



**FCC 47 CFR PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 8**

**CERTIFICATION TEST REPORT**

**FOR**

**HANDHELD COMPUTING DEVICE**

**MODEL NUMBER: 1572**

**FCC ID: C3K1572**

**IC: 3048A-1572**

**REPORT NUMBER: 13U15414-1, Revision A**

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**NVLAP LAB CODE 200065-0**

Revision History

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--	09/16/13	Initial Issue	T. LEE
A	09/25/13	Revised section 9.1	D. Garcia

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** MICROSOFT CORPORATION  
ONE MICROSOFT WAY  
REDMOND, WA 98052, U.S.A.

**EUT DESCRIPTION:** HANDHELD COMPUTING DEVICE WITH 802.11 A/B/G/N WLAN  
AND BLUETOOTH RADIOS

**MODEL:** 1572

**SERIAL NUMBER:** 000604433152

**DATE TESTED:** AUGUST 5, 2013 to SEPTEMBER 16, 2013

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	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:

Tested By:



TIM LEE  
WISE PROGRAM MANAGER  
UL Verification Services Inc.

JOE VANG  
EMC ENGINEER  
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 C63.10-2009, RSS-GEN Issue 3, and RSS-210 Issue 8.

## 3. FACILITIES AND ACCREDITATION

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
<input type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D
<input checked="" type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

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

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

### 4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a handheld computing device with 802.11 a/b/g/n WLAN and Bluetooth radios.

### 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	16.26	42.27
2412 - 2462	802.11g	20.84	121.34
2412 - 2462	802.11n HT20	20.55	113.50
2422 - 2452	802.11n HT40	22.23	167.11
5745 - 5825	802.11a	20.67	116.68
5745 - 5825	802.11n HT20	18.46	70.15
5755 - 5795	802.11n HT40	18.26	66.99



### **5.3. DESCRIPTION OF AVAILABLE ANTENNAS**

The radio utilizes an PIFA antenna, with a maximum gain of 3.1 dBi and 2.6 dBi in the 2.4 GHz band and 2.2 dBi and 3.9 dBi in the 5 GHz band.

### **5.4. SOFTWARE AND FIRMWARE**

The EUT driver software installed during testing was Window RT 8.1 Preview Build 943

The test utility software used during testing was Laptool 189.1.0.9.0\ WIFI Tool.exe

### **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 Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

Based on the baseline scan, the worst-case data rates were:

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

Radiated emissions for EUT with antenna was performed and passed; therefore, antenna port spurious was not performed.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
USB Ethernet Adaptor	CISCO	USB 300M	CU90MC02233	DoC
Laptop	Lenovo	L420	7854CT0	DoC
AC Adaptor (laptop)	Lenovo	92P1156	111S92P1156ZDXN272091	N/A

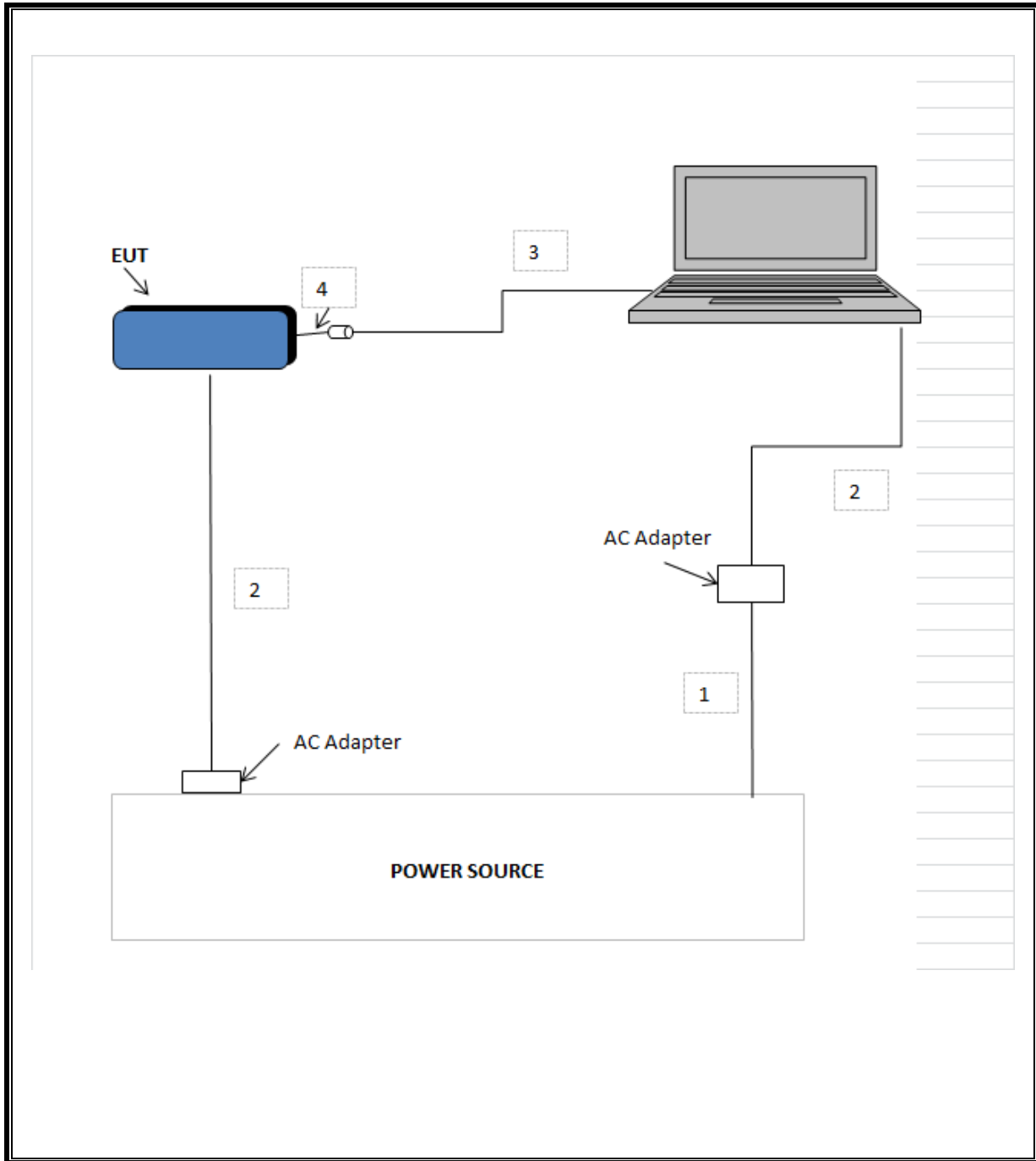
### I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Unshielded	1.8	AC adapter
2	USB	1	USB	Unshielded	0.1	USB to Ethernet adapter
3	DC	1	DC	Unshielded	1.8	
4	Ethernet	1	RJ 45	Unshielded	7.62	Connects to USB adapter

### TEST SETUP

The EUT is a standalone wireless handheld computing device. Test software exercised the wireless module installed within the device under test.

**SETUP DIAGRAM FOR TESTS**



## 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 Date
Spectrum Analyzer, 26.5 GHz	Agilent	E4440A	C01179	02/26/13
Spectrum Analyzer, 26.5 GHz	Agilent	E4440A	C01176	12/13/12
Spectrum Analyzer, 40 GHz	Agilent	8564E	C00951	07/29/13
Preamplifier, 1300 MHz	Agilent	8447D	C00580	01/28/13
PreAmplifier, 1-26.5GHz	Agilent	8449B	F00167	03/23/13
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	F00064	03/06/13
Horn Antenna, 1-18GHz	ETS Lindgren	3117	F00132	02/19/13
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	11/14/12
Single Channel PK Power Meter	Agilent	N1911A	F00026	04/02/13
Peak and Average Power Sensor	Agilent	E9323A	F00160	04/03/13
High Pass Filter	Micro-Tronics	HPM17543	F00223	N/A
Low Pass Filter	Micro-Tronics	LPS17541	F00220	N/A
High Pass Filter	Micro-Tronics	HPS17542	F00221	N/A
RF PreAmplifier, 1-18GHz	Miteq	To Be Determined	F00351	N/A

## 7. MEASUREMENT METHODS

KDB 558074 Measurement Procedure PK2 is used for power and PKPSD is used for power spectral density.

Unwanted emissions within Restricted Bands are measured using traditional radiated procedures.

### 7.1.1. ON TIME AND DUTY CYCLE RESULTS

2.4GHz Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
802.11b	1.00	1.00	1.000	100.0%	0.00	0.010
802.11g	1.00	1.00	1.000	100.0%	0.00	0.010
802.11n HT20	0.283	0.289	0.980	98.0%	0.09	3.534
802.11n HT40	0.299	0.304	0.984	98.4%	0.00	0.010

5.8GHz Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
802.11a	1.62	1.63	0.994	99.4%	0.00	0.010
802.11n HT20	0.283	0.288	0.982	98.2%	0.00	0.010
802.11n HT40	0.299	0.304	0.986	98.6%	0.00	0.010

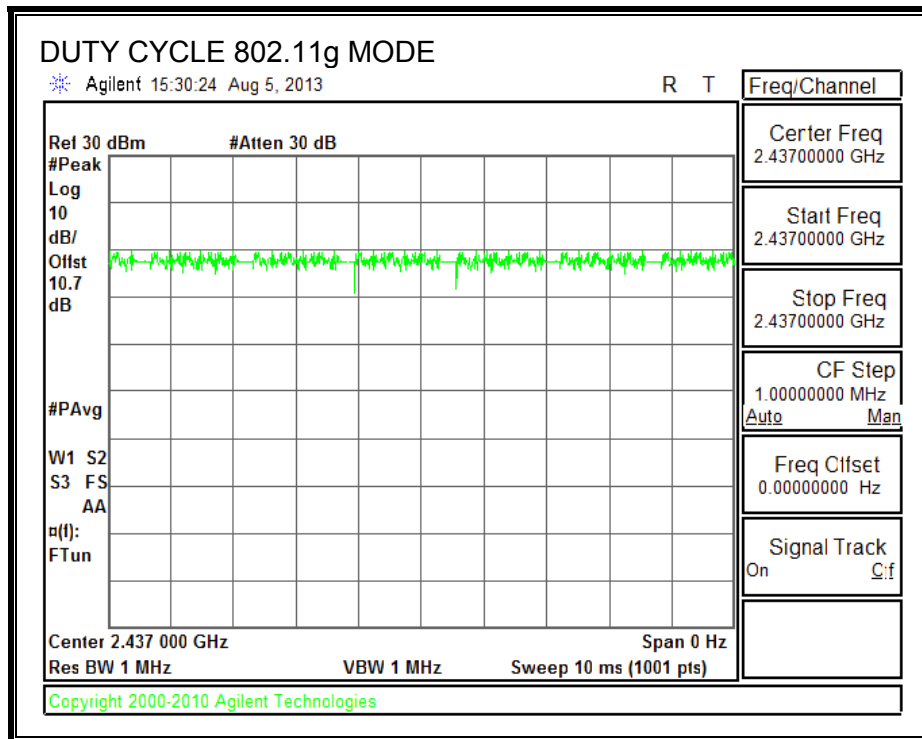
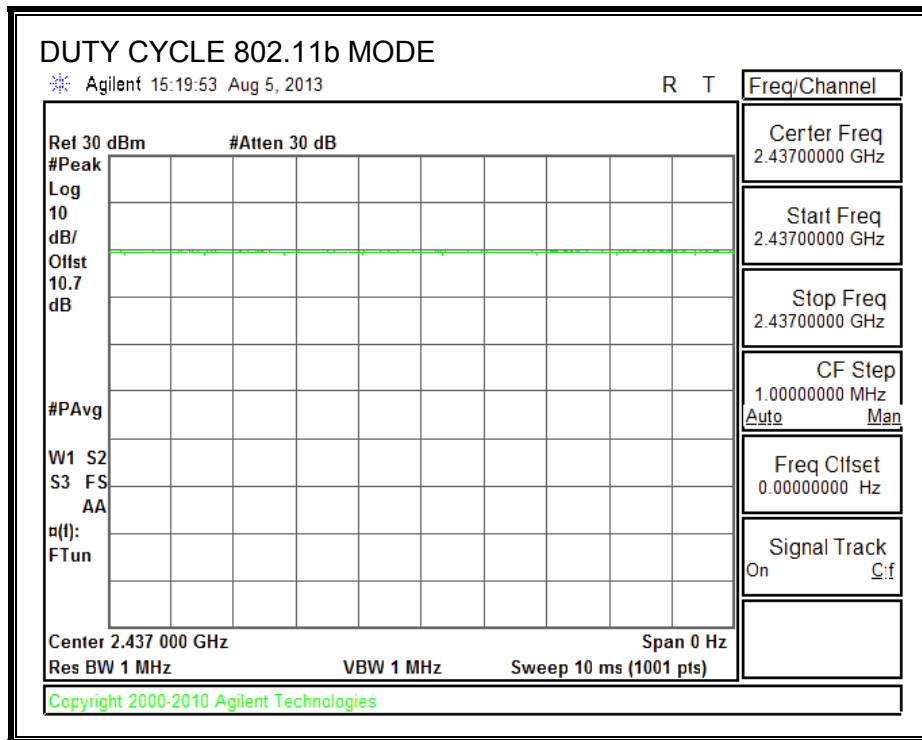
### 7.1.2. MEASUREMENT METHOD FOR POWER AND PPSD

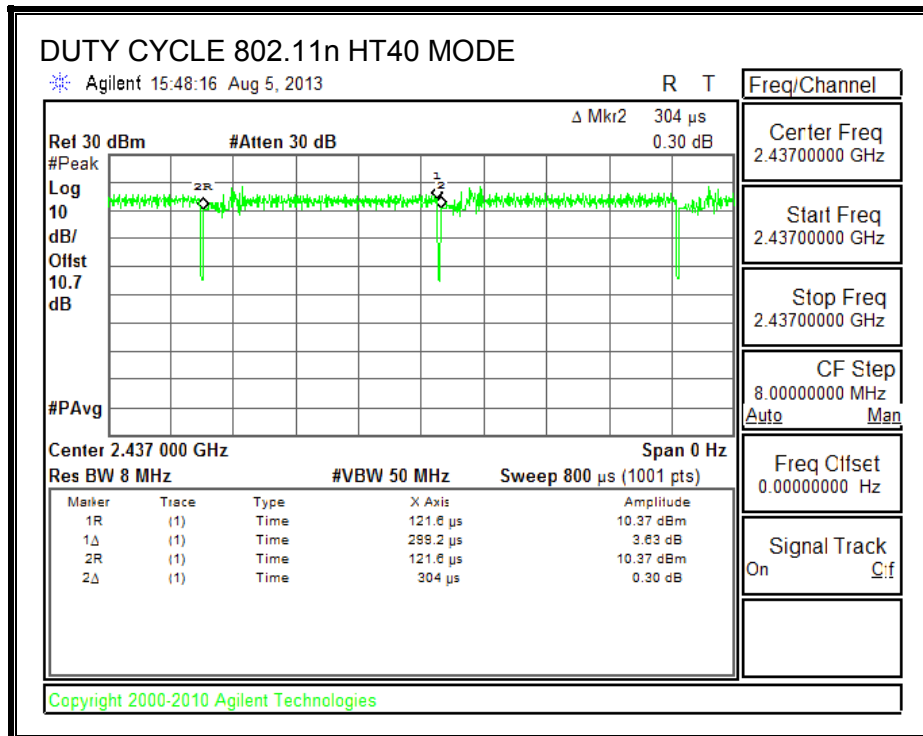
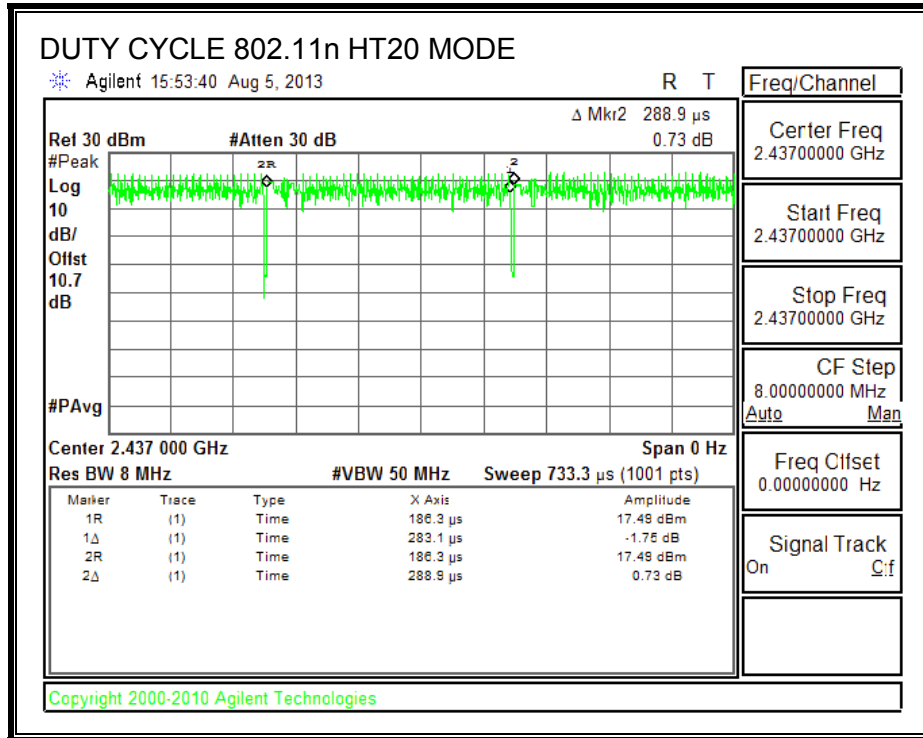
The Duty Cycle is greater than or equal to 98% therefore KDB 789033 Method SA-1 is used.

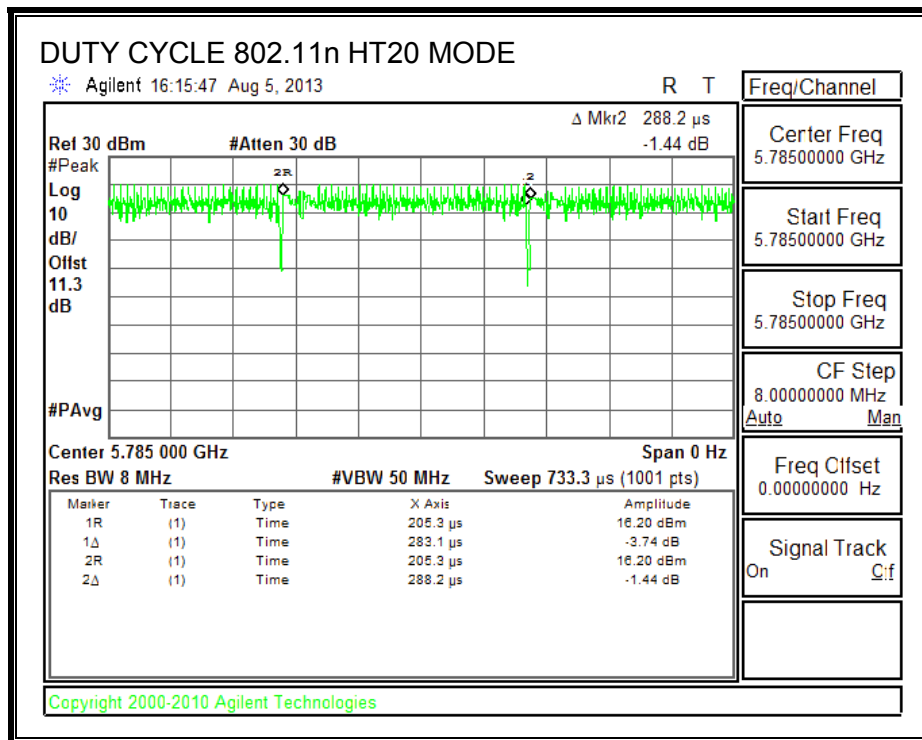
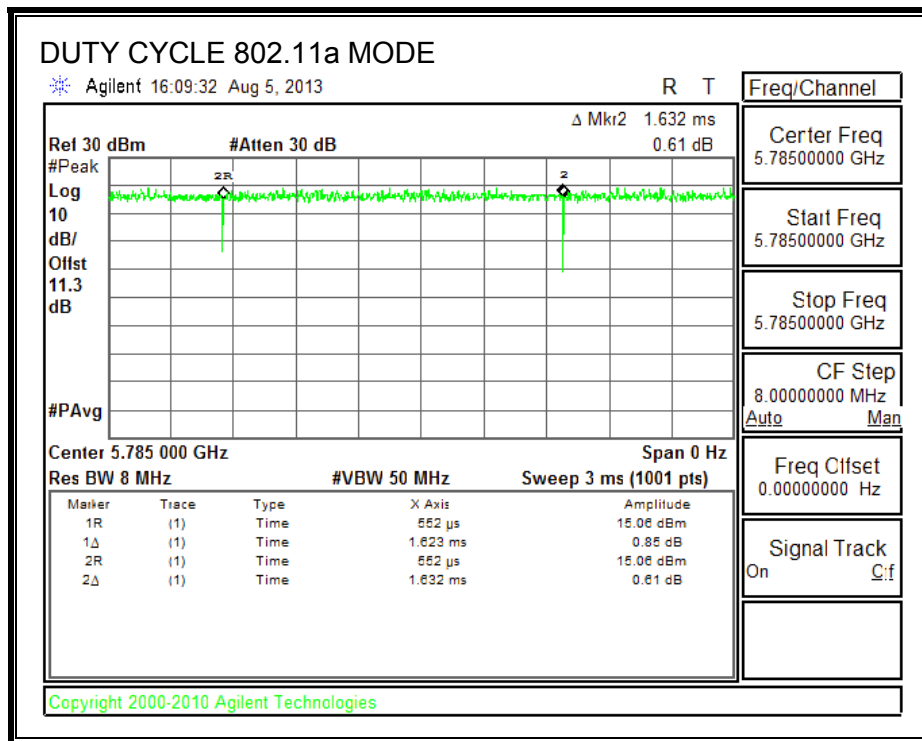
### 7.1.3. MEASUREMENT METHOD FOR AVERAGE SPURIOUS EMISSIONS ABOVE 1 GHz

The Duty Cycle is greater than or equal to 98%, KDB 789033 Method AD with Power RMS Averaging is used.

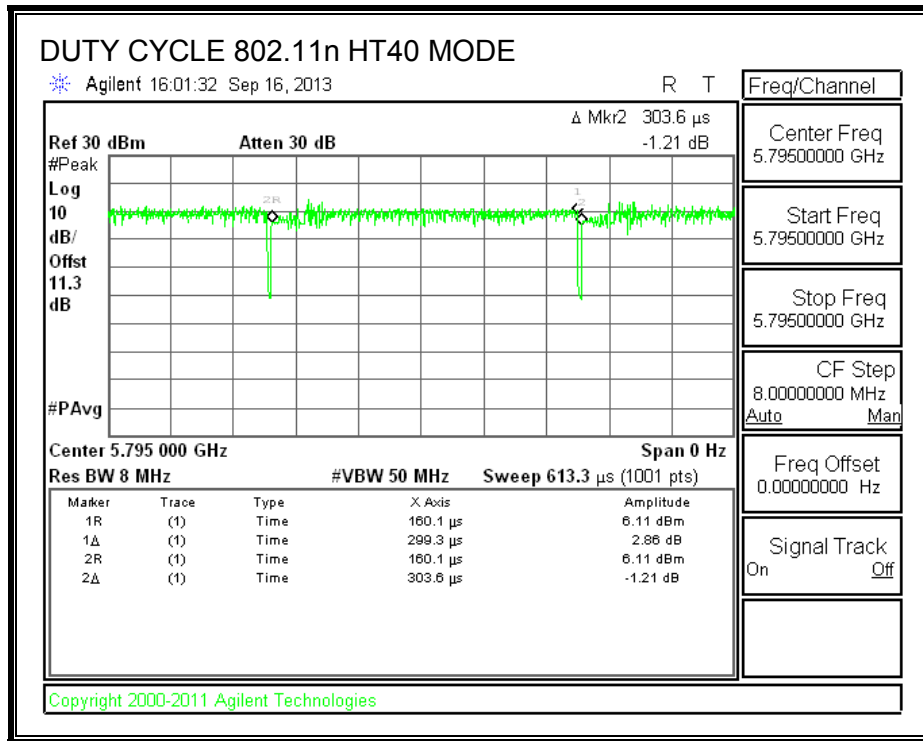
### 7.1.4. DUTY CYCLE PLOTS











## 8. ANTENNA PORT TEST RESULTS

### 8.1. 802.11b MODE IN THE 2.4 GHz BAND

#### 8.1.1. 6 dB BANDWIDTH

##### LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

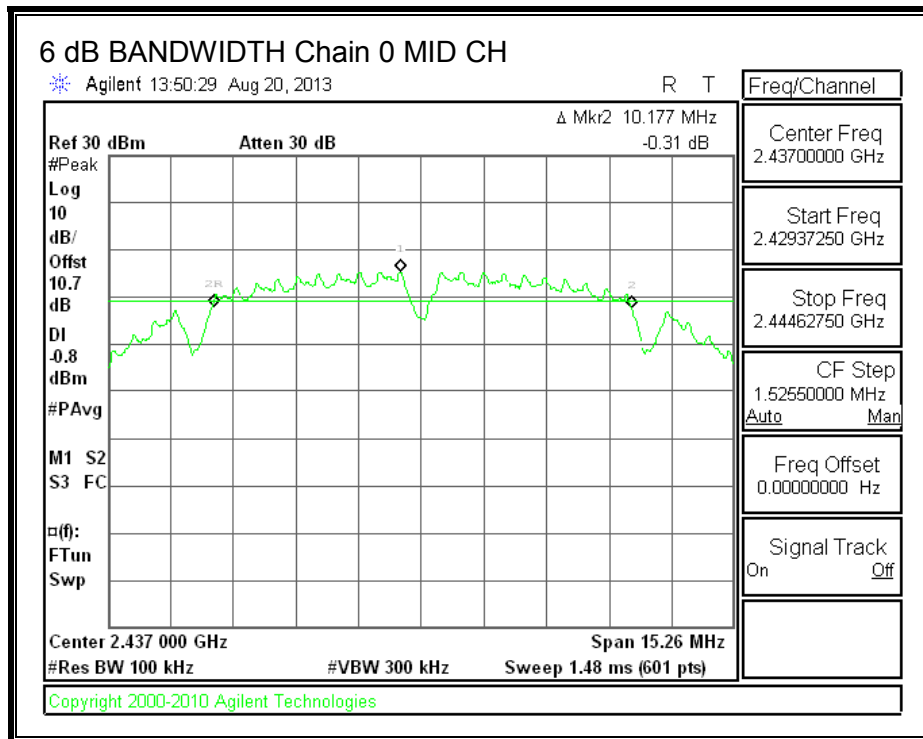
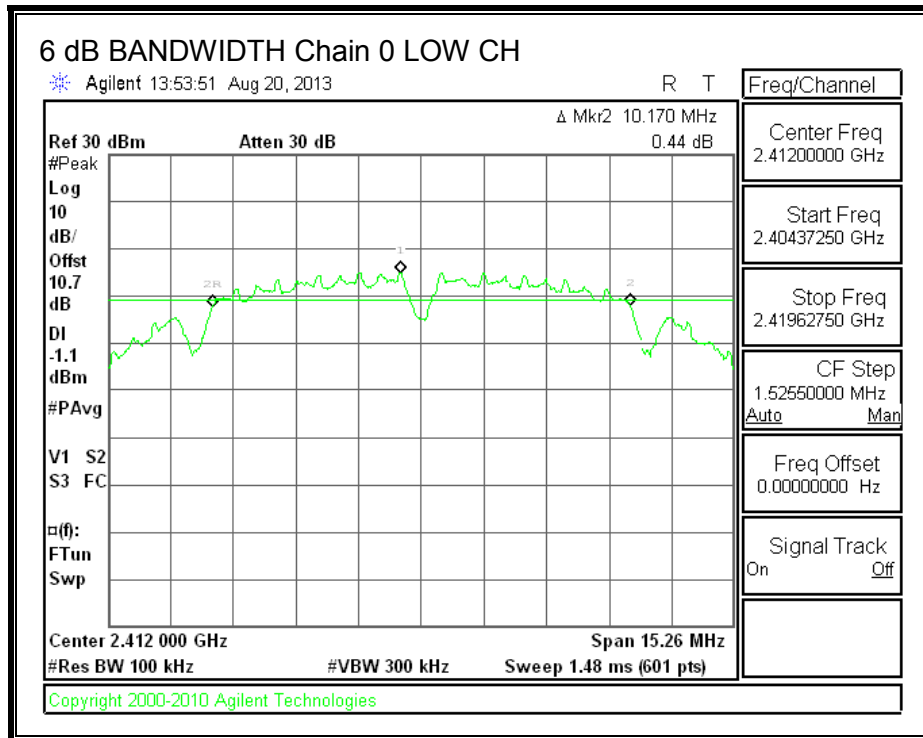
##### TEST PROCEDURE

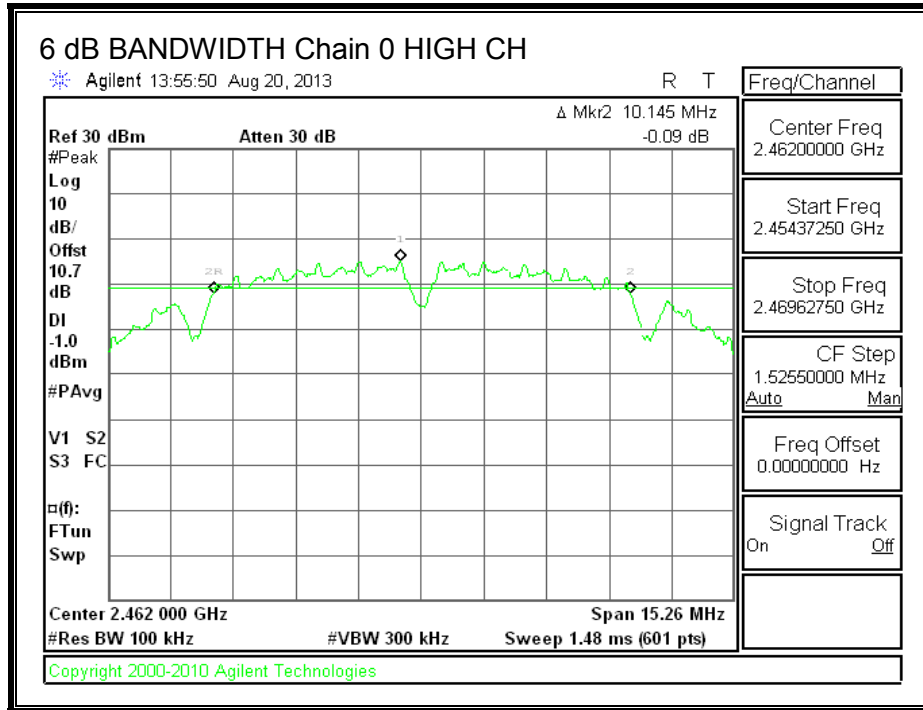
The transmitter output is connected to a spectrum analyzer with the RBW set between 1% and 5% of the EBW, the VBW  $\geq 3 \times$  RBW, peak detector and max hold.

##### RESULTS

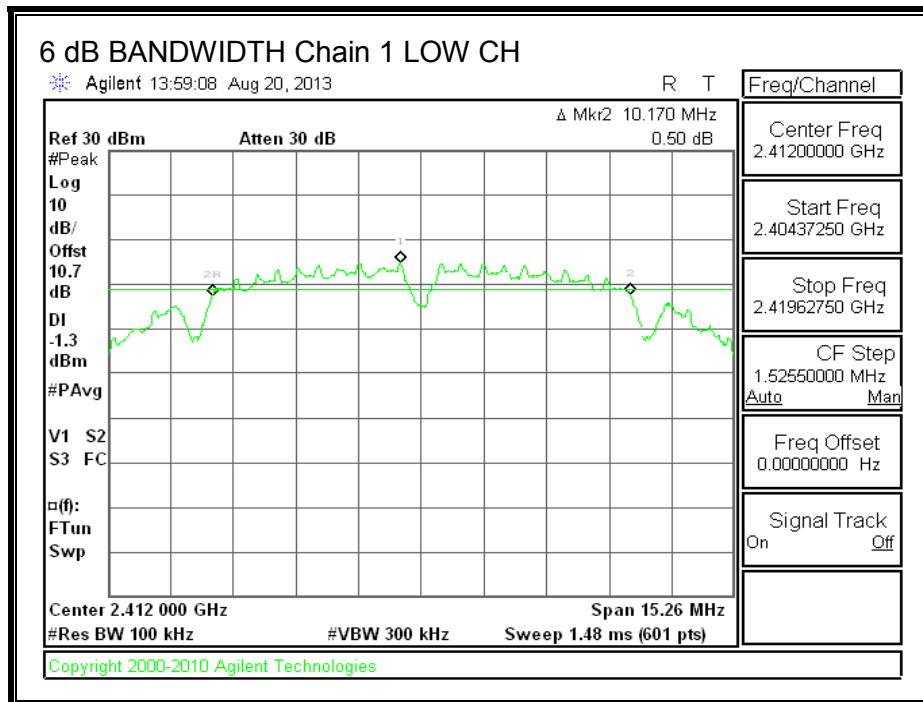
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	2412	10.170	10.170	0.5
Mid	2437	10.177	10.170	0.5
High	2462	10.145	9.860	0.5

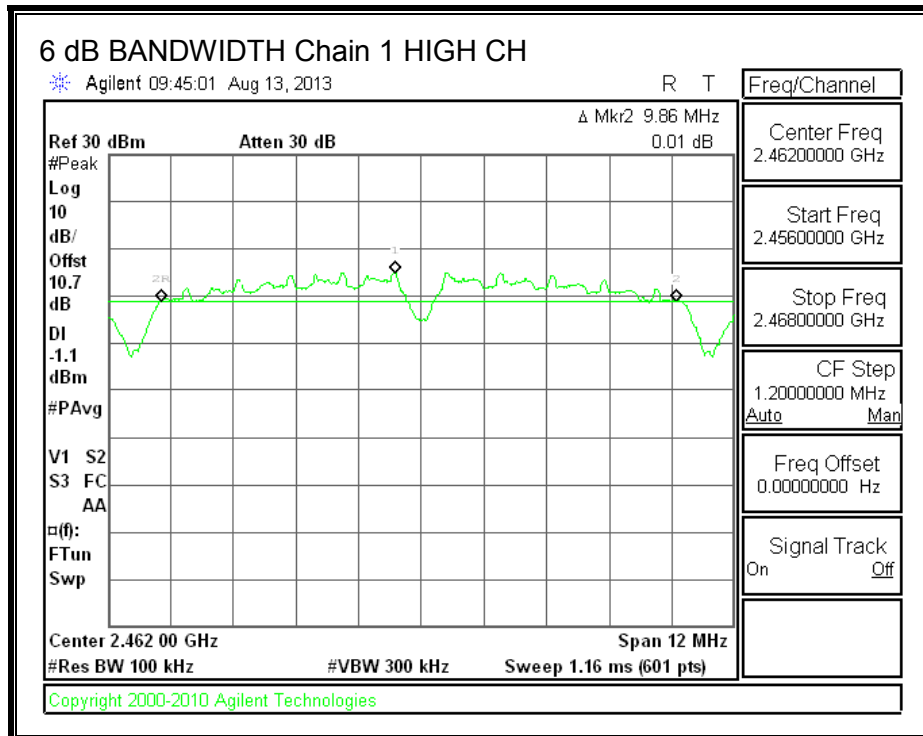
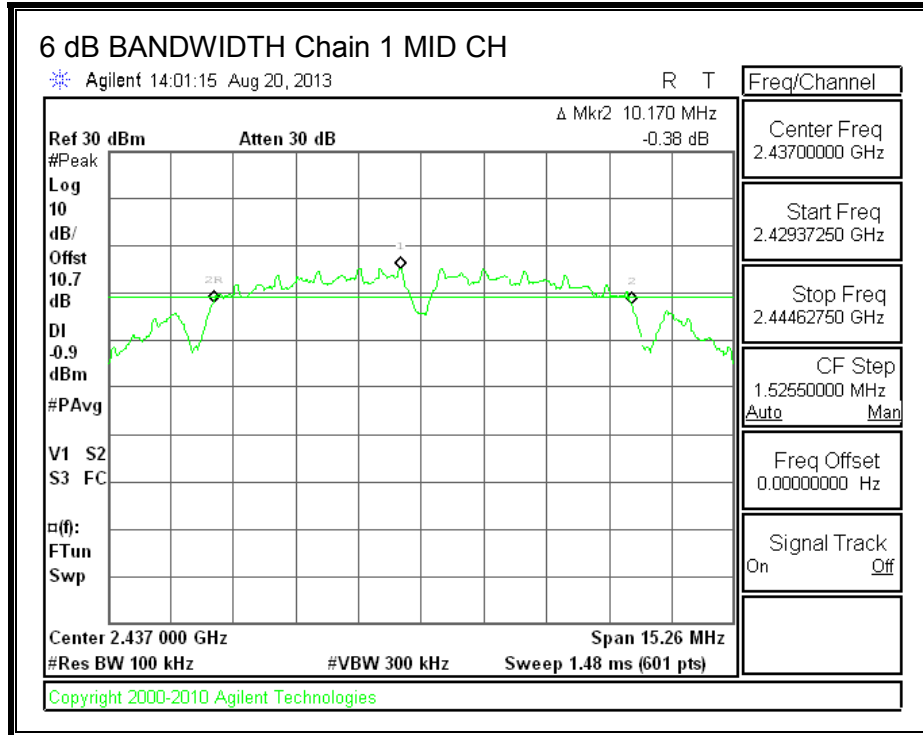
**6 dB BANDWIDTH, Chain 0**





**6 dB BANDWIDTH, Chain 1**





### 8.1.2. 99% BANDWIDTH

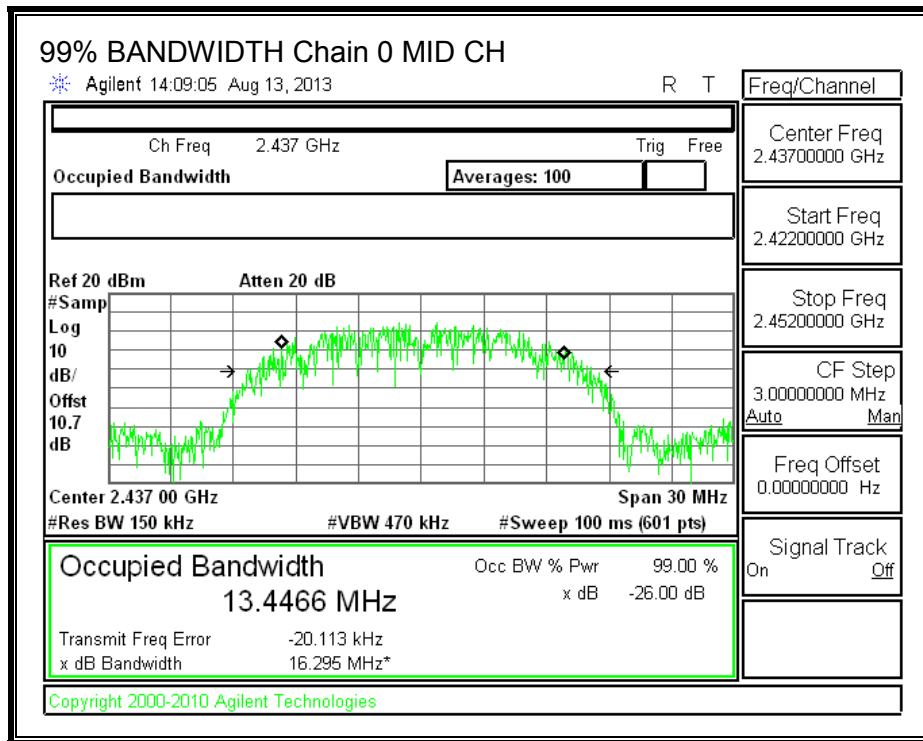
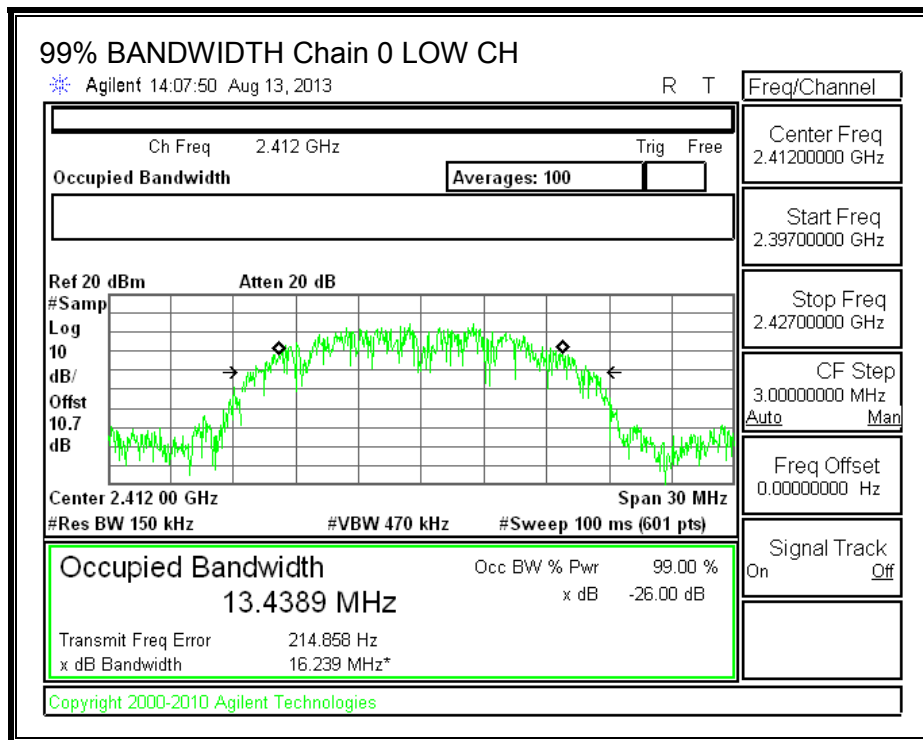
#### LIMITS

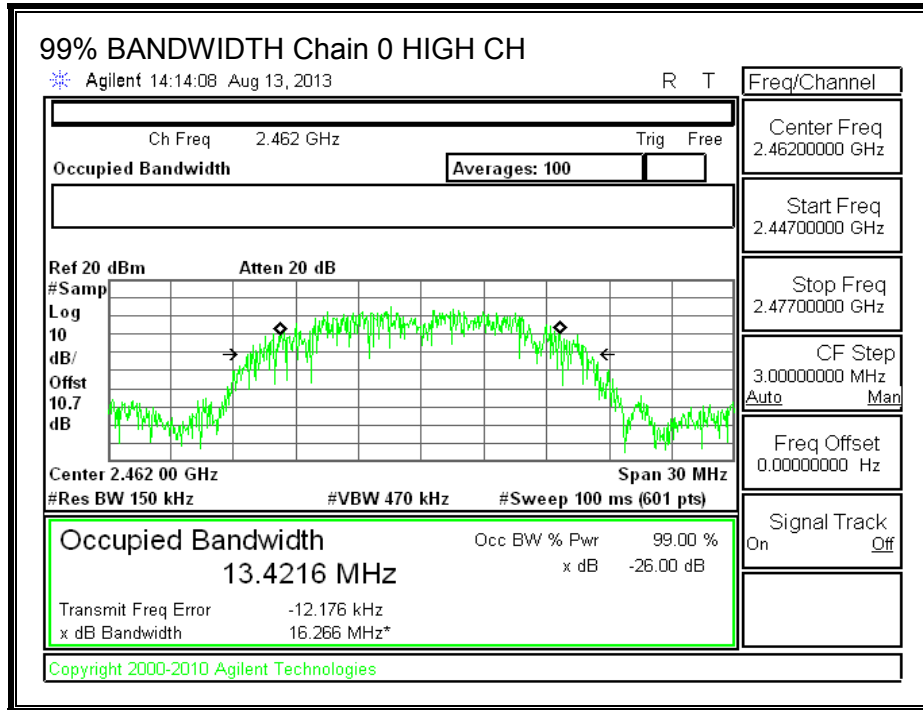
None; for reporting purposes only.

#### RESULTS

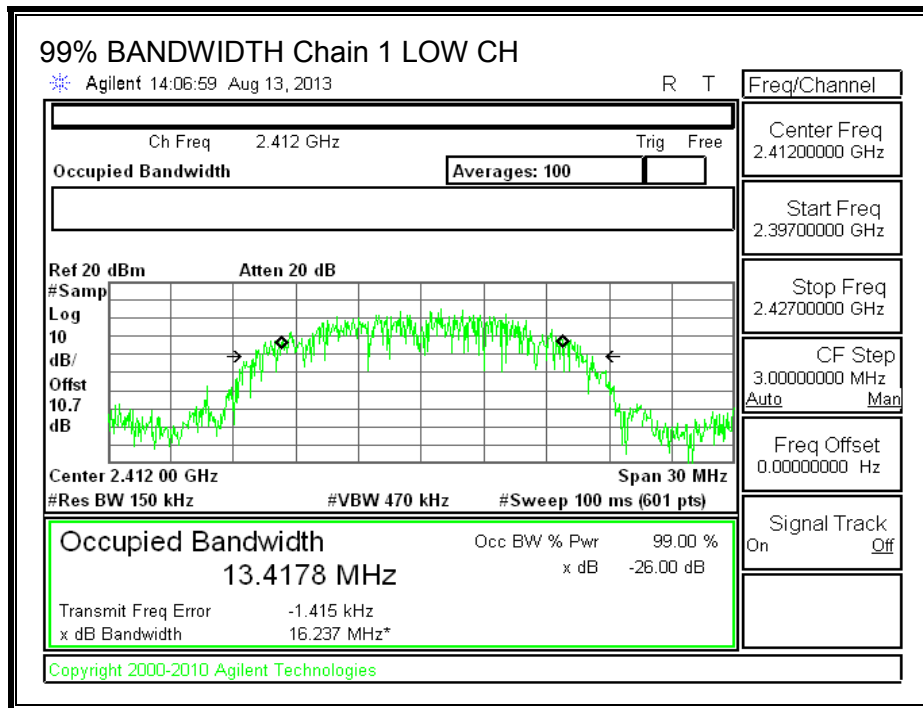
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	2412	13.4389	13.4178
Mid	2437	13.4466	13.4090
High	2462	13.4216	13.4103

**99% BANDWIDTH, Chain 0**

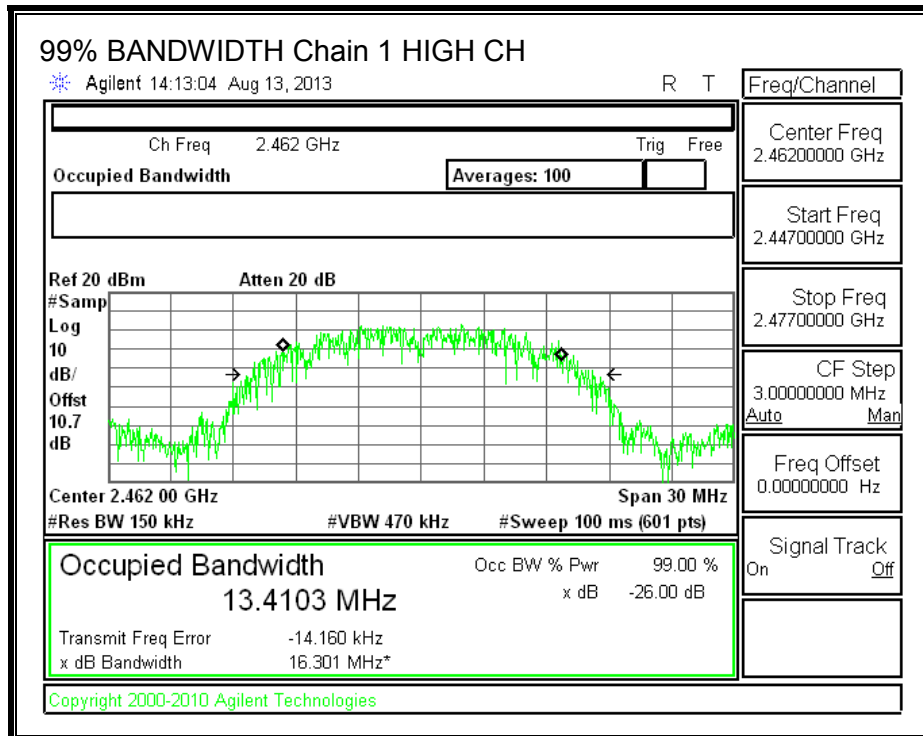
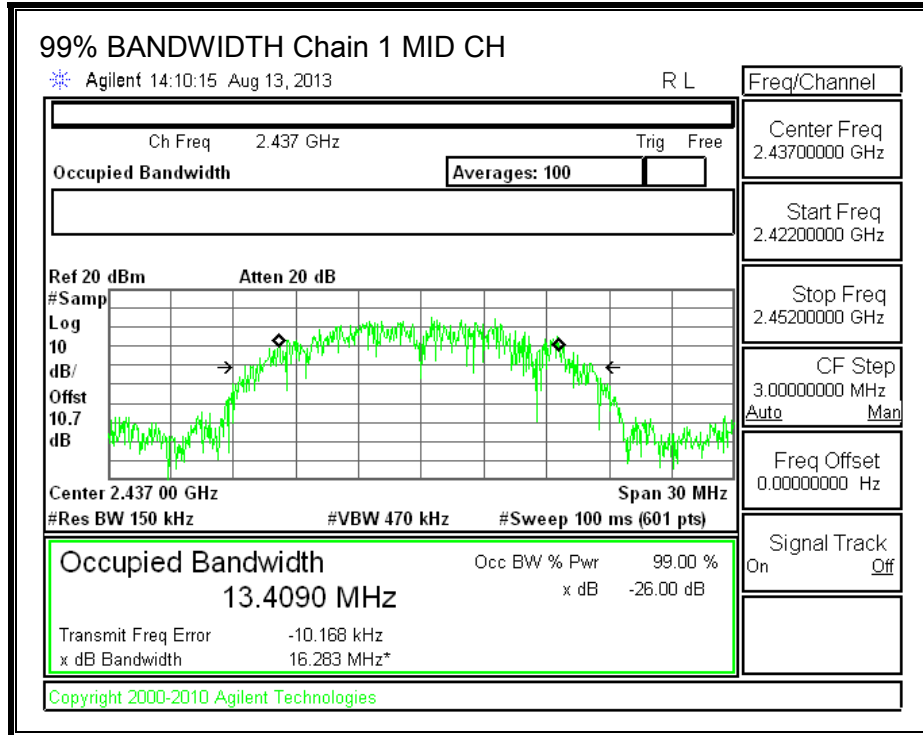




**99% BANDWIDTH, Chain 1**







### 8.1.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.75 dB (including 10 dB pad and .75 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### RESULTS

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	2412	12.98	12.27	15.65
Mid	2437	12.85	12.81	15.84
High	2462	12.91	12.84	15.89

### 8.1.4. OUTPUT POWER

#### LIMITS

FCC §15.247

IC RSS-210 A8.4

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 the same for each chain. The directional gain is equal to the antenna gain.

<b>Chain 0 Antenna Gain (dBi)</b>	<b>Chain 1 Antenna Gain (dBi)</b>	<b>Uncorrelated Chains Directional Gain (dBi)</b>
3.10	2.60	2.86

**RESULTS**

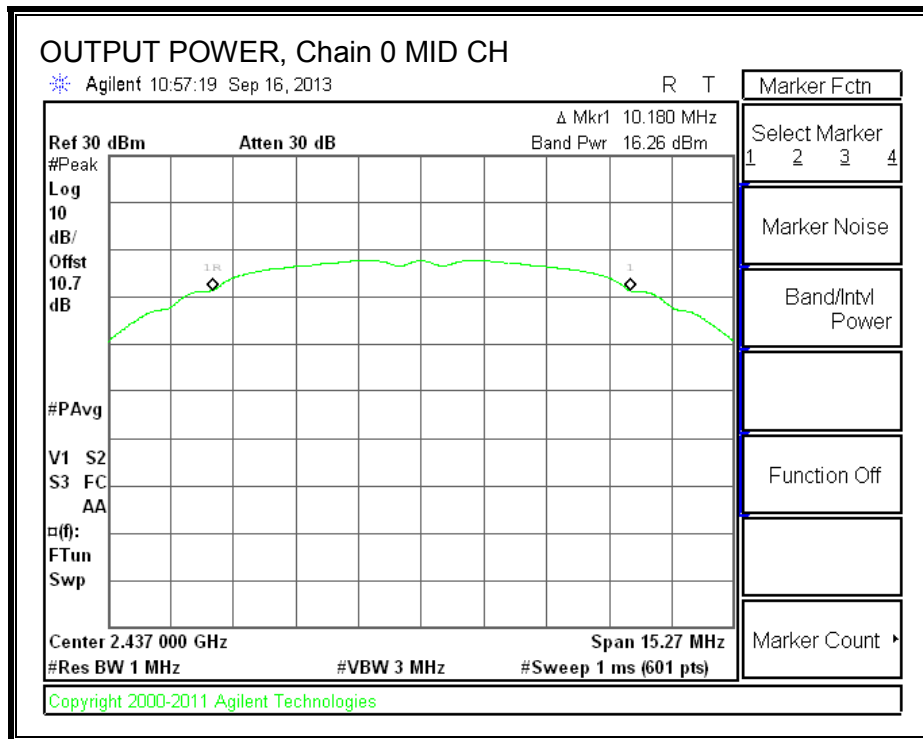
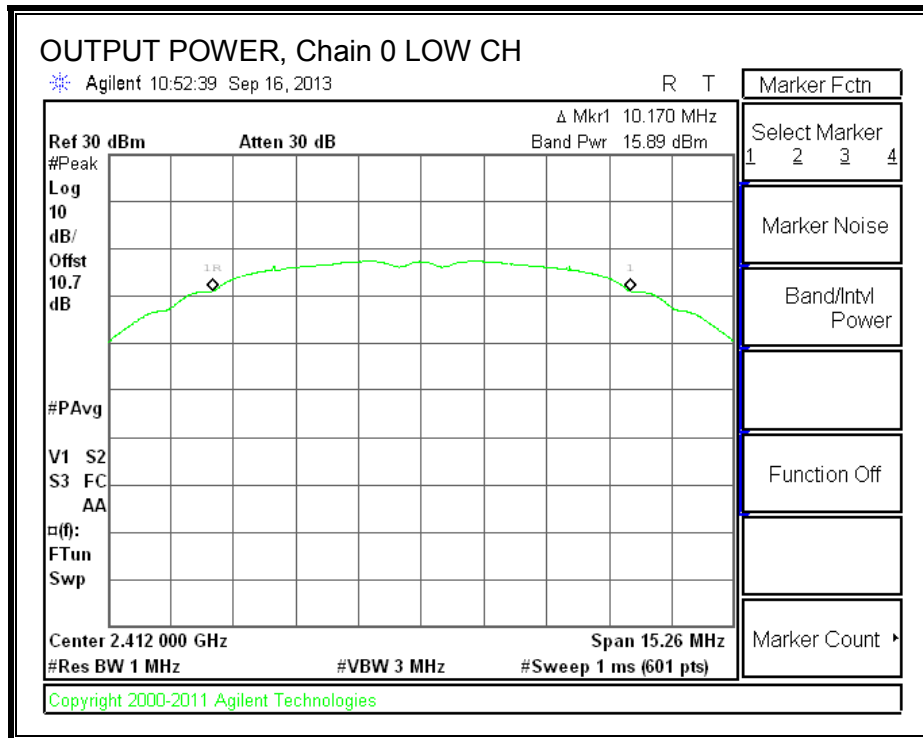
**Limits**

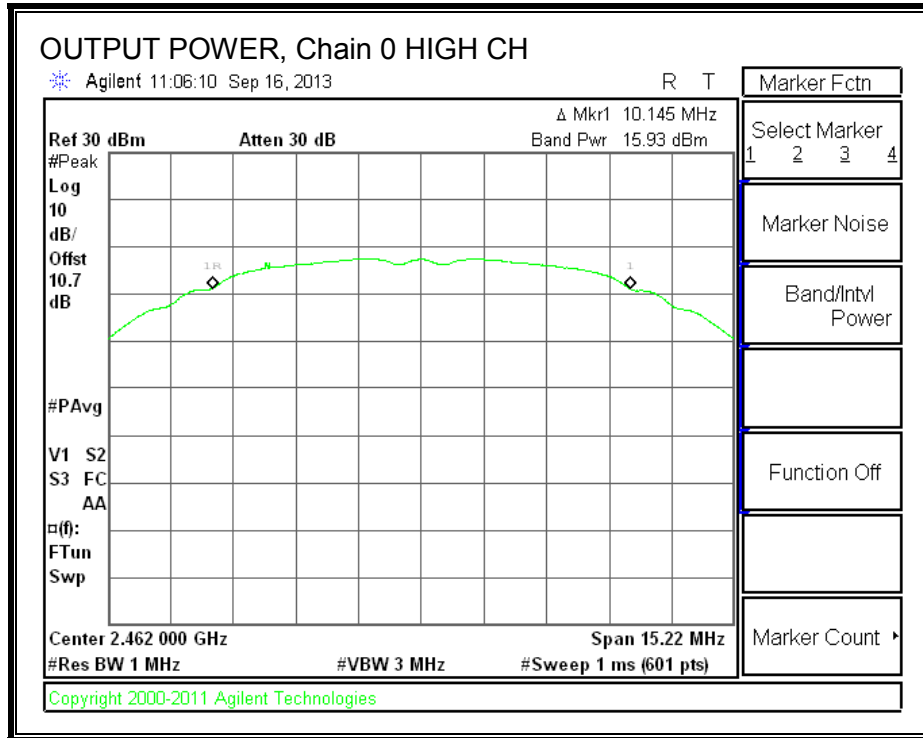
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	2.86	30.00	30	36	30.00
Mid	2437	2.86	30.00	30	36	30.00
High	2462	2.86	30.00	30	36	30.00

**Results**

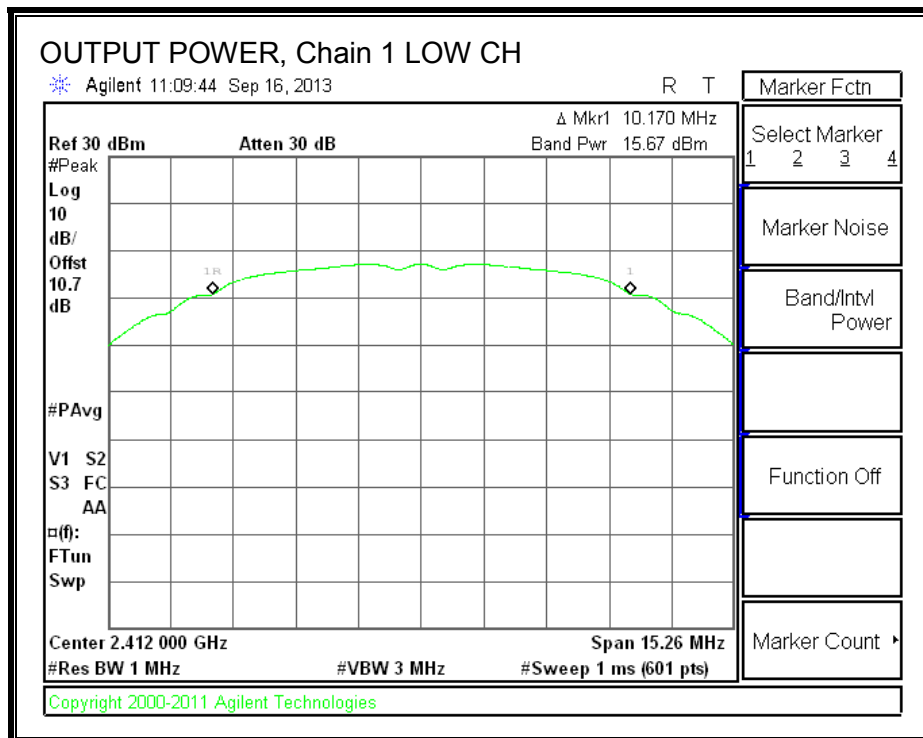
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margi (dB)
Low	2412	15.89	15.67	18.79	30.00	-11.21
Mid	2437	16.26	16.19	19.24	30.00	-10.76
High	2462	15.93	15.91	18.93	30.00	-11.07

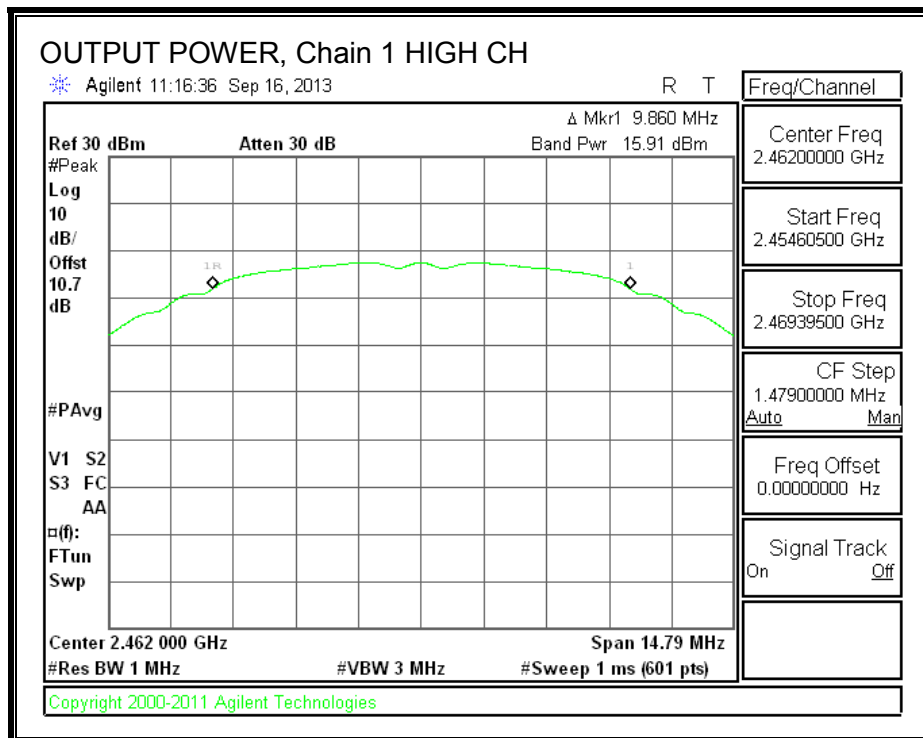
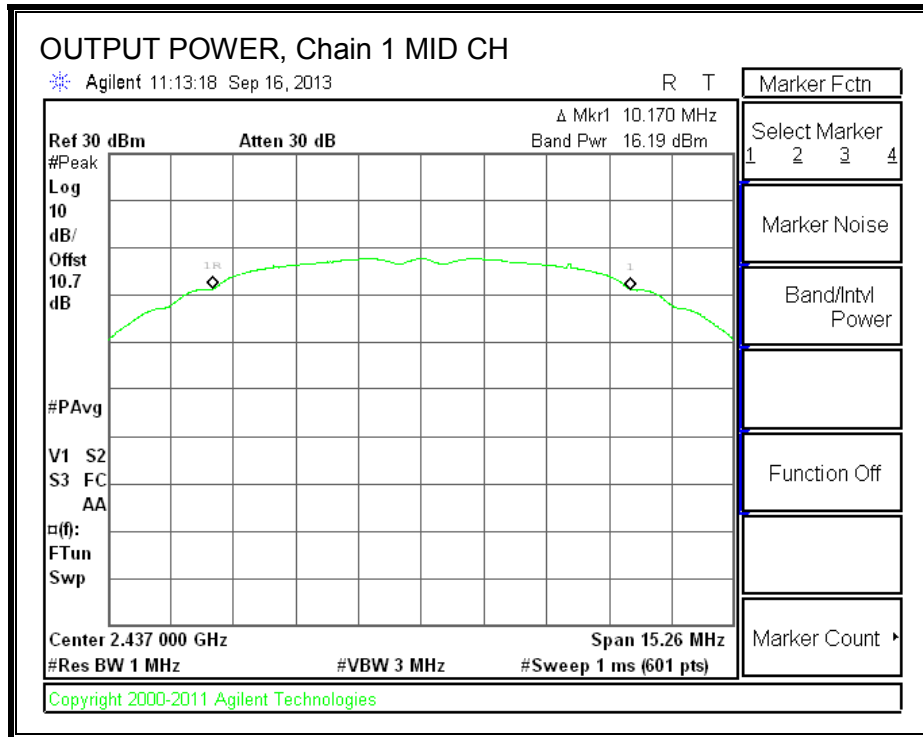
**OUTPUT POWER, Chain 0**





**OUTPUT POWER, Chain 1**





### 8.1.5. PSD

#### LIMITS

FCC §15.247

IC RSS-210 A8.2

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

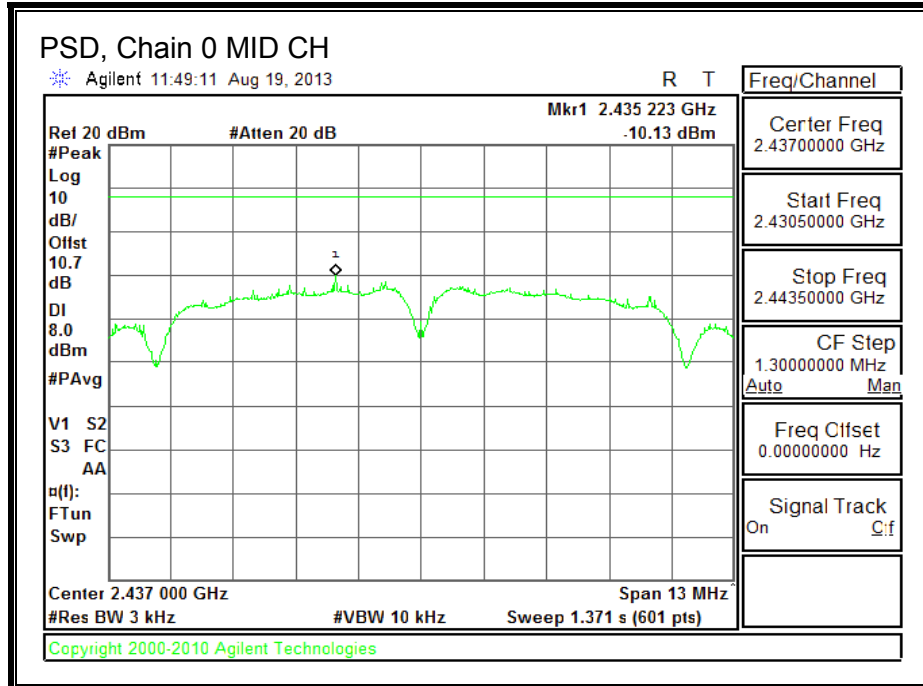
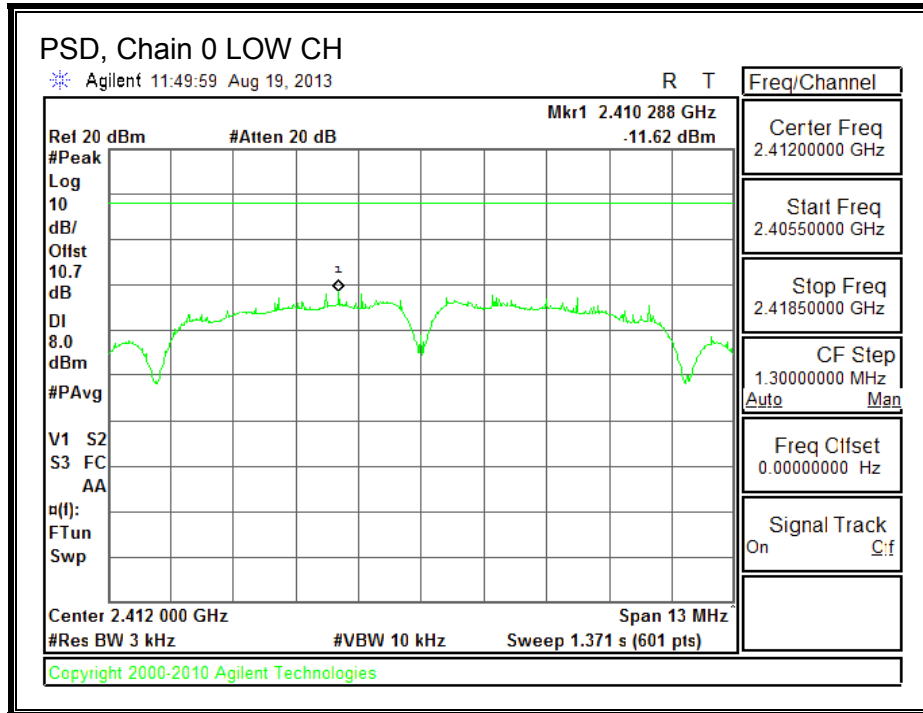
#### RESULTS

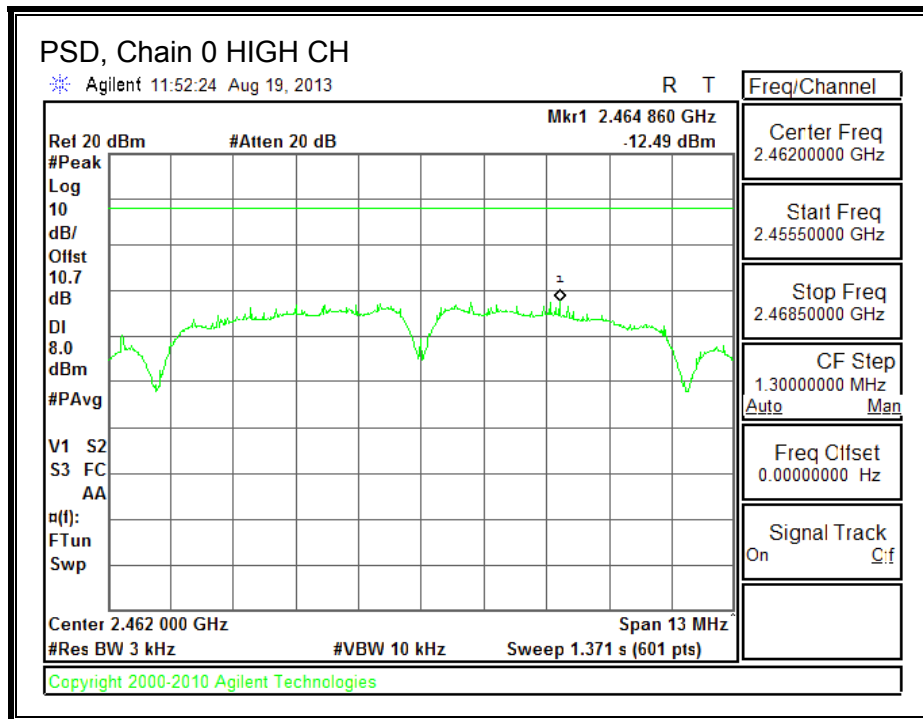
##### PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-11.62	-13.04	-9.26	8.0	-17.3
Mid	2437	-10.13	-11.43	-7.72	8.0	-15.7
High	2462	-12.49	-11.71	-9.07	8.0	-17.1

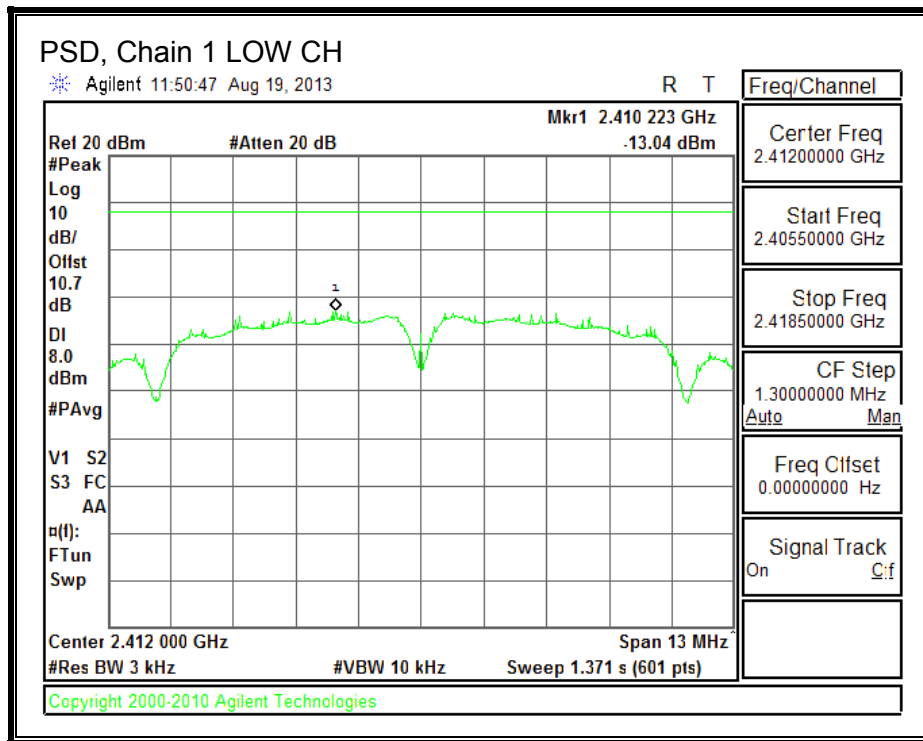


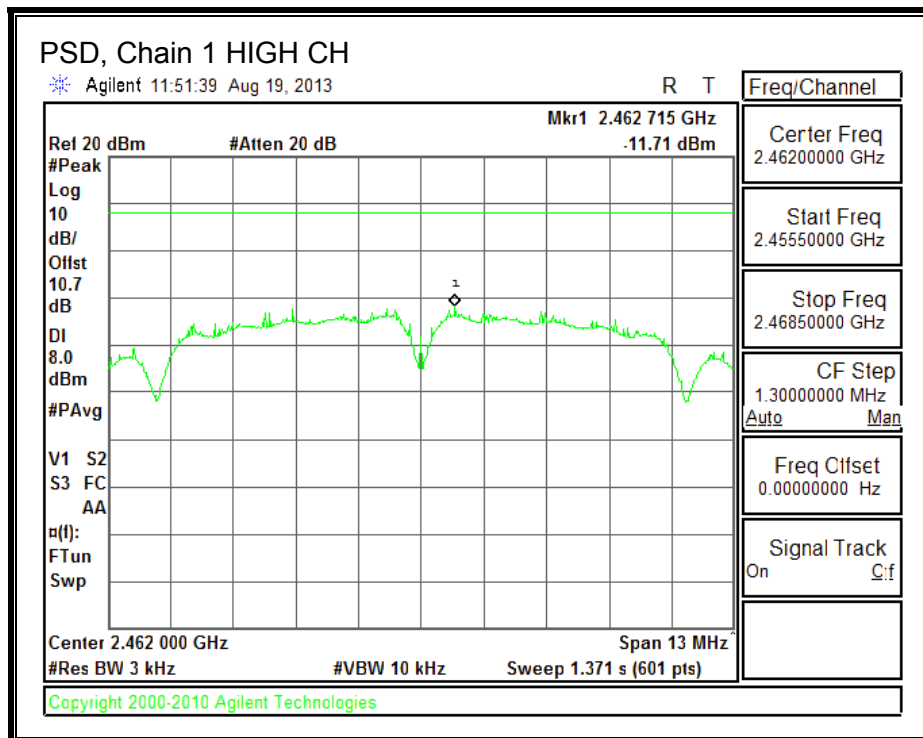
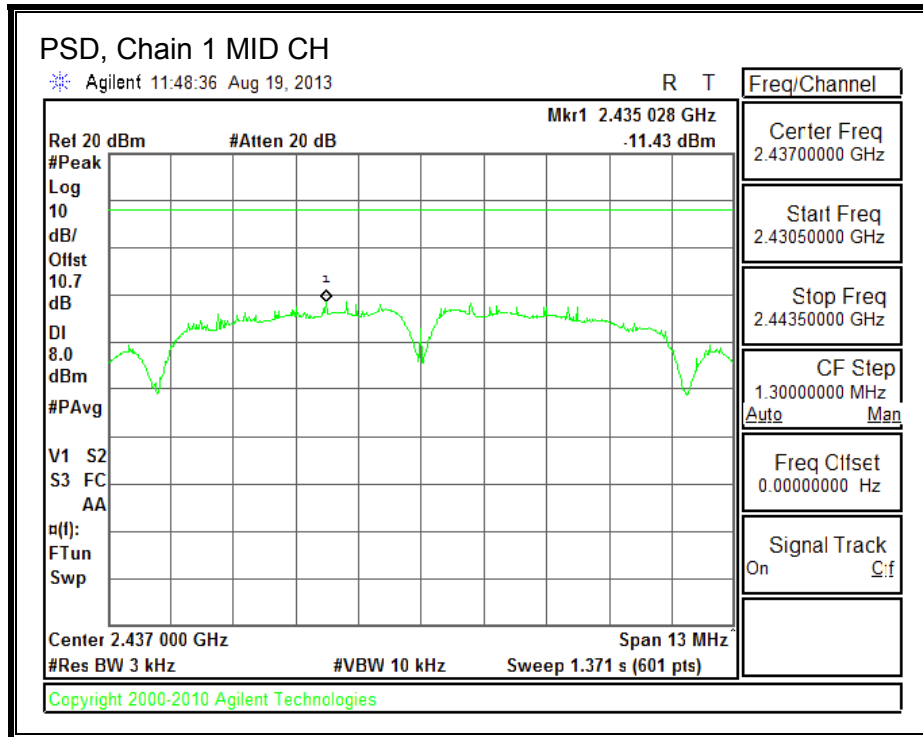
**PSD, Chain 0**





**PSD, Chain 1**





## 8.1.6. OUT-OF-BAND EMISSIONS

### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

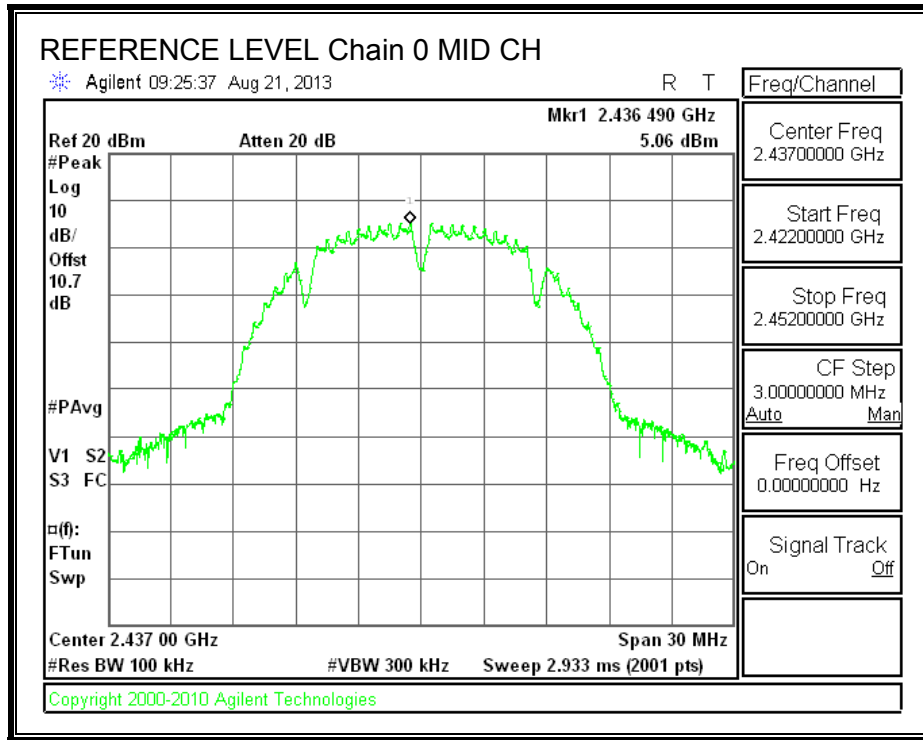
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

### TEST PROCEDURE

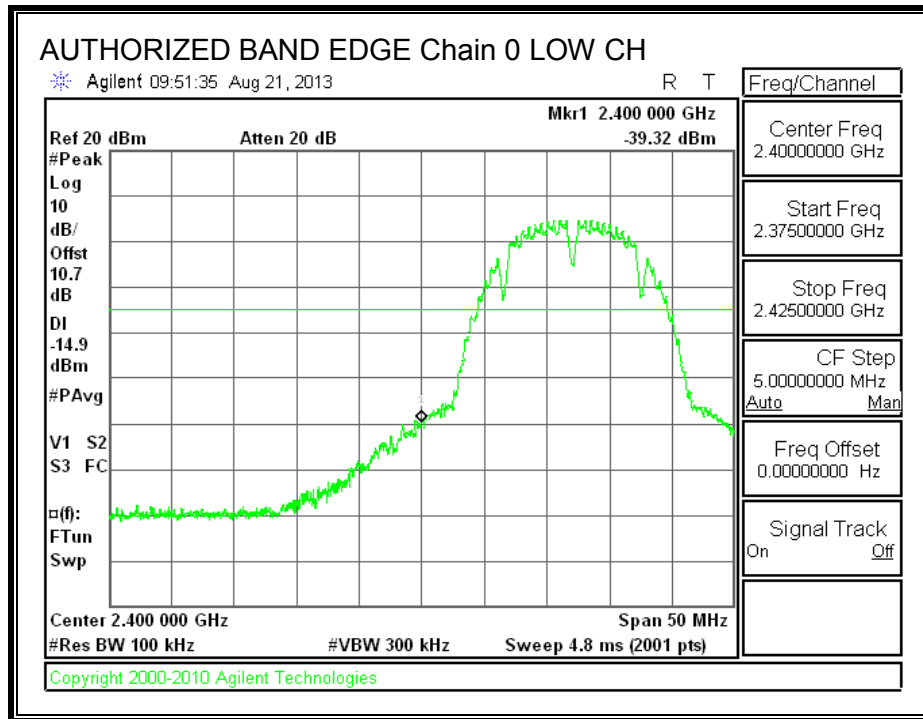
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

**RESULTS**

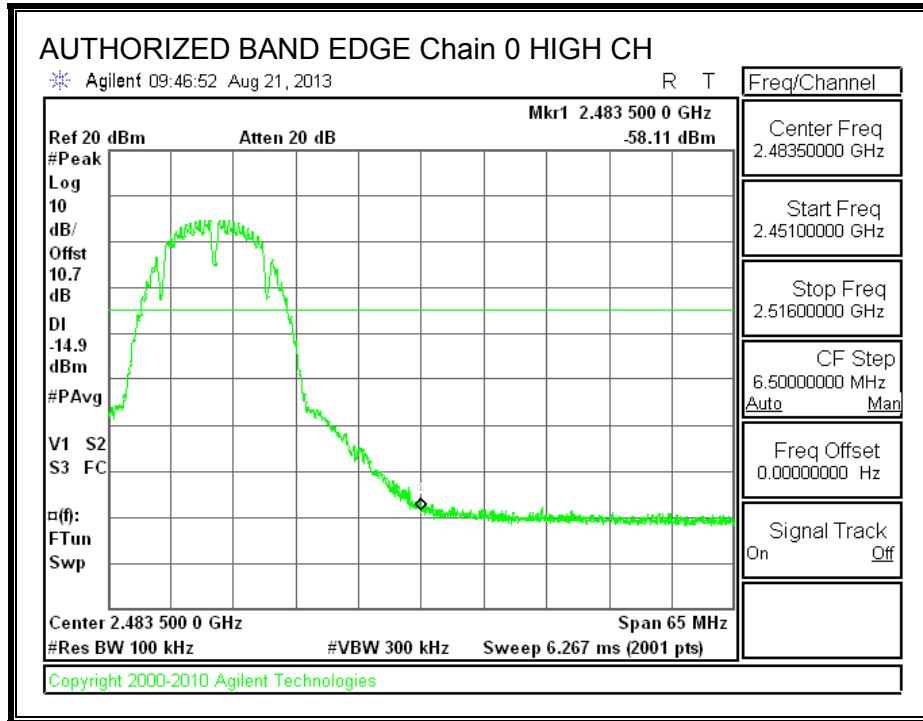
**IN-BAND REFERENCE LEVEL, Chain 0**



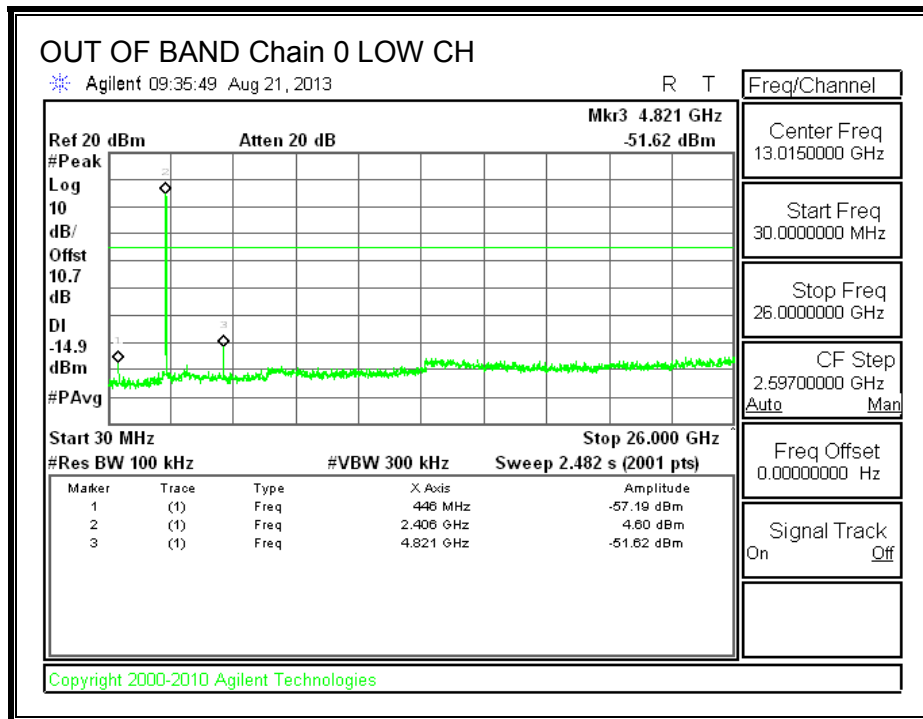
**LOW CHANNEL BANDEDGE, Chain 0**

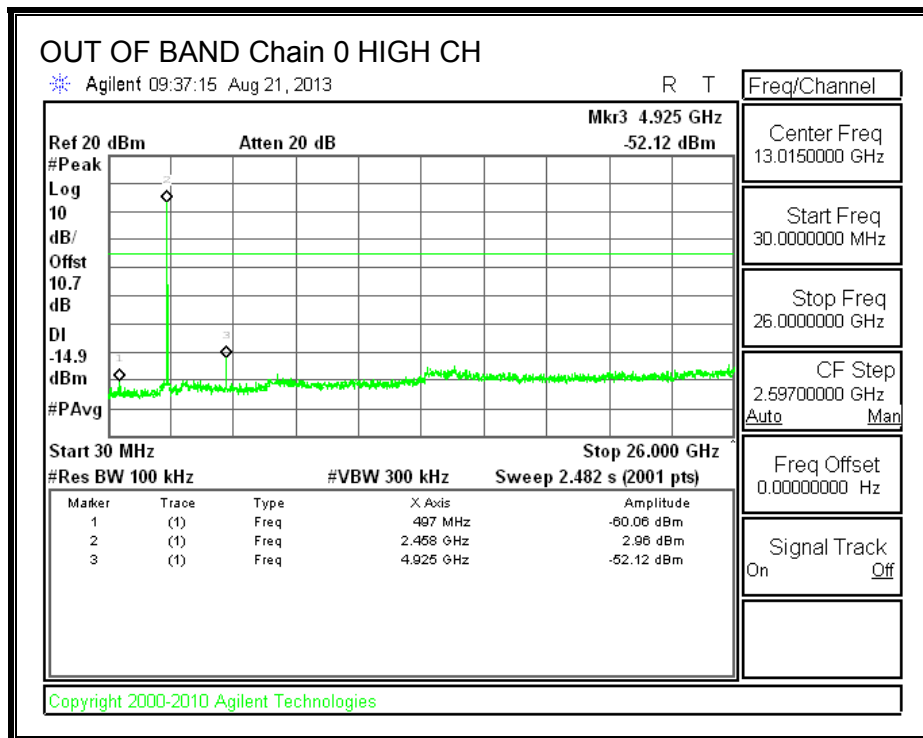
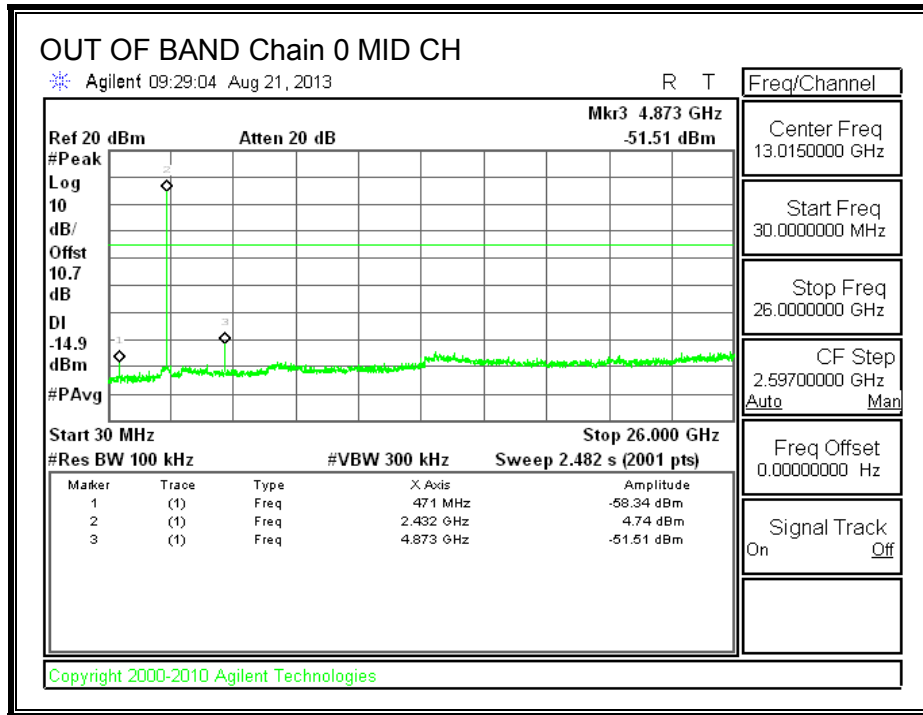


**HIGH CHANNEL BANDEDGE, Chain 0**

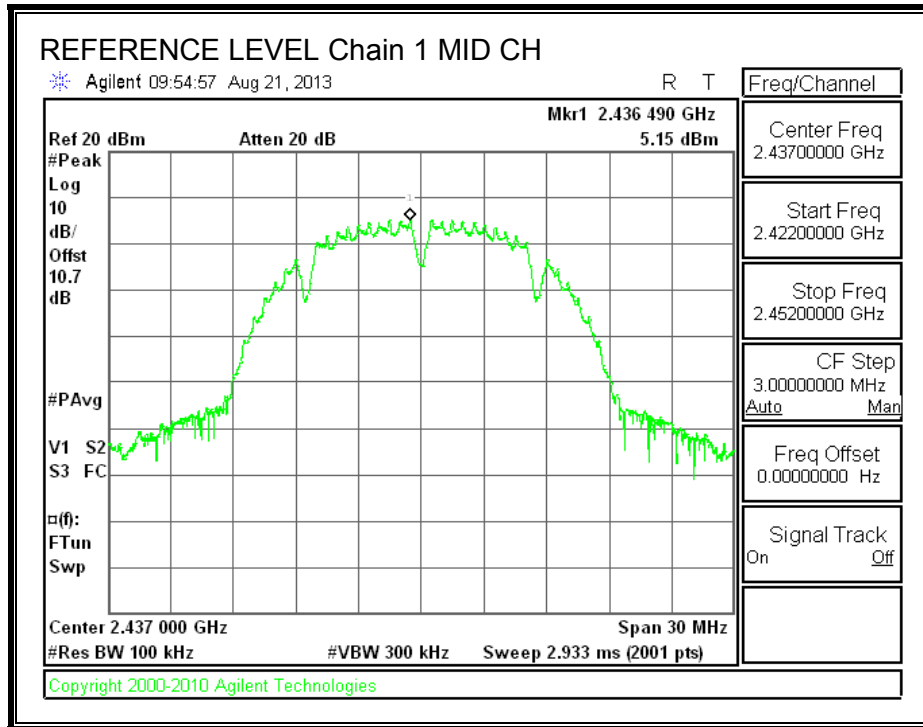


**OUT-OF-BAND EMISSIONS, Chain 0**

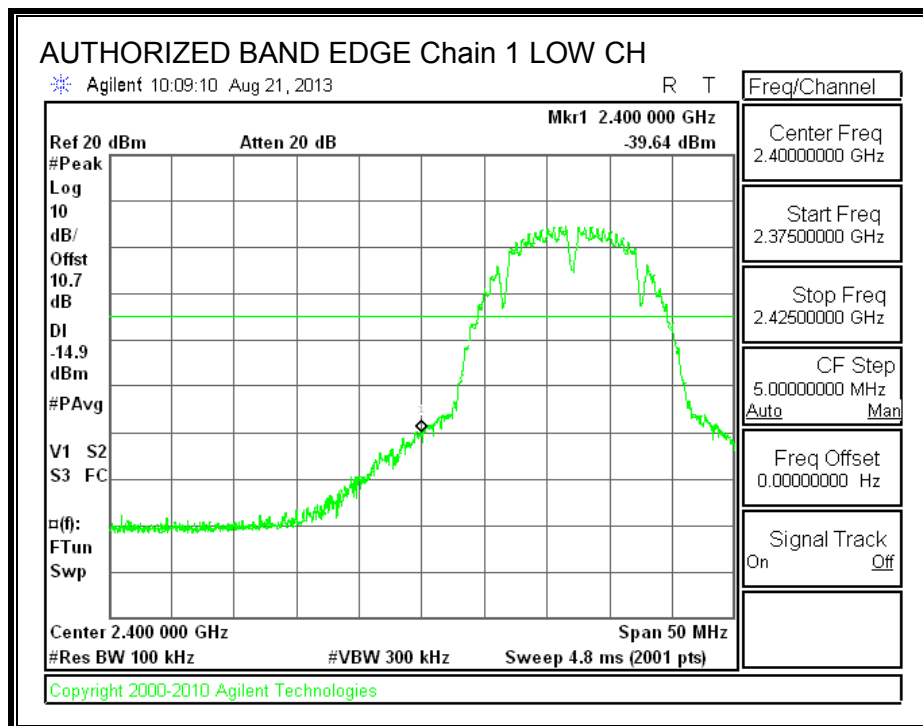




**IN-BAND REFERENCE LEVEL, Chain 1**

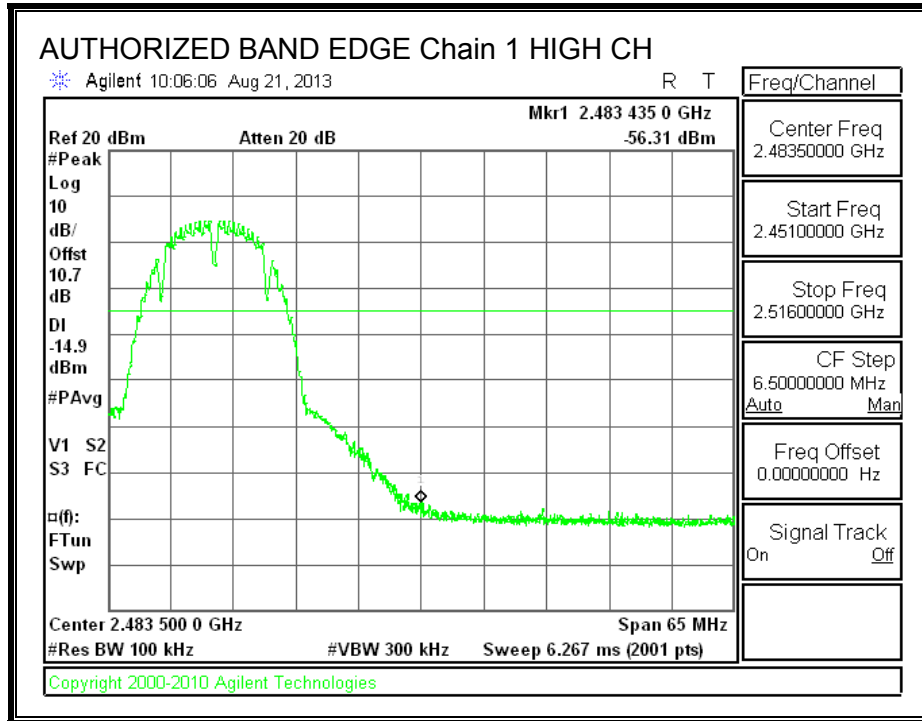


**LOW CHANNEL BANDEDGE, Chain 1**

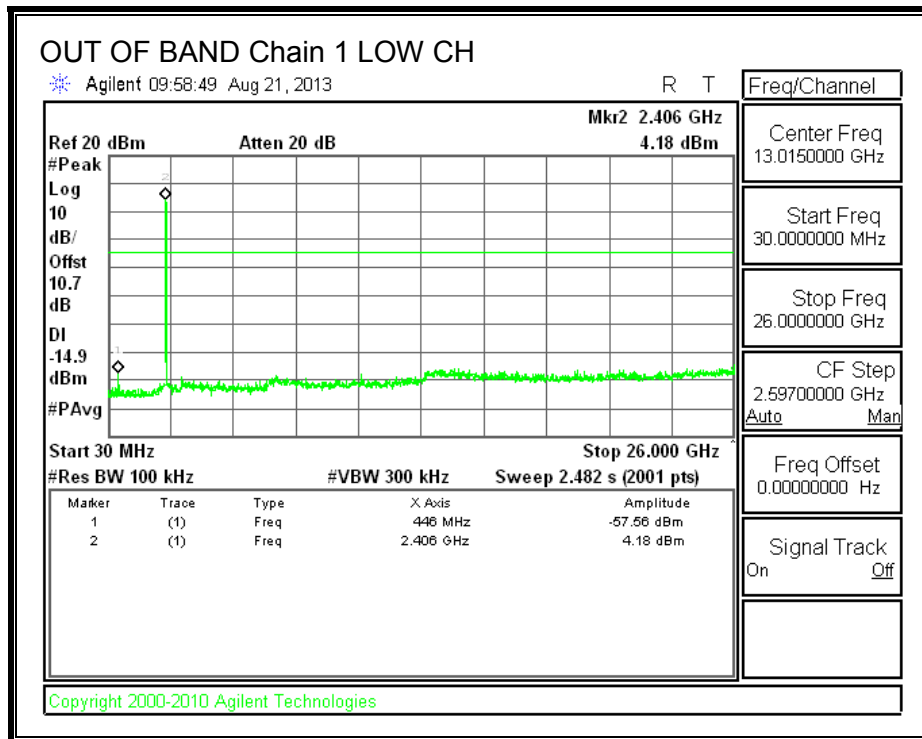


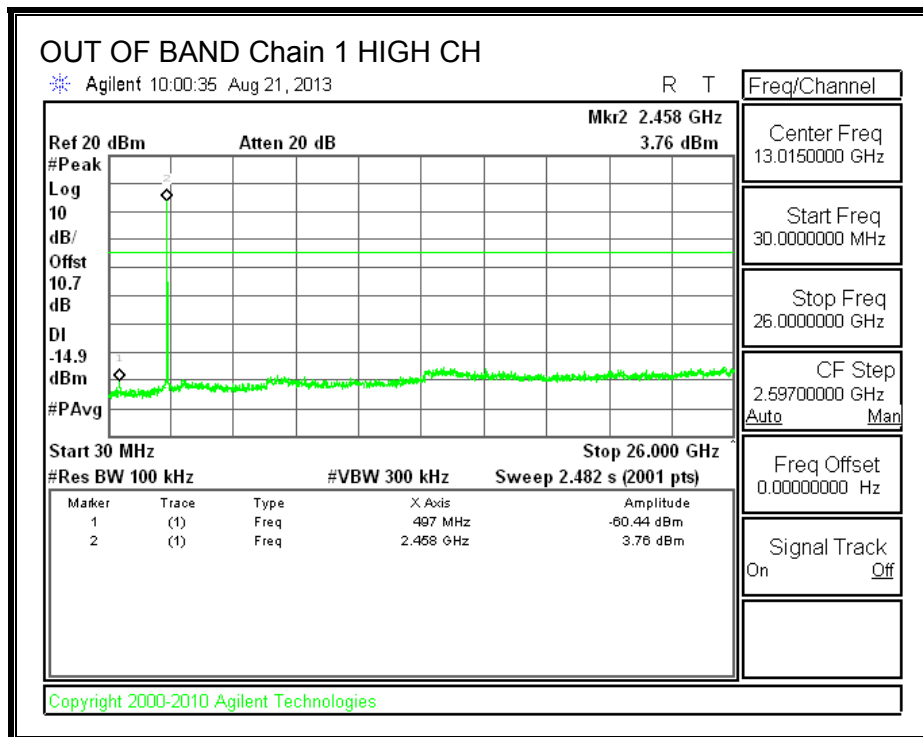
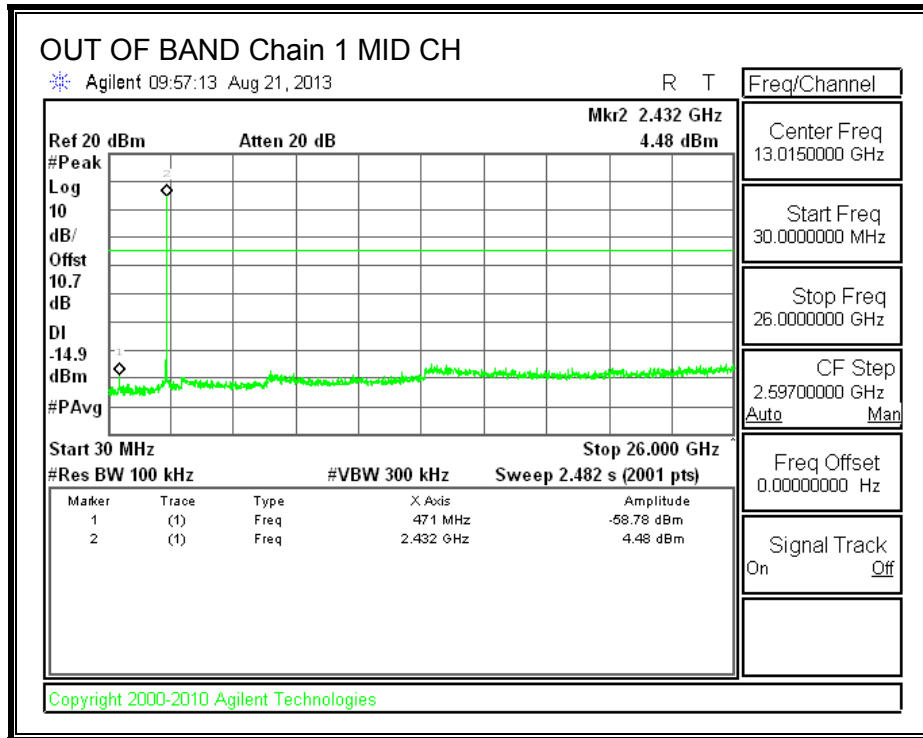


**HIGH CHANNEL BANDEDGE, Chain 1**



**OUT-OF-BAND EMISSIONS, Chain 1**





## 8.2. 802.11g MODE IN THE 2.4 GHz BAND

### 8.2.1. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

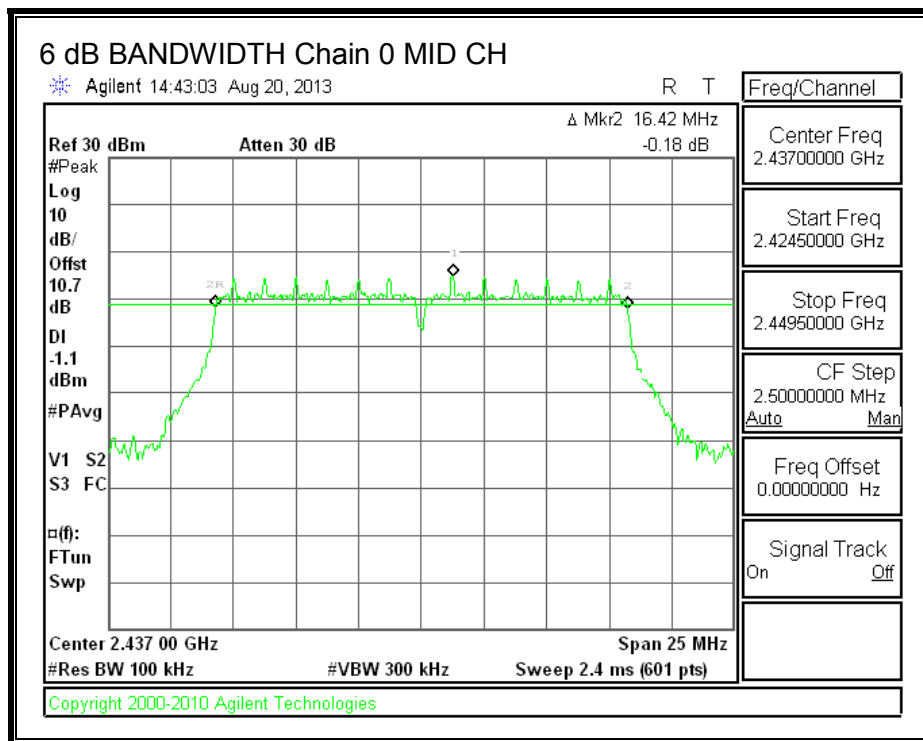
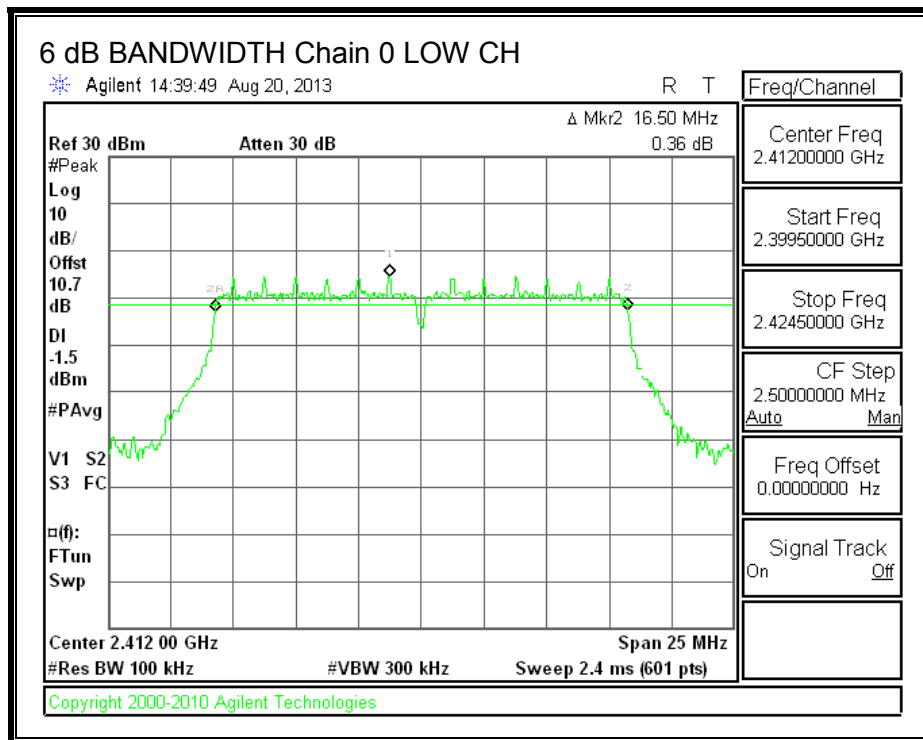
#### TEST PROCEDURE

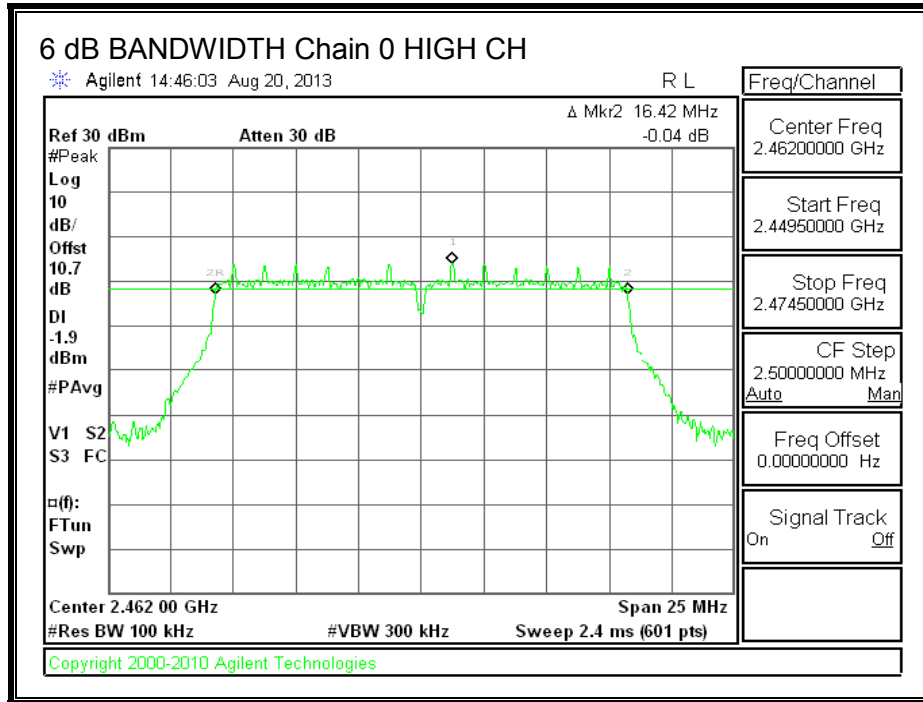
The transmitter output is connected to a spectrum analyzer with the RBW set between 1% and 5% of the EBW, the VBW  $\geq 3 \times$  RBW, peak detector and max hold.

#### RESULTS

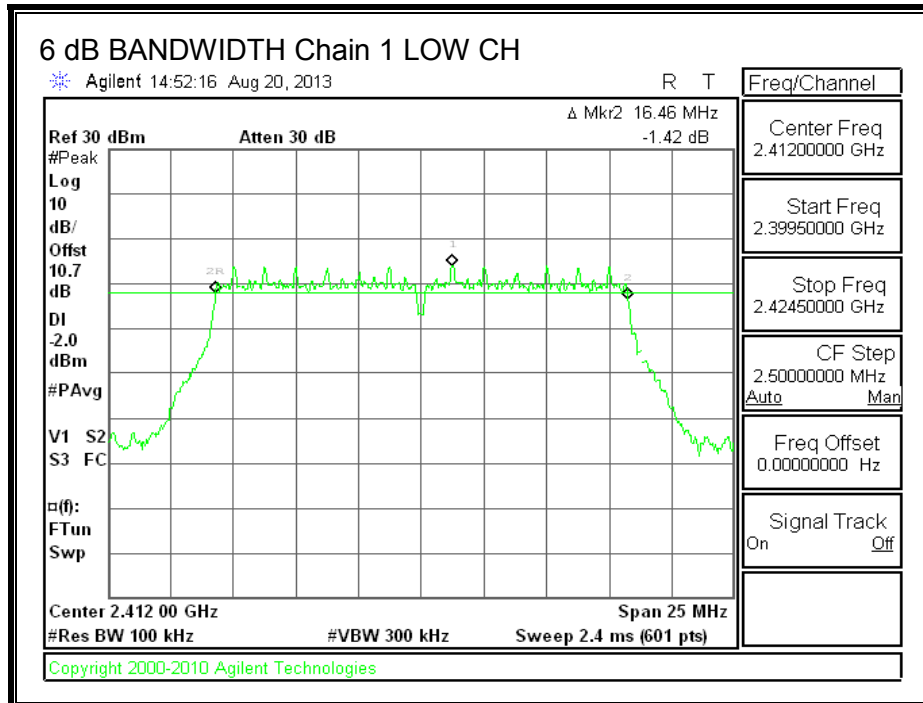
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	2412	16.50	16.46	0.5
Mid	2437	16.42	16.54	0.5
High	2462	16.42	16.50	0.5

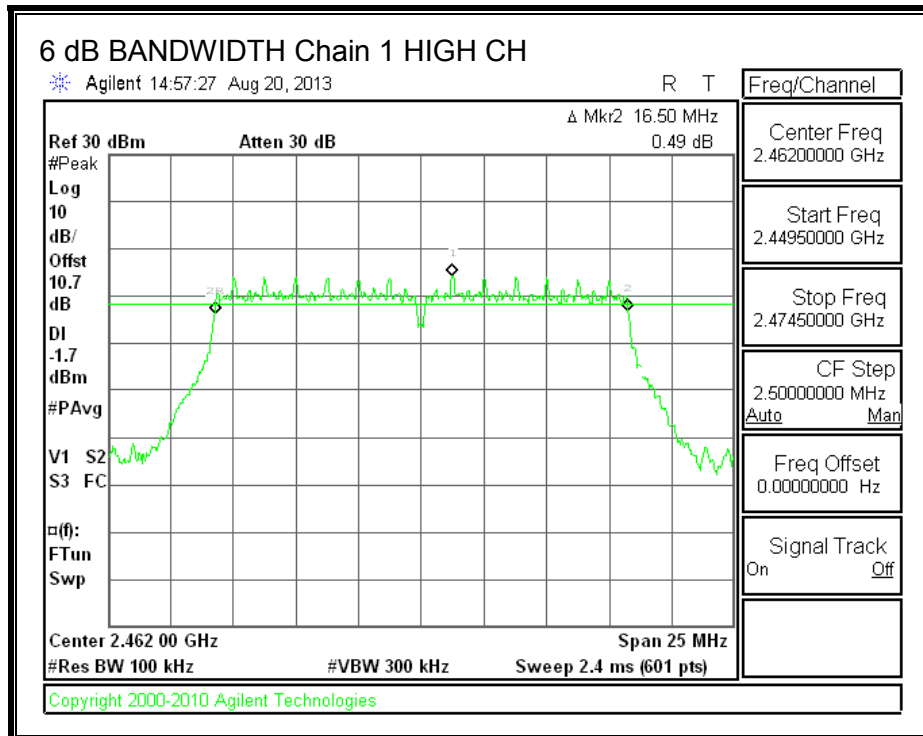
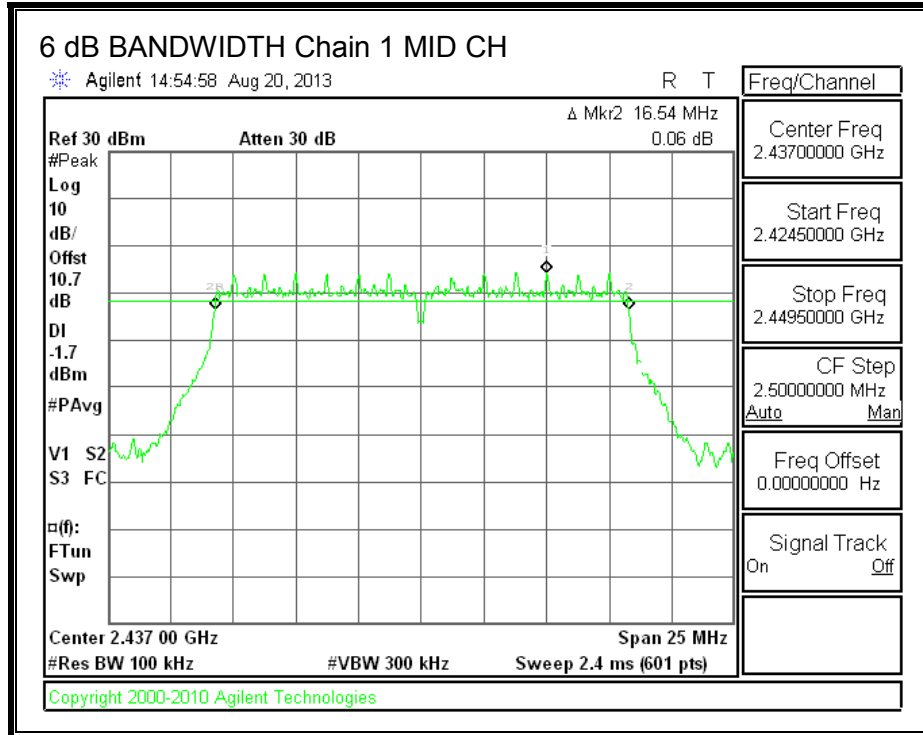
**6 dB BANDWIDTH, Chain 0**





**6 dB BANDWIDTH, Chain 1**





### 8.2.2. 99% BANDWIDTH

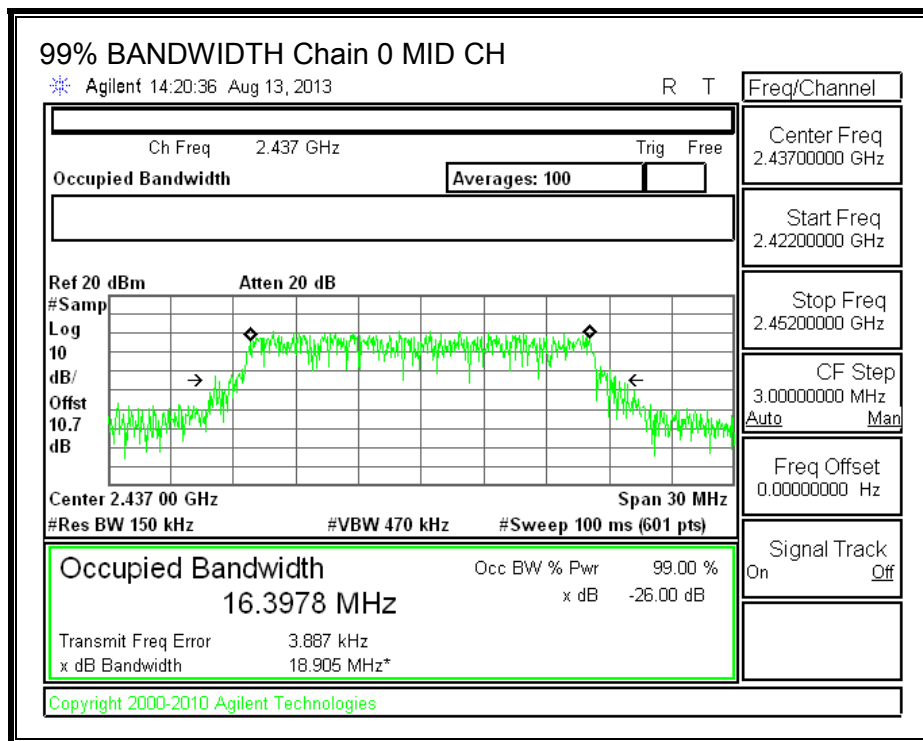
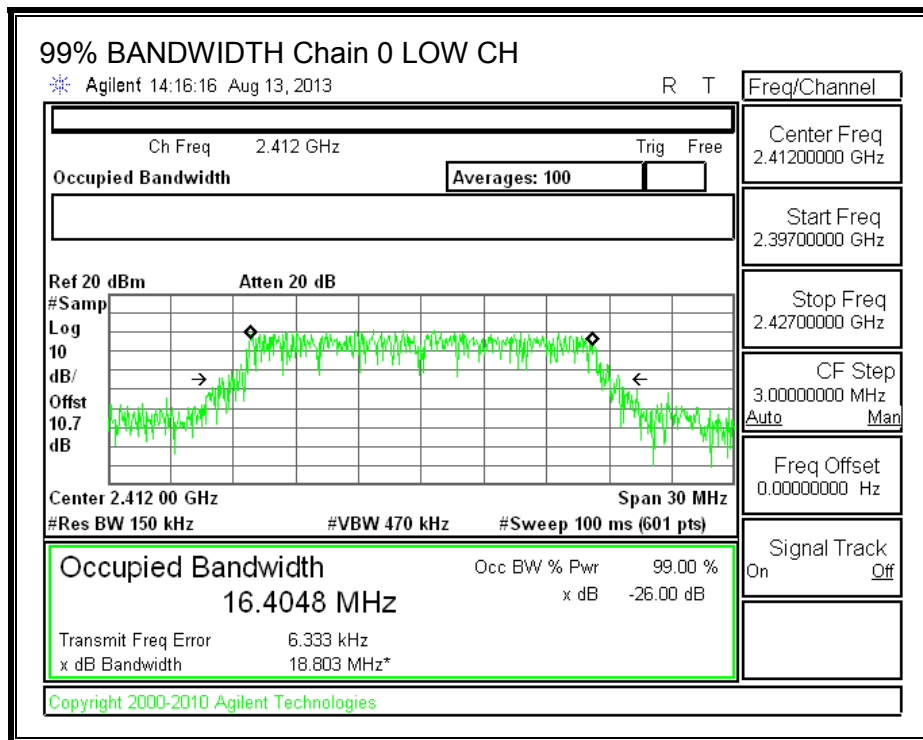
#### LIMITS

None; for reporting purposes only.

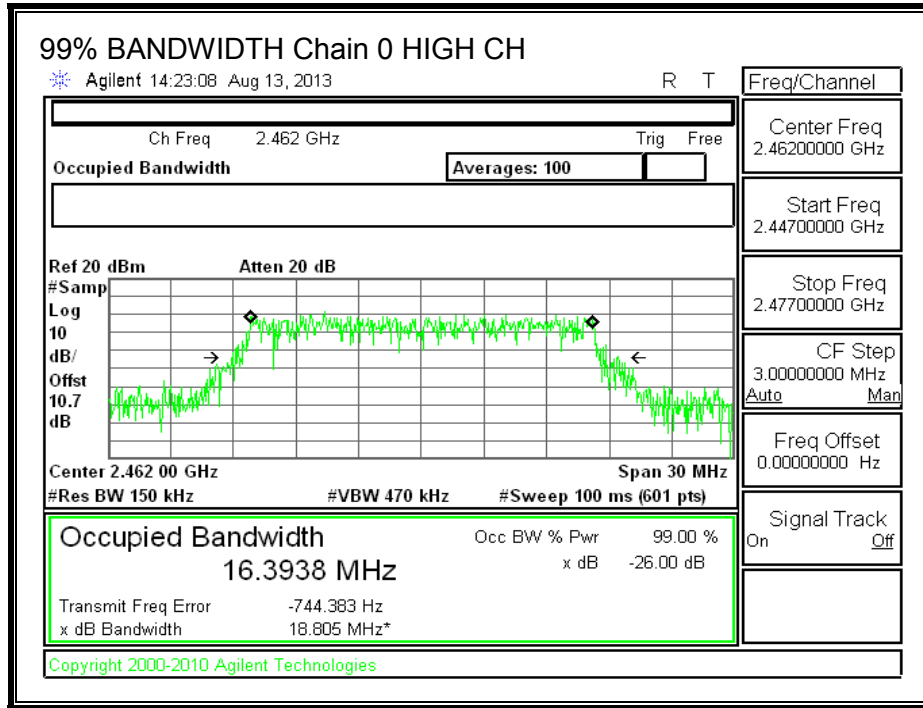
#### RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	2412	16.4048	16.4079
Mid	2437	16.3978	16.4002
High	2462	16.3938	16.3987

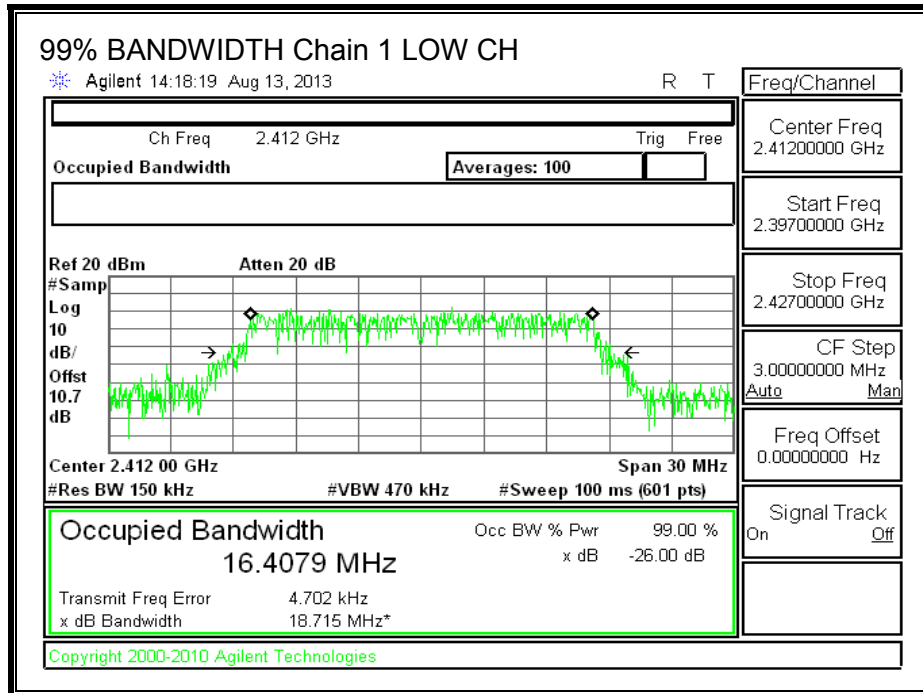
**99% BANDWIDTH, Chain 0**

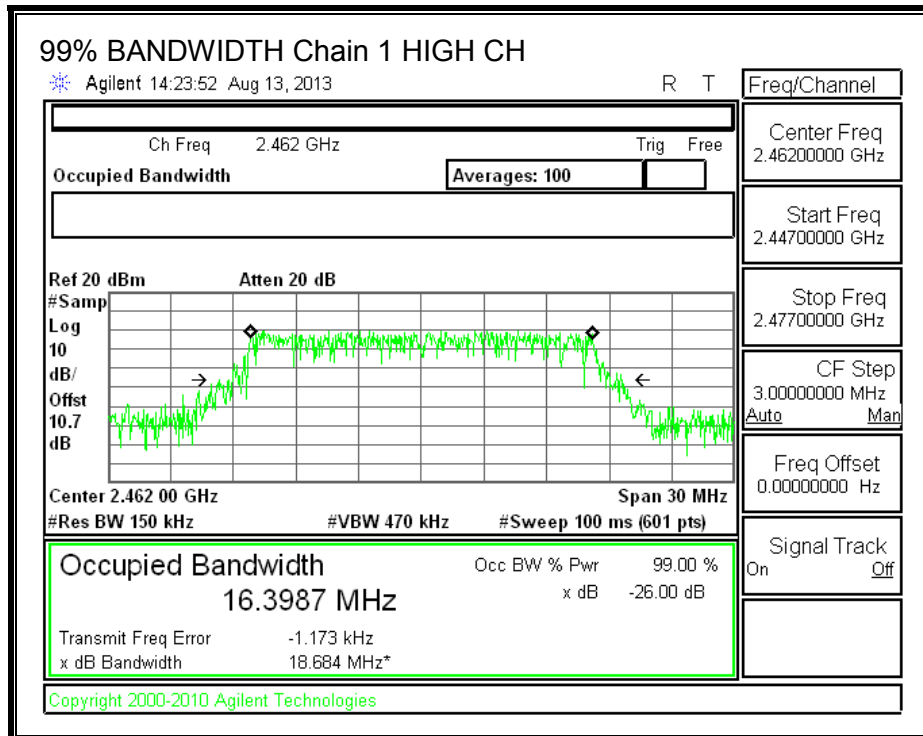
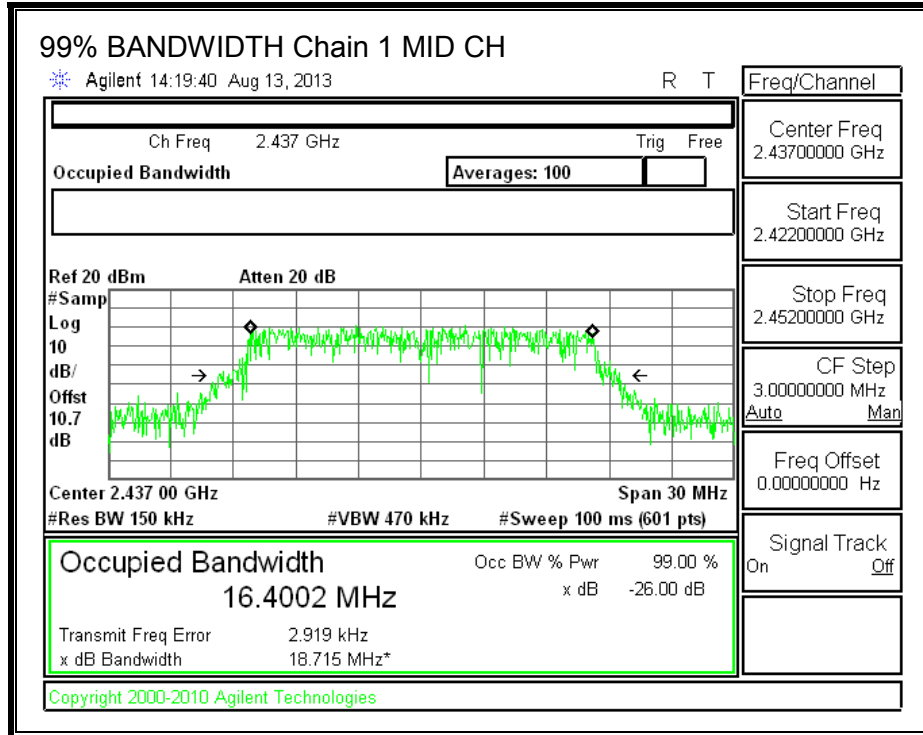






**99% BANDWIDTH, Chain 1**





### 8.2.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.75 dB (including 10 dB pad and .75 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### RESULTS

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	2412	11.09	10.72	13.92
Low	2417	12.18	11.75	14.98
Mid	2437	12.03	11.70	14.88
High	2462	11.21	11.42	14.33

## 8.2.4. OUTPUT POWER

### LIMITS

FCC §15.247

IC RSS-210 A8.4

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 the same for each chain. The directional gain is equal to the antenna gain.

<b>Chain 0 Antenna Gain (dBi)</b>	<b>Chain 1 Antenna Gain (dBi)</b>	<b>Uncorrelated Chains Directional Gain (dBi)</b>
3.10	2.60	2.86

**RESULTS**

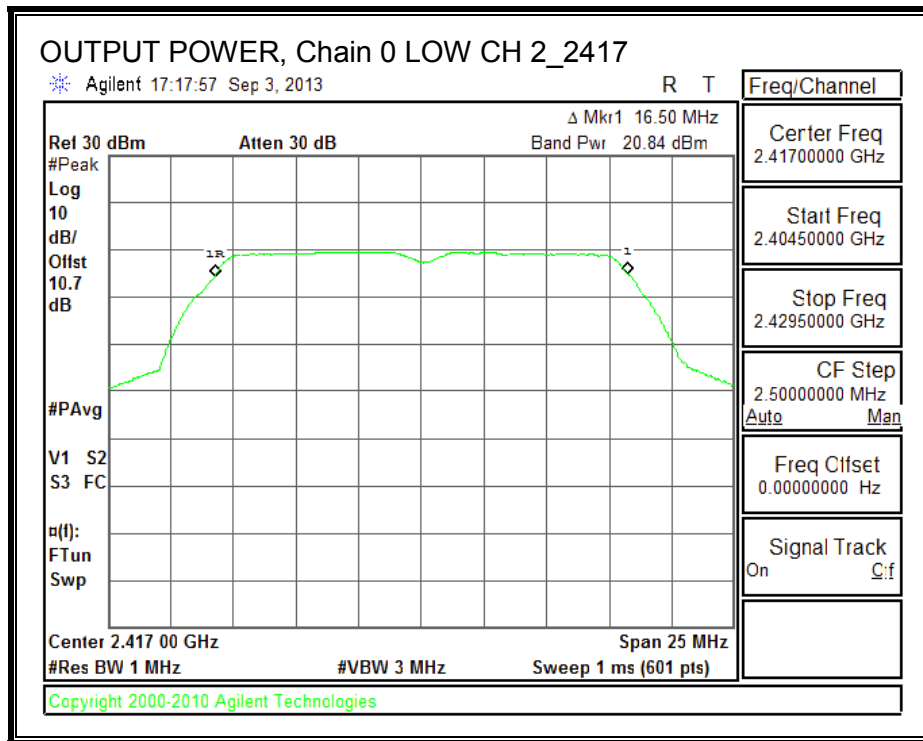
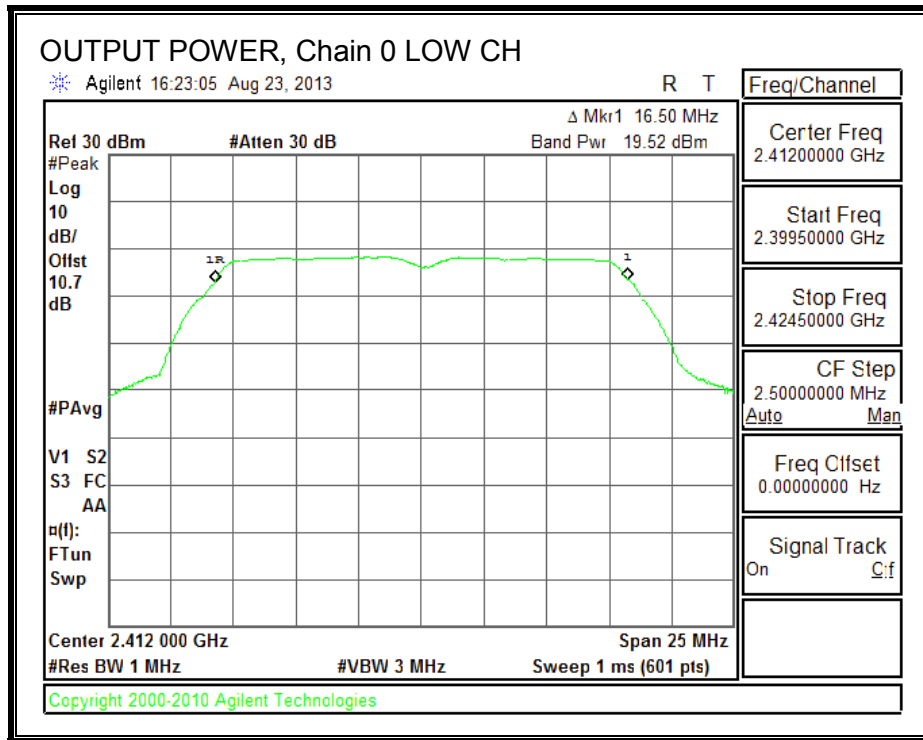
**Limits**

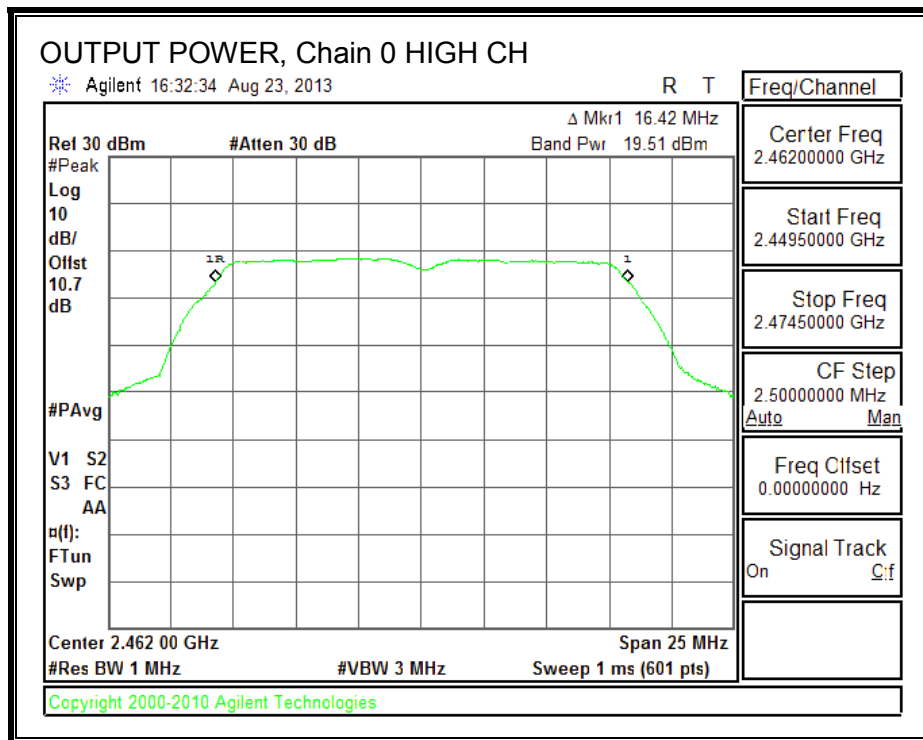
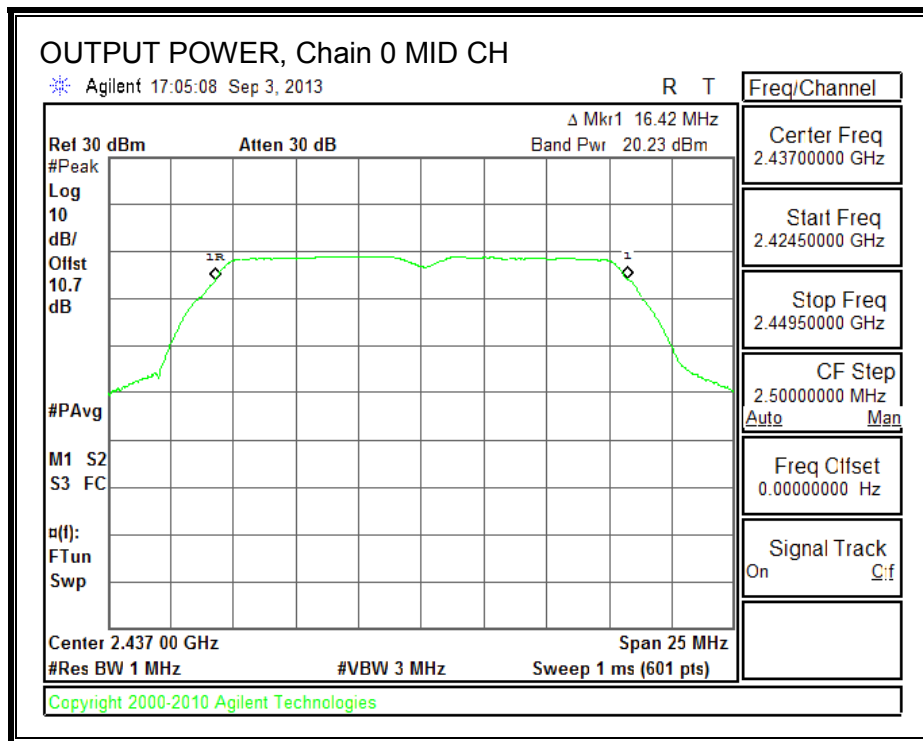
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	2.86	30.00	30	36	30.00
Low	2417	2.86	30.00	30	36	30.00
Mid	2437	2.86	30.00	30	36	30.00
High	2462	2.86	30.00	30	36	30.00

**Results**

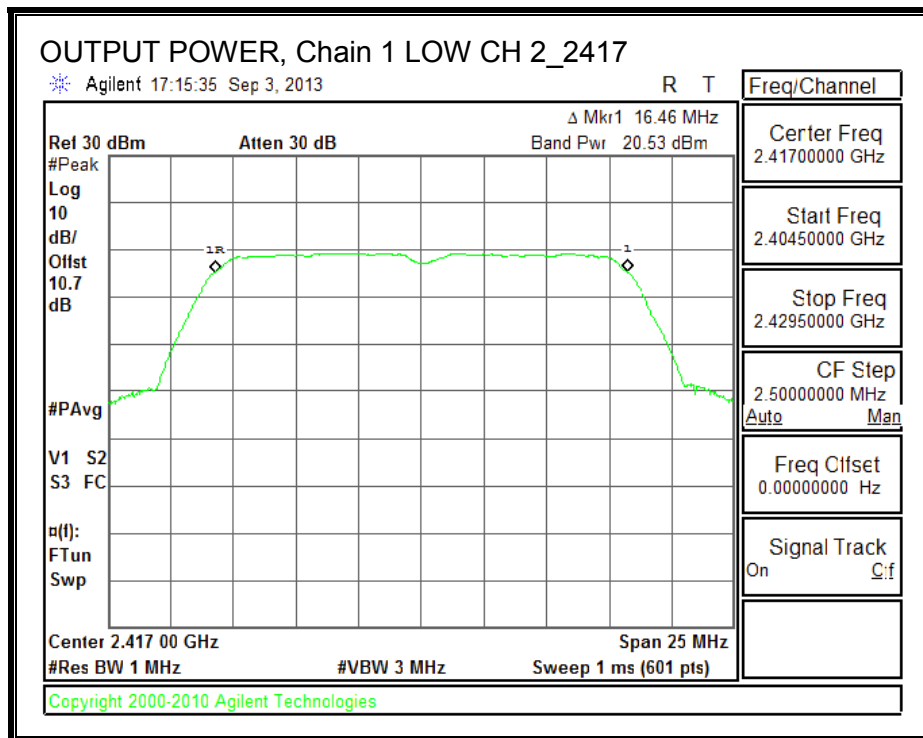
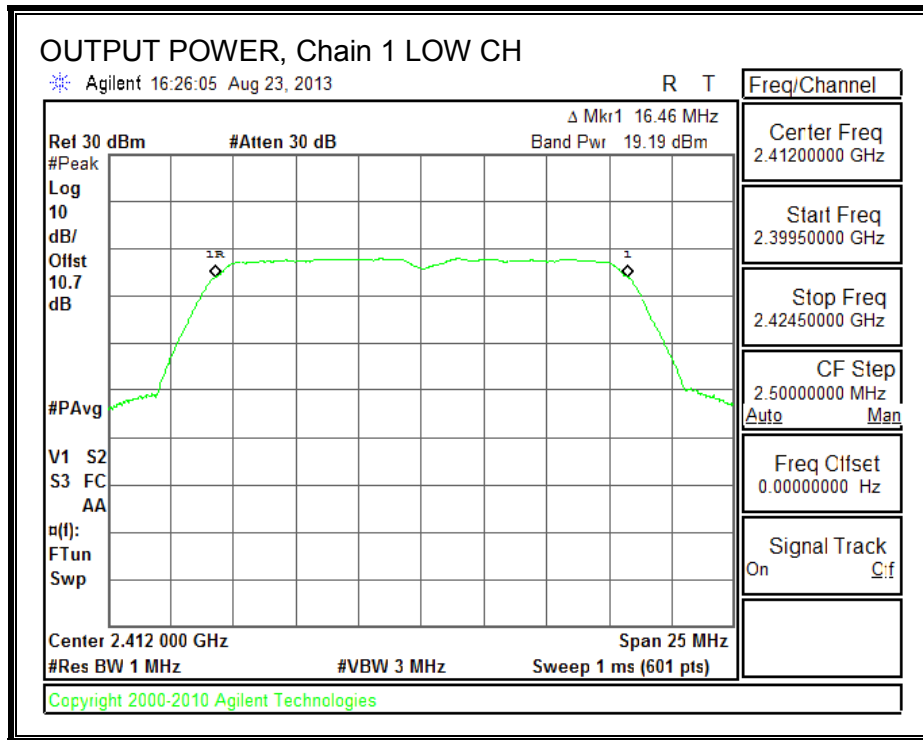
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margi (dB)
Low	2412	19.52	19.19	22.37	30.00	-7.63
Low	2417	20.84	20.53	23.70	30.00	-6.30
Mid	2437	20.23	19.98	23.12	30.00	-6.88
High	2462	19.51	19.91	22.72	30.00	-7.28

**OUTPUT POWER, Chain 0**

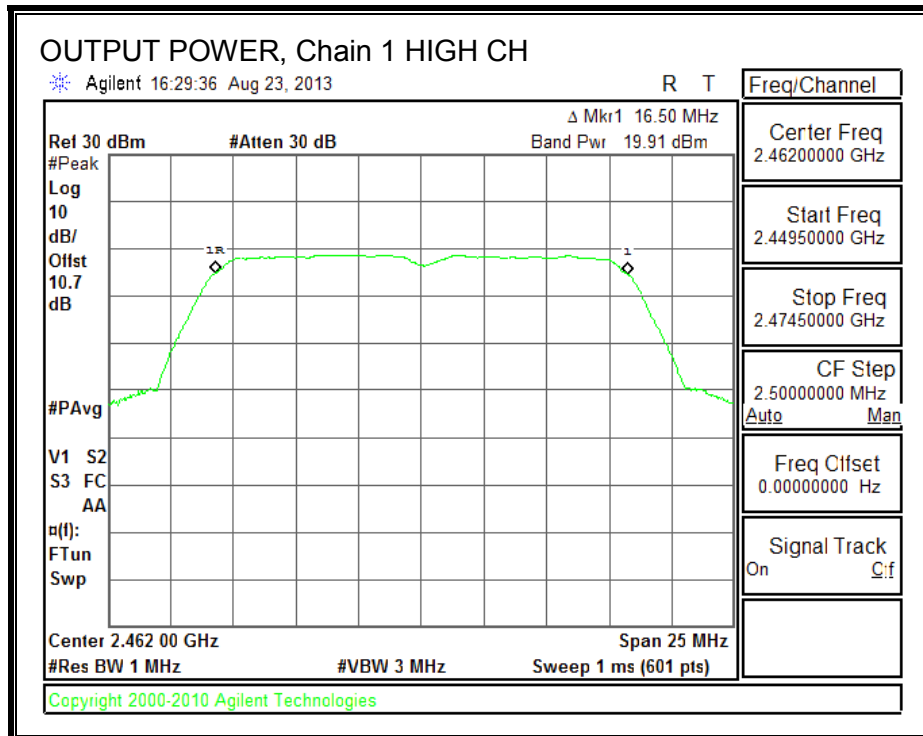
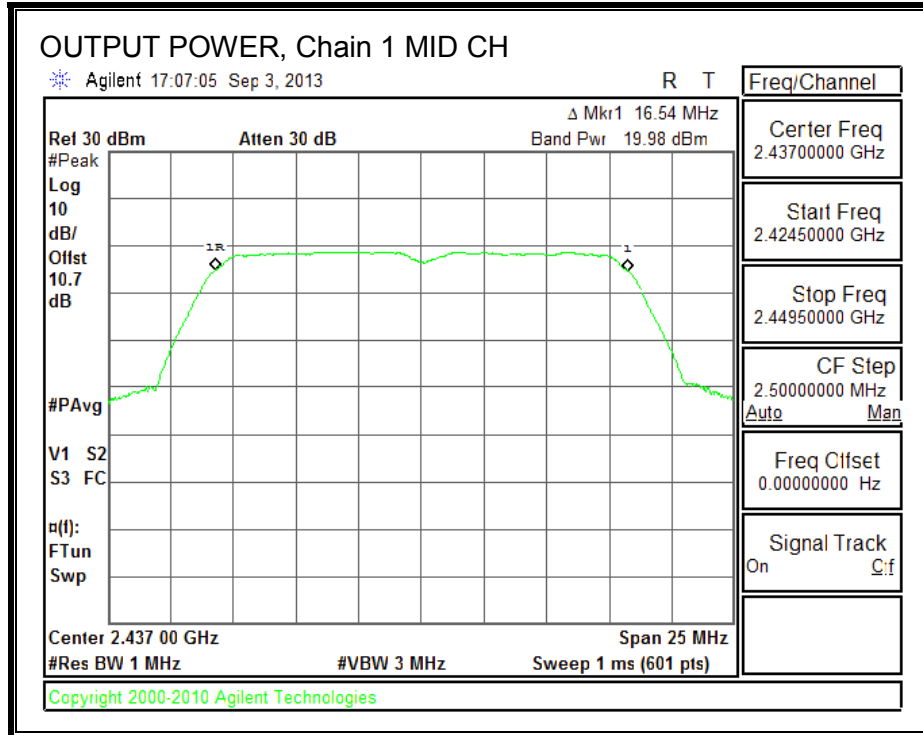




**OUTPUT POWER, Chain 1**







### 8.2.5. PSD

#### LIMITS

FCC §15.247

IC RSS-210 A8.2

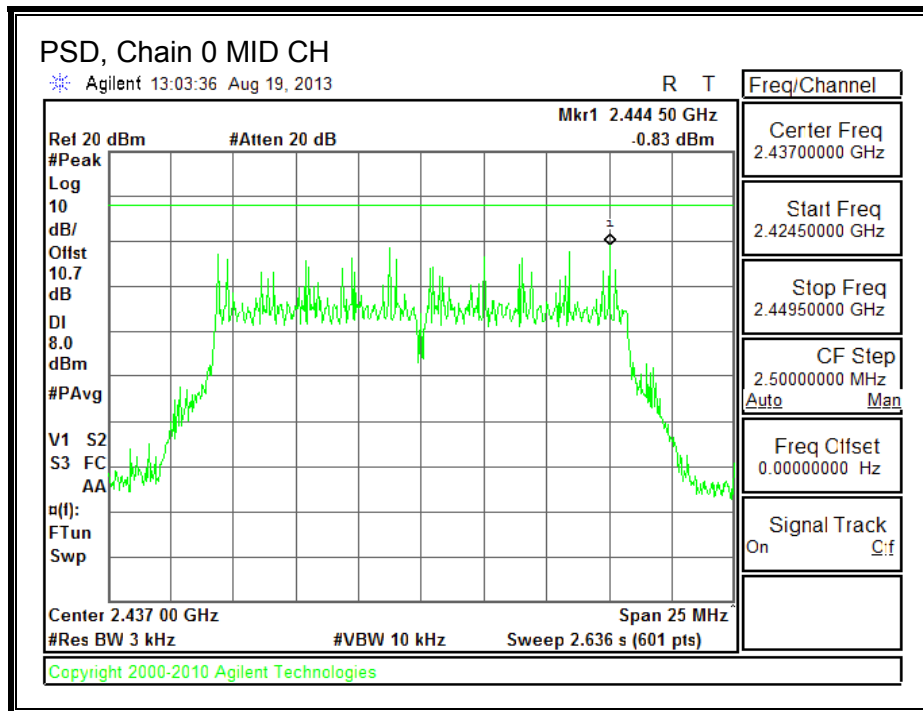
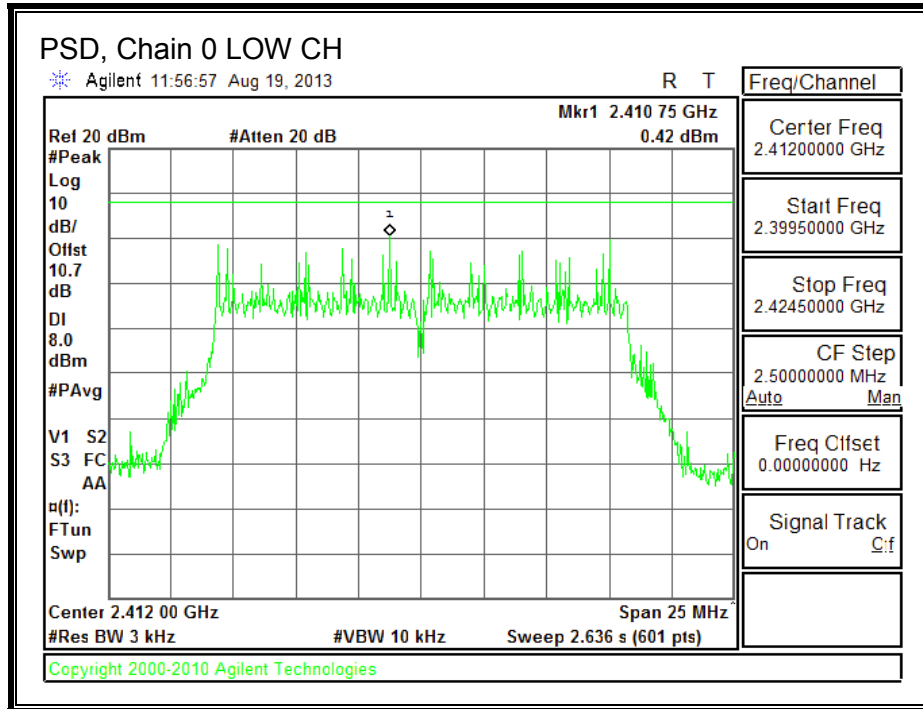
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

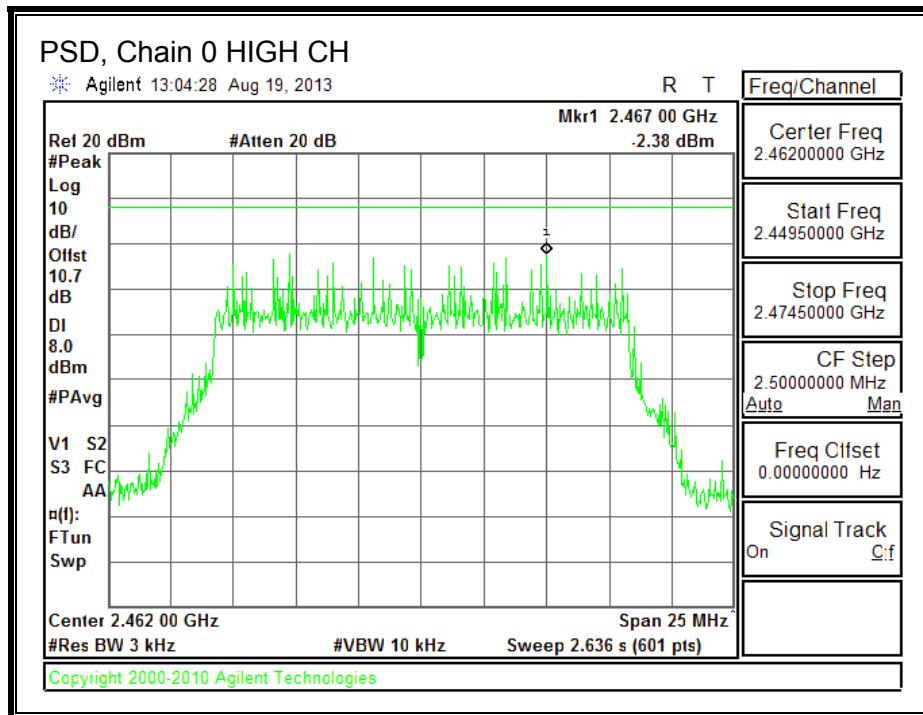
#### RESULTS

##### PSD Results

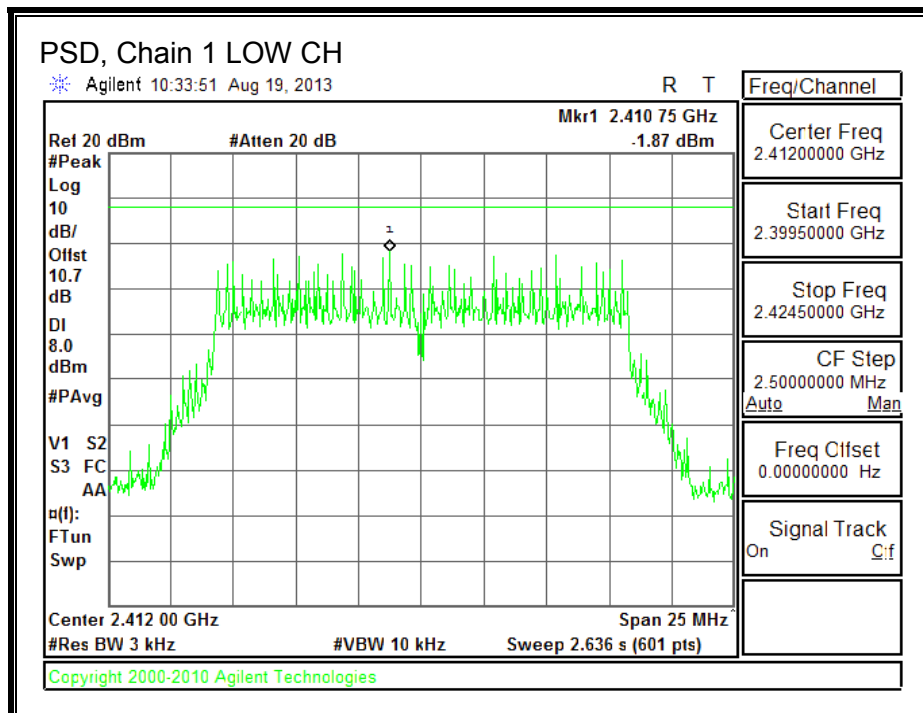
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	0.42	-1.87	2.43	8.0	-5.6
Mid	2437	-0.83	-0.63	2.28	8.0	-5.7
High	2462	-2.38	-2.17	0.74	8.0	-7.3

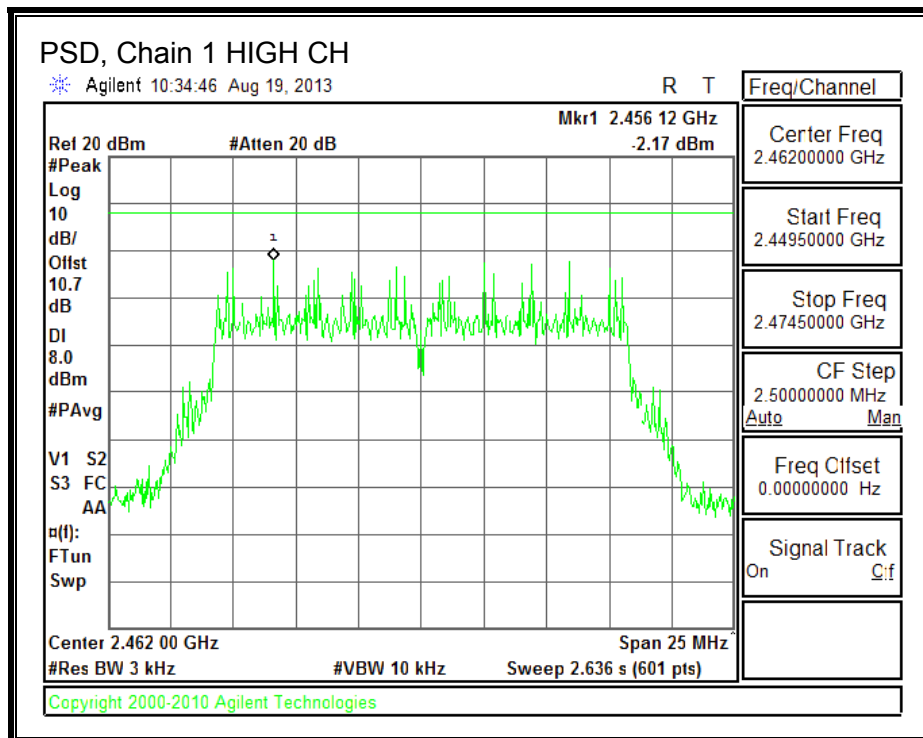
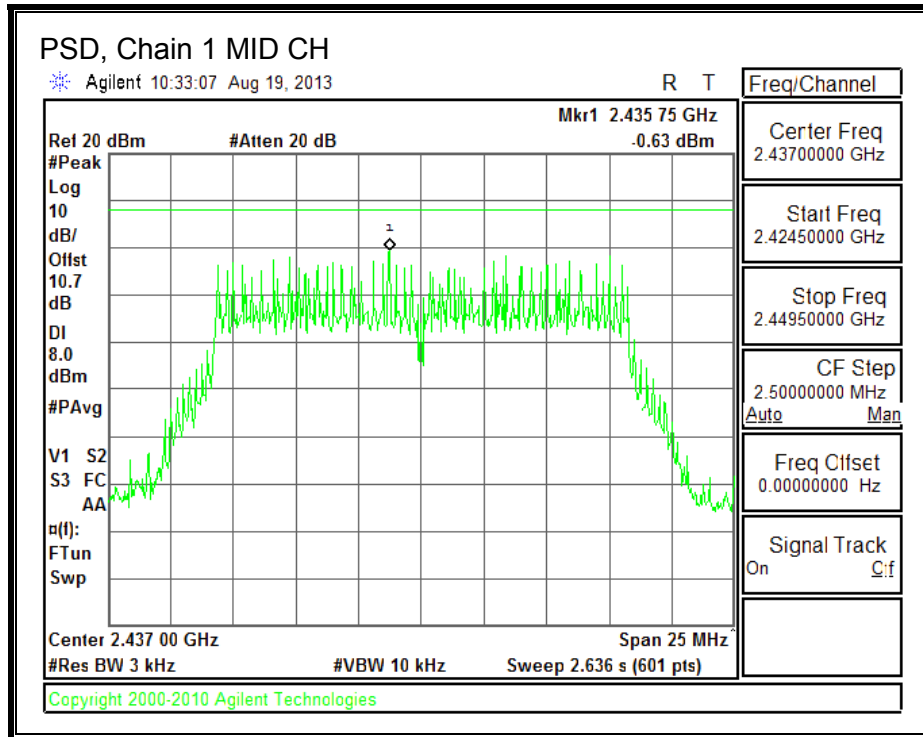
**PSD, Chain 0**





**PSD, Chain 1**





## 8.2.6. OUT-OF-BAND EMISSIONS

### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

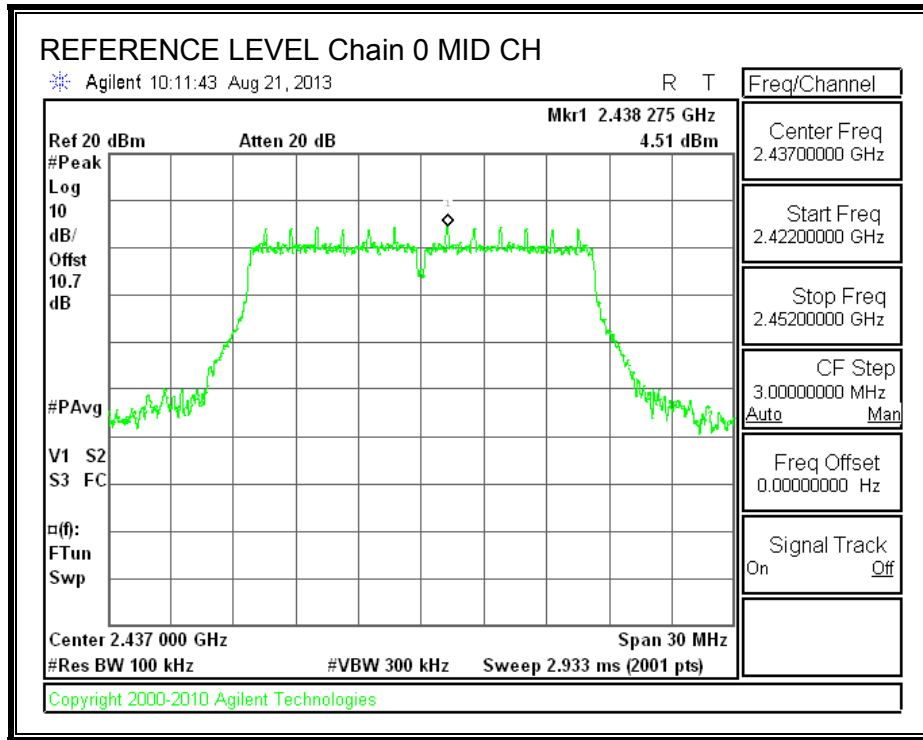
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

### TEST PROCEDURE

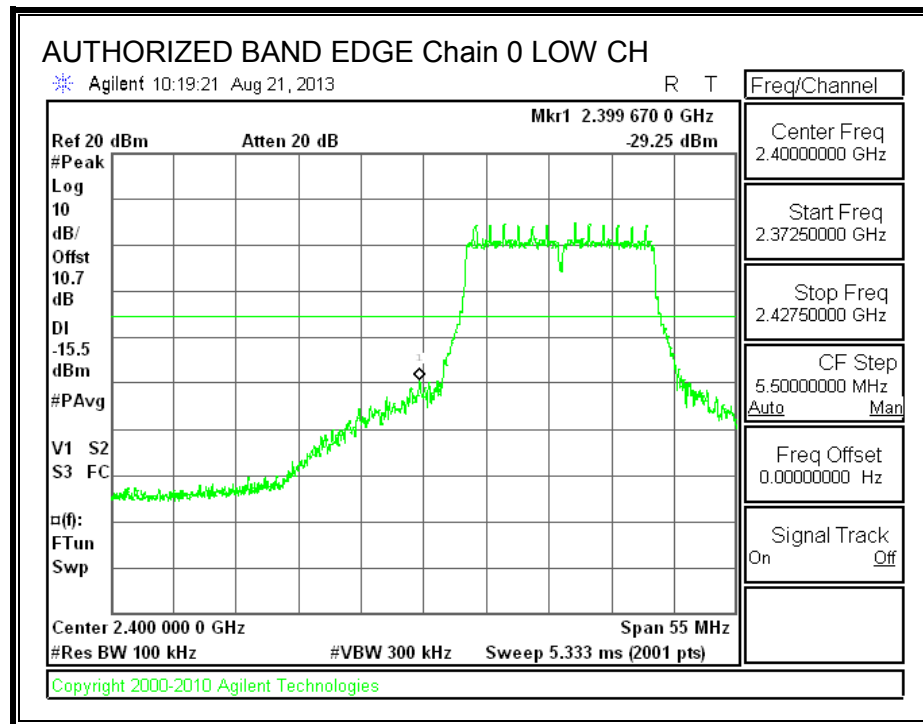
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

**RESULTS**

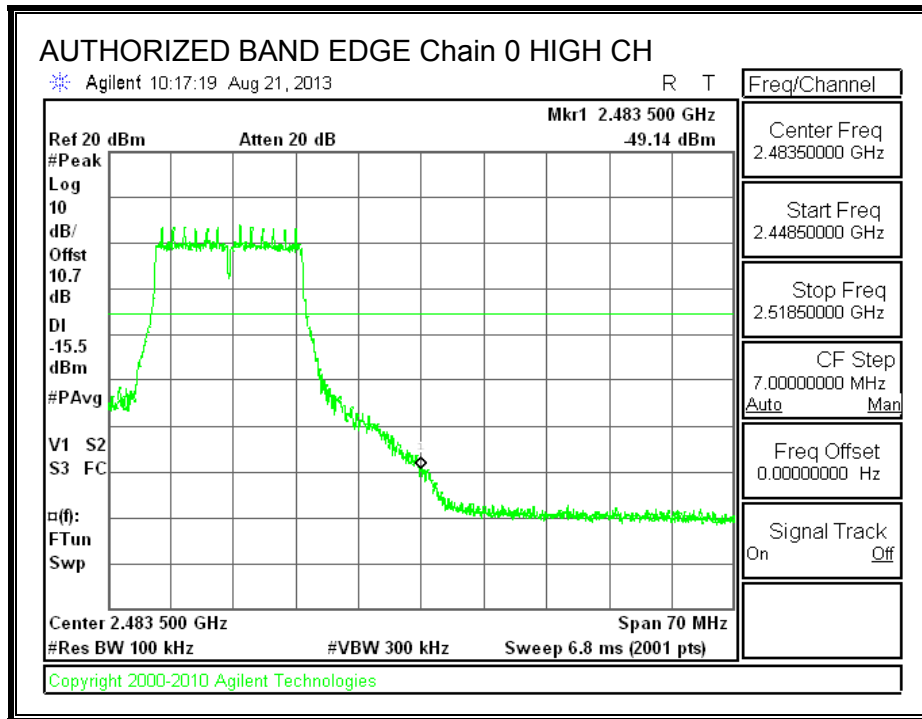
**IN-BAND REFERENCE LEVEL, Chain 0**



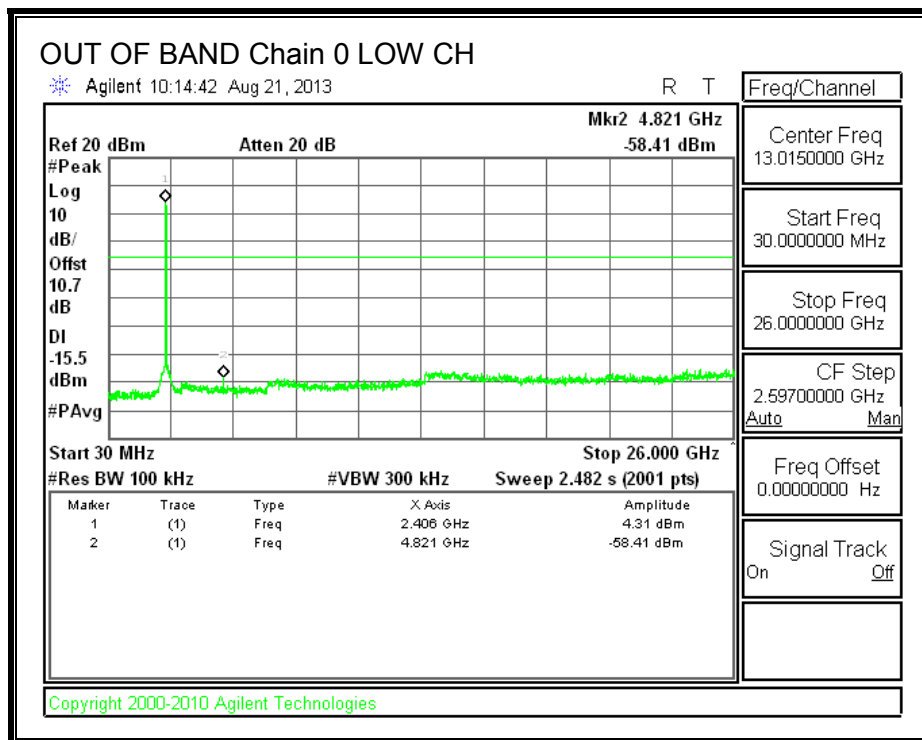
**LOW CHANNEL BANDEDGE, Chain 0**



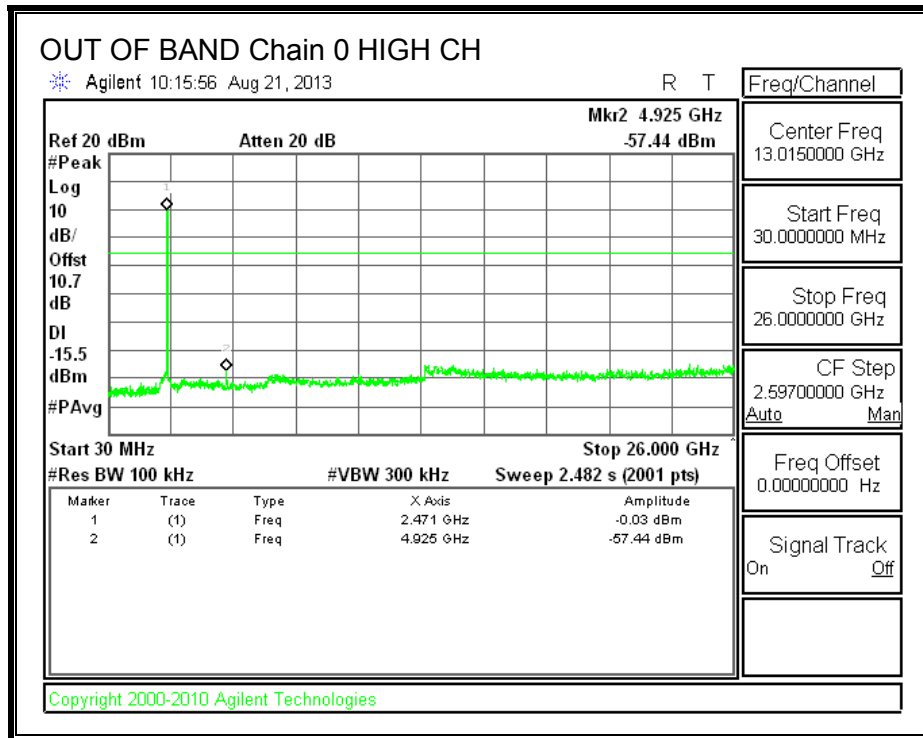
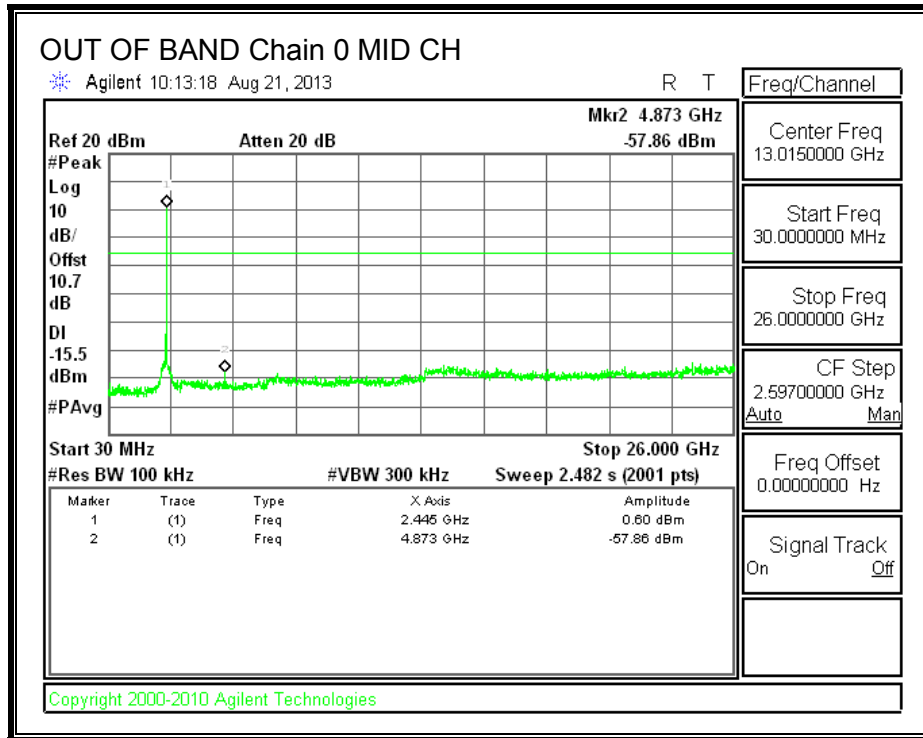
**HIGH CHANNEL BANDEDGE, Chain 0**



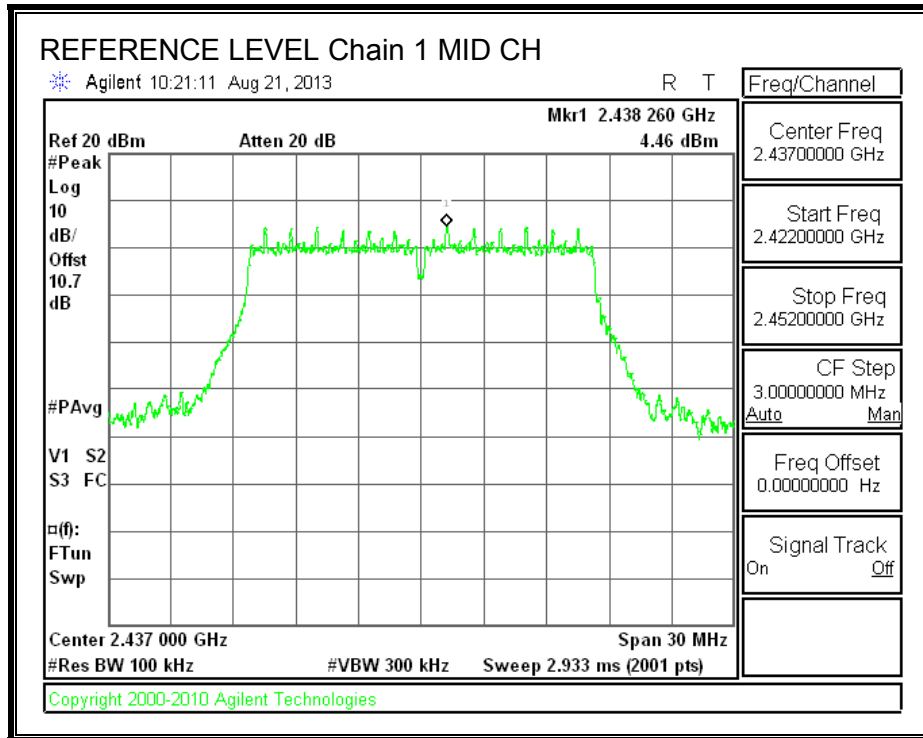
**OUT-OF-BAND EMISSIONS, Chain 0**



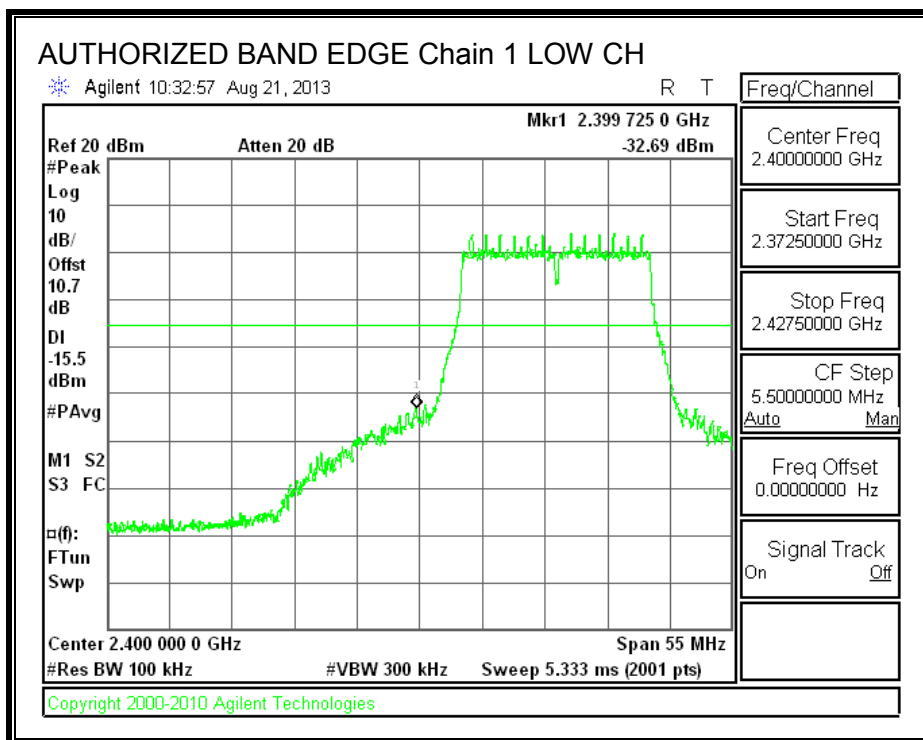




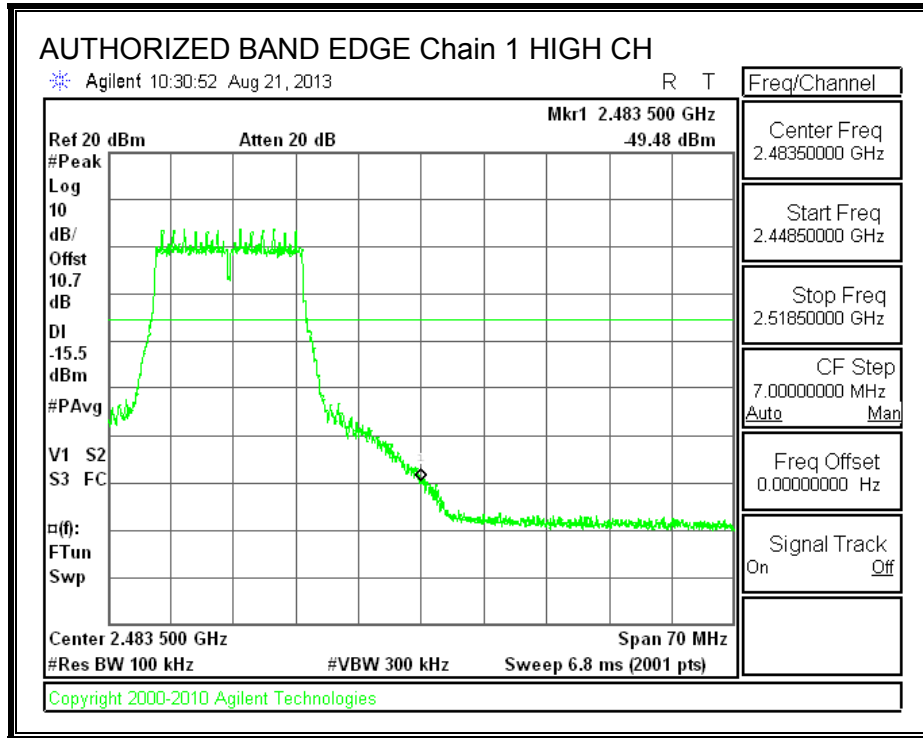
**IN-BAND REFERENCE LEVEL, Chain 1**



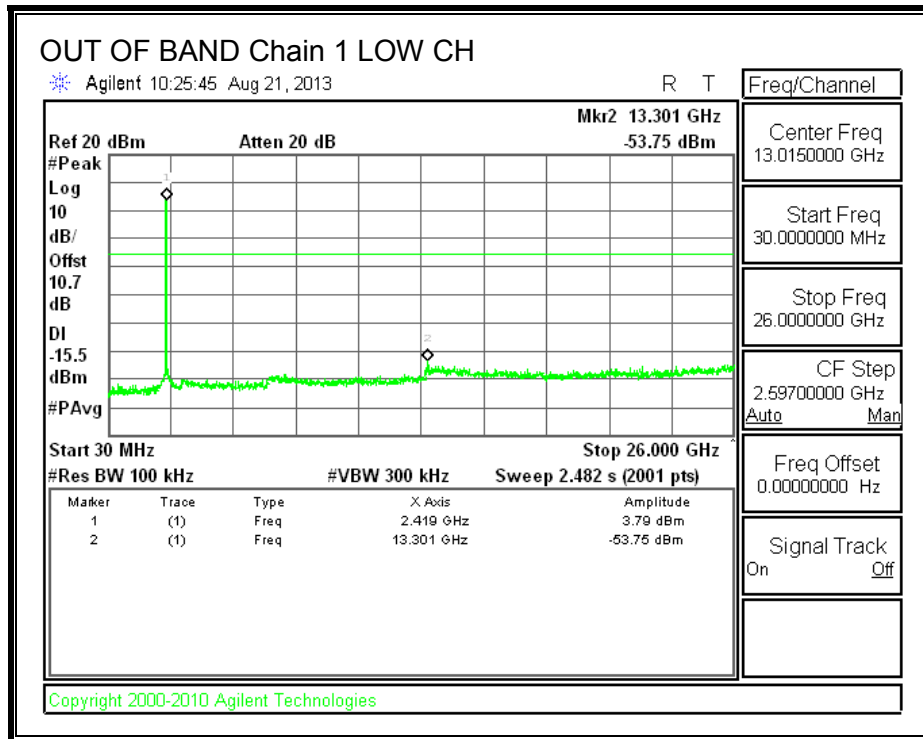
**LOW CHANNEL BANDEDGE, Chain 1**

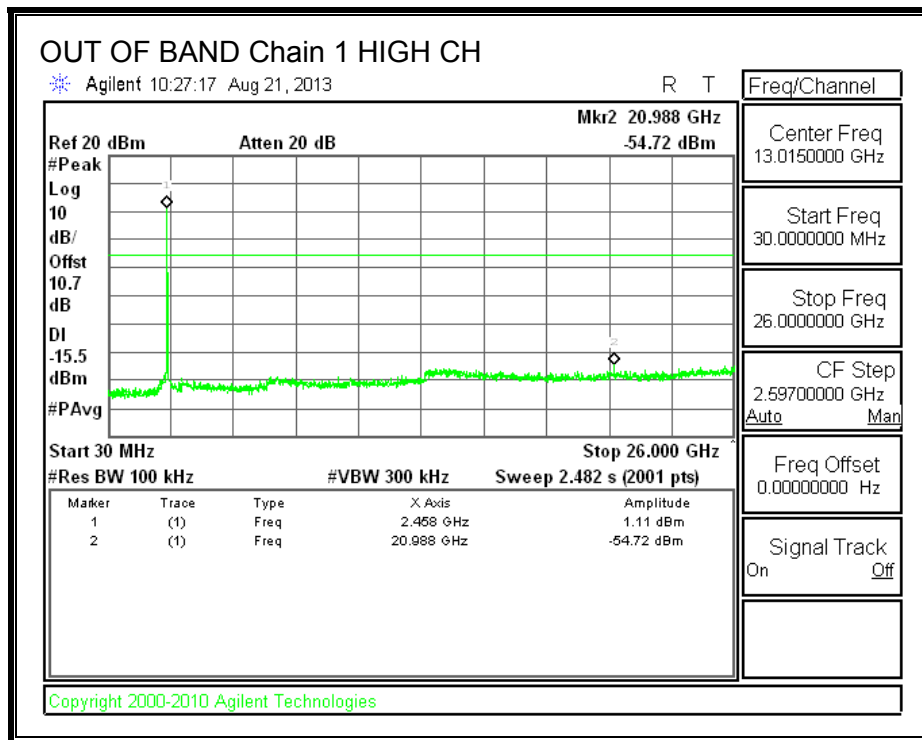
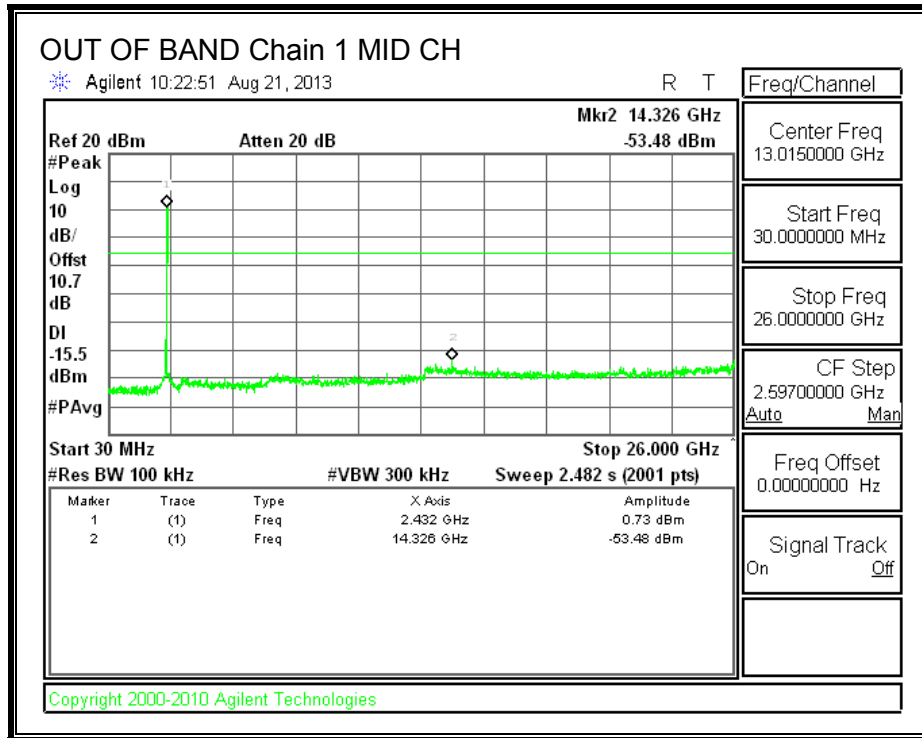


**HIGH CHANNEL BANDEDGE, Chain 1**



**OUT-OF-BAND EMISSIONS, Chain 1**





### 8.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

#### 8.3.1. 6 dB BANDWIDTH

##### LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

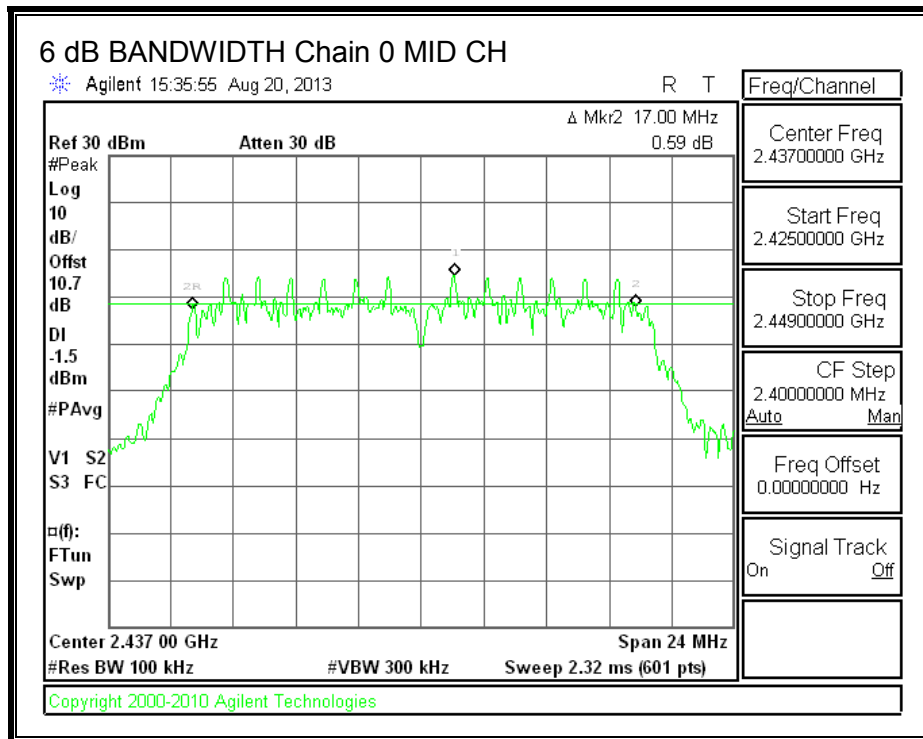
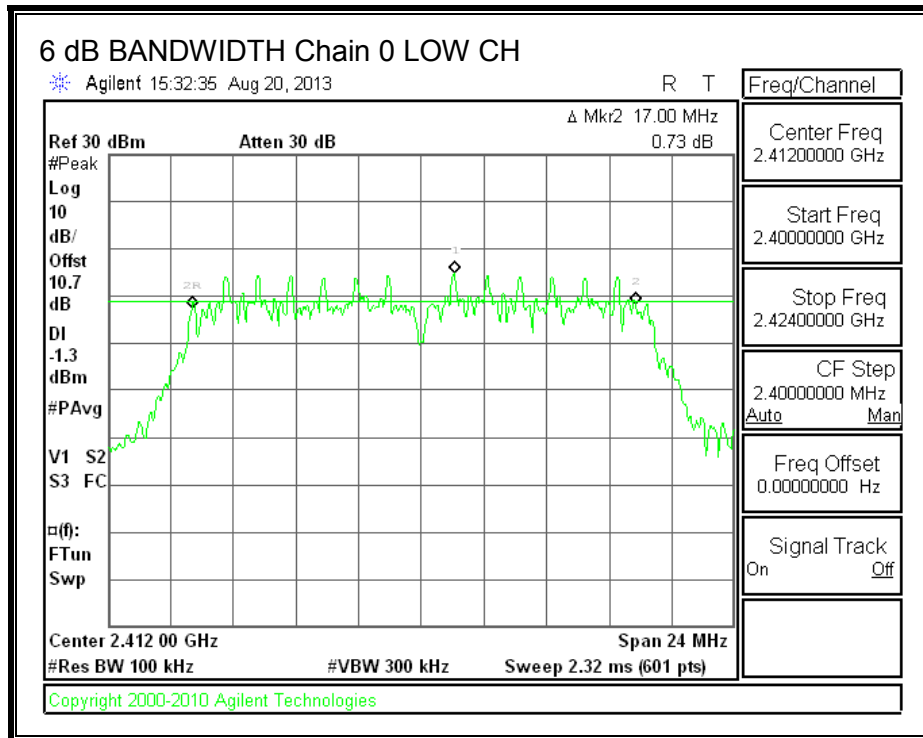
##### TEST PROCEDURE

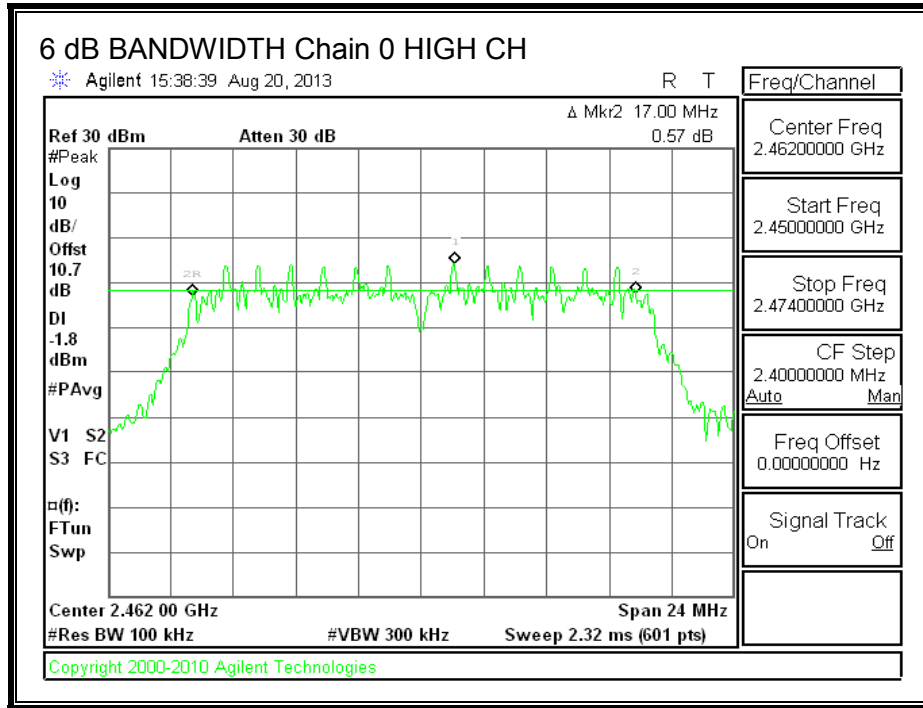
The transmitter output is connected to a spectrum analyzer with the RBW set between 1% and 5% of the EBW, the VBW  $\geq 3 \times$  RBW, peak detector and max hold.

##### RESULTS

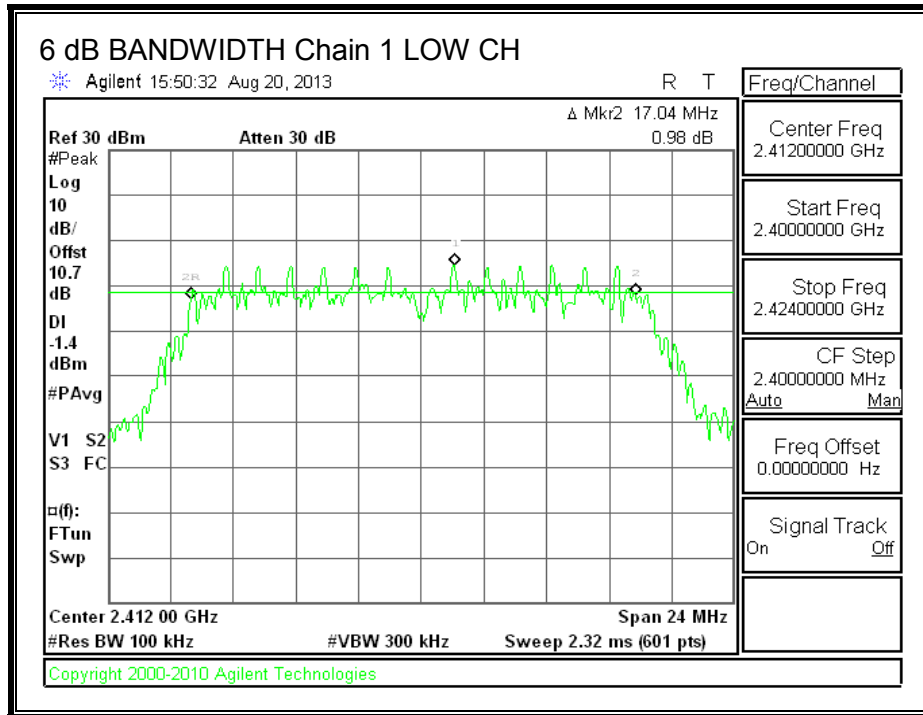
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	2412	17.00	17.04	0.5
Mid	2437	17.00	17.04	0.5
High	2462	17.00	17.04	0.5

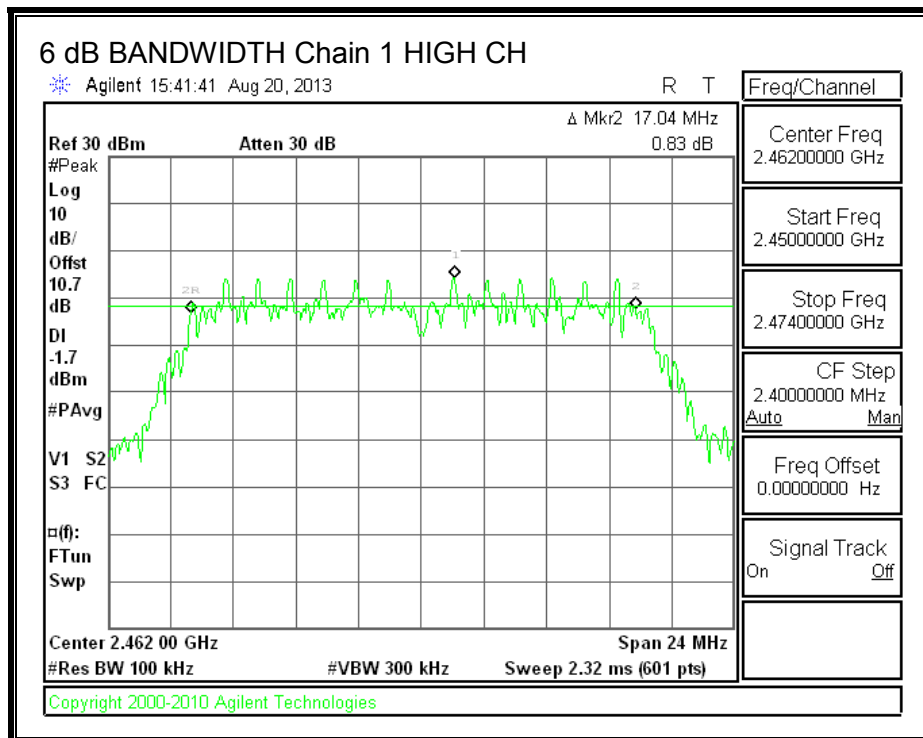
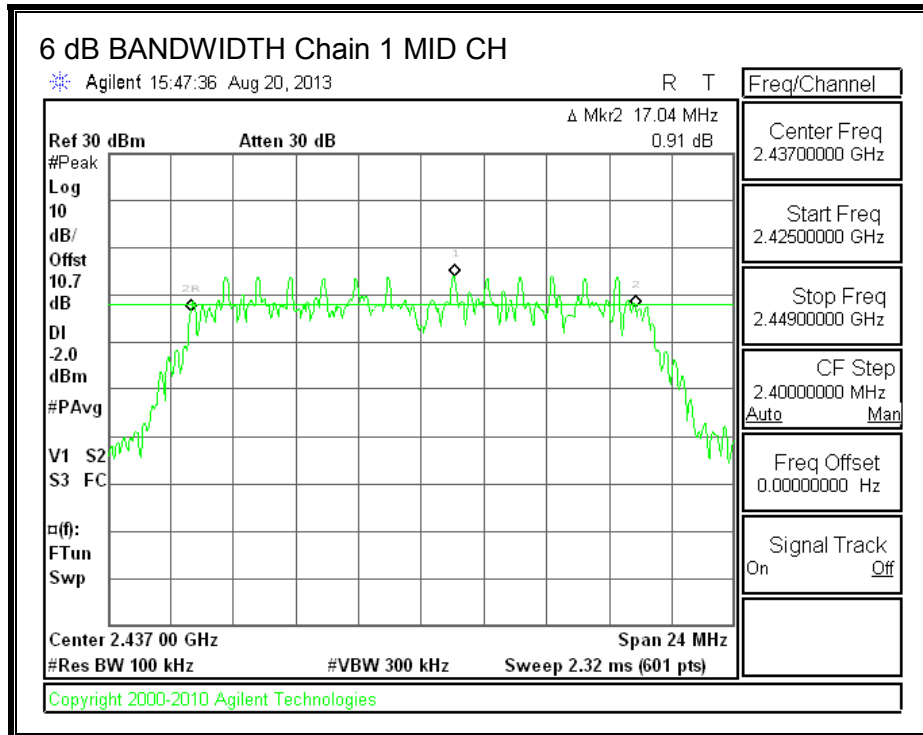
**6 dB BANDWIDTH, Chain 0**





**6 dB BANDWIDTH, Chain 1**







### 8.3.2. 99% BANDWIDTH

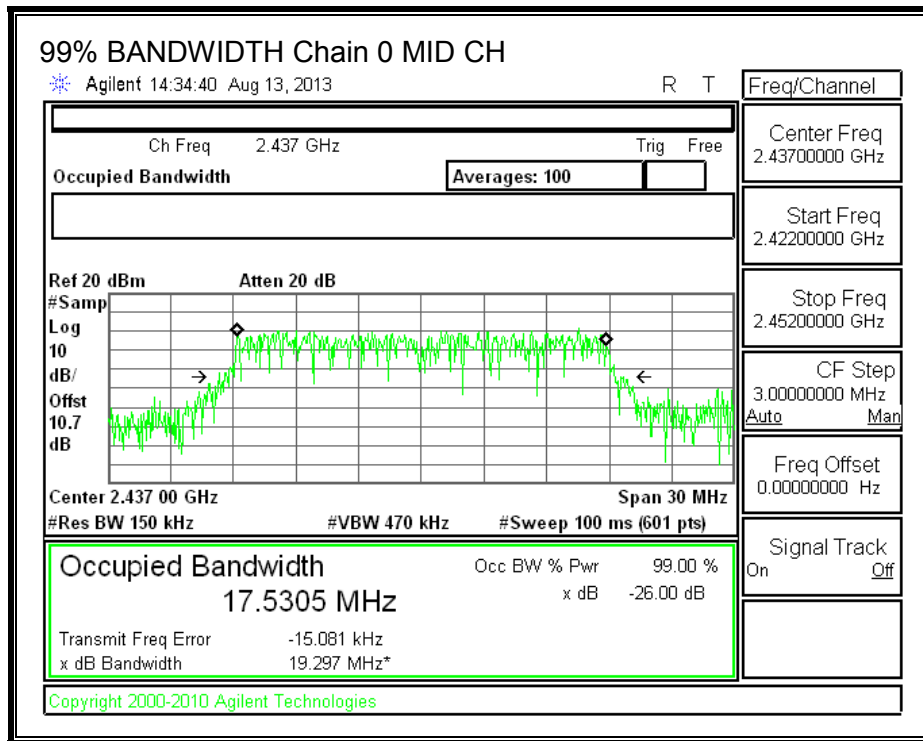
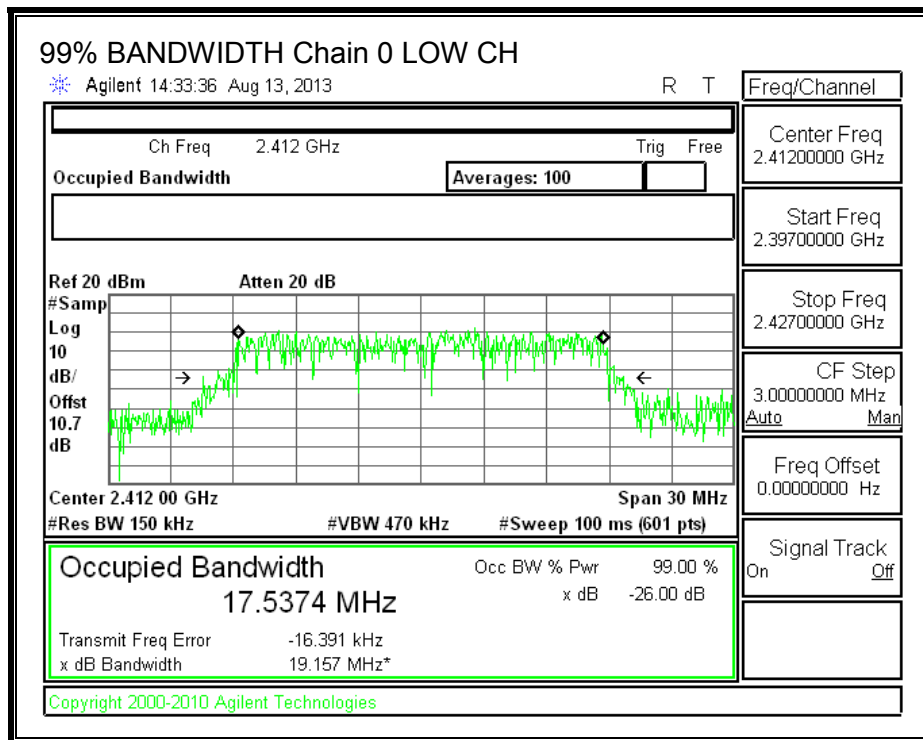
#### LIMITS

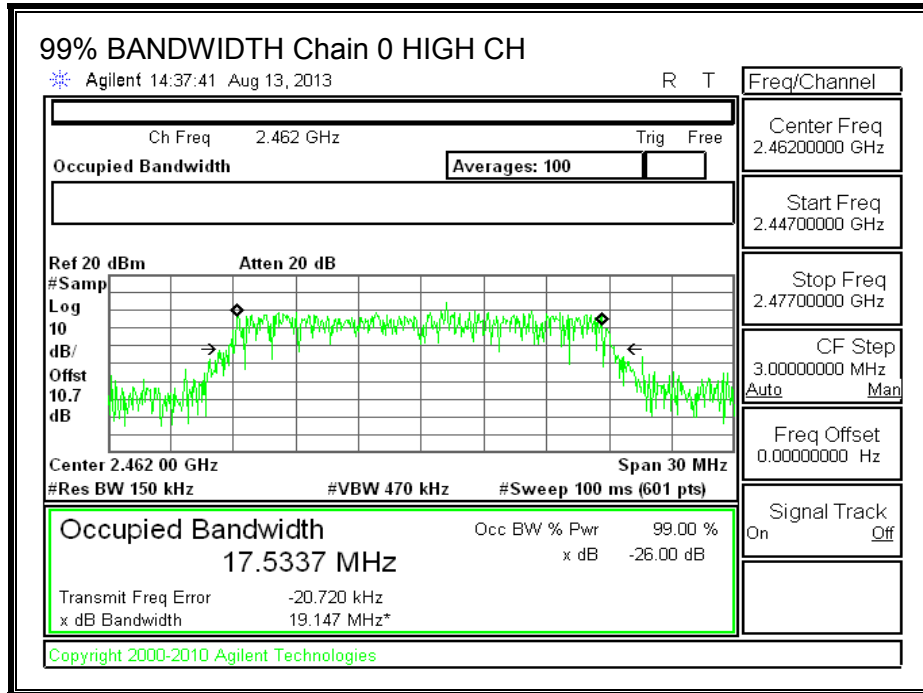
None; for reporting purposes only.

#### RESULTS

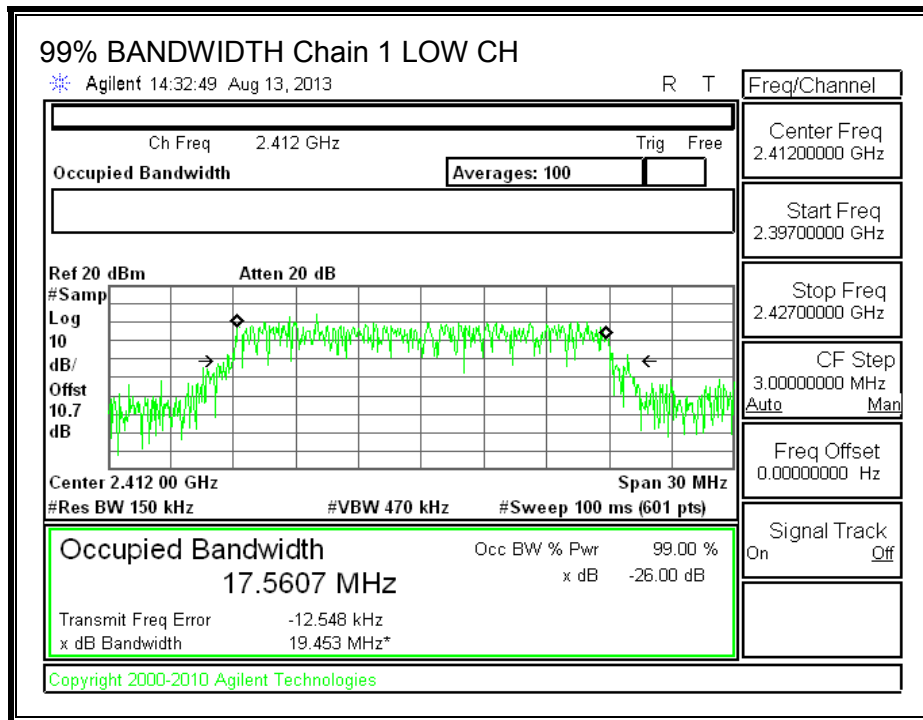
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	2412	17.5374	17.5607
Mid	2437	17.5305	17.5614
High	2462	17.5337	17.5565

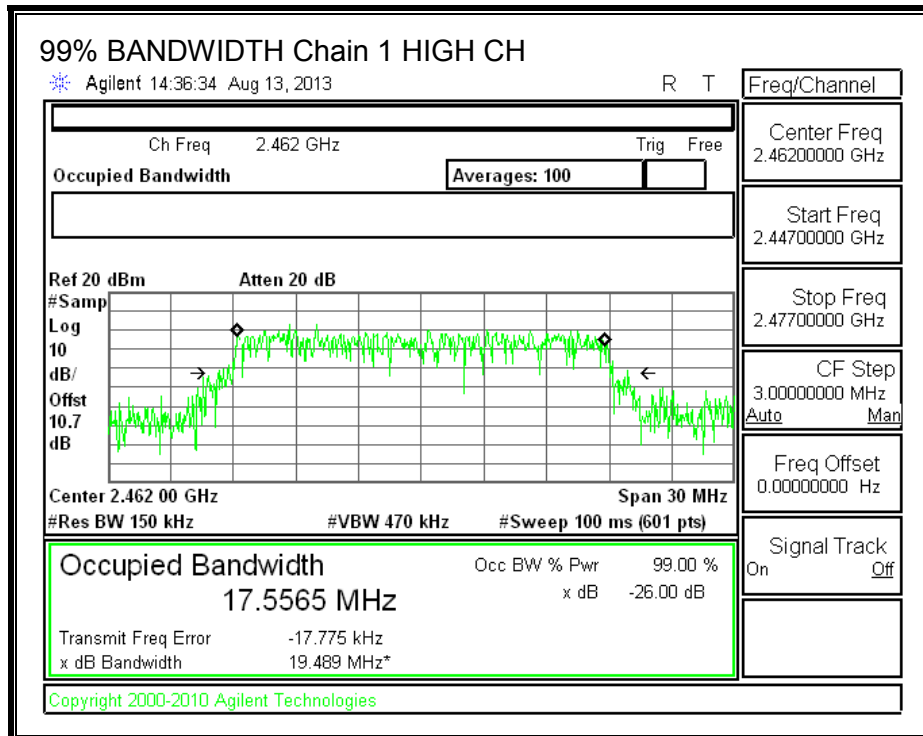
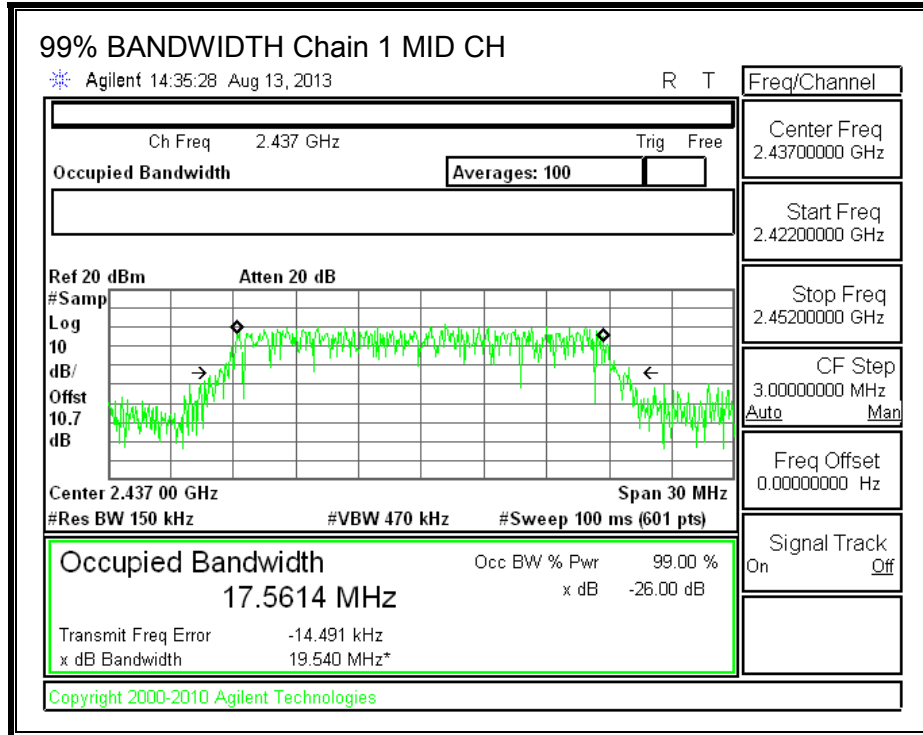
**99% BANDWIDTH, Chain 0**





**99% BANDWIDTH, Chain 1**





### 8.3.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.75 dB (including 10 dB pad and .75 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### RESULTS

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	2412	11.12	10.74	13.94
Low	2417	12.14	11.77	14.97
Mid	2437	11.97	11.66	14.83
High	2457	11.62	11.48	14.56
High	2462	10.01	10.55	13.30

### 8.3.4. OUTPUT POWER

#### LIMITS

FCC §15.247

IC RSS-210 A8.4

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 the same for each chain. The directional gain is equal to the antenna gain.

<b>Chain 0 Antenna Gain (dBi)</b>	<b>Chain 1 Antenna Gain (dBi)</b>	<b>Uncorrelated Chains Directional Gain (dBi)</b>
3.10	2.60	2.86

**RESULTS**

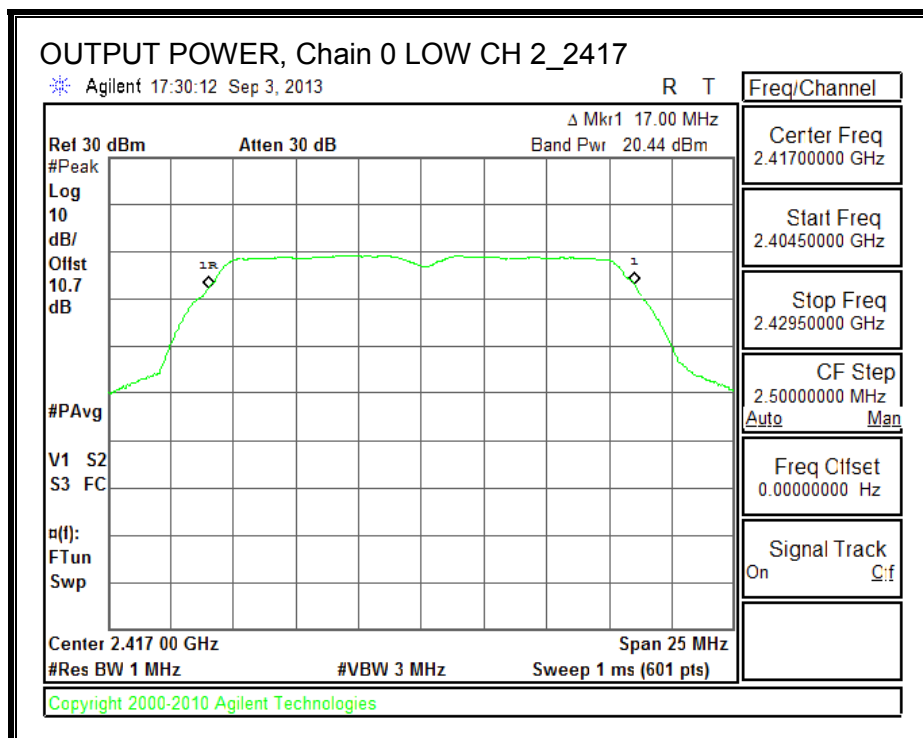
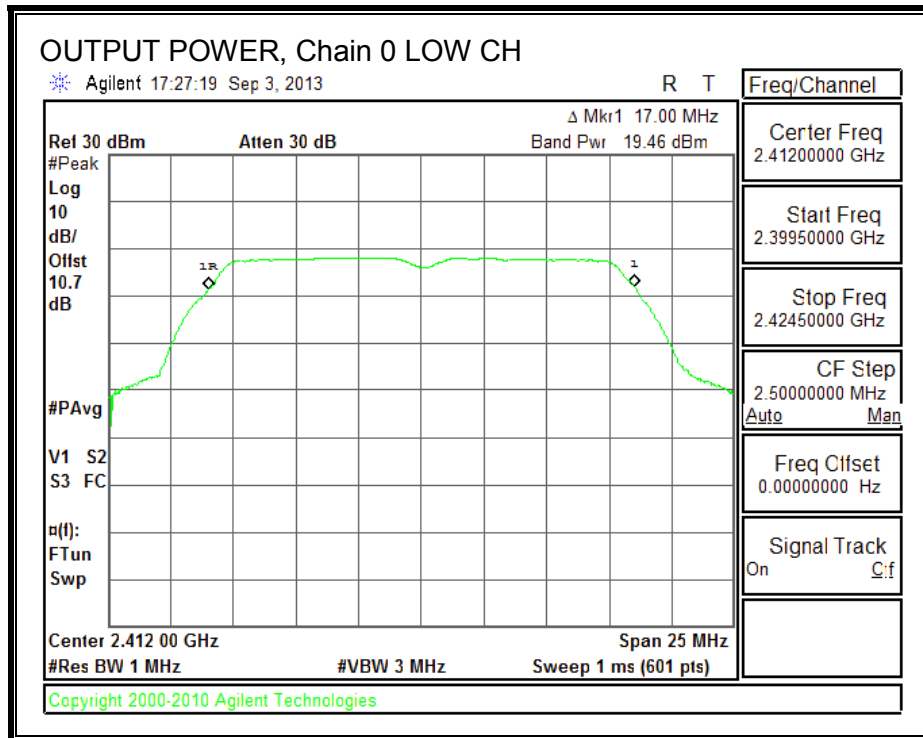
**Limits**

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	2.86	30.00	30	36	30.00
Low	2417	2.86	30.00	30	36	30.00
Mid	2437	2.86	30.00	30	36	30.00
High	2457	2.86	30.00	30	36	30.00
High	2462	2.86	30.00	30	36	30.00

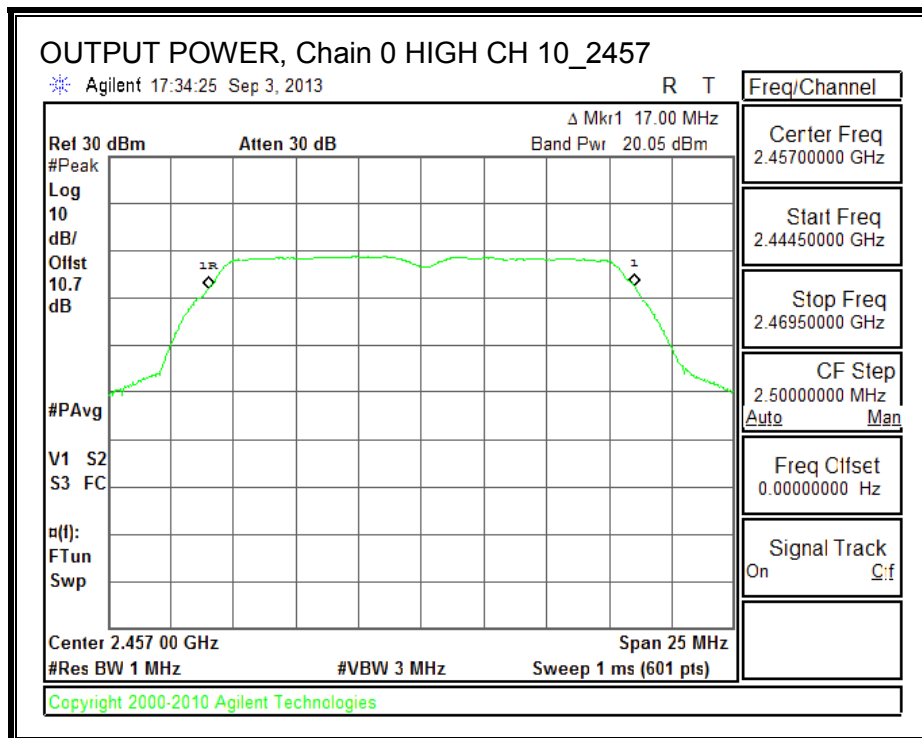
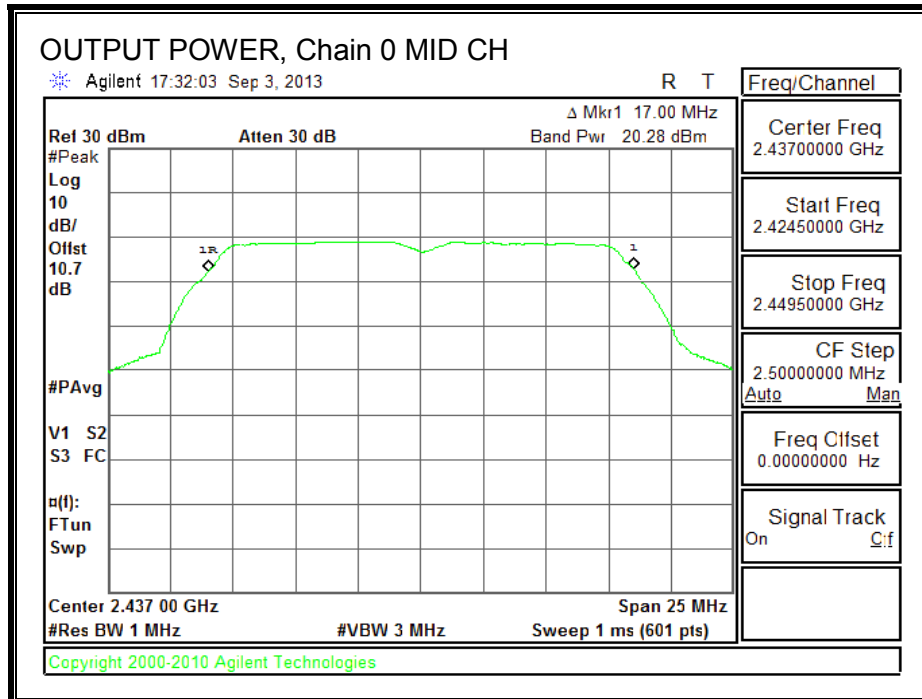
**Results**

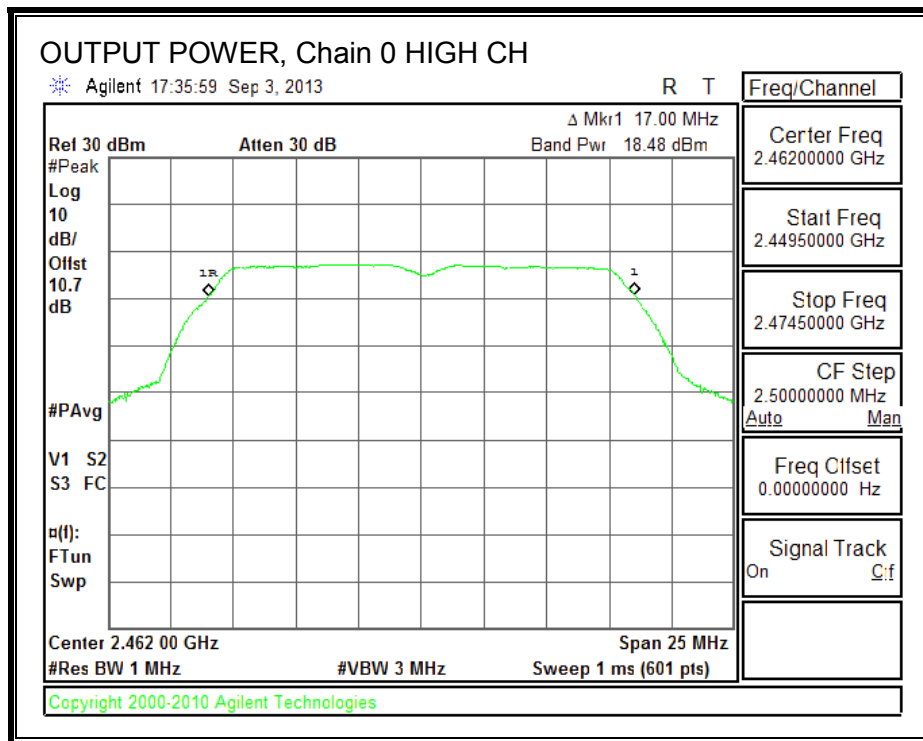
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margi (dB)
Low	2412	19.46	19.13	22.31	30.00	-7.69
Low	2417	20.44	20.10	23.28	30.00	-6.72
Mid	2437	20.28	20.55	23.43	30.00	-6.57
High	2457	20.05	19.88	22.98	30.00	-7.02
High	2462	18.48	18.85	21.68	30.00	-8.32

**OUTPUT POWER, Chain 0**

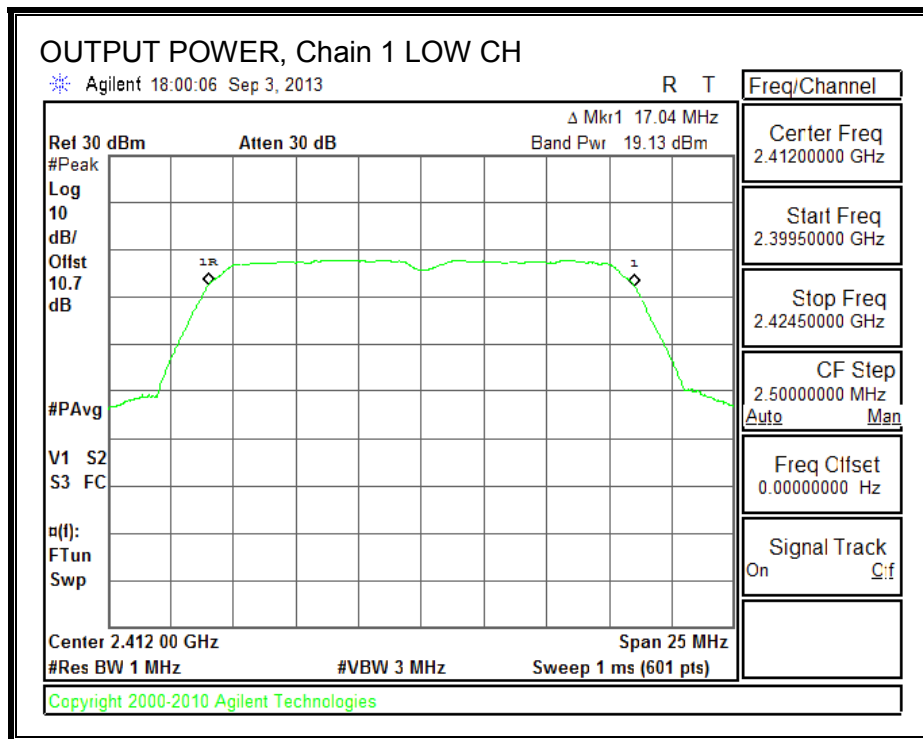


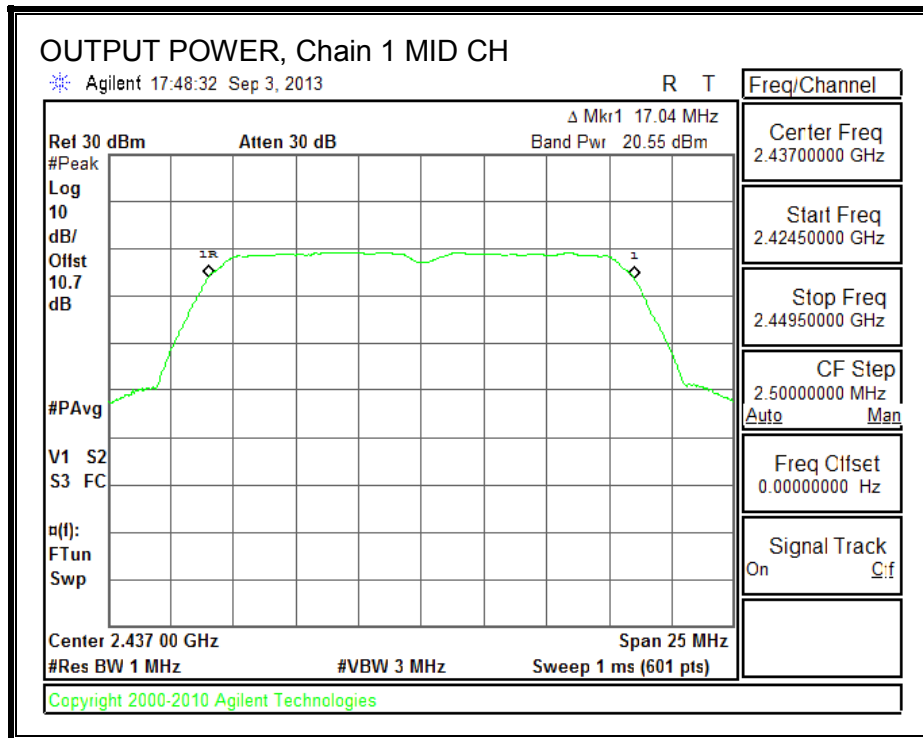
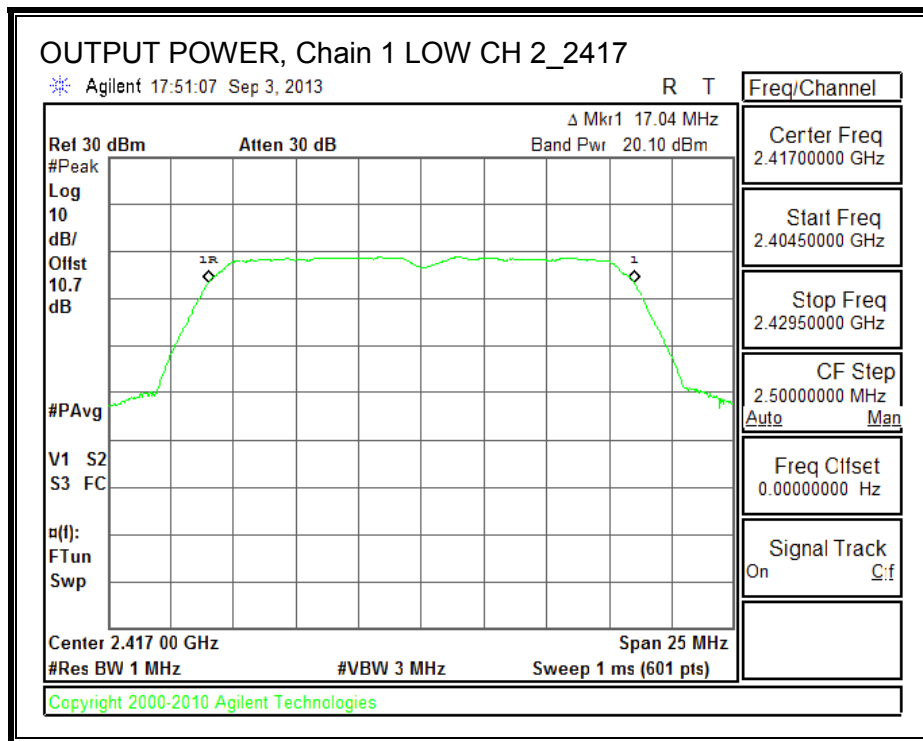


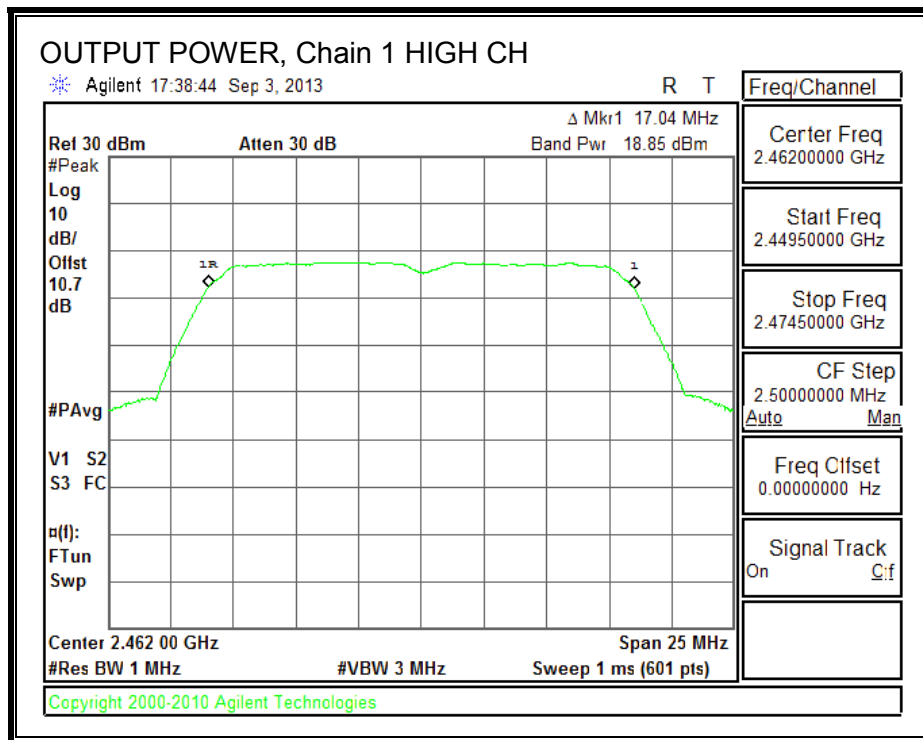
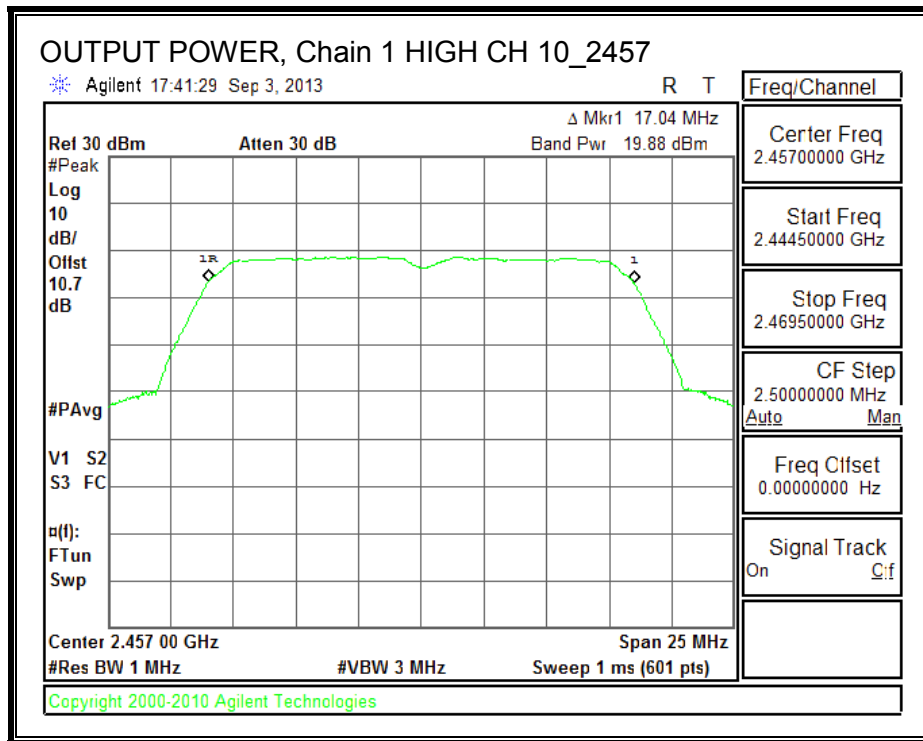




**OUTPUT POWER, Chain 1**







### 8.3.5. PSD

#### LIMITS

FCC §15.247

IC RSS-210 A8.2

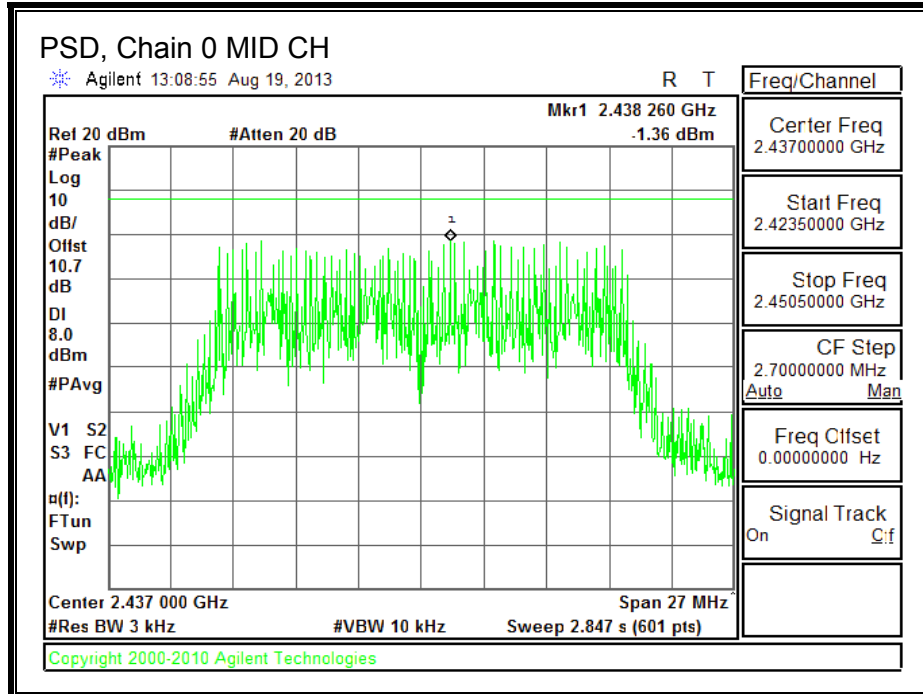
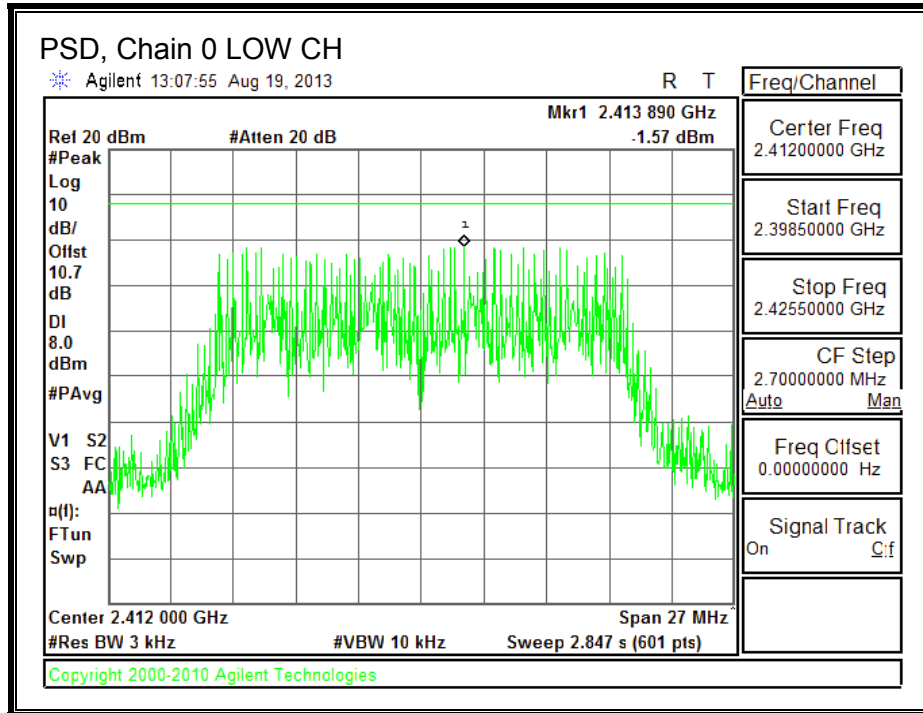
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

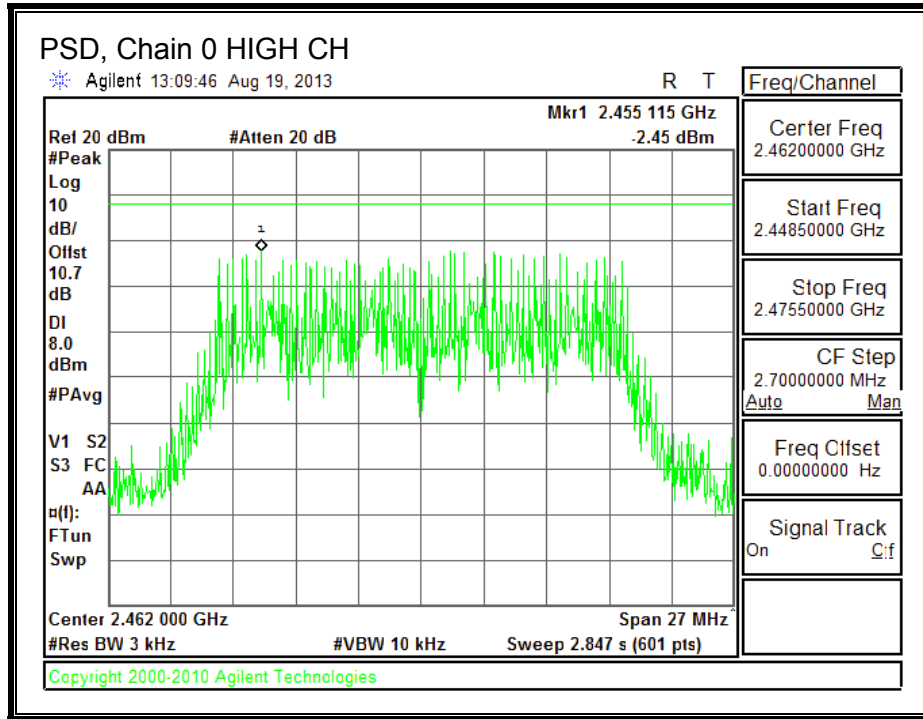
#### RESULTS

##### PSD Results

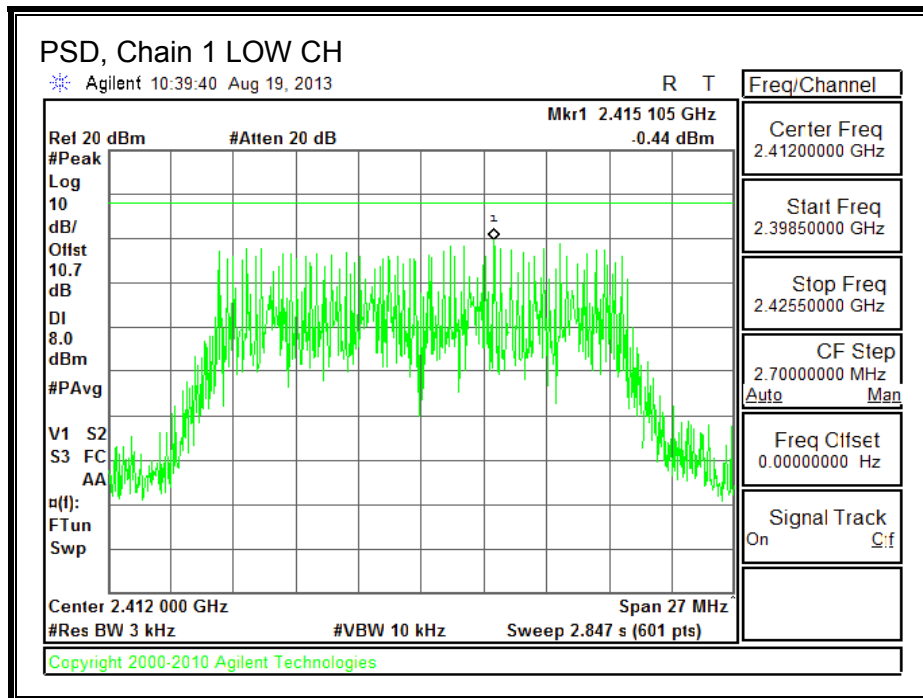
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-1.57	-0.44	2.04	8.0	-6.0
Mid	2437	-1.36	-0.44	2.13	8.0	-5.9
High	2462	-2.45	-0.86	1.43	8.0	-6.6

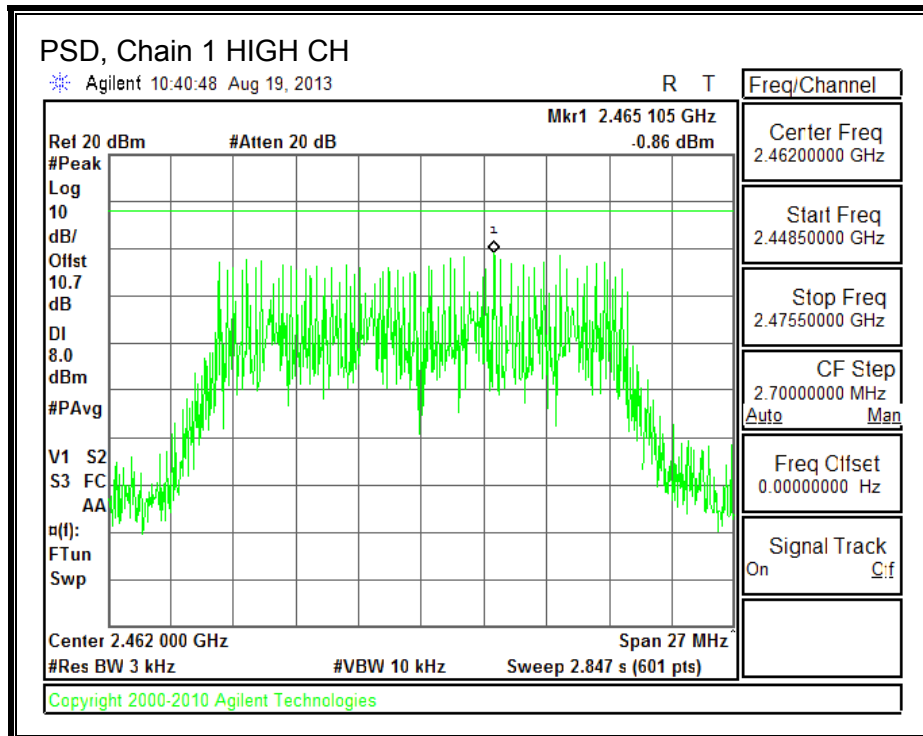
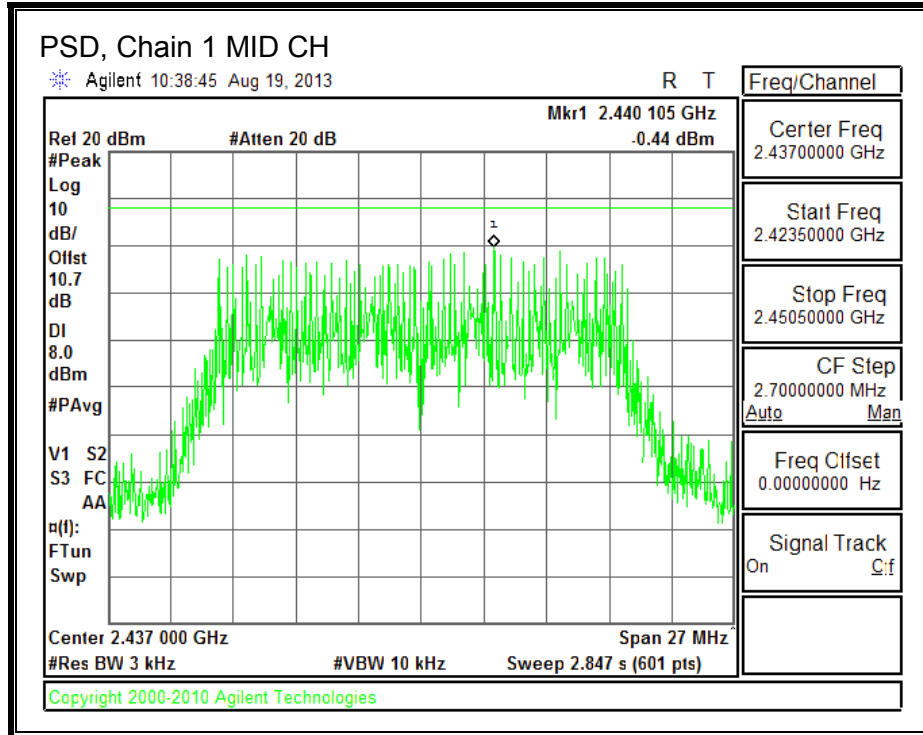
**PSD, Chain 0**





**PSD, Chain 1**







### **8.3.6. OUT-OF-BAND EMISSIONS**

#### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

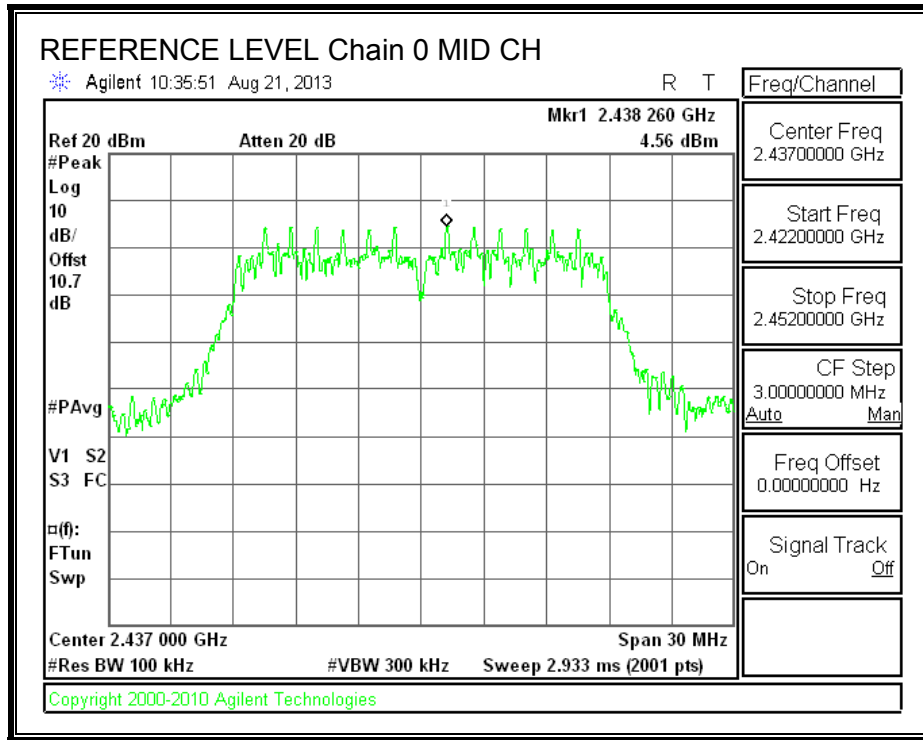
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

#### **TEST PROCEDURE**

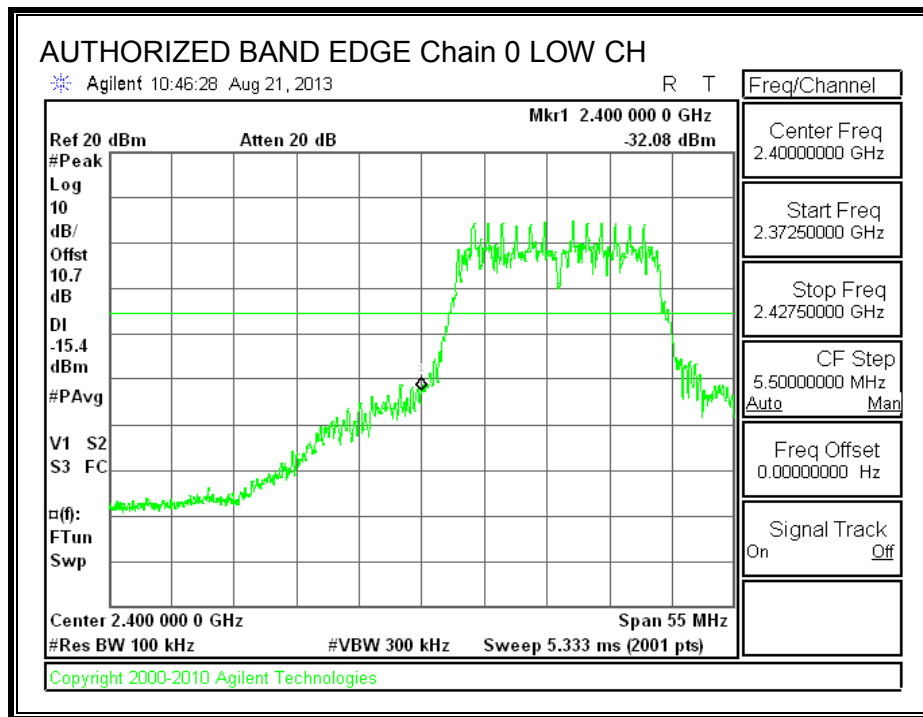
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

**RESULTS**

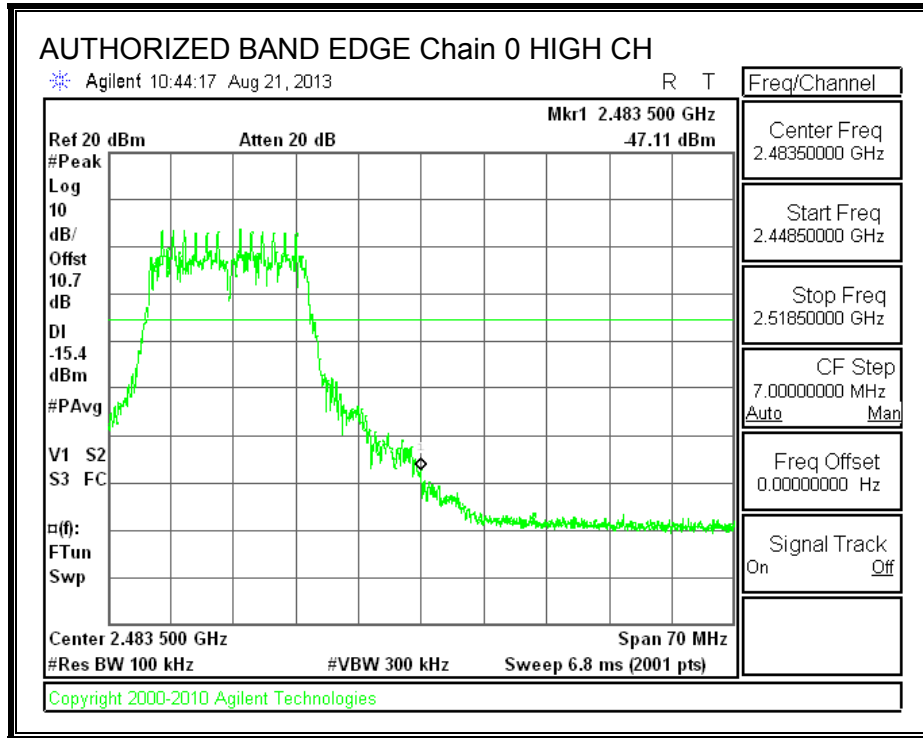
**IN-BAND REFERENCE LEVEL, Chain 0**



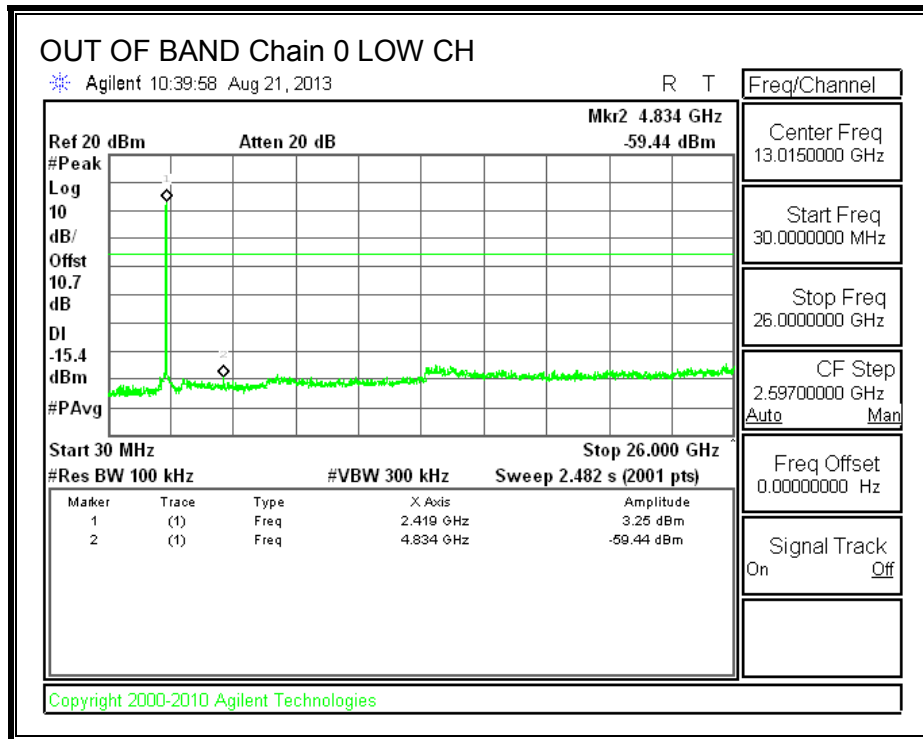
**LOW CHANNEL BANDEDGE, Chain 0**

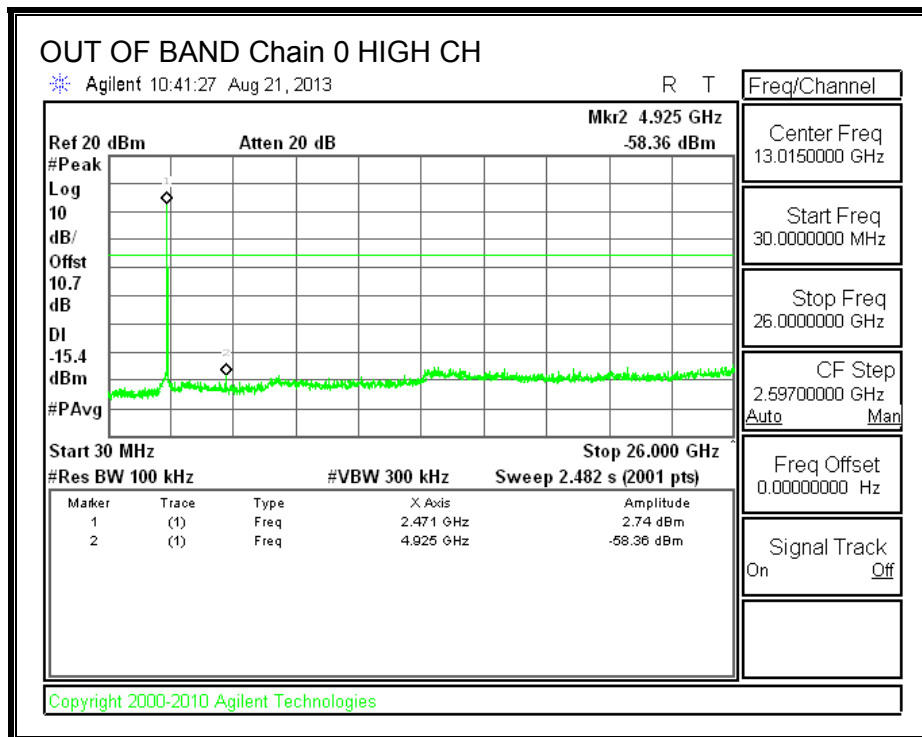
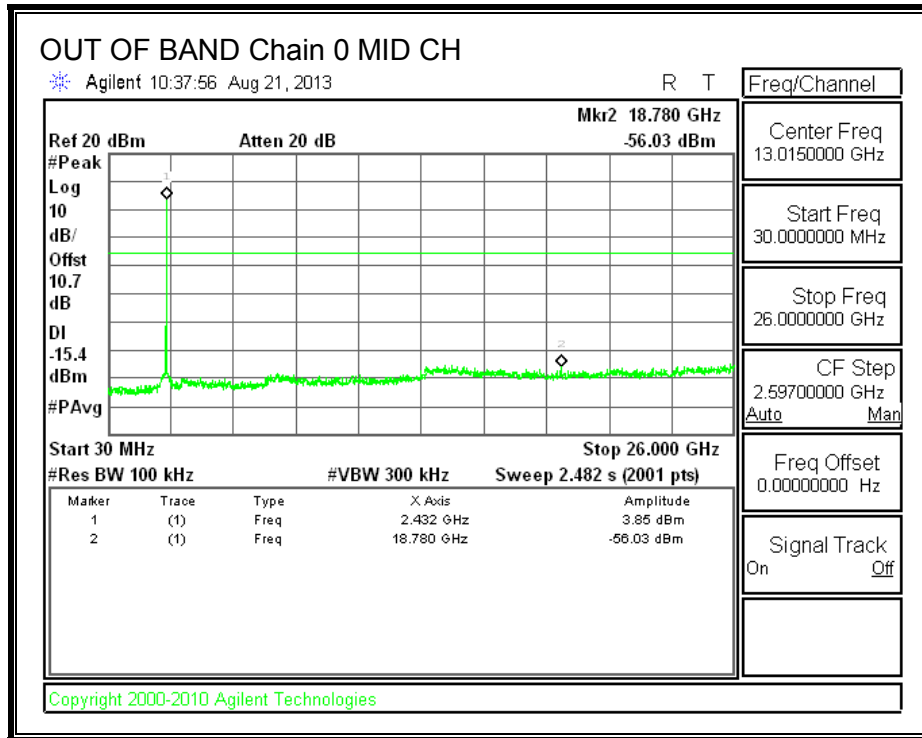


**HIGH CHANNEL BANDEDGE, Chain 0**

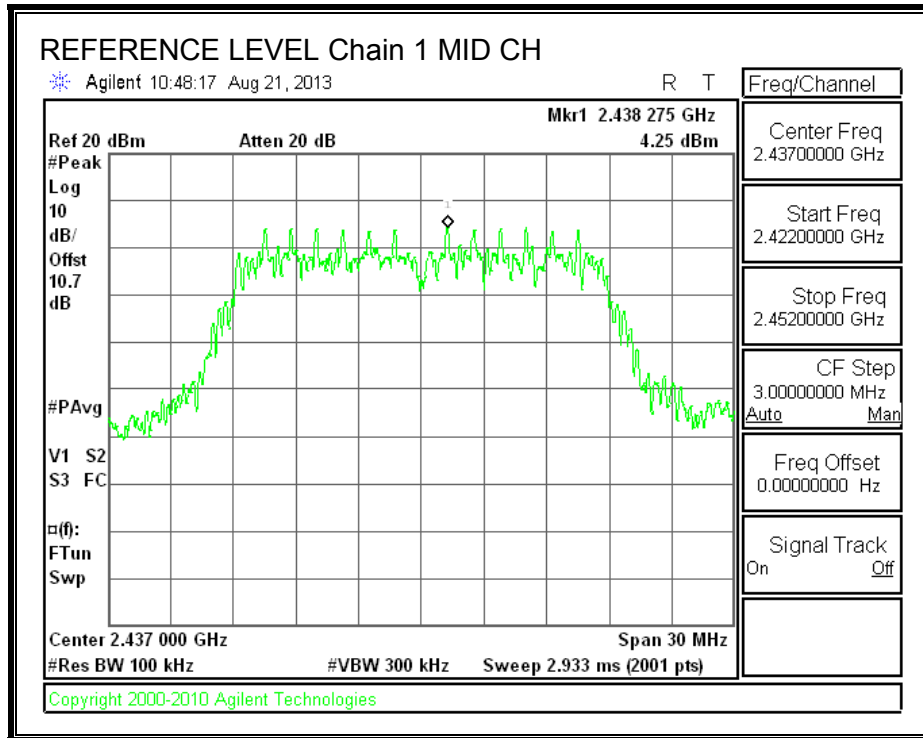


**OUT-OF-BAND EMISSIONS, Chain 0**

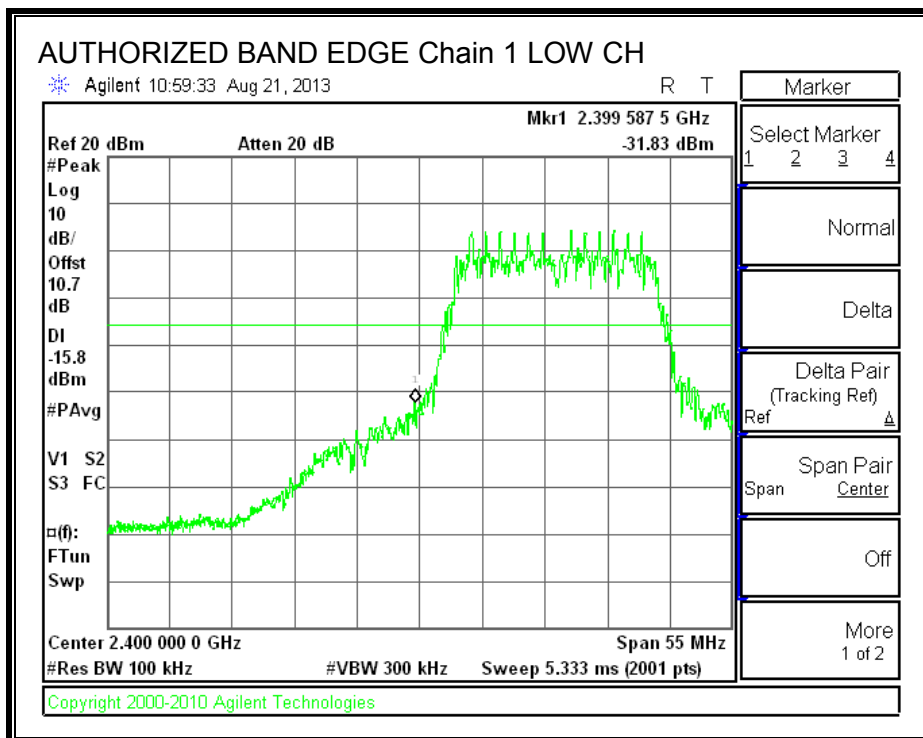




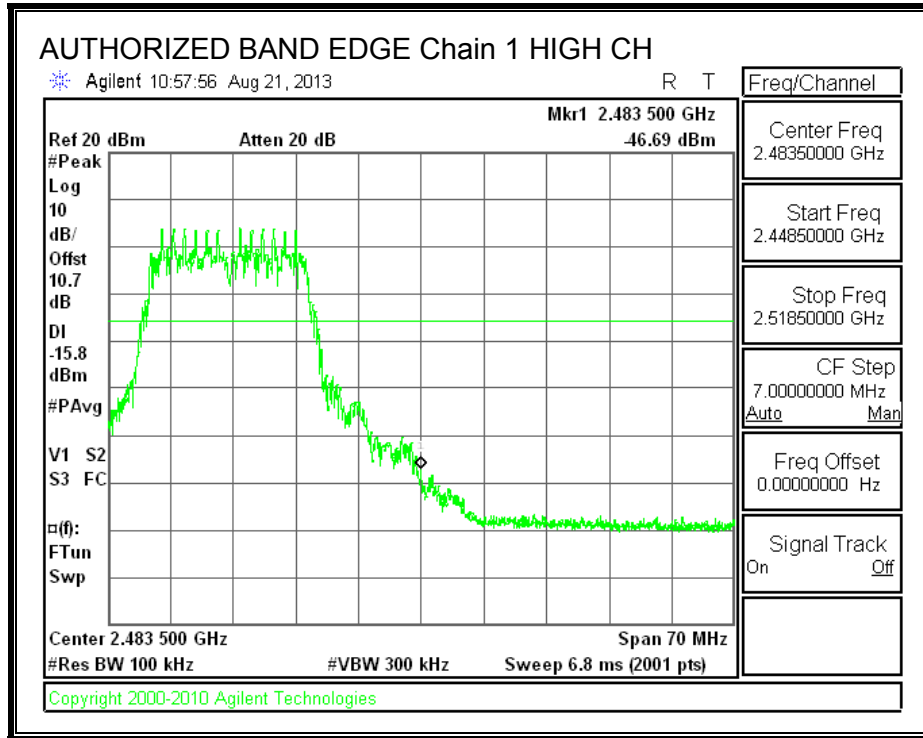
**IN-BAND REFERENCE LEVEL, Chain 1**



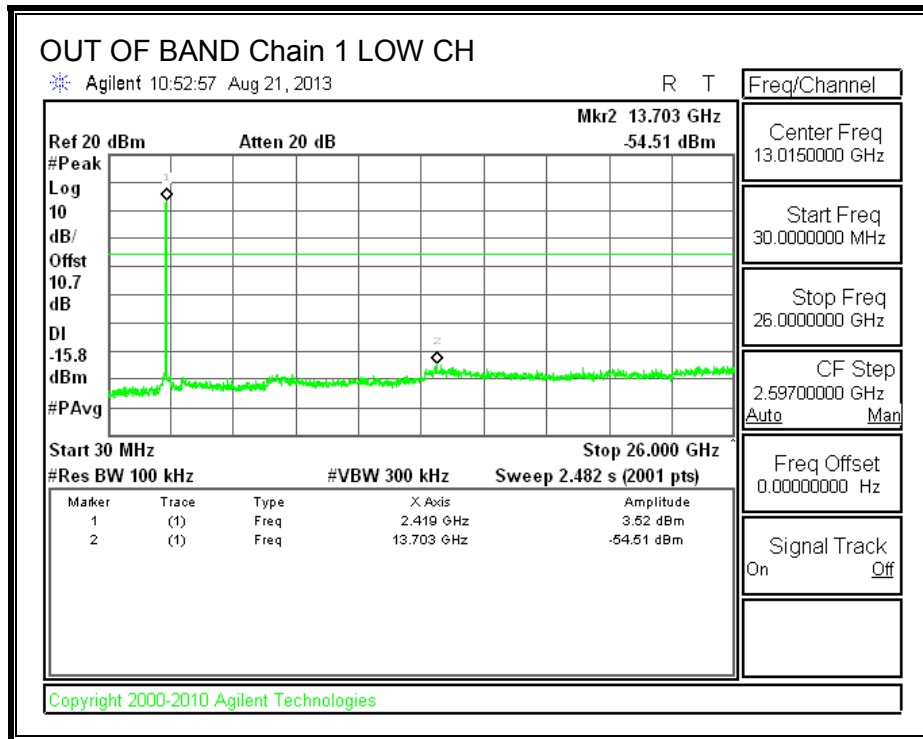
**LOW CHANNEL BANDEDGE, Chain 1**

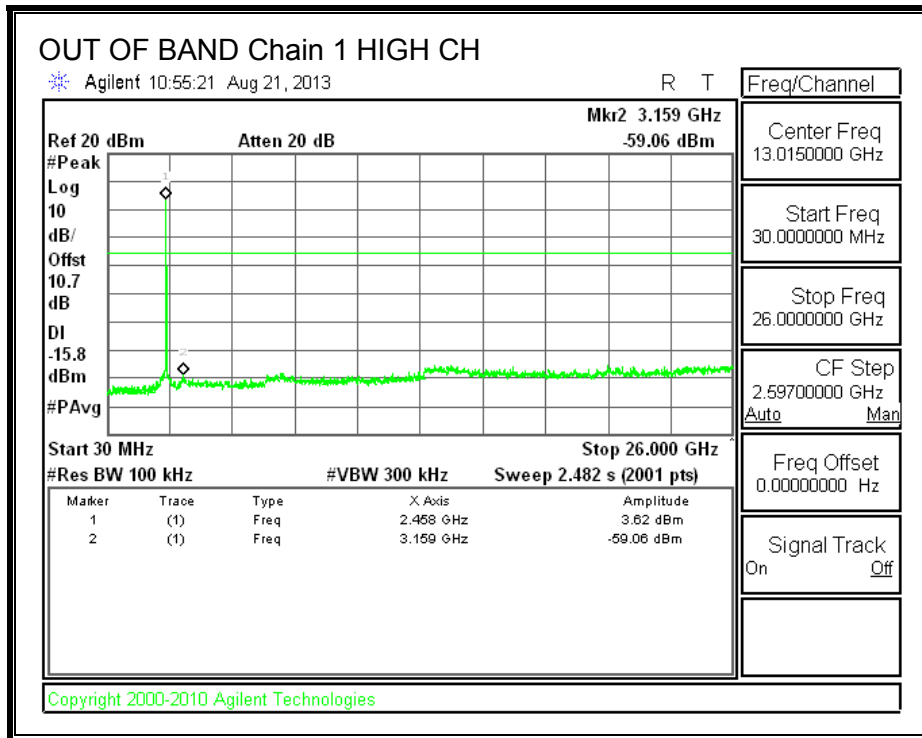
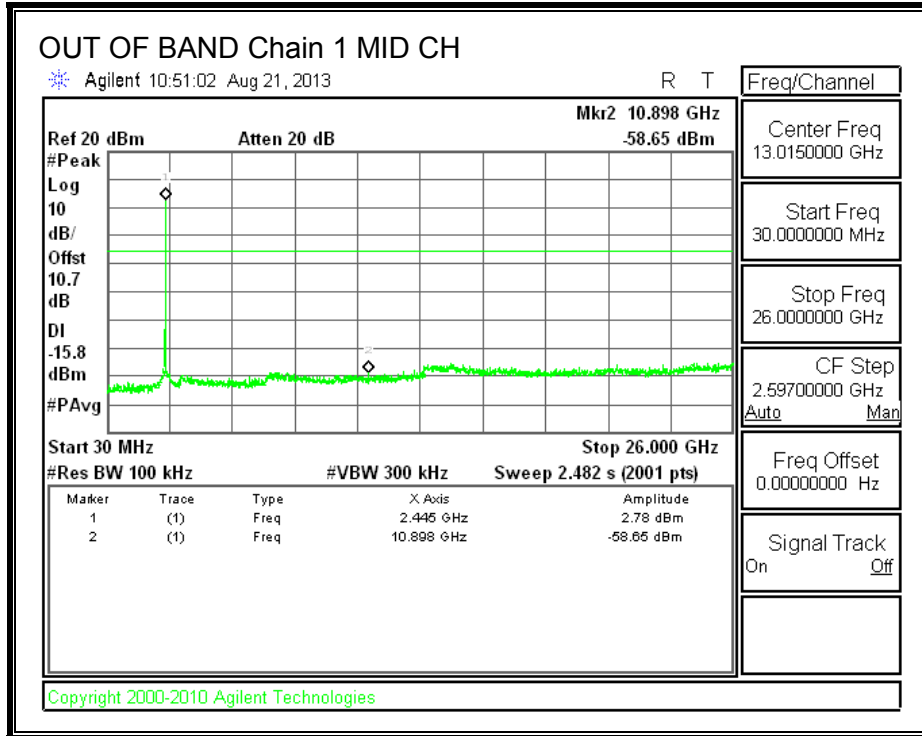


**HIGH CHANNEL BANDEDGE, Chain 1**



**OUT-OF-BAND EMISSIONS, Chain 1**





## 8.4. 802.11n HT40 MODE IN THE 2.4 GHz BAND

### 8.4.1. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

#### TEST PROCEDURE

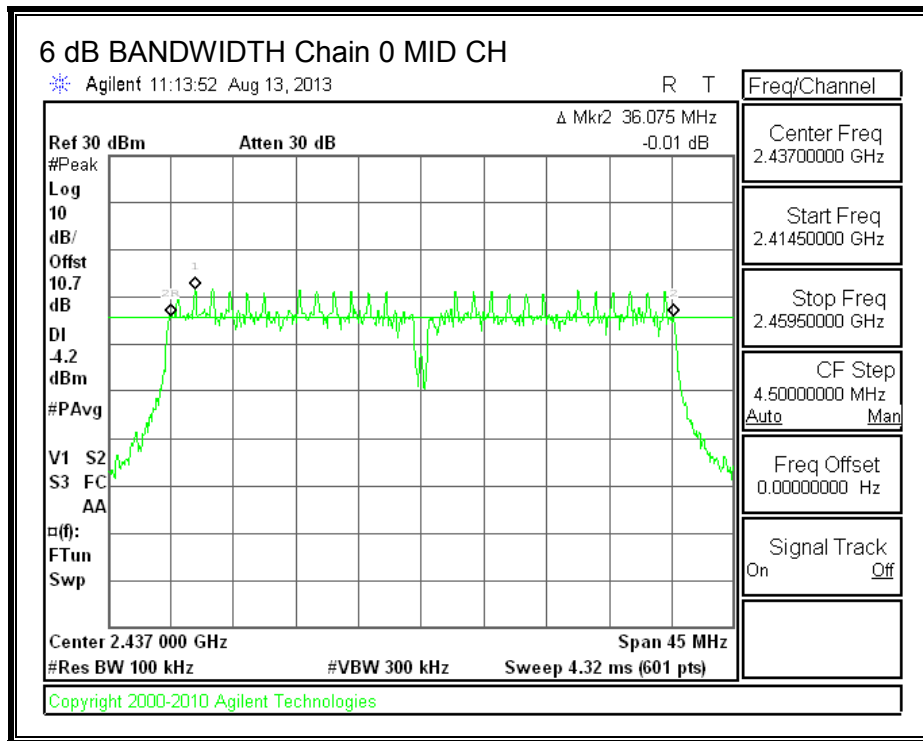
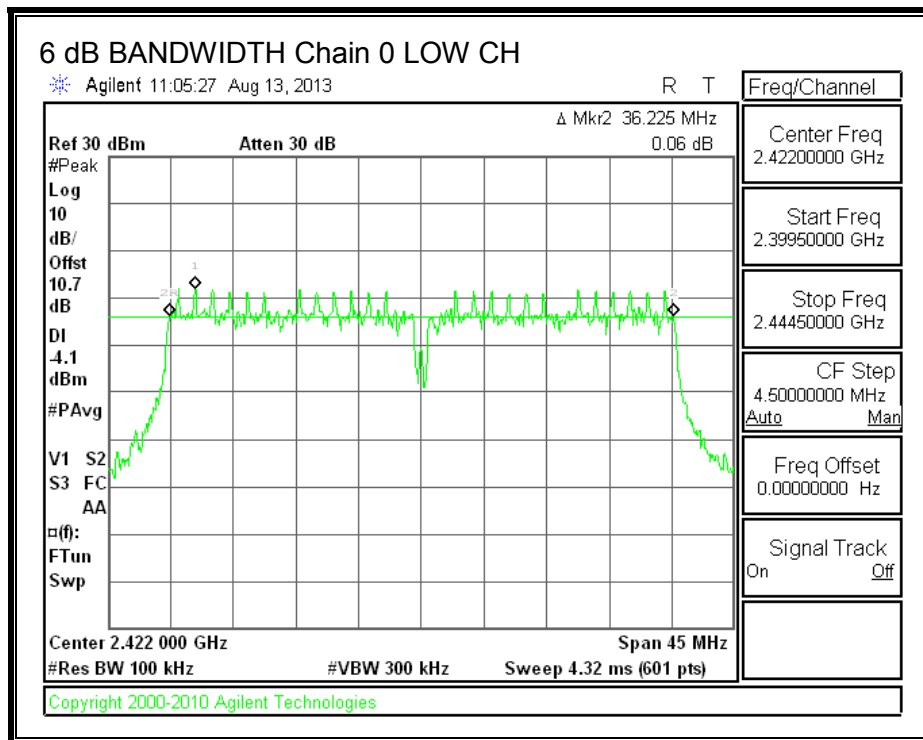
The transmitter output is connected to a spectrum analyzer with the RBW set between 1% and 5% of the EBW, the VBW  $\geq 3 \times$  RBW, peak detector and max hold.

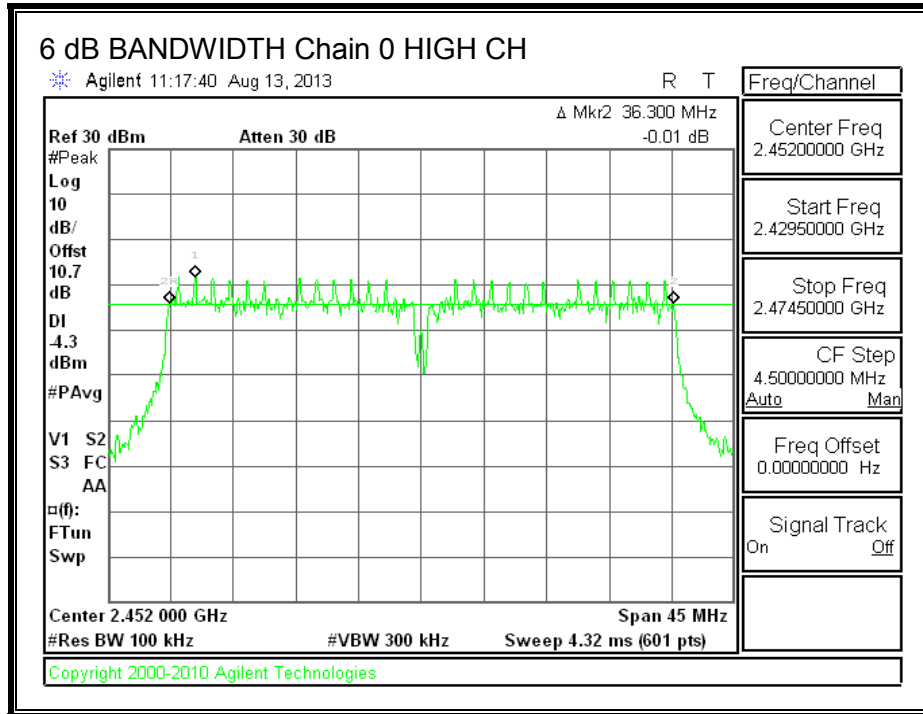
#### RESULTS

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	2422	36.225	36.000	0.5
Mid	2437	36.075	36.000	0.5
High	2452	36.300	36.000	0.5

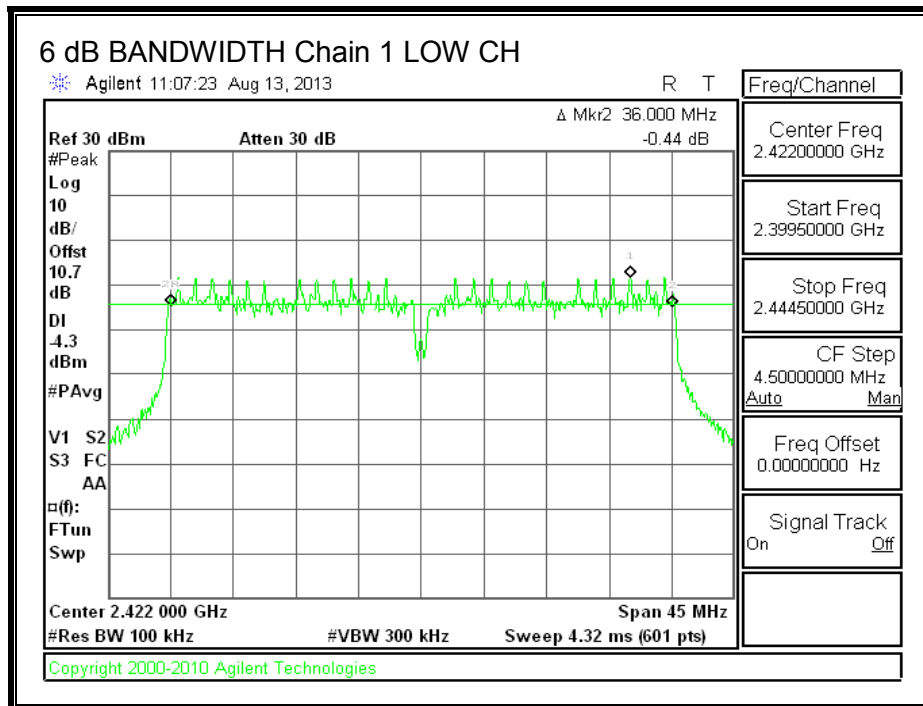


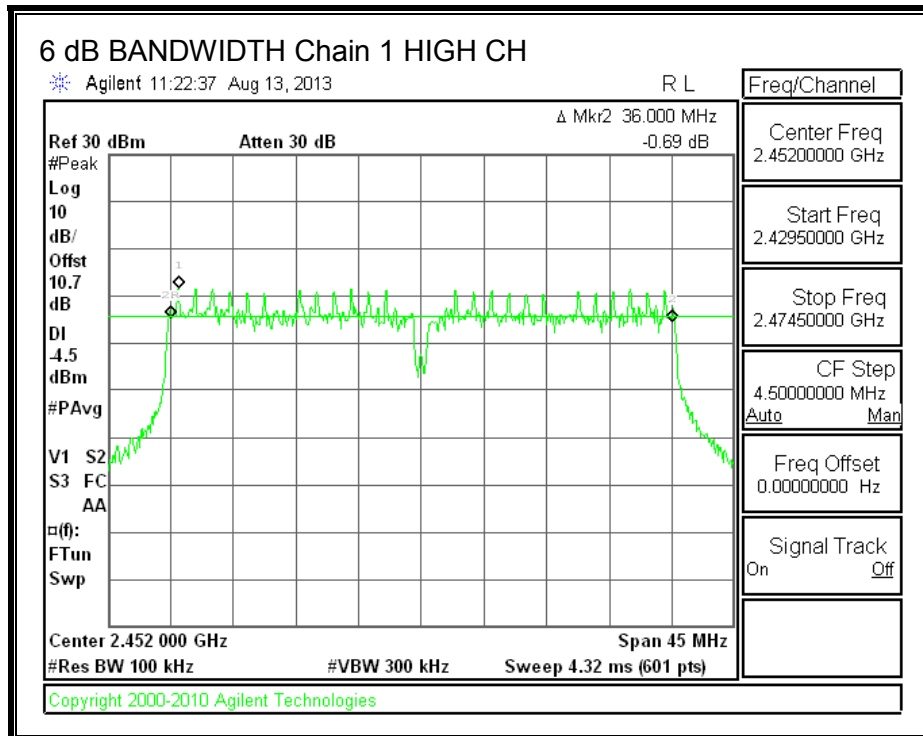
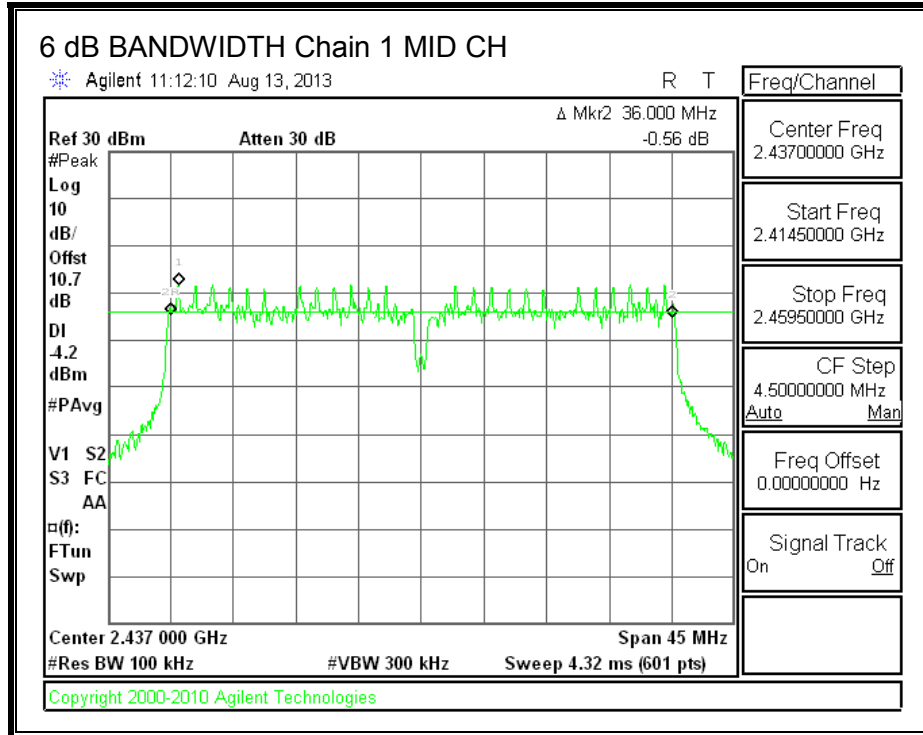
**6 dB BANDWIDTH, Chain 0**





**6 dB BANDWIDTH, Chain 1**





### 8.4.2. 99% BANDWIDTH

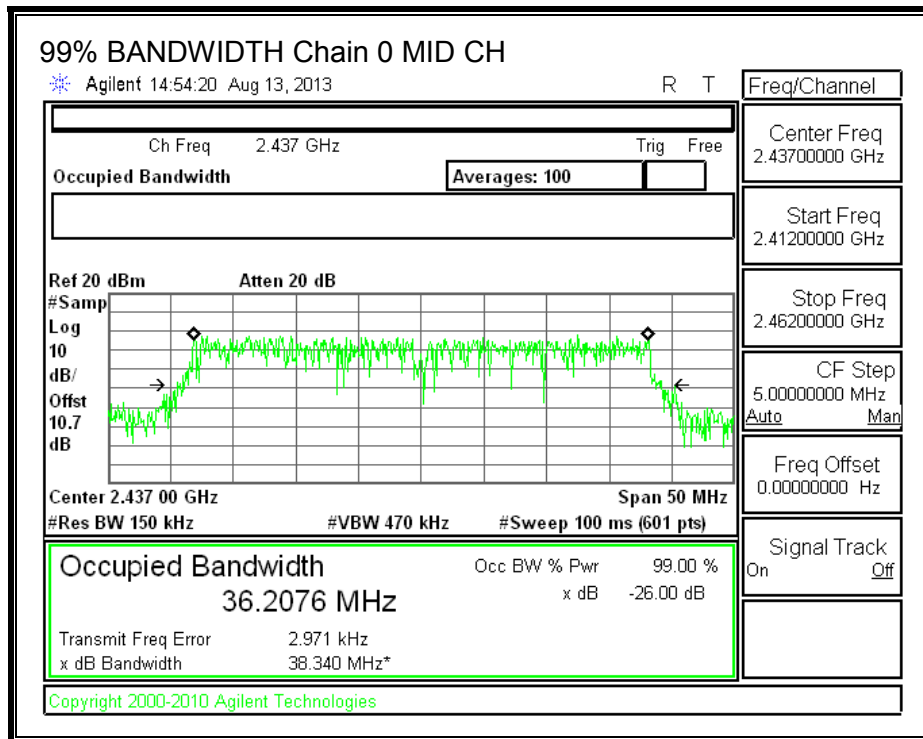
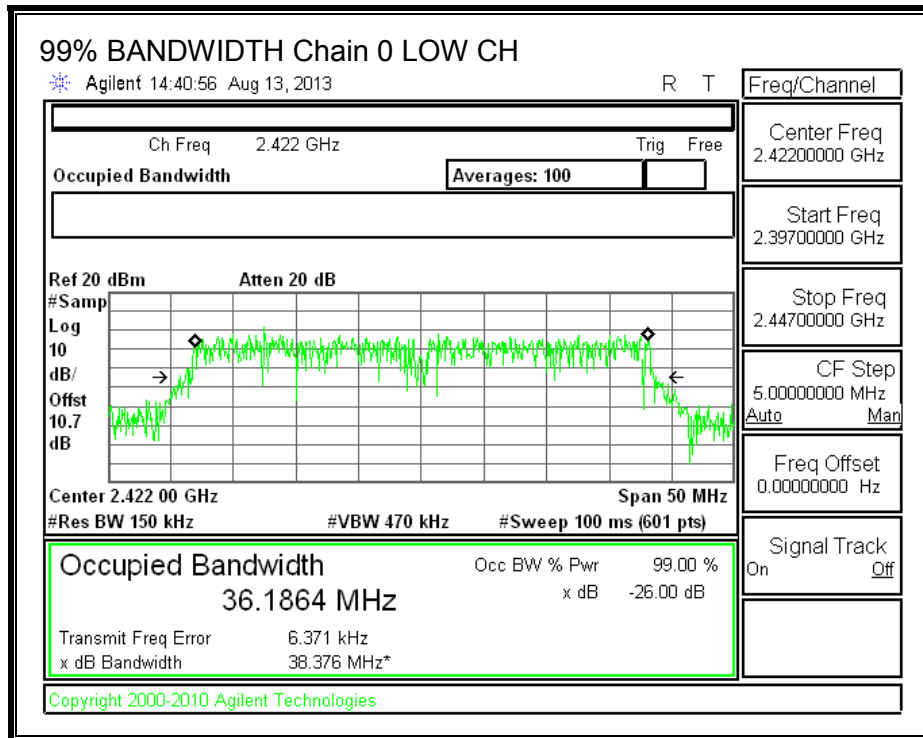
#### LIMITS

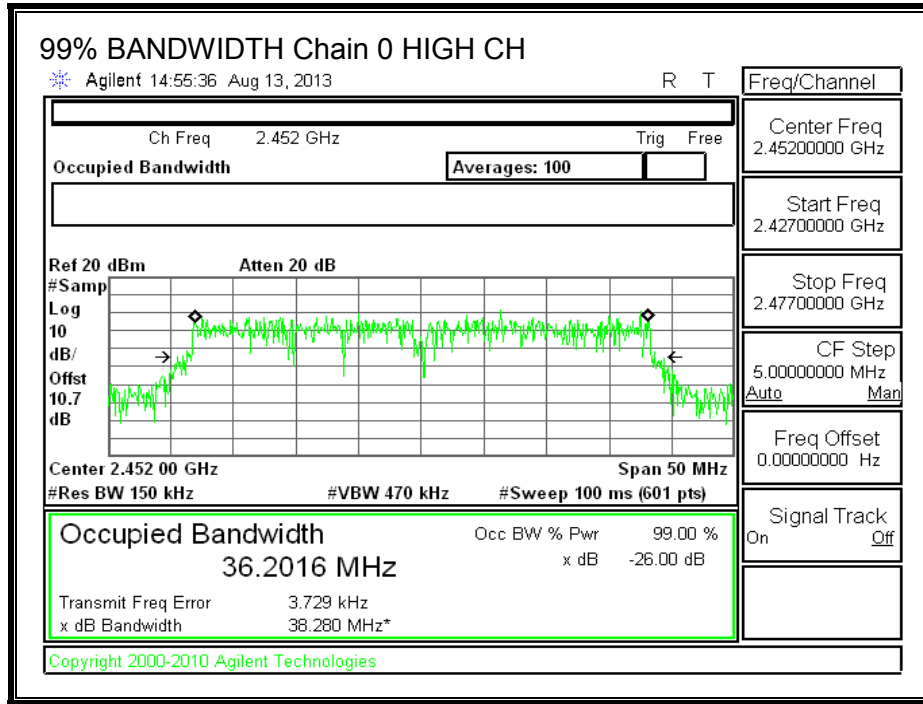
None; for reporting purposes only.

#### RESULTS

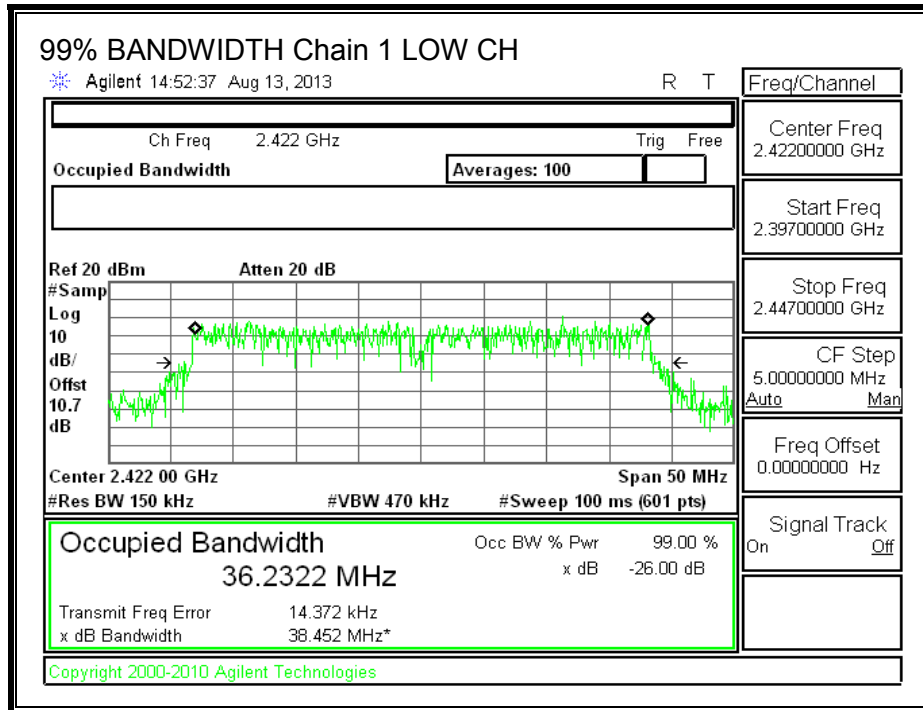
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	2422	36.1864	36.2322
Mid	2437	36.2076	36.2353
High	2452	36.2016	36.2329

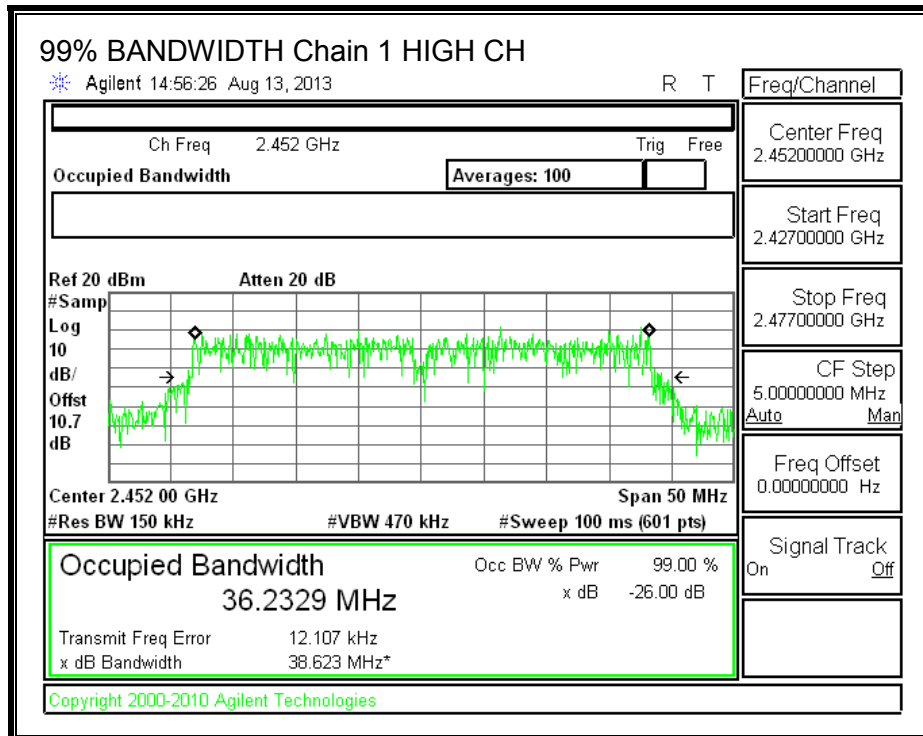
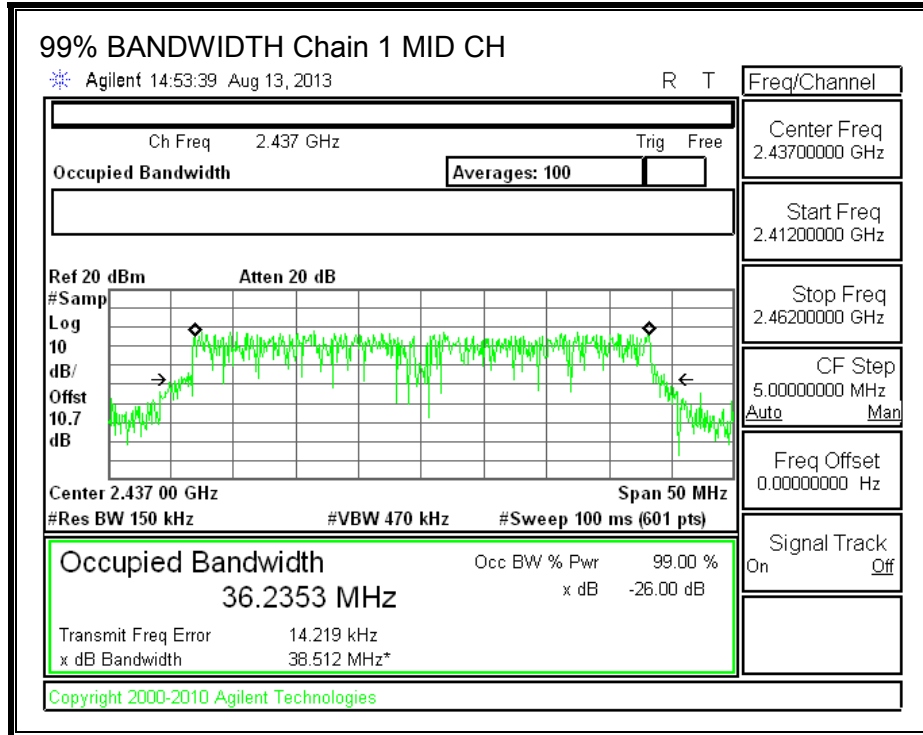
**99% BANDWIDTH, Chain 0**





**99% BANDWIDTH, Chain 1**





### 8.4.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.75 dB (including 10 dB pad and .75 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### RESULTS

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	2422	11.49	11.39	14.45
Mid	2437	15.87	15.88	18.89
High	2452	11.52	11.57	14.56



### 8.4.4. OUTPUT POWER

#### LIMITS

FCC §15.247

IC RSS-210 A8.4

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 the same for each chain. The directional gain is equal to the antenna gain.

<b>Chain 0 Antenna Gain (dBi)</b>	<b>Chain 1 Antenna Gain (dBi)</b>	<b>Uncorrelated Chains Directional Gain (dBi)</b>
3.10	2.60	2.86

**RESULTS**

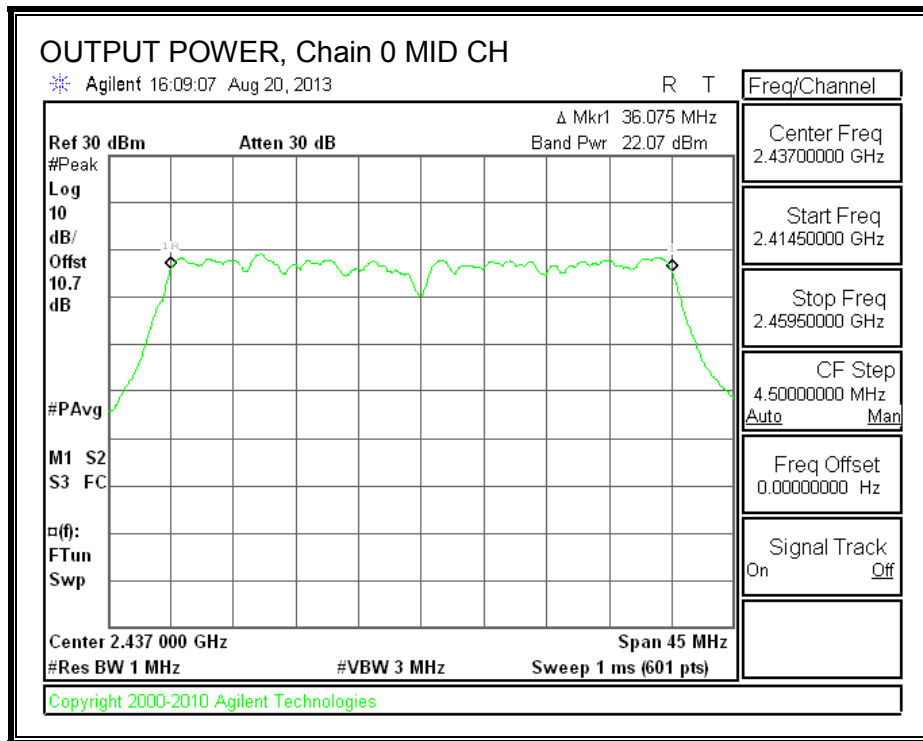
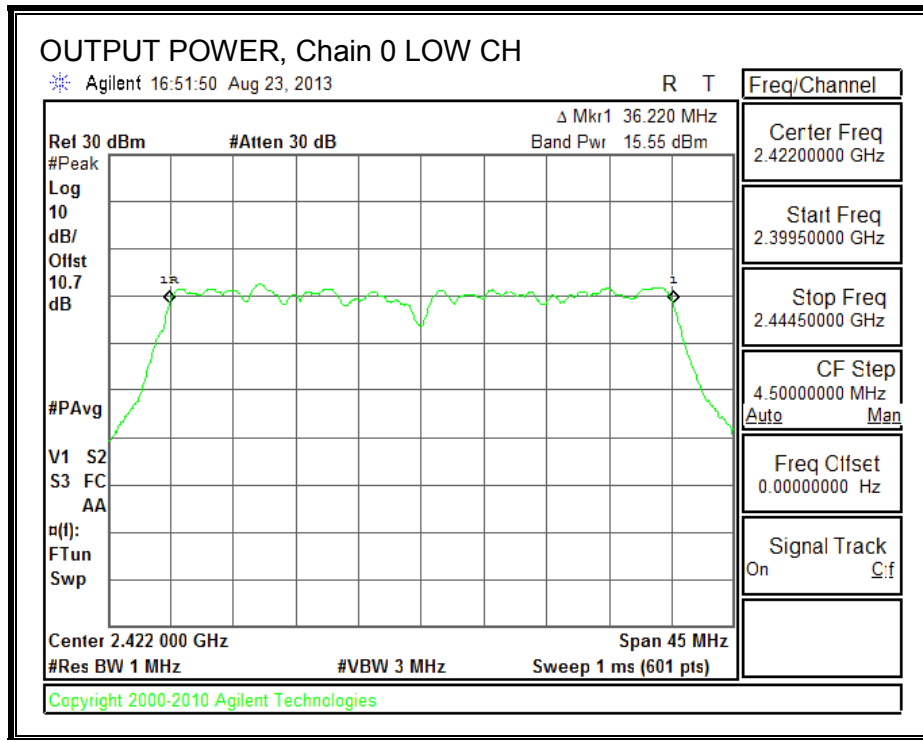
**Limits**

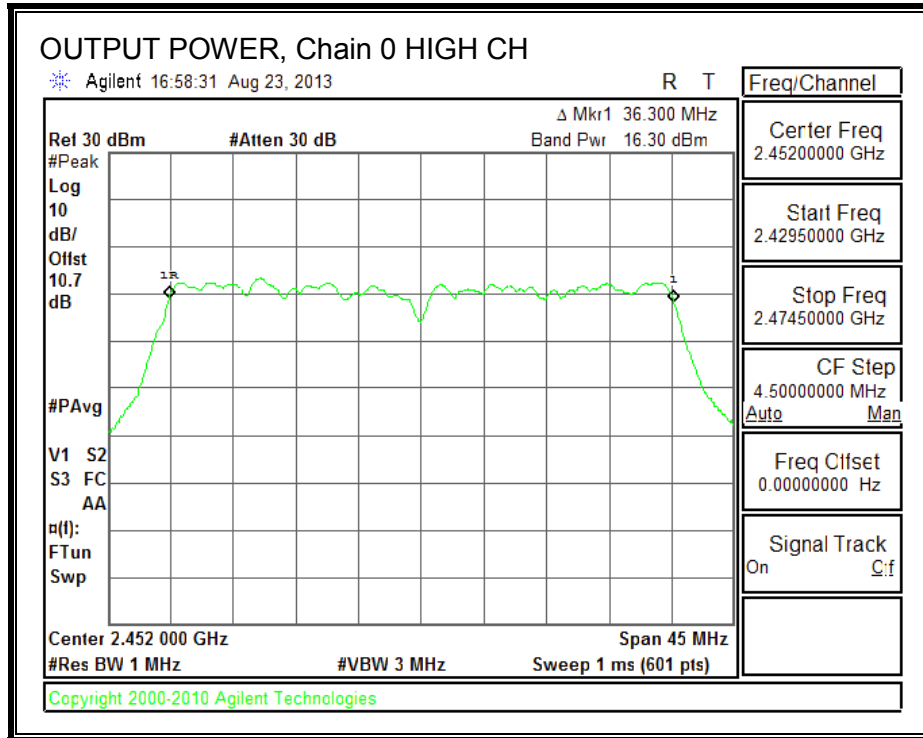
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	2.86	30.00	30	36	30.00
Mid	2437	2.86	30.00	30	36	30.00
High	2462	2.86	30.00	30	36	30.00

**Results**

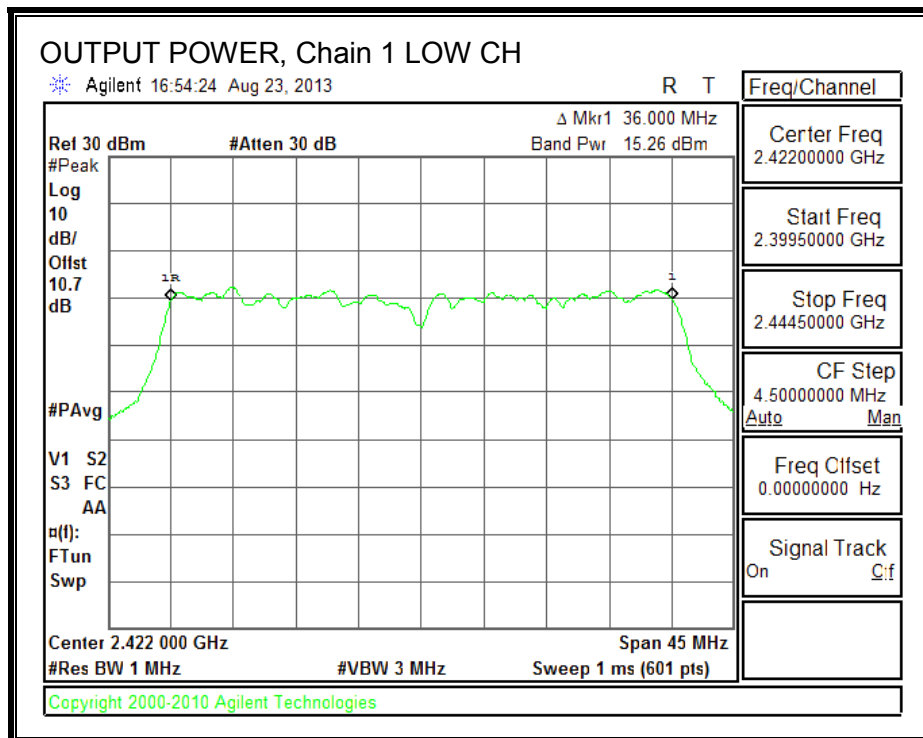
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margi (dB)
Low	2412	15.55	15.26	18.42	30.00	-11.58
Mid	2437	22.07	22.23	25.16	30.00	-4.84
High	2462	16.30	16.14	19.23	30.00	-10.77

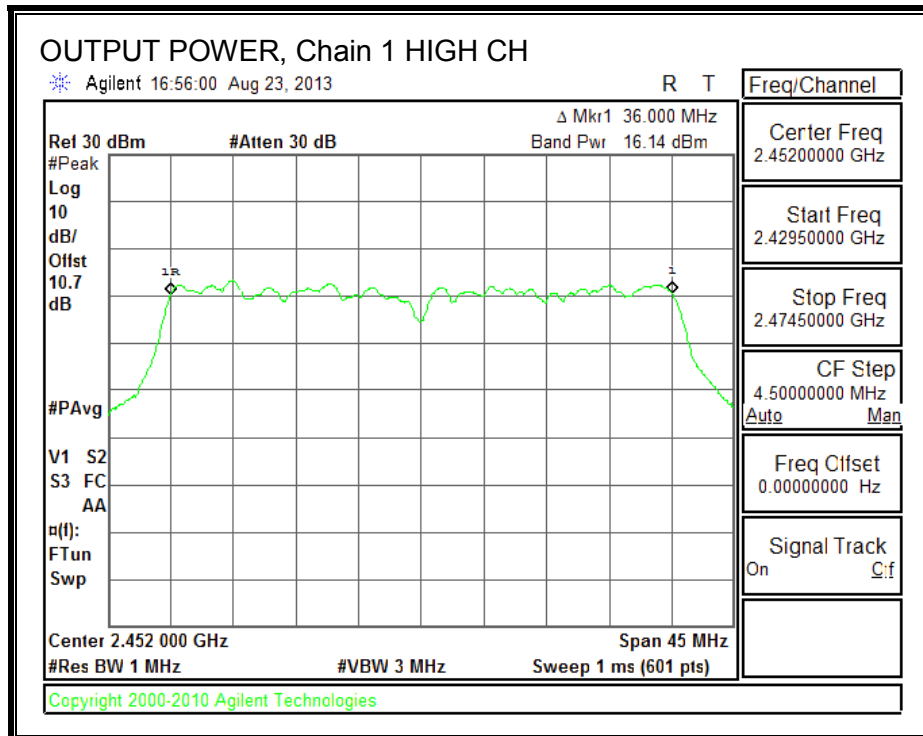
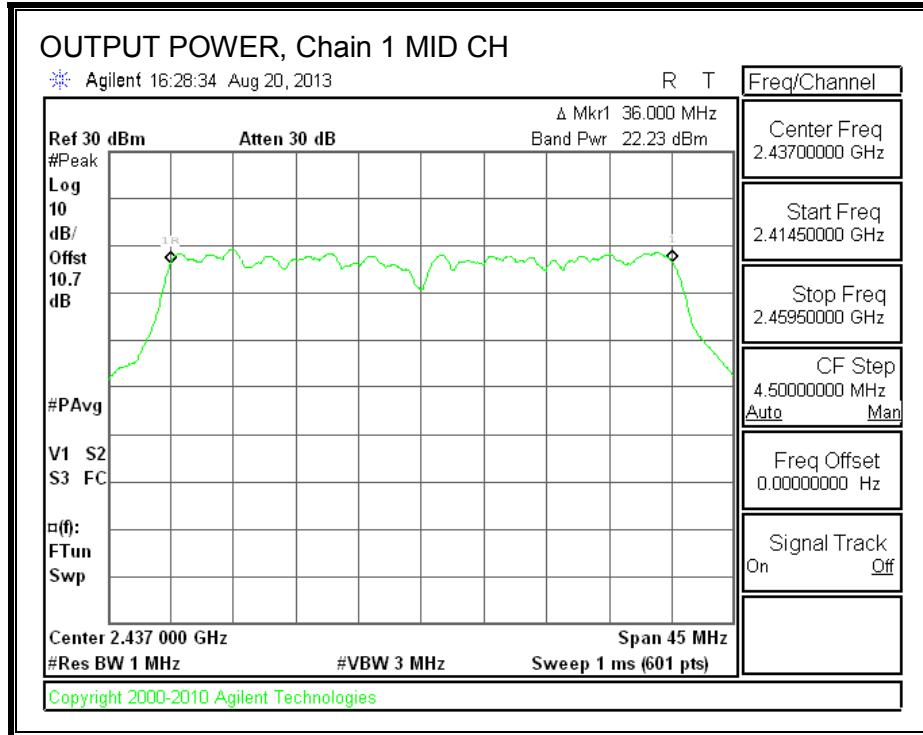
**OUTPUT POWER, Chain 0**





**OUTPUT POWER, Chain 1**





### 8.4.5. PSD

#### LIMITS

FCC §15.247

IC RSS-210 A8.2

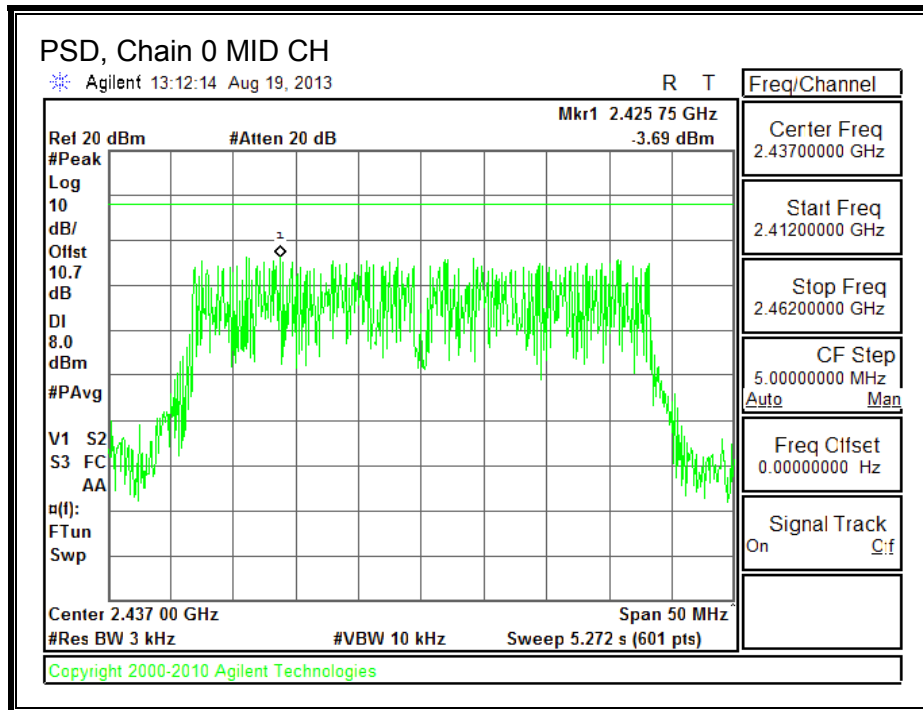
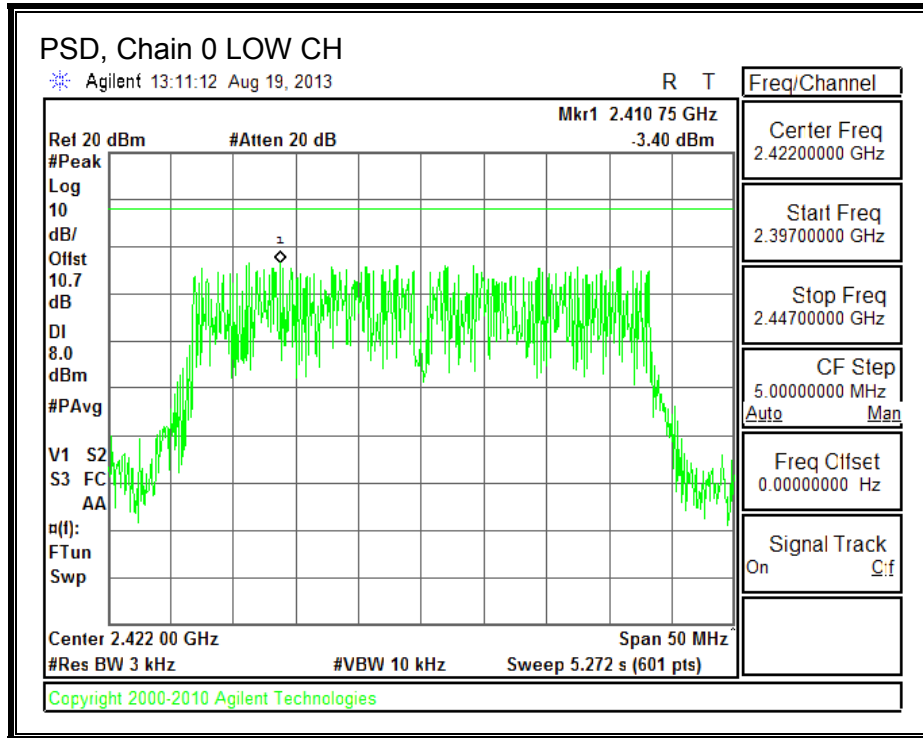
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

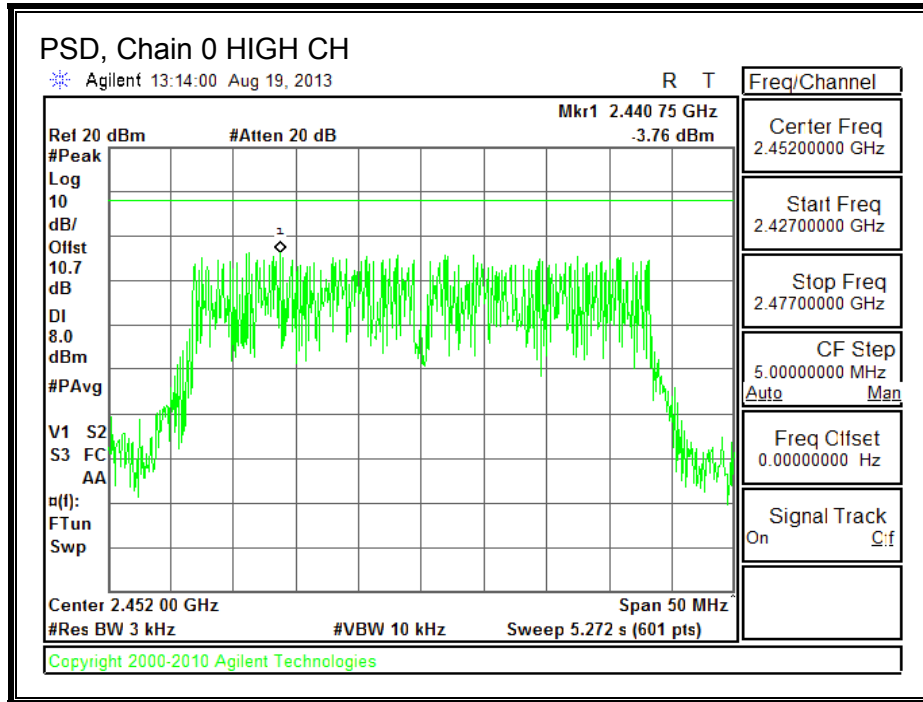
#### RESULTS

##### PSD Results

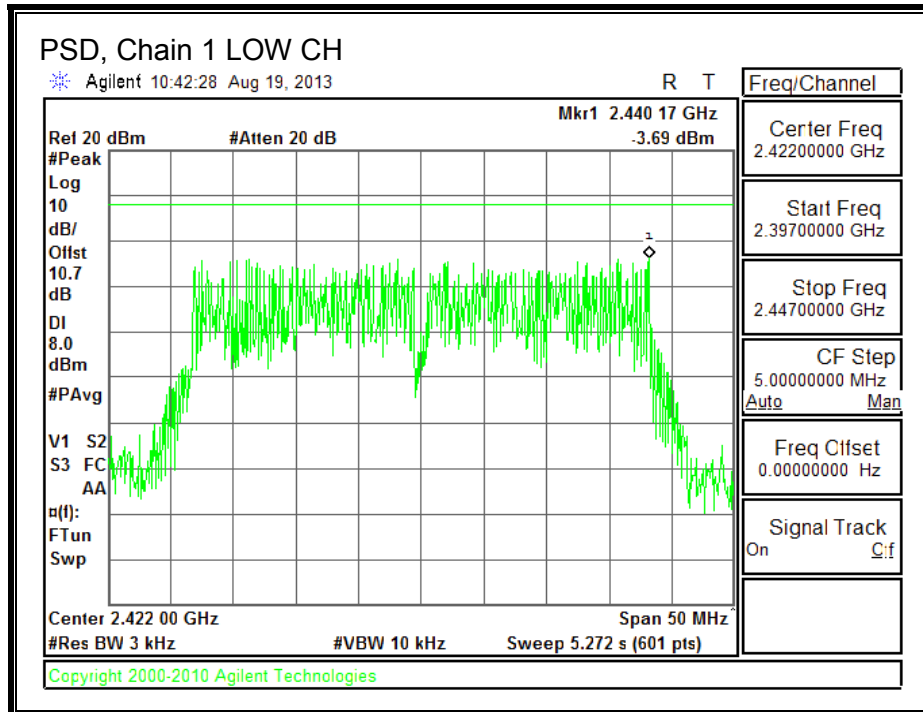
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-3.40	-3.69	-0.53	8.0	-8.5
Mid	2437	-3.69	-3.03	-0.34	8.0	-8.3
High	2462	-3.76	-2.65	-0.16	8.0	-8.2

**PSD, Chain 0**

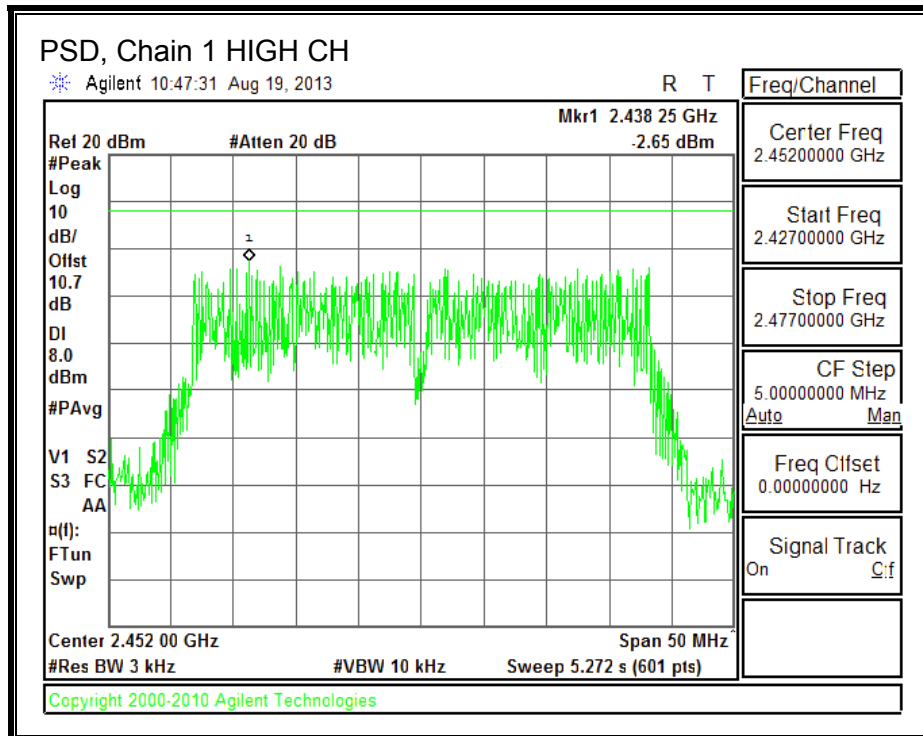
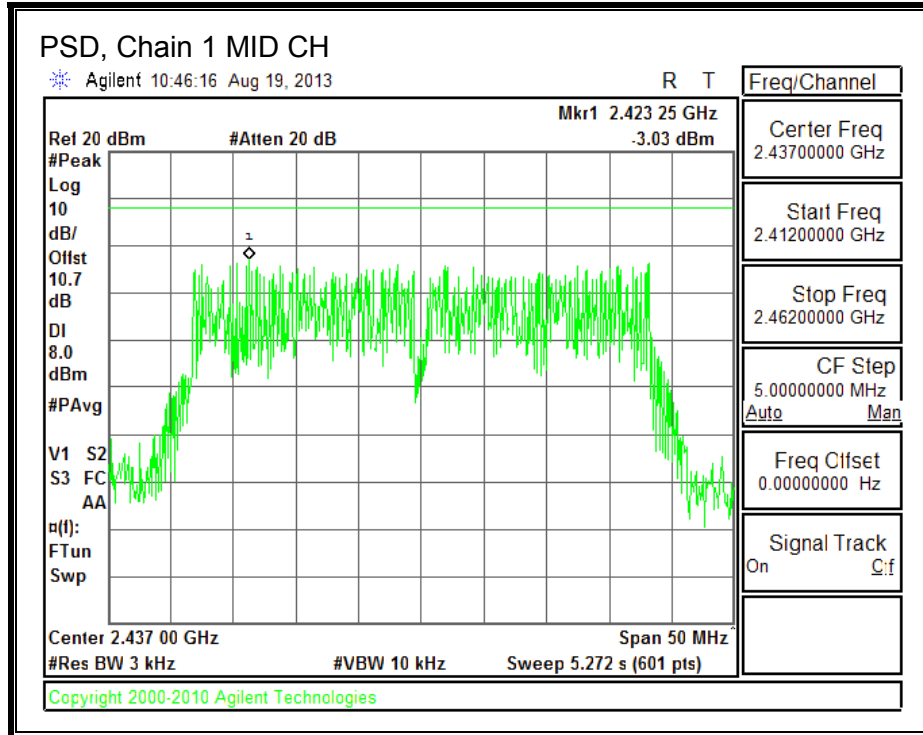




**PSD, Chain 1**







## 8.4.6. OUT-OF-BAND EMISSIONS

### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

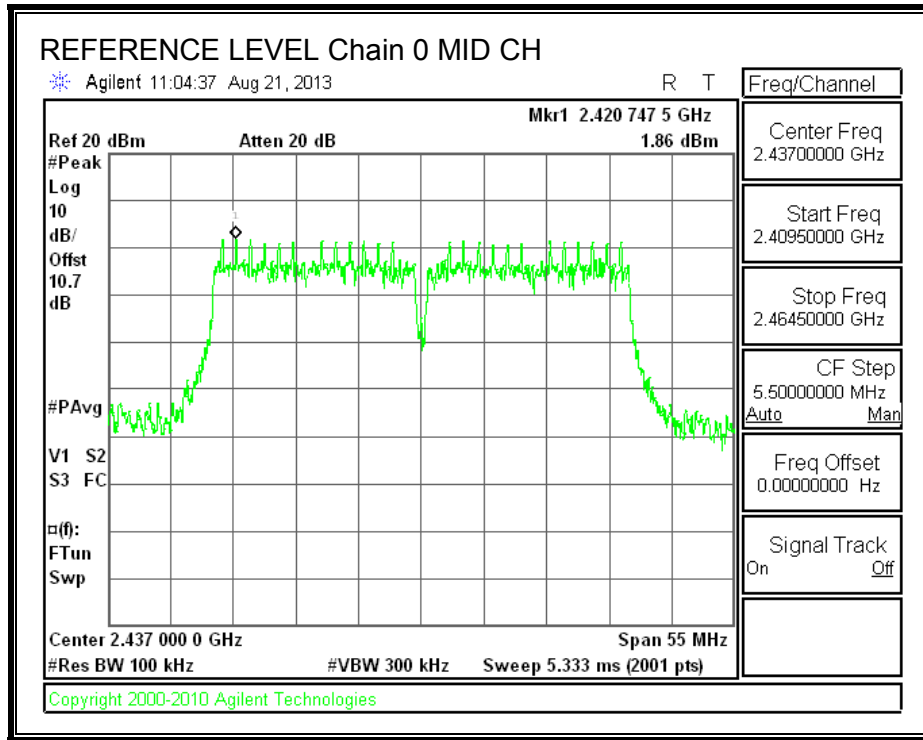
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

### TEST PROCEDURE

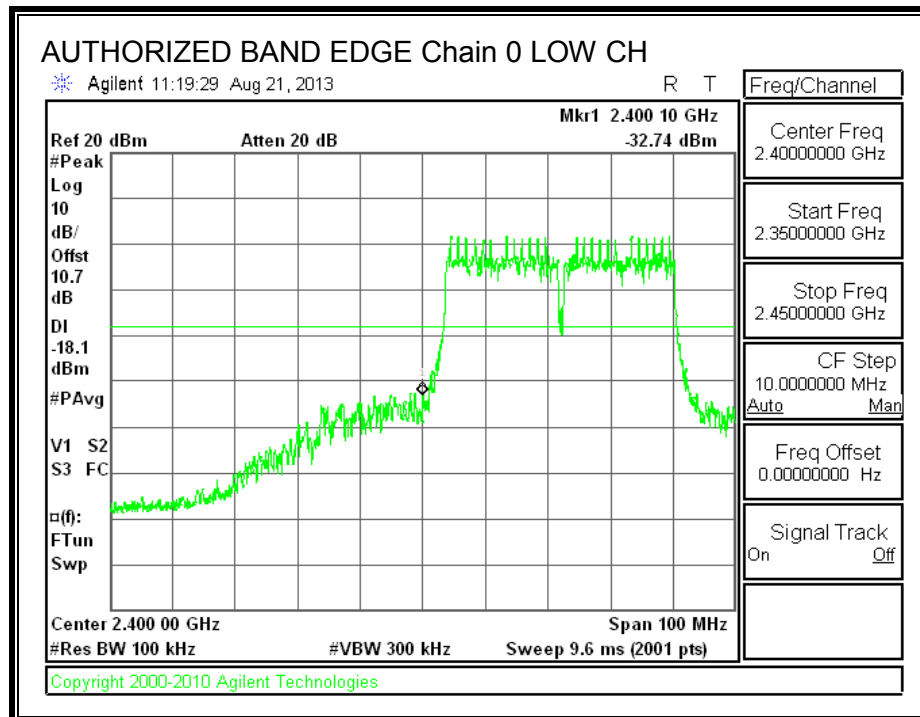
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

**RESULTS**

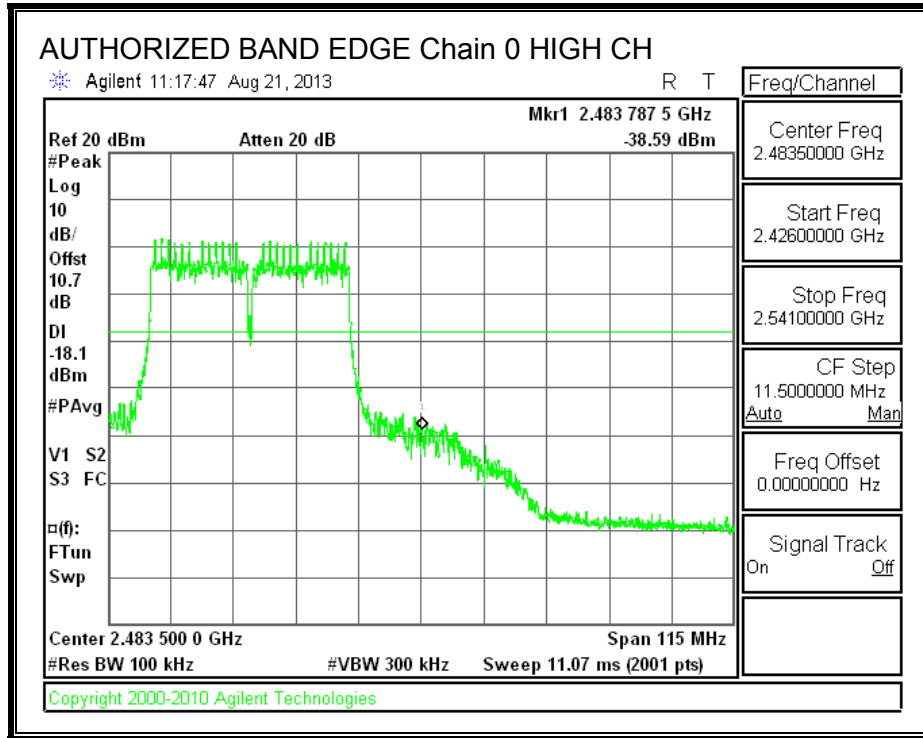
**IN-BAND REFERENCE LEVEL, Chain 0**



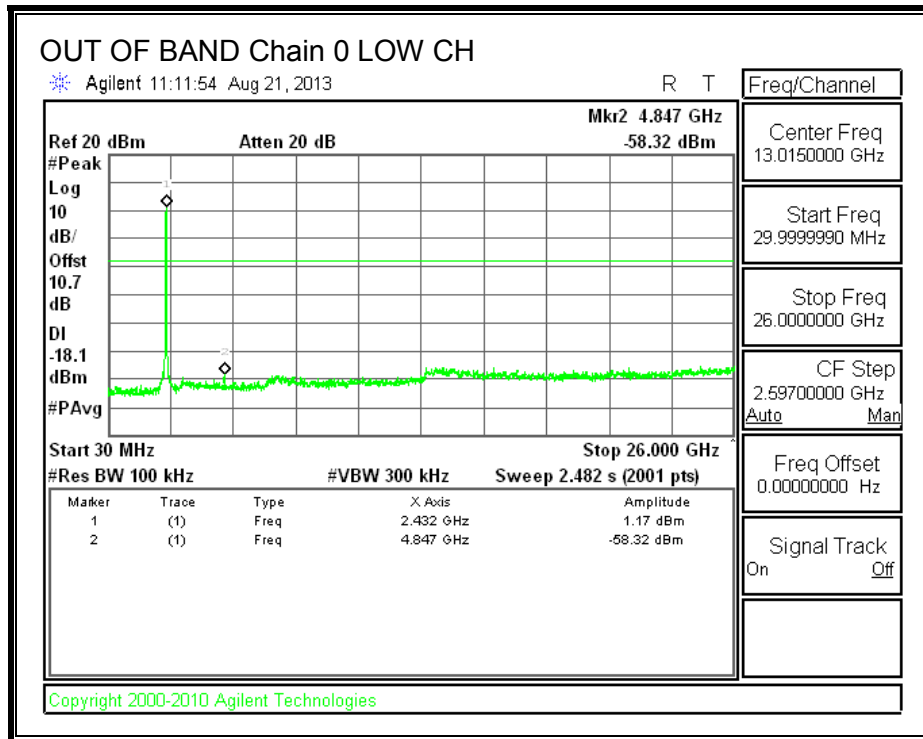
**LOW CHANNEL BANDEDGE, Chain 0**

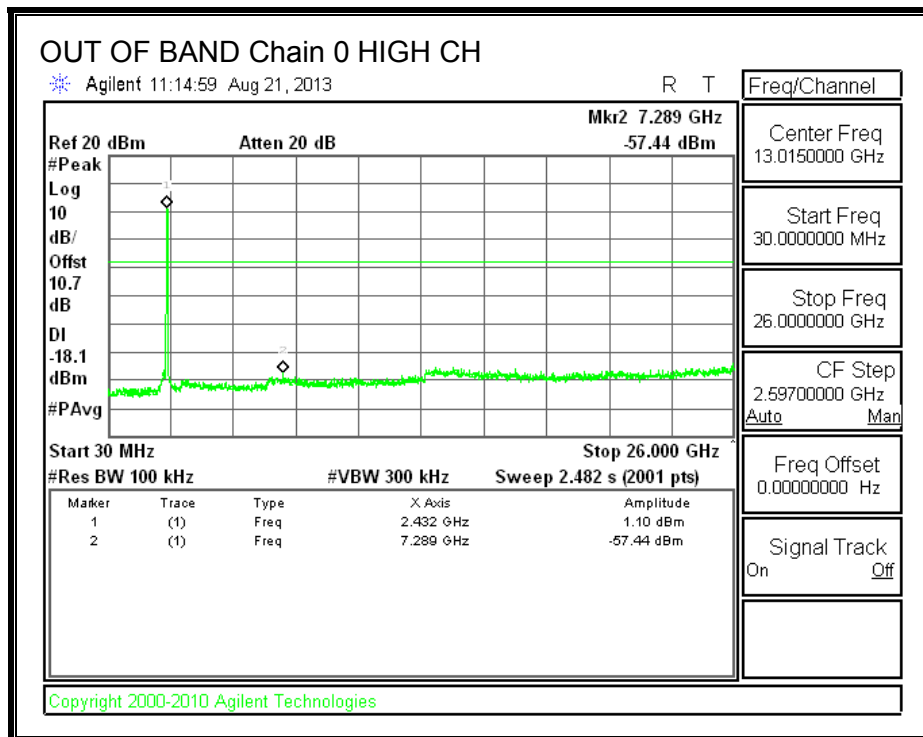
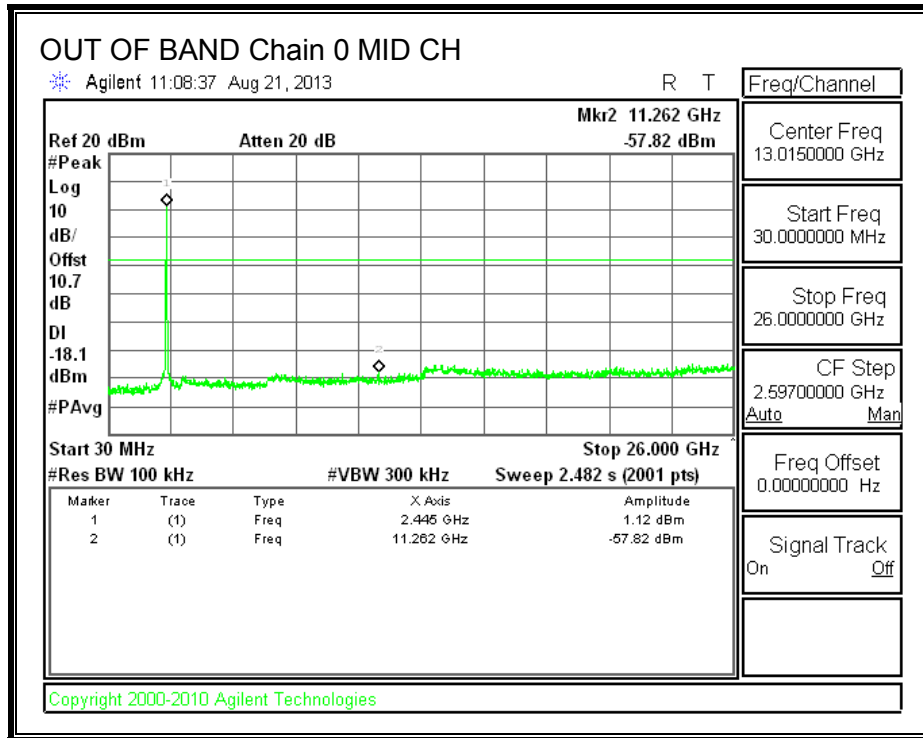


**HIGH CHANNEL BANDEDGE, Chain 0**

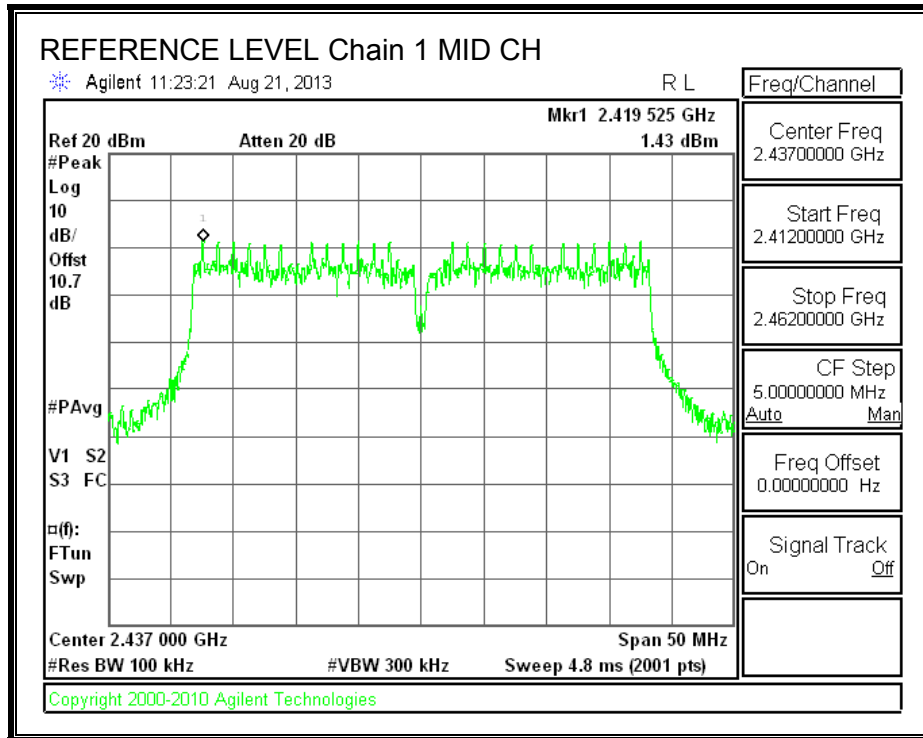


**OUT-OF-BAND EMISSIONS, Chain 0**

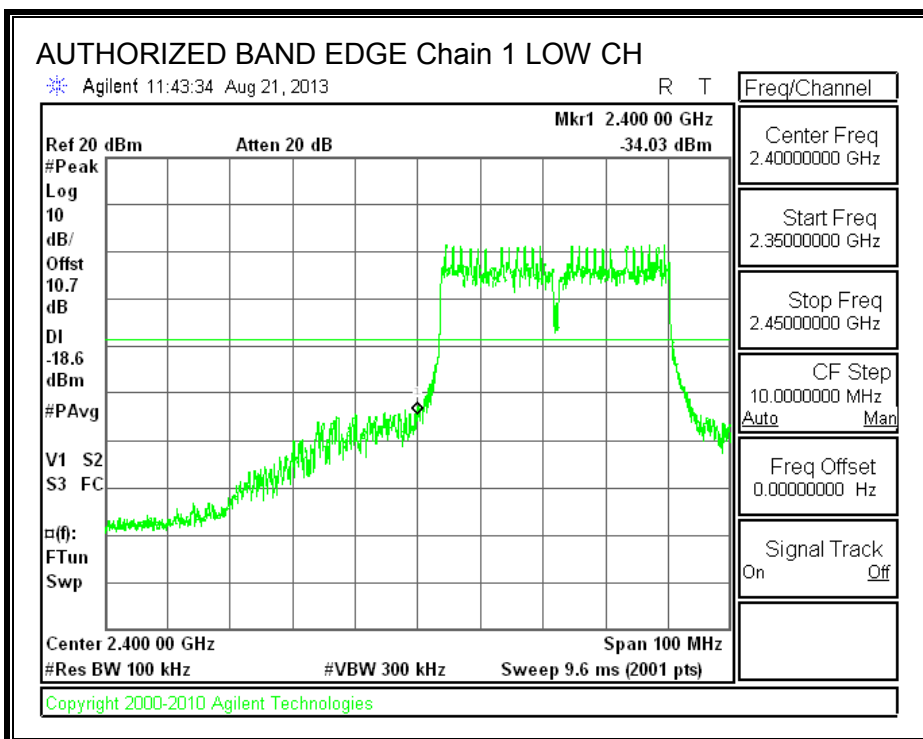




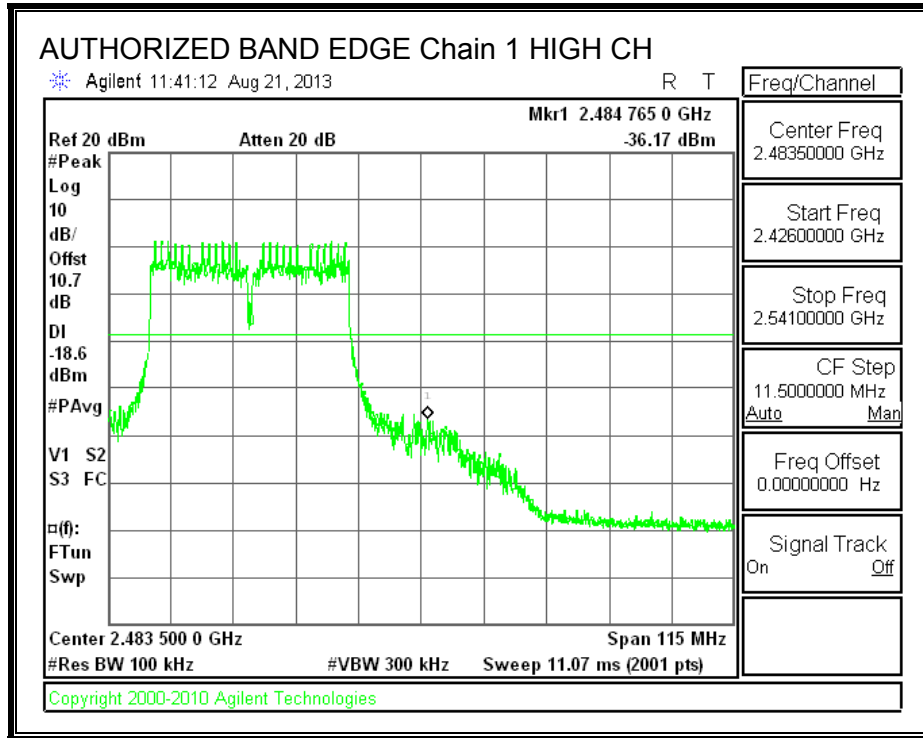
**IN-BAND REFERENCE LEVEL, Chain 1**



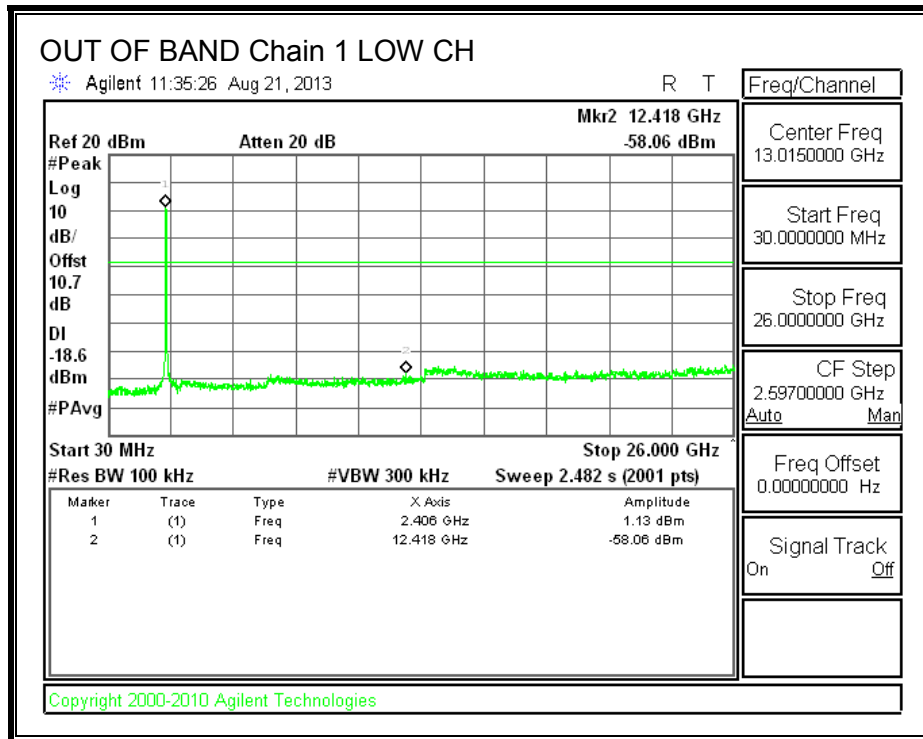
**LOW CHANNEL BANDEDGE, Chain 1**

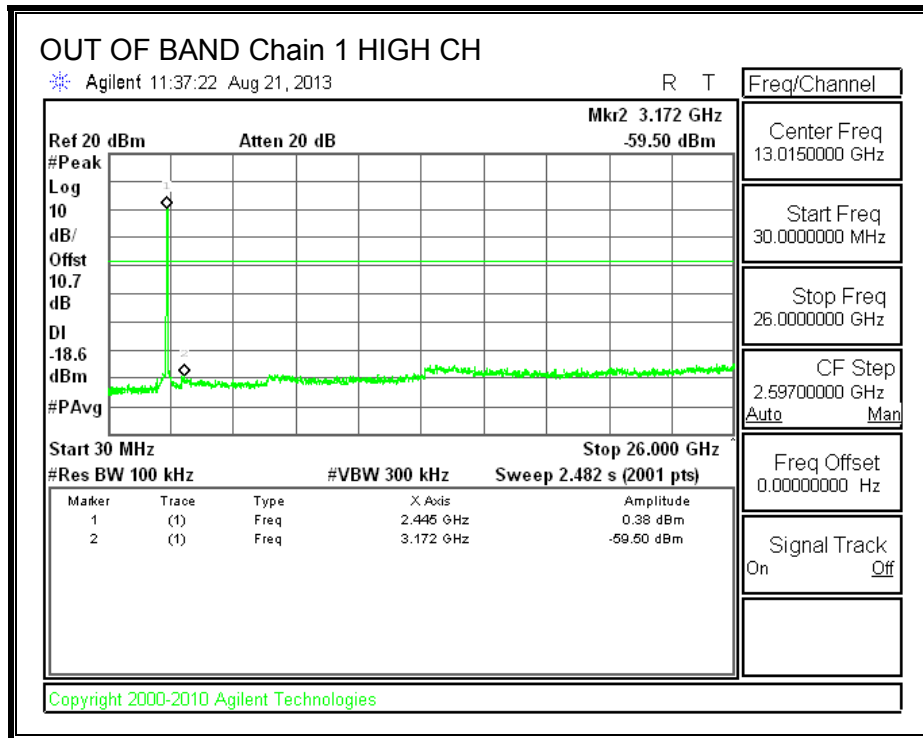
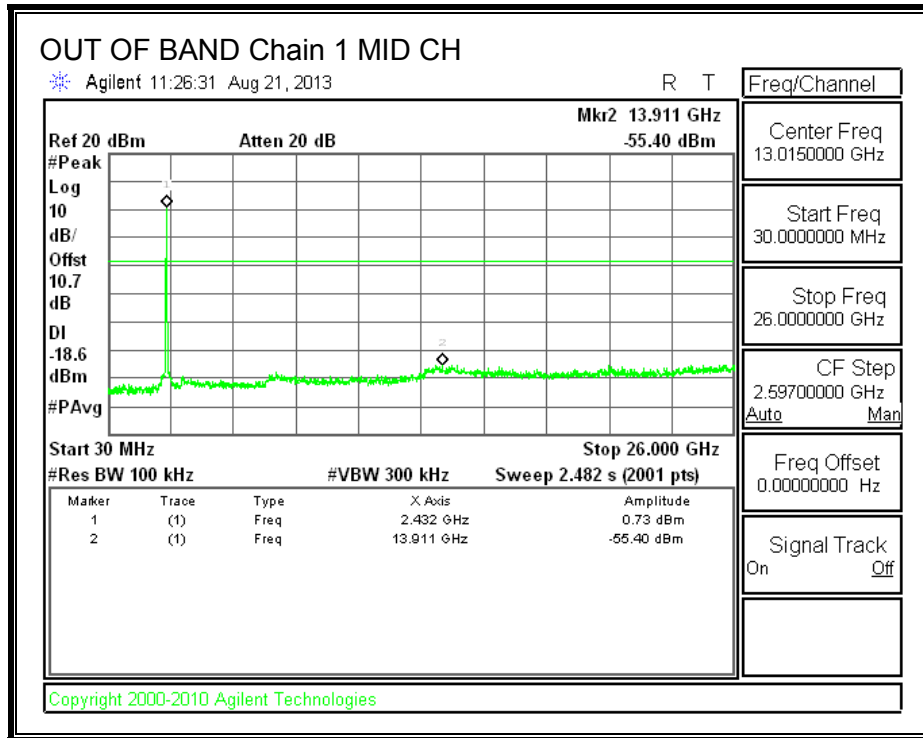


**HIGH CHANNEL BANDEDGE, Chain 1**



**OUT-OF-BAND EMISSIONS, Chain 1**







## 8.5. 802.11a MODE IN THE 5.8 GHZ BAND

### 8.5.1. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

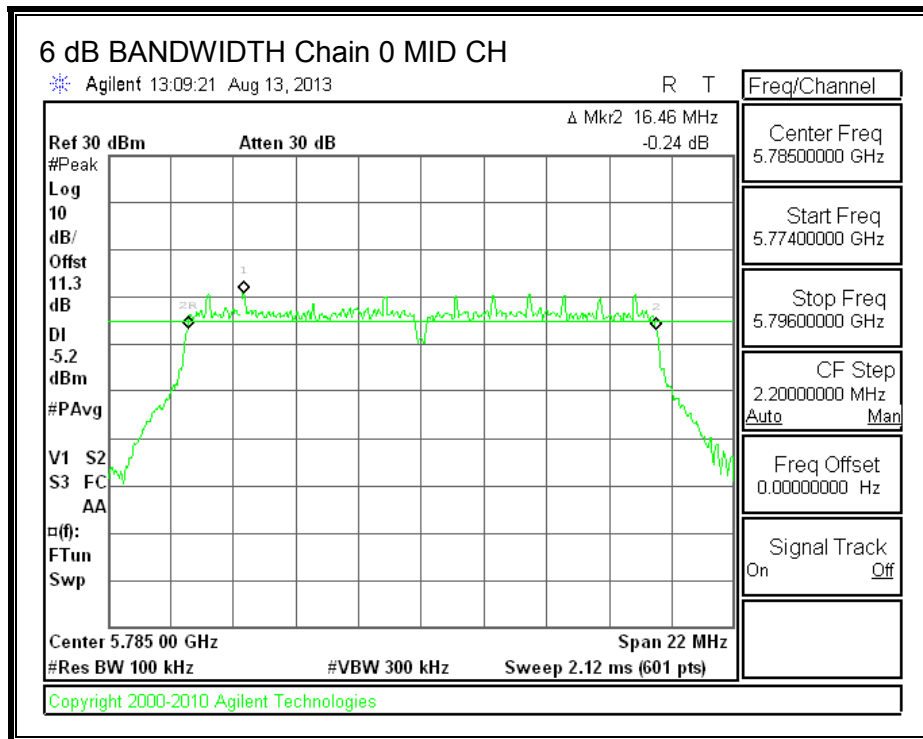
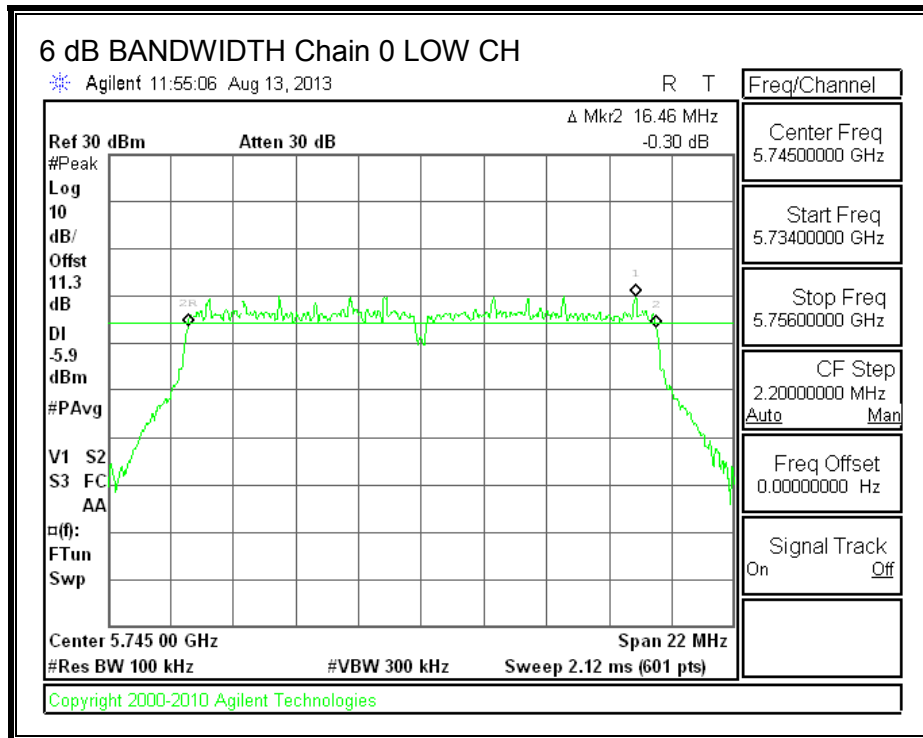
#### TEST PROCEDURE

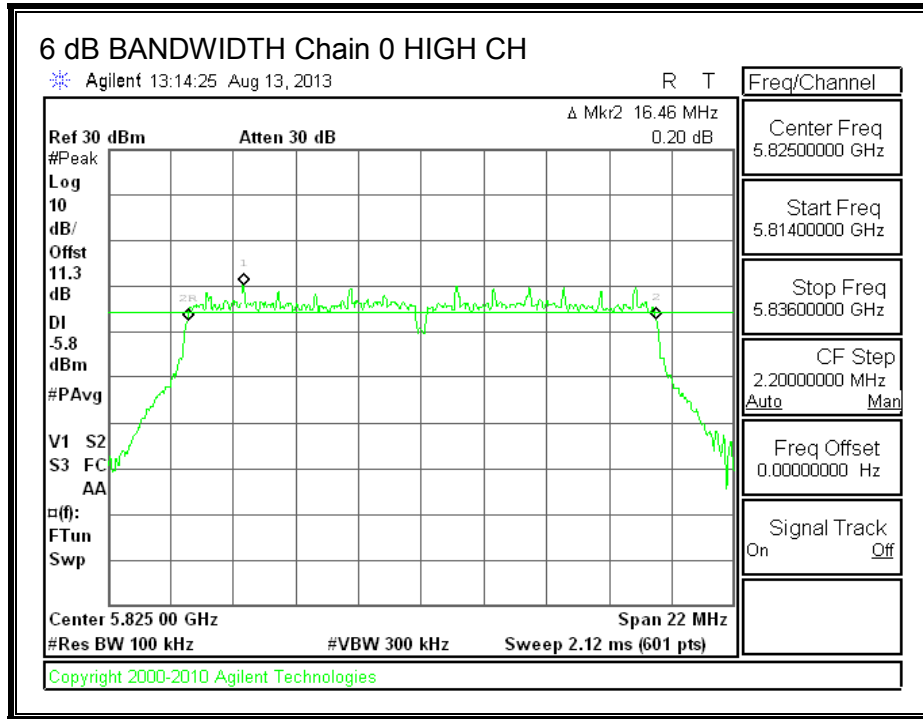
The transmitter output is connected to a spectrum analyzer with the RBW set between 1% and 5% of the EBW, the VBW  $\geq 3 \times$  RBW, peak detector and max hold.

#### RESULTS

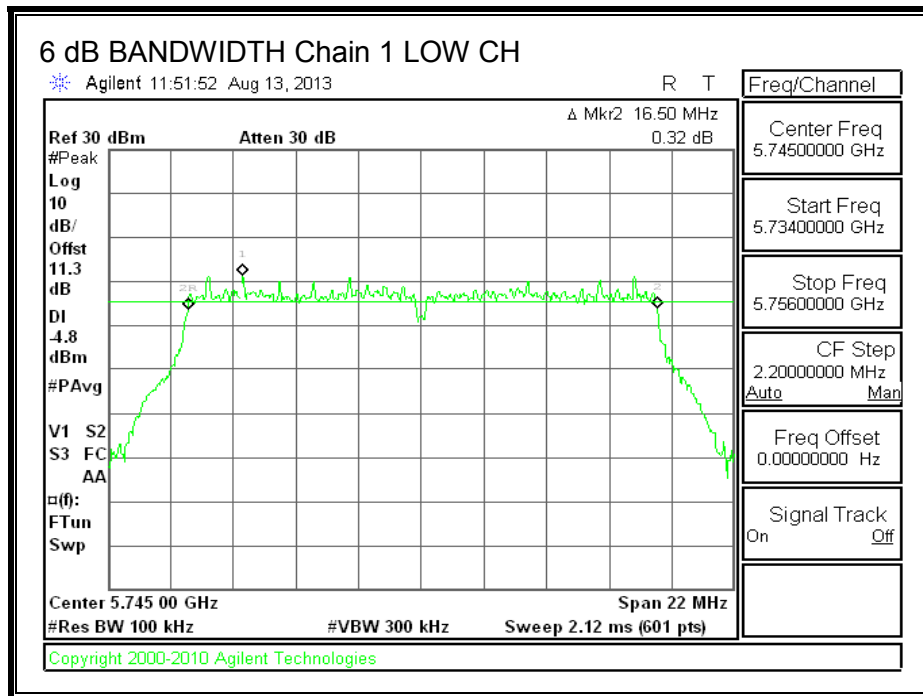
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	5745	16.46	16.50	0.5
Mid	5785	16.46	16.50	0.5
High	5825	16.46	16.50	0.5

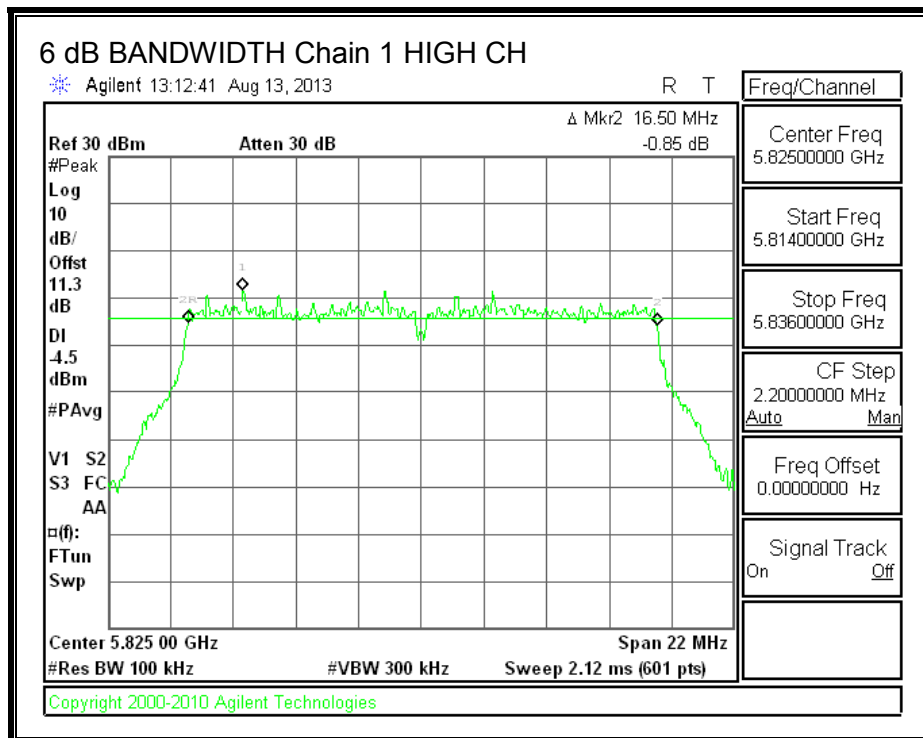
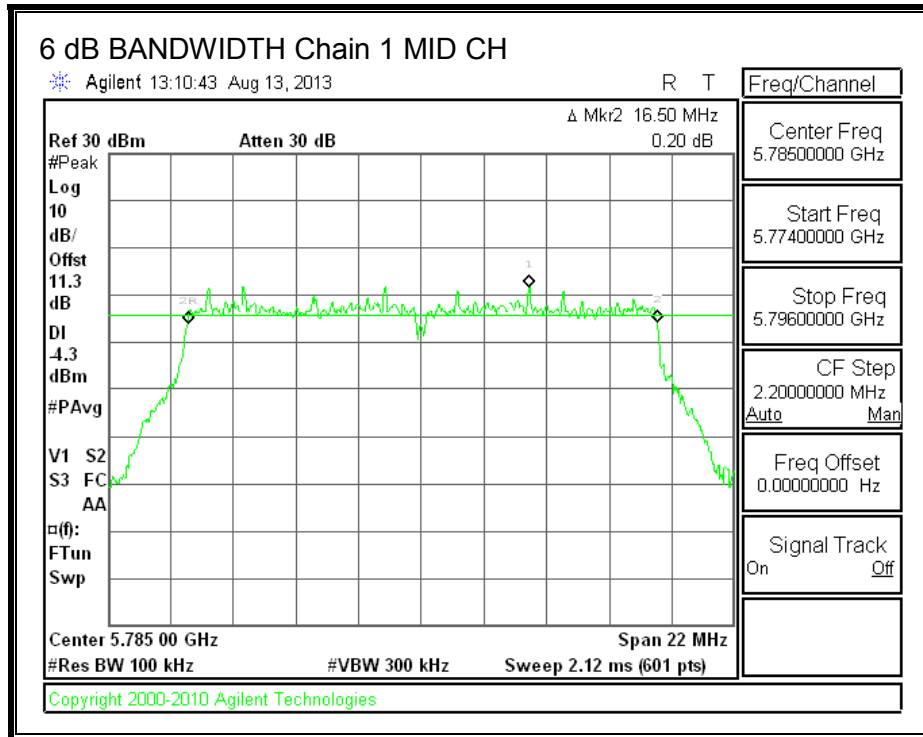
**6 dB BANDWIDTH, Chain 0**





**6 dB BANDWIDTH, Chain 1**





### 8.5.2. 99% BANDWIDTH

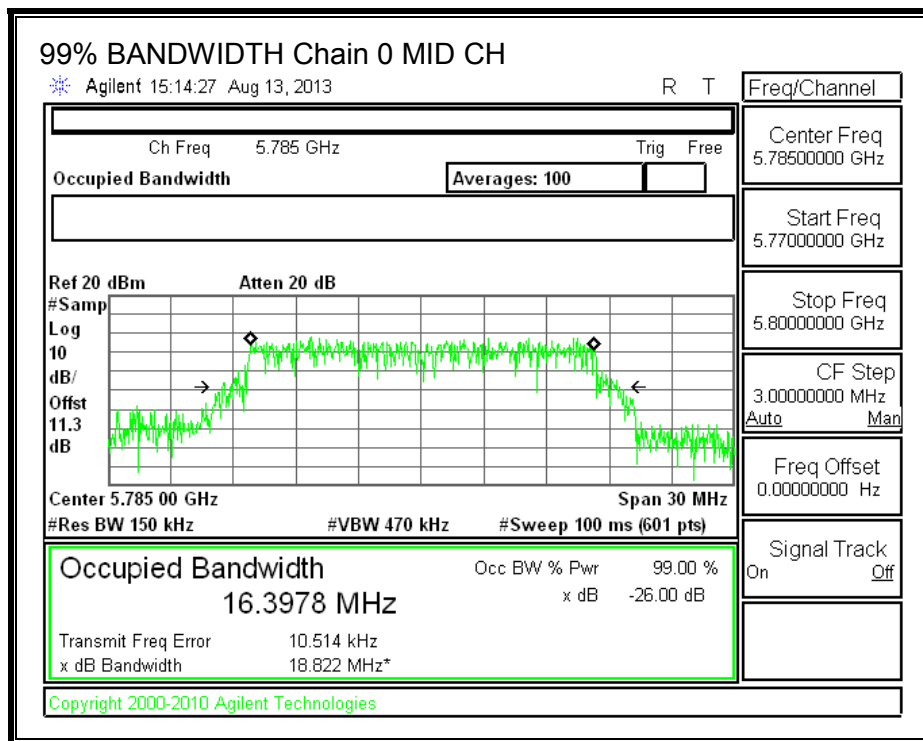
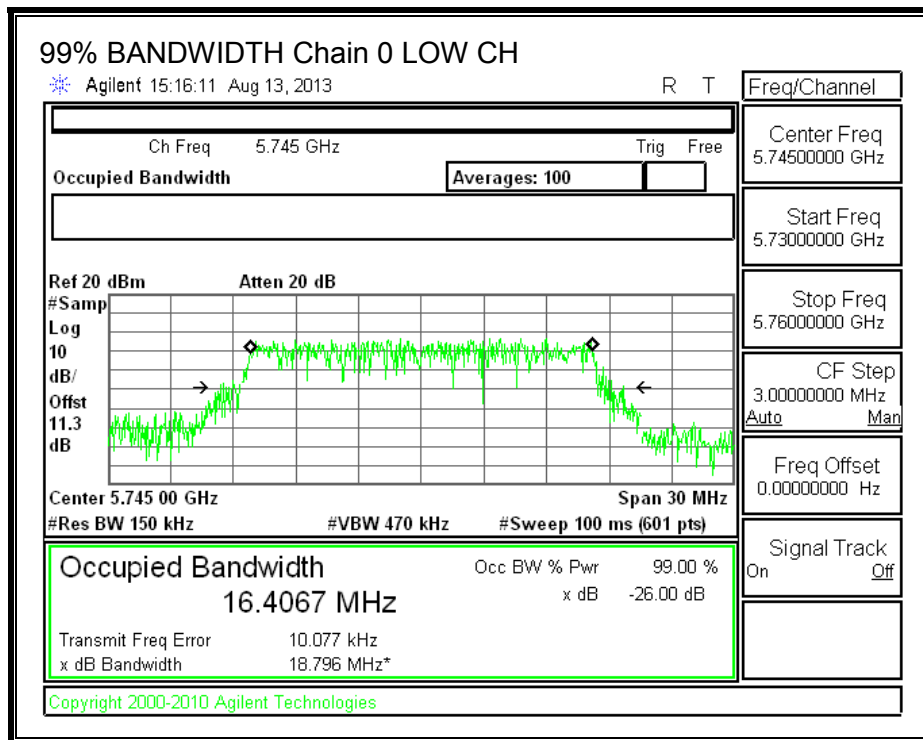
#### LIMITS

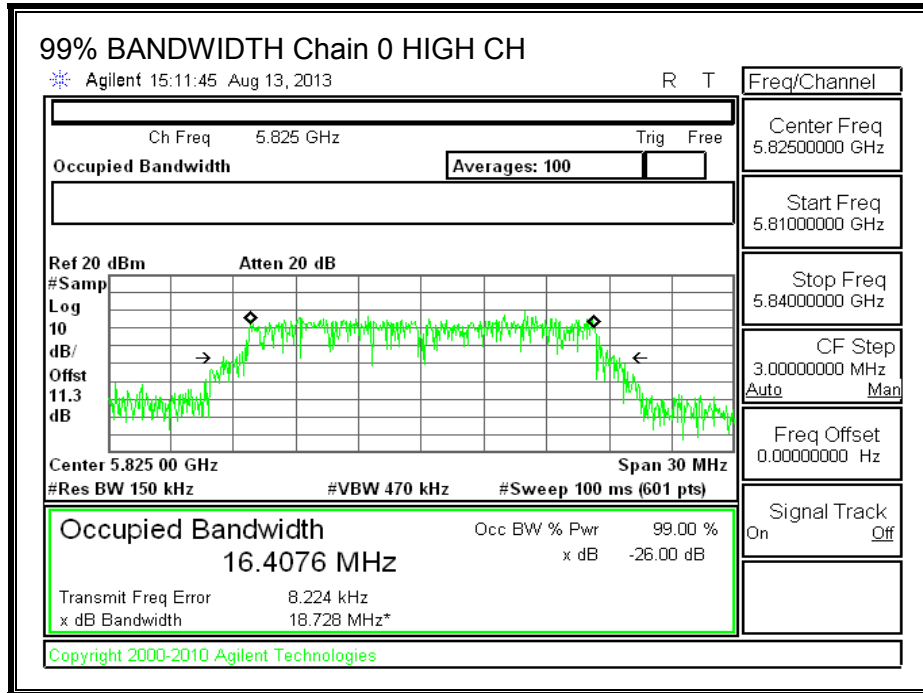
None; for reporting purposes only.

#### RESULTS

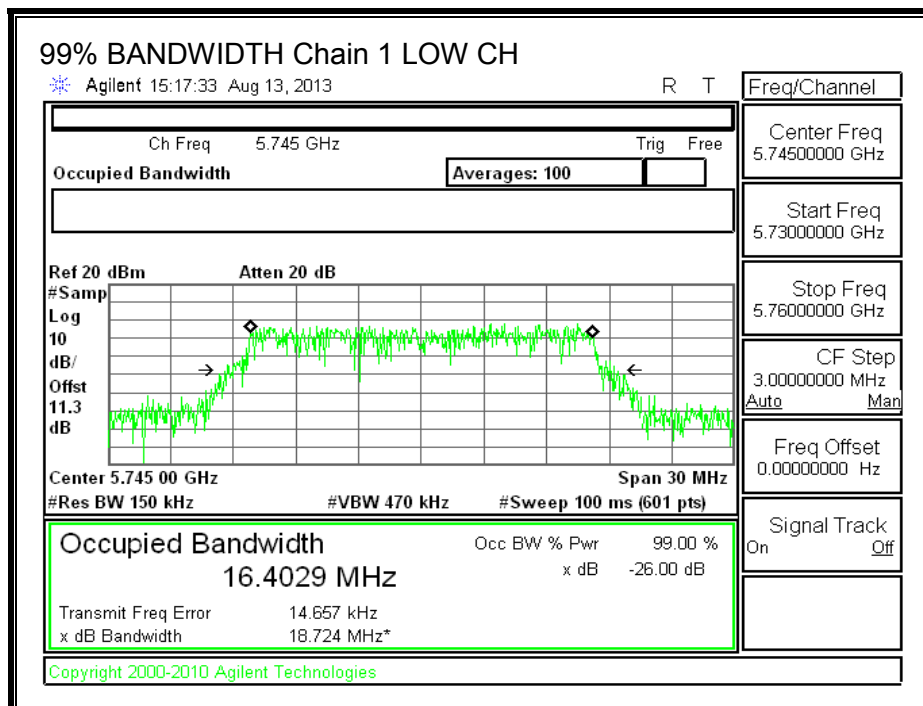
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5745	16.4067	16.4029
Mid	5785	16.3978	16.4058
High	5825	16.4076	16.4133

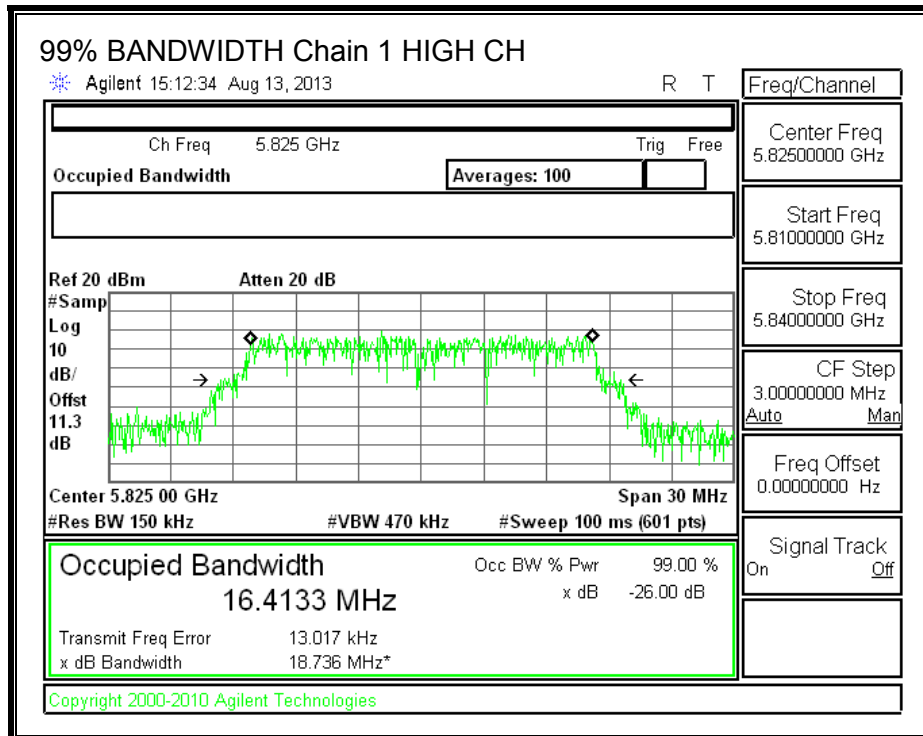
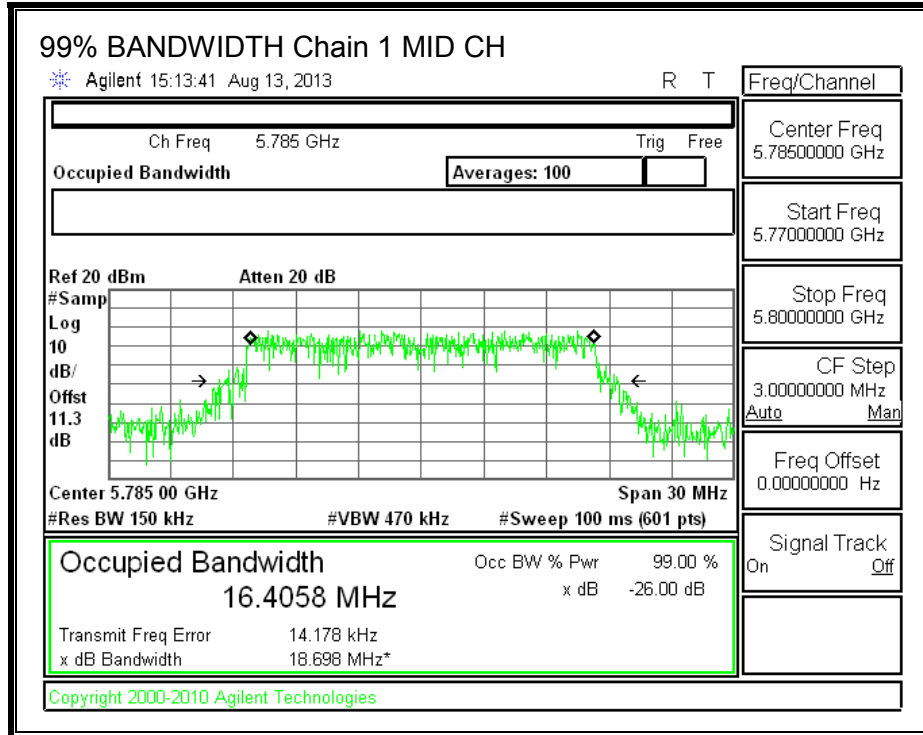
**99% BANDWIDTH, Chain 0**





**99% BANDWIDTH, Chain 1**







### 8.5.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### RESULTS

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5745	10.49	10.41	13.46
Mid	5785	11.83	11.34	14.60
High	5825	10.04	10.61	13.34

### 8.5.4. OUTPUT POWER

#### LIMITS

FCC §15.247

IC RSS-210 A8.4

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 the same for each chain. The directional gain is equal to the antenna gain.

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.90	3.20	3.56

#### RESULTS

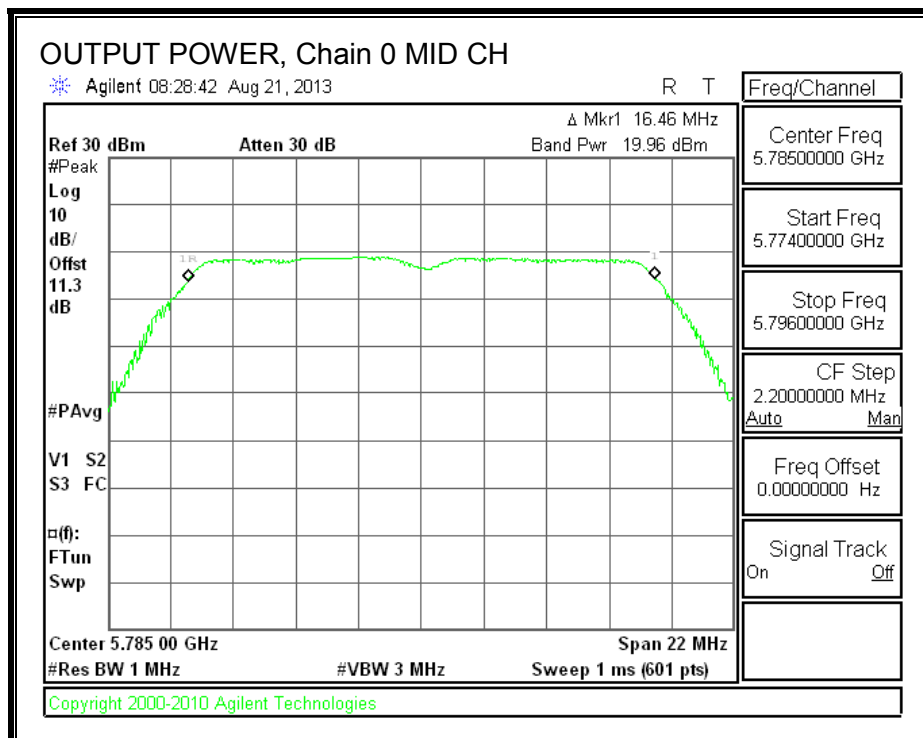
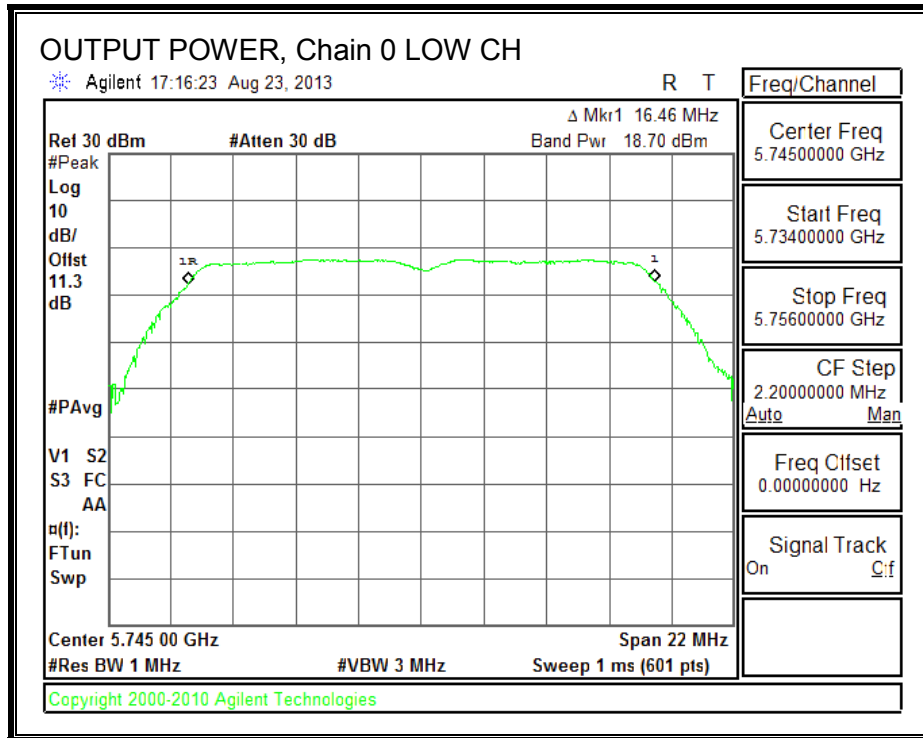
##### Limits

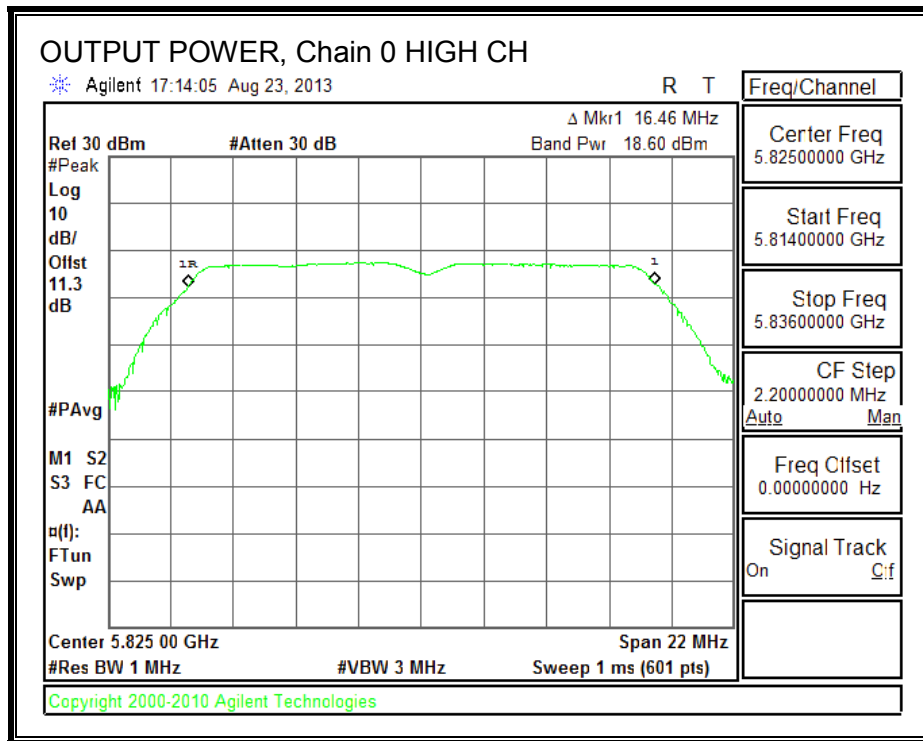
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	5745	3.56	30.00	30	36	30.00
Mid	5785	3.56	30.00	30	36	30.00
High	5825	3.56	30.00	30	36	30.00

##### Results

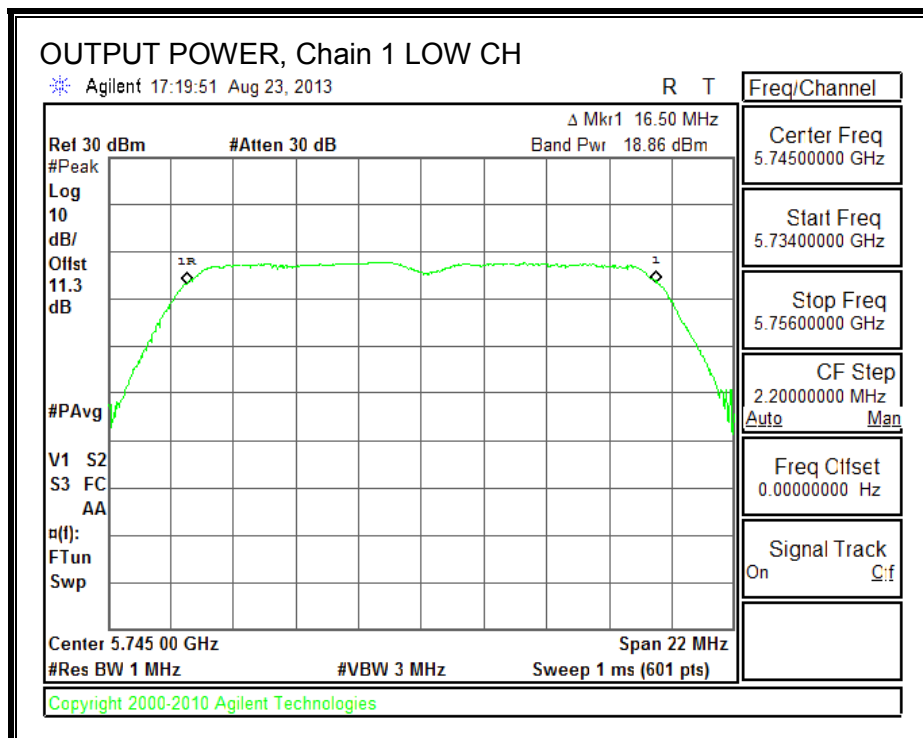
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margi (dB)
Low	5745	18.70	18.86	21.79	30.00	-8.21
Mid	5785	19.96	20.67	23.34	30.00	-6.66
High	5825	18.60	19.17	21.90	30.00	-8.10

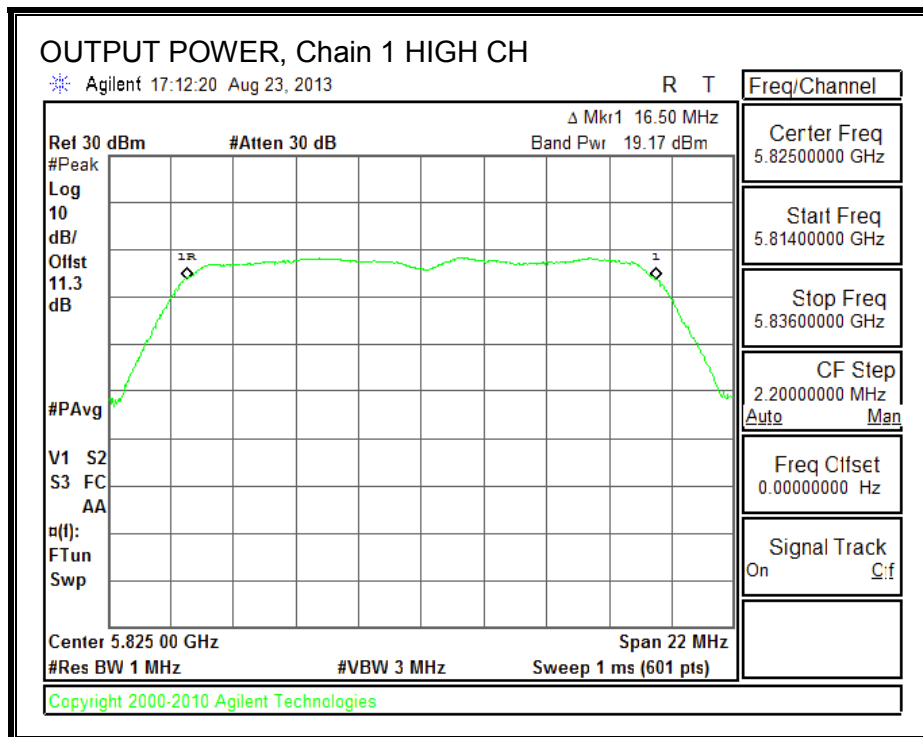
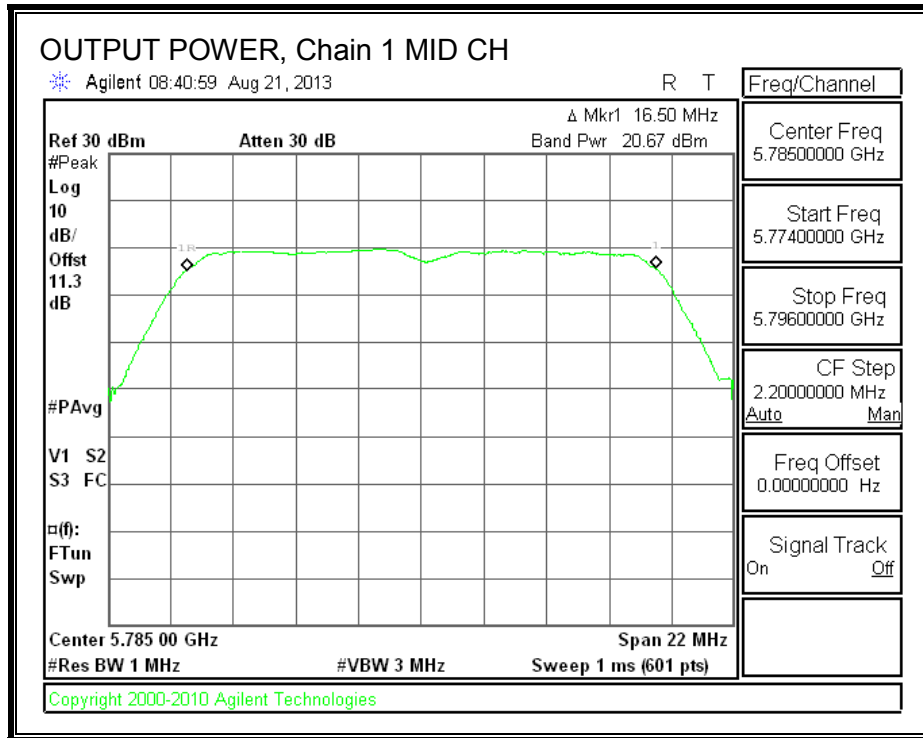
**OUTPUT POWER, Chain 0**





### OUTPUT POWER, Chain 1





### 8.5.5. PSD

#### LIMITS

FCC §15.247

IC RSS-210 A8.2

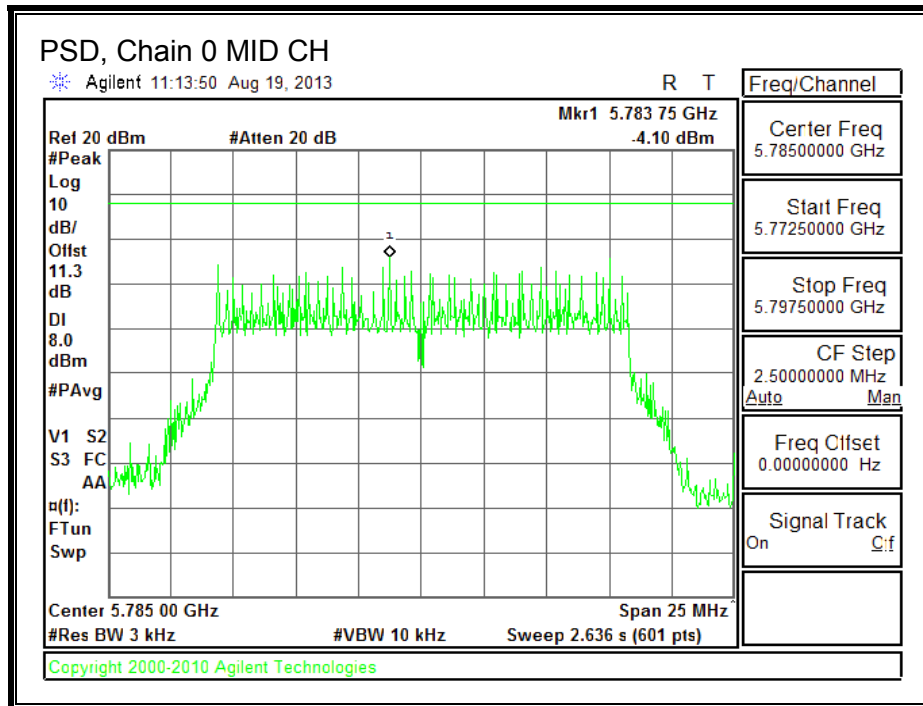
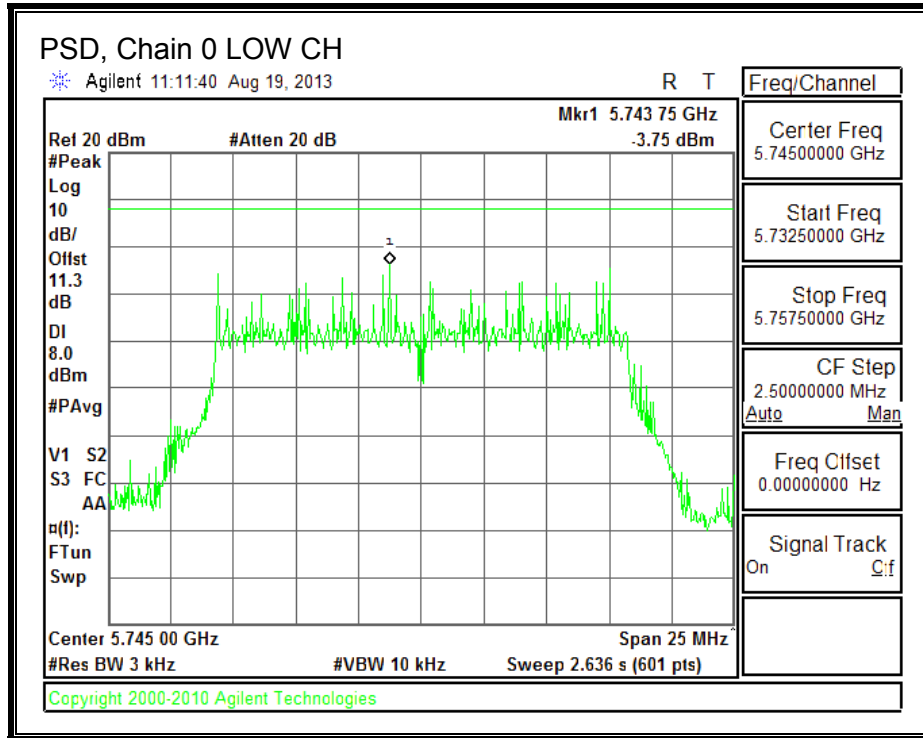
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

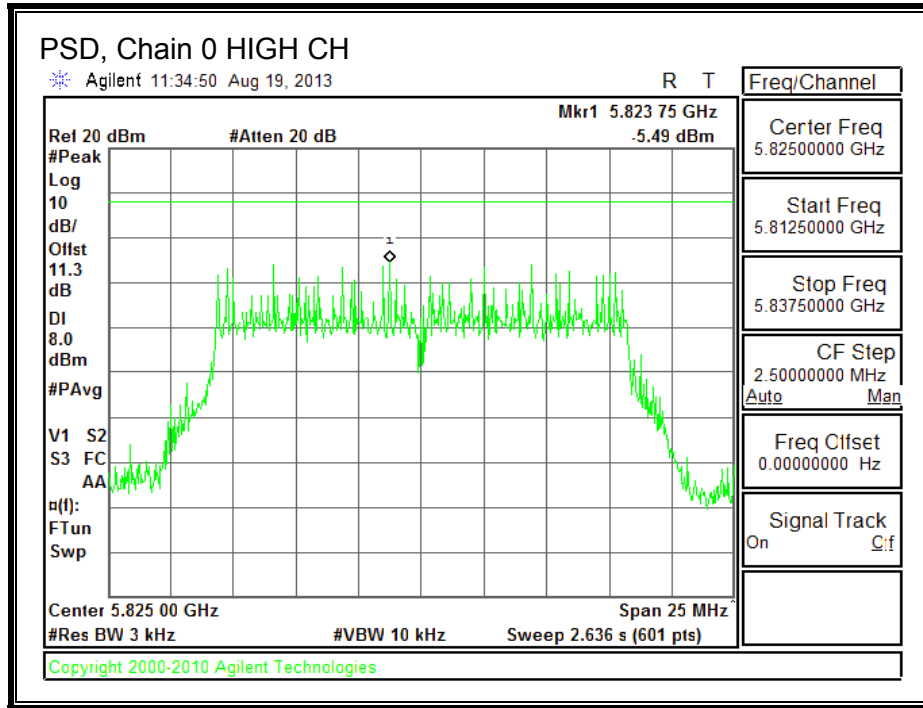
#### RESULTS

##### PSD Results

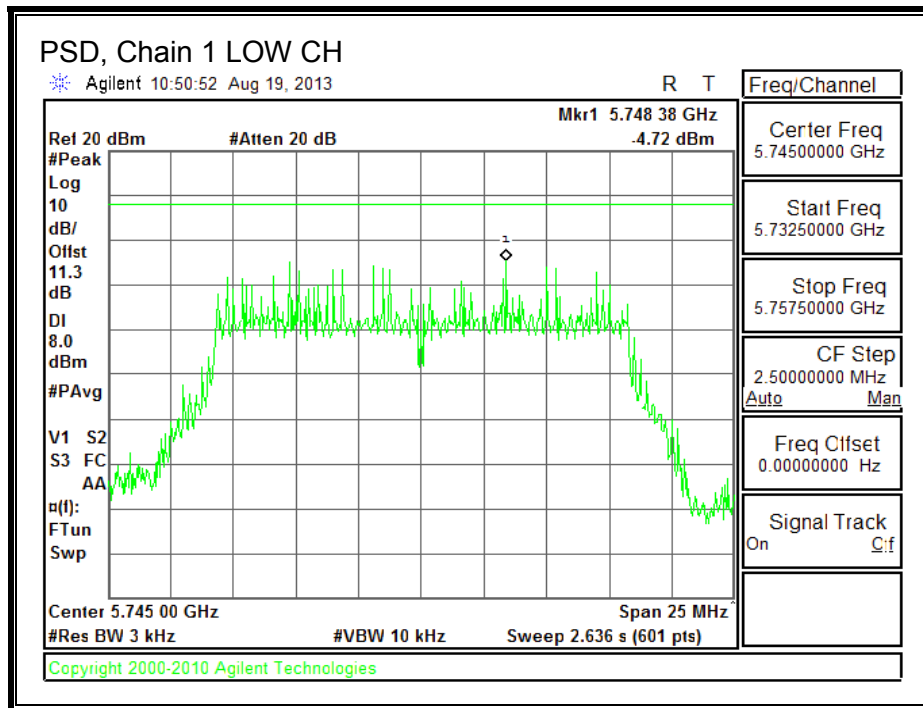
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-3.75	-4.72	-1.20	8.0	-9.2
Mid	5785	-4.10	-2.65	-0.30	8.0	-8.3
High	5825	-5.49	-5.01	-2.23	8.0	-10.2

**PSD, Chain 0**

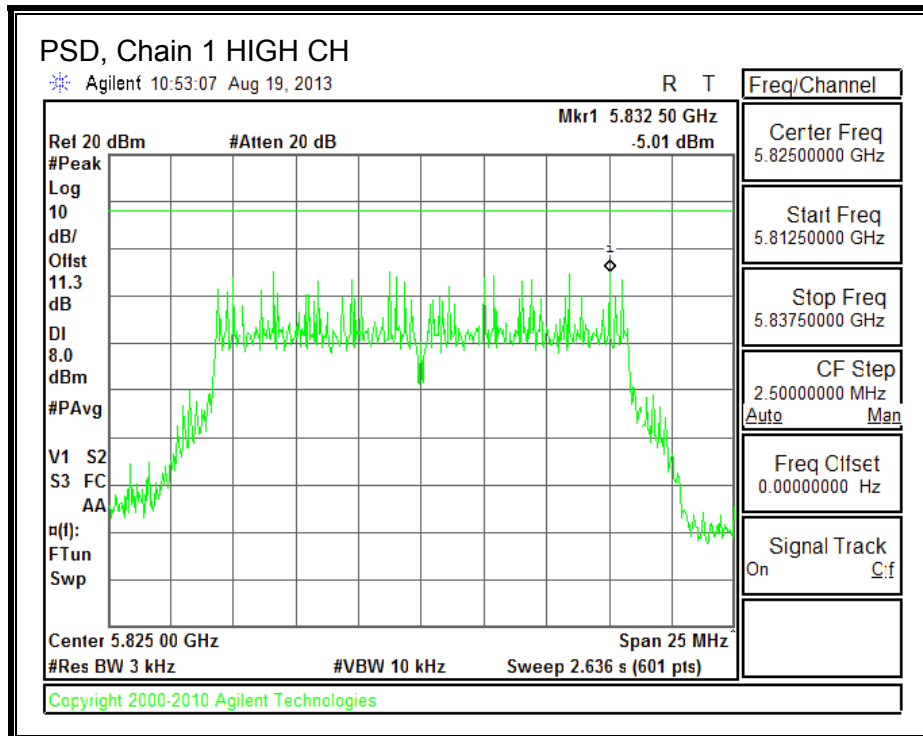
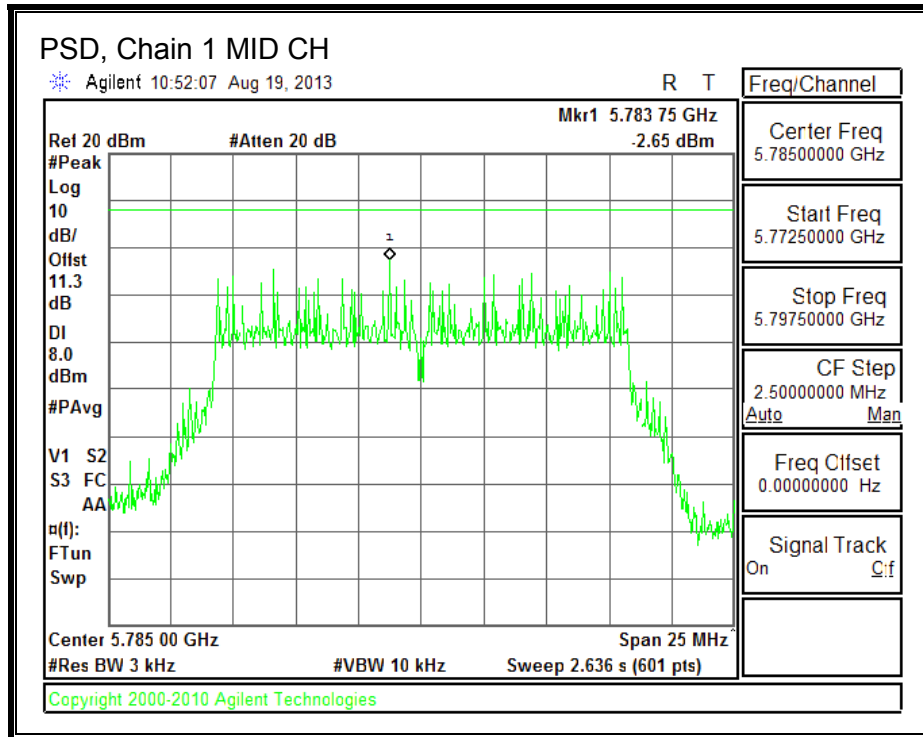




**PSD, Chain 1**







## 8.5.6. OUT-OF-BAND EMISSIONS

### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

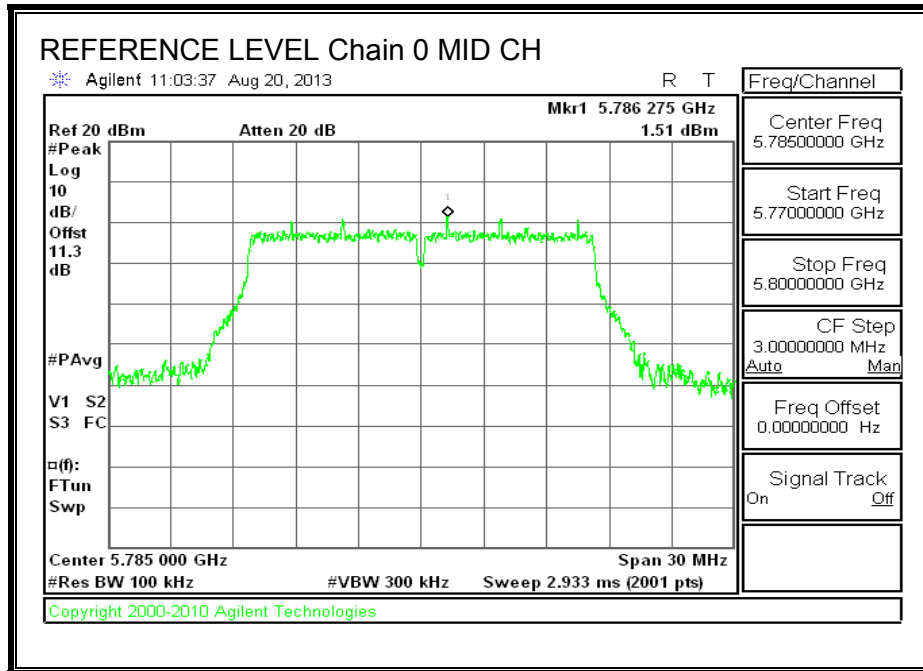
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

**RESULTS**

**IN-BAND REFERENCE LEVEL, Chain 0**



**LOW CHANNEL BANDEDGE, Chain 0**

