FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

WIFI ACCESS POINT

MODEL NUMBER: GFMN100

FCC ID: A4RGFMN100

REPORT NUMBER: 15U20617-E1V3

ISSUE DATE: SEPTEMBER 17, 2015

Prepared for
GOOGLE
1600 AMPHITEATRE PARKWAY
MOUNTAIN VIEW, CA 94043, U.S.A.

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	9/4/15	Initial Issue	F. de Anda
V2	9/15/15	Added reference to KDB 662911 D01 in section 2	F. de Anda
V3	9/17/15	Update- Sections 7, 9.1 and 9.4	F. de Anda

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: GOOGLE
1600 AMPHITEATRE PARKWAY
MOUNTAIN VIEW, CA 94043, U.S.A

EUT DESCRIPTION: WIFI ACCESS POINT

MODEL: GFMN100

SERIAL NUMBER: BWAFNS1524E0004

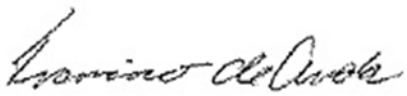
DATE TESTED: May 12, 2015 – July 29, 2015

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

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

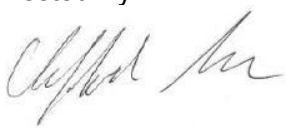
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section.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

Approved & Released For
UL Verification Services Inc. By:



FRANCISCO DE ANDA
PROJECT LEAD
UL Verification Services Inc.

Tested By:



CLIFFOR SUSA
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15 and KDB 662911 D01.

Testing for radiated emissions above 1GHz was performed with the EUT elevated at 1.5m instead of 0.8m. 1.5m is the required height in ANSI C63.10:2013 as referenced by RSS GEN issue 4. This test height has been permitted by FCC as discussed in FCC/TCB conference call in December 2014.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

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

47173 Benicia Street	47266 Benicia Street
☐ Chamber A	☐ Chamber D
☐ Chamber B	☐ Chamber E
☐ Chamber C	☒ Chamber F
	☐ Chamber G
	☐ Chamber H

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

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
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11b/g/n WiFi Access Point

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)
2412 - 2462	802.11b	19.34	85.90
2412 - 2462	802.11g	24.58	287.08
2412 - 2462	802.11n HT20	23.3	213.80
2422 - 2452	802.11n HT40	21.09	128.53

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes stamped metal antennas, with a maximum gain of 3.7 dBi for antenna 1 and 2.5 dBi for antenna 2 .

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Diags v1.4

The test utility software used during testing was Linux version 2.6.31-00004-gd5a938e-dirty

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 fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

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

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20mode: MCS0
802.11n HT40mode: MCS0

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	B590	WB14412731	N/A
AC Adapter	Google	OTD017	7079618	N/A
AC Adapter	Lenovo	45N0121	11S45N0121Z1ZHXU23A5UK	N/A
Ethernet Switch(POE/LAN)	Netgear	PROSAFE GS108T	29SA385L00E0D	N/A

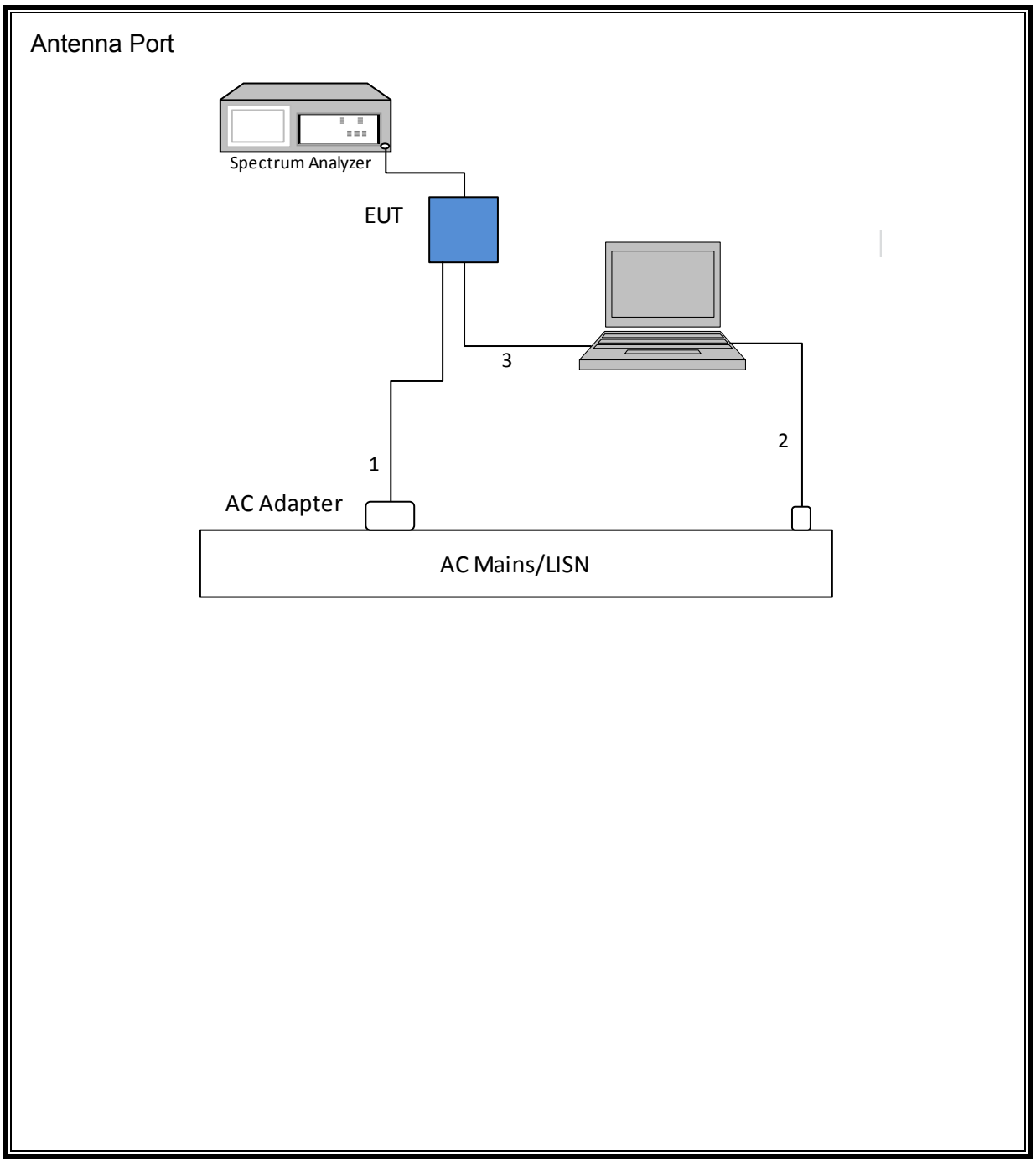
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC	1	Barrel	Unshielded	1.5	
2	DC	1	Barrel	Unshielded	1.5	
3	LAN	1	RJ45	Unshielded	1	
4	LAN	2	RJ45	Unshielded	3	

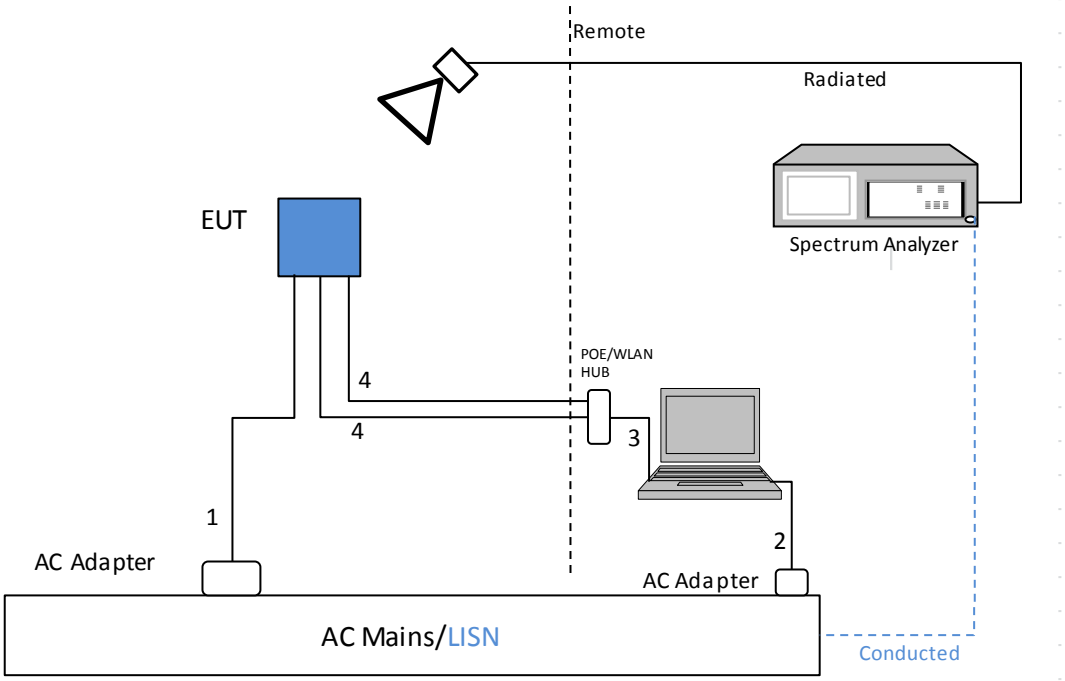
TEST SETUP

The EUT is connected to the laptop via LAN link. Test software exercises the radio.

SETUP DIAGRAM FOR TESTS



Radiated and LC Emissions



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	341	02/20/16
Antenna, Horn 1-18GHz	ETS Lindgren	3117	120	03/26/16
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	122	02/13/16
Amplifier, 10KHz to 1GHz,	Sonoma	310N	173	06/09/16
Amplifier, 1 - 18GHz	Miteq	AFS42-	742	01/31/16
Amplifier, 26 - 40GHz	Miteq	NSP4000-SP2	88	4/7/2016
Filter, HPF 3.0GHz	Micro-Tronics	HPM17543	427	01/31/16
Filter, LPF 5.0GHz	Micro-Tronics	LPS17541	421	1/31/2016
Filter, HPF 6GHz HPF	Micro-Tronics	HPS17542	425	1/31/2016
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826	89	12/17/15
Amplifier, 1 to 26.5GHz	Agilent	8449B	404	04/13/16
Spectrum Analyzer, 40 GHz	Agilent	8564E	106	08/14/16
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent	E4446A	123	10/28/15
LISN, 30MHz	FCC	50/250-25-2	24	01/16/16
Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	341	02/20/16
UL EMC Software	UL	UL EMC	Rev 9.5.03	
Antenna Port Software	UL	UL RF	Ver 3.3	

7. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v03r03, Section 8.1.

Output Power: KDB 558074 D01 v03r03, Section 9.2.2.2.

Power Spectral Density: KDB 558074 D01 v03r03, Section 10.3.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r03, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r03, Section 12.1.

Band-edge: KDB 558074 D01 v03r03, Section 13.2.

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

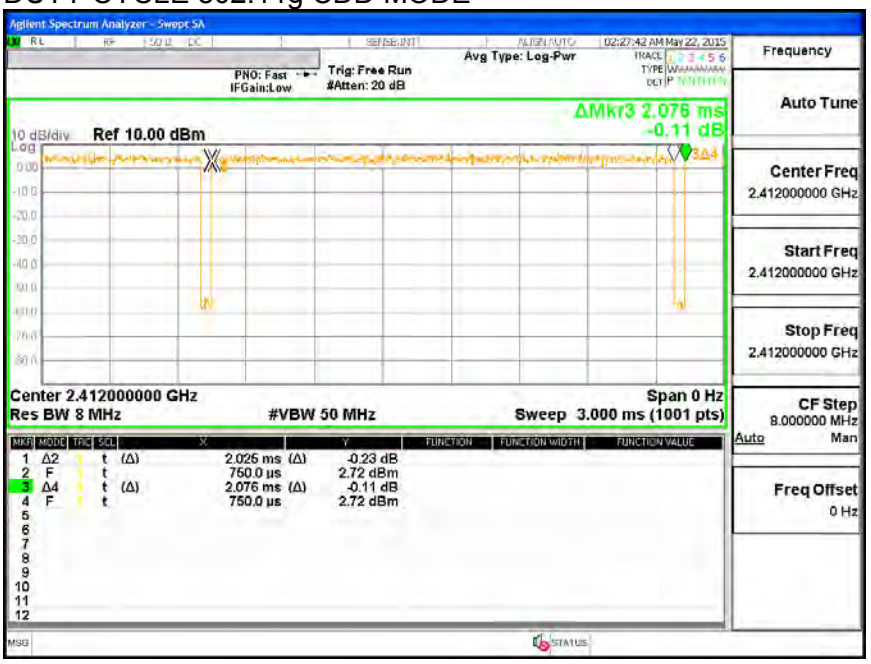
ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
802.11b CDD	12.200	12.280	0.993	99.35%	0.00	0.010
802.11g CDD	2.025	2.076	0.975	97.54%	0.11	0.494
802.11n HT20 CDD	1.891	1.944	0.973	97.27%	0.12	0.529
802.11nHT40 CDD	0.8900	0.9650	0.922	92.23%	0.35	1.124

DUTY CYCLE PLOTS

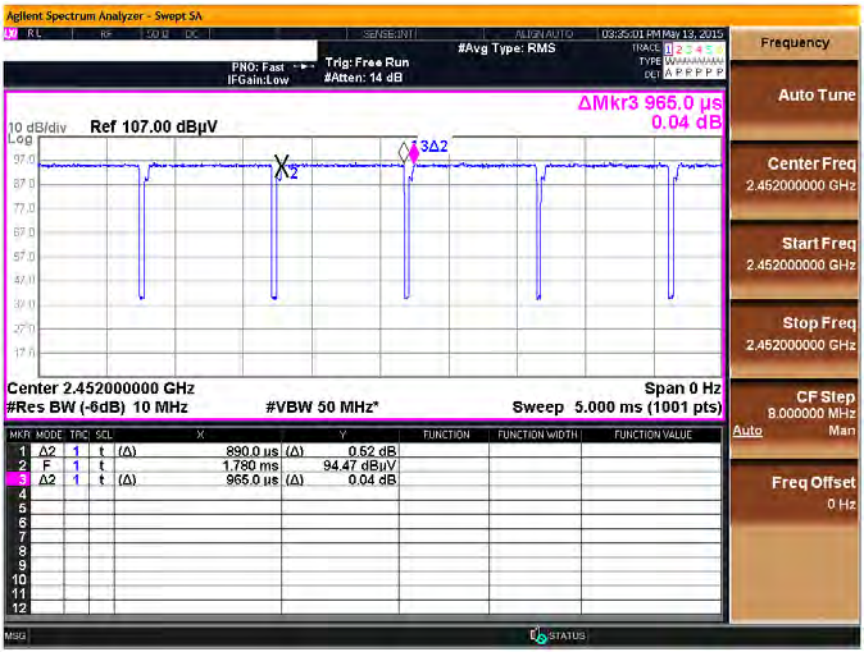
DUTY CYCLE 802.11b CDD MODE

DUTY CYCLE 802.11g CDD MODE



DUTY CYCLE 802.11n HT20 CDD MODE

DUTY CYCLE 802.11n HT40 CDD MODE



8.2. 802.11b 2TX MODE IN THE 2.4 GHz BAND

8.2.1. 6 dB BANDWIDTH

LIMITS

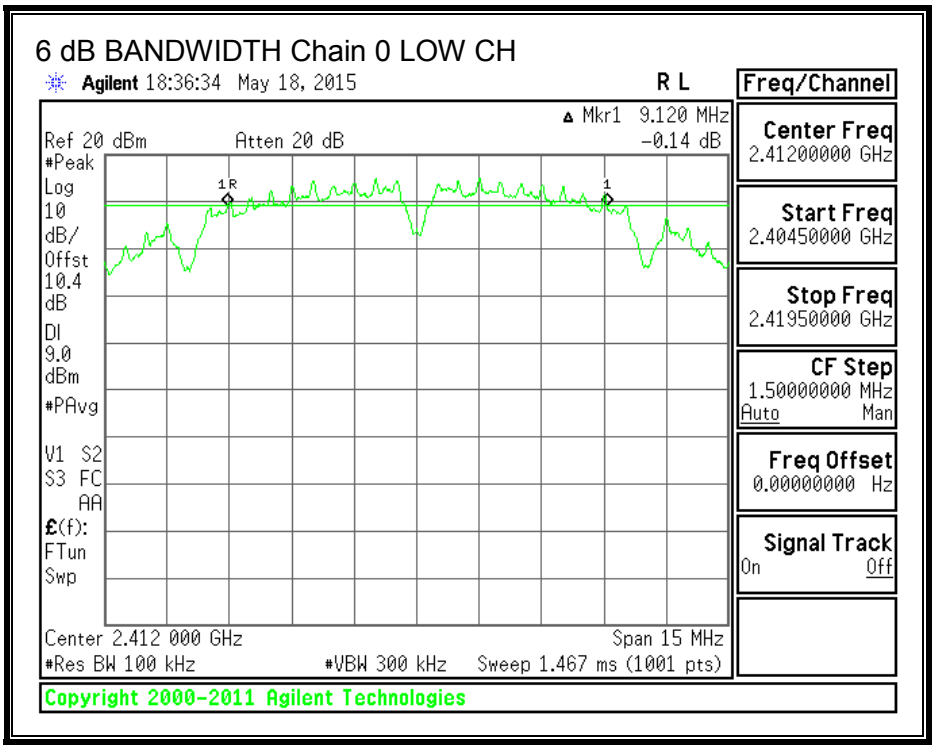
FCC §15.247 (a) (2)

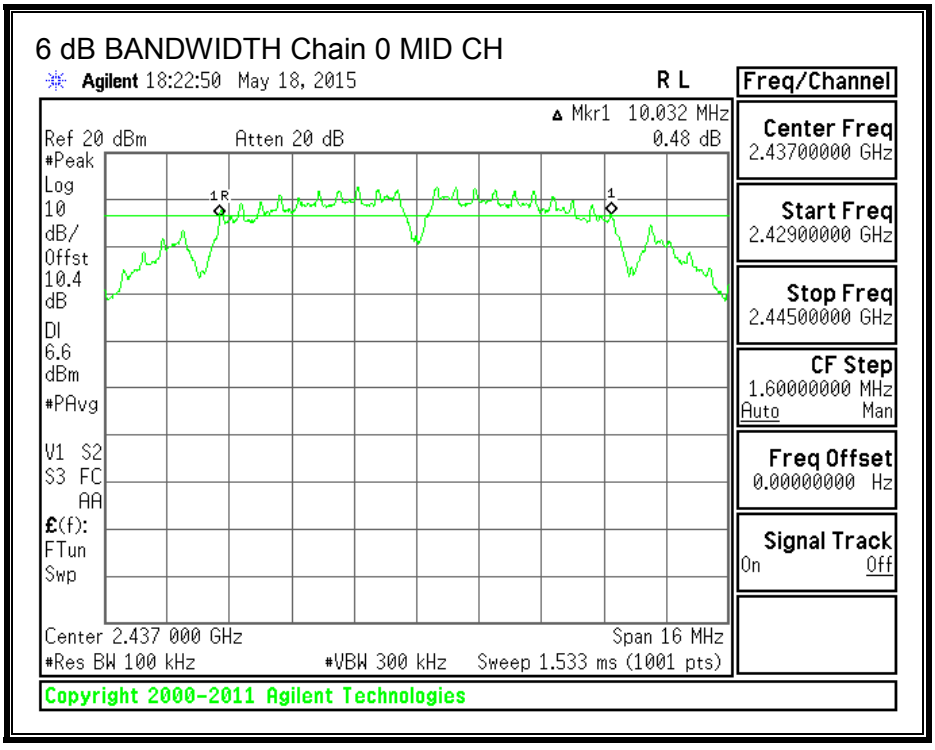
The minimum 6 dB bandwidth shall be at least 500 kHz.

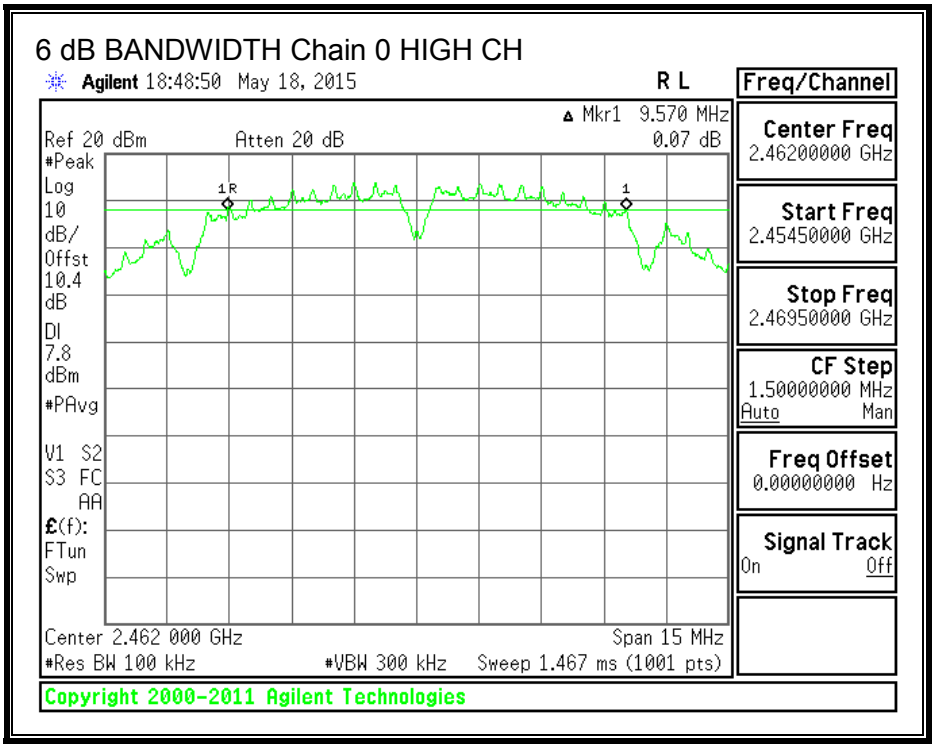
RESULTS

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	2412	9.120	9.540	0.5
Mid	2437	10.032	9.570	0.5
High	2462	9.570	9.060	0.5

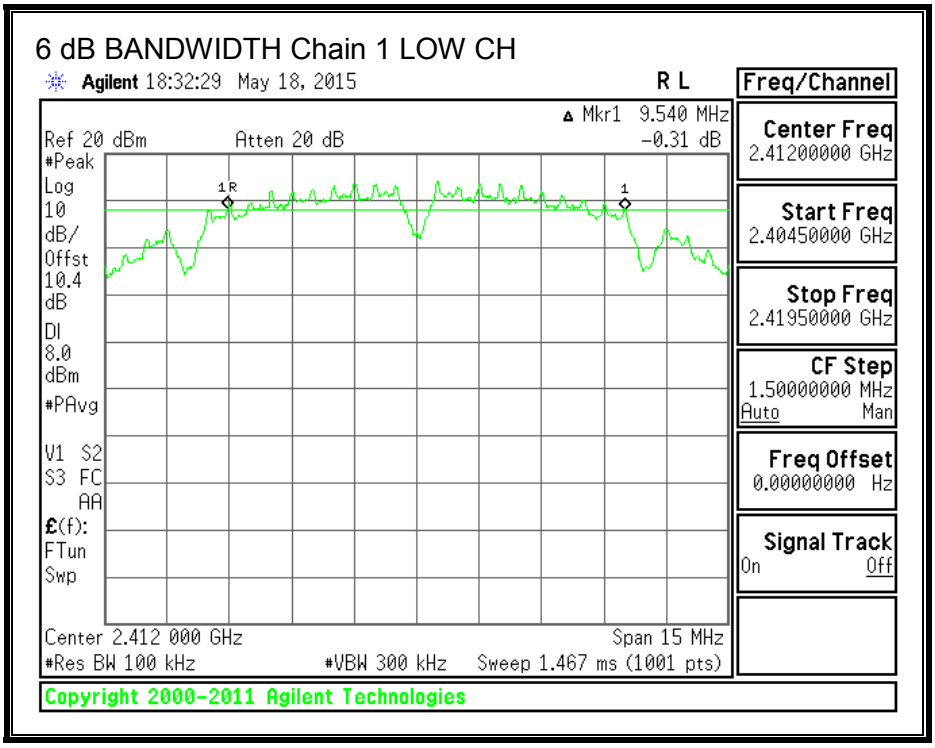
6 dB BANDWIDTH, Chain 0

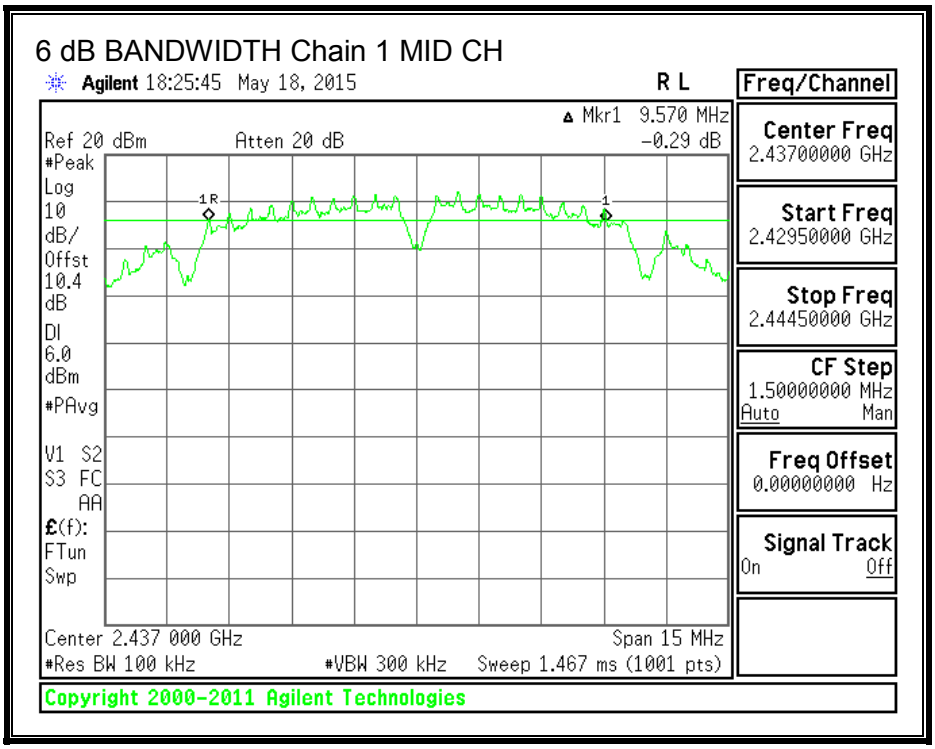


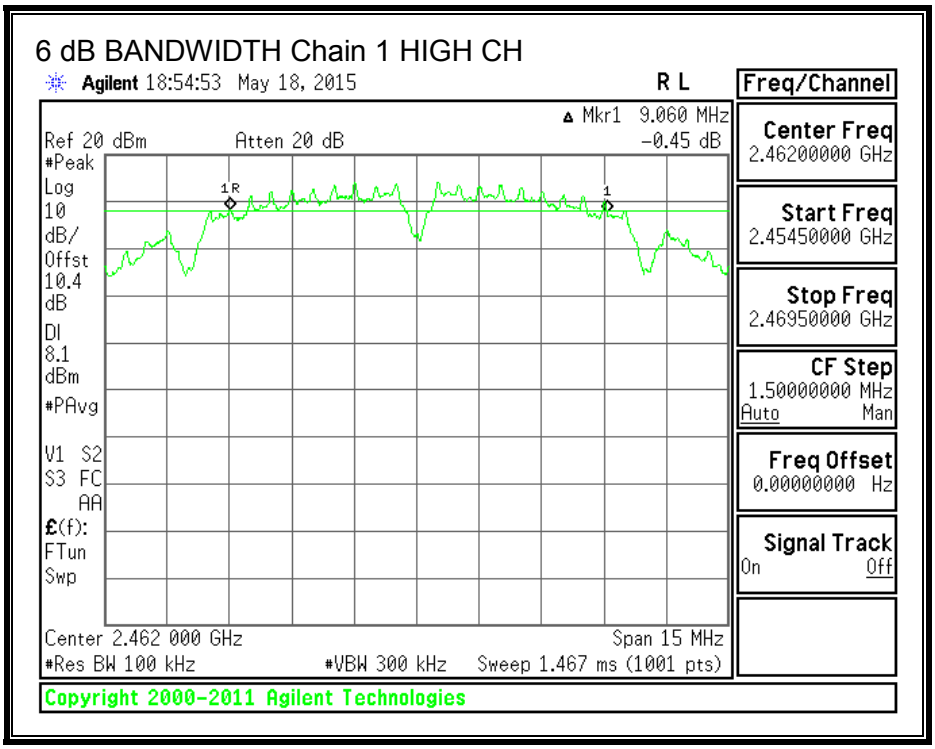




6 dB BANDWIDTH, Chain 1







8.2.2. 99% BANDWIDTH

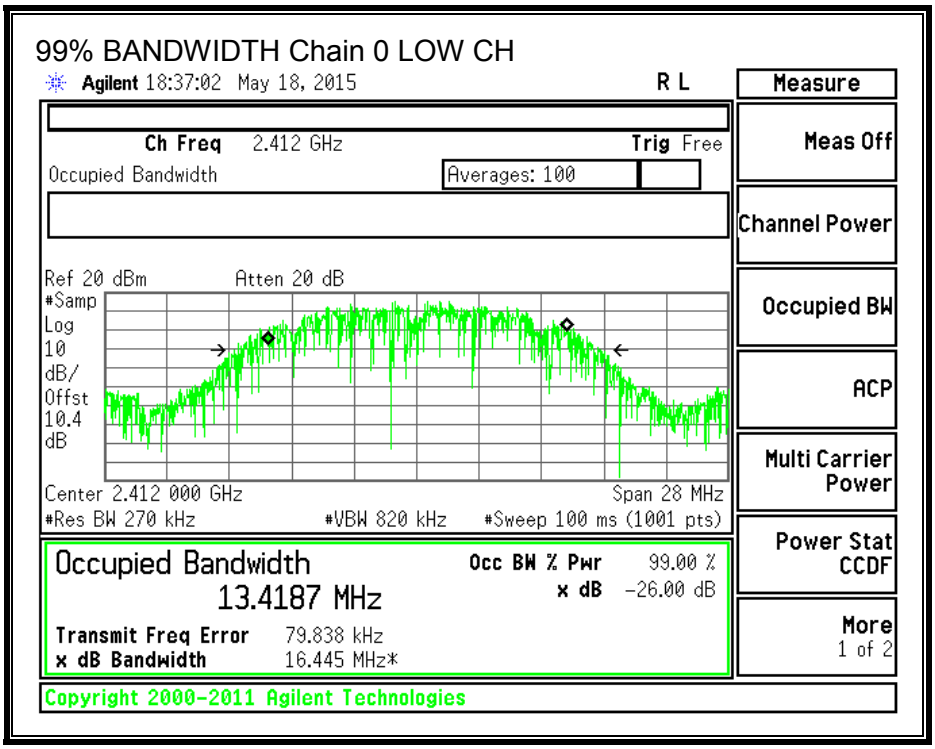
LIMITS

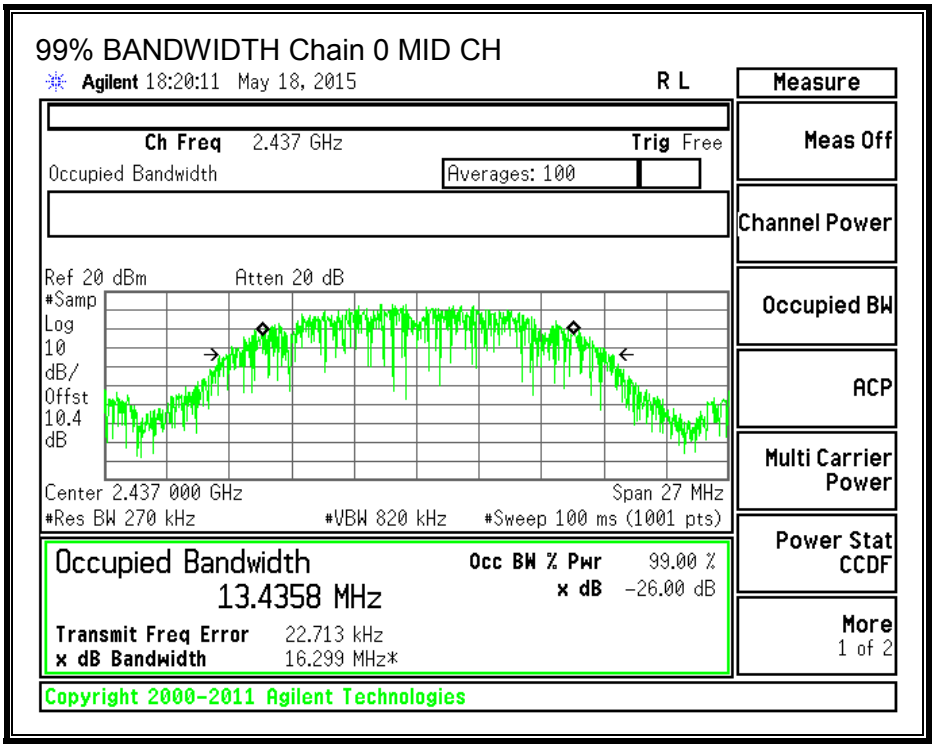
None; for reporting purposes only.

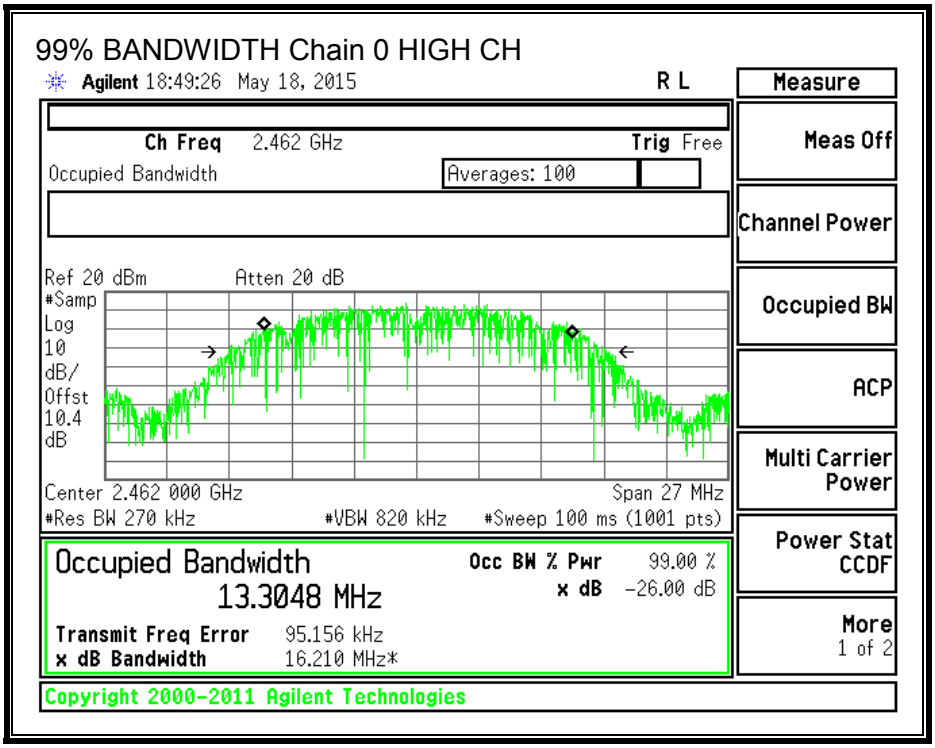
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	2422	13.4187	13.3105
Mid	2437	13.4358	13.4511
High	2452	13.3048	13.3412

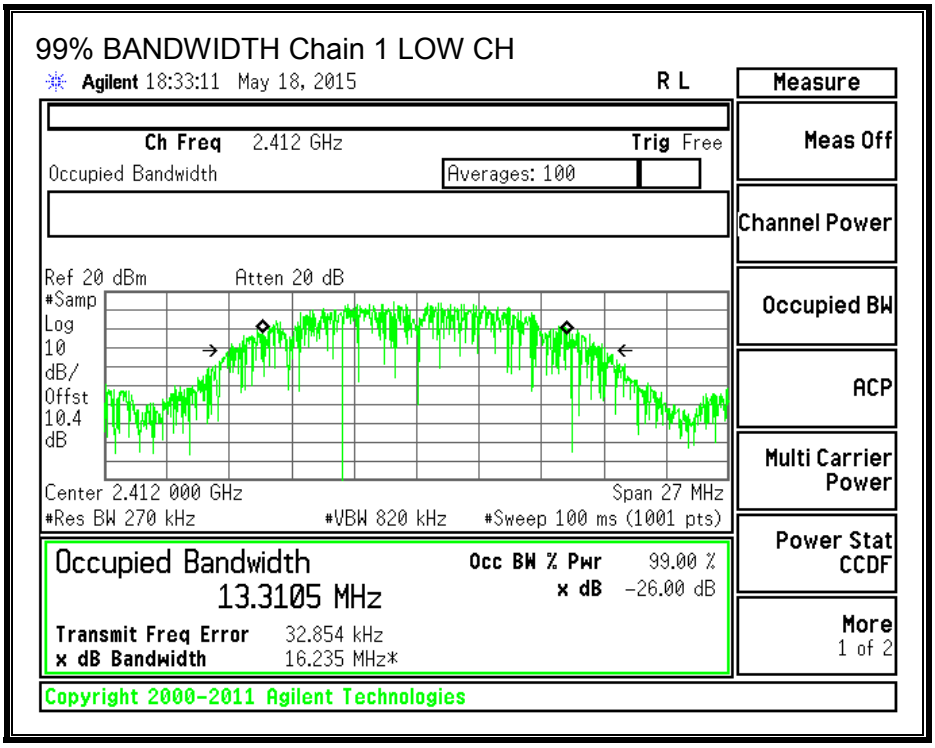
99% BANDWIDTH, Chain 0

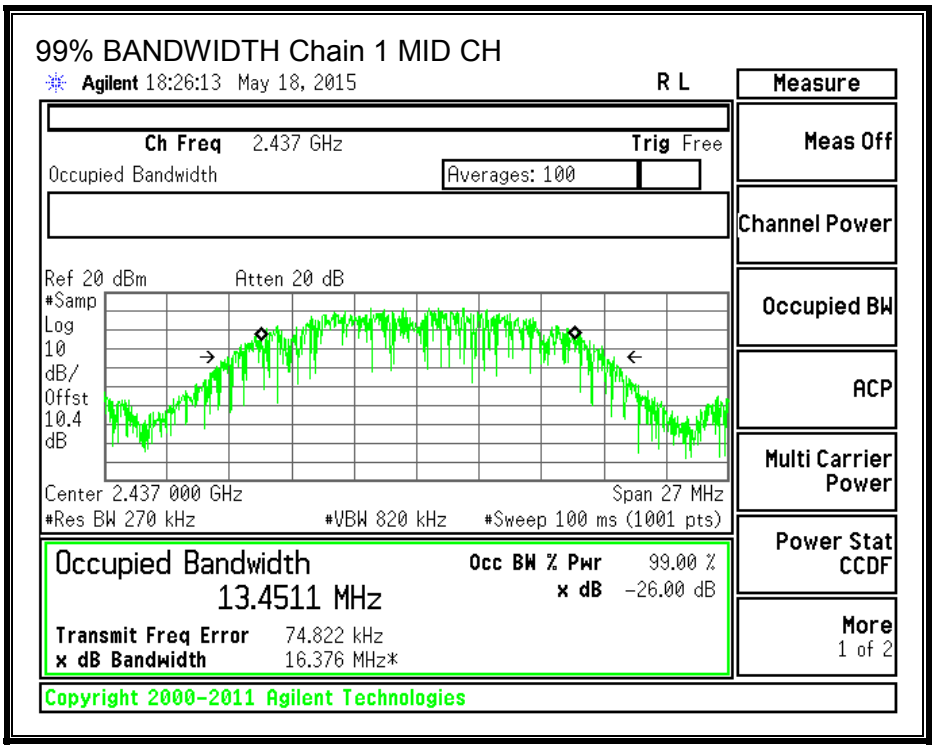


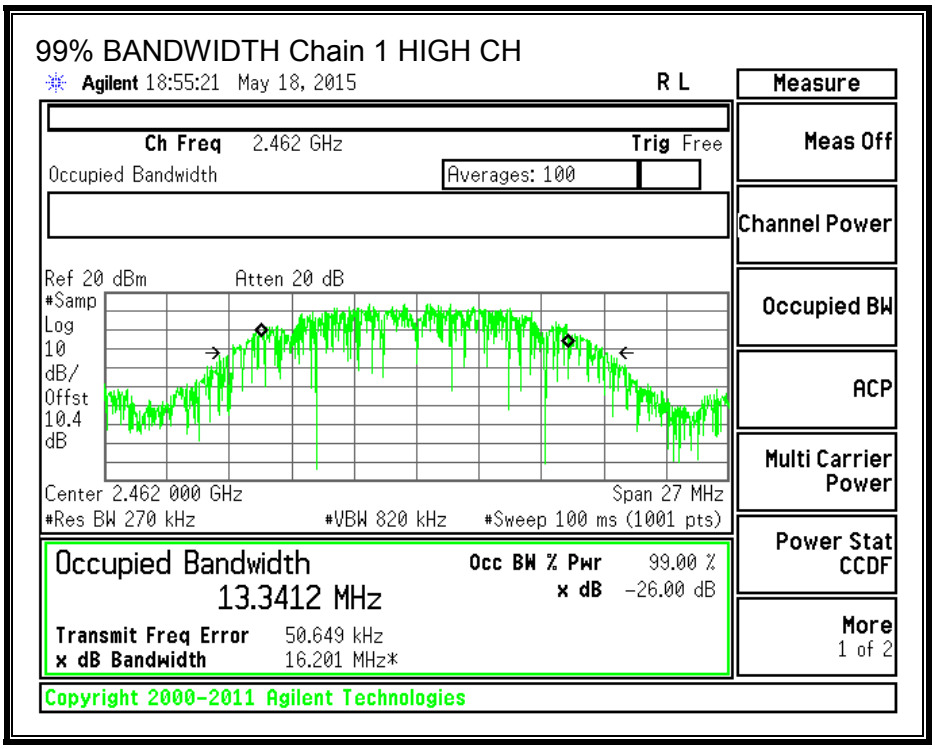




99% BANDWIDTH, Chain 1







8.2.3. OUTPUT POWER

LIMITS

FCC §15.247

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.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.70	2.50	3.14

RESULTS

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	3.14	30.00	30	36	30.00
Mid	2437	3.14	30.00	30	36	30.00
High	2462	3.14	30.00	30	36	30.00

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

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margi (dB)
Low	2412	15.55	15.33	18.45	30.00	-11.55
Mid	2437	16.24	16.42	19.34	30.00	-10.66
High	2462	15.65	16.29	18.99	30.00	-11.01

8.2.1. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

RESULTS

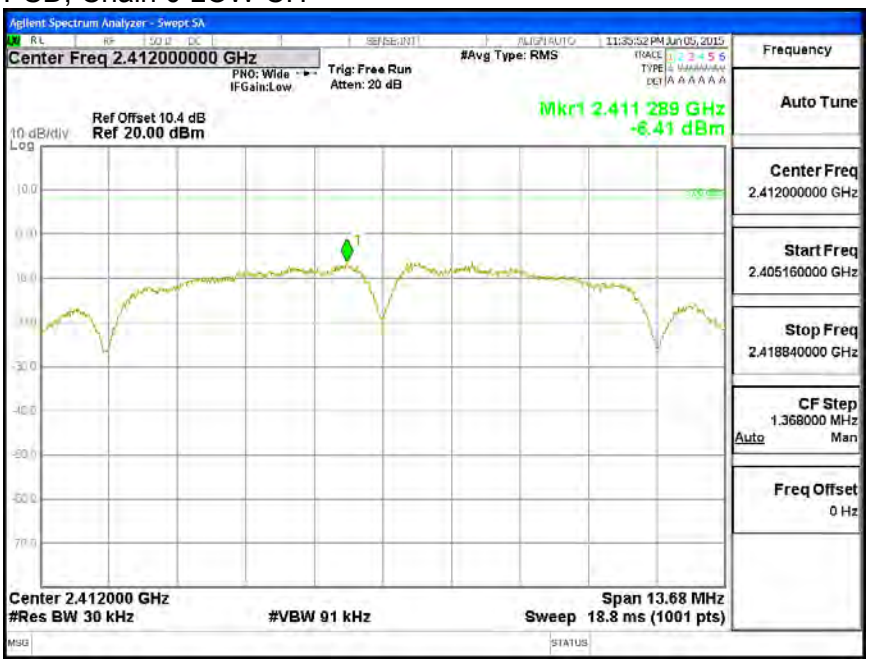
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

PSD Results

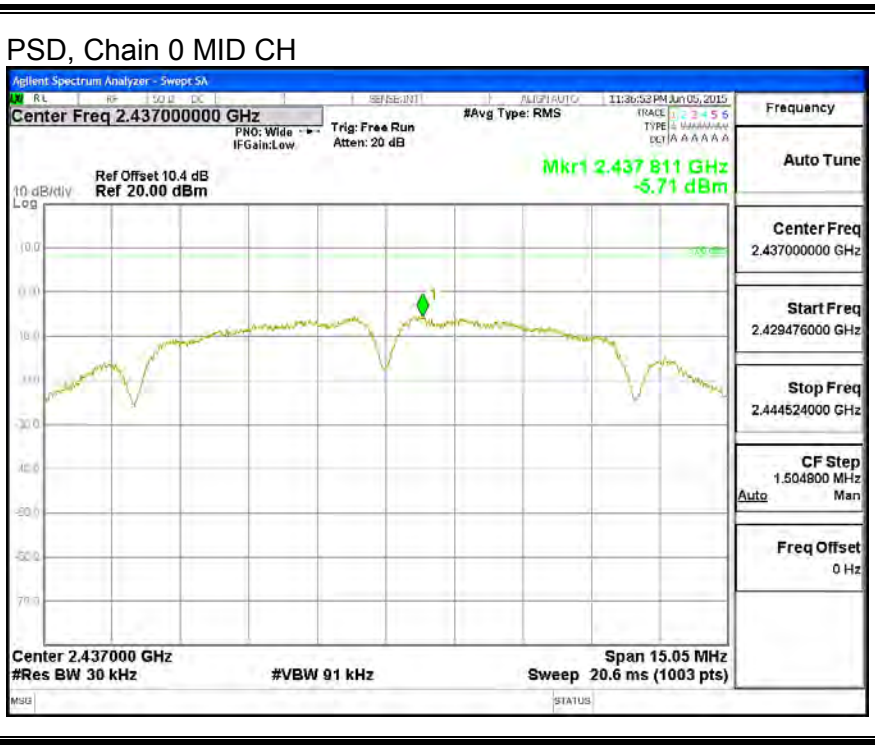
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total Corr'd PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-6.41	-6.63	-3.51	8.0	-11.5
Mid	2437	-5.71	-5.79	-2.74	8.0	-10.7
High	2462	-6.73	-6.03	-3.36	8.0	-11.4

PSD, Chain 0

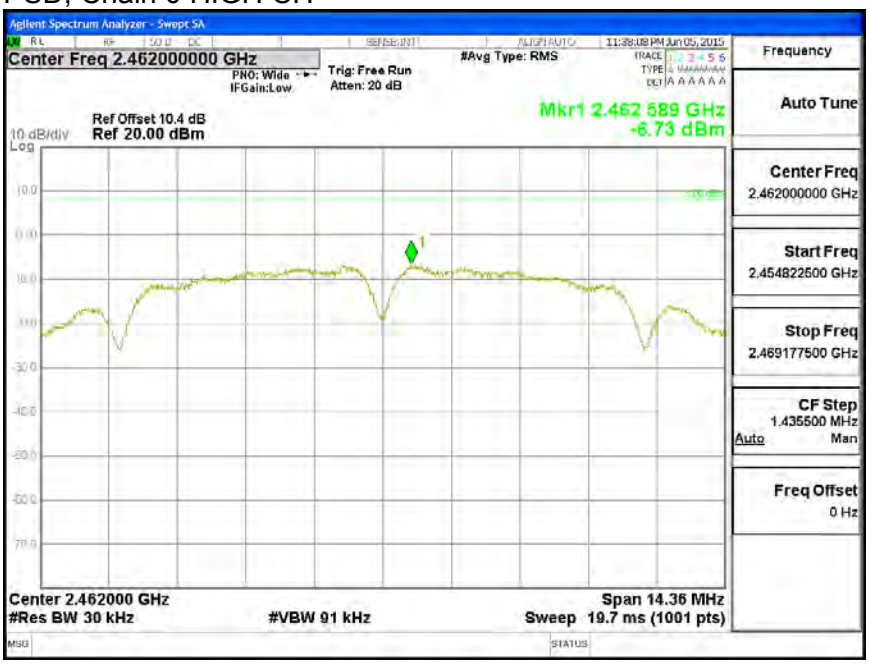
PSD, Chain 0 LOW CH



PSD, Chain 0 MID CH

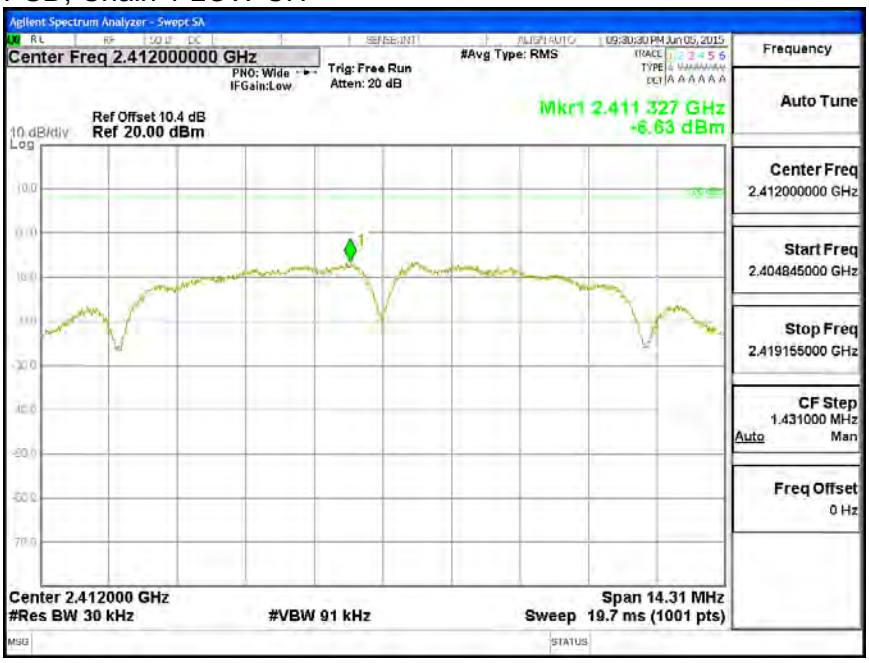


PSD, Chain 0 HIGH CH



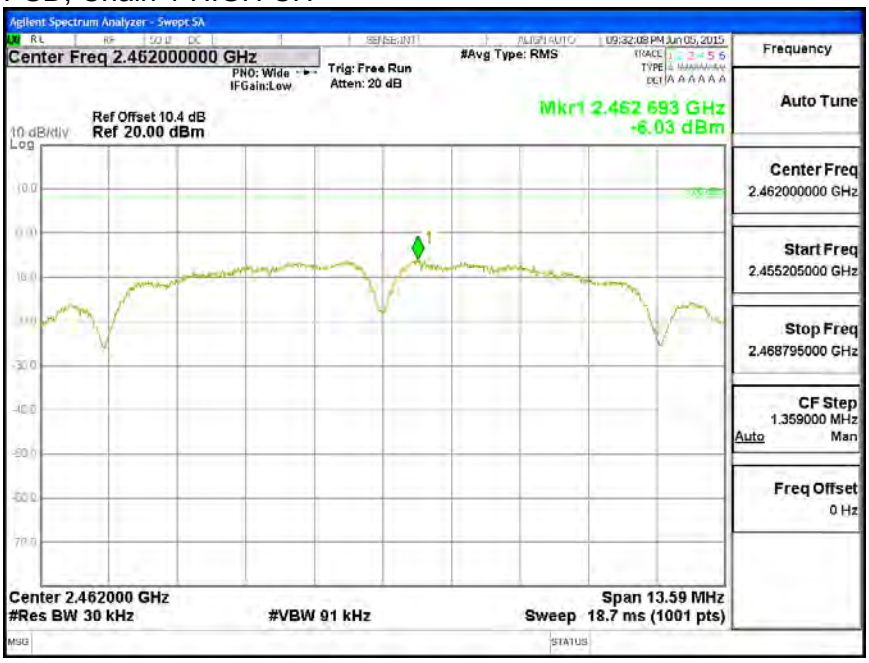
PSD, Chain 1

PSD, Chain 1 LOW CH



PSD, Chain 1 MID CH

PSD, Chain 1 HIGH CH



8.2.2. OUT-OF-BAND EMISSIONS

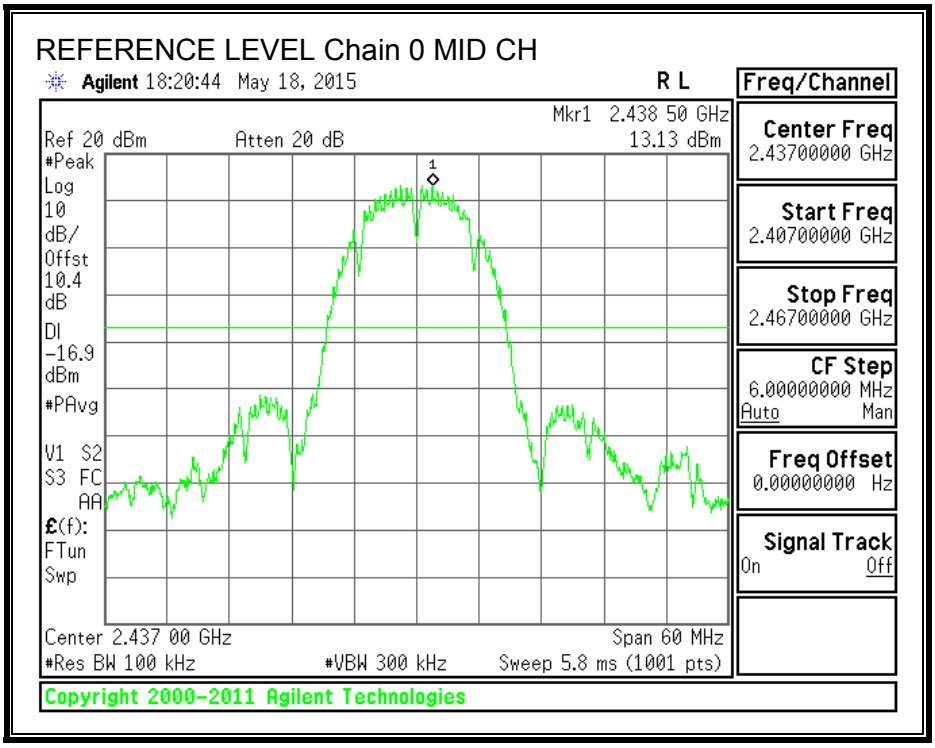
LIMITS

FCC §15.247 (d)

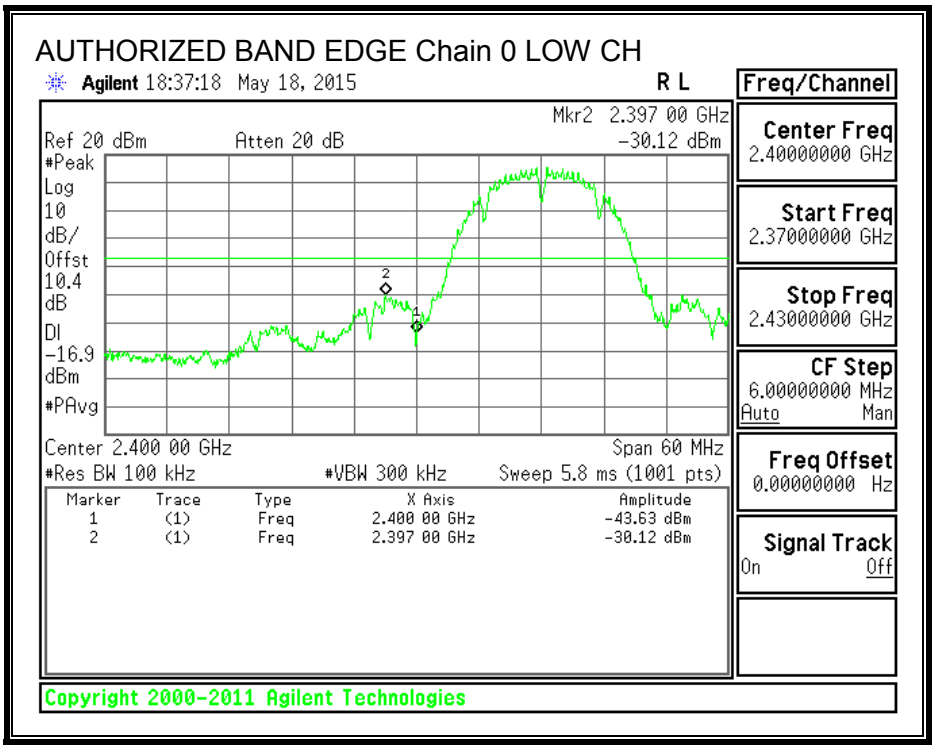
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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

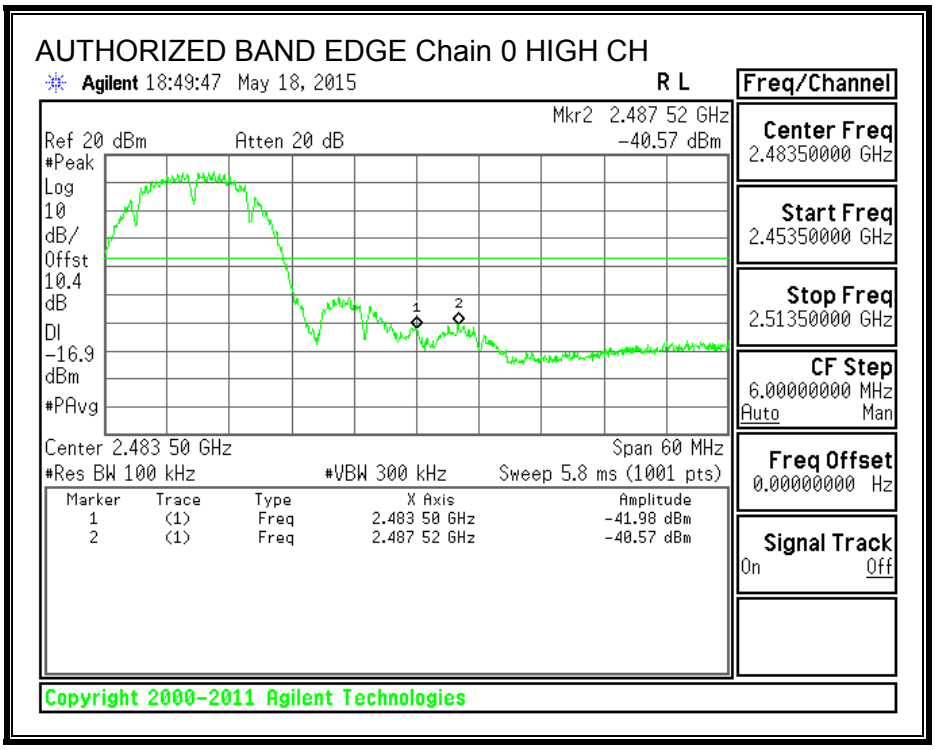
IN-BAND REFERENCE LEVEL, Chain 0



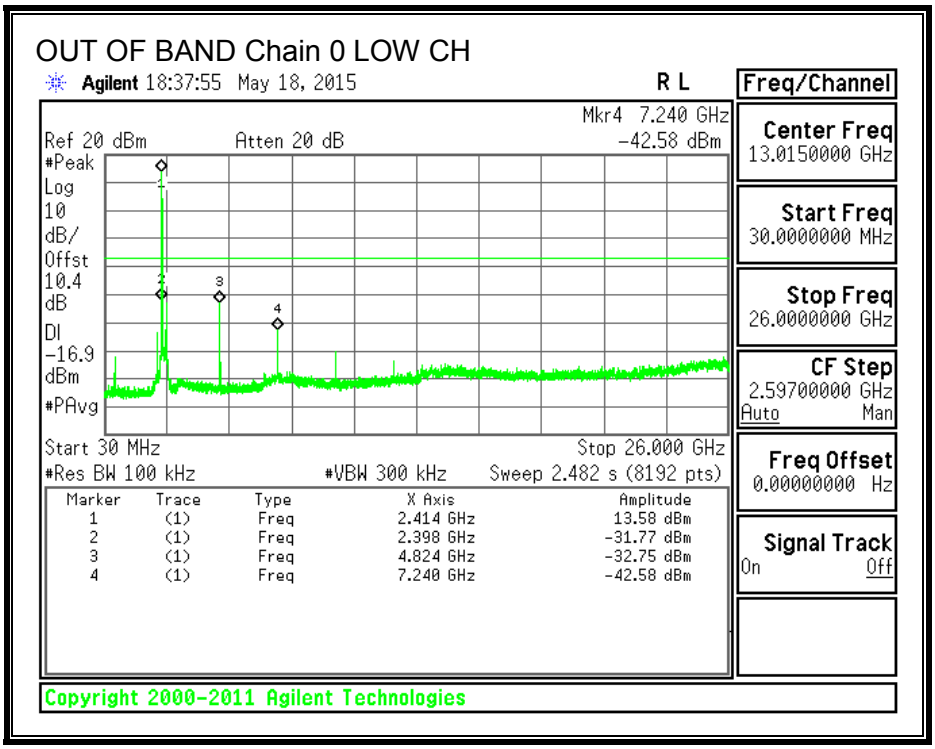
LOW CHANNEL BANDEDGE, Chain 0

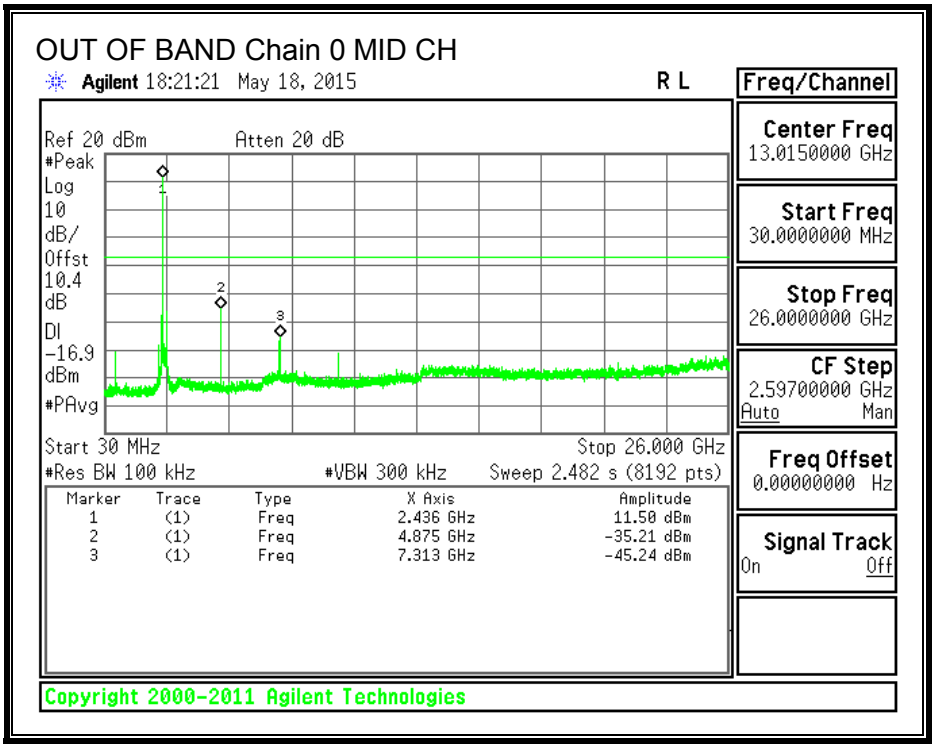


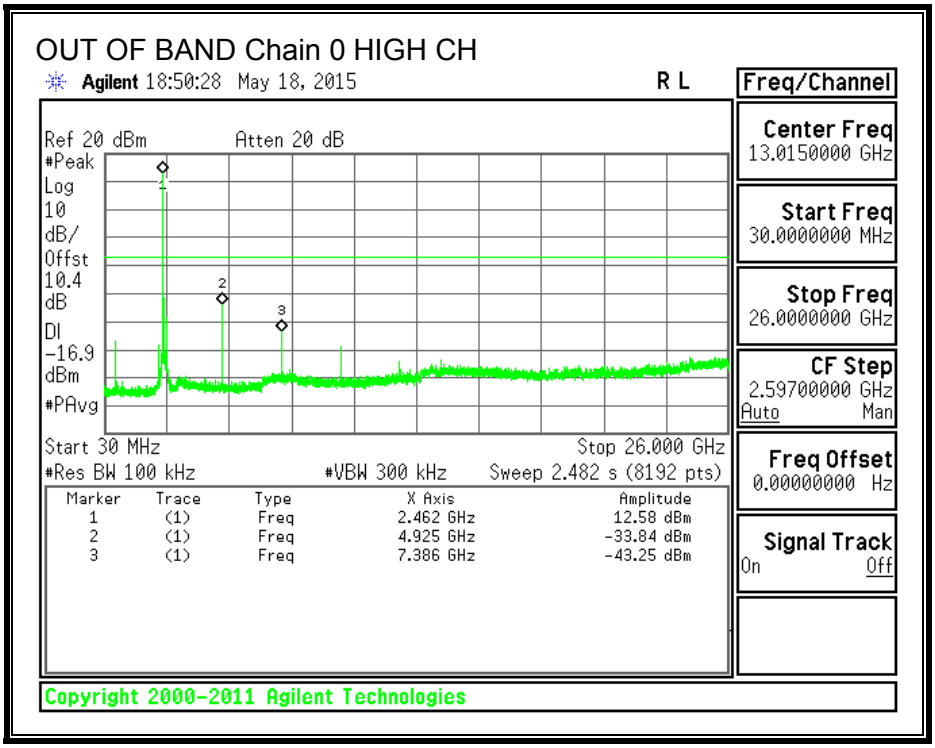
HIGH CHANNEL BANDEDGE, Chain 0



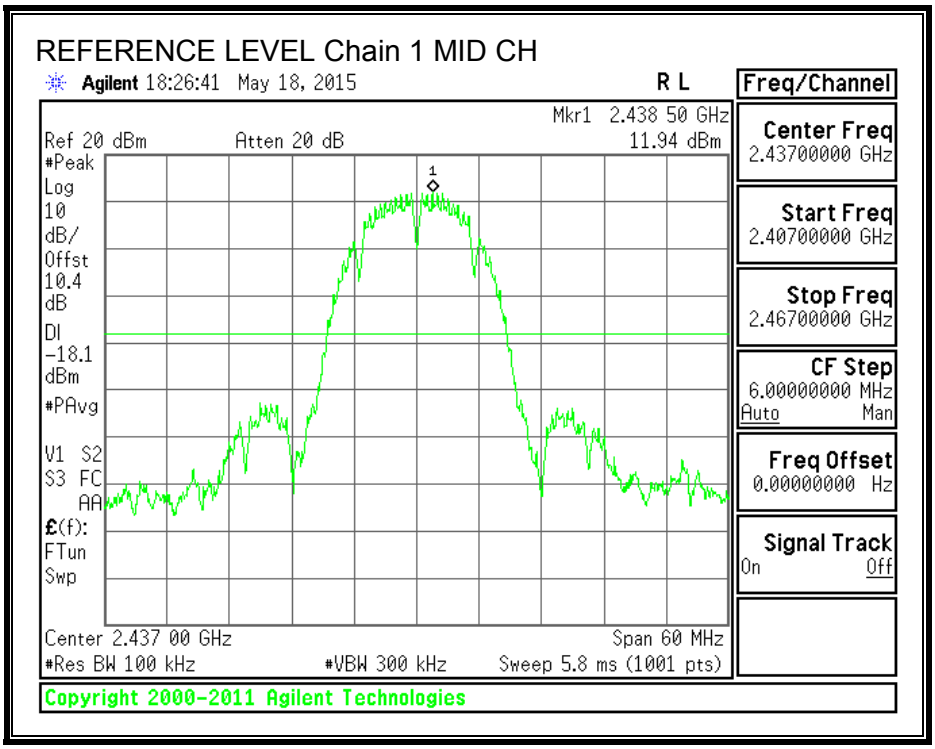
OUT-OF-BAND EMISSIONS, Chain 0



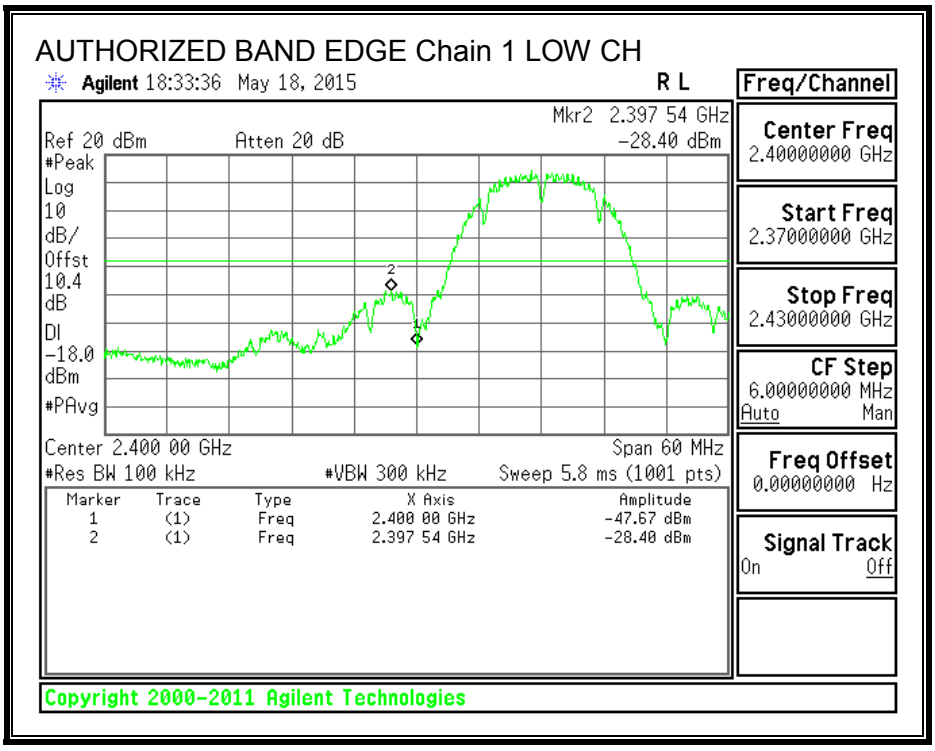




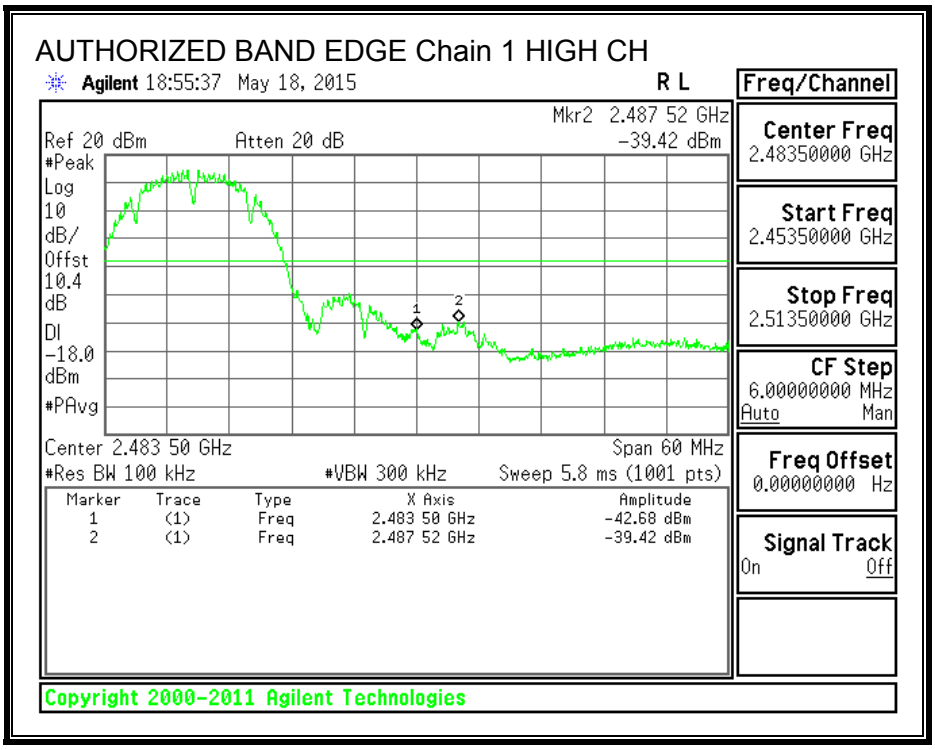
IN-BAND REFERENCE LEVEL, Chain 1



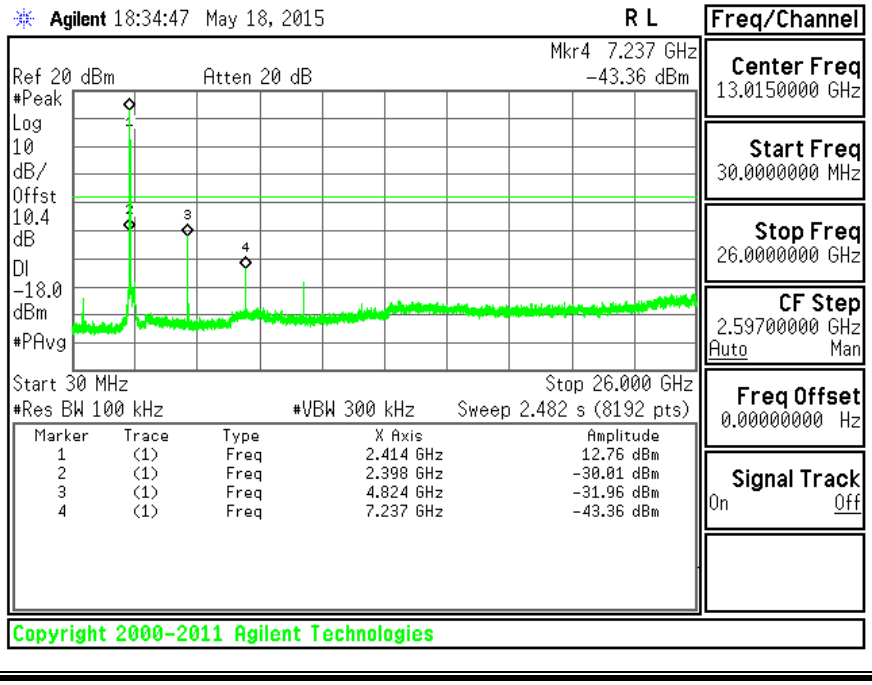
LOW CHANNEL BANDEDGE, Chain 1



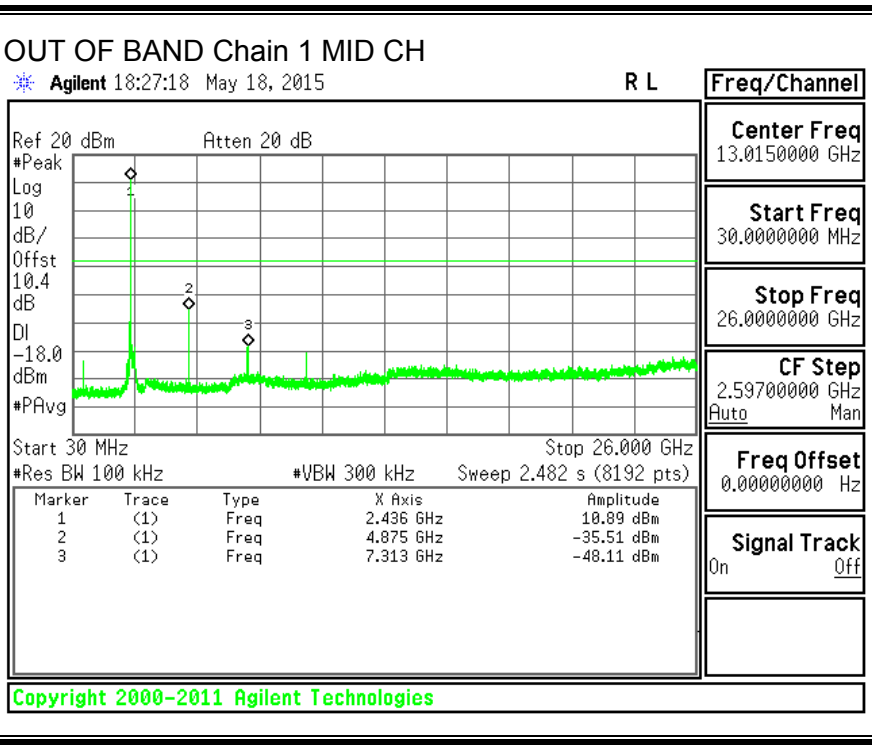
HIGH CHANNEL BANDEDGE, Chain 1

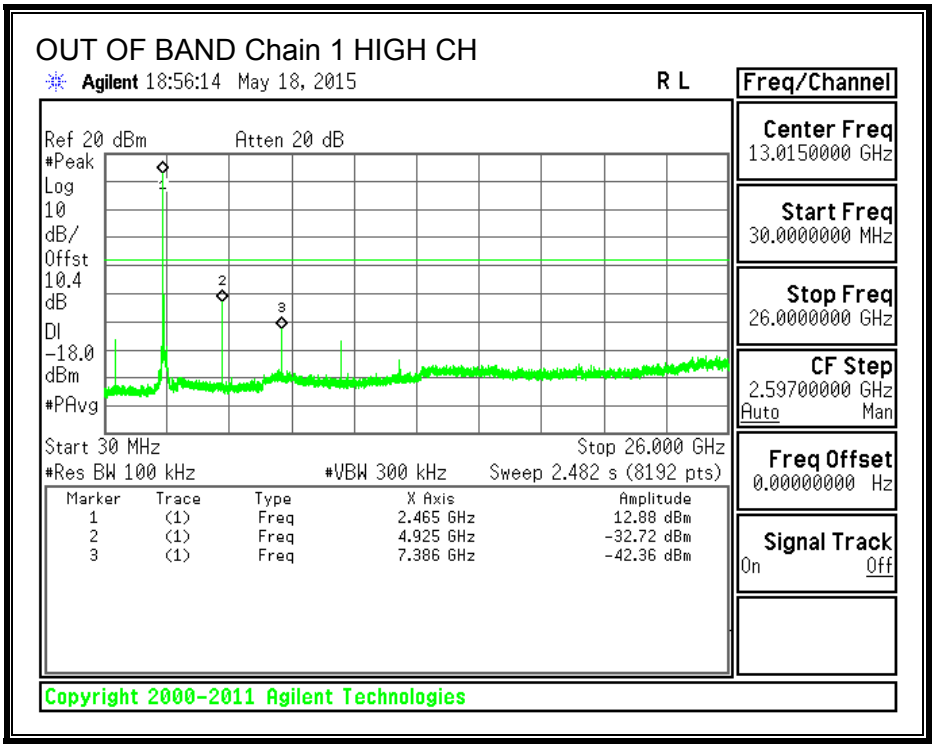


OUT OF BAND Chain 1 LOW CH



OUT OF BAND Chain 1 MID CH





8.3. 802.11g 2TX MODE IN THE 2.4 GHz BAND

8.3.1. 6 dB BANDWIDTH

LIMITS

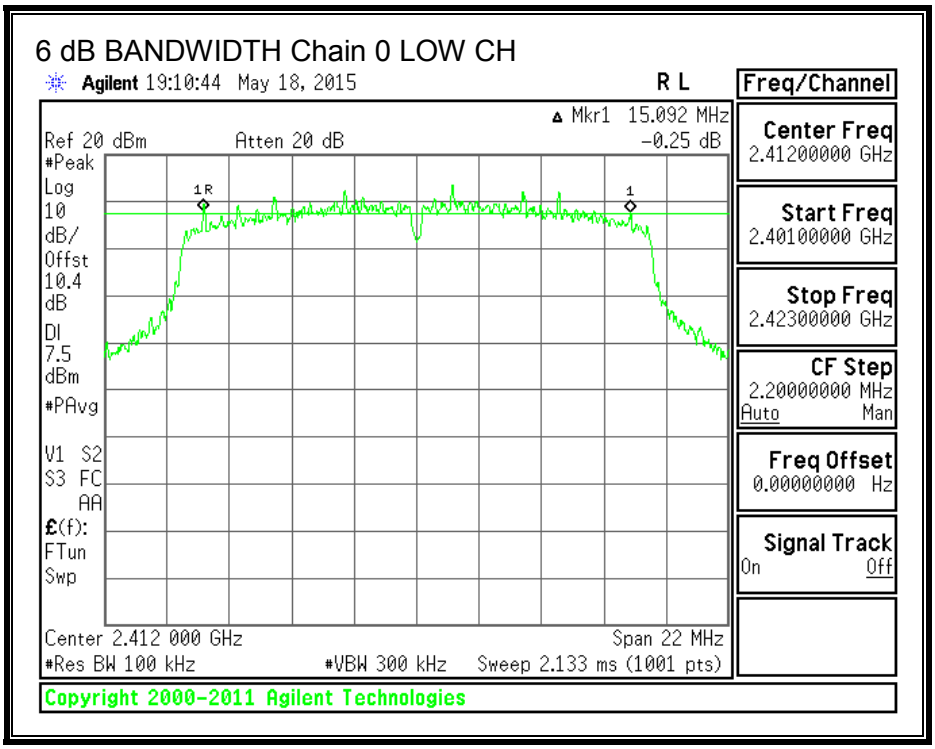
FCC §15.247 (a) (2)

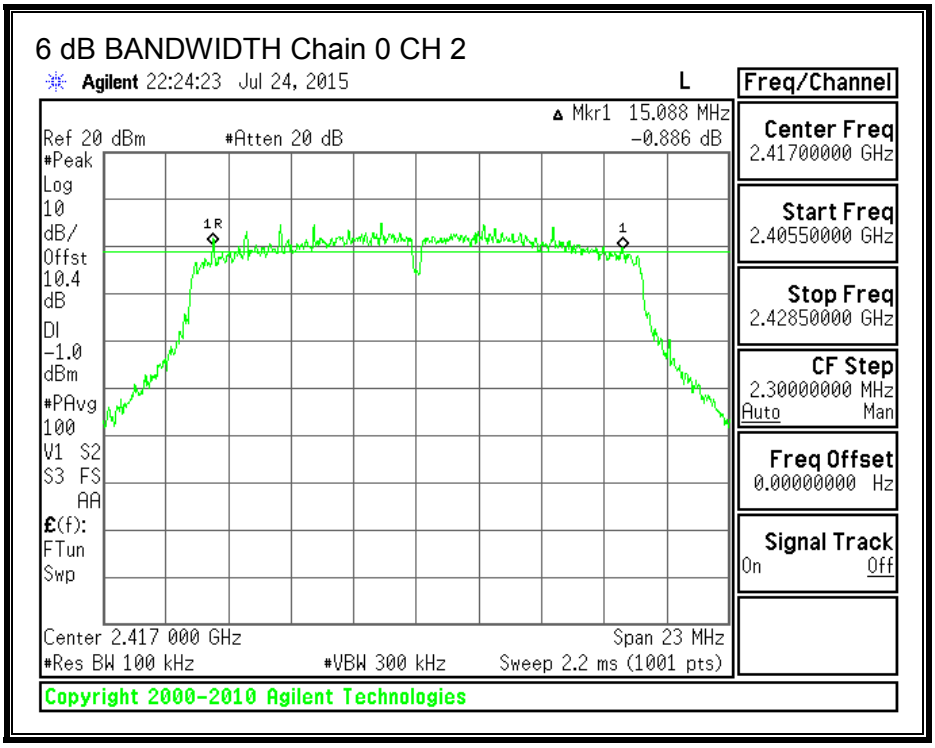
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	2412	15.092	14.720	0.5
2	2417	15.088	15.019	0.5
3	2422	13.986	13.860	0.5
Mid	2437	13.881	13.419	0.5
9	2452	15.624	15.272	0.5
10	2457	13.881	13.818	0.5
High	2462	15.088	15.019	0.5

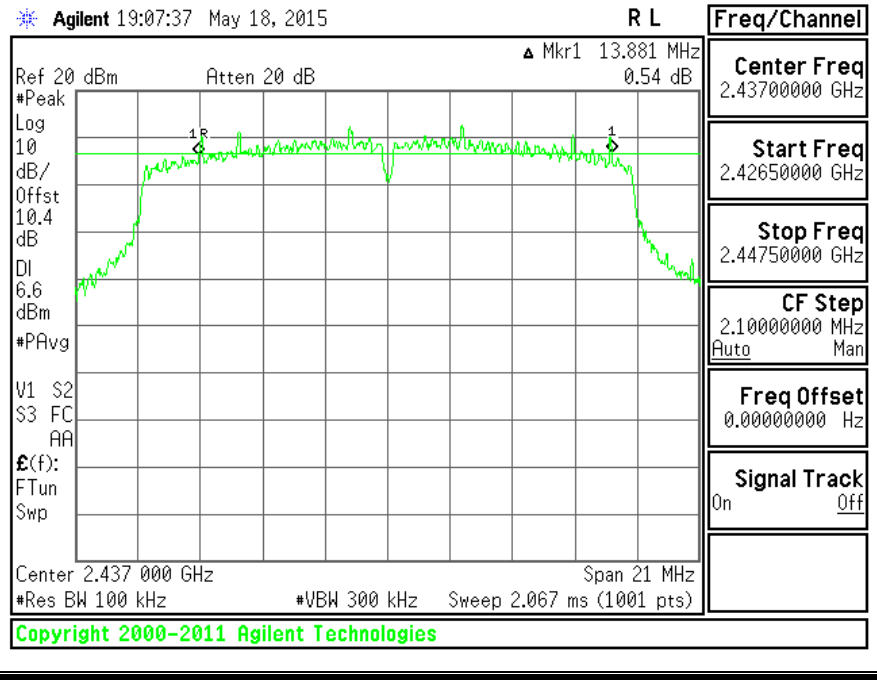
6 dB BANDWIDTH, Chain 0



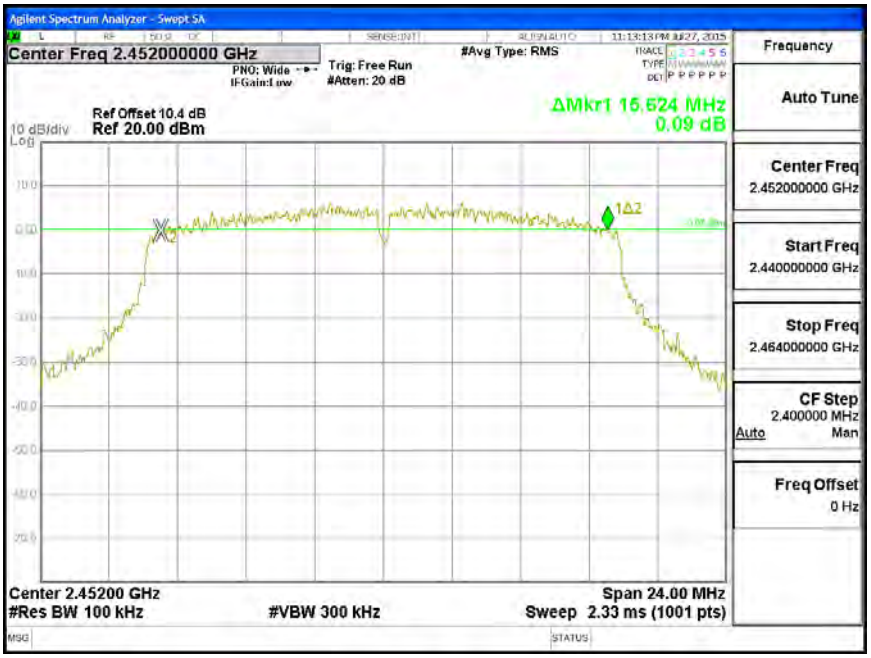


6 dB BANDWIDTH Chain 0 CH 3

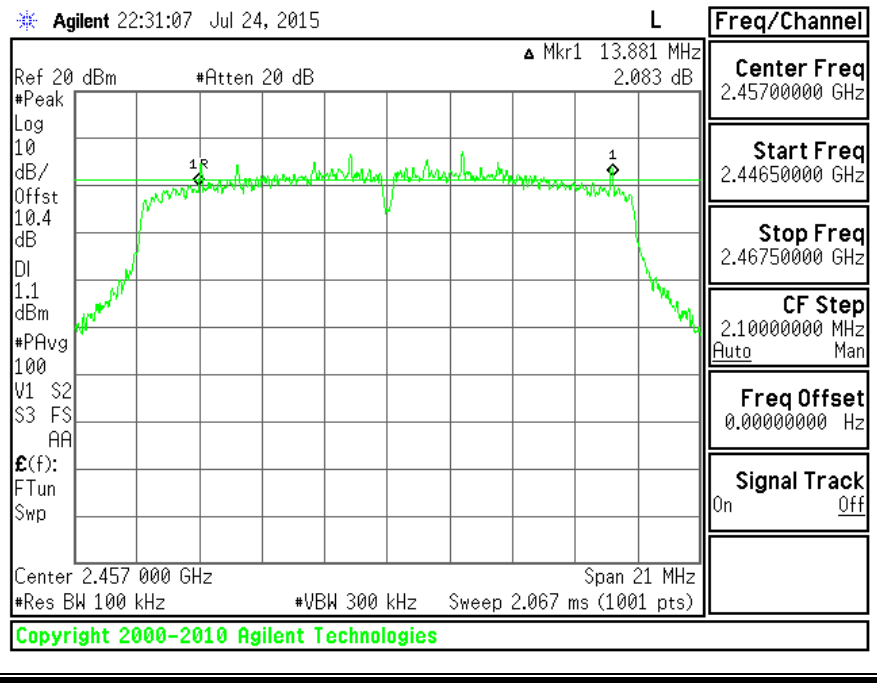
6 dB BANDWIDTH Chain 0 MID CH



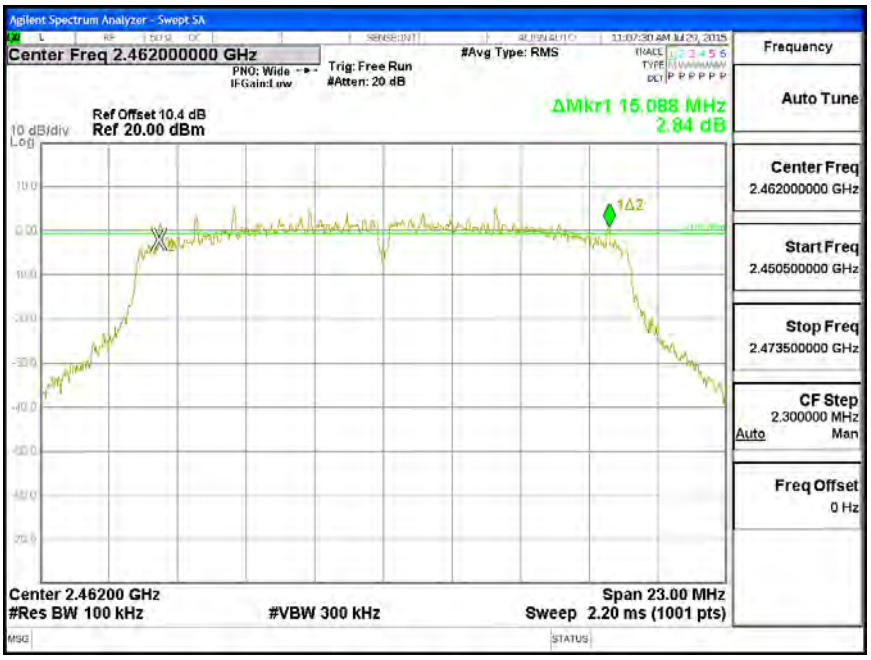
6 dB BANDWIDTH Chain 0 CH 9



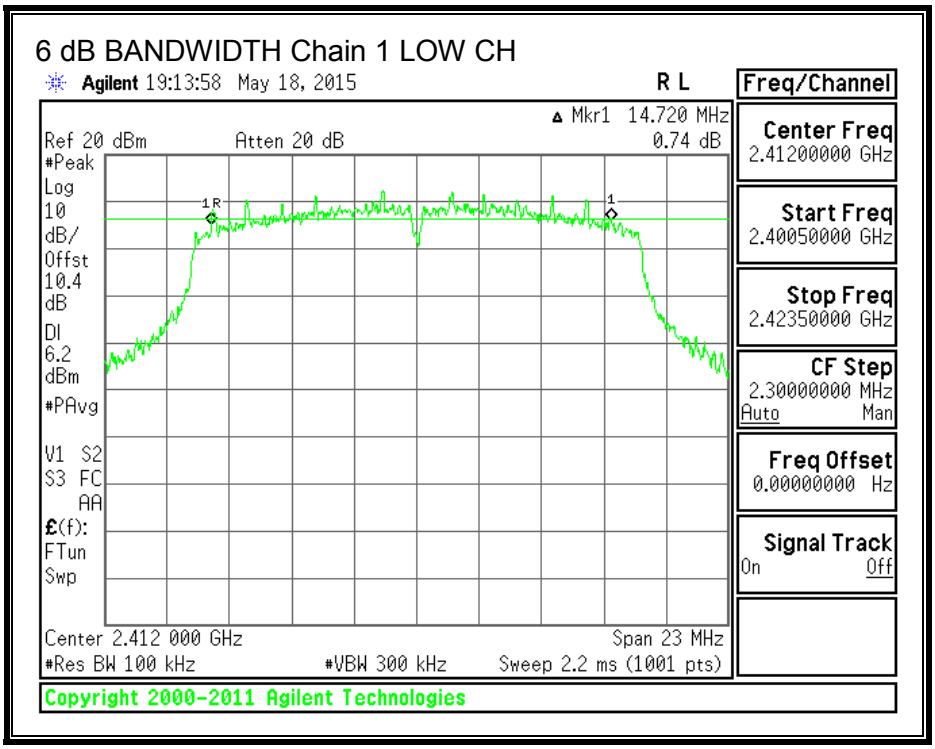
6 dB BANDWIDTH Chain 0 CH 10

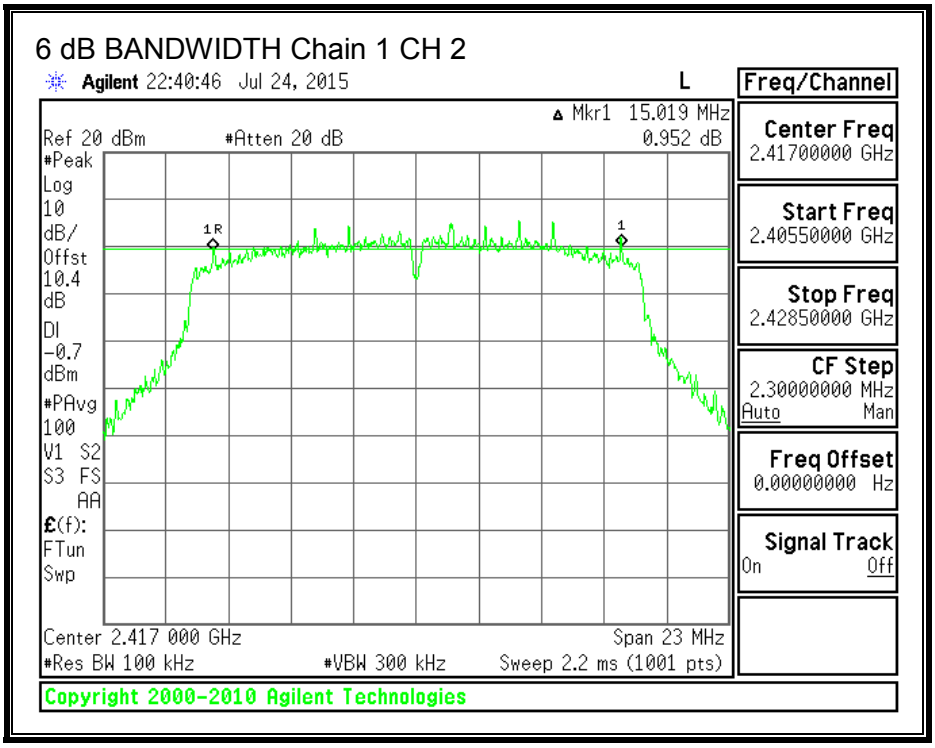


6 dB BANDWIDTH Chain 0 HIGH CH

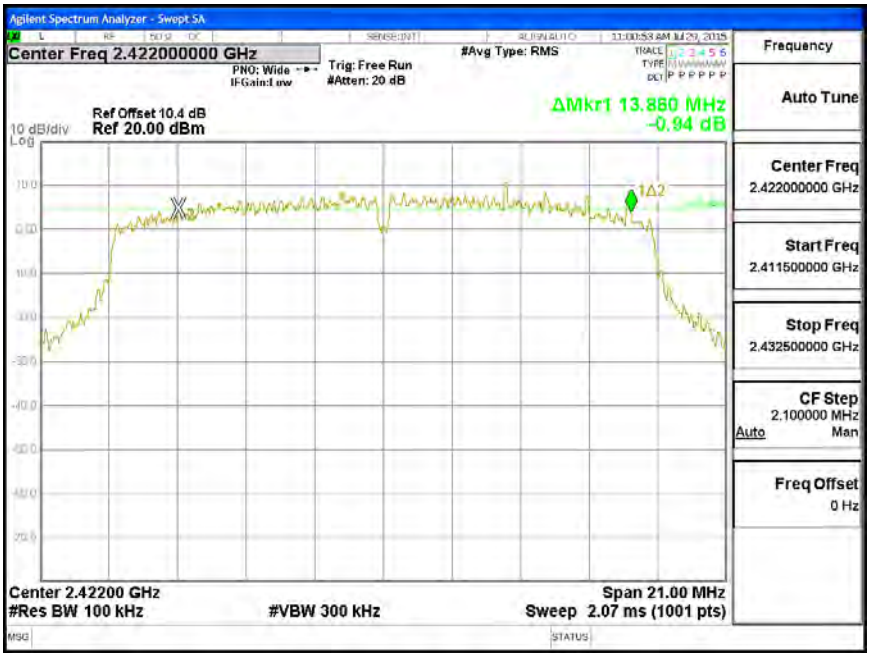


6 dB BANDWIDTH, Chain 1

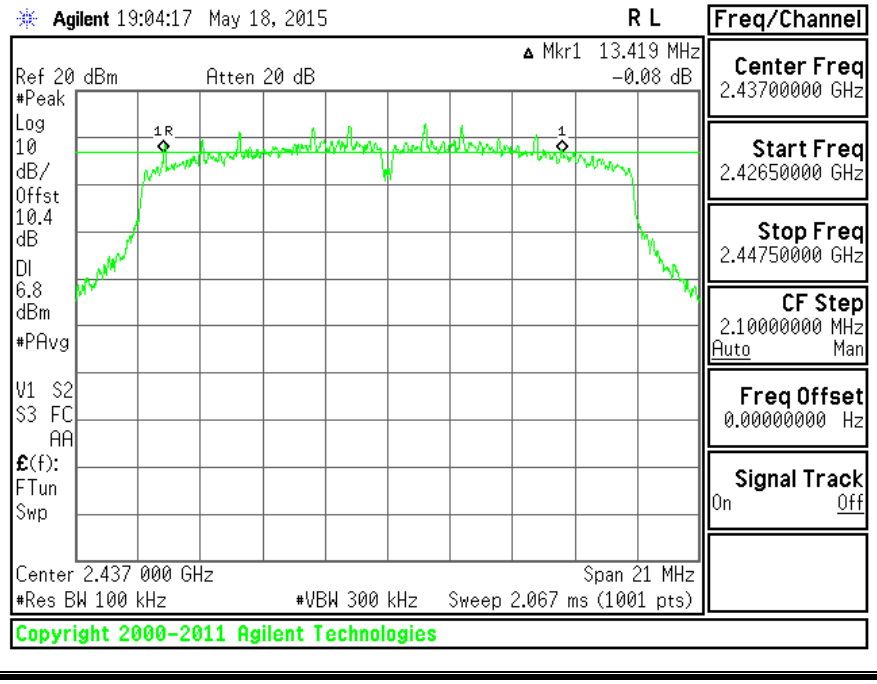




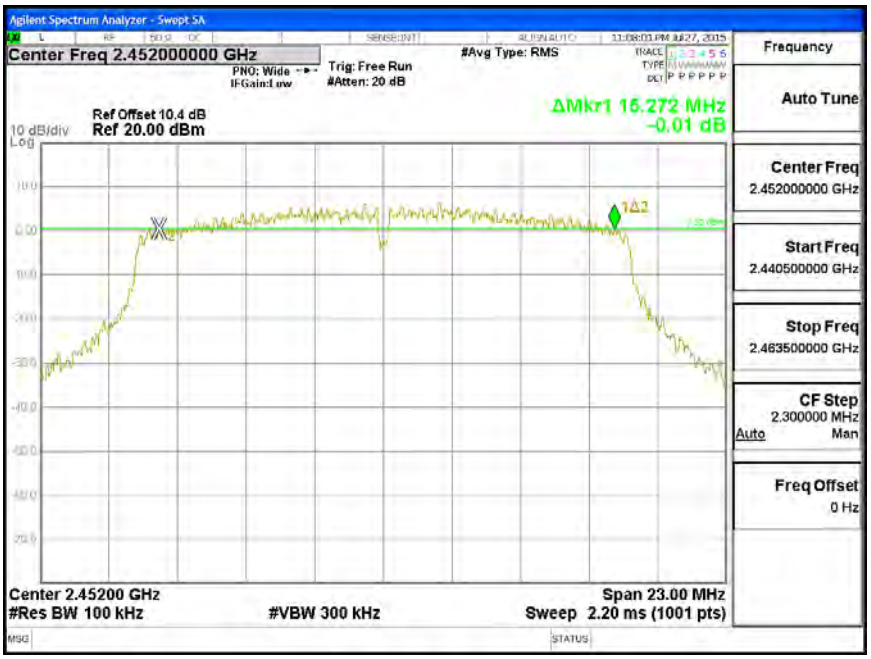
6 dB BANDWIDTH Chain 1 CH 3



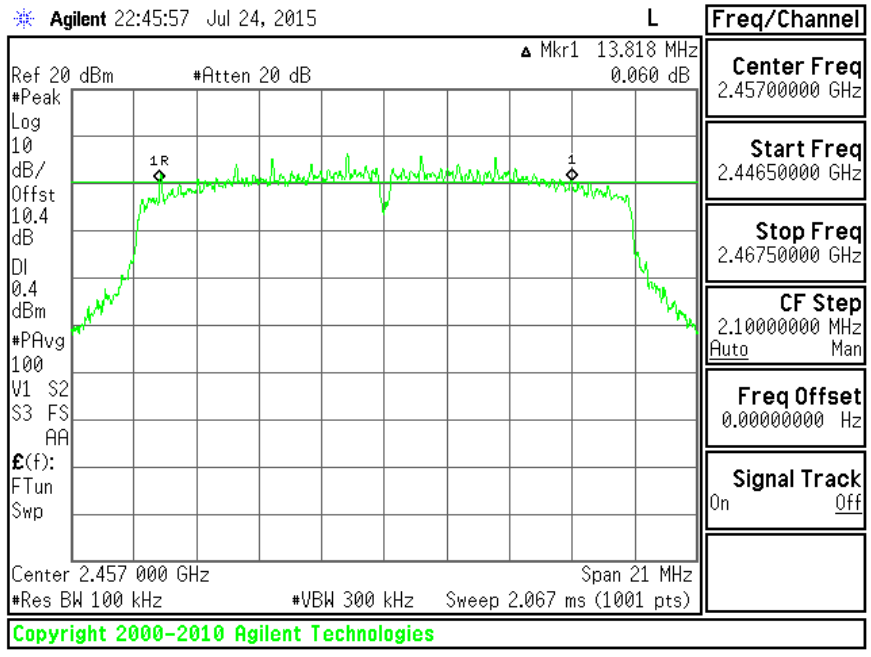
6 dB BANDWIDTH Chain 1 MID CH



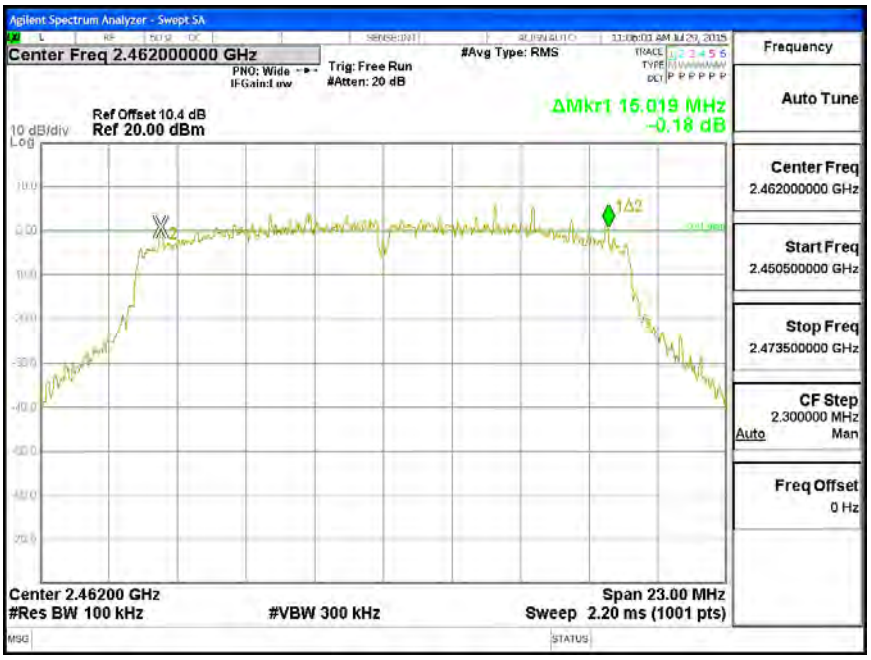
6 dB BANDWIDTH Chain 1 CH 9



6 dB BANDWIDTH Chain 1 CH 10



6 dB BANDWIDTH Chain 1 HIGH CH



8.3.2. 99% BANDWIDTH

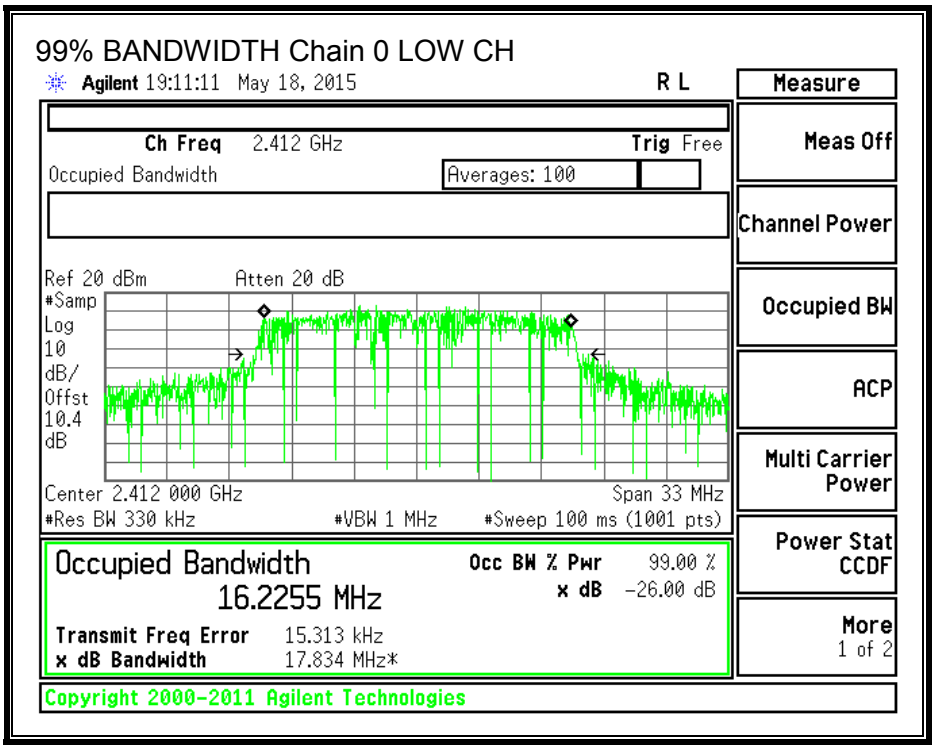
LIMITS

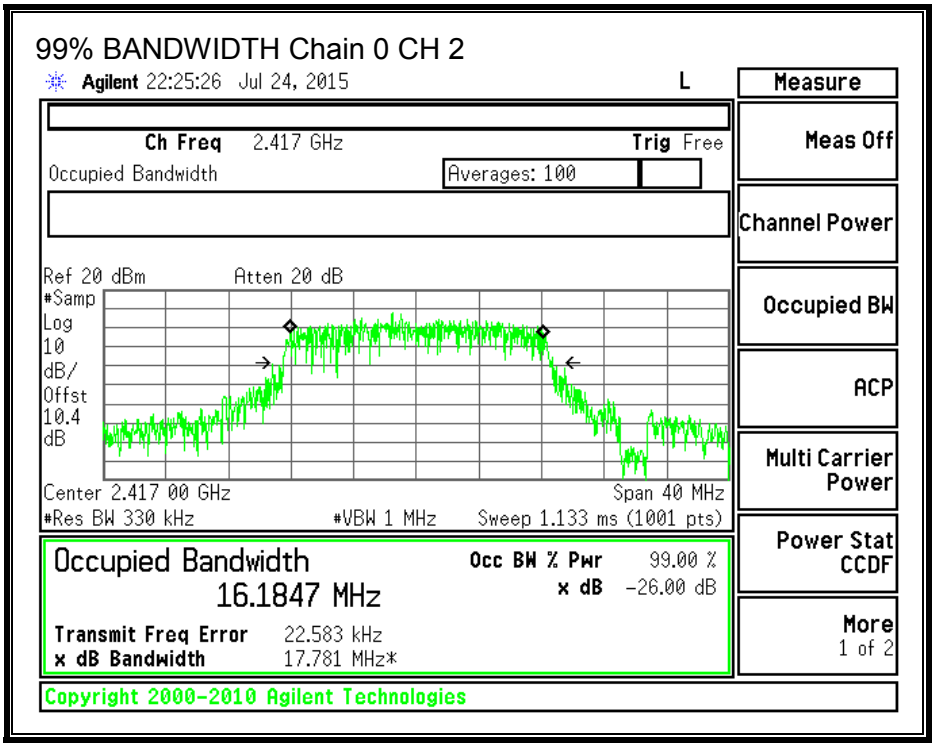
None; for reporting purposes only.

RESULTS

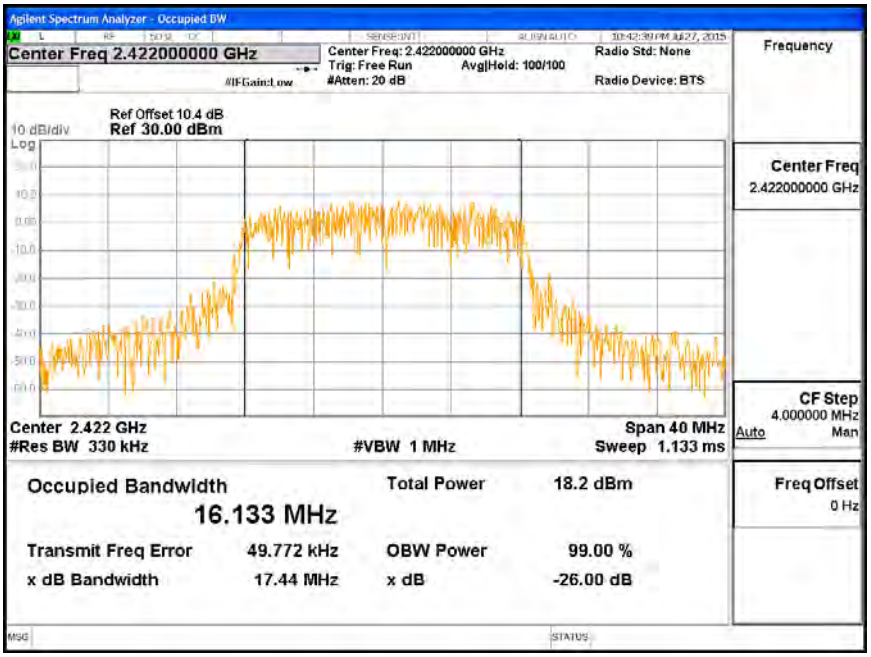
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	2412	16.2255	16.1988
2	2417	16.1847	16.1022
3	2422	16.1330	16.2230
Mid	2437	16.2216	16.1960
9	2452	16.2620	16.0870
10	2457	16.1517	16.0852
High	2462	16.1843	16.1891

99% BANDWIDTH, Chain 0

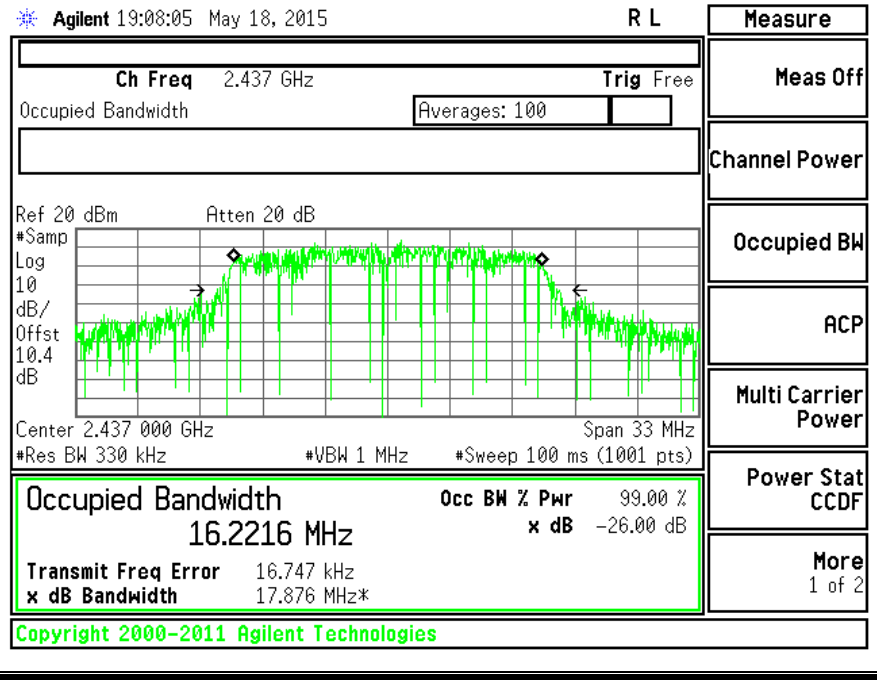




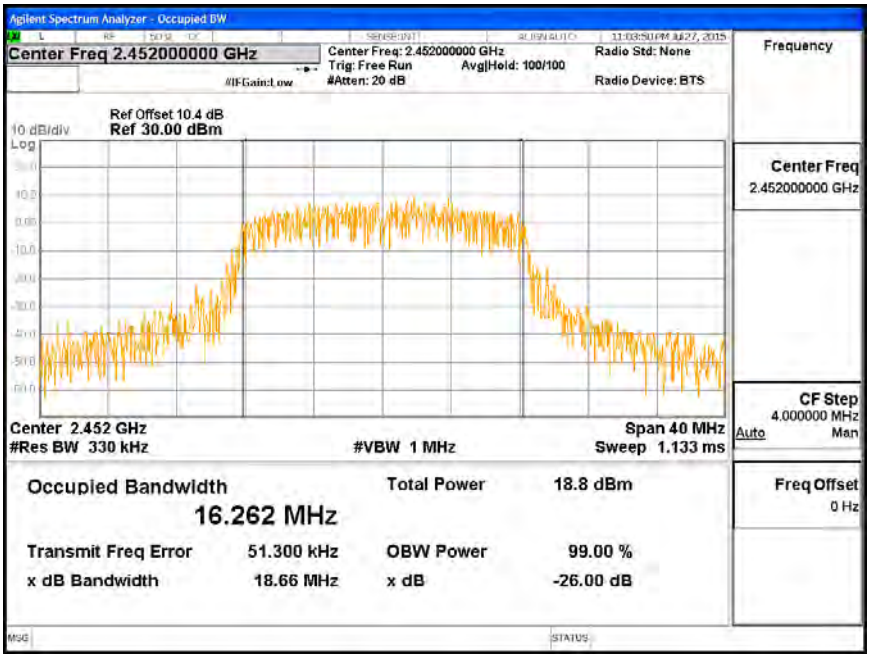
99% BANDWIDTH Chain 0 CH 3



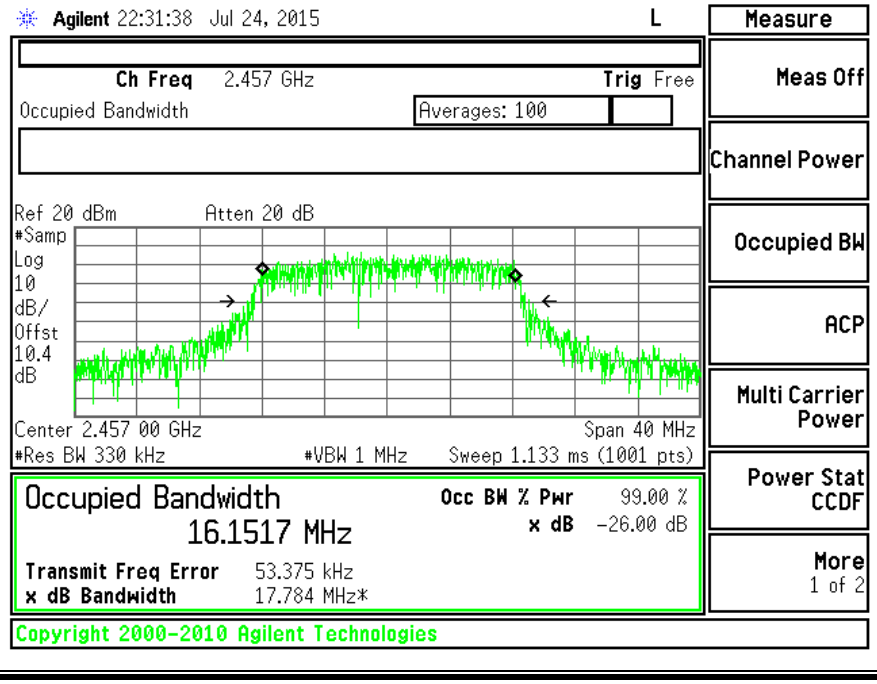
99% BANDWIDTH Chain 0 MID CH

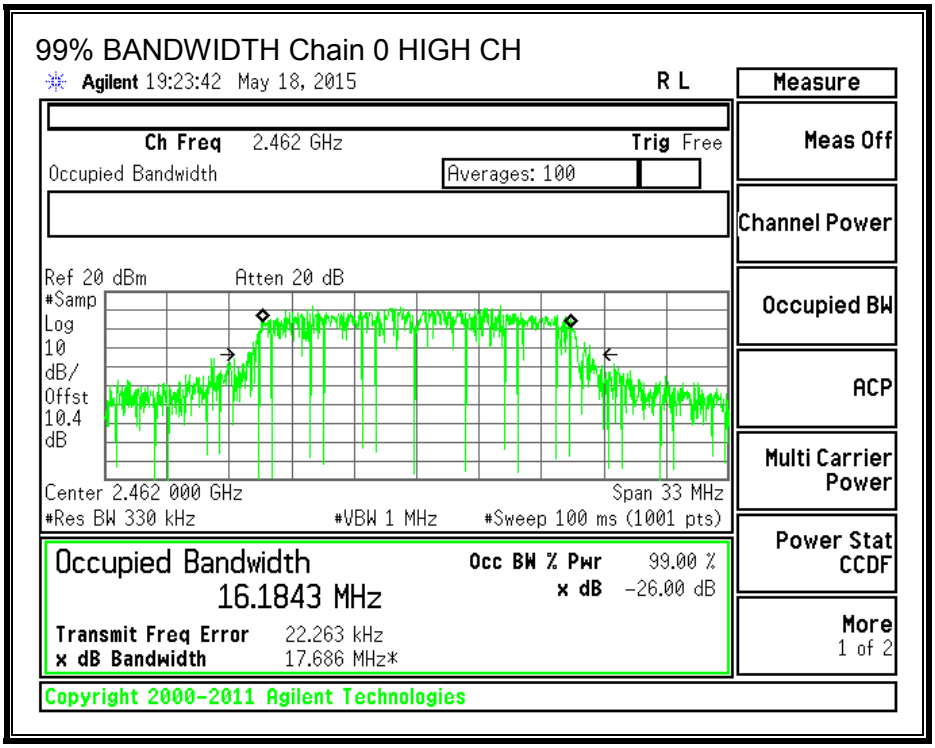


99% BANDWIDTH Chain 0 CH 9

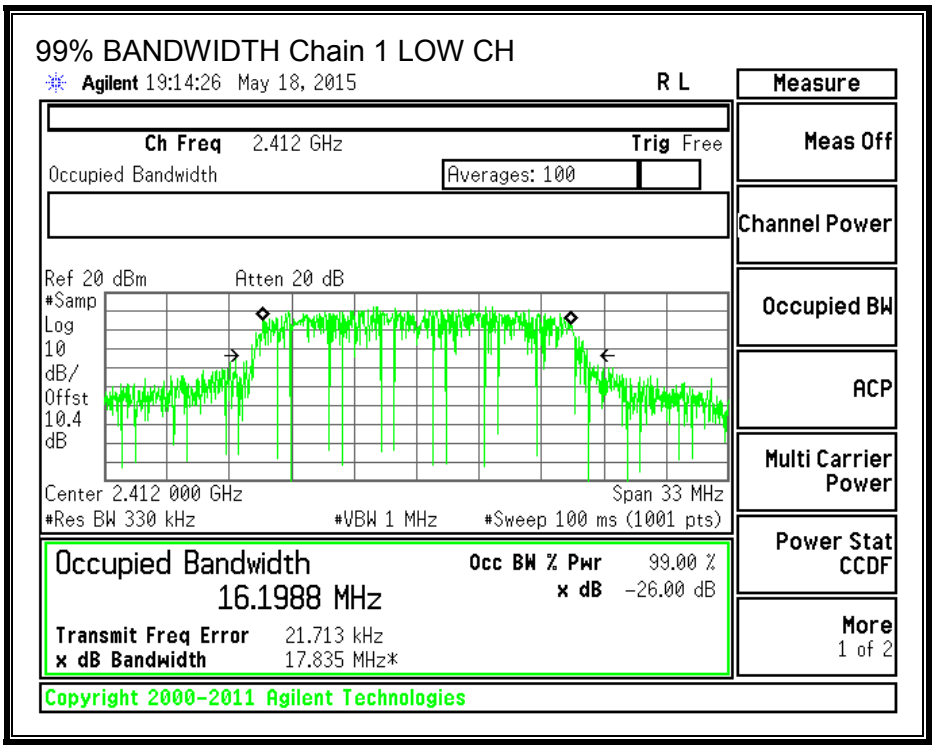


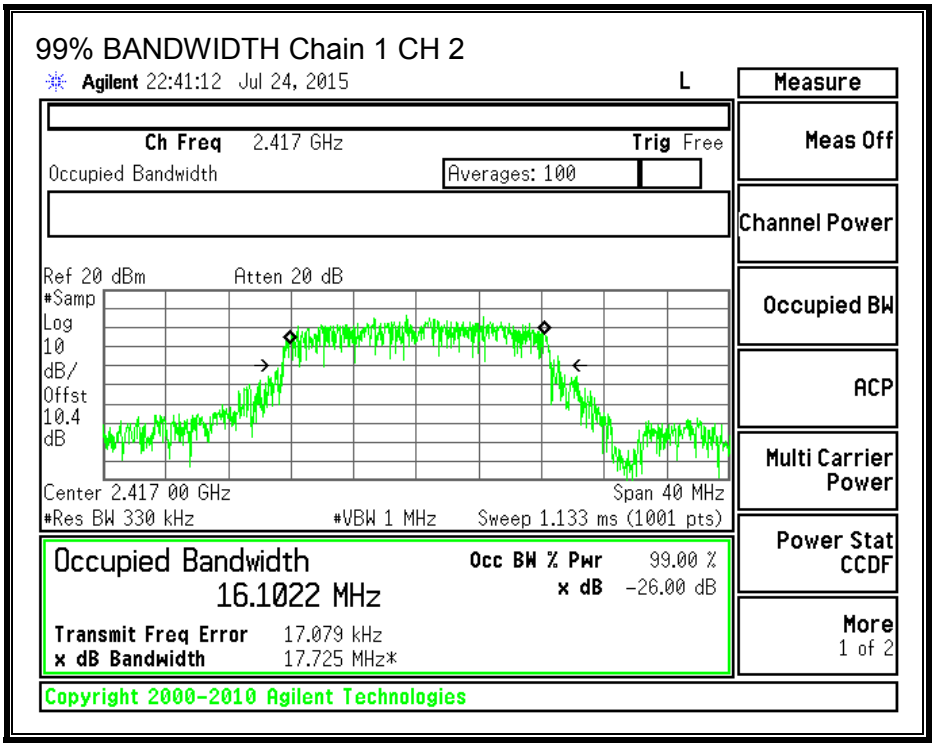
99% BANDWIDTH Chain 0 CH 10



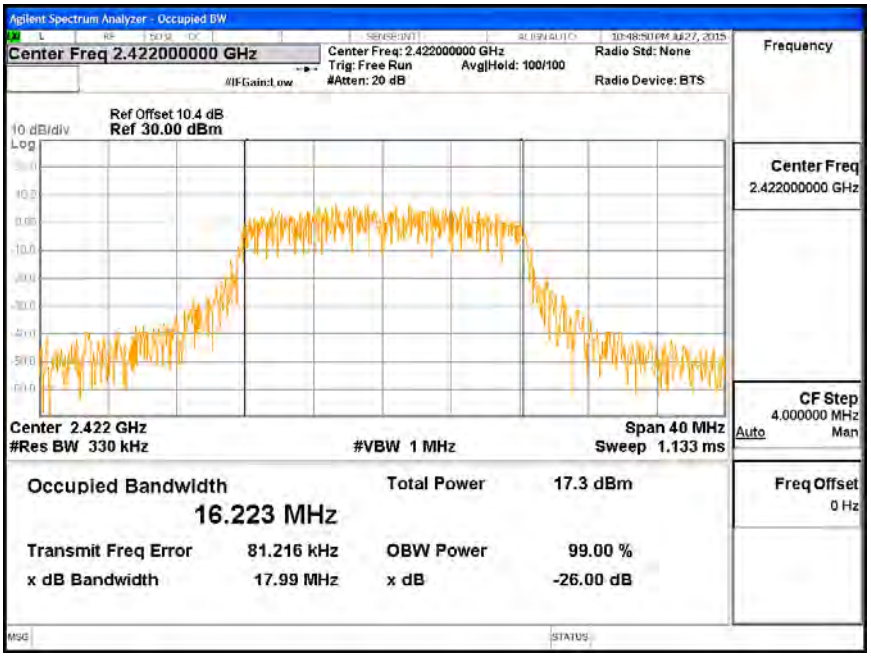


99% BANDWIDTH, Chain 1

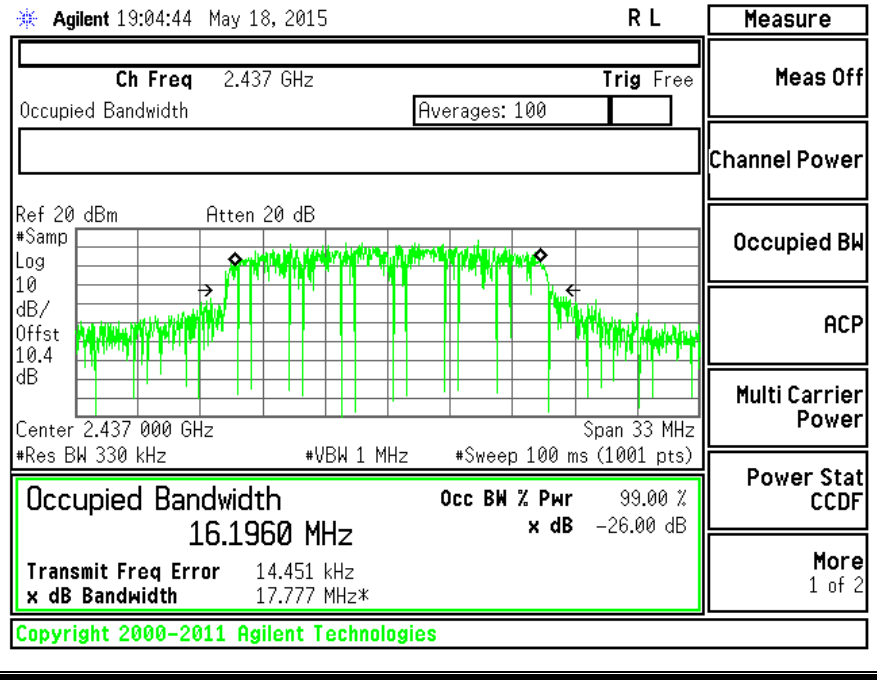




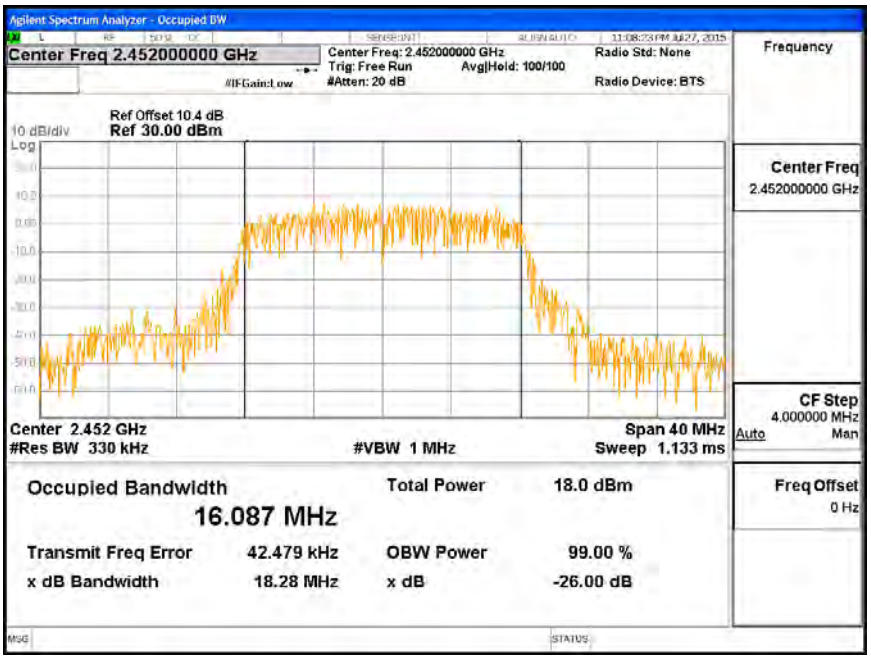
99% BANDWIDTH Chain 1 CH 3



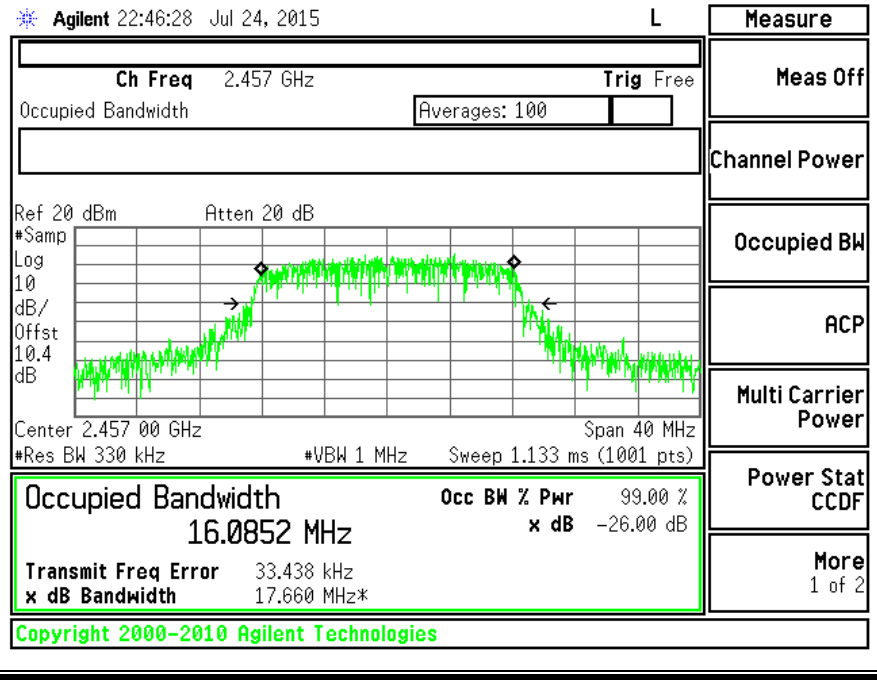
99% BANDWIDTH Chain 1 MID CH

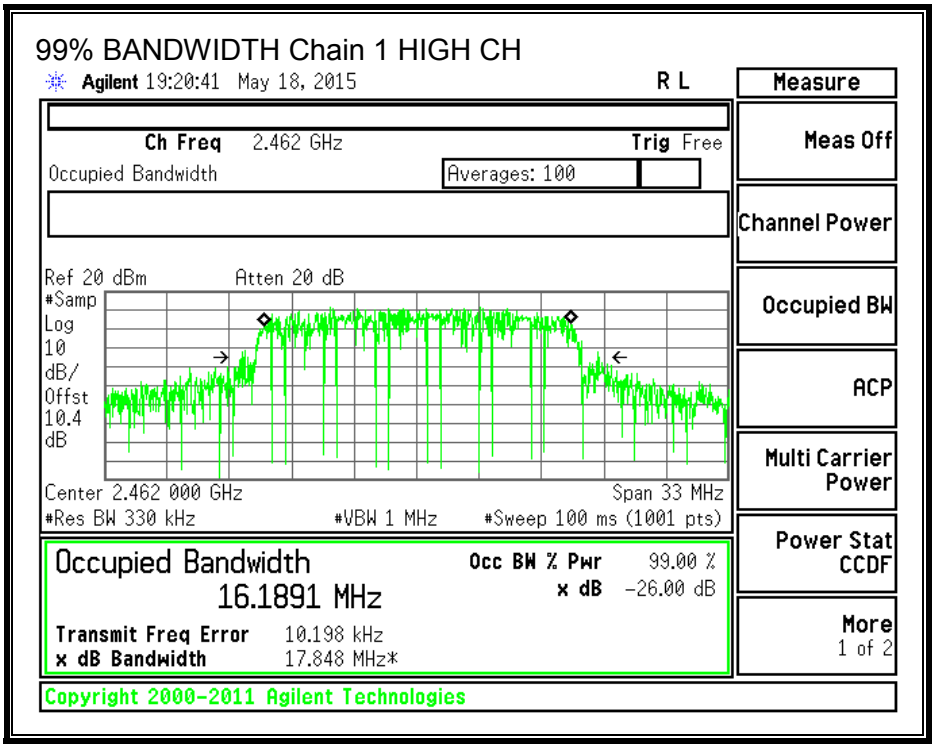


99% BANDWIDTH Chain 1 CH 9



99% BANDWIDTH Chain 1 CH 10





8.3.3. OUTPUT POWER

LIMITS

FCC §15.247

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.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.70	2.50	3.14

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	3.14	30.00	30	36	30.00
2	2417	3.14	30.00	30	36	30.00
3	2422	3.14	30.00	30	36	30.00
Mid	2437	3.14	30.00	30	36	30.00
9	2452	3.14	30.00	30	36	30.00
10	2457	3.14	30.00	30	36	30.00
High	2462	3.14	30.00	30	36	30.00

Duty Cycle CF (dB)	0.11	Included in Calculations of Corr'd Power

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margi (dB)
Low	2412	19.03	18.10	21.71	30.00	-8.29
2	2417	15.48	15.02	18.38	30.00	-11.62
3	2422	20.95	20.47	23.84	30.00	-6.16
Mid	2437	21.76	21.13	24.58	30.00	-5.42
9	2452	18.33	17.98	21.28	30.00	-8.72
10	2457	15.82	15.53	18.80	30.00	-11.20
High	2462	14.98	15.36	18.29	30.00	-11.71

8.3.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

RESULTS

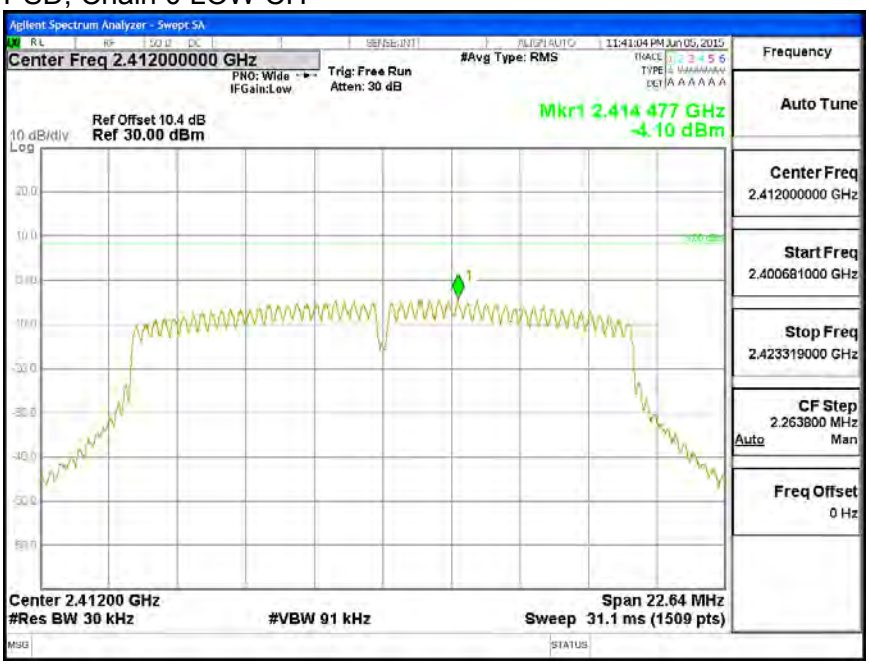
Duty Cycle CF (dB)	0.11	Included in Calculations of Corr'd PSD

PSD Results

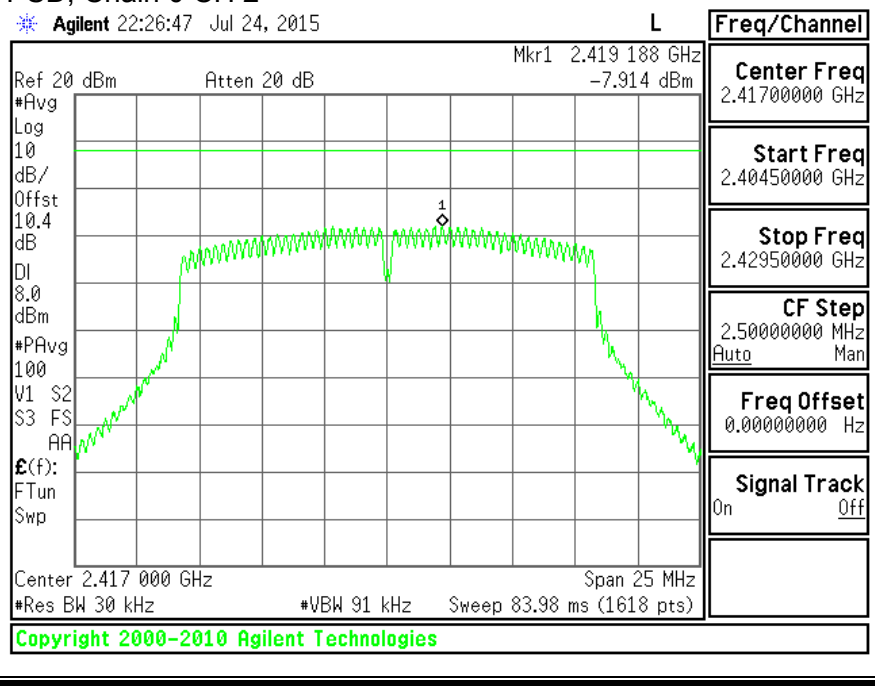
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total Corr'd PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-4.10	-5.45	-1.60	8.0	-9.6
2	2417	-7.91	-8.77	-5.20	8.0	-13.2
3	2422	-5.83	-6.03	-2.81	8.0	-10.8
Mid	2437	-1.80	-2.33	1.06	8.0	-6.9
9	2452	-4.78	-5.43	-1.97	8.0	-10.0
10	2457	-7.62	-7.58	-4.48	8.0	-12.5
High	2462	-7.66	-7.52	-4.47	8.0	-12.5

PSD, Chain 0

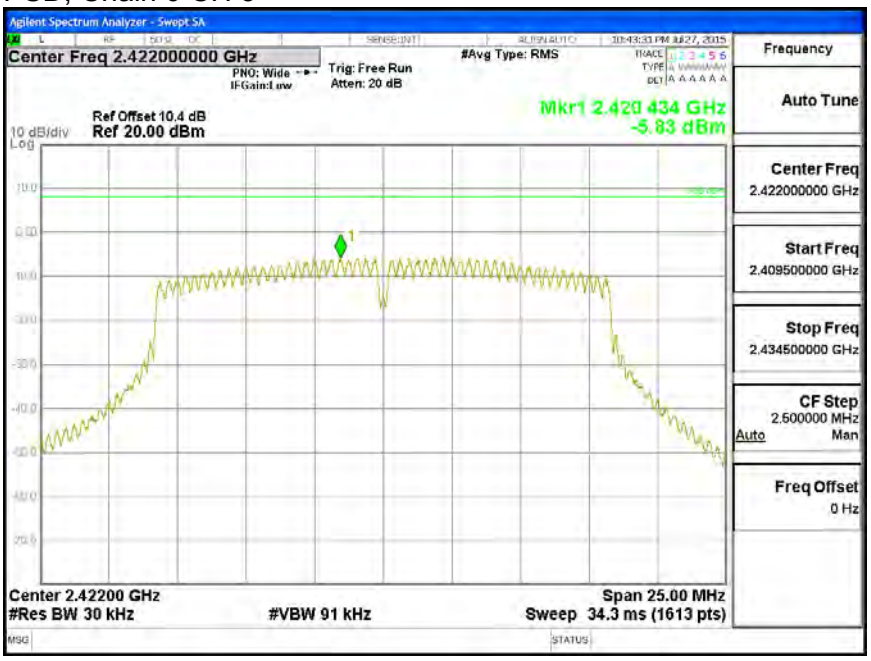
PSD, Chain 0 LOW CH



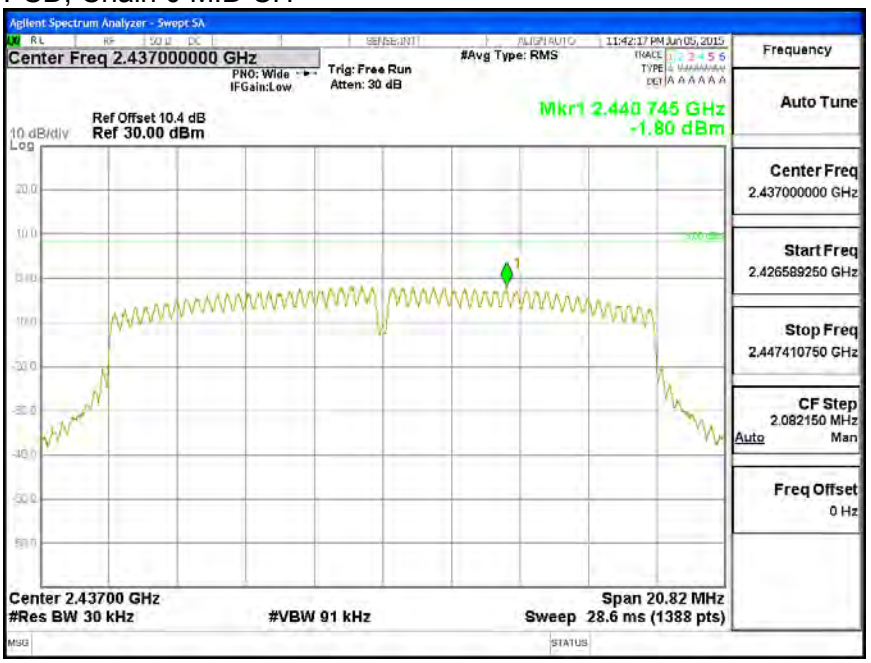
PSD, Chain 0 CH 2



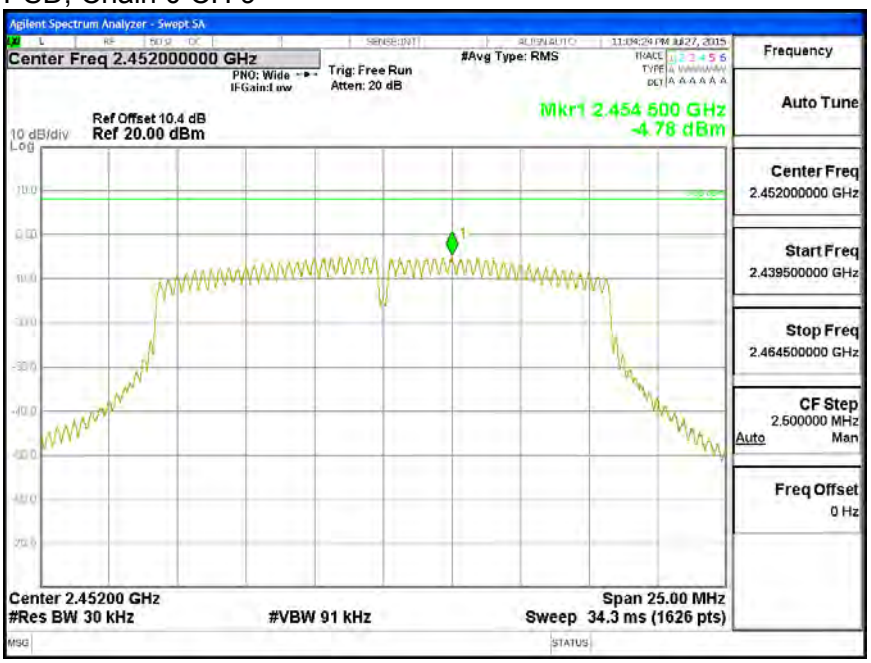
PSD, Chain 0 CH 3



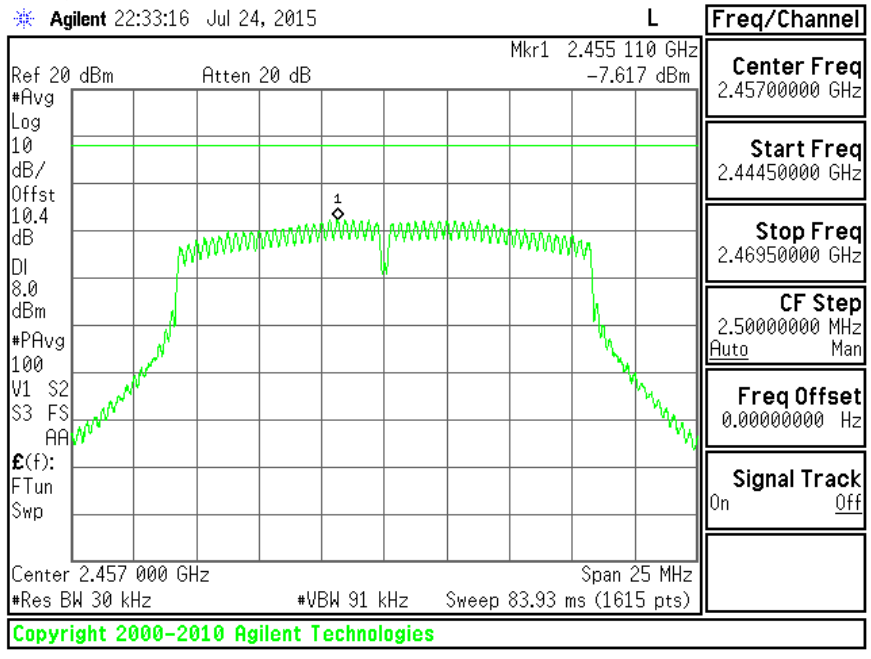
PSD, Chain 0 MID CH



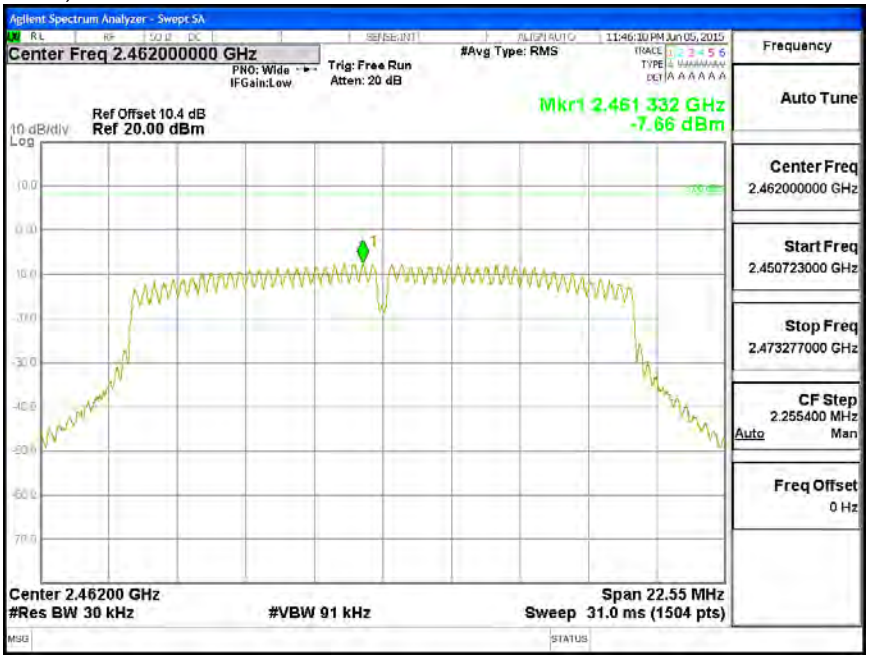
PSD, Chain 0 CH 9



PSD, Chain 0 CH 10

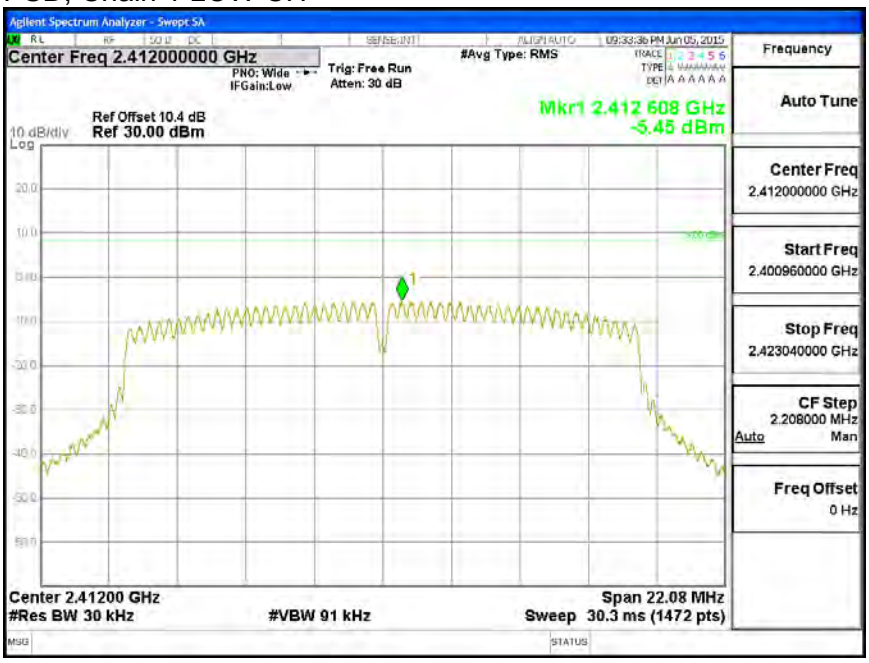


PSD, Chain 0 HIGH CH

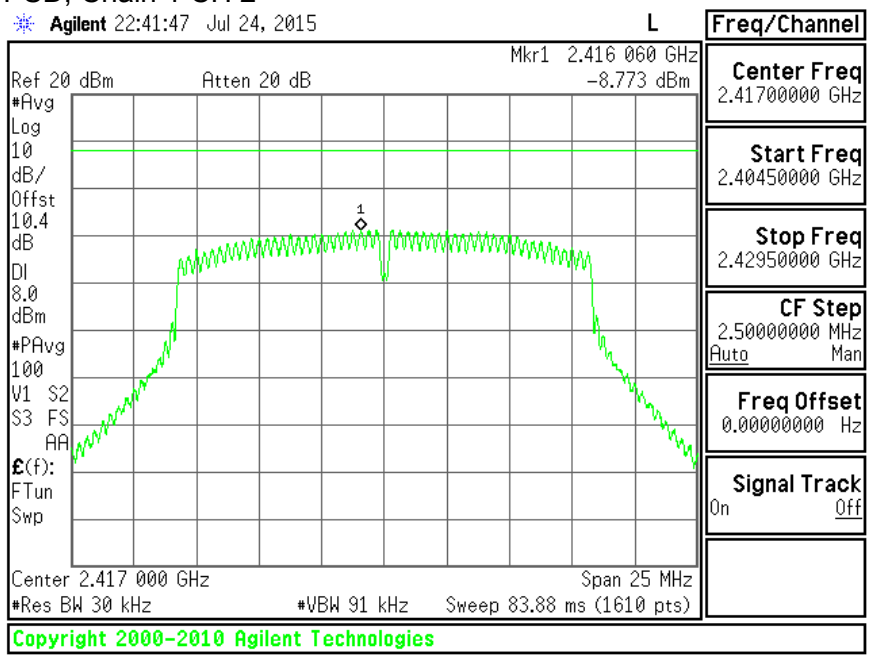


PSD, Chain 1

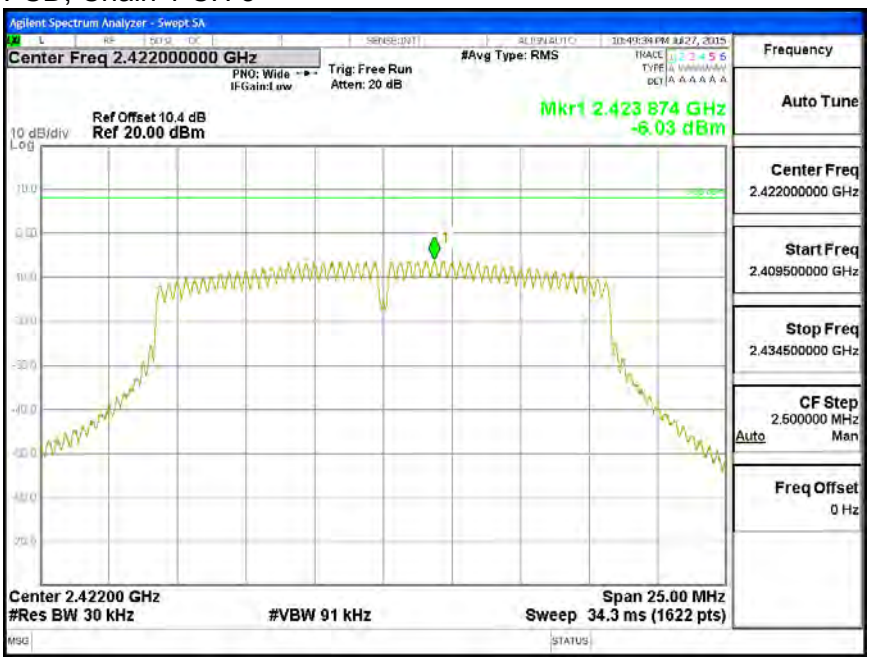
PSD, Chain 1 LOW CH



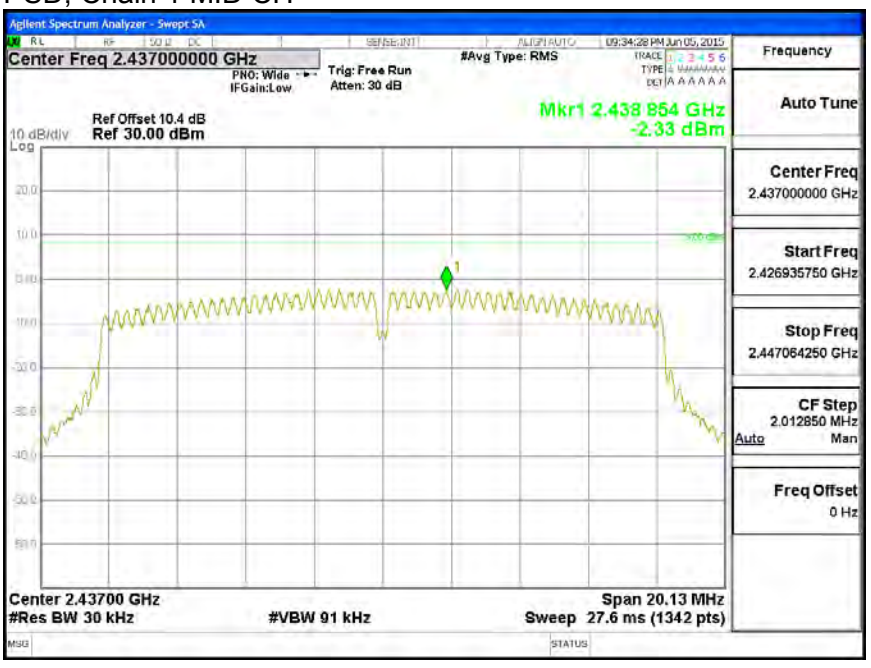
PSD, Chain 1 CH 2



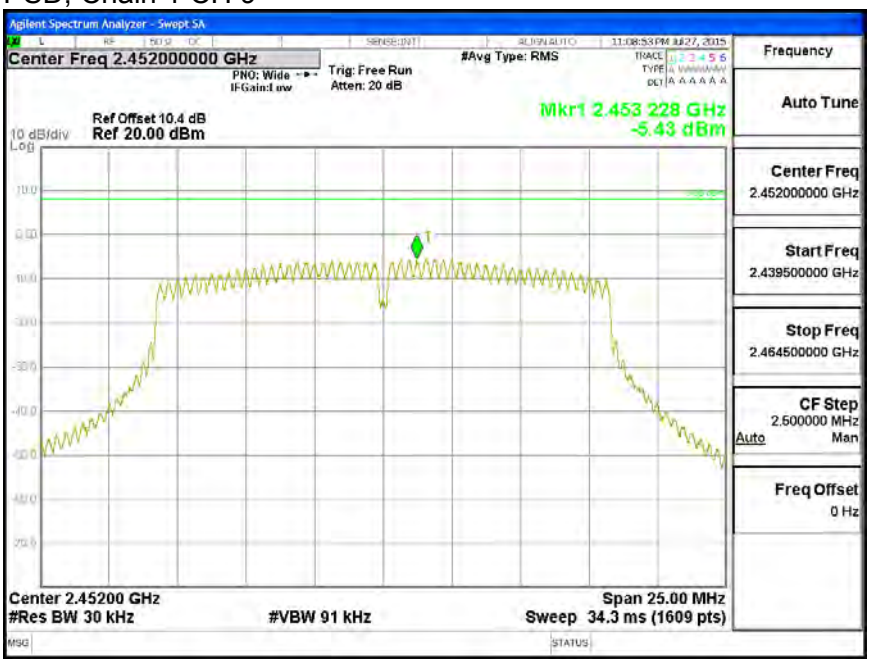
PSD, Chain 1 CH 3



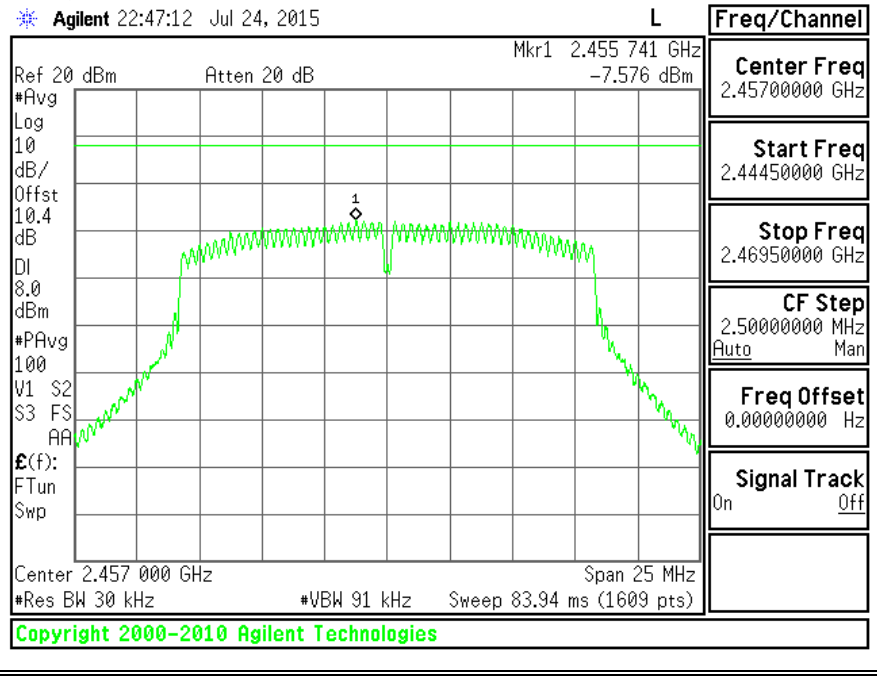
PSD, Chain 1 MID CH



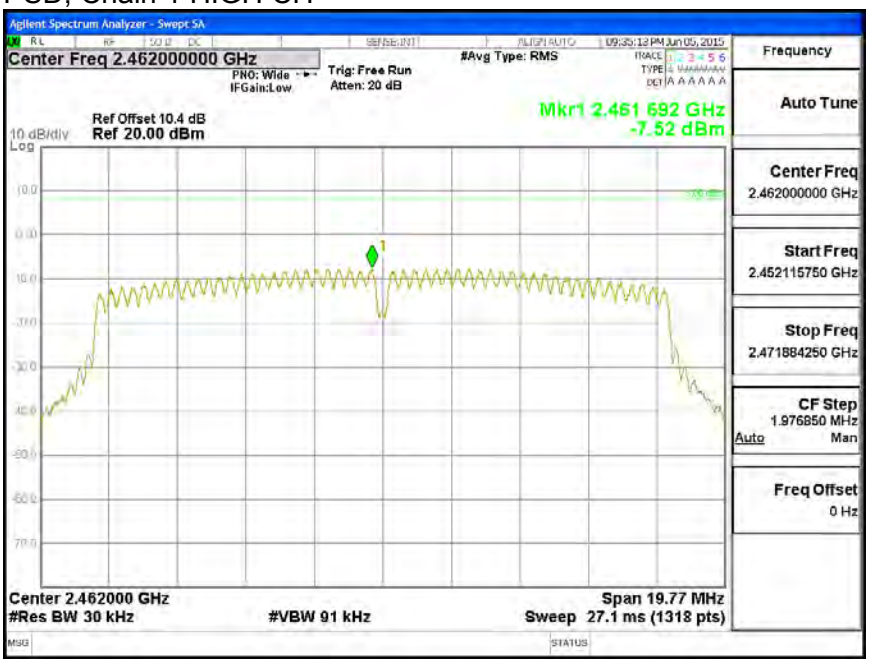
PSD, Chain 1 CH 9



PSD, Chain 1 CH 10



PSD, Chain 1 HIGH CH



8.3.5. OUT-OF-BAND EMISSIONS

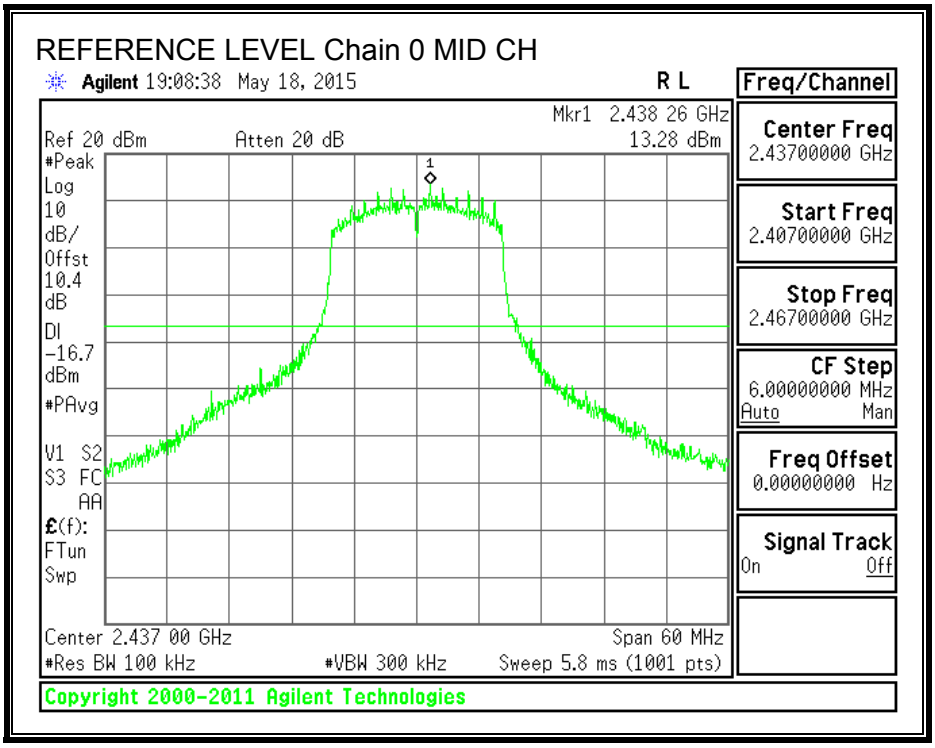
LIMITS

FCC §15.247 (d)

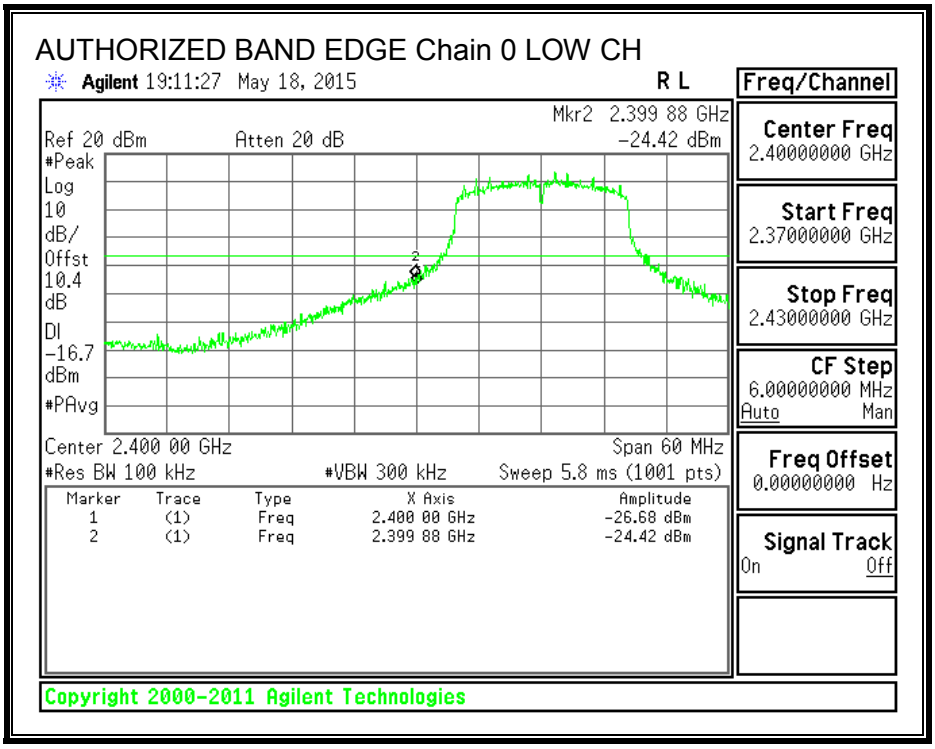
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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.

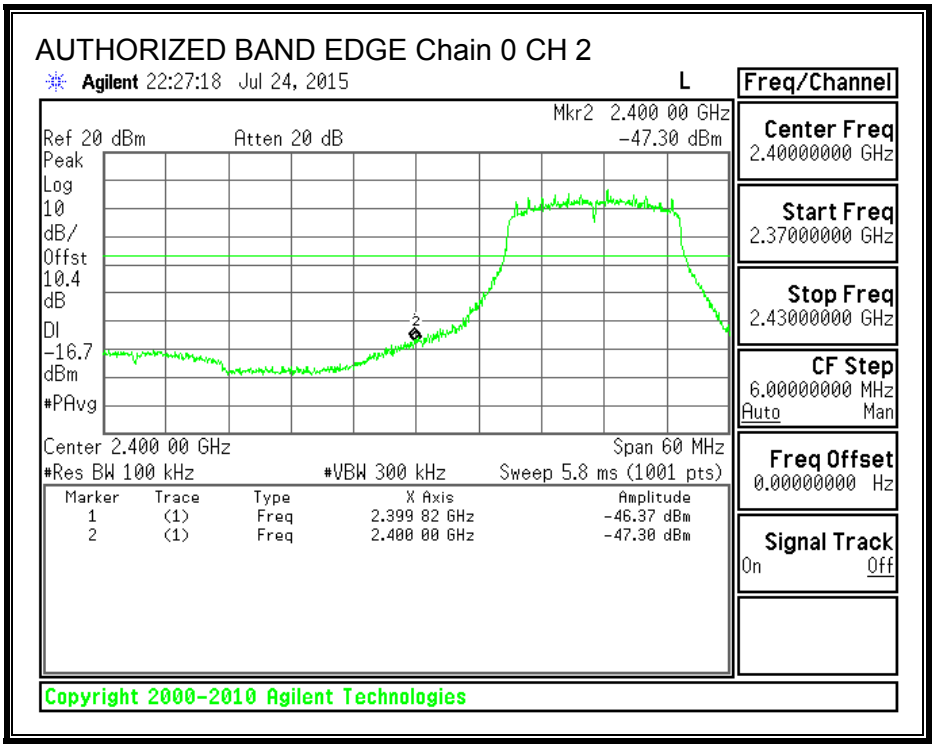
RESULTS

IN-BAND REFERENCE LEVEL, Chain 0

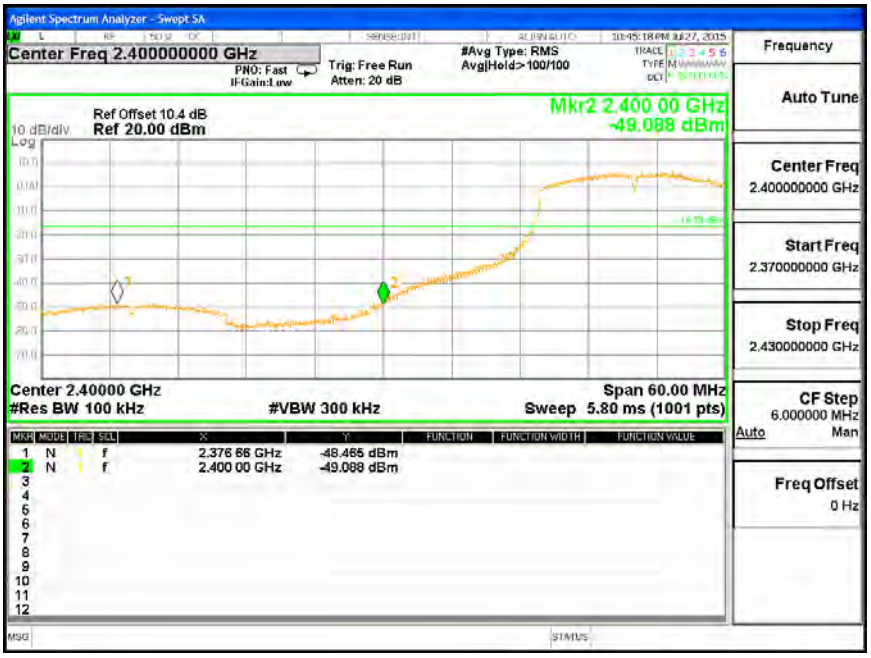


LOW CHANNEL BANDEDGE, Chain 0



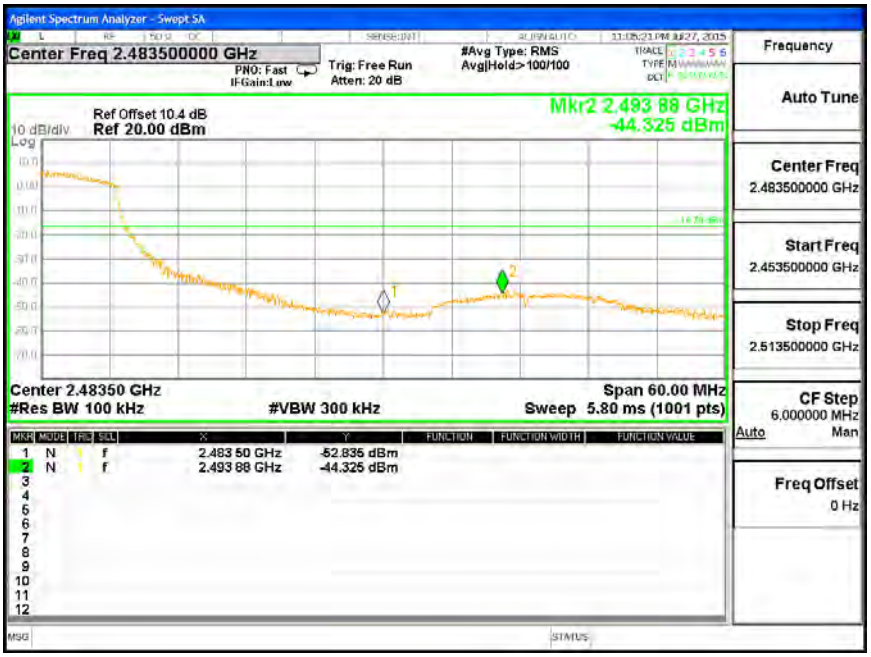


AUTHORIZED BAND EDGE Chain 0 CH 3

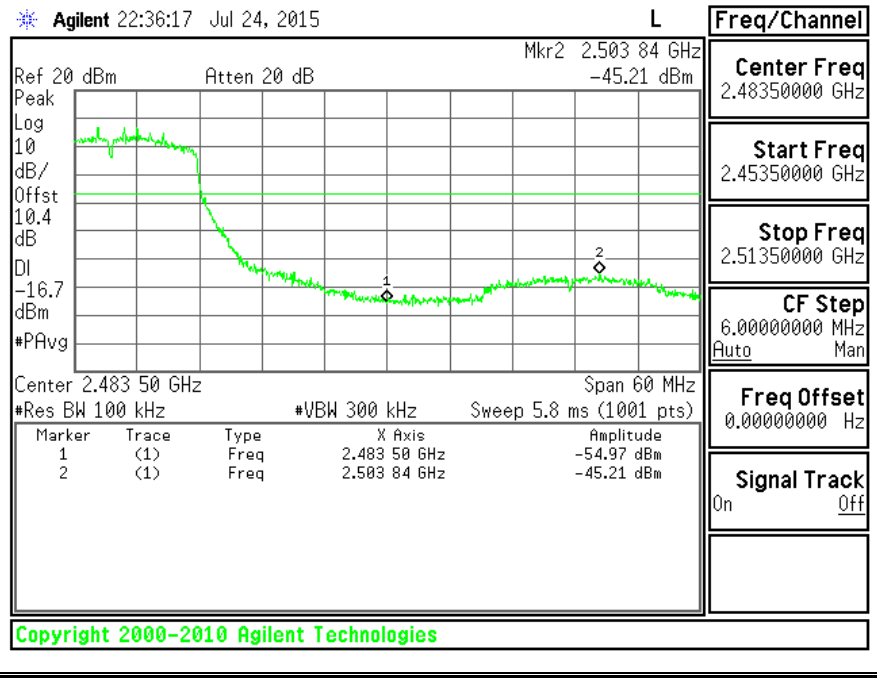


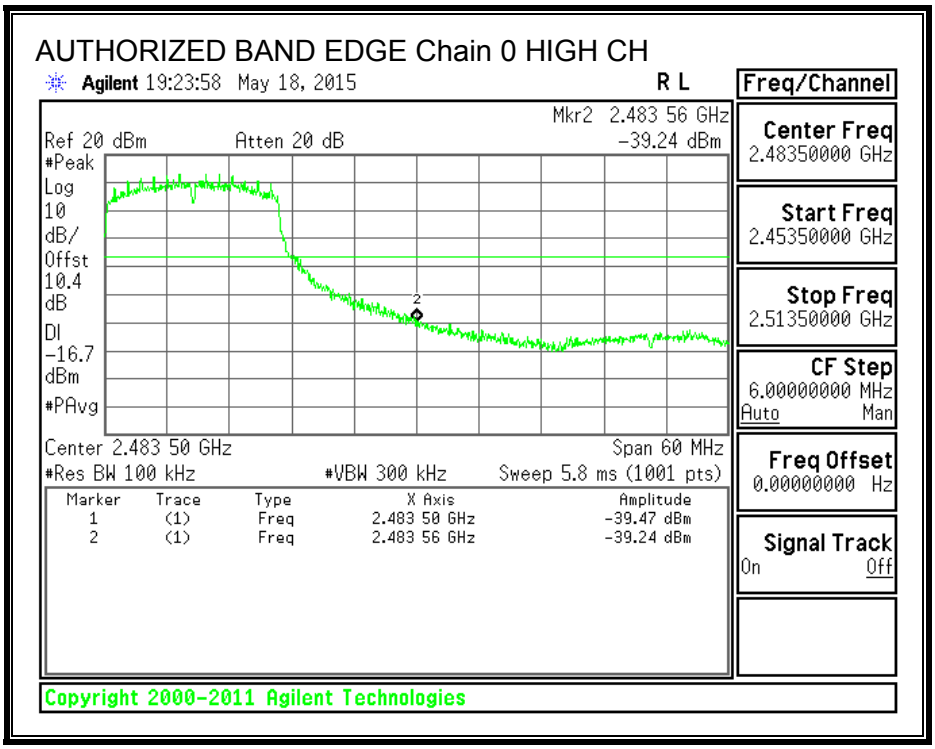
HIGH CHANNEL BANDEDGE, Chain 0

AUTHORIZED BAND EDGE Chain 0 CH 9

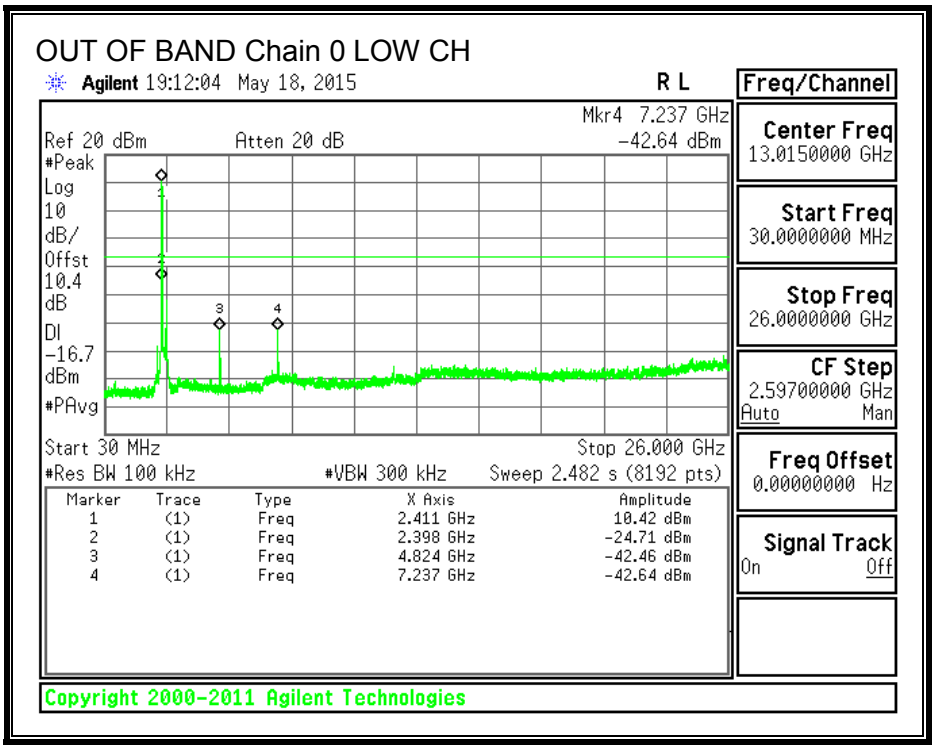


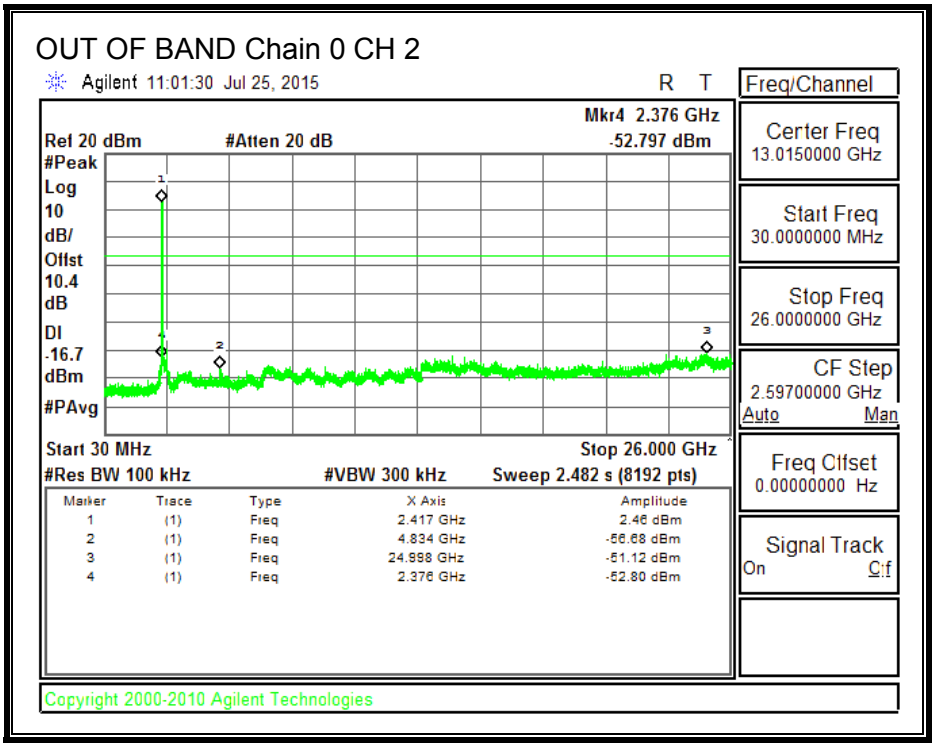
AUTHORIZED BAND EDGE Chain 0 CH 10



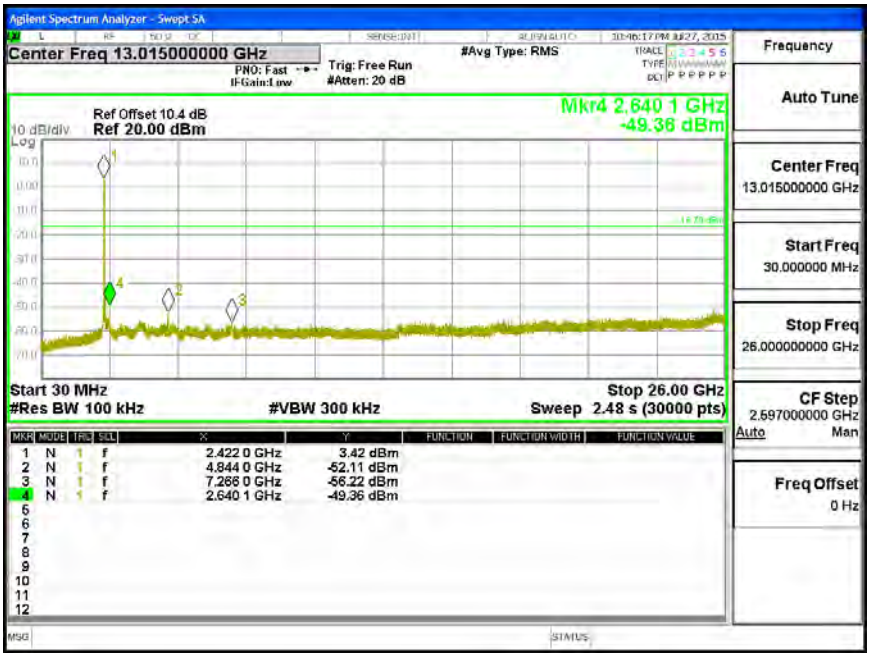


OUT-OF-BAND EMISSIONS, Chain 0

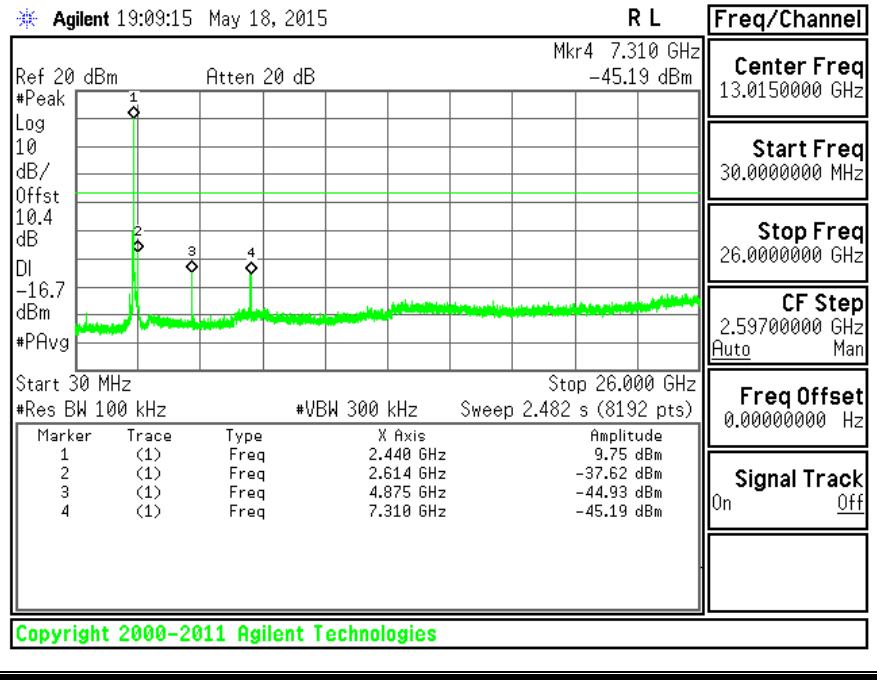




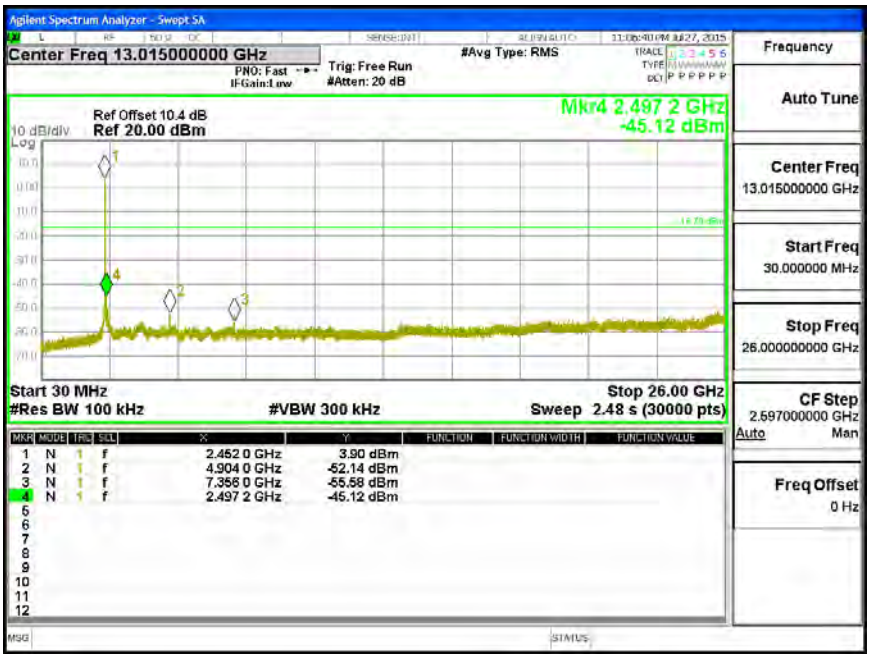
OUT OF BAND Chain 0 CH 3



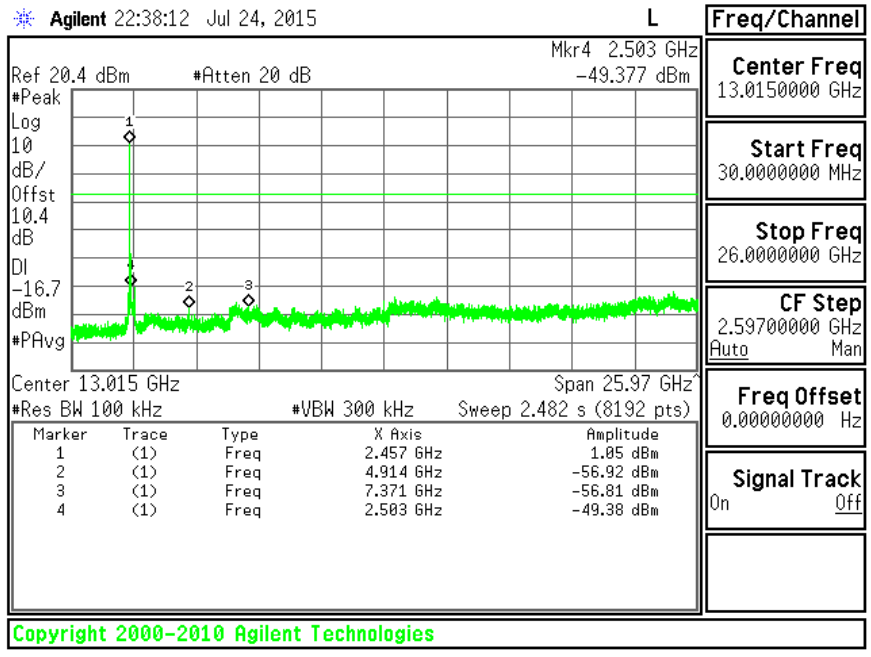
OUT OF BAND Chain 0 MID CH

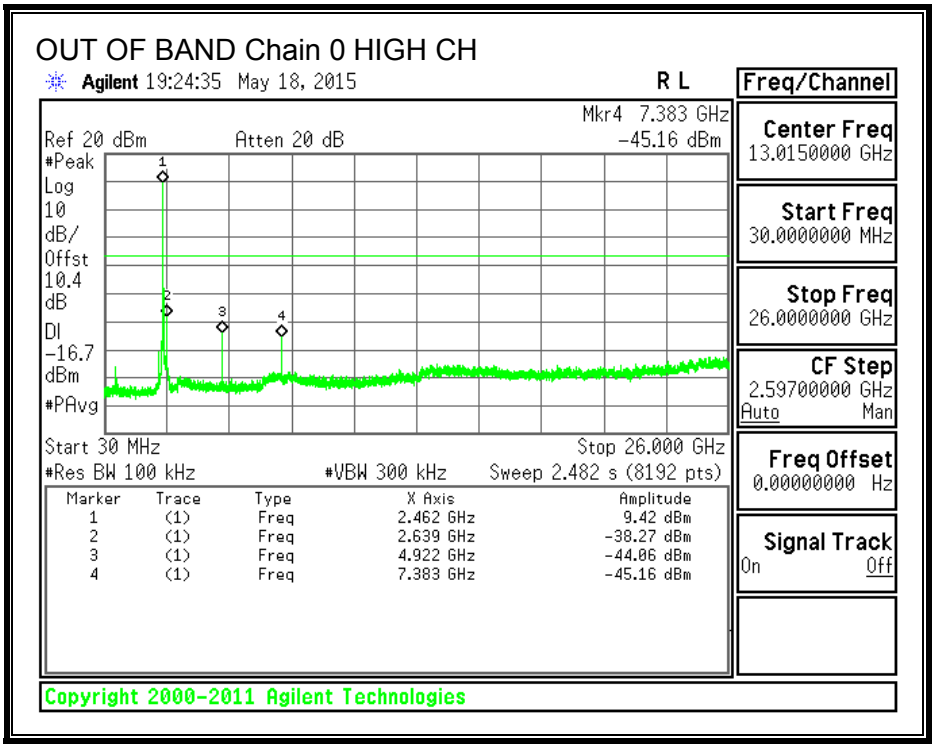


OUT OF BAND Chain 0 CH 9

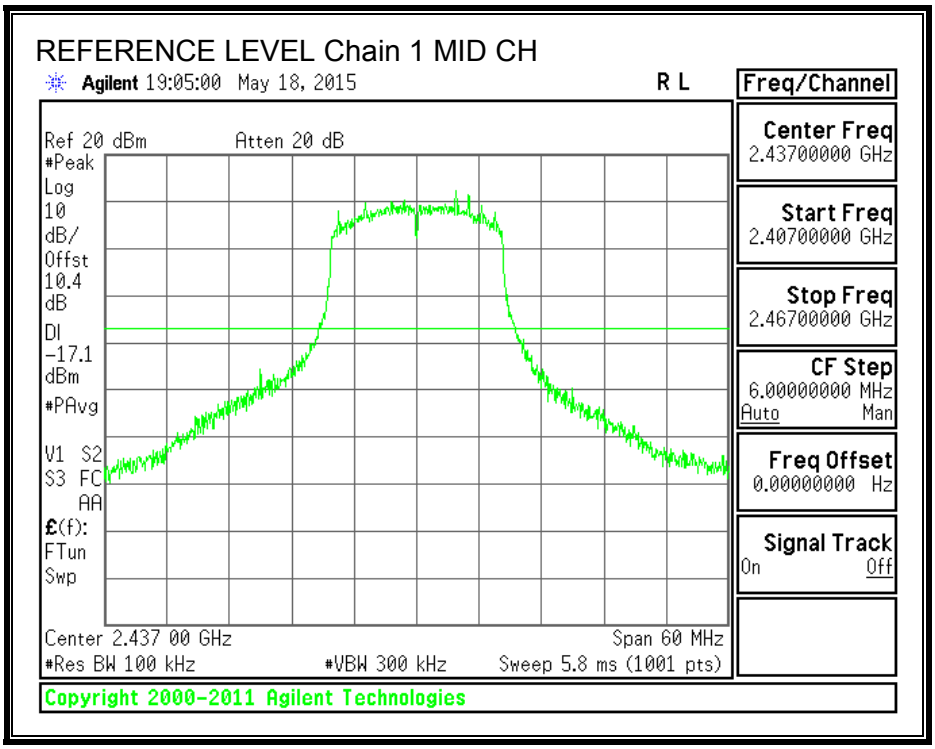


OUT OF BAND Chain 0 CH 10

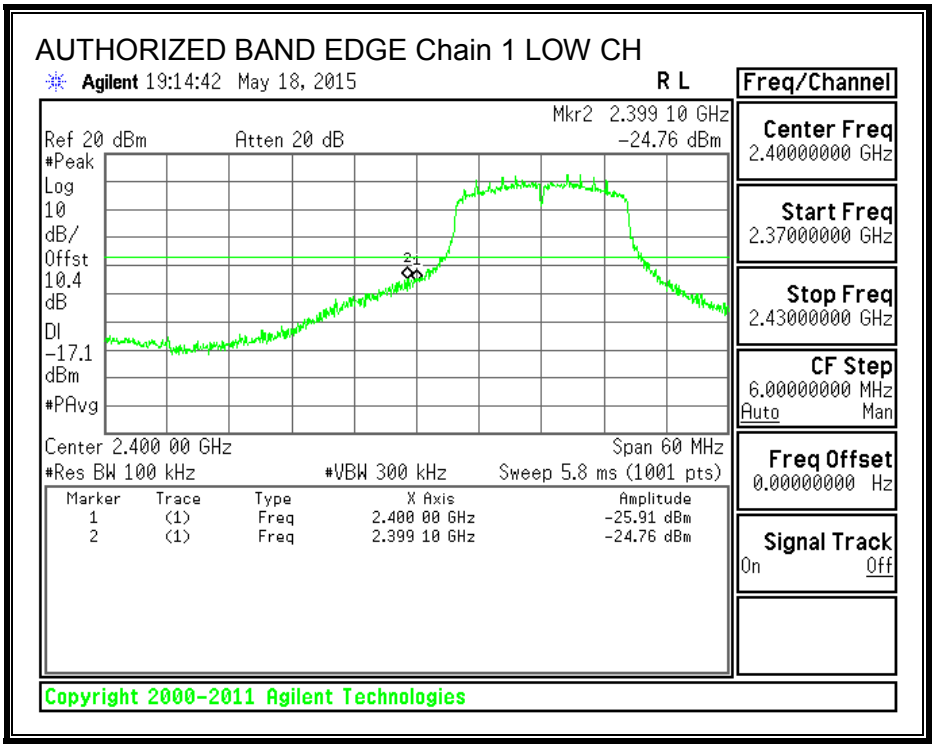


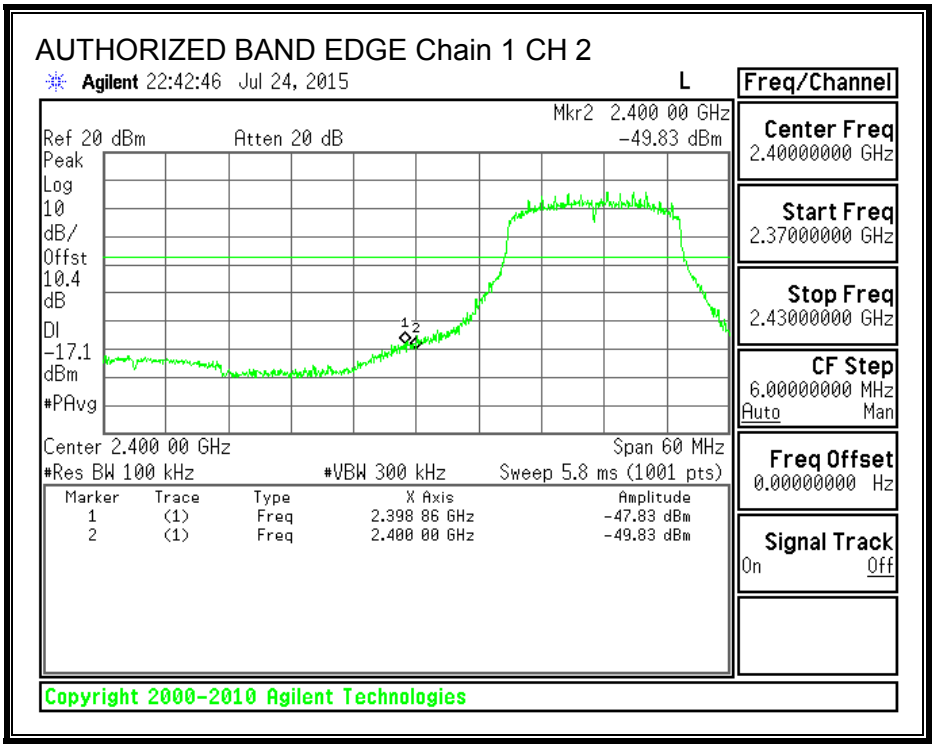


IN-BAND REFERENCE LEVEL, Chain 1

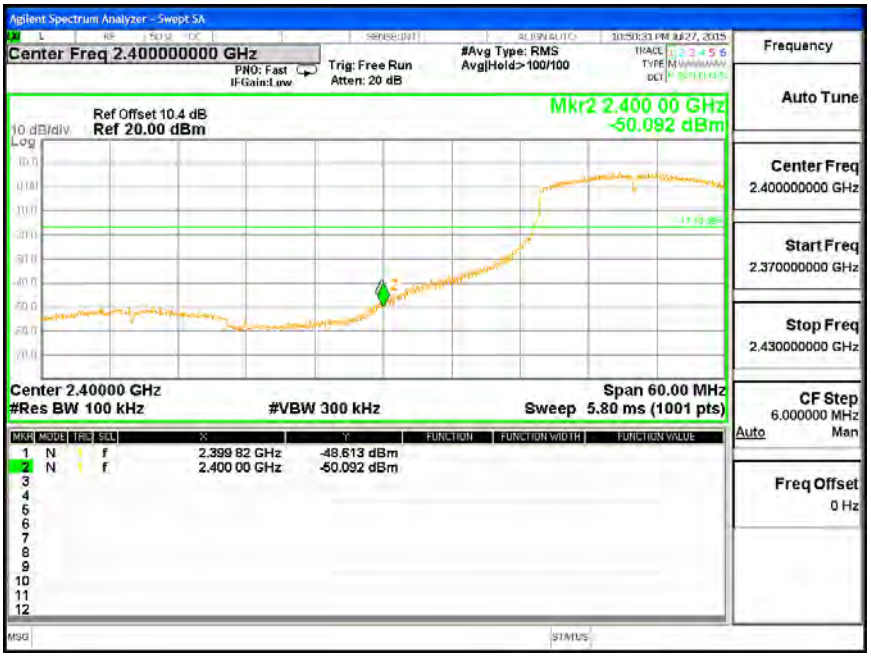


LOW CHANNEL BANDEDGE, Chain 1



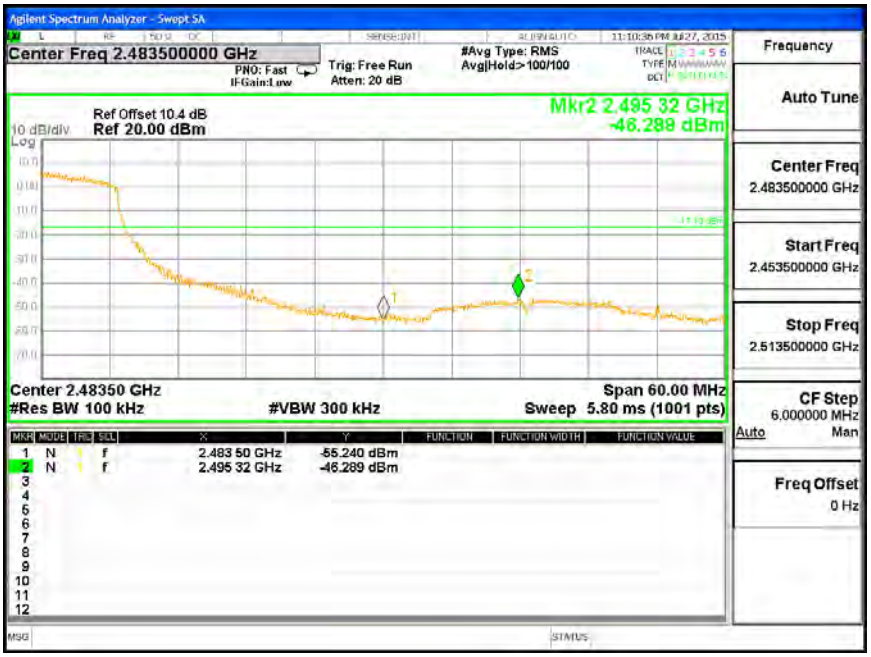


AUTHORIZED BAND EDGE Chain 1 CH 3

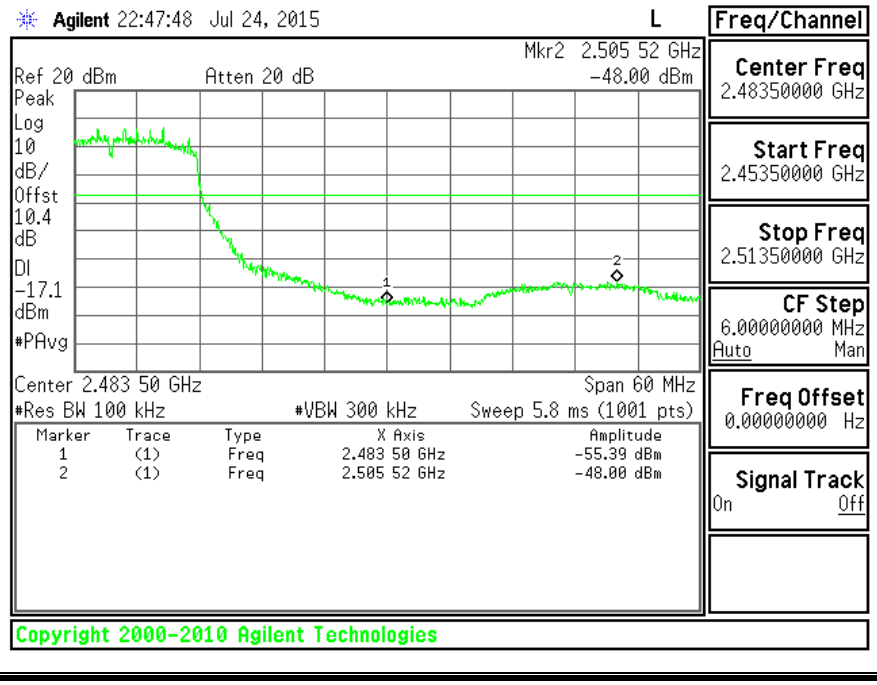


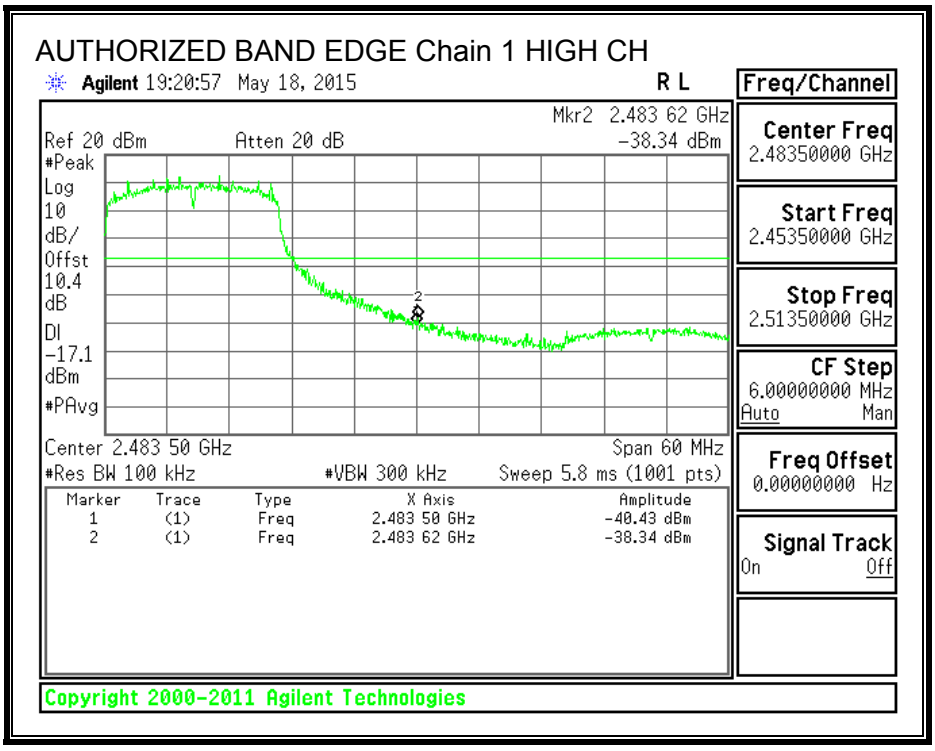
HIGH CHANNEL BANDEDGE, Chain 1

AUTHORIZED BAND EDGE Chain 1 CH 9

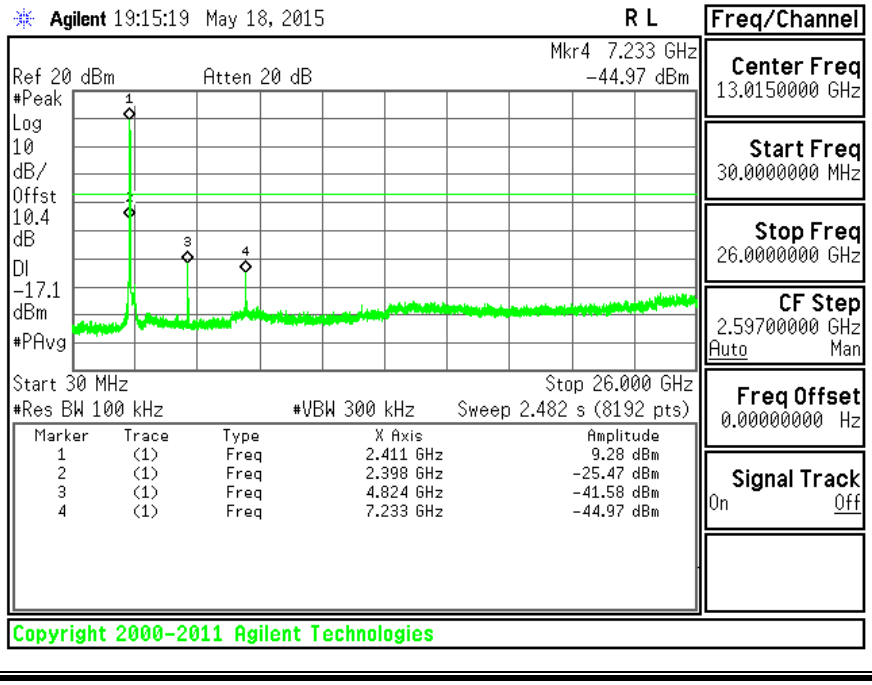


AUTHORIZED BAND EDGE Chain 1 CH 10

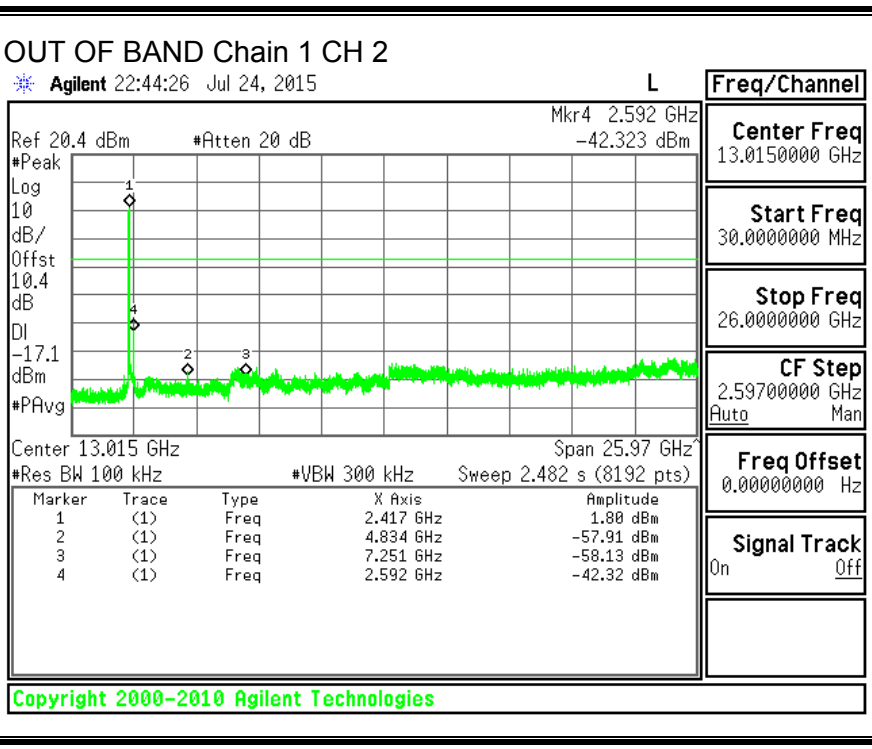




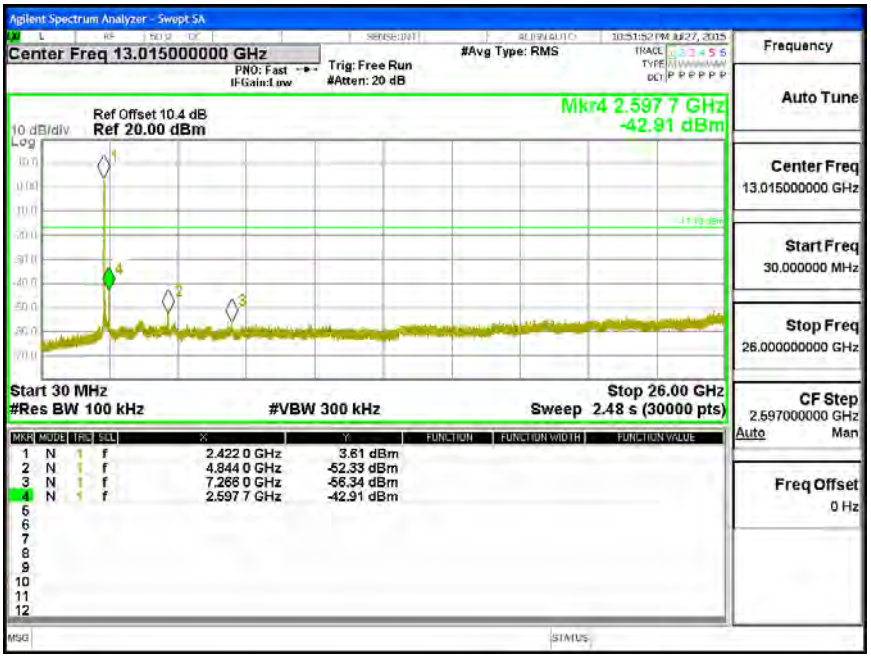
OUT OF BAND Chain 1 LOW CH



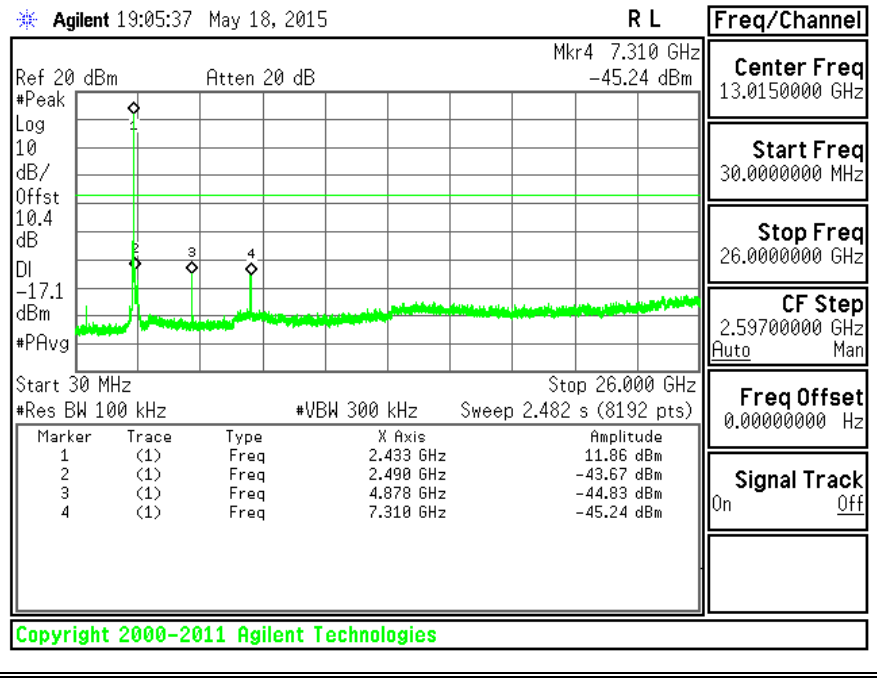
OUT OF BAND Chain 1 CH 2



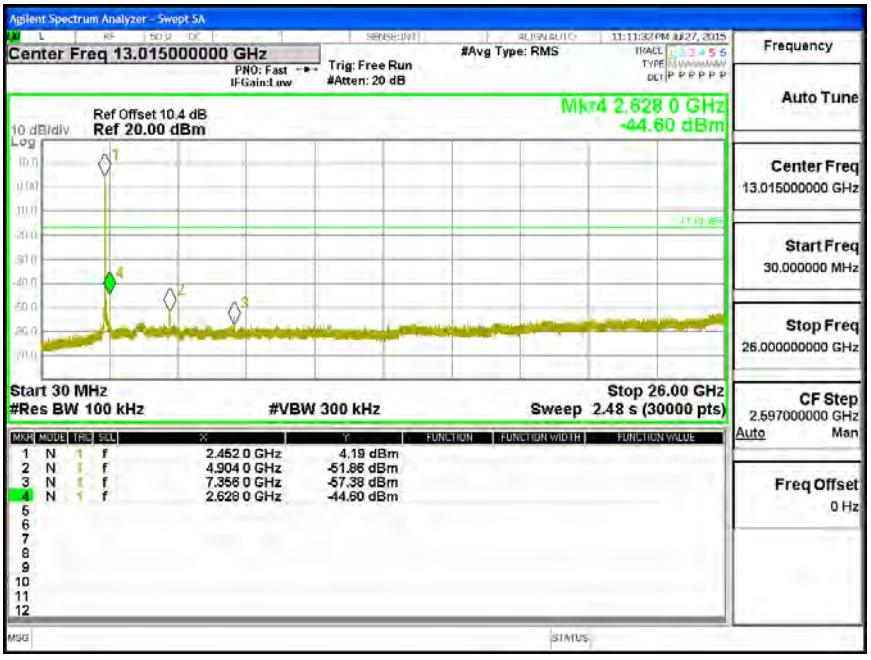
OUT OF BAND Chain 1 CH 3



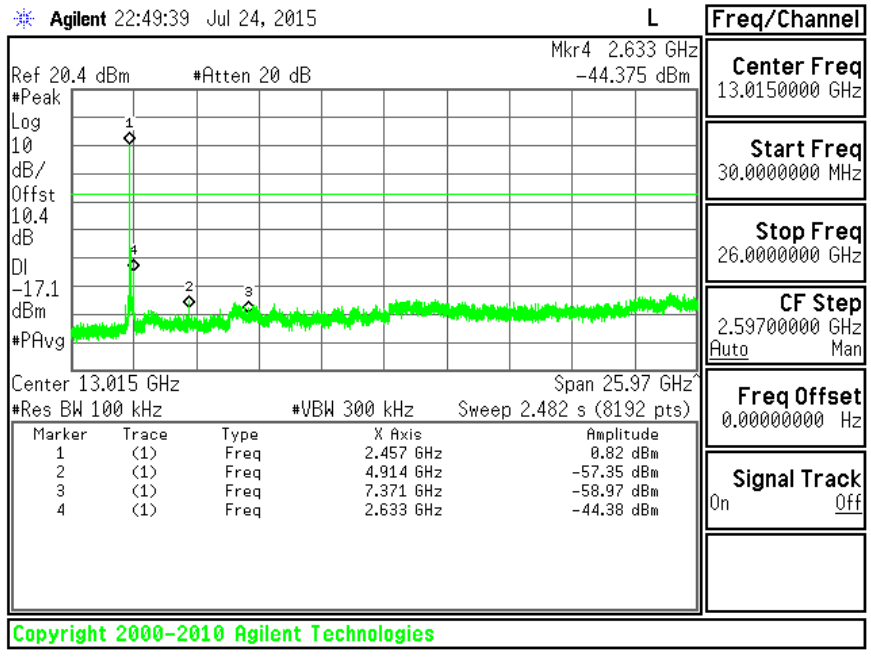
OUT OF BAND Chain 1 MID CH

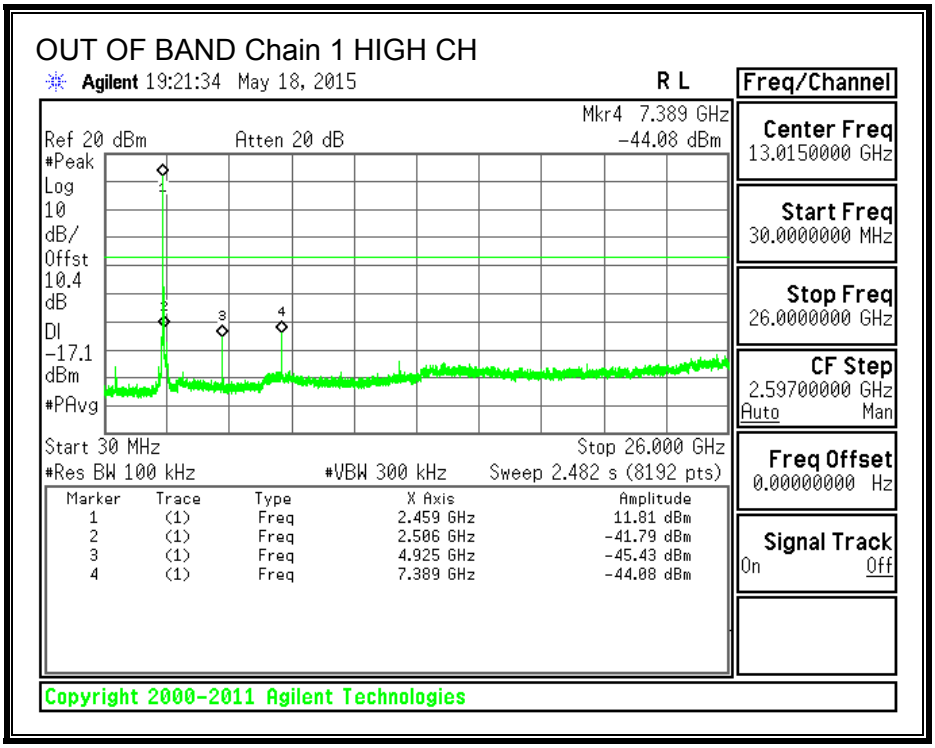


OUT OF BAND Chain 1 CH 9



OUT OF BAND Chain 1 CH 10





8.4. 802.11n HT20 2TX MODE IN THE 2.4 GHz BAND

8.4.1. 6 dB BANDWIDTH

LIMITS

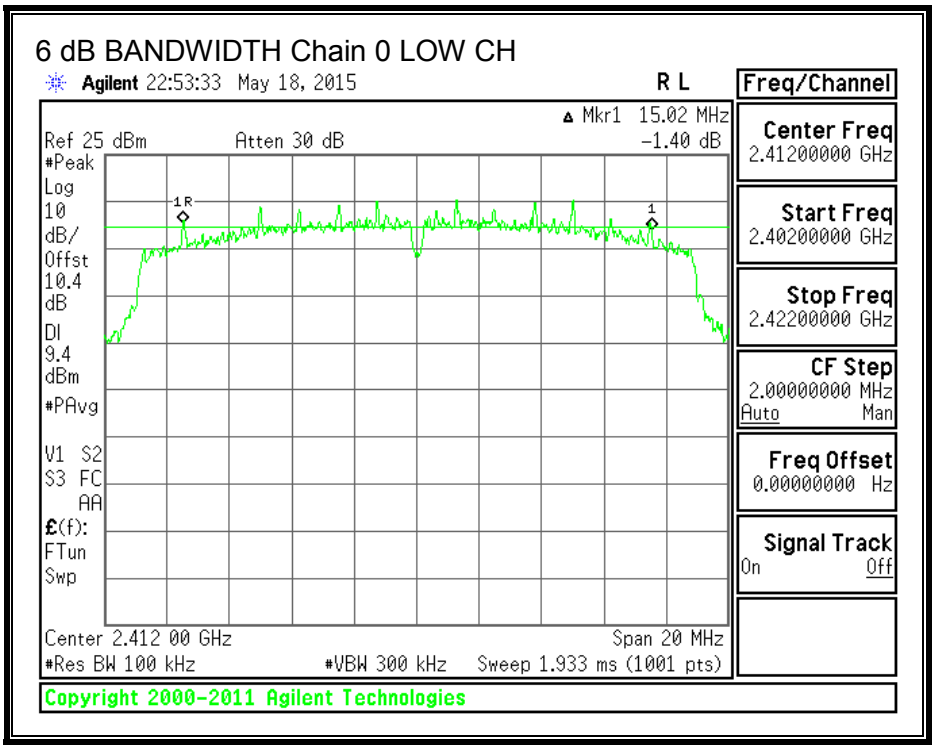
FCC §15.247 (a) (2)

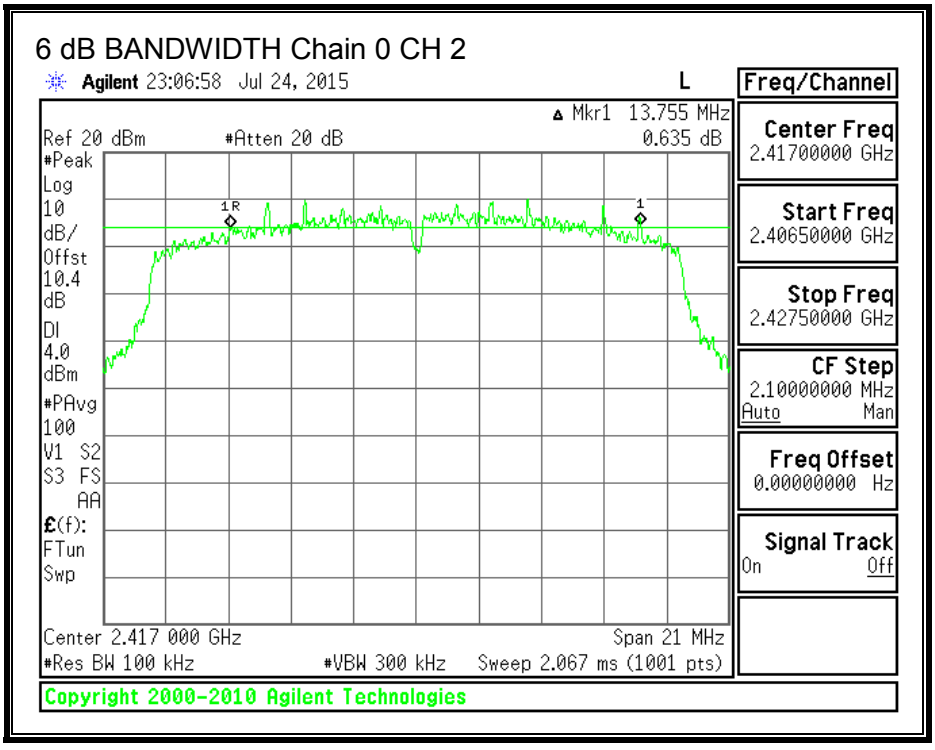
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

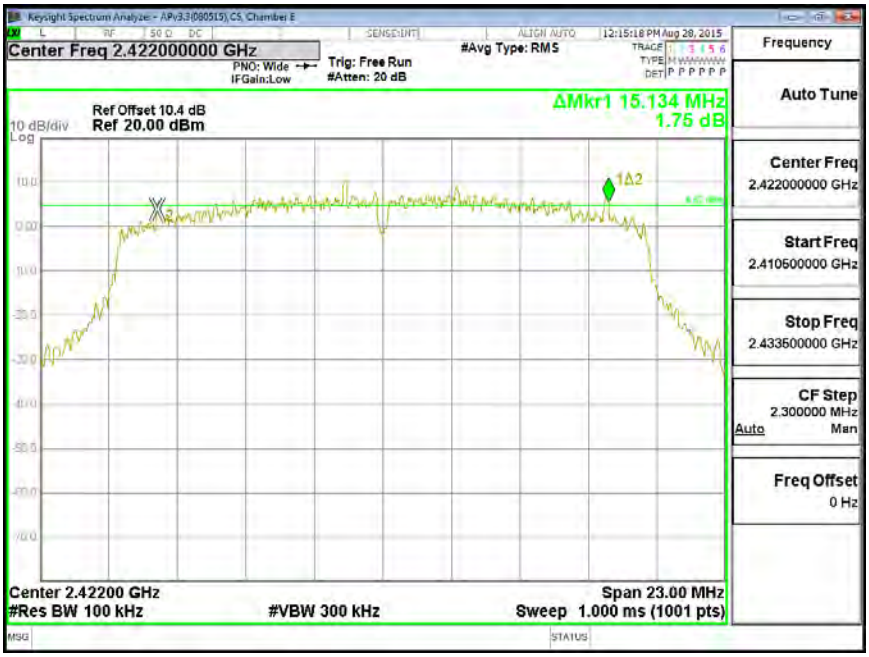
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	2412	15.020	15.088	0.5
2	2417	13.755	13.797	0.5
3	2422	15.134	15.042	0.5
Mid	2437	15.111	15.042	0.5
9	2452	15.111	15.065	0.5
10	2457	15.111	15.042	0.5
High	2462	15.099	13.547	0.5

6 dB BANDWIDTH, Chain 0

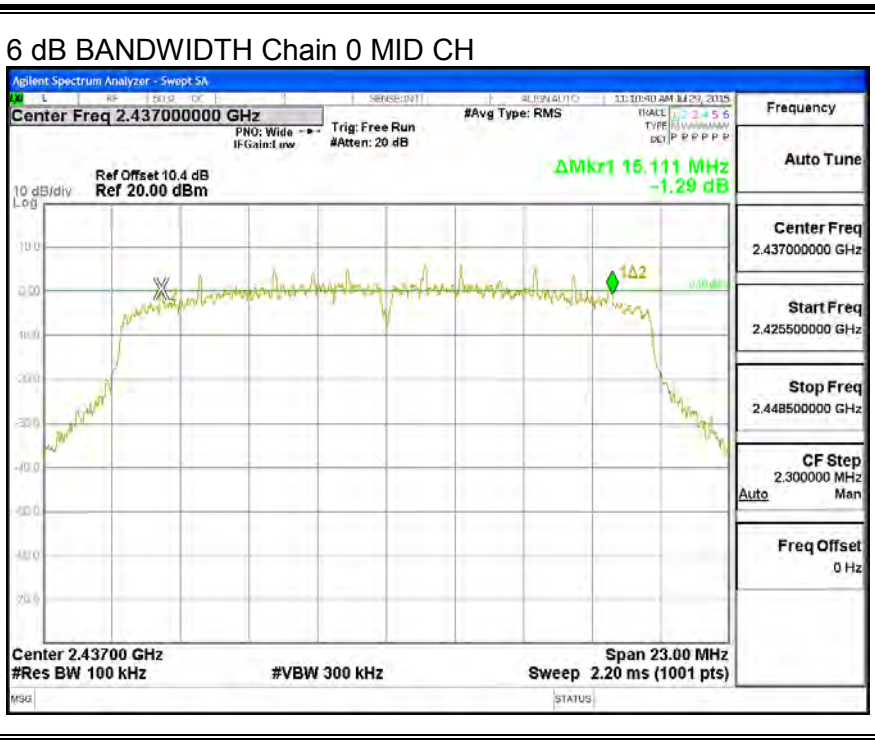




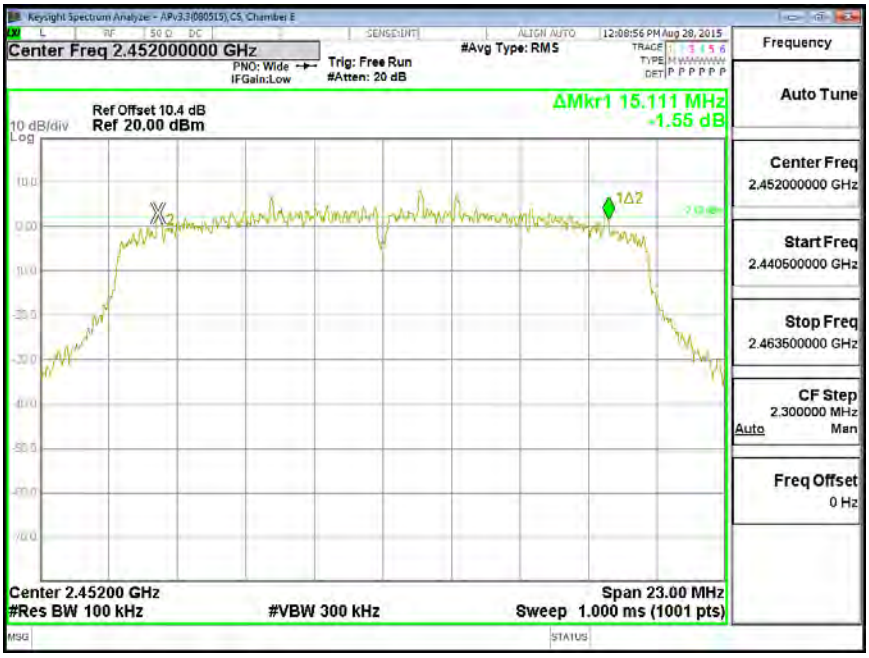
6 dB BANDWIDTH Chain 0 CH 3



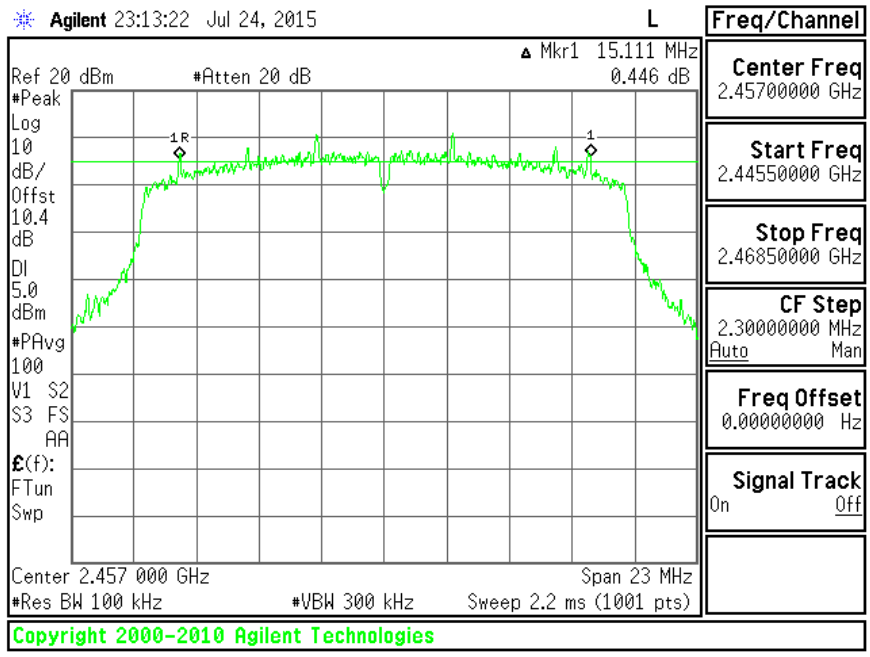
6 dB BANDWIDTH Chain 0 MID CH

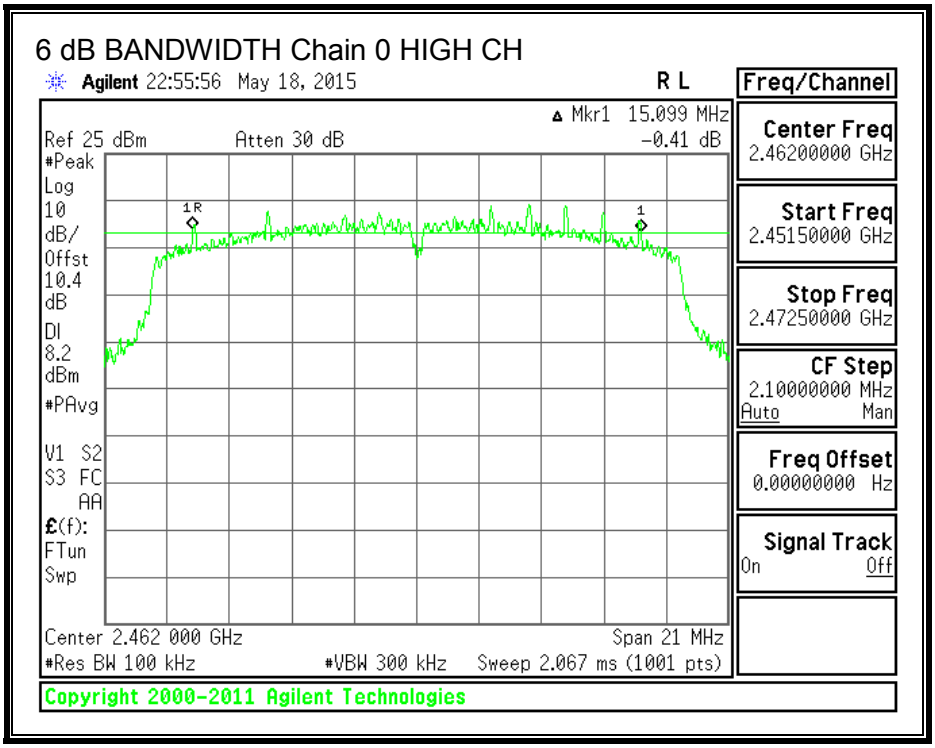


6 dB BANDWIDTH Chain 0 CH 9

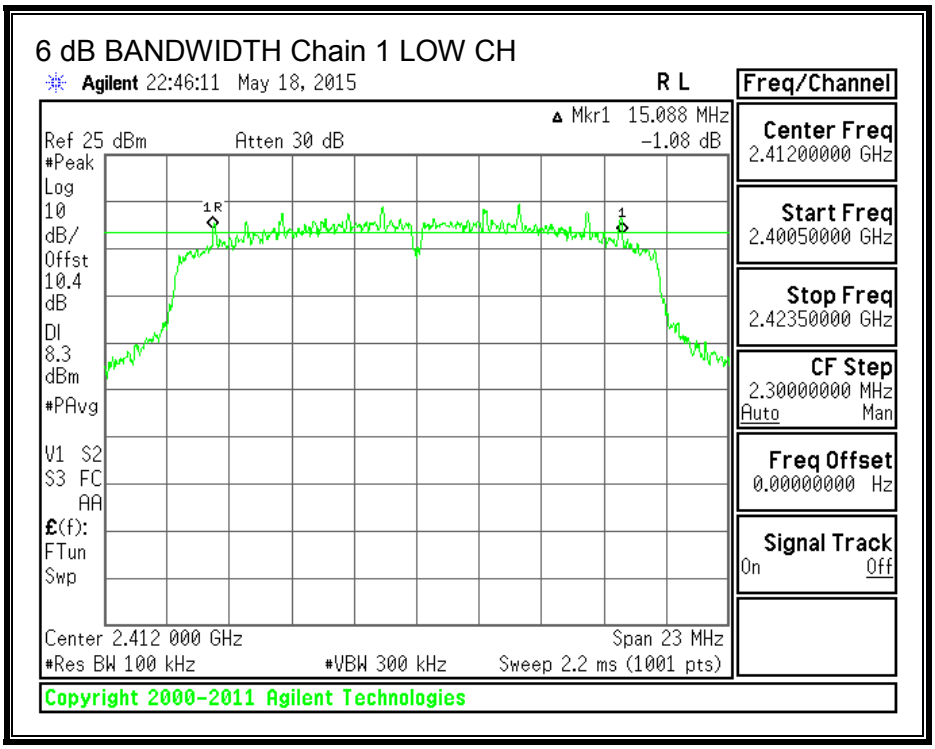


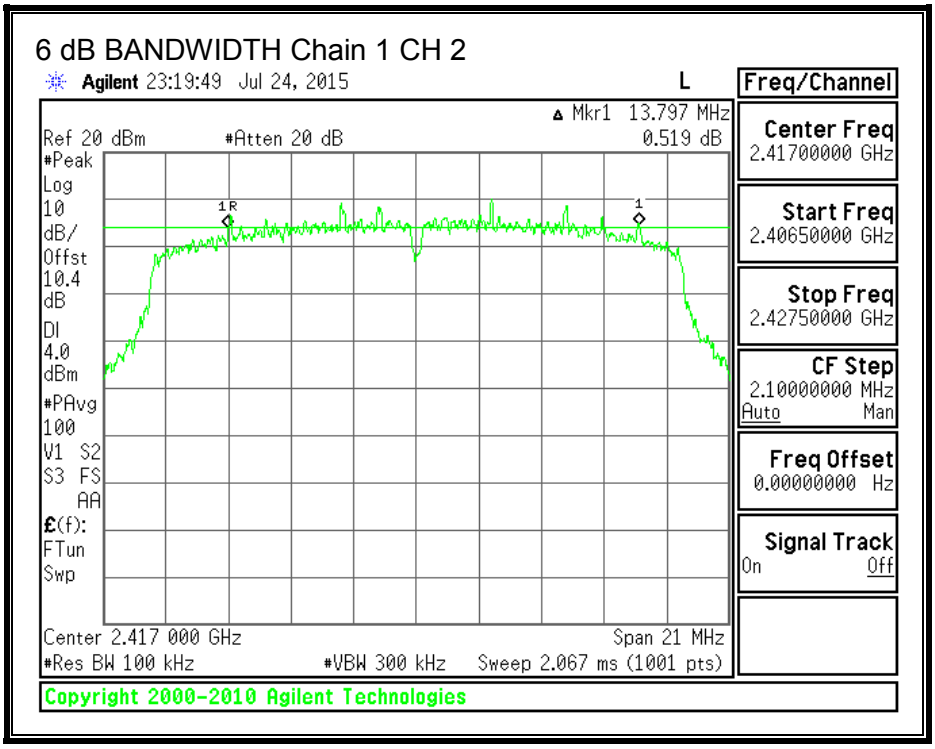
6 dB BANDWIDTH Chain 0 CH 10



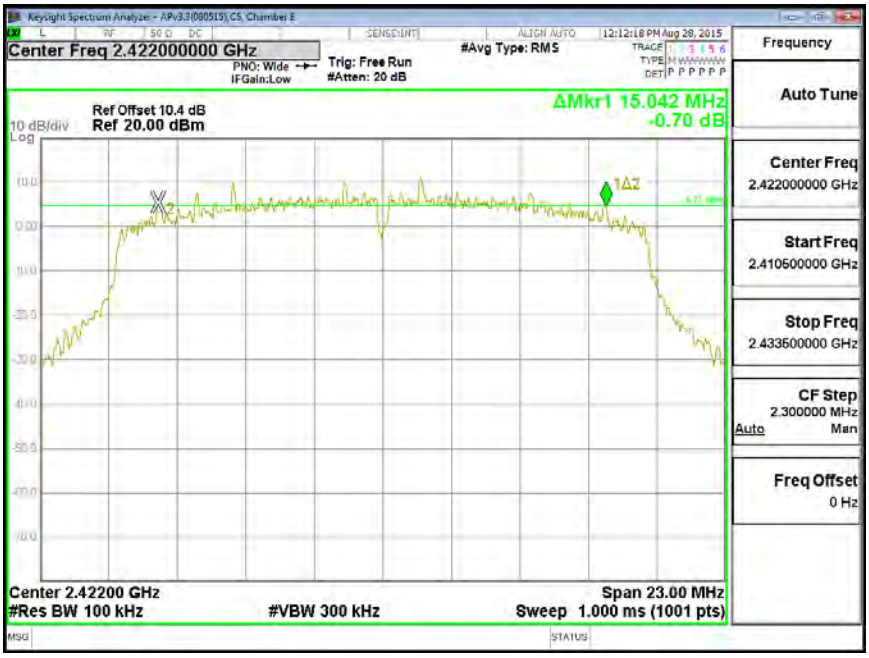


6 dB BANDWIDTH, Chain 1

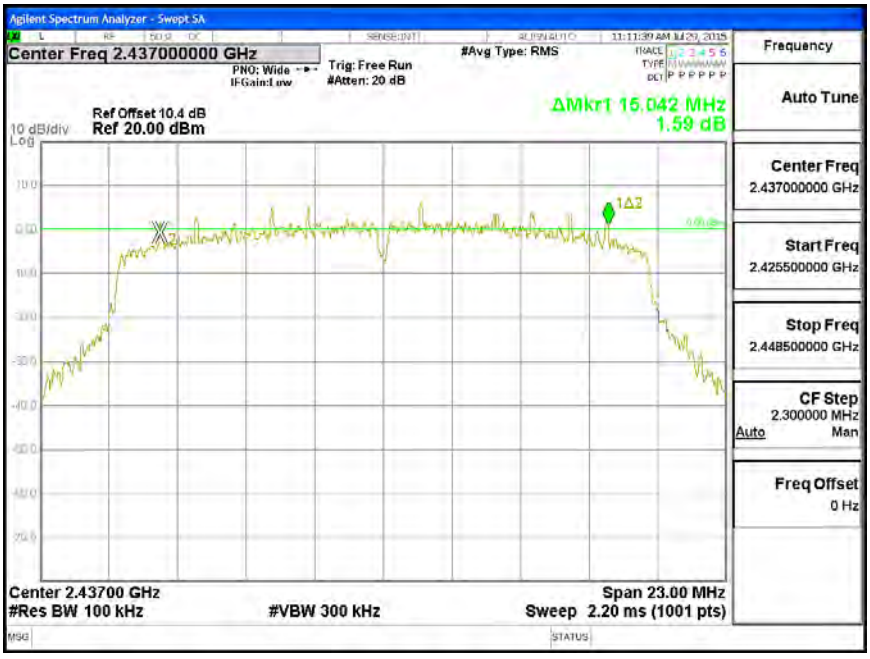




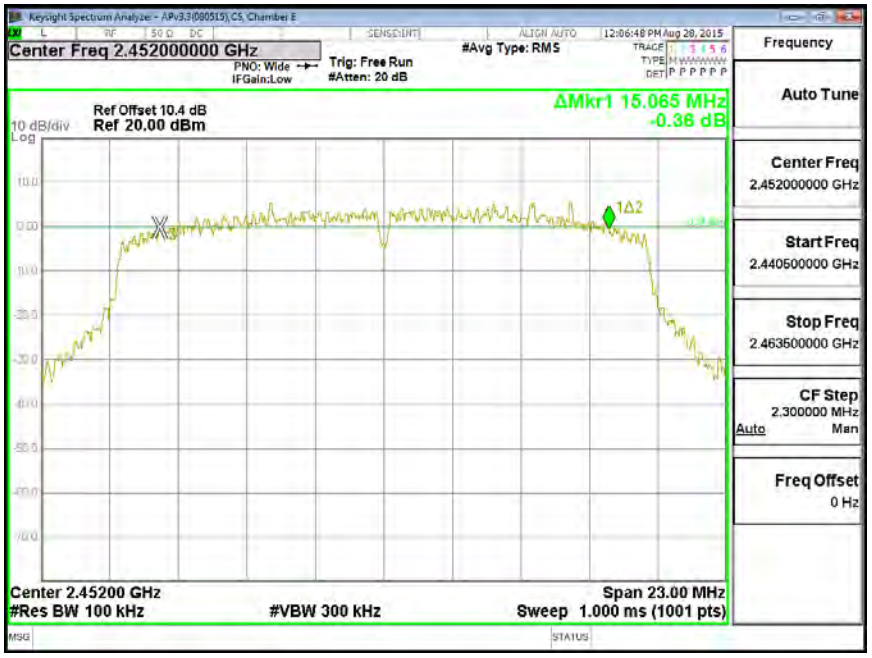
6 dB BANDWIDTH Chain 1 CH 3



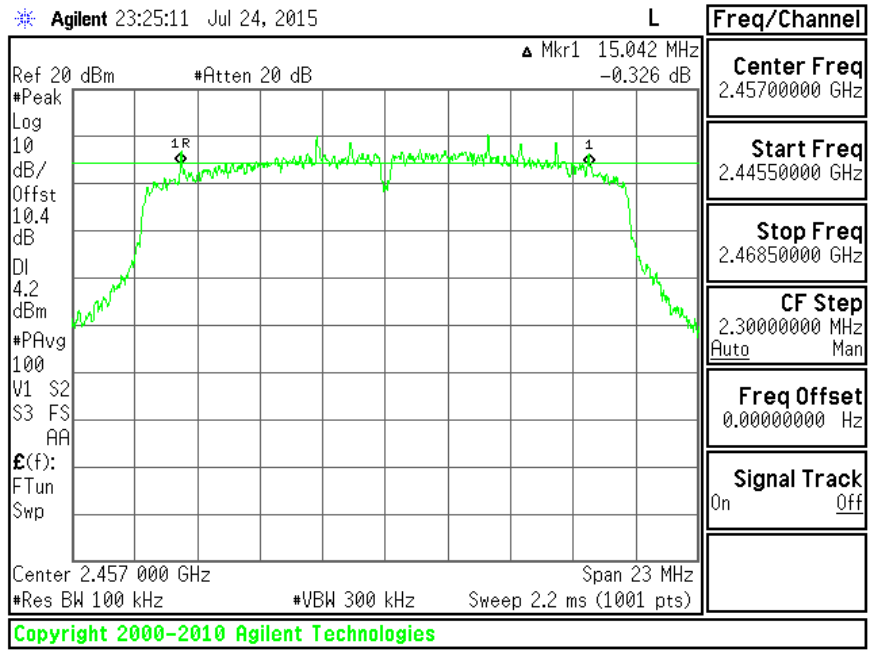
6 dB BANDWIDTH Chain 1 MID CH

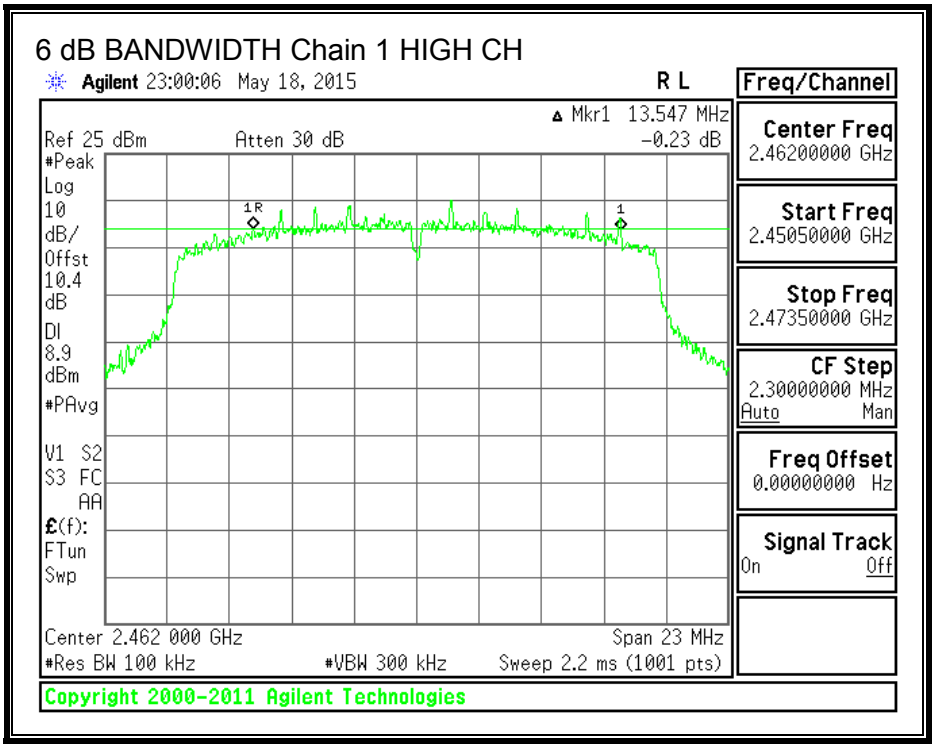


6 dB BANDWIDTH Chain 1 CH 9



6 dB BANDWIDTH Chain 1 CH 10





8.4.2. 99% BANDWIDTH

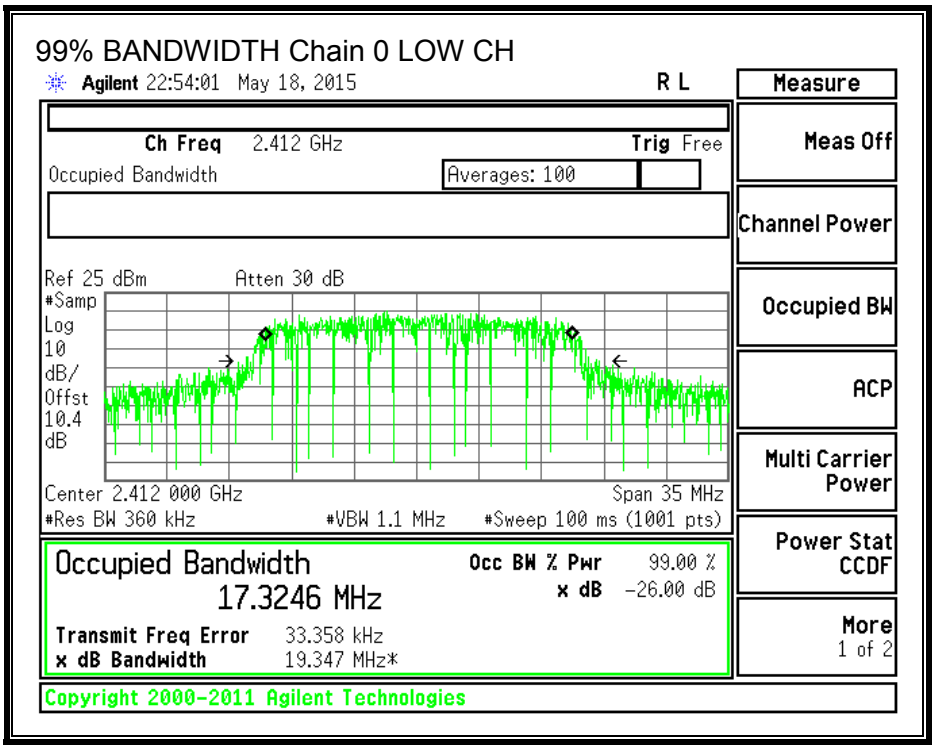
LIMITS

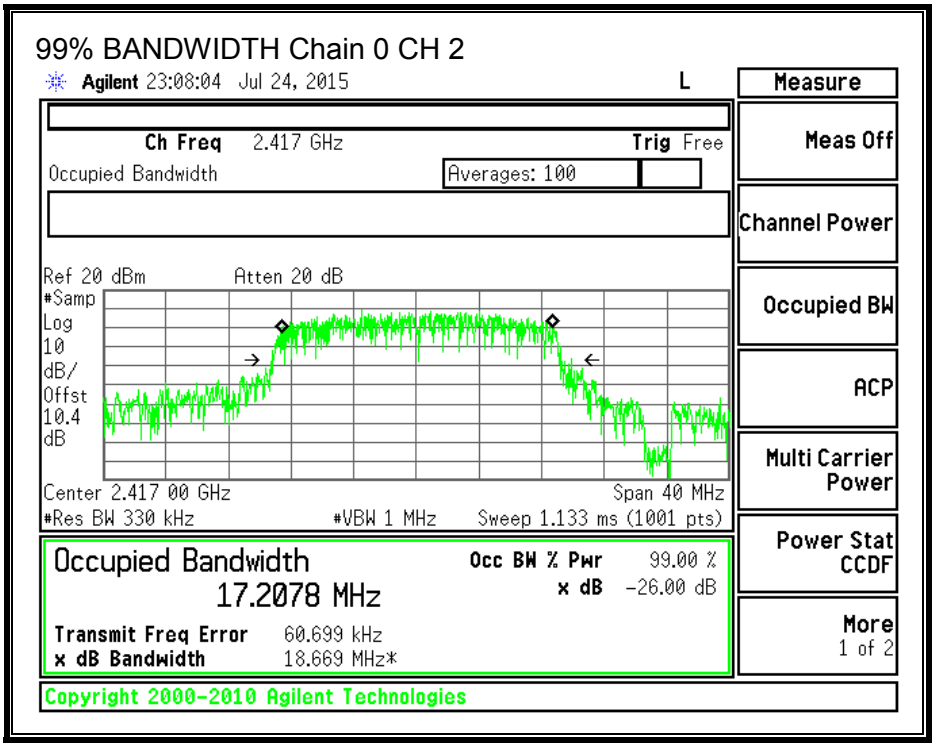
None; for reporting purposes only.

RESULTS

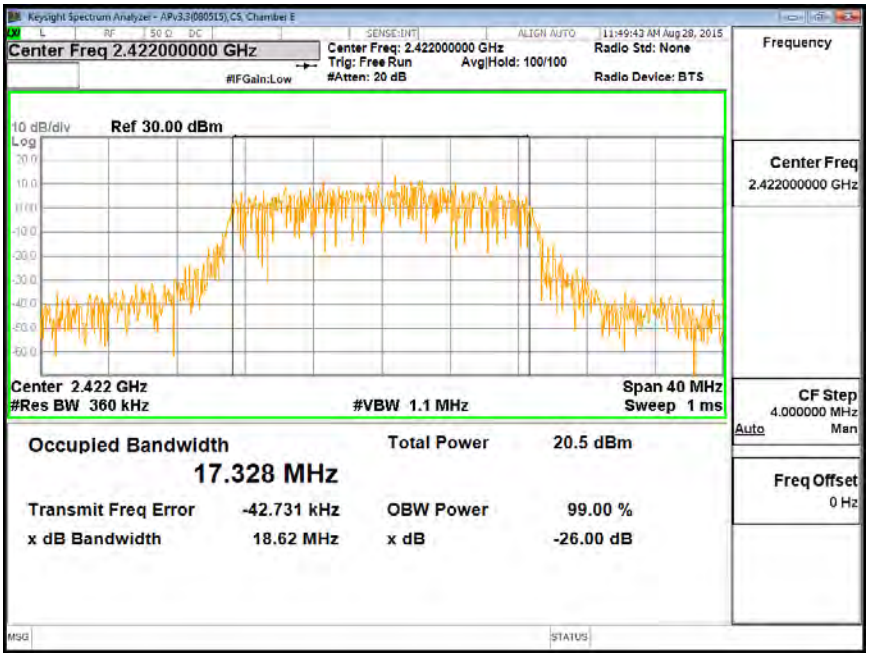
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	2412	17.3246	17.3270
2	2417	17.2078	17.2284
3	2422	17.3280	17.3860
Mid	2437	17.3713	17.2761
9	2452	17.3430	17.2400
10	2457	17.3183	17.2479
High	2462	17.2955	17.3521

99% BANDWIDTH, Chain 0

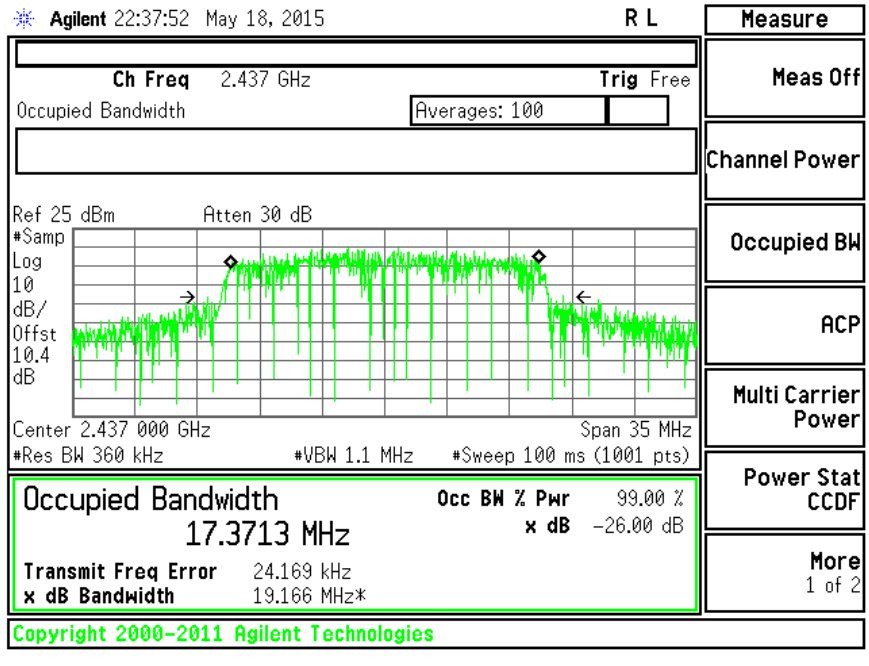




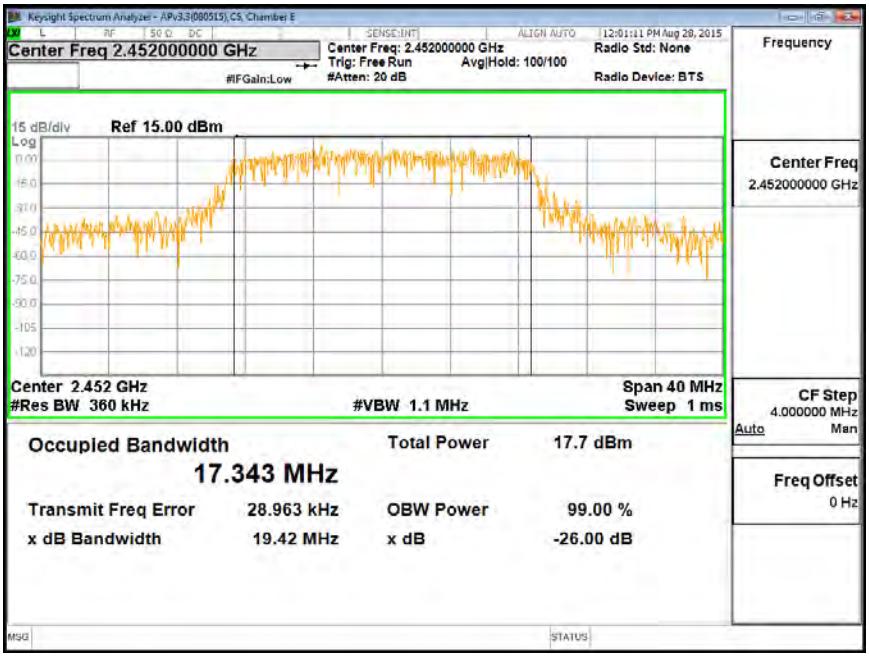
99% BANDWIDTH Chain 0 CH 3



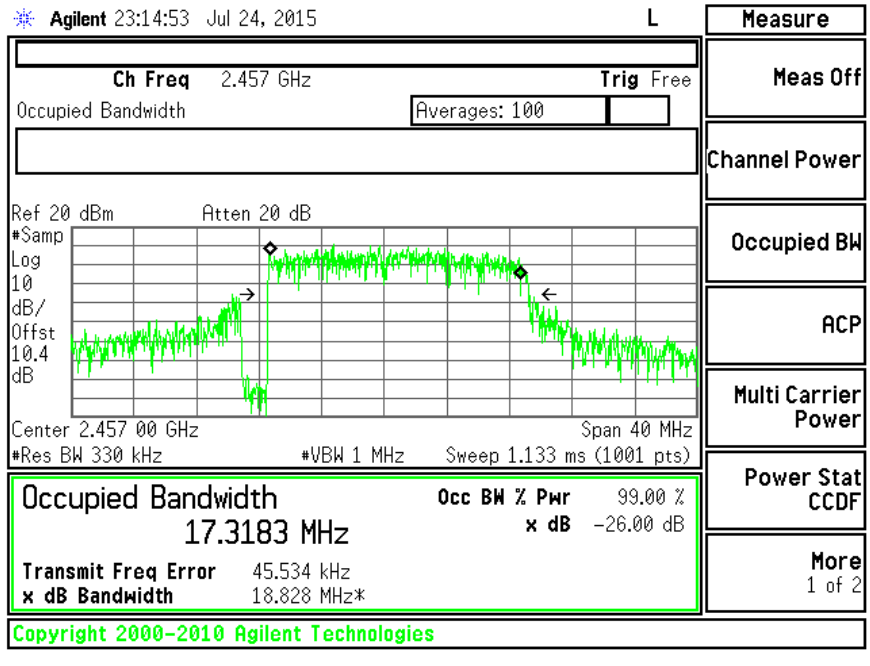
99% BANDWIDTH Chain 0 MID CH

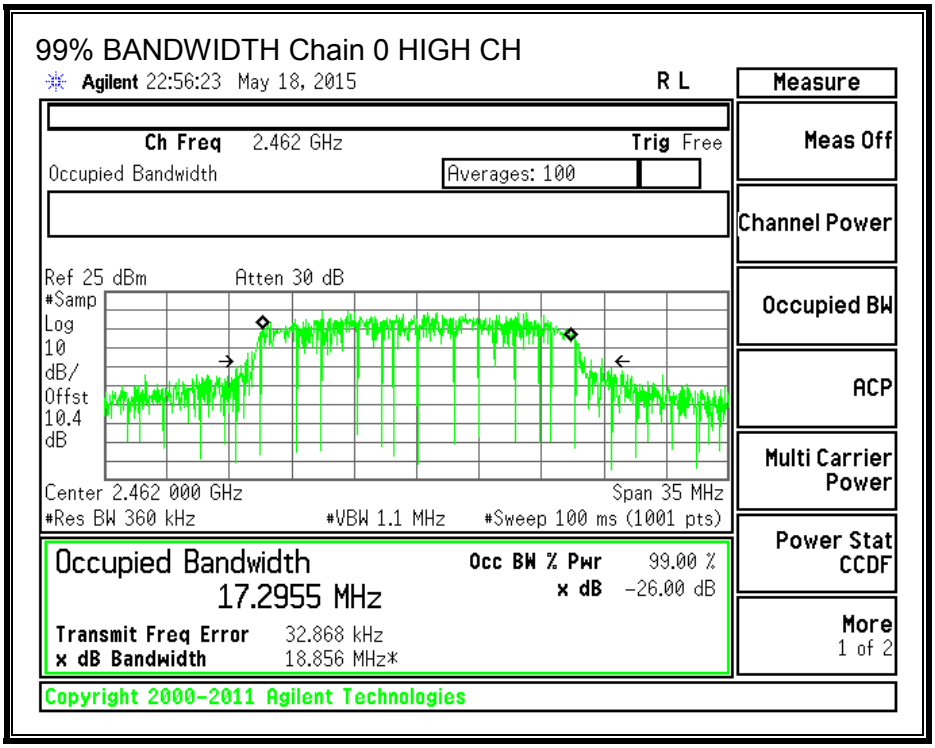


99% BANDWIDTH Chain 0 CH 9

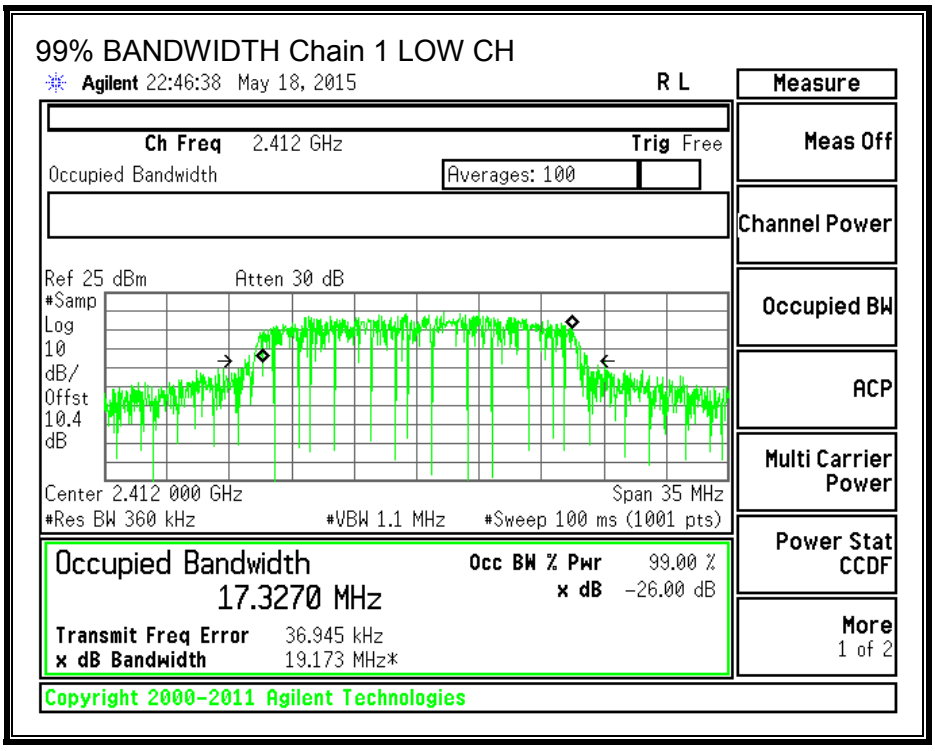


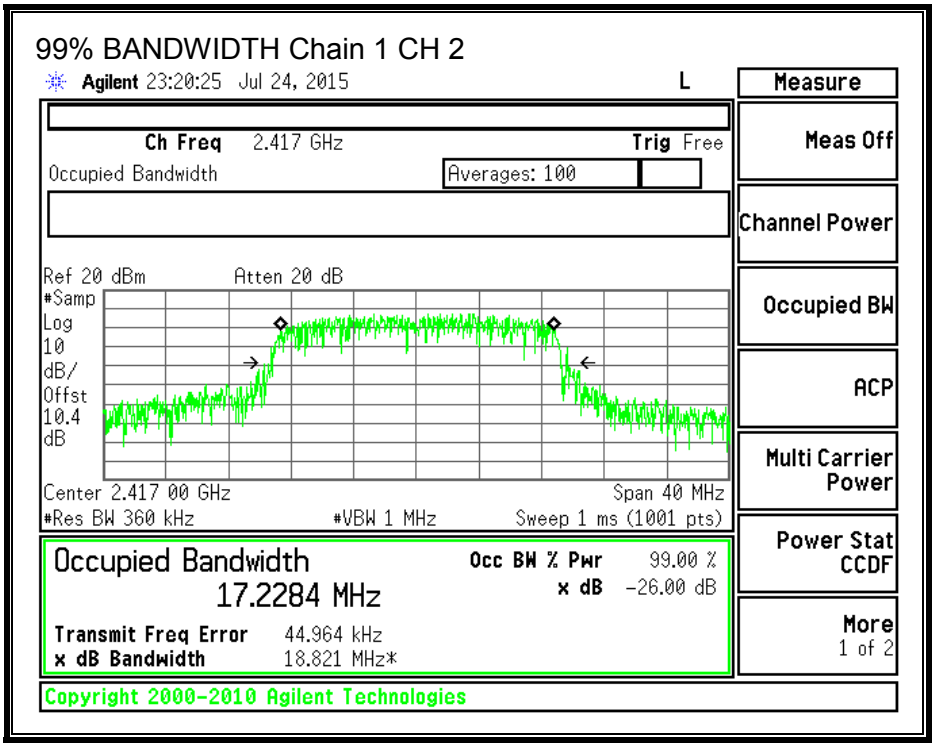
99% BANDWIDTH Chain 0 CH 10



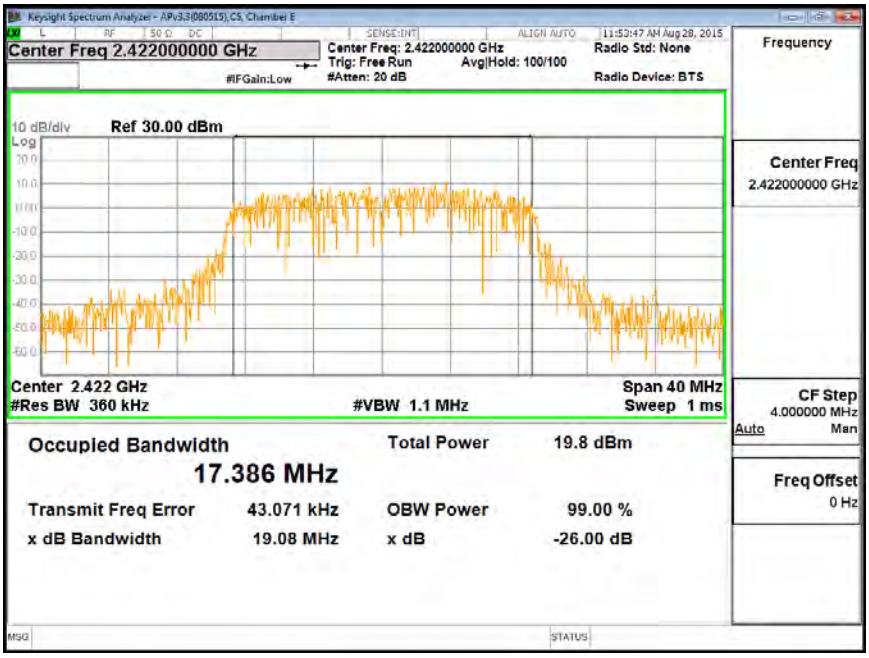


99% BANDWIDTH, Chain 1

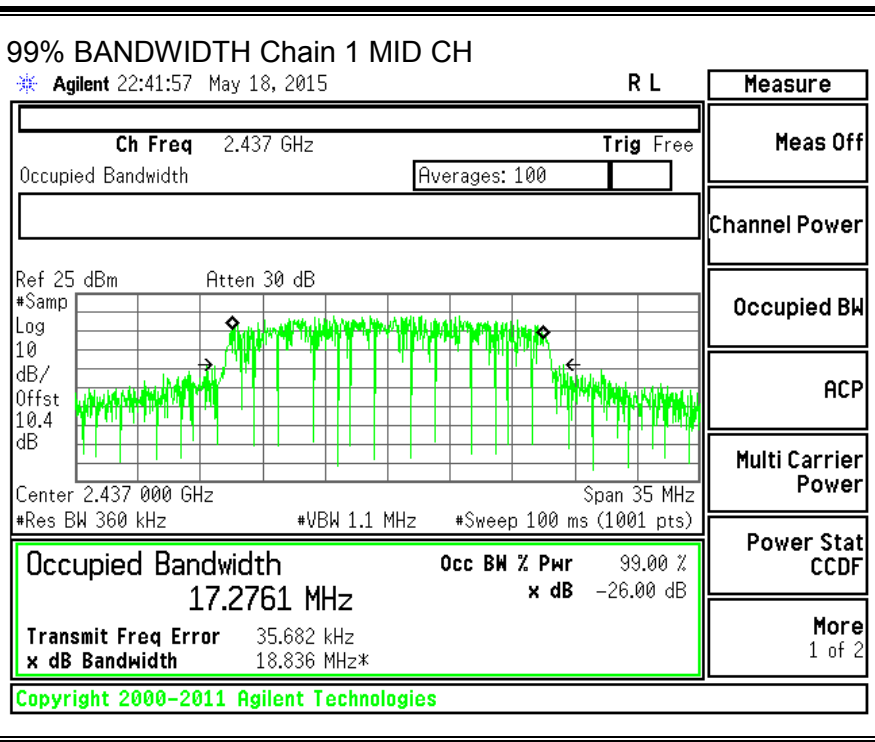




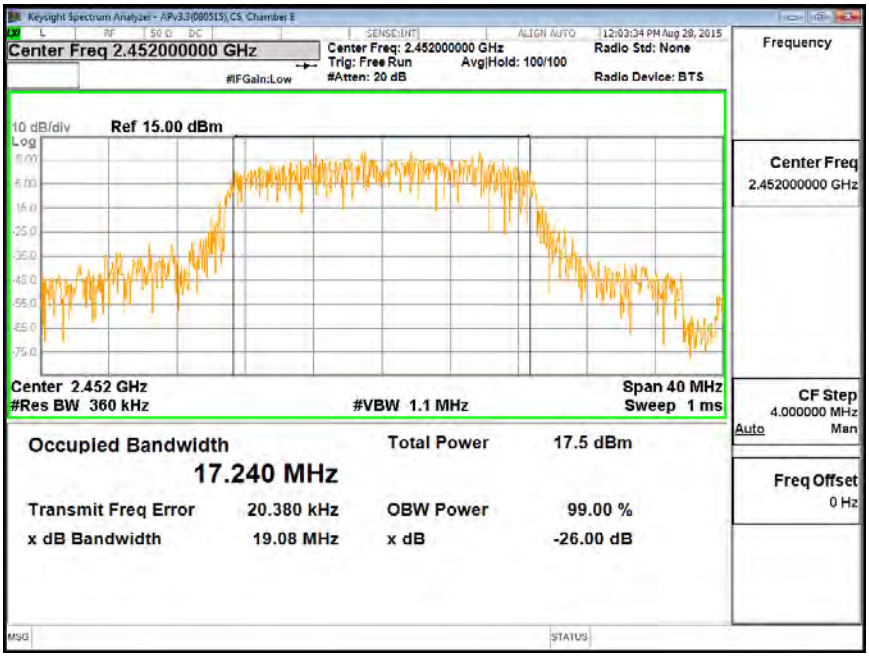
99% BANDWIDTH Chain 1 CH 3



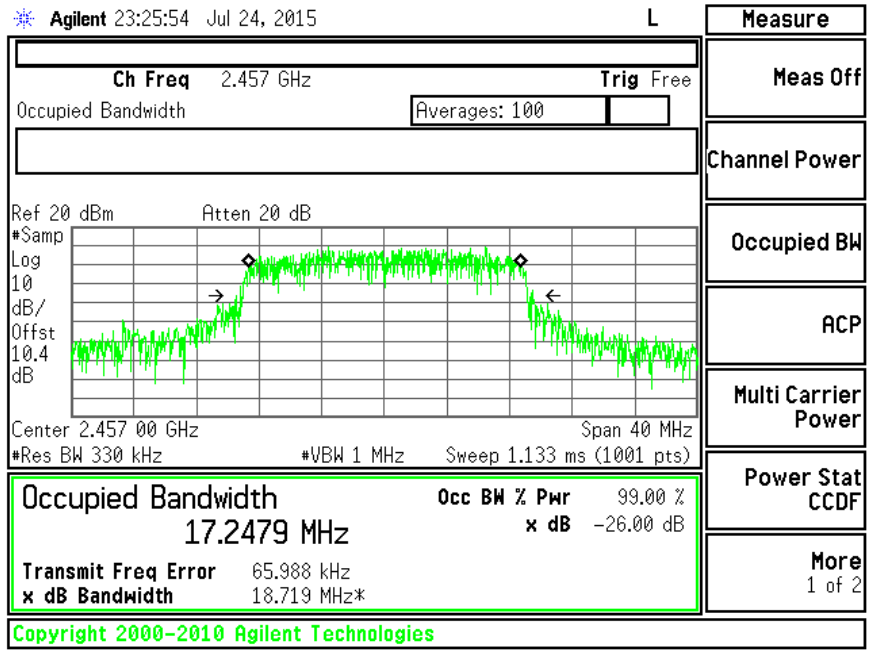
99% BANDWIDTH Chain 1 MID CH

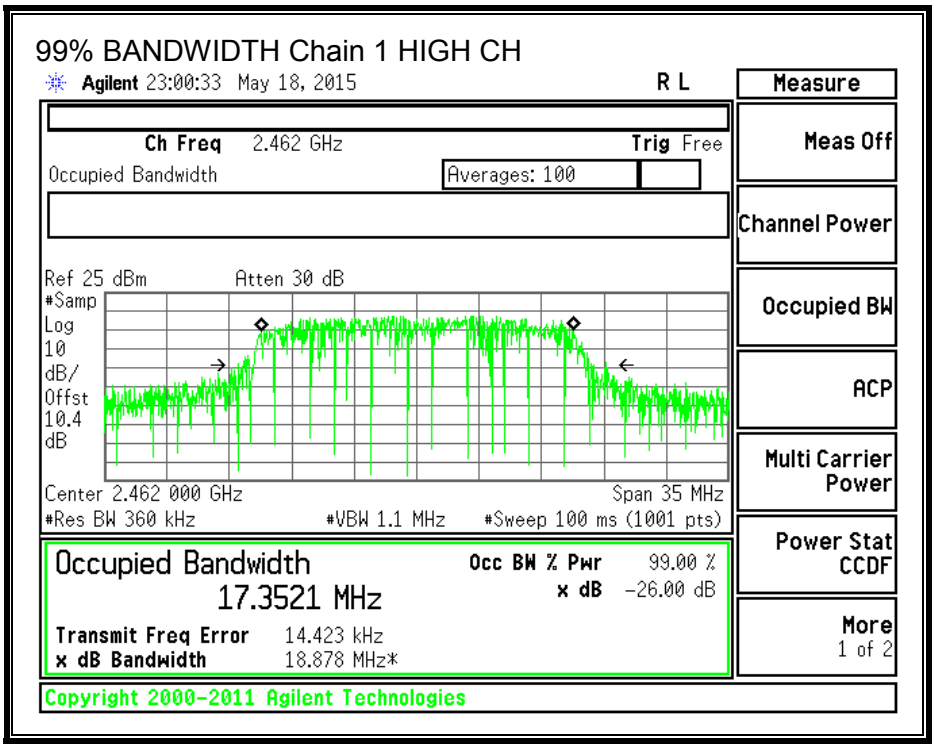


99% BANDWIDTH Chain 1 CH 9



99% BANDWIDTH Chain 1 CH 10





8.4.3. OUTPUT POWER

LIMITS

FCC §15.247

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.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.70	2.50	3.14

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	3.14	30.00	30	36	30.00
2	2417	3.14	30.00	30	36	30.00
3	2422	3.14	30.00	30	36	30.00
Mid	2437	3.14	30.00	30	36	30.00
9	2452	3.14	30.00	30	36	30.00
10	2457	3.14	30.00	30	36	30.00
High	2462	3.14	30.00	30	36	30.00

Duty Cycle CF (dB)	0.12	Included in Calculations of Corr'd Power

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margi (dB)
Low	2412	15.52	15.83	18.81	30.00	-11.19
2	2417	15.98	15.32	18.79	30.00	-11.21
3	2422	19.97	20.12	23.18	30.00	-6.82
Mid	2437	20.35	19.98	23.30	30.00	-6.70
9	2452	17.92	18.12	21.15	30.00	-8.85
10	2457	15.61	14.85	18.38	30.00	-11.62
High	2462	16.12	15.63	19.01	30.00	-10.99

8.4.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

RESULTS

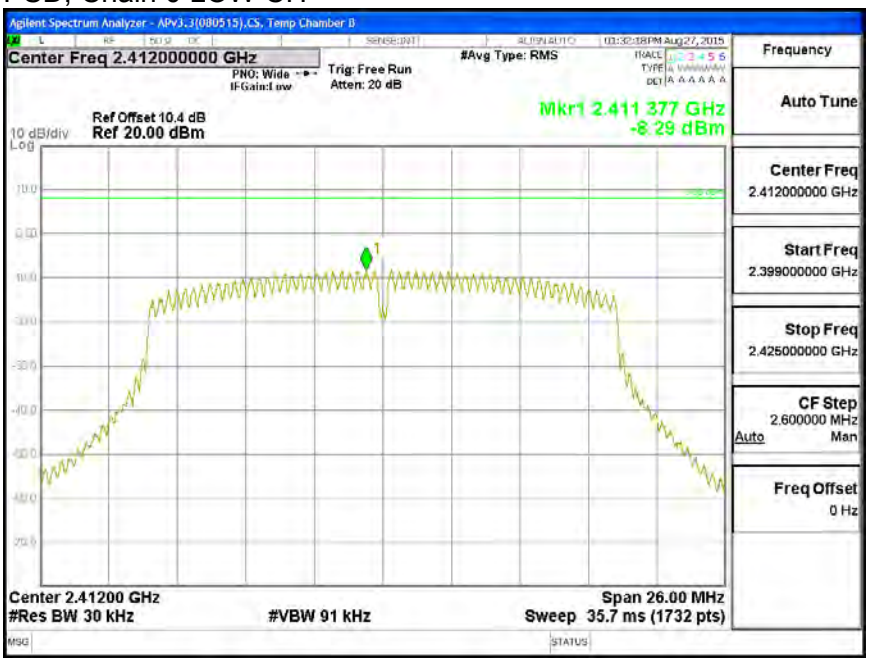
Duty Cycle CF (dB)	0.12	Included in Calculations of Corr'd PSD

PSD Results

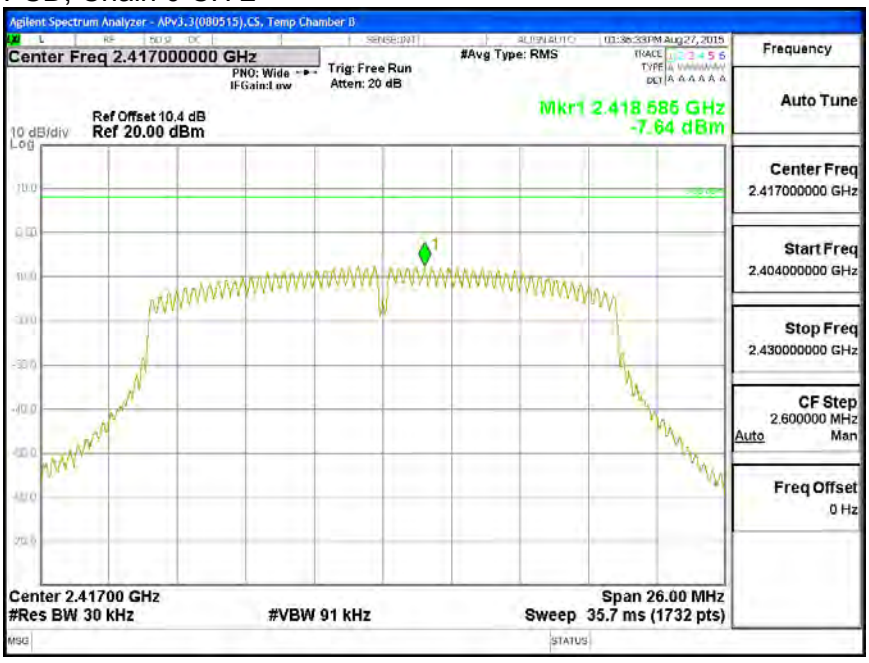
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total Corr'd PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-8.29	-8.04	-5.03	8.0	-13.0
2	2417	-7.64	-8.02	-4.70	8.0	-12.7
3	2422	-4.11	-4.14	-0.99	8.0	-9.0
Mid	2437	-3.27	-3.45	-0.23	8.0	-8.2
9	2452	-6.42	-6.42	-3.29	8.0	-11.3
10	2457	-8.19	-8.69	-5.30	8.0	-13.3
High	2462	-7.75	-7.69	-4.59	8.0	-12.6

PSD, Chain 0

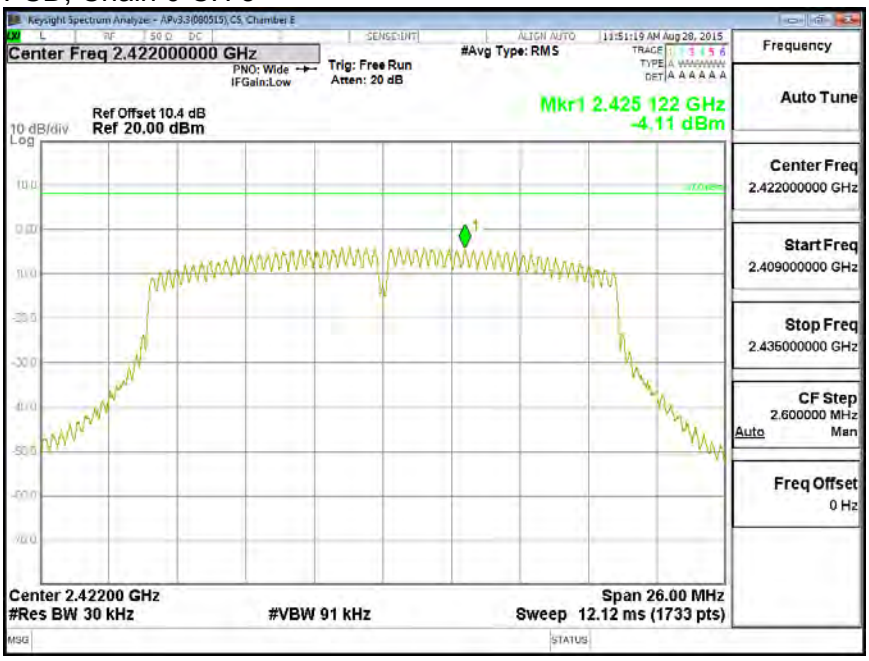
PSD, Chain 0 LOW CH



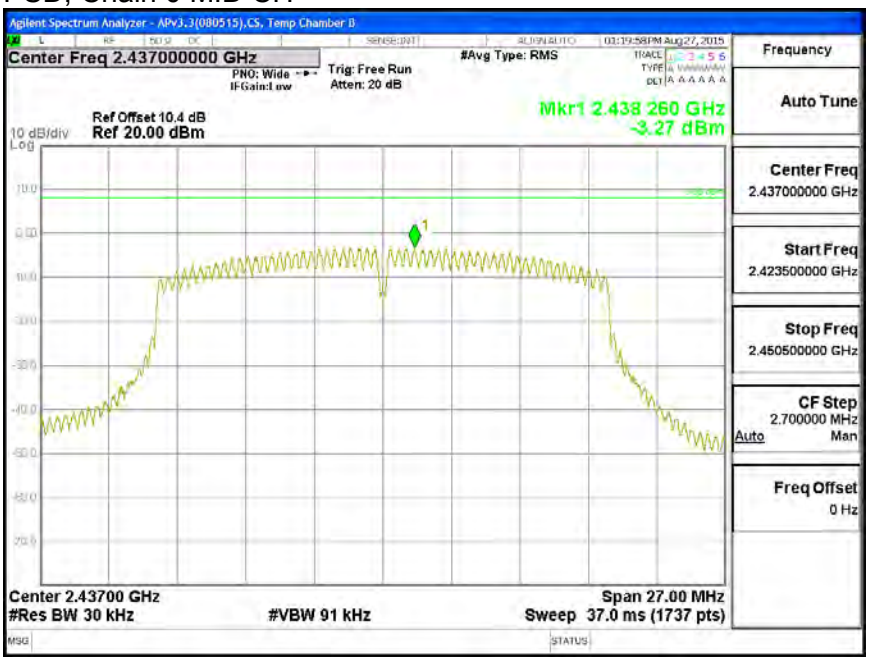
PSD, Chain 0 CH 2



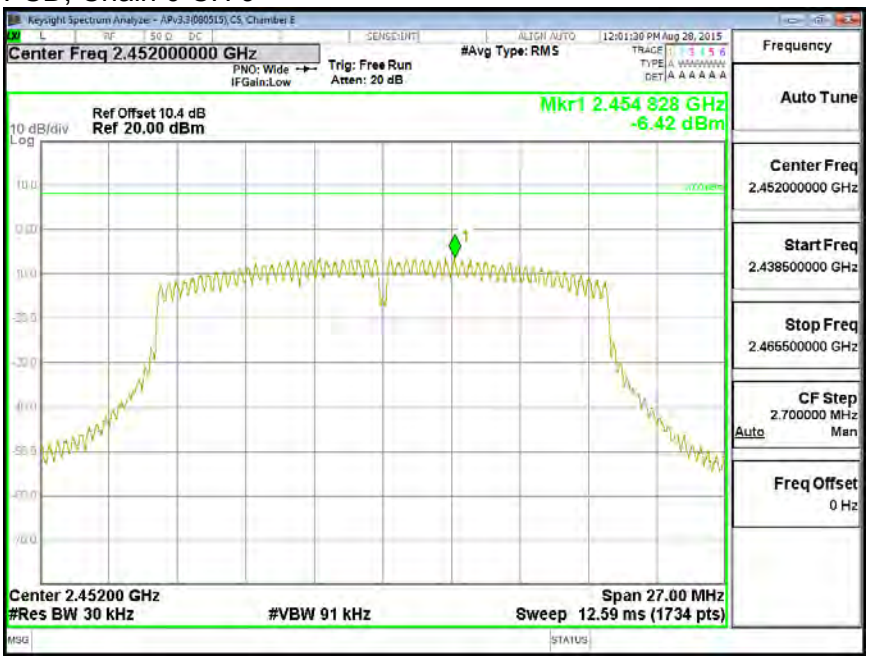
PSD, Chain 0 CH 3



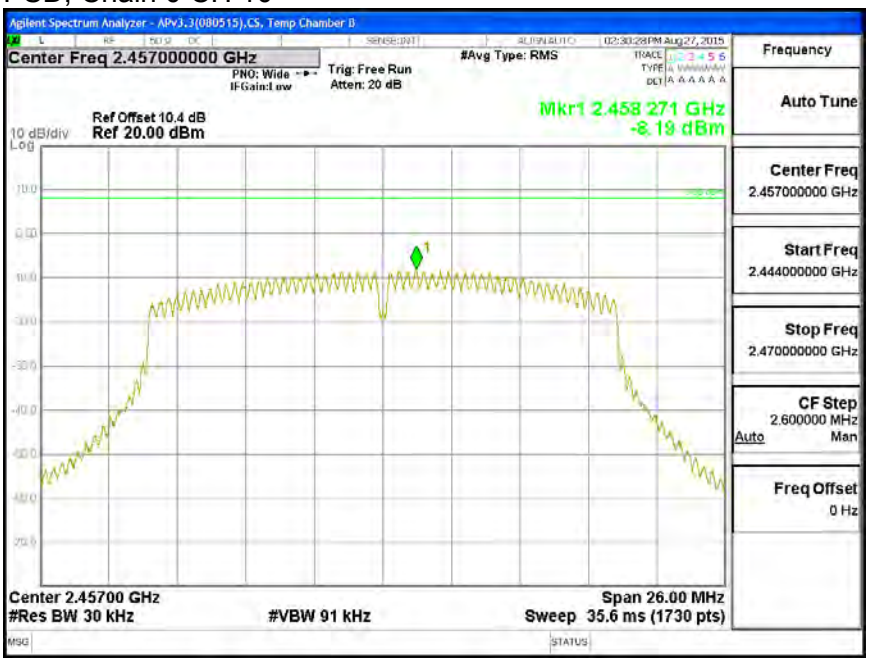
PSD, Chain 0 MID CH



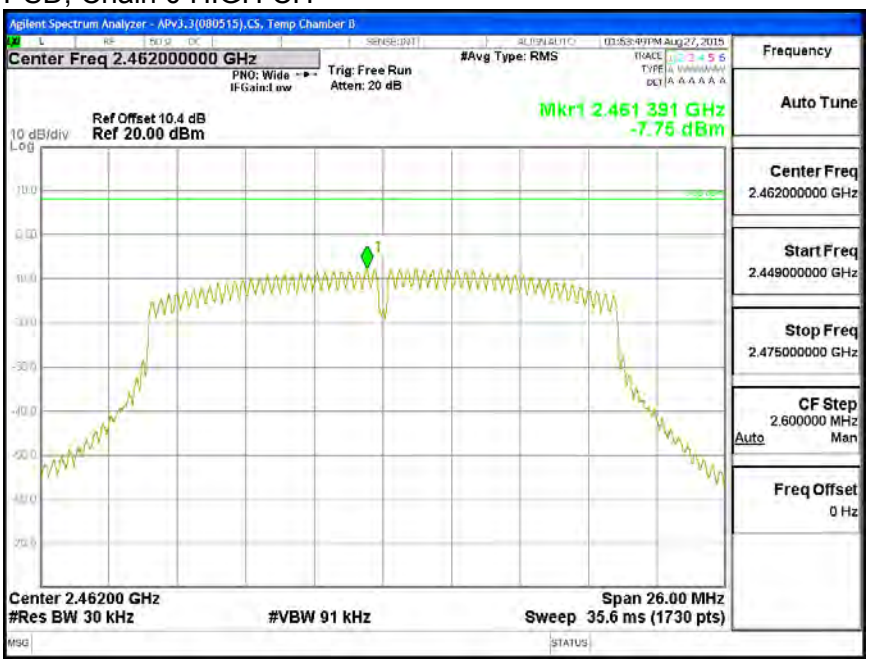
PSD, Chain 0 CH 9



PSD, Chain 0 CH 10

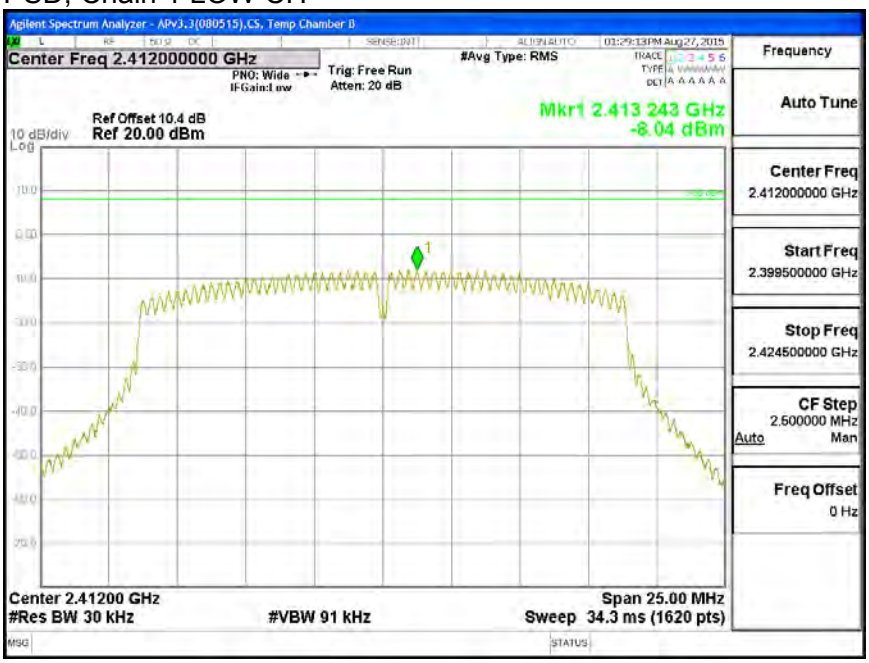


PSD, Chain 0 HIGH CH

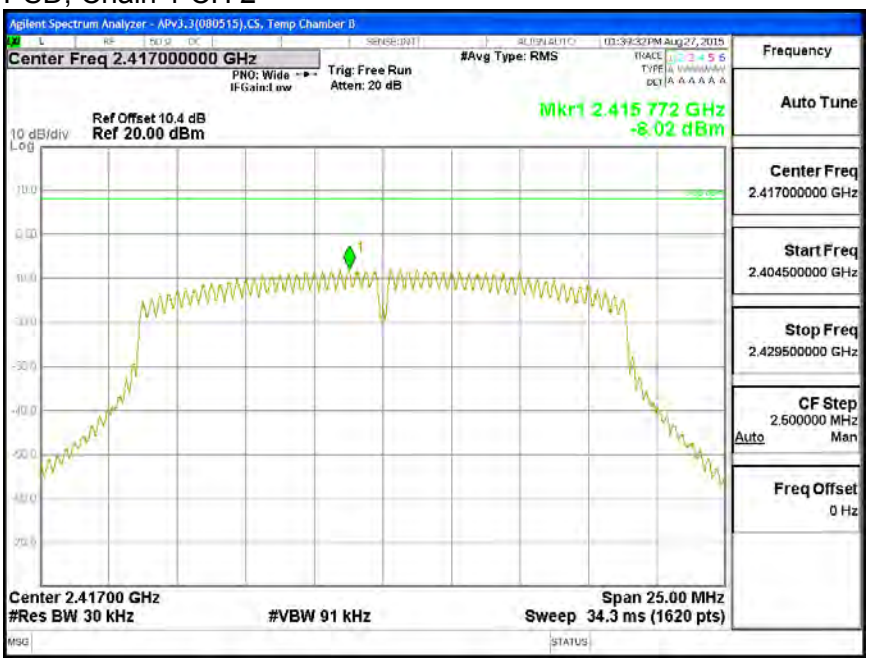


PSD, Chain 1

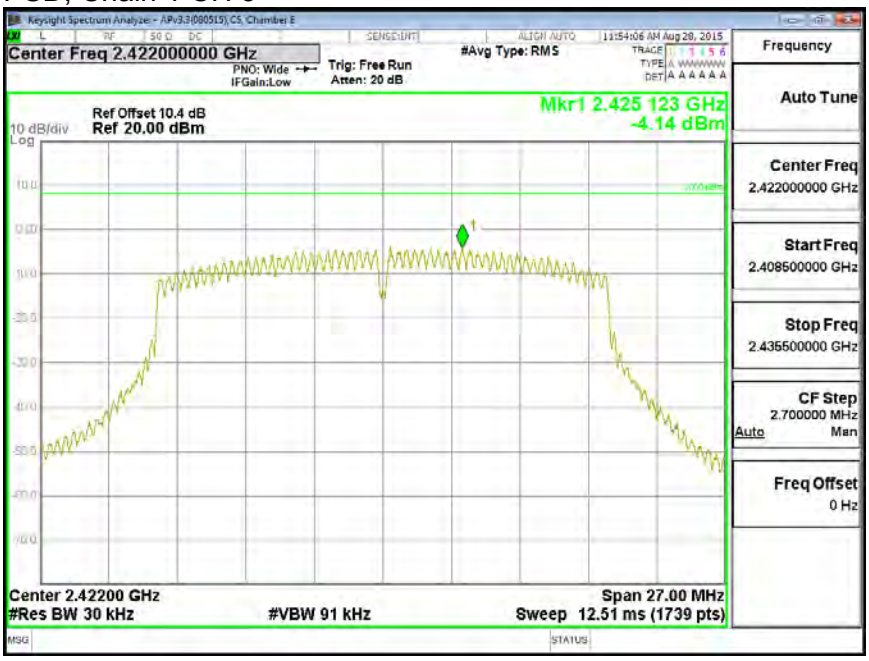
PSD, Chain 1 LOW CH



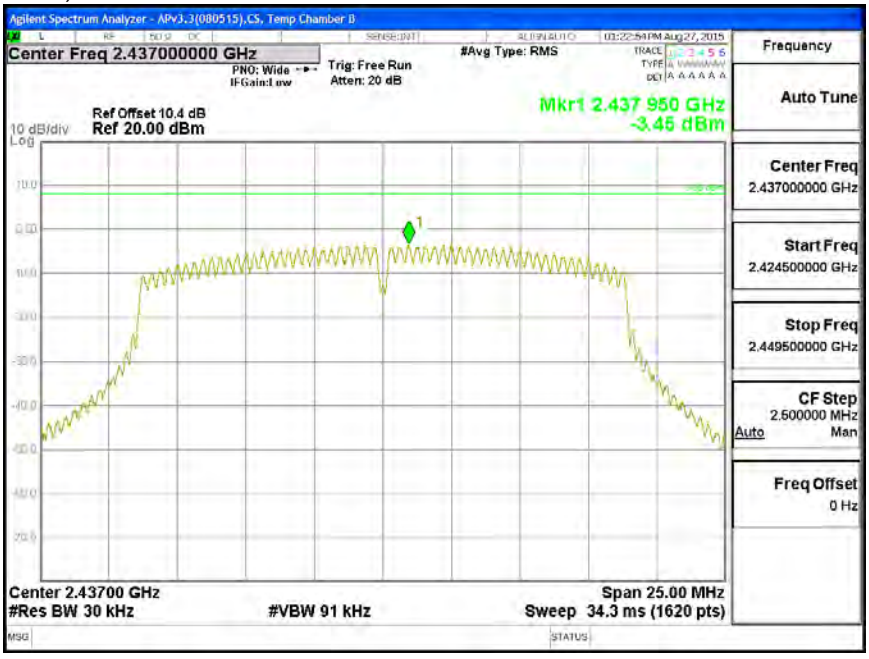
PSD, Chain 1 CH 2



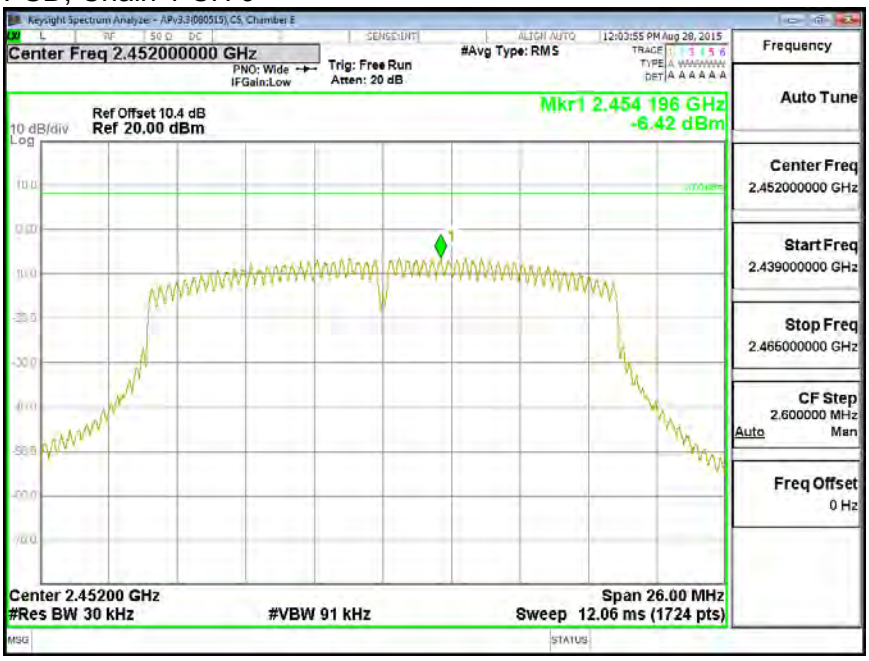
PSD, Chain 1 CH 3



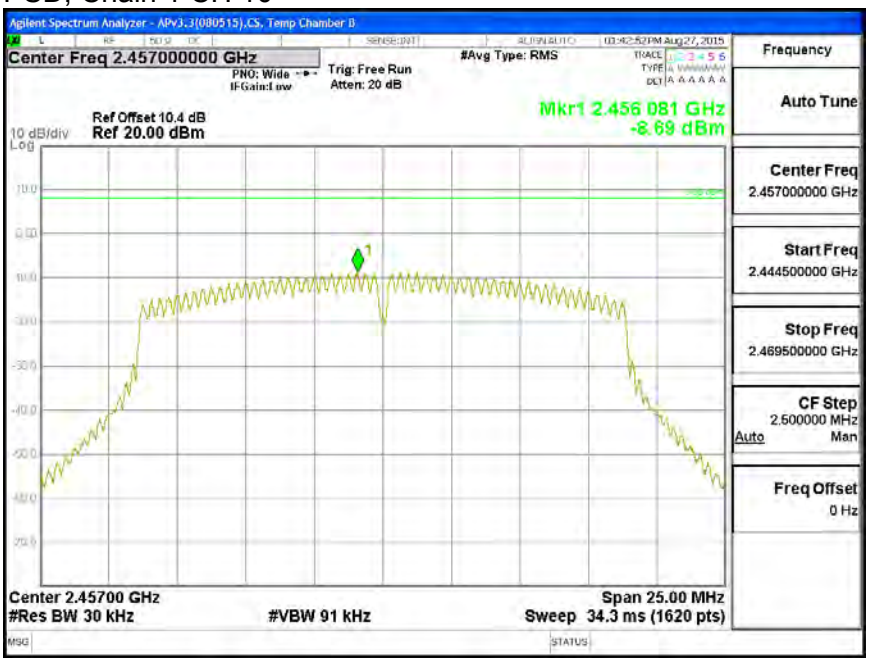
PSD, Chain 1 MID CH



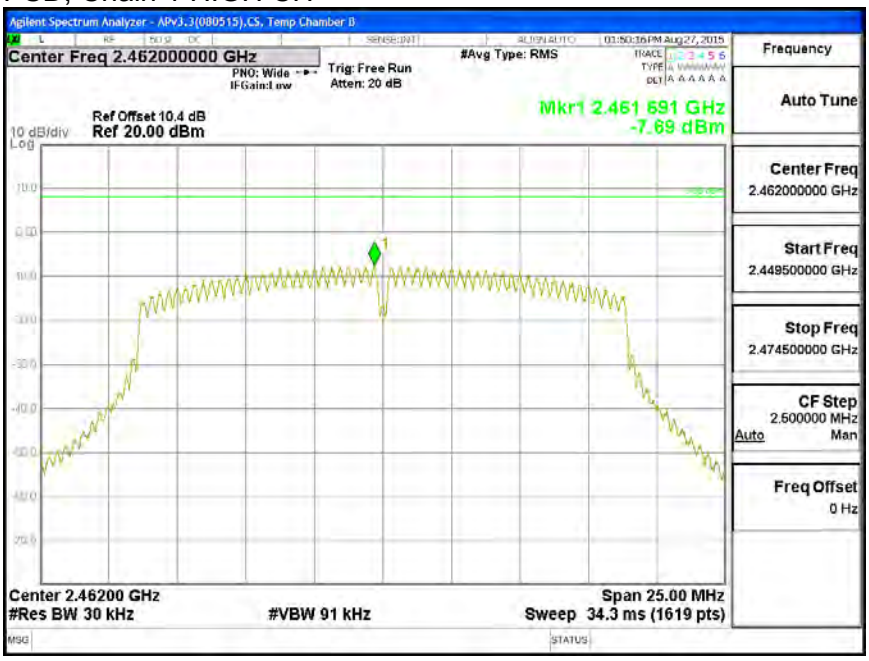
PSD, Chain 1 CH 9



PSD, Chain 1 CH 10



PSD, Chain 1 HIGH CH



8.4.5. OUT-OF-BAND EMISSIONS

LIMITS

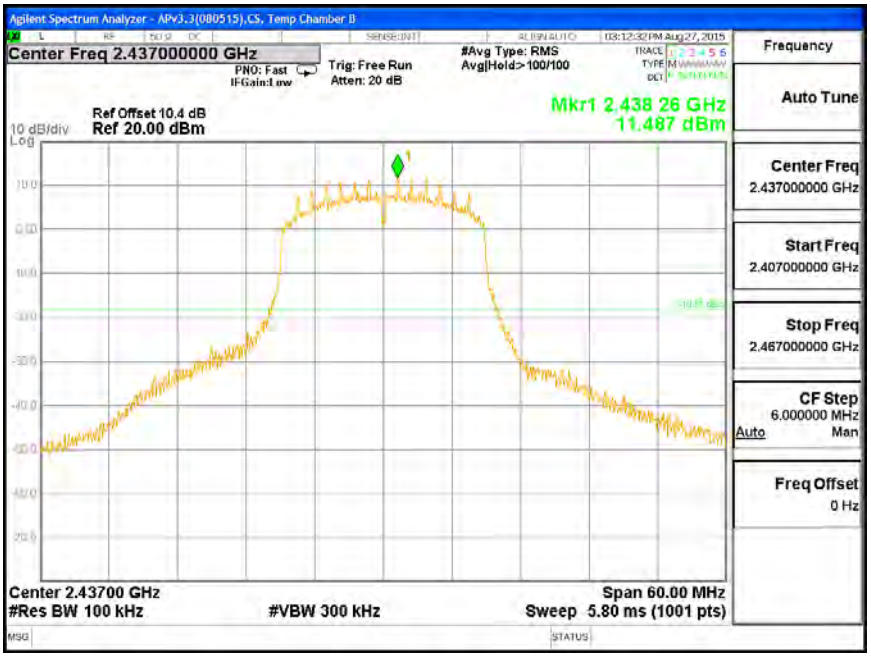
FCC §15.247 (d)

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

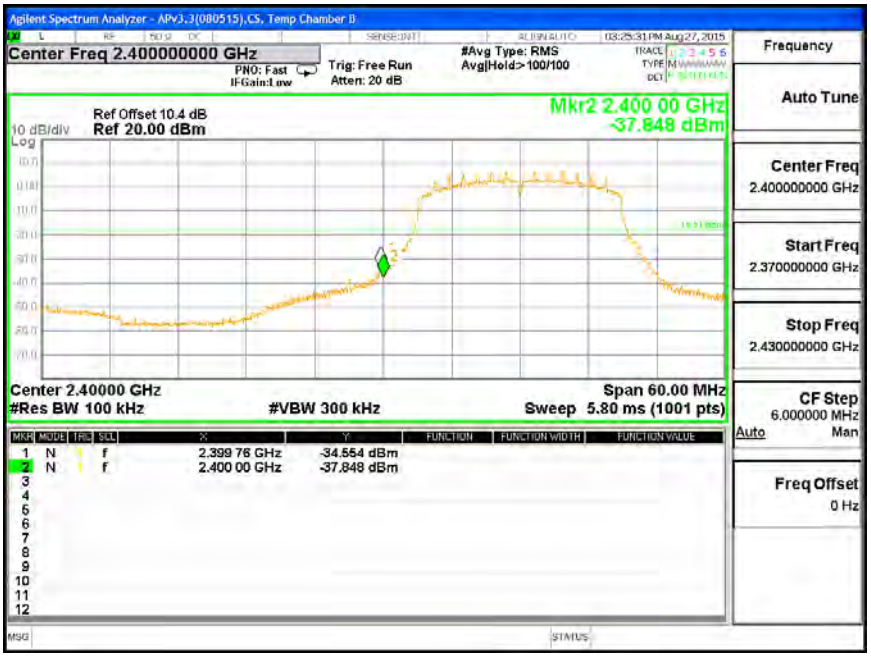
IN-BAND REFERENCE LEVEL, Chain 0

REFERENCE LEVEL Chain 0 MID CH

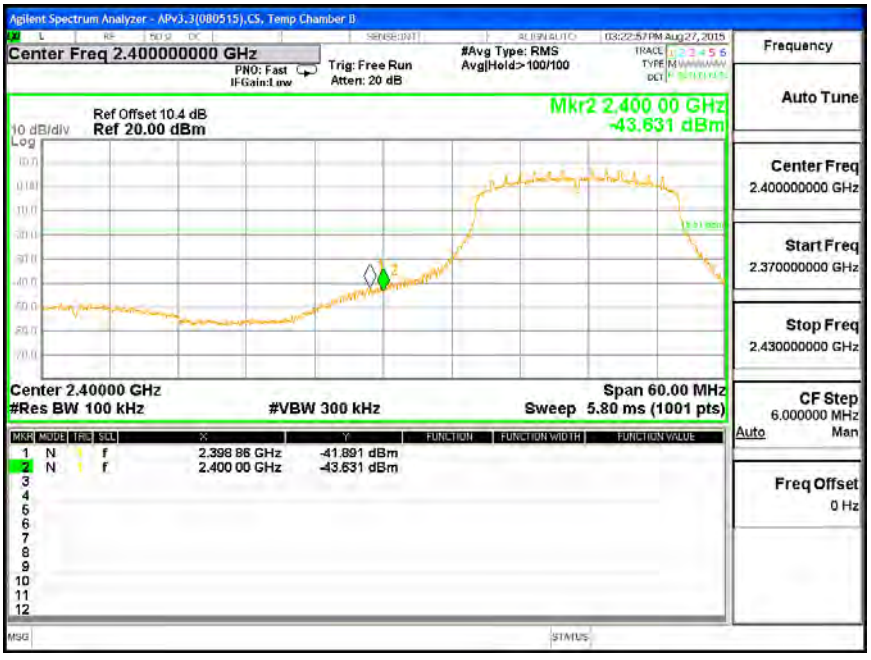


LOW CHANNEL BANDEDGE, Chain 0

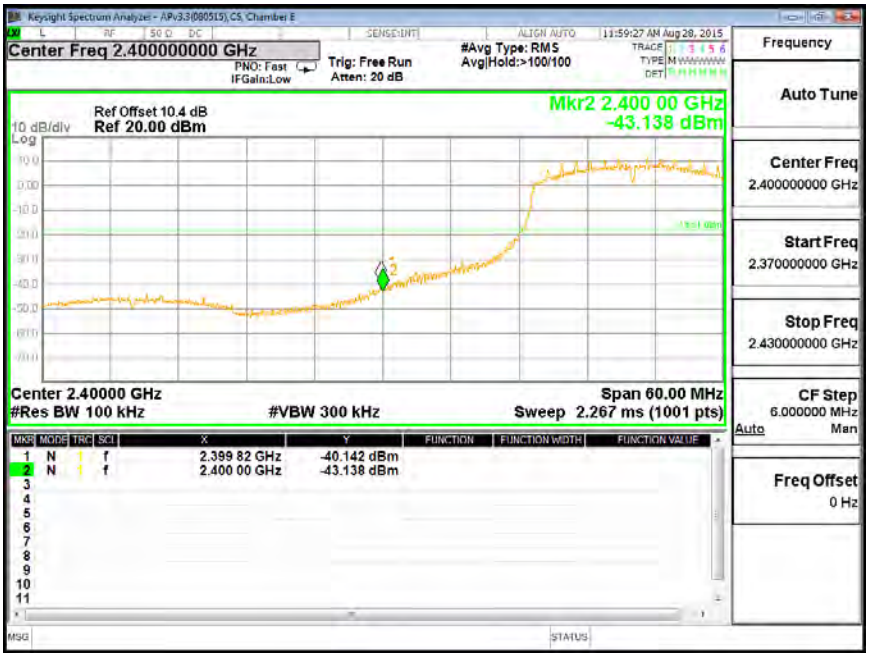
AUTHORIZED BAND EDGE Chain 0 LOW CH



AUTHORIZED BAND EDGE Chain 0 CH 2

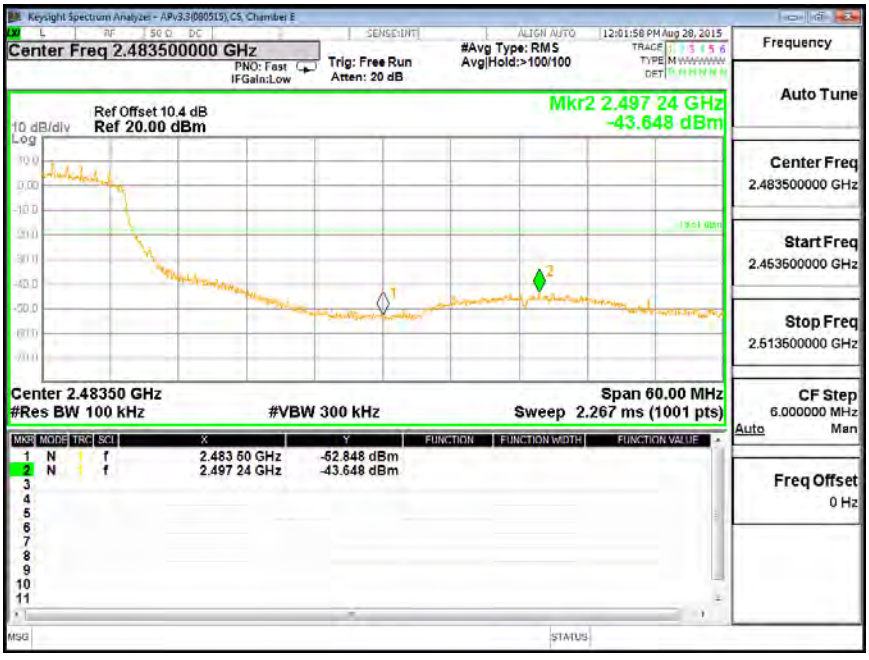


AUTHORIZED BAND EDGE Chain 0 CH 3

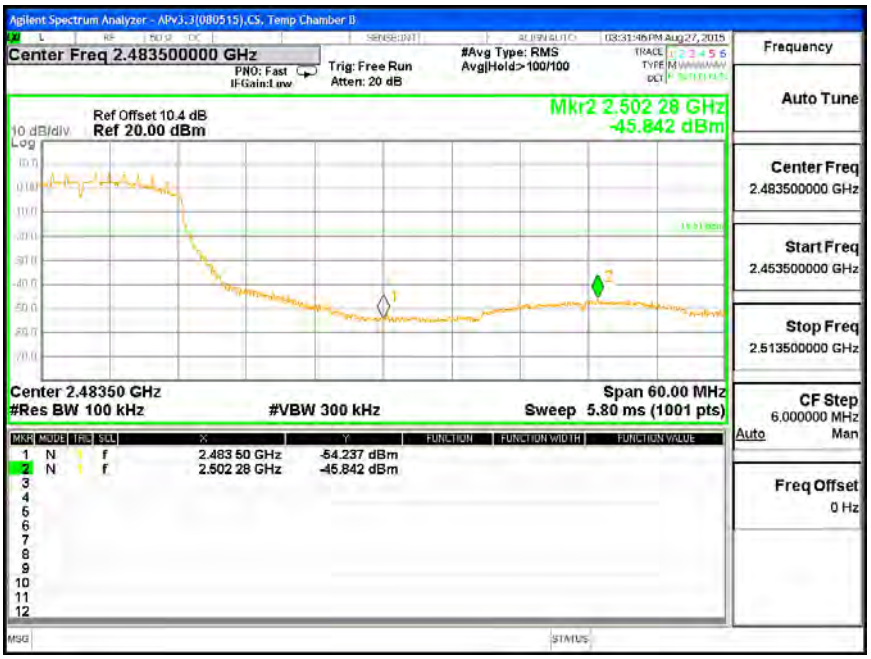


HIGH CHANNEL BANDEDGE, Chain 0

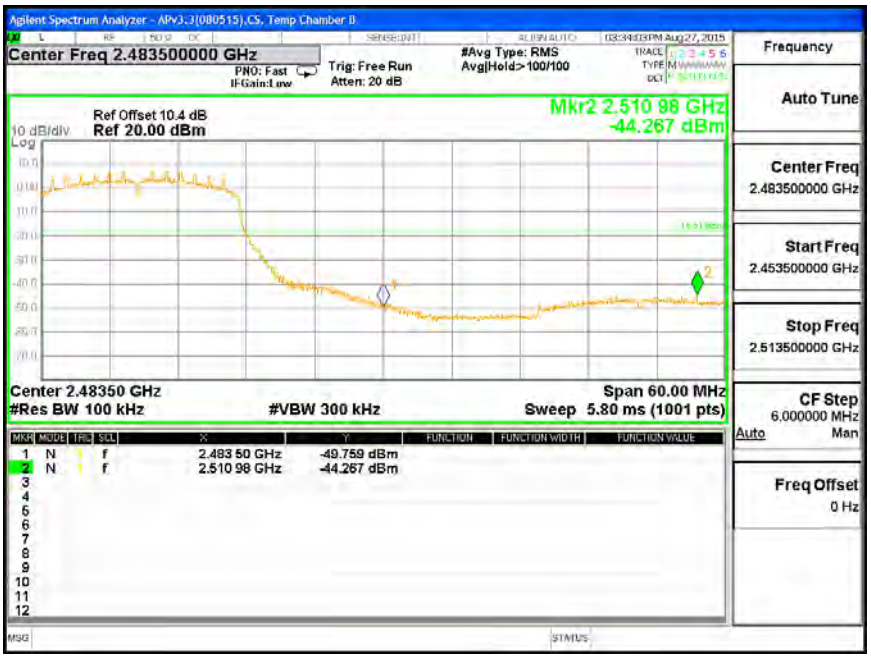
AUTHORIZED BAND EDGE Chain 0 CH 9



AUTHORIZED BAND EDGE Chain 0 CH 10

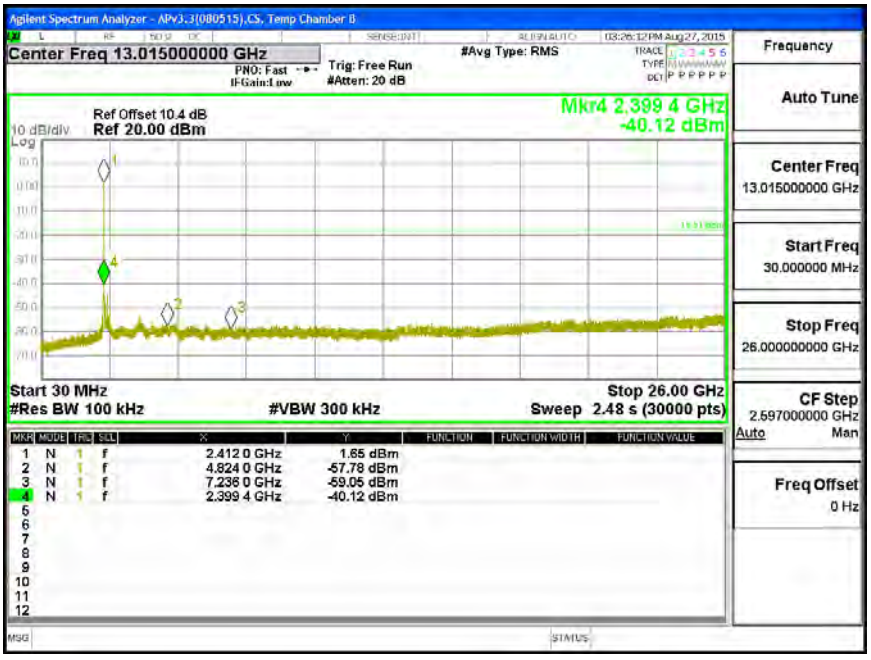


AUTHORIZED BAND EDGE Chain 0 HIGH CH

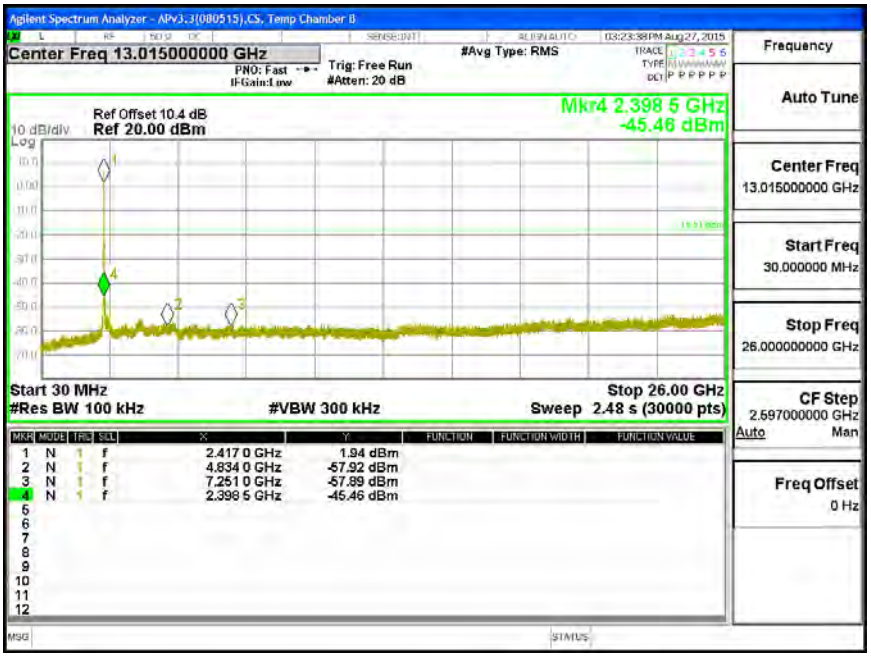


OUT-OF-BAND EMISSIONS, Chain 0

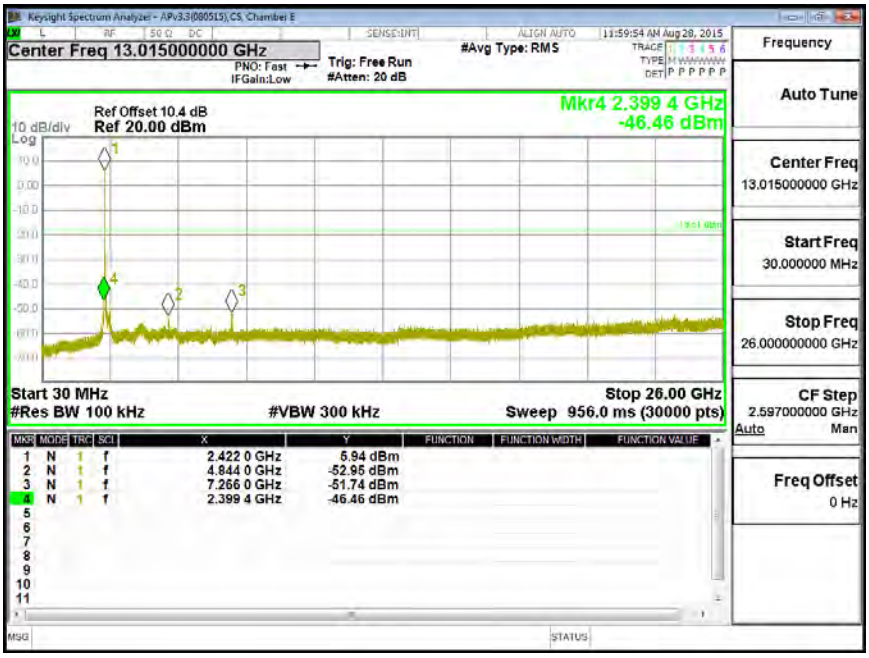
OUT OF BAND Chain 0 LOW CH



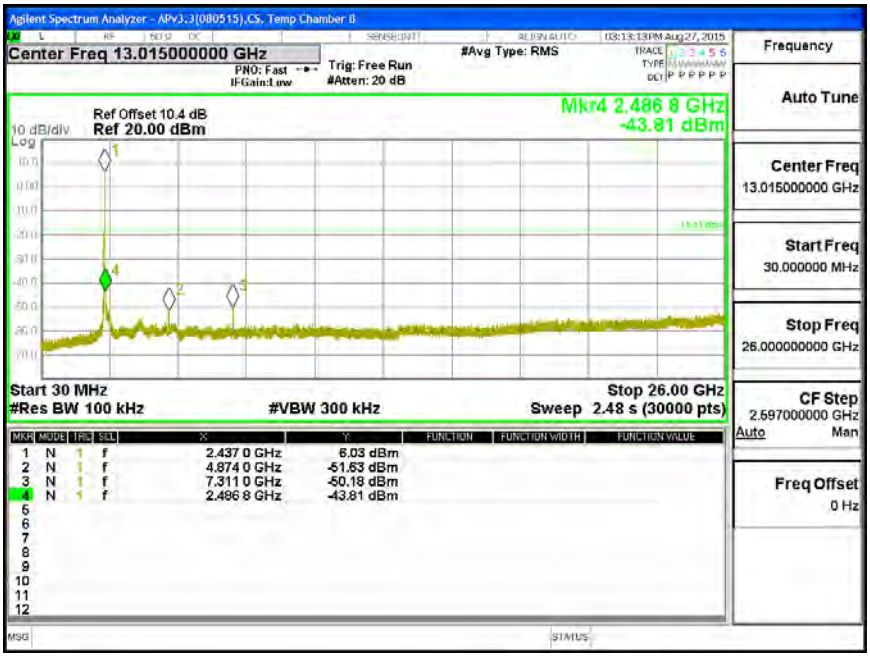
OUT OF BAND Chain 0 CH 2



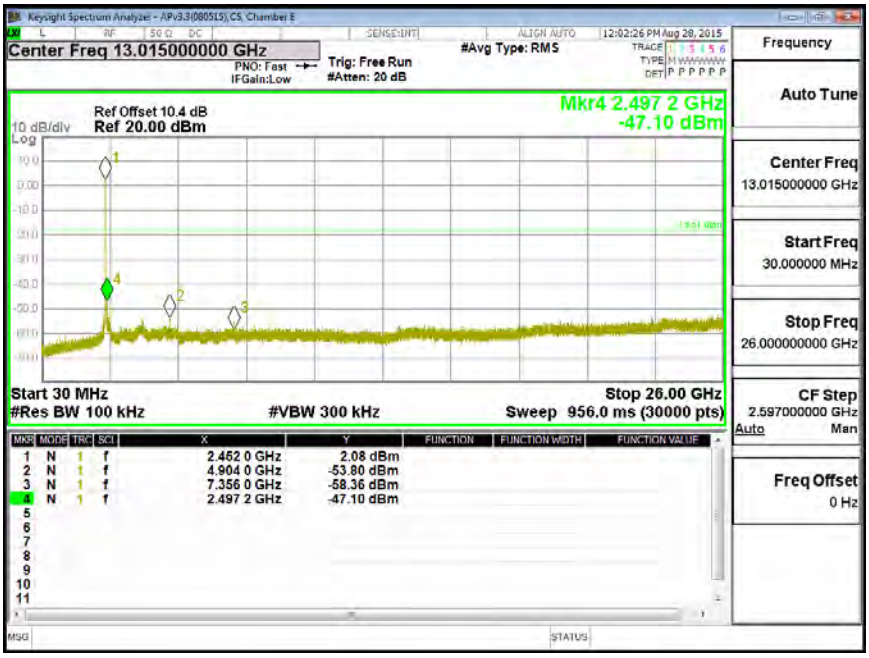
OUT OF BAND Chain 0 CH 3



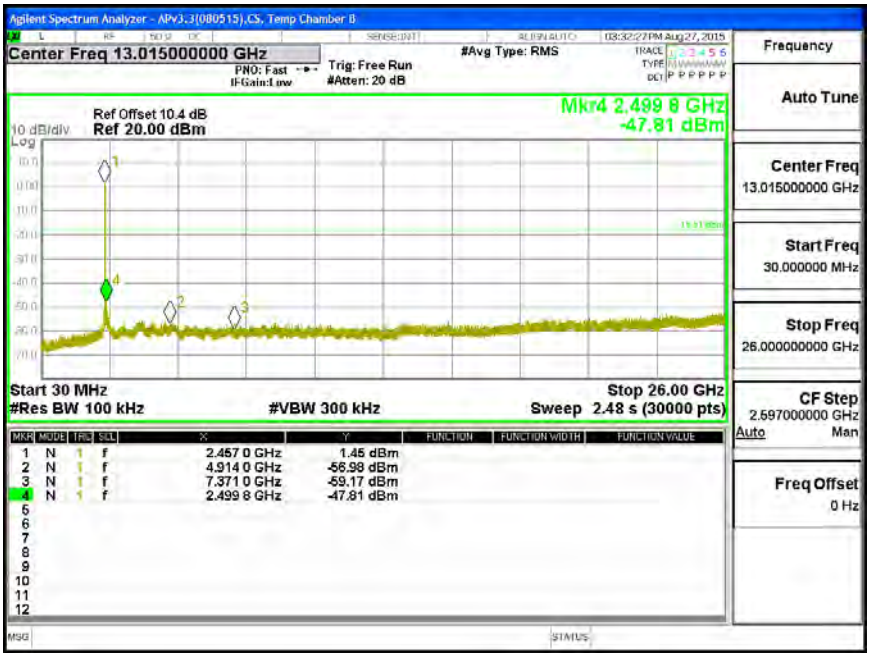
OUT OF BAND Chain 0 MID CH



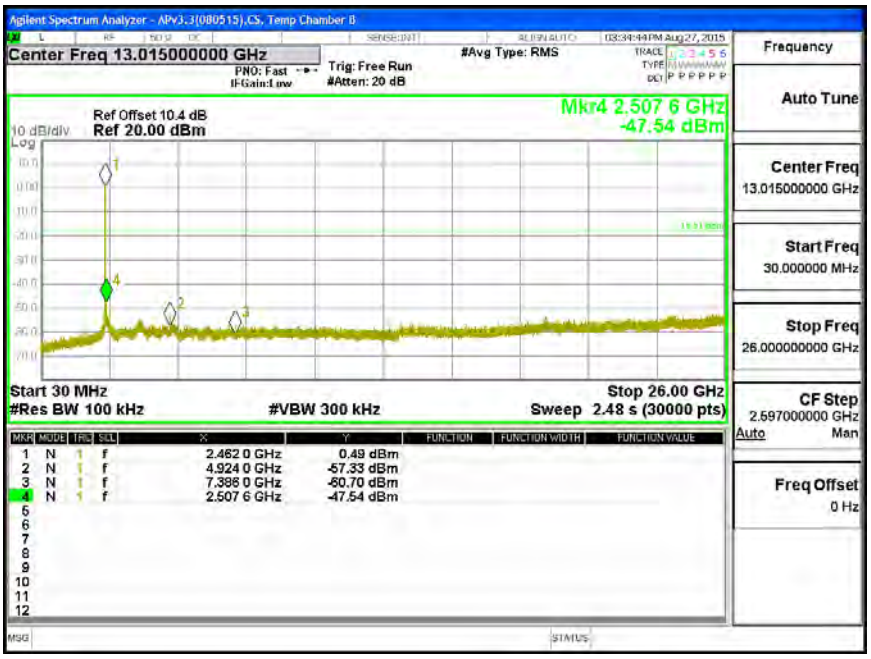
OUT OF BAND Chain 0 CH 9



OUT OF BAND Chain 0 CH 10

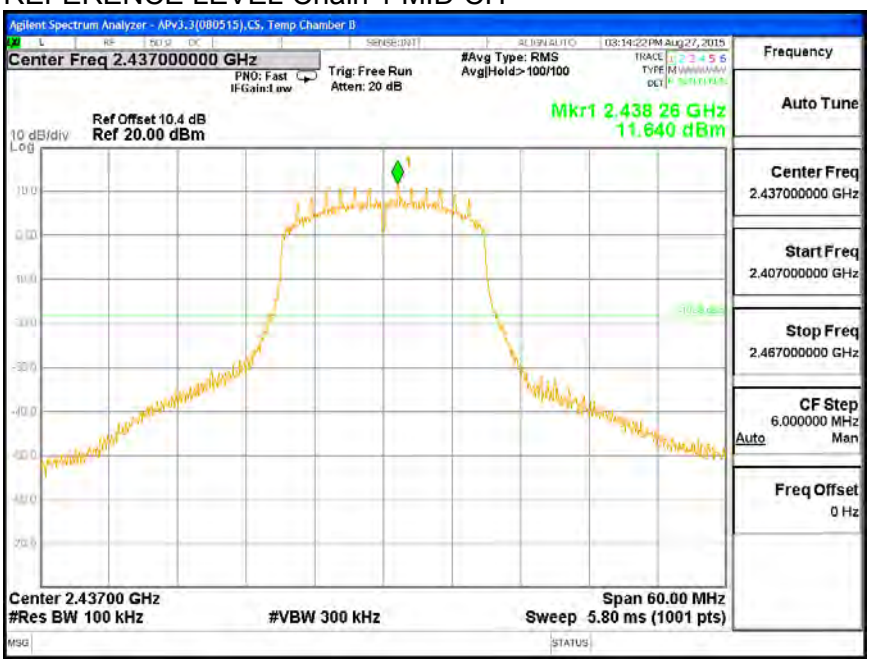


OUT OF BAND Chain 0 HIGH CH



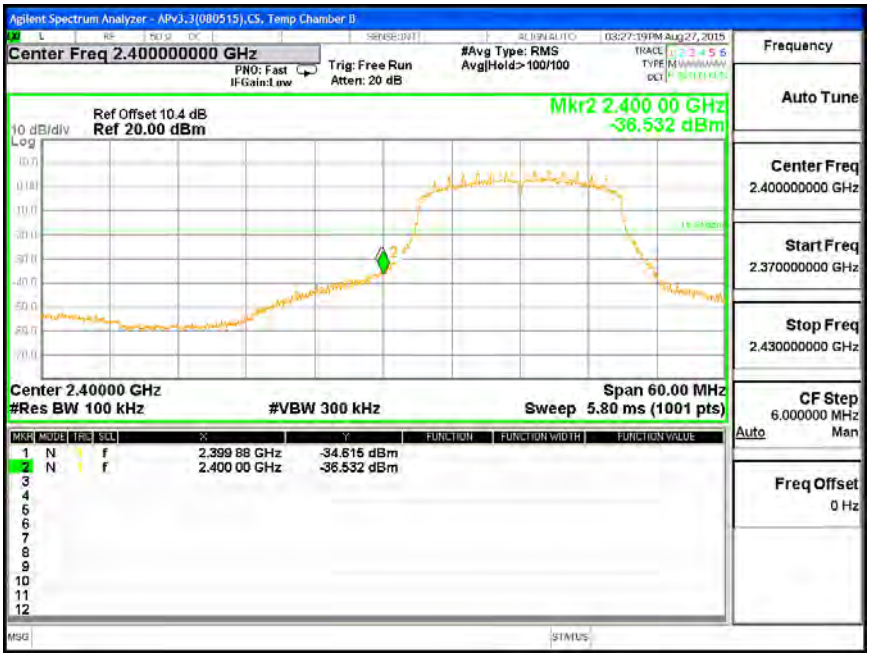
IN-BAND REFERENCE LEVEL, Chain 1

REFERENCE LEVEL Chain 1 MID CH

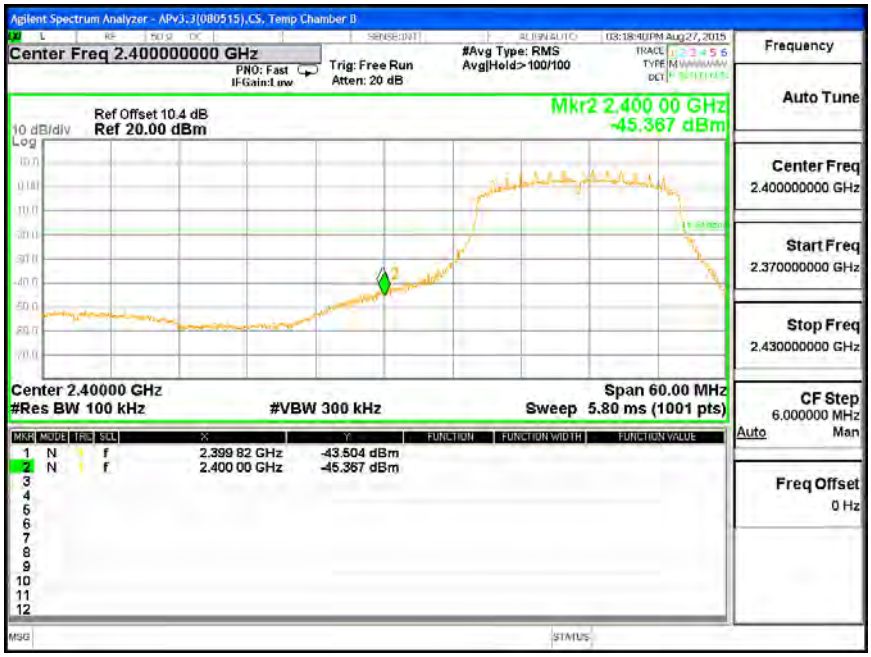


LOW CHANNEL BANDEDGE, Chain 1

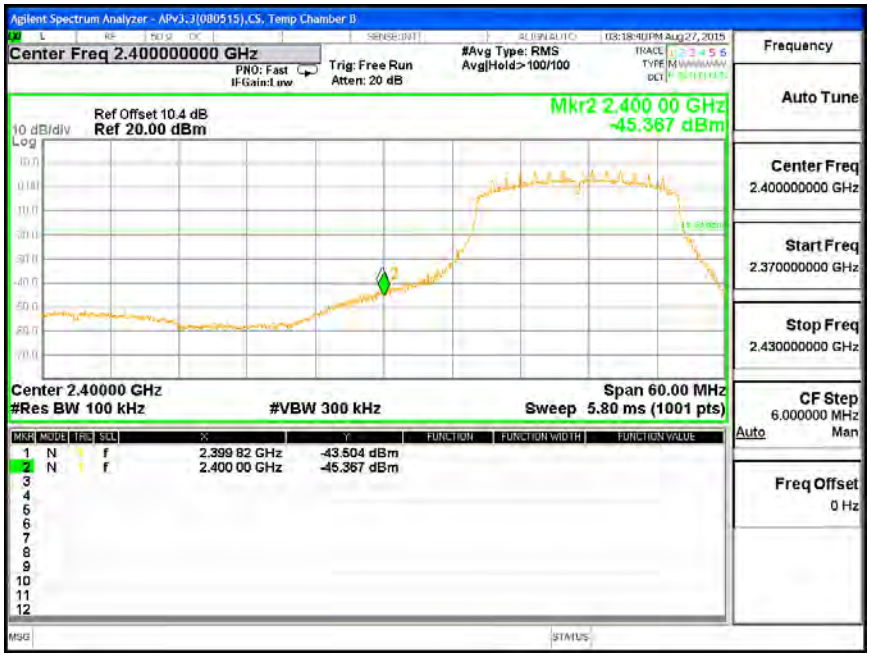
AUTHORIZED BAND EDGE Chain 1 LOW CH



AUTHORIZED BAND EDGE Chain 1 CH 2

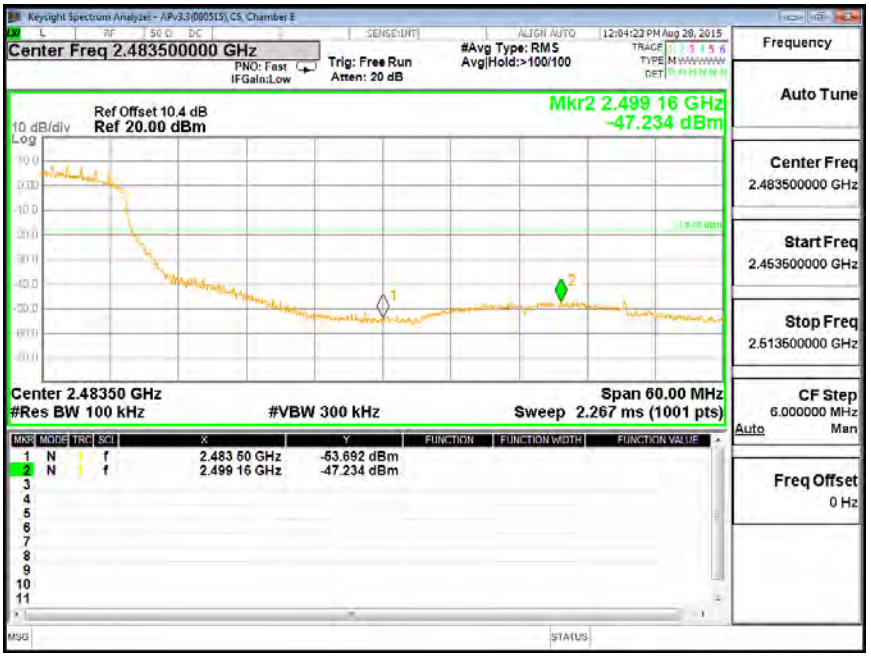


AUTHORIZED BAND EDGE Chain 1 CH 3

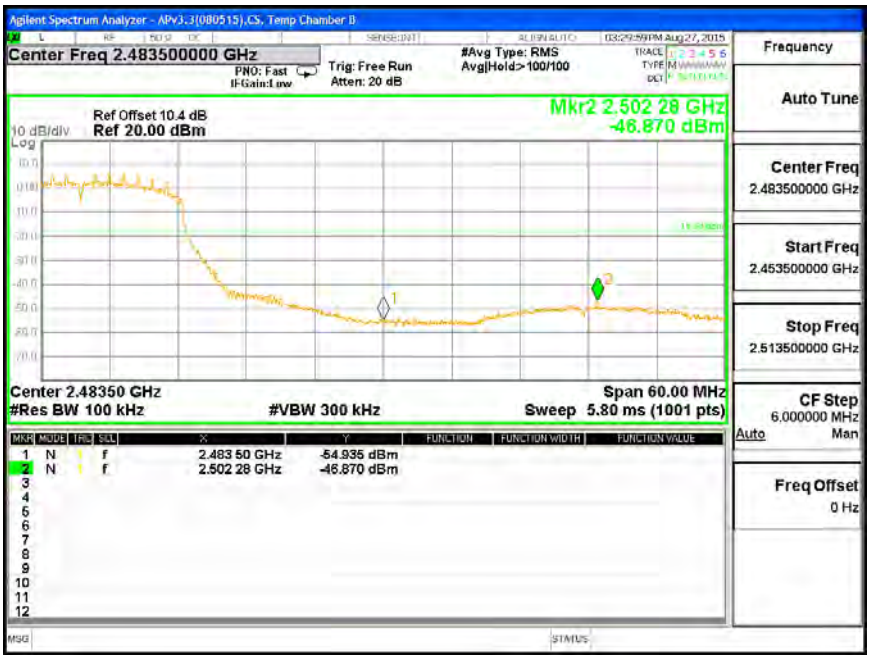


HIGH CHANNEL BANDEDGE, Chain 1

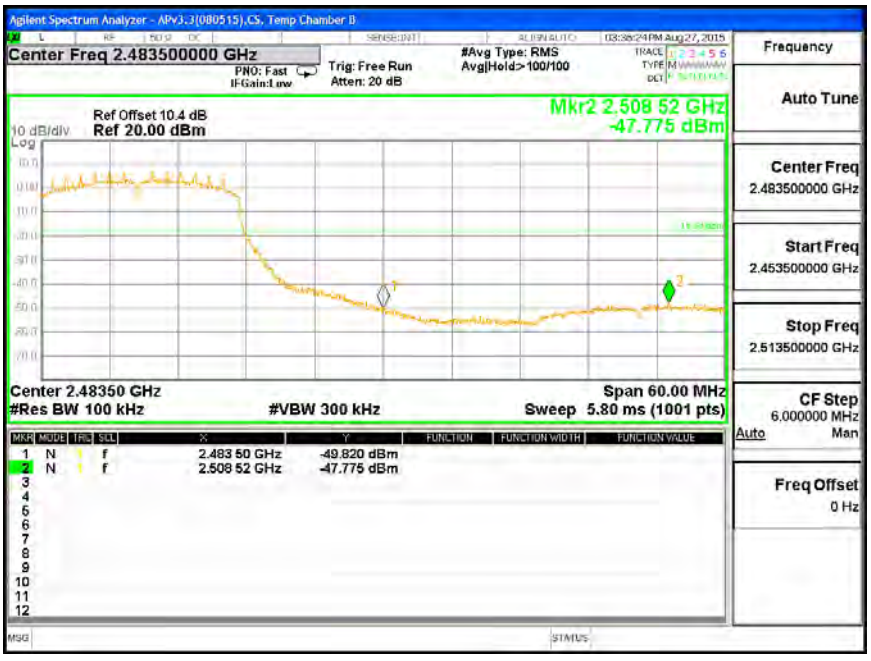
AUTHORIZED BAND EDGE Chain 1 CH 9



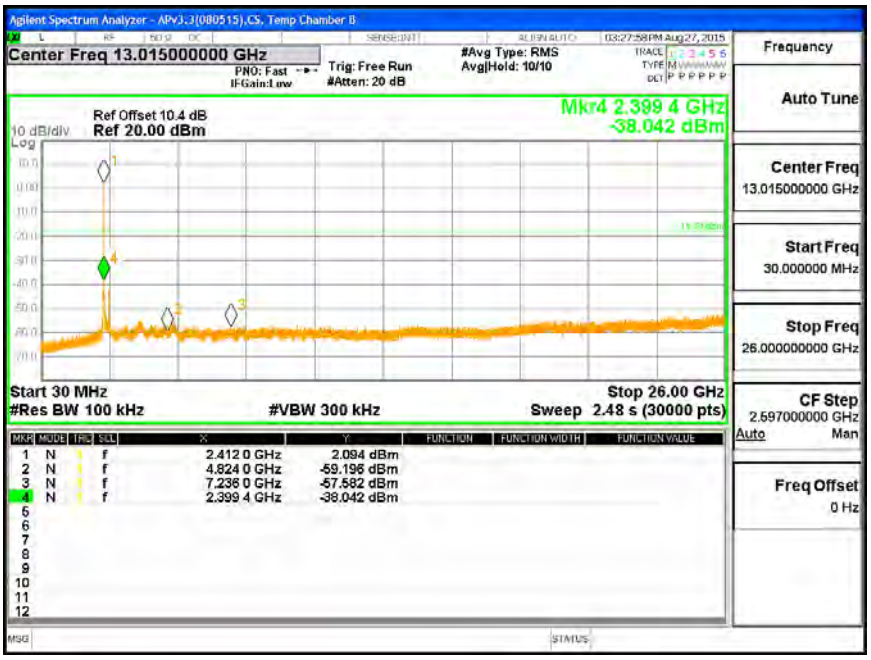
AUTHORIZED BAND EDGE Chain 1 CH 10



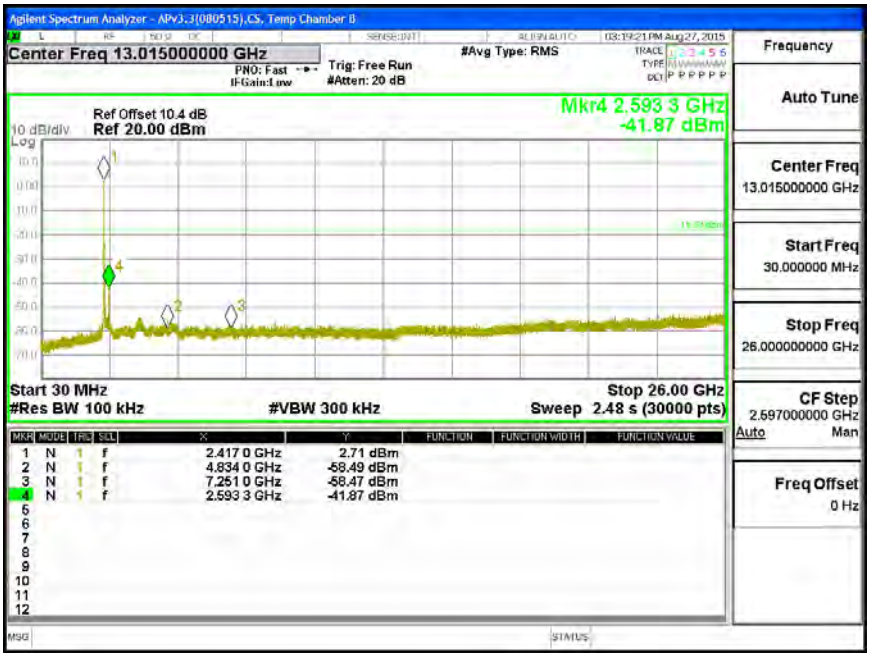
AUTHORIZED BAND EDGE Chain 1 HIGH CH



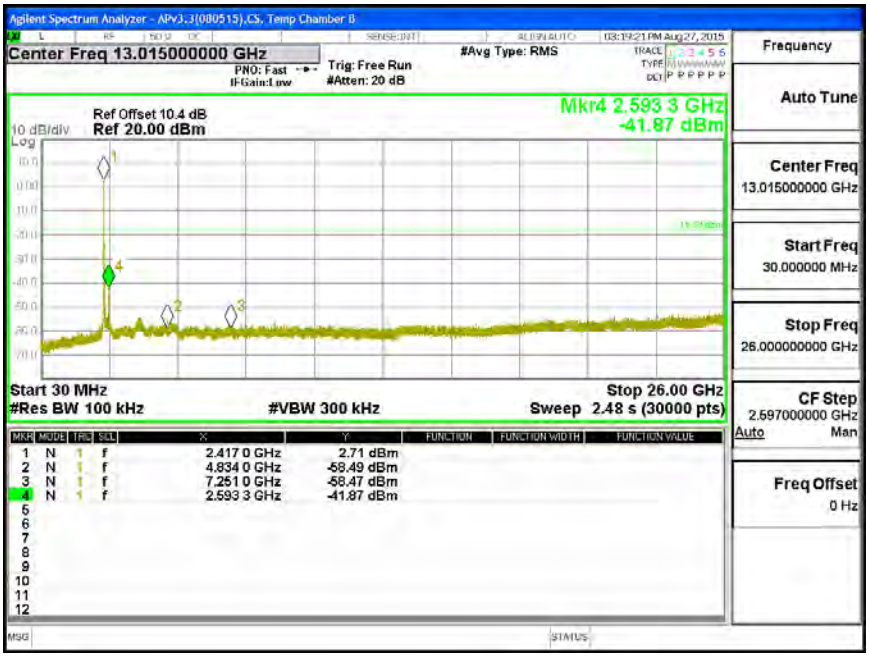
OUT OF BAND Chain 1 LOW CH



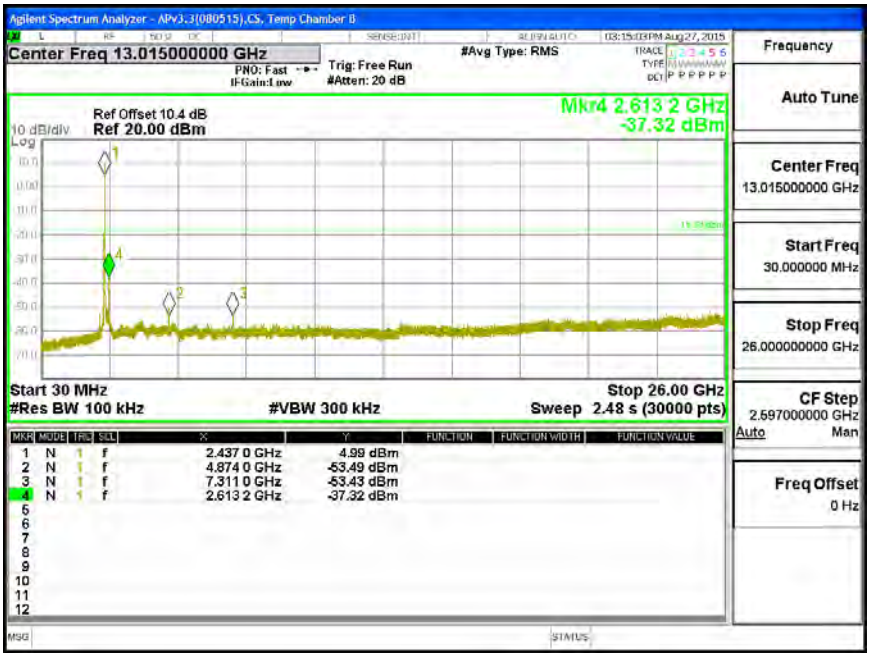
OUT OF BAND Chain 1 CH 2



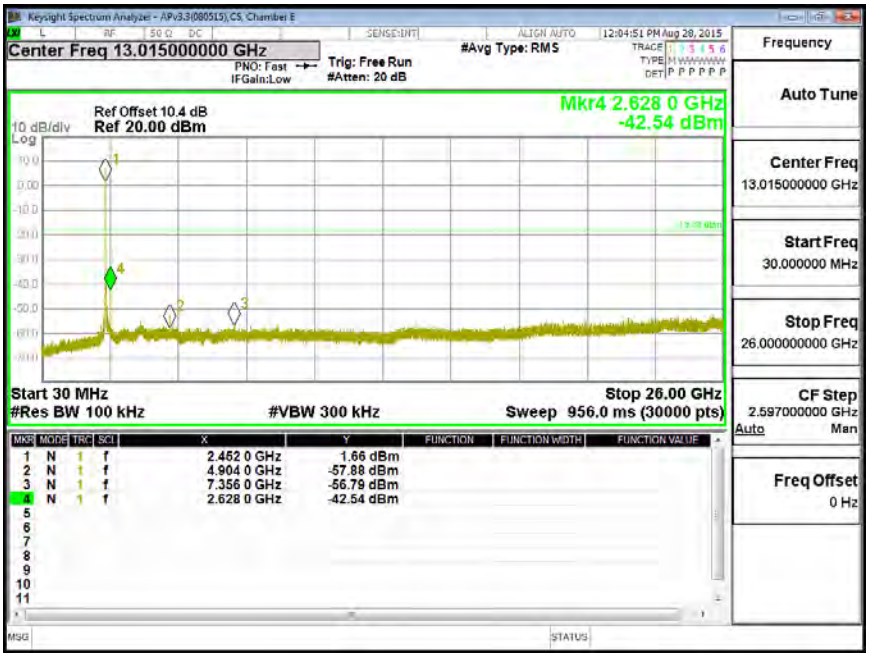
OUT OF BAND Chain 1 CH 3



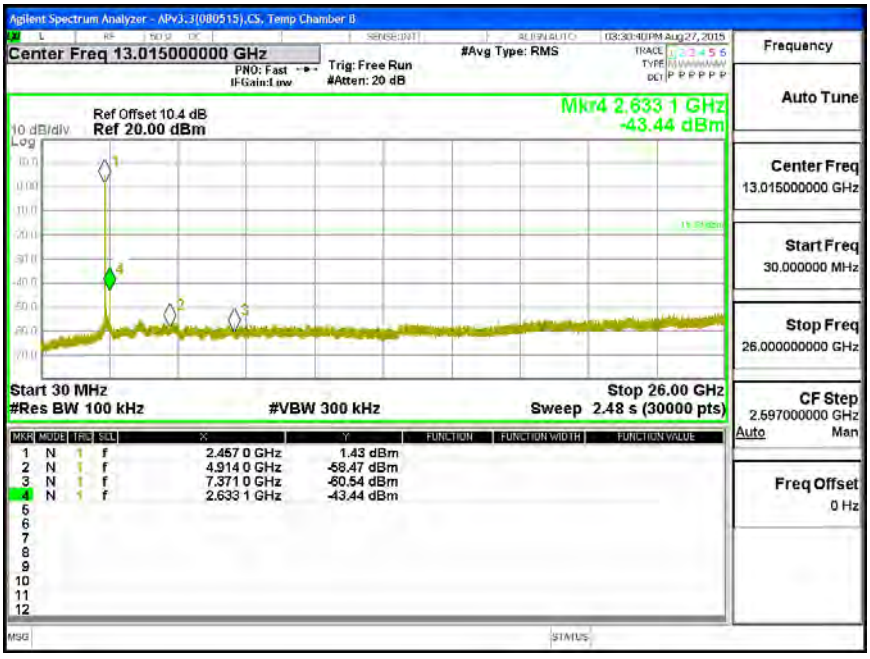
OUT OF BAND Chain 1 MID CH



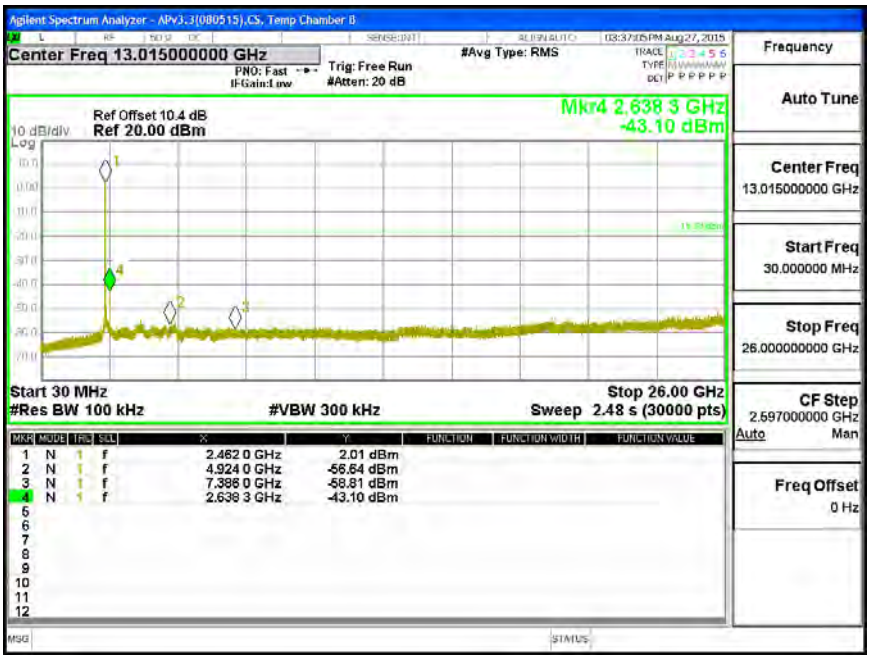
OUT OF BAND Chain 1 CH 9



OUT OF BAND Chain 1 CH 10



OUT OF BAND Chain 1 HIGH CH



8.5. 802.11n HT40 2TX MODE IN THE 2.4 GHz BAND

8.5.1. 6 dB BANDWIDTH

LIMITS

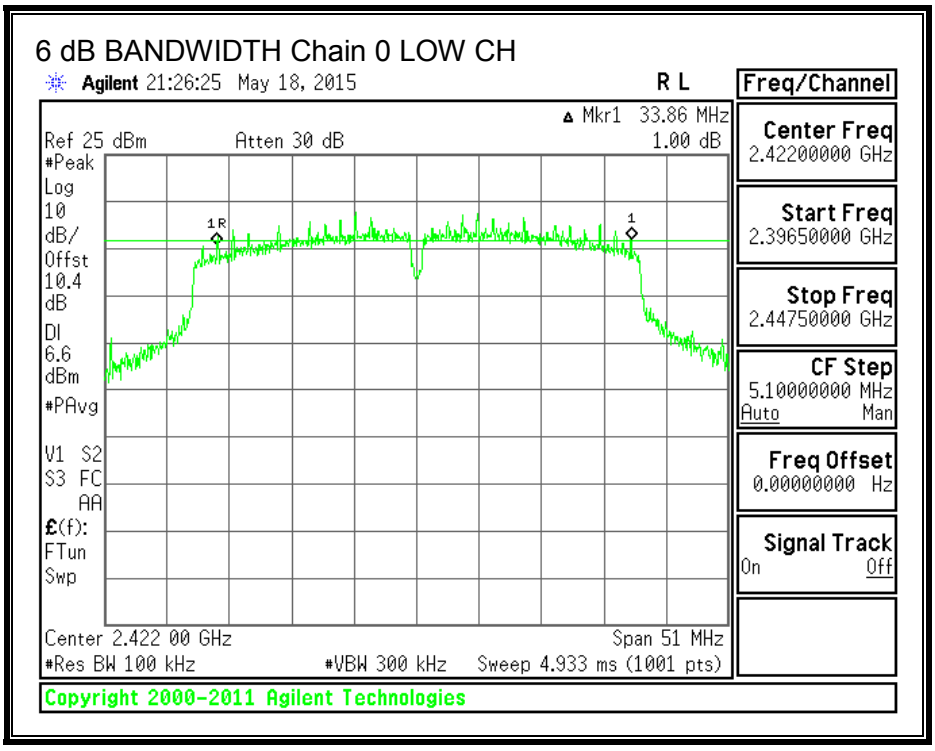
FCC §15.247 (a) (2)

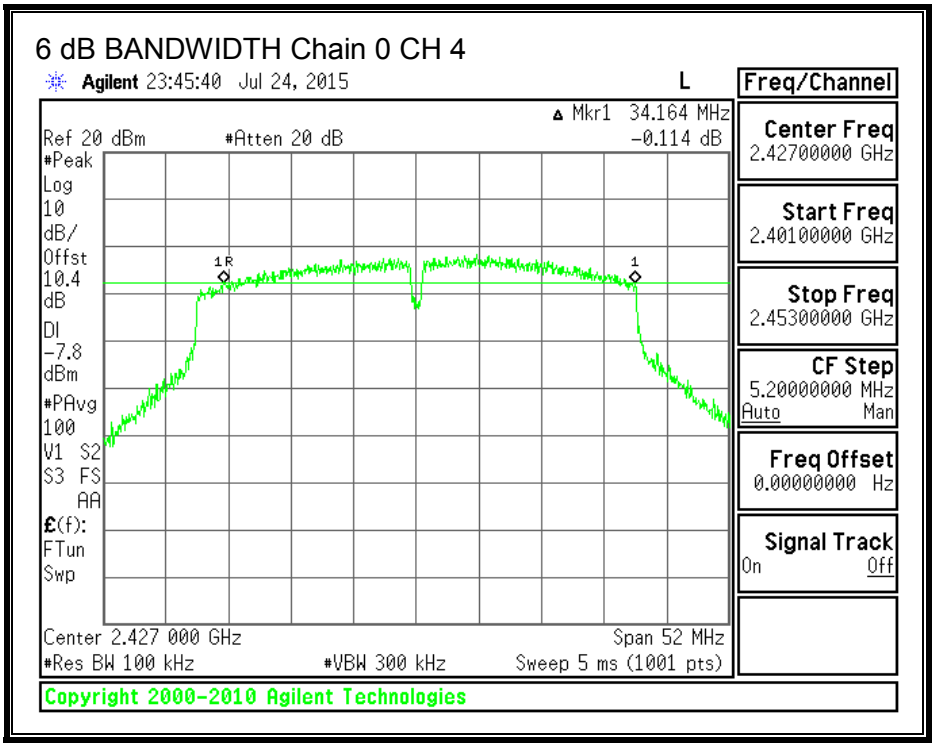
The minimum 6 dB bandwidth shall be at least 500 kHz.

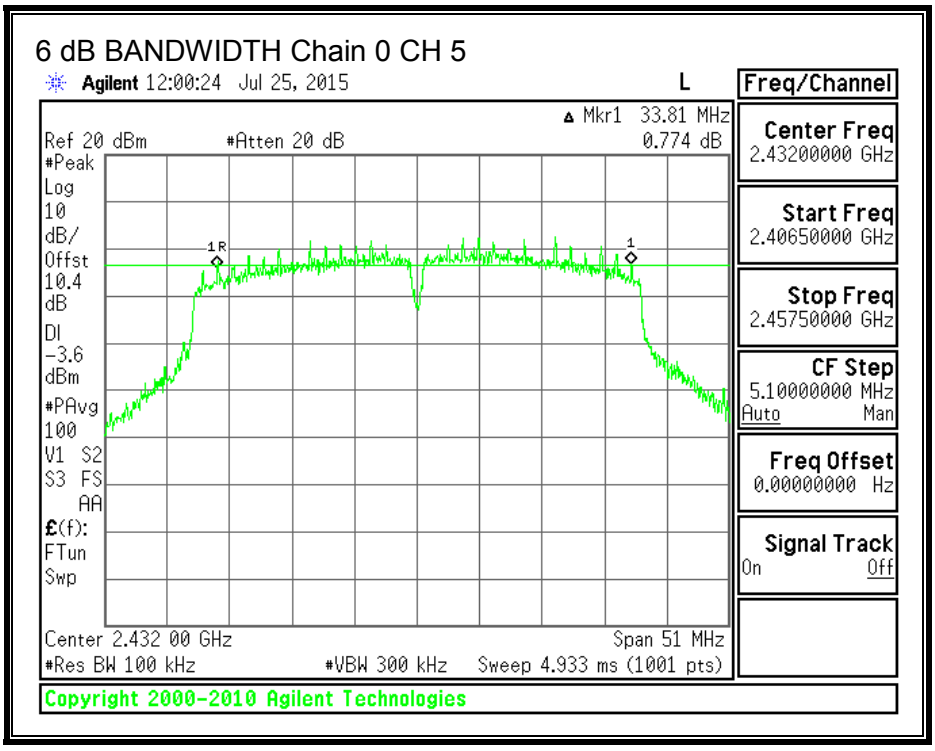
RESULTS

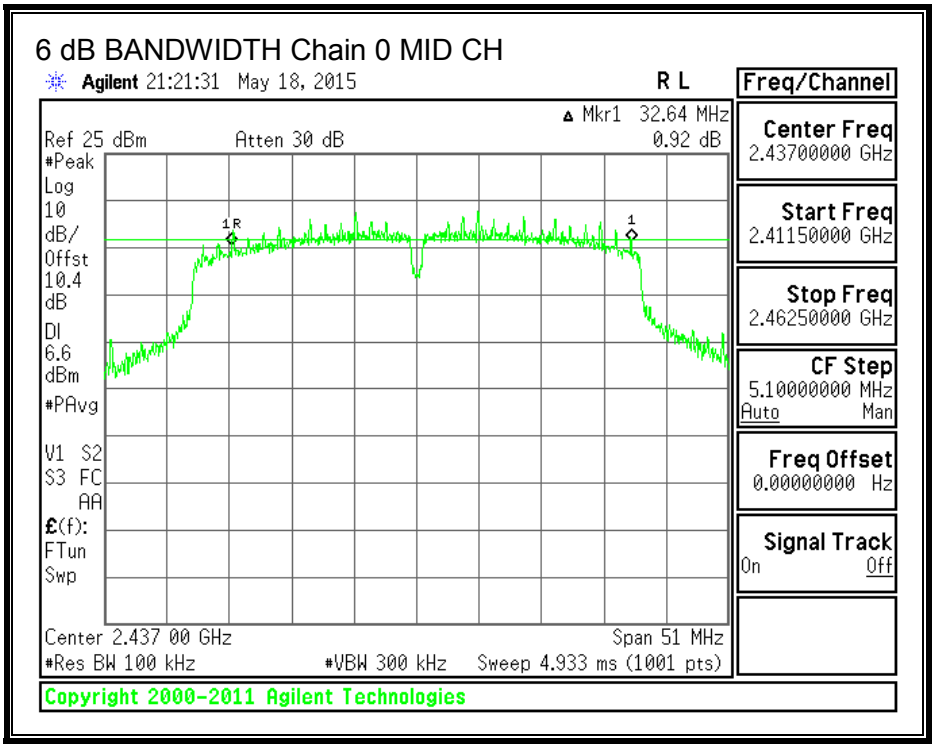
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	2422	33.860	33.760	0.5
4	2427	34.164	33.810	0.5
5	2432	33.810	33.860	0.5
Mid	2437	32.640	32.640	0.5
7	2442	33.810	32.540	0.5
8	2447	33.810	33.760	0.5
High	2452	33.860	33.760	0.5

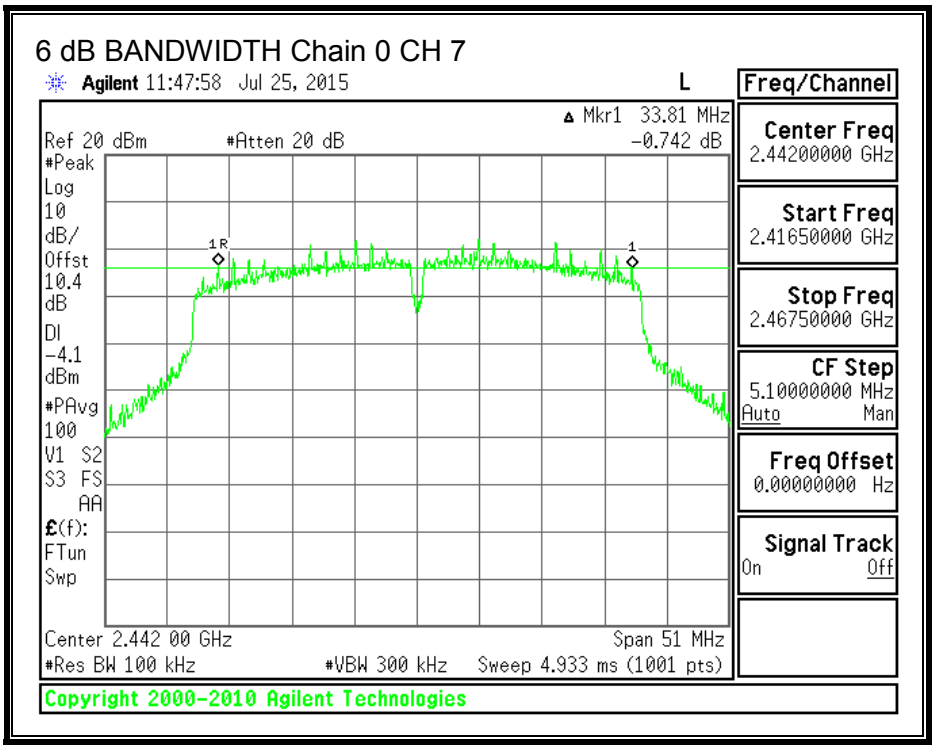
6 dB BANDWIDTH, Chain 0

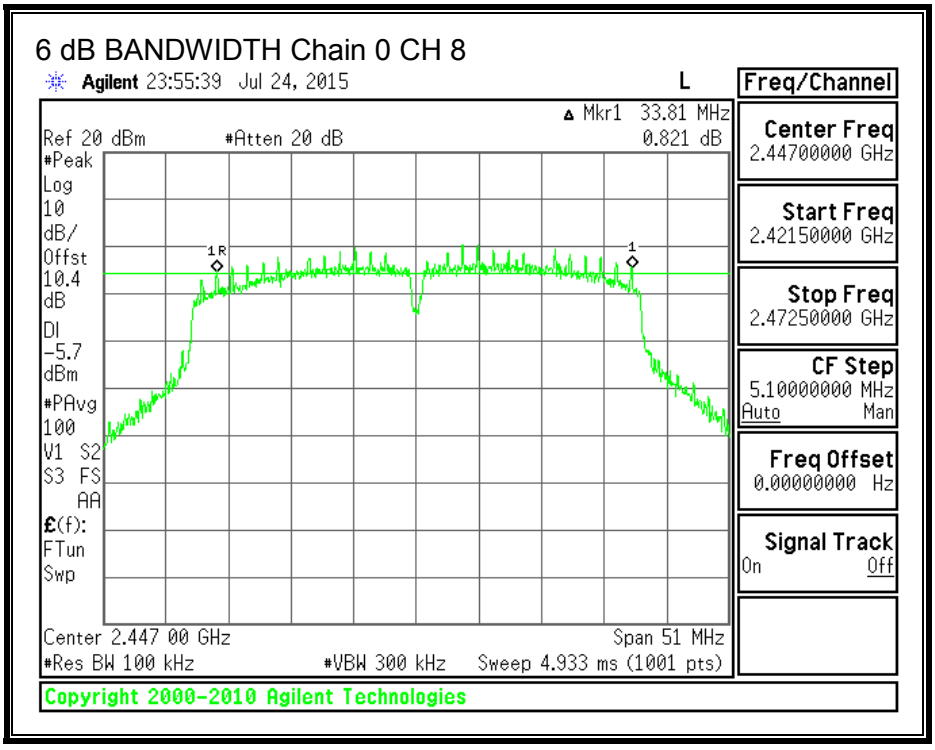


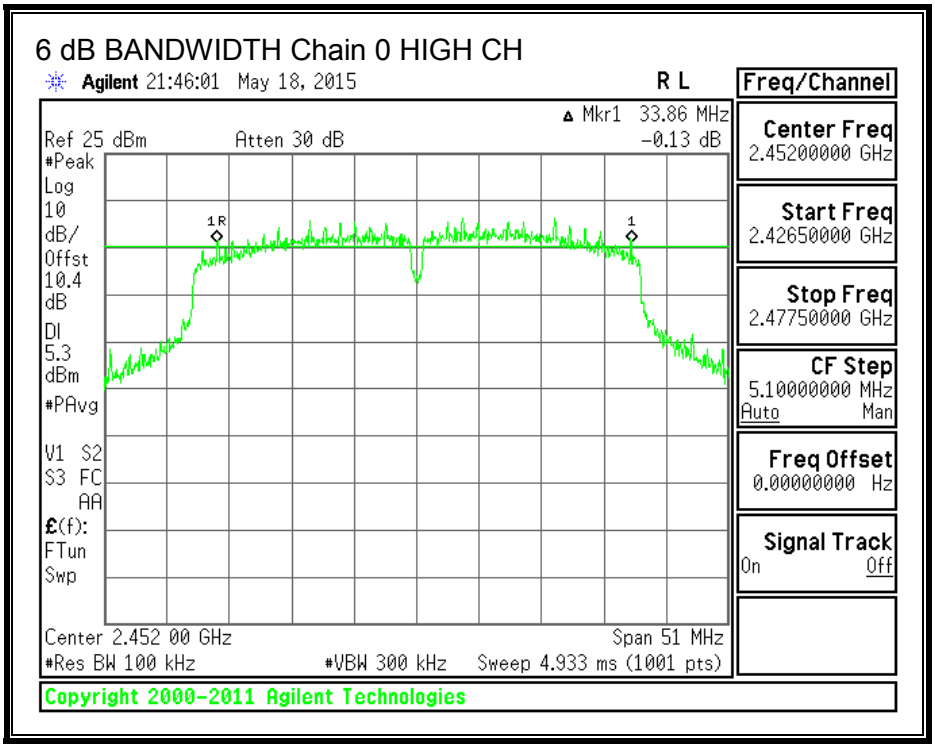




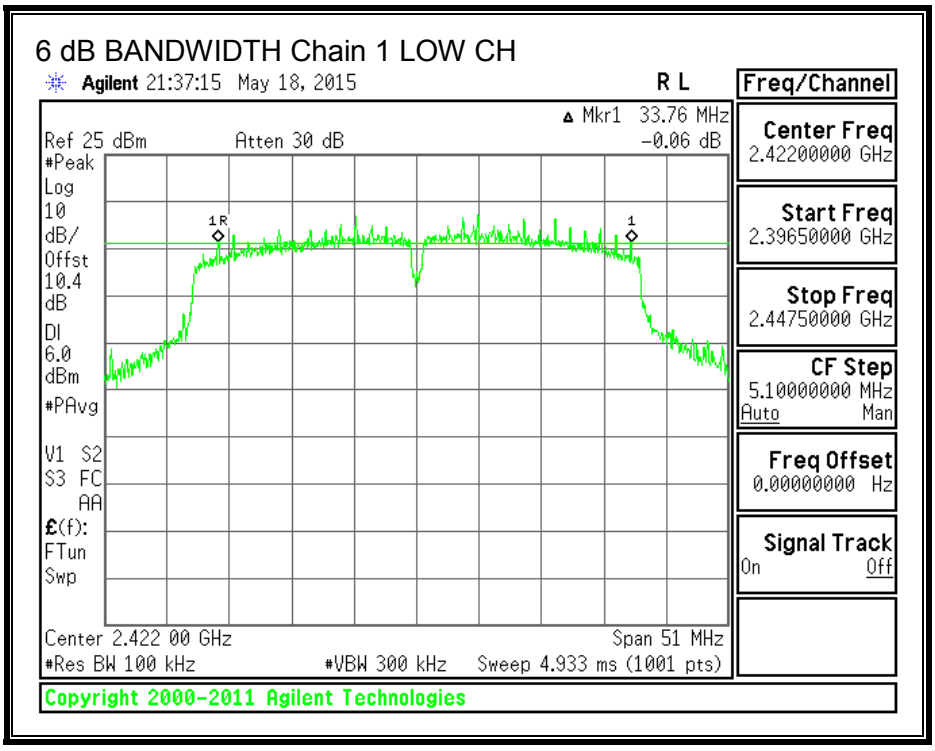


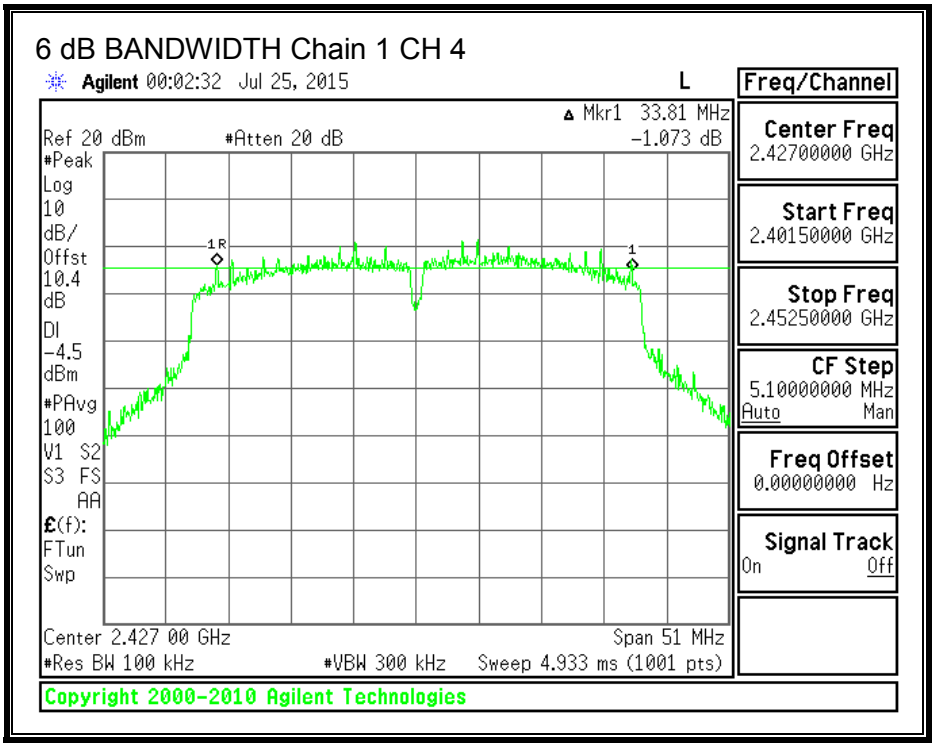


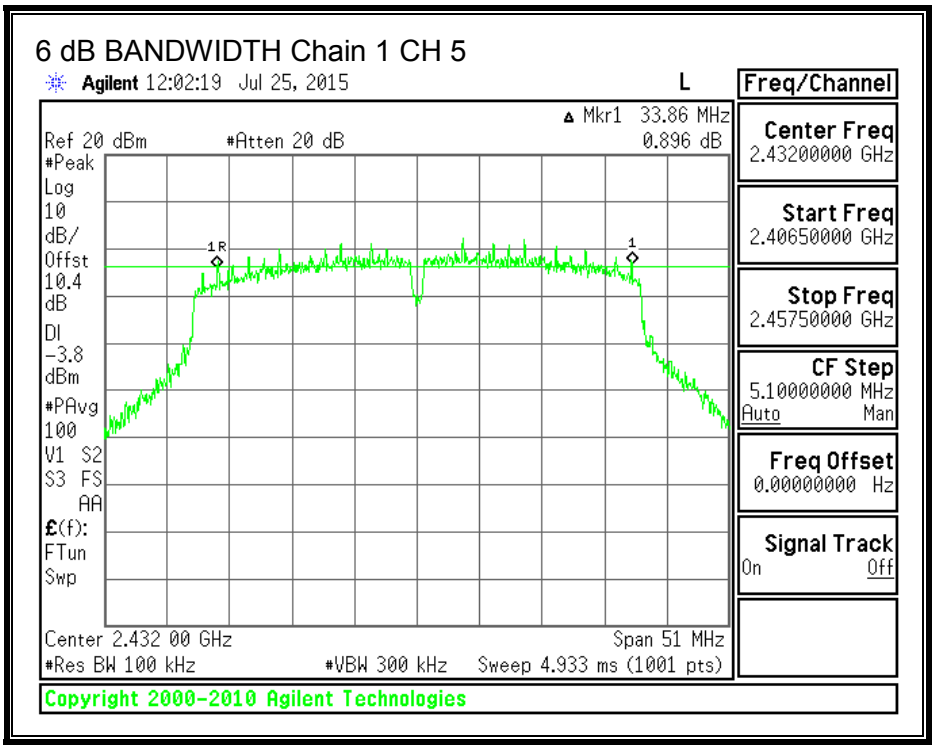


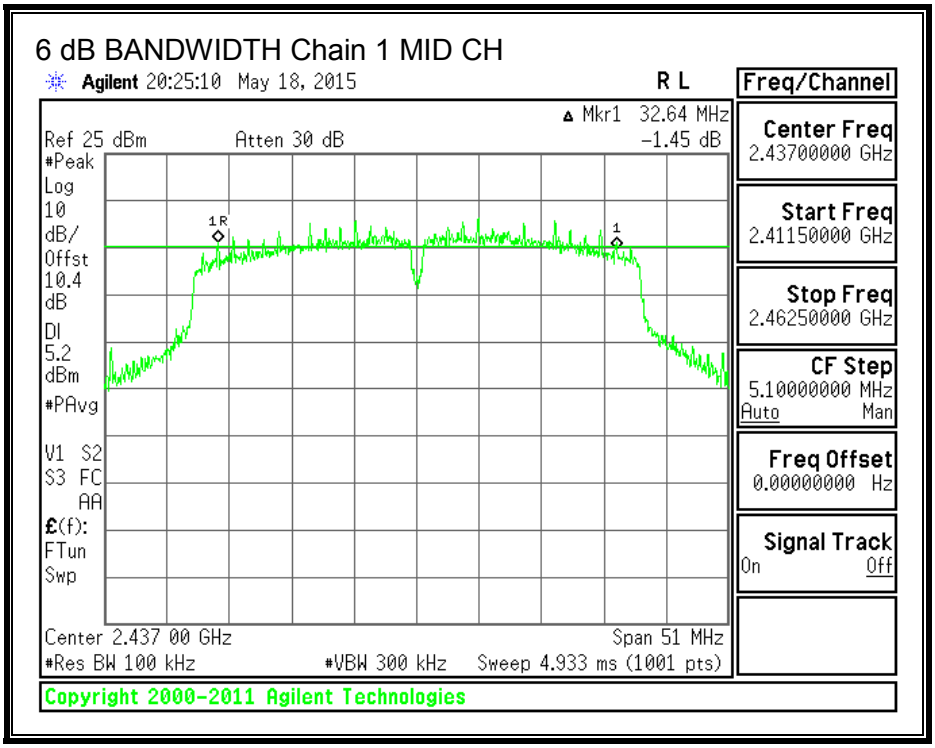


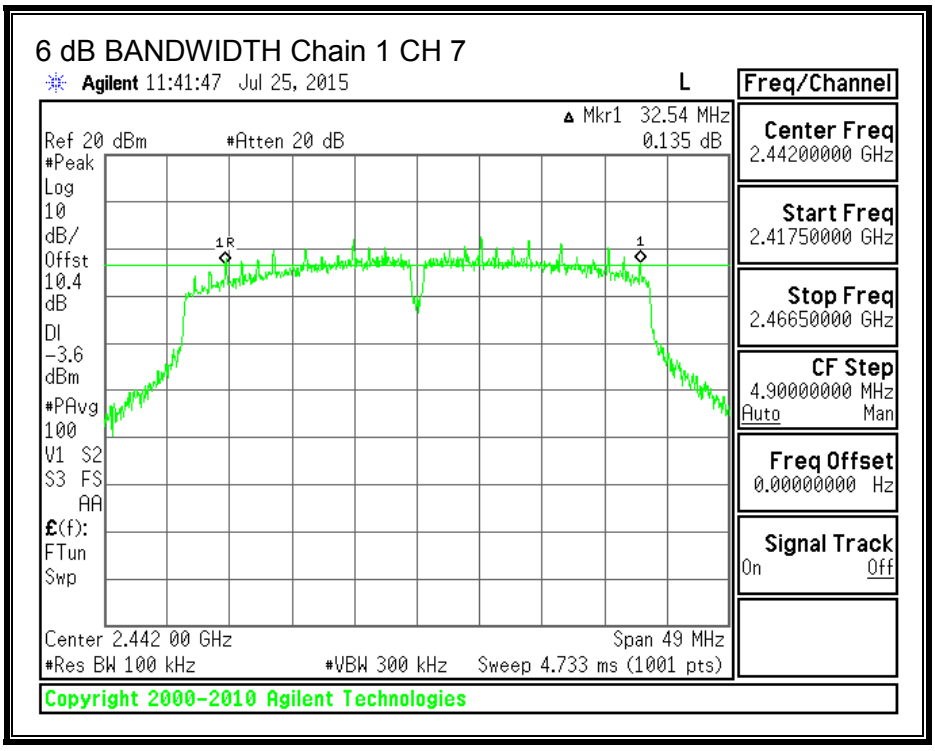
6 dB BANDWIDTH, Chain 1

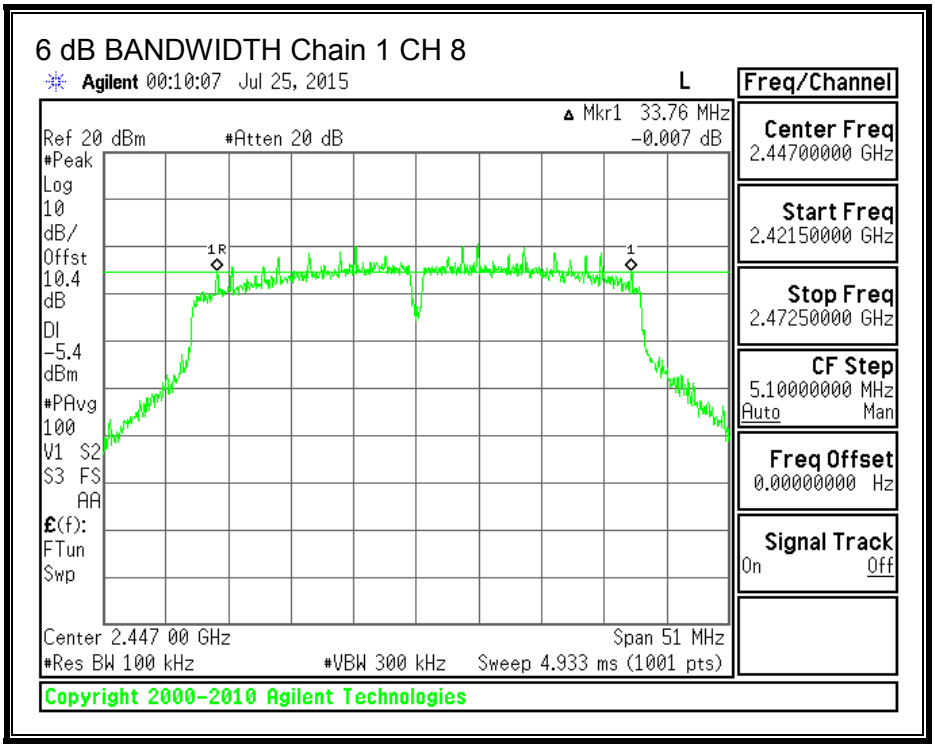


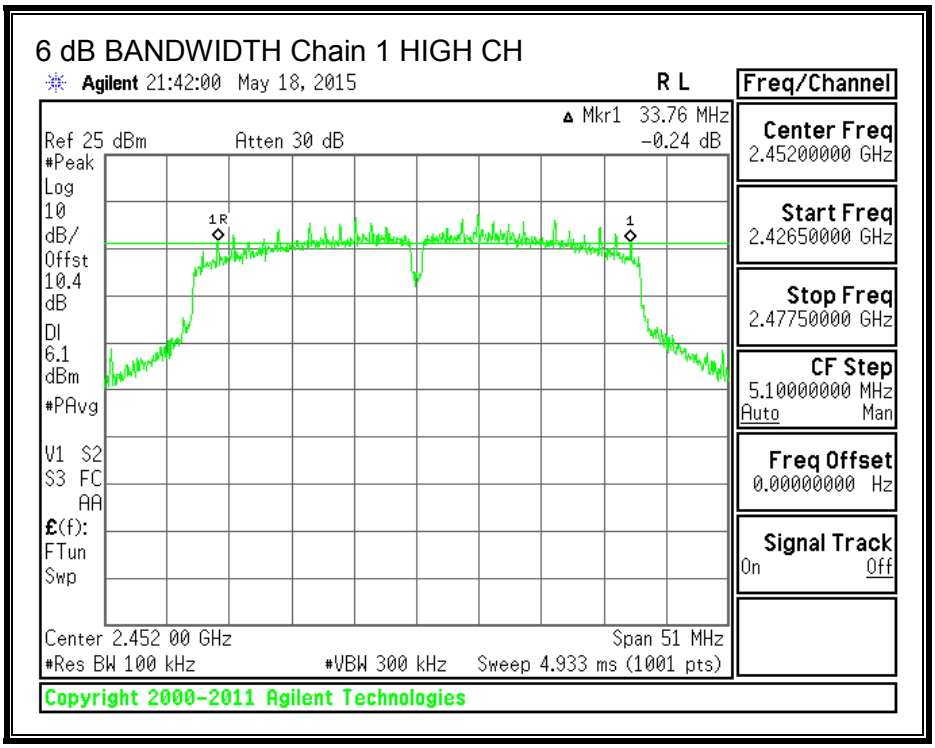












8.5.2. 99% BANDWIDTH

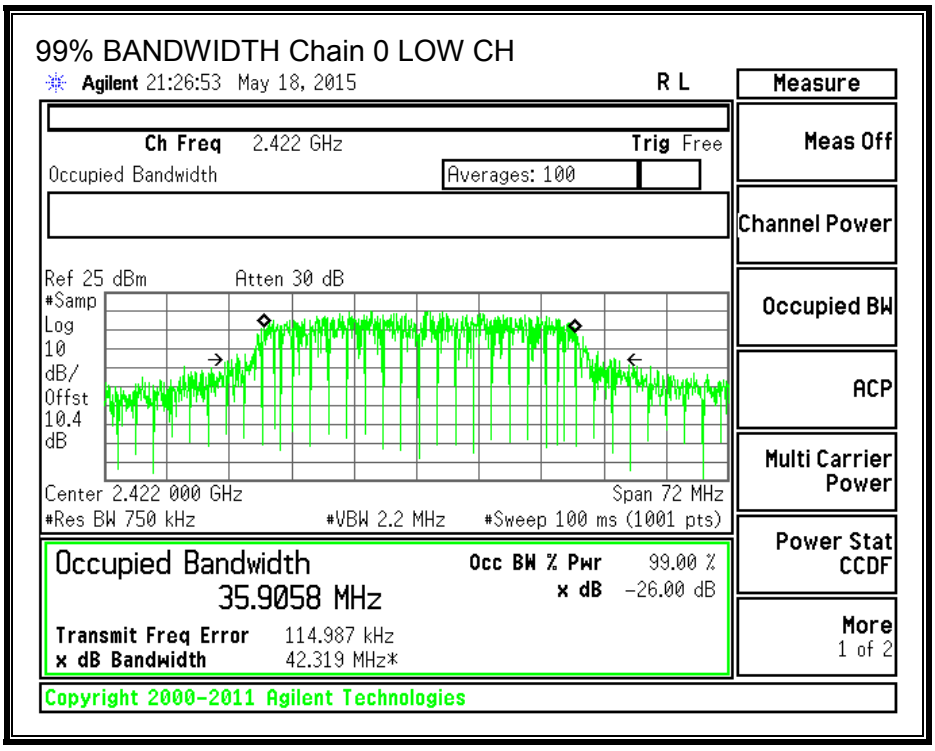
LIMITS

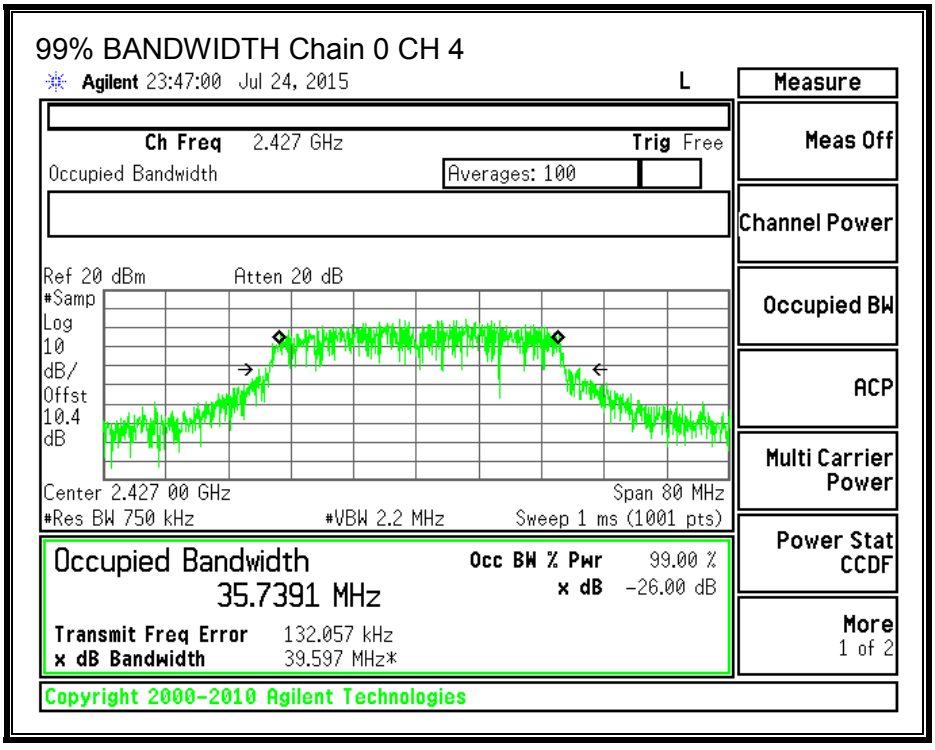
None; for reporting purposes only.

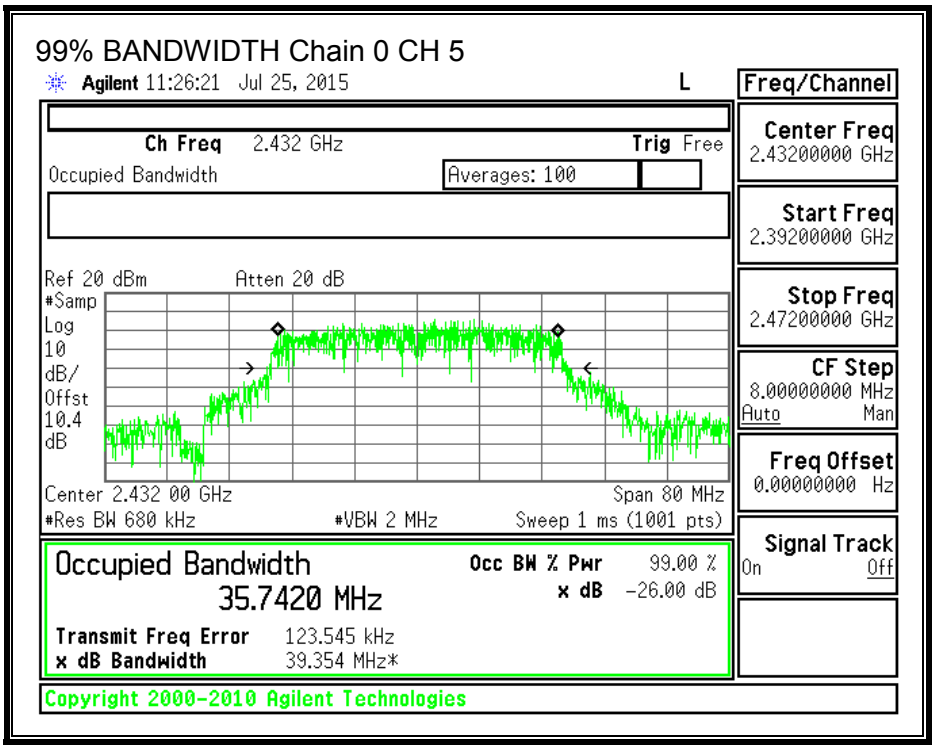
RESULTS

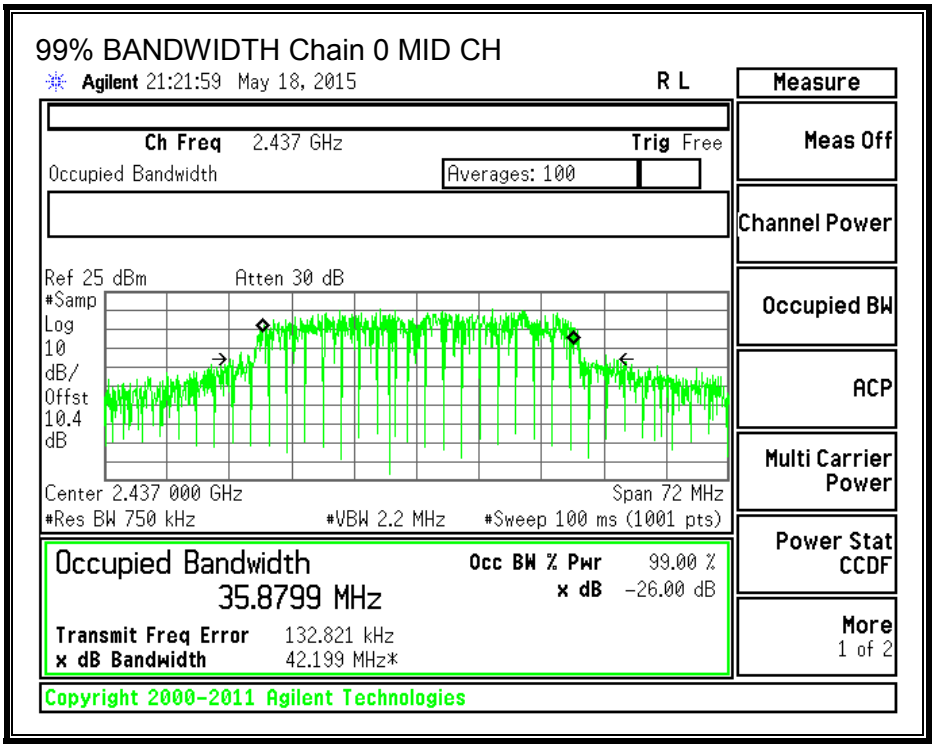
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	2422	35.9058	35.8559
4	2427	35.7391	35.5484
5	2432	35.7420	35.6804
Mid	2437	35.8799	35.7629
7	2442	35.7737	35.4453
8	2447	35.5520	35.6437
High	2452	35.7315	35.7903

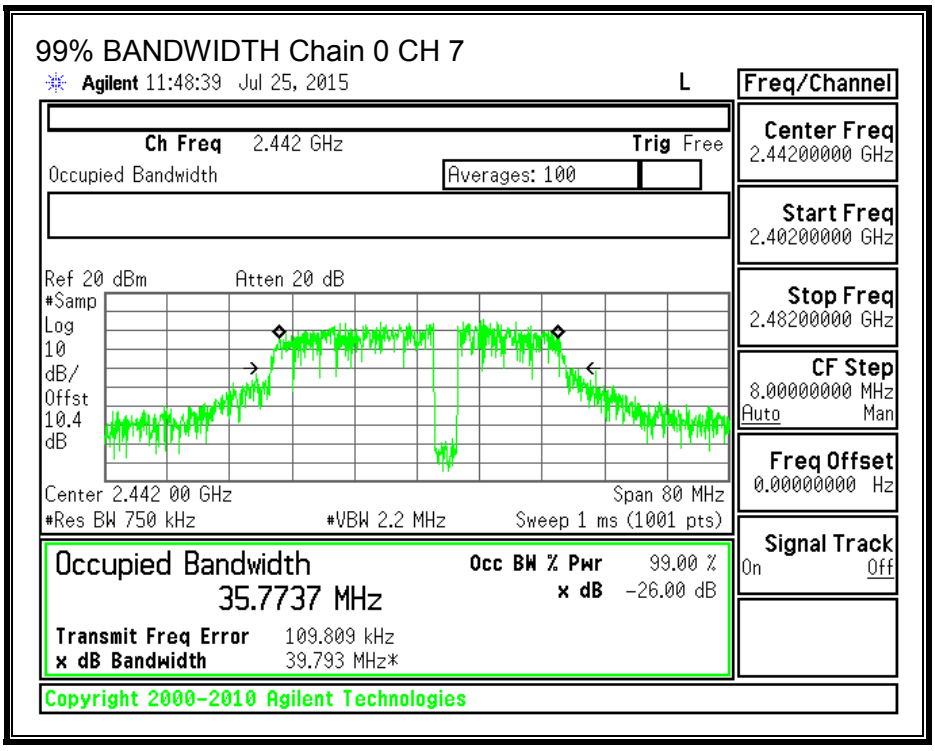
99% BANDWIDTH, Chain 0

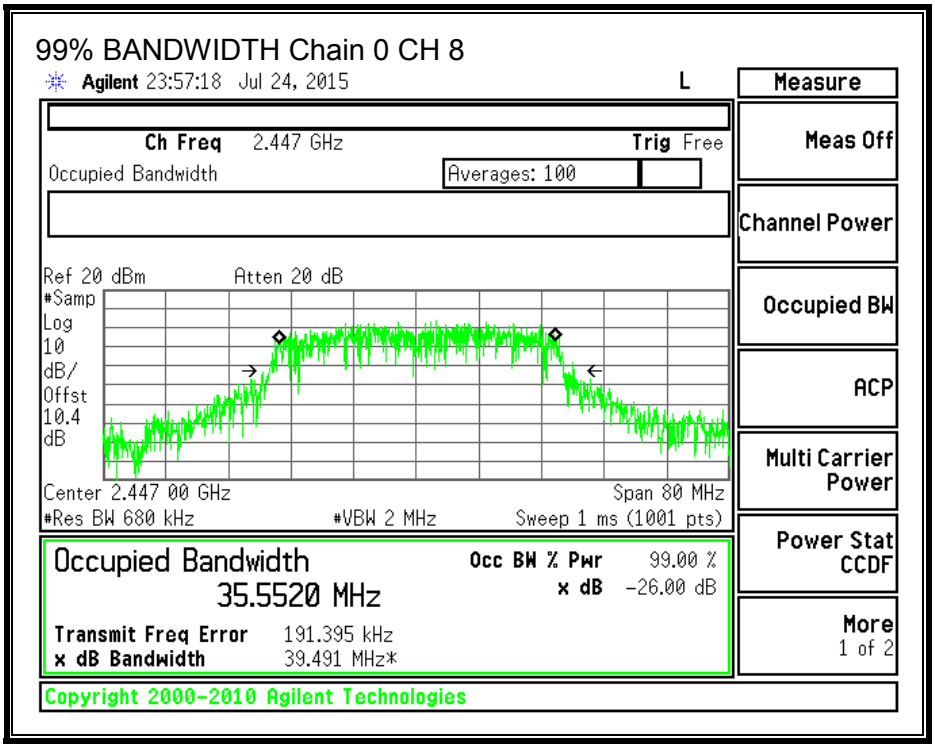


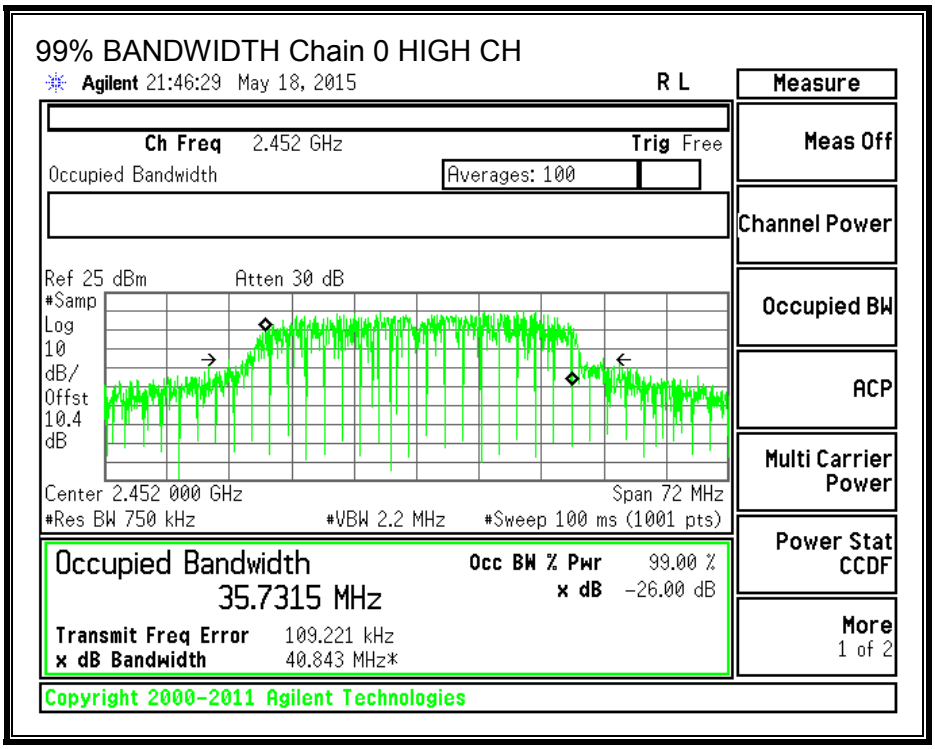












99% BANDWIDTH, Chain 1