



FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

802.11 a/b/g/n WLAN, BT 2.1 and RF4CE SATELLITE SETTOP BOX

MODEL NUMBER: ID: 075

FCC ID: DKNCB1138

REPORT NUMBER: 13U16072-3 Revision A

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Prepared for

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NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	10/14/13	Initial Issue	T. Chan
A	10/28/13	Update the KDB version referenced; Additional BE Power Table On Section 5.2 and BE Plots	O. Su

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	7
2. TEST METHODOLOGY	8
3. FACILITIES AND ACCREDITATION	8
4. CALIBRATION AND UNCERTAINTY	8
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i>	<i>8</i>
4.2. <i>SAMPLE CALCULATION</i>	<i>8</i>
4.3. <i>MEASUREMENT UNCERTAINTY.....</i>	<i>9</i>
5. EQUIPMENT UNDER TEST.....	10
5.1. <i>DESCRIPTION OF EUT</i>	<i>10</i>
5.2. <i>MAXIMUM OUTPUT POWER.....</i>	<i>10</i>
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	<i>11</i>
5.4. <i>SOFTWARE AND FIRMWARE.....</i>	<i>11</i>
5.5. <i>WORST-CASE CONFIGURATION AND MODE.....</i>	<i>11</i>
5.6. <i>DESCRIPTION OF TEST SETUP.....</i>	<i>12</i>
6. TEST AND MEASUREMENT EQUIPMENT	14
7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS	15
7.1. <i>MEASUREMENT METHODS</i>	<i>15</i>
7.2. <i>ON TIME AND DUTY CYCLE RESULTS.....</i>	<i>15</i>
8. ANTENNA PORT TEST RESULTS.....	23
8.1. <i>802.11b MODE IN THE 2.4 GHz BAND.....</i>	<i>23</i>
8.1.1. <i>6 dB BANDWIDTH.....</i>	<i>23</i>
8.1.2. <i>99% BANDWIDTH.....</i>	<i>26</i>
8.1.3. <i>AVERAGE POWER.....</i>	<i>29</i>
8.1.4. <i>OUTPUT POWER</i>	<i>30</i>
8.1.5. <i>PSD.....</i>	<i>33</i>
8.1.6. <i>OUT-OF-BAND EMISSIONS</i>	<i>36</i>
8.2. <i>802.11g SISO MODE IN THE 2.4 GHz BAND</i>	<i>40</i>
8.2.1. <i>6 dB BANDWIDTH.....</i>	<i>40</i>
8.2.2. <i>99% BANDWIDTH.....</i>	<i>43</i>
8.2.3. <i>AVERAGE POWER.....</i>	<i>46</i>
8.2.4. <i>OUTPUT POWER</i>	<i>47</i>
8.2.5. <i>PSD.....</i>	<i>51</i>
8.2.6. <i>OUT-OF-BAND EMISSIONS</i>	<i>54</i>
8.3. <i>802.11g 2TX CDD MODE IN THE 2.4 GHz BAND.....</i>	<i>58</i>
8.3.1. <i>6 dB BANDWIDTH.....</i>	<i>58</i>
8.3.2. <i>99% BANDWIDTH.....</i>	<i>62</i>

8.3.3.	AVERAGE POWER	66
8.3.4.	OUTPUT POWER	67
8.3.5.	PSD	73
8.3.6.	OUT-OF-BAND EMISSIONS	77
8.4.	<i>802.11n HT20 SISO MODE IN THE 2.4 GHz BAND</i>	84
8.4.1.	6 dB BANDWIDTH	84
8.4.2.	99% BANDWIDTH	87
8.4.3.	AVERAGE POWER	90
8.4.4.	OUTPUT POWER	91
8.4.5.	PSD	95
8.4.6.	OUT-OF-BAND EMISSIONS	98
8.5.	<i>802.11n HT20 2TX CDD MODE IN THE 2.4 GHz BAND</i>	102
8.5.1.	6 dB BANDWIDTH	102
8.5.2.	99% BANDWIDTH	106
8.5.3.	AVERAGE POWER	110
8.5.4.	OUTPUT POWER	111
8.5.5.	PSD	117
8.5.6.	OUT-OF-BAND EMISSIONS	121
8.6.	<i>802.11n HT40 SISO MODE IN THE 2.4 GHz BAND</i>	128
8.6.1.	6 dB BANDWIDTH	128
8.6.2.	99% BANDWIDTH	130
8.6.3.	AVERAGE POWER	132
8.6.4.	OUTPUT POWER	133
8.6.5.	PSD	135
8.6.6.	OUT-OF-BAND EMISSIONS	137
8.7.	<i>802.11n HT40 2TX CDD MODE IN THE 2.4 GHz BAND</i>	140
8.7.1.	6 dB BANDWIDTH	140
8.7.2.	99% BANDWIDTH	143
8.7.3.	AVERAGE POWER	146
8.7.4.	OUTPUT POWER	147
8.7.5.	PSD	150
8.7.6.	OUT-OF-BAND EMISSIONS	153
8.8.	<i>802.11a SISO MODE IN THE 5.8 GHz BAND</i>	158
8.8.1.	6 dB BANDWIDTH	158
8.8.2.	99% BANDWIDTH	161
8.8.3.	AVERAGE POWER	164
8.8.4.	OUTPUT POWER	165
8.8.5.	PSD	168
8.8.6.	OUT-OF-BAND EMISSIONS	171
8.9.	<i>802.11a 2TX CDD MODE IN THE 5.8 GHz BAND</i>	177
8.9.1.	6 dB BANDWIDTH	177
8.9.2.	99% BANDWIDTH	181
8.9.3.	AVERAGE POWER	185
8.9.4.	OUTPUT POWER	186
8.9.5.	PSD	190
8.9.6.	OUT-OF-BAND EMISSIONS	194
8.10.	<i>802.11n HT20 SISO MODE IN THE 5.8 GHz BAND</i>	204
8.10.1.	6 dB BANDWIDTH	204

8.10.2.	99% BANDWIDTH	207
8.10.3.	AVERAGE POWER	210
8.10.4.	OUTPUT POWER.....	211
8.10.5.	PSD.....	214
8.10.6.	OUT-OF-BAND EMISSIONS.....	217
8.11.	<i>802.11n HT20 2TX CDD MODE IN THE 5.8 GHz BAND.....</i>	<i>223</i>
8.11.1.	6 dB BANDWIDTH	223
8.11.2.	99% BANDWIDTH	227
8.11.3.	AVERAGE POWER	231
8.11.4.	OUTPUT POWER.....	232
8.11.5.	PSD.....	236
8.11.6.	OUT-OF-BAND EMISSIONS.....	240
8.12.	<i>802.11n HT40 SISO MODE IN THE 5.8 GHz BAND</i>	<i>250</i>
8.12.1.	6 dB BANDWIDTH	250
8.12.2.	99% BANDWIDTH	252
8.12.3.	AVERAGE POWER	254
8.12.4.	OUTPUT POWER.....	255
8.12.5.	PSD.....	257
8.12.6.	OUT-OF-BAND EMISSIONS.....	259
8.13.	<i>802.11n HT40 2TX CDD MODE IN THE 5.8 GHz BAND.....</i>	<i>263</i>
8.13.1.	6 dB BANDWIDTH	263
8.13.2.	99% BANDWIDTH	266
8.13.3.	AVERAGE POWER	269
8.13.4.	OUTPUT POWER.....	270
8.13.5.	PSD.....	273
8.13.6.	OUT-OF-BAND EMISSIONS.....	276
9.	RADIATED TEST RESULTS.....	283
9.1.	<i>LIMITS AND PROCEDURE.....</i>	<i>283</i>
9.2.	<i>TRANSMITTER ABOVE 1 GHz.....</i>	<i>284</i>
9.2.1.	TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND	284
9.2.2.	TX ABOVE 1 GHz 802.11g SISO MODE IN THE 2.4 GHz BAND.....	297
9.2.3.	TX ABOVE 1 GHz 802.11g 2TX CDD MODE IN THE 2.4 GHz BAND	312
9.2.4.	TX ABOVE 1 GHz 802.11n HT20 SISO MODE IN THE 2.4 GHz BAND	326
9.2.5.	TX ABOVE 1 GHz 802.11n HT20 2TX CDD MODE IN THE 2.4 GHz BAND	339
9.2.6.	TX ABOVE 1 GHz 802.11n HT40 SISO MODE IN THE 2.4 GHz BAND	352
9.2.7.	TX ABOVE 1 GHz 802.11n HT40 2TX CDD MODE IN THE 2.4 GHz BAND	361
9.2.8.	TX ABOVE 1 GHz 802.11a SISO MODE IN THE 5.8 GHz BAND.....	369
9.2.9.	TX ABOVE 1 GHz 802.11a 2TX CDD MODE IN THE 5.8 GHz BAND	378
9.2.10.	TX ABOVE 1 GHz 802.11n HT20 SISO MODE IN THE 5.8 GHz BAND.....	387
9.2.11.	TX ABOVE 1 GHz 802.11n HT20 2TX CDD MODE IN THE 5.8 GHz BAND ..	394
9.2.12.	TX ABOVE 1 GHz 802.11n HT40 SISO MODE IN THE 5.8 GHz BAND.....	401
9.2.13.	TX ABOVE 1 GHz 802.11n HT40 2TX CDD MODE IN THE 5.8 GHz BAND ..	407
9.3.	<i>WORST-CASE ABOVE 18 GHz</i>	<i>413</i>
9.4.	<i>WORST-CASE BELOW 1 GHz.....</i>	<i>416</i>
10.	AC POWER LINE CONDUCTED EMISSIONS	420

11. SETUP PHOTOS425

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ECHOSTAR CORPORATION
90 INVERNESS CIRCLE EAST
ENGLEWOOD, CO 80112, U.S.A.

EUT DESCRIPTION: 802.11 a/b/g/n WLAN, BT 2.1 and RF4CE Satellite SetTop Box

MODEL NUMBER: ID: 075

SERIAL NUMBER: 200101R01292Y00107H (Conducted), 200101R01292Y0110H (Radiated)

DATE TESTED: SEPTEMBER 25 – OCTOBER 10, 2013 & OCTOBER 23-25, 2013

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

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UL Verification Services Inc.

Tested By:



MONA HUA
WiSE Test 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, and ANSI C63.10-2009.

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 type="checkbox"/> Chamber B	<input checked="" type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input checked="" 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.UL.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 an 802.11 a/b/g/n WLAN, BT 2.1 and RF4CE Satellite SetTop Box operates in the 2400-2483.5MHz, 5150-5250MHz and 5725-5825 bands.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted peak output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	20.86	121.90
2412 - 2462	802.11g SISO	23.64	231.21
2412 - 2462	802.11g 2TX CDD	25.26	335.74
2412 - 2462	802.11n HT20 SISO	23.74	236.59
2412 - 2462	802.11n HT20 2TX CDD	24.69	294.44
2422 - 2452	802.11n HT40 SISO	13.36	21.68
2422 - 2452	802.11n HT40 2TX CDD	16.81	47.97
5745 - 5825	802.11a SISO	26.38	434.51
5745 - 5825	802.11a 2TX CDD	29.59	909.91
5745 - 5825	802.11n HT20 SISO	25.99	397.19
5745 - 5825	802.11n HT20 2TX CDD	29.31	853.10
5755 - 5795	802.11n HT40 SISO	26.25	421.70
5755 - 5795	802.11n HT40 2TX CDD	29.39	868.96

Additional channels for the BE power reduction on g and HT20 modes at 2.4GHz band:

2.4GHz Band - 20MHz Channels			CH1 - 3	CH4	CH5	CH6	CH7	CH8	CH9 - 11
802.11g	SISO	q #	22	57	68	68	58	38	30
		Peak Output Power (dBm)	12.50	20.45	Same as Ch. 6	23.64	21.23	16.85	15.01
	CDD	q #	20	50	60	60	60	42	30
		Peak Output Power (dBm)	15.78	24.39	Same as Ch. 6	25.26	Same as Ch. 6	22.47	19.05
802.11n-HT20	SISO	q #	22	57	68	68	58	39	30
		Peak Output Power (dBm)	12.23	20.67	Same as Ch. 6	23.74	20.90	16.92	14.89
	CDD	q #	20	50	58	58	58	42	30
		Peak Output Power (dBm)	18.34	23.91	Same as Ch. 6	24.69	Same as Ch. 6	21.97	18.34

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain		Uncorrelated Gain	Correlated Gain
	Tx0	Tx1		
2.4	3.10	2.00	2.58	5.58
5.8	3.20	1.80	2.56	5.54

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was SW0906 v.1

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT supports only one orientation; therefore, X orientation (Lay down) was investigated and is considered the worst case.

Worst-case data rates from the base line scans of output power were:

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11g 2TX CDD mode: 6 Mbps
802.11a SISO mode: 6 Mbps
802.11n 2TX CDD mode, MCS0
802.11n HT20 SISO mode, MCS0
802.11n HT20 2TX CDD mode: MCS0
802.11n HT40 SISO mode, MCS0
802.11n HT40 2TX CDD mode: MCS0

The worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was in the mode and channel with the highest output power.

For all modes with two chains, CDD was selected per the software provided by the client. Based on the testing of the two chains, chain 1 was found to be worst-case for the antenna port. The radiated emissions test was based on the port with the higher antenna gain.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Remote Control	Echostar	21.0 IR/UHF PRO	158925	DKNFSK03

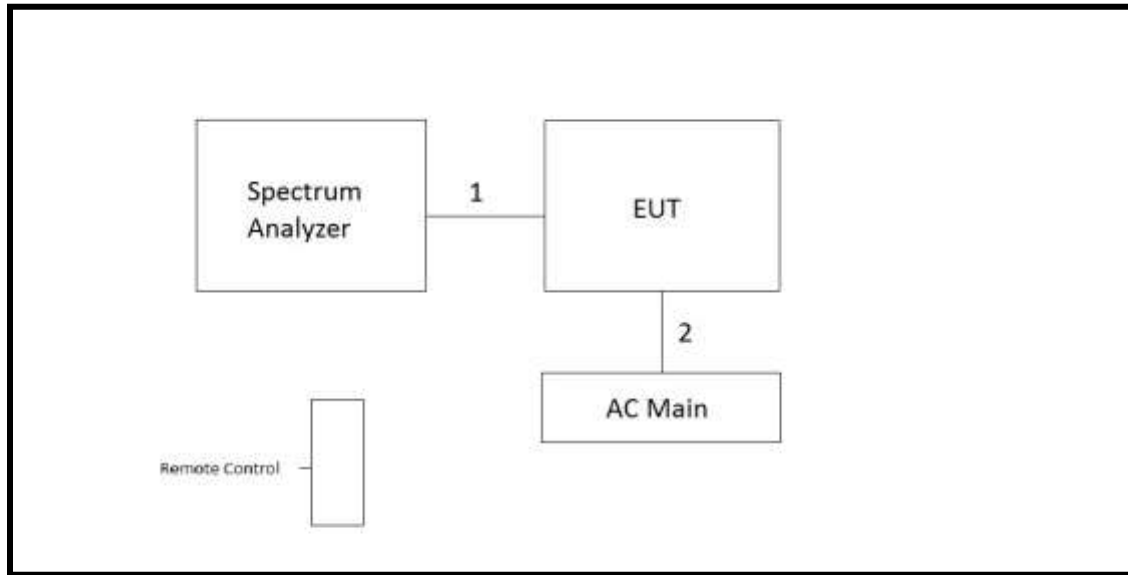
I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	COAX	0.1m	To Spectrum Analyzer
2	AC	1	AC	Un-Shielded	1.5m	NA

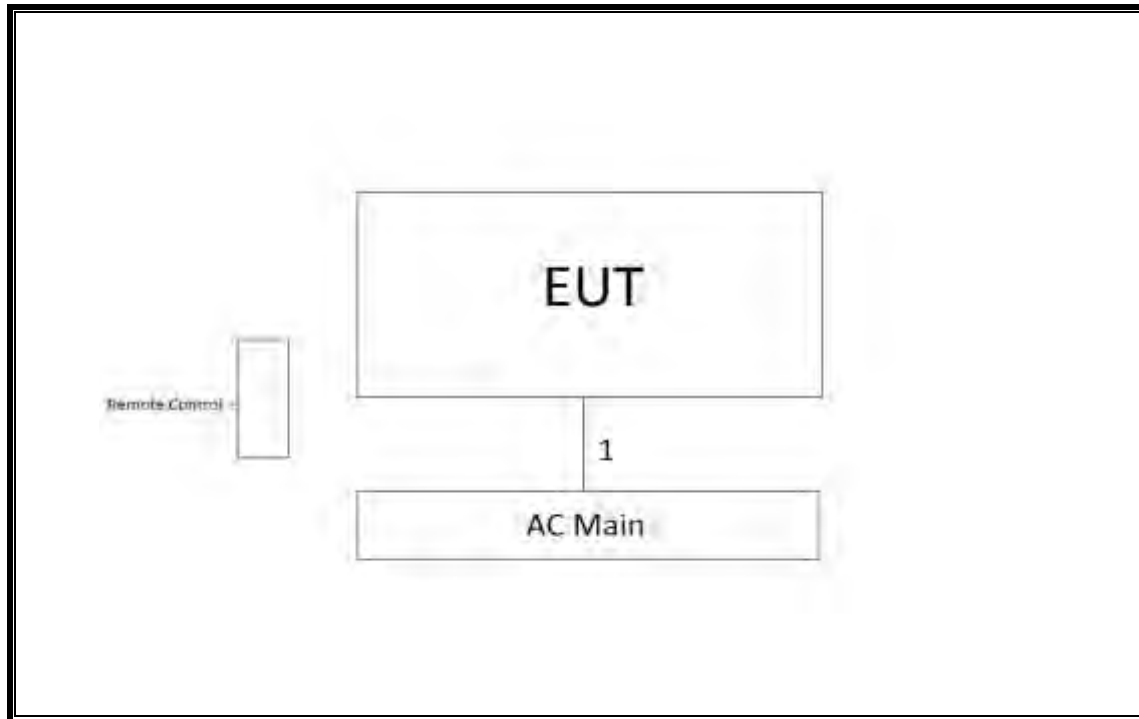
I/O CABLES (RADIATED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-Shielded	1.5m	NA

SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED 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 Due
Horn Antenna 1-18GHz	ETS Lindgren	3117	F00131	02/19/14
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/28/14
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	05/06/14
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB3	F00027	03/07/14
Spectrum Analyzer, 40 GHz	Agilent / HP	8564E	C00951	07/29/14
Peak / Average Power Sensor	Agilent / HP	E9323A	F00163	04/03/14
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/14
P-Series single channel Power Meter	Agilent / HP	N1911A	F00164	04/03/14
Spectrum Analyzer, 3Hz-44GHz	Agilent	N9030A	F00127	02/22/14
PreApmplifier, 1-26.5GHz	Agilent	8449B	C01052	10/22/13
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	F00194	05/14/14
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/15/14
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/20/14

6.1.1.

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

7.1. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01.

Output Power: KDB 558074 D01.

Power Spectral Density: KDB 558074 D01.

Out-of-band emissions in non-restricted bands: KDB 558074 D01.

Out-of-band emissions in restricted bands: KDB 558074 D01.

7.2. ON TIME AND DUTY CYCLE RESULTS

LIMITS

None; for reporting purposes only.

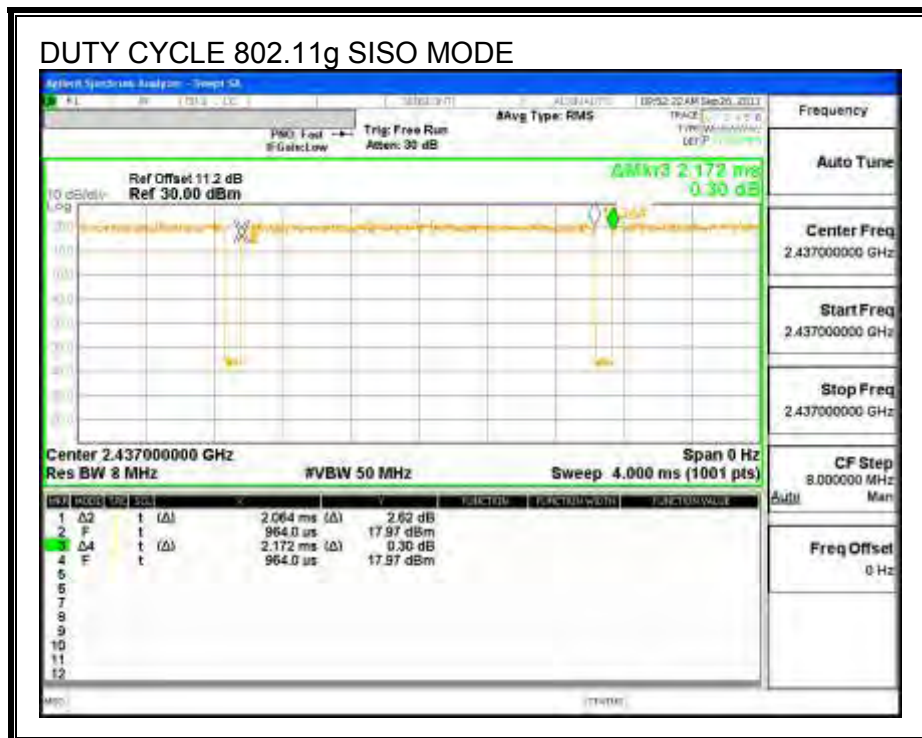
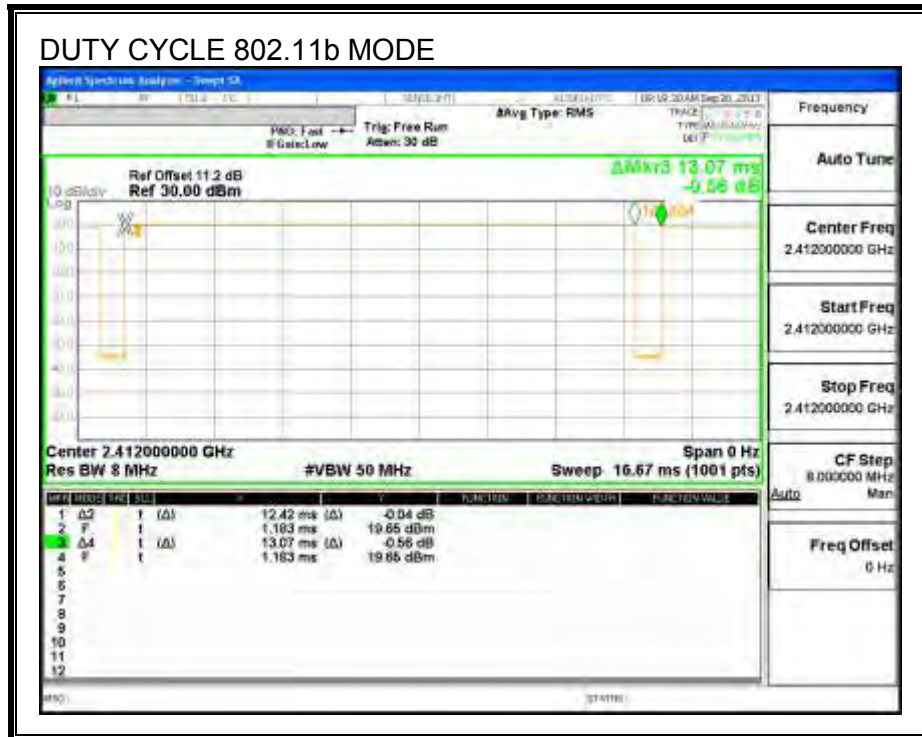
PROCEDURE

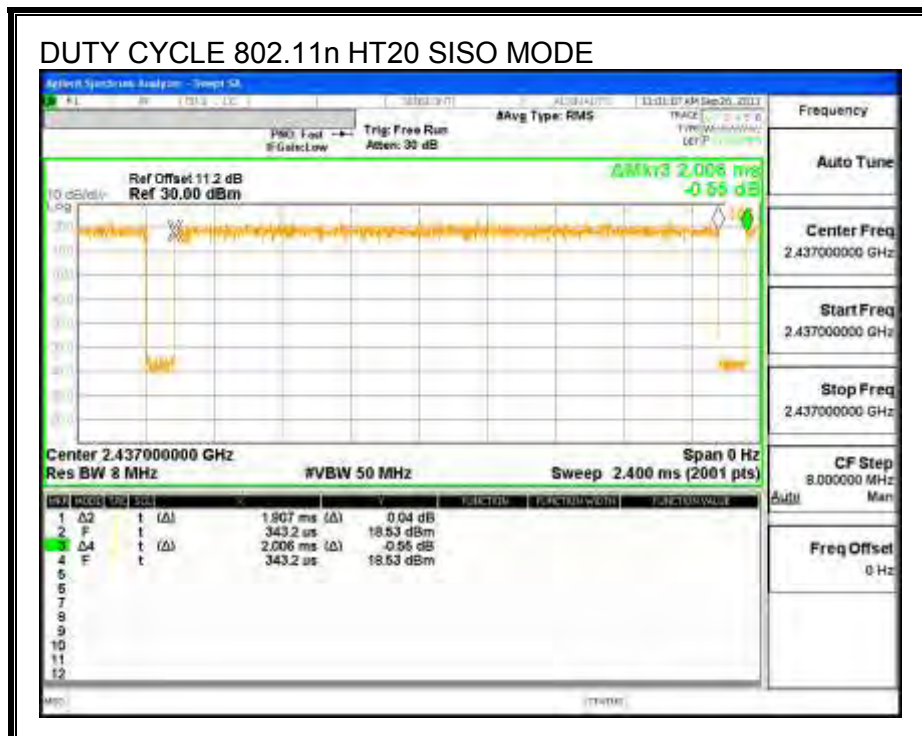
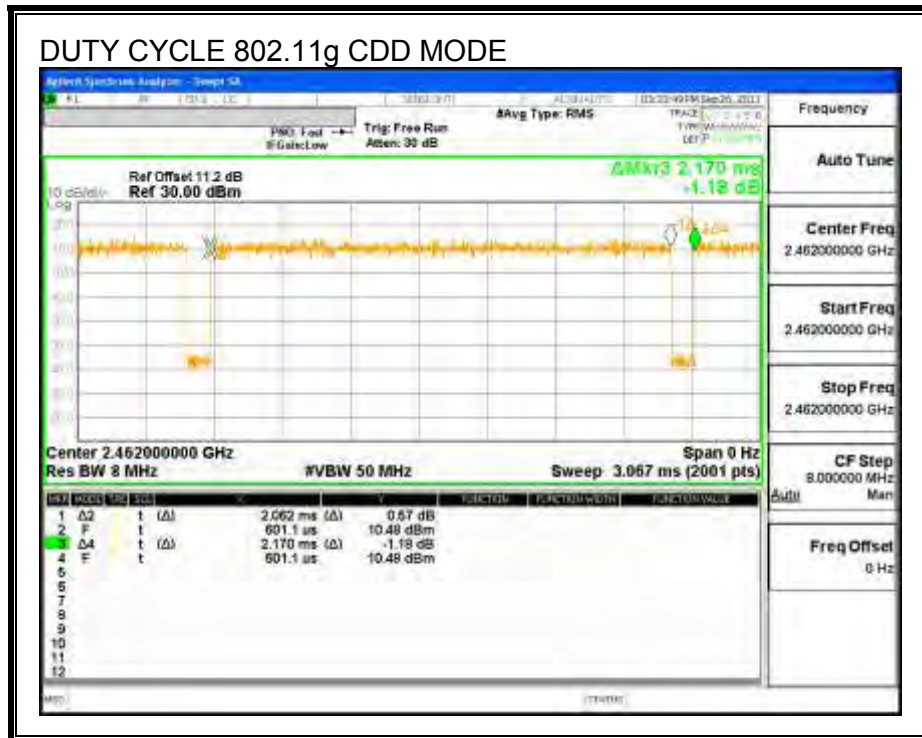
KDB 789033 Zero-Span Spectrum Analyzer Method.

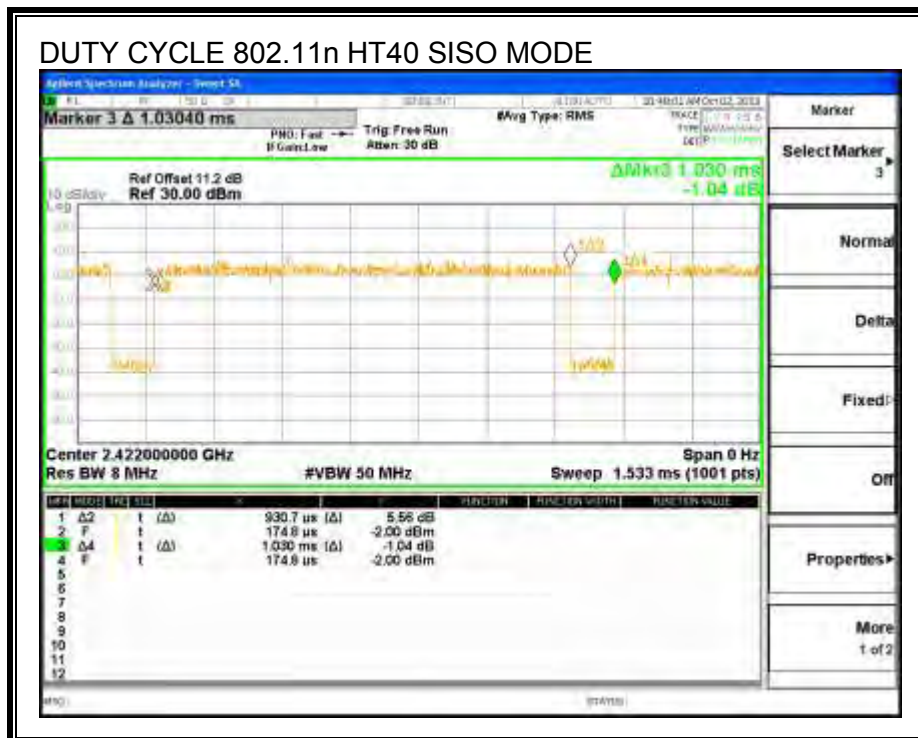
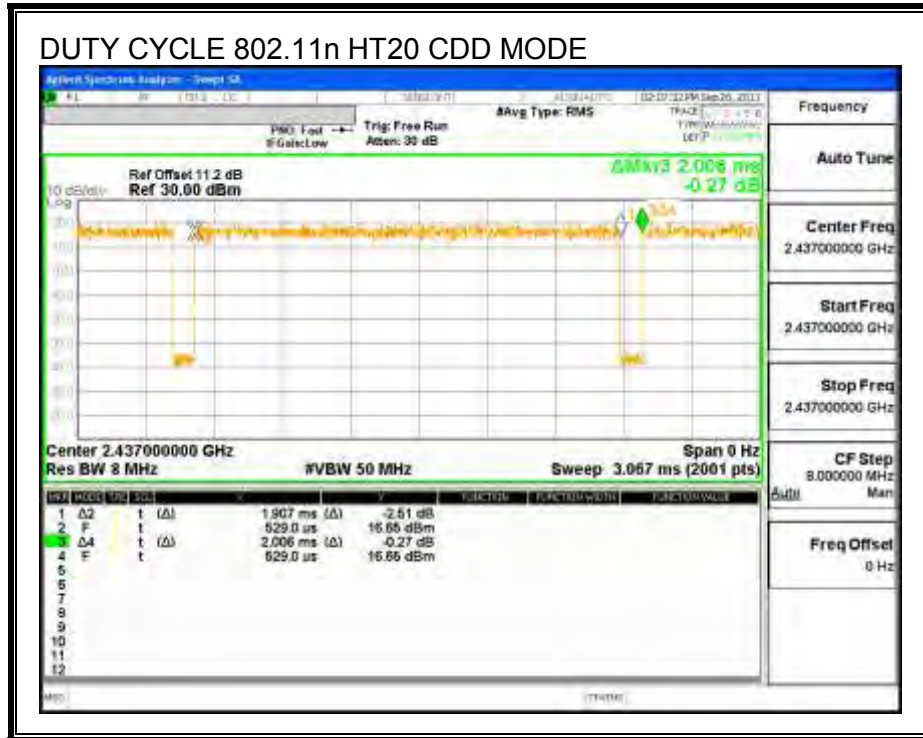
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
2.4 GHz						
802.11b	12.42	13.07	0.950	95.0%	0.22	0.081
802.11g SISO	2.064	2.172	0.950	95.0%	0.22	0.484
802.11g CDD	2.062	2.170	0.950	95.0%	0.22	0.485
802.11n HT20 SISO	1.907	2.006	0.951	95.1%	0.22	0.524
802.11n HT20 CDD	1.907	2.006	0.951	95.1%	0.22	0.524
802.11n HT40 SISO	0.931	1.030	0.904	90.4%	0.44	1.074
802.11n HT40 CDD	0.929	1.027	0.905	90.5%	0.44	1.076
5.8 GHz						
802.11a SISO	2.063	2.171	0.950	95.0%	0.22	0.461
802.11a CDD	2.061	2.171	0.949	94.9%	0.23	0.461
802.11n HT20 SISO	1.904	2.005	0.950	95.0%	0.22	0.499
802.11n HT20 CDD	1.906	2.005	0.951	95.1%	0.22	0.499
802.11n HT40 SISO	0.920	1.028	0.895	89.5%	0.48	0.973
802.11n HT40 CDD	0.922	1.030	0.895	89.5%	0.48	0.971

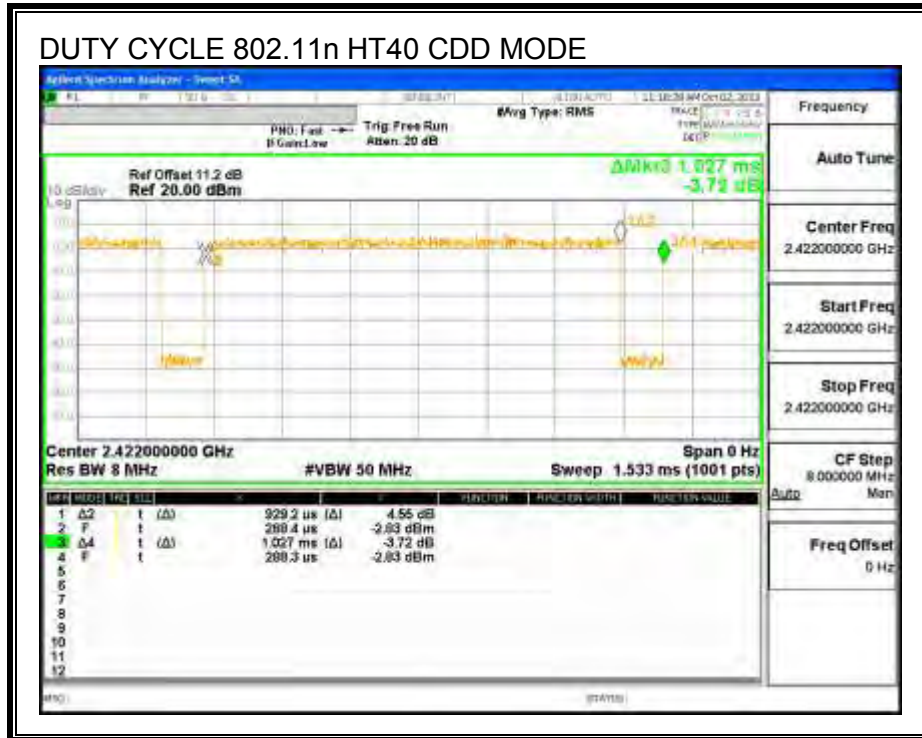
7.2.1. DUTY CYCLE PLOTS

2.4 GHz Band

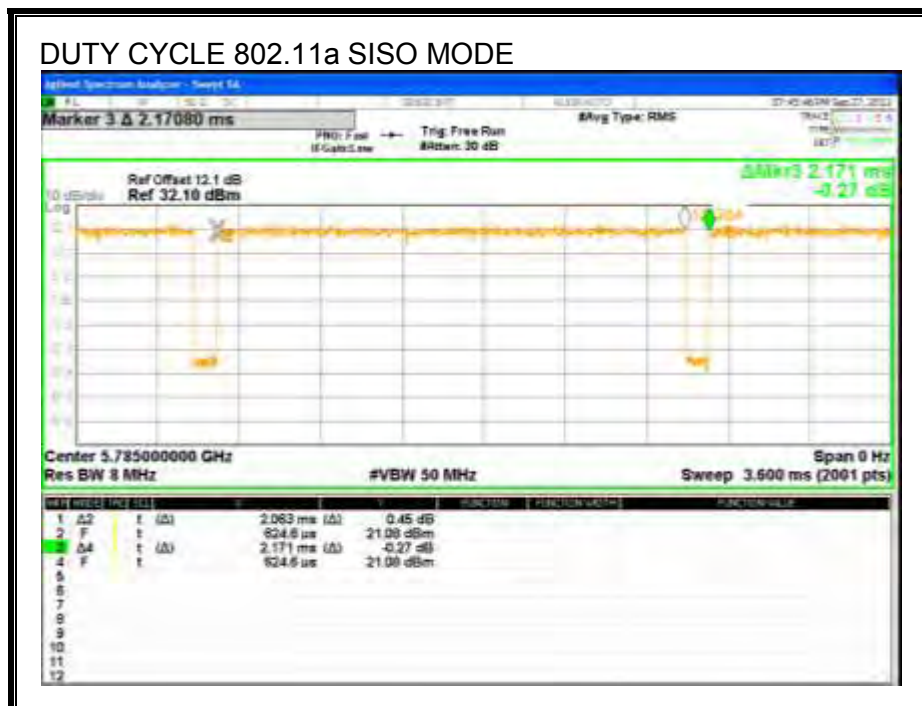


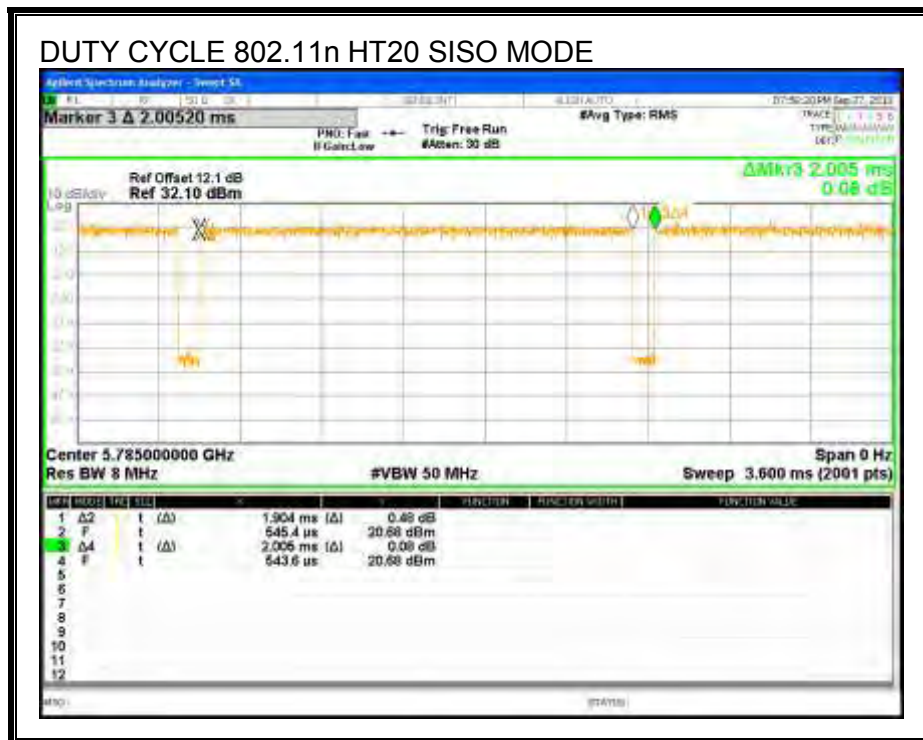
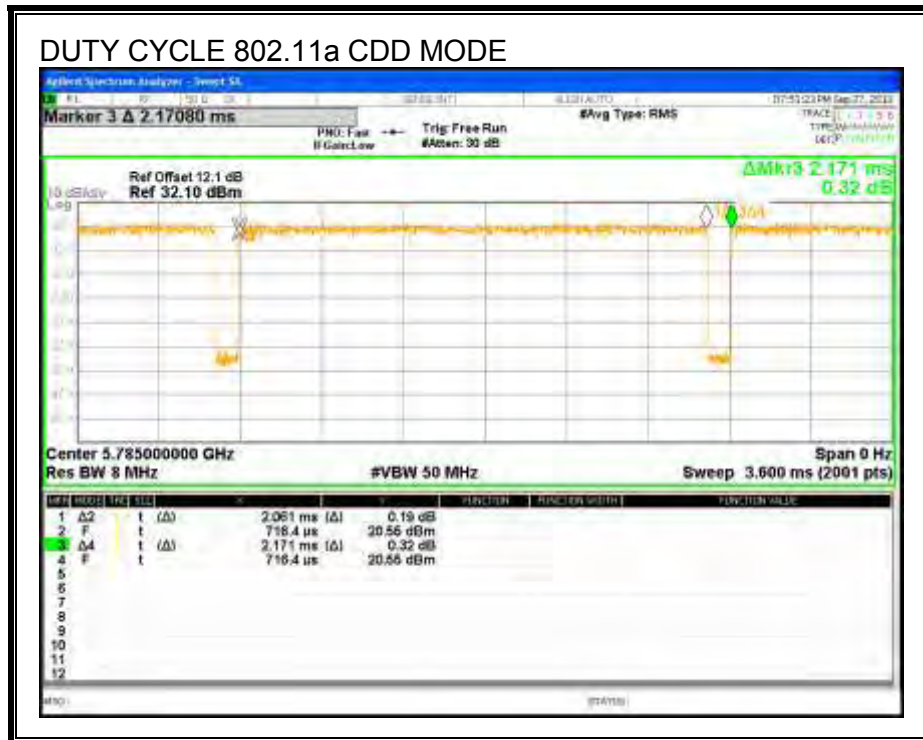


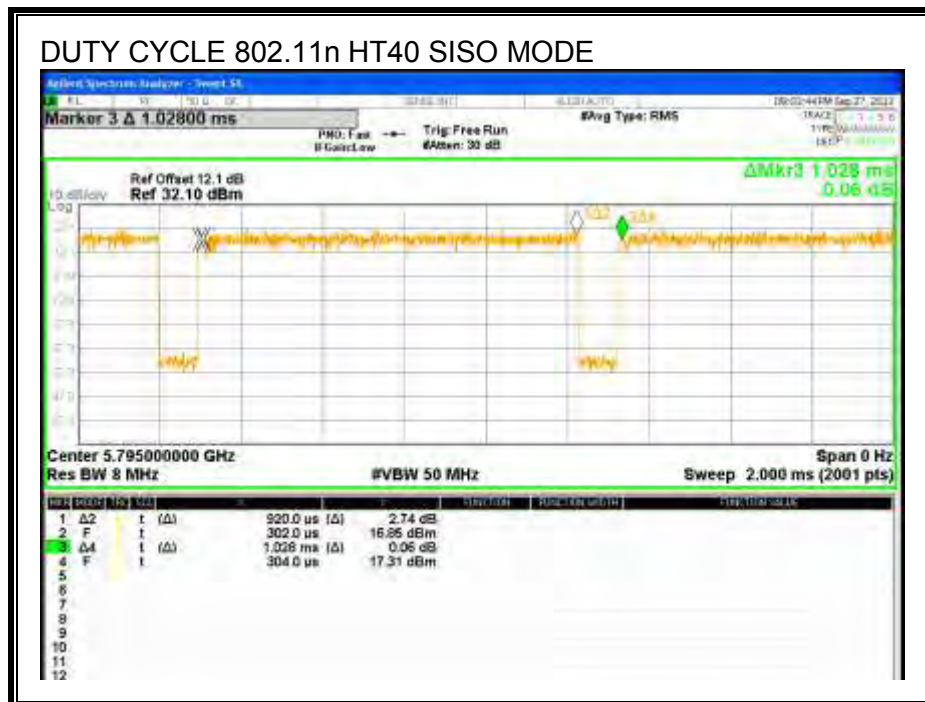
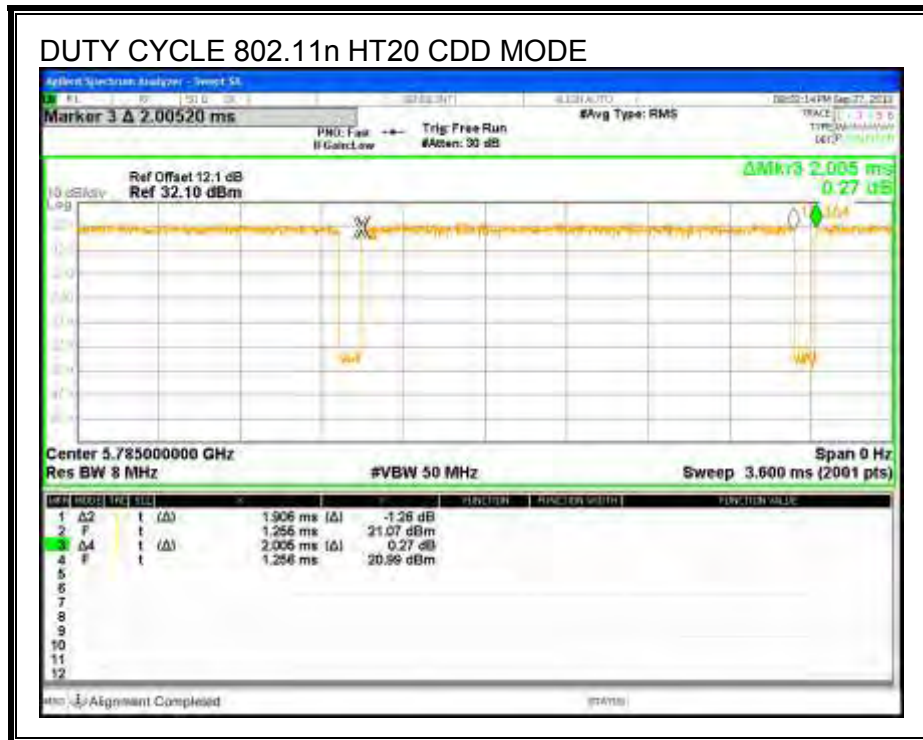


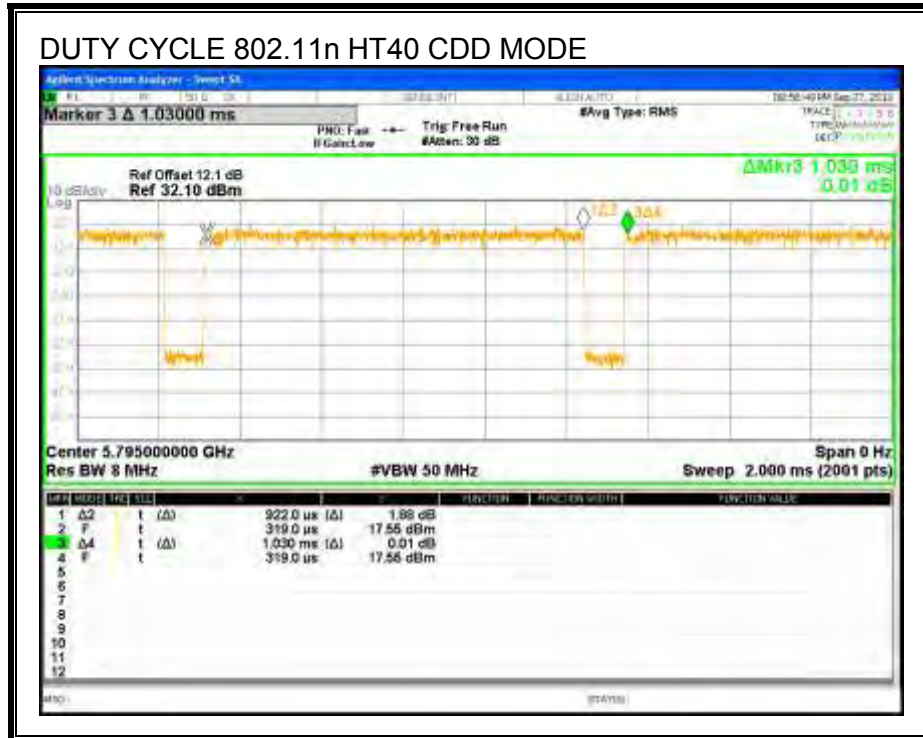


5.8GHz Band









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)

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

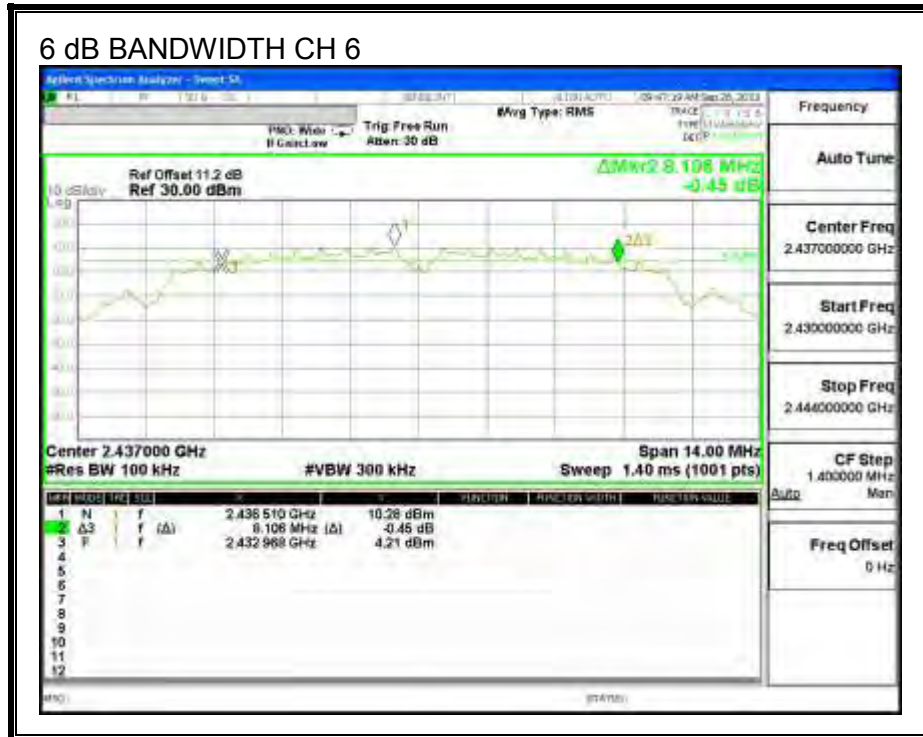
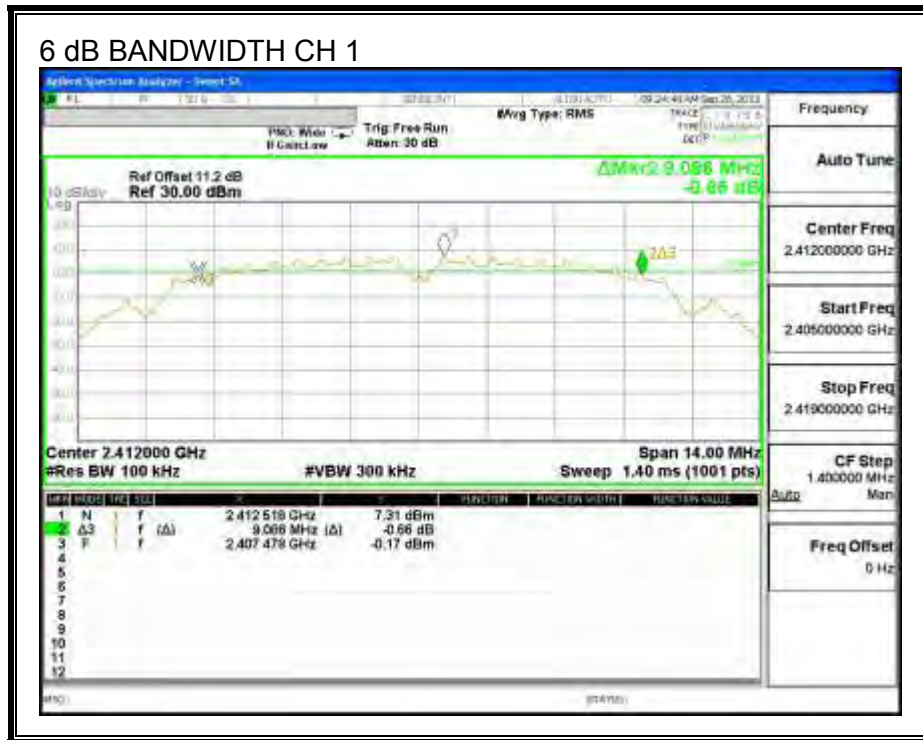
TEST PROCEDURE

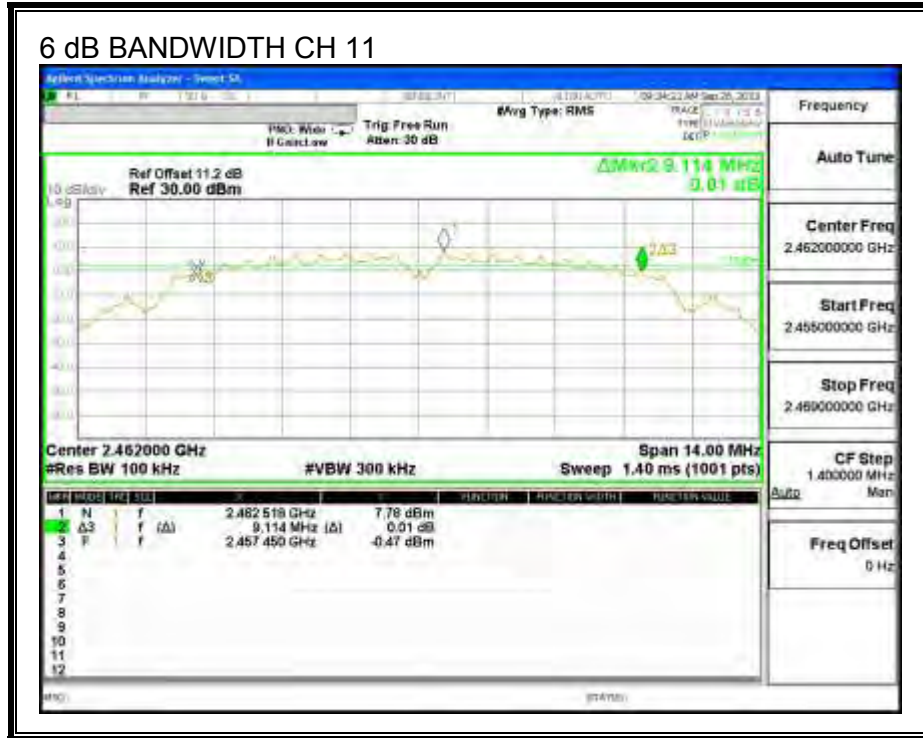
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
1	2412	9.086	0.5
6	2437	8.106	0.5
11	2462	9.114	0.5

6 dB BANDWIDTH





8.1.2. 99% BANDWIDTH

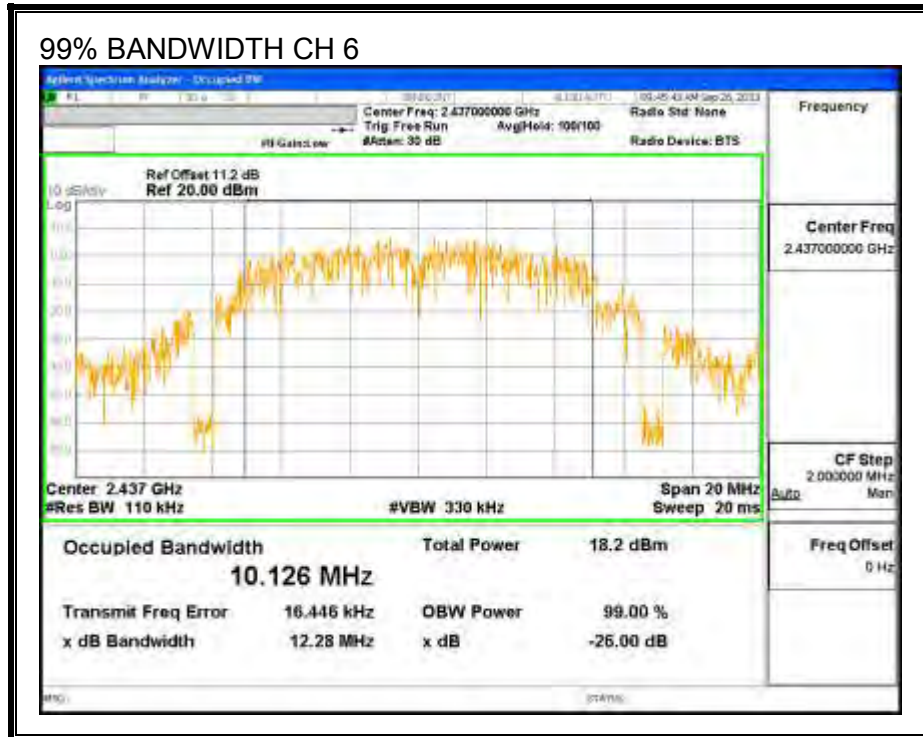
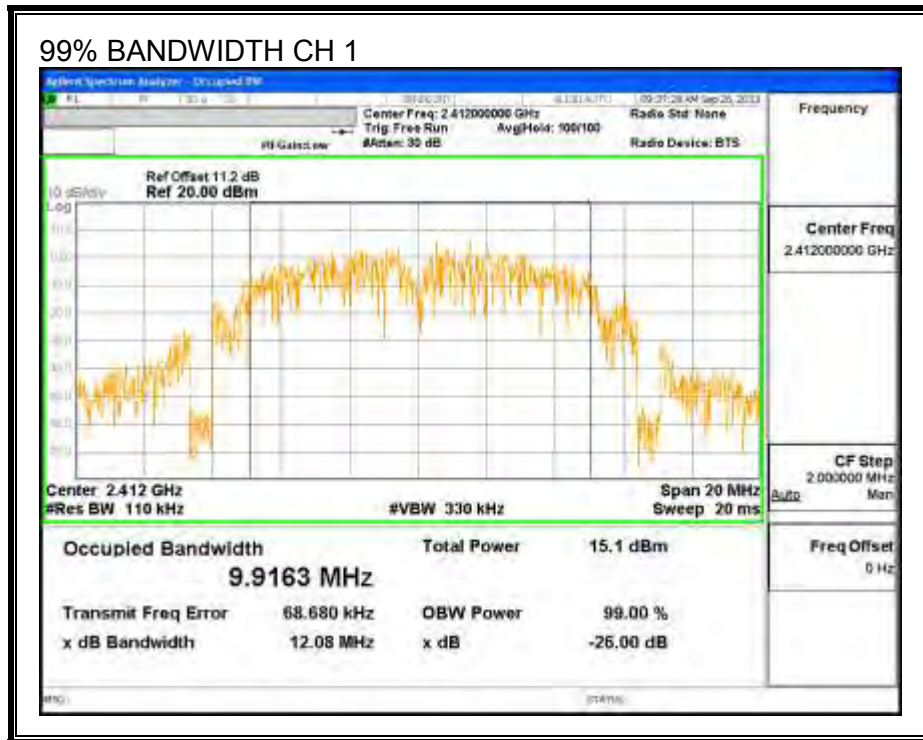
LIMITS

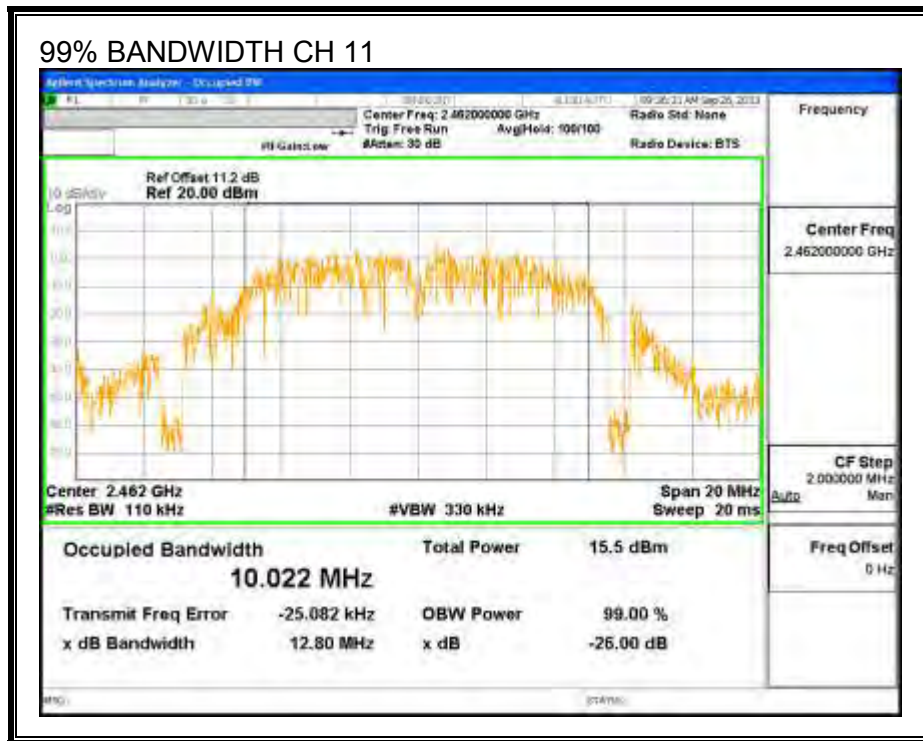
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
1	2412	9.9163
6	2437	10.126
11	2462	10.022

99% BANDWIDTH





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 11.42 dB (including 10 dB pad, 1.2 dB cable, and .22 duty cycle correction factor) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
1	2412	15.16
6	2437	17.90
11	2462	15.30

8.1.4. 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

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

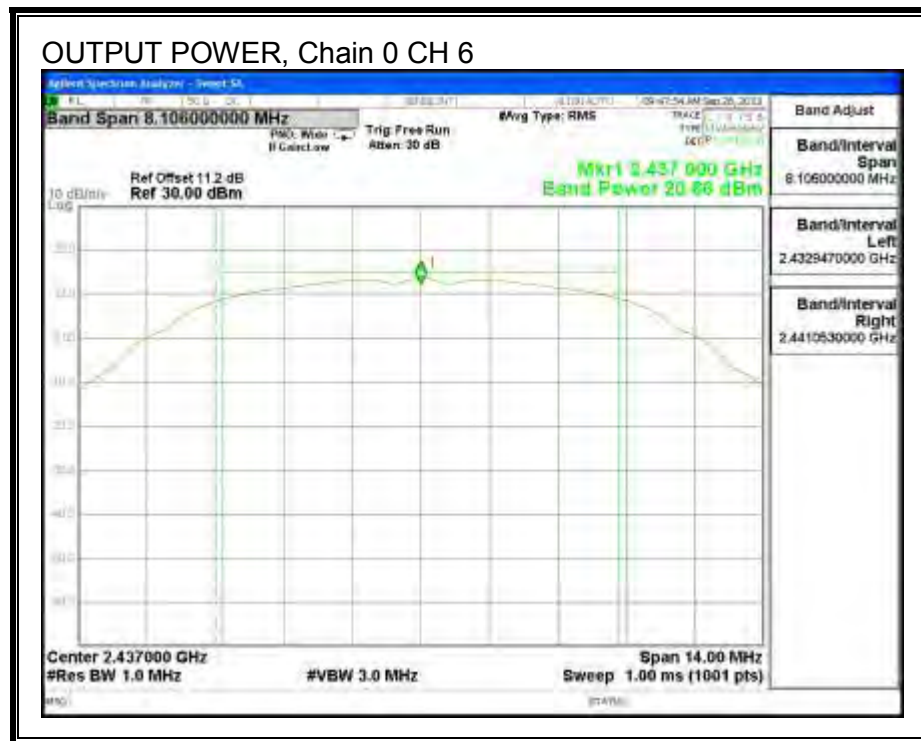
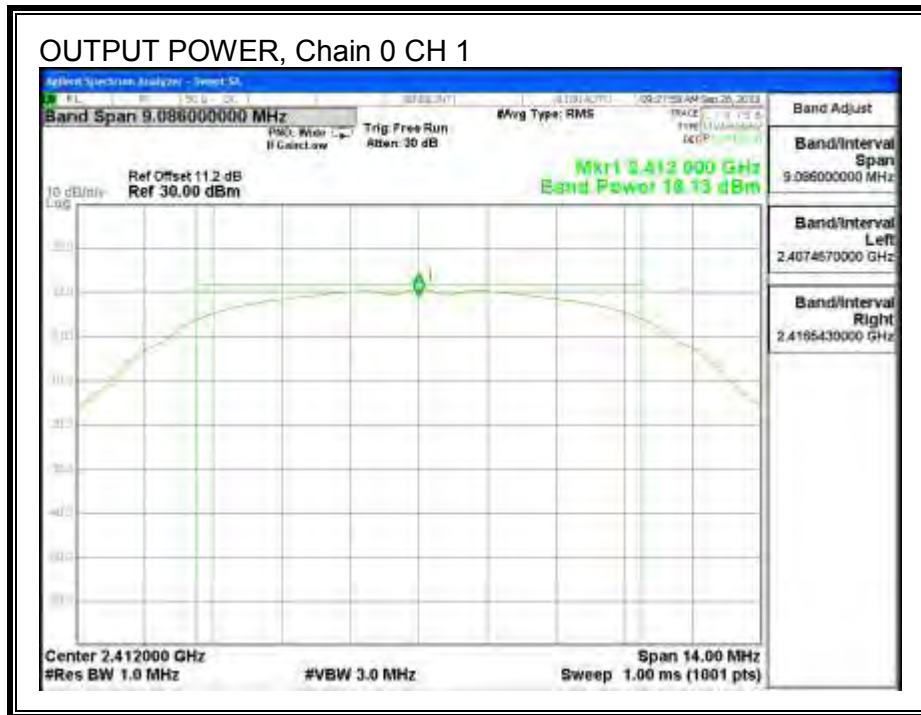
Limits

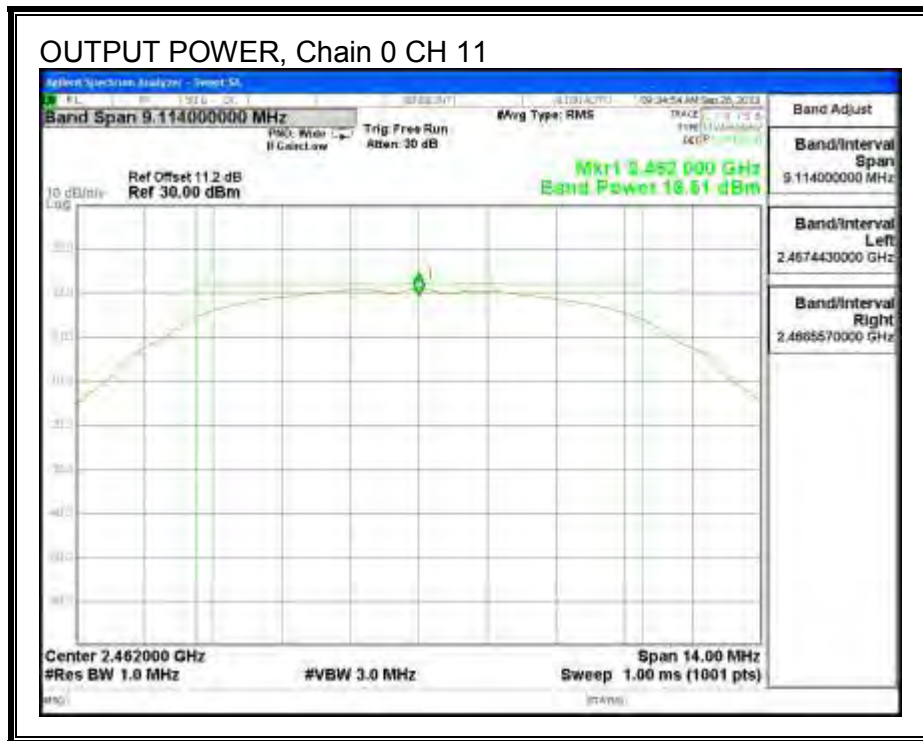
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
1	2412	3.1	30.00	30	36	30.00
6	2437	3.1	30.00	30	36	30.00
11	2462	3.1	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
1	2412	18.13	18.13	30.00	-11.87
6	2437	20.86	20.86	30.00	-9.14
11	2462	18.51	18.51	30.00	-11.49

OUTPUT POWER, Chain 0





8.1.5. PSD

LIMITS

FCC §15.247

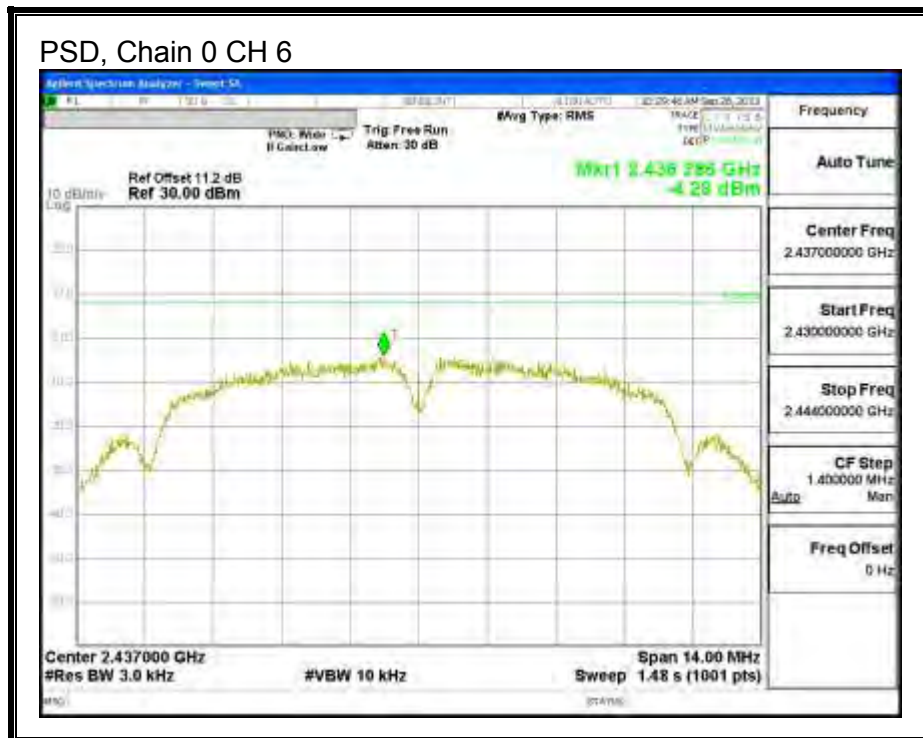
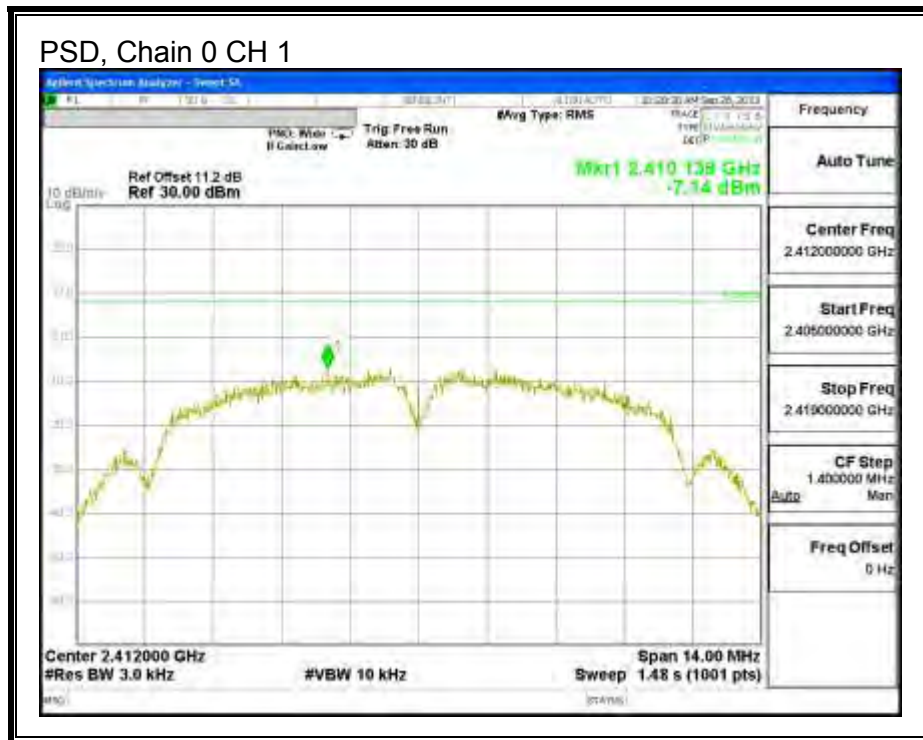
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

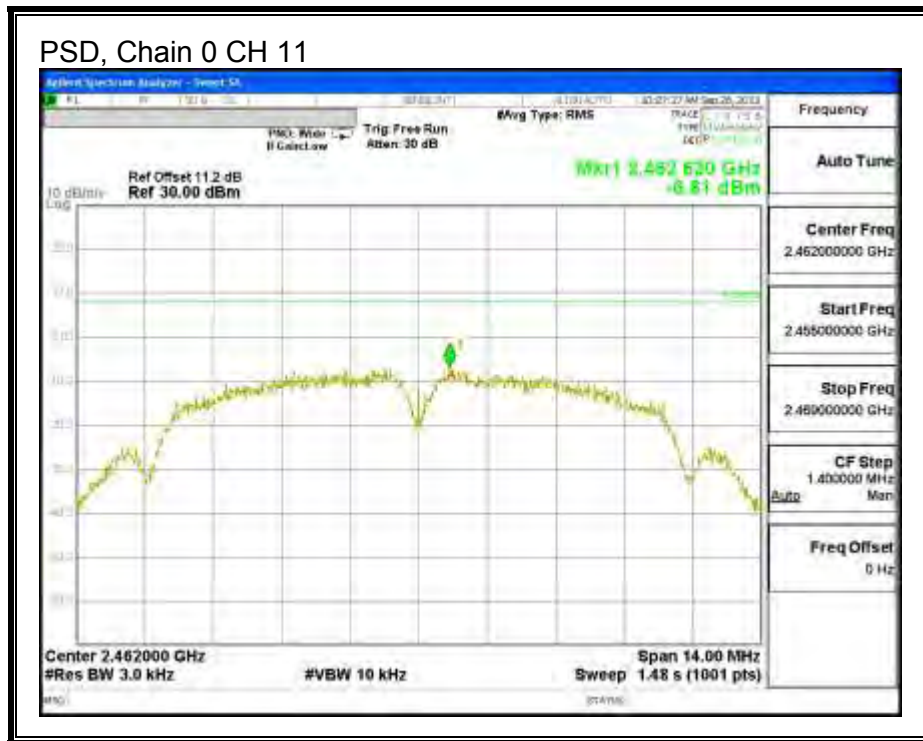
RESULTS

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Limit (dBm)	Margin (dB)
1	2412	-7.14	8.0	-15.1
6	2437	-4.28	8.0	-12.3
11	2462	-6.81	8.0	-14.8

PSD, Chain 0





8.1.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

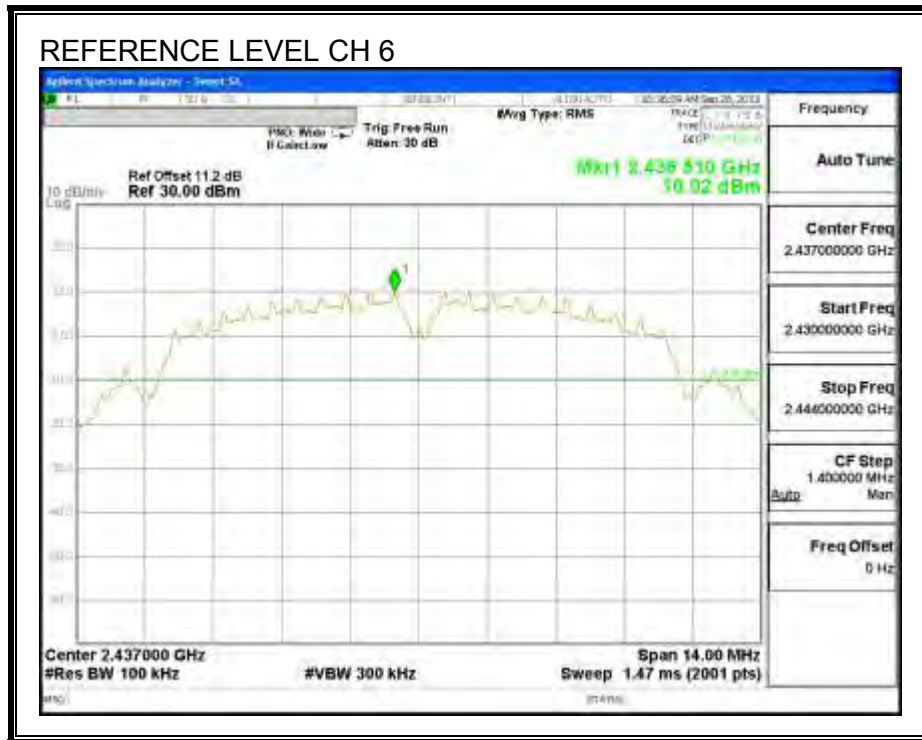
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

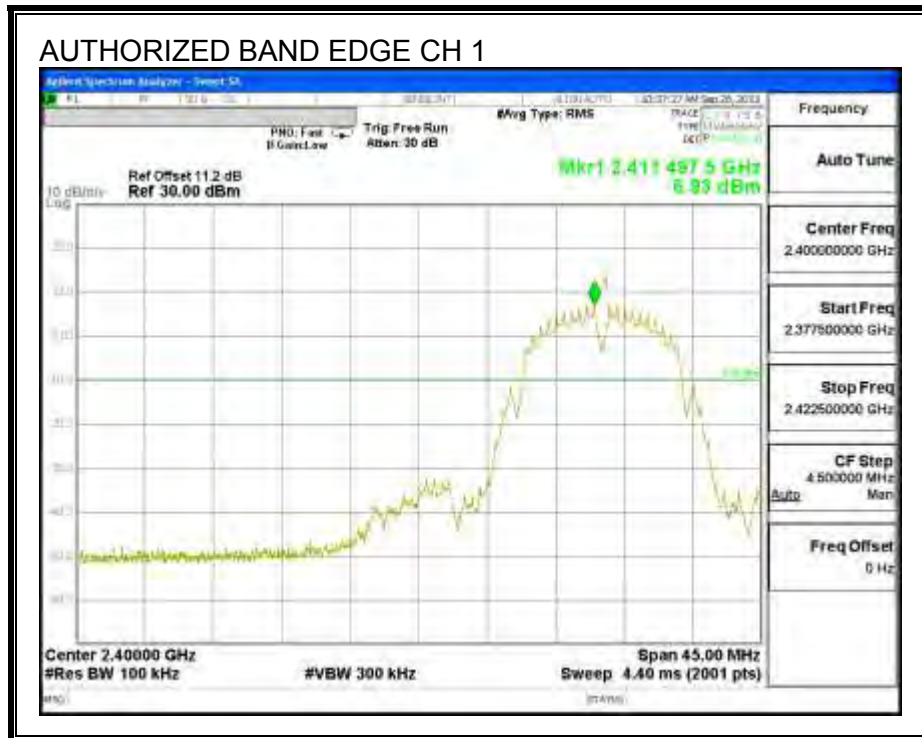
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

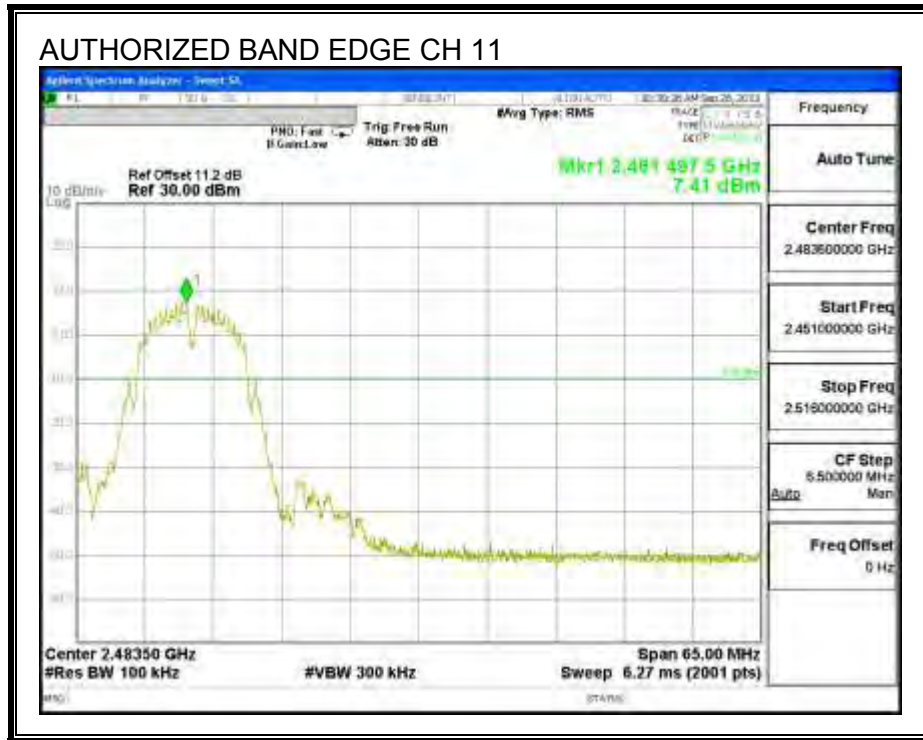
IN-BAND REFERENCE LEVEL



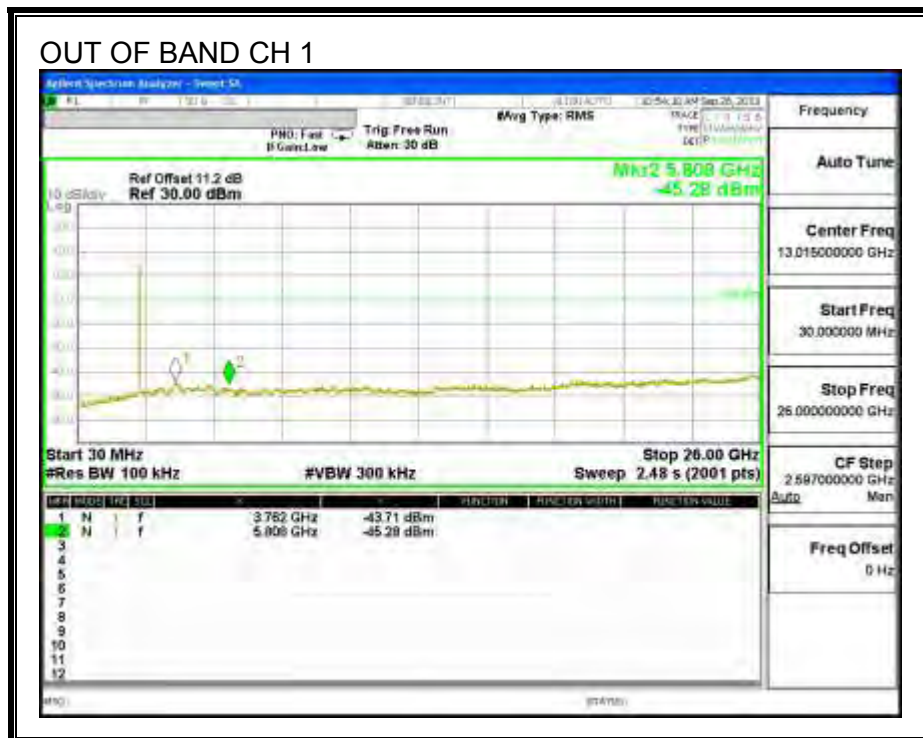
LOW CHANNEL BANDEDGE

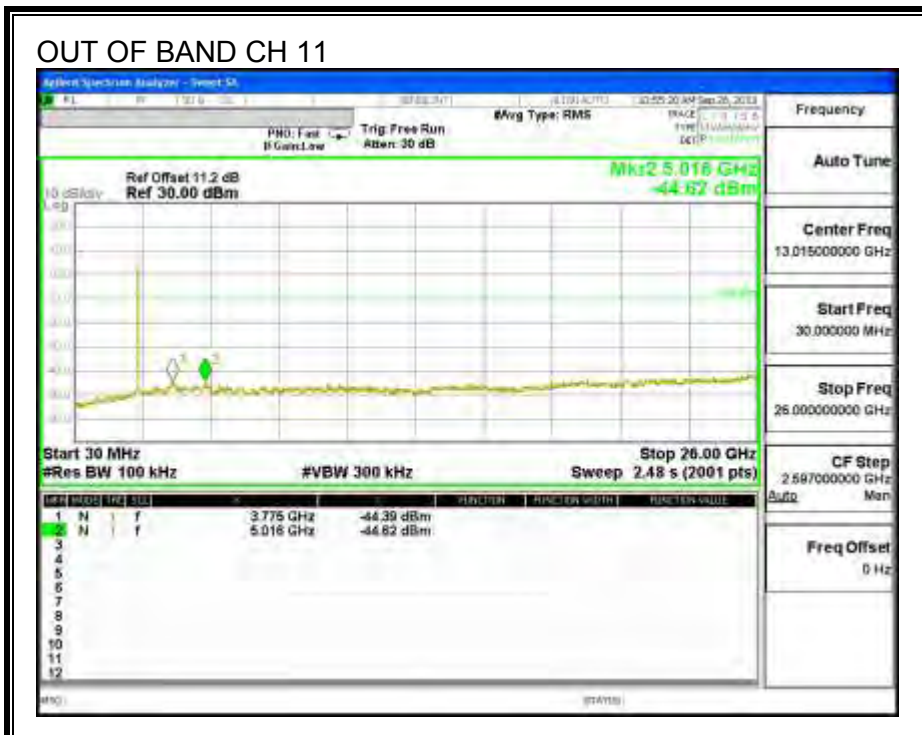
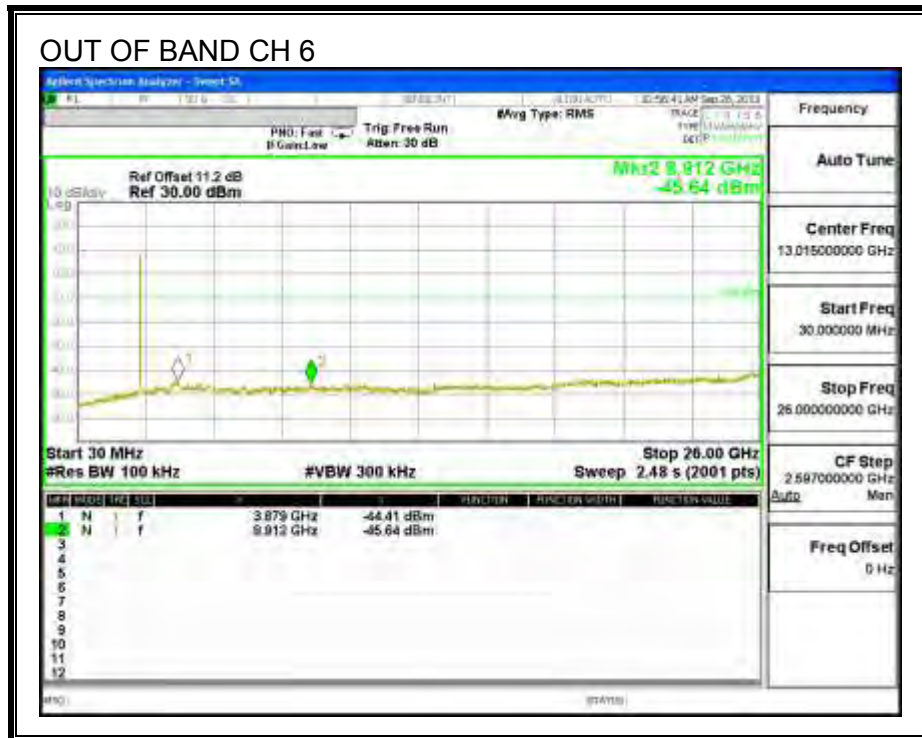


HIGH CHANNEL BANDEDGE



OUT-OF-BAND EMISSIONS





8.2. 802.11g SISO 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.

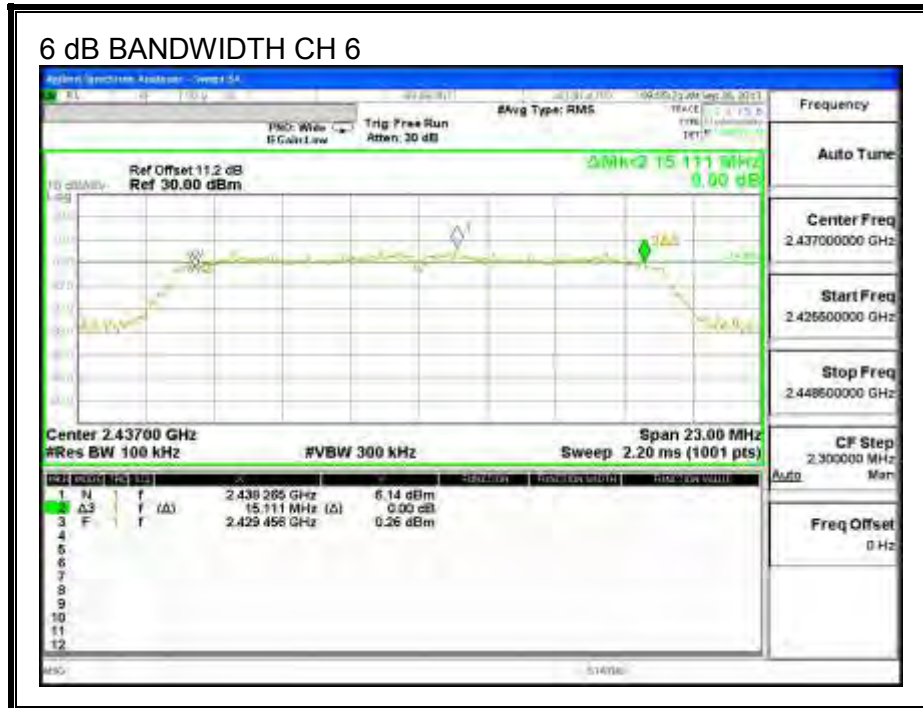
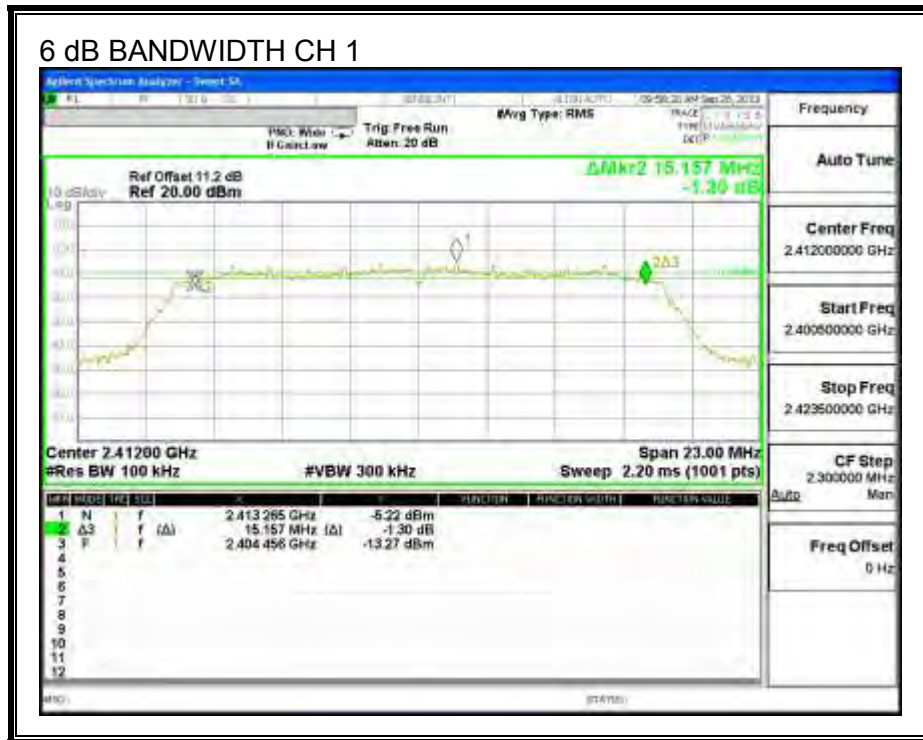
TEST PROCEDURE

558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
1	2412	15.157	0.5
6	2437	15.111	0.5
11	2462	15.134	0.5

6 dB BANDWIDTH



8.2.2. 99% BANDWIDTH

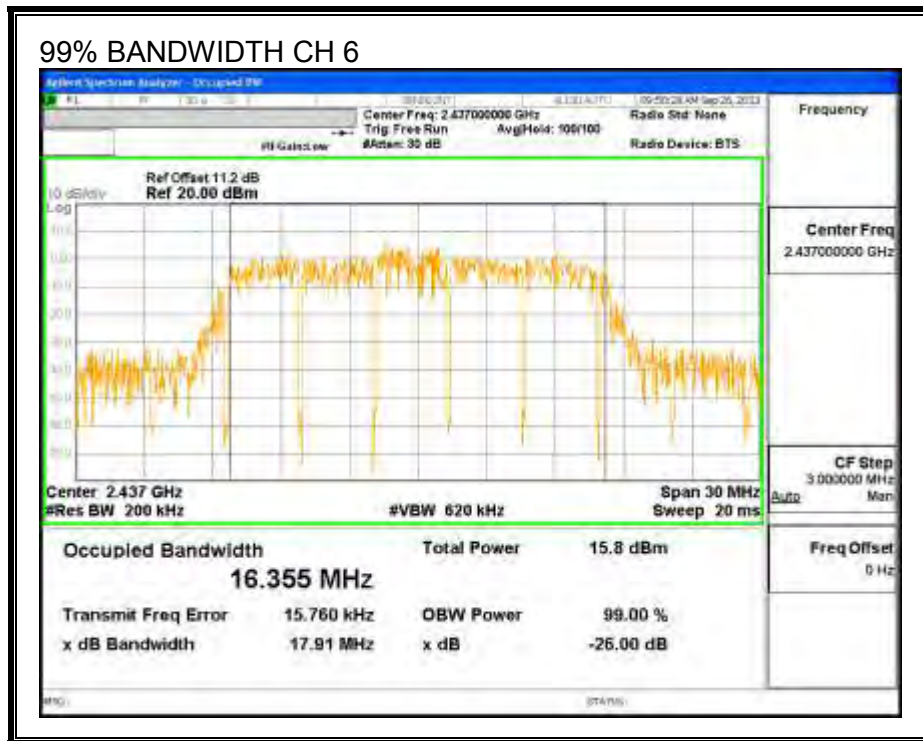
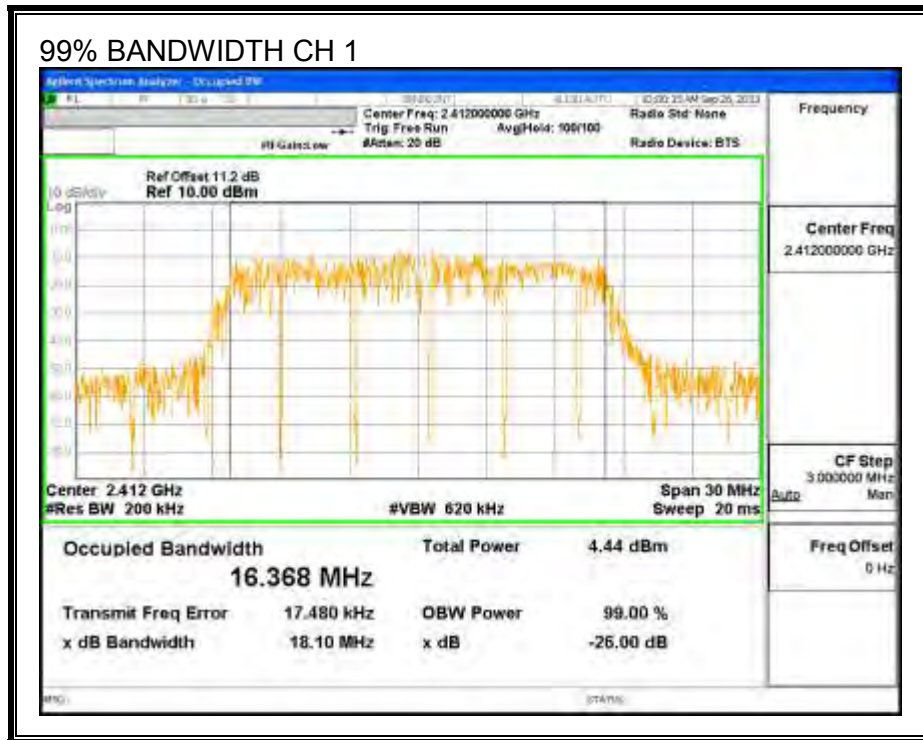
LIMITS

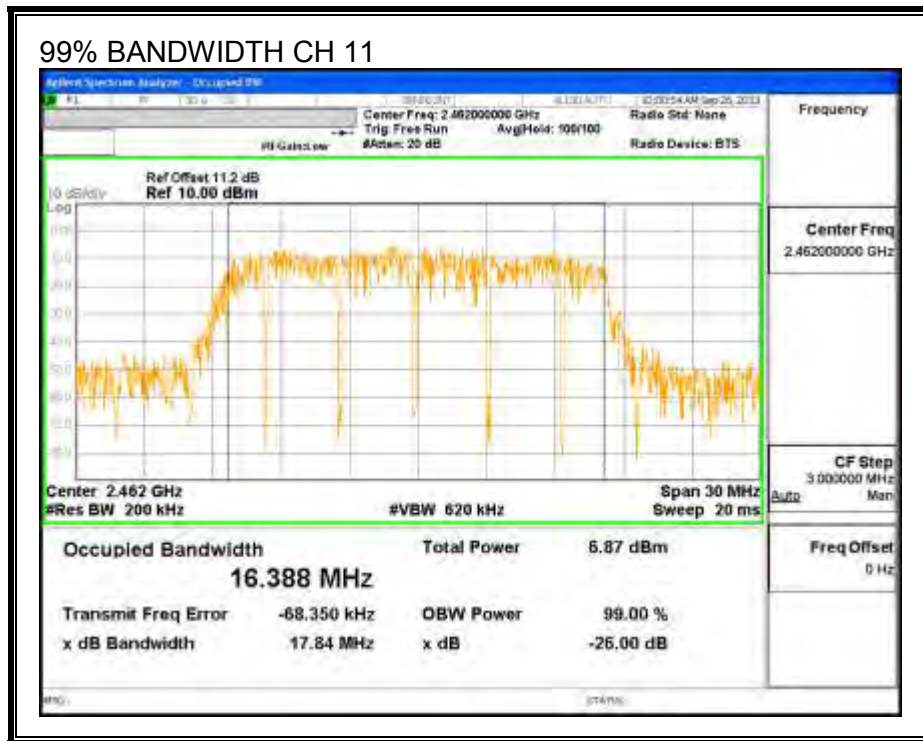
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
1	2412	16.368
6	2437	16.355
11	2462	16.388

99% BANDWIDTH





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 11.42 dB (including 10 dB pad, 1.2 dB cable, and .22 duty cycle correction factor) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
1	2412	4.50
4	2427	13.68
6	2437	15.91
7	2442	13.95
8	2447	9.74
11	2462	6.93

8.2.4. 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

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

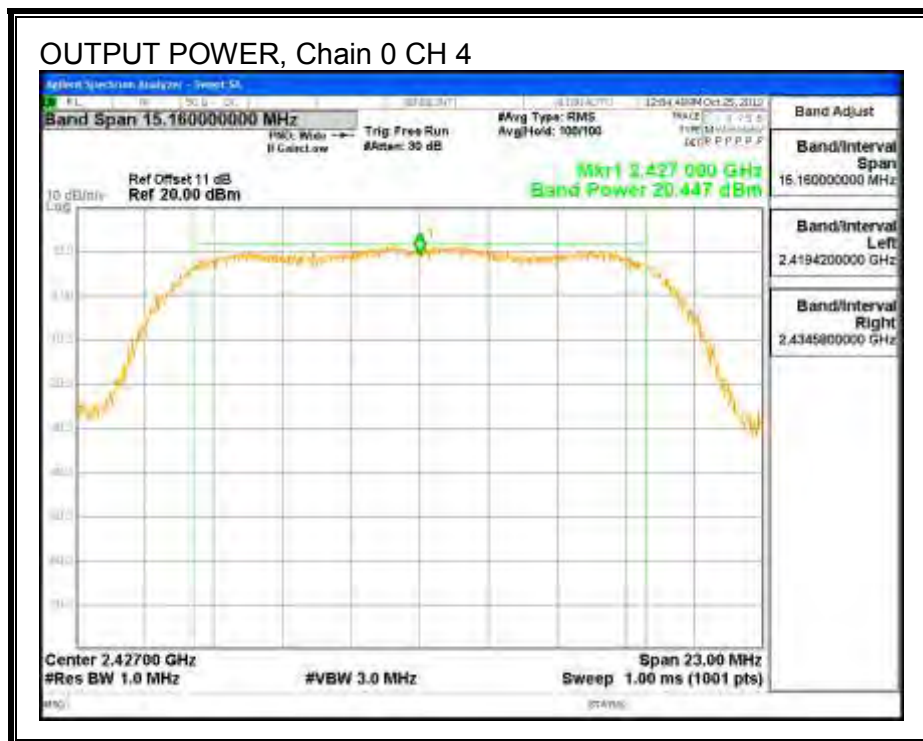
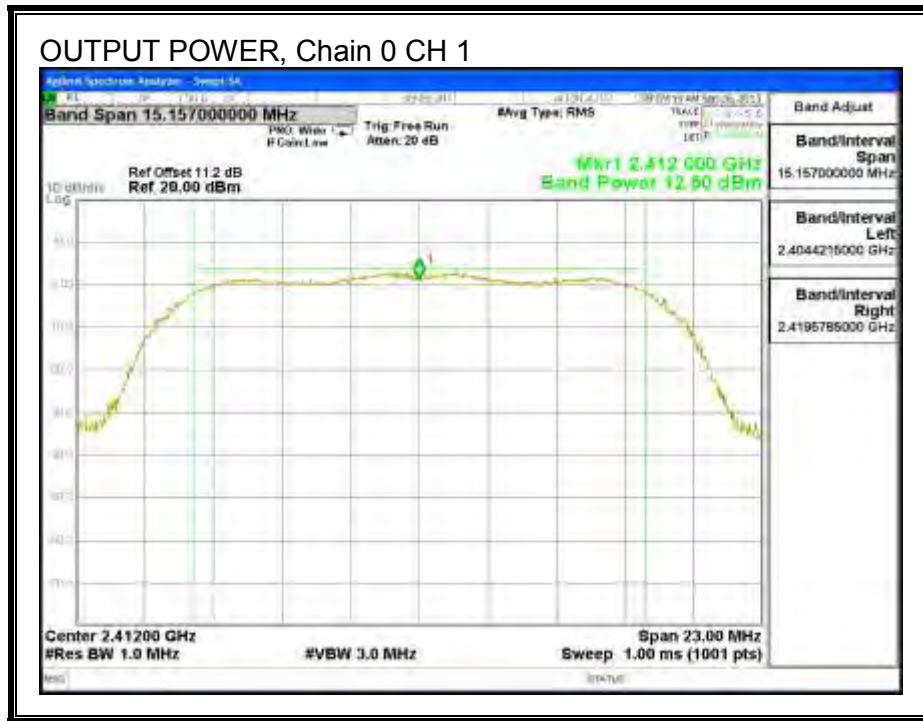
Limits

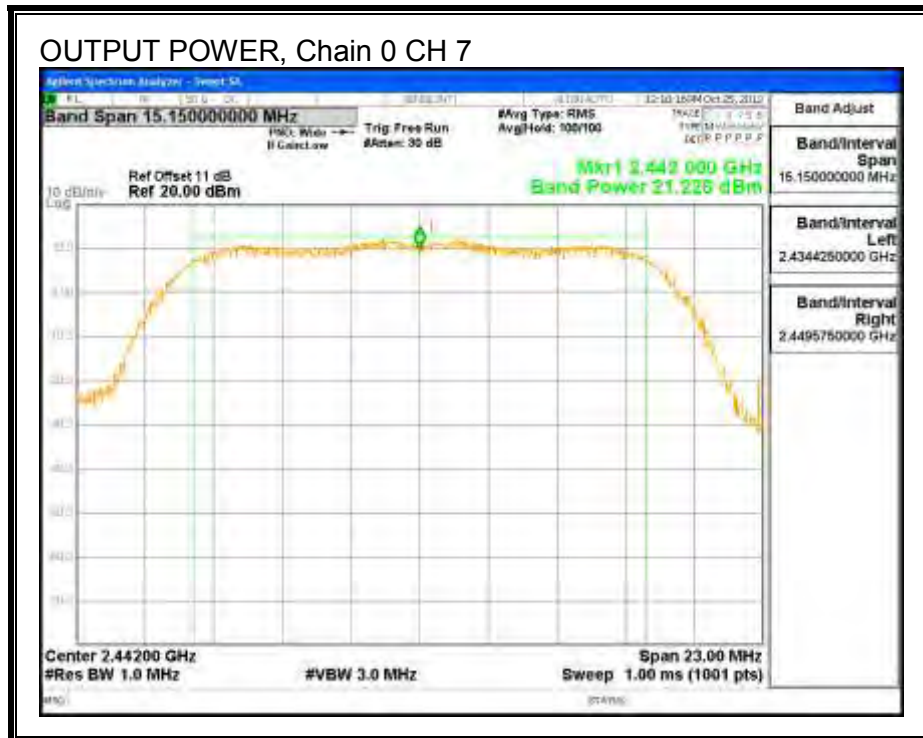
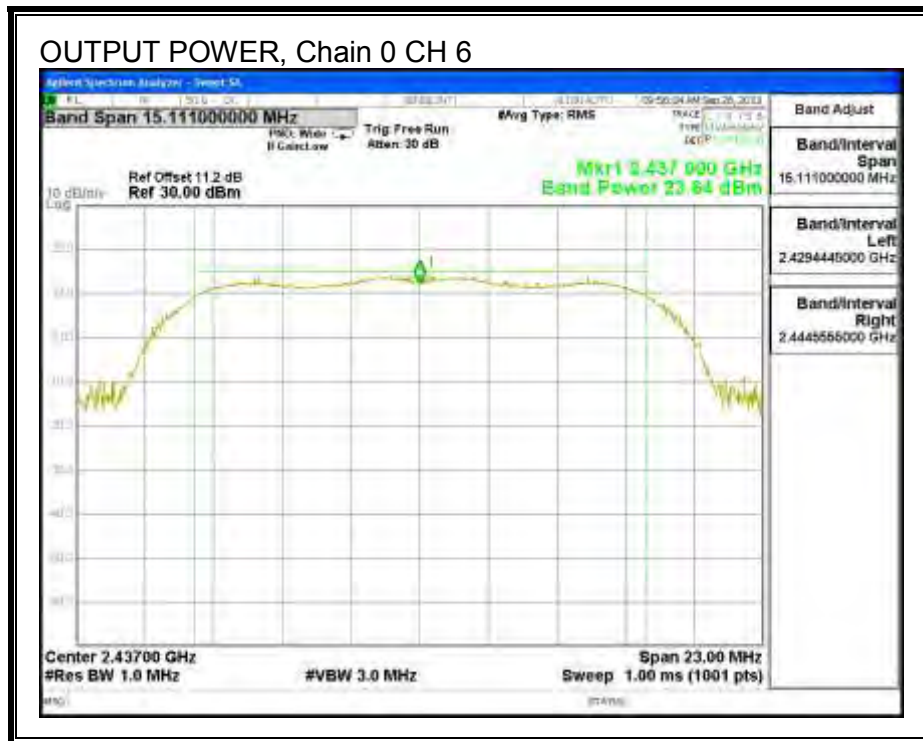
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
1	2412	3.1	30.00	30	36	30.00
4	2427	3.1	30.00	30	36	30.00
6	2437	3.1	30.00	30	36	30.00
7	2442	3.1	30.00	30	36	30.00
8	2447	3.1	30.00	30	36	30.00
11	2462	3.1	30.00	30	36	30.00

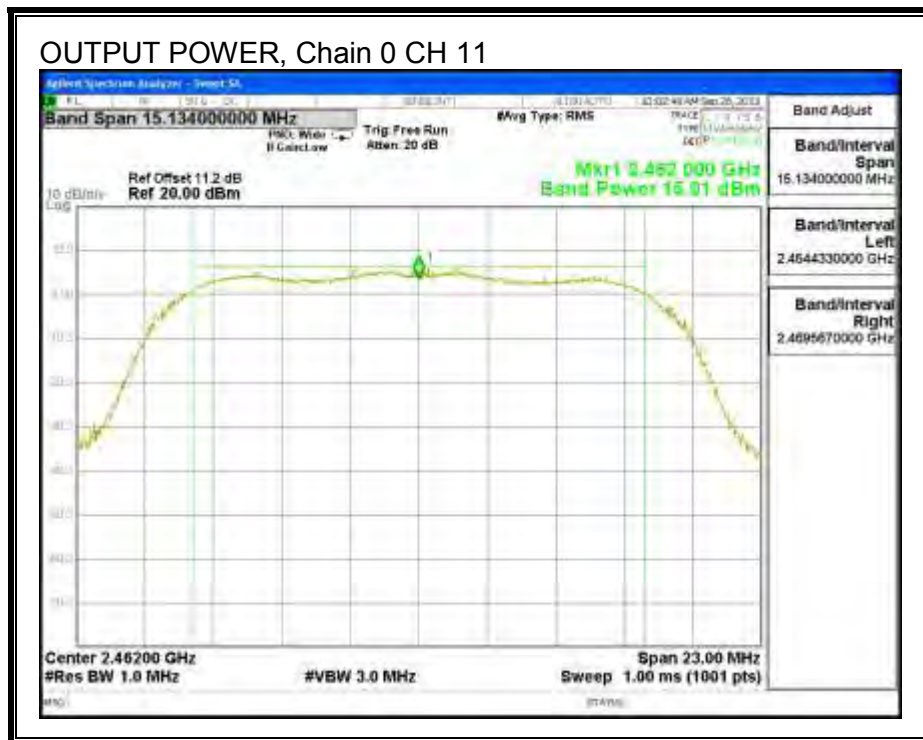
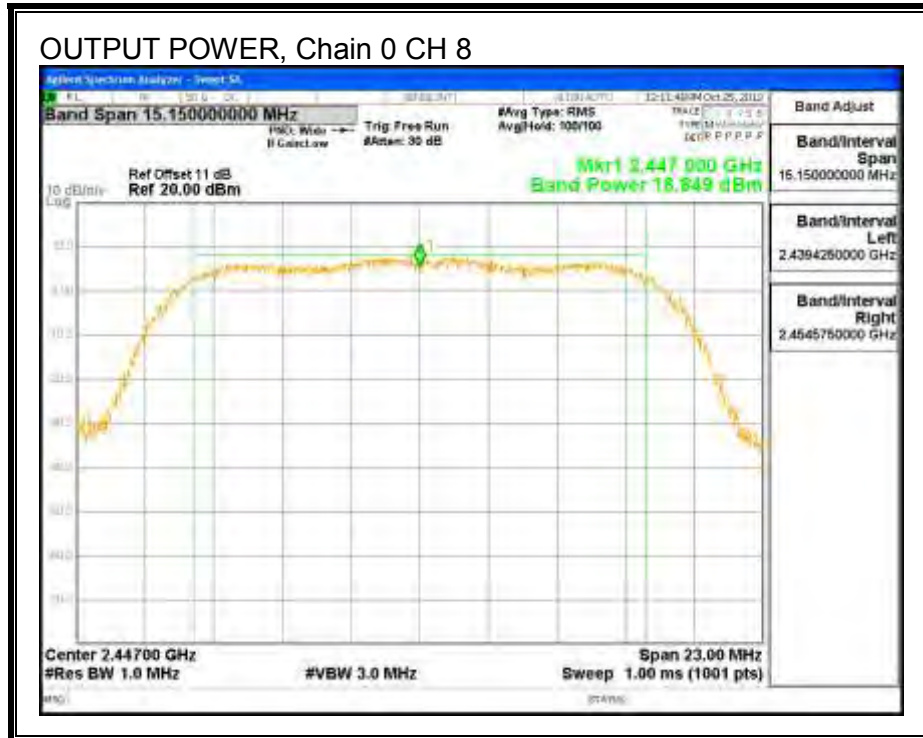
Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
1	2412	12.50	12.50	30.00	-17.50
4	2427	20.45	20.45	30.00	-9.55
6	2437	23.64	23.64	30.00	-6.36
7	2442	21.23	21.23	30.00	-8.77
8	2447	16.85	16.85	30.00	-13.15
11	2462	15.01	15.01	30.00	-14.99

OUTPUT POWER, Chain 0







8.2.5. PSD

LIMITS

FCC §15.247

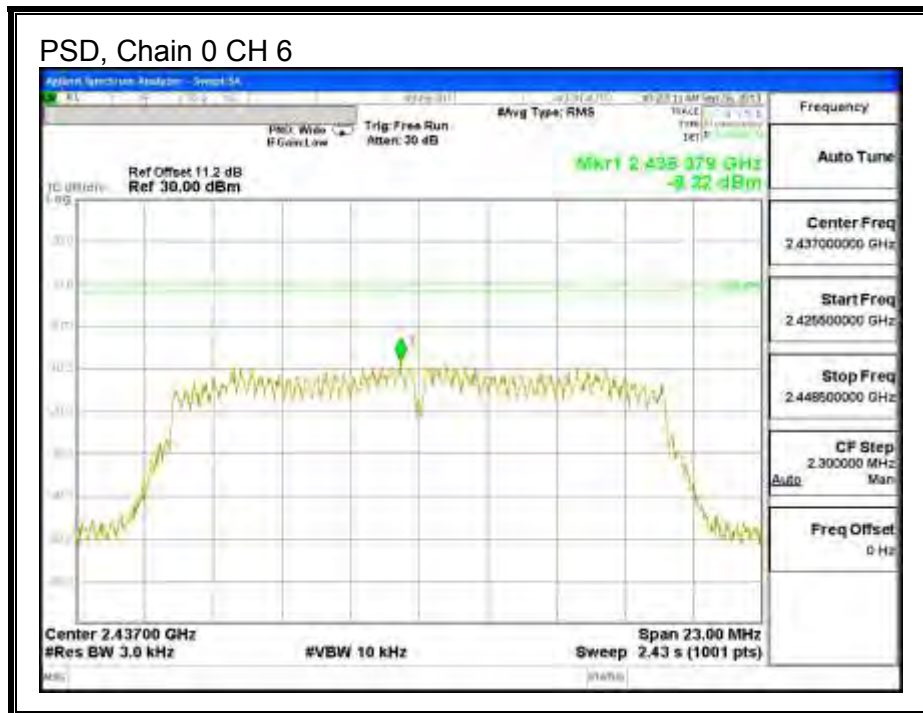
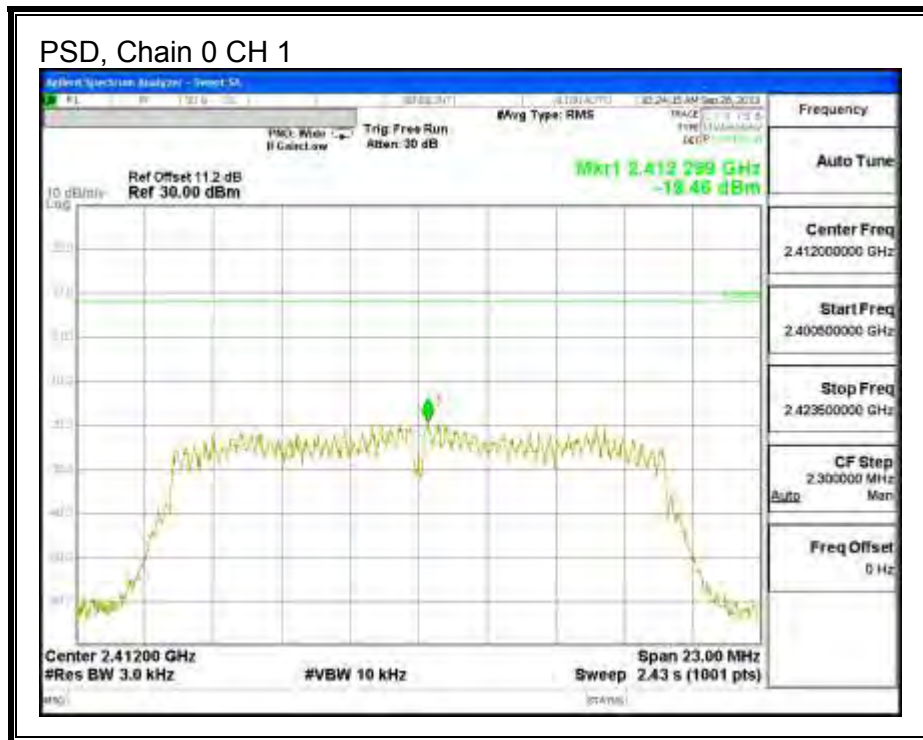
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

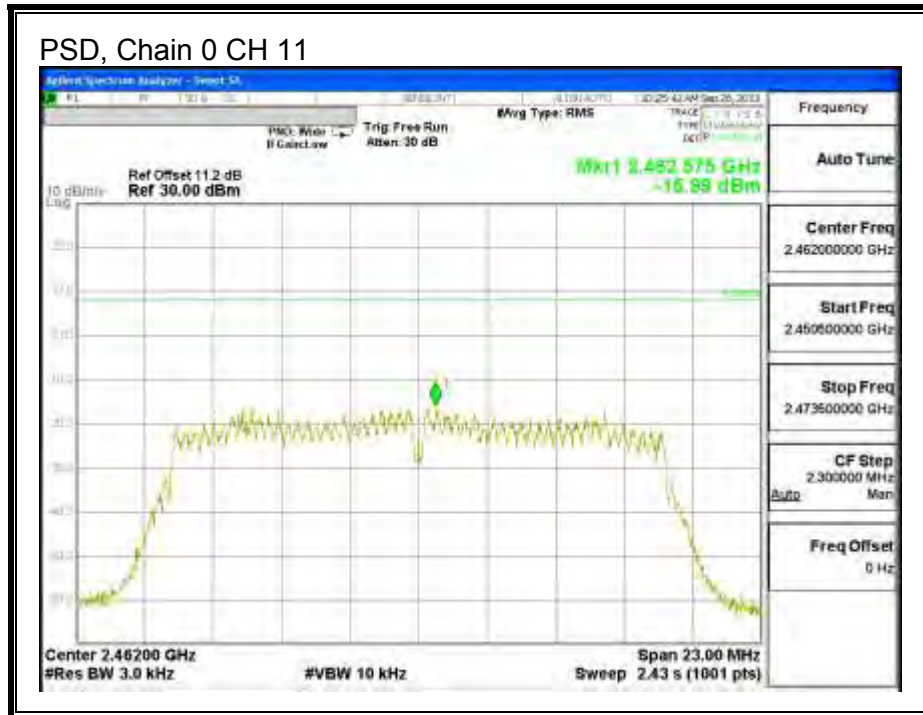
RESULTS

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Limit (dBm)	Margin (dB)
1	2412	-19.46	8.0	-27.5
6	2437	-8.22	8.0	-16.2
11	2462	-15.99	8.0	-24.0

PSD, Chain 0





8.2.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

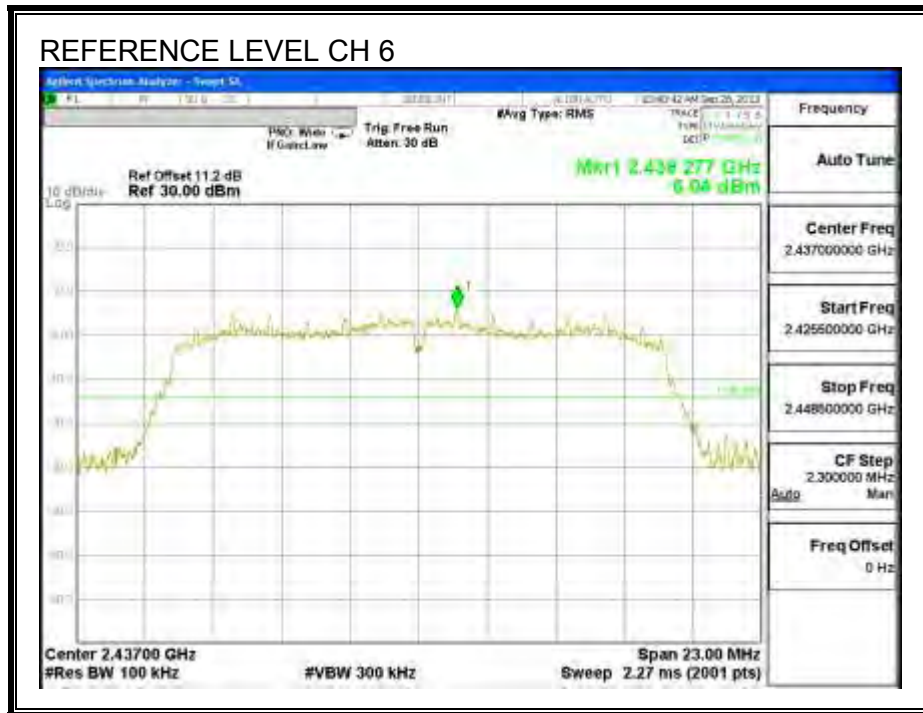
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

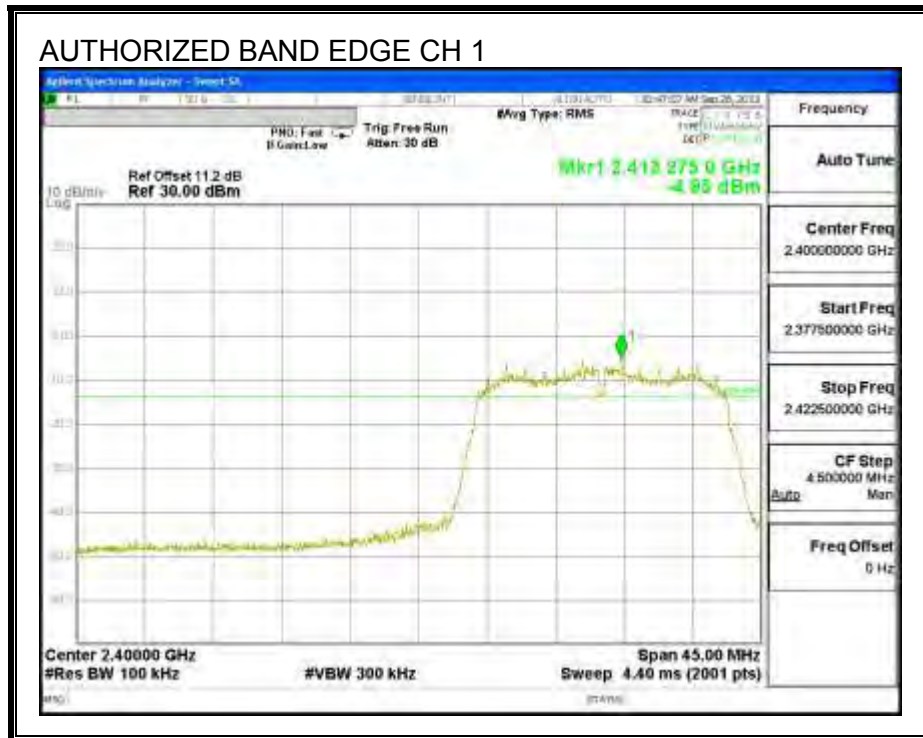
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

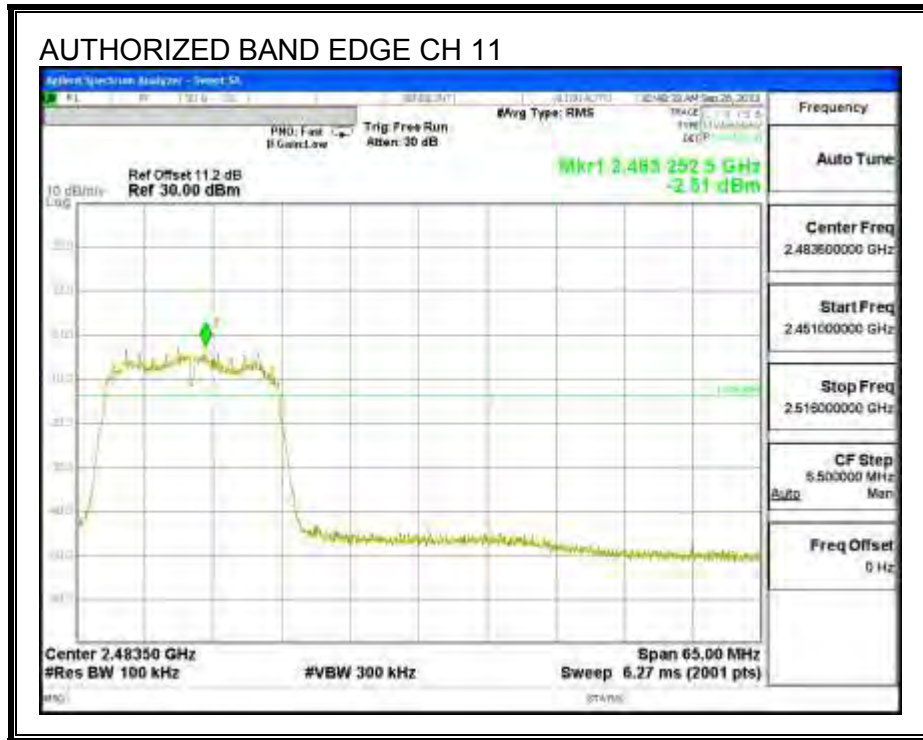
IN-BAND REFERENCE LEVEL



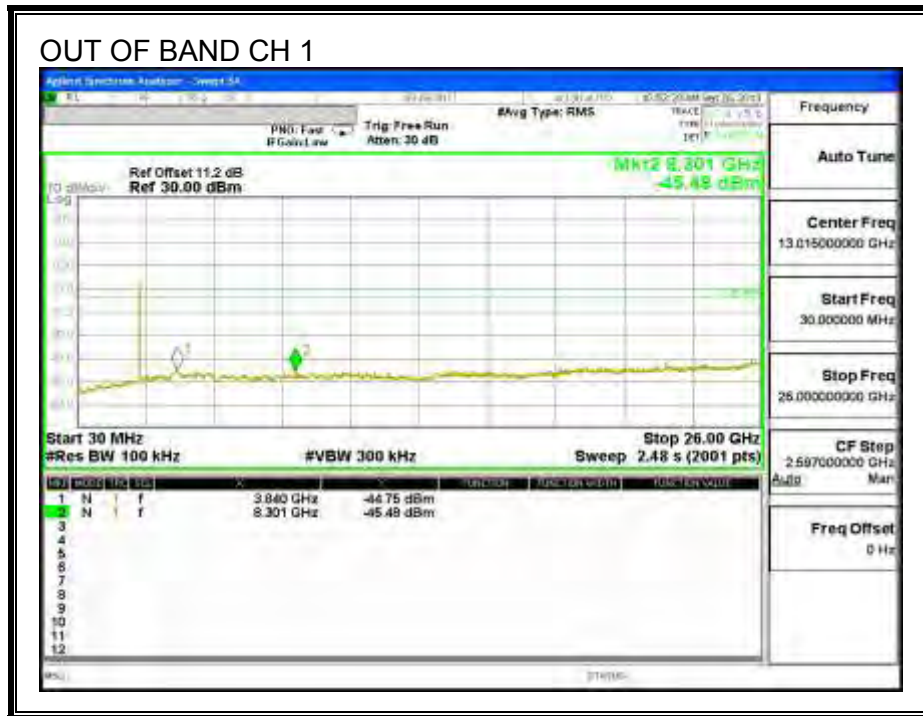
LOW CHANNEL BANDEDGE

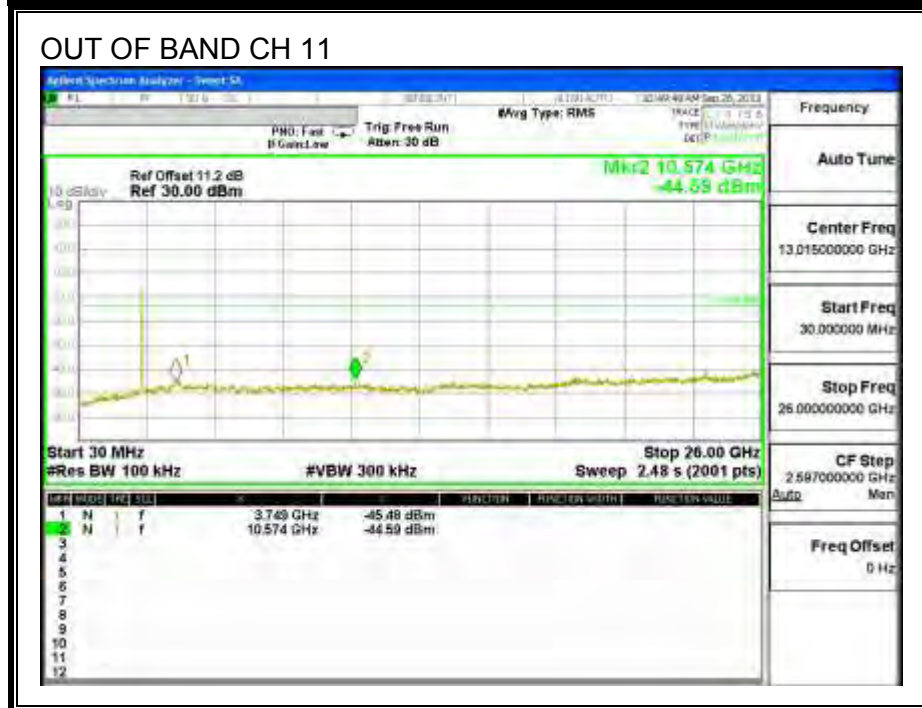
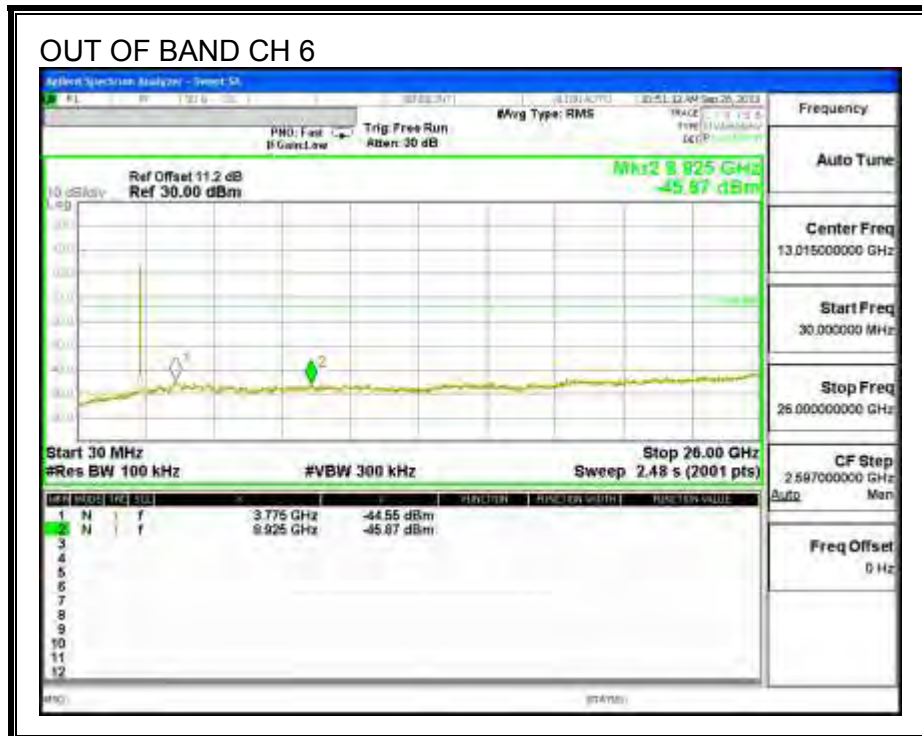


HIGH CHANNEL BANDEDGE



OUT-OF-BAND EMISSIONS





8.3. 802.11g 2TX CDD 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.

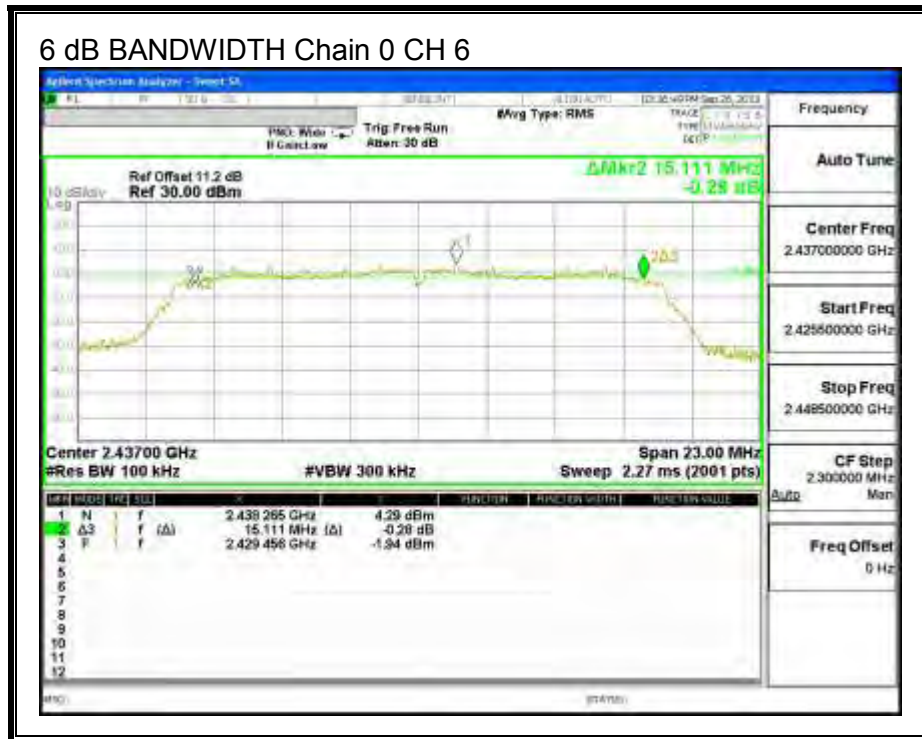
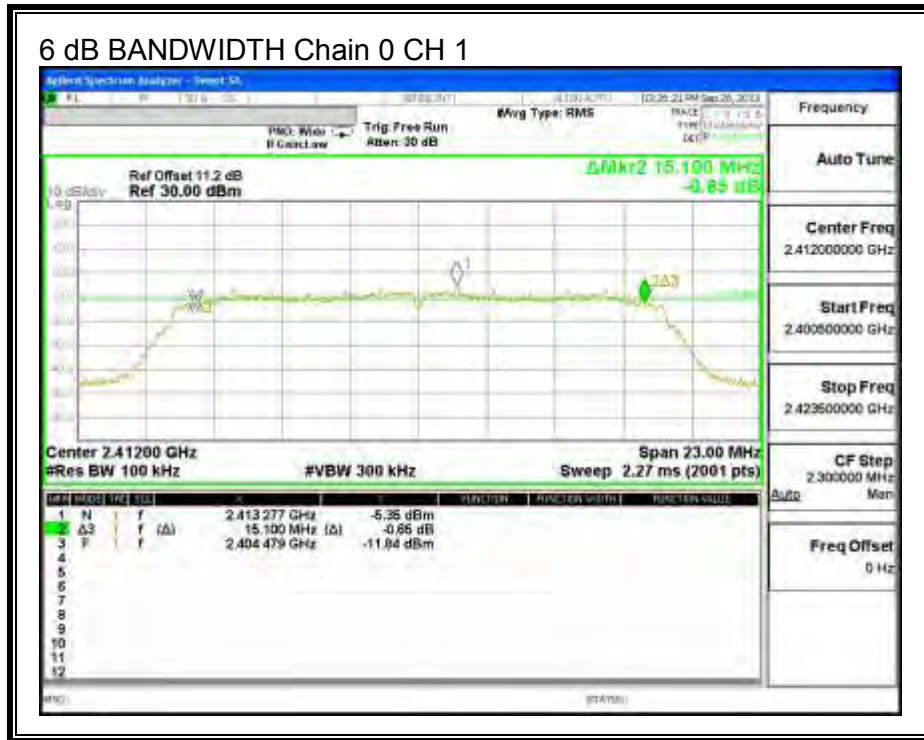
TEST PROCEDURE

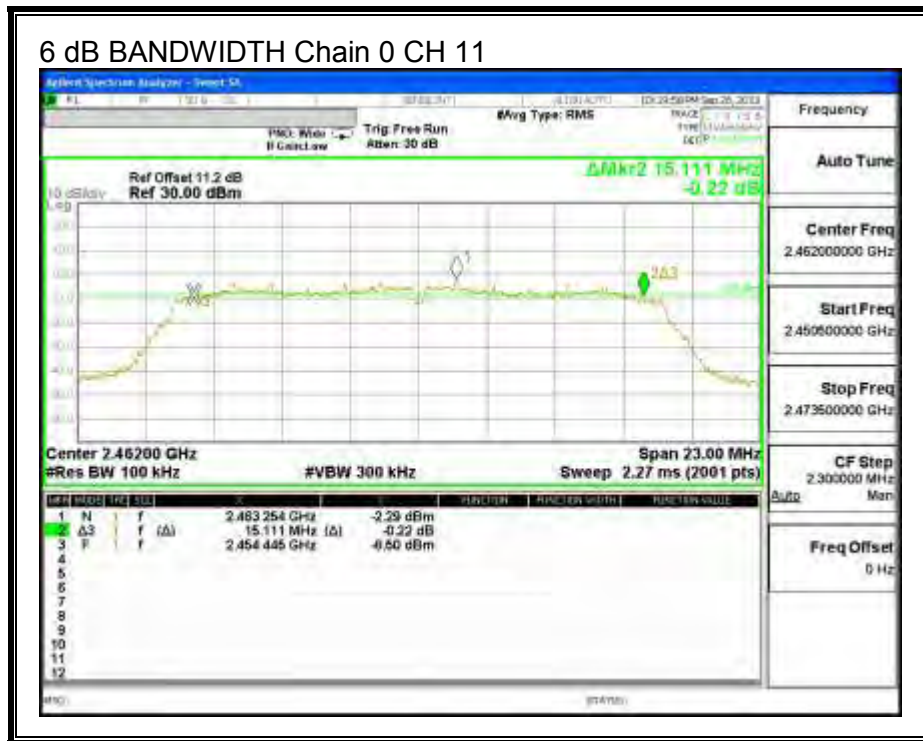
558074 D01 DTS Meas Guidance v03r01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

RESULTS

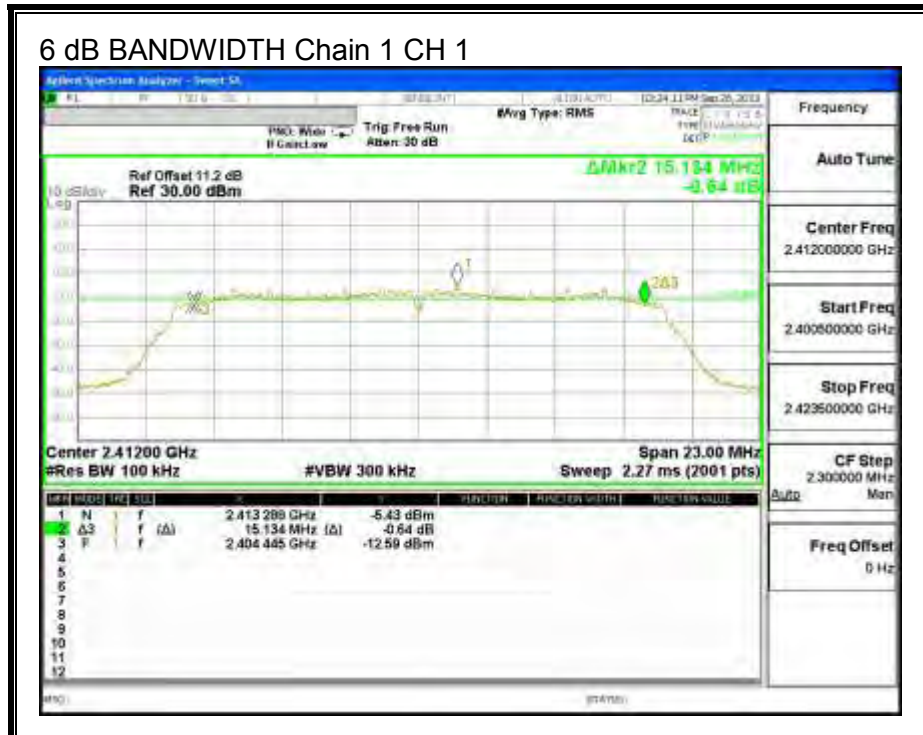
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
1	2412	15.100	15.134	0.5
6	2437	15.111	15.134	0.5
11	2462	15.111	15.111	0.5

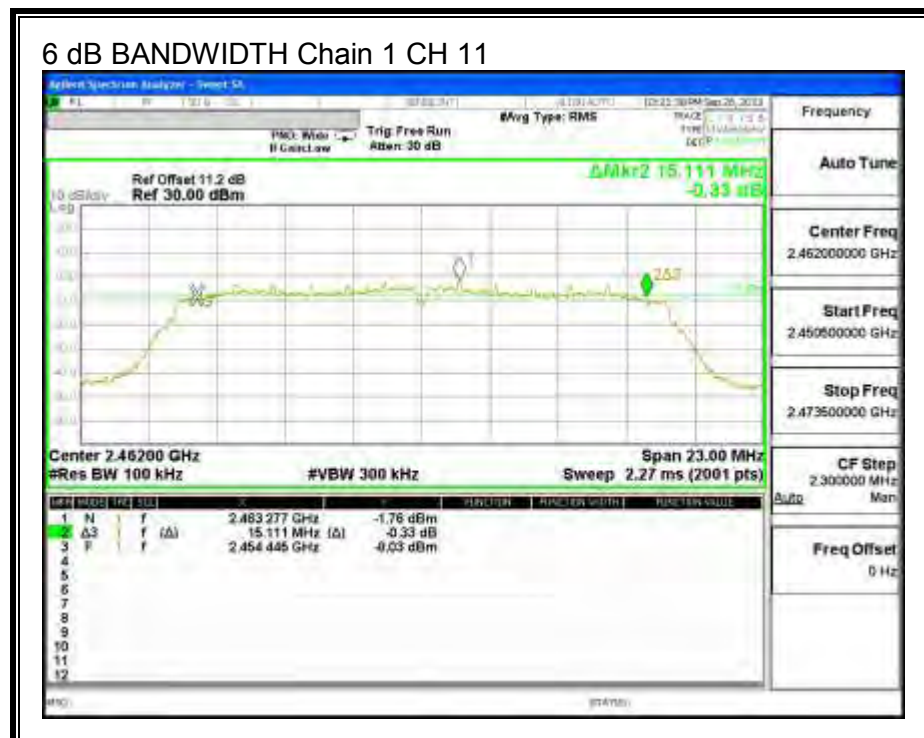
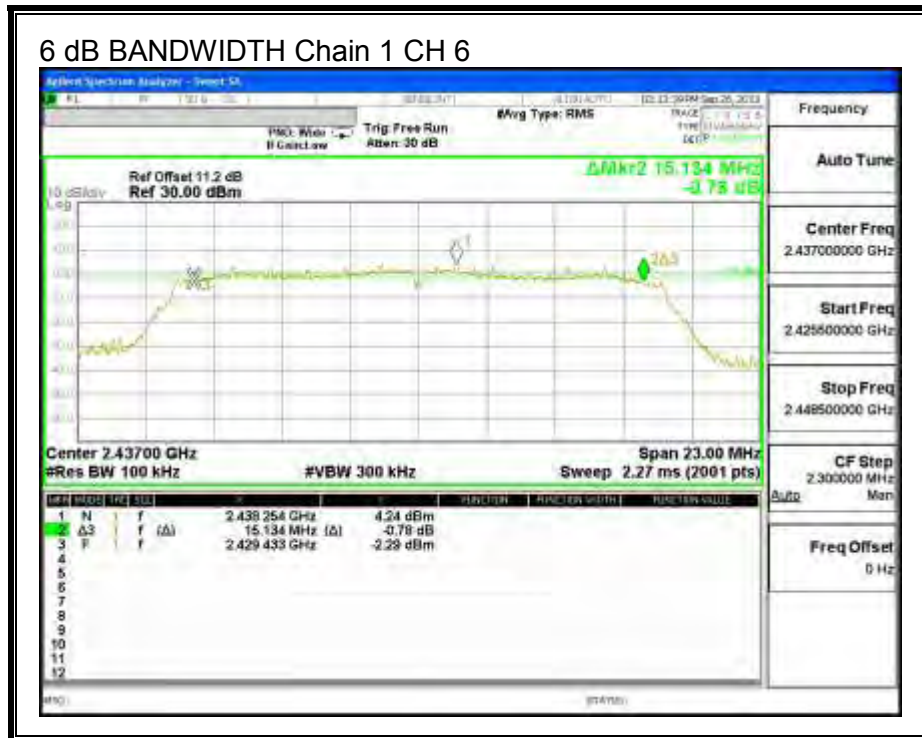
6 dB BANDWIDTH, Chain 0





6 dB BANDWIDTH, Chain 1





8.3.2. 99% BANDWIDTH

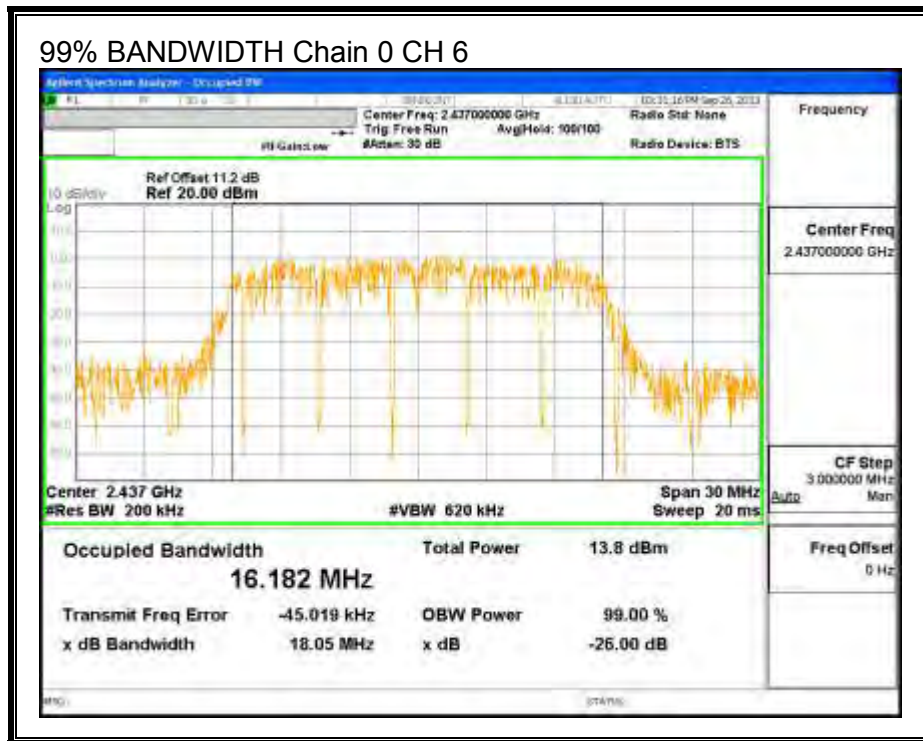
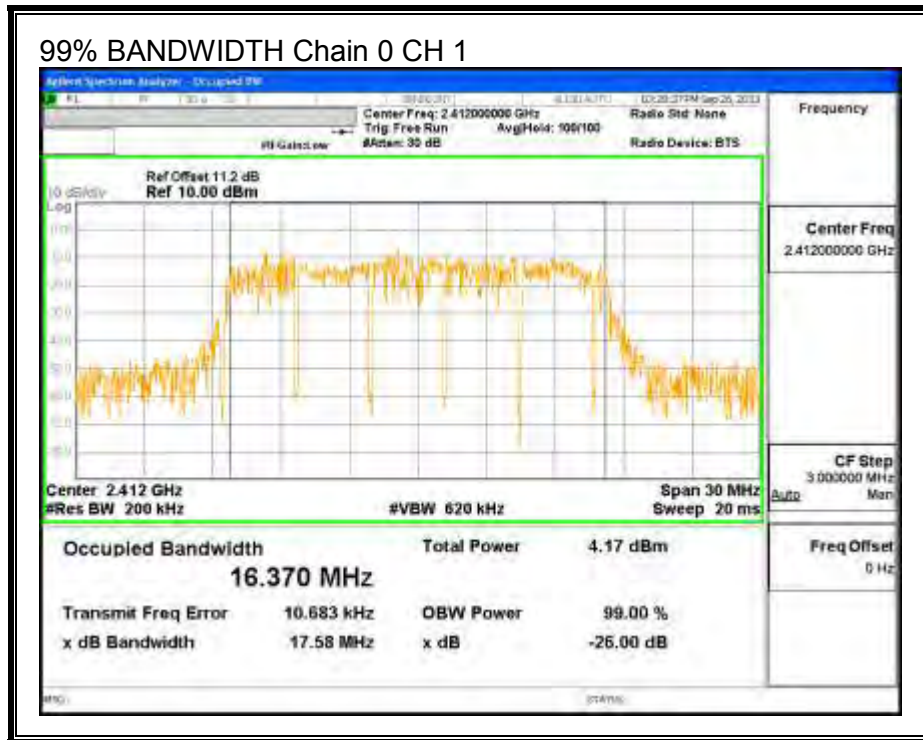
LIMITS

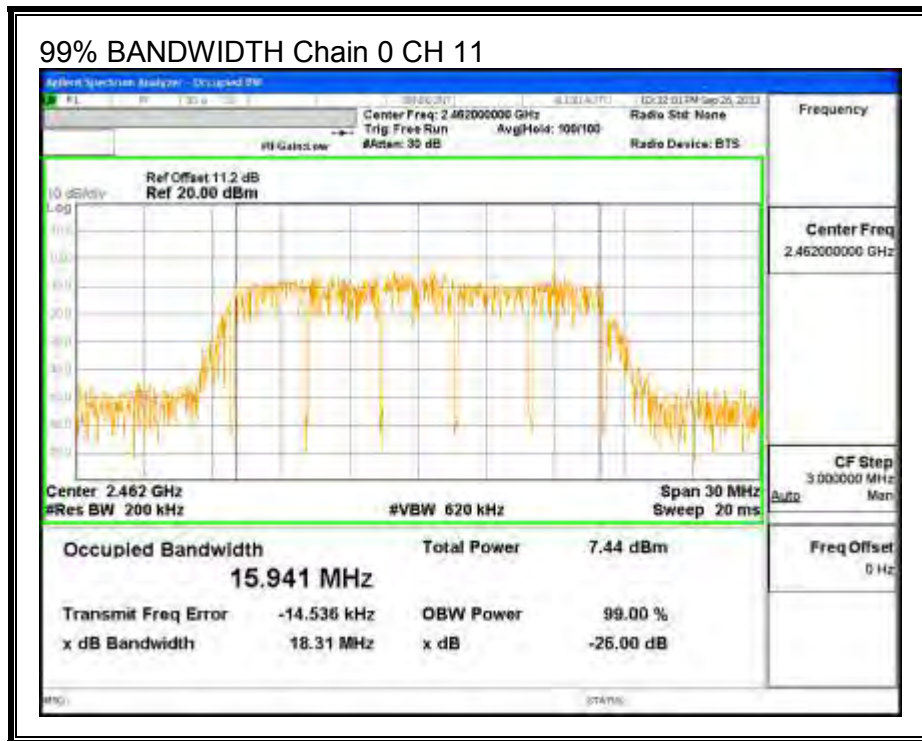
None; for reporting purposes only.

RESULTS

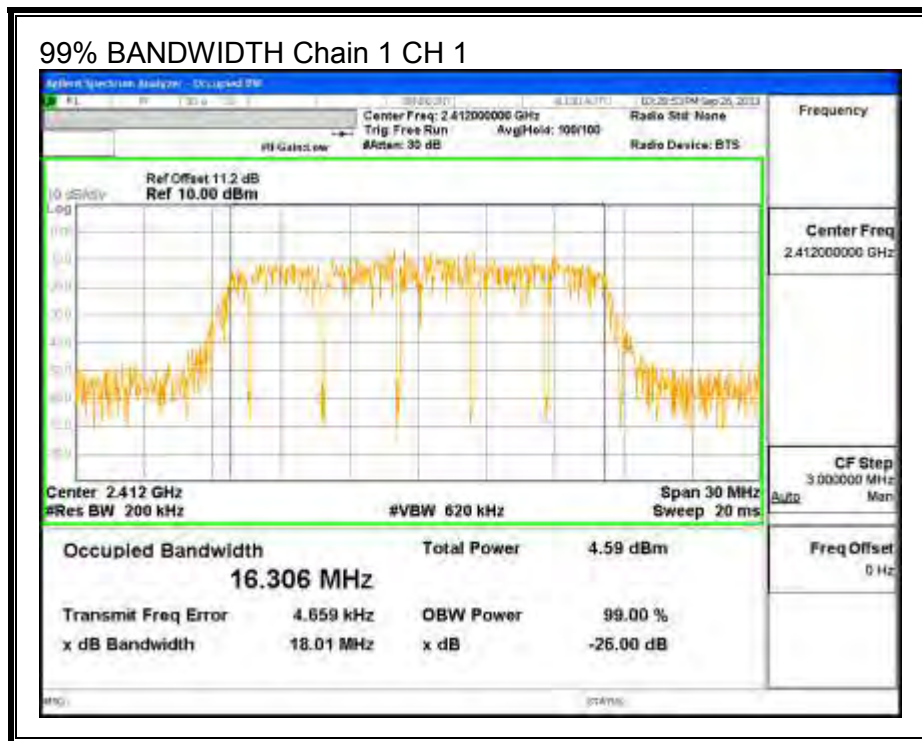
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
1	2412	16.370	16.306
6	2437	16.182	16.290
11	2462	15.941	16.364

99% BANDWIDTH, Chain 0

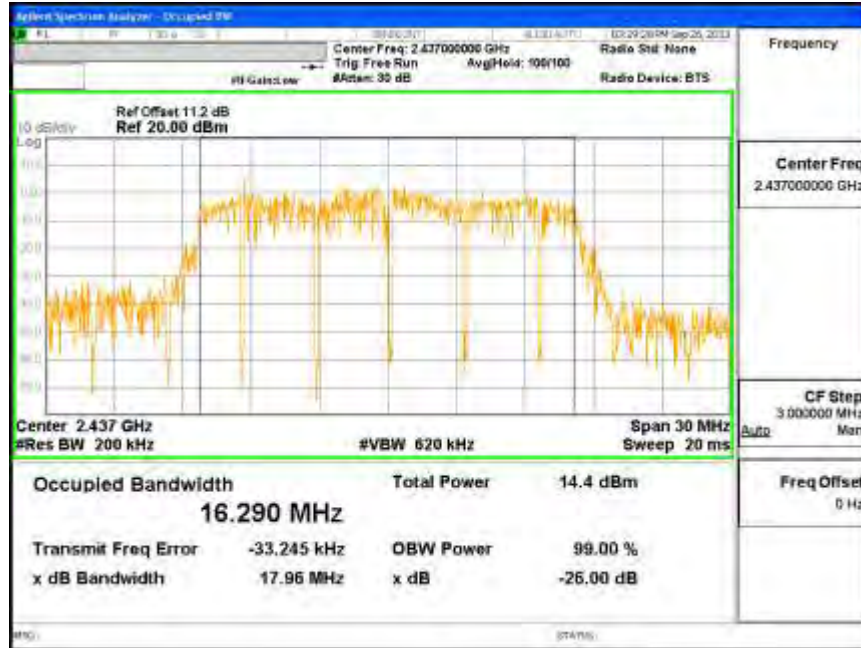




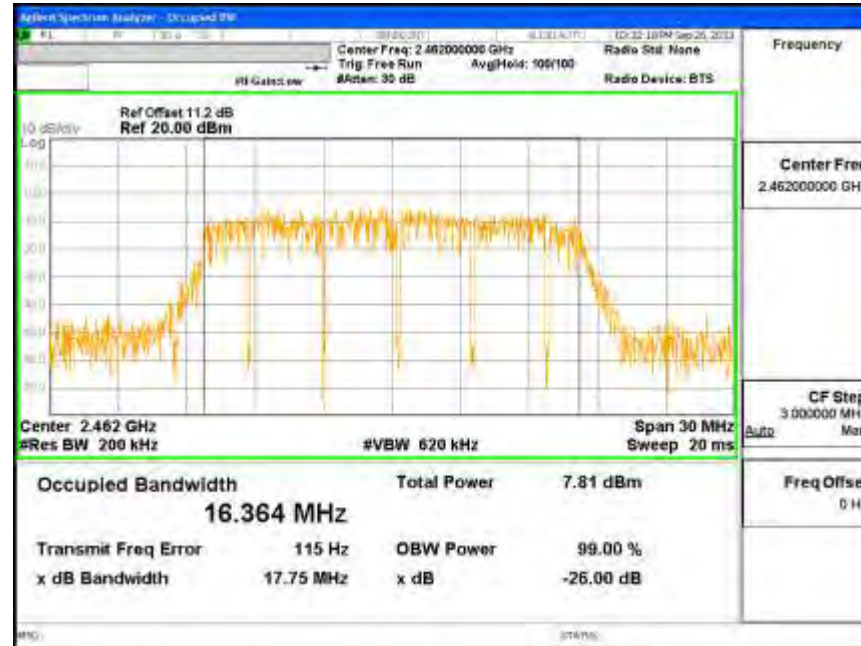
99% BANDWIDTH, Chain 1



99% BANDWIDTH Chain 1 CH 6



99% BANDWIDTH Chain 1 CH 11



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 11.42 dB (including 10 dB pad, 1.2 dB cable, and .22 duty cycle correction factor) 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)
1	2412	4.65	4.76	7.72
4	2427	12.29	12.09	15.20
6	2437	14.08	14.17	17.14
8	2447	10.83	10.33	13.60
11	2462	7.39	7.76	10.59

8.3.4. 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)
3.10	2.00	2.58

RESULTS

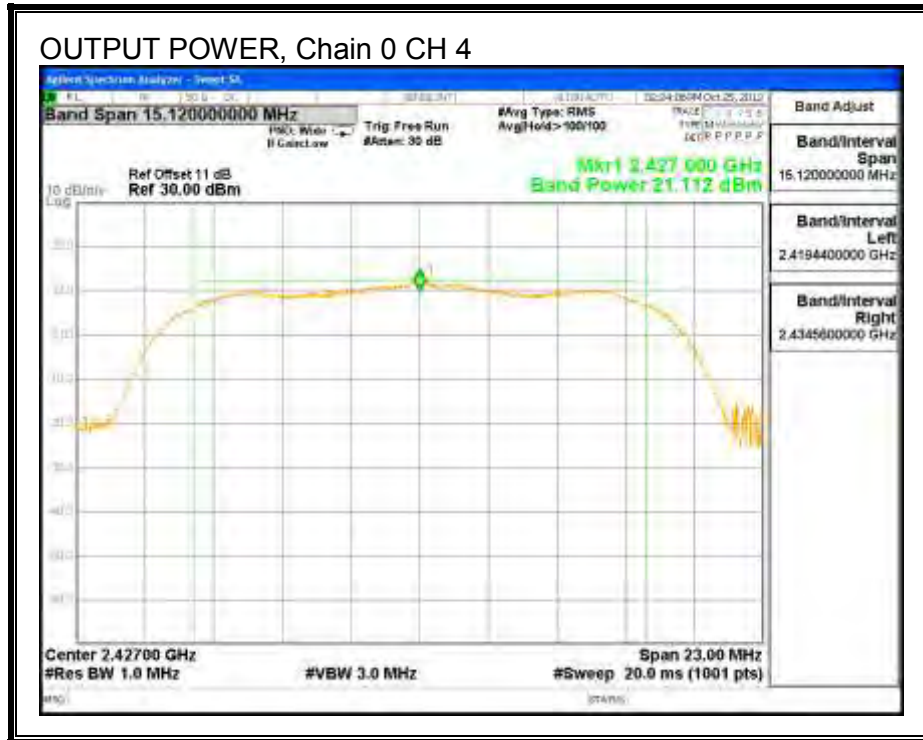
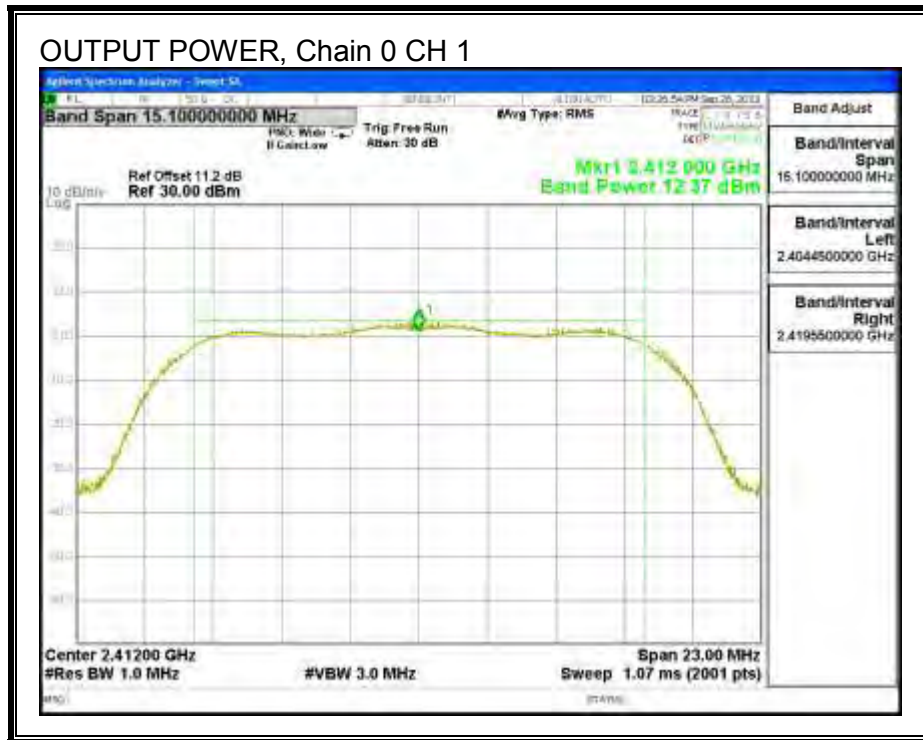
Limits

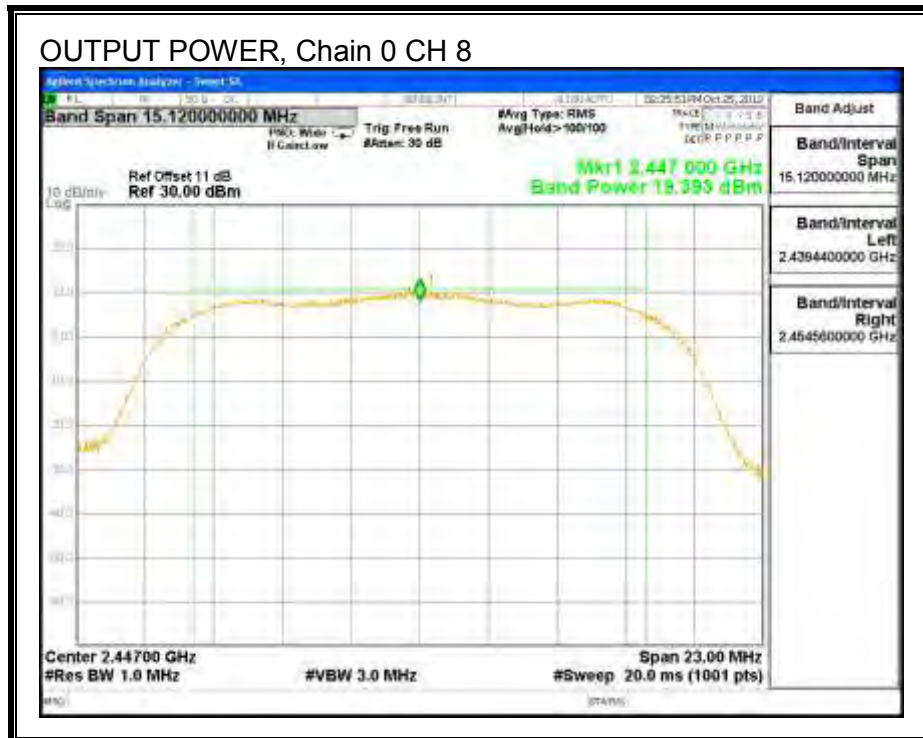
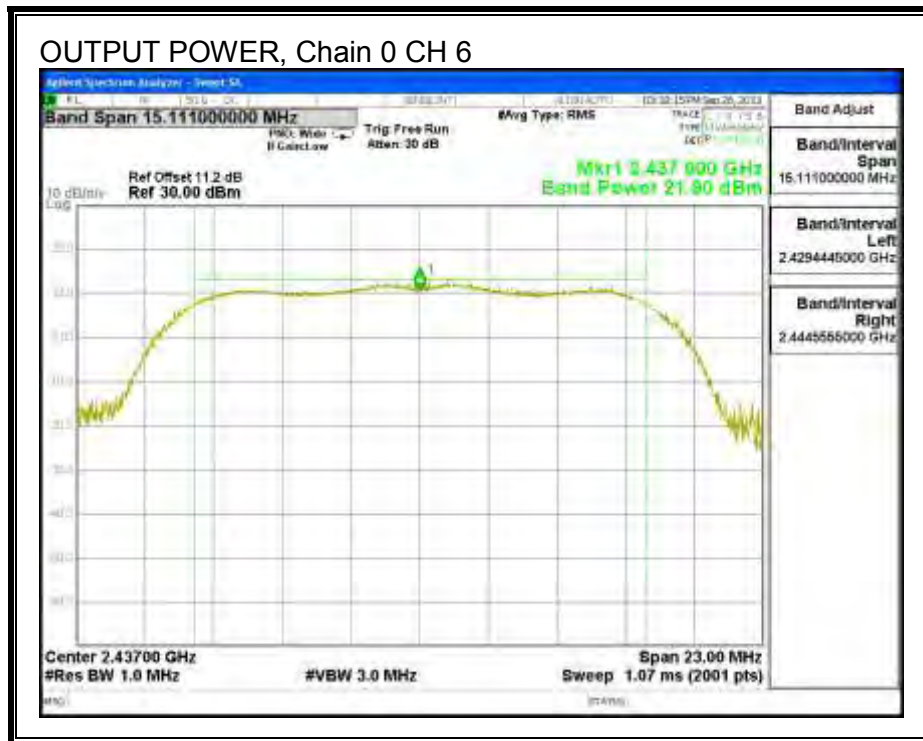
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
1	2412	2.58	30.00	30	36	30.00
4	2427	2.58	30.00	30	36	30.00
6	2437	2.58	30.00	30	36	30.00
8	2447	2.58	30.00	30	36	30.00
11	2462	2.58	30.00	30	36	30.00

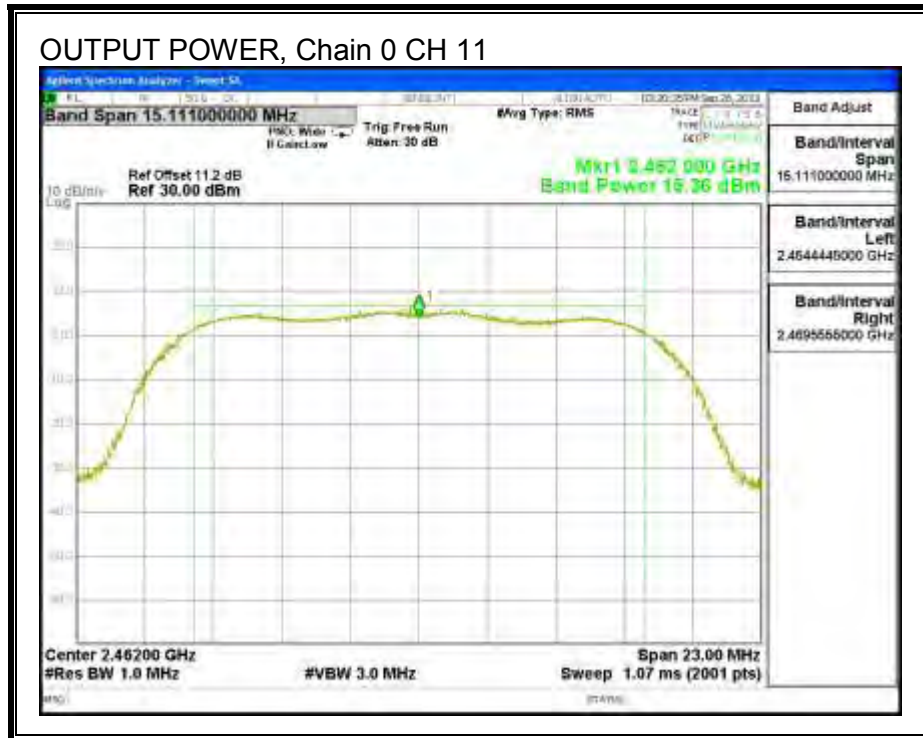
Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
1	2412	12.37	13.13	15.78	30.00	-14.22
4	2427	21.11	21.64	24.39	30.00	-5.61
6	2437	21.90	22.58	25.26	30.00	-4.74
8	2447	19.39	19.53	22.47	30.00	-7.53
11	2462	15.36	16.62	19.05	30.00	-10.95

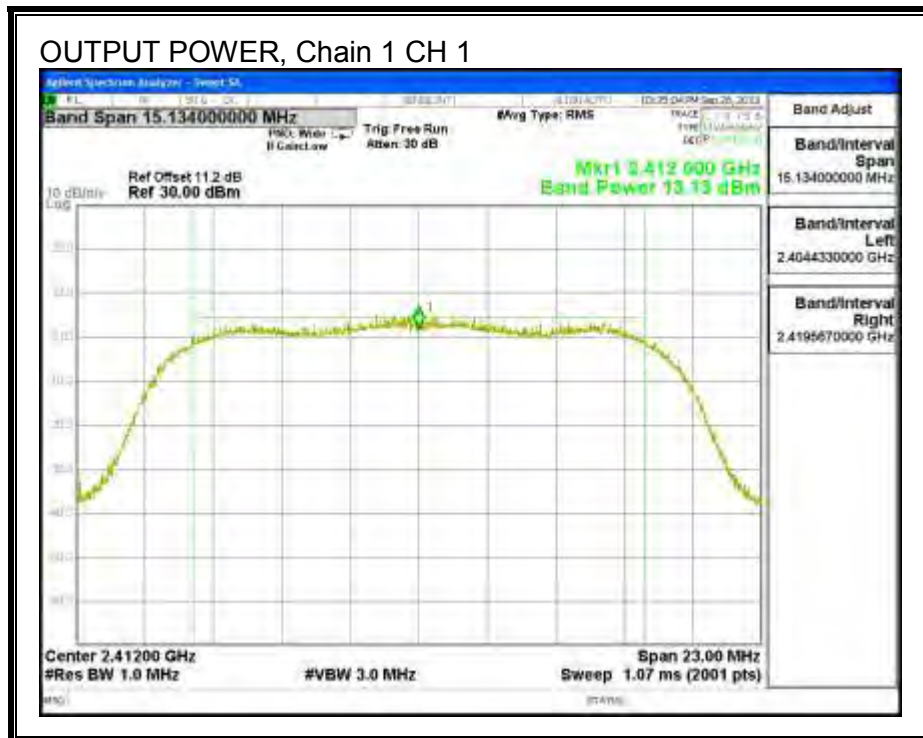
OUTPUT POWER, Chain 0

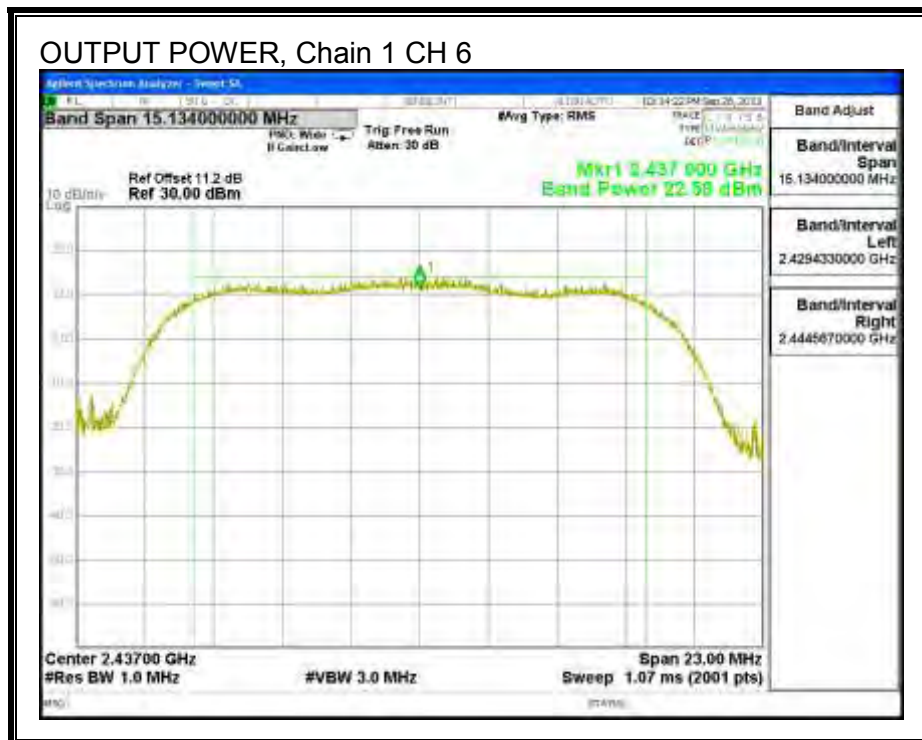
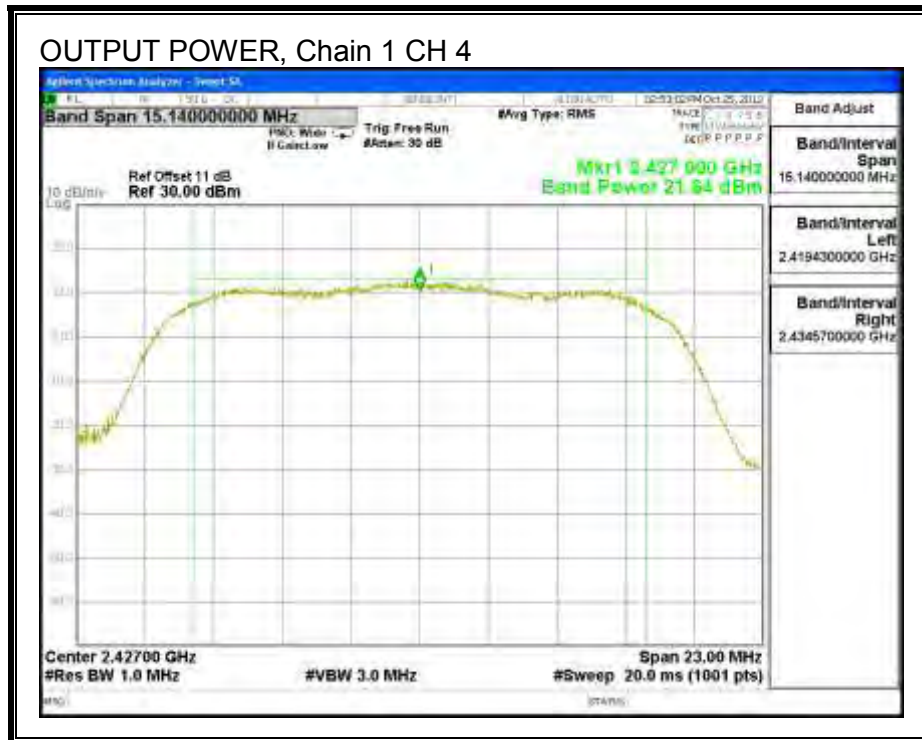


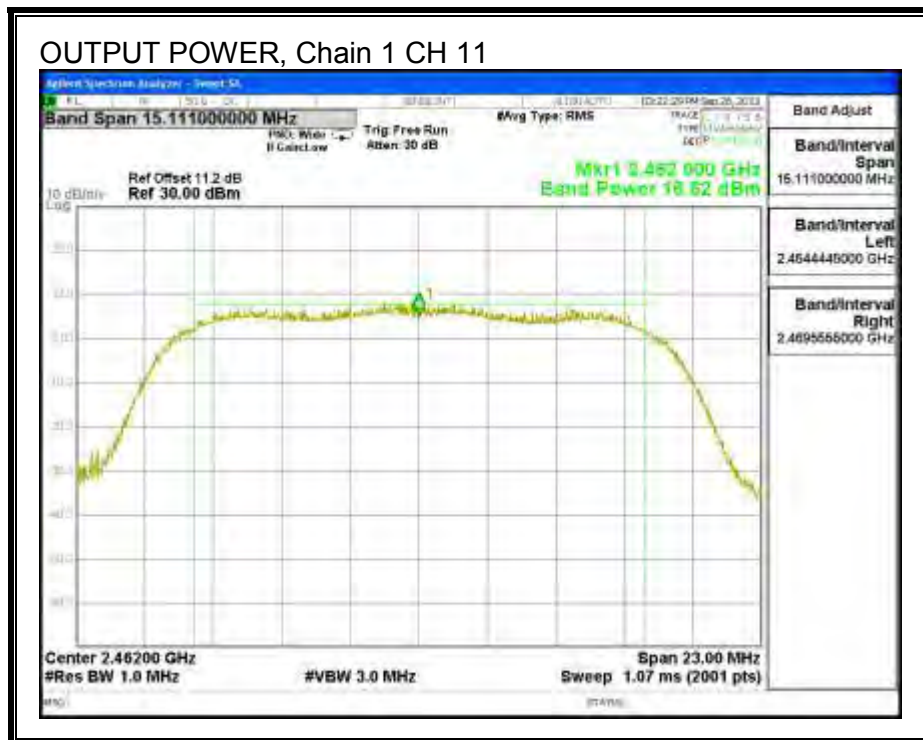
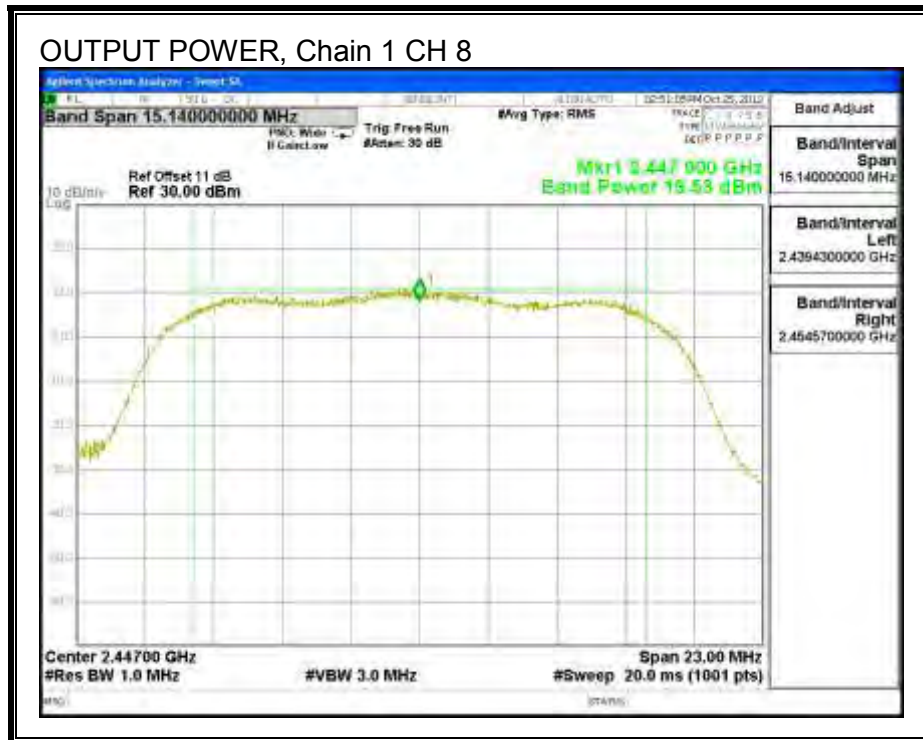




OUTPUT POWER, Chain 1







8.3.5. PSD

LIMITS

FCC §15.247

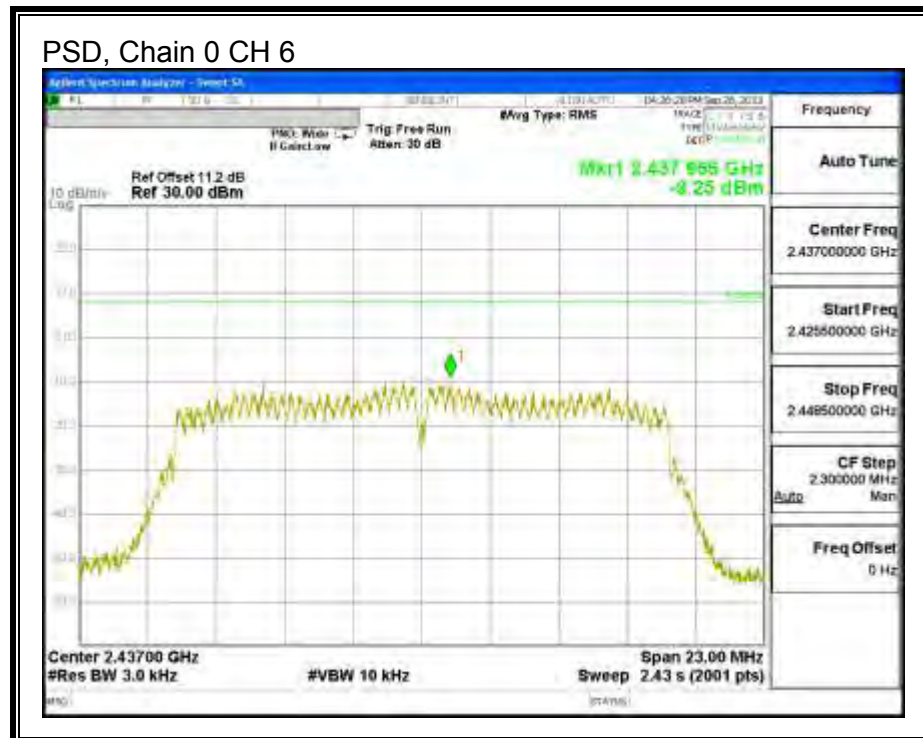
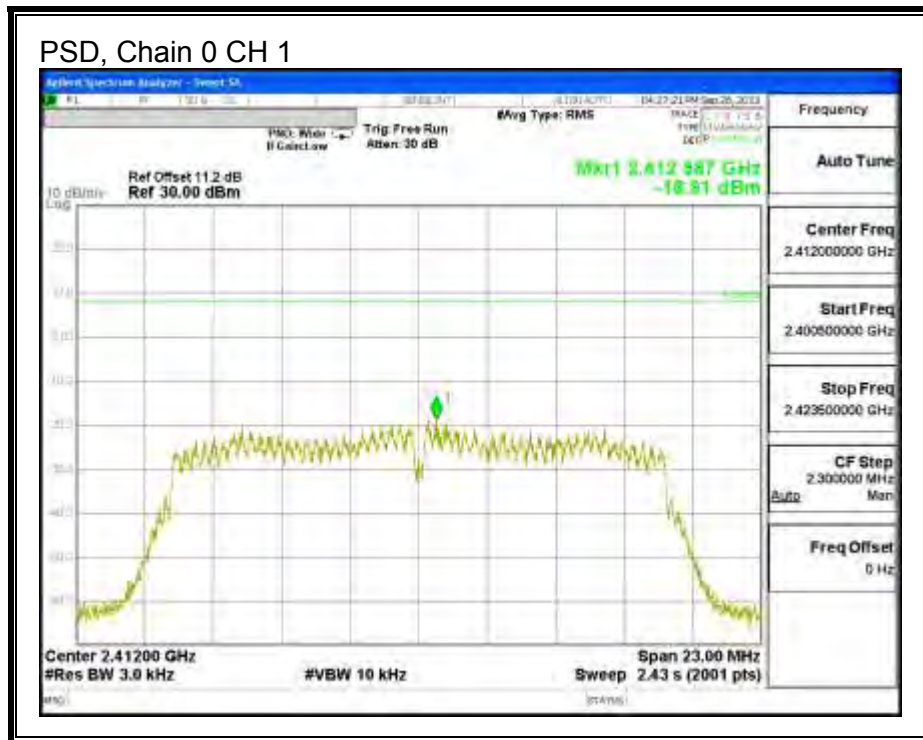
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

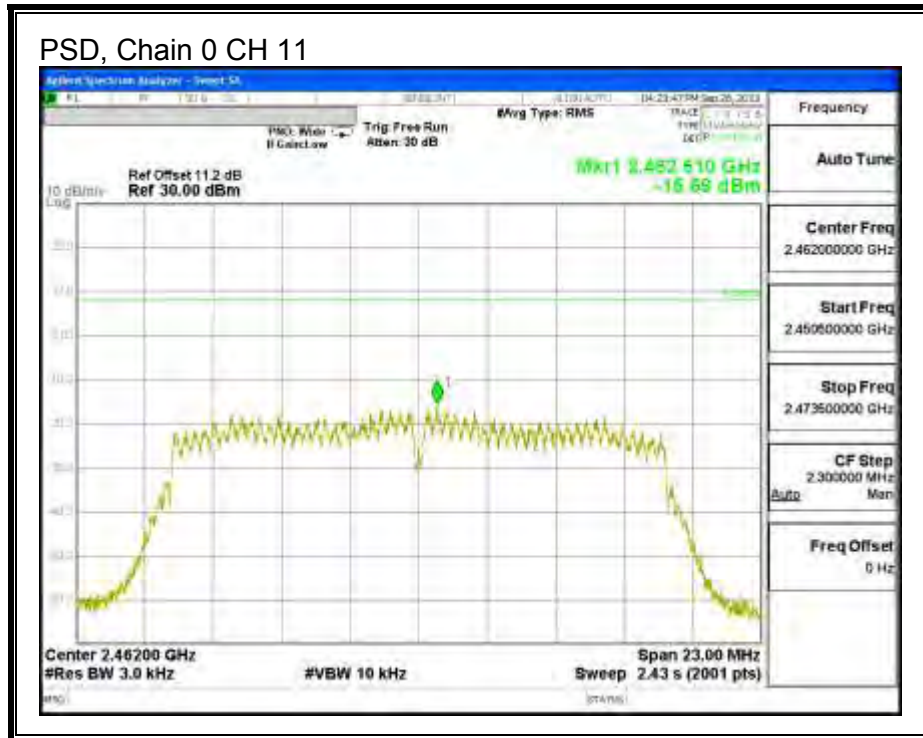
RESULTS

PSD Results

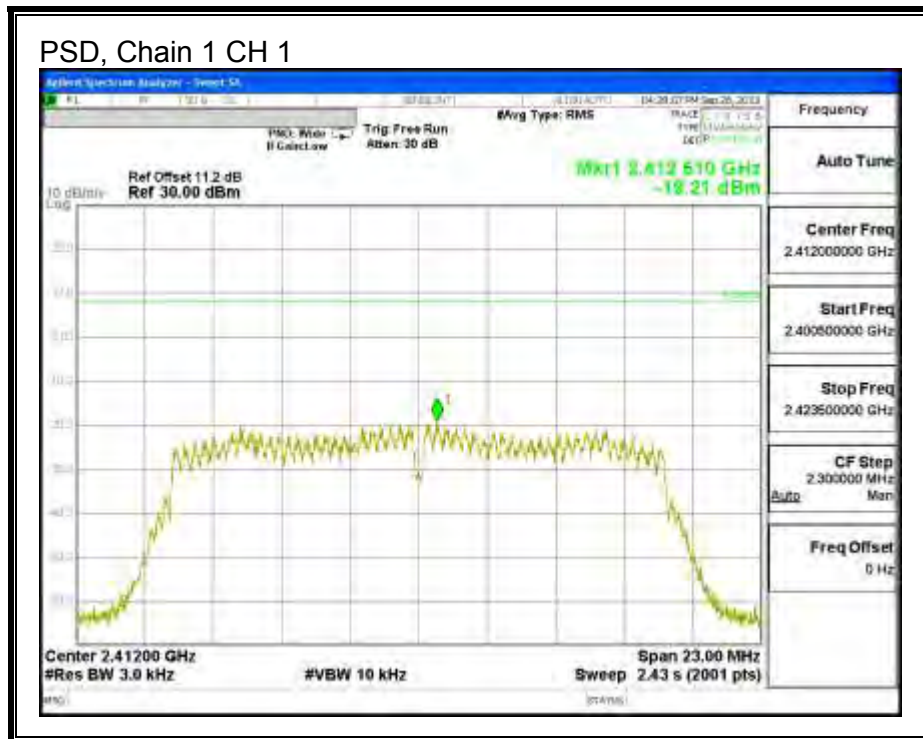
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
1	2412	-18.91	-19.21	-16.05	8.0	-24.0
6	2437	-9.25	-9.57	-6.40	8.0	-14.4
11	2462	-15.69	-16.16	-12.91	8.0	-20.9

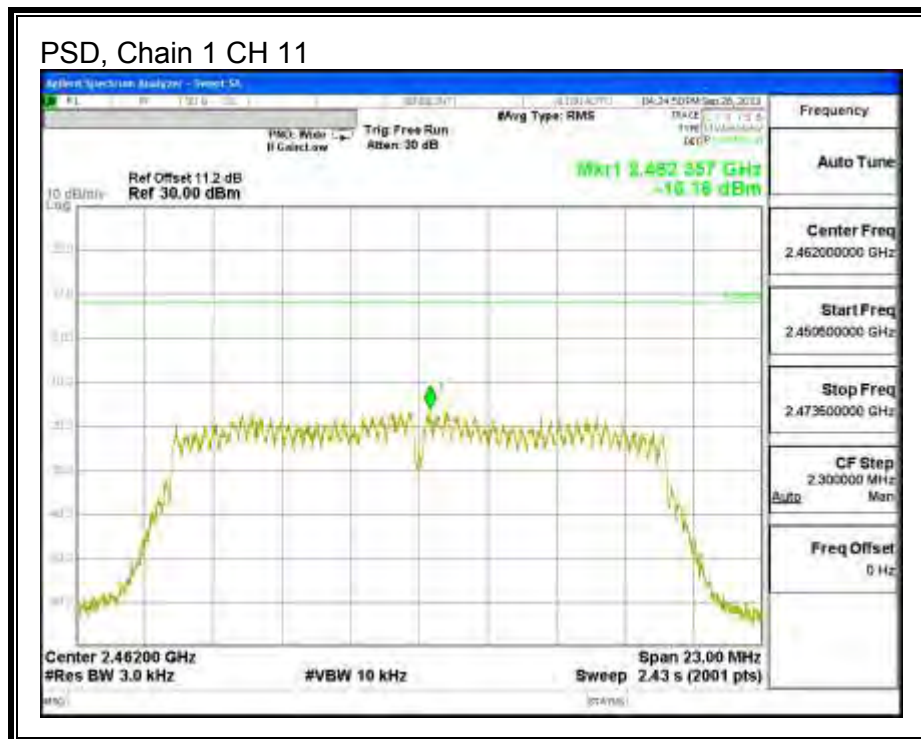
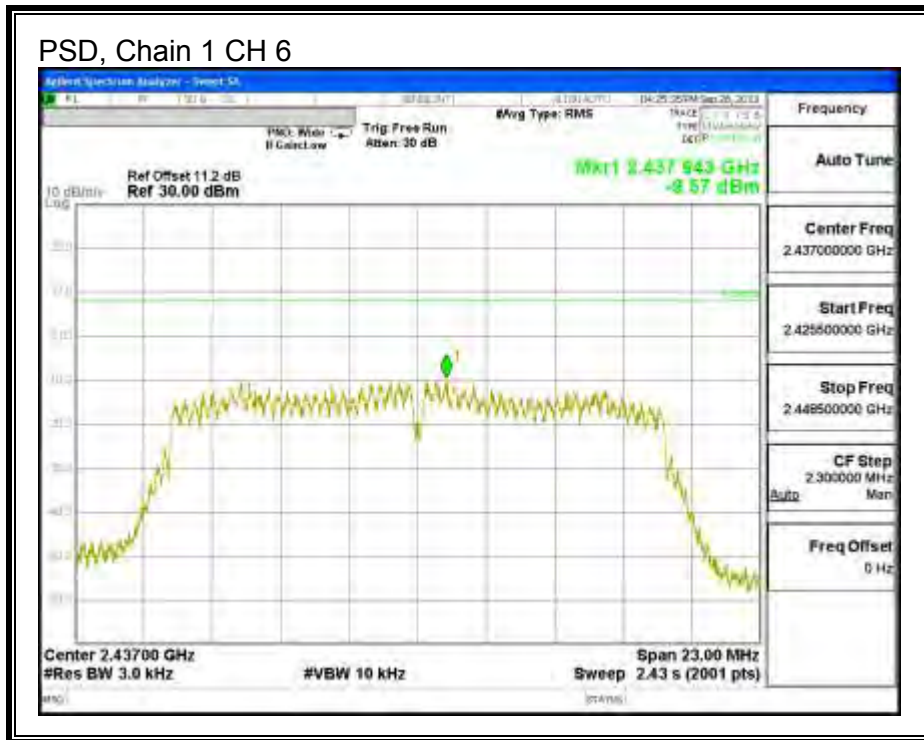
PSD, Chain 0





PSD, Chain 1





8.3.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

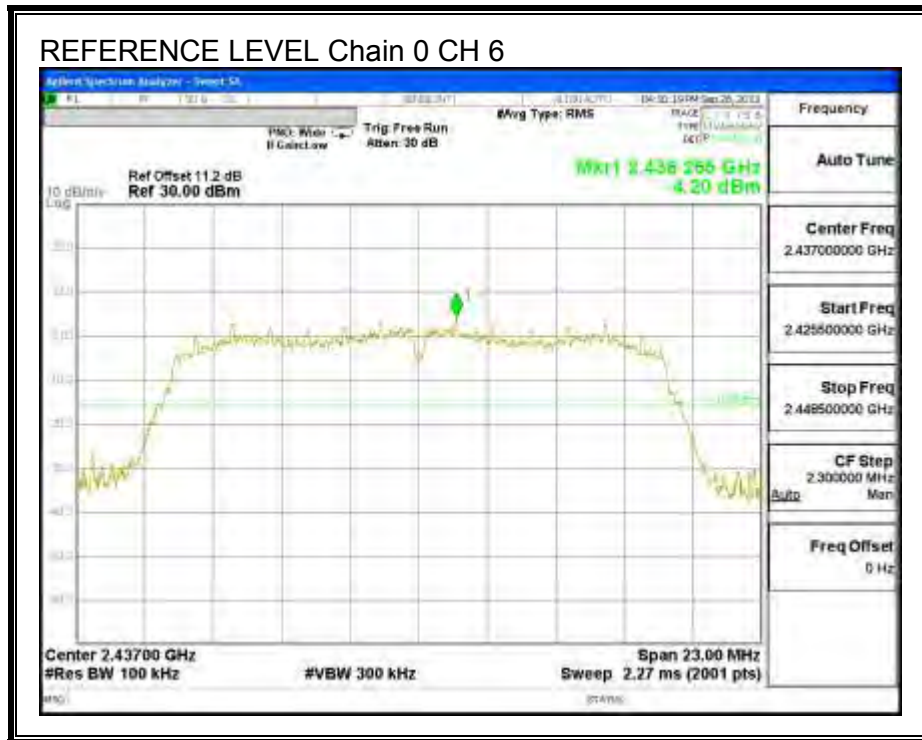
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

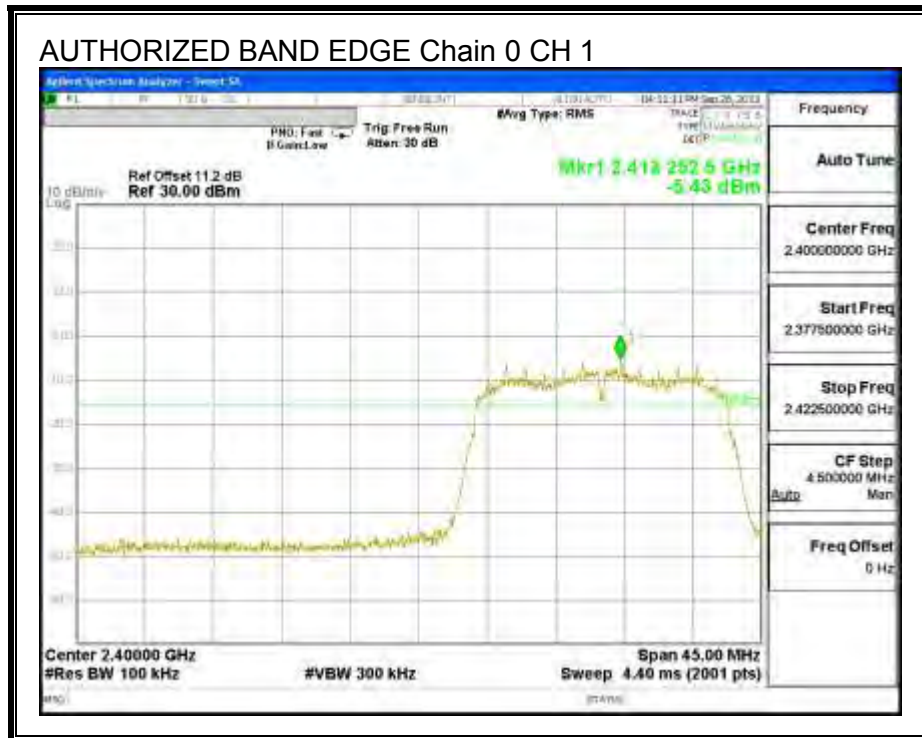
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

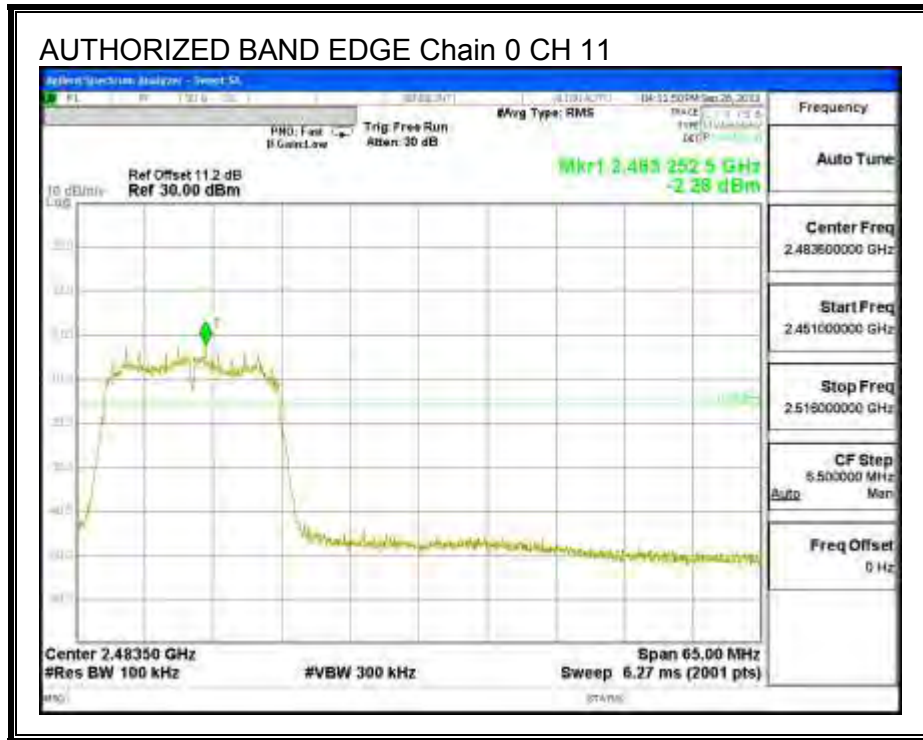
IN-BAND REFERENCE LEVEL, Chain 0



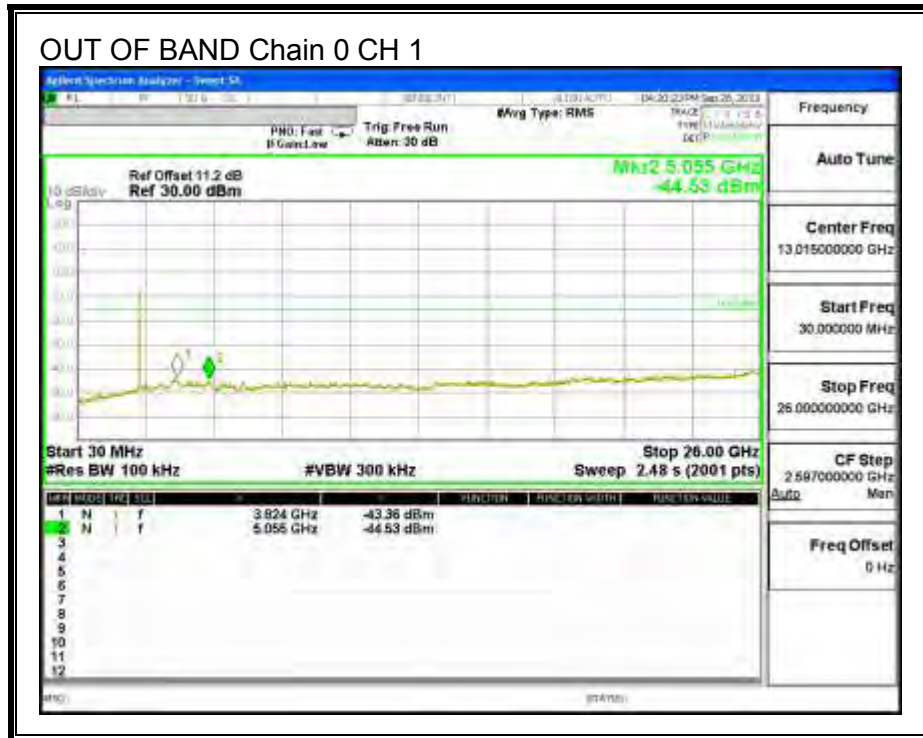
LOW CHANNEL BANDEDGE, Chain 0

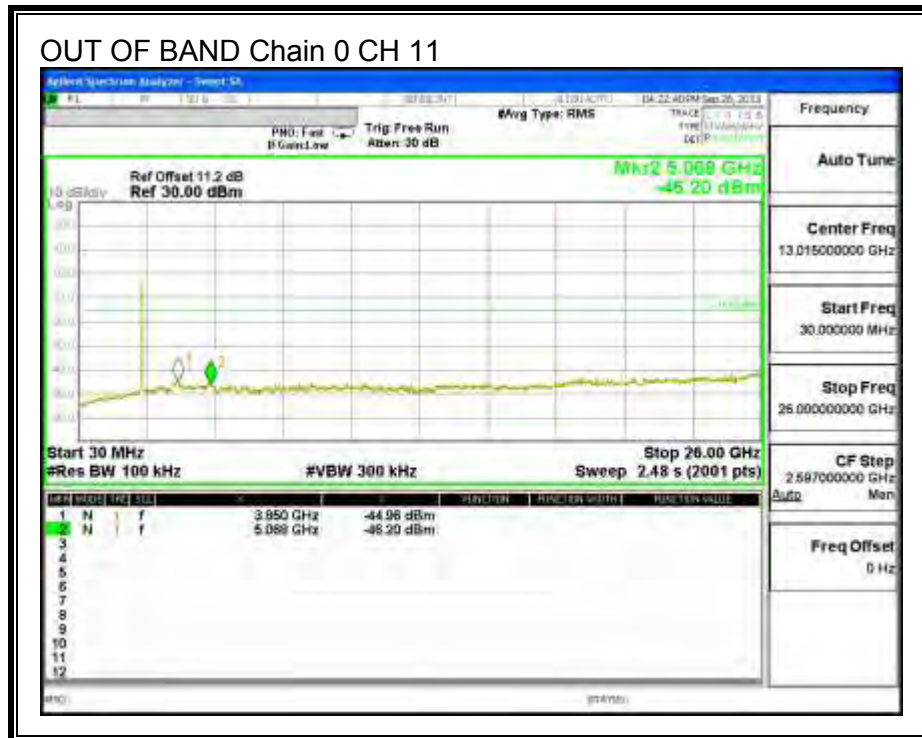
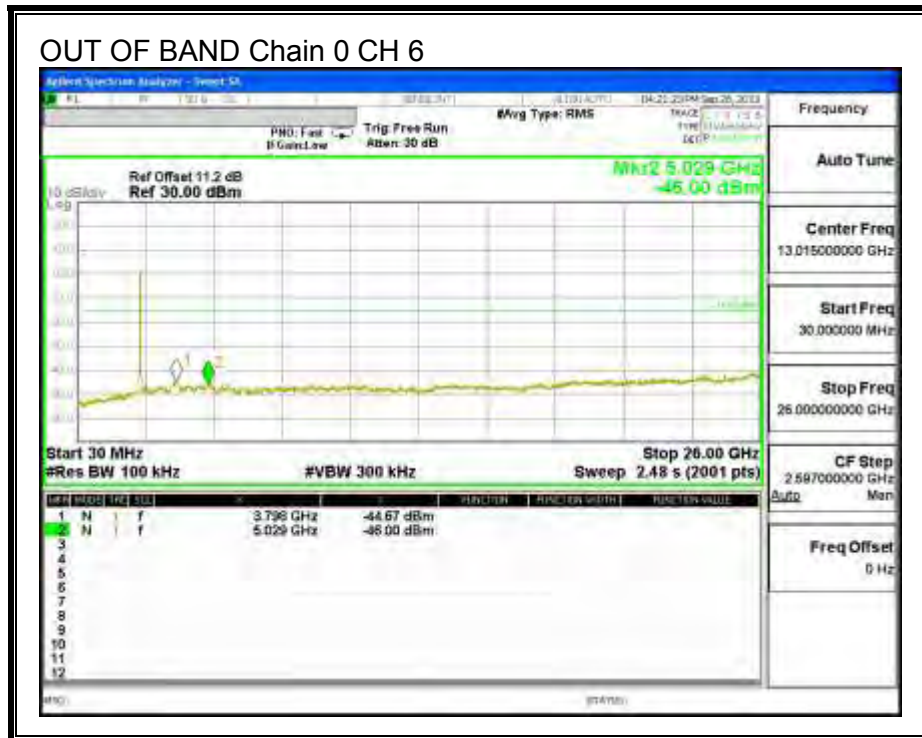


HIGH CHANNEL BANDEDGE, Chain 0

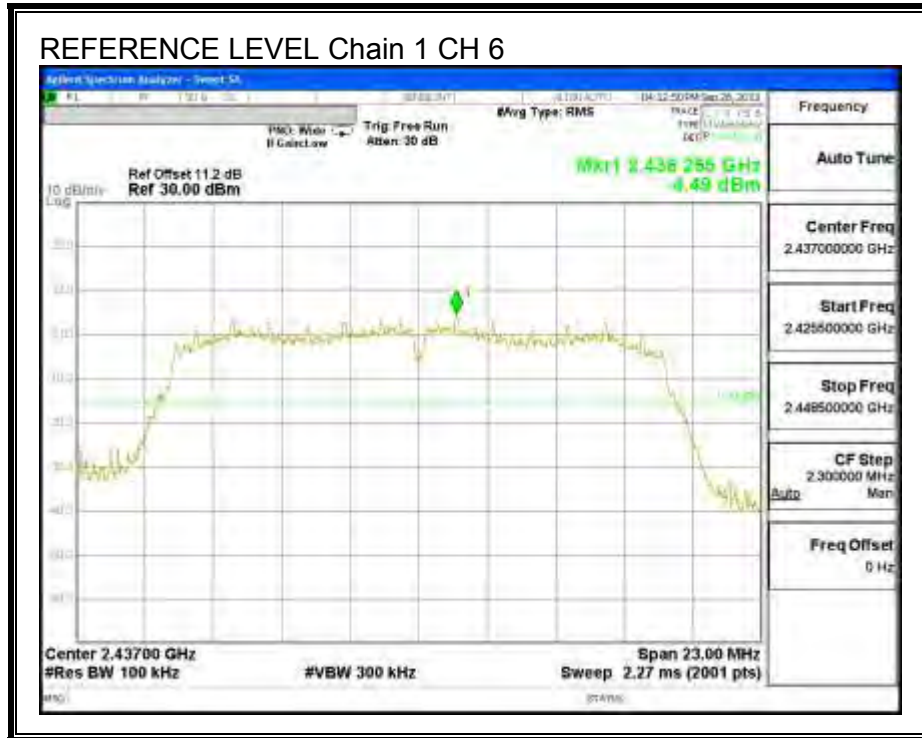


OUT-OF-BAND EMISSIONS, Chain 0

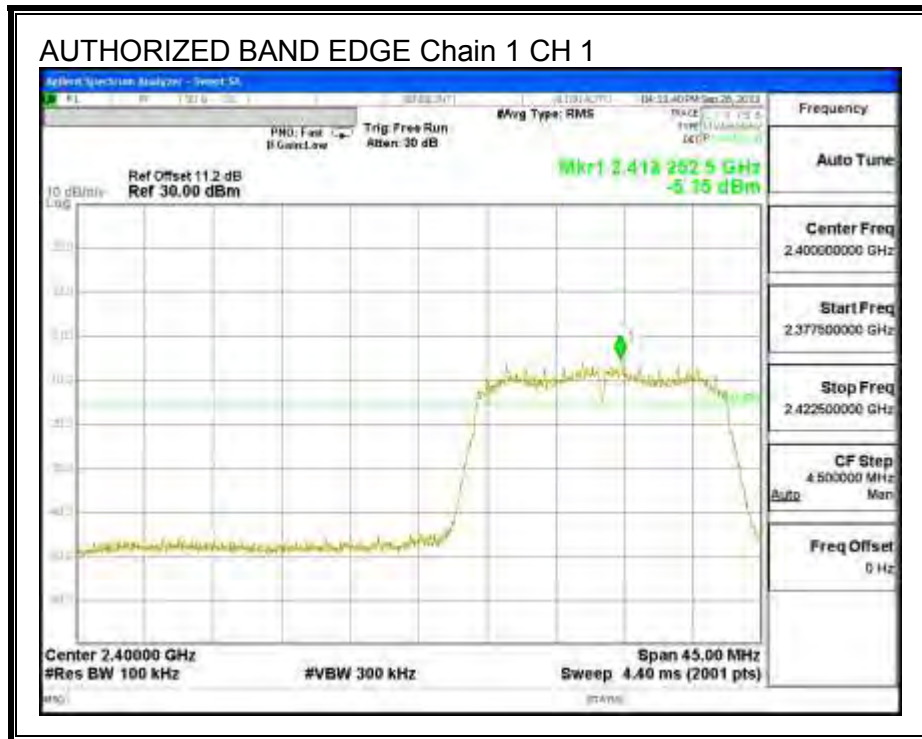




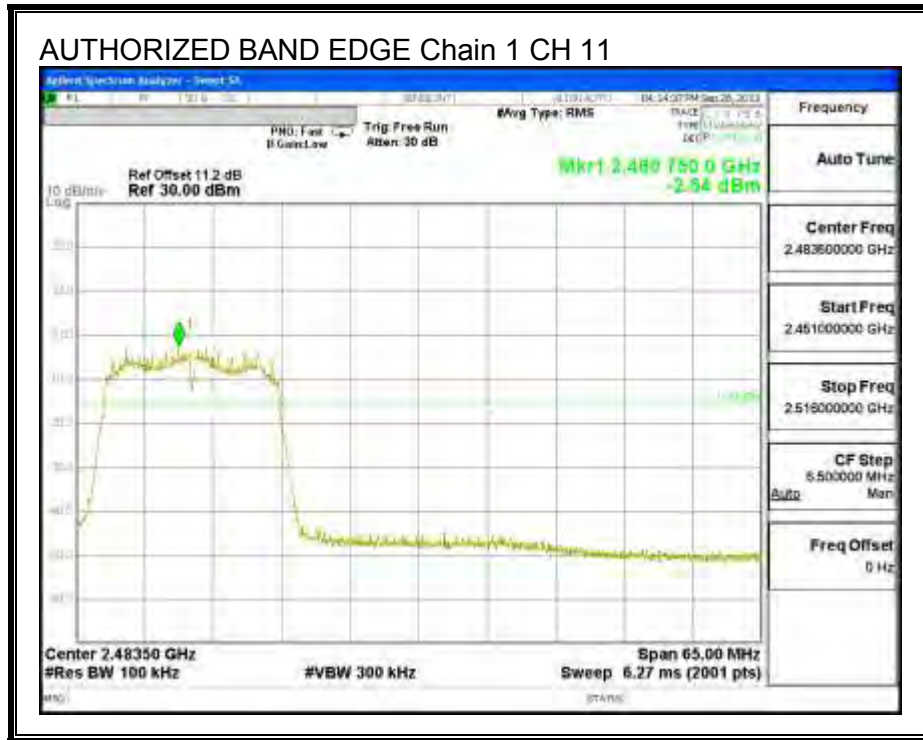
IN-BAND REFERENCE LEVEL, Chain 1



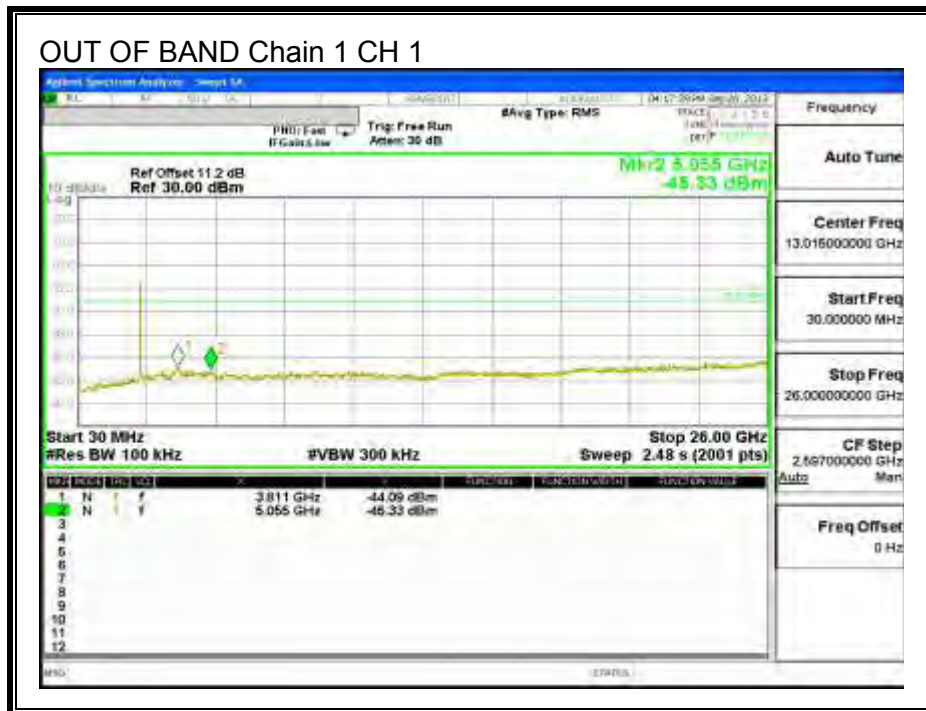
LOW CHANNEL BANDEDGE, Chain 1

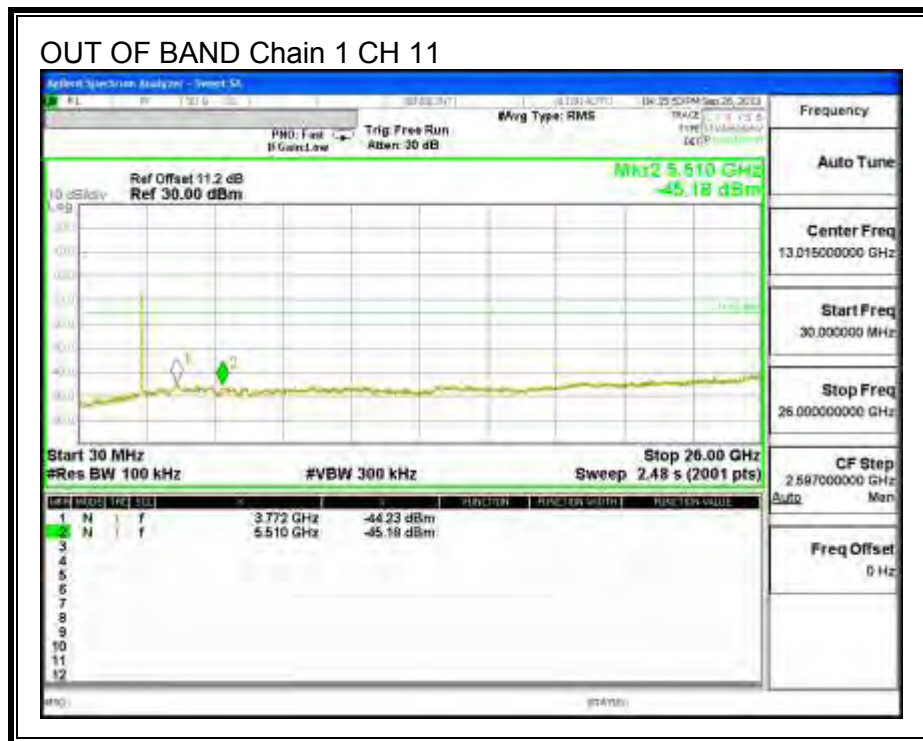
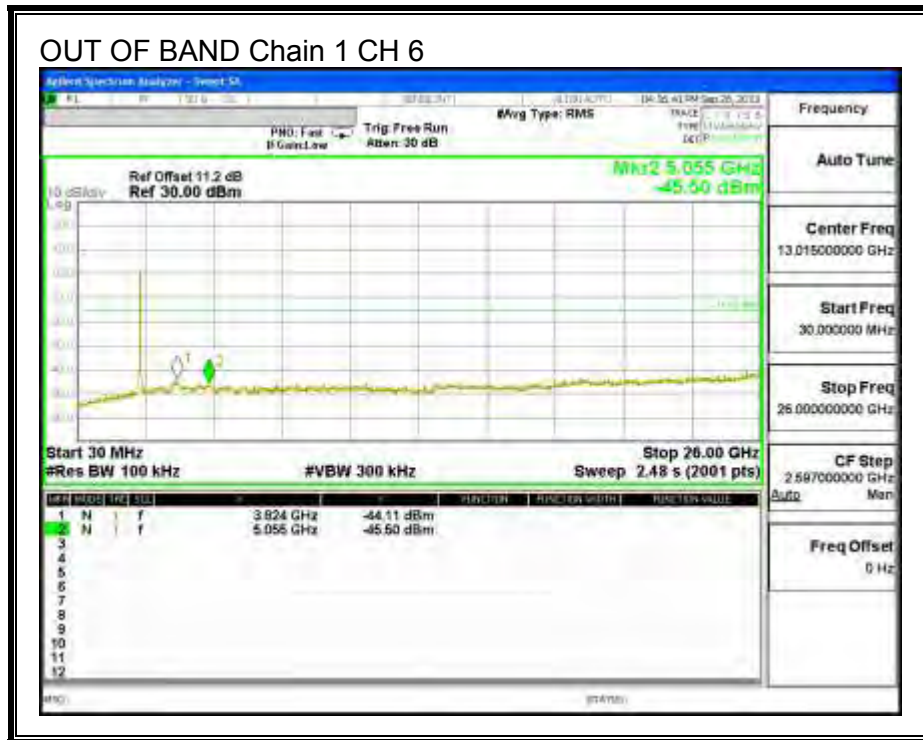


HIGH CHANNEL BANDEDGE, Chain 1



OUT-OF-BAND EMISSIONS, Chain 1





8.4. 802.11n HT20 SISO 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.

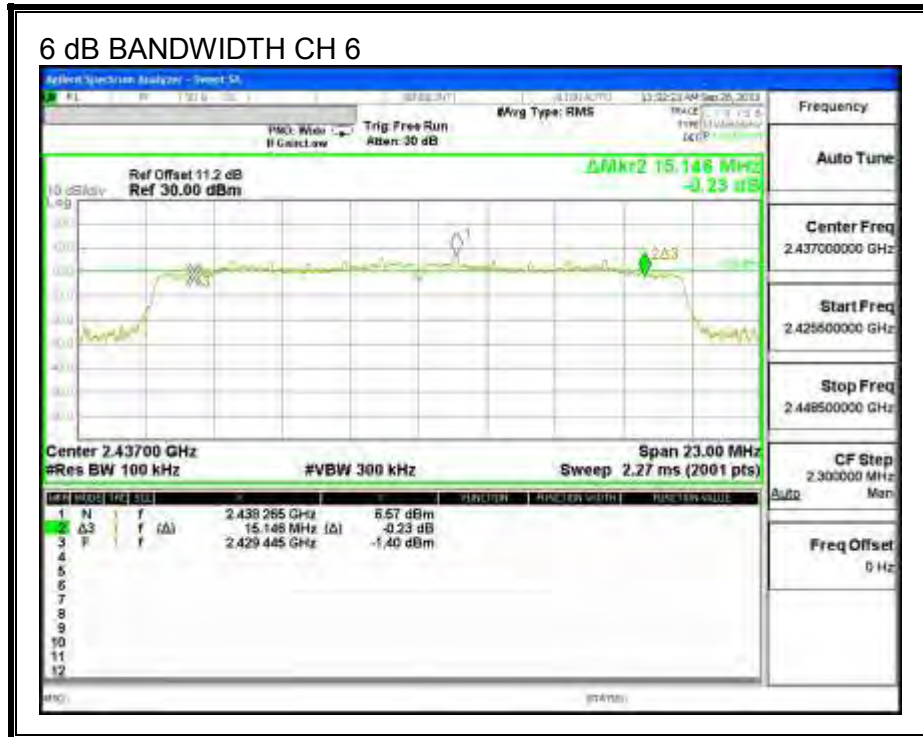
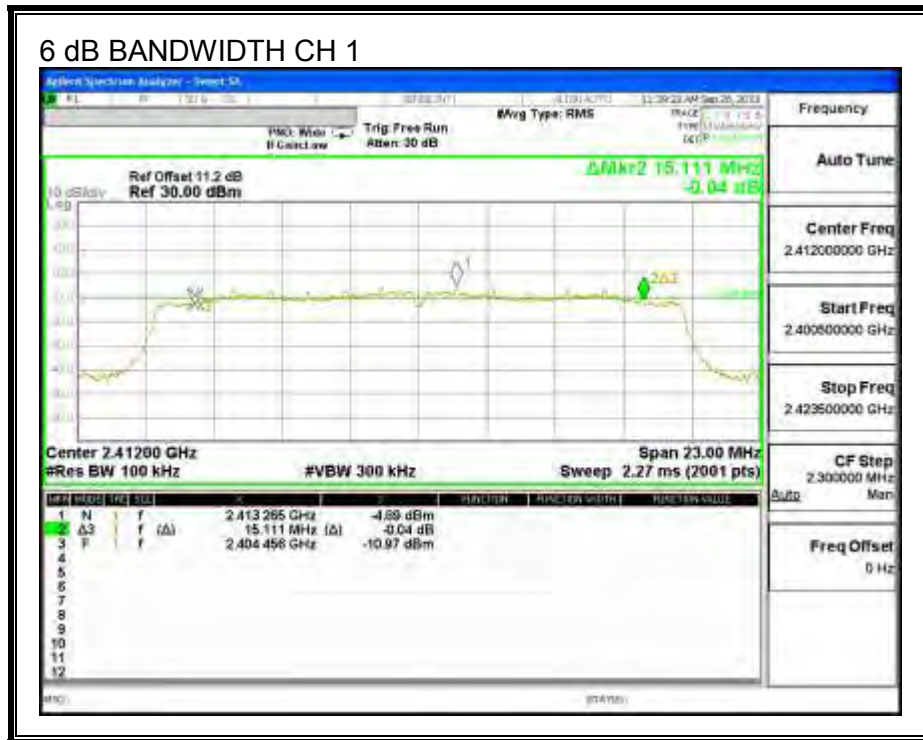
TEST PROCEDURE

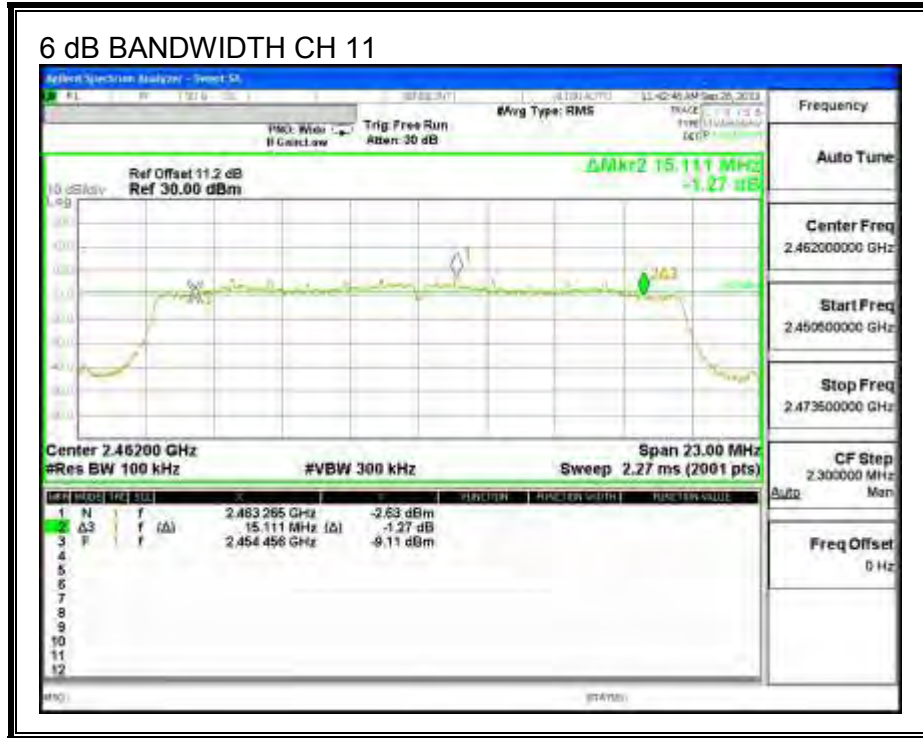
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
1	2412	15.111	0.5
6	2437	15.146	0.5
11	2462	15.111	0.5

6 dB BANDWIDTH





8.4.2. 99% BANDWIDTH

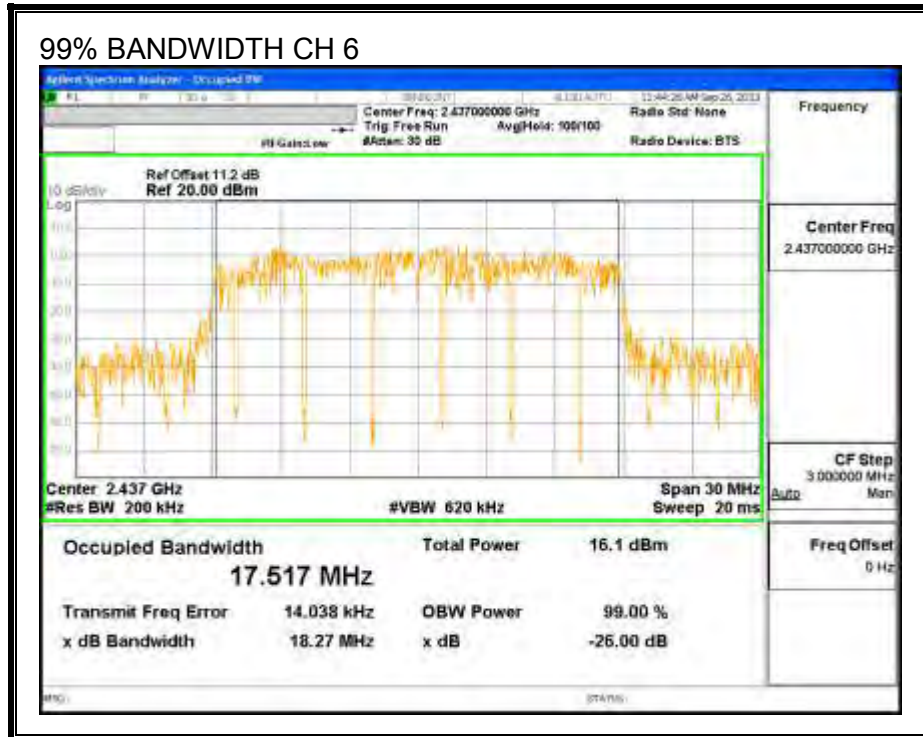
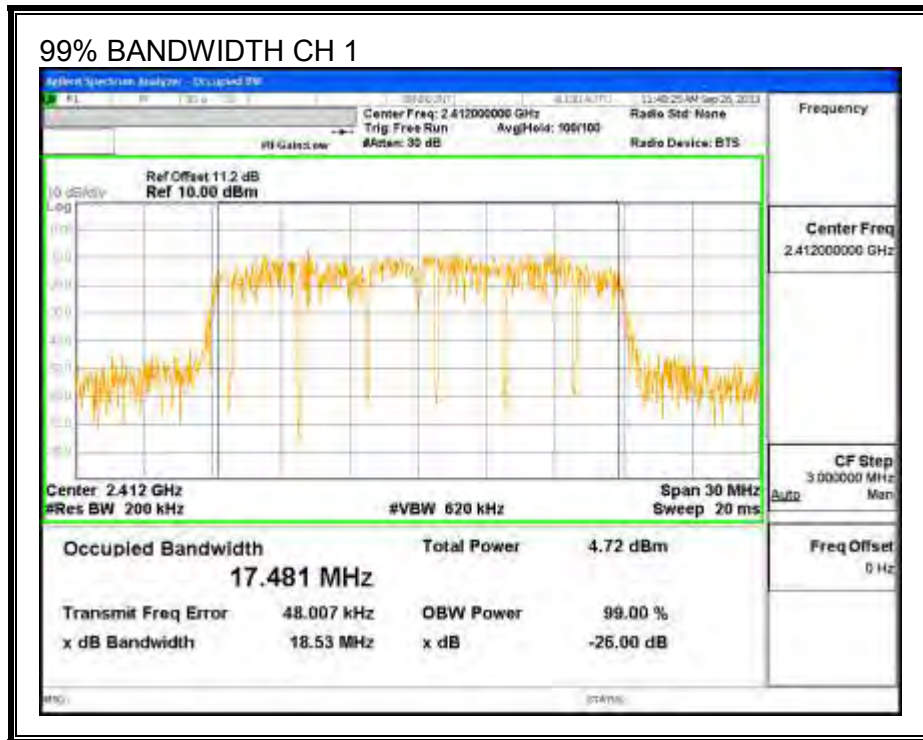
LIMITS

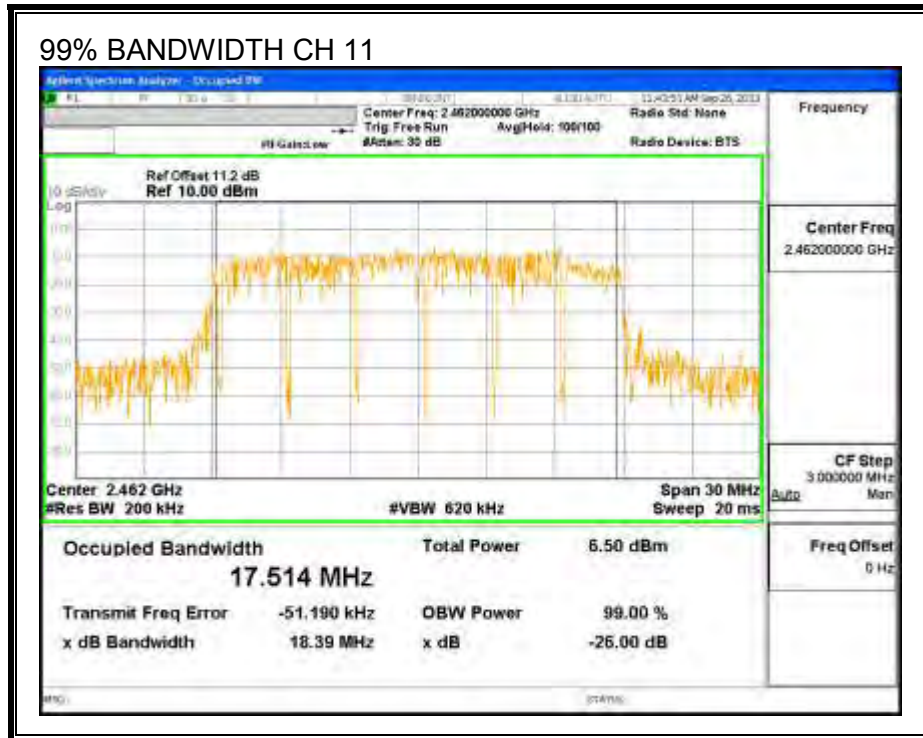
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
1	2412	17.481
6	2437	17.517
11	2462	17.514

99% BANDWIDTH





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 11.42 dB (including 10 dB pad, 1.2 dB cable, and .22 duty cycle correction factor) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
1	2412	4.52
4	2427	13.58
6	2437	16.15
7	2442	13.98
8	2447	9.82
11	2462	7.11

8.4.4. 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

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

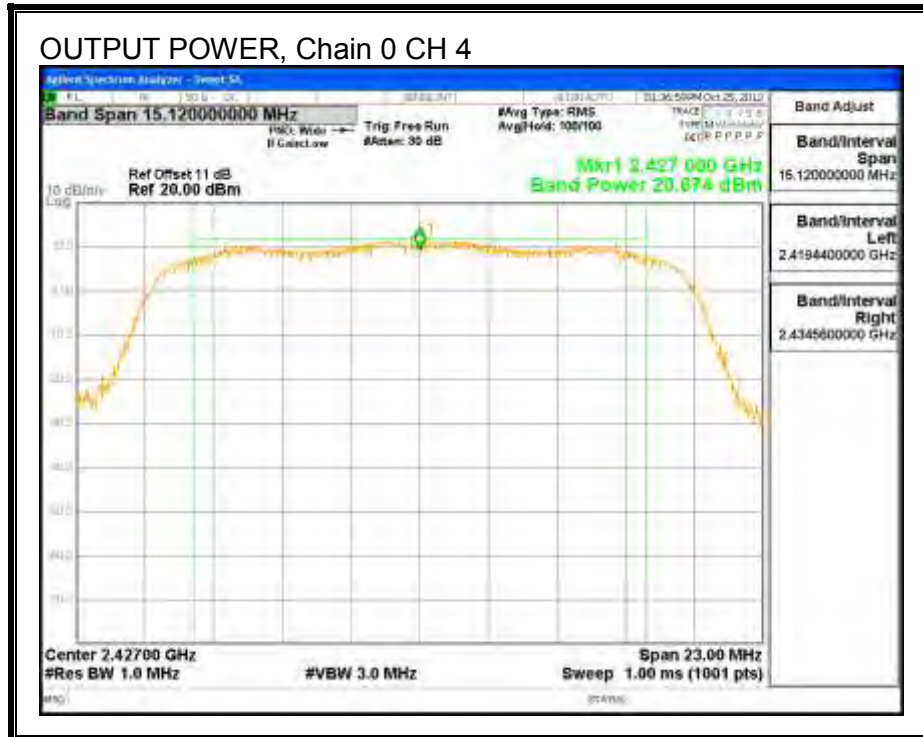
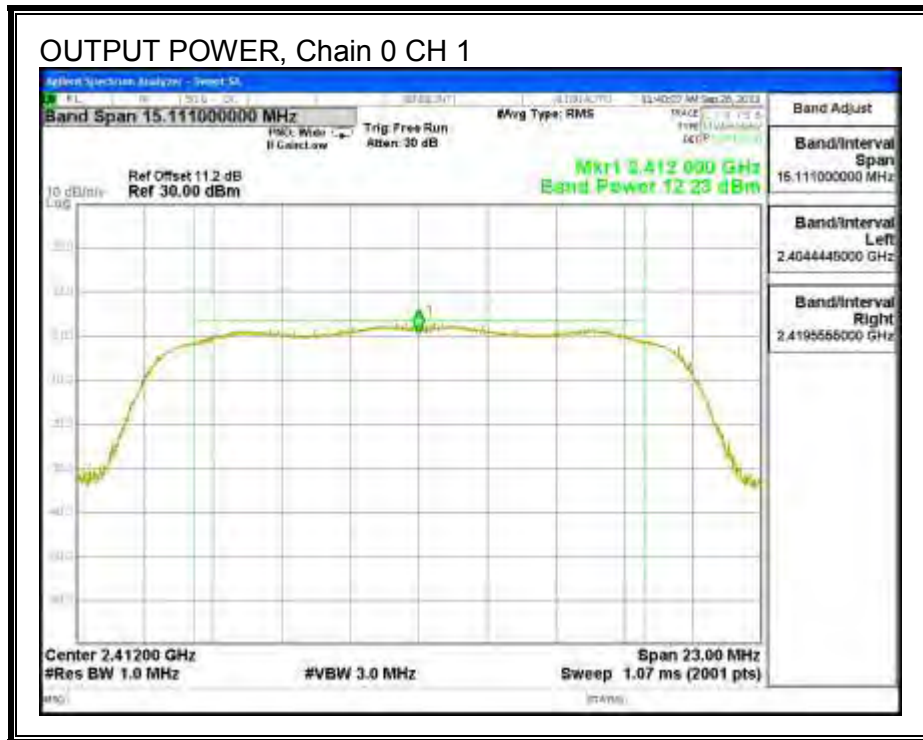
Limits

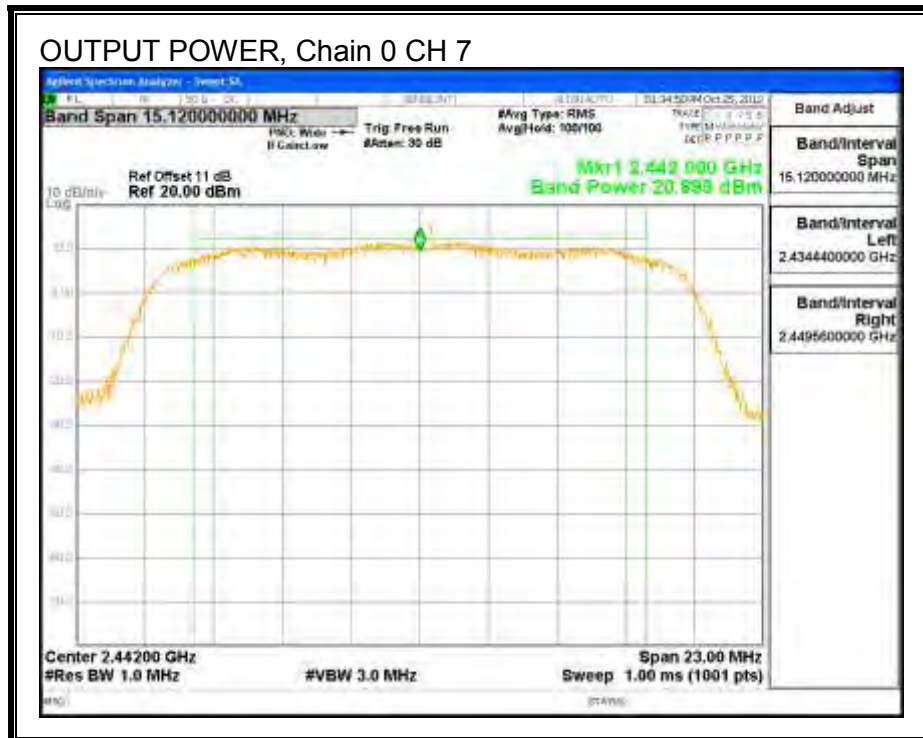
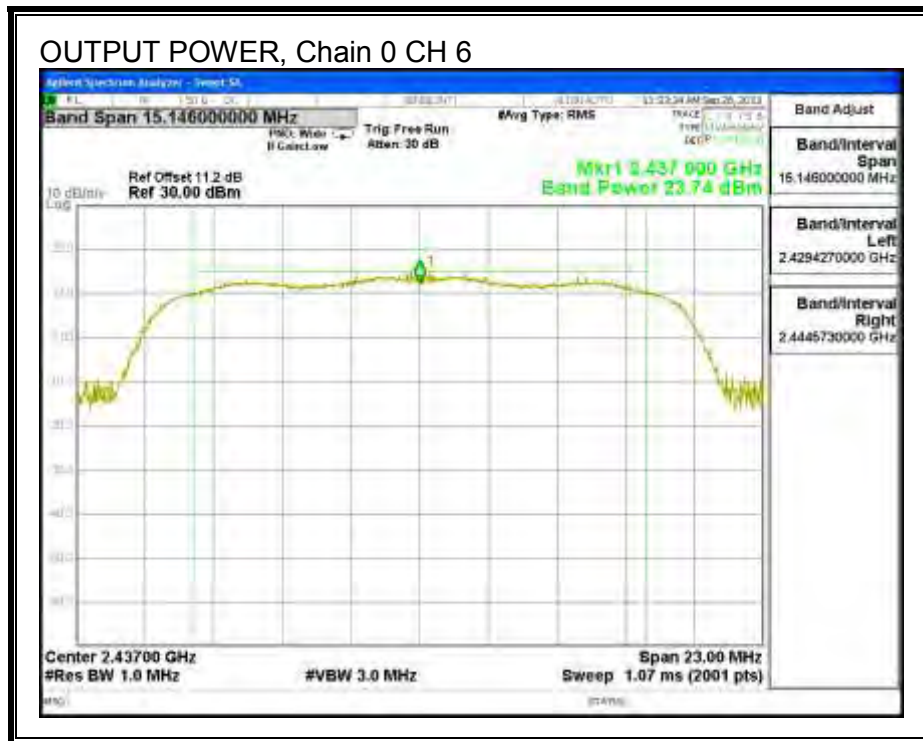
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
1	2412	3.1	30.00	30	36	30.00
6	2437	3.1	30.00	30	36	30.00
11	2462	3.1	30.00	30	36	30.00

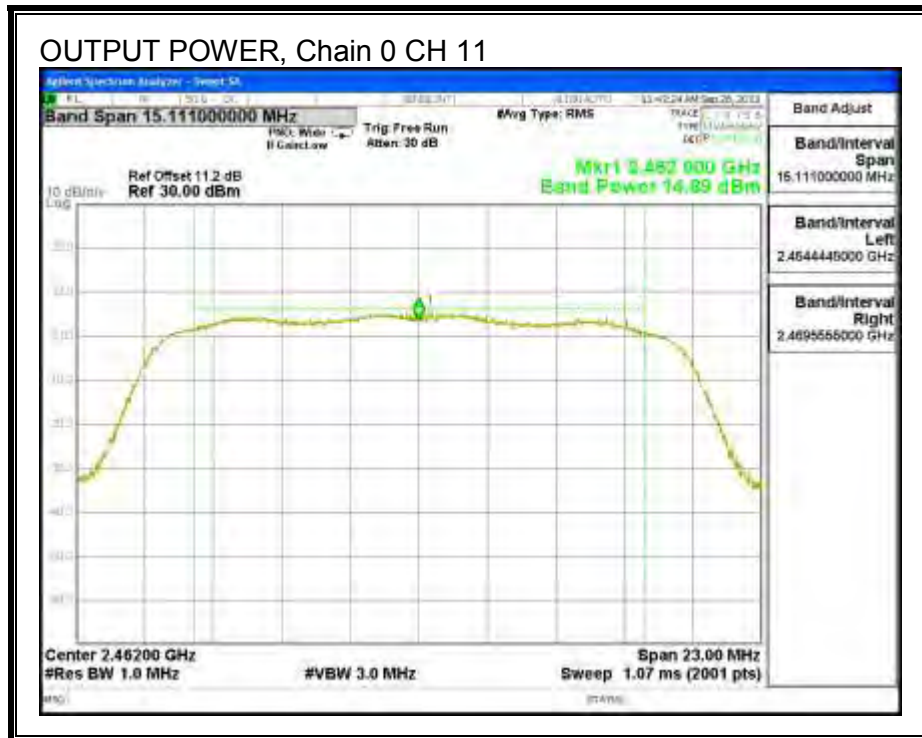
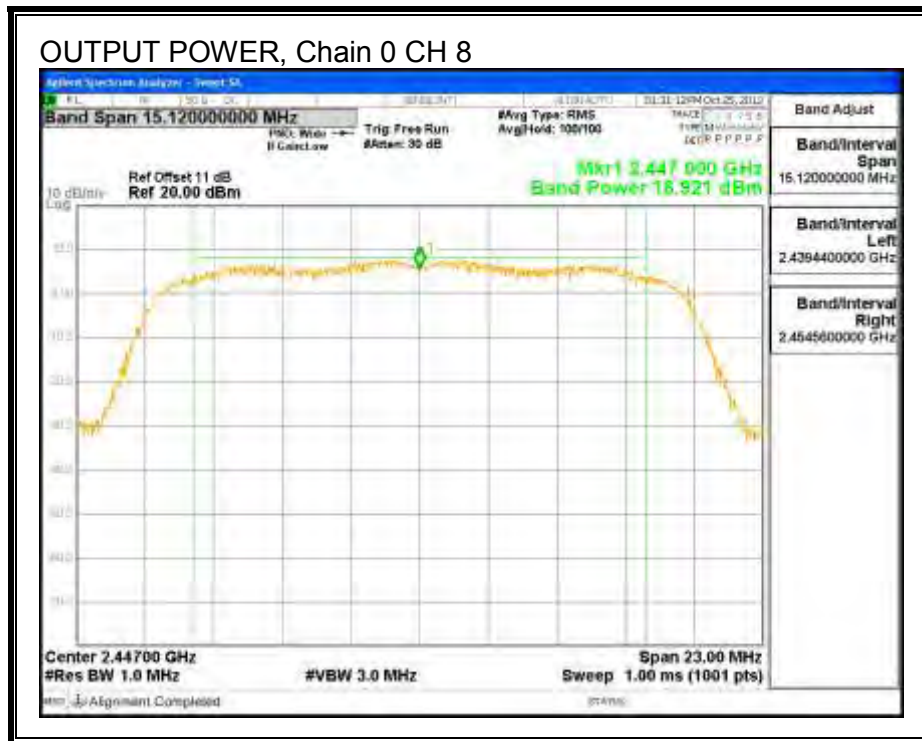
Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
1	2412	12.23	12.23	30.00	-17.77
4	2427	20.67	20.67	30.00	-9.33
6	2437	23.74	23.74	30.00	-6.26
7	2442	20.90	20.90	30.00	-9.10
8	2447	16.92	16.92	30.00	-13.08
11	2462	14.89	14.89	30.00	-15.11

OUTPUT POWER, Chain 0







8.4.5. PSD

LIMITS

FCC §15.247

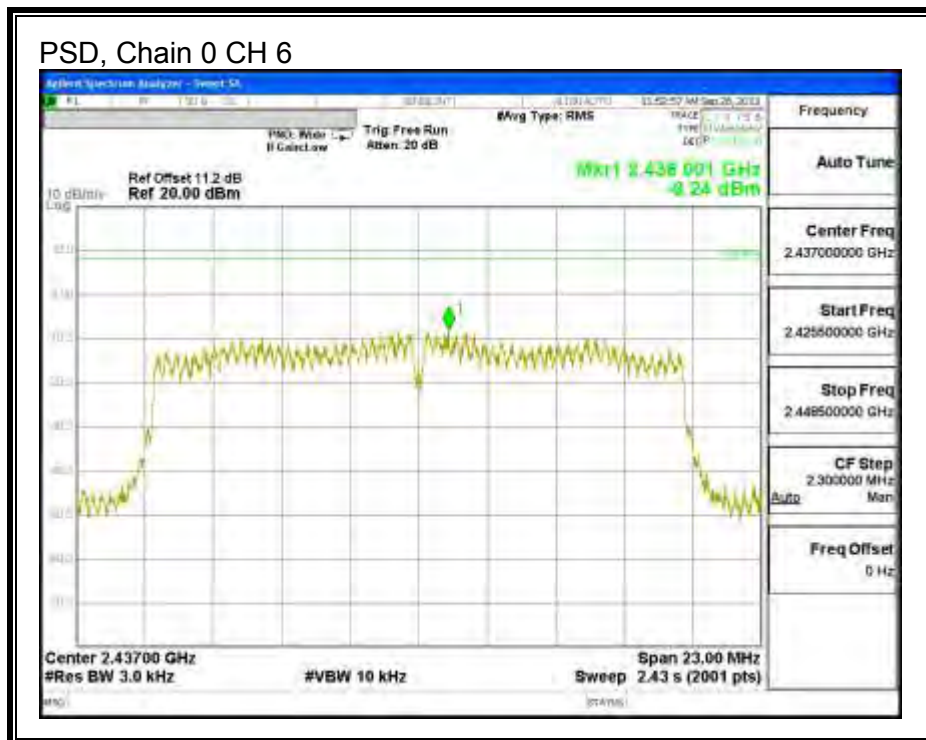
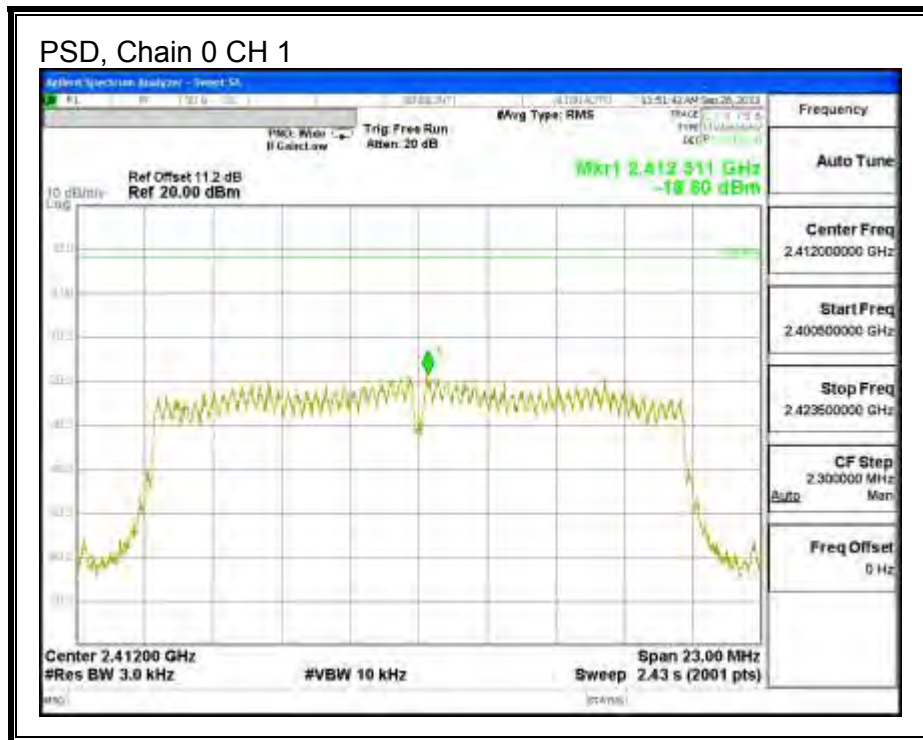
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

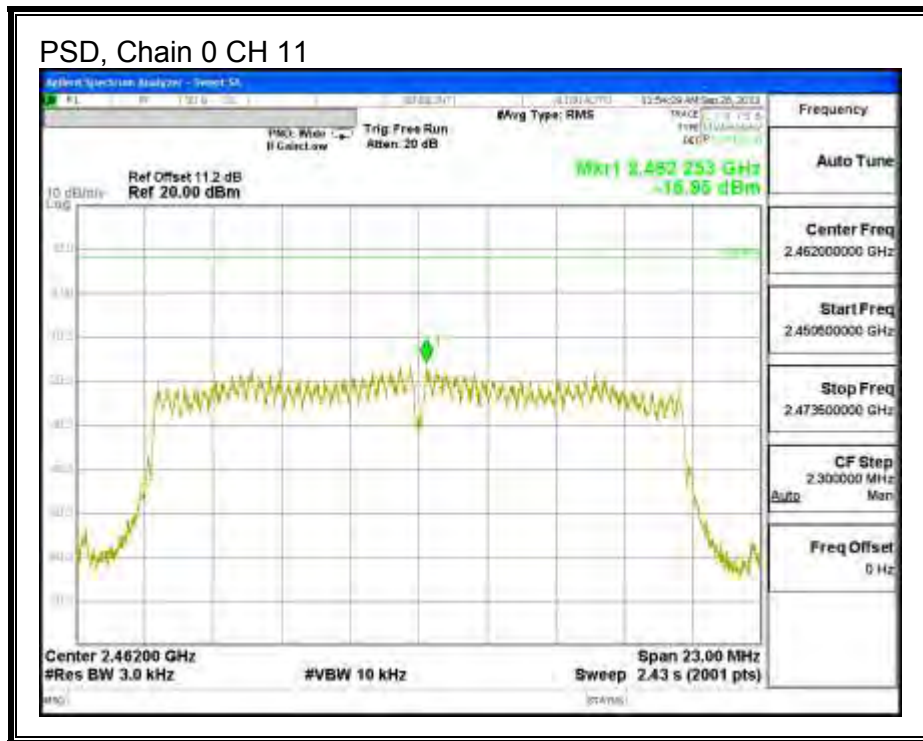
RESULTS

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Limit (dBm)	Margin (dB)
1	2412	-18.60	8.0	-26.6
6	2437	-8.24	8.0	-16.2
11	2462	-15.95	8.0	-24.0

PSD, Chain 0





8.4.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

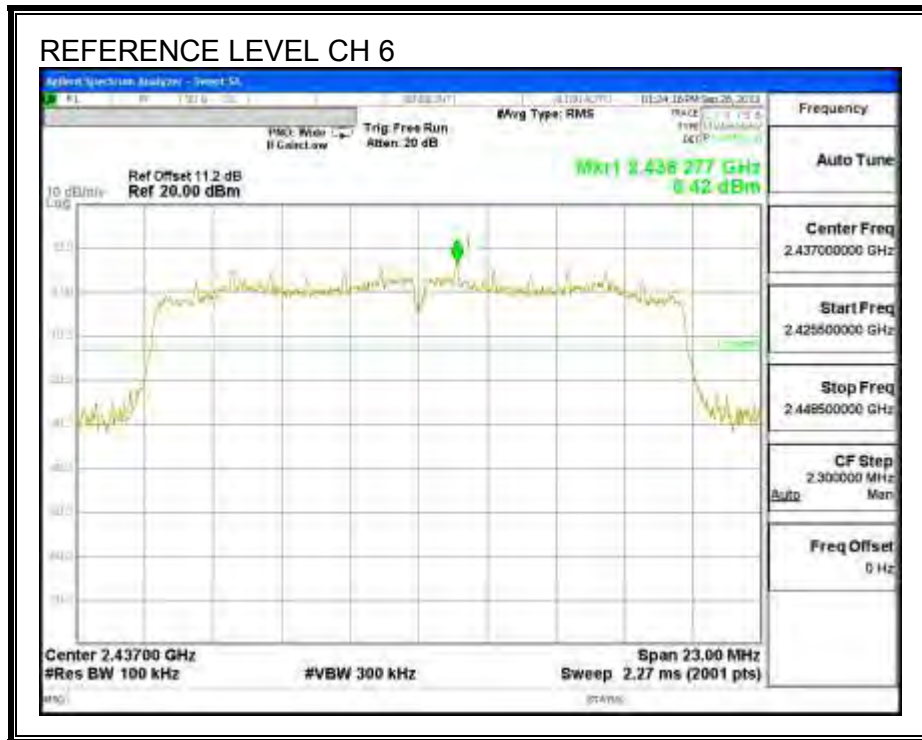
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

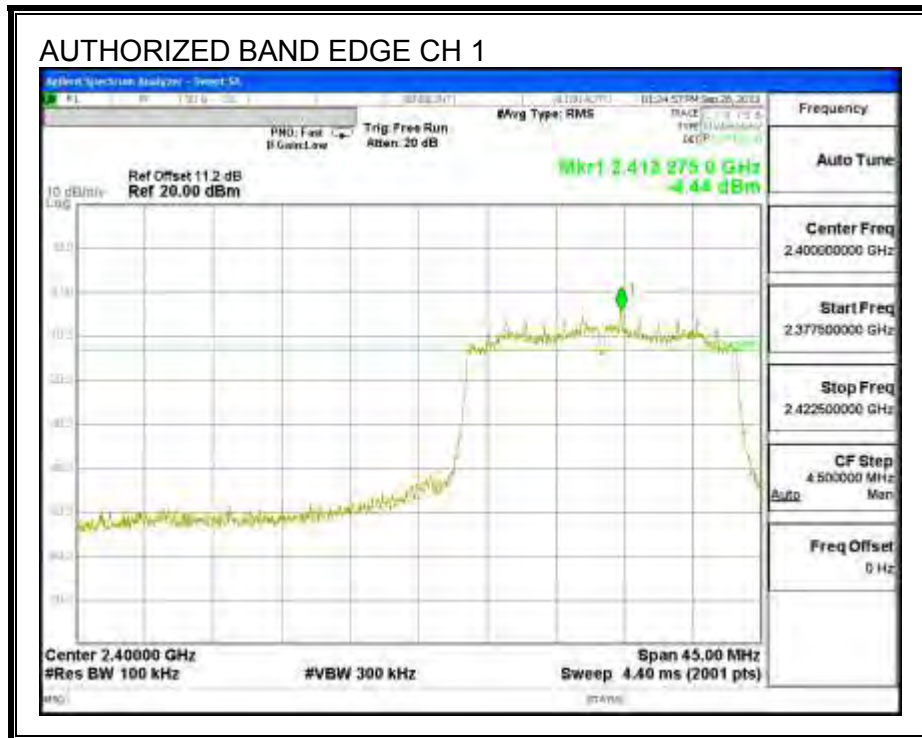
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

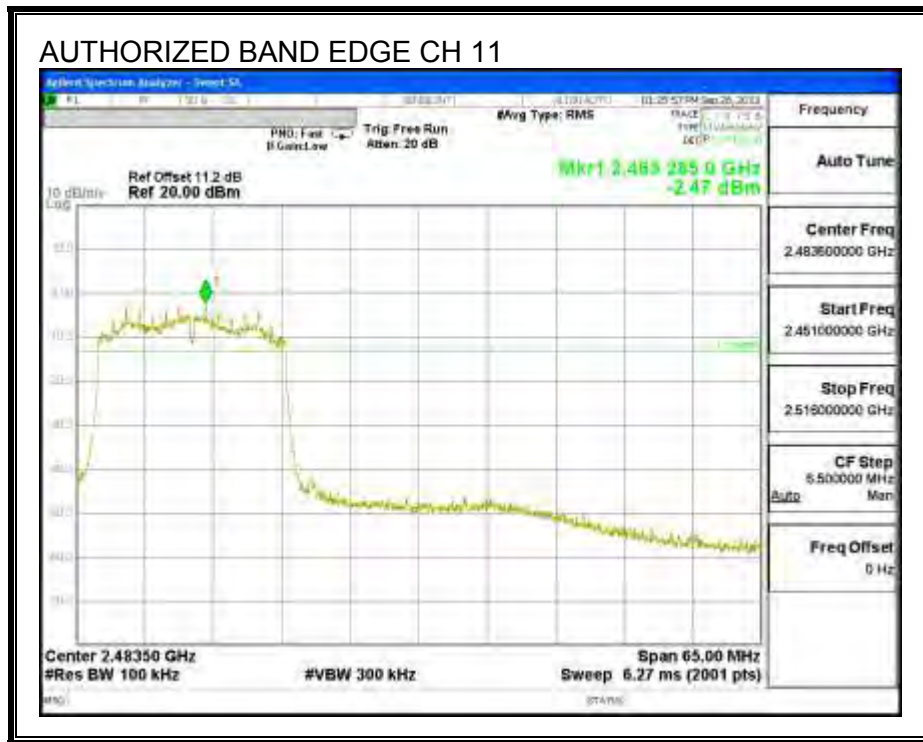
IN-BAND REFERENCE LEVEL



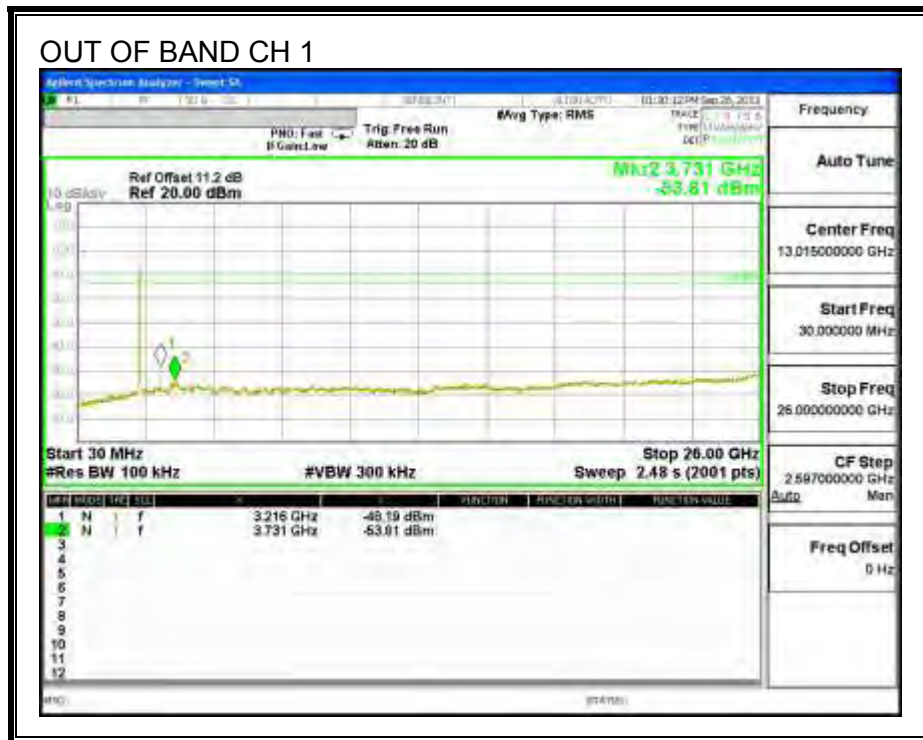
LOW CHANNEL BANDEDGE

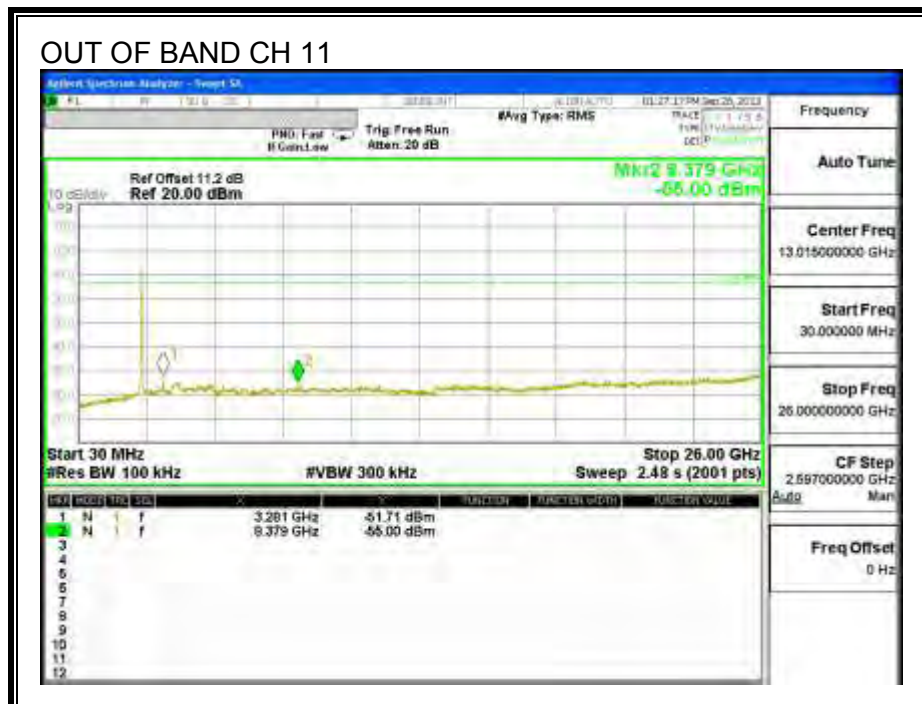
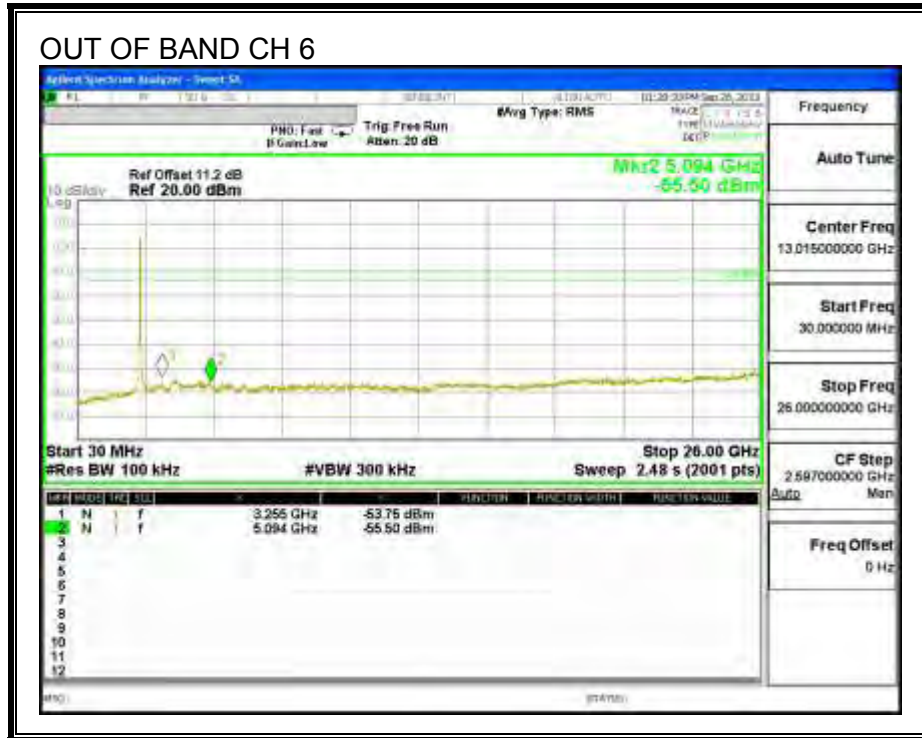


HIGH CHANNEL BANDEDGE



OUT-OF-BAND EMISSIONS





8.5. 802.11n HT20 2TX CDD 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.

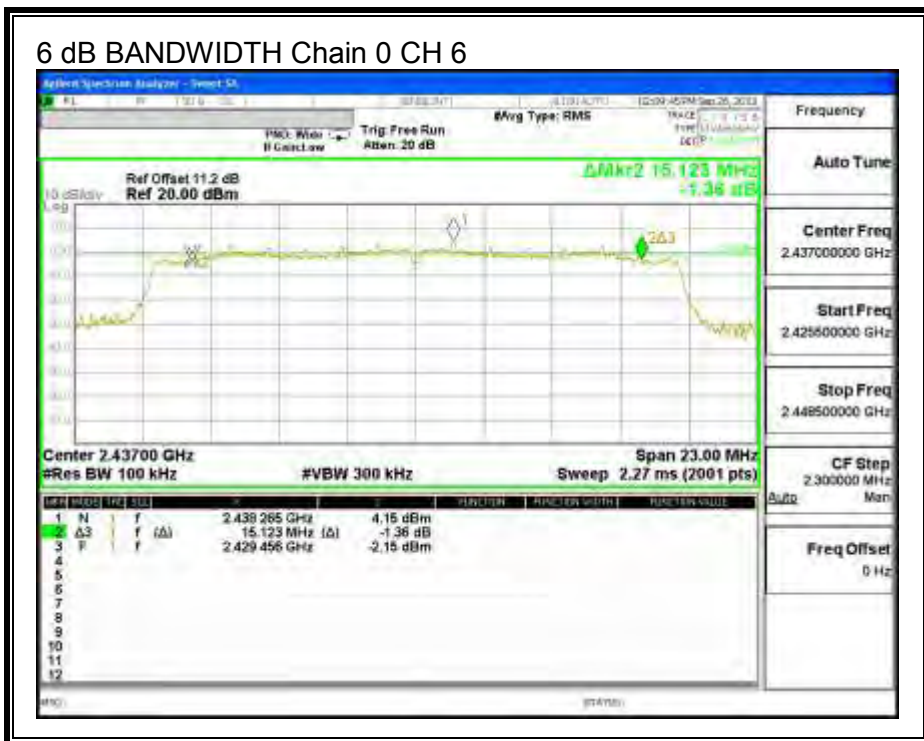
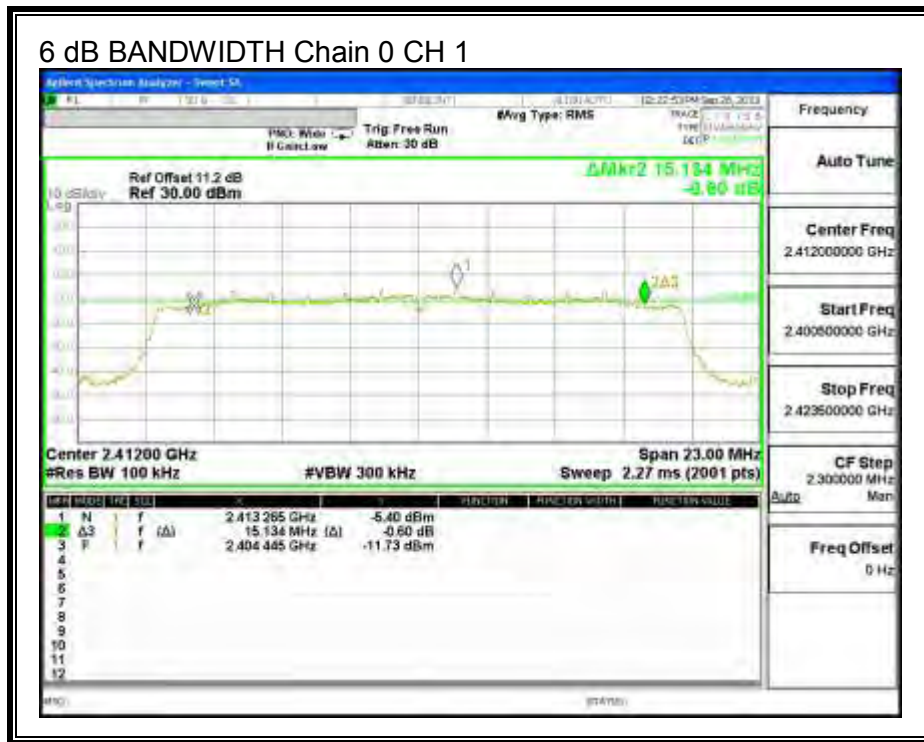
TEST PROCEDURE

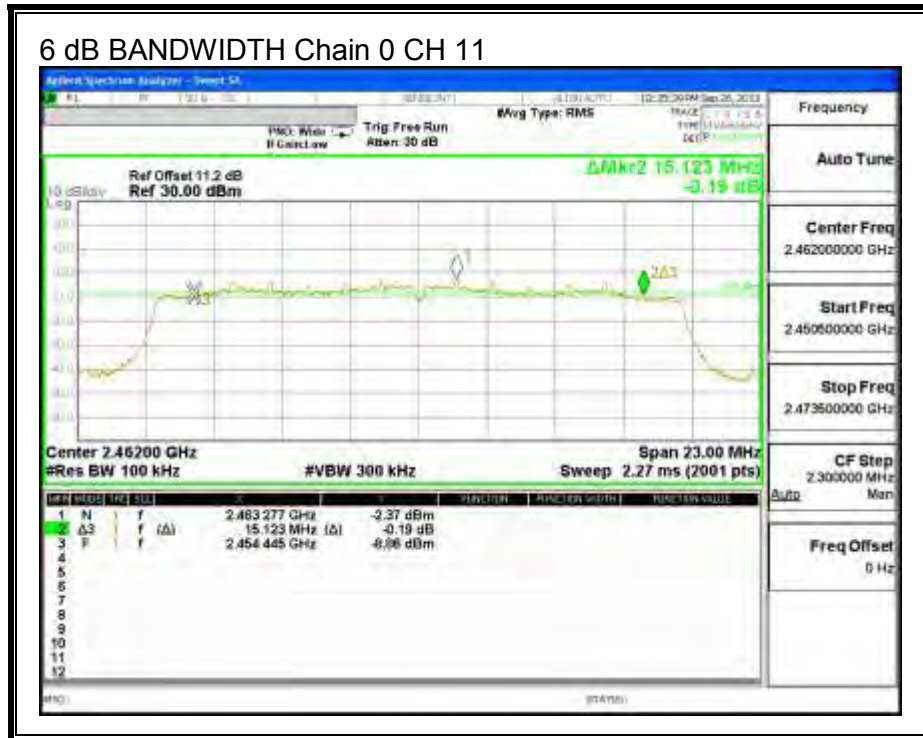
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

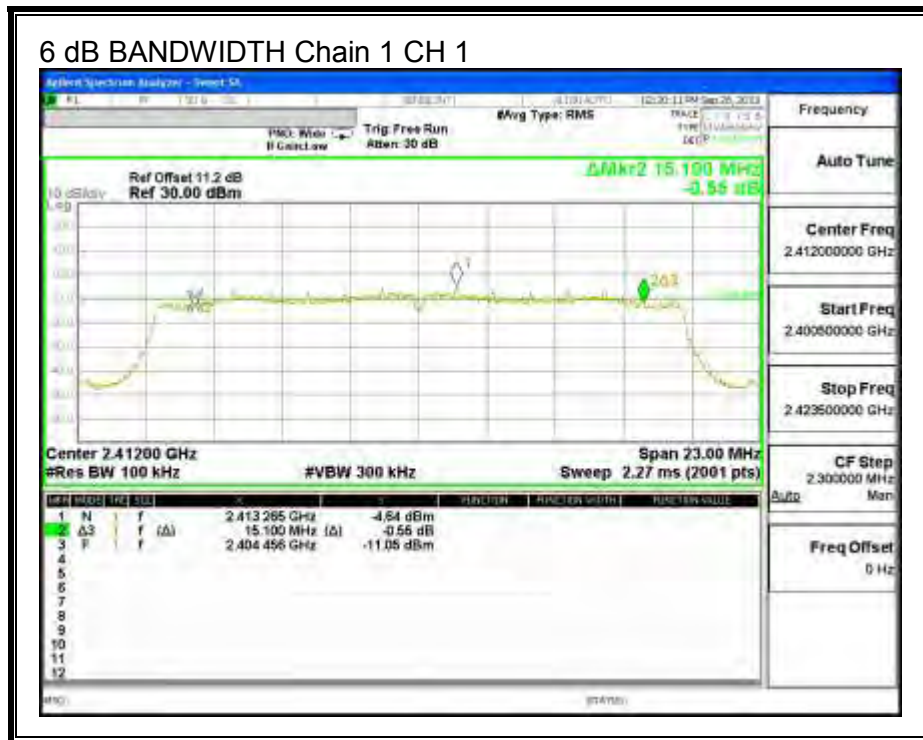
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
1	2412	15.134	15.100	0.5
6	2437	15.123	15.100	0.5
11	2462	15.123	15.123	0.5

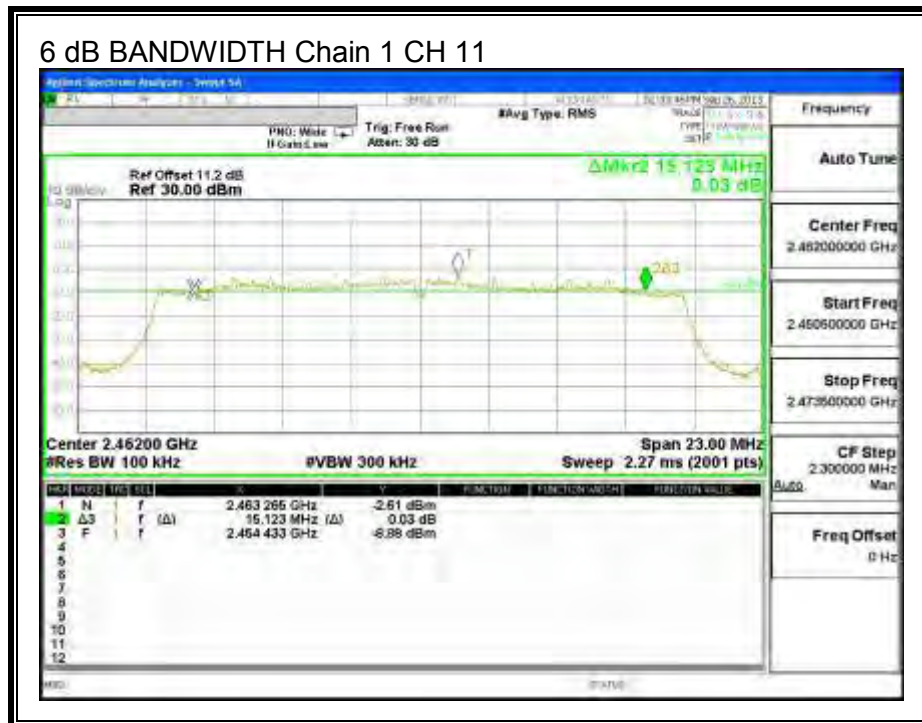
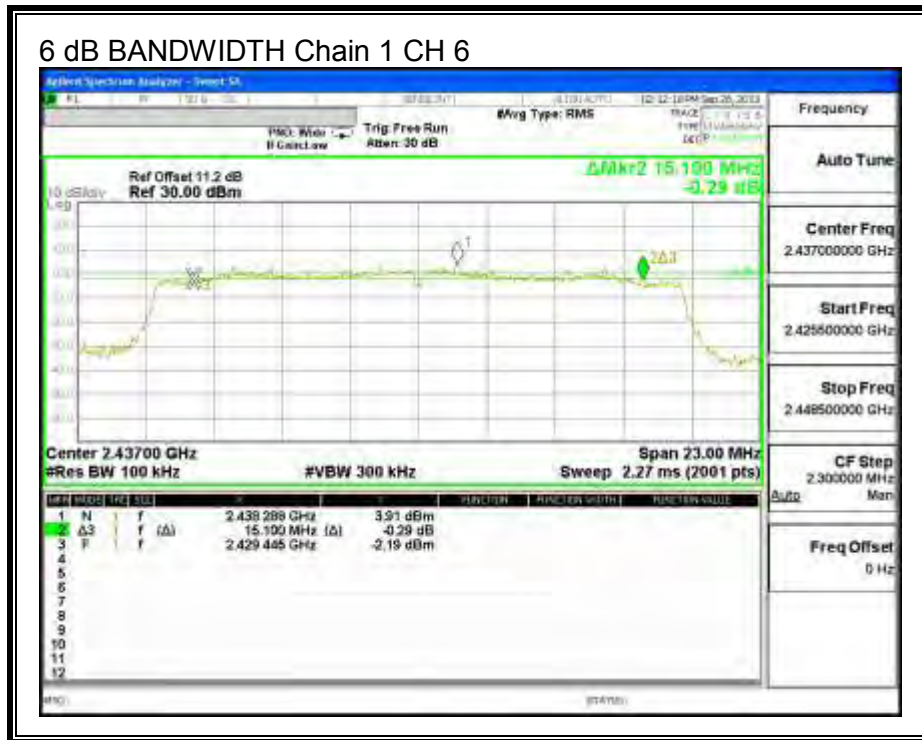
6 dB BANDWIDTH, Chain 0





6 dB BANDWIDTH, Chain 1





8.5.2. 99% BANDWIDTH

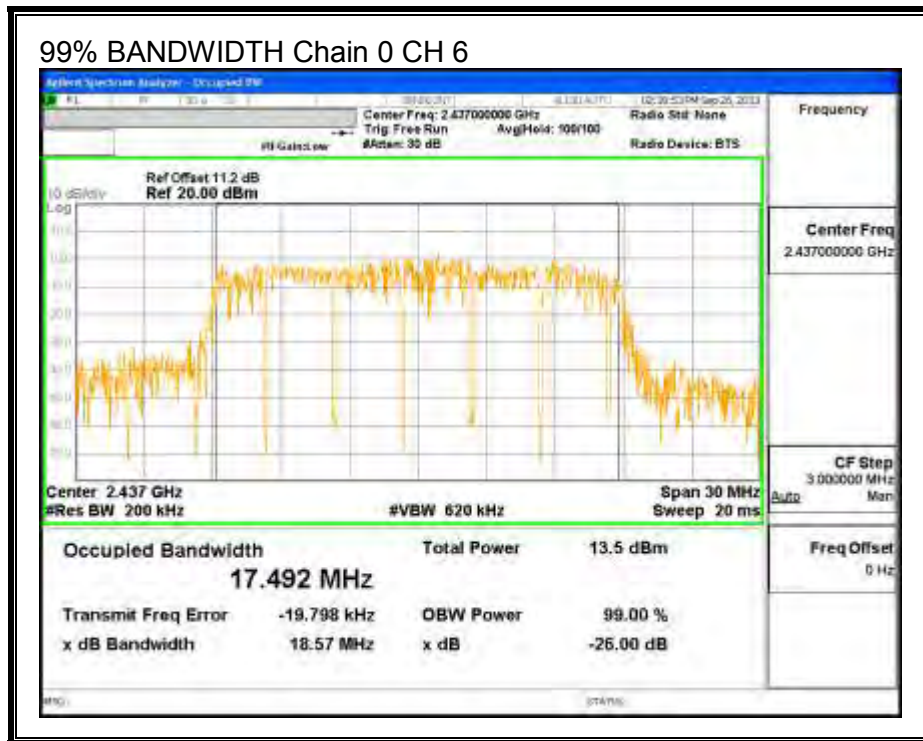
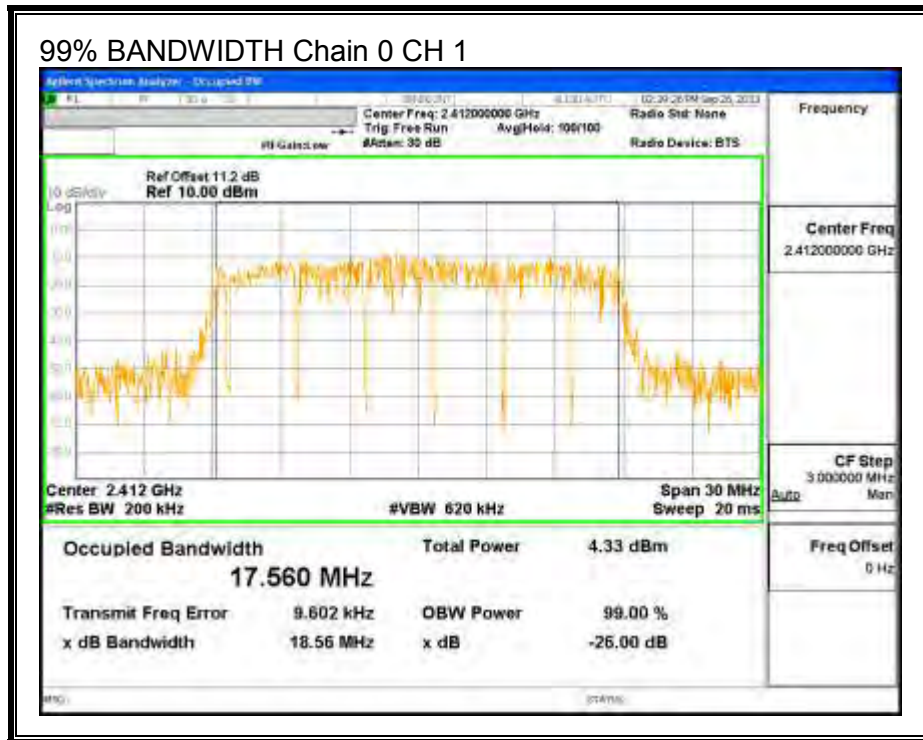
LIMITS

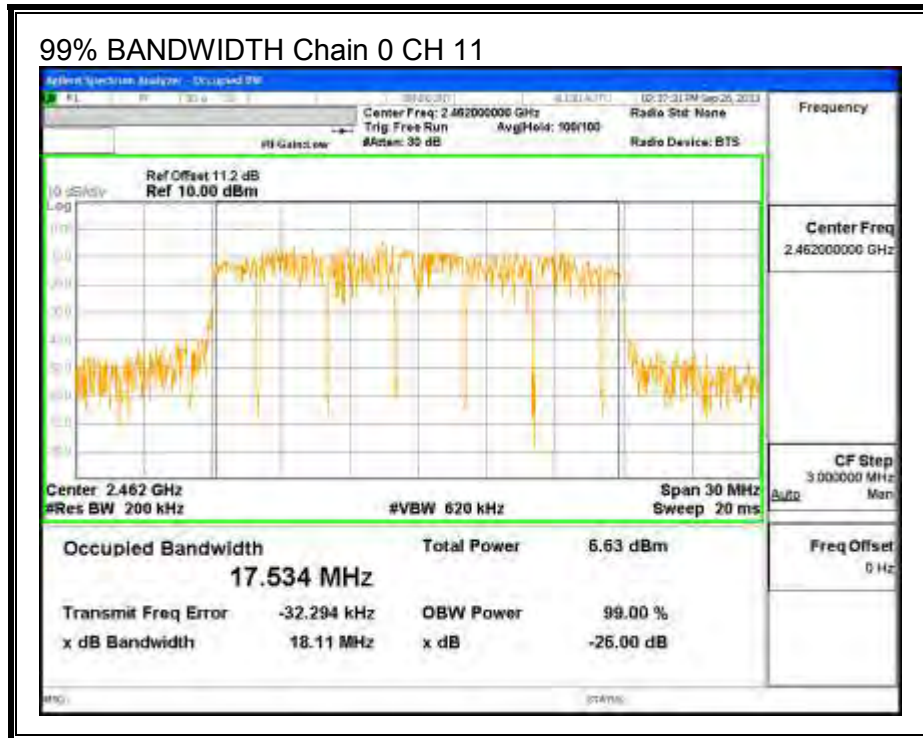
None; for reporting purposes only.

RESULTS

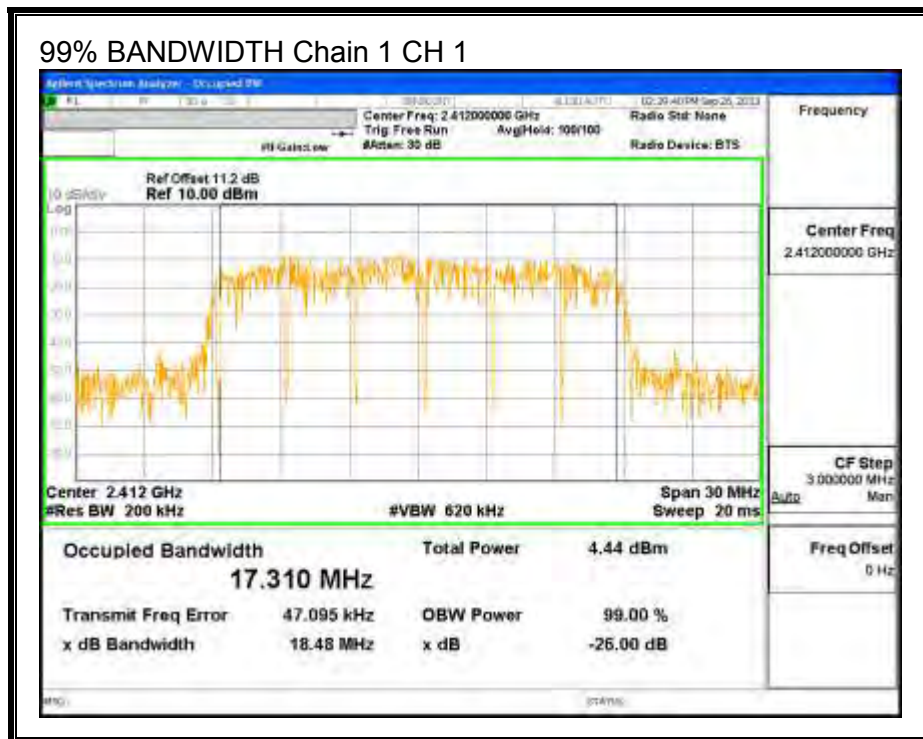
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
1	2412	17.560	17.310
6	2437	17.492	17.435
11	2462	17.534	17.463

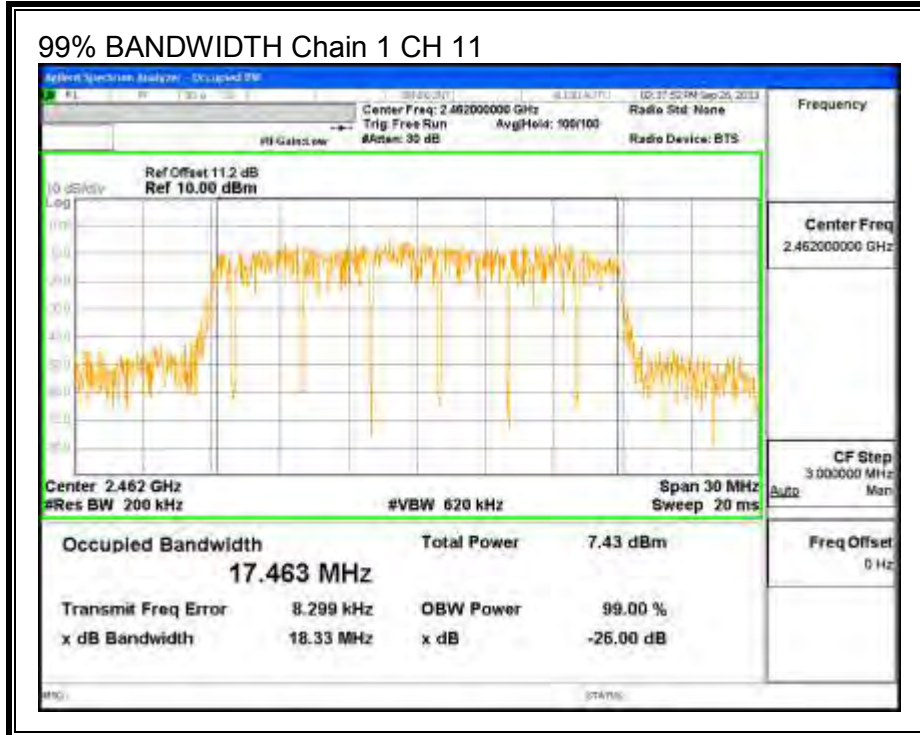
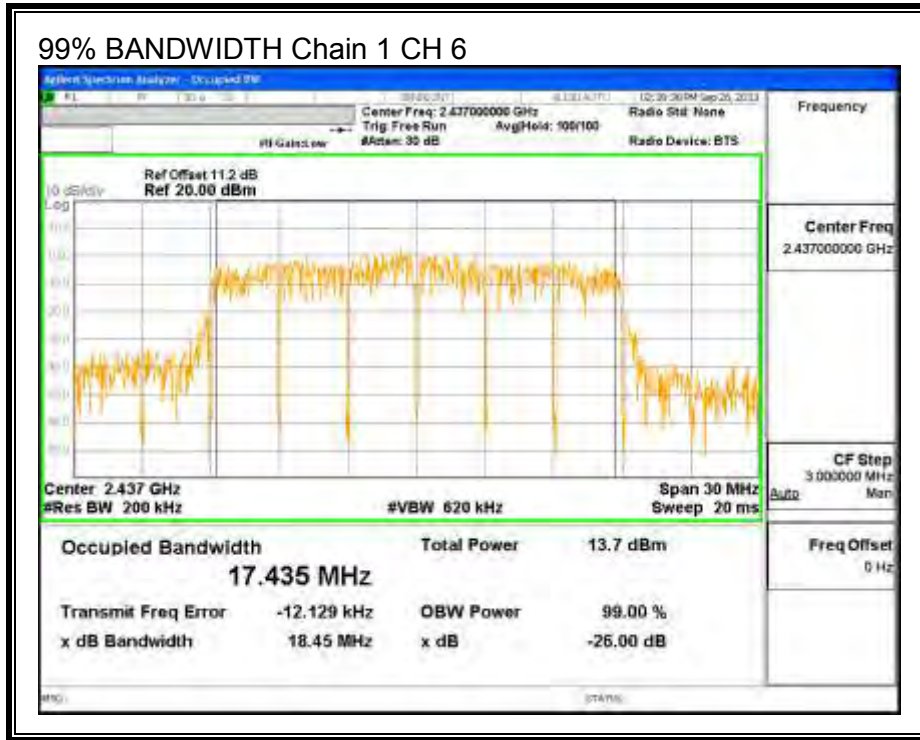
99% BANDWIDTH, Chain 0





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 11.42 dB (including 10 dB pad, 1.2 dB cable, and .22 duty cycle correction factor) 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)
1	2412	4.53	4.76	7.66
4	2427	12.28	11.99	15.15
6	2437	13.73	13.74	16.75
8	2447	10.79	10.01	13.43
11	2462	7.43	7.51	10.48

8.5.4. 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)
3.10	2.00	2.58

RESULTS

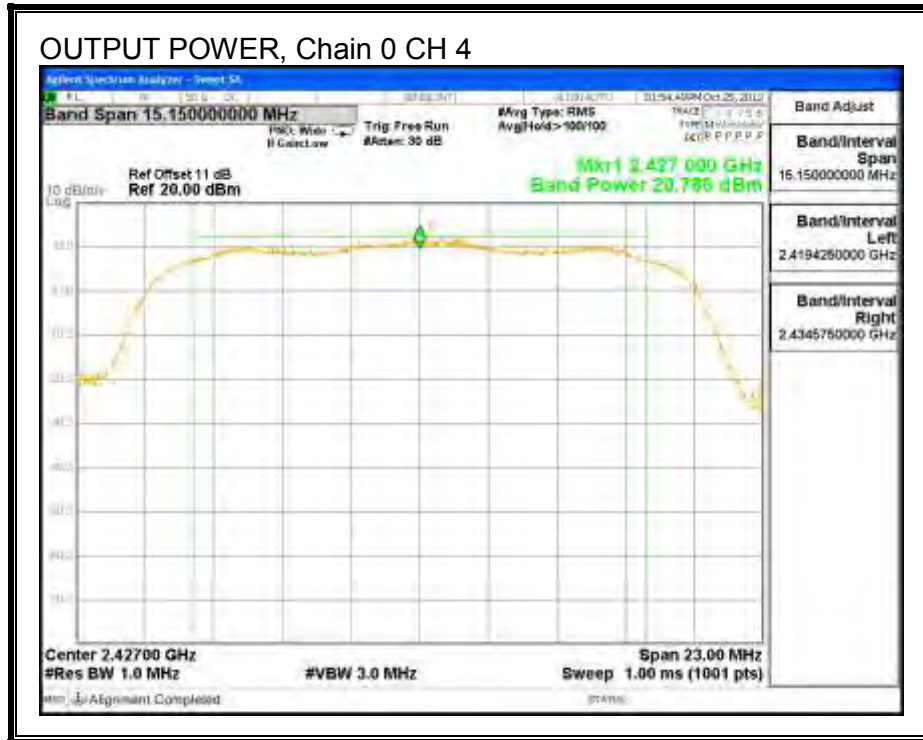
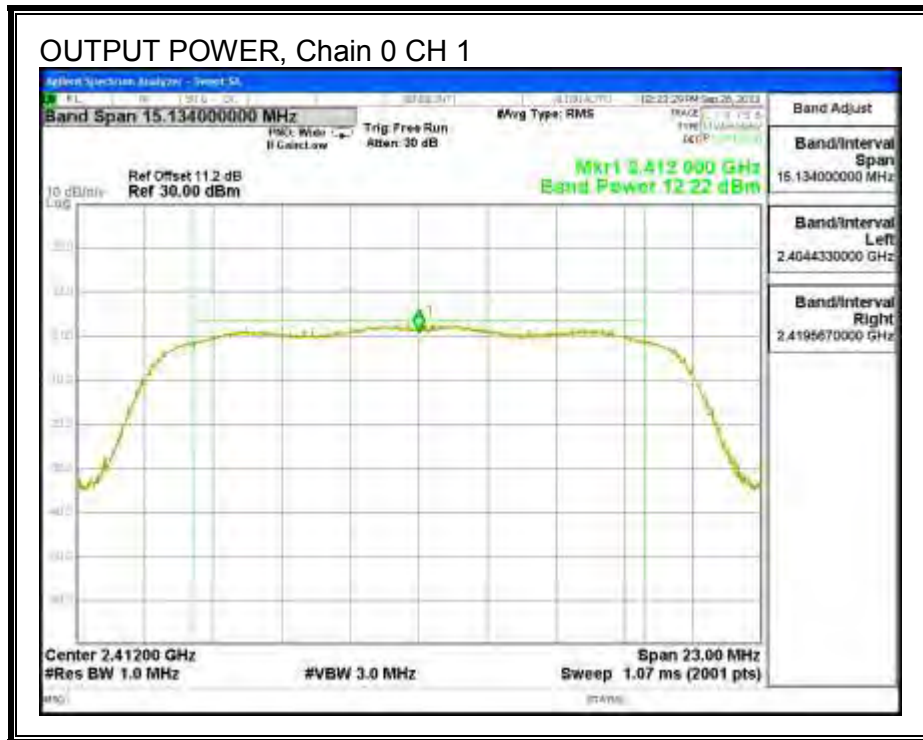
Limits

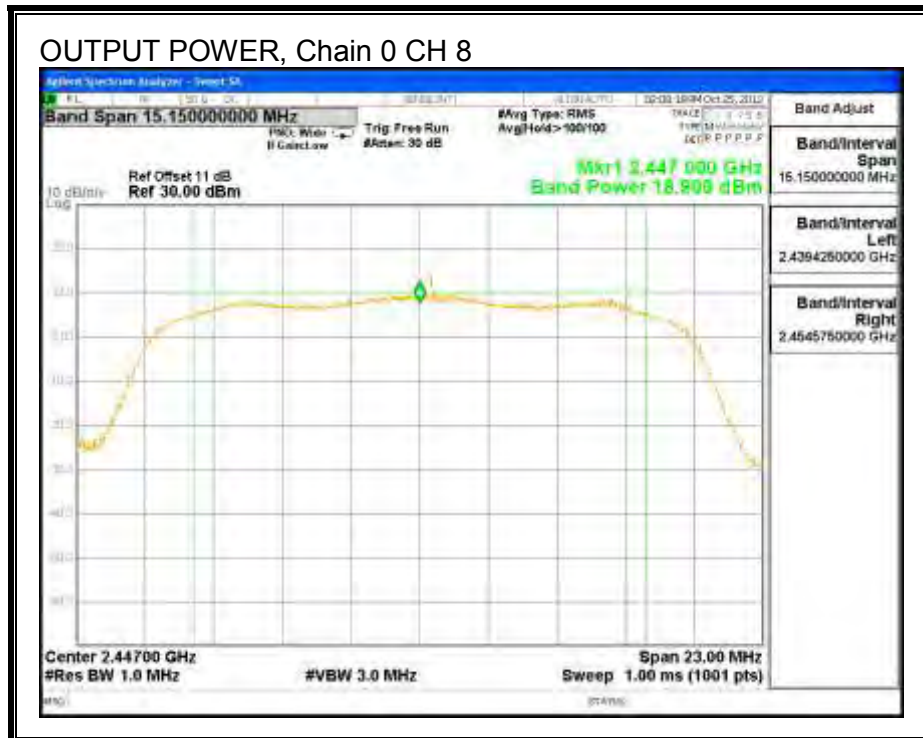
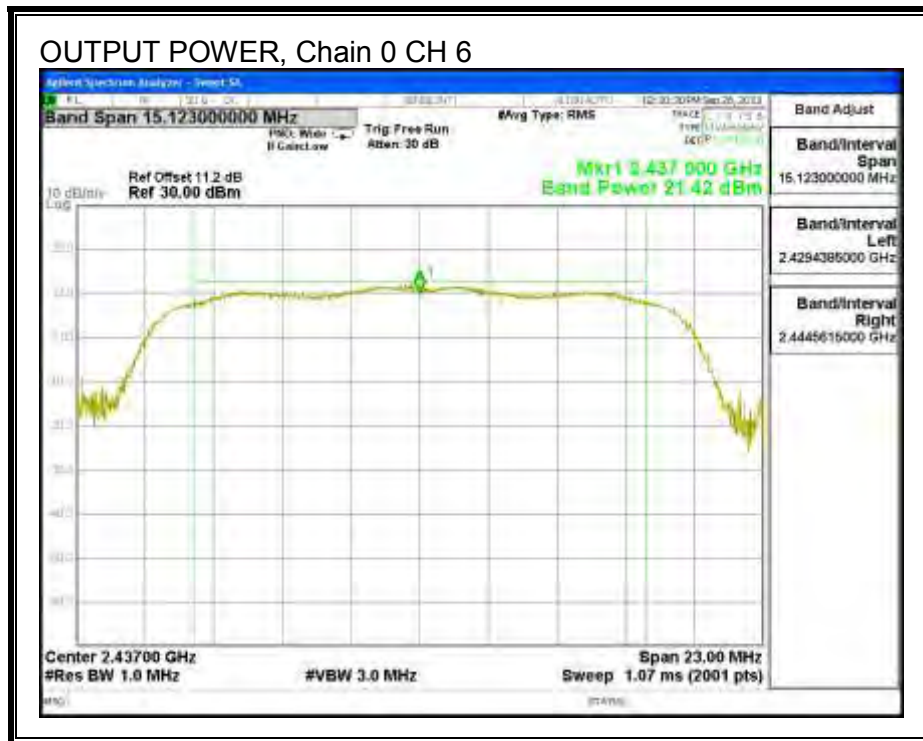
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
1	2412	2.58	30.00	30	36	30.00
4	2427	2.58	30.00	30	36	30.00
6	2437	2.58	30.00	30	36	30.00
8	2447	2.58	30.00	30	36	30.00
11	2462	2.58	30.00	30	36	30.00

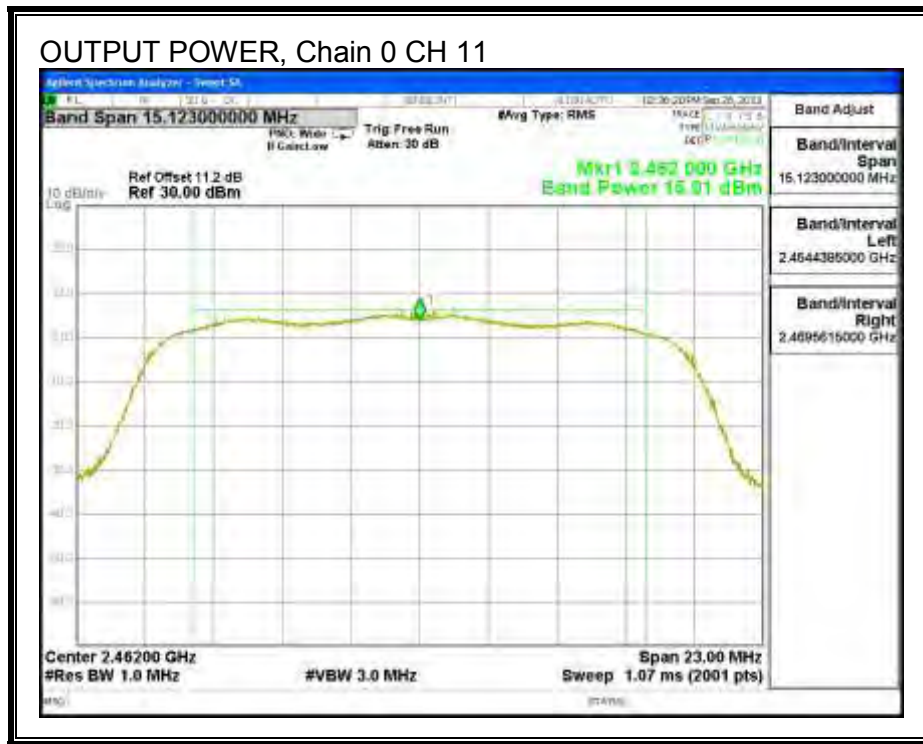
Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
1	2412	12.22	12.73	15.49	30.00	-14.51
4	2427	20.79	21.01	23.91	30.00	-6.09
6	2437	21.42	21.92	24.69	30.00	-5.31
8	2447	18.91	19.01	21.97	30.00	-8.03
11	2462	15.01	15.63	18.34	30.00	-11.66

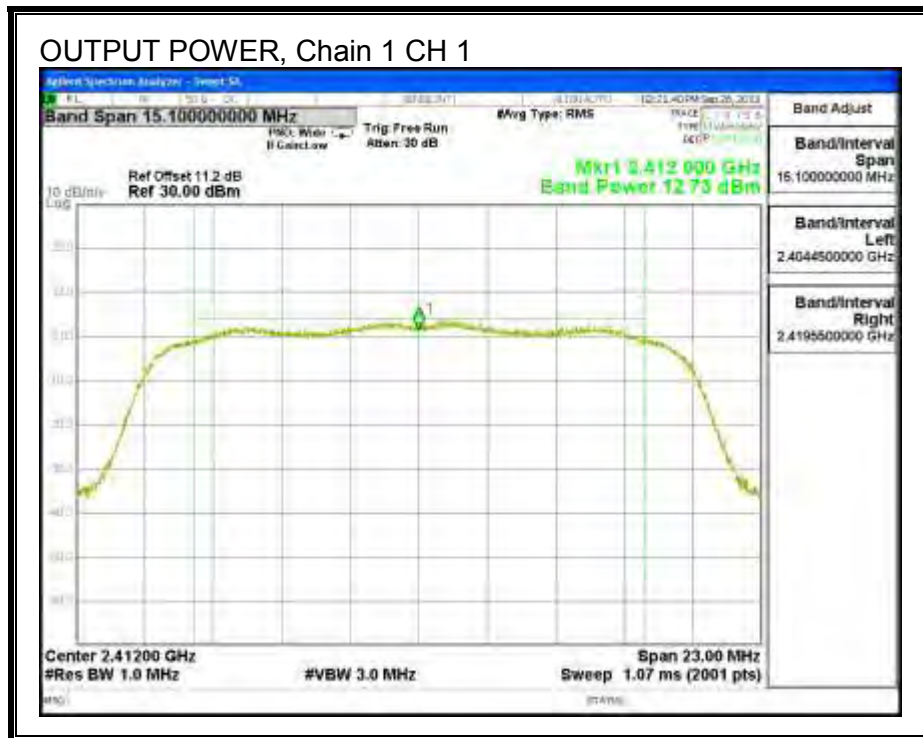
OUTPUT POWER, Chain 0

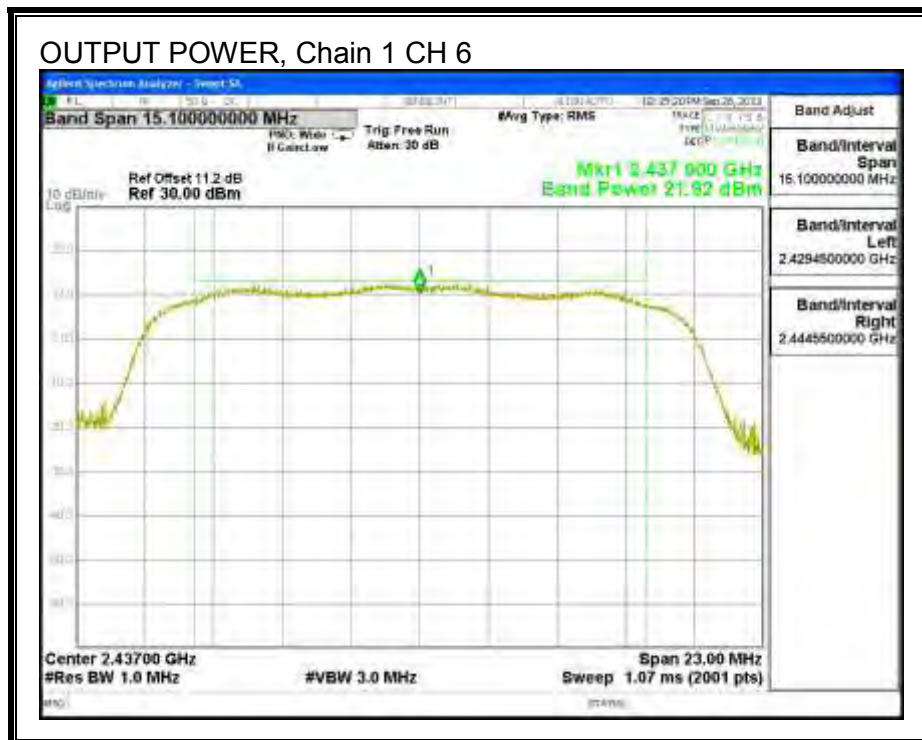
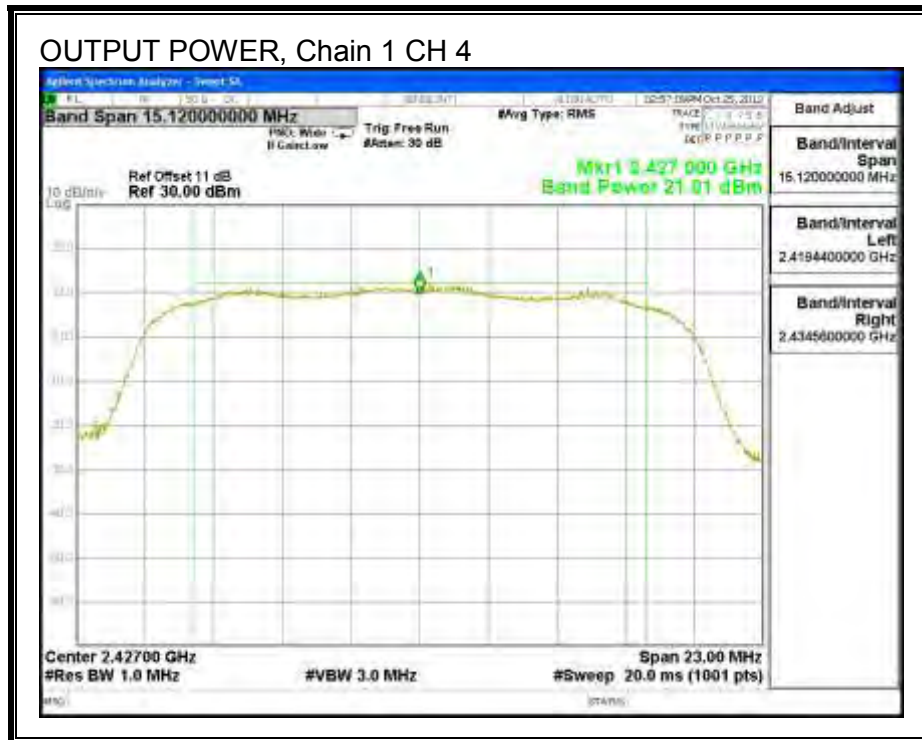


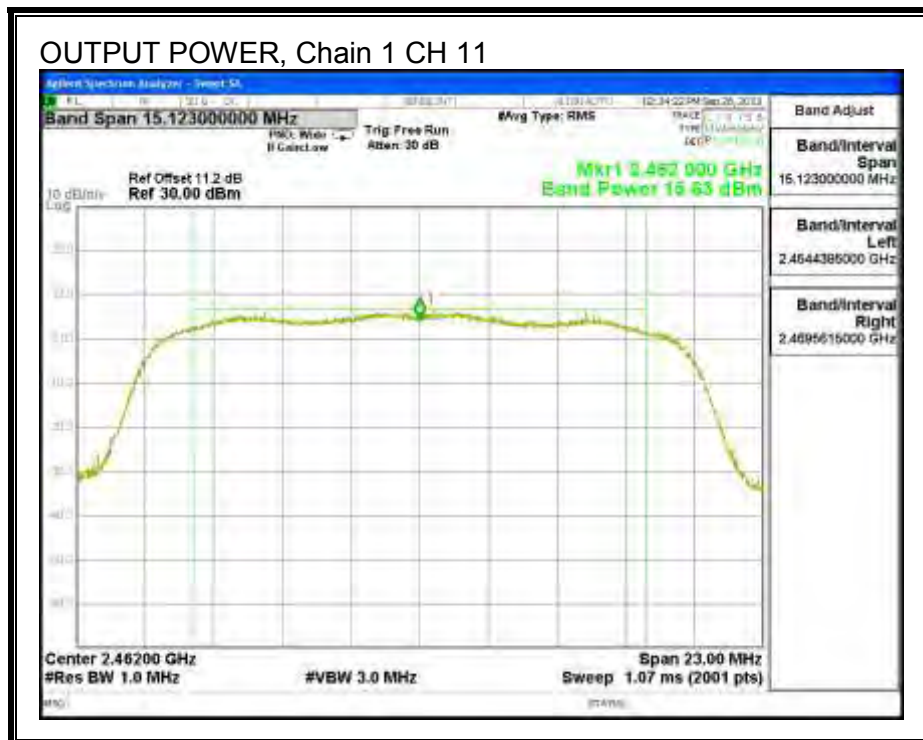
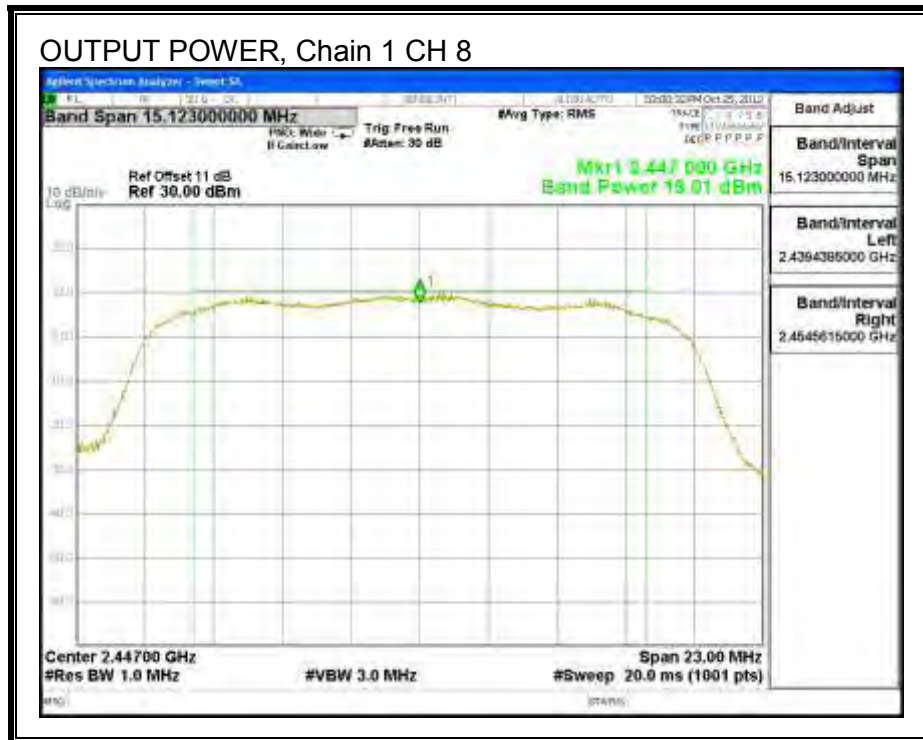




OUTPUT POWER, Chain 1







8.5.5. PSD

LIMITS

FCC §15.247

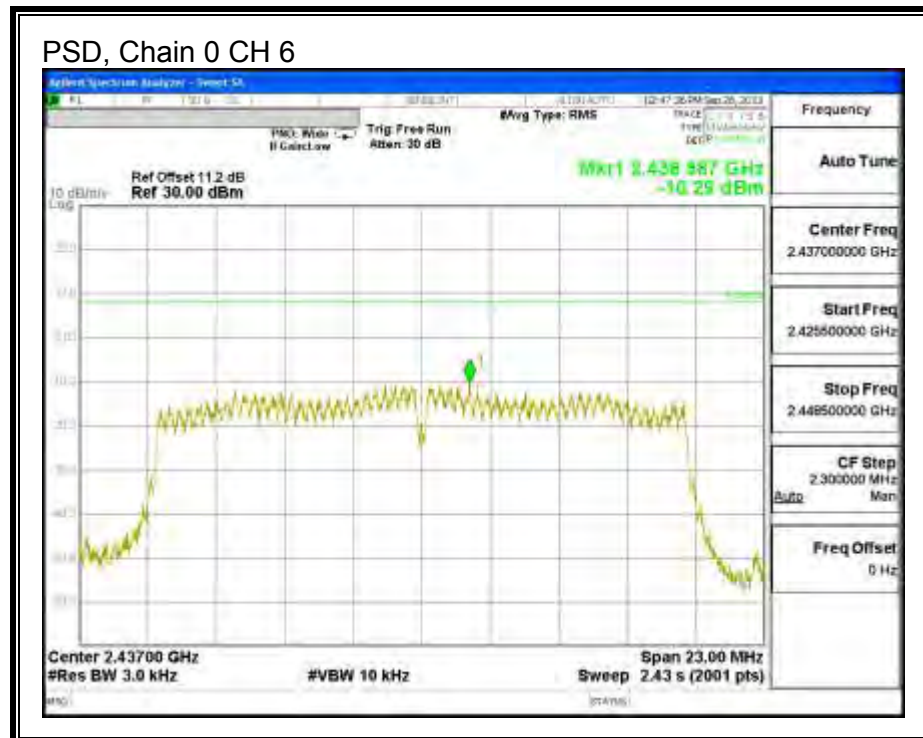
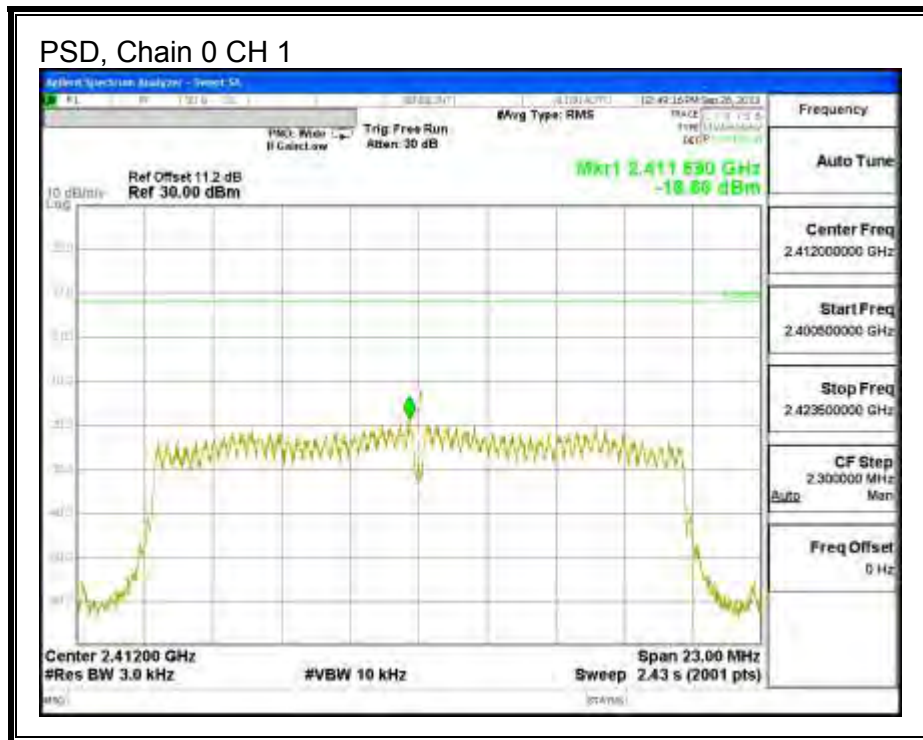
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

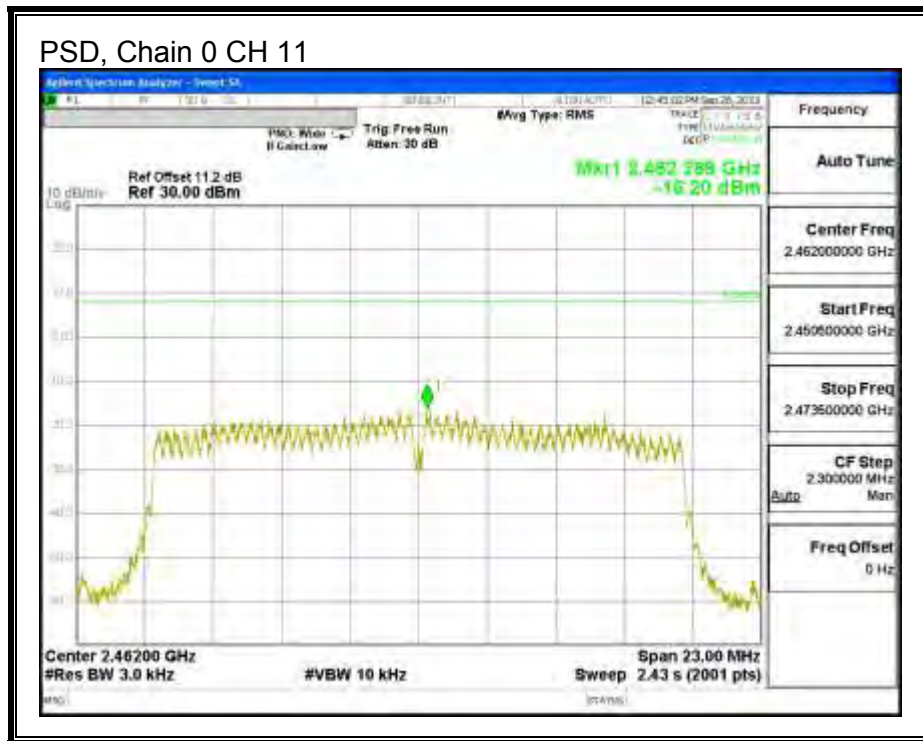
RESULTS

PSD Results

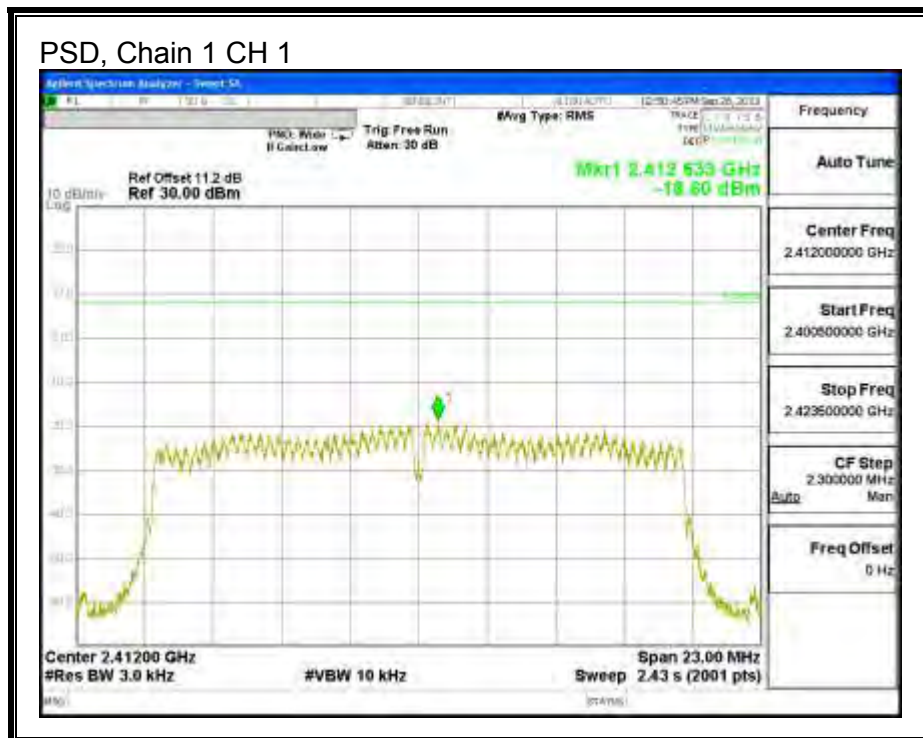
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
1	2412	-18.86	-18.60	-15.72	8.0	-23.7
6	2437	-10.29	-9.40	-6.81	8.0	-14.8
11	2462	-16.20	-16.34	-13.26	8.0	-21.3

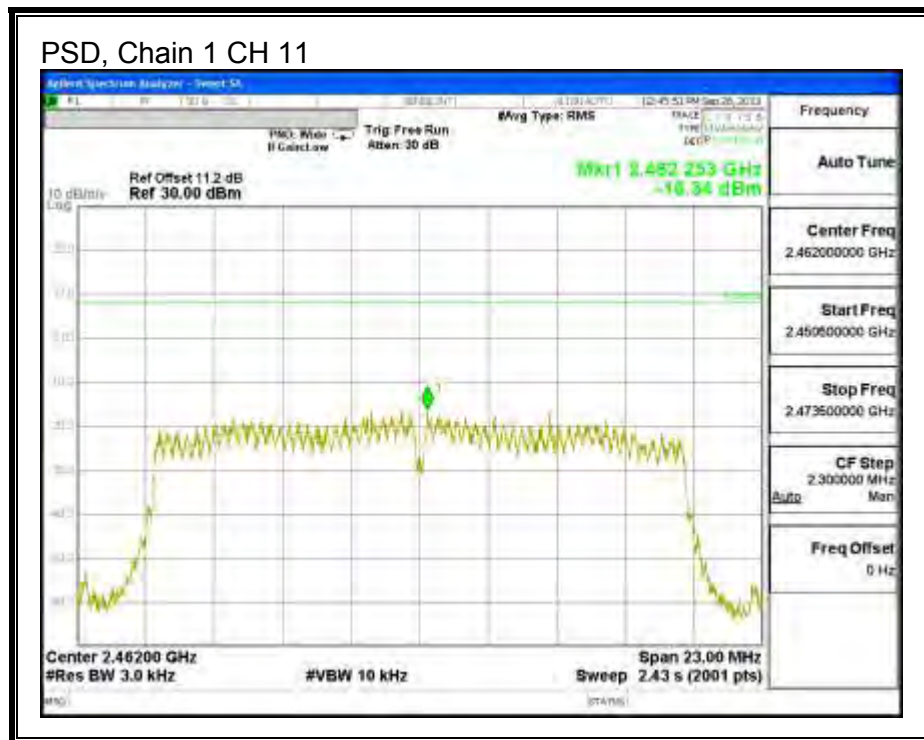
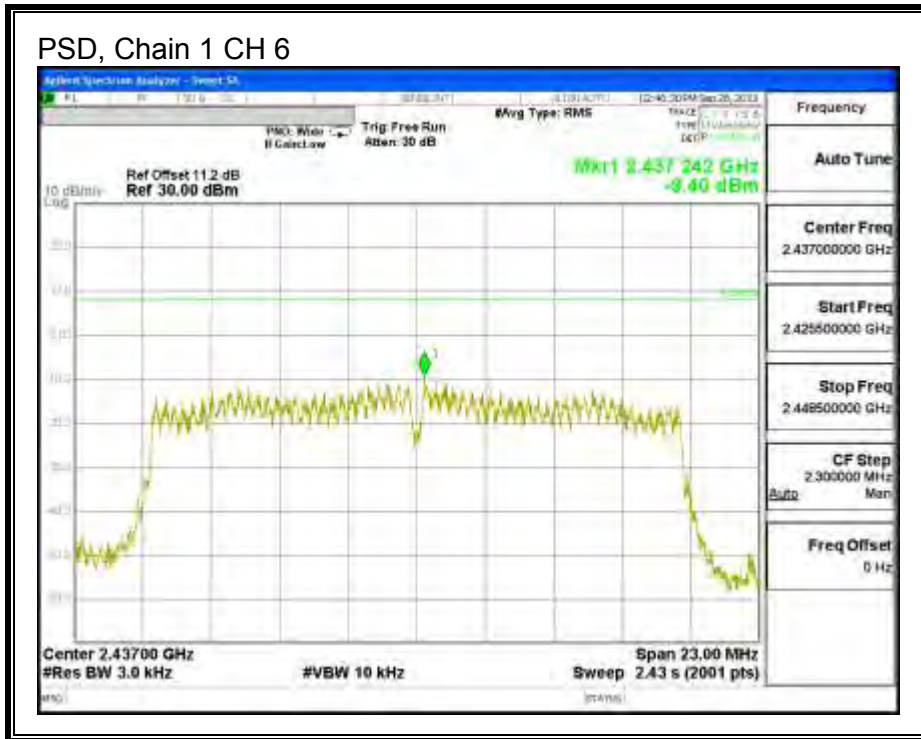
PSD, Chain 0





PSD, Chain 1





8.5.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

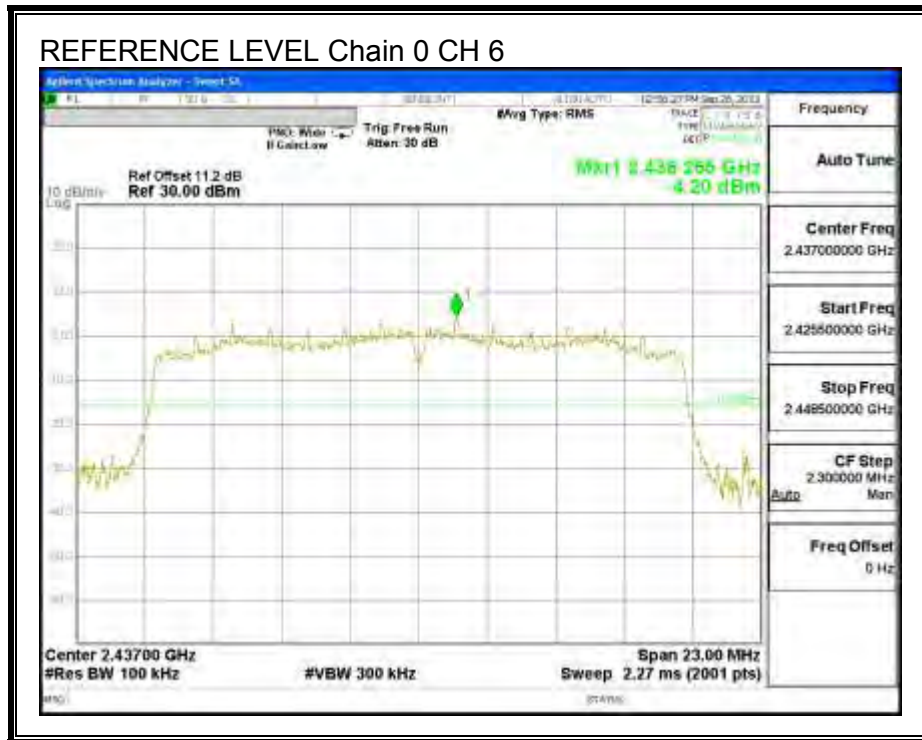
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

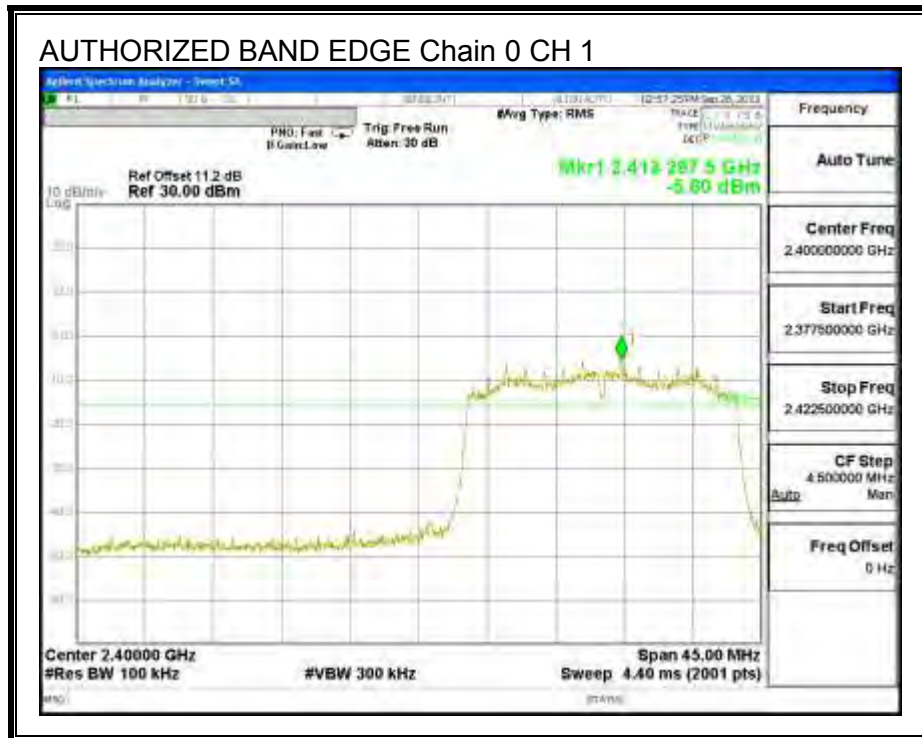
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

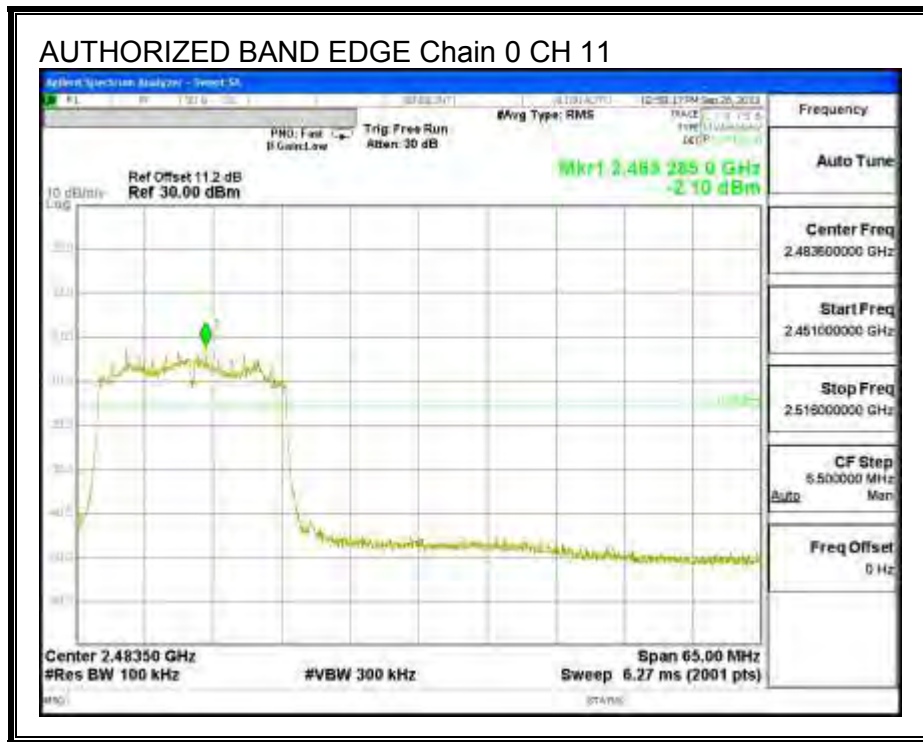
IN-BAND REFERENCE LEVEL, Chain 0



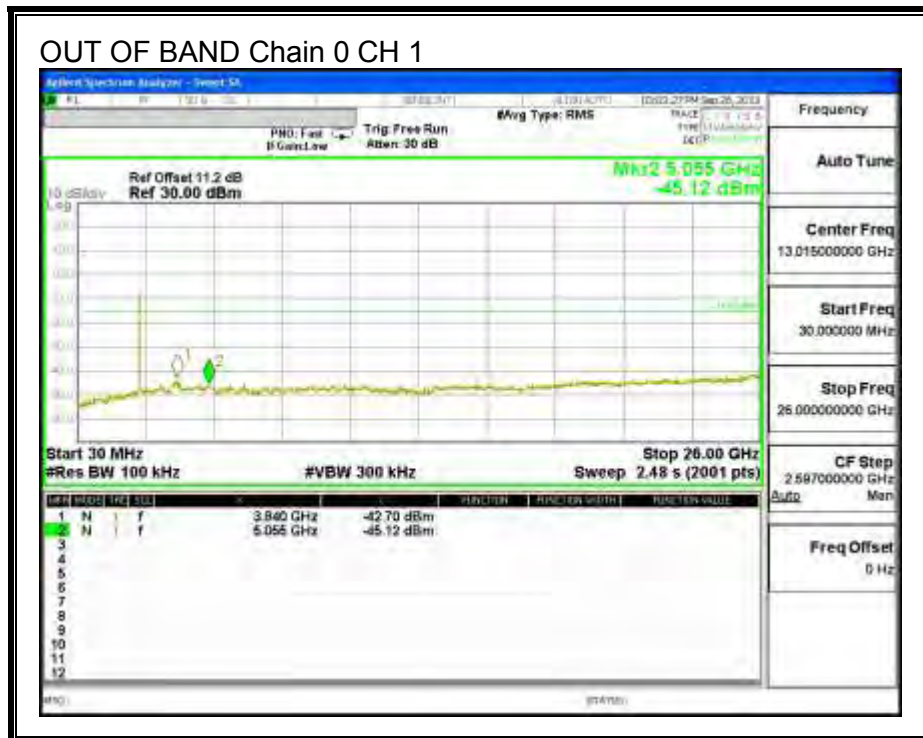
LOW CHANNEL BANDEDGE, Chain 0



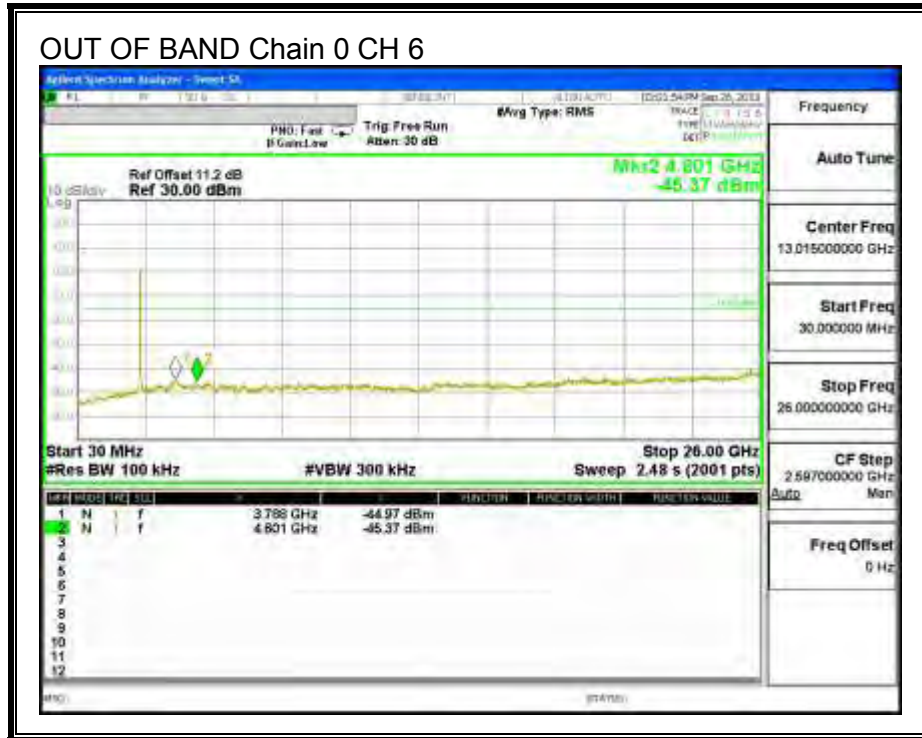
HIGH CHANNEL BANDEDGE, Chain 0



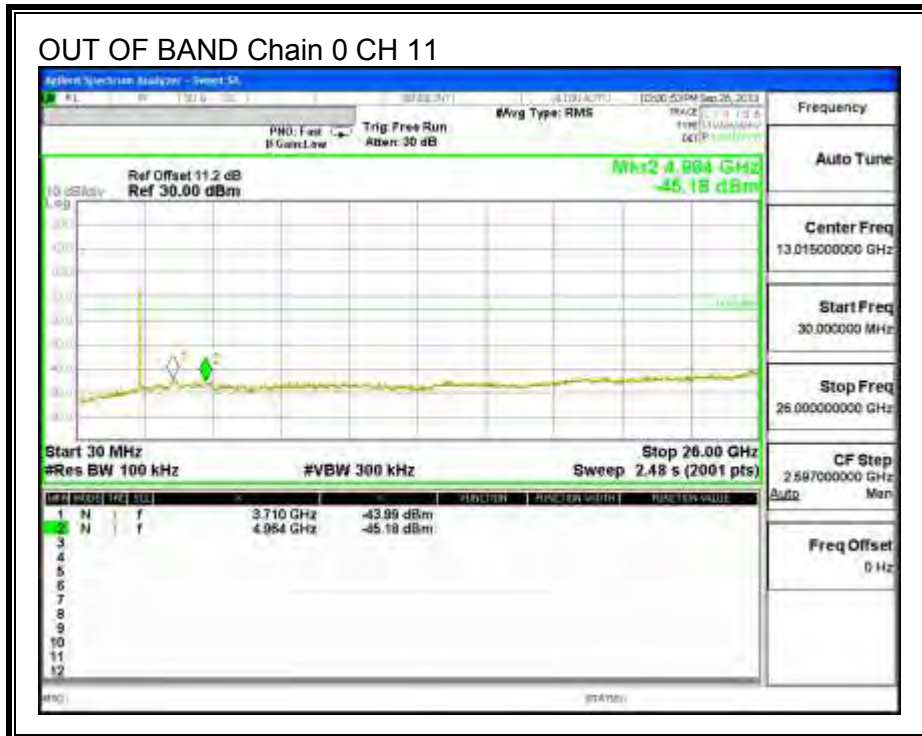
OUT-OF-BAND EMISSIONS, Chain 0



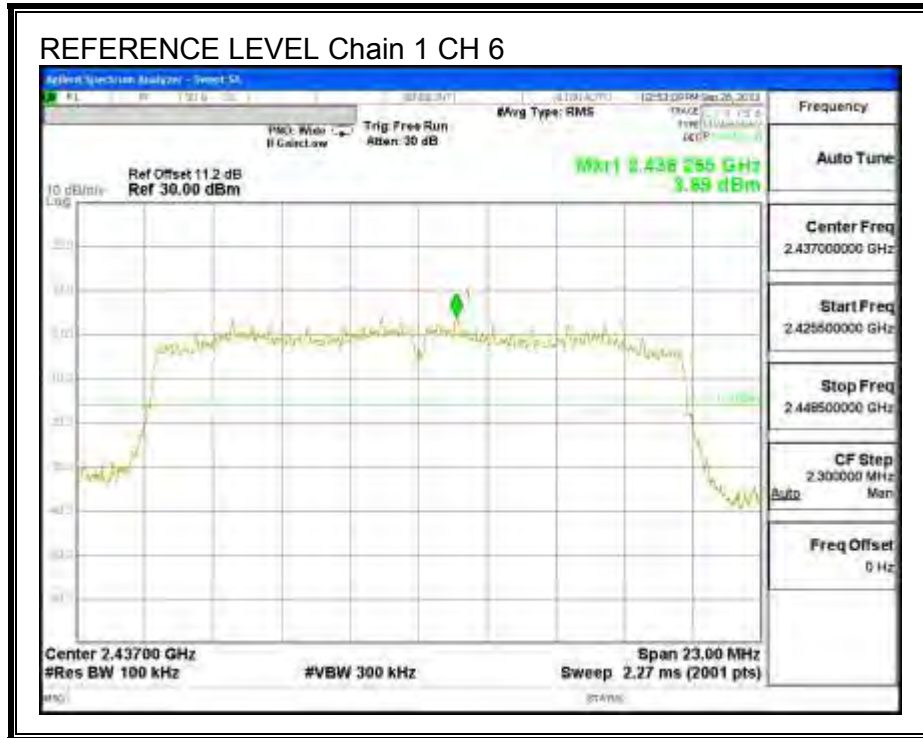
OUT OF BAND Chain 0 CH 6



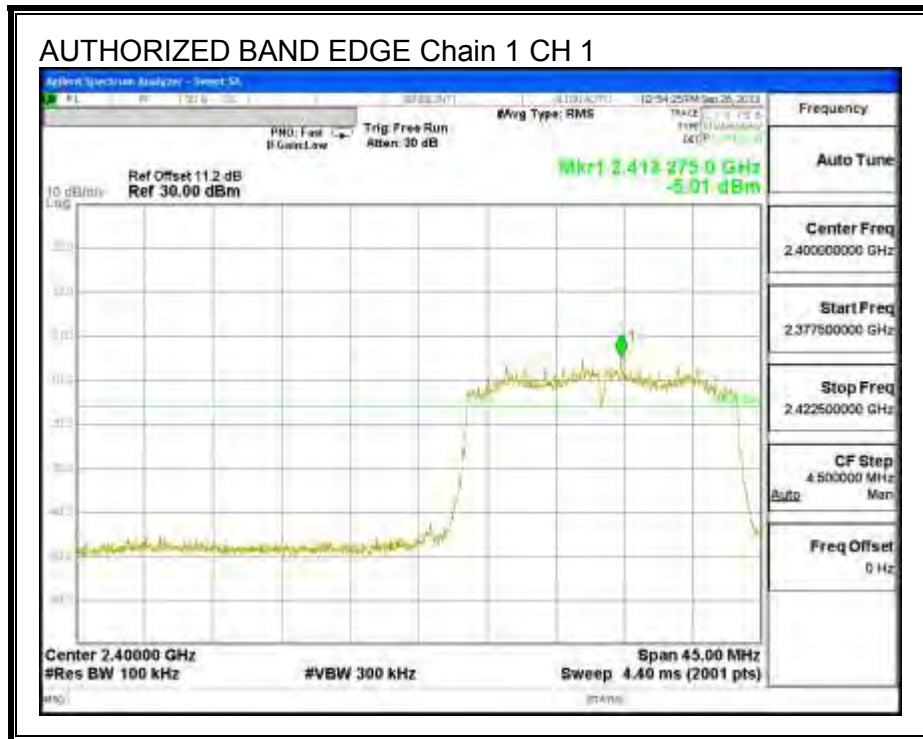
OUT OF BAND Chain 0 CH 11



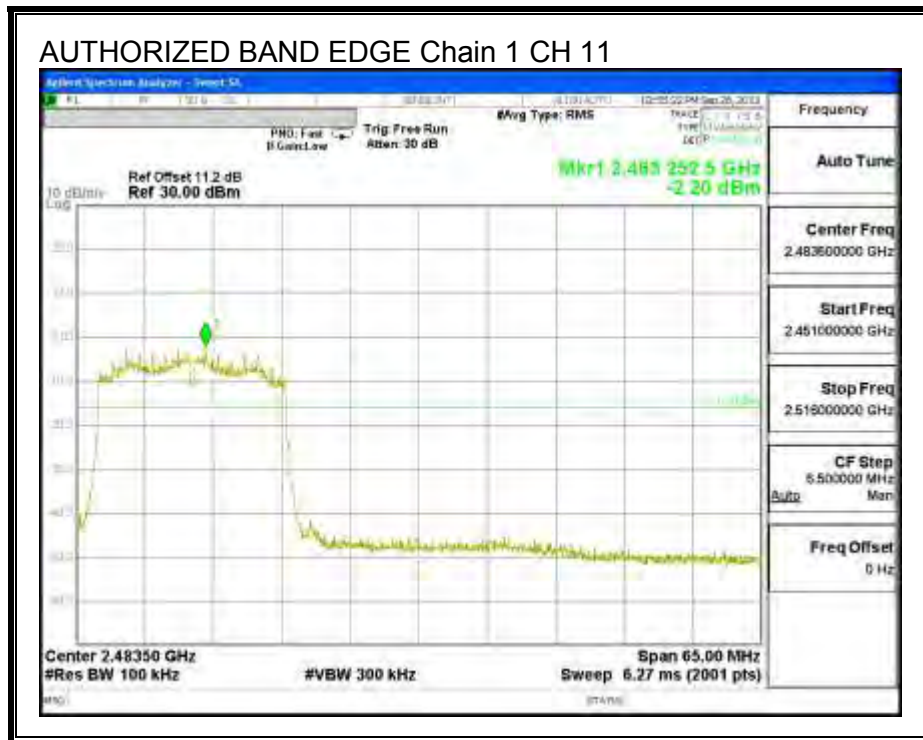
IN-BAND REFERENCE LEVEL, Chain 1



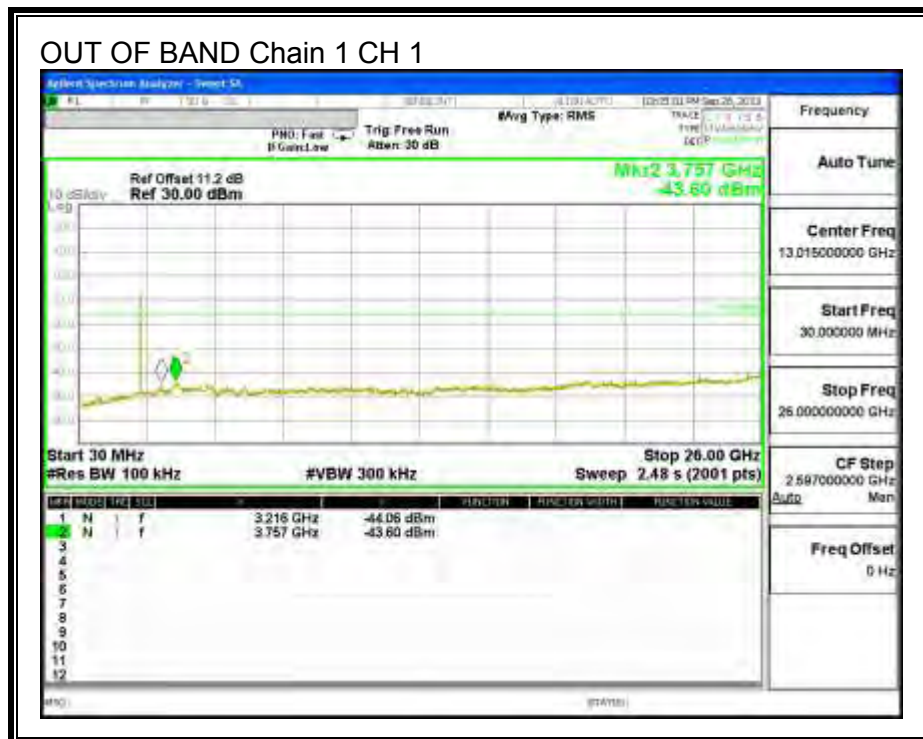
LOW CHANNEL BANDEDGE, Chain 1

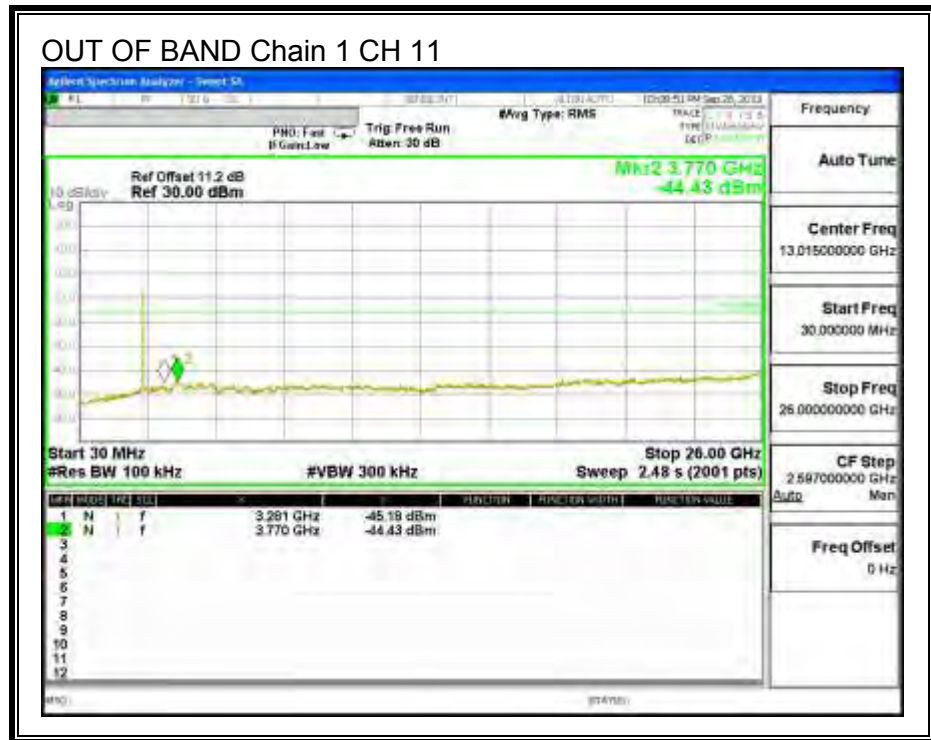
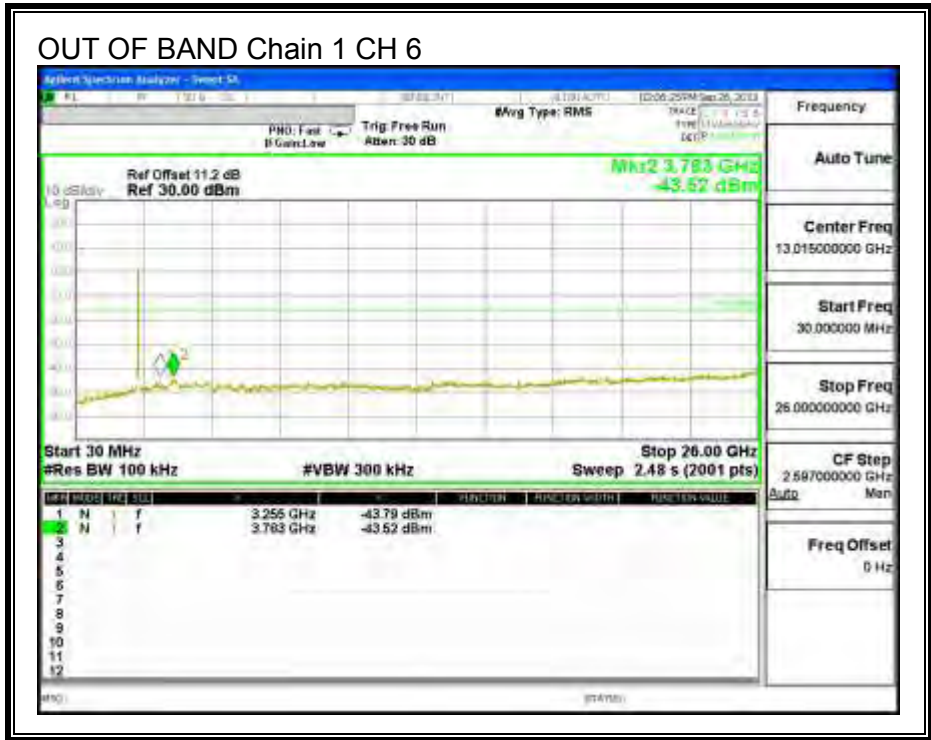


HIGH CHANNEL BANDEDGE, Chain 1



OUT-OF-BAND EMISSIONS, Chain 1





8.6. 802.11n HT40 SISO MODE IN THE 2.4 GHz BAND

8.6.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

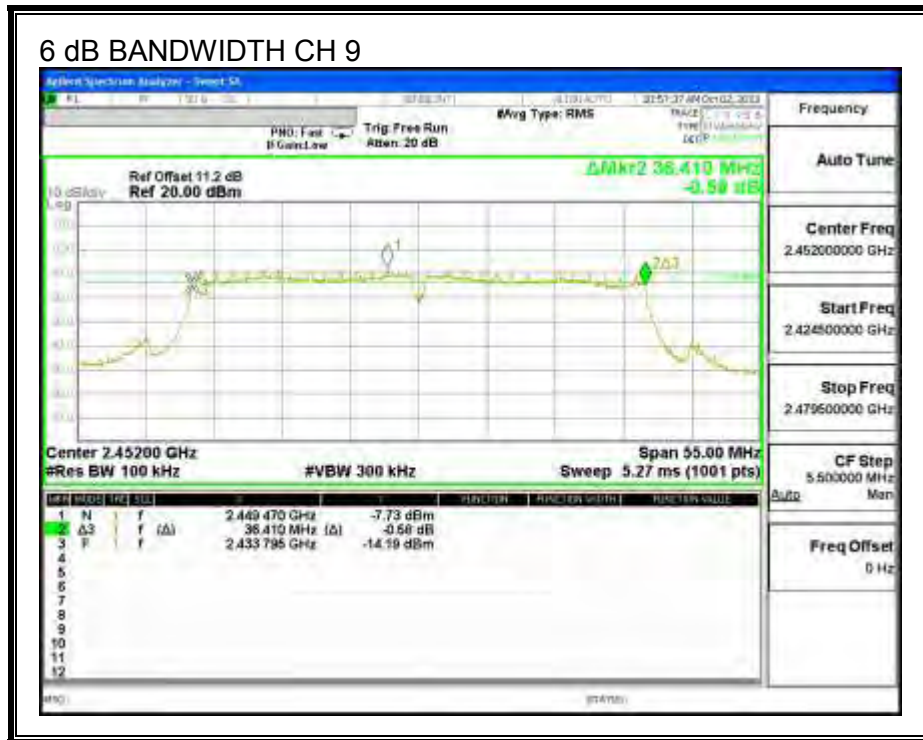
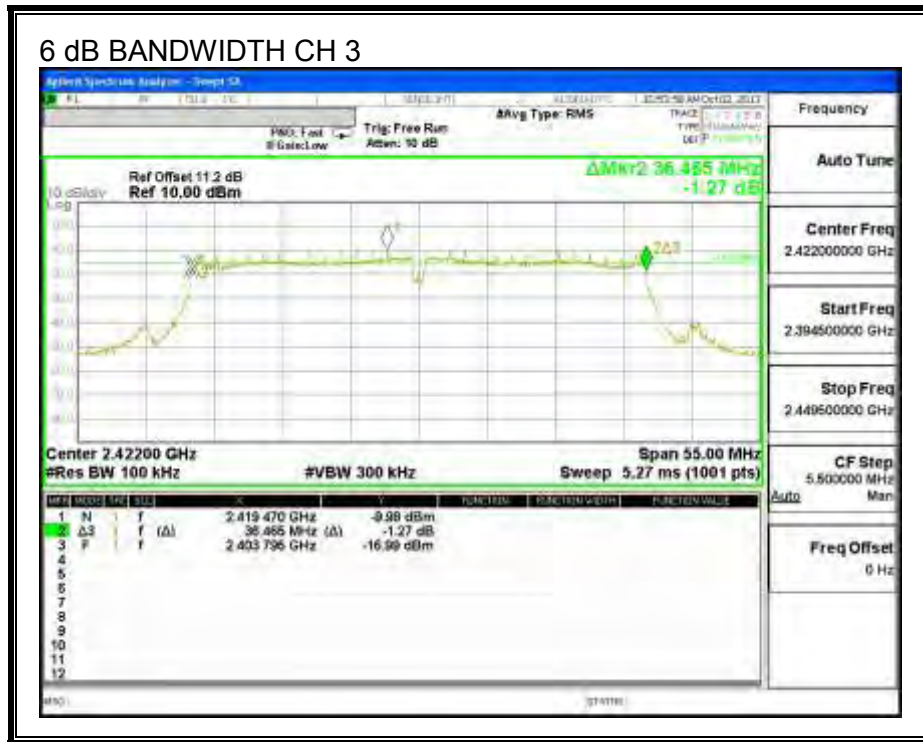
TEST PROCEDURE

558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
3	2422	36.465	0.5
9	2452	36.410	0.5

6 dB BANDWIDTH



8.6.2. 99% BANDWIDTH

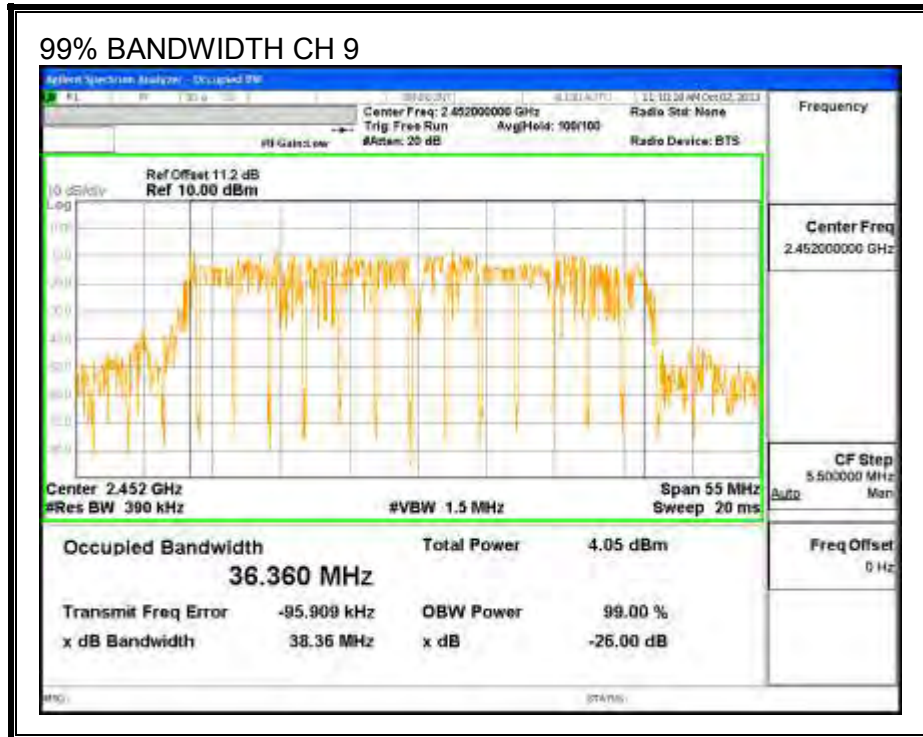
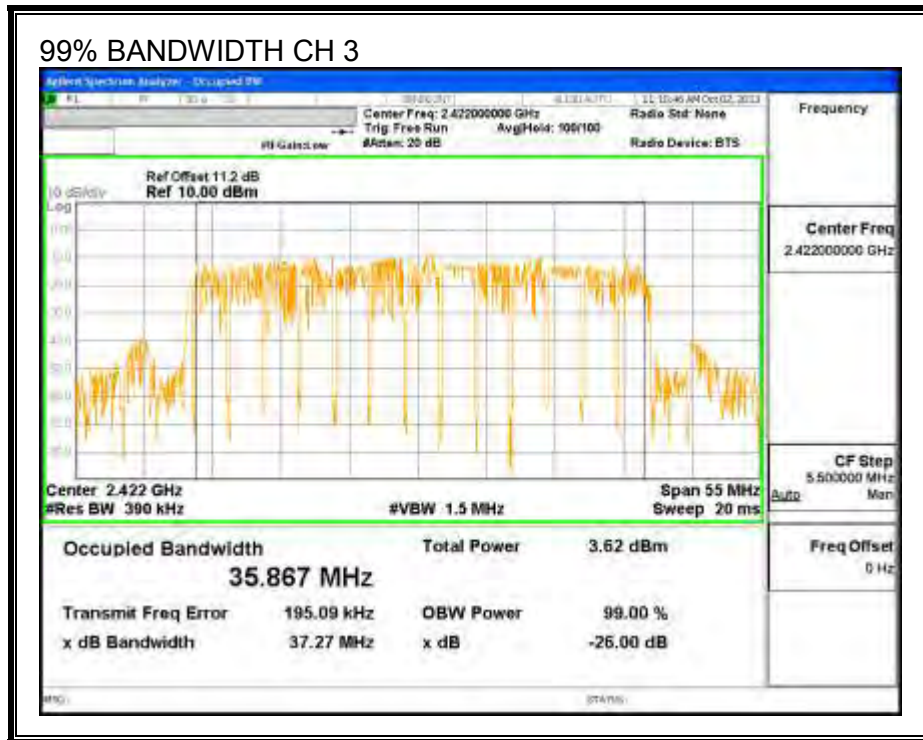
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
3	2422	35.867
9	2452	36.360

99% BANDWIDTH



8.6.3. 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 11.64 dB (including 10 dB pad, 1.2 dB cable, and .44 duty cycle correction factor) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
3	2422	3.87
9	2452	4.60

8.6.4. 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

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

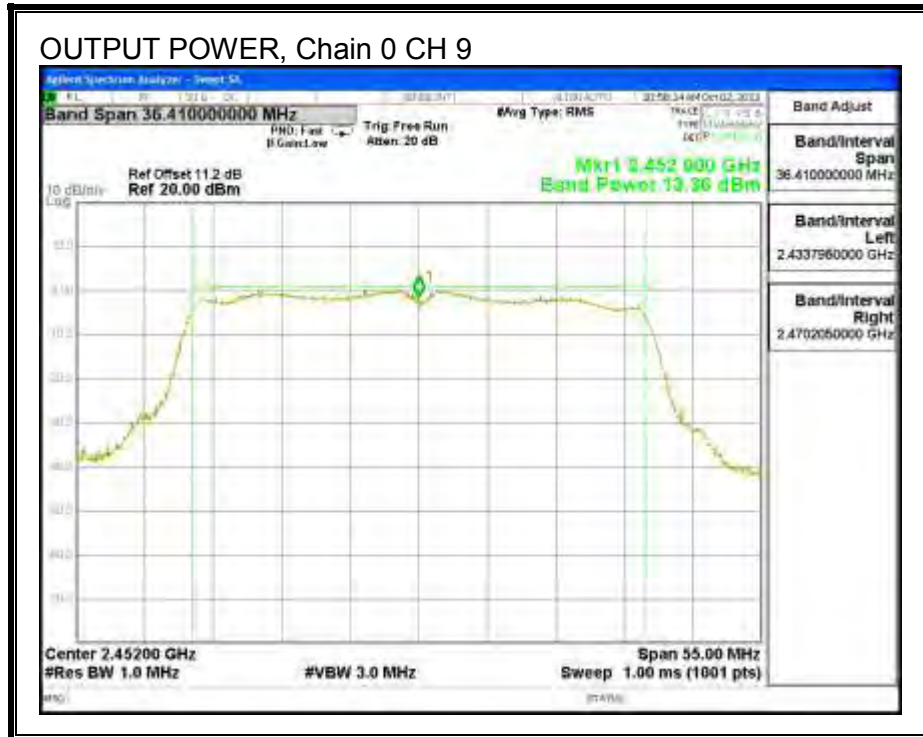
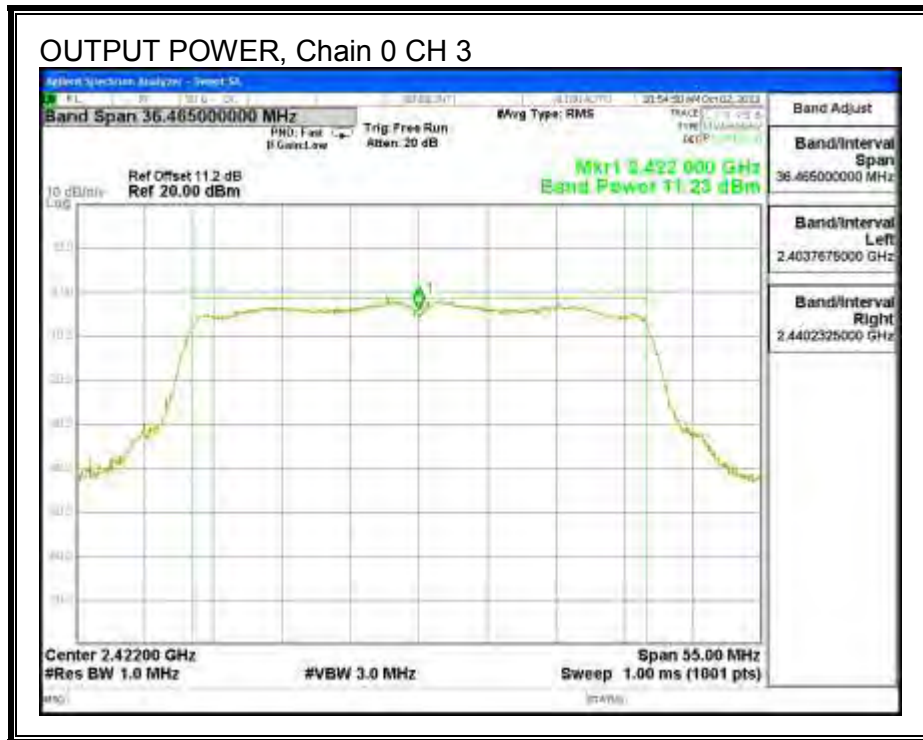
Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
3	2422	3.1	30.00	30	36	30.00
9	2452	3.1	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
3	2422	11.23	11.23	30.00	-18.77
9	2452	13.36	13.36	30.00	-16.64

OUTPUT POWER, Chain 0



8.6.5. PSD

LIMITS

FCC §15.247

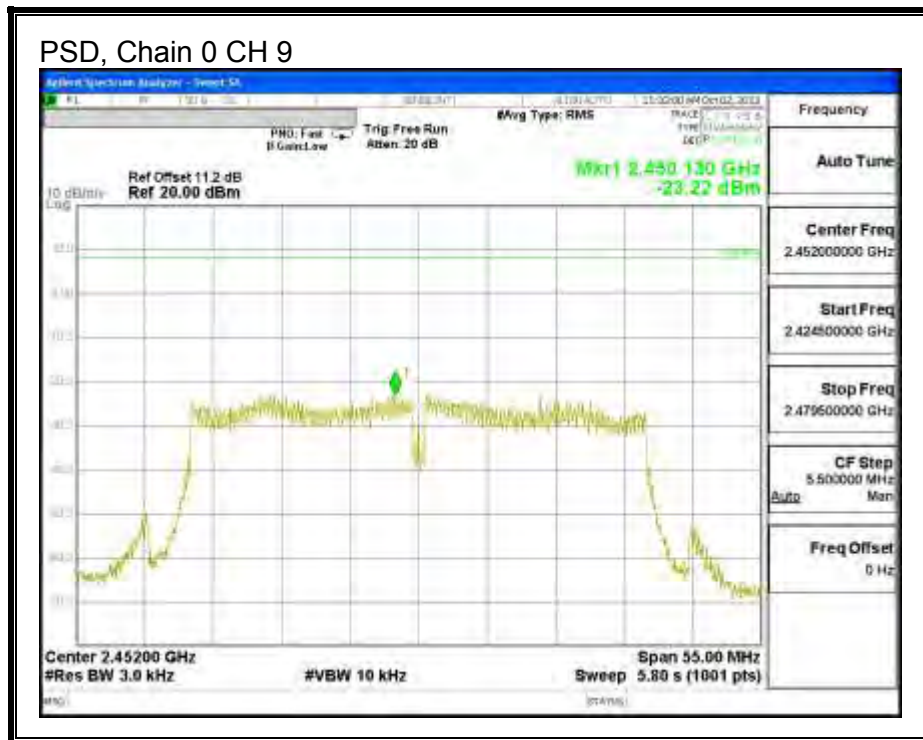
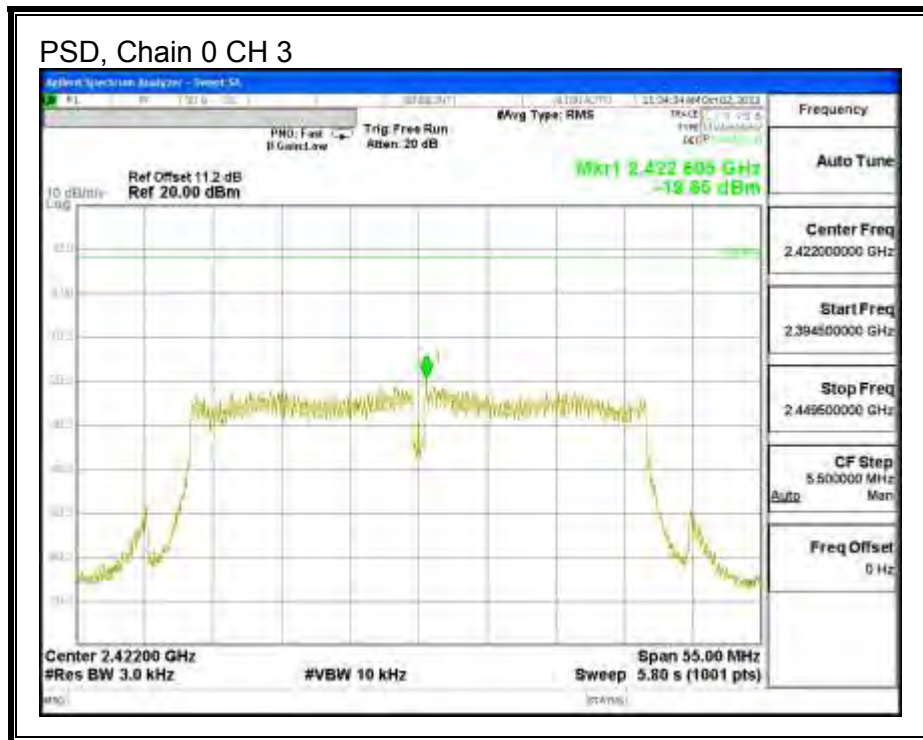
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Limit (dBm)	Margin (dB)
3	2422	-19.65	8.0	-27.7
9	2452	-23.22	8.0	-31.2

PSD, Chain 0



8.6.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

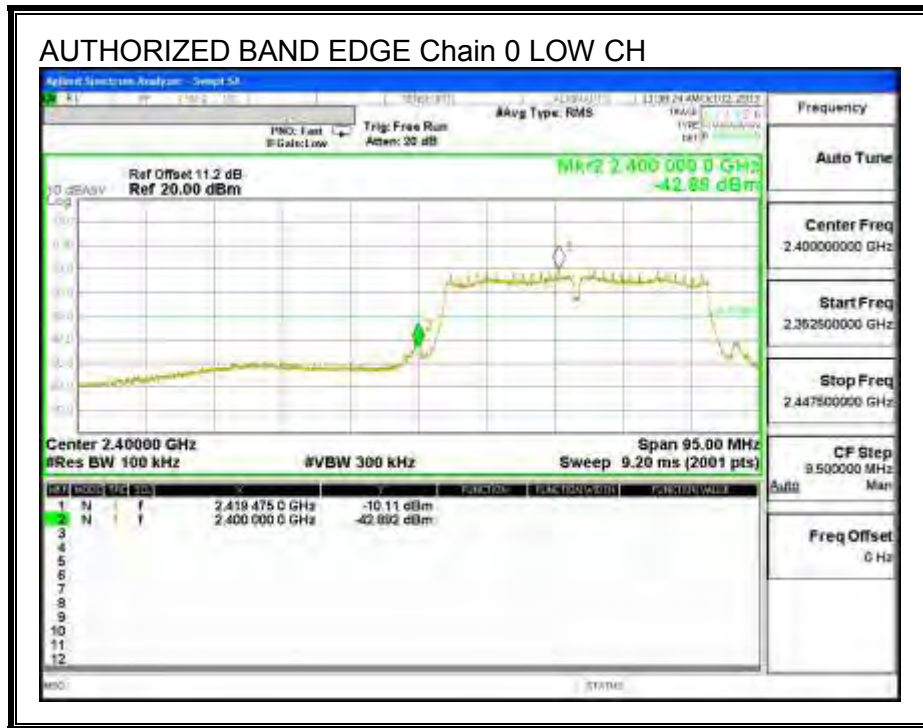
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

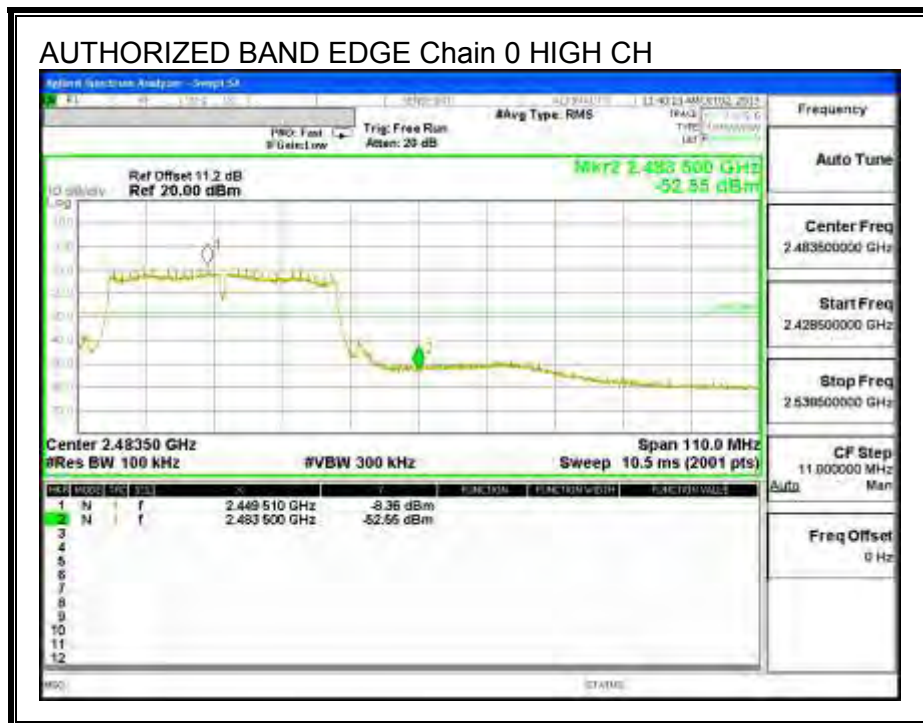
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

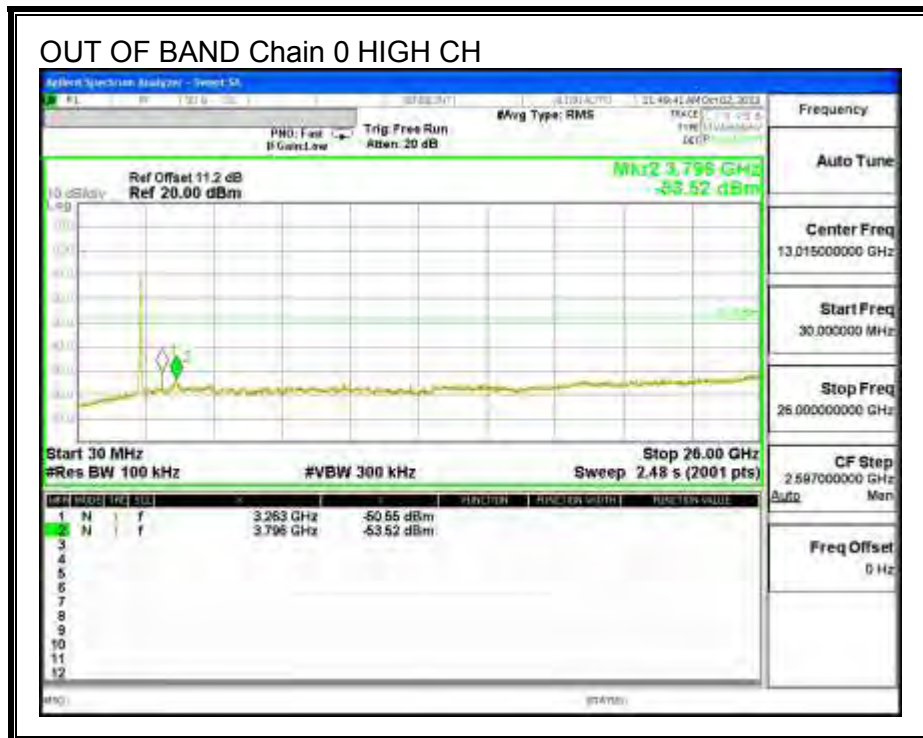
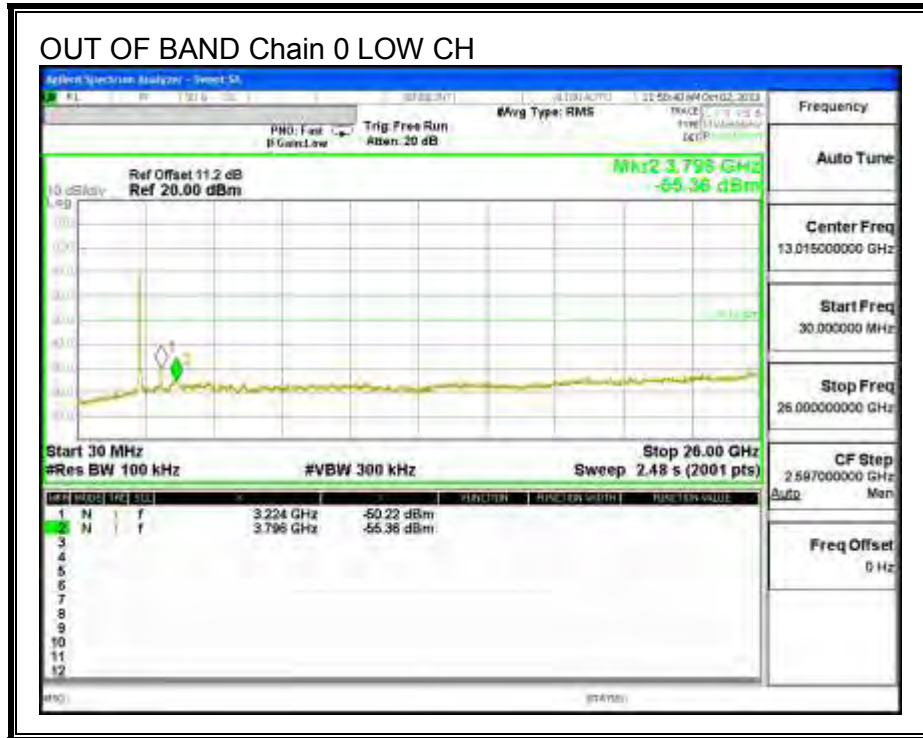
LOW CHANNEL BANDEDGE, Chain 0



HIGH CHANNEL BANDEDGE, Chain 0



OUT-OF-BAND EMISSIONS, Chain 0



8.7. 802.11n HT40 2TX CDD MODE IN THE 2.4 GHZ BAND

8.7.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

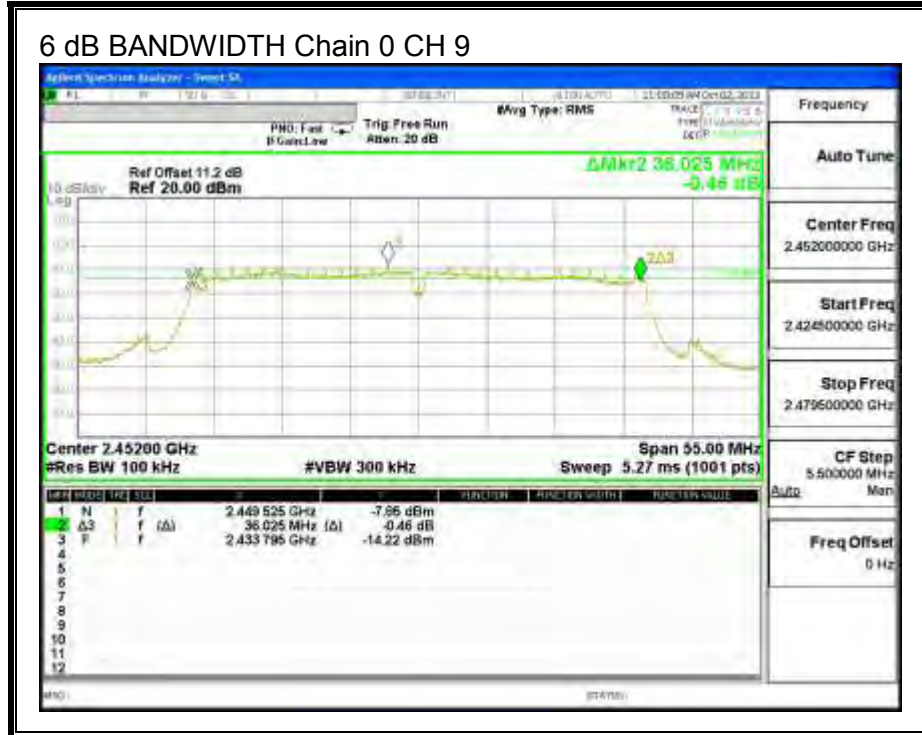
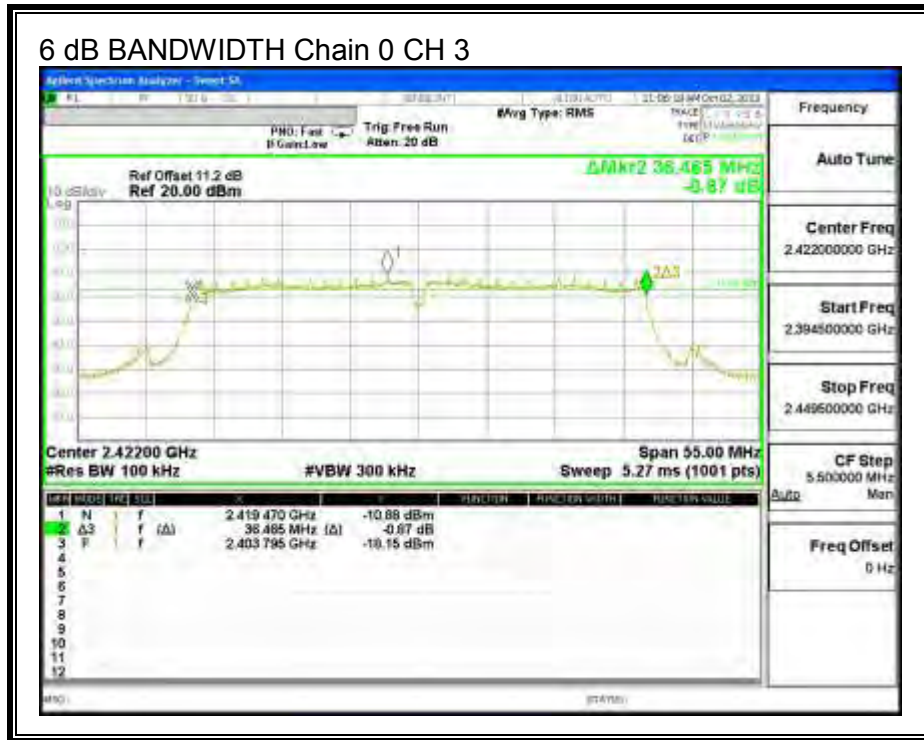
TEST PROCEDURE

558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

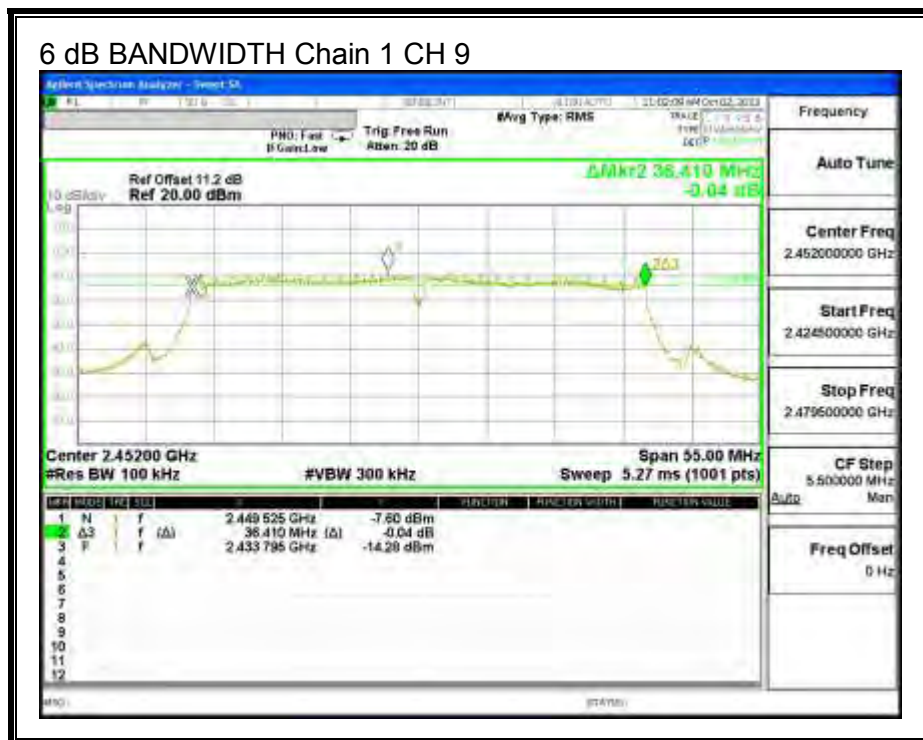
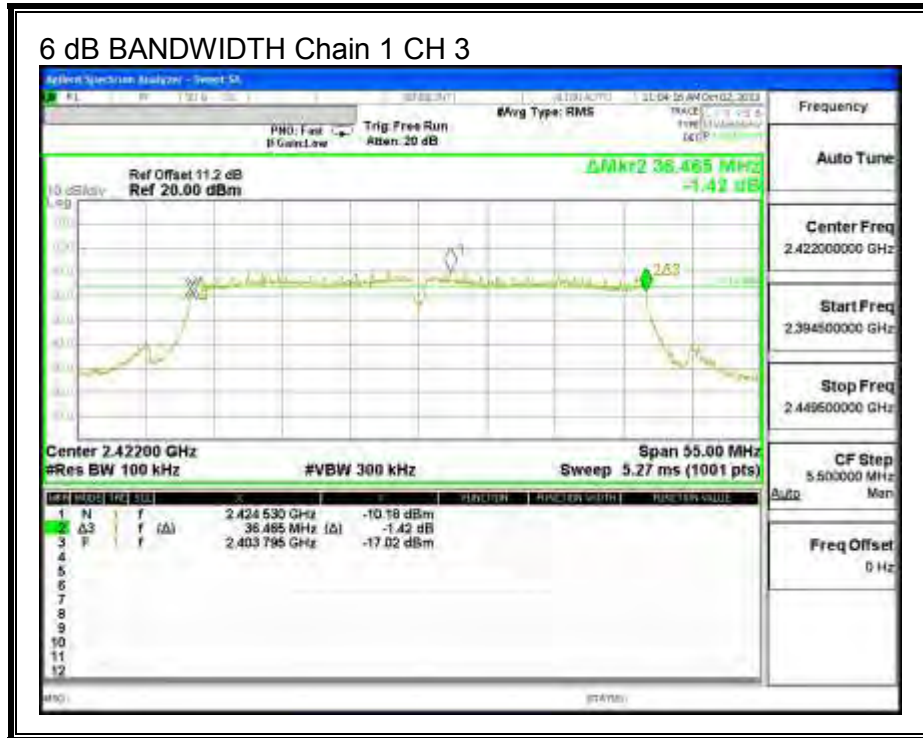
RESULTS

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
3	2422	36.465	36.465	0.5
9	2452	36.025	36.410	0.5

6 dB BANDWIDTH, Chain 0



6 dB BANDWIDTH, Chain 1



8.7.2. 99% BANDWIDTH

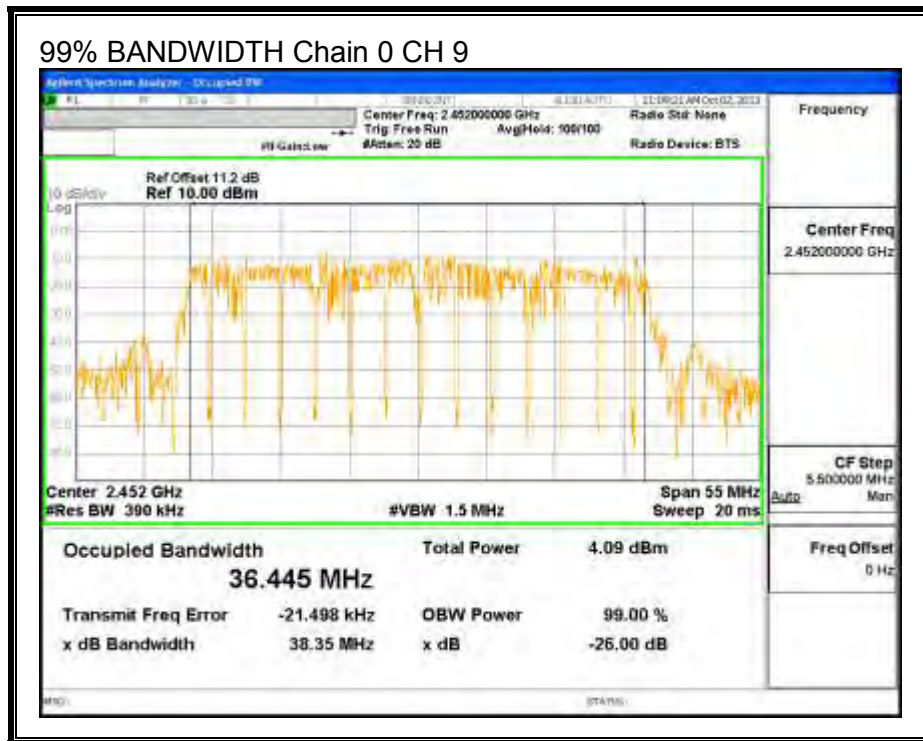
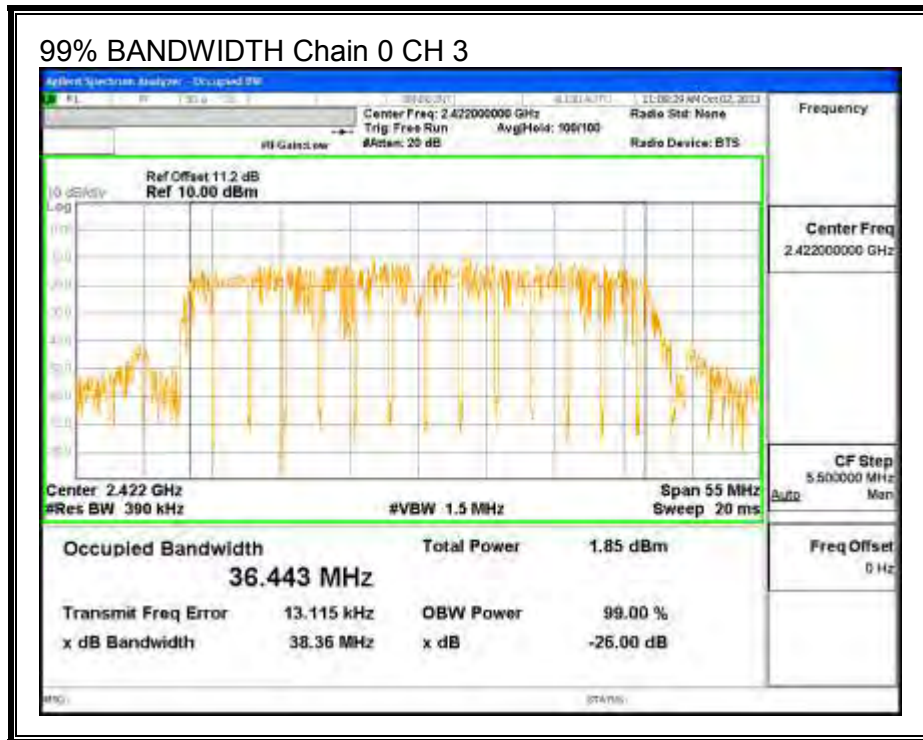
LIMITS

None; for reporting purposes only.

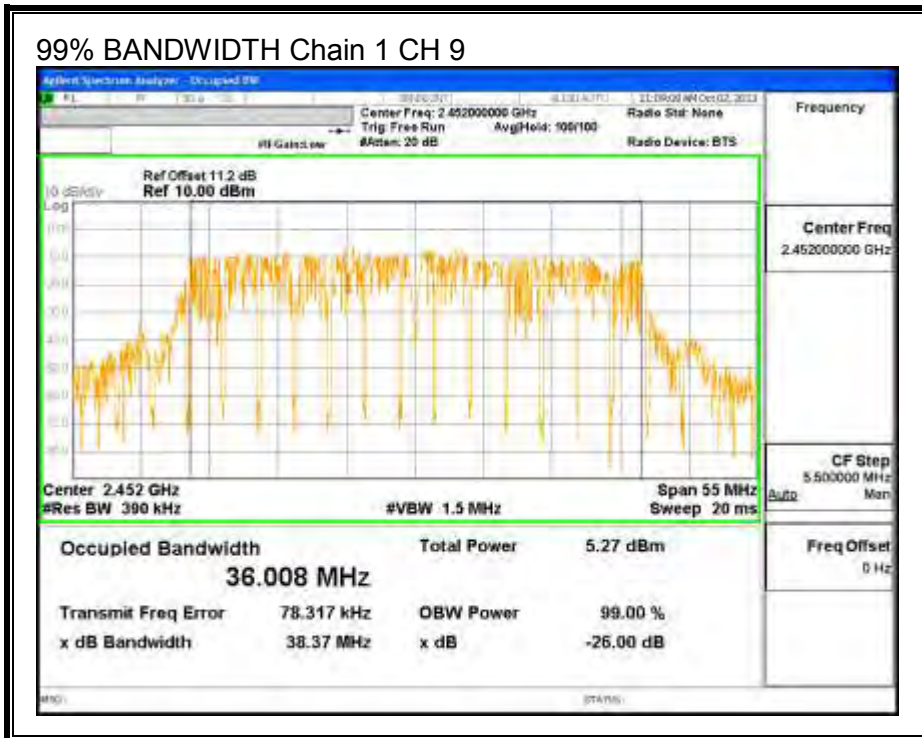
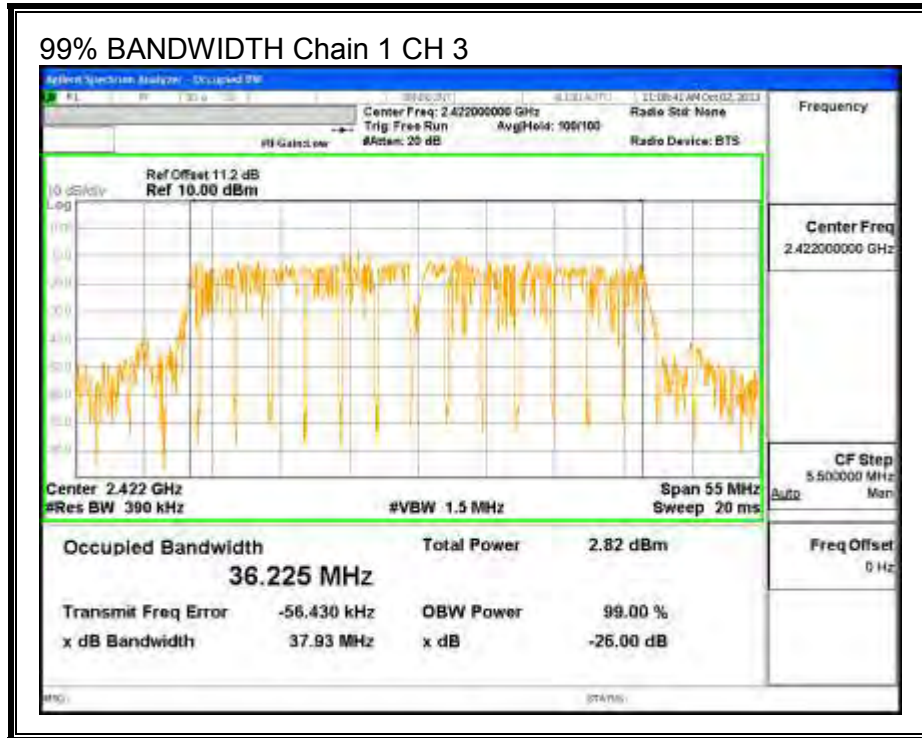
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
3	2422	36.443	36.225
9	2452	36.445	36.008

99% BANDWIDTH, Chain 0



99% BANDWIDTH, Chain 1



8.7.3. 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 11.64 dB (including 10 dB pad, 1.2 dB cable, and .44 duty cycle correction factor) 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)
3	2422	2.45	3.02	5.75
9	2452	4.49	4.92	7.72

8.7.4. 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)
3.10	2.00	2.58

RESULTS

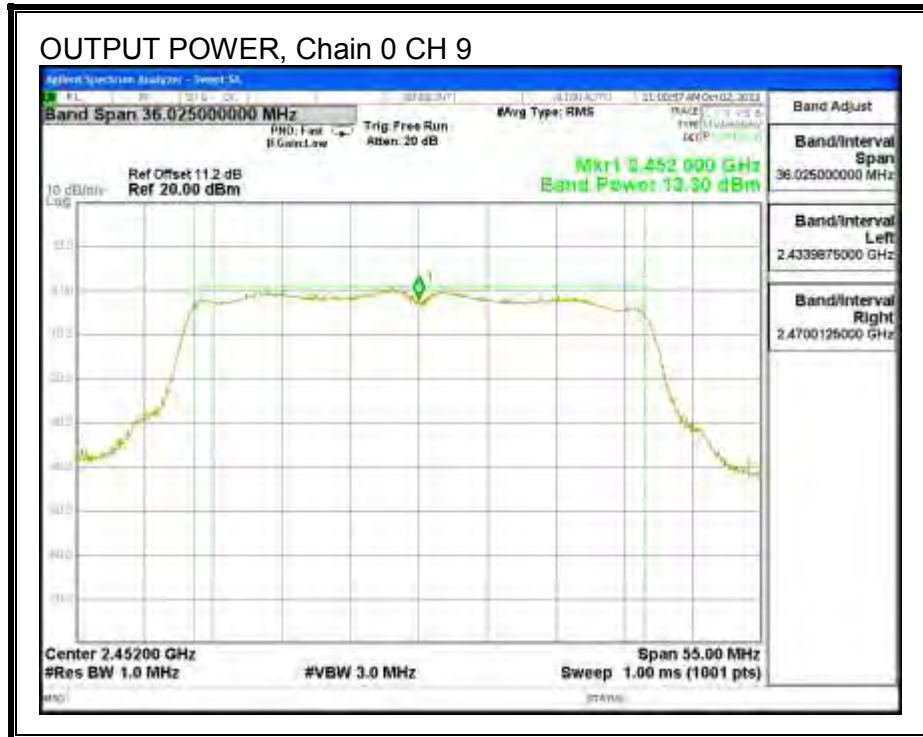
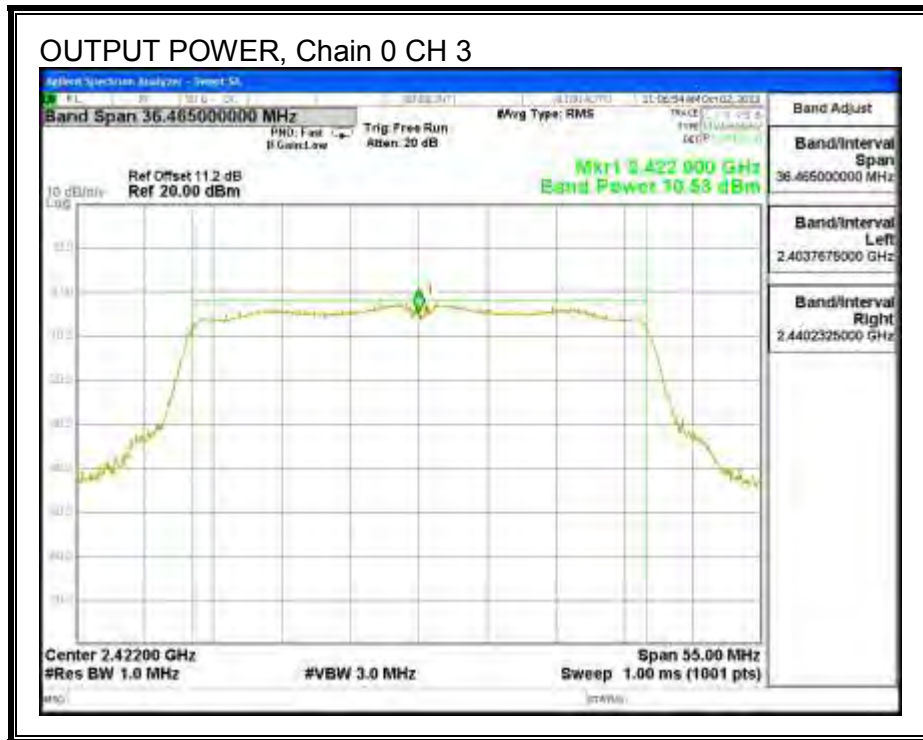
Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
3	2422	2.58	30.00	30	36	30.00
9	2452	2.58	30.00	30	36	30.00

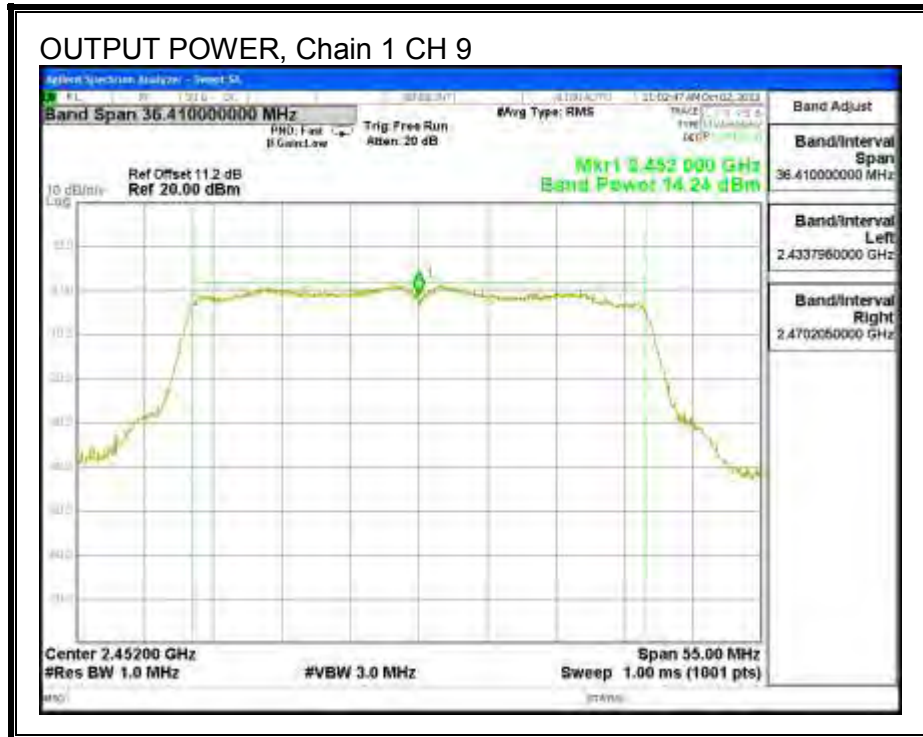
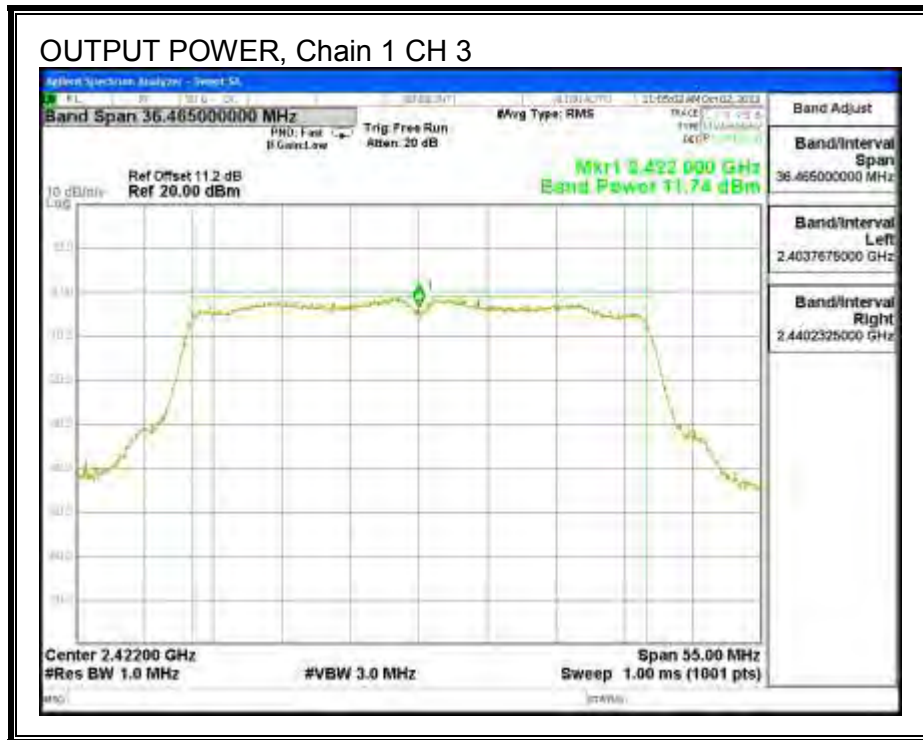
Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
3	2422	10.53	11.74	14.19	30.00	-15.81
9	2452	13.30	14.24	16.81	30.00	-13.19

OUTPUT POWER, Chain 0



OUTPUT POWER, Chain 1



8.7.5. PSD

LIMITS

FCC §15.247

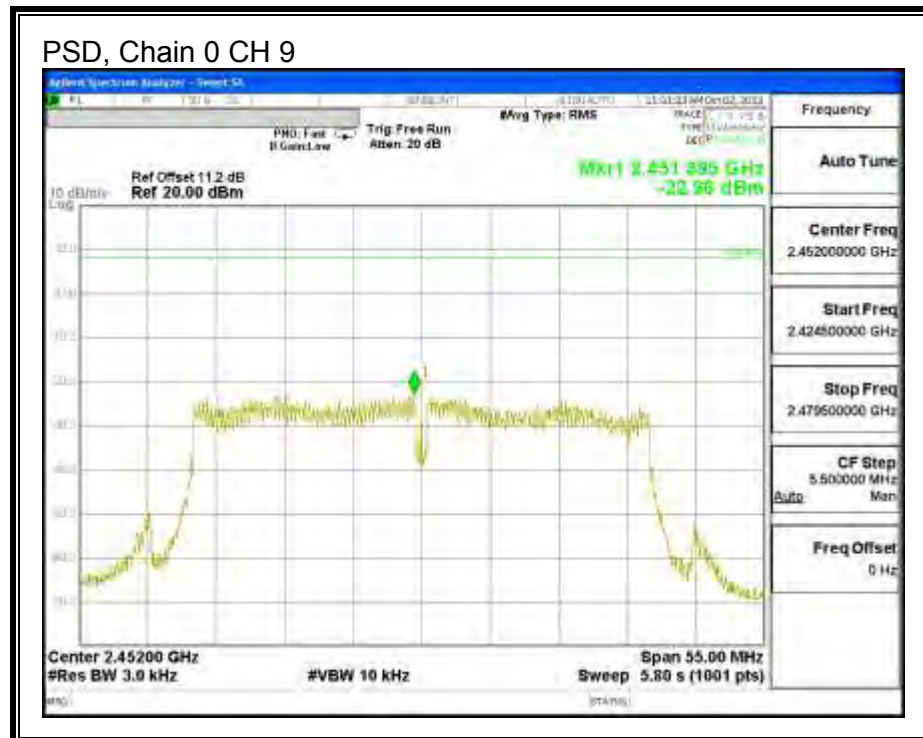
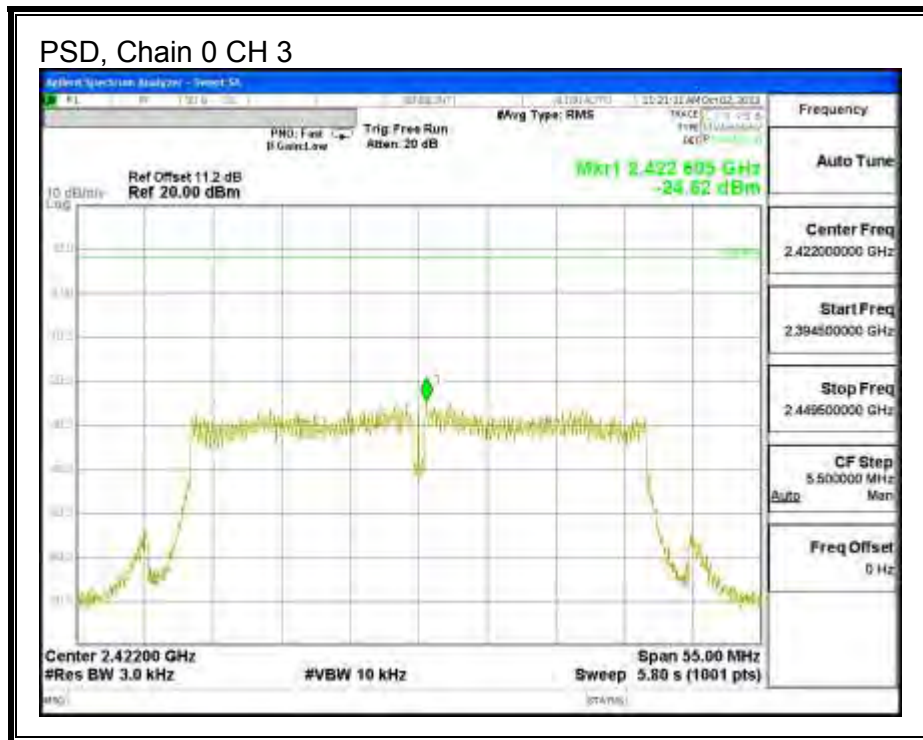
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

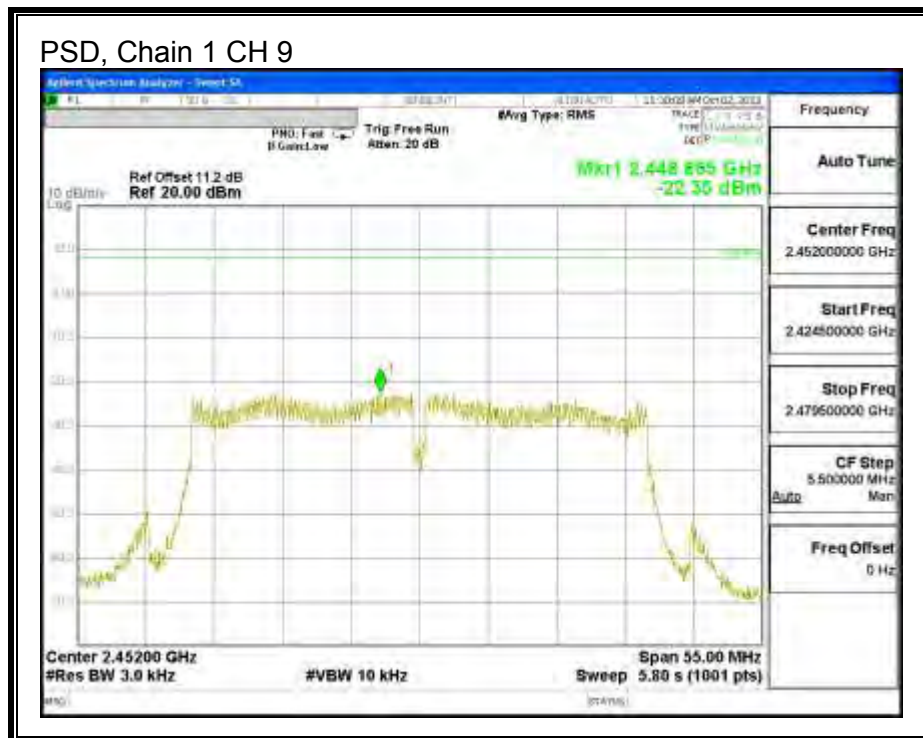
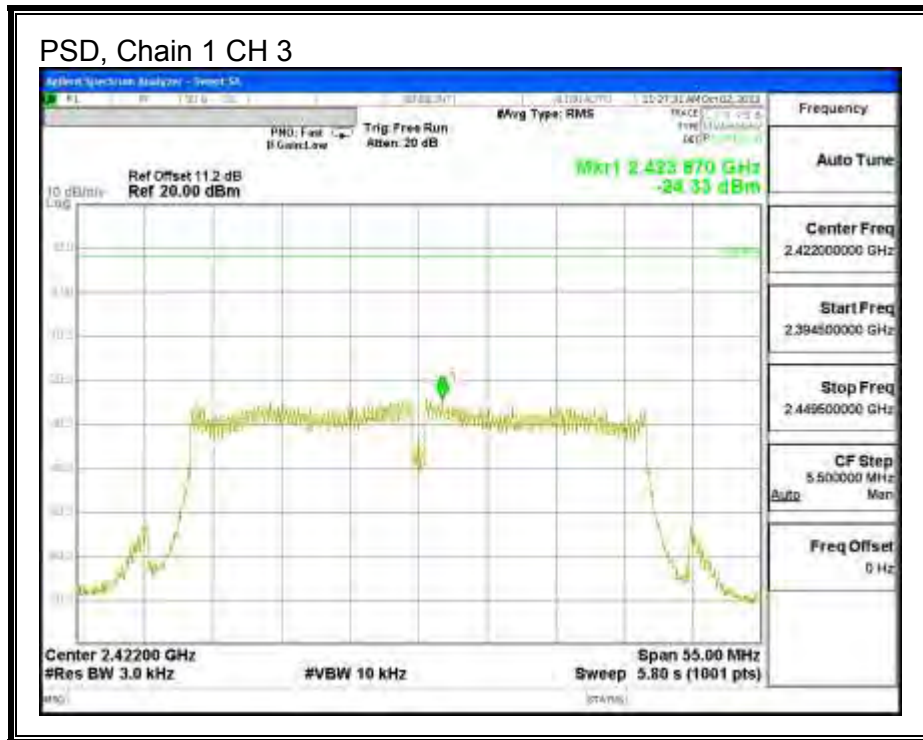
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
3	2422	-24.62	-24.33	-21.46	8.0	-29.5
9	2452	-22.96	-22.35	-19.63	8.0	-27.6

PSD, Chain 0



PSD, Chain 1



8.7.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

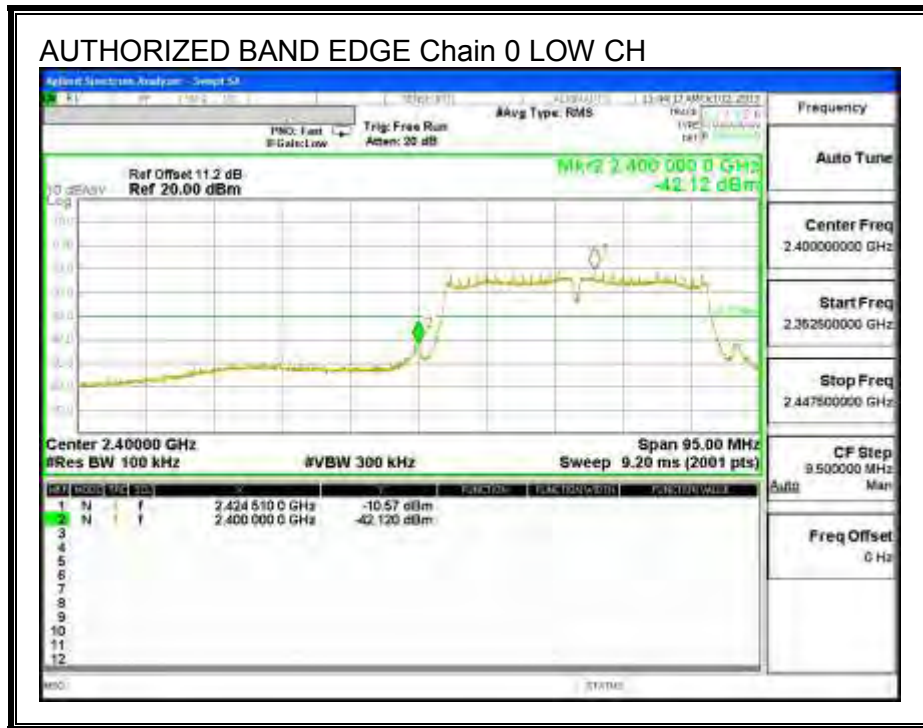
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

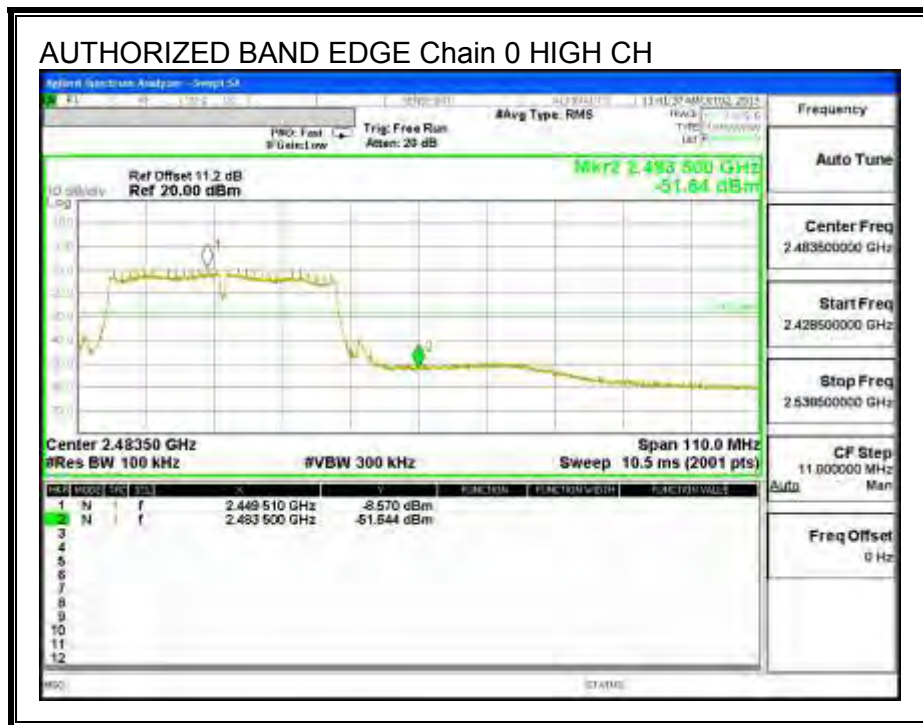
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

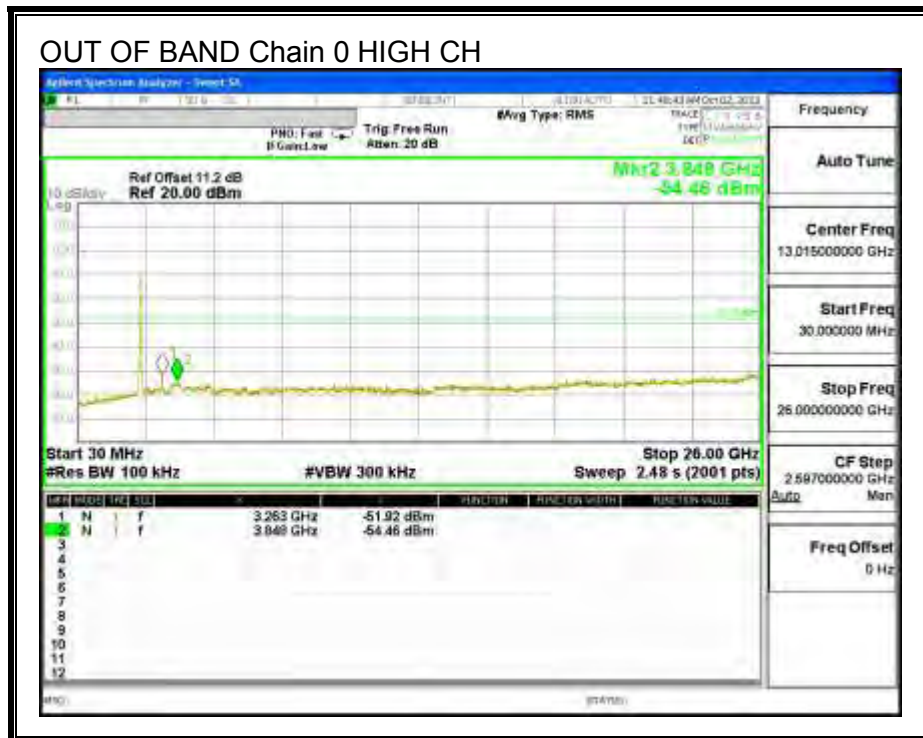
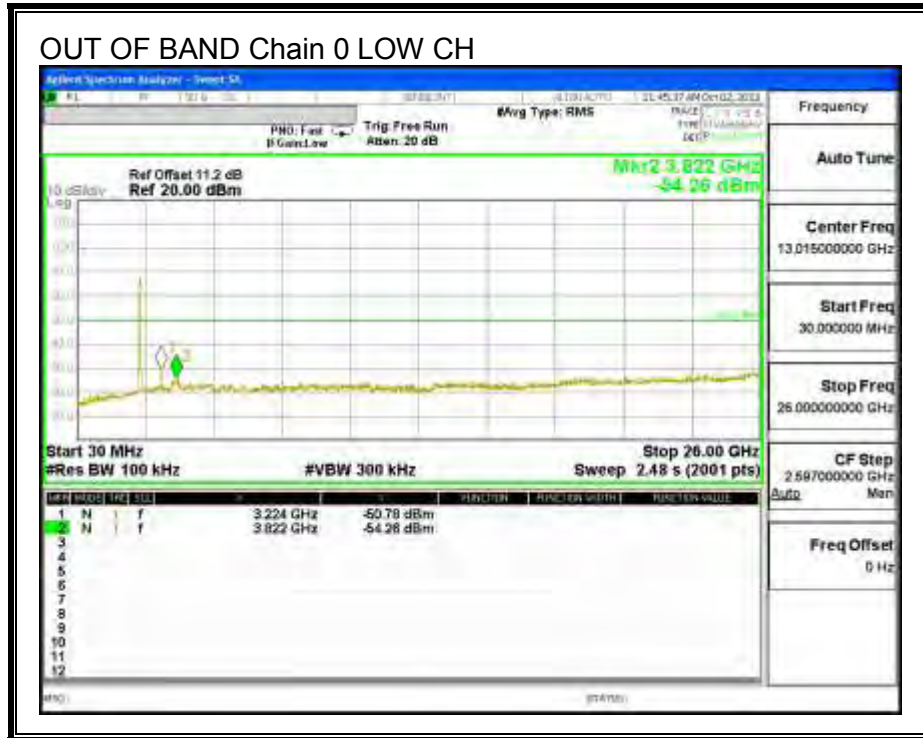
LOW CHANNEL BANDEDGE, Chain 0



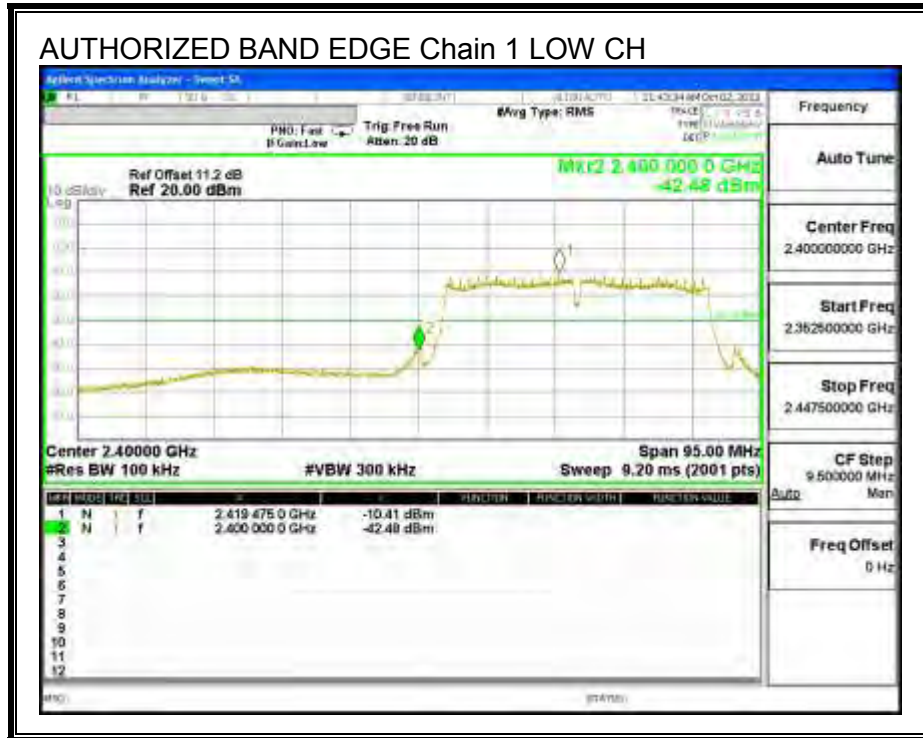
HIGH CHANNEL BANDEDGE, Chain 0



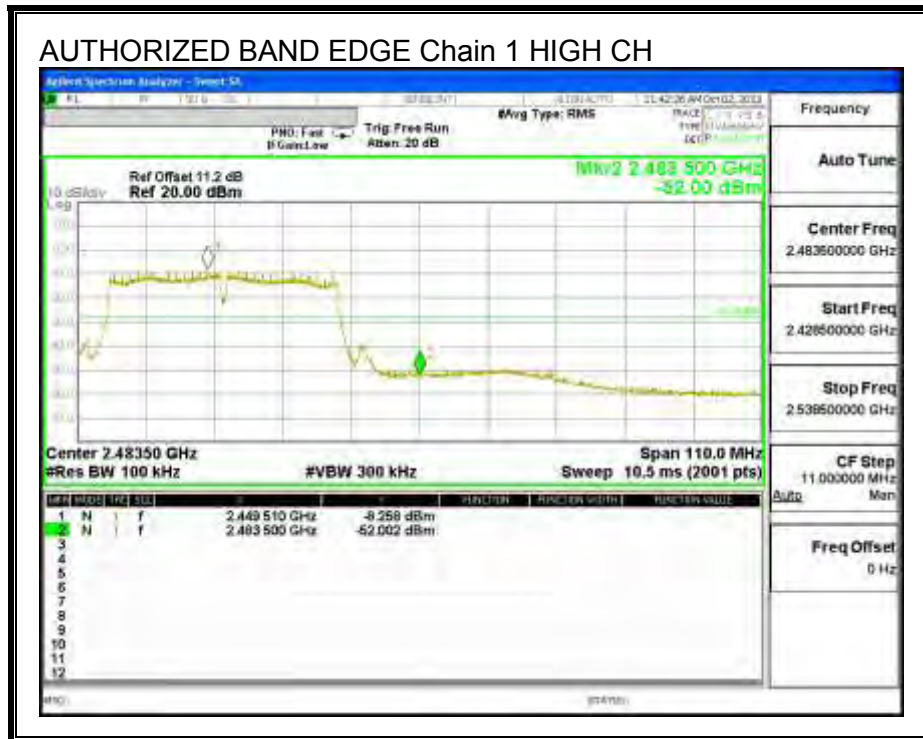
OUT-OF-BAND EMISSIONS, Chain 0

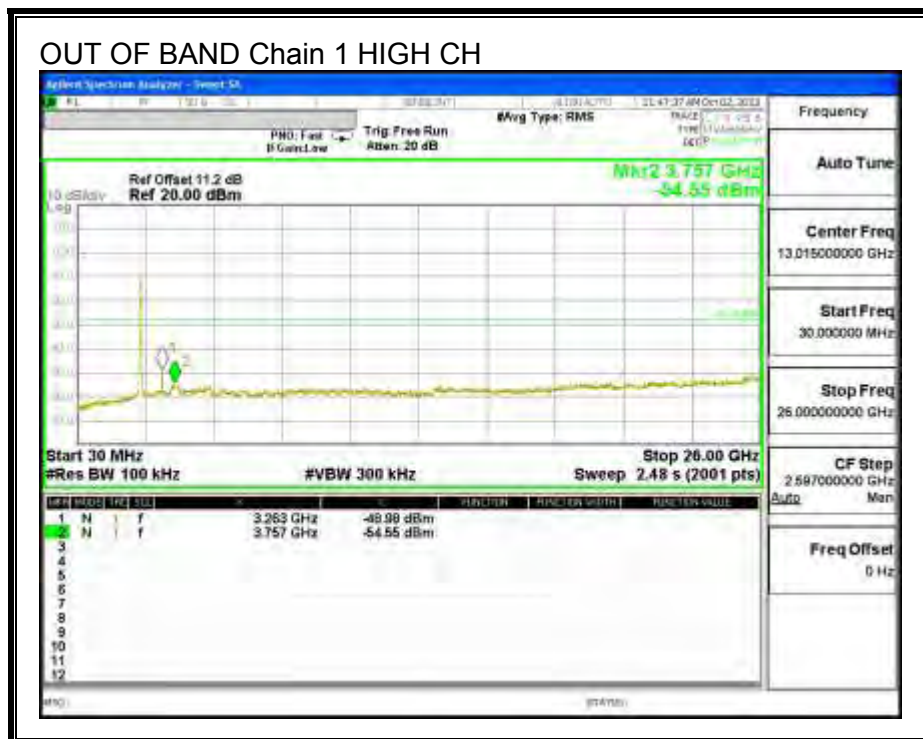
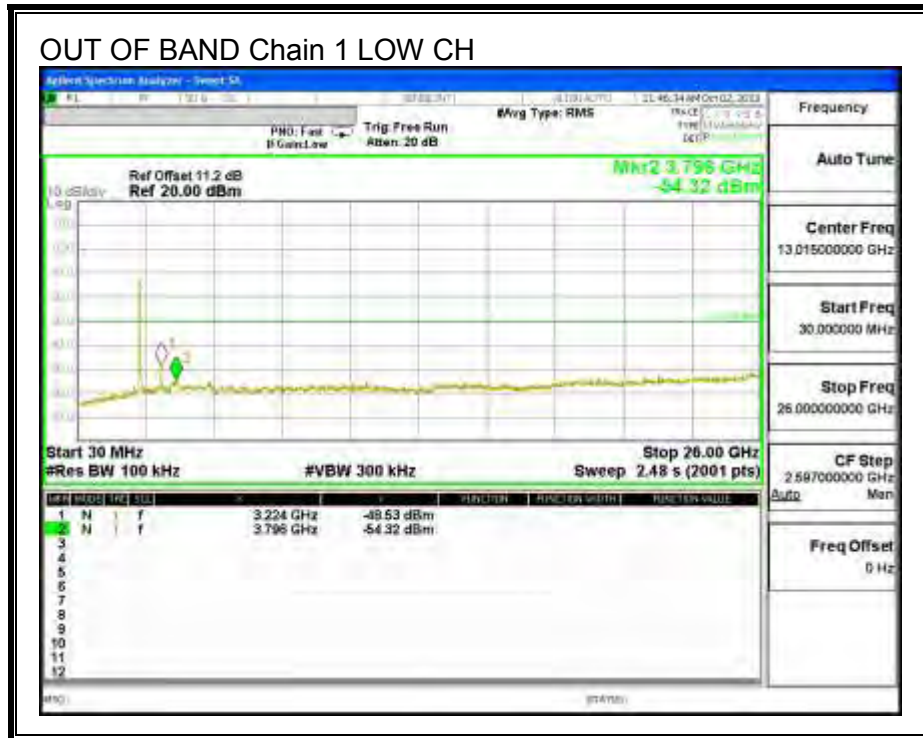


LOW CHANNEL BANDEDGE, Chain 1



HIGH CHANNEL BANDEDGE, Chain 1





8.8. 802.11a SISO MODE IN THE 5.8 GHz BAND

8.8.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

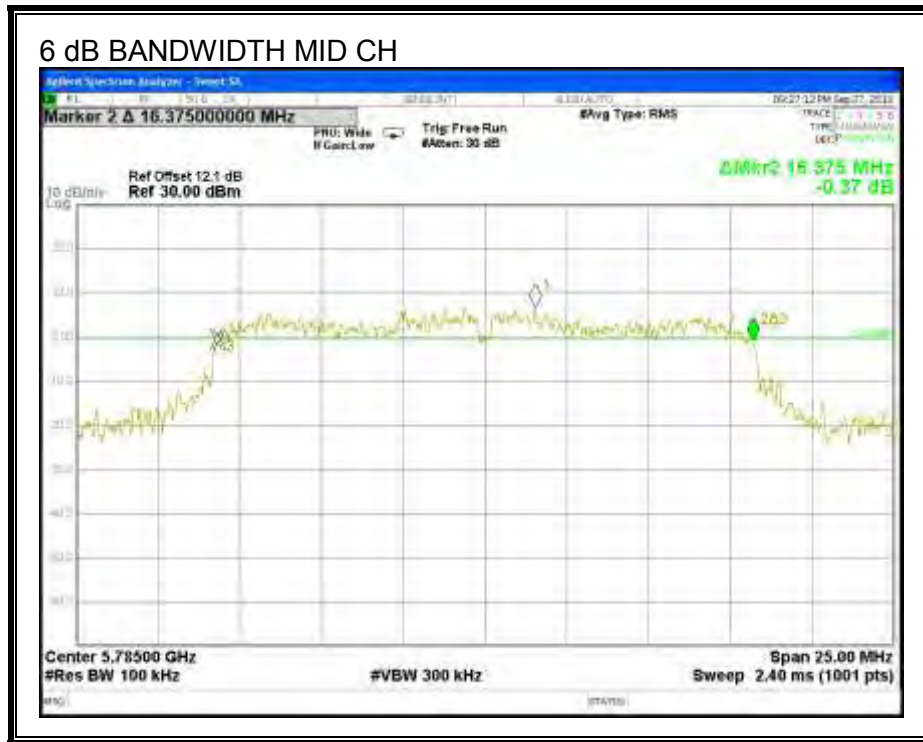
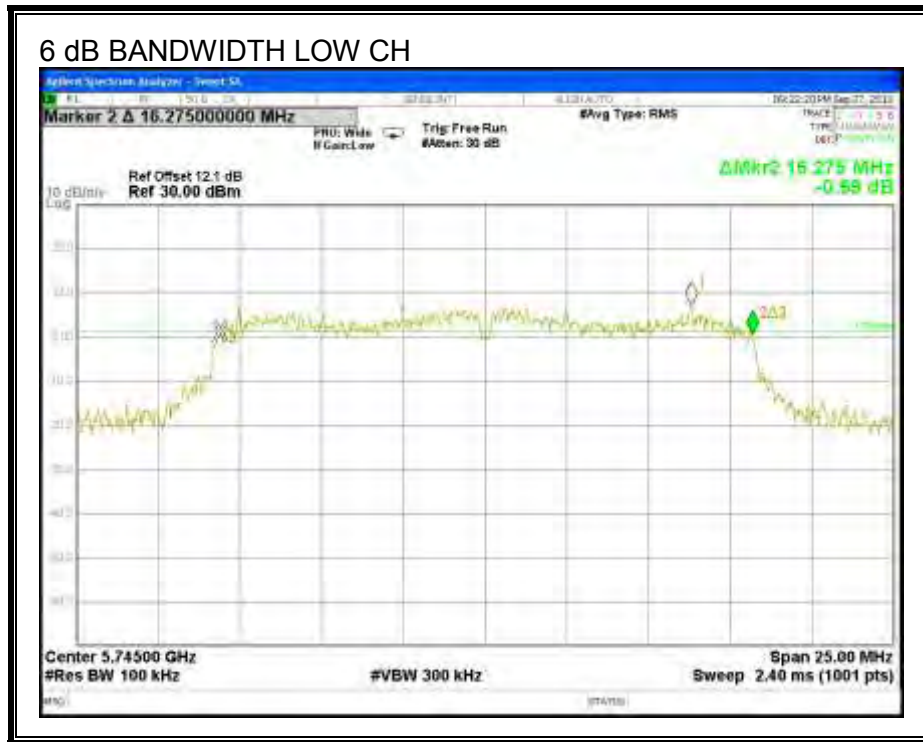
TEST PROCEDURE

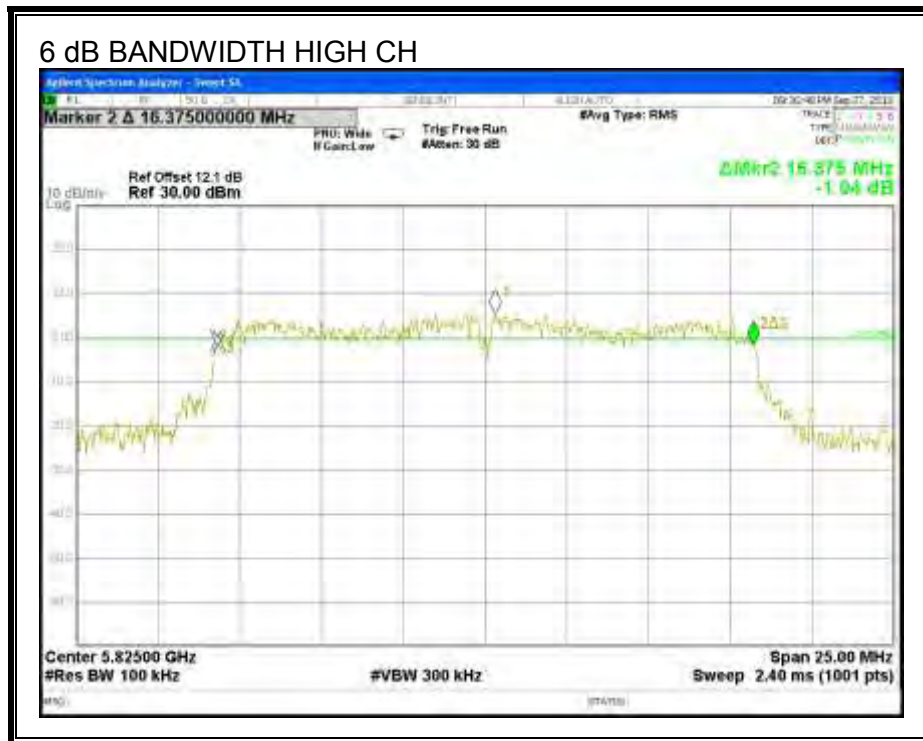
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5745	16.275	0.5
Mid	5785	16.375	0.5
High	5825	16.375	0.5

6 dB BANDWIDTH





8.8.2. 99% BANDWIDTH

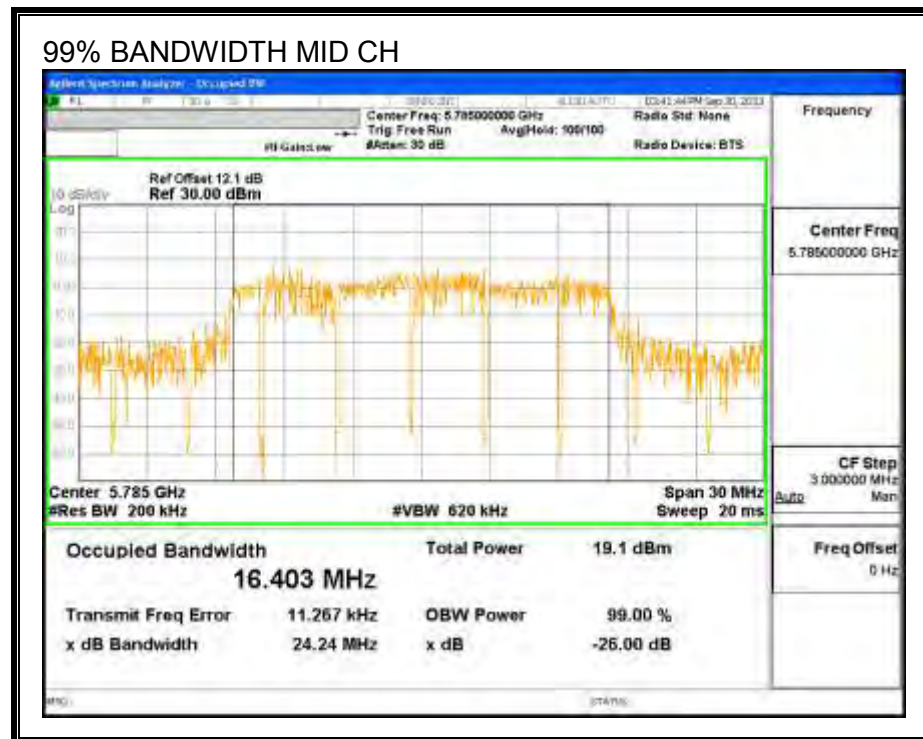
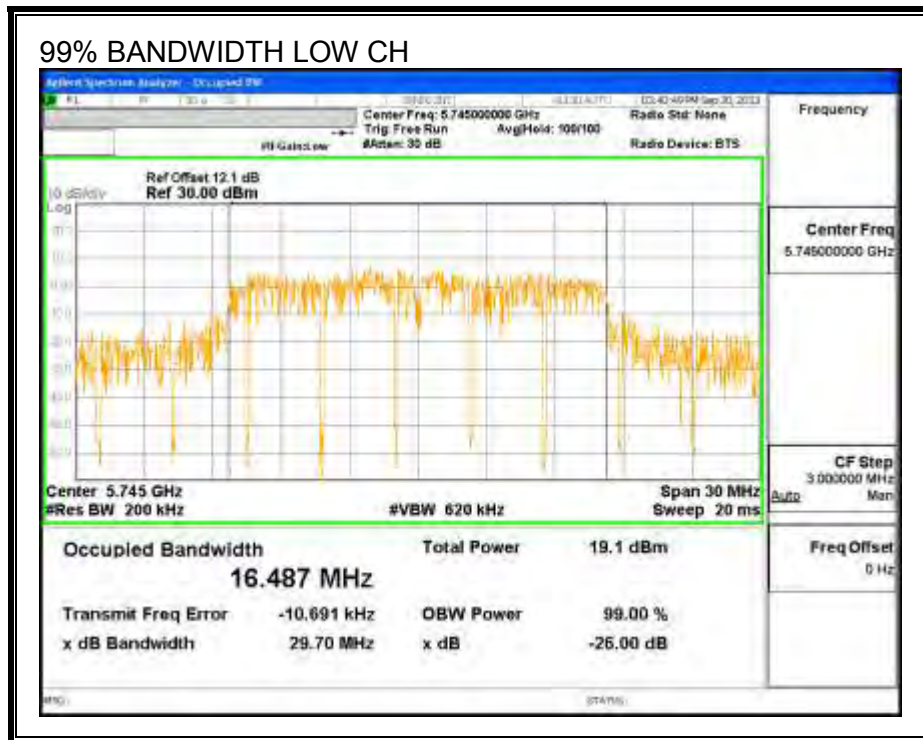
LIMITS

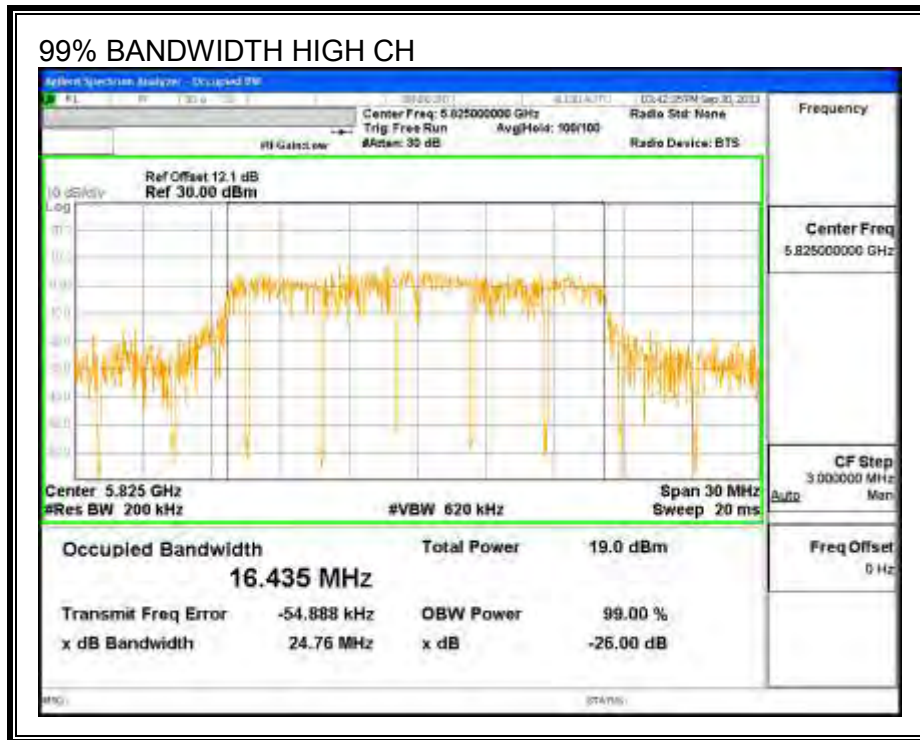
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	16.487
Mid	5785	16.403
High	5825	16.435

99% BANDWIDTH





8.8.3. 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 12.32dB (including 10 dB pad, 2.1 dB cable, and .22 duty cycle correction factor) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	5745	19.07
Mid	5785	19.17
High	5825	18.74

8.8.4. 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

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

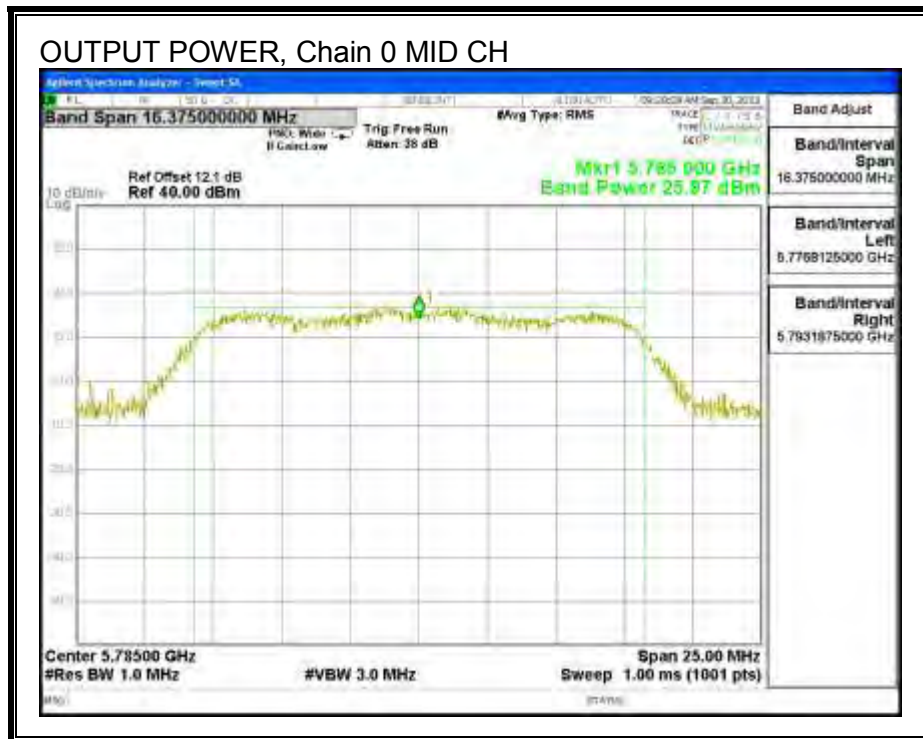
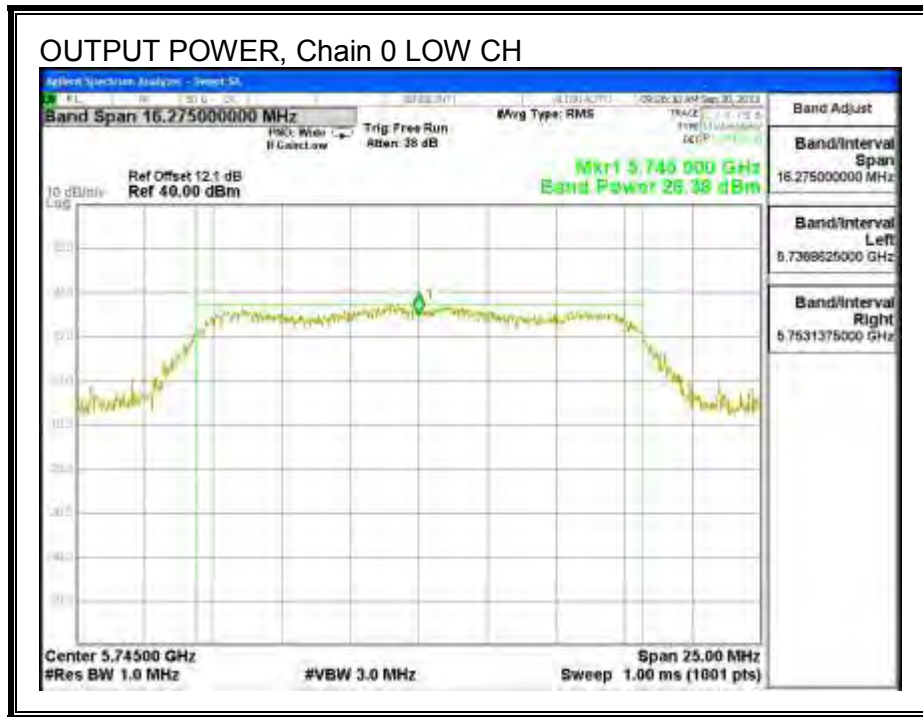
Limits

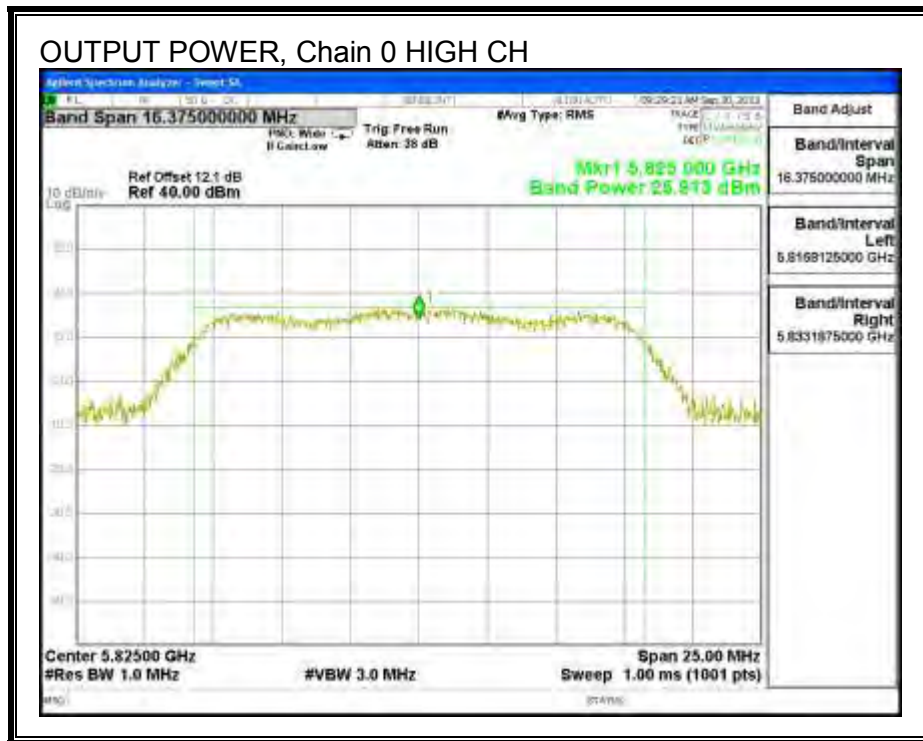
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	5745	3.2	30.00	30	36	30.00
Mid	5785	3.2	30.00	30	36	30.00
High	5825	3.2	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	5745	26.380	26.38	30.00	-3.62
Mid	5785	25.970	25.97	30.00	-4.03
High	5825	25.913	25.91	30.00	-4.09

OUTPUT POWER, Chain 0





8.8.5. PSD

LIMITS

FCC §15.247

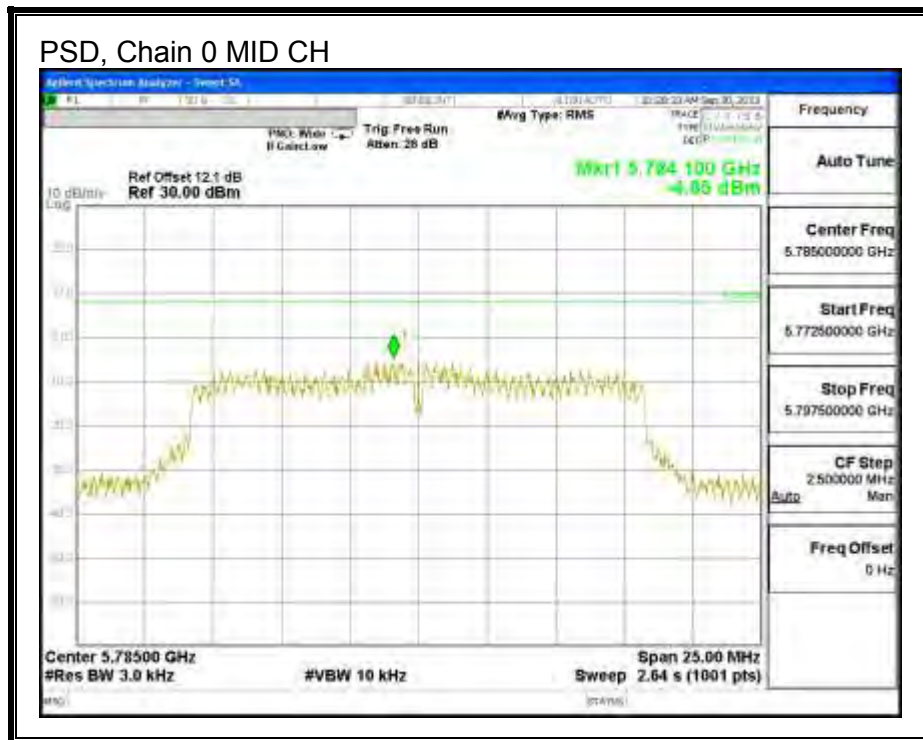
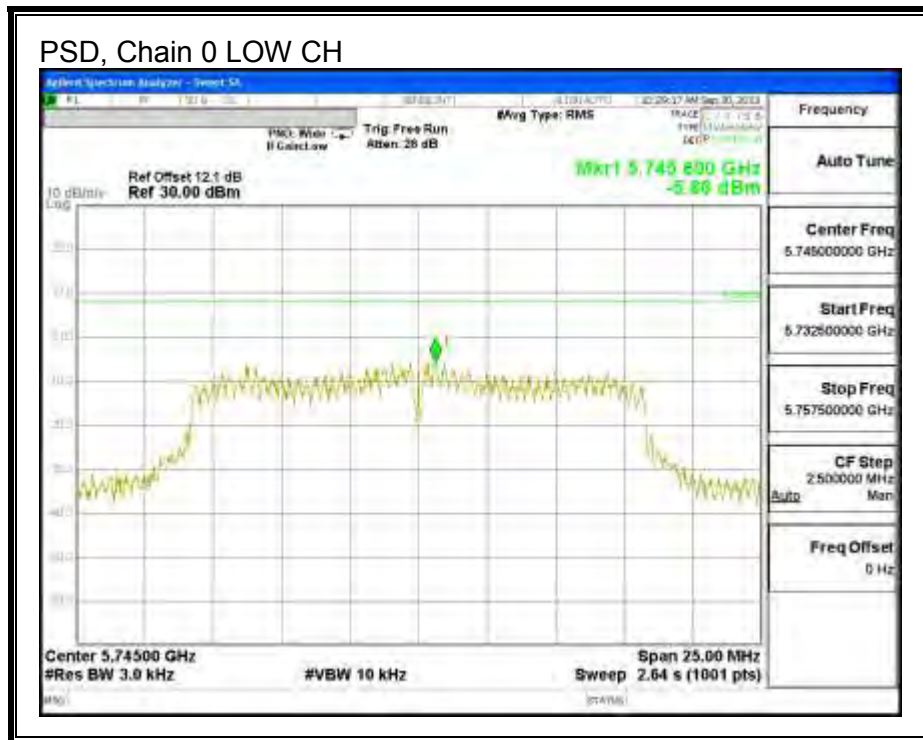
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

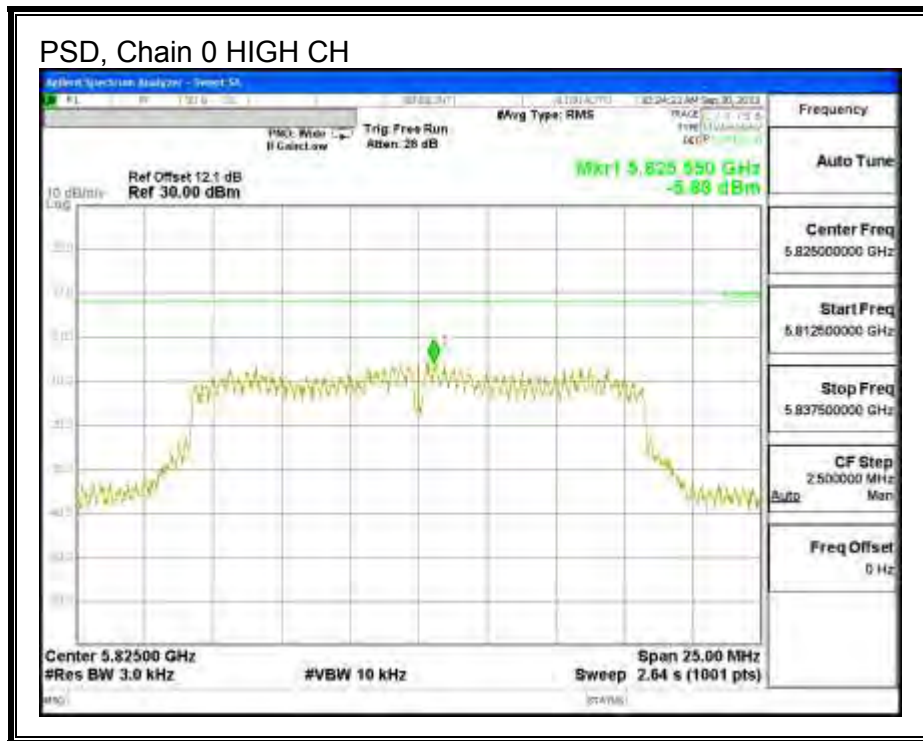
RESULTS

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-5.86	8.0	-13.9
Mid	5785	-4.85	8.0	-12.9
High	5825	-5.88	8.0	-13.9

PSD, Chain 0





8.8.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

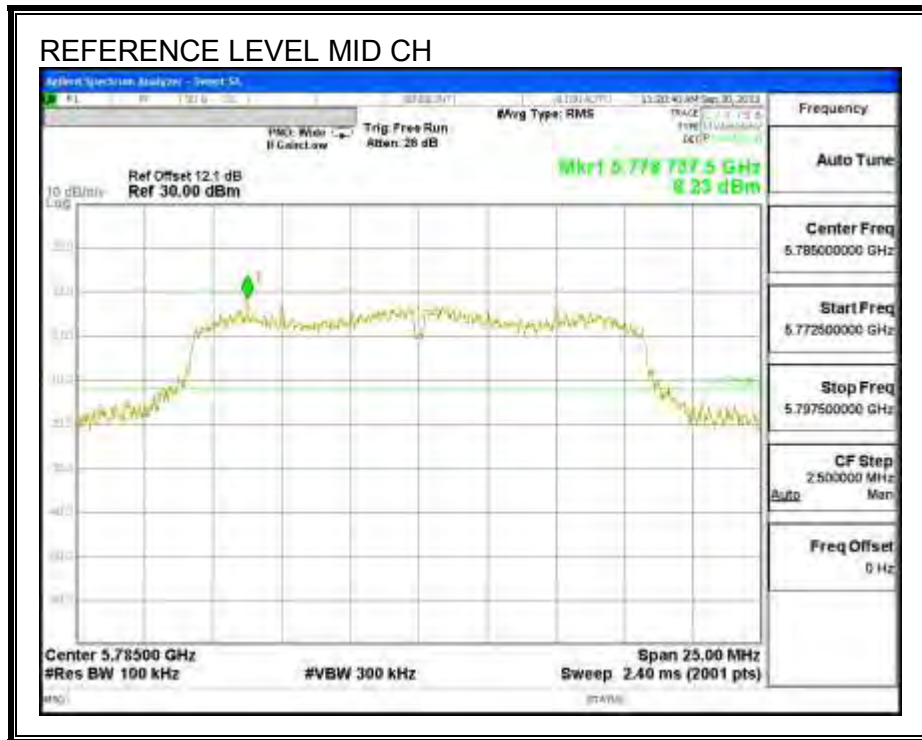
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

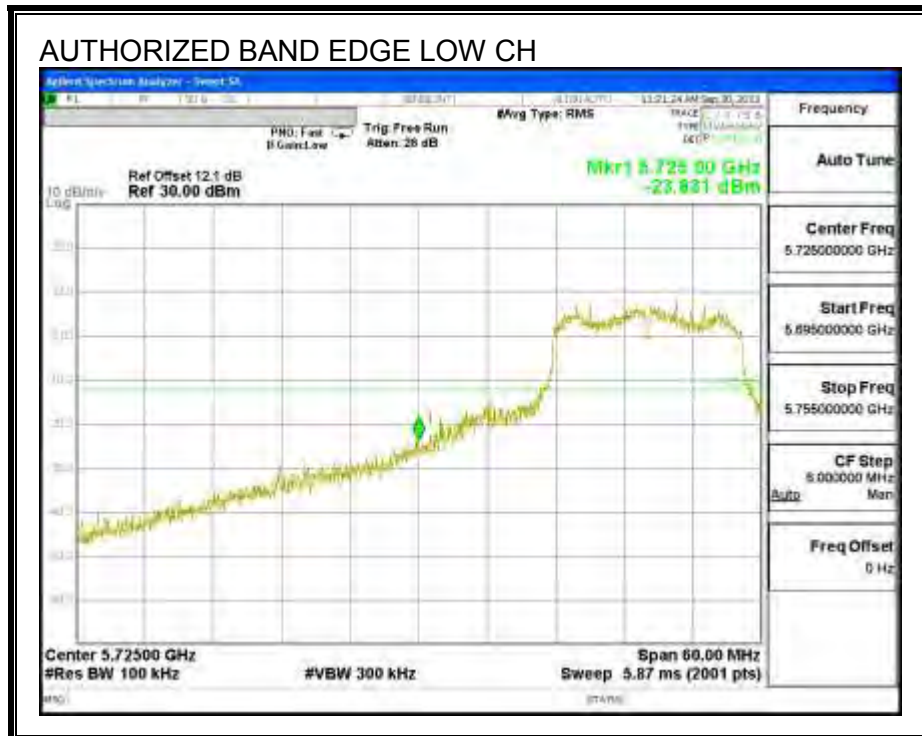
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

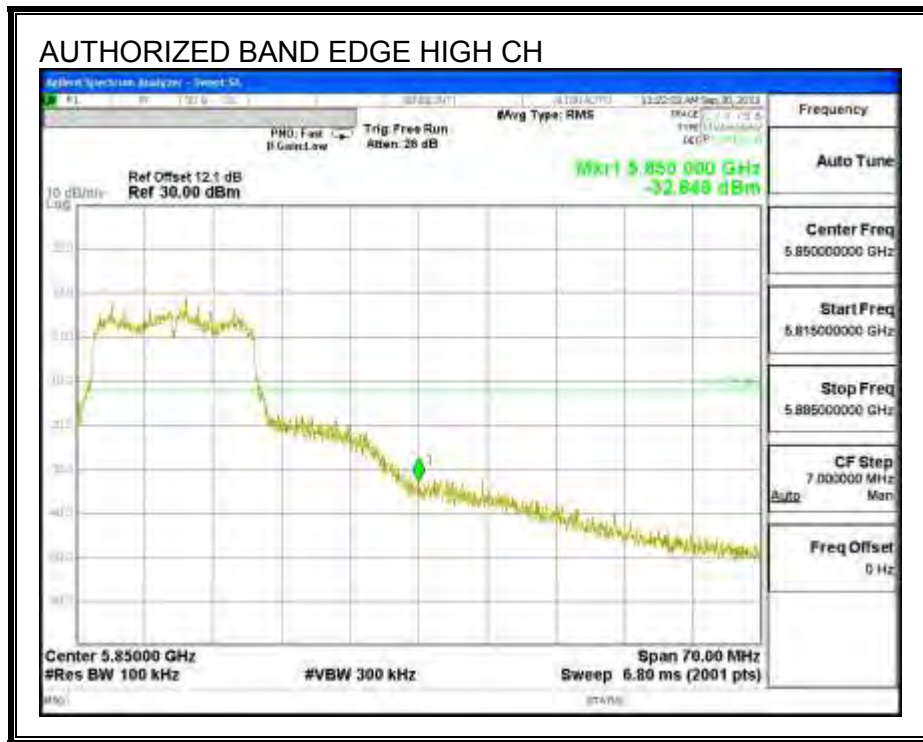
IN-BAND REFERENCE LEVEL



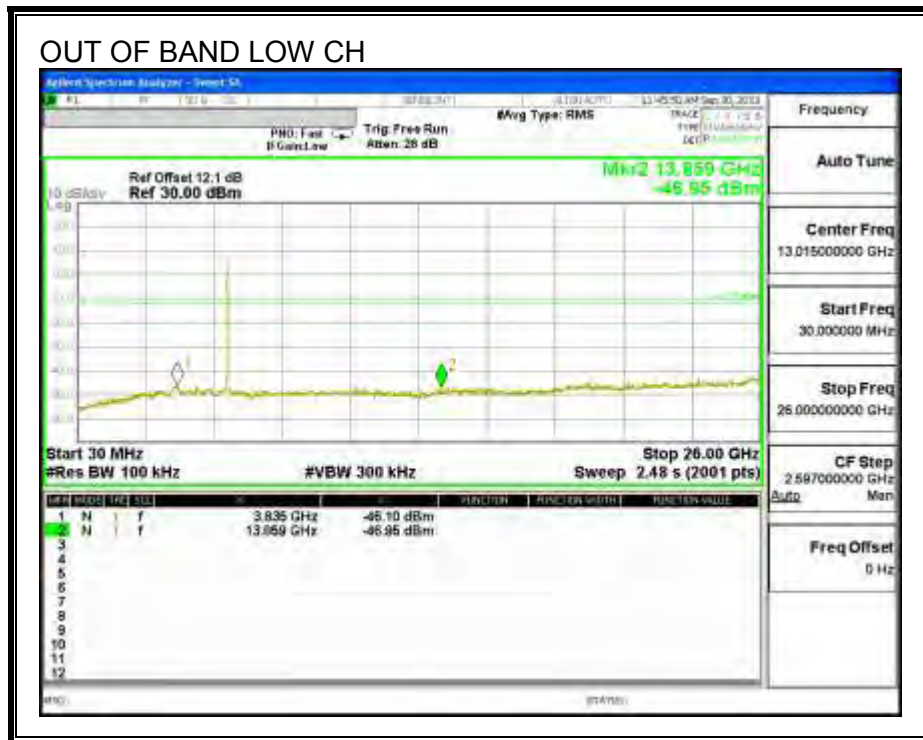
LOW CHANNEL BANDEDGE

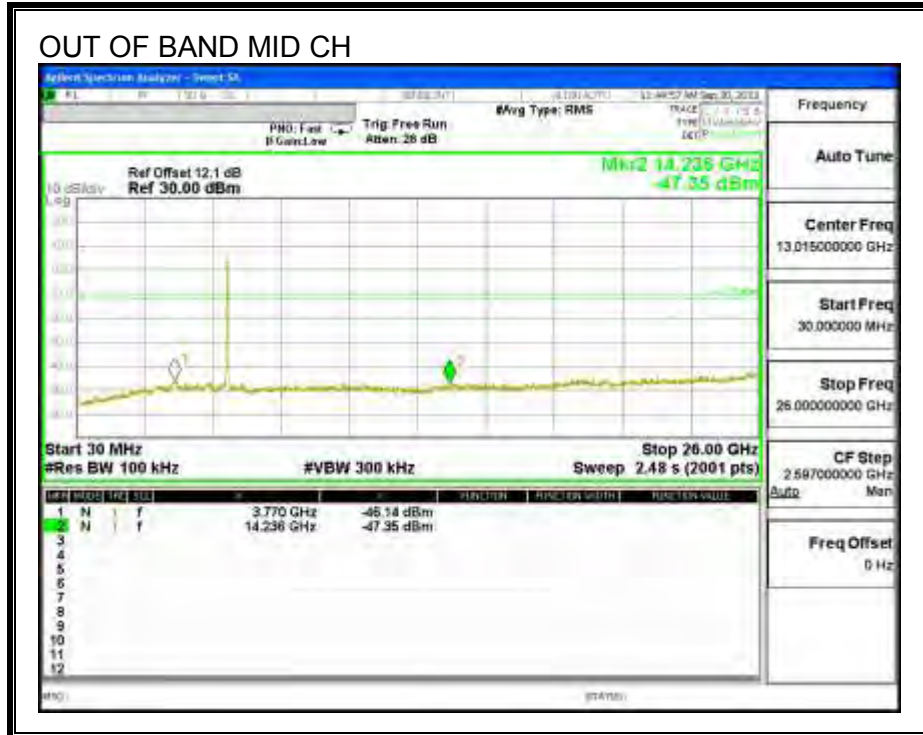
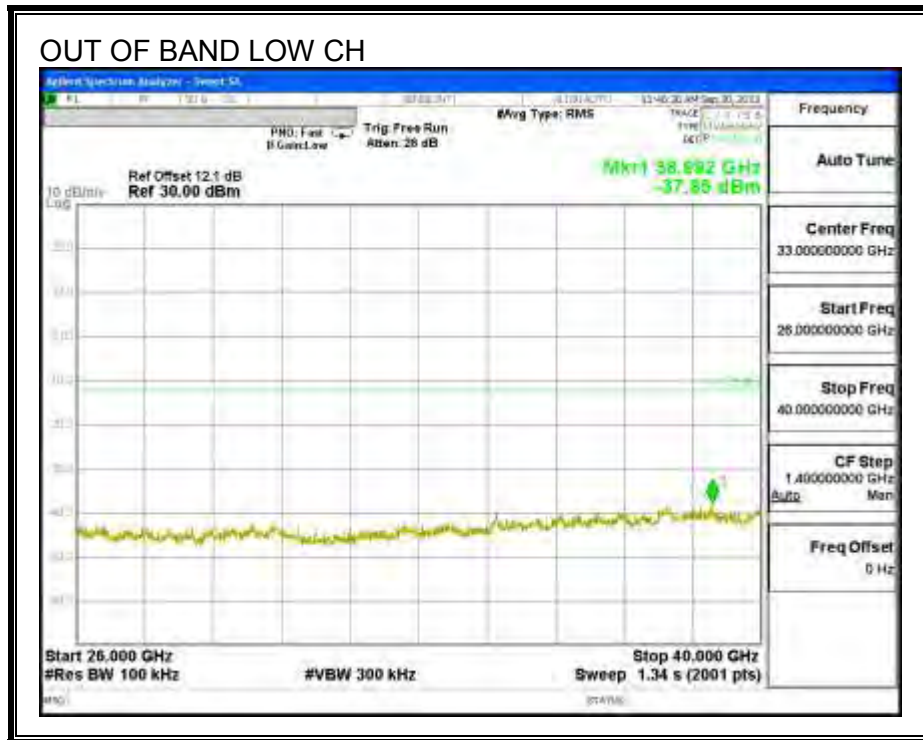


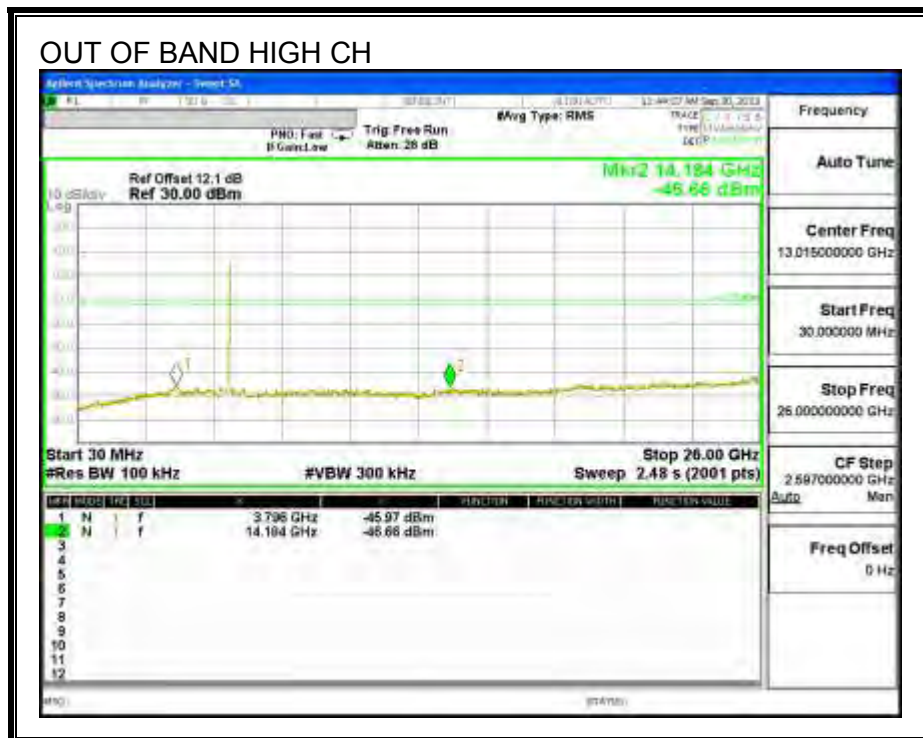
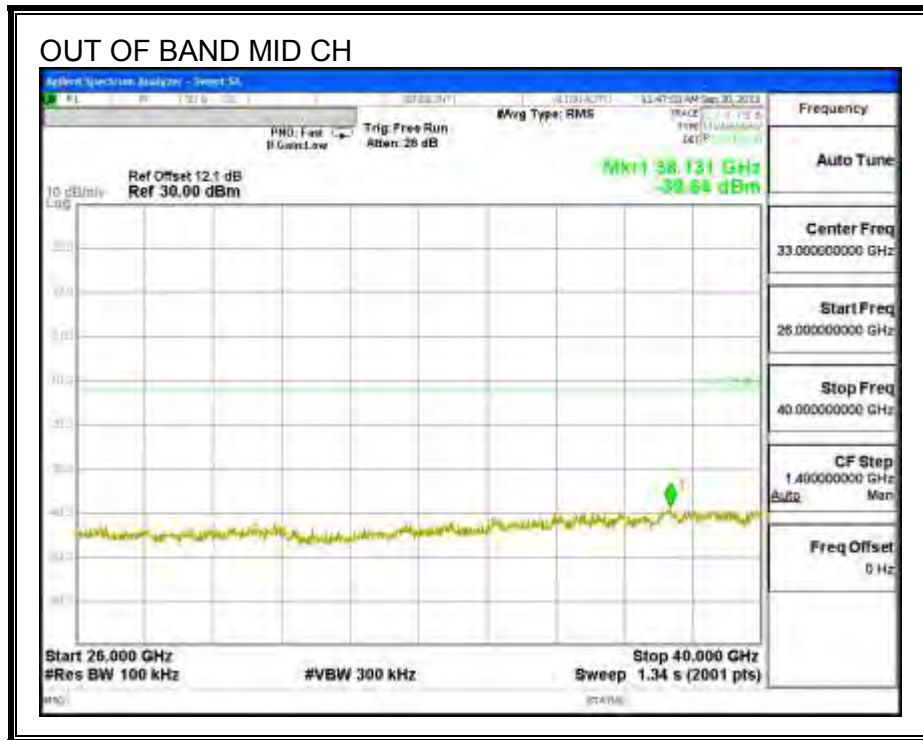
HIGH CHANNEL BANDEDGE

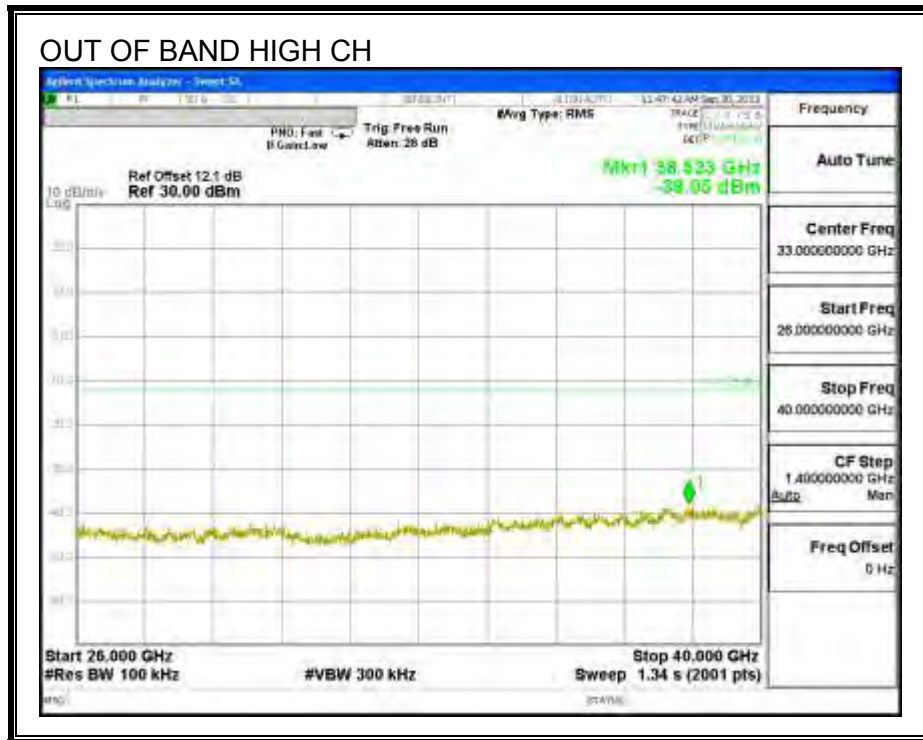


OUT-OF-BAND EMISSIONS









8.9. 802.11a 2TX CDD MODE IN THE 5.8 GHZ BAND

8.9.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

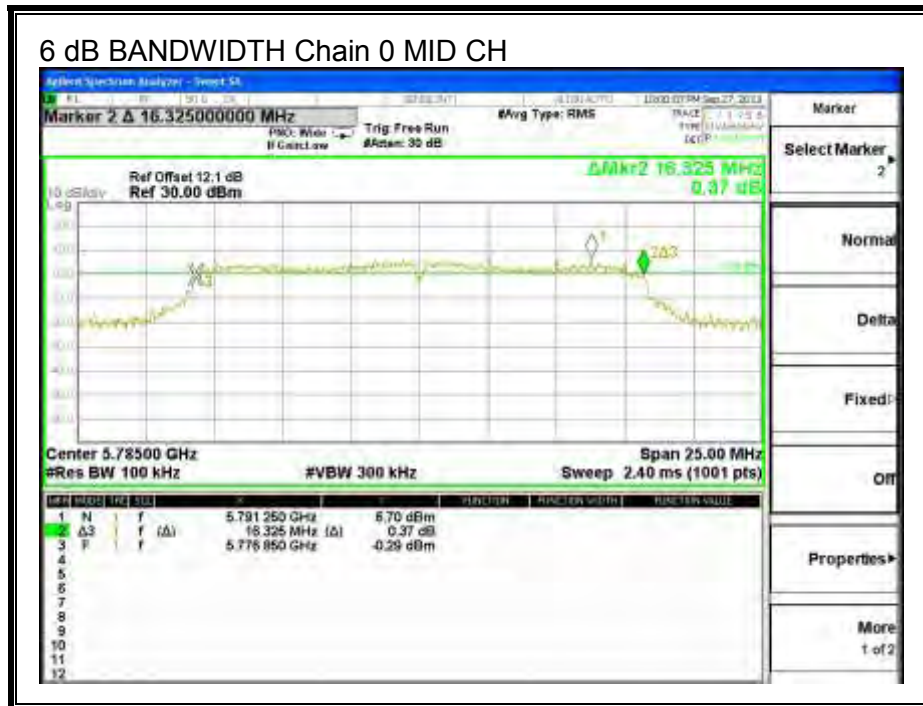
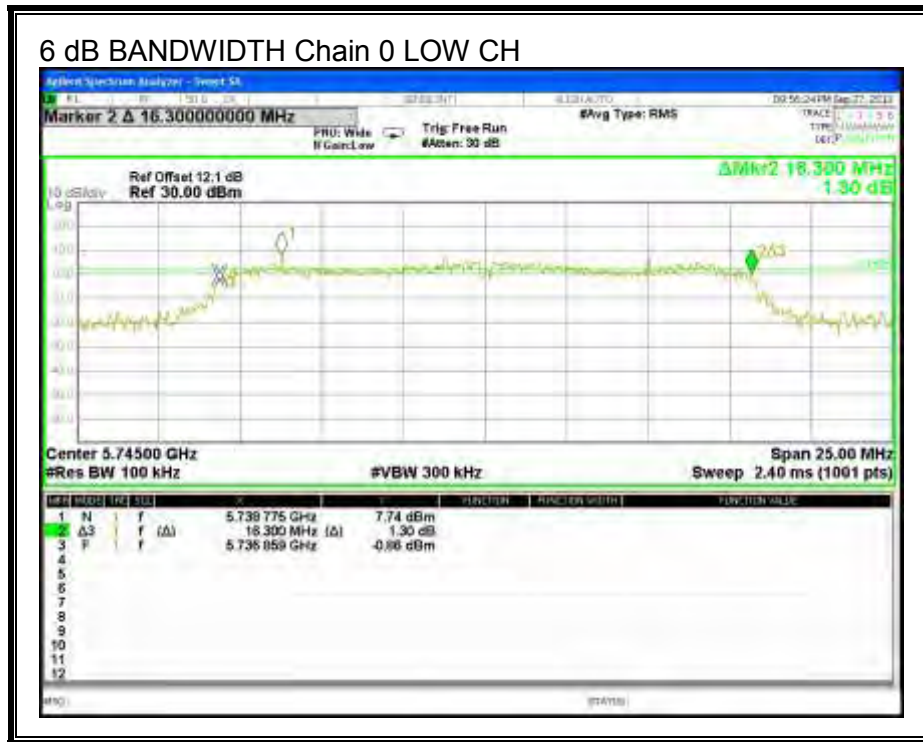
TEST PROCEDURE

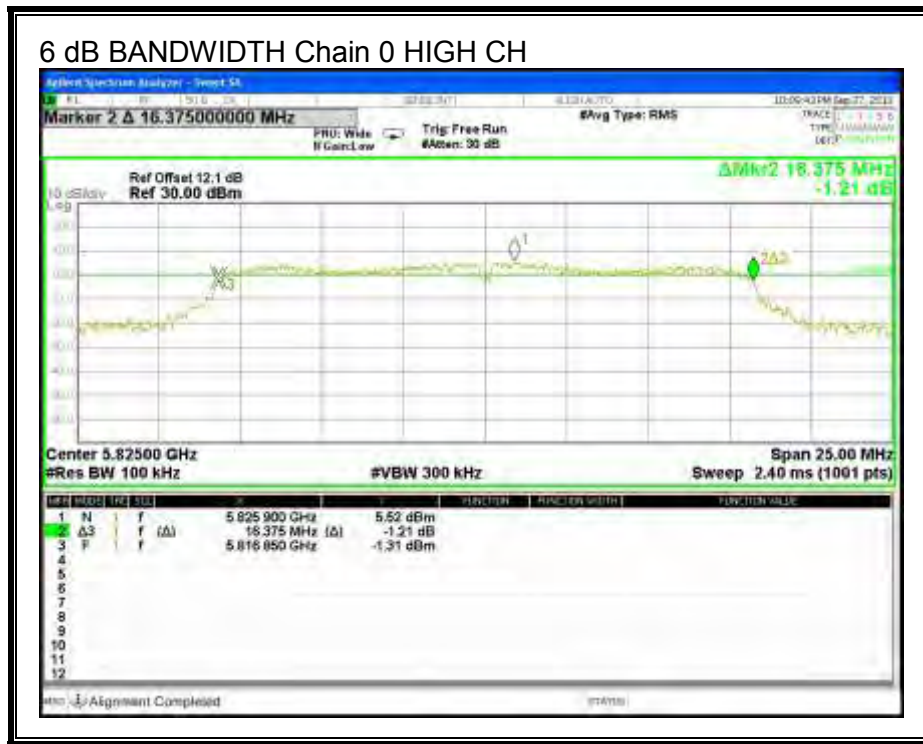
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

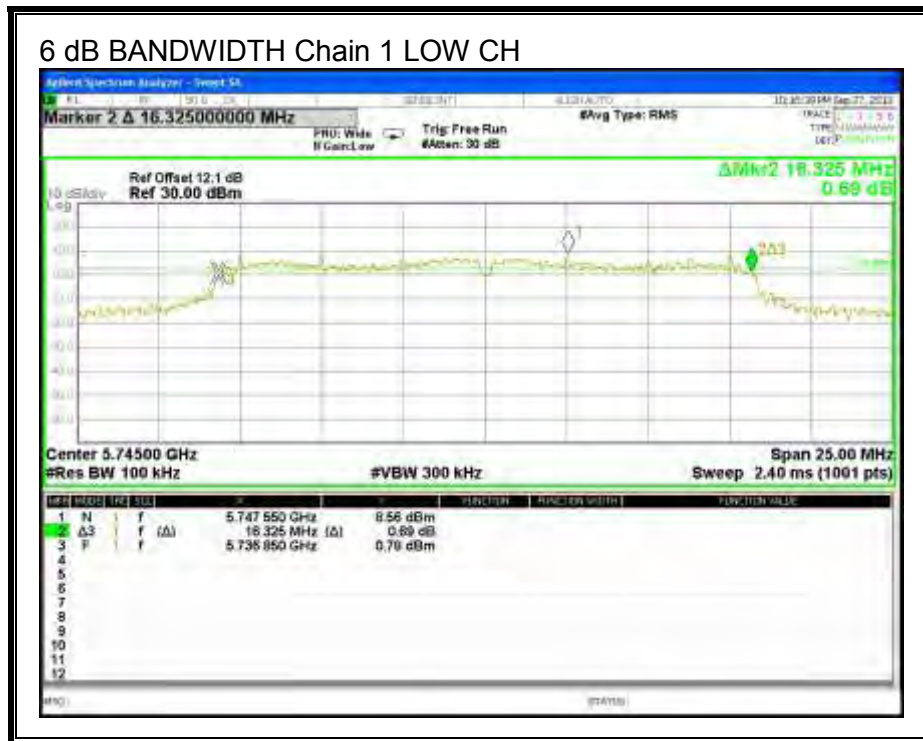
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	5745	16.300	16.325	0.5
Mid	5785	16.325	16.300	0.5
High	5825	16.375	16.400	0.5

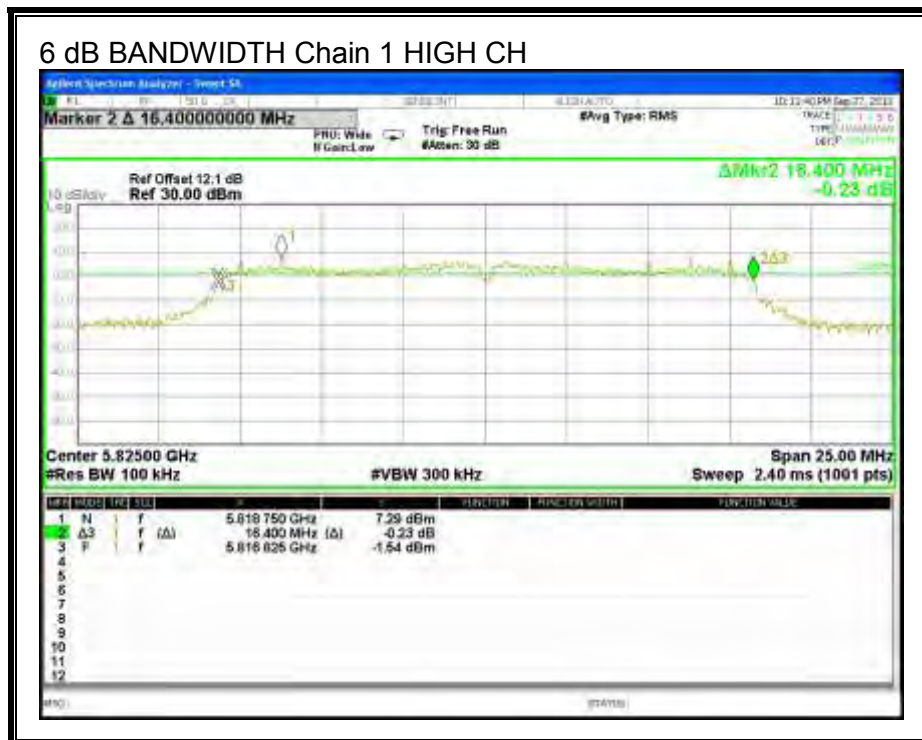
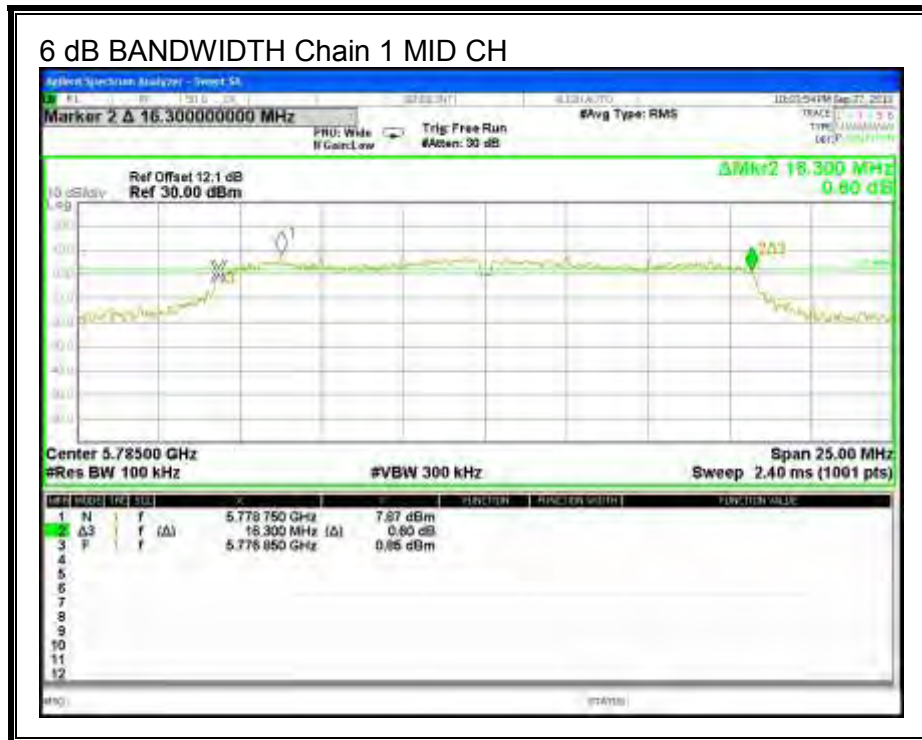
6 dB BANDWIDTH, Chain 0





6 dB BANDWIDTH, Chain 1





8.9.2. 99% BANDWIDTH

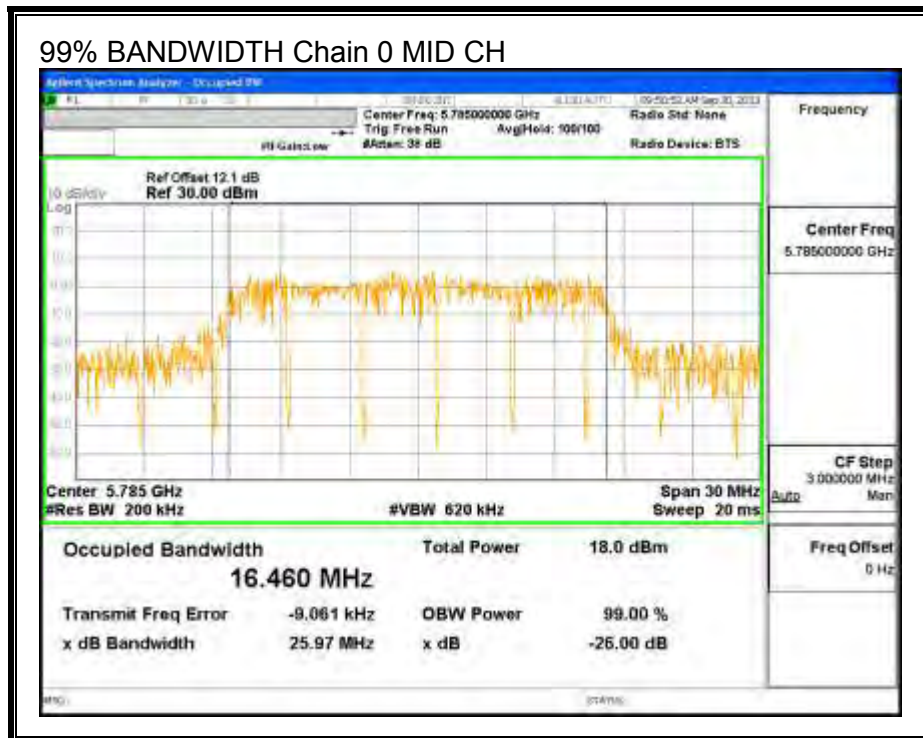
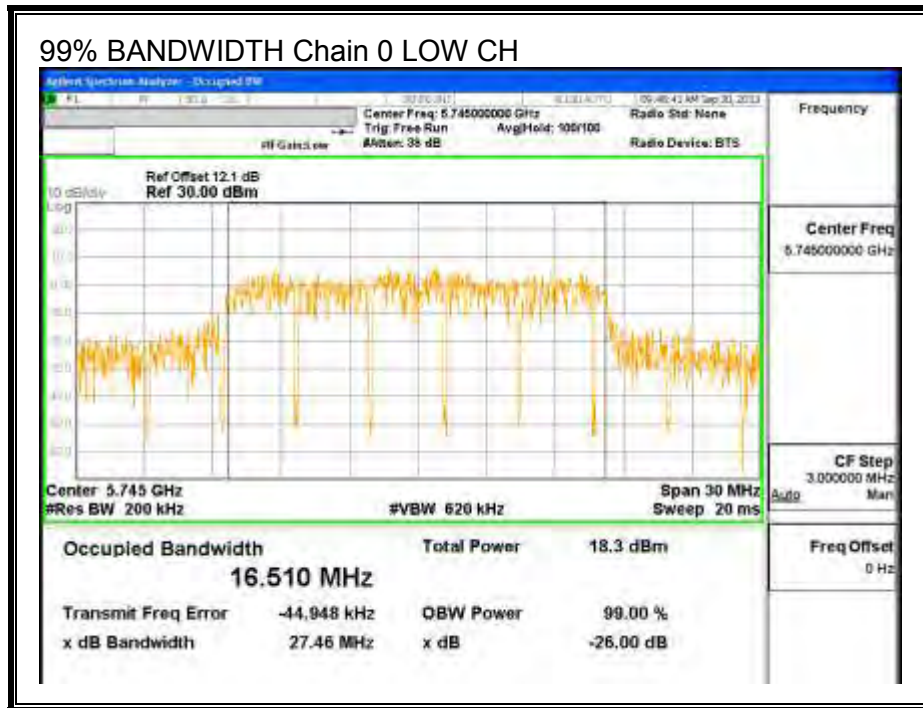
LIMITS

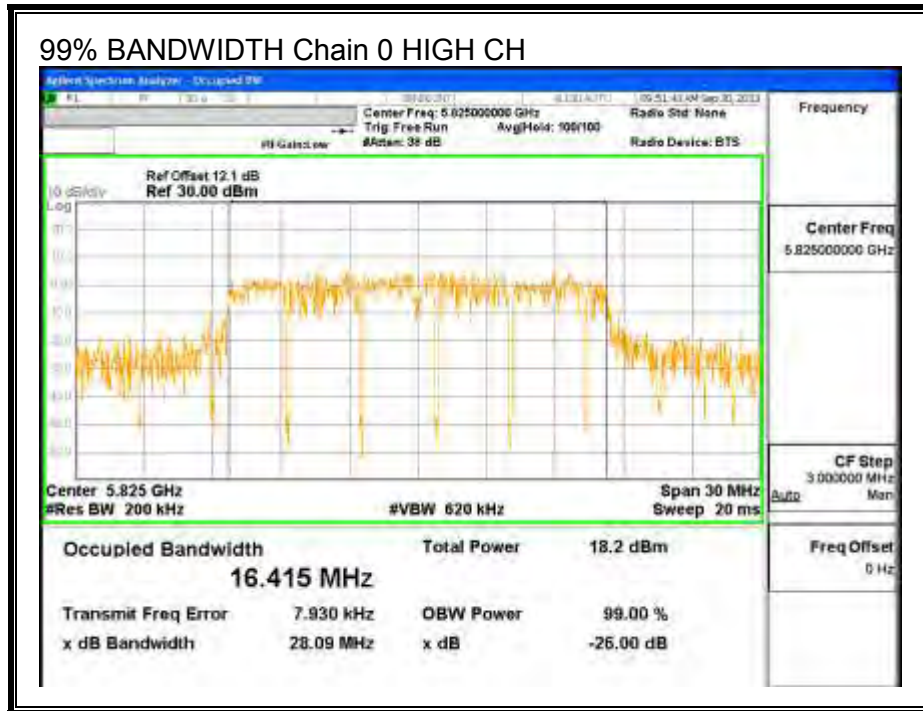
None; for reporting purposes only.

RESULTS

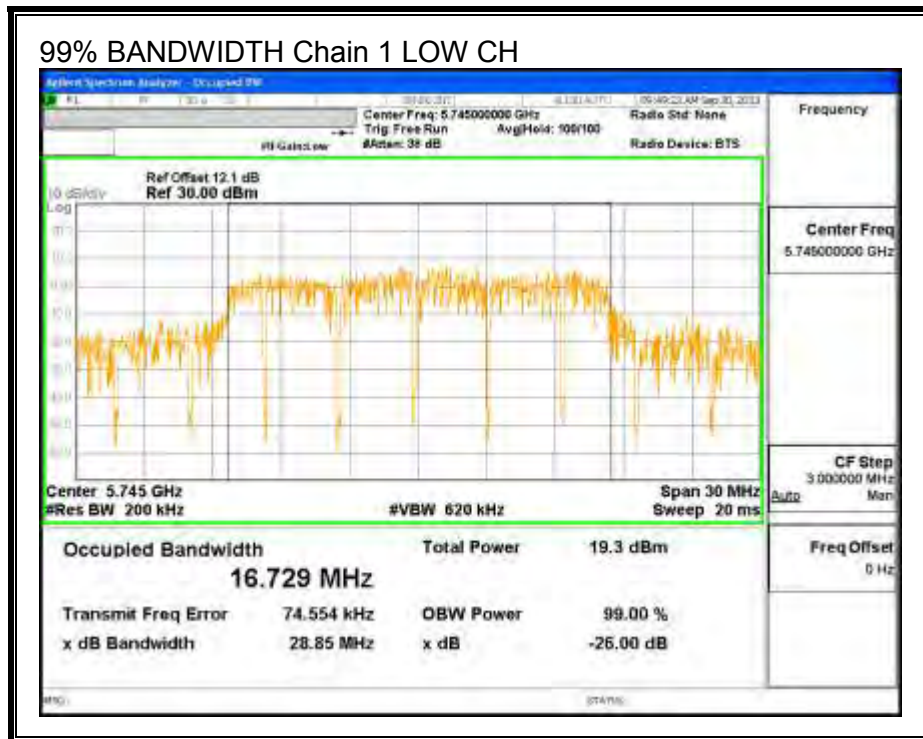
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5745	16.510	16.729
Mid	5785	16.460	16.527
High	5825	16.415	16.390

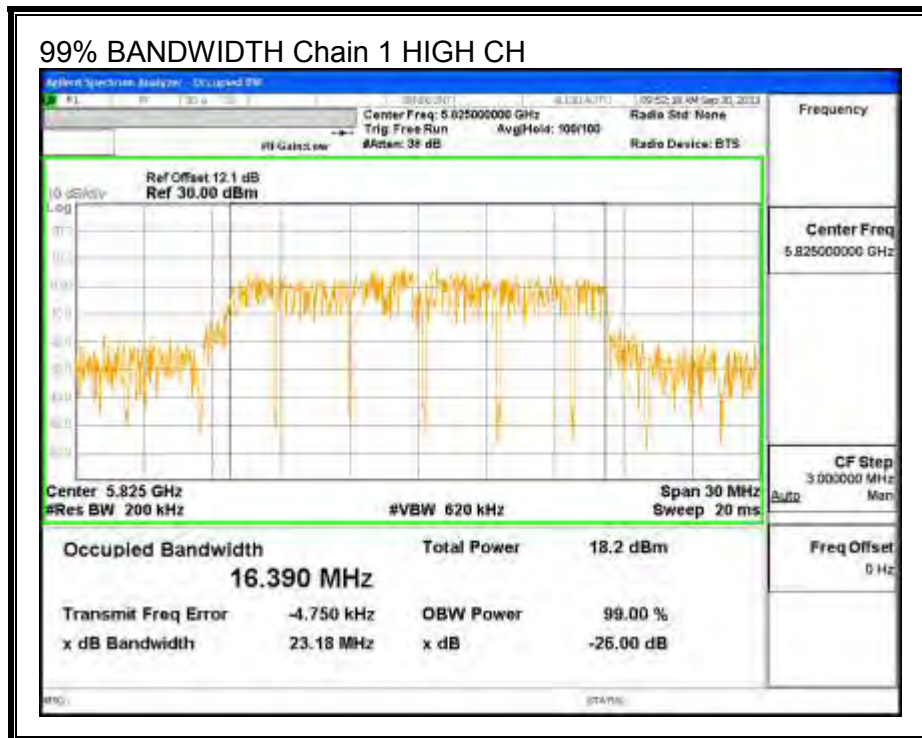
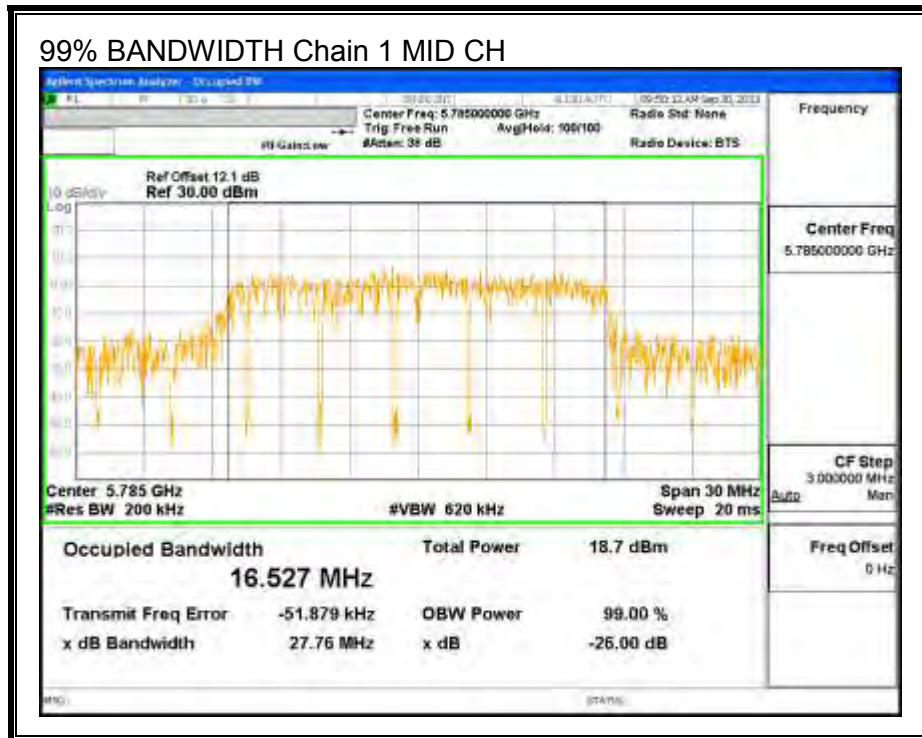
99% BANDWIDTH, Chain 0





99% BANDWIDTH, Chain 1





8.9.3. 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 12.32dB (including 10 dB pad, 2.1 dB cable, and .22 duty cycle correction factor) 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	19.00	20.00	22.54
Mid	5785	18.63	19.36	22.02
High	5825	18.83	18.54	21.70

8.9.4. 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)
3.20	1.80	2.56

RESULTS

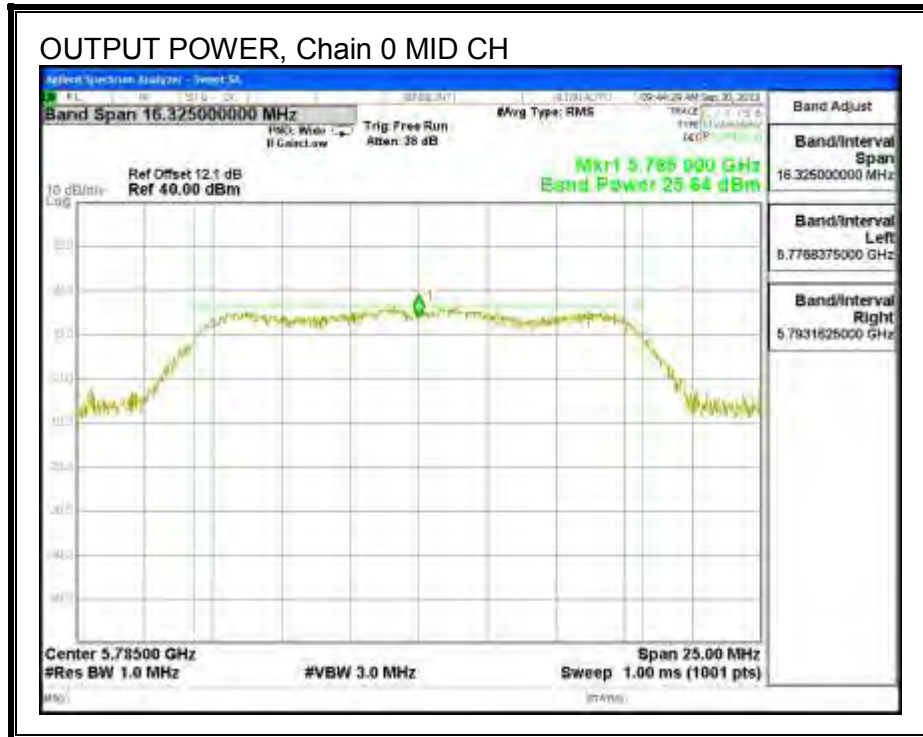
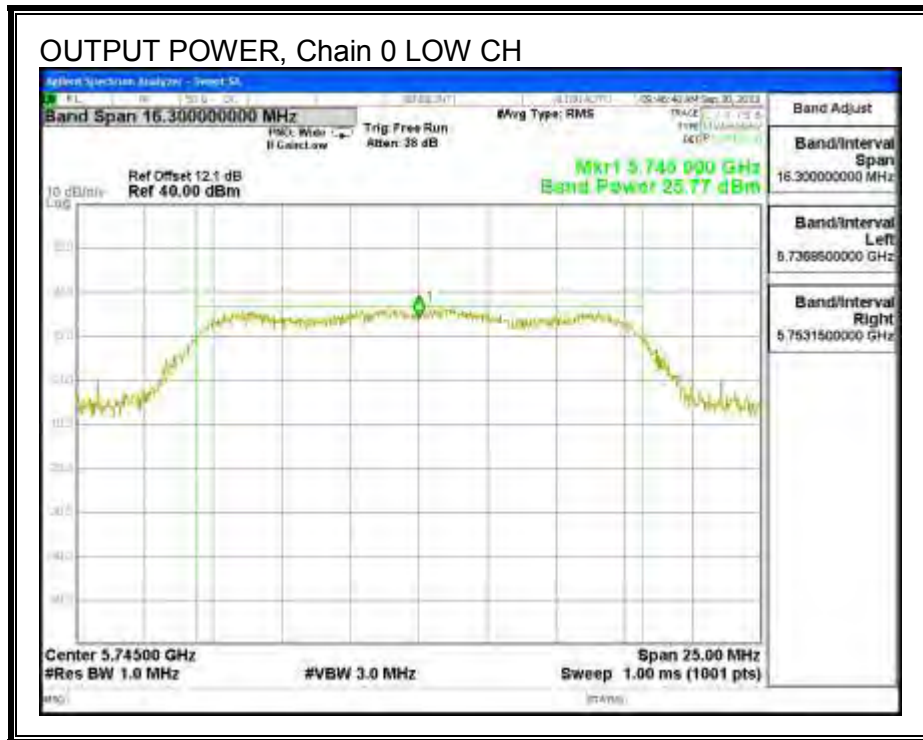
Limits

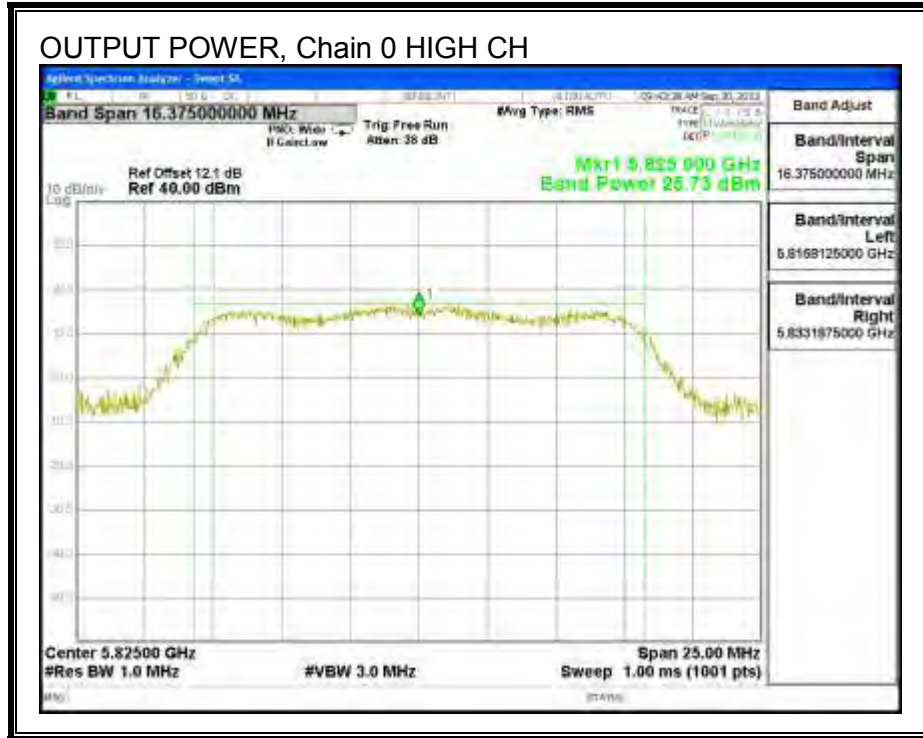
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	5745	2.56	30.00	30	36	30.00
Mid	5785	2.56	30.00	30	36	30.00
High	5825	2.56	30.00	30	36	30.00

Results

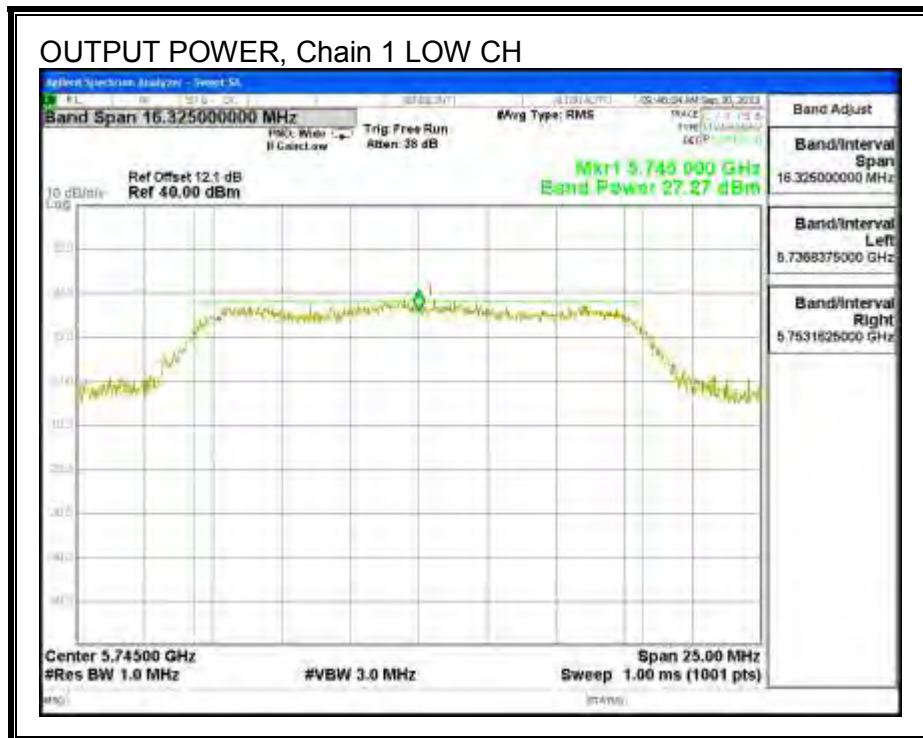
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	5745	25.77	27.27	29.59	30.00	-0.41
Mid	5785	25.64	26.49	29.10	30.00	-0.90
High	5825	25.73	26.02	28.89	30.00	-1.11

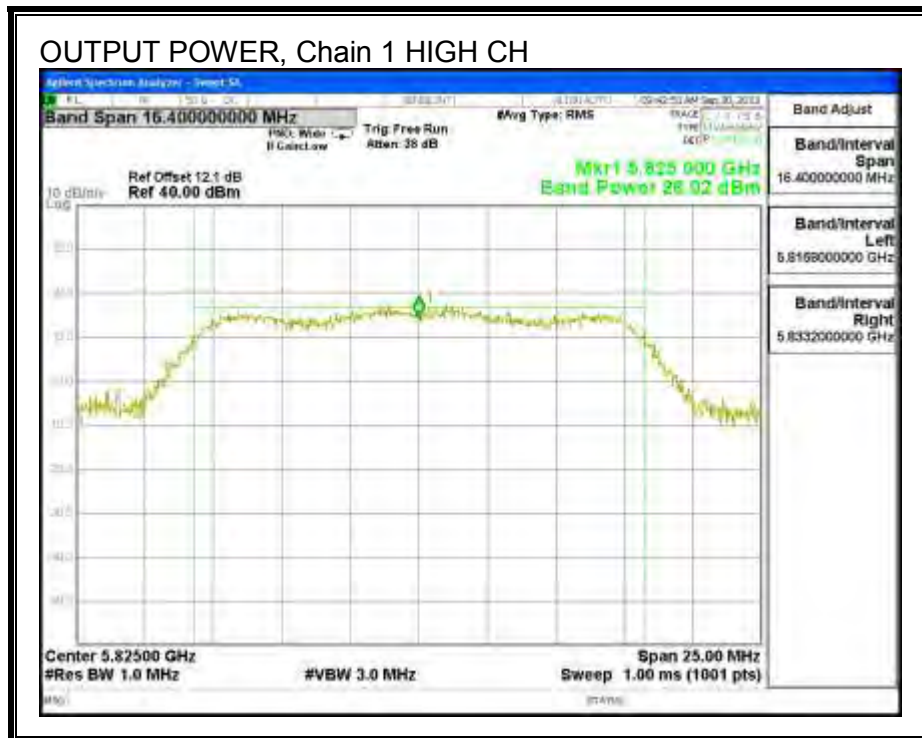
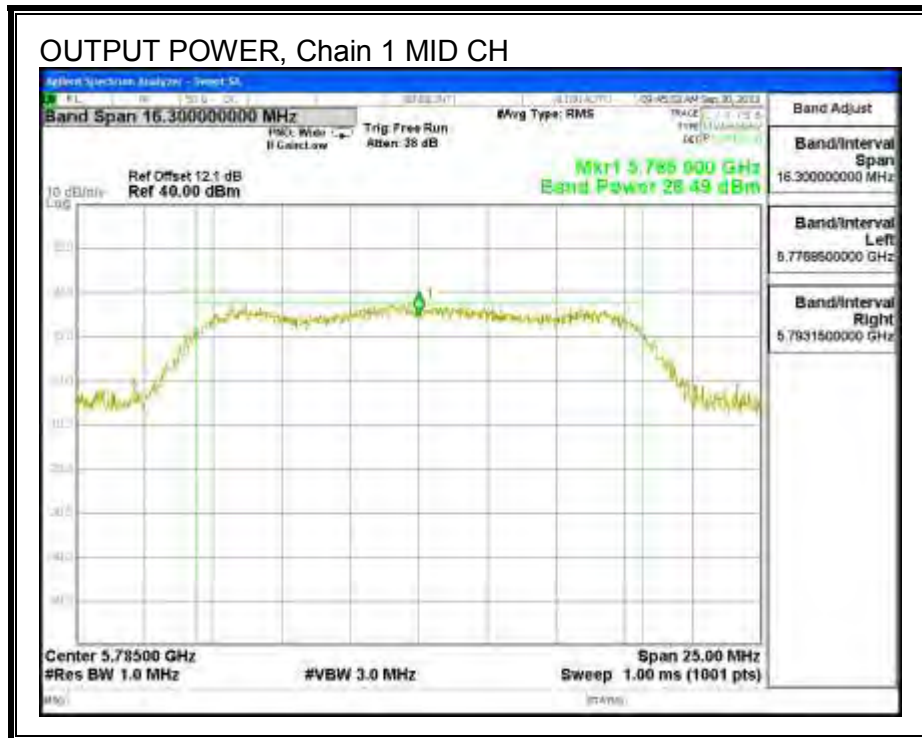
OUTPUT POWER, Chain 0





OUTPUT POWER, Chain 1





8.9.5. PSD

LIMITS

FCC §15.247

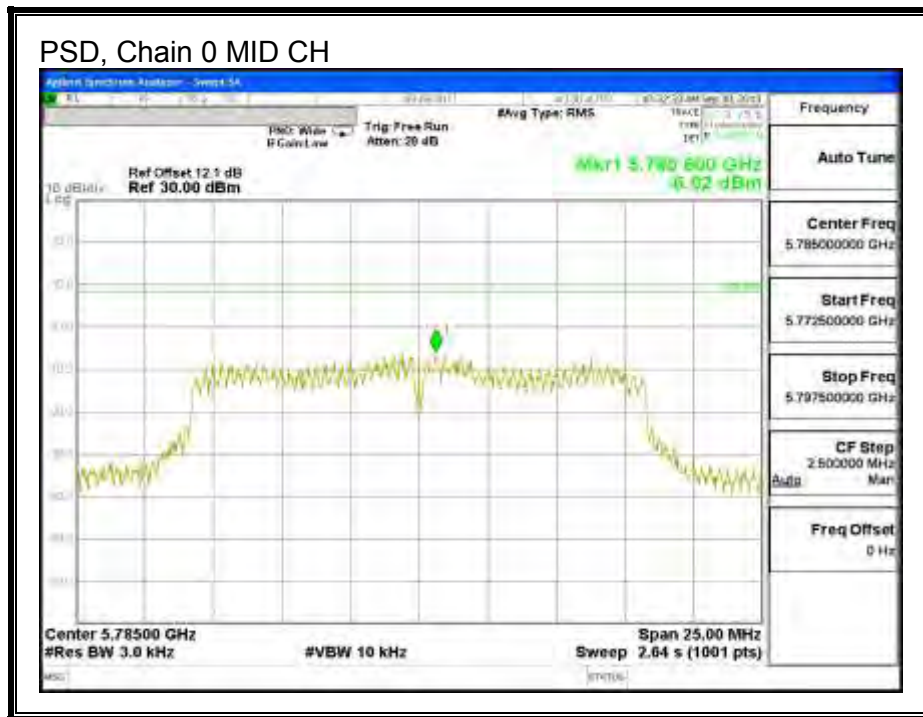
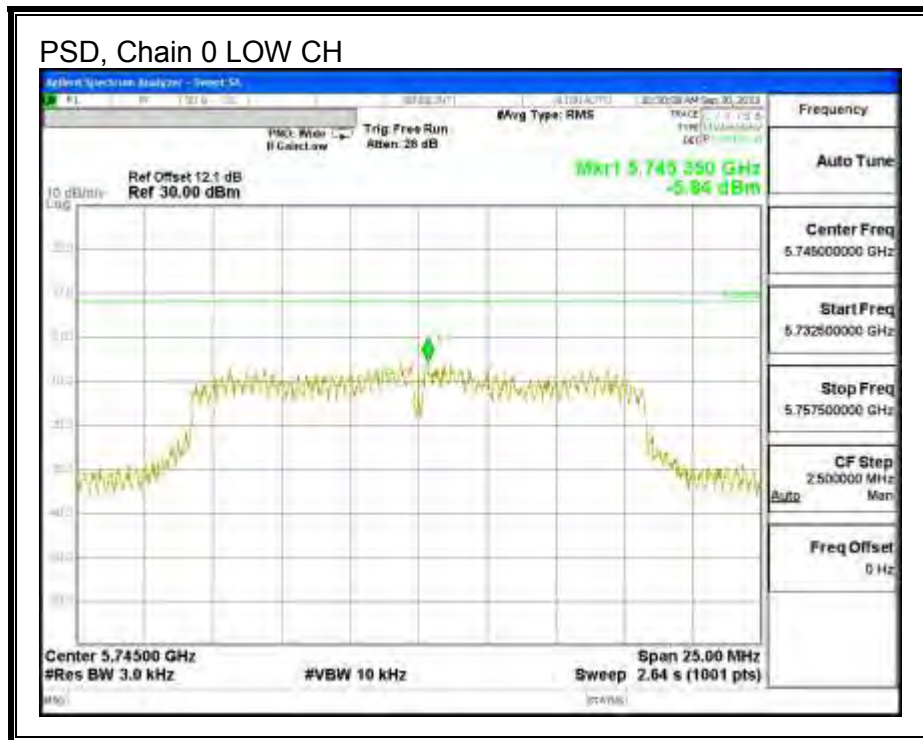
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

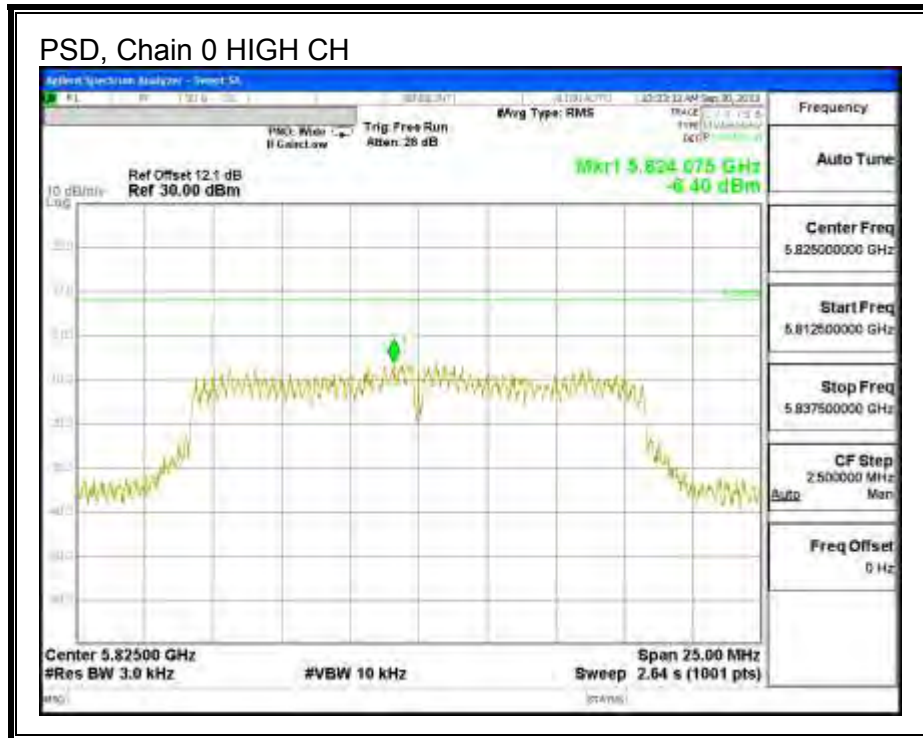
RESULTS

PSD Results

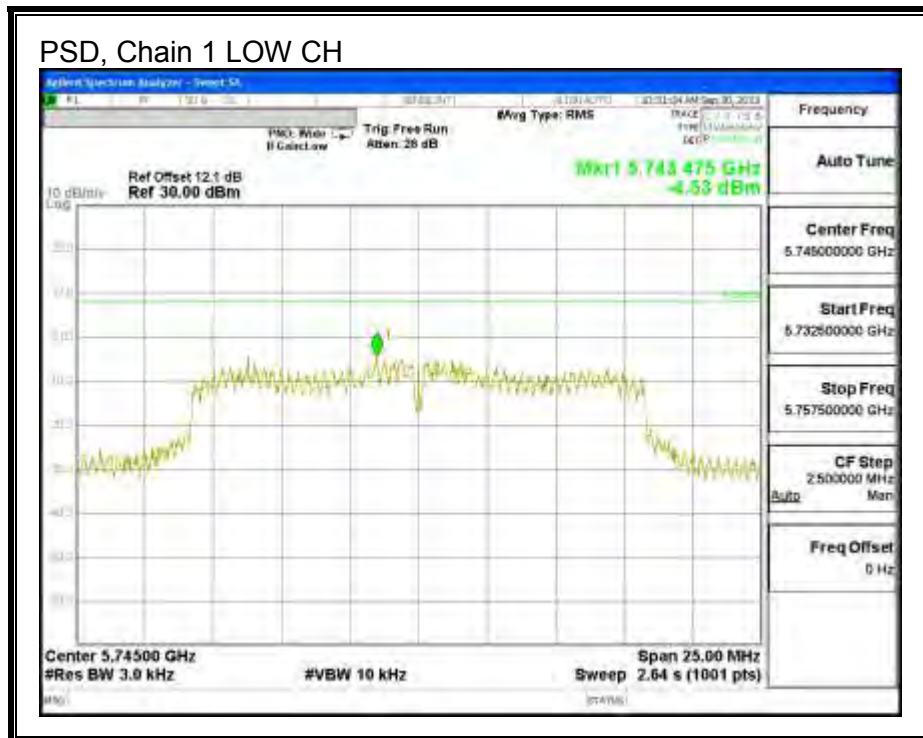
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-5.84	-4.53	-2.13	8.0	-10.1
Mid	5785	-6.02	-5.19	-2.57	8.0	-10.6
High	5825	-6.40	-4.80	-2.52	8.0	-10.5

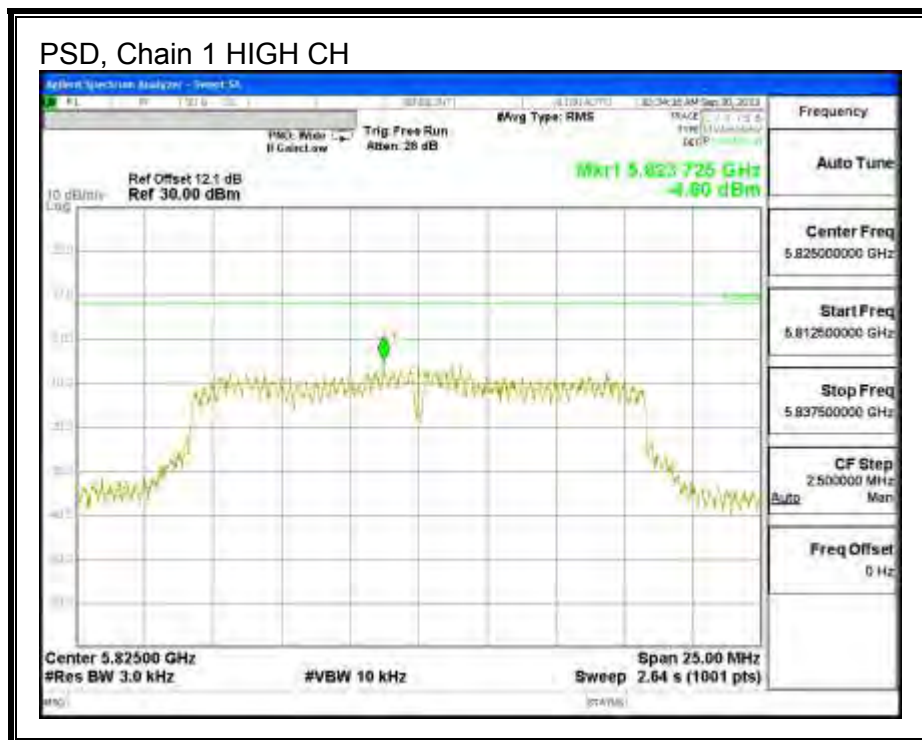
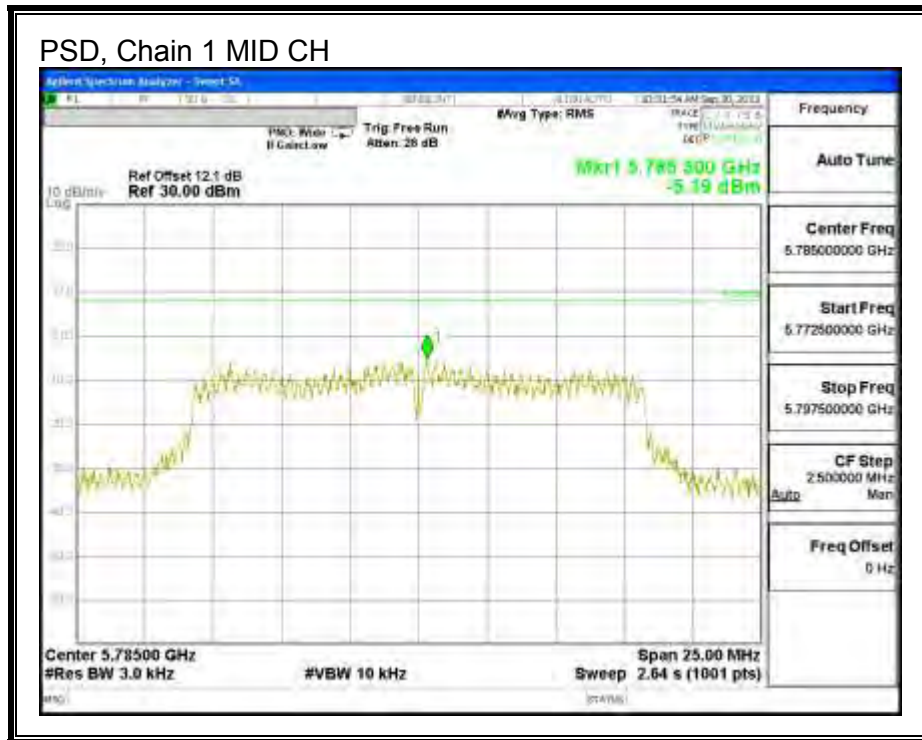
PSD, Chain 0





PSD, Chain 1





8.9.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

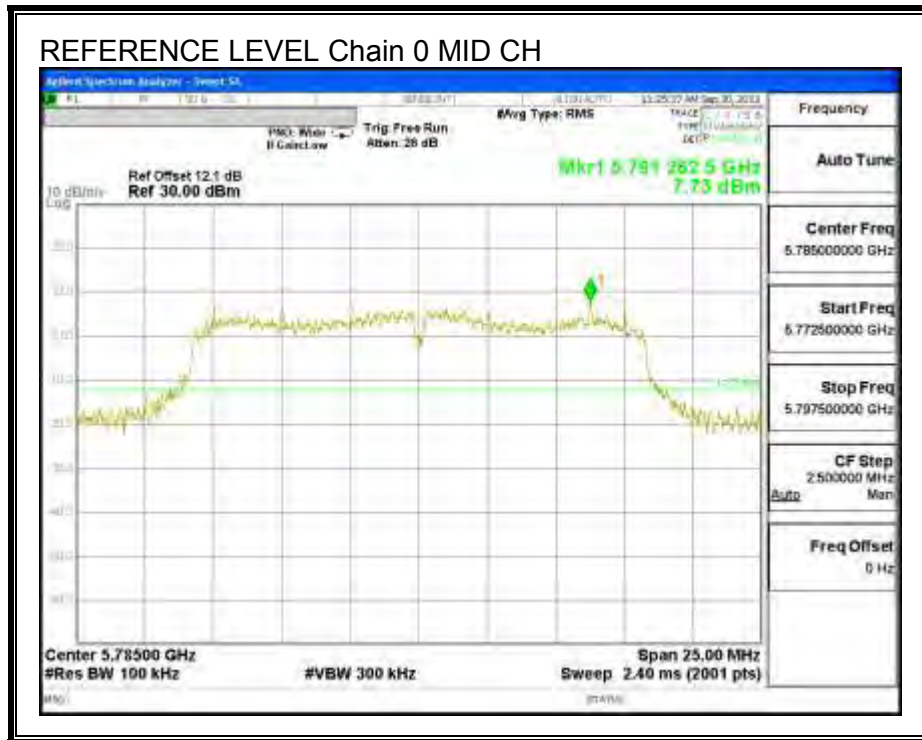
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

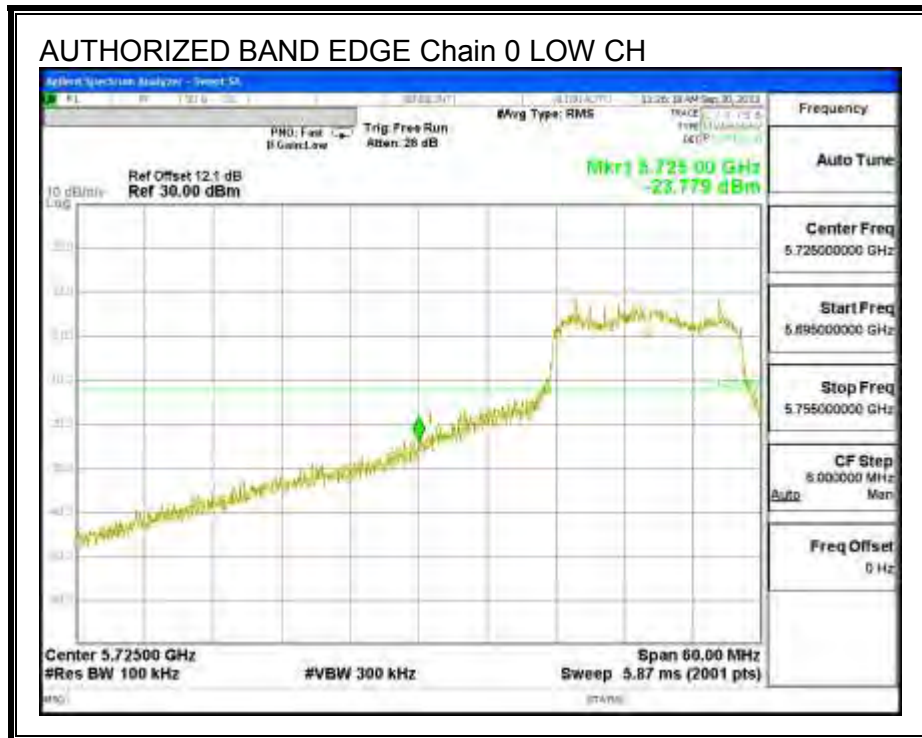
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

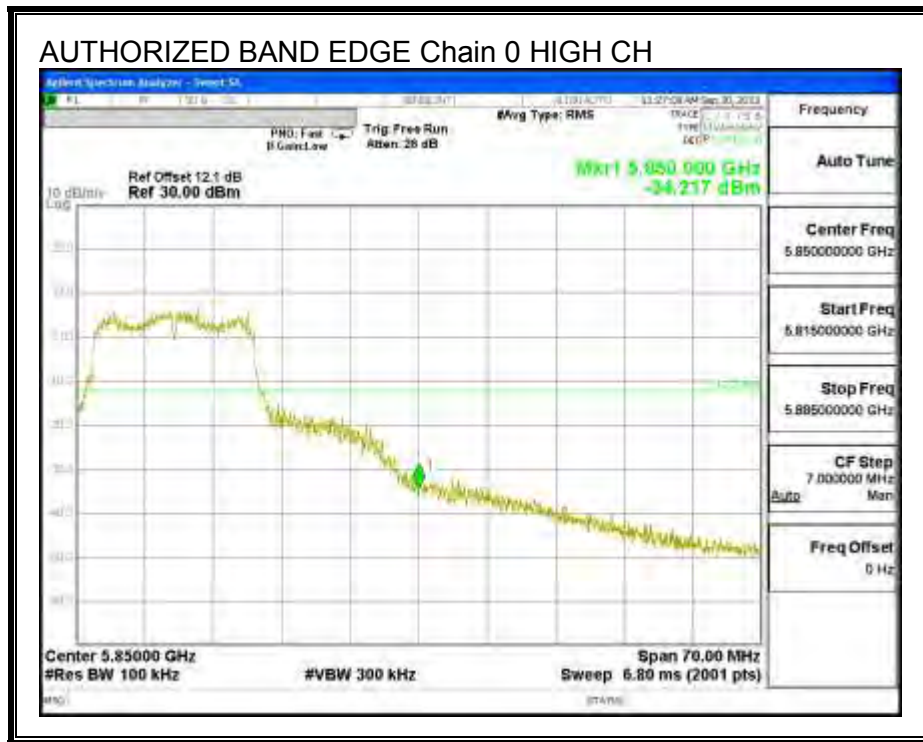
IN-BAND REFERENCE LEVEL, Chain 0



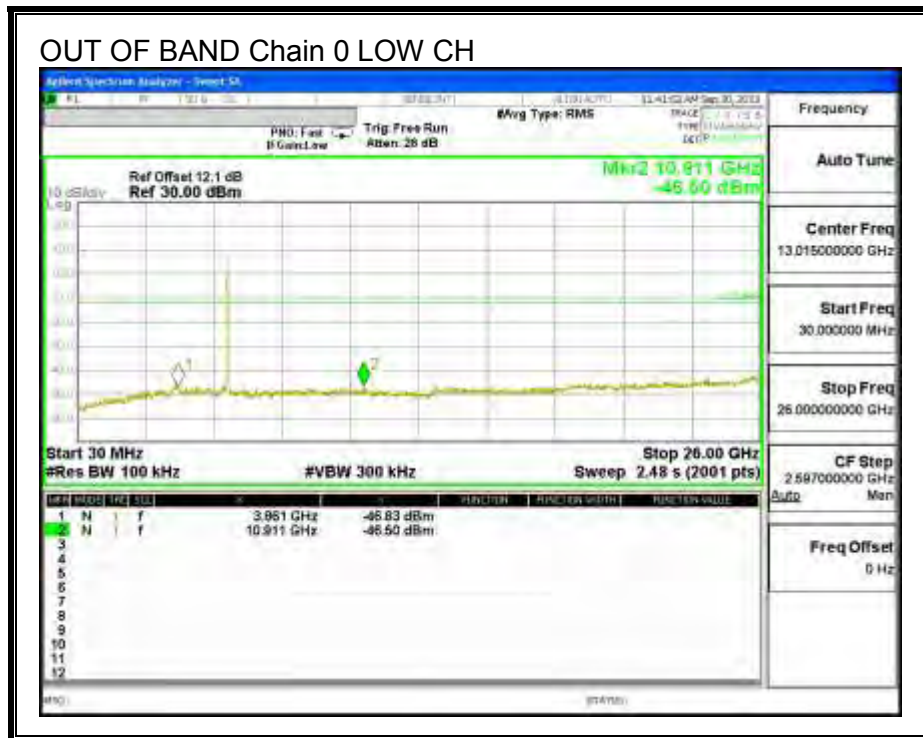
LOW CHANNEL BANDEDGE, Chain 0

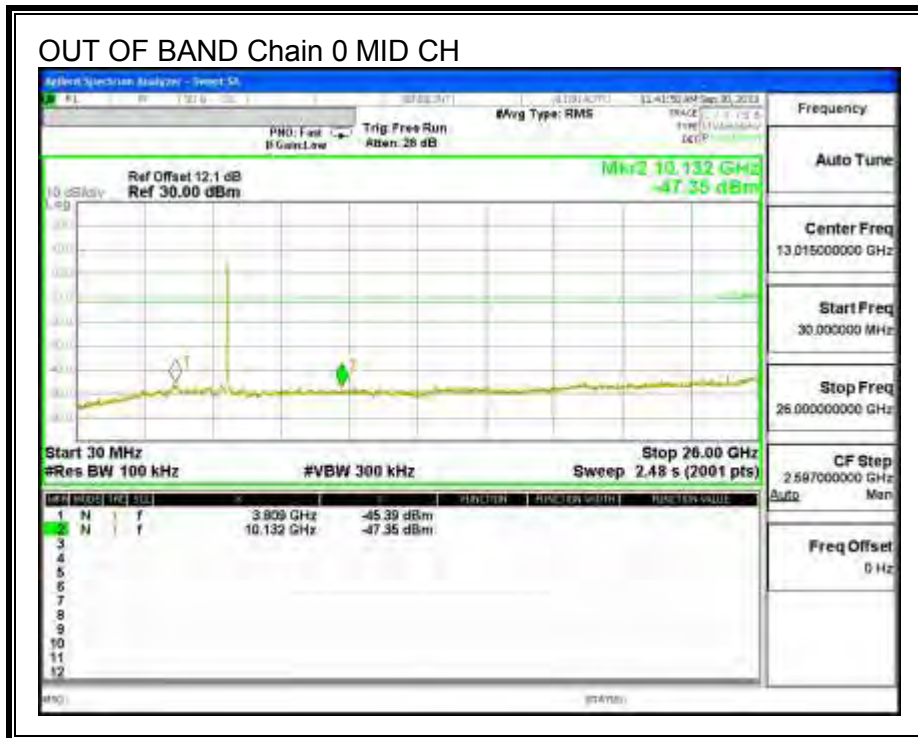
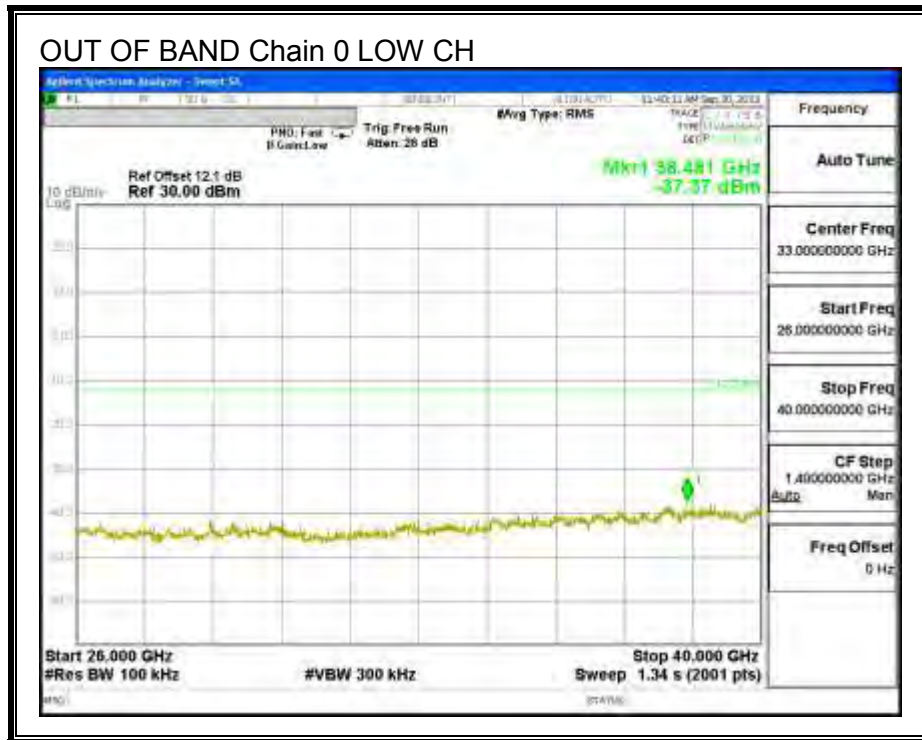


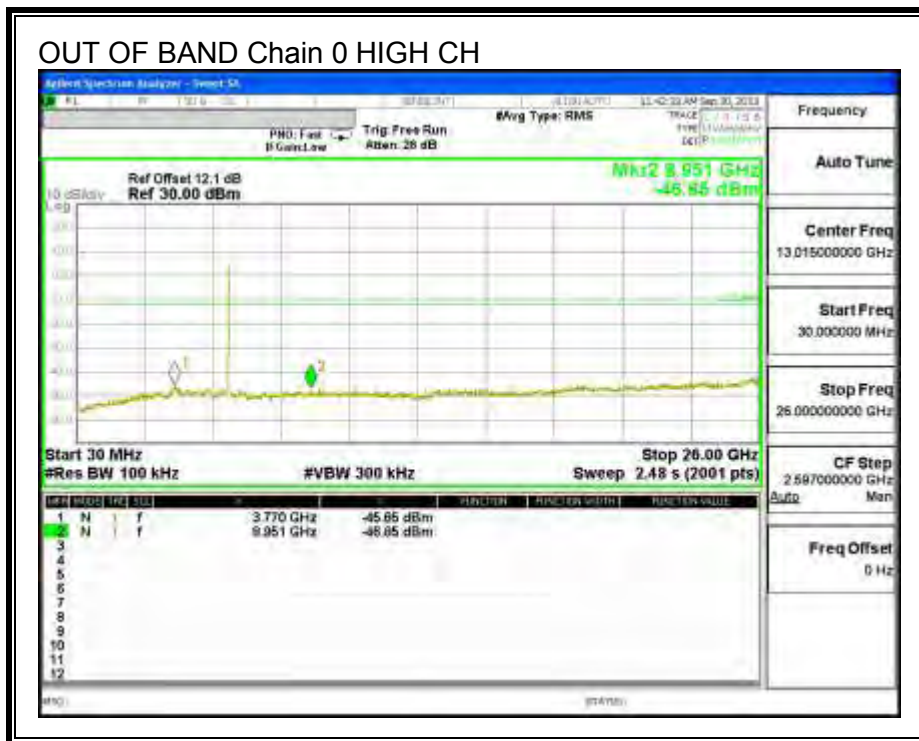
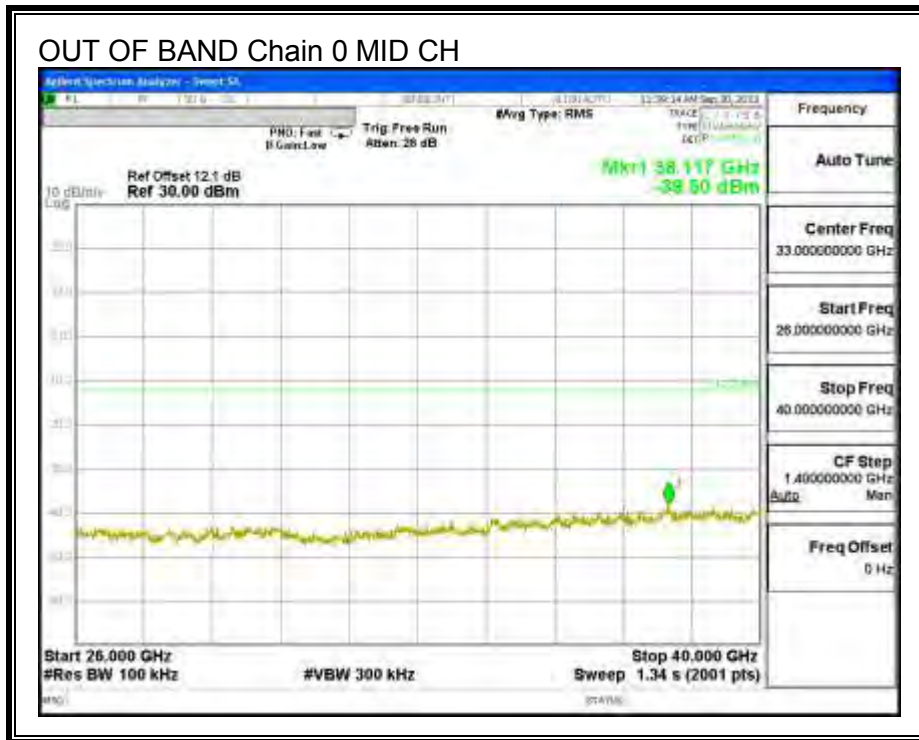
HIGH CHANNEL BANDEDGE, Chain 0

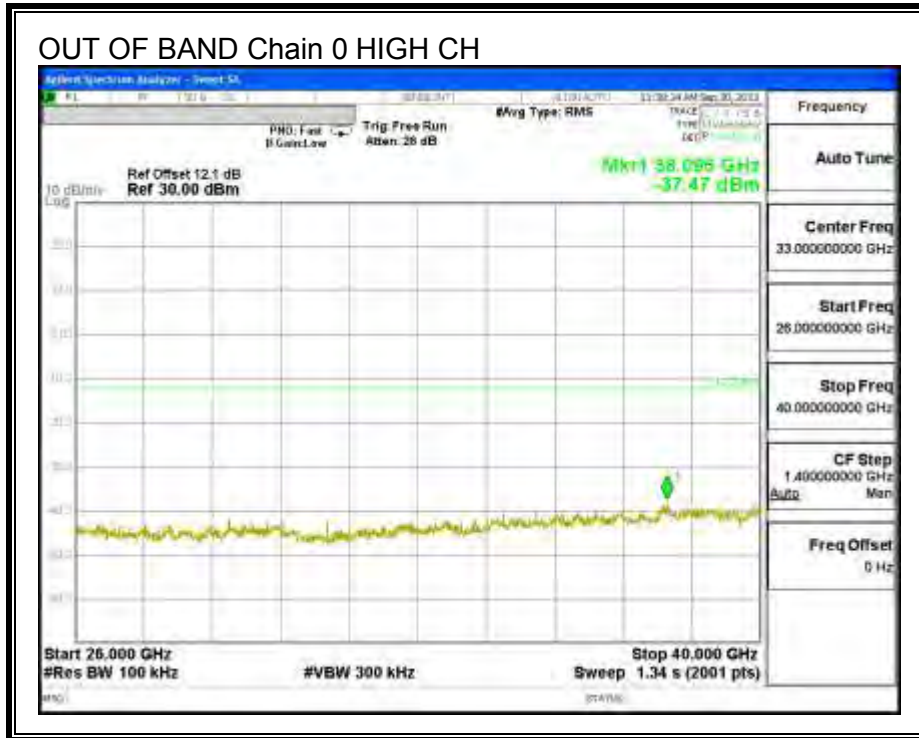


OUT-OF-BAND EMISSIONS, Chain 0

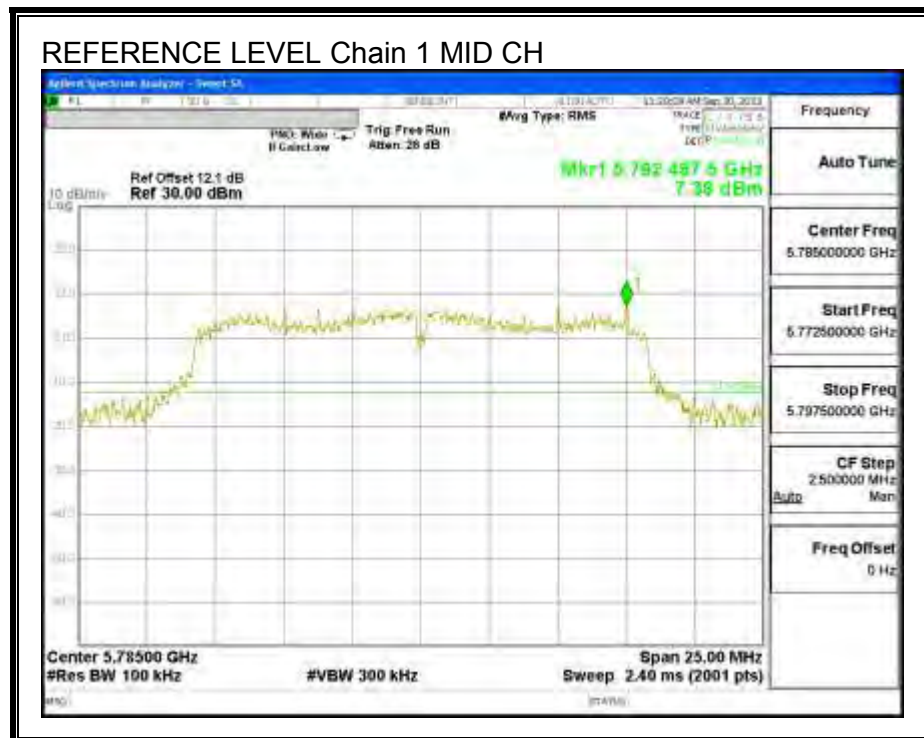




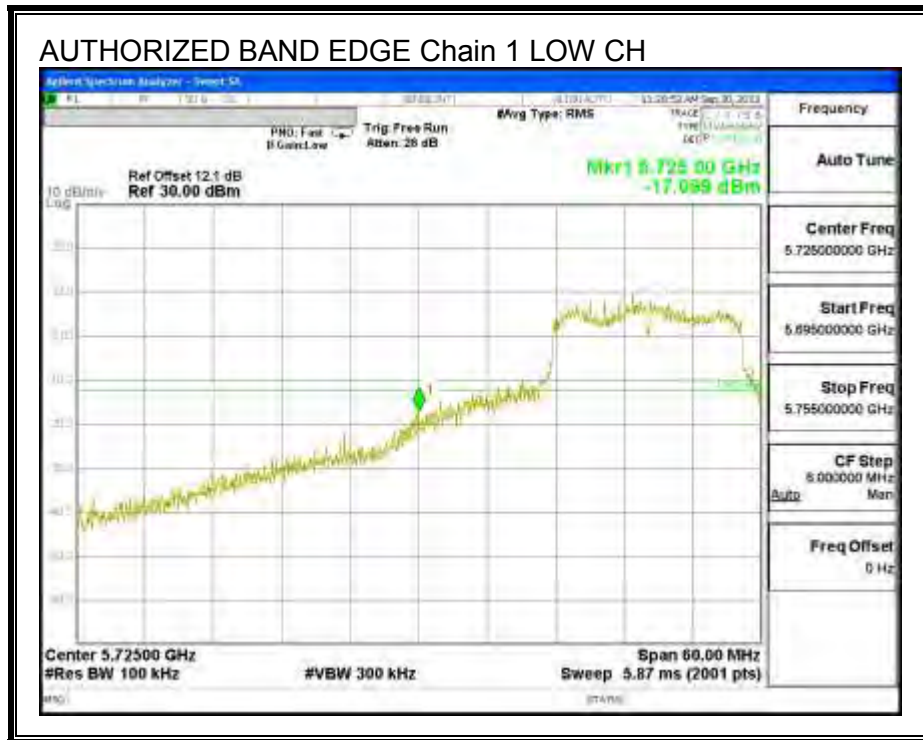




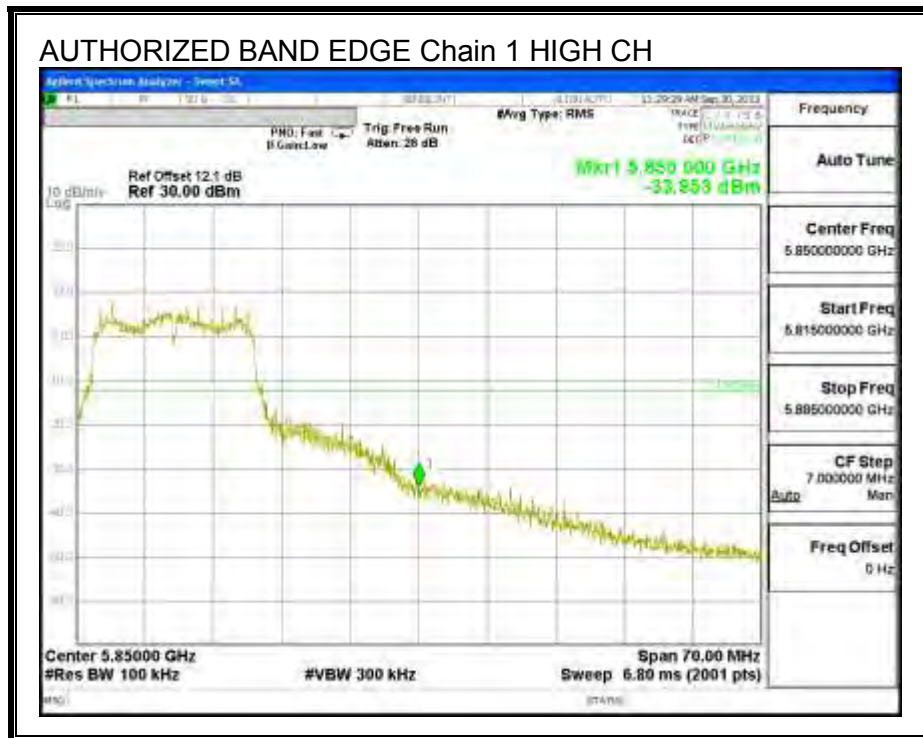
IN-BAND REFERENCE LEVEL, Chain 1

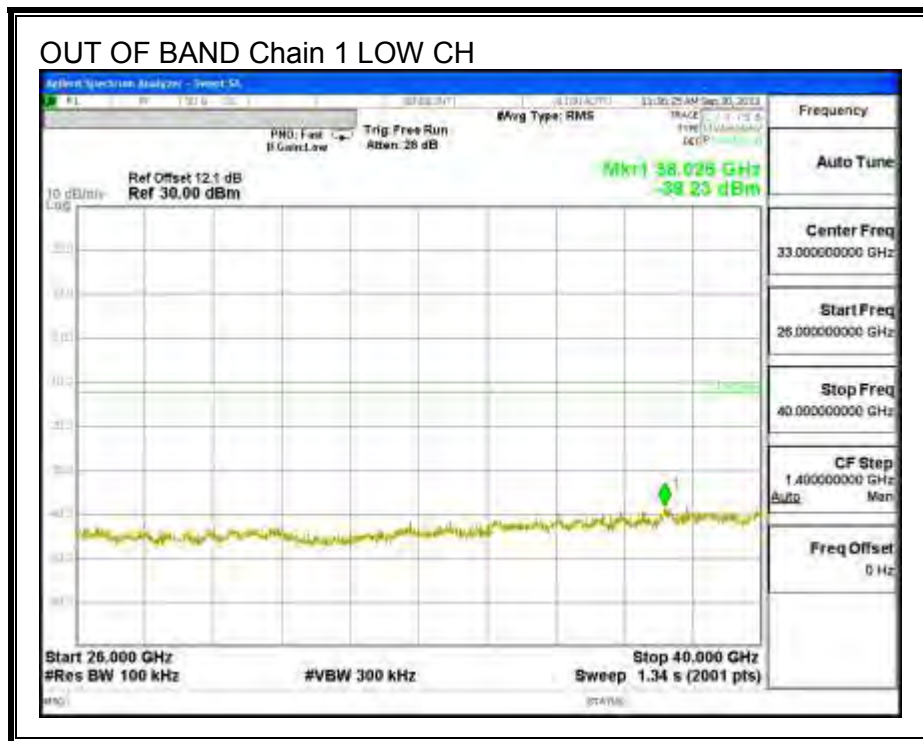
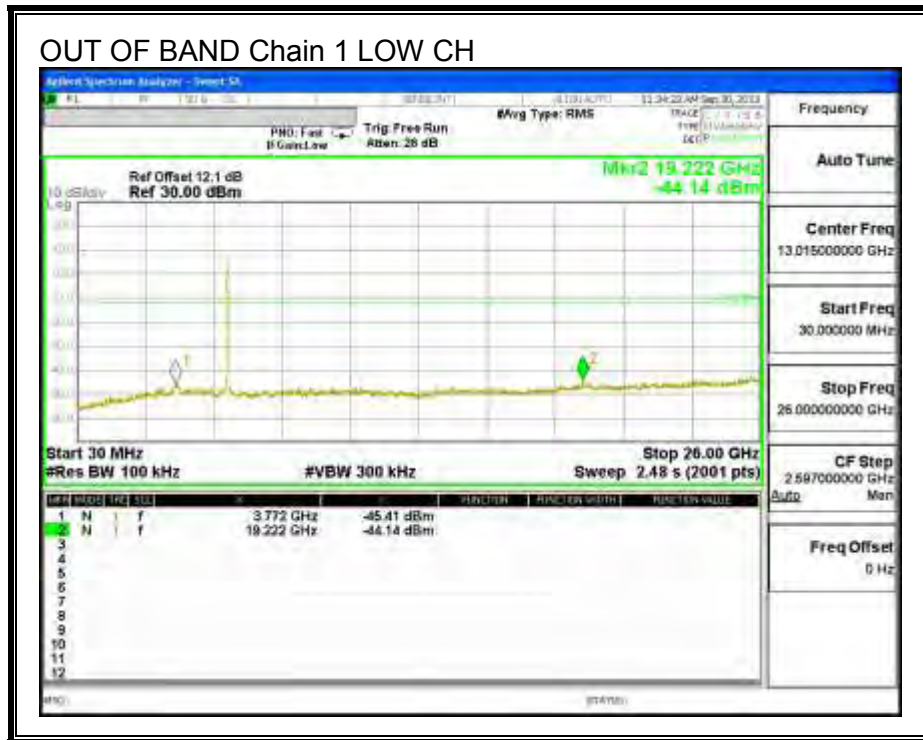


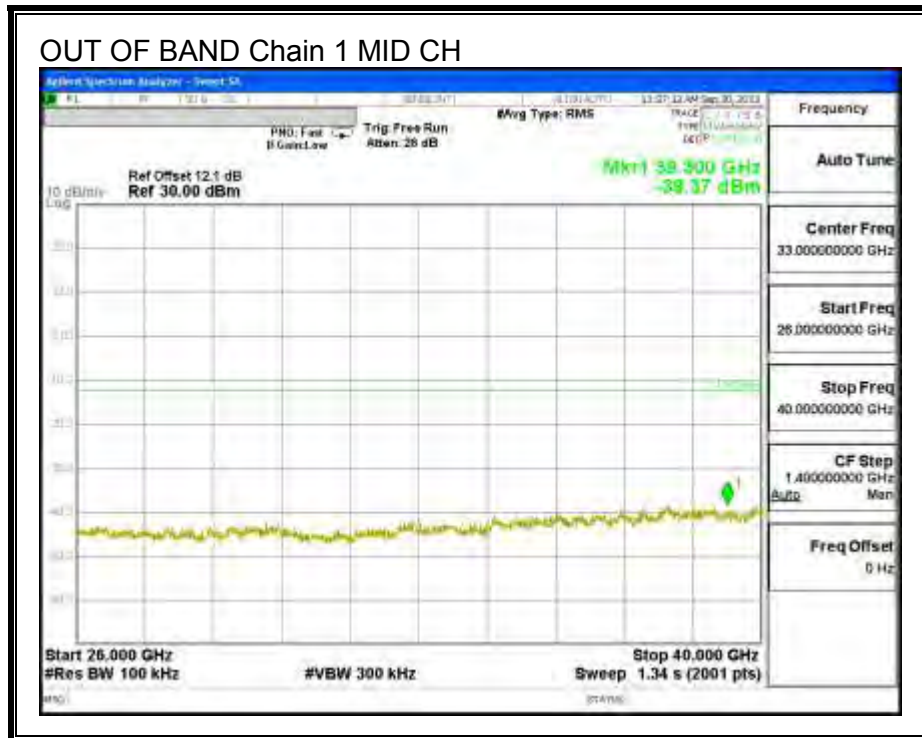
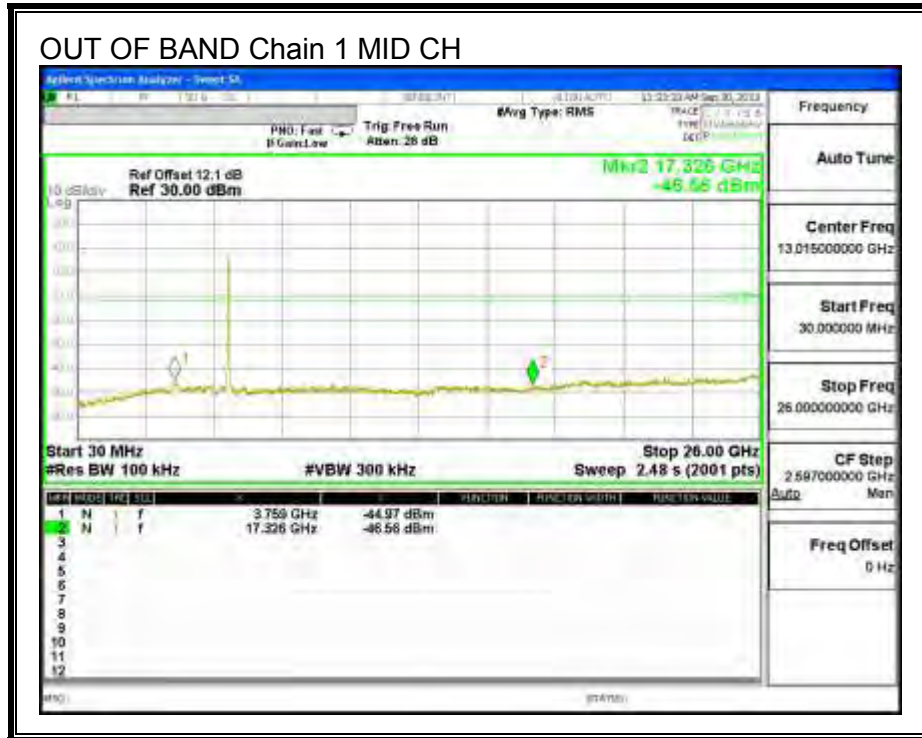
LOW CHANNEL BANDEDGE, Chain 1

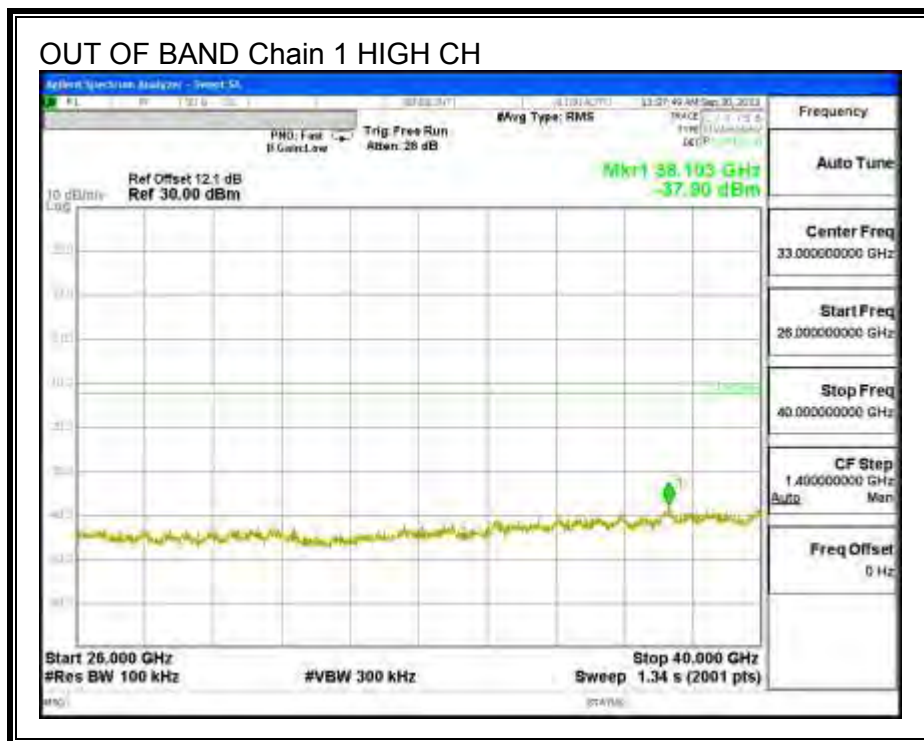
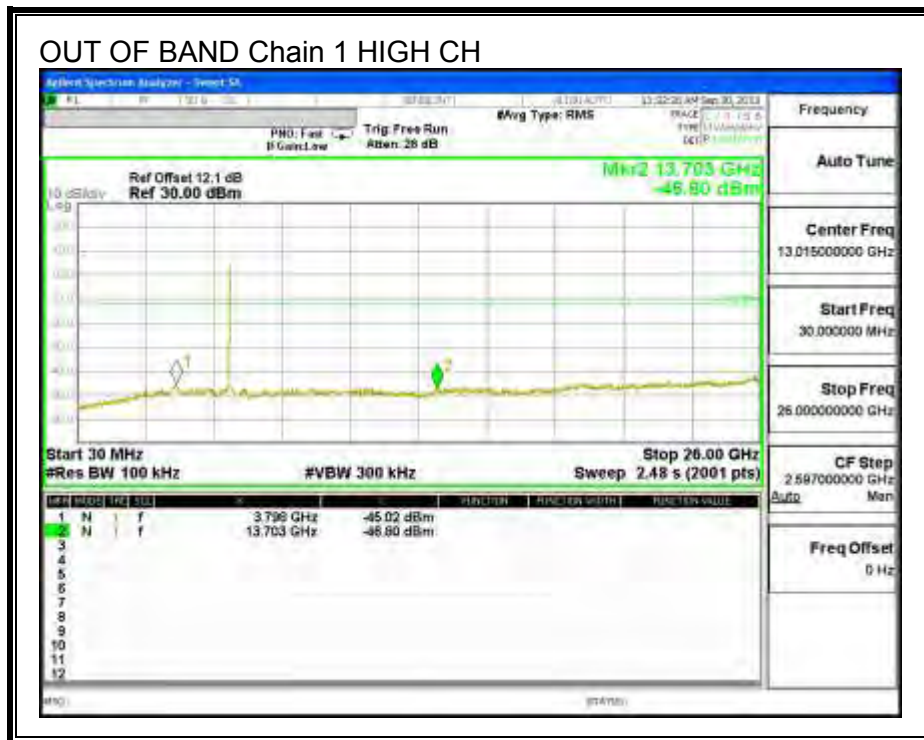


HIGH CHANNEL BANDEDGE, Chain 1









8.10. 802.11n HT20 SISO MODE IN THE 5.8 GHz BAND

8.10.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

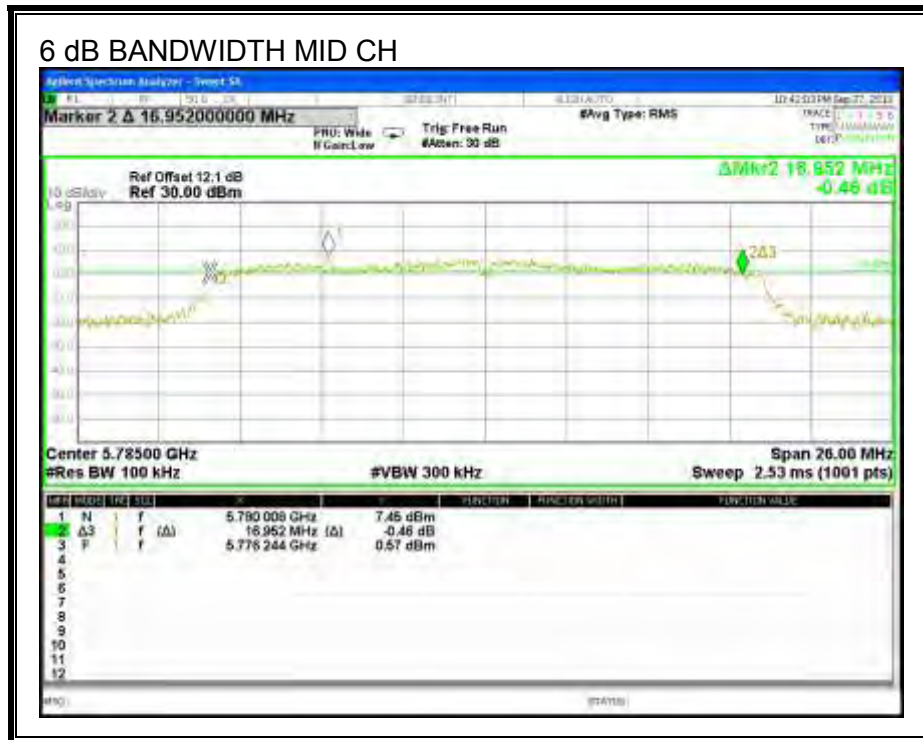
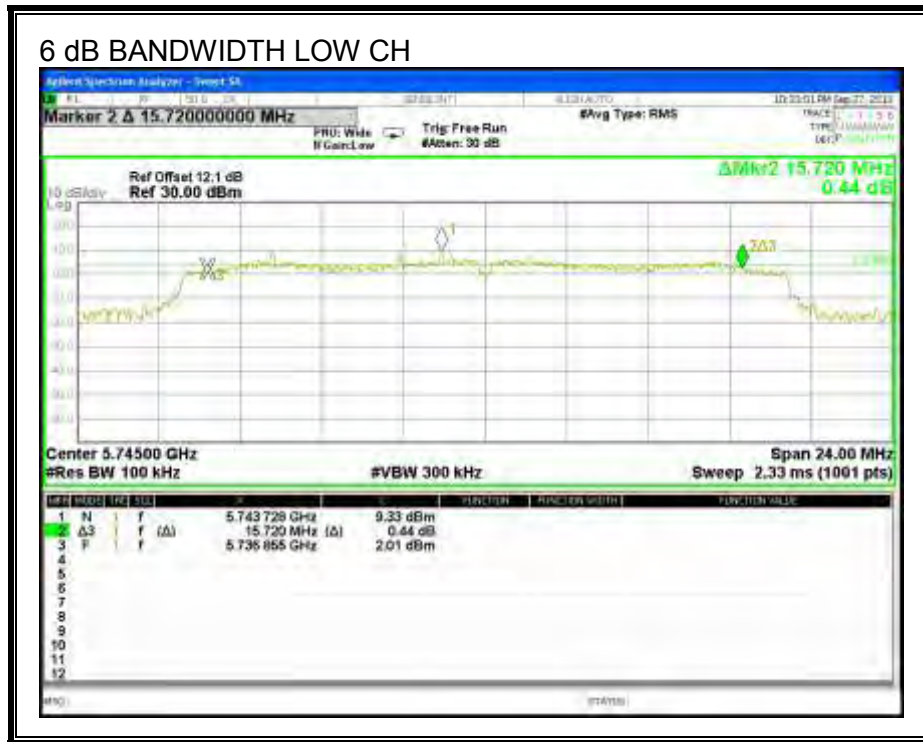
TEST PROCEDURE

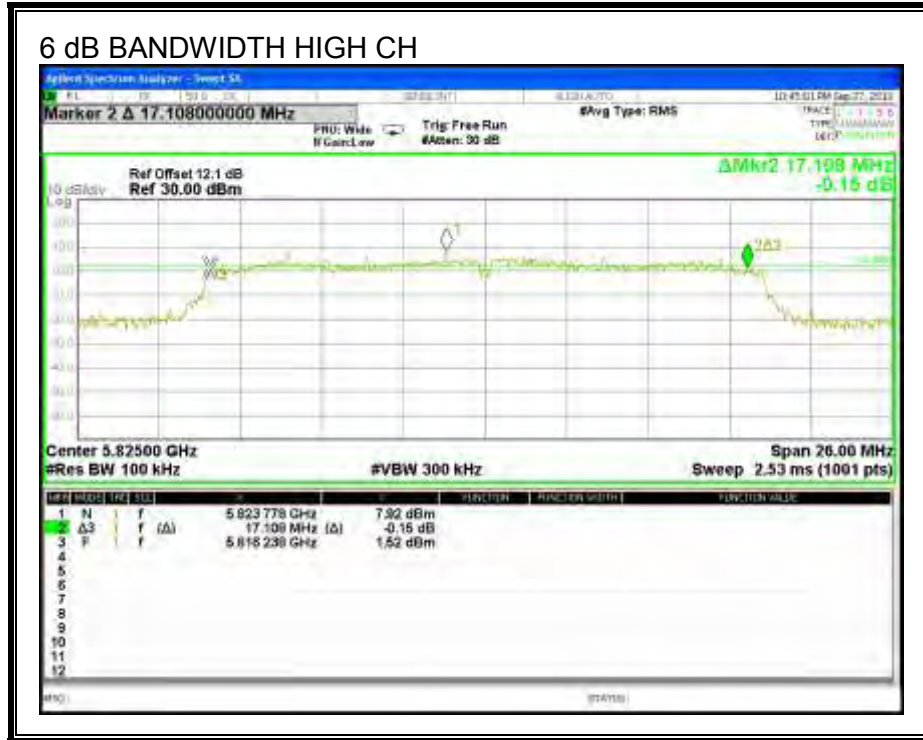
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5745	15.720	0.5
Mid	5785	16.952	0.5
High	5825	17.108	0.5

6 dB BANDWIDTH





8.10.2. 99% BANDWIDTH

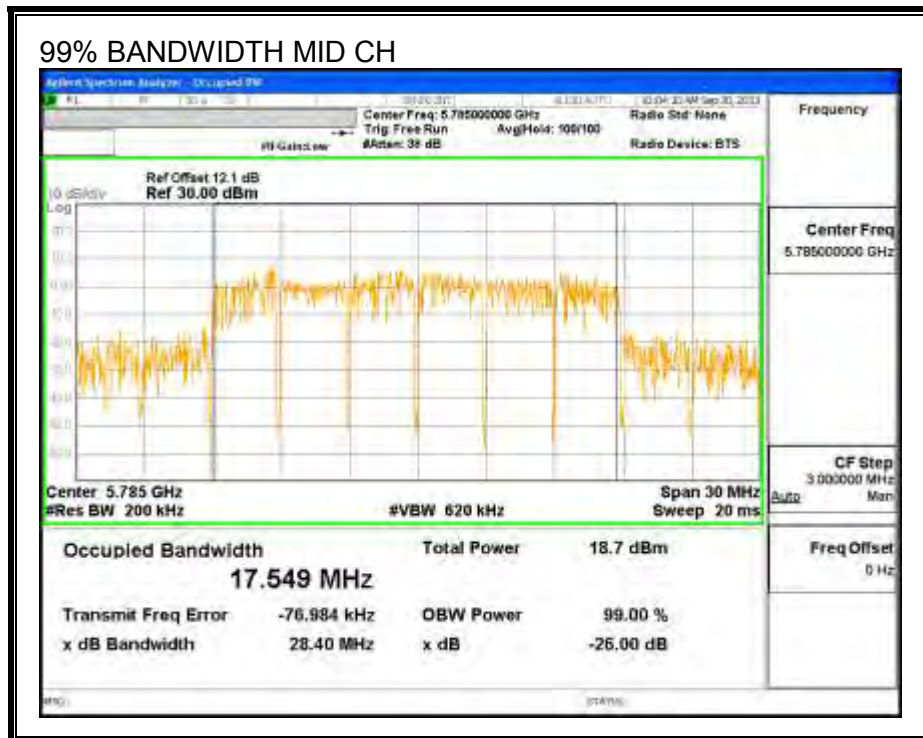
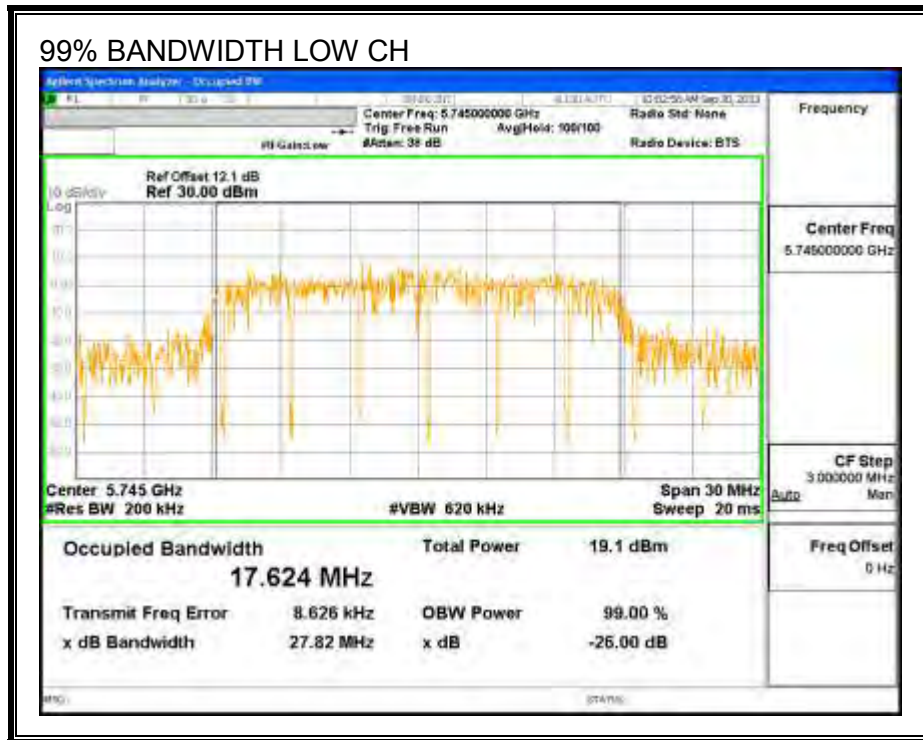
LIMITS

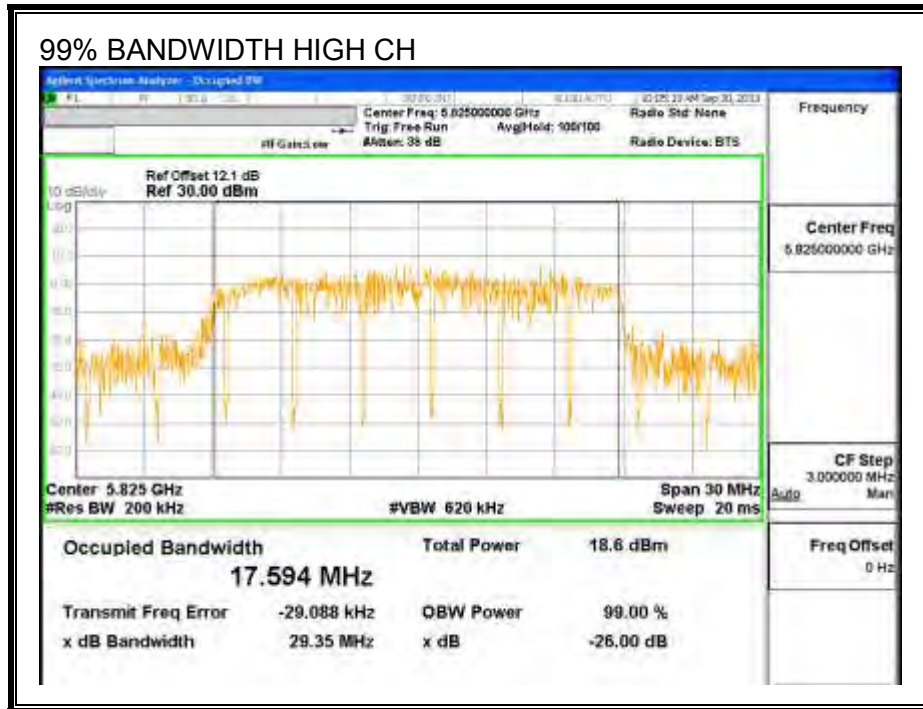
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.624
Mid	5785	17.549
High	5825	17.594

99% BANDWIDTH





8.10.3. 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 12.32dB (including 10 dB pad, 2.1 dB cable, and .22 duty cycle correction factor) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	5745	19.33
Mid	5785	19.22
High	5825	18.86

8.10.4. 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

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

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	3.2	30.00	30	36	30.00
Mid	5785	3.2	30.00	30	36	30.00
High	5825	3.2	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	5745	25.91	25.91	30.00	-4.09
Mid	5785	25.99	25.99	30.00	-4.01
High	5825	25.87	25.87	30.00	-4.13

OUTPUT POWER, Chain 0

