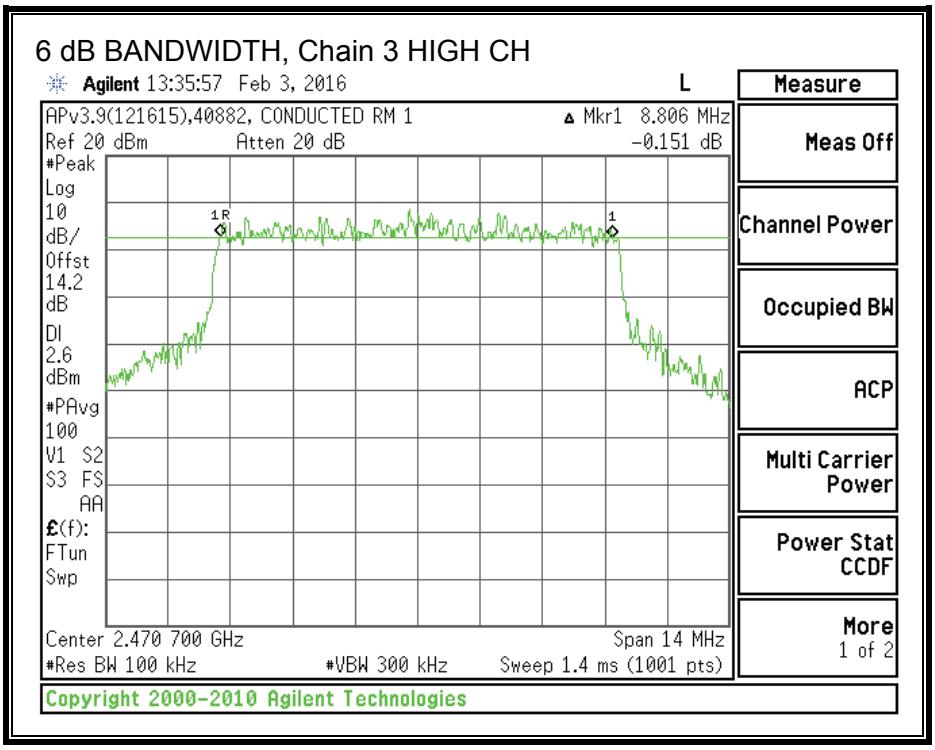
6 dB BANDWIDTH, Chain 2 HIGH CH



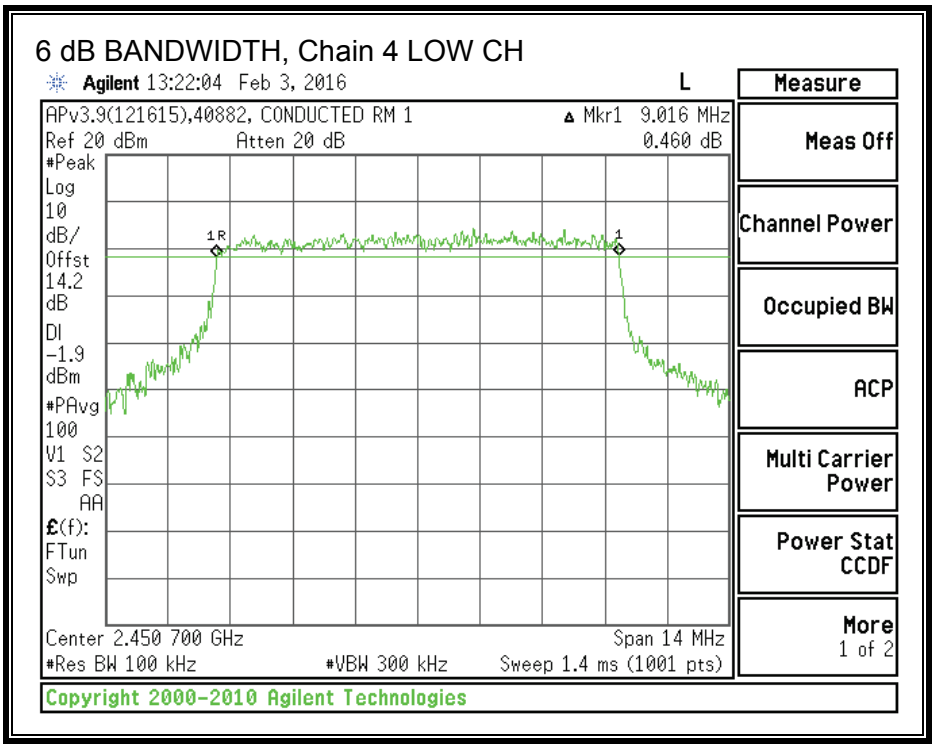
6 dB BANDWIDTH, Chain 3



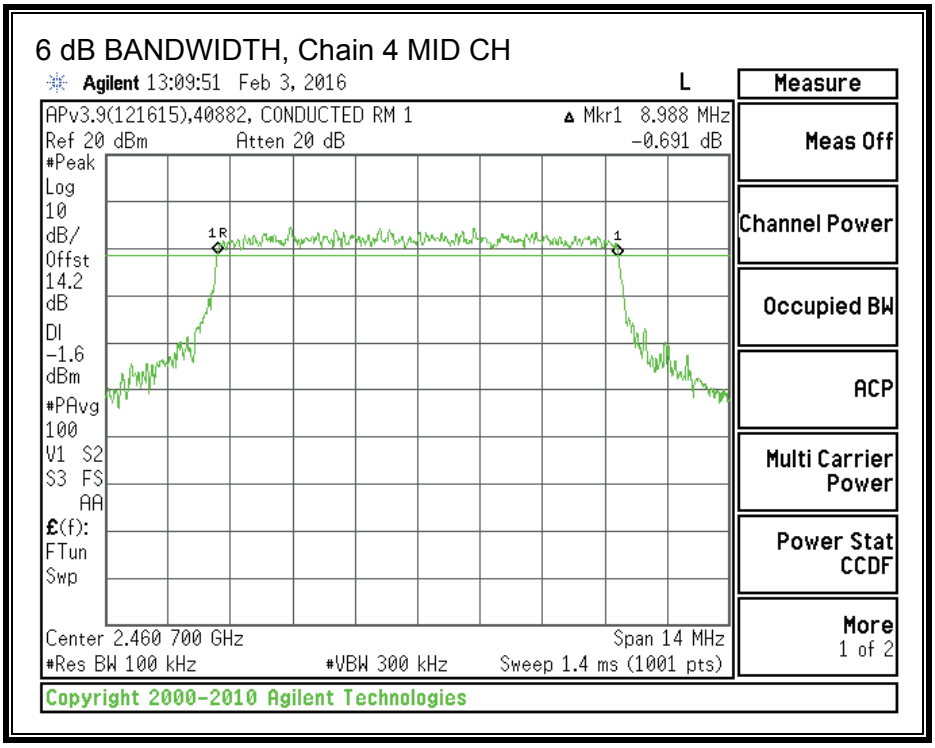




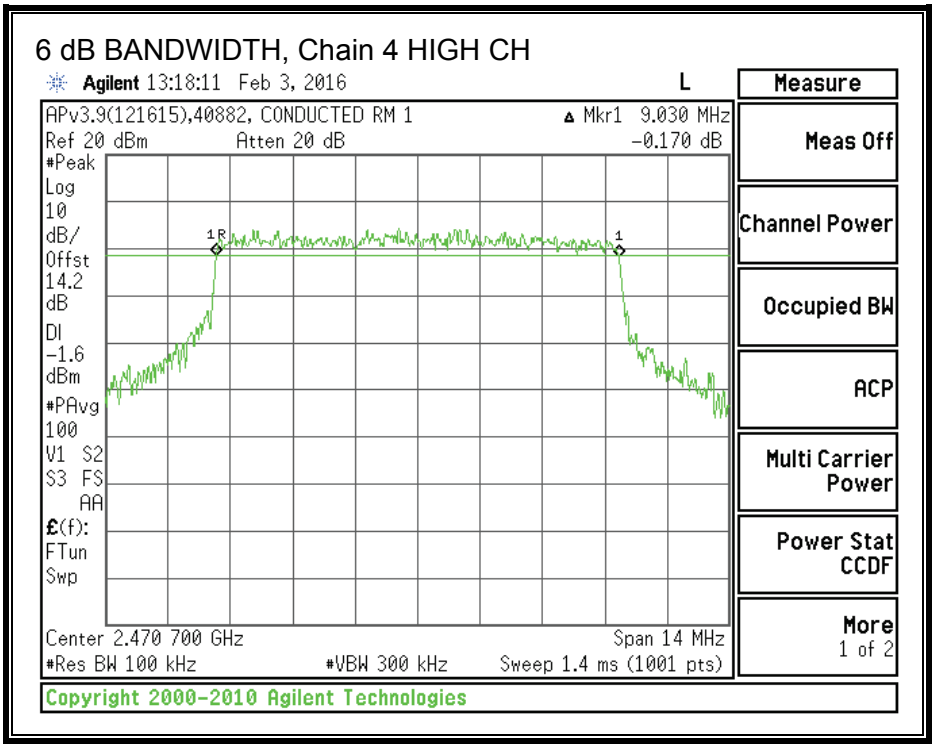
6 dB BANDWIDTH, Chain 4



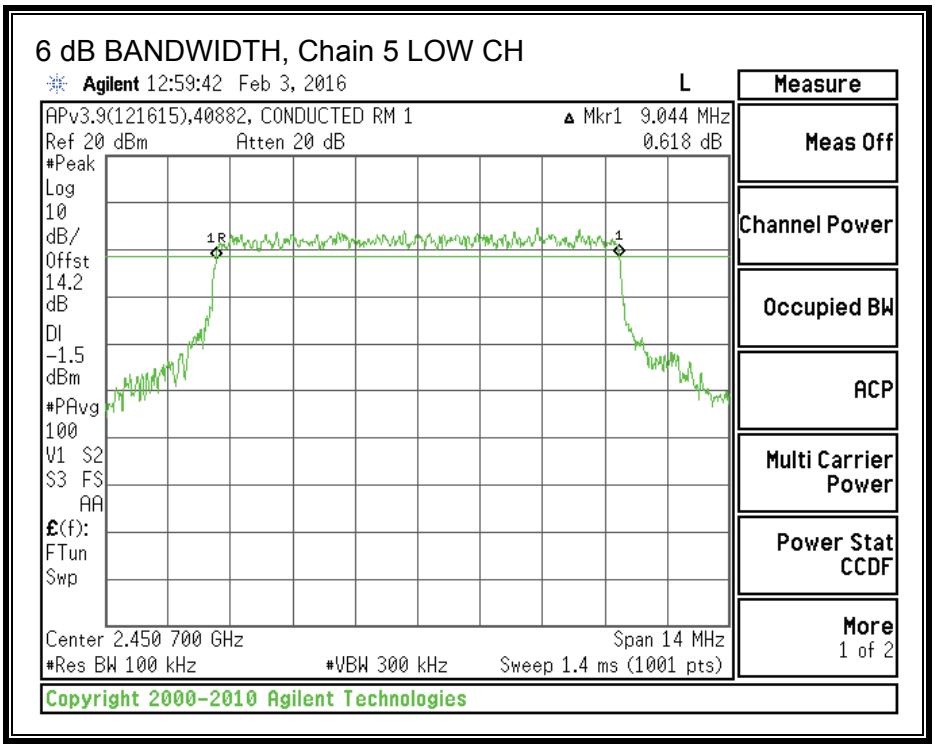
6 dB BANDWIDTH, Chain 4 MID CH

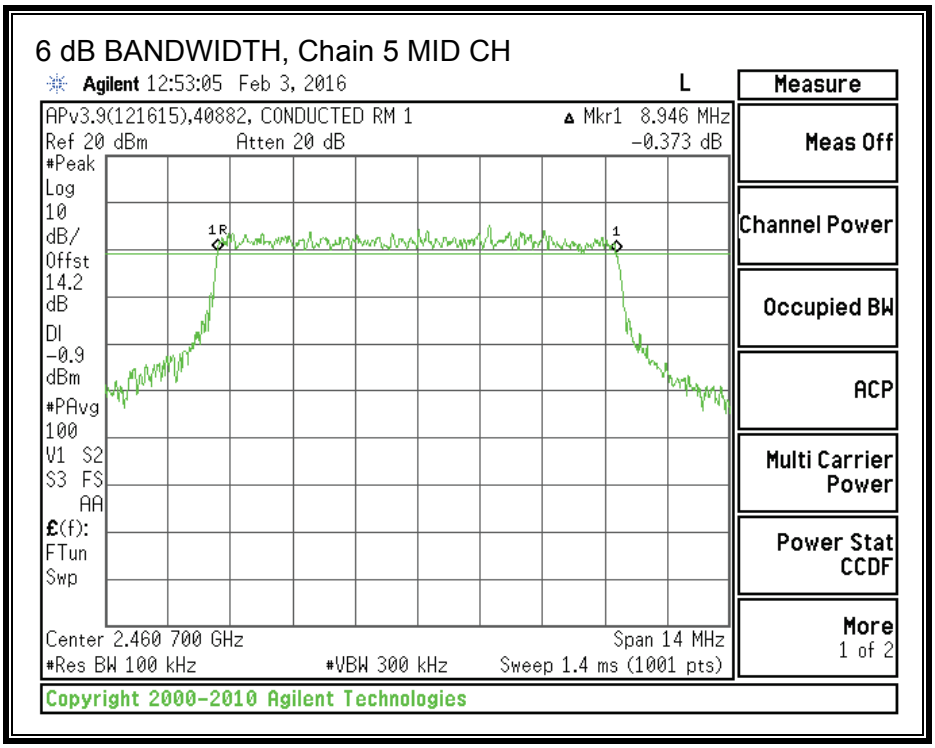


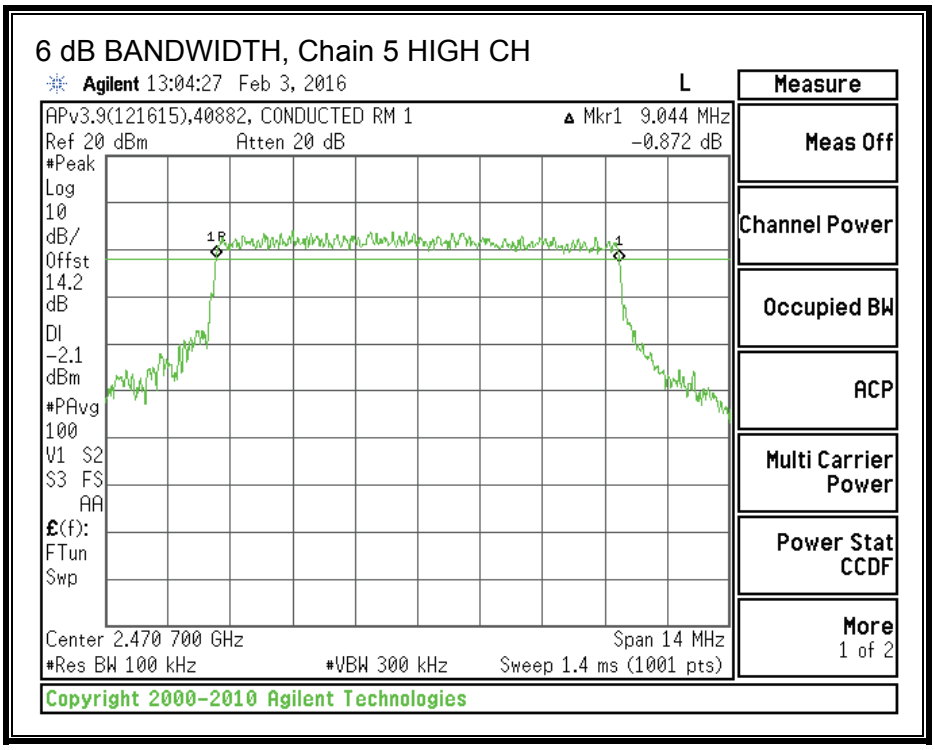
6 dB BANDWIDTH, Chain 4 HIGH CH



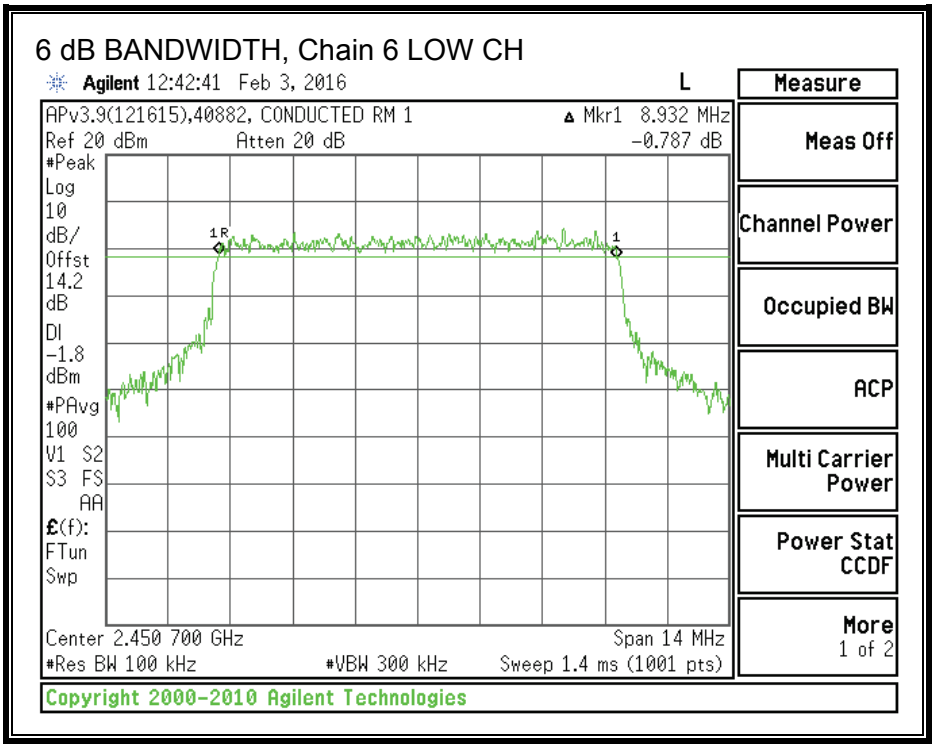
6 dB BANDWIDTH, Chain 5



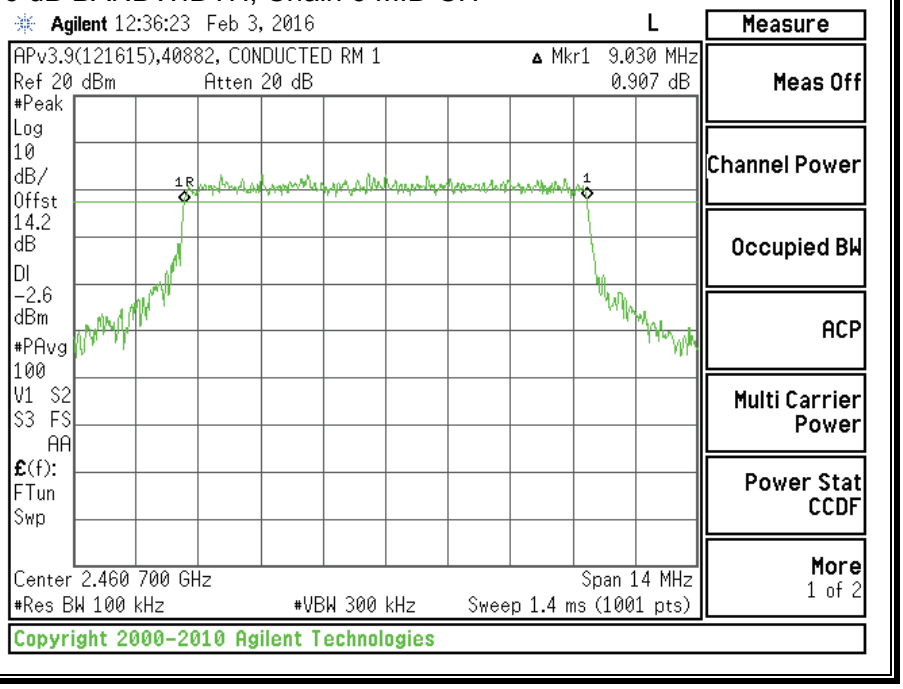




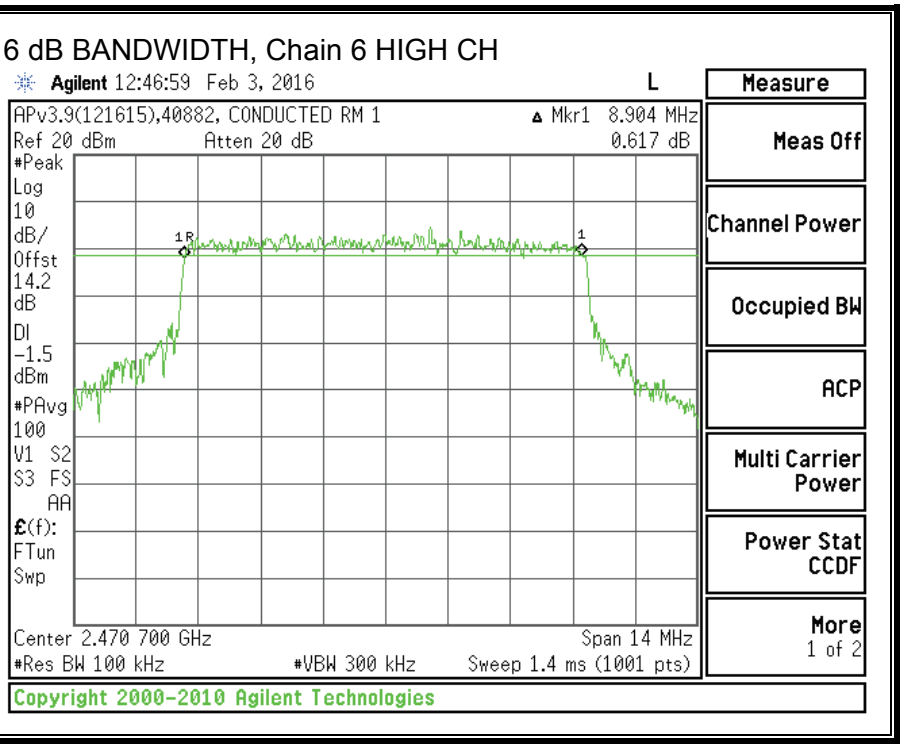
6 dB BANDWIDTH, Chain 6



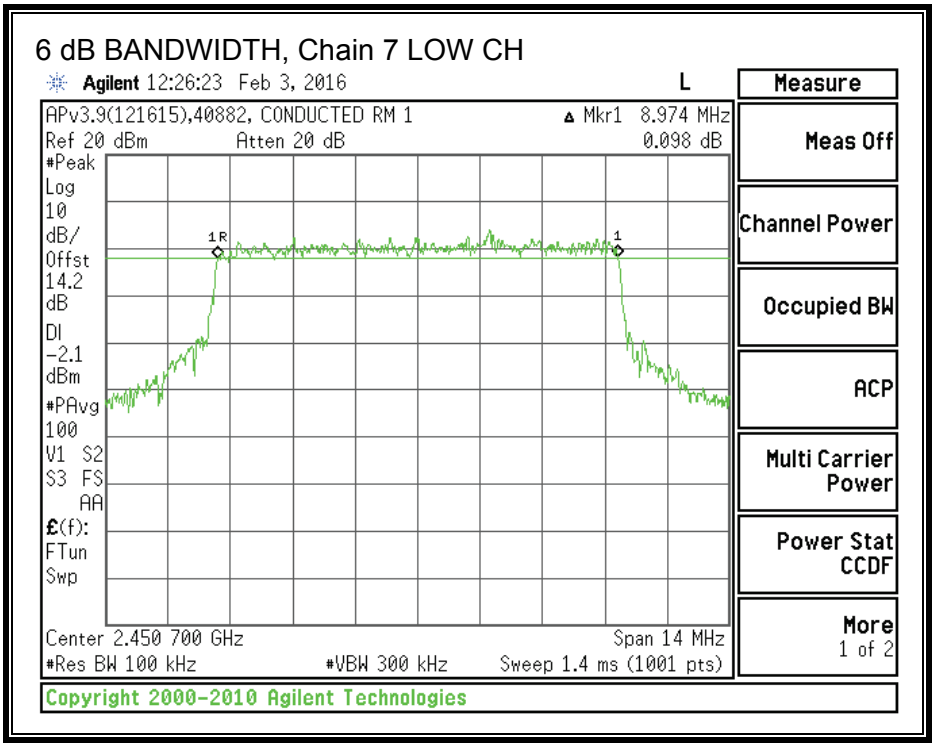
6 dB BANDWIDTH, Chain 6 MID CH

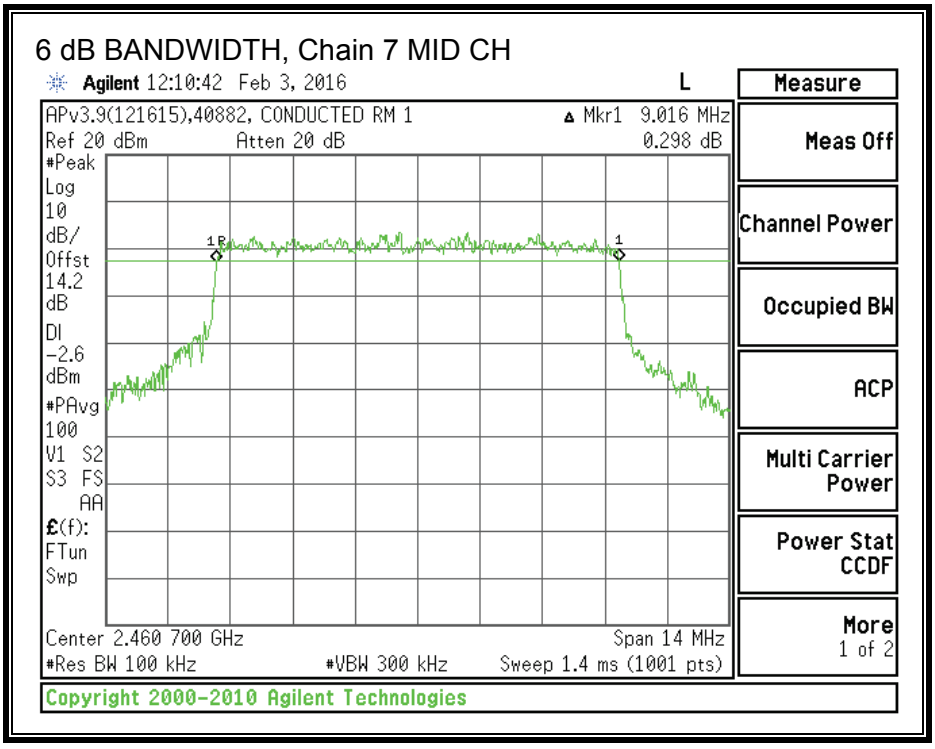


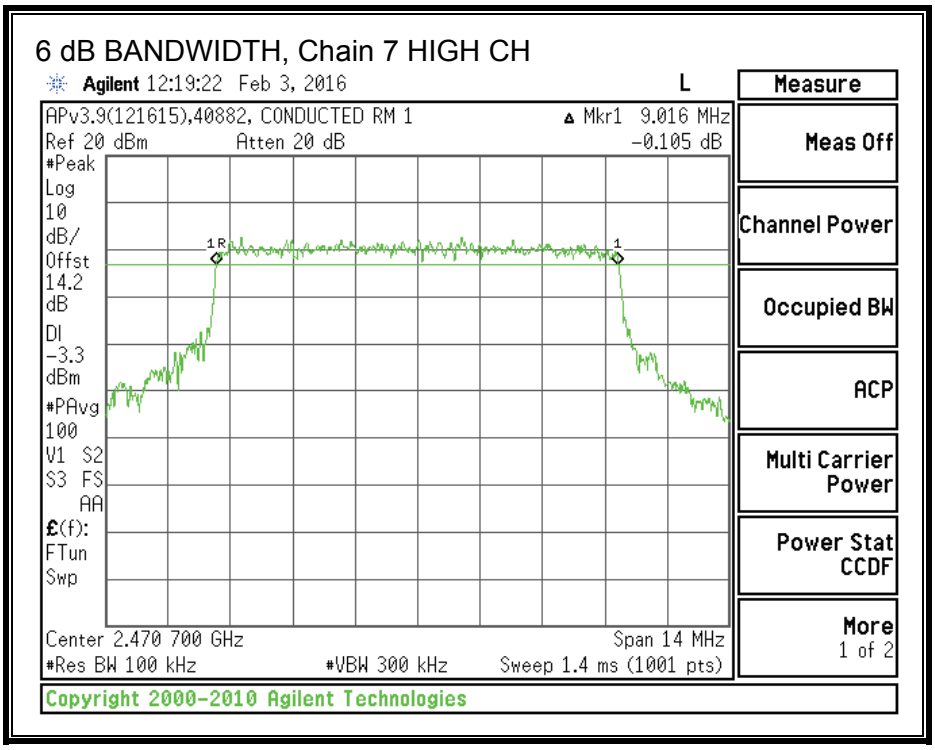
6 dB BANDWIDTH, Chain 6 HIGH CH



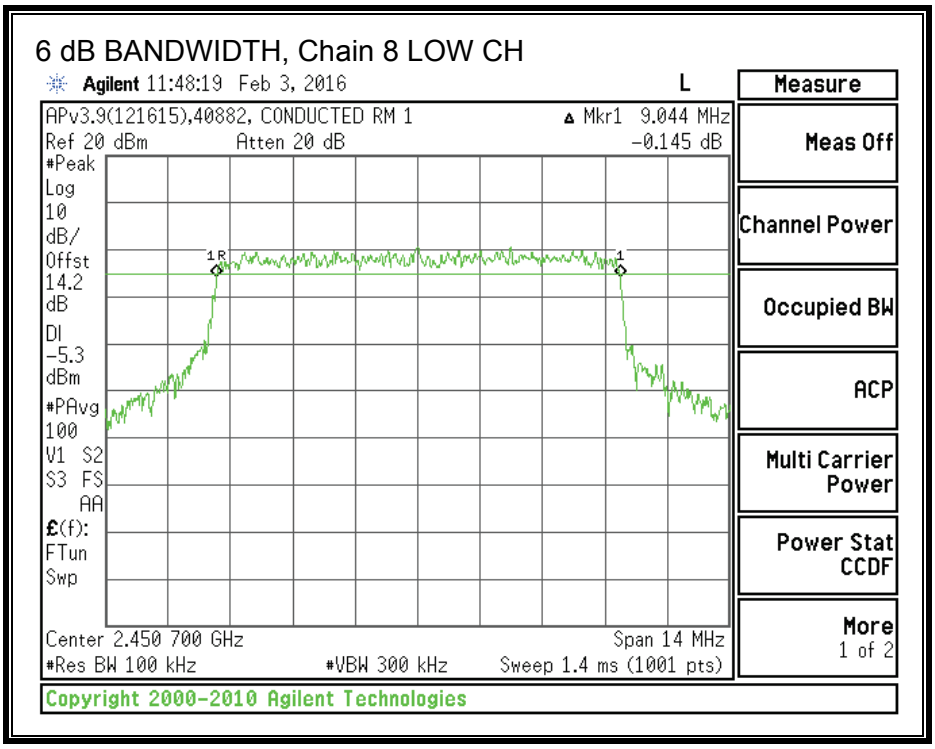
6 dB BANDWIDTH, Chain 7



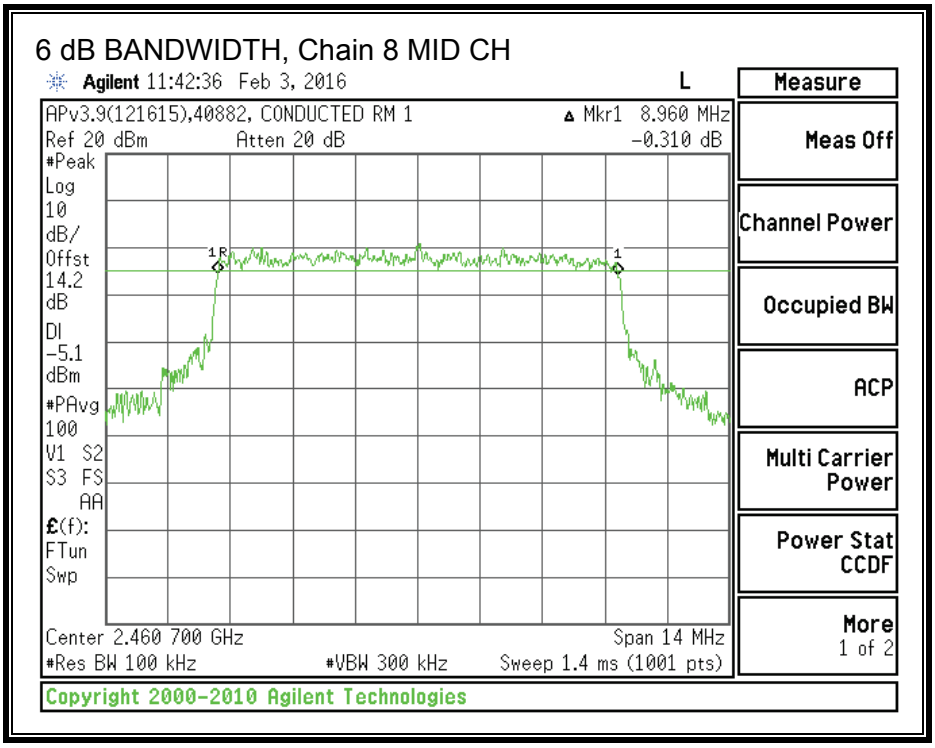




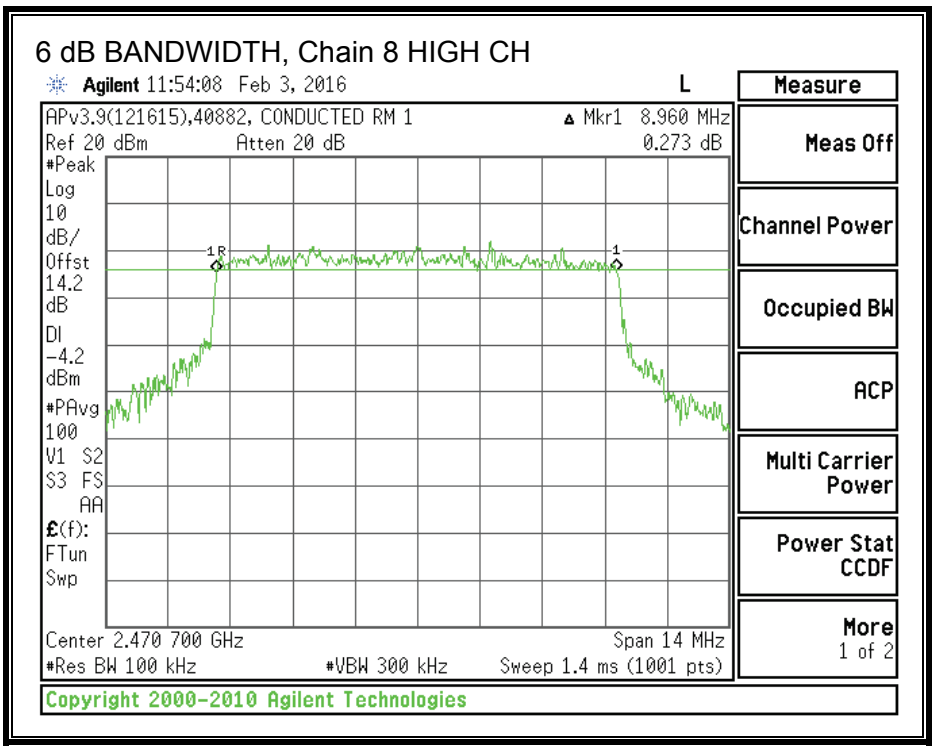
6 dB BANDWIDTH, Chain 8



6 dB BANDWIDTH, Chain 8 MID CH



6 dB BANDWIDTH, Chain 8 HIGH CH



8.5.2. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

	Included in Calculations of Corr'd Power							
Duty Cycle CF (dB)	0.68	0	0	0	0.67	0.67	0.68	0.68

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Chain 4 Power (dBm)	Chain 5 Power (dBm)	Chain 6 Power (dBm)	Chain 7 Power (dBm)	Chain 8 Power (dBm)	Total Power (dBm)
Low	2450.7	9.14	11.87	13.83	12.63	12.65	12.27	10.92	8.90	21.21
Mid	2460.7	9.07	11.64	14.77	12.81	12.35	11.29	10.96	8.47	21.20
High	2470.7	8.94	10.62	14.32	12.71	12.65	11.08	10.95	8.87	21.02

8.5.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

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.

§15.247 (c) (2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Chain 3 Antenna Gain (dBi)	Chain 4 Antenna Gain (dBi)	Chain 5 Antenna Gain (dBi)	Chain 6 Antenna Gain (dBi)	Chain 7 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
19.7	19.9	20	20.2	20.2	20.1	19.9	19.6	28.98

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)
Low	2450.7	28.98	23.00
Mid	2460.7	28.98	23.00
High	2470.7	28.98	23.00

	Included in Calculations of Corr'd Power			
Duty Cycle CF (dB)	0.68	0	0	0
	0.68	0.67	0.75	0.73

Results

Channel	Frequency (MHz)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Chain 4 Meas Power (dBm)
Low	2450.7	9.14	11.87	13.83	12.63
Mid	2460.7	9.07	11.64	14.77	12.81
High	2470.7	8.94	10.62	14.32	12.71

Channel	Frequency (MHz)	Chain 5 Meas Power (dBm)	Chain 6 Meas Power (dBm)	Chain 7 Meas Power (dBm)	Chain 8 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2450.7	12.65	12.27	10.92	8.90	21.22	23.00	-1.78
Mid	2460.7	12.35	11.29	10.96	8.47	21.21	23.00	-1.79
High	2470.7	12.65	11.08	10.95	8.87	21.03	23.00	-1.97

8.5.4. POWER SPECTRUM DENSITY

LIMITS

FCC §15.247 (e)

RESULTS

Note – The Pk method was used. Therefore, no Duty Cycle correction was required.

	Included in Calculations of Corr'd PSD			
Duty Cycle CF (dB)	0.00	0	0	0
	0.00	0	0	0

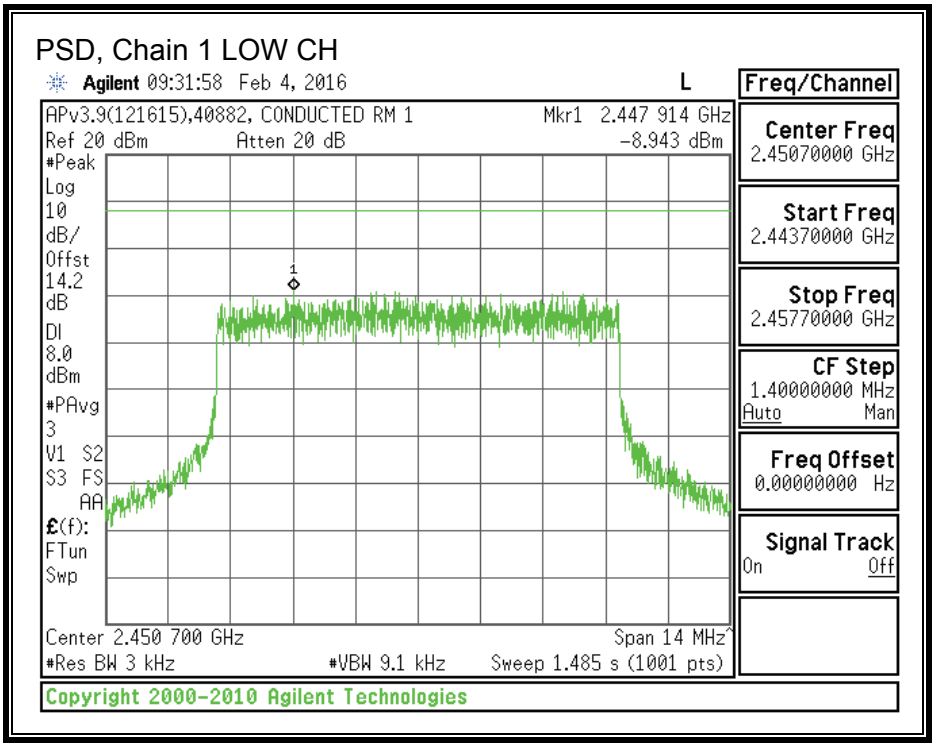
PSD Results

Channel	Frequency (MHz)	Chain 1 Meas (dBm)	Chain 2 Meas (dBm)	Chain 3 Meas (dBm)	Chain 4 Meas (dBm)
Low	2450.700	-8.94	-13.23	-7.56	-11.32
Mid	2460.700	-12.07	-12.67	-7.26	-10.51
High	2470.700	-12.32	-13.40	-5.54	-10.44

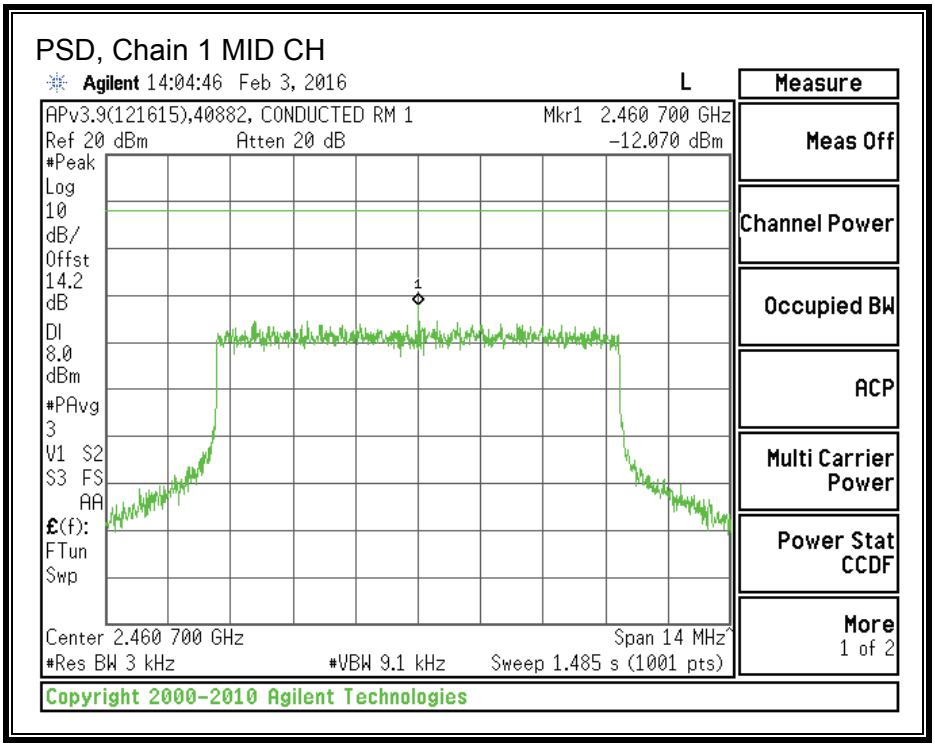
Channel	Frequency (MHz)	Chain 5 Meas (dBm)	Chain 6 Meas (dBm)	Chain 7 Meas (dBm)	Chain 8 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2450.700	-11.44	-10.11	-8.53	-9.28	-0.70	8.0	-8.7
Mid	2460.700	-12.32	-10.15	-8.56	-9.37	-0.95	8.0	-9.0
High	2470.700	-11.94	-11.11	-7.31	-8.07	-0.19	8.0	-8.2

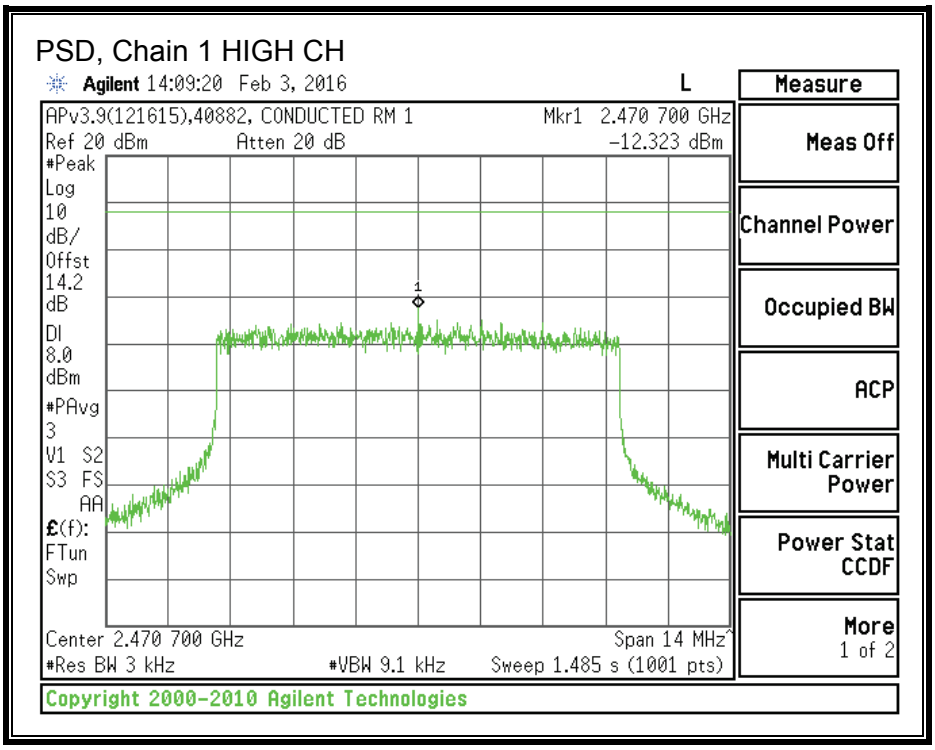
PSD, Chain 1

PSD, Chain 1 LOW CH

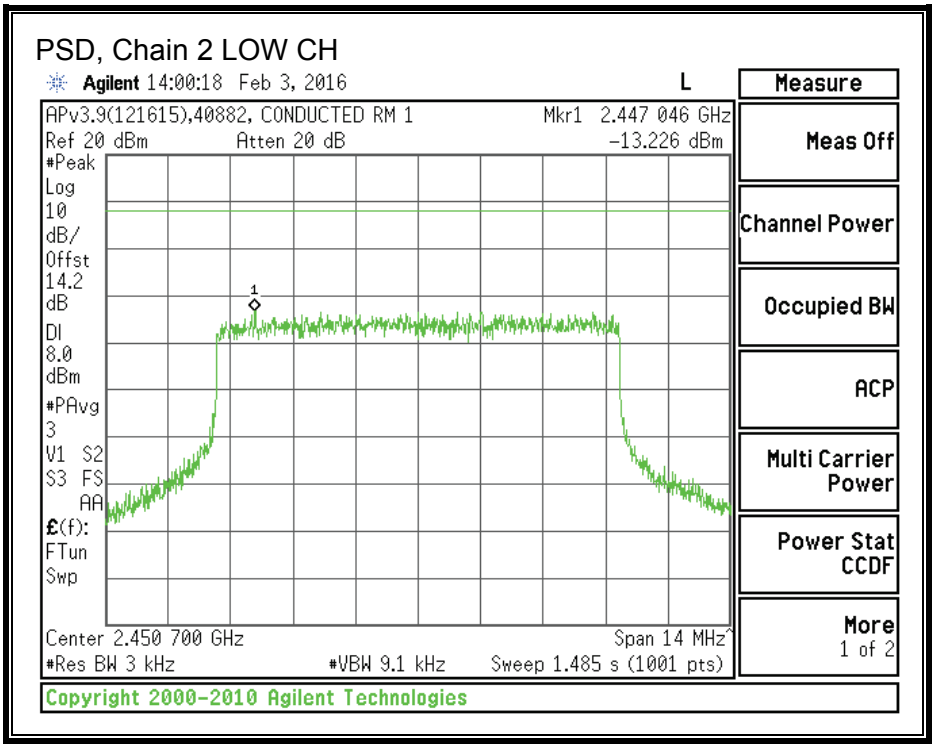


PSD, Chain 1 MID CH

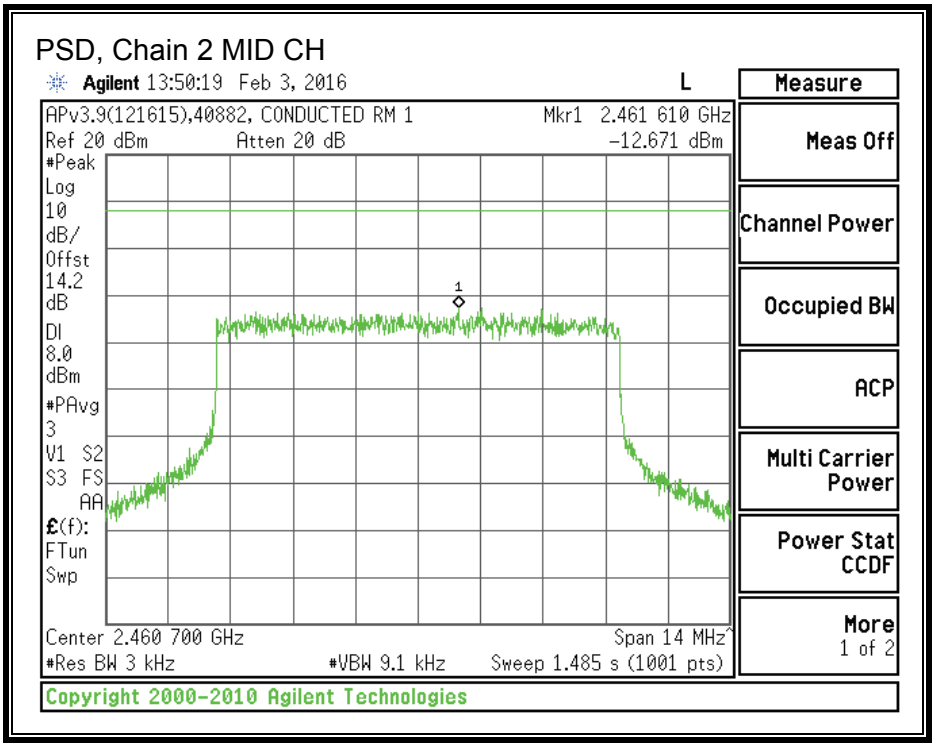




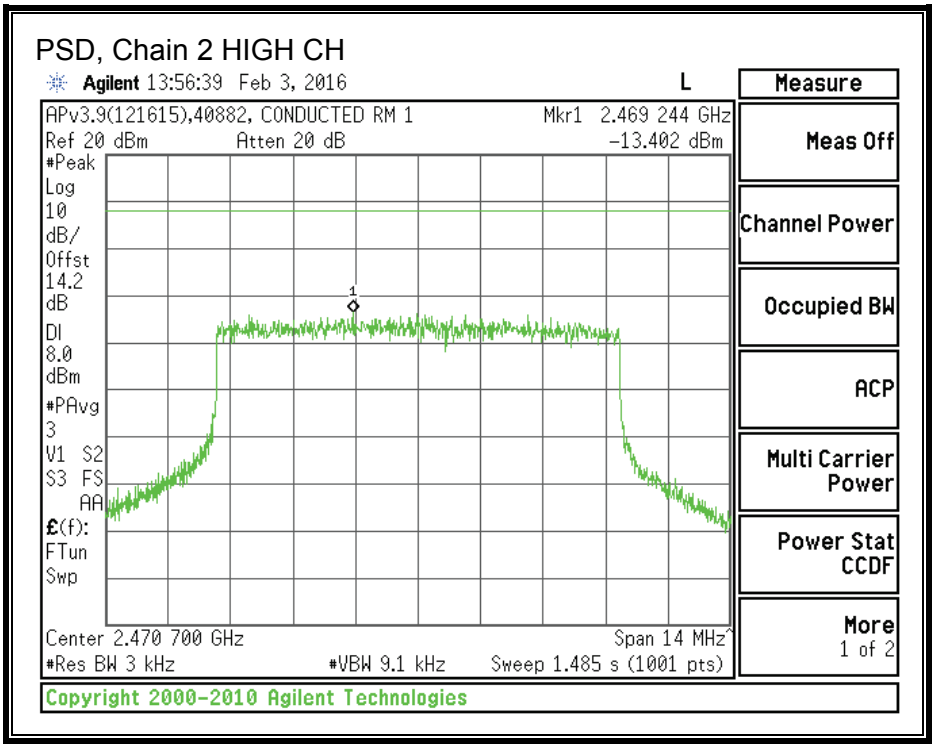
PSD, Chain 2



PSD, Chain 2 MID CH

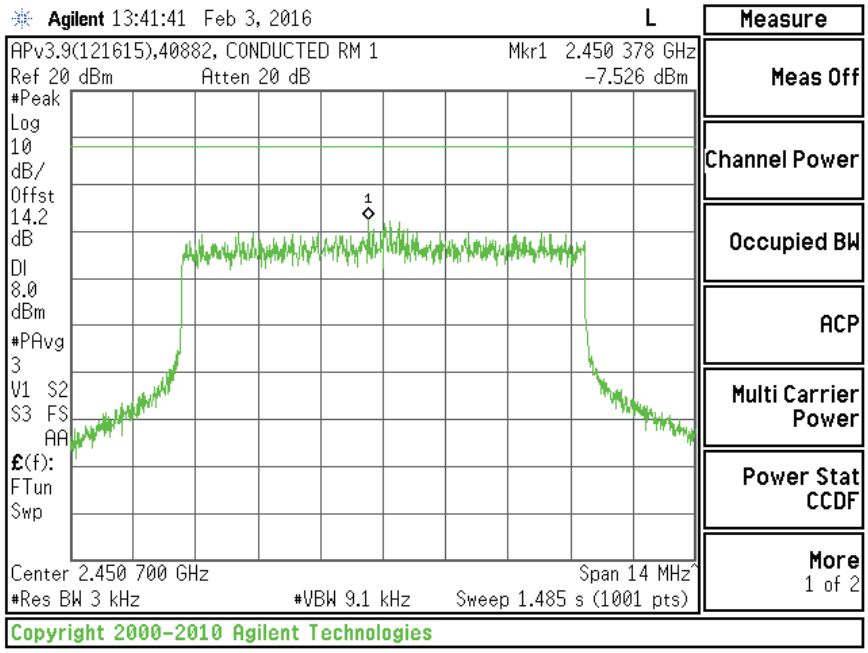


PSD, Chain 2 HIGH CH

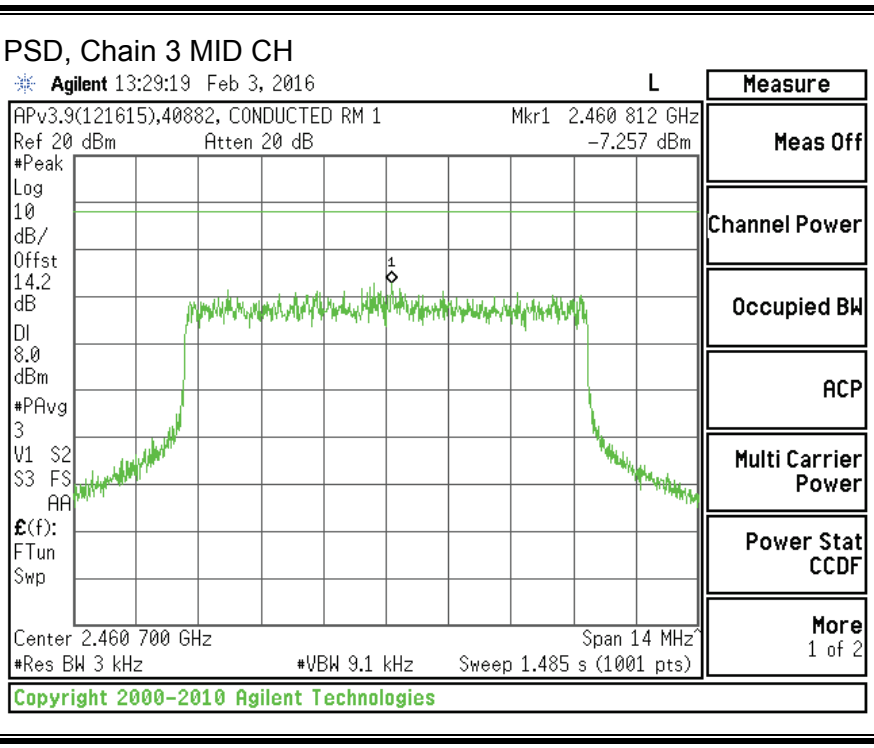


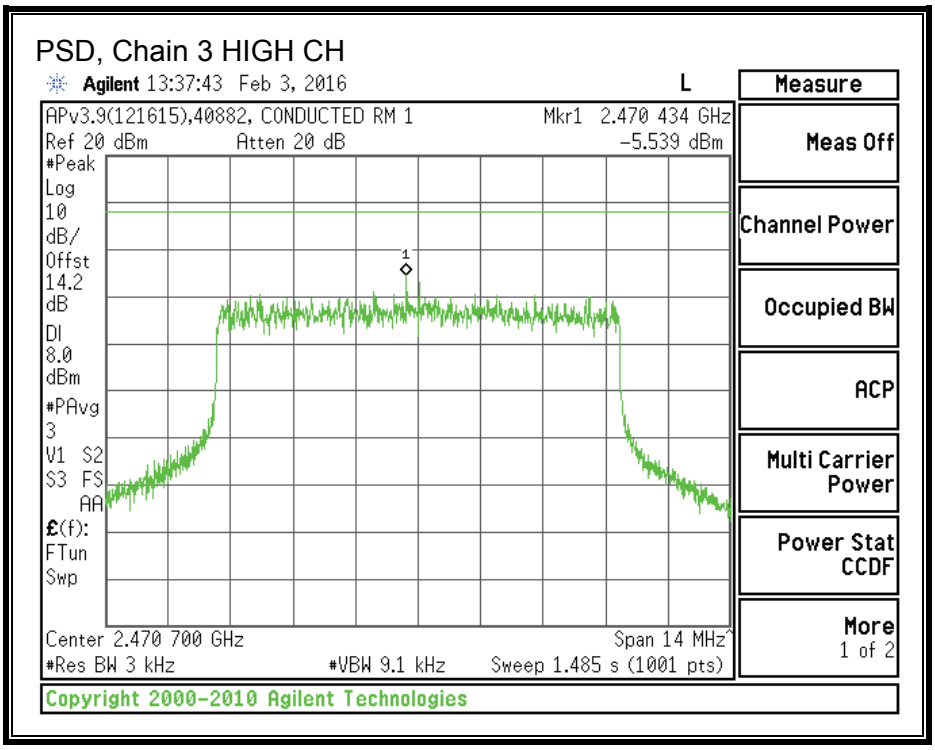
PSD, Chain 3

PSD, Chain 3 LOW CH

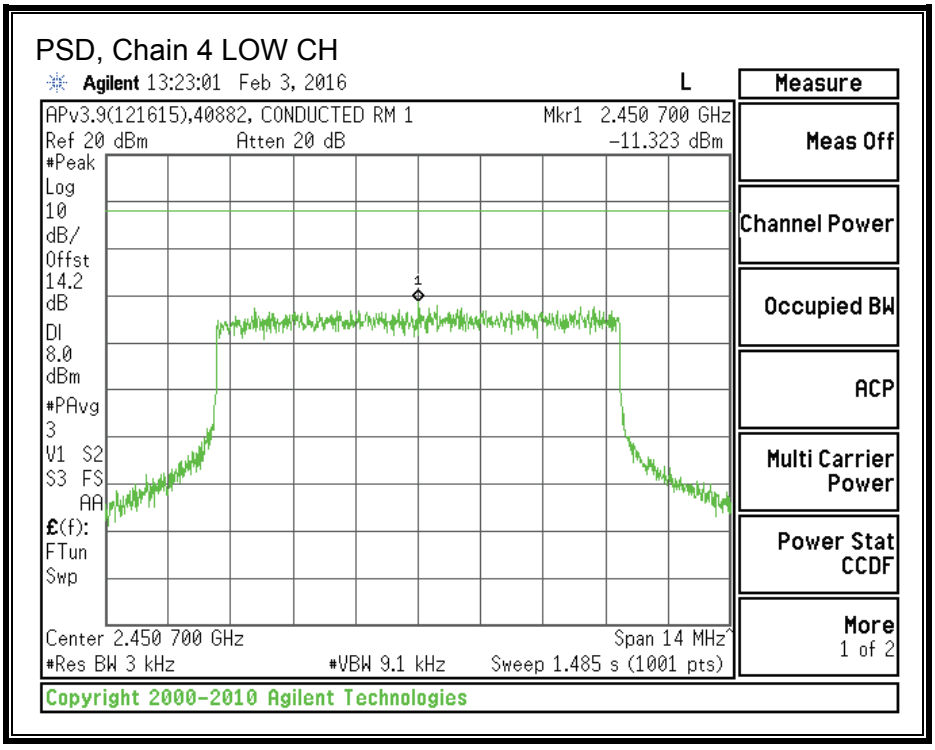


PSD, Chain 3 MID CH

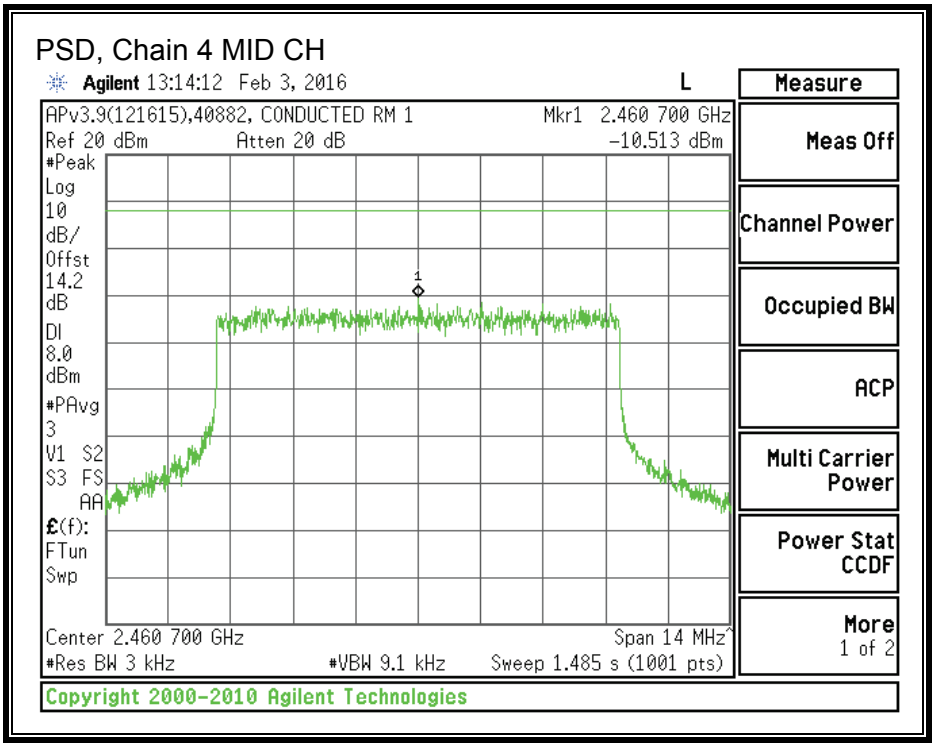




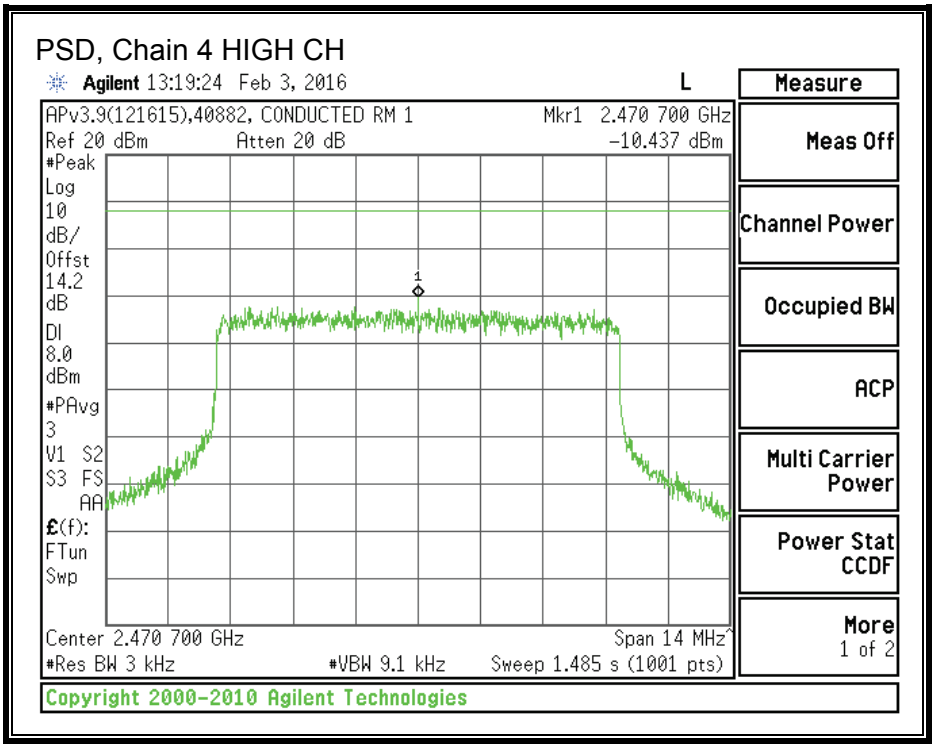
PSD, Chain 4



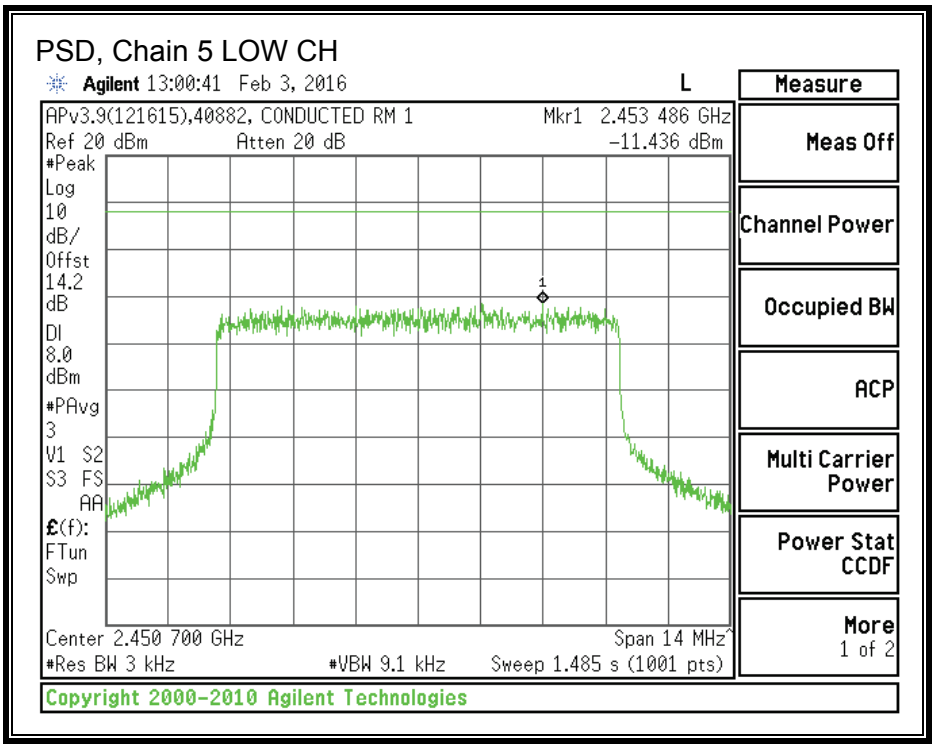
PSD, Chain 4 MID CH

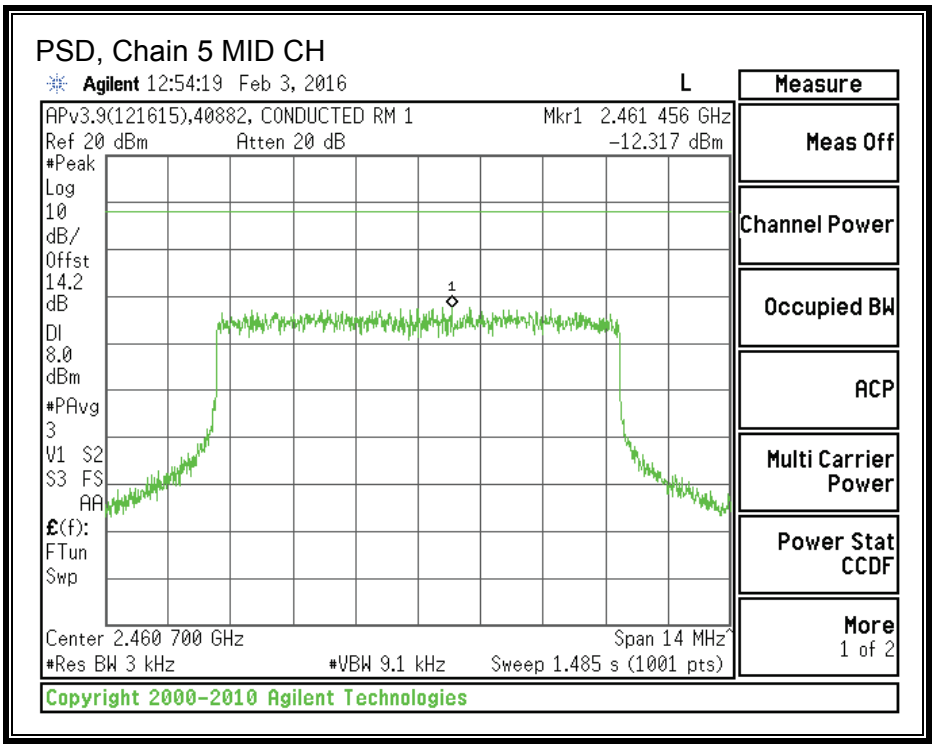


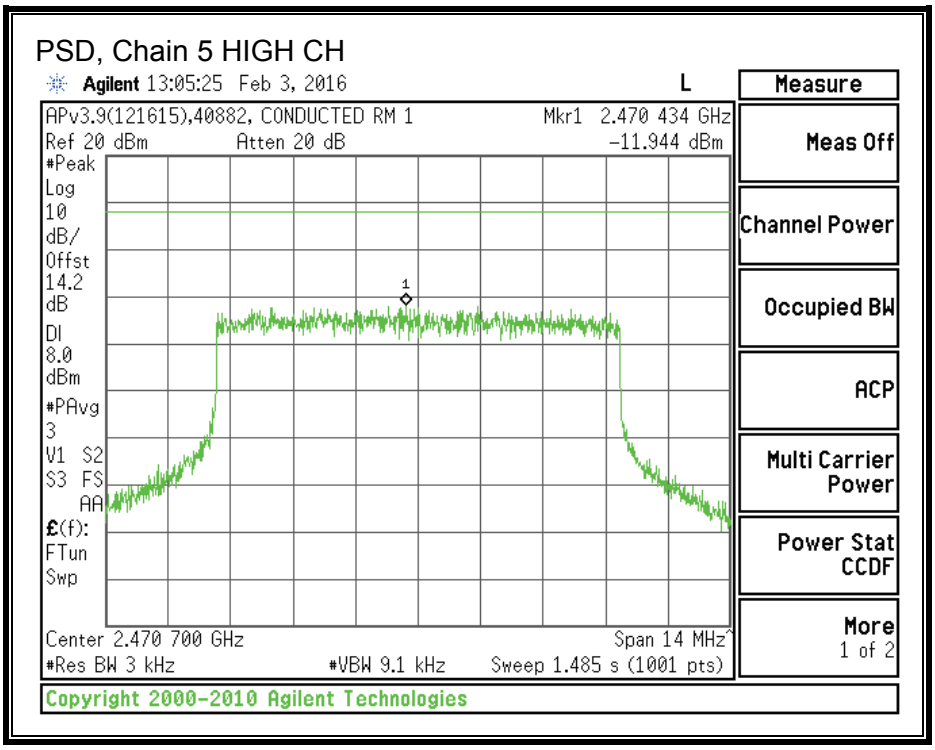
PSD, Chain 4 HIGH CH



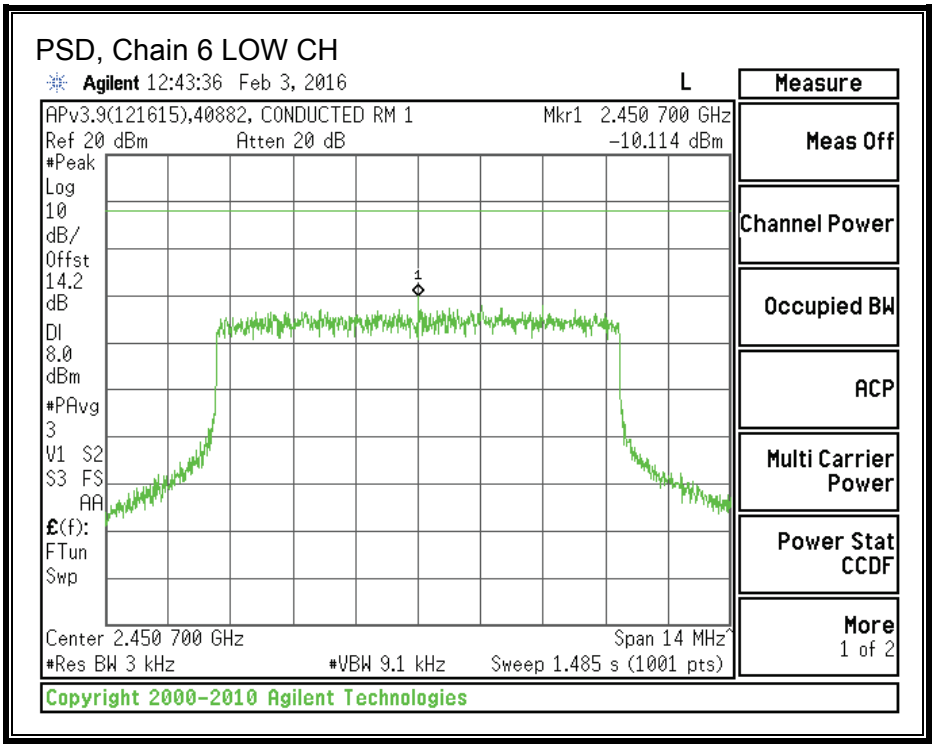
PSD, Chain 5



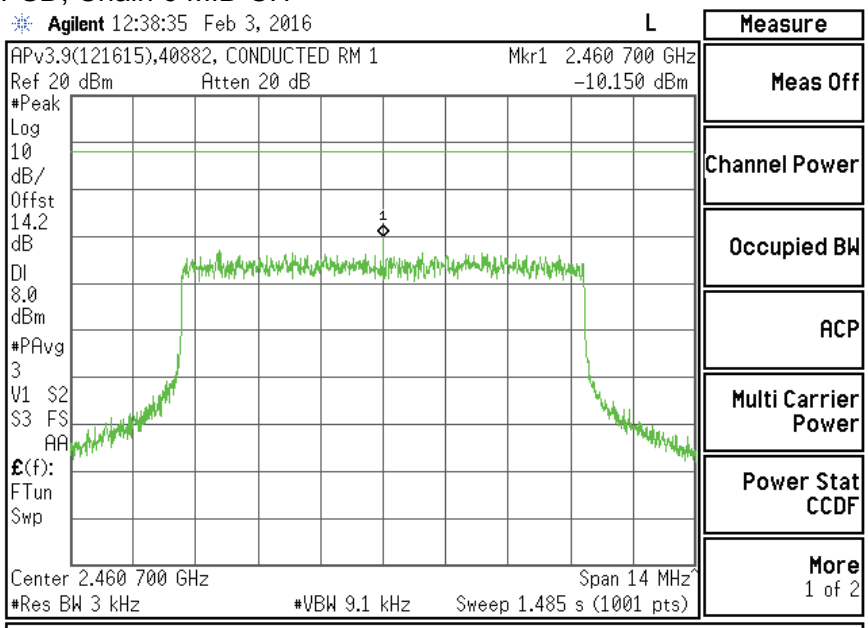




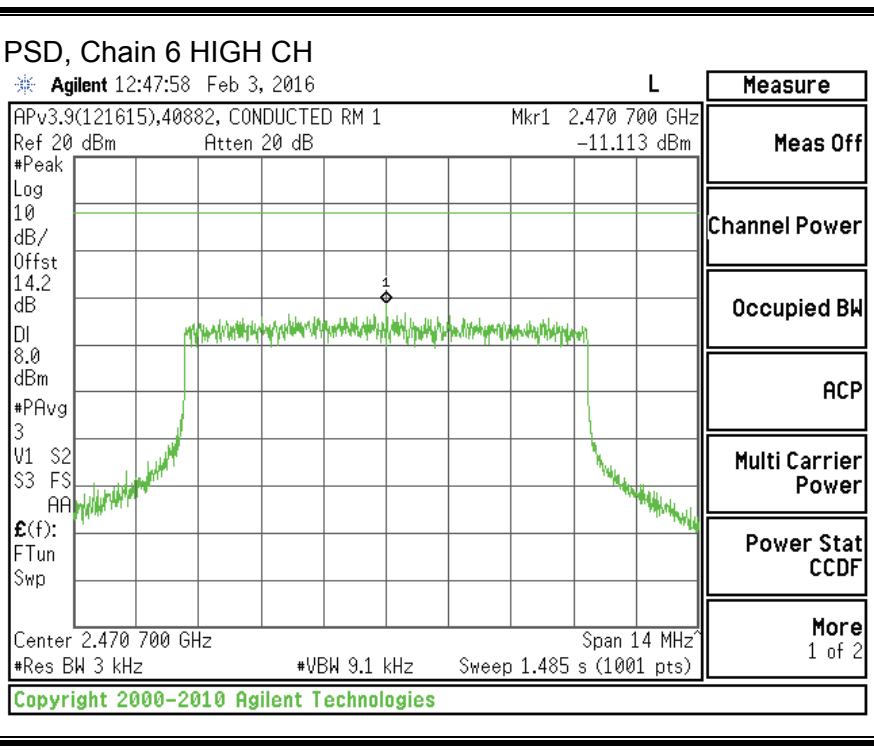
PSD, Chain 6



PSD, Chain 6 MID CH

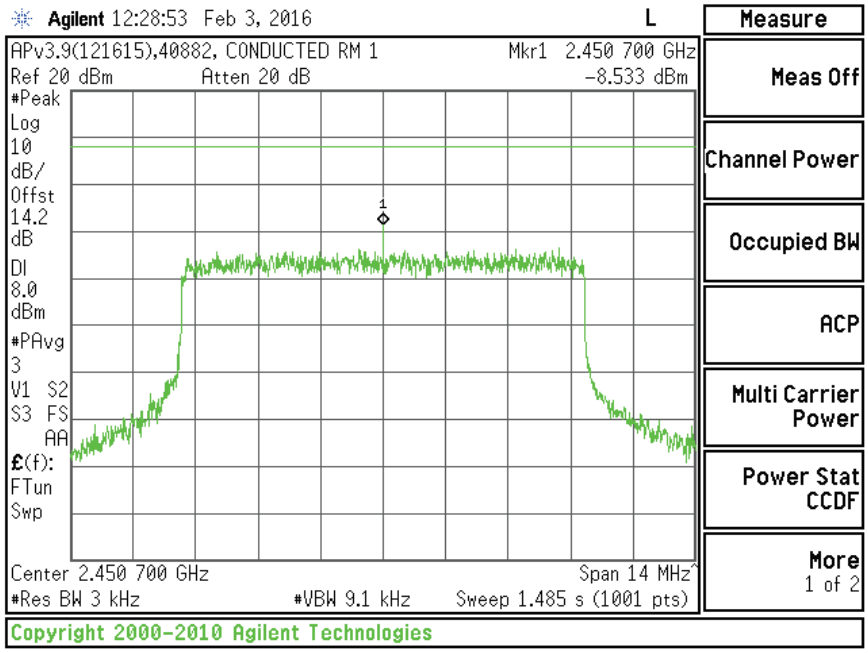


PSD, Chain 6 HIGH CH

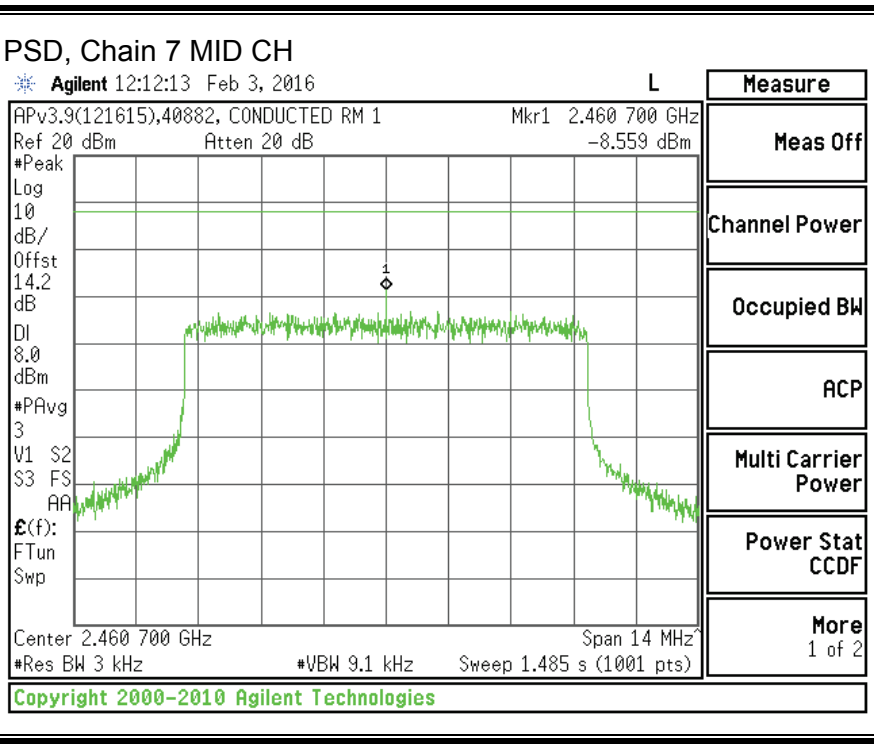


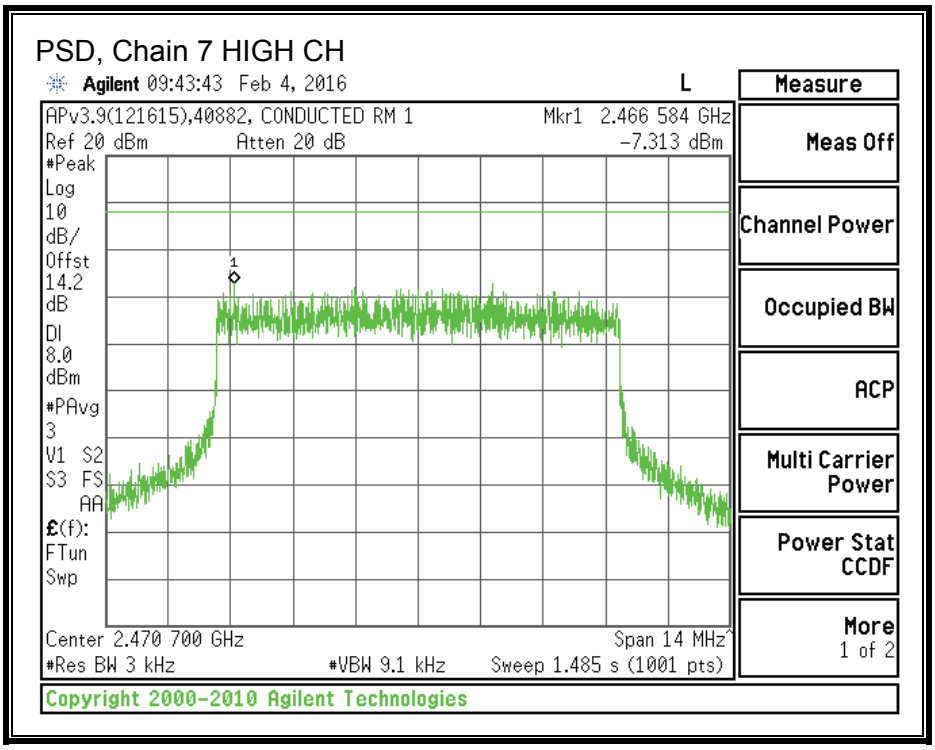
PSD, Chain 7

PSD, Chain 7 LOW CH

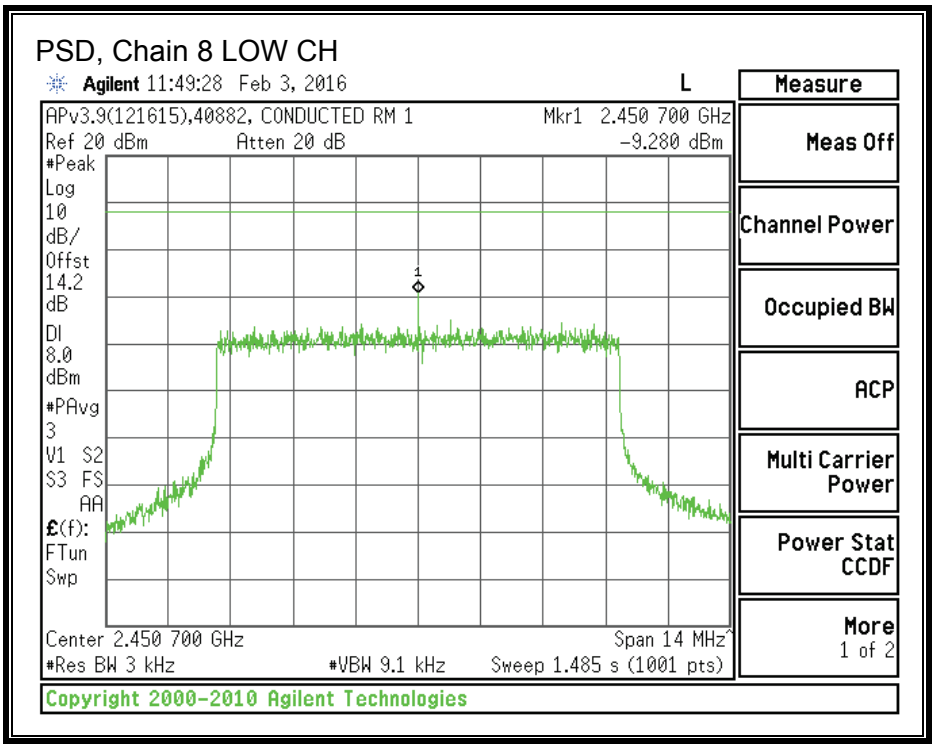


PSD, Chain 7 MID CH

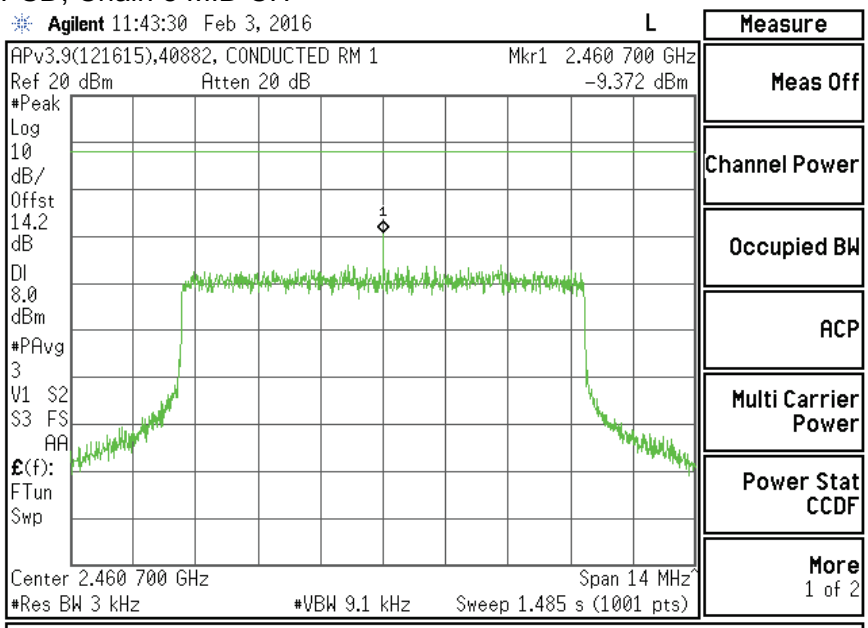




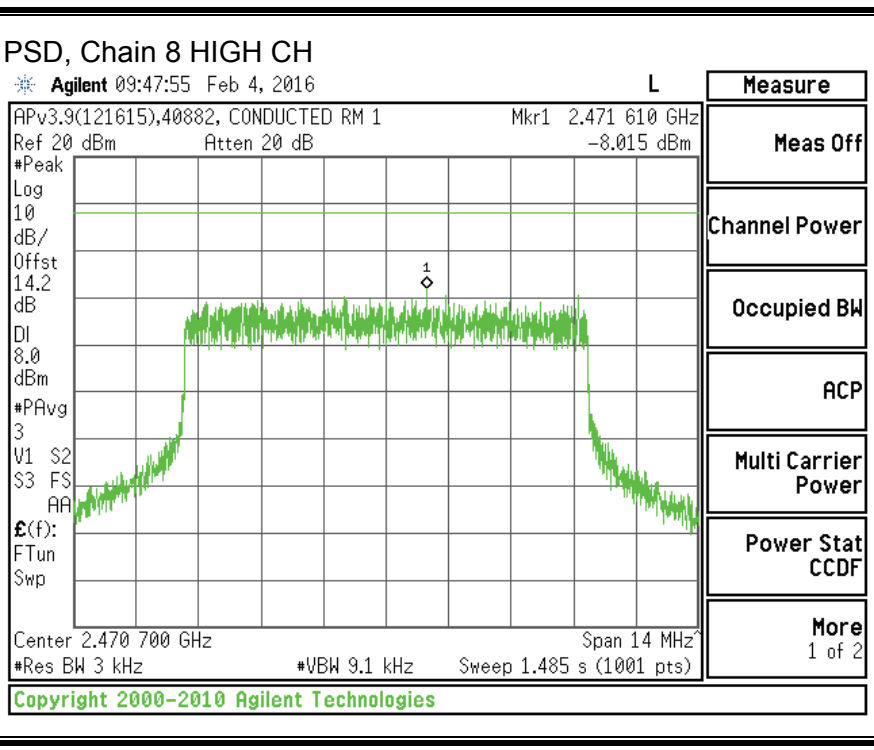
PSD, Chain 8



PSD, Chain 8 MID CH



PSD, Chain 8 HIGH CH



8.5.5. OUT-OF-BAND EMISSIONS

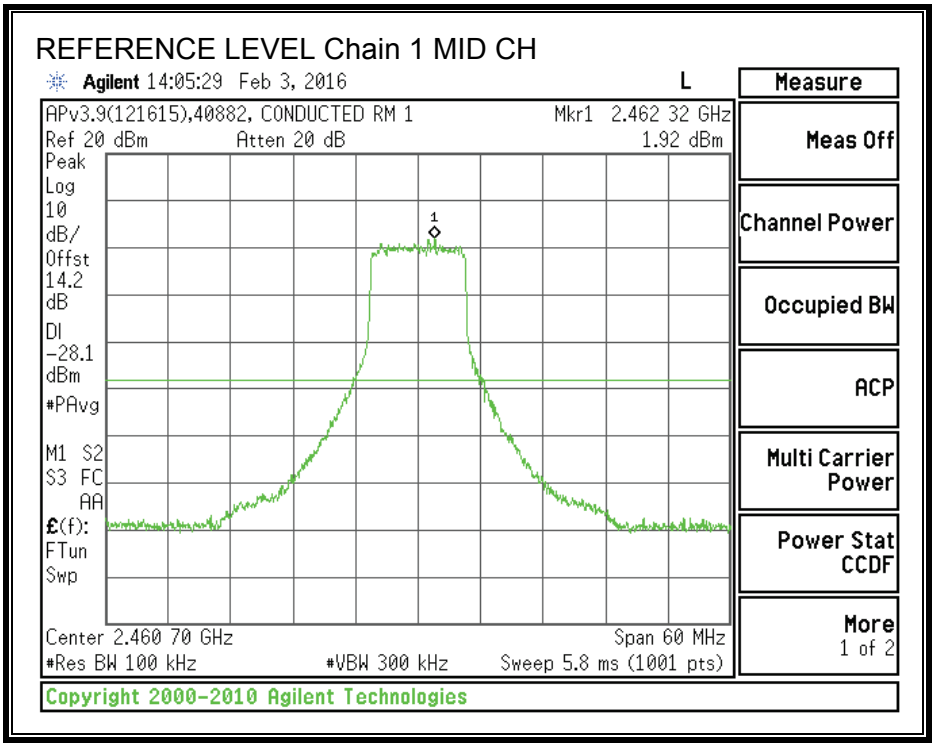
LIMITS

FCC §15.247 (d)

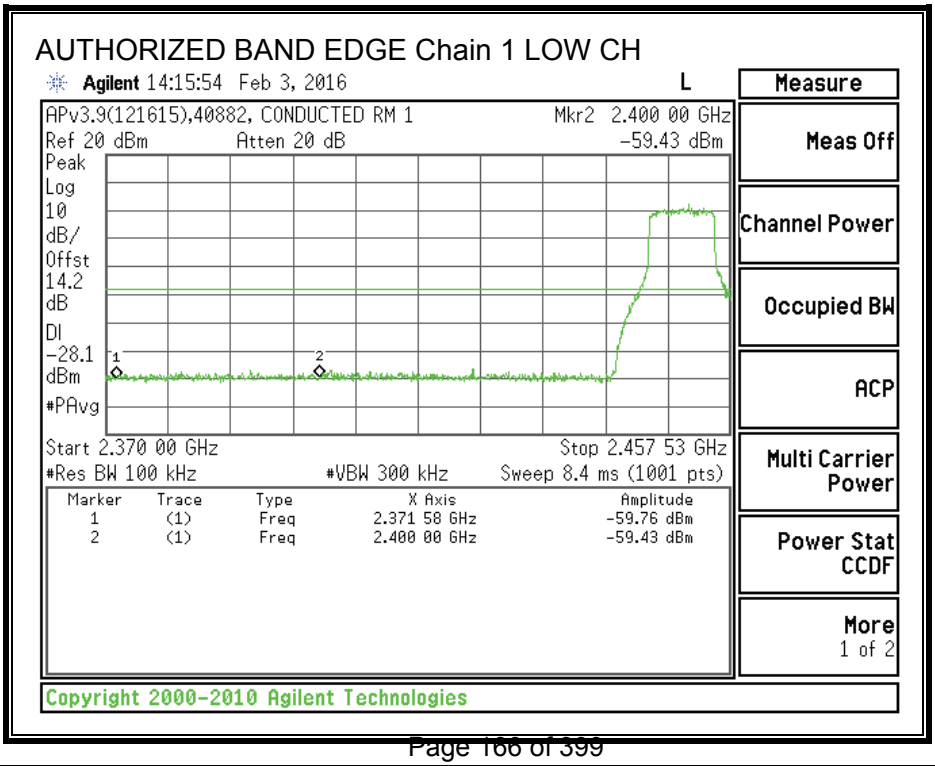
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

RESULTS

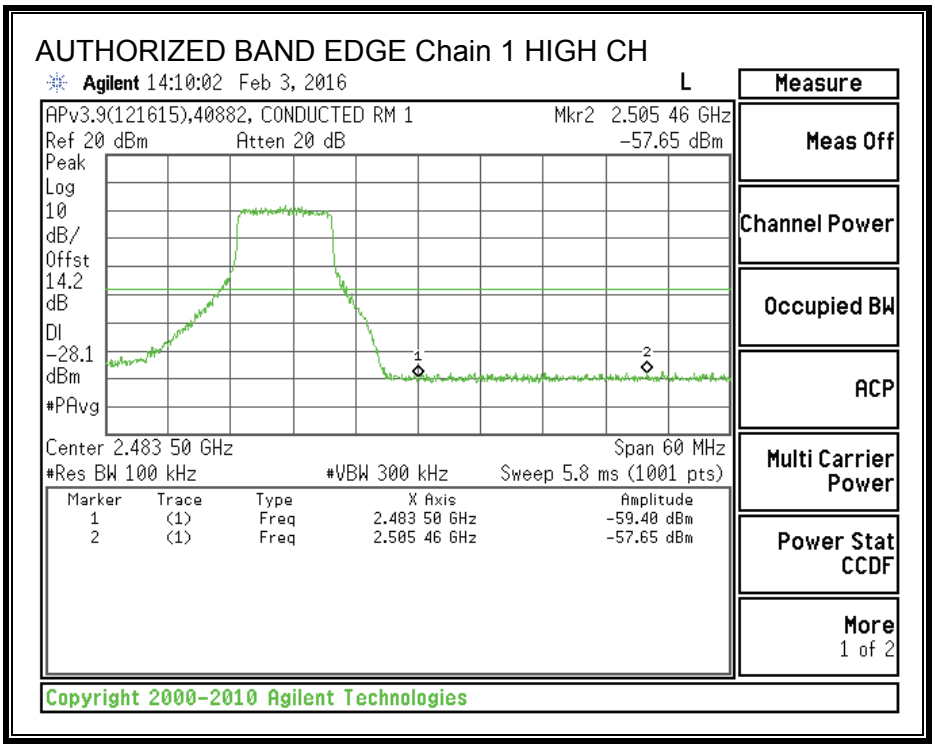
IN-BAND REFERENCE LEVEL, Chain 1



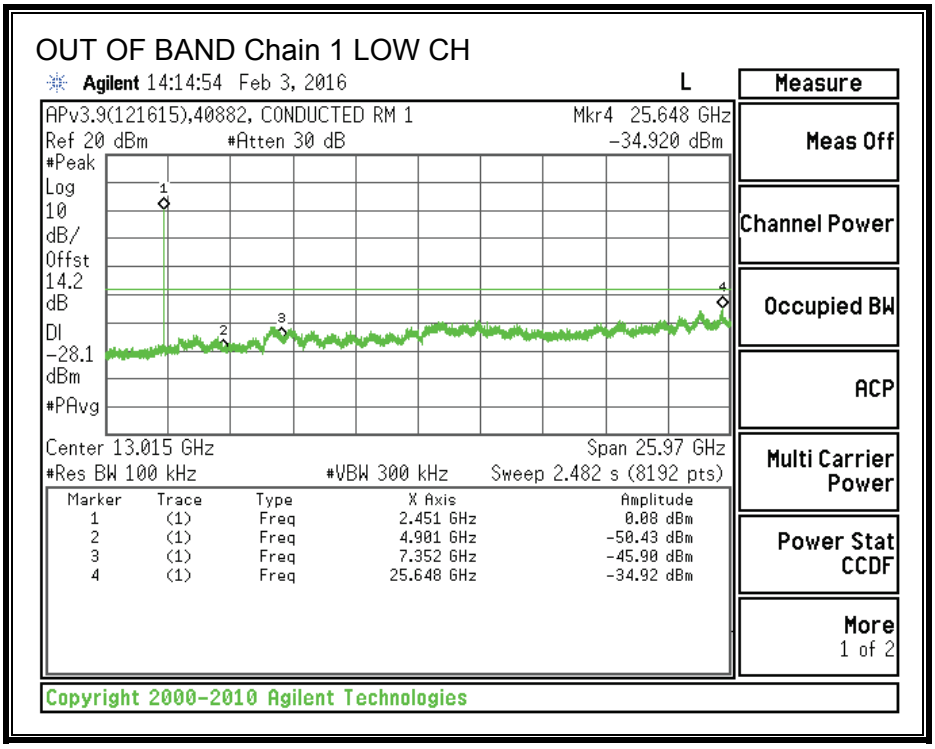
LOW CHANNEL BANDEDGE, Chain 1



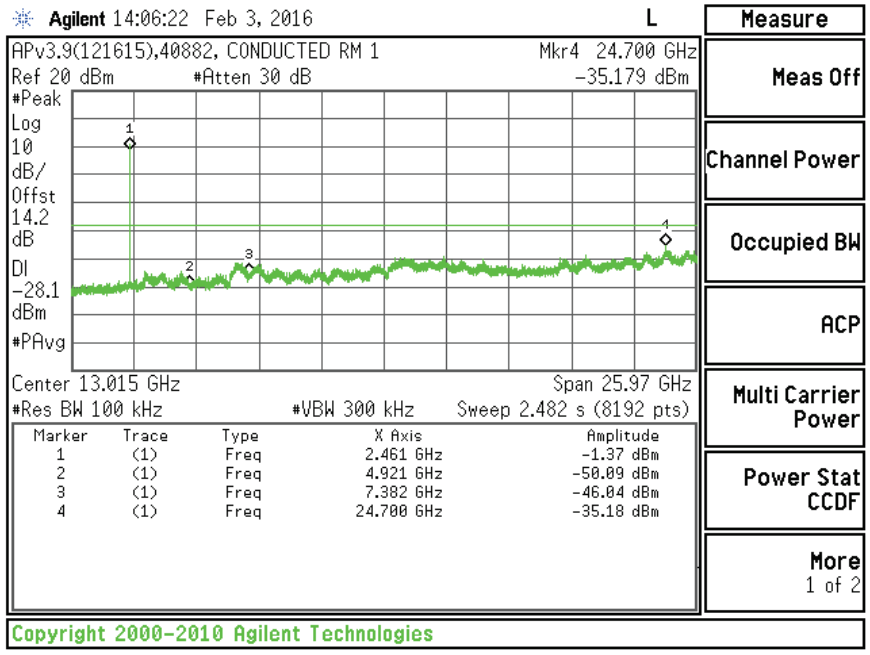
HIGH CHANNEL BANDEDGE, Chain 1



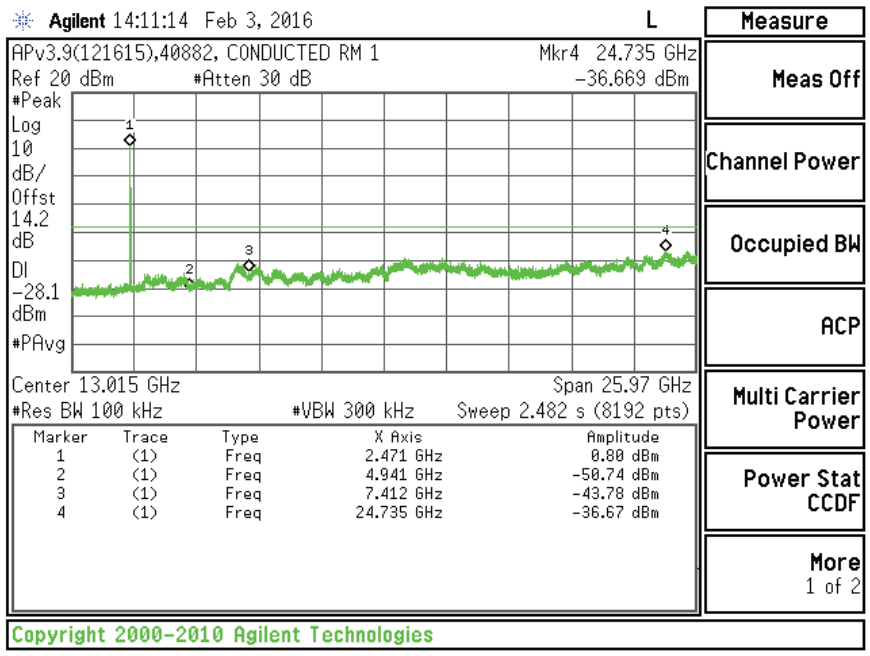
OUT-OF-BAND EMISSIONS, Chain 1



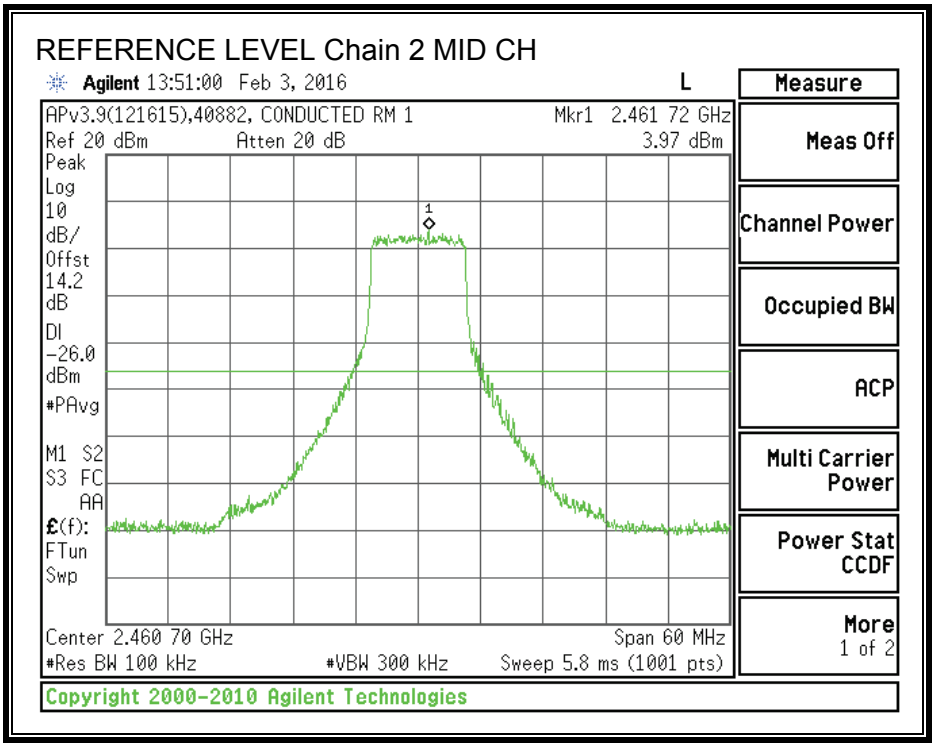
OUT OF BAND Chain 1 MID CH



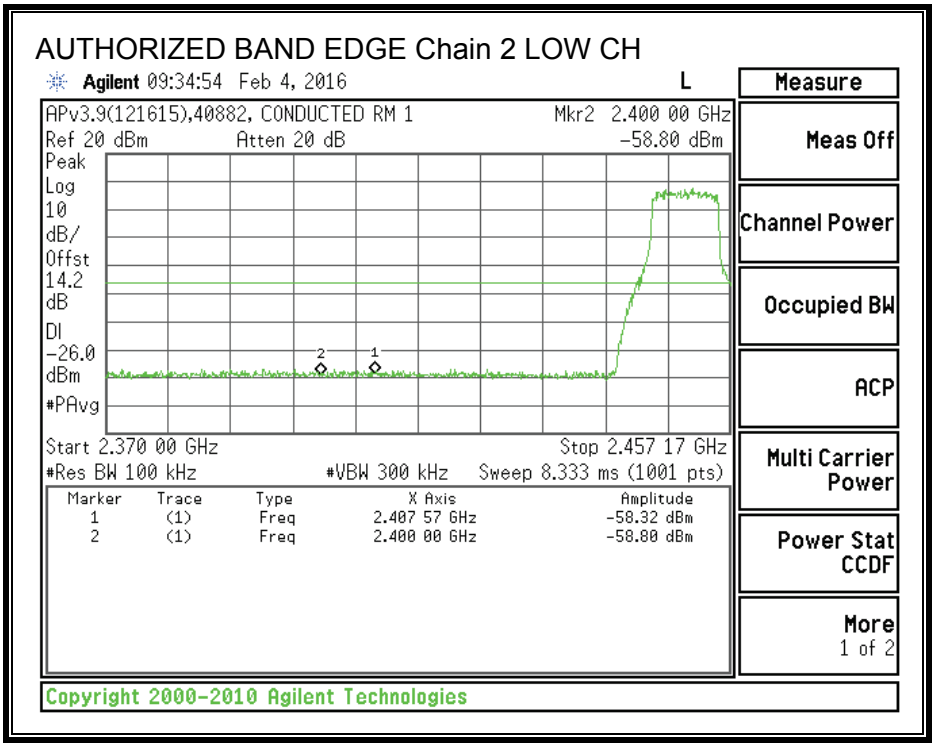
OUT OF BAND Chain 1 HIGH CH



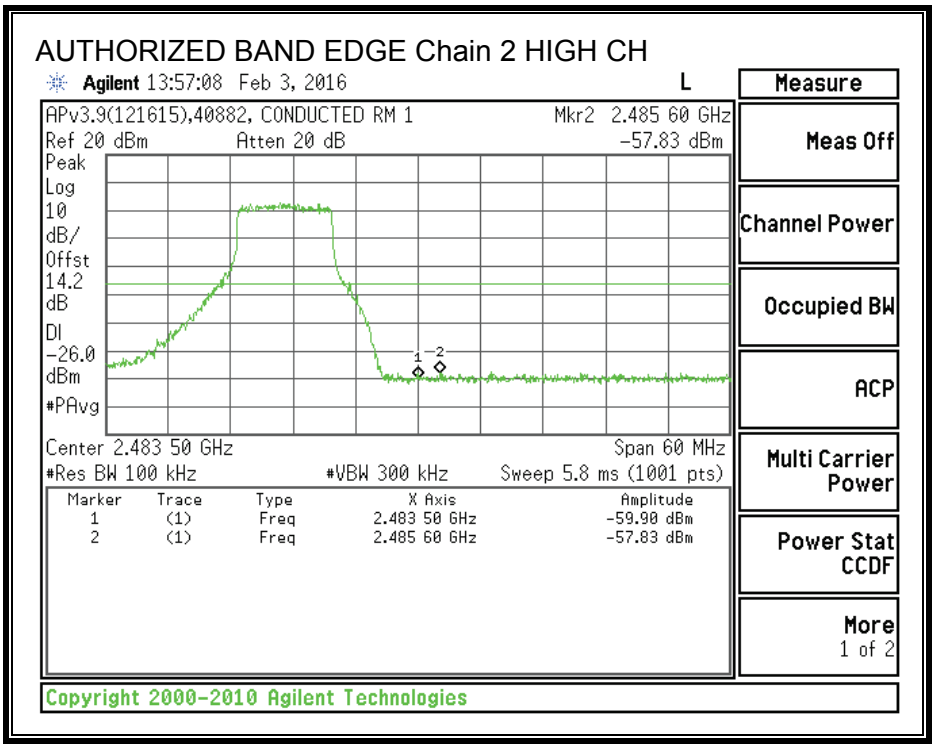
IN-BAND REFERENCE LEVEL, Chain 2



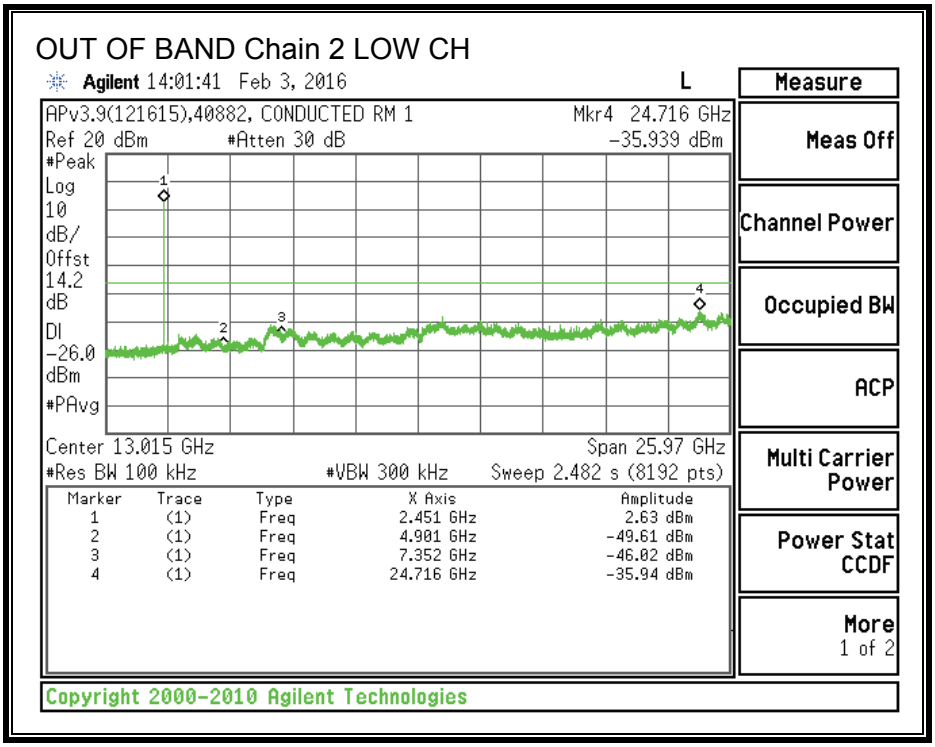
LOW CHANNEL BANDEDGE, Chain 2



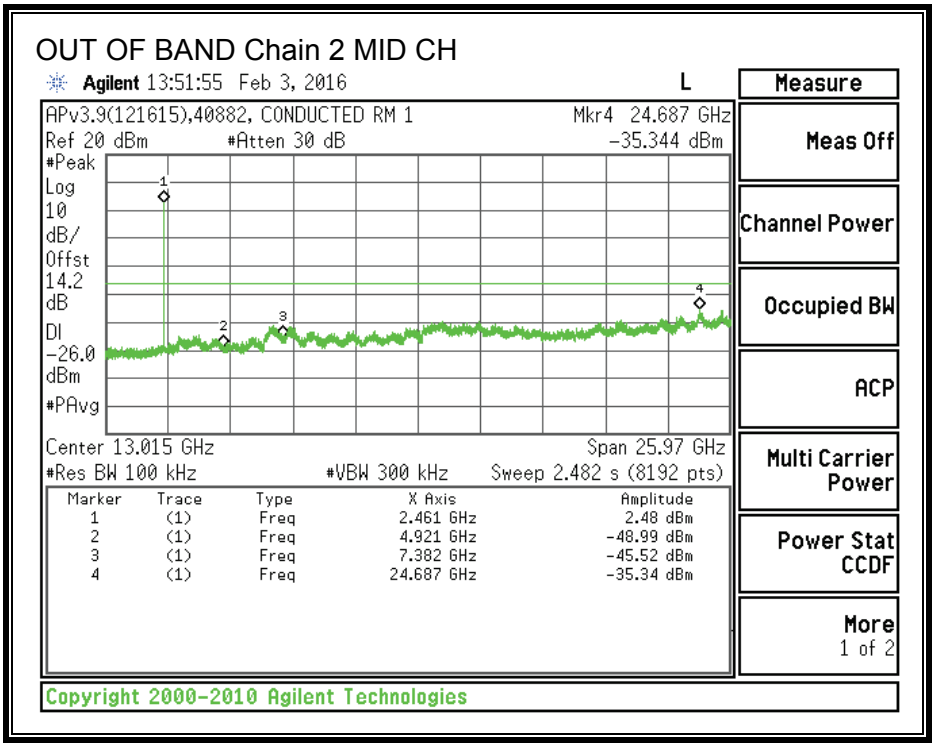
HIGH CHANNEL BANDEDGE, Chain 2



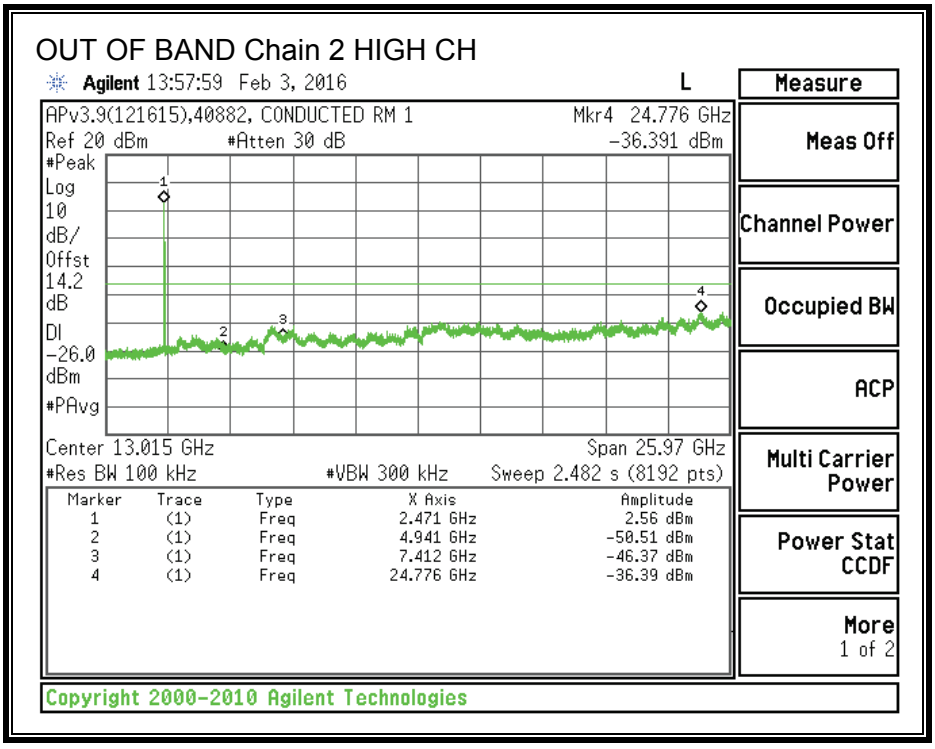
OUT-OF-BAND EMISSIONS, Chain 2



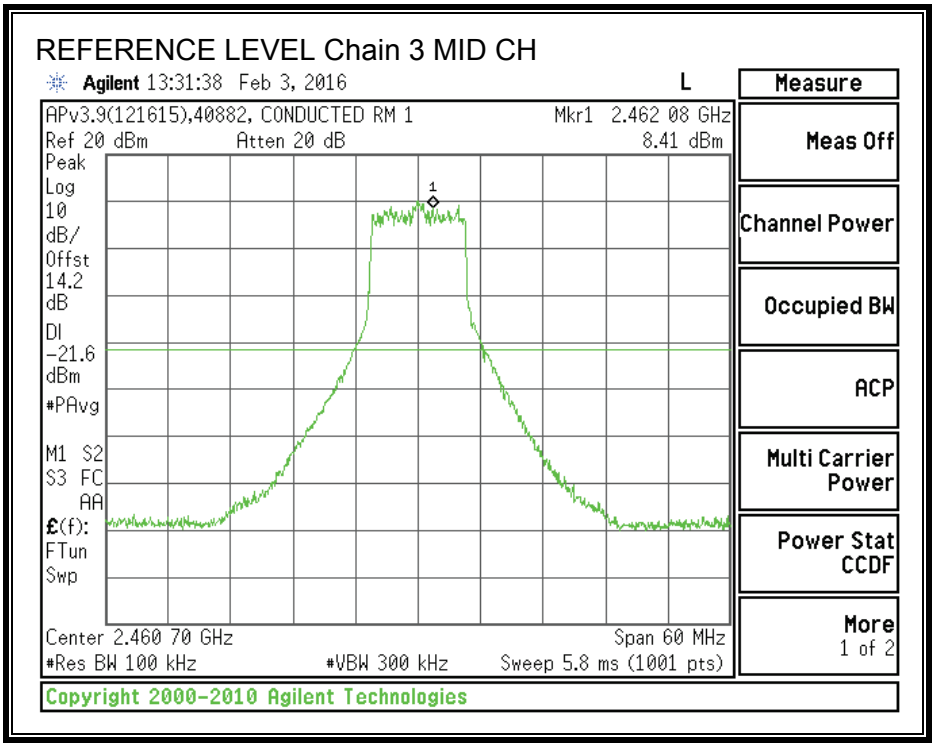
OUT OF BAND Chain 2 MID CH



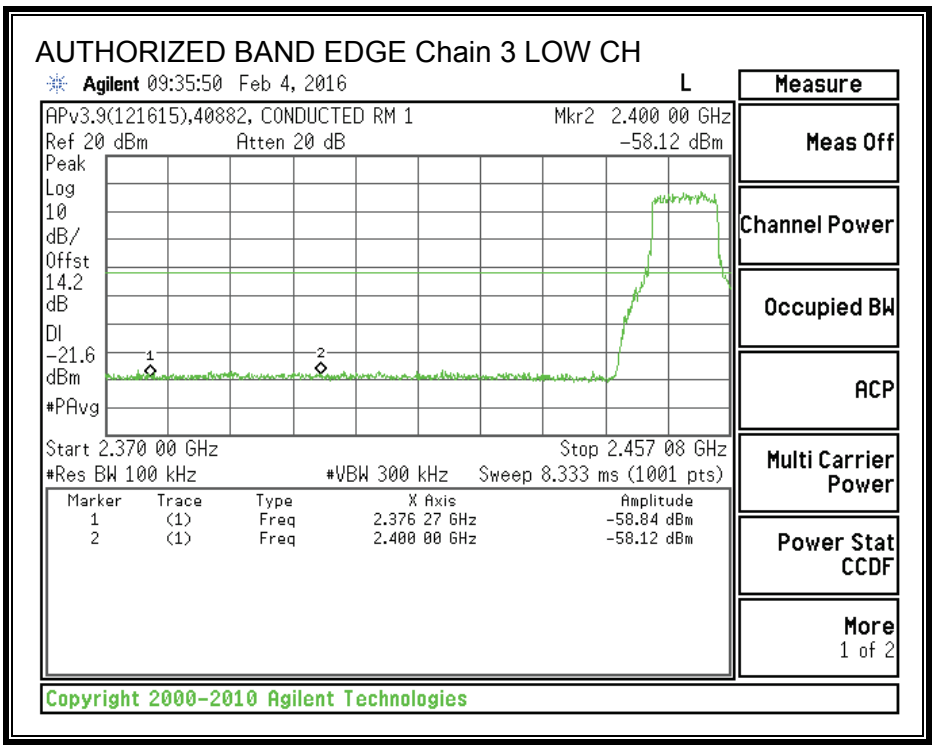
OUT OF BAND Chain 2 HIGH CH



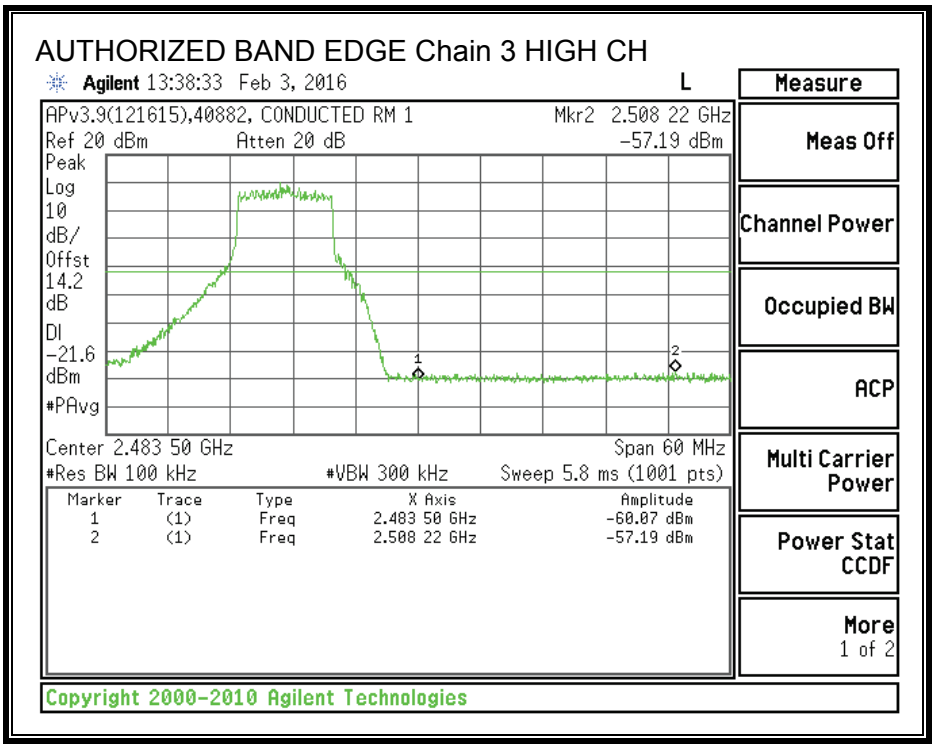
IN-BAND REFERENCE LEVEL, Chain 3



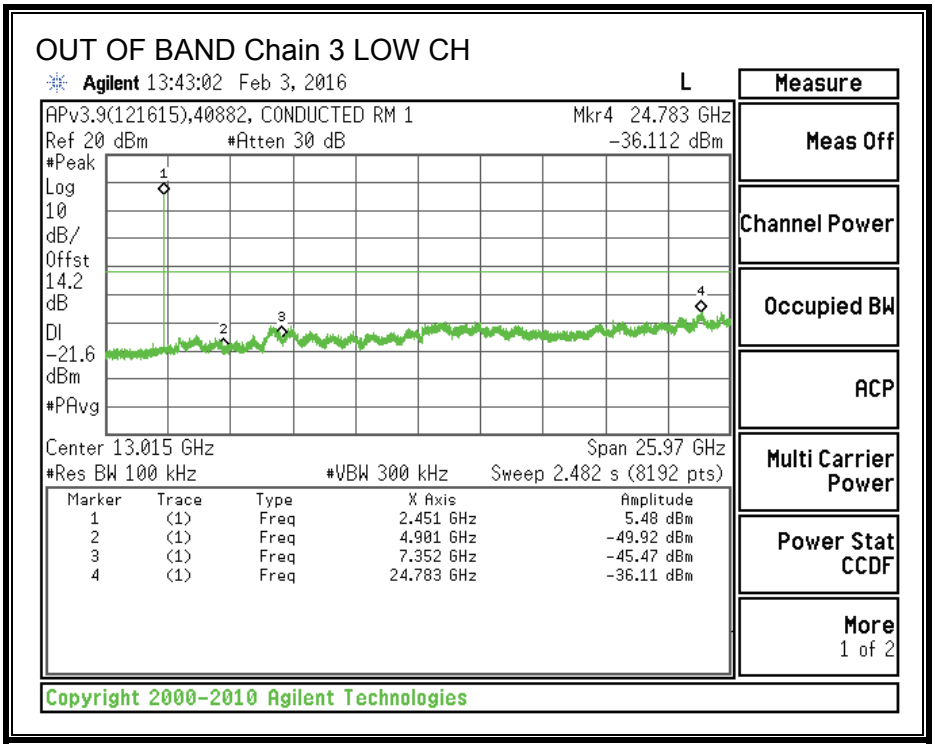
LOW CHANNEL BANDEDGE, Chain 3



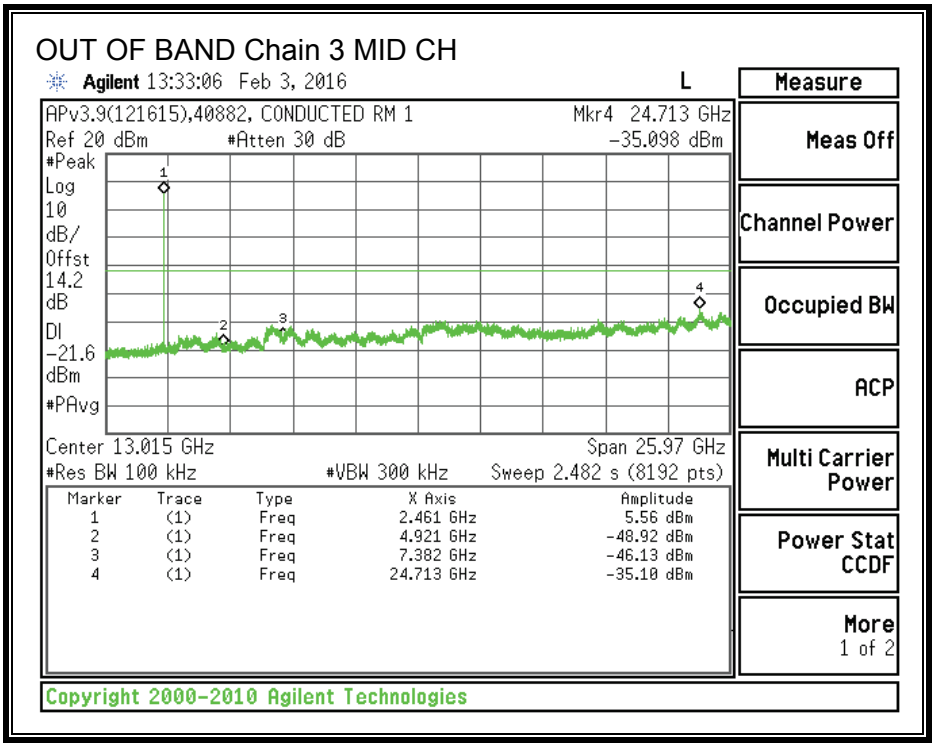
HIGH CHANNEL BANDEDGE, Chain 3



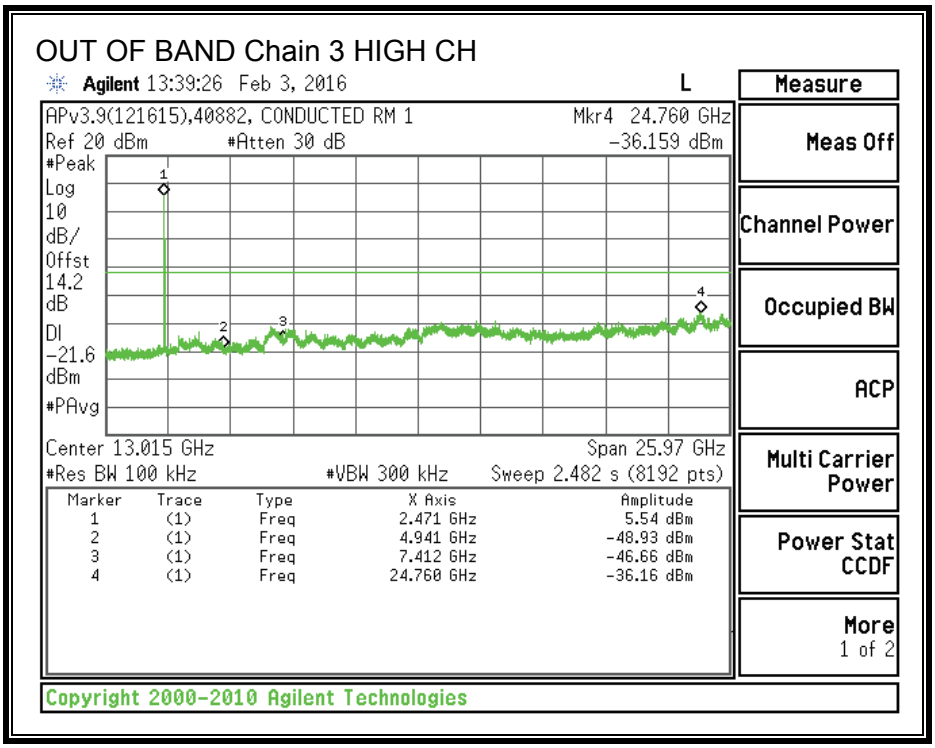
OUT-OF-BAND EMISSIONS, Chain 3



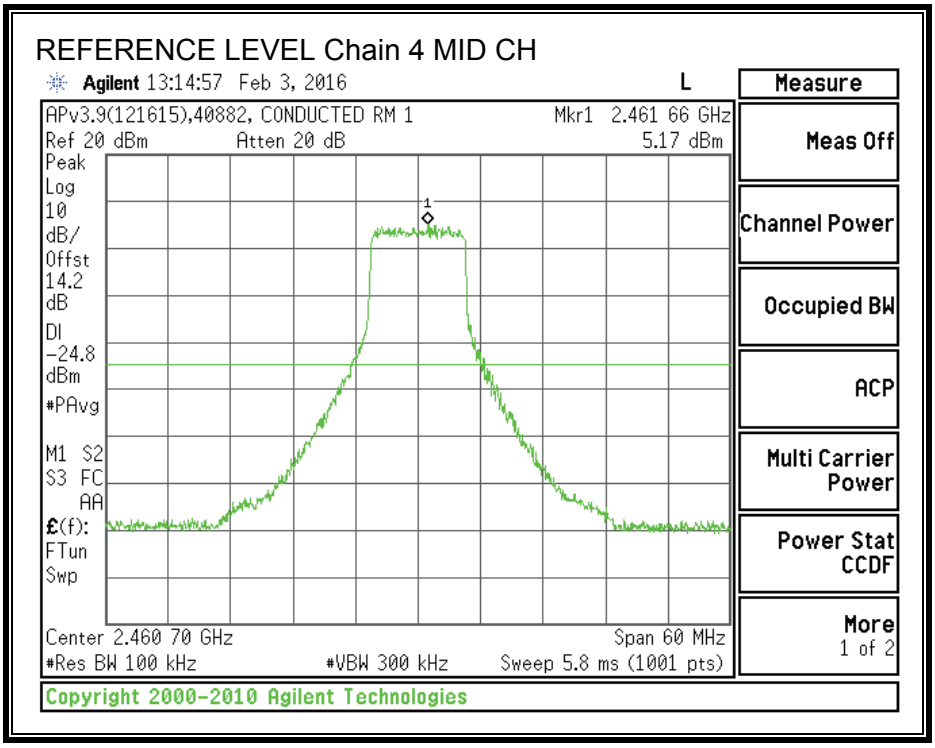
OUT OF BAND Chain 3 MID CH



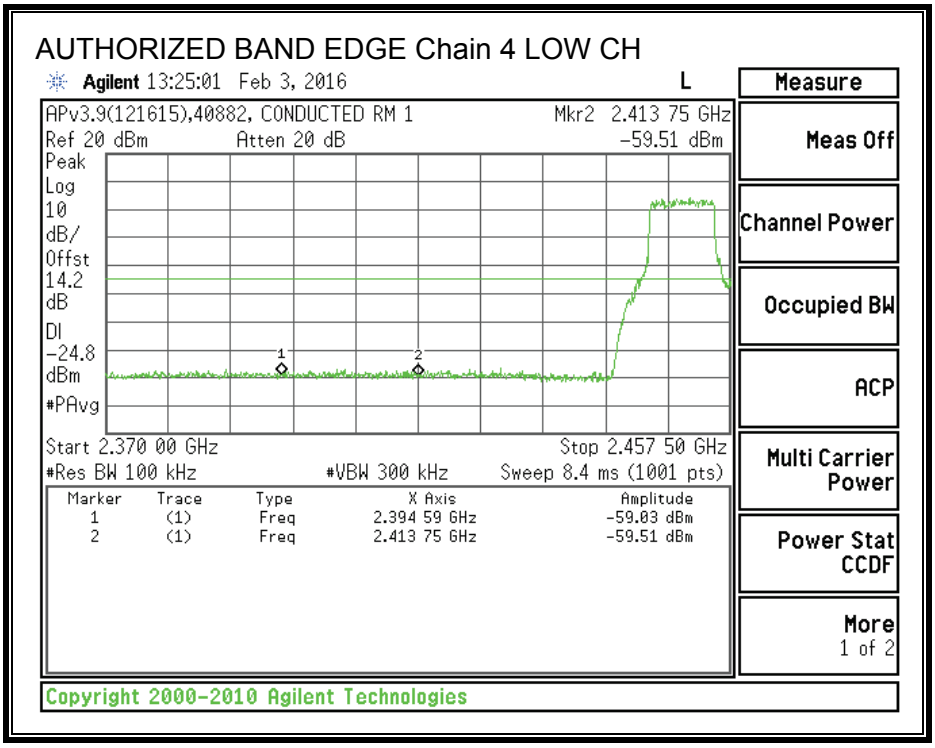
OUT OF BAND Chain 3 HIGH CH



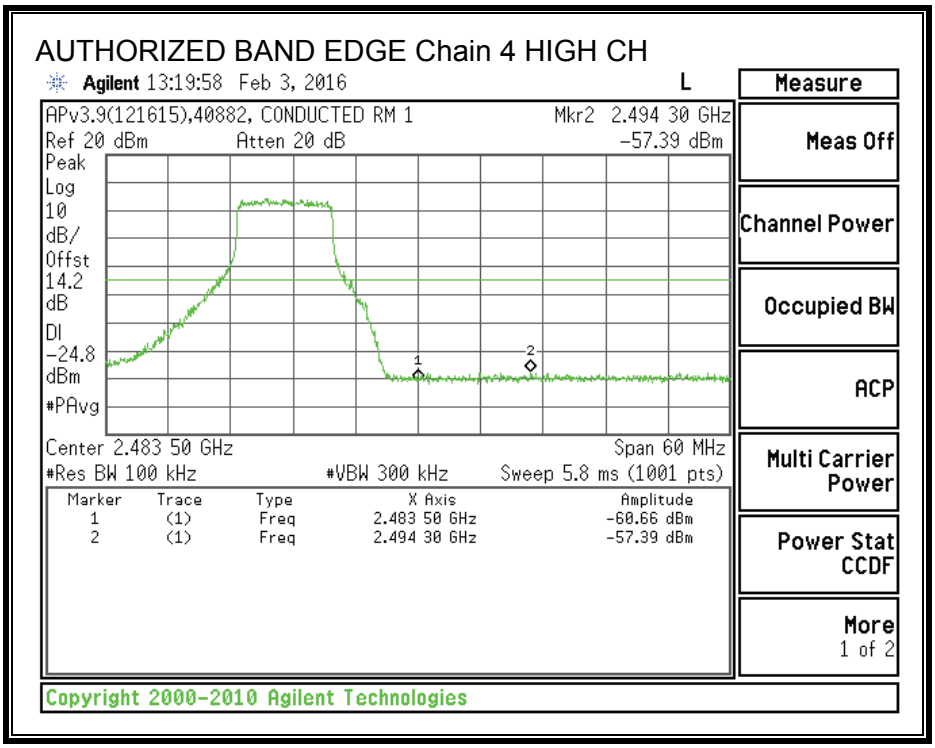
IN-BAND REFERENCE LEVEL, Chain 4



LOW CHANNEL BANDEDGE, Chain 4

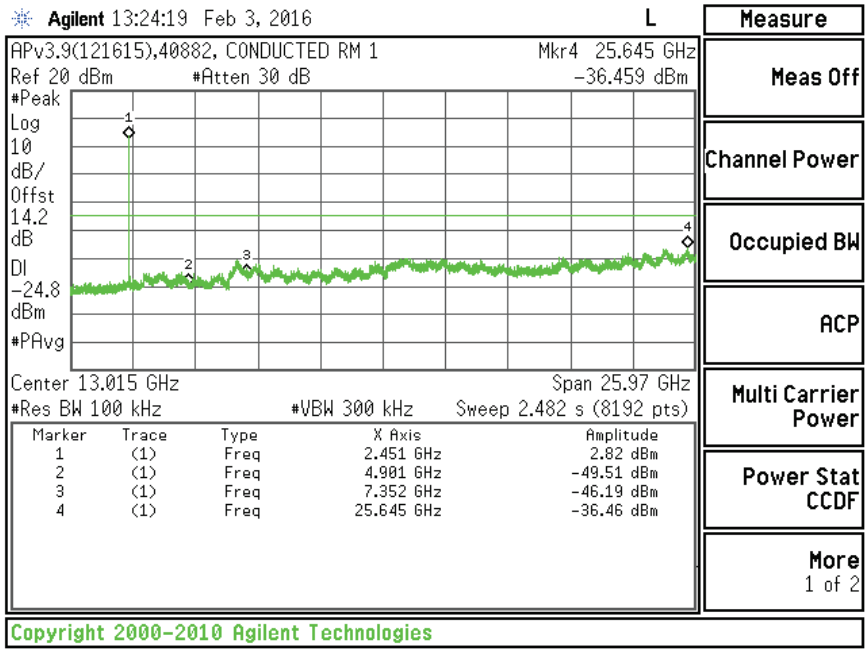


HIGH CHANNEL BANDEDGE, Chain 4

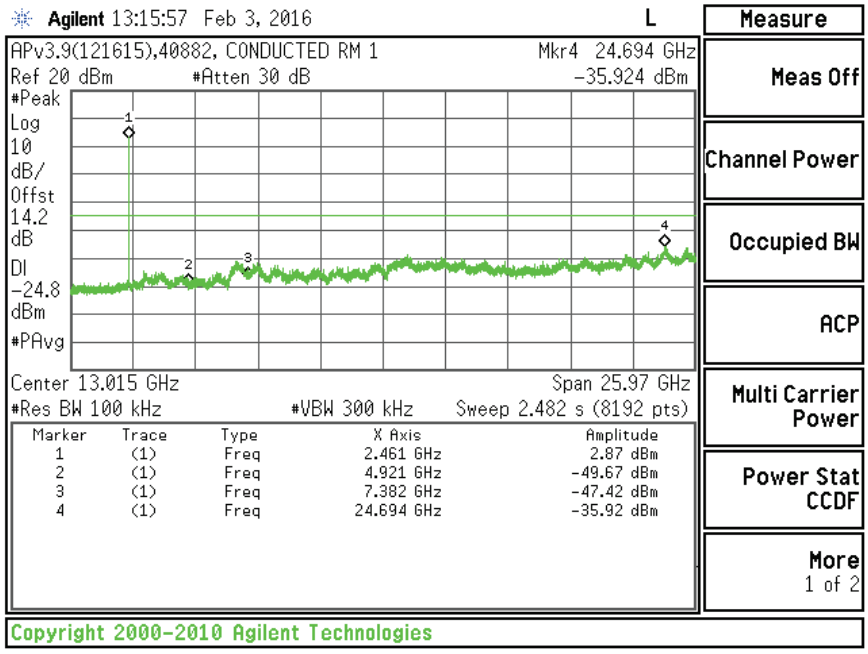


OUT-OF-BAND EMISSIONS, Chain 4

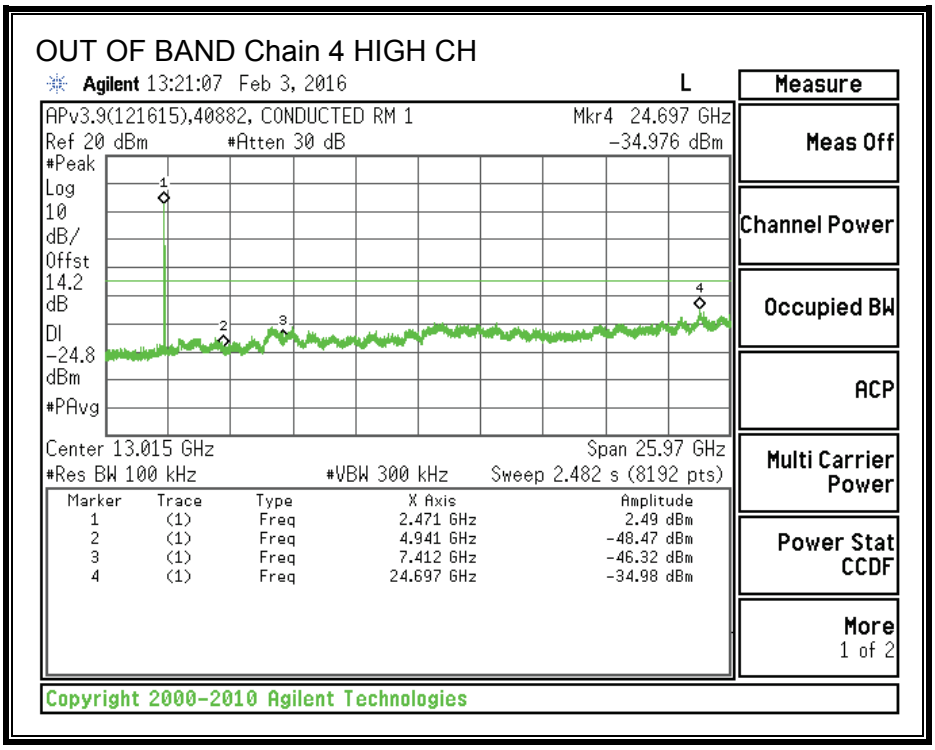
OUT OF BAND Chain 4 LOW CH



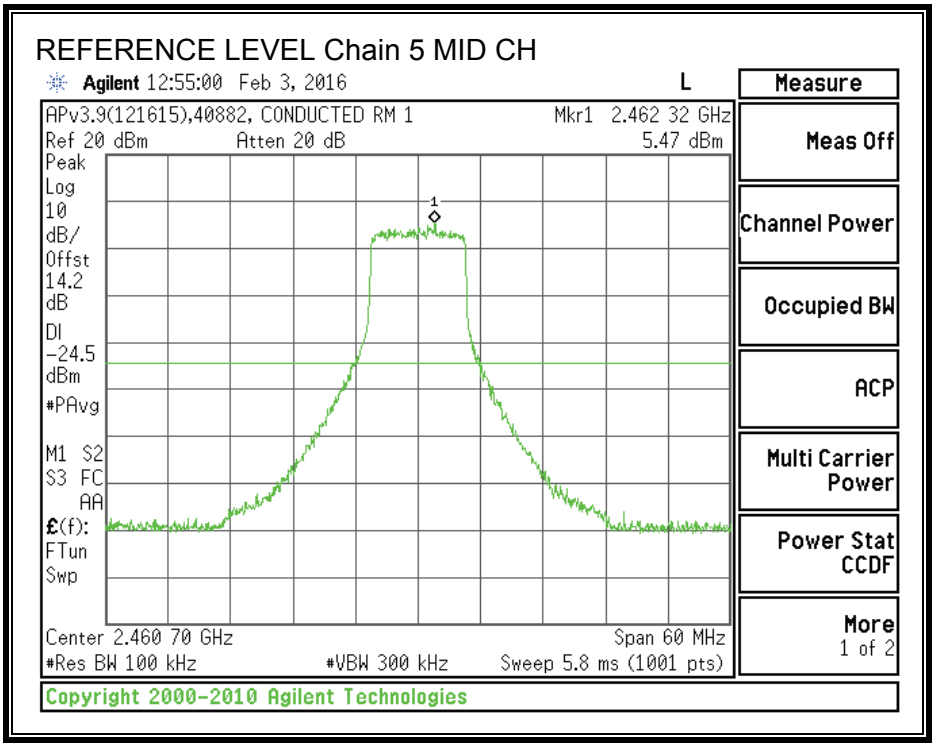
OUT OF BAND Chain 4 MID CH



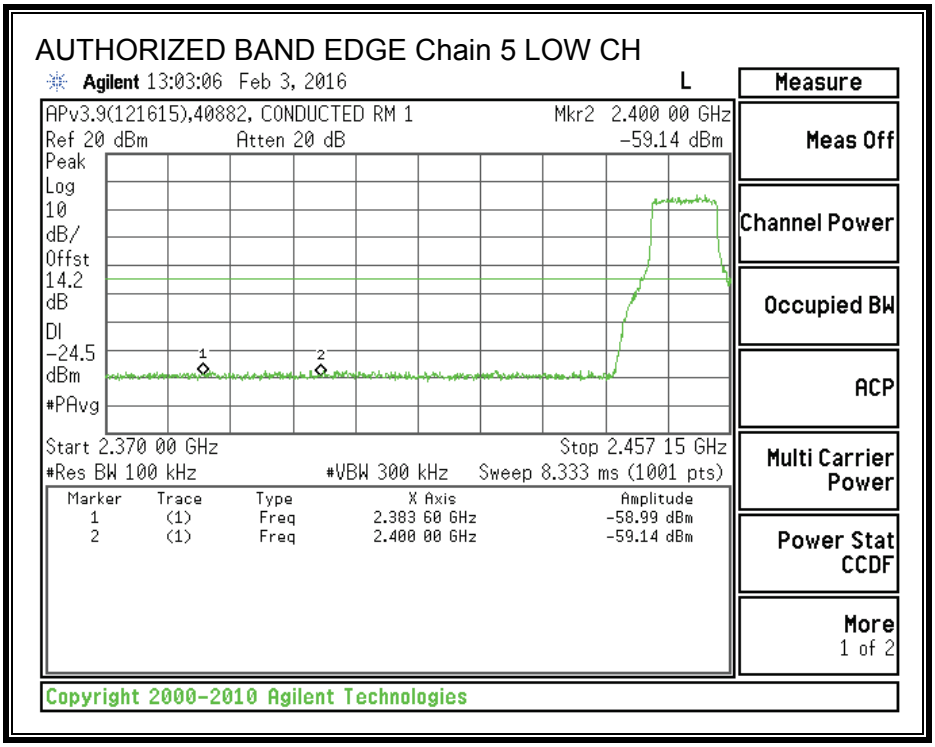
OUT OF BAND Chain 4 HIGH CH



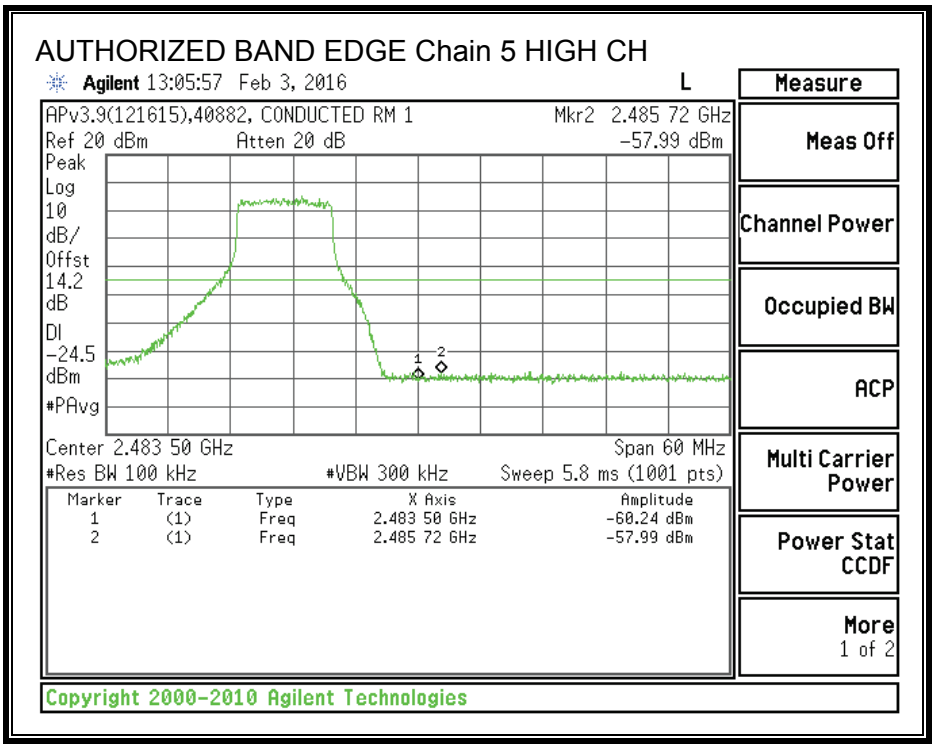
IN-BAND REFERENCE LEVEL, Chain 5



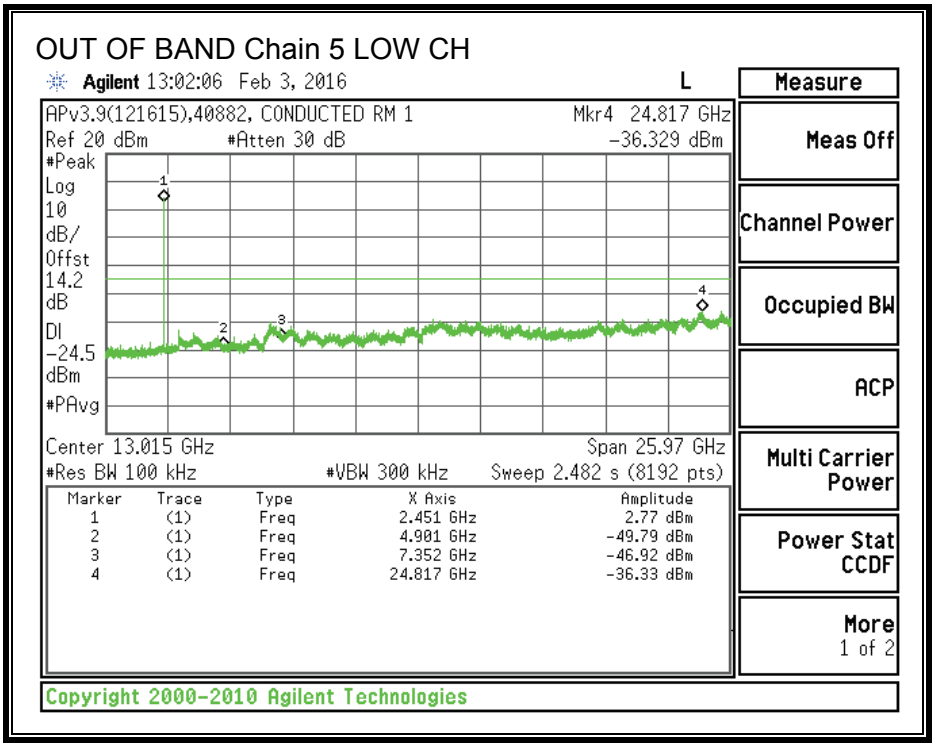
LOW CHANNEL BANDEDGE, Chain 5



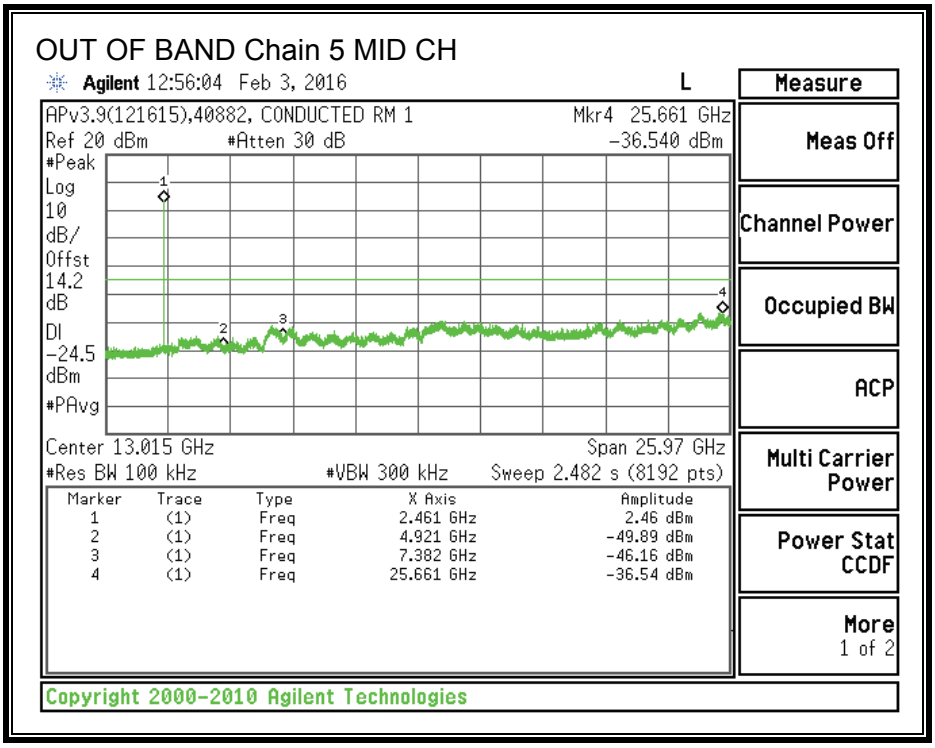
HIGH CHANNEL BANDEDGE, Chain 5



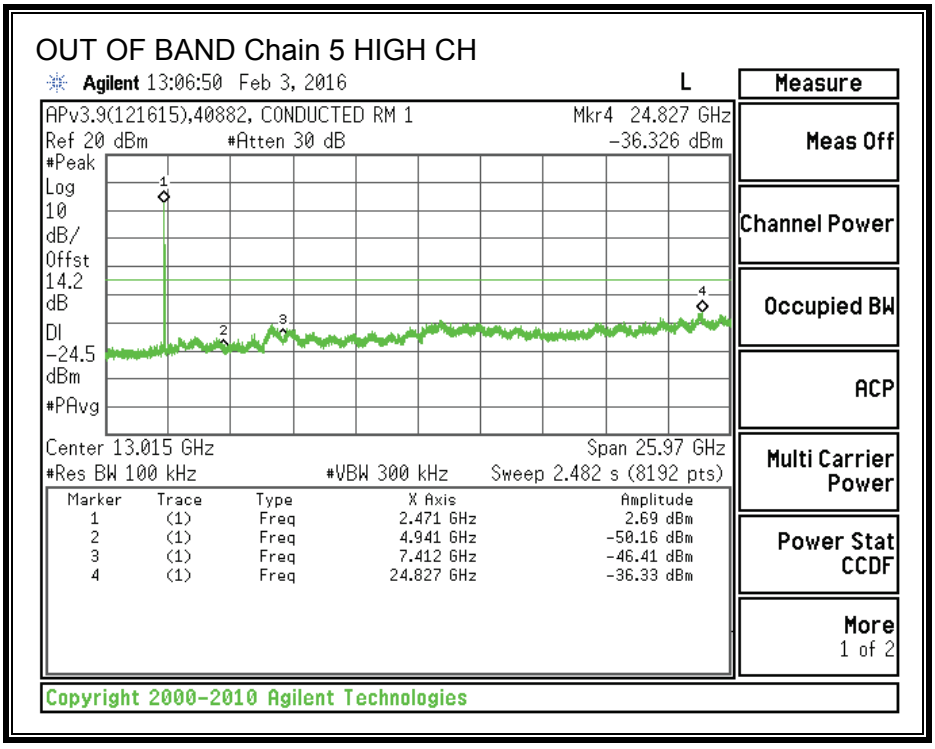
OUT-OF-BAND EMISSIONS, Chain 5



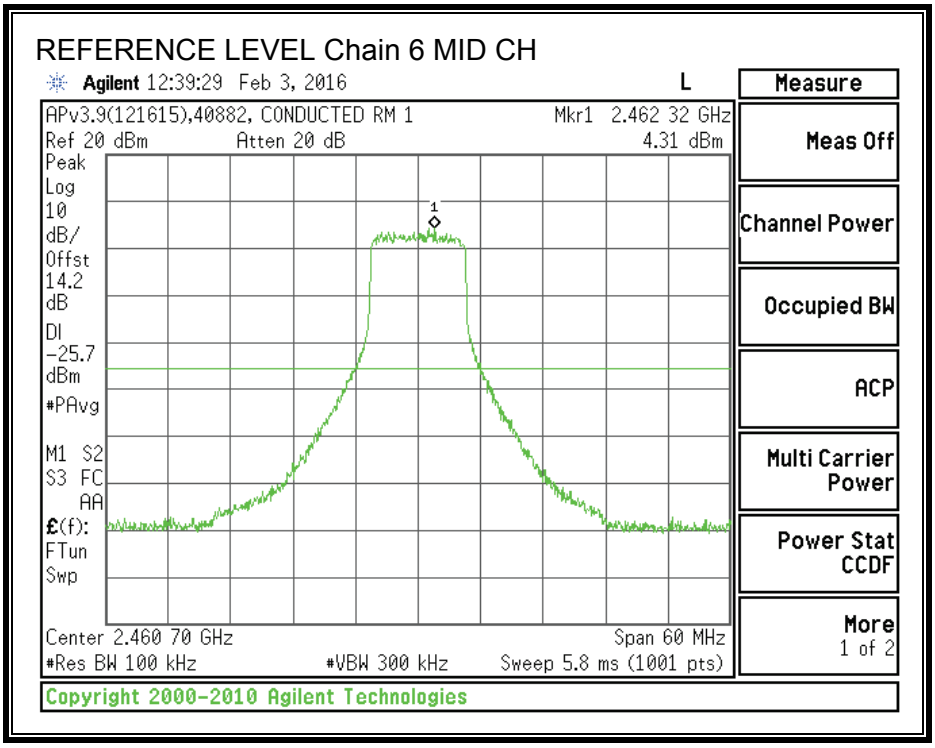
OUT OF BAND Chain 5 MID CH



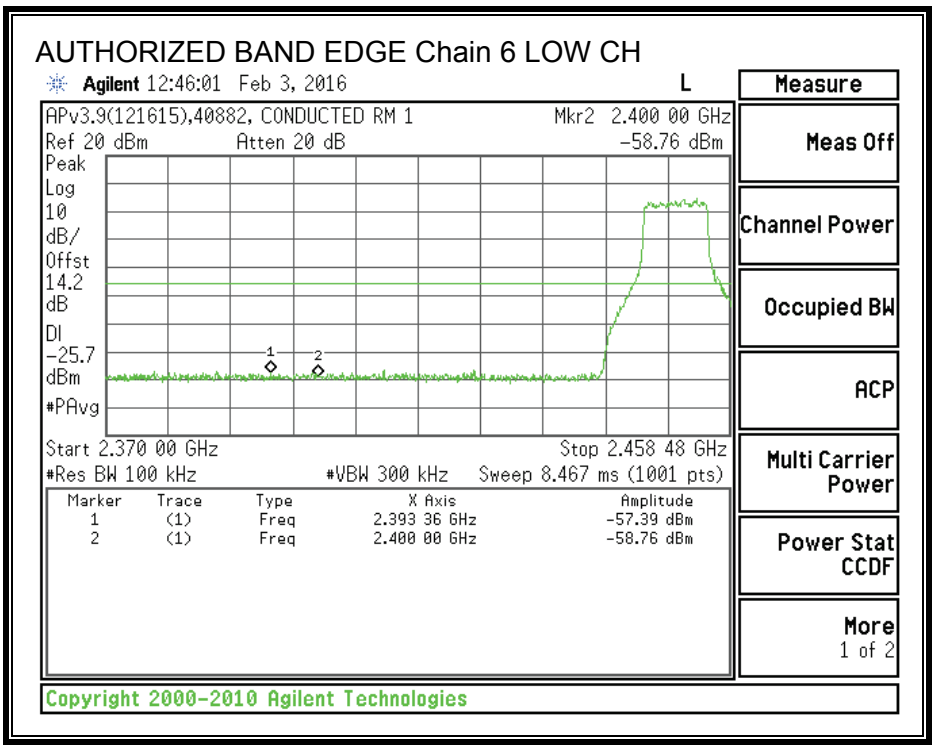
OUT OF BAND Chain 5 HIGH CH



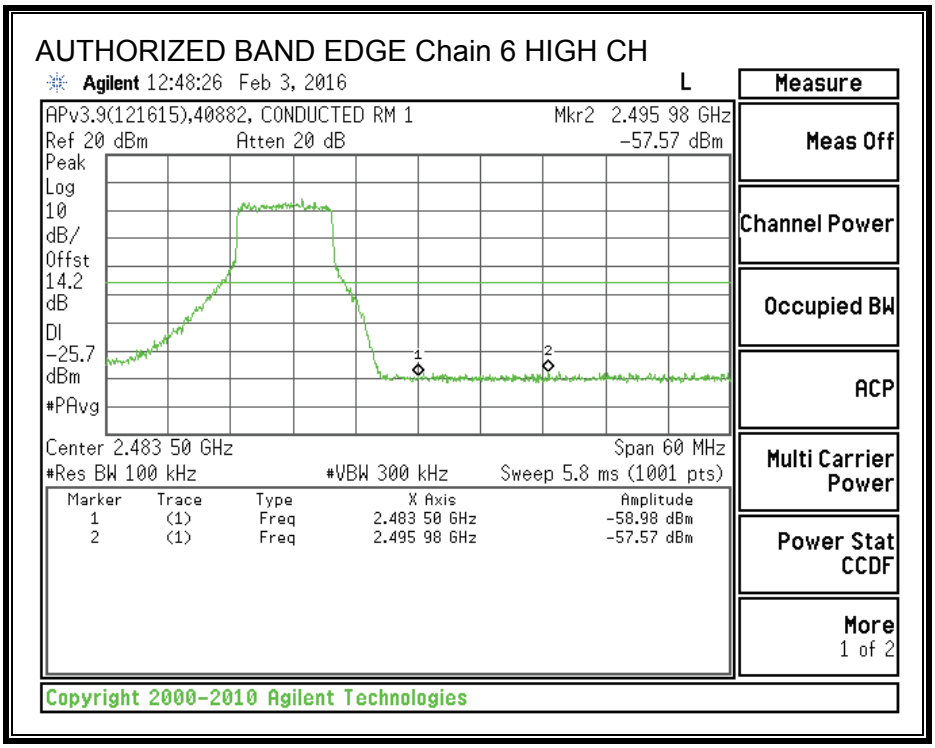
IN-BAND REFERENCE LEVEL, Chain 6



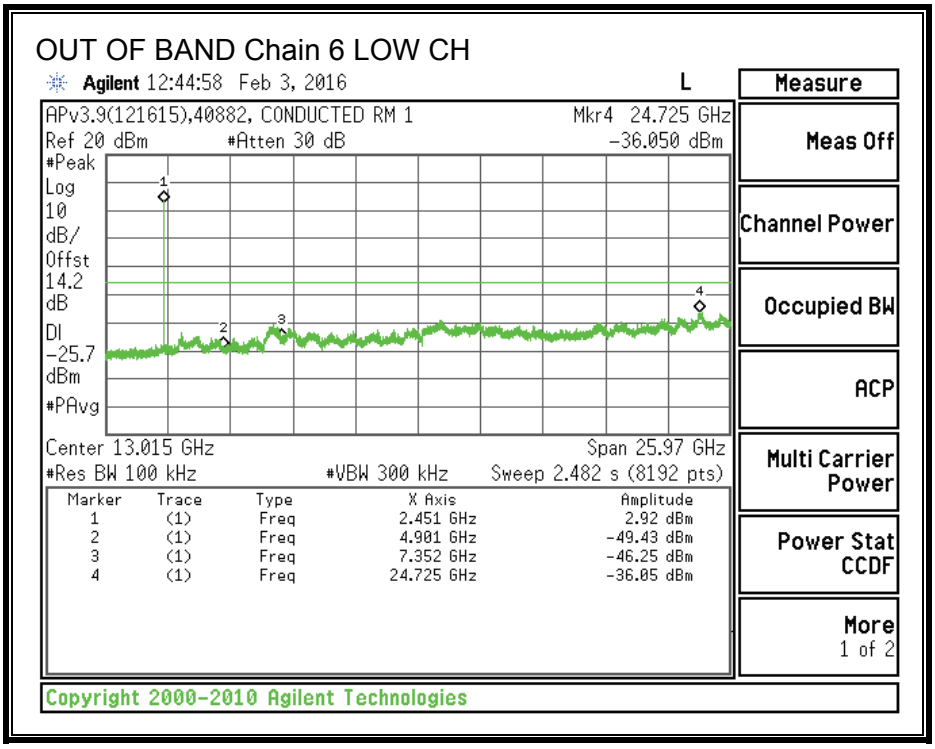
LOW CHANNEL BANDEDGE, Chain 6



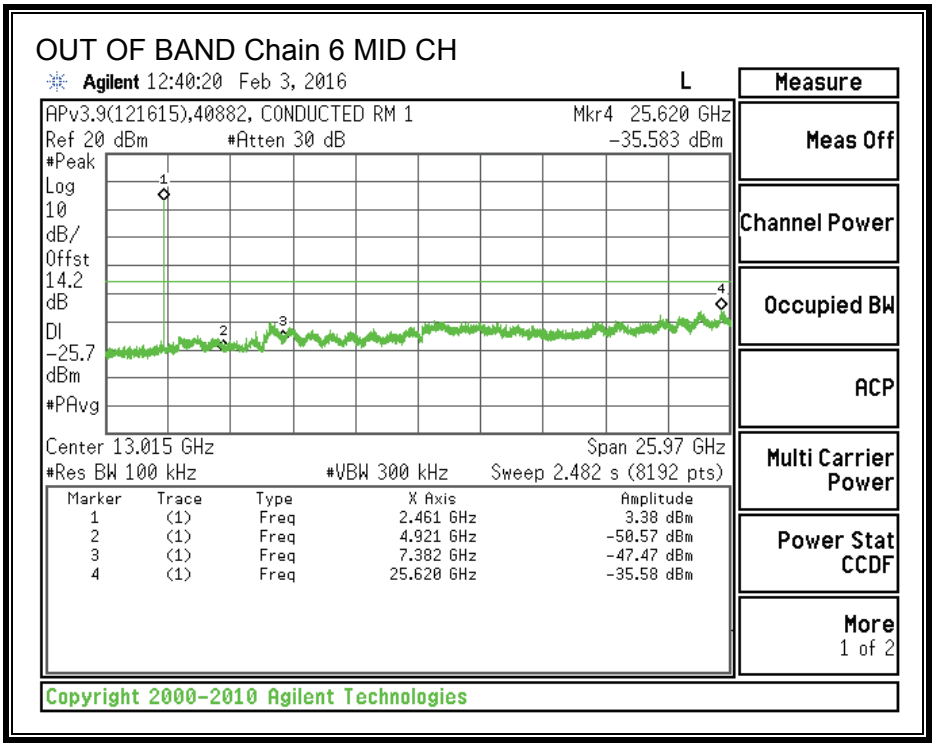
HIGH CHANNEL BANDEDGE, Chain 6



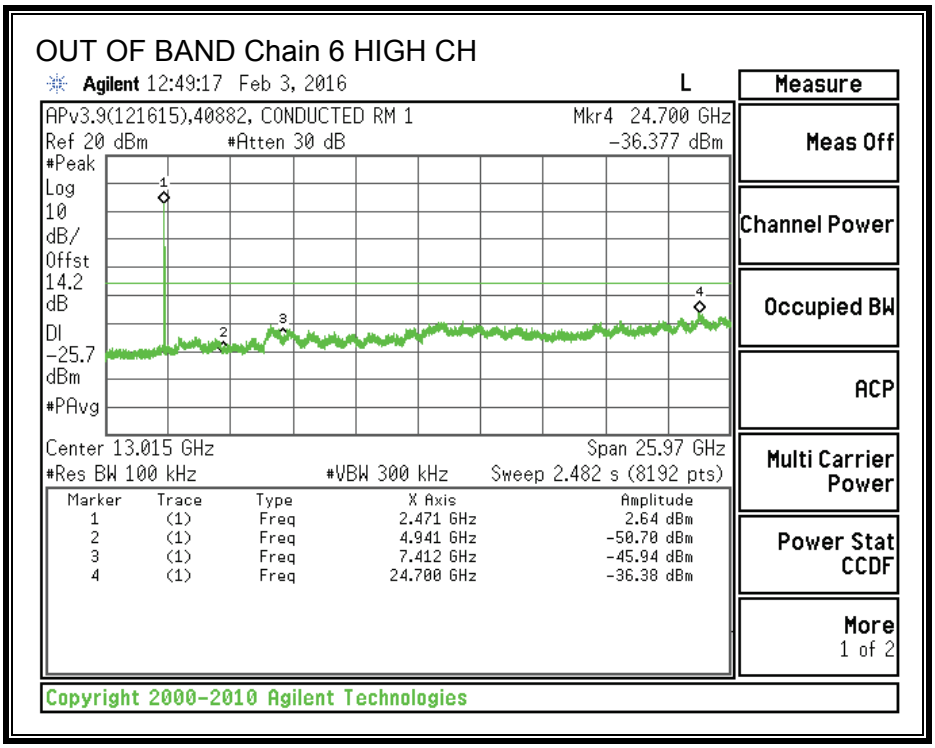
OUT-OF-BAND EMISSIONS, Chain 6



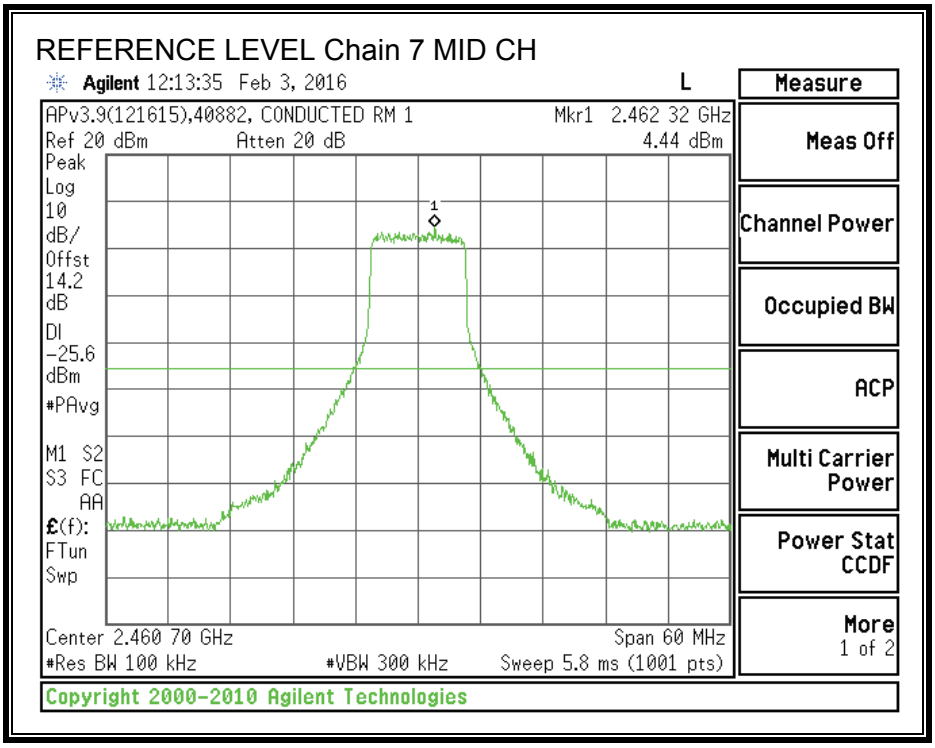
OUT OF BAND Chain 6 MID CH



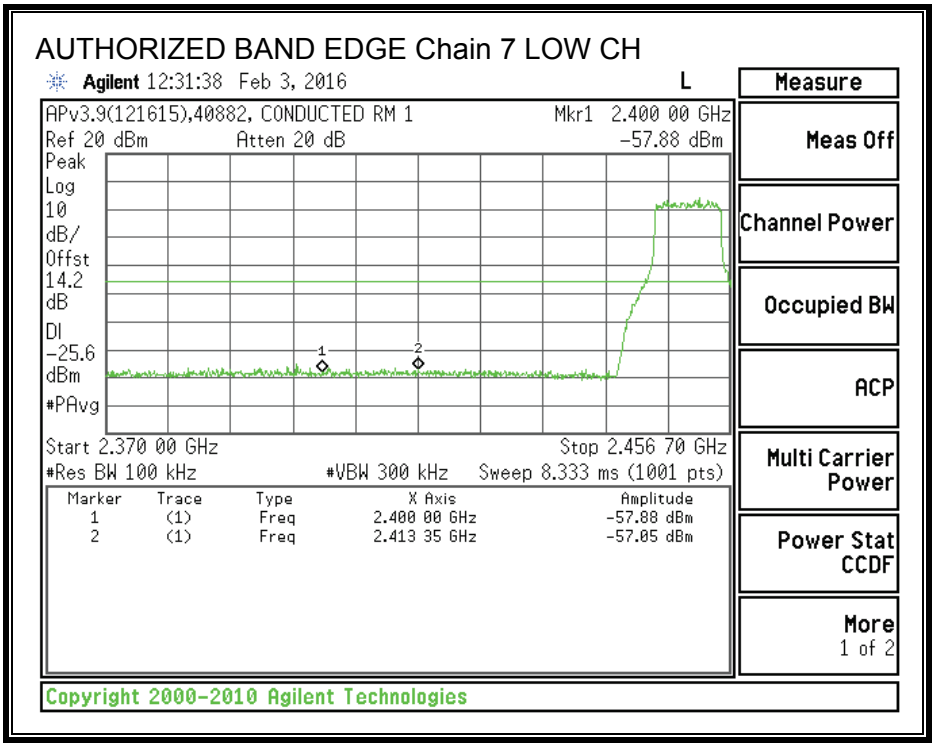
OUT OF BAND Chain 6 HIGH CH



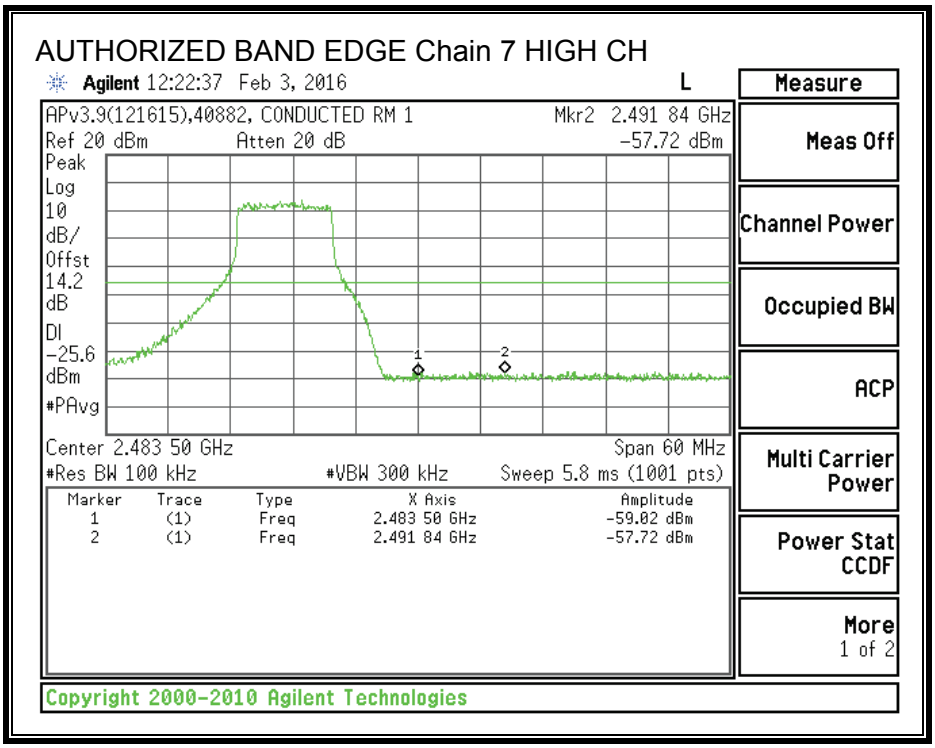
IN-BAND REFERENCE LEVEL, Chain 7



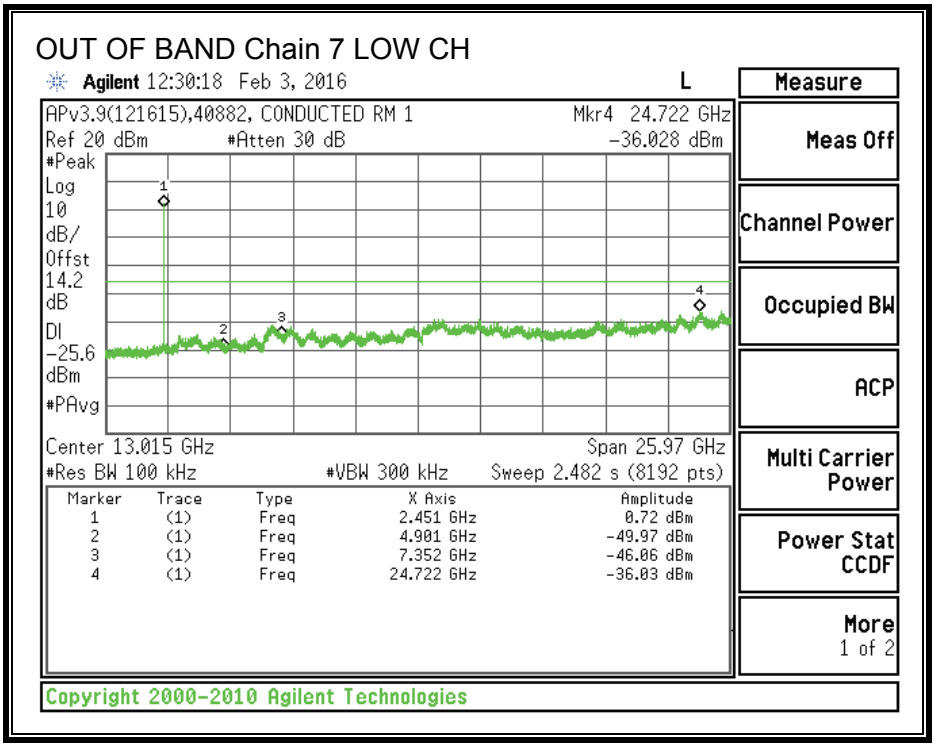
LOW CHANNEL BANDEDGE, Chain 7



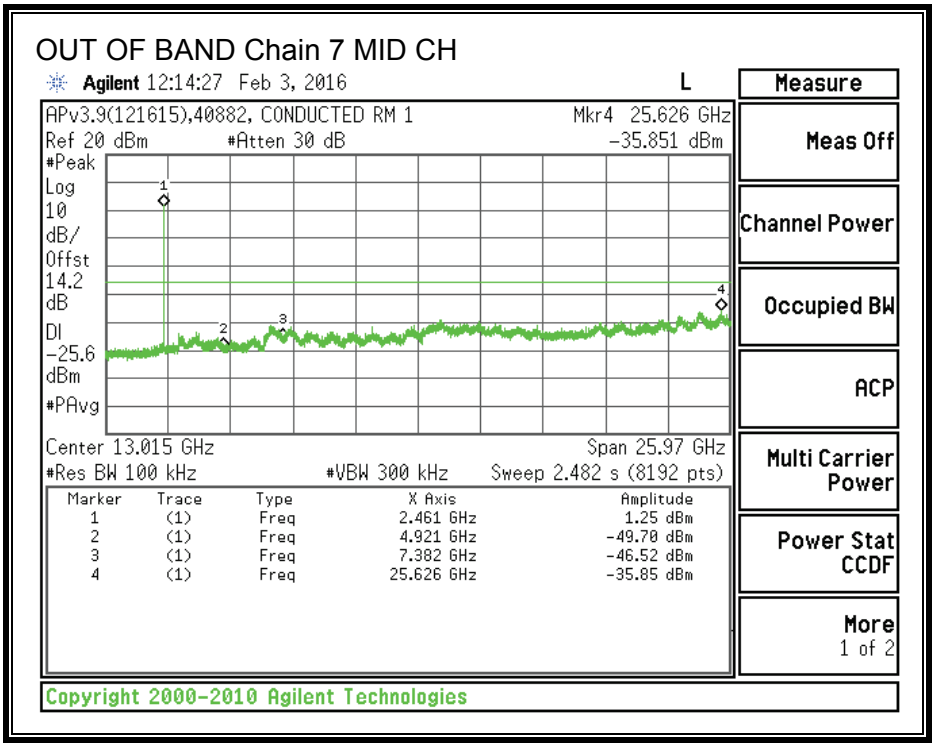
HIGH CHANNEL BANDEDGE, Chain 7



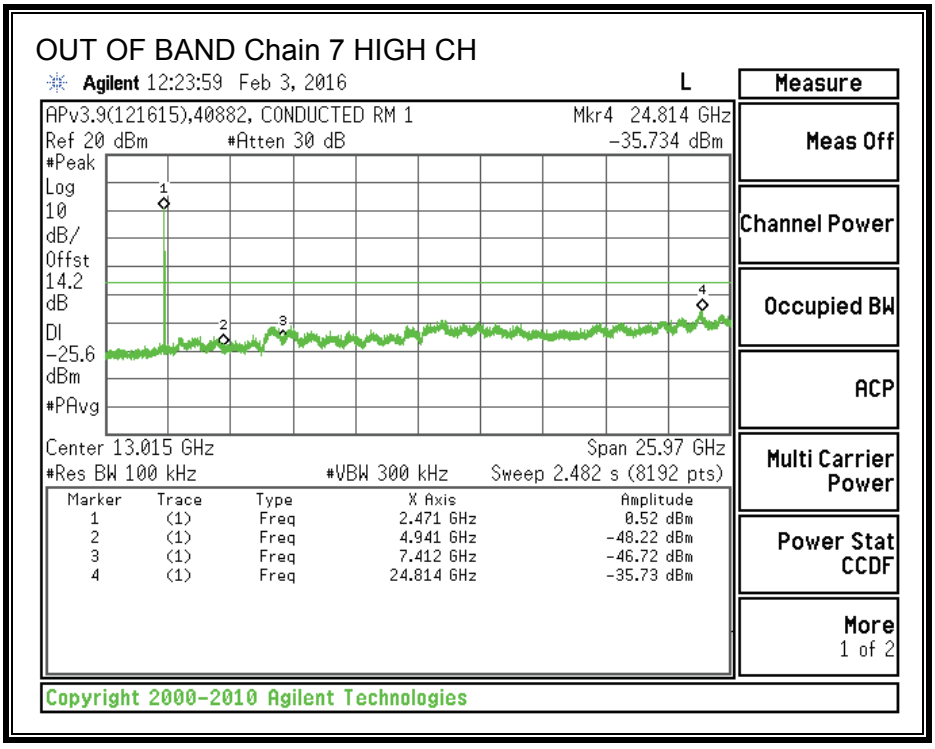
OUT-OF-BAND EMISSIONS, Chain 7



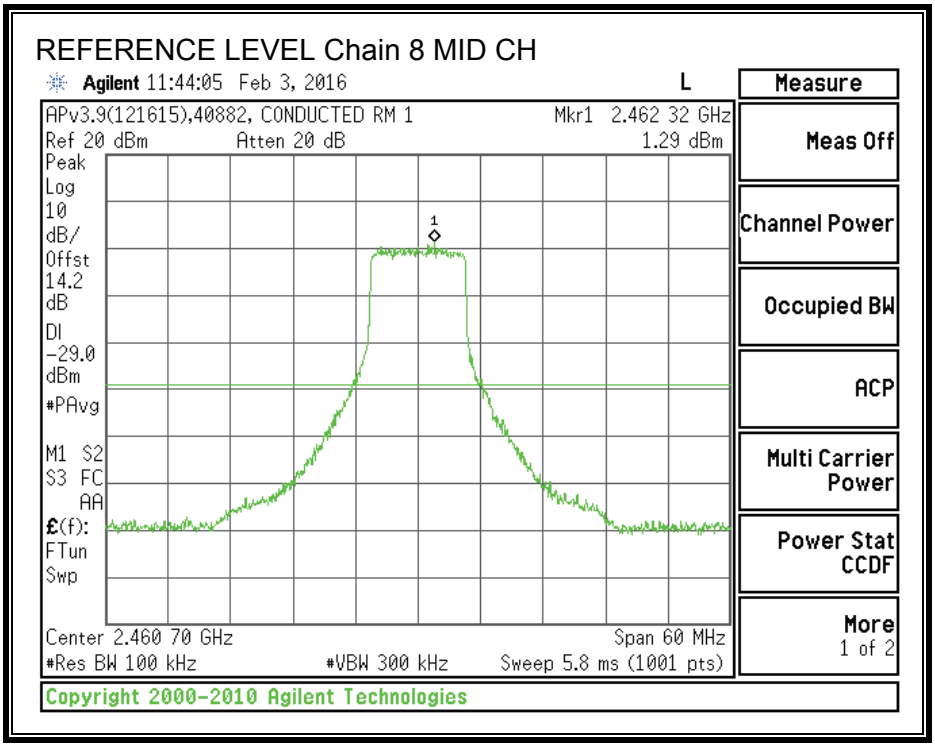
OUT OF BAND Chain 7 MID CH



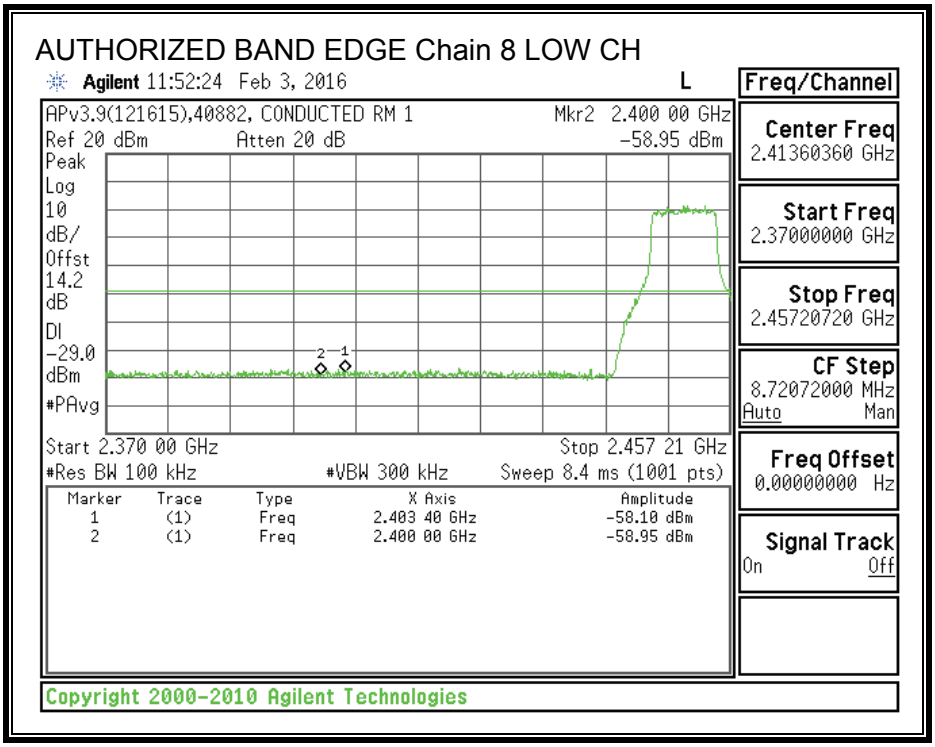
OUT OF BAND Chain 7 HIGH CH



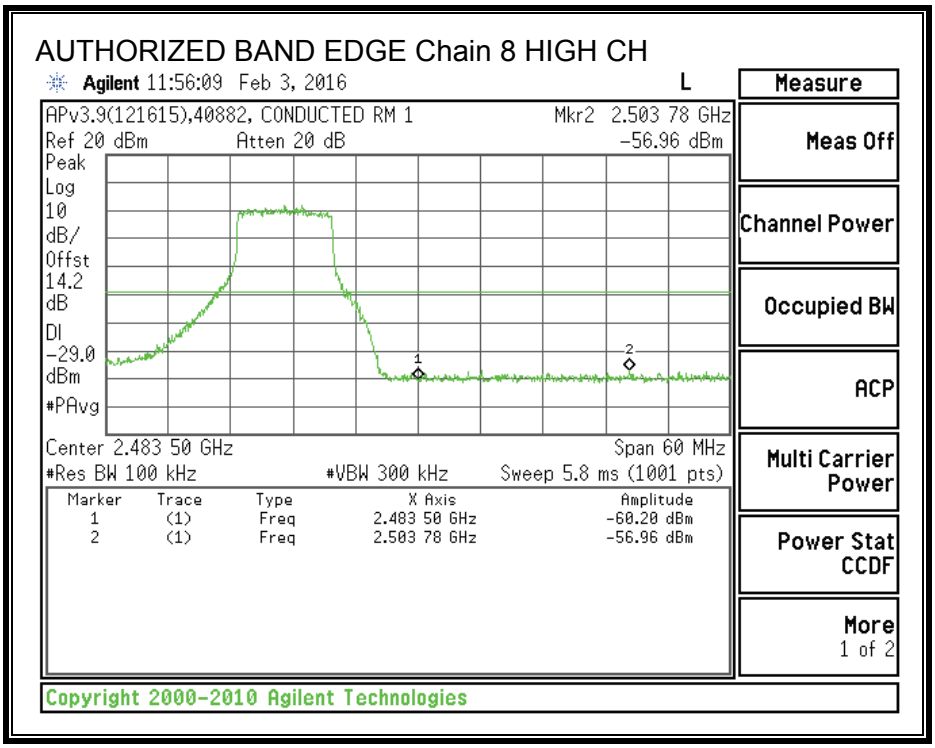
IN-BAND REFERENCE LEVEL, Chain 8



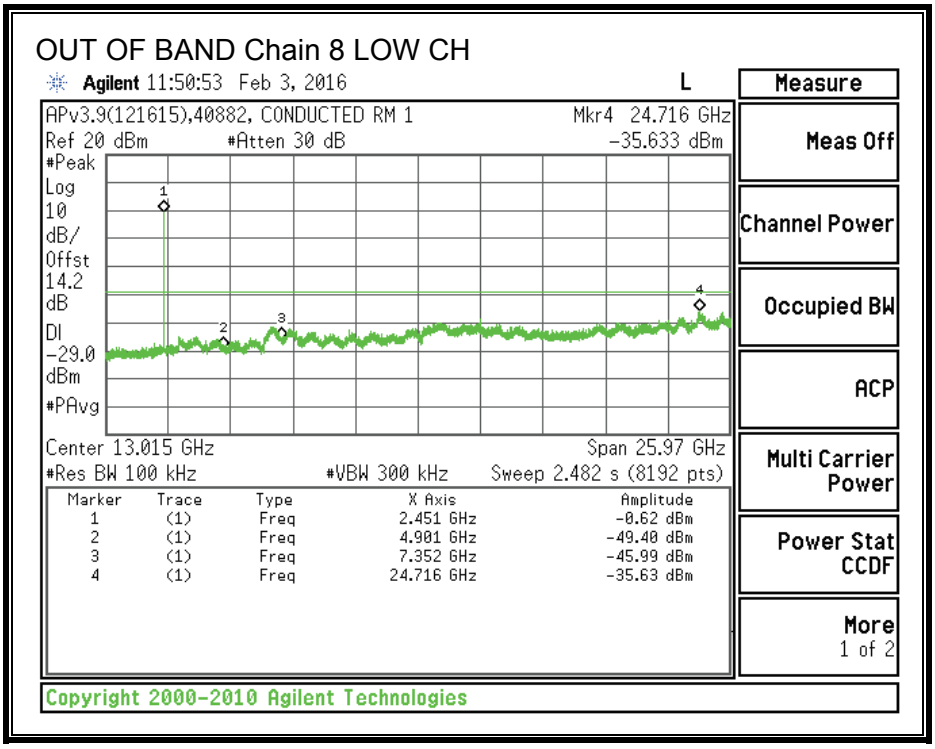
LOW CHANNEL BANDEDGE, Chain 8



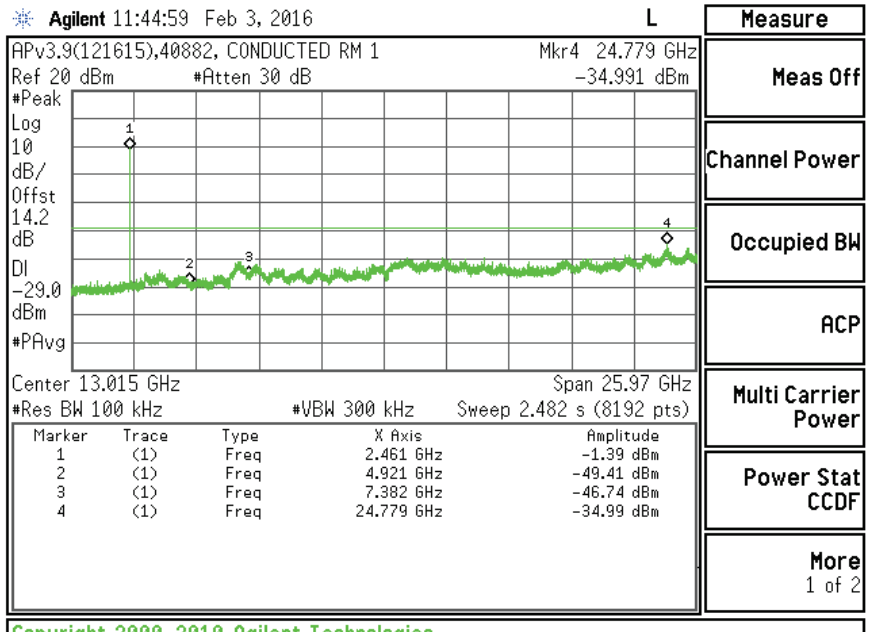
HIGH CHANNEL BANDEDGE, Chain 8



OUT-OF-BAND EMISSIONS, Chain 8



OUT OF BAND Chain 8 MID CH



OUT OF BAND Chain 8 HIGH CH