

### 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

**ISSUE DATE: OCTOBER 28, 2013** 

Prepared for

ECHOSTAR 90 INVERNESS CIRCLE EAST ENGLEWOOD, CO 80112, U.S.A.

Prepared by UL VERIFICATION SERVICES INC. 47173 BENICIA STREET FREMONT, CA 94538, U.S.A. TEL: (510) 771-1000 FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

#### **Revision History**

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

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# **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.

Approved & Released For UL Verification Services Inc. By:

THU CHAN WiSE Operations Manager UL Verification Services Inc.

Tested By:

MONA HUA WiSE Test Engineer UL Verification Services Inc.

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# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, 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
Chamber A	Chamber D
Chamber B	🛛 Chamber E
Chamber C	🛛 Chamber F

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

# 4. CALIBRATION AND UNCERTAINTY

# 4.1. MEASURING INSTRUMENT CALIBRATION

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

# 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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# 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%.

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# 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	Mode	Output Power	Output Power
(MHz)		(dBm)	(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 Cha	annels	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	Anten	na Gain	Uncorrelated Gain	Correlated Gain	
(GHz)	Tx0	Tx1	Sheorrelated Gam		
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.

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## 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)

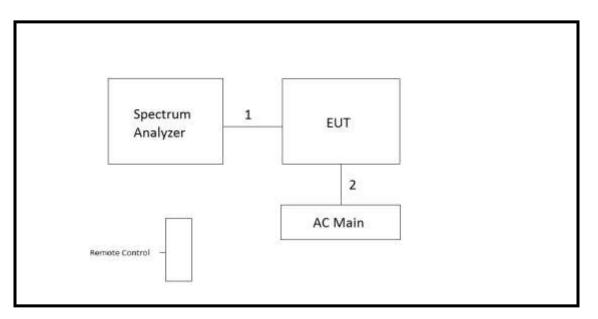
	I/O Cable List										
Cable	Port	# of identical	Connector	Cable Type	Cable	Remarks					
No		ports	Туре		Length (m)						
1	Antenna	1	SMA	COAX	0.1m	To Spectrum Analyzer					
2	AC	1	AC	Un-Shielded	1.5m	NA					

#### I/O CABLES (RADIATED TEST)

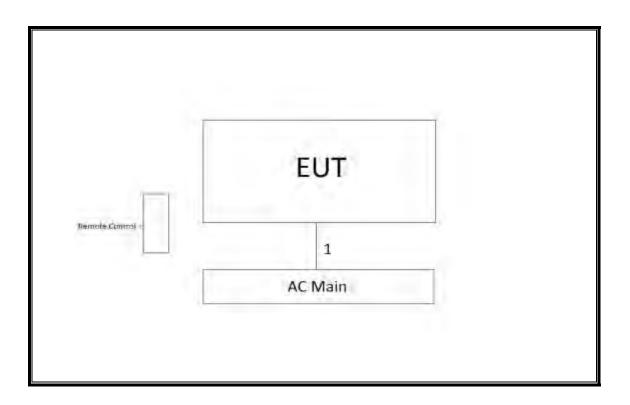
	I/O Cable List									
Cable	Cable Port # of identical		Connector	Cable Type Cable		Remarks				
No		ports	Туре		Length (m)					
4	AC	4	AC	Un-Shielded	1.5m	NA				

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#### SETUP DIAGRAM FOR CONDUCTED TESTS



#### SETUP DIAGRAM FOR RADIATED TESTS



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# 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.

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# 7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

# 7.1. MEASUREMENT METHODS

<u>6 dB BW</u>: 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.

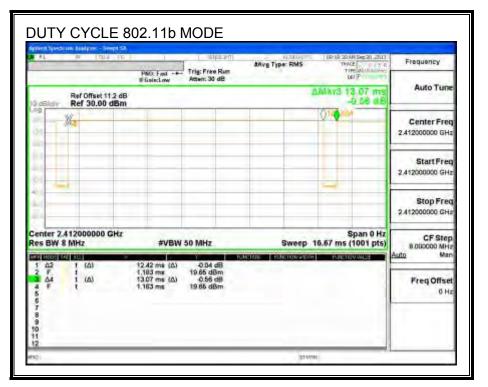
#### PROCEDURE

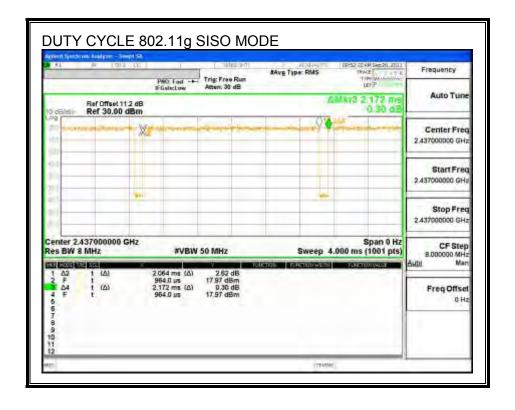
KDB 789033 Zero-Span Spectrum Analyzer Method.

Mode	<b>ON</b> Time	Period	<b>Duty Cycle</b>	Duty	Duty Cycle	1/T
	В		х	Cycle	<b>Correction Factor</b>	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(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

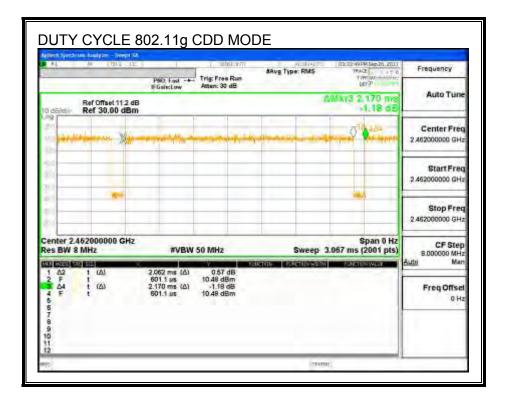
### 7.2.1. DUTY CYCLE PLOTS

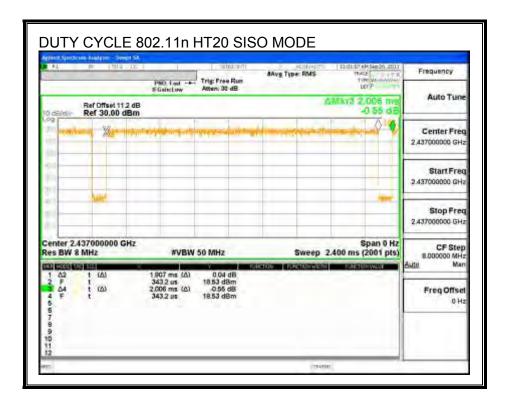
#### 2.4 GHz Band





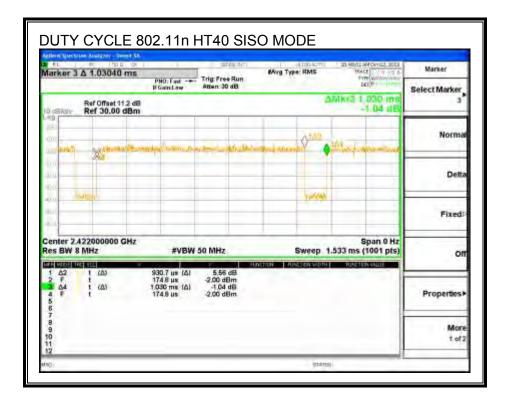
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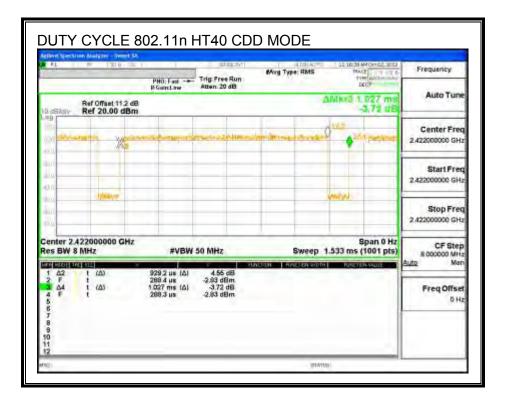


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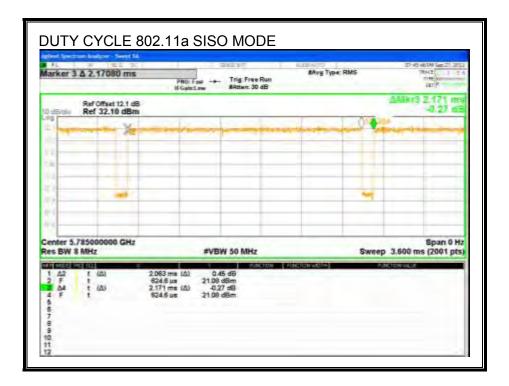
*1	in (ma.).cc	PSO Fast -+	Trig: Free Run Atten: 30 dB	AAve Type: RMS	TPA2	Frequency
0 d8/di/-	Ref Offset 11.2 dB Ref 30,00 dBm				AMK/3 2.008 mis -0.27 dB	Auto Tune
		No Badrin	and the second second	A Martin Provide South	A Continuous antipe	Center Freq 2,437000000 GHz
0.0						Start Freq 2.437000000 GHz
					*	Stop Freq 2.437000000 GHz
enter 2. tes BW 8	437000000 GHz 8 MHz	#VBW	50 MHz	Sweep	Span 0 Hz 3.067 ms (2001 pts)	CF Step 8.000000 MHz
1 Δ2 2 F 0 Δ4 4 F 5 5 7 8 9 10	t (A) t t t t	1.907 ms (Δ) 529.0 as 2.006 ms (Δ) 629.0 as	251 dB 16 65 dBm 0.27 dB 16.65 dBm	Alertak (Parentak work	E FUNETRAN WAVE	Freq Offset 0 Hz



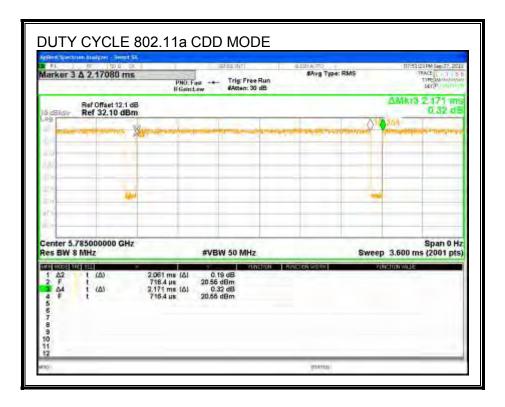
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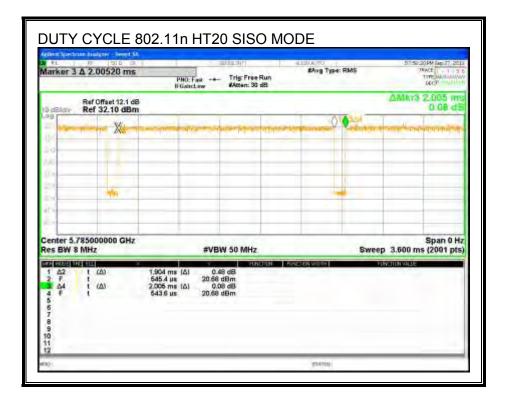


#### 5.8GHz Band



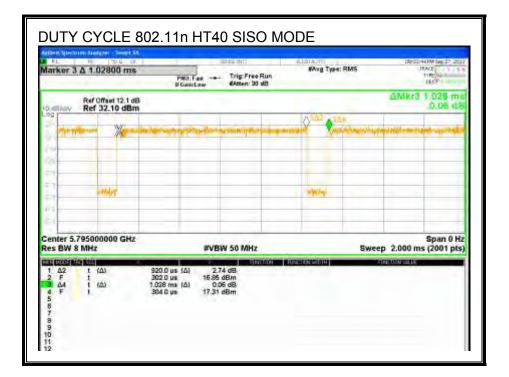
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Marker 3 $\Delta$ 2	.00520 ms	PHO: Fast ++	Trig Free Run #Atten: 30 dB	#Avg Type:	RMS	17	UNCE [] - 3 - 5 1 THE W DECE
0 dellaty Re	f Offset 12.1 dB f 32.10 dBm					AMIN'S:	0.27 us
		wet	UN TO DUI		and a state of the	Q'	1
Center 5.7850 Res BW 8 MH		#VE	SW 50 MHz		Sweep	3.600 ms	Span 0 Ha
1 Δ2 t 2 F t 3 Δ4 t 4 F t 5 7 8 9 10 11	(白) 1.9 (白) 1.2 (白) 2.0	56 ms (Δ) 0	26 dB 7 dBm 27 dB 27 dB 8 dBm	HINCOR WOTH	ηι	NCTION VALUE	



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	3 ∆ 1.03000 ms	1		Trig: Free F #Atten: 30 s	tun	sAvg Typ	e: RMS	182-50	HAD DE TO 201 TRACE
5 dElety	Ref Offset 12.1 de Ref 32.10 dBn				_			AMARS	0.01 de
0g	W.		and.	i i inn		0102	304	Carmente	
2	patron Mart	and the second		2-Davinit	of the state of th		Section Advances	- and the party of	and the second second
- 0									
1									
	The state		-	_			1		
-	ALL		-	-		Anifelia)			-
-									
	5.795000000 GHz 8 MHz		#VBW	/ 50 MHz		1	Swi	rep 2.000 n	Span 0 Ha
1 A2	t (Δ)	922.0 us (Δ)	1.88		IDH THIS	C ON VEDICAL		FOR THIS WAR	-
2 F 4 5 5 5 7 8 9 0 1 2	i cas	319.0 με 1,030 ms (Δ) 319.0 με	17.55 d 0.01 17.55 d	dB					

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# 8. ANTENNA PORT TEST RESULTS

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

### 8.1.1. 6 dB BANDWIDTH

#### <u>LIMITS</u>

FCC §15.247 (a) (2)

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

#### TEST PROCEDURE

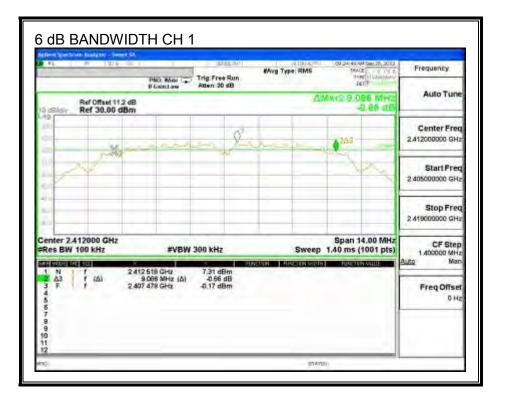
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

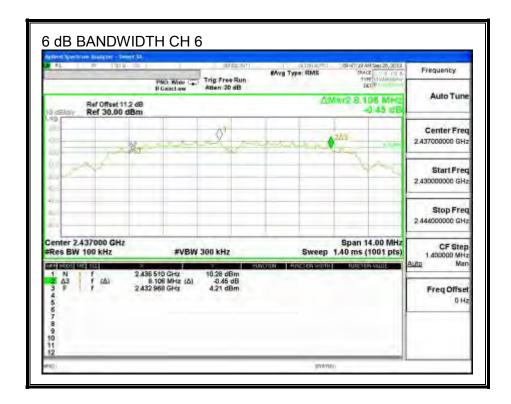
#### **RESULTS**

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

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#### 6 dB BANDWIDTH





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RL IN THE	Pilo: Miler 😱	Trig Free Run Atten 30 dB	Morg Type: RMS	109-34-22-89 Sep 26, 2013 104-22 - 11-13-5 1118 11-13-6 1418 11-14-6-6-6-7 160 P	Frequency
Ref Offset 11.2 Ref 30.00 dB		Allen 20 ab	۵۸	18/2 9.114 MH2 0.01 #B	Auto Tuni
	- man	e e	have	12A3	Center Free 2.462000000 GH
				Jac -	Start Free 2.455000000 GH
					Stop Free 2.469000000 GH
enter 2.462000 GHz Res BW 100 kHz	#vBW	300 kHz	Sweep	Span 14.00 MHz 1.40 ms (1001 pts)	CF Step
24 Δ102 Δ124 Δ103 1 N T 3 F T 5 6 7 8 9 9 0 1 2	2.482 519 GHz 9.114 MHz (Δ) 2.457 450 GHz	7,76 dBm 0.01 dB 0.47 dBm	ALIGN PROTOKOVAL	HIGH GAROUT	Auto Mar Freq Offse 0 H

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### 8.1.2. 99% BANDWIDTH

#### **LIMITS**

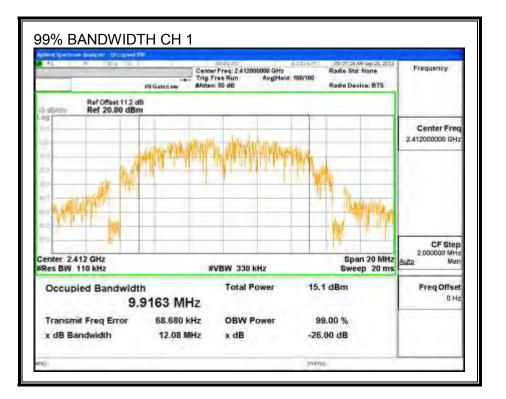
None; for reporting purposes only.

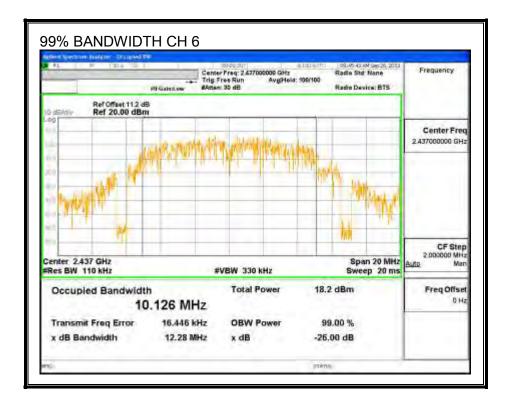
#### **RESULTS**

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

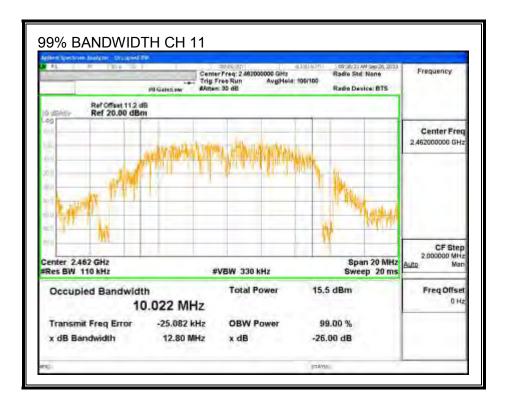
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#### 99% BANDWIDTH





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### 8.1.3. AVERAGE POWER

#### <u>LIMITS</u>

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

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### 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**

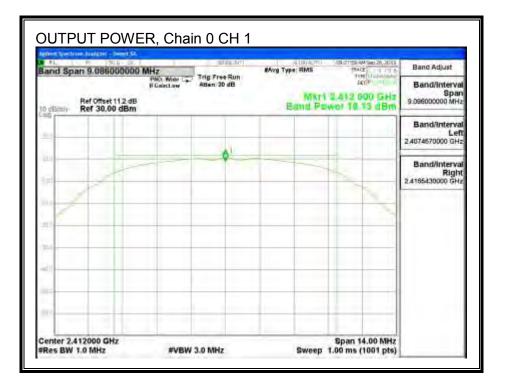
Limits						
Channel	Frequency	requency Directional		IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
1	2412	3.1	30.00	30	36	30.00
6	2437	3.1	30.00	30	36	30.00
11	2462	3.1	30.00	30	36	30.00

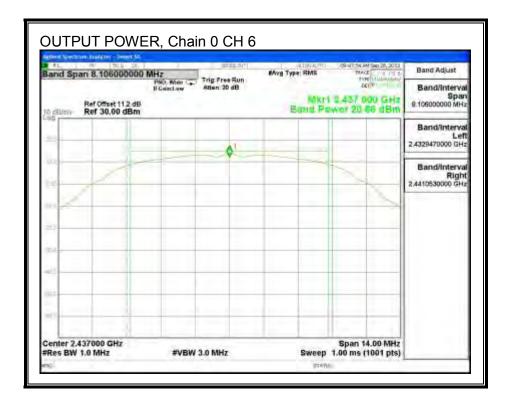
Results

Channel	Frequency	Chain 0	Total	Power	Margin
		Meas	Corr'd	Limit	
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(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

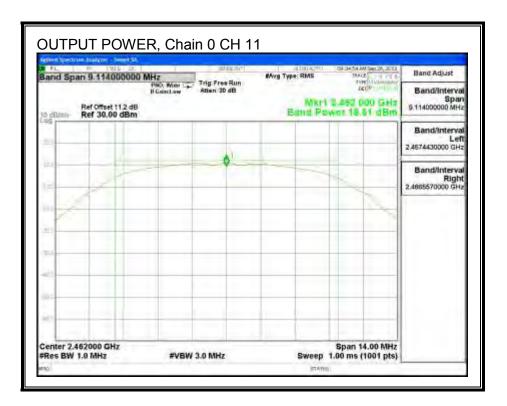
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#### **OUTPUT POWER, Chain 0**





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#### 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.

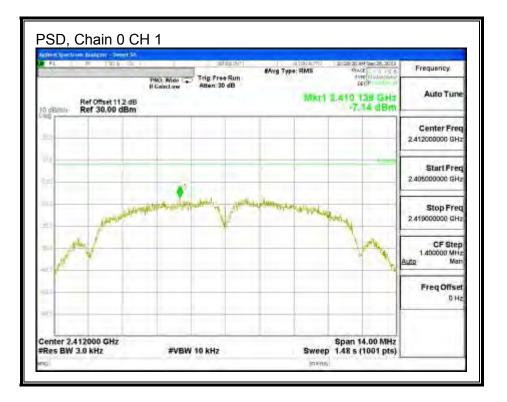
#### **RESULTS**

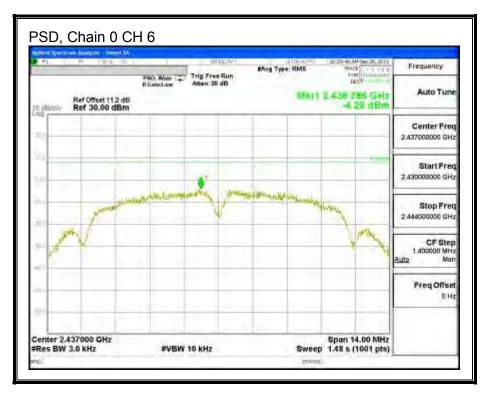
#### **PSD** Results

Channel	Frequency	Chain 0	Limit	Margin
		Meas		
	(MHz)	(dBm)	(dBm)	(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

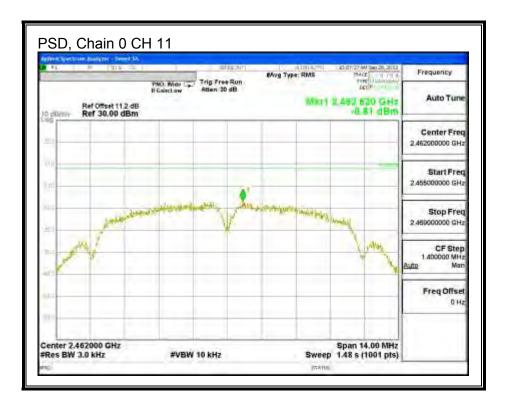
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#### PSD, Chain 0





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### 8.1.6. OUT-OF-BAND EMISSIONS

#### <u>LIMITS</u>

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.

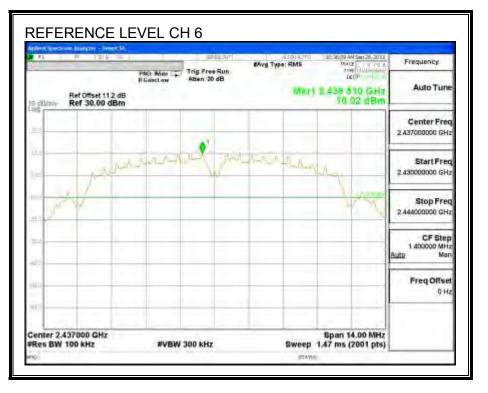
#### TEST PROCEDURE

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 inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

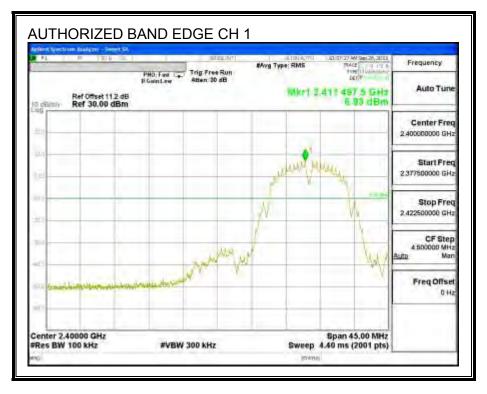
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### **RESULTS**

### **IN-BAND REFERENCE LEVEL**

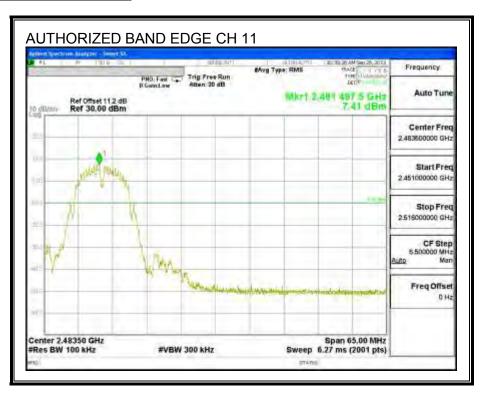


### LOW CHANNEL BANDEDGE

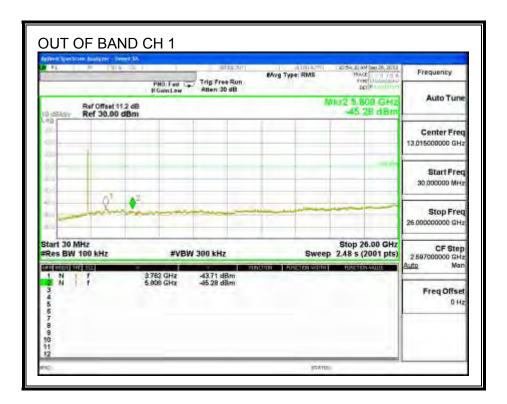


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#### HIGH CHANNEL BANDEDGE

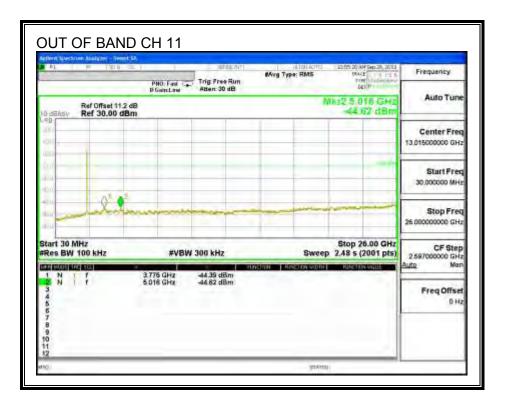


### **OUT-OF-BAND EMISSIONS**



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*L	THE THE	PNO: Fast	Trig Free Run Atten 30 dB	Myg Type: RMS	E-5641.MV Sep.26, 2013 MACE 11 1 3 5- fride Litzbandson LGTP	Frequency
10 desiletiy	Ref Offset 11.2 dB Ref 30.00 dBm		Such to all		Wkr2 8,912 GHz 	Auto Tun
						Center Free 13,015000000 GH
						Start Free 30.000000 MH
	-li-	mili			-	Stop Free 26.00000000 GH
Start 30 #Res BV	MHz V 100 kHz	#VBW	300 kHz	Swee	Stop 26.00 GHz p 2.48 s (2001 pts)	CF Ster 2.597000000 GH
1 N N 3 4 5 6 7 8 9 10 11 12		3879 GHz 9913 GHz	-44.41 dBm -45.64 dBm	NCIRN   ANCIEN WITH	HIGHTS VALUE OF	Auto Mar Freq Offse 0 H



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# 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

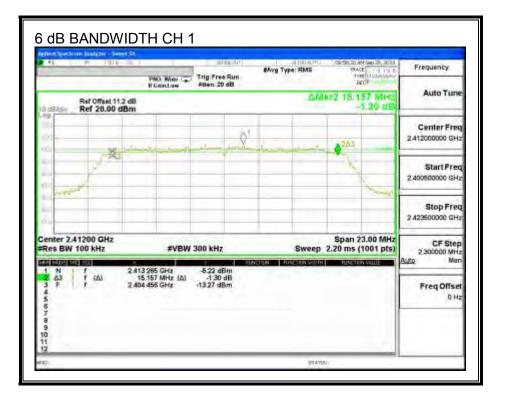
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

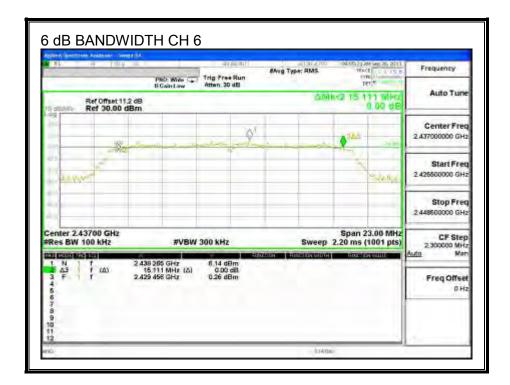
### <u>RESULTS</u>

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

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#### 6 dB BANDWIDTH





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-		a tari e		PMO: Mor 💭	Trig Free	Bun	Mvg Type: F	RMS	784	09 Sep 28, 2013 CE	Frequency
10 65		of Offset 11.		If Gainchow	Atten 20	dB		<u>L</u> IAK	_	61 <sup>P</sup> 84 MH2 9.42 UB	Auto Tun
000		- 1/-	- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1-			Ø'	1 ml	-	243		Center Fre 2.46200000 GH
2000 2020 -2070	1	1.000							3		Start Fre 2.450500000 GH
										~	Stop Fre 2.473500000 GH
#Res	er 2.462 BW 10	) kHz		#VBW	300 kHz		S		.20 ms (	23.00 MHz (1001 pts)	CF Ste 2.300000 Mi Auto Ma
1	N 13	εΔì	. 15	265 GHz 134 MHz (Δ) 456 GHz	-2.52 df -0.42 -10.03 df	3m dB					Freq Offse 5 H

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## 8.2.2. 99% BANDWIDTH

### **LIMITS**

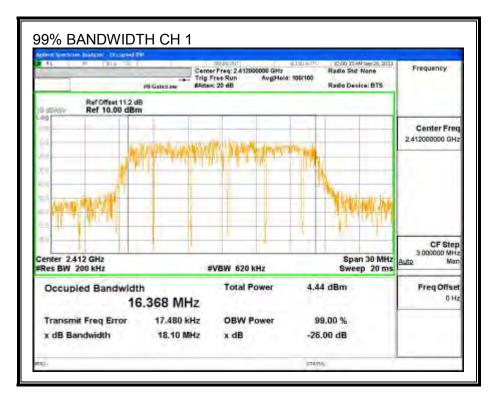
None; for reporting purposes only.

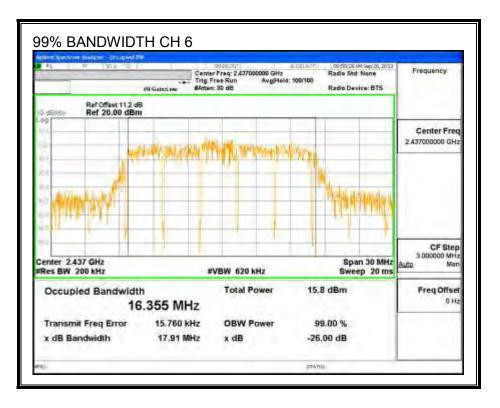
### **RESULTS**

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

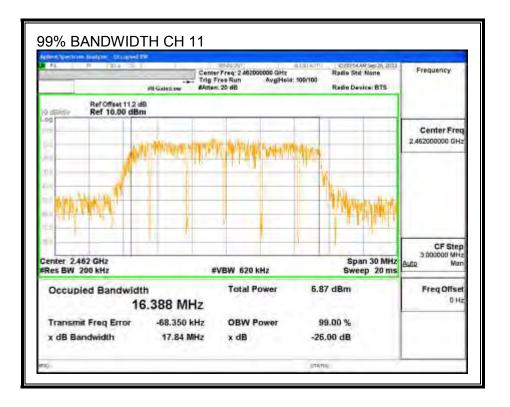
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#### 99% BANDWIDTH





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## 8.2.3. AVERAGE POWER

### <u>LIMITS</u>

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	Power
	(MHz)	(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

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# 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**

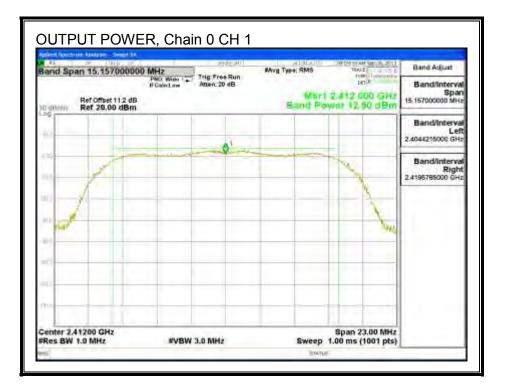
Limits	Limits										
Channel	Frequency	Directional	FCC	IC	IC	Max					
		Gain	Power	Power	EIRP	Power					
			Limit	Limit	Limit						
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)					
1	2412	3.1	30.00	30	36	30.00					
4	2427	3.1	30.00	30	36	30.00					
6	2437	3.1	30.00	30	36	30.00					
7	2442	3.1	30.00	30	36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

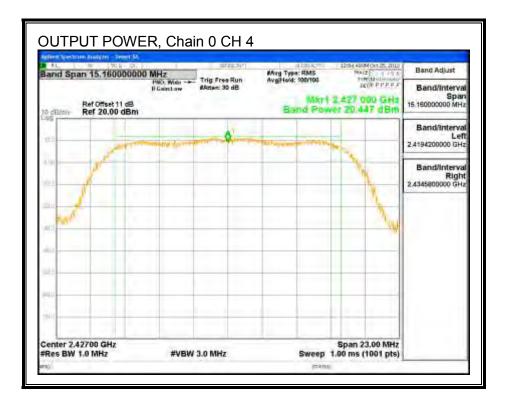
#### Results

Channel	Frequency	Chain 0	Total	Power	Margin
		Meas	Corr'd	Limit	
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(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

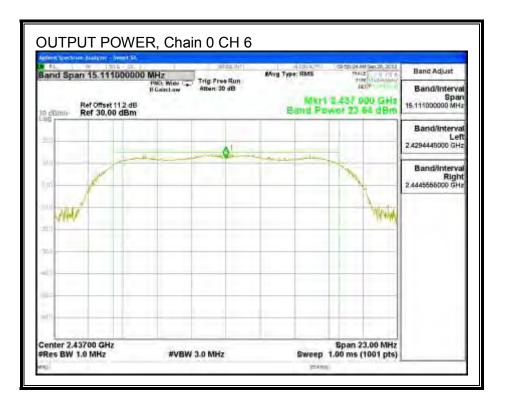
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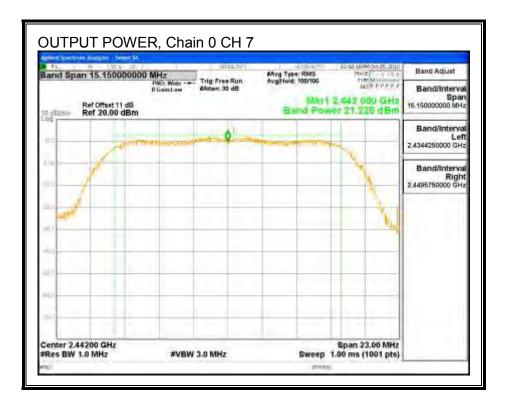
### **OUTPUT POWER, Chain 0**



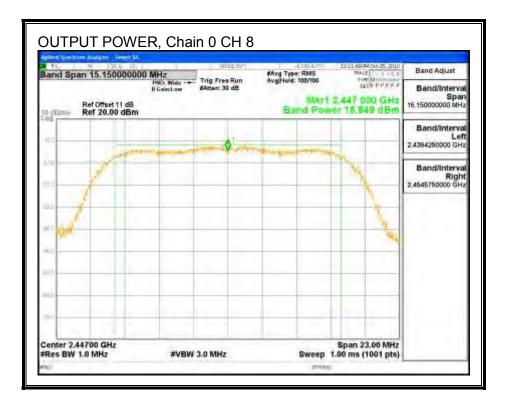


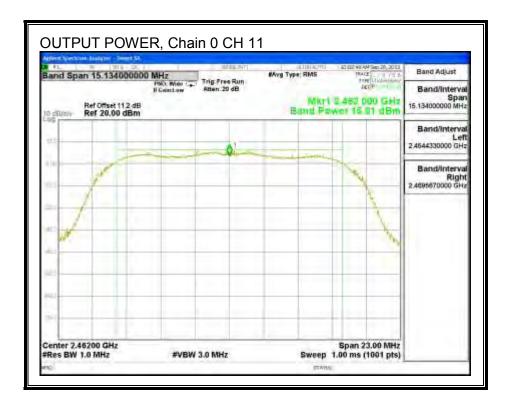
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### 8.2.5. PSD

### 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.

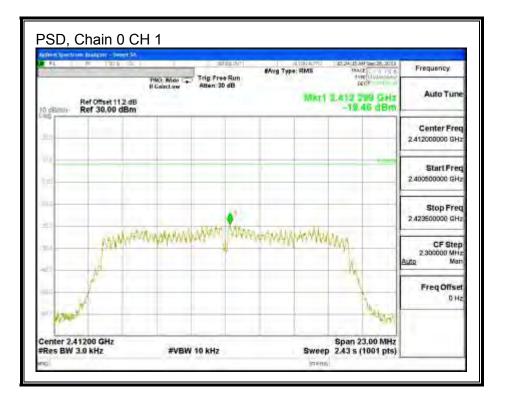
#### **RESULTS**

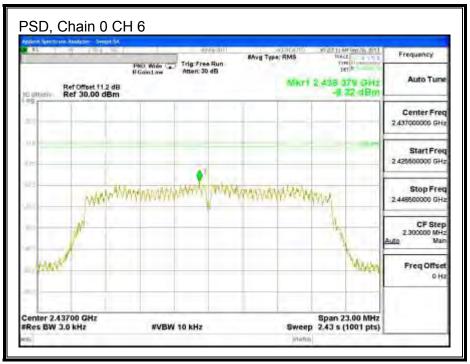
#### **PSD** Results

Channel	Frequency	Chain 0	Limit	Margin
		Meas		
	(MHz)	(dBm)	(dBm)	(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

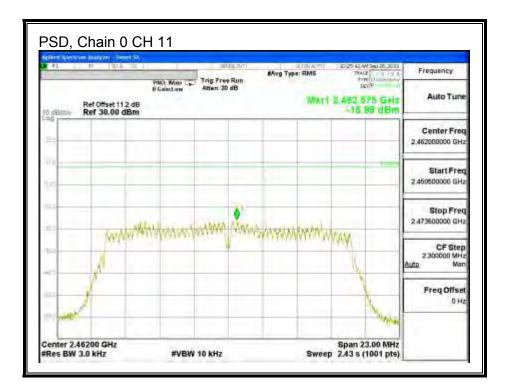
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### PSD, Chain 0





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# 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.

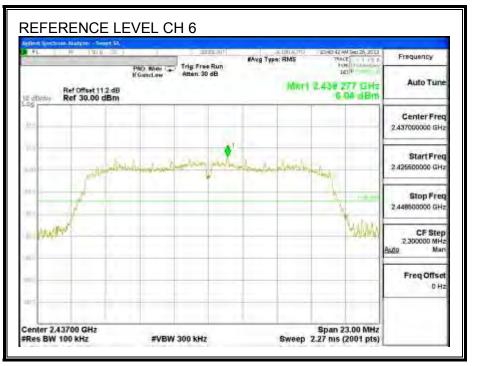
### TEST PROCEDURE

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 inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

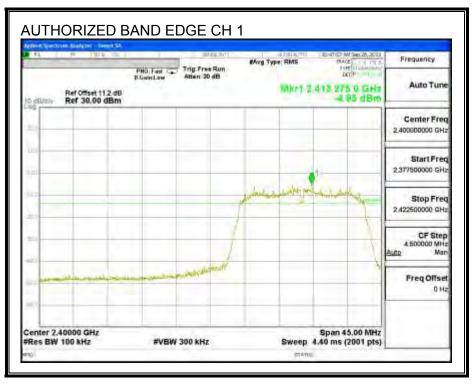
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### **RESULTS**

### **IN-BAND REFERENCE LEVEL**

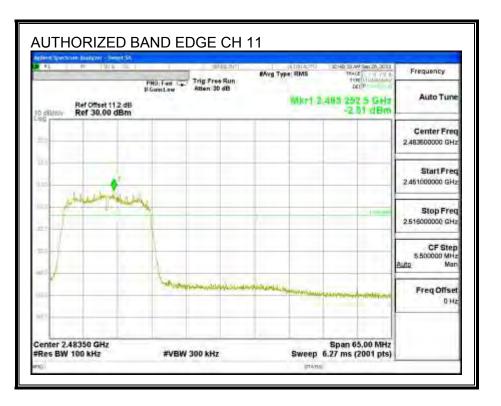


#### LOW CHANNEL BANDEDGE

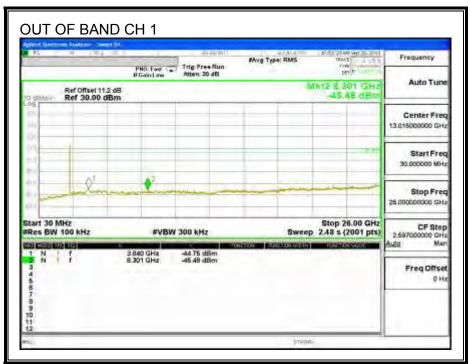


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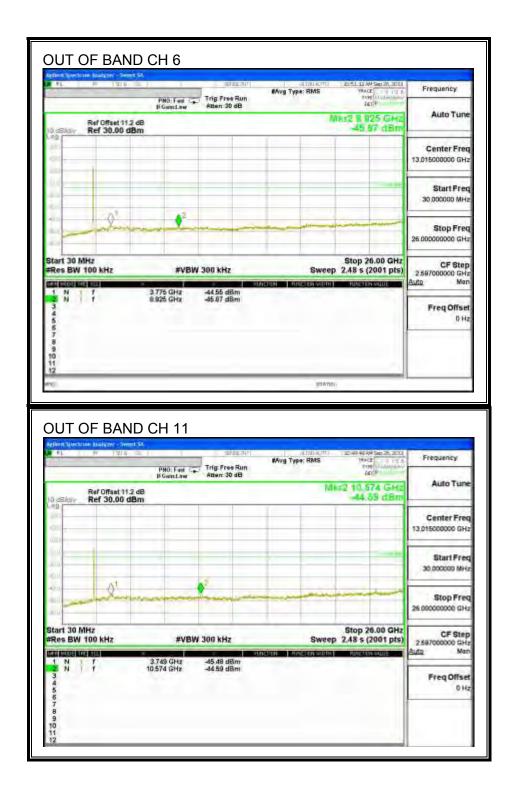
### HIGH CHANNEL BANDEDGE



#### **OUT-OF-BAND EMISSIONS**



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# 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

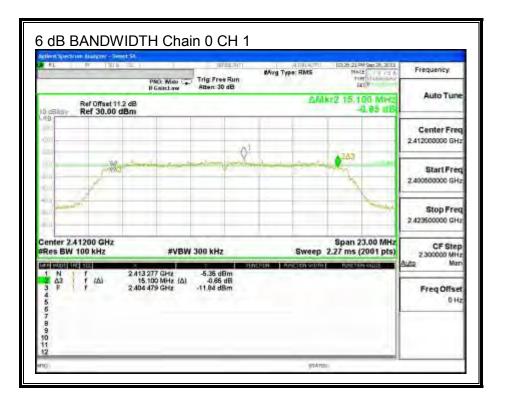
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

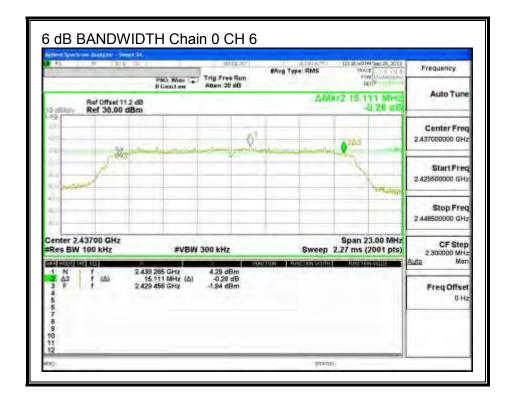
### <u>RESULTS</u>

Channel	Frequency	6 dB BW	6 dB BW	Minimum
		Chain 0	Chain 1	Limit
	(MHz)	(MHz)	(MHz)	(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

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#### 6 dB BANDWIDTH, Chain 0

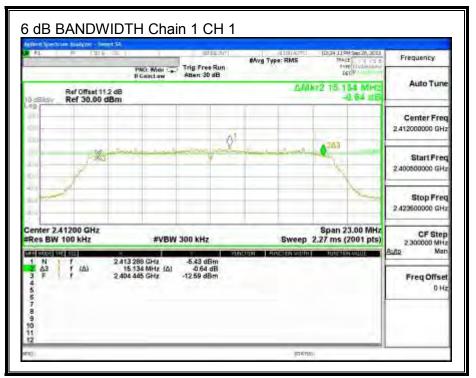




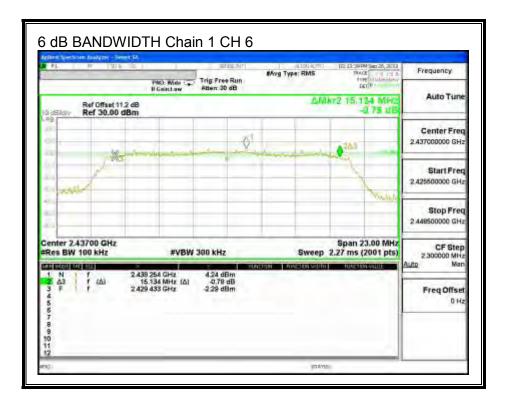
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NI.	912'T VI	-	PMO: When	Trig Free R	un	Marg Type:	RMS	100	28 Sep 26, 2013	Frequency
0 dSildiv	Ref Offset 11. Ref 30.00 d		If GalicLaw	Start So de			AM		-0.22 dB	Auto Turk
					Q1			263		Center Free 2.462000000 GH
	Alle A	-	- inch			dancar		-hay		Start Free 2.450500000 GH
									and the second s	Stop Free 2.473500000 GH
enter 2.4 Res BW	6200 GHz 100 kHz		#VBW	300 kHz	1 20		Sweep	2.27 ms	23.00 MHz (2001 pts)	CF Ster 2.300000 MH Auto Mar
1 N 2 Δ3 3 F 5 6 7 8 9 0 1	f (Δ)	. 15	254 GHz 111 MHz (Δ) 445 GHz	-2 29 dBm -0 22 dB -0.50 dBm						Freq Offse

### 6 dB BANDWIDTH, Chain 1



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## 8.3.2. 99% BANDWIDTH

### **LIMITS**

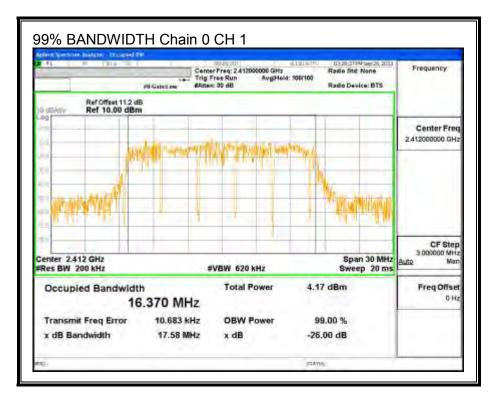
None; for reporting purposes only.

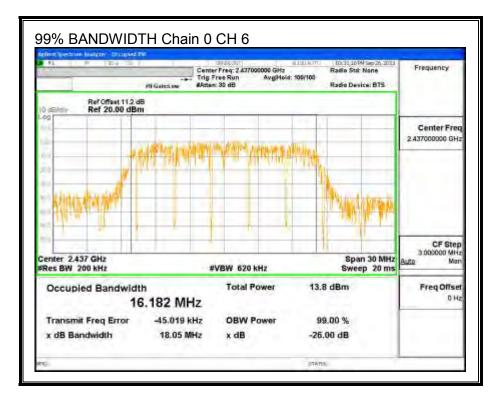
### **RESULTS**

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

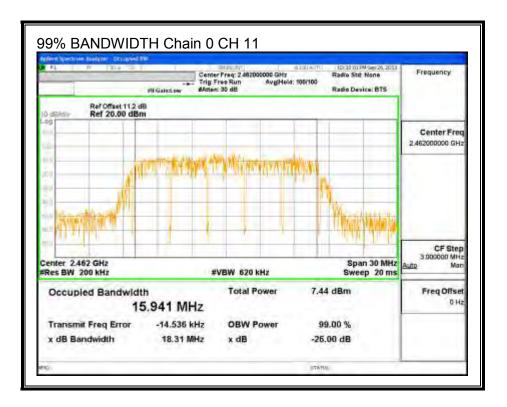
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#### 99% BANDWIDTH, Chain 0

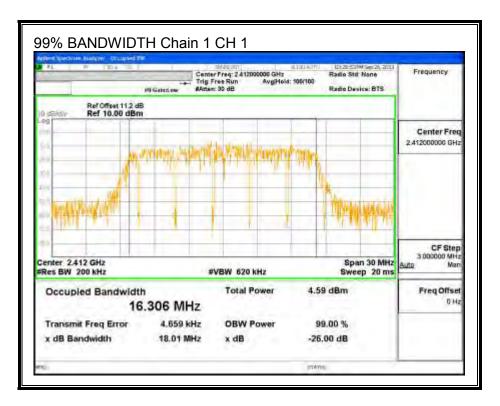




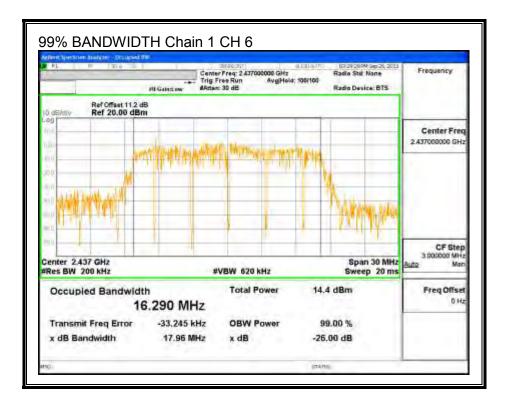
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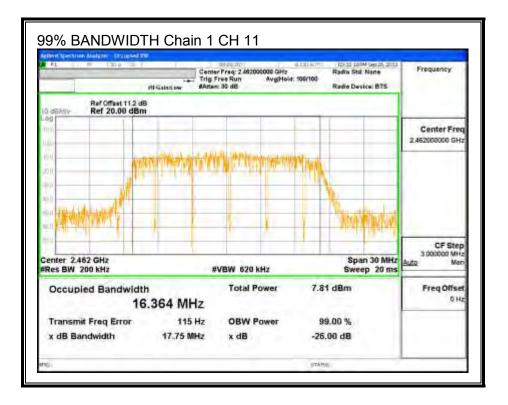


### 99% BANDWIDTH, Chain 1



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## 8.3.3. AVERAGE POWER

### <u>LIMITS</u>

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	Chain 0	Chain 1	Total
		Power	Power	Power
	(MHz)	(dBm)	(dBm)	(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

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# 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	Chain 1	<b>Uncorrelated Chains</b>
Antenna	Antenna	Directional
Gain	Gain	Gain
(dBi)	(dBi)	(dBi)
3.10	2.00	2.58

### **RESULTS**

Limits

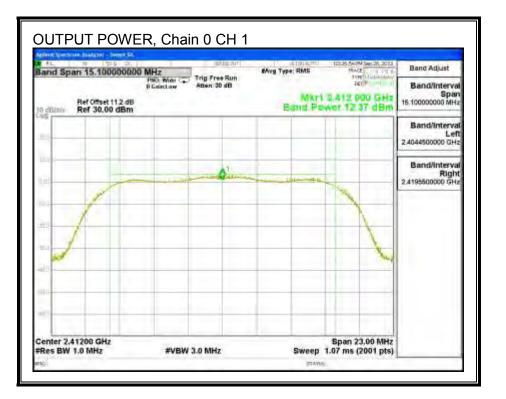
Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
1	2412	2.58	30.00	30	36	30.00
4	2427	2.58	30.00	30	36	30.00
6	2437	2.58	30.00	30	36	30.00
8	2447	2.58	30.00	30	36	30.00
11	2462	2.58	30.00	30	36	30.00

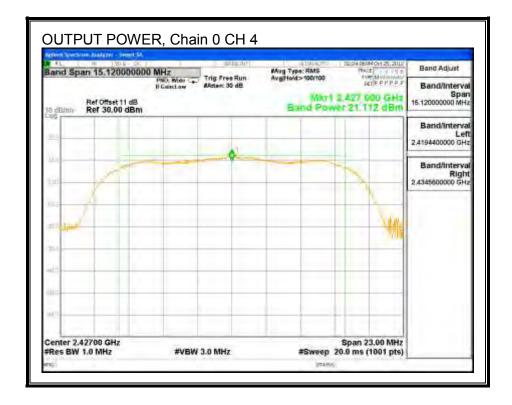
Results

Channel	Frequency	Chain 0	Chain 1	Total	Power	Margin
		Meas	Meas	Corr'd	Limit	
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(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

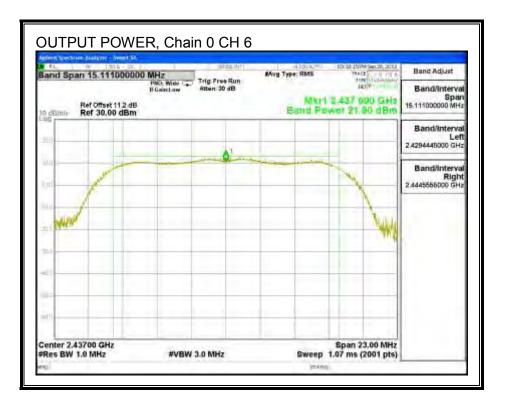
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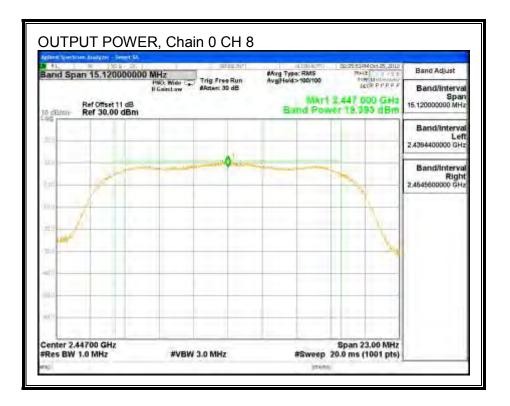
### **OUTPUT POWER, Chain 0**



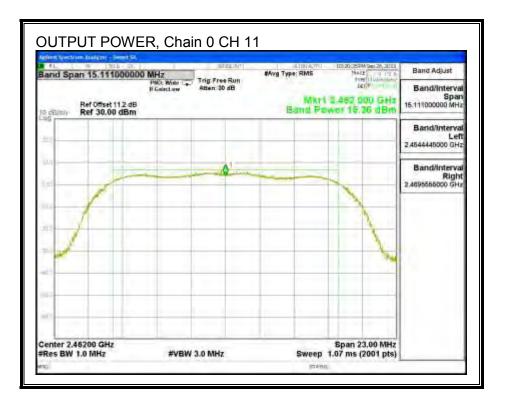


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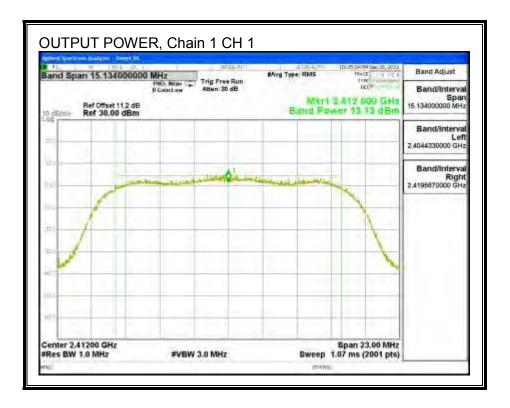




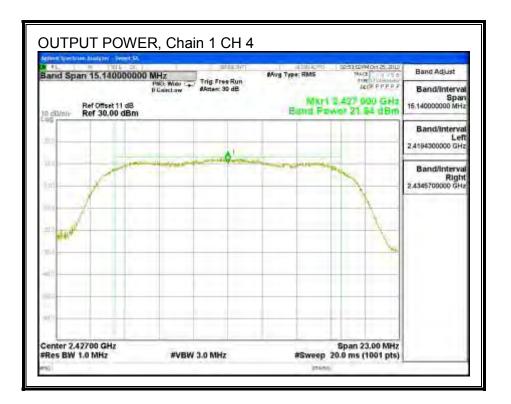
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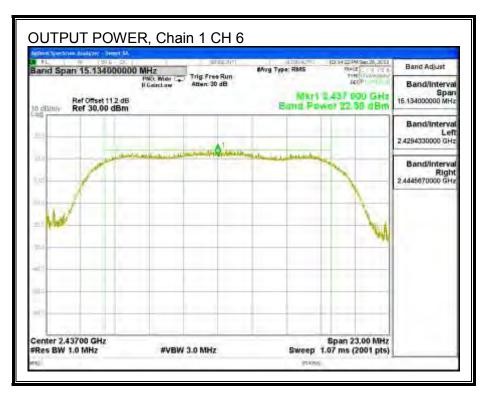


### **OUTPUT POWER, Chain 1**

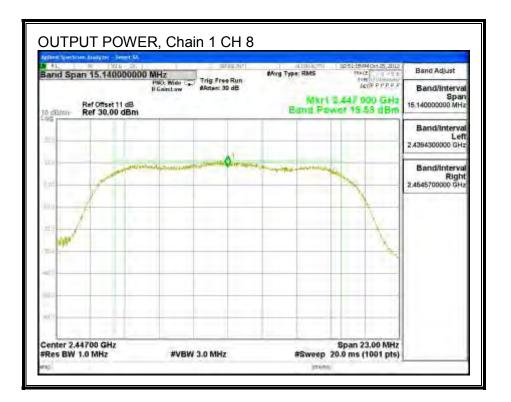


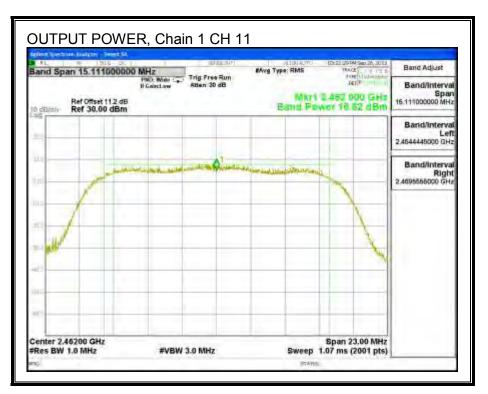
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## 8.3.5. PSD

#### 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.

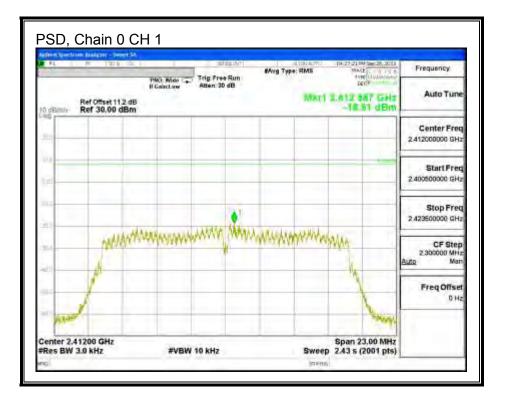
#### **RESULTS**

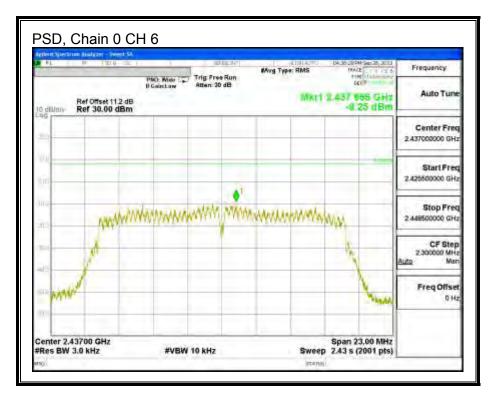
#### **PSD** Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Meas	Meas	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(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

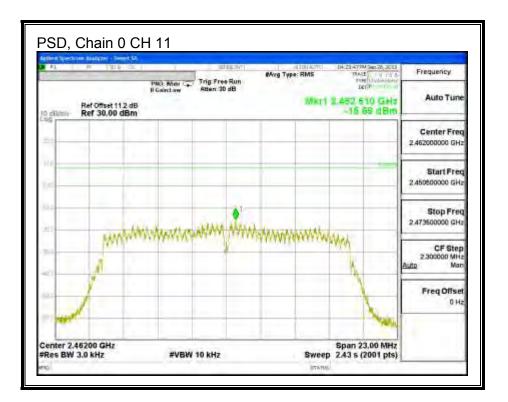
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## PSD, Chain 0

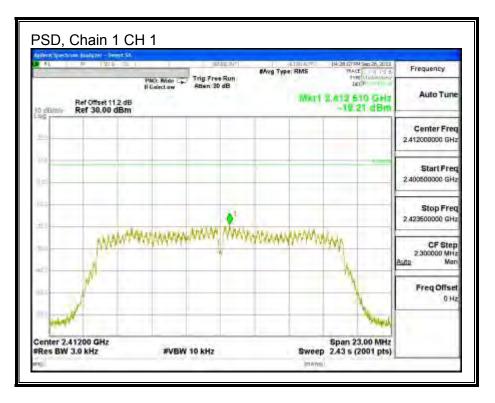




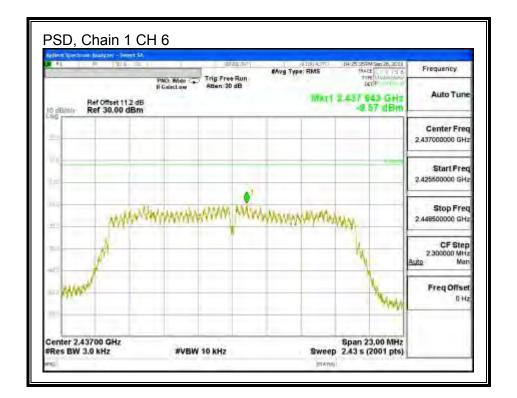
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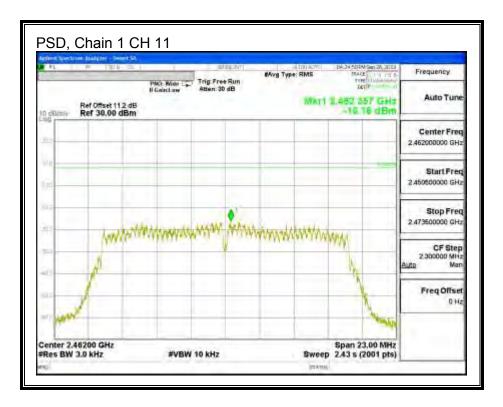


PSD, Chain 1



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# 8.3.6. OUT-OF-BAND EMISSIONS

## <u>LIMITS</u>

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.

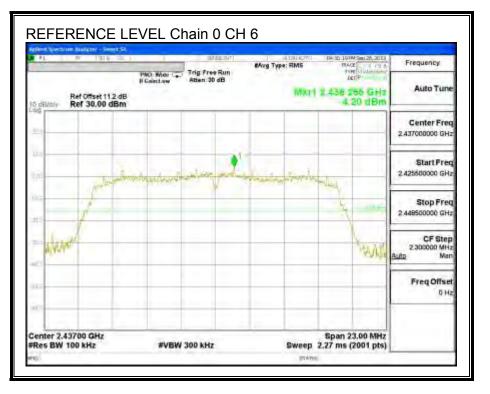
## TEST PROCEDURE

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 inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

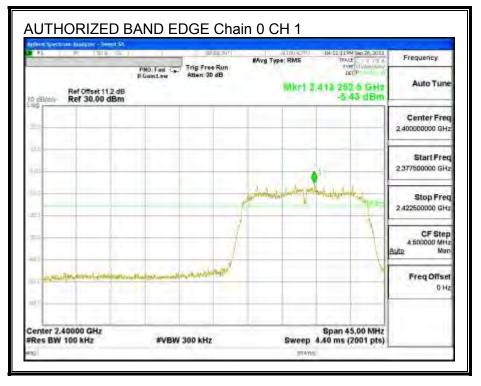
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### **RESULTS**

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

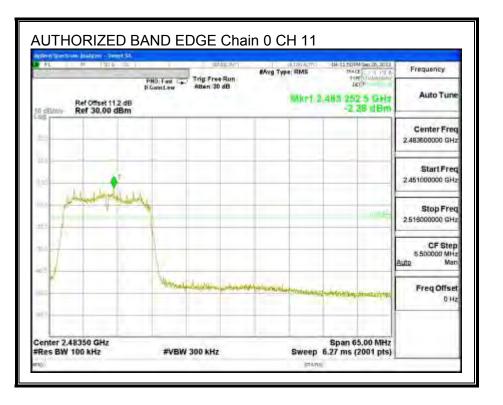


## LOW CHANNEL BANDEDGE, Chain 0

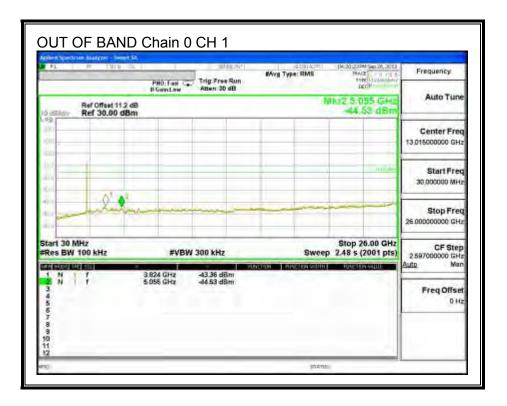


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#### HIGH CHANNEL BANDEDGE, Chain 0

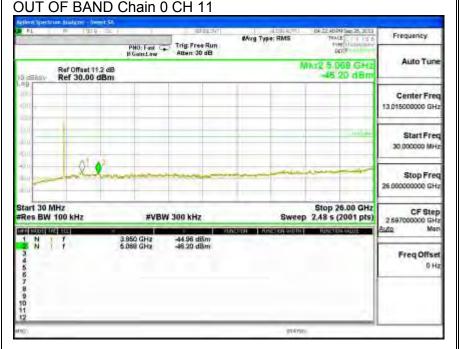


#### **OUT-OF-BAND EMISSIONS, Chain 0**



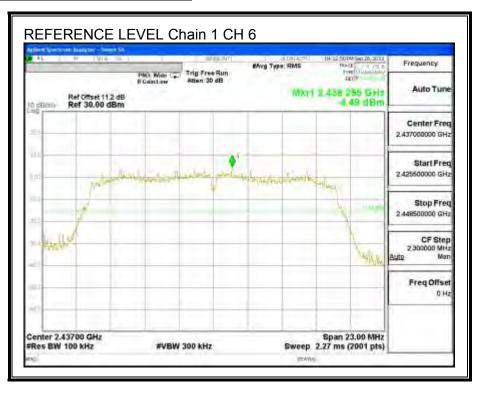
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		Trig Free Run	Marg Type: RMS	194.25.23194/Sep.26,2013 194.02 11 13 5 1949 11 Washington	Frequency
-	PHO: Fast Can If GainsLow	Atten 30 dB		MNT2 5.029 CH2	Auto Tun
Ref Offset 11.2 dB Ref 30.00 dBm				-45.00 dBm	
					Center Frei 13,01500000 GH
				-112.44	Start Free 30.000000 MH
- l'the					Stop Free 26.00000000 GH
art 30 MHz tes BW 100 kHz	#VBW	300 kHz	Swee	Stop 26.00 GHz	CF Ster 2 59700000 GH
H 1903 199 50	3.796 GHz	-44.67 dBm	NUMBER OF STREET		Auto Mer
N I I	5.029 GHz	-46.00 dBm			Freq Offse D H
3					10.0
1	_	_	pt Ave	D)	
1			JET A YU	m	
DUT OF BAND	Chain 0	CH 11	17470	5	

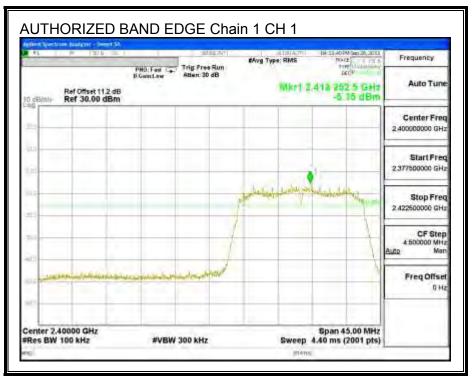


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#### **IN-BAND REFERENCE LEVEL, Chain 1**

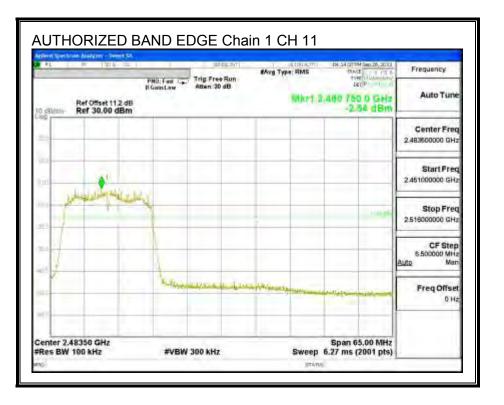


#### LOW CHANNEL BANDEDGE, Chain 1

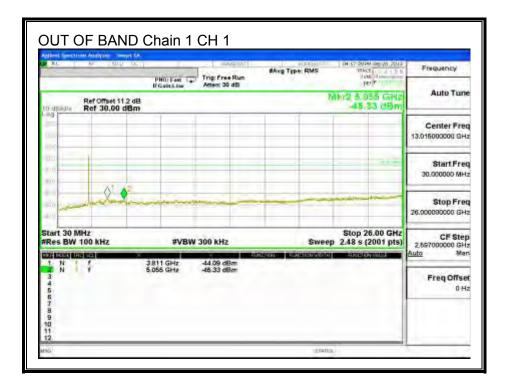


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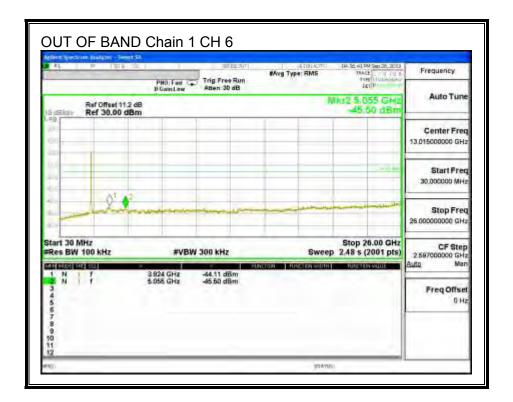
#### HIGH CHANNEL BANDEDGE, Chain 1

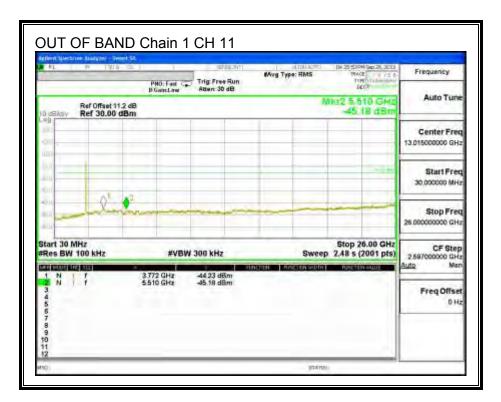


#### **OUT-OF-BAND EMISSIONS, Chain 1**



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# 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

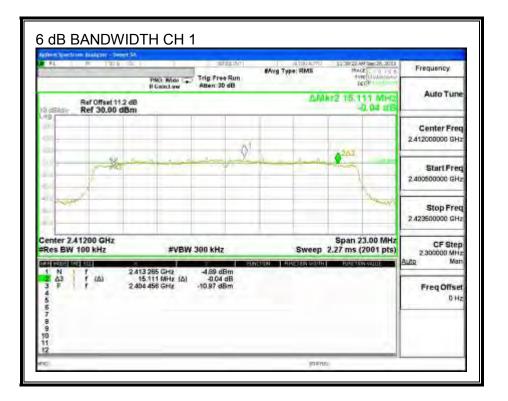
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

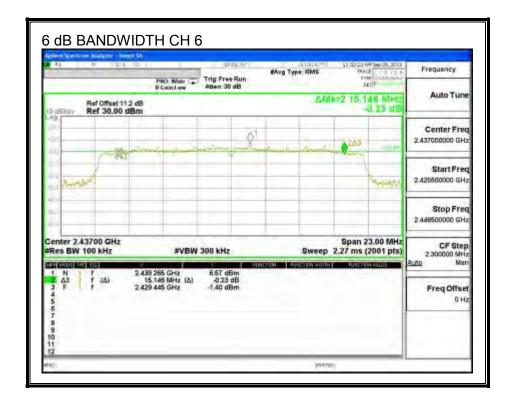
#### <u>RESULTS</u>

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

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#### 6 dB BANDWIDTH





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ų.	14 I.Z	16- 1- 1 P	100 Milei 😱	Trig Free	Run	Mirg Typ	e: RMS	10.4	KE LIVER CON	Frequency
dalaiv	Ref Offset Ref 30.0	11.2 dB	Gainclaw	Allen 30 s	10		LIA	_	11 MH2 1.27 IIE	Auto Tuni
					01			£263		Center Free 2.462000000 GH
	Frid	No - 10 - 0		in	1-1-			-		Start Free 2.450500000 GH
	-					-			Marana	Stop Free 2.473500000 GH
	46200 GHz 100 kHz		#VBW	300 kHz		-	Sweep		23.00 MHz (2001 pts)	CF Ster 2 300000 MH
1 N 2 A3 3 F 4 5 6 6 7 7 8 9 0 0 1 2	τ τ τ τ τ τ	2,463,26 15,11 2,454,45	1 MHz (A)	-2.63 dB/ -1.27 d -9.11 dB/	m B	113H 414		HLN: T	IN STUE	Auto Mer Freq Offse 0 H

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## 8.4.2. 99% BANDWIDTH

#### **LIMITS**

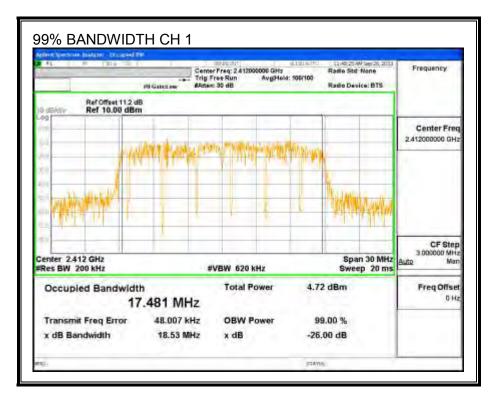
None; for reporting purposes only.

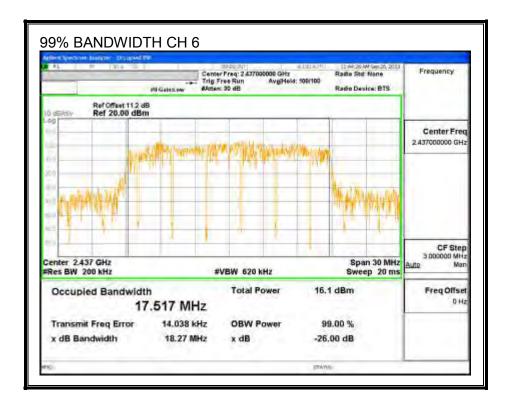
#### **RESULTS**

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

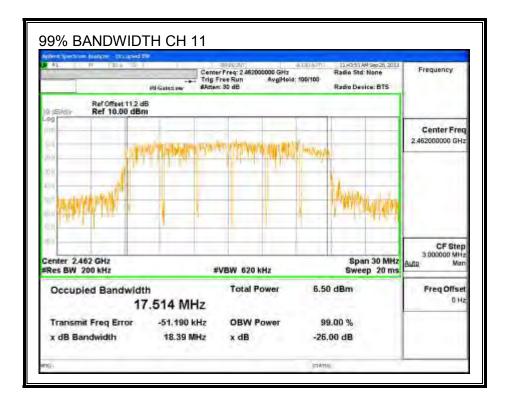
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#### 99% BANDWIDTH





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## 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	Power
	(MHz)	(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

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# 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**

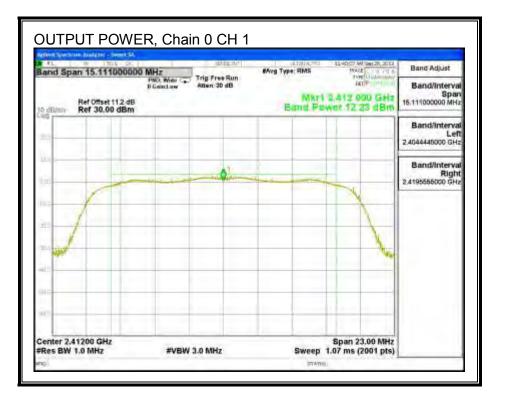
Limits						
Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
1	2412	3.1	30.00	30	36	30.00
6	2437	3.1	30.00	30	36	30.00
11	2462	3.1	30.00	30	36	30.00

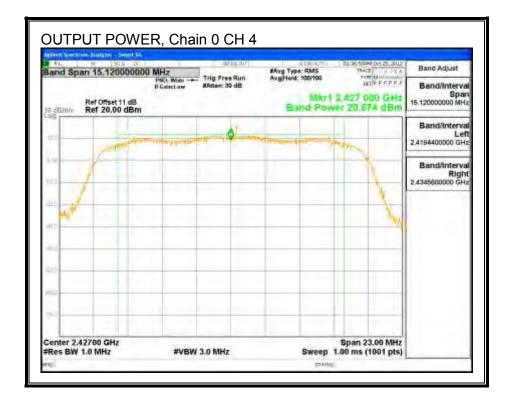
Results

Channel	Frequency	Chain 0	Total	Power	Margin
		Meas	Corr'd	Limit	
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(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

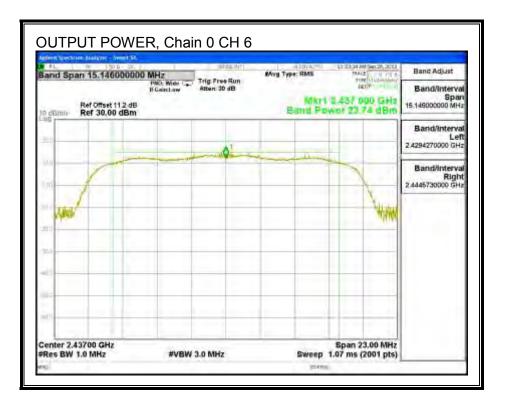
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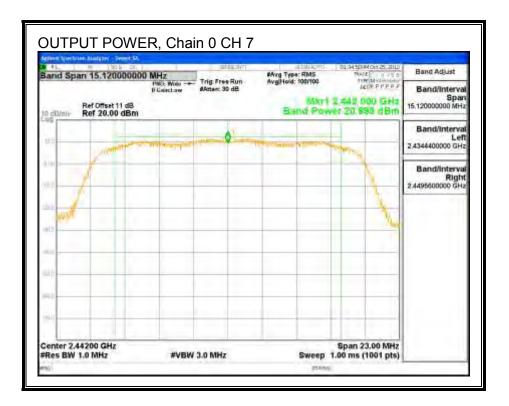
### **OUTPUT POWER, Chain 0**



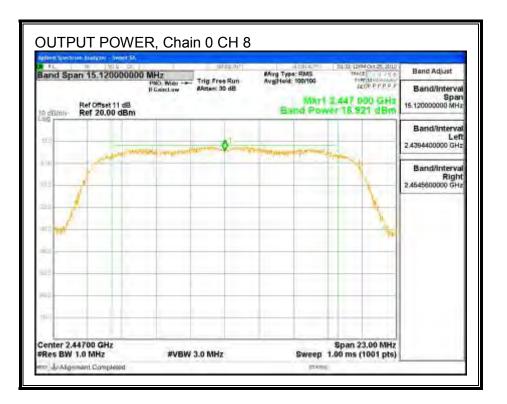


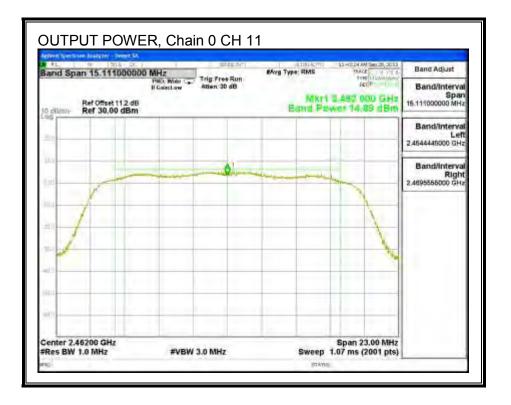
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## 8.4.5. PSD

#### 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.

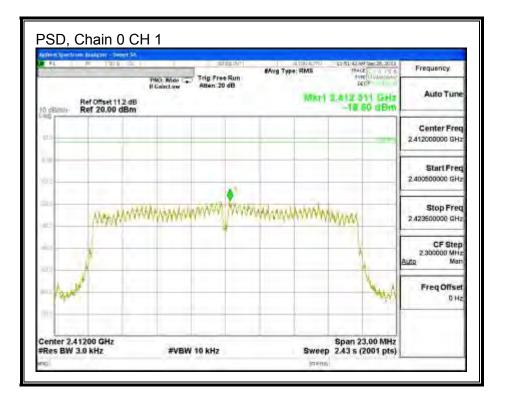
#### **RESULTS**

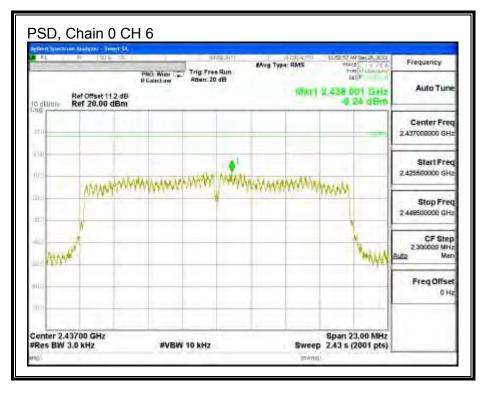
#### **PSD** Results

Channel	Frequency	Chain 0	Limit	Margin
		Meas		
	(MHz)	(dBm)	(dBm)	(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

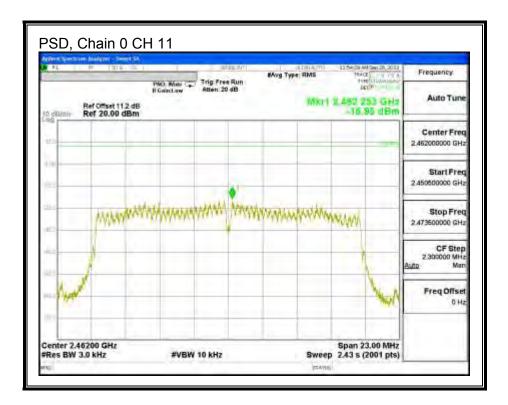
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## PSD, Chain 0





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# 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.

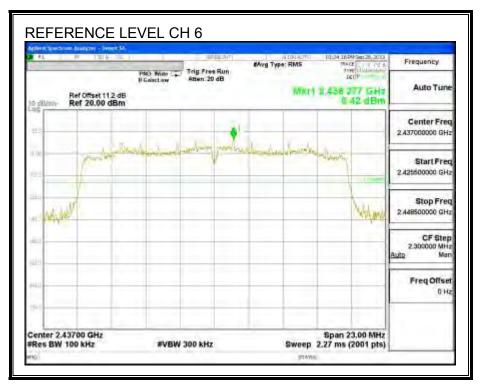
## TEST PROCEDURE

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 inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

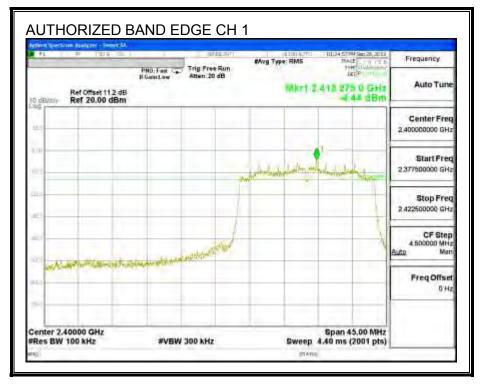
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### **RESULTS**

## **IN-BAND REFERENCE LEVEL**

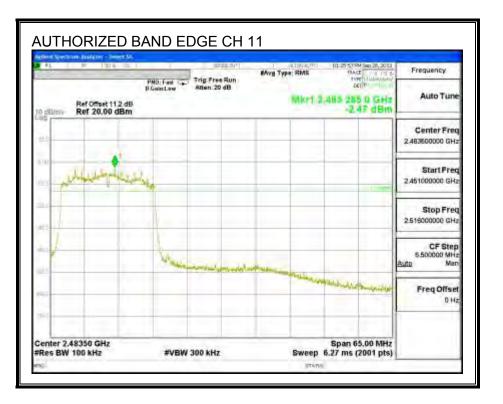


### LOW CHANNEL BANDEDGE

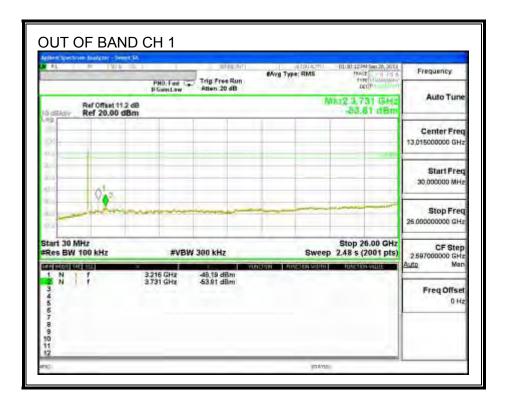


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#### HIGH CHANNEL BANDEDGE

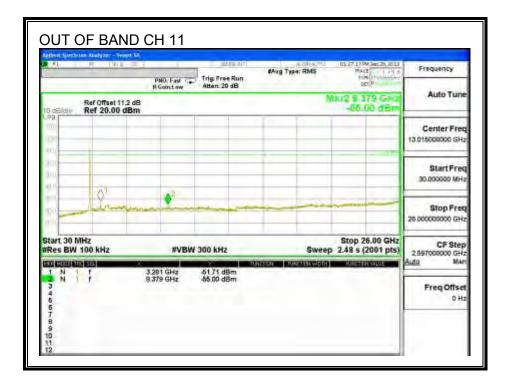


#### **OUT-OF-BAND EMISSIONS**



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11 I	W THIS	PHD: Fast	Trig Free Run Atten 20 dB	Marg Type: RMS	101-29-20194 San 26, 2013 184/2 11-13-5 1118 11-14-14-14 161 P	Frequency
diskay	Ref Offset 112 Ref 20.00 dl		elten 20 dB		Mr2 5.094 GHz	Auto Tune
						Center Freq 13.015000000 GHz
						Start Freq 30.000000 MHz
	lind					Stop Freq 26.00000000 GHz
tart 30 M Res BW	NHZ 100 kHz	#vBW	300 kHz	Swee	Stop 26.00 GHz 2.48 s (2001 pts)	CF Step 2 597000000 GHz
1 N 3 4 5 5 6 7 7 8 9 0 0 1 2	r f	3.255 GHz 5.094 GHz	-53.75 dBm -55.50 dBm	адаан   Анстан өзгөн	AUC: THE SAULE OF	Auto Man Freq Offset 0 Hz



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# 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

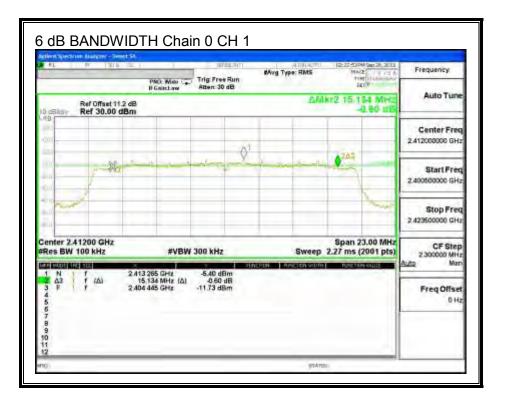
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

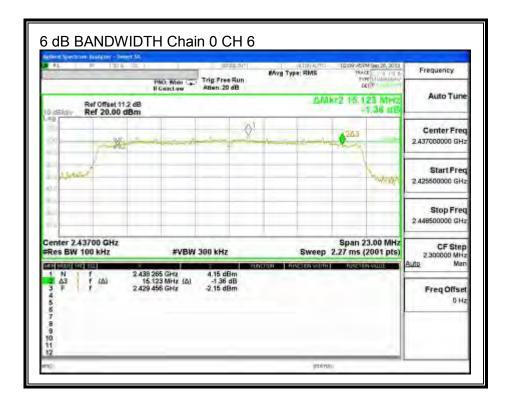
## <u>RESULTS</u>

Channel	Frequency	6 dB BW	6 dB BW	Minimum
		Chain 0	Chain 1	Limit
	(MHz)	(MHz)	(MHz)	(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

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#### 6 dB BANDWIDTH, Chain 0

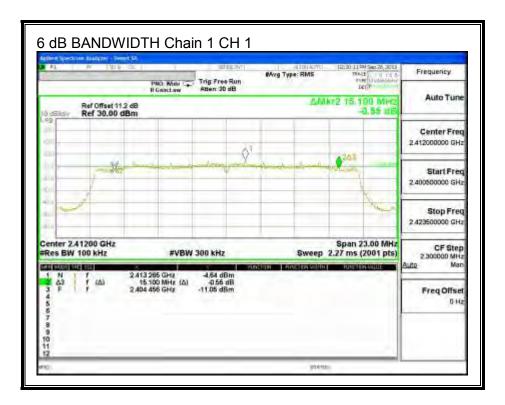




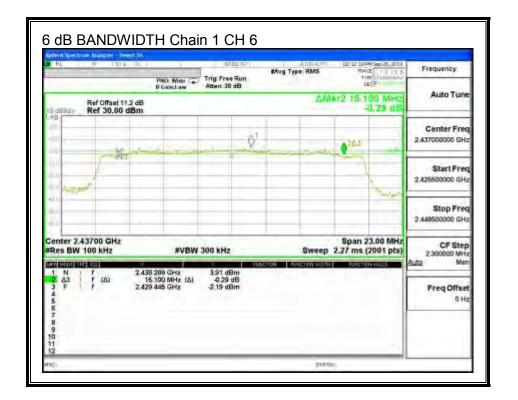
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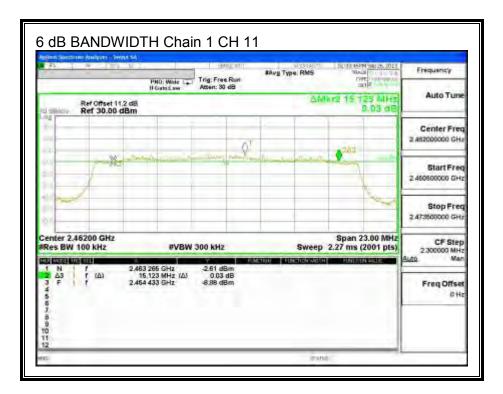
41	W THE	Photo Winter	Trig Free Run Atten 30 dB	Myg Type: RMS	102:25:3694 Sep 26, 2011 194/2 1111 1115 1998 11101-1115 1999 1101-1115	Frequency
distant	Ref Offset 11: Ref 30.00 d		Aden ou do	ы	Akr2 15.123 MHz -0.19 IE	Auto Tune
			0		203	Center Freq 2.462000000 GHz
		and and a second se				Start Free 2.450500000 GHz
	~				~	Stop Fred 2.473500000 GH
	46200 GHz 100 kHz	#VBW	300 kHz	Sweep	Span 23.00 MHz 2.27 ms (2001 pts)	CF Step 2 300000 MHz
1 N 2 A3 3 F	τ τ τ τ τ τ	2.483 277 GHz 15.123 MHz (Δ) 2.454 445 GHz	-2.37 dBm -0.19 dB -8.06 dBm	NETEN ANCLEN WO	HI HINCIDA ANUE	Auto Mar FreqOffse
5 7 8 9 0 1 2						

## 6 dB BANDWIDTH, Chain 1



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## 8.5.2. 99% BANDWIDTH

#### **LIMITS**

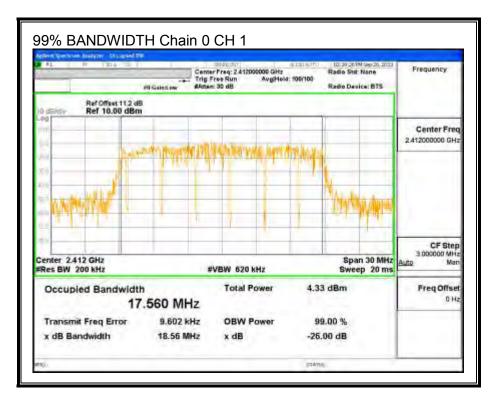
None; for reporting purposes only.

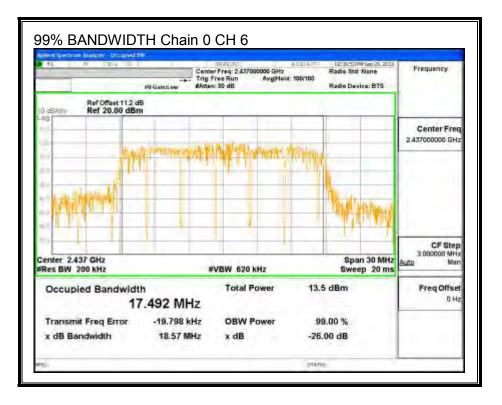
### **RESULTS**

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

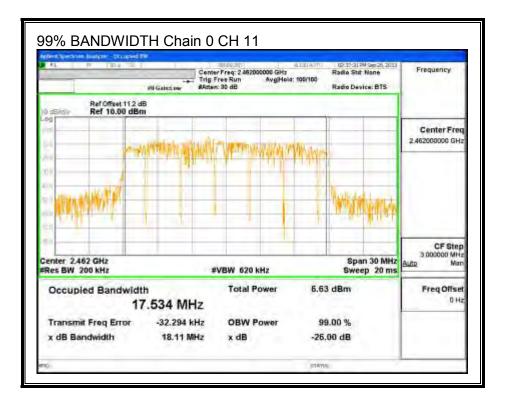
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#### 99% BANDWIDTH, Chain 0

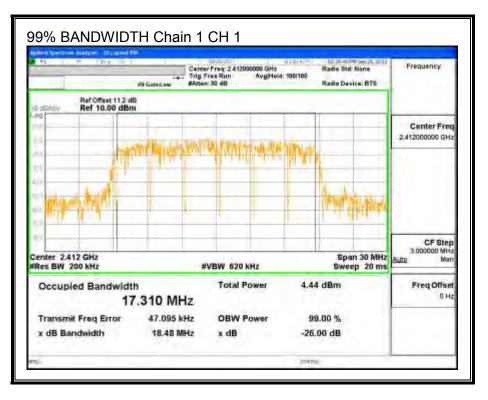




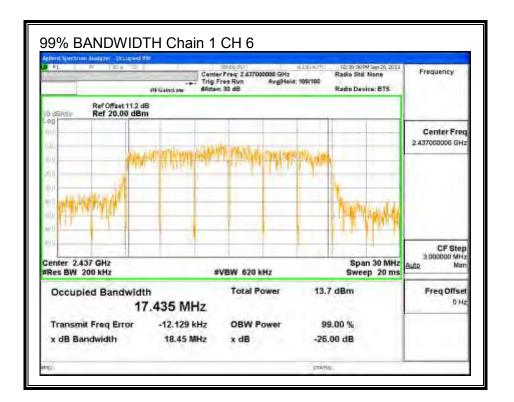
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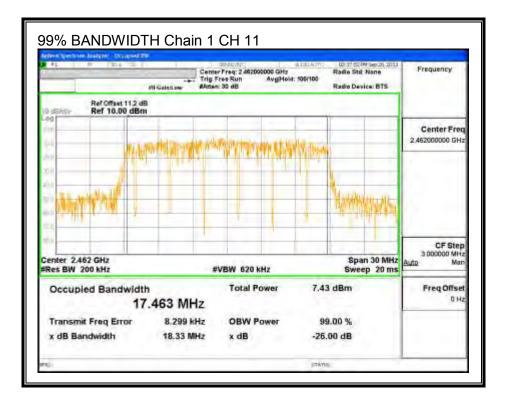


## 99% BANDWIDTH, Chain 1



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## 8.5.3. AVERAGE POWER

## <u>LIMITS</u>

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	Chain 0	Chain 1	Total
		Power	Power	Power
	(MHz)	(dBm)	(dBm)	(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

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# 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	Chain 1	<b>Uncorrelated Chains</b>
Antenna	Antenna	Directional
Gain	Gain	Gain
(dBi)	(dBi)	(dBi)
3.10	2.00	2.58

## **RESULTS**

Limits

Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(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

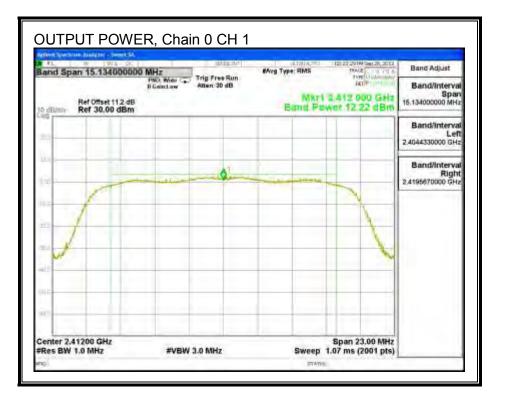
Results

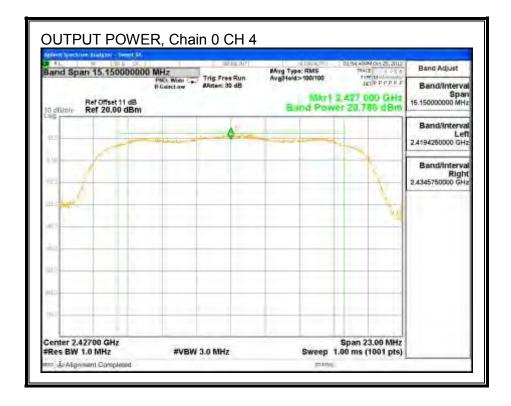
Channel	Frequency	Chain 0	Chain 1	Total	Power	Margin
		Meas	Meas	Corr'd	Limit	
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
1	2412	12.22	12.73	15.49	30.00	-14.51
4	2427	20.79	21.01	23.91	30.00	-6.09
6	2437	21.42	21.92	24.69	30.00	-5.31
8	2447	18.91	19.01	21.97	30.00	-8.03
11	2462	15.01	15.63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

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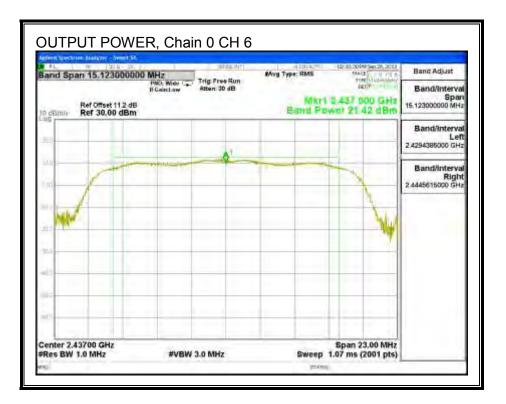
UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. FORM NO: CCSUP4701J FAX: (510) 661-0888

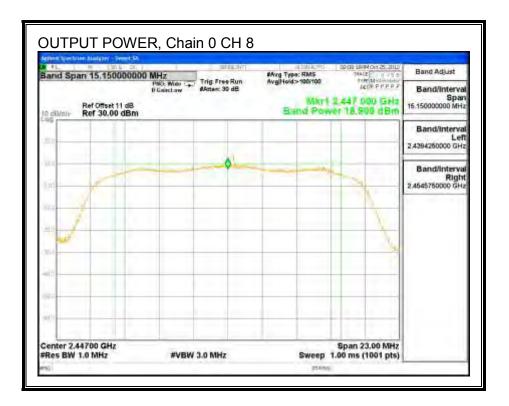
## **OUTPUT POWER, Chain 0**



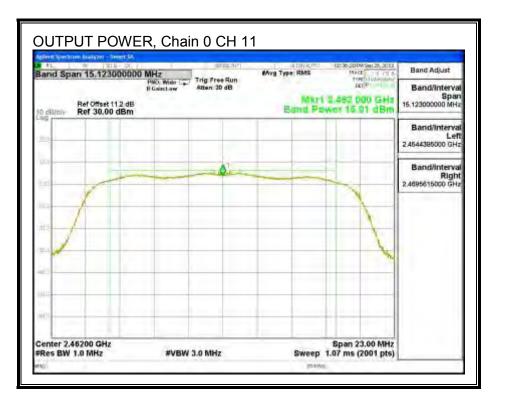


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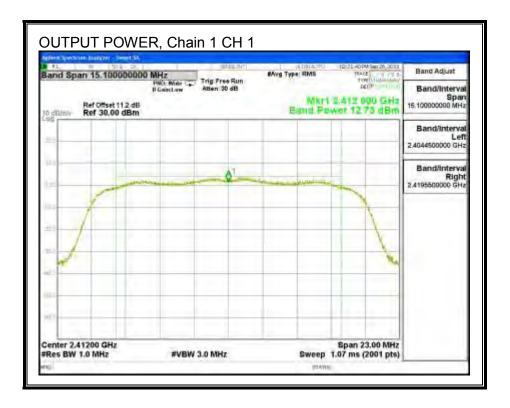




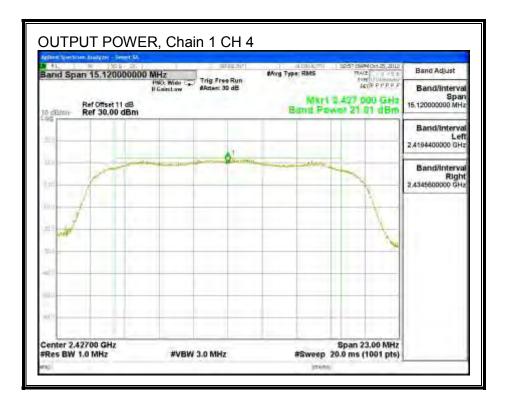
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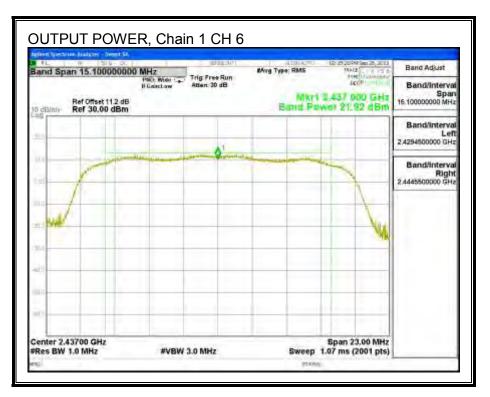


## **OUTPUT POWER, Chain 1**

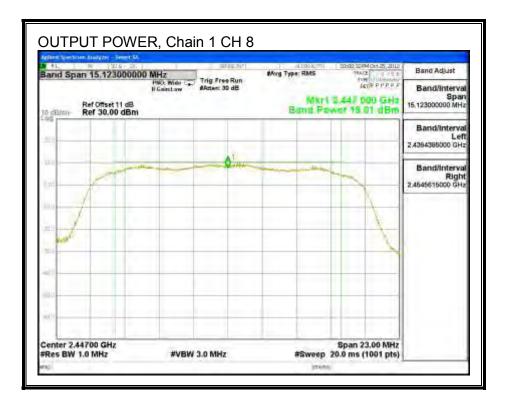


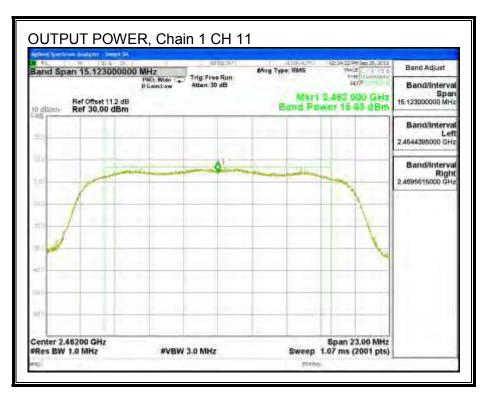
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## 8.5.5. PSD

## 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.

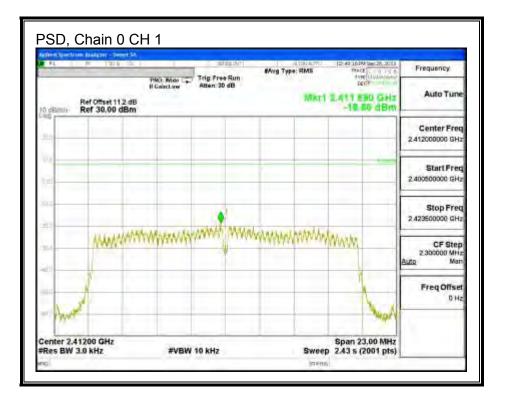
#### **RESULTS**

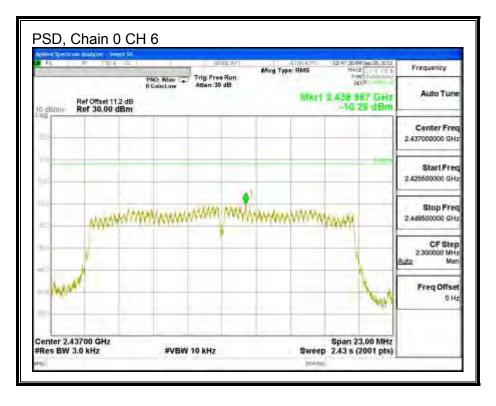
#### **PSD** Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Meas	Meas	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(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

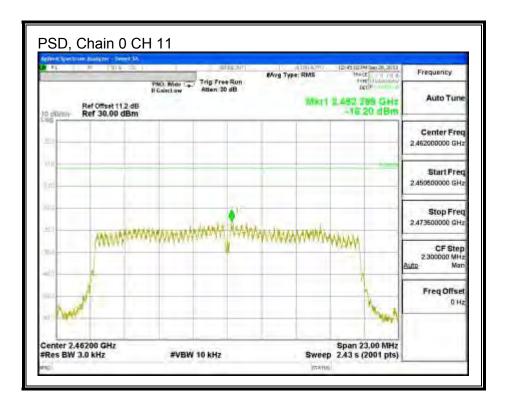
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## PSD, Chain 0

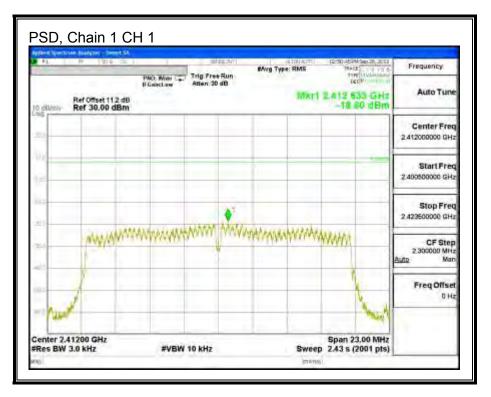




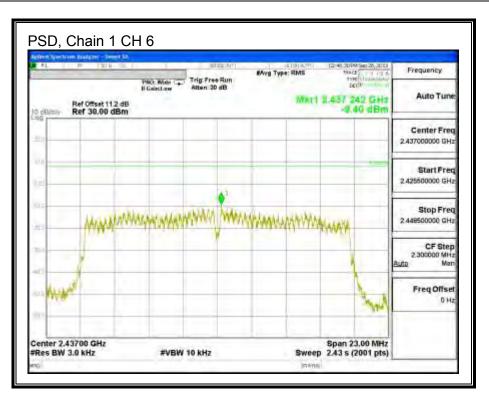
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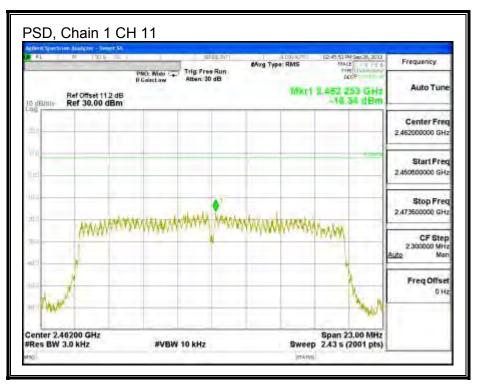


## PSD, Chain 1



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# 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.

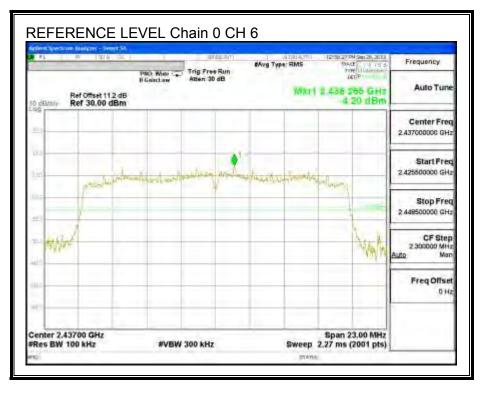
## TEST PROCEDURE

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 inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

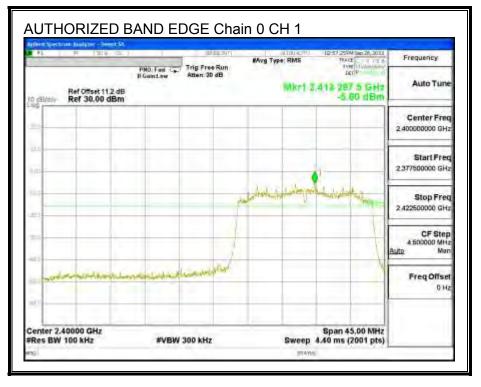
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## **RESULTS**

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

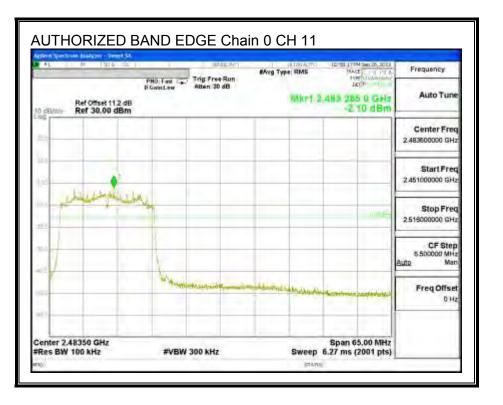


## LOW CHANNEL BANDEDGE, Chain 0

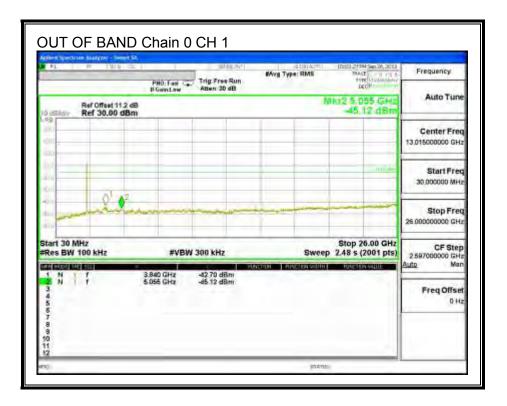


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## HIGH CHANNEL BANDEDGE, Chain 0

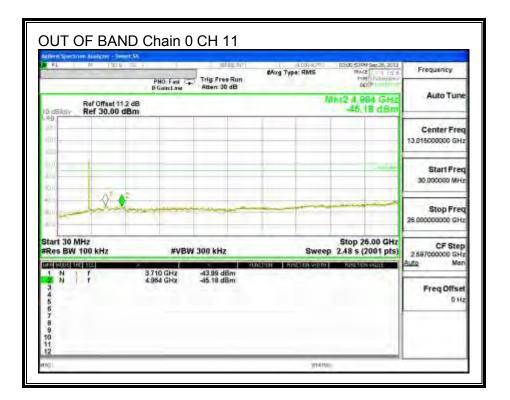


## **OUT-OF-BAND EMISSIONS, Chain 0**



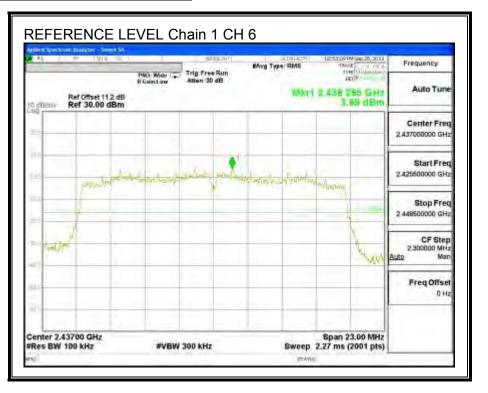
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*L	W THE	PHO: Fast Ca	Trig Free Run Atten 30 dB	#Avg Type: RMS	10:02:5474 Sep 26, 2013 10:402	Frequency
0 desilativ	Ref Offset 11.2 dB Ref 30.00 dBm	b cantaw	autor of all		Wks2 4.801 GHz -45.37 dBm	Auto Tune
						Center Freq 13,01500000 GHz
					-111	Start Free 30.000000 MH
	- let					Stop Free 26.00000000 GH
itart 30 l Res BW	MHz 100 kHz	#VBW	300 kHz	Swee	Stop 26.00 GHz p 2.48 s (2001 pts)	CF Step 2 597000000 GH
1 N 2 N 3 4 5 6 7 8 9 10 11	f	3788 GHz 4 801 GHz	-44.97 dBm -45.37 dBm	ndan   Hinden Gali	AUSC 11 N VALUE	Auto Men Freq Offset 0 Ha

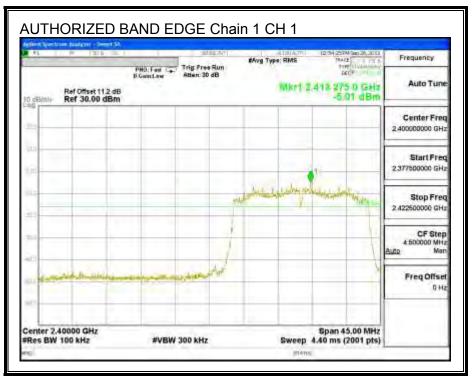


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## **IN-BAND REFERENCE LEVEL, Chain 1**

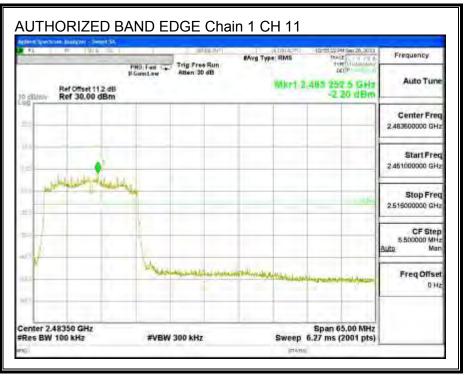


## LOW CHANNEL BANDEDGE, Chain 1

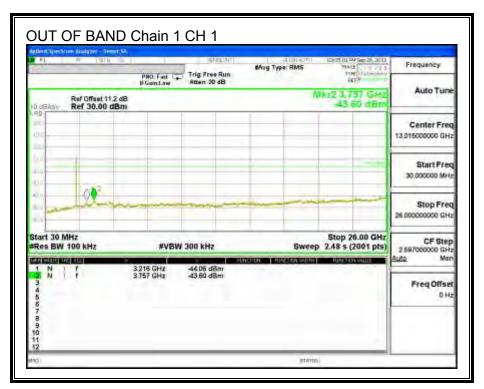


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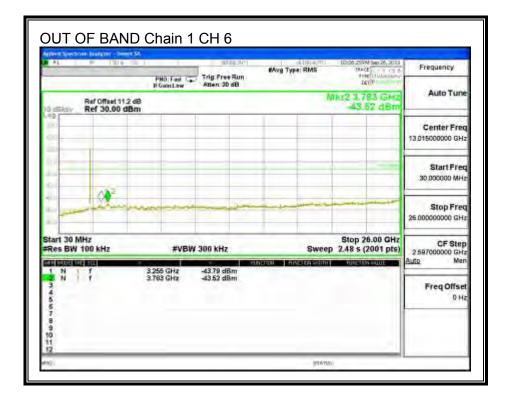
## HIGH CHANNEL BANDEDGE, Chain 1

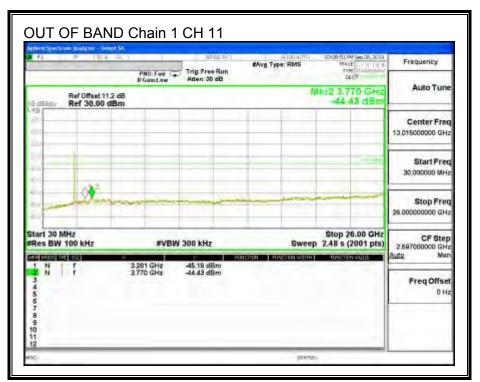


#### **OUT-OF-BAND EMISSIONS, Chain 1**



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# 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

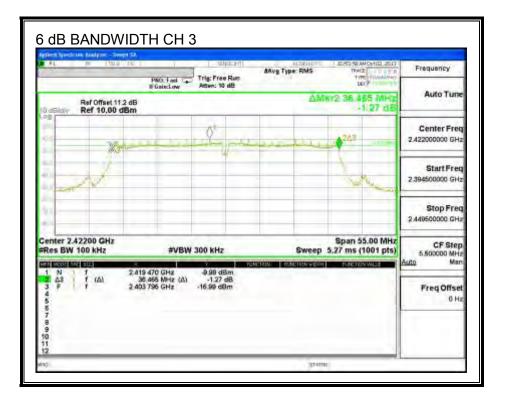
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

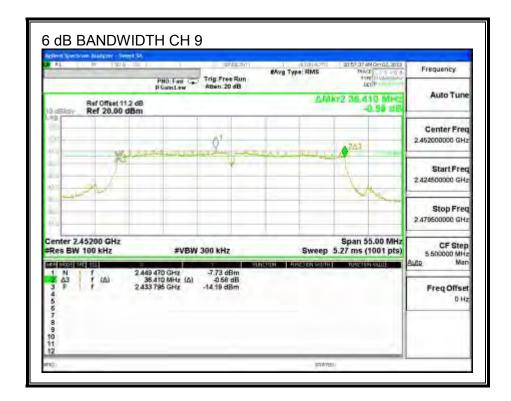
## <u>RESULTS</u>

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

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#### 6 dB BANDWIDTH





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## 8.6.2. 99% BANDWIDTH

## **LIMITS**

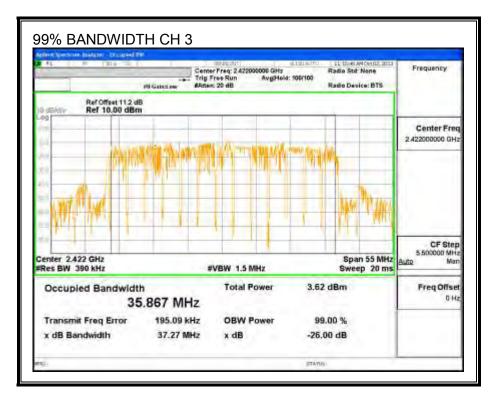
None; for reporting purposes only.

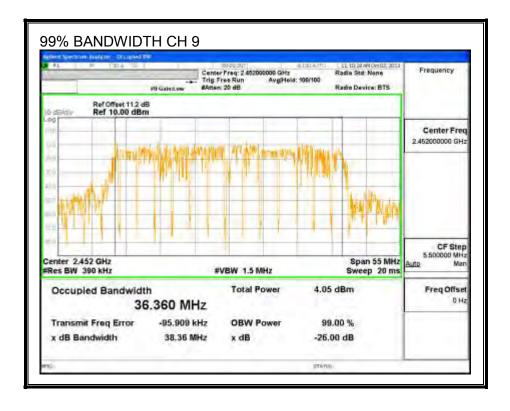
## **RESULTS**

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

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#### 99% BANDWIDTH





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## 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	Power
	(MHz)	(dBm)
3	2422	3.87
9	2452	4.60

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# 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.

## <u>RESULTS</u>

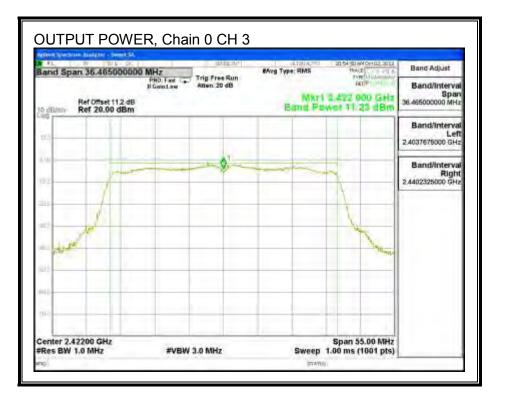
Limits						
Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
3	2422	3.1	30.00	30	36	30.00
9	2452	3.1	30.00	30	36	30.00

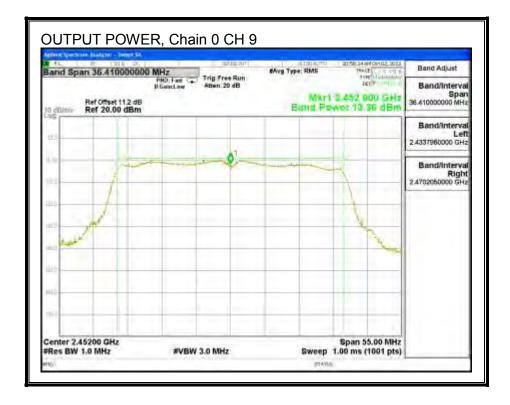
Results

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

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## **OUTPUT POWER, Chain 0**





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## 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.

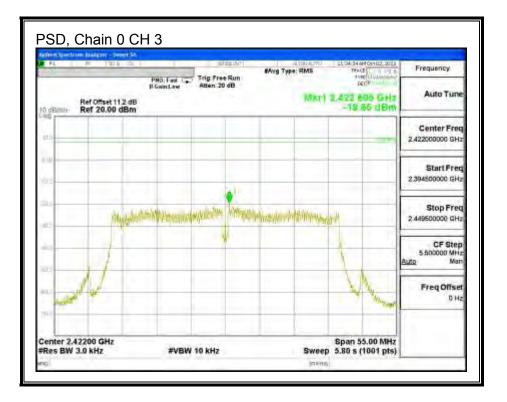
#### **RESULTS**

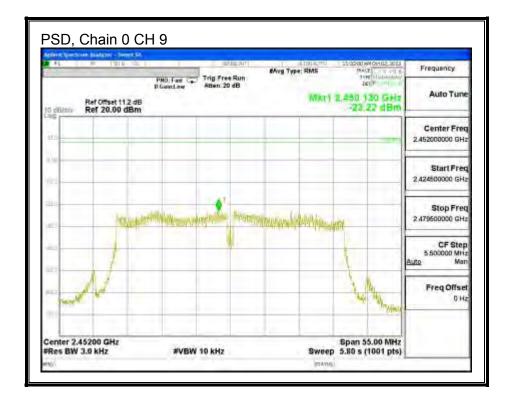
#### **PSD** Results

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

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## PSD, Chain 0





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# 8.6.6. OUT-OF-BAND EMISSIONS

## <u>LIMITS</u>

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.

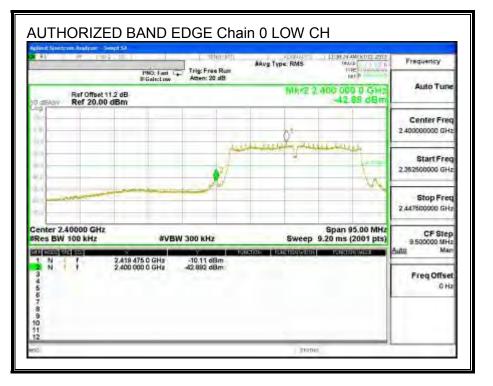
## TEST PROCEDURE

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 inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

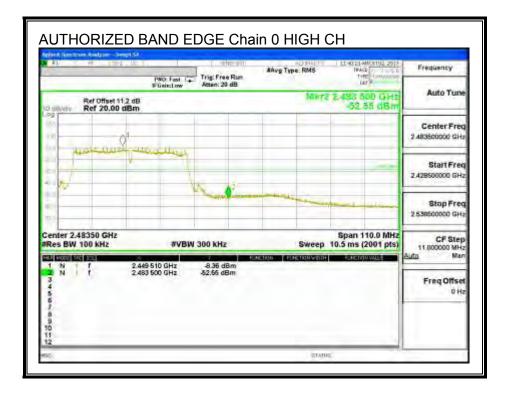
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## **RESULTS**

## LOW CHANNEL BANDEDGE, Chain 0

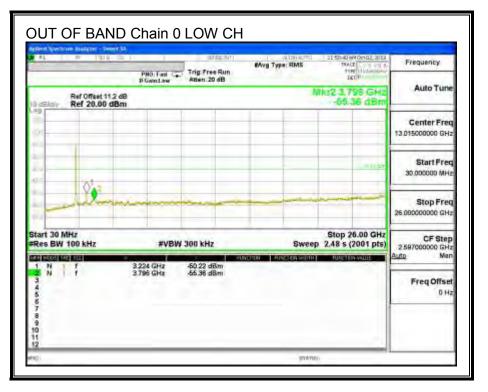


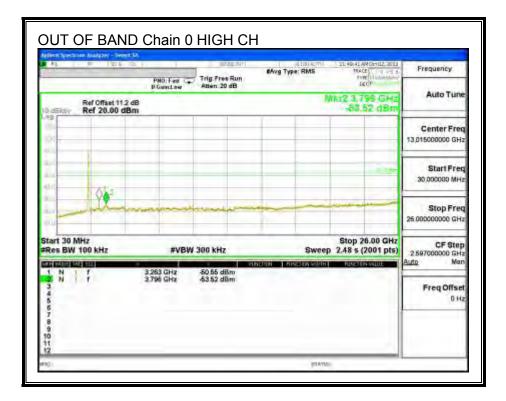
#### HIGH CHANNEL BANDEDGE, Chain 0



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





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# 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

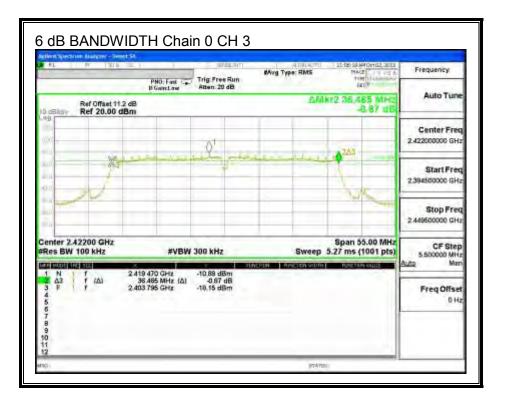
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

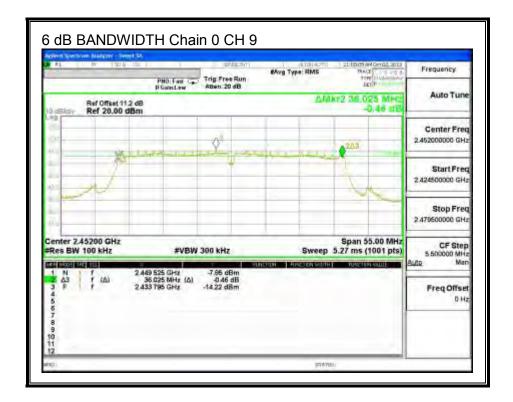
## <u>RESULTS</u>

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

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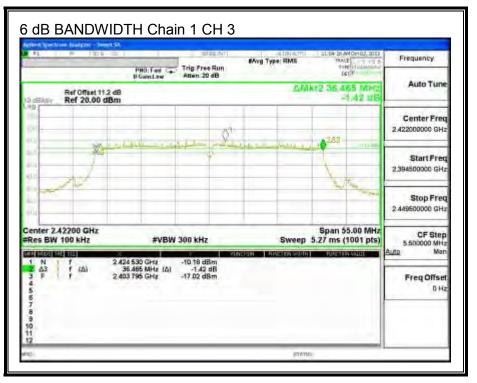
## 6 dB BANDWIDTH, Chain 0

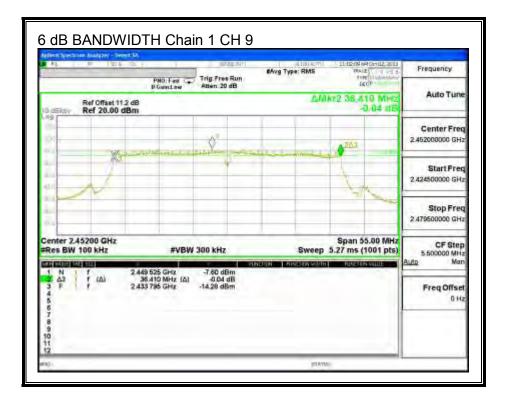




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#### 6 dB BANDWIDTH, Chain 1





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## 8.7.2. 99% BANDWIDTH

## **LIMITS**

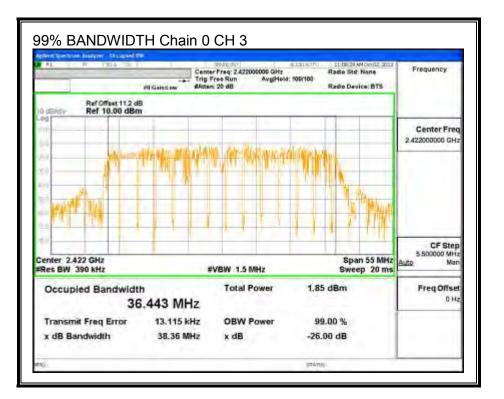
None; for reporting purposes only.

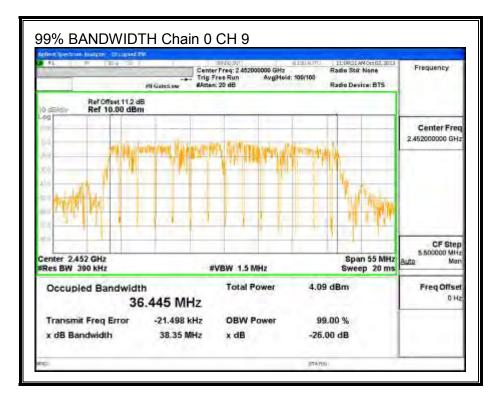
## **RESULTS**

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

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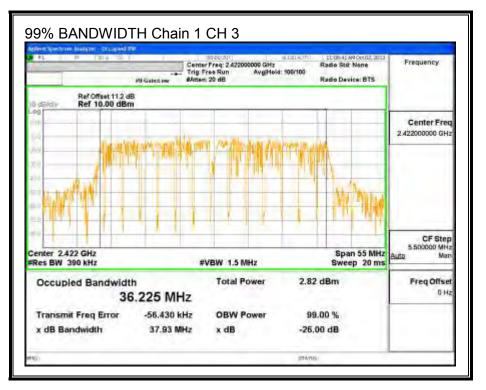
#### 99% BANDWIDTH, Chain 0

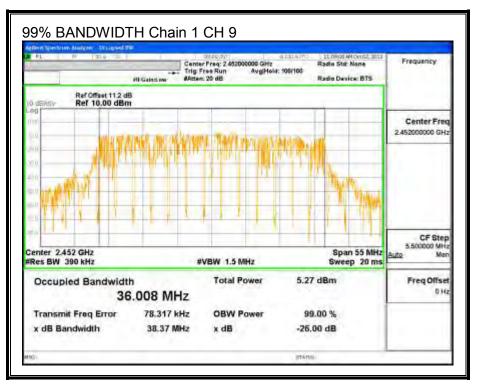




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### 99% BANDWIDTH, Chain 1





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## 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	Chain 0 Chain 1		Total
		Power	Power	Power
	(MHz)	(dBm)	(dBm)	(dBm)
3	2422	2.45	3.02	5.75
9	2452	4.49	4.92	7.72

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# 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	Chain 1	<b>Uncorrelated Chains</b>
Antenna	Antenna	Directional
Gain	Gain	Gain
(dBi)	(dBi)	(dBi)
3.10	2.00	2.58

## **RESULTS**

Limits

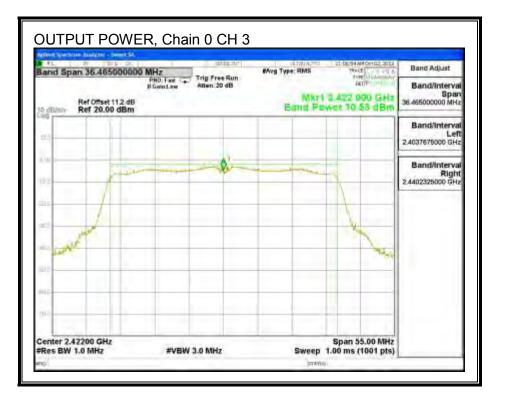
Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
3	2422	2.58	30.00	30	36	30.00
9	2452	2.58	30.00	30	36	30.00

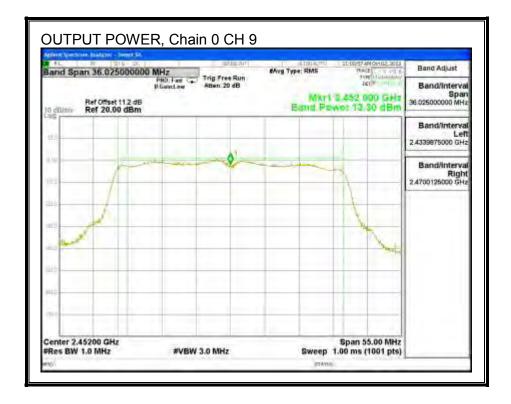
Results

Channel	Frequency	Chain 0	Chain 1	Total	Power	Margin
		Meas	Meas	Corr'd	Limit	
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(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

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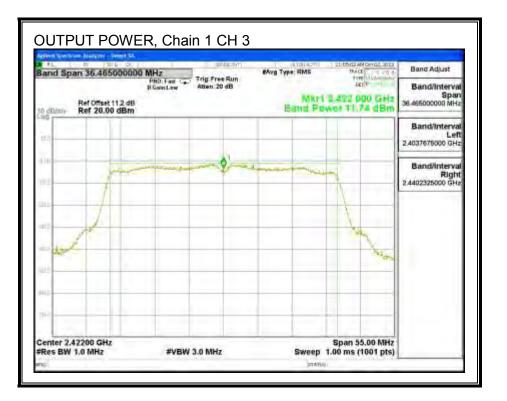
### **OUTPUT POWER, Chain 0**

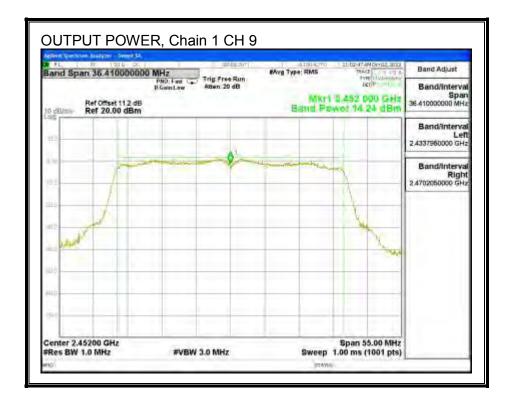




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### **OUTPUT POWER, Chain 1**





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## 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.

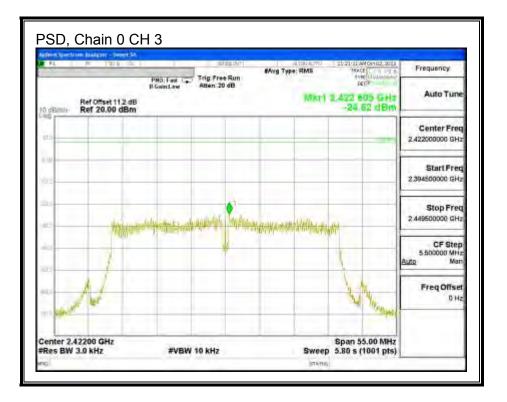
### **RESULTS**

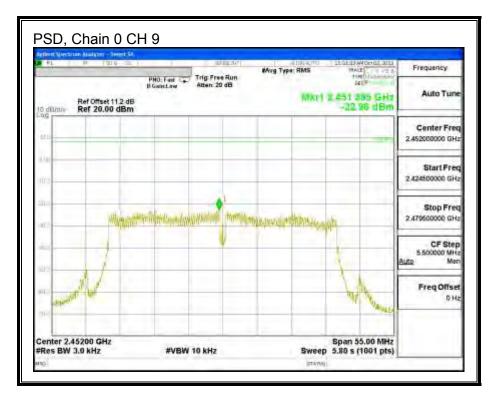
#### **PSD** Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Meas	Meas	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(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

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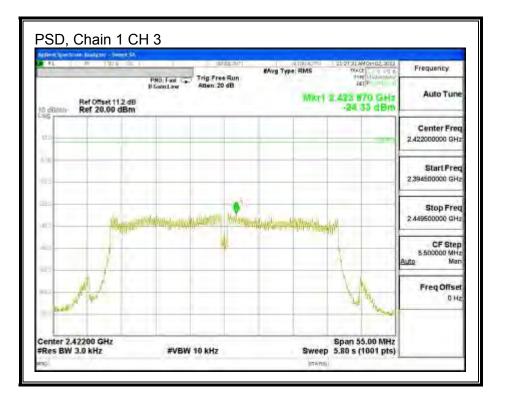
## PSD, Chain 0

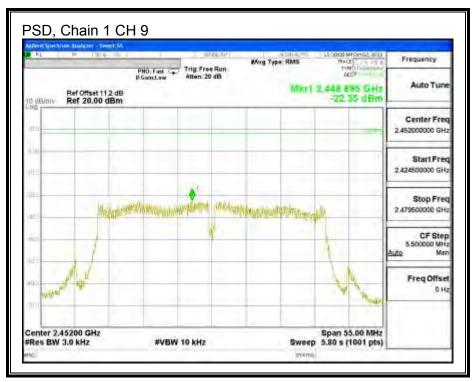




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## PSD, Chain 1





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# 8.7.6. OUT-OF-BAND EMISSIONS

## <u>LIMITS</u>

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.

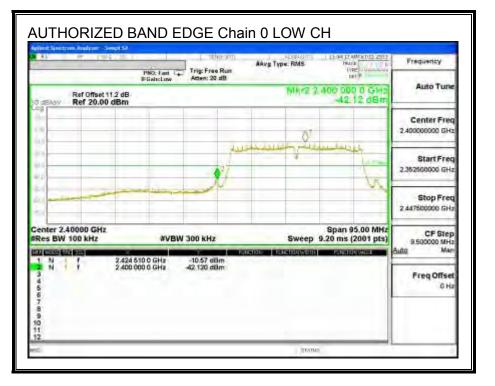
## TEST PROCEDURE

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 inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

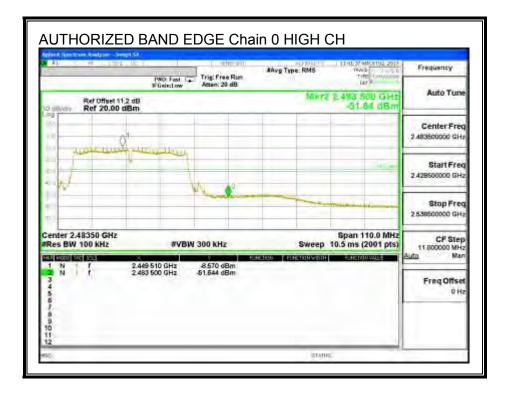
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### **RESULTS**

### LOW CHANNEL BANDEDGE, Chain 0



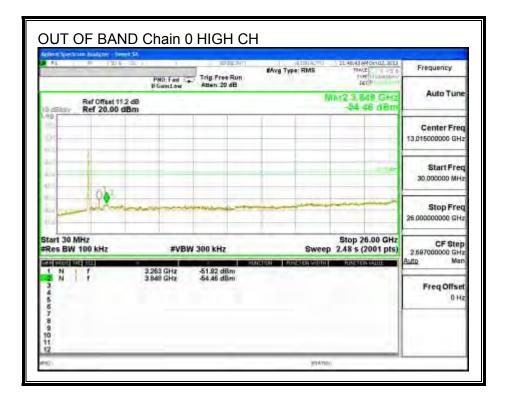
### HIGH CHANNEL BANDEDGE, Chain 0



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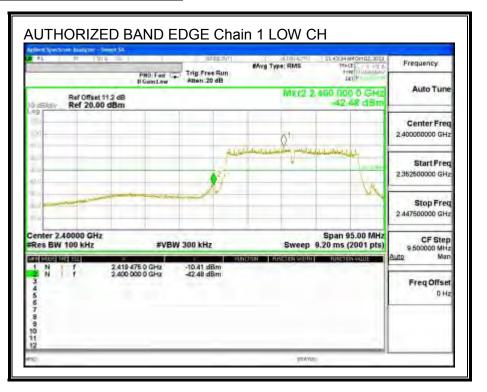
### **OUT-OF-BAND EMISSIONS, Chain 0**

*T	N THE	PNO Fast	Trig Free Run	Myg Type: RMS	TRACE TO A STA	
	Ref Offset 11.2	16 GaincLow	Atten 20 dB		Mhr2 3,822 GHz	Auto Tune
	Ref 20.00 dB	m			Secto della	Center Freq 13,01500000 GHz
10	1					Start Free 30.000000 MH
	liting				abitiz fammifiki	Stop Free 26.00000000 GH
tart 30 N Res BW	1Hz 100 kHz	#VBI	W 300 kHz	Swee	Stop 26.00 GHz p 2.48 s (2001 pts)	2.597000000 GH
1 N 1 3 4 5 6 7 8 9 0 0 1 2	f f	3224 GHz 3822 GHz	-50.78 dBm -54.28 dBm	ntinn   Ancien with	Proc 1994 value	Auto Man Freq Offset 0 Ha

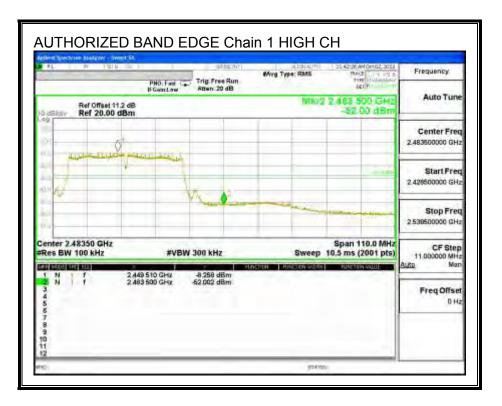


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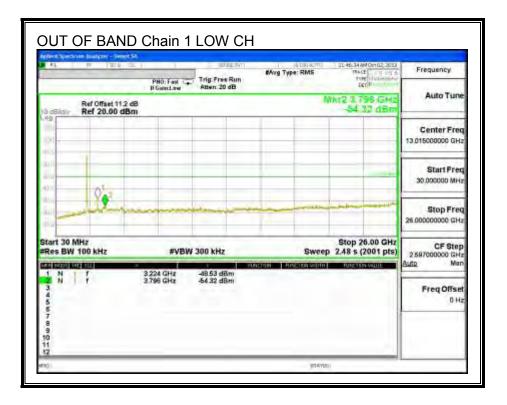
### LOW CHANNEL BANDEDGE, Chain 1

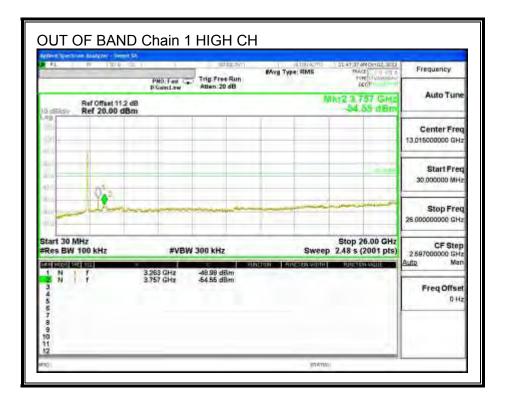


### HIGH CHANNEL BANDEDGE, Chain 1



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# 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

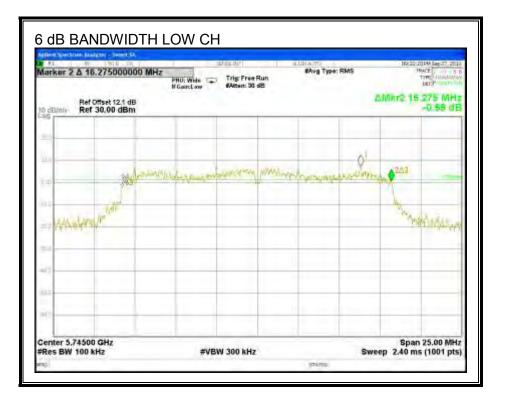
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

### <u>RESULTS</u>

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

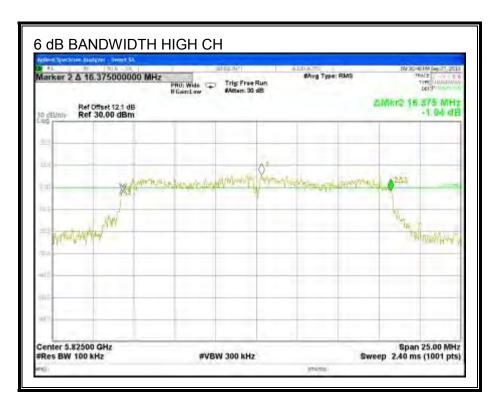
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### 6 dB BANDWIDTH





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## 8.8.2. 99% BANDWIDTH

### **LIMITS**

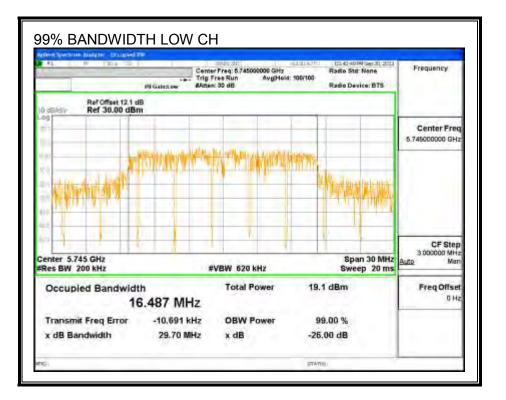
None; for reporting purposes only.

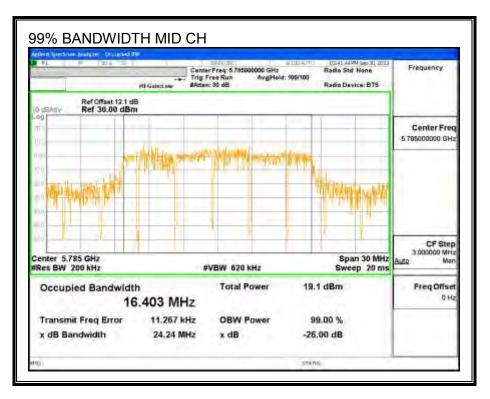
### **RESULTS**

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

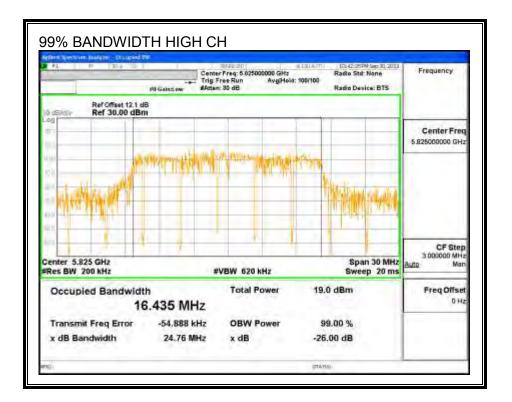
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### 99% BANDWIDTH





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

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# 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**

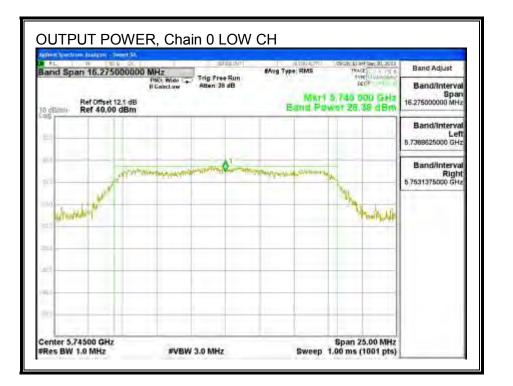
Limits								
Channel	Frequency	Directional	FCC	IC	IC	Max		
		Gain	Power	Power	EIRP	Power		
			Limit	Limit	Limit			
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)		
Low	<b>(MHz)</b> 5745	(dBi) 3.2	(dBm) 30.00	<b>(dBm)</b> 30	<b>(dBm)</b> 36	(dBm) 30.00		
Low Mid	. ,	. ,	, ,	• •	• •	. ,		

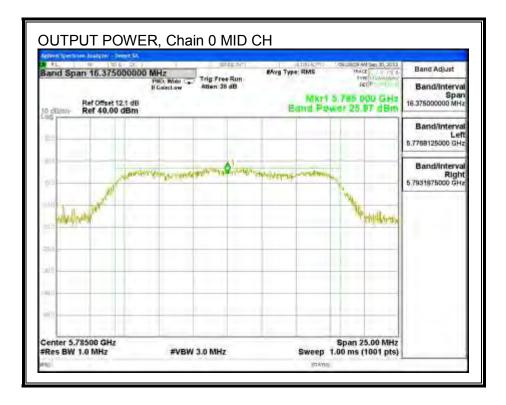
Results

Channel	Frequency	Chain 0	Total	Power	Margin
		Meas	Corr'd	Limit	
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(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

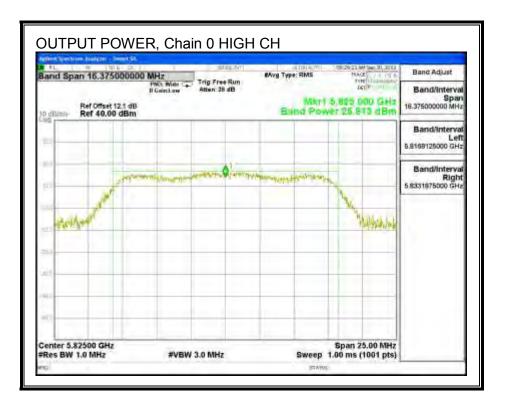
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### **OUTPUT POWER, Chain 0**





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## 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.

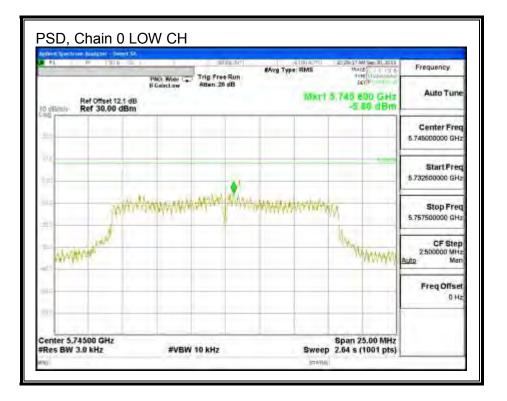
### **RESULTS**

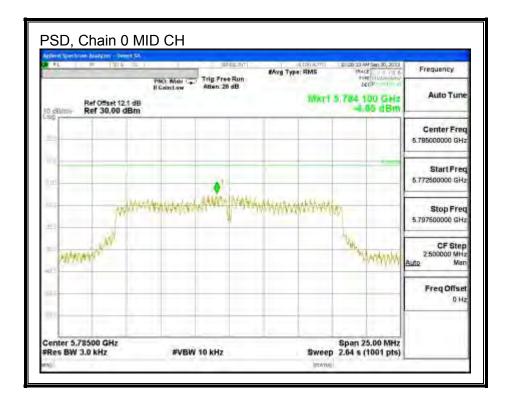
#### **PSD** Results

Channel	Frequency	Chain 0	Limit	Margin
		Meas		
	(MHz)	(dBm)	(dBm)	(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

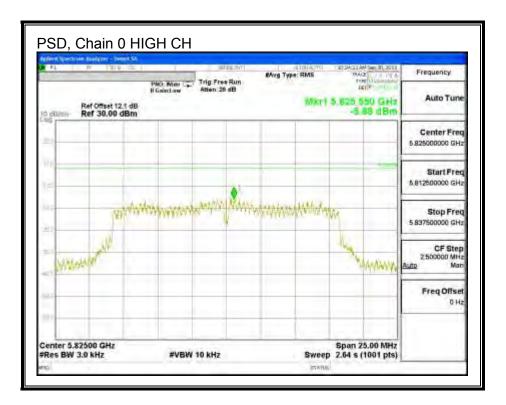
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## PSD, Chain 0





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# 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.

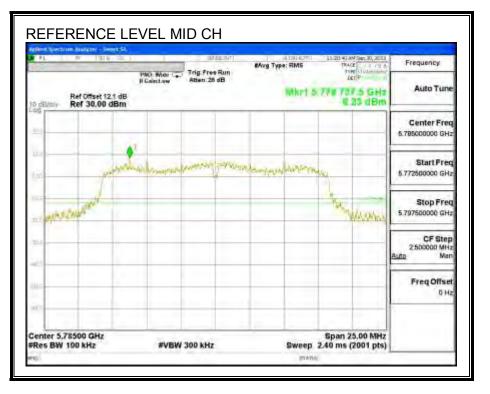
## TEST PROCEDURE

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 inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

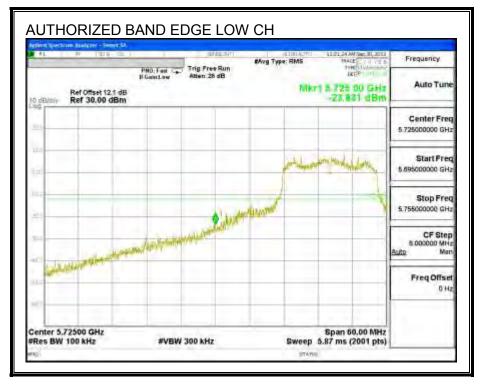
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### **RESULTS**

### **IN-BAND REFERENCE LEVEL**

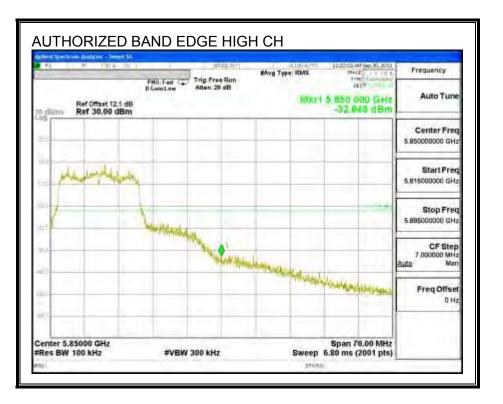


### LOW CHANNEL BANDEDGE

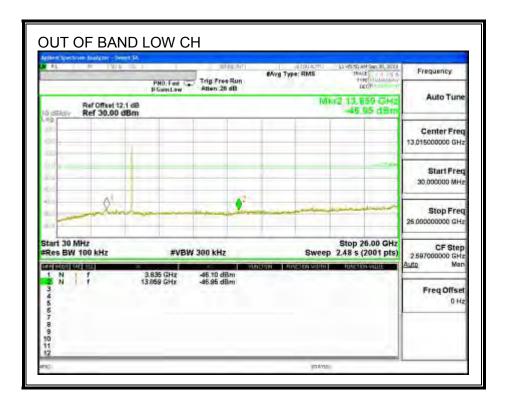


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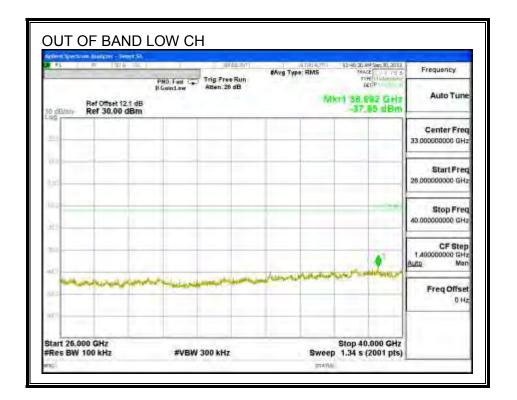
### HIGH CHANNEL BANDEDGE

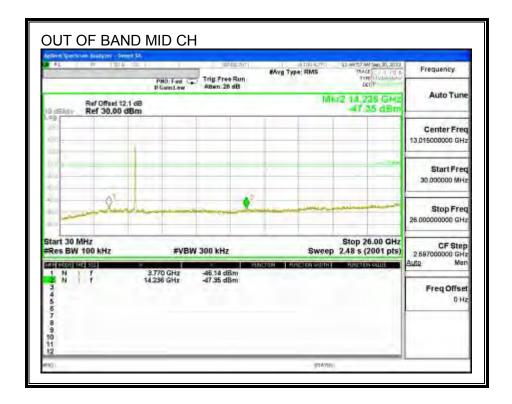


### **OUT-OF-BAND EMISSIONS**

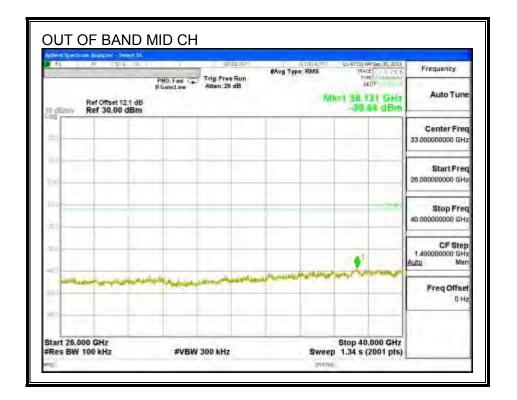


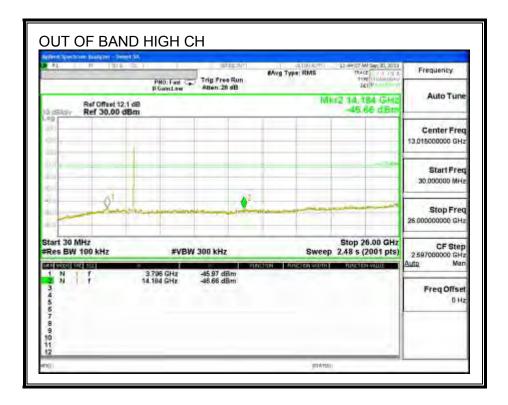
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ari n 1310	auto in comme	Trig Free Run	Myg Type: RMS	11-47:47.49 Sec. 20, 2011 78.402 11:00 11:00 11:00	Frequency	
Ref Offset 12		Atten 26 dB	Mkr) 38.523 G -39.05 d		Auto Tune	
					Center Freq 33.000600000 GHz	
un					Start Freq 26.00000000 GHz	
10.2					Stop Freq 40.00000000 GHz	
10				-	CF Step t 40000000 GHz Auto Man	
Mining and the stand of	and an and the second of the	and the particular man	وياليه والمجلوعيد والمجل		Freq Offset 0 Hz	
Start 26,000 GHz #Res BW 100 kHz		300 kHz		Stop 40.000 GHz	1	

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# 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

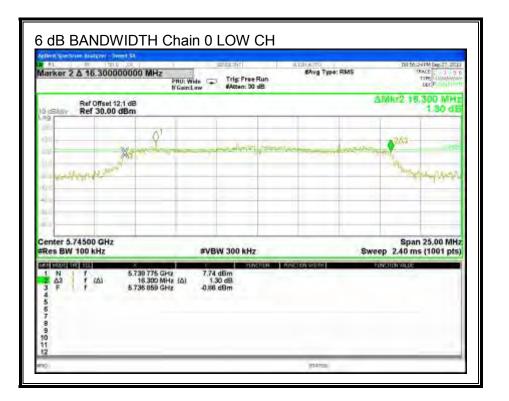
558074 D01 DTS Meas Guidance v03r01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

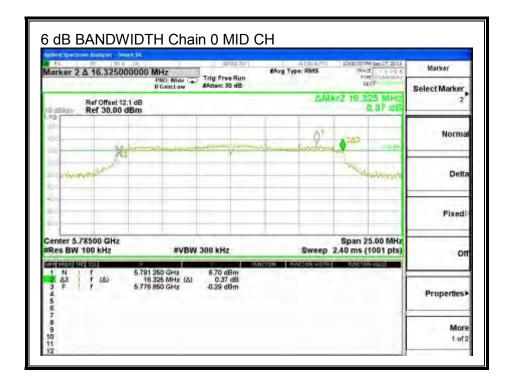
## <u>RESULTS</u>

Channel	Frequency	6 dB BW	6 dB BW	Minimum	
		Chain 0	Chain 1	Limit	
	(MHz)	(MHz)	(MHz)	(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	

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### 6 dB BANDWIDTH, Chain 0





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RL OVER	16.3750000001	MHz PHU: Wide WGaircLaw	Trig Free F 6Atten: 30 :	tun	SAvg Type: RMS	IIEOG-ADPAN TRACE TUPE DET	Sale 2
	ef Offset 12:1 dB ef 30.00 dBm					AMR/2 18.37	5 MH 21 di
00)		anthread and a second		Q1		243	
	Ma -					Wight with	SAM
enter 5.825 Res BW 100		≠VB	W 300 kHz		s	Span 25. weep 2.40 ms (10	
1 N 1 2 A3 1 3 P 1 4 5 6 7 8 9 0	(A) 18.	375 MHz (Δ) -1.5	dBm 21 dB dBm	ITTH AND		TERMITERANELS.	

## 6 dB BANDWIDTH, Chain 1



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# 8.9.2. 99% BANDWIDTH

## **LIMITS**

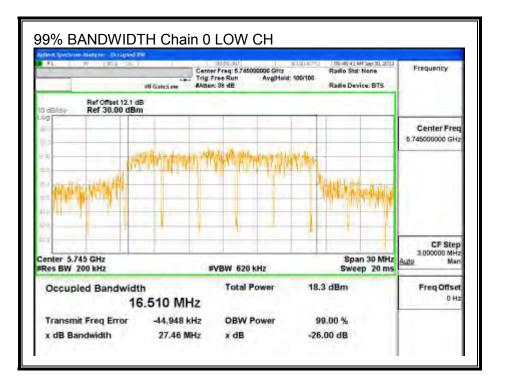
None; for reporting purposes only.

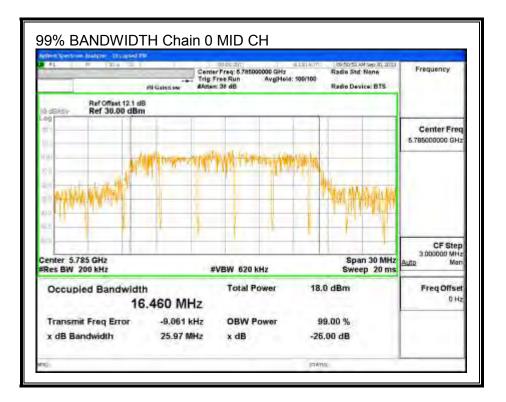
# **RESULTS**

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

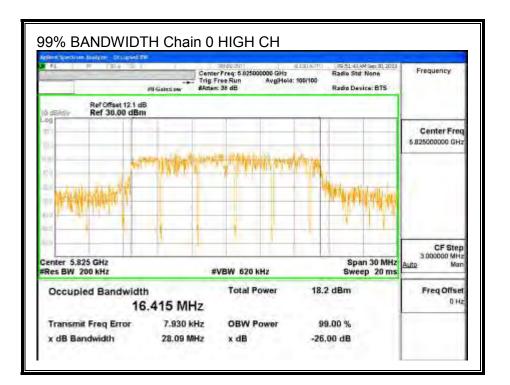
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#### 99% BANDWIDTH, Chain 0

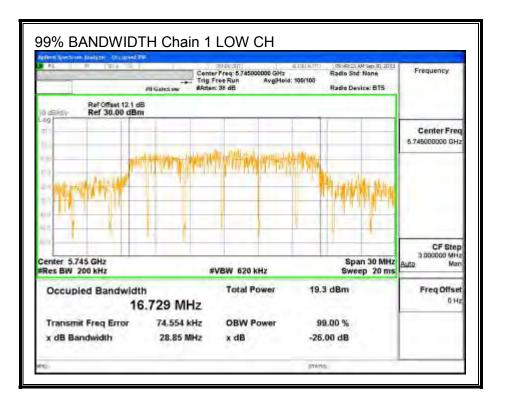




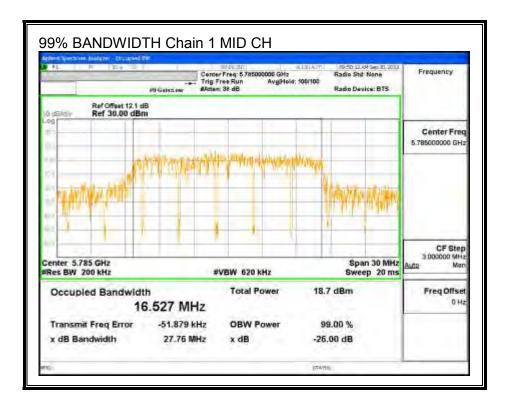
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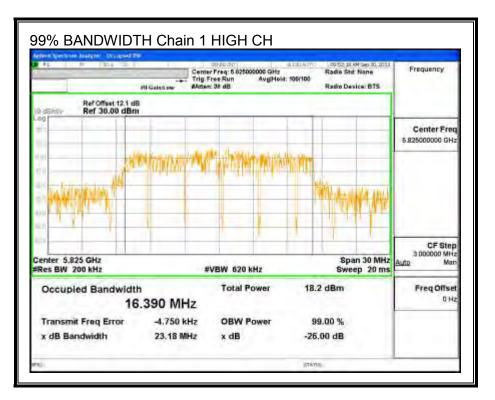


### 99% BANDWIDTH, Chain 1



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# 8.9.3. AVERAGE POWER

# <u>LIMITS</u>

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	Chain 0	Chain 1	Total
		Power	Power	Power
	(MHz)	(dBm)	(dBm)	(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

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# 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	Chain 1	<b>Uncorrelated Chains</b>
Antenna	Antenna	Directional
Gain	Gain	Gain
(dBi)	(dBi)	(dBi)
3.20	1.80	2.56

# **RESULTS**

Limits

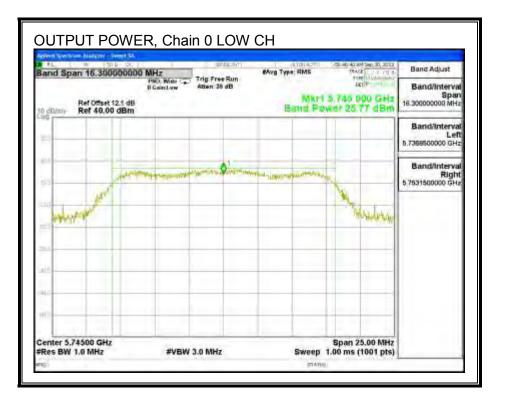
Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
Low	5745	2.56	30.00	30	36	30.00
Mid	5785	2.56	30.00	30	36	30.00
High	5825	2.56	30.00	30	36	30.00

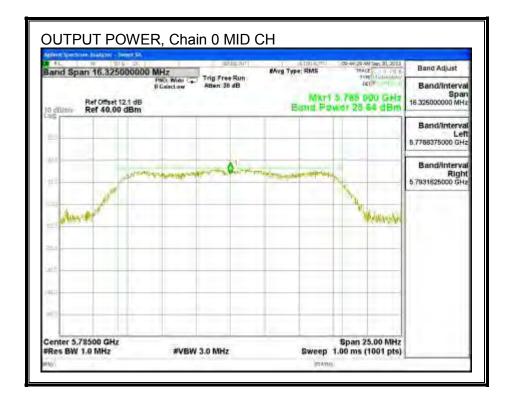
#### Results

Channel	Frequency	Chain 0	Chain 1	Total	Power	Margin
		Meas	Meas	Corr'd	Limit	
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(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

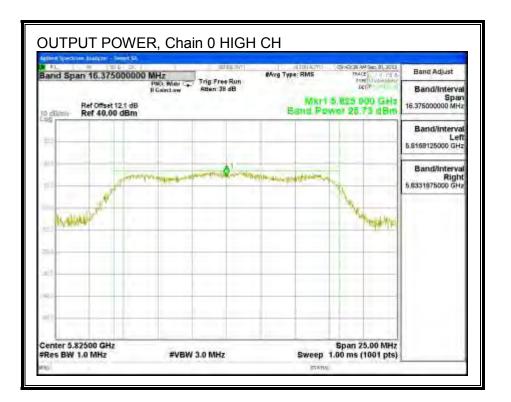
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# **OUTPUT POWER, Chain 0**

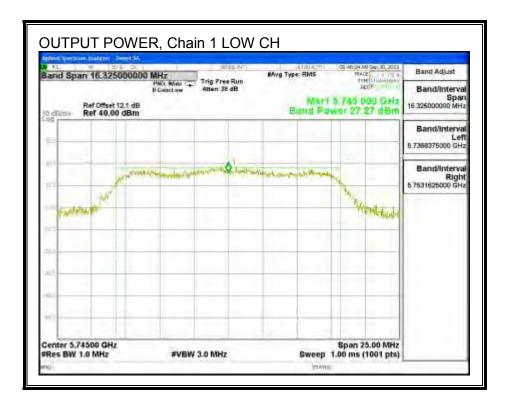




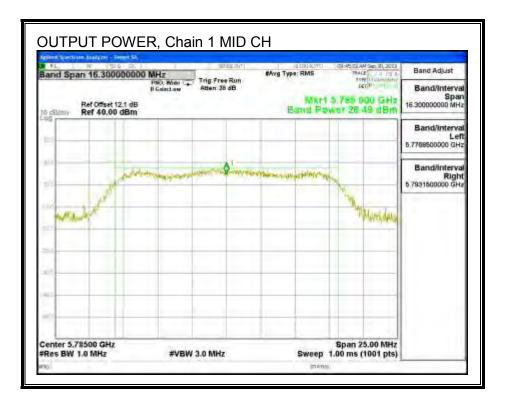
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# **OUTPUT POWER, Chain 1**



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# 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.

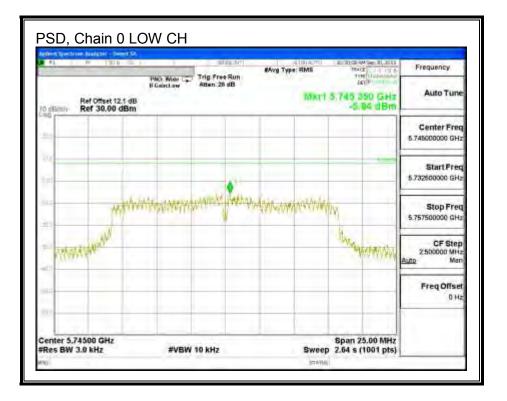
#### **RESULTS**

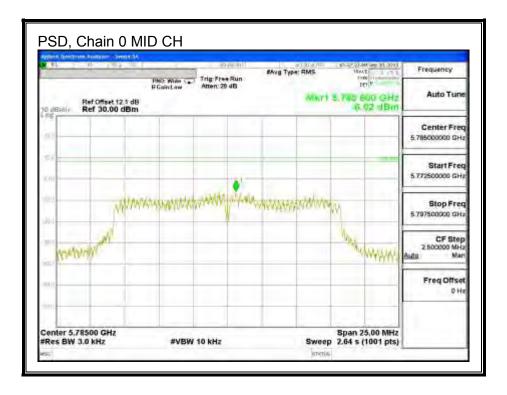
#### **PSD** Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Meas	Meas	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(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

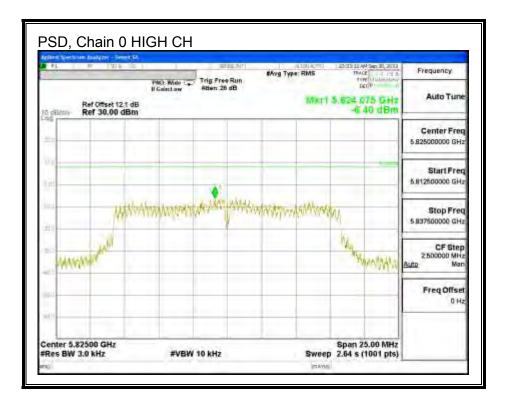
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# PSD, Chain 0

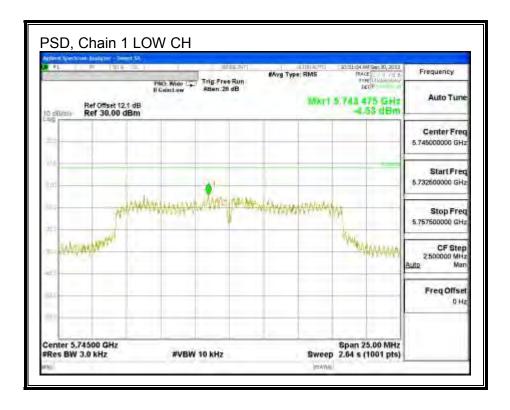




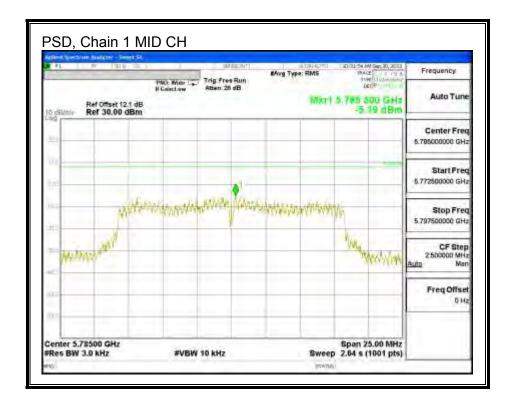
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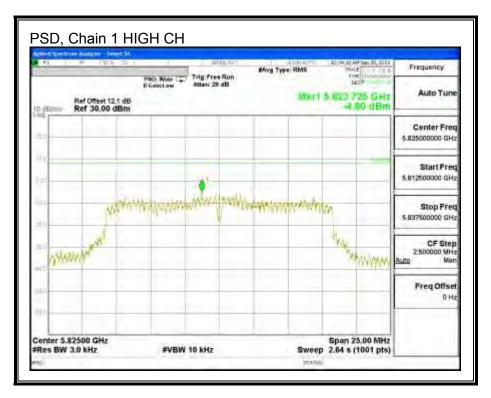


PSD, Chain 1



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# 8.9.6. OUT-OF-BAND EMISSIONS

# <u>LIMITS</u>

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.

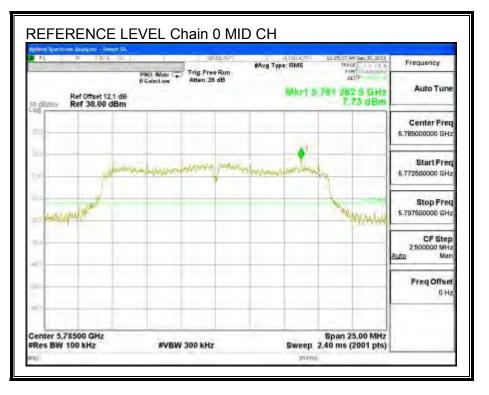
# TEST PROCEDURE

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 inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

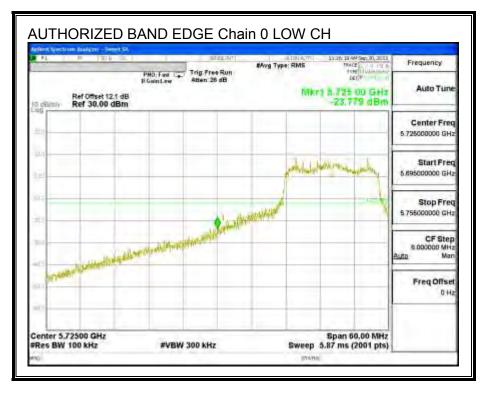
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# **RESULTS**

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

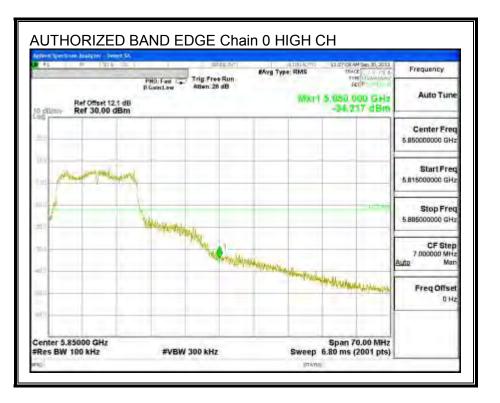


### LOW CHANNEL BANDEDGE, Chain 0

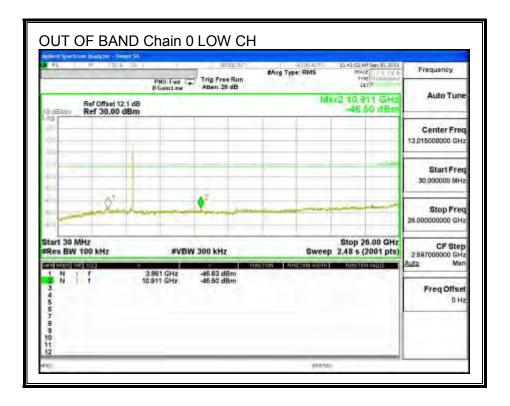


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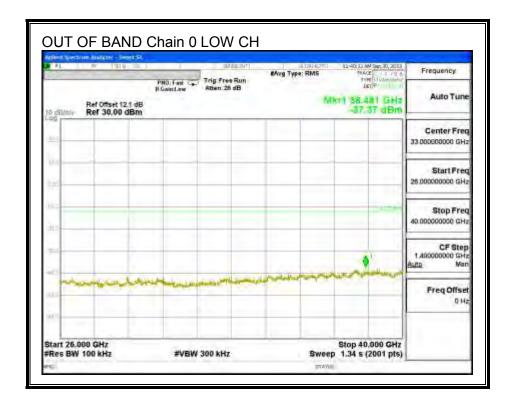
### HIGH CHANNEL BANDEDGE, Chain 0

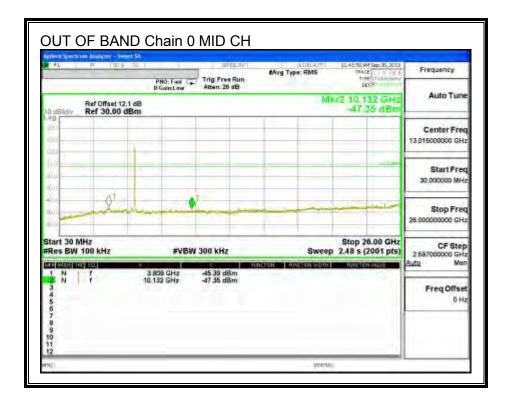


# OUT-OF-BAND EMISSIONS, Chain 0

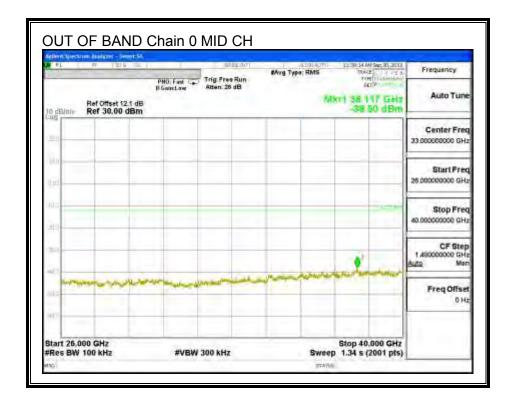


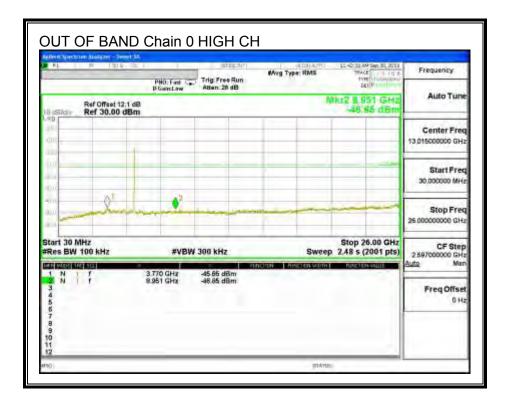
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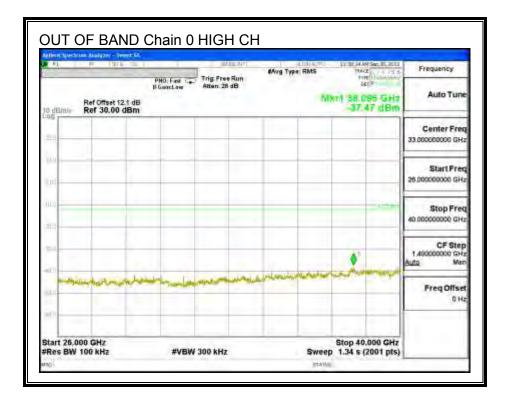


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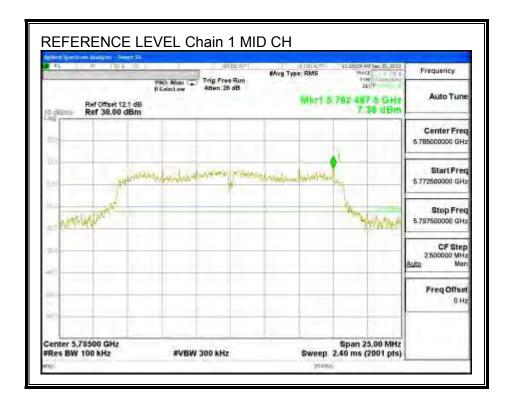




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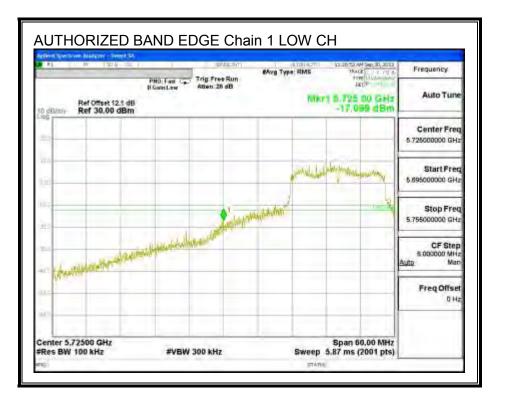


# **IN-BAND REFERENCE LEVEL, Chain 1**

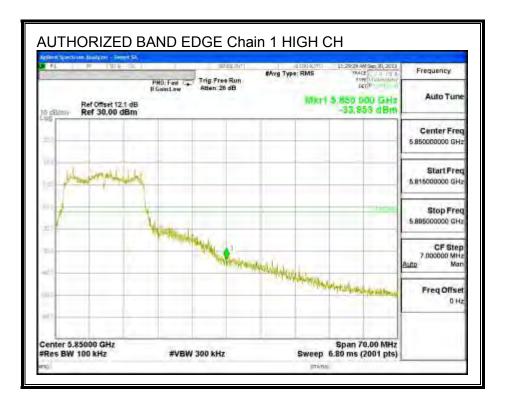


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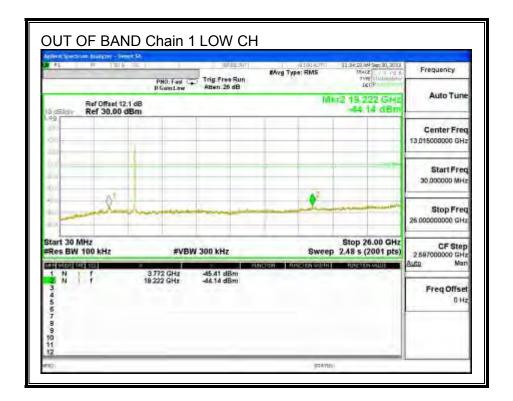
### LOW CHANNEL BANDEDGE, Chain 1

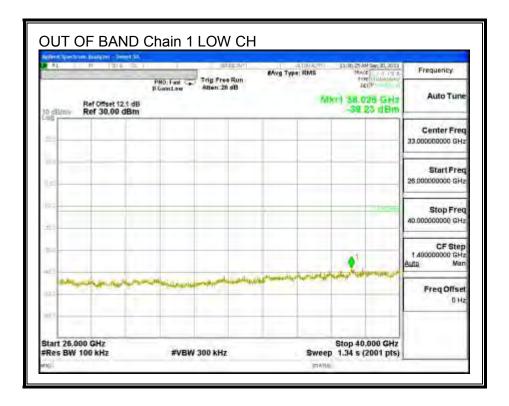


#### HIGH CHANNEL BANDEDGE, Chain 1



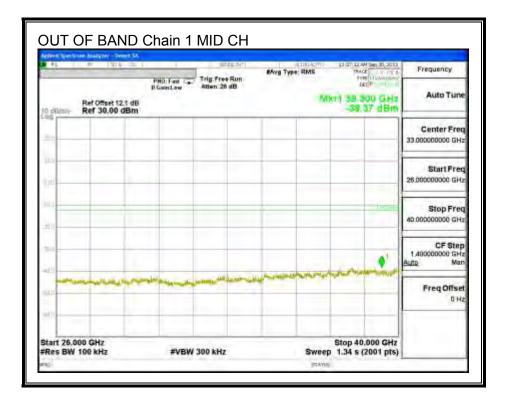
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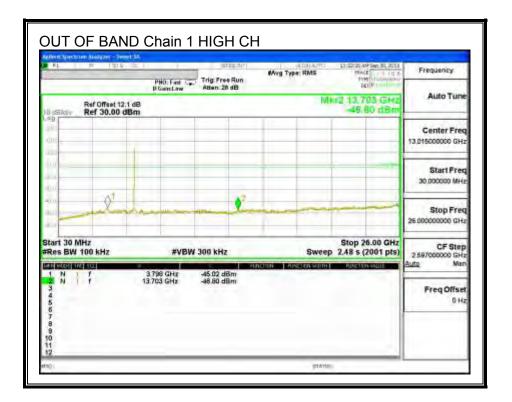


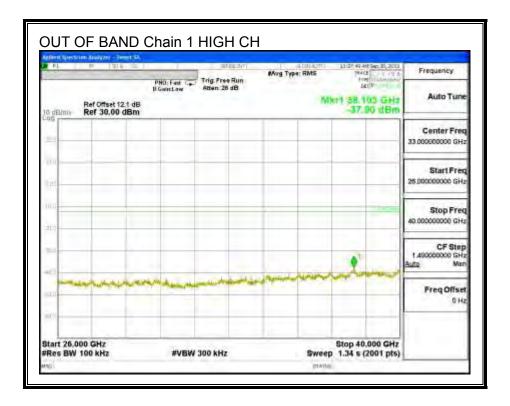
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#1	M I'I'	1	HO: Fast	Trig Free Run Atten 26 dB	Marg Type:	RMS	13-23-23 AM Sep 10, 2013 18402 - 1 1 13 5 1116 - 1110 - 13 5 1116 - 1110 - 1410	Frequency
o desidei v	Ref Offset 12 Ref 30.00	1.1 dB	CHARTER OF COMPANY			TV11	45 65 dBm	Auto Tune
		1						Center Fred 13,01500000 GH:
							-	Start Free 30.000000 MH
	_2'	du						Stop Free 26 00000000 GH:
tart 30 / Res BW	NHz 100 kHz		#VBW	300 kHz	-	Sweep	Stop 26.00 GHz 2.48 s (2001 pts)	
1 N 2 N 3 4 5 5 6 7 8 9 0 1 2	1	375 17.3	SS GHZ 16 GHZ	-44.97 dBm -46.56 dBm	NCOUN HINC	EN WITH		Auto Mer Freq Offset 0 Ha



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# 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".

### <u>RESULTS</u>

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

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#### 6 dB BANDWIDTH





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# 8.10.2. 99% BANDWIDTH

# **LIMITS**

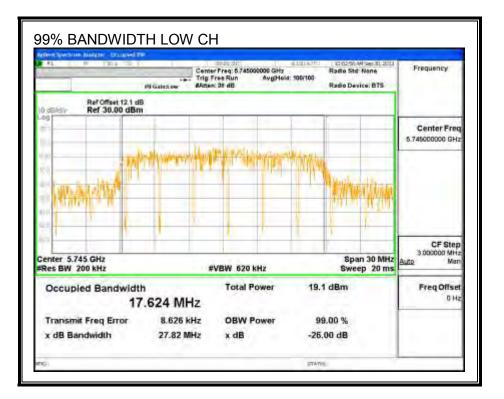
None; for reporting purposes only.

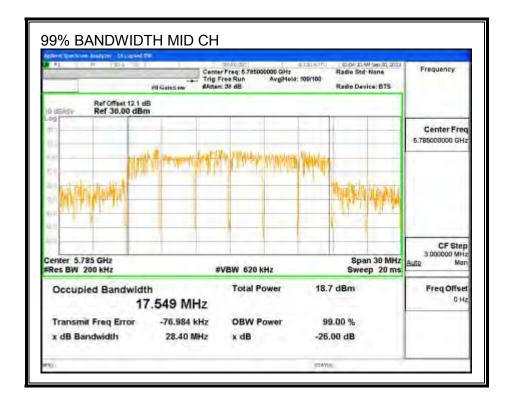
# **RESULTS**

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

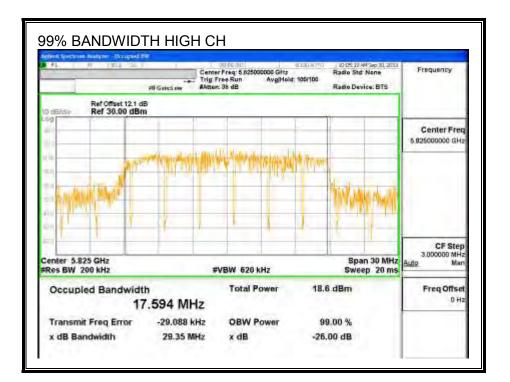
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#### 99% BANDWIDTH





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

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# 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

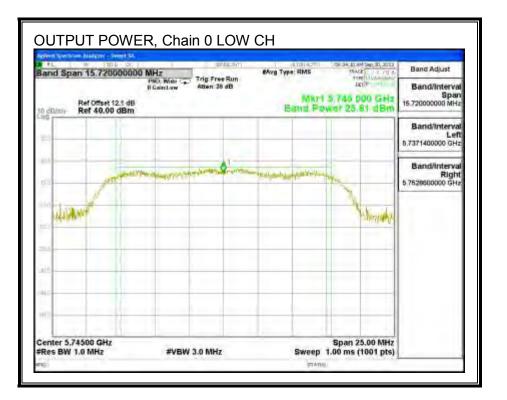
Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
Low	5745	3.2	30.00	30	36	30.00
Mid	5785	3.2	30.00	30	36	30.00
High	5825	3.2	30.00	30	36	30.00

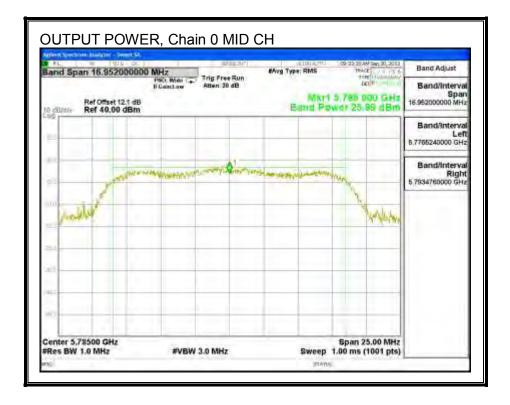
#### Results

Channel	Frequency	Chain 0	Total	Power	Margin
		Meas	Corr'd	Limit	
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(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

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# **OUTPUT POWER, Chain 0**





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